A Brief History of HCI

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Lecture notes in this series are based on

- Ahmed Sabbir Arif. 2021. Statistical Grounding. *Intelligent Computing for Interactive System Design: Statistics, Digital Signal Processing, and Machine Learning in Practice*, ACM
- Ann Blandford, Dominic Furniss, Stephann Makri. 2016. Qualitative HCI Research: Going Behind the Scenes. Morgan & Claypool
- Jonathan Lazar, Jinjuan Feng, Harry Hochheiser. 2017. Research Methods in Human-Computer Interaction. Morgan Kaufmann
- I. Scott MacKenzie. 2013. Human-Computer Interaction: An Empirical Research Perspective, Morgan Kaufmann
- Interaction Design Foundation. 2022. Design Thinking
- Lecture notes of Amy Bruckman, Mark Dunlop, Niels Henze, I. Scott MacKenzie, Laura Moody, Albrecht Schmidt, Kami Vaniea

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1

History of HCI

- To avoid mistakes and exploit that worked
- Take inspirations (research is incremental not monumental)

- Timeline of significant events:

1945	1962	1963	1965	1968	1981	1982	1983	1984	1985	1990-2010	1995	2007
•Vannevar Bush publishes "As We May Think" in Atlantic Monthly	•Ivan Sutherland develops *Sketchpad*	•Douglas Engelbart invents the computer mouse	•Eric Johnson invents touchscreen	•Ivan Sutherland invents the first *head mounted display*	•Xerox Star launched	•ACM SIGCHI formed •Mehta, Smith invent multi-touch	•Card, Moran, Newell publish *The Psychology of Human-Computer Interaction*	•Apple *Macintosh* launched	•Lee, Buxton, Smith invent multi-touch tablet	•Personal Digital Assistants (PDAs) and early smartphones	•Fitzmaurice, Ishii, Buxton invent *tangibles*	•Apple introduces *iPhone*

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Memex (As We May Think): Vannevar Bush (1945)

Vannevar Bush. 1945. As We May Think. The Atlantic Monthly 176.1, 101-108.
https://www.youtube.com/watch?v=fIsPFWSYf3c&t=194s

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Memex (As We May Think): Vannevar Bush (1945)

- We think by association when we interact with information-rich environment
  - A stimulus in the ambient environment, printed paper, or user interface stimulates a thought or a reaction that we associate with the stimulus
  - The reaction directs our next impulse to seek information
- Memex machine was designed to catch this associated reaction, allowing users *"to instantaneously retrieve support information for this associated reaction, and the next one, and the next one, and so on, creating a trail through the information store that duplicated and supported the user's natural way of thinking about a topic"* (source)

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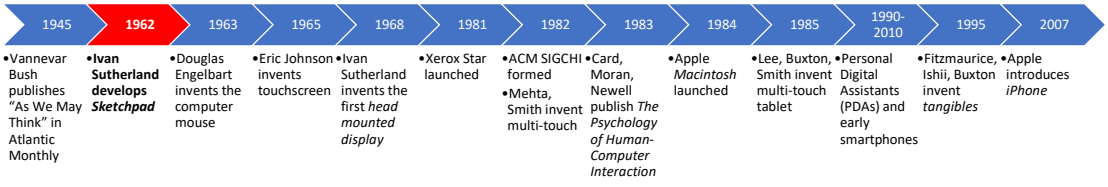
Timeline of Significant Events



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Sketchpad: Ivan Sutherland (1962)

Ivan Edward Sutherland. 1963. Sketchpad: A Man-Machine Graphical Communication System. PhD Thesis, Massachusetts Institute of Technology, United States.
https://www.youtube.com/watch?v=6orsmFndx_o&t=264s

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Sketchpad: Ivan Sutherland (1962)

- Enabled direct manipulation:
  - Visibility of objects
  - Incremental action & rapid feedback
  - Reversibility
  - Exploration
  - Syntactic correctness of all actions
  - Replacing language with action
- Term coined by Ben Shneiderman

Ben Shneiderman. 1983. Direct Manipulation: A Step Beyond Programming Languages. In IEEE Computer, 57-69.

