

Sociology of Science, Graduate Level
Spring 2001
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Description: This course attempts to examine (a) the institutional features of modern science (understood as a particular system of cognition production) and (b) the ways in which the dominance of this structure has changed the cognitive styles of persons exposed to it. As a result, historical and comparative works are used to supplement more traditional institutional analysis. The second question is necessarily somewhat vague; we will be focusing on one or two important epistemic characteristics of “life after science.”

The class is organized as a discussion seminar; each week we will read one or two pieces that take a particular approach to our problem; we will use the reading to critically evaluate this approach. Because the sociology of science draws upon the philosophy of science, some works are a bit difficult for the novice. I indicate further readings for each week for students who either want to pursue a particular theme further, or get background that will be helpful for putting the readings in context.

Requirements:

Regular and cheerful attendance is of course expected; participants will be expected to come to class prepared to discuss the work(s) in question. At times I will begin by asking students what they want to talk about, and try to structure discussion around that theme. Students will write one paper, preferably a research paper that represents the fruits of an ongoing project, however modest in scope, which can be used to concretize some of the themes of the course. **NOTE:** Since you will have read Ludwig Fleck’s book for your theory class, we will begin discussing that the first day.

Caveat:

The purpose of this course is, as said above, to attempt to examine the specific social causes and effects of modern science as a system of cognitive production. This is an empirical question, if a tough one. Resolutely excluded from discussion are such topics as (1) is truth true?; (2) are physicists better than sociologists or vice-versa?; or (variation) (3) can we prove that there is no difference between physics and sociology; (4) is western science cold and prickly?; (5) is our gut feeling that it all boils down to power, etc.

Books:

The following books are available at the Livingstone Bookstore:

Thomas Kuhn, The Structure of Scientific Revolutions, 2nd or 3rd edition.

Steven Shapin, A Social History of Truth.

Joseph Needham, Science in Traditional China: An Introduction

Karin Knorr-Cetina, Epistemic Cultures

Bruno Latour, Science in Action

*Other readings (those marked with an *) will be in a course packet which will only exist as a packet after the fact—I'll put selections in the floating Sergeant Joyce Kilmer memorial library two weeks ahead of time.*

In some cases, I indicate a set of readings and ask students to choose one: this distributed cognition will hopefully allow our collectivity a wider grasp than could be asked of any one student.

SECTION I: WHAT IS DISTINCTIVE ABOUT SCIENCE AS COGNITION PRODUCTION?

Our first question is simple: to understand what we are going to talk about. There certainly is something distinctive about modern science, yet it turns out to be very hard to pin down. Without dumping on everyone else, a few sprawling comparisons of a good account of standard science and other ways of looking at the world help focus our attention on some distinctive attributes of modern science as a social system.

What is Science?

WEEK 1: Ludwig Fleck, Genesis and Development of a Scientific Fact.

I begin by laying out the questions prompting this class, and some fundamental definitions that may be of use in pursuing them. As an aid, we turn to Fleck. You should all have read this book in your theory class; we will leap right in and discuss it. If you didn't read all of it before, I strongly suggest you do so now. It is unsurpassed as a framework for the sociology of science.

Suggested additional readings for the fanatic:

Steven Shapin has a tremendous review of Fleckian (i.e. good) sociology of science, "History of Science and Its Sociological Reconstructions," History of Science 20(1982):157-211, reprinted in Cognition and Fact—Materials on Ludwig Fleck, a stunning collection of essays by and about Fleck, edited by R.S. Cohen and T. Schnelle. Look also at Fleck's incredible essay "On the Crisis of 'Reality'"—a short piece which anticipates the most important parts of 1960s/70s sociology/history of science. Also in that collection.

If you doubt the emphasis on fact construction, I strongly suggest you read Ian Hacking's wonderful Representing and Intervening, especially section B. Some other works on experiment are found in The Uses of Experiment—I can't remember who edited it, it has nice contributions by Pickering, Nickles et al; and Andrew Pickering, The Mangle of Practice; there's also a shorter version in an AJS article of the same name, perhaps 1994. A very deep critique of Pickering's approach, with broad implications, is found in a recent article by Daniel Breslau, "Sociology After Humanism," Sociological Theory 18(2000):289-307. A book that we would have read if this were not the first week is Jed Buchwald, The Creation of Scientific Effects, on how Hertz "discovered" ? electric waves.

