Computers and Society

Course Introduction
History of Computing

COURSE INTRODUCTION

Why This Course

- Student self introduction in a few sentences
- Why offering/taking this course?

Student Reasons to Take the Course

The Runaway Trolley

The runaway trolley is a moral dilemma first posed in a philosophy paper (Foot, 1967 - Wikipedia has the citations for the original paper, and for some subsequent papers that reformulate the choices).

You could control a trolley car that …

http://en.wikipedia.org/wiki/Trolley_problem

What would YOU do?!!!

1

An Extreme, But True Story

- In the summer of 1884, four English sailors were floating on a lifeboat after their ship sank. On the 20th day, they voted to kill the young and sick sailor to keep the other three alive. The other three sailors survived. They were arrested and tried upon return.

Justice with Michael Sandel. Accessed September 23rd, 2010 from: http://www.justiceharvard.org/

Sandel, M. (2009). *Justice – What's the Right Thing to Do?* NY:Farrar, Straus and Giroux.

What would YOU do?!!!

Course Introduction

The place of the computer in modern society. An in-depth study of the societal, ethical, and legal issues of computing. Historical as well as futurists' views of computing and technology. Public perception of computers and computer scientists and how that influences the role of the computer scientist as a professional. Course work includes oral and written presentations.

From Bucknell couse catalog

Basic Information

- Course home page at
  - http://www.eg.bucknell.edu/~xmeng/computer-society/
- Syllabus at
  - http://www.eg.bucknell.edu/~xmeng/computer-society/syllabus.html
- A tentative schedule at
  - http://www.eg.bucknell.edu/~xmeng/computer-society/schedule.html
- TAs: 赵睿, 浦楚楠

Goals of The Course

- After taking this course, a student will be able to
  - collect and analyze information from a variety of sources about societal issues related to computers and computing, and present informed opinions based on the information and analysis;
  - analyze ethical issues concerning both computer technologies and the exercise of their professional responsibilities.

Topics to Discuss (1)

- A brief history of computing and its impact on society
- Framework of ethics
  - What's the right thing to do?
- Internet and the world wide web
  - Email and spam; freedom of expression vs. censorship.
- Intellectual Property and the Media Industry
  - Changing business models in the music, film, and publishing industries; copyright law; music and movie piracy.

Topics To Discuss (2)

- Intellectual Property: Software
  – Software patents; Proprietary vs. open software; licensing arrangements; software piracy; Creative Commons.
- Privacy
  – Privacy concepts; public and personal information; laws governing information access
  – Surveillance; social networks; data mining; identity theft; encryption & export restrictions
- Computer Security
  – Security threats (viruses, worms, trojan horses); hacking, ethical and otherwise; legal issues; government sponsored hacking

Topics To Discuss (3)

- Software Reliability and Liability
  – Software failure, moral and professional responsibility.
- Computers, Government, and Politics
  – Campaigns, blogs, e-voting, social networks.
- Computer Technologies in the Workplace
  – Automation and the job market; effects of technology on productivity.
- Globalization and Computers
  – Trade agreements; offshoring and outsourcing

Topics To Discuss (4)

- Computers and Education Divide
  – Digital divide; net neutrality; "winner-takes-all"?
- Professional Ethics
  – Professional associations' codes of ethics; professional ethical dilemmas.

Student Work

- Go over the syllabus
- Expected of the students
  – Reading the assigned papers
  – Participating discussions
  – Writing three short summary papers
  – Three quizzes
- A tentative schedule

COMPUTING AND THEIR HISTORICAL IMPACT ON SOCIETY

Aids to Manual Calculating

- Tablet
  – Clay, wax tablets (ancient times)
  – Slates (late Middle Ages)
  – Paper tablets (19th century)
- Abacus
  – Rods or wires in rectangular frame
  – Lines drawn on a counting board
- Mathematical tables
  – Tables of logarithms (17th century)
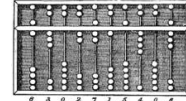 – Income tax tables (today)

Slate and Counting Board

Chinese Abacus

the number represented in the picture is 6,302,715,408
http://en.wikipedia.org/wiki/Suanpan

http://www.chinahighlights.com/travelguide/culture/the-chinese-abacus.htm

The earliest known written documentation of the Chinese abacus dates to the 2nd century BC

http://en.wikipedia.org/wiki/Suanpan

Early Mechanical Calculators -- Pascaline

- Calculators of Pascal and Leibniz (17th century)
  - The only functional mechanical calculator in the 17th century
  - Worked with whole numbers
  - Unreliable

http://en.wikipedia.org/wiki/Pascal%27s_calculator

Early Mechanical Calculators -- Arithmometer

- Arithmometer of (Charles Thomas) de Colmar (19th century)
  - Took advantage of advances in machine tools
  - Much more reliable, can be used in daily work
  - Adopted by insurance companies
  - Its production debut of 1851 launched the mechanical calculator industry which ultimately built millions of machines well into the 1970s.

