Chapter 2
Understanding and Conceptualizing interaction
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
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

[Images of interface metaphors for calculators]
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?

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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.
- Exploits 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

(for more see chapter 6)
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
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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