Introduction to Informatics

Lecture 5: Cyborgs and the History of Computers

Readings until now

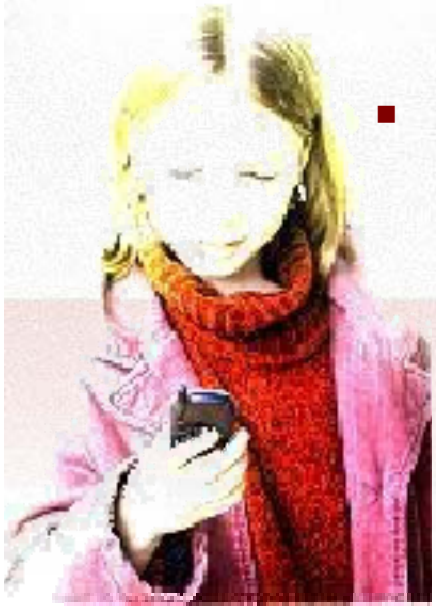
- Lecture notes
  - Posted online @ http://informatics.indiana.edu/rocha/i101
    - *The Nature of Information*
    - *Technology*
  - @ *infoport* and web
- From course package
  - Von Baeyer, H.C. [2004]. *Information: The New Language of Science*. Harvard University Press.
    - Chapters 1, 4 (pages 1-12)
  - From Andy Clark's book "*Natural-Born Cyborgs*"
    - Chapters 2 and 6 (pages 19 - 67)

Assignment Situation

- Labs
  - Past
    - Lab 1: Blogs
      - Closed (Friday, January 19)
    - Lab 2: Basic HTML
      - Due this Friday, January 26
  - Next
    - Advanced HTML: Cascading Style Sheets
      - Due Friday, February 2
- Assignments
  - Individual
    - First installment
      - Lecture 7: Thursday, February 1

Transparent Technology

- So well fitted to, and integrated with, our own lives, biological capacities, and projects as to become almost invisible in use (Andy Clark)
  - Glasses, wrist-watches, driving cars, mobile phones, pens, sports and musical equipment: human-centered
    - Not the same as easy to understand
- Opaque Technology
  - Highly visible in use: technology-centered
    - Computers, industrial machines
  - Opaque technology can become transparent with practice
    - But it works better when biologically suited
      - Natural fit, ergonomics



http://www.baddesigns.com/examples.html

http://www.jnd.org/

(Donald Norman)

Natural-born Cyborgs?

- Humans more than using, incorporate technology
  - We know we "know" the time, simply because we are equipped with a watch
  - As more portable computing devices become available, will we incorporate easily accessible collective knowledge as our own?
    - Transparent ***knowledge*** technology
      - Example: Google SMS
      - Adaptive Knowledge Technology (Clark, Chapter 6)

http://www.google.com/sms/howtouse.html#top

Information appliances

- Geared to support a specific activity
  - Via storage, reception, processing, and transmission of *information*
- Form an intercommunicating web
  - Talk to each other
- Are transparent tools
  - Easy to use and fade into background: *poised to be taken for granted*

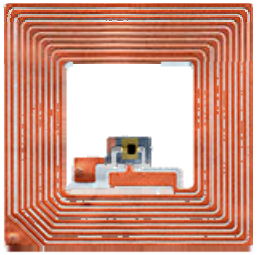
Donald Norman

Luis M.Rocha and Santiago Schnell

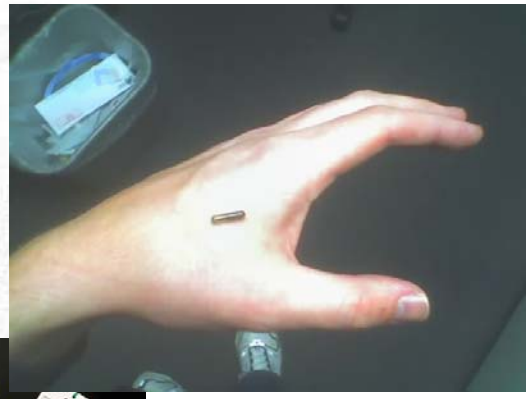
Knowledge Technology

- Recommendation Systems that respond to your context
  - First: data analysis or data mining
    - Consumer behavior
      - Database analysis of the transactions in a Midwest supermarket chain found that on Thursdays and Saturdays males who buy diapers also buy beers.
      - Used to relocate merchandises to more strategic places,
  - Second: A move from “pull” to “push” technology
    - Proactive tools that Recommend rather than waiting to be queried
  - Third: enabling individualized and specific responses
    - Brain-like Hebbian Learning
      - The more certain items get associated, the stronger they get in a network of associations
    - Ubiquitous computing, smart-rooms, etc.
- Building everyday tools which respond, adapt, and evolve to and with our situations without us being aware
  - Portability, Adaptability, Proaction
  - How will we change?
    - Identity, Security, Ownership and Copyright, Alienation
- Andy Clark, Chapter 6

Getting tagged



- RFID
  - Radio Frequency Identification
    - RFID tag can be attached to or incorporated into a product, animal, or person for the purpose of identification using radio waves
- Bluetooth
  - Protocol for wireless personal area networks (PANs)
    - connect and exchange information between devices via a secure short-range radio frequency

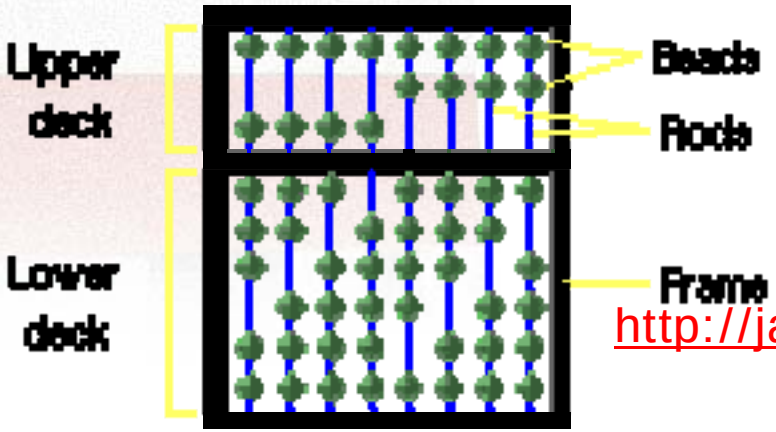


Luis M.Rocha and Santiago Schnell


Describes a future society with androids. As with any transformative technology, society changes to the point where humans are not sure what the difference between human and machine is.
BLADE RUNNER
From the "*Do Androids Dream of Electric Sheep?*" book by Phillip K. Dick.

History of Information Technology: Part I

- Abacus
  - A counting aid, may have been invented in Babylonia in the fourth century B.C.
    - Not automatic: memory aid for intermediate calculations
  - Very used in China and Japan
    - Each bead on the upper deck has a value of 5,
    - Each bead on the lower deck has value of 1
      - Beads are considered counted, when moved towards the beam that separates the two decks.

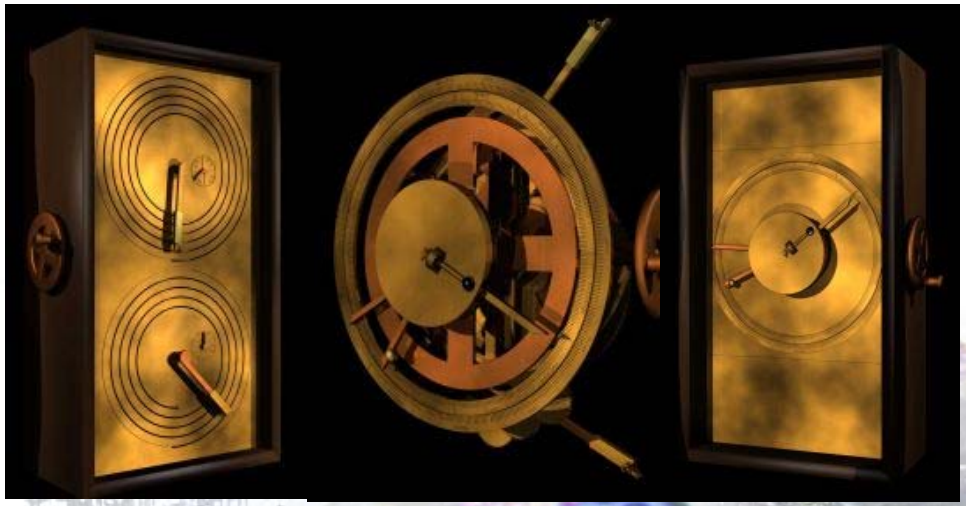


Reconstruction of a Roman abacus in the *Cabinet des Médailles, Bibliothèque nationale*, Paris.

http://java.sun.com/applets/archive/beta/Abacus/

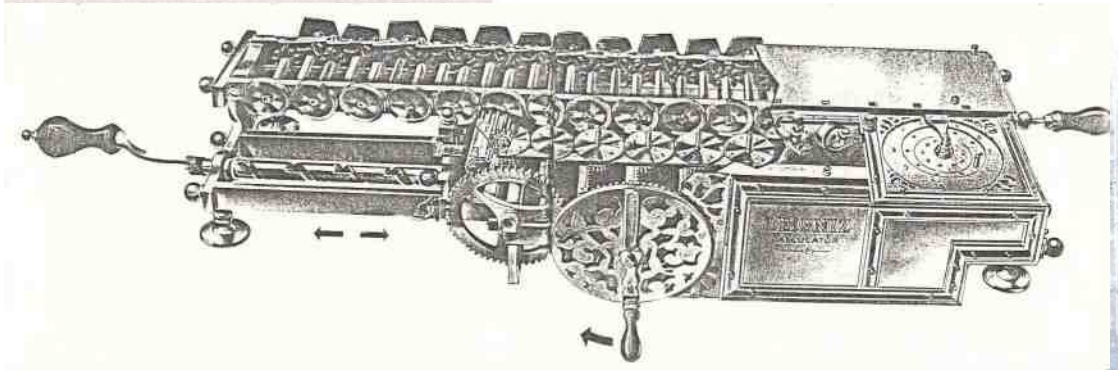
The Antikythera Mechanism

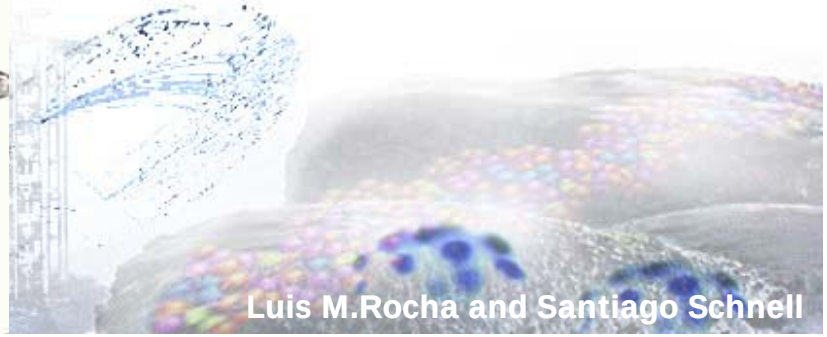
- 2,000-year-old astronomical calculator
  - bronze mechanical analog computer
    - discovered more than 100 years ago in a Roman shipwreck, was used by ancient Greeks to display astronomical cycles.
  - built around the end of the second century BC to calculate astronomical positions
  - With imaging and high-resolution X-ray tomography to study how it worked.
    - complicated arrangement of at least 30 precision, hand-cut bronze gears housed inside a wooden case covered in inscriptions.
    - technically more complex than any known device for at least a millennium afterwards.



Forefathers of the modern computer

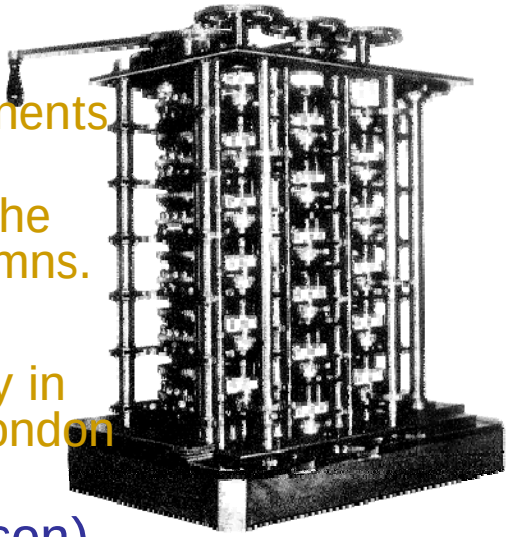
- Wilhelm Schickard (1592- 1635)
  - In 1623 built the first mechanical calculator
    - can work with six digits, and carries digits across columns. It works, but never makes it beyond the prototype stage.
- Blaise Pascal (1623-1662)
  - built a mechanical calculator in 1642
    - It has the capacity for eight digits, but has trouble carrying and its gears tend to jam.
    - 10-teeth gears
- Gottfried von Leibniz (1614-1716)
  - built a mechanical calculator in 1670 capable of multiplication and division





Charles Babbage (1791 – 1871)

- Difference Engine
  - Special-purpose digital computing machine for the automatic production of mathematical tables.
    - logarithm tables, tide tables, and astronomical tables
    - Steam-driven, consisted entirely of mechanical components - brass gear wheels, rods, ratchets, pinions, etc.
    - Numbers were represented in the decimal system by the positions of 10-toothed metal wheels mounted in columns.
  - Never completed the full-scale machine
    - Completed several fragments. The largest is on display in the London Science Museum. In 1990, it was built (London Science Museum)
  - The Swedes Georg and Edvard Scheutz (father and son) constructed a modified version of Babbage's Difference Engine.
    - Three were made, a prototype and two commercial models, one of these being sold to an observatory in Albany, New York, and the other to the Registrar-General's office in London, where it calculated and printed actuarial tables.
  - For an interesting “what-if” scenario read “The Difference Engine” by Bruce Sterling and William Gibson
    - Britain goes through both the Industrial and Information Revolutions simultaneously in the 19th Century



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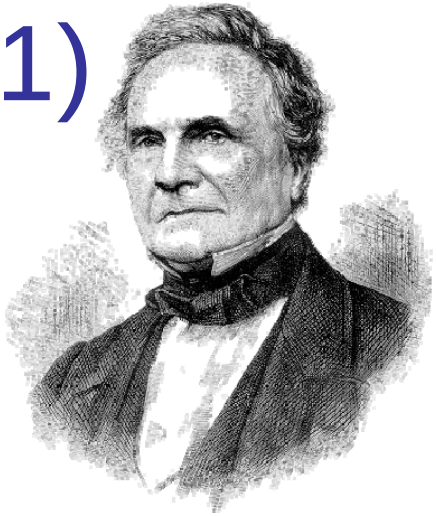
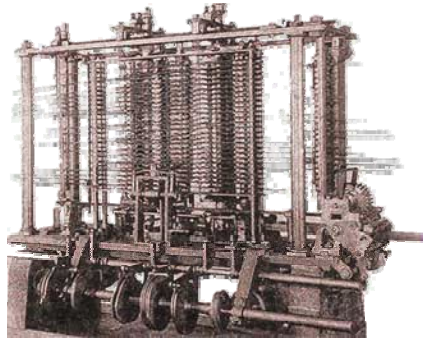
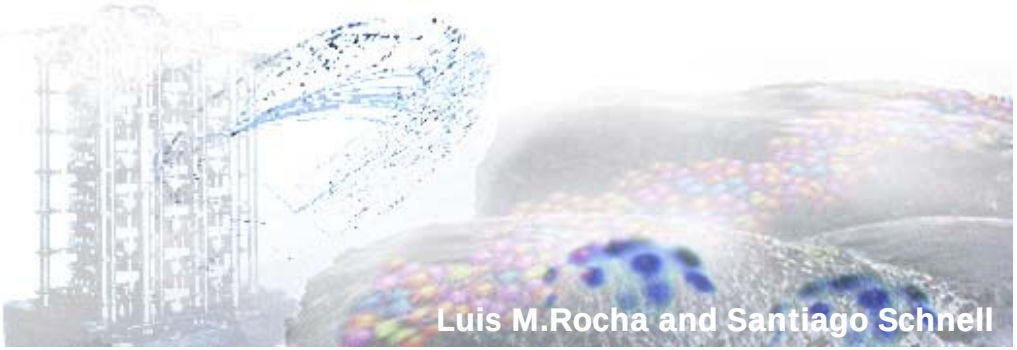


- Analytical Engine
  - Working with Ada Lovelace (daughter of Lord Byron) designed what was to have been a general-purpose mechanical digital computer.
    - With a memory store and a central processing unit (or 'mill') and would have been able to select from among alternative actions consequent upon the outcome of its previous actions
      - Conditional branching: Choice, information
    - Programmed with instructions contained on punched cards



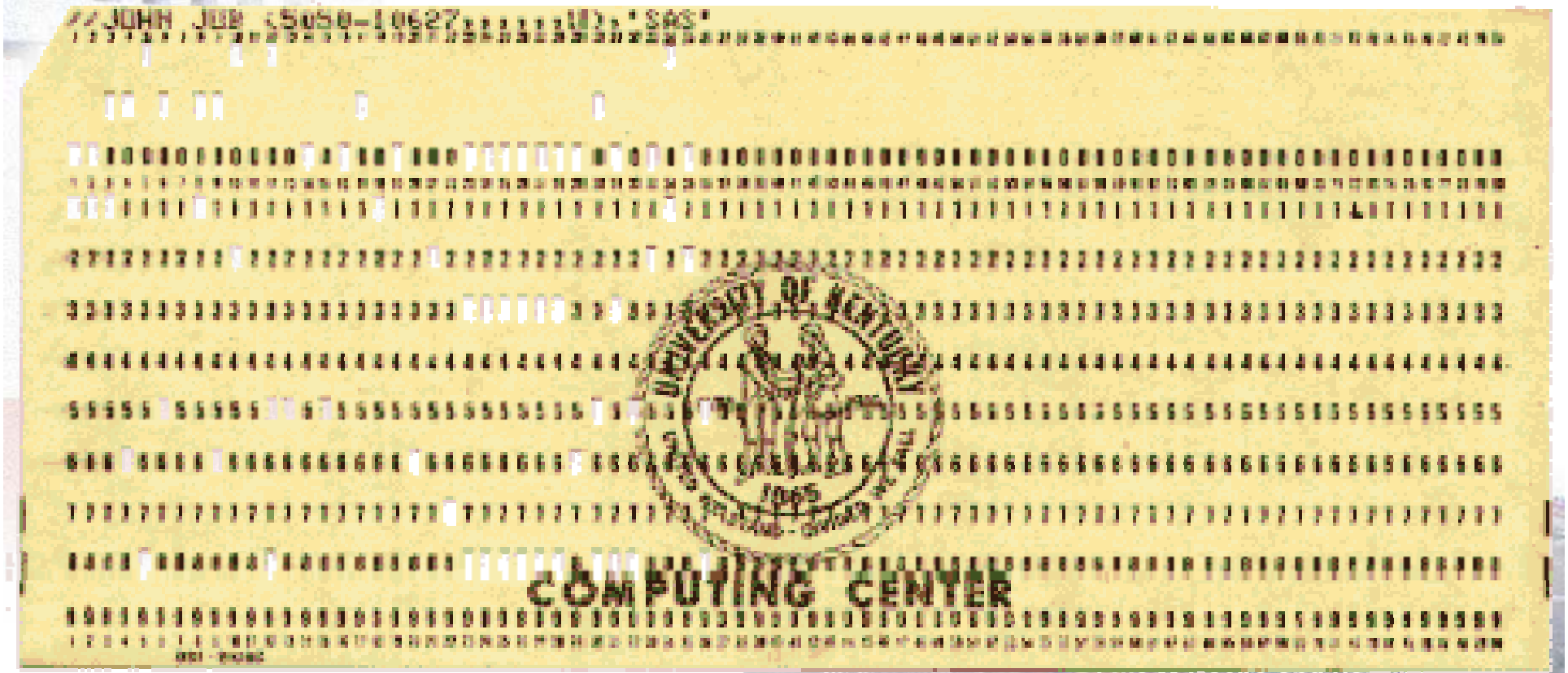


Herman Hollerith (1860-1929)

- Devised a system of encoding data on cards through a series of punched holes.
  - Hollerith's machine, used in the 1890 U.S. census, "read" the cards by passing them through electrical contacts. Closed circuits, which indicated hole positions, could then be selected and counted.
  - His Tabulating Machine Company (1896) was a predecessor to the International Business Machines Corporation (IBM)
- Reduced reading errors, work flow was increased, and, more important, stacks of punched cards could be used as an ***accessible memory store*** of almost unlimited capacity

Memory: Punch Card

- Binary Representation
  - Holes denote 1's
    - With 8 holes permissible $2^8 = 256$ numbers possible per column



Alan Turing (1912-1954)

- In 1935, at Cambridge University, Turing invented the principle of the modern computer: ***Universal Turing Machine***.
  - abstract digital computing machine consisting of a ***limitless memory*** and a scanner that moves back and forth through the memory, symbol by symbol, reading what it finds and writing further symbols (Turing [1936]).

The actions of the scanner are dictated by a program of instructions that is stored in the memory in the form of symbols.

During the Second World War, Turing was a leading cryptanalyst at the Government Code and Cypher School, Bletchley Park.

- Breaking of the German code ENIGMA
- Prosecuted for homosexuality: forced to undergo hormone treatment

ENIAC (1945)

- First fully functioning electronic digital computer to be built in the U.S.
  - Electrical Numerical Integrator and Computer
  - University of Pennsylvania, for the Army Ordnance Department, by J. Presper Eckert and John Mauchly.
    - Far from general-purpose: The primary function was calculation of tables used in aiming artillery.
    - ENIAC was not a stored-program computer, and setting it up for a new job involved reconfiguring the machine by means of plugs and switches.
    - Used decimal digits instead of binary ones
    - Nearly 18,000 ***vacuum tubes for switching.***
      - Storage of all those vacuum tubes and the machinery required to keep the cool took up over 167 square meters (1800 square feet) of floor space.
      - invented by American physicist Lee De Forest in 1906.
      - worked by using large amounts of electricity to heat a filament inside the tube. the presence of current represented a one.
    - punched-card input and output

Next Class!

- Topics
  - History of Information Technology
    - From Silicon Chips to PCs
    - The History of the Internet
  - Modeling the World
- Readings for Next week
  - Lecture notes Posted online @ http://informatics.indiana.edu/rocha/i101
    - *Technology*
  - @ *infoport*
  - From course package
    - From Andy Clark's book "*Natural-Born Cyborgs*"
      - Chapter 6: Global Swarming (pp. 45-67)
- Lab 3
  - Advanced HTML (Cascading Style Sheets)