

Epistemology of Experimental Practices (2074)
Prof. E. Machery & S. Mitchell
Spring 2007

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Class Meetings

Thursday 9.30-12.00 pm
Room: G28

Office Hours

By appointment.
1017CL.

Course Description/Goals

Observation and Experimentation have long been taken as central to the legitimacy of scientific claims. Richard Feynman wrote “The test of all knowledge is experiment”. Experiment is the sole judge of science ‘truth’ (1963). But how do experiments reveal the way nature is organized? Since Duhem, the problem of the under determination of theory by observation has been known and descriptions of observational results are theory laden. So what is the reasoning by which experimental observations direct the community of scientists to accept or reject a given hypothesis? This seminar will be organized as a research group on the epistemology of experimentation – each participant will develop their own research project within the framework of more general philosophical issues, which jointly engages both the philosophical issues and particular scientific practices and results. Ongoing research reports, a final presentation of results, and an annotated bibliography will be required.

Prerequisites

Graduate standing or permission of instructor.

Texts

Readings will be available for photocopying in the ‘Course Mailbox’ in the HPS office, 1017CL or on the gmail account (log-in: pitthps06; password: hpsgrad).

Seminar Organization

The seminar will be organized as *a research group*. Each participant will define *a research project* for this seminar. You will present your research approximately every third week—presentations might include discussion of readings, discussion of philosophical issues, etc. Your presentation should be based on a one-page research

report that should be sent to the other members of the seminar before your presentation. You should keep (and turn it in at the end of the term) a record of your research (preferably in digital form). A final research report is required which will include sections on

- Problem identification and development
 - o Discussion of differing views, conceptions, debates, etc.
- Strategy for how to solve a problem
- A report about the status of your research project at the end of the seminar.
- Annotated bibliography (at least 15 items, which can include up to 7 from course readings).

You are invited to meet with Sandy and/or Edouard on a regular basis to discuss the development of your research project.

In the first half of each meeting, we will read one or two. In the second half, participants will present the current state of their research. Each presentation should last approximately 20 minutes (10 minutes presentation, 10 minutes discussion).

You can, but are not required, to write a paper on your research topic.

COURSE SCHEDULE

(Subject to revision as the semester proceeds)

Thursday 01/04

Topic: Syllabus & Introduction

Readings: Klotz, I. (1980). The N-ray affair. *Scientific American* 242, 5, 168-175.

Thursday 01/11

Topic: Underdetermination

Readings: Duhem, P. (1954). *The Aim and Structure of Physical Theory*. Princeton University Press: Part II. Chapters I-V

Additional Readings

Duhem, P. (1954). *The Aim and Structure of Physical Theory*. Princeton University Press: Part I: Chapter IV

Quine, W.V.O. (1951). Two dogmas of empiricism.

<http://www.ditext.com/quine/quine.html>

Thursday 01/18

Topic: Underdetermination

Readings: Duhem, P. (1954). *The Aim and Structure of Physical Theory*. Princeton University Press: Part II. Chapters VI-VII

Magnus, P. D. (2003). Underdetermination and the problem of identical rivals. *Philosophy of Science* 2003, 1256-1264.

Thursday 01/25

Topic: Experiment and Realism

Readings: Hacking, I. (1982). Experimentation and scientific realism. Reprinted in M. Curd and J.A. Cover, (ed.), *Philosophy of Science*, Norton.

Norton, J. D. How we know about electrons. In R. Nola and H. Sankey, eds., *After Popper, Kuhn and Feyerabend; Recent Issues in Theories of Scientific Method*. Dordrecht Kluwer, pp. 67- 97.

Additional Readings: Franklin, A. (2002). Milikan' measurement of the charge of the electron. In *Selectivity and Discord*, University of Pittsburgh Press (Chap. 3).

Thursday 02/01

Topic: Data and Evidence

Readings: Bogen, J., and Woodward, J. (1988). Saving the phenomena. *Philosophical Review* 97, 303-52.

Bogen, J., and Woodward, J. (1992). Observations, theories and the evolution of the human Spirit. *Philosophy of Science* 59, 590-611

Rothbart, D. and Sladen, S. (1994). The epistemology of a spectrometer. *Philosophy of Science* 61, 25-38.

