Chapter 1

What is interaction design?

Topics

- Introduction
- Good and Poor Design
- What is Interaction Design
- The User Experience
- The process of Interaction Design
- Interaction Design and the user Experience

Introduction

Some Interactive products have been designed primarily with the user in mind (enjoyabe to use)

Others are engineered primarily as systems to perform set functions.

Introduction

- **Designers are concerned with how to create interactive usable products that elicit positive responses from users (easy, effective, and pleasurable to user)**

- **Reduce the negative aspects (e.g. frustration, annoyance)**

Introduction

Definition

- *Designing Interactive products to support the way people communicate and interact in their everyday and working lives*

Key Elements

- *Understanding of the capabilities and desires of people*
- *Technology available to interaction designers*
- *Methodology (knowledge of how to identify requirements and develop them into a suitable design*

Bad designs

- – 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 same mistake for the labels and buttons on the top row. Why not?

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

Bad design

Voice Mail system in Hotel that has many steps to access a message.
For example:
1. Touch 41
2. Touch *, your room number, and #

Problems:
You have to pick up the handset to find out if you have messages and then go to a series of steps to listen to them

It is not obvious what to do: the instructions are provided partially by the system and partially by the card beside phone

Difficult to use and inefficient

Good design

- Incoming messages are represented by physical marbles
- # of marbles that moved into the chute indicates the # of messages
- Dropping one of these marbles into a slot in the machine causes a recorded message to play
- Dropping one of these marbles into another slot dials the caller who recorded message.
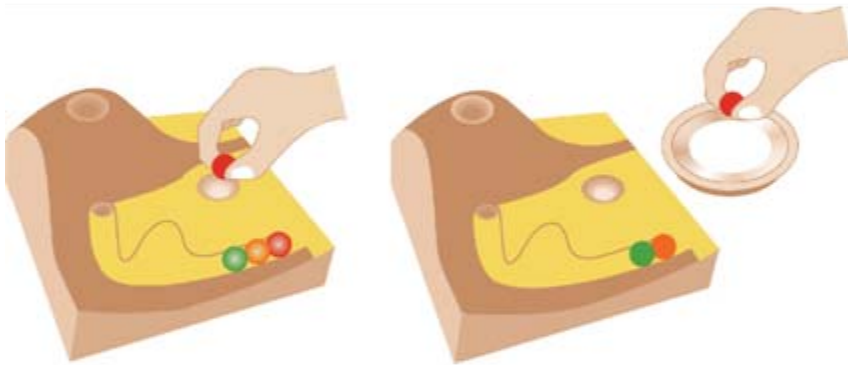
Good design

- Marble answering machine (Bishop, 1995)
- Based on how everyday objects behave
- Easy, intuitive and a pleasure to use
- Only requires one-step actions to perform core tasks
- But not practical, why?

Good design

- When designing an interactive product, it is important to take into account where it is going to be used and who is using it.

Good and bad design

What is wrong with the remote on the right?

Why is the TiVo remote so much better designed?

– Peanut shaped to fit in hand

– Logical layout and color-coded, distinctive buttons

– Easy to locate buttons

TiVo company followed a user-centered design process (involve users, get their feedback)

What to design

- Need to take into account:
  - Who the users are (average, expert, etc)
  - What activities are being carried out
  - Where the interaction is taking place

