
Interaction paradigms

(Based on Nielsen, 2004)

Why paradigms?

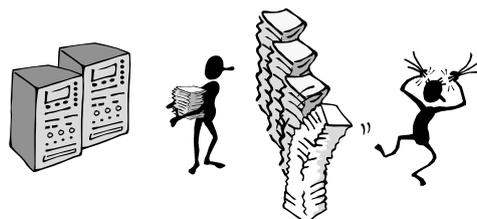
- **Concern**
 - How can an interactive system be developed to ensure its usability?
 - How can the usability of an interactive system be demonstrated or measured?
- **Approach**
 - **Exemplification – Interaction paradigms**
 - History of interactive system design provides paradigms for usable designs
 - **Abstraction – Usability principles**
 - Theoretically derived principles from knowledge of psychological, computational and sociological aspects of the problem domain.

Interaction paradigms

- 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
- The greatest advances in HCI have come by way of exploratory and creative design.
- 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.

Interaction paradigms

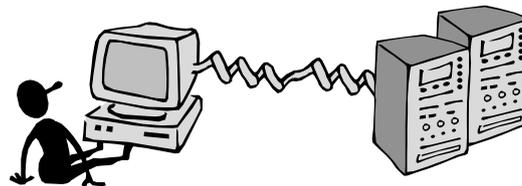
- The initial paradigm
 - **Batch processing**



Impersonal computing

Interaction paradigms

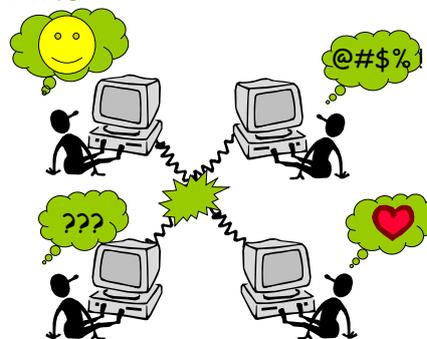
- Example paradigm shifts
 - Batch processing
 - Time-sharing



Interactive computing

Interaction paradigms

- Example paradigm shifts
 - Batch processing
 - Time-sharing
 - Networking

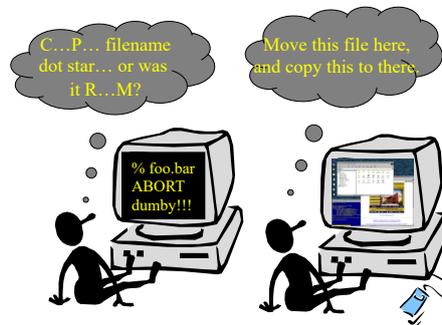


Community computing

Interaction paradigms

- Example paradigm shifts

- Batch processing
- Time-sharing
- Networking
- Graphical displays



Direct manipulation

Interaction paradigms

- Example paradigm shifts

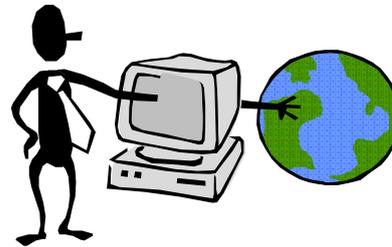
- Batch processing
- Time-sharing
- Networking
- Graphical displays
- Microprocessor



Personal computing

Interaction paradigms

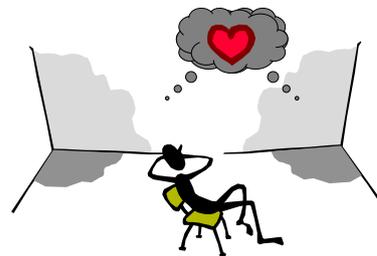
- Example paradigm shifts
 - Batch processing
 - Time-sharing
 - Networking
 - Graphical displays
 - Microprocessor
 - WWW



Global information

Interaction paradigms

- 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.

