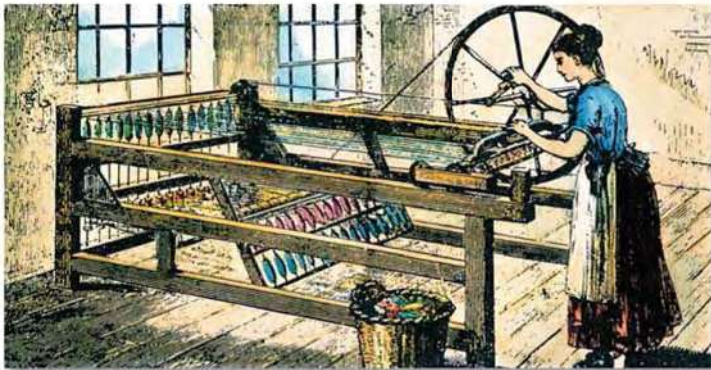
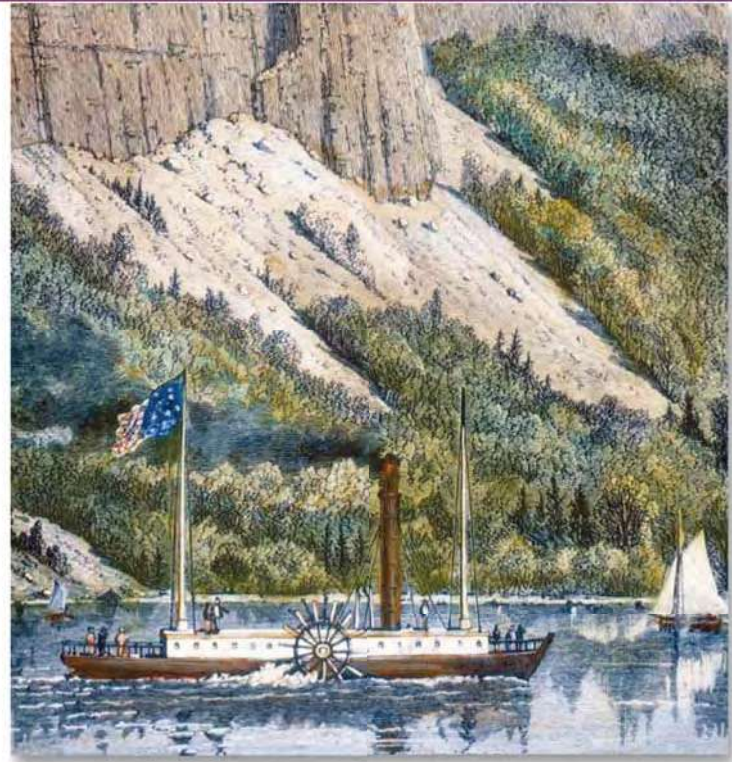


# A Period of Change

The period from 1700 to 1914 was a time of tremendous scientific and technological change. The great number of discoveries and inventions in Europe and the United States promoted economic, social, and cultural changes. Use the information on these six pages to study the impact of scientific and technological changes.



### ▲ Spinning Jenny

Using James Hargreaves's invention, a spinner could turn several spindles with one wheel and produce many threads. Machine-made thread was weak, so it was used only for the horizontal threads of fabric.

### Theory of Atoms

John Dalton theorized that atoms are the basic parts of elements and that each type of atom has a specific weight. He was one of the founders of atomic chemistry.

### ▲ Steamboat

Robert Fulton held the first commercially successful steamboat run. One advantage of a steamboat was that it could travel against a river's current. These boats soon began to travel rivers around the world.



### 1733 Flying Shuttle

A shuttle is a holder that carries horizontal threads back and forth between the vertical threads in weaving. John Kay's mechanical flying shuttle enabled one weaver to do the work of two.

### 1785 Power Loom

Edmund Cartwright created the first water-powered loom. Others later improved on the speed and efficiency of looms and the quality of the fabrics.

### 1830 ▼ Steam Locomotive

In 1830, the first steam locomotive was put into operation in the United States. Besides passengers, locomotives could rapidly transport tons of raw materials from mines to factories, and manufactured goods from factories to consumers and ports.





### Panama Canal

The Panama Canal shortened trips between the Atlantic and Pacific oceans by thousands of miles since ships no longer had to go around South America.

### ◀ Radioactivity

Marie Curie won the Nobel prize in chemistry for her (and her late husband's) discovery of the elements polonium and radium. Their work paved the way for later discoveries in nuclear physics and chemistry.

### Antiseptics

Joseph Lister pioneered the use of carbolic acid to kill bacteria in operating rooms and later directly in wounds. The rate of death by infection after surgery dropped from about 50 to 15 percent.

