

The epistemology of experiment

Summer term 2010, Tuesdays 16-18 hrs, Room E 405

Postgraduate seminar / Hauptseminar
Dr. Samuel Schindler
samuel.schindler@uni-konstanz.de
Office: Y2: 219 (Zukunftskolleg)
Office hours: by appointment

Scientific knowledge is widely regarded as the epistemically most secure knowledge mankind is capable of gaining. Naturally we tend to think of this 'epistemic security' as being grounded in the observational and experimental practices of science. Particularly the latter have been championed by the proponents of so-called New Experimentalism as crucial for our reasons to believe in the existence of scientific phenomena or even so-called 'theoretical entities' like electrons. This course will discuss this view and some of the problems associated with it. Among the specific questions to be considered are the following: How do scientists determine that observational and experimental results are trustworthy? What are artifacts and errors and how well can they be controlled for? How do theories figure in our attempts to ensure data reliability? We will read original philosophical papers relevant to the above questions on a weekly basis. Traditionally, these papers often contain examples from scientific practice. Thus, although no prior scientific knowledge will be required for succeeding in this course, a willingness to tackle unknown terrain will be. An introductory text to the seminar is Ian Hacking, *Representing and Intervening*, Cambridge University Press, 1983. The preferred language of this course is English. The content of this course is closely related to instructor's research project at the *Zukunftskolleg* and offers the opportunity for students to gain insights into contemporary research in the philosophy of science.

Assessment and Course Requirements

All course material can be found on **ILIAS (<http://ilias.uni-konstanz.de>) and the Semesterapparat ('Schindler')**

- **Attendance:** attendance to all classes is obligatory. **(10%)**
- **One essay** on any topic of this course (3,000 words), which must be submitted (electronically or in paper) by 17 hrs on Friday 17th July. **(60%)**
- **Presentations:** you must present one topic of your choosing in class. The presentations will be approximately 20min and will have to be presented freely and in English. **(20%)**
- **"Weekly remark":** all students not presenting must submit to me a philosophical remark on the paper(s) we will discuss in class. This remark can be on any aspect of the paper and can also be phrased in terms of a question. **(10%)**

Topics

*** Only topics marked with Δ are available for presentation! ***
(Topics marked with \circ will be presented by the authors themselves.)

Also note that you are not always asked to read the whole paper / book chapter.

Week 1 (13.4.10): Introduction

Background readings

- Arabatzis, T. (2008), 'Experiment', *The Routledge companion to the Philosophy of Science*, pp. 161-70.
- Bogen, Jim, "Theory and Observation in Science", *The Stanford Encyclopedia of Philosophy (Spring 2010 Edition)*, Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2010/entries/science-theory-observation/>.
- Greenwood, J. G., (1990), "Two Dogmas of Neo-Empiricism: The 'Theory-Informity' of Observation and the Quine-Duhem Thesis", *Philosophy of Science*, Vol. 57, No. 4 (Dec., 1990), pp. 553-574.
- Hudson, R. (unpublished manuscript), "Evaluating Background Independence", downloadable at <http://www.philsci.org/archives/psa2000/ebi-psa2k.pdf>.
- Mayo, D., (1996), *Error and the Growth of Experimental Knowledge*, Chicago: CUP, pp. 57-69.
- Hacking, I., *Representing and Intervening*, Cambridge University Press, Chapter 10 (pp. 167-185).

Week 2 (20.04.10): Replication and the Experimenter's regress

- Collins, H. (1986), *Changing Order*, SAGE publications: London, chapter 4 (pp. 79-111)
- Giles, J. (2006), 'The Trouble with Replication', *Nature*, vol. 442, pp. 344-7.

Further readings

- Franklin, A., (1994), "How to avoid the experimenter's regress", *Stud. Hist. Phil. Sri.*, Vol. 25, NO. 3, pp. 463-491.
- Collins, H. (1994), "A strong confirmation of the experimenter's regress," *Stud. Hist. Phil. Sci.*, Vol. 25, No. 3, pp. 493-503.
- Franklin, A. (2002), *Selectivity and Discord*, University of Pittsburgh Press, chapter 2 (pp. 53-66).
- Collins, H. (1984), 'Discussion: When do scientists prefer to vary their experiments?', *Studies in Hist. Phil. Sci.*, vol. 15 (2), pp. 169-74.

Week 3 (27.04.10): Reasons or Social construction?

- Pickering, A. (1991), 'Reasons enough? More on Parity-Violation Experiments and Electroweak Gauge Theory', *Proceedings of the Biennial Meeting of the Philosophy of Science Association*, pp. 459-69.
- Nelson, A. (1994), "How could scientific facts be socially constructed", *Stud. Hist. Phil. Sci.*, Vol. 25, No. 4, pp. 535-547.
- Franklin, A. (2002), *Selectivity and Discord*, University of Pittsburgh Press, pp. 242-7.

Further readings

- Pickering, A. (1984), *Constructing Quarks*, Chicago: CUP, Introduction, pp. 1-20.
- Burian, R. (1990), Review of Pickering's *Constructing Quarks*, *Synthese*, 82, pp.163-174.
- Collin, H. (1981), 'What is TRASP? The Radical Programme as a Methodological Imperative', *Phil. Soc. Sci.* 11, pp. 215-24.
- Roth, P. (1996), 'Will the Real Scientists Please Stand up?', *Stud. Hist. Phil. Sci.*, vol. 27, pp. 43-68

Week 4 (04.05.10): Millikan-Ehrenhaft debate

- Franklin, A. (1997), 'Millikan's Oil-drop experiments', *The Chemical Educator*, vol. 2(1), pp. 1-14.
- Niaz, M. (2005), 'An Appraisal of the Controversial Nature of the Oil Drop Experiment: Is Closure Possible?', *Brit. J. Phil. Sci.* 56, 681–702

Further readings:

- Holton, G. (1998), *The Scientific Imagination*, Harvard Univ. Press, pp. 25-83; in particular pp. 25-9 and 51-83.

