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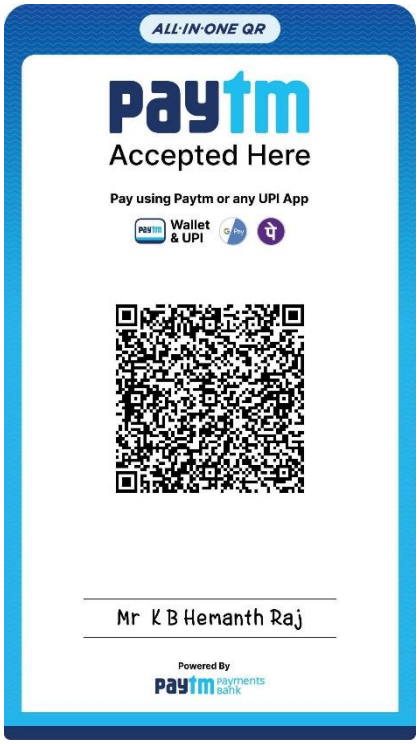

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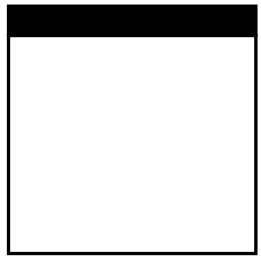


The Essential Guide to User Interface Design

An Introduction to GUI Design Principles and Techniques

Third Edition

Wilbert O. Galitz

Wiley Publishing, Inc.

STEP
7

Choose the Proper Screen-Based Controls

Screen controls, sometimes called *widgets*, are the elements of a screen that constitute its body. By definition, they are graphic objects that represent the properties or operations of other objects. A control may

- Permit the entry or selection of a particular value.
- Permit the changing or editing of a particular value.
- Display only a particular piece of text, value, or graphic.
- Cause a command to be performed.
- Possess a contextual pop-up window.

In the last decade, some platforms have expanded the definition of a control to include all specifiable aspects of a screen, including screen text, headings, and group boxes. For the purposes of this discussion, this broader definition of a control will be assumed. This step will encompass

- Identifying the characteristics and capabilities of the various screen controls, including
  - Buttons.
  - Text entry/read-only controls.
  - Selection controls.
  - Combination entry/selection controls.
  - Specialized operable controls.
  - Custom controls.

  - Presentation controls.
  - Web controls.
- Selecting the proper controls for the user and tasks.

The screen designer is presented with an array of screen controls to choose from. Selecting the right one for the user and the task is often difficult. But, as with input devices, making the right choice is critical to system success. A proper fit between user and control will lead to fast, accurate performance. A poor fit will result in lower productivity, more errors, and dissatisfaction.

We'll start by describing the types of controls and identifying their advantages, disadvantages, and proper usage. Relevant control design guidelines will also be presented. Not all toolkits or platforms will necessarily possess all the kinds of controls to be described. After describing the controls, we'll look at several research studies addressing the way to choose the best control or controls for particular situations. By the time these studies are reviewed, their findings will have been incorporated into the control usage and design guidelines already presented. This organization has been chosen because it is more meaningful to first clearly describe each control before discussing it in a research context. We'll finish by providing some general guidance in choosing the proper kind of control to enable tasks to be performed quickly and efficiently by the user.

In describing the controls, we'll break them down into categories that reflect the way they are used. We'll begin with operable controls, those that are manipulable, changeable, or settable. We'll then review presentation controls, those used to inscribe permanent information on a screen or used to give the screen structure. Before starting this review, three extremely important principles regarding controls should be noted:

- A control must
  - Look the way it works.
  - Work the way it looks.
- A control must be used exactly as its design intended.
- A control must be presented in a standard manner.

The look of a control should make it obvious that it is a control. Its design characteristics should signal "enterability" or "clickability." Microsoft Windows, for example, presents the following simple rules:

- Raised elements can be pressed.
- Recessed elements cannot be pressed.
- Elements on a flat white background can be opened, edited, or moved.

A control must also be presented in a standard and consistent manner, and used exactly as its design intended. The nonstandard design use of controls destroys consistency and aggravates and frustrates users, who have developed expectations based upon their past experiences. Using standard controls allows people to focus on their tasks or the content of the screens with which they are interacting, instead of having to figure out what to do.

Web page design has unleashed and exposed thousands of instances where these basic principles (and others to be described) have been violated. Page designers, all too often it seems, have been placing greater value on personal creativity than on interface usability. Some examples will be presented throughout the following pages.

Operable Controls

Operable controls are those that permit the entry, selection, changing, or editing of a particular value, or cause a command to be performed. Classes include buttons, text entry/read-only, selection, combination entry/selection, and other specialized controls.

Buttons

- Description:
  - — A square or rectangular-shaped control with a label inside that indicates action to be accomplished.
  - — The label may consist of text, graphics, or both.
- Purpose:
  - — To start actions.
  - — To change properties.
  - — To display a pop-up menu.
- Advantages:
  - — Always visible, reminding one of the choices available.
  - — Convenient.
  - — Can be logically organized in the work area.
  - — Can provide meaningful descriptions of the actions that will be performed.
  - — Larger size generally provides faster selection target.
  - — Can possess 3-D appearance:
    - Adds an aesthetically pleasing style to the screen.
    - Provides visual feedback through button movement when activated.
  - — May permit use of keyboard equivalents and accelerators.
  - — Faster than using a two-step menu bar/pull-down sequence.
- Disadvantages:
  - — Consumes screen space.
  - — Size limits the number that may be displayed.
  - — Requires looking away from main working area to activate.
  - — Requires moving the pointer to select.
- Proper usage:
  - — Use for frequently used actions that are specific to a window.
    - To cause something to happen immediately.
    - To display another window.
    - To display a menu of options.
    - To set a mode or property value.
  - — In Web page or application design use buttons to perform an action.
    - Use links to show information

A button comes in three styles. The first resembles the control commonly found on electrical or mechanical devices and is sometimes called a pushbutton. These are most often rectangular, with text that indicates the action to be taken when they are selected or pressed. These buttons are usually placed within a window, and activating them causes the action or command described on them to be performed immediately. This kind of button may take a variety of forms, some of which are illustrated in Figure 7.1. They are often referred to as *command buttons.*

The second style is square or rectangular in shape with an icon or graphic inside. It may have an associated label. This kind of button is illustrated in Figure 7.2. The label may be permanently affixed to the screen within the button, adjacent to it, or only appear when the pointer is moved to the button (called ToolTip, to be discussed). These buttons may appear singly or be placed in groupings commonly called button bars or toolbars. We'll refer to them as *toolbars* in this text. They are most frequently used to quickly access commands, many of which are normally accessed through the menu bar, or to initiate other actions or functions. These button groupings are usually placed at the screen's top or side. They are usually relocatable and removable by the user.

The third style is square or rectangular in shape with a symbol inscribed inside, as illustrated in Figure 7.3. The symbol, when learned, identifies the button and the action to be performed when the button is selected. These buttons, specific to a platform and provided by it, are located in the borders of windows and are used to do such things as obtain a system menu or resize a window. They are discussed in more detail in Step 5 and will not be addressed in this step. This step will focus on command and toolbar buttons.

Figure 7.1: Command buttons.

Figure 7.2: Toolbar buttons without labels.

Figure 7.3: A symbol button.

Command button advantages. An advantage of a command button is that it is always visible, providing a reminder of its existence. Command buttons are conveniently and logically located in the work area and can be inscribed with meaningful descriptions of what they do. Their ability to assume a fairly large size speeds selection, and their three-dimensional appearance is aesthetically pleasing. Buttons can also provide meaningful visual feedback through the movement of the button when activated. Their activation is much easier and faster than using a two-step menu bar/pull-down sequence.

Command button disadvantages. Among the disadvantages of command buttons is their larger size, which consumes considerable screen space and limits the number that can be displayed.

Toolbar advantages. Advantages of toolbar buttons include their continuous visibility and ease and speed of use. They also, individually, consume a relatively small amount of space.

Toolbar disadvantages. Disadvantages include their location being away from the main work area and their small size, which slows down selection. Another disadvantage is that when a large number of buttons are grouped in a bar, they consume a great deal of screen space, and they can easily create screen clutter. In circumstances where they do not possess a label, the necessity of learning and remembering what they are used for can also cause problems.

Proper usage. Buttons are best for frequently used actions in a window. They can be used to cause actions to occur immediately, such as saving a document, quitting a system, or deleting text. They can be used to display a menu of options, such as colors or fonts. Microsoft Windows calls a button that leads to a menu a *menu* button. Buttons can also be used to display other secondary windows or dialog boxes, and to expand the dialog or invoke dialog features. Windows calls a button that expands the dialog an *unfolding* button. Buttons may also be used to reflect a mode or property value setting similarly to the use of radio buttons or check boxes. In some kinds of windows, command buttons may be the only command method available to the user.

In Web application or page design, buttons should be only used to cause an action to occur. They should never be used to retrieve or show information. A button is designed to imply it can be pressed. When it is pressed it does something. Always use links to show information. Maintaining this distinction aids understanding and learning.

Command Buttons

Command button guidelines include the following.

Usage

- For windows with a menu bar,
  — Use to provide fast access to frequently used or critical commands.
- For windows without a menu bar,
  — Use to provide access to all necessary commands.

For fast access to commands contained in a menu bar, especially those frequently used or critical, also provide access by command buttons. Buttons must also be provided for situations where a command is not available through the menu bar. For windows without menu bars, buttons must be provided to provide access to all window commands.

Structure

- Provide a rectangular shape with the label inscribed within it.
- Give the button a raised appearance.
- Maintain consistency in style throughout an application.

The shape of a button can vary. Generally, rectangular-shaped buttons are preferred because they provide the best fit for horizontally arrayed textual captions. Square-cornered rectangles are found in some platforms including Microsoft Windows, while rounded-cornered rectangles are found in others. The button style chosen must reflect the three cornerstone principles presented at the beginning of this step, including giving it a raised appearance to make it obvious that it is a command button. To do this, drop shadows are used in some platforms, beveled edges in others. "Invisible" buttons must never exist. Web command button styles are noted for their variety in shape and size. The button style chosen is mostly a matter of preference. Web-specific button styles should be consistently designed and maintained throughout the Web site.

Labels

- Use standard button labels when available.
- Provide meaningful descriptions of the actions that will be performed.
- Use single-word labels whenever possible.
  — Use two to three words for clarity, if necessary.
- Use mixed-case letters with the first letter of each significant label word capitalized.
- Display labels
  — In the regular system font.
  — In the same size font.
- Do not number labels.
- Center the label within the button borders, leaving at least two pixels between the text and the button border.
- Provide consistency in button labeling across all screens.

Labels. Button labels should be clearly spelled out, with meaningful descriptions of the actions they will cause to be performed. Choices should be composed of mixed-case single words. Multiple words are preferred, however, to single words lacking clarity in their intent. If multiple-word labels are used, capitalize the first letter of each word (headline style). Use the same size and style of font in all buttons. The regular system font is preferred. Never change font style or size within buttons; these kinds of changes can be very distracting to the viewer. Center each label within the button borders, leaving at least two pixels between the text and the border.

Common button functions should have standard names and uses. Microsoft windows, for example, provides these standard names and definitions:

OK — Any changed information in the window is accepted and the window is closed.

Cancel — Closes window without implementing unsubmitted changes.

Reset — Resets defaults and cancels any changed information that has not been submitted.

Apply — Any changed information in the window is accepted and again displayed in the window that remains open.

Close — Closes the window.

Help — Opens online Help.

Always follow all platform presentation and usage guidelines for standard button functions.

Size

- Provide as large a button as feasible.
- Maintain consistent button heights and widths.
- Exception: Buttons containing excessively long labels may be wider.

Provide as large a button as possible, consistent with Fitts' Law (see Step 1). Buttons must, at minimum, be wide enough to accommodate the longest label. Leave at least two pixels between labels and button borders. A command button's minimum height should be 25 pixels. Create, however, standard, equal-sized buttons encompassing the majority of system functions. When a button's label will not fit within the standard size, expand the button's size to achieve a proper label fit. Never reduce the font size of some labels to create equal-sized buttons. In this case, buttons of different widths are preferable. Also, do not create an unnecessarily wide button for aesthetic balance purposes, as illustrated by the Color Palette button in Figure 7.4. The perceptual model we possess in our memory for a button will be lost.

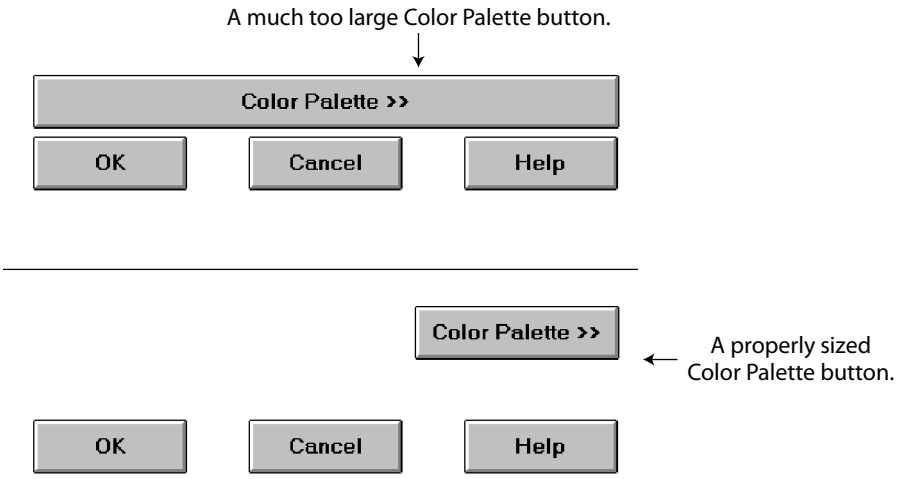


Figure 7.4: Improper and proper button sizes.

Number

- Restrict the number of buttons on a window to six or fewer.

The maximum number of buttons on a window must reflect a balance between effectiveness, real estate efficiency, and operational simplicity. Having no more than six buttons per window or dialog box seems to appropriately balance these issues. If an extra button or two is necessary and space is available, they may be included.

Location and Layout

- Maintain consistency in button location between windows.
- Never simply "fit" buttons in available space.
- If buttons are for exiting the dialog
  — Position them centered and aligned horizontally at the bottom.
- If buttons are used for invoking a dialog feature or expanding the dialog
  — Position them centered and aligned vertically on the right side.
- If a button has a contingent relationship to another control
  — Position it adjacent to the related control.
- If a button has a contingent relationship to a group of controls
  — Position it at the bottom or to right of related controls.
- If there are space constraints, exiting and expanding/invoking feature buttons must be placed together
  — If at the bottom, place exiting buttons to the right, separating the groupings by one button's width.
  — If along the right side, place exiting buttons at the bottom, separating the groupings by one button's height.

- For exiting and expanding/invoking feature buttons, do not
  — Align with the other screen controls.
  — Present displayed within a line border.
- Provide equal and adequate spacing between adjacent buttons.
- Provide adequate spacing between buttons and the screen body controls.
- For Web pages spanning more than one screen
  — Repeat the buttons at the top and bottom of the page.

Command buttons should be positioned in consistent positions within a window. This enables a person to memorize button locations and predict where they will appear when a window is presented. For an experienced user this permits faster pointing and activation because a button may be identified simply by its location without its label having to be read, and a mouse movement to that location may be commenced before a window is even displayed. Consistent locations also aid in quickly discriminating the different kinds of buttons described below. A common failing of many windows is that buttons are positioned within windows *after* locations for the other window controls are established. When this occurs, buttons are positioned where there is space available. The result is usually a hodgepodge of locations. Never simply "fit" buttons in available space. Allocate a space for buttons before the other control locations are established.

Button location within a window is dependent upon the type of button. Buttons *exiting* a dialog, and usually closing the window, should be positioned horizontally and centered across the lower part of the window. This positioning places the buttons at the end of the dialog. A study of Web pages (Spool et al., 1997) found that people preferred to scroll to the bottom of a page to press the final buttons. If a button *invokes* a dialog feature or *expands* the dialog, position it centered and aligned vertically along the right side of the window. Maintaining these consistent locations will enable a person to quickly identify what general kind of button it is, and what kind of action will occur if the button is activated. The location of the exiting buttons across the bottom will also allow more efficient use of window real estate when invoking/expanding buttons are not included within a window. Exiting and expanding/invoking feature button locations are illustrated in Figure 7.5. If exiting and expanding/invoking feature buttons must be positioned together at the screen bottom because of screen space constraints, place the exiting buttons to the right, separating the groupings by one standard button's width. If they are located together along the right side, place exiting buttons at the bottom, separating the groupings by one button's height.

If a button has a *contingent* relationship to another control, position it adjacent to the related control in the order in which the controls are usually operated, as illustrated in Figure 7.6. If a button possesses a contingent relationship to a group of controls, position it at the bottom or to the right of the grouping, again in logical flow order, as illustrated in Figure 7.7.

For Web pages containing buttons and longer than one screen, repeat the buttons at the top and bottom of the page. This will provide easier access to the buttons from varying locations within the page, minimize the chance of people missing the buttons, and comply with the expectancies of people who assume they will be found both at the top and bottom.

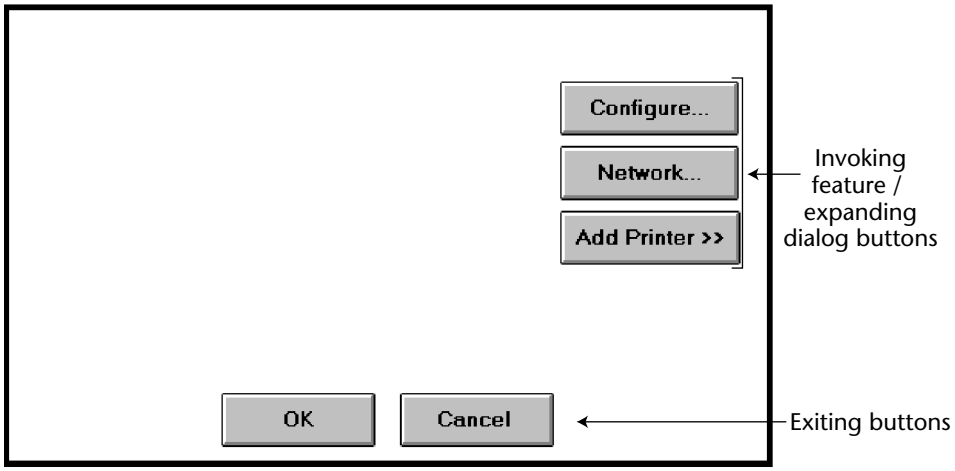


Figure 7.5: Exiting and invoking feature/expanding dialog buttons.

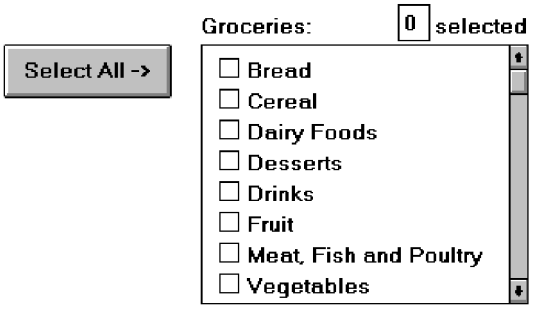


Figure 7.6: Button with contingent relationship to a control.

For exiting and expanding/invoking feature buttons, do not provide alignment with the other screen controls. Maintain alignment and spacing only within the buttons themselves. Trying to align the buttons to other screen controls will most often create variable spacing between the buttons themselves, which is visually distracting. Also, do not display buttons within a line border; instead present them on the background of the window itself. The unique physical look of the buttons is strong enough for them to create their own visual grouping. Reserve line borders for individual controls or groups of controls that are in greater need of closure. Too many borders can also create visual clutter.

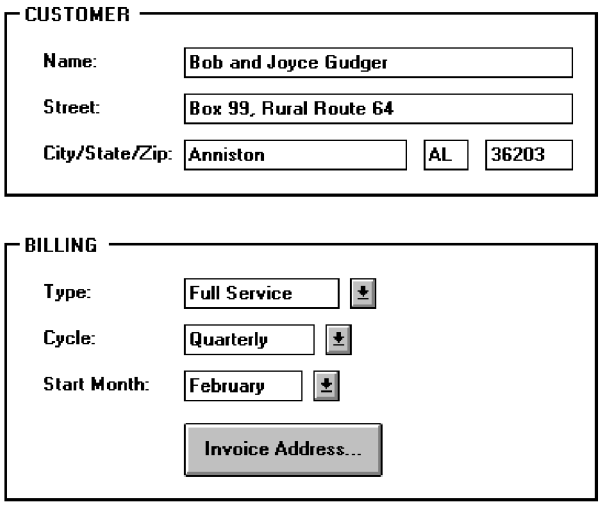


Figure 7.7: Button with contingent relationship to a grouping.

Provide equal and consistent spacing between adjacent buttons, and groups of buttons. Also, maintain adequate separation between screen buttons and other screen controls.

Organization

- Organize standard buttons in the manner recommended by the platform being used.
- For other buttons, organize them in common and customary grouping schemes.
  - — For buttons ordered left to right, place those for most frequent actions to the left.
  - — For buttons ordered top to bottom, place those for most frequent actions at the top.
- Keep related buttons grouped together.
- Separate potentially destructive buttons from frequently chosen selections.
- Buttons found on more than one window should be consistently positioned.
- The order should never change.
- For mutually exclusive actions, use two buttons; do not dynamically change the text.

Follow the standard, consistent ordering schemes recommended by the platform being used. Windows recommends the following:

- An affirmative action to the left (or above).
- The default first.
- OK and Cancel next to each other.
- Help last, if supported.

Other platforms may suggest a different ordering. If differences exist, and people may be using more than one platform, some organizational compromises may be necessary.

Buttons should be ordered logically, such as by frequency of use, sequence of use, or importance. For buttons arrayed left to right, start the ordering from left to right. For buttons arrayed top to bottom, start the ordering from top to bottom.

Keep related buttons grouped together. Separate potentially destructive buttons from frequently chosen selections to avoid inadvertent activation and potentially catastrophic results. Always locate the same buttons that appear on different windows in consistent positions. For mutually exclusive actions, avoid using one button that toggles changing text. This can be confusing. Use two buttons with labels that clearly describe the two actions.

Intent Indicators

- When a button causes an action to be immediately performed, no intent indicator is necessary.

Figure 7.8

- When a button leads to a cascading dialog, include an ellipsis (...) after the label.

Figure 7.9

- When a button leads to a menu, include a triangle pointing in the direction the menu will appear after the label.

Figure 7.10

- When a button leads to an expanding dialog, include a double arrow (>>) with the label.

Figure 7.11

- When a button has a contingent relationship to another control that must be indicated, include a single arrow (->) pointing at the control.

Figure 7.12

Button intent indicators will follow, where applicable, the same conventions used for menu items. When a button causes a command to be performed immediately, no special intent indicator is necessary on the button. When a button leads to a cascading dialog box, include an *ellipsis* with the label. When a button leads to a menu of choices, include a *triangle* after the label; point the triangle in the direction the menu will appear. If a button expands the dialog, include a *double arrow* with the label. When a button has a contingent relationship to another control, include a *single arrow* pointing at the control. Intent indicators are very useful because they enable the user to predict the consequences of an intended action.

Expansion Buttons

- Gray a button out after expansion.
- Provide a contraction button, if necessary.
  - — Locate it beneath, or to right of, the expansion button.
  - — Gray it out when not applicable.

When a button that expands a dialog is activated, and the dialog is expanded, display the button dimmed or grayed out. If the dialog can again be contracted, provide a contraction button beneath the expansion button or to the right of it. Gray this button out when the dialog is contracted; display it at normal intensity when the dialog is expanded.

Defaults

- Intent:
  - — When a window is first displayed, provide a default action, if practical.
- Selection:
  - — A default should be the most likely action.
    - A confirmation.
    - An application of the activity being performed.
    - A positive action such as OK, unless the result is catastrophic.
  - — If a destructive action is performed (such as a deletion), the default should be Cancel.
- Presentation:
  - — Indicate the default action by displaying the button with a bold or double border.
- Procedures:
  - — The default can be changed as the user interacts with the window.
  - — When the user navigates to a button, it can temporarily become the default.
  - — Use the Enter key to activate a default button.
  - — If another control requires use of the Enter key, temporarily disable the default while the focus is on the other control.
  - — Permit double-clicking on a single selection control in a window to also carry out the default command.

When a window with buttons is first displayed, provide a default action whenever practical. The default action should be the most likely action within the window. It may be a confirmation, an application of the activity being performed, or a positive response such as OK. If the default is irreversible or destructive (such as Delete), the default should be Cancel, requiring a person to change the selection in order to perform the destructive action. If none of the buttons is destructive in nature, the default button should be the one most frequently selected.

The default can be changed as the user interacts with a window. When the user navigates to a button, it can temporarily become the default. Return the button to its original state when the focus leaves a button. Permit use of the Enter key to activate a default button. If another control requires use of the Enter key, temporarily disable the default while the focus is on the other control. Permit double-clicking on a single selection control in a window to also carry out the default command.

Unavailable Choices

- Temporarily unavailable choices should be dimmed or grayed out.

A button should visually indicate whether it is available for activation. Dim or gray-out buttons for actions that are not available.

Keyboard Equivalents and Accelerators

- Equivalents:
  - — Assign a keyboard equivalent mnemonic to each button to facilitate keyboard selection.
  - — The mnemonic should be the first character of the button's label.
    - If duplication exists in first characters, for duplicate items, use another character in the label.
    - Preferably, choose the first succeeding consonant.
  - — Designate the mnemonic character by underlining it.
  - — Maintain the same mnemonic on all identical buttons on other screens.

