The Philosophy of Science of Models
Spring 2003-2004

Rasmus Grønfeldt Winther
Instituto de Investigaciones Filosóficas,
UNAM
Oficina: Segundo Piso del IIF
Tlf.: 56-22-74-44
Email: rasmus@filosoficas.unam.mx

We will explore, primarily from a philosophy of science point of view, the nature and role of models in scientific theory, practice, and data collection/interpretation. Although many case studies will stem from biology, other sciences will also be investigated, including physics and cognitive science.

The course is divided into four sections, moving, roughly, from general to specific:

(I) Theoretical Worlds
(II) General Aspects, Resources, and Components of Models
(III) Accounts of Models in Philosophy of Science
(IV) Non-Canonical Model-Types Requiring Philosophy of Science Analysis

How Can You Reach Me?

I do not have specific office hours, but I am always available to set up an appointment. I respond promptly to email. I will read and comment on any student class work.

Class Requirements

- Do *all* of the reading for each class. All readings can be found in the course reader which you can purchase directly from me. Note that all weeks have *only* approx. 50 pages of reading. *For some particularly difficult articles, I will provide notes to guide your reading*.

- *Weekly* short (less than one page) *reaction pieces*. You can choose a theme or an article for that week on which to comment. This is an opportunity for you to wrestle, on a regular basis, with the material. These pieces *must* be sent to me, via email, by 9 pm each Monday before Tuesday's class. I will then address your concerns, questions, and analyses in lecture.

• *A few* 10-minute *presentations* during the course. The exact number will depend on the number of students in the class. For 10 of the weeks listed below, one student will present the paper marked by "##." The format and content of the presentation is decided by the student. Presentations can include handouts or Power Point formatting (or both). They can be expository or critical (or both).

• *Two papers*. The first paper, due during the middle of the course (Tuesday March 30, right before Semana Santa), should be between 5 and 8 pages. The second final paper, due on Friday June 18, should be between 10 and 15 pages. A final paper proposal is due on Tuesday May 18 and a rough draft of the final paper is due on Tuesday June 8. Please include a bibliography in both papers. *Potential paper topics will be provided*. I expect each student to discuss each of the two paper topics with me.

• A note on language. Lectures will be in English. Discussion can be in either English or Spanish (or both). Your written work and presentations can be in either English or Spanish (or Danish). I am perfectly happy to receive work in any of these languages.

Organization of Readings by Week

(I) Theoretical Worlds

(1) Beyond Kuhn's "Paradigms": Goodman's "Versions" and Wimsatt's "Theoretical Perspectives" (February 17)

• Goodman, Nelson. 1978. *Ways of Worldmaking*. Harvester Press, Hassocks, Sussex, pp. 1-22.
• Wimsatt, William. 1974. Complexity and Organization. *PSA 1972* 1: 67-86.

(II) General Aspects, Resources, and Components of Models

(2) Abstraction. The "Richness" of the Abstract: The *a priori* Account of Friedman (March 2 – note NO CLASS on February 24)

• Friedman, Michael. 1983. *Foundations of Space-Time Theories. Relativistic Physics and Philosophy of Science*. Princeton University Press, Princeton, pp. 236-250.
• Friedman, Michael. 1999. *Dynamics of Reason*. CSLI Publications, Stanford, CA, pp. 71-92.

(3) Abstraction. The "Poverty" of the Abstract: The *Pragmatic* Account of James and Dewey and the *Empiricist* Account of Cartwright (March 9)

• James, William. 1975. *The Meaning of Truth*. Harvard University Press, Boston, MA, pp. 134-145. ##
• Dewey, John. 1948. *Reconstruction in Philosophy*. Beacon Press, Boston, MA, pp. 149-155.
• Cartwright, Nancy. 1989. *Nature's Capacities and Their Measurement*. Oxford University Press, Oxford, U.K., pp. 183-230.

(4) Concept Formation. Approaches from Psychology and Philosophy (March 16)

- Murphy, Gregory and Douglas Medin. 1985. The Role of Theories in Conceptual Coherence. *Psychological Review* 92: 289-316. ##
- Laurence, Stephen and Eric Margolis. 1999. Concepts and Cognitive Science. In Margolis, E. and S. Laurence (eds.). *Concepts. Core Readings*. MIT Press, Cambridge, MA, pp. 3-8.
- Fodor, Jerry. 2004. Distributed Representations; Enough Already. (5 pp.) http://www.nyu.edu/gsas/dept/philo/courses/representation/

(5) Tradeoffs in Model Desiderata: Truth/Realism vs. Explanatory Power/Generality (March 23)

- Cartwright, Nancy. 1983. *How the Laws of Physics Lie*. Oxford University Press, Oxford, U.K., pp. 44-53. ##
- Levins. Richard. 1968. *Evolution in Changing Environments*. Princeton University Press, Princeton, pp. 3-9.
- TBA

(6) Assumptions and Biases of/in Models (March 30 – first paper due)

- Wade, Michael. 1978. A Critical Review of the Models of Group Selection. *The Quarterly Review of Biology* 53: 101-114. ##
- Wimsatt, William C (1984): Reductionistic Research Strategies and Their Biases in the Units of Selection Controversy. In Sober,Elliott (ed.). *Conceptual Issues in Evolutionary Biology*. 1st ed. MIT Press, Cambridge, MA, pp. 142-183.
- Tversky, Amos and Daniel Kahneman. 1982. Judgment Under Uncertainty: Heuristics and Biases. In Kahneman, D, P. Slovic, and A. Tversky (eds.). *Judgment Under Uncertainty: Heuristics and Biases*. New York: Cambridge University Press, pp. 3-20.

