Midterm

- Thursday, October 16, in class
- Closed-book
- ~75 minutes (tentative)

Widgets

More GUI goo

Outline

- What is a widget?
- Buttons
- Combo boxes
- Tool bars
- Text components
- Dialog boxes
- Sliders
- Scrollbars

What is a Widget?

- Widgets are interactive objects - the basic building blocks of graphical user interfaces
- Used for input and output
- Input - information and commands
- Output - information and application status
- An important part of user interface design is choosing and laying out widgets on the screen

Categories of Widgets

- Two broad categories
- Meta-level widgets – widgets that contain other widgets (aka compound component)
- Atomic widgets – atomic components (cannot contain other components)
- Examples…
- Meta-level widgets
  - Windows
  - Dialog/message boxes
  - Toolbars
  - Panels (JPanel)

Atomic widgets

Buttons

Text components Sliders

Scrollbars

Combo boxes

Menus

Outline

- What is a widget?
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What is a Button?

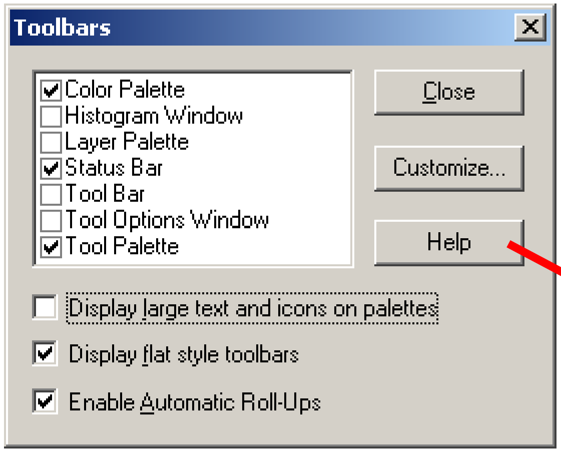
- An individual and isolated region of a display that is selectable by the user to invoke a state or command
- Designed to look like physical buttons to suggest they can be “pushed” (like physical buttons)
- Four types
  - Push buttons - invoke a command
  - Radio buttons - enable a state and indirectly disable one or more other states
  - Checkboxes - toggle a state on/off
  - Modal buttons – hybrid of push button and checkbox (aka toggle buttons)

Push Buttons

- The most common type
- Pushed ("clicked") to invoke a command
- Three ways to organize push buttons…
  - Isolated
    - An individual button in a window
    - Pushed ("clicked") to invoke a command (e.g., Canel, OK, Close, Preview)
  - Menus
    - A menu is simply a popup collection of buttons
  - Toolbars
    - A collection of buttons with commonly used functions
    - Presentation is "persistent" (rather than popup, as with menus)
    - Usually employ a small icon, rather than text

Push Button Examples

Isolated



Toolbars

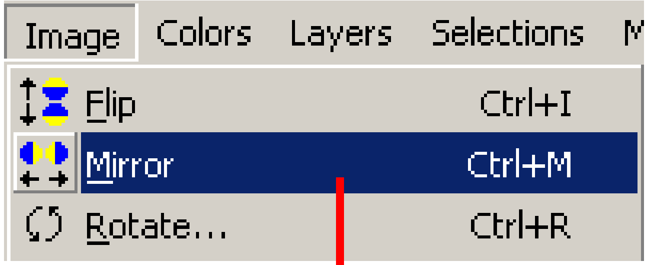
☑ Color Palette
□ Histogram Window
□ Layer Palette
☑ Status Bar
□ Tool Bar
□ Tool Options Window
☑ Tool Palette

