The Scientific Revolution and The Enlightenment

Reason’s Triumph
16th-18th Centuries
Topic 16: Condensed and Basic
Scientific Revolution
Scientific Revolution
Scientific Revolution

- Copernicus (Polish) - earth round; rotates; revolves around sun
- Risked punishment for view against church.
- Church view = Ptolemaic View
Nicolaus Copernicus (19 February 1473 – 24 May 1543)

Renaissance astronomer

First to formulate heliocentric cosmology

displaced the Earth from the center of the universe

Book: De revolutionibus orbium coelestium
New Theories about the Universe

- Johannes Kepler = mathematical proof that planets orbit sun at changing speeds and in ellipses
- Copernicus thought constant speed and orbits circular
Kepler
Kepler

- December 27, 1571 – November 15, 1630
- German mathematician, astronomer and astrologer,
- best known for his eponymous laws of planetary motion, codified by later astronomers,
- *Astronomia nova, Harmonices Mundi, and Epitome of Copernican Astronomy*.
- one of the foundations for Isaac Newton's theory of universal gravitation.
Challenging the Church

• 1632 – Gaileo uses telescope to confirm Copernicus

• Pope Urban VIII puts him on trial

• Galileo recants
Galileo

- improvements to the telescope
- consequent astronomical observations, and support for Copernicanism
- telescopic confirmation of the phases of Venus,
- discovery of the four largest satellites of Jupiter
- Sunspots
- improved military compass and other instruments
Galileo
New ways of Thinking

- Francis Bacon – scientific method
- Method = deduce conclusion based on observations and experiments
- Don’t assume a truth to try to prove
Bacon
Francis Bacon

- father of empiricism
- *inductive* methodologies for scientific inquiry,
- often called the Baconian method, or simply the scientific method.
- new turn in the rhetorical and theoretical framework for science, much of which still surrounds conceptions of proper methodology today.
René Descartes

- Je pense, donc je suis.

- Cogito ergo sum
Descartes
More Descartes
Newton’s Universe

- *Principia* = explains and expands Copernicus, Galileo, Kepler
- Theory of Gravity ("Just a theory"?)
- Math = describes reality
Newton

- universal gravitation
- three laws of motion
- showed that the motions of objects on Earth and of celestial bodies are governed by the same set of natural laws
  - removing the last doubts about heliocentrism and advancing the scientific revolution.
- first practical reflecting telescope
- studied the speed of sound.
- Mathematics -- shares the credit with Leibniz for development of differential & integral calculus.
Physical World

- Sir Isaac Newton
  - "world machine"
Investigating the Human Body

- Andreas **Vesalius** – dissections 1500s
- William **Harvey** – blood circulates, pumped by heart, veins and arteries – 1600s
- Robert **Hooke** discovers cell using new invention “microscope”
Andreas Vesalius
Enlightenment
The Essence Of Science Explained In 63 Seconds

It comes from Richard Feynman, one of the great scientists of the 20th century, who wrote it on the blackboard during a class at Cornell in 1964.
The Enlightenment

... after the Scientific Revolution
Causes: Scientific Revolution

- Renaissance
  - examination of ancient writings = new old ideas
- New technology
  - telescope, microscope, printing press
- Mathematics
  - letters as variables, decimal system
Philosophy and Reason

Descartes
• doubt
• First principle: Cogito, ergo sum
• only accept things his own reason said were true
• Second principle: "b/c mind cannot be doubted and material world can, the two must be different"
• father of rationalism

Bacon
• scientific method
• inductive reasoning (particular to general)
Enlightenment
Reexamine Everything!

- John Locke
  - tabula rasa
Human Society

If you can use science to discover how the universe works, then you can use science to understand human society.
Les Philosophes

- Baron Montesquieu
  - *Spirit of Laws*
  - *separation of powers*
  - *republic for small states, despots for large states, monarchy for medium-sized states*
  - *checks and balances*
Montesquieu

- Separate govt into legislative, executive, judicial
- *Esprit des Lois* (Spirit of Law) – what’s the best govt form?
Dr. Bucholtz on Voltaire
Les Philosophes

- Denis Diderot
  - "Encyclopedie"
  - spread Enlightenment ideas
Les Philosophes
Economics is Born

• Adam Smith
  - *Wealth of Nations*
  - laissez-faire
  - The Gov't's job = army, police, infrastructure
Social Contract

- Jean-Jacques Rousseau
  - "Discourse on the Origins of the Inequality of Mankind"
  - laws = protect property = creates gov't that removes natural freedom
  - liberty = follow the good of the many "general will"
END 2012
Rousseau, continued

- "Emile"
Ideas Spread

- Salons
- Printing
  - books
  - magazines
  - newspapers
Religion in the Enlightenment

