Universitas Esa Unggul

Smart, Creative and Entrepreneurial

# CCA220-Analisis dan Perancangan system Informasi

www.esaunggul.ac.id


**Dosen Pengampu :**

**5165-Kundang K Juman, Ir, MMSI**

**Prodi Teknik Informatika dan Sistem Informasi - Fakultas Ilmu Komputer**

# Systems Analysis and Design

## 5th Edition

# Chapter 9. User Interface Design

Alan Dennis, Barbara Haley Wixom, and Roberta Roth

# Chapter 9 Outline

- Principles of user interface design.
- User interface design process.
- Navigation design.
- Input design.
- Output design.

# INTRODUCTION

- **Interface design** is the process of defining how the system will interact with external entities.
- In this chapter, we focus on the design of ***user interfaces*** – how the system will interact with the users.
- The design of system interfaces defines how the systems exchange information with other systems.

# (cont'd)

- The user interface includes three fundamental parts:

- The ***Navigation mechanism*** - the way in which the user tells the system what to do.
- The ***input mechanism*** – the way in which the system captures information.
- The **output mechanism** - the way in which the system provides information to the user or to other systems.

- **Graphical user interfaces (GUI)** use windows, menus, icons, etc., and are the most common type of user interfaces.

# PRINCIPLES FOR USER INTERFACE DESIGN

- User interface design is an art.
- The goal is to make the interface pleasing to the eye and simple to use, while minimizing the user's effort.
- Difficulty lies in using space effectively

# (cont'd)

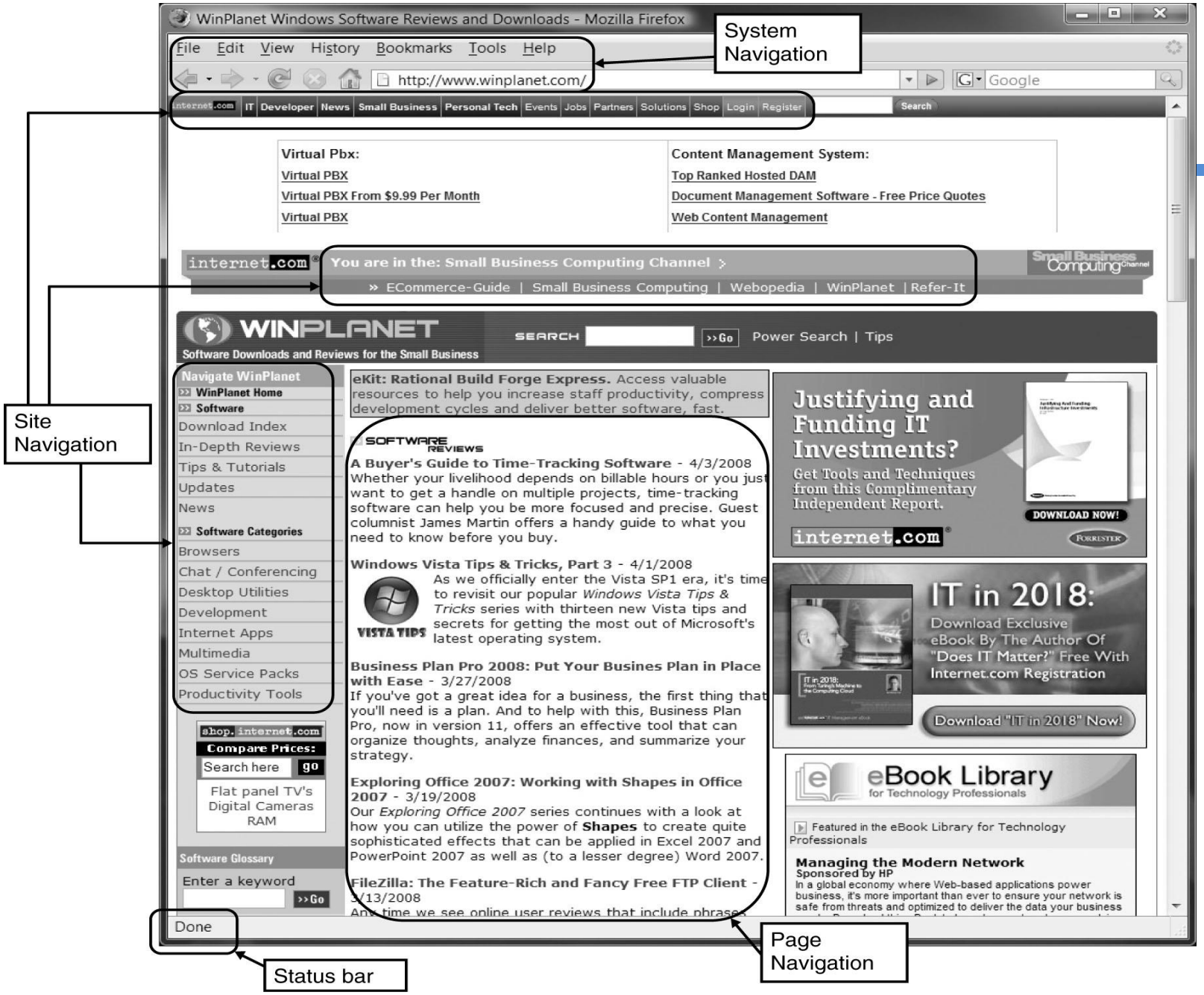
| Principle | Description |
|---|---|
| Layout | The interface should be a series of areas on the screen that are used consistently for different purposes—for example, a top area for commands and navigation, a middle area for information to be input or output, and a bottom area for status information. |
| Content awareness | Users should always be aware of where they are in the system and what information is being displayed. |
| Aesthetics | Interfaces should be functional and inviting to users through careful use of white space, colors, and fonts. There is often a trade-off between including enough white space to make the interface look pleasing and losing so much space that important information does not fit on the screen. |
| User experience | Although ease of use and ease of learning often lead to similar design decisions, there is sometimes a trade-off between the two. Novice users or infrequent users of software will prefer ease of learning, whereas frequent users will prefer ease of use. |
| Consistency | 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. |
| Minimize user effort | 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. |

# Layout

- ***Layout*** refers to organizing areas of the screen and document for different purposes and using these areas consistently throughout the user interface.
- The screen is often divided into three areas:
  - The top area provides the user with ways to navigate through the system;
  - The middle and the largest area is for display of user's work; and
  - The bottom area contains status information about that the user is doing.

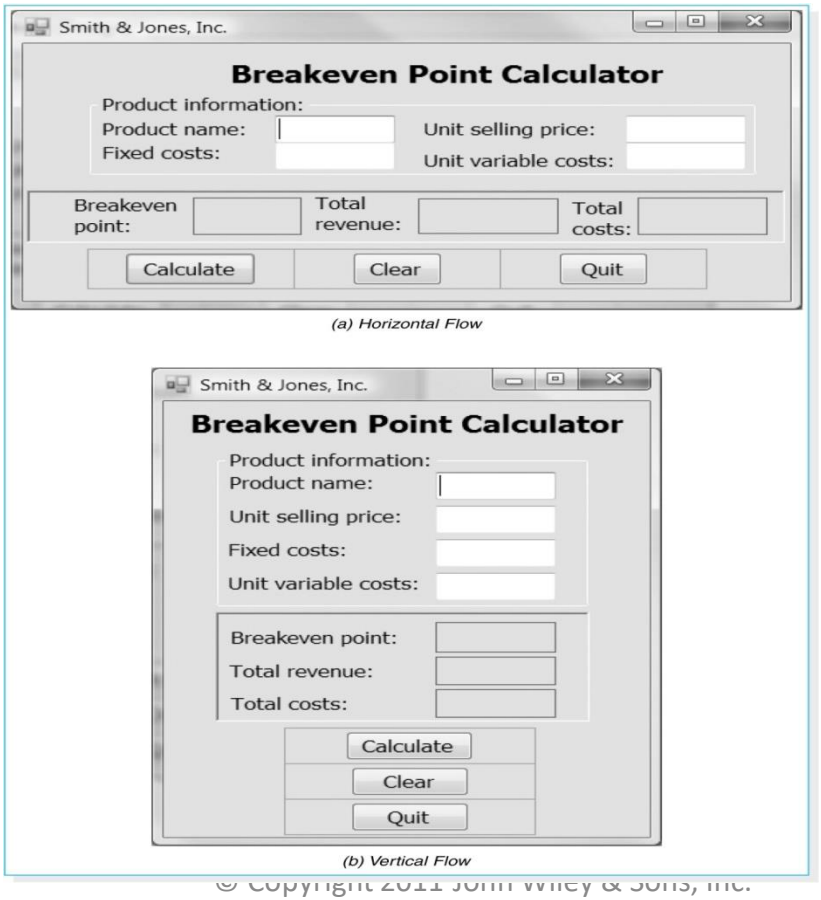
# (cont'd)

