The Origins of the Industrial Revolution

The political and moral advantages of this country, as a seat of manufactures, are not less remarkable than its physical advantages. The arts are the daughters of peace and liberty. In no country have these blessings been enjoyed in so high degree, or for so long a continuance, as in England. Under the reign of just laws, personal liberty and property have been secure; mercantile enterprise has been allowed to reap its reward; capital has accumulated in safety; the workman has "gone forth to his work and to his labour until the evening;" and, thus protected and favoured, the manufacturing prosperity of the country has struck its roots deep, and spread forth its branches to the ends of the earth. [Edward Baines, *The History of the Cotton Manufacture in Great Britain*, 1835]

In the eighteenth century, a series of inventions transformed the manufacture of cotton in England and gave rise to a new mode or production -- the factory system. During these years, other branches of industry effected comparable advances, and all these together, mutually reinforcing one another, made possible further gains on an ever-widening front. The abundance and variety of these innovations almost defy compilation, but they may be subsumed under three principles: the substitution of machines -- rapid, regular, precise, tireless -- for human skill and effort; the substitution of inanimate for animate sources of power, in particular, the introduction of engines for converting heat into work, thereby opening to man a new and almost unlimited supply of energy; the use of new and far more abundant raw materials, in particular, the substitution of mineral for vegetable or animal substances. These improvements constitute the Industrial Revolution. [David Landes, *The Unbound Prometheus*, 1969]

The Industrial Revolution of the late 18th and early 19th centuries was revolutionary because it changed -- revolutionized -- the productive capacity of England, Europe and United States. But the revolution was something more than just new machines, smoke-belching factories, increased productivity and an increased standard of living. It was a revolution which transformed English, European, and American society down to its very roots. Like the Reformation or the French Revolution, no one was left unaffected. Everyone was touched in one way or another -- peasant and noble, parent and child, artisan and captain of industry. The Industrial Revolution serves as a key to the origins of modern Western society. As Harold Perkin has observed, "the Industrial Revolution was no mere sequence of changes in industrial techniques and production, but a social revolution with social causes as well as profound social effects" [*The Origins of Modern English Society, 1780-1880* (1969)].

The INDUSTRIAL REVOLUTION can be said to have made the European working-class. It made the European middle-class as well. In the wake of the Revolution, new social relationships appeared. As [Benjamin] Franklin once said, "time is money." Man no longer treated men as men, but as a commodity which could be bought and sold on the open market. This "commodification" of man is what bothered Karl Marx -- his solution was to transcend the profit motive by social revolution […].

There is no denying the fact that the Industrial Revolution began in England sometime after the middle of the 18th century. England was the "First Industrial Nation." As one economic

historian commented in the 1960s, it was England which first executed "the takeoff into self-sustained growth." And by 1850, England had become an economic titan. Its goal was to supply two-thirds of the globe with cotton spun, dyed, and woven in the industrial centers of northern England. England proudly proclaimed itself to be the "Workshop of the World," a position that country held until the end of the 19th century when Germany, Japan and United States overtook it.

More than the greatest gains of the Renaissance, the Reformation, Scientific Revolution or Enlightenment, the Industrial Revolution implied that man now had not only the opportunity and the knowledge but the physical means to completely subdue nature. No other revolution in modern times can be said to have accomplished so much in so little time. The Industrial Revolution attempted to effect man's mastery over nature. This was an old vision, a vision with a history. In the 17th century, the English statesman and "Father of Modern Science, Francis Bacon (1561-1626), believed that natural philosophy (what we call science) could be applied to the solution of practical problems, and so, the idea of modern technology was born. For Bacon, the problem was this: how could man enjoy perfect freedom if he had to constantly labor to supply the necessities of existence? His answer was clear -- machines. These labor saving devices would liberate mankind, they would save labor which then could be utilized elsewhere. "Knowledge is power," said Bacon, and scientific knowledge reveals power over nature.

