

SYLLABUS

History of Science 907, Spring 2007

Historiography of Technology

2:25-5:00 Tuesday, 6105 Social Science

Professor:	Eric Schatzberg	Office Hrs:	10-11 Thu. or by appt.
Office:	7129 Social Science	Telephone:	262-3973
		Email:	eschatzb@wisc.edu

Description:

This graduate seminar provides an intensive survey of the methodological and theoretical issues that have shaped scholarly work in the history of technology. Readings will range from classic works, like Lewis Mumford's 1934 *Technics and Civilization*, to the latest books and articles. Topics examined include the role of grand narratives, microhistories of invention, the use of methods from science and technology studies, such as social construction and actor-network theory, economics of technology, and the intersection of technology with cultural studies, environmental history, and gender studies.

Requirements:

- 1) I expect everyone to have done the readings with enough care to participate intelligently in every class meeting.
- 2) Each week, one student will serve as a lead discussant for the seminar meeting; each student will serve as a lead discussant twice during the semester. Lead discussants are required to post a brief analysis of the readings to the class email list, along with suggested discussion questions. This posting is due the evening before the seminar meeting. The lead discussant will lead the first half of the meeting; I will lead the second half.
- 3) Seminar participants will write a 15-25 page paper on a topic related to the historiography of technology. In general, this paper will be a historiographic essay, called in some fields a literature survey. This type of paper provides a critical evaluation of a body of secondary literature related to a particular topic, taking account of various controversies and interpretations, and how these have changed over time.

Students may, if it suits their pedagogic purposes, produce one of two other types of papers in place of the historiographic essay. The first alternative is a research prospectus (akin to a grant proposal). This paper defines a research problem and provides a specific plan to investigate this problem. The second alternative is a traditional research paper based on primary sources.

Email Class List:

The email list for this course is histsci907-1-s07@lists.wisc.edu. **PLEASE** put HS907 at the start of the subject line when you send email to the list. Avoid attachments. If you must use attachments, put your name in the file name.

Grades

Grading in this graduate seminar reflects my subjective judgment about the quality of your work and your scholarly potential. I value creative insight, independent thinking, thoughtful analysis of the readings, evidence of thorough preparation, clear prose, and consistent participation in discussions.

Course Books and Packet:

I have not ordered books for this course. You may place your own orders on-line, or the class can place an order collectively. Mumford is out of print, but ample used copies are available. The cost for the other books is about \$120 from Amazon. Here is the list of required books:

Lewis Mumford, *Technics and Civilization*
Mikael Hård and Andrew Jamison, *Hubris and Hybrids*
Peter Galison, *Einstein's Clocks, Poincare's Maps*
David Edgerton, *The Shock of the Old*
Virginia Scharff, *Taking the Wheel*
Lisa Parks, *Cultures in Orbit*

A course packet for the other required readings will be available for purchase by the end of January from the History of Science department office, 7143 Social Science (262-1406); office hours 8:00 am to 3:00 pm. Note that **NO REFUNDS** are permitted.

All readings will be on reserve at College Library.

Religious Holidays and ADA Notice:

You can take off any religious holidays you want, as long as you make up the work.

If you have a disability that might adversely affect your performance in this course, let me know and I'll do my best to accommodate you. For more information, contact the McBurney Disability Resource Center, 263-2741.

Freaking Out:

Graduate students are often under a tremendous amount of stress. If you feel like things are getting a bit too weird, either for personal or academic reasons, please let me know, and also contact the Counseling and Consultation Service, part of the University Health Service, 905 University Avenue, 265-5600. For more information, see <http://www.uhs.wisc.edu>.

COURSE OUTLINE

Introduction and Overviews

Week 1 (1/23): Introduction – The Meaning of "Technology"

The concept of technology has received little historical attention until recently. Recent research suggests that we don't really know what we are talking about when we invoke "technology" as a historical category.

Reading: Eric Schatzberg, "*Technik Comes to America: Changing Meanings of Technology Before 1930*," *Technology and Culture* 47 (July 2006): 486-512, available from http://muse.jhu.edu/journals/technology_and_culture/v047/47.3schatzberg.html.

Please have this reading completed for the first meeting of the seminar.

Supplemental reading: Ruth Oldenziel, "Signifying Semantics for History of Technology," *Technology and Culture* 47 (July 2006): 477-85; Leo Marx, "*Technology: The Emergence of a Hazardous Concept*," *Social Research* 64 (1997): 165-88.

