Lecture 2- Science & Technology

Cover:
- Definitions
- Historical background

Basic definition of science and technology
- science ~ systematic study of nature (the physical world)
- technology ~ things we create to solve problems and meet needs

Distinction between "doing" science and "studying" science

Doing science….
- scientists actually study nature, and create new ideas
- engineers and other look for ways to put scientific knowledge to use

A. Scientific method….
- Ideal
- Hypothesis, test, verify or falsify
- Inductive-deductive method

B. Actual
- Varies from science to science
- Different scientists have different approaches
- Important points
- Accepted approach to specific problems
- Must ultimately conform to nature

Studying science…..
- historians - change over time
- sociologists -how groups of scientists act
- psychologists - how scientists think
- anthropologists - the culture of science
- political scientists - the politics of science
- scholars of literature - how scientists use language

Questions asked about science:
- world views/science of different eras?
- methods used to derive those world views/science?
- reasons worldviews/scientific ideas change?
- relationship of scientific knowledge to other knowledge?
- role of science in society?

General points to think about

- can describe the world in different ways
- descriptions of the world depend on needs/wants/problems
- at any time, content of science is shaped by both human and natural elements
- because there is always a human component to science, science is never totally objective or value free

Brief history of science

2 million, first humans
200,000 human intelligence
100,000 human culture
20,000 beginnings of science
700-200, Greek science
200-400 Roman science
400-1400 Middle Ages
1400-1600 Ren & Ref
1600-1700 Sci. Revolution
1700-1900 early modern sci.
20th century, modern science

Major periods in the history of science

5000 bpe	mythopoeic
500 bpe-1500 pe	natural philosophy
1500-1700	Scientific Revolution
1700-1940	early modern science
1940 ff	modern science

Mythopoeic (pre-history)

- stems from ability to recognize future
- uses regular elements in nature to explain future
- organizes nature based on human society

Natural Philosophy (500 bpd - 1500)

- eliminate gods and humans from explanation of nature
- reduce nature to fundamental parts or characteristics
- qualities - hot, cold, wet, dry
- elements - earth, air, fire, water
- numbers
- atoms

Scientific Revolution (1500-1700)

- Copernicus, *De revolutionibus* (1543)
- Vesalius, *De fabrica* (1543)
- Physics ~ Galileo, Descartes, Newton
- Astronomy ~ Brahe, Kepler, Newton
- Biology ~ Harvey
- Chemistry ~ Boyle
- Scientific societies and scientific journals

Early Modern Science (1700-1940)

- by 1700, physics & astronomy
- by 1800, chemistry
- 1859, Darwin, evolution
- by 1900
- germ theory of disease
- biochemistry
- 1830s-1900 beginning of social sciences
- economics, political science, anthropology, psychology ....
- 20th C. modern medicine

History of Technology

Questions asked about the history of technology:

- Methods and products of technological development
- Reasons for technological change?
- Impact of technology on society?
- Lessons from studying technology, e.g.
- technological determinism?

Earliest human technologies also used by animals

- animals (sea otters) use stone tools
- champanzies use stick tools
- monkeys can learn and transmit technologies (separating rice from sand)
- by 500,000 bpe, humans surpassed animals as creators of technology

Technology is not always developed simply to solve problems

First Industrial Revolution

- Deep plow
- Water power
- New military technology
- Stirrup
- Metal armor
- Longbow
- Gunpowder
- Magnetic compass
- Clock
- Cannel locks

Not all useful

- Clear eyeglasses
- Mechanical clocks
- Mechanical angels

Before 1800

- Laws of basic physics (Galileo, Kepler, Newton)
- Prediction and discover of Uranus
- Beginnings of chemistry (Lavosier)
- Microscope and telescope
- Broader changes
- New forms of energy (steam)
- Scientific societies and journals
- Science becomes a profession

By 1850

- Inorganic chemistry (periodic table)
- Laws of electricity and light
- Telegraph and railroad
- First research universities in Europe
- NAS, AAAS, and AMA

By 1900

- Darwin and evolution (1860)
- Organic chemistry
- Germ theory of disease
- Aseptic surgery and anesthesia
- Telephone, radio, electric light, recorded sound
- Assembly line production/exchangable parts
- Research universities in US

By 1900 continued

- Scientific knowledge begins to produce technological change
- Technology has become an essential component of society
- Early 20th C.
- Einstein, relativity, and quantum mechanics
- Technology contributed to WW I
- Treatment of bacterial diseases, discovery of virus
- Go to hospitals to be cured, not stay away from them
- Heavier than air flight
- National Research Council

Early 20th C.

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