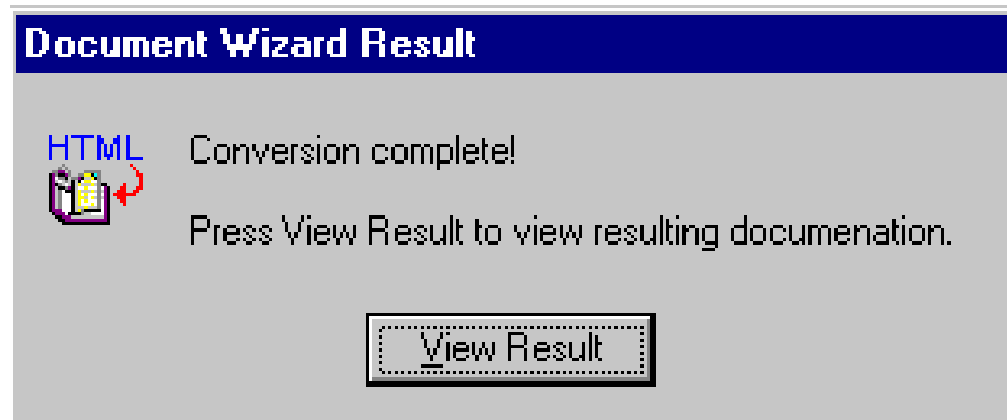

Human Computer Interaction

HCI Paradigms

Lecture # 6

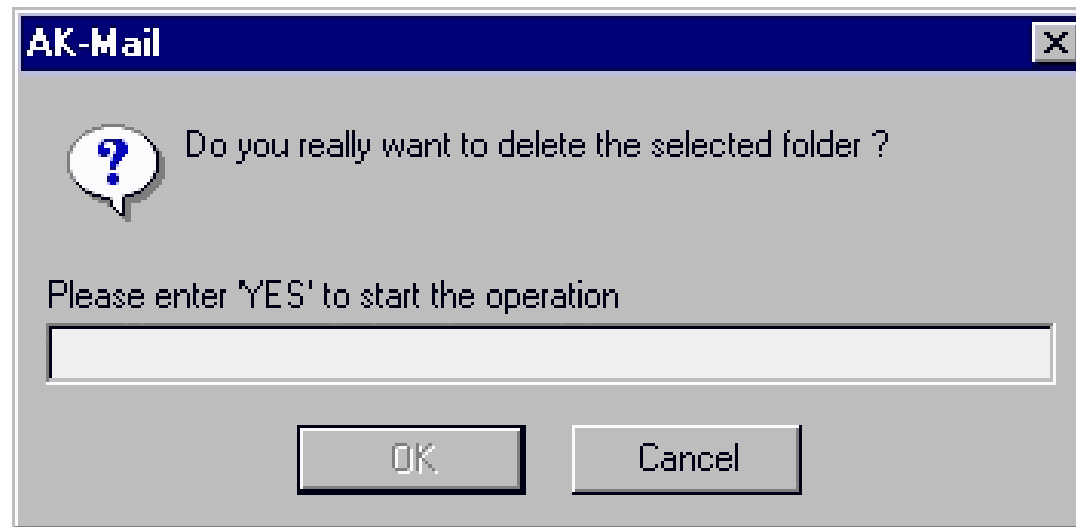
Imran Siddiqi
imran.siddiqi@gmail.com

Today's Interface Hall of Shame



- The message appears when generating a Word document from an online help project
- Problem
 - It's the only option; the user cannot elect to *not* view the document

Today's Interface Hall of Shame



Today's Interface Hall of Shame

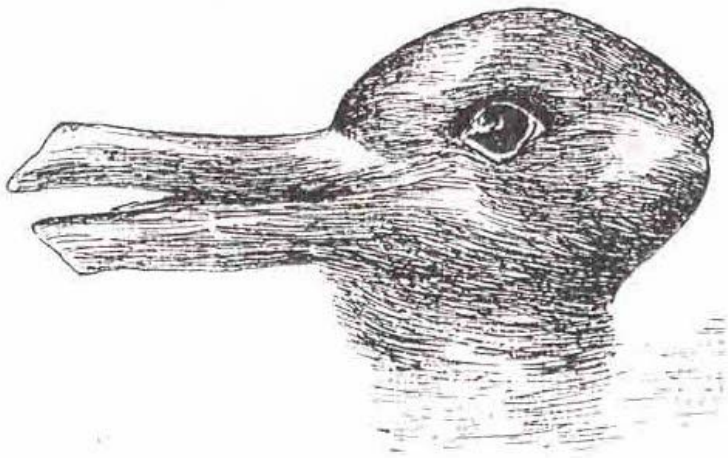
- Circular Logic



What are Paradigms

- A pattern or model, an exemplar in any scientific discipline
- A set of practices that define a scientific discipline at any particular period of time
- Predominant theoretical frameworks or scientific world views
 - E.g. Aristotelian, Newtonian, Einsteinian paradigms in physics
- Paradigm Shifts
 - Change from one way of thinking to another
 - From one framework to another → Typically improvement
 - Classical mechanics → Quantum Mechanics

