Vorlesung
Mensch-Maschine-Interaktion

Albrecht Schmidt
Embedded Interaction Research Group
LFE Medieninformatik
Ludwig-Maximilians-Universität München
http://www.hcilab.org/albrecht/

Vorlesung
Mensch-Maschine-Interaktion

- Albrecht Schmidt
  Embedded Interaction Research Group
  LFE Medieninformatik, LMU München
  Amalienstr. 17, 5. Stock, Raum 505
  80333 München
  http://www.hcilab.org/albrecht/
  albrecht@hcilab.org

- Vorlesungstermin
  Donnerstag, 14-16 Uhr, Theresienstr. 39, Raum E47

- Übungstermine: Mittwoch 9-11Uhr und ???
  Übungsleitung: Richard Atterer, richard.atterer@ifi.lmu.de

- Weitere Informationen zur Veranstaltung
  http://www.medien.ifi.lmu.de/lehre/ws0506/mmi.html

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
    (Abgabe der **Übungsaufgaben**, ein kurzer **Aufsatz** zu einem
    vorgegebenen Thema, eine **Designentwurf** für ein interaktives System)
  - Schriftliche **Zusammenfassung** des Lesematerials (ca. 100 Worte pro
    Artikel)

- Vorkenntnisse
  - Grundstudium Medieninformatik oder Informatik
  - Grundkenntnisse in der Programmierung von graphischen
    Benutzerschnittstellen
 - Englische Sprachkenntnisse

---

1. Introduction

- **1.1 Terms and concepts**
- 1.2 Motivation for Usability
- 1.3 Example of a Simple Interface
- 1.4 How to make usable products?
- 1.5 Overview of the Course
- 1.6 About the Exercises, the essay, and the design sketch

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
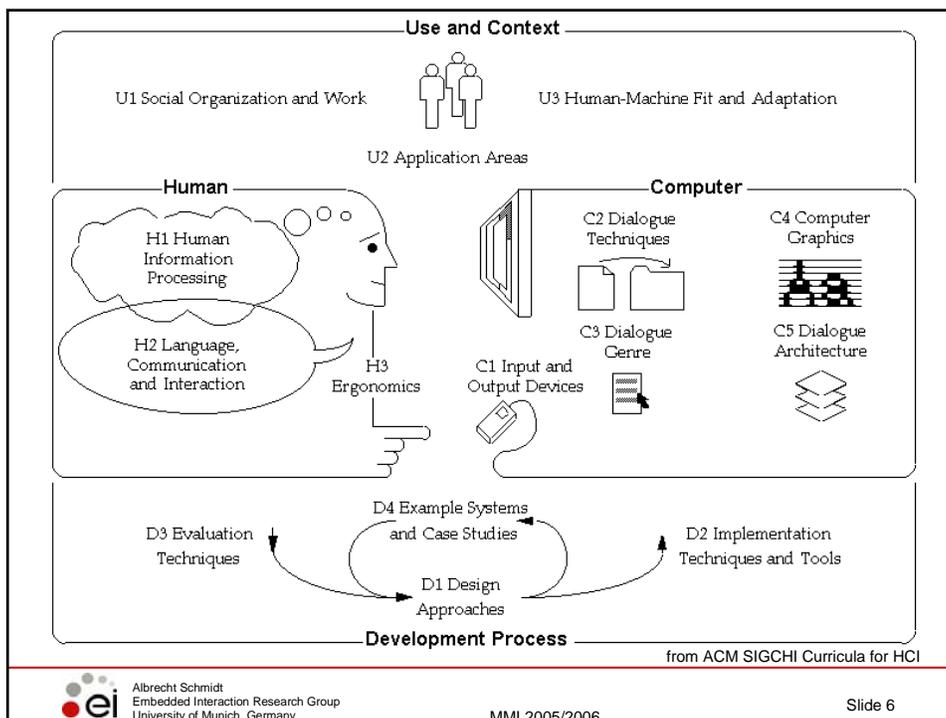
HCI - An Interdisciplinary Area

- **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

Interface and interaction design

- Interface design (ID)
  - 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
  - enjoyable experience

- Usable products = successful products?

- Involve users in the design process

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?

1. Introduction

- 1.1 Terms and concepts
- **1.2 Motivation for Usability**
- 1.3 Example of a Simple Interface
- 1.4 How to make usable products?
- 1.5 Overview of the Course
- 1.6 About the Exercises, the essay, and the design sketch

Motivation is everywhere…

…and design is not necessarily Usability

CS Building in Saarbrücken

DFKI in Saarbrücken

(Photos A. Butz)

Usability is not restricted to digital system (see ergonomics)

(German Rail IC-Train)

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

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 to fill in correctly the order form are not going to buy

There are many jobs that require and understanding of HCI

- **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)

Albrecht Schmidt
Embedded Interaction Research Group
University of Munich, Germany
MMI 2005/2006
Slide 21

---

1. Introduction

- 1.1 Terms and concepts
- 1.2 Motivation for Usability
- **1.3 Example of a Simple Interface**
- 1.4 How to make usable products?
- 1.5 Overview of the Course
- 1.6 About the Exercises, the essay, and the design sketch

Albrecht Schmidt
Embedded Interaction Research Group
University of Munich, Germany
MMI 2005/2006
Slide 22

Example: Currency Converter

- Design a user interface for the following scenario:
  Mary works at XY-import-export GmbH in Munich. She checks frequently prices for goods in the USA and in Japan. For calculating her budget she needs to convert them 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

Example: Currency Converter …a solution?
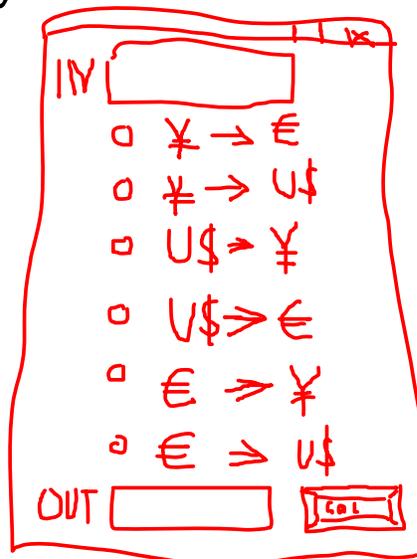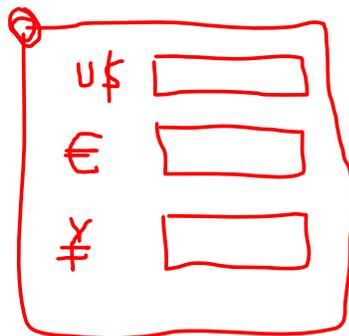
Reflect on your result…

- Why do you use certain widgets – why do you need a button?
- How much is just copying what you are used to?
- How to create new ideas and explore new interaction concepts?

- What are limitations in current desktop systems?
  - Processor? – No
  - Memory? – No
  - Human computer interaction, joint performance?

1. Introduction

- 1.1 Terms and concepts
- 1.2 Motivation for Usability
- 1.3 Example of a Simple Interface
- **1.4 How to make usable products?**
- 1.5 Overview of the Course
- 1.6 About the Exercises, the essay, and the design sketch

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

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 guidelines 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

Structured Process for Creating Usable Products

- Precondition
  - Understanding how people interact with their environment
  - Understanding the capabilities and limitations of users
  - Basic ergonomics
- **Analyze** what interaction is required and what technical options are available in a **user centered** way, evaluate the results of the analysis
- **Design** and **prototype** user interfaces with user involvement, evaluate prototypes
- **Implement** an interactive digital product
- Test and **study** the product created

- Usability Engineering **is a part** of the overall development
- The process is **iterative** (overall and at each step)

Evolution of the Software Development Process
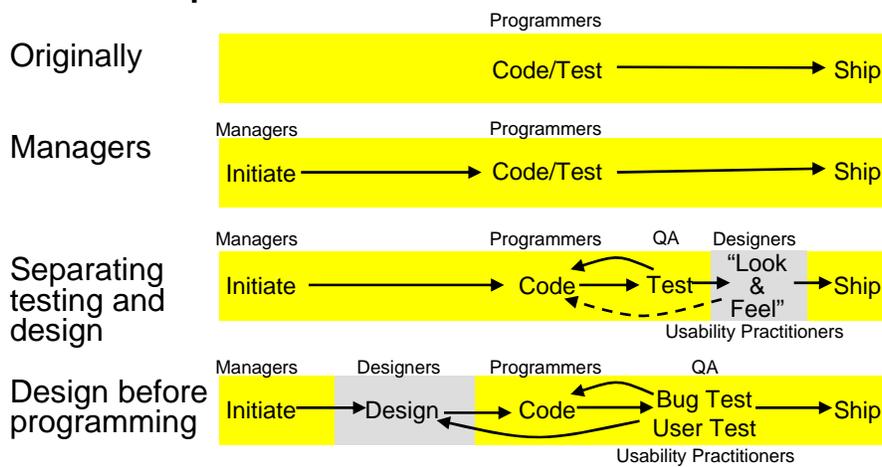
From A. Cooper, About Face 2.0

How it does **NOT** work

- Usability tests at the end when the product is ready and needs to be shipped
- Designing a new and pretty skin to a product
- Introducing HCI issues after the system architecture and the foundations are completed

- Comparison: *An interior designer can not make a great house if the architect and engineers forgot windows, set the doors at the wrong locations, and created an unsuitable room layout.*

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/competing 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 I
(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?

Usability Testing II
(high level overview – more details later)

- 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?
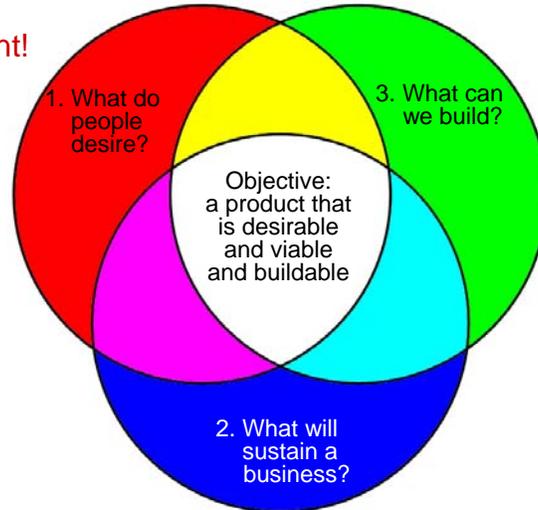
Building Successful Digital Products –

Not only what users want!

- tension
  - different objectives
  - different design goals

- step by step 1-2-3

- solution
  - Products in the overlapping space

- User centered design is not about creating what users want.

1. What do people desire?

3. What can we build?

Objective: a product that is desirable and viable and buildable

2. What will sustain a business?

From A. Cooper, About Face 2.0

How easy is it to work in multidisciplinary teams?

- Many people are involved in the process of designing and implementing an interactive product
  - Different background (design, business, CS, marketing, administration)
  - Different objectives
- Communication can be very difficult!

- 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!

1. Introduction

- 1.1 Terms and concepts
- 1.2 Motivation for Usability
- 1.3 Example of a Simple Interface
- 1.4 How to make usable products?
- **1.5 Overview of the Course**
- 1.6 About the Exercises, the essay, and the design sketch

Outline of the course

- 1 Introduction
- 2 Basics of HCI and History
- 3 Designing Systems for Humans
- 4 Analysis
- 5 Designing interactive Systems
- 6 Implementing interactive Systems
- 7 Evaluation

1. Introduction

- 1.1 Terms and concepts
- 1.2 Motivation for Usability
- 1.3 Example of a Simple Interface
- 1.4 How to make usable products?
- 1.5 Overview of the Course
- 1.6 About the Exercises, the essay, and the design sketch

2. Basics of HCI

- Basic principles of usable interactive systems
- What are errors and how to deal with them?
- Basic models of HCI
- A history of HCI

3. Designing Systems for Humans

- Design for humans - human capabilities
- Perception and reading
- Cognitive abilities and memory
- Motor skills
- Disabilities and limitations
- Intuitive? Natural? Affordances

4. Analysis

- Factors on the user interface
- Interaction analysis and analyzing work processes
- Conceptual models
- Analyses of existing systems
- Target users / Specific human capabilities
- Documenting the results of the Analyze
- Understanding the solution space and potential technologies to use
- Design space for input and output
- Technology overview

5. Designing interactive Systems

- The application is part of the process
- Creativity methods
- Tools and methods in the early design phase
- Prototyping
- Wizard of Oz
- Specification of interactive system
- Formal tools to describe interaction systems
- Device independent specification languages and representations for UIs

6. Implementing interactive Systems

- Development process
- Abstractions and separation of concerns
- User interface architectures anduser interface management systems
- Development tools and best practice
- Guidelines and rules
- Device independent development
- Testing software with UIs

7. Evaluation

- Motivation for (formal) evaluation
- Qualitative and quantitative evaluation
- Basis statistics for usability evaluation
- Expert evaluation
- Heuristic evaluation
- Cognitive Walkthrough
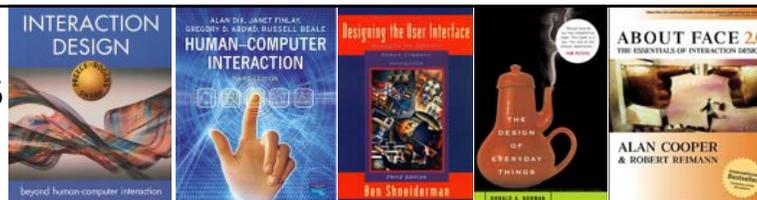- Discount usability
- User studies for computer science

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.
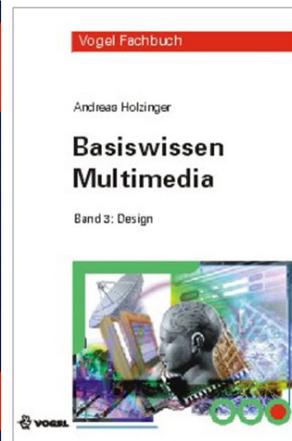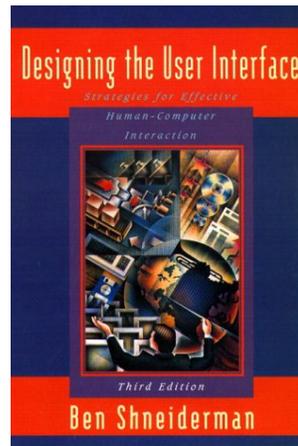
Meet the Authors

5. November 2005
16.00 Uhr
AudiMax der LMU

Medieninformatiktreffen
and der LMU

Es sprechen
Ben Shneiderman
und **Andreas Holzinger**

- Ben Shneiderman. (1998) Designing the User Interface, 3rd Ed., Addison Wesley; ISBN: 0201694972
- Andreas Holzinger. (2001) Basiswissen Multimedia. Band 3: Design; ISBN: 3802318587

---

1. Introduction

- 1.1 Terms and concepts
- 1.2 Motivation for Usability
- 1.3 Example of a Simple Interface
- 1.4 How to make usable products?
- 1.5 Overview of the Course
- **1.6 About the Exercises, the essay, and the design sketch**

Exercises

- Exercises in groups (of 2-4)
- Groups are selected by random (by murx.medien.ifi.lmu.de)
- 1 or 2 weeks to complete
- Results are submitted in written form (electronically) and groups have to present
- Topics may be additional to the lecture
- Richard Atterer is in charge of it

Essay

- On a specific topic
- Fixed deadline
- Done individually
- Results will be online
- About 1500-2000 words
- If copied from sources that are not referenced → kein Schein

Video Design Sketch

- Individual Exercise
- Creating a new user interface for X (and we will give out a list for X)
- Showing the concept in 45-90 seconds
- Based on still images that are connected to a story

Take Part in User Tests!

- Experience new technologies before they exist!
- Learn how user tests are done
- See what your fellow students do in their projects
- Get idea for your own projects.

Mobile Interaction for Near Field Communication
User Study vom 24. bis 28. Oktober 2005

<u>Near Field Communication:</u>
• kontaktlose Nahfunktechnologie zum schnellen
Austausch von Daten über kurze Entfernungen
• Weiterentwicklung von RFID
• Lesen, Schreiben und P2P möglich
• Vorteile: Schnell, Energieeffizient, Viele neue
Anwendungen denkbar

<u>Eure Chance:</u>
  • Zukunftstechnologie schon heute testen
  • Teilnahme an User Study
  • Kleine Belohnung

<u>Organisatorisches:</u>
  • Ort: Amalienstraße 17, Raum 505
  • Zeit: Auf Liste eintragen oder Email an Oliver Falke
  (oliverfalke@web.de)
  • Zeitaufwand pro Person: ca. 20 Minuten

Albrecht Schmidt
Embedded Interaction Research Group
University of Munich, Germany   MMI 2005/2006

Benutzerstudie

Interaktion mit Tangible Displays

Organisatorisches:
  • Dienstag, 25.10.2005
  • Uhrzeit: auf Liste eintragen / email an **krausix@gmail.com**
  • Raum 103, Amalienstr. 17
  • Dauer: ca. 15 Minuten

Thema:
  • Evaluierung eines Prototypen
  • Tangible Displays als Kommunikationsmedium

Albrecht Schmidt
Embedded Interaction Research Group
University of Munich, Germany   MMI 2005/2006