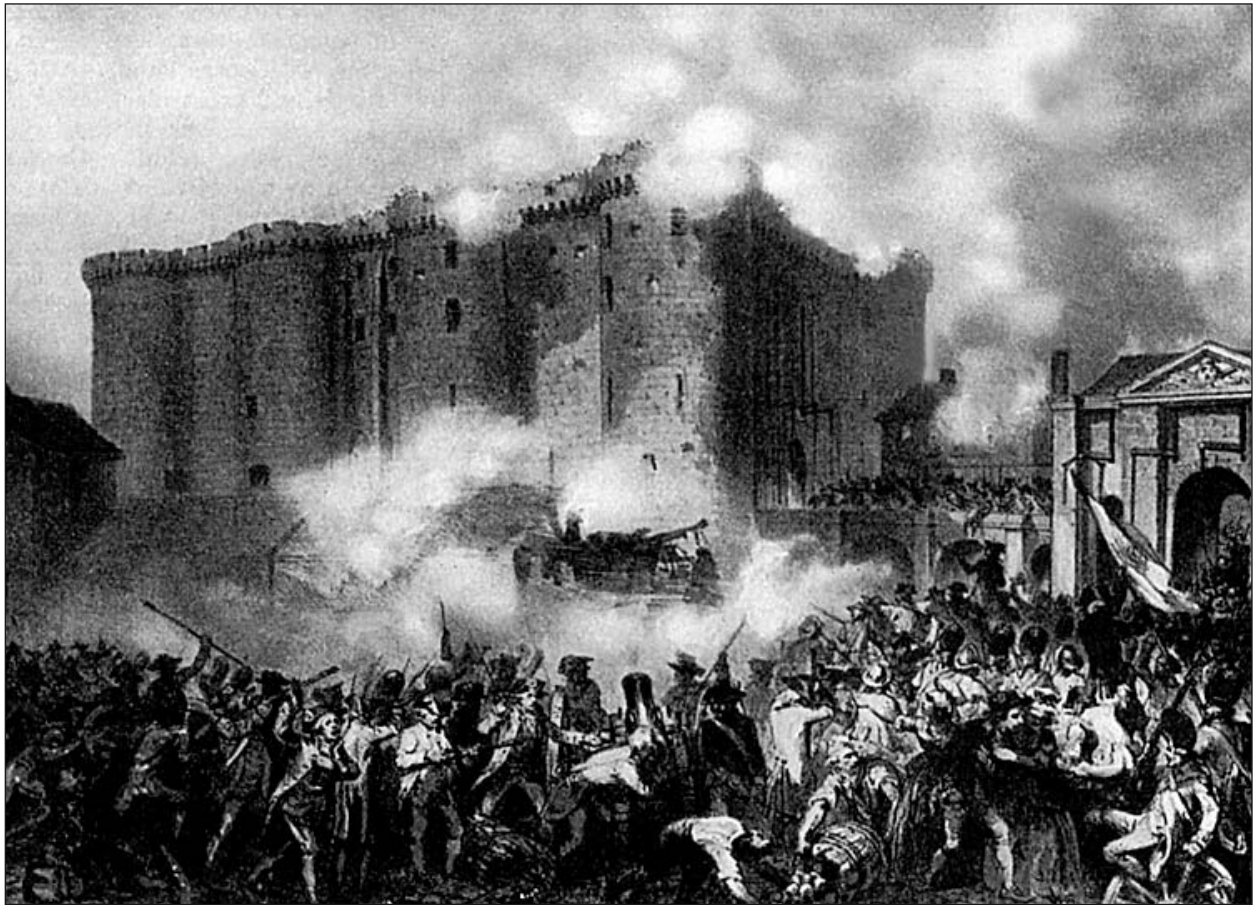


World History Unit 5

An Age of Revolution (1750–1914)

by Jonathan D. Kantrowitz



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THE SCIENTIFIC REVOLUTION

The Scientific Revolution in early modern European history brought about a dramatic shift in the way that scientists described the universe and the place of the earth within it. Discoveries in astronomy, mathematics and physics contributed to this shift in worldview and led to conflicts with long-held beliefs, both scientific and religious.

The 'Scientific Revolution' runs from Nicholas Copernicus (1473-1543) to Isaac Newton (1642-1727).



The beginning of the Scientific Revolution can be traced to Copernicus' bold claim that the earth moves. This claim clearly ran contrary to tradition, to the authority of the Ancients and to established views in the universities and most church officials. Copernicus claimed that the earth is not fixed and stationary in the center of the cosmos but instead argued that it rotates on its axis each day and revolves around the sun each year.

A series of new developments supported Copernicus' view. Among these were new astronomical observations associated with Tycho Brahe (1546-1601); new theoretical modifications concerning planetary orbits and their motions, associated with Johannes Kepler (1571-1630); and not least, new theories of motion that would accommodate a moving earth, these theories associated with Galileo Galilei (1564-1642), and René Descartes (1596-1650).

