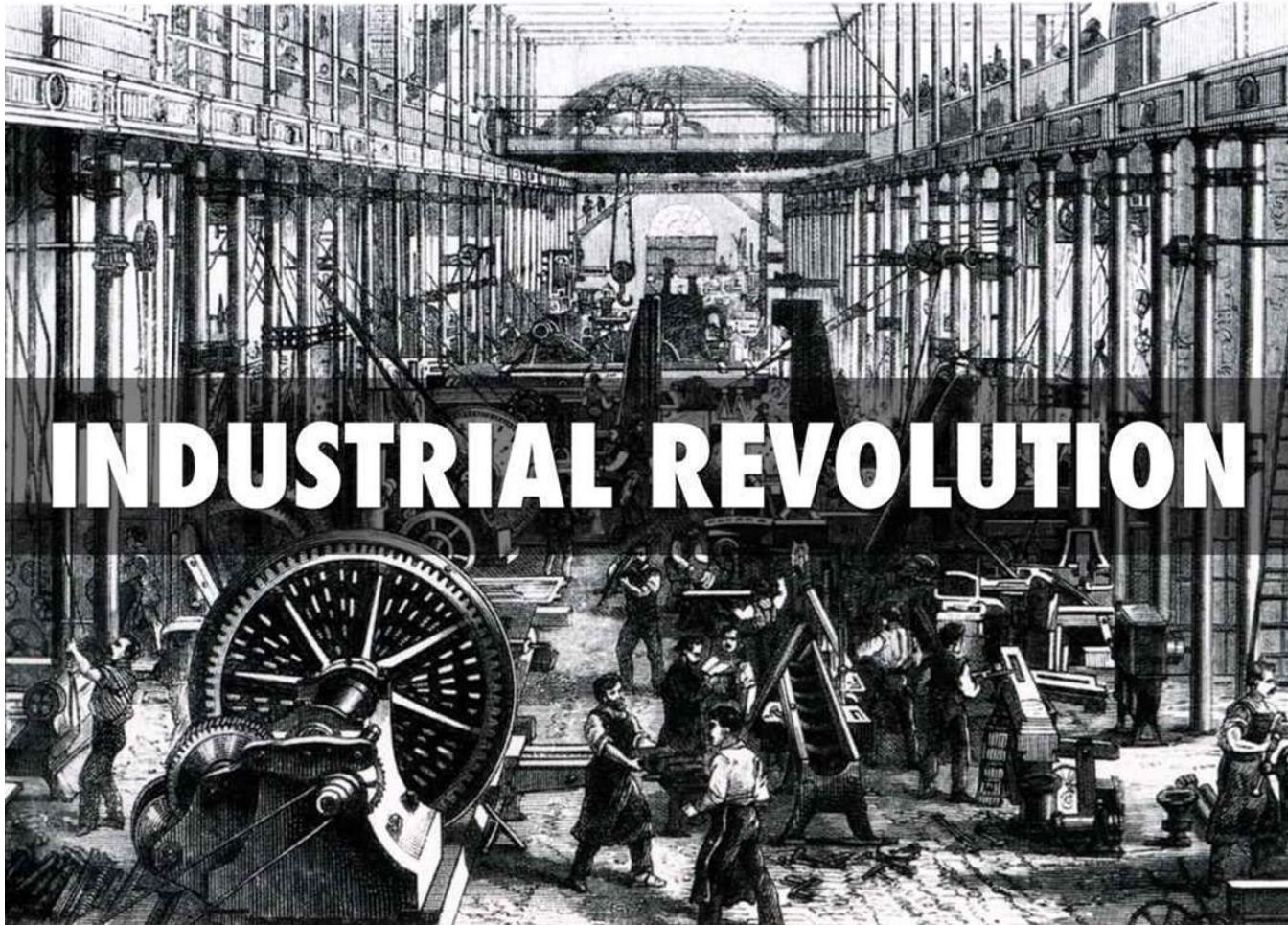


Aim #8: How did the production of goods change during the late 1700s and 1800s?

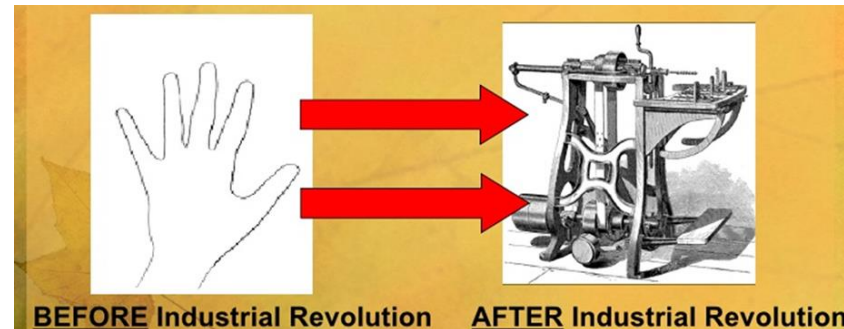


What is the Industrial Revolution?



Before

After



[the PBS video Mill Times](#) until 8:50

Watch this [video on the Agricultural Revolution \(1:27-end\)](#)

The Industrial Revolution (1750 -1850)

The **Industrial Revolution** was the period in which the production of goods shifted from hand production methods to complex machines. This period of **industrialization** resulted in social and economic changes.

The Industrial Revolution started in **Great Britain** around 1750. The process of industrialization **spread throughout the world** in the following centuries.



Illustration of two women working at home to make finished goods as part of the domestic system.

