History of Computers and the Internet
Graduate Sections — Winter 2011
Syllabus v2.4 (26 January 2011)

School of Information 589/History 594 sec. 003
Prof. Paul N. Edwards
University of Michigan, Winter 2011
TTh 2:30-4:00, 1110 Weill Hall (Ford School)

Most current syllabus always available [here](http://pne.people.si.umich.edu/PDF/589syll.pdf) (http://pne.people.si.umich.edu/PDF/589syll.pdf).

Course Description

This nontechnical course covers the development and use of computers from the ancient world to the present. We will discuss automatic calculation from the abacus to the integrated circuit; logic machines from Boole to neural networks; and the evolution of programming languages from assemblers to Ada.

Our primary focus will be the social, political, and cultural contexts of post-1939 digital computers and computer networks. We will explore such topics as:

- A design for a steam-powered, mechanical computer in Victorian England
- How early computers cracked the Nazi Enigma cipher during World War II
- Why digital computing replaced analog methods in the 1940s and 1950s
- How the Cold War changed computers, and how computers changed the Cold War
- Computing in Europe, the Soviet Union, and the developing world
- How amateur hobbyists invented the personal computer
- Video games: their origins and their role in shaping modern computing
- The story behind the Internet and the World Wide Web
- Google, Facebook, Wikipedia, and Web 2.0

This course makes the argument that new technologies and their social effects evolve together along a variety of dimensions. Some of these are technical: innovation, design, and opportunity. Some are social: funding sources, societal values, and organizational structures. Still others are macro-scale economic, political, and social forces.

The questions that motivate our study of computers concern "why" issues. Why were computers invented? Who wanted them, and for what purposes? How have computers changed the shape of society and culture — and how did society and culture shape them? The course is relevant to anyone interested in the history, politics, and culture of technology.

Prerequisites: none. However, students completely unfamiliar with basic computer concepts will be expected to research these independently. Wikipedia is a reasonable resource for this purpose.

Open to: all UM graduate students.

Meets requirements for: the graduate certificates in Science, Technology & Society and Science, Technology & Public Policy (STPP). It also counts as an elective in SI's Information Policy (IPOL) specialization.

Only graduate students may register under the SI589 and History 594 course numbers.

Instructors:

Prof. Paul N. Edwards, School of Information, 3439 North Quad
Email: pne@umich.edu
Office hours: Mondays 12:30-1:30 PM or by appointment

Course policies and expectations:

Class attendance. You can miss up to 3 class sessions during the semester without penalty. After that, **each** missed class will result in a one-third letter grade reduction in your **final** course grade. For example, if your grade should be a B+ but you missed a total of six classes during the semester, you would receive a C+ instead.

For these reasons, I strongly suggest that you *not miss any classes early in the semester*. Save your "skip" days for later in the semester, when you'll really need them.

Policy on laptops, cellphones, iPods, etc.: just as you would not read a newspaper in class, please respect your instructors and your fellow students by refraining from non-course-related use of electronic devices during class. You are welcome to share notes with others, but since the process of note-taking itself improves your retention and understanding, we expect everyone to take their own notes and to review them later. It's fine to use a laptop for this purpose. If you want to do this, however, you must sit in the **front of the room** (first three rows), and **wireless access must be turned off**. These are non-negotiable conditions of using a laptop during class. Wifi use creates a "cone of distraction" that harms both your class performance and that of those around you. Using email, Facebook, YouTube, ESPN, etc., will produce a **single one-time warning** from the instructor or GSI. Any further wifi use means no laptop access is permitted for the duration of the semester, and all subsequent notes must be taken longhand. *Cellphones should also be turned off at the start of every class*.

If you object to this policy, please do not enroll in this course.

Plagiarism policy: At the University of Michigan and in professional settings generally, plagiarism is an extremely serious matter. **Please paraphrase wherever possible,** since this helps you process and understand what you have read. If truly necessary, you can quote published work, but quotations must be clearly marked and properly attributed. You may obtain copy editing assistance, and you may discuss your ideas with others, but all substantive writing and ideas must be your own or else be explicitly attributed to another, using a citation sufficiently detailed for someone else to easily locate your source.

