User-Centered Design and Development

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CAL POLY

Chapter 1

Overview of User-Centered Design and Human-Computer Interaction

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Chapter Overview

- Good vs. bad design
- Interaction design
- Interaction design process
- Goals of interaction design
- Design and usability practices

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Motivation

- More and more products and systems have become highly complex, posing challenges to users.
- As much as possible products should be designed to accommodate their users, not vice versa.
- Computer-based products can be extremely versatile, but their interaction with the user can also be adapted relatively easily.

Objectives

- To become familiar with the main concepts and terms in the area of user-centered design (UCD) and human-computer interaction (HCI).
- To understand the contributing factors to good and poor design.
- To know about important principles for good interaction design.

What is Interaction Design?

What is interaction design?

- Designing interactive products to support people in their everyday and working lives
  - Sharp, Rogers and Preece (2011)
- The design of spaces for human communication and interaction
  - Winograd (1997)

Goals of interaction design

- Develop usable products
  - Usability means easy to learn, effective to use and provide an enjoyable experience
- Involve users in the design process

Examples of Bad Design

- Elevator Controls example
- Vending Machine example

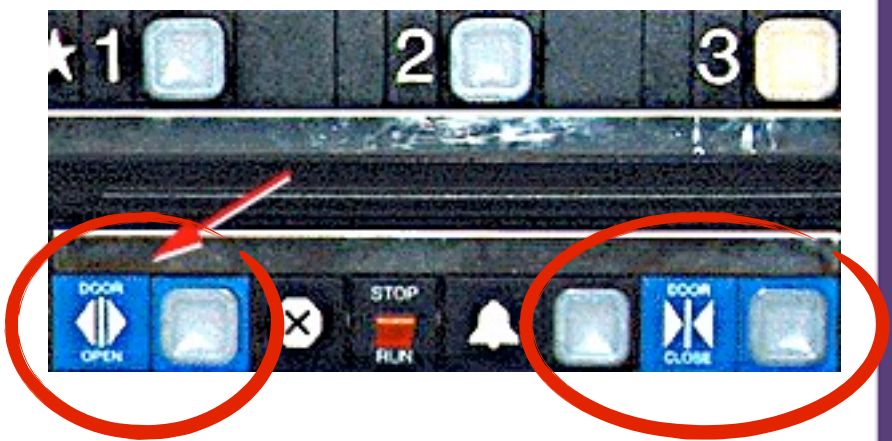
Elevator Controls

- People don't seem to have problems hitting the right buttons on the top row.
- On the bottom row, many push a label instead of a control button.

From: www.baddesigns.com

Elevator Controls

- clear distinction between labels and buttons on the top row
- visual similarity between lable and control button in the bottom row



From: www.baddesigns.com

Why is this vending machine so bad?

- Need to push button first to activate reader
- Normally insert bill first before making selection
- Contravenes well known convention

From: www.baddesigns.com

Can I afford the Snack?

- **Snack vending machine in the back of 14-227**
  - displays price only after selecting an item through the number pad
- **Scenario: I have one dollar and need some junk food. What can I afford?**
  - requires multiple steps for each single item
  - visual scan of item prices would be much faster

Examples of Good Design

- Marble answering machine example
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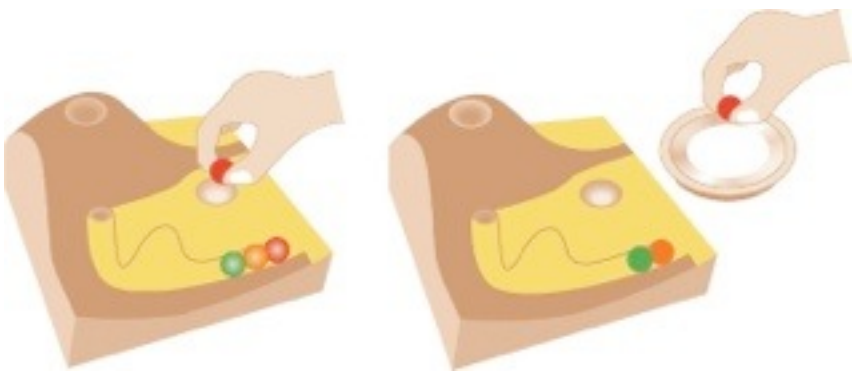
Marble Answering Machine