Δ Week 5 (11.05.10): Experimental strategies

- Rasmussen, N. (2001), 'Evolving Epistemologies and the Artifacts of Empirical Philosophy of Science: a reply concerning mesosomes', *Biology and Philosophy*, 16, pp. 629-654.
- For Franklin's "epistemological strategies" see: Franklin, A. (2009), "Experiment in Physics", *The Stanford Encyclopedia of Philosophy (Spring 2009 Edition)*, Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2009/entries/physics-experiment/>.

Δ Week 6 (18.05.10): Robustness and discord of evidence

- Hacking, I., *Representing and Intervening*, Cambridge University Press, Chapter 11 (pp. 186-209)
- Stegenga, J. (2009), 'Robustness, Discordance, and Relevance', *Philosophy of Science*, 76, pp. 650-61

○ Week 7 (25.05.10): Theory-driven data reliability judgements

- Schindler, S. (manuscript), 'The problem of conflicting evidence and theory-driven data reliability judgements'

Δ Week 8 (01.06.10): Experiment and realism (1)

- Achinstein, P. (2002), 'Is there a valid experimental argument for scientific realism?', *The Journal of Philosophy*, vol. 99(2), pp. 470-95.

Further readings:

- Mayo, D., (1996), *Error and the Growth of Experimental Knowledge*, Chicago: CUP, Chapter 7, (pp. 214-50)

Δ Week 9 (08.06.10): Experiment and realism (2): Entity realism

- Reiner, R, and R. Pierson (1995), 'Hacking's Experimental Realism: An Untenable Middle Ground', *Philosophy of Science*, vol 62 (1), pp. 60-9.
- Clarke, S. (2001), 'Defensible Territory for Entity Realism', *Brit. J. Phil. Sci.*, pp. 701-22

Further readings:

- Hacking, I., *Representing and Intervening*, Cambridge University Press, Chapter 16, (pp. 262-75)
- Cartwright, N. (1983), *How the Laws of Physics Lie*, Chapter 4 (pp. 74-86).
- Resnik, D. (1994), 'Hacking's Experimental Realism', *Canadian Journal of Philosophy*, vol. 24, pp. 395-412.
- Elsamahi, M. (1994), 'Could Theoretical Entities Save Realism?', *Biennial Meeting of the Philosophy of Science Association*, pp. 173-80.

△ **Week 10 (15.06.10): Data vs. Phenomena (1)**

- Bogen, J., & Woodward, J. (1988). Saving the phenomena. *Philosophical Review*, 97, 303–352.

Further readings

- Woodward, J. (1989). Data and phenomena. *Synthese*, 79, 393–472.
- Woodward, J. (2000). Data, phenomena, and reliability. *Philosophy of Science*, Vol. 67, Supplement. Proceedings of the 1998 Biennial Meetings of the Philosophy of Science Association, Part II: Symposia Papers, pp. S163–79.

△ **Week 11 (22.06.10): Data vs. Phenomena (2): Theory-ladenness and exploratory experiments**

- Schindler, S. (forthcoming), 'Bogen and Woodward's data-phenomena distinction, forms of theory-ladenness, and the reliability of data', *Synthese*
- Steinle, F. (1996), 'Entering New Fields: Exploratory Uses of Experiments', *Philosophy of Science*, vol. 64, Supplement, (pp. S65-6 and S69-72)

Further readings

- Massimi, M. (forthcoming) "From data to phenomena: a Kantian stance", in *Synthese, Special Issue* edited by P. Machamer, J. Apel *et al.*
- Schindler, S. (2007), "Rehabilitating Theory. The Refusal of the bottom-up construction of Scientific Phenomena", *Studies in History and Philosophy of Science, Volume 38(1)*, pp. 160-184.
- Heidelberger, M. (2003). Theory-ladenness and scientific instruments in experimentation. In H. Radder (Ed.), *The philosophy of scientific experimentation* (pp. 138–51). Pittsburgh, PA: University of Pittsburgh Press.

△ **Week 12 (29.06.10): Data vs. Phenomena (3): antirealism about phenomena**

- McAllister, J. (1997), 'Phenomena and Patterns in Data Sets', *Erkenntnis* 47, pp. 217-28.
- Woodward, J. (forthcoming) 'Data and Phenomena: A Restatement and Defense', *Synthese*, DOI 10.1007/s11229-009-9618-5.

Further readings

- *Synthese* special volume (forthcoming), available online
- McAllister, J. (2007), 'Model Selection and the Multiplicity of Patterns in Empirical Data', *Philosophy of Science*, 74, pp. 884–94.

△ **Week 13 (06.07.10): Experimentalism and the Duhem problem (1)**

- Franklin, A. (1989), *The Neglect of Experiment*; Cambridge University Press, chapter 4 (p. 103-9).
- Mayo, D. (1997), 'Severe Tests, Arguing from Error, and Methodological Underdetermination', *Philosophical Studies*, pp. 243-66

○ **Week 14 (13.07.10): Experimentalism and the Duhem problem (2)**

- Weber, M. (2008), 'The Crux of Crucial Experiments: Duhem's Problems and Inference to the Best Explanation', *The British Journal for the Philosophy of Science*, pp. 1-31.

Further readings

- Schindler, S. (2008), 'Model, Evidence, and Theory in the discovery of the DNA Structure', *Brit. J. Phil. Sci.* 59, 619–58