□ Display large text and icons on palettes

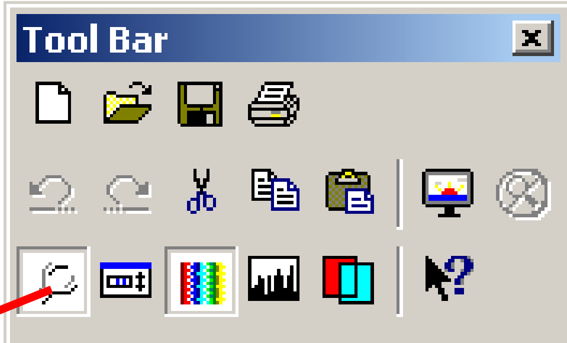
☑ Display flat style toolbars

☑ Enable Automatic Roll-Ups

Menu



Toolbar



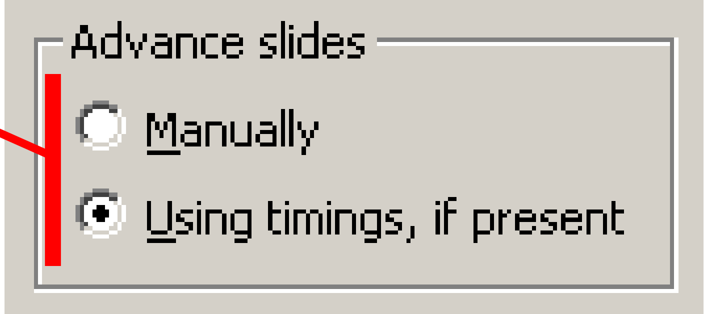
Push Button

Radio Buttons

- Allow a user to select one feature from a set of mutually exclusive features
- Name derived from radio station selector buttons

Radio Button Example

Two mutually-exclusive options



Advance slides

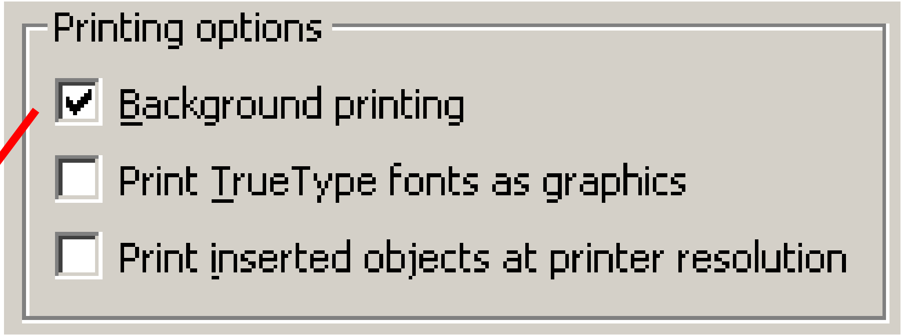
○ Manually

● Using timings, if present

Checkboxes

- “Checked” to turn a state on/off
- Use checkboxes...
  - When a feature or characteristic has precisely two states and these are appropriately described as being “enabled” or “on” vs. “disabled or “off” (e.g., lightbulb = on | off)
- Do not use checkboxes…
  - When a feature or characteristic has more than two states (e.g., season = spring | summer | autumn | winter)
  - When enabled/on and disabled/off are inappropriate descriptions of the states (e.g., gender = male | female)

