HS 312 – Introduction to Science and Technology Studies

Lecture 3

Mahendra Shahare

Outline

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

Ad hoc is a Latin phrase meaning "for this". In English, it typically signifies a solution designed for a specific purpose, problem, or task rather than a generalized solution adaptable to collateral instances

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

click RHS

- 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

regimenting (present participle) - organize according to a strict system or pattern

- 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

Anti-essentialist: A perspective that rejects the idea of fixed, inherent, or universal essences in things, emphasizing that meanings, identities, and properties are socially constructed and context-dependent.
Artifacts: Human-made objects, tools, or systems that are designed to serve a specific purpose, often reflecting cultural, historical, or technological contexts.

Science and Technology Studies

science, tech, society science and tech.

- 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

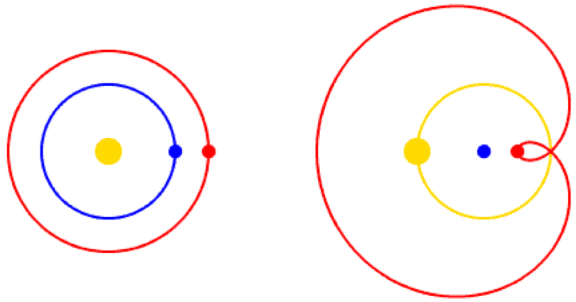
- Scientific theory is the logical representation of data, and no more or less than a condensed summary of possible observations
- Formal – Theories are built up by the logical manipulation of observations
- Inductive process – individual data points -> general statements
- Problem of induction – David 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

heliocentric geocentric

- Many meaningful claims not systematically related to observations
- Nonetheless, positivist view is deeply intuitive



Source: Wikipedia

Falsification

Freudianism: A psychological framework based on the theories of Sigmund Freud, focusing on the role of the unconscious mind, childhood experiences, and internal conflicts in shaping human behavior, emphasizing concepts like the id, ego, and superego.

- 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

Marxism: A socio-economic and political theory developed by Karl Marx and Friedrich Engels, emphasizing the role of class struggle, material conditions, and economic systems in shaping society, advocating for a classless society through the abolition of capitalism and the establishment of socialism.

The Duhem–Quine thesis

- Theories are parts of webs of belief theories originate from multiple beliefs, assumptions, etc.
- 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