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Human Computer Interaction

Lecture 2

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Rise of HCI:

- HCI surfaced in the 1980s with the advent of personal computing started turning up in homes and offices in society.
- Until the late 1970s, the only people who interacted with computers were IT professionals.
- As computers were no longer room-sized, expensive tools exclusively built for experts in specialized environments, computers became affordable for common people, the importance of focus on interaction for less experienced users became increasingly vital.

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- Computer graphics and information retrieval had emerged in the 1970s, and rapidly came to recognize that **interactive systems** were the key to progressing.
- Interactive systems based on graphics were called Graphical User Interface (GUI)
- At that time WIMP became a milestone in Human Computer Interaction.
 - i.e. **WIMP**: Windows Icons, Menu, Pointers

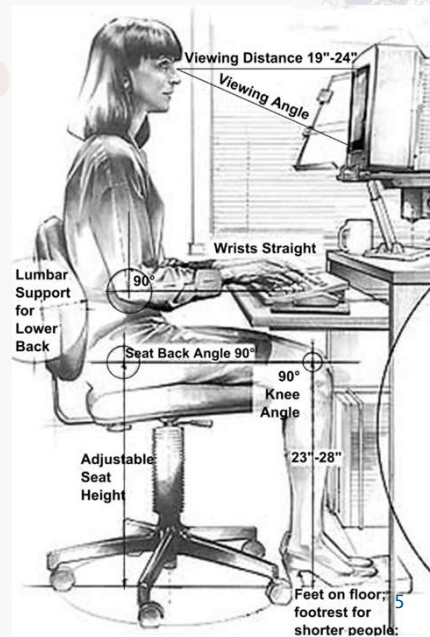
GUI to address commands remembering problems:

- With a GUI, the user issues a command to the computer by selecting a command from a menu rather than typing it on the keyboard.
- Menus require recognition vs Typing requires recall
- It is known that **recognition** is preferred over **recall** in user interfaces at least for novices, but a new problem then surfaces.

Emergence of Ergonomics

'Human factors' is another phrase for the concept of ergonomics.

Ergonomics deals with the correct body position to help lower the possibilities of strains and injuries while using computer systems (or industrial systems).



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Health Issues Associated with Poor Ergonomics



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Moving to non-desktop environment

- Initially, HCI researchers focused on improving the usability of desktop computers (i.e., how easy computers are to learn and use).
- However, with the rise of technologies such as the Internet and the Smart Phones, computer use would increasingly move away from the desktop to embrace the mobile world.
- Now most of HCI work is about non-desktop environment.

Interaction Design become more important as HCI expanded

- HCI steadily encompassed the following fields:
 - Multimodal Interactions
 - Visualization
 - Healthcare Applications
 - Augmented Reality / Virtual Reality
 - E-Learning
 - Accessibility (Elders, Children, physically impaired)
 - ICT for Development (ICT4D)
 - Wearable Technologies
 - IoT





Some Examples of Earlier Major Achievements in HCIs

Sketchpad (1962)

- Ivan Sutherland developed Sketchpad in the early 1960s as part of his PhD research in electrical engineering at the Massachusetts Institute of Technology (M.I.T.).
- Sketchpad was a graphics system that supported the manipulation of geometric shapes and lines (objects) on a display using a **light pen**.
- With Sketchpad, commands were not typed. Users did not “write letters to” the computer. Instead, objects were drawn, resized, grabbed and moved, extended, deleted—directly, using the light pen.
- The use of a pointing device for input makes Sketchpad the first *direct manipulation* interface—a sign of things to come.

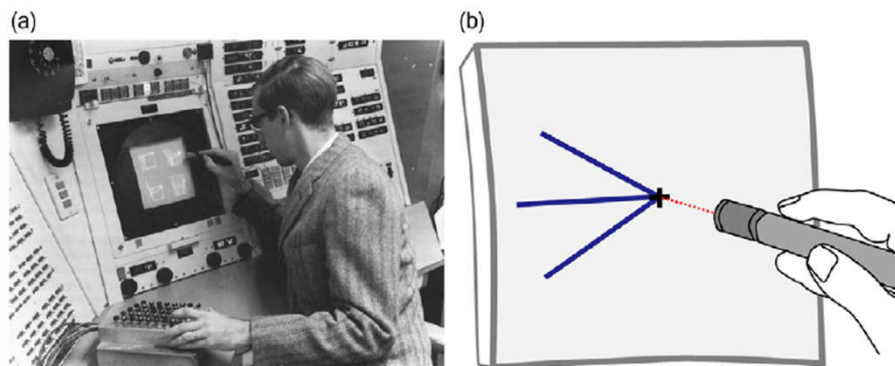


FIGURE 1.3

(a) Demo of Ivan Sutherland's Sketchpad. (b) A light pen dragging ("rubber banding") lines, subject to constraints.

