Human-Computer Interaction

1. Session:
Introduction
Historical background

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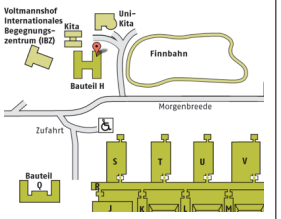

Modul „Mensch-Maschine Interaktion“

Mensch-Maschine-Interaktion (V+Ü)
- 180h = 6 LP
- Vorlesung, Bestehen der Klausur/Prüfung (3 LP), erfolgreiche Teilnahme an Übungen (3 LP)

Natürliche Benutzerschnittstellen (S bzw. Pj/Pr)
- 120h = 4 LP
- Vortrag mit Ausarbeitung im Seminar (4 LP) bzw. erfolgreiche Teilnahme am Projekt und Ausarbeitung (4 LP)

- Dieses Semester: 239642 *Künstliche konversationale Agenten* (S)

Vorlesung „Mensch-Maschine-Interaktion“

Vorlesung
Grundlagen, zentrale Methoden und aktuelle Ansätze der Gestaltung interaktiver Systeme

Übungen
- Dipl.-Inform. Kirsten Bergmann
- Konzeption, Realisierung und Evaluation einer Nutzerschnittstelle nach Usability-Gesichtspunkten
- Schriftliche Ausarbeitung + Präsentation im Tutorium

http://www.techfak.uni-bielefeld.de/~skopp/MMI.html

Inhaltliche Struktur

Benutzer als kognitive Systeme
- Wahrnehmung & Aufmerksamkeit
- Gedächtnis
- Nachdenken & Handeln

Computer & Schnittstellen
- Ansätze und Technologien
- Designprozess
- Evaluation

Interaktionen
- Sprache
- Multimodale Schnittstellen
- Dialogsysteme
- Konversationale Agenten
- Kollaborative Systeme
- Soziale Kompanions und Roboter

Literatur

Dix et al.: *Human-Computer Interaction* (3. Aufl.). London: Prentice Hall, 2003.

Shneiderman: *Designing the User Interface - Strategies for Effective Human-Computer Interaction* (3. Aufl.). Addison Wesley, 1998.

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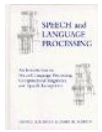
Reed: Cognition (5. Aufl.), Wadsworth, 1999.



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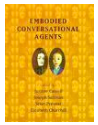


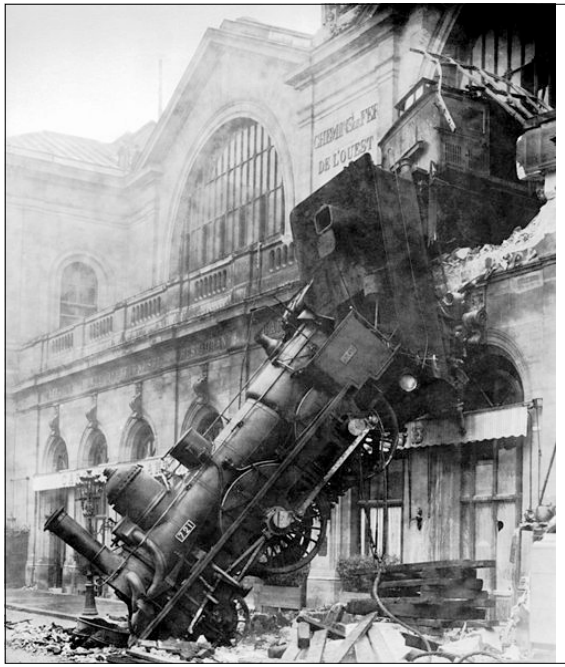
Cassell et al.: *Embodied Conversational Agents*, MIT Press, 2000.

Breazeal, C.: *Designing Sociable Robots*, MIT Press

What is HCI?
Why should I learn about it?

