Chapter 14: Designing the User Interface

Systems Analysis and Design in a Changing World, 3rd Edition

Learning Objectives

- Understand the difference between user interfaces and system interfaces
- Explain why the user interface is the system to the users
- Discuss the importance of the three principles of user-centered design
- Describe the historical development of the field of human-computer interaction (HCI)

Learning Objectives (continued)

- Describe the three metaphors of human-computer interaction
- Discuss how visibility and affordance affect usability
- Apply the eight golden rules of dialog design when designing the user interface
- List the key principles used in Web design
- Define the overall system structure as a menu hierarchy

Learning Objectives (continued)

- Write user-computer interaction scenarios as dialogs
- Create storyboards to show the sequence of forms used in a dialog
- Use UML class diagrams and sequence diagrams to document dialog designs
- Design windows forms and browser forms that are used to implement a dialog

Overview

- User interfaces handle input and output that involve a system user directly
- Focus on interaction between user and computer, called human-computer interaction (HCI)
- Metaphors to describe the user interface
- Usability and Web-based development guidelines
- Approaches to documenting dialog designs, including UML diagrams from OO approach

Identifying and Classifying Inputs and Outputs

- Identified by analyst when defining system scope
- Requirements model produced during analysis
  - Event table includes trigger to each external event
  - Triggers represent inputs
  - Outputs are shown as responses to events

Traditional and OO Approaches to Inputs and Outputs

- Traditional approach to inputs and outputs
  - Shown as data flows on context diagram, data flow diagram (DFD) fragments, and detailed DFDs
- OO approach to inputs and outputs
  - Defined by message entering or leaving system
  - Included in event table as triggers and responses
  - Actors provide inputs for many use cases
  - Use cases provide outputs to actors

User versus System Interface

- System interfaces: I/O requiring minimal human interaction
- User interfaces:
  - I/O requiring human interaction
  - User interface is everything end user comes into contact with while using the system
  - To the user, the interface is the system
- Analyst designs system interfaces separate from user interfaces
- Requires different expertise and technology

Understanding the User Interface

- Physical Aspects of the User Interface
  - Devices touched by user, manuals, documentation, and forms
- Perceptual Aspects of the User Interface
  - Everything else user sees, hears, or touches such as screen objects, menus, and buttons
- Conceptual Aspects of the User Interface
  - What user knows about system and logical function of system

Aspects of the User Interface

FIGURE 14-1

Physical, perceptual, and conceptual aspects of the user interface.

User-Centered Design

- Focus early on the users and their work by focusing on requirements
- Usability - system is easy to learn and use
- Iterative development keeps focus on user
  - Continual return to user requirements and evaluate system after each iteration
- Human-computer interaction (HCI)
  - Study of end users and interaction with computers
- Human factors engineering (ergonomics)

Fields Contributing to the Study of HCI

FIGURE 14-2

The fields contributing to the study of HCI.

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Metaphors for Human-Computer Interaction

- Direct manipulation metaphor
  - User interacts with objects on display screen
- Document metaphor
  - Computer is involved with browsing and entering data on electronic documents
  - WWW, hypertext, and hypermedia
- Dialog metaphor
  - Much like carrying on a conversation

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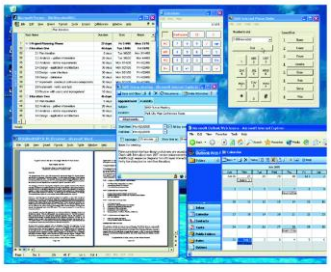
Desktop Metaphor Based on Direct Manipulation Shown on Display Screen

FIGURE 14-3
The desktop metaphor based on direct manipulation, shown on a display screen.



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Desktop Metaphor Shown as Hypermedia in a Web Browser

FIGURE 14-4
The document metaphor shown as hypermedia in a Web browser.

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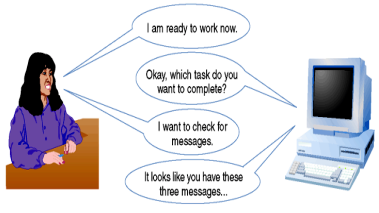
Dialog Metaphor Expresses the Messaging Concept

FIGURE 14-5
The dialog metaphor expresses the concept that the user and computer interact by sending messages.