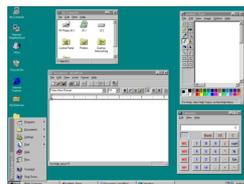
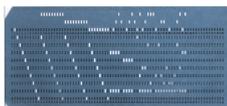
Interfaces Brief History

Interfaces Brief History



70 years ago

Today



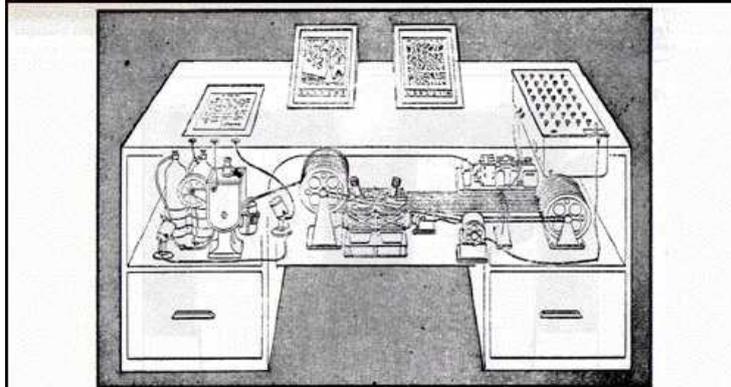
Interfaces Brief History

- 1940s and 1950s – explosive technological growth.
- 1960s – the explosion of growth in computing power would be wasted if there was not an equivalent explosion of ideas about how to channel that power.
- Licklider (director ARPA - US DoD Advanced Research Projects Agency)
 - <http://www.ibiblio.org/pioneers/licklider.html>
 - finance various research centres in USA to encourage new ideas about how best apply the new technology.
 - **Time-Sharing** - single computer supporting multiple users.

Interfaces Brief History

- 1945 - Vannevar Bush “[As we may think](#)” in The Atlantic Monthly.
 - First IPM Researcher, first approach to hypertext concept
 - need support in managing explosion of information and scientific knowledge generated after the beginning of the World War II.
- Memex – desk with the ability to produce and store a massive quantity of photographic copies of documented information. In addition, the Memex could keep track of links between parts of different documents (the stored information resembled a vast interconnected mesh of data).

Interfaces Brief History



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).

Interfaces Brief History

- Mid 1950s – researchers were experimenting with the possibility of presenting and manipulating information from a computer in the form of images on a VDU (**Video Display Unit**).
- More suitable medium than paper to present vast quantities of strategic information for rapid assimilation.
- First applications were developed for military use.

Interfaces Brief History

- 1962 - Ivan Sutherland (MIT) astonished the computer science community with the Sketchpad project

https://www.youtube.com/watch?v=6orsmFndx_o

- Computers for visualizing and manipulating different representation of the same data.

Part 3: Historical
Perspective:
"Computer Sketchpad"
(not shown
at CHI'83)

- * a classic and beautiful system
- * first CAD system
- * introduced constrained input
- * introduced instantiation

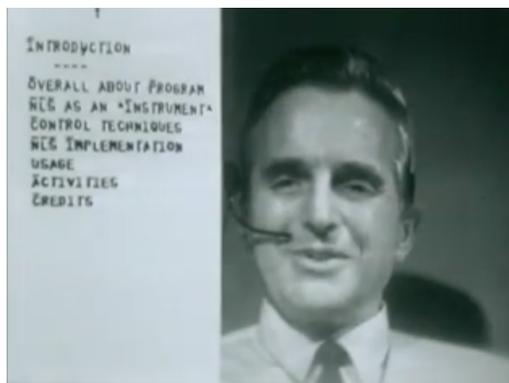
ACM CHI '83, SGVR Issue 13

Interfaces Brief History

- Douglas Engelbart (1960s) - **Programming Toolkits**
 - Stanford Research Institute
 - 1963 – augmenting man's intellect
 - use computer technology as a means of complementing human problem solving capacities; use computers to teach humans.
 - humans attack complex intellectual problems like a carpenter produces beautifully complicated pieces of woodwork with a good set of tools.
 - the right programming toolkit provides building blocks to producing complex interactive systems.
 - 1968 NLS/Augment system demonstration

