

# User-Centered Design and Development

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# Chapter Overview

- **Problem space**
- **Conceptual models**
- **Interface metaphors**
- **Interaction paradigms**
- **Conceptual models and physical design**

# Logistics

- ❖ **Open House: Fri, April 13 + Sat, April 14**
  - ❖ opportunity for usability evaluations and data collection
    - ❖ Fri: new students, parents
    - ❖ Sat: alumni, other visitors
- ❖ **Goodies!**
  - ❖ loans, not giveaways ;-{
  - ❖ 4 \* Microsoft Xbox + Kinect
  - ❖ 1 Sony PS3 +
  - ❖ 4 Apple iPad 2
  - ❖ ~50 Qualcomm mobile development kits
- ❖ **Assignments**
  - ❖ A1 overview
- ❖ **Term Project**
  - ❖ teams and topics stable
  - ❖ project time line
  - ❖ Skype chat with Elton Billings => Workday projects

# Motivation

- Good intentions are not sufficient to develop good user interfaces.
- It is important to understand the background, tasks, mind set, and experiences of users.
- Carefully considering the interactions of the user with the system before they are committed to code offers the flexibility to discard ideas and approaches that don't work.

# Objectives

- Understand the terms *problem space* and *conceptual model*.
- Use them to develop abstract descriptions of interactions.
- Identify mappings between the abstract descriptions and the methods and techniques available for implementation.
- Evaluate advantages and problems of various approaches to such mappings.

# Recap

- HCI has moved beyond designing interfaces for desktop machines
- About extending and supporting all manner of human activities in all manner of places
- Facilitating user experiences through designing interactions
  - Make work effective, efficient and safer
  - Improve and enhance learning and training
  - Provide enjoyable and exciting entertainment
  - Enhance communication and understanding
  - Support new forms of creativity and expression

# Understanding the problem space

- What do you want to create?
- What are your assumptions?
- Will it achieve what you hope it will?

# What is an assumption?

- taking something for granted when it needs further investigation
  - e.g. people will want to watch TV while driving





# What is a claim?

- stating something to be true when it is still open to question
  - e.g. a multimodal style of interaction for controlling GPS — one that involves speaking while driving — is safe

# A framework for analysing the problem space

- Are there problems with an existing product or user experience? If so, what are they?
- Why do you think there are problems?
- How do you think your proposed design ideas might overcome these?
- If you are designing for a new user experience how do you think your proposed design ideas support, change, or extend current ways of doing things?

# Activity

- What are the assumptions and claims made about 3D TV?



# Assumptions: realistic or wish-list?

- People would not mind wearing the glasses that are needed to see in 3D in their living rooms - reasonable
- People would not mind paying a lot more for a new 3D-enabled TV screen- not reasonable
- People would really enjoy the enhanced clarity and color detail provided by 3D - reasonable
- People will be happy carrying around their own special glasses - reasonable only for a very select bunch of users

# Activity: Conceptual Model

- **What is *your* conceptual model of a video recorder (*not* video player)?**
  - Do you believe it is close to the actual design of such a system?
  - Do you know people who have an “interesting” conceptual model of a video recorder?

# Activity: Mis-Conceptual Model

- **Do you know examples of systems or devices for which some people have incorrect conceptual models?**
  - This does not necessarily mean that those people are stupid!
  - Conceptual models should be largely independent of the actual technology used in the implementation of the system.

# Benefits of conceptualising

- Orientation

- enables design teams to ask specific questions about how the conceptual model will be understood

- Open-minded

- prevents design teams from becoming narrowly focused early on

- Common ground

- allows design teams to establish a set of commonly agreed terms

# From problem space to design space

- Having a good understanding of the problem space can help inform the design space
  - e.g. what kind of interface, behavior, functionality to provide
- But before deciding upon these it is important to develop a conceptual model



# Conceptual model

- A conceptual model is:
  - “a high-level description of how a system is organized and operates” (Johnson and Henderson, 2002, p 26)
- Enables
  - “designers to straighten out their thinking before they start laying out their widgets” (p 28)