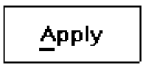


Figure 7.13

- Accelerators:
  - — Assign a keyboard accelerator to each button to facilitate keyboard selection.

Enabling the user to select button actions through the typewriter keyboard provides flexibility and efficiency in the dialog. To do this, provide keyboard equivalent, single-character mnemonic codes that, when typed, will cause the action to be performed. The suggested method is to indicate the accelerator by underlining the proper character in the button label.

Keyboard accelerators, a keyboard key or combination of keys, may also be assigned to buttons to facilitate keyboard activation.

Keyboard equivalents and accelerators, including Microsoft Windows standard ones, are discussed in more detail in Step 4.

Scrolling

- If a window can be scrolled, do not scroll the command buttons.
  — Exception: if the screen cannot scroll independently of the buttons.
- Use buttons to move between multipage forms, not scroll bars.
  — Label buttons Next and Previous.

If scrolling the contents of a window, never scroll the buttons. They should be available at all times. Web page screens, whose content cannot be scrolled independently of buttons, are exceptions to this rule at the moment. Use buttons to move between multipage forms, not scroll bars. Paging is, conceptually, easier for people to use and understand, and is discussed in detail in Step 3. Label the buttons Next and Previous.

Button Activation

- Pointing:
  — Highlight the button in some visually distinctive manner when the pointer is resting on it and the button is available for selection.
- Activation:
  — Call attention to the button in another visually distinctive manner when it has been activated or pressed.
  — If a button can be pressed continuously, permit the user to hold the mouse button down and repeat the action.

Highlight the button in some visually distinctive manner when the pointer is resting on it and it is available for selection. This will provide the user with feedback indicating that the selection process may be performed. Some platforms display a brighter button.

Highlight the button in another visually distinctive manner when it has been activated or pressed, to indicate that the action is successful. One platform subdues or grays out the button. Another has raised beveled buttons that appear to sink into the screen when selected. Another alternative is to move the button slightly as if it has been depressed. If a button can be pressed continuously, permit the mouse button to be held down and the action repeated.

Toolbars

Toolbars are compilations of commands, actions, or functions, usually graphical in structure, but sometimes textual, grouped together for speedy access. Microsoft Windows defines a toolbar as a panel that contains a *set* of controls. Toolbars may also be called *button bars*, *control bars*, or *access bars*. Specialized toolbars may also be referred to as *ribbons*, *toolboxes*, or *palettes*. Toolbars may also appear in palette windows.

Usage

- To provide easy and fast access to most frequently used commands or options across multiple screens.
- To invoke a subapplication within an application.
- To use in place of certain menu items.

Provide toolbars to allow fast and easy access to a system's most frequently used commands, functions, or options. Also provide toolbars for easily invoking subapplications within an application. Toolbars are considered "fast paths" or expert aids. All toolbar functions must also be obtainable by normal textual menu means, including through use of the menu bar. One exception: If menu text cannot clearly explain an item and a graphical toolbar representation can, the toolbar item may replace the menu item.

Structure

- Images:
  - — Provide buttons of equal size.
  - — Create a meaningful and unique icon.
    - Design them using icon design guidelines.
  - — Center the image within the button.
  - — Give the button a raised appearance.
  - — Ensure that toolbar images are discernible from Web page graphical images.
- Text:
  - — Create a meaningful label, adhering to label guidelines for command buttons.
  - — Create toolbar buttons of equal size, following the size guidelines recently described.
- Consistency:
  - — Use the same icon throughout an application and between applications.

Create meaningful and unique images and icons utilizing the icon design guidelines in Step 11. Center the image within the button and provide an associated textual label. A label is always necessary to ensure button comprehensibility. One study has found that placing graphics and words on buttons, makes them more usable than including graphics only (Vaughan, 1998). Create the label following the guidelines for command buttons. The label may be located within the button, positioned beneath it, or presented on demand through a ToolTip control. Labels beneath toolbar button images will provide a larger pointing target. If the label is located within the button and the system will be translated into one or more other languages, allow extra space for the label. See "International Considerations" in Step 10 for further important considerations. A ToolTip control is discussed later in this chapter. Give the button a raised appearance to convey that it is a screen navigation element to be pressed. Ensure that toolbar images are discernible from all Web page graphical images.

For text-only toolbar buttons, create a meaningful label, adhering to the label guidelines for command buttons. Provide consistent icons throughout all applications.

Size

- Button:
  - — 24 (w) by 22 (h) pixels, including border.
  - — 32 (w) by 30 (h) pixels, including border.
  - — Larger buttons can be used on high-resolution displays.
- Label:
  - — 16 (w) by 16 (h) pixels.
  - — 14 (w) by 24 (h) pixels.
- Default:
  - — Provide the smaller size as the default size with a user option to change it.
- Image:
  - — Center the image in the button.

A toolbar button should be large but not too large because of the number that may need to be displayed. Microsoft provides the preceding guidelines. Other sizing guidelines and much more detailed image guidelines are presented in Step 11.

Organization

- Order the buttons based on common and customary grouping schemes.
  - — For buttons ordered left to right, place those for the most frequently used actions to the left.
  - — For buttons ordered top to bottom, place those for the most frequently used actions at the top.
- Keep related buttons grouped together.
- Separate potentially destructive buttons from frequently chosen selections.
- Permit user reconfiguration of button organization.

Toolbar buttons should be ordered logically, such as by frequency of use, sequence of use, or importance. If the buttons reflect a quality on a continuum such as colors or shades, follow standard and expected ordering schemes. For buttons arrayed left to right, start the ordering from left to right. For buttons arrayed top to bottom, start the ordering from top to bottom.

Keep related buttons grouped together. Separate potentially destructive buttons from frequently chosen selections to avoid inadvertent activation and potentially catastrophic results. Permit the user to reconfigure the button organizational structure to better meet his or her unique needs.

Location

- Position main features and functions bar horizontally across top of window just below menu bar.
- Position subtask and subfeatures bars along sides of window.
- Permit the location of the bar to be changed by the user.
- Permit display of the bar to be turned on or off by the user.
  — Also provide access through standard menus.

Locate the main features and functions tool bar horizontally across the top of the window just below the menu bar. Locate subtask and subfeature tool bars along sides of window. Permit the location of the toolbar to be changed by the user. Because a toolbar can create visual noise, permit its display to be turned on or off. Always also provide access to the toolbar actions through standard menus.

Active Items

- Make only currently available toolbar items available.
- Temporarily not available items may be displayed grayed out.

As the user moves around through an application, items at various points that are not applicable do not have to be displayed. Temporarily unavailable items may be grayed out.

Customization

- Permit toolbars to be turned off by the user.
- Allow the customizing of toolbars.
  — Provide a default, however.

Permit the toolbars to be turned off by the user, should their use not be necessary or should more screen space be desired. Also, allow users to customize the toolbar, determining what they would like to add or remove. Many users do not customize them, however, so a default set should always be provided.

Keyboard Equivalents and Accelerators

- Equivalents:
  — Assign keyboard equivalents to facilitate keyboard selection.
  — Maintain the same mnemonic on all identical buttons on all screens.
- Accelerators:
  — Assign a keyboard accelerator to facilitate keyboard selection.

Provide keyboard equivalents and accelerators to facilitate keyboard selection. Maintain the same mnemonic on all identical buttons on all screens. One caution, if a

particular mnemonic is being used somewhere else in the window: It may not be available for use on the toolbar.

Button Activation

- Pointing:
  - — Highlight the button in some visually distinctive manner when the pointer is resting on it and the button is available for selection.
- Activation:
  - — Call attention to the button in another visually distinctive manner when it has been activated or pressed.

Highlight the button in some visually distinctive manner when the pointer is resting on it and the button is available for selection. This will provide the user with feedback indicating that the selection process may be performed. Highlight the button in another visually distinctive manner when it has been activated or pressed, to indicate that the action is successful.

Text Entry/Read-Only Controls

A Text Entry control contains text, free-form in nature that is exclusively entered or modified using the keyboard. A Read-Only control will contain text or values being presented for reading or display purposes only. Through tradition, these controls are usually referred to as *fields*. In graphical system terminology they are called *text boxes*. A text box into which information can be keyed is called an *unprotected* field. A text box used for display purposes only is referred to as a *protected* field. Historically, they have been called *inquiry*, *display* or *read-only* fields.

An unprotected text entry field can also be designated as required or optional. A *required* unprotected field is one in which the necessary information must be always be keyed. That the entry is complete and valid may also be a requirement. An *optional* field is one in which information need not always be keyed. Whether information is keyed into it depends on the circumstances of the moment. General design guidelines for text boxes are the following.

Text Boxes

- Description:
  - — A control, usually rectangular in shape, in which
    - Text may be entered or edited.
    - Text may be displayed for read-only purposes.
  - — Usually possesses a caption or label describing the kind of information contained within it.
  - — An outline field border
    - Is included for enterable/editable text boxes.
    - Is not included for read-only text boxes.

— Two types exist:
  - Single-line.
  - Multiple-line.

— When first displayed, the box may be blank or contain an initial value.

- Purpose:
  — To permit the display, entering, or editing of textual information.
  — To display read-only information.
- Advantages:
  — Very flexible.
  — Familiar.
  — Consumes little screen space.
- Disadvantages:
  — Requires use of typewriter keyboard.
  — Requires user to remember what must be keyed.
- Proper usage:
  — Most useful for data that is
    - Unlimited in scope.
    - Difficult to categorize.
    - Of a variety of different lengths.

  — When using a selection list is not possible.

While display-only text boxes are not operable in the true sense of the word, the information contained within them is capable of being modified by other controls. Hence, they will be reviewed as an operable control because their characteristics, and the characteristics of an entry field, are very similar.

Description. Text boxes almost always possess a separate caption describing the kind of information to be keyed. An enterable text box is visually presented on the screen, its shape being defined by an outline border appearing recessed, and a lighter background so that it contrasts with the screen background. The information in a read-only text field is most effectively displayed on the screen background, not in a box. Therefore, a box does not surround the information contained in read-only text boxes. Text boxes may be single-line or multiple-line. Text boxes will usually contain captions or labels. Because the most important component of a text box is the data, captions should be lighter or less visible than the data. When first displayed, a text box may be blank or contain an initial value.

Advantages/Disadvantages. Text boxes are very flexible, accepting almost any keyed entry. They are familiar entities and do not consume much screen space. Disadvantages include the requirement that the user must find and/or remember what information must be keyed. One's powers of recall are often tested. Because a keyboard must be used for typing, one's typing skill influences speed and accuracy of use.

Proper Usage. Text boxes are most useful when the data for entry is unlimited in scope, difficult to categorize, and quite variable in length. Text boxes are usually the only alternative when creating a selection list is not possible.

Single-Line and Multiple-Line Text Boxes

- Single-line:
  - — Description:
    - A control consisting of no more than one line of text.
  - — Purpose:
    - To make textual entries when the information can be contained within one line of the screen.
  - — Typical uses:
    - Typing the name of a file to save.
    - Typing the path of a file to copy.
    - Typing variable data on a form.
    - Typing a command.
- Multiple-line:
  - — Description:
    - A control consisting of a multiline rectangular box for multiple lines of text.
  - — Purpose:
    - To type, edit, and read passages of text.
  - — Typical uses:
    - Creating or reading an electronic mail message.
    - Displaying and editing text files.

Text boxes exist in two forms: *single-line* and *multiple-line*. A single-line box is used when the information contained within it can be confined to one screen line. Multiple-line boxes are used when the information exceeds a single line. Text boxes are illustrated in Figure 7.14.

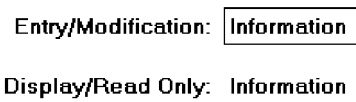


Figure 7.14: Text boxes.

Captions or Labels

- Structure and size:
  - — Provide a descriptive caption to identify the kind of information to be typed, or contained within, the text box.
  - — Use a mixed-case font.
  - — Display the caption in normal intensity or in a color of moderate brightness.
- Formatting:
  - — Single fields:
    - Position the field caption to the left of the text box.
      - Place a colon (:) immediately following the caption.
      - Separate the colon from the text box by one space.

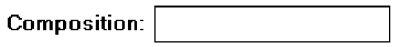


Figure 7.15

- Alternately, the caption may be placed above the text box.
  - Place a colon (:) immediately following the caption.
  - Position above the upper-left corner of the box, flush with the left edge.

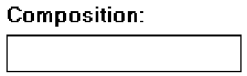


Figure 7.16

  - — Multiple occurrence fields:
    - For entry/modification text boxes, position the caption left-justified one line above the column of entry fields.

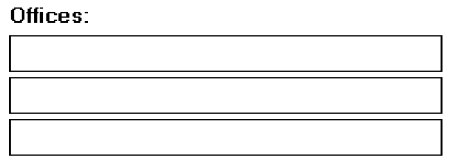


Figure 7.17

- For display/read-only boxes, if the data field is long and fixed-length, or the displayed data is about the same length, center the caption above the displayed text box data.

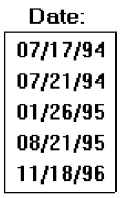


Figure 7.18

- If the data displayed is alphanumeric, short, or quite variable in length, left-justify the caption above the displayed text box data.

Figure 7.19

- If the data field is numeric and variable in length, right-justify the caption above the displayed text box data.

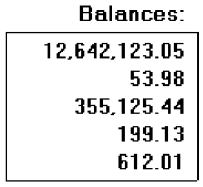


Figure 7.20

Structure and size. Captions or labels are usually added to text boxes using *static text* fields, to be described shortly. Many toolsets do not include captions as part of text box controls. Captions must be understandable and fully spelled out in a language meaningful to the user. In general, abbreviations and contractions should not be used. To achieve the alignment recommendations (to be discussed shortly), however, an occasional abbreviation or contraction may be necessary. If so, choose those that are common in the everyday language of the user or those that are meaningful or easily learned. Use mixed-case text in the headline style, capitalizing only the first letter of each word (except for articles, conjunctions, and prepositions — a, the, and, for, and so on). Acronyms, abbreviations, or proper nouns that are normally capitalized, however, may be capitalized. If the caption is of a sentence-style nature, sentence-style capitalization should be followed. In this case, capitalize only the first letter of the first word of the caption.

In comparison to the text box, the caption should be captions should be lighter or less visible than the data. Visual emphasis should always be given to the information in the text box.

Single fields. For single fields, it is recommended that the caption precede the text box. Place a colon (:) directly following the caption to visually separate the caption from the data; separate the colon from the text box by one space.

Multiple occurrence fields. For multiple-occurrence fields, the caption should be positioned above the columnized text boxes. The exact location of the caption will depend on the kind of screen and the kind of data displayed. For entry screens, the caption should be left-justified above the columnized entry fields.

This will signal the starting point of the text box and ensure that the caption is positioned directly above the keyed data.

For display/read-only or inquiry screens in which text box information already exists, the positioning of the caption depends on the kind of information displayed within the box. The objective is to center the caption over the information. If the box is fixed-length, or the information to be displayed within it usually fills, or almost fills, the box, center the caption above the data. If the information is alphanumeric and can be quite variable in length, left-justify the caption. This will keep the caption directly above the data when it appears in the box. Similarly, for numeric fields, right-justify the caption to keep it above the data that will be right-justified when it appears.

Data Fields

- Structure:
  - — Present entry/modification text boxes surrounded by a line border.
    - Present the box in a recessed manner to indicate that it is an enterable field,
    - Provide a lighter color box background contrasting with the screen background.

Figure 7.21

  - — Present display/read-only text boxes on the window background.

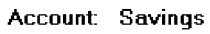


Figure 7.22

  - — Segment long text boxes through
    - Incorporation of slashes (/), dashes (-), spaces, or other common delimiters.
    - If fixed-length data, segment into logical boxes using auto-skip to move between.

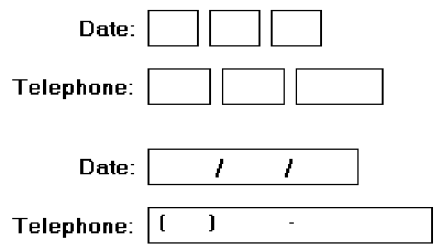


Figure 7.23

- Size:
  - — Size to indicate the approximate length of the field.
  - — Text boxes for fixed-length data must be large enough to contain the entire entry.

— Text boxes for variable-length data must be large enough to contain the majority of the entries.
— Where entries may be larger than the entry field, scrolling must be provided to permit keying into, or viewing, the entire field.
— Employ word wrapping for continuous text in multiple-line text boxes.

- Highlighting:
  — Call attention to text box data through a highlighting technique.
    - Higher intensity.
    - If color is used, choose one that both complements the screen background and contrasts well with it.
- Unavailable fields:
  — Gray-out temporarily unavailable text boxes.
- Fonts:
  — To support multiple fonts, use a rich-text box.

Structure. A text box should attract attention, but not detract from the legibility of the data contained within it, be capable of allowing an indication of the structure of the data contained within it, and indicate the appropriate number of characters to be keyed into it. An early study found that, in meeting these objectives, a broken underscore and an outlined box were the best delimiters for screen entry fields. The older text-based screens traditionally have used the underscore as the delimiter; graphical screens, the outlined box. Interestingly, both resemble the coding areas most frequently found on paper forms. To visually indicate that it is an enterable field, present the box in a recessed manner, as is done by Microsoft Windows.

Present display/read-only text boxes on the window background. To make text boxes more readable, it is desirable to break them up into logical pieces. Slashes, dashes, and spaces should be inserted into the entry fields as illustrated.

Segment long text boxes by including slashes, dashes, or other common delimiters between their logical groups. For fixed-length data, provide multiple logical boxes using auto-skip to move between them.

Size. The size of a field must give an approximate indication of the data length. Text boxes for fixed-length data must be long enough to contain the entry. Variable-length text boxes should be large enough to contain the majority of the entries. The size of a variable-length text box will be dependent on field alignment, space utilization, and aesthetics. If a text box is not large enough to key or view the entire entry, it must be scrollable. Scrolling, however, should be avoided whenever possible.

Highlighting. Text box data (as opposed to captions) is the most important part of a screen. Call attention to it through highlighting techniques. With monochrome screens, display it bright or in high intensity. With color, use the brightest colors. If a box is the delimiter, choose a background color that complements the screen body background and provides good contrast with the color chosen for the data.

Temporarily unavailable. For fields temporarily unavailable for entry, gray-out the box and its associated label. This temporary graying out implies, however, that the user can perform some action that will again make the field enterable.

Rich-text boxes. Most text boxes typically support only the standard system font. A Microsoft Windows rich-text box is similar to a text box but provides, in addition, font properties, such as typeface, size, color, bold, and italics. It also supports character and paragraph alignment, tabs, indents, and numbering, as well as printing.

Selection Controls

A selection control presents on the screen all the possible alternatives, conditions, or choices that may exist for an entity, property, or value. The relevant item or items are selected from those displayed. Some selection controls present all the alternatives together and visible on a screen; others may require an action to retrieve the entire listing and/or scrolling to view all the alternatives. Selection controls include radio buttons, check boxes, list boxes, drop-down/pop-up list boxes, and palettes. Radio buttons and check boxes are similar in structure and use. The distinguishing conceptual difference is that radio buttons permit selecting only choice from the options presented, whereas check boxes permit the selecting of multiple choices.

Radio Buttons

- Description:
  - — A two-part control consisting of the following:
    - Small circles, diamonds, or rectangles.
    - Choice descriptions.
  - — When a choice is selected
    - The option is highlighted.
    - Any existing choice is automatically unhighlighted and deselected.
- Purpose:
  - — To set one item from a small set of mutually exclusive options (2 to 8).
- Advantages:
  - — Easy-to-access choices.
  - — Easy-to-compare choices.
  - — Preferred by users.
- Disadvantages:
  - — Consume screen space.
  - — Limited number of choices.
- Proper usage:
  - — For setting attributes, properties, or values.
  - — For mutually exclusive choices (that is, only one can be selected).
  - — Where adequate screen space is available.

— Most useful for data and choices that are
- Discrete.
- Small and fixed in number.
- Not easily remembered.
- In need of a textual description to meaningfully describe the alternatives.
- Most easily understood when the alternatives can be seen together and compared to one another.
- Never changed in content.

— Do not use
- For commands.
- Singly to indicate the presence or absence of a state.

Structure. Controls of this type take several different physical forms. They are most often called *radio buttons* because of their resemblance to similar controls on radios. Microsoft Windows, however, refers to these controls as *option buttons*. One common display method consists of a circle associated with each choice description. When an alternative is selected, the center of the circle is partially or fully filled in to provide a visual indication that it is the active choice. Other styles of radio buttons have also been implemented. Microsoft Windows uses a small depressed circle that contains a small dot when selected. Other presentation methods include small circular buttons that look recessed when not selected and are raised when selected, and small diamond-shaped buttons that look raised when not selected and depressed when selected. Another method for presenting exclusive choices is the butted box or button where the alternatives are inscribed in horizontally arrayed adjoining rectangles resembling command buttons. The selected alternative is highlighted in some way. Examples of radio buttons are illustrated in Figures 7.24 and 7.25. Deciding on which style to use seems to be more a matter of preference than performance. No published comparison studies are available for guidance. However, the dominance of Microsoft products suggests that most users are familiar with their presentation style.

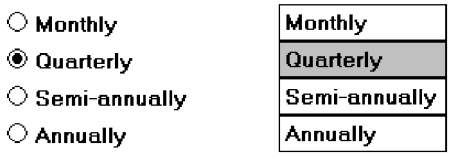


Figure 7.24: Radio buttons.

Figure 7.25: Radio buttons.

Purpose. Radio buttons are used to designate one of a small set of options, no more than about eight. As with a radio, the choices are mutually exclusive, only one frequency or setting is permitted at one time in the presented array.

Advantages/disadvantages. With radio buttons, all alternatives are always visible. Therefore, it is easy to access and compare choices. Two studies (Johnsgard et al., 1995; Tullis and Kodimer, 1992) have found radio buttons a preferred and very effective control for presenting mutually exclusive choices. These studies will be described later in this chapter. On the negative side, radio buttons do consume a certain amount of screen real estate, limiting the number of alternatives that can reasonably be displayed.

Proper usage. Radio buttons are useful for setting attributes, properties, or values where adequate screen space is available. The choices should be discrete, small in number, and in need of a textual description to identify them meaningfully. Radio buttons are helpful in situations where the alternatives cannot always be easily remembered or where displaying the alternatives together facilitates understanding and selecting the proper choice. The radio button choices displayed should be stable, never changing in content. Never use radio buttons for implementing commands, such as causing a dialog box to immediately appear based upon a button setting. Commands to the system should result from direct user command actions, such as pressing a command button. This allows control to remain with the user. Unfortunately, use of a radio button to perform an action is a common Web page design problem. Also, do not use one radio button by itself to indicate the presence or absence of a state. A single check box is recommended for this purpose.

Choice Descriptions

- Provide meaningful, fully spelled-out choice descriptions clearly describing the values or effects set by the radio buttons.
- Display in a single line of text.
- Display using mixed-case letters, using the sentence style.
- Position descriptions to the right of the button. Separate them by at least one space from the button.
- When a choice is conditionally unavailable for selection, display the choice description grayed out or dimmed.
- Include a "None" choice if it adds clarity.

Choice descriptions must be clear, meaningful, fully spelled out, and displayed in a mixed-case text. For multiword descriptions, capitalize the first letter of the description and use the sentence style for the remainder of the description. Small button-type indicators should be located to the left of the choice description; rectangular boxes that resemble a command button will find the description within the box. Small buttons associated with text are advantageous when the choice description must be lengthy. Descriptions in boxes impose restrictions on the number of words that can be inscribed within them. When a choice is unavailable for selection in the present condition,

display the choice selection grayed out or dimmed. Where a "None" alternative clarifies the alternatives presented, provide it in the listing.

Size

- Show a minimum of two choices, a maximum of eight.

Generally, selection fields of this style should not present more than eight choices. Displaying more than eight is usually not efficient, wasting screen space. If the number of choices exceeds this maximum, consider using a single selection list box or a drop-down list box. Johnsgard et al. (1995) have found, however, that even for as many as thirty choices, radio buttons were preferred by users, and performed better, than these other controls.

Defaults

- When the control possesses a state or affect that has been predetermined to have a higher probability of selection than the others, designate it as the default and display its button filled in.
- When the control includes choices whose states cannot be predetermined, display all the buttons without setting a dot, or in the *indeterminate* state.
- When a multiple selection includes choices whose states vary, display the buttons in another unique manner, or in the *mixed value* state.

Provide a default setting for a radio button whenever possible. In some situations, however, a default setting may be difficult to predetermine, or inappropriate to predetermine (sex: male or female?). Microsoft Windows provides for additional settings called the indeterminate or mixed value states. When a default setting cannot be preestablished because of the nature of the information, leave all the buttons blank or not filled in. If a multiple selection on an object is performed and the values in the selection are mixed or differ, display the applicable radio buttons in another distinctive manner, such as a gray shadow.

Structure

- A columnar orientation is the preferred manner of presentation.
- Left-align the buttons and choice descriptions.

Figure 7.26

- If vertical space on the screen is limited, orient the buttons horizontally.
- Provide adequate separation between choices so that the buttons are associated with the proper description.
  — A distance equal to three spaces is usually sufficient.

Figure 7.27

- Enclose the buttons in a border to visually strengthen the relationship they possess.