**Radio**  
Guglielmo Marconi's radio sent Morse code messages by electromagnetic waves that traveled through the air. It enabled rapid communication between distant places.

1865

1876

1879

1895

1903

1908

1911

1914

### ▼ Telephone

Alexander Graham Bell produced the first instrument that successfully carried the sounds of speech over electric wires. The telephone's design underwent a number of changes in its early years.



### Light Bulb

The light bulb that Thomas A. Edison and his staff made was first used in businesses and public buildings that installed small lighting plants. Cities slowly built the electrical systems needed to power lights.

### Airplane

The Wright brothers built the first machine-powered aircraft, which burned gasoline. The edge of the wing was adjusted during flight to steer.

### Model T Ford

By using a moving assembly line, Henry Ford produced an automobile that working people could afford to buy.

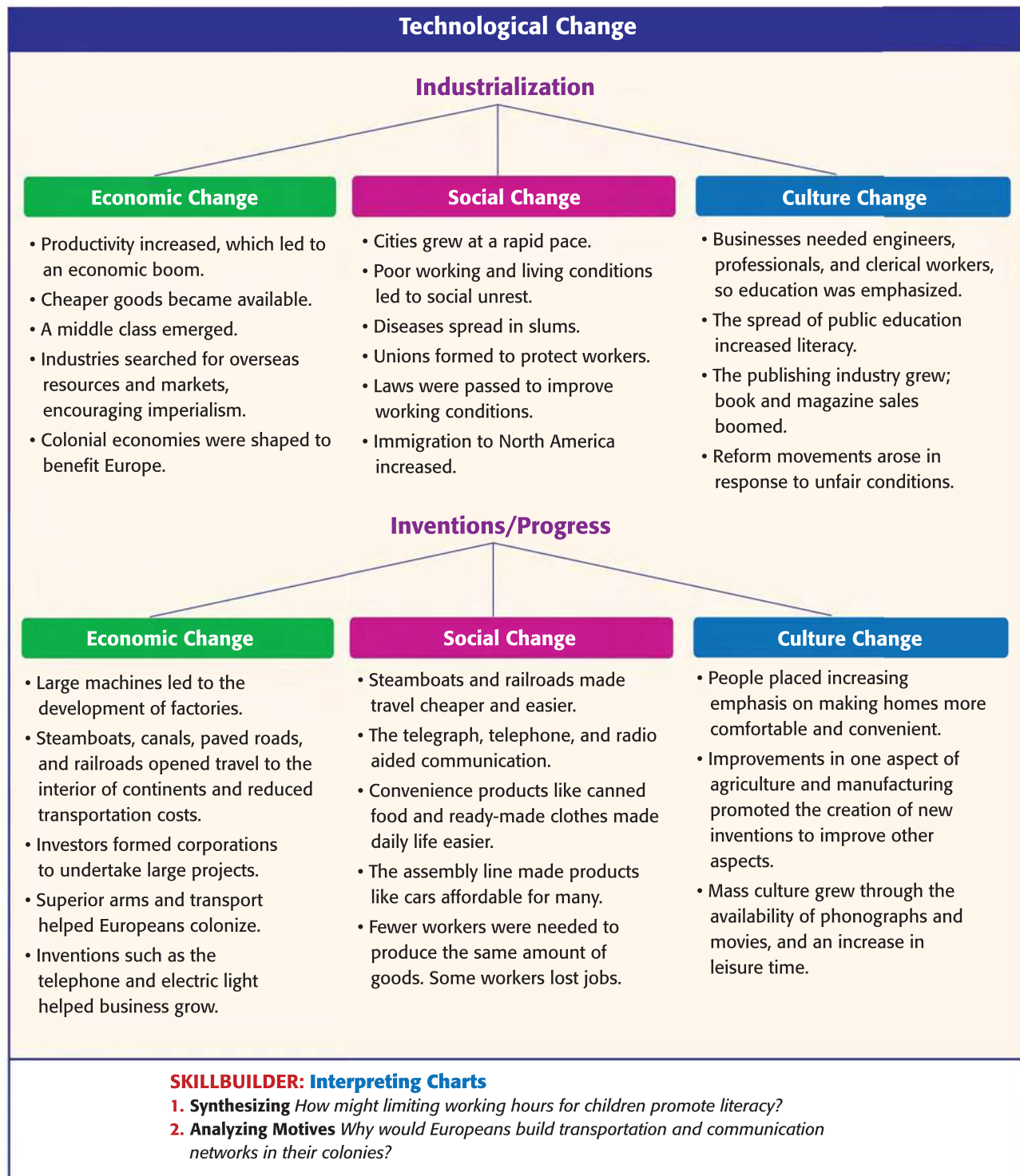
## Comparing & Contrasting

1. How were the steamboat and the locomotive similar in their impact?
2. How did the scientific theory of John Dalton differ from Joseph Lister's discovery in terms of its impact on daily life?



