

Tutorial

**Fundamentals of Human-Computer Interaction (HCI)
for e-Learning**

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Welcome

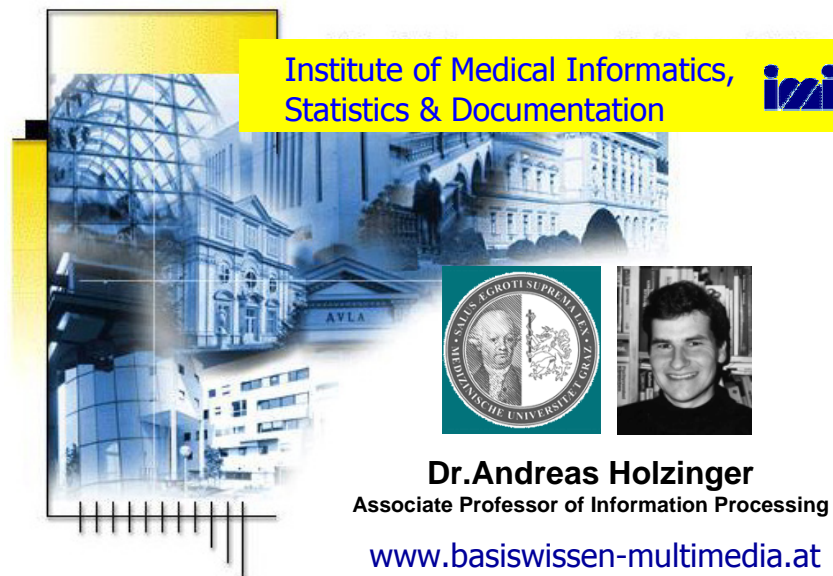


Thank you for choosing this Tutorial




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- (1) About your Lecturer
 - (2) Motivation, Objectives and Overview
 - (3) Audience Background Analysis
 - (4) Example: User Centered Design
 - (5) HCI and Media
-
- Targeted End 15:30

A collage of images in the background, including a modern glass-domed building, a classical university building with columns, and a smaller building with a sign that says 'AVLA'.

Institute of Medical Informatics,
Statistics & Documentation

The logo for the Institute of Medical Informatics, Statistics & Documentation (IMI), featuring the letters 'imi' in a stylized blue font.The official seal of the University of Graz, featuring a portrait of a man and Latin text.A black and white portrait of Dr. Andreas Holzinger, a man with dark hair, smiling.

Dr.Andreas Holzinger
Associate Professor of Information Processing
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andreas.holzinger@meduni-graz.at

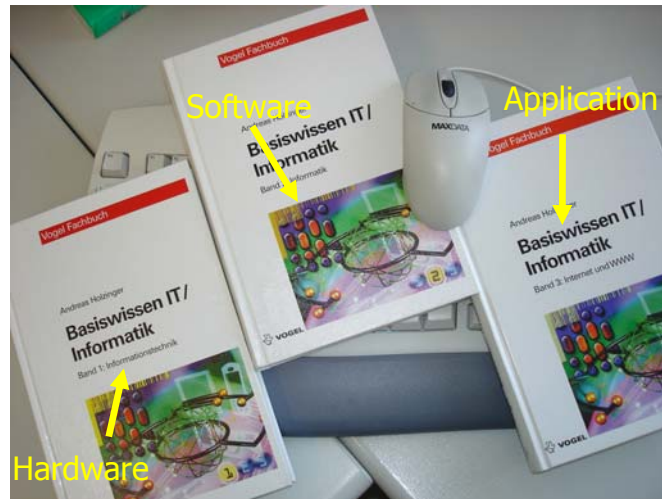
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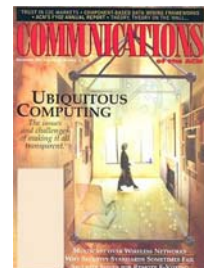
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- Current Reading:
Holzinger A. (2005): Usability Engineering for Software Developers. Communications of the ACM (CACM), 2005, Vol 48, Issue 1, 71-74

