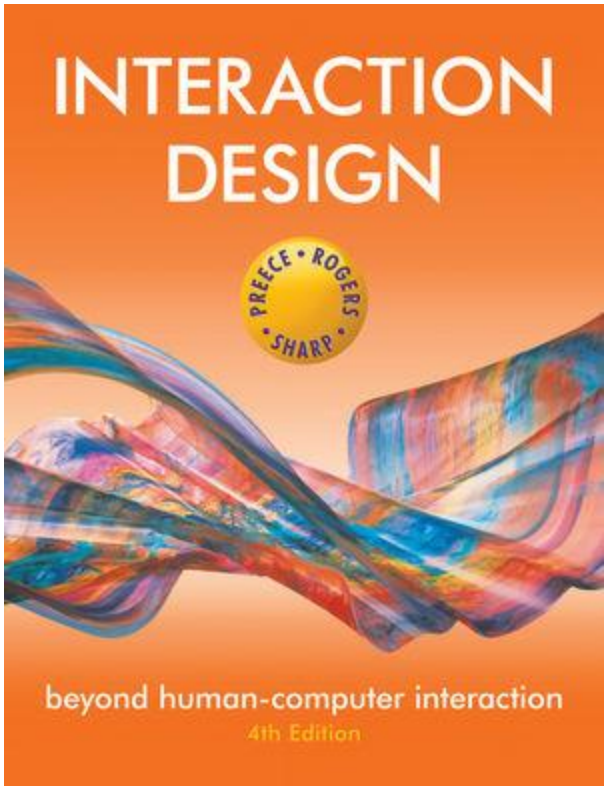


Chapter 2

UNDERSTANDING AND CONCEPTUALIZING INTERACTION DESIGN

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

RoadMap

- **Chapter (2) – Understanding And Conceptualization Interaction Design**
  - **2.1 : Introduction**
  - **2.2 : Understanding the Problem Space and Conceptualizing Interaction**
  - **2.3 : Conceptual Models**
  - **2.4 : Interface Metaphors**
  - **2.5 : Interaction Types**

Objectives

- Explain what is meant by the problem space
- Explain how to conceptualize interaction.
- Describe what a conceptual model is and how to begin to formulate one.
- Discuss the use of interface metaphors as part of a conceptual model.
- Outline the core interaction types for informing the development of a conceptual model.
- Outline the core interaction types for informing the development of a conceptual model.
- Introduce paradigms, visions, theories, models , and frameworks informing interaction design.

2.3 Conceptual model

- A conceptual model is:
  - "…a high-level description of how a system is organized and operates" (Johnson and Henderson, 2002, p26)
- Enables
  - "…designers to straighten out their thinking before they start laying out their widgets" (Johnson and Henderson, 2002, p28)

A conceptual model provides a working strategies and a framework of general concepts and their interrelations.

Components of Conceptual Models

1-Concepts (objects, attributes, operations)

2-Relationships between Concepts

3-Metaphors

Components of Conceptual Models

- 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

Interaction types

- Interaction types are the ways a person interacts with a product or application.

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

Interaction types

- **Deciding upon which of these to use and why can help designers formulate a conceptual model before committing to a particular interface in which to implement them e.g. speech-based, gesture-based, touch-based, menu-based, and so on.**

Activity

- **Consider the following problem description:**
- **a company has been asked to design a computer-based system that will encourage autistic children to communicate and express themselves better. What type of interaction would be appropriate to use at the interface for this particular user group?**

Activity

- **It is known that autistic children find it difficult to express what they are feeling or thinking through talking and are more expressive when using their bodies . Clearly an interaction style based on talking would not be effective, but one that involves the children interacting with a system by moving in a physical or digital space would seem a more promising starting point.**