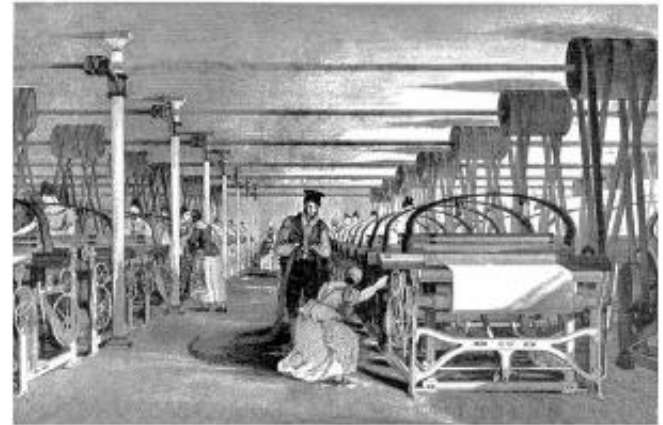
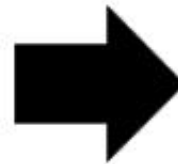


Illustration of a power loom weaving drawn by Thomas Allom (1835)
[image](#) is courtesy of wikimedia commons and is public domain



Manchester, England in 1820

[image](#) is courtesy of wikimedia commons and is public domain

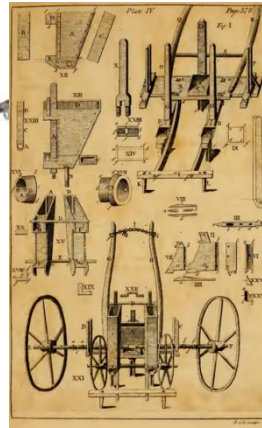
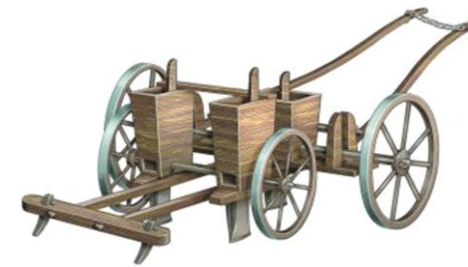


Manchester, England in 1852

[image](#) is courtesy of wikimedia commons and is public domain

Causes: Agricultural Rev. → I.R.

- New Methods & more efficient production



New
Farming
Technology

More Food
Produced

Fewer
Farmers
Needed

More
Workers
Available

New Inventions Sped Up Production



The new technology set off a cycle that dramatically affected how people lived.

More affordable goods caused still lower prices.

Lower prices created more consumers and greater demand.

Greater demand led to new inventions and still more affordable goods.



Innovation during the Industrial Revolution

The technological innovations of the Industrial Revolution in Great Britain, and the innovations developed elsewhere when industrialization spread to other countries, changed the course of human history and paved the way for our modern lives. These advances **accelerated** human technological achievement to a pace that people had never experienced before.

➔ **Directions:** Examine the innovations on the following pages and respond to the accompanying questions & then complete chart below.

FA

SQ 4. How did innovations during the Industrial Revolution change life in Great Britain in the 19th century?



Connect Cause
and Effect

Task: Complete the chart below using information you learned in this lesson and your knowledge of Global History and the word bank below.

after	before	during	then	but
-------	--------	--------	------	-----



Compare

Category of Life in Great Britain	What changed as a result of innovations during the Industrial Revolution?
Source of Energy	
How goods were made and where people worked	
How people and goods were transported	

1. Innovations in Energy Sources: Human, Animal, Wood and Water Power to Coal

Before the Industrial Revolution

Before the Industrial Revolution, the main sources of energy were **human, animal, wood, and water** power. In addition to using animals to push and pull, they were also used to power machines. A modern version can be seen in the video below. Water power had been used for centuries to power mills, but this limited where someone could put a factory because it needed to be near fast moving water. In the early years of the Industrial Revolution, factories were located near rivers and streams to use the water power to move gears that powered the machines inside. Wood was also used as fuel once steam engines were invented but it took time to replenish after the trees were harvested and it was heavy and bulky to transport.

▶ [Click to watch a modern animal-powered sawmill in Belize.](#)



▶ [Click to watch a restored water-powered sawmill in Ireland.](#)



Industrial Innovation: Coal



Watch this [BBC Video on the Industrial Revolution \(2:22-5:08\)](#) to learn about the importance and power of coal as a source of energy.

Coal is a black or brownish-black sedimentary rock. It is extracted from the Earth by underground mining or by digging large pits until the coal is unearthed. Coal is a common rock in many parts of the world and with improved mining technology in the 18th century, it became easy to get. Because it can be set on fire and it burns at a high temperature for a long period of time, it is an extremely powerful fuel for the generation of heat and electricity. Today, approximately 40 percent of the world's electricity production depends on coal, making it the largest single source of electricity worldwide.



Fireman shovels coal into the engine of a steam-powered train.
[Image](#) is courtesy of wikimedia commons and is public domain

[Click to watch a modern animal-powered sawmill in Belize.](#)

[Click to watch a restored water-powered sawmill in Ireland.](#)

Watch this [BBC Video on the Industrial Revolution \(2:22- 5:08\)](#) to learn about the importance and power of coal as a source of energy.

1a. What were the disadvantages to using wood and water power?

1b. Why was the use of coal an improvement on using human, animal, wood or water power for energy?

2. Innovations in Engines: James Watt's Steam Engine

James Watt

James Watt (January 19, 1736 – August 25, 1819) was a Scottish inventor and engineer whose improvements to the **steam engine** provided much of the force behind the Industrial Revolution. His invention turned heat from burning coal into movement through a series of valves and gears. His invention made it possible to use coal for energy in areas far away from coal fields. The steam engine was used in manufacturing to run machines at great speeds for long periods of time so work could be performed on large scales, almost year-round, with vastly higher efficiency. The steam engine was also used in the **locomotive [train]** and **steamboat**, thus leading to a revolution in transportation.



