History of Human Computer Interaction

Where did HCI innovations and philosophy come from?

Who were the major personalities?

What were the important systems?

How did ideas move from the laboratory to the market?

Input/output devices

|	*Input*	*Output*
Early days	connecting wires paper tape & punch cards keyboard	lights on display paper teletype

Today	keyboard
	    + cursor keys
	    + mouse
	    + microphone
		scrolling glass teletype
		character terminal
		bit-mapped screen
		audio

Soon?	data gloves + suits computer jewelry natural language cameras	head-mounted displays ubiquitous computing autonomous agents multimedia

The lesson

– keyboards & terminals are just artifacts of today's technologies

– new input/output devices will change the way we interact with computers

Eniac (1943)

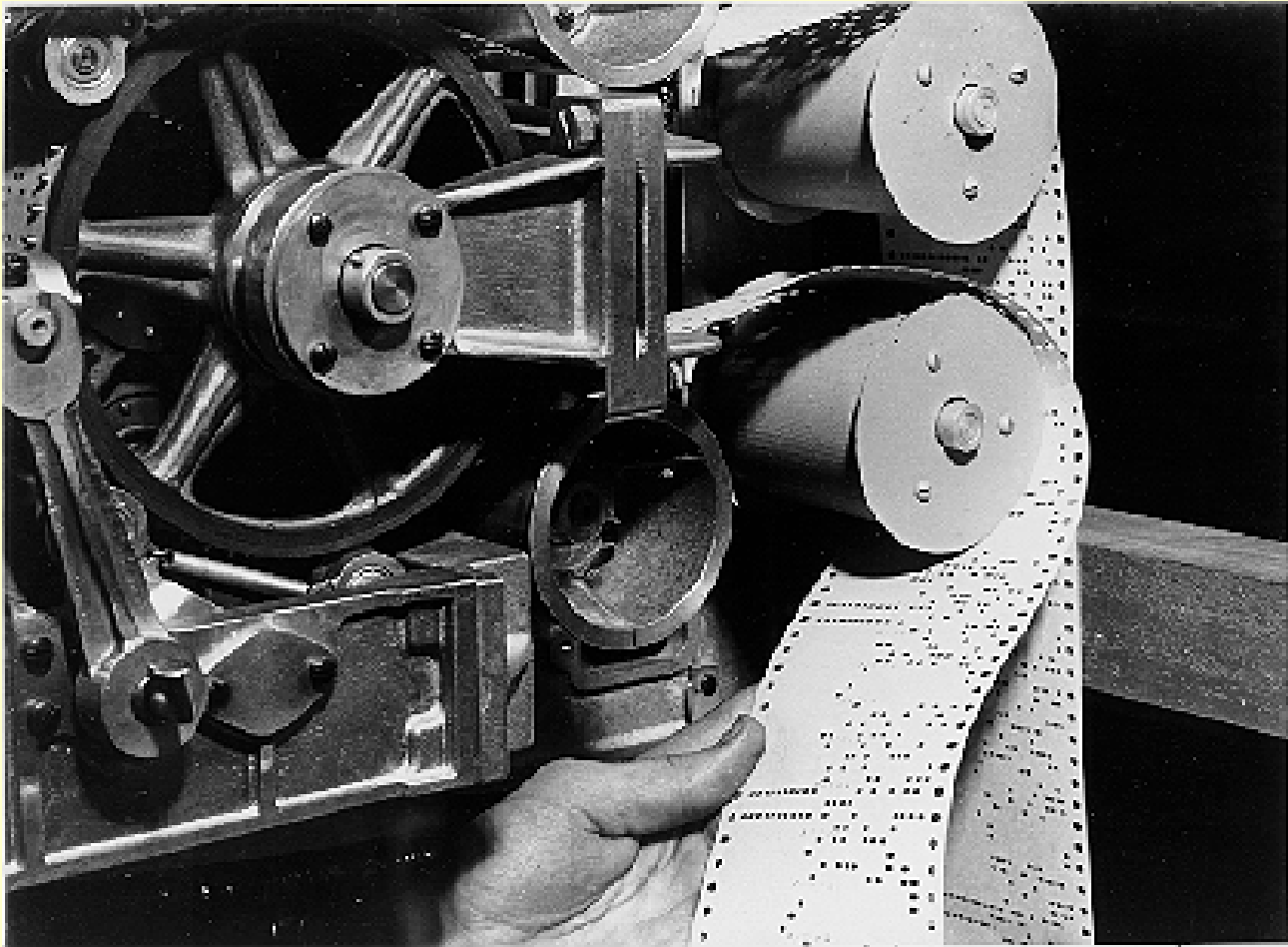– A general view of the ENIAC, the world's first all electronic numerical integrator and computer.
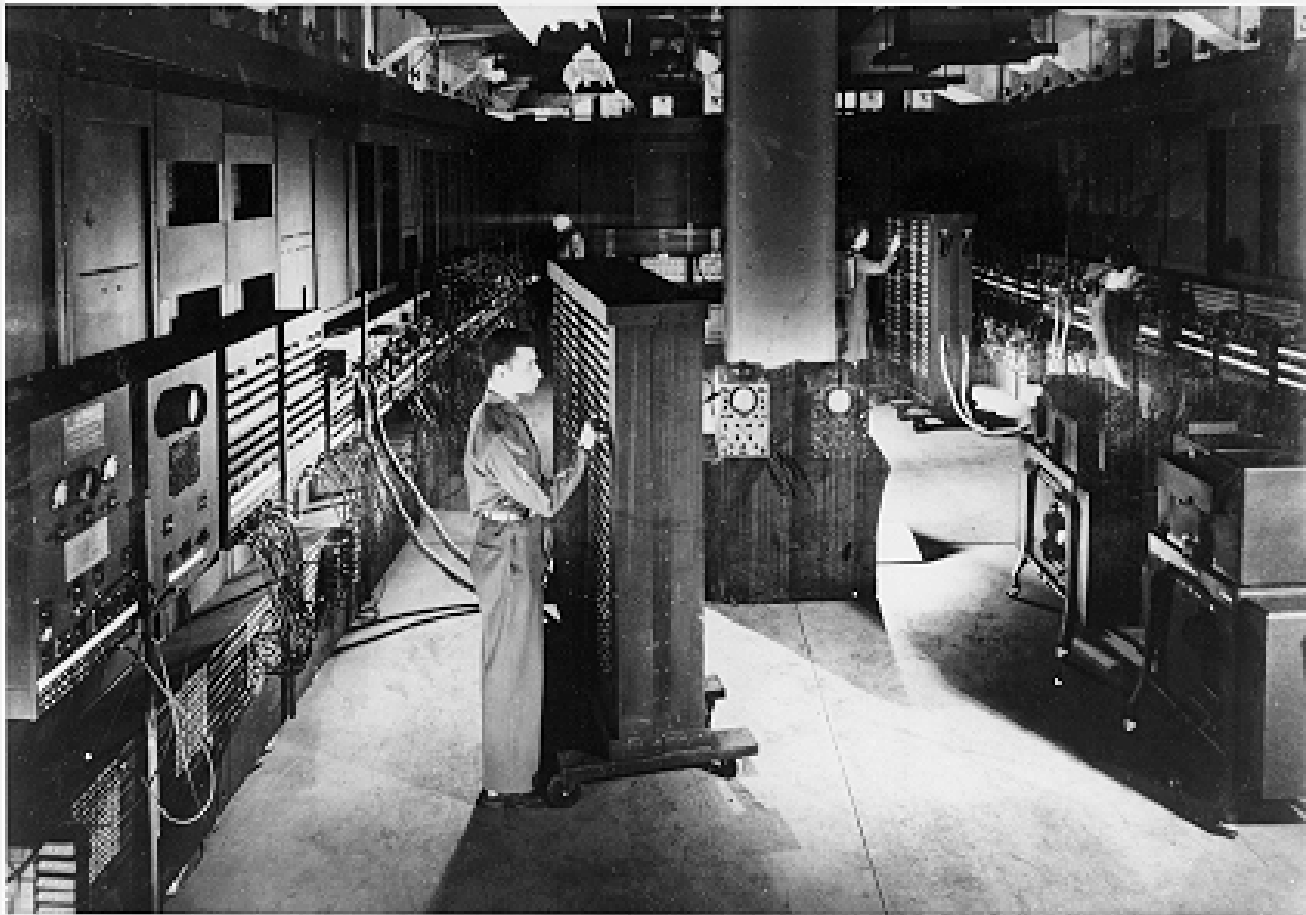
From IBM Archives.

