



Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Usability Principles and Paradigms

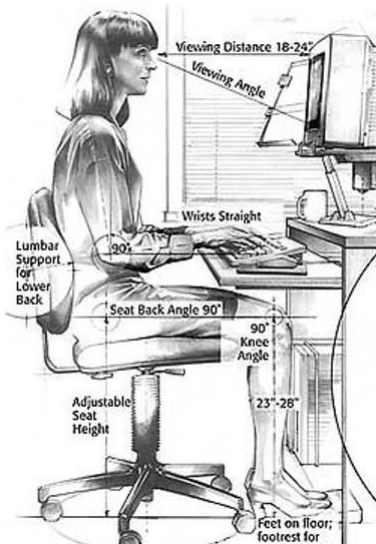


(Design of everyday things)

- Introduction
- History
- Usability and standards
- Principles
- Paradigms

- During and after the World War II the following disciplines emerged:

Ergonomics – physical aspects **Human factors** – also cognitive aspects



Man-Machine Interaction → **Human-Computer Interaction**
(nighties)

Ergonomics and Human Factors



- Interaction emerged as new independent field within Computing in the 80s, mainly due to:
 - Lower price of technology
 - Technology migration
 - Need to increase users productivity
- It expanded rapidly
- It is currently an interdisciplinary field
- Human Centered Computing is a ACM scientific area within Computing (also at the University of Aveiro)

Interactive systems design

- Interactive systems include a “module” which we don’t control:

The user, who:

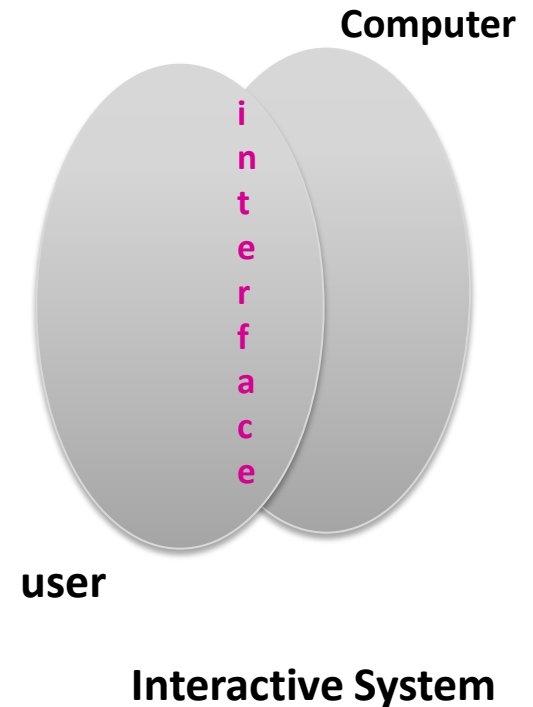
- is very complex
- not well known
- we cannot control



(and users may be very different)

This makes design difficult

- User Interface (UI) is the means by which the user and a computer system interact
- To the user **“the interface is the system”**
- The user interface design involves a considerable effort



Interactive system design

- Involves knowing:

Usability principles (independent from technology)

Usability paradigms (more technology dependent)

+ **Evaluation**

+ **Methods**

- We must know the **success examples** (usability paradigms)
- Understand **why they work** (usability principles)
- Use the **adequate methods** (user-centered approach)
- And **test**, re-design,
test, redesign
...
until we attain the usability goals

- **Usability** is, according to **ISO 9241-11**:

“the extent to which a product can be used by specified users to achieve specified goals with **effectiveness**, **efficiency** and **satisfaction** in a specified context of use”

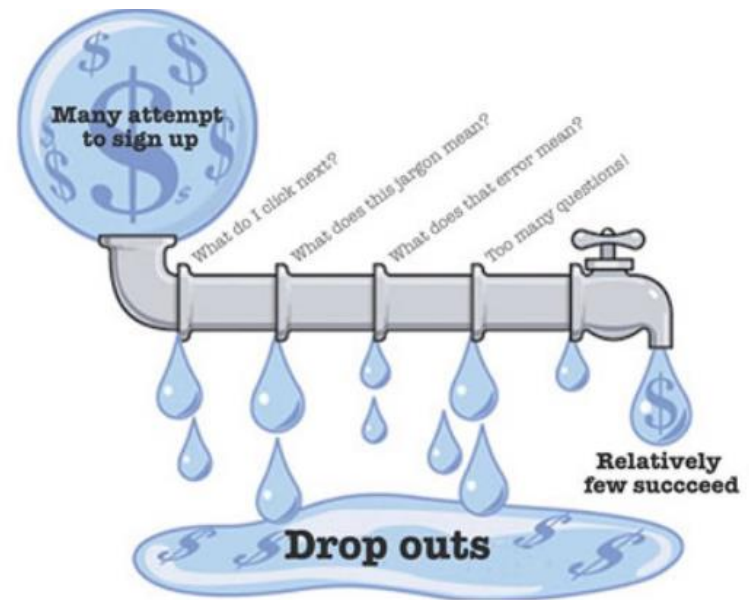
Usability

- Is directly related to the system capacity to allow users attaining their goals through its usage
- Three fundamental aspects (dimensions):
 - **easy to learn and remember** (learnability, memorability)
 - **easy to use** (fast and with few errors) (efficiency, efficacy)
 - **satisfaction**