Week 2 (1/30): Classic Grand Narratives

In 1934, Lewis Mumford published the first historically sophisticated grand narrative of the development of technology in the West. His analysis in this book contains the germ of almost every major theme in the subsequent historiography of technology.

Reading: Lewis Mumford, *Technics and Civilization* (New York: Harcourt Brace Jovanovitch, 1934). Read entire book, but you may skim chaps. 5 and 7.

Supplemental reading: Siegfried Giedion, *Mechanization Takes Command: A Contribution to Anonymous History* (Oxford: Oxford University Press, 1948); Abbot Payson Usher, *A History of Mechanical Inventions*, rev. ed. (Boston: Beacon Press, 1954); Arthur P. Molella, "Mumford in Historiographical Context," in *Lewis Mumford: Public Intellectual*, ed. Thomas P. Hughes and Agatha C. Hughes (New York: Oxford University Press, 1990), 21-42; Rosalind Williams, "Lewis Mumford as a Historian of Technology in *Technics and Civilization*," *ibid.*, 43-65.

Week 3 (2/6): Reconstructing the Narrative 1

Since the 1960s, historians of technology have turned away from grand narratives like Mumford's, except when writing for the textbook market. Recently, several historians have tried to create a new synthesis.

Reading: Mikael Hård and Andrew Jamison, *Hubris and Hybrids : a Cultural History of Technology and Science* (New York: Routledge, 2005).

Supplemental reading: Thomas J. Misa, *Leonardo to the Internet: Technology & Culture from the Renaissance to the Present* (Baltimore: Johns Hopkins University Press, 2004); Robert Friedel, *A Culture of Improvement: Technology and the Western Millennium* (Cambridge: MIT Press, 2007); Arnold Pacey, *The Maze of Ingenuity: Ideas and Idealism in the Development of Technology*, 2nd ed. (Cambridge: MIT Press, 1992).

Microhistories of Technology

Week 4 (2/13): Conceptualizing Technical Change

The core of scholarship in the history of technology consists of careful case studies of the origins and development of specific technologies. These best of these studies have sought to uncover patterns in the process of change, most importantly in the nature of invention. Key to this historiography is a shift from a heroic concept of invention to an understanding of invention as an extended social process.

Reading: S. Colum Gilfillan, "Who Invented It?" *Scientific Monthly* 25 (Dec. 1927): 529-34; Thomas P. Hughes, "Introduction: The Development Phase of Technological Change," *Technology and Culture* 17 (1976): 423-41; Hughes, *Networks of Power: Electrification in Western Society, 1880-1930* (Baltimore: Johns Hopkins University Press, 1983), 1-46, 79-105 (chaps. 1-2, 4); David Pye, *The Nature and Aesthetics of Design* (New York: Van Nostrand Reinhold Co., 1978), 11-35, 58-65 (chaps. 1-2, 6).

Supplemental reading: Robert Friedel and Paul Israel, *Edison's Electric Light: Biography of an Invention* (New Brunswick, NJ: Rutgers University Press, 1986); Walter G. Vincenti, *What Engineers Know and How They Know It: Analytical Studies From Aeronautical History* (Baltimore: Johns Hopkins University Press, 1990); Eric Schatzberg, *Wings of Wood, Wings of Metal: Culture and Technical Choice in American Airplane Materials, 1914-1945* (Princeton: Princeton University Press, 1999).

Week 5 (2/20): SCOT and ANT – History of Technology Meets Post-Kuhnian Sociology of Science

In the 1980s, scholars began to apply to technology new approaches drawn from the sociology of science. One approach was the social construction of technology (SCOT), a fairly direct application of ideas from sociology of scientific knowledge (SSK). A second influential approach to both science and technology was actor-network theory (ANT), developed in part as an alternative to SSK.

Reading: Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science* 14 (1984): 399-441; Donald Mackenzie, "Theories of Technology and the Abolition of Nuclear Weapons," in *The Social Shaping of Technology*, ed. Donald Mackenzie and Judy Wajcman, 2nd ed. (Buckingham: Open University Press, 1999), 419-442; Bruno Latour, "The Prince for Machines as Well as for Machinations," in Brian Elliot, ed., *Technology and Social Process* (Edinburgh: Edinburgh University Press, 1988), 20-43; Jim Johnson [pseud.], "Mixing Humans and Nonhumans Together: The Sociology of a Door-Closer," *Social Problems* 35 (1988): 298-310.

