

## History of HCI

Chaklam Sil-pasuwanchai

### Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

# History of HCI

Chaklam Silpasuwanchai

Asian Institute of Technology

*chaklam@ait.asia*

January 10, 2020

# Homework

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- HW1 is up
- Team forming
- Both due next Friday

# Overview

History of HCI

Chaklam Sil-  
pasuwanchai

Historical  
Context

Introduction

Vannevar Bush's  
"as we may  
think" (1945)

Ivan  
Sutherland's  
Sketchpad  
(1962)

Invention of the  
Mouse (1963)

Xerox Star  
(1981)

Birth of HCI  
(1983)

Graphical User  
Interfaces (GUI)

HCI Research  
Resources

1

## Historical Context

- Introduction
- Vannevar Bush's "as we may think" (1945)
- Ivan Sutherland's Sketchpad (1962)
- Invention of the Mouse (1963)
- Xerox Star (1981)
- Birth of HCI (1983)
- Graphical User Interfaces (GUI)
- HCI Research
- Resources

# Sources

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Mackenzie, Chapter 1, **History Context**, Human Computer Interaction: An Empirical Research Perspective, 1st ed. (2013)
- Shneiderman, **Direct Manipulation: A Step Beyond Programming Languages** (1983)
- Macintosh 128K,  
[https://en.wikipedia.org/wiki/Macintosh\\_128K](https://en.wikipedia.org/wiki/Macintosh_128K)

# Early Days

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- In early days 1940s, computers are too **precious**, too **complicated** that *not* any average humans can interact with computers
- Computers are **secluded** inside locked doors
- Only selected scientists/engineers were allowed to access
  - Most **non-user-friendly** tasks like *grep that requires regular expression* or *vi's editor that lack feedback when switching mode* is *NOT* an issue, because these people are the one **who invent themselves!**
  - Interactions was **not on the minds** of the engineers and scientists who designed, built, configured the early computers
- But by 1980s, everything changes. Computers become not only powerful, but **accessible by anyone!** HCI becomes a very important aspect that are responsible for dramatic shift in computing practices

# Interdisciplinary Nature of HCI

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- HCI owes a lot to older disciplines, just like how every discipline stems from **philosophy**
- The most central is *human factors* or *ergonomics*
  - Indeed, the flagship conference in HCI - *the Association for Computing Machinery Conference on Human Factors in Computing Systems (ACM SIGCHI)* - uses the term
- Human factors is a mix of **science** and **engineering**
  - Concerns **human capabilities**, **limitations**, and **performance**, and with design of systems that are efficient, safe, comfortable, and even enjoyable
  - One need only change *systems* to *computer systems* to leap from human factors to HCI
- However, HCI is not narrowly focused. It is instead very broad in scope. It draws interests from (cognitive psychology and experimental psychology), sociology, anthropology, cognitive science, computer science, and linguistics.

# Notable events in the history of HCI

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

### Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

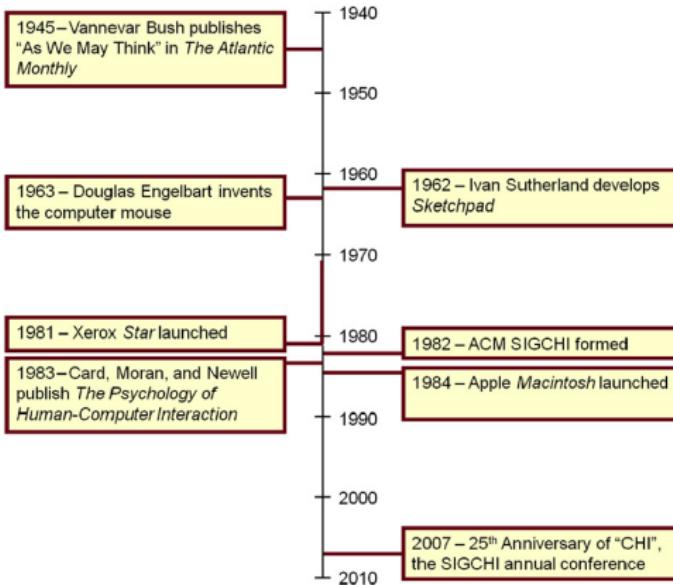


FIGURE 1.1

Timeline of notable events in the history of human-computer interaction HCI.