The vision was all-important. It was optimistic and progressive. Man was going somewhere, his life has direction. This vision is part of the general attitude known as the idea of progress, that is, that the history of human society is a history of progress, forever forward, forever upward. This attitude is implicit throughout the Enlightenment and was made reality during the French and Industrial Revolutions. With relatively few exceptions, the philosophes of the 18th century embraced this idea of man's progress with an intensity I think unmatched in our own century. Human happiness, improved morality, an increase in knowledge were now within man's reach. This was indeed the message, the vision, of Adam Smith, Denis Diderot, Voltaire, Thomas Jefferson and Ben Franklin […].

"Tremble all ye oppressors of the world," wrote Richard Price -- and tremble they did […]. The American and French Revolutions, building on enlightened ideas, swept away enthusiasm, tyranny, fanaticism, superstition, and oppressive and despotic governments. "*Sapere Aude!*" exclaimed Kant -- Dare to know!. With history and superstition literally swept aside, man could not only understand man and society, man could now change society for the better. These are all ideas, glorious, noble visions of the future prospect of mankind. By the end of the 18th century, these ideas became tangible. The vision was reality. Even Karl Marx understood this when he wrote, "Philosophers have only interpreted the world in various ways; the point, however, is to change it."

Engines and machines, the glorious products of science began to revolutionize the idea of progress itself. If a simple machine can do the work of twenty men in a quarter of the time formerly required, then could the New Jerusalem be far behind? When you view the Industrial Revolution alongside the democratic revolutions of 1776 and 1789, we cannot help but be struck by the optimism so generated. Heaven on Earth seemed reality and no one was untouched by the prospects. But, as we will soon see, while the Industrial Revolution brought its blessings, there was also much misery. Revolutions, political or otherwise, are always mixed blessings. If we can thank the Industrial Revolution for giving us fluoride, internal combustion engines, and laser guided radial arm saws, we can also damn it for the effect it has had on social relationships. We live in the legacy of the Industrial Revolution, the legacy of

the "cash nexus," as the mid-19th century Scottish critic Thomas Carlyle (1795-1881) put it, where the only connection between men is the one of money, profit and gain.

The origins of the Industrial Revolution in England are complex and varied and, like the French Revolution, the Industrial Revolution is still a subject of a vast historical debate over origins, developments, growth and end results. This debate has raged among historians since at least 1884, when Arnold Toynbee (1852-1883), an English historian and social reformer, published the short book, *Lectures on the Industrial Revolution in England*. Toynbee was in a fairly good position to assess the revolution in industry -- England had, by the 1880s, endured more than a century of industrialization.

Still, like any revolution, the Industrial Revolution leaves us with many questions: was the revolution in industry simply an issue of new machinery or mechanical innovation? did young boys and girls work and live shoulder to shoulder for more than twelve hour a day? was industrial capitalism nothing more than a clever system devised by clever capitalists to exploit the labor of ignorant workers? was the revolution in industry the product of conscious planning or did it appear spontaneously? I can't answer all these questions in one lecture -- indeed, an entire course of study on the subject would perhaps get us no closer to the answers to these important questions. However, we can make one serious confession -- what the Industrial Revolution accomplished was nothing less than a structural change in the economic organization of English and European society. This is what made the Revolution revolutionary. In other words, England, then the Continent and the United States, witnessed a shift from a traditional, pre-modern, agrarian society to that of an industrial economy based on capitalist methods, principles and practices.

In general, the spread of industry across England was sporadic. In other words, not every region of England was industrialized at the same time. In some areas, the factory system spread quickly, in others not at all. Such a development also applies to the steam engine -- one would think that once steam engines made their appearance that each and every factory would have one. But this is clearly not the case. The spread of industry, or machinery, or steam power, or the factory system itself was erratic. I imagine the reason why we assume that industrialization was a quick process is that we live live in an age of rising expectations -- we expect change to occur rapidly and almost without our direction. Late 20th century developments in technology are perhaps most responsible for this attitude. We know that technology supplies a constant stream of products that are "new and improved." We know that the moment we bring home a top of the line computer that within six months it will become not necessarily obsolete but "old."

