Mensch-Maschine-Interaktion (Human-Machine Interaction)

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Sommersemester 2009

Example: „I am not able to program my VCR.“

14 Press **TIMER REC**. The timer indicator " 🕐 " will appear on the display and the unit stands by for recording.

Example: "I am not able to ..."
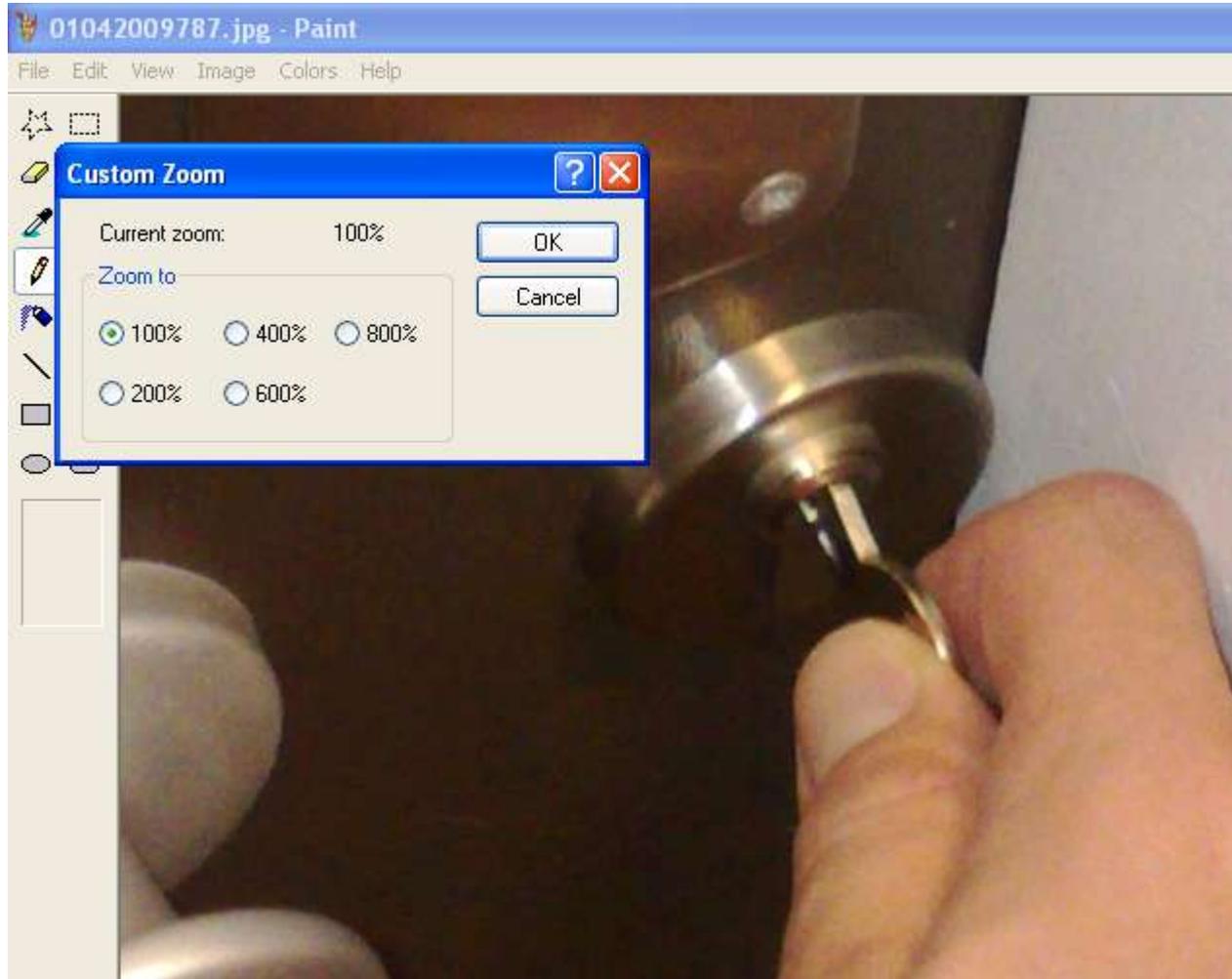
Vorbemerkung: Deutsch and English

- Viele Materialien sind nur in englischer Sprache verfügbar
  - ...oder in besserer Qualität/Aktualität

- Wissenschaftliches Arbeiten ist international
  - Die Wissenschaftssprache ist englisch
  - Austausch von Materialien zwischen Lehre und Forschung in deutscher Sprache ist schwierig
  - Viele Begriffe sind in englischer Sprache geprägt und schwer zu übersetzen

- Konsequenz:
  - Lehrmaterialien in *englischer* Sprache
  - Vortrag in *deutscher* Sprache

Paul Holleis from DOCOMO Euro-Labs

- Diploma Informatics, University of Passau
- PhD in Computer Science, Media Informatics Group, LMU Munich

Mission

- Research on Smart Services & Advanced mobile Network Technologies
- Collaboration with European Universities and Industry
- Standardization

Research Fields

Smart & Secure Services
- Life support & community services based on context information and reasoning
- Building the „Internet of Things" with NFC
- Secure software and data usage control

Wireless Access
- Wireless access technologies for increased efficiency
  in spectrum usage, e.g., SU/MU-MIMO, Interference management

Network Platform
- Future transport network enhanced with overlays & virtualization
- Service delivery platform cooperating with 3rd services
- Network security

Further information

www.docomolab-euro.com

Who's NTT DoCoMo?

- Major mobile operator

- Japan's premier mobile operator
  - 50+ million subscriber
  - 40+ million i-mode users
  - 30+ million FeliCa users

- Leadership in mobile data
  - i-mode success story
  - Commercial 3G network (FOMA) since 2002
  - **R&D innovations** in networks, terminals, services
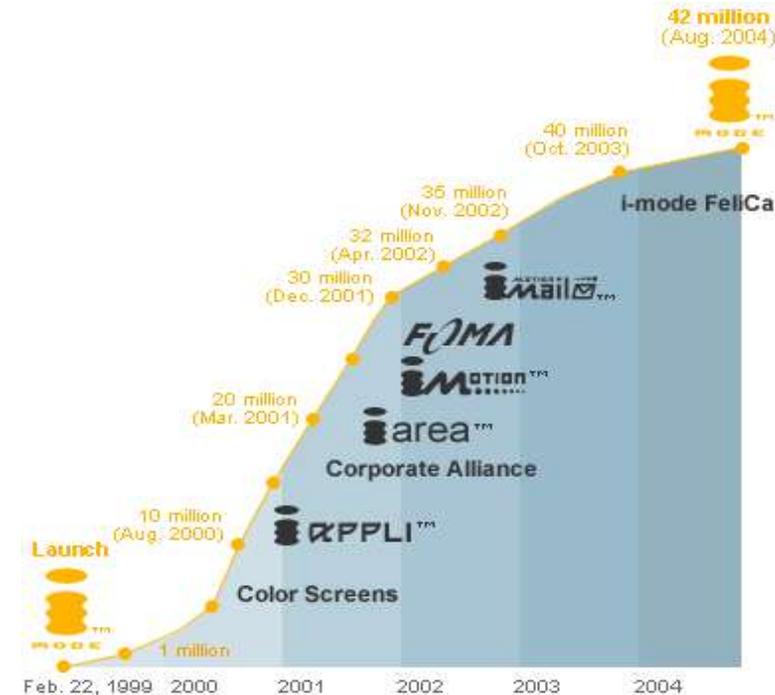
i-mode services	Wristomo	FingerWhisper

