Vorlesung Mensch-Maschine-Interaktion

Ludwig-Maximilians-Universität München
LFE Medieninformatik
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http://www.medien.informatik.uni-muenchen.de/

Vorlesung Mensch-Maschine-Interaktion

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- Vorlesung: Donnerstag, 14-16 Uhr, Theresienstraße, Raum 112
- Übungen: Montag, 14-16 Uhr,
  Theresienstraße, Raum 113 oder Amalienstraße 17, Raum 105
  Übungsleitung: Siegfried Wagner
- Informationen zur Vorlesung und Übung:
  http://www.medien.informatik.uni-muenchen.de/de/lehre/ws03/mmi/

Inhalt

- Die Vorlesung „Mensch-Maschine-Interaktion“ behandelt grundlegende Aspekte der Interaktion zwischen Mensch und Computer. Es geht dabei im Wesentlichen darum, wie Schnittstellen an Computern, Maschinen und Geräten gestaltet und implementiert werden können, um Menschen ein effizientes und angenehmes Arbeiten zu ermöglichen.

- Themen
  - Grundlagen und Beispiele für den Entwurf von Benutzungsschnittstellen
  - Informationsverarbeitung des Menschen
  - Designgrundlagen und Designmethoden
  - Ein- und Ausgabeeinheiten für Computer
  - Prinzipien, Richtlinien und Standards für den Entwurf von Benutzerschnittstellen
  - Methoden zur Modellierung von Benutzungsschnittstellen
  - Evaluierung von Systemen zur Mensch-Maschine-Interaktion

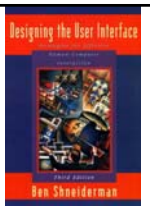
Ablauf und Anforderungen

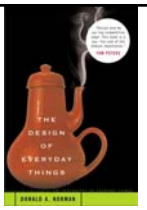
- Vorlesung mit Übung, 2h+2h
- Lesematerial (ca. ein Artikel pro Woche)
- Übungsaufgaben

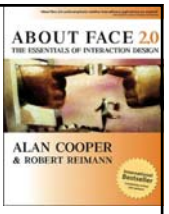
- Scheinkriterien
  - Erfolgreiche Teilnahme an den Übungen (ca. 4 Übungsaufgaben und zwei kurze Aufsätze zu vorgegebenen Themen)
  - Schriftliche Zusammenfassung des Lesematerials (ca. 150 Worte pro Artikel)

- Vorkenntnisse
  - Grundstudium Medieninformatik oder Informatik
  - Grundkenntnisse in der Programmierung von graphischen Benutzerschnittstellen (z.B. Applets in JAVA oder TCL/TK)
  - Englische Sprachkenntnisse

Books







- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale. (1998) Human Computer, Interaction (second edition), Prentice Hall, ISBN 0132398648 (new Edition announced for October 2003)
- Ben Shneiderman. (1998) Designing the User Interface, 3rd Ed., Addison Wesley; ISBN: 0201694972
- Donald A. Norman. (1990) The Design of Everyday Things; ISBN: 0465067107
- Alan Cooper, Robert M. Reimann. (2003) About Face 2.0: The Essentials of Interaction Design; ISBN: 0764526413
- Andreas Holzinger. (2001) Basiswissen Multimedia. Band 3: Design; ISBN: 3802318587
- Sven Heinsen, Petra Vogt (Herausgeber). (2003) Usability praktisch umsetzen. Ein Handbuch für Software, Web, Mobile Devices und andere interaktive Produkte; ISBN: 3-446-22272-3.