Interfaces Brief History

The Mother of All Demos



<https://www.youtube.com/watch?v=B6rKUf9DWRl&t=3s>

Interfaces Brief History



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Interfaces Brief History

- 1970s – emergence of computing power aimed at the masses - **Personal Computing**.
 - Seymour Papert - LOGO language – for simple graphics programming by children.
 - computer controlled mechanical turtle that dragged a pen along a surface to trace its path.
 - by typing English sentences, such as “Go forward” or “Turn left”, a child/programmer could teach the turtle to draw more and more complicate figures.
 - A system is more powerful as it becomes easier to use
 - “Logo is a programming language plus a philosophy of education”
<http://www.microworlds.com/company/philosophy.pdf>

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Interfaces Brief History

- 1970s - Alan Kay view of the future of computing was embodied in small, powerful machines which were dedicated to single users – **personal computers**.
 - together with the funding team of researchers at XEROX PARC creates a powerful and simple visually based programming environment for personal computing hardware - Smalltalk.
 - the Dynabook as the ultimate hand-held personal computer.

Interfaces Brief History



Interfaces Brief History



Interfaces Brief History

- **Windows Systems** and the **WIMP** interface
 - humans can pursue more than one task at a time.
 - windows used for dialogue partitioning => easy to “change the topic” .
 - 1981 - Xerox Star first commercial windowing system.
 - windows, icons, menus and pointers now familiar interaction mechanisms.

Interfaces Brief History

- 1982 - Ben Shneiderman describes the following features of a **direct manipulation** interface:
 - visibility of objects
 - incremental action and rapid feedback
 - reversibility encourages exploration
 - syntactic correctness of all actions
 - replace language with action

Interfaces Brief History

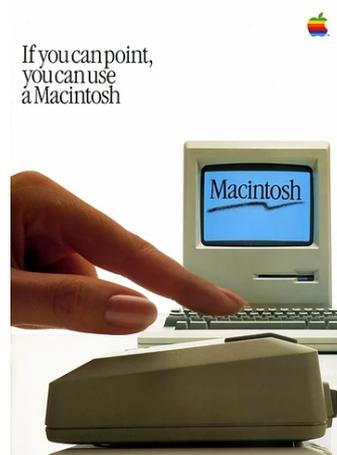
- 1984 - Apple Macintosh

1984 commercial

<https://www.youtube.com/watch?v=VtvjbmDx-I>

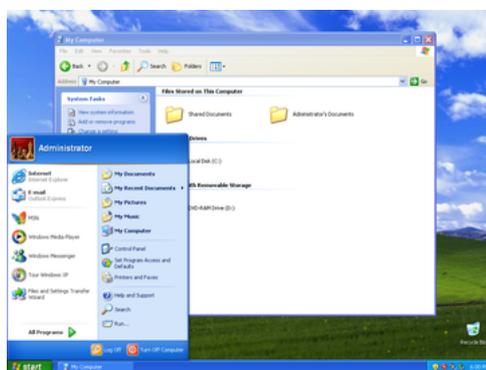
1984 Young Steve Jobs introduces the Macintosh

<https://www.youtube.com/watch?v=2B-XwPjn9YY>



Interfaces Brief History

- 1985 - Microsoft
MS-DOS → Windows



Interfaces Brief History

- **Hypertext**
 - 1945 - Vannevar Bush "As we may think" in The Atlantic Monthly.
 - mid 1960s – Ted Nelson describes hypertext as non-linear browsing structure
 - the concept was coined by Ted Nelson to describe the non-linear structure of his system Xanadu.
 - "a potentially revolutionary worldwide publishing and information retrieval system based on the idea of interconnected, non-linear text and other media forms."
 - 1960s - NLS (oN-Line System) include many characteristics of the hypertext systems: point- and-click, multiple windows, remote colaboration, cross-referencing. Many of the ideas that Engelbart's team developed – word processing, mouse – only attained commercial success decades after their invention.