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Computer Mouse: Douglas Engelbart (1963)

Douglas Engelbart's demo at ACM/IEEE's Fall Joint Computer Conference in San Francisco on December 9, 1968.
https://www.youtube.com/watch?v=vv85FSf_6vw

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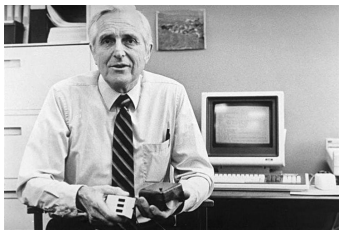
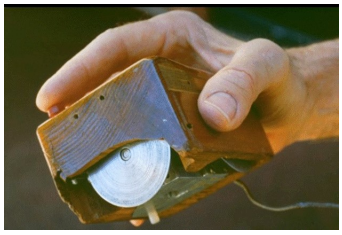
Computer Mouse: Douglas Engelbart (1963)

- The *Mother of All Demos*
- Fatigue with light pen

- Resulted in the first user study in HCI





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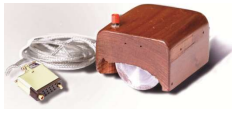
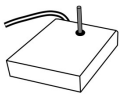
Computer Mouse: HCI's First User Study

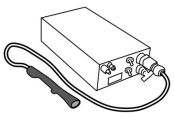
- A comparative evaluation of…



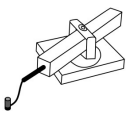
Mouse



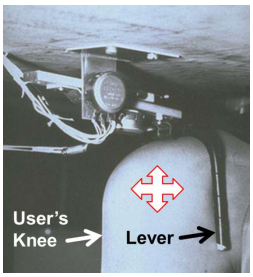
Joystick



Lightpen



Grafacon



Knee-controlled lever

W. K. English, D. C. Engelbart, M. L. Berman. 1967. Display Selection Techniques for Text Manipulation. IEEE Transactions on Human Factors in Electronics, HFE-8(1), 5-15.

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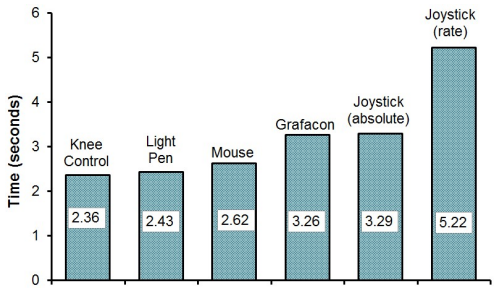
Computer Mouse: Experiment Design

- 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
- Within-subjects, counterbalanced
- Task:
  - Press spacebar, acquire device, position cursor on target, select target



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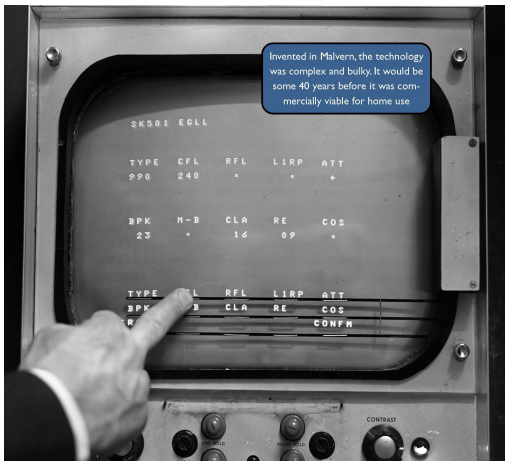
Touchscreen: Eric Johnson (1965)

- Invented by Eric Johnson at Royal Radar Establishment (RRE) in Malvern, U.K.
  - To facilitate quick and accurate decisions and consequent communications in Air Traffic Control duties
  - Supported by the U.K. Artillery and Air Defence for fast reaction to jet aircraft threats

Eric Arthur Johnson. 1965. Touch Display—A Novel Input/Output Device for Computers. Electronics Letters 1.8: 219-220.

Touchscreen: Eric Johnson (1965)

- Used thin copper wires across a computer cathode-ray tube (CRT) to reliably sense when these were touched
- Envisioned various applications, including a keyboard for entering characters
- Did not support multi-touch



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Sword of Damocles: Ivan Sutherland (1968)

Demonstration by Ivan Sutherland
https://www.youtube.com/watch?v=eVUgfUvP4uk

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Sword of Damocles: Ivan Sutherland (1968)

- Primitive in design and interaction
- Displayed output from a computer program in the stereoscopic display
- Perspective changed based on the user's gaze
- Tracked head by attaching the HMD to a mechanical arm suspended from the ceiling of the lab, just like *the Sword of Damocles* anecdote

- Further reading: Dom Barnard. 2019. *History of VR - Timeline of Events and Tech Development*, Virtual Speech

Richard Westall's Sword of Damocles (1812)

