History UNFOLDING

SCIENCE, TECHNOLOGY, AND THE ENLIGHTENMENT

MindSparks
Challenging Students to Think Historically

Contents

Introduction

An Age of Reason

By the mid-1600s, Europe had just about exhausted itself after more than a century of bitter religious warfare arising out of the Reformation and Counter-Reformation.

It was as if a kind of spiritual dead-end had been reached.

Yet the times were not quite as bleak as this. Dynamic forces were at work pushing Europe outward in a great age of exploration and discovery. And one of the forces contributing to this process and feeding off of it was a whole new way of looking at the world—a new way of deciding what was true and of understanding nature and human nature. For this was the time when a great scientific revolution began, upsetting notions about everything. This revolution transformed our understanding and unleashed social, political, technical, and economic forces that would change the world. The age of Enlightenment set the stage for the revolutionary era to come. It gave birth to the modern age.

This set uses 12 visual displays to focus on several key themes in this story of the emergence of science, the age of Enlightenment, and the earliest phases of the industrial transformation of economic life in the 1700s and early 1800s. Each lesson uses three visual displays to explore one broad topic. Briefly, the four lessons are as follows:

Science and the Universe
At the heart of the Scientific Revolution of the 1500s and 1600s were new ideas about the universe and the motions of the planets. The illustrations here focus on that key aspect of the emergence of a scientific approach to nature.

Science, Man, and Society
Given a scientific view of the world, how was human nature itself to be understood? The illustrations here focus primarily on that issue.

Philosophers and Kings
Enlightenment ideas had their greatest impact on the educated and wealthy classes of Europe. This is somewhat ironic, given the way the Enlightenment undermined respect for the old order and the aristocratic class that benefitted from it.

Reason, Technology, and the Industrial Revolution
The Enlightenment and the Scientific Revolution together helped trigger a cumulative and accelerating process of technical and economic change. The illustrations here focus on some key themes at the heart of this early phase of the Industrial Revolution.

Using Photos, Cartoons, and Other Visuals to Teach History

Many textbooks are full of colorful visuals. However, all too often these visuals function primarily as window dressing. They make the text more entertaining, or at least more palatable. Only occasionally do the visuals in textbooks do more than offer simple pictorial reinforcement of ideas already presented in the text. In many cases, they pander to the visual orientation of the young while doing little to help young people master the challenges of the visual media that dominate their lives.

By way of contrast, our approach to using visual materials emphasizes their unique strengths as historical documents. The lessons in this booklet focus students on the visual symbols and metaphors in editorial cartoons, the dramatic qualities of certain photographs, the potential of many images to make abstract ideas more specific and concrete, the implicit biases and stereotypes in certain images, their emotional power, and their ability to invoke the spirit of a time and place. In the process, we make every effort to strengthen students' visual literacy skills in general, as well as their ability to think critically and engage in spirited but disciplined discussions.

How to Use This Booklet

The booklet is divided into four lessons, with three illustrations per lesson. Each lesson consists of the following:

A BACKGROUND INFORMATION SHEET This page provides brief summaries explaining the three illustrations on which the lesson is based and their relevance to the lesson's objectives.

DIGITAL IMAGES The booklet's PDF allows you to project the images for use in your class discussions.

DISCUSSION-ACTIVITY SHEETS
Each sheet displays one illustration. It includes a sequence of questions to help you plan an all-class discussion while using the projected images. The questions take students step by step through an analysis of the illustration. If you wish, you may reproduce these pages and hand them out. In addition to the discussion questions on the illustration itself, one or two follow-up activities are suggested. Some of these can be made into individual assignments. Others will work best as small-group or all-class activities.

Science and the Universe

OBJECTIVES

1. Students will better understand why astronomical discoveries of the 1500s and 1600s helped launch the Scientific Revolution.
2. Students will better appreciate the enormous social and cultural impact of these discoveries.

Use the background information on this page to help your students better understand the three illustrations making up this lesson. The questions and activities presented in the rest of the lesson can be used to help students clarify meanings and debate important issues.

BACKGROUND INFORMATION

Illustrations 1A & 1B

In the 1600s, a new way of looking at the world took hold—a new way of deciding what was true and of understanding nature and human nature. It was the beginning of a scientific revolution that would upset notions about everything from matter and motion, to man's place in the universe, to the nature of the mind and the soul. But it began with ideas about the planets, the stars, and Earth's place in the heavens. In Europe's Middle Ages, it was believed that God created the universe as a home for man, and therefore that Earth must naturally be at its center. Greek Egyptian scientist Ptolemy's Earth-centered universe (Illustration 1A) was accepted by nearly all. In the early 1500s, Polish astronomer Nicolaus Copernicus upset this comforting view by proposing that Earth, like the other planets, revolves around the sun. His notion launched an intellectual revolution.