- The areas and information within areas should have a natural intuitive flow to minimize user's movement from one area to the next.
- Ideally, the areas will remain consistent in
  - size,
  - shape,
  - placement for the forms, and
  - reports used to present it.


WinPlanet Windows Software Reviews and Downloads - Mozilla Firefox
System Navigation
File Edit View History Bookmarks Tools Help
http://www.winplanet.com/
Google
internet.com IT Developer News Small Business Personal Tech Events Jobs Partners Solutions Shop Login Register
Search
Virtual Pbx:
Virtual PBX
Virtual PBX From $9.99 Per Month
Virtual PBX
Content Management System:
Top Ranked Hosted DAM
Document Management Software - Free Price Quotes
Web Content Management
internet.com
You are in the: Small Business Computing Channel
» ECommerce-Guide | Small Business Computing | Webopedia | WinPlanet | Refer-It
Small Business Computing Channel
WINPLANET
Software Downloads and Reviews for the Small Business
SEARCH
>>Go
Power Search | Tips
Site Navigation
Navigate WinPlanet
WinPlanet Home
Software
Download Index
In-Depth Reviews
Tips & Tutorials
Updates
News
Software Categories
Browsers
Chat / Conferencing
Desktop Utilities
Development
Internet Apps
Multimedia
OS Service Packs
Productivity Tools
shop.internet.com
Compare Prices:
Search here
go
Flat panel TV's
Digital Cameras
RAM
Software Glossary
Enter a keyword
>>Go
eKit: Rational Build Forge Express. Access valuable resources to help you increase staff productivity, compress development cycles and deliver better software, fast.
SOFTWARE REVIEWS
A Buyer's Guide to Time-Tracking Software - 4/3/2008
Whether your livelihood depends on billable hours or you just want to get a handle on multiple projects, time-tracking software can help you be more focused and precise. Guest columnist James Martin offers a handy guide to what you need to know before you buy.
Windows Vista Tips & Tricks, Part 3 - 4/1/2008
VISTA TIPS
As we officially enter the Vista SP1 era, it's time to revisit our popular Windows Vista Tips & Tricks series with thirteen new Vista tips and secrets for getting the most out of Microsoft's latest operating system.
Business Plan Pro 2008: Put Your Busines Plan in Place with Ease - 3/27/2008
If you've got a great idea for a business, the first thing that you'll need is a plan. And to help with this, Business Plan Pro, now in version 11, offers an effective tool that can organize thoughts, analyze finances, and summarize your strategy.
Exploring Office 2007: Working with Shapes in Office 2007 - 3/19/2008
Our Exploring Office 2007 series continues with a look at how you can utilize the power of Shapes to create quite sophisticated effects that can be applied in Excel 2007 and PowerPoint 2007 as well as (to a lesser degree) Word 2007.
FileZilla: The Feature-Rich and Fancy Free FTP Client - 3/13/2008
Justifying and Funding IT Investments?
Get Tools and Techniques from this Complimentary Independent Report.
DOWNLOAD NOW!
internet.com
FORRESTER
IT in 2018:
Download Exclusive eBook By The Author Of "Does IT Matter?" Free With Internet.com Registration
Download "IT in 2018" Now!
eBook Library
for Technology Professionals
Featured in the eBook Library for Technology Professionals
Managing the Modern Network
Sponsored by HP
In a global economy where Web-based applications power business, it's more important than ever to ensure your network is safe from threats and optimized to deliver the data your business
Done
Status bar
Page Navigation

# (cont'd)

The flow between sections should also be consistent.




(a) Horizontal Flow

(b) Vertical Flow

# Content Awareness

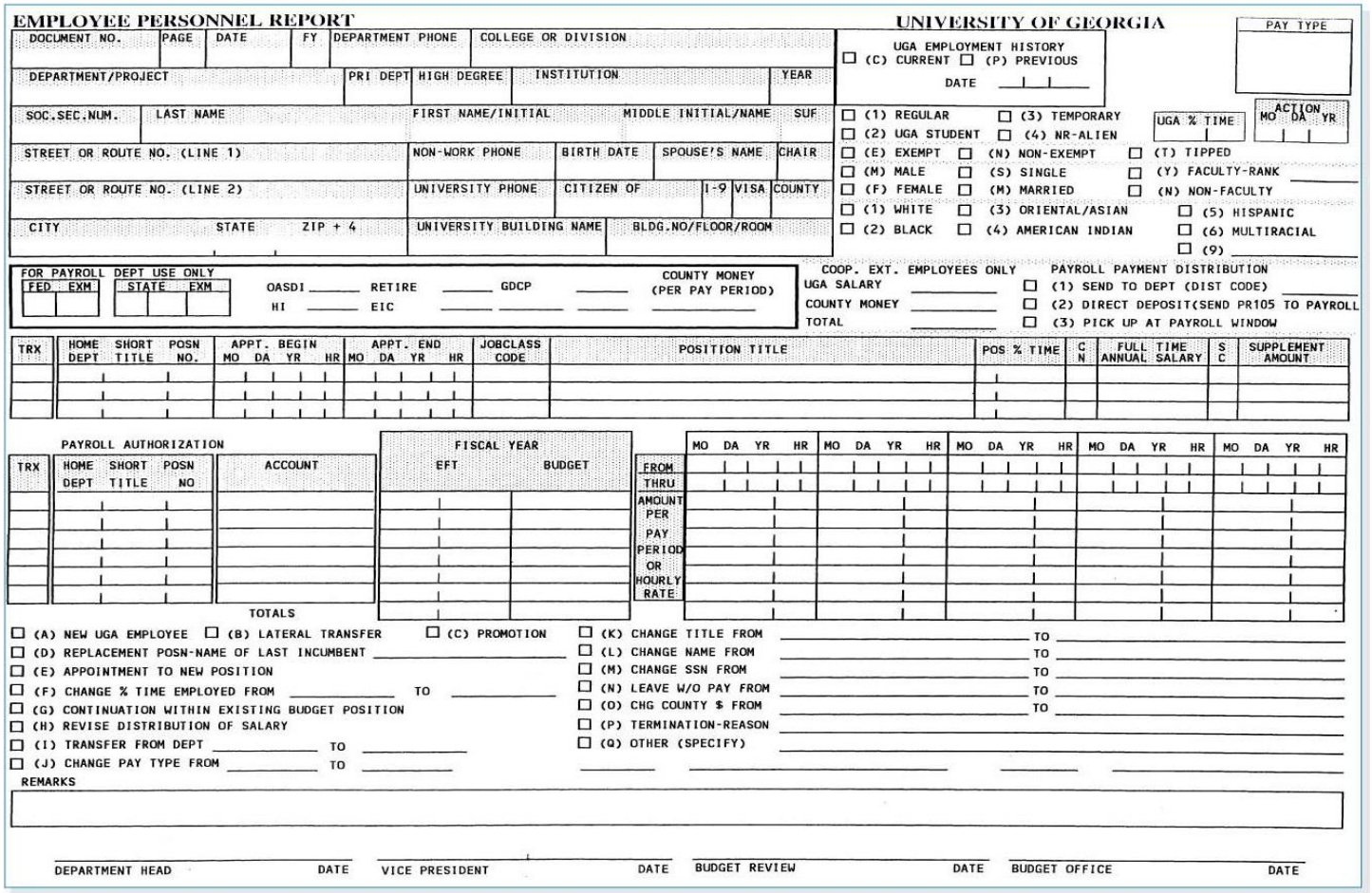
- ***Content awareness*** refers to the ability of an interface to make the user aware of the information it contains.
- All interfaces should have titles.
- Menus should show where the user are and where the user came from to get there.
- All area should be clear and well defined.
- Content awareness also applies to the *fields* and *field labels* within each area, and the information that a form or report contains.