Historians are now agreed that beginning in the 17th century and continuing throughout the 18th century, England witnessed an agricultural revolution. English (and Dutch) farmers were the most productive farmers of the century and were continually adopting new methods of farming and experimenting with new types of vegetables and grains. They also learned a great deal about manure and other fertilizers. In other words, many English farmers were treating farming as a science, and all this interest eventually resulted in greater yields. Was the English farmer more enterprising than his French counterpart? Perhaps, but not by virtue of intelligence alone. English society was far more open than French -- there were no labor obligations to the lord. The English farmer could move about his locale or the country to sell his goods while the French farmer was bound by direct and indirect taxes, tariffs or other kinds of restrictions. In 1700, 80% of the population of England earned its income from the land. A century later, that figure had dropped to 40%.

The result of these developments taken together was a period of high productivity and low food prices. And this, in turn, meant that the typical English family did not have to spend almost everything it earned on bread (as was the case in France before 1789), and instead could purchase manufactured goods.

There are other assets that helped make England the "first industrial nation." Unlike France, England had an effective central bank and well-developed credit market. The English government allowed the domestic economy to function with few restrictions and encouraged both technological change and a free market. England also had a labor surplus which, thanks to the enclosure movement, meant that there was an adequate supply of workers for the burgeoning factory system.

England's agricultural revolution came as a result of increased attention to fertilizers, the adoption of new crops and farming technologies, and the enclosure movement. Jethro Tull (1674-1741) invented a horse-drawn hoe as well as a mechanical seeder which allowed seeds to be planted in orderly rows. A contemporary of Tull, Charles "Turnip" Townshend (1674-1738), stressed the value of turnips and other field crops in a rotation system of planting rather than letting the land lay fallow. Thomas William Coke (1752-1842) suggested the utilization of field grasses and new fertilizers as well as greater attention to estate management.

In order for these "high farmers" to make the most efficient use of the land, they had to manage the fields as they saw fit. This was, of course, impossible under the three field system which had dominated English and European agriculture for centuries. Since farmers, small and large, held their property in long strips, they had to follow the same rules of cultivation. The local parish or village determined what ought to be planted. In the end, the open-field system of crop rotation was an obstacle to increased agricultural productivity. The solution was to enclose the land, and this meant enclosing entire villages. Landlords knew that the peasants would not give up their land voluntarily, so they appealed by petition to Parliament, a difficult and costly adventure at best. The first enclosure act was passed in 1710 but was not enforced until the 1750s. In the ten years between 1750 and 1760, more than 150 acts were passed and between 1800 and 1810, Parliament passed more than 900 acts of enclosure. While enclosure ultimately contributed to an increased agricultural surplus, necessary to feed a population that would double in the 18th century, it also brought disaster to the countryside. Peasant formers were dispossessed of their land and were now forced to find work in the factories which began springing up in towns and cities.

England faced increasing pressure to produce more manufactured goods due to the 18th century population explosion -- England's population nearly doubled over the course of the century. And the industry most important in the rise of England as an industrial nation was cotton textiles. No other industry can be said to have advanced so far so quickly. Although the putting-out system (cottage industry) was fairly well-developed across the Continent, it was fully developed in England. A merchant would deliver raw cotton at a household. The cotton would be cleaned and then spun into yarn or thread. After a period of time, the merchant would return, pick up the yarn and drop off more raw cotton. The merchant would then take the spun yarn to another household where it was woven into cloth. The system worked fairly well except under the growing pressure of demand, the putting-out system could no longer keep up.

There was a constant shortage of thread so the industry began to focus on ways to improve the spinning of cotton. The first solution to this bottleneck appeared around 1765 when James Hargreaves (c.1720-1778), a carpenter by trade, invented his cotton-spinning jenny. At almost

the same time, Richard Arkwright (1732-1792) invented another kind of spinning device, the water frame. Thanks to these two innovations, ten times as much cotton yarn had been manufactured in 1790 than had been possible just twenty years earlier. Hargreaves' jenny was simple, inexpensive and hand-operated. The jenny had between six and twenty-four spindles mounted on a sliding carriage. The spinner (almost always a woman) moved the carriage back and forth with one hand and turned a wheel to supply power with the other. Of course, now that one bottleneck had been relieved, another appeared -- the weaver (usually a man) could no longer keep up with the supply of yarn. Arkwright's water frame was based on a different principle. It acquired a capacity of several hundred spindles and demanded more power -- water power. The water frame required large, specialized mills employing hundreds of workers. The first consequence of these developments was that cotton goods became much cheaper and were bought by all social classes. Cotton is the miracle fiber -- it is easy to clean, spin, weave and dye and is comfortable to wear. Now millions of people who had worn nothing under their coarse clothes could afford to wear cotton undergarments.