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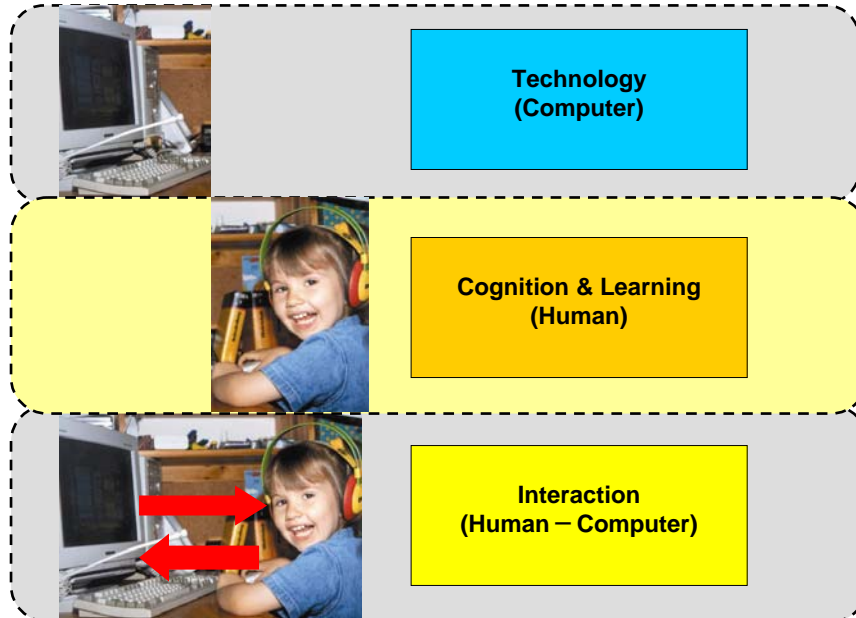
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- Targeted End max. 15:45



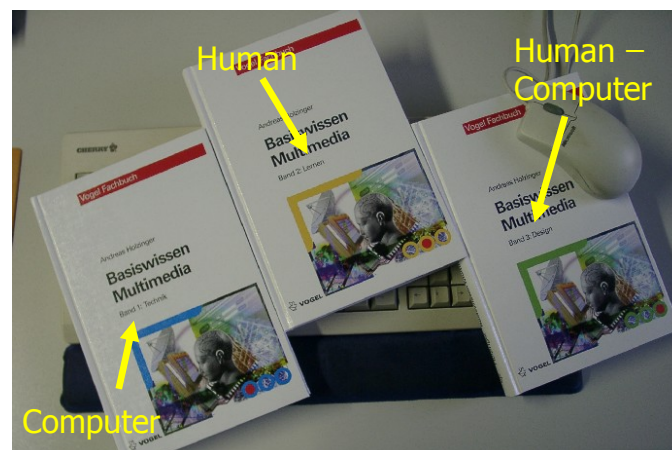
What is HCI?



- Not just screen design, but
- EVERY aspect that affects the user (=learner)



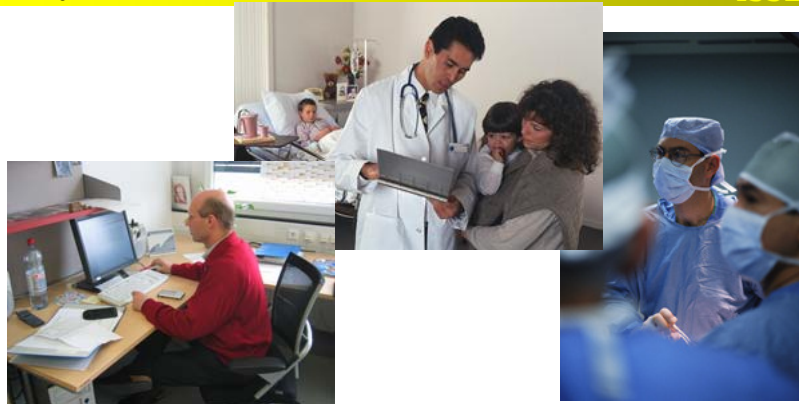
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- Why is HCI for Health Care and Medicine relevant?