# Impact of Technological Change

Use the charts below, and the documents and photograph on the next page, to learn about some of the great changes technology produced.



## PRIMARY SOURCE

### Child Workers in Textile Factory

Many jobs did not require skilled workers, so children were hired to do them because they could be paid lower wages than adults. Some industries also hired children because their small fingers could fit between the machinery or handle fine parts more easily than adult fingers could.



#### DOCUMENT-BASED QUESTION

*Judging by the children's appearance, how generous were the wages they received? Explain your answer.*

## PRIMARY SOURCE

INTERACTIVE

### Impact of the Telephone

In this excerpt from "Thirty Years of the Telephone," published in September 1906, John Vaughn discussed how Bell's invention affected life in the United States.

Various industries, unknown thirty years ago, but now sources of employment to many thousands of workers, depend entirely on the telephone for support. . . . The Bell Companies employ over 87,000 persons, and it may be added, pay them well. . . . These figures may be supplemented by the number of telephones in use (5,698,000), by the number of miles of wire (6,043,000) in the Bell lines, and by the number of conversations (4,479,500,000) electrically conveyed in 1905. The network of wire connects more than 33,000 cities, towns, villages, and hamlets.

#### DOCUMENT-BASED QUESTION

*What were some of the effects of the invention of the telephone?*

## SECONDARY SOURCE

INTERACTIVE

### How Technology Aided Imperialism

In this excerpt from the book *Guns, Germs, and Steel*, Jared Diamond related an incident to show how technology helped Europeans conquer other lands.

In 1808 a British sailor named Charlie Savage equipped with muskets and excellent aim arrived in the Fiji Islands. [He] proceeded single-handedly to upset Fiji's balance of power. Among his many exploits, he paddled his canoe up a river to the Fijian village of Kasavu, halted less than a pistol shot's length from the village fence, and fired away at the undefended inhabitants. His victims were so numerous that . . . the stream beside the village was red with blood. Such examples of the power of guns against native peoples lacking guns could be multiplied indefinitely.

#### DOCUMENT-BASED QUESTION

*How did guns give Europeans an advantage over native peoples?*

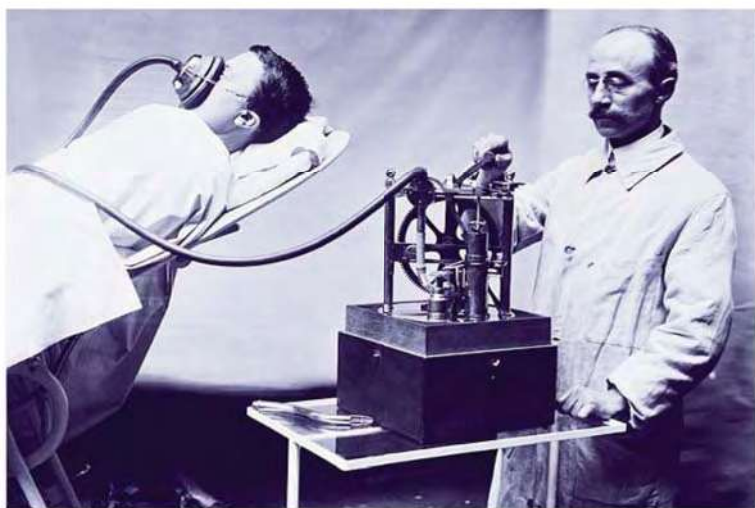
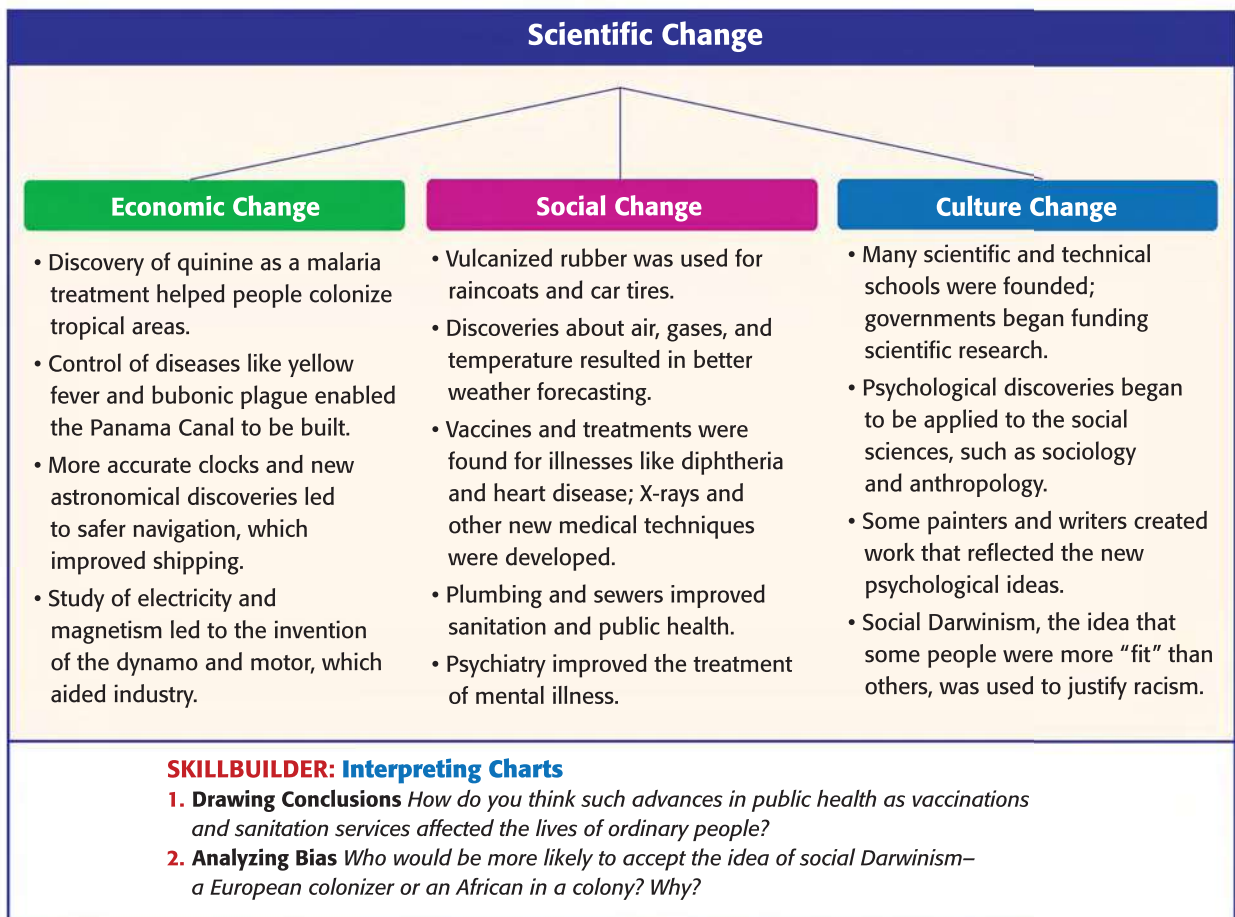
## Comparing & Contrasting