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

Novel interface
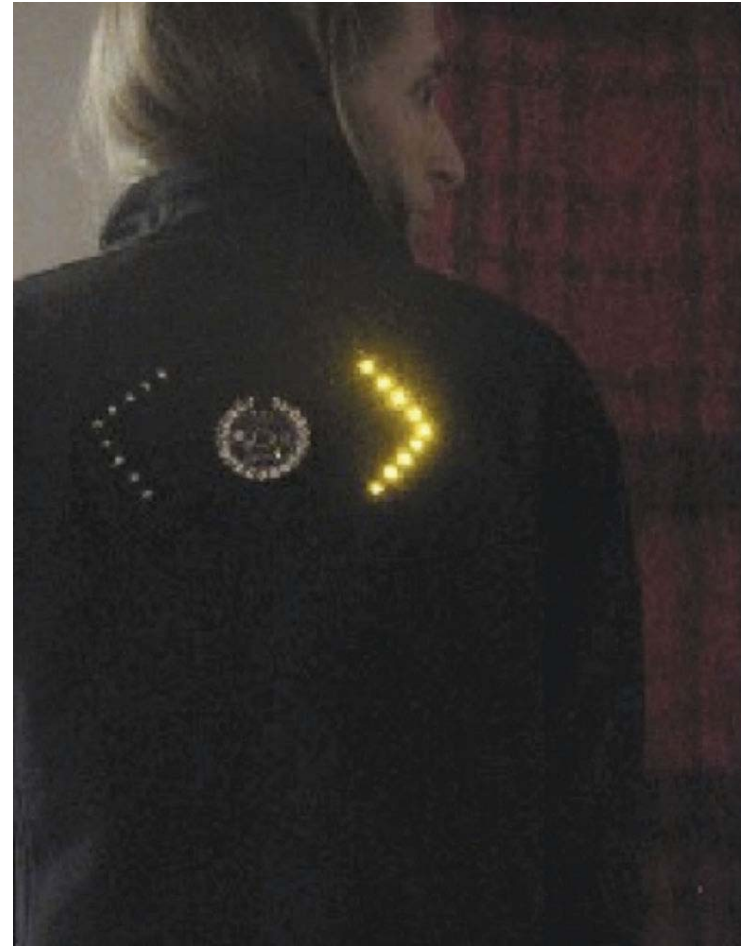
Understanding users' needs

- 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
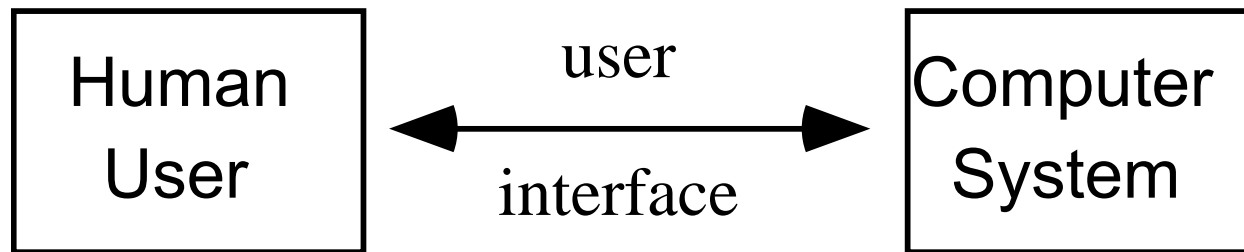- Use tried and tested user-centered methods

Activity

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

Understanding Users

- **Dual Processor" Theory**:
  - Every interactive system is a distributed system running on two processors:

Human User	← user / interface →	Computer System

  - User interface design specifies/constrains both:
   - User behaviour
    - System behaviour

Understanding Users (Cont'd)

- Users can be categorized:
  - By class
    - Determined by the pattern of use:
      » e.g., manager, salesperson, shipper, client
  - By personality type
    - Shy or reticent
    - Inarticulate
    - Disinterested or defensive
    - Intimidated
    - Involved designer!
  - By ability
    - Physical disability
      » --> innovative I/O may be needed
    - Colourblind
      » --> don't use colours as the only means of conveying information
    - Dyslexia or other cognitive glitches
      » --> watch out for left vs. right!
    - Illiteracy
      » --> icons may be needed
    - Computer illiteracy
    - Ignorance of domain / learner

User Productivity & Usability

- **User productivity =**

  Functionality (what the computer can do)

  *

  Usability (what people can do with the computer)

- **If either of these is zero, the system is useless**

  – Factors Influencing User Productivity
    - Kind and number of tasks
    - Characteristics of users (ability, experience etc.)
    - Work environment (distractions etc.)
    - Training and documentation
   - Functionality and usability of available software and hardware

