Human-Computer Interaction

Introduction to HCI

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What is HCI?

- Minimalist definition:

  “HCI is the science that studies the relationship between humans and computers”

- Diverse perspectives/motivations:
  - Computational
  - Psychological / Cognitive
  - Social / Cultural
  - Economic
  - Philosophical

What is HCI?

- Goal: to facilitate the communication between two complex systems:
  - The computer
    - Data structures
    - Communications
    - Algorithms
  - The human
    - Senses / Cognition
    - Emotions
    - Previous experiences / Culture

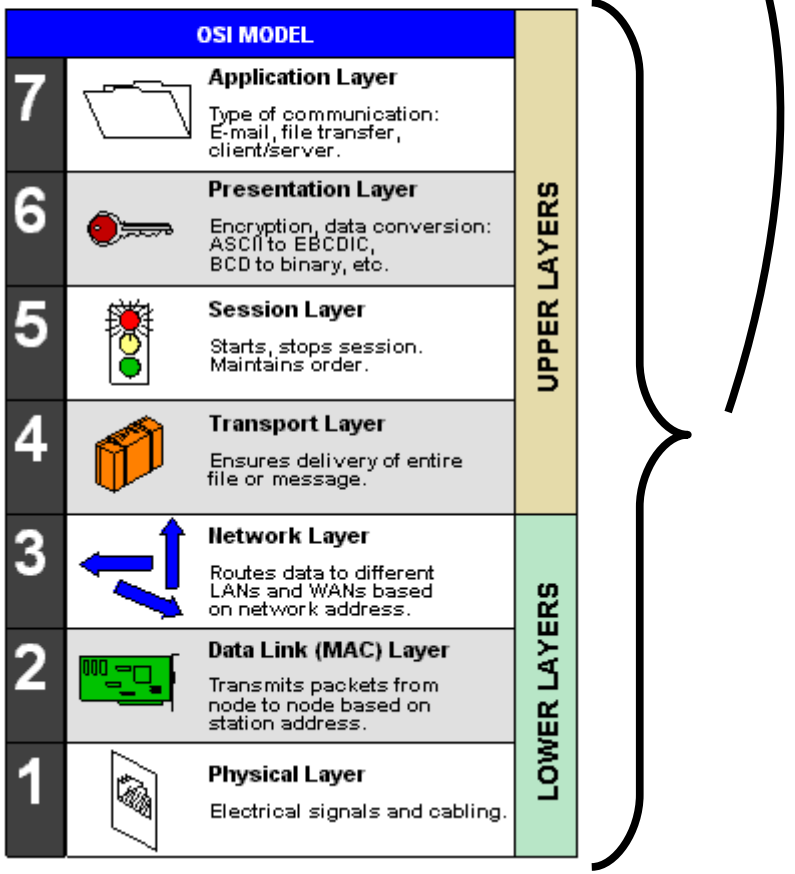
Challenges

- Both humans and computers have different skills and behavior

HUMAN	COMPUTER	Example
Creative	Non-creative	Brainstorming
Flexible	inflexible	“looks like...”
Weak memory	Reliable memory	Memorize bank account numbers
inductive	deductive	Is this a dog?
Slow calculation	Fast calculation	Decimals of pi

Scope of action for HCI

“Layer 8”



- “Layer 8 error”
- “ID10T error”
- “PICNIC”
  - (“Problem In Chair, Not In Computer”)

- RSA Security:
  - Layer 8: Human
  - Layer 9: Organization
  - Layer 10: External/Legal

Importance of HCI

- 50%+ of code is consecrated to interface
  - With consequent cost and effort during development

- Poor interface restrict the real use of the system
  - Regardless of its features
  - Market competition on user-friendless

