SI 311/History 329.003/RCSSCI 360, Winter 2016

Computers and the Internet: A Global History

Syllabus v3.0 (revised 3-29–16)

TuTh 4-5:30, 1255 North Quad
Prof. Paul N. Edwards

Why were computers invented? Who wanted them, and for what?
How have computers and the Internet changed societies and cultures
— and how have societies and cultures shaped them?

This nontechnical seminar explores the social, political, and cultural history of computers and computer networks around the world, from the 19th century to the present. We will cover Charles Babbage's designs for steam-powered, mechanical computers in Victorian England; pre-1950 human "computers" in business, science, and war; how early digital computers cracked the Nazi Enigma cipher during World War II; how the Cold War changed computers, and how computers changed the Cold War in the United States, the Soviet Union, France, and Germany. We'll look at the 1970s computer-based experiment with socialist economic management in Allende's Chile, the ways that character encoding standards delayed Internet adoption by speakers of Asian languages, and the role of computers in apartheid South Africa. Finally, we'll study the story behind the Internet and the World Wide Web.

Requirements: reading logs, class participation, two in-class midterm exams, take-home final exam OR final paper/project.

Open to: juniors and seniors, sophomores by permission. Counts toward Social Science distribution requirement and Science, Technology & Society (STS) minor. Preference to BSI students, History concentrators, and STS minors.

Format: readings, videos, lectures, discussion.

Required book: Martin Campbell-Kelly, William Aspray, Nathan Ensmenger, and Jeffrey Yost, *Computer: A History of the Information Machine* (Basic Books, 2014). *Please purchase the third edition (2014)*. The previous editions are outdated.

Instructor:

Prof. Paul N. Edwards, School of Information, 4437 North Quad
Email: pne@umich.edu
Office hours: Tuesday 2:30-3:30 and Thursday 1:00–2:00 PM, or by appointment

Assignments

NB: to pass the class, you must complete all of the assignments, miss no more than 3 classes in total, and achieve a passing grade in class participation.

(1) **Reading log** (15 percent of grade). For each session, you will write a short reading log following the format provided. Your log entry must connect the main Readings with one of the other categories (Context, Computing, Primary Sources). *Due before class.* Logs turned in after class will not be accepted. You must complete at least 18 logs (on time) in order to pass the course.

(2) **Class participation** (15 percent of grade). Most class sessions will involve both small-group and all-group discussions. You should plan to contribute **at least twice to every discussion**. If you attend but do not participate, you will lose points.

Cold calls: sometimes I'll call on people without warning (cold call). Always be prepared to recount one or two of the main arguments or points of the *Context, Computing,* or *Primary Sources* readings you did for the session. It's OK to repeat what you said in your reading log.

(3) **Two in-class midterm exams (20 percent each).** Midterms cover only the material from that section of the course.

(4) Choose one:

Take-home final exam (2500-3500 words, 30 percent of grade), due April 27. Cumulative (covers all materials from the entire course).

Term research project (2500-3500 words, 30 percent of grade). This can be a traditional paper, or the same amount of writing presented in another medium, such as a website or an iPhone app. Up to three students may collaborate on a single project (3000-4000 words for 2 students, 3500-4500 words for 3 students). The assignment has four parts.

(a) A 300-500 word *prospectus,* clearly describing your topic, is due in class on March 8. You *must* turn this in when it is due, but you can change your topic later by turning in another prospectus no later than March 22.

(b) An *annotated source list* (minimum 750 words) describing the materials you will use for your term research project. The list must include at least 15 high-quality sources directly related to your topic. Discussions of each reference should be at least 2-4 sentences for short pieces such as articles or websites, and at least 6-8 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 29.

(c) A *full-length, high-quality draft* (NOT a "rough" draft) is due in class April 12. It will be returned within 7 days, with comments and suggestions for revisions.

(d) The *final version,* edited, revised, and proofread, is due no later than April 27. Final versions <u>must</u> respond to comments on the draft and incorporate extensive revisions.

