

# **Human Computer Interaction**

# Course Overview (1)

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- 13.9.1 Code: ITU 08204
- 13.9.2 Name: Human Computer Interface Design
- 13.9.3 Number of Credits 12
- 13.9.4 Sub enabling outcomes:
  - ❖ 2.6.1 Describe fundamental principles for Human Computer Interaction
  - ❖ 2.6.2 Describe Paradigms of Human Computer Interaction
  - ❖ 2.6.3 Describe constituent of HCI design process
  - ❖ 2.6.4 Discuss design approaches that are suitable to different classes of user and application
  - ❖ 2.6.5 Discuss different kinds of prototyping to be used for different purposes at different stages

## **Course Overview (2)**

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1. History and Future of HCI
  - (i) History of HCI
  - (ii) Future HCI technologies (Research & Prediction)
2. Goals of HCI, Affordance, Usability and Usability Principles
3. Human Factors in Interaction Design
4. Prototyping Purpose, Process and Techniques
5. User-Centered Design Basics
6. Usability Evaluation Basics (Usability Testing)
7. Process of Interaction Design

# Goals of HCI

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Allow users to carry out tasks

- Safely
- Effectively
- Efficiently
- Enjoyably

# HCI

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What happens when a human and a computer get together to perform a task

- task - write document, calculate budget, solve equation, learn about Antarctica, drive home,...

# **HCI Deals With The Interaction Of A Person And A Computer**



**Technological perspective**



**Human perspective**

# Technological Perspective

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Technical constraints

- **Beyond the mouse the and keyboard?**



# Human Perspective

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How people process information

- **Memory, perception, motor skills, attention etc.**

Language, communication and interaction

Ergonomics





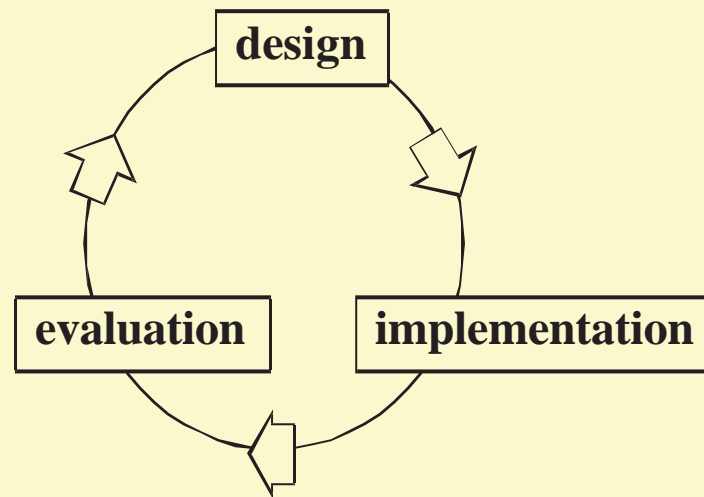
# Human Computer Interaction

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A discipline concerned with the

design,  
implementation and  
evaluation

...of interactive computing systems for human use



# EXAMPLES OF USER INTERFACES

```
C:\>dir /x
Volume in drive C is System
Volume Serial Number is ██████████

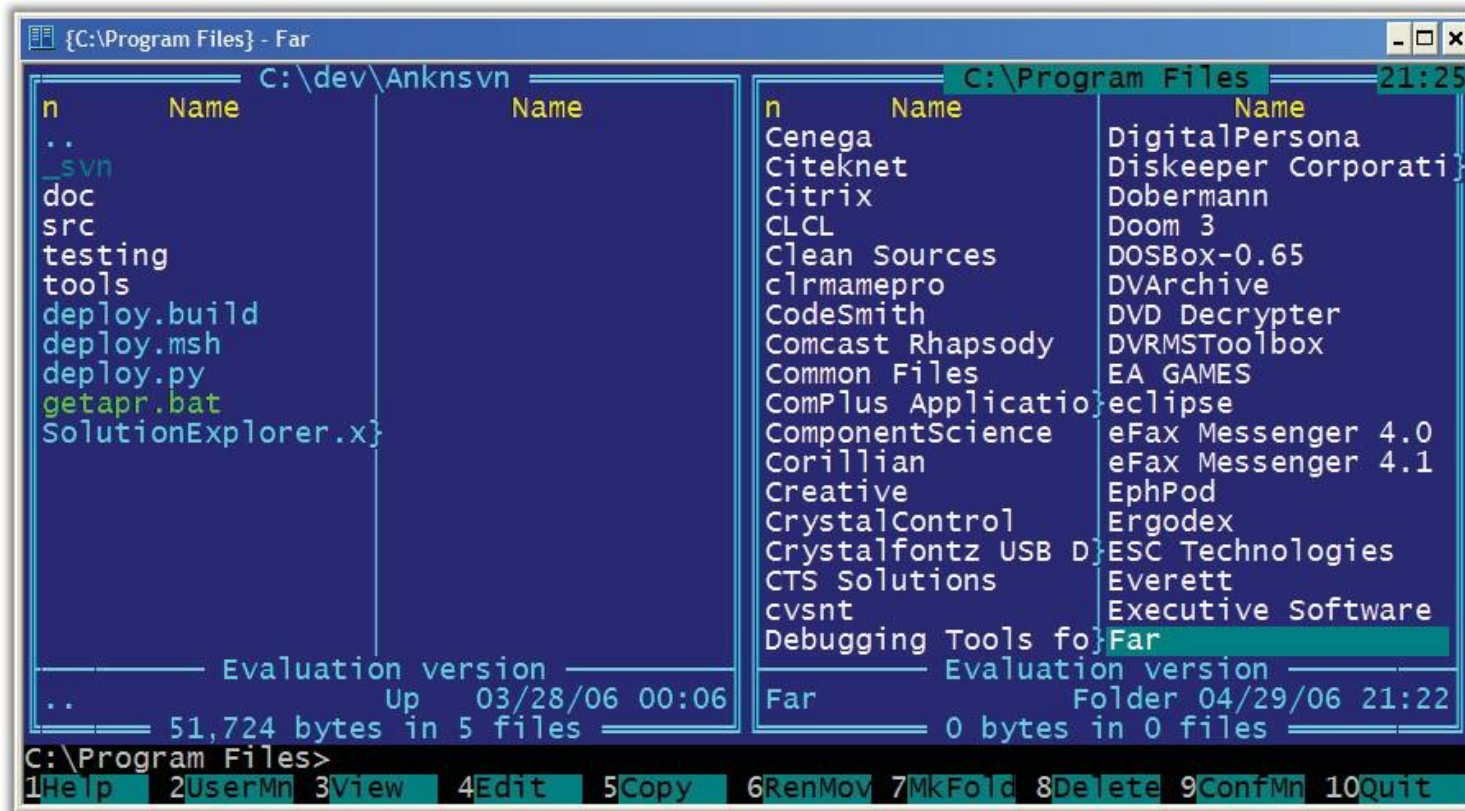
Directory of C:\

08/12/2004  03:45 AM                0      AUTOEXEC.BAT
08/12/2004  03:45 AM                0      CONFIG.SYS
11/24/2008  11:01 AM        <DIR>      DOCUME~1      Documents and Settings
01/04/2007  01:51 AM        <DIR>      i386
01/02/2007  10:17 PM        4,128      INFCACHE.1
04/25/2009  06:21 AM        <DIR>      PROGRA~1      Program Files
05/05/2009  07:29 AM        <DIR>      WINDOWS

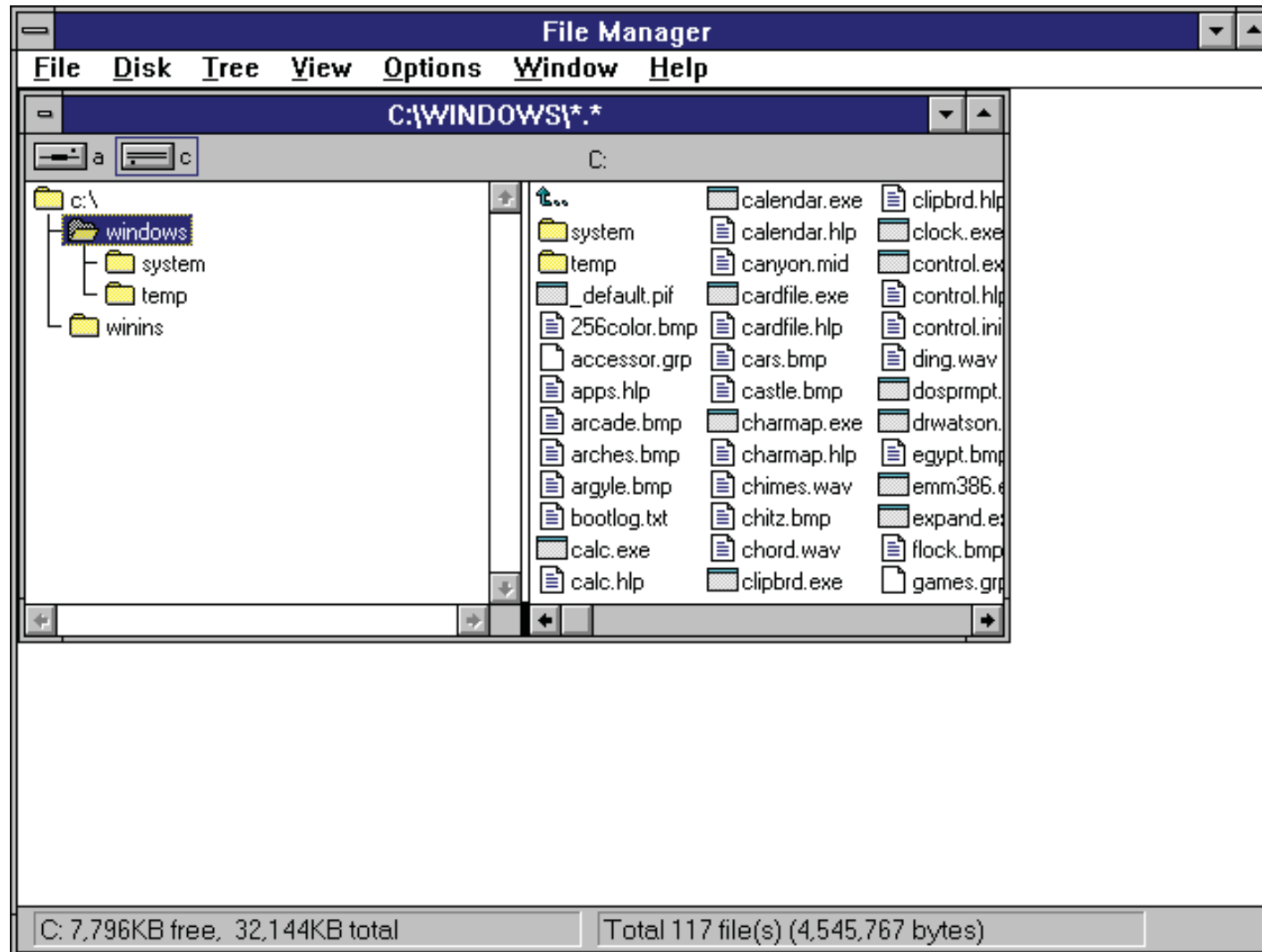
        3 File(s)                4,128 bytes
        4 Dir(s)  20,856,143,872 bytes free

C:\>_
```

