

# Human-Computer Interaction

Prof. Antonella De Angeli, PhD

[Antonella.deangeli@disi.unitn.it](mailto:Antonella.deangeli@disi.unitn.it)

---

# Ground rules



- To keep disturbance to your fellow students to a minimum
  - Switch off your mobile phone during the lecture!!!
  - Arrive on time. If you are more than 15 minutes late, please wait until there is a break and copy the notes from a friend.
  - Keep talking, whispering and other background noise to a minimum.
  - If there is something you don't understand, please interrupt me at any time to ask if I could clarify.
  - If you want to make a general remark, please wait until there is a natural break.
  - **Participate!!!!**

# Module aims

- Present the techniques and issues involved in promoting usable and engaging interaction design
- Present new and emerging platforms for interaction
- Give examples on how to
  - document users needs and goals
  - translate user needs/goals into design specifications
  - evaluate the quality of user interfaces and design alternatives

# Reading List

- CORE READING:

Sharp, H., Rogers, Y., & Preece, J. (2011).  
Interaction Design: beyond human-computer  
interaction. New York: John Wiley & Sons, Inc.  
3<sup>rd</sup>

- Gamberini, L. Chittaro, L. and Paternò, F.  
Human-Computer Interaction, Pearson, 2012.

– NOTE THE HANDOUTS AND LECTURE NOTES DO NOT REPLACE  
THE CORE READING

# On-line resources

- <http://www.sigchi.org/>
  - ACM special interest group
- <http://www.id-book.com/>
  - companion website for Preece et al.'s book
- <http://hcc.cc.gatech.edu/>
  - web portal maintained by Georgia Tech.
- <http://www.baddesigns.com/>
  - illustrated examples of things that are hard to use because they do not follow human factors principles

# Assessment

- Coursework 50%
  - A practical exercise of UCD (group project with individual activities) – during the teaching Semester

<http://goo.gl/Ru2iu>
- Oral Exam 50%
  - open questions addressing analysis, design and critique of Interactive systems

# Human-computer interaction

“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, 1996, p.5)

# Goals of HCI

- “To develop or improve the safety, utility, effectiveness, efficiency, and usability of systems that include computers”
  - Interacting with computers 1989, p. 3



# Disciplines contributing to HCI

- Computer Science
- Cognitive psychology
- Social and organisational psychology
- Ergonomics & Human-Factors
- Linguistics
- Artificial Intelligence
- Philosophy, sociology, and anthropology
- Engineering
- Design

# Design

- Technology-driven design
  - Technology influences the design of the interface which give the user the functionality and interaction mechanisms of the system
- User-centered design
  - User requirements define the functionality of the interface which runs the design of the technology

# What is an interface?



# Evolution of interfaces

- **50s** - Interface at the hardware level for engineers - switch panels
- **60-70s** - interface at the programming level - COBOL, FORTRAN
- **70-90s** - Interface at the terminal level - command languages
- **80s** - Interface at the interaction dialogue level - GUIs, multimedia (<http://www.cs.cmu.edu/~amulet/papers/uihistory.tr.html>)
- **90s** - Interface at the work setting - networked systems, groupware
- **00s** - Interface becomes pervasive
  - RF tags, Bluetooth, mobile devices, consumer electronics, interactive screens, embedded technology
- **10s** -Interface disappears
  - Focus on tasks, experiences, emotions, social connections, beauty



- We become part of the interface or rather we bring the interface with us everywhere, we create practices around the interface
  - Christensen M.S. (2006) As We May Feel -- Interpreting the Culture of Emerging Personal Affective Mobile Media. PhD Thesis, IT University of Copenhagen

# Interaction Design

- “the design of spaces for human communication and interaction”
  - Winograd (1997)
- designing interactive products to support people in their everyday and working life
- Creating (user) experiences which fit, extend, and enhance the way people work, communicate and interact
- Increasingly, more application areas, more technologies and more issues to consider when designing ‘interfaces’

# Interaction Design -ID

## Unit 1



# Learning outcomes

- **Understand** what ID is
- Understand and apply PACT analysis
- Understand the basic step of the user-centred design



# What do you think of as design?

Discuss in groups ---

- What is design?
- What factors should a designer consider when developing a new product?
- Is fashion design different from engineering design?
- What differentiates good design from bad design?
- What does an interactive system designer design?
- Are interface designers artists or software engineers? What is the difference?
- How can we promote good design when designing interactive systems?
- How can YOU become an interactive system designer?