Figure: Source: Fg 1.1 (Mackenzie)

# Who is Vannevar Bush

History of HCI

Chaklam Sil-  
pasuwanchai

Historical  
Context

Introduction  
Vannevar Bush's  
"as we may  
think" (1945)

Ivan  
Sutherland's  
Sketchpad  
(1962)

Invention of the  
Mouse (1963)

Xerox Star  
(1981)

Birth of HCI  
(1983)

Graphical User  
Interfaces (GUI)  
HCI Research  
Resources



**Figure:** Source: Figure 1.2  
(Mackenzie)

- Bush published a **prophetic essay** "As We May Think" in Atlantic Monthly in July, 1945 (cited 4000+ times)
- Bush was U.S. government's Director of the Office of Scientific Research and scientific advisor to Roosevelt
- During WWII, he leads 6,000 scientists in the application of science to warfare

# Vannevar Bush's Essay (1945)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- His essay concerns the **dissemination, storage, and access** to scholarly knowledge
- Raises the problem of **information overload** and **difficulty** in accessing important knowledge
- Proposes *memex*, which contains a key concept of *associative indexing* - points of interests are connected where selecting one item retrieves other relevant (sounds a lot like **hyperlink** today!)
- Although some other of his ideas appear naive, his brilliant foretelling of our HCI challenges are the beginning of many inspirations to follow (just like how *Doraemon* inspires engineering culture in Japan culture)

# Ivan Sutherland's Sketchpad (1962)

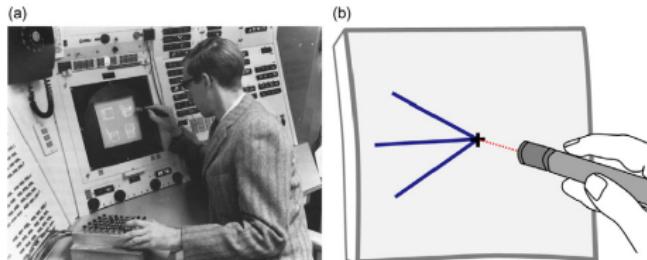


FIGURE 1.3

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

Figure: Source: Fg 1.3 (Mackenzie)

- Developed *Sketchpad* as part of his PhD research in electrical engineering at MIT
- Sketchpad was a graphic system supported the **drawings** of shapes and lines using a **light pen**
- Sketchpad was developed under the usability issues of commands that require expertise and cognitive effort

# First “Direct Manipulation” Interface

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Sketchpad - the first *direct manipulation* interface
- The term “direct manipulation” was coined many years later by Ben Shneiderman
  - Include features like visibility of objects, incrementation action, rapid feedback, reversibility, exploration, syntactic correctness of all actions, and replacing language with action
- Many other direct manipulation systems such as *Dynabook* by Alan Kay of Xerox Palo Alto Research Center soon followed

# Direct Manipulation

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- **Visibility of objects** - continuous representations of objects
- **Incremental action** - action such as mouse selection that incrementally changing the state of the system
- **Rapid feedback** - provides feedback of the action where impact on the object of interest is immediately visible; users can check whether how far from their goal is
- **Reversibility** - can be easily undo and users experience less anxiety in trying; error message is rarely needed
- **Exploration** - permits discovery and learning process, and users gain confidence and mastery - novice to experts
- **Syntactic correctness of all actions** - menus and buttons make sure the systems can limit users to only legal actions
- **Replacing language with action** - directly manipulating the object of interests using pen, touch,, or any other    

# Douglas Engelbart's mouse (1963)

History of HCI

Chaklam Sil-  
pasuwanchai

Historical  
Context

Introduction

Vannevar Bush's  
"as we may  
think" (1945)

Ivan  
Sutherland's  
Sketchpad  
(1962)

Invention of the  
Mouse (1963)

Xerox Star  
(1981)

Birth of HCI  
(1983)

Graphical User  
Interfaces (GUI)

HCI Research  
Resources

- Mouse **symbolizes** the emergence of HCI
- Invented by Douglas Engelbart in 1963, **fundamentally change** the way humans interact with computers
- Engelbart was working at Stanford Research Institute on an hypertext system called NLS. The light pen was not so usable as **user held the pen in the air in front of the display which is tiring**