# EXAMPLES OF USER INTERFACES



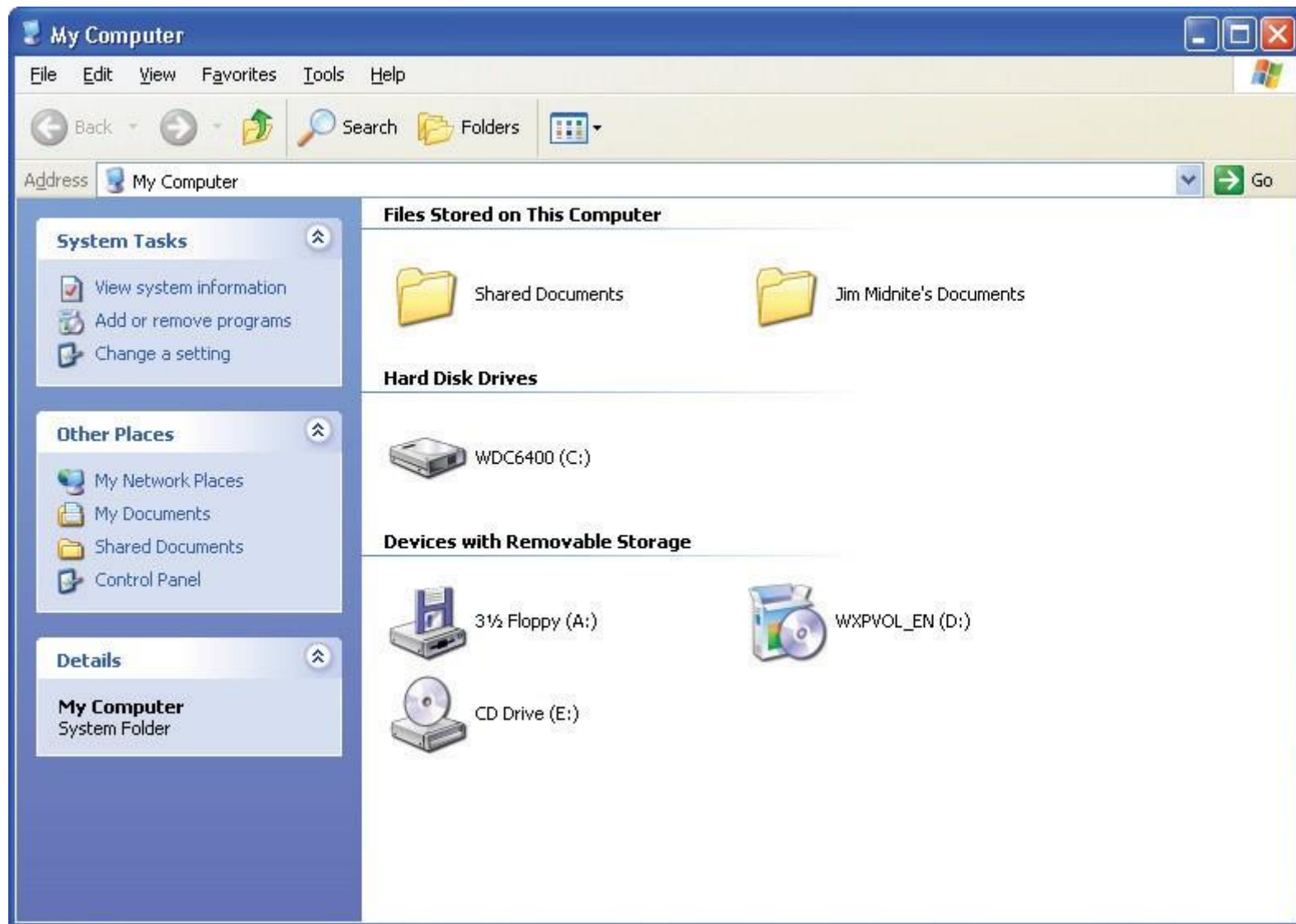
# EXAMPLES OF USER INTERFACES



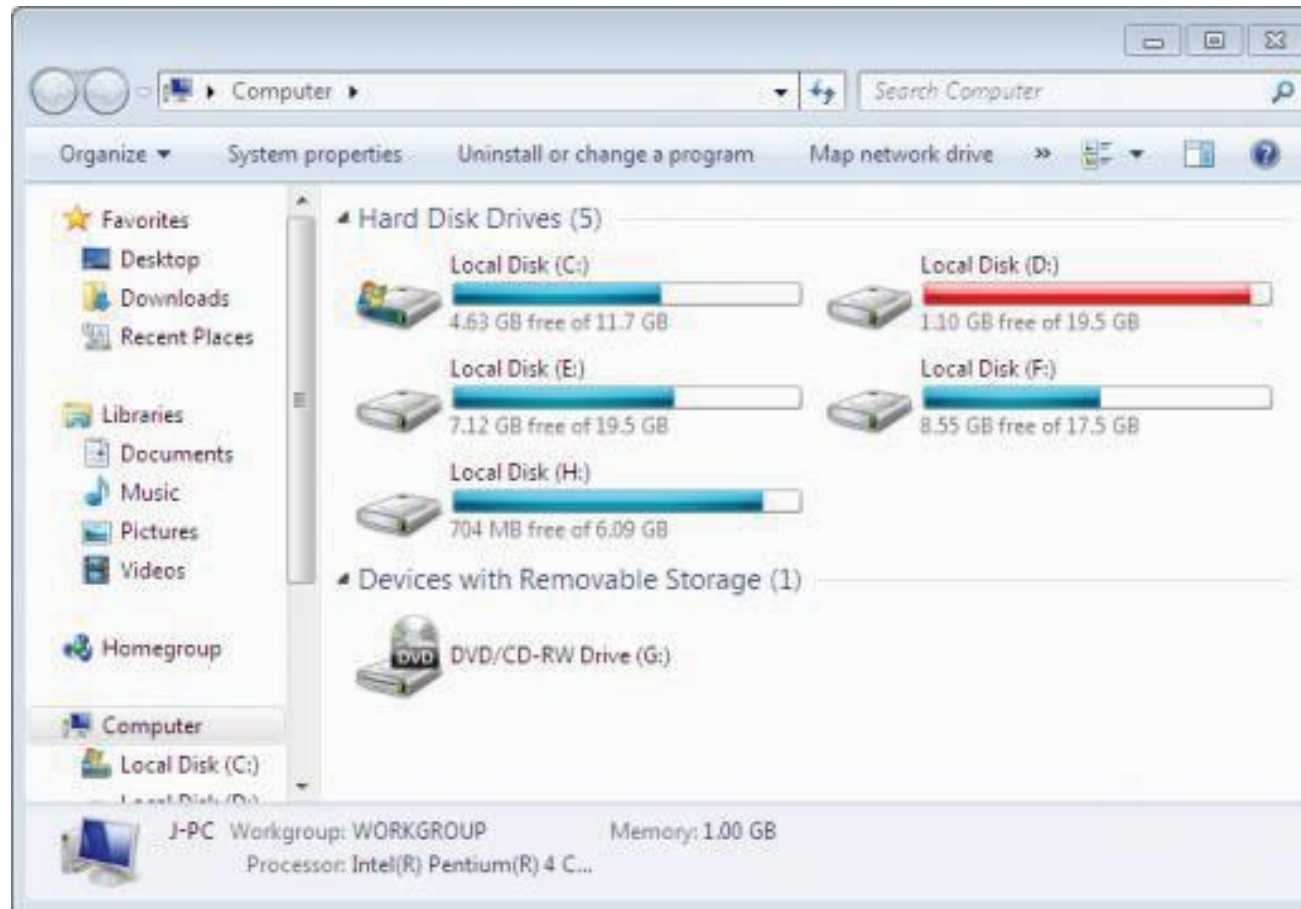
# EXAMPLES OF USER INTERFACES



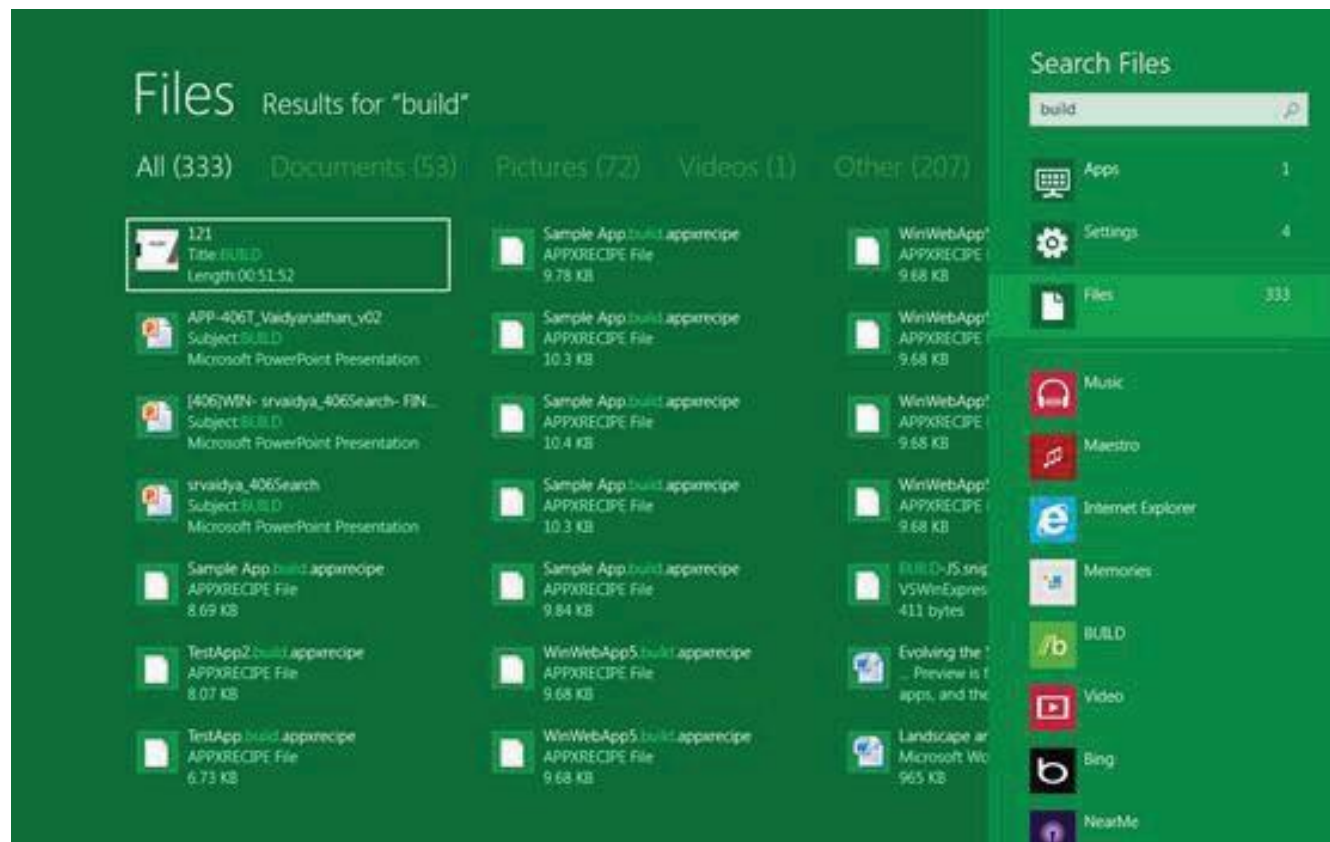
# EXAMPLES OF USER INTERFACES



# EXAMPLES OF USER INTERFACES



# EXAMPLES OF USER INTERFACES





# **History of HCI**

# History of HCI

## Input/output devices

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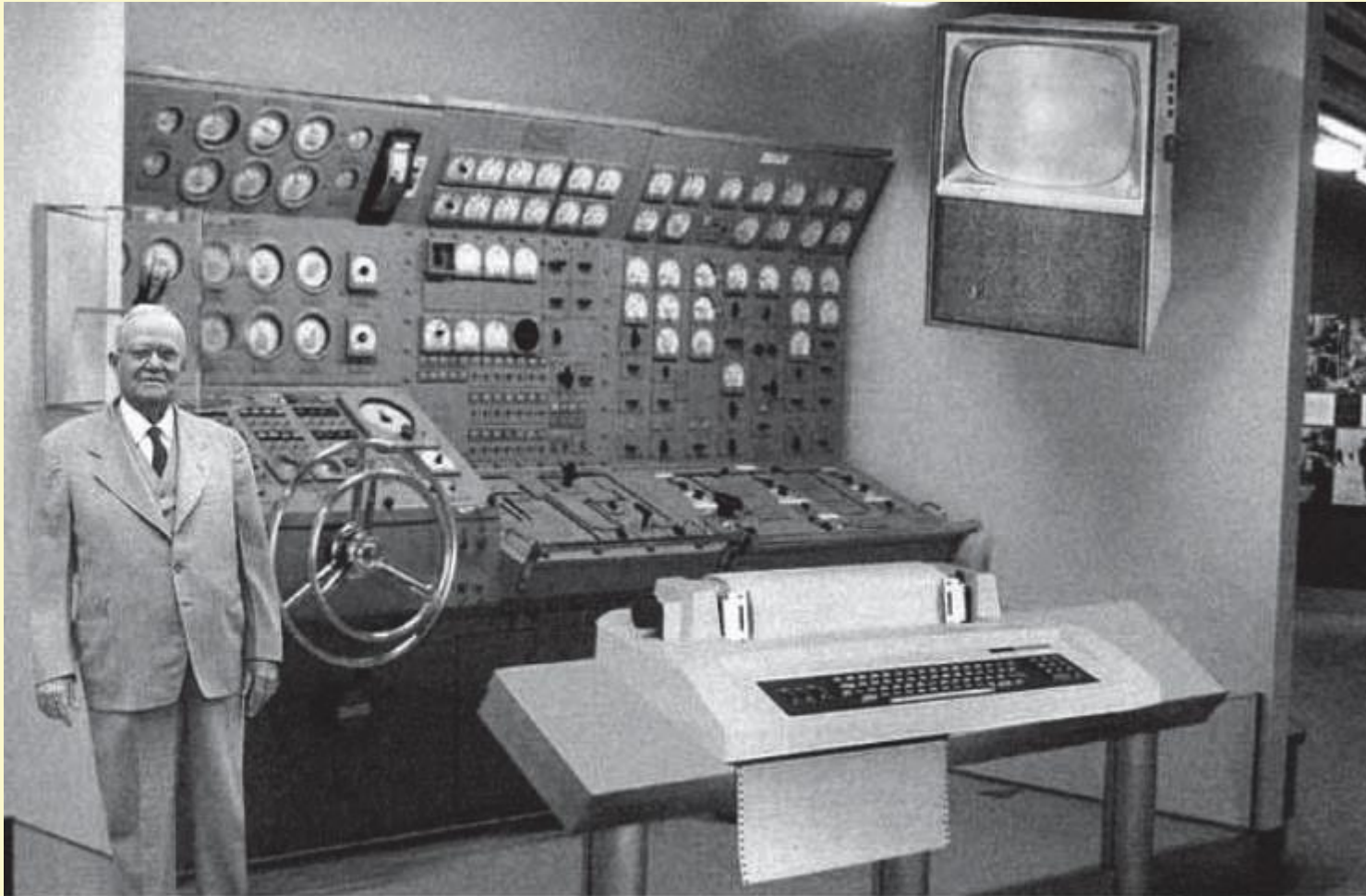
	<i>Input</i>	<i>Output</i>
<b>Early days</b>	connecting wires paper tape & punch cards keyboard	lights on display paper teletype
<b>Today</b>	keyboard + cursor keys + mouse + microphone	scrolling glass teletype character terminal bit-mapped screen audio