- Marbles represent messages
- dropping a marble into a slot initiates an action
  - different slots for different actions
- Based on how everyday objects behave
- Easy, intuitive and a pleasure to use
- Only requires one-step actions to perform core tasks

Good and bad design

- Which of the two remote is better designed?
- Why

Good and bad design

- TiVo remote on the left is much better designed
  - Peanut shaped to fit in hand
  - Logical layout
  - Color-coded, distinctive buttons
  - Easy to locate buttons

Simple Remote Usability Test

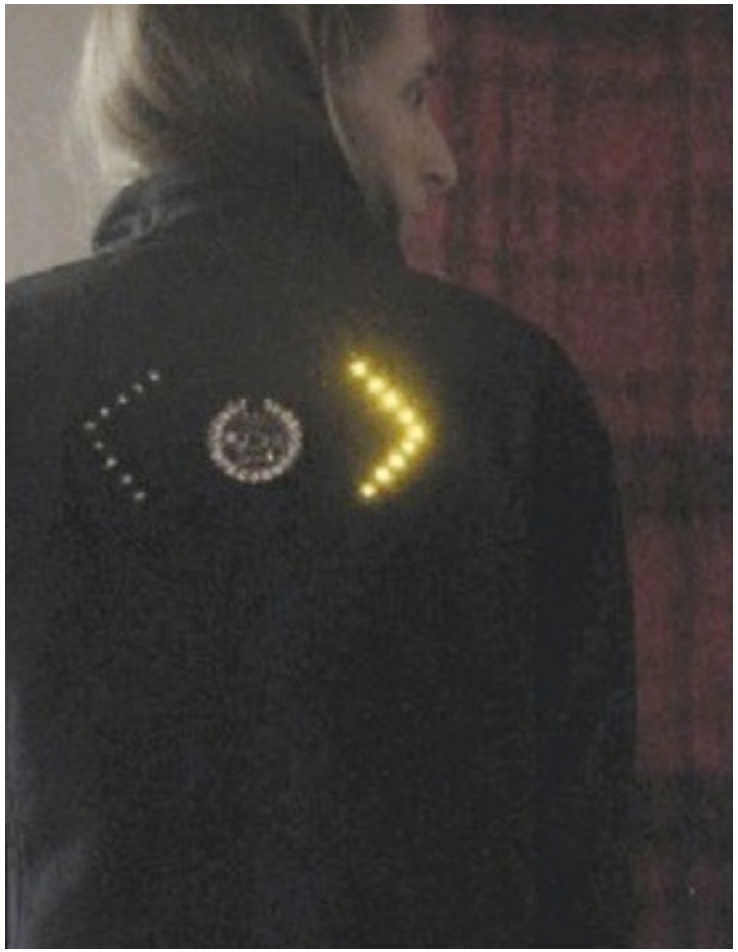
- **identify the main functions**
  - without looking at the remote
  - with a quick glance
  - after careful reading of the labels
  - trial and error
  - reading the manual

What to design

- Need to take into account:
  - Who the users are
  - What activities are being carried out
  - Where the interaction is taking place

- Need to optimise the interactions users have with a product
  - Such that they match the users' activities and needs

Novel interface



Understanding users' needs

- Need to take into account what people are good and bad at
- Consider what might help people in the way they currently do things
- Think through what might provide quality user experiences
- Listen to what people want and get them involved
- Use tried and tested user-centered methods

Activity

- How does making a call differ when using a:
  - Cell phone
  - regular phone (land-line, corded)
  - Public phone box?
- Consider the kinds of user, type of activity and context of use

