PRINCETON UNIVERSITY

FRS 159 - Fall 2007

Creating the Computer: From ENIAC to the Internet

Professor Michael S. Mahoney

Tuesday, 1:30-4:30, Friend 205

Books to be Purchased (available at PU Store or online):

Janet Abbate, *Inventing the Internet* (MIT Press) [Amazon]
Frederick P. Brooks, *The Mythical Man-Month* (20th Anniversary edition; Addison Wesley) [Amazon]
John Seely Brown and Paul Duguid, *The Social Life of Information* [Amazon}
Lawrence Lessig, *Code and Other Laws of Cyberspace* (Basic Books) [Amazon] or *Code: Version 2.0* (Basic Books) [Amazon]
Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine* (Westview Press) [Amazon]

As you will gather from the links, most of the readings are online. Other readings will be handed out in class or will be on reserve at Firestone Library.

Week I (18 September) ***Getting Started: What do we want to know?***

M.S.Mahoney, "The History of Computing in the History of Technology", *Annals of the History of Computing* 10(1988), 113-125 [pdf];
and "Issues in the History of Computing", in Thomas J. Bergin and Rick G. Gibson (eds.), *History of Programming Languages* II (NY: ACM Press, 1996), 772-81 [pdf]
and "The Histories of Computing(s)", *Interdisciplinary Science Reviews* 30,2(2005), 119-135 [pdf];
George H. Daniels, "The Big Questions in the History of American Technology", *Technology and Culture* 11,1(1970), 1-21 [JSTOR]

Week II (25 September) ***The Protean Machine***

David Barker-Plummer , "Turing Machines", *Stanford Encyclopedia of Philosophy*
Andrew Hodges, "Alan Turing", *ibid.*
John von Neumann, "First Draft of a Report on the Edvac" (1945), ed. Michael D. Godfrey (pdf version); cf. M.D. Godfrey and D.F. Hendry, "The Computer as von Neumann Planned It", *IEEE Annals of the History of Computing* 15,1(1993) (pdf version)
Optional and Background
- William Aspray (ed.), *Computing Before Computers*
- Andrew Hodges, *Alan Turing, The Enigma* (visit Hodge's extensive Turing home page, which includes a link to a working Turing Machine applet)
- William Aspray, *John von Neumann and the Origins of Modern Computing*

Week III (2 October) ***Computers in the Business World***

Campbell-Kelly and Aspray, *Computer*, Chaps. 1-6
Thomas Haigh, "The Chromium-Plated Tabulator: Institutionalizing an Electronic Revolution,

1954-1958", *IEEE Annals of the History of Computing* 23,4(2001), 75-104 [PDF (PU only)] [E-reserves]
Thomas Haigh, "Inventing Information Systems: The Systems Men and the Computer, 1950-1968", *The Business History Review* 75, 1(2001), 15-61 [JSTOR]
Martin Greenberger, "The Computers of Tomorrow", *Atlantic Monthly*, May 1964
Optional and Background
James W. Cortada, *The Computer in the United States: From Laboratory to Market, 1930-1960*
Katharine Davis Fishman, *The Computer Establishment*
Emerson W. Pugh, *Building IBM: Shaping an Industry and its Technology*
John Hendry, *Innovating For Failure: Government Policy and the Early British Computer Industry*
David E. Lundstrom, *A Few Good Men From Univac*
For other studies of the industry, check out the Firestone shelves around call number HD9696.

Week IV (9 October) *Thinking with Computers*
Campbell-Kelly & Aspray, Chap. 9
Vannevar Bush, "As We May Think". That online copy has links, which are worth following out. The original article appeared in *Atlantic Monthly* for July 1945, and the magazine has also posted an online version, and it was reprinted in ACM's *interactions* [pdf]. You will find a downloadable animation of the Memex at the Dynamic Diagrams Interactive Publications site. Trevor Smith at PARC is building a simulator called MemexSim.
J.C.R. Licklider, "Man-Computer Symbiosis", *IRE Transactions on Human Factors in Electronics*, HFE-1(1960), 4-11, and "The Computer as Communication Device", *Science and Technology*, April 1968 [reprints by Systems Research Center of DEC, Palo Alto; also available online]
Doug [Douglas C.] Engelbart, "The Augmented Knowledge Workshop", in *A History of Personal Workstations* (ed. Adele Goldberg; ACM Press, 1988) [pdf], 185-232; cf. his "Augmenting Human Intellect: A Conceptual Framework", prepared for the Air Force Office of Scientific Research in 1962. Pictures of the components of Engelbart's workstation and of the environment at the ARC can be found at the site of his Bootstrap Institute.
Optional and Background
Howard Rheingold, *Tools for Thought: The History and Future of Mind-Expanding Technology*
James M. Nyce and Paul Kahn, *From Memex to Hypertext: Vannevar Bush and the Mind's Machine* (Boston: Academic Press, 1991)
On J.C.R. Licklider's leadership of DARPA's Information Processing Technology Office, see Arthur L. Norberg and Judy E. O'Neill, *Transforming Computer Technology: Information Processing for the Pentagon, 1962-1986* (Baltimore: Johns Hopkins University Press, 1996)
On Licklider, see A. Mitchell Waldrop, *The Dream Machine: J.C.R. Licklider and the Revolution That Made Computing Personal* (Viking, 2001)

