

HPS 220

Nineteenth-Century Philosophy of Science

Fall 2009
Wednesdays 3:15-5:05

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SYLLABUS
(as of September 22, 2009)

The transition in philosophy of science from the determinism of the seventeenth and eighteenth centuries to the more statistically oriented science of the late nineteenth century and the early twentieth. A concentrated examination of the reconceptualization in England of induction and inductive science. The Baconian and Newtonian heritage, John F. W. Herschel, Whately's revival of logic, the Mill-Whewell debate, Stanley Jevons, connection of induction to probability, Adolphe Quetelet, Darwin, Maxwell, prelude to quantum mechanics. (4 units), Autumn.

The nineteenth century was the center of what has been called the Second Scientific Revolution. John Dalton revolutionized chemistry with his atomic theory, Adolphe Quetelet social sciences with his development of statistics, Charles Darwin life sciences with his theory of natural selection, Louis Pasteur medicine with his germ theory. Whole sciences of electricity, electromagnetism and thermodynamics were built up virtually from scratch. The foundations were laid for relativity and quantum mechanics.

With all this there was also a revolution—or rather several overlapping revolutions—in the philosophy of science. The century opened with a virtually universal belief in a Newtonian world of deterministic laws and in the method of inductive inquiry developed by Francis Bacon. By the end of the century, statistically oriented science was replacing deterministic and Bacon's inductive method was mocked.

In this course we will explore this revolutionary shift in the philosophy of science, giving particular attention to the complete reversal in admiration for Bacon's inductive method. How did it happen that by the end of the century philosophers of science were saying that the method all those revolutionary scientists said they used was in fact worthless?

Primary sources will be the core of our study. Secondary courses will supplement. That is, for example, we will rely most heavily on our own reading of Herschel or Mill or Darwin than on what some modern commentator says about them. We will mostly read the methodologists but add in some practitioners along the way, picking those of most interest to students in the class.

During the course you will meet people who thought about science differently than we do today and you will discover the ideas that formed the foundation for twentieth- and twenty-first-century science.

Course grade

Your course grade will be based as follows on class participation, three papers, each 900–1200 words long, and one short quiz given during the final class.

30%	Class participation
20%	Paper #1
20%	Paper #2
25%	Paper #3 (You should be getting better at this, so I count the final one a bit more.)
5%	Quiz on last day of class

There is no final exam.

I will give you direction on paper topics in class.

Grades

I have no reservation about giving all As. I have no reservation about giving Bs, Cs, and Ds. In a small seminar class, as this one is, I am fully capable of finding enough time and energy to help any student excel who wants to.

Necessary Background

This is an upper level seminar, but with no specific prerequisites. I expect grad students and upper-level undergraduates, and historians, philosophers, and scientists, engineers, or mathematicians. Ideally, we will have a rich mix.

If you have it, deep expertise in twentieth-century philosophy of science will be both a blessing and a curse. It will help you see the importance and subtleties in the issues but it will tempt you to make the big mistake of reading modern concerns back into the past. You must be ready to challenge and maybe even abandon what your training in philosophy of science has taught you to take for granted.

If you have some expertise in a technical discipline, you do not need any special training in philosophy of science. You will have already picked up what you need just as part of your practical training in scientific method.

We will make no use of twentieth-century scientific or philosophical wizardry. Our subjects did not use it and neither will be.

For my seminars, variety is good. If your expertise and background are different from others in the class, don't worry—that's a good thing.

Class participation

When I say that 30% of your grade is for class participation, I'm serious. I do not mean class attendance, I mean class participation. If you write all A papers but never engage in the class discussion, you could get a C for the course.

Moreover, when I say class participation, I mean quality, not quantity. You do not need to be a big player in every single conversation. Some discussions will be outside your areas of expertise and you'll get more out of them by just listening. That's OK. But you need to show me you have read and thought about the assignments, and you must be ready to engage in scholarly discussion with me and your classmates. I will make sure everyone has the opportunity to do so.

Workload

We meet for less than two hours a week. Budget your time with the presumption that most of your learning will be done by yourself reading the materials. Class will begin with the assumption that everyone has read and already thoughtfully considered the week's reading assignments.

Do not panic when you see the amount of reading. It need not all be read with equal care. I will give you advice on which parts can be read quicker and what you should be looking for.

The three papers are not long and will not require outside research beyond what you need for class discussion. The reading will be lighter on the weeks when papers are due, but you will still need to budget your time for the papers and be thinking about them well before they are due.

I will adjust the syllabus once I see what students are interested in.

Plagiarism

Until I had a student turn in a paper that was copied nearly verbatim from an old journal article, I never thought I'd see a case of plagiarism at Stanford University. But now that I have, let all be forewarned. Some professors prefer to handle cases of plagiarism themselves, exercising their own discretion, and working the matter out with the student one on one. I don't. I prefer to utilize the procedures administered by Stanford's Office of Judicial Affairs. It eliminates any arbitrariness by the professor, and it places decision-making authority in the hands of a panel composed primarily of fellow students. And therein lies the warning: In cases of honest ignorance, there is nothing to fear, but in unambiguous and blatantly intentional cases of plagiarism, a panel of students judging other students can be flat-out merciless.

For info on plagiarism, see www.stanford.edu/dept/vpsa/judicialaffairs/students/plagiarism.sources.htm. For sample cases, see www.stanford.edu/dept/vpsa/judicialaffairs/judicialprocess/samplecases.htm. (Note the frequency of the phrase "one-quarter suspension.") For any questions, ask me.