<b>Soon?</b>	data gloves + suits computer jewelry 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

## History of HCI

# RAND's vision of the future



*Scientists from the RAND Corporation have created this model to illustrate how a "home computer" could look like in the year 2004. However the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 50 years from now scientific progress is expected to solve these problems. With teletype interface and the Fortran language, the computer will be easy to use.*

## Future Prediction

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A previous picture is from an issue of 1954 Popular Mechanics magazine forecasting the possibility of ‘home computers’ in 50 years. It appears that the ‘mouse’ replaced the steering wheel ...

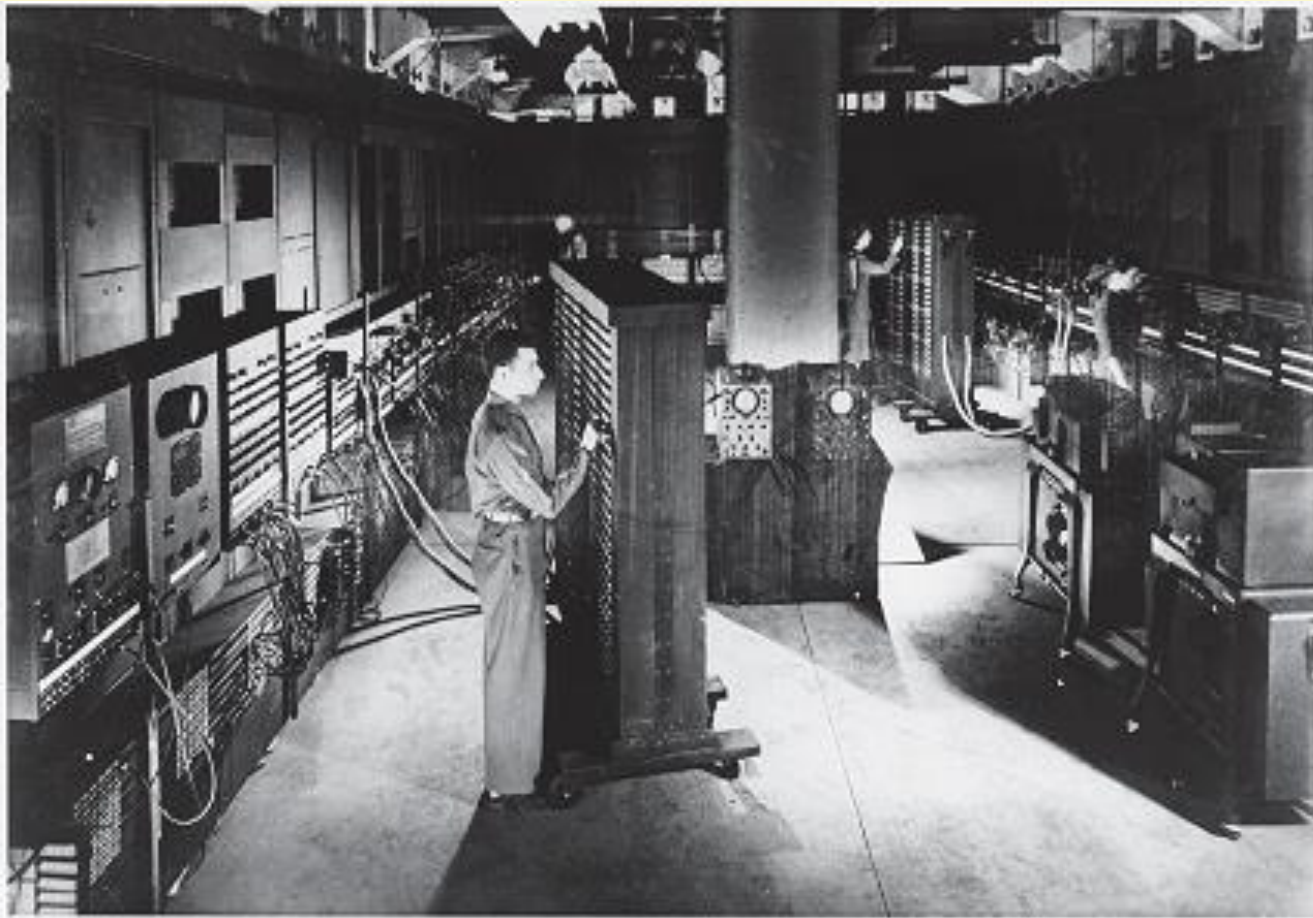
*“Scientists from RAND Corporation have created this model to illustrate how a “home computer” could look in the year 2004. However the needed technology will not be economically feasible for the average home. Also the scientists readily admit that the computer will require not yet invented technology to actually work, but 50 years from now scientific progress is expected to solve these problems. With teletype interface and the Fortran language, the computer will be easy to use.”*

