Chapter 1
Historical Perspective

Human-Computer Interaction

An Empirical Research Perspective

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I. Scott MacKenzie

Why HCI Emerged

- In early days builders were users and vice versa
  - they knew what they were doing
- Later on casual users came along
  - they did not know what they were doing
- The need for HCI emerged
  - need to make systems usable for mainstream folks
  - gets away from command-line interface
  - makes it more visual and direct

"As We May Think"
Vannevar Bush (1945)

Vannevar Bush

- Memex
  - build knowledge base called *memex*
  - navigate by links and connections
  - reminds of hyperlinks and bookmarks

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As we may think

Full Text: 📄 Pdf

Author: Vannevar Bush Director of the Office of Scientific Research and Development

Published in:
· Magazine
  interactions Interactions Homepage archive
  Volume 3 Issue 2, March 1996
  Pages 35 - 46
  ACM New York, NY, USA
  table of contents doi>10.1145/227181.227186

1996 Article

Bibliometrics
· Downloads (6 Weeks): 54
· Downloads (12 Months): 446
· Citation Count: 19

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Sketchpad
Ivan Sutherland (1962)

Sketchpad

- Commands were not typed
  - users did not write letters to the computer
- They were
  - drawn
  - grabbed and moved
  - extended
  - deleted
  - **directly** manipulated using a lightpen
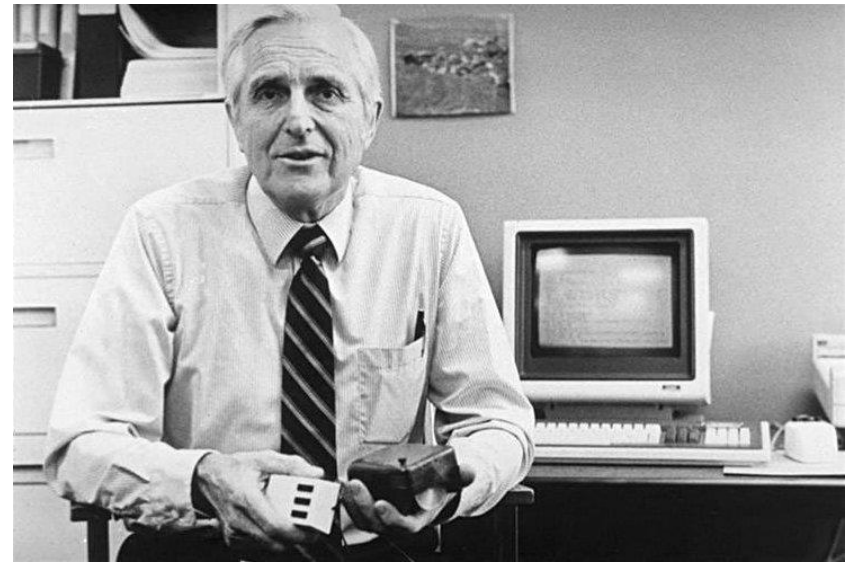
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Sketchpad: "Direct Manipulation"

- Direct manipulation features:
    - Visibility of objects
    - Incremental action and rapid feedback
    - Reversibility
    - Exploration
    - Syntactic correctness of all actions
    - Replacing language with action
- Term coined by Ben Shneiderman[1]

[1] Shneiderman, B., Direct manipulation: A step beyond programming languages, in *IEEE Computer*, 1983, August, 57-69.

Invention of the Mouse
Doug Engelbart (1963)

Read About Doug Engelbart at…

WIKIPEDIA
The Free Encyclopedia

DOUG ENGELBART INSTITUTE
"Boosting mankind's capability for coping with complex, urgent problems"
- Doug Engelbart

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HCI's First User Study[1]
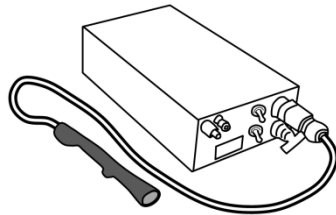
A comparative evaluation of…
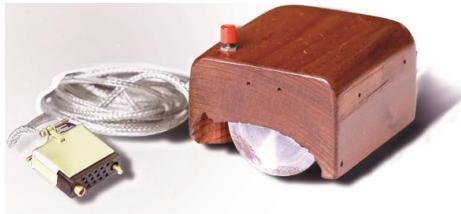
Mouse
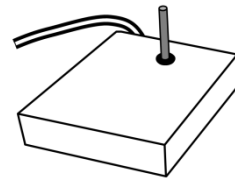
Joystick

Lightpen

Grafacon

User's Knee →   Lever →
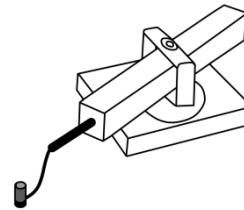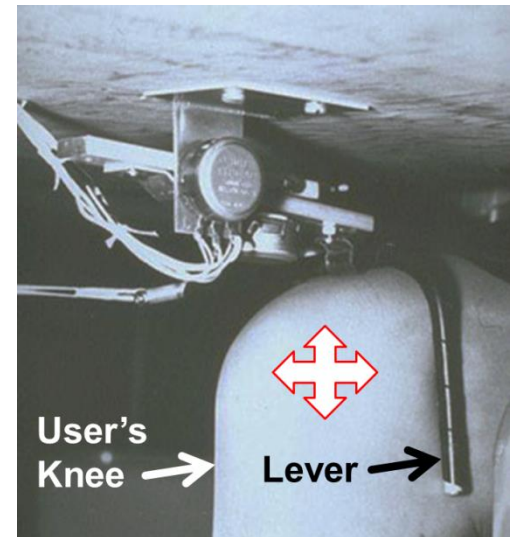
Knee-controlled lever

[1] English, W. K., Engelbart, D. C., & Berman, M. L. (1967). Display selection techniques for text manipulation. *IEEE Transactions on Human Factors in Electronics*, *HFE-8*(1), 5-15.