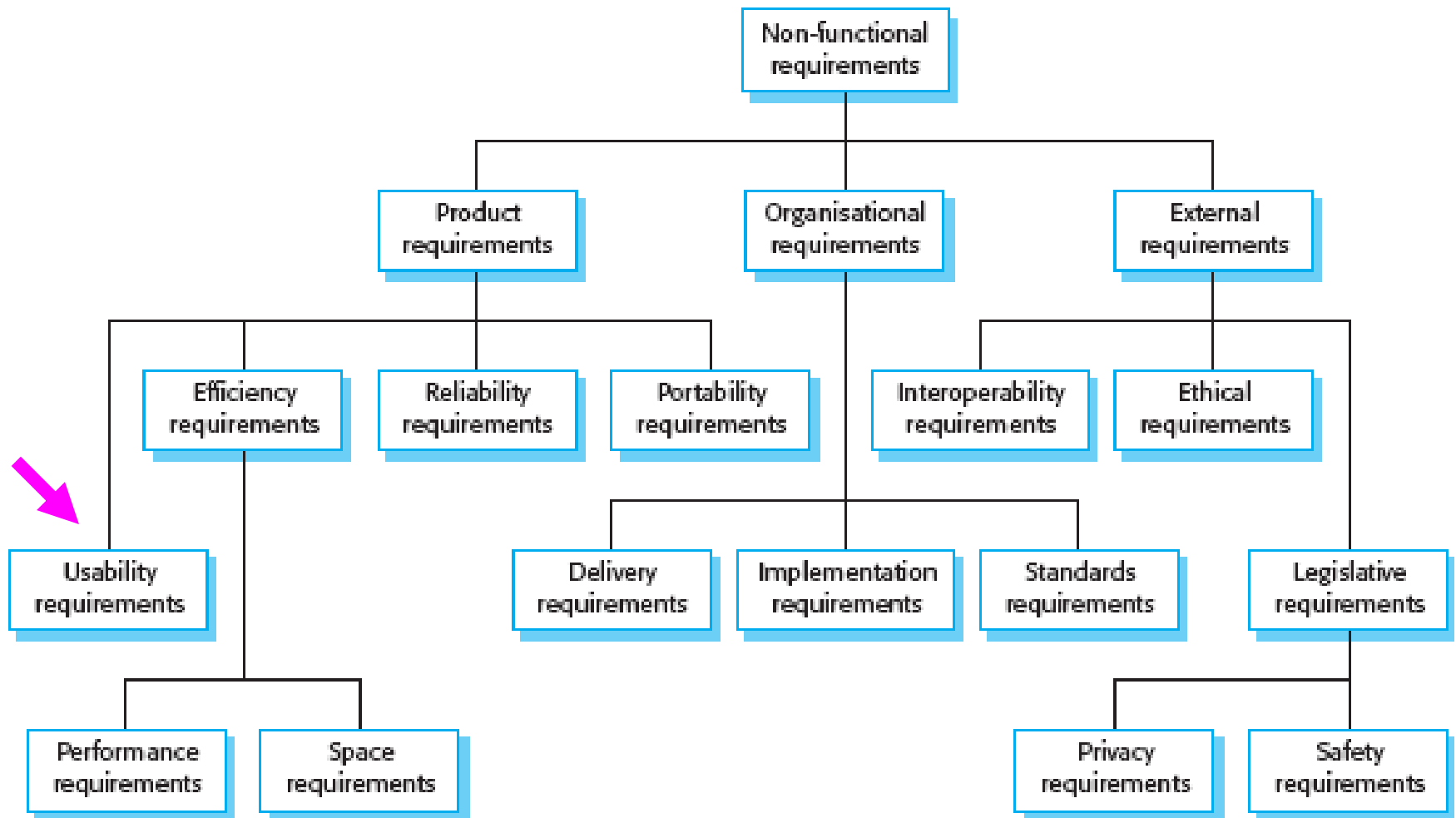
Is defined in a **context of use**: is a system property of allowing specific users to perform specific tasks efficiently with efficacy and satisfaction

(John M. Carroll. 2004. Beyond fun. *interactions* 11, 5 (September 2004), 38-40.
DOI=<http://dx.doi.org/10.1145/1015530.1015547>)

- Main usability benefits:
 - Higher user performance and satisfaction
 - Lower development costs
 - Lower support costs
- **Higher profits for everyone!**



Usability is a non-functional requirement





https://en.wikipedia.org/wiki/ISO/IEC_9126

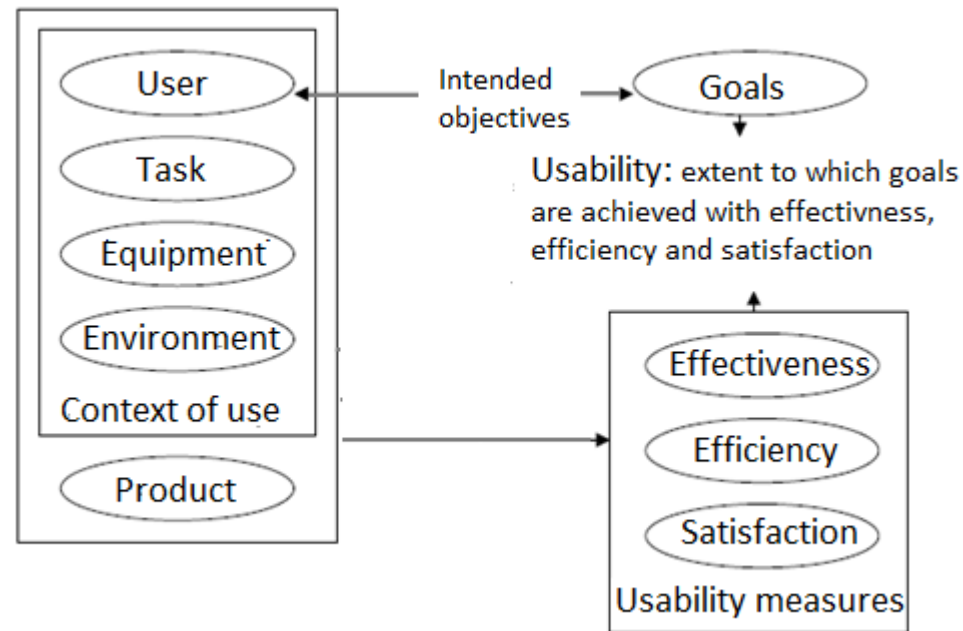
Usability standards

- **ISO 9241-11 (1998)**
Ergonomic requirements for office work with visual display terminals
Part 11 : Guidance on usability

Explains how to identify the information needed to specify or evaluate usability in terms of measures of:

- performance
- satisfaction

- **ISO 13407 -> ISO 9241-210 (2010)**
Human-centred design processes for interactive systems
- And others related **ISO 13.180 Ergonomics**



- **ISO 13407 addresses:**
- **... Four Principles of Human-Centered Design:**
 - active involvement of users
 - appropriate allocation of function to system and to user
 - iteration of design solutions
 - multi-disciplinary design
- **... and Four Human-Centered Design Activities:**
 - understand and specify the context of use
 - specify user and organizational requirements
 - produce more than one candidate design solution
 - evaluate designs against requirements

Some usability paradigms (along the history)

Video Display Unites (VDUs) (1950s)

Time sharing (1960s)

WIMP (Windows, Icons, Menus, Pointers) (1980s)

Direct manipulation (1980s)

WWW (1990s)

Ubiquitous computing (1990s)

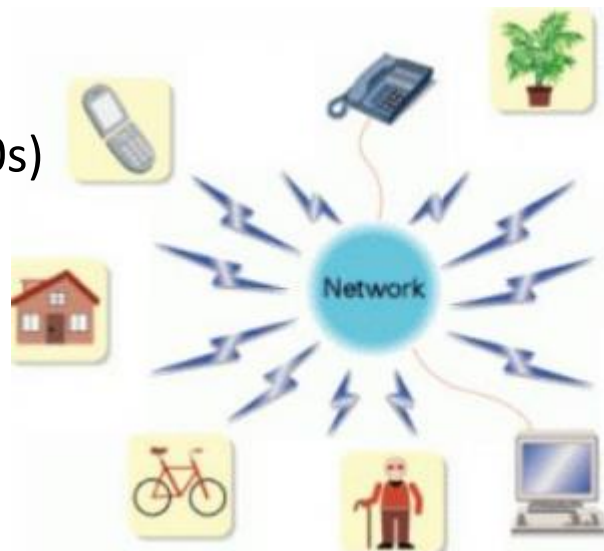
(anytime, anywhere...)