# Aesthetics

- ***Aesthetics*** refers to designing interfaces that pleasing to the eye.
- Interfaces need to be functional and inviting to use.
- In general, all forms and reports need a certain amount of white space.
- The design of text is also important.
  - Fonts and font sizes
  - Colors and patterns

# (cont'd)

An example of form with high ***density***



EMPLOYEE PERSONNEL REPORT

UNIVERSITY OF GEORGIA

DOCUMENT NO. | PAGE | DATE | FY | DEPARTMENT PHONE | COLLEGE OR DIVISION

UGA EMPLOYMENT HISTORY
☐ (C) CURRENT ☐ (P) PREVIOUS
DATE ___/___/___

PAY TYPE

DEPARTMENT/PROJECT | PRI DEPT | HIGH DEGREE | INSTITUTION | YEAR

SOC.SEC.NUM. | LAST NAME | FIRST NAME/INITIAL | MIDDLE INITIAL/NAME | SUF

☐ (1) REGULAR ☐ (3) TEMPORARY
☐ (2) UGA STUDENT ☐ (4) NR-ALIEN

UGA % TIME

ACTION MO DA YR

STREET OR ROUTE NO. (LINE 1) | NON-WORK PHONE | BIRTH DATE | SPOUSE'S NAME | CHAIR

☐ (E) EXEMPT ☐ (N) NON-EXEMPT ☐ (T) TIPPED
☐ (M) MALE ☐ (S) SINGLE ☐ (Y) FACULTY-RANK ____
☐ (F) FEMALE ☐ (M) MARRIED ☐ (N) NON-FACULTY

STREET OR ROUTE NO. (LINE 2) | UNIVERSITY PHONE | CITIZEN OF | I-9 | VISA | COUNTY

☐ (1) WHITE ☐ (3) ORIENTAL/ASIAN ☐ (5) HISPANIC
☐ (2) BLACK ☐ (4) AMERICAN INDIAN ☐ (6) MULTIRACIAL
☐ (9) ____

CITY | STATE | ZIP + 4 | UNIVERSITY BUILDING NAME | BLDG.NO/FLOOR/ROOM

FOR PAYROLL DEPT USE ONLY
FED EXM | STATE EXM
OASDI ____ RETIRE ____ GDCP ____ COUNTY MONEY (PER PAY PERIOD)
HI ____ EIC ____ ____ ____

COOP. EXT. EMPLOYEES ONLY
UGA SALARY ____
COUNTY MONEY ____
TOTAL ____

PAYROLL PAYMENT DISTRIBUTION
☐ (1) SEND TO DEPT (DIST CODE) ____
☐ (2) DIRECT DEPOSIT(SEND PR105 TO PAYROLL
☐ (3) PICK UP AT PAYROLL WINDOW

| TRX | HOME DEPT | SHORT TITLE | POSN NO. | APPT. BEGIN MO DA YR HR | APPT. END MO DA YR HR | JOBCLASS CODE | POSITION TITLE | POS % TIME | C N | FULL TIME ANNUAL SALARY | S C | SUPPLEMENT AMOUNT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

PAYROLL AUTHORIZATION

| TRX | HOME DEPT | SHORT TITLE | POSN NO | ACCOUNT | FISCAL YEAR EFT | FISCAL YEAR BUDGET | | MO DA YR HR | MO DA YR HR | MO DA YR HR | MO DA YR HR | MO DA YR HR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | FROM | | | | | |
| | | | | | | | THRU | | | | | |
| | | | | | | | AMOUNT PER PAY PERIOD OR HOURLY RATE | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | TOTALS | | | | | | | | |

☐ (A) NEW UGA EMPLOYEE ☐ (B) LATERAL TRANSFER ☐ (C) PROMOTION
☐ (D) REPLACEMENT POSN-NAME OF LAST INCUMBENT ____
☐ (E) APPOINTMENT TO NEW POSITION
☐ (F) CHANGE % TIME EMPLOYED FROM ____ TO ____
☐ (G) CONTINUATION WITHIN EXISTING BUDGET POSITION
☐ (H) REVISE DISTRIBUTION OF SALARY
☐ (I) TRANSFER FROM DEPT ____ TO ____
☐ (J) CHANGE PAY TYPE FROM ____ TO ____

☐ (K) CHANGE TITLE FROM ____ TO ____
☐ (L) CHANGE NAME FROM ____ TO ____
☐ (M) CHANGE SSN FROM ____ TO ____
☐ (N) LEAVE W/O PAY FROM ____ TO ____
☐ (O) CHG COUNTY $ FROM ____ TO ____
☐ (P) TERMINATION-REASON ____
☐ (Q) OTHER (SPECIFY) ____

REMARKS

DEPARTMENT HEAD ____ DATE | VICE PRESIDENT ____ DATE | BUDGET REVIEW ____ DATE | BUDGET OFFICE ____ DATE

# User Experience

- ***User experience*** refers to designing the user interface with the users' level of computer experience in mind.
- Novice users are concerned with *easy of learning*.
- Expert users are concerned with *easy of use*.
- Often, the two objectives are complementary and lead to similar design decisions, but sometimes there are trade-offs.