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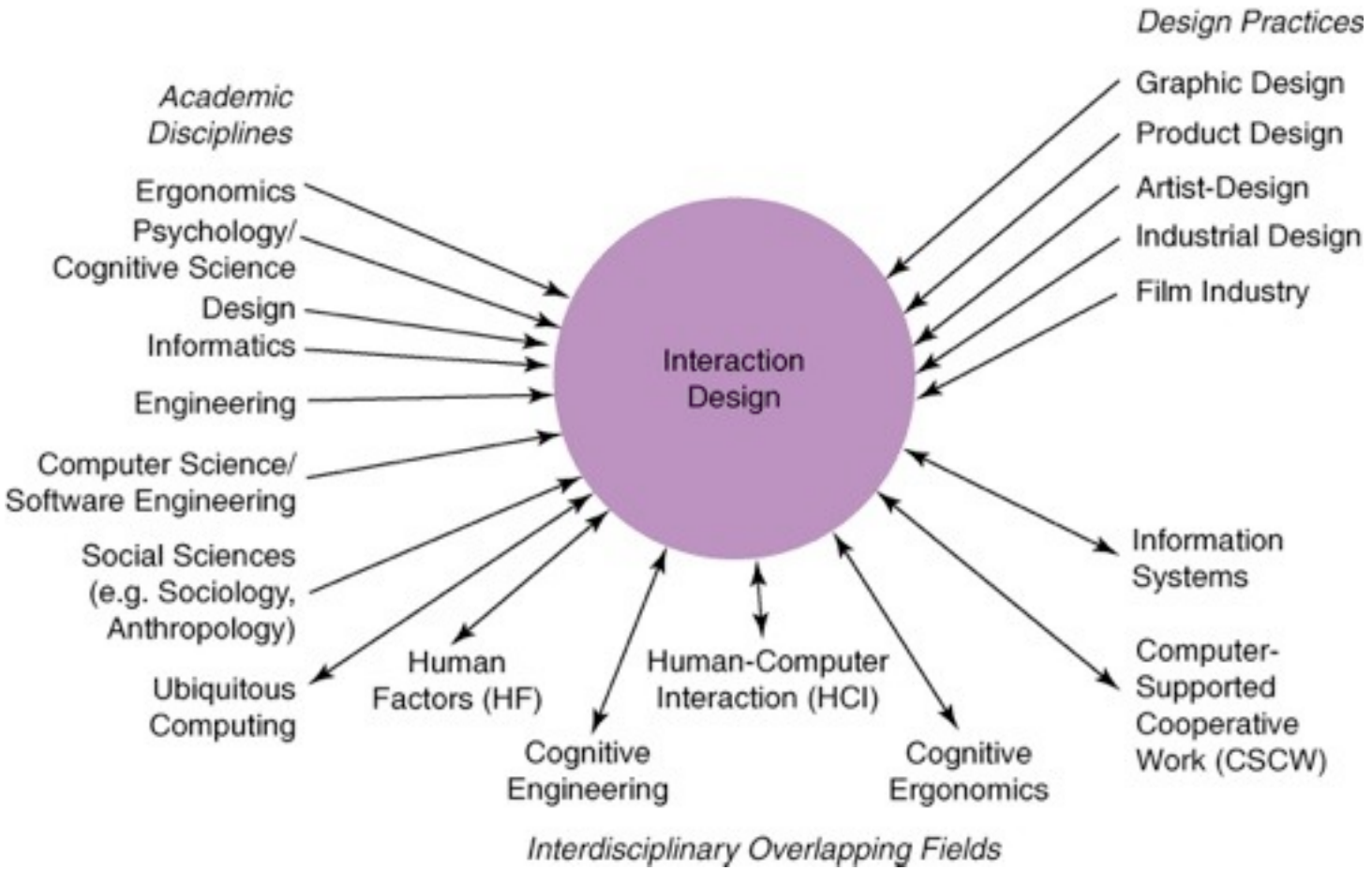
Which kind of design?