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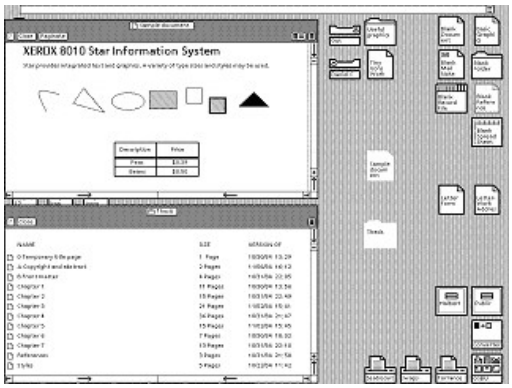
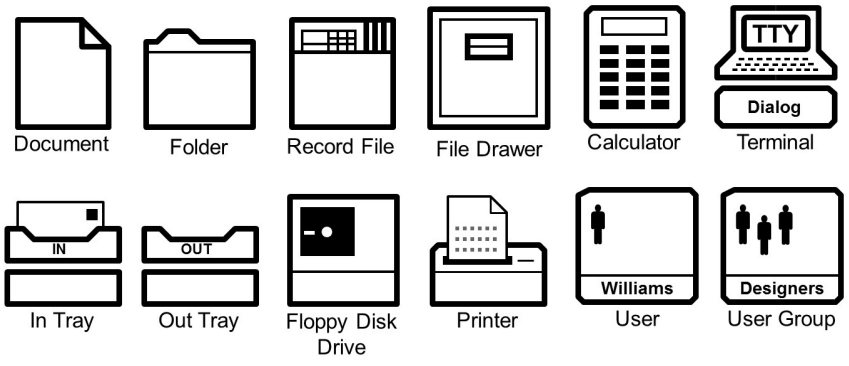
Xerox Star (1981)

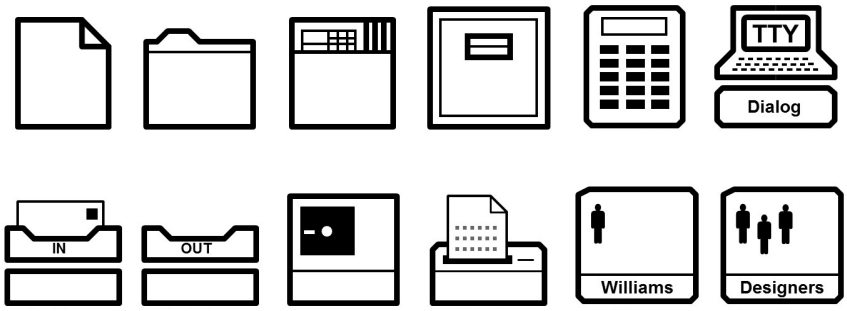
- First commercial PC designed for "business professionals"



Xerox Star (1981): Icons



Xerox Star (1981): Icons



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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.

- Visit http://www.sigchi.org/

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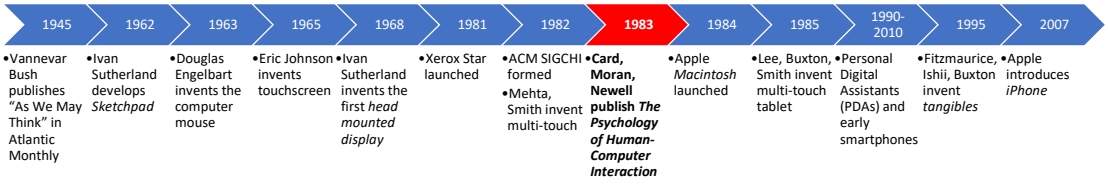
Timeline of Significant Events



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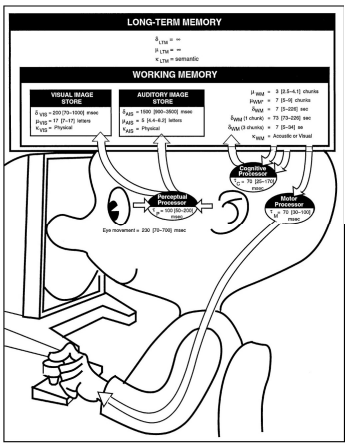
Psychology of HCI: Card, Moran, Newell (1983)

- The model human processor (MHD) calculates how long it takes to perform a certain task
- Other cognitive modeling methods:
  - Parallel design
  - Goals, operators, methods, and selection (GOMS) rules model
  - Keystroke-level model (KLM)
- Hick's law for choice reaction time (1952)
- Fitts' law for rapid aimed movement (1954)



Stuart K. Card, Thomas P. Moran, Allen Newell. 2983. The Psychology of Human-Computer Interaction. CRC Press.