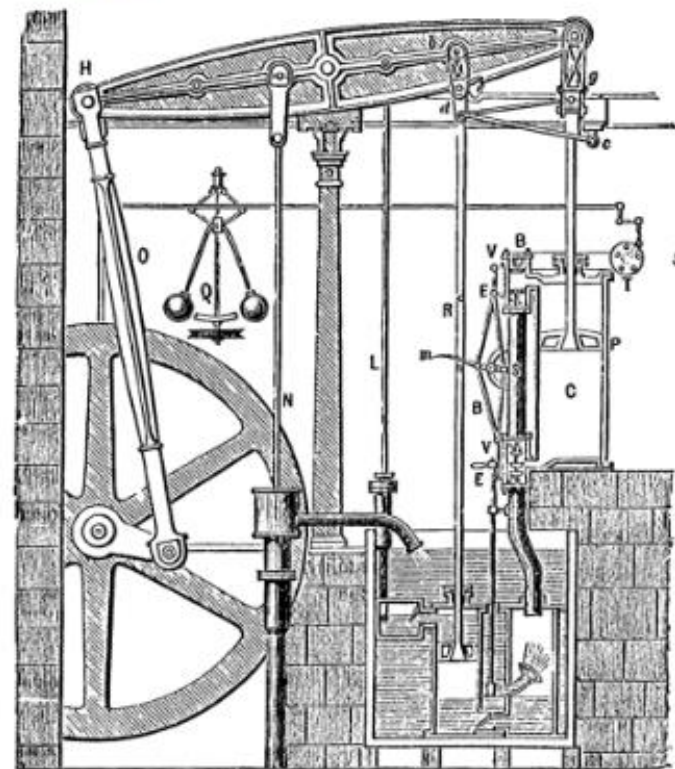
Portrait James Watt, 1792 by Carl Frederik Von Breda

[image](#) is courtesy of wikimedia commons and is public domain

How do steam engines work?



[How a Steam Engine Works Animation, A Working Glass Model of a Steam Engine, Britain's Greatest Machines with Chris Barrie \(5:00- 8:07\)](#)



Sketch showing a steam engine designed by Boulton & Watt, England, 1784.

[image](#) is courtesy of wikimedia commons and is public domain

[How a Steam Engine Works Animation, A Working Glass Model of a Steam Engine, Britain's Greatest Machines with Chris Barrie \(5:00- 8:07\)](#)

2a. What uses did Watt's steam engine have during the Industrial Revolution?

2b. How did the steam engine improve manufacturing and transportation?

3. Innovations in Manufacturing: Putting Out System to the Factory Model

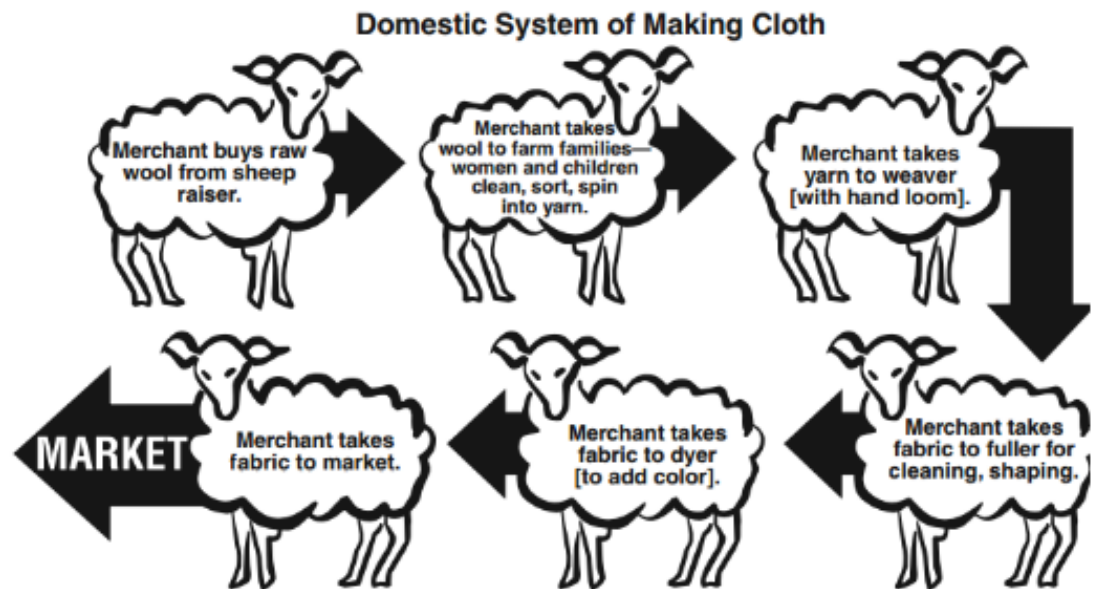
Before the Industrial Revolution: Domestic/Putting Out System

The **Domestic system**, also called the **Putting-out System**, was a system used in 17th-century western Europe in which merchants provided materials, like cotton, to workers in rural areas who usually worked in their homes to produce goods like clothing. Workers returned finished products to the merchants and were paid for each finished product they produced. The merchants bought the raw materials like cotton and then sold the finished products, so they only paid workers for their labor. The advantages to the merchant were the lower wage costs and increased efficiency due to the **division of labor**. Division of labor is the separation of steps in the process of making something into different jobs. For example, the merchants were in charge of getting cotton, and the rural workers were responsible for turning the cotton into yarn.

Source: *Encyclopædia Britannica Online*, s. v. "domestic system", accessed November 19, 2015, <http://www.britannica.com/technology/domestic-system>.

