

Vorlesung Mensch-Maschine-Interaktion

Ludwig-Maximilians-Universität München

LFE Medieninformatik

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WS2004/2005

<http://www.medien.ifi.lmu.de/>

Vorlesung Mensch-Maschine-Interaktion Lehr- und Forschungseinheit Medieninformatik

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- Vorlesung: Dienstag, 12-14 Uhr, Theresienstraße, Raum 113
- Übungen: Freitag, 8-10 und 10-12 Uhr,
Amalienstraße 17, Raum 105
Übungsleitung: Andreas Pleuß
- Informationen zur Vorlesung und Übung:
<http://www.medien.ifi.lmu.de/lehre/ws0405/mmi.html>

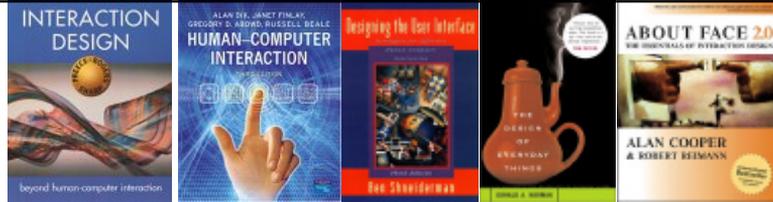
Inhalt

- 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
 - 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
- Vorlesungsfolien und Übungsaufgabe in englischer Sprache
- Lesematerial (ca. ein Artikel pro Woche)
- Übungsaufgaben
- Scheinkriterien
 - Erfolgreiche Teilnahme an den Übungen (ca. 5 Übungsaufgaben und ein kurzer Aufsatz zu einem vorgegebenen Thema)
 - Schriftliche Zusammenfassung des Lesematerials (ca. 100-150 Worte pro Artikel)
- Vorkenntnisse
 - Grundstudium Medieninformatik oder Informatik
 - Grundkenntnisse in der Programmierung von graphischen Benutzerschnittstellen (z.B. Applets in JAVA, Visual Basic oder TCL/TK)
 - Englische Sprachkenntnisse

Books



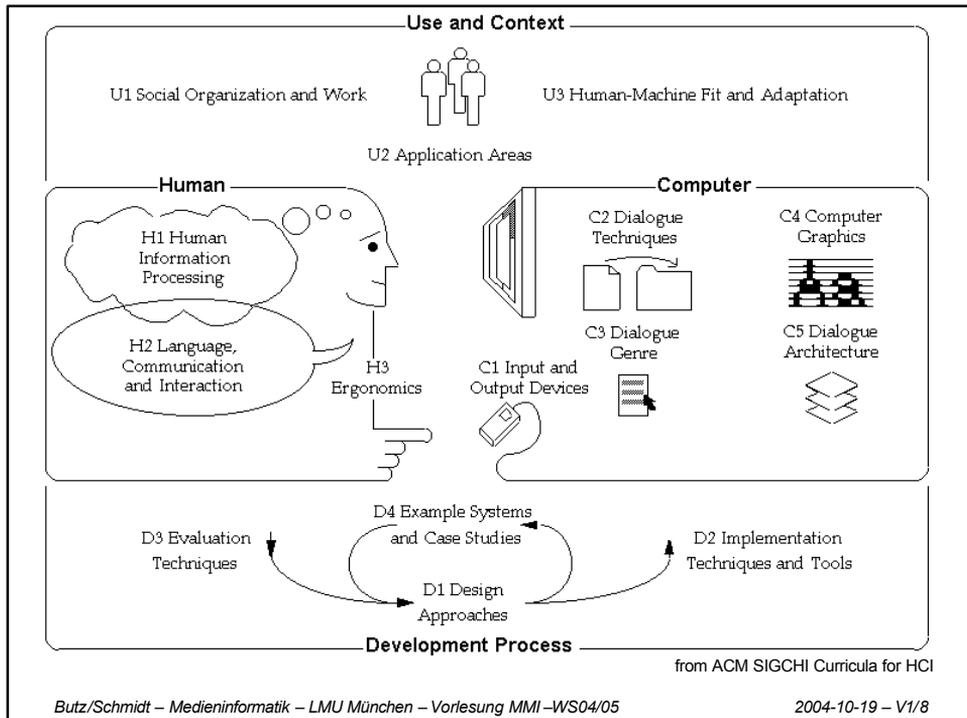
- Jennifer Preece, Yvonne Rogers, Helen Sharp (2002). Interaction Design. ISBN 0471492787
- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale. (2003) Human Computer, Interaction (third edition), Prentice Hall, ISBN 0130461091
- Ben Shneiderman. (1998) Designing the User Interface, 3rd Ed., Addison 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.



