Human-computer interaction: usability & cognition

Christian Kaiser
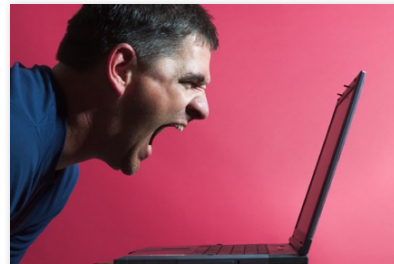
Interactive systems

·· Technological system requiring interaction with users in order to accomplish the task it has been designed for

·· Human Computer Interaction (**HCI**) focuses on how to best design interactive systems
  ·· Focus **is not** on adding more and more **features**
  ·· Focus is on what people **can actually do** with the technology

·· **Ease of use** is important

Useful, Usable and Accessible

·· An **efficient system** is useful, usable and accessible.

·· **Useful:** the user **can actually achieve** the task he wants to do. The system supports the user objectives and purpose.
  ·· If the user wants to write a text and uses Microsoft Word, then Microsoft Word is *useful*.

·· **Usable**: the user **achieves a task easily**.
  ·· If the user wants to buy a train ticket for the first time at the machine and is able to do so without any difficulty, then the ticket machine was *usable*.

·· **Accessible:** the system can be used by the full range of intended users.
  ·· Google gives a simple, very interactive user design that everybody can use. Google is in this case *accessible*.
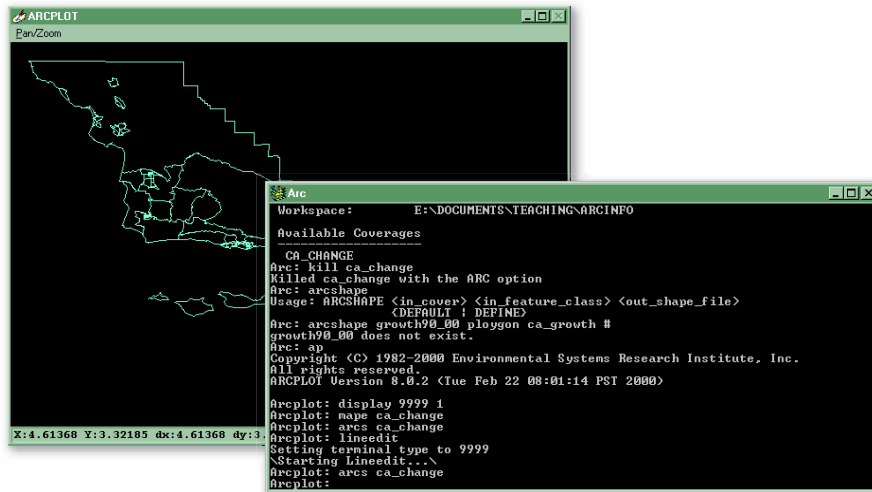

Example…

·· Useful?

·· Usable?

·· Accessible?

Example…

Example…

Usability problems

CAN'T YOU DO ANYTHING RIGHT?

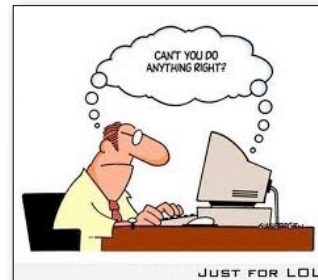JUST FOR LOL
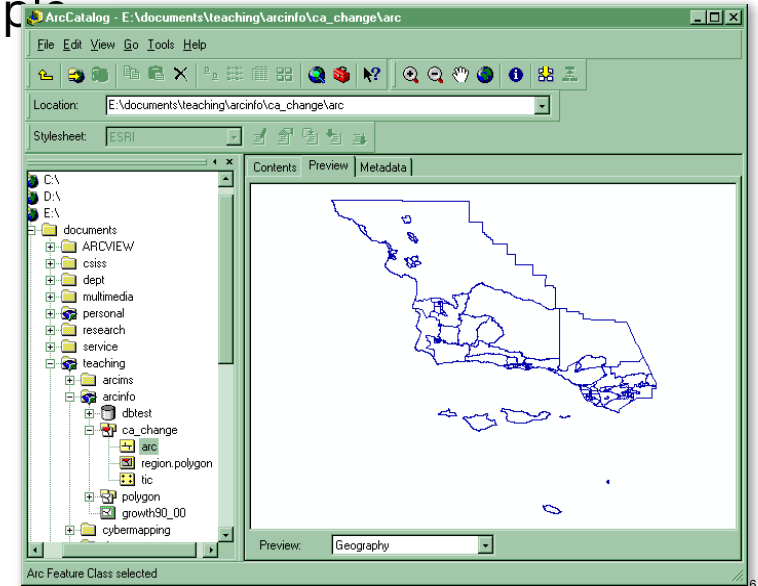
- Incompatibility of user's and system's conceptual models
- Poor error messages
- Extra functionality at the expense of usability
- Design not based on application-/user-specific requirements
- Usability is strongly correlated with users's productivity → **better design!**