What are Paradigms



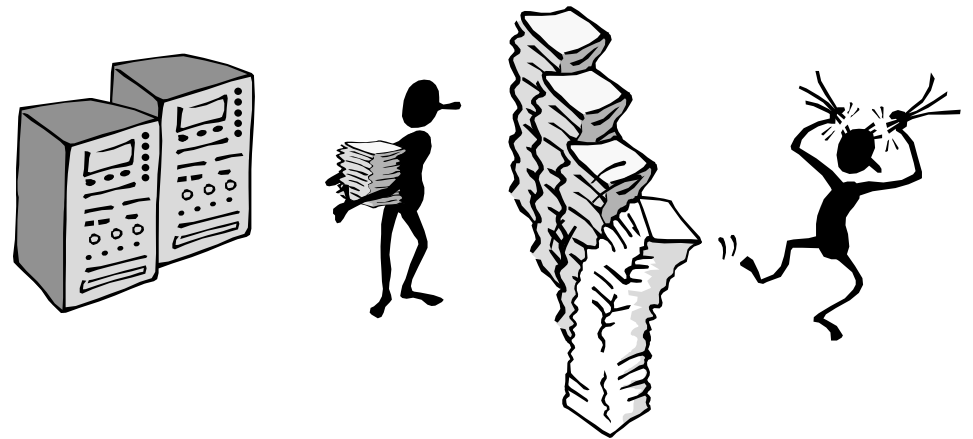
Examples of Visual Paradigm Shift

Paradigms for Interaction

- Investigate some principle historical advances in Interactive Design
- Successive interactive systems are commonly believed to enhance usability
- New computing technologies arrive, creating a new perception of the human—computer relationship