History of HCI

## **Eniac (1943)**

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- A general view of the ENIAC, the world's first all electronic numerical integrator and computer.



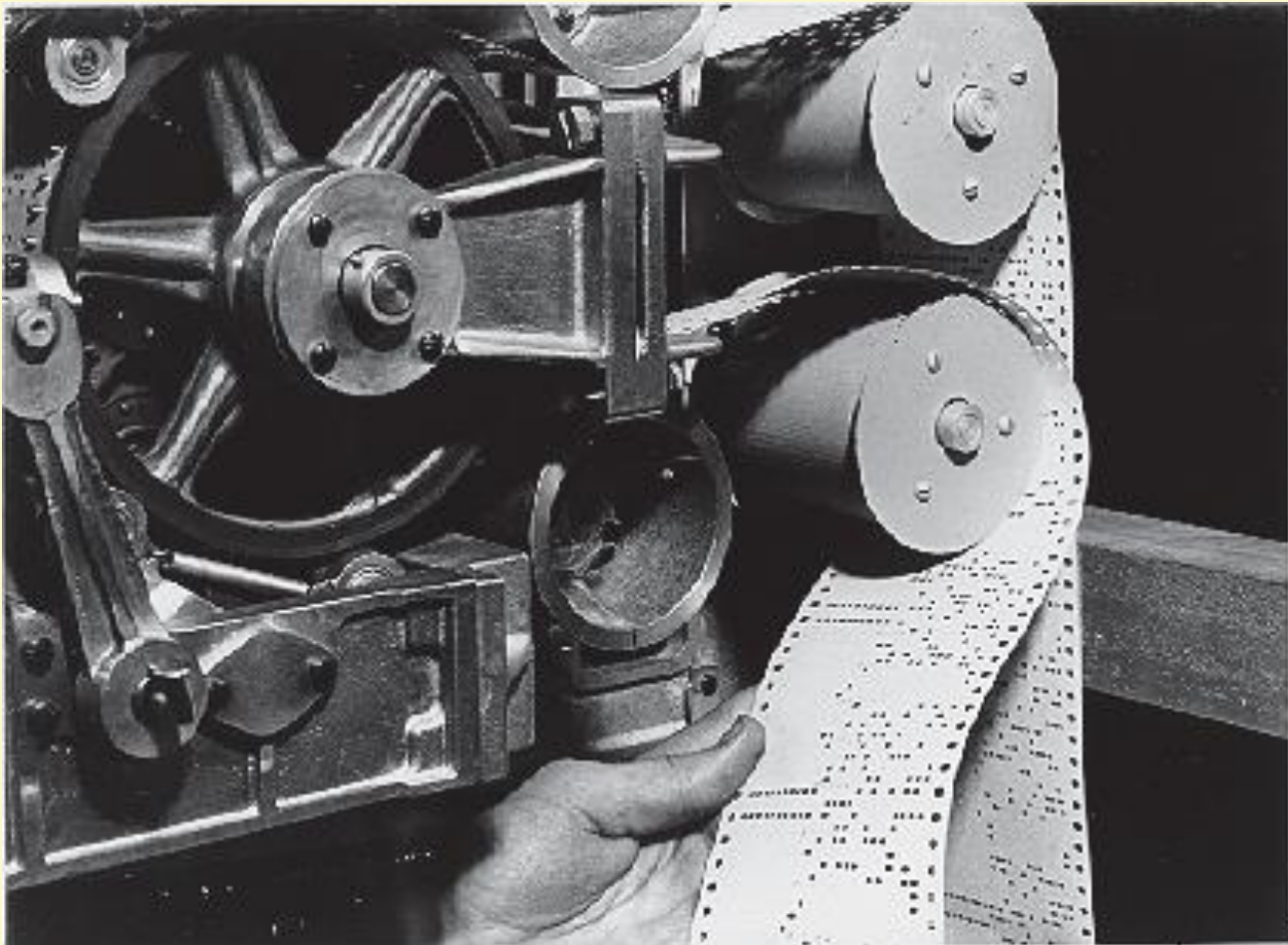
*From IBM Archives.*

History of HCI

## **Mark I (1944)**

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- The Mark I paper tape readers.