http://en.wikipedia.org/wiki/Arithmometer

Feminization of Bookkeeping

• Women can be as productive as men in work place when doing bookkeeping
• In 1880, 5.7 percent of cashiers, bookkeepers, and accountants were women. By 1910, the numbers had risen to 38.5 percent

Social Change → Market for Calculators

- Gilded Age (late 19th century America)
  - Rapid industrialization
  - Economic expansion
  - Concentration of corporate power
- New, larger corporations
  - Multiple layers of management
  - Multiple locations
  - Needed up-to-date, comprehensive, reliable, and affordable **information**

Calculator Adoptions → Social Change

- Fierce market
  - Continuous improvements in size, speed, ease of use
  - Sales increased rapidly
- "Deskilling" and feminization of bookkeeping
  - People of average ability quite productive
  - Calculators 6× faster than adding by hand
  - Wages dropped
  - Women replaced men

Cash Register

- NCR: the original name came from National Cash Register Company (1884)

- The company contributed or invented various systems involving computing
  - Teradata: parallel database machines
  - ATM machines
  - Modern cash registers
  - Barcode scanners

- An active high-tech company today

http://en.wikipedia.org/wiki/NCR_Corporation

http://www.ncr.com/about-ncr/company-overview/history-timeline
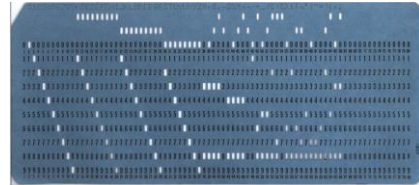
Punched Card Tabulation

- Punched cards (late 19th century)
  - Herman Hollerith invented punched card and mechanical tabulating machine
  - One record per card
  - Cards could be sorted into groups, allowing computation of subtotals by categories
  - Greatly reduced the time needed for tabulating the census data
    - 1880 census data took 8 years to finish
    - 1890 data used 2 years to finish with Hollerith's machines

Punched Cards

http://en.wikipedia.org/wiki/Punched_card

Electric Tabulator at U.S. Census Bureau

© Bettmann/CORBIS

Social Impact

- Time needed for census data shortened
- Possible statistical analysis of data from cash registers
- Keeping accounting information
- Creation of IBM (International Business Machines) and modern data-processing systems

Dawn of the Computing Age

- **Colossus** was the world's first electronic digital computer that was at all programmable.
  - The prototype, **Colossus Mark 1**, was shown to be working in December 1943 and was operational at Bletchley Park by 5 February 1944
  - An improved **Colossus Mark 2** first worked on 1 June 1944, just in time for the Normandy Landings
  - Ten Colossus computers were working by the end of WWII
  - Breaking German communication code, played a critical role in winning WWII --- *social impact!!*

http://en.wikipedia.org/wiki/Colossus_computer

Computers and Society   31

Colossus Computers
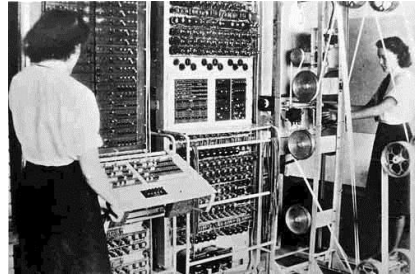
http://en.wikipedia.org/wiki/Colossus_computer

Computers and Society   32

Precursors of Commercial Computers

- Atanasoff-Berry Computer: vacuum tubes
- ENIAC: externally programmed with wires
- EDVAC: program stored in memory
- Small-Scale Experimental Machine: CRT memory

Computers and Society   33

Computer Technology: Vacuum Tubes

http://en.wikipedia.org/wiki/Vacuum_tube

Computers and Society   34

Computer Technology: Transistors

http://en.wikipedia.org/wiki/Transistor
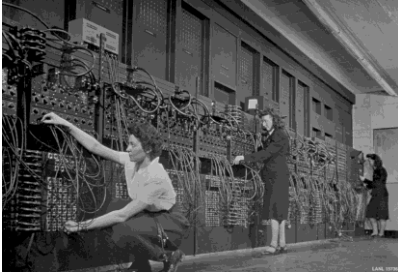
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Computer Technology: Integrated Circuits

http://en.wikipedia.org/wiki/Integrated_circuit

Computers and Society   36

Programming the ENIAC

© CORBIS

First Commercial Computers

- Remington-Rand
  - Completed UNIVAC in 1951
  - Delivered to U.S. Bureau of the Census
  - Predicted winner of 1952 Pres. election
- IBM
  - Larger base of customers
  - Far superior sales and marketing organization
  - Greater investment in research and development
  - Dominated mainframe market by mid-1960s