Checkbox Example



Printing options

☑ Background printing

□ Print TrueType fonts as graphics

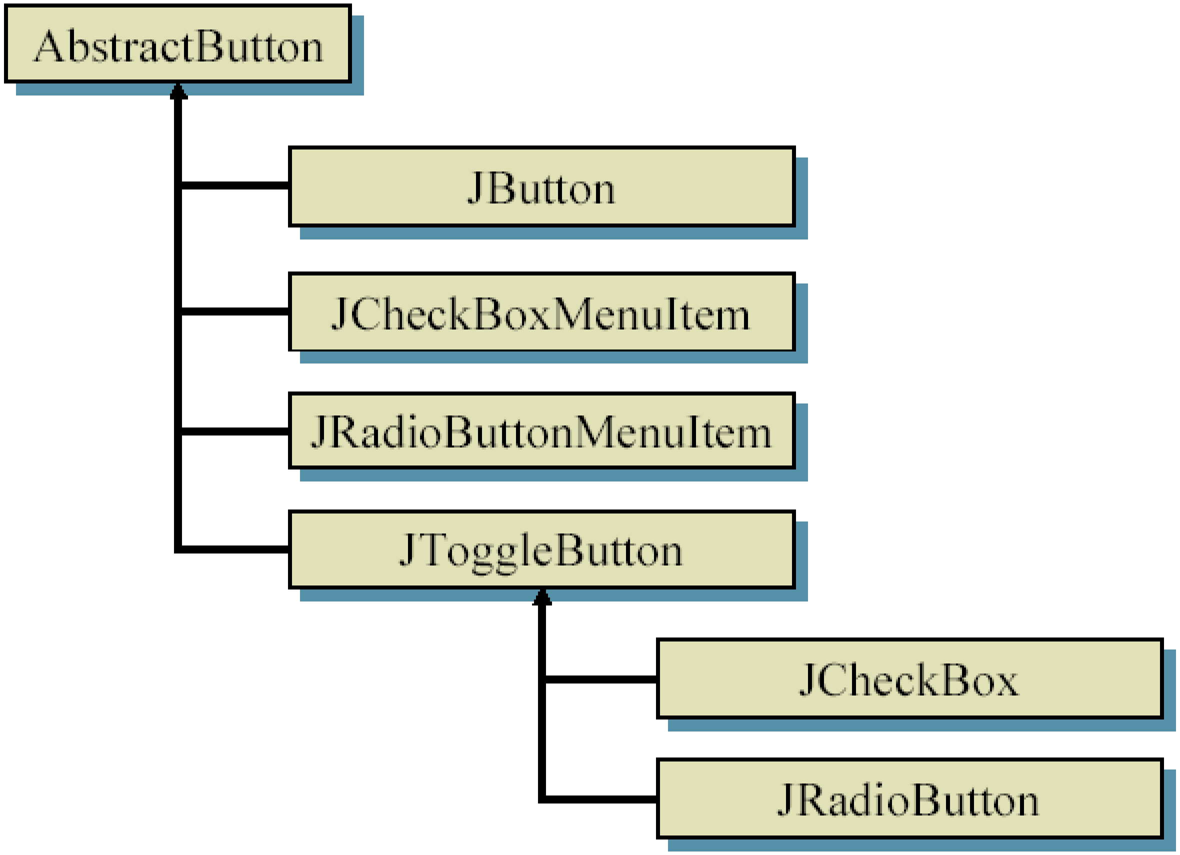
□ Print inserted objects at printer resolution

Checked = Enable “Background printing”
Unchecked = Disable “Background printing”