Interfaces Brief History

- **WWW**
 - Tim Berners-Lee
 - Simple, universal protocols (e.g. HTTP) and mark-up languages (e.g. HTML) made publishing and accessing easy
- **Multi-Modality**
 - a mode is a human communication channel
 - emphasis on simultaneous use of multiple channels for input and output
- **CSCW**
 - interaction between humans via the computer
 - the needs of the many must be represented in the one product
 - Social aspects
 - E-mail is the most prominent success

Interfaces Brief History

- **Agent-based Interfaces**
 - e-mail agents – filter e-mail
 - web crawlers – search the WWW for documents user may find interesting.
 - agents can:
 - perform repetitive tasks
 - watch and respond to events when the user is not present
 - learn from the user's own actions.
 - MS Excel (sum function).
 - Eager on HyperCard – when it notices that the user is repeating similar actions, it suggests the next action, which can be accepted or ignored by the user.

Interfaces Brief History

- **Augmented and virtual reality**

- AR :
 - Combines real objects with virtual objects in a real environment;
 - registers (aligns) real and virtual objects with each other.
- VR:
 - the user interacts in a synthetic world
 - immersion
- 1960s - Ivan Sutherland implemented the first virtual reality system. Using wireframe graphics and a see-through head-mounted display (HMD), it allowed users to occupy the same space as virtual objects.

Interfaces Brief History

- **Ubiquitous Computing**

“The most profound technologies are those that disappear.”

Mark Weiser, 1991

- Late 80s – 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
- Invisible computing, smart objects...

Interfaces Brief History

- **Sense-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) is becoming easier.

Interfaces Brief History

- **Looking into the future**
 - most innovative products today are based on technology that has been around for over 20 years
 - the transition from a product first demo to broad usage takes around 20 years
 - First mouse was built by Doug Engelbart and William English in 1964
 - Macintosh was released with a mouse in 1984

Interfaces Brief History

- Looking into the future

- James Russell invented CD in 1965
- He patented it in 1970
- Philips released its first production CD players in 1982
- In 1990 industry reach \$1 billion
- ...it took 25 years after the initial concept and 20 years after first prototype.

Interfaces Brief History

- Looking into the future

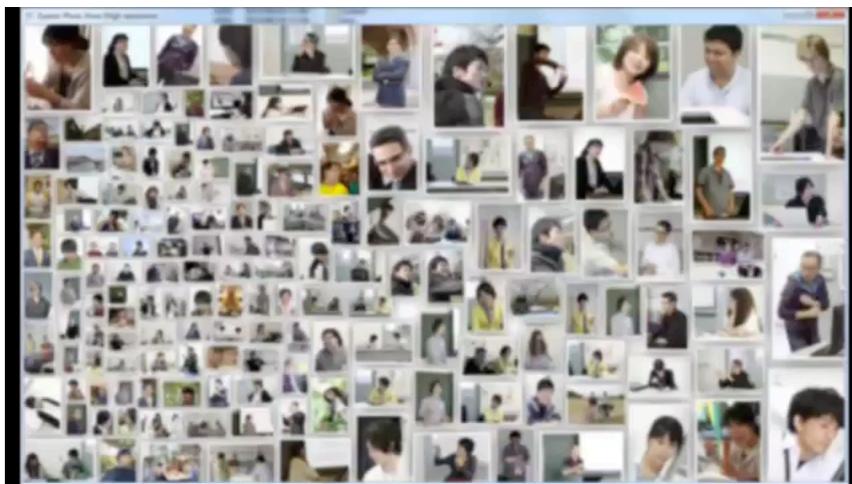
- Brad Myers analysed the evolution of some of the key user interface technologies that we are using today (Myers, 1998). The period from concept to product is about 20 years.
- Based on history, it is highly probable that any technology that is going to have a significant impact over the next 10 years is already 10 years old.