What is Human-Computer-Interaction?

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”



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

Interaction Design and New Interfaces

Interface and interaction design

- Interface design
 - Primarily design of 2D/3D widgets
- Designing interactive products to support people in their everyday and working lives
 - Sharp, Rogers and Preece (2002)
- The design of spaces for human communication and interaction
 - Winograd (1997)

Goals of interaction design

- Develop usable products
 - Usability means easy to learn
 - effective to use
 - provide an enjoyable experience
- Usable products = successful products?
- Involve users in the design process

Example of good and bad design



CS Building



DFKI

Doors

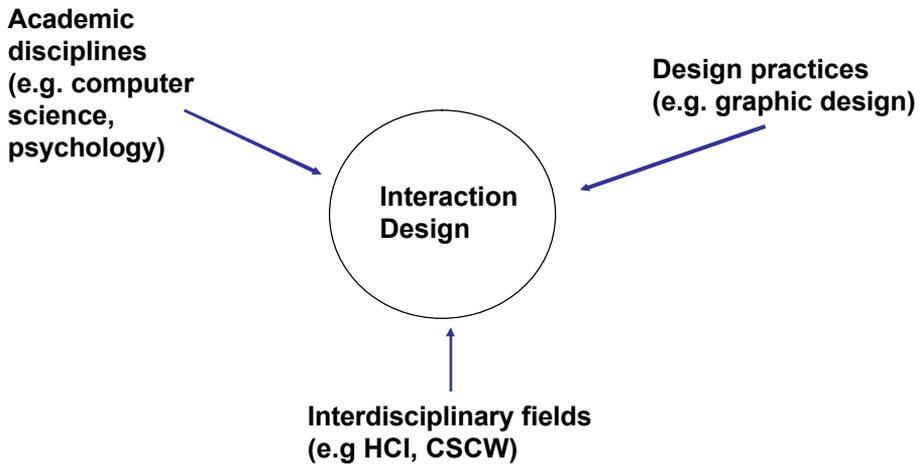


Opening the door from inside seems to be easy, if the door isn't locked.

From HCI to Interaction Design

- **Human-computer interaction (HCI)** is:
“concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them” (ACM SIGCHI, 1992, p.6)
- **Interaction design (ID)** is:
“the design of spaces for human communication and interaction”
– Winograd (1997)
- Increasingly, more application areas, more technologies and more issues to consider when designing ‘interfaces’

Relationship between ID, HCI and other fields



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 Nielsen

- *“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?

How easy is it to work in multidisciplinary teams?

- More people involved in doing interaction design the more ideas and designs generated...but...
- The more difficult it can be to communicate and progress forwards the designs being created
- To be able to work in a team is essential!
 - Team work is a skill that can be learned
 - We will force this in the exercise!

break

User Centered Design – it is the whole process...

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

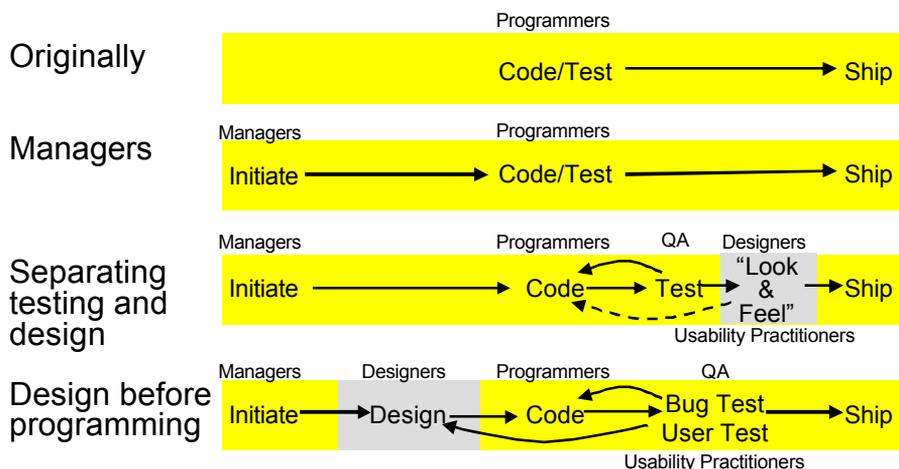
It is not Simple to Make Good User Interfaces

- 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*

HCI and Interaction Design are serious business

- Increasing number of consultancies, examples of well known ones include:
 - **Nielsen Norman Group**: “help companies enter the age of the consumer, designing human-centered products and services”
 - **Swim**: “provides a wide range of design services, in each case targeted to address the product development needs at hand”
 - **IDEO**: “creates products, services and environments for companies pioneering new ways to provide value to their customers”



Butz/Schmidt – Medieninformatik – LMU München – Vorlesung MMI –WS04/05



2004-10-19 – V1/31

What do professionals do in the HCI and ID business?