Course Schedule

Each week's assignment includes four elements: *Reading, Context, Computing,* and *Primary Sources.* Everyone should do the *Reading* for every session. Also choose at least one of the other three elements to read.

Each reading log must cover the *Reading* plus at least one of the three other elements.

January 7 — **Introduction: Automatic Computation in the 19th Century**

Reading: *Computer*, Chapter 1. Also read the section of Chapter 3 on the Analytical Engine.
Johnstone, "Babbage's Language of Thought" (blog post)

Context: BBC Timeline, Victorian Britain

Computing: demo of Babbage's Difference Engine (video)
Many other resources at the Fourmilab Analytical Engine website, including an emulator of the Analytical Engine

Primary sources: Cayley et al., *Report of the Committee appointed to consider the advisability and to estimate the expense of constructing* Mr. Babbage's *Analytical Machine, and of printing Tables by its means* (1878)
Major General H.P. Babbage (Charles Babbage's son), "The Analytical Engine" (1888)

January 12 — **Analog Computing, part 1**

Reading: Computer, Chapter 3 (parts you didn't read for Week 1)
New Scientist, "2000-year-old computer recreated" (video, 2 min)
Freeth et al., "Decoding the ancient Greek astronomical calculator known as the Antikythera Mechanism" (2006)
Charles Petzold, "Computer of the Tides" (video of lecture from Code on the Beach 2014 — 1 hr). Who's that on his t-shirt?

Context: van den Ende, "Tidal Calculations in The Netherlands, 1920-1960" (1992)
"Model saves SF Bay from Ecological Disaster" (video, 4 min)

Computing: Ulmann (2013 SIGINT lecture), Analog Computing (video, 38 min, good for those who know some higher math and/or electronics)

Primary sources: browse the Analog Museum — includes examples of real analog computers, and a library of manuals and articles about analog computation.

January 14 — **Analog Computing, part 2**

Reading: Gallagher, "Gears of War: When mechanical analog computers ruled the waves" Watch the embedded videos (about 15 min total).
Williams, "Differential Analyzers" (2013)
The Vannevar Bush Differential Analyzer and UCLA Differential Analyzer (videos)

Context: Gallagher, "Before Silicon Valley got nasty, the Pirates of Analog Alley fought it out" (a companion piece to the main reading). Explore some of the embedded links.

Computing: solution of $\ddot{y} = -y$ by a differential analyzer (simulation)
Howe, "Analog computers in academia and industry: a history of analog computing at the University of Michigan and the founding of Applied Dynamics International" (2005)

Primary sources: Mechanical Computer: a 6-part US Navy training film (1953, 41 minutes). Explains fire control from shipboard using mechanical analog computers. It helps to know a little calculus and/or basic physics, but most of the math discussed here is not very complicated. (Parts of these videos appear in the main reading.)

January 19 — **From Hollerith to IBM**

Reading: Computer, Chapter 2
FDR Presidential Library, "The Great Depression: Facts and Figures"

history.com, [The New Deal](). Watch the video, read the text, and visit at least three of the topic and photo pages.

FDR Presidential Library, ""[Our Plain Duty": FDR and America's Social Security](#)" and [this video]() of FDR's speeches about it

Context: Puckett, "[Administering Social Security: Challenges Yesterday and Today](#)"

Computing: "[The Mechanical Work of the Twelfth Census](#)" (1908)
"[Uncle Sam Counts Noses](#)" (1940)
"[The 1950 US Census](#)" (1950)

Primary sources: OASIS News, "[The Bureau: A Profile](#)" (1952)
Staruch, "[Filing Little Wooden Sticks](#)" (1978)

January 21 — **Computers and World War II, part 1**

Reading: *Computer*, Chapter 4
[ENIAC]() (1946 video, 9 min) and [Jean Bartik and the ENIAC Women]() (video, 7 min)
Black, "[Final Solutions]()"
Edwin Black, [IBM and the Holocaust]() (video, 4 min)

Context: [History of WWII]()

Computing: Goldstine, "von Neumann and the Computer" and "Beyond the ENIAC" ([book chapters](), 1972). Skim Chapter 6 (about von Neumann); read chapter 7, "Beyond the ENIAC," more carefully.