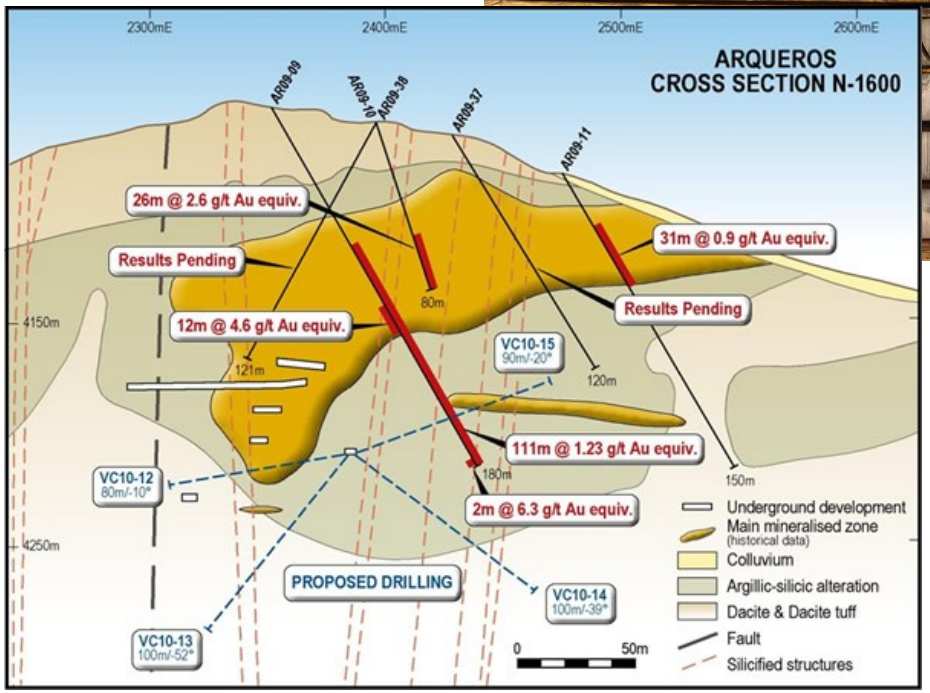
Importance of HCI

- Social and economic impact
  - Speed and accuracy of data entry
  - Error-proof design: money savings
  - Impact due to mass use of technology