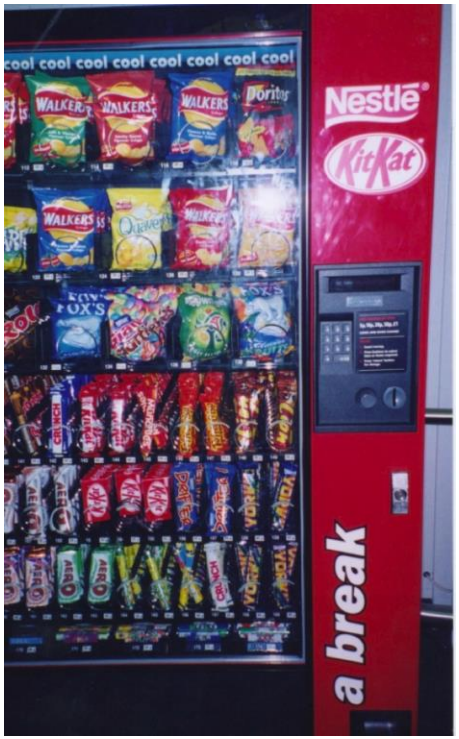
1. Instructing

- Where users instruct a system and tell it what to do.
  - Give examples ?
- Very common conceptual model, underlying a diversity of devices and systems.
  - Give examples ?

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?



- The first vending machine has been designed using simple instructions. There is a small number of drinks to choose from and each is represented by a large button displaying the label of each drink. The user simply has to press one button and this should have the effect of returning the selected drink. The second machine is more complex, offering a wider range of snacks. The trade-off for providing more choices, however, is that the user can no longer instruct the machine by using a simple one-press action but is required to use a more complex process, involving: (i) reading off the code (e.g., C12) under the item chosen, then (ii) keying this into the number pad adjacent to the displayed items, and (iii) checking the price of the selected option and ensuring that the amount of money inserted is the same or greater (depending on whether or not the machine provides change). Problems that can arise from this type of interaction are the customer misreading the code and or miskeying in the code, resulting in the machine not issuing the snack or providing the wrong item.
- A better way of designing an interface for a large number of choices of variable cost might be to continue to use direct mapping, but use buttons that show miniature versions of the snacks placed in a large matrix (rather than showing actual versions). This would use the available space at the front of the vending machine more economically. The customer would need only to press the button of the object chosen and put in the correct amount of money. There is less chance of error resulting from pressing the wrong code or keys. The trade-off for the vending company, however, is that the machine is less flexible in terms of which snacks it can sell. If a new product line comes out they will also need to replace part of the physical interface to the machine – which would be costly.

1. Instructing

- **In Windows and other GUI-based systems, control keys or the selection of menu options via a mouse, touch pad, or touch screen are used. Typically, a wide range of functions are provided from which users have to select when they want to do something to the object on which they are working. For example, a user writing a report using a word processor will want to format the document, count the number of words typed, and check the spelling. The user instructs the system to do these operations by issuing appropriate commands.**

2. Conversing

- https://www.youtube.com/watch?v=R2IJdfxWtPM

- Examples ?

2. Conversing

- https://www.youtube.com/watch?v=R2IJdfxWtPM

- This type of “conversational assistant” capability is already reaching mainstream consumers due to mobile device features and applications like Apple’s Siri, Samsung’s S-Voice and Nuance’s Dragon Mobile Assistant.

2. Conversing

- **Conversing is based on the idea of a person having a conversation with a system, where the system act as a dialog partner. The system is designed to respond in a way another human being might when having a conversation.**

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

Conversational User Interface

- The CUI is more than just speech recognition and synthesized speech; it's an intelligent interface. It's "intelligent" because it combines these voice technologies with natural-language understanding of the intention behind those spoken words, not just recognizing the words as a text transcription. The rest of the intelligence comes from contextual awareness (who said what, when and where), perceptive listening (automatically waking up when you speak) and artificial intelligence reasoning.

Advantageous of Conversational Model

Advantageous of Conversational Model

- **A main benefit of developing a conceptual model that uses a conversational style of interaction is that it allows people to interact with a system in a way that is familiar to them. For example, Apple's speech system, Siri, lets you talk to it as if it were another person. You can ask it to do tasks for you, such as make a phone call, schedule a meeting, or send a message. You can also ask it indirect questions that it knows how to answer, such as "Do I need an umbrella today?" It will look up the weather for where you are and then answer with something**
- **like, "I don't believe it is raining" while also providing a weather forecast .**