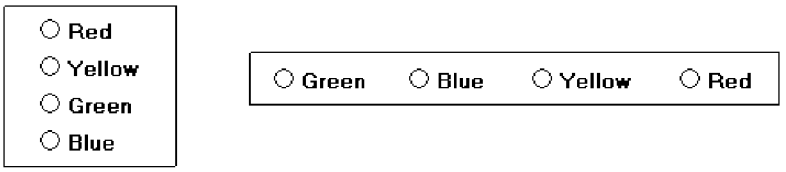


Figure 7.28

The preferred orientation of radio buttons is columnar. This aids visual scanning and choice comparison. Controls with small button indicators usually fit best in this manner because choice descriptions do not have to be restricted in size. Left-align the buttons and choice descriptions. Provide adequate separation-about three spaces-between choices if they must be presented horizontally. Enclose the buttons in a border. Rectangular boxes should be of equal height and/or width and be butted up against one another. This will distinguish them from nonexclusive choice fields (check boxes) that will be separated from one another. Figure 7.29 illustrates the best ways to, and not to, present radio buttons.

Organization

- Arrange selections in expected order or follow other patterns such as frequency of occurrence, sequence of use, or importance.
  — For selections arrayed top to bottom, begin ordering at the top.
  — For selections arrayed left to right, begin ordering at the left.
- If, under certain conditions, a choice is not available, display it subdued or less brightly than the available choices.

Selection choices should be organized logically. If the alternatives have an expected order, follow it. Other ordering schemes such as frequency of use, sequence of use, or importance may also be considered. Always begin ordering at the top or left. If, under certain conditions, a choice is not available, display the nonselectable choice subdued or less brightly than the available choices.

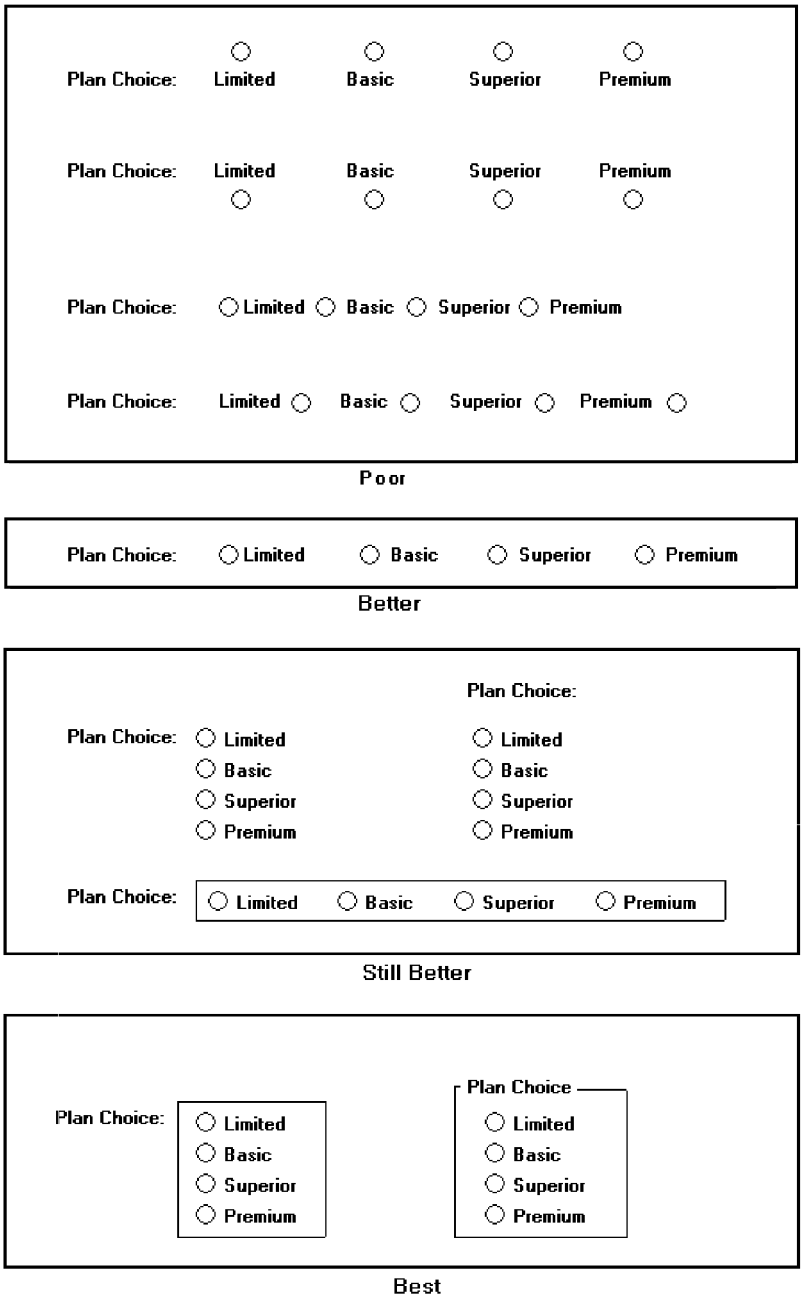


Figure 7.29: Ways to, and not to, present radio buttons.

Related Control

- Position any control related to a radio button immediately to the right of the choice description.
- If the radio button choice description also acts as the label for the control that follows it, end the label with an arrow (>).

◉ Responsible Person > Grandfather

❍ No Resposible Party

Figure 7.30

Position any control related to a check box immediately to the right of the choice description. If a the check box label also acts as the label for the control that follows it, present it in mixed case, sentence style text, and end the label with an arrow (>) to relate the choice description to the control.

Captions

- Structure:
  — Provide a caption for each radio button control.
    - Exception: In screens containing only one radio button control, the screen title may serve as the caption.
- Display:
  — Fully spelled out.
  — In mixed-case letters, capitalizing the first letter of all significant words.
- Columnar orientation:
  — With a control border, position the caption
    - Upper-left-justified within the border.

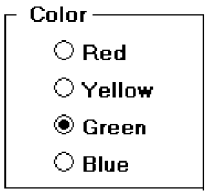


Figure 7.31

- Alternately, the caption may be located to the left of the topmost choice description.

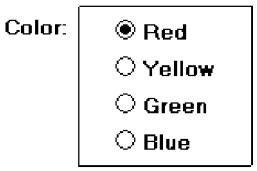


Figure 7.32

— Without an enclosing control border, position the caption

- Left-justified above the choice descriptions, separated by one space line.

Figure 7.33

- Alternately, the caption may be located to the left of the topmost choice description.

Figure 7.34

■ Horizontal orientation:
— Position the caption to the left of the choice descriptions.

Figure 7.35

- Alternately, with an enclosing control border, left-justified within the border.

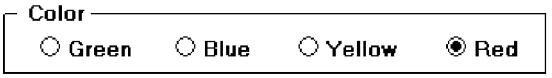


Figure 7.36

— Be consistent in caption style and orientation within a screen.

Structure. Using a static text or group box control field, display the caption fully spelled out, using mixed-case letters in the headline style. Some occasional common abbreviations may be used, however, to achieve the alignment goals to be specified.

Columnar orientation. The preferred location of a radio button control caption within a screen can vary. Ideally, the caption is placed upper-left-justified within a line border or group box that surrounds columnar-oriented radio buttons, as shown in the example in the preceding guideline summary. If other controls on a screen possess captions positioned to the left, and the radio button control is aligned with these controls, position the caption to the left of the control. This will help achieve screen efficiency, minimize viewer eye movements, and provide caption and choice distinctiveness. Without an enclosing control border, position the caption left-justified above the choice descriptions, or to the left of the topmost choice description.

Horizontal orientation. In a horizontal orientation, position the caption to the left of the choice descriptions, or left-justified within an enclosing control border. If the screen contains only one radio button control, the screen title may serve as the control caption. Be consistent in caption style and orientation within a screen.

Keyboard Equivalents

- Assign a keyboard mnemonic to each choice description.
- Designate the mnemonic by underlining the applicable letter in the choice description.

Figure 7.37

Assign unique keyboard mnemonics for each alternative in the standard way, choosing the first letter (or another) and designating it by character underlining.

Selection Method and Indication

- Pointing:
  - — The selection target area should be as large as possible.
    - Include the button and the choice description text.
  - — Highlight the selection choice in some visually distinctive way when the cursor's resting on it and the choice is available for selection.
    - This cursor should be as long as the longest choice description plus one space at each end. Do not place the cursor over the small button.

Figure 7.38

- Activation:
  - — When a choice is selected, distinguish it visually from the unselected choices.
    - A radio button should be filled in with a solid dark dot or made to look depressed or higher through use of a shadow.
  - — When a choice is selected, any other selected choice must be deselected.
- Defaults:
  - — If a radio button control is displayed that contains a choice previously selected or a default choice, display the selected choice as set in the control.

Pointing. The selection target area should be as large as possible in order to make it easy to move to. If a small button is the selection indication method used, the target area should include the button and the choice description text. If the rectangular box selection method is used, the entire box should be the target. Highlight the selection choice in some visually distinctive way when the pointer is resting on it and the choice is available for selection. If a small button is the selection indication method used, a distinctive reverse video, reverse color, or dotted or dashed box selection cursor or bar may be used to surround the selected choice description. This cursor should be as long as the longest description plus one space at each end. The cursor should not cover the small button.

Activation. When a choice is selected, distinguish it visually from the unselected choices. A radio button should be filled in with a solid dark dot or other similar marking (for example, making the button look depressed or higher than the others through the use of a drop shadow). A rectangular box can be highlighted in a manner different from when it is pointed at, or a bolder border can be drawn around it. When a choice is selected, any other selected choice must be deselected or made inactive.

Defaults. If a selection field is displayed with a choice previously selected or a default choice, display the currently active choice in the same manner as when it is selected.

MYTH **Our software is highly usable — it includes all the latest interface widgets.**

Check Boxes

- Description:
  - — A two-part control consisting of a square box and choice description.
  - — Each option acts as a switch and can be either "on" or "off."
    - When an option is selected (on), a mark such as an "X" or "check" appears within the square box, or the box is highlighted in some other manner.
    - Otherwise the square box is unselected or empty (off).
  - — Each box can be
    - Switched on or off independently.
    - Used alone or grouped in sets.
- Purpose:
  - — To set one or more options as either on or off.
- Advantages:
  - — Easy-to-access choices.
  - — Easy-to-compare choices.
  - — Preferred by users.
- Disadvantages:
  - — Consume screen space.
  - — Limited number of choices.
  - — Single check boxes difficult to align with other screen controls.
- Proper usage:
  - — For setting attributes, properties, or values.
  - — For nonexclusive choices (that is, more than one can be selected).
  - — Where adequate screen space is available.
  - — Most useful for data and choices that are
    - Discrete.
    - Small and fixed in number.
    - Not easily remembered.
    - In need of a textual description to describe meaningfully.
    - Most easily understood when the alternatives can be seen together and compared to one another.
    - Never changed in content.
  - — Can be used to affect other controls.
  - — Use only when both states of a choice are clearly opposite and unambiguous.

Description. *Check box* controls, also referred to as *tick box* or *ballot box* controls, differ from radio buttons in that they permit selection of more than one alternative. Each option acts as a switch and can be either "on" or "off." When an option is selected (on), an X or check appears within the square box, or it is highlighted in some other manner. When not selected, the square box is unselected or empty (off). Each box can be switched on or off independently. Check boxes may be used alone or grouped in sets.

Check boxes, too, may take different physical forms and be called by different names. The most common name is *check boxes*, the name used by Microsoft

Windows. Others names include *toggle buttons*, *switches*, and *two state nonexclusive settings*. Not only their names differ; differences also exist in the way these fields are presented on screens. One very common display method is a check box, which, resembling its namesake, consists of a square placed adjacent to each alternative. When the choice is selected, some systems place an X in the square to provide a visual indication that it is active. Others, including Microsoft Windows, place a check mark in the square, or fill in the selected square or make it look depressed when selected.

Interestingly, in the past decade, Microsoft Windows and others have switched from Xs to checks as the "on" mark in a check box. This has occurred because of possible confusion concerning Xs that have existed in some using communities. In an engineering environment, for example, an X marked in a box means not applicable or not set, while a check mark customarily means active or set. Internationally, also, an X is not universally recognized. (This control is called a check box, isn't it?)

Another style for this type of field is a button or box with the choice description inscribed inside. When selected, the alternative is highlighted in some way. To distinguish these fields visually from similarly constructed fields presenting mutually exclusive choices, the buttons are not adjacent to, or butted up against, one another. Check boxes are illustrated in Figures 7.39 and 7.40. Again, deciding on which style to use seems to be more a matter of preference than performance (other than for the possible confusion of Xs and checks). No published comparison studies are available for guidance.

Purpose. The purpose of a check box, then, is to set one or more options either on or off.

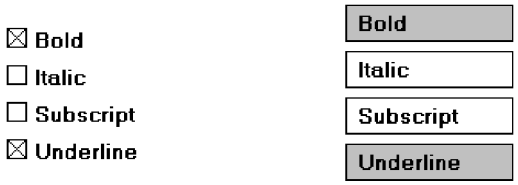


Figure 7.39: Check boxes.

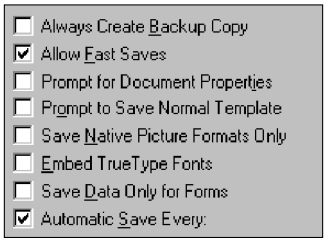


Figure 7.40: Check boxes.

Advantages/disadvantages. With check boxes, all alternatives are always visible. Therefore, it is easy to access and compare choices. Like radio buttons, check boxes were the preferred, and fastest to use, controls in the Johnsgard et al. (1995) study. One disadvantage is the large amount of screen real estate they consume, limiting the number of alternatives that can be efficiently displayed. Another potential disadvantage is that it can be difficult to align a single check box with other arrayed screen controls because they often possess long descriptions for clarity purposes.

Proper usage. Check boxes are useful for setting attributes, properties, or values where adequate screen space is available. The alternatives should be discrete, small in number, and in need of a textual description to identify meaningfully. Check boxes are helpful in situations where the alternatives cannot always be easily remembered and the displaying of the alternatives together aids in understanding and selecting the proper choice. The choices displayed should be stable, never changing in content.

Check boxes can be used to affect other controls. The contents of a list can, for example, be filtered by setting check boxes. Use a check box only when both states of a choice are clearly opposite and unambiguous. If opposite states are not clear, use two radio buttons, clearly stating the opposite states.

Choice Descriptions

- Provide meaningful, fully spelled-out choice descriptions clearly describing the values or effects set by the check boxes.
  — Do not use negatives in the description.
- Display them in a single line of text.
- Display them using mixed-case letters in sentence style.
- Position descriptions to the right of the check box. Separate by at least one space from the box.
- When a choice is unavailable for selection under a certain condition, display the choice description visually dimmed.

Choice descriptions must be clear, meaningful, fully spelled out, and displayed in a mixed-case text. Do not use negatives (such as *dis-*) in the description because the chance for a confusing double negative exists. Always use a positive statement such as *enable*, not *disable*. For multiword descriptions, capitalize the first letter and present the description in the sentence style. Small box-type indicators should be located to the left of the choice description; rectangular boxes that resemble a command button will find the description within the box. Small boxes associated with text are advantageous when the choice description must be lengthy. Descriptions in boxes impose restrictions on the number of words that can be inscribed within them. When a choice is conditionally unavailable for selection, display it grayed out or dimmed.

Size

- Show a minimum of one choice, a maximum of eight.

Generally, selection fields of this style should not offer more than eight choices. Displaying more than eight is usually not efficient because it wastes screen space. If the number of choices exceeds this maximum, consider using a multiple selection list box. Johnsgard et al. (1995) have found, however, that even for as many as 30 choices, check boxes were preferred by users and performed better than other nonexclusive controls.

Defaults

- When the control possesses a state or affect that has been preset, designate it as the default and display its check box marked.
- When a multiple selection includes choices whose states vary, display the buttons in another unique manner, or the mixed value state.

Provide a default setting for a check box whenever possible. If a multiple selection is performed and the values in the selection differ, display the applicable check boxes in the mixed value state, or in another distinctive manner such as with a gray shadow.

Structure

- Provide groupings of related check boxes.
- A columnar orientation is the preferred manner of presentation for multiple related check boxes.
- Left-align the check boxes and choice descriptions.

Figure 7.41

- If vertical space on the screen is limited, orient the boxes horizontally.
- Provide adequate separation between boxes so that the buttons are associated with the proper description.
  — A distance equal to three spaces is usually sufficient.

Figure 7.42

- Enclose the boxes in a border to visually strengthen the relationship they possess.

Figure 7.43

Provide groupings of related check boxes. The preferred check box orientation is columnar. This aids scanning and choice comparison. Controls with small box indicators usually fit best in this manner because choice descriptions are not restricted in size. Left-align the check boxes and choice descriptions. Rectangular boxes should be of equal width and separated from one another by small and equidistant spaces. This will distinguish them from mutually exclusive choices that will be butted up against one another. If the boxes must be horizontally oriented, provide adequate separation between them. Enclose the boxes in a border to emphasize their relationship. Figure 7.44 illustrates ways to, and not to, present groupings of check boxes.

Organization

- Arrange selections in logical order or follow other patterns such as frequency of occurrence, sequence of use, or importance.
  - — For selections arrayed top to bottom, begin ordering at the top.
  - — For selections arrayed left to right, begin ordering at the left.
- If, under certain conditions, a choice is not available, display it subdued or less brightly than the available choices.

Selection choices should be organized logically. If the alternatives have an expected order, follow it. Other ordering schemes such as frequency of use, sequence of use, or importance may also be considered. Always begin the ordering at the top or left. If, under certain conditions, a choice is not available, display the unavailable choice subdued or less brightly than the available choices.

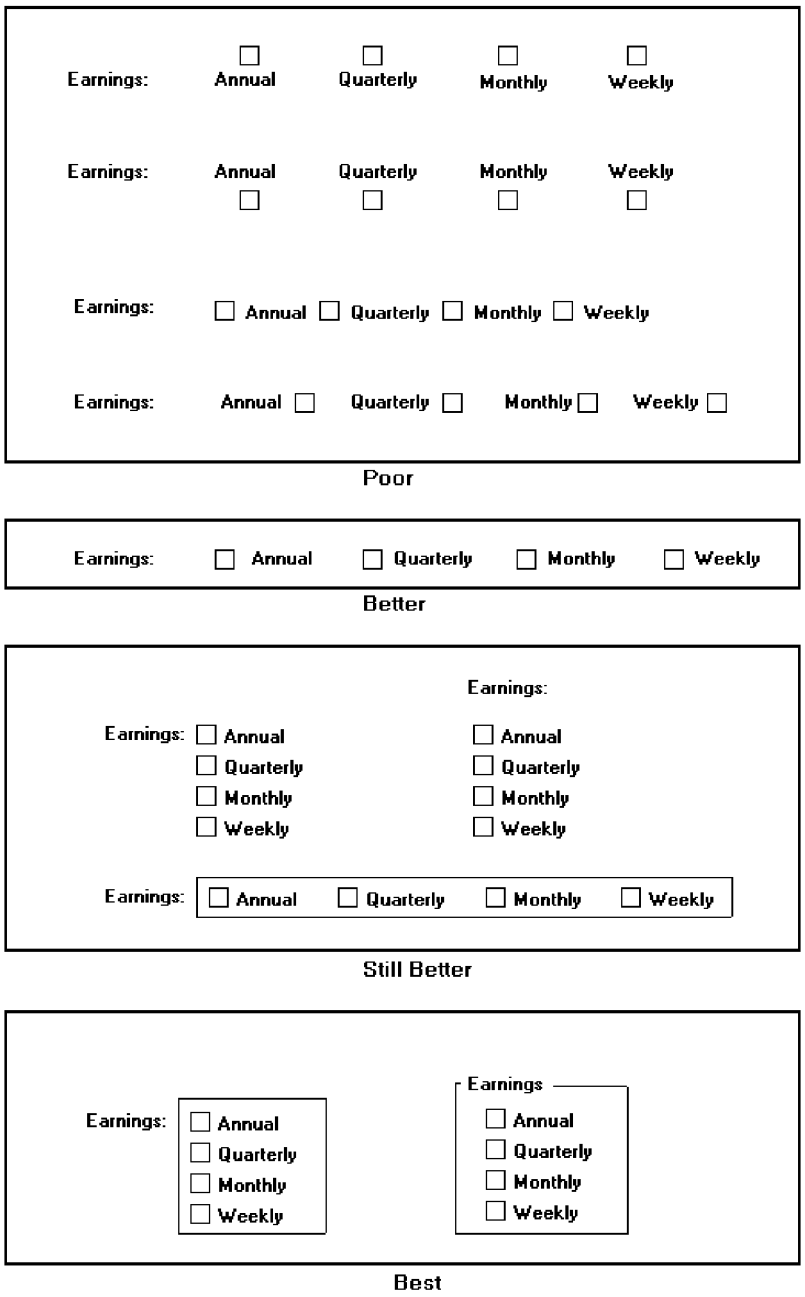


Figure 7.44: Ways to, and not to, present check boxes.

Related Control

- Position any control related to a check box immediately to the right of the choice description.
  - — If the check box choice description also acts as the label for the control that follows it, end the label with an arrow (>).

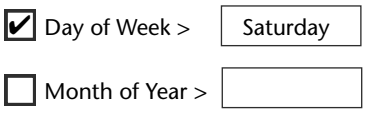


Figure 7.45

Position any control related to a check box immediately to the right of the choice description. If a the check box label also acts as the label for the control that follows it, present it mixed case, sentence style text and end the label with an arrow (>) to relate the choice description to the control.

Captions

- Structure:
  - — Provide a caption for each grouping of related check boxes.
    - Exception: In screens containing only one check box grouping, the screen title may serve as the caption.
  - — Display:
    - Fully spelled out.
    - In mixed-case letters capitalizing the first letter of all significant words.
- Columnar orientation:
  - — With a control border, position the caption
    - Upper-left-justified within the border.

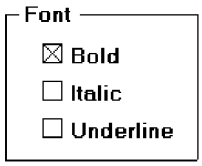


Figure 7.46

- Alternately, the caption may be located to the left of the topmost choice description.

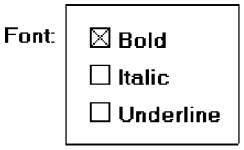


Figure 7.47

— Without an enclosing control border, position the caption
- Left-justified above the choice descriptions separated by one space line.

Figure 7.48

- Alternately, the caption may be located to the left of the topmost choice description.

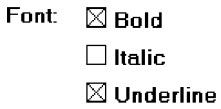


Figure 7.49

■ Horizontal orientation:
— Position the caption to the left of the choice descriptions.

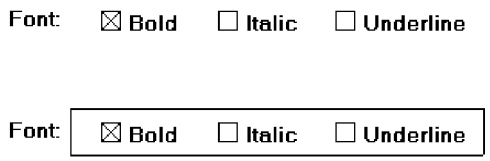


Figure 7.50

- Alternately, with an enclosing control border, it should be left-justified within the border.

Figure 7.51

— Be consistent in caption style and orientation within a screen.

Structure. Using a static text or group box control, provide a caption for each grouping of related check boxes. Display the caption fully spelled out using mixed-case letters. Some occasional common abbreviations may be used, however, to achieve the alignment goals to be specified.

Columnar orientation. The preferred location of a check box control caption within a screen can vary. Ideally, the caption is placed upper-left-justified within a line border, or group box, surrounding columnar-oriented check boxes as shown in the first example in the preceding guideline summary. If other controls on a screen possess captions positioned to the left, and the check box control is aligned

with these controls, position the caption to the left of the control. This is the second example previously illustrated . This will help achieve screen efficiency, minimize viewer eye movements, and provide caption and choice distinctiveness. Without an enclosing border, position the caption left-justified above the choice descriptions, or to the left of the topmost choice.

Horizontal orientation. If horizontal orientation is necessary, position the caption to the left of the choice descriptions, or left-justified within an enclosing control border. If the screen contains only one related grouping of check boxes, the screen title may serve as the control caption. Be consistent in caption style and orientation within a screen.

Keyboard Equivalents

- Assign a keyboard mnemonic to each check box.
- Designate the mnemonic by underlining the applicable letter in the choice description.

Figure 7.52

Assign unique keyboard mnemonics for each check box in the standard way, choosing the first letter (or another) and designating it by character underlining.

Selection Method and Indication

- Pointing:
  - — The selection target area should be as large as possible.
    - Include the check box and the choice description text.
  - — Highlight the selection choice in some visually distinctive way when the cursor's resting on it and the choice is available for selection.
    - This cursor should be as long as the longest choice description plus one space at each end. Do not place the cursor over the check box.

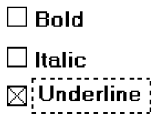


Figure 7.53

- Activation:
  - — When a choice is selected, distinguish it visually from the non-selected choices.
    - A check box should be filled in or made to look depressed or higher through use of a shadow.

- Defaults:
  — If a check box is displayed that contains a choice previously selected or default choice, display the selected choice as set in the control.
- Select/deselect all:
  — Do not use Select All and Deselect All check boxes.
- Mixed-value state:
  — When a check box represents a value, and a multiple selection encompasses multiple value occurrences set in both the on and off state, display the check box in a mixed value state.
    - Fill the check box with another easily differentiable symbol or pattern.

Figure 7.54

  — Toggle the check box as follows:
    - Selection 1: Set the associated value for all elements. Fill the check box with an "X" or "check."
    - Selection 2: Unset the value for all associated elements. Blank-out the check box.
    - Selection 3: Return all elements to their original state. Fill the check box with the mixed value symbol or pattern.

Pointing. The selection target area should be as large as possible in order to make it easy to move to. If a small check box is the selection indication method used, the target area should include the box and the choice description text. If the rectangular box selection method is used, the entire box should be the target. Highlight the selection choice in some visually distinctive way when the pointer is resting on it and the choice is available for selection. If a check box is the selection indication method used, a distinctive reverse video, reverse color, or dotted or dashed box selection cursor or bar may be used to surround the selected choice description. This cursor should be as long as the longest description plus one space at each end. The cursor should not cover the check box.