(VDUs)

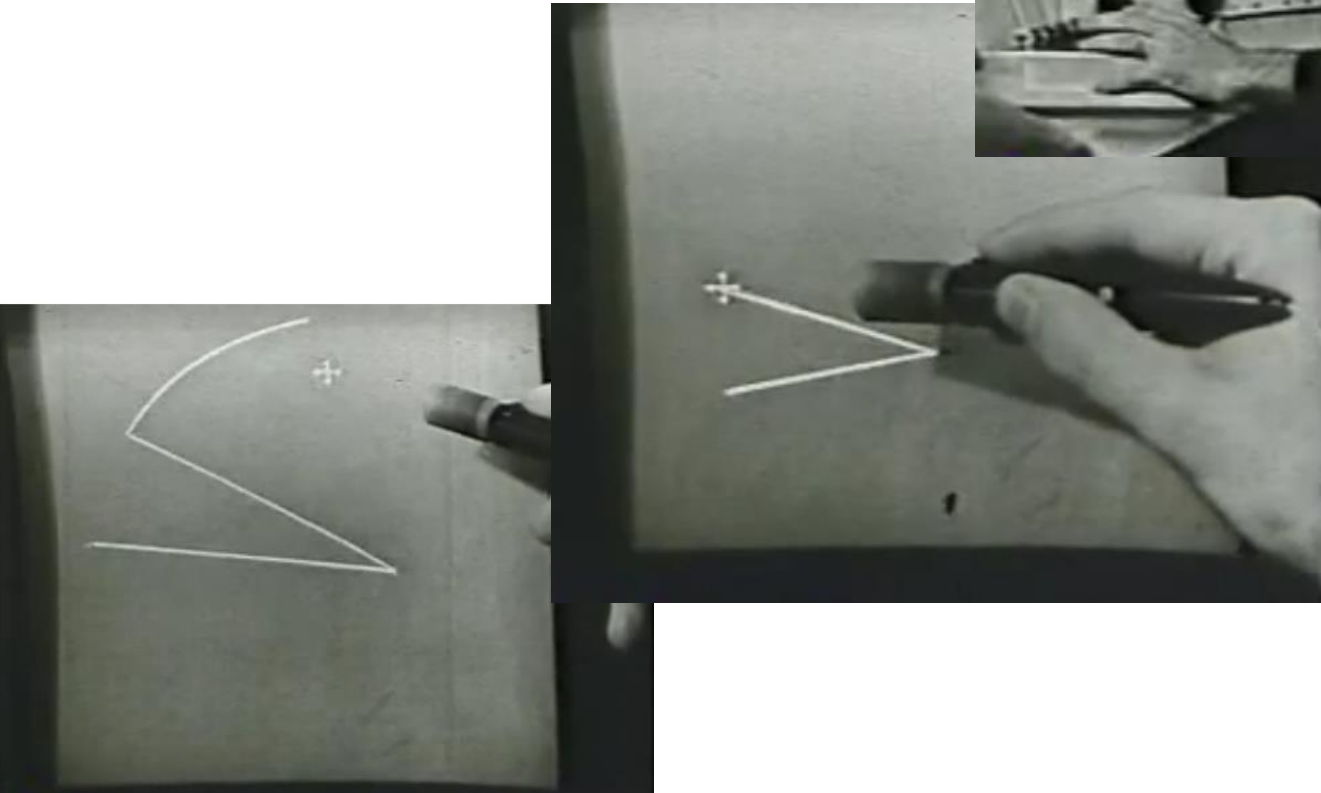


(WIMP)



(networking everything ...)

Sketchpad (Ivan Sutherland, 1963)



Alto and Macintosh



^

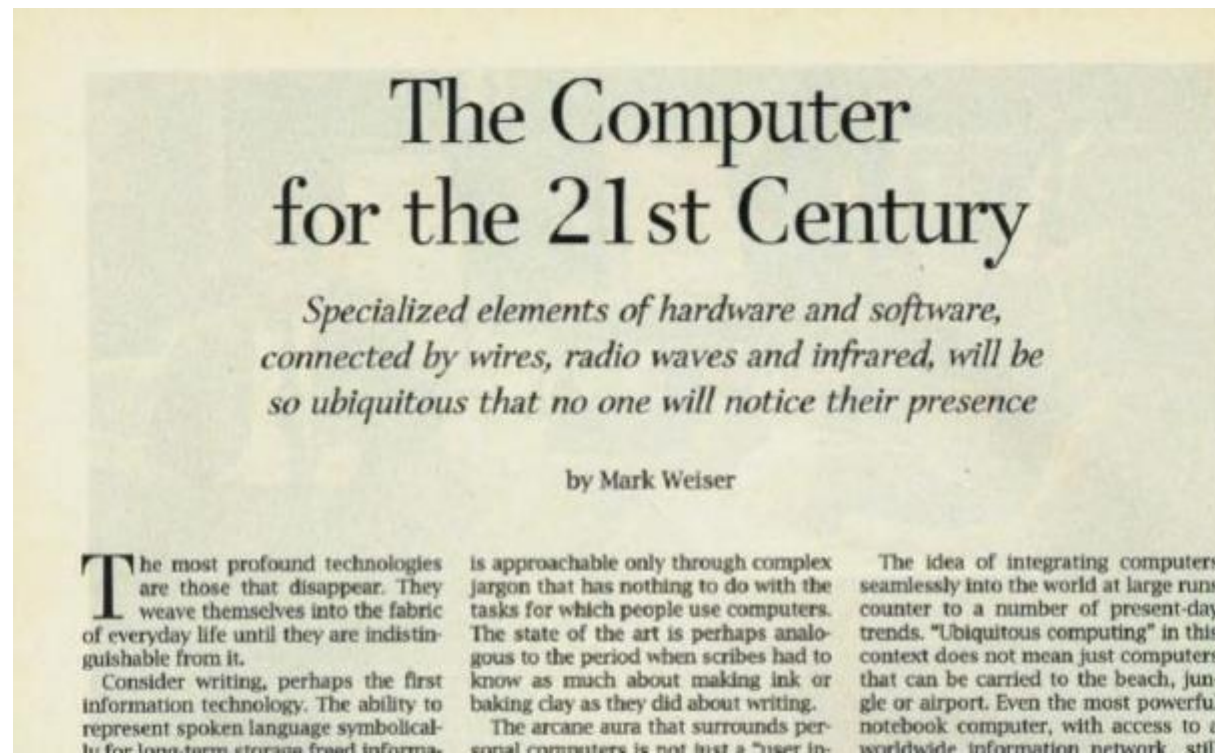
Apple Macintosh 512KB, 1984

< Xerox PARC, 1973

Ubiquitous computing (Ubicomp)

Mark Weiser, "The Computer for the 21st Century", Scientific American, Sept 1991, pp. 94-104 (<http://wiki.daimi.au.dk/pca/files/weiser-orig.pdf>)

- Computing everywhere and anywhere
- Related concepts:
 - Pervasive computing
 - Ambient intelligence
 - Physical computing
 - Internet of things
 - Haptic computing



- Ubiquitous computing involves:
 - small, inexpensive, robust networked processing devices
 - distributed at all scales throughout everyday life
- Examples:
 - refrigerators "aware" of their suitably tagged contents
 - domestic control illumination and heating, continuously and imperceptibly considering the occupants
- Ubiquitous computing presents challenges across computer science:
in systems design and engineering, in systems modelling , in user interfaces

<http://www.youtube.com/watch?v=CbGw1fX9tMk>

http://www.youtube.com/watch?v=H_gLVlYOl0w

Usability principles (a possible list)

User compatibility

Task compatibility

Work-flow compatibility

Product compatibility

Feedback

Coherence

Familiarity

Simplicity

Flexibility

Control

Technology invisibility

Robustness

Error protection

Usability goals:

Easy to learn and memorise

Easy to use

Satisfaction

Principles should be used in interactive computer systems...