The Initial Paradigm

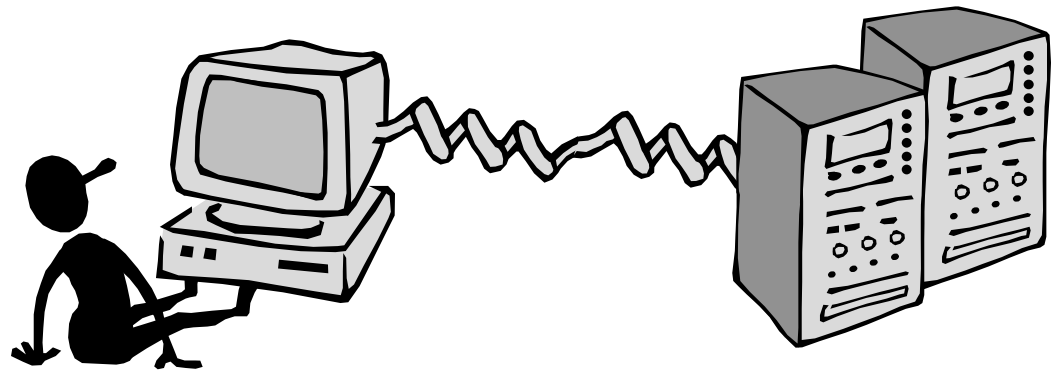
- Batch Processing



Impersonal computing

Example Paradigm Shifts

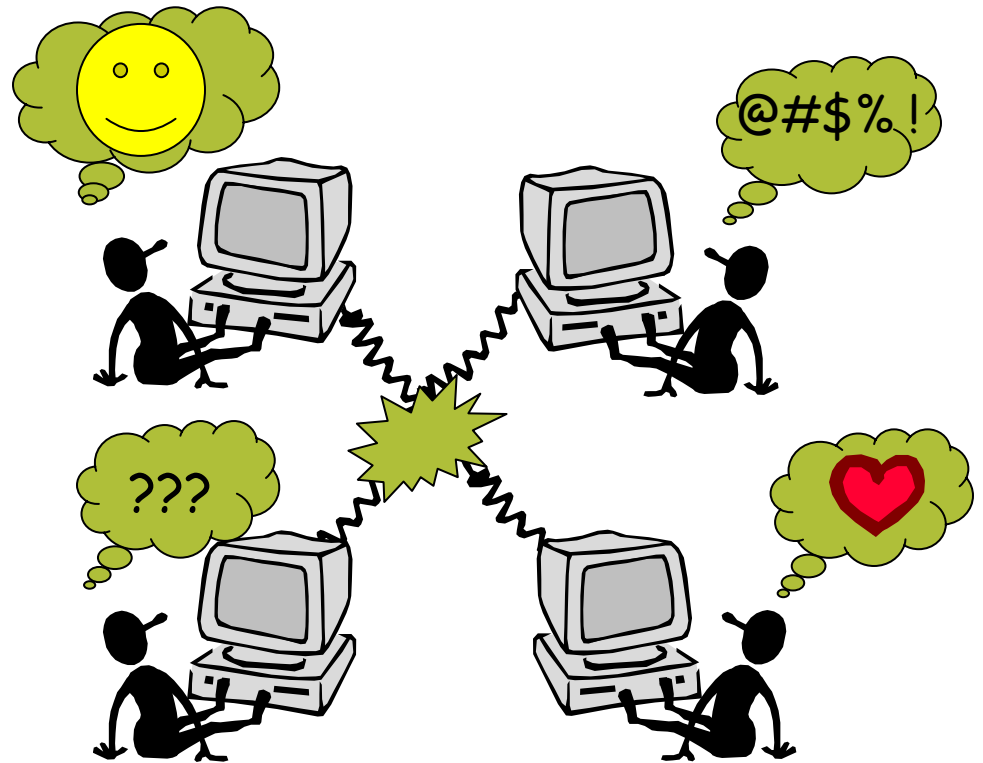
- Batch Processing
- Time Sharing



Interactive computing

Example Paradigm Shifts

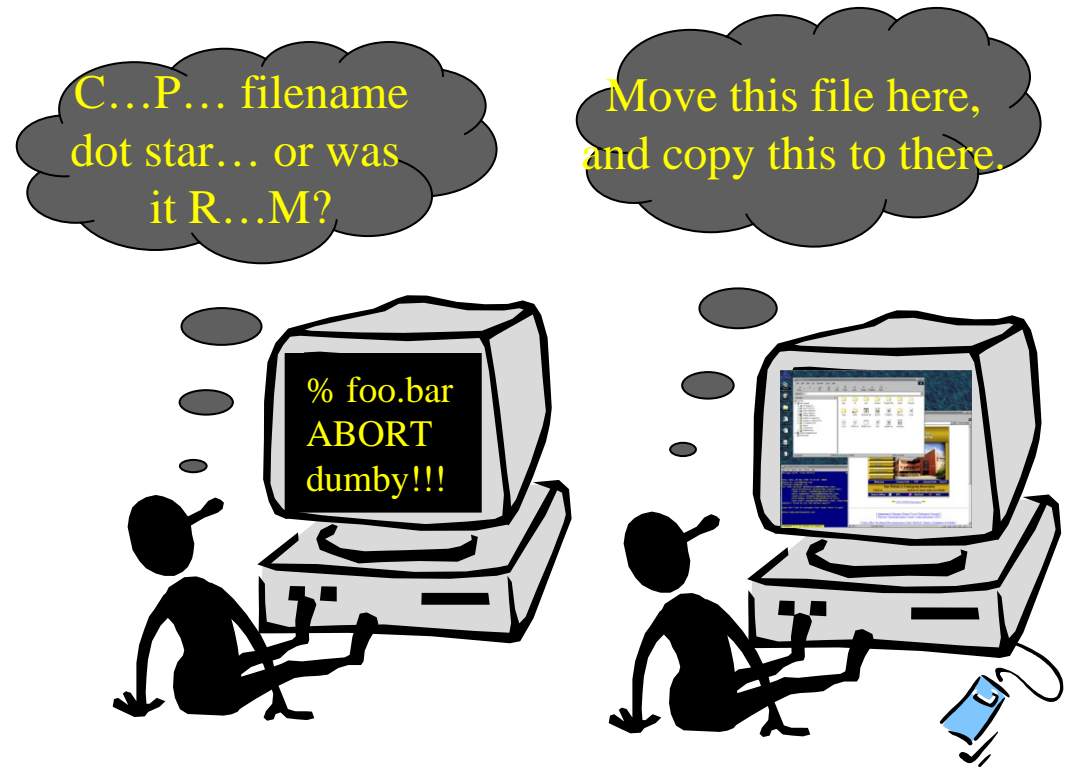
- Batch Processing
- Time Sharing
- **Networking**



Community computing

Example Paradigm Shifts

- Batch Processing
- Time Sharing
- Networking
- Graphical Displays



Direct manipulation

Example Paradigm Shifts

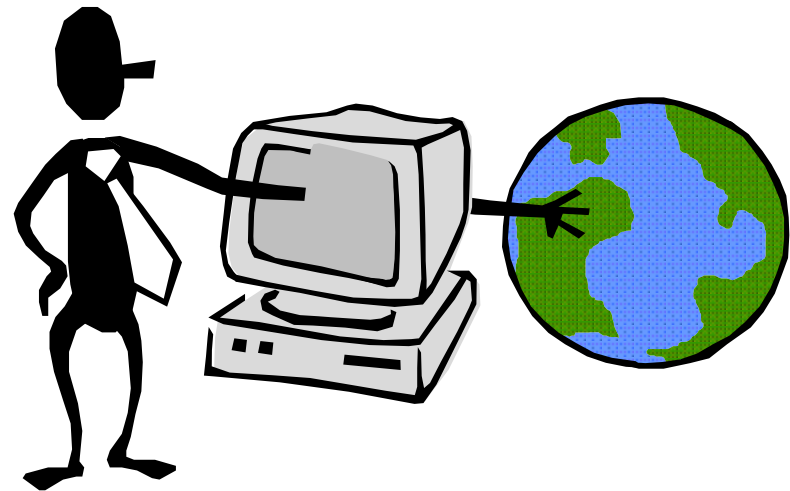
- Batch Processing
- Time Sharing
- Networking
- Graphical Displays
- **Microprocessor**