Why human-centred design?

- Minimize **hazards**
  - Accidents: transportation, industry, computing…
- Avoid and reduce **human error**
  - Avoid confusing or difficult to use designs
  - Avoid designs not matching our needs
- Need for **good designs** and **usability evaluation**
  - Design focusing on users, needs, tasks and goals
  - Usability evaluation based on empirical data with actual users

Examples of poor design…

http://seibt-bautzen.de/ews/bilder/herd.jpg
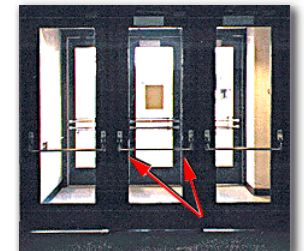
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Examples of poor design…
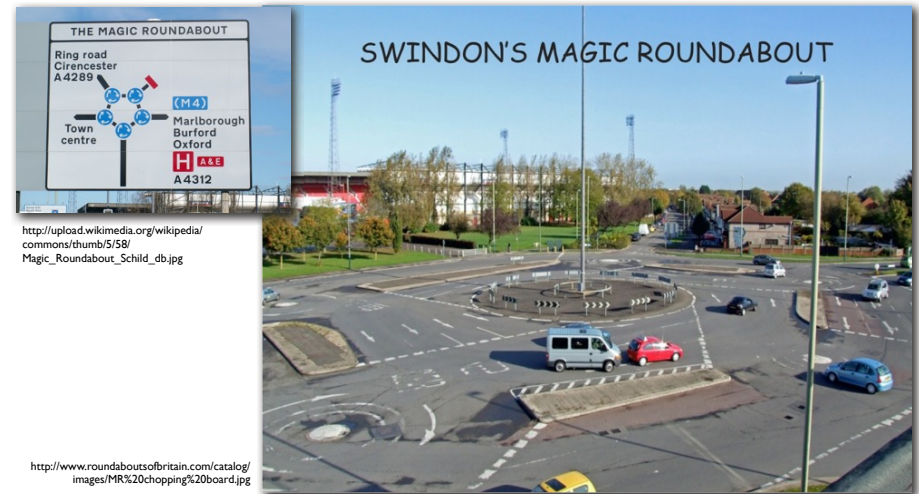
http://upload.wikimedia.org/wikipedia/
commons/thumb/5/58/
Magic_Roundabout_Schild_db.jpg

http://www.roundaboutsofbritain.com/catalog/
images/MR%20chopping%20board.jpg

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Examples of poor design…

http://www.visitwiltshire.co.uk/xsdbimgs/
X-20081018094755593.jpg

http://www.roundaboutsofbritain.com/catalog/images/mr
%20t-shirt%20design%205.jpg

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User-centred systems design

·· Lessons to learn…

  ·· Most failures (errors) of human-tool/system use is due to poor design

  ·· Good design leverages human capabilities

·· User-centred systems design (UCSD): focusing on **usability** during **development** process and system **life cycle**

