

# Vorlesung Advanced Topics in HCI (Mensch-Maschine-Interaktion 2)

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

## Advanced Topics in HCI Vorlesung Mensch-Maschine-Interaktion 2

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- Vorlesung: Donnerstag, 12-14 Uhr, Theresienstraße, Raum 112
- Übungen: Mittwoch, 12.00 bis 14.00 oder Donnerstag, 14.00 bis 16.00, Amalienstraße 17, Raum 105/107 oder Computerraum EG  
Übungsleitung: Richard Atterer, Paul Holleis, Heiko Drewes
- Informationen zur Vorlesung und Übung:  
<http://www.medien.ifi.lmu.de/lehre/ss2006/mmi2/>

## Inhalt

- Die Vorlesung „Advanced Topics in HCI“ (Mensch-Maschine-Interaktion 2) behandelt weitergehende Aspekte der Interaktion zwischen Mensch und Computer. Prinzipien und Konzepte der Mensch-Maschine-Interaktion werden in konkreten Anwendungsbereichen behandelt.
- Themen
  - Hypertext, Web Design, Web Usability, Accessibility
  - Visualisierung von Information
  - UIs für mobile Geräte
  - Benutzerschnittstellen für Spiele
  - Weitere Themen:
    - User Interface Softwareentwicklung
    - Adaptive Benutzerschnittstellen und Intelligente UIs
    - Multimodale Benutzerschnittstellen
    - Tangible User Interfaces
    - Groupware, CSCW, CSCCL

## Ablauf und Anforderungen




- Vorlesung mit Übung, 2h+2h
- Lesematerial (ca. ein Artikel pro Woche)
- Übungsaufgaben
- Scheinkriterien
  - Erfolgreiche, termingerechte Abgabe aller Übungsaufgaben (oder aller bis auf eine)
  - Die abgegebenen Lösungen müssen von ausreichender Qualität sein.
  - Zusammenfassung der Pflichtlektüre (ca. 100 Worte pro Artikel)
  - Analyse von verschiedenen Web Anwendungen
- Vorkenntnisse
  - Grundstudium Medieninformatik oder Informatik
  - Grundkenntnisse im Bereich Mensch-Maschine-Interaktion
  - Grundkenntnisse in der Programmierung von graphischen Benutzerschnittstellen
  - Englische Sprachkenntnisse

## Books

- 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
- Alan Cooper, Robert M. Reimann. (2003) About Face 2.0: The Essentials of Interaction Design; ISBN: 0764526413.
- John M. Carroll. Human-Computer Interaction in the New Millennium, Addison-Wesley Professional (2001), ISBN: 0201704471
- Jennifer Preece, Yvonne Rogers, Helen Sharp. Interaction Design. John Wiley and Sons Ltd (2002). ISBN: 0471492787



## Structure

- Chapter 1: HCI and the WWW 
- Chapter 2: Information Visualization 
- Chapter 3: Mobile and Ubiquitous User Interfaces 

## Chapter 1: HCI and the WWW

### Table of Content

- 1.1 Human Computer Interaction (HCI)
  - a quick reminder
- 1.2 Web Usability
  - Web Technology
  - Web Design
  - Management of Web projects
  - Usability evaluation of Web sites and applications
- 1.3 Web Accessibility, Universal Access to Information
- 1.4 Usability Report

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## 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**”

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## 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

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## What is Usability

- “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.” (Jakob Nielsen)
- “Scientific discipline using observation, measurement and design principles to enhance a site visitor’s ability to perform specific tasks” (Kathy Gill)
- “... the **effectiveness, efficiency and satisfaction** with which a specified set of users can achieve a specified set of tasks ...” (ISO)

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## 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

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## Web Usability

- Usability of Web sites and applications delivered over the WWW
- Dependent on several issues related to
  - Web technology
  - Web design
  - Project Management
  - Usability evaluation
- Web usability is **not** about “adding some fancy graphics, color, and cool styles at the end of the project”
- Web usability can be measured!

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## Excuse: Web Technology

- Web technology basics
- Heterogeneous distributed systems
- Hypertext and Hypermedia
- Media, Media Types, MIME
- Caching

## What do we need for a distributed system to share documents

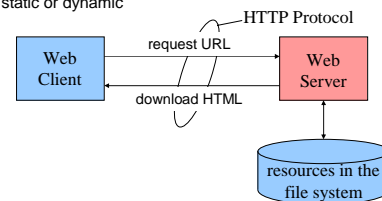
- How are documents encoded?
  - content
  - semantics
  - presentation
- How documents are identified?
  - Where is data held?
  - How can data be accessed?
- How are the documents transmitted/transported to the user?