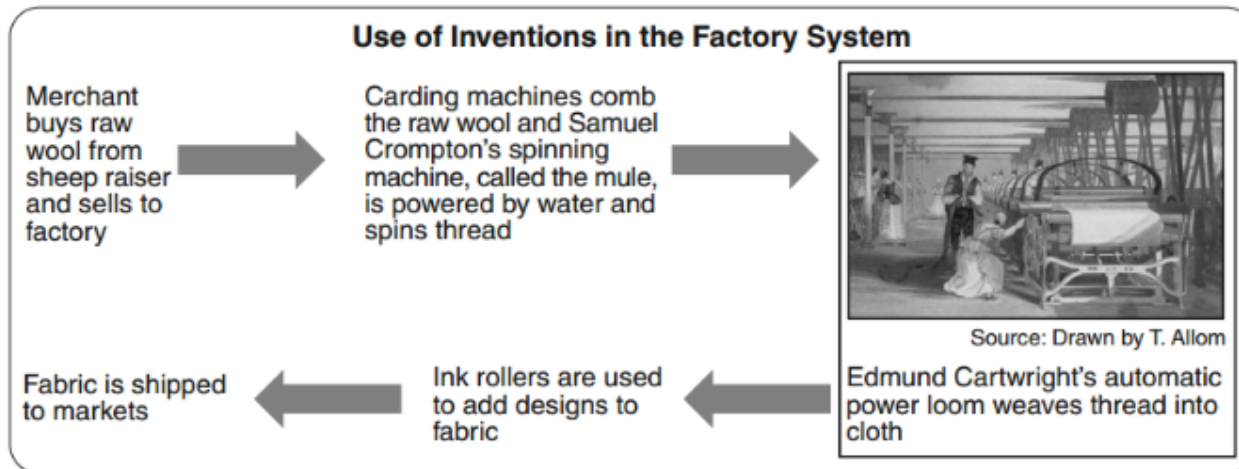


Illustration of two women working at home to make finished goods as part of the **domestic system**.



Source: Farah and Karls, *World History: The Human Experience*, Section Focus Transparencies, Glencoe McGraw-Hill (adapted) from the NYS Global History and Geography Regents Exam, January 2009.

Industrial Innovation: Factory System



Source: NYS Global History and Geography Regents Exam, January 2009.

The **factory system** of manufacturing that began in the early 18th century was based on

- requiring workers to come to a factory to produce goods
- division of labor (separating the steps of making something into separate jobs)
- keeping the cost of making something as low as possible
- mass production (making a lot of the same good)

The factory system **replaced the domestic system**. The use of **waterpower** and then the **steam engine** to **mechanize** processes such as cloth weaving in England in the second half of the 18th century marked the beginning of the factory system. The introduction of **interchangeable parts** made the factory system even more efficient. Interchangeable parts were first introduced to the production of guns, but later applied to other goods. Prior to this, each part of a gun (or anything else assembled from multiple components) had been individually shaped by a workman to fit with the other parts which took a long time and made it difficult to create replacement parts for the gun if something malfunctioned. In the new system, the gun parts were created so precisely that a part of any gun could be replaced by the same part from any other gun of the same design. This advance signaled the start of **mass production**, in which **standardized parts** could be assembled by relatively **unskilled workmen** into complete finished products.

The resulting system, in which **work was done on machines powered by water or coal** and **goods were produced on a large scale** had important social effects: formerly, workers had been independent craftsmen who owned their own tools and designated their own working hours, but in the factory system, the **employer owned the tools and raw materials** and set the hours and other conditions under which the workers labored. The location of work also changed. Whereas many workers had lived in rural areas under the domestic system, the factory system **concentrated workers in cities and towns** because the new factories had to be located near waterpower and transportation (alongside waterways, roads, or railways). Also, many of the new **unskilled jobs could be performed equally well by women, men, or children**, so factory owners hired whoever would work for the least amount of money which **lowered wages**. Factories tended to be poorly lit, cluttered, and unsafe places where workers put in **long hours for low pay**.

Source: Adapted from *Encyclopædia Britannica Online*, s. v. "factory system", accessed November 19, 2015, <http://www.britannica.com/topic/factory-system>.

3a. Describe the Domestic System of manufacturing goods.

3b. Who benefited the most from the Domestic System (merchant or rural worker)? Why?

3c. What are the differences between the Domestic System and the Factory System?

Industrial Innovations in Manufacturing

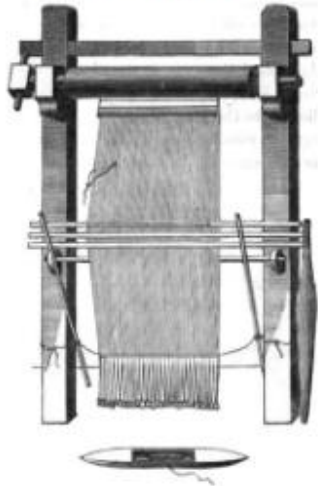
Before Industrial Revolution

Wool was spun in homes and made into yarn



Source: The Costume of Yorkshire, Richard Jackson, Publisher from the NYS Global History and Geography Regents Exam, August 2005.

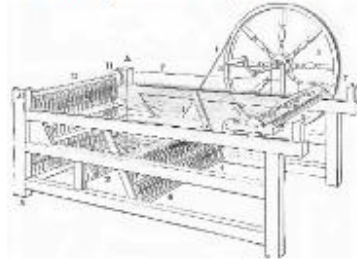
Yarn was turned into fabric by people in their homes using hand looms.



[Image](#) is courtesy of wikimedia commons and is public domain

Early Industrial Revolution

▶ [PBS video on water frame](#)
Spinning Jenny, invented in 1764, and the water frame, invented in 1769 mechanized the process of spinning wool into yarn and improved the quality and speed of the process.



Workers used more complex frame looms. They used an invention called a flying shuttle to pass yarn from one side of the fabric to another with ease.



