HS 312 – Introduction to Science and Technology Studies

Lecture 3

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Outline

- Common picture of science and technology
- Why common picture of S&T is problematic

Common Picture of Science

- What is science ? What counts as scientific knowledge and how it is produced?
- Common picture – science is a *formal* (rule based not ad-hoc or improper) activity that directly confronts the natural world for the creation and accumulation of knowledge
- Philosophical question – "How can we have knowledge as opposed to mere belief or opinion?"
- General answer is "follow the scientific method"
- Knowledge is *justified* true belief
- What justification amounts to; specially when it is provided by following scientific methods for testing and arriving at our beliefs

Common Picture of Technology

- What we mean by technology ? How technologies are created/constructed?
- Common picture – technology is application of science
- Linear model of innovation – basic science -> applied science -> development and production
- Technology as problem solving – identify needs/problem/opportunity -> combine existing knowledge creatively to solve the problem -> as the end result technology becomes combination of scientific methods and human creativity

Technology and its Effects

- Lewis Mumford – technology comes in two varieties
- *Polytechnics* are "life-oriented," integrated with broad human needs and potentials
- *Monotechnics* produce "mega machines" that can increase power dramatically, but by regimenting and dehumanizing
- Martin Heidegger – From the point of view of modern technology, the world consists of resources to be turned into new resources
- John Dewey – science as theoretical technology and technology as applied science

Technology and its Effects

- Technology and its effects – whether social relations are determined by technology? Is technology humanizing or dehumanizing? Do contemporary technologies serve broad public goals?
- These questions view technology as a finished product and generally do not focus on the creation of particular technologies
- If technology is applied science then it is limited by the limits of scientific knowledge

Science and Technology Studies

- The point of departure for STS is – S&T are thoroughly social activities; scientists and engineers are always members of communities
- Anti-essentialist positions – "The sources of knowledge and artifacts are complex and various: there is no privileged scientific method that can translate nature into knowledge, and no technological method that can translate knowledge into artifacts" (Sismondo, p11).
- Therefore, S&T are active processes

What it is to be scientific?

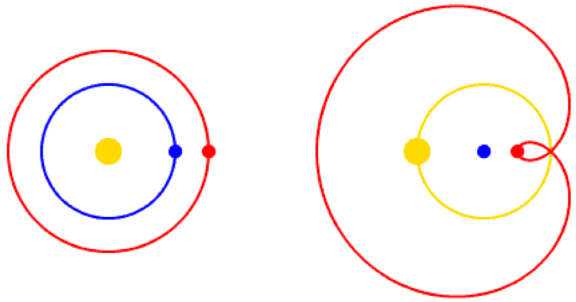
- Common picture – science is a *formal* (rule based not ad-hoc or improper) activity that directly confronts the natural world for the creation and accumulation of knowledge
- Science makes *progress* because of its systematic method
- But in what ways science is a *formal* activity?
- Logical Positivism/Empiricism – The Vienna Circle (1930s) project to develop a philosophical understanding of science; was aimed at extending the scientific worldview into the social sciences and philosophy

Logical Positivism/Empiricism

- Scientific theory is the logical representation of data, and no more or less than a condensed summary of possible observations
- Formal – Theories are built up by the logical manipulation of observations
- Inductive process – individual data points -> general statements
- Problem of induction – David Hume: 'the sun rises every 24 hours' -> take *n* cases and extend the pattern to the $n+1^{st}$ -> we can't appeal to regularity because the regularity of the nature is at issue

Logical Positivism

- If scientific theories are the logical representation of data, meanings are reduced to observations
- Synonyms – various theories or statements that contain very different meanings but make similar predictions
- Copernican astronomy Vs. Ptolemaic system – similar observations but one has Earth spinning around the world and second has Earth at the centre of the universe
- Many meaningful claims not systematically related to observations
- Nonetheless, positivist view is deeply intuitive



Source: Wikipedia

Falsification

- Karl Popper – criterion to distinguish between science and non-science
- Loosely positivist – scientific theories allow to make predictions of observations by pure logical means, and theories that make all the right predictions are the best
- Genuine scientific theories are falsifiable – if a theory's prediction is falsified the theory itself is to be treated as false -> this way science is a formal activity
- Non-scientific theories (Marxism, Freudianism) can explain or explain away anything – no risky or firm predictions

The Duhem–Quine thesis

- Theories are parts of webs of belief
- A theory can never be conclusively tested in isolation
- Newton's predictions about the path of the moon did not match with the data he observed -> but he did not reject his theory but assumed something wrong with the data and modified (fudged it) -> later physicist found that problem was with certain optical assumption and not with his theory

Falsification

- Karl Popper – no method for creating scientific theories but are imaginative creations
- But theories generally are fairly abstract, and make risky predictions by replying on host of extra assumptions
- When theories make incorrect predictions, scientists often do not reject it but search for reasons to explain away the observations or predictions
- Nonetheless, idea of falsification remains well ingrained
- Accordingly, for positivism and falsificationism, what makes science scientific are formal relations between theories and data

Thank you