- Deists
- New Christian Movements
  - Methodists
  - John Wesley
Examining Religion

- Deism = God = “perfect clockmaker” who made natural laws, rights, human reason and science; conforms to reason, not faith
- Secularization of society
Disagreements about God
Le salon
John Locke

- Social contract =
- Ppl in state of nature are reasonable, moral, and have rights (life, liberty, property)
John Locke

- *Two Treatises on Government* = ppl created gov’t to protect natural rights
- Gov’t functions best when power limited and accepted by most citizens
- If gov fails in protecting natural rights, ppl have right to overthrow it
Spreading Ideas

- *Philosophes* – mostly French enlightenment philosophers supporting Locke and Newton; freedoms like speech, individual liberty
- Encyclopédie (banned by Catholic Ch.)
- Salon
Effects Enlightenment
Opponents of Enlightenment

Jean-Jacques Rousseau
Romanticism
Catholic Ch.
Kant

Opponents of Enlightenment
Rousseau
Immanuel Kant
Enlightenment’s Effects
Impact of the Enlightenment

"Enlightened Absolutism"
Seven Years' War
American Revolution
"Enlightened Absolutism"
Enlightened Absolutism

- Enlightenment thought...

- equality before law
- freedom of
  - religion
  - speech
  - press
  - property
  - seek happiness
Enlightened Absolutism

- Prussia
- Frederick the Great
- abolish torture except for murder & treason
- some freedom of press & speech
- some religious toleration
Enlightened Absolutism

- Austrian Empire
- Maria Theresa
  - improve conditions of serfs
- Joseph II
  - abolish serfdom
  - eliminated death penalty
Enlightened Absolutism

• Joseph II continued...
  - equality under law
  - religious toleration

• ... failed
  - nobles mad
  - church mad
  - serfs duh...
Enlightened Absolutism

- Russia
- Catherine the Great (followed Peter...)
- looked into Enlightenment but...
Seven Years' War

"The fundamental rule of governments is the principle of extending their territories."
- Friedrich II of Prussia
1. **Place** How did the serfs fare under the enlightened rulers represented on the map?
Austrian Succession

- Charles VI (Austria) dies w/o heir
- daughter Maria-Theresa succeeds
- Frederick II (Prussia) invades Silesia (part of Austria)
- France takes Frederick's side against Austria
Austrian Succession 1740-48

- Treaty of Aix-la-Chapelle
  - all territories returned to owners... except Silesia
- another war...
- Maria-Theresa works to separate alliance of France and Prussia
- success!... complicated...
... to make a long story short...

1) Russia, France and Austria VERSUS Britain and Prussia
2) 1756 "World War" aka "Seven Years' War" aka "French and Indian War"
3) 1763 war ended - Britain and Prussia gain
American Revolution

Then this happened...
enlightened despotism
1. **Place** How did the serfs fare under the enlightened rulers represented on the map?

- **Russia**: Catherine the Great considered abolishing serfdom, but political realities made her abandon this plan.
- **Prussia**: Frederick II granted limited freedom of speech and press but kept serfdom and a rigid social structure.
- **Austria**: Joseph II abolished serfdom and the death penalty and enacted reforms which alienated the nobility and the Church. Successors undid many of his reforms.
Frederick II

• *Friedrich der Große*
• proponent of enlightened absolutism.
• correspondent of Voltaire, friendship.
• modernized the Prussian bureaucracy and civil service
• promoted religious tolerance throughout his realm.
• patronized the arts and philosophers, and wrote flute music
Joseph II

• proponent of enlightened absolutism;
  – significant opposition eventually culminated in an ultimate failure

• ranked, with Catherine II of Russia and Frederick II of Prussia, as one of the three great Enlightenment monarchs.

• His policies are now known as Josephinism.
“Josephinism”

- Elementary education was made compulsory for all boys and girls.
- Scholarships for talented poor students.
- Religious toleration was the most advanced of any state in Europe.
- “Too much too good too soon”
- Example of why it doesn’t work: opposition!

- Regulate and reorder every aspect of the empire.
- Benevolent and paternal.
- Rationalized, centralized, and uniform government.
- Complete reform of the legal system.
- Abolished brutal punishments and the death penalty.
- Complete equality of treatment for all offenders.
- Ended censorship of the press and theatre.
Enlightened Monarchs

Maria Theresa, Austria

Catherine the Great, Russia
Analysis … Enlightened Monarchy

• Opposed by forces of tradition, custom, ignorance – too much “potens”, not enough “autoritas”.
  – Just because it’s good doesn’t mean people will support it
  – Great leaders bring most people on board with reform

• Some reverted to tyranny when population failed to respond to enlightened despotism
  – Catherine of Russia