## The WWW Approach

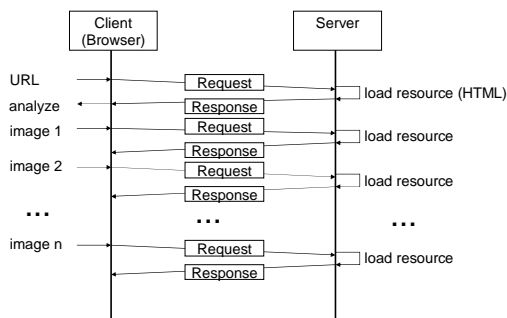
- Document format
  - Hypertext Markup Language, HTML
    - Document Type Definition (DTD)
    - Standardized General Markup Language (SGML)
- Mechanism for identification
  - Uniform Resource Identifier, URI
    - use as Uniform Resource Locator, URL
- Transfer protocol
  - Hypertext Transfer Protocol, HTTP
    - ASCII-coded Request-Reply protocol using TCP/IP

## Architecture and Protocol (simplified)

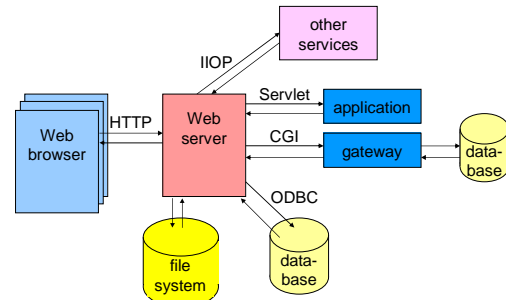
- client-server architecture
- synchronous communication model (request/response)
- resources
  - Unit that is communicated between Client and Server
  - static or dynamic



## Documents contain Resources IV



## Example Architecture



## The WWW is a Distributed System

- What is a distributed System?
  - Tanenbaum, A.,S. (from Computer Networks)  
*"... in a distributed system, the existence of multiple autonomous computers is transparent (i.e., not visible) to the user."*
  - Lamport (?)  
*a distributed system is a system that you can not use at a certain moment because a machine is crashed which you even do not know that this exists.*

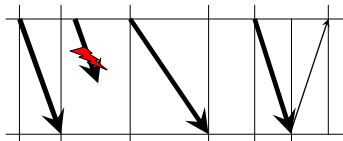
## Information Exchange Between Browser and Server

- Obviously the document
- Further information available (e.g. header fields)
  - Browser type and version
  - Operating system (version)
  - Referrer
  - Cookies
  - Screen size, window size
  - If Java/JavaScript/VBScript are enabled
  - List of plug-ins installed
  - Network parameter and route
  - ...
- Rich source of information
  - Can make applications more usable
  - Information may not be complete or may be wrong

Try it out at:  
<http://network-tools.com/analyze/>

## The WWW is a Distributed System Usability Issues

- Network
  - Delay
  - Failure
  - Jitter
  - Latency
  - Bandwidth
- Multi-user System
  - Work load, system performance
  - Concurrency problems



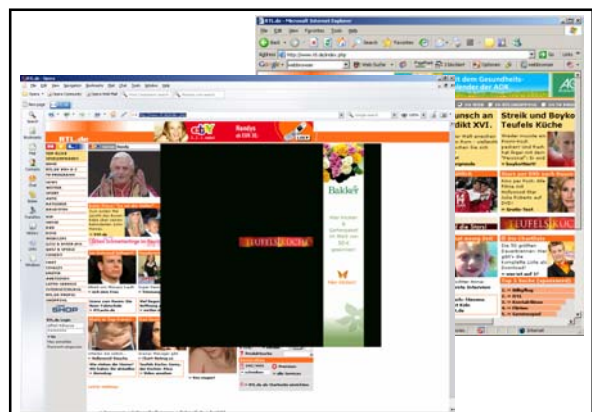
## Designing Distributed Applications

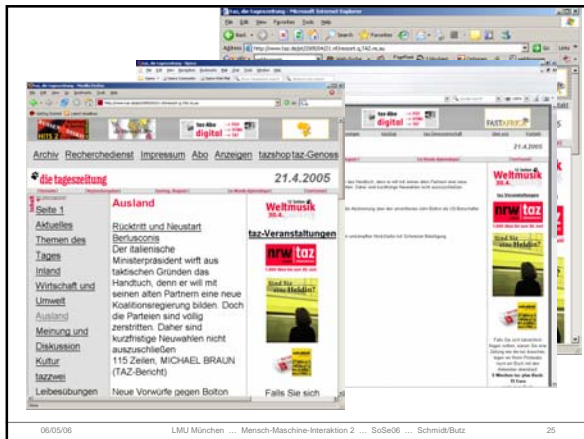
- Basics
  - applications consist of several parts (e.g. different processes)
  - in general these parts are executed on different machines
  - these parts of the application are executed concurrently or one after another
  - there is communication between these parts
- Software/Application Design Aspects
  - data
    - analyzing data transfer (optimize for minimum)
    - investigate how caching can be supported
    - keep data save (minimize data that is given away)
  - functional
    - execute functions where it is most reasonable
    - regard the infrastructure on that the applications will be executed
  - response time (optimize for minimum)

