SE 204, IES 506 – Human Computer Interaction

Lecture 10: Direct Manipulation Interfaces

Lecturer: Gazihan Alankuş

Please look at the end of the presentation for assignments (marked with TODO)
CHAPTER 5:
Direct Manipulation and Virtual Environments

Designing the User Interface:
Strategies for Effective Human-Computer Interaction

Fifth Edition

Ben Shneiderman & Catherine Plaisant

in collaboration with
Maxine S. Cohen and Steven M. Jacobs

Modified by Gazihan Alankuş

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Overview

• Midterm exam review
• Homework reminders
• Course content
  – Direct Manipulation
  – Virtual Environments
Midterm and grade percentages

• Syllabus for IES 506 is valid
• Syllabus for SE 204 has changed without my information or control
  – This is a passive-aggressive note in case it was not clear 😊
• Midterm
  – 30% for SE 204
  – 20% for IES 506
Grade Percentage Reminders

SE 204
- %10 Attendance
- %20 Homeworks
- %30 Midterm
- %40 Final

(ignores what ECTS syllabus says)

IES 506
- %10 Attendance
- %20 Homeworks
- %20 Midterm
- %50 Project

(as it says on ECTS syllabus)
Homework Reminders

• Look at the last slides
Overview

• Direct Manipulation
• Virtual Environments
Some emotions related to user interfaces

Boring!
Some emotions related to user interfaces
Introduction

• Positive feelings associated with good user interfaces:
  – Mastery of the interface
  – Competence in performing tasks
  – Ease in learning the system originally and in assimilating advanced features
  – Confidence in the capacity to retain mastery over time
  – Enjoyment in using the system
  – Eagerness to show the system off to novices
  – Desire to explore more powerful aspects of the system
Direct-Manipulation Interfaces (Briefly mentioned in Week 3)

An example of progression towards more direct manipulation: less recall/more recognition, fewer keystrokes/fewer clicks, less capability to make errors, and more visible context.

- a. Command line
- b. Form fill-in to reduce typing
- c. Improved form fill-in to clarify and reduce errors
- d. Pull-down menus offer meaningful names and eliminate invalid values
- e. 2-D menus to provide context, show valid dates, and enable rapid single selection
Direct-Manipulation Interfaces

• Central ideas:
  – Visibility of the objects and actions of interest
  – Rapid, reversible, incremental actions
  – Replacement of typed commands by a pointing action on the object of interest
A History of Text Editors (with demonstrations)

- Ed
- Emacs, vi, etc
- WYSIWYG (word)
Examples of Direct-Manipulation Systems

Command line vs. display editors and word processors

- Training times with display editors are much less than line editors
- Line editors were initially more flexible and powerful
- The advances of WYSIWYG word processors:
  - Display a full page of text
  - Display of the document in the form that it will appear when the final printing is done
  - Show cursor action
  - Control cursor motion through physically obvious and intuitively natural means
  - Use of labeled icon for actions
  - Display of the results of an action immediately
  - Provide rapid response and display
  - Offer easily reversible actions
Examples of Direct-Manipulation Systems

Text editors / word processing software
Remember the example of curb cuts
Technologies that derive from the word processor:

- Integration of media
- Desktop publication software
- Slide-presentation software
- Hypermedia environments
- Improved macro facilities
- Spell checker and thesaurus
- Grammar checkers
Examples of Direct-Manipulation Systems (cont.)

The VisiCalc spreadsheet and its descendants (Excel, etc)

- VisiCalc users delighted in watching the program propagate changes across the screen.
Examples of Direct-Manipulation Systems (cont.): spreadsheet

![Spreadsheet Image]

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<th>League</th>
<th>At Bats</th>
<th>Runs</th>
<th>Hits</th>
<th>Games Played</th>
<th>Hits per game</th>
<th>Doubles</th>
<th>Triples</th>
<th>Home Run</th>
<th>RBI</th>
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Examples of Direct-Manipulation Systems (cont.)