# Engineering of the Mouse

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

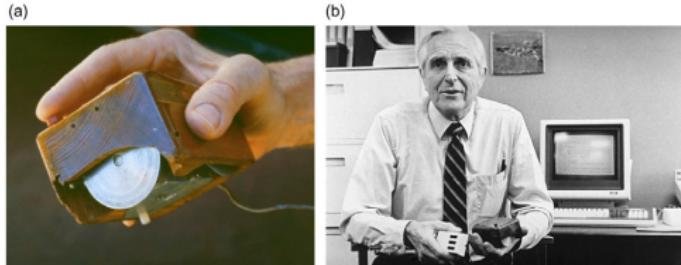


FIGURE 1.4

(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.

Figure: Source: Fg 1.4 (Mackenzie)

- Device besides the keyboard makes most sense
- The first prototype included **one button** and **two wheels** positioned at right angles to each other, marking xy
- A selection button at the user's index finger.
- Later, Engelbart developed a three-button version

# HCI First User Study

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

### Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

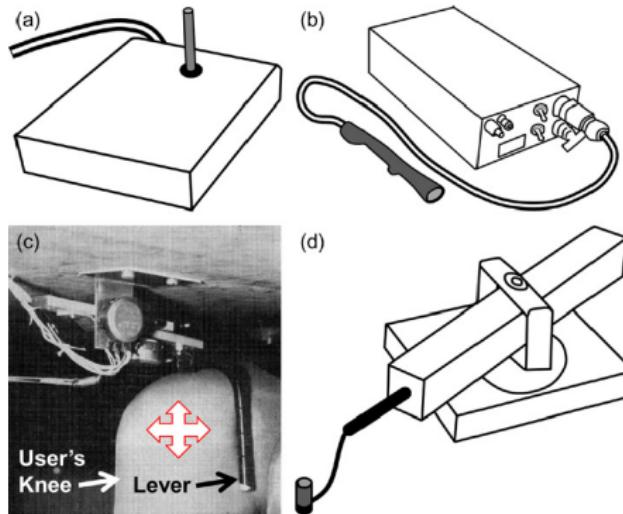
Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources



**FIGURE 1.5**

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

(Source: a, b, d, adapted from English et al., 1967; c, 1967 IEEE. Reprinted with permission)

Figure: Source: Fg 1.5 (Mackenzie)

# HCI First User Study

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Initial testing focus on **selecting** and **manipulating** text
- Engelbart also conducted the first ever “user study” which will later inspire how HCI conducts research
- Engelbart compared **mouse** with
  - Light pen** - selection at pen barrel, pen pointing directing to the object,
  - Joystick** - selection by pressing, moving using stick
  - Knee-controlled lever** - selection by keyboard, moving by knee movements
  - Grafacon** - selection by pressing knobs, moving using extensible arms
- Access time** - the time to move the hand from the keyboard to the device and **Motion time** - the time from the onset of cursor movement to the final selection were measured

# HCI First User Study

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vanavar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

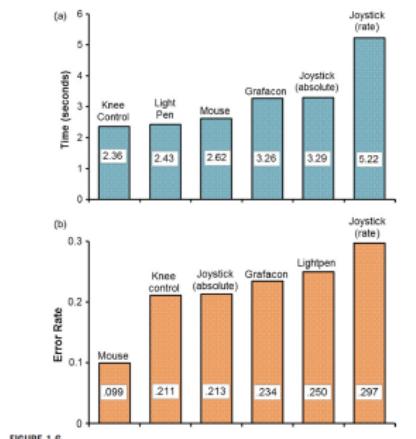


FIGURE 1.6  
Results of first comparative evaluation of a computer mouse: (a) Task completion time in seconds. (b) Error rate as the ratio of missed selections to all selections.  
(Adapted from English et al., 1967)

**Figure:** Source: Fg 1.6 (Mackenzie) - Access time + Motion time = Task Completion time

- Included 13 participants (8 experienced and 3 inexperienced)
- For each trial, a character target appeared, with surrounding distractors
- The trial begin with a spacebar hit, a cursor will appear, and participant move his or her hand to the input device and move the cursor to the target, and make selection
- Ten sequences were conducted