Activation. When a choice is selected, distinguish it visually from the unselected choices. A check box may be marked with an X or check or filled in. Other methods include making the button look depressed or raised through appropriate use of drop shadows. A rectangular box can be highlighted in a manner different from when it is pointed at, or a bolder border can be drawn around it. The style chosen must be consistently applied throughout an application or system.

Defaults. If a selection field is displayed with a choice previously selected or a default choice, display the currently active choice in the same manner as when it is selected.

Select/deselect all. Do not use Select All and Deselect All check boxes. If this option is necessary, consider using a multiple selection list box with command buttons to accomplish these actions.

Mixed-value state. A check box can have three states.

- Checked — the associated property or value is set.
- Cleared — the associated value or property is not set.
- Mixed value — the associated value is set for some, but not all elements of the selection.

An example of the mixed value state would be when a sentence is selected and the selected text is partly bold and partly normal. So, when a check box represents a value, and a selection encompasses multiple value occurrences set in both the on and off state, display the check box in the mixed value state. Fill the check box with another easily differentiable symbol or pattern. Toggle the check box through clicking as described in the preceding guidelines.

Palettes

- Description:
  - — A control consisting of a series of graphical alternatives. The choices themselves are descriptive, being composed of colors, patterns, or images.
  - — In addition to being a standard screen control, a palette may also be presented on a pull-down or pop-up menu or a toolbar.
- Purpose:
  - — To set one of a series of mutually exclusive options presented graphically or pictorially.
- Advantages:
  - — Pictures aid comprehension.
  - — Easy-to-compare choices.
  - — Usually consume less screen space than textual equivalents.
- Disadvantages:
  - — A limited number of choices can be displayed.
  - — Difficult to organize for scanning efficiency.
  - — Requires skill and time to design meaningful and attractive graphical representations.
- Proper usage:
  - — For setting attributes, properties, or values.
  - — For mutually exclusive choices (that is, only one can be selected).
  - — Where adequate screen space is available.
  - — Most useful for data and choices that are
    - Discrete.
    - Frequently selected.
    - Limited in number.
    - Variable in number.
    - Not easily remembered.
    - Most easily understood when the alternatives may be seen together and compared to one another.
    - Most meaningfully represented pictorially or by example.

- Can be clearly represented pictorially.
- Rarely changed in content.

— Do not use

- Where the alternatives cannot be meaningfully and clearly represented pictorially.
- Where words are clearer than images.
- Where the choices are going to change.

Description. Like radio buttons, palettes can also be used to present two or more mutually exclusive alternatives. The choices presented, however, are visually descriptive within themselves, no choice descriptions being needed to identify them. Examples of palettes might be fill-in colors, patterns, or different shades of a color. A palette may also be referred to as *value set* or *well*. A palette is illustrated in Figure 7.55. In addition to being a standard screen control, a palette may also be presented on a pull-down or pop-up menu, included in a toolbar, or be contained in a Palette window.

Purpose. A palette's purpose is to set one of a series of mutually exclusive options presented in a graphic or pictorial form.

Advantages/disadvantages. Palettes are preferable to radio buttons in that they take up less space and allow the viewer to focus on the visual characteristics of the choice itself, instead of having to read the choice text and cross-reference it to a radio button. Some qualities, such as colors, patterns, and shades, are much more easily comprehended when they are actually seen. While a larger number of choices can be presented than with radio buttons, there is still a limit to how many can be practically displayed. Because of their larger size, palettes are also more difficult to organize for scanning efficiency. Palettes also require skill and time to design meaningful and attractive graphical representations.

Proper usage. Palettes are used for setting attributes, properties, or values of mutually exclusive choices where adequate screen space is available. Consider using a palette when the choices have qualities that can be best described by actual illustration. They are useful for data and choices that are discrete and limited in number. They are most useful when the choices' being seen together and compared to one another aids identification and selection of the proper alternative. They are also most useful when the alternatives can be meaningfully and clearly represented pictorially or by example. Palettes should rarely change in content.

Palettes should be displayed in the proper manner. If the attributes on a palette must be available at all times, place them on a standard control or fixed palette. If the attributes on the palette are sometimes used frequently and other times used infrequently, place them on a pop-up or tear-off menu. Do not place frequently used palettes on pull-down menus.

Also, from a presentation perspective, do not use a palette if the alternatives cannot be meaningfully and clearly represented pictorially. In addition, do not use one where words are clearer than images, or in situations where the choices are going to change.

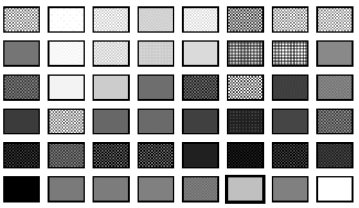


Figure 7.55: Palette.

Graphical Representations

- Provide meaningful, accurate, and clear illustrations or representations of choices.
- Create images large enough to
  — Clearly illustrate the available alternatives.
  — Permit ease in pointing and selecting.
- Create images of equal size.
- Always test illustrations before implementing them.

Provide meaningful, accurate, and clear illustrations of alternative choices. Create equal size images large enough to illustrate clearly the available alternatives and permit ease in pointing and selecting. Always test illustrations with users before implementing them, to ensure that they will work satisfactorily. While most palettes will not possess textual choice descriptions, under certain circumstances textual descriptions may be needed. For example, a choice might require selection of a style of font. The palette may contain the names of the available styles (such as Roman) with the text displayed as the font style would actually appear.

Size

- Present all available alternatives within the limits imposed by
  — The size of the graphical representations.
  — The screen display's capabilities.

Because palettes will consume less screen space, more choices can be displayed in a given area of a screen than can be displayed when using textual descriptions. Present all available alternatives within the limits imposed by how big the graphical representations must be and the capabilities of the display hardware in creating clear illustrations. Limitations in people's ability to accurately differentiate the kinds of graphical representations being presented must also be considered.

Layout

- Create boxes large enough to
  — Effectively illustrate the available alternatives.
  — Permit ease in pointing and selecting.
- Create boxes of equal size.
- Position the boxes adjacent to, or butted up against, one another.
- A columnar orientation is the preferred manner.
- If vertical space on the screen is limited, orient the choices horizontally.

Palette boxes must be large enough to illustrate effectively the available alternatives and to maximize ease in selecting. Created boxes should be of equal size and positioned adjacent to, or butted up against one another, because they are mutually exclusive choices. Columns are preferred, but horizontal rows can be used if space constraints exist on the screen.

Organization

- Arrange palettes in expected or normal order.
  — For palettes arrayed top to bottom, begin ordering at the top.
  — For palettes arrayed left to right, begin ordering at the left.
- If an expected or normal order does not exist, arrange choices by frequency of occurrence, sequence of use, importance, or alphabetically (if textual).
- If, under certain conditions, a choice is not available, display it subdued or less brightly than the other choices.

Palettes should be organized logically. If the alternatives have an expected order, follow it. Colors, for example, should be ordered from the right or top by their spectral position: red, orange, yellow, green, blue, indigo, and violet. If an expected or normal order does not exist, arrange choices by frequency of occurrence, sequence of use, or importance. Palettes with text may be arranged alphabetically. If, under certain conditions, a choice is not available, display the unavailable choice subdued or less brightly than the available choices.

Captions

- Provide a caption for each palette.
  — On screens containing only one palette, the screen title may serve as the caption.
- Display the caption fully spelled out using mixed-case letters.
- Columnar orientation:
  — The field caption may be positioned left-aligned above the palette.

Figure 7.56

— Alternately, the caption may be positioned to the left of the topmost alternative.

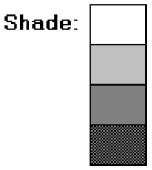


Figure 7.57

- Horizontal orientation:
  — The field caption may be positioned above the palette.

Figure 7.58

— Alternately, the caption may be positioned to the left of the alternatives.

Figure 7.59

Use a static text control to provide a caption for each palette. In screens containing only one palette, the screen title may serve as the caption. Display the caption fully spelled out using mixed-case letters, although some abbreviations may be used to achieve the alignment goals to be specified. Captions may be located above or to the left of the palette, as previously shown. With a horizontal orientation, the caption may be positioned above the palette or to the left of the alternatives. Positioning on any one screen will be dependent on other caption-control relationships within the screen.

Selection Method and Indication

- Pointing:
  — Highlight the choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection.

- Activation:
  — When a choice is selected, distinguish it visually from the unselected choices by highlighting it in a manner different from when it is pointed at, or by placing a bold border around it.
- Defaults:
  — If a palette is displayed with a choice previously selected or a default choice, display the currently active choice in the manner used when it was selected.

Pointing. The selection target should be as large as possible in order to make it easy to move to. Highlight the selection choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection.

Activation. When a choice is selected, distinguish it visually from the unselected choices by highlighting it in a manner different from when it is pointed at, or by placing a bolder border around it.

Defaults. If a palette is displayed with a choice previously selected or a default choice, display the currently active choice in the manner used when it was selected.

List Boxes

- Description:
  — A permanently displayed box-shaped control containing a list of attributes or objects from which
    - A single selection is made (mutually exclusive), or
    - Multiple selections are made (non-mutually exclusive).
  — The choice may be text, pictorial representations, or graphics.
  — Selections are made by using a mouse to point and click.
  — Capable of being scrolled to view large lists of choices.
  — No text entry field exists in which to type text.
  — A list box may be may be associated with a *summary list box* control, which allows the selected choice to be displayed or an item added to the list.
- Purpose:
  — To display a collection of items containing
    - Mutually exclusive options.
    - Non-mutually-exclusive options.
- Advantages:
  — Unlimited number of choices.
  — Reminds users of available options.
  — Box always visible.
- Disadvantages:
  — Consumes screen space.
  — Often requires an action (scrolling) to see all list choices.
  — The list content may change, making it hard to find items.
  — The list may be ordered in an unpredictable way, making it hard to find items.

- Proper usage:
  - — For selecting values or setting attributes.
  - — For choices that are
    - Mutually exclusive (only one can be selected).
    - Non-mutually exclusive (one or more may be selected).
  - — Where screen space is available.
  - — For data and choices that are
    - Best represented textually.
    - Not frequently selected.
    - Not well known, easily learned, or remembered.
    - Ordered in an unpredictable fashion.
    - Frequently changed.
    - Large in number.
    - Fixed or variable in list length.
  - — When screen space or layout considerations make radio buttons or check boxes impractical.

Description. A *list box* is a permanently displayed rectangular box control that contains a list of values or attributes from which single or multiple selections are made. It can also be referred to as a *fixed list box* because it is fixed on the screen. In Java, they are called *lists*, and in HTML, *selection lists/scrolling lists*. The choices are usually text, but they may be pictorial representations or graphics as well. A list box may be scrollable to view large lists, and the user uses a mouse to point and click to make selections. No text entry field exists in which to type text, but a single-selection list box may be associated with a text box where the selected choice is displayed or an item may be added to the list. Examples of single-selection list boxes are illustrated in Figure 7.60.

Purpose. The purpose of a list box is display a collection of items. The choices may be mutually exclusive (single-selection) or not mutually exclusive (multiple-selection).

Advantages/disadvantages. List boxes are always visible, reminding users of the choices available. They permit an unlimited number of options to be displayed. Among their disadvantages are the excessive screen space they consume and the possible necessity for time-consuming scrolling to see all items. Because the list content can change, and items can be ordered in an unpredictable way, it can be hard to find items.

Proper usage. List boxes are used for selecting objects or values or setting attributes, either mutually exclusive or not, where sufficient screen space is available to display six to eight choices. Their best use is for data and choices that are textual; large in number; fixed or variable in list length; not well known, easily learned or remembered; and ordered in an unpredictable fashion. List box items should not have to be selected or changed frequently. List boxes may be used when screen space, list size, and data volatility considerations make use of radio buttons and check boxes impractical. The content of a list box is easier to change than that of radio buttons and check boxes.

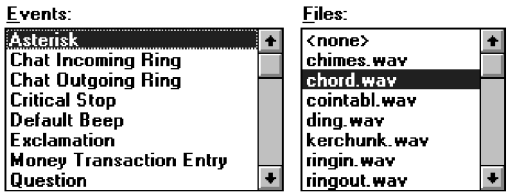


Figure 7.60: List boxes.

List Box General Guidelines

First, general list box guidelines will be presented. Then, specific guidelines for single- and multiple-selection lists will be reviewed.

Selection Descriptions

- Clearly and meaningfully describe the choices available. Spell them out as fully as possible.
  — Graphical representations must clearly represent the options.
- Present in mixed case, using the sentence style structure.
- Left-align into columns.

Selection descriptions will reflect the selection alternatives available. They should be meaningful, fully spelled out, and follow the sentence style of presentation. Array the descriptions into columns. Meaningful ordering schemes include logical order, frequency of use, sequence of use, and importance. If no such pattern exists, arrange the list alphabetically. Display the list of choices using mixed-case letters.

List Size

- No actual limit in size.
- Present all available alternatives.
- Require no more than 40 page-downs to search a list.
  — If more are required, provide a method for using search criteria or scoping the options.

A list being displayed in a fixed list box has no actual size limit. All available alternatives should be capable of being displayed. Searching a very long list, however, can be very time-consuming. A list should not require more than 40 page-downs to completely search it. If more are necessary, provide a method for using search criteria or scoping the options, perhaps through a first-letter search.

Box Size

- Show as many items as possible, considering screen space constraints.
- Minimally, must be long enough to display six to eight items without requiring scrolling.
  - — Exceptions:
    - If screen space constraints exist, the box may be reduced in size to display at least three items.
    - If it is the major control within a window, the box may be larger.
  - — If more items are available than are visible in the box, provide vertical scrolling to display all items.
- Must be wide enough to display the longest possible choice.

Figure 7.61

- — When box cannot be made wide enough to display the longest entry
  - Make it wide enough to permit entries to be distinguishable, or,
  - Break the long entries with an ellipsis (...) in the middle, or,
  - Provide horizontal scrolling.

The exact size of a fixed list box will depend on its function and screen space constraints. Generally, boxes should be restricted to displaying no more than eight choices at one time. Larger boxes that eliminate the need for scrolling, however, are preferable to list boxes that require scrolling. If screen space constraints exist, the box may be reduced in size to display at least three items. If scrolling is necessary, include a scroll bar on the right side of the box.

The list box should be wide enough to display fully all item wording. When a box cannot be made wide enough to display the longest entry, make it wide enough to permit entries to be distinguishable, or, break the long entries with an ellipsis in the middle. If breaking long entries, preserve the important characteristics needed to distinguish them. When shortening an item's name in this way, include a ToolTip that displays the item's full name.

As a last resort, provide horizontal scrolling and a scroll bar at the bottom of the list box. Many people dislike horizontal scrolling, however.

Organization

- Order in a logical and meaningful way to permit easy browsing.
  - — Consider using separate controls to enable the user to change the sort order or filter items displayed in the list.

- If a particular choice is not available in the current context, omit it from the list.
  — Exception: If it is important that the existence and unavailability of a particular list item be communicated, display the choice dimmed or grayed out instead of deleting it.

Choices should be organized logically to permit easy browsing. If the alternatives have an expected order, follow it. Other ordering schemes such as frequency of use, sequence of use, or importance may also be considered. When no obvious scheme exists, use alphabetic order. You can provide separate controls to enable the user to change the sort order or filter items displayed in the list.

If a particular choice is not available in the current context, it should be omitted from the list. If it is important that the existence and unavailability of a list item be communicated, however, display the choice dimmed or grayed out instead of deleting it.

Layout and Separation

- Enclose the choices in a box with a solid border.
  — The border should be the same color as the choice descriptions.
- Leave one blank character position between the choice descriptions and the left border.
- Leave one blank character position between the longest choice description in the list and the right border, if possible.

Enclose the box in a solid border in the color of the choice descriptions. To provide adequate legibility, leave one space between the choice descriptions and the left border, and one space between the longest choice description and the right border.

Captions

- Use mixed-case letters.
- The preferred position of the control caption is above the upper-left corner of the list box.

Figure 7.62

— Alternately, the caption may be located to the left of the topmost choice description.

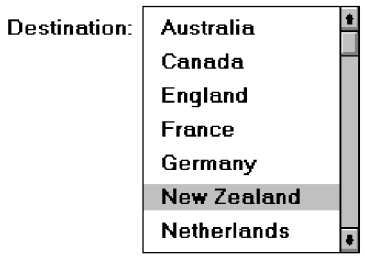


Figure 7.63

- Be consistent in caption style and orientation within a screen, and related screens.

To identify the list box, a field caption in mixed-case letters, with each significant word capitalized is necessary. A list box does not have a caption, so create one using a static text control. Place this caption either above the upper-left corner of the box or to the left of the first choice description. The caption style chosen will again be dependent upon caption-control relationships in other controls included within the screen. It should be consistently oriented with the other control captions.

Disabling

- When a list box is disabled, display its caption and show its entries as grayed out or dimmed.

Display a list box's caption and entries as dimmed or grayed when the list box is entirely disabled.

Selection Method and Indication

- Pointing:
  - — Highlight the selection choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection.
- Selection:
  - — Use a reverse video or reverse color bar to surround the choice description when it is selected.
  - — The cursor should be as wide as the box itself.

Figure 7.64

— Mark the selected choice in a distinguishing way.

- Activation:
  — Require the pressing of a command button when an item, or items, is selected.

Pointing. Highlight the selection choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection. One method used for this is to place a bold border around the choice.

Selection. Indicate the selected choice through use of a reverse video or reverse color bar, as wide as the box itself. Visually differentiate multiple-choice (nonexclusive) from single-choice (mutually exclusive) fixed list boxes, as described in the following sections.

Activation. Require the pressing of a command button when an item, or items, is selected. Double-clicking is difficult for many people. Always provide for a single click followed by a button press.

Single-Selection List Boxes

- Purpose:
  — To permit selection of only one item from a large listing.
- Design guidelines:
  — Related text box:
    - If presented with an associated text box control,
      — Position the list box below and as close as possible to the text box.
      — The list box caption should be worded similarly to the text box caption.

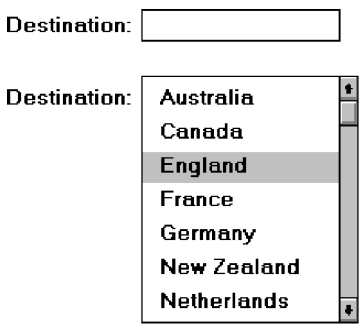


Figure 7.65

— If the related text box and the list box are very close in proximity, the caption may be omitted from the list box.

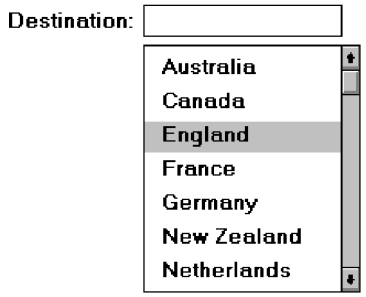


Figure 7.66

— Use the same background color for the text box as is used in the list box.

— Defaults:

- When the list box is first displayed:
  - — Present the currently active choice highlighted or marked with a circle or diamond to the left of the entry.
  - — If a choice has not been previously selected, provide a default choice and display it in the same manner that is used in selecting it.
  - — If the list represents mixed values for a multiple selection, do not highlight an entry.

— Other:

- Follow other relevant list box guidelines.

Purpose. A *single-selection* list box is used for selecting only one item in a list. It provides a mutually exclusive operation similar to a group of radio or option buttons. This kind of list box, however, can handle a large number of items more efficiently.

Related text box. If the list box is associated with a text field, position the list box below and as close as possible to the related text box. If this cannot be accomplished, position the text box to the left. Captions of related text boxes and list boxes must be worded similarly. If, however, the text box and the list box are located in close physical proximity, the caption may be omitted from the list box. Visually relate a list box to a text box by using the same background color for both boxes.

For single-selection fixed list boxes, indicate an active choice by highlighting it or marking it with a circle or diamond to the left of the choice description. If the list represents mixed values for a multiple selection, do not highlight any entry.

Extended and Multiple-Selection List Boxes

- Purpose:
  — To permit selection of more than one item in a long listing.
    - Extended list box: optimized for individual item or range selection.
    - Multiple-selection list box: optimized for independent item selection.
- Design guidelines:
  — Selection indication:
    - Mark the selected choice with an X or check mark to the left of the entry.

Figure 7.67

- Consider providing a summary list box.
  — Position it to the right of the list box.
  — Use the same colors for the summary list box as are used in the list box.

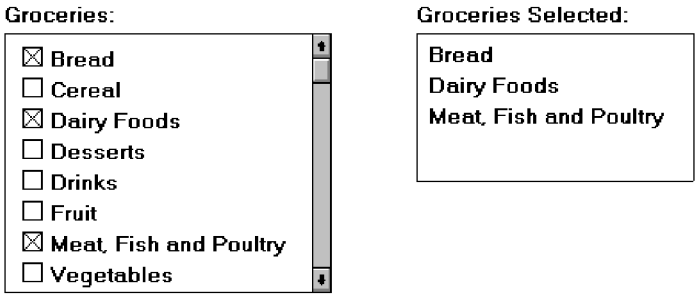


Figure 7.68

  — Provide command buttons to Add (one item) or Add All (items) to the summary list box, and Remove (one item) or Remove All (items) from the summary list box.
- Consider providing a display-only text control indicating how many choices have been selected.
  — Position it justified upper-right above the list box.

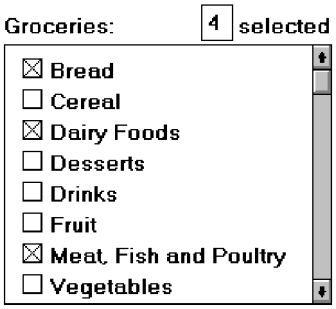


Figure 7.69

— Select All and Deselect All buttons
- Provide command buttons to accomplish fast Select All and Deselect All actions, when these actions must be frequently or quickly performed.

— Defaults:
- When the list box is first displayed:
  — Display the currently active choices highlighted.
  — Mark with an X or check mark to the left of the entry.
  — If the list represents mixed values for a multiple selection, do not highlight an entry.

— Other:
- Follow other relevant list box guidelines.

Purpose. *Multiple-selection* list boxes permit selection of multiple items from a long listing. They provide a nonexclusive operation similar to a group of check boxes. This kind of list box, however, can handle a large number of items more efficiently. *Extended list* boxes are optimized for individual item or range selection. Multiple-selection list boxes are optimized for independent item selection.

Selection indication. For choice selections, mark them with an X or check mark to the left of the entry. Also consider providing a *summary list* box, another list box containing a compilation of the active selections from the multiple-selection list box. This will permit quick scanning and comparison of these active choices and greatly reduce the need for scrolling if the selectable list is lengthy. The summary list box can be made scrollable, if necessary. Position the summary list adjacent to, and to the right of, the multiple-selection list box. Use the same colors for the summary list box and the multiple-selection list box. Include command buttons to Add (one item) or Add All (items) to the summary list box, and Remove (one item) or Remove All (items) from the summary list box.

Also consider providing a *display-only text box* control indicating how many choices have been selected in the multiple-selection list box. This text box can be associated with either the multiple-selection or summary list box. It is useful in situations where the multiple selections may be numerous and all the choices cannot be seen without scrolling. It is also useful when the user must know exactly how many choices have been selected. Position this text box justified upper-right above the list box.

Select All and Deselect All buttons. Provide command buttons to accomplish fast "select all" and "deselect all" actions, when these actions must be frequently or quickly performed.

Defaults. When the list box is first displayed, the active selection will depend on previous activities. If a choice has been previously selected, display the currently active choice in the same manner used when it was selected. If the list represents mixed values for a multiple selection, do not highlight any list entries.

List View Controls

- Description:
  - — A special extended-selection list box that displays a collection of items, consisting of an icon and a label.
  - — The contents can be displayed in four different views:
    - Large Icon: Items appear as a full-sized icon with a label below.
    - Small Icon: Items appear as a small icon with label to the right.
    - List: Items appear as a small icon with label to the right.
      —Arrayed in a columnar, sorted layout.
    - Report: Items appear as a line in a multicolumn format.
      — Leftmost column includes icon and its label.
      — Subsequent columns include application-specific information.
- Purpose and usage:
  - — Where the representation of objects as icons is appropriate.
  - — To represent items with multiple columns of information.

Description. A *list view* control is a special extended-selection list box that displays a collection of items, each consisting of an icon and a label. List view controls can display content in four different views: large icon, small icon, list, and report. The control also supports options for aligning, selecting, and sorting icons, and for editing icon labels.

Purpose and usage. Use list views when the representation of objects as icons is appropriate, or to represent items with multiple columns of information.

Drop-Down/Pop-Up List Boxes

- Description:
  - — A single rectangular control that shows one item with a small button to the right side.
    - The button provides a visual cue that an associated selection box is available but hidden.
  - — When the button is selected, a larger associated box appears, containing a list of choices from which one may be selected.

— Selections are made by using the mouse to point and click.
— Text may not be typed into the control.

- Purpose:
  — To select one item from a large list of mutually exclusive options when screen space is limited.
- Advantages:
  — Unlimited number of choices.
  — Reminds users of available options.
  — Conserves screen space.
- Disadvantages:
  — Requires an extra action to display the list of choices.
  — When displayed, all choices may not always be visible, requiring scrolling.
  — The list may be ordered in an unpredictable way, making it hard to find items.
- Proper usage:
  — For selecting values or setting attributes.
  — For choices that are mutually exclusive (only one can be selected).
  — Where screen space is limited.
  — For data and choices that are
    - Best represented textually.
    - Infrequently selected.
    - Not well known, easily learned, or remembered.
    - Ordered in a unpredictable fashion.
    - Large in number.
    - Variable or fixed in list length.
  — Use drop-down/pop-up lists when
    - Screen space or layout considerations make radio buttons or single-selection list boxes impractical.
    - The first, or displayed, item will be selected most of the time.
  — Do not use a drop-down list if it important that all options be seen together.

