Introduction to Human Computer Interaction

Some important aspect in the development of interactive systems

Paulo Dias, Beatriz Sousa Santos

deti departamento de electrónica telecomunicações e informática
universidade de aveiro

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Outline

- Definition
- Usability
- Examples
- Paradigms and Principles of Usability

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Human Computer Interaction

" Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. "

ACM SIGCHI Curricula for Human-Computer Interaction

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Human Computer Interaction

- 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 Centred Computing is a ACM scientific area within Computing

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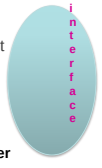
Interactive system design – Human in the loop

- 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

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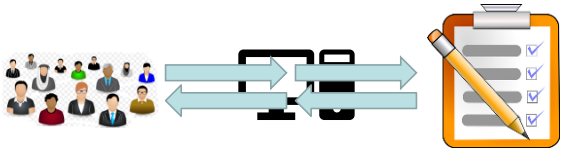
Interactive system – Human in the loop



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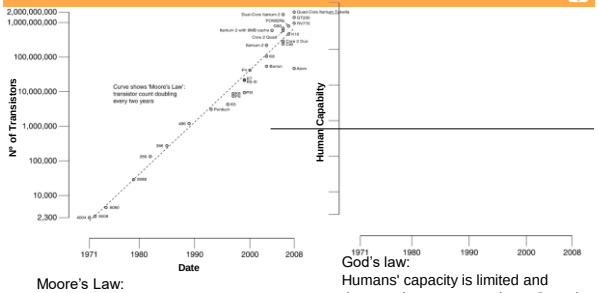
Interactive system design – Human in the loop



Moore's Law:
The number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years.

Buxton, W. (2001). Less is More (More or Less), in P. Denning (Ed.), The Invisible Future: The seamless integration of technology in everyday life. New York: McGraw Hill, 145 – 179.

God's law:
Humans' capacity is limited and does not increase over time. Stated more simply, our neurons do not fire faster, our memory doesn't increase in capacity, and we do not learn or think faster as time progresses.

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Usability Defined

- Is directly related to the system capacity to allow users attaining their goals through its usage
- Fundamental aspects (dimensions):
  - **easy to learn and remember** (learnability, memorability)
  - **easy to use** (fast and with few errors) (efficiency, efficacy)
  - **Satisfaction**
  - **Visibility** (Is the state visible)
  - **Errors** (few and recoverable)

Efficacy: Fulfill its objectives
Efficiently: Fast.

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UI design is hard

```
/**
 * Simple HelloButton() method.
 * @version 1.0
 * @author John Doe <doe.j@example.com>
 */
HelloButton()
{
  JButton hello = new JButton( "Hello, wor
  hello.addActionListener( new HelloBtnLis

  // use the JFrame type until support for t
  // new component is finished
  JFrame frame = new JFrame( "Hello Button"
  Container pane = frame.getContentPane();
  pane.add( hello );
  frame.pack();
} frame.show();          // display the fra
```

- Easy to communictae with people like you (programmers)
- UI need to communicate to Users (not programmers)
- User is always right

Usability problems are design's fault

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UI design is hard
User are always right but are not designers

- Users do not always know what they want
  - Google survey users about how many search results per page (10, 20, 30),
  - users say "30 results".
  - Google actually deploys 30-result search pages (as part of an "A/B test", usage drops by 20%)
  - Probably because the 30-result page takes a half second longer to load

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UI design is hard

- Is defined in a **context of use**

safety

efficiency

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UI design is hard

- Depends on the user
  - Novice users need learnability
  - Experts need efficiency
  - But no user is uniformly novice or expert

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UI design is hard - HCI complex area

- Very active and multidisciplinary:
  - Psichology
  - Computer Science
  - Design
  - Ergonomy
  - Sociology
  - User experience (UX)
  - …

Example: small modifications, Big differences

- Automatic serynge

Example: small modifications, Big differences

- Robuter OS

AlbatrOS,
Command line

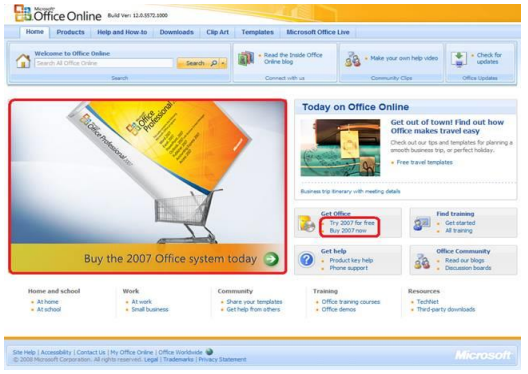
>>AM 10 10
>>AM -20 -20
>>AM 10 100

No, no, no!!!