# Consistency

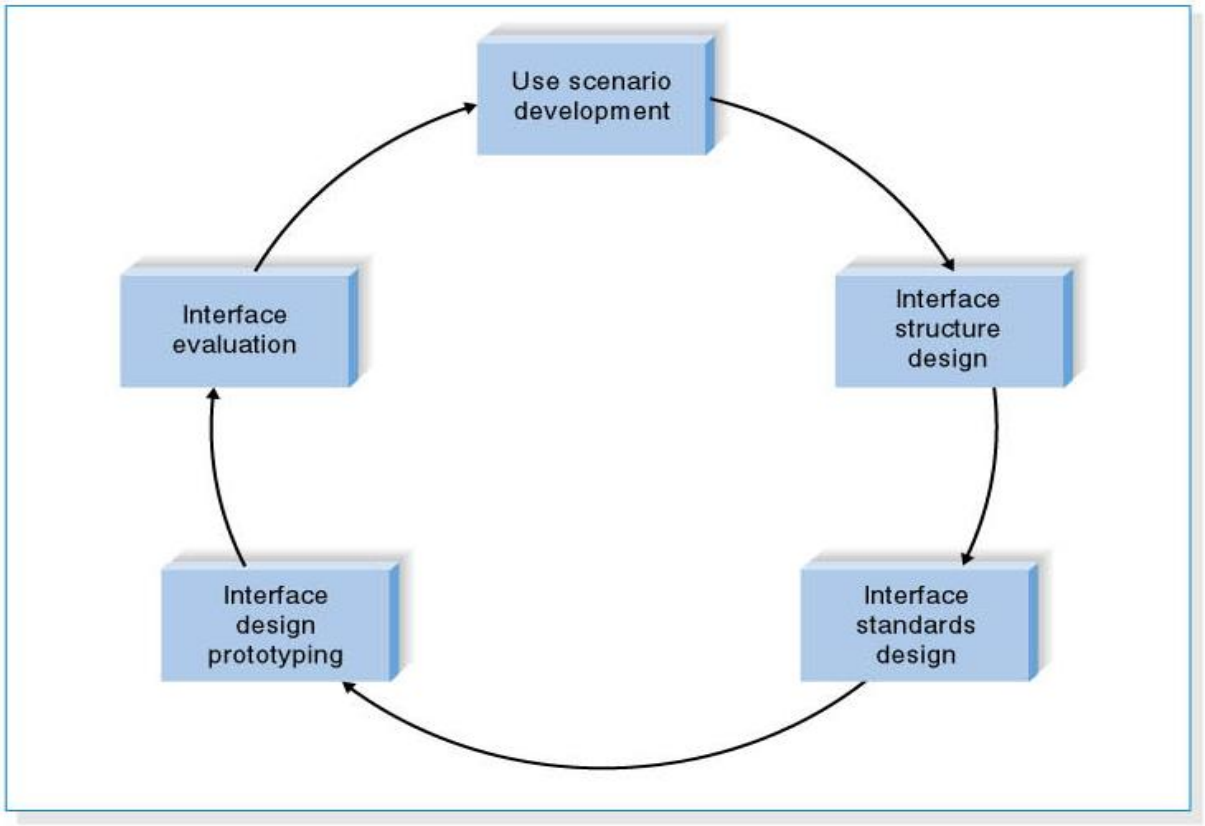
- ***Consistency*** usually refers to the interface within one computer system, so that all parts of the same system work in the same way. Ideally, however, the system also should be consistent with other computer systems in the organization.
- Consistency enables users to predict what will happen, and to reduce the amount of learning.
- Consistency occurs at many different levels.
  - Navigation controls;
  - Terminology;
  - Report and form design.

# Minimize User Effort

- ***Minimizing user effort*** means using the fewest possible mouse clicks or keystrokes to move from one part of the system to another.
- ***Three-clicks rule***
  - Users should be able to go from the start or main menu of a system to the information or action they want in no more than three mouse clicks or three keystrokes.

# USER INTERFACE DESIGN PROCESS

- **User interface design** is a five-step process that is iterative.

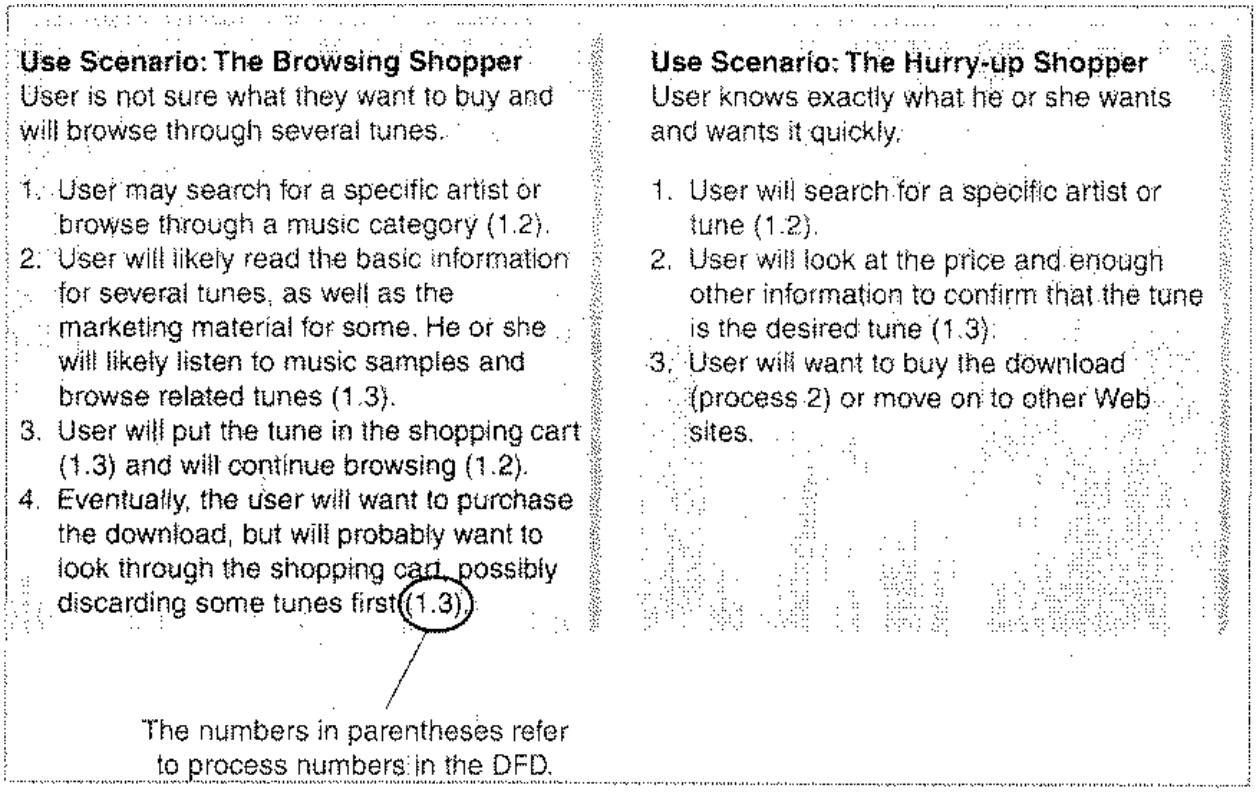


# Use Scenario Development

- A ***use scenario*** is an outline of steps that user s perform to accomplish some part of their work.
- Use scenarios are presented in a simple narrative description that is tied to the DFD.

# (cont'd)

## Examples of use scenarios



**Use Scenario: The Browsing Shopper**
User is not sure what they want to buy and will browse through several tunes.

1. User may search for a specific artist or browse through a music category (1.2).
2. User will likely read the basic information for several tunes, as well as the marketing material for some. He or she will likely listen to music samples and browse related tunes (1.3).
3. User will put the tune in the shopping cart (1.3) and will continue browsing (1.2).
4. Eventually, the user will want to purchase the download, but will probably want to look through the shopping card, possibly discarding some tunes first (1.3).

**Use Scenario: The Hurry-up Shopper**
User knows exactly what he or she wants and wants it quickly.

1. User will search for a specific artist or tune (1.2).
2. User will look at the price and enough other information to confirm that the tune is the desired tune (1.3).
3. User will want to buy the download (process 2) or move on to other Web sites.

The numbers in parentheses refer to process numbers in the DFD.