Organisatorisches

- Die Lehrveranstaltung (3V+2Ü) ist eine Mischung aus:
  - Vorlesung (voraussichtlich 12 Termine)
  - Übungen zur Durchführung von Experimenten (ca. 7 Aufgabenblätter)
  - Diskussions- und Unterstützungs-Übungen

- Einteilung für die Übungen in 4er-Gruppen *(per Los!)*

- Für Leistungsnachweis:
  - Erfolgreiche Bearbeitung der Aufgabenblätter (als Gruppe)
  - Teilnahme an einer zusätzlichen Benutzerstudie (verschiedene Angebote)
    - » Aus Projekt-, Diplom- und Forschungsarbeiten
  - Lesen und schriftliches Zusammenfassen von wiss. Arbeiten
  - Abgabe einer Arbeitsmappe am Ende

- Keine Klausur / keine abschließende mündliche Prüfung

Website

- http://www.medien.informatik.uni-muenchen.de/mmi

- Content
  - General Information / news
  - Lecture Slides
  - Exercises
  - Literature
  - Links

- *Remark*: There is an online video podcast of the lecture given by Prof. Hussmann in WS 06/07:

  http://videoonline.edu.lmu.de/wintersemester-2006-2007/04/

1 Introduction and History

Why is Usability Important?

- Improving usability can
    - increase productivity of users
    - reduce costs (support, efficiency)
    - increase sales/revenue
        » E.g. web shop: In the web, the competitor is just one click away!
    - enhance customer loyalty
    - win new customers

- Several case studies show the benefit of usability

- Usability studies can trigger new ideas

- Usability is often considered as sign of quality

Interaction Design and Product Design

- Product design determines the appearance of the product

- Interaction design determines the usability of the product

- Both are closely coupled

Sophisticated Design does not entail Usability

CS Building in Saarbrücken

DFKI in Saarbrücken

(Photos A. Butz)

Usability applies to a wide range of systems

(German Rail IC-Train)

(CS Building, Lancaster University)

- Signs and explanations for things that are usually obvious are an indicator for a potential problem.

- Not having (necessary) explanations is also not a solution

Usability applies to a wide range of systems

CSE HTML Validator v3.05

Warning Checkbox Options
- ☑ Show warnings
- ☐ Show comment warnings
- ☑ Show missing attribute warnings

Tag Name Program Options
- ☑ Enable programs

☑ Flag 1 ☑ 2 ☑ 3 ☑ 4 ☑ 5 ☑ 6 ☑ 7 ☑ 8 ☑ 9 ☐ 10
☑ Flag 11 ☑ 12 ☑ 13 ☑ 14 ☑ 15 ☑ 16 ☑ 17 ☑ 18 ☑ 19 ☑ 20

CSE HTML Validator v4.0

Program Flags

☑ 1	☑ 2	☑ 3	☑ 4	☑ 5	☑ 6	☑ 7	☑ 8	☑ 9	☑ 10	☑ 11	☑ 12
☑ 13	☑ 14	☑ 15	☑ 16	☑ 17	☑ 18	☑ 19	☑ 20	☑ 21	☑ 22	☑ 23	☑ 24
☑ 25	☑ 26	☑ 27	☑ 28	☑ 29	☑ 30	☑ 31	☑ 32	☑ 33	☑ 34	☑ 35	☑ 36
☑ 37	☑ 38	☑ 39	☑ 40	☑ 41	☑ 42	☑ 43	☑ 44	☑ 45	☑ 46	☑ 47	☑ 48
☑ 49	☑ 50	☑ 51	☑ 52	☑ 53	☑ 54	☑ 55	☑ 56	☑ 57	☑ 58	☑ 59	☑ 60

http://homepage.mac.com/bradster/iarchitect/clarity.htm

There are many jobs that require an understanding of usability

- **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

Example: Currency Converter

- Design a user interface for the following scenario:

  Scenario 1: Mary needs a currency converter tool.

  Scenario 2: Mary works at XY-import-export GmbH in Munich. On her laptop, she frequently checks prices for goods in the USA and in Japan. For calculating her budget she needs to convert these into Euro. Sometimes when she writes offers, she converts her company's sales prices (which are in Euro) into US$ or Yen.

- Task: draw a sketch of a user interface for an application that supports Mary in her work.

- Think about how you would integrate such an application with her current computer system and software infrastructure

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1   Introduction and History

What is the right title for the lecture?

- *Mensch-Maschine-Interaktion* (**MMI**) / Human-Machine Interaction (**HMI**)
  - "Man-Machine Interaction" politically incorrect
  - Study of the ways how humans use machines

- *Mensch-Computer-Interaktion* (**MCI**) / Human-Computer Interaction (**HCI**)
  - More special, main focus of this lecture
  - *"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 SIG**CHI** Curricula for HCI)

- *Interaktionsdesign* / Interaction Design
  - More general than HMI
  - *"designing interactive products to support people in their everyday and working live"* (Sharp, Rogers, and Preece, 2002)
  - "interaction design is related to software engineering in the same way as architecture is related to civil engineering" (Winograd, 1997)

- *Benutzerfreundlichkeit* / Usability
  - The overall goal of interaction design