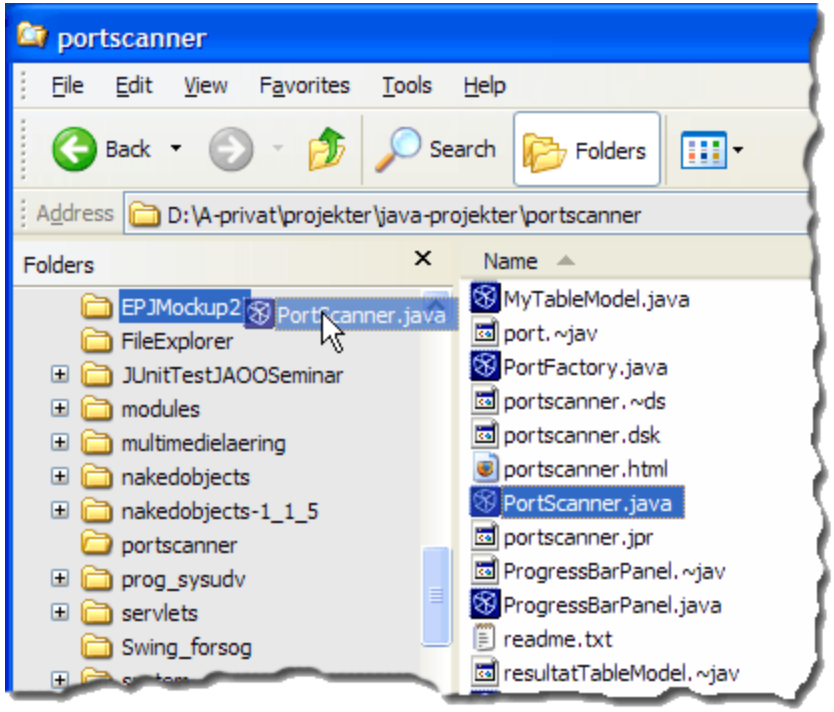
Pros and cons (advantageous and disadvantageous) of conversational model

- 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

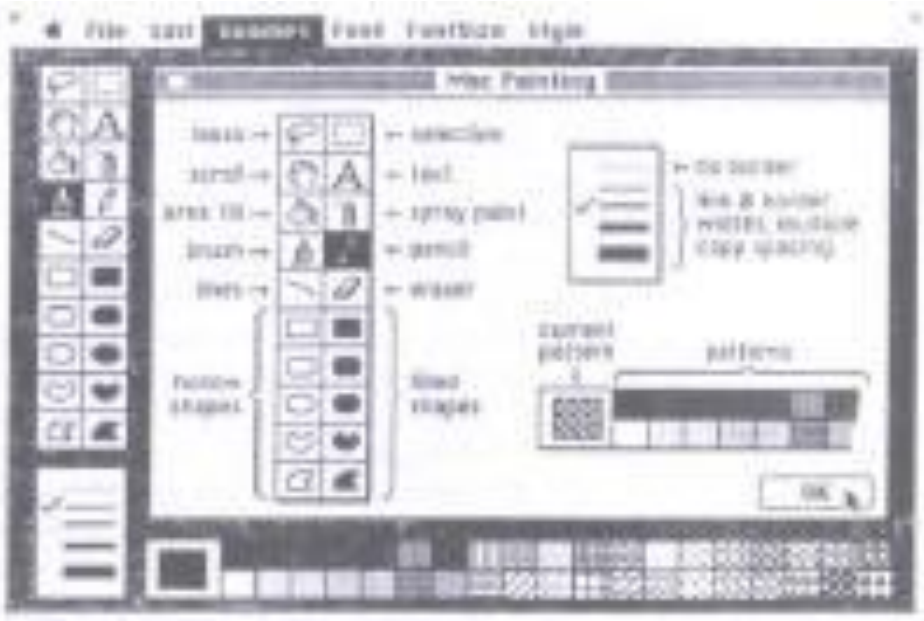
- This type of interaction involves manipulating objects as they do in the physical world.
- Involves dragging, selecting, opening, closing and zooming actions on virtual objects