Personal computing

Example Paradigm Shifts

- Batch Processing
- Time Sharing
- Networking
- Graphical Displays
- Microprocessor
- WWW

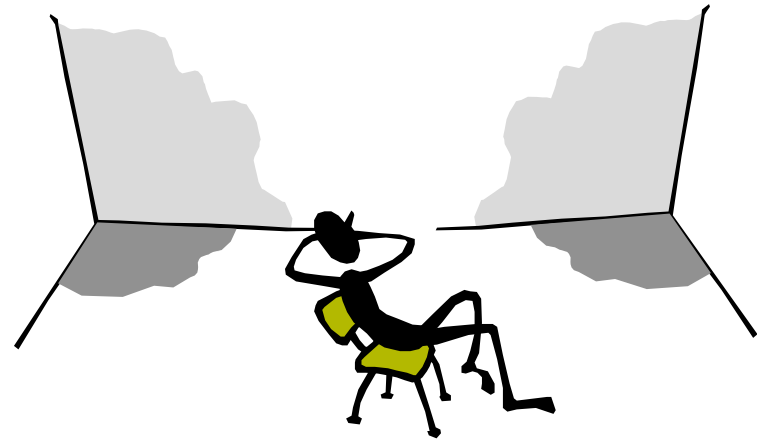


Global information

Example Paradigm Shifts

- Batch Processing
- Time Sharing
- Networking
- Graphical Displays
- Microprocessor
- WWW
- Ubiquitous Computing

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



Batch Processing

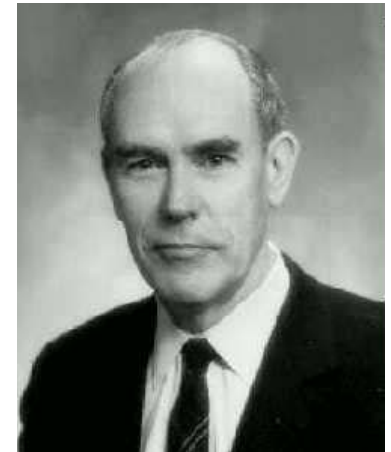
- 1950s – 1960s
- Computers first appeared onto the commercial scene
- Often run in “batch-mode”
- Jobs were submitted on punched cards or paper tape to a computer operator who would then run them individually on the computer
- Difficult to use, cumbersome, and Unpredictable

Time Sharing

- Appeared in 1960s
 - E.g. IBM 360, SDS 940, PDP-10
- Sharing computing resource among many users
- Schedule which task may be the one running at any given time via user interrupt
- Earliest systems that supported truly interactive exchange between operators and computers

Video Display Units

- More suitable medium than paper
- Originated in the Mid 1950s
- Sketchpad (Ivan Sutherland, 1962)
 - Allowed a computer operator to use the computer to create, very rapidly, sophisticated visual models on a display screen that resembled a television set
 - Computers for visualizing and manipulating data



Ivan Sutherland

Video Display Units



Sutherland's Sketchpad

Personal Computing

- Emergence of computing power aimed at masses in 1970s
- Tools for computer novices: LOGO
 - Language for simple graphics programming by children
 - A computer-controlled mechanical turtle that drags a pen along a surface to trace its path
 - Children can easily direct the turtle to trace out simple geometric shapes and teach the turtle to draw more complicated figures
- Future of computing in small, powerful machines dedicated to the individual

Window Interface & WIMP Systems

- Window

- A visual area (usually rectangular), containing a user interface which displays output and allows input
- Enable a single user to be engaged in multiple tasks which are separated physically in one computer screen
- Usually associated with graphic displays where they can be manipulated with a pointing device

- WIMP

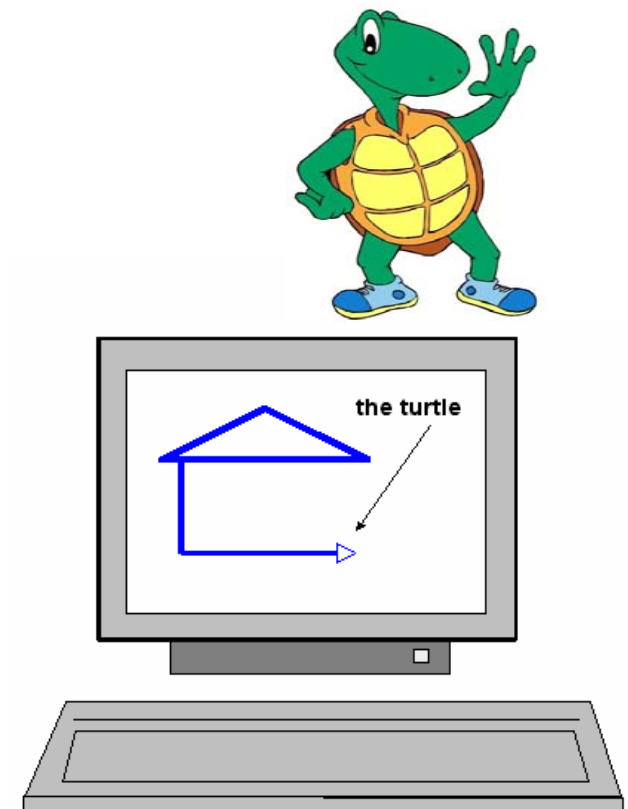
- “Window, Icon, Menu, Pointing device”, denoting a style of interaction using these elements