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Experiment Design

- Participants: 13
- Independent variable
  - "Input method" with six levels: mouse, light pen, Grafacon, joystick (position-control), joystick (rate-control), knee-controlled lever
- Dependent variables
  - Task completion time, error rate
  - (Note: task completion time = access time + motion time)
- Within-subjects, counterbalanced
- Task:
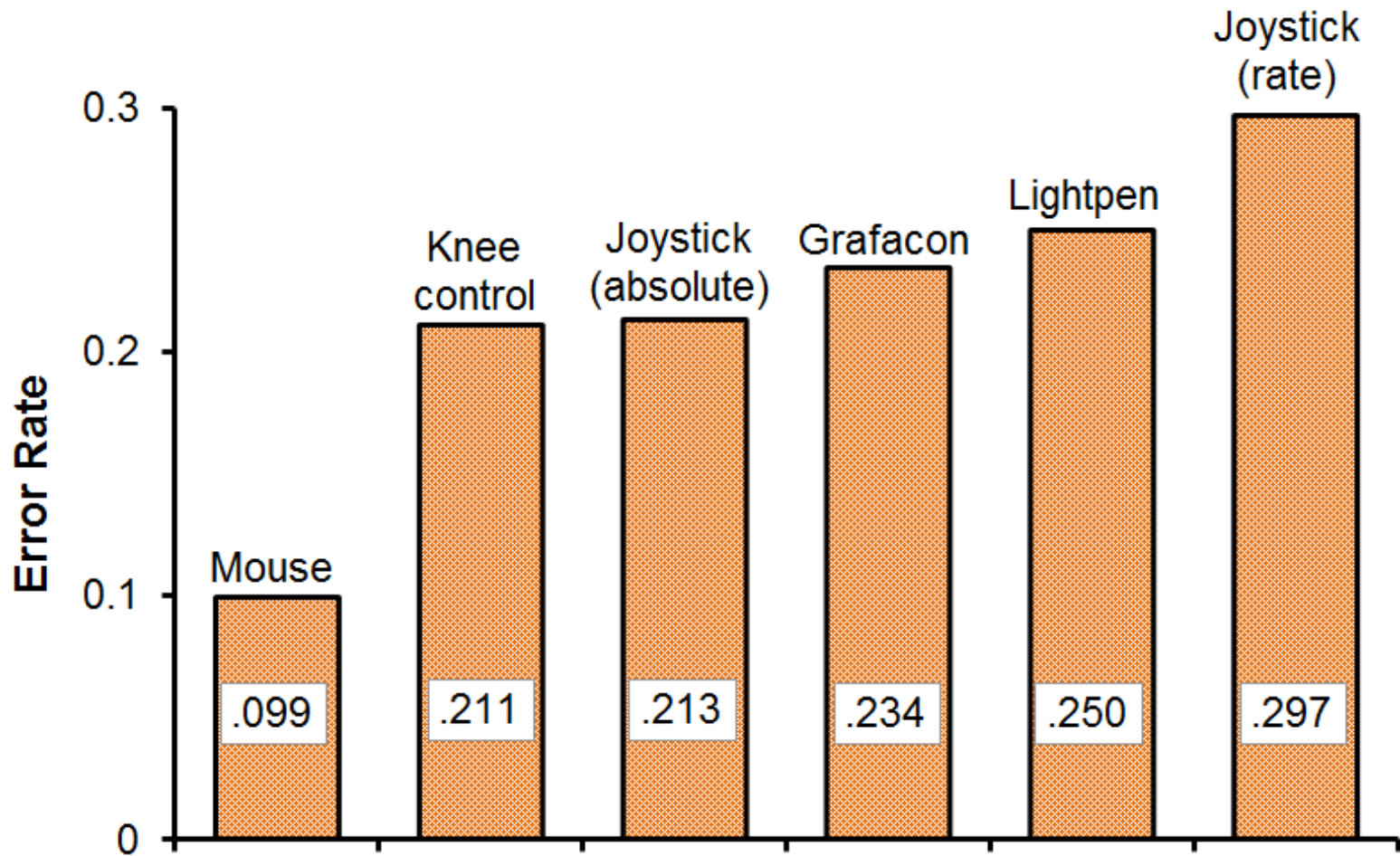 - Press spacebar, acquire device, position cursor on target, select target
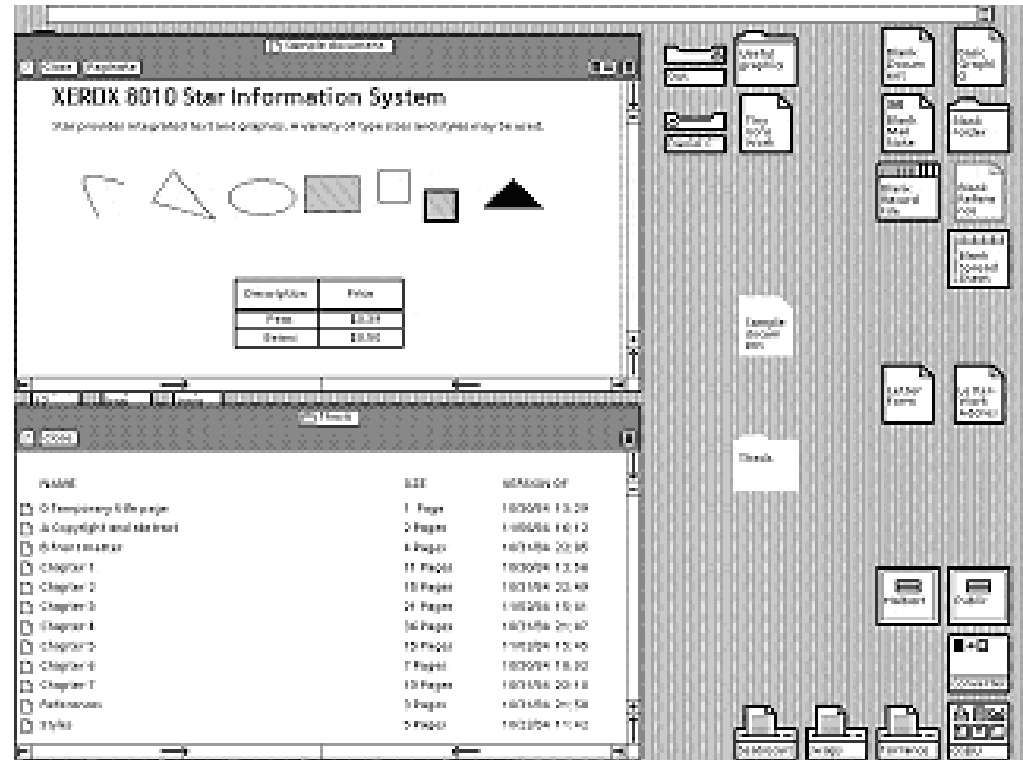
Results (1)
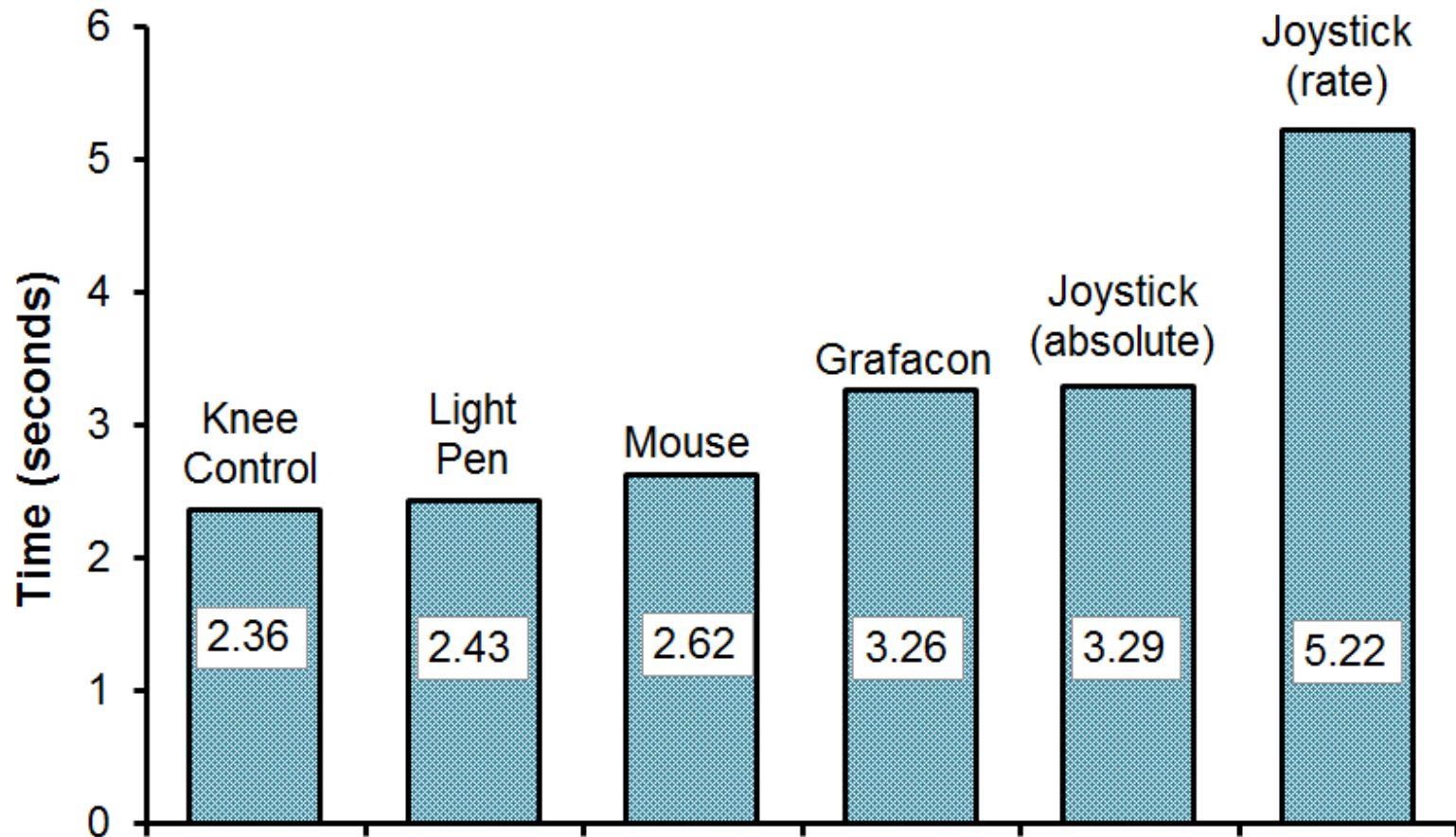
Notes:

[1] Access time with the knee-controlled lever was zero (since the device is always "acquired").

[2] Light pen use is fatiguing, since the user's arm is held in the air in front of the display.
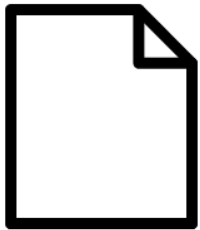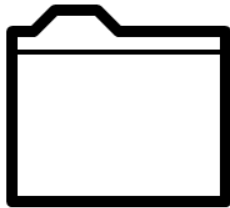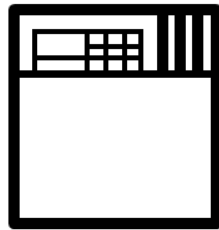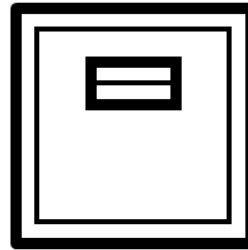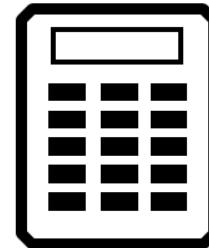
Results (2)

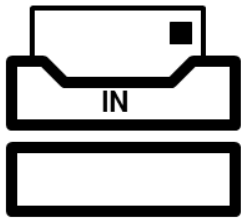# Xerox *Star* (1981)

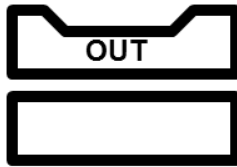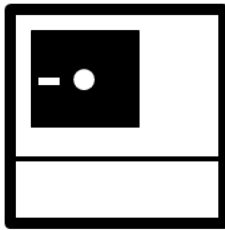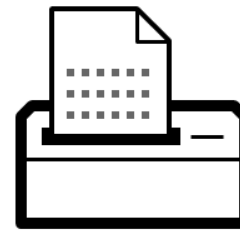# *Star* GUI Icons

Document · Folder · Record File · File Drawer · Calculator · Terminal (Dialog, TTY)

In Tray · Out Tray · Floppy Disk Drive · Printer · User (Williams) · User Group (Designers)
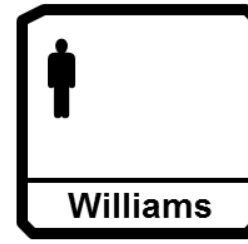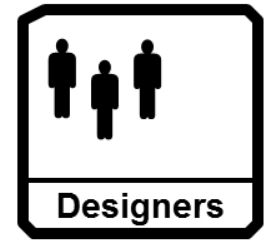
Xerox Star

- bitmapped images (pixelated)
  - not character-mapped (distinct patterns-based)
- pixels need more memory
  - but are more flexible than a fixed set of characters
- completed the triad mouse, sketchpad, Star
  - uses an event-driven model, not sequential command
  - promotes more spontaneous, asynchronous interaction
  - manipulation-driven

Xerox Star

- Was not a commercial success
- it was not a personal computer
  - was a dumb terminal connected to a central server
- Apple II (1977) was the first personal computer
  - highly successful
  - historical landmark

Birth of HCI - 1983

- Notable events:

  1. First ACM SIGCHI conference (1983)

  2. Publication of *The Psychology of Human-Computer Interaction* by Card, Moran, and Newell (1983)

  3. Apple *Macintosh* announced via brochures (December, 1983) and launched (January, 1984)
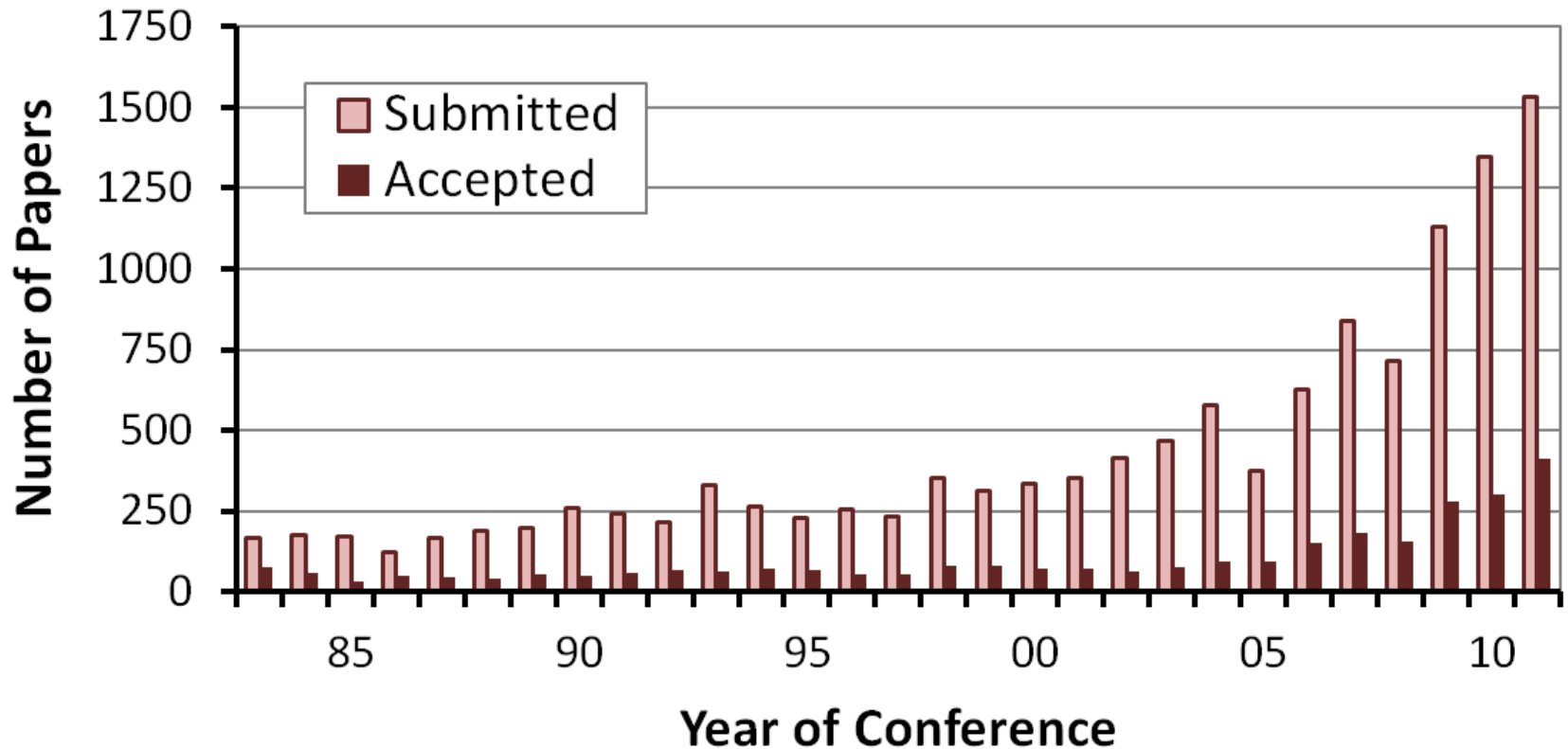
ACM SIGCHI Mission

The ACM Special Interest Group on Computer-Human Interaction is the world's largest association of professionals who work in the research and practice of computer-human interaction. This interdisciplinary group is composed of computer scientists, software engineers, psychologists, interaction designers, graphic designers, sociologists, and anthropologists, just to name some of the domains whose special expertise come to bear in this area. They are brought together by a shared understanding that designing useful and usable technology is an interdisciplinary process, and believe that when done properly it has the power to transform persons' lives.
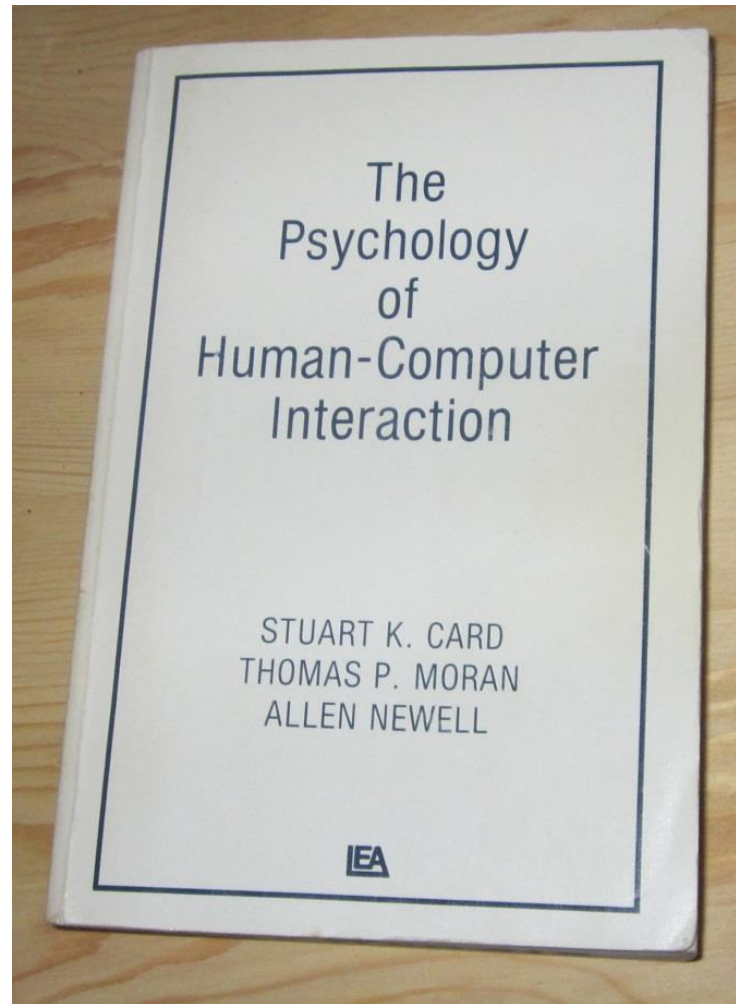
SIGCHI Web Site