What is not Science?

WEEK2: Levi-Strauss, The Savage Mind, selections*; Peter Worsley, Knowledges, selection*; Robin Horton, “African Thought and Science”*; J. E. Wiredu, “How Not to Compare African Thought With Western Thought.”*

You also should look at least one of the following: Bantu philosophy by Placied Tempels, selection*, and H. Minkus’s “Causal Theory in Akwapim Akan Philosophy” in African Philosophy: An Introduction edited by Richard A. Wright; John R. Farella, The Main Stalk, selections*

Suggested additional Readings for the fanatic: Levy-Bruhl’s How Natives Think became widely reviled in the period of decolonialism for the implicitly patronizing way in which the thought of primitives (itself a word then beginning to raise hackles) was considered “pre”-Logical, where Logic was Eurocentrically defined. However, in many ways it may do better justice to the actual differences among ways of thinking than most later treatments, and must be read to understand the development of the Durkheimian school, which includes Levi-Strauss. Many other sources on other “ways of thinking” are selective, present a false picture of unity, and deliberately accentuate contrasts to the West—in other words, pre-Worsleyan.

SECTION II: WHAT IS THE INSTITUTIONAL STRUCTURE OF SCIENCE?

Our next question might easily form an entire course in the sociology of science, namely what is the institutional structure—the organizations, the norms, and the principles of inter-organizational or inter-group coordination—that characterizes modern science? To fit more things in, we need to race through this, but fortunately there is wide consensus on this, though you wouldn’t guess it from all the posturing.

The first synthesis—Science as Institutionally Guided Cognition

WEEK 3: T. S. Kuhn, The Structure of Scientific Revolutions; David Hull, Science as a Process, selections (you may skim over ch 11, characteristics of selection processes).

We continue talking about what is and what is not science using Kuhn, whose reflections on the relation between art and science are the best place to start.

Recommended: Bloor, Knowledge and Social Imagery, Chaps 1, 2; Keller, A Feeling for the Organism.

It would be wrong to teach a class on this topic and not cover Kuhn...besides, it is good, if wrong. Is it better than Fleck’s analysis? Hmmm..... Bloor has a reasonable methodological position that is worth looking over for those who are unsure of how a sociology of science might proceed...Keller describes the processes of interpersonal communication of scientific discovery from the perspective of one with a failure to communicate.

Suggested additional readings for the fanatic:

On where Kuhn fits in:

Karl Popper, The Logic of Scientific Discovery—the leading pre-Kuhnian philosophy of science.

Hans Reichenbach, The Rise of Scientific Philosophy, Part I. This helps with Popper—perhaps; the discussion of the context of justification vs. the context of discovery is still vital and interesting.

Imre Lakatos's essay in Criticism and the Growth of Knowledge. In practice, few differences from Kuhn, but still considered a must-read. I don't know why.

Paul Feyerabend, Against Method. Badly printed and occasionally rambling, but full of lovely concrete discussions that demonstrate the weaknesses of the Kuhn/Lakatos approach.

A useful collection of essays on Kuhn's approach is Gutting, ed, Paradigms and Revolutions. Note that most of these miss the point somewhat (applying Kuhn to irrelevant fields), but Heidleberger's analysis of the Copernican revolution is a must-read (since that was Kuhn's own exemplar).

On Tacit Knowledge:

Michael Polanyi, Personal Knowledge. A wonderful book, but too long and deftly incorporated by Kuhn.

H. Collins, "Tacit Knowledge and the TEA Set." A good example of Polanyish dynamics in action.

M. Steven Tracton, "On the Skill and Utility of NMC's [National Meteorological Center of the National Weather Service, for the uninitiated] Medium-Range Central Guidance," Weather and Forecasting (I think is the journal—I have a xox but it isn't exactly clear) 1992, Volume 8.

Anyway, it's cited in Braving the Elements by David Laskin. New York: Doubleday, 1996, and it is a great piece of evidence that experienced judgment, even when it can't be formalized, counts, even (especially) where formalization is incredibly high already.