# HCI First User Study

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Although **Knee-controlled lever** is best in terms of time, since Knee-controlled has zero access time, the authors argued that considering only motion time, Knee control does not perform well
- **Light pen** performs slightly better than **mouse**, but because of possible fatigue, mouse will be better in the long run
- **Mouse** is the clear winner in terms of accuracy

# HCI First User Study

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- This mouse evaluation marks an important milestone in empirical research in HCI
  - Detailed description of participants, apparatus, procedure
  - **Input methods** is the **Independent Variable (IV)**, with six levels - mouse, light pen, joystick (position-control), joystick (rate-control), knee controlled lever and Grafacon
  - **Task completion time** and **error rate** are two **Dependent Variables (DV)**
  - To make sure that there are no order effects, **counterbalancing** procedure was used
  - Authors did not do **analysis of variance (ANOVA)** but one needs to know that authors at that time have limited tools at their disposal

# Mouse continue to evolve

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Next published comparative evaluation involving a mouse was by Card, English, and Burr (1978) about 10 years later
- The work was carried out at Xerox PARC and was part of the larger effort to make the first windows-based GUI.
- Considerable refining and reengineering of mouse was done at PARC
  - Most notably, wheels were replaced with a rolling ball assembly, developed by Rider (1974)
- In year 1997, Engelbart receive the ACM Turing Award (similar to Nobel Prize in Engineering) and the ACM SIGCHI Lifetime Achievement Award (1998; 1st recipient).
- Commercialization of mouse starts at 1981, when the Xerox Star was launched

# At the NCC (1981)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources



Figure: Source: Fig 1.7 (Mackenzie)

- **National Computer Conference (NCC)** was the yearly conference for computing. It gathered major players like IBM. The attendance for NCC exceeded 100,000 (Abrahams, 1987)
- In May 1981 at the NCC, **Xerox** attracted a lot of buzz regarding their *Xerox 8100 Star Information System*, the first system to fully featuring windows, icons, menus and a pointing device (WIMP). It supported direct manipulation and what-you-see-is-what-you-get (WYSIWYG) interaction

# Journey of the Star

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- The journey of *Star* began around 1970, when Xerox established its research center, PARC in Palo Alto, CA and in the following year, signed an agreement with SRI licensing Xerox to use Engelbart's invention.
- *Alto*, the *Star*'s predecessor, began in 1972 and include a GUI and mouse. Nevertheless, Alto was never released commercially
- *Star* followed the *Alto*, featuring a novel bit-mapped display, providing rich image (comparing to character-mapped displays), a two-button mouse, and keyboard. Supports ethernet connection. Documents, graphic tables, presentations are supported too

# Star's Desktop Metaphor

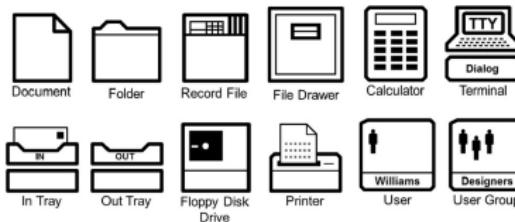


FIGURE 1.8

Examples of icons appearing on the Xerox Star desktop.

(Adapted from Smith, Irby, Kimball, and Harslem, 1982)

Figure: Source: Fg 1.8 (Mackenzie)

- One novel feature of the Star was the use of *desktop metaphor*
- Metaphors** are important in HCI. It allows almost no learning in understanding how to use systems
  - Uses icons like documents, folders, trays, trashcan, calculator, printer, or notepad
- By using **existing knowledge** of a desktop, user has an immediate sense of what to do.

