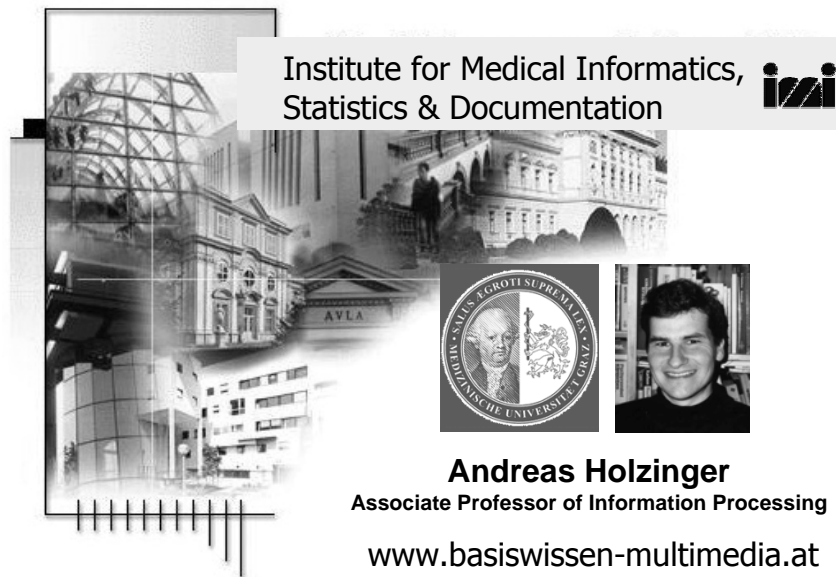Andreas Holzinger

LV 706.046 3SE AK Mensch-Maschine Kommunikation
Usability Engineering for Software Developers

Applying User Centered Design

Institute for Medical Informatics,
Statistics & Documentation

Andreas Holzinger
Associate Professor of Information Processing

www.basiswissen-multimedia.at

www.basiswissen-it.at

Software

Application

Hardware

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Human

Human – Computer

Computer

TUG
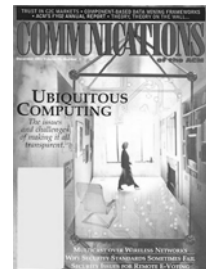
Reading:

- A 34. Holzinger A. (2005): Usability Engineering for Software Developers. Communications of the ACM (CACM), 2005, Vol 48, Issue 1, 71-74
- A 25. Holzinger, A. (2004): Application of Rapid Prototyping to the User Interface Development for a Virtual Medical Campus. IEEE Software. Vol. 21, Iss. 1, January 2004, 92-99.

TUG

Medical faculty, founded in 1772, combined with the University Hospital Graz approx. 2.300 beds

- One of the biggest Hospitals in Europe ...
- is the flagship of 21 Styrian County Hospitals ...

3

21 Styrian General Hospitals TUG

Styria Pop.
1.200.000

Hospitals	21
Beds	approx. 6.900
Inpatients	250.000/year
Physicians	approx. 1850
Total staff	approx 14.700

Map of Styria showing hospital locations: LKH Bad Aussee, LKH Mariazell, LKH Eisenerz, LKH Mürzzuschlag, LKH Rottenmann, LKH Bruck/Mur, LKH Hartberg, LKH Leoben, LKH Hörgas-Enzenbach, LKH Weiz, LKH Stolzalpe, LKH Judenburg, LKH Knittelfeld, LKH Graz / KAGes, LKH Fürstenfeld, LKH Voitsberg, LKH Deutsch-landsberg, LNKH Graz, LKH Feldbach, LPH Schwanberg, LKH Wagna, LKH Bad Radkersburg

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My assistants ... TUG

HCI International 2003
22 - 27 June 2003

Angela
Katharina
Barbara

"The old computing is about what computers can do;
The new computing is about what people can do"

Shneiderman (2002)

"Research is what I'm doing
when I don't know what I'm doing"

Wernher von Braun (1912-1977)

Some facts about Medical Informatics

■ Why Health Care and Medicine?

IT in Hospitals - everywhere!