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Slide 1

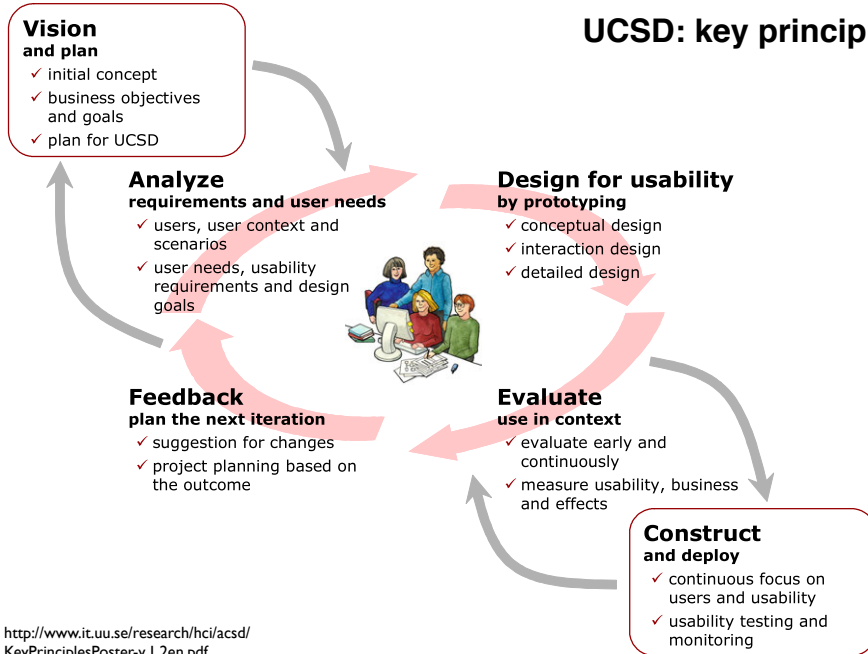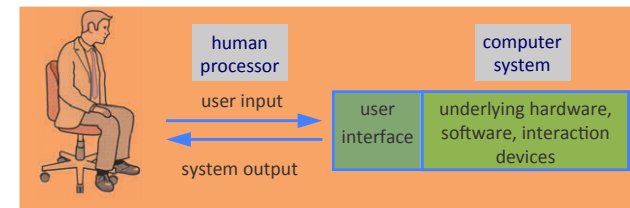**UCSD: key principles**

Vision
and plan
- ✓ initial concept
- ✓ business objectives and goals
- ✓ plan for UCSD

Analyze
requirements and user needs
- ✓ users, user context and scenarios
- ✓ user needs, usability requirements and design goals

Design for usability
by prototyping
- ✓ conceptual design
- ✓ interaction design
- ✓ detailed design

Feedback
plan the next iteration
- ✓ suggestion for changes
- ✓ project planning based on the outcome

Evaluate
use in context
- ✓ evaluate early and continuously
- ✓ measure usability, business and effects

Construct
and deploy
- ✓ continuous focus on users and usability
- ✓ usability testing and monitoring

http://www.it.uu.se/research/hci/acsd/
KeyPrinciplesPoster-v.1.2en.pdf

Slide 2

Cognitive-oriented HCI

- ·· Interactive system is a **distributed system** running on two information processors

- ·· Based on cognitive theories: **perception**, **attention**, and **memory** to understand problem-solving and productivity in the sense of response times

After D. Stone, C. Jarrett, M. Woodroffe, S. Minocha. User interface design and evaluation. Elsevier. 2005

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Slide 3

Design for **attention**

- ·· Make information that needs attention **salient**
  - ·· Colour, animation, ordering of items, etc.
  - ·· Avoid cluttering the interface with too much information
 - ·· Plain interfaces are easier to use

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Slide 4
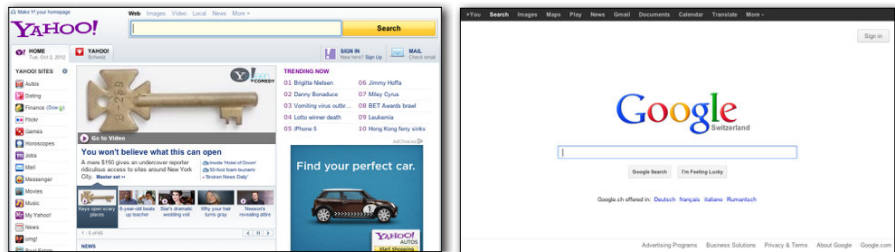
Design for **perception & memory**

- ·· **Perception**
  - ·· Icons should enable users to know easily (not guess) their meaning
  - ·· Sound should be audible and distinguishable
  - ·· Text should be legible: typeface, size, contrast, etc.