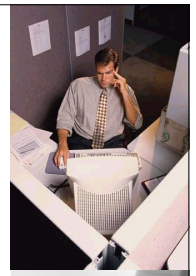
Simple answer: because computers are built for and will be used by humans

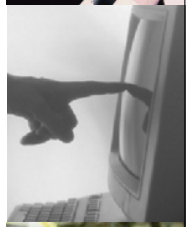
→ Humans interact with computers and everything has to work properly, the human, the computer, and the interaction



Train crash at Montparnasse (1895) due to maloperation

Three integral parts of one system





The Human

- wants to get a particular task/problem done

The Computer

- built for accomplishing a certain range of tasks
- hardware and software, used as one system
- specialized devices for input/output

The Interaction

- user needs to „tell“ the computer what s/he wants
- computer solves task and communicates results back

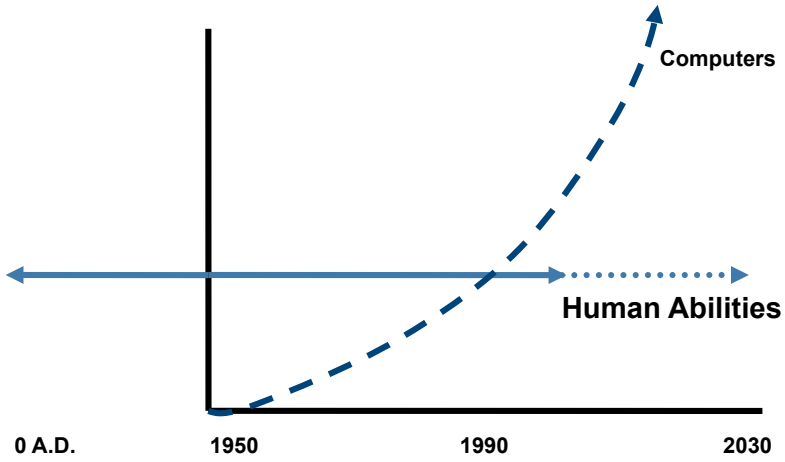
Moore’s Law (1964)

Memory
Speed
Portability
Affordability
Functionality

Computer Abilities

1950 **1990** **2030**

Human Psychology



A320 crash Bangalore (1990)

"The pilot put the plane into OPEN DESCENT mode without realizing it. This change resulted in the aircraft's speed being controlled by pitch rather than thrust. The throttles went to idle. In that mode, the automation ignores any preprogrammed altitude constraints. To maintain the pilot-selected speed without power, the automation had to use an excessive rate of descent, which led to a crash short of runway."

Nancy G. Leveson,
Safeware Engineering Corp.

Shootdown of an Iranian airliner (July 1988)

"We have determined that the Aegis radars and computers functioned correctly and that the misidentification of an Airbus airliner as an F-14 was due to human error induced by combat stress. ... The operator interpreted a display indicating the Airbus was at 12,000 feet and flying level as indicating it was at 7,500 feet and descending toward the ship ... However, we are looking at the user interface - what we show on the displays - there may be some room for improvement there, to make it even more user-friendly than it is now..."

Defense secretary Frank Carlucci said that to find range and altitude information of a target on the screen, one must examine a computer readout, which is distracting. "We think it's a good idea to display altitude and range on a large screen," Carlucci said. "I think you could probably even put an arrow on whether it's ascending or descending." ... "I'm not indicating it wasn't designed correctly," he said, but "as you go through experience with any weapon system you improve the design, particularly in combat."

Die neuen Fahrkarten-Automaten in NRW: All

In Ihrem Verkehrsverbund in NRW erhalten Sie künftig Fern-, Nah- und Verbundfahrkarten an einem Automaten. Wir zeigen Ihnen hier, wie einfach die Bedienung ist. Neu: Fern- Nah- und Verbundfahrkarten an einem Automaten. Spürbar schneller, einfach in der Bedienung, volle Zahlungsflexibilität.