CBS News Coverage of 1952 Presidential Election Featured UNIVAC Computer

Hagley Museum and Library. Accession number 1984.240

The Infamous 1952 President Election Prediction

- UNIVAC became known for predicting the outcome of the U.S. presidential election in 1952.
- The computer predicted an Eisenhower landslide when traditional pollsters all called it for Adlai Stevenson.
- The numbers were so skewed that CBS's news boss in New York, Mickelson, decided the computer was in error and refused to allow the prediction to be read.
- The CBS called an 8-7 win for Eisenhower (the actual computer prediction was 100-1).
- When the predictions proved true and Eisenhower won a landslide within 1% of the initial prediction, Charles Collingwood, the on-air announcer, embarrassingly announced that they had covered up the earlier prediction.

http://en.wikipedia.org/wiki/UNIVAC

Reflection

- As the technology advances, things that were unimaginable are now a possibility!
- Society changes;
- People changes;
- Culture changes.

COMPUTER, INTERNET, AND STORAGE

Microprocessor and Personal Computing

- Computer inside a single semiconductor chip
- Invented in 1970 at Intel
- Made personal computers practical

Interl 4004
http://en.wikipedia.org/wiki/Microprocessor

Antecedents to the Personal Computer

- *Whole Earth Catalog*
  - "Sort of like Google in paperback form" (Steve Jobs)
  - Stewart Brand saw "technology as a tool for individual and collective transformation" (Fred Turner)
- People's Computer Company
  - Educated people on how to use computers
  - People gathered around time-share computers
  - Culture promoted free exchange of software
- Homebrew Computer Club
  - Meeting place for hobbyists interested in building personal computers
  - Member Steve Wozniak created system that became Apple I

Steve Wozniak and Steve Jobs with Apple I Personal Computer

© Kimberly White/Corbis

Personal Computer

- Altair 8800
  - Gates and Allen create BASIC interpreter
  - Interpreter pirated at Homebrew Computer Club meeting
- Personal computers become popular
  - Apple Computer: Apple II
  - Tandy Corporation: TRS 80
- Developments draw businesses to personal computers
  - Computer spreadsheet program: VisiCalc
  - IBM launches IBM PC

Milestones in Networking

Early Networking: Semaphore Telegraph Tower

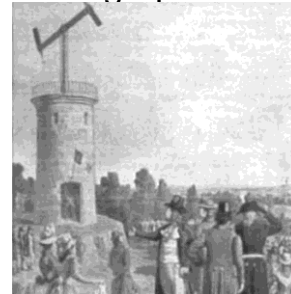Photo l'Adresse Musée de La Poste, Paris / La Poste

Chinese Beacon Towers
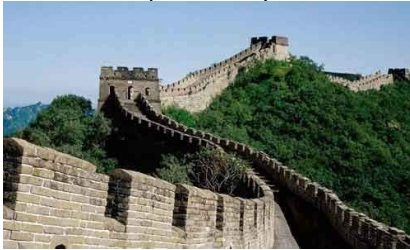(烽火台)

http://www.wsbedu.com/jia/showw-402-w8.html

Telegraph

- U.S. government funded first line
  - 40 miles from Washington, D.C. to Baltimore
  - Built by Samuel Morse in 1843-1844
- Private networks flourished
  - 12,000 miles of lines in 1850
  - Transcontinental line in 1861 put Pony Express out of business
  - 200,000 miles of lines by 1877
- Technology proved versatile
  - Fire alarm boxes
  - Police call boxes

Transcontinental Telegraph: Pony Express Riders Lose Jobs

© North Wind Picture Archives / Alamy

Telephone

- Alexander Graham Bell
  - Constructed harmonic telegraph
  - Leveraged concept into first telephone
- Social impact of telephone
  - Blurred public life / private life boundary
  - Eroded traditional social hierarchies
  - Reduced privacy
  - Enabled first "online" communities

Typewriter and Teletype

- Typewriter
  - Individual production of "type set" documents
  - Common in offices by 1890s
- Teletype
  - Typewriter connected to telegraph line
  - Popular uses
    - Transmitting news stories
    - Sending records of stock transactions

Radio

- Pioneers
  - Hertz creates electromagnetic waves
  - Marconi invents radio
- First used in business
  - Wireless telegraph
  - Transmit voices
- Entertainment uses
  - Suggested by Sarnoff
  - Important entertainment medium by 1930s

Orson Welles Broadcasts
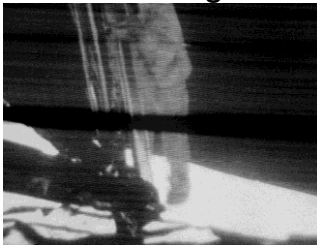*War of the Worlds*