Hand Loom Weaving by Hogarth

[Image](#) is courtesy of wikimedia commons and is public domain

Late Industrial Revolution

The power loom spun wool into yarn and weaved that yarn into thread

▶ Watch an excerpt of the video [“Factories and Machines”](#) from [Timelines.tv](#) (start- 1:22) to observe the effects of the POWER LOOM.



Sketch of a power loom (1892).

[Image](#) is courtesy of wikimedia commons and is public domain

[PBS video on water frame](#)

Watch an excerpt of the video [“Factories and Machines”](#) from [Timelines.tv](#) (start- 1:22) to observe the effects of the POWER LOOM

3e. Identify three innovations in manufacturing that took place during the Industrial Revolution?

4. Innovations in Transportation

Industrial Innovation in Transportation: Turnpikes



Turnpike in Romania, 1877 by The Graphic
[Image is courtesy of Wikimedia Commons and is public domain](#)

As trade increased in the mid-1700s, merchants needed better roads to travel on. To pay for new and improved roads, the Parliament in England started to issue local governments the right to create **turnpikes**, roads that required users to pay tolls. The tolls were used to pay for road repairs and upgrades. A pike was a barrier laid across the road that prevented people from using it until they paid. The operator then turned or lifted the pike to allow them to pass.

Industrial Innovation in Transportation: Canals



The Bridgewater Canal in England 1887 by Hedley Fitton
[Image is courtesy of Wikimedia Commons and is public domain](#)

Canals are **man-made waterways** used to transport people and goods from one place to another that usually connect to a larger body of water like a river, lake, or sea. As manufacturing increased during the industrial revolution, the need to transport heavy fuel like coal and more finished products made transporting over land less effective. As a result, large canal systems were built all over England and other countries.

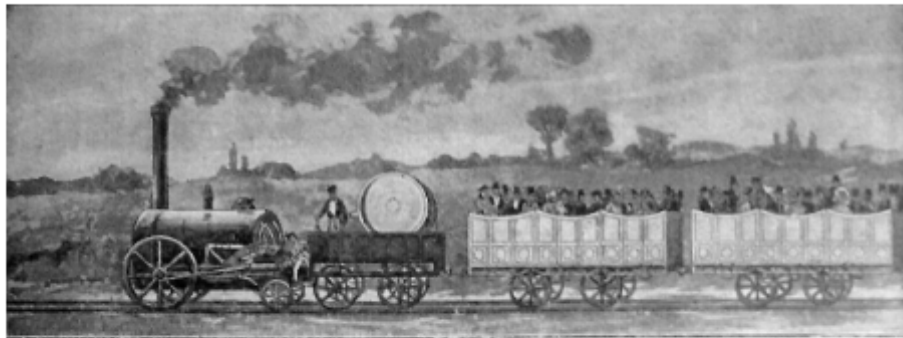
Industrial Innovation in Transportation: Locomotives (Trains)

▶ Watch an excerpt from [Britain's Greatest Machines with Chris Barrie \(16:44- 18:35 the first locomotive, 24:00- 27:45 the first passenger locomotive, 34:43-39:43 early locomotive competition, 41:34-end\)\)](#) for a brief history of early trains in Great Britain.

In the 1500s, 1600s, and for most of the 1700s, railroad tracks were used to move goods from one place to another over short distances but they were pushed or pulled using human muscle or animal power. **James Watt's steam engine** (1774) breathed new life into the railroad when it was adapted to pull railcars for the first time by English inventor Richard Trevithick's **locomotive** in 1804. Innovators throughout Great Britain, the United States, and Europe improved upon Watts and Trevithick's technology creating faster, more powerful, more efficient, and safer trains.

The speed and power of trains transformed the lives of those who used them to travel and ship goods. Before the locomotive, the fastest way to travel overland was on horseback which averaged around 30 mph, but was uncomfortable, required frequent stops for rest, and could carry very little weight. In contrast, by 1829 George Stephenson's locomotive, *Rocket*, could travel 29 mph and one hundred years later trains were traveling at speeds over 120 mph. Locomotives only required fuel, like coal to keep moving and could pull massive loads.

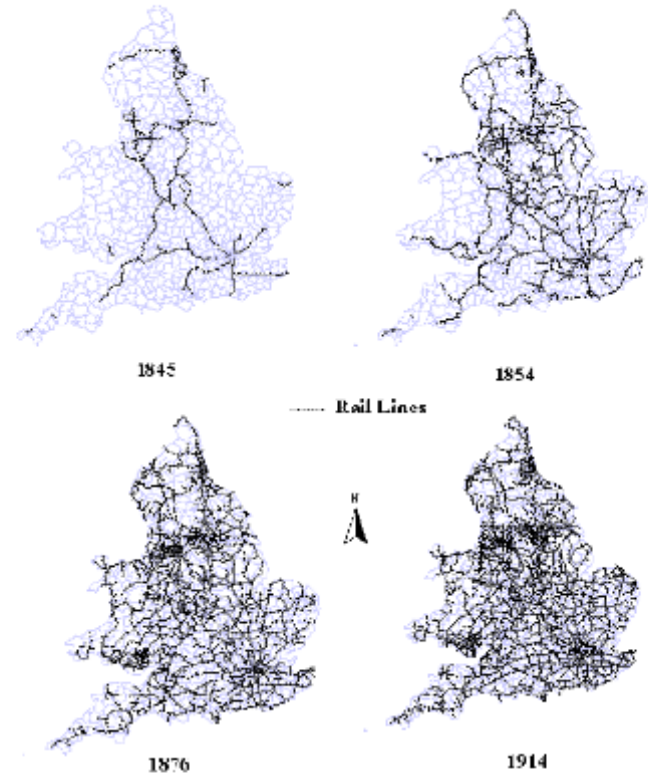
Railroad lines quickly spread throughout Great Britain and all over the world bringing people and goods closer to one another than they had ever been before.