Galileo was punished by certain important members of the Catholic Church. Remember that in Europe in Galileo's time, there was no separation of church and state; the religious authorities ran the universities and could censor publications, and worked hand-in-hand with the governments of the various countries. Galileo lived in Italy, which was Catholic, and got into trouble with some people close to the Pope.

The basic problem that these religious authorities found was that some of Galileo's scientific discoveries appeared to contradict the official Catholic interpretation of Christian scripture, or to contradict the official Catholic interpretation of Aristotle. For example, Galileo discovered more stars in the sky than are mentioned in the Bible or Aristotle, because he had a telescope and Aristotle and the ancient Hebrews did not. Galileo discovered that a heavier object falls no faster than a lighter one. Therefore the Church authorities claimed that Galileo had contradicted sacred truths.

Galileo pointed out that he was not denying God's perfection or role as a creator; that the Bible did not specify exactly how many stars there were; that some statements in the Bible are not understood literally (for example, even the Church agreed that the sun does not literally "rise"). Galileo and the Scientific Revolution argued that perhaps religious revelation was needed in order to learn the ultimate meaning of things and the way to salvation, but that observation and reasoning would tell us about how things work on an everyday basis; and that any human could learn these things if he or she worked hard enough.

Descartes set himself a dual task: (1) Show that Galileo was right about how to seek knowledge; and (2) Avoid getting imprisoned or executed for this.

This meant that Descartes had to show that true things can be discovered by means of observation and reasoning; and that this independent inquiry did not violate any religious or moral rules.

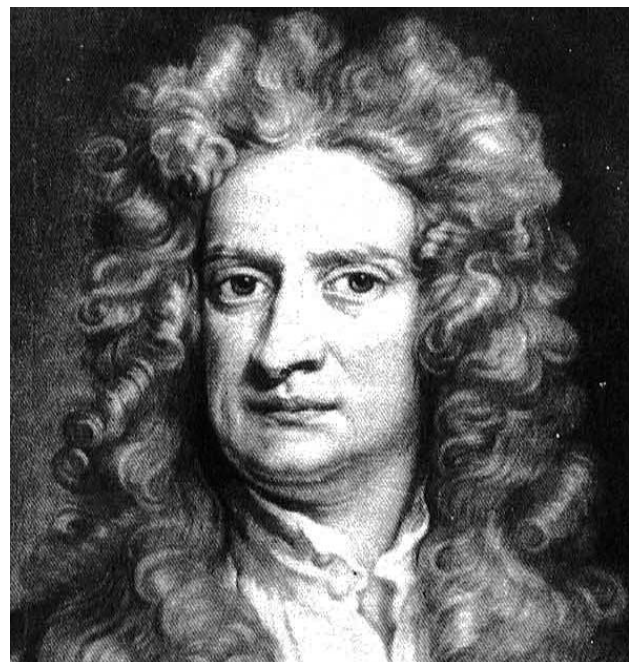
Descartes was uniquely equipped for this project in that he was a mathematical genius (he invented analytic geometry, or what became analytic geometry; the Cartesian coordinate system is named after him), a scientist (he did work in optics and physics), and a philosopher.

Descartes was very careful in his publishing, and got into only minimal trouble with religious authorities. Times were beginning to change politically. But Descartes had to stay out of certain countries for his own safety. He found safe havens in places with more tolerant regimes, and even served as a sort of professor to the Queen of Sweden, who was a very able philosopher and scientist in her own right. Descartes also sent his work informally to philosophers and scientists who he thought would be sympathetic to his projects, and this got the word out.

In addition, Descartes did something new and clever: he put his work out in French as well as in Latin. Latin was the language of the Catholic Church and the universities, so it was important for Descartes to use it. But many people in Europe knew only minimal Latin, and some of these people were able to be very helpful. The people who knew Latin well were Catholic (and some Protestant) clergy, and those who could study at universities. But most of the people at universities were nobility, and all were men. There was a growing number of noblewomen, and members of the merchant and artisan classes of both sexes, who had the resources and the interest to study philosophy and science. They had not had much of a chance so far. French was a language that many people knew; it was used often outside of France. So these people read Descartes with great interest, and provided him with scholarly discussion as well as in some cases political and financial support.

Isaac Newton

Isaac Newton (1642-1727) joined heaven and earth by uniting terrestrial and celestial bodies under one set of universal laws of motion. Newton invented the universe. It displaced the traditional Aristotelian cosmos. Newton's *Principia* formulated the laws of motion and universal gravitation that dominated scientists' view of the physical universe for the next three centuries. It also demonstrated that the motion of objects on the Earth and that of celestial bodies could be described by the same principles. By deriving Kepler's laws of planetary motion from his mathematical description of gravity, Newton removed the last doubts about the validity of the heliocentric (sun-centered) model of planetary system.