Primary sources: Bush, "[As We May Think](#)" (1945)

January 26 — **Computers and World War II, part 2**

Reading: Computer History Museum, "[Breaking the Code](#)" (video, 5 min)
"[History of the Enigma](#)," "[Bombe](#)," and "[Colossus](#)," Cryptomuseum.com. Explore side links.
"[Breaking the Code](#)," Masterpiece Theater (90 min). An excellent film starring the great British actor, Sir Derek Jacobi. Watch it with friends.

Context: *Top Secret Rosies* (PBS video, 56 min) — [rent for $1.99](#)(high quality), or [watch free](#)(lower quality)

Computing: Haigh, "[Actually, Turing did not invent the computer](#)"
Numberphile, "[158,962,555,217,826,360,000 (Enigma Machine)](#)"

Primary sources: Turing, "[Computing Machinery and Intelligence](#)" (1950). One of the most famous articles in the history of computing, and source of the title of *The Imitation Game* (film, 2014).

January 28 — **Computers and the Cold War, part 1**

Reading: *Computer,* Chapter 5
History.com, The 1950s. Read the text and view/listen to the video/audio materials.

Context: Wikipedia entry on "Cold War" and its subentries. If you are unfamiliar with Cold War history, spend a while on this site.
Haigh, "Computing the American Way: Contextualizing the Early US Computer Industry" (2010)

Computing: EDSAC Project – mercury delay lines (video, 4 min)
Wikipedia, Williams tube

Primary sources: Valley, "How the SAGE Development Began" (1985)

February 2 — **Computers and the Cold War, part 2**

Reading: *Computer,* Chapter 7
US Air Force, "In Your Defense" (video, 1960s, 23 min)

Context: 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)

Computing: Magnetic Core Memory Systems
Wikipedia, Magnetic-core memory
"Genesis of the Transistor," 1965 documentary by AT&T
"The First Chip War and California Startup Culture" (video, 10 min)

Primary sources: Everett et al., "SAGE: A Data-Processing System for Air Defense" (1957)

February 4 — **From Mainframe to Mini**

Reading: *Computer*, Chapters 6, 8

Context: Ensmenger, "The Black Art of Programming" (2010)

Computing: Hoare, "Programming: Sorcery or Science?" (1984)

Primary sources: Brooks, The Mythical Man-Month (1974). This is a 220-page book, so I don't expect you to read the whole thing — but it's written in a very engaging, often funny style, and it's still full of good lessons. Read the intro and chapters 1-4, at a minimum.

February 9 — **Cybernetics and Computing in the Soviet Union**

Reading: Pangaro, "'Getting Started' Guide to Cybernetics". Read the main page and
watch the intro video. Explore some of the links.
Wikipedia, "History of the Soviet Union." This is the general page; use the links
to read all 5 "main articles" (not very long), covering 1917-1991
Gerovitch, "'Mathematical Machines' of the Cold War: Soviet Computing,
American Cybernetics and Ideological Disputes in the Early 1950s" (2001)

Context: McHenry and Goodman, "MIS in Soviet Industrial Enterprises: The Limits of
Reform from Above" (1986)

Computing: Prokhorov, "Computers in Russia: Science, Education, and
Industry" (1999)

Primary sources: Gerovitch, "InterNyet: Why the Soviet Union Did Not Build a
Nationwide Computer Network" (2008)

February 11 — **The Arpanet**

Reading: Lukasik, "Why the Arpanet was Built" (2011)
Computer, Chapter 11
"Packet switching," Wikipedia

Context: Ornstein, Computing in the Middle Ages, Ch. 14 (2002)
Licklider, "Memorandum For Members and Affiliates of the Intergalactic
Computer Network," 1963

Computing: "Computer Networks: The Heralds of Resource Sharing" (1972 video, 30
min)
Vint Cerf on the history of packet switching (video, 15 min)
Len Kleinrock: the First Two Packets on the Internet (video, 13 min)