- Number of other terms used emphasizing what is being designed, e.g.
  - user interface design, software design, user-centered design, product design, web design, experience design (UX)
- Interaction design is the umbrella term covering all of these aspects
  - fundamental to all disciplines, fields, and approaches concerned with researching and designing computer-based systems for people

HCI and interaction design



Relationship between ID, HCI and other fields

- Academic disciplines contributing to ID:
  - Psychology
  - Social Sciences
  - Computing Sciences
  - Engineering
  - Ergonomics
  - Informatics

Relationship between ID, HCI and other fields

- Design practices contributing to ID:
  - Graphic design
  - Product design
  - Artist-design
  - Industrial design
  - Film industry

Relationship between ID, HCI and other fields

- Interdisciplinary fields in interaction design:
  - HCI
  - Ubiquitous Computing
  - Human Factors
  - Cognitive Engineering
  - Cognitive Ergonomics
  - Computer Supported Co-operative Work
  - Information Systems

Working in multidisciplinary teams

- Many people from different backgrounds involved
- Different perspectives and ways of seeing and talking about things
- Benefits
  - more ideas and designs generated
- Disadvantages
  - difficult to communicate and progress forward the designs being create

Interaction design in business

- Increasing number of ID consultancies, examples of well known ones include:
  - **Nielsen Norman Group**: "help companies enter the age of the consumer, designing human-centered products and services"
  - **Cooper:** "From research and product to goal-related design"
  - **Swim:** "provides a wide range of design services, in each case targeted to address the product development needs at hand"
  - **IDEO: "**creates products, services and environments for companies pioneering new ways to provide value to their customers"

cooper

IDEO

What do professionals do in the ID business?

- **interaction designers** - people involved in the design of all the interactive aspects of a product
- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers (UX)** - people who do all the above but who may also carry out field studies to inform the design of products

User Experience

The User Experience

- How a product behaves and is used by people in the real world
  - the way people feel about it and their pleasure and satisfaction when using it, looking at it, holding it, and opening or closing it
  - "every product that is used by someone has a user experience: newspapers, ketchup bottles, reclining armchairs, cardigan sweaters." (Garrett, 2003)
- Cannot design a user experience, only design *for* a user experience

Case Study: iPod Nano Touch

Why was the iPod user experience such a success?

- Quality user experience from the start
- Simple, elegant, distinct brand, pleasurable, must have fashion item, catchy names, cool, etc.,

What is involved in the process of interaction design

- Establishing requirements
- Developing alternatives
- Prototyping
- Evaluating

Core characteristics of interaction design

- users should be involved through the development of the project
- specific usability and user experience goals need to be identified, clearly documented and agreed at the beginning of the project
- iteration is needed through the core activities

Why go to this length?

- Help designers:
  - understand how to design interactive products that fit with what people want, need and may desire
  - appreciate that one size does not fit all
    e.g., teenagers are very different to grown-ups
  - identify any incorrect assumptions they may have about particular user groups
    e.g., not all old people want or need big fonts
  - be aware of both people's sensitivities and their capabilities

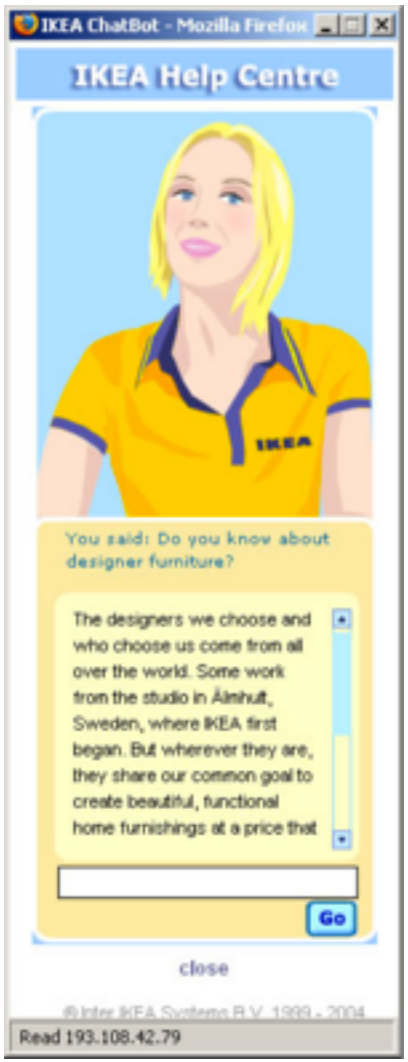
Are cultural differences important?