HCI as an interdisciplinary field

Computer science

Psychology

(Industrial) Design

Sociology and Anthopology

HCI
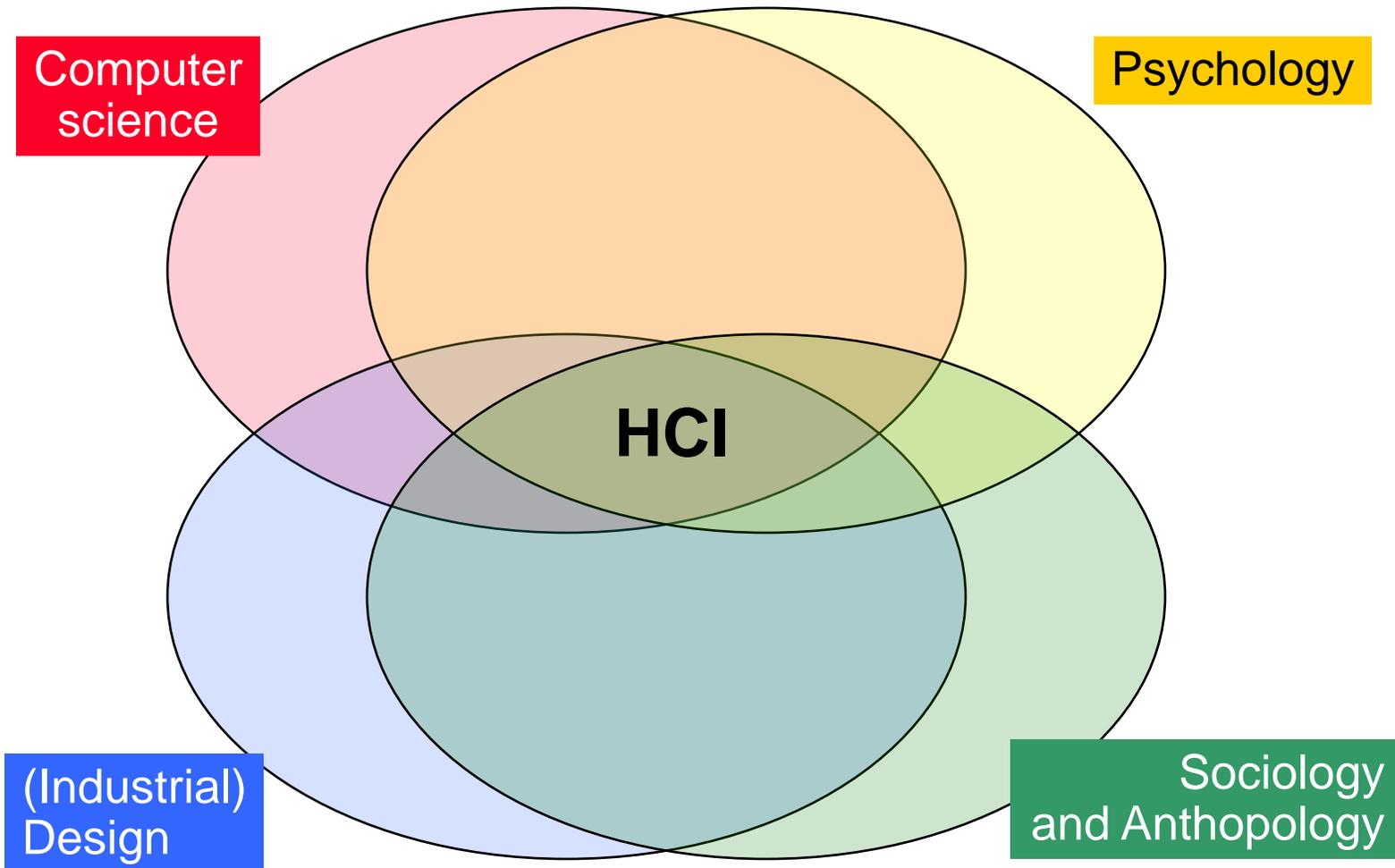
Elements of HCI

- Joint performance of tasks by humans and machines

- 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

- Process of specification, design, and implementation of interfaces

- Design trade-offs

Aspects of Product Design
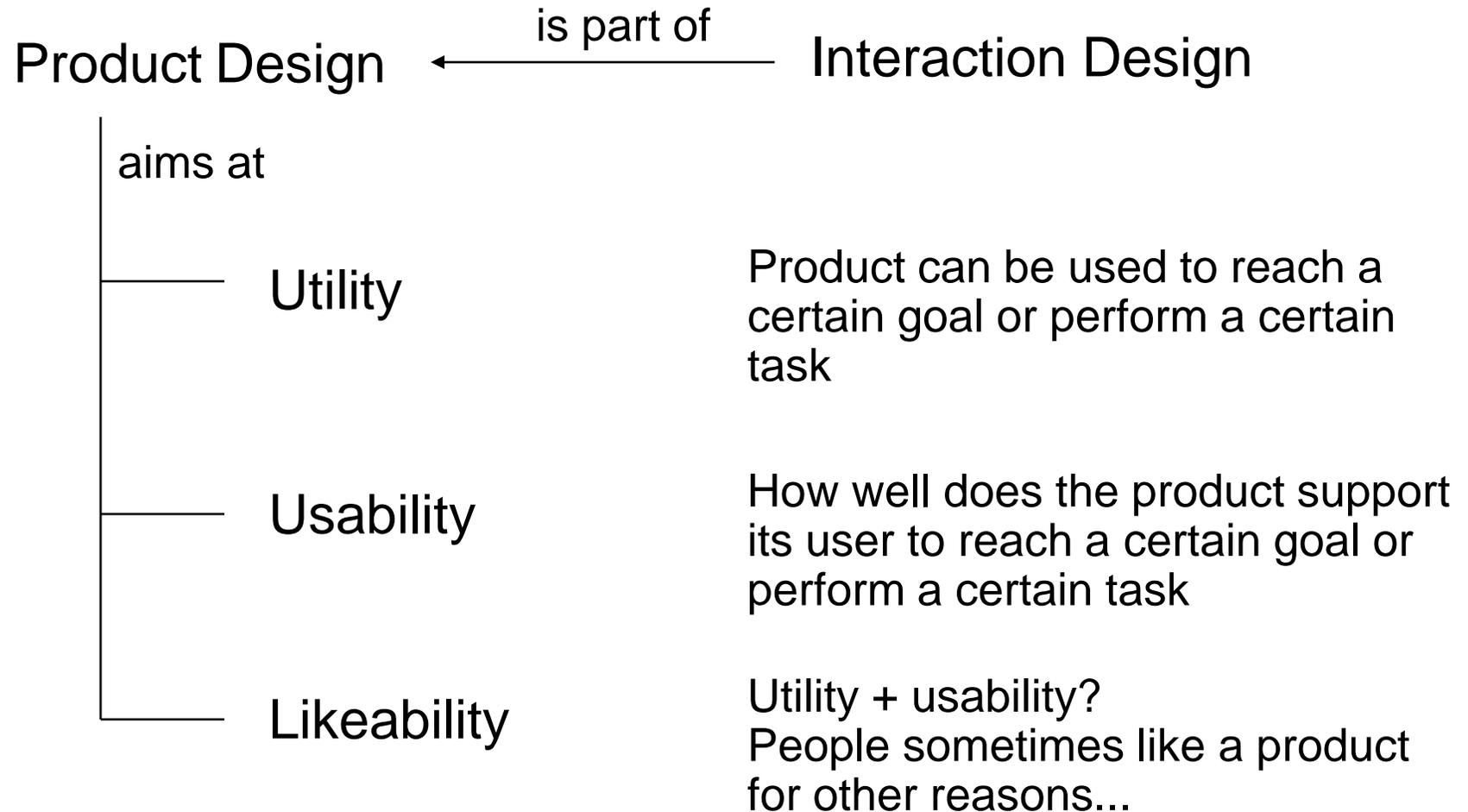
Product Design ← is part of ── Interaction Design

aims at

Utility — Product can be used to reach a certain goal or perform a certain task

Usability — How well does the product support its user to reach a certain goal or perform a certain task

Likeability — Utility + usability?
People sometimes like a product for other reasons...

