

# Historical Perspective

CSI 60: User Interfaces  
Maneesh Agrawala

## Upcoming Schedule

### Final Presentation and Report (due May 4)

- Revise interface based on pilot study
- Last chance to finish implementation
- Presentations held in my office on May 4
  - Sign up for 15 min slot next week
- We are planning a project fair for Wed May 6
  - Time is TBD (doodle poll)

## **Presentation Schedule (May 4)**

- 9:00-9:15
- 9:20-9:35
- 9:40-9:55 TGTGSH
- 10:00-10:15 Interface Galactica
- 10:20-10:35 31337
- 10:40-10:55 NGRS
- 11:00-11:15
- 11:20-11:35
- 11:40-11:55
- 1:00-1:15
- 1:20-1:35
- 1:40-1:55
- 2:00-2:15
- 2:20-2:35
- 2:40-2:55

## **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)



From Computer Desktop Encyclopedia  
© 2000 The Computer Language Co. Inc.



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

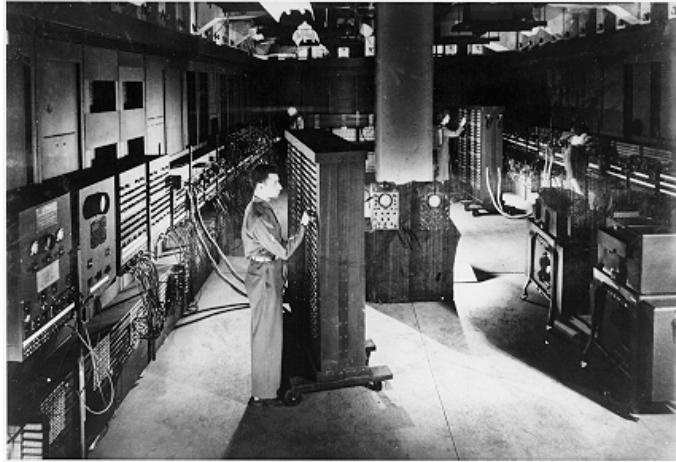
## Teletype (ca. 1910)



## 1940's Early Visions

## ENIAC (1943)

World's first numerical integrator and computer



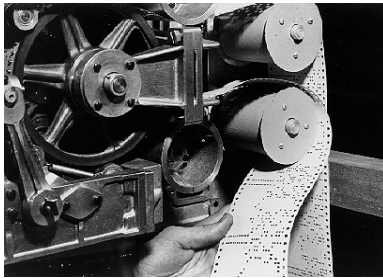
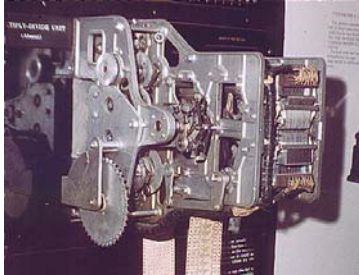
*From IBM Archives.*

## 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

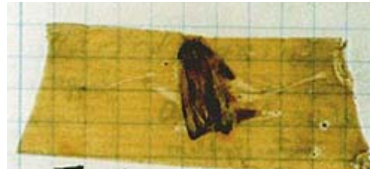


First programmer of Mark I

# Adm. Grace Murray Hopper



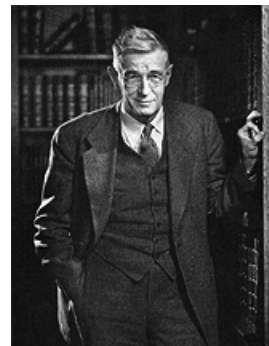
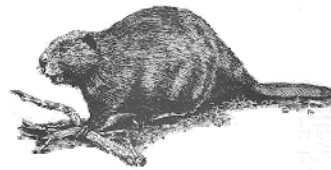
First programmer of Mark I