Future Perspectives

Looking into the past



Future perspectives



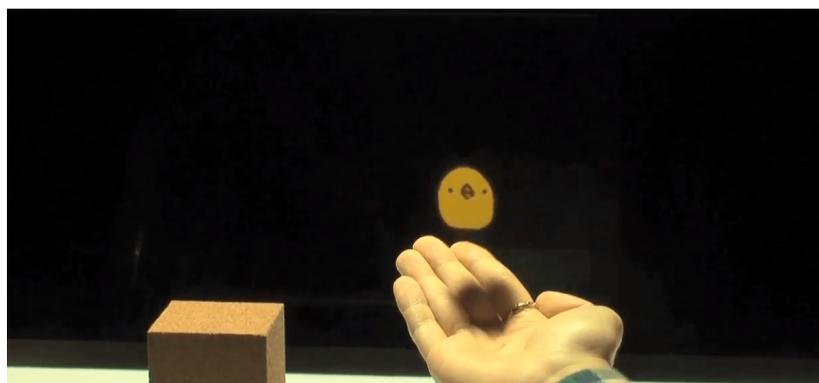
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Future perspectives

MARIO: Mid-Air Augmented Reality Interaction with Objects

Hanyuool Kim, Issei Takahashi, Hiroki Yamamoto, Takayuki Kai, Satoshi Maekawa, and Takeshi Naemura

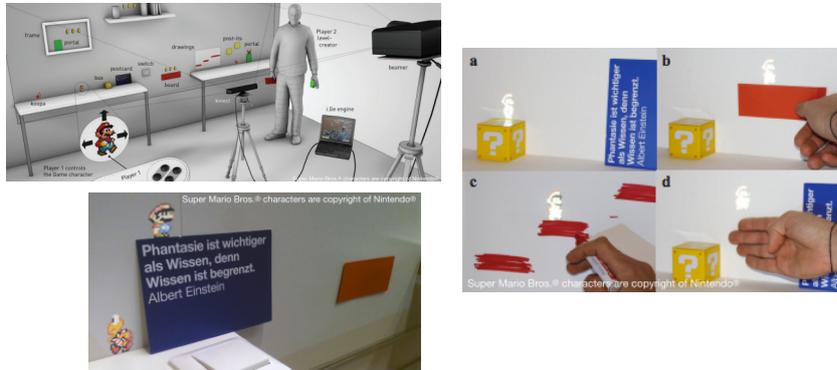


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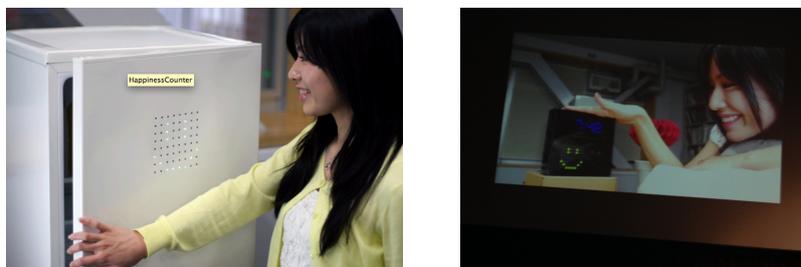
Future perspectives

Entertainment – ACE



Oswald, P., Tost J. and Wettach, R., The Real Augmented Reality: Real-time game editor in a Spatial Augmented Environment, ACE 2014.

Future perspectives



Tsujita, H. and Rekimoto, J. Smiling Makes Us Happier: Enhancing Positive Mood and Communication with Smile-Encouraging Digital Appliances, UbiComp 2011.