Description. A *drop-down/pop-up list box* is a single rectangular field with a small button to the side and an associated hidden list of options. In Java, they are called *choice/pop-up lists*, in HTML, *selection lists/pop-up menus*. The button provides a visual cue to the user that an associated selection box of choices is hidden but available on demand. When requested, a larger associated rectangular box appears containing a scrollable list of choices from which one is selected. Selections are made by using the mouse to point and click. No text field exists in which to type text.

Fields of this nature go by many different names. They are called *drop-down lists* because they appear to drop down from the single-selection field. Microsoft Windows calls them *drop-down list boxes*. Other common names are *pull-down lists*, *option menus*, and simply *list boxes*. Other list boxes of this type seem to pop up on the screen, either next to or over the selection field. Even a Microsoft Windows "drop-down" will "pop up" if it is opened near the bottom of the screen. In this discussion, these variously named controls will be given the generic name of drop-down/pop-up list boxes. A drop-down list is illustrated in Figures 7.70 and 7.71. Figure 7.72 shows a pop-up list.

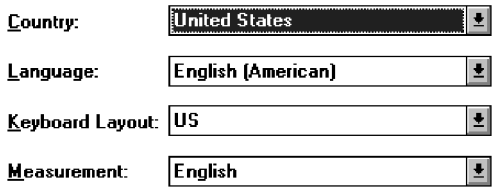


Figure 7.70: Drop-down list boxes. There are four unopened boxes: Country, Language, Keyboard Layout, and Measurement.

Figure 7.71: Drop-down list box opened for Country.

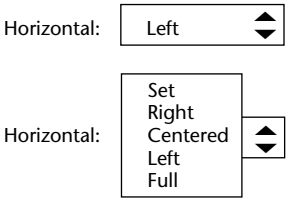


Figure 7.72: Pop-up list box, closed and opened.

Purpose. The purpose of these list boxes is to permit selection from a large set of mutually exclusive choices when screen space is scarce.

Advantages/disadvantages. The most useful feature of drop-down/pop-up list boxes is that they conserve screen space. They may be retrieved on demand, reminding users of the choices available. They permit an unlimited number of options to be displayed.

A significant disadvantage of these lists is that they necessitate an extra step to display the available options. Scrolling may also be necessary to see all items. Because items can be ordered in an unpredictable way, they can be hard to find occasionally. Generally, drop-down/pop-up list boxes require more work on the part of the user than many other screen controls because of the activation step and the possible need for scrolling. A study comparing drop-down/pop-up lists to other similar controls will be described later in this step.

Proper usage. Drop-down/pop-up list boxes are used much like regular list boxes, except that the choices are not visible at all times. They are used for selecting values or setting attributes when sufficient screen space is not available to display the choices permanently. Their best use is for data and choices that are textual; large in number; fixed or variable in list length; not well known, easily learned or

remembered; and ordered in an unpredictable fashion. Items should not have to be selected frequently. Drop-down/ pop-up lists are most useful when screen space or layout considerations make radio buttons or single-selection list boxes impractical. It is also desirable that most users select the first, or displayed, item in the listing so the box does not have to be opened. Never use a drop-down/pop-up list if it is important that all options be seen together at one time.

Prompt Button

- Provide a visual cue that a box is hidden by including a downward pointing arrow, or other meaningful image, to the right side of the selection field.
  — Position the button directly against, or within, the selection field.

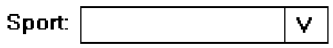


Figure 7.73

Most systems indicate the presence of a drop-down or pop-up list by associating a meaningful icon with the applicable field. This icon can be seen positioned to the left of the selection field, within the selection field as is done by Microsoft Windows, or to the right of the selection field. Other platforms do not provide any visual indication that a hidden list is available. An indication to the user that a drop-down or pop-up list is available should be indicated on the screen. This is especially critical if not all fields have associated hidden lists. The best location is to the right of the selection field where it is out of the way until needed. To visually differentiate it from another control (the drop-down/pop-up combination box), position the button abutting or within the selection field. (A drop-down/pop-up combination box button will be separated by a space.) The indicator should be large enough to provide a good pointing target.

Selection Descriptions

- Clearly and meaningfully describe the choices available. Spell them out as fully as possible.
  — Graphical representations must clearly represent the options.
  — Left-align them in columns.
  — Display the descriptions using mixed-case letters.

Selection descriptions will reflect what choices exist in the control. They should be meaningful, fully spelled out, and organized in columns. Display the list of choices using mixed-case letters. Box descriptions should be displayed in the same color as the selection field text. If a particular choice is not available in the current context, it should be omitted from the list.

List Size

- Not limited in size.
- Present all available alternatives.

A list being displayed in a drop-down/pop-up list box has no size limit. All available alternatives should be capable of being displayed. It would seem practical that for large scrollable lists, the same rules as presented for list boxes should also be applied. Restrict page-downs to no more than 40 and provide a method to scope actions.

Box Size

- Long enough to display six to eight choices without scrolling.
  - — If more than eight choices are available, provide vertical scrolling to display all items.
- Wide enough to display the longest possible choice.
- When a box cannot be made wide enough to display the longest entry
  - — Make it wide enough to permit entries to be distinguishable, or,
  - — Break long entries with ellipses (...) in the middle, or,
  - — Provide horizontal scrolling.

Drop-down/pop-up list boxes should be restricted to eight or fewer choices. If more must be displayed, permit scrolling and include a scroll bar on the right side of the box. The list box should be wide enough to fully display all selection choice wording. When a box cannot be made wide enough to display the longest entry, make it wide enough to permit entries to be distinguishable, or break the long entries, inserting an ellipsis in the middle. If breaking entries, preserve the important characteristics needed to distinguish them. When shortening an item's name in this way, include a ToolTip that displays the item's full name. As a last resort, provide horizontal scrolling and a scroll bar at the bottom of the list box. Avoid horizontal scrolling whenever possible, however.

Organization

- Order in a logical and meaningful way to permit easy browsing.
- If a particular choice is not available in the current context, omit it from the list.
  - — Exception: If it is important that the existence and unavailability of a particular list item be communicated, display the choice dimmed or grayed out instead of deleting it.

Selection choices should be organized logically. If the alternatives have an expected order, follow it. Other ordering schemes such as frequency of use, sequence of use, or importance, may also be considered. Always begin ordering at the top or left. If, under certain conditions, a choice is not available, display the unavailable choice subdued or less brightly than the available choices.

Layout and Separation

- Enclose the choices in a box composed of a solid line border.
  - — The border should be the same color as the choice descriptions.
  - — Leave one blank character position between the choices and the left border.
  - — Leave one blank character position between the longest choice description in the list and the right border, if possible.

To provide adequate legibility, leave one space between the choice descriptions and the left border, and one space between the longest choice description and the right border. Extending the listing box to the right edge of the prompt button allows the user to move easily from the button to the list. To set off the box from the screen body background, use the same color background for the box as is used in the entry field. Also incorporate a solid line border around the box in the same color as the choice descriptions.

Captions

- Display using mixed-case letters.
- Position the caption to the left of the box.
  - — Alternately, it may be positioned left-justified above the box.

To identify the drop-down/pop-up list box, a field caption in mixed-case letters, with each significant word capitalized is necessary. Use a static text control to create the caption. The recommended position is to the box's left. Select a positioning consistent with other controls presented on the window.

Defaults

- When the drop-down/pop-up listing is first presented, display the currently set value.
- If a choice has not been previously selected, provide a default choice.

When the drop-down/pop-up listing is first presented, display the currently set value. If a choice has not been previously selected, provide a default choice. The list must be opened to change the choice.

Disabling

- When a drop-down/pop-up list box is disabled, display its caption and entries as disabled or dimmed.

Display a drop-down/pop-up list box's caption and entries as dimmed or grayed out when the list box is entirely disabled.

Selection Method and Indication

- Pointing:
  — Highlight the selection choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection.
- Activation:
  — Close the drop-down/pop-up list box when an item is selected.

Highlight the selection choice in some visually distinctive way when the pointer or cursor is resting on it and the choice is available for selection. Close the listing when an item is selected.

Combination Entry/Selection Controls

It is possible for a control to possess the characteristics of both a text field and a selection field. In this type of control, information may either be keyed into the field or selected and placed within it. The types of combination entry/selection fields are spin boxes, attached combination boxes, and drop-down/pop-up combination boxes.

Spin Boxes

- Description:
  — A single-line field followed by two small, vertically arranged buttons.
    - The top button has an arrow pointing up.
    - The bottom button has an arrow pointing down.
  — Selection/entry is made by
    - Using the mouse to point at one of the directional buttons and clicking. Items will change by one unit or step with each click.
    - Keying a value directly into the field itself.
- Purpose:
  — To make a selection by either scrolling through a small set of meaningful predefined choices or typing text.
- Advantages:
  — Consumes little screen space.
  — Flexible, permitting selection or typed entry.

- Disadvantages:
  - — Difficult to compare choices.
  - — Can be awkward to operate.
  - — Useful only for certain kinds of data.
- Proper usage:
  - — For setting attributes, properties, or values.
  - — For mutually exclusive choices (only one can be selected).
  - — When the task requires the option of either key entry or selection from a list.
  - — When the user prefers the option of either key entry or selection from a list.
  - — Where screen space is limited.
  - — Most useful for data and choices that are
    - Discrete.
    - Infrequently selected.
    - Well known, easily learned or remembered, and meaningful.
    - Ordered in a predictable, customary, or consecutive fashion.
    - Infrequently changed.
    - Small in number.
    - Fixed or variable in list length.

Description. A *spin box*, also called a *spin button* or an *up-down control*, is a single-line field followed by two small, vertically arranged buttons inscribed with up and down arrows. These buttons may also be referred to as up-down buttons. Selection of an item is accomplished using the mouse to point at one of the buttons and clicking. Items in a listing in the display field will change by one unit or step in the direction selected with each click. The list is searched as the ring or circle of alternatives "spins" by. Keying a value directly into the field itself may also complete a spin box. A spin box is illustrated in Figure 7.74.

Advantages/disadvantages. Spin boxes are flexible, permitting either selection or typed entry. They also consume little screen space. On the other hand, spin boxes are useful only for certain kinds of data, that which is predictable or consecutive. Because only one item is displayed at a time, it is difficult to compare choices. Spin boxes may also be awkward to operate, often requiring several back and forth iterations to bring the desired value into view.

Proper usage. Spin boxes are used for setting attributes, properties, or values that are mutually exclusive. They are useful when the task requires, or the user prefers, the option of either key entry or selection from a list. Spin boxes are useful for data and choices that are discrete and small in number. The choices themselves should be well known, easily learned or remembered, and meaningful. Choices should be ordered in a predictable, customary, or consecutive fashion so people can anticipate the next not-yet-visible choice. Items in spin boxes should not require frequent selection, and the array of items listed should be stable.

Figure 7.74: Spin boxes.

List Size

- Keep the list of items relatively short.
- To reduce the size of potentially long lists, break the listing into subcomponents, if possible.

Because the list must be manipulated to display its contents, it should be as short as feasible. To reduce the size of potentially long lists, break the listing into subcomponents whenever possible. A date, for example, may be broken into its components of month, day, and year.

List Organization

- Order the list in the customary, consecutive, or expected order of the information contained within it.
  — Ensure that the user can always anticipate the next (not-yet-visible) choice.
- When first displayed, present a default choice in the box.

Spin boxes are most effective when the values they contain have a customary or consecutive order that is predictable. Information can be letters or numbers. Examples are days of the week, months of the year, shoe sizes, and so on. The user must always be able to anticipate the next choice before it is displayed. The control should always contain a default value when first displayed.

Other Spin Box Guidelines

- Box size:
  — The spin box should be wide enough to display the longest entry or choice.
- Caption:
  — Display it using mixed-case letters.
  — Position the caption to the left of the box.
    - Alternately, it may be positioned left-justified above the box.
- Entry and selection methods:
  — Permit completion by
    - Typing directly into the box.
    - Scrolling and selecting with a mouse.
    - Scrolling and selecting with the up/down arrow keys.

— For alphabetical values,
  - Move down the order using the down arrow.
  - Move up the order using the up arrow.

— For numeric values or magnitudes,
  - Show a larger value using the up arrow.
  - Show a smaller value using the down arrow.

Box size. Fully display all alternatives within the spin box. The box should be wide enough to display the longest entry or choice.

Caption. To identify the spin box, use a static text field to provide a field caption in mixed-case letters, with each significant word capitalized. The recommended position is to the box's left. Select a positioning consistent with other controls presented on the window.

Entry and selection. Spin box completion should be possible by typing directly into the field or by scrolling and selecting options with a mouse or keyboard keys. When spinning alphabetical values, move down the order using the down arrow and up the order using the up arrow. For numeric values or magnitudes, display a larger value using the up arrow and a smaller value using the down arrow.

Combo Boxes

- Description:
  — A single rectangular text box entry field, beneath which is a larger rectangular list box (resembling a drop-down list box) displaying a list of options.
  — The text box permits a choice to be keyed within it.
  — The larger box contains a list of mutually exclusive choices from which one may be selected for placement in the entry field.
    - Selections are made by using a mouse to point and click.
  — As text is typed into the text box, the list scrolls to the nearest match.
  — When an item in the list box is selected, it is placed into the text box, replacing the existing content.
  — Information keyed may not necessarily have to match the list items.
- Purpose:
  — To allow either typed entry in a text box or selection from a list of options in a permanently displayed list box attached to the text box.
- Advantages:
  — Unlimited number of entries and choices.
  — Reminds users of available options.
  — Flexible, permitting selection or typed entry.
  — Entries not necessarily restricted to items selectable from list box.
  — List box always visible.
- Disadvantages:
  — Consumes some screen space.
  — All list box choices not always visible, requiring scrolling.

— Users may have difficulty recalling sufficient information to type entry, making text box unusable.
— The list may be ordered in an unpredictable way, making it hard to find items.

■ Proper usage:
— For entering or selecting objects or values or setting attributes.
— For information that is mutually exclusive (only one can be entered or selected).
— When users may find it practical to, or prefer to, type information rather than selecting it from a list.
— When users can recall and type information faster than selecting it from a list.
— When it is useful to provide the users a reminder of the choices available.
— Where data must be entered that is not contained in the selection list.
— Where screen space is available.
— For data and choices that are
- Best represented textually.
- Somewhat familiar or known.
- Ordered in an unpredictable fashion.
- Frequently changed.
- Large in number.
- Variable or fixed in list length.

Description. A *combo box*, also known as an *attached combination box,* is a single rectangular entry field, beneath which is a larger rectangular box (resembling a drop-down list box) displaying a list of options. In Java, combo boxes are called *editable choice pop-up lists*. The entry field permits a choice to be keyed within it, while the larger box contains a list of mutually exclusive choices, from which one may be selected for placement in the entry field. A combo box combines the capabilities of both a text box and a list box. It visually resembles a drop-down list box or drop-down combo box (to be described). The text box and its associated list box have a dependent relationship. As text is typed into the text box, the list scrolls to the nearest match. Also, when an item in the list box is selected, that item is placed within the text box, replacing the existing content. When typing into the field, the information keyed does not have to match the list items. Combo boxes are illustrated in Figure 7.75.

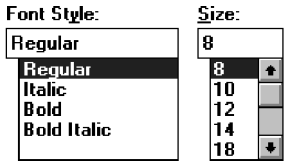


Figure 7.75: Combo boxes.

Advantages/disadvantages. Combo boxes are flexible, permitting selection or typed entry. Alternatives are always visible, or retrievable, reminding people of the available options. An unlimited variety of entries and choices are possible. Entries are not necessarily restricted to items selectable from a box. Combo boxes do consume quite a bit of screen space. Because all box choices may not be visible, some scrolling may be required. It is always possible that people may have difficulty recalling sufficient information to type, making the text box unusable. The list may also be ordered in an unpredictable way, making it hard to find items. Additional work is required of the user if selection scrolling must be performed.

Proper usage. Combo boxes are useful for entering or selecting objects or values or setting attributes that are mutually exclusive. They are most valuable when users may find it practical to, or prefer to, type information rather than selecting it from a list, but where reminders of alternatives available must occasionally be provided. They are also useful when the listings are dynamic and changeable, permitting the user to key items not contained on the list in the box. They do require that screen space be available to display them, but they eliminate the extra steps involved in retrieving drop-down lists. Combo boxes are useful for textual data and choices that are frequently changed and somewhat familiar or known, fostering keyed entry. The lists may be long, variable, and ordered in an unpredictable fashion.

Combo Box Guidelines

For the text box entry field, see "Text Box/Single Line" guidelines. For the list box, see "Drop-Down/Pop-Up List Boxes" guidelines.

Drop-Down/Pop-Up Combo Boxes

- Description:
  - — A single rectangular text box with a small button to the side and an associated hidden list of options.
    - The button provides a visual cue that an associated selection box is available but hidden.
  - — When requested, a larger associated rectangular box appears, containing a scrollable list of choices from which one is selected.
  - — Selections are made by using the mouse to point and click.
  - — Information may also be keyed into the field.
  - — As text is typed into the text box, the list scrolls to the nearest match.
  - — When an item in the list box is selected, it is placed into the text box, replacing the existing content.
  - — The information keyed does not necessarily have to match list items.
  - — Combines the capabilities of both a text box and a drop-down/pop-up list box.
- Purpose:
  - — To allow either typed entry or selection from a list of options in a list box that may be closed and retrieved as needed.

- Advantages:
  - — Unlimited number of entries and choices.
  - — Reminds users of available options.
  - — Flexible, permitting selection or typed entry.
  - — Entries not restricted to items selectable from list box.
  - — Conserves screen space.
- Disadvantages:
  - — Requires an extra step to display the list of choices.
  - — When displayed, all box choices may not always be visible, requiring scrolling.
  - — User may have difficulty in recalling what to type.
  - — The list content may change, making it hard to find items.
  - — The list may be ordered in an unpredictable way, making it hard to find items.
- Proper usage:
  - — For entering or selecting objects or values or setting attributes.
  - — For information that is mutually exclusive (only one can be entered or selected).
  - — When users may find it practical to, or prefer to, type information rather than selecting it from a list.
  - — When users can recall and type information faster than selecting from a list.
  - — When it is useful to provide the users with an occasional reminder of the choices available.
  - — Where data must be entered that is not contained in the selection list.
  - — Where screen space is limited.
  - — For data and choices that are
    - Best represented textually.
    - Somewhat familiar or known.
    - Ordered in an unpredictable fashion.
    - Frequently changed.
    - Large in number.
    - Variable or fixed in list length.

Description. A *drop-down/pop-up combo box* is a single rectangular field with a small button to the side and an associated hidden list of options. The button provides a visual cue to the user that an associated selection box of choices is available but hidden. When requested, a larger associated rectangular box appears, containing a scrollable list of choices from which one can be selected. One makes selections by using the mouse to point and click. The text box and its associated list box have a dependent relationship. As text is typed into the text box, the list scrolls to the nearest match. Also, when an item in the list box is selected, that item is placed within the text box, replacing the existing content. It closely resembles a drop-down/pop-up list box. Information, however, may also be keyed into the field. The information keyed does not necessarily have to match items in the list. A drop-down/pop-up combination box, therefore, combines the capabilities of both a text box and a selection field. A drop-down combo box is illustrated in Figures 7.76 and 7.77.

Figure 7.76: Windows 3.1 Drop-down combo box, closed.

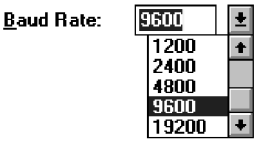


Figure 7.77: Windows 3.1 Drop-down combo box, opened.

Advantages/disadvantages. Drop-down/pop-up combo boxes are flexible, permitting selection or typed entry. They conserve screen space, but alternatives are always retrievable, reminding people of the available options. An unlimited variety of entries and choices are possible. Entries are not restricted to items selectable from a box.

In terms of disadvantages, they necessitate an extra step to display the available options. Scrolling may also be necessary to see all items. Because the list content can change, and items can be ordered in an unpredictable way, it can be hard to find items. It is always possible also that people may have difficulty recalling sufficient information to type, making the entry field unusable. Generally drop-down/pop-up combination boxes require more work on the part of the user than many other screen controls.

Proper usage. Drop-down/pop-up combo boxes are useful for entering or selecting objects or values or setting attributes that are mutually exclusive. They are most valuable when users may find it practical to, or prefer to, type information rather than selecting from a list but where reminders of alternatives available must occasionally be provided. The box may only be retrieved as needed, thereby conserving screen space. They are also useful when the listings are dynamic and changeable, permitting the user to key items not contained on the list in the box. Drop-down/pop-up combo boxes are useful for textual data and choices that are frequently changed and somewhat familiar or known, fostering keyed entry. The list may be long, variable, and ordered in an unpredictable fashion.

Prompt Button

- Provide a visual cue that a list box is hidden by including a downward-pointing arrow to the right of the text box.
- Separate the button from the text box by a small space.

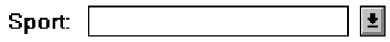


Figure 7.78

Provide a visual cue that a list box is hidden by including a downward-pointing arrow to the right of the entry field. Unfortunately, Microsoft Windows has provided drop-down list boxes and combo boxes that are visually almost identical. The only way to differentiate the two types is to click and see whether a box can be typed into. This is extremely poor design. Each unique control should be identifiable by the way it looks so trial and error behavior can be avoided. Microsoft, in Windows 3.1, did provide this distinction. The prompt button was slightly separated from the text box, as shown in Figures 7.76 and 7.77. Ideally, then, position the prompt button separated by a space from the associated text box.

Other Guidelines

For the text box entry field, see the "Text Box/Single Line" guidelines. For the box and selection components, see the "Drop-Down/Pop-Up List Boxes" guidelines.

Other Operable Controls

Other more specialized operable controls also exist. Among them are sliders, tabs, date-pickers, and scroll bars.

Slider

- Description:
  - — A scale exhibiting degrees of a quality on a continuum.
  - — Includes the following:
    - A shaft or bar.
    - A range of values with appropriate labels.
    - An arm indicating relative setting through its location on the shaft.
    - Optionally, a pair of buttons to permit incremental movement of the slider arm.
    - Optionally, a text box for typing or displaying an exact value.
    - Optionally, a detent position for special values.
  - — May be oriented vertically or horizontally.
  - — Selected by using the mouse to
    - Drag a slider across the scale until the desired value is reached.
    - Point at the buttons at one end of the scale and clicking to change the value.
    - Keying a value in the associated text box.
- Purpose:
  - — To make a setting when a continuous qualitative adjustment is acceptable, it is useful to see the current value relative to the range of possible values.
- Advantages:
  - — Spatial representation of relative setting.
  - — Visually distinctive.

- Disadvantages:
  - — Not as precise as an alphanumeric indication.
  - — Consumes screen space.
  - — Usually more complex than other controls.
- Proper usage:
  - — To set an attribute.
  - — For mutually exclusive choices.
  - — When an object has a limited range of possible settings.
  - — When the range of values is continuous.
  - — When graduations are relatively fine.
  - — When the choices can increase or decrease in some well-known, predictable, and easily understood way.
  - — When a spatial representation enhances comprehension and interpretation.
  - — When using a slider provides sufficient accuracy.

Description. A *slider* is a scale that exhibits the amount or degree of a quantity or quality on a continuum (see Figure 7.79). It is sometimes called a track bar control. A slider incorporates the range of possible values and includes a shaft or bar representing the range, the values themselves with appropriate labels, and a visual indication of the relative setting through the location of a sliding arm. Optionally, sliders also may include a pair of buttons to permit incremental movement of the slider arm, an entry/display text box for typing and displaying an exact value, and a detent position for special values. A slider may be oriented vertically or horizontally. Slider values can be set by using the mouse to drag a slider across the scale until the desired value is reached. A visual indication of the relative setting is seen as the setting movement is made. In addition, some sliders may also be set by pointing at slider buttons located at one end of the scale and incrementally moving the arm through button clicks. Finally, keying a value in an associated text box may also set some sliders. A slider is used to make a setting when a continuous qualitative adjustment is acceptable, and it is advantageous to see the current value relative to all possible values.

Advantages/disadvantages. A slider displays a spatial representation of a relative setting, providing an excellent indication of where a value exists within a range of values. They are also visually distinctive and very recognizable. Sliders, however, are not as precise as an alphanumeric indication, unless a display field is provided. They also consume more screen space than other kinds of fields, and they can be more complex to operate.

Proper usage. Sliders are used to set an attribute when a limited range of continuous, relatively fine, possible settings exist. The choices must increase or decrease in some well-known, predictable, and easily understood way. Spatial representation of the attribute should enhance comprehension and interpretation and be sufficiently accurate.

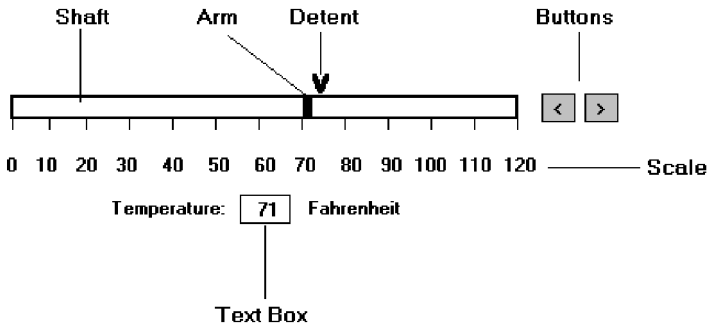


Figure 7.79: Slider.

General

- Use standard sliders whenever available.

Use of standard system sliders will speed learning.

Caption and Labels

- Caption:
  — Provide meaningful, clear, and consistent captions.
  — Display them using mixed-case letters.
  — Position the caption to the left of the box.
    - Alternately, it may be positioned left-justified above the slider.
- Labels:
  — Provide meaningful and descriptive labels to aid in interpreting the scale.