# Components

- Metaphors and analogies
  - understand what a product is for and how to use it for an activity
- Concepts that people are exposed to through the product
  - task-domain objects, their attributes, and operations (e.g. saving, revisiting, organizing)
- Relationship and mappings between these concepts

# First steps in formulating a conceptual model

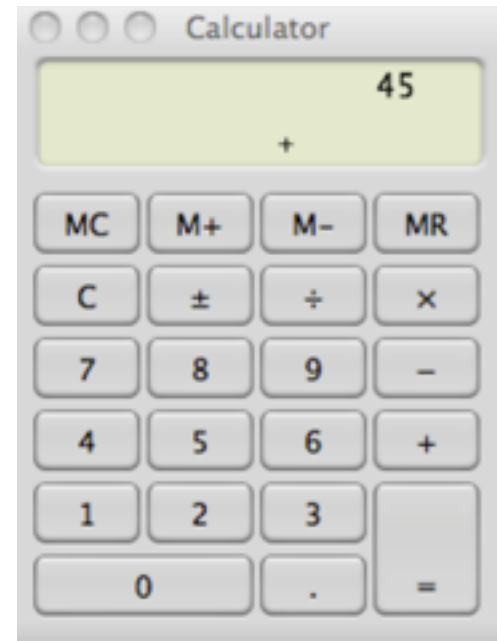
- What will the users be doing when carrying out their tasks?
- How will the system support these?
- What kind of interface metaphor, if any, will be appropriate?
- What kinds of interaction modes and styles to use?

always keep in mind when making design decisions how the user will understand the underlying conceptual model

# Conceptual models

- Many kinds and ways of classifying them
- We describe them in terms of core activities and objects
- Also in terms of interface metaphors

# Interface metaphors



# Interface metaphors

- Conceptualizing what we are doing, e.g. surfing the web
- A conceptual model instantiated at the interface, e.g. the desktop metaphor
- Visualising an operation,
  - e.g. an icon of a shopping cart for placing items into

# Activity

- Describe the components of the conceptual model underlying most online shopping websites, e.g.
  - Shopping cart
  - Proceeding to check-out
  - 1-click
  - Gift wrapping
  - Cash till?

# Interface metaphors

- Interface designed to be similar to a physical entity but also has own properties
  - e.g. desktop metaphor, web portals
- Can be based on activity, object or a combination of both
- Exploit user's familiar knowledge, helping them to understand 'the unfamiliar'
- Conjures up the essence of the unfamiliar activity, enabling users to leverage of this to understand more aspects of the unfamiliar functionality



# Benefits of interface metaphors

- Makes learning new systems easier
- Helps users understand the underlying conceptual model
- Can be very innovative and enable the realm of computers and their applications to be made more accessible to a greater diversity of users

# Problems with interface metaphors

- Break conventional and cultural rules
  - e.g. recycle bin placed on desktop
- Can constrain designers in the way they conceptualize a problem space
- Conflict with design principles
- Forces users to only understand the system in terms of the metaphor
- Designers can inadvertently use bad existing designs and transfer the bad parts over
- Limits designers' imagination in coming up with new conceptual models

# Interaction types

- **Instructing**
  - issuing commands and selecting options
- **Conversing**
  - interacting with a system as if having a conversation
- **Manipulating**
  - interacting with objects in a virtual or physical space by manipulating them
- **Exploring**
  - moving through a virtual environment or a physical space

# 1. Instructing

- Where users instruct a system and tell it what to do
  - e.g. tell the time, print a file, save a file
- Very common conceptual model, underlying a diversity of devices and systems
  - e.g. word processors, VCRs, vending machines
- Main benefit is that instructing supports quick and efficient interaction
  - good for repetitive kinds of actions performed on multiple objects