# What is Interaction Design (ID)?

- Designing interactive products to support people in their everyday and working lives
- ID is a process:
  - a goal-directed problem solving activity informed by intended use, target domain, materials, cost, and feasibility
  - a creative activity
  - a decision-making activity to balance trade-offs

# Bad design

- Elevator controls and labels on the bottom row all look the same, so it is easy to push a label by mistake instead of a control button



- People do not make the same mistake for the labels and buttons on the top row. Why not?

# Goals of interaction design

- Develop usable products
  - Usability means easy to learn, effective to use
- Which also provide an enjoyable experience
- Involve users in the design process – User-centred system design

# Importance of Interaction Design

- Poor design can:
  - reduce user productivity
  - increase learning times
  - increase errors
  - induce frustration
  - lead to system rejection by the user
- Poor design is easy, good design is hard!

# Good design

- Takes into account:
  - Who the users are – People
  - What activities are being carried out - Activities
  - Where the interaction is taking place - Context
  - What technologies are used - Technologies
- User-centric View of Design Problems: ***PACT Analysis***

# PACT Analysis

- ‘User-centric’ framework for thinking about a design problem
- Take each category -----People-Activities- Context and Technology --- and work through it
- Use the analysis to help focus/orient early design thinking
- Important: revisit the analysis
  - As you get deeper into the problem the analysis should change and/or get richer

# People: Who are the users/stakeholders?

- Those who interact directly with the product
  - those who manage direct users
  - those who receive output from the product
  - those who make the purchasing decision
  - those who use competitor's products
- Three categories of user (Eason, 1987):
  - primary: frequent hands-on
  - secondary: occasional or via someone else
  - tertiary: affected by its introduction, or will influence its purchase



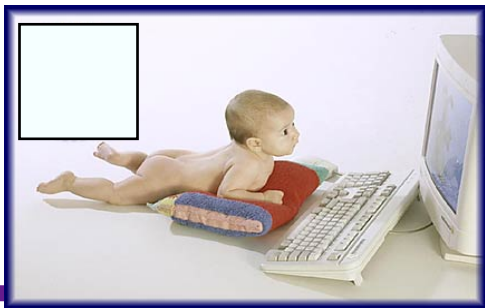
# People: variability

- Consider range of characteristics of people
- Physiologically
  - Age differences, physical abilities
- Psychologically
  - Attention, perception, memory
  - Forming the right ‘mental model’
- Socially and Culturally

# People: What are the users' capabilities?

Humans vary in many dimensions:

- size of hands may affect the size and positioning of input buttons
- motor abilities may affect the suitability of certain input and output devices
- height if designing a physical kiosk
- strength - a child's toy requires little strength to operate, but greater strength to change batteries
- different abilities (e.g. sight, hearing, dexterity)