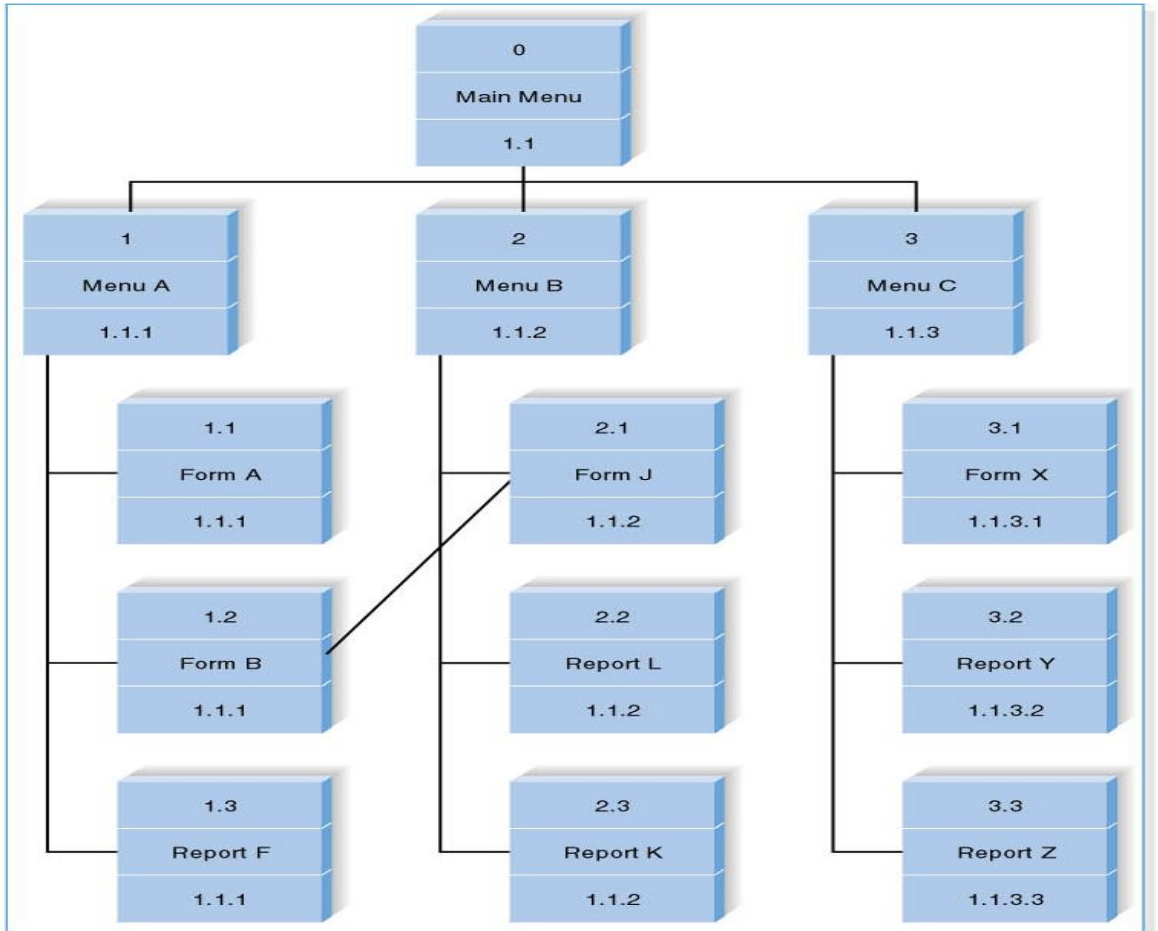
FIGURE 9-6
Two Use Scenarios for the Search and Browse Tunes Use Case

# Interface Structure Design

- The ***interface structure design*** defines the basic components of the interface and how they work together to provide functionality to users.
- An interface structure diagram (ISD) is used to show how all screens, forms, and reports are related and how the user moves from one to another.
- An ISD is similar to a DFD in that it uses boxes and lines to show the structure. However, unlike DFDs, there are no commonly used rules or standards for ISDs.
- The basic structure of the interface follows the basic structure of the business process itself as defined in the process model.

# (cont'd)

## Interface Structure Diagram Example



# Interface Standards Design

- The interface standards are the basic design elements that are common across the individual screens, forms, and reports within the system.
- An ***interface metaphor*** is a concept from the real world that is used as a model for the computer system.
  - E.g., Quicken uses a checkbook metaphor.
- The ***interface template*** defines the general appearance of all screens and the paper-based forms and reports.

# (cont'd)

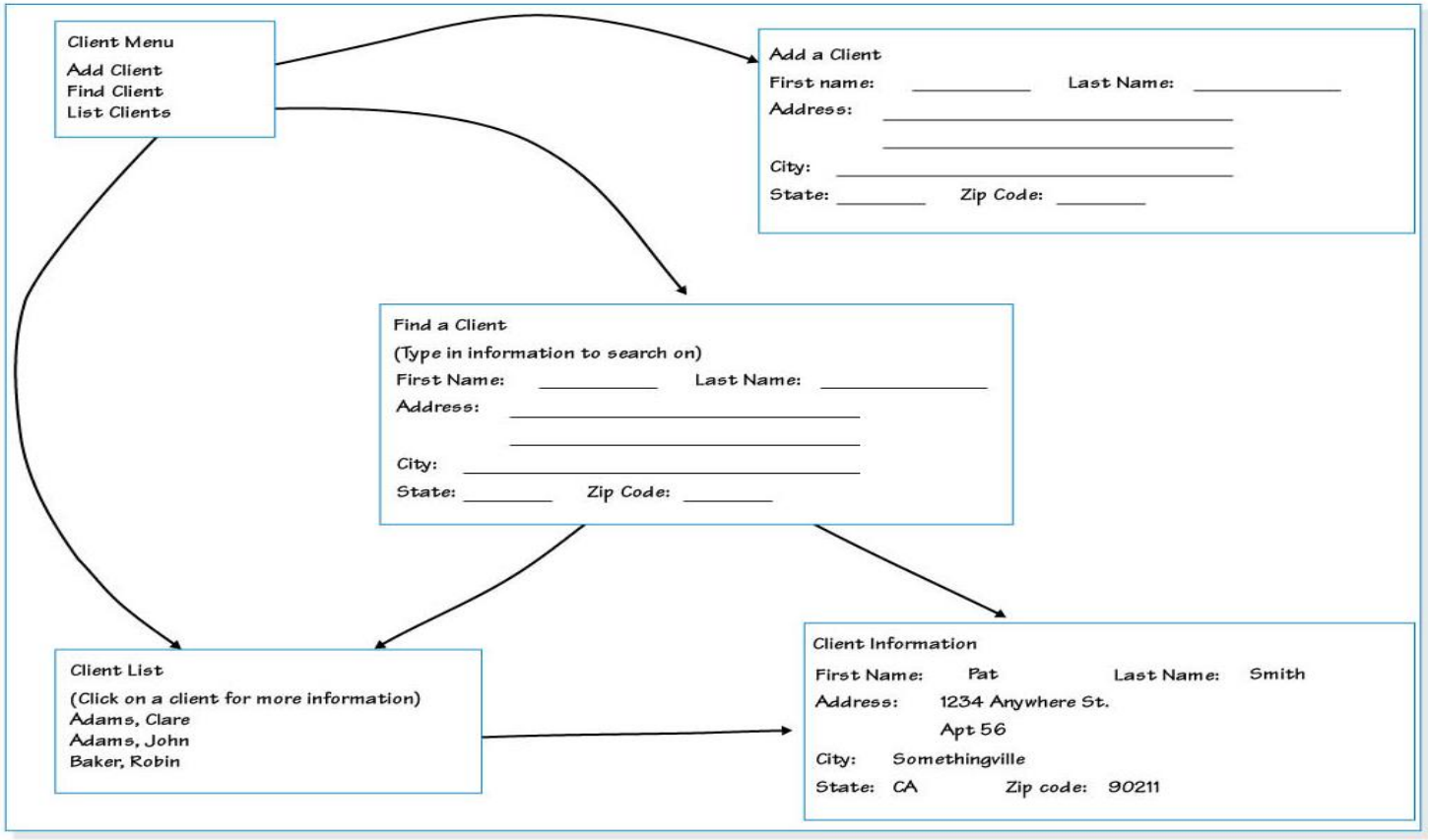
- The template specifies the names that the interface will use for the major ***interface objects***, the fundamental building blocks of the system.
- The template gives names to the most commonly used *interface actions*.
- The interface objects and actions, and also their status, may be represented by ***interface icons***.