Institutional and Normative Science

WEEK 4: Robert Merton, The Sociology of Science: "The Normative Structure of Science," 267-278*, "The Matthew Effect in Science," 439-459; Harwood, Styles of Scientific Thought, selections*

As Gieryn pointed out (somewhere, I don't remember), much of the "oh, too cool" recent work in the sociology of science was there in Merton, just without the attitude. Norms are no longer cool, but it provides an excellent starting place for the understanding of how communities operate.

Strongly Recommended: Diana Crane, Invisible Colleges, 1-84, 99-114, 128. The argument is important, but the data extremely weak—skim over if you have time to get an understanding of the importance of scientific networks.

Suggested additional readings for the fanatic:

Merton's corpus is large and idiosyncratic. "Priorities in Scientific Discovery," 286-324 in The Sociology of Science is a classic but easily summarized and so we are not reading it. Science Technology and Society is an important argument regarding the historical origins of modern

science, though somewhat dated in evidence; Merton's bizarre and self-indulgent On the Shoulders of Giants makes lovely bed-time reading. Harriet Zuckerman's stuff on the Nobel prize winners is closely related to Merton's concern. Merton also has a history of the sociology of science from his own perspective, The Sociology of Science, an episodic memoir. Also see the comments under Week 9. David Hull has, in Science as a Process (also see a working paper "What's Wrong with Invisible Hand Explanations") basically restated Merton's basic point in "Priorities" and "Normative Structures". Joseph Ben-David's most important essay on the institutionalization of science have been recently collected in Scientific Growth, which might prove helpful. His analysis of the formation of psychology as a discipline is especially interesting.

On organization: Cole and Cole's Social Stratification in Science; Thomas Gieryn on Boundary Work in science.

On Networks: Struan Jacobs and Brian Mooney, "Sociology as a Source of Anomaly in Thomas Kuhn's System of Science" (Philosophy of the Social Sciences 27:466-485) argue that these findings wreck Kuhn's system. Noah Friedkin has a complex analysis of scientific networks in A Structural Theory of Influence

On Norms: A related though different take on the generalization of authority in science may be found in Michael Polanyi, Science, Faith and Society.

Anomic Science

WEEK 5: Bruno Latour, Science in Action, either all of it, or selections TBA; The Pasteurization of France, selections from first part.*

Don't get put off by the juvenility—this is an important and reasonable understanding of how science as an institutional system channels individuals and groups to produce cumulative knowledge.

Suggested additional readings for the fanatic:

Note that much of this is implicit in Merton on priorities, but this adds the blood and guts. On science as control of uncertainty, see Susan Leigh Starr's wonderful piece, "Scientific Work and Uncertainty" in Social Studies of Science. Latour is also heavily influenced by Wittgensteinian linguistic philosophy—indeed, the embarrassing second section of Pasteurization is a basically a trivial recapitulation of the linguistic philosophy, though written in the forced style of Nietzsche's Zarathustra. Look at the chart of linguistic philosophy in Gellner, Words and Things, p. 160, and you don't have to read "Irreductions."

A unification

WEEK 6: Bourdieu, Homo Academicus, "Preface for English Edition," "A Book for Burning?," 36-8, 48, 53-59, 77-84, 86-94, 98-101, 125-127, 143-151 (149 is key!), 210-225 (this part is fun!) (and you can skip the little print parts without coming to harm: skim over the "note on the factor analysis of correspondences" if you need help interpreting the graphs); "Creative Project and Intellectual Field"*; Latour and Woolgar, Laboratory Life, selection on the cycle of credibility*.

Strongly recommended: Terry N. Clark, Prophets and Patrons, 13-61, 67-92*.

Unfortunately, I have to use sociology as the “science” for this example, because the two best works here both deal with sociology. However, as we recall from Merton’s “Matthew Effect,” there is reason to expect some type of translatability. Here we look at the organizational side of science, a series of overlapping, competing, and nested pyramids of patronage.

Suggested additional readings for the fanatic:

You really should read all of Bourdieu’s book, it actually has a good account of his theoretical approach, but you might also want to consult his Distinction and The Logic of Practice. Both of those are must-reads sooner or later...why not today?

Epistemic Cultures

WEEK 7: Karin Knorr-Cetina, Epistemic Cultures.

No, I don’t know what these are either, but we will after we read this book, and then we’ll try to fit it in.