2012-2013

Human-Computer Interaction



26

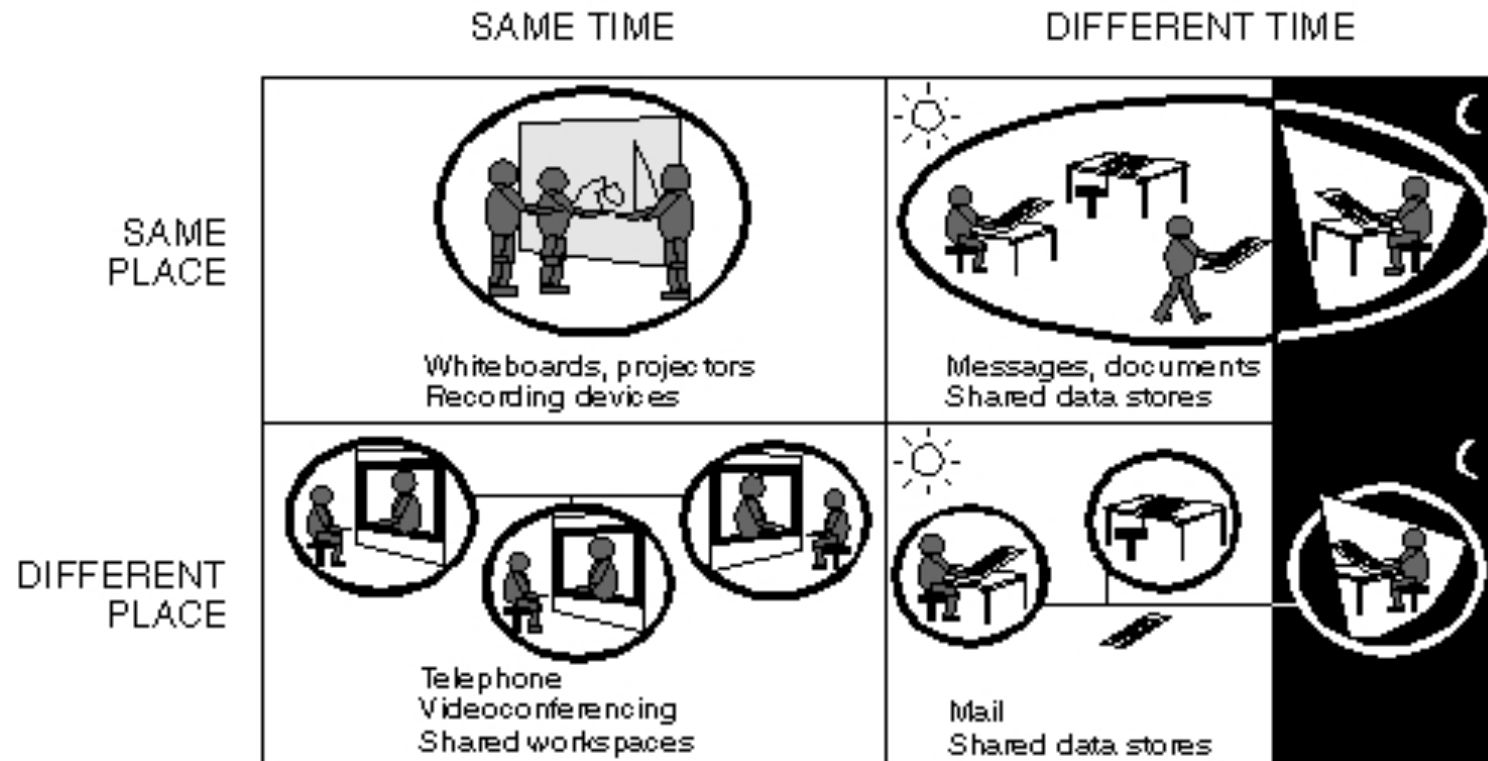
# Activities

- What is the overall purpose of the activity?
- Temporal aspect
  - Regular or infrequent
  - Time pressure
  - Continuous or interruptions
  - Processing time
- Cooperation
  - One or more actors
- Complexity
  - Well defined or vague?
- Safety critical
  - Impact of error (how much?)
- The nature of the content
  - Type of data to be processed
  - Type of media

# Context

- Where does the interaction occur?
  - Physical context
    - Noise, light, time
    - In the office, on the move
  - Social context
    - Individual activity, group activity
    - Computer-mediated social activity
    - Social norms
  - Psychological context
    - Motivation, attitudes
    - Cognitive demands
    - Level of arousal