# Interface Design Prototyping

- An interface design prototype is a mock-up or a simulation of a computer screen, form, or report.
- Common approaches to interface design prototyping:
  - Storyboards
  - HTML prototypes
  - Language prototypes.

# Storyboard

- The ***storyboard*** shows hand-drawn pictures of screens.

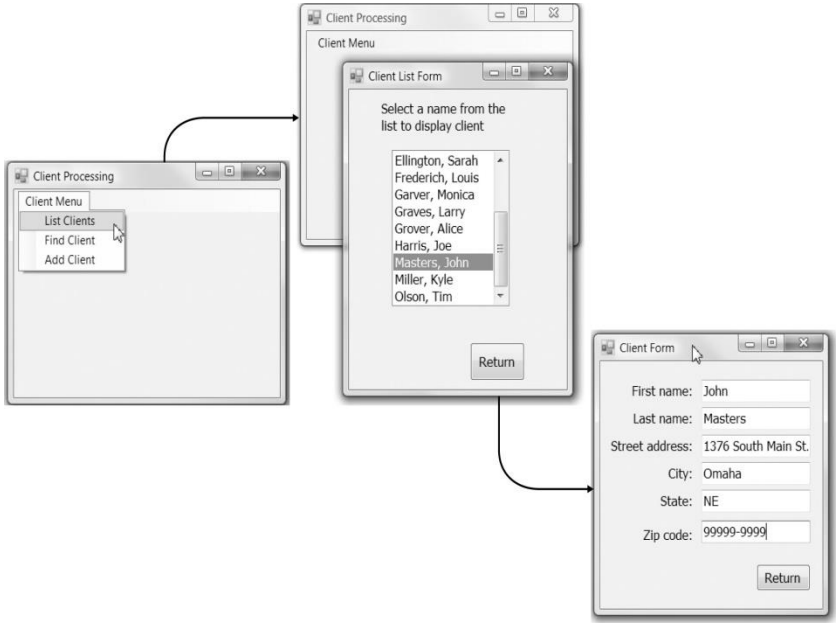


# HTML Prototype

- An ***HTML prototype*** is built with the use of Web pages created in HTML (hypertext mark-up language).
- The designer uses HTML to create a series of Web pages that show the fundamental parts of the system.

# Language Prototype

- A language prototype is an interface design prototype built in the actual language or by the actual that will be used to build the system.
- An example of language prototype.



# Interface Evaluation

- The objective of interface evaluation is to understand how to improve the interface design.
- There are four common approaches to interface evaluation.

1. ***Heuristic evaluation -*** Compare the interface to a checklist of design principles.
2. ***Walk-through evaluation -*** It is a meeting conducted with the users to walk through the interface.
3. ***Interactive evaluation -*** Users try out the interface.
4. ***Formal usability testing -*** It is a formal testing process to understand how usable the interface is.

# NAVIGATION DESIGN

- **Basic Principles**

- Analysts usually must assume that users have not read the manual, have not attended training, and do not have external help readily at hand.
- All controls should be clear and understandable and placed in an intuitive location on the screen.

# (cont'd)

- **Prevent Mistakes** - The first of principle of designing navigation control is to prevent users from making mistakes.
  - Labeling commands appropriately and limiting choices.
  - Confirming with the user that the actions are difficult or impossible to undo.
- **Simplify Recovery from Mistakes** – making "undo" buttons whenever possible.
- **Use Consistent Grammar Order** – Windows application uses an *object-action* grammar order.

# Types of Navigation Control

- There are three basic software approaches for defining user commands:

- **Languages**: ***command language*** and ***natural language.***
- **Menus**: A ***menu*** presents the user with a list of choices.
- **Direct Manipulation**: With ***direct manipulation***, the user enters commands by working directly with interface objects.

# Types of Menus

| | | |
|---|---|---|
| **Menu Bar**<br>List of commands at the top of the screen. Always on screen. | Main menu for system | • Use the same organization as the operating system and other packages (e.g., File, Edit, View)<br>• Menu items are always one word, never two<br>• Menu items lead to other menus, rather than performing action<br>• Never allow users to select actions they can't perform (instead use grayed-out items) |
| **Drop-Down Menu**<br>Menu that drops-down immediately below another menu. Disappears after one use. | Second level menu, often from menu bar | • Menu items are often multiple words<br>• Avoid abbreviations<br>• Menu items perform action or lead to another cascading drop-down menu, pop-up menu, or tab menu |
| **Hyperlink Menu**<br>A set of items arranged as a menu, usually along one edge of the screen. | Main menu for Web-based system | • Most users are familiar with hyperlink menus on the left edge of the screen, although they can be placed along any edge<br>• Menu items are usually only one or two words |
| **Embedded Hyperlinks**<br>A set of items embedded and underlined in text. | As a link to ancillary, optional information | • Used sparingly to provide additional information because they can complicate navigation<br>• Usually open a new window that is closed once the action is complete so the user can return to the original use scenario |
| **Pop-up Menu**<br>Menu that pops-up and floats over the screen. Disappears after one use. | As a shortcut to commands for experienced users | • Often (not always) invoked by a right click in Windows-based systems<br>• Menu choices vary depending on pointer position<br>• Often overlooked by novice users, so usually should duplicate functionality provided in other menus |
| **Tab Menu**<br>Multi-page menu with one tab for each page that pops-up and floats over the screen. Remains on screen until closed. | When user needs to change several settings or perform several related commands | • Menu items should be short to fit on the tab label<br>• Avoid more than one row of tabs because clicking on a tab to open it can change the order of the tabs and in virtually no other case does selecting from a menu rearrange the menu itself. |
| **Tool Bar**<br>Menu of buttons (often with icons) that remains on the screen until closed | As a shortcut to commands for experienced users | • All buttons on the same tool bar should be the same size<br>• If the labels very dramatically in size, then use two different sizes (small and large)<br>• Buttons with icons should have a tool tip—an area that displays a text phase explaining the button when the user pauses the pointer over it |
| **Image Map**<br>Graphical image in which certain areas are linked to actions or other menus. | Only when the graphical image adds meaning to the menu | • Image should convey meaning to show which parts perform an action when clicked<br>• Tool tips can be helpful |

# Messages

- Messages are the way in which the system responds to a user and informs the user of the status of the interaction.
- Messages should be clear, concise, and complete.
- All messages should be grammatically correct and free of jargon and abbreviations (unless they are the users' ones).
- Avoid negatives and humor.

# (cont'd)

- Types of messages

| Type of Messages | When to Use | Notes |
|---|---|---|
| **Error message**<br>Informs the user that he or she has attempted to do something to which the system cannot respond | When user does something that is not permitted or not possible | Always explain the reason and suggest corrective action.<br>Traditionally, error messages have been accompanied by a beep, but many applications now omit it or permit users to remove it. |
| **Confirmation message**<br>Asks the user to confirm that he or she really wants to perform the action selected | When user selects a potentially dangerous choice, such as deleting a file | Always explain the cause and suggest possible action.<br>Often include several choices other than "OK" and "cancel." |
| **Acknowledgment message**<br>Informs the user that the system has accomplished what it was asked to do | Seldom or never; users quickly become annoyed with all the unnecessary mouse clicks | Acknowledgment messages are typically included because novice users often like to be reassured that an action has taken place.<br>The best approach is to provide acknowledgment information without a separate message on which the user must click. For example, if the user is viewing items in a list and adds one, then the updated list on the screen showing the added item is sufficient acknowledgment. |
| **Delay message**<br>Informs the user that the computer system is working properly | When an activity takes more than seven seconds | This message should permit the user to cancel the operation in case he or she does not want to wait for its completion.<br>The message should provide some indication of how long the delay may last. |
| **Help message**<br>Provides additional information about the system and its components | In all systems | Help information is organized by table of contents and/or keyword search.<br>*Context-sensitive help* provides information that is dependent on what the user was doing when help was requested.<br>Help messages and on line documentation are discussed in Chapter 13. |

# INPUT DESIGN

- Input mechanisms facilitate the entry of data into the computer system.
- Input design means designing the screen used to enter information and forms on which the users write and type information.