A Model of Usability Factors
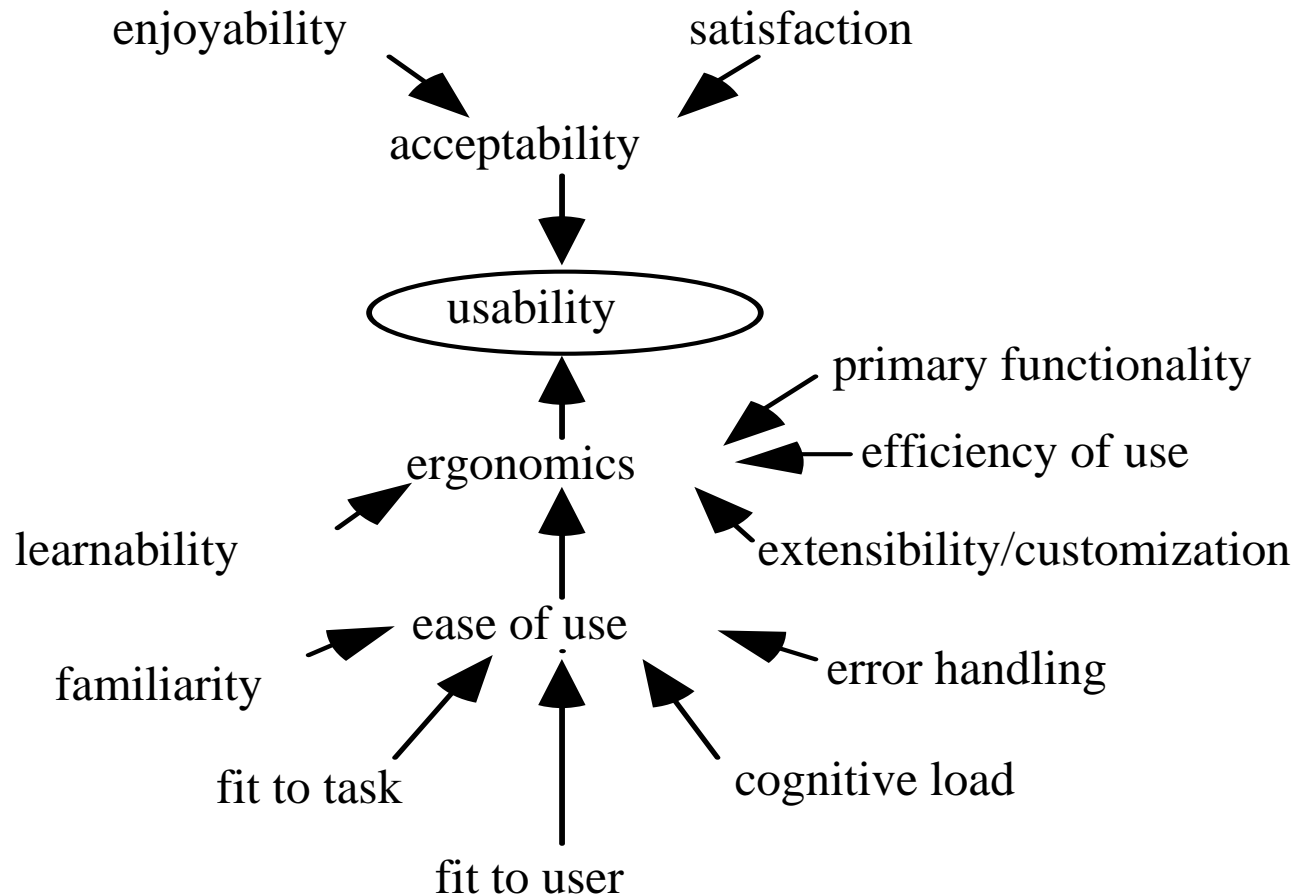
Which kind of design?