Supplemental reading: Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge: Harvard University Press, 1987); Steven Shapin, "Here and Everywhere: Sociology of Scientific Knowledge," *Annual Review of Sociology* 21 (1995): 289-321.

Week 6 (2/27): Questioning SSK, SCOT, ANT

These new approaches generated tremendous excitement but also considerable criticism, especially on the grounds of relativism and idealism. Most of the critics did not distinguish between the various approaches, nor between the analysis of technology as opposed to science, while the whole debate was partly overshadowed by the so-called "science wars" of the 1990s. The readings here focus, for the most part, on a few more careful critiques of these approaches as applied to technology.

Reading: Walter G. Vincenti, "The Technical Shaping of Technology: Real-World Constraints and Technical Logic in Edison's Electrical Lighting System," *Social Studies of Science* 25 (1995): 553-574; Scott Frickel, "Engineering Heterogeneous Accounts: The Case of Submarine Thermal Reactor Mark-I," *STHV* 21 (1996): 28-53; Werner Rammert, "New Rules of Sociological Method: Rethinking Technology Studies," *British Journal of Sociology* 48 (1997): 171-91; Paul Boghossian, "What is Social Construction," *TLS*, Feb. 23, 2001 (<http://as.nyu.edu/docs/IO/1153/socialconstruction.pdf>); Bruno Latour, "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry* 30 (2004): 225-48.

Supplemental reading: Steve Woolgar, "The Turn to Technology in Social Studies of Science," *STHV* 16 (1991): 20-50; Langdon Winner, "Social Constructivism: Opening the Black Box and Finding it Empty," *Science as Culture* 3 (1993): 427-52; Daniel Lee Kleinman, "Untangling Context: Understanding a University Laboratory in the Commercial World," *STHV* 23 (1998): 285-314; David Bloor, "Anti-Latour," *Studies in the History and Philosophy of Science* 30 (1999): 81-112, reply by Latour, 113-29, response by Bloor, 131-36; Ian Hacking, *The Social Construction of What?* (Cambridge: Harvard University Press, 1999).

Week 7 (3/6): Economics of Technological Change

Much, although not all, technological change occurs within the context of capitalist markets. Neo-classical (mainstream) economics does a surprisingly poor job accounting for technological change. Readings for this week focus on alternative economic theories that offer more promise for the history of technology.

Reading: Christopher Freeman, "Economics of Research and Development," 223-74 in *Science, Technology and Society: A Cross-Disciplinary Perspective*, ed. Ina Spiegel-Rösing and Derek de Solla Price (London: Sage, 1977); Paul A. David, "Understanding the Economics of QWERTY: the Necessity of History," in *Economic History and the Modern Economist*, ed. William N. Parker (New York: Basil Blackwell, 1986), 30-49; W. Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review* (July-Aug. 1996): 101-109; Vernon W. Ruttan, "Induced Innovation, Evolutionary Theory and Path Dependence: Sources of Technical Change," *Economic Journal* 107 (1997): 1520-29; Gavin Wright, "Towards a More Historical Approach to Technological Change," *ibid.*, 1560-66

Supplemental reading: Paul A. David, "The Hero and the Herd in Technological History: Reflections on Thomas Edison and the Battle of the Systems," in *Favorites of Fortune: Technology, Growth, and Economic Development since the Industrial Revolution*, ed. P. Higonnet, D. S. Landes and H. Rosovsky (Cambridge: Harvard University Press, 1991), 72-119; W. Brian Arthur, *Increasing Returns and Path-Dependence in the Economy* (Ann

Arbor, Mich.: University of Michigan Press, 1994). For a polemical critique of David's QWERTY argument, see S. J. Liebowitz and Stephen E. Margolis, "The Fable of the Keys," *Journal of Law & Economics* 33 (April 1990): 1-25; for serious empirical research on the topic, see Delphine Gardey, "The Standardization of a Technical Practice: Typing (1883-1930)," *History and Technology* 15 (1999): 313-43.

Beyond Microhistory: Technology in Broader Contexts

Week 8 (3/13): Technology, Industrialization, and Business

This week focuses on disputes over the nature of industrialization.