1   Introduction and History

Use and Context

U1 Social Organization and Work

U3 Human-Machine Fit and Adaptation

U2 Application Areas

Human

H1 Human Information Processing

H2 Language, Communication and Interaction

H3 Ergonomics

Computer

C2 Dialogue Techniques

C4 Computer Graphics

C3 Dialogue Genre

C5 Dialogue Architecture

C1 Input and Output Devices
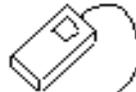
D4 Example Systems and Case Studies

D3 Evaluation Techniques

D2 Implementation Techniques and Tools

D1 Design Approaches

Development Process

from ACM SIGCHI Curricula for HCI

The Development Process

A circular diagram showing the development process cycle with four stages arranged around a circle connected by arrows: Design (top), Realization (right), Evaluation (bottom), Analysis (left). Arrows flow clockwise from Analysis → Design → Realization → Evaluation → back to Analysis.
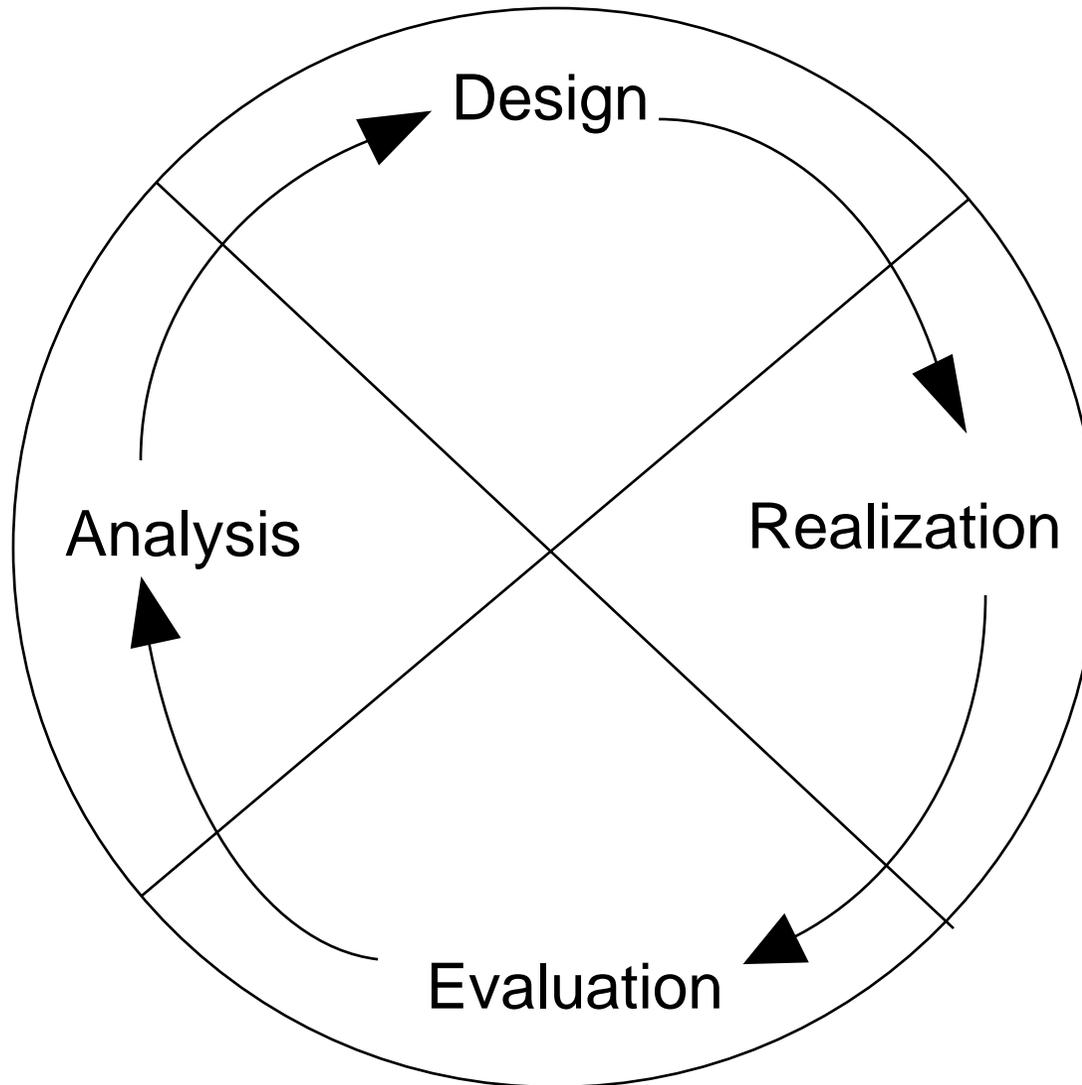
(Preliminary) Outline (1/2)

1. **Introduction, History, and Basic HCI Principles**

   Motivation, terms and concepts, course overview, history
   → Users, Golden Rules, Psychology of Everyday Action, GOMS
   → Basics of user study design (evaluation technique)

2. **Capabilities of Humans and Machines**

   Human senses, cognitive abilities, memory
   Hardware technologies for interaction; natural and intuitive interaction
   → GOMS, Keystroke-Level Model; advanced interface technologies

3. **User-Centred Development Process**

   User-centred development, iterative development, prototyping
   → Paper prototyping, video prototyping, Wizard of Oz technique

4. **Analyzing the Requirements**

   Focus groups, ethnographic observation
   Task analysis, scenarios, use cases, conceptual models

(Preliminary) Outline (2/2)

5. Designing Interactive Systems

Paradigms, styles and principles of interaction
Activity-based and object-oriented design
Describing and specifying interactive systems, design patterns
$\rightarrow$ Creativity techniques

6. Implementing Interactive Systems

Constraints, mapping, implementation technologies for interactive systems
$\rightarrow$ Standards and guidelines

7. Evaluation

Analytic and empirical evaluation, user studies, heuristic evaluation
$\rightarrow$ Statistics for evaluation

8. Outlook

Usability in industrial practice
$\rightarrow$ Outlook to follow-up lecture MMI2 (Web usability, mobile usability)

Book Selection
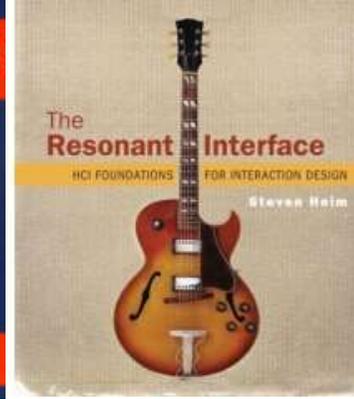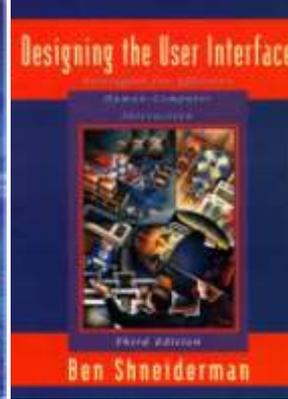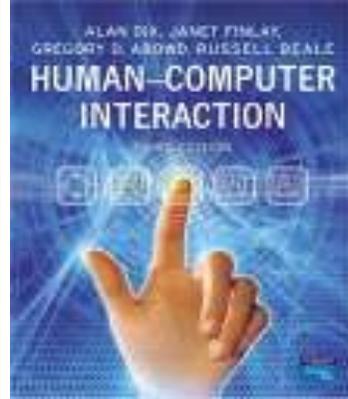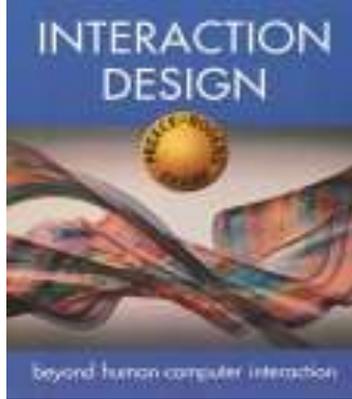
- Jennifer Preece, Yvonne Rogers, Helen Sharp (2002). Interaction Design. ISBN 0471492787

- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale. (2003) Human Computer, Interaction (third edition), Prentice Hall, ISBN 0130461091

- Steven Heim (2007). The Resonant Interface: HCI Foundations for Interaction Design. Addison-Wesley; ISBN 978-0321375964

- Markus Dahm (2005). Grundlagen der Mensch-Computer-Interaktion. Pearson Studium; ISBN 3827371759

- Ben Shneiderman. (2004) Designing the User Interface, 4th Ed., Addison Wesley; ISBN 978-0321197863

- Donald A. Norman. (1990) The Design of Everyday Things; ISBN 0465067107

- Alan Cooper, Robert M. Reimann. (2007) About Face 3.0: The Essentials of Interaction Design; ISBN 978-0470084113
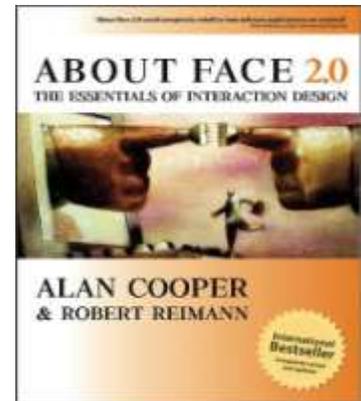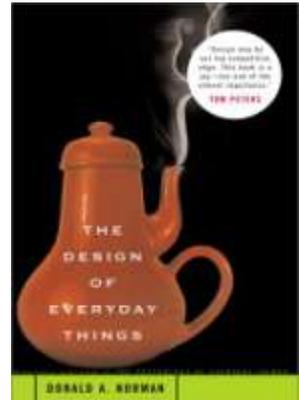
1   Introduction and History

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)

- **2000s**: Interface becomes pervasive ('allgegenwärtig')

    – RF tags, Bluetooth technology, mobile devices, blogging, user generated content, consumer electronics, interactive screens, embedded technology, sensor networks

- **2010s**: ???

Student Project
http://www.hcilab.org/projects/historybook/

VisiCalc - Widespread use of an Interactive Application

VisiCalc Screen, early Alpha 1/4/79
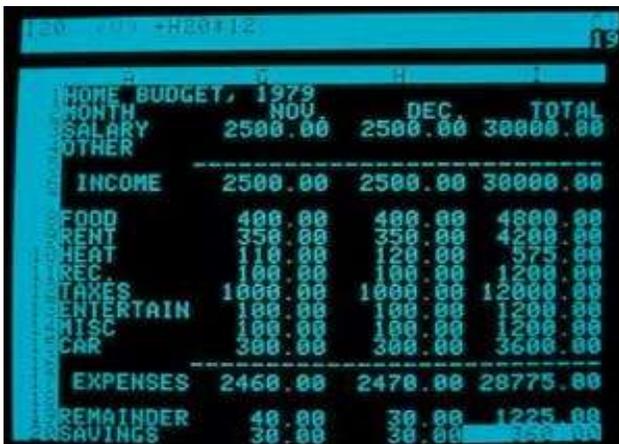
First version of VisiCalc screenshot

- Instantly calculating electronic spreadsheet
  - D. Bricklin/J. Frankston 1979
  - For Apple II computers

- Significant value to non-technical users
  - Usability was key...

- Early killer app for PCs
  - Motivated IBM to enter the PC market

http://www.danbricklin.com/visicalc.htm

A *VISICALC*™ Screen:

A labeled diagram of a VisiCalc spreadsheet screen with the following annotations:

- Current Entry's coordinates
- Entry Type: V for value, L for label, /– for repeating label.
- Recalculation Order Indicator: If R, across rows; if C, down columns.
- Memory Indicator: How many K memory available. If flashing M, out of room.
- Explicit Format indication
- Direction Indicator: If ↕, arrows keys will move cursor up and down; if ↔, arrow keys will move cursor left and right.
- Entry Contents
- Entry Contents Line
- Prompt Line
- Edit Line: flashing block means awaiting input.
- Row and Column labels
- Dollars and Cents Format (/F$)
- Label Entry
- Cursor
- Two windows when the screen is split.
- Right Justified Format (/FR)
- Integer Format (/FI)
- Graph Format (/F*)
- Value Entry
- Left Justified Format (/FL)
- General Format (/FG)
- Repeating Label (/–)

Screen contents:

```
B9  /FI  (V) 1.2*B7                        CI
VALUE                                      25
+B8*B7
         A          B              K          L
 1 COST/SLS:  .8    1 RATE:         .25
 2 OVHD INC: 10     2
 3   SLS GRW: .29   3 NPV:        62.0151
 4                  4
 5 YEAR       1979  5 TOTAL   %/SALES
 6 --------          6 ---------------
 7 # SOLD      100  7 3066
 8   PRICE    1.20  8
 9 SALES      120   9 3680          100
10 COST        80  10 2453           67
11 OVHD        15  11  495           13
12 PROFIT       5  12  118            3
13                 13
14                 14 1979 ***
15                 15 1980 **
16                 16 1981 *
17                 17 1982 *
18                 18 1983 **
19                 19 1984 ***
20                 20 1985 ******
```