# Star's File Systems

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- To make the system usable, Star focus on **interactions with files, rather than program**. Thus, when user clicked a file, the file should automatically open the associated program
- All these programs are hidden from the users, thus users are not burdened with lots of programs, but instead, work with the more familiar “file-system”

# Star's Direct Manipulation

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Supports point-select interaction
- Previous command-line interfaces had a single channel of input, i.e., specific syntax and commands
- Direct manipulation in Star supports **multiple input channels**, and each channel has a direct correspondent of the task - **display brightness** or **sound** use *slider*, **font size** or **family** use *menu item*
- These direct manipulation channels can be done **in any order** - giving users the sense of **control**
- To implement direct manipulation, systems shifted from *sequential programming* to *event-driven programming*

# Star's GUI

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- To design GUI, PARC lead by Alan Kay developed a new object-oriented programming language known as *Smalltalk* and a software architecture known as Model-View-Controller
- This GUI takes almost 10 years to develop, where a lot of the time was spent on inventing the architecture on which this new style of interaction was built

# Star's commercial failure and Apple II

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

### Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- In the end, Star was not so successful
- Two reasons were identified
  - Star was not really a *personal* computer. PARC viewed Star as a beefed up version of a terminal connected to a central server, i.e., a networked workstation.
  - It was **expensive** - \$16,000
- Anyhow, the *Apple II*, introduced in 1977, was hugely successful. The original retail price was \$1,298 featuring the same components as Star and supports 4KB of ram (but without mouse) thus require typing to launch programs
  - the platform for VisiCalc, the first spreadsheet application which sells over 700,000 copies and become known as the first "killer app"
  - Compared to Xerox, the Star architecture was "closed" - it could only run applications developed by Xerox

# Other personal computers

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Around the same time as Apple II, there were other personal computers include *PET*, *VIC-20*, *Commodore 64*, and *TRS-80*
- However, they were unsuccessful because of their **terrible** user interface. These system worked mostly with traditional command-line interfaces
- Operating Systems usually consisted of BASIC-language interpreter and a console prompt. LOAD, SAVE, RUN, EDIT and few other commands were about it.
- Technical users love these systems but that's it. These systems did not go far.

# Birth of HCI (1983)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- 1983 was possibly among the most notable milestones of HCI and were defined by three important feats:
  - the first **ACM SIGCHI conference**
  - publication of Card, Moran, and Newell's *The Psychology of Human Computer Interaction (1983)*
  - arrival of **Apple Macintosh** in January 1984

# First ACM SIGCHI Conference (1983)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- HCI roots reach as early as 1969, when ACM's *Special Interest Group on Social and Behavioral Computing (SIGSOC)* was formed
- SIGSOC focused on computers in the social sciences, however, the emphasis shifted to user needs
- In 1978, SIGSOC lobbied for a name change and was eventually change to SIGCHI - *Conference on Human Factors in Computing Systems*
- SIGCHI's mission defined as follows where the interdisciplinary nature was evident: *This interdisciplinary group is composed of computer scientists, software engineers, psychologists, interaction designers, graphic designers, sociologists, and anthropologists...brought together by a shared understanding that designing useful and usable technology is an interdisciplinary process, and believe....(can) transform persons' lives.*

# First ACM SIGCHI Conference (1983)

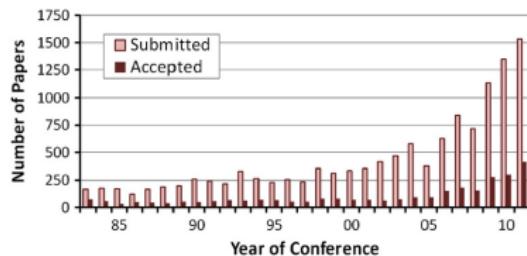


Figure: Source: Fg 1.9 (Mackenzie)

- The **first SIGCHI conference** was held in Boston with 59 technical papers presentations.
- Since then, SIGCHI is widely known as CHI (k sound) and has attendance of about 2,500 people
- CHI publication has since becomes the standard of HCI academia in many universities for faculty position
- Research papers in CHI is peer-reviewed and competitive. Statistics from 1982 to 2011 indicate a total of 12,671 paper submissions with 3,018 acceptances, for an overall acceptance rate of 24 percent.