# Context of CMC



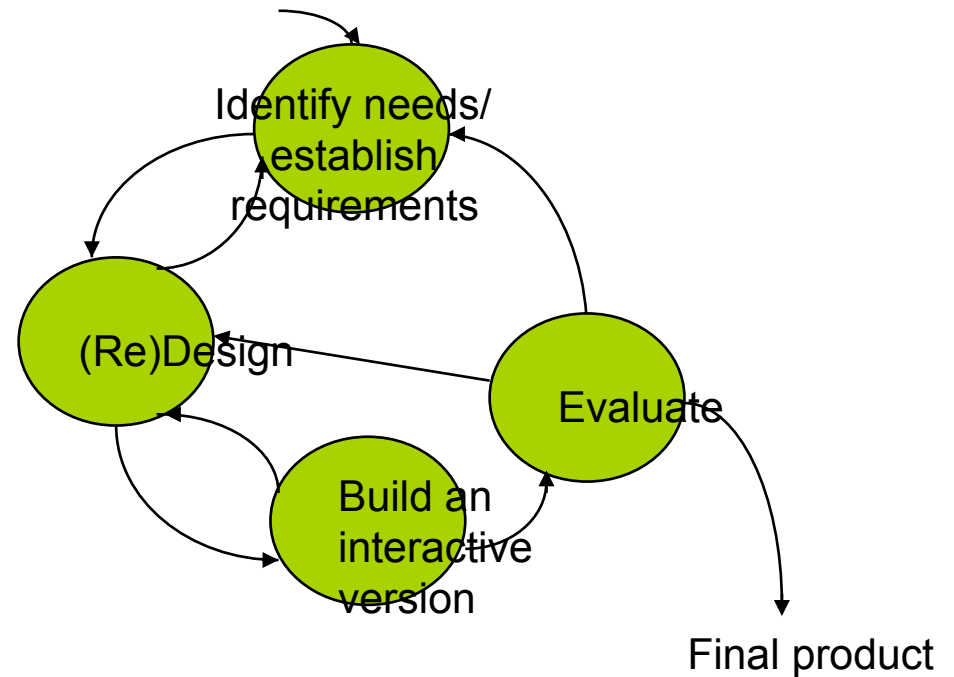
# Technology

- Input
  - Getting data in; getting commands; security
- Output
  - video vs. photographs; speech vs. screen
- Communication
  - Between people, between devices, speed,
- Content
  - What data in the system: a web site is all about content



# User-centred design process

1. Identify needs and establish requirements
2. Generate alternative solutions/designs
3. Build interactive prototypes that can be communicated and assessed
4. Evaluating design



User centred design

**ITERATE...**

# Key characteristics

- Focus on users early in the design and evaluation of the artefact
- Identify, document and agree specific usability and user experience goals at the beginning of the project
- Iteration is inevitable. Designers never get it right first time



# Understanding user needs

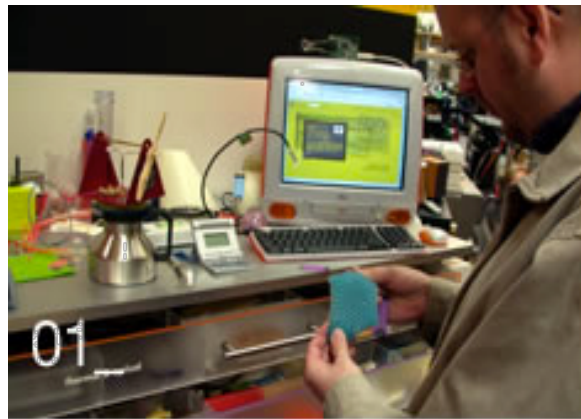
- ASK-WATCH-ANALYSE
- Users rarely know what is possible they can't tell you what they 'need' to help them achieve their goals
- Take into account people's capabilities
- Look at existing tasks:
  - their context
  - what information do they require?
  - who collaborates to achieve the task?
  - why is the task achieved the way it is?
- Envisioned tasks:
  - can be rooted in existing behaviour
  - can be described as future scenarios