- 5/21/2012 versus 21/5/2012?
  - Which should be used for international services and online forms?

- Why is it that certain products, like the iPod, are universally accepted by people from all parts of the world whereas websites are reacted to differently by people from different cultures?

Anna, IKEA online sales agent

- Designed to be different for UK and US customers
- What are the differences and which is which?
- What should Anna's appearance be like for other countries, like India, South Africa, or China?



What is involved in the process of interaction design

- Identify needs and establish requirements
- Develop alternative designs
- Build interactive prototypes that can be communicated and assessed
- Evaluate what is being built throughout the process

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Usability goals

- Effective to use
- Efficient to use
- Safe to use
- Have good utility
- Easy to learn
- Easy to remember how to use

Activity on usability

- How long should it take and how long does it actually take to:
  - use a VCR/DVD player/TiVo to play a video?
  - use a VCR/DVD recorder/TiVo to pre-record two programs?
  - use an authoring tool to create a website?

User experience goals

Desirable aspects

satisfying
enjoyable
engaging
pleasurable
exciting
entertaining
helpful
motivating
challenging
enhancing sociability
supporting creativity
cognitively stimulating
fun
provocative
surprising
rewarding
emotionally fulfilling

Undesirable aspects

boring
frustrating
making one feel guilty
annoying
childish
unpleasant
patronizing
making one feel stupid
cutesy
gimmicky

Usability and user experience goals

- Selecting terms to convey a person's feelings, emotions, etc., can help designers understand the multifaceted nature of the user experience
- How do usability goals differ from user experience goals?
- Are there trade-offs between the two kinds of goals?
  - e.g. can a product be both fun and safe?
- How easy is it to measure usability versus user experience goals?

Design principles

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

Visibility

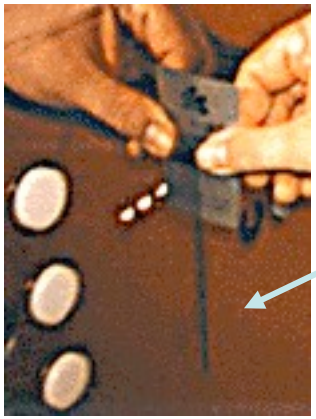
From:
www.baddesigns.com

- This is a control panel for an elevator.
- How does it work?
- Push a button for the floor you want?

- Nothing happens. Push any other button? Still nothing. What do you need to do?

It is not visible as to what to do!

Visibility



…you need to insert your room card in the slot by the buttons to get the elevator to work!

How would you make this action more visible?

- make the card reader more obvious
- provide an auditory message, that says what to do (which language?)
- provide a big label next to the card reader that flashes when someone enters

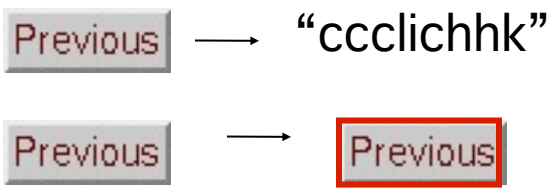
- make relevant parts visible
- make what has to be done obvious

What do I do if I am wearing black?

- Invisible automatic controls can make it more difficult to use

Feedback

- Sending information back to the user about what has been done
- Includes sound, highlighting, animation and combinations of these
  - e.g. when screen button clicked on provides sound or red highlight feedback:



Constraints

- Restricting the possible actions that can be performed
- Helps prevent user from selecting incorrect options
- Physical objects can be designed to constrain things
  - e.g. only one way you can insert a key into a lock

Logical or ambiguous design?

From: www.baddesigns.com

- Where do you plug the mouse?
- Where do you plug the keyboard?
- top or bottom connector?
- Do the color coded icons help?