The first passenger carriage in Europe, 1830, George Stephenson's steam locomotive, Liverpool and Manchester Railway

[Image](#) is courtesy of wikimedia commons and is public domain

The Extension of the Railway System in England and Wales, 1845-1914



Source: © Robert Schwartz Mt. Holyoke College.
https://www.mtholyoke.edu/courses/rschwartz/rail/intro_hist_gis.htm from the NYS Social Studies Toolkit.

Watch an excerpt from [Britain's Greatest Machines with Chris Barrie \(16:44- 18:35 the first locomotive, 24:00- 27:45 the first passenger locomotive, 34:43-39:43 early locomotive competition, 41:34-end\)\)](#) for a brief history of early trains in Great Britain.

- 4a. Explain how turnpikes & canals improved transportation during the Industrial Rev.?**
- 4b. What earlier innovation of the Industrial Rev. was used to create the first locomotive?**
- 4c. Based on the map of the railway system in England & Wales (1845-1914), how did the state of rail lines change during the period represented in the maps?**
- 4d. What were the benefits of using locomotives to transport people & goods over horsepower?**



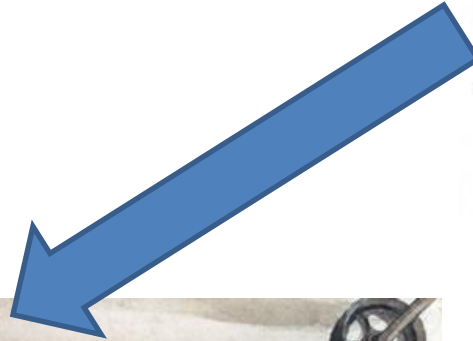
1st

Fabric first made by hand in the home



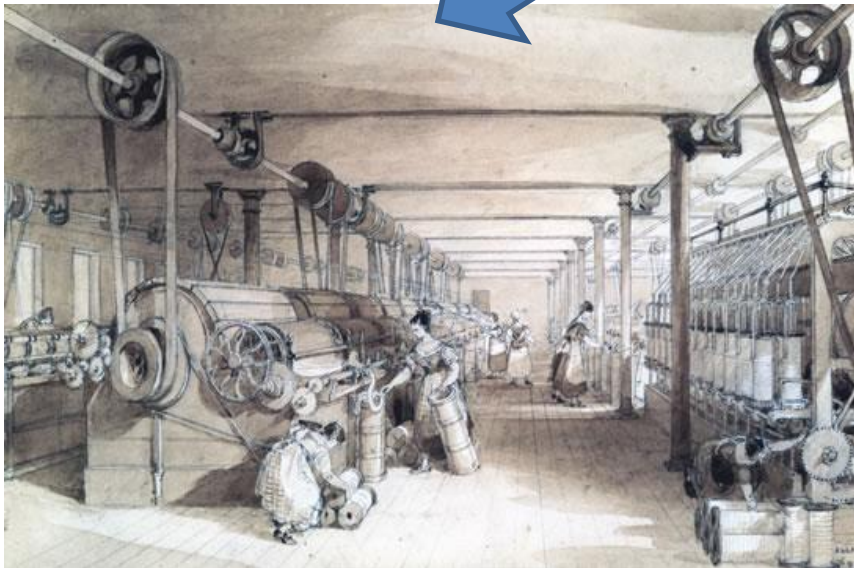
2nd

Then by machine in the home



3rd

Finally, With all the new machines used to produce clothing, factories were made to house all of the production



Why does the I.R. begin in England?

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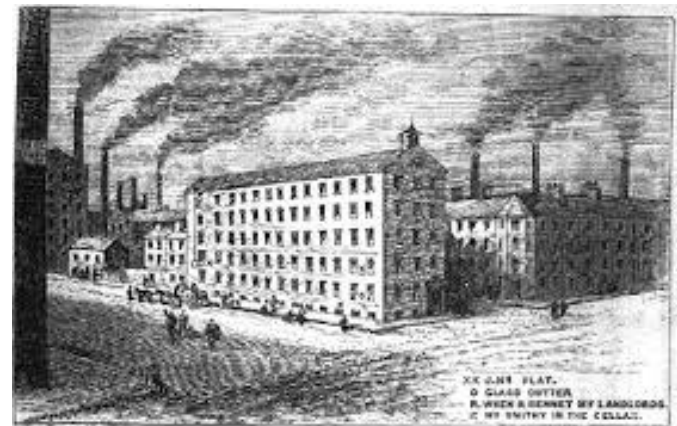
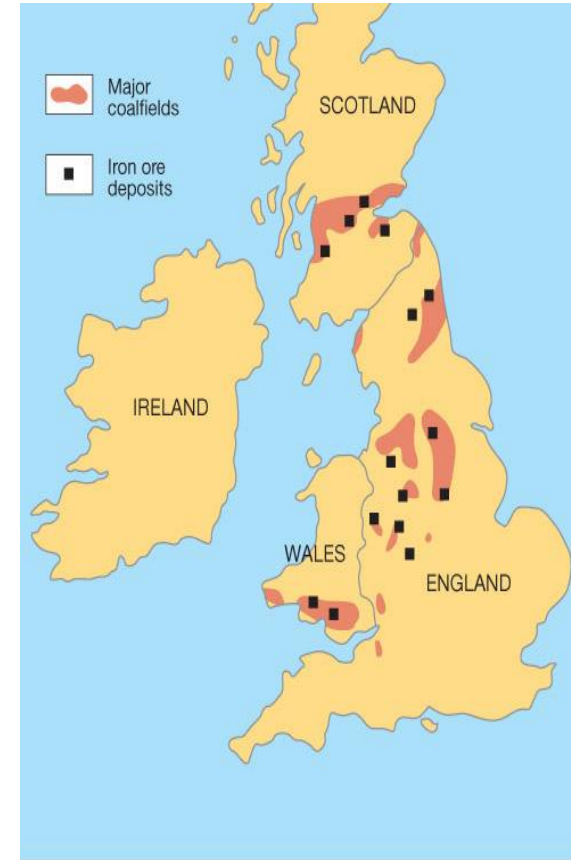
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Why does the I.R. begin in England?