# Which is easiest and why?



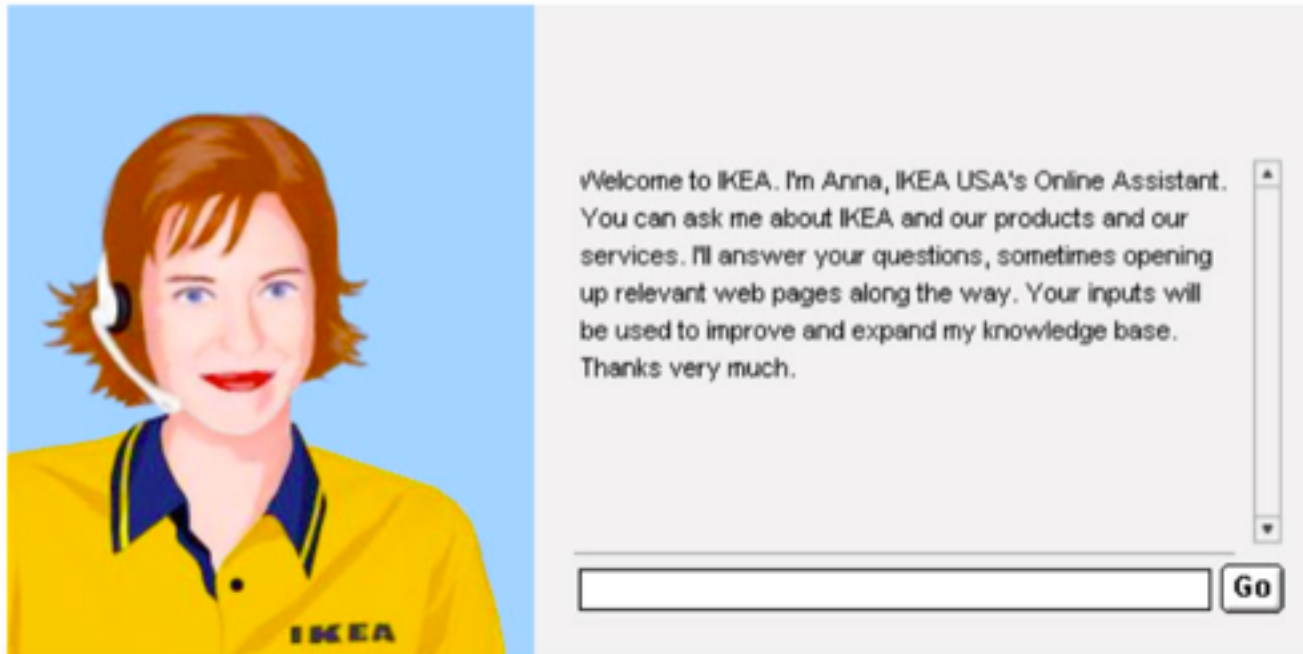
## 2. Conversing

- Underlying model of having a conversation with another human
- Range from simple voice recognition menu-driven systems to more complex 'natural language' dialogs
- Examples include timetables, search engines, advice-giving systems, help systems
- Also virtual agents, toys and pet robots designed to converse with you

# Would you talk with Anna?

IKEA Help Center

close window



© Inter IKEA Systems B.V. 1999 - 2004

# Pros and cons of conversational model

- Allows users, especially novices and technophobes, to interact with the system in a way that is familiar
  - makes them feel comfortable, at ease and less scared
- Misunderstandings can arise when the system does not know how to parse what the user says



# 3. Manipulating

- Involves dragging, selecting, opening, closing and zooming actions on virtual objects
- Exploit's users' knowledge of how they move and manipulate in the physical world
- Can involve actions using physical controllers (e.g. Wii) or air gestures (e.g. Kinect) to control the movements of an on screen avatar
- Tagged physical objects (e.g. balls) that are manipulated in a physical world result in physical/digital events (e.g. animation)

# Direct Manipulation

- Shneiderman (1983) coined the term DM, came from his fascination with computer games at the time
  - Continuous representation of objects and actions of interest
  - Physical actions and button pressing instead of issuing commands with complex syntax
  - Rapid reversible actions with immediate feedback on object of interest