Although the spinning jenny and water frame managed to increase the productive capacity of the cotton industry, the real breakthrough came with developments in steam power. Developed in England by Thomas Savery (1698) and Thomas Newcomen (1705), these early steam engines were used to pump water from coal mines. In the 1760s, a Scottish engineer, James Watt (1736-1819) created an engine that could pump water three times as quickly as the Newcomen engine. In 1782, Watt developed a rotary engine that could turn a shaft and drive machinery to power the machines to spin and weave cotton cloth. Because Watt's engine was fired by coal and not water, spinning factories could be located virtually anywhere.

Steam power also promoted important changes in other industries. The use of steam-driven bellows in blast furnaces helped ironmakers switch over from charcoal (limited in quantity) to coke, which is made from coal, in the smelting of pig iron. In the 1780s, Henry Cort (1740-1800) developed the puddling furnace, which allowed pig iron to be refined in turn with coke. Skilled ironworkers ("puddlers") could "stir" molten pig iron in a large vat, raking off refined iron for further processing. Cort also developed steam-powered rolling mills, which were capable of producing finished iron in a variety of shapes and forms.

Aided by revolutions in agriculture, transportation, communications and technology, England was able to become the "first industrial nation." This is a fact that historians have long recognized. However, there were a few other less-tangible reasons which we must consider. These are perhaps cultural reasons. Although the industrial revolution was clearly an unplanned and spontaneous event, it never would have been "made" had there not been men who wanted such a thing to occur. There must have been men who saw opportunities not only for advances in technology, but also the profits those advances might create. Which brings us to one very crucial cultural attribute -- the English, like the Dutch of the same period, were a very commercial people. They saw little problem with making money, nor with taking their surplus and reinvesting it. Whether this attribute has something to do with their "Protestant work ethic," as Max Weber put it, or with a specifically English trait is debatable, but the fact remains that English entrepreneurs had a much wider scope of activities than did their Continental counterparts at the same time.

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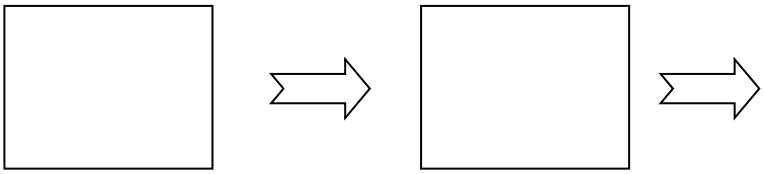
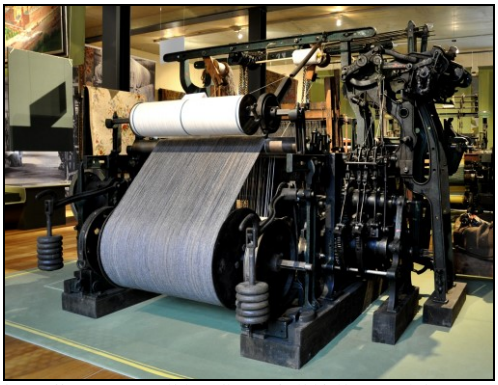
Source: http://www.historyguide.org/intellect/lecture17a.html

Tasks (to be completed with the help of a dictionary) :

1) List the vocabulary you think is essential to deal with the Industrial Revolution.
2) Produce a mind map of the different factors bringing about the Industrial Revolution in Britain.
3) Having established a mind map in 2), please produce a flow chart that shows the sequence / order in which those aspects occurred and produced the Industrial Revolution.

Flow chart:





https://commons.wikimedia.org/wiki/File:Teppich-Museum_Oelsnitz_24.jpg

Additional tasks:

➔ You might also want to watch the following documentary on the British Industrial Revolution and take notes on what developments happened in which order:

Coalbrookdale: origins of the Industrial Revolution (21.39), produced in the 1980s by Imperial College Video ➔ http://www.youtube.com/watch?v=kuWTlzwsmOc