- **interaction designers** - people involved in the design of all the interactive aspects of a product
- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers** - people who do all the above but who may also carry out field studies to inform the design of products

Jobs in this field...

USABILITY ENGINEER – [...] From: British HCI New, September 19, 2004

- To provide usability expertise to Self Service (including cash machines) product development teams.
- The position is to provide usability expertise for the creation of solutions for self-service terminals for banks internationally with particular emphasis on the service and replenishment tasks. The successful candidate will be working within the Design, Usability and Accessibility team which is part of Architecture & Technology in support of the Development teams responsible for products and devices. You will work as an integral team member within multidisciplinary project teams.
- Responsibilities include:
 - Design and develop Usability activities to support project requirements
 - Execute the User Centred Design (UCD) process
 - Contribute to usability and serviceability specifications
 - Plan and assist in the usability validation of new ideas
 - Support other Design, Usability and Accessibility Associates
 - Develop a high level of understanding of customer requirements, NCR solutions and the Self-Service environment
 - Be aware of competitors self-service solutions
 - Active participation in DU&A brainstorming events
 - Develop and deliver presentations and reports to support the effective communication of project activities and results to internal audiences.
 - ...

Jobs in this field...

- Job title: **Senior Interaction Designer / Experience UI designer**
From: British HCI New, July 21, 2004
- **JOB PURPOSE**
Responsibility for ensuring that the user-interface for the website, desktop software systems, internal systems and email templates (digital channels) meets customer experience requirements, promotes high usability, meets brand core values and drives sales.
- **KEY ACCOUNTABILITIES**
 - To identify customer experience requirements and design drivers for development of each digital channel
 - To provide navigational structures and storyboards for new business initiatives that meet customer experience requirements
 - To produce mock-ups for all new projects when working within established creative style guidelines
 - To work with in-house design agency to establish creative solutions when a new look and feel is required to meet requirements
 - To understand the interaction between digital and human channels and ensure appropriate, consistent customer experience is designed into digital channels.
 - To develop rapid prototypes for usability testing to ensure rapid and iterative improvements
 - To instigate usability testing for new designs for digital channels as and when appropriate
- **KEY EXPERIENCE**
 - Experience of capturing customer experience requirements and design drivers - essential
 - Information Architecture experience for developing user-centred websites - essential

Jobs in this field...

- **User-centred design Specialist (Investment Banking)**

From: British HCI New, May 3, 2004

- Leading global investment banking firm currently seeking a UE specialist to champion user-centred design within the organisation; presenting to IT teams and management, training other members of staff in user-centred design techniques and planning appropriate techniques for system evaluation, enhancement and redesign.
- You will be responsible for:
 - conducting user and stakeholder requirements elicitation research; using various techniques such as contextual enquiry, field interviews, participatory design sessions and surveys with internal and external users
 - conducting usability evaluations of existing systems prior to redesign (lab testing, heuristic evaluations, cognitive walkthroughs etc)
 - analysing user research findings and communicating these findings to designers, developers and business owners
 - working closely with designers and developers to produce interface prototypes including deliverables such as schematics, site maps, wireframes, HTML prototypes
- The successful candidate will have:
 - thorough understanding of design issues for web-based interfaces (Java, HTML, and Javascript), 2/3 years experience working on web-based systems desirable
 - experience producing interface prototypes in vector-based drawing tools (Visio, CorelDraw, illustrator)
 - excellent communication skills (written, spoken, presentation, negotiation, persuasion)

Interacting with Computers – Very Brief History

Evolution of HCI 'interfaces'

- **50s** - Interface at the hardware level for engineers - switch panels
- **60-70s** - interface at the programming level - COBOL, FORTRAN
- **70-90s** - Interface at the terminal level - command languages
- **80s** - Interface at the interaction dialogue level - GUIs, multimedia
- **90s** - Interface at the work setting - networked systems, groupware
- **00s** - Interface becomes pervasive
 - RF tags, Bluetooth technology, mobile devices, consumer electronics, interactive screens, embedded technology