Invention of the mouse (1963)

Moving beyond typing Commands

- If there is one device that symbolizes the emergence of HCI, it is the computer mouse. *Invented by Douglas Engelbart in 1963.*
- The mouse was destined to fundamentally change the way humans interact with computers.
- Instead of typing commands, a user could manipulate a mouse to control an on-screen tracking symbol, or cursor.
- With the cursor positioned over a graphic image representing the command, the command is issued with a select operation—pressing and releasing a button on the mouse.

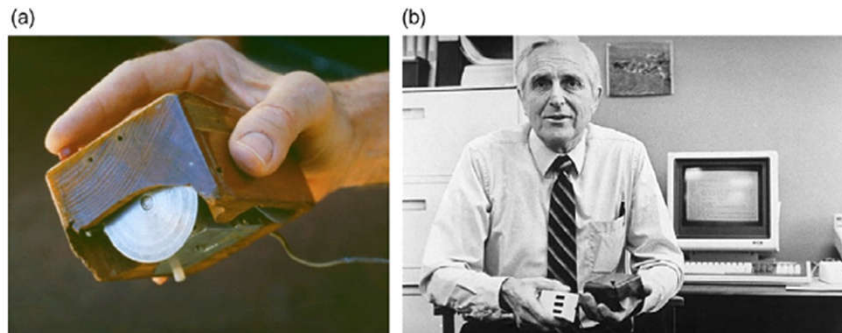


FIGURE 1.4

(a) The first mouse. (b) Inventor Douglas Engelbart holding his invention in his left hand and an early three-button variation in his right hand.

Mouse Testing: HCI First User Study

- Initial testing of the mouse focused on selecting and manipulating text, rather than drawing and manipulating graphic objects.
- Engelbart was second author of the first published evaluation of the mouse.
- This was, arguably, **HCI's first user study**.
- Engelbart, along with English and Berman conducted a controlled experiment comparing several input devices capable of both selection and x-y position control of an on-screen cursor.
- Besides the mouse, the comparison included a **light pen**, a **joystick**, a **knee-controlled lever**, and a **Grafacon**.



User Studies come at the very core of HCI
– because it informs the system designers about if the system is working for the users or not and what problems exist in the interaction with the system?

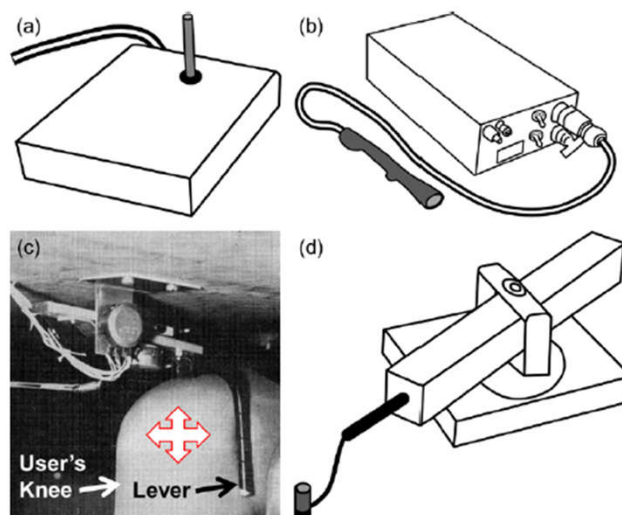


FIGURE 1.5

Additional devices used in the first comparative evaluation of a mouse: (a) Joystick. (b) Lightpen. (c) Knee-controlled lever. (d) Grafacon.