The Metaphor

- What is a metaphor?
- A **metaphor** is an **analogy** between two objects or ideas
- A metaphor is the expression of an understanding of one concept in terms of another concept, where there is some similarity or correlation between the two
- Example (English)
 - *All the world's a stage, And all the men and women merely players; They have their exits and their entrances*

The Metaphor

- Easy to comprehend
- 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



The Metaphor - Issues

- Some of the tasks we perform with a computer do not have real-world equivalents or a single metaphor cannot account for all of them
 - E.g. There is no office equivalent for ejecting a floppy disk, and it is not intuitive to drag the icon of a floppy disk to the wastebasket metaphor in order to eject from the system
- Interpretation of a metaphor can be affected by culture
 - E.g. Things thrown into a trashcan are recoverable in some countries, but they are gone for good in other countries



Direct Manipulation

- A term coined to describe the graphics-based interactive systems (Ben Shneiderman, 1982)
- Important Features:
 - Visibility of the objects of interest
 - E.g. Documents and folders are made visible to the user as icons which represent the underlying files and directories, respectively
 - Incremental action at the interface with rapid feedback on all actions
 - E.g. The operation of moving a file from one directory to another is mirrored as an action on the visible document which is “picked up and dragged” along the desktop from one folder to another

Direct Manipulation

- Important Features (Contd...)
 - Reversibility of all actions, so that users are encouraged to explore without severe penalties
 - E.g. If the user moves a document to a wrong place, it is relatively easy to detect and recover from the error
 - Syntactic correctness of all actions, so that every action is a legal operation
 - E.g. It is impossible to formulate a syntactically incorrect move operation with the pick-up-and-drag style of command (Mistype filename)
 - Replacement of complex command language with actions to manipulate directly the visible objects

Direct Manipulation

- “Trash” on the Desktop
 - An excellent example of direct manipulation
 - Users can see both the trash and the files or folders they want to move to the trash
 - They then physically select the files and drag them to the trash can
 - While the user is doing this, all of the selected files move as well, illustrating which items the user has selected
 - When the mouse is placed over the trash, there is a shading indication that it has been selected



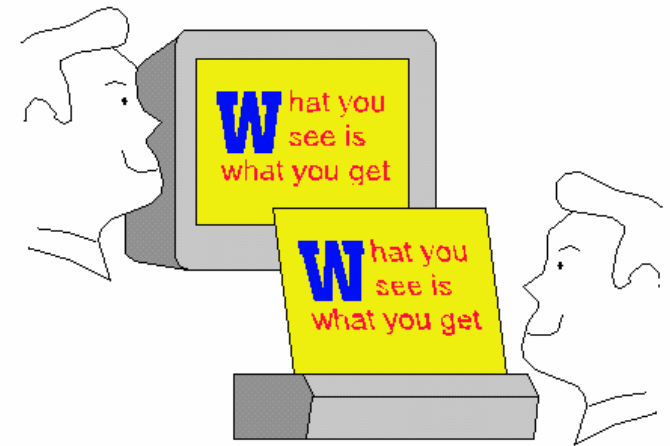
Direct Manipulation

- “Trash” on the Desktop (Contd...)
 - The user then has to release the mouse button to move the files to the trash
 - If there are many files, a dialogue box will show up illustrating the progress of moving files to the trash
 - Once the action is completed, the files are no longer visible in their original location
 - The user can change his mind at any time while dragging the files to the trash
 - Even after placing them there, they can as easily be taken out of the trash and put back in place



WYSIWYG

- What You see is What You Get (WYSIWYG)
- Related to the visualization provided direct manipulation
- Describes a user interface in which representation during editing appears very similar to that in the final product
 - E.g. word processors, web (HTML) development
- The simplicity and immediacy of the mapping between representation and final product are main concerns



WYSIWYG

- It is not a criterion for usability
 - It is difficult to achieve complex design if you must always see the results on screen
 - Word Processor – Picture in a Document
 - Requirement: Top of the page on which it is first referenced
 - Changes to the document – Picture position changes
 - Make adjustments to the picture
 - Use directive – Sacrifice WYSIWYG

Action vs. Language

- Direct Manipulation Interfaces

- Make some tasks (usually simple ones) easier to perform correctly
- E.g. Recognizing and pointing to an object reduces the difficulty
- Some tasks are difficult or even impossible to perform