Student Project Last Term

HUMAN COMPUTER INTERACTION
a brief history

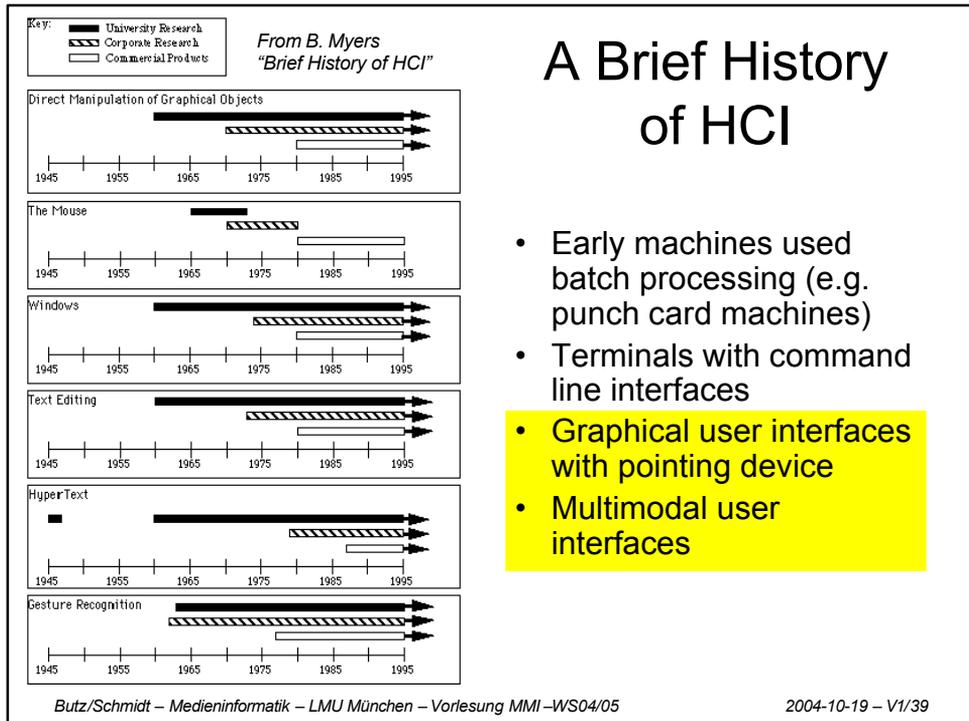
1983 Apples Lisa erscheint mit Maus

In January 1983 Apple releases "Lisa" the first mouseoperated personal computer. This highly praised computer indeed was no success as well. Again because of its high price with 10.000,-\$ no "normal people" could afford it.

By the way apple mouse was produced by Logitech with only one key, and it still meege along with only one key on their latest mice.

Start

Arbeitsplatz



VisiCalc - Widespread use of an Interactive Application



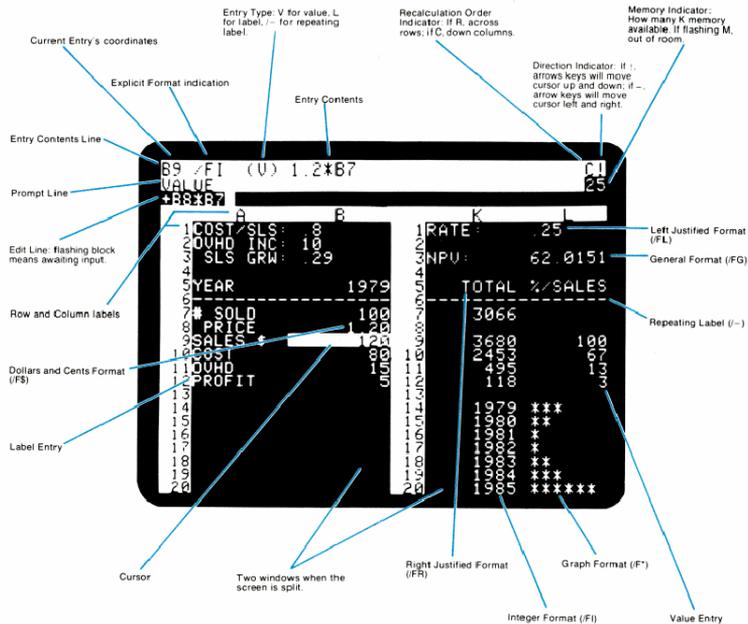
VisiCalc Screen, early Alpha 1/4/79



First version of VisiCalc screenshot

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

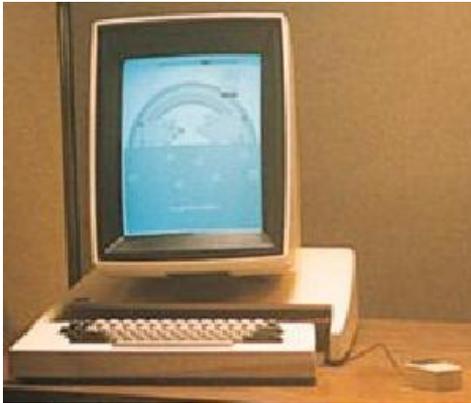
A VISICAL™ Screen:



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 and 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



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

Start

Ready:
Select file names with the mouse.
Red-Copy, Yel-Copy/Rename, Blue-Delete
Click Start to execute file name commands

Quit
Clear
Type

Pages: 832
Files listed: 60
Files selected: 0
Copy/Rename: 0

DP0: <SysDir> *.*

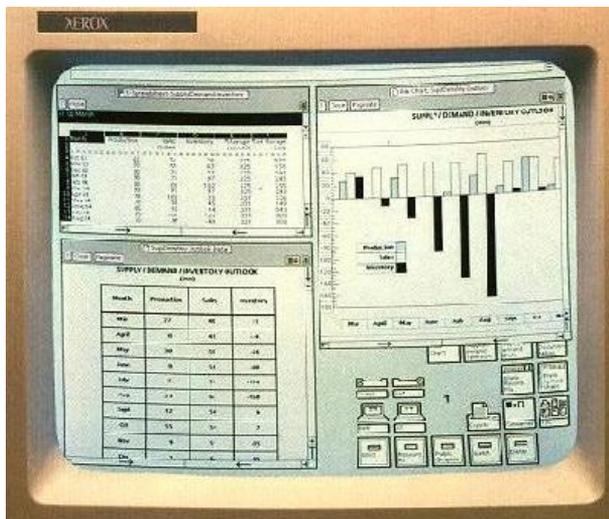
```

-- BEGINNING --
1012: A:strogaide.Boot.
Anonymous.1.
BattleShip.er
BattleShip.RUN.
Book1.doc.RUN.
BuildKal.cm.
CalcSource.cm.
Calculator.RUN.
Chess.log
Chess.run.
Com.Cm.
CompJdeKal.cm.
CFTPEST.RUN.
DMT.boot.
E88Build.run.
ezpress.run.
Executive.Run.
Fly.run.
golan.boot.
Garbage.S
Go9.run.
GoFont.A.L.
Invaders.Run.
junk
junk.press.
Kal.kcpl.
Kal.cm.
KalA.cm.
KalMc.cm.
Kinetics4.RUN.
LoadKal.cm.
MasterMind.RUN.
maze.run.
Memo.Typescript.
Missile.run.
NEPTUNE.RUN.
othello.run.
Pindoll.easy.run.
POLYCONS.RUN.
                    
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Pages: 0
Files listed: 0
Files selected: 0
Copy/Rename: 0

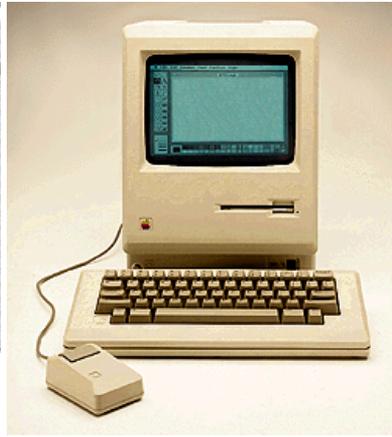
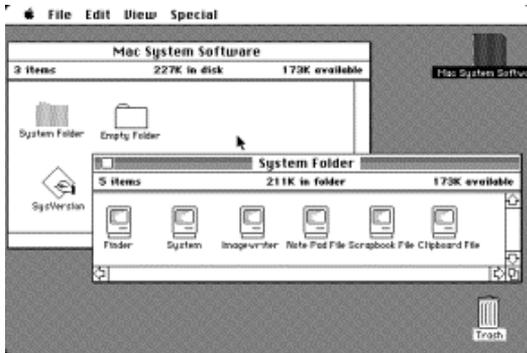
No Disk: <SysDir> *.*

XEROX Star



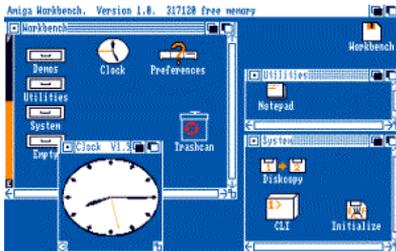
Photos from <http://members.fortunecity.com/pcmuseum/alto.html>

Apple Macintosh



1984 – commercially successful GUI

More GUIs



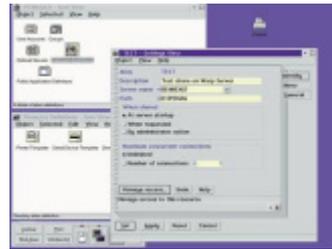
Amiga 1985



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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