# First ACM SIGCHI Conference (1983)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- CHI papers usually have **high visibility**, and thus has a tendency to have **high citations**
- In contrast to other fields, CHI proceedings are much **more valuable** than most HCI journals
- Feel free to check the impact at **Google Scholar h5-index** in the field of HCI (search “google scholar HCI”)
- Along the way, there were establishments of other venues, including tier-1 journals for HCI - *TOCHI (ACM)*, *HCI* (Taylor and Francis) and tier-1 conferences such as *User Interface Software and Technology (UIST)*
- Let's look at some promotional video of CHI 2019 (can be found in Youtube channel of SIGCHI)

# The Psychology of Human-Computer Interaction (1983)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- This book emerged from work done at Xerox PARC
- Card and Moran arrived at PARC in 1974 and soon joined PARC's *Applied Information-Processing Psychology Project (AIP)*, where Newell, a professor of computer science and cognitive psychology at CMU was a consultant
- The project was “to create an applied psychology of HCI” by conducting requisite basic research
- Applied psychology is about applying the knowledge of human sensory, cognitive and motor systems to HCI.
- Often, in 1980s, computer science students found it challenging developing intuitive interfaces. Thus, for many students, Card, Moran, and Newell's book was eye-opening, featuring a formalized understanding of human perceptual input (the time to visually perceive a stimulus), cognition (time to react) and motor input (time to move the hand to a target)

# Model Human Processor

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Card, Moran and Newell proposed *Model Human Processor* (MHP), describing the connection between low-level human processes and computer interactions
- The MHP had an **eye** and a **ear** (for sensory input to a perceptual processor), a **brain** (with a cognitive processor, short-term memory, and long-term memory), and an **arm**, **hand**, and **finger** (for motor responses)
- MHP is the first but not the last model to show that **human behavior can be understood, or even modeled**, as an information processing activity

# Model Human Processor

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

### Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

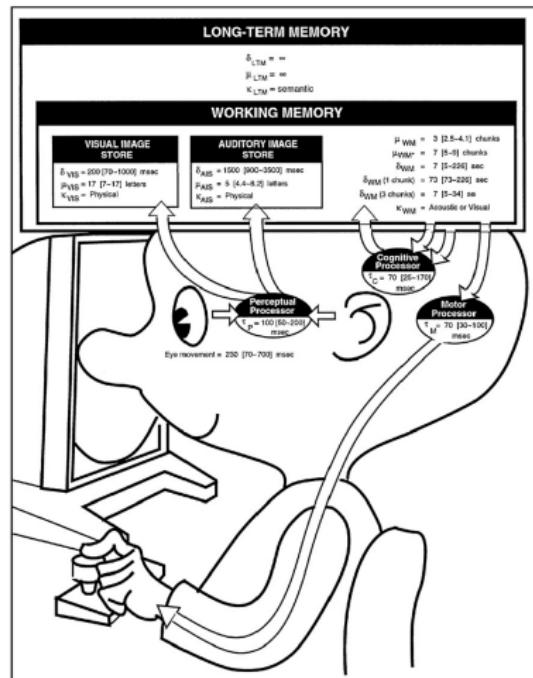


Figure: Source: Fg 1.11 (Mackenzie)

# The use of MHP

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- For example, suppose a user types "hello" on some predictive text-entry system (T9). After entering 4(GHI), 3(DEF), 5(JKL), 5(JKL), 6(MNO), a word appears on the display. If the word matches what the user wants, he select the word. If isn't, he swipe to next word. What is the task completion time between signal and response for the matching case? (Card et al., 1983, p. 66)
- We can **use MHP to model the task completion** time. Here there are four low-level processing cycles: a perceptual processor cycle  $t_p$  (look at the word), two cognitive processor cycles  $t_c$  (think whether it matches, and then have decided it's a yes) and a motor processor cycle  $t_m$  (tell the hand to select). For each value, it is bracketed by an expected minimum and maximum, where these values were obtained through basic research.

$$\begin{aligned}t_{\text{total}} &= t_p + 2 \times t_c + t_m \\&= 100 [50, 200] + 2 \times 70 [25, 170] + 70 [30, 100] \\&= 310 [130, 640] \text{ msec.}\end{aligned}$$

# HCI models

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Most prominent models of human behaviors include **keystroke-level model (KLM), goals, operators, methods, and selection rules models (GOMS), Hick's law for choice reaction time (Hick, 1952) and Fitts' law for rapid aimed movement (Fitts, 1954)**. More on it on week 11.
- Model is powerful because it allows a better understanding of **relationships** (descriptive models) or a **quantitative prediction** (predictive models).
- Current research is about using these models as **cost functions** for optimizations