- 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

Disciplines contributing to HCI
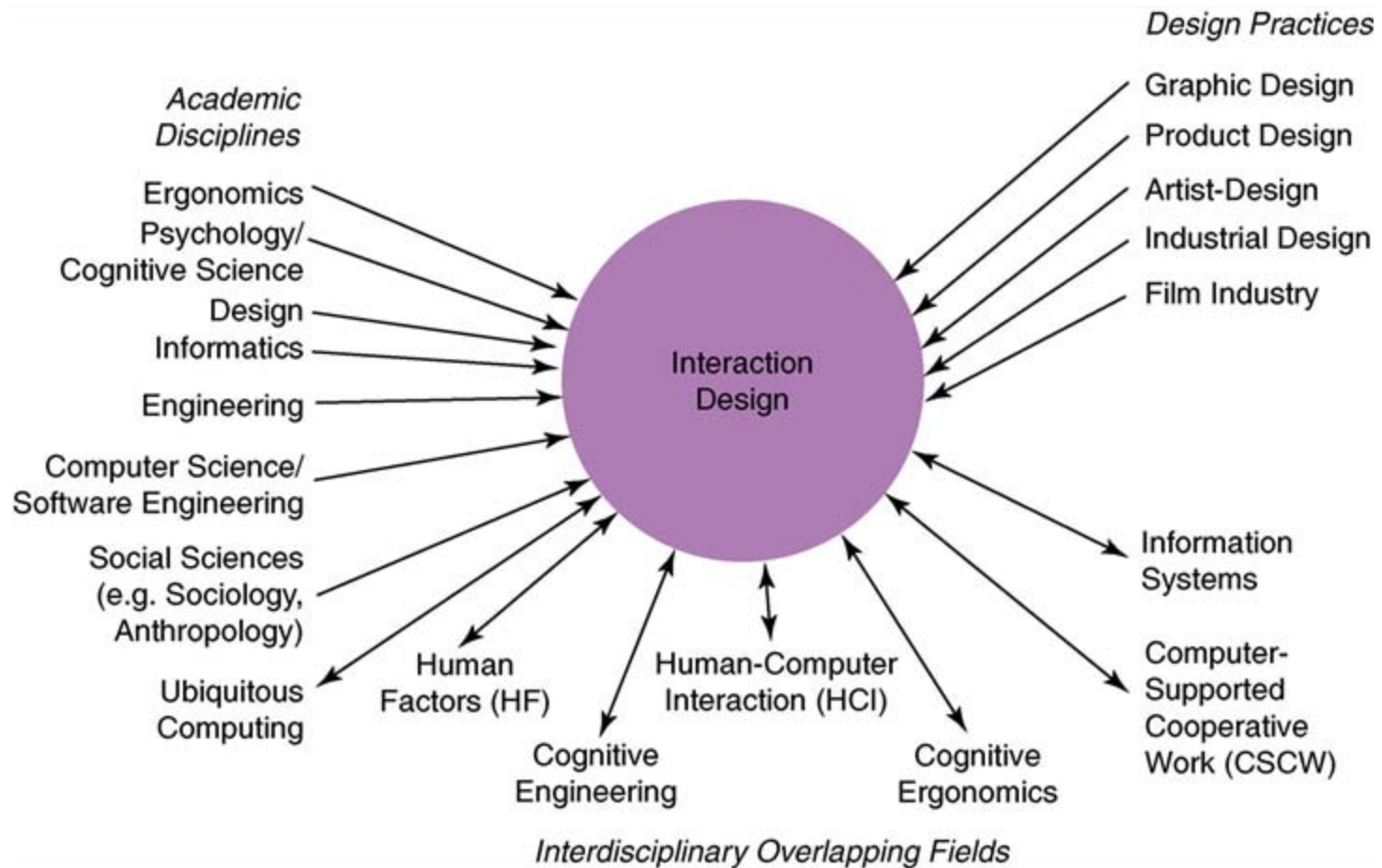
Disciplines Contributing to HCI

- Cognitive psychology
  - Capabilities and limitations of human senses and thought processes
- Ergonomics
  - Hardware and software efficiency of use and safety
- Linguistics
  - Syntax and semantics of commands
  - Speech I/O
- Artificial intelligence
  - Speech I/O
  - Intelligent 'guessing' what the user wants to do
  - Knowledge representations of users and tasks
- Sociology and social psychology
  - Assisting people to work in groups with software
  - Ensuring software works in different cultures
- Engineering and industrial design
  - Disciplined measurement-based approaches
  - Esthetics
  - Storyboarding etc.