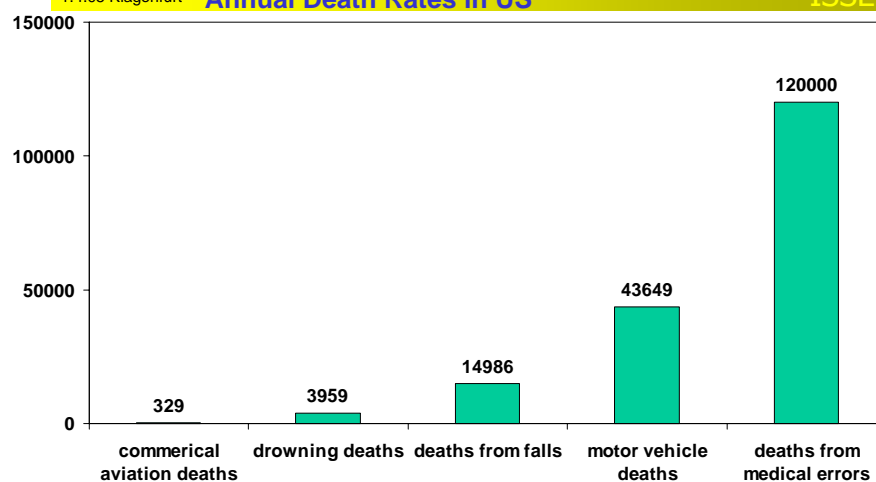
Photo by Institute of Medical Informatics



- Medical people are highly mobile workers
- Complex, interrupt-driven
- Intense clinical workload *versus*
- Inefficiencies in workflow, information and comm.

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Source: Philadelphia Enquirer (9/12/99)

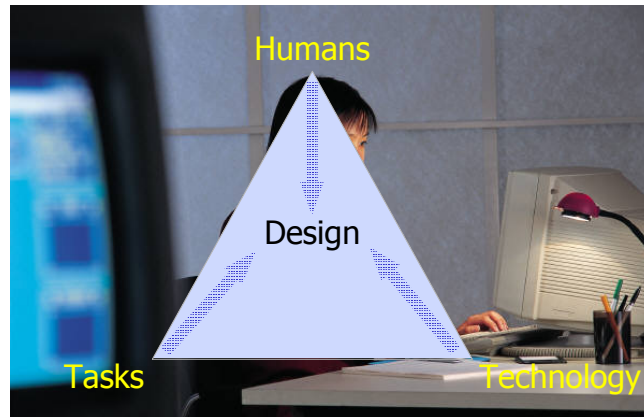
One jumbo jet crash every day



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Human-Computer Interaction (HCI) & Usability Engineering (UE)



Holzinger (2004), Holzinger (2005)

Easy-to-use Interfaces ...



"... the Vision of ambient intelligence seeks to place the user, the human being, at the centre of the future development of the knowledge based society ..."

IST Framework Programme 6

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Please record the following information on an index card:

- Name
(or preferred way to address you)
- Place of employment
- Domains of interest (e.g. computer science, biology, etc.)
- Self-characterization: Indicate your level of agreement with the following statements by recording low, medium, or high for each:
 - I consider myself a designer
 - I consider myself adept at incorporating learner (user) considerations into my work
- Evaluation criteria: What criteria would you use to evaluate a) a Hair Dryer, b) a Learning Object
- Design process: Write down the sequence of approx. five steps we should consider in developing and evaluating a Learning Object.
- Techniques: What techniques do you use (have you used) to focus on learners (users) in your work?