# Basic Principles

- The goal of input design is to capture accurate information for the system simply and easily.

# Use Online and Batch Processing Appropriately

- There are two general formats for entering inputs into a computer system: online processing and batch processing.
- **Online processing**: each input item is entered into the system immediately.
- **Batch processing**: all the inputs collected over some period are gathered together and entered into the system at one time in a batch.
- Batch processing simplifies data communications and cuts communications costs.

# Capture Data at the Source

- The most important principle of input design is to capture the data in an electronic format at the original source.
- It reduces duplication work, reduces, processing time, decreases the cost, decreases the probability of error.

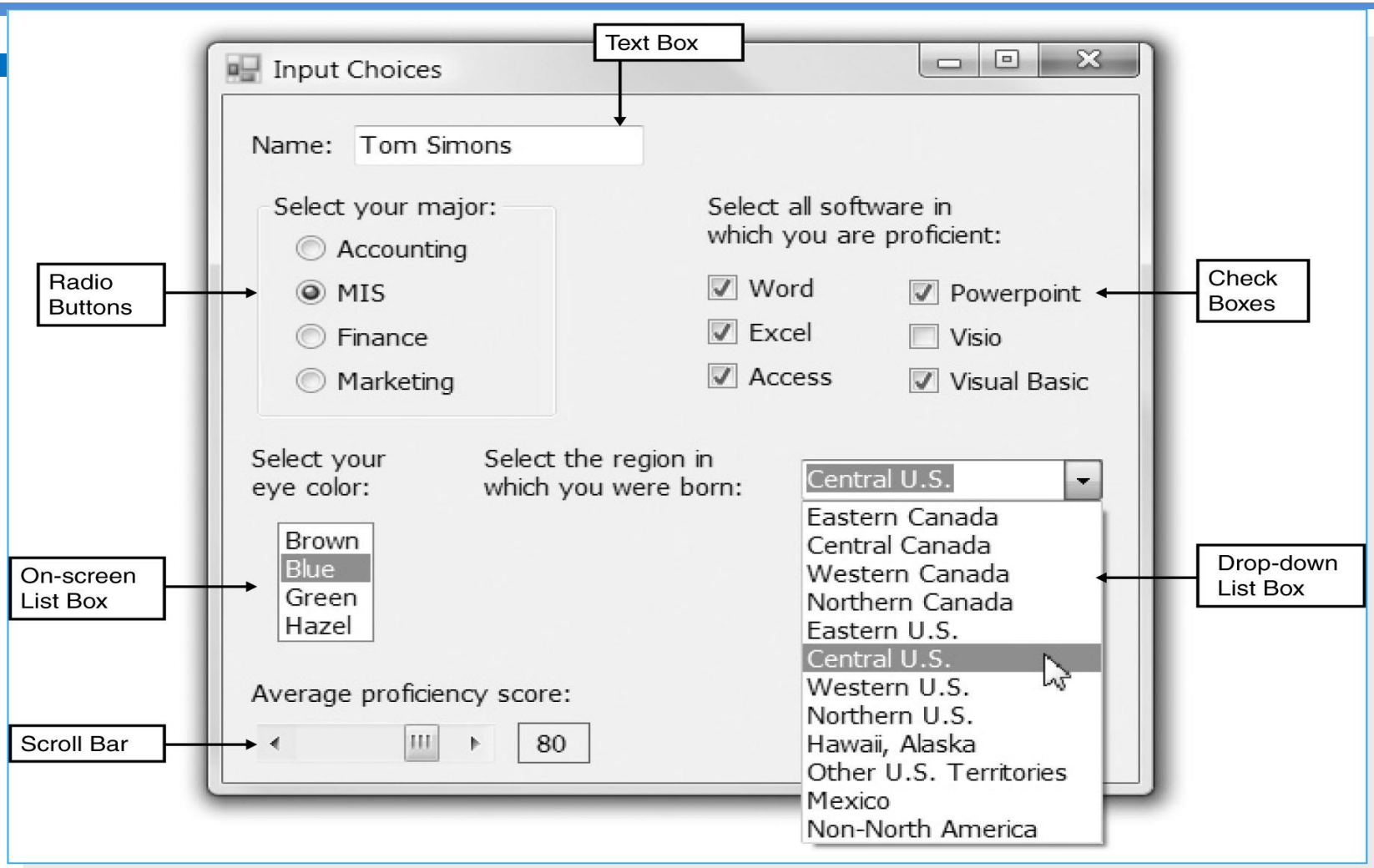
# (cont'd)

- ***Source data automation*** refers to using special hardware devices to automatically capture data without requiring anyone to type it.
- Source data automation technologies:
  - bar code readers
  - optical character recognition
  - magnetic stripe readers
  - smart cards
  - RFID (radio frequency identification) tags
  - the Web.

# Minimize Keystrokes

- Keystrokes cost time and money.
- The system should never ask for information that can be obtained in another way (e.g., by retrieving it from a database).
- The system should not require a user to type information that can be selected from a list.
- The frequent values should be used as the ***default value*** for the data.

# Types of Inputs



# (cont'd)

| Type of Box | When to Use | Notes |
|---|---|---|
| **Check box**<br>Presents a complete list of choices, each with a square box in front | When several items can be selected from a list of items | Check boxes are not mutually exclusive.<br>Do not use negatives for box labels.<br>Check box labels should be placed in some logical order, such as that defined by the business process, or failing that, alphabetically or most commonly used first.<br>Use no more than ten check boxes for any particular set of options. If you need more boxes, group them into subcategories. |
| **Radio button**<br>Presents a complete list of mutually exclusive choices, each with a circle in front | When only one item can be selected from a set of mutually exclusive items | Use no more than six radio buttons in any one list; if you need more, use a drop-down list box.<br>If there are only two options, one check box is usually preferred to two radio buttons, unless the options are not clear.<br>Avoid placing radio buttons close to check boxes to prevent confusion between different selection lists. |
| **On-screen list box**<br>Presents a list of choices in a box | Seldom or never—only if there is insufficient room for check boxes or radio buttons | This type of box can permit only one item to be selected (in which case it is an ugly version of radio buttons).<br>This type of box can also permit many items to be selected (in which case it is an ugly version of check boxes), but users often fail to realize they can choose multiple items.<br>This type of box permits the list of items to be scrolled, thus reducing the amount of screen space needed. |
| **Drop-down list box**<br>Displays selected item in one-line box that opens to reveal list of choices | When there is insufficient room to display all choices | This type of box acts like radio buttons but is more compact.<br>This type of box hides choices from users until it is opened, which can decrease ease of use; conversely, because it shelters novice users from seldom-used choices, it can improve ease of use.<br>This type of box simplifies design if the number of choices is unclear, because it takes only one line when closed. |
| **Combo box**<br>A special type of drop-down list box that permits user to type as well as scroll the list | Shortcut for experienced users | This type of box acts like drop-down list but is faster for experienced users when the list of items is long. |
| **Slider**<br>Graphic scale with a sliding pointer to select a number | Entering an approximate numeric value from a large continuous scale | The slider makes it difficult for the user to select a precise number.<br>Some sliders also include a number box to enable the user to enter a specific number. |

