

# Vorlesung Mensch-Maschine-Interaktion

## **Models and Users (2)**

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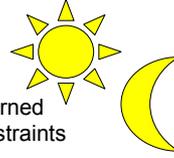
<http://www.medien.informatik.uni-muenchen.de/>

## Table of Content Models and Users (2)

- Recap Constraints
- Examples: Mapping, Conceptual Models
- Conceptual Model in Detail
- Interface Metaphors
- Interaction Paradigms

# Cultural Constraints

- Universal or culturally specific
- Arbitrary conventions that have been learned
- Users expectations build on cultural constraints



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"Hi there!"



# Mapping – Examples (1)

- Relationship between controls and action

**Please attach a Message to Your Order.**

Message Text:

Position to Print Message:

- bottom
- bottom-left
- bottom-right
- centre
- left
- right
- top
- top-left
- top-right

## Mapping – Examples (2)

- Relationship between controls and action

**Please attach a Message to Your Order.**

Message Text:

Position to Print Message:

- bottom
- bottom-left
- bottom-right
- centre
- left
- right
- top
- top-left
- top-right

Possible Label Positions



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## Mapping – Examples (3)

- Relationship between controls and action

**Please attach a Message to Your Order.**

Message Text:

Position to Print Message

- top-left
- top
- top-right
- left
- centre
- right
- bottom-left
- bottom
- bottom-right

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## Mapping – Examples (4)

- Relationship between controls and action

### Please attach a Message to Your Order.

Message Text:

Position to Print Message

<input type="radio"/> top-left	<input type="radio"/> top	<input type="radio"/> top-right
<input type="radio"/> left	<input type="radio"/> centre	<input checked="" type="radio"/> right
<input type="radio"/> bottom-left	<input type="radio"/> bottom	<input type="radio"/> bottom-right

## Mapping – Examples (6)

- Relationship between controls and action

### Please attach a Message to Your Order.

Message Text:

Position to Print Message:

bottom  
 bottom-left  
 bottom-right  
 centre  
 left  
 right  
 top  
 top-left  
 top-right

### Please attach a Message to Your Order.

Message Text:

Position to Print Message

<input type="radio"/> top-left	<input type="radio"/> top	<input type="radio"/> top-right
<input type="radio"/> left	<input type="radio"/> centre	<input checked="" type="radio"/> right
<input type="radio"/> bottom-left	<input type="radio"/> bottom	<input type="radio"/> bottom-right

## Mapping – Examples (5)



- "natural" mappings can be found in many areas
- It is not always obvious what the "natural" mapping is
- Correlation with cultural constraints

## Physical Constraints & Affordances Examples

- USB Memory Stick vs. DVD vs. money
  - If there is more than one option (physically) cater these cases



- Dials vs. Buttons vs. Sliders
  - Dials are turned
  - Buttons are pressed
  - Sliders are pushed



## Example: 'Geldkarte' - Difference between the Conceptual Model and Implementation Model

- Store cash on the card



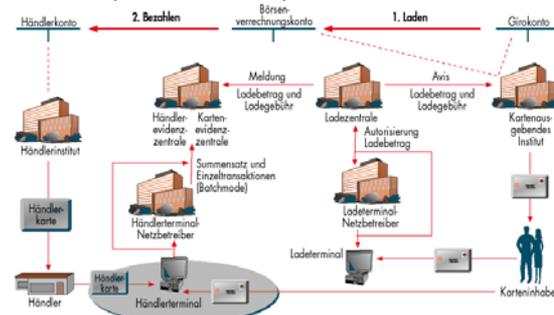
Conceptual Model – by the user

- Pay with the card



## Example: 'Geldkarte' - Difference between the Implementation Model and Conceptual Model

### Some aspects of the implementation model



## Models – Human and Computer

- Applications are based on an Implementation Model
- User operate on their Conceptual Model/Mental Model
- The user interfaces translates between models
- Provocative Statement from A. Cooper  
*“Computer literacy is nothing more than a euphemism for making the user stretch to understand an alien logic rather than having software-enabled products stretch to meet the user’s way of thinking”*

## Implementation Model

- Model how a product is implemented
- Implementation details
  - data structures
  - control flow
  - functional components
- Constraints for the implementation, e.g.
  - remote data access vs. local data access
  - different ways to access records in a database depend on the existents of an index
- Terminology
  - terms/wording used reflect on technology
  - example – see error messages on various systems

# Conceptual Model

- From the user's point of view
  - the explanation how something works
  - describing the basic properties and possible behaviour
  - the basis on which assumptions and predictions about the system and its behaviour are made
- Technically this is
  - in most cases a simplification of the underlying technology and
  - will most likely not reflect the correct mechanism or the actual implementation
- From the developers/designer point of view
  - how will the system appear to the user
  - how will the user understand the process
  - a conceptual description of the system at high level
- For the user the conceptual model is a psychological shorthand to understand how they can interact with a system

# Conceptual Model

## A Definition and its Significance

- A conceptual model is “the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended”  
(Preece, Rogers & Sharp, 2002, Interaction Design, Wiley, p 40)
- “The most important thing to design is the user's conceptual model. Everything else should be subordinated to making that model clear, obvious and substantial. That is almost exactly the opposite of how most software is designed.”  
(David Liddle, 1996, Design of the conceptual model. In T. Winograd, (editor), Bringing Design to Software. Reading, MA: Addison-Wesley, p17)

## Why is this a big issue new with digital products?

- For simple mechanical systems/processes the conceptual model and implementation model very similar, e.g.
  - Hammer
  - Power drill
- For digital systems the implementation model is often very complex
  - Many components, often distributed
  - The service provided is a result of contributions from different parts
  - The digital components are not visible – even when you open the device
- Users still have a simple conceptual models to operate digital products
  - Based on what they see and their experience gained in use
  - By the control options they are given
  - By the behaviour and reactions they observe
  - By what they have learned about the system

## How to get a Conceptual Model? 1<sup>st</sup> Analyse Problem Space

- Understand and analyse the problem space
  - Make problems of existing solution explicit (e.g. list of issue)
  - Why did you characterize them as problem? (because of intuition, reports, user studies, experiments?)
  - How does the envisioned concept solve the problem better? (is it faster, easier to use, easier to deploy, more fun?)
  - How would you see people using it with their current way of doing things?
  - How will it support people in their activities?
  - Will it really help them?
  - Would the envisioned solution introduce new problems? Which?
- Understanding the problem space leads to ideas about
  - What type of device/technology may be appropriate
  - What functionality is required under what conditions
  - What interaction metaphors can be used

## How to get a Conceptual Model?

### 2<sup>nd</sup> Understand the User's Goals

- What is the user (or are the users) trying to achieve
  - What is the final goal?
  - Are there intermediate goals?
  - Are there conflicting goals and trade-offs?
  - If multiple users - how are their goals related?
- Understand the tasks involved
  - What tasks and subtasks are carried out?
  - Why is the user doing these tasks?
  - How is this related to a potential solution?
  - Will the solution eliminate task and still reach the goals?
- Relate the user's goals and tasks to the business model of the envisioned solution
  - Especially for service oriented digital products
  - Are there conflicts of interest between provider and consumer (e.g. quick answers and hence short connection time may conflict with a business model based on connection time)

## How to get a Conceptual Model?

### 3<sup>rd</sup> Make an Explicit Model

- Based on the analyses of the problem space and goals identified identify
  - appropriate interface
  - Interaction methods and metaphors
  - Interaction paradigms
- Make the conceptual model explicit
  - Describe scenarios in detail and the use of the products
  - Storyboarding and videos
  - Sketching out ideas, design sketches
  - Put the solution into the wider context (e.g. an application on the mobile phone in the context of phone usage in general, what happens if a call comes in while you use the application?)
  - Create prototypes
    - low fidelity, e.g. paper prototypes, digital mock-ups (e.g. Flash examples, HTML-Forms with no Backend)

## Example of Explicit Conceptual Model and Concept Studies

- Concept Video from Aarhus School of Architecture

Video

- Reading for this week

[http://www.phonescoop.com/articles/moto\\_wearables/](http://www.phonescoop.com/articles/moto_wearables/)



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## How to get a Conceptual Model? Options for Model in HCI

- Activity based
  - Giving instructions
    - issuing commands using keyboard and function keys and selecting options via menus
  - Conversing
    - interacting with the system as if having a conversation
  - Manipulating and navigating
    - acting on objects and interacting with virtual objects
  - Exploring and browsing
    - finding out and learning things
- Based on (physical) objects or artefacts, e.g.
  - Office equipment
  - Tool
  - Book

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## Giving instructions

- Where users instruct the system and tell it what to do
  - e.g. tell the time, print a file, save a file
- Very common conceptual model, underlying a diversity of devices and systems
  - e.g. CAD, word processors, DVD player, vending machines
- Main benefit is that instructing supports quick and efficient interaction
  - good for repetitive kinds of actions performed on multiple objects



## Conversing

- Underlying model of having a conversation with another human
- Range from simple voice recognition menu-driven systems to more complex 'natural language' dialogues
- Examples include timetables, search engines, advice-giving systems, help systems
- Recently, much interest in having virtual agents at the interface, who converse with you, e.g. Microsoft's Agents (e.g. Clippy)



# Manipulating and Navigating

- Involves dragging, selecting, opening, closing and zooming actions on virtual objects
- Exploit's users' knowledge of how they move and manipulate in the physical world
- Examples
  - what you see is what you get (WYSIWYG)
  - the direct manipulation approach (DM)
- Shneiderman (1983) coined the term DM, came from his fascination with computer games at the time
- Common model in the desktop world



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# Exploring and browsing

- Similar to how people browse information with existing media (e.g. newspapers, magazines, libraries)
- Information is structured to allow flexibility in way user is able to search for information
  - e.g. multimedia, web



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## Which conceptual model is best?

- Direct manipulation is good for 'doing' types of tasks, e.g. designing, drawing, flying, driving, sizing windows
- Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management
- Having a conversation is good for children, computer-phobic, disabled users and specialised applications (e.g. phone services)
- Exploring and browsing is good if the task is explorative
  
- Hybrid conceptual models are often employed, where **different ways of carrying out the same actions is supported at the interface**
  - Toolbar, Menus and Keyboard short cut offer same function
  - Can replace *Expert-Mode* and *Novice-Mode* in the UI

## Interface Metaphors

- Interface designed to be similar to a physical entity but also has own properties
  - e.g. desktop metaphor, web portals
- Can be based on activity, object or a combination of both
- Exploit user's familiar knowledge, helping them to understand 'the unfamiliar'
  
- Benefits
  - Makes learning new systems easier
  - Helps users understand the underlying conceptual model
  - Can be very innovative and enable the applications to be made more accessible to a greater diversity of users

## Problems with Interface Metaphors

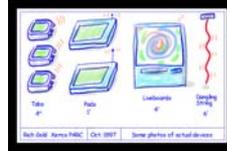
- Break conventional and cultural rules
  - e.g. recycle bin placed on desktop
- Can constrain designers in the way they conceptualise a problem space
- Conflict with design principles
- Forces users to only understand the system in terms of the metaphor
- Designers can inadvertently use bad existing designs and transfer the bad parts over
- Limits designers' imagination in coming up with new conceptual models

## Interaction Mode vs. Interaction Style

- Interaction mode:
  - what the user is doing when interacting with a system, e.g. instructing, talking, browsing or other
- Interaction style:
  - the kind of interface used to support the mode
  - E.g. Command, Speech, Data-entry, Form fill-in, Query, Graphical, Web, Pen, Augmented reality, Gesture

# Interaction paradigms

- “a particular philosophy or way of thinking about interaction design” Preece, Rogers & Sharp, 2002, Interaction Design, Wiley, p60
- Past: The Desktop – intended for single user sitting in front of standard PC
- Present: “Beyond the Desktop”
- Alternative interaction paradigms
  - Ubiquitous computing
  - Pervasive computing
  - Wearable computing
  - Augmented reality
  - Tangible bits



## Example Conceptual Model Supporting Traffic Warden

- Analyse Problem Space
  - Understand and analyse the problem space
  - Understanding the problem space leads to ideas about
- Understand the User's Goals
  - What is the user (or are the users) trying to achieve
  - Understand the tasks involved
  - Relate the user's goals and tasks to the business model of the envisioned solution
- Make an Explicit Model
  - identify interface, interaction methods and metaphors, Interaction paradigms
  - Make the conceptual model explicit (sketches, video, ...)
- Activity based Model
  - Instructions, Conversing, Manipulating and Navigating, Exploring and browsing, or combination
- Interaction Metaphors
- Interaction Paradigms



## Example Conceptual Model Supporting Traffic Warden

- Lets work out a conceptual model...

## References

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- Selected Slides from <http://www.id-book.com/>