Modal Buttons

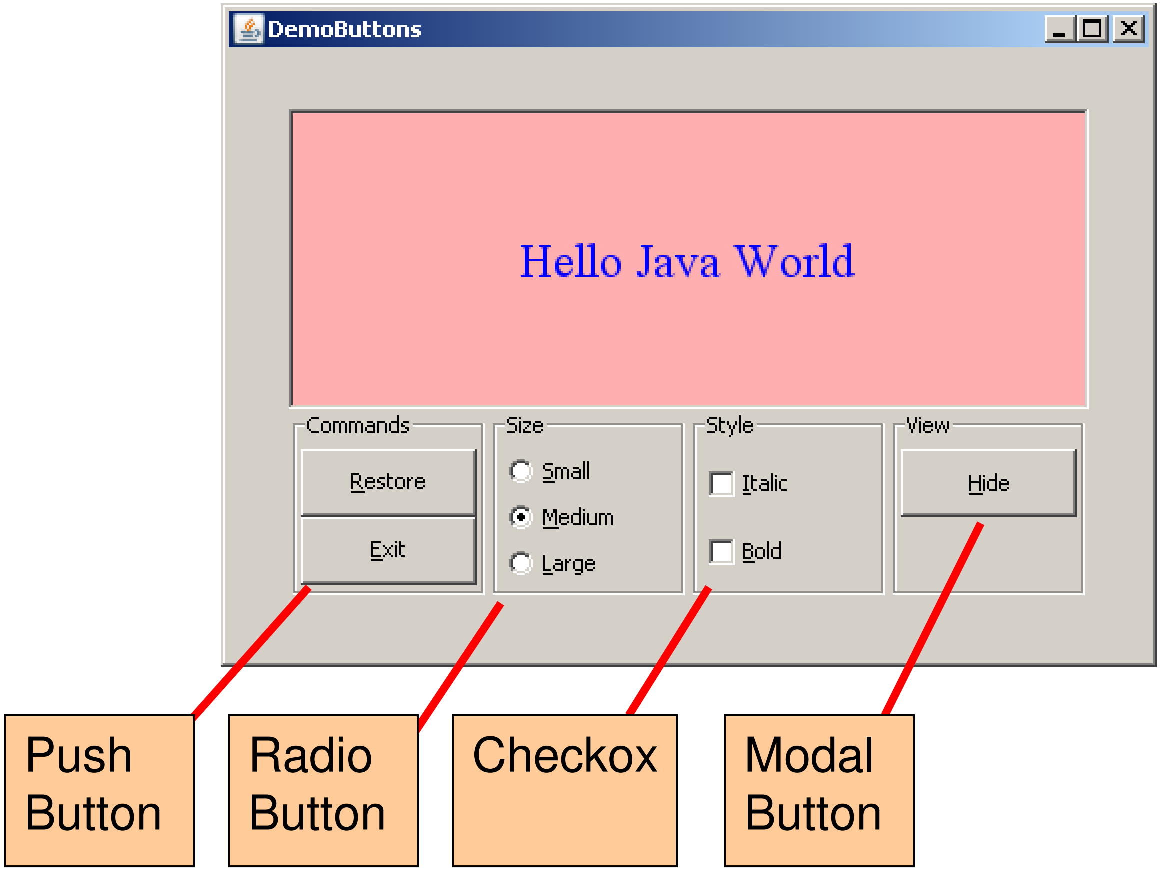
- A hybrid of push buttons and checkboxes
- A modal button…
  - Looks like a push button
  - Toggles a state
- Text or icon in button indicates the next state
  - E.g., “show details” vs. “hide details” (example soon)