Primary sources: ARPA Computer Network – Request For Proposals (pp. 20-42, using
pagination in the lower left corner; skim the rest)
Request For Comments #3 (2 pp)

February 16 — **FIRST MIDTERM EXAM**

February 18 — **Chile: Project Cybersyn**

Reading: Medina, "Designing Freedom, Regulating a Nation: Socialist Cybernetics in
Allende's Chile" (2006)
Morozov, "The Planning Machine: Project Cybersyn and the origins of the Big
Data nation," *The New Yorker* (October 2014)

Vinsel, "[An Unresolved Issue: Evgeny Morozov, The New Yorker, and the Perils of "Highbrow Journalism"](#)"

Optional: browse the debate about Morozov's article vs. Medina's book:

Society for the History of Technology SIG on Computers, Information & Society (SIGCIS), email list archive. [Start here](#) (note that this post takes a satirical approach). Then click "next message" in the headers to see followups.

Context: Wikipedia, "[Chile](#)" and "[Presidency of Salvador Allende](#)". Explore some of the links and the source materials (notes at end of each page), focusing on the period between 1960 and 1980.

US Dept. of State, [Memorandum for Henry Kissinger on Chile, December 4, 1970](#). This is a long document - read at least one full section, e.g. pp. 3-11, to get the general idea. "OAS" is the Organization of American States, i.e. the diplomatic organization of South American governments.

Garcia Marquez, "[Why Allende Had to Die](#)" (1974, republished 2013)

Computing: Beer, "The Intelligent Organization" [Part 1](#) (video, about 1h15min)

Espejo and Gill, "[The Viable System Model as a Framework for Understanding Organizations](#)". If this is too hard to follow, check out the Wikipedia entry for the Viable System Model.

Primary sources: Hanlon, "[Chile Leaps into Cybernetic Future](#)"

Grosch, "[Chilean economic controls](#)" (letter to editor)

Beer, [Cyberstride](#) (handwritten report)

Beer, [Designing Freedom](#) (text of 6 radio talks, with notes, 1973)

February 23 — F**rom Mini to Micro**

Reading: *Computer*, Chapter 9

Context: Levy, *Hackers,* [Chapters 1-2](#) (1984)

Bill Gates, "[Open Letter to Hobbyists](#)" (1976)

Computing: Garland, "[Design Innovations in Personal Computers](#)" (1977)

Primary sources: *Triumph of the Nerds* (PBS video series), Part 1, [Impressing their Friends](#).

February 25 — **Apple and the Graphical User Interface (GUI, pronounced "gooey")**

Reading: *Computer*, Chapter 10

Context: *Triumph of the Nerds* (PBS video series). Part 2, [Riding the Bear](#)

Computing: Reimer, [History of the Graphical User Interface](#), at ArsTechnica (not entirely reliable)

Primary sources: *Triumph of the Nerds* (PBS video series). Part 3, [Great Artists Steal](#).

March 1 and March 3 — **NO CLASS (Winter break)**

March 8 — **Movie day**

   DUE: prospectus for final paper (if you're doing that)

March 10 — **From ARPAnet to NSFnet**

   Reading: *Computer*, Chapter 12

   Context: Edwards, "[Some Say the Internet Should Never Have Happened](#)" (2010)

   Computing: Cats-Baril and Jelassi, "[The French Videotex System Minitel: A Successful Implementation of a National Information Technology Infrastructure](#)" (1994)

   Primary sources: MERIT, "[NSFNET: A Partnership for High-Speed Networking — Final Report, 1987-1995](#)"

March 15 — **Japan**

   Reading: Wikipedia, "[Post-occupation Japan](#)" and "[Ministry of International Trade and Industry](#)"
   Cortada, "[Computing Comes to Japan](#)" (2012)

   Context: Flamm, "[Government and Computers in Japan and Europe](#)" (read only the section on Japan, and the Summary at the end) (1987)
   New York Times, 1992. "'[Fifth Generation' Became Japan's Lost Generation](#)"
   Nielsen, 1988. "[Fifth Generation 1988 trip report](#)."
   Wikipedia, "[Fifth Generation Computer](#)."
   Hendler, 2008. "[Avoiding Another AI Winter](#)."