Bahn.de (13.10.2010)

Bahn rüstet Fahrkartenautomaten auf

Hilflos stehen viele Bahnkunden vor den Ticketautomaten und wissen nicht, wie sie an ihre Fahrkarte kommen sollen. Das will die Bahn endlich ändern: Alle 6000 Automaten werden mit neuer Software ausgestattet. In Essen ging ein Test gründlich daneben.

Dem Zeitungsbericht zufolge haben sich am Mittwoch im Essener Hauptbahnhof zum Teil lange Schlangen vor den Ticketautomaten gebildet, da Reisende länger als sonst für den Kauf ihrer Fahrkarte benötigten. Teilweise seien die Computerprogramme der Automaten abgestürzt. Der Bahn-Sprecher konnte die Pannen nicht bestätigen.

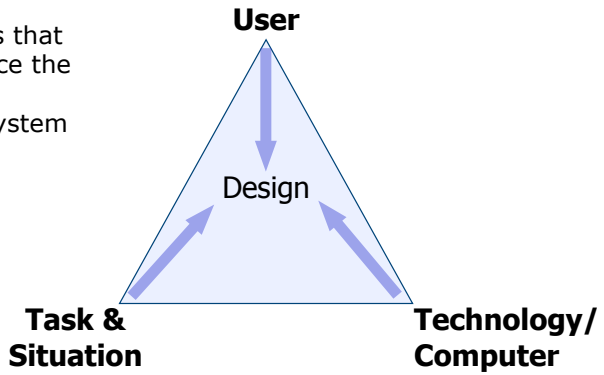
FTD (6.10.2010)

http://www.hamburg1.de/aktuell/Fahrkartenautomaten_machen_Probleme-5076.html

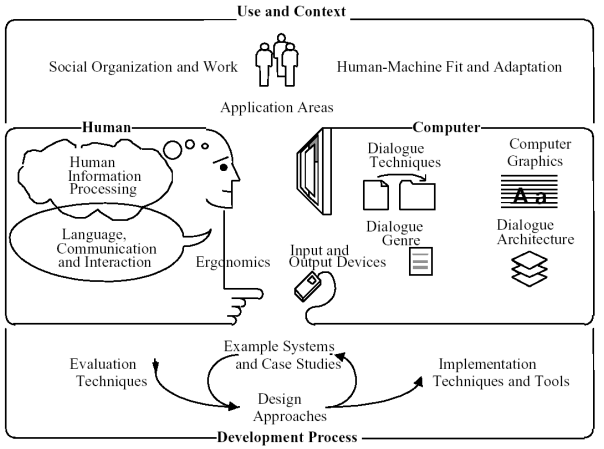
Human-Computer Interaction

...is concerned with the design, evaluation and implementation of interactive systems for human use.

Three factors that must influence the design of an interactive system



Important Issues



ACM SIGCHI - „contents of CHI“

Related terms

Software Ergonomics
Human-Computer Communication
Human-Factors Engineering
User-centered Design
Cognitive Engineering
Usability Design
Informatics Usability
User Interface Design
…

Why learn about HCI?

Interface is of major importance in “real” systems

- is all the ordinary user will experience (sees, operates, feels)
- major part in terms of developmental costs & code
- of utmost importance in systems with high costs of failure and high demands on operators

Bad interfaces cause users to...

- need more time for learning & performing their tasks
- make errors
- feel dissatisfied
- miss the full functionality of the software
- refrain from buying and using the software

Why improve HCI?