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



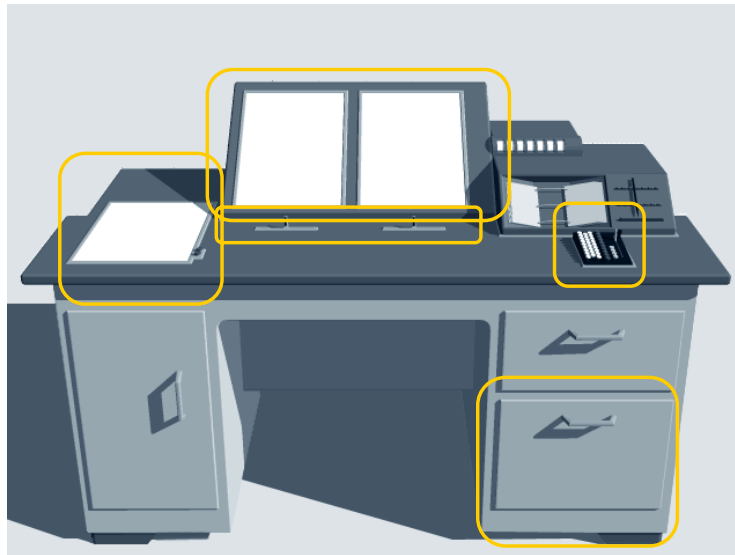
1890 - 1974



## As We May Think

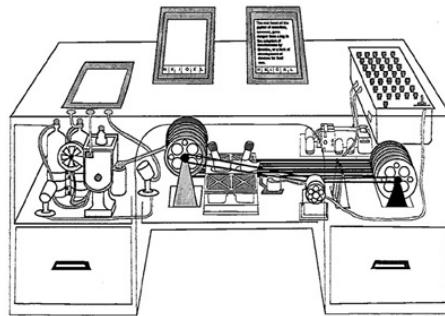
- Published in the *Atlantic Monthly* in 1945!
- What will the computer of the future look like?
  - Wearable cameras for photographic records
  - Encyclopedia Brittanica for a nickel
  - Automatic transcripts of speech
  - Memex
  - Trails of discovery
  - Direct capture of nerve impulses

## 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)

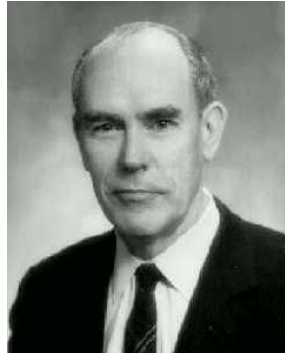
- Ivan E Sutherland's PhD thesis
- Modern pen-based system supporting
  - CAD design
  - 3D modeling
- Key: Interactivity (real-time computing was non-existent)



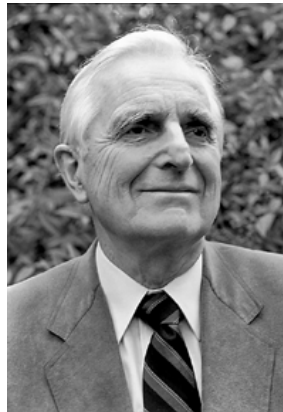
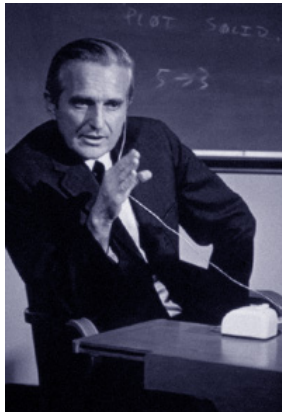
Video: 4:30 – 9:18

## Ivan Sutherland (1938 - )

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



## Doug Engelbart (1925 - )

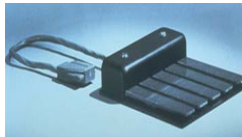


Strongly influenced by Bush

– How would you implement the Memex in 1963?