All cases of plagiarism will be reported immediately. There will be no warnings, no second chances, no opportunity to rewrite. *Consequences can range from failing the assignment (a grade of zero) or failing the course to expulsion from the University.* For additional information about plagiarism, see the Rackham pamphlet on Academic Integrity and Plagiarism: What It is and How to Recognize and Avoid It from Indiana University. If you have the slightest doubt about whether you are using the words or ideas of others appropriately, please ask.

Assignments:

NB: You must complete all of the assignments, and you must achieve a passing grade in **each** of the following components in order to pass the class.

(1) **Class participation** (10 percent of grade). Most class sessions will be 50-minute lectures followed by Q&A; you should participate frequently. Plan to contribute at least once at each session.

Papers: all SI students taking SI 589 for IPOL credit must treat policy-oriented topics in all three papers. Further details will appear on the assignment guidelines.

(2) **First paper** (1250-1750 words, 20 percent of grade) due in class February 8.

(3) **Second paper** (2500-3000 words, 30 percent of grade), due in class March 10.

(4) **Term research project** (4000-5000 words, 50 percent of grade). This can be a traditional paper 3500-4500 words in length, or the same amount of writing presented in another medium, such as a website. Up to three students may collaborate on a single project. All projects must involve a very substantial, fully referenced research component. In all cases, the assignment has four parts.

(a) A 500-750 word prospectus, clearly describing your topic and listing sources, is due in class on February 17. You must turn this in when it is due, but you can change your topic later by turning in another prospectus by March 8.

(b) An annotated source list (minimum 1500 words) describing the materials you will use for your term research project. The list must include at least 12 high-quality sources directly related to your topic. Discussions of each reference should be at least 3-6 sentences for short pieces such as articles or websites, and at least 8-10 sentences for long pieces such as books. Each description should indicate how you will use the source to develop or support your main argument(s). Due in class March 17.

(c) A full-length, high-quality draft (4000-5000 words) is due in class April 5. It will be returned within 7 days, with comments and suggestions for revisions.

(d) The final version, edited, revised, and proofread, is due at the final class session on April 19. Final versions must respond to comments on the draft and incorporate extensive revisions.

Extension policy: please ask me in advance about an extension; do not assume you can have one.

Required books:

Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine* (Basic Books, 2004). ***Please purchase the second edition (2004),*** not the first edition (1996)

Fred Turner, *From Counterculture to Cyberculture* (University of Chicago Press, 2006)

Martin Campbell-Kelly, *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry* (MIT Press, 2003)

Janet Abbate, *Inventing the Internet* (MIT Press, 1999)

Course Schedule

Thursday 1/6 — Introduction: Computing in the Pre-industrial World

Guest mini-lecture: Ulysses J. Balis, "Ancient Greek 'High Technology' as Viewed through the Prism of the Antikythera Mechanism"

Tuesday 1/11 — Automatic Computation in the 19th Century

Reading: *Computer*, Chapters 1 and 2
L.F. Menabrea with notes by Lady Ada Lovelace, "Sketch of the Analytical Engine" (1842). Skip the mathematics — focus on the introductory paragraphs and the speculations about the powers of the Analytical Engine, in Lovelace's notes (at the end of the document).
Report of the Committee, consisting of Professor Cayley, Dr. Farr, Mr. J. W. L. Glaisher, Dr. Pole, Professor Fuller, Professor A. B. W. Kennedy, Professor Clifford, and Mr. C. W. Merrifield, *appointed to consider the advisability and to estimate the expense of constructing* Mr. Babbage's *Analytical Machine, and of printing Tables by its means. Drawn up by* Mr. Merrifield, 1878.
Explore other resources at the Fourmilab Analytical Engine website, such as an emulator of the Analytical Engine