Suggested additional readings for the fanatic:

Knorr-Cetina wrote perhaps the best ethnography of science, Manufacturing Knowledge. You should take a look at it.

SECTION III: ARE THERE CIVILIZATIONAL DIFFERENCES BETWEEN SCIENCES?

This section is largely devoted to works I haven’t read yet, so I will forbear from commenting. The examples chosen are ones in which there was a continuous pattern of scientific progress that was still underway at the time of the rise of modern western science in Europe. Other places in which continuous empirical cognition creation may have taken place, but then suffered cataclysmic disruption (such as South America and Ancient Egypt) are harder to study, though equally relevant. Questions that will need to be asked involve not only cultural and institutional differences, but whether medicine and astronomy, generally strong points of pre-modern science in the great empires, may have different developmental tendencies than materials science. This section and the next will be to some extent a consideration of claims made by H. Floris Cohen in The scientific revolution : a historiographical inquiry.

There is a teeny bit of difficulty in that there is a clearly dominant source for each civilization, and their perspectives are different. Thus our understanding of India might be different if Chattopadhyaya had Nasr’s perspective. Supplementary readings will therefore be available, mostly taken from what is now in the “additional readings” section (which I have to read and sort through).

China

WEEK 8: Joseph Needham, Science in Traditional China: An Introduction

China is interesting not only in that there was a high degree of development of mechanical science without the mechanistic worldview of the British materialists, but there was also nothing

like Merton's emphasis on universalistic norms. Yet the social structure was also productive of advance.

Suggested additional readings for the fanatic:

Needham has been, for the past half century, writing the largest multi-volume work on anything ever written by a human being. He has basically swamped everyone else out of the history-of-science-in-China pond, so you'll need to look further at his work.

India

WEEK 9: We will rely on Debiprasad P. Chattopadhyaya's wonderful History of Science and technology in Ancient India, 1991: preface, 1-27, 34-43, 55-69, 82-102, 117-121, 126-132, 135-148, further selections TBA*. Other readings now listed under the "fanatic" section will be announced.

India is most well known for its contributions to mathematics, and also that funny form of mathematics called astronomy. Did it equal China in chemical science? If not, why not?

Suggested additional readings for the fanatic:

History of Astronomy in India by S. N. Sen and K. S. Shukla is a good compilation though oriented to the non-sociological side; Chattopadhyaya also has a good compilation of older works called Studies in the History of Science in India; in addition, you might want to read Chattopadhyaya's Science and society in ancient India from his Marxist days; also see History of oriental astronomy edited by G. Swarup et al; and Sharma and Mehra, "Precision Instruments of Sawai Jai Singh" Indian Journal of History of Science 26 (1991): 249-276. Zaheer Baber, The Science of Empire, focuses on the colonial period but has a good review of earlier times.;

Islam

WEEK 10: Seyyed Hossein Nasr, Science and Civilization in Islam, selections.* Other selections to be announced, mostly taken from the "fanatic" section below.

The dark ages were only dark for Christians; philosophical advance switched to being centered in Islamic cities. Did this affect the relative emphasis from natural philosophy further towards legal philosophy?

Suggested additional readings for the fanatic:

Studies in the Islamic Exact Sciences by Edward S. Kennedy contains almost all of his papers and some of his students. It is not sociologically oriented and has lots of math; How Greek science passed to the Arabs by De Lacy Evans O'Leary; and Islamic mathematical astronomy by David A. King.

SECTION IV: CAN AN EPISTEMIC BREAK BE LOCATED BEYOND THE ESOTERIC CIRCLES?

Now we switch lenses and look at the historical development of modern science, not to explain its causes, but to examine whether there was a fundamental societal change in the understanding of the world that was related to the development of

modern science, and, even more interesting (says I), whether the development of modern science changed the normal cognitive patterns of nonscientists.

Pre-Scientific Knowledge Accumulation

WEEK 11: Keith Thomas, Religion and the Decline of Magic, selections*; Ioan P. Couliano, Eros and Magic in the Renaissance, selections*

Suggested additional readings for the fanatic:

Thomas's Man and the Natural World is also a wonderful contribution here. Note that as we are brought back to participation, much of the post-Levy-Bruhl literature is relevant here. For more on this epistemology which will be contrasted in two weeks, see Vernant, The Greeks on classical understandings of vision, and Theories of vision from al-Kindi to Kepler by David C. Lindberg.