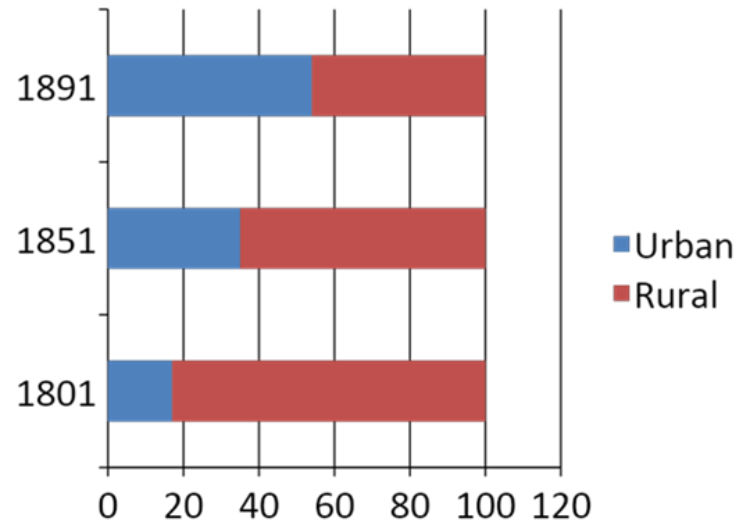
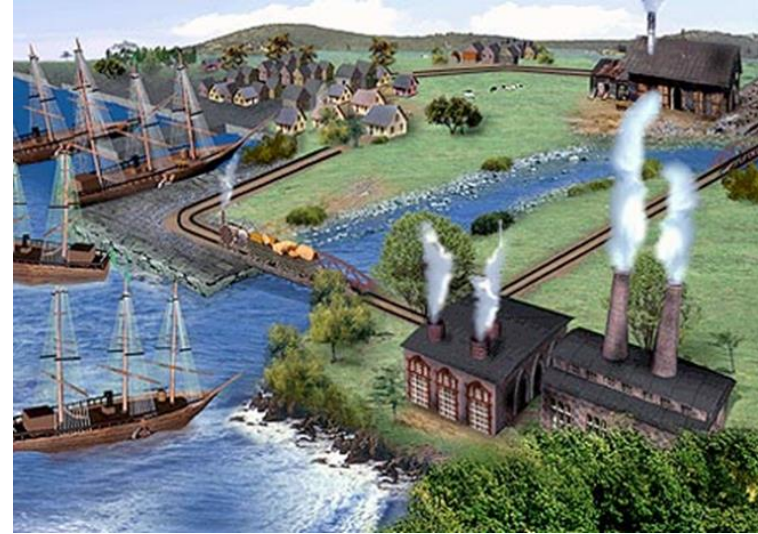
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What historical circumstances & geographic context led to the Industrial Revolution in Great Britain?

Task: Explain the historical circumstances and geographic context that led to the Industrial Revolution in Great Britain.

When?

date, year, era, "before __," "after __"

Where?

continents, regions, countries, geographic features nearby, describe the geography if relevant

Why?

use words and phrases like "led to," "because," and "so" to show connections between events and to explain why

Combined Contextualization:

Why did it happen when and where it happened?

Industrialization by 1850



- Manufacturing and industrial areas
- No peasant emancipation before 1848
- Railways by 1850
- Banks

- Coal mining
- Iron industry
- Textile industries
- Silk industries

- Major cities:
- 1820
 - 1850



Connect Cause
and Effect



Identify
Patterns

Why did the Industrial Revolution start in Great Britain in the 1750s? What historical circumstances and geographic context led to the Industrial Revolution in Great Britain?

→ **Directions:** As you read through the following documents take notes in the graphic organizer below to help you answer the questions above.

Document Title	Notes: Why did the Industrial Revolution start in Great Britain in the 1750s? What historical circumstances and geographic context led to the Industrial Revolution in Great Britain?
Cause #1: Geography-Location, Geographic Features, and Natural Resource	
Cause #2: Agricultural Revolution	
Cause #3: New Technology	
Cause #4: Colonial Markets for Raw Materials and Goods	

