

Lecture #3 Feb 4 Jan 2010 What is Science?

Last time: Development of science includes tension between *logic* and *observation/experiment*.

Plato: distrust imperfect material world, use logic and intuition

Aristotle: logic (but also observation); hierarchal cosmos

Scholastics: Use Aristotle's rhetoric to "find truth"

Bacon: distrust intuition, start from observation

Galileo, Newton: active experimentation, universal laws

Last time: Two kinds of *discourse*

Irreproducible: based on revelation, authority, argument alone

Reproducible: based on recipes that can be replicated by anyone (leads to science)

What do scientists want?

Scientists interested in *convincing novelty*:

- new observations or theories

- but must be able to convince others of their ideas

This requires:

- reproducible recipes: in principle, *anyone* can duplicate

- outward skepticism towards authority

- inward skepticism of one's own ideas

Today: The mechanics of science

observation or experiment -> theory (a narrative about those observations) -> *predict* new observations

A theory of theories

A theory is a narrative or related narratives that help us to (a) organized established empirical facts and (b) make predictions about observations or experiments not yet carried out.

A good theory will (a) explain a large of *already known* facts

(b) within as simple a framework as possible

(c) make predictions about future facts

Falsifiability: A theory is "falsifiable" if all parties agree that certain outcomes would mean the theory is false. (due to Karl Popper)

"Just a theory"?

False dichotomy: "theory" vs. "law"

Better: how much evidence is there for a given theory?

Science and rhetoric

Scientists are (generally) mistrustful of heavy reliance upon argument and rhetoric *alone*
Nonetheless, theories and other "narratives" are needed to shape and guide inquiry.

Two views on science and rhetoric

Naïve realism: science is “just the facts” and rhetoric and culture play *no* role in science

Naïve idealism/rhetoricism: science is *all* culturally determined

Science and culture

Here culture = assumptions from politics, tradition, religion, etc.

Ideally, through skepticism and experimentation, science can reduce the influence of “culture.” Nonetheless, culture can have strong influence:

- Limiting or directing the questions
- Masking unquestioned assumptions
- Rhetoric and argument overwhelm skepticism

Science is not culture neutral: science is *guided* by narratives and metaphors those narratives are influenced by culture. Nonetheless, science is *not just* a product of culture. Observation and experiment can and often do contradict cultural assumptions.

If this were not true, we would not have so many “surprising” scientific results:

Controversies in science vs. culture

Sometimes “controversies” in science are really collisions between scientific narratives (theories) and cultural narratives.

Narratives *about* science

Narratives about the *nature* of science

- * science is about the “real world”
- * science is a product of culture

Narratives about change in science

- * science is smooth and continuous; builds upon past
- * science has discontinuous “revolutions”
 - old ideas completely overturned

3 models for scientific “progress”

1. Eternal growth
2. Eternal revolution
3. Plateau

Summary

- Science relies on *repeatable recipes* not authority or argument to settle issues
- Modern science has an *economy of novelty*
 - *focussed skepticism* to get good return of novelty
(often many small payoffs rather than infrequent large payoffs)
- Scientists wary of narratives (such as theories) but still use them to guide thinking, experiments
- Scientists try to use skepticism to eliminate influence of culture
- Cultural assumptions can still influence the *questions* scientists ask

Useful to look at narratives *about* science, in particular narratives regarding scientific progress: steady growth *or* revolution *or* plateau