Business view:
- to exploit humans more productively/effectively
- human costs far outweigh hardware and software costs

Personal view:
- people want computers to perform like appliances
- want systems to save own work, with little training, easy to use
- not tolerant of poorly designed systems

Societal view:
- machines get used for all kinds of important tasks
- interact with all kinds of heterogeneous user groups

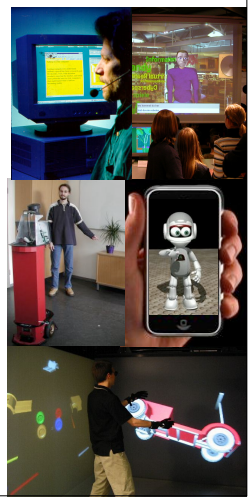
Why research HCI?

CITEC

To explore how HCI can be improved in a systematic way to benefit people

To understand how future interactive systems need to be built and what machine abilities are crucial for this

To understand principles and mechanisms of interaction and cognition in humans (constructivist approach)



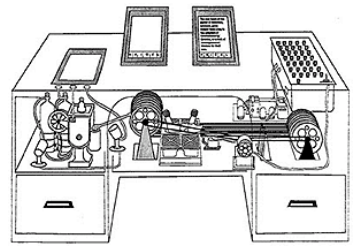
History of HCI
Pioneers & Visions

Vannevar Bush

Coordinator of US scientific activities during and after WW II

„As we may think" (1945):
„The summation of human experience is being expaned at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships"

Memex (memory expander):
Hypothetical device for storage and retrieval of knowledge
➜ multimedia, hyperlinks



Joseph C.R. Licklider

Director ARPA Information Processing Technology Office (1962-64)

„Man-Computer Symbiosis" (1960):
"The hope is that […] human brains and computing machines will be coupled together very tightly and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached […] today."

Enable humans „to cooperate [with computers] in making decisions and controlling complex situations" and „to think in interaction with a computer in the same way that you think with a colleague whose competence supplements your own".

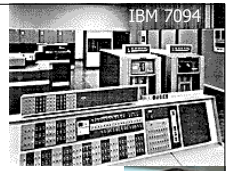
Joseph C.R. Licklider

Visions in 1960:

- Short-term
  Time-sharing, input/ouput of symbolic and graphical information, real-time systems
- Mid-term
  Facilitate human cooperation, speech recognition, character recognition, light-pen editing
- Long-term
  Natural language understanding, heuristic programming (=A.I.), learning systems

Time-Sharing

Bob Bemer, John McCarthy (Mid´60s)



- Before: batches of jobs scheduled by operator
- Now: multiple users can use a computer at the same time; every user has the impression that they are on their own personal machine
- Afforded interactive systems and interpreted programming languages
- Foundations of, e.g., current word processors

➜ need for support in human-computer interaction

First graphical user interfaces

Whirlwind (MIT, 1951):
„real time"-rendering of text and graphics on CRT terminal

SAGE (Semi-Automatic Ground Environment) project (1963): advancement of Whirlwind for military purposes (radar intelligence)

- visualization of large data sets
- „point-and-click" predecessor with light pistol (selection)

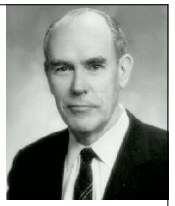
First Speech Recognizers

First recognizer:
Davies, K.H., Biddulph, R. and Balashek, S. (1952). *Automatic Speech Recognition of Spoken Digits*, J. Acoust. Soc. Am.

IBM Shoebox (William C. Dersch)

- Recognized and responded to 16 spoken words, including the ten digits from "0" through "9"
- Simple arithmetic calculations
- Demonstrated to the public at the 1962 World's Fair in Seattle and 1964 in New York

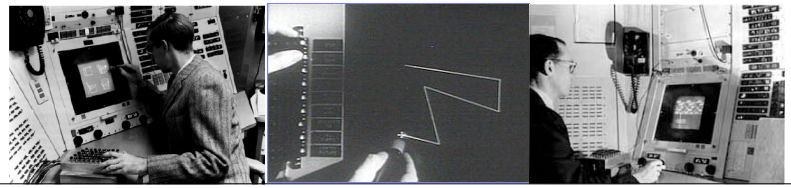
Ivan Sutherland



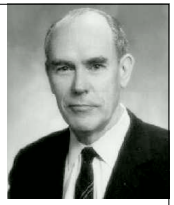
Ph.D. (MIT, 1963): *"A man-machine graphical communication system"*