Cause #1: Geography- Location, Geographic Features, and Natural Resources

Location

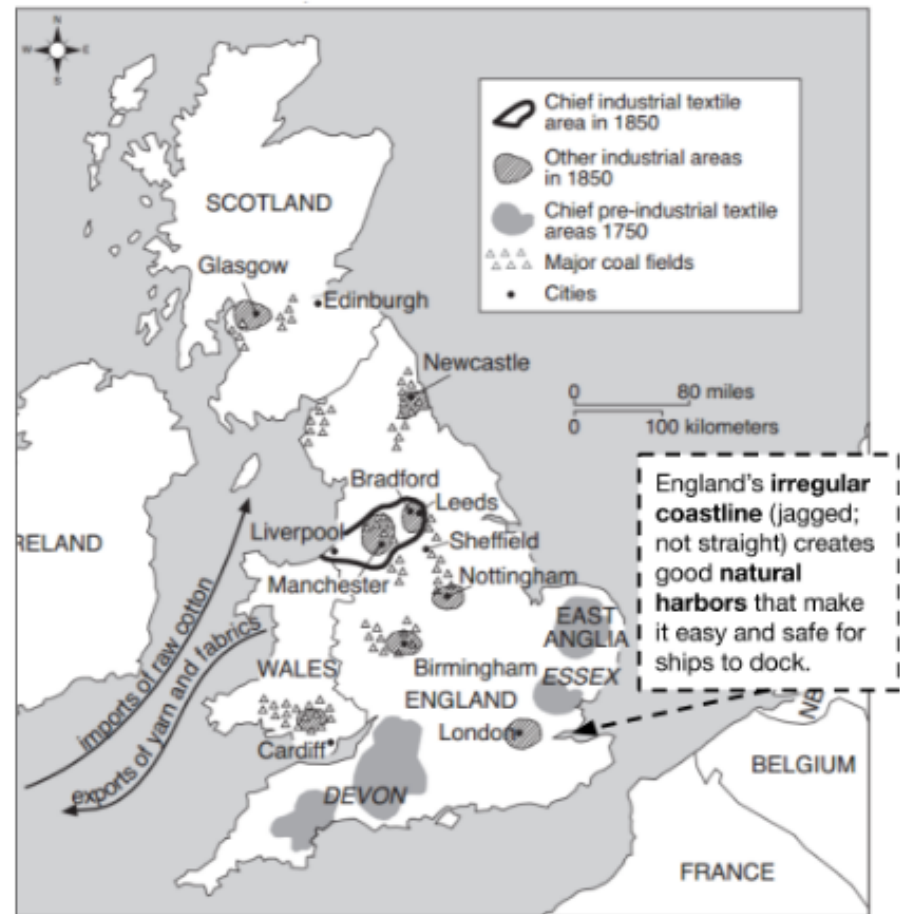
Great Britain is the main island of the modern-day country called the United Kingdom and is located northwest of mainland Europe. The Atlantic Ocean is to the west, the North Sea is to the northeast and the English Channel separates Great Britain from France. Because of its location close to mainland Europe and surrounded by major bodies of water, Great Britain was a leader in overseas trade with connections to the Mediterranean Sea and the rest of Europe and to the Americas across the Atlantic Ocean and to Asia around the tip of Africa. As the Industrial Revolution progressed, Great Britain's location made it easy to ship raw materials to factories and finished goods to other places to be sold.

Geographic Features

Two of Great Britain's common geographic features made it a good place to manufacture goods and ship them. First, the island has many gently-flowing rivers which early factories used as energy sources by placing water wheels in the rivers which turned the gears in their factories to run the machines that made goods. The rivers were also used to ship goods to and from factories. The second geographic feature, is an irregular coastline which often creates safe places for ships to dock, called harbors. Great Britain's natural harbors led to the creation of cities that were centers of shipping. Boats carrying goods and people came from the Atlantic Ocean, the North Sea, and English Channel to Great Britain's harbors where their cargo was sold or shipped inland on rivers.

Natural Resources

Great Britain was rich with a natural resource that became very important later in the Industrial Revolution and is still important today, coal. Coal is a rock that is combustible, meaning that it burns easily when set on fire. Coal fueled engines that replaced water wheels as the main source of energy for factories and since it was prevalent in Great Britain, there was an inexpensive source that could be used to power factories and later, trains.



Source: Adapted from Holt and O'Connor, *Exploring World History Workbook*, Globe Book Company (adapted) from the NYS Global History and Geography Regents Exam, August 2007



Learn more about coal by watching this video from [Student Energy](#) entitled "[Coal 101.](#)"

Learn more about coal by watching this video from [Student Energy](#) entitled "[Coal 101.](#)"

Cause #2: Agricultural Revolution


New tools, fertilizers, and harvesting techniques during the **Agricultural Revolution** increased productivity which resulted in an increase in population. Innovations, such as the seed drill, made the process of planting seeds easier and more efficient which meant that fewer farmers were needed to produce the same amount of food. Since there were fewer jobs in rural areas, many **farmers and their families migrated to cities** where factories hired large numbers of workers.

Cause #3: New Technology

New technological innovation in machinery meant that factories could produce more goods in less time, for less money. The cheaper goods were produced, the more money factory owners made and the faster the Industrial Revolution grew and spread.

... Four great inventions altered [changed] the character of the cotton manufacture; the **spinning jenny**, patented by Hargreaves in 1770; the **water-frame**, invented by Arkwright the year before; **Crompton's mule** [spinning machine] introduced in 1779, and the self-acting mule, first invented by Kelly in 1792, but not brought into use until Roberts improved it in 1825. None of these by themselves would have revolutionised the industry. But in 1769...**James Watt** took out his patent for the **steam-engine**. Sixteen years later it was applied to the cotton manufacture. In 1785 Boulton and Watt made an engine for a cotton-mill at Papplewick in Notts, and in the same year Arkwright's patent expired. These two facts taken together mark the introduction of the factory system.

Source: Arnold Toynbee, Lectures on the Industrial Revolution of the 18th Century in England, Humboldt (adapted) from the NYS Global History and Geography Regents Exam, June 2006.

Invention	Description
 Improved steam engine (James Watt)	Improved version of steam engine that used coal rather than water power. First used to pump water from mines and to forge iron. By the late 1780s, powered machines in cotton mills.

Source: Ellis and Esler, World History: Connections to Today, Prentice Hall, 1999 (adapted) from the NYS Global History and Geography Regents Exam, January 2013.

Cause #4: Colonial Markets for Raw Materials and Goods

As a result of the **Age of Exploration**, Great Britain became wealthy and powerful, and gained **colonies** in North and South America, Africa, and South Asia. During the Industrial Revolution, English traders brought raw materials like cotton from its colonies to the factories in Great Britain where they were turned into finished goods. These manufactured goods were then sold throughout Great Britain, Europe, the United States, and back to people living in the British colonies. The money made from selling manufactured goods to Britain's colonies fueled the expansion of industry at home.