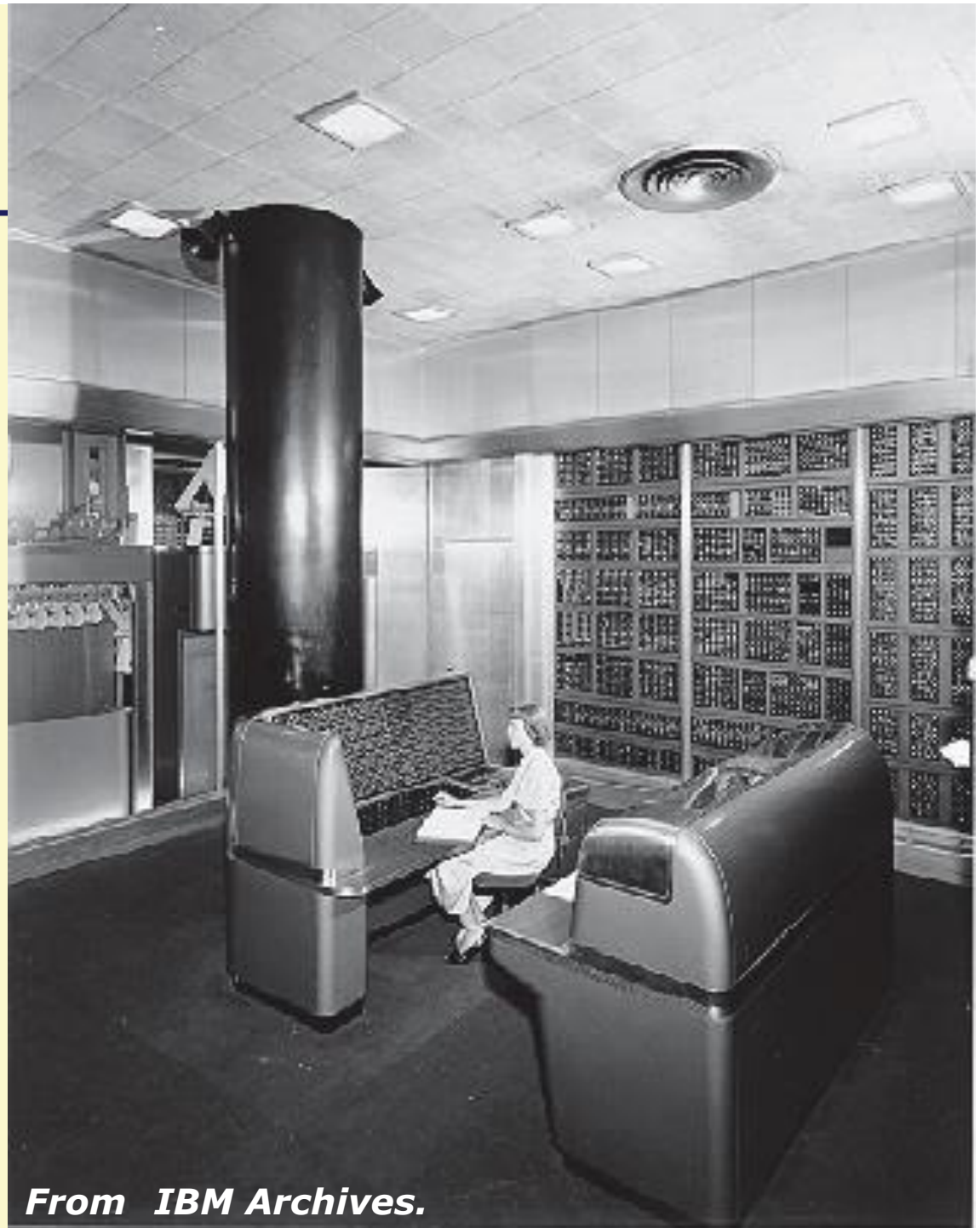


*From Harvard University Cruft Photo Laboratory.*



History of HCI

## IBM SSEC (1948)



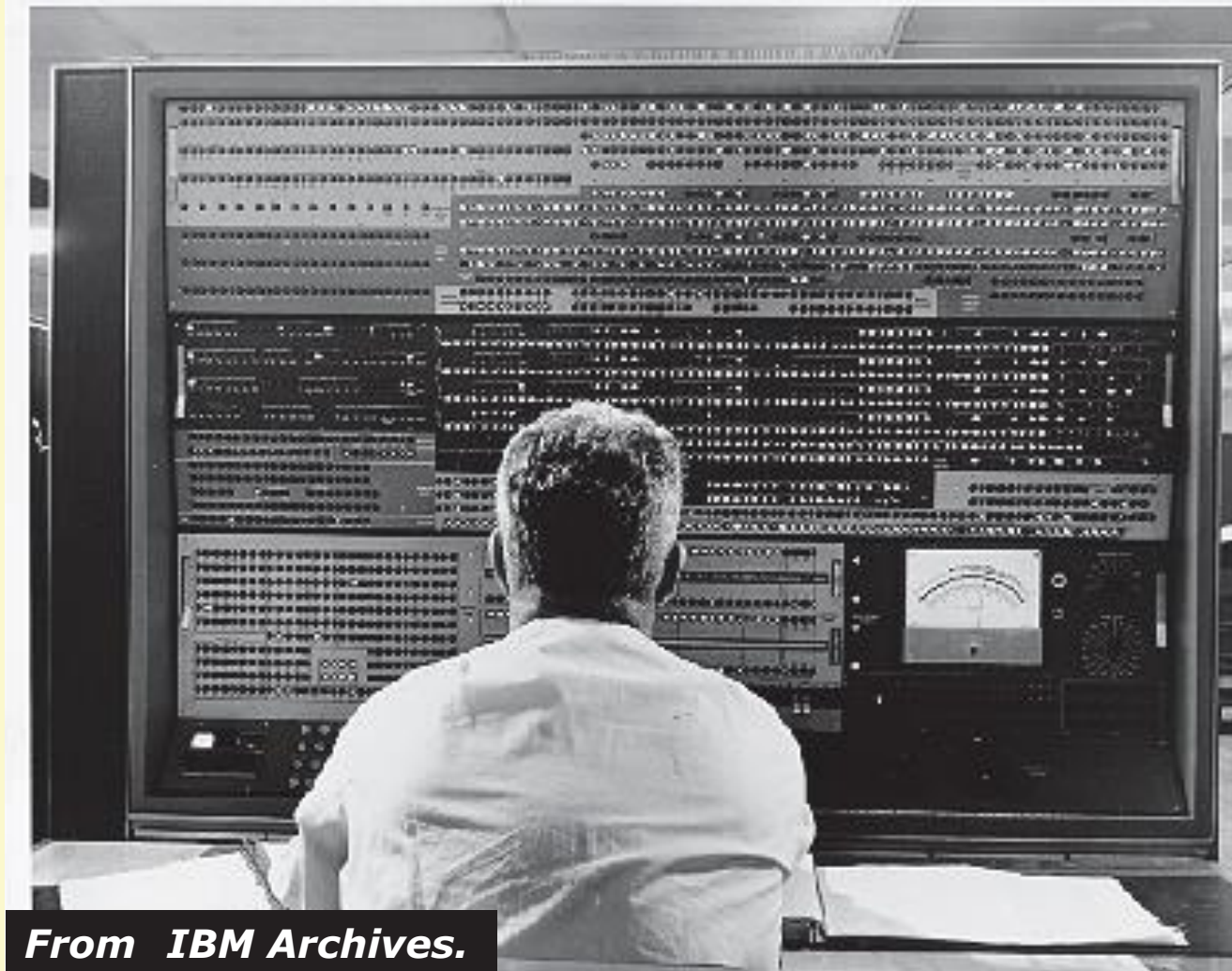
*From IBM Archives.*

History of HCI

## Stretch (1961)

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A close-up of the Stretch technical control panel.



*From IBM Archives.*



## **Bush's Memex**

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**Memex** is the name of the hypothetical electromechanical device that [Vannevar Bush](#) described in his 1945 article "[As We May Think](#)". Bush envisioned the memex as a device in which individuals would compress and store all of their books, records, and communications, "mechanized so that it may be consulted with exceeding speed and flexibility". The individual was supposed to use the memex as automatic personal [filing system](#), making the memex "an enlarged intimate supplement to his memory"