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Guidelines for Designing User Interfaces

- Visibility
  - All controls should be visible
  - Provide immediate feedback to indicate control is responding
- Affordance
  - Appearance of control should suggest its functionality – purpose for which it is used
- System developers should use published interface design standards and guidelines

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Eight Golden Rules for Interactive Interface Design

FIGURE 14-7
The eight golden rules for designing interactive interfaces.

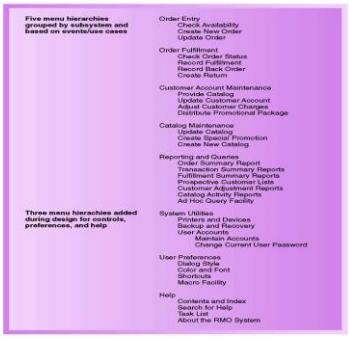
1. Strive for Consistency
2. Enable Frequent Users to Use Shortcuts
3. Offer Informative Feedback
4. Design Dialogs to Yield Closure
5. Offer Simple Error Handling
6. Permit Easy Reversal of Actions
7. Support Internal Locus of Control
8. Reduce Short-Term Memory Load

Documenting Dialog Designs

- Done simultaneously with other system activities
- Based on inputs and outputs requiring user interaction
- Used to define menu hierarchy
  - Allows user to navigate to each dialog
  - Provides overall system structure
- Storyboards, prototypes, and UML diagrams

Overall Menu Hierarchy Design

FIGURE 14-8



Dialogs and Storyboards

- Many methods exist for documenting dialogs
  - Written descriptions following flow of events
  - Narratives
  - Sketches of screens
  - Storyboarding – showing sequence of sketches of display screen during a dialog

Storyboard for Downtown Videos

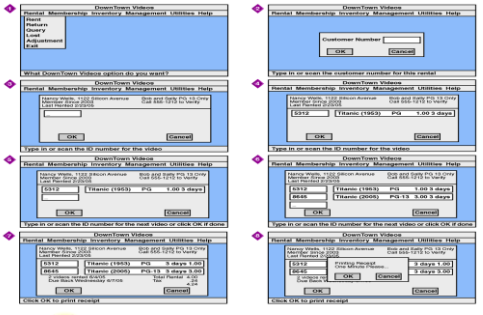


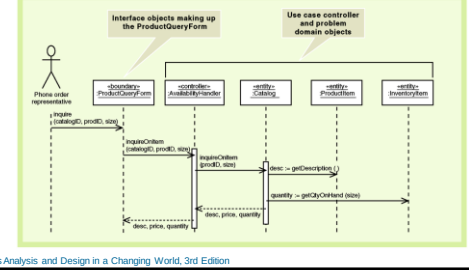
FIGURE 14-9

Dialog Documentation with UML Diagrams

- OO approach provides UML diagrams
- Use case descriptions
  - List of steps followed as system and user interact
- Activity diagrams
  - Document dialog between user and computer for a use case
- System sequence diagrams (SSD)
  - Actor (a user) sends messages to system
  - System returns information in form of messages

Sequence Diagram for the RMO *Look Up Item Availability* dialog

FIGURE 14-10



Class Diagram Showing Interface Classes Making up ProductQueryForm

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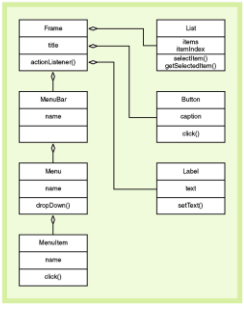
FIGURE 14-11
A class diagram showing interface classes making up the ProductQueryForm.



Sequence Diagram Showing Specific Interface Objects

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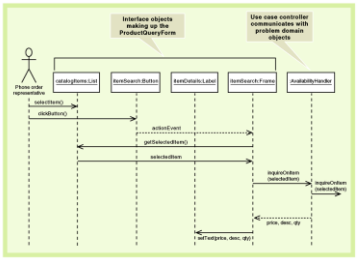

FIGURE 14-12
A sequence diagram showing specific interface objects making up the ProductQueryForm for the Look up item availability dialog (not all problem domain objects are shown).