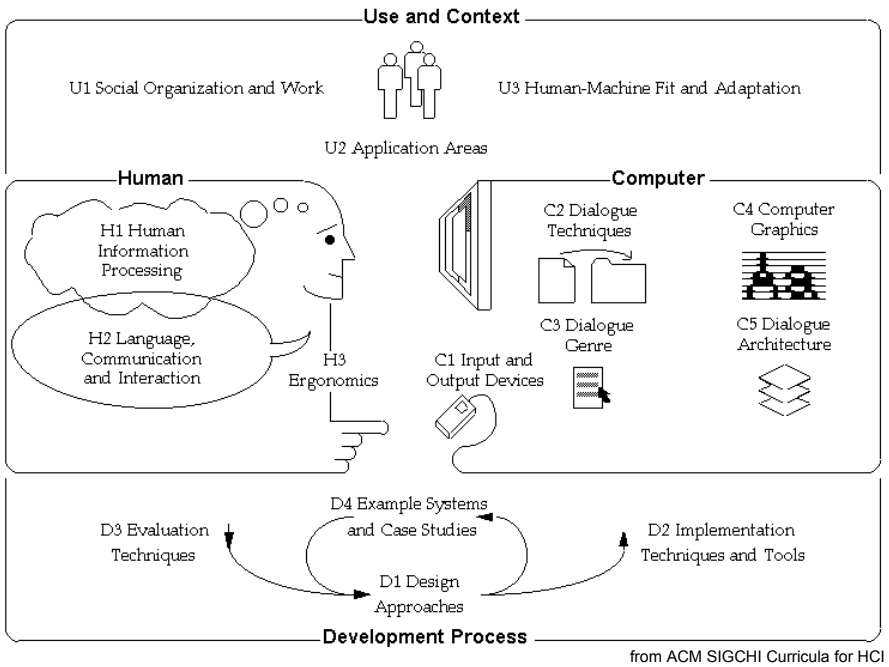
Table of Content

- Human Computer Interaction (HCI) explaining the field
- Digital Products and the Problem of Good User Interfaces
- HCI and the development process
- Usability, Utility, Likeability
- A brief history of HCI
- Implementation Model, Conceptual Model, and Represented Model
- Traditional Interfaces vs. Digital Interfaces

Human Computer Interaction (HCI)

- *"Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them"*
  (working definition in the ACM SIGCHI Curricula for HCI)

- Computer science view point:
  "Interaction between one or more humans and one or more computational machines"



from ACM SIGCHI Curricula for HCI

HCI - An Interdisciplinary Area

- **Computer Science**
  application design and engineering of human-computer interfaces
- **Psychology**
  the application of theories of cognitive processes and the empirical analysis of user behavior
- **Sociology and Anthropology**
  interactions between technology, work, and organization
- **Design and Industrial Design**
  creating interactive products

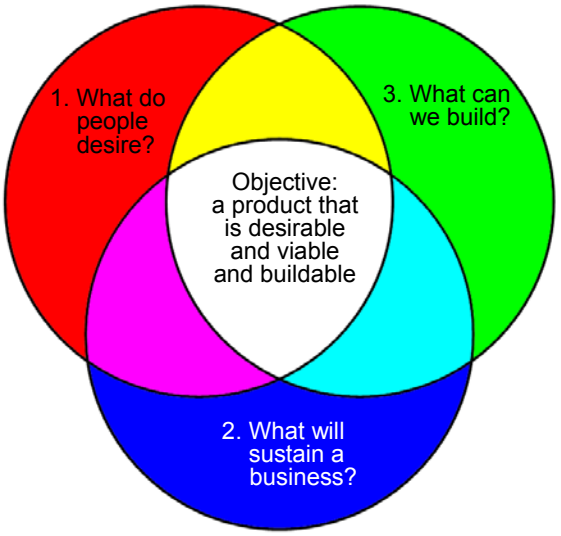
Concerns in HCI

Science, Engineering, and Design Aspects

- the joint performance of tasks by humans and machines
- the structure of communication between human and machine
- human capabilities to use machines (including the learnability of interfaces)
- algorithms and programming of the interface itself
- engineering concerns that arise in designing and building interfaces
- the process of specification, design, and implementation of interfaces
- design trade-offs

Building Successful Digital Products

- tension
  - different objectives
  - different design goals
- step by step 1-2-3
- solution
  - Products in the overlapping space



From A. Cooper, About Face 2.0

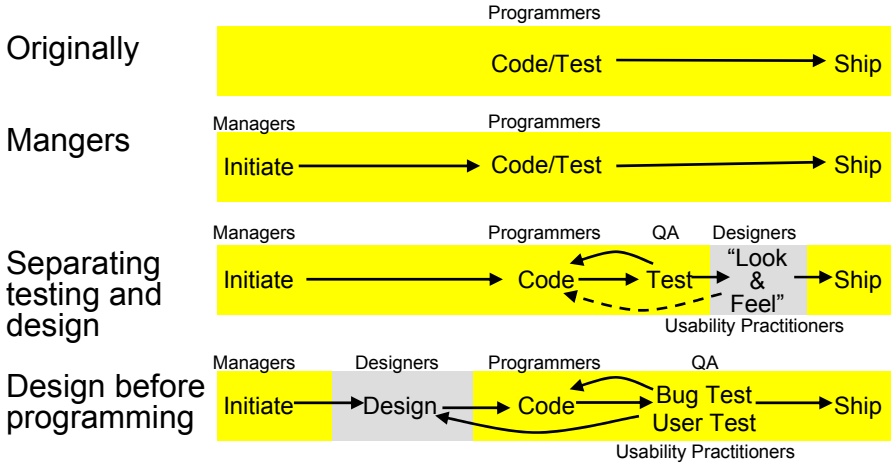
It is not Simple to Make Good User Interfaces