Week V (16 October) - *Thinking Machines*
Alan M. Turing, "Computing Machinery and Intelligence", *Mind* 59(1950) [JSTOR]
John McCarthy, Marvin Minsky, Nathaniel Rochester, Claude E. Shannon, A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence (1956)
Allen Newell, "Intellectual Issues in the History of Artificial Intelligence", in Fritz Machlup and Una Mansfeld (eds.), *The Study of Information: Interdisciplinary Messages*, 187-227
John Searle, "Minds, Brains, and Programs", in *The Behavioral and Brain Sciences*, vol. 3; see also "Artificial Intelligence: A Debate" (John Searle vs. Paul and Patricia Churchland), *Scientific American* (January 1990), 25-37, and David Cole, "The Chinese Room Argument" , *Stanford Enyclopedia of Philosophy*
Optional and Background
Hubert L. Dreyfus, *What Computers Can't Do* (Harper & Row, 1972)

Pamela McCorduck, *Machines Who Think* (W.H. Freeman, 1979)
Marvin Minsky, *The Society of Mind* (Simon and Schuster, 1986)
Daniel Crevier, *AI: The Tumultuous History of the Search for Artificial Intelligence* (Basic Books, 1993)

Week VI (23 October)-*Computers and the World of Work*

John Diebold, "Automation - The New Technology", *Harvard Business Review* [hereafter *HBR*] 31,6(1953), 63-71
James R. Bright, "How to Evaluate Automation", *HBR* 33,4(1955), 101-111
Charles R. Walker, "Life in the Automatic Factory", *HBR* 36,1(1958), 111-119
Shoshanna Zuboff, *In the Age of the Smart Machine* (NY: Basic Books, 1988), Chaps. 1 (pp. 19-24), 2, 4
Optional and Background
Douglas T. Ross, "Origins of the APT language for automatically programmed tools", *ACM SIGPLAN Notices* 13,8(1978), 61-99 [pdf], final version in *History of Programming Languages*, ed. Richard Wexelblat (NY, 1978), 279-338 [pdf]
David F. Noble, *Forces of Production: A Social History of Industrial Automation*

FALL BREAK

Week VII (6 November) *The World of the Programmer*

Campbell-Kelly and Aspray, *Computer*, Chap. 8
Frederick P. Brooks, Jr., *The Mythical Man-Month* [PU online]
One of the papers from the first two History of Programming Languages Conferences, published in
Richard L. Wexelblat, *History of Programming Languages* (New York: Academic Press, 1981) (FORTRAN, ALGOL, LISP, COBOL, APT, JOVIAL, GPSS, Simula, JOSS, BASIC, PL/I, Snobol, APL)
Thomas J. Bergin, Jr. and Richard G. Gibson, Jr., *History of Programming Languages II*, (New York: ACM Press, 1996) (Algol 68, Pascal, Monitors and Concurrent Pascal, Ada, Lisp, Prolog, Discrete Event Simulation Languages, FORMAC, CLU, Smalltalk, Icon, Forth, C, C++)
Both volumes are archived online in the ACM Digital Archives [link (PU only)]; click through the link to the pertinent volume and thence to the language of your choice.
Optional and Background
Gerald M. Weinberg, *The Psychology of Computer Programming* (New York: Van Nostrand Reinhold, [1971])
Philip Kraft, *Programmers and Managers: The Routinization of Computer Programming in the United States* (New York: Springer-Verlag, c1977)