How to design them more logically

From: www.baddesigns.com

(i) A provides direct adjacent mapping between icon and connector

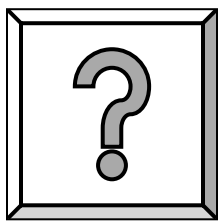
(ii) B provides color coding to associate the connectors with the labels

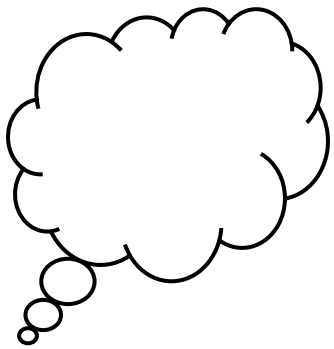
Cultural constraints

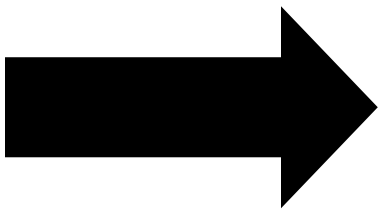
- Learned arbitrary conventions like red triangles for warning

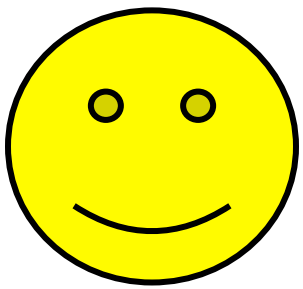
- Can be universal or culturally specific

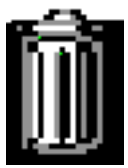
Which are universal and which are culturally-specific?





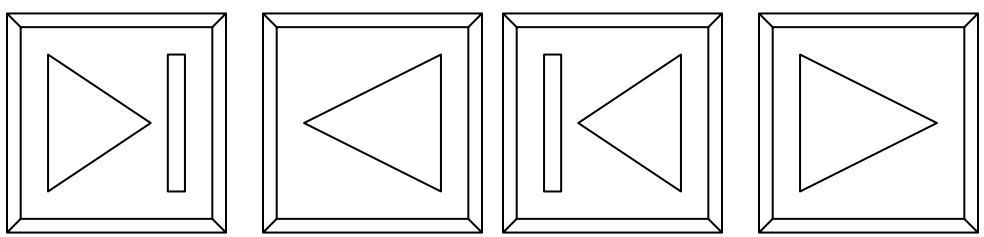






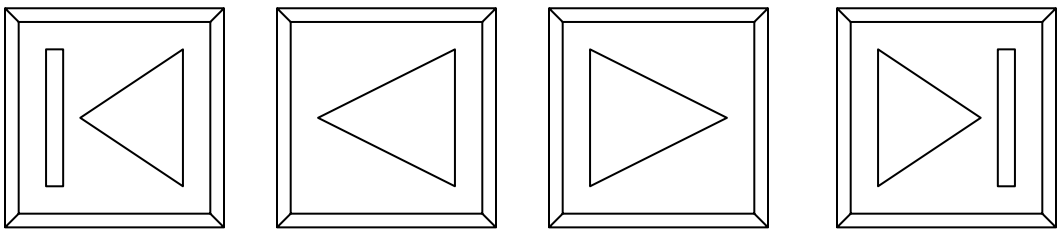
Mapping

- Relationship between controls and their movements and the results in the world
- Why is this a poor mapping of control buttons?



Mapping

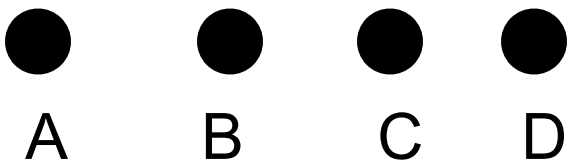
- Why is this a better mapping?



- The control buttons are mapped better onto the sequence of actions of fast rewind, rewind, play and fast forward

Activity on mappings

– Which controls go with which rings (burners)?



Why is this a better design?

