

Data Entry, Mice and Manipulation

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SWE 632

User Interface Design and Development

Cooper, Ch 18-19

Outline / Overview

1. Improving Data Entry (*ch 18*)
2. Pointing, Selecting, and Direct Manipulation (*ch 19*)

Ch 18 : Improving Data Entry

- Being considerate (*ch 12*) is particularly important when users enter data
- Implementation-model thinking (*ch 13*) makes it particularly difficult to design usable data entry screens
- Some major issues :
 - Data integrity and data immunity
 - Auditing and editing data

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3

Data Integrity versus Data Immunity

- I've heard the phrase "garbage in, garbage out" since I was in college
- It means if the users enter incorrect data then the program will behave incorrectly
- Experienced developers design the user interface to block invalid data

Data Integrity : The state of the program is based on correct, valid input data

- *Input data validation* means checking the data before sending it to the software and rejecting it if does not conform

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Input Data Validation is Anti-Usable

Input data validation is like a rude guard at a security check who won't let you through if you (*gasp*) have a 4 ounce bottle of eyedrops !

- It puts the needs of the database before the needs of the users
- It makes users feel like suspects
- It treats typos like malicious behavior
- Sometimes invalid data is reasonable
 - We don't have the complete data
 - We mis-typed something
 - It really doesn't matter – the rules are overly restrictive
- This makes users feel they are **not** in control

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Data Immunity

- Instead of using data validation to ensure integrity ...
- Make the software **immune** from invalid data

**Most invalid data can be modified to be valid
by the software !**

- Four types of immunization
 1. Repairing automatically
 2. Masking out invalid data
 3. Flexible rule enforcement
 4. Auditing instead of editing

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(1) Repair Data

- Think about google ... if you search on “gorge mson”, google will respond : “Showing results for george mason”
 - Plus a link to a page that matches the original string
- Examples of automatically fixing data:
 - Words can be converted to numbers (“five” to “5”)
 - Look for relationships in data (“Fairfax, BA” to “Fairfax, VA”)
- Let the programmers be creative !

Ultimately, it saves money to have the programmers work harder than requiring the users to work harder

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(2) Mask Out Invalid Data

- For many types of data, the UI can prevent invalid data from being entered
 - Why allow “five” for a number – use masking to ignore all non-numeric characters
 - Fill in dashes automatically, so it doesn’t matter if the users entered “123-45-6789” or “123456789”
 - Use radio buttons or dropdowns when possible

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(3) Enforce Rules Flexibly

- Defining good rules is hard – defining perfect rules is impossible !
- Three levels of rules :
 1. The restrictions we really want (intent)
 2. The restrictions we describe (specifications)
 3. The restrictions we implement (law)
- The three never match perfectly, and a considerate person will consider the intent instead of the law
- Allow some rules to be bent
 - Always keep a log to check later

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(4) Audit, Don't Edit

If it can't be fixed ...

Do we have to alert the users *right now* ?

- Missing data is often flagged as a data integrity error
- The missing data can sometimes be entered later
- Tell the users the data is missing with modeless feedback
 - Modeless : feedback that they do not have to respond to
- Missing data can often be inferred from existing data – but the programmers have to work instead of the users

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(4) Audit, Inform, and Postpone Edits

- TurboTax has a separate “tax audit” phase where it looks for data errors after all the data entry
 - This does not interfere with the user’s flow
- Real-time spell checking unobtrusively tells you when a word is misspelled
 - Users can go back and check it later – if they want !
 - Some “misspelled” words are okay ... no dictionary is complete and perfect (they usually don’t include “*Offutt*”)

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Data Entry Summary

**Protect the users from mistakes
Don’t prevent them from doing their jobs**

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Ch 19 : Direct Manipulation

- Direct Manipulation is about *visual feedback*, not just about *using a mouse*
 - Visual representation of objects
 - Physical actions instead of text entry
 - Immediate feedback from operations
- Cooper : “*I’ve seen many instances of direct-manipulation idioms implemented without adequate visual feedback, and these idioms fail to satisfy the definition of effective direct manipulation.*”
- That’s what I mean by “*a menu system with a mouse.*”

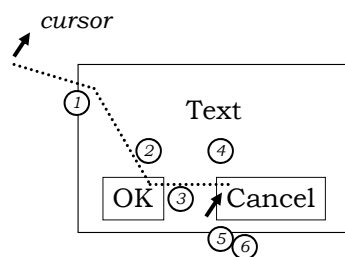
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13

GUI Events

Events are state changes generated when the interface is manipulated (usually the cursor is moved or the mouse is clicked)



Mouse Events

1. Into text box
2. Into OK button
3. Out of OK
4. Into Cancel button
5. Left mouse button down
6. Left mouse button up

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GUI Events (2)

Speeding up a GUI is primarily about reducing the number of events needed to accomplish a task.