## Systems are Heterogeneous

Platform may vary to a great extent – it still should be usable

- Processing power
  - processor, co-processors, cache
  - RAM
- I/O-performance
  - hard drive speed
  - network
- Input and Output
  - displays
  - keyboard layout
- Additional Hardware and Periphery
  - video and audio (in/out)
  - card reader, printer, scanner
- Software,
  - Browser
  - Operating System





## Text or Audio Browser, e.g. Lynx

## Compatibility

- To ensure usability define systems and environments that are supported (e.g. functional specification)
  - hardware
  - operating system(s)
  - Browser(s)
  - network (bandwidth, latency)
- the logfiles of an existing website for this user group can be used to calculate the percentage of compatibility
 

MSIE 6.0	46%
MSIE 5.0	3%
Firefox 1.5	20%
Firefox 1.0	7%
Bots	15%
Safari	2%
Others	7%
- Trade-off compatibility vs. cost
- Try to optimize the design for the "main" visitors and make sure it is still usable for the others.
 

*Example figures from last week at hciab.org*

## Compatibility

### Visitors at hciab.org

Browser of Visitors at hciab.org (March 2006)		OS of Visitors at hciab.org (March 2006)	
MSIE	53%	WinXP	65%
Mozilla/Firefox	29%	Win2000	12%
Netscape	5%	OS unknown	7%
msnbot	4%	Robots	5%
Opera	3%	Linux	4%
Safari	2%	Win98	3%
googlebot	1%	Mac	2%
other	3%	Misc	2%

## Hypertext

- concept to organize information
- motivation
  - "knowledge" is not linear, it is associative
  - authoring a document = making knowledge linear
  - reading a document = reproduce the non-linear structure of the knowledge → navigation

**One problem...**  
People structure their knowledge differently.

→ hypertext-documents:

- keep the inherent association of information in a document

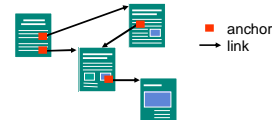
## Roots of Hypertext

- "Memex"
  - Vannevar Bush: "As we may think", 1945
  - "Memory Expander"-Machine
  - associative storage/access
  - personal annotation linked to documents
- Xanadu
  - Ted Nelson, 1965/1981
  - term Hypertext
  - Docuverse: global hypertext system, Pay per View
- Augment/NLS (oNLine System)
  - Douglas Englebart, 1968
  - Shared Hypertext Document Spaces

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## Hypertext Components

- structure
  - hypertext document: directed graph
- components
  - node: information unit
  - anchor: Information chunk within a node, target for a link
  - link: connections between nodes



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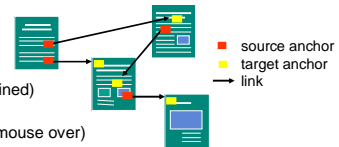
## Node

- single media nodes
  - only one media type per node
- mixed media nodes
  - different media types possible per node
  - alternatives, combination
- systems with limited content size
  - no internal navigation
  - e.g. HyperCard
- systems with unlimited content size
  - internal navigation necessary
  - e.g. Scrolling

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## Anchor

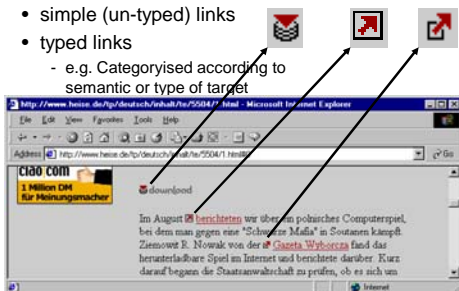
- types of anchors
  - source anchor
  - target anchor
- represented as
  - button
  - icon
  - text (e.g. Underlined)
  - hidden
  - animation (e.g. mouse over)
  - ...
- representation of source anchors as link
- representation of target anchors is often hidden



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## Links

- information content of a link
  - simple (un-typed) links
  - typed links
    - e.g. Categorised according to semantic or type of target



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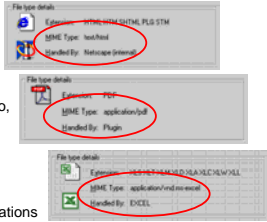
## Media Types in the Web

- text / hypertext
- Inline graphics in Hypertext
- icons / graphics (bitmap, vector) / drawings / photos
- interactive graphics: active maps
- animations
- programs (e.g. JavaScript)
- audio clips / video clips (e.g. MP3, MPG)
- audio / video streams
- 3D-scenes (e.g. VRML)
- objects, like Applets, Flash, ---
- any type of media ...