Illustration 2

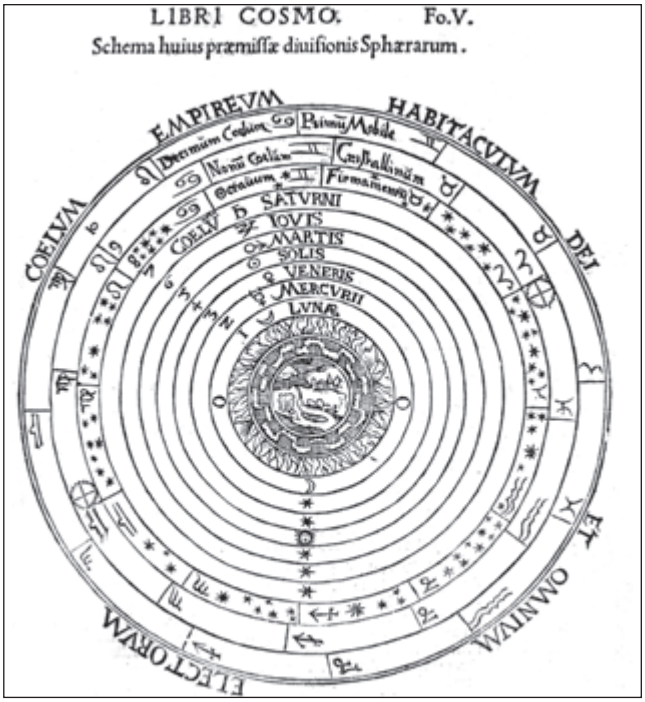
In the late 1500s, Tycho Brahe and Johannes Kepler furthered the work of Copernicus. But it was Italian mathematician Galileo Galilei who, in the 1600s, convinced many that Copernicus was right. With his telescope, Galileo reported seeing mountains on the moon and other moons around Jupiter. In other words, the planets were ordinary matter like the Earth, not the perfect spheres of light previously imagined. The Catholic Church was not happy with Galileo. But this new way of making sense of the world was already attracting wider interest and acceptance.

Illustration 3

Copernicus and Galileo set the stage for the Scientific Revolution, which reached its high point with English physicist Isaac Newton. In 1687, Newton published his *Mathematical Principles of Natural Philosophy*, or the *Principia*. In it, Newton worked out fully the problems posed by Copernicus, Galileo, and many others. He did this by describing the basic laws of all matter and motion, both on Earth as well as in outer space. His three laws of motion are shown here. Newton pictured the universe as a giant machine, ruled by simple and sweeping general laws. Moreover, he inspired others to see that these laws could be discovered by human reason and experimentation. Out of Newton's work came a view of the natural world as more impersonal and mechanistic, but also as more knowable and controllable.

Illustrations 1A & 1B

1A

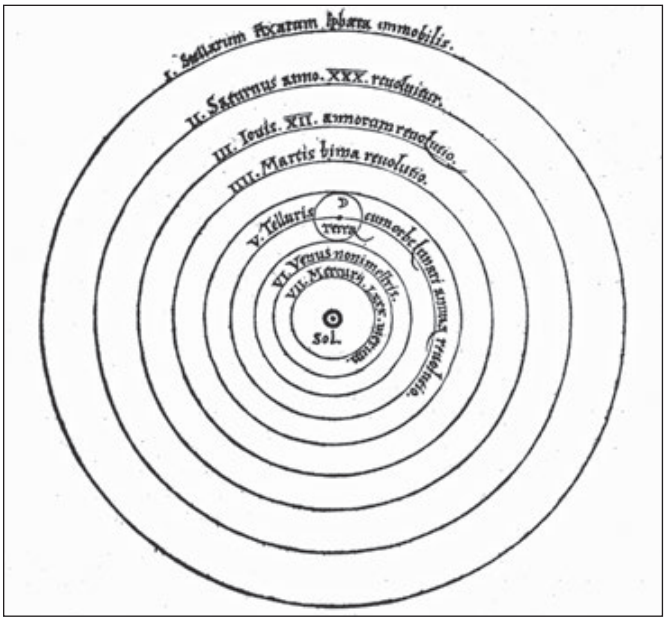


Courtesy of the Lilly Library, Indiana University–Bloomington

Ptolemy's Earth-centered universe

Copernicus's sun-centered universe

1B



Courtesy of the Lilly Library, Indiana University–Bloomington

Discussing the Illustrations

1. In the 1500s and 1600s, a new way of looking at the world began to take hold—a way we would now call scientific. In time, it affected the way people looked at just about every aspect of life. But it began basically with new ways of thinking about the universe. These two diagrams help make the point. Illustration 1A is Ptolemy's version of the universe. Who was Ptolemy?
2. Ptolemy's "geocentric" view of the universe had been accepted for centuries. From the diagram and your knowledge of history, can you explain what this geocentric view of the universe was?
3. In the mid-1500s, a Polish thinker named Nicolaus Copernicus disputed Ptolemy's geocentric view of the universe with his revolutionary new theory of a "heliocentric" universe. Using Illustration 1B, explain what his "heliocentric" theory of the universe was?
4. This heliocentric theory was deeply disturbing and revolutionary in Europe in the 1500s. Why do you think it was so disturbing and revolutionary?

Follow-up Activities

1. In the second century CE, the Greek Egyptian astronomer and mathematician Ptolemy offered a "geocentric" view of the universe—a universe with Earth at the center. Up to the 16th century, Christians found this geocentric view highly reassuring from a religious point of view. Write an essay explaining why Ptolemy's geocentric view of the universe was so reassuring to them.
2. The ideas and theories of Copernicus were not that believable even to many well-educated people at the time. Pretend you are a well-educated European in the 1400s, before Copernicus was born. A friend in another city has written to tell you about some other ancient Greeks (not Ptolemy) who suggested that the earth revolves around the sun. Write a letter back describing your observations of the heavens the previous day and night, and why you find his theory absurd. Do some reading on this subject in order to make your letter as historically believable as possible.