Reading: David S. Landes, "The Fable of the Dead Horse; or, The Industrial Revolution Revisited," in *The British Industrial Revolution: An Economic Perspective*. ed. Joel Mokyr (Boulder: Westview Press, 1993), 132-70; Jonathan Zeitlin and Charles Sabel, "Historical Alternatives to Mass Production: Politics, Markets and Technology in Nineteenth-Century Industrialization," *Past and Present* 108 (1985): 133-76; Jonathan Zeitlin, "Productive Alternatives: Flexibility, Governance, and Strategic Choice in Industrial History," in *Business History Around the World*, ed. edited by Franco Amatori and Geoffrey Jones (New York: Cambridge University Press, 2003), 62-80; Richard Blundel and Angela Tregear, "From Artisans to "Factories": The Interpenetration of Craft and Industry in English Cheese-Making, 1650-1950," *Enterprise and Society* 7 (Dec. 2006): 705-39.

Supplemental reading (a few randomly chosen works): Maxine Berg, *The Age of Manufacturers: Industry, Innovation and Work in Britain*, 2nd ed. (London: Routledge, 1994); Alfred D. Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Belknap Press, 1977); Michael J. Piore and Charles F. Sabel, *The Second Industrial Divide: Possibilities for Prosperity* (New York: Basic Books, 1984)

Week 9 (3/20): Consequences: Debating Technological Determinism

The article by Winner below has been widely cited and discussed, and is often assigned in undergraduate classes. It is actually more complex and subtle than it appears. However, one of the article's most widely cited claims turns out to be in dispute.

Reading: Langdon Winner, "Do Artifacts Have Politics?" in *The Whale and the Reactor* (Chicago: University of Chicago Press, 1986), 19-39; Bernward Joerges, "Do Politics Have Artefacts?" *Social Studies of Science* 29 (1999): 411-31; Steve Woolgar and Geoff Cooper, "Do Artefacts Have Ambivalence? Moses' Bridges, Winner's Bridges and Other Urban Legends in S&TS," *ibid.*, 433-39; Bernward Joerges, "Scams Cannot Be Busted: Reply to Woolgar & Cooper," *ibid.*, 450-57.

Supplemental reading: Merritt Roe Smith and Leo Marx, eds., *Does Technology Drive History?: The Dilemma of Technological Determinism* (Cambridge: MIT Press, 1994).

Week 10 (3/27): Science-Technology Relationship 1

Since the late 1950s, historians of technology have engaged in endless and often fruitless discussions about the relationship between science and technology. My article that opened this course suggests one reason for this confusion, a reason rooted in the history of the term "technology." This week we will examine this historiography and read about the role of science in industry ("industrial research").

Reading: Sungook Hong, "Historiographic Layers in the Relationship Between Science and Technology," *History and Technology* 15 (1999): 289-311; Philip Scranton, "Technology, Science, and American Innovation," *Business History* 48 (2006): 311-31; Ronald R. Kline and Thomas C. Lassman, "Competing Research Traditions in American Industry: Uncertain Alliances between Engineering and Science at Westinghouse Electric, 1886-1935," *Enterprise and Society* 6 (Dec. 2005): 601-45; Steven Shapin, "Who Is the Industrial Scientist?" in *The Science-Industry Nexus: History, Policy, Implications*, Nobel Symposium 123, ed. Karl Grandin, Nina Wormbs, Sven Widmalm (Sagamore Beach, MA: Science History Publications, 2004).

Supplemental reading: Otto Mayr, "The Science-Technology Relationship as a Historiographic Problem," *Technology and Culture* 17 (1976): 663-73; John J. Beer, "Coal Tar Dye Manufacture and the Origins of the Modern Industrial Research Laboratory," *Isis* 49 (1958): 123-31; Thomas Parke Hughes, "The Science-Technology Interaction: The Case of High-Voltage Power Transmission Systems," *Technology and Culture* 17 (Oct., 1976): 646-61; Walter G. Vincenti, "The Air-Propeller Tests of W. F. Durand and E. P. Lesley: A Case Study in Technological Methodology," *Technology and Culture* 20 (1979): 712-51; David Edgerton, "The Linear Model Did Not Exist," with a reply by David Hounshell, "Industrial Research," in *The Science-Industry Nexus*, 31-65. There is also a large literature on the role of science in the British industrial revolution, most recently Margaret C. Jacob and Larry Stewart, *Practical Matter: Newton's Science in the Service of Industry and Empire, 1687-1851* (Cambridge: Harvard University Press, 2004); contrast this with A. Rupert Hall, "What Did the Industrial Revolution in Britain Owe to Science?" in *Historical Perspectives: Studies in English Thought and Society in Honour of J. H. Plumb*, ed. Neil McKendrick (London: Europa, 1974), 129-51.