Financial benefits & Costs of improved user interfaces

- Increased user productivity
  - Direct financial savings
- Increased revenues from sales
  - The system is more attractive and customer satisfaction is higher
- Decreased training and support costs
  - The system is more intuitive
- Decreased maintenance cost
  - The system does what user wants
  - Much maintenance involves fixing UI problems
  - Pay a little during development, or pay a lot after application/product release!

- But
  - Staff must be trained in user interface analysis and design
  - Users must participate
  - UI design tools are needed.
- The benefits almost always outweigh the costs

Who is involved in Interaction Design

- 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"
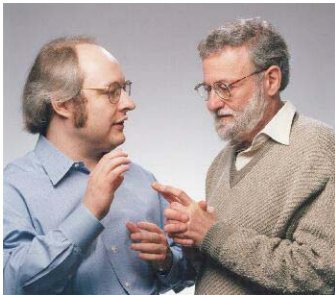
What do professionals do in the ID business?

- **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

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
- One cannot design a sensual experience, but only create design features that evoke it

The 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?

IKEA ChatBot - Mozilla Firefox

IKEA Help Centre

You said: Do you know about designer furniture?

The designers we choose and who choose us come from all over the world. Some work from the studio in Älmhult, Sweden, where IKEA first began. But wherever they are, they share our common goal to create beautiful, functional home furnishings at a price that

Go

close

© Inter IKEA Systems B.V. 1999 - 2004

Read 193.108.42.79

IKEA ChatBot

IKEA Help Center

You said: Do you have interaction designers working

Which product would you like to know the designer for?

Go

close

© Inter IKEA Systems B.V. 1999 - 2004

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

Usability goals

- Effective to use (is product capable of doing what is supposed to do?)
- Efficient to use (can users sustain a high level of productivity, e.g marble answering machine)
- Safe to use (what is the range of possible errors? Need to protect users from dangerous conditions, Xray?)
- Have good utility (does the product have an appropriate set of functions?
- Easy to learn (how fast can you learn the product?)
- Easy to remember how to use

Activity on usability

- How long should it take and how long does it actually take to:
  - Using a DVD to play a movie?
  - Use a DVD to pre-record two programs?
  - Using a web browser tool to create a website?

User experience goals

Desirable aspects

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

Undesirable aspects

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

- Some combinations of goals will be incompatible for some interactive products.

- 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 (e.g feedback, findability, etc)

- The do's and don'ts of interaction design

- What to provide and what not to provide at the interface

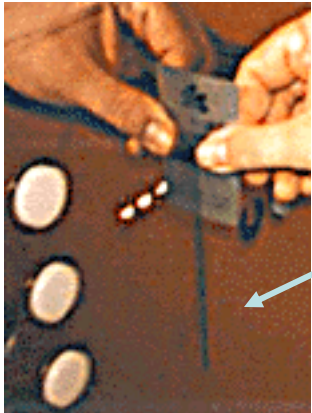- Derived from a mix of theory-based knowledge, experience and common-sense

Visibility

- 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!

From:
www.baddesigns.com

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:

  Previous ⟶ "ccclichhk"

  Previous ⟶ Previous

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?

- Where do you plug the mouse?

- Where do you plug the keyboard?

- top or bottom connector?

- Do the color coded icons help?

From: www.baddesigns.com

How to design them more logically

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

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

From: www.baddesigns.com

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

1	2	3
4	5	6
7	8	9
	0	

(b) calculators, computer keypads

7	8	9
4	5	6
1	2	3
0		

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 conceptualized as 'perceived' affordances
  - Learned conventions of arbitrary mappings between action and effect at the interface
  - Some mappings are better than others
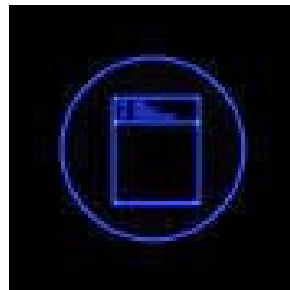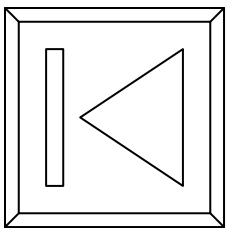
Activity