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SIGCHI Conference Publications

The Psychology of Human-Computer Interaction
Card, Moran, and Newell (1983)

The Psychology of Human-Computer Interaction

- First 100 pages are on human psychology
  - sensory
  - cognitive
  - motor
  - must understand human first before building an interface for humans
- Exploit synergy between psychology and computer science
  - completely novel idea/concept back then
  - man-machine psychology, human factors, HCI

Reaction Time

- User is presented with two symbols in sequence
  - if the first is the same as the second then hit 'yes'. else 'no'
  - this has implications still today (smartphone communication)
  - measure
  $$\text{Reaction time} = t_p + 2 \times t_c + t_M$$
  $$= 100[30 \sim 200] + 2 \times (70[25 \sim 170]) + 70[30 \sim 100]$$
  $$= 310[130 \sim 640]\,\text{ms}$$
  - low-level perceptual, cognitive, motor proc. cycles
  - fastman slowman range
  - can decompose any complex task into basic ones like this

The Model Human Processor
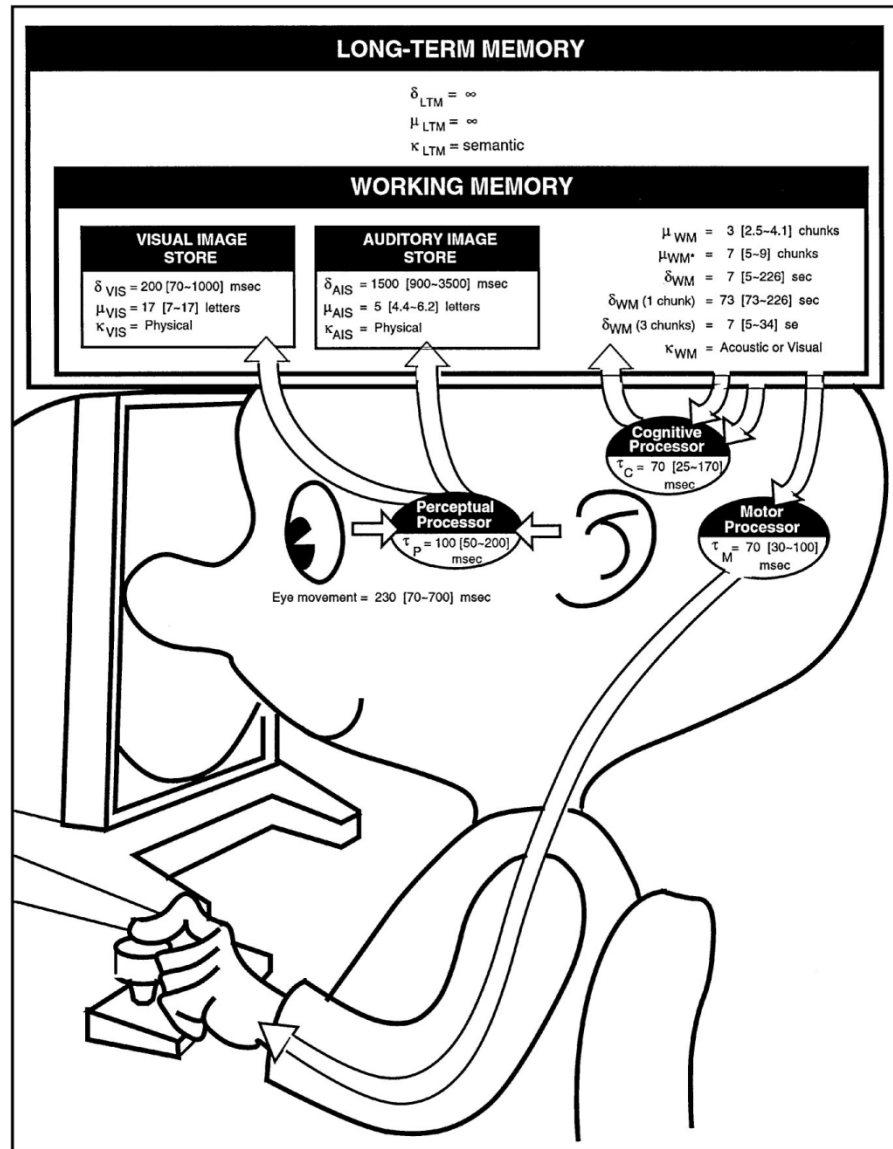
Apple *Macintosh* (1984)

