Systems Analysis and Design

Alan Dennis, Barbara Wixom, and David Tegarden

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Slides by Fred Niederman
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Objectives

■ Understand several fundamental user interface design principles.
■ Understand the process of user interface design.
■ Understand how to design the user interface structure.
■ Understand how to design the user interface standards.
■ Understand commonly used principles and techniques for navigation design.
■ Understand commonly used principles and techniques for input design.
■ Understand commonly used principles and techniques for output design.
■ Be able to design a user interface.
Principles for User Interface Design
## Principles

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout</td>
<td>The interface should be a series of areas on the screen that are used consistently for different purposes—for example, a top area for commands and navigation, a middle area for information to be input or output, and a bottom area for status information.</td>
</tr>
<tr>
<td>Content awareness</td>
<td>Users should always be aware of where they are in the system and what information is being displayed.</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>Interfaces should be functional and inviting to users through careful use of white space, colors, and fonts. There is often a tradeoff between including enough white space to make the interface look pleasing without losing so much space that important information does not fit on the screen.</td>
</tr>
<tr>
<td>User experience</td>
<td>Although ease of use and ease of learning often lead to similar design decisions, there is sometimes a tradeoff between the two. Novice users or infrequent users of software will prefer ease of learning, whereas frequent users will prefer ease of use.</td>
</tr>
<tr>
<td>Consistency</td>
<td>Consistency in interface design enables users to predict what will happen before they perform a function. It is one of the most important elements in ease of learning, ease of use, and aesthetics.</td>
</tr>
<tr>
<td>Minimal user effort</td>
<td>The interface should be simple to use. Most designers plan on having no more than three mouse clicks from the starting menu until users perform work.</td>
</tr>
</tbody>
</table>
User Interface Design Process

Chapter 12
Key Definitions

- The **navigation mechanism** provides the way for users to tell the system what to do.
- The **input mechanism** defines the way the system captures information.
- The **output mechanism** defines the way the system provides information to users or other systems.
Key Definitions

- The **graphical user interface (GUI)** is the most common type of interfaces most students are likely to use personally and for developing systems.
Use Scenario Development

- Use, scenario development
- Interface structure design
- Interface standards design
- Interface design prototyping
- Interface evaluation
FIGURE 12-7  An Example Window Navigation Diagram
Interface Standards Design

- The *interface standards* are the basic design elements that are common across the individual screens, forms, and reports within the system.
Interface Design Prototyping

- Storyboard
- HTML Prototype
- Language Prototype
- Interface Evaluation
  - Heuristic
  - Walkthrough
  - Interactive
- Formal Usability Testing
NAVIGATION DESIGN
Basic Principles

- Assume users
  - Have not read the manual
  - Have not attended training
  - Do not have external help readily at hand
- All controls should be clear and understandable and placed in an intuitive location on the screen.
Basic Principles

- Prevent mistakes
  - Limit choices
  - Never display commands that can’t be used (or “gray them out”)
  - Confirm actions that are difficult or impossible to undo

- Simplify recover from mistakes
- Use consistent grammar order
Types of Navigation Control

- Languages
  - Command language
  - Natural language

- Menus
  - Generally aim at broad shallow menu
  - Consider using “hot keys”

- Direct Manipulation
  - Used with icons to start programs
  - Used to shape and size objects
  - May not be intuitive for all commands
A Traditional Menu in a UNIX System

Copyright 1989-1997. PINE is a trademark of the University of Washington.
Common Types of Menus

Drop-Down Menu
Tool Bar with Buttons
Line Dividing Menu Group
Menu Bar
Graved Out Commands

A pop-up menu that is also a tab menu

Menu design needs to be user-friendly, with each menu containing a logical structure (i.e., consistent sequence of commands). A broad user interface ensures that users can perform actions. A menu can have up to eight items, and it should take no more than two mouse clicks or keystrokes from any menu to perform an action.

Never display a command that cannot be used. For example, many Windows applications gray out commands that cannot be used; they are displayed on pull-down menus in a very light-colored font, but they cannot be used. This shows that they are available (and keeps all menu items in the same place), but that they cannot be used at that time.
Example of an Image Map

When ancient navigators first crossed the Pacific by a compass of stars, they found a place of almost celestial beauty. The islands of Hawaii. Where the ocean turns luminous, and sand glitters in ivory, gold, and obsidian.

Today you may find its beauty in the sun-blushed vistas of Sheraton's Hawaii. A world of eight unique resorts, each at the heart of the islands' most legendary locations.
## Types of Menus

<table>
<thead>
<tr>
<th>Types of Menus</th>
<th>When Would You Use Each of These Menu Types?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu bar</td>
<td></td>
</tr>
<tr>
<td>Drop-down menu</td>
<td></td>
</tr>
<tr>
<td>Pop-up menu</td>
<td></td>
</tr>
<tr>
<td>Tab menu</td>
<td></td>
</tr>
<tr>
<td>Toolbar</td>
<td></td>
</tr>
<tr>
<td>Image map</td>
<td></td>
</tr>
</tbody>
</table>
Message Tips

- Should be clear, concise, and complete
- Should be grammatically correct and free of jargon and abbreviations (unless they are for the users)
- Avoid negatives and humor
Types of Messages

<table>
<thead>
<tr>
<th>Types of Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error message</td>
</tr>
<tr>
<td>Confirmation message</td>
</tr>
<tr>
<td>Acknowledgment message</td>
</tr>
<tr>
<td>Delay message</td>
</tr>
<tr>
<td>Help message</td>
</tr>
</tbody>
</table>

When Would You Use Each of These Message Types?
An Example of Crafting an Error Message

Stating the problem before the corrective action is more intuitive.