Week VIII (13 November) *The World of Unix*

Campbell-Kelly and Aspray, *Computer*, Chap. 9 (review)
Michael and Rhonda Hauben, "On the Early History and Impact of Unix: Tools to Build the Tools for a New Millenium", in *Netizens: An Anthology*, Chap. 9
Michael S. Mahoney (ed.), "The Unix Oral History Project: Release.0, The Beginning" (AT&T Bell Laboratories, 1989); see the people mentioned
[Added 01/07/2006] As a final project, the members of the 1998 seminar edited the transcripts of the interviews, wrote précis, and collaborated on a joint "Oral History of Unix"; all the material is at the link.
Dennis M. Ritchie and Ken Thompson, "The Unix Time-Sharing System", *Communications of the ACM* 17,7 (1974), 365-375 [pdf] (first published description)
D.M. Ritchie, "Reflections on software research", *Communications of the ACM* 27,8(1984), 758-60 [pdf]

Ken Thompson, "Reflections on trusting trust", *ibid.*, 761-763 [pdf]

Optional and Background

Check out the two mains web pages for Multics, the one maintained by the Multicians and the other by MIT, where you will find online copies of many of the seminal historical sources. The MIT site has a link to recently posted source files for the final Multics release 12.5.

On the origins of time-sharing, see John McCarthy's Memorandum to P.M. Morse Proposing Time Sharing (1959) and his Reminiscences on the History of Time Sharing

Dennis M. Ritchie, "The Development of the C Language"

Brian W. Kernighan and Peter J. Plauger, *The Elements of Programming Style* (NY: McGraw-Hill, 1974; 2nd ed. 1978) and *Software Tools*, (Reading, MA: Addison Wesley, 1976)

Week IX (20 November) - *A Man's World?*

Sherry Turkle, *The Second Self: Computers and the Human Spirit*, Chap. 3 [ACLS Humanities E-Book online]; this is a classic work and worth reading in its entirety [start of ebook]

Michael S. Mahoney, "Boys' Toys and Women's Work: Feminism Engages Software", in Angela N.H. Creager, et al. (eds.), *Feminism in Twentieth Century Science, Technology and Medicine* (Chicago: University of Chicago Press, 2001), Chap. 9 [E-reserves]

IEEE Annals of the History of Computing 18,3 (Fall 1996) is dedicated to articles on women in computing; read the following:

W. Barkley Fritz, "The Women of ENIAC", 13-28 [pdf]

T. Estrin, "Women's studies and computer science: their intersection", 43-46 [pdf]

Alison Adam, "Constructions of Gender in the History of Artificial Intelligence", 47-53 [pdf]

Optional and Background

David Grier, *When Computers Were Human*

Week X (27 November) - *The Social Life of Information*

Brown and Duguid, *The Social Life of Information*

Optional and Background

Fernando Flores and Terry Winograd, *Understanding Computers and Cognition*

Rosalind Williams, *Retooling: A Historian Confronts Technological Change*

Week XI (4 December) *Networking Worlds*

Campbell-Kelly and Aspray, *Computer*, Chaps. 10, 11

Abbate, *Inventing the Internet*

Optional and Background

Ted Nelson, *Computer Lib/Dream Machines* (Redmond, WA: Tempus Books of Microsoft Press, 1987; original edition, 1974)

Paul Freiberger and Michael Swaine, *Fire in the Valley: The Making of the Personal Computer* (Berkeley: Osborne/McGraw-Hill, 1984)

Susan Lammers, *Programmers at Work* (Redmond, WA: Microsoft Press, 1986) [Interviews with many of the people discussed in this week's readings]

James Chposky and Ted Leonsis, *Blue Magic: The People, Power and Politics Behind the IBM Personal Computer* (NY: Facts on File Publications, 1988)

Douglas K. Smith and Robert C. Alexander, *Fumbling the Future: How Xerox Invented, Then Ignored, the First Personal Computer* (NY: William Morrow & Co., 1988)

Michael A. Cusumano and Richard W. Selby, *Microsoft Secrets: How the World's Most Powerful Software Company Creates Technology, Shapes Markets, and Manages People* (NY: The Free Press, 1995)

Collection of online articles on the History of the Internet

See also Internet History and WWW History: Internet Resources

Harvard Information Infrastructure Project

Week XII (11 December) ***The World of Cyberspace***

Lessig, *Code, and Other Laws of Cyberspace*

Optional and Background

John K. Galbraith, *The New Industrial State*

Clifford Stoll, *The Cuckoo's Egg*

Langdon Winner, "Do Artifacts Have Politics?" *Daedalus*(Winter, 1980), 121-136 (online)

Charles Petzold, Code: The Hidden Language of Computer Hardware and Software