Guidelines for Designing Windows and Browser Forms

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- Each dialog might require several window forms
- Standard forms are widely available
  - Windows: Visual Basic, C++, Java
  - Browser: HTML, VB-Script, JavaScript, ASP or Java servlets
- Implementation
  - Identify objectives of form and associated data fields
  - Construct form with prototyping tools

Forms Design Issues

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- Form layout and formatting consistency
  - Headings, labels, logos
  - Font sizes, highlighting, colors
  - Order of data-entry fields and buttons
- Data keying and data entry (use standard control)
  - Text boxes, list boxes, combo boxes, etc.
- Navigation and support controls
- Help support: tutorials, indexed, context-sensitive

Guidelines for Designing Web Sites

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- Draw from guidelines and rules for designing Windows forms and browser forms
- Website uses:
  - Corporate communication
  - Customer information and service
  - Sales, distribution, and marketing
- Must work seamlessly with customers 24/7

Dialog Design for RMO Phone-Order

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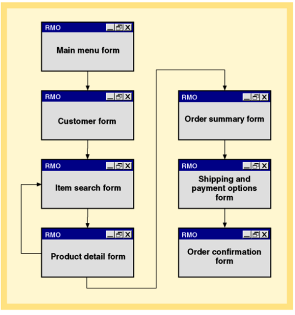
- Steps in dialog models
  1. Record customer information
  2. Create new order
  3. Record transaction details
  4. Produce order confirmation
- Traditional approach – produce structure chart
- OO approach – expand SSD to include forms

Required Forms for RMO

- Main menu
- Customer
- Item search
- Product detail
- Order summary
- Shipping and payment options
- Order confirmation

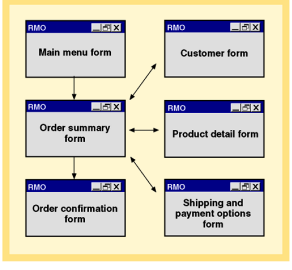
Design Concept for Sequential Approach to Create New Order Dialog

FIGURE 14-15
A design concept for the sequential approach to the *Create new order* dialog.



Design Concept for Order-Centered Approach to Create New Order Dialog

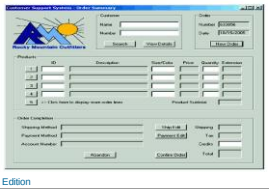
FIGURE 14-16
A design concept for an order-centered approach to the *Create new order* dialog.



Prototype Forms for an Order-Centered Approach to the Dialog

FIGURE 14-17
Prototype forms for an order-centered approach to the dialog.
(a) The Main Menu form for an order-centered approach to the dialog.

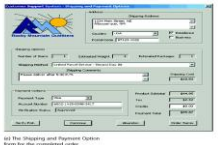
(b) The Order Summary form for an order-centered approach to the dialog beginning a new order.



Prototype Forms for an Order-Centered Approach to the Dialog (continued)

(c) The Product Detail form after the user has searched for a product.

(d) The Order Summary form after the user adds the product.



(e) The Shipping and Payment Option form for the completed order.

Dialog Design for RMO Web Site

- Basic dialog between user and customer similar to phone-order representative
- Web site will provide more information for user, be more flexible, and be easier to use
- More product pictures are needed
- Information needs are different for customer than for phone-order employees
- Guidelines for visibility and affordance are used to convey positive company image

RMO's Home Page

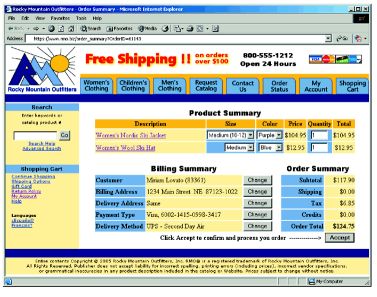
FIGURE 14-18
Rocky Mountain Outfitters' home page.

Product Detail Page from RMO Web Site

FIGURE 14-19
The Product Detail page from the Rocky Mountain Outfitters' Web site.

Shopping Cart Page from RMO Web Site

FIGURE 14-20
The shopping cart page from Rocky Mountain Outfitters' Web site.



Summary

- User interface is everything user comes into contact with while using the system
  - Physically, perceptually, and conceptually
- To some users, user interface is the system
- User-centered design means:
  - Focusing early on users and their work
  - Evaluating designs to ensure usability
  - Applying iterative development

Summary (continued)

- User interface is described with metaphors (desktop, document, dialog)
- Interface design guidelines and standards are available from many sources
- Dialog design starts with events, adds dialogs for integrity controls, user preferences, help, menus
- OO approach provides UML models to document dialog designs, including sequence diagrams, collaboration diagrams, and class diagrams