More conventional ...



other devices ...

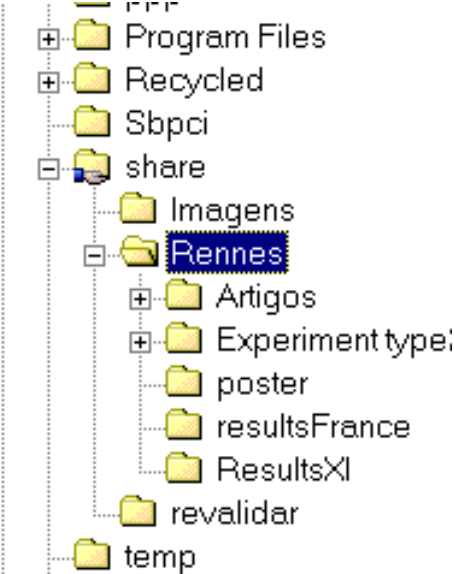
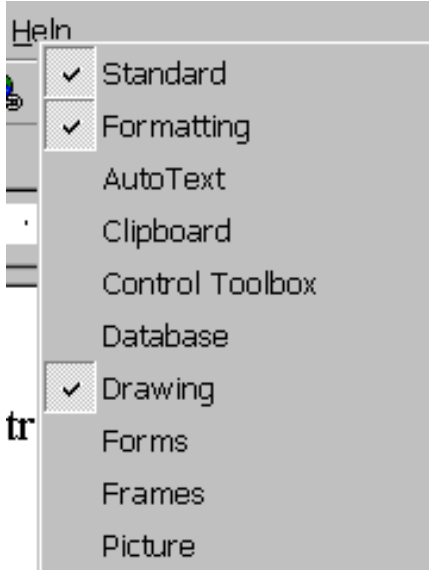
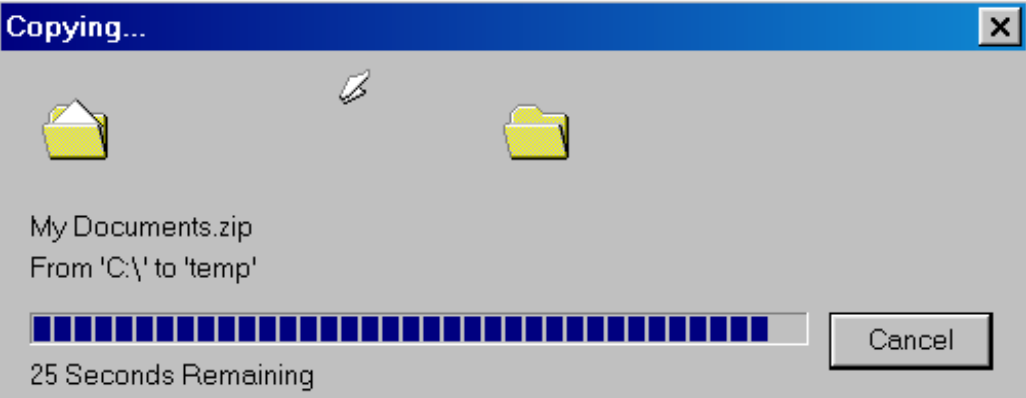


And less conventional interactive computer systems...

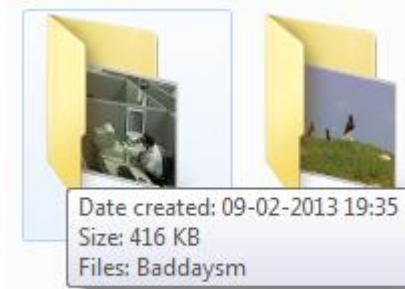
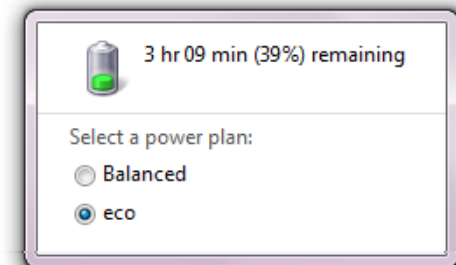
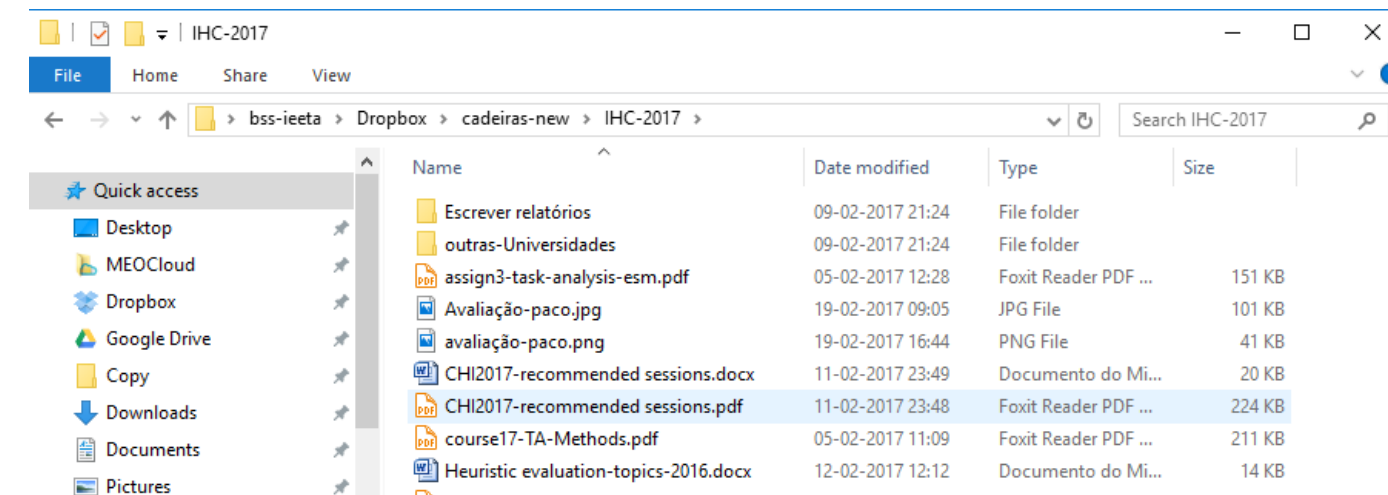
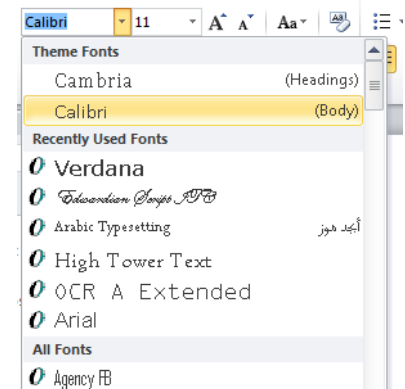
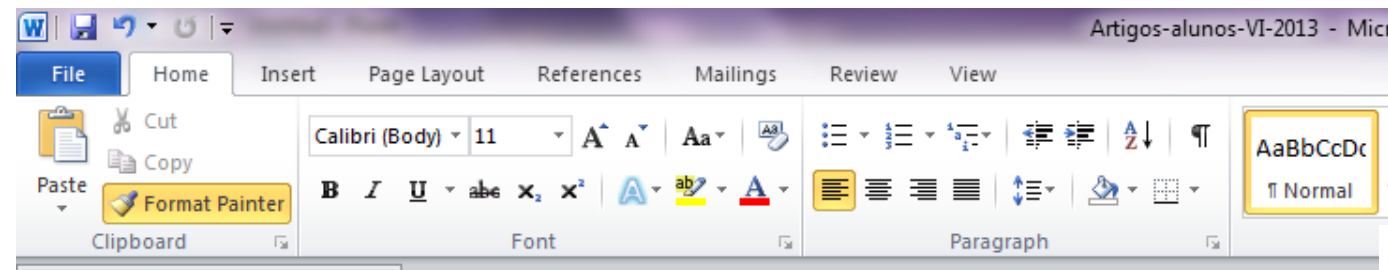
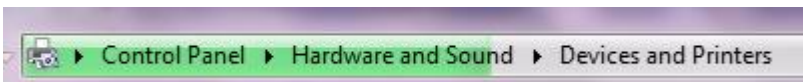
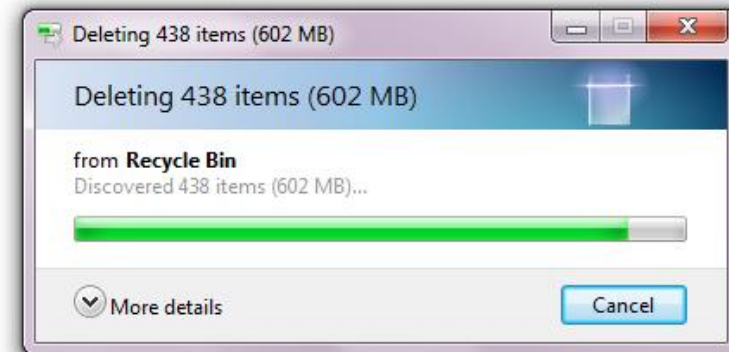