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## Media Types in the Web - Concept

- open concept to integrate arbitrary media
  - transmitted in the MIME format
- interpretation of different Media types in the WWW
  - browser build-in for most basic types
    - text, HTML hypertext, GIF and JPEG images
  - using browser Plug-Ins
    - e.g. for Acrobat PDF, Real-Audio, RealVideo, Shockwave, Flash
  - using external applications (helper applications)
    - e.g. ghostscript for PostScript, other proprietary formats/applications
  - save files
    - Download of arbitrary formats



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## MIME Extension

- mapping of file types (e.g. extensions in the file system, UNIX) onto MIME types (on the server)
  - fo.c.ps → application/postscript
  - application/postscript → ghostview
- mapping of MIME types to applications (in the browser)
- ... it is open – but this may be a serious usability problem
  - Do the users have the right connection?
  - Does the external program, plug-in work?

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## Technology Overview Client

- content that can be displayed/provided
  - text, HTML, images, videos, audio, ...
- content and programs that can be interpreted by the browser
  - HTML
  - browser script: JavaScript, VBScript, SMIL, MathML, ...
- programs that are executed in the context of the browser
  - Java Applets (Byte Code, Virtual Machine)
  - Flash
  - ActiveX (Native Code, executed directly by the operating system)
- programs that are plugged into the browser and executed in the context of the browser for specific data types
  - Plug-Ins
- external programs that are started by the browser to handle data that can not be handled by the browser
  - helper applications

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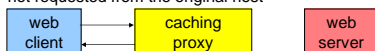
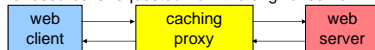
## Technology Overview Server

- content (e.g. HTML-pages) that contains statements that can be replaced or executed:
  - SSI, XSSI
  - server side scripting (ASP, PHP, JSP, ...)
- programs that create content
  - additional process: CGI
  - In the context of the servers: Servlets, ...
- extensions of web servers
  - NSAPI, IISAPI, Apache-Modules, ...
- gateways and front-ends for databases
- application server
- dedicated/specific server

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## Caching-Proxy - Example

- Cache - MISS
  - The requested resource is not stored in the cache
  - The resource is requested from the original server
- Cache - HIT
  - The requested resource is stored in the cache of the proxy and is still valid
  - The resource sent back directly from the caching proxy, it is not requested from the original host



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## Web Error Messages I

- categories of errors (see HTTP)
  - most often : 404 (file not found)
  - 4xx – error on client side
  - 5xx – error on server side
- errors should be intercepted
  - define useful reaction
  - make specific pages for errors
  - e.g. 404 – file not found
    - possible reasons: file does not exist (anymore), typos, ...
    - some possible solutions
      - show an error page – tell the user that the page is not available :-)
      - show the main page of the server
      - show a search page on the server, tell the user to search
      - try to find with the filename and the path the page or a related page in the internal search engine and show this page :-)

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## Web Error Messages II

- errors should be intercepted!
  - e.g. 500 – server error
    - possible reasons: CGI-program crashed, hard drive full, database down, permission changes, gateway not available, ...
    - some possible solutions
      - a) show CGI/Server error messages :-(
      - b) give the user an alternative: e.g.  
*„Sorry our WWW online ordering system is currently not available. Please print out your order or send us a fax (0815/007007) or order by email (orders@shop.com). The system will be online in a minute. Sorry for any inconvenience.“*

```
SoftArtisans.SAFile.1 error '80020009'  
Error occurred when moving cached file to final destination. Please  
check the NTFS permissions for the directory "C:\WINNT\" and the  
directory containing the file "D:\CMTLibrary\SIGCHIShort\523_admin.pdf".  
These directories require Read, Write and Delete permissions by the  
anonymous user ( NT account: IUSR_computername ) as well as for your  
authenticated users.  
/sigchishort/PaperEditProcess.asp, line 107
```

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## Excuse: Web Technology Essentials

- Be aware that
  - That the web is heterogeneous distributed systems
  - Hypertext and Hypermedia allows complex information architecture
  - That any media type can be used, however there is little control how they are handled at the client
  - There is a mixture of code and content
- Try to minimize technical complexity
- Specify technical requirements
  - Minimal setup
  - Anticipated setup
  - Test under these conditions

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## References

- ACM SIGCHI Curricula for Human-Computer Interaction  
<http://www.acm.org/sigchi/cdg/>
- Blockvorlesung "Web-Technologien"  
<http://www.medien.ifi.lmu.de/lehre/ws0506/pwt.html>  
(login and password on request)

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