Source: Wikipedia

<https://en.wikipedia.org/wiki/Memex>

## **Bush's Memex**

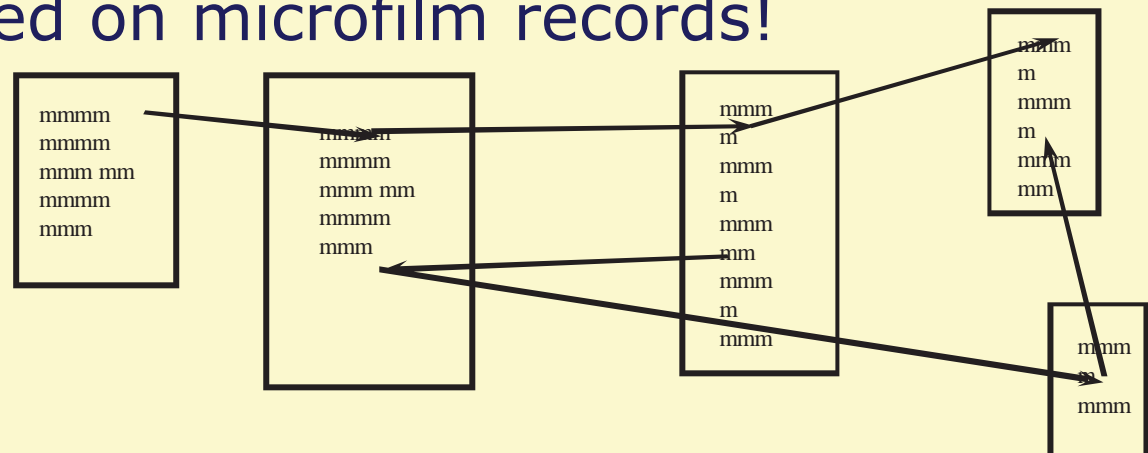
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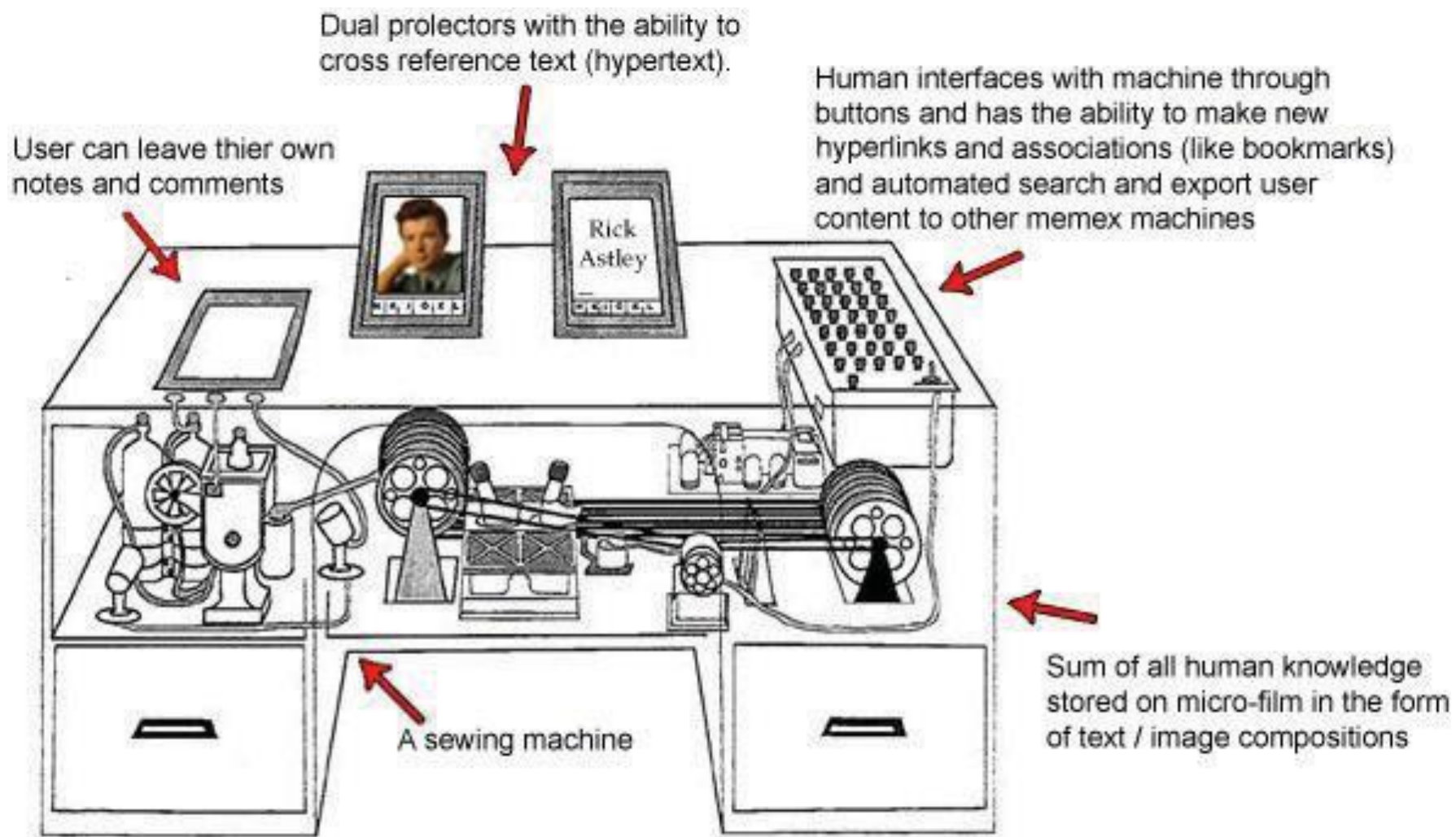
### Conceiving Hypertext and the World Wide Web

- 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





**THE MEMEX** order yours today!

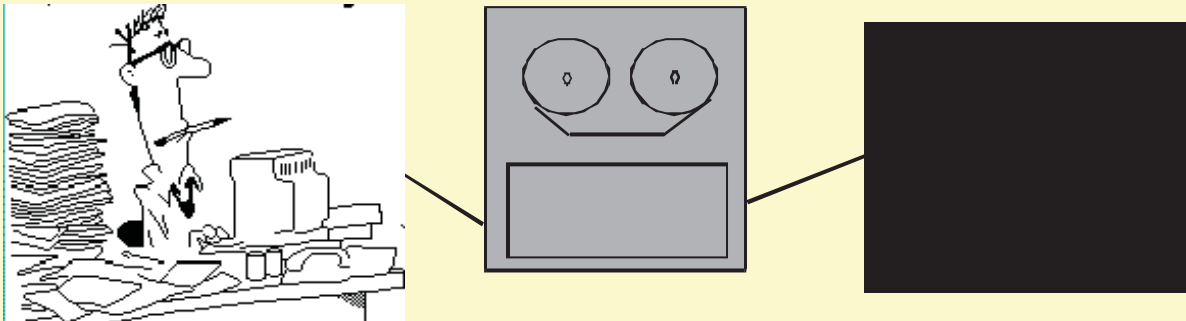
## Significant Advances 1960 - 1980

### 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.



History of HCI

## 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)

## Douglas Engelbart

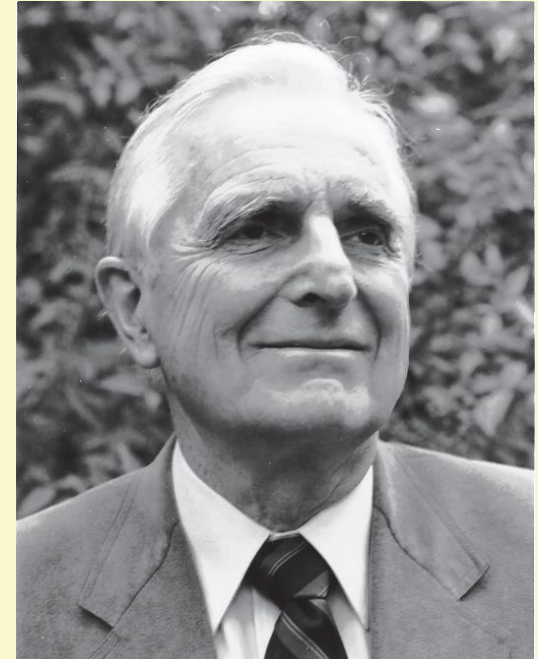
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### The Problem (early '50s)

"...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**

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### 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