Caption. The slider caption must clearly reflect the quality being displayed. Use a static text or group box control to provide a field caption in mixed-case letters with each significant word capitalized. Use a static text field; the recommended position is to the box's left. Alternately, captions may be positioned above the slider, aligned with the left edge. Select a positioning consistent with other controls presented in the window.

Labels. Provide meaningful and descriptive labels to aid in interpreting the scale. A temperature slider will necessitate the inclusion of numeric temperature values. A volume slider may be labeled *low* and *high*. Create the labels using static text fields.

Scale

- Show a complete range of choices.
- Mark the low, intermediate, and high ends of the scale.
- Provide scale interval markings, where possible.
- Provide consistent increments.
- Permit the user to change the units of measure.
- If the precise value of a quantity represented is important, display the value set in an adjacent text box.

Provide a complete range of choices on the scale. Mark the low, intermediate, and high ends of the scale. For example, volumes may be indicated by low and high. Provide scale interval markings at consistent increments. Allow the user to change the units of measure, for example, changing a temperature from Fahrenheit to centigrade. If the precise value of a quantity represented is critical, display the set value in an adjacent entry/display text box control. This will also permit typed entry of the desired value.

Slider Arm

- If the user cannot change the value shown in a slider, do not display a slider arm.

Do not display a slider arm if the user cannot change the value shown in a slider. Fill in the shaft in a distinctive way to indicate the relative setting, as illustrated in the guideline for proportions.

Slider Buttons

- Provide slider buttons to permit movement by the smallest increment.
- If the user cannot change the value shown in a slider, do not display slider buttons.

Provide slider buttons to permit movement by the smallest increment. Movement is achieved by pointing and clicking. If the user cannot change the value shown in a slider, do not display slider buttons.

Detents

- Provide detents to set values that have special meaning.
- Permit the user to change the detent value.

For values that have special meaning, provide detents that can be changed by the user.

Proportions

- To indicate the proportion of a value being displayed, fill the slider shaft in some visually distinctive way.
  - — Fill horizontal sliders from left to right.
  - — Fill vertical sliders from bottom to top.

When the proportion of a value is also important, provide proportional indicators by filling in the slider shaft in a distinctive way. Fill it from left to right and bottom to top.

Tabs

- Description:
  - — A window containing tabbed dividers that create pages or sections.
  - — Navigation is permitted between the pages or sections.
- Purpose:
  - — To present information that can be logically organized into pages or sections within the same window.
- Advantages:
  - — Resemble their paper-based cousins.
  - — Visually distinctive.
  - — Effectively organize repetitive, related information.
- Disadvantages:
  - — Visually complex.
- Proper usage:
  - — To present discrete, logically structured, related, information.
  - — To present the setting choices that can be applied to an object.
  - — When a short tab label can meaningfully describe the tab's contents.
  - — When the order of information use varies.
  - — Do not use for sequential steps.

Description. A *tab* control is a window containing tabbed dividers that create pages or sections. Also referred to as a *notebook*, the tabs are analogous to dividers in a file cabinet or notebook. Navigation is permitted between the tabbed pages or sections. Microsoft Windows has a window organization scheme called a *workbook* (see Step 4) that is similar to the notebook control. Tabs from Microsoft Windows are illustrated in Figure 7.80.

Advantages/disadvantages. Tabs resemble their paper-based cousins, entities that are familiar to almost everyone. They are very meaningful electronic metaphors. Tabs are visually distinctive, and they permit effective organization of repetitive and related information. One drawback: They may result in a visually more complex screen.

Proper usage. Tabs can be used to present independent data that can be logically structured into discrete and meaningful pages or sections. They are most useful for presenting the choices that can be applied to an object, for example, a person and the person's descriptive data such as address, employment, family, and so forth. When the information on one tab is heavily dependent on information found on another tab, tabs are a poor choice because the user will have to keep flipping between tabs. Tabs are useful only if a brief tab label can identify their contents. Tabs are also useful when the order in which information is used varies.

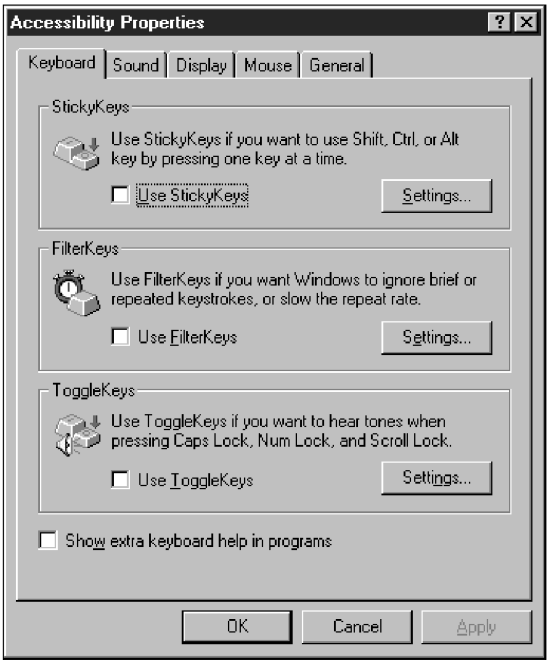


Figure 7.80: Tabs from Microsoft Windows.

Sections and Pages

- Place related information within a page or section.
- Order them meaningfully.
- Arrange pages so they appear to go deeper, left to right and top to bottom.
- Provide pages of equal size.

Place related information within a page or section. Order the pages in a meaningful way, based upon the window's content. Arrange the pages so they appear to go deeper, left to right and top to bottom. Provide pages of equal size.

Location, Size, and Labels

- Place the tabs at the top of the page or section.
- Assure the tabs look like real-world tabs.
- Provide fixed-width tabs for pages or sections of related information.
- Provide labels clearly descriptive of their function or destination.
  - — Use system fonts.
  - — Keep information brief and the same general length.
    - Nouns are usually better than verbs.
  - — Use mixed case, capitalizing each significant word.
  - — Assign a keyboard equivalent for keyboard access.
- Center the labels within the tabs.
- Restrict tabs to only one row.
- Arrange tabs so that they appear to go deeper, left to right and top to bottom.

Place tabs at the top of the page or section. This is the most customary location. Tabs may be capable of being located at all four points of the compass but these positions are not as common. Left and right tabs will provide label readability problems. Bottom tabs do not reflect the file cabinet analogy and may be confusing. Assure the tabs look like real-world tabs. A study found that people are more likely to click on tabs that look like paper-based tabs. Fixed-width tabs are preferred but variable-width tabs may be used if screen space constraints exist. For labels, use the standard system fonts in mixed case, capitalizing each significant word. Keep tab text labels brief and of the same general length. Nouns are usually better than verbs. If tab labels cannot be made clear because of tab size constraints, do not use tabs. Assign each tab a keyboard equivalent to facilitate keyboard access. Center the labels within the tabs and restrict them to only one row.

Avoid multiple rows of tab or scrolling a single row of tabs. This adds complexity to the interface and makes it harder for the user to read and access a particular tab. As an alternative, consider separating the tabbed pages into sets and using another control to move between sets, or use subordinate dialog boxes. Arrange tabs so that they appear to go deeper, left to right and top to bottom.

Command Buttons

- If they affect only a page or section, locate the buttons on the page or section.
- If they affect the entire tabbed control, locate the buttons outside the tabbed pages.

For command buttons that affect only the tabbed page being displayed, locate the buttons on that page. If they affect the entire tabbed control, position the buttons outside the pages but within the window holding the pages. Tab users often have trouble understanding that command buttons actions within a tab page only affect that page, but that command buttons outside all the pages affect the entire tab window. The users may not always be aware that when the window is closed, actions taken within a window are not "activated" until the *window's* OK button is pressed. Guidance may have to be provided to the users to ensure that all expected user actions are actually performed. Alternatives include providing instructions on the window or providing a confirming message box if the window is closed.

Date-Picker

- Description:
  - — A drop-down list box that displays a one-month calendar in the drop-down list box.
  - — The displayed month can be changed through pressing command buttons with left- and right-pointing arrows.
    - The left arrow moves backward through the monthly calendars.
    - The right arrow moves forward through the monthly calendars.
  - — A date for the list box can be selected from the drop-down calendar.
- Purpose:
  - — To select a date for inscribing in a drop-down list box.
- Advantages:
  - — Provides a representation of a physical calendar, a meaningful entity.
  - — The calendar listing is ordered in a predictable way.
  - — Visually distinctive.
- Disadvantages:
  - — Requires an extra step to display the calendar.
  - — When displayed, all month choices are not visible, requiring a form of scrolling to access the desired choice.
- Proper usage:
  - — To select and display a single date in close monthly proximity to the default month presented on the drop-down list box.

A *date-picker*, illustrated in Figure 7.81, is a drop-down list box that displays a one-month calendar in the drop-down. The displayed month can be changed by pressing command buttons with left- and right-pointing arrows. A relevant date to be

entered in the list box is selected from the calendar drop-down list box. Advantages and disadvantages are similar to drop-down list boxes. Its structure as a calendar is a meaningful representation for most users. Like drop-down list boxes, the date-picker requires exposing the list before the date can be chosen. If the date desired as not within the default month's calendar presented, the calendar must be scrolled to the proper month. If the date is far away in time, excessive scrolling may be required to obtain it. Therefore, it is most useful for dates close in time to the default month presented. A wide range of dates would best be collected through a text box.

Tree View

- Description:
  - — A special list box control that displays a set of objects as an indented outline, based on the objects' logical hierarchical relationship.
  - — Includes, optionally, buttons that expand and collapse the outline.
    - A button inscribed with a plus (+) expands the outline.
    - A button inscribed with a minus (-) collapses the outline.
  - — Elements that can optionally be displayed are
    - Icons.
    - Graphics, such as a check box.
    - Lines to illustrate hierarchical relationships.
- Purpose and proper usage:
  - — To display a set of objects as an indented outline to illustrate their logical hierarchical relationship.

A tree view control, as illustrated in Figure 7.82, is a special list box control that displays a set of objects as an indented outline, based on their logical hierarchical relationship. The control is used to display the relationship between a set of containers or other hierarchical elements, and, optionally, includes buttons to expand or collapse the hierarchy. Icons can be included with the text label for each item in the tree. Different icons can be displayed when the tree expands or collapses. A graphic, such as a check box, can be used to reflect state information about the item. The tree view control also supports an optional display of lines to illustrate the hierarchical relationship of the items in the list.

Figure 7.81: A date-picker control.

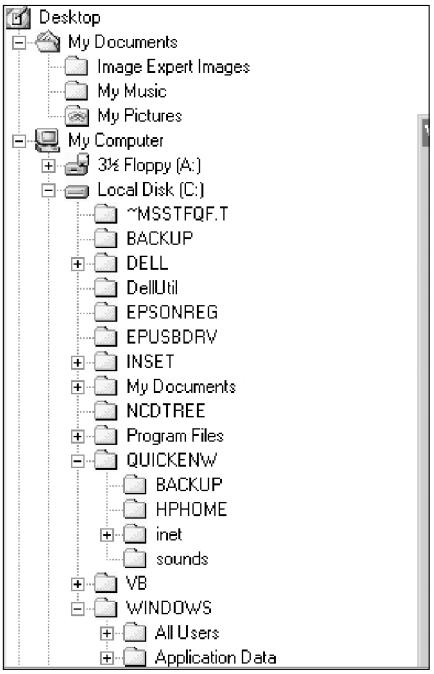


Figure 7.82: A tree view control.

Scroll Bars

- Description:
  - — An elongated rectangular container consisting of
    - A scroll area.
    - A slider box or elevator inside.
    - Arrows or anchors at either end.
  - — Available, if needed, in primary and secondary windows, some controls, and Web pages.
  - — May be oriented vertically or horizontally at the window or page edge.
- Purpose:
  - — To find and view information that takes more space than the allotted display space.
- Advantages:
  - — Permits viewing data of unlimited size.
- Disadvantages:
  - — Consumes screen space.
  - — Can be cumbersome to operate.
- Proper use:
  - — When more information is available than the window space for displaying it.
  - — Do not use to set values.

Figure 7.83: Scroll bar.

Description. A *scroll bar* is an elongated rectangular container consisting of a scroll area, a slider box, or elevator inside the scroll bar, and arrows or anchors at either end. They may be placed, if needed, in windows, in some controls, and in Web pages. They may be oriented vertically or horizontally at the right or bottom of a screen. Historically, scroll bars have been designed in a variety of styles; a typical one is illustrated in Figure 7.83.

Purpose. Scroll bars are used to find and view information that occupies more space than the allotted display space.

Advantages/disadvantages. While they permit viewing data of unlimited size, they do consume screen space and can be cumbersome to operate.

Proper usage. Use a scroll bar, or bars, when more information is available than the window space for displaying it. Do not use scroll bars to set values. If a value must be set or adjusted, use a slider or another control such as a spin box. Because scroll bars are designed for scrolling through information, using a scroll bar to set values may confuse the user about the purpose or interaction of the control.

Scroll Bar Design Guidelines

- General:
  — Provide a scroll bar when invisible information must be seen.
- Scroll area or container:
  — To indicate that scrolling is available, a scroll area or container should be provided.
    - Construct it of a filled-in bar displayed in a technique that visually contrasts with the window and screen body background.
- Scroll slider box or handle:
  — To indicate the location and amount of information being viewed, provide a slider box or handle.
    - Constructed of a movable and sizable open area of the scroll area, displayed in a technique that contrasts with the scroll area.
    - By its position, spatially indicate the relative location in the file of the information being viewed.
    - By its size, indicate, proportionately, the percentage of the available information in the file being viewed.

- Scroll directional arrows:
  - — To indicate the direction in which scrolling may be performed, directional arrows should be provided.
    - Construct them as arrows in small boxes, with backgrounds that contrast with the scroll area.
- Selection:
  - — When the slider box/handle has been selected, highlight it in some visually distinctive way.
- Location:
  - — Position a vertical (top-to-bottom) scroll bar to the right of the window.
  - — Position a horizontal (left-to-right) scroll bar at the bottom of the window.
- Size:
  - — A vertical scroll bar should be the height of the scrollable portion of the window body.
  - — A horizontal scroll bar should be at least one-half the width of the scrollable portion of the window body.
- Current state indication:
  - — Whenever the window's size or the position of the information changes, the scroll bar components must also change, reflecting the current state.
  - — Include scroll bars in all sizable windows.
    - If no information is currently available by scrolling in a particular direction, the relevant directional arrow should be subdued or grayed out.

General. A *scroll bar* provides a method to permit the displaying of information that may not always fit within a window on a screen. A scroll bar should only be included when scrolling may be necessary. In today's systems, scroll bars come in a variety of styles. Scroll bars consist of three elements: a scroll area or container, a slider box or handle that moves within a track made by the scroll area/container, and directional or scroll arrows.

Scroll area or container. The scroll area or, as it is sometimes called, the scroll container, is an elongated rectangular-shaped bar. Its presence indicates scrolling is available. It usually is constructed of a filled-in area displayed in a technique that visually contrasts with the window and screen body background. The chosen display technique should be of moderate intensity, neither too powerful nor too subtle. A powerful technique will be distracting; a subtle technique may be overlooked.

Slider box or handle. To indicate the location and amount of information being viewed, a slider box or, as it is sometimes called, a scroll handle, is included within the scroll area/container. It is constructed of a movable and sizable portion of the scroll area displayed in a technique that contrasts with the scroll area. It should indicate, by its position, the relative spatial location in the file of the information being viewed. It should indicate by its size, proportionately, the percentage of the available information in the file being viewed. Displaying, within a scrollable screen, the page number of page-organized material being viewed can further enhance the usability of the slider box or handle.

Directional or scroll arrows. To indicate the direction in which scrolling may be performed, directional or scroll arrows are also included. They are constructed of variously shaped arrows in small boxes with backgrounds that contrast with the scroll area/container. They are most often located at each end of the scroll bar, but some systems locate them adjacent to one another within the scroll area/container itself.

Placing directional arrows at opposite ends of the scroll bar is conceptually the clearest. The mouse pointer is moved in the same direction, away from the current position, when either the scroll arrow or scroll handle is manipulated. The distance that the directional arrows are separated by, however, causes increased effort when a window's contents must be adjusted by scrolling in opposite directions.

One platform solved the direction-switching problem by positioning the directional arrows adjacent to one another at one end of the scroll bar. While the forward-backward scrolling is made more efficient, the spatial correspondence between the beginning, middle, and end of the data is lost.

Another platform took another approach, placing the directional arrows at opposite ends of the slider box/handle to maintain the desirable spatial correspondence while at the same time minimizing their separation. Since during a continuous scrolling operation the directional arrows move as the slider box/handle moves, this platform automatically moves the mouse pointer to keep it aligned with the scroll arrow. This eliminates the need for the user to move the pointer during the continuous scrolling operation, but it requires that the user relinquish control of the mouse operation, and may be disorienting.

Using a scroll bar, the scrolling movement can be performed in several ways. The most common actions involve grabbing the slider box/handle and moving it in the desired direction, or selecting the proper directional arrow. Clicking a mouse button while selecting a directional arrow moves the contents of a window one line. Pressing the mouse button scrolls the window's contents continuously until the button is released. One platform provides another more efficient process. A region of the scroll area/container can also be selected, automatically moving the slider box/handle to that point and displaying the proper window contents.

Based upon early scrolling research (Bury et al., 1982), movement of the window data usually follows the window-up or telescope approach, whereby the window moves around over data that appears fixed in location. This causes the data in a window to move in the direction opposite the one indicated by the directional arrow or the direction of movement of the scroll container/handle. Scrolling using window systems, however, seems to be especially mistake-prone, users often assuming the arrows will move the data in the same direction as the directional arrow or scroll container/handle. In other words, it is sensed that the data moves under the window, not the window over the data (Billingsley, 1988). Why this happens is open to conjecture. Billingsley speculates that, because windows seem to move on screens, when data scrolls or moves in a window, people may conclude the data must be moving because the window remains still during the scrolling operation. Or, because of the close physical proximity of the directional arrows in scroll bars to the data, people may feel that the arrows are acting

on the data, not the window. The implication is that the scrolling procedure should be rethought and restudied. Some recent applications have devised scrolling methods through actually point at the window data.

Selection. When the slider box/handle has been selected, highlight it in some visually distinctive way. Most systems do provide some visual feedback of this kind.

Location. While, again, no universal agreement exists, the majority of systems locate the vertical (top-to-bottom) scroll bar to the right of the window and the horizontal (left-to-right) scroll bar at the bottom of the window.

Size. A vertical scroll bar should be the height of the scrollable portion of the window body. A horizontal scroll bar should be at least one-half the width of the scrollable portion of the window body.

Current state indication. Whenever the window's size or the position of information changes, the scroll bar components must also change, reflecting the current state of the scrolling process. Providing accurate information about the scrolling location facilitates user navigation and makes it easier to reposition the slider box/container. Include scroll bars in all sizable windows.

If scrolling cannot be performed in a particular direction, the relevant arrow box should be reduced in contrast or grayed out. If all the information in a window is displayed and no information is available for scrolling, both directional arrows should be reduced in contrast or grayed out.

Scroll Bar Usage Guidelines

- Scroll bar style:
  — Stick with standard, proven design styles.
- Directional preference:
  — Use vertical (top-to-bottom) scrolling.
  — Avoid horizontal (left-to-right) scrolling.

Style. The standard, well-known, proven design style used in graphical systems works best. A scroll bar is complex enough that presenting a new style to the user will focus attention away from the screen content as the user struggles to learn how to deal with the new style. This is a form of "senseless" learning and must be avoided.

Directional preferences. Where the choice exists, people prefer and deal better with vertical (top-to-bottom) scrolling rather than horizontal (left-to-right) scrolling. Avoid horizontal scrolling whenever possible.

The usability aspects of scrolling, and paging are thoroughly discussed in Step 3.

Media Controls

- For all playable files provide the following controls.
  — Play.
  — Pause/Resume.
  — Stop.
  — Rewind.
  — Fast Forward.
  — Volume.
  — Provide the content and size of all media objects.

Some media products provide their own controls. For others, controls may have to be designed. Always provide the above standard media controls. Instructions for downloading should include media type, file size, and a description of the subject matter.

Custom Controls

- Implement custom controls with caution.
- If used, make the look and behavior of custom controls different from that of standard controls.

Many toolkits and interface builders provide the ability to create custom controls; implement them with caution. The user is currently presented with a multitude of controls whose usage and operation must be learned and remembered. The addition of custom controls adds to this learning and increases system complexity. If custom controls must be developed and implemented, make their look and behavior as different as possible from the standard controls. This will avoid confusion between the various controls.

MAXIM **Fewer is usually better.**

Presentation Controls

Presentation controls are purely informational. They provide details about other screen elements or controls, or assist in giving the screen structure. Common presentation controls are static text fields, group boxes column headings, ToolTips, balloon tips, and progress indicators.

Static Text Fields

- Description:
  — Read-only textual information.
- Purpose:
  — To identify a control by displaying a control caption.
  — To clarify a screen by providing instructional or prompting information.
  — To present descriptive information.
- Proper usage:
  — To display a control caption.
  — To display instructional or prompting information.
  — To display descriptive information.

Description. A *static text field*, as illustrated in Figure 7.84, provides read-only textual information. It is a standard Microsoft Windows control.

Purpose/proper usage. Use static text fields to create and present read-only information, including all control captions. Also using static text fields clarify screen usage by providing prompting or instructional information. Other descriptive screen information can also be provided through static text fields. Examples are headings, subheadings, slider scales, progress indicator text, and so on. In Microsoft Windows, static text cannot be selected, so avoid using it for any text the user might want to copy to the clipboard.

Static Text Field Guidelines

- Captions:
  — Include a colon (:) as part of the caption.
  — Include a mnemonic for keyboard access.
  — When the associated control is disabled, display it dimmed.
  — Follow all other presented guidelines for caption presentation and layout.
- Instructional or prompting information:
  — Display it in a unique and consistent font style for easy recognition and differentiation.
  — Follow all other presented guidelines for prompting and instructional information.
- Descriptive information:
  — Follow all other guidelines for required screen or control descriptive information.

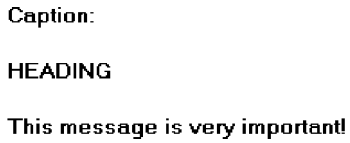


Figure 7.84: Static text field.

Captions. Always include a colon as part of the caption. The colon immediately identifies the element as a caption. In Microsoft Windows the colon is also used by screen review utilities. Include a keyboard equivalent (mnemonic) for all captions to provide keyboard access to its associated control. Captions may also provide a means of indicating that their associated controls are disabled. Follow all the rules for caption display presented throughout these guidelines.

Instructional or prompting information. Display in a unique and consistent font style for easy recognition and differentiation. Follow all other presented guidelines for prompting and instructional information. Guidelines for writing instructional or prompting information are discussed in Step 8.

Descriptive information. Other descriptive information includes headings, subheadings, slider scales, progress indicator text, and so forth. Also, follow all the rules for these other kinds of screen information presented throughout these guidelines.

Group Boxes

- Description:
  - — A rectangular frame that surrounds a control or group of controls.
  - — An optional caption may be included in the frame's upper-left corner.
- Purpose:
  - — To visually relate the elements of a control.
  - — To visually relate a group of related controls.
- Proper usage:
  - — To provide a border around radio button or check box controls.
  - — To provide a border around two or more functionally related controls.
- Guidelines:
  - — Label or heading:
    - Typically, use a noun or noun phrase for the label or heading.
    - Provide a brief label or heading, preferably one or two words.
    - Relate label or heading's content to the group box's content.
    - Capitalize the first letter of each significant word.
    - Do not include and ending colon (:).
  - — Follow all other guidelines presented for control and section borders.

Description. A *group box* is a standardized rectangular frame that surrounds a control or group of controls. An optional caption may be included in the frame's upper-left corner. Standard Microsoft Windows Group boxes are illustrated in Figure 7.85.

Purpose/proper usage. The purpose of a group box is to visually relate the elements of a single control or a grouping of related controls. Group boxes should be used to provide a border around a radio button control, a grouping of related check boxes, or two or more functionally related controls.

Guidelines. Typically, use a noun or noun phrase for group box labels or headings. Keep the text brief, one or two words. Consider the group box content and relate the control captions inside the group box to the label or heading being created. Use headline-style capitalization, but do not include any ending colon. Refer to all the guidelines presented for control and section borders, in designing group boxes.

Figure 7.85: Group boxes.

Column Headings

- Description:
  - — Read-only textual information that serves as a heading above columns of text or numbers.
  - — Can be divided into two or more parts.
- Purpose:
  - — To identify a column of information contained in a table.
- Proper usage:
  - — To display a heading above a column of information contained in a table.
- Guidelines:
  - — Heading:
    - Provide a brief heading.
    - Can include text and a graphic image.
    - Capitalize the first letter of each significant word.
    - Do not include an ending colon (:).
  - — The width of the column should fit the average size of the column entries.
  - — Does not support keyboard access.

Description. A *column heading control*, also known as a *header control*, is used to display a heading above columns of text or numbers. A column heading is illustrated in Figure 7.86. It can be divided into two or more parts.

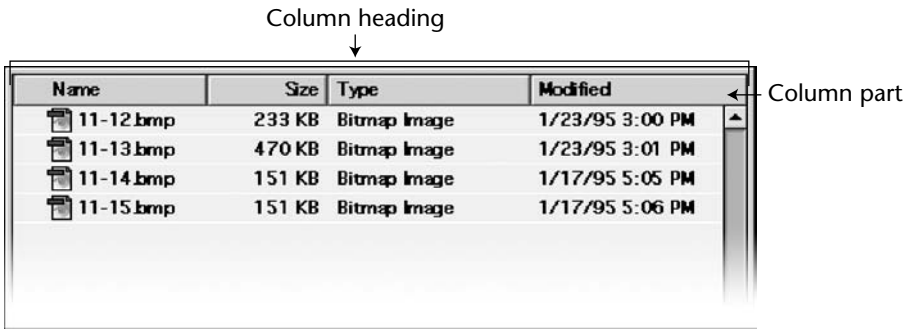


Figure 7.86: Column heading control.