– Physical affordances:

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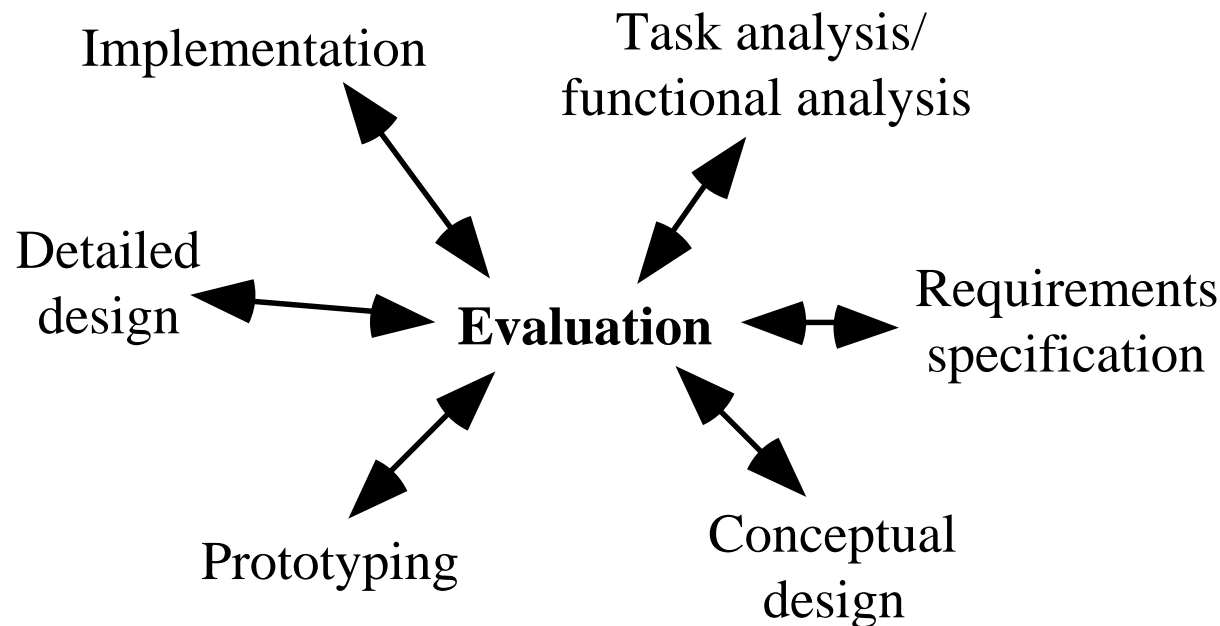
Activity

– Virtual affordances

How do the following screen objects afford?

What if you were a novice user?

Would you know what to do with them?

Up Arrow →

Elevator Button

Down Arrow →

HCI Eng. as a Branch of SW Eng.

- A conceptual model of the user interface development process:
  – Star model
  – Evaluation is the central process
    • UI is repeatedly revised when problems are found

Implementation Task analysis/ functional analysis

Detailed design **Evaluation** Requirements specification

Prototyping Conceptual design
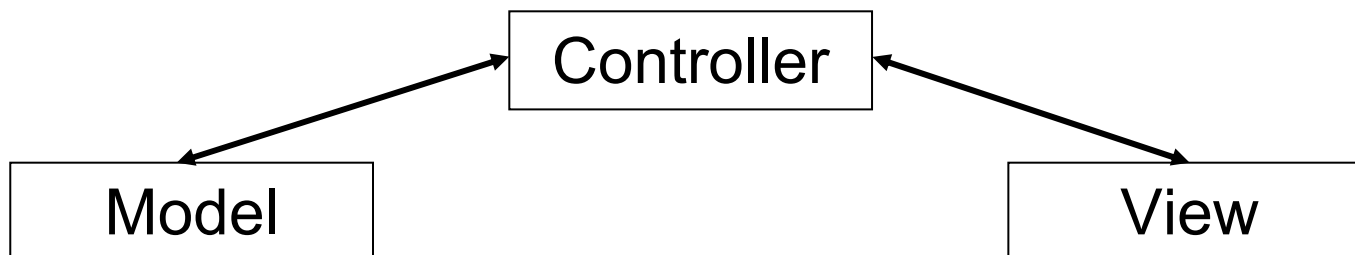
A five level conceptual model of the UI