History of HCI

# The First Mouse (1964)

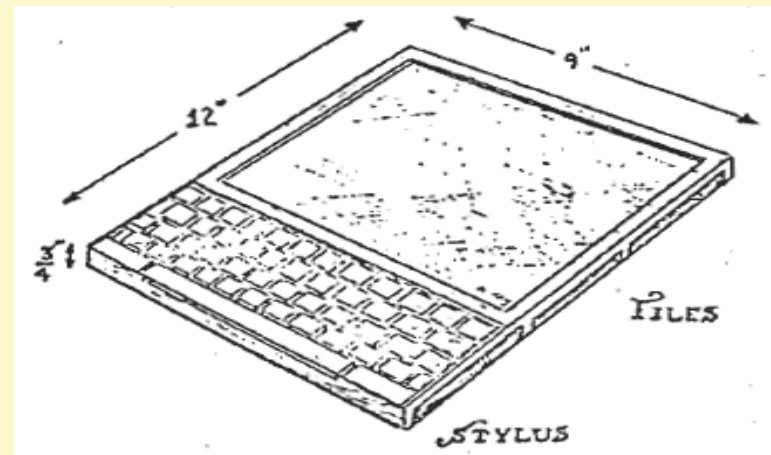


# The Personal Computer

## 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...”



## 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**

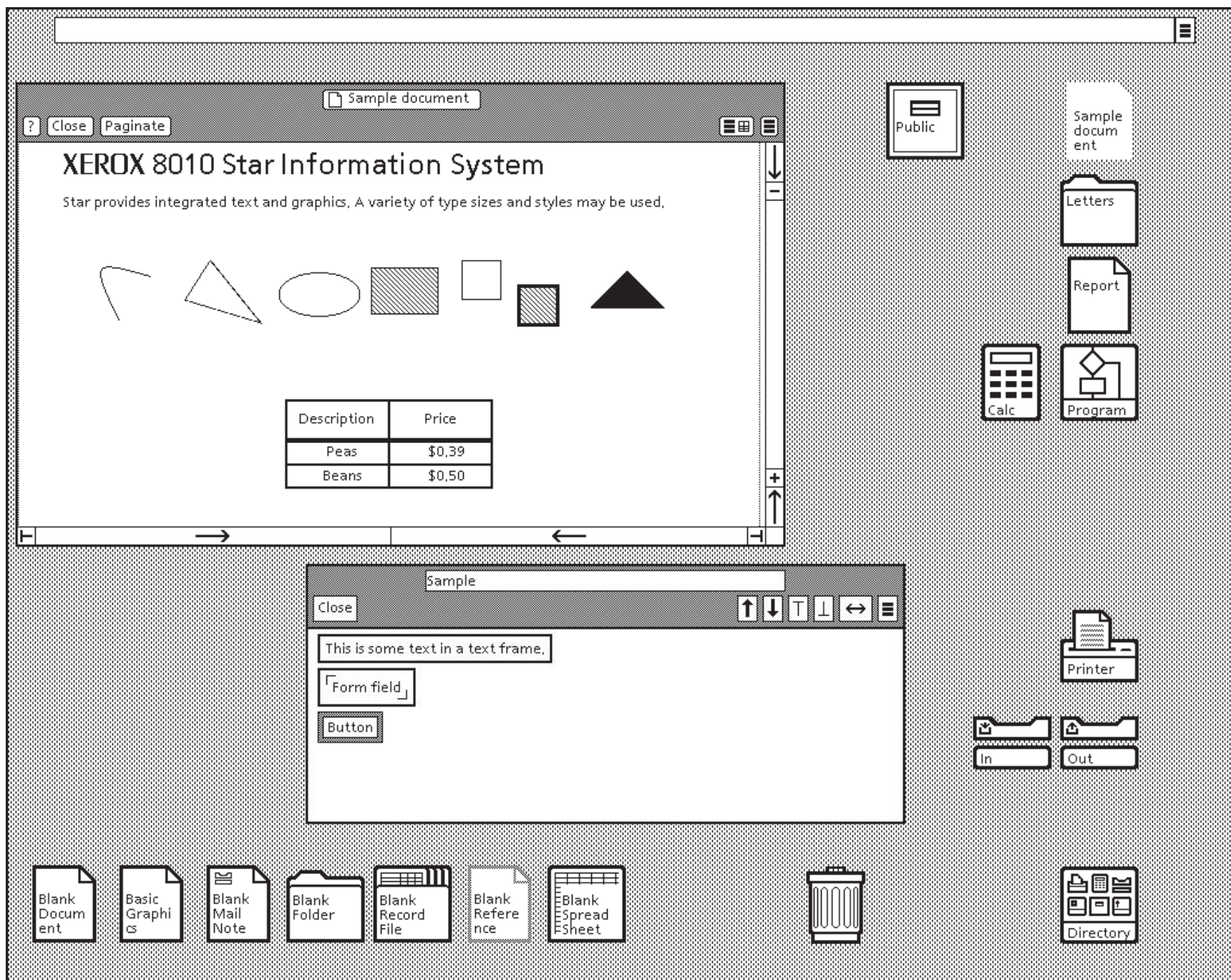
First commercial personal computer designed for “business professionals”

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)**

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### First system based upon usability engineering

- inspired design
- extensive paper prototyping and usage analysis
- usability testing with potential users
- iterative refinement of interface

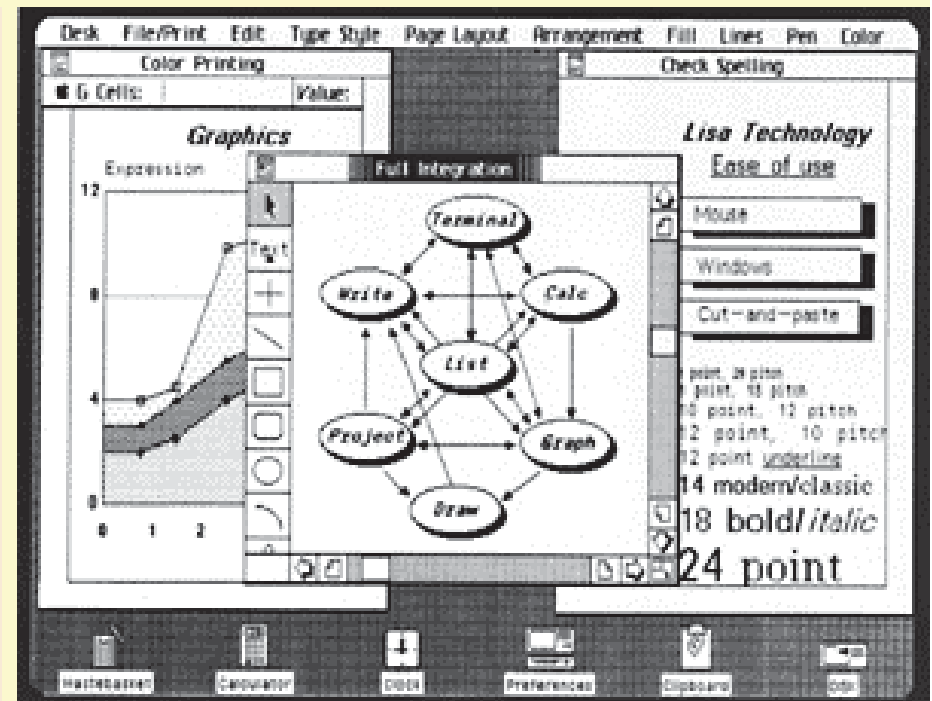
### Commercial failure

- 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!

## Commercial Machines: Apple Lisa (1983)

based upon many ideas in the Star

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





## **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

# History (and future) of HCI

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- Large displays
- Small displays
- Peripheral displays
- Alternative I/O
- Ubiquitous computing
- Virtual environments
- Implants
- Speech recognition
- Multimedia
- Video conferencing
- Artificial intelligence
- Software agents (AI: Alexa and Siri)
- Recommender systems (Machine Learning)
- ...

## You know now:

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### 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