>> Maximum speed set
>> Front(10)
>> Left (20)…

Example: small modifications, Big differences

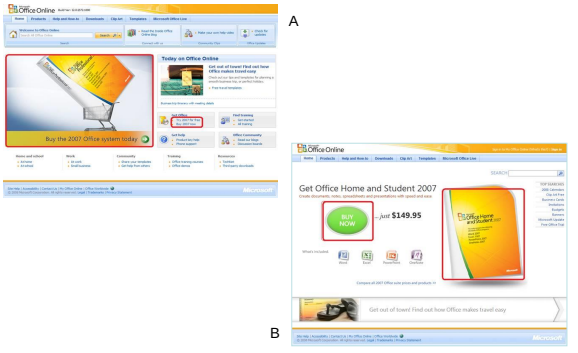
A



small modifications, big differences

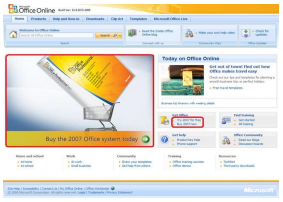
B

Example: small modifications, Big differences



Example: small modifications, big differences

A



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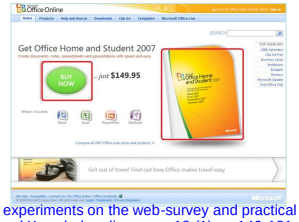

B pior em 64%

Kohavi et al. Controlled experiments on the web-survey and practical guide. Data mining and Knowledge discovery, 18 (1), pp140-181.

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small modifications, big differences

We have an unprecedented opportunity to run A/B tests with online users and innovate more quickly based on actual user response. Microsoft needs to shift the culture from planning the exact features to planning a set of possible features, and letting customers guide us.

-- Ray Ozzie, Chief Software Architect

Microsoft's Experimentation Platform
(http://exp-platform.com)

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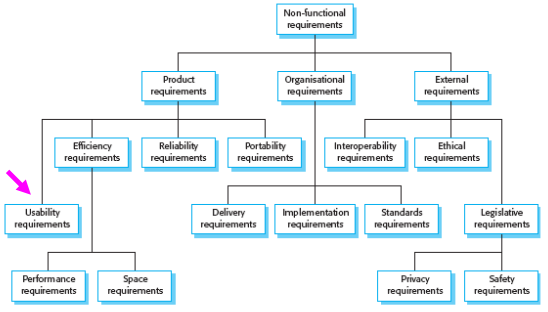
Usability: non functional requirement



Ian Sommerville, *Software Engineering*, 6th ed., Addison Wesley, 2001

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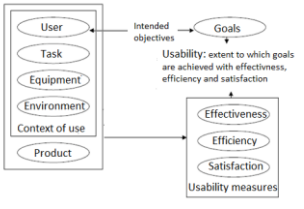
Usability standards

- **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**

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Usability standards

- **ISO 13407 adresses**
- **… 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

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Usability paradigms

(VDUs)

Video Display Units (VDUs) (1950s)

Time sharing (1960s)

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

(WIMP)

Direct manipulation (1980s)

WWW (1990s)

Ubiquitous computing (1990s)

(networking everything ...

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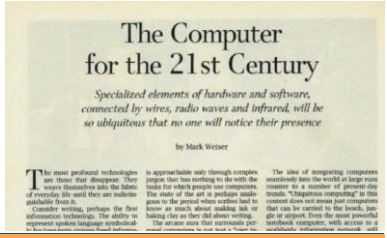
Ubiquitous computing (Ubicomp)

Mark Wiser, "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



The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

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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
Visibility and errors

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Principal bibliografia

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