Levels of events

1. User level
 - Selecting
 - Dragging
 - Resizing
2. GUI level
 - Crossing a widget boundary
 - Button down
 - Button up

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Program vs. Content Manipulation

- Program manipulation is about managing the program and its interface – all syntax
- Content manipulation is about manipulating content – based on task semantic knowledge
- Types of program manipulation :
 - Selection
 - Drag and drop
 - Control manipulation
 - Resizing, reshaping and repositioning
 - Connecting objects

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The Mouse

- “Democracy is a terrible system of organizing a society, but it’s better than any of the others”
 - Winston Churchill
- So is a mouse a terrible selection device, but it’s better than any other
- The worst aspect of a mouse is that it forces us to take our hands off the keyboard
- MS Word 2012? :
 - We type text
 - We issue commands with voice
 - CLs are natural – typing commands is not

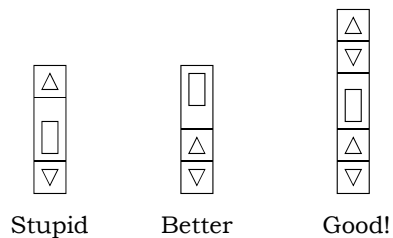
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Selecting Events

- Cooper talks about using a pen input to be used as a pointer, but it is much harder to pick up a pen than grasp a mouse
 - This is why pens are no longer widely used
- Keep events close together!



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User Level Language Hints

- Provide a way to escape from dragging
 - escape
 - any keystroke
 - chord-click-click right button to cancel
 - MS API does not define chord-click
 - Programmers must go to the GUI level
- Try to avoid mixing fine motor control (clicking) with gross motor (dragging) as much as possible
- Provide visual feedback when grasping (selecting)
- Apply the principle of locality
 - Put widgets that users will use adjacently in time adjacent in space

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Direct Manipulation Summary

**All interaction with the mouse
should result in visual feedback**

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Selection

- Just as with command languages (CLs), GUI operations have two parts:
 - Operation (verb)
 - Operands (objects)
- CLs often use natural speaking style : verb-object
- GUIs should usually let the user select an object, then apply an operation : object-verb
- This makes selection very important

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Discrete and Contiguous Selection

- Discrete data : Objects that are independent and need to be selected independently
 - Picture elements in a drawing tool
- Contiguous data : Objects that are grouped together in lists or matrices
 - Spreadsheet cells and words in word processors
- Whether data is discrete or contiguous sometimes depends on user needs
 - Files can often be selected in both ways
 - Shift-left mouse for contiguous selection
 - Ctrl-left mouse for discrete selection

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Selection Styles

- Mutual Exclusion : Selecting a new object “unselects” the previous object
- Additive Selection : Selecting a new object adds it to the group of selected objects
 - Usually implemented with a meta-key such as shift or ctrl
- Insertion selection allows a new object to be inserted between existing objects
- Replacement selection allows a new object to replace existing objects

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Selection Summary

The user must always know what was selected before choosing an operation

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Drag and Drop

- Drag-and-drop is one of the most powerful direct manipulation idioms
- The Web has decreased its use
 - How do you drag-and-drop in a Web interface?
 - How do you program drag-and-drop in HTML?
 - Use JavaScript ...
 - <http://www.dhtmlgoodies.com/scripts/drag-drop-custom/demo-drag-drop-3.html>
- From the book : “Microsoft ... pioneered some novel uses ... movable toolbars and dockable palettes”
 - These were in the Xerox Star circa 1982

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Source-and-Target

- Selecting an object and dragging it to another object
 - Moving documents among directories
 - Not moving an object around on a background
- Dragging to a control
 - Printer, trashcan, file archiving, compilers
 - Receiver must be able to accept anything, or refuse objects it cannot recognize
 - Another instance of data integrity / immunity

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Visual Feedback

- The source-object must change appearance when
 - The cursor is on its handle
 - It is selected
- When an object passes over a possible recipient (“*drop candidate*”), it must change its appearance to indicate that it can accept the object
- Users need to know what happens if they “let go”
 - Letting go is easy to do accidentally, so it shouldn’t cause problems
 - Always provide undo

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Other Issues

- Auto-scrolling : When dragging an object outside the visible window, the application should scroll automatically
 - Excel has a real problem ... if we are not careful we can suddenly move tens of thousand of rows down!
- Avoid “twitchiness” : When I select, my hand “twitches” a few pixels (except for surgeons and pilots)
 - Don’t start the drag until the object moves 3 or 4 pixels
- How do users move precisely 1 or 2 pixels?
 - Add more resolution (*mouse vernier*)
 - Use arrow keys for 1 pixel movements

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De-sensitizing the Mouse

- Don't move objects when users twitch while releasing the button
 - Desensitize the mouse after precise pixel movements
- Don't let the heel of the thumb move the mouse on a laptop keypad
 - My laptop turns the keypad off after 2 or 3 keystrokes

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Drag and Drop Summary

Users expect everything to be draggable

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Control Manipulation

- Too much detail, let's skip it ...

Data Entry and Visual Manipulation Summary

**Be polite to users and
give them controls that let them
focus on their jobs**