# Why are DM interfaces so enjoyable?

- Novices can learn the basic functionality quickly
- Experienced users can work extremely rapidly to carry out a wide range of tasks, even defining new functions
- Intermittent users can retain operational concepts over time
- Error messages rarely needed
- Users can immediately see if their actions are furthering their goals and if not do something else
- Users experience less anxiety
- Users gain confidence and mastery and feel in control

# What are the disadvantages with DM?

- Some people take the metaphor of direct manipulation too literally
- Not all tasks can be described by objects and not all actions can be done directly
- Some tasks are better achieved through delegating
  - e.g. spell checking
- Can become screen space 'gobblers'
- Moving a mouse around the screen can be slower than pressing function keys to do same actions

## 4. Exploring

- Involves users moving through virtual or physical environments
- Physical environments with embedded sensor technologies
  - Context aware

# Which conceptual model is best?

- Direct manipulation is good for 'doing' types of tasks, e.g. designing, drawing, flying, driving, sizing windows
- Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management
- Having a conversation is good for children, computer-phobic, disabled users and specialised applications (e.g. phone services)
- Hybrid conceptual models are often employed, where different ways of carrying out the same actions is supported at the interface - but can take longer to learn

# Conceptual models: interaction and interface

- Interaction type:
  - what the user is doing when interacting with a system, e.g. instructing, talking, browsing or other
- Interface type:
  - the kind of interface used to support the mode, e.g. speech, menu-based, gesture

# Many kinds of interface types available...

- Command
- Speech
- Data-entry
- Form fill-in
- Query
- Graphical
- Web
- Pen
- Augmented reality
- Gesture





# Which interaction type to choose?

- Need to determine requirements and user needs
- Take budget and other constraints into account
- Also will depend on suitability of technology for activity being supported
- This is covered in course when designing conceptual models

# Paradigm

- Inspiration for a conceptual model
- General approach adopted by a community for carrying out research
  - shared assumptions, concepts, values, and practices
  - e.g. desktop, ubiquitous computing, in the wild

# Examples of new paradigms

- Ubiquitous computing (mother of them all)
- Pervasive computing
- Wearable computing
- Tangible bits, augmented reality
- Attentive environments
- Transparent computing
  - and many more....

# Theory

- Explanation of a phenomenon
  - e.g. information processing that explains how the mind, or some aspect of it, is assumed to work
- Can help identify factors
  - e.g. cognitive, social, and affective, relevant to the design and evaluation of interactive products

# Models

- A simplification of an HCI phenomenon
  - intended to make it easier for designers to predict and evaluate alternative designs
  - abstracted from a theory coming from a contributing discipline, e.g. psychology, e.g. keystroke model

# Framework

- Set of interrelated concepts and/or specific questions for 'what to look for'
- Many in interaction design
  - e.g. Norman's conceptual models, Benford's trajectories
- Provide advice on how to design
  - e.g. steps, questions, concepts, challenges, principles, tactics and dimensions

Concern	Past	Future
Frame of reference	<ul style="list-style-type: none"> <li>• users</li> </ul>	<ul style="list-style-type: none"> <li>• context</li> </ul>
Method, theory, and perspective	<ul style="list-style-type: none"> <li>• scientific approach</li> <li>• interaction design</li> </ul>	<ul style="list-style-type: none"> <li>• pluralistic</li> <li>• mixing</li> </ul>
Outputs	<ul style="list-style-type: none"> <li>• ethnographies</li> <li>• models and tools for analysis</li> <li>• design guidance</li> </ul>	<ul style="list-style-type: none"> <li>• insights</li> <li>• creating new ways of experiencing</li> <li>• value-based analyses</li> </ul>

**Table 2.1** A new framework for human–computer interaction (Rogers, 2009)

# Summary

- Important to have a good understanding of the problem space
- Fundamental aspect of interaction design is to develop a conceptual model
- Interaction modes and interface metaphors provide a structure for thinking about which kind of conceptual model to develop
- Interaction styles are specific kinds of interfaces that are instantiated as part of the conceptual model
- Paradigms, theories, models and frameworks can also shape a conceptual model