

Philosophy of science (problems)

Sample syllabus

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Course description

The philosophy of science asks fundamental questions about the epistemology of scientific discovery and justification. Though the discipline deals with a wide variety of topics of interest to the working of the special sciences, it is possible to discern interconnections between these various topics. This course surveys a variety of positions on standard philosophy of science topics while attempting to show which questions are fundamental to others.

The course begins by asking “What is science?” i.e., what demarcates it from other fields or modes of discourse? Answers to this question often turn on further questions about what science *does*, and how it manages to do it. Thus questions about the nature of scientific justification or confirmation are of central importance to the philosophy of science. Theories of confirmation also influence theories of explanation, because our model for how we know *what* is true in science often influences our model for how we know *why* something is true. How we understand both confirmation and explanation further influences how we are to understand the reality of scientific conclusions: if we think evidence is adequate to justify scientific theories, we will be more likely to think that scientific conclusions reveal an objective reality; if not, not. By the same token, if we think evidence is adequate, and not influenced by subjective factors, we will think that science is not a social construct.

Though some of these problems in the philosophy of science seem pedantic, this course will emphasize that they have real importance for our contemporary cultural/political scene. What counts as genuine science vs. pseudo-science is often the focus of debates over the teaching of evolution vs. creationism, and controversies over the reliability of environmental science, especially climate science. The theories we have studied often purport to establish criteria for proper science, and to the extent that a picture of proper science often depends on further theories of confirmation and explanation, these theoretical topics come to be of tremendous cultural importance.

Texts

- Theodore Schick, *Readings in the Philosophy of Science: From Positivism to Postmodernism* (McGraw-Hill, 1999)

Lecture and reading schedule

What makes science what it is?

- Science is verifiable: A.J Ayer, “The Elimination of Metaphysics”
- Science is falsification: Karl Popper, “Science: Conjectures and Refutations,” “Darwinism as a Metaphysical Research Program”
- Science is puzzle-solving: Thomas Kuhn, “Logic of Discovery or Psychology of Research”
- Science has no clear essence: Larry Laudan, “Science at the Bar—Causes for Concern”

What data does science draw on?

- Observations are distinct from theory: Rudolf Carnap, “The Methodological Character of Theoretical Concepts”
- Observations depend on theory: N.R. Hanson, “Observation”
- Observations depend on a social paradigm: Thomas Kuhn, from *The Structure of Scientific Revolutions*
- Basic observations are not theory-dependent in any interesting way: Michael Huemer, from *Skepticism and the Veil of Perception*

How does science justify itself on the basis of this data?

- Ampliative inferences is not logically justified: David Hume, from *The Enquiry*
- Confirmation is deducing predicted observations from hypotheses: Carl Hempel, “The Role of Induction in Scientific Inquiry”

- Science is not confirmed by hypothetico-deduction: Karl Popper, “The Problem of Induction”
- Science is underdetermined by evidence: Pierre Duhem, “Physical Theory and Experiment”
- Scientific inference is inference to the best explanation: Peter Lipton, “Contrastive Inference”
- Science is justified through a chain of inductive inference: John Norton, “A Material Theory of Induction”
- Basic cause and effect relationships can be directly observed: Rom Harre and Edward Madden, from *Causal Powers: A Theory of Natural Necessity*

How does science explain facts/formulate laws of nature?

- Explanation works by deducing an observation from a law of nature: Carl Hempel, “Laws and their Role in Scientific Explanation”
- Explanation works by describing a causal process: Wesley Salmon, “Why Ask, Why?”
- Explanation relies on pragmatic factors: Bas Van Fraasen, “The Pragmatics of Explanation”
- Explanation unifies disparate pieces of knowledge: Philip Kitcher, “Explanatory Unification”
- Explanation cites analogical models: Rom Harre, from *Principles of Scientific Thinking*

Does science reveal objective reality?

- Unobservables are real: Grover Maxwell, “The Ontological Status of Theoretical Entities”
- Unobservables are not real: Bas van Fraasen, “Constructive Empiricism”
- Beyond realism and anti-realism: Arthur Fine, “The Natural Ontological Attitude”
- Realism and explanatory success: James Brown, “Reality and Scientific Progress”

Which field is paradigmatic of scientific discipline?

- Science should reduce to physics: Paul Oppenheim and Hilary Putnam, “Unity of Science as a Working Hypothesis”
- Not all science reduces to physics: Jerry Fodor, “Special Sciences”
- Different sciences involve different explanatory standards: John Dupre, “The Disunity of Science”
- Scientific pluralism is too permissive: George Reisch, “Pluralism, Logical Empiricism, and the Problem of Pseudoscience”

What role do social values play in scientific conclusions?

- Scientific conclusions are socially constructed: Bruno Latour and Steve Woolgar, “The Social Construction of Scientific Facts”
- Scientific conclusions are not socially constructed: Stephen Cole, “Voodoo Sociology: Recent Developments in the Sociology of Science”
- Some but not all facts are socially constructed: John Searle, from *The Construction of Social Reality*
- Social values determine what counts as “significant truth”: Philip Kitcher, from *Science, Truth and Democracy*
- The values that aid scientific theories can themselves be objective: Tara Smith, “Social Objectivity and the Objectivity of Value”

Applying philosophy of science to contemporary controversies

- Evolution vs. creationism
- Climate science: pro and contra