Thursday 1/13 — Analog Computing

Reading: Small, "Analogue Computing Devices in the 19th and early 20th Centuries" (CTools)
The Vannevar Bush Differential Analyzer
International Slide Rule Museum — read the instructions and then solve at least 2 problems using the virtual slide rule on the website
Lang, 'Analog' was not a Computer Trademark!" (CTools; skim the technical sections)
Explore the Analog Computer Museum and History Center

Tuesday 1/18— Information Technology before 1945

Reading: *Computer*, Chapter 3
Yates, "Business Use of Information Technology During the Industrial Age" (CTools)
Grier, "Captains of Academe," from *When Computers Were Human* (CTools)

Thursday 1/20 — Computers and World War II

Reading: Black, "Final Solutions," Village Voice, 2002
Luebke and Milton, "Locating the Victim: An Overview of Census-Taking, Tabulation Technology, and Persecution in Nazi Germany" (CTools)
Computer, Chapter 4
Konrad Zuse's early computers
World War II codebreaking in Britain
Bush, *Science: The Endless Frontier* (1945)

Recommended: Budiansky, "The Code War" (CTools)

Tuesday 1/25 — Computers and the Cold War

Reading: CBC Digital Archives on "Cold War Culture: The Nuclear Fear of the 1950s and 1960s." Watch several video clips and listen to several radio episodes (your choice)
Bracken, "Warning and Intelligence," from *The Command and Control of Nuclear Forces*, 1983 (CTools)
Computer Science and Telecommunications Board, "The Organization of Federal Support: A Historical Review" (read online, or buy a PDF of the chapter for $4.50)
Wikipedia entry on "Cold War" and its subentries. If you are unfamiliar with Cold War history, spend a while on this site.

Thursday 1/27 — Reconceiving Minds at the Dawn of the Computer Age

Reading: Bush, "As We May Think" (1945) (CTools)
Small, "Negotiating a Place for Electronic Analogue Computers: The Analogue versus Digital Debate" (CTools)
Turing, "Computing Machinery and Intelligence" (1950) (CTools)
Simon and Newell, "Heuristic Problem Solving: the Next Advance in Operations Research" (1958)
Rees, "The Federal Computing Machine Program" (CTools)

Recommended: von Neumann, *The Computer and the Brain* (1958). The Google Book edition doesn't let you see the whole book, but it exposes enough to give you the general idea.

Tuesday 2/1 — Project Whirlwind and SAGE

Reading: Everett et al., "SAGE — A Data-Processing System for Air Defense" (1957) (CTools)
Valley, "How the SAGE Development Began" (CTools)
MITRE Corporation, "Semi-Automatic Ground Environment"
Computer, Chapter 7

Thursday 2/3 — Mainframes

Reading: *Computer*, Chapters 5 and 6
Small, "General-Purpose Electronic Analog Computing: 1945-65" (CTools)

Tuesday 2/8 — Grad-only discussion meeting

DUE: first paper

Thursday 2/10 — Early Computer Languages and Software

Reading: *From Airline Reservations to Sonic the Hedgehog,* Ch. 1-2

Ensmenger, "The Black Art of Programming" (CTools)

Tuesday 2/15 — **Computers and Culture in the 1960s**

    Reading: Licklider, "Man-Computer Symbiosis" (1960) (CTools)
        Van Creveld, "The Helicopter and the Computer" (CTools)
        Usselman, "Public Policies, Private Platforms: Antitrust and American
            Computing" (CTools)
        From Counterculture to Cyberculture, Introduction and Ch. 1

    Recommended: *From Counterculture to Cyberculture,* Ch. 2. This chapter does an
        outstanding job of describing the 1960s counterculture.