- ·· **Memory**
  - ·· Do **not overload** the user's memory with complicated procedures
  - ·· Promote interfaces that support recognition

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Design for perception: example

·· Recent study from MIT's Age Lab shows:

«The Font on Your Car's Dash Might Increase Your Risk of Crashing»

http://agelab.mit.edu/files/
AgeLab_typeface_white_paper_2012.pdf

Figure 7. Menu screen in a humanist font

Figure 8. Menu screen in a square grotesque font
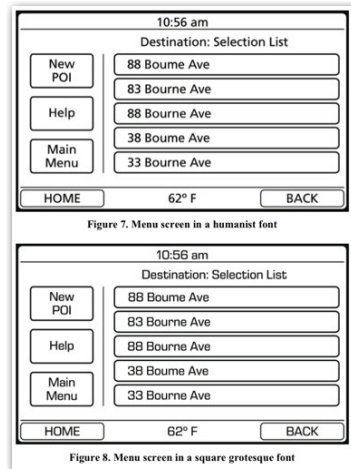
Design for learning & problem solving

·· Learning
  ·· Encourage exploration (and allow come back easily)
  ·· Constrain and guide users to select appropriate actions

·· Problem solving
  ·· Provide additional «hidden» information easy to access for advanced users, i.e. information how to accelerate and automate tasks (e.g. keyboard short cuts)

Some design guidelines…

·· Make relevant parts visible (salient)
  ·· Systems are more usable when they clearly indicate their status, the possible actions that can be performed and the consequence of performed actions

·· Give immediate feedback
  ·· Feedback is about sending back what action has been done and what has been accomplished allowing the user to continue with the activity
  ·· When anything changes it should be made visible (be salient!)

·· Be consistent
  ·· Use of same interface elements everywhere
  ·· Use known elements if possible, and use metaphors

·· Constrain the user
  ·· Restrict the possible interaction, but be consistent with the interface

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8 golden rules for designing interfaces
(Ben Shneiderman)

1. Strive for consistency
   · identical terminology
   · similar menus, colour, layout, fonts, etc.

2. Enable frequent users to use shortcuts

3. Offer informative feedback

4. Design dialogs to yield closure
   · Group actions, make a sequence with clear progress and end

5. Offer simple error handling
   · No serious errors
   · Detect errors and offer simple handling

6. Permit easy reversal of actions
   · Undo, cancel action

7. Support internal locus of control
   · Users should be initiators of actions and not simple responders

8. Reduce short-term memory load
   · Keep displays simple
   · Don't ask user to memorise some information

B. Shneiderman and C. Plaisant. Designing the user interface: strategies for effective human-computer interaction. Pearson/Addison Wesley, Boston. 2004.

Apple's interface design guidelines

- Metaphors
  - familiarity for abstract domain
  - trash can => delete
  - no real world constraints
- Direct manipulation/user control
  - empowerment of user
  - see, point & click, drag & drop
- Feedback and communication
  - keep user informed
- Consistency
  - knowledge transfer
  - «Apple» & «File» always first two menu items

- What You See Is What You Get (WYSIWYG)
  - no hidden codes in file
  - bold is **bold**
- Forgiveness
  - UNDO, escape, cancel
- Perceived stability
  - clear set of options
  - grayed text, options
- Modelessness
  - «what & whenever they want it»
  - acceptable if familiar: drawing tool

HCI for Geovis?

- Cognitive principles are the same
  - Apply the same design principles!
- HCI principles also valid for cartography…!
  - Make relevant information visible!
  - Easy to recognise symbols on the map
  - Consistent symbols and colours
- … especially for interactive maps!
  - State of interactive map should always be clear
  - Forgiveness: go back to initial view
  - Offer informative feedback
  - Support exploring

HCI for Geovis: evaluate…

- Usability tests
  - Provide typical task to users
  - Measure efficiency (time)
  - Measure accuracy (correct answers)
  - Compare!
- Interface design is an iterative process

Users don't read, they scan!
http://www.useit.com/alertbox/reading_pattern.html

Exercice

- Interactive mapping with Leaflet
- Applied HCI …
- Don't forget these principles!

One more thing

- If one day you do a project:
  - in urban planning, development, tourism, etc.
  - Don't forget the users
  - Don't forget human-xyz-interface