# Input Validation

- All data entered into the system must be validated in order to ensure accuracy.
- ***Input validation*** (also called ***edit checks***) can take many forms

# (cont'd)

| Type of Validation | When to Use | Notes |
|---|---|---|
| **Completeness check**<br>Ensures all required data have been entered | When several fields must be entered before the form can be processed | If required information is missing, the form is returned to the user unprocessed. |
| **Format check**<br>Ensures data are of the right type (e.g., numeric) and in the right format (e.g., month, day, year) | When fields are numeric or contain coded data | Ideally, numeric fields should not permit users to type text data, but if this is not possible, the entered data must be checked to ensure it is numeric.<br>Some fields use special codes or formats (e.g., license plates with three letters and three numbers) that must be checked. |
| **Range check**<br>Ensures numeric data are within correct minimum and maximum values | With all numeric data, if possible | A range check permits only numbers between correct values. Such a system can also be used to screen data for "reasonableness"—e.g., rejecting birthdates prior to 1880 because people do not live to be a great deal over 100 years old (most likely, *1980* was intended). |
| **Check digit check**<br>Check digits are added to numeric codes | When numeric codes are used | Check digits are numbers added to a code as a way of enabling the system to quickly validate correctness. For example, U.S. Social Security Numbers and Canadian Social Insurance Numbers assign only eight of the nine digits in the number. The ninth number—the check digit—is calculated using a mathematical formula from the first eight numbers. When the identification number is typed into a computer system, the system uses the formula and compares the result with the check digit. If the numbers don't match, then an error has occurred. |
| **Consistency checks**<br>Ensure combinations of data are valid | When data are related | Data fields are often related. For example, someone's birth year should precede the year in which he or she was married.<br>Although it is impossible for the system to know which data are incorrect, it can report the error to the user for correction. |
| **Database checks**<br>Compare data against a database (or file) to ensure they are correct | When data are available to be checked | Data are compared against information in a database (or file) to ensure they are correct. For example, before an identification number is accepted, the database is queried to ensure that the number is valid.<br>Because database checks are more "expensive" than the other types of checks (they require the system to do more work), most systems perform the other checks first and perform database checks only after the data have passed the previous checks. |

# OUTPUT DESIGN

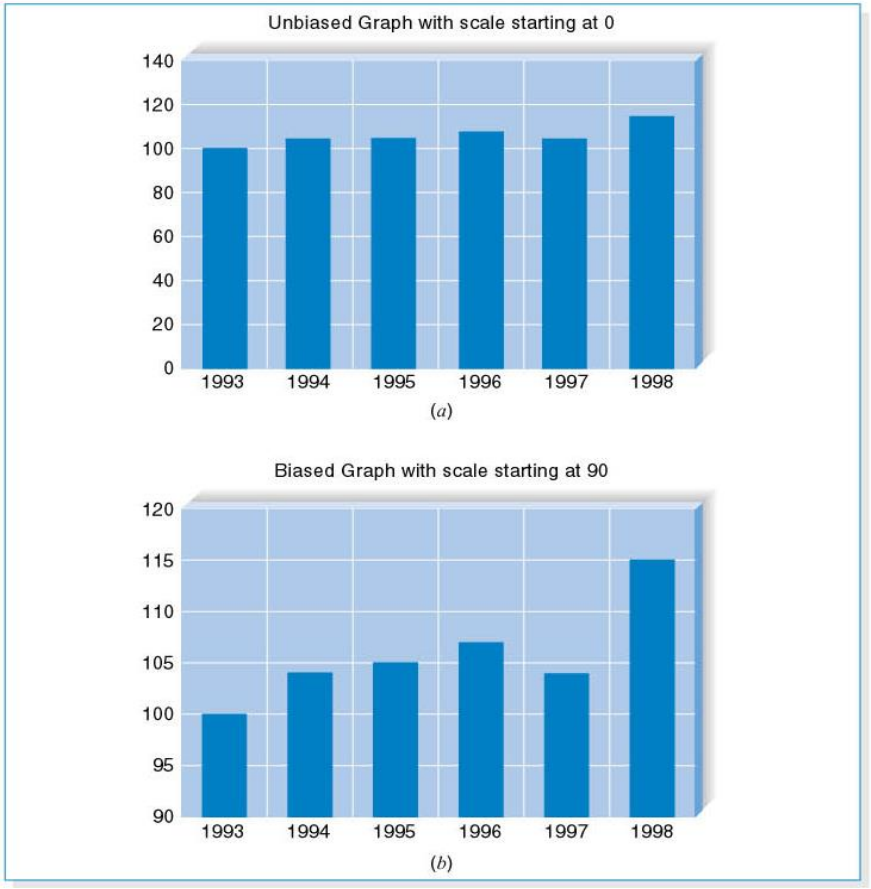
- Outputs are the reports that the system produces, whether on the screen, on paper, or in other media, such as the Web.
- Outputs are the most visible part of any system.

# Basic Principles

- The goal of the output mechanism is to present information to users so that they can accurately understand it with the least effort.
- **Understand report usage** – the first principle in designing reports is to understand how they are used.
- **Manage information load** – the goal of a well-designed report is to provide all needed information without information overload.
- **Minimize bias** – no analyst sets out to design a biased report.

# (cont'd)

- Example of bias: Bias in graphs.



# Types of Outputs

| Type of Reports | When to Use | Notes |
|---|---|---|
| Detail report<br>Lists detailed information about all the items requested | When user needs full information about the items | This report is usually produced only in response to a query about items matching some criteria.<br>This report is usually read cover to cover to aid understanding of one or more items in depth. |
| Summary report<br>Lists summary information about all items | When user needs brief information on many items | This report is usually produced only in response to a query about items matching some criteria, but it can be a complete database.<br>This report is usually read for the purpose of comparing several items to each other.<br>The order in which items are sorted is important. |
| Turnaround document<br>Outputs that "turn around" and become inputs | When a user (often a customer) needs to return an output to be processed | Turnaround documents are a special type of report that are both outputs and inputs. For example, most bills sent to consumers (e.g., credit card bills) provide information about the total amount owed and also contain a form that consumers fill in and return with payment. |
| Graphs<br>Charts used in addition to and instead of tables of numbers | When users need to compare data among several items | Well-done graphs help users compare two or more items or understand how one has changed over time.<br>Graphs are poor at helping users recognize precise numeric values and should be replaced by or combined with tables when precision is important.<br>Bar charts tend to be better than tables of numbers or other types of charts when it comes to comparing values between items (but avoid three-dimensional charts that make comparisons difficult).<br>Line charts make it easier to compare values over time, whereas scatter charts make it easier to find clusters or unusual data.<br>Pie charts show proportions or the relative shares of a whole. |

# Media

- The two dominant media of reports are paper and electronic.
- Paper is the more traditional medium and is relatively permanent, easy to use, highly portable, and accessible in most situations.
- However, paper reports are expensive.
- Many organizations are moving to electronic production of reports.

# SUMMARY

- User interface design principles
  - Layout, content awareness, aesthetics, user experience, consistency, minimize user effort.
- The user interface design process
  - Use scenario development, interface structure design, interface standards design, interface design prototyping, and interface evaluation.

# (cont'd)

- Navigation design
  - The fundamental goal of navigation design is to make the system as simple to use as possible.
- Input design
  - The goal of input design is to simply and easily capture accurate information for the system.
- Output design
  - The goal of the output design is to present information to users so that they can accurately understand it with the least effort.

# Copyright 2011 John Wiley & Sons, Inc.