Spatial Data Management

• In some cases, spatial representations provide a better model of reality (e.g., Google maps)
• Successful spatial data-management systems depend on choosing appropriate:
  – Icons
  – Graphical representations
  – Natural and comprehensible data layouts
Examples of Direct-Manipulation Systems (cont.)
spatial data management
Examples of Direct-Manipulation Systems (cont.)

Video games

- Great example for direct manipulation
- Games require pleasant and easy experiences.
- Direct-manipulation interfaces can provide such experiences
Examples of Direct-Manipulation Systems (cont.)

Video games

• Nintendo Wii, Sony PlayStation, Microsoft Xbox, etc.
• Field of action is visual and compelling
• Commands are physical actions whose results are immediately shown on the screen
• No syntax to remember
• Most games continuously display a score
• Direct manipulation in SimCity
• Second Life virtual world
• Spore, WoW, Sims, etc.
Examples of Direct-Manipulation Systems (cont.)

Video games

Welcome to LustyMud!

There's an Easter egg hunt going on! You may pick up your baskets in the town square. Eggs are hidden all over the mud; find them and put them in your basket. They don't count unless they are in your basket. The contest ends Easter Sunday at midnight (mad time), and the player with the most eggs will win a great prize.

You are the Rebel without Cause (link-dead).

The entrance to the Lusty Mud Neotile Guild is north.

A digital clock hangs from a signpost here.

> (m) And was "Pretty in Pink" (High Priest) (idle)
> (m) Bumro has killed Gislaror (Independent)
> (m) Ellingsen was victorious over Puny (Independent)
> (m) Jib the Incredible Hulk (Cardinal) (idle)
> (m) Maximus the great champion (idle)
> (m) Pest the Great King Khufu (Lesser Hierophant) (idle)
> (m) Sandor the Anarchist (Cardinal) (idle)

Total of 7 players.

You have 8769735 experience points, 75000 gold coins,
107 hit points (of 194), and 194 spell points.

You are Bumro the Most Honorable Do-Gooder (Independent) (level 19).

Your alignment puts you in the category of paladin.

You are in a drunken stupor.

Vingy mode (Flee when below 1/5 hit points).
Examples of Direct-Manipulation Systems (cont.)

Guitar Hero video game
Examples of Direct-Manipulation Systems (cont.)

Computer-aided design
Examples of Direct-Manipulation Systems (cont.)

Computer-aided design

• Computer-aided design (CAD) use direct manipulation
• Manipulate the object of interest
• Generate alternatives easily
• Explain the impact
• Problem solving by analogy to the real-world
Examples of Direct-Manipulation Systems (cont.)

Office automation

- Xerox Star was a pioneer with sophisticated formatting
- Apple Lisa System
- Rapid and continuous graphical interaction
- Microsoft Windows is a descendant
Continuing evolution of Direct-Manipulation Systems

Direct-Manipulation interfaces are being used in a wide range of applications, e.g. management dashboard for a retail store.
Continuing evolution of Direct-Manipulation Systems (cont.)
Discussion of Direct Manipulation

Successful direct manipulation

- Present appropriate representation or model of reality
- Do not have to mimic the real world
- Should enrich the experience and make it intuitive
- Should require minimal effort
Discussion of Direct Manipulation

Problems with direct manipulation

• Spatial or visual representations can be too spread out
• High-level flowcharts and database-schema can become confusing
• Designs may force valuable information off of the screen
• Users must learn the graphical representations
• The visual representation may be misleading
• Typing commands with the keyboard may be faster
Principles of Direct Manipulation

1. Continuous representations of the objects and actions of interest with meaningful visual metaphors.
2. Physical actions or presses of labeled buttons, instead of complex syntax.
3. Rapid, incremental, reversible actions whose effects on the objects of interest are visible immediately.
Successful Use of Direct Manipulation

- Novices can learn quickly, usually through watching demonstrations
- Experts can work rapidly without limitation
- Knowledgeable users can retain usage
- Error messages are rarely needed
- Users can immediately see if they are making progress towards their goals and can quickly change direction if not
- Users have less anxiety because they can undo
- Confidence, mastery, feelings of control, ability to predict what will happen
Interface-Building Tools