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 ALTO

Photos from

http://members.fortunecity.com/pcmuseum/alto.html
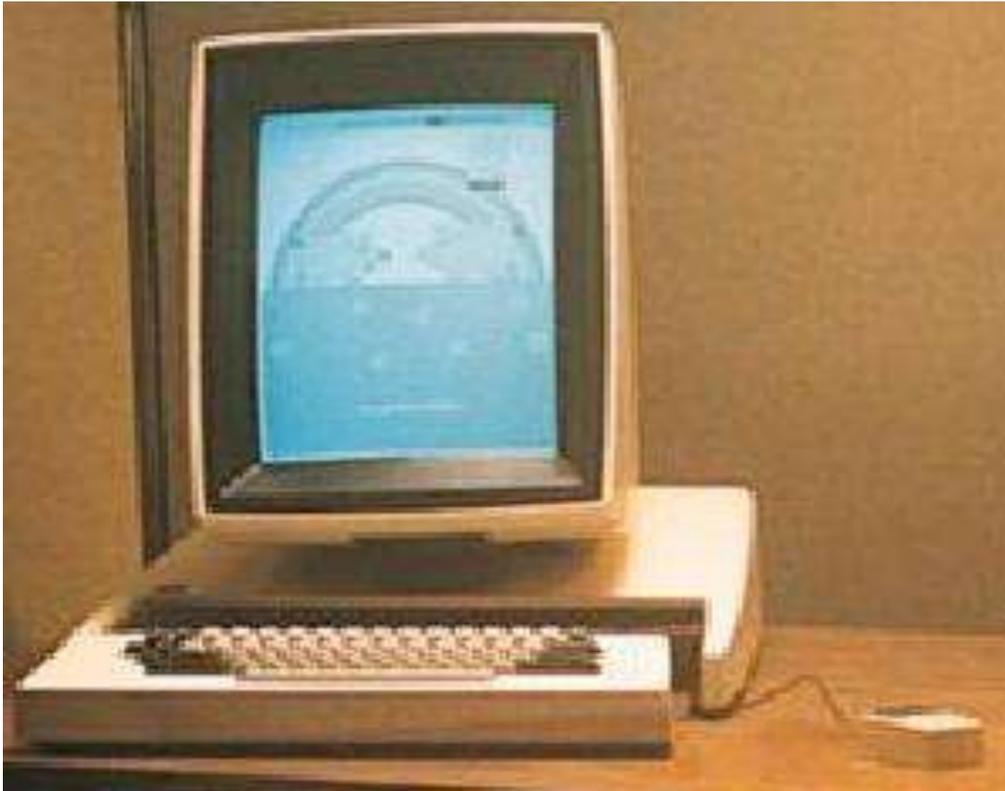
| Start | Ready:
Select file names with the mouse
Red-Copy, Yel-Copy/Rename, Blue-Delete
Click 'Start' to execute file name commands | Quit
Clear
Type |

--

| Pages: 032 | | Log |
Files listed: 60		
Files selected: 0	Delete: 0	
Copy/Rename: 0	Copy: 0	

DP0: <SysDir.> *.*

```
-- BEGINNING --
1012-AstroRoids.Boot.
Anonymous.1.
BattleShip.er.
BattleShip.RUN.
BlackJack.RUN.
BuildKal.cm.
CalcSources.dm.
Calculator.RUN.
Chess.log.
Chess.run.
Com.Cm.
CompileKal.cm.
CRTTEST.RUN.
DMT.boot.
EdsBuild.run.
empress.run.
Executive.Run.
Fly.run.
galaxian.boot.
Garbage.S.
Go9.run.
GoFont.AL.
Invaders.Run.
junk.
junk.press.
Kal.bcpl.
Kal.cm.
KalA.asm.
KalMc.mu.
Kinetic4.RUN.
LoadKal.cm.
MasterMind.RUN.
maze.run.
Mesa.Typescript.
Missile.run.
NEPTUNE.RUN.
othello.run.
Pinball-easy.run.
POLYGONS.RUN.
```

Pages: 0		Log
Files listed: 0		
Files selected: 0	Delete: 0	
Copy/Rename: 0	Copy: 0	

No Disk: <SysDir.> *.*

XEROX Star

Photos from http://toastytech.com/guis/alto.html
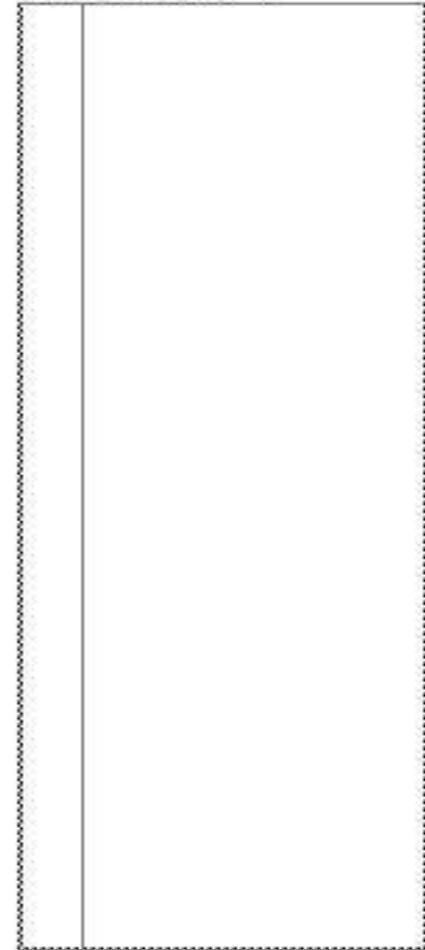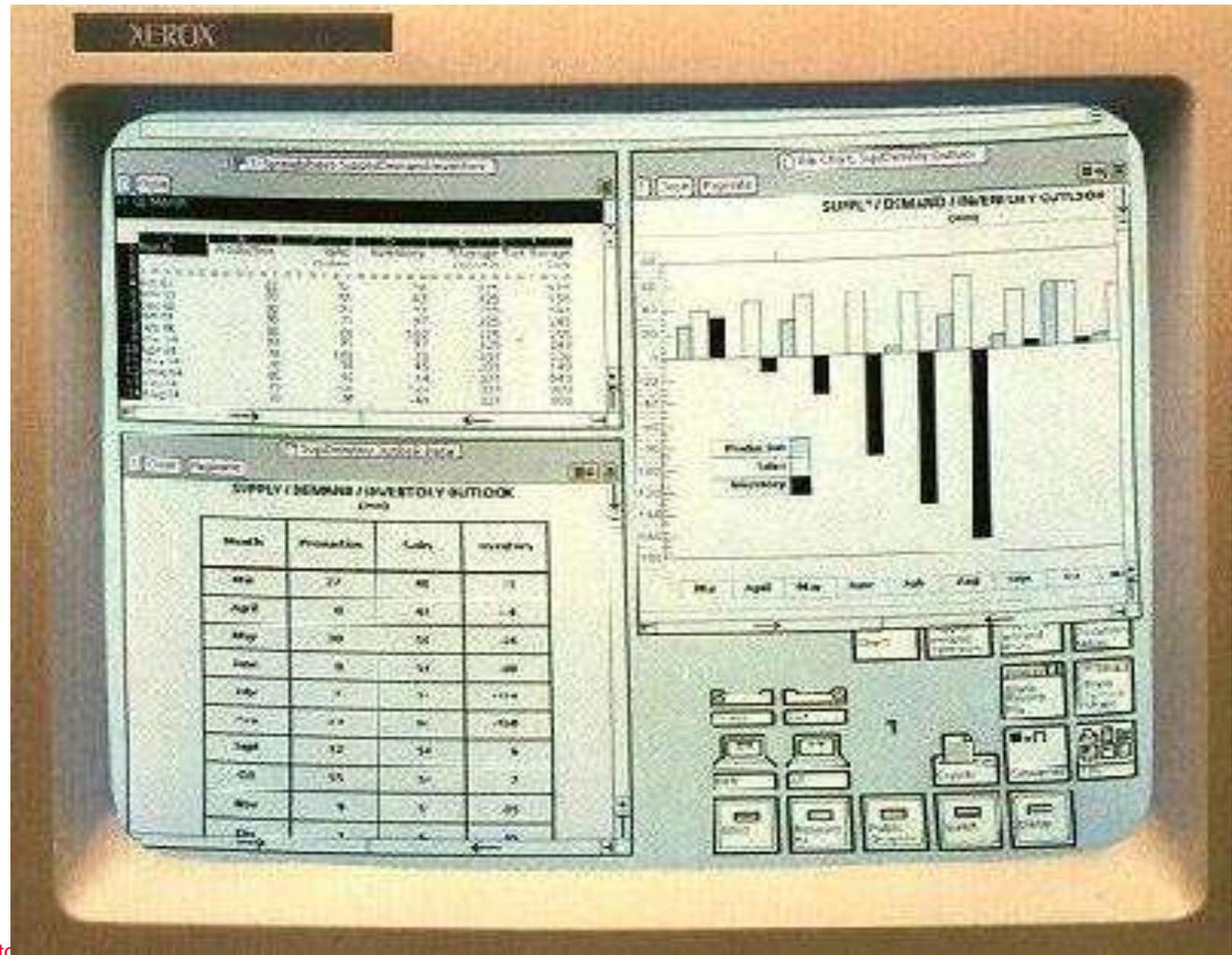