- At each level:
  - Design must be done
  - Problems can occur

1. Task Level
   - What is to be done by the user
2. Conceptual Level
   - User's intended mental model of the system
3. Interaction Style Level
   - Command-driven, menu-driven, direct manipulation, hypermedia
   - Design elements that are repeated throughout the system
4. Interaction Element Level
   - Specific windows, dialogs, commands, menus
5. Physical Element Level
   - Bitmaps, characters, data structures, callbacks

Evolution from plain SW- to usability Eng.

- Normal software development (involving the UI)
  - Focuses on physical and interaction elements
  - Waterfall model dominates (sequential), Spiral model
  - Evaluation by functional spec reviews and testing
- User interface development
  - Focuses on users and tasks
  - Star model dominates (iterative)
  - Evaluation by continuous user involvement
  - Driven by heuristics and guidelines
  - Integrates psychology etc.
  - Influence on functionality
- Usability engineering
  - Driven by engineering objectives
  - Integrates rigorous engineering discipline
  - Drives functionality

A conceptual model of user interface system architecture

- Why layers?
  - Simplifies software development and maintenance
- All layers:
  - Are developed in parallel
  - Influence each other
  - Included in complete system specifications
  - Evaluated together
- Evolution of layers:
  - Functional layer should need to change less often during iterative tuning of the interface
  - All layers may need to change when business functions change but hopefully interaction styles should remain similar

```
            ┌────────────┐
            │ Controller │
            └────────────┘
           ↙              ↘
┌───────┐                  ┌──────┐
│ Model │                  │ View │
└───────┘                  └──────┘
```

User Interface Malfunctions

- Key idea:
- "There are no good user interfaces … just user interfaces that <u>fit</u>"
  - A truly bad user interface never fits
  - But among the 'good' ones, some will suit one task/user; some with suit another

- To maximize *fitness*, we must minimize the occurrence of '<u>malfunctions</u>' in the context of the expected use of the system

Definitions of malfunction

- "A mismatch between what the user <u>wants, needs</u> or <u>expects</u> and what the system <u>provides</u>"

- "A <u>breakdown</u> in usability"

- "An <u>obstacle</u> to performing a desired task"

- You should know that:
  - Occasional malfunctions are normal
  - Systematic or frequent malfunctions need to be fixed

Related ideas to 'malfunction'

- Error: Identifiable mistake on the part of the designer
- Defect: A deviation from what the user needs

- A malfunction is a usability defect
  - A defect in the smooth functioning of the user/computer system!
  - Users may not be aware of many malfunctions
    - the malfunctions may only be located through careful analysis
    - they may be subtle
- More discussion of malfunctions in next chapter

Case Studies in UI malfunctions

- Aircraft disasters

  - China Airlines pilot loses control:
    - Human was expected to act as a monitor, but humans are bad monitors (get bored)
    - Humans need to control things and get feedback

  - US Vincennes downs Iranian jet; 290 lives lost
    - Critical information about the plane was on different displays
    - When gathering relevant facts from different places, a wrong match was made

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

Ευχαριστώ

THANK YOU

谢谢

Merci

ขอบคุณ

Vielen Dank

Hvala

DMnvwd

Grazie

Gracias

شكرا

Bedankt

Dankie

Díky

go raibh maith agaibh

Köszönettel

Obrigado!

شكرايا

ありがとう

Dziękuję

감사합니다

Teşekkürler

WAD MAHAD SAN TAHAY

متشكرم

GADDA GUEY

Asante Urakoze