© Bettmann/CORBIS

Television

- Became popular in 1950s
  - Price fell dramatically
  - Number of stations increased
- Social effects
  - Worldwide audiences
  - Networks strive to be first to deliver news
  - Impact of incorrect information; e.g., 2000 presidential election (*Bush v. Gore*)

Hundreds of Millions Watch Moon Landing in 1969

Courtesy of NASA

Remote Computing

- Stibitz and Williams build Complex Number Calculator at Bell Labs
- Bell Labs part of AT&T (phone company)
- Teletype chosen for input/output
- Allows operator to be distant from machine
- Long-distance demonstration between New Hampshire and New York City

ARPANET

- DoD creates ARPA in late 1950s
- Licklider conceives of "Galactic Network"
- Decentralized design to improve survivability
- Packet-switching replaces circuit switching
- First working ARPANET was established in 1969 among four nodes across different states.

Email

- Creation
  - Tomlinson at BBN writes software to send, receive email messages
  - Roberts creates email utility
- Current status
  - One of world's most important communication technologies
  - Billions of messages sent in U.S. every day

Internet

- Kahn conceives of open architecture networking
- Cerf and Kahn design TCP/IP protocol
- Internet: network of networks communicating using TCP/IP

Broadband

- Broadband
  - High-speed Internet connection
  - At least 10x faster than dial-up connection
  - Enhanced by fiber optic networks
- Typical broadband speeds (2011 figures)
  - Japan (#1 in world): 63 megabits/second
  - South Korea (#2): 40 megabits/second
  - United States (#15): 2 megabits/second

http://www.akamai.com/html/about/press/releases/2011/press_072611.html

Milestones in Information Storage and Retrieval

Codex

- Codex
  - Rectangular pages sewn together on one side
  - Replaced papyrus scrolls as way of storing books
- Advantages of codex over scroll
  - More durable
  - Allows quicker access to particular passages
- Manufacturing technologies
  - Copying by hand
  - Wood engraving

Gutenberg's Printing Press

- Based on movable metal type
- Church principal customer of early publishers
- Powerful mass communication tool
- Printing press's impact on Reformation
  - More than 300,000 copies of Luther's publications
  - Protestants out-published Catholics by 10-to-1 in the middle 16th century

Newspapers

- Newspapers: Stimulated free expression
- Governments responded
  - Licensing
  - Censorship
- Impact on American Revolution
  - Newspapers helped unify colonies
  - Swayed public opinion toward independence

Hypertext

- Vannevar Bush envisions Memex (1945)
- Ted Nelson (1963)
  - Coined word hypertext
  - Proposed creation of Xanadu
- Douglas Engelbart (1962)
  - Directed construction of NLS (oNLine System)
  - Demonstrated windows, email, mouse, videoconferencing

Douglas Engelbart: "The Mother of All Demos"

Courtesy of SRI

Graphical User Interface

- Xerox PARC (Palo Alto Research Center)
  - Alan Kay sees Doug Engelbart demo in 1968
  - Alto personal computer (early 1970s)
  - Bit-mapped display, keyboard, and mouse
- Apple Computer
  - Steve Jobs visits Xerox PARC in 1979
  - Macintosh (1984)
  - Bit-mapped display, keyboard, and mouse
- Microsoft Windows (1990)
  - Released in May 1990
  - Quickly became dominant graphical user interface

Single-Computer Hypertext Systems

- Peter Brown at University of Kent
  - Guide (1982)
  - Released versions for Macintosh and IBM PC
- Apple Computer
  - HyperCard (1987)
  - Hypertext system based on "stacks" of "cards"
  - Links represented by buttons
  - Basis for best-selling games Myst and Riven

World Wide Web

- First browser built at CERN in Switzerland
  - Tim Berners-Lee: World Wide Web (1990)
  - Berners-Lee created Web protocols
  - Protocols based on TCP/IP → general
- Later browsers
  - Mosaic
  - Netscape Navigator
  - Netscape Mozilla
  - Microsoft Internet Explorer (most popular)
  - Google's Chrome
  - Apple's Safari

Traffic Information on the Web

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Search Engines

- Crawler-based engines (Google, AltaVista)
  - Programs called spiders follow hyperlinks and visit millions of Web pages
  - System automatically constructs Web page database
- Human-assisted engines (Open Directory)
  - Humans build Web page database
  - Web page summaries more accurate
  - Far fewer Web pages in database
- Hybrid systems (MSN Search)

Summary and Your Work

- We gave an introduction to the topics in the course and how the course will run;
- We discussed some of the historical computing events and their impact on the society;
- Your work
  - Read the chapter 1 and chapter 2 of the text, as well as Vesilind's ethics decision process
  - Ask questions!