Mark I (1944)

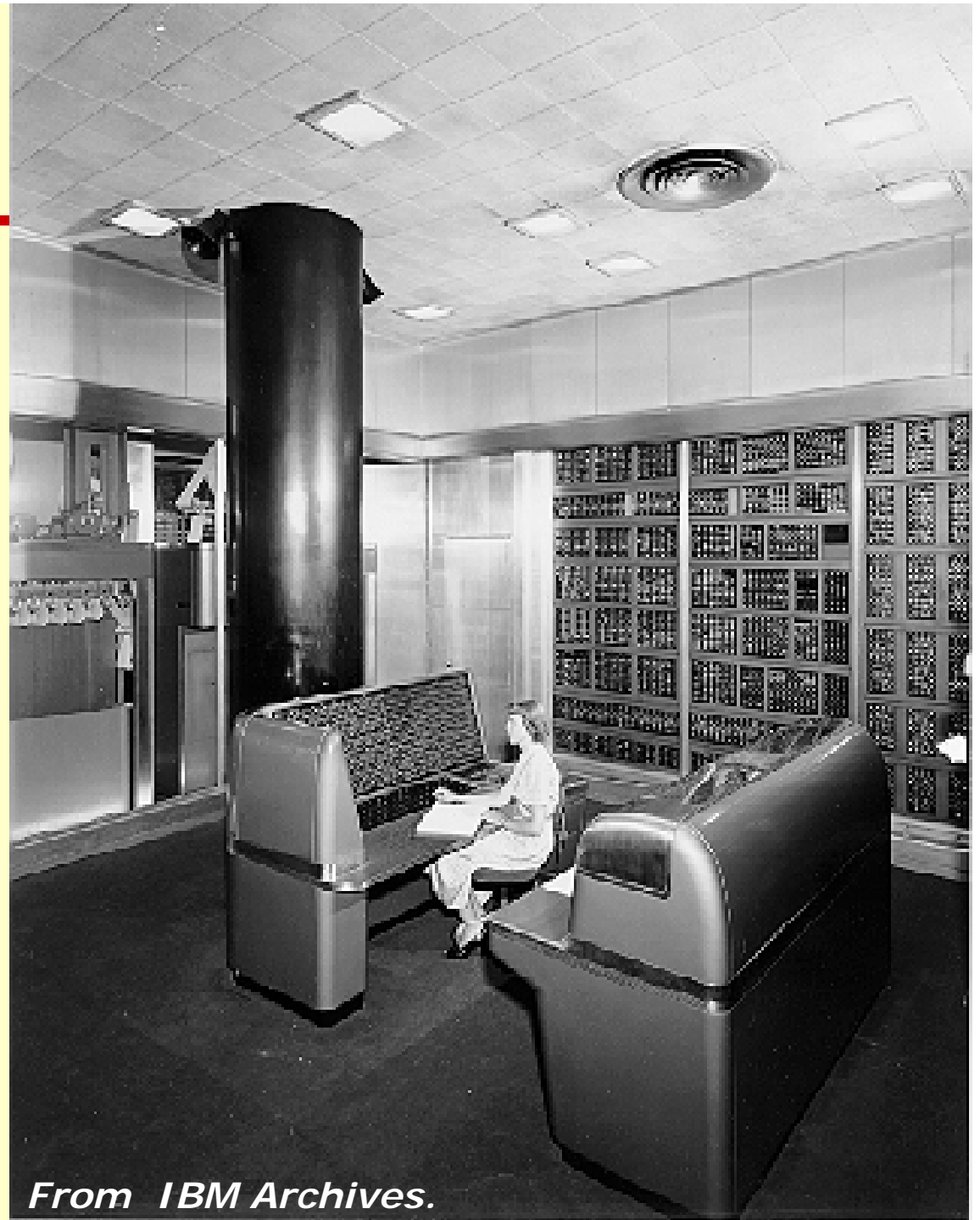- The Mark I paper tape readers.