Apple Macintosh
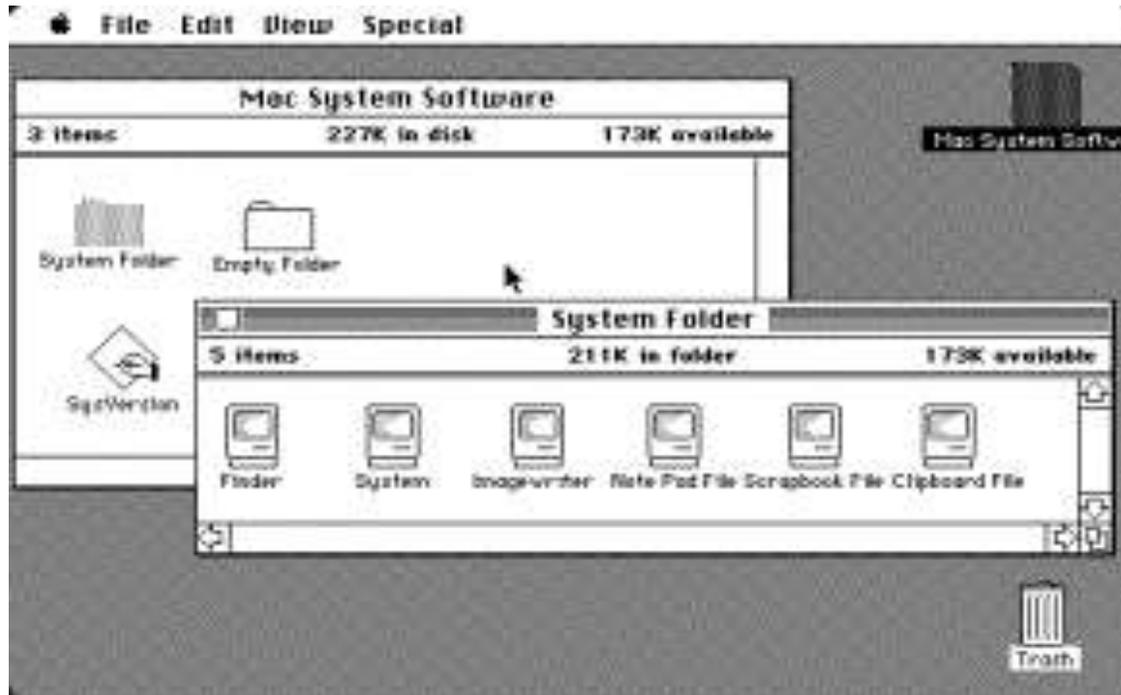
1984 – commercially successful GUI
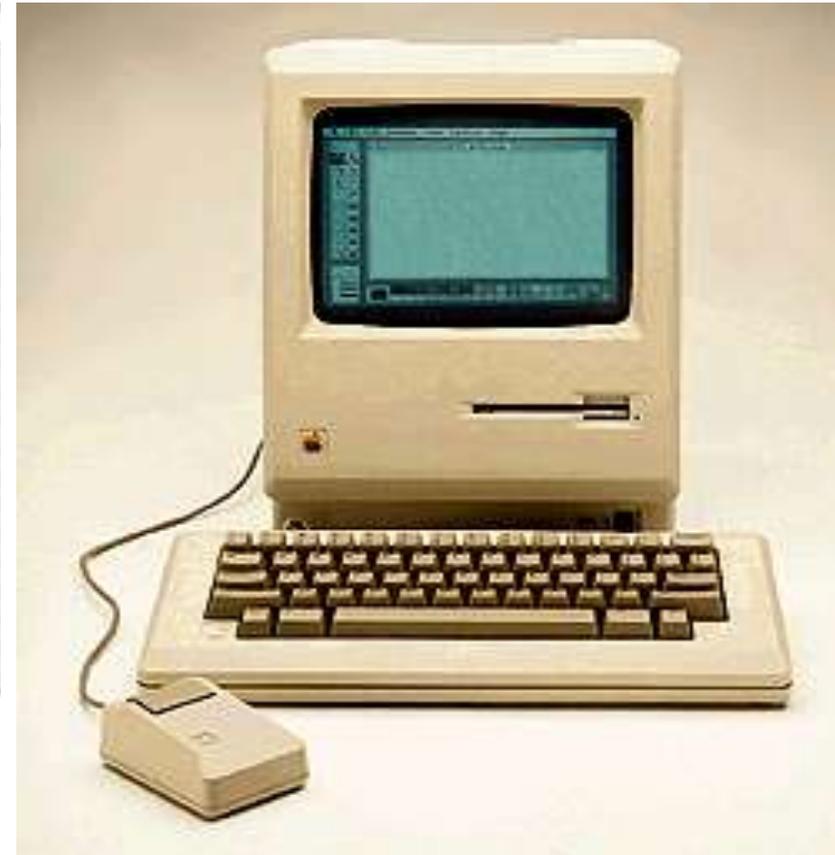
More GUIs