- Language

- The user gives the interface instructions and it is the responsibility of the interface to see that those instructions are carried out
- Suitable for complicated tasks
 - E.g. Information Retrieval System – You know WHAT info is but you do not know HOW it is organized – May be type the question
 - Repeated Tasks – Renaming all files in a directory

Hypertext

- Hypertext

- Deal with information overload issue in scientific knowledge
- Coined by Ted Nelson (1965) to describe a way of organizing material that attempts to overcome the inherent limitations of traditional text and in particular its linearity
- Contains automated cross-references to other documents called **hyperlinks**

- Hypermedia

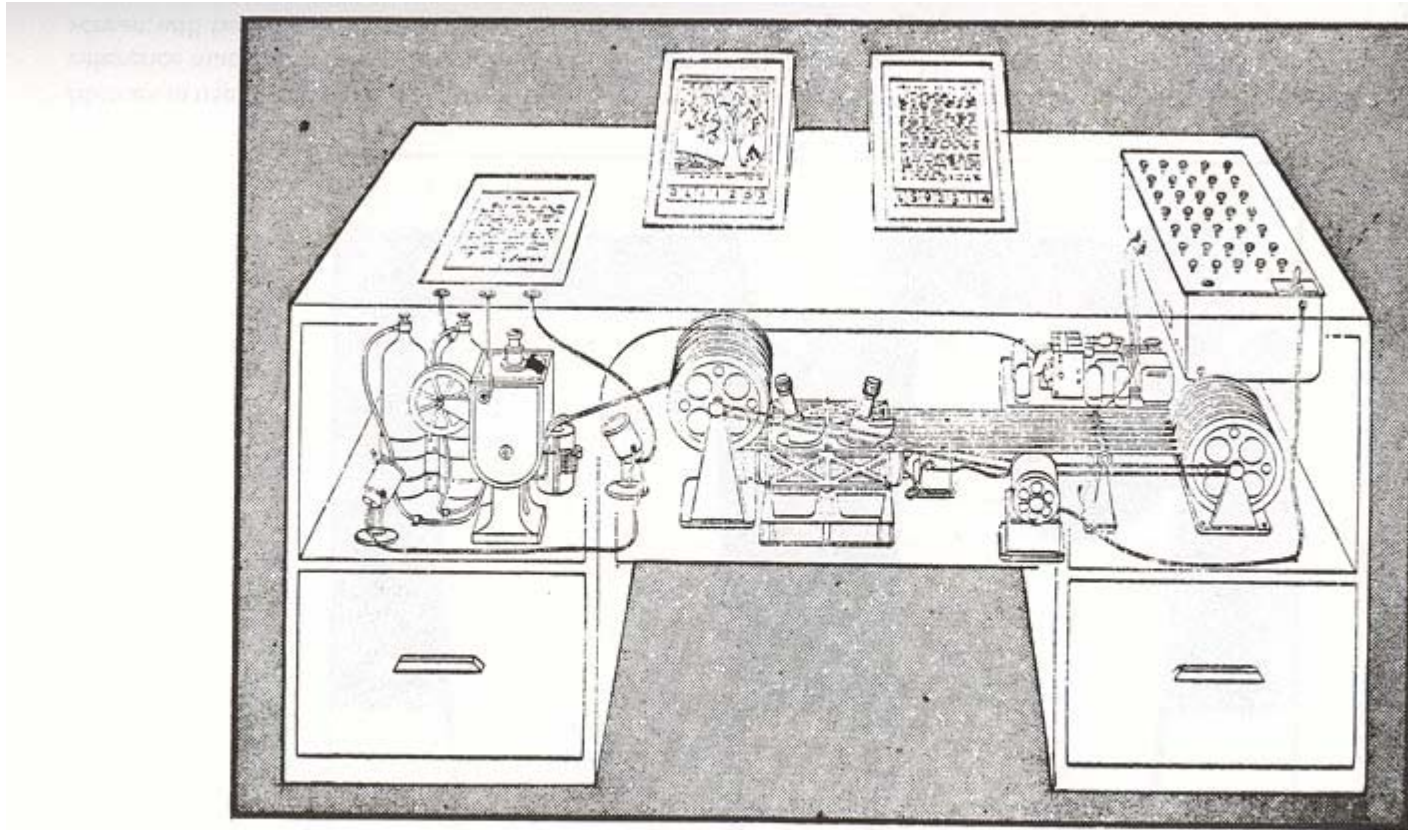
- An extension of hypertext, in which graphics, audio, video, plain text and hyperlinks intertwine

Hypertext

- Vannevar Bush's article "*As We May Think*" (1945)
 - An innovative futuristic information storage and retrieval device called a "Memex"
 - Memex is a device in which an individual compresses and stores all of their books and records which may then be consulted with exceeding speed and flexibility. A document can be given a simple numerical code that allows the user to access it after dialing the number combination



Hypertext



Memex in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference (*LIFE* 19(11), p. 123).