From Harvard University Cruft Photo Laboratory.
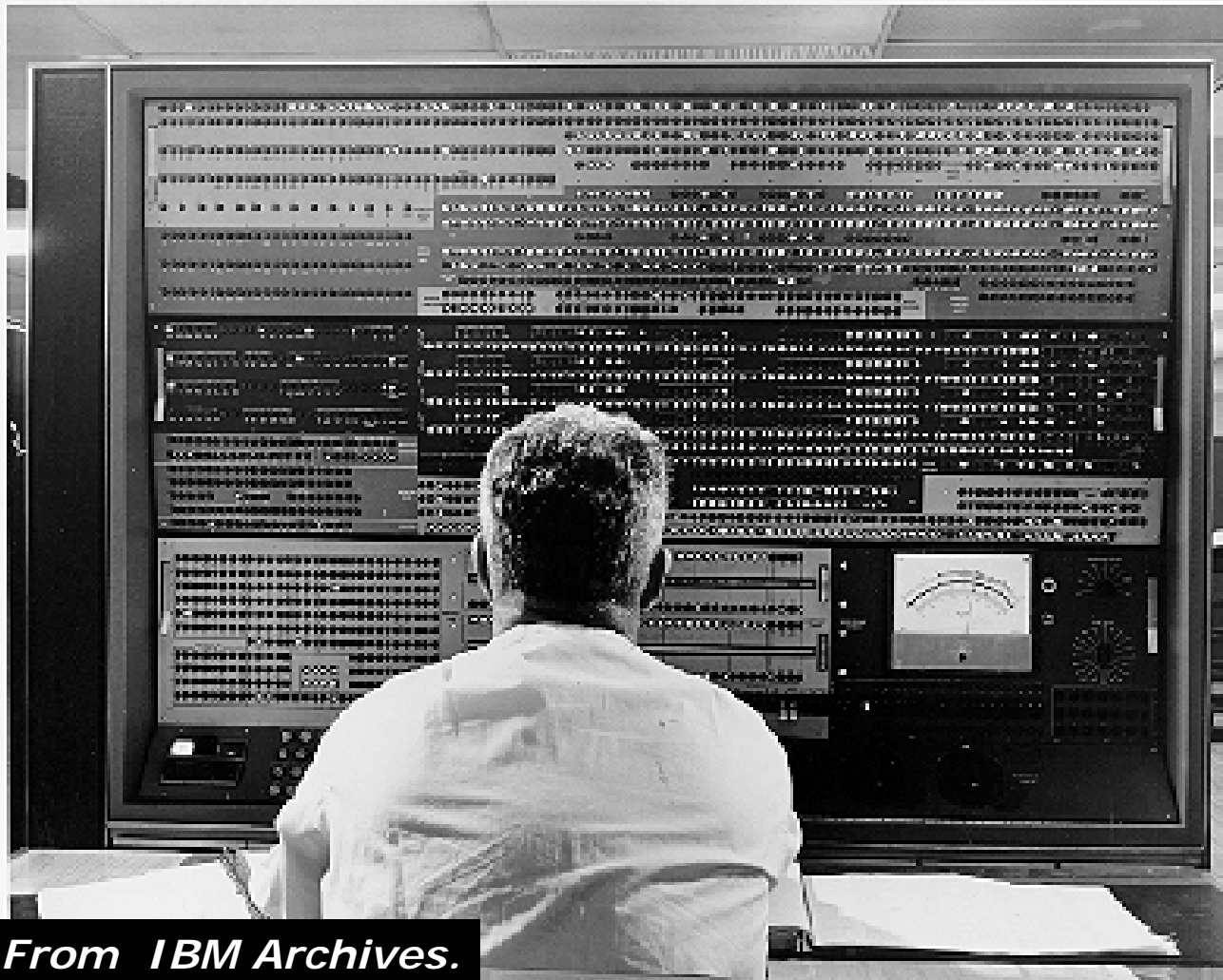
Saul Greenberg

IBM SSEC (1948)

From IBM Archives.

Stretch (1961)

A close-up of the Stretch technical control panel.

From IBM Archives.

Saul Greenberg

Intellectual foundations

Vannevar Bush (1945)

– "As we may think" article in Atlantic Monthly

– Identified the information storage and retrieval problem:
  new knowledge does not reach the people who could benefit
  from it

  "publication has been extended far beyond our present
 ability to make real use of the record"

Bush's Memex

Conceiving Hypertext and the World Wide Web

– a device where individuals stores all personal books, records, communications etc

– items retrieved rapidly through indexing, keywords, cross references,…

– can annotate text with margin notes, comments…

– can construct and save a trail (chain of links) through the material

– acts as an external memory!

Bush's Memex based on microfilm records!