Direct Manipulation



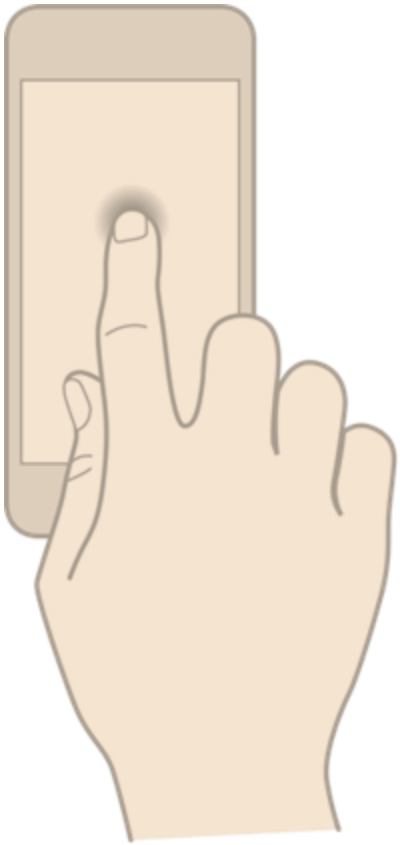
The text-book example of Direct Manipulation, the Windows File Explorer, where files are dragged and dropped.

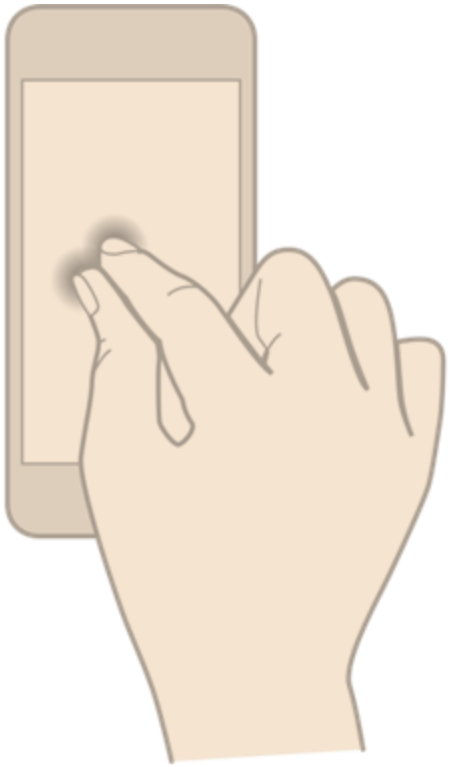
Direct Manipulation

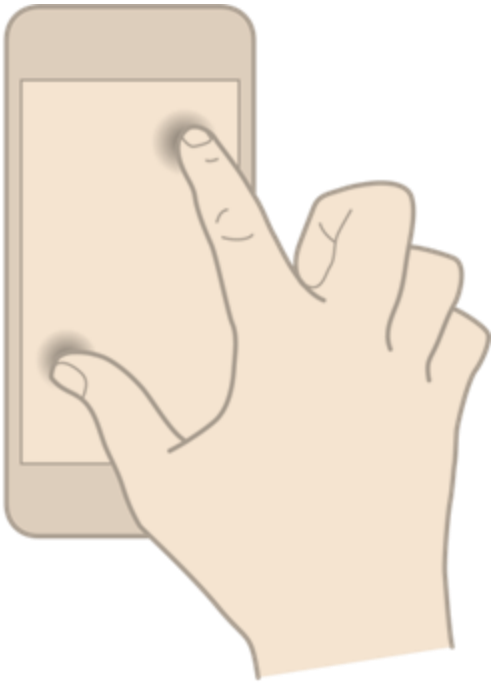


One of the earliest commercially available direct manipulation interfaces was MacPaint.