*Photo by Institute of Medical Informatics
(Computer Guided Surgery)*
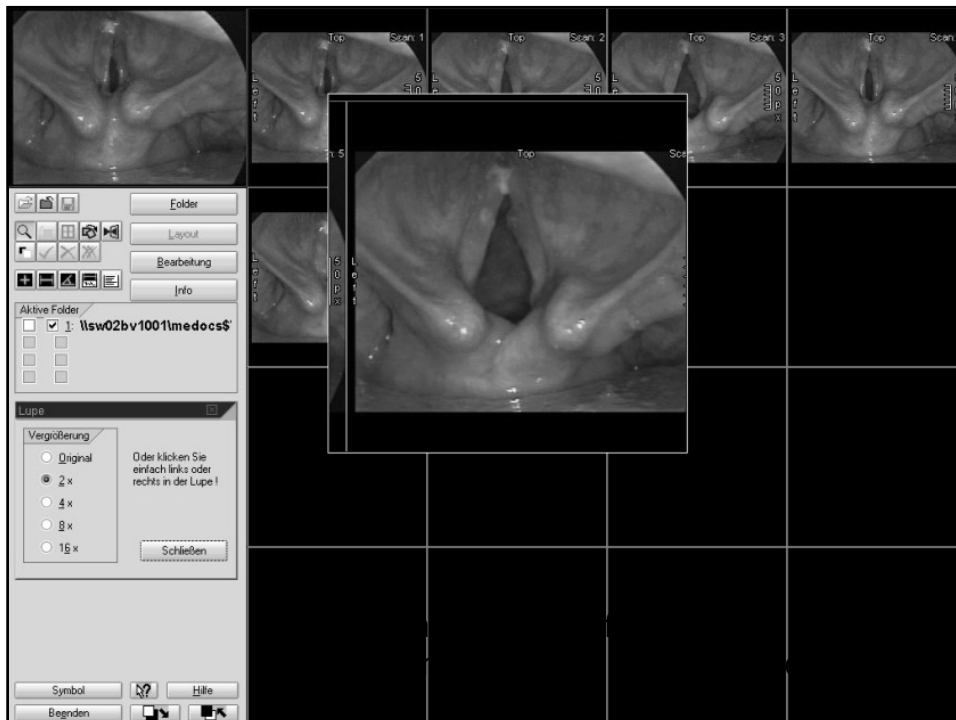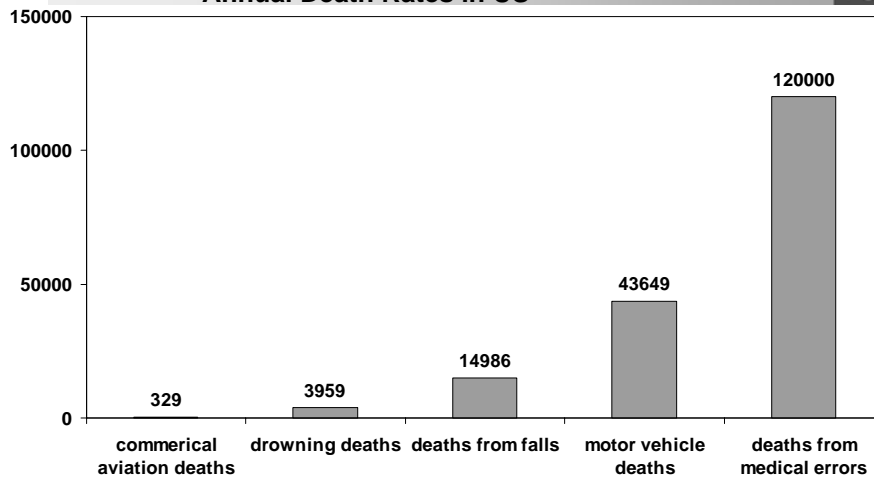
TUG

- medical people are highly mobile workers
- consequently we considered early to make various applications mobile ...

