HUMAN-COMPUTER INTERACTION THIRD EDITION

DIX FINLAY ABOWD BEALE

chapter 4

# paradigms

## why study paradigms

Concerns

- how can an interactive system be developed to ensure its usability?
- how can the usability of an interactive system be demonstrated or measured?

History of interactive system design provides paradigms for usable designs

## What are Paradigms

- Predominant theoretical frameworks or scientific world views
  - e.g., Aristotelian, Newtonian, Einsteinian (relativistic) paradigms in physics
- Understanding HCI history is largely about understanding a series of paradigm shifts
  - Not all listed here are necessarily "paradigm" shifts, but are at least candidates
  - History will judge which are true shifts

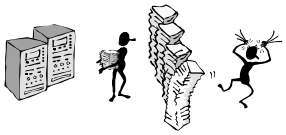
## Paradigms of interaction

New computing technologies arrive, creating a new perception of the human—computer relationship.

We can trace some of these shifts in the history of interactive technologies.

## The initial paradigm

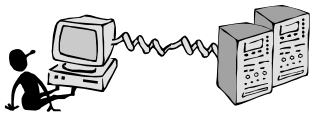
- Batch processing



*Impersonal computing*

## Example Paradigm Shifts

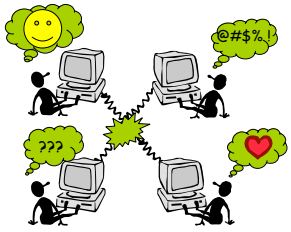
- Batch processing
- Time-sharing



*Interactive computing*

## Example Paradigm Shifts

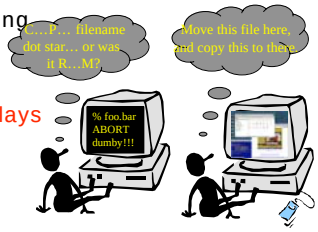
- Batch processing
- Timesharing
- Networking




*Community computing*

## Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical displays




*Direct manipulation*

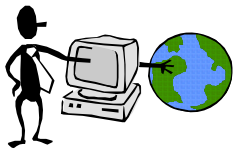
## Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor

*Personal computing*

## Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor
- WWW

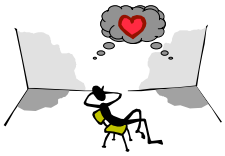


*Global information*

## Example Paradigm Shifts

- Batch processing
- Timesharing
- Networking
- Graphical display
- Microprocessor
- WWW
- Ubiquitous Computing

- A symbiosis of physical and electronic worlds in service of everyday activities.



## Time-sharing

- 1940s and 1950s – explosive technological growth
- 1960s – need to channel the power
- J.C.R. Licklider at ARPA
- single computer supporting multiple users

## Video Display Units

- more suitable medium than paper
- 1962 – Sutherland's Sketchpad
- computers for visualizing and manipulating data
- one person's contribution could drastically change the history of computing

## Programming toolkits

- Engelbart at Stanford Research Institute
- 1963 – augmenting man's intellect
- 1968 NLS/Augment system demonstration
- the right programming toolkit provides building blocks to producing complex interactive systems

## Personal computing

- 1970s – Papert's LOGO language for simple graphics programming by children
- A system is more powerful as it becomes easier to user
- Future of computing in small, powerful machines dedicated to the individual
- Kay at Xerox PARC – the Dynabook as the ultimate personal computer

## Window systems and the WIMP interface

- humans can pursue more than one task at a time
- windows used for dialogue partitioning, to "change the topic"
- 1981 – Xerox Star first commercial windowing system
- windows, icons, menus and pointers now familiar interaction mechanisms

## Metaphor

- relating computing to other real-world activity is effective teaching technique
  - LOGO's turtle dragging its tail
  - file management on an office desktop
  - word processing as typing
  - financial analysis on spreadsheets
  - virtual reality – user inside the metaphor
- Problems
  - some tasks do not fit into a given metaphor
  - cultural bias

## Direct manipulation

- 1982 – Shneiderman describes appeal of graphically-based interaction
  - visibility of objects
  - incremental action and rapid feedback
  - reversibility encourages exploration
  - syntactic correctness of all actions
  - replace language with action
- 1984 – Apple Macintosh
- the model-world metaphor
- What You See Is What You Get (WYSIWYG)

## Language versus Action

- actions do not always speak louder than words!
- DM – interface replaces underlying system
- language paradigm
- interface as mediator
- interface acts as intelligent agent
- programming by example is both action and language

## Hypertext

- 1945 – Vannevar Bush and the memex
- key to success in managing explosion of information
- mid 1960s – Nelson describes hypertext as non-linear browsing structure
- hypermedia and multimedia
- Nelson's Xanadu project still a dream today

## Multimodality

- a mode is a human communication channel
- emphasis on simultaneous use of multiple channels for input and output

## Computer Supported Cooperative Work (CSCW)

- CSCW removes bias of single user / single computer system
- Can no longer neglect the social aspects
- Electronic mail is most prominent success

## The World Wide Web

- Hypertext, as originally realized, was a closed system
- Simple, universal protocols (e.g. HTTP) and mark-up languages (e.g. HTML) made publishing and accessing easy
- Critical mass of users lead to a complete transformation of our information economy.

## Agent-based Interfaces

- Original interfaces
  - Commands given to computer
  - Language-based
- Direct Manipulation/WIMP
  - Commands performed on "world" representation
  - Action based
- Agents - return to language by instilling proactivity and "intelligence" in command processor
  - Avatars, natural language processing

## Ubiquitous Computing

*"The most profound technologies are those that disappear."*

Mark Weiser, 1991

Late 1980's: computer was very apparent

How to make it disappear?

- Shrink and embed/distribute it in the physical world
- Design interactions that don't demand our intention

## Sensor-based and Context-aware Interaction

- Humans are good at recognizing the "context" of a situation and reacting appropriately
- Automatically sensing physical phenomena (e.g., light, temp, location, identity) becoming easier
- How can we go from sensed physical measures to interactions that behave as if made "aware" of the surroundings?