Future perspectives

Smell on mobile phone communications



Scentee smartphone notification smells



Mugaritz - smell a dish before you taste it

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Entertainment

The Cube (YDreams),
Vodafone Headquarters, Lisbon



<https://www.youtube.com/watch?v=O72BKIGLpnQ>

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Entertainment



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Future perspectives

Siftables
David Merrill

<https://www.youtube.com/watch?v=JP0w9IZoLwU>



Future perspectives

The Visitors Center, Santander Headquarters, Madrid, YDreams 2014

<https://www.youtube.com/watch?v=bzDIJ6TTc6w>



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Interaction

Proxemic Interactions

The Video

Designing for a Proximity
and Orientation-Aware Environment

Till Ballendat, Nicolai Marquardt, Saul Greenberg

Interactions Lab
University of Calgary

<https://www.youtube.com/watch?v=OHm9teVoNE8>

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Future perspectives



<https://www.youtube.com/watch?v=fGaVFRzTTP4>

Future perspectives

Persuasion

An attempt to change attitudes or behaviours or both (without using coercion or deception).

B. J. Fogg, 2003

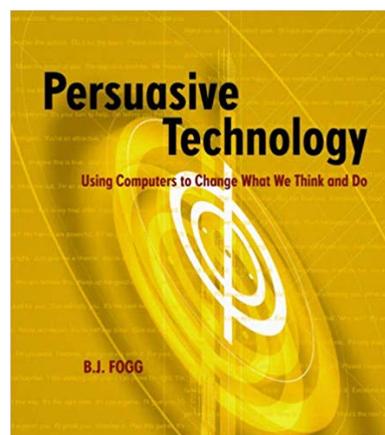
Future perspectives

Persuasive Technology

Interactive computing systems designed to change people's attitudes and behaviours.

B. J. Fogg, 2003

Future perspectives



Future perspectives

<https://www.youtube.com/watch?v=iyznHWwJXaA>



Future perspectives

<https://www.youtube.com/watch?v=UqrJh1W0FOw>



Future perspectives



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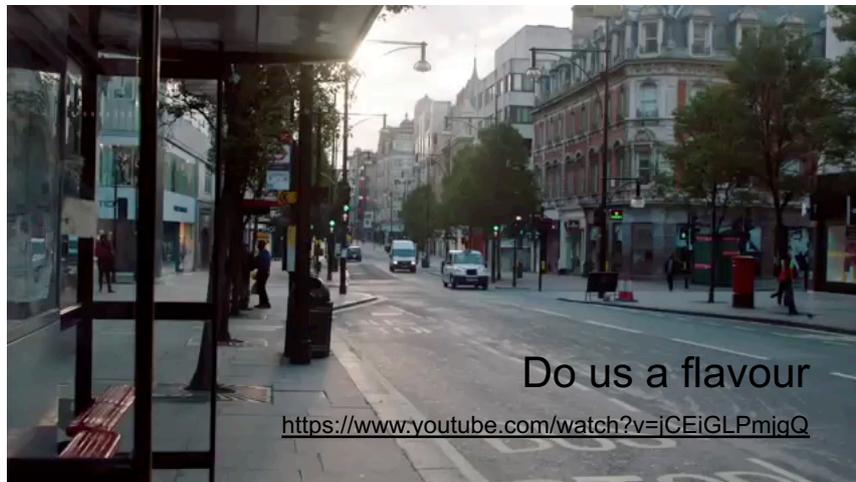
Future perspectives



Interação Pessoa-Máquina

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Future perspectives



Interação Pessoa-Máquina

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Future perspectives

Moon for All Mankind

<https://www.framestore.com/projets/moon-all-mankind?language=fr>



Future perspectives

Field trip to Mars

<https://www.youtube.com/watch?v=e0XNIsXnKp0>



Future perspectives

... and don't forget ... BE CREATIVE!

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<http://web.mit.edu/STS.035/www/PDFs/think.pdf>
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