- As technology spreads, it is available to more non-expert users

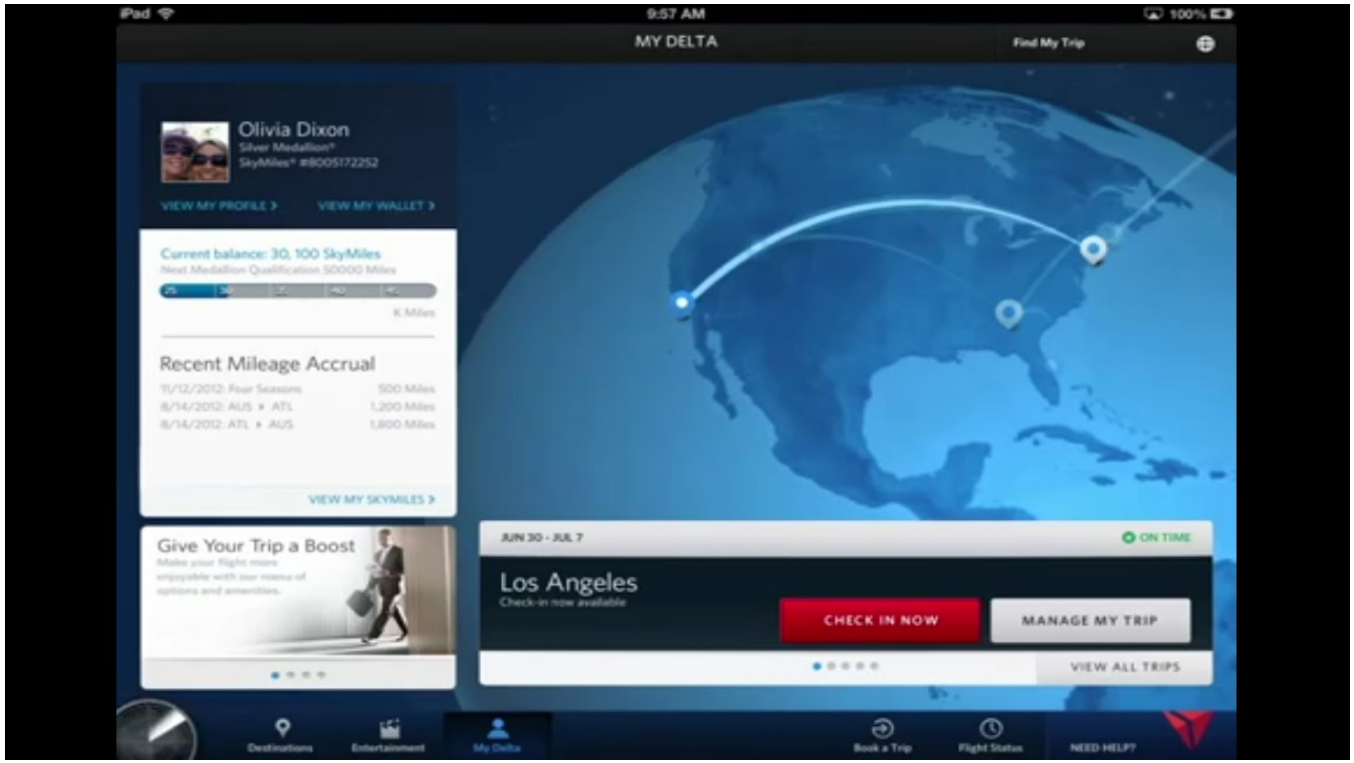
HCI: Impact on productivity

- Example: Core mapping (geology)



HCI: Impact on value

- Example: satisfies needs of a traveller ***experience***
  - (So travellers are ready to pay for it)
  - Fly Delta for iPad
    - (https://www.youtube.com/watch?v=LXMKNojKwg0)



HCI: Social Impact

- Example: videoconferences

HCI: Impact on software

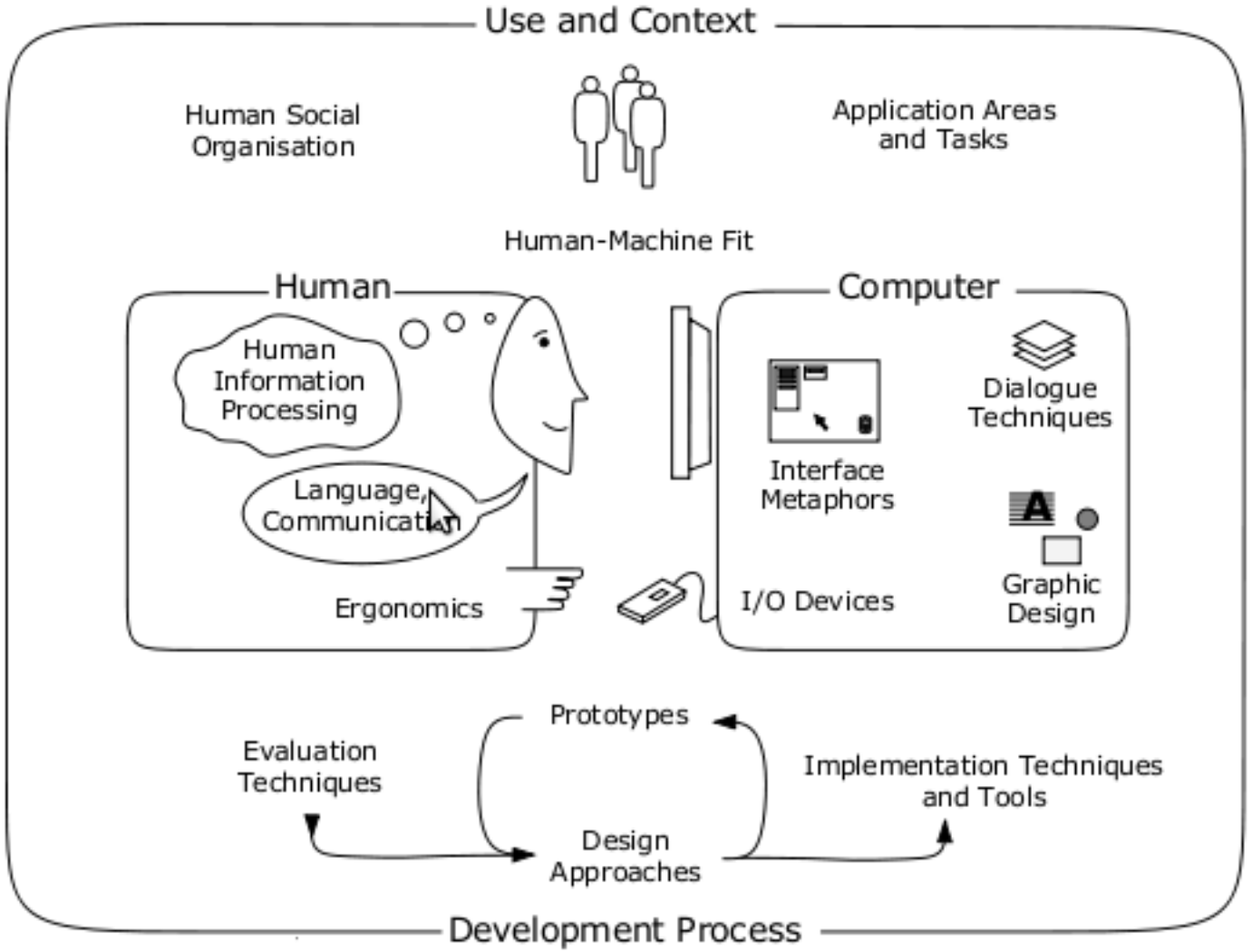
- Example: query redesign on DBs
  - To decrease idle times
  - To allow collaborative work