MacWrite Software

Apple *Macintosh* Superbowl Commercial (1984)

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Apple *Macintosh* Timeline

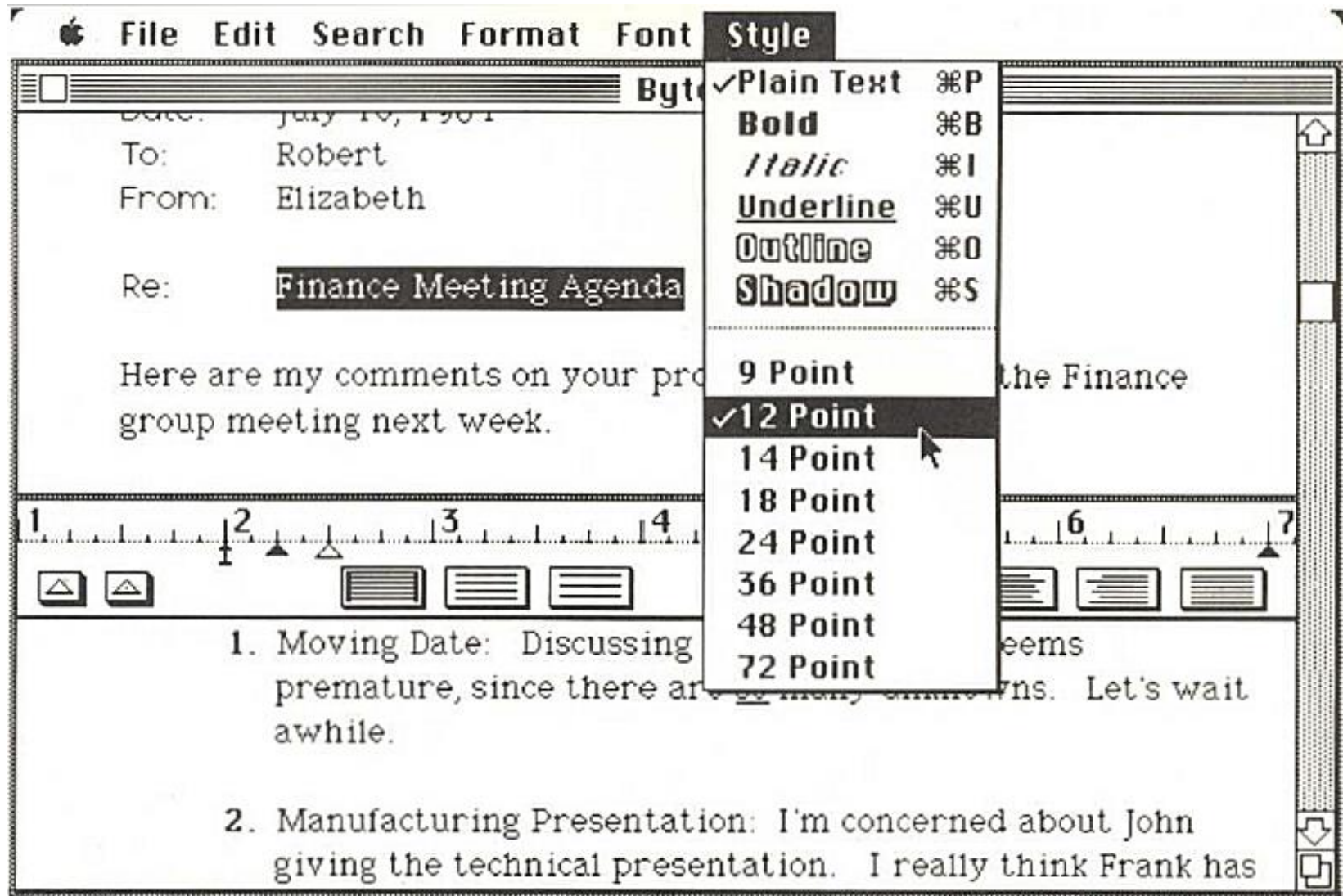| 1976	April – Apple Computer Inc. founded in Cupertino, California.
1977	Launch of Apple II. Sells for $1300 U.S. with 4KB RAM. Hugely successful (more than one million units sold). Works with a text-based command-line interface.
1978	*Lisa* project started . Goal of producing a powerful (and expensive!) personal computer.
1979	September – *Macintosh* project started. Goal of producing a low-cost easy-to-use computer for the average consumer. December – Apple and Xerox sign an agreement that allows Xerox to invest in Apple. In return Apple's engineers visit Xerox PARC and see the Xerox *Alto*. The GUI ideas in the *Alto* influence *Lisa* and *Macintosh* development.
1980	December – Apple goes public through initial public offering (IPO) of its stock.
1981	May – Xerox *Star* launched at the National Computer Conference (NCC) in Chicago. Members of the *Lisa* design team are present and see the *Star* demo. They decide to re-vamp the *Lisa* interface to be icon-based. August – IBM PC announced. Highly successful, but embodies traditional text-based command-line interface.
1982	*Lisa* and *Macintosh* development continue. Within Apple, there is an atmosphere of competition between the two projects
1983	January – *Lisa* released. *Lisa* incorporates a GUI and mouse input. Sells for $10,000 U.S. In the end, *Lisa* is a commercial failure. December -- brochures distributed in magazines (e.g., *Time*) pre-announcing the *Macintosh*.
1984	January 22 – *Macintosh* ad plays during Super Bowl XVIII. January 24 – *Macintosh* released. Sells for $2500 U.S.