1. Reread the passage by John Vaughn and then compare it with the information on the chart. What could you add to the chart based on this passage?
2. Does the photograph of factory workers confirm or contradict the information on the chart? Explain.



# Impact of Scientific Change

Many scientific discoveries resulted in practical applications that affected daily life. Other discoveries increased our understanding of the way the universe works. Use the information on these two pages to explore the impact of scientific change.



**PRIMARY SOURCE**

### Chloroform Machine

The person with the mask is receiving the anesthetic chloroform. By removing pain, anesthetics enabled doctors to perform procedures—such as surgery—that would have been difficult for the patient to endure.

**DOCUMENT-BASED QUESTION**

*How did practical inventions, like the chloroform machine, contribute to medicine and other sciences?*

## PRIMARY SOURCE

### Smallpox Vaccination

This newspaper engraving shows a Board of Health doctor administering the smallpox vaccine to poor people at a police station in New York City.

#### DOCUMENT-BASED QUESTION

*Why would public health officials especially want to carry out vaccination programs in poor neighborhoods?*



## SECONDARY SOURCE

### INTERACTIVE

### Impact of Scientific Research

This passage from *The Birth of the Modern* by Paul Johnson discusses the far-reaching results of Michael Faraday's experiments with electromagnetism in the 1820s.

[By 1831, Faraday] had not only the first electric motor, but, in essence, the first dynamo: He could generate power. . . . What was remarkable about his work between 1820 and 1831 was that by showing exactly how mechanical could be transformed into electrical power, he made the jump between theoretical research and its practical application a comparatively narrow one. The electrical industry was the direct result of his work, and its first product, the electric telegraph, was soon in use. The idea of cause and effect was of great importance, for both industry and governments now began to appreciate the value of fundamental research and to finance it.

#### DOCUMENT-BASED QUESTION

*How did Faraday's work affect society in the long term?*

## Comparing & Contrasting

1. In your opinion, was there more economic progress or social progress during the period 1700 to 1914? Use information from the charts on pages 832 and 834 to support your answer.
2. Consider the impact of medical advances and the idea of Social Darwinism on imperialism. How were their impacts alike?

#### EXTENSION ACTIVITY

Research a more recent scientific or technological change, such as the development of computer chips, plastics, the Internet, or space travel. Make a chart like the one shown on page 834 listing the economic, social, and cultural changes that have resulted.