- Basic misconceptions
  - If I (the developer) can use it everyone can use it
  - If our non-technical staff can use it – everyone can
  - Good user interfaces are applied common sense
  - A system is usable if all style guideline are met
- Examples of bad software are easy to find in the WWW or in various “Usability Hall of Shame”
- Creating usable systems is a structured process and can be achieved by use of different methods

HCI is Central to the Design and Development Process

- … even if done unconsciously. Decisions made in the development process are likely to influence how a product can be used.
- thinking about the user interface when a first version of a product is finished is to late!
- good user interfaces – and often good products – are a joined effort of all participants in the design and development process
- similar to building a house… the interior designer can't solve problems caused by bad engineering.

Evolution of the Software Development Process



From A. Cooper, About Face 2.0

Utility, Usability, Likeability

- **Utility**
  a product can be used to reach a certain goal or to perform a certain task. This is essential!

- **Usability**
  relates to the question of quality and efficiency. E.g. how well does a product support the user to reach a certain goal or to perform a certain task.

- **Likeability**
  this may be related to utility and usability but not necessarily. People may like a product for any other reason…

What is Usability

Usability 101 by Jakob Nielson

- *"Usability is a quality attribute that assesses how easy user interfaces are to use. The word 'usability' also refers to methods for improving ease-of-use during the design process."*

- Usability has five quality components:
  - **Learnability**: How easy is it for users to accomplish basic tasks the first time they encounter the design?
  - **Efficiency**: Once users have learned the design, how quickly can they perform tasks?
  - **Memorability**: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
  - **Errors**: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
  - **Satisfaction**: How pleasant is it to use the design?

Why is Usability Important?

- Improving usability can
  - increase productivity of users
  - reduce costs (support, efficiency)
  - increase sales/revenue (web-shop)
  - enhance customer loyalty
  - win new customers
- Several case studies that show the benefit of usability
- Usability is often considered as sign of quality
- Working with users can create ideas for new products, e.g. "similarities" feature (*people who bought this also bought that*) at amazon.com, see Interview Maryam Mohit

Why is Usability Important in the Context of WWW and New Media?

- Competition is very close (just another link…)
- User Interface is often the central discriminating factor
- Comparison is easily possible
- Example – Online-Shop
  - Direct correlation between usability and sales is reported in many cases
  - Users who can't find the product in the shop can not buy it
  - Users who are not able fill in correctly the order form are not going to buy

How to Achieve Usability

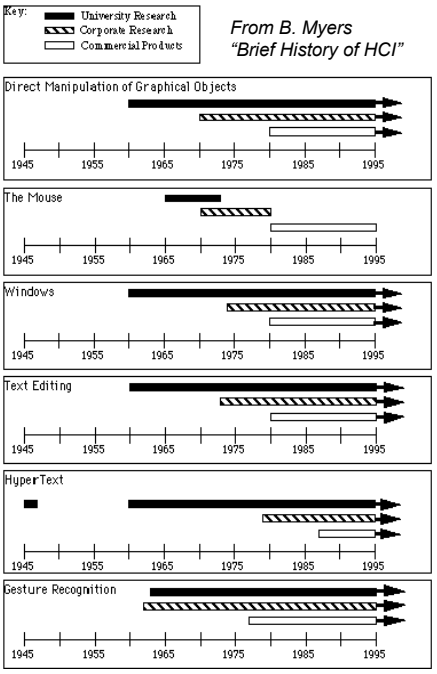
(high level overview – more details later)

- Identify what utility and usability for the product means
  - main purpose of the product
  - anticipated users, target audience
  - compare with similar/competitive products (if applicable)
- Common effort in the design and development process
  - trade-offs between design, engineering, and usability
- Iterative evaluation
  - usability testing with different methods at various stages of the development process
- Improvement after product release
  - monitoring user behavior
  - evaluation of changes to the product (e.g. adding a new feature to a web shop)

Usability Testing

(high level overview – more details later)