Already are designers ...	High		2	
	Medium	5	7	2
	Low		5	2
		Low	Medium	High

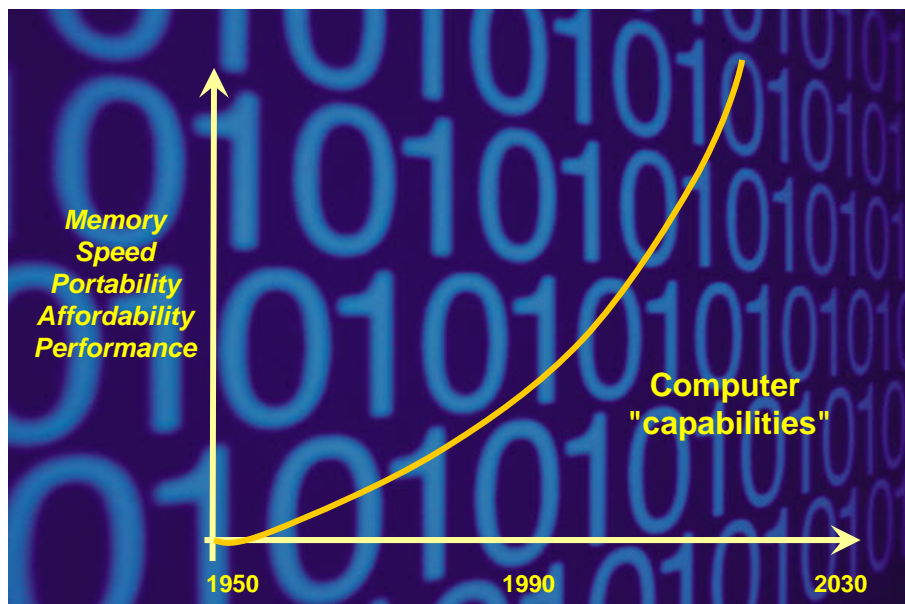
Adept at prioritizing user issues...

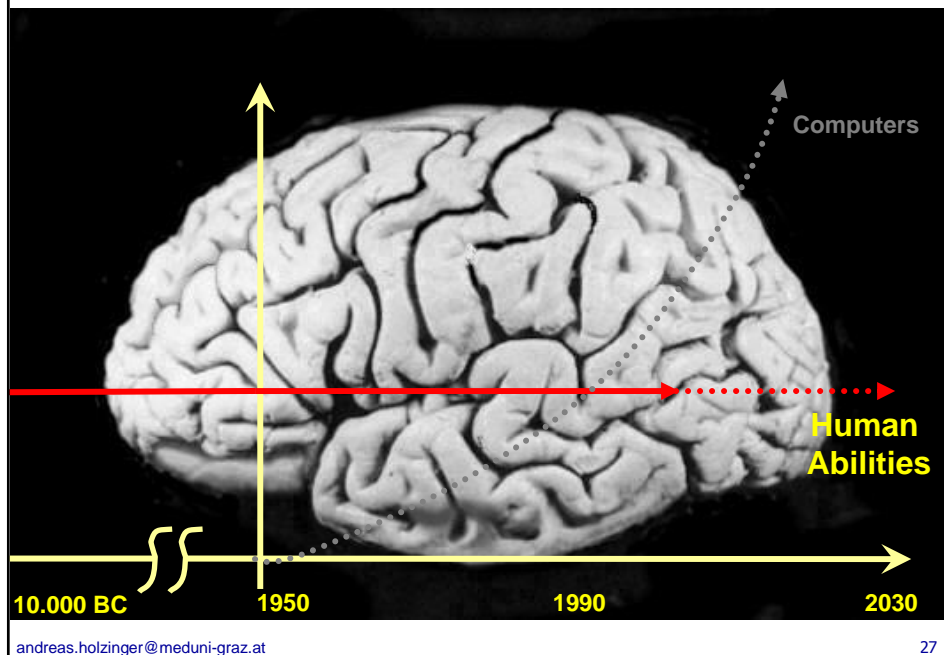
- Presupposed knowledge
- What can a learner learn from the object
- Can the learning process be assessed?
- Time / effectiveness
- Documentation
- Design of user interface
- Standardization? / hard- and software
- Methods
- Does it fit the curriculum?
- Adaptiveness
- Simple to use?
- Costs
- Meta-data
- Acceptance

- Learnability
- Satisfaction
- Memorability
- Fault tolerance
- Time it takes for the teacher to provide the object
- Time it takes the students know how to handle the object
- Balance of theory & practice
- Re-usability
- Suits which learner types?
- Inter-connectability to other learning objects
- Provocative?

- As Bob Stake puts Scriven (1991):
- *"When the cook tastes the soup in the kitchen, that's formative; when the guests taste the soup, that's summative"*
- When should we taste our soup?