Why you could be working with Ubicomp

The Major Trends in Computing

—Mainframe (one computer, many people)
—PC (one person, one computer)
—Ubiquitous Computing (one person, many computers)

Sales/Yr

(x-axis: 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000, 2005)

---

commerical aviation deaths	drowning deaths	deaths from falls	motor vehicle deaths	deaths from medical errors
329	3959	14986	43649	120000

(y-axis: 0, 50000, 100000, 150000)

Philadelphia Enquirer (9/12/99)

One jumbo jet crash every day

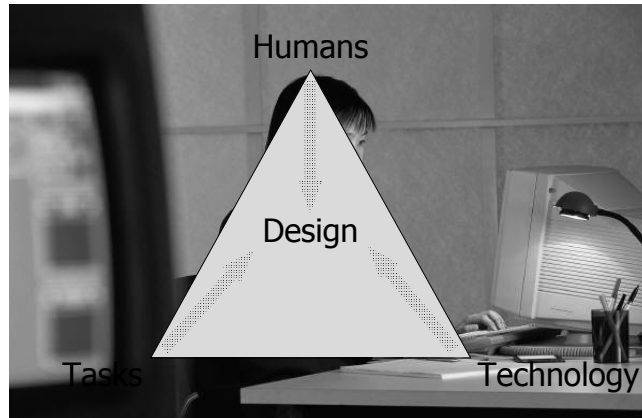Human-Computer Interaction (HCI) & Usability Engineering (UE) slide — triangle with vertices Humans, Tasks, Technology and Design in the center.

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

Holzinger, A. (2005), Usability Engineering for Software Developers. *Communications of the ACM,* 48, 1, 71-74.

Holzinger, A. (2004), Application of Rapid Prototyping to the User Interface Development
for a Virtual Medical Campus. *IEEE Software,* 21, 1, 92-99.

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

- ■ 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

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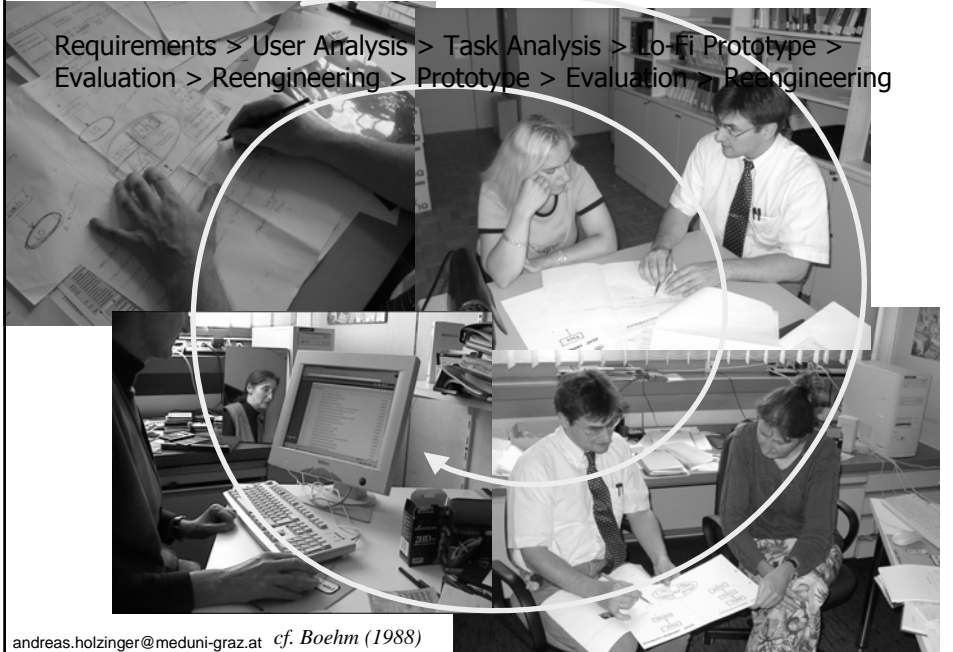 - ● **Feature driven: What can be realized on our platform?**
  - ● **Tool driven: What can be created by using available tools?**
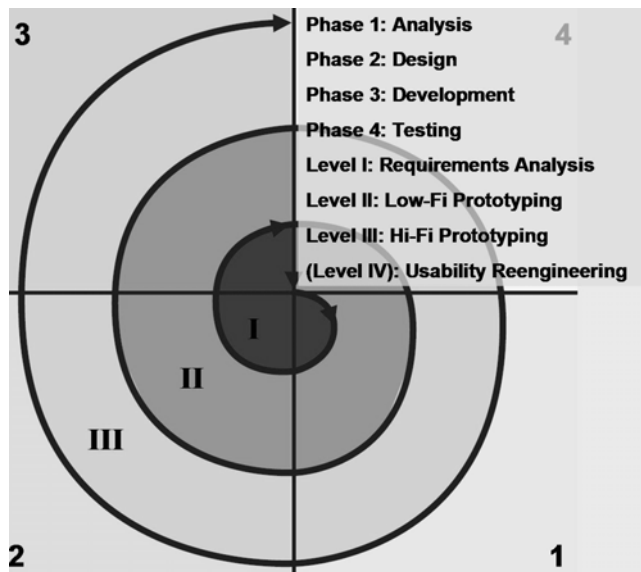 - ● **Interest Driven: What do the programmer find interesting?**