Feedback (the past)

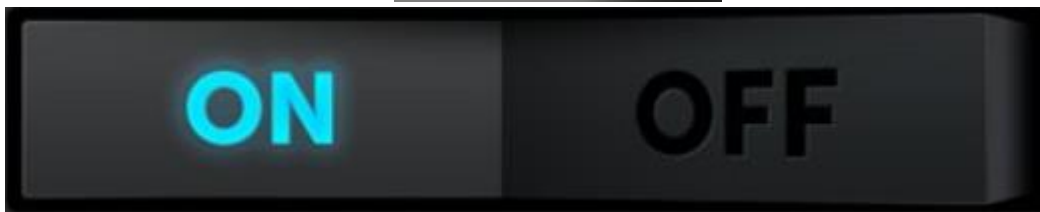
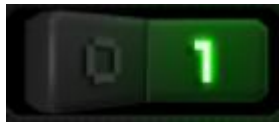
Visibility of the system status



Visibility of the system status Feedback (in more conventional platforms)



Feedback is important not only in Interactive Computer systems:

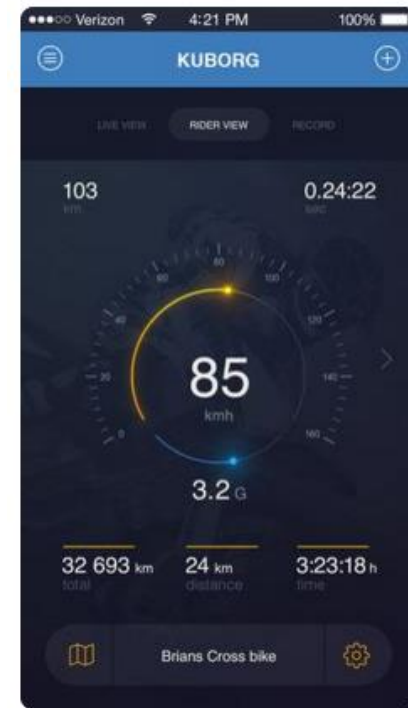
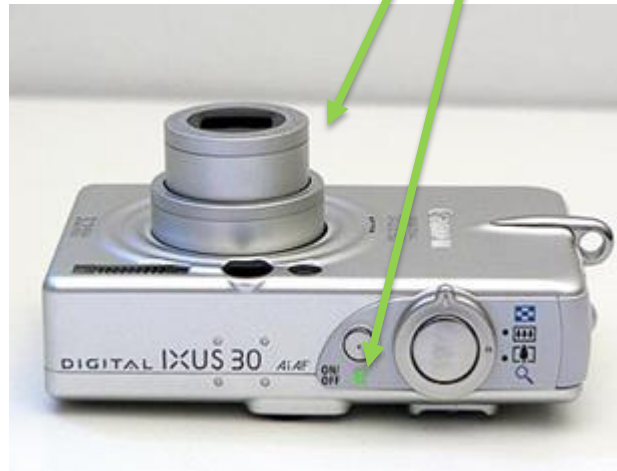