Sketchpad (1963)

- First interactive graphics application & sophisticated drawing package
- Direct manipulation interface
- Major impact on HCI and user interfaces



Ivan Sutherland



Ph.D. (MIT, 1963): *"A Man-machine graphical Communications System"*

Douglas C. Engelbart

„I had the image of sitting at a big CRT screen with all kinds of symbols, new and different symbols, not restricted to our old ones. The computer could be manipulated, and you could be operating all kinds of things to drive the computer"

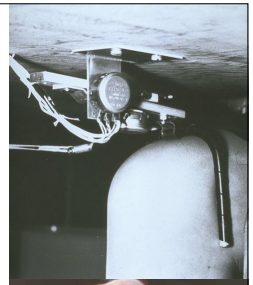
ONLine System (1968)

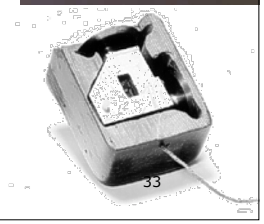
- Two persons collaboratively edit a text from two separate consoles
- Multiple windows, on-screen teleconferencing
- need for new input devices for text selection and manipulation

Douglas C. Engelbart

First „usability evaluation“: Which device most suitable for CRT display-selection in text-manipulation systems?

Light pen?
Joystick?
Knee input device?
„Mouse“ !!





Douglas C. Engelbart

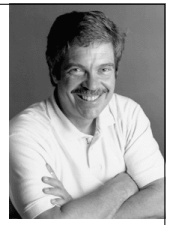
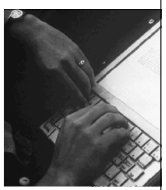
ONLine system demo with the first mouse (1968)

Alan Kay

Smalltalk, Ethernet, laser printer, client-server network model

Dynabook (1977)

- Predecessor of notebooks/PDAs, first laptop with graphical user interface
- *"We envision a device as small and portable as possible which could both take in and give out information in quantities approaching that of human sensory systems"*
- Further developed and realized later on by Apple as „Newton“


First „Personal Computers“

Xerox Alto (1973):

- GUI: Windows, Icons, Menus, Pointing
- first computer with mouse and ethernet
- WYSIWYG-Editor *Bravo/BravoX (what you see is what you get)*, direct predecessor of MS Word
- meant as a scientific computing device
- $40.000 - commercial failure

Apple II (1977)

- $1298, meant to be affordable and easy to use
- colors and sound, no GUI
- „open system“: extension slots for specific applications (word processing, games, etc.)



First „Personal Computers“

Commodore PET 2001 (1977)

- first industrially manufactured PC
- $795
- no extension slots, no color, no sound

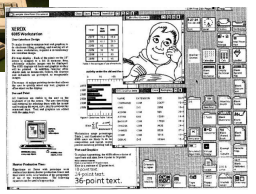
IBM 5150 (1981):

- termed and advertised as „IBM PC“
- $3000 - sold well, used in many companies due to IBM‘s dominant market position
- great marketing, weak technology
  - operating system PC-DOS
  - purely text-based, monochrome display
  - no GUI, no mouse

First GUIs

Xerox Star (1981):

- first operating system with GUI („star“) in a commercial end-user system
- idea of the „invisible computer“ -- hide away machine from users
- instead: desktop metaphor
  - windows, icons, folders, menues
  - direct data manipulation & graphical control with pointer
  - „progressive disclosure“ present common choices to user, hide complex ones (e.g. expanding dialogue box)



First GUIs

Apple Lisa (1983)