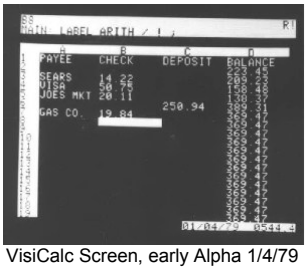
- Usability testing of software/web-applications assesses several factors, e.g.
  - Does application functionality match the user's needs?
  - Is the application easy to learn?
  - How easy is it for the user to accomplish tasks with the application?
  - Is it easy to remember how to use the application?
  - Does the user enjoy using the application, or does he/she become easily frustrated by it?
  - Does the application do what the user expects?
- Ways to quantify usability include measuring
  - How many mistakes get made in a given time period?
  - How long do users take to complete a specific task successfully?
  - How long it takes for users to learn the application's distinct functions/features
  - How repeatable users' experiences are
  - What paths do they take in trying?
  - The users' satisfaction levels
  - How long does it take to correct an error?



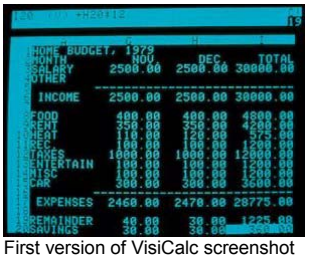
A Brief History of HCI

- Early machines used batch processing (e.g. punch card machines)
- Terminals with command line interfaces
- Graphical user interfaces with pointing device
- Multimodal user interfaces

VisiCalc - Widespread use of an Interactive Application



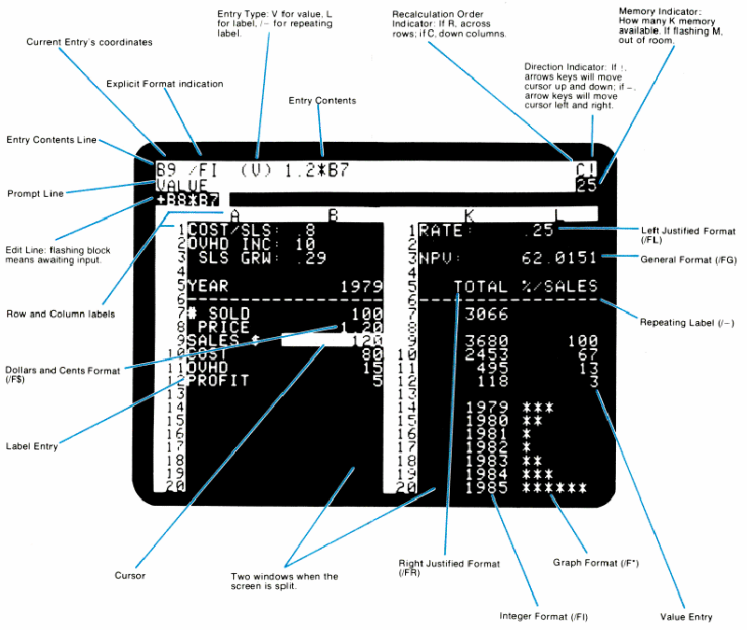
VisiCalc Screen, early Alpha 1/4/79



First version of VisiCalc screenshot

- Instantly calculating electronic spreadsheet
- Early killer app for PCs
- Significant value to non-technical users

A VISICALC™ Screen:

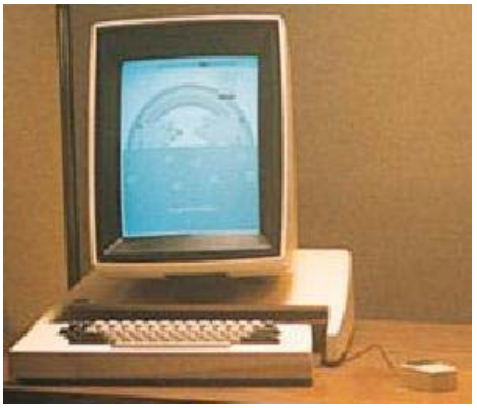


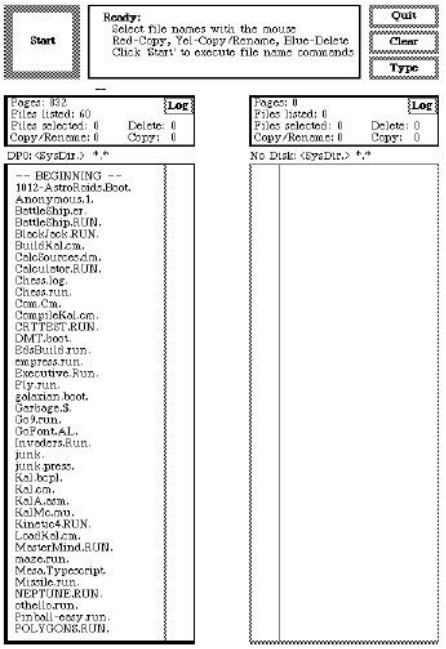
Changing Interaction Paradigms

- Replacement of command-language
- Direct manipulation of the objects of interest
- Continuous visibility of objects and actions of interest
- Graphical metaphors (desktop, trash can)
- Windows, icons, menus and pointers
- Rapid, reversible, incremental actions