HCI: more than keyboard/screen/mouse

- Plenty of interfaces
- Addressed to different senses

https://www.youtube.com/watch?v=azwL5eoE5aI

HCI: General vision



(Source: Keith Andrews, 2016)

Clarifying buzzwords

- Human-Computer Interaction
- Human-machine interaction
- Man-machine interaction
- User experience (UX) design
  - https://www.youtube.com/watch?v=IYWOzxVCTao&t=21s
  - https://www.youtube.com/watch?v=SRcBsoYwNgI
- User Interface (UI) design
  - https://www.youtube.com/watch?v=Q5763pPchvw
  - https://www.youtube.com/watch?v=r34XQDoZ0y0
- Human-centered design
- User-driven design

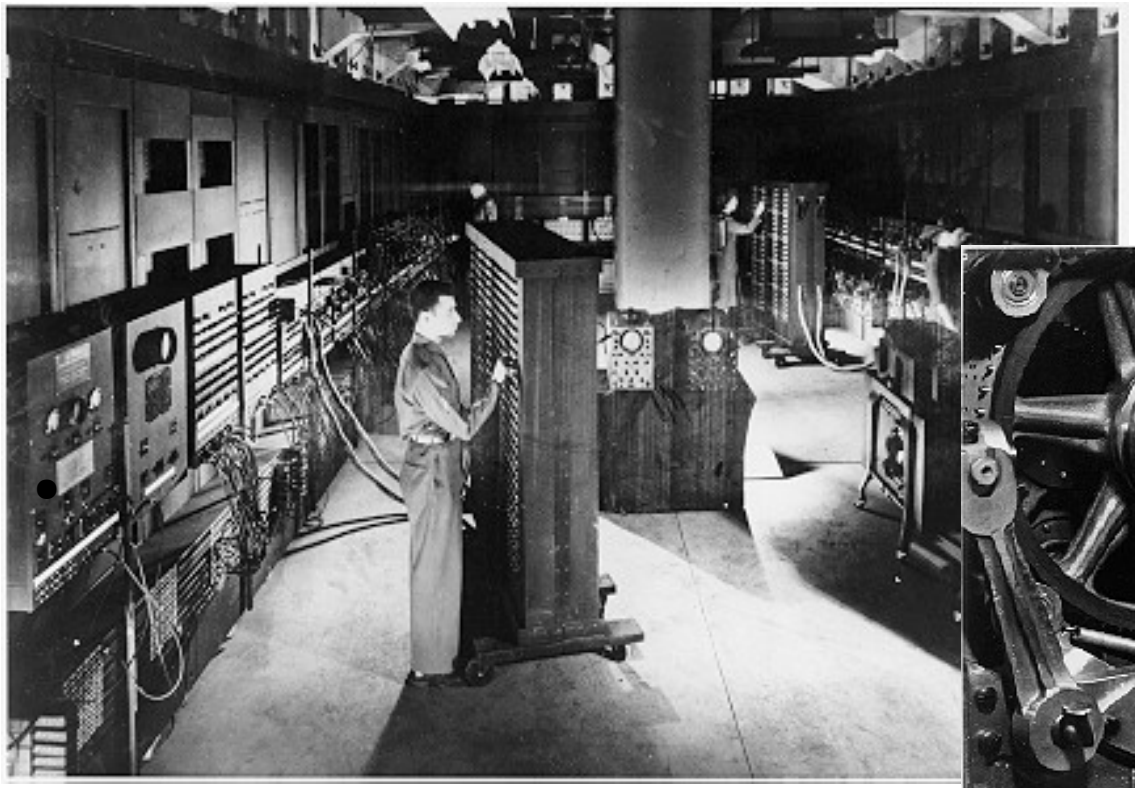
HCI: Associated tasks

- To detect difficulties in Human-Computer communication

- To adapt/improve whatever it takes:
  - **Computational system**: query optimization, add multimedia management, include 'intelligence', etc.
  - **Interface**: adapt them to senses (sight, touch, etc.)
  - **Human**: training, manuals, mental models, etc.