- ■ **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?**

UCDev, Marcus (2002), Holzinger (2003) TUG

Requirements > User Analysis > Task Analysis > Lo-Fi Prototype >
Evaluation > Reengineering > Prototype > Evaluation > Reengineering

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TUG

3 **4**

Phase 1: Analysis
Phase 2: Design
Phase 3: Development
Phase 4: Testing
Level I: Requirements Analysis
Level II: Low-Fi Prototyping
Level III: Hi-Fi Prototyping
(Level IV): Usability Reengineering

I

II

III

2 **1**

Holzinger (2004)

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Start

Refer to figure 2

It is possible to
extrapolate from
the time already
expended.

small release & customer approval

small release & customer approval

small release & customer approval

In principle,
mini success snails (see fig. 2)
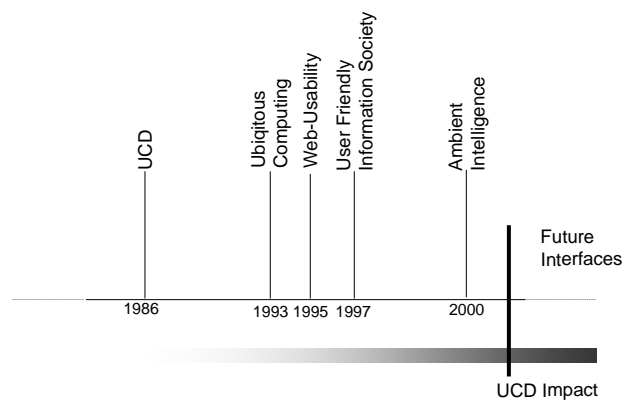are used in XP, thus, testing
takes place practically constantly.

t

Holzinger, Errath, Searle, Thurnher, Slany (2005)

It is rare that projects adopt a fully integrated UCD approach in one strategic shift ...

UCD

Ubiqitous
Computing

Web-Usability

User Friendly
Information Society

Ambient
Intelligence

Future
Interfaces

1986   1993 1995 1997   2000

UCD Impact

cf. Norman & Draper (1986), Dray & Siegel (1998), Gulliksen (1999), Vredenburg (2002)
Holzinger (2002), Holzinger (2003), Holzinger (2004)

- **Requirements Analysis**
  (Def. formaler Anforderungen)
- **User Analysis**
  (Feststellung der Eigenschaften potentieller Benutzer)
- **Context Analysis**
  (Analyse des organisationalen, politischen und sozialen Umfeld)
- **Task Analysis**
  (detaillierte Aufgabenbeschreibung)
- **Functional Analysis**
  (Abbildung auf die Implementierungsebene)
- **Task/Function Allocation**
  (Aufteilung zwischen Benutzer und System)
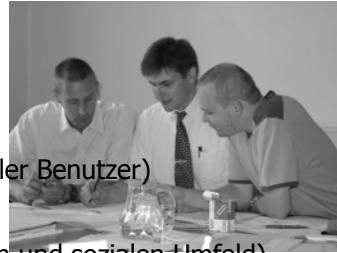
cf. Johnson (1985), Benyon (1992), Sutcliffe (1997), Hackos & Redish (1998), Caroll (2002)