   Optional: poke around in the [Fifth Generation Computer Systems Museum](#) (mostly technical documents, some pictures)

   Computing: Shapard, "[Islands in the (Data)Stream: Language, Character Codes, and Electronic Isolation in Japan](#)" (1993)

   Primary sources: Ferguson and Morris, "[Coloring the World Blue](#)"

March 17 — **South Africa**

    Reading: Brief history of South Africa (read only the history section on this page)
           Brief history of apartheid (more detailed histories are linked from here)
         Edwards and Hecht, "History and the Technopolitics of Identity: The Case of
           Apartheid South Africa" (2010)

    Context: Itano, 2002. "Should IBM and others pay apartheid bill?"
         Cohen, Milstein, Hausfeld & Toll, PLLC, "Apartheid Litigation: Plaintiffs' Personal
           Stories." Stories of some of the plaintiffs in the lawsuits discussed in the
           Itano article. (2004)

    Computing: Levey and Young, Rowing upstream: snapshots of pioneers of the
           information age in Africa. I've selected a few pieces: ICT timeline, Chapter 4,
           and Chapter 7. (2002)

    Primary sources: Slob, "Computerizing Apartheid" (1990)

March 22 — **Web 1.0: From CERN to the Dot-com Bubble**

    Reading: CERN (European Laboratory for Particle Physics), Birth of the Web. Visit all
           the links here. See a reproduction of the first website (ever) and an emulator
           of the first web browser.
         Berners-Lee, "How It All Started" (slideshow with working links; visit the links)
         Discovery Science, 2008. The True Story of the Internet: Browser Wars and Dot-
           Com Bubble (video, each episode about 45 minutes).

    Context: McCracken, "A History of AOL, as Told in Its Own Old Press Releases" (2010)
           and "20 Years of AOL Annoyances and Foul-Ups" (2009)
         Barlow, "Is there a there in cyberspace?"

    Computing: Brain, How Web Servers Work
         Frana, "Before the Web there was Gopher" (2004)

    Primary sources: RFC 1192 (Commercialization of the Internet)
         Berners-Lee, 1989. "Information Management: A Proposal" (original proposal
         for the WWW)

March 24 — **SECOND MIDTERM EXAM**

March 29 — **The Dark Side: Hackers, Spam, and Black Markets**

    Reading: Brunton, "A Short History of Spam" (2014)
         Brunton, "Constitutive Interference: Spam and Online Communities" (2012)

    Context: Froomkin, "The Internet as a Source of Regulatory Arbitrage" (1997)

Brunton, 2013. "Spam, Porn, and Bodily Computation" (video, 24 min)

Computing: Geiger and Ribes,"The Work of Sustaining Order in Wikipedia: The Banning of a Vandal" (2010)

Primary sources: Templeton, "Origin of the term 'spam' to mean net abuse". Visit some of the links to the original spam messages.

March 31 — **Ghana**

Reading: Brief history of Ghana; CIA World Factbook on Ghana
Burrell, "User Agency in the Middle Range: Rumors and the Reinvention of the Internet in Accra, Ghana" (2011)
Wiens, "An Infamous E-Waste Slum Needed Us. It Got Razed Instead."

Context: Burrell, "The Import of Secondhand Computers and the Dilemma of Electronic Waste" (2012)

Computing: United Nations Environment Programme, 2011. Where Are WEee in Africa? Findings From the Basel Convention E-Waste Africa Programme (Basel: Secretariat of the Basel Convention)

Primary sources: Aljazeera, "E-Waste Republic"
Hakkens, "A Free Trip" (video, 4 min)

April 5 — **Web 2.0: From Google to Wikipedia, Facebook, and Twitter**

Reading: Discovery Science, 2008. The True Story of the Internet: Search (video, 45 min)
Wales, 2005. TED talk, "The Birth of Wikipedia" (video, 20 min)
Wales, 2014. "The Future of Wikipedia" (video, 16 min)
Bloomberg Game Changers, 2013. "Mark Zuckerberg: Building the Facebook Empire" (video, 45 min)
Lotan et al., 2011. "The Revolutions Were Tweeted: Information Flows During the 2011 Tunisian and Egyptian Revolutions"

Context: Wikipedia, "History of the Encyclopedia Britannica". Skim sections 2 and 3; read the rest carefully, especially from section 4.5 to the end.