Purpose/proper usage. To identify and display a heading above a column of information contained in a table.

Guidelines. Provide a brief heading. Headings can include text as well as a graphic image. Use the headline style of capitalization, without an ending colon. The width of each column should fit the average size of the column entries. Column heading controls do not support keyboard access.

ToolTips

- Description:
  - — A small pop-up window containing descriptive text that appears when a pointer is moved over a control or element either
    - Not possessing a label.
    - In need of additional descriptive or status information.
- Purpose:
  - — To provide descriptive information about a control or screen element.
- Advantages:
  - — Identifies an otherwise unidentified control.
  - — Reduces possible screen clutter caused by control captions and descriptive information.
  - — Enables control size to be reduced.
- Disadvantages:
  - — Not obvious, must be discovered.
  - — Inadvertent appearance can be distracting.
- Proper usage:
  - — To identify a control that has no caption.
  - — To provide additional descriptive or status information about a screen element.

Description. A *ToolTip*, sometimes called a *Screen Tip*, is a standard Microsoft Windows control, a small pop-up window that displays descriptive text when the pointer is moved over a control that does not possess a caption, or that possesses only an abbreviated caption. A ToolTip is illustrated in Figure 7.87. A *Gloss* on a Web page is essentially a ToolTip.

Figure 7.87: ToolTip.

Purpose/proper usage. The purpose of a ToolTip is to simply provide thorough descriptive information about a control when its function must be quickly identified. It is also used to provide additional descriptive or status information about a screen element.

Advantages/disadvantages. A ToolTip provides an easy way to identify an otherwise unidentifiable control, or a control with a cryptic caption. It reduces possible screen clutter caused by control captions, enabling the control size to be reduced. A ToolTip, however, is not obvious and must be discovered. Its appearance when the pointer is positioned incorrectly, or is slowly passing over it, can be distracting to the screen viewer.

ToolTip Guidelines

- Display after a short time-out.
- For toolbars, provide a brief word as a label.
  — Use mixed case in the headline style of presentation with no ending punctuation.
- For other elements, provide a brief phrase presenting descriptive or status information.
  — Use mixed case in the sentence style of presentation.
- Present ToolTips at the lower-right edge of the pointer.
  — Display them fully on the screen.
  — For text boxes, display ToolTips centered under the control.
- Display them in the standard system ToolTip colors.
- Remove the ToolTip when the control is activated or the pointer is moved away.
- Don't substitute ToolTips for good design.

Display the ToolTip on the screen after a short pause, ideally three-quarters of a second. This avoids its appearing briefly as the pointer is just being moved over a control or element that possesses a ToolTip. When used to provide descriptions of toolbar buttons, keep ToolTips brief, usually one or two words that identify the button's action. Use the headline style of capitalization with no ending punctuation. For other elements, descriptive or status information may be provided. In this case, use a short phrase, in sentence-style capitalization, which briefly describes the item or status. Position the ToolTip to the lower right of the pointer, but fully on the screen. Always adjust the location for a full fit. For text boxes, present the ToolTip centered under the control it relates to. Display it in the system's standard ToolTip colors so it will be immediately recognized as a ToolTip. Remove the ToolTip when the control is clicked or the pointer is moved away.

Don't substitute ToolTips for good design. Presented screen elements should always be designed for maximum comprehension. ToolTips are supplements.

Balloon Tips

- Description:
  - — A small pop-up window that contains information in a word balloon.
  - — Components can include:
    - Title.
    - Body text.
    - Message Icons.
      - — Appear adjacent to the item to which they apply, generally above or to left.
      - — Only one tip, the last posted, is visible at any time.
      - — Tips are removed after a specified time period.
- Purpose:
  - — To provide additional descriptive or status information about a screen element.
- Advantages:
  - — Provides useful reminder and status information.
- Disadvantages:
  - — If overused they lose their attention-getting value.
  - — If overused in situations the user considers not very important, their continual appearance can be aggravating.
- Proper usage:
  - — To display noncritical
    - Reminder information.
    - Notification information.
  - — Do not use tips to display critical information.

Description. A *balloon tip*, illustrated in Figure 7.88, is a small pop-up window that contains information presented in a word balloon. Its components can include a title, body text, and informational, warning, or critical icons. (These icons are described in the Step 8.) Custom icons are not supported. Balloon tips appear adjacent to the item to which they apply, generally, above or to the left of the item. However, the system automatically adjusts their position so they remain on-screen. Although a tip can be posted at any time, only one, the last posted, will be visible at any time. Balloon tips used for the taskbar are presented for a specified time, within minimum and maximum limits.

Purpose. To provide additional descriptive or status information about a screen element.

Advantages/disadvantages. Balloon tips can provide useful reminder and status information to the user. Their sudden appearance can at some times be distracting, and perhaps aggravating, however, especially if overused in situations the user considers not very important. If overused the also lose their attention-getting value.

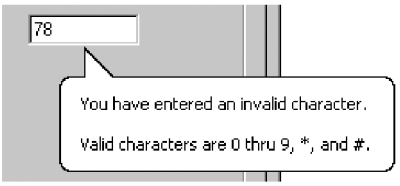


Figure 7.88: Balloon tip.

Proper usage. For noncritical reminder or notification information, special conditions, or status information that would otherwise require a message box. They are very useful for informing the user of unexpected system behaviors. Because of their brief nature and frequent out-of-the-way location, never rely on balloon tips to display critical information.

Balloon Tip Guidelines

- General:
  - — Use a notification tip to inform the user about state changes.
  - — Use a reminder tip for state changes that the user might not usually notice.
  - — Point the tip of the balloon to the item it references.
  - — Do not use them to replace ToolTips.
  - — Do not overuse balloon tips.
- Content:
  - — Restrict them to a length of 100 characters, including title and body text.
  - — Title text should
    - If the tip refers to an icon or other image representing a specific object, include
      - — The object's name, using its normal capitalization.
      - — The object's status, using sentence-style presentation without ending punctuation.
    - Be presented in bold.
  - — Body text should:
    - Include a description of the situation in one or two brief sentences.
    - Include a brief suggestion for correcting the situation.
    - Be presented using mixed-case in the sentence style.

General. Balloon tips can provide either notifications or reminders. The notification balloon is displayed and then times out. This tip style should be used to notify the user about state changes. The reminder balloon appears at regular intervals. The default interval is 60 minutes. Use the reminder balloon only for state changes that the user might not usually notice. Notification and reminder styles are supported for taskbar components. Other screen elements are only supported by the notification style. Tips are automatically removed when the user clicks it or clicks elsewhere.

Always point the tip of the balloon to the item it references. Balloon tips are not intended to replace standard ToolTips. ToolTips and balloon tips are mutually exclusive; if a ToolTip is currently displayed and a balloon tip is presented, the balloon tip will automatically cause the ToolTip to be removed. ToolTips will not appear until the balloon tip is dismissed. Finally, be careful not to overuse balloon tips. The user may ignore them if they appear too frequently.

Content. The notification balloon tip has a maximum length of 100 characters, including the title and body text. Title text automatically appears as bold text. Body text uses the text style and size of standard ToolTips. For the title text, if the balloon tip refers to an icon or other image representing a specific object, include the object's name using its normal capitalization and its status using sentence-style capitalization without ending punctuation. Otherwise, just display the status text. The body text should include a statement of the problem in one or two brief sentences, followed by a brief suggestion for correcting the problem. Use sentence-style capitalization and appropriate punctuation.

Progress Indicators

- Description:
  — A rectangular bar that fills as a process is being performed, indicating the percentage of the process that has been completed.
- Purpose:
  — To provide feedback concerning the completion of a lengthy operation.
- Proper usage:
  — To provide an indication of the proportion of a process completed.

A *progress indicator* is a rectangular bar that fills as a process is being performed. The filled-in area indicates the percentage of a process that has been completed. A progress indicator, sometimes called a *progress bar*, is illustrated in Figure 7.89.

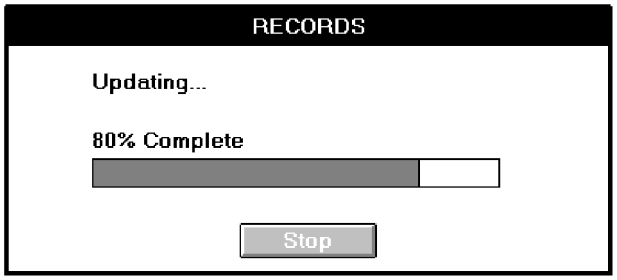


Figure 7.89: Progress indicator.

Progress Indicator Guidelines

- When filling the indicator:
  — If horizontally arrayed, fill it from left to right.
  — If vertically arrayed, fill it from bottom to top.
- Fill it with a color or a shade of gray.
- Include descriptive text for the process, as necessary.
- Place text outside of the control.

Fill horizontally arrayed progress indicators from left to right; fill vertically arrayed progress indicators from bottom to top. Fill them with a color or a shade of gray. Create necessary descriptive text using a static text control. Position the text outside of the control. Progress indicators are also discussed in the Step 9.

Sample Box

- Description:
  — A box illustrating what will show up on the screen based upon the parameter or parameters selected.
  — May include text, graphics, or both.
- Purpose:
  — To provide a representation of actual screen content based upon the parameter or parameters selected.
- Guidelines:
  — Include a brief label.
  — Use mixed case in the headline style.
  — Locate it adjacent to the controls upon which it is dependent.

Description. A *sample box* is a box illustrating what will show up on the screen based upon the parameter or parameters currently selected. A common example, shown in Figure 7.90, illustrates a font selected for display on a screen. Sample boxes may include text, graphics, or both.

Purpose. To provide a representation of actual screen content based upon the parameter or parameters selected so that the choice may actually be seen.

Guidelines. Include a brief label using mixed case in the headline style. Position the sample box immediately adjacent to the control or controls affecting its content.

Figure 7.90: Sample box.

SOME THOUGHTS ON POOR SCREEN DESIGN

Following is a collection of control design inadequacies whose most endearing qualities are that they *really, really aggravate* the author.

Why do interface designers insist on collecting state codes through drop-down list boxes, when all other name and address details are collected through text boxes?

I'm merrily typing away my "mentally programmed" name and address when I encounter the state field and come to a screeching halt. Do I reach for the mouse? Open the drop-down list box with the keyboard? I stumble, grumble, open the drop-down list box, find my home state, Arizona, and select it, thinking all the while how glad I am I live in a state whose name is near the top of the alphabetized list. My condolences go out to friends in places like Illinois and Texas who'll have to scroll to their state name. I return my hands to the keyboard and forge ahead to zip code. Why, I'm now thinking, do they need my zip code? They now have enough information to determine it — but that's another story.

Why am I often penalized by American systems for living in the United States?

Back to the name and address again; now I must indicate country. Can I type USA? Nope, back to a drop-down list box. Opening it, I stare at an alphabetized list of countries within which, I quickly realize, the United States of America lies well submerged. I look at the system's owner (a large hotel chain) and, because 95 percent of their hotels are in the USA, I estimate that the overwhelming majority of guests must be American. Have these people ever thought of another sequence like, perhaps, frequency of use? Or a combination of frequency and alphabetical with the several most frequent possibilities at the top? I guess not, I think, wondering if I should move to Australia to avoid this nonsense. "They're getting even with you for living in Arizona," you may be thinking, and this may be true. My friends in Illinois and Texas are double-whammed, however.

Why do they clear one critical piece of information when they re-present a screen?

With another hotel system, I encounter a "sorry, no room at this inn" for the days I'd like to be there. I select a different hotel and glance at the booking screen. The dates I previously entered are still there as well as the room type. I click "send." You didn't tell us whether your trip was for business or pleasure, their error message sternly advises. (Can't I also have pleasure on a business trip, I wonder?) I glance at the top of the screen. The radio buttons designating business or pleasure have magically been cleared, but nothing else on the reservation screen has changed. If I'm looking for another hotel on the same dates as just a moment ago, would I now be doing it for business instead of pleasure (or vice versa), I wonder. Perhaps some hotels are only for business, others only for pleasure — a worthwhile subject for usability research...

Why do they give me a small command button and surround it by acres of white space?

Are they afraid it might be too easy to find? Don't they really want it pressed? Are they testing my perceptual-motors skills? Is an anorexic button beautiful? Have they ever heard of Fitts' Law? Undoubtedly not!

Scrolling Tickers

- Description:
  — Text that scrolls horizontally through a container window.
- Advantages:
  — Consume less screen space than full text.
- Disadvantages:
  — Hard to read.
  — Time-consuming to interpret.
  — Distracting.
- Guideline:
  — Do not use.

Description. A *scrolling ticker* is a window that contains text scrolling horizontally.

Advantages/disadvantages. The biggest advantage of a scrolling ticker is its efficient use of screen space. Disadvantages include scrolling text being hard to read and time-consuming to interpret. Human memory being what it is, information scrolled out of sight is difficult to remember, and longer messages may not be understood. Scrolling screen elements are also visually distracting.

Guideline. The most prudent guideline at the moment is: Do not use scrolling tickers.

Selecting the Proper Controls

Providing the proper control, or mix of controls, is critical to a system's success. The proper control will enable a person to make needed selections, entries, and changes quickly, efficiently, and with fewer mistakes. Improper selection most often leads to the opposite result. In general, when selecting controls do the following:

Choose familiar controls. Never assume that all people are familiar with all types of controls. Unfamiliar controls will slow people down, and may even prevent people from using them at all. A study (Koyani et al., 2004) showed that some people, particularly those older, do not know how to use a drop-down list box. Be extremely cautious in using custom controls.

Consider the task. Will the choices to be made involve selecting one of many alternatives, or several items at once?

Reduce the number of "clicks." Design a data entry application so that people can stay with one entry method as long as possible. A study (Zavod and Fulop, 2001) comparing entry speeds using an entry field and drop-down lists found experienced users are much faster using entry fields. Requiring any user to continually shift between the keyboard and a mouse can substantially slow their entry speed.

Display as many control choices as possible. Available screen space is important in choosing the proper control. Can all, or most, of the control's options be dis-

played together on the screen, or do screen space constraints require using a control that hides most of the options, necessitating scrolling to see the entire list? A study by Couper et al. 2004, reached an interesting conclusion — what people see is what they select from! The options in this study were in a survey, so the alternatives to choose from required comparing and was essentially discretionary in nature. (Which of the following nutrients is most important in selecting a breakfast cereal? versus What is your home state? is hardly a discretionary choice.)

The study found that people tended to select from the entire list of options that they were first presented and saw. Rarely was an effort made to find additional options through scrolling. If eleven items were presented, the choice was from these eleven, if five, the choice was from these five (replicating what is known from paper survey research). Study design enabled the researchers to postulate why this happened:

- People spend more time thinking about the first presented options than the additional ones, so they pick them more often.
- People's thinking about the first options is clearer because they have fewer choices to consider.
- Initial options are harder to dislodge as option experience accumulates.

The conclusion: When options must be compared with one another, controls presenting all the options together will yield the best results. Controls initially presenting only a few of many options will not be the best choice.

This section will begin with a survey of several other research studies addressing control selection. Studies such as these, while few in number, appear in the research literature. The results of these studies have already been incorporated within the control usage guidelines just discussed. Next, the criteria that must be considered in control selection will be summarized. Finally, some selection guidelines will be presented.

Entry versus Selection — A Comparison

The first studies to be described are a series performed by IBM. These studies (Gould et al., 1988; Greene et al., 1988; Greene et al., 1992) looked at the advantages and disadvantages of using either entry fields or selection fields for data collection. Entry involved keying text; selection was performed by pointing at a choice through the keyboard using the cursor control keys (not a mouse). The information compared was of three kinds: dates, text, and data. The first conclusion follows:

Choosing a Type of Control

- For familiar, meaningful data, choose the technique that, in theory, requires the fewest number of keystrokes to complete.
- If the data is unfamiliar or prone to typing errors, choose a selection technique.

The studies found that if the data to be entered was familiar, the technique that required the minimum theoretical number of keystrokes to complete the task was the fastest. Theoretical keystrokes are the minimum number possible, excluding mis-keys, and erroneous cursor or selection movements. However, as the information became less familiar or became subject to spelling or typing errors, the minimum keystroke principle broke down. Selection techniques, and the reminders and structure they provide for unfamiliar items, hard-to-spell words, and items prone to typing errors becomes advantageous. The point at which the changeover occurs is not known. It would be influenced by the nature of the task and the nature of the user.

These studies point out the advantages of the techniques that permit both typed entry and selection to enter the data (spin box, drop-down/pop-up combination box, and attached combination box).

Aided versus Unaided Entry

- Provide aided entry whenever possible.
  - — Absorb any extra and unnecessary keystrokes.
  - — Provide an auditory signal that autocompletion has been performed.

The studies also compared unaided typed entry (the entire field had to be keyed) with aided entry (the system automatically and immediately completed the field when enough characters were keyed to make the desired data known). They found that aided entry, also known as autocompletion, was preferred over unaided entry methods, and it was also the fastest. Autocompletion was also preferable to, and faster than, many selection methods. Greene et al. (1992) found that, for keying of difficult to spell words, aided entry was much faster, and significantly reduced errors, when compared to unaided entry.

The result is that, when possible, autocompletion of text entry fields should be provided. Autocompletion will minimize the user's effort by reducing input time and keystrokes. It should also enhance the user's opinion of the system. If aided entry is provided, extra keystrokes must be absorbed by the system. The software will finish spelling a word much faster than a person's fingers are capable of stopping movement. Also, provide some kind of auditory signal that autocompletion has begun. A person may not be looking directly at the control when the completion is performed.

Comparison of GUI Controls

Tullis and Kodimer (1992) compared seven controls used for direct manipulation, selection, and data entry. The task was to reorder four items in a table (Filename, Number, Size, and Date). The controls studied were the following. Complete descriptions of control usage methods are summarized in Table 7.1.

- Direct Manipulation
  1. Drag and drop on
  2. Drag and drop between

- Selection
  3. Icons
  4. Radio buttons
  5. Menus (drop-down list boxes)
- Entry
  6. One entry area
  7. Four entry areas

The direct manipulation methods reflected the perceived strength of graphical systems, namely, manipulation of objects on the screen. The selection methods utilized indirect manipulation and illustrated the types of controls available in graphical screen design. The entry methods are a carryover from text-based screens, the only way the task could be accomplished for many years. Study participants were experienced Microsoft Windows users. No instructions were provided on how to carry out the item reorganization tasks. Users had to rely on their experience.

The two fastest methods were radio buttons and the one entry field. The methods most preferred by participants were radio buttons, drop-down list boxes, and one entry field. The direct manipulation methods fared rather poorly, ending midlist in the speed and preference rankings. The surprise, perhaps, was the good showing of an old control: the one entry field, or text box.

Tullis (1993) performed a follow-up to this study by asking a group of programmers to predict the study results (without, of course, being privy to its results). For both reordering speeds and subjective preferences, their predictions were way off the mark. They anticipated that the direct manipulation methods would be the fastest and most preferred. This, of course, was not at all the case. They predicted that radio buttons would be midway in the speed and preference ordering and that one entry field would be near the bottom. Again, they were quite mistaken. The correlation between their predictions and actual reordering speed was a dismal .07. They did slightly better on predicting preferences, the correlation being .31.

Based on these studies, Tullis concludes that control selection decisions made according to convention and intuition may not necessarily yield the best results. This conclusion might be modified to say, with a great deal of justification, that such decisions made using *common sense* may not even yield *good* results. Just because a control or process is new does not necessarily make it better. Just because the control has been around a long time does not necessarily make it poorer. Controls should be selected on the basis of the objectives they are to achieve, and they should be subjected to the same rigorous testing as all other parts of the system.

Another control comparison study was conducted by Johnsgard et al. (1995). They evaluated a variety of controls including check boxes, drop-down list boxes, drop-down combination boxes, text boxes, list boxes, radio buttons, sliders, and spin boxes. Speeds, errors, and preferences were obtained for the various controls under various conditions.

Table 7.1: Controls Evaluated by Tullis and Kodimer (1992)

DIRECT MANIPULATION
1. Drag and Drop On • The items are arrayed horizontally. An item is dragged to a new location above another item and released. The item in that position moves to the old location of the arriving item.
2. Drag and Drop Between • The items are arrayed horizontally. An item is dragged to a new location between two other items and released. The items are readjusted into new positions, including, when necessary, automatic wrap-around for items located at the end of the line.
SELECTION
3. Icons • The items are arrayed horizontally. Icons are positioned between each pair of items. Selecting an icon switches the positions of each adjacent item.
4. Radio Buttons • The items are presented in a matrix, item name along the left side, item position numbers across the top. Radio buttons in the matrix are selected to represent each item's position.
5. Menus (Drop-Down List Boxes) • Items are positioned horizontally. A drop-down listing is activated, and the item for that location selected.
ENTRY
6. One Entry Area • A single text entry field is provided. A one-character mnemonic (F,N,S,D) is provided for each choice. The mnemonics are keyed in the order in which the items are to be arrayed.
7. Four Entry Areas • Four text entry fields, labeled with the item names are arranged vertically. A number (1-4) is keyed into each field, indicating the manner in which the items are to be ordered.

Mutually Exclusive Choice Controls

For a small set of options (5), a medium set (12), and a large set (30), radio buttons were significantly faster than the other mutually exclusive controls. They were also the most accurate and most preferred by the study participants. This result is consistent with the results of the Tullis and Kodimer (1992) study. Among other findings: As control set sizes increased, control activation speeds significantly increased (took longer), and sets organized in a meaningful way were searched significantly faster than those in random orders.

The medium and large set sizes (12 and 30) are larger than generally recommended for radio buttons (8 or less). The results indicate that radio buttons may effectively be used for these larger quantities, if sufficient screen space exists for their presentation. Controls requiring scrolling to see all the choices, or requiring an action to display a listing of choices (drop-downs), seem to significantly impede selection speeds.

Nonexclusive Choice Controls

For a small set of options (5) with two selected choices, a medium set (12) with three selected choices, and a large set (30) with eight selected choices, check boxes were significantly faster than the other nonexclusive controls. Check boxes were also the most preferred by the study participants. Among other findings: Like radio buttons, as control set sizes increased, control activation speeds increased (took longer), and sets organized in a meaningful way were searched significantly faster than those in random order.

The medium and large set sizes (12 and 30) are also larger than generally recommended for check boxes (8 or less). The results also seem to indicate that check boxes may effectively be used for these larger quantities, if sufficient screen space exists for their presentation. Again, scrolling and retrieving lists slow one down.

Combination Selection and Entry Controls

Two controls were compared: a drop-down combination box and an array of radio buttons, including an "other" choice with an associated text entry field for keying the "other" value. The fastest, most accurate, and preferred: radio buttons with the text entry field.

Controls for Selecting a Value within a Range

Setting range values included indicating a time, a percentage, or the transmission frequency of a radio station. Controls evaluated were the spin button, text entry field, and the slider. The spin button was the most accurate, and the text entry field fastest and most preferred. The slider finished last in all three measurement categories.

The study's general conclusions are

- Making all options always visible will enhance performance.
- Requiring additional actions to make further options visible slows performance.
- For longer lists, scrolling tends to degrade performance more than the action associated with retrieving a hidden list.

As set size increases, performance times increase more for controls that require scrolling than for those that do not. For a large set size (30 options) scrolling slowed performance more than the action to retrieve a list.

Control Selection Criteria

Selection of the proper control, then, depends on several factors. The first is the structure and characteristics of the property or data itself. Other considerations include the nature of the task, the nature of the user, and the limitations of the display screen itself.

Property or data considerations reflect the characteristics of the data itself. Some kinds of controls are very restrictive in that they permit only specific kinds of information with specific qualities to be presented within them. Other kinds of controls may not be as restrictive concerning a data's qualities, but they are not well suited to the kind of data being used. Data considerations include the following:

- Is the property or data *mutually exclusive* or *nonexclusive*? Does entry/selection require single or multiple items?
- Is the property or data *discrete* or *continuous*? Discrete data can be meaningfully specified and categorized, while continuous data cannot.
- Is the property or data *limited* or *unlimited* in scope? If limited, how many items will the data normally not exceed?
- Is the property or data *fixed* or *variable* in list length? Are there always a fixed number of items, or will it vary?
- Is the property or data ordered in a *predictable* or *unpredictable* fashion? If predictable, will the user be able to anticipate the next, unseen, item?
- Can the property or data be *represented pictorially*? Will a picture or graphic be as meaningful as a textual description?

Task considerations reflect the nature of the job. Considerations include the following:

- How *often* is an item *entered* or *selected*?
- How *often* is an item *changed*?
- How *precisely* must the item be entered or selected?

User considerations reflect the characteristics of the user. Important considerations:

- How much *training* in control operation will be provided?
- How *meaningful* or *known* is the property or data to the user?
- How *easily remembered or learned* by the user is the property or data?
- How *frequently used* will the system be?
- Is the user an *experienced typist*?

Display considerations reflect the characteristics of the screen and hardware.

- How much *screen space* is available to display the various controls?

Choosing a Control Form

In light of the above research and considerations, and the known characteristics of the various controls, some guidance in control selection can be presented.

When to Permit Text Entry

- Permit text entry if any of the following questions can be answered *Yes*:
  - — Is the data unlimited in size and scope?
  - — Is the data familiar?
  - — Is the data *not* conducive to typing errors?
  - — Will typing be faster than choice selection?
  - — Is the user an experienced typist?

Permit text entry when any of the above conditions exist. The use of combination controls is almost always the best alternative, permitting the user to *choose* when to type and when to point and select.