Holzinger (2004)

User Centered Development ...
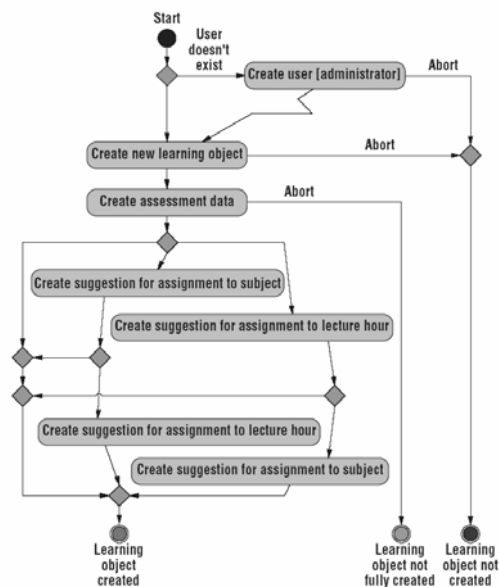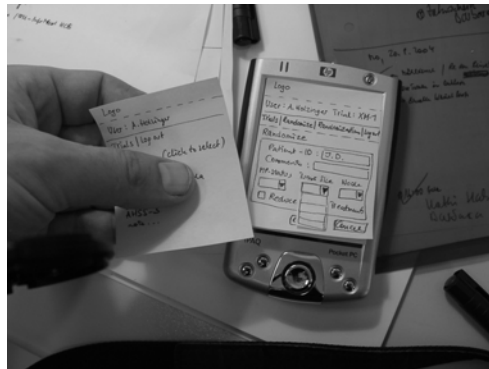
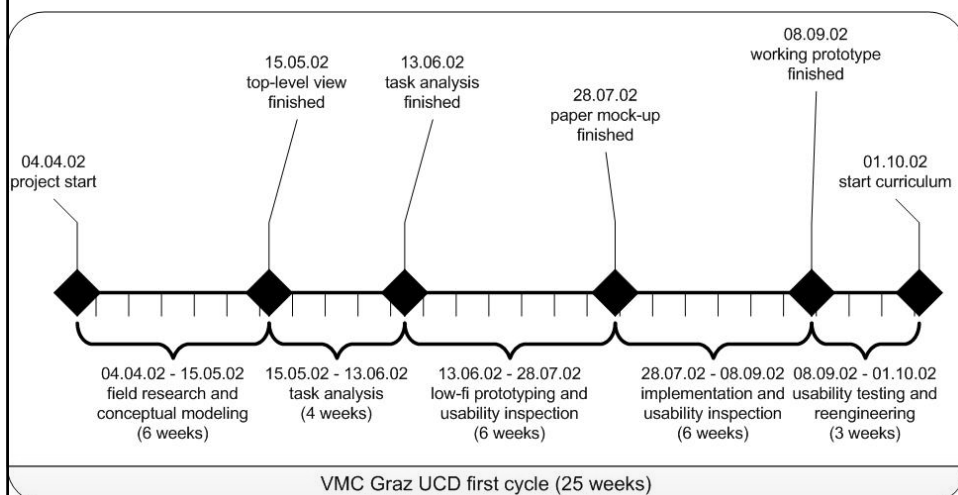- who are the end-users? what are the tasks?
- iterative design
- mock-ups, prototypes
- develop and test designs with end-users!