# Develop alternative design

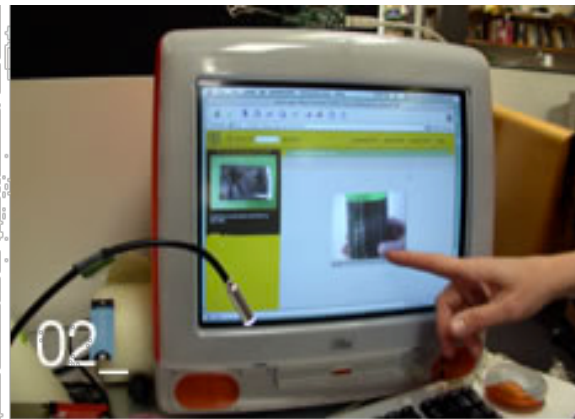
- Humans stick to what they know works
- But considering alternatives is important to ‘break out of the box’
- Designers are trained to consider alternatives, software people generally are not
- How do you generate alternatives?
  - ‘Flair and creativity’: research and synthesis
  - Seek inspiration: look at similar products or look at very different products

# IDEO TechBox

- Library, database, website - all-in-one
- Contains physical gizmos for inspiration



The Tech Box is centrally located



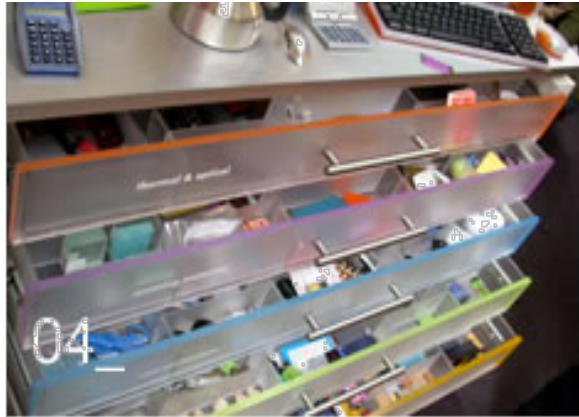
An item on the intranet website



The drawers are sorted by categories

From: [www.ideo.com/](http://www.ideo.com/)

# The TechBox



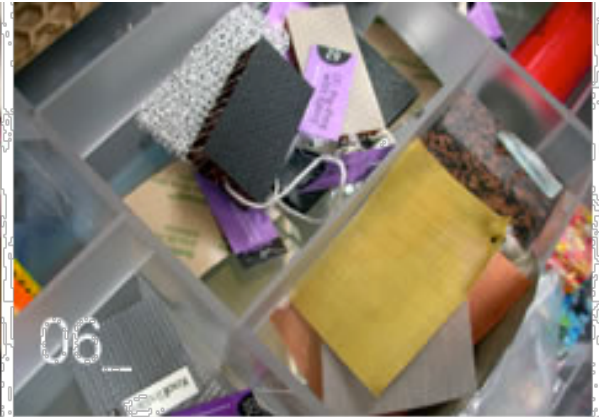
04\_

Each drawer resembles a bento box



05\_

The curator keeps order



06\_

All the entries are tagged



07\_

It really is used daily



08\_

Two demonstration units on top

# How do you choose among alternatives?

- Evaluation with users or with peers, e.g. prototypes
- Technical feasibility: some not possible
- Quality thresholds: Usability goals lead to usability criteria set early on and checked regularly
  - safety: how safe?
  - utility: which functions are superfluous?
  - effectiveness: appropriate support? task coverage, information available
  - efficiency: performance measurements
    - Easy to learn
    - Easy to remember how to use

# Idea generation

- <http://grouplab.cpsc.ucalgary.ca/papers/videos/>

# Key points

- ID is concerned with designing interactive products to support people in their everyday and working lives
- ID involves taking into account a number of interdependent factors including context of use, type of task and kind of user and available technology
- PACT framework
- Four basic activities in the design process:
  - Identify needs and establish requirements
  - Design potential solutions (re-design)
  - Choose between alternatives (evaluate)
  - Build the artifact

# Exercise

- How does making a call differ when using:
  - Cell phone
  - Public phone box
  - Home phone
- Brainstorm the variety of P, A, C and Ts that are possible
- Explore design implications
  - Write detailed concrete stories...
  - Think about how these might affect design



# Reading

- Sharp et al. (2007)
  - Chapter 1: What is Interaction design
  - Chapter 9: The process of Interaction design
    - (Chapter 6 in 1<sup>st</sup> Edition)
- Benyon: chapter 2