Consistency

- Design interfaces to have similar operations and use similar elements for similar tasks
- For example:
  - always use ctrl key plus first initial of the command for an operation – ctrl+C, ctrl+S, ctrl+O
- Main benefit is consistent interfaces are easier to learn and use

When consistency breaks down

- What happens if there is more than one command starting with the same letter?
  - e.g. save, spelling, select, style
- Have to find other initials or combinations of keys, thereby breaking the consistency rule
  - E.g. ctrl+S, ctrl+Sp, ctrl+shift+L
- Increases learning burden on user, making them more prone to errors

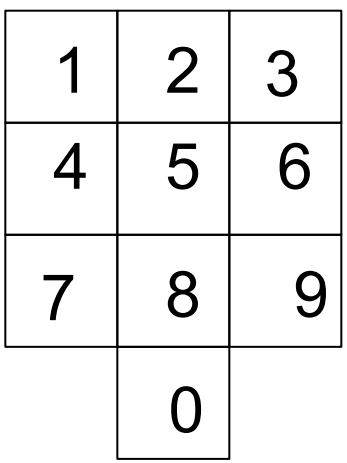
Internal and external consistency

- Internal consistency refers to designing operations to behave the same within an application
  - Difficult to achieve with complex interfaces
- External consistency refers to designing operations, interfaces, etc., to be the same across applications and devices
  - Very rarely the case, based on different designer's preference

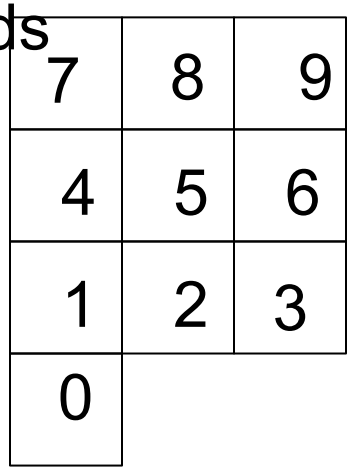
Keypad numbers layout

- A case of external inconsistency

(a) phones, remote controls



(b) calculators, computer keypads



Affordances: to give a clue

- Refers to an attribute of an object that allows people to know how to use it
  - e.g. a mouse button invites pushing, a door handle affords pulling
- Norman (1988) used the term to discuss the design of everyday objects
- Since has been much popularised in interaction design to discuss how to design interface objects
  - e.g. scrollbars to afford moving up and down, icons to afford clicking on

What does ‘affordance’ have to offer interaction design?

- Interfaces are virtual and do not have affordances like physical objects
- Norman argues it does not make sense to talk about interfaces in terms of ‘real’ affordances
- Instead interfaces are better conceptualised as ‘perceived’ affordances
  - Learned conventions of arbitrary mappings between action and effect at the interface
  - Some mappings are better than others

Activity

- Physical affordances:

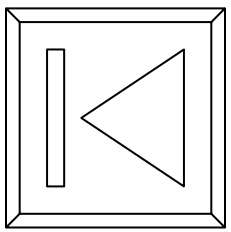
  How do the following physical objects afford? Are they obvious?

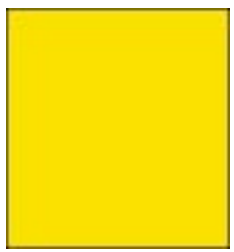
Activity: Affordance Discovery

- Take an object or product that is unfamiliar to the test subject, and ask them to find the affordances.
  - Ideally, the product should perform a pleasant activity once the affordance has been identified and used.

Activity

- Virtual affordances
  - How do the following screen objects afford?
  - What if you were a novice user?
  - Would you know what to do with them?





Usability principles

- Similar to design principles, except more prescriptive
- Used mainly as the basis for evaluating systems
- Provide a framework for heuristic evaluation

Usability principles (Nielsen 2001)

- Visibility of system status
- Match between system and the real world
- User control and freedom
- Consistency and standards
- Help users recognize, diagnose and recover from errors
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help and documentation

Key points

- Interaction design is concerned with designing interactive products to support the way people communicate and interact in their everyday and working lives
- It is concerned with how to create quality user experiences
- It requires taking into account a number of interdependent factors, including context of use, type of activities, cultural differences, and user groups
- It is multidisciplinary, involving many inputs from wide-reaching disciplines and fields