Direct Manipulation



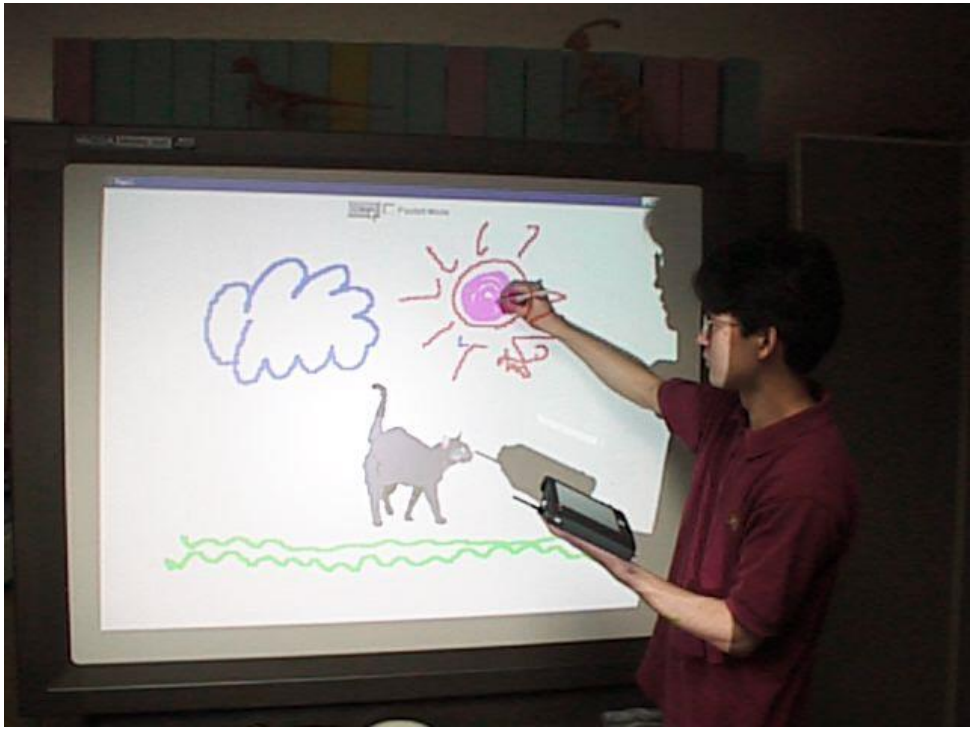




Direct Manipulation

Tom Cruise in the Minority Report uses direct manipulation to interface his data

Direct Manipulation



- **Jun Rekimoto, "Pick-and-Drop: A Direct Manipulation Technique for Multiple Computer Environments“**
- **Copyright(C) 1997-1998, Sony Computer Science Laboratories, Inc.**

Direct Manipulation

- The term direct manipulation was introduced by Ben Shneiderman in his keynote address at the NYU Symposium on User Interfaces (Shneiderman 1982) and more explicitly in Shneiderman (1983) to describe a certain ‘direct’ software interaction style that can be traced back to Sutherlands sketchpad (Sutherland 1963).

Direct Manipulation

- Direct manipulation captures the idea of “direct manipulation of the object of interest” (Shneiderman 1983: p. 57), which means that objects of interest are represented as distinguishable objects in the UI and are manipulated in a direct fashion.

Direct Manipulation

Direct manipulation systems have the following characteristics:

- Visibility of the object of interest.
- Rapid, reversible, incremental actions.
- Replacement of complex command language syntax by direct manipulation of the object of interest.

Advantages of Direct Manipulation

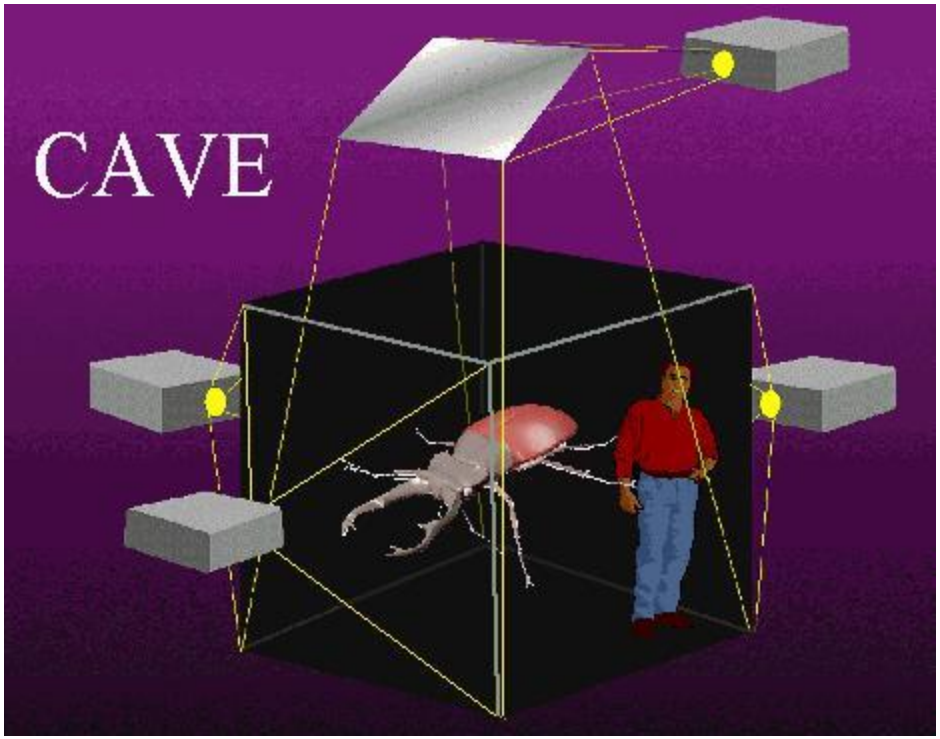
- Visually presents task concepts.
- Easy to learn.Errors can be avoided more easily.
- Encourages exploration.High subjective satisfaction.Recognition memory (as opposed to cued or free recall memory)
- Novices can learn the basic functionality quickly