(III) Accounts of Models in Philosophy of Science

(7) The Semantic View: Two Classics (April 13)

- Suppes, Patrick. 1962. Models of Data. In Nagel, E., P. Suppes, A. Tarski (eds.). *Logic, Methodology and Philosophy of Science. Proceedings of the 1960 International Congress*. Stanford University Press, Stanford, California, pp. 252-261.
- van Fraassen, Bas. 1989. *Laws and Symmetry*. Oxford University Press, Oxford, U.K., pp. 217-232.

(8) The Semantic View: the View from Biology (April 20)

- Lewontin, Richard. 1974. *The Genetic Basis of Evolutionary Change*. Columbia University Press, New York, NY, pp. ix-16. ##
- Lloyd, Elisabeth A. 1988. *The Structure and Confirmation of Evolutionary Theory*. Princeton University Press, Princeton, NJ, 11-25.
- Beatty, John. 1980. What's Wrong with the Received View of Evolutionary Theory? *PSA 1980* 2: 397-426.

(9) An Alternative to the Semantic View: the Mediating Models View (April 27)

- Morrison, Margaret and Mary Morgan. 1999. Models as Mediating Instruments. In Morgan, M., and M. Morrison (eds.). *Models as Mediators. Perspectives on Natural and Social Sciences.* Cambridge University Press, Cambridge, U.K., pp. 10-37. ##
- Morrison, Margaret. 1999. Models as Autonomous Agents. In Morgan, M., and M. Morrison (eds.). *Models as Mediators. Perspectives on Natural and Social Sciences.* Cambridge University Press, Cambridge, U.K., pp. 38-65.

(10) An "Expanded" (?) Semantic View: Two Proposals (May 4)

- Downes, Stephen. 1992. The Importance of Models in Theorizing: A Deflationary Semantic View. *PSA 1992* 1: 142-153. ##
- Griesemer, James. 1990. Modeling in the Museum: On the Role of Remnant Models in the Work of Joseph Grinnell. *Biology & Philosophy* 5: 3-36. (Only read up to p. 11)
- Griesemer, James. 1991. Material Models in Biology. *PSA 1990* 2: 79-93.

(IV) Non-Canonical Model-Types Requiring Philosophy of Science Analysis

(11) Mental and Computational Models (May 11)

- Greeno, James. 1989. Situations, Mental Models, and Generative Knowledge. In Klahr, D. and K. Kotovsky (eds.). *Complex Information Processing: The Impact of Herbert Simon*. Lawrence Erlbaum Associates, Inc. Mahwaw, NJ, pp. 285-318. ##
- Cantwell Smith, Brian. 1996. *On the Origin of Objects*. MIT Press, Cambridge, MA, pp. 27-36; 49-68.

(12) Narrative Models (May 18 – final paper proposal due)

- Hull, David. 1975. Central Subjects and Historical Narratives. *History and Theory* 14: 253-274. ##
- Richards, Robert. 1981. Natural Selection and Other Models in the Historiography of Science. In Brewer, M. and B. Collins. *Scientific Inquiry and the Social Sciences*. Jossey-Bass Publishers, San Francisco, pp. 37-76.
- López-Beltrán, Carlos. 1998. Narrativa y Explicación en las Ciencias Naturales. En: Barahona, Ana y Sergio Martínez. *Historia y Explicación en Biología*. Fondo de Cultura Económica, D.F., México, 197-211

(13) Physical Models (May 25)

- Griesemer, James. 1990. Modeling in the Museum: On the Role of Remnant Models in the Work of Joseph Grinnell. *Biology & Philosophy* 5, 3-36. (From p. 11 to end)
- Plutynski, Anya. 2001. Modeling Evolution in Theory and Practice. *Philosophy of Science* 68 (Proceedings), S225-S236.
- Giere, Ronald. 2002. How Models are Used to Represent Physical Reality. (10 pp.) http://philsci-archive.pitt.edu/archive/00000838/

(14) Diagrammatic/Pictorial Models (June 1)

- Lynch, Michael and John Law. 1999. Pictures, Texts, and Objects. The Literary Language Game of Bird-Watching. In Biagioli, M. (ed.). *The Science Studies Reader*. Routledge, NY, pp. 317-341. ##
- Kemp, Martin. 1997. Seeing and Picturing. Visual Representation in Twentieth-Century Science. In Krige, J. and D. Pestre (eds.). *Science in the Twentieth Century*. Taylor & Francis, London, pp. 361-390.

(15) Student Presentations on Their Respective Papers. Format to be Announced. (June 8 – rough draft of final paper due)

(16) Wrap-Up Session. Final Thoughts and Open Discussion. (June 15)