Visual Thinking and Icons

- The visual nature of computers can challenge the first generation of hackers
- An icon is an image, picture, or symbol representing a concept
- Icon-specific guidelines
  - Represent the object or action in a familiar manner
  - Limit the number of different icons
  - Make icons stand out from the background
  - Consider three-dimensional icons
  - Ensure a selected icon is visible from unselected icons
  - Design the movement animation
  - Add detailed information
  - Explore combinations of icons to create new objects or actions
Overview

• Direct Manipulation
• Virtual Environments
3D Interfaces
3D Interfaces

• “Pure” 3D interfaces have strong utility in some contexts, e.g., medical, product design. In other situations, more constrained interaction may actually be preferable to simplify interactions.

• “Enhanced” interfaces, better than reality, can help reduce the limitations of the real-world, e.g., providing simultaneous views.

• Avatars in multiplayer 3-D worlds

• First person games
3D Interfaces
3D Interfaces (cont.)

Features for effective 3D

- Use occlusion, shadows, perspective, and other 3D techniques carefully.
- Minimize the number of navigation steps for users to accomplish their tasks.
- Keep text readable.
- Avoid unnecessary visual clutter, distraction, contrast shifts, and reflections.
- Simplify user movement.
- Prevent errors.
- Simplify object movement
- Organize groups of items in aligned structures to allow rapid visual search.
- Enable users to construct visual groups to support spatial recall.
3D Interfaces (cont.)

Guidelines for inclusion of enhanced 3D features:

- Provide overviews so users can see the big picture
- Allow teleoperation
- Offer X-ray vision so users can see into or beyond objects.
- Provide history keeping
- Permit rich user actions on objects
- Enable remote collaboration
- Give users control over explanatory text and let users select for details on demand.
- Offer tools to select, mark, and measure.
3D Interfaces (cont.)

Guidelines for inclusion of enhanced 3D features (cont.):

– Implement dynamic queries to rapidly filter out unneeded items.
– Support semantic zooming and movement
– Enable landmarks to show themselves even at a distance
– Allow multiple coordinated views
– Develop novel 3D icons to represent concepts that are more recognizable and memorable.
Teleoperation

- Two “parents”: direct manipulation in personal computers and process control in complex environments
- Physical operation is remote
Teleoperation

• Complicating factors in the architecture of remote environments:
  – Time delays
    • transmission delays
    • operation delays
  – Incomplete feedback
  – Feedback from multiple sources
  – Unanticipated interferences
Virtual and Augmented Reality
Virtual and Augmented Reality

- Virtual reality breaks the physical limitations of space and allow users to act as though they were somewhere else
- Augmented reality shows the real world with an overlay of additional overlay
- Situational awareness shows information about the real world that surrounds you by tracking your movements in a computer model
Virtual and Augmented Reality (cont.)

• Successful virtual environments depend on the smooth integration of:
  – Visual Display
  – Head position sensing
  – Hand-position sensing
  – Force feedback
  – Sound input and output
  – Other sensations
  – Cooperative and competitive virtual reality
Impact of this technology in our everyday lives

*da Vinci* Surgical System in a General Procedure Setting

- **OR Monitor**
- **Patient-Side Cart**
- **Anesthesiologist**
- **Assistant**
- **Nurse**
- **Surgeon at Operative Console**
- **Foot pedals reposition an image**
- **InSite2 Vision** provides true-to-life 3-D images of the operative field.
- **Surgeon uses open-surgery hand movements which are precisely replicated in the operative field by the EndoWrist Instruments.**

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Todo Homework Reminders
Todo: Homework week 7 due April 23 (Today)

- Get two users to test your prototype
  - Don’t have to be on campus (can be if you want)
  - Should be in your target audience (people that do not know the IEU campus well)
  - Identify a couple of clear tasks that your interface is created to address
    - Test each of them one by one
  - Videotape the prototype
    - Optionally, also videotape the user’s face
  - Learn from the user test
    - Follow the instructions in Saul Greenberg’s slides
    - Create the necessary deliverables
TODO: Homework for IES 506 only, due today (April 916)

  – Summarize it in about a page

• Also
  – Send me weekly reports about your projects!!