- Phone Number Error
  - Phone number is invalid.
  - Enter correct phone number.
  - OK Cancel

THE PROBLEM SHOULD BE STATED IN AS MUCH DETAIL AS POSSIBLE.

- Area Code Error
  - Phone number area code is invalid.
  - Enter correct phone number.
  - OK Cancel

ERROR MESSAGES SHOULD INCLUDE A MESSAGE NUMBER.

- Area Code (1265)
  - Phone number area code not recognized.
  - Please enter area code again.
  - OK Cancel

- Stating corrective action before the problem explanation can be confusing.
Your Turn

- Pretend that you are designing the new interface to a career services system at your university.
- How would you incorporate the basic principles of input design into your interface design?
INPUT DESIGN
Basic Principles

- The goal is to simply and easily capture accurate information for the system
- Reflect the nature of the inputs
- Find ways to simplify their collection
Online versus Batch Processing

- **Online processing** immediately records the transaction in the appropriate database.
- **Batch processing** collects inputs over time and enters them into the system at one time in a batch.
- Batch processing simplifies data communications and other processes, but means that inventory and other reports are not accurate in real time.
Capture Data at the Source

- Reduces duplicate work
- Reduces processing time
- Decreases cost
- Decreases probability of error
Source Data Automation

- Can be obtained by using the following technologies:
  - bar code readers
  - optical character recognition
  - magnetic stripe readers
  - smart cards

- How can internet be used for source data automation?
Minimize Keystrokes

- Never ask for information that can be obtained in another way
- List selection is more efficient than entering information
- Use default values where possible
Types of Inputs

- Data items linked to fields
- Text
- Numbers
- Selection boxes
Types of Input Boxes

Sample Input Form

Name:  

What is your major:  
(Check one only)
- MIS
- Accounting
- Marketing
- Computer Science
- Management

What software do you feel comfortable using:  
(Check all that apply)
- Word
- WordPerfect
- Excel
- Lotus 1-2-3
- Access

Select where you were born:

- Eastern Canada
- Central Canada
- Western Canada
- Northern Canada
- Eastern U.S.
- Central U.S.
- Southern U.S.
- Western U.S.
- Pacific U.S.
- Hawaii, Alaska
- Other U.S.
- Mexico
- Non-North America

Hair Color:  

- Brown
- Blonde
- Black
- Red

Interest Score:  

0  50  100  50

Document Done
## Types of Selection Boxes

<table>
<thead>
<tr>
<th>Types of Boxes</th>
<th>When Would You Use Each of These Box Types?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check box</td>
<td></td>
</tr>
<tr>
<td>Radio button</td>
<td></td>
</tr>
<tr>
<td>On-screen list box</td>
<td></td>
</tr>
<tr>
<td>Drop-down list box</td>
<td></td>
</tr>
<tr>
<td>Combo box</td>
<td></td>
</tr>
<tr>
<td>Slider</td>
<td></td>
</tr>
</tbody>
</table>
# Types of Input Validation

<table>
<thead>
<tr>
<th>Types of Validation</th>
<th>When Would You Use Each of These Validation Methods?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness check</td>
<td></td>
</tr>
<tr>
<td>Format check</td>
<td></td>
</tr>
<tr>
<td>Range check</td>
<td></td>
</tr>
<tr>
<td>Check digit check</td>
<td></td>
</tr>
<tr>
<td>Consistency check</td>
<td></td>
</tr>
<tr>
<td>Database checks</td>
<td></td>
</tr>
</tbody>
</table>
Your Turn

- Consider a Web form that a student would use to input student and resume information into a career services application.
  - Sketch out how this form would look and what data fields would be used
  - What validity checks would you need?
OUTPUT DESIGN
Basic Principles

- Understand report usage
  - Reference or cover-to-cover?
  - Frequency?
  - Real-time or batch reports?
- Manage information load
  - All needed information, no more
- Minimize bias
Bias in Graphs

Unbiased Graph with scale starting at 0

Biased Graph with scale starting at 90
### Types of Reports

<table>
<thead>
<tr>
<th>Types of Reports</th>
<th>When Would You Use Each of These Report Types?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail reports</td>
<td></td>
</tr>
<tr>
<td>Summary report</td>
<td></td>
</tr>
<tr>
<td>Turnaround document</td>
<td></td>
</tr>
<tr>
<td>Graphs</td>
<td></td>
</tr>
</tbody>
</table>
Report Media

Electronic

Versus Paper
Your Turn

- Under what conditions would you be most likely to replace reports on paper with ones delivered electronically? When might you NOT want to make the change?
CD Selections
CD Selections

(a) Search Results for: Stewart, Al
- 24 Carrots (1993) $11.97
- Best of Al Stewart (1987) $11.97
- Between the Wars (1995) $15.97
- Famous Last Words (1993) $15.97
- Modern Times (1992) $11.97

(b) Search Results for: Stewart, Al
- 24 Carrots by Al Stewart (1993)
  - CD Price: $11.97
  - Shipping Cost: $2.00
  - Usually ships within 2 days

  Buy Now
  Add to Cart

- Tracks:
  1. Running Man
  2. Midnight Rocks
  3. Constantinople
  4. Merlin's Time
  5. Mondo Sinistro
  6. Mumanak Run
  7. Rocks in the Ocean
  8. Paint by Number
  9. Optical Illusion
  10. Here in Angola
  11. Pandora
  12. Indian Summer

More Information
Summary

- The fundamental goal of navigation design is to make the system as simple to use as possible.
- The goal of input mechanism is to simply and easily capture accurate information.
- The goal of the output mechanism is to provide accurate information to users that minimize information overload and bias.
Expanding the Domain

- For many years, the University of Maryland has been a leader in research for ideas in human-computer interfaces. For more information investigate:

  http://www.cs.umd.edu/hcil/