Feedback

Visibility of the system status



TV off



TV on



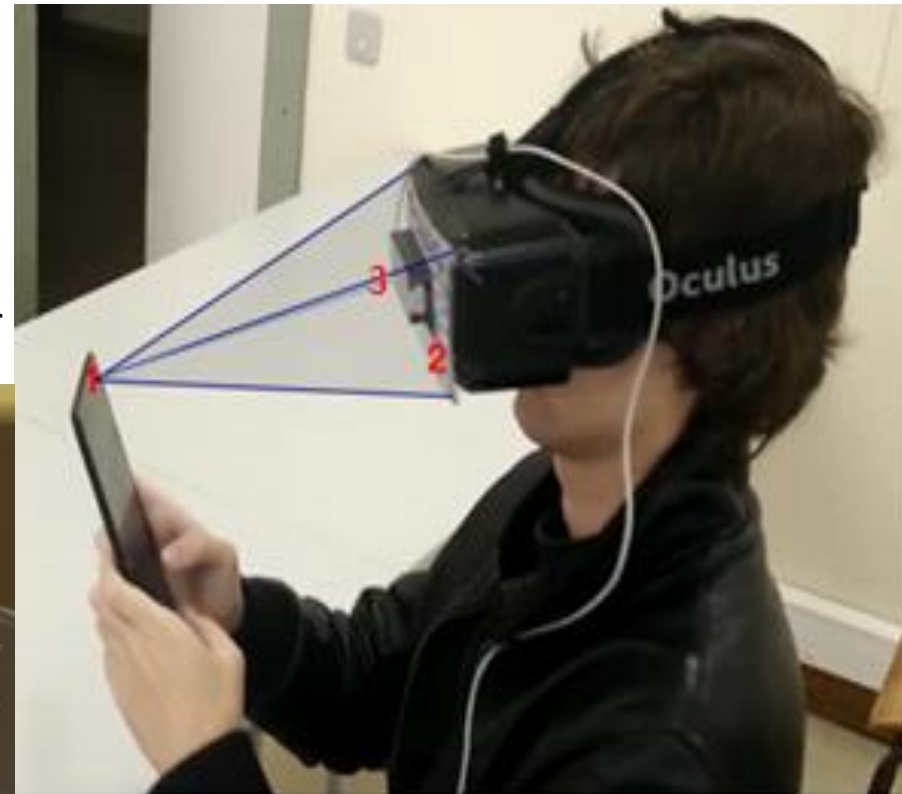
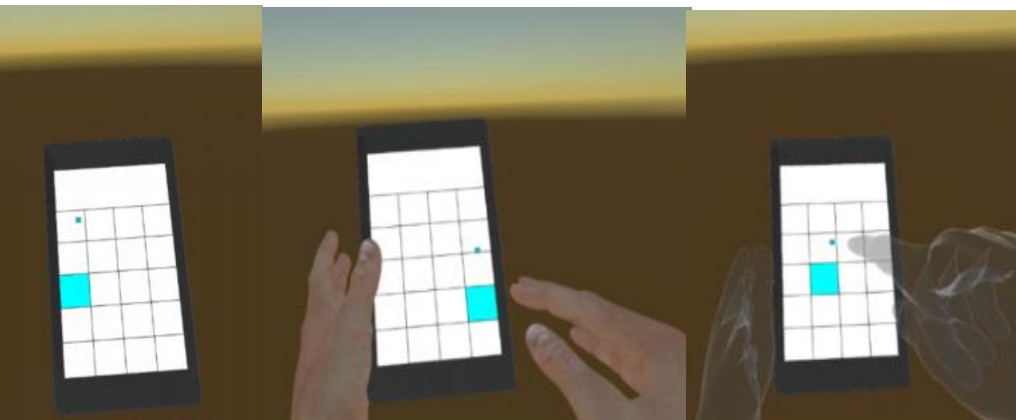
Feedback

Visibility of the system status

In a virtual reality system it is important to have:

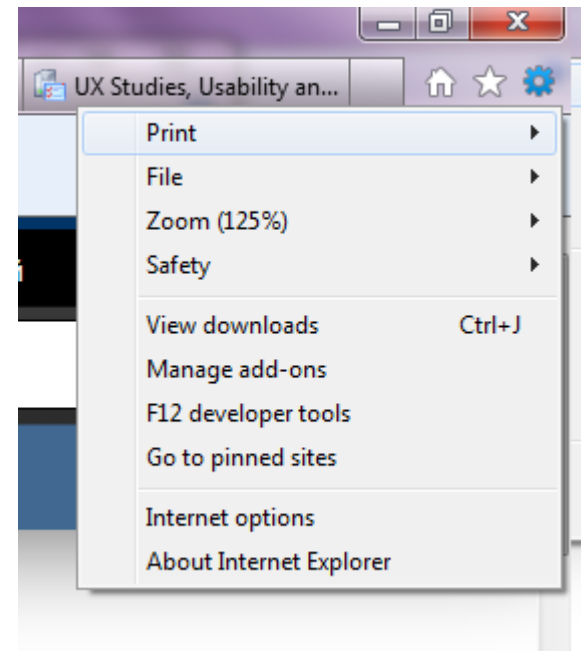
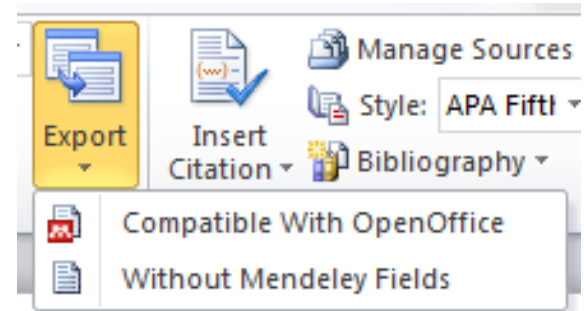
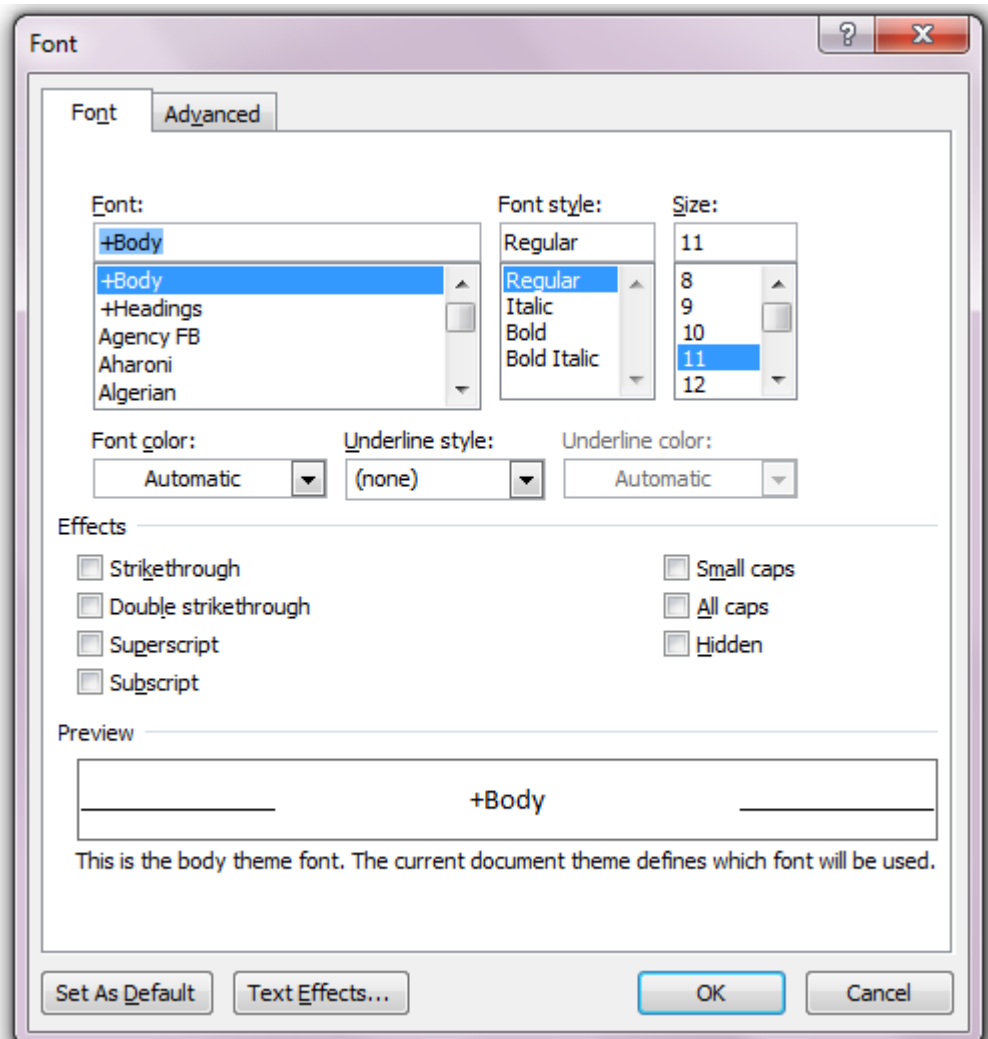
- Feedback in tasks (navigation, manipulation, selection ...)
- Visibility concerning body position (avatar)
- ...