– but not implemented
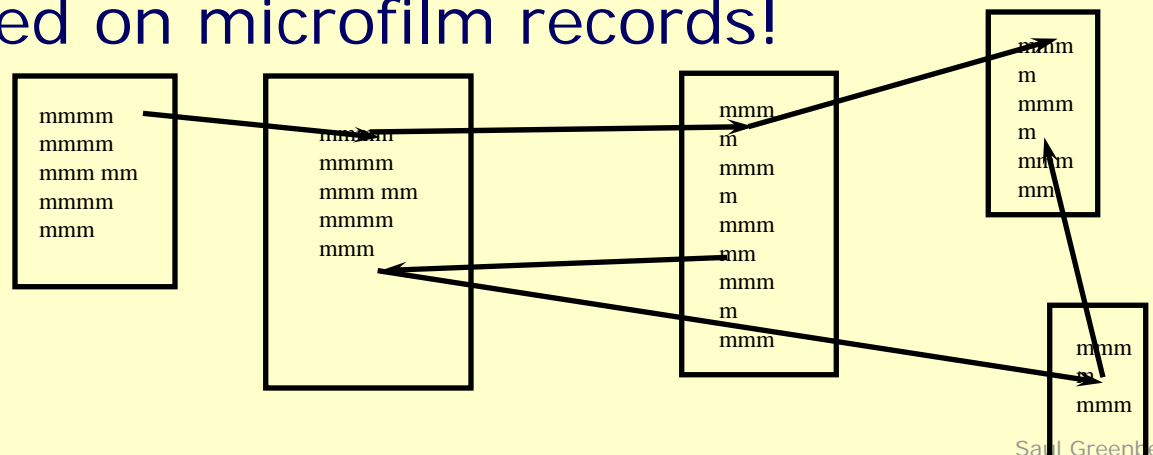
J.C.R. Licklider (1960)

Outlined "man-computer symbiosis"

> "The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today."

J.C.R. Licklider (continued)

Produced goals that are pre-requisite to "man-computer symbiosis"

Immediate goals:

– time sharing of computers among many users
– electronic i/o for the display and communication of symbolic and pictorial information
– interactive real time system for information processing and programming
– large scale information storage and retrieval

J.C.R. Licklider (continued)

intermediate goals:

– facilitation of human cooperation in the design & programming of large systems

– combined speech recognition, hand-printed character recognition & light-pen editing

long term visions:

– natural language understanding (syntax, semantics, pragmatics)

– speech recognition of arbitrary computer users

– heuristic programming

Significant Advances 1960 - 1980

Mid '60s

– computers too expensive for a single person

Time-sharing

– the illusion that each user was on their own personal machine
– led to immediate need to support human-computer interaction
  • dramatically increased accessibility of machines
  • afforded interactive systems and languages *vs* batch "jobs"
  • community as a whole communicated through computers
    (and eventually through networks) via email, shared files, etc.
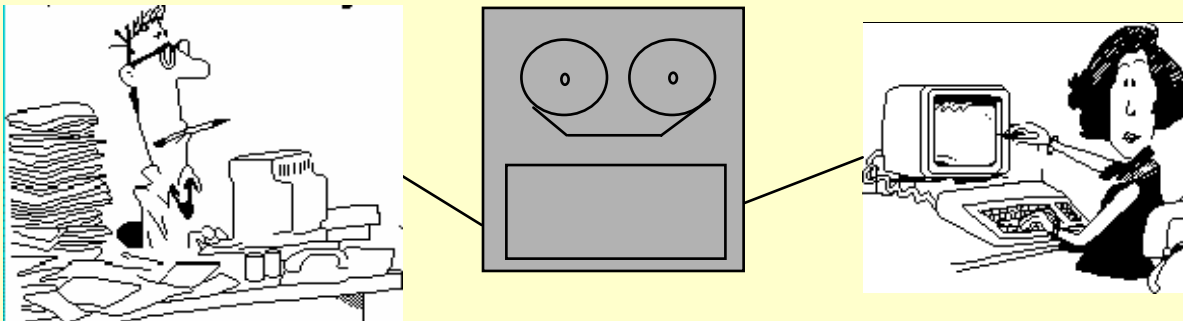
Ivan Sutherland's SketchPad-1963 PhD