Amiga 1985
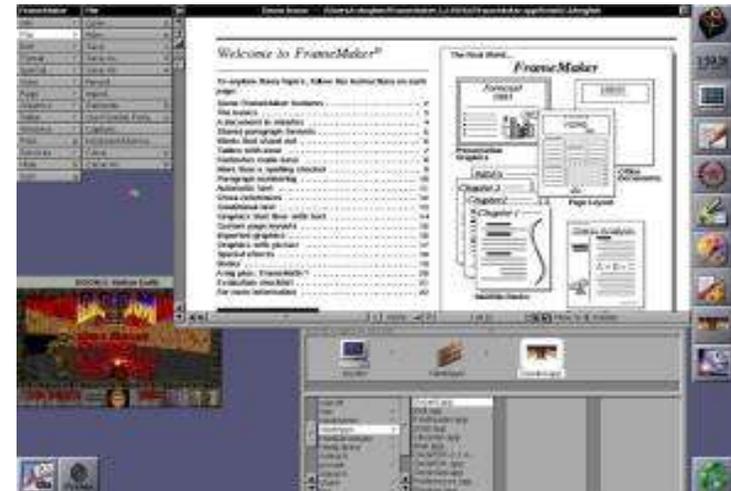
NextStep 1989

Win 3.11 1992
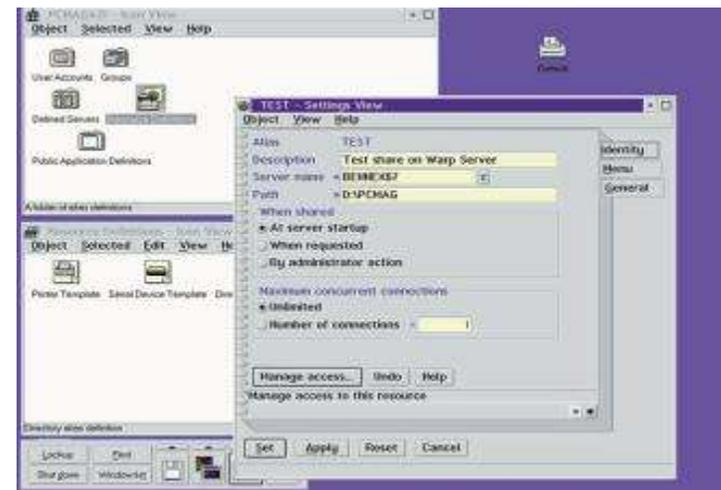
OS/2 1992

From B. Myers "Brief History of HCI"

Research and Products
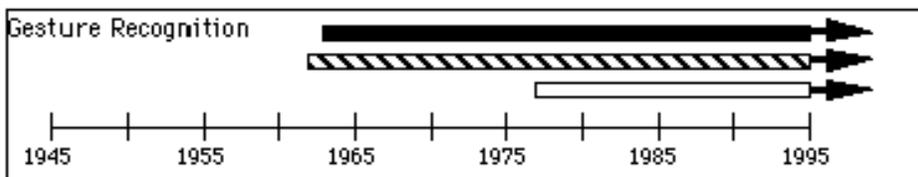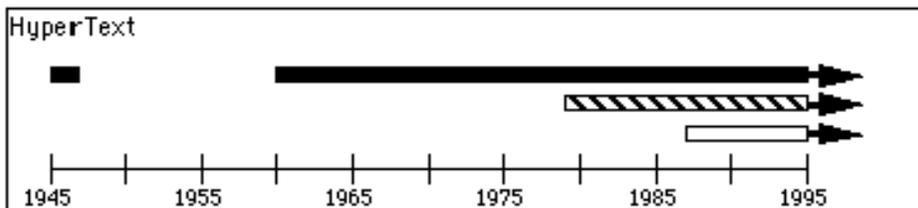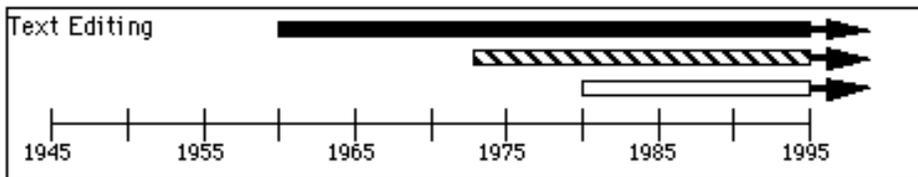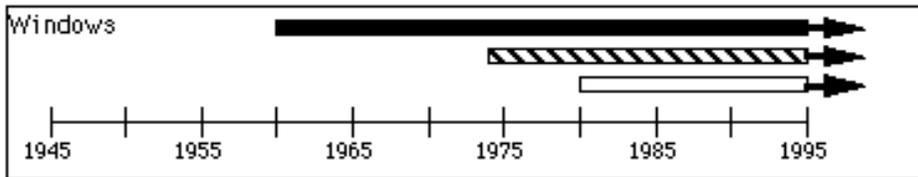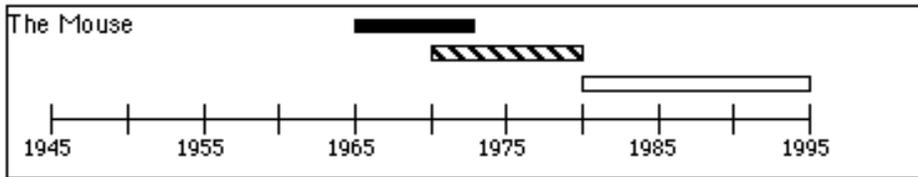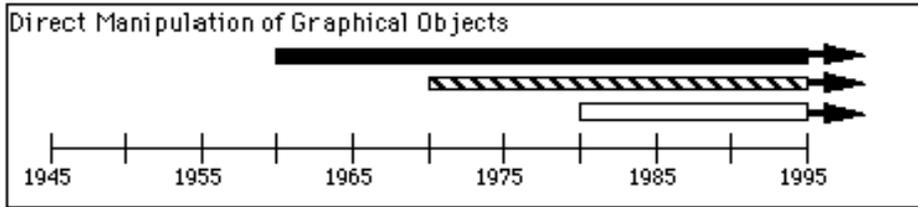
- Early machines used batch processing (e.g. punch card machines)

- Terminals with command line interfaces

- Graphical user interfaces with pointing device

- Multimodal user interfaces

References
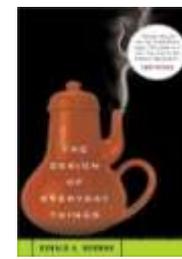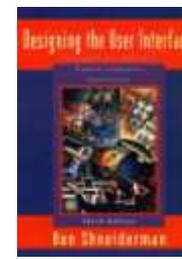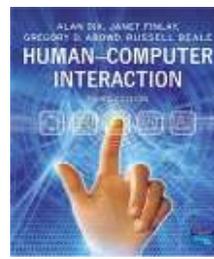
- D. A. Norman. The Design of Everyday Things. Basic Books 2002. ISBN: 0465067107

- B. Shneiderman. Designing the User Interface: Strategies for Effective Human-Computer Interaction , Third Edition. 1997. ISBN: 0201694972

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- *Preece*, J., *Rogers*, Y. & *Sharp*, H. (*2002*) Interaction Design: Beyond Human-Computer Interaction. New York, NY: John Wiley & Sons

- Winograd, Terry (1997), "The Design of Interaction ," in Peter Denning and Bob Metcalfe (eds.), *Beyond Calculation, The Next 50 Years of Computing*, Springer-Verlag, 1997.

- Jef Raskin, The Humane Interface, ACM Press 2000

- Brad A. Myers. "A Brief History of Human Computer Interaction Technology." *ACM interactions*. Vol. 5, no. 2, March, 1998. pp. 44-54.
  http://www-2.cs.cmu.edu/~amulet/papers/uihistory.tr.html

- Software Arts and VisiCalc
  http://www.bricklin.com/history/intro.htm