- inspired by Xerox Alto
- besides Xerox Start, the first commercial system with keyboard and mouse
- Document-centered view
- $10.000, commercial failure
- → Lisa2 → Macintosh XL

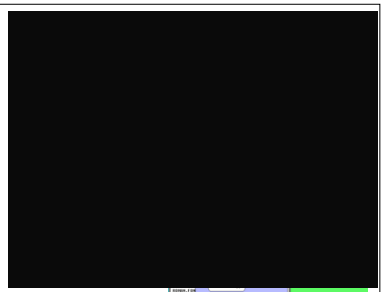
Apple Macintosh (1984)

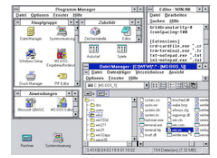
- Consequent GUI: integral part of the OS, no cursor keys
- $2495 – commercial success
- „Killer applications“: Finder, MacDraw, MacWrite, DTP, MS Word

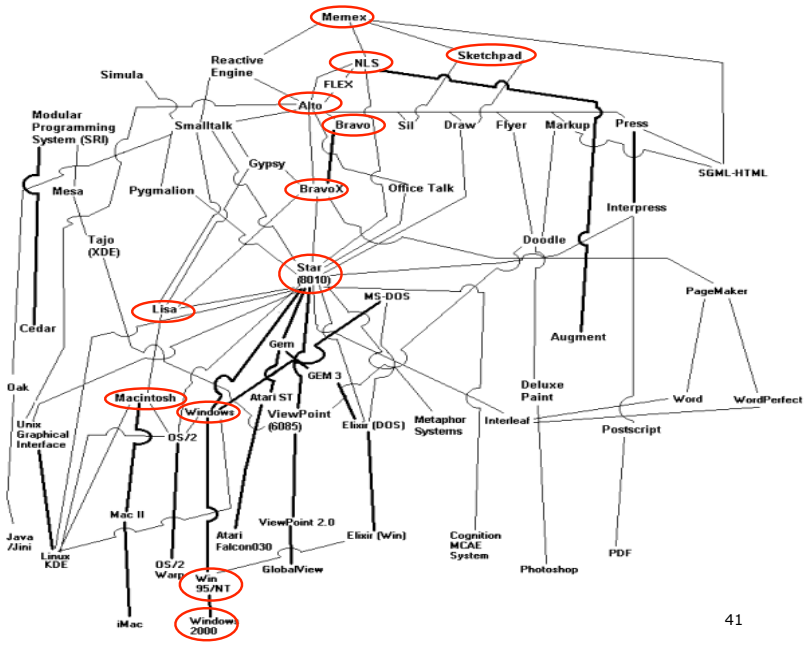
First GUIs

Microsoft Windows

- GUI on top of PC-/MS-DOS
- 1985: Apple CEO Sculley signed agreement allowing Microsoft to use Mac OS technology, in exchange for further development of MS software for Mac
- 1985: Windows 1.01 - no applications
- 1987: Windows 2.03 - Word, Excel
- 1992: Windows 3.1 - first commercial success
- Win 95, 98, NT, 2000, XP, Vista, Windows 7







Visions from the past

The Knowledge Navigator
(concept video created by Apple in 1989)

Tablet, camera

Touch, pointing

Continuous speech

Dialogue

Embodied agent

Collaboration

Personal assistant, trust

Today

iPhone 4S with **Personal Assistant „Siri"**

Evolution

~ Outline of this lecture

Year	Paradigm	Implementation
1950s		*Switches, punched cards*
1970s	*Typewriter*	*Command-line interface*
1980s	*Desktop*	*Graphical user interface, direct manipulation*
1980s+	*Spoken Language*	*Speech recognition/synthesis, natural language processing, dialogue systems*
1990s+	*Natural interaction*	*Perceptual, multimodal, interactive, conversational, tangible, adaptive*
2000+	*Social interaction*	*Agent-based, anthropomorphic, social, emotional, affective, collaborative, assistive*