Thursday 2/17 — **Software, part II**

    Reading: *From Airline Reservations to Sonic the Hedgehog*, Chapter 4
        Computer, Chapter 8
        Hoare, "Programming: Sorcery or Science?" (CTools)
        Ensmenger, "Engineering a Solution" (CTools)

    Recommended: *From Airline Reservations to Sonic the Hedgehog,* Chapters 5-6

    DUE: Prospectus for final paper

Tuesday 2/22 — **Hackers, Timesharing, Unix, and Free Software**

    Reading: *From Counterculture to Cyberculture,* Chapters 3 and 4
        Hauben, "[On the Early History and Impact of Unix](#)"

Thursday 2/24 — **From Mini to Micro**

    Reading: *Computer*, Chapters 9 and 10
        Bill Gates, "[Open Letter to Hobbyists](#)" (1976)

Winter break — Feb. 26-March 6

Tuesday 3/8 — **ARPANET**

    Reading: *Inventing the Internet,* pp. 1-81
        Ornstein, *Computing in the Middle Ages,* Ch. 14 (CTools)
        Norberg and O'Neill, *Transforming Computer Technology,* Introduction and Ch. 6
            (CTools)

Thursday 3/10 — **From ARPANET to Internet**

    Reading: *Inventing the Internet,* pp. 83-145
        Gerovitch, "InterNyet: Why the Soviet Union did not build a Nationwide Computer
            Network" (CTools)
        Norberg and O'Neill, *Transforming Computer Technology,* Ch. 4 (CTools)

Tuesday 3/15 — **PCs: Apple, IBM, and Microsoft**

> **Reading:** Freiberger and Swaine, *Fire in the Valley,* pp. 253-310, 328-354 (CTools)
> Ferguson and Morris, selection from *Computer Wars* (CTools)

Thursday 3/17 — **Hackers and Personal Computing**

> **Reading:** *From Counterculture to Cyberculture,* Chapter 5
> *Computer,* Chapter 11

Tuesday 3/22 — **The Graphical User Interface**

> **Reading:** *From Airline Reservations to Sonic the Hedgehog,* Chapter 8
> Reimer, History of the Graphical User Interface (not entirely reliable)
> Norberg and O'Neill, *Transforming Computer Technology*, ch. 3 (CTools)

Thursday 3/24 — **Graphics and Computer Games**

> **Reading:** *From Airline Reservations to Sonic the Hedgehog,* Chapter 9
> Lenoir, "All but War Is Simulation: The Military-Entertainment Complex" (CTools)

Tuesday 3/29 — **High Performance Computing**

> **Reading:** Aspray and Williams, "Arming American Scientists: NSF and the Provision of
> Scientific Computing Facilities for Universities, 1950-73" (CTools)
> Dongarra et al., "Netlib and NA-Net: Building a Scientific Computing
> Community" (CTools)
> Mackenzie, "The Influence of the Los Alamos and Livermore National Laboratories
> on the Development of Supercomputing" (CTools)

Thursday 3/31 — **Computer Networks**

> **Reading:** Campbell-Kelly and Swartz, "History of the Internet: The Missing
> Narratives" (CTools)
> Sterling, "Pioneering Risk: Lessons from the US Teletext/Videotex Failure"

Tuesday 4/5 — **Grad-only discussion meeting**

Thursday 4/7 — **The Internet: guest lecture, Don Blumenthal, ICANN**

> **Reading:** *Inventing the Internet*, pp. 147-220
> Russell, "Rough Consensus and Running Code" (CTools)
> Frazer et al., "NSFNet Final Report" (1996, CTools)

Mowery and Simcoe, "Is the Internet a US invention?—an economic and technological history of computer networking" (CTools)
Froomkin, "The Internet as a Source of Regulatory Arbitrage" (CTools)

Tuesday 4/12 – **The World Wide Web**

Reading: Wright, "The Web Time Forgot"
P. L. Frana, "Before the Web there was Gopher" (CTools)
Howard Rheingold, "Xanadu, Network Culture, and Beyond," Ch. 14 of *Tools For Thought* (online version of 1985 book)
CERN (European Laboratory for Particle Physics) web site on CERN and the history of the WWW. See especially the original proposal documents.
Wikipedia, "History of the World Wide Web." Explore some of the links and sources.

Thursday 4/14 — **Web 2.0: Google, Facebook, and Wikipedia**

Reading: *Computer,* Ch. 12
From Counterculture to Cyberculture, Ch. 8

Tuesday 4/19 — **Conclusion**

No reading

DUE: Final version of final paper