Java’s Button Classes



Example Program

DemoButtons.java



Hello Java World

Push Button

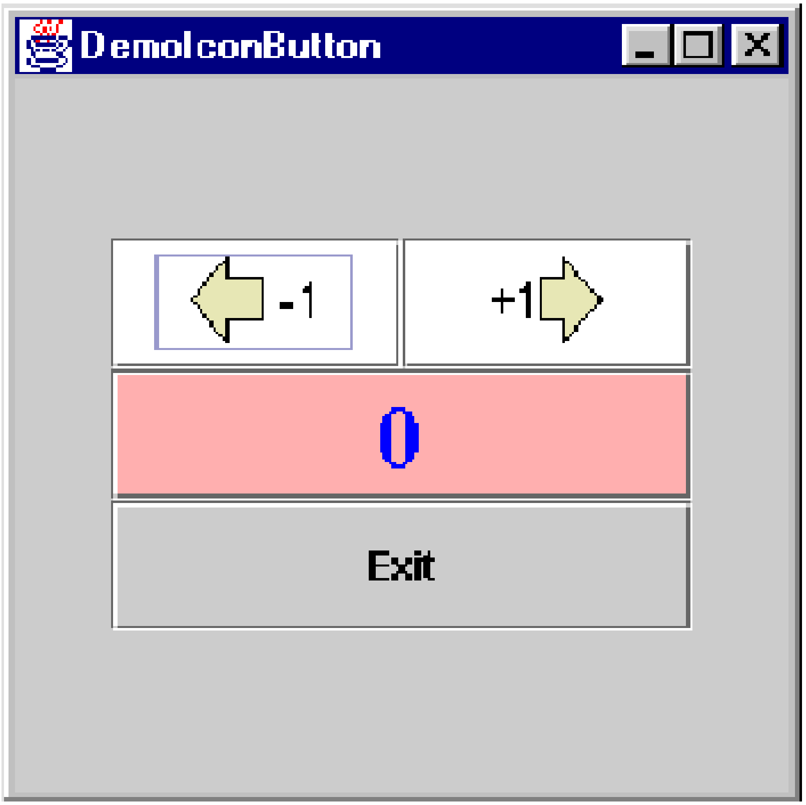
Radio Button

Checkox

Modal Button

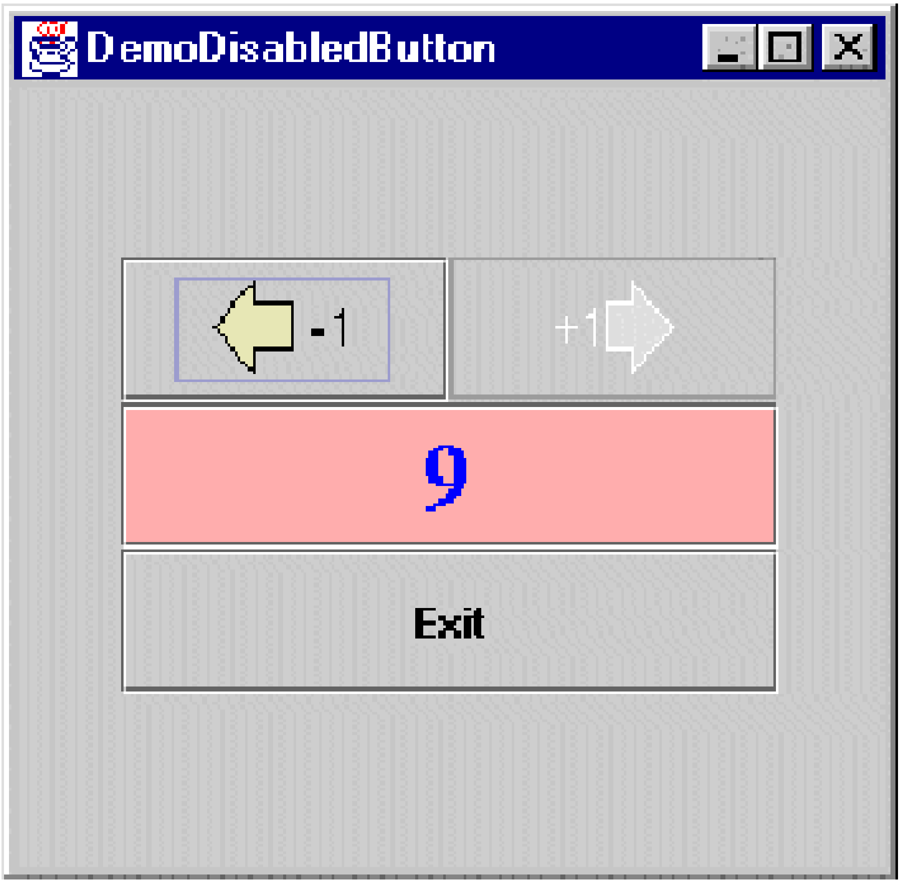
Example Program

DemoIconButton.java



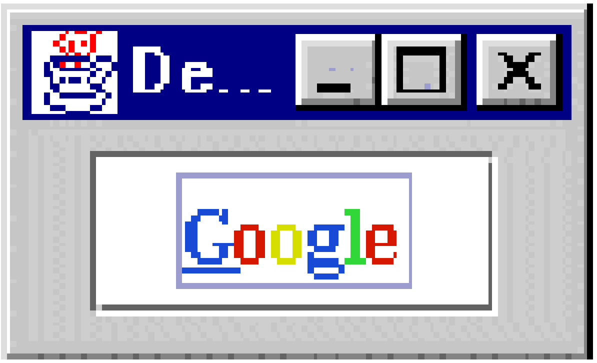
Example Program

DemoDisabledButton.java



Example Program

DemoHTMLButton.java



Outline

- What is a widget?
- Buttons