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- For an interface to be a **success**
 - it must provide
 - the right functionality
 - at the right time
 - in the right place
 - and in the right form
 - *from the user's point of view!*
- usability testing is the process of ensuring that a user-interface is usable





■ System Centered Design

- Feature driven: What can be realized on our platform?
- Tool driven: What can be created by using available tools?
- Interest Driven: What do the programmer find interesting?



■ User Centered Design

- Task based: What do the users really need?
- Ability based: What abilities do the users have?
- Domain based: In what context do the users work?

	Inspection Methods			Test Methods		
	Heuristic Evaluation	Cognitive Walkthrough	Action Analysis	Thinking Aloud	Field Observation	Questionnaires
Applicably in Phase	<i>all</i>	<i>all</i>	<i>Design</i>	<i>Design</i>	<i>Final Testing</i>	<i>all</i>
Required Time	<i>low</i>	<i>medium</i>	<i>high</i>	<i>high</i>	<i>medium</i>	<i>low</i>
Needed Users	<i>none</i>	<i>none</i>	<i>none</i>	<i>3+</i>	<i>20+</i>	<i>30+</i>
Required Evaluators	<i>3+</i>	<i>3+</i>	<i>1-2</i>	<i>1</i>	<i>1+</i>	<i>1</i>
Required Equipment	<i>low</i>	<i>low</i>	<i>low</i>	<i>high</i>	<i>medium</i>	<i>low</i>
Required Expertise	<i>medium</i>	<i>high</i>	<i>high</i>	<i>medium</i>	<i>high</i>	<i>low</i>
Intrusive	<i>no</i>	<i>no</i>	<i>no</i>	<i>yes</i>	<i>yes</i>	<i>no</i>
Comparison of Usability Evaluation Techniques						

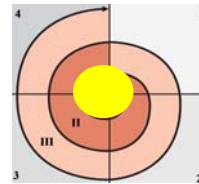
cf. Nielsen (1994), Andrews (2002), Holzinger (2003), Holzinger (2005)



- Know thy end-users!
 - Cognitive abilities
 - Physical abilities
 - Motivational background
 - Previous knowledge and skills!
- Keep users involved throughout the development process

- Corresponding reading:
- A. Holzinger and R. Motschnik-Pitrik (2005), "Considering the Human in Multimedia: Learner-Centered Design (LCD) & Person-Centered e-Learning (PCeL)" in *Innovative Concepts for Teaching Informatics*, R. T. Mittermeir et al., Eds., Carl Ueberreuter, Vienna, 2005. pp. 102-112.

Phase 1: Analysis
 Phase 2: Design
 Phase 3: Development
 Phase 4: Testing



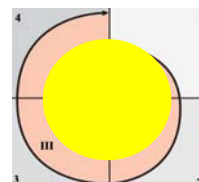
Level I: Requirements Analysis & Specification

Focus on: Who? What? Why? Where? When?

- A) Identify users and analyze learning requirements
- B) Define learning outcomes
- C) Define context
- D) Define content

Participants: Learners, Teacher (usually Domain Expert), Multimedia Expert (usually software Freak), Design Expert (usually Usability Engineer), Didactical Expert

Phase 1: Analysis
 Phase 2: Design
 Phase 3: Development
 Phase 4: Testing



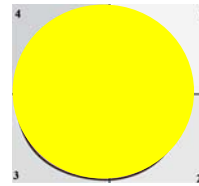
Level II: Multimedia Application Design

Focus on: Presentation, Access, Engagement

- A) Select appropriate Didactical Model
- B) Follow pedagogical Design Guidelines (Pedagogy)
- C) Follow principal Design Guidelines (Information Design)
- D) Select proper Interactions (Interaction Design)

Participants: Learners, Teacher (usually Domain Expert), Multimedia Expert (usually software Freak), Design Expert (usually Usability Engineer), Didactical Expert

Phase 1: Analysis
 Phase 2: Design
 Phase 3: Development
 Phase 4: Testing



Level III: Multimedia Application Development

Focus on: Usability Engineering

- A) Prototype and implement Design from Level II
- B) Follow pedagogical Design Guidelines (Pedagogy)
- C) Apply current technology (Media, XML, Metadata etc.)
- D) Provide always good accessibility (bandwidth etc.)