The Development of Trust

WEEK 12: Steven Shapin, A Social History of Truth, espec Ch 1-3, 5, 6 (pp. 266-309).

Shapin takes seriously the idea that science is social knowledge, which requires an investigation of the sources of belief transmission from one person to another...i.e. trust and authority between scientists. A long book, but I seriously suggest you read the whole thing.

Suggested additional readings for the fanatic:

Eugene Klaaren's Religious Origins of Modern Science makes a good alternative to Shapin's perspective on Boyle; you also might want to look at Merton or Bloor on Boyle.

Susan Faye Cannon, Science in Culture: The Early Victorian Period, 1-71, 111-224, 263-287* describes the importance of the Cambridge network in the production of professional scientists.

A Change in Epistemology

WEEK 13: E. A. Burt, The Metaphysical Foundations of Modern Physics, selections* OR

Richard S. Westfall, The Construction of Modern Science; Jack Goody, The Domestication of the Savage Mind, selections; Edwin Hutchins, Cognition in the Wild, 96, 112-116, 128-30, 153-5, 164-174*.

Eventually, we have to at least recognize that science doesn't simply lope along behind society, the former tugging the latter by its leash. Rather, modern science has been part of a profound cultural shift, entailing for one thing an emphasis on cooperatively producing knowledge that can be individually internalized by the next generation, and for another, doing this by allowing people to visualize knowledge.

Suggested additional readings for the fanatic:

On Alternatives:

Here I stress the British materialist side of science, but the German *Naturphilosophie* associated with Goethe had more in common with the "pre-scientific" world views we have been discussing. See Greene, "Darwinian Revolution" in Gutting, Paradigms and Revolutions. The question of Japanese science has been most prominent, as far as I am aware of, in primatology. There's an article in Laura Nader's Naked Science in the library for the interested to take a look at ("Japanese Science and Western Hegemonies" by Pamela Asquith), although it is far from

authoritative, as well as Frans De Waal's ruminations that are scattered in his books but also in a recent article in Natural History (around December 2000).

On the scientific revolution:

Steven Shapin, The Scientific Revolution

I.B. Cohen, Revolution in Science.

Jack Goldstone, "The Rise of the West—Or Not?" (Sociological Theory 18[2000]:175-194) has a deliberately simple and reductive argument regarding the explosion of science in England. (It is the antithesis to the "all the way back" arguments made by Jared Diamond in his recent Germ, Guns, and Steel.) While this "lone gunman" type of theory may not satisfy us, it is worth serious consideration.

On literacy

Jack Goody, "The Uses of Literacy." Also take a look at his The Domestication of the Savage Mind, Walter J. Ong, Orality and Literacy: The Technologizing of the Word.

On cognition

The basic insight upon which Hutchins seizes is from Lev Vygotsky. See the latter's "The development of the Higher Mental Functions" in J. Wertsch, ed, The Concept of Activity in Soviet Psychology. Also see Hutchins' Culture and Inference: A Trobriand Case Study. Also see J. Cole and S. Scribner, Culture and Thought: A Psychological Introduction,

A Change in Vision

WEEK 14: Bruno Latour "Visualization and Cognition," Knowledge and Society 1986:1-40*; Samuel Edgerton, The Heritage of Giotto's Geometry: Art and Science on the Eve of the Scientific Revolution, 1-22, 36, 38-46, 111, 239-253, 270-271*, Selections TBA from Picturing Science, Producing Art, edited by Caroline Jones and Peter Galison.

Strongly recommended, but didn't have the heart to pile on as requirement: Alfred Crosby, The Measure of Reality, 129-137, 140-142, 150-157, 161-178, 182-192, 227-240, Fig 1*;

On visualization and science:

A classic piece is also Michael Lynch, "Discipline and the Material form of Images: An Analysis of scientific visibility", Social Studies of Science 15(1985):37-66. Also see Eileen Reeves, Painting the Heavens: Art and Science in the Age of Galileo Princeton U, c. 1997.

On visualization and art:

S. Alpers, The Art of Describing: Dutch Art in the 17th Century, Edgerton's The Renaissance Discovery of Linear Perspective, W. M. Ivins, On the Rationalization of Sight;