# Launch of the Apple Macintosh (1984)

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources



Figure: Source: Fg 1.12 (Mackenzie)

# Launch of the Apple Macintosh (1984)

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Apple Macintosh was launched in January 22, 1984, selling at \$2,495. Sold 70,000 unit by May 3, 1984
- The most obvious difference between Apple II and Macintosh was the **one-button mouse**, instead of only using the keyboard
- While Apple II used a text-based operating systems, the Macintosh used **MacOS** where rather than typing program to run things, you **click on their icons**
- Macintosh featured 128KB Ram, and for storage, it introduced **3.5 inch disks** that stored 400K (later 800K then 1.44MB), enough to store the System Software, an application, and files of the application. One need to swap disks for more applications. Harddisks were optional
- Bundled with System, Finder, MacPaint, MacWrite, MacProject, MacTerminal, and Microsoft Word

# Growth of HCI and GUIs

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Microsoft was a latecomer in GUIs. Early version of Microsoft *Windows* appeared in 1985, but it was not until *Windows 3.0* (1990) and *Windows 3.1* (1992) that Microsoft became a real threat to Mac
- Major **universities** offered courses in HCI or user interface (UI) design, with graduate students often choosing HCI as topic for their thesis research
- **Companies** also paid great effort in their HCI departments after realizing that designing good user interfaces was good business
- **SIGCHI conferences** remain the main driver along with **industry specialists** in advancing the field of HCI

# Growth of HCI research

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)  
Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Research interests in HCI was about **quality**, **effectiveness**, and **efficiency** of the interface. How **accurately** and **quickly** can people do common tasks using a GUI vs. command-line interface? Given two implementations of GUI, which one is **quicker** or **accurate**?
- Empirical research (also known as formal approach) are commonly used. **Qualitative/Heuristic** evaluation are also used but are often debated how “objective” these methods are, and how it depends on ones’ interpretations rather than on factual measurements. **Bio-signals metrics** are proposed as alternative for more objective measurement of emotions, cognitions, and behaviors

# Growth of HCI research

## History of HCI

Chaklam Sil-pasuwanchai

## Historical Context

Introduction  
Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- A classic example of early days is on the **design of menus**. Menus require *recognition*, while typing requires *recall*
  - *If there are many items in Menus, how should they be organized? One way to organize is to use hierarchy that includes depth and breadth. But if we used an hierarchy, what is the best hierarchy.*
  - *How menu items should be ordered? Alphabetically or by function?*
  - *Is access improved if an icon is added to the label?*
  - *Is there a depth versus breadth advantage for menus on mobile devices?*
  - *Can menu be pie shaped?*
- Although most of these answers were addressed, the **spirit of HCI research** remains similar to above questions.

# Online Resources

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- ACM Digital Library - <http://dl.acm.org>
- HCI pioneers - <https://hcipioneers.wordpress.com/>
- ACM Interactions - <http://interactions.acm.org/>
- HCI Bibliography - <http://www.hcibib.org/>
- Textbook - <http://www.yorku.ca/mack/HCIbook/>
- Human Computer Interaction - **Brief Intro by John Carroll**, <https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-edition/human-computer-interaction-brief-intro>

# Readings For Next Week

History of HCI

Chaklam Sil-pasuwanchai

Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

- Norman, **The Design of Everyday Things**, Revised and Expanded ed. (2013)
- Shneiderman, **Designing the User Interfaces**, 6th ed. (2016).
- Steve, **Don't Make Me Think: A Common Sense Approach to Web Usability**, 2nd ed. (2006).
- Keith, Chapter 4, 6, 7, **Human Computer Interaction Course Notes**, Graz University (2017) -  
<https://courses.isds.tugraz.at/hci/hci.pdf>
- Jeff, **Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines**, 2nd ed. (2014).

## History of HCI

Chaklam Sil-pasuwanchai

### Historical Context

Introduction

Vannevar Bush's "as we may think" (1945)

Ivan Sutherland's Sketchpad (1962)

Invention of the Mouse (1963)

Xerox Star (1981)

Birth of HCI (1983)

Graphical User Interfaces (GUI)

HCI Research Resources

# Questions