- Combo boxes
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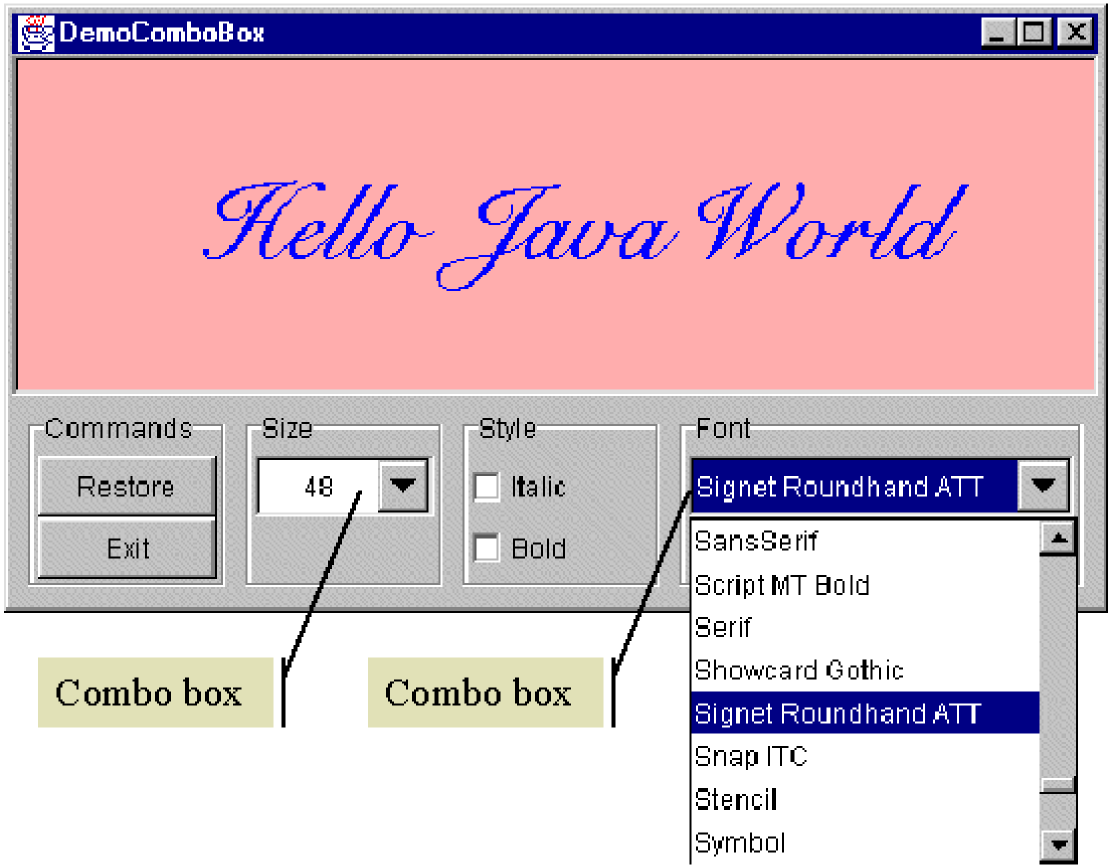
Combo Boxes

- An alternative to radio buttons when the number of mutually-exclusive options is large
- Advantage over radio buttons
  - More choices can be displayed in less screen space
- Disadvantage over radio buttons
  - Choices are not displayed until combo box is selected (remember ‘recognize’ vs. ‘recall’)