4. Exploring

- Involves users moving through virtual or physical environments

- Physical environments with embedded sensor technologies

4. Exploring



http://alexei.nfshost.com/3d/cave.html

4. Exploring

- **This mode of interaction involves users moving through virtual or physical environments. For example users can explore aspects of a virtual 3D environment, such as the interior of a building.**
- **Physical environments can also be embedded with sensing technologies that, when they detect the presence of someone or certain body movements, respond by triggering certain digital or physical events. The basic idea is to enable people to explore and interact with an environment, be it physical or digital, by exploiting their knowledge of how they move and navigate through existing spaces.**

4. Exploring

- **Many 3D virtual environments have been built that include virtual worlds designed for people to move between various spaces to learn (e.g. virtual universities) and fantasy worlds where people wander around different places to socialize or play games (e.g. Minecraft).**
- **Numerous virtual landscapes depicting cities, parks, buildings, rooms, and datasets have also been built, both realistic and abstract, that enable users to fly over them and zoom in and out of different parts. Other virtual environments that have been built include worlds that are larger than life, enabling users to move around them, experiencing things that are normally impossible or invisible to the eye;**

4. Exploring

- **Highly realistic representations of architectural designs, allowing clients and customers to imagine how they will use and move through planned buildings and public spaces; and visualizations of complex datasets that scientists can virtually climb inside and experience**

4. Exploring

- **Navigation: The computer needs to provide the user with information regarding location and movement. Navigation tasks have two components. Travel involves moving from the current location to the desired point.**

4. Exploring

- **Wayfinding : Wayfinding refers to finding and setting routes to get to a travel goal within the virtual environment. Wayfinding in virtual space is different and more difficult to do than in the real world because synthetic environments are often missing perceptual cues and movement constraints. It can be supported using user-centred techniques such as using a larger field of view and supplying motion cues, or environment-centred techniques like structural organization and wayfinding principles.**

Which conceptual model is best?

- Direct manipulation
- Issuing instructions
- Having a conversation
- Hybrid conceptual models

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 including…

- 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

Case Study

- The aim of this assignment is for you to think about the appropriateness of different kinds of conceptual models that has been designed for similar physical and digital information artifacts;
- Compare the following:
  - A paperback book and an e-book
  - A paper-based map and a smartphone map.
- What are the main concepts and metaphors that have been used for each (think about the way time is conceptualized for each of them)?
- How do they differ?
- What aspects of the paper-based artifact have informed the digital app?
- What is the new functionality?
- Are any aspects of the conceptual model confusing?
- What are the pros and cons?

Case Study

- The aim of this case study is for you to think about the appropriateness of different kinds of conceptual models that has been designed for similar physical and digital information artifacts;
- Compare the following:
  - A paperback book and an e-book.
- What are the main concepts and metaphors that have been used for each (think about the way time is conceptualized for each of them)?

Compare the following:
A paperback book and an e-book.
What are the main concepts and metaphors that have been used for each (think about the way time is conceptualized for each of them)?