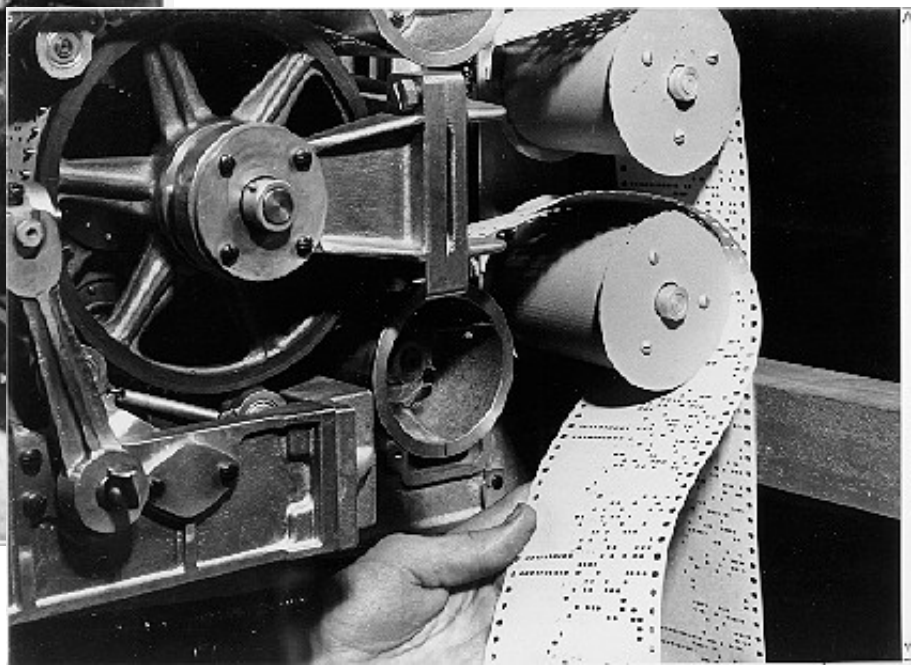
A bit of history

- In the beginning...
  - Computers were for specialists
  - **Interfaces**: wires, lights, punched tape