Sophisticated drawing package

introduced many ideas/concepts now found in today's interfaces

- **hierarchical structures** defined pictures and sub-pictures
- **object-oriented programming**: master picture with instances
- **constraints**: specify details which the system maintains through changes
- **icons**: small pictures that represented more complex items
- **copying**: both pictures and constraints
- **input techniques**: efficient use of light pen
- **world coordinates**: separation of screen from drawing coordinates
- **recursive operations**: applied to children of hierarchical objects

From http://accad.osu.edu/~waynec/history/images/ivan-sutherland.jpg

Ivan Sutherland's SketchPad-1963 PhD

Parallel developments in hardware:

– "low-cost" graphics terminals

– input devices such as data tablets (1964)

– display processors capable of real-time manipulation of images (1968)

Douglas Engelbart

The Problem (early '50s)

"…The world is getting more complex, and problems are getting more urgent. These must be dealt with collectively. However, human abilities to deal collectively with complex / urgent problems are not increasing as fast as these problems.

If you could do something to improve human capability to deal with these problems, then you'd really contribute something basic."

…Doug Engelbart
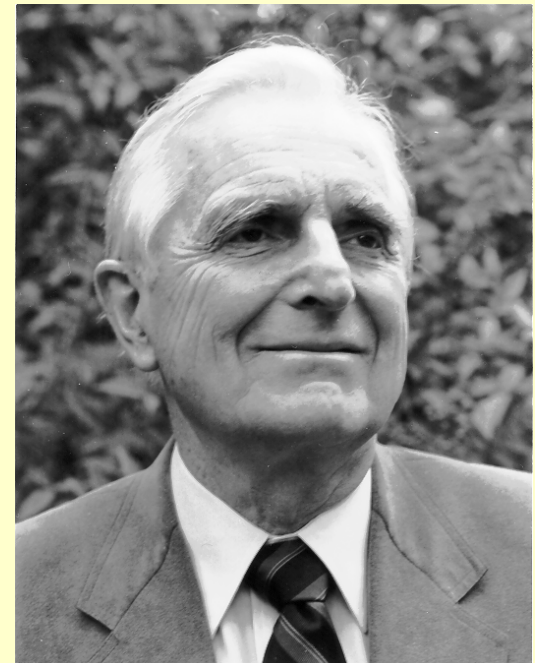
Douglas Engelbart

The Vision (Early 50's)

...I had the image of sitting at a big CRT screen with all kinds of symbols, new and different symbols, not restricted to our old ones. The computer could be manipulated, and you could be operating all kinds of things to drive the computer

... I also had a clear picture that one's colleagues could be sitting in other rooms with similar work stations, tied to the same computer complex, and could be sharing and working and collaborating very closely. And also the assumption that there'd be a lot of new skills, new ways of thinking that would evolve "

...Doug Engelbart

Douglas Engelbart

A Conceptual Framework for Augmenting Human Intellect (SRI Report, 1962)

"By *augmenting man's intellect* we mean increasing the capability of a man to approach a complex problem situation, gain comprehension to suit his particular needs, and to derive solutions to problems.

One objective is to develop new techniques, procedures, and systems that will better adapt people's basic information-handling capabilities to the needs, problems, and progress of society."

…Doug Engelbart

The First Mouse (1964)