Result of the first HCI user study

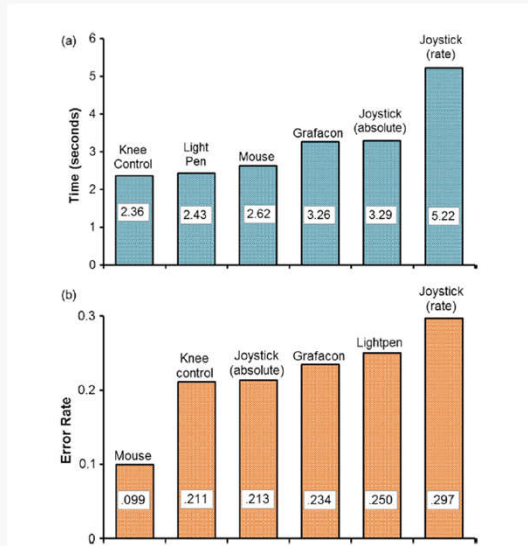


FIGURE 1.6

Results of first comparative evaluation of a computer mouse: (a) Task completion time in seconds, (b) Error rate as the ratio of missed selections to all selections.

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(Adapted from English et al., 1967)

Time to complete the given task using different devices.

Error rate during task completion using different devices.

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Xerox star (1981)

- The Xerox Star was the first commercially released computer system with a **GUI**.
- It had windows, icons, menus, and a pointing device (WIMP).
- It supported direct manipulation and what-you-see-is-what-you-get (WYSIWYG) interaction.



FIGURE 1.7

Xerox Star workstation.

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One novel feature of the Star was use of the desktop metaphor. Metaphors are important in HCI.

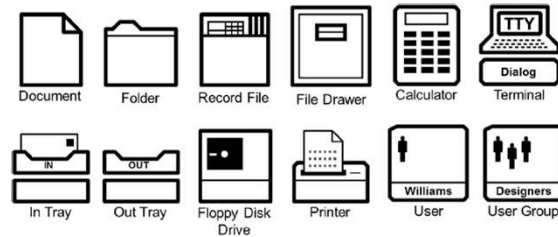


FIGURE 1.8

Examples of icons appearing on the Xerox Star desktop.

Xerox Star was basically a “**Serious Business Personal Computers**” – which was still overpriced for common people. It was priced at \$9,995 for a base system

Launch of the Apple Macintosh (1984)



FIGURE 1.12 The Apple Macintosh.



- The Macintosh, priced between \$1,995 and \$2,495, aimed to change the way computers were used by “**person in the street**”.
- It was the first computer developed for home users with an affordable price that used window-and-mouse system.
- **It changed how people (Humans) interacted with computers.**
- The Mac was not only cool, the interface was simple and intuitive. Anyone could use it. It was sleek and sported the latest input device, a computer mouse.
- The operating system and applications software indicated the new age of the GUI with direct manipulation and point-select interaction.
- Part of the simplicity was its one-button mouse. With one button, there was no confusion on which button to press.

Early HCI Research Focus and Examples

These examples will give you an idea of the types of the issues and problems studied by earlier HCI researchers.



Early HCI Research Examples

- Initially the focus of human-computer interaction was on research in the *quality, effectiveness, and efficiency* of interfaces.

- **Example:**

- How quickly and accurately can people do common tasks using a GUI versus a text-based command-line interface?
- Given two or more variations in a GUI implementation, which one is quicker or more accurate?

These or similar questions formed the basis of much empirical research in the early days of HCI.

Other Early HCI research examples:

- A classic example of early research topic in HCI is how to design menus.
 - For example, if there were numerous commands in a menu, how should they be organized?
 - One approach is to organize menu commands in a *hierarchy* that includes depth and breadth. The question then arises:
 - what is the best structure for the hierarchy? Consider the case of 64 commands organized in a menu.
 - The menu could be organized with depth = 2 and breadth = 8 or depth=6 and breadth = 2, or with.

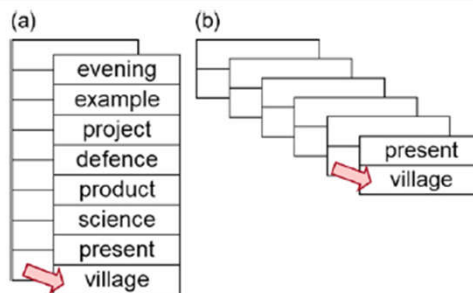


FIGURE 1.14

Breadth versus depth in menu design: (a) 8x8 choices in a broad hierarchy.
(b) 2x2x2x2x2x2 choices in a deep hierarchy.

- Depth = # of levels
- Breadth = Can be described as average items per level or as maximum items per level.

Early HCI Research Examples

- Should items be ordered *alphabetically* or by *functionality*?
- Is access improved if an *icon* is added to the label?
- Do people in different age groups respond differently to broad versus deep menu hierarchies?
 - Diversity in people is considered here.
 - Such knowledge can help in customization of interfaces.