- Origins of direct manipulation an graphical user interfaces
  - Ivan Sutherland's Sketchpad, 1963, object manipulation with a light pen (grabbing, moving, resizing)
  - Douglas C. Engelbart, 1968, Mouse, NLS
  - XEROX ALTO (50 units at Universities in 1978)
  - XEROX Star (1981)
  - Apple Macintosh (1984)

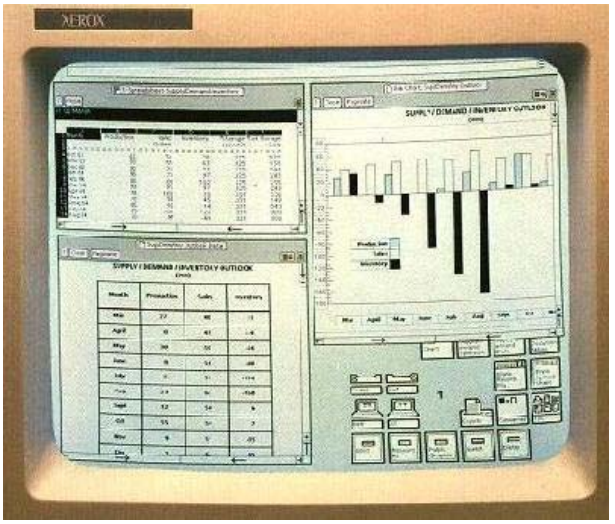
XEROX ALTO





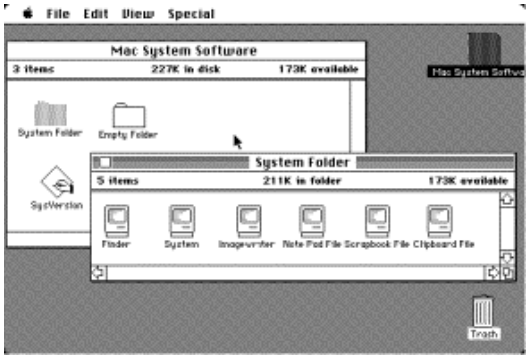
Photos from
http://members.fortunecity.com/pcmuseum/alto.html

XEROX Star



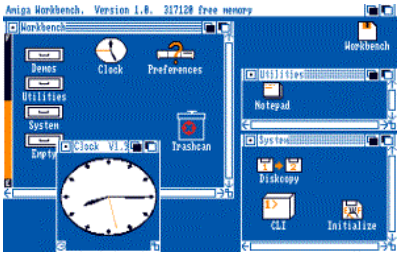
Photos from http://members.fortunecity.com/pcmuseum/alto.html

Apple Macintosh



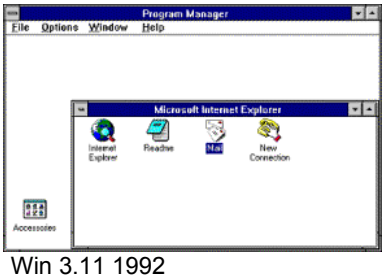
1984 – commercially successful GUI

More GUIs

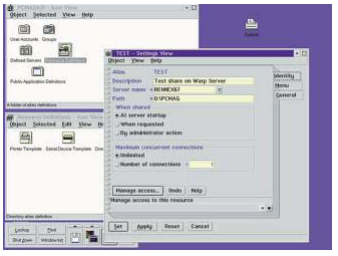


Amiga 1985

NextStep 1989



Win 3.11 1992



OS/2 1992

Lessons Learned from History

- Technology drives new user interface concepts and interaction metaphors
- New user interfaces create new applications
- Designs and user interface concepts evolve
- You can not hide the user interface - good ideas spread out
- The first to come out with a new user interface is not necessarily the most successful

- Technologies to look out for?
  - Eye gaze detection
  - Speech and gesture recognition
  - EEG, ECG, EMG interfaces (e.g. http://www.biosemi.com/products.htm) ElectroEncephaloGraphy, ElectroCardioGraphy, ElectroMyoGraphy

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