What Kind of Control to Choose

Next are two tables providing some control recommendations based upon a control's known advantages, disadvantages, and proper usage characteristics. Table 7.2 is a simple decision chart for small listings, based upon Johnsgard et al. (1995). Table 7.3 is more thorough and is based upon the known characteristics of the controls described in this chapter.

The recommendations presented by Johnsgard et al. in these tables are based upon their research study. The names of some controls have been modified to reflect the control classification scheme found in this text. It would seem worth considering for controls containing a small number of choices. All controls in their study, except *setting a value within a range*, were limited to 30 options. For more than 30 choices, the use of radio buttons or check boxes still seems inappropriate at this time. More research is needed in this area.

Table 7.2: Best Controls for Certain Tasks and Screen Conditions

TASK	BEST CONTROL	IF SCREEN SPACE CONSTRAINTS EXIST
Mutually Exclusive	Radio Buttons	Drop-Down/Pop-Up List Box
Not Mutually Exclusive	Check Boxes	Multiple-Selection List Box
Select or Type a Value Text Entry Field	Radio Buttons with "Other"	Drop-DownComboBox
Setting a Value within a Range	Spin Button	TextBox

From Johnsgard et al. (1995).

Table 7.3: Suggested Uses for Graphical Controls

1. *IF*:	*USE:*
• Mutually exclusive alternatives. • Discrete data. • Best represented verbally. • Very limited in number (2 to 8).	
AND:	
• Typed entry is never necessary. • Content can never change. • Adequate screen space is available.	RadioButtons

(continued)

Table 7.3 *(continued)*

OR:	
• Typed entry is never necessary. • Content can never change. • Adequate screen space is not available.	Drop-Down/Pop-Up List Box
OR:	
• Typed entry may be necessary. • Content can change. • Adequate screen space is available.	Combo box
OR:	
• Typed entry may be necessary. • Content can change. • Adequate screen space is not available.	Drop-Down/Pop-Up Combo Box
2. IF:	*USE:*
• Mutually exclusive alternatives. • Discrete data. • Best represented verbally. • Potentially large in number (9 or more).	
AND:	
• Typed entry is never necessary. • Content can never change. • Adequate screen space is available.	Single-Selection List Box
OR:	
• Typed entry is never necessary. • Content can never change. • Adequate screen space is not available.	Drop-Down/Pop-Up List Box
OR:	
• Typed entry may be necessary. • Content can change. • Adequate screen space is available.	Combo Box
OR:	
• Typed entry may be necessary. • Content can change. • Adequate screen space is not available.	Drop-down/Pop-up Combo Box
3. IF:	*USE:*
• Mutually exclusive alternatives. • Discrete data. • Best represented graphically. • Content rarely changes. • Small or large number of items.	Palette

Table 7.3 *(continued)*

4. IF:	*USE:*
• Mutually exclusive alternatives. • Not frequently selected. • Content does not change. • Well-known, easily remembered data. • Predictable, consecutive data. • Typed entry sometimes desirable.	
AND:	
• Adequate screen space is not available.	Spin Box
OR:	
• Adequate screen space is available.	Combo Box
5. IF:	*USE:*
• Mutually exclusive alternatives. • Continuous data with a limited range of settings. • Value increases/decreases in a well-known, predictable way. • Spatial representation enhances comprehension.	Slider
6. IF:	*USE:*
• Nonexclusive alternatives. • Discrete data. • Best represented verbally. • Typed entry is never necessary. • Content can never change. • Adequate screen space is available.	
AND:	
• Very limited in number (2 to 8).	Check Boxes
OR:	
• Potentially large in number (9 or more).	Multiple-Selection List Box

Choosing between Buttons and Menus for Commands

Determining the proper way to present a command also depends on several factors. The following considerations are involved in choosing the correct command form:

- Whether or not the command is part of a *standard tool set*.
- The total *number* of commands in the application.
- The *complexity* of the commands.
- The *frequency* with which commands are used.
- Whether or not the command is used in association *with another control*.

Guidelines for choosing the proper command form are presented in Table 7.4.

Table 7.4: Choosing a Command Form

IF THE COMMANDS:	USE:
Are standard commands provided by a tool set.	Commands provided by the tool set.
Total seven or more, and can be arranged hierarchically into groups.	Menu bar and pull-downs
Total six or fewer, are selected frequently, and affect an entire window.	Buttons in a window
Total seven or more, are selected frequently, and affect an entire window.	Buttons in a toolbar
Are used with other controls, or are complicated commands and need to be simplified.	Buttons in a dialog box
Are sometimes used frequently and are sometimes used infrequently.	Buttons in a dialog box
Are frequently accessed and have only two conditions.	Toggled menu item

Examples

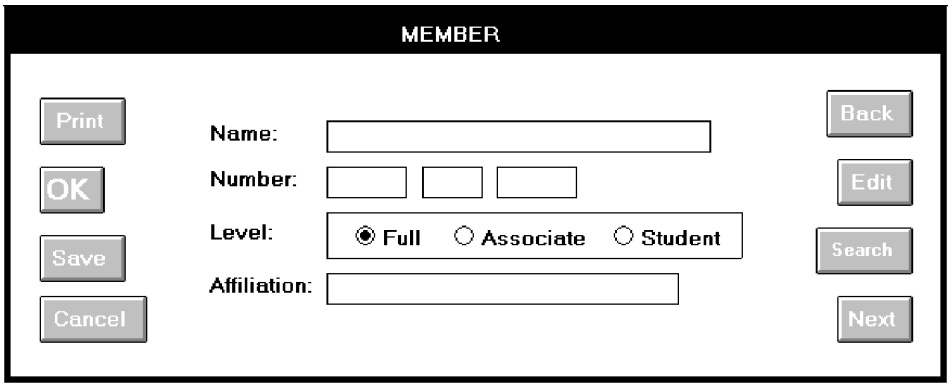
Improper and proper usage of several controls are illustrated and discussed.

Example 1

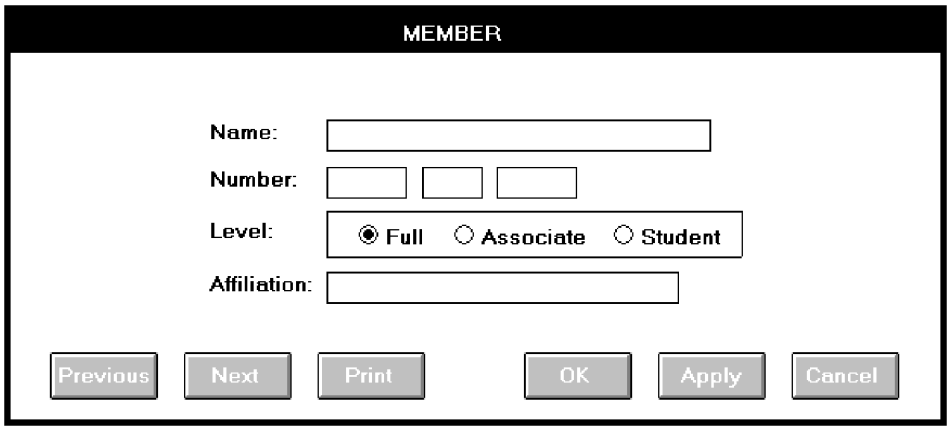
This is an instance of improper and proper presentation of command buttons.

Screen 1.1

Here the design and display of buttons is poor. Problems include: (1) The buttons are split between the left and right side of the screen, causing a wide separation. Positioning buttons to the left, from a screen usage and flow standpoint, is illogical. (2) Differences in sizes exist between buttons. OK, a very frequently used button, is the smallest, slowing down selection speed if a pointer is used. (3) Different size labels also exist (OK and Search). (4) There appears to be redundancy in button use and purpose. How does OK differ from Save? What does Edit do? (5) From an organization standpoint, standard and application buttons appear to be intermixed. (6) The Back and Next actions are widely separated, making fast reversal of actions more difficult.



Screen 1.1



Screen 1.2

Screen 1.2

This shows a much better button design and presentation. Enhancements include: (1) The buttons are located at the bottom of the screen, in a position following the screen usage flow. (2) Button size is standardized, presenting generally larger targets. (3) Button label size is standardized. (4) The seemingly redundant buttons are eliminated. (5) Function-specific buttons are grouped separately from standard buttons, and button groupings are created through a larger spacing between Print and OK. (6) Back, now called Previous, and Next are positioned together for fast paging reversal.

Example 2

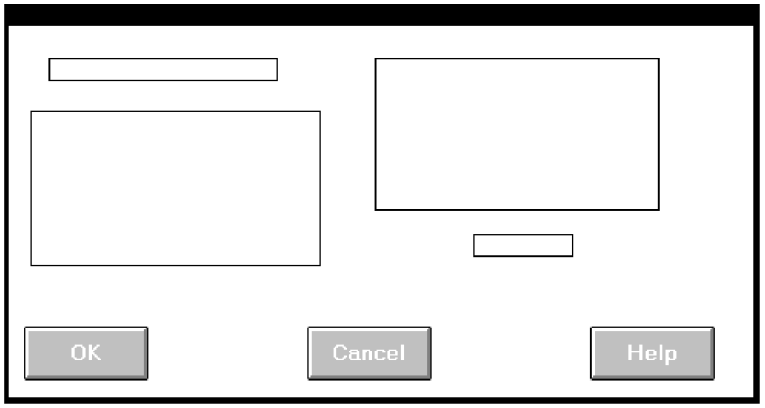
Here inconsistent locations of command buttons are reviewed.

Screens 2.1 to 2.4

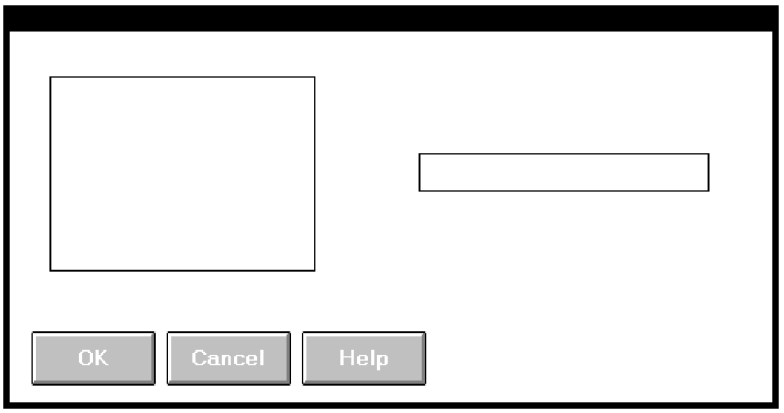
These are the button locations found on four windows within a graphical system. Positions include spread out across the window's bottom (Screen 2.1), left-justified at the bottom (Screen 2.2), centered along the right side (Screen 2.3), and top-justified along the right side (Screen 2.4). Memorization and prediction of button location will be very difficult, slowing down the experienced user.

Screen 2.5

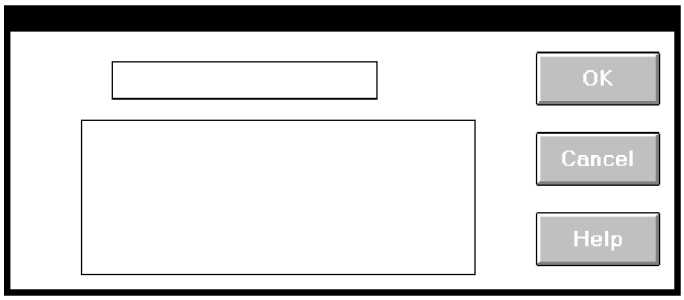
Proper positioning would have found *all* the command buttons consistently positioned, as at the bottom center, illustrated in Screen 2.5.



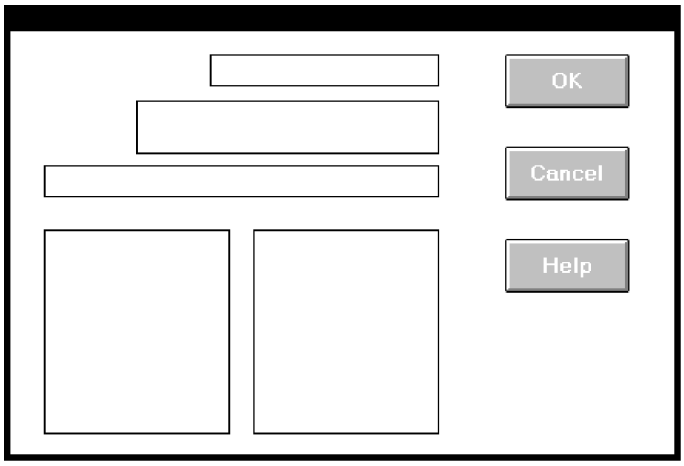
Screen 2.1



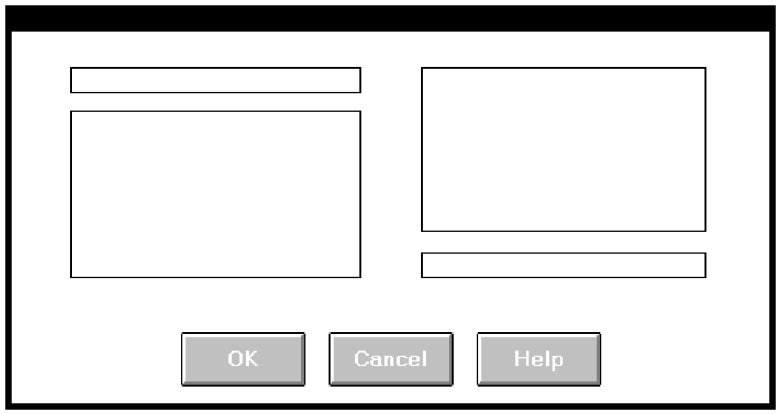
Screen 2.2



Screen 2.3



Screen 2.4



Screen 2.5

Example 3

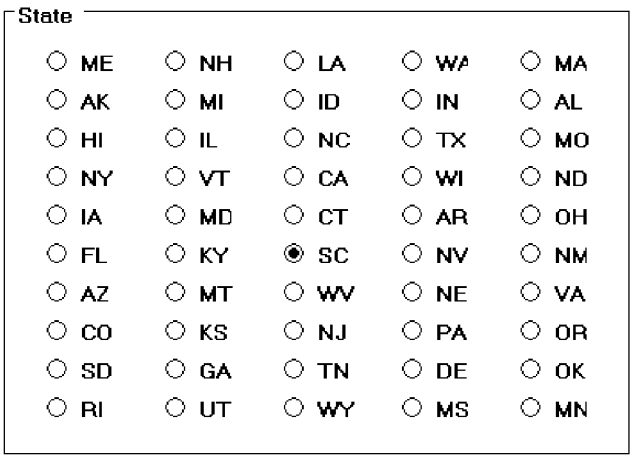
This is an example of improper and proper use of a control.

Control 3.1

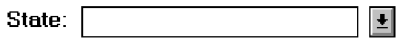
The names of states must be selected using radio buttons. Problems include: (1) The large number of choices presented makes scanning very difficult. (2) Are all the state abbreviations familiar to you, and all users? (3) The organization of states must have been established by a lottery. The name of the state I want is Mississippi. How do I find it in the array?

Control 3.2

This shows a much better alternative, a drop-down/pop-up combination box. If the state name is known, it can be typed in the field. Ideally, typing the state code, if known, will also be acceptable. If the name of a particular state is unknown, or if it's spelling is unclear, the drop-down/pop-up can be retrieved and the state name selected from the list presented. Ideally, also, a misspelled keyed state name will still be correctly identified by the system and displayed properly.



Control 3.1



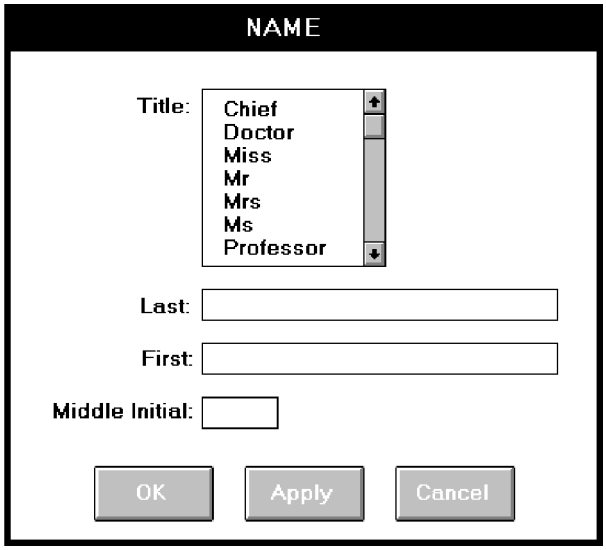
Control 3.2

Example 4

Here is another example of improper and proper use of a control.

Screen 4.1

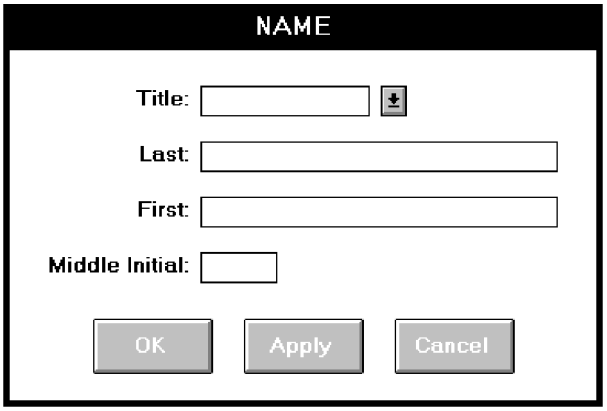
A listing of names is being collected. A courtesy title is selected through list box; last name, first name, and middle initial are typed. The problem: The task is heavily keyboard intensive. To select a title requires shifting to an alternative device control, such as a mouse, or tabbing through the list box listing to find the proper title. This slows down the keying process and may be awkward. The list box also consumes a great deal of space on the screen.



Screen 4.1

Screen 4.2

A solution: Collect the courtesy title using a pop-up/drop-down combination box. Familiar titles may be quickly typed, along with the remainder of the name data. Rare or unusual titles may be identified by selecting, displaying, and searching the listing of all alternatives. The title may then be entered in the field by selecting from the list or keying it into the field.



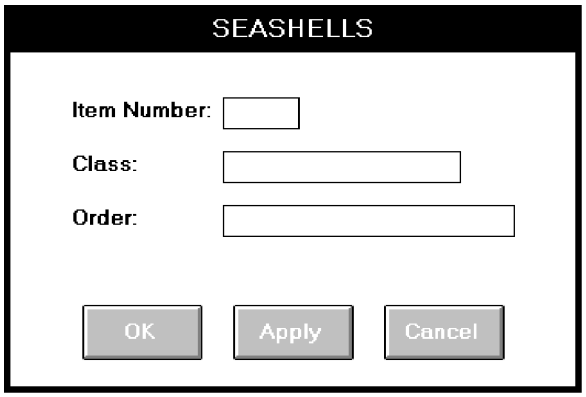
Screen 4.2

Example 5

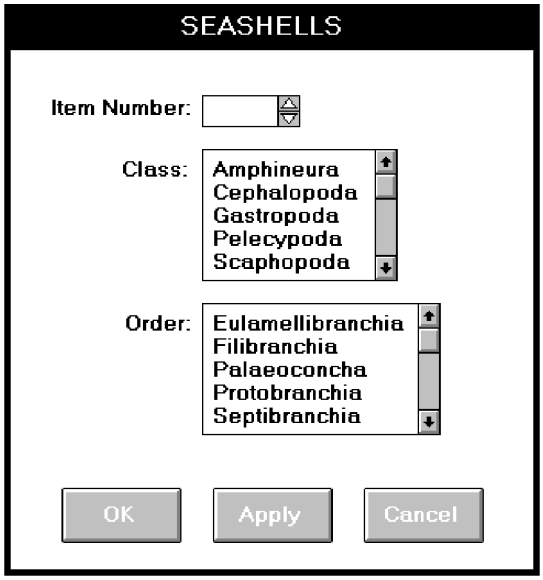
Again, here is an example of improper and proper use of controls.

Screen 5.1

A collection of seashells is being cataloged by class and order. Text boxes are provided for the task. The catalog process includes typing words such as "Cephalopoda" and "Eulamellibranchia." The process is slow and conducive to spelling errors.



Screen 5.1



Screen 5.2

Screen 5.2

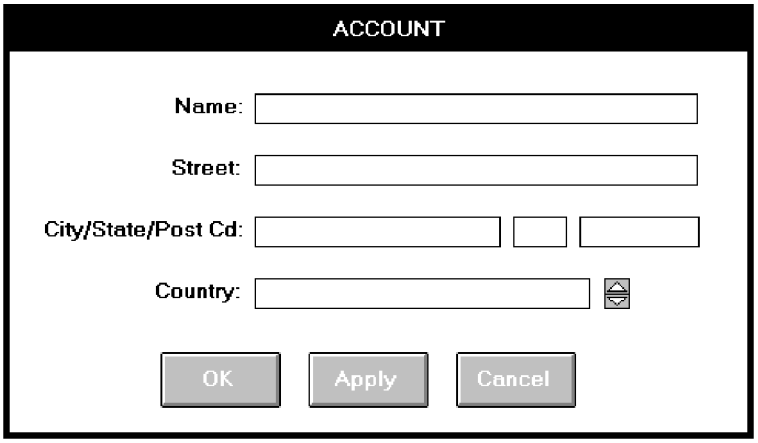
A solution: Present Class and Order in list boxes from which the proper varieties are selected. This will speed up the cataloguing process and eliminate the possibility of spelling errors. To make the entire procedure a selection task, also make Item Number a selectable and incrementable spin box.

Example 6

Again, here is an example of improper and proper use of a control.

Screen 6.1

An international corporation is setting up a worldwide account database. Names from dozens of different countries are added each day. Country is collected though a spin box. Is this proper usage for a spin box?



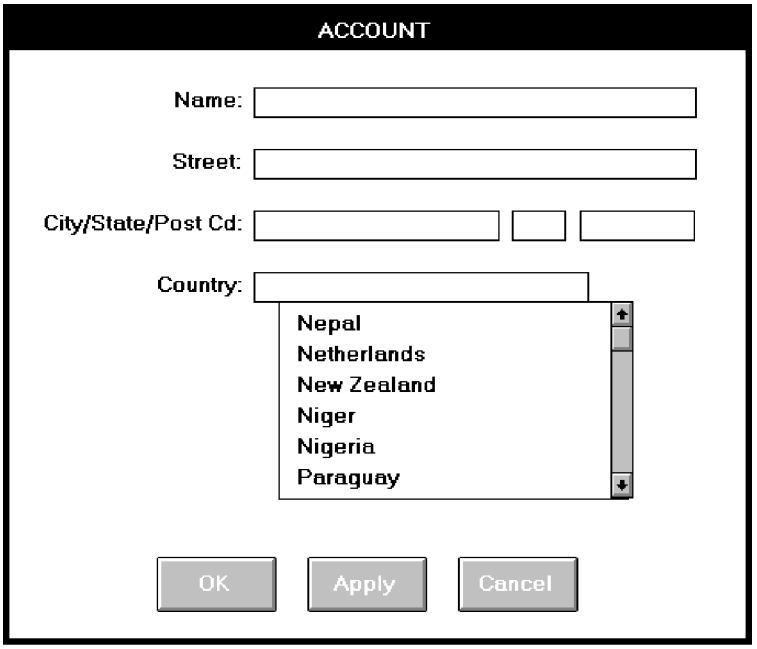
Screen 6.1

Screens 6.2 and 6.3

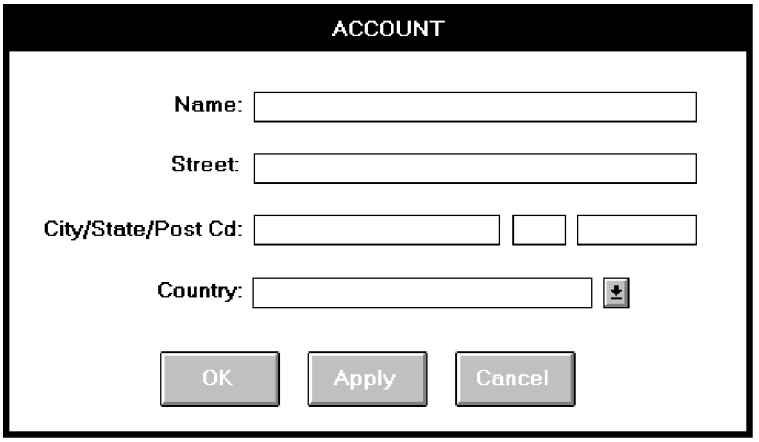
With a spin box, the next unseen choice must be capable of being anticipated. If not, tedious clicking and searching to find the correct choice might have to be performed. (What country follows Greece in the worldwide alphabetical listing of countries today? Guatemala, at least at this writing.) The data in spin boxes should be stable, not often changing. This quality does not accurately reflect the state of countries in the world today.

The best choice would really depend on the variability of the information being collected. If the account information being collected tended to be quite variable in flow, that is, successive account entries were usually from different countries, a better choice would be a combo box (Screen 6.2). Well-known country names can be typed and less-well-known ones found in the listing. Because of the dynamic nature of country names, frequent reference to the list can be expected. Permanently displaying the list avoids the step of retrieving it when needed. The attached listing also permits scanning several names at one time, alleviating the predictability problem. Names can also be easily added or changed as needed. The combo box is also at the bottom of the window where it tends to be out of the way.

If successive account entries tended to be from the same country, that is, the information is batched, a pop-up/drop-down combination would be more appropriate (Screen 6.3). The box can remain closed through successive same country entries and only needs to be opened occasionally.



Screen 6.2



Screen 6.3

Step 7 Exercise

An exercise for Step 7 can be found on this book's companion Web site, www.wiley.com/college/galitz.

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