The Epistemology of Science

Christian Wüthrich — Phil 204A, Fall 2011

Class schedule:	F 1:00-3:50pm, HSS 7077 (Philosophy seminar room)
Website:	http://philosophy.ucsd.edu/faculty/wuthrich/
Christian Wüthrich:	Office hours are Tu 3-4:50, and by appointment
	Room 8047 HSS ☎ 858-534-6548 ✉ wuthrich@ucsd.edu

Science asserts an epistemically privileged role among our attempts to grasp the world around and within us. This assertion is based on the empirical support which mature scientific theories garner and on the systematic and methodical way in which they do this. To understand this relation between evidence and theory is the ambition of theories of 'confirmation'. This seminar attempts to survey a few of these, to analyze what 'evidence' is, and to enter various recent philosophical debates concerning some types of experiments and their epistemic status in various fields of scientific enquiry.

Prerequisites: I assume no particular background either in philosophy or in science. Having said that, however, there will be some more technically and scientifically more involved readings. If you don't want to present or write on these—which is fine—, you should at least be prepared to make a reasonable effort to grasp the material.

Distribution requirements: This course can be counted towards the fulfillment of the distribution requirement in philosophy of science.

Required texts

All mandatory (and perhaps some recommended) readings will be made available through e-reserves or online. The Stanford Encyclopedia of Philosophy entries are downloadable from http://plato.stanford.edu/. Go to the course web page for links.

Course requirements and evaluation

The following are necessary and jointly sufficient conditions to obtain letter grade credit for this seminar:

1. **Participation:** You are expected to attend all classes and to actively participate in discussions. If you have to miss a class, you must let me know in advance.

2. **Class presentations:** Every participant gives two presentations of no more than 15 minutes. You are expected to do something visual (blackboard, overheads, handout). Do not try to be comprehensive; rather, synthesize the important parts (main thesis, main argument) and offer some critical thoughts for discussion.

3. **Short papers:** Submit 5 short papers of 3 to 4 pages, reflecting readings for the meeting when the paper is submitted. I want to see a clear statement of the main thesis of the article you are discussing, a brief summary of the main argument, and *your independent judgment and critical reflection.*

   or

   Seminar paper: Submit a term paper of 15 to 20 pages or so, on a topic approved by me. Please submit a paragraph-long outline of your project by Friday, **18 November 2011**. The full paper is due on Thursday, **8 December 2011**.

Topics and readings

Please note that the topics listed do not map bijectively to meetings; the plan would to just go through them more or less in order. The reading list is tentative and may still change, in particular upon popular demand. In particular, I only expect us to cover a strict subset of this list.

Background reading

For those of you who have never studied inductive logic, confirmation, probability, Bayesianism etc before, the following are useful sources at a more introductory level:

- Ian Hacking, *An Introduction to Probability and Inductive Logic*, Cambridge (2001).
- John Earman and Wesley Salmon, "The confirmation of scientific hypotheses", in Merrilee H Salmon et al. (eds.), *Introduction to the Philosophy of Science*, Indianapolis (1992): 42-103.
- Michael Strevens, *Notes on Bayesian Confirmation Theory*, available at `http://www.nyu.edu/classes/strevens/BCT/BCT.pdf`.
- There are a number of articles on the *Stanford Encyclopedia of Philosophy* at `http://plato.stanford.edu/`, such as "Bayes' theorem" by James Joyce, "Bayesian epistemology" by William Talbott, "Inductive logic" by James Hawthorne, "Evidence by Thomas Kelly, and perhaps others.

(1) Hypothetico-deductivism and the paradoxes of confirmation

- Carl G Hempel, "Studies in the logic of confirmation", in his *Aspects of Scientific Explanation*, New York (1965): 3-51. (Reprinted from *Mind* **54** (1945): 1-26 and 97-121)
- Nelson Goodman, "New riddle of induction", in his *Fact, Fiction, and Forecast*, Cambridge, MA ([1953]1983): 59-83.
- John Earman, *Bayes or Bust*, Cambridge, MA (1992): 63-73 (§§3.1-3.3).