Eniac, 1943

Mark I, 1944



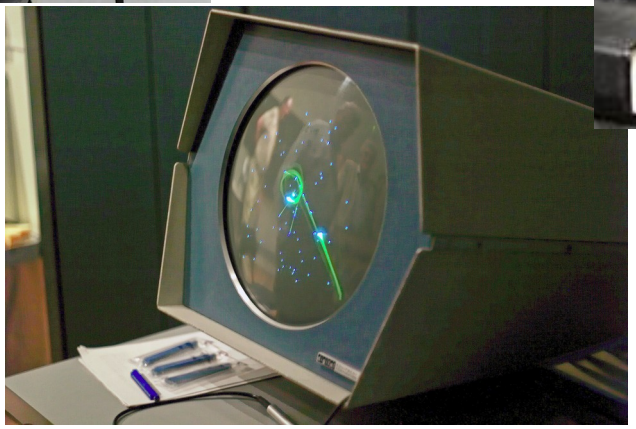
Monitors

- Original problem: The display required as much memory as the computer

OA-1008 (SAGE defense system, 1958) with a light pen

Tektronix 4010, 1972

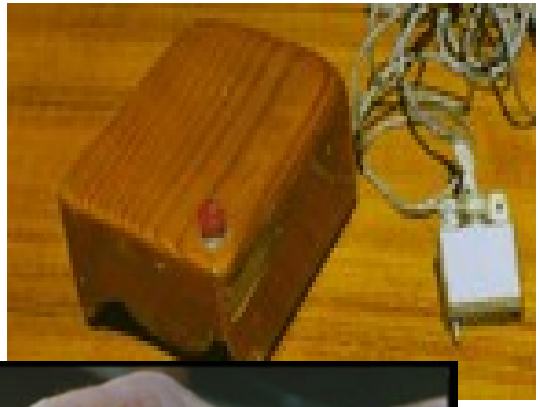
DEC VT52, 1975

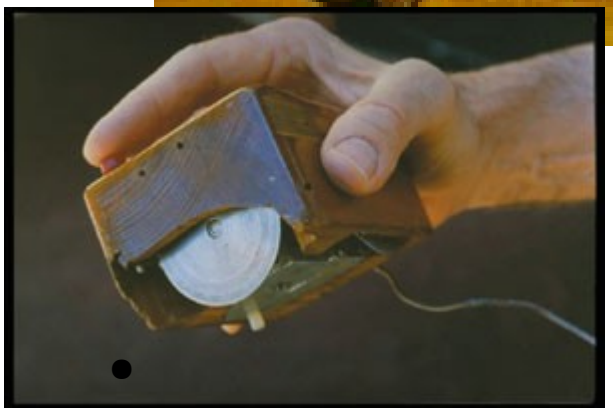


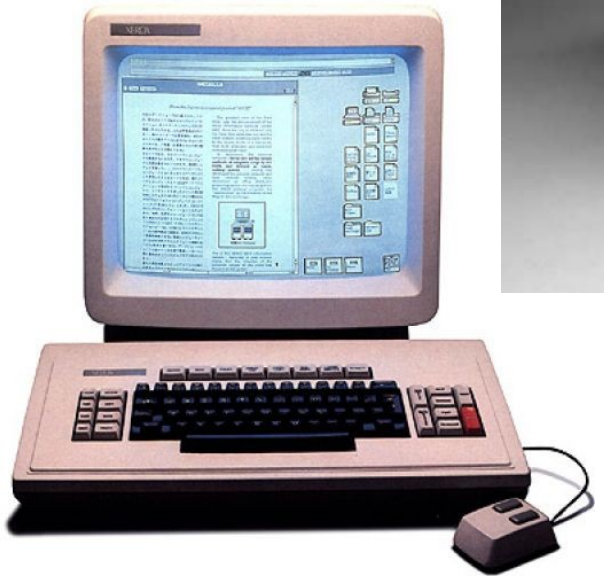
PDP playing Spacewar!, 1961

A bit of history

- Other devices: **Mouse**
  - Patent: Douglas Engelbart, 1964
  - First commercial version: Xerox Star 8010, 1981
  - Popularization: Apple Macintosh, 1984 (“If you can point, you can use a Macintosh”)