## NLS: oNLine System (1968)

- 1968 Fall Joint Computer Conference (SF)
- Demonstrated NLS to 1000 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



One-Handed,  
Chord Keyset:

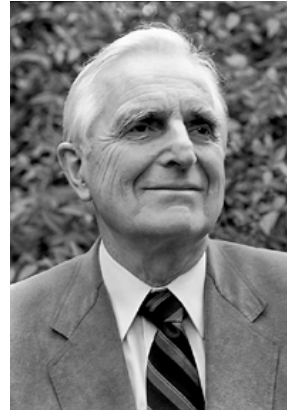
Code for "a" →

b	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
x	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
y	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
z	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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)

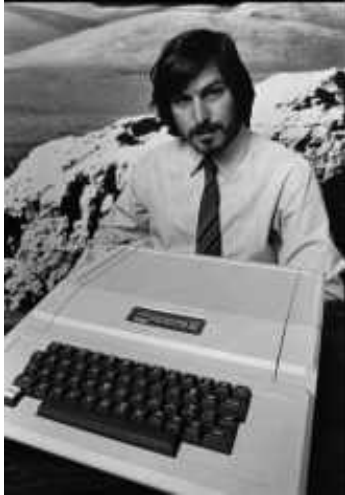


## Apple I (1976)



© 1992 Smithsonian Institution

# Personal Computers



Apple II 1977



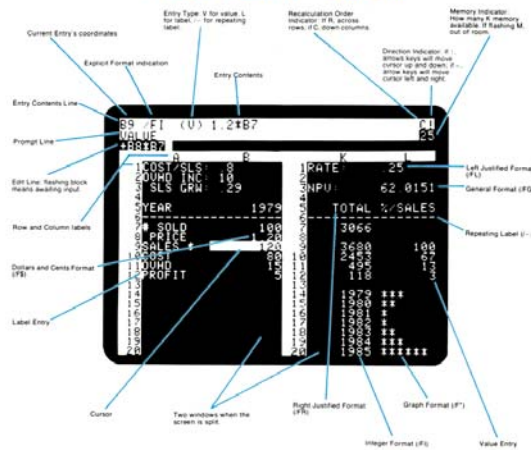
IBM PC 1981

# VisiCalc (Bricklin, 1979)

9

A VISICALC™ Screen:

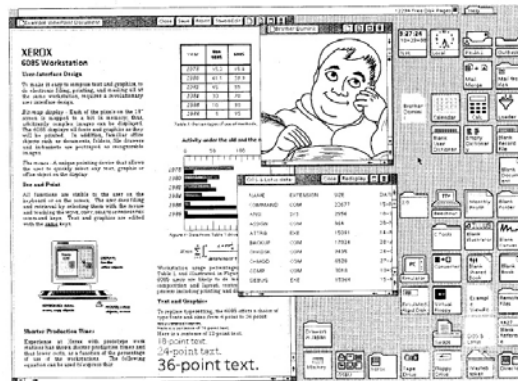
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# 1980's Graphical User Interfaces

## 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)

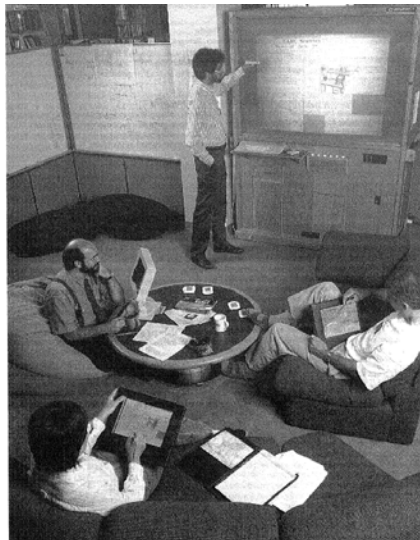
Palm Pilot (1996)



# Mobile Devices



# Ubiquitous Computing (1991)



## Marc Weiser's vision

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



PARC tab  
(Inch scale)



Liveboard  
(Yard scale)

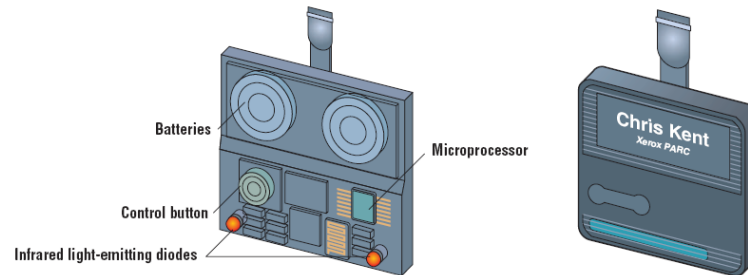


PARC pad  
(Foot scale)

# 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