Thursday 02/08

Topic: Replicability & Reliability

Readings: Cartwright, N. (1991). Replicability, reproducibility and robustness: Comments on Harry Collins. *History of Political Economy* 23, 143-155.
Franklin, A. (1994). How to avoid the experimenter's regress. *Studies in History and Philosophy of Science* 25, 51-62.
Collins, H.M. (1994) A strong confirmation of the experimenter's regress. *Studies in History and Philosophy of Science* 25, 493-503.

Thursday 02/15

Topic: Validity

Readings: Cronbach, L. and Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin* 52, 281-302.
Campbell, D. T. et al. (1979). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Chap. 2 & 3.
Mook, D.G. (1983). In defense of external validity. *American Psychologist* 379-387.

Additional readings: Messick, S. (1995). Validity of psychological assessment. *American Psychologist* 50, 741-749.

Thursday 02/22

Topic: Hypothesis testing I: Null-hypothesis testing

Readings: Hempel, C. (1965). Science and human values. In *Aspects of Scientific Explanation*. New York: The Free Press, pp. 81-96.
Meehl, P. E. (1967). Theory-testing in psychology and physics: A methodological paradox. *Philosophy of Science* 34, 103-115.
Cohen, J. (1994). The earth is round ($p < .05$). *American Psychologist* 49, 997-1003. (commentaries in *American Psychologist*, 1995, 50, c. 1100.)

Additional Readings: Nickerson, R. (2000). Null hypothesis significance testing: A review of an old and continuing controversy. *Psychological Methods* 5, 241-301.
Douglas, H. (2000). Inductive risk and values in science. *Philosophy of Science* 67, 559-579.

Thursday 03/01

Topic: Type of experiments I: Case studies

Readings: Caramazza, A. (1986). On drawing inferences about the structure of normal cognitive systems from the analysis of patterns of impaired performance: The case for single-patient studies. *Brain and Cognition* 5, 41-66.
Shrader-Frechette, K. and McCoy, E. D. (1994). Applied ecology and the logic of case studies. *Philosophy of Science* 61, 228-249.
Yin, R. (1994). *Case Study Research: Design and Methods*. 2nd ed. Chap. 1 & 2.

Thursday 03/08

Topic: **Type of experiments II: Controlled experiments**
Readings: Greenspan, R. (2001). The flexible genome. *Nature Review Genetics* 2(5), 383-7
Worrall, J. (2002). What evidence in evidence-based medicine. *Philosophy of Science*, S316-S330.
Guala, F. (2005). Causation and experimental control. In *The Methodology of Experimental Economics*, CUP (Chap. 4).

Thursday 03/15

Topic: **Type of experiments III: Quasi-experiments**
Readings: Campbell, DT et al. (1979) *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Chap. 4.
Meyer, B. (1995). Natural and quasi-experiments in economics. *Journal of Business and Economic Statistics* 13, 151-161.
Additional Readings: Rosenbaum, P. (1999). Choice as an alternative to control in observational studies. *Statistical Science* 14, 259-304. (& commentaries same issue)

Thursday 03/22

Topic: **Type of experiments IV: Model organisms**
Readings: Ankeny, R. (1998). Fashioning descriptive models in biology: Of worms and wiring diagrams. *Philosophy of Science*, 67, S260-S272.
Weber, M. 2005. Model organisms: of flies and elephants. In *Philosophy of Experimental Biology*, Cambridge University Press, pp. 154-187.

Thursday 03/29

Topic: **Type of experiments V: Simulations**
Readings: Galison, P. (1996). Computer simulations and the trading zone. In P. Galison and D. J. Stump (eds.), *The Disunity of Science: Boundaries, Contexts, and Power*, Stanford University Press, Stanford, California, pp. 118-157.
Guala, F. (2002). Models, simulations, and experiments. In L. Magnani and N. J. Nersessian (eds.) *Model-Based Reasoning: Science, Technology, Values*. New York: Kluwer, pp. 59-74.
Morgan, M. (2003). Experiments without material intervention: Model experiments, virtual experiments, and virtually experiments. In H. Radder (ed), *The Philosophy of scientific Experimentation*, University of Pittsburgh Press.
Additional Readings: Küppers, G. and Lenhard, J. (2004). The controversial status of simulations. *Proceedings 18th European Simulation Multiconference*.

Thursday 04/05

RESEARCH REPORTS

Thursday 04/12

RESEARCH REPORTS