Example Program

DemoComboBox.java



Size: 48

Font: Signet Roundhand ATT

Combo box

Combo box

Outline

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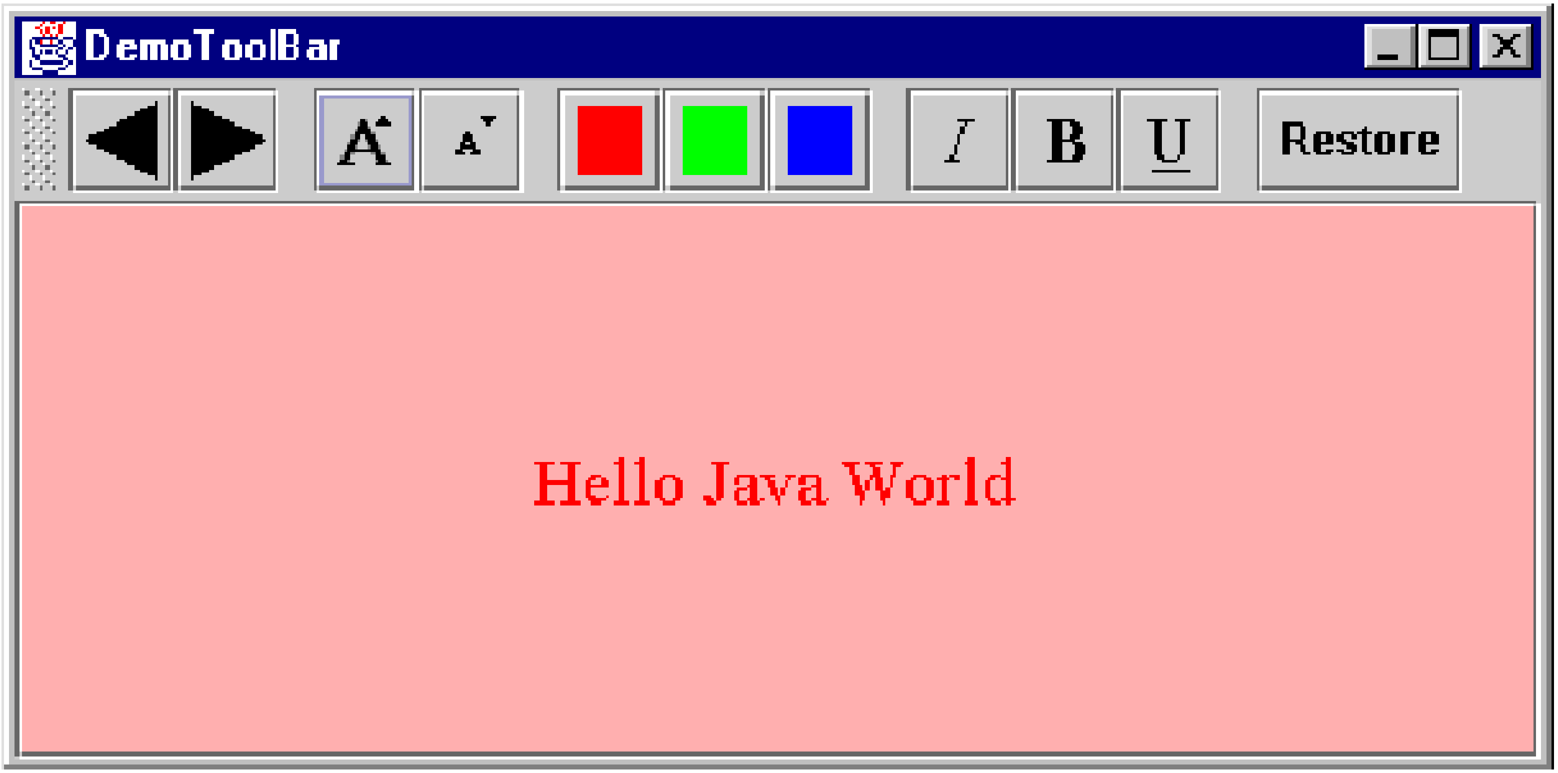
What is a tool bar?