No avatar Realistic avatar Translucent avatar



Simplicity

(defaults hide complexity)



Much of the functionality is not directly accessible

Familiarity

(profit from the user's experience)



CutePDF Writer



Fax



Familiarity



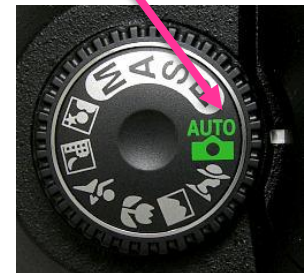
Windows Mobile



Android

Familiarity

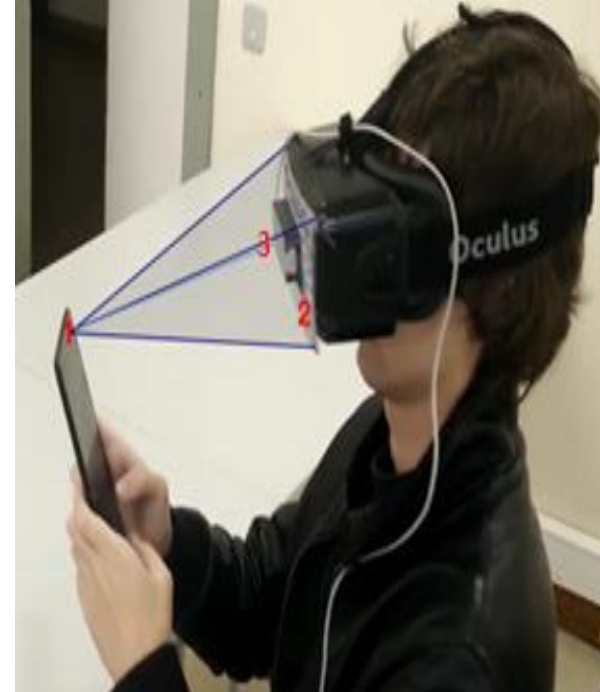
Familiar Icons



Familiarity

In less conventional interactive systems it is important to have:

- Familiar gestures to perform tasks (navigation, manipulation, selection ...)



Selection method



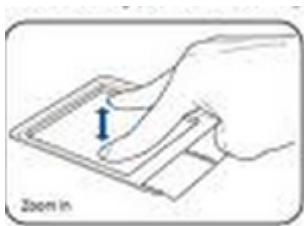
Manipulation method

Bike navigation method



Flexibility

(let the user choose)



Taskbar and Start Menu

Customize the Start menu | Customize icons on the taskbar |
Change the picture on the Start menu



Ease of Access Center

Accommodate low vision | Use screen reader |
Turn on easy access keys | Turn High Contrast on or off

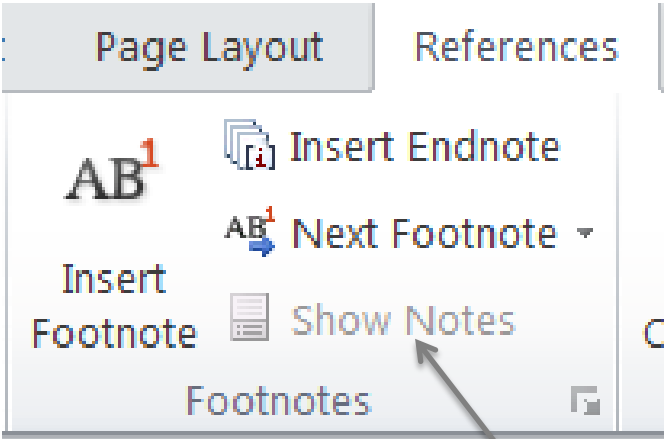


Folder Options

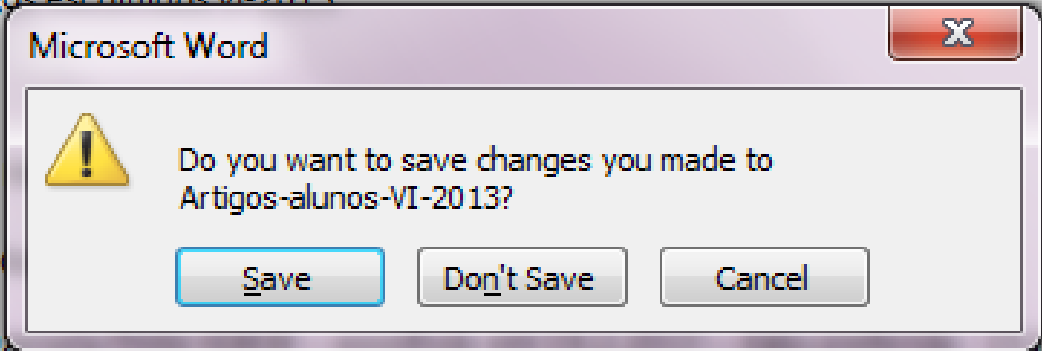
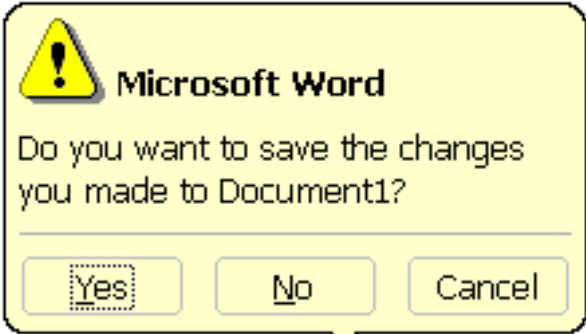
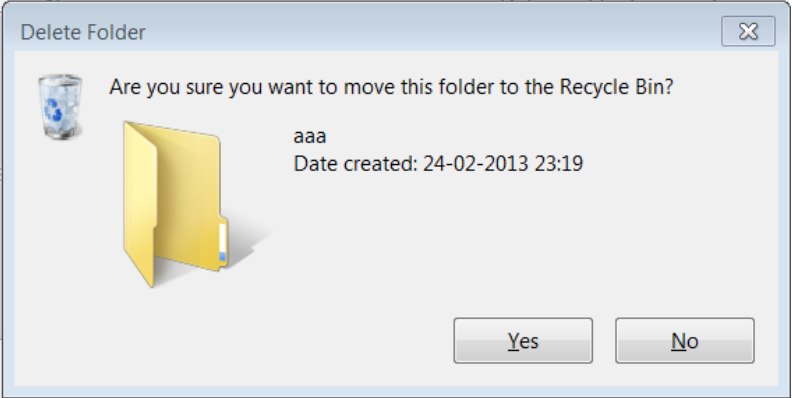
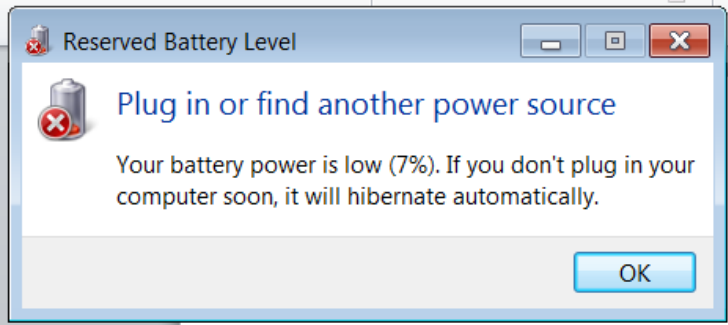
Specify single- or double-click to open |
Show hidden files and folders