(2) Bayesianism

(a) The basics: probability calculus and Bayesian confirmation

- Colin Howson and Peter Urbach, *Scientific Reasoning: The Bayesian Approach*, Chicago ([3]2006): 13-90 (Chs. 2 and 3).
- Earman, *Bayes or Bust*, Chs. 2 and §§6.1-6.6.

(b) Bayes and underdetermination

- Pierre Duhem, *The Aim and Structure of Physical Theory*, Princeton ([1914, 1954] 1982): 180-218 (Part II, Ch. 6).
- Jon Dorling, "Bayesian personalism, the methodology of scientific research programmes, and Duhem's problem", *Studies in the History and Philosophy of Science* **10** (1979): 177-187.
- Howson and Urbach, *Scientific Reasoning*, 103-114 (§4.e).
- Earman, *Bayes or Bust*, 83-85 (§3.7).

(c) Criticisms of Bayesianism

- Clark Glymour, "Why I am not a Bayesian", in his *Theory and Evidence*, Chicago (1981): 63-93 (Ch. 3).
- Kevin T Kelly and Clark Glymour, "Why probability does not capture the logic of scientific justification", in Christopher Hitchcock (ed.), *Contemporary Debates in Philosophy of Science*, Malden, MA (2004): 94-114.

(3) Alternatives: formal learning theory and severe testing/error analysis

- Kevin T Kelly, "The logic of success", *British Journal for the Philosophy of Science* **51** (2000): 639-666.
- Deborah G Mayo, *Error and the Growth of Experimental Knowledge*, Chicago (1996): 412-464 (Ch. 12 and 13).

(4) Data and evidence

- James Bogen and James Woodward, "Saving the phenomena", *Philosophical Review* **97** (1988): 303-352.
- Jim Bogen and Jim Woodward, "Observations, theories and the evolution of human spirit", *Philosophy of Science* **59** (1992): 590-611.
- Daniel Rothbart and Suzanne W Slayden, "The epistemology of a spectrometer", *Philosophy of Science* **61** (1994): 25-38.

(5) Types of experiments

(a) Controlled experiments in different sciences

- Ralph J Greenspan, "The flexible genome", *Nature Review Genetics* **2** (2001): 383-387.
- John Worrall, "*What* evidence in evidence-based medicine?", *Philosophy of Science* **69** (2002): S316-S330.
- Nancy Cartwright, "Are RCTs the gold standard?", *BioSocieties* **2** (2007): 11-20.
- Francesco Guala, *The Methodology of Experimental Economics*, Cambridge (2005): 62-83 (Ch. 4).

(b) Simulations and modelling

- Evelyn Fox Keller, "Models, simulation, and 'computer experiments' ", in Hans Radder (ed.), *The Philosophy of Scientific Experimentation*, Pittsburgh (2003): 198-215.
- Mary S Morgan, "Experiments without material intervention", in Hans Radder (ed.), *The Philosophy of Scientific Experimentation*, Pittsburgh (2003): 216-235.
- Wendy S Parker, "Does matter really matter? Computer simulations, experiments, and materiality", *Synthese* **169** (2009): 483-496.
- Eric Winsberg, "A tale of two methods", *Synthese* **169** (2009): 575-592; reprinted in *Science in the Age of Computer Simulation*, Chicago (2009): 49-71.

(c) Thought experiments

- Galileo Galilei, *Dialogues Concerning Two New Sciences*, New York ([1638, 1914]1954): 61-67.
- Albert Einstein, *Relativity: The Special and General Theory*, New York ([1916] 1920): 25-33 (§§8 and 9).
- James Robert Brown, "Why thought experiments transcend empiricism", in Christopher Hitchcock (ed.), *Contemporary Debates in Philosophy of Science*, Malden, MA (2004): 23-43.
- John D Norton, "Why thought experiments do not transcend empiricism", in Christopher Hitchcock (ed.), *Contemporary Debates in Philosophy of Science*, Malden, MA (2004): 44-66.