AFIP Fall Joint Conference, 1968

Document Processing

– modern word processing

– outline processing

– hypermedia

Input / Output

– the mouse and one-handed corded keyboard

– high resolution displays

– multiple windows

– specially designed furniture

Shared work

– shared files and personal annotations

– electronic messaging

– shared displays with multiple pointers

– audio/video conferencing

– ideas of an Internet

User testing, training
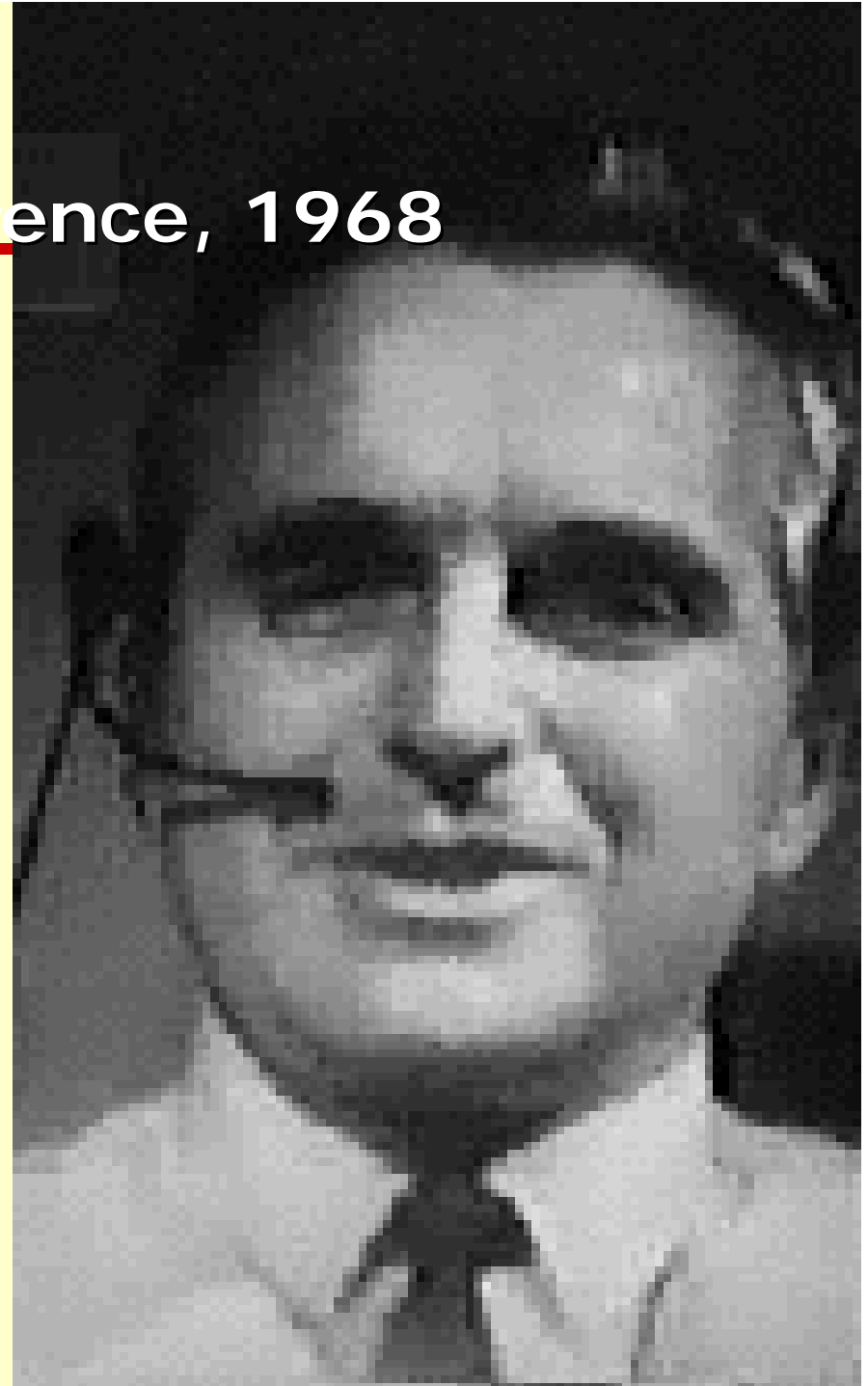
The Personal Computer

Alan Kay (1969)

– Dynabook vision (and cardboard prototype) of a notebook computer:

"Imagine having your own self-contained knowledge manipulator in a portable package the size and shape of an ordinary notebook. Suppose it had enough power to out-race your senses of sight and hearing, enough capacity to store for later retrieval thousands of page-equivalents of reference materials, poems, letters, recipes, records, drawings, animations, musical scores…"

Ted Nelson

– 1974: "Computer Lib/Dream Machines"
– popular book describing what computers can do for people (instead of business!)

The Personal Computer

Xerox PARC, mid-'70s
- Alto computer, a personal workstation
  - local processor, bit-mapped display, mouse
- modern graphical interfaces
  - text and drawing editing, electronic mail
  - windows, menus, scroll bars, mouse selection, etc
- local area networks (Ethernet) for personal workstations
  - could make use of shared resources

ALTAIR 8800 (1975)
- Popular electronics article that showed people how to build a computer for under $400

Commercial machines: Xerox Star-1981

First commercial personal computer designed for "business professionals"

First comprehensive GUI used many ideas developed at Xerox PARC
- familiar user's conceptual model (simulated desktop)
- promoted recognizing/pointing rather than remembering/typing
- property sheets to specify appearance/behaviour of objects
- what you see is what you get (WYSIWYG)
- small set of generic commands that could be used throughout the system
- high degree of consistency and simplicity
- modeless interaction
- limited amount of user tailorability

Xerox Star (continued)

First system based upon usability engineering

- inspired design

- extensive paper prototyping and usage analysis

- usability testing with potential users

- iterative refinement of interface

Commercial failure

- cost ($15,000);
    - IBM had just announced a less expensive machine

- limited functionality
    - e.g., no spreadsheet

- closed architecture,
    - 3rd party vendors could not add applications

- perceived as slow
    - but really fast!

- slavish adherence to direct manipulation

Commercial Machines: Apple Lisa (1983)

based upon many ideas in the Star

- predecessor of Macintosh,
- somewhat cheaper ($10,000)
- commercial failure as well

http://fp3.antelecom.net/gcifu/applemuseum/lisa2.html
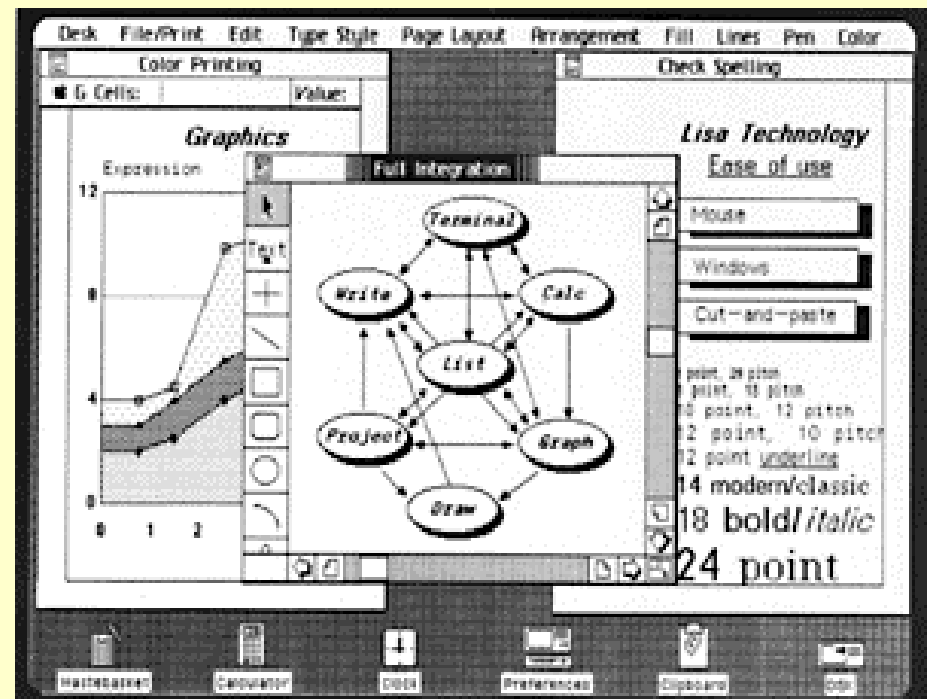
Commercial Machines: Apple Macintosh (1984)

"Old ideas" but well done!

succeeded because:

- aggressive pricing ($2500)
- did not need to trailblaze
    - learnt from mistakes of Lisa and corrected them; ideas now "mature"
    - market now ready for them
- developer's toolkit encouraged 3rd party non-Apple software
- interface guidelines encouraged consistency between applications
- domination in desktop publishing because of affordable laser printer
  and excellent graphics

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Other events:

MIT Architecture Machine Group
– Nicholas Negroponte (1969-1980+)
– many innovative inventions, including
  • wall sized displays
  • use of video disks
  • use of artificial intelligence in interfaces (idea of agents)
  • speech recognition merged with pointing
  • speech production
  • multimedia hypertext
  • ....

ACM SIGCHI (1982)
– special interest group on computer-human interaction
– conferences draw between 2000-3000 people

HCI Journals
– Int J Man Machine Studies (1969)
– many others since 1982

You know now:

HCI importance result of:

– cheaper/available computers/workstations meant people more important than machines

– excellent interface ideas modeled after human needs instead of system needs (user centered design)

– evolution of ideas into products through several generations
  • *pioneer* systems developed innovative designs, but often commercially unviable
  • *settler* systems incorporated (many years later) well-researched designs

– people no longer willing to accept products with poor interfaces