Holzinger & Errath (2004)
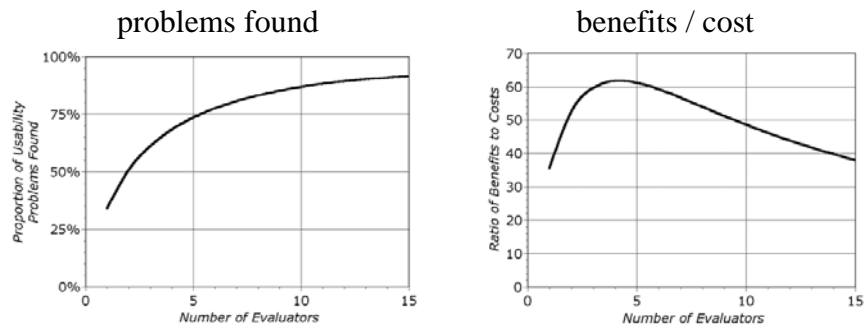
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Medico-legal pressures

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Rapid Prototyping ...

paper mock-ups > electronic prototypes

cf. Rettig (1994), McConell (1996), Hall (2001), Holzinger (2004)

Rapid development ... traditonal

08.09.02
working prototype
finished

15.05.02
top-level view
finished

13.06.02
task analysis
finished

28.07.02
paper mock-up
finished

04.04.02
project start

01.10.02
start curriculum

04.04.02 - 15.05.02
field research and
conceptual modeling
(6 weeks)

15.05.02 - 13.06.02
task analysis
(4 weeks)

13.06.02 - 28.07.02
low-fi prototyping and
usability inspection
(6 weeks)

28.07.02 - 08.09.02
implementation and
usability inspection
(6 weeks)

08.09.02 - 01.10.02
usability testing and
reengineering
(3 weeks)

VMC Graz UCD first cycle (25 weeks)

Holzinger (2004)

problems found   benefits / cost

Caveat: graphs for a specific example

cf. Nielsen (1994)

Some Previous HCI Theory

- ■ Model Human Processor & GOMS (Card, Moran, & Newell, 1983)

- ■ Artifact Theory (Carroll & Campbell, 1986)

- ■ Human Factors Engineering (Dowell & Long, 1989)

- ■ Cognitive Systems (Rasmussen, et al. 1994; Vicente, 1999)

- ■ Activity Theory (Nardi, 1996)

Example: Metrics

Objective	*Effectiveness*	*Efficiency*	*Satisfaction*
Suitability	*% of goals achieved*	*Time to Complete*	*Subjective Rating*
Appro- priateness	*# of power features used*	*Relative to expert*	*Rating of power*
Learnability	*% learned*	*Time to learn*	*Rating of learning*
Error	*% errors corrected*	*Time to correct*	*Rating of error handling*

Dix et al. (1998), ISO 9241, ISO 13407

Methods used

	Inspection Methods			Test Methods		
	Heuristic Evaluation	Cognitive Walkthrough	Action Analysis	Thinking Aloud	Field Observation	Question-naires
Applicably in Phase	*all*	*all*	*Design*	*Design*	*Final Testing*	*all*
Required Time	*low*	*medium*	*high*	*high*	*medium*	*low*
Needed Users	*none*	*none*	*none*	*3+*	*20+*	*30+*
Required Evaluators	*3+*	*3+*	*1-2*	*1*	*1+*	*1*
Required Equipment	*low*	*low*	*low*	*high*	*medium*	*low*
Required Expertise	*medium*	*high*	*high*	*medium*	*high*	*low*
Intrusive	*no*	*no*	*no*	*yes*	*yes*	*no*

Comparison of Usability Evaluation Techniques

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

Experiences within
implementation

- UCD paid off during implementation
- Small team, rapid prototyping, iterative development
- Development and Testing totally integrated,
immediate feedback

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What problems did occur?

- Resistance from end-users generally! (Much
persuasiveness was necessary)
- the broad non-informatics audience (end-users)
needed special attention (low computer literacy)
- acceptance resulted in severe interface
adaptations

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User Centered Development …

- … is a must, NOT an option!
- … is still NOT common sense!
- … is much more than design!
- … is a Project-Philosophy, not only a Methodology!
- … is inherently interdisciplinary!
- … generates clear added values!
- … is realized by a mosaic of techniques!
- … can be seen as a mediator!
- … means research matters!

We must provide benefits and gain acceptance!