- A group of buttons arranged in a row or column
- Tool bar buttons usually display an icon, rather than text
- Provide convenient access to common menu commands
- Often, the tool bar can be dragged into a separate window
- Advantage of tool bars
  - Commands are displayed (remember ‘recognize’ vs ‘recall’)
- Disadvantage of tool bars
  - Consume display space (less space for application)

Example Program

DemoToolBar.java



Hello Java World

Outline

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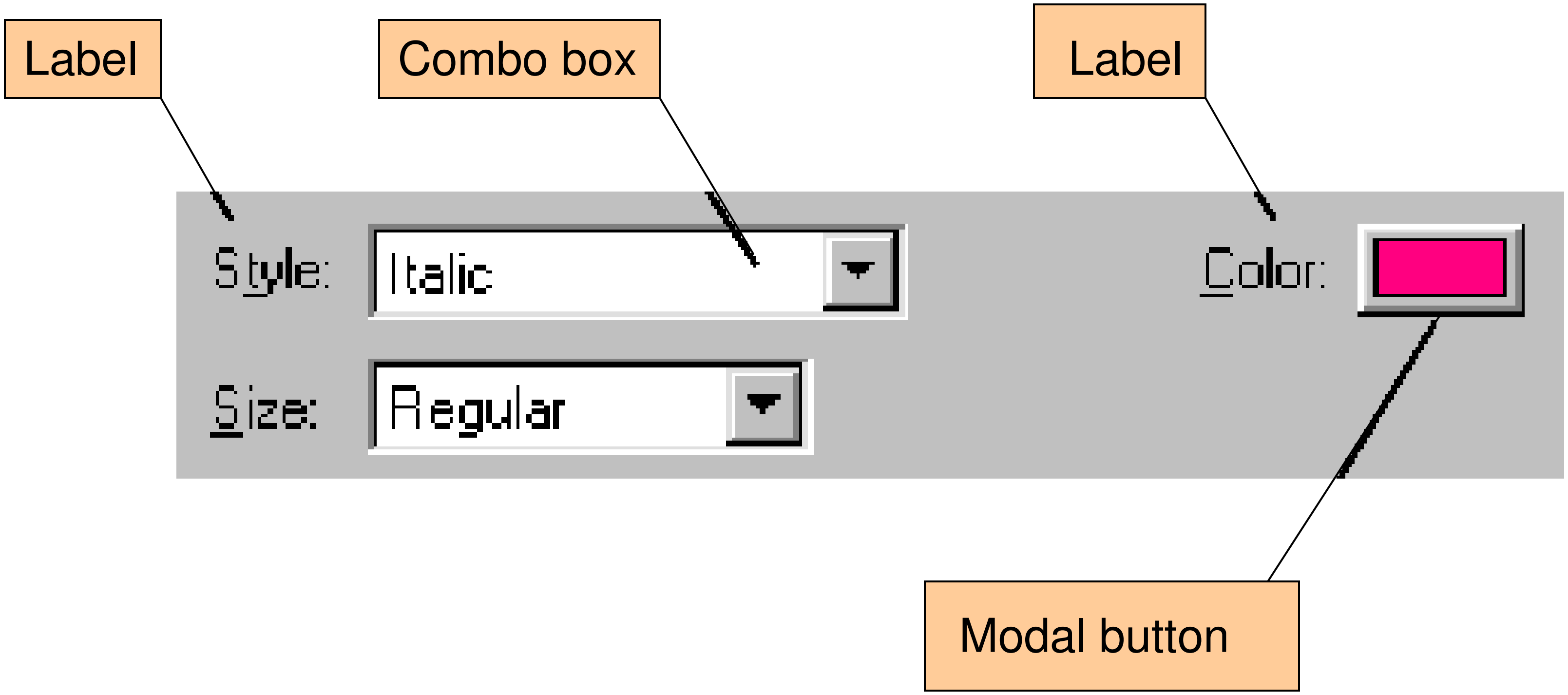
Types of Text Components

- Output (aka non-editable)
  - Labels
  - Labeled borders
  - Tool tips
  - Message Boxes
- Input/output (aka editable)
  - Text fields
  - Text areas
  - Editable combo boxes
  - Dialog boