Historical Perspective

CS160: User Interfaces

Maneesh Agrawala

Upcoming Schedule

Final Presentation and Report (due Apr 29)

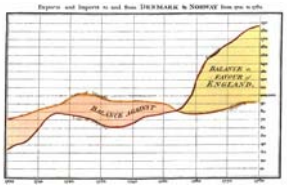
- Revise interface based on pilot study
- Last chance to finish implementation
- Presentations held in my office Apr 29 and May 1
  - Sign up for 15 min slot next week
- We are planning a project fair for Tue May 6 3:30-5pm

Review: 3 Functions of Vis.

Record information
- Photographs, blueprints, …

Support reasoning about information (analyze)
- Process and calculate
- Reason about data
- Feedback and interaction

Convey information to others (present)
- Share and persuade
- Collaborate and revise
- Emphasize important aspects of data



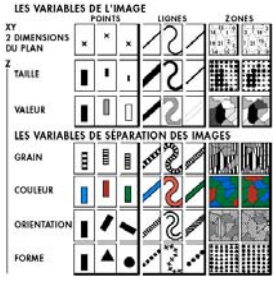
Review: Data and Image

N - Nominal (labels)
- Fruits: Apples, oranges, …

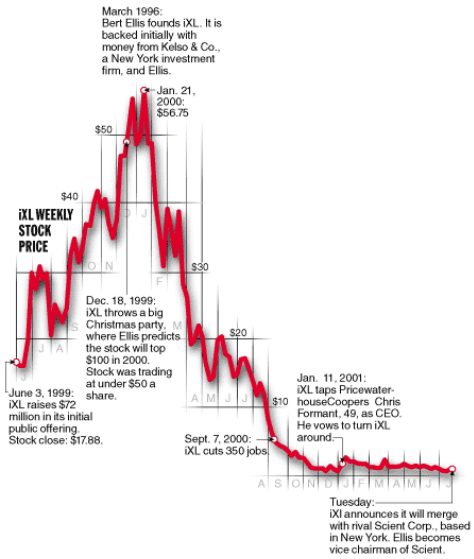
O - Ordered
- Quality of meat: Grade A, AA, AAA

Q - Quantitative
- Ordered, with measurable distances, or amounts
- Physical measurement: Length, Mass, Temp, …

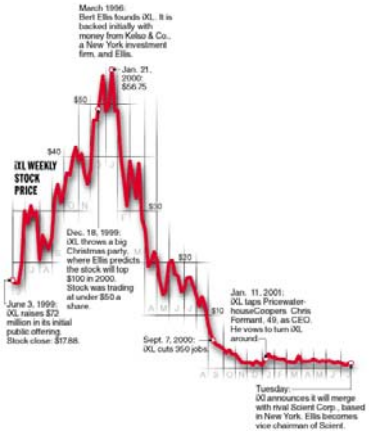
Visual Variables
- Position
- Size
- Value
- Texture
- Color
- Orientation
- Shape



Review: Deconstruction

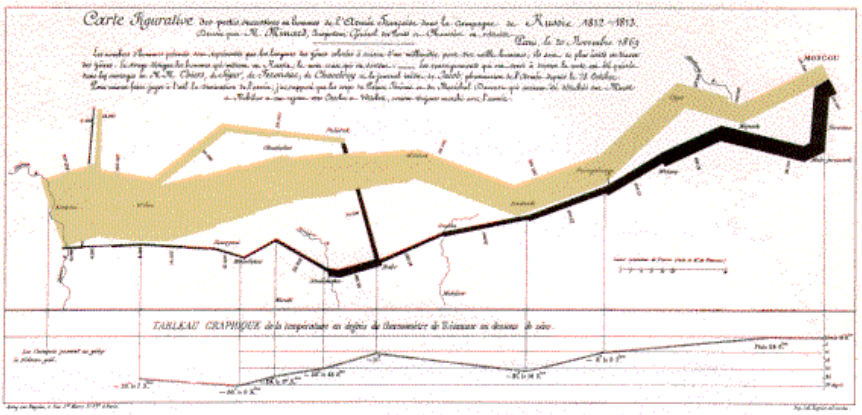


Review: Deconstruction

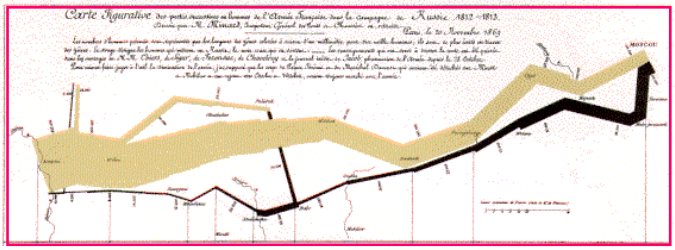


x-axis: time (Q)
y-axis: price (Q)

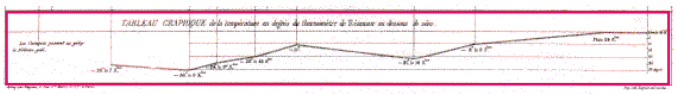
Napoleon's March [Minard 1869]



Single Axis Composition



+



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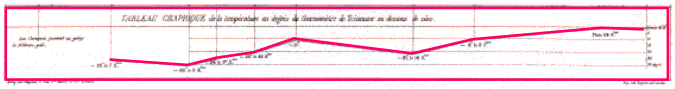
[based on slide from Mackinlay]

Mark Composition

y-axis: temperature (Q)

\+ x-axis: time (Q)

=



temp over time (Q x Q)

[based on slide from Mackinlay]

Mark Composition

y-axis: longitude (Q)

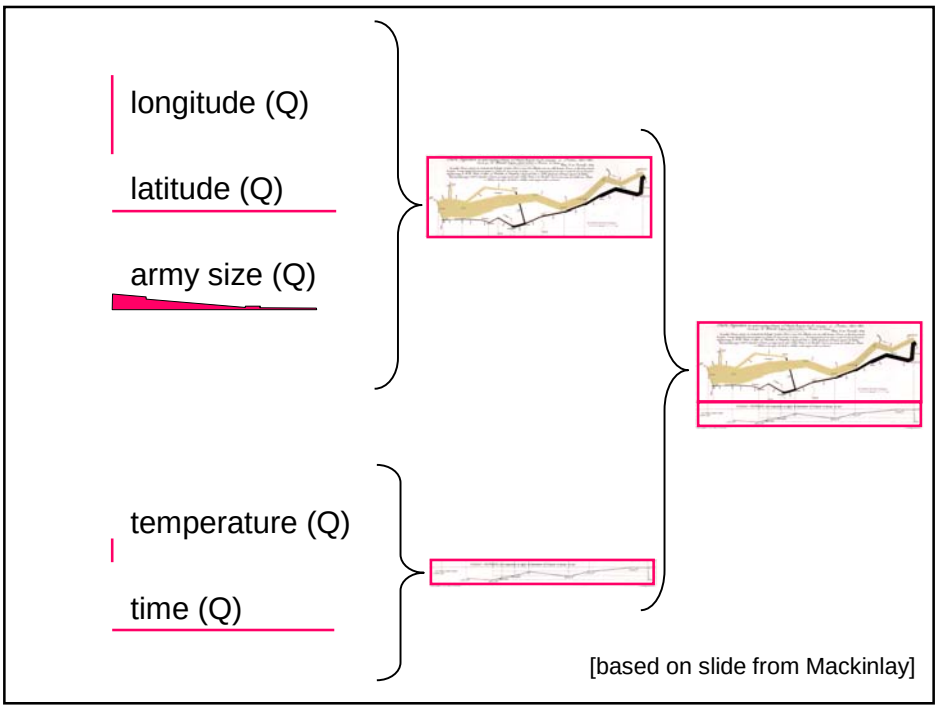
\+ x-axis: latitude (Q)

\+ width: army size (Q)

=

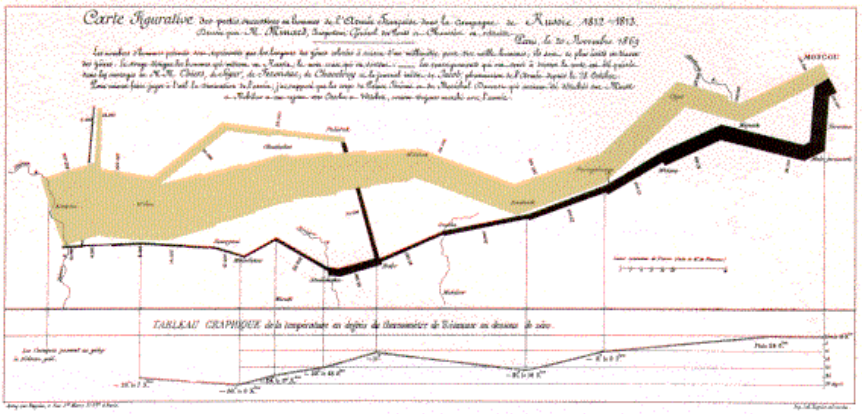
army position (Q x Q) and army size (Q)

[based on slide from Mackinlay]



[based on slide from Mackinlay]

Napoleon's March [Minard 1869]



- Depicts at least 5 quantitative variables
- Any others?

Historical Perspective

Topics

- Precursors
- 1940's Early Visions
- 1960's Visionary Demos
- 1970's Personal Computing
- 1980's Graphical User Interfaces
- 1990's Mobile and Ubiquitous

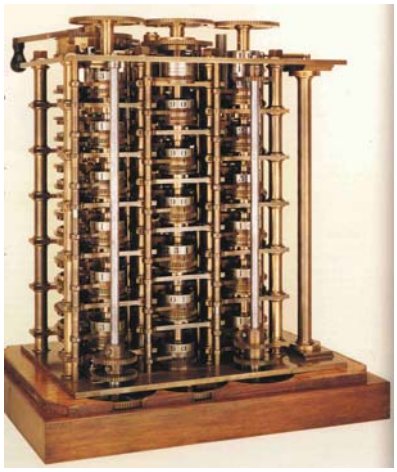
Precursors

Astrolabe (Middle Ages)

Convenient interface to complex computation

Mechanical Control & Computation

Jacquard Loom (1804)

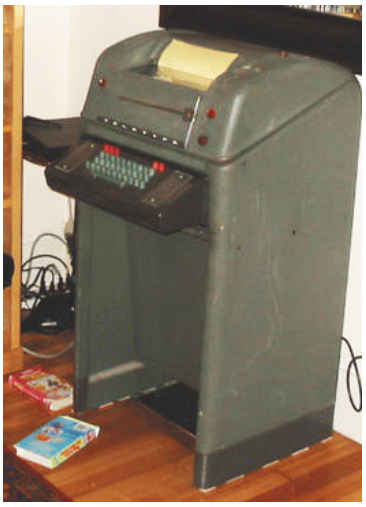


Babbage Difference Engine (1849)

Hollerith Punch Cards (1890)

Hollerith Electric Tabulator, US Census Bureau, Washington, DC, 1908,
Photograph by Waldon Fawcett. Library of Congress, LC-USZ62-45687.

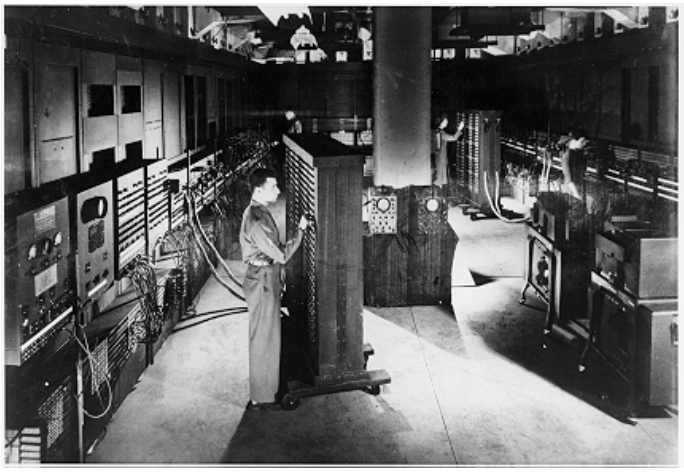
Teletype (ca. 1910)



1940's Early Visions

ENIAC (1943)

World's first numerical integrator and computer

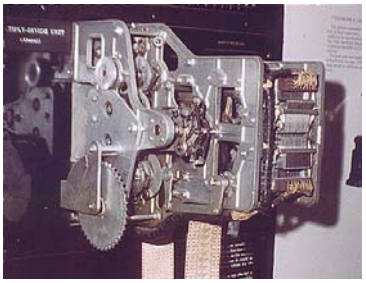


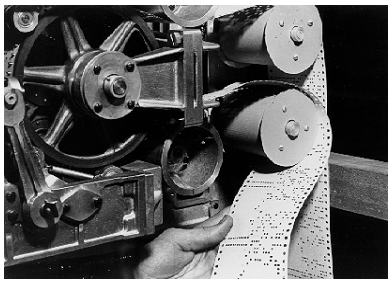
From IBM Archives.

Harvard Mark I (1944)

55 feet long, 8 feet high, 5 tons

Harvard Mark I (1944)





Hardware

- Physical switches (before microprocessors)
- Paper tape

Uses

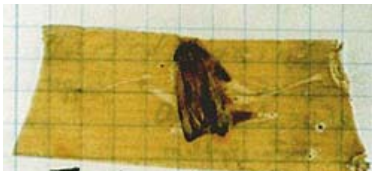
- Ballistics calculations
- Simple arithmetic & fixed calculations (before programs)
- 3 seconds to multiply

Adm. Grace Murray Hopper

First programmer of Mark I

Adm. Grace Murray Hopper

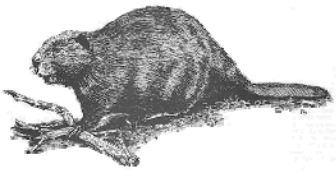
First programmer of Mark I

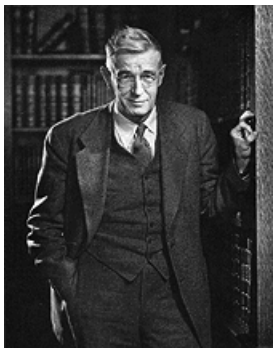


Filed first bug report

Vannevar Bush

- Name rhymes with "Beaver"
- Faculty member MIT
- Coordinated WWII effort with 6000 US scientists
- Social contract for science
  - Federal government funds universities
  - Universities do basic research
  - Research helps economy & national defense



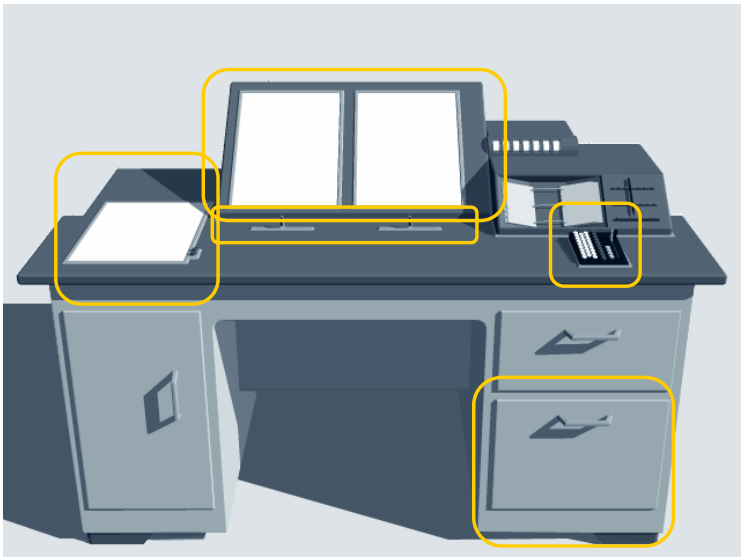


1890 - 1974

As We May Think

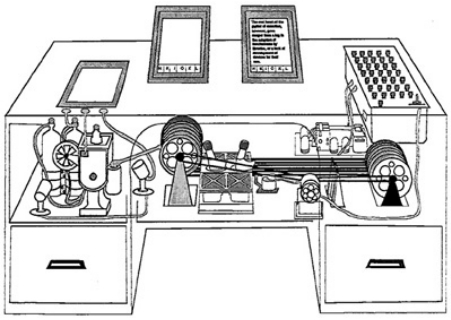
- Published in the *Atlantic Monthly* in 1945!
- What will the computer of the future look like?
  - Wearable cameras for photographic records
  - Encyclopedia Brittanica for a nickel
  - Automatic transcripts of speech
  - Memex
  - Trails of discovery
  - Direct capture of nerve impulses

Memex



Memex

- Store all personal books, records, communications
- Items retrieved through indexing, keywords, cross references,...
- Can annotate text with margin notes, comments...
- Can construct a trail through the material and save it
- Acts as an external memory



1960's Visionary Demos

Context - Computing in 1960s

- Transistor (1948)
- ARPA (1958)
- Timesharing (1950s)
- Terminals and keyboards

Vacuum Tube

Transistor

- Computers still primarily for scientists and engineers

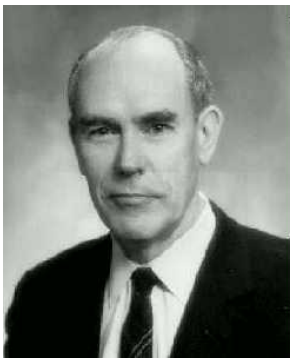
Sketchpad (1963)

- Ivan E Sutherland's PhD thesis
- Modern pen-based system supporting
  - CAD design
  - 3D modeling
- Key: Interactivity (real-time computing was non-existent)

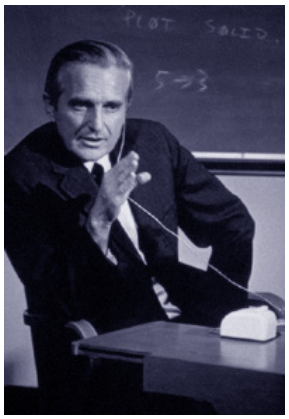
Video: 4:30 – 9:18

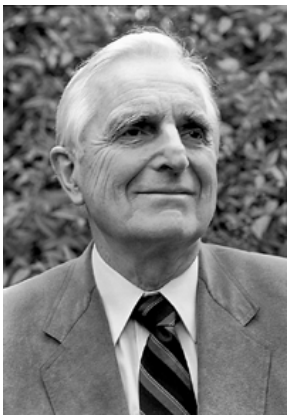
Ivan Sutherland (1938 -)

- Established Computer Graphics
- Turing award 1988
- Now a fellow at Sun and visiting Professor at Berkeley



Doug Engelbart (1925 -)



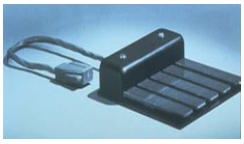


Strongly influenced by Bush

- How would you implement the Memex in 1963?

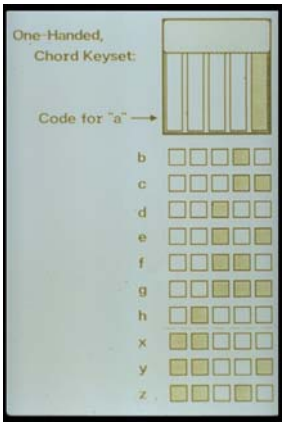
NLS: oNLine System (1968)

- 1968 Fall Joint Computer Conference (SF)
- Demonstrated NLS to1000 computer scientists
  - Video screen, chording keyboard, mouse, videoconferencing, hyperlinking, word processing, email,
  - User testing
  - Extremely influential



Video: 10:54 – 17:00

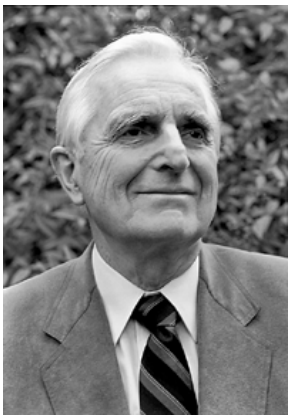
Chording Keyboard and Mouse



Advantages/Disdvantages?

Doug Engelbart (1925 -)

- Graduate of Berkeley (EE '55)
  - bi-stable gaseous plasma digital devices
- Stanford Research Institute (SRI)
  - Augmentation Research Center 1959
- ARPA funding in 1963
  - Starts work on NLS
- Funding dwindles in 70's, AI↑ HCI↓
- McDonnell-Douglas 1984-1989
  - Worked on open hypertext systems
- Started Bootstrap institute in 1989
- Turing award 1997

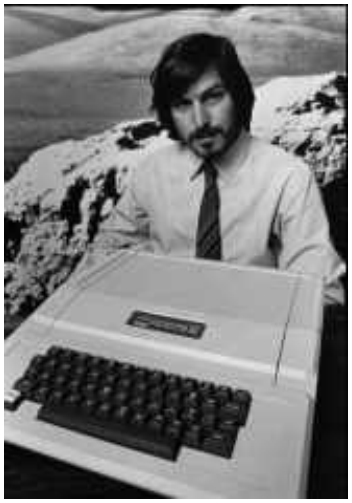


1970's Personal Computing

Altair (1975)

Apple I (1976)

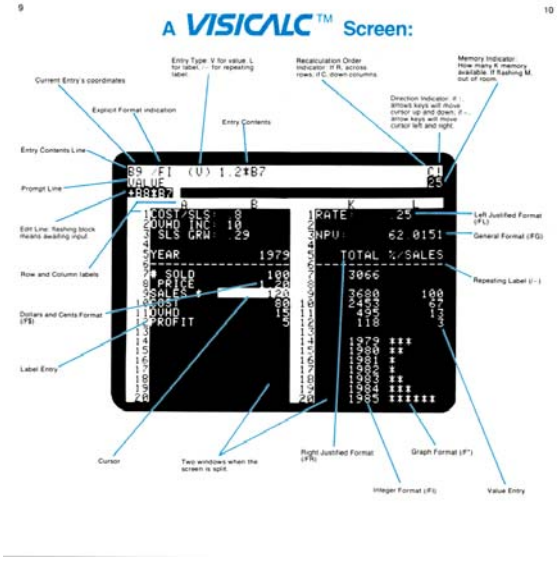
Personal Computers



Apple II 1977

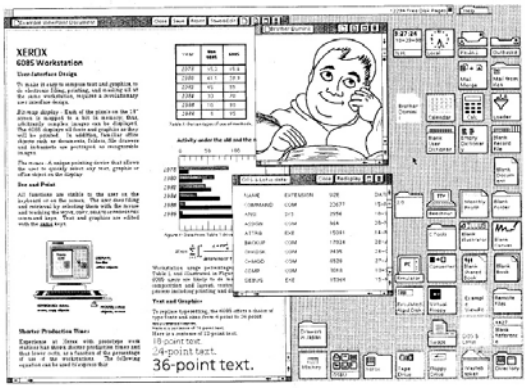
IBM PC 1981

VisiCalc (Bricklin, 1979)



1980's Graphical User Interfaces

Xerox Star (1982)



Bitmapped display, windows, icons, menus, pointer, desktop, direct manipulation, WYSIWYG …

Video: 1:11 – 8:20

Designing the Star

Design team developed new methodology

- Task analysis
- Wide range of users
- Usage scenarios
- Decomposition of design:
  - Display and control interface
  - User's conceptual model
- Many prototyping cycles

User centered design

Star → Mac

But the Star was expensive and slow ($25k).

Steve Jobs visits PARC in 1979

- Sees Alto (precursor to Star)
- Lisa ships in 1983 at $10,000,
  - 1-button mouse
  - Menu bar (instead of pop-up menus)
- Fails in marketplace

Macintosh ships in 1984 at $2500

- Most consistent WIMP UI
  - Look and feel guidelines
- Personal computing market changes for good

1990's Mobile & Ubiquitous

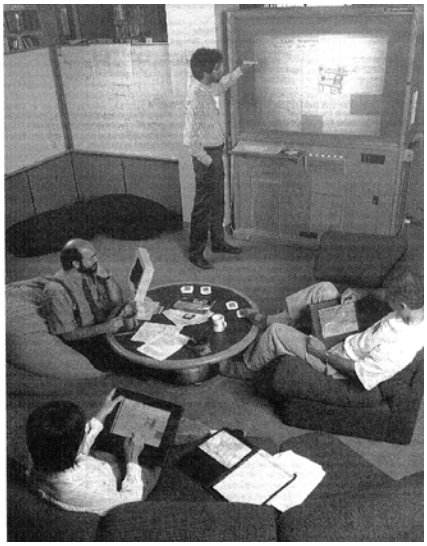
Personal Digital Assistants

Apple Newton (1993)

Palm Pilot (1996)

Mobile Devices

Ubiquitous Computing (1991)



Marc Weiser's vision

- 100s of computers work together
- Will disappear (invisible)

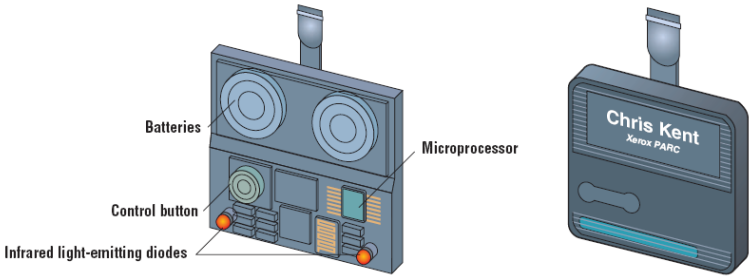
Liveboard
(Yard scale)

PARC tab
(Inch scale)

PARC pad
(Foot scale)

Ubiquitous Computing (1991)

Context awareness through active badges
- Privacy and security



Marc Weiser (1952 – 1999)

- Ph.D Univ. of Michigan 1979
- Prof at Univ. of Maryland 79-87
- Joined Xerox PARC 1987
  - Head of Computer Science Lab 1988

Coined term "ubiquitous computing" in 1988

What's Next?

- Smart rooms, cars & homes
- Wearable computers
- Multimodal and tangible UIs
- Context-aware and "anywhere" interfaces

Summary

- Many seminal ideas came from early years of computing
- Considering the user leads to new ideas
- Innovation happened in bursts
- A modern design process led to GUI (the Xerox Star)
  - User-centered design
- Some appealing kinds of interaction haven't taken over
  - VR
  - Speech
  - Agents
  - Beware naïve models of human behavior

Next Time

Mike Kuniavarsky - User Experience Design of Ubiquitous Computing Devices

The Computer for the 21st Century. *Scientific American Ubicomp Paper.* Weiser.

Yesterday's tomorrows: notes on ubiquitous computing's dominant vision. *Original Paper.* Bell, Dourish.

- Only sections 1, 2, 7, and 8 are required. The others will probably be interesting if you want a cohesive picture.