Memex

Multi-Modality

- Modality

- A **sense** through which the human can receive the **output** of the computer
 - For example *vision modality*
- A **sensor** or **device** through which the computer can receive the **input** from the human

- Multi-Modal Systems

- Provide the user with multiple modes of interfacing with a system
- Increased usability by combining the strengths of different communication channels
 - All interactive systems can be considered multi-modal - Visual + Touch

Computer-Supported Cooperative Work

- Computer Networks – Communication between separate machines
 - No longer single user / single computer system
 - How to support collaborative activities and their coordination by means of computer systems – CSCW
- Groupware
 - CSCW tools built to support users working in groups
 - E.g. Electronic mail (email) by which individuals at physically separate locations can communicate via electronic

Computer-Supported Cooperative Work

- Asynchronous Collaboration

- The participants do not have to be working at the same time
- E.g. Email

- Synchronous Collaboration

- Interactions among participants happen at near-real-time
- E.g. instant message, electronic whiteboard

World Wide Web

- **The Web**, is a system of interlinked hypertext documents contained on the Internet.
- Most significant (recent) development in interactive computing.
- Communicate using common transmission protocols (TCP/IP).
- Simple, universal protocols (e.g. HTTP) and mark-up languages (e.g. HTML) made publishing and accessing easy



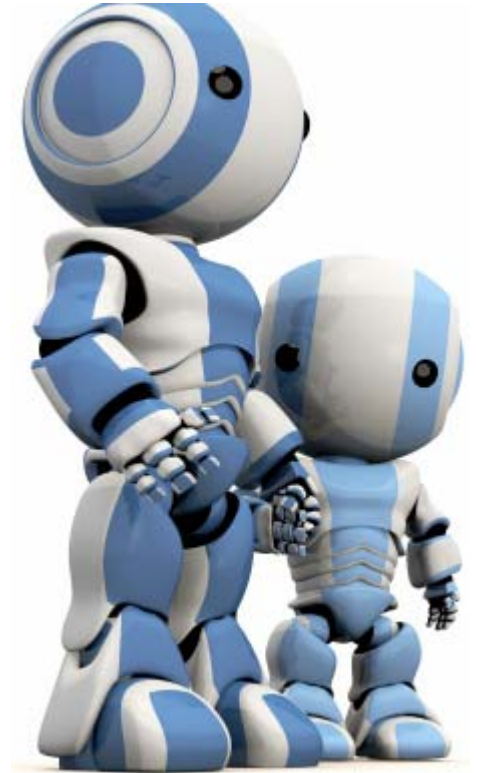
Agent-based Interfaces

- Human Agents

- Agents work on someone's behalf – estate agents, travel agents

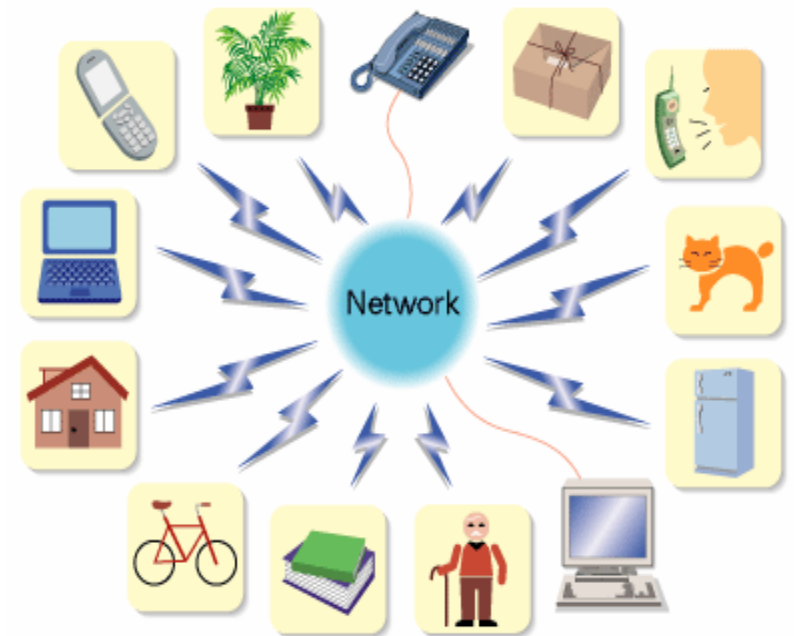
- Software Agent

- A piece of software that carries out some set of operations on behalf of a user or another program with some degree of independence or autonomy
 - E.g. email agents that filter spam for you, web crawlers which search the internet for documents you might find interesting
 - Some agents simply use if then rules
 - Others may use Artificial Intelligence techniques to learn based on user actions



Ubiquitous Computing (Pervasive Computing)

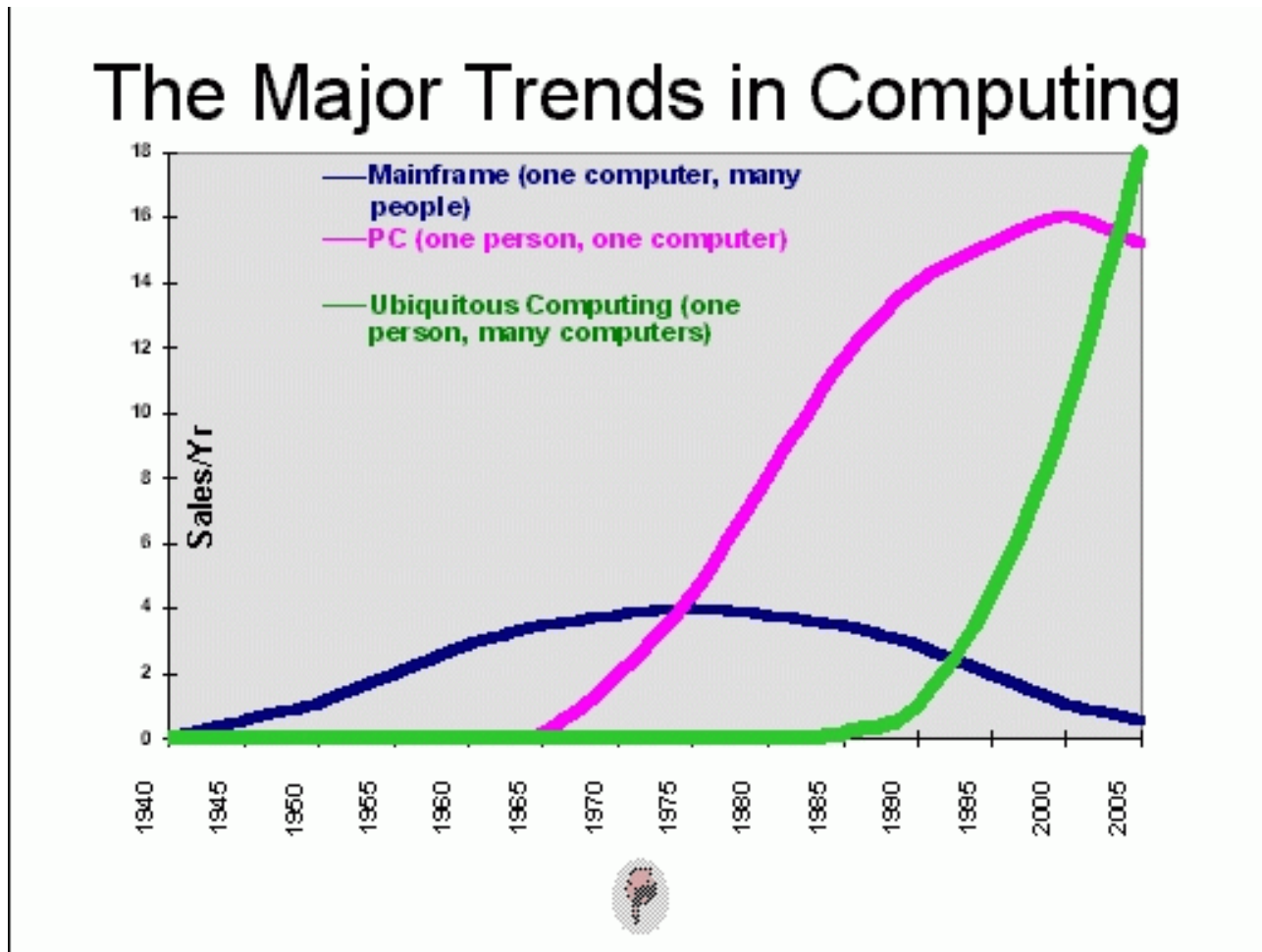
- Post-Desktop Model of computing
- Computer – Very apparent
- How to make it disappear?
 - Shrink and embed/distribute it in the physical world
- Information processing – integrated into everyday objects and activities



Ubiquitous Computing

- Mainframe
 - Many people share one computer
- Personal Computer
 - One person with one computer
- Ubiquitous Computing
 - Many computers serve one person

Ubiquitous Computing



Ubiquitous Computing – Three Scales of Computing Technology

■ Yard-size

- Suitable for wide open public spaces and shared by a group of people
- E.g. High-resolution large screens and project displays

■ Foot-size

- Much like today's personal computer
- Suitable for every individual to have one
- E.g. Laptop, desktop, tablet computer

■ Inch-size

- A computing device that can fit in the palm of a hand
- Everyone would have a number of these at their disposal
- E.g. PDA, electronic dictionary, cell phone

Ubiquitous Computing - Sensor-Based and Context-Aware Interaction

- An extreme case of ubiquitous computing in which the user is totally unaware of the interactions that are taking place
- Sensors in the environment
 - E.g. Automatic lights, smoke detectors etc.
- Sensors in our information world
 - E.g. Websites visited, time spent online, books purchased etc.
- Sensors in our bodies
 - E.g. Heart rate, skin temperature, brain signal etc.
- Information from sensors is used by systems to make inferences about our past patterns and current context in order to modify the explicit interfaces we deal with

References

- Chapter 4 - Human Computer Interaction by Dix et al.
- HCI Paradigms and User Centred Design, Yan Liu, Wright State University
- User Interface Hall of Fame/Shame