*Participants: Learners, Teacher (usually Domain Expert),
 Multimedia Expert (usually software Freak), Design Expert
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- Learning Goals according to Bloom (1956):
 - 1) Cognitive Goals (Information, Knowledge, ...)
 - 2) Affective Goals (Curiosity, Awareness, ...)
 - 3) Psychomotoric Goals (Hands-On, Know-How)

What does the nature of your content require?

■ Orientation

"Students need to know where they are, how they got there, and how to get back"

- Electronic Medium Conceals Information
- Placement Cues
- Hierarchies and Indices
- Semantic Nets (make the associations between related information specific)

■ Navigation

“Minimize the mental load required to understand the interface”

- Simple and Consistent
- Layer Content
- Use Inverted Pyramids

“When a screen changes, change only the information to which the learner is directed”



■ Most information students receive is text ...



APFEL

- enactiv (haptic)
- iconic (visual)
- symbolic (abstract)

cf. Holzinger 2000

■ Text

- Amount of Text
- Text Display
- Text Structure
- Readability
- Fragmentation

Nielsen (1994), Holzinger (2002)

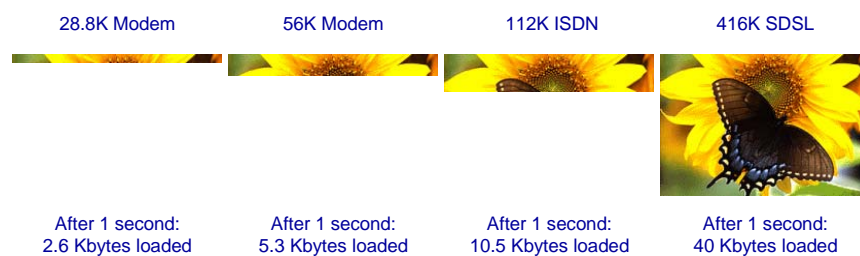
- Proximity
- Alignment
- Consistency
- Contrast

- Comes from the Latin root for line
 - align items that are related or have similar importance
- Common forms:
 - left alignment (best for reading, common)
 - right alignment (novelty, advertisement,)
 - center alignment (best for titles)
 - text justified (both right and left; avoid on web)

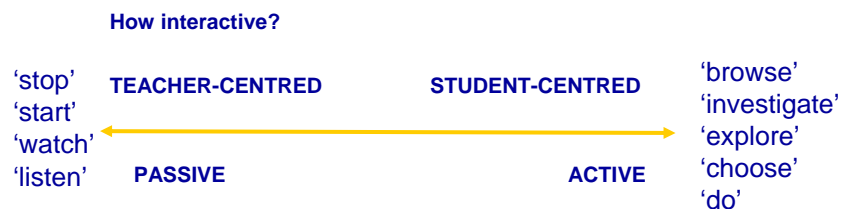
■ Multimedia

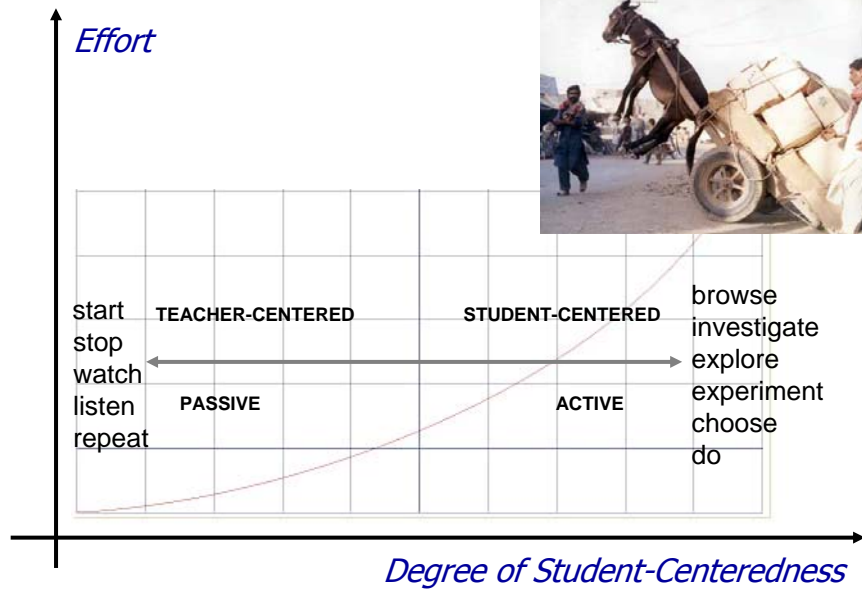
- Keep Download Time to a Minimum
- Hybrid Approach for Rich Media

Example: Downloading a 40 kilobyte image



■ Interactivity





... but details matter too
example – colours

■ styles

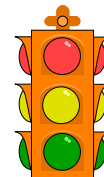
- cold north west - drab, low contrast
- hot south east - bright, movement

■ human eye

- contrast not colour
- distractions



- using conventions (red for alarms etc.)
- 'branding' parts of an interface
- occasional emphasis
- redundant coding
 - i.e. in addition to other means
 - e.g. web links - also underlined
 - for diagrams, etc.



bad use of colour

■ **over** use - without very good reason (e.g. kids' site)

- **over** use - without very good reason (e.g. kids' site)
- colour blindness
- poor use of contrast
- do adjust your set!
 - adjust your monitor to greys only
 - can you still read your screen?

3 1 4 1 5 9 2 6 5 3 5 8 9 7 9
3 2 3 8 4 6 2 6 4 3 3 8 3 2 7
9 5 0 2 8 8 4 1 9 7 1 6 9 3 9
9 3 7 5 1 0 5 8 2 0 9 7 4 9 4
4 5 9 2 3 0 7 8 1 6 4 0 6 2 8
6 2 0 8 9 9 8 6 2 8 0 3 4 8 2
5 3 4 2 1 1 7 0 6 7 9 8 2 1 4

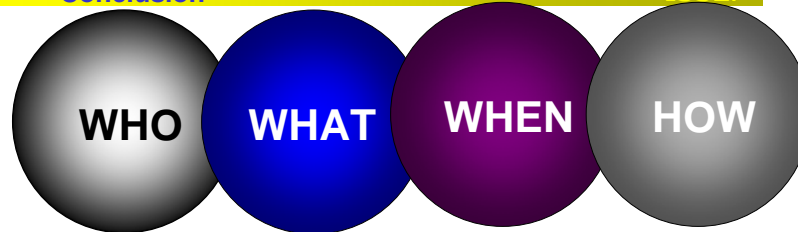
3 1 4 1 5 9 2 6 5 3 5 8 9 7 9
3 2 3 8 4 6 2 6 4 3 3 8 3 2 7
9 5 0 2 8 8 4 1 9 7 1 6 9 3 9
9 3 7 5 1 0 5 8 2 0 9 7 4 9 4
4 5 9 2 3 0 7 8 1 6 4 0 6 2 8
6 2 0 8 9 9 8 6 2 8 0 3 4 8 2
5 3 4 2 1 1 7 0 6 7 9 8 2 1 4

Bertin (1977), Card., Mackinlay & Shneiderman (1999), Holzinger (2001)

What students hate ...

- Download Delays
- Downloading millions of Plug-ins
- Having to Change Fonts or Other Settings
- Having to Reboot after every session
- Long Scrolling Text – endless reading on screens
- Links Within a Page and not finding back
- Dead Ends/Can't Get Back
- Getting Lost
- No Online Moderator, no instructor available
- Overly Detailed Graphical User Interface
- Unnecessary Distractions (flashing, popping, ...)





- A good learning object fits to its end-users; It addresses the questions:
- Who are the learners?
- What do they need to be able to achieve the learning goals?
- When do they achieve the learning goal?
- How will they get to the learning goal?

Further Reading



www.basiswissen-multimedia.at



www.basiswissen-it.at

- [http://webdb.uni-graz.at/
~holzinge/holzinger/
holzinger-publications.html](http://webdb.uni-graz.at/~holzinge/holzinger/holzinger-publications.html)