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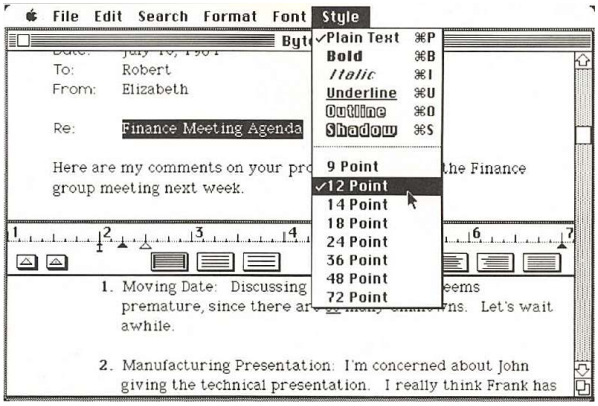
Apple Macintosh (1984)



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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.

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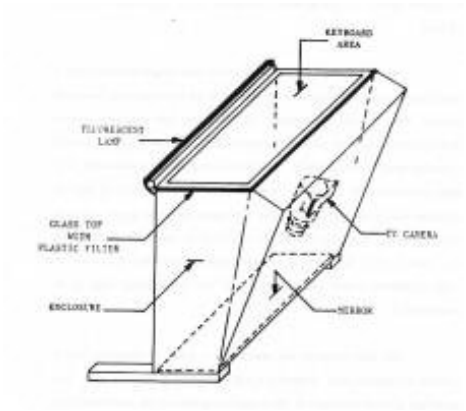
Multi-touch: Mehta, Smith (1982)

- K. C. Smith with MS student Nimish Mehta at the University of Toronto, Canada
- Uses a frosted-glass panel with a white background:
  - When users touched the panel, black spot(s) could be viewed behind the panel with a camera
  - The size of the spots determined touch using image processing algorithms



Nimish Mehta. 1982. A Flexible Machine Interface. MSc Thesis, Department of Electrical Engineering, University of Toronto, Canada. Supervised by K. C. Smith.

Multi-touch: Lee, Buxton, Smith (1985)

- S. K. Lee, William Buxton, K. C. Smith at the University of Toronto, Canada
- Developed a touch tablet capable of sensing an arbitrary number of simultaneous touch inputs
  - Reports both location and degree of touch for each contact point
- Used capacitance in place of optical sensing, hence was thinner and much simpler than camera-based systems

S. K. Lee, William Buxton, K. C. Smith. 1985. A Multi-touch Three Dimensional Touch-Sensitive Tablet. SIGCHI Bull. 16, 4 (April 1985), 21–25.

Multi-touch: Lee, Buxton, Smith (1985)

Demonstration by William Buxton
https://www.youtube.com/watch?v=Arrus9CxUiA&t=4s

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Early Smartphones (1990-2010)

- Enabled mobility
- Increased productivity
- Addictive in nature
  - Danger Hiptop (Japan)
  - Palm
  - Apple Newton
  - Nokia
  - Windows Phone

From Lab Bible

From DigitalSpy

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Tangibles: Fitzmaurice, Ishii, Buxton (1995)

Demonstration by George W. Fitzmaurice
https://www.youtube.com/watch?v=ydy1O7IDzyc

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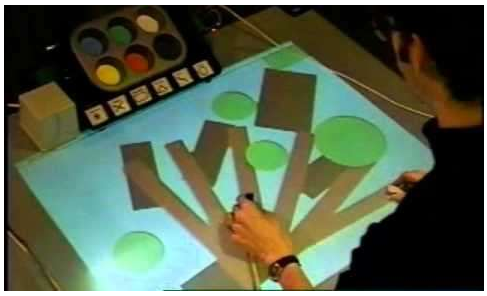
Tangibles: Fitzmaurice, Ishii, Buxton (1995)

- Introduced the concept of *Graspable user interfaces*
  - *Tangible user interfaces*
  - *Tangible bits*
- Allows direct control of electronic or virtual objects through physical handles for control
  - Originally called bricks
    - Tangibles
      - Active and passive
  - Essentially new input devices with new interaction approaches



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iPhone, Apple (2007)

Introduced by Steve Jobs at Macworld San Francisco Keynote Address on January 9, 2007.
https://www.youtube.com/watch?v=MnrJzXM7a6o&t=305s