Computing: Brin et al., 1998. "The PageRank Citation Ranking: Bringing Order to the Web". Some of this is highly technical, but most of the paper can be understood by anyone.

Primary sources: Petersen, "In the World of Facebook" (2010)

April 7 — **China** (guest lecturer: Silvia Lindtner)

Reading: Kaiser Kuo, 2014. Sinica Podcast on the [History of the Internet in China](#) (56 minutes). Kuo is a heavy metal guitarist who also runs the Sinica podcast. Listen to this at the website above, or [download it here as an MP3 file](#).
Lindtner, 2015. "[Hacking with Chinese Characteristics: The Promises of the Maker Movement against China's Manufacturing Culture](#)"

Context: "[Continental Shift: How China is changing Africa](#)" (podcast, 33 min - listen on the website, or download)

Computing: David Rowan, 2016,"[Xiaomi's $45bn formula for success (and, no it's not 'copy Apple')](#)", *Wired*
Anna Greenspan, Silvia Lindtner, David Li, 2015, "[Shanzhai: China's Collaborative Electronics-Design Ecosystem](#)", *The Atlantic*

Primary sources: Wikipedia, "[Golden Shield Project](#)"
Wired magazine, 2007. "[The Great Firewall: China's Misguided — and Futile — Attempt to Control What Happens Online](#)."
Buckley, 2013. [Crackdown on bloggers is mounted by China](#).

April 12 — **Conclusion** (no reading)

April 14 — **NO CLASS**

Course policies and expectations

Workload averages 9 hrs/week outside of class. As with all University of Michigan courses, 3 hours of out-of-class work are expected for each course credit. This is a 3-credit class, so **out-of-class workload should average 9 hours/week over the semester,** including exam week. (Some weeks will take more time, others less.) If you have trouble completing the reading in a timely way, please see my pamphlet [How to Read a Book](#).

Attendance is required. Lectures and in-class activity are major elements of this course; if you don't come, you aren't doing the work. You can miss up to 3 class sessions — more than 10 percent of the course — without penalty. *After that, each missed class will result in a two-thirds letter grade reduction in your final course grade.* For example, if your grade should be a B+ but you missed a total of 4 classes, you would receive a B- instead. **If you miss more than 5 classes, you cannot pass the course.**

In the past, some students have tried to get around this policy by creating an imaginary emergency. Therefore, with apologies for the inconvenience, I require documentation for all absences, including deaths, family emergencies, illness, etc., up to and including nuclear war.

I strongly suggest that you *not miss any classes early in the semester.* Save your "skip" days for late in the semester, when you'll need them more.

Lectures are part of the course material. Please take notes on lectures. You'll be expected to cite them intelligently on your exams. Many of my Powerpoints do not contain a lot of words, so they will not substitute for your own notes. Studies show that handwritten notes produce better learning than notes typed on a computer.

Laptops, smartphones, etc.: only when authorized, only for course purposes. Just as you would not spread out a newspaper and read it in class, please respect your instructor and your fellow students by refraining from all non-course-related use of electronic devices during class. This means no web-surfing, texting, tweeting, etc. Active screens, as well as the diversion of your attention, are distracting for everyone else and detrimental to your own learning. *Students seen violating this policy will be marked "absent" for that session.*

Laptop quadrant: students who want to use laptops during class must sit in the first two rows on the left-hand side. No laptop use is permitted in the rest of the classroom.

Intellectual honesty: 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 [Academic Integrity](#) and [Plagiarism: What It is and How to Recognize and Avoid It](#). If you have even the slightest doubt about whether you are using the words or ideas of others appropriately, please ask.