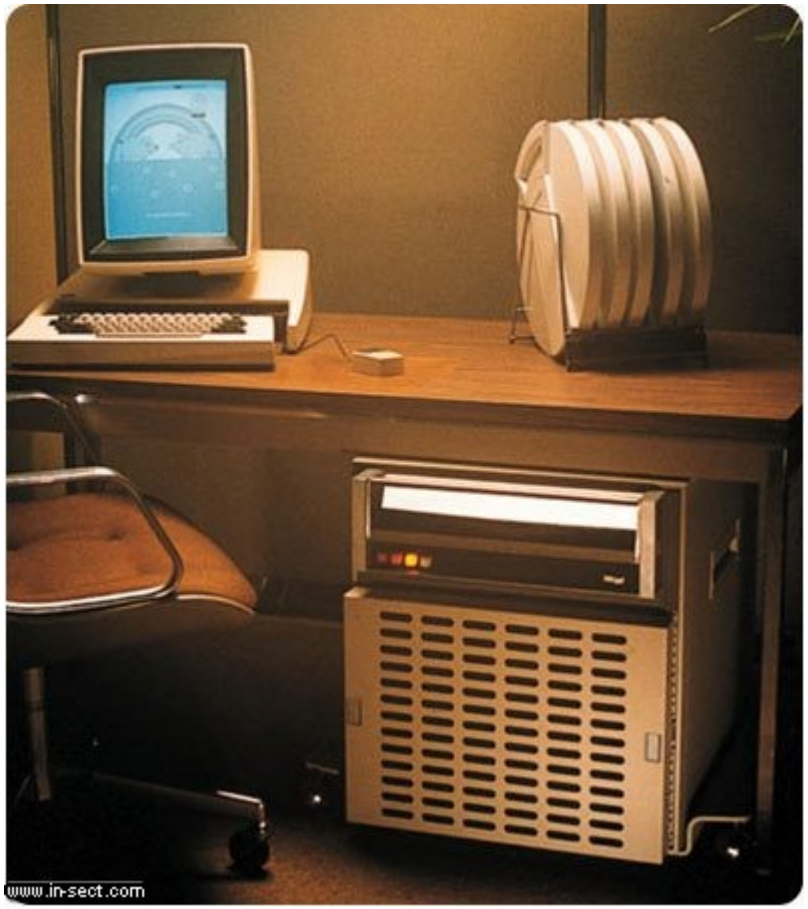


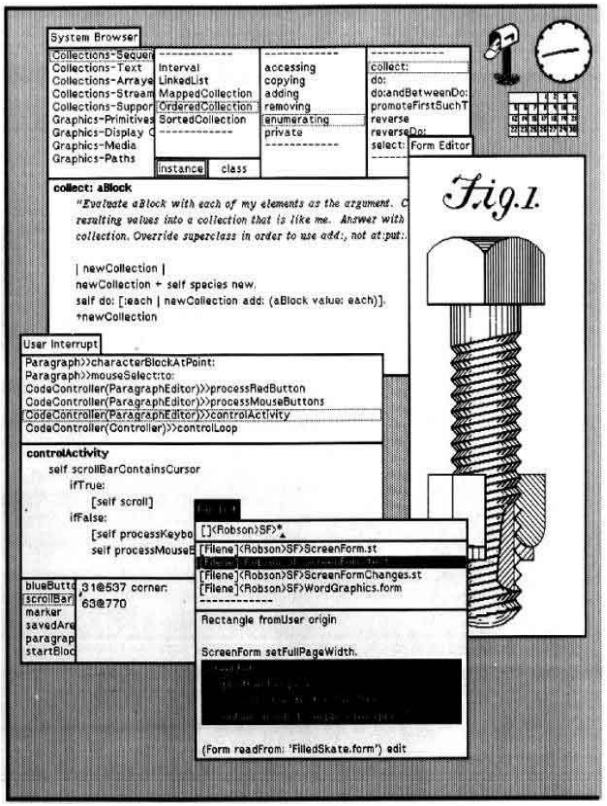




A bit of history

- Xerox Alto, 1973 (experimental computer):
  - The desktop metaphor is born
  - GUI WIMP: Windows, Icon, Menu, Pointing device





A bit of history

- 1980s: the computer became personal
- 1981: launch of **IBM PC** (5150)
  - 16 kB RAM, 40 kB ROM, without hard disk drive, PC-DOS v1.0

A bit of history

- WWW born at CERN, 1991
- 1995- Browser war
- YouTube 2005
- Other applications
  - Voice recognition
  - Virtual reality
  - Face recognition
- Diversity of platforms
  - Smartphones
  - Integration: PDAs, cellphones, video, games
- Mobile OS war: Android, iOS, ... (2011-)
- Gesture interaction (Wii, Kinect, etc.)
- Wearable computer: Google Glass
- Low-cost VR kits: Oculus Rift
- Augmented Reality: Pokemon GO
- IoT: natural interaction, everywhere

Usability

- A good design provides the functionalities that the user need in order to reach their goals (***functionality***)
- A good design is ***easy to use***:
  - Easy to **learn**
    - How long a user takes to learn it?
    - How intuitive is it? It accords to some metaphor?
    - Are manuals needed? Are features easy to remember?
    - Steep learning curve?
  - Easy to **use**
    - Use efficiency: ~“mouse clicks”
    - Provide context: let the user know in which part of the system is her
    - Perceptible affordance

Usability factors

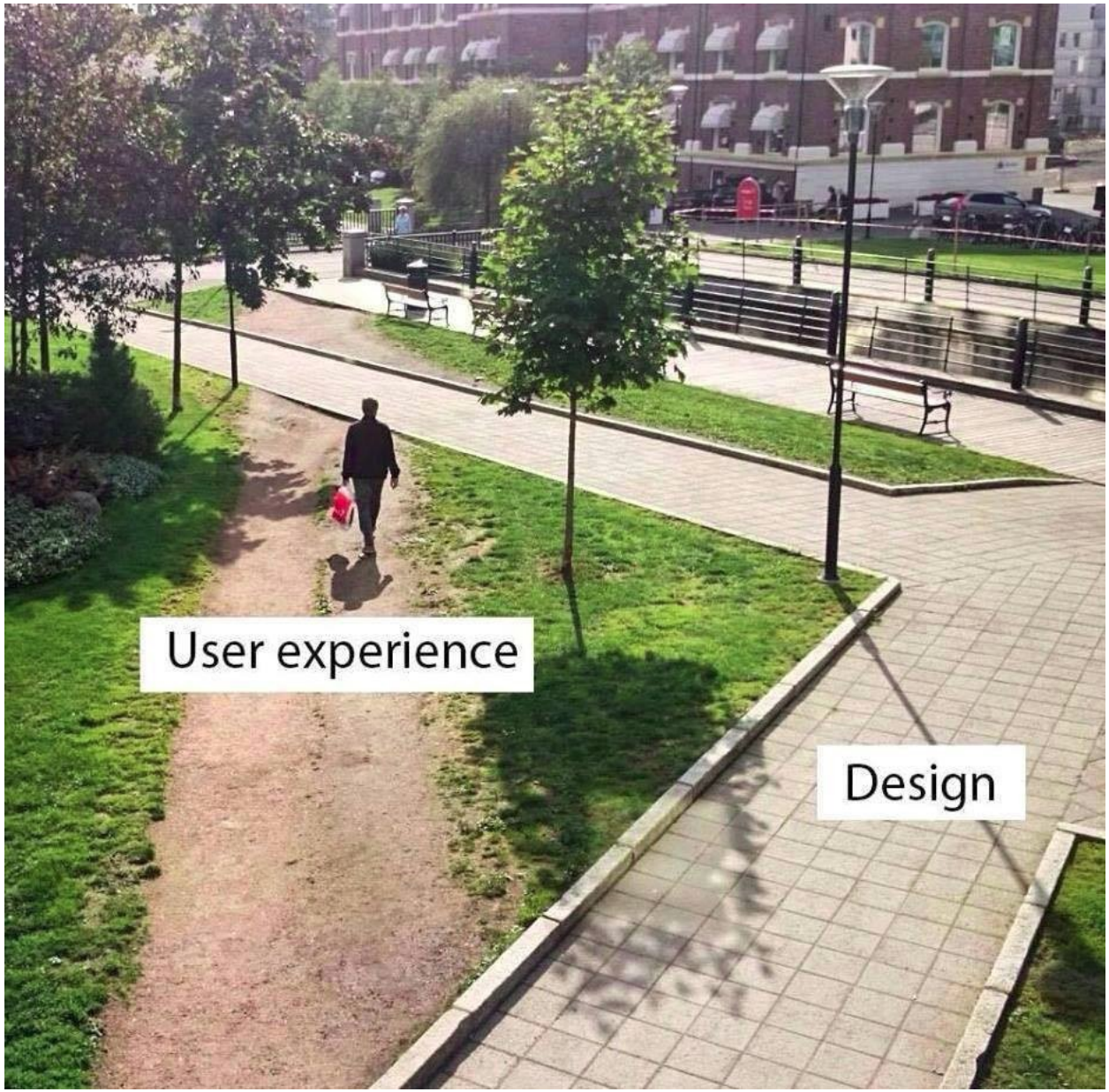
- **Fit to use**
  - Do the system provide the needed functionalities?
- **Learnability**
  - How long it takes to use the system properly?
- **Task efficiency**
  - Number of clicks, item distribution in menus, time to perform some task, ...
- **Ease to remember**
  - If not used often, can a user remember how to deal with the system?
- **Subjective satisfaction**
  - How satisfied is the user with the system
- **Ease of understanding**
  - It proposes a clear mental model

Usability evolution

- Formerly, programmers wrote the code and ***cover*** it with interfaces
  - Later, manuals were written, to teach users to use a poor designed system
  - ***People had to adapt to user interface***

- Nowadays, interface design has a key role
  - Market competition: users have a higher power of choice
  - Is not rare to design the interface first (prototypes) and then build the rest of the software
  - ***Now, user interfaces must adapt to people, moreover, they must provide a pleasant experience***

Expectations vs reality



A USER INTERFACE IS LIKE A JOKE.
IF YOU HAVE TO EXPLAIN IT,
IT'S NOT THAT GOOD.

Summary

- HCI: Study of the relationship between humans and machines
- HCI goal: to provide **usability** and **experience**
- Goal: Build intuitive interfaces adapted to user's and business needs
- HCI is a multidisciplinary field of study
- Economic importance
- This course involves:
  - Theory and practice
  - Application to traditional and research domains
  - Individual and teamwork