Isaac Newton

1. The Scientific Revolution began in the field of
 - a. biology.
 - b. chemistry.
 - c. physics.
 - d. astronomy.

2. The Scientific Revolution was opposed by
 - a. the Catholic church.
 - b. the Queen of Sweden.
 - c. Tycho Brahe.
 - d. Johannes Kepler.

3. Who do you think was the most significant contributor to science in the Scientific Revolution? Why? Use evidence from the text to support your answer.

THE ENLIGHTENMENT IN EUROPE

A result of the Scientific Revolution was the Enlightenment. The Enlightenment changed the way people lived as political and social scholars began to question the workings of society and government, while rejecting traditional ideas. While the Scientific Revolution focused on the physical world, the Enlightenment attempted to explain the purpose of government, and describe the best form of it. The most influential Enlightenment thinkers were Thomas Hobbes, John Locke, Voltaire, Baron de Montesquieu, and Jean Jacques Rousseau.

Enlightenment Thinkers

Descartes: Rene Descartes was the bridge between the Scientific Revolution and the Enlightenment. He said that human reason was capable of discovering and explaining the laws of nature and man. The idea of human reason being superior to tradition led to the beginning of the Enlightenment, a time of political awakening that became revolution.

Hobbes: Thomas Hobbes based his theories of government on his belief that man was basically greedy, selfish, and cruel. In his book *Leviathan*, Hobbes states that life would be a state of constant warfare without a strong government to control man's natural impulses. He believed people would enter into a Social Contract to escape from this. In the Social Contract, people would exchange most of their freedoms for the safety of organized society. Once people entered into this contract, there was no release. Hobbes did not believe in revolutions, and supported the idea of absolute monarchs.

Locke: John Locke also based his theories on his assessment of human nature. However, Locke believed that people could be reasonable and moral. In his book *Two Treatises of Government*, Locke explained that all men have Natural Rights, which are Life, Liberty, and Property, and that the purpose of government was to protect these rights. Furthermore, Locke states that if government does not protect these rights, and becomes bad for the people, then they have a right to revolution. Locke supported a limited government that protected people's natural rights.

Montesquieu: Baron de Montesquieu was an Enlightenment thinker from France who wrote a book called *The Spirit of the Laws* in 1748. In his book, Montesquieu describes what he considers to be the best government. He states that government should divide itself according to its powers, creating a Judicial, Legislative, and Executive branch. Montesquieu explained that under this system each branch would Check and Balance the others, which would help protect the people's liberty. The ideas of Separation of Powers and Checks and Balances can be seen in the government of the United States.

Voltaire: was a French intellectual who wrote and lectured about freedom of speech. Voltaire is best known for saying, "I do not agree with a word that you say, but I will defend to the death your right to say it." He believed that freedom of speech was the best weapon against bad government. He also spoke out against the corruption of the French government, and the intolerance of the Catholic Church.

Rousseau: Jean Jacques Rousseau wrote a book called *The Social Contract*, where he stated that people were basically good, and that society, and its unequal distribution of wealth, were the cause of most problems. Rousseau believed that government should be run according to the will of the majority, which he called the General Will. He claimed that the General Will would always act in the best interest of the people.

Enlightenment ideas helped to stimulate people's sense of individualism, and the basic belief in equal rights. This in turn led to the Glorious Revolution in Britain, the American Revolution, the French Revolution, and the Latin American Revolutions. Some of these revolutions resulted in government based upon the ideas of the Enlightenment, as in Great Britain and the United States.

Elsewhere, a few monarchs retained absolute control of their countries while also enacting reform based on Enlightenment ideas. These monarchs are called Enlightened Despots. In Austria, Maria Teresa and her son Joseph II each introduced reforms based on Enlightenment ideas. They reduced the tax load on the peasants, provided free education, and ended censorship in their empire. In Russia, Catherine the Great introduced similar reforms. She enacted laws for religious toleration and free education, and also sought the advice of nobles and peasants in the running of government. However, these reforms seldom outlived the monarchs who had enacted them.

1. The ideas in the Declaration of Independence can be traced to
 - a. Descartes.
 - b. Hobbes.
 - c. Locke.
 - d. Montesquieu.

2. The ideas in the U.S. Constitution can be traced to
 - a. Rousseau.
 - b. Hobbes.
 - c. Locke.
 - d. Montesquieu.

3. The First Amendment to the U.S. Bill of rights can be traced to
 - a. Voltaire.
 - b. Hobbes.
 - c. Locke.
 - d. Montesquieu.

4. Which Enlightenment thinker do you think had the most influence on the American Revolution? Why? Cite evidence from the text to support your position.