Robustness and error prevention



Not accessible (in grey)



Old usability problems @ DETI (already solved!)

I always got confused;
Wouldn't you?



Up



Down



Back light

Front light

Middle light

Solved just recently: lights control @ room 4.1.02





How does it open?



Wrong affordance!

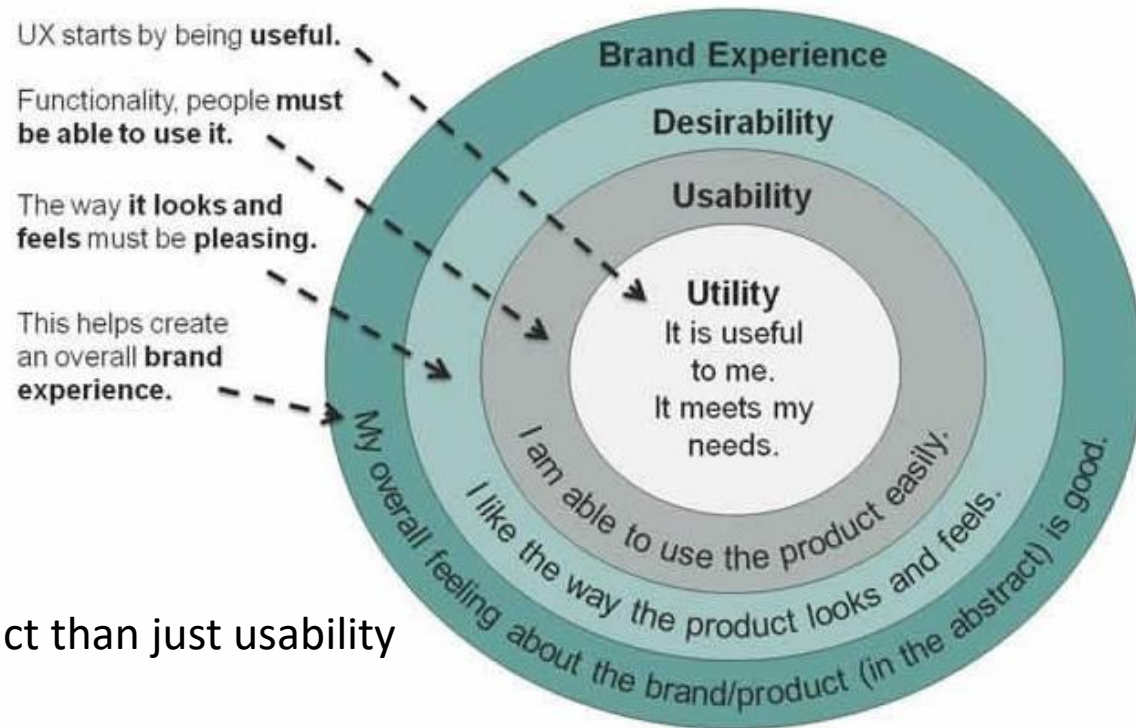


User Experience (UX)



- The ease in which people interact with a system to achieve specific goals
- The experience a person has when he/she interacts with a product (encompasses all aspects)

Usability -> function



A positive UX has a greater impact than just usability

<https://www.nngroup.com/articles/ux-research-cheat-sheet/>

<http://uxpa.org/resources/definitions-user-experience-and-usability>

- **Usability** is concerned with the “effectiveness, efficiency and satisfaction with which specified **users** achieve specified goals in particular environments”
- **User experience** is concerned with “all aspects of the **user's experience** when interacting with the product, service,
- User experience (UX) involves a person's:
 - behaviors,
 - attitudes,
 - and emotions about using a particular product, system or service
- It includes the practical, experiential, affective, meaningful and valuable aspects of human-computer interaction and product ownership
- and also a person’s perceptions of system aspects such as utility, ease of use and efficiency
- may be considered subjective and is dynamic as it is constantly modified over time

Main bibliography

- Dix, A., J. Finley, G. Abowd, B. Russell, *Human Computer Interaction*, 3rd ed., Prentice Hall, 2003
- Shneiderman, B., Plaisant, C., Cohen, M., and Jacobs, S., *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 5th ed., Addison-Wesley, 2009

or previous editions

- The Encyclopedia of Human Computer Interaction, 2nd ed., Interaction Design Foundation. <https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed>

Paper presentation

- After each paper presentation all students attending should vote
- Follow the link available in Moodle

IHC - votação em apresentação de artigo/ HCI - paper presentation voting

Por favor deixe a sua classificação e comentários para o grupo indicado / Please vote and leave your comments

* Required

Alunos que apresentaram o artigo/ Students presenting the paper *

(por ex: Maria + Manuel - TP1)

Your answer

Classificação geral /Overall grading *

(Deve ter em conta os slides, apresentação, resposta a questões / you should take into consideration the slides, presentation, answers to questions)

- ☐ insuficiente / insufficient
- ☐ suficiente - / sufficient -
- ☐ Suficiente / Sufficient
- ☐ Suficiente +/ Sufficient +
- ☐ bom - / good-
- ☐ Bom / Good
- ☐ Bom + / Good+
- ☐ Muito Bom / Very Good

Grupo - código correspondente ao grupo / Group code *

Este código será indicado pela professora antes da votação / this code will be given just before voting

Your answer

Comentários - pf deixe comentários construtivos / Constructive comments

Your answer

SUBMIT