Growth of HCI (1983-…)

- Example of an early research topic
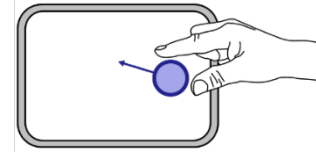 - Breadth vs. depth in menu design
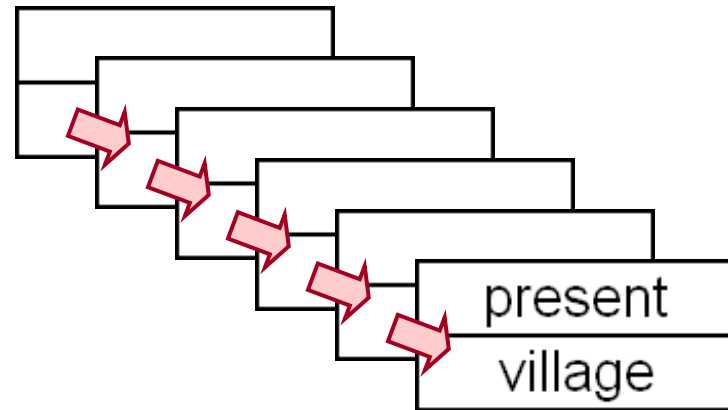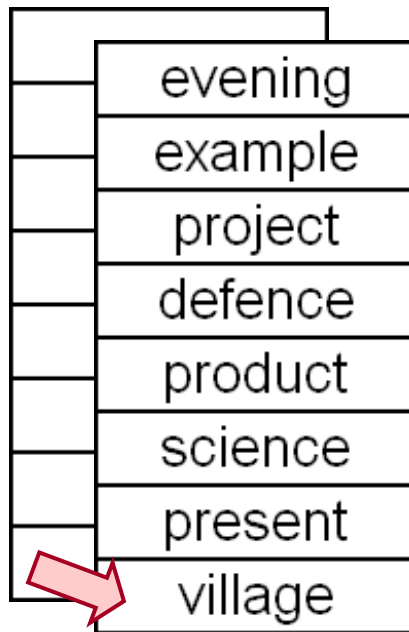
Other Research on Menus

- Order alphabetically or by function?
- Is access improved if an icon is added to he label?
- Do people with different age groups respond differently?
- Does auditory feedback improve menu access?
- Can tilt of mobile phones be used for menu access?
- Should a menu be linear or pie-shaped?

HCI Research

- Research precedes products

- Consider…

  - Two-finger gestures (Apple *iPhone*, 2007)

  - Acceleration-sensing (Nintendo *Wiimote*, 2005)

  - Wheel mouse (Microsoft *Intellimouse*, 1996)

  - Single-stroke text input (Palm's *Graffiti*, 1995)

- Were these ideas born out of engineering or design brilliance? Not really…

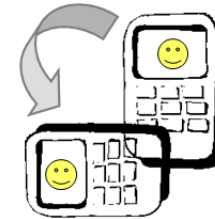- Two-finger gestures: ~~2007?~~   **1978** [1]
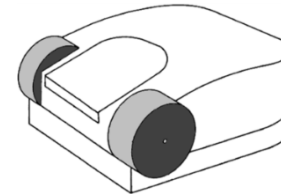
- Acceleration-sensing: ~~2005?~~   **1998** [2]

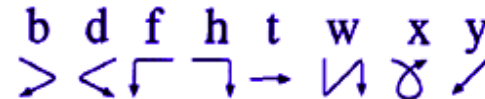- Wheel mouse: ~~1996?~~   **1993** [3]

- Single-stroke text input: ~~1995?~~   **1993** [4]

[1] Herot, C. F., & Weinzapfel, G. (1978). One-point touch input of vector information for computer displays. *Proc SIGGRAPH '78*, 210-216, New York: ACM.

[2] Harrison, B., Fishkin, K. P., Gujar, A., Mochon, C., & Want, R. (1998). Squeeze me, hold me, tilt me! An exploration of manipulative user interfaces. *Proc CHI '98*, 17-24, New York: ACM.

[3] Venolia, D. (1993). Facile 3D manipulation. *Proc CHI '93*, 31-36, New York: ACM.

[4] Goldberg, D., & Richardson, C. (1993). Touch-typing with a stylus. *Proc CHI '93*, 80-87, New York: ACM.

Resources

Google Scholar: `http://scholar.google.ca/`

ACM Digital Library: `http://portal.acm.org/`

HCI Bibliography: `http://hcibib.org/`

Wikipedia: `http://en.wikipedia.org/`

Book web site: `http://www.yorku.ca/mack/HCIbook`

Thank You