Paperback book

- A book consists of chapters and sections
- The book has a title and author(s)
- Each chapter and section has a title.
- Each page has a page number
- A book has a table of contents.
- A reader reads from the book, makes summary, highlight some text

e-book

- A book consists of chapters and sections
- The book has a title and author(s)
- Each chapter and section has a title.
- Each page has a page number
- A book has a table of contents.
- A reader reads from the book, makes summary, highlight some text, remove highlight
- Search for specific word or sentence.
- Go to a particular page directly.
- Add book mark

Case Study

- Compare the following:
  - A paperback book and an e-book
- How do they differ?

Compare the following:
-A paperback book and an e-book
How do they differ?

Paperback book

- Clarity: Text size is fixed
- Look: Books can be of different shapes and sizes, different paper feel (silky, rough), different color, fancy covers, may look attractive.
- Carrying: bulk, takes space, heavy to carry, difficult to travel with them
- Searching for a book is more difficult in a crowded book-case
- Searching for a sentence or word can be time-consuming and needs lots of effort
- Highlighting text can not be removed
- Writing notes will spoil the book
- Difficult to read in a meeting

e-book

- Clarity: Text size can be resized for better clarity.
- Look: Looks Hi-Tech, thin, book readers display many books.
- Carrying: may carry hundreds at the same time, easy to take during travelling
- Searching for a book is very easy
- Searching for a sentence takes only seconds
- highlight and un-highlight at any time
- Writing notes without affecting the original look.
- Can read at any time and place.

Case Study

- Compare the following:
  - A paperback book and an e-book
- What aspects of the paper-based artifact have informed the digital app?

Case Study

- Compare the following:
  - A paperback book and an e-book
- What aspects of the paper-based artifact have informed the digital app?
  - Titles
  - Division into sections and sub sections
  - Page numbers
  - Table of contents
  - Operation : read

Case Study

- Compare the following:
  - A paperback book and an e-book
- What is the new functionality?

Case Study

- Compare the following:
  - A paperback book and an e-book
- What is the new functionality?
  - Searching
  - jumping to a specific page
  - Highlight and remove the highlight

Case Study

- Compare the following:
  - A paperback book and an e-book
- Are any aspects of the conceptual model confusing?

Case Study

- Compare the following:
  - A paperback book and an e-book
- Are any aspects of the conceptual model confusing?
  - Turning the pages from right to left in the paperback book but in the e-book, the pages are scrolled up and down (solved in new readers of e-books).
  - Having multiple book marks.

Case Study

- Compare the following:
  - A paperback book and an e-book
- What are the pros and cons (advantageous and disadvantageous)?

Compare the following:
A paperback book and an e-book
What are the pros and cons (advantageous and disadvantageous)?

Pros (advantageous)

- Clarity: Text size can be resized for better clarity
- Carrying: may carry hundreds at the same time, easy to take during travelling.
- Searching for a book is very easy
- Searching for a sentence takes only seconds
- highlight and un-highlight at any time
- Writing notes without affecting the original look.
- Can read at any time and place.

Cons (disadvantageous)

- Look: Looks Hi-Tech, thin but Books can be of different shapes and sizes, different paper feel (silky, rough), different color, fancy covers, may look attractive.
- E-book readers needs charging to work, requires basic computer experience but the paperback you just have to read them when you have them.
- Can not share the book.

Summary

- Developing a conceptual model involves good understanding of the problem space, specifying what it is you are doing, why, and how it will support users
- A conceptual model is a high-level description of a product in terms of what users can do with it and the concepts they need to understand how to interact with it
- Interaction types (e.g. conversing, instructing) provide a way of thinking about how best to support user's activities

References

- http://library.ndsu.edu/tools/dspace/load/?file=/repository/bitstream/handle/10365/23054/Swati_Online%20Shopping%20Cart%20Application.pdf?sequence=1
- http://www.wired.com/2013/03/conversational-user-interface/
- https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/interaction-styles
- http://www.blastam.com/blog/index.php/2010/08/usability-and-user-experience
- https://en.wikipedia.org/wiki/3D_interaction
- http://webstaff.itn.liu.se/~matco/TNM053/Papers/VEinteractionTechniques.ps
- http://pt.slideshare.net/guestb7fe74/exploring-the-use-of-tangible-user-interface-for-humanrobot-interaction
- https://en.wikiversity.org/wiki/Designing_a_Problem_Space_for_a_Collaborative_Work_Environment
- http://southworks.com/blog/2008/09/28/thesis-software-as-a-service/