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Student Disability Resource Center (SDRC) located within the Office of Accessible Education (OAE). SDRC staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an *Accommodation Letter* for faculty dated in the current quarter in which the request is being made. Students should contact the SDRC as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066).

Required Texts

Almost all the readings are in the HPS 220 Course Reader available in the bookstore.

The only exception is the material from John Stuart Mill. The copyright on these is such that you can legitimately download them for free, but if we include them in the course reader, you need to pay a license fee. So you will need to get these from <http://oll.libertyfund.org>. (Or, if you are going to study philosophy of science in the future, buy the hardcopy edition of *System of Logic* from Liberty Fund. It's a remarkably good price for an outstanding scholarly edition.)

Assignments.

- Week 1**
September 23
Background. Two views of induction. Newton. The clockwork universe.
In-class handout:
- Bernardino Telesio, from *On the Nature of Things According to Proper Principles*.
 - Jacopo Zabarella, selection on induction.
 - Francis Bacon, *Novum Organum*, selections on induction.
 - Isaac Newton, “Rules of Philosophizing,” *Principia*.
 - Pierre-Simon Laplace, *Philosophical Essay on Probability*, paragraphs on deterministic universe
- Week 2**
September 30
1820s and 30s. John Herschel the conventionalist and Richard Whately the rebel.
Read and be prepared to discuss the following:
- John F. W. Herschel, *A Preliminary Discourse on the Study of Natural Philosophy*, (1st, 1830)
 - pt. II.
 - Richard Whately, *Elements of Logic* (1st: 1826, we need 5th: 1834 or later). Be sure to read the footnotes.
 - bk. II, ch. I, §1–2. We’ll discuss what Whately thinks logic is.
 - bk. IV, intro and ch. I.
- Week 3**
October 7
William Whewell updates Bacon.
Read and be prepared to discuss the following:
- John McCaskey, “William Whewell (1794–1866).” This is a highly condensed summary of Whewell’s epistemology. It should make working through Whewell much easier.
 - William Whewell, *Philosophy of the Inductive Sciences*
 - bk. I, ch. 1–3. You can read ch. 1 quickly; the others will require more care. You can skip sections 7 and 9 of ch. 2.
 - bk. XI, ch. 1–2, 4–7.
 - plus the associated aphorisms
- Week 4**
October 14
John Stuart Mill builds on Whately’s idea.
Read and be prepared to discuss the following:
- John Stuart Mill, *A System of Logic: Ratiocinative and Deductive*
 - “On the Ground of Induction,” bk. III, ch. III.
 - “Of the Four Methods of Experimental Inquiry,” bk. III, ch. VIII.
 - You might not need to read this chapter. It explains what are now called “Mill’s Methods.” You need to know what Mill’s Methods are, but you don’t really need to read Mill to learn them. They are now explained in shorter and often clearer form in many textbooks and web sites. You may in fact have already learned them elsewhere.
 - Be sure to work through the summary and examples of Mill’s Methods included in the Course Reader.
 - “Of Plurality of Causes, and Of the Intermixture of Effects,” bk. III, ch. X.
 - “Of the Deductive Method,” bk. III, ch. XI.
 - “Of the Evidence of the Law of Universal Causation,” bk. III, ch. XXI.

FIRST PAPER DUE beginning of class October 21.

- Week 5**
October
21
- The great battle over induction: Whewell vs. Mill**
Read and be prepared to discuss the following:
- Laura J. Snyder, *Reforming Philosophy: A Victorian Debate on Science and Society* (University of Chicago Press, 2006), pp. 7–26.
 - William Whewell, “Induction or Description?” *Mr. Mill’s Logic*.
 - John Stuart Mill, “Of Observation and Description,” *A System of Logic*, bk. 4, ch. 1.

- Week 6**
October
28
- W. Stanley Jevons connects induction and probability.**
Read and be prepared to discuss the following:
- Larry Laudan, “A Note on Induction and Probability in the 19th Century,” *Science and Hypothesis: Historical Essays on Scientific Methodology*, ch. 12, pp. 192–201.
 - W. Stanley Jevons, *The Principles of Science*,
 - Preface to the first edition
 - Table of Contents
 - Chapters 7 (from “Transition from Perfect to Imperfect Induction”), 11, 12, 23 (up to “Descriptive Hypothesis”), 31.

- Week 7**
November
4
- The rise of statistical thinking.**
Read and be prepared to discuss the following:
- Theodore Porter, *The Rise of Statistical Thinking 1820–1900* (Princeton University Press, 1986), pp. 3–13, 40–70.
 - Adolphe Quetelet, “Preface” and “Introductory,” *A Treatise on Man* (1842).
- Depending on your interest, begin researching the work of a scientist of mid-century and consider to what extent he or she is adopting the new statistical thinking. I can help you with suggestions. This will be the beginning of work toward your second paper.

SECOND PAPER DUE beginning of class November 11.

- Week 8**
November
11
- Philosophy of science in practice.**
For this week, you will continue outside research into the work of some practicing scientist. Last week, we looked at your scientist’s use of statistical methods. This week that limit is removed. Assess your scientist’s work against all the methods and methodological issues we have seen in the course so far. Whose, if anyone’s, method is he or she following? Write your paper on this topic and in class we will discuss what each of you found, so be prepared to present in class a verbal summary of your paper.

- Week 9**
November
18
- Culture and philosophy of science just before modern physics.**
Read and be prepared to discuss the following:
- Paul Forman. “Weimar Culture, Causality, and Quantum Theory.” *Historical Studies in the Physical Sciences* 3 (1971). 1-115.

- Week 10**
December
2
- To be determined.**
I’ll wait and see what students want and then determine the assignment based on that.

THIRD PAPER DUE December 10.