Spring Break

Week 11 (4/10): Science-Technology Relationship 2: Does Technology Shape Science?

Historians of technology have long argued that technology drives science as much as the converse. Yet only recently have historians of science embraced this view with subtlety, examining how the technologically shaped world provides metaphors and models used in scientific theory.

Reading: Peter Galison, *Einstein's Clocks, Poincare's Maps: Empires of Time* (New York: W. W. Norton, 2003).

Supplemental reading: *The Invisible Industrialist: Manufactures and the Production of Scientific Knowledge*, ed. Jean-Paul Gaudillière and Ilana Löwy (New York: St. Martin's, 1998); Bruce J. Hunt, "Michael Faraday, Cable Telegraphy and the Rise of Field Theory," *History of Technology* 13 (1991): 1-19; M. Norton Wise, "Mediating Machines," *Science in Context* 2 (1988): 77-113; Lynn White, "Pumps and Pendula: Galileo and Technology," in *Medieval Religion and Technology: Collected Essays* (Berkeley: University of California Press, 1978), 121-132.

Week 12 (4/17): Reconstructing the Narrative 2: Technology in Use

This book is part of a major historiographic trend in the field, a trend that shifts focus from innovation to the use of technology.

Reading: David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (New York: Oxford University Press, 2006).

Supplemental reading: David Edgerton, "From Innovation to Use: Ten (Eclectic) Theses on the History of Technology," *History and Technology* 16 (1999): 1-26; Nelly Oudshoorn and Trevor Pinch, eds., *How Users Matter: The Co-Construction of Users and Technologies* (Cambridge: MIT Press, 2003); Ronald R. Kline, *Consumers in the Country: Technology and Social Change in Rural America* (Baltimore: Johns Hopkins University Press, 2000); Ruth Schwartz Cowan, "The Consumption Junction: A Proposal for Research Strategies in the Sociology of Technology," in *The Social Construction of Technological Systems*, ed. Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Cambridge: MIT Press, 1987), 261-80.

Week 13 (4/24): Culture, Gender and Technology

Culture and gender have become major themes in the history of technology during the past 20 years. This book combines both approaches in a fascinating study of the early history of the automobile in America.

Reading: Virginia Scharff, *Taking the Wheel: Women and the Coming of the Motor Age* (New York: Free Press, 1991).

Week 14 (5/1): History of Technology Meets Cultural Studies

Scholars in cultural studies have been examining technological topics for decades, but exchanges with historians of technology remain limited. Here's a recent example of work from this field (based on a UW-Madison dissertation).

Reading: Lisa Parks, *Cultures in Orbit: Satellites and the Televisual* (Durham, NC: Duke University Press, 2005).

Supplemental reading: Dick Hebdige, "Object as Image: the Italian Scooter Cycle," in *Hiding In the Light: On Images and Things* (London: Routledge, 1988), 77-115; Paul Du Gay et al., *Doing Cultural Studies: The Story of the Sony Walkman* (London: Sage, 1997).

Week 15 (5/8): Technology and the Environment

This topic represents another hot intersection of fields. Josephson's book is notable for its multinational scope and attention to the role of state structures in the environmental effects of technology.

Reading: Paul R. Josephson, *Resources under Regimes: Technology, Environment, and the State* (Cambridge: Harvard University Press, 2004).

Supplemental reading: Jeffrey K. Stine and Joel A. Tarr, "At the Intersection of Histories: Technology and the Environment," *Technology and Culture* 39 (1998): 601-40; Alfred W. Crosby, *Children of the Sun: A History of Humanity's Unappeasable Appetite for Energy* (New York: W. W. Norton, 2006); Richard White, *The Organic Machine: The Remaking of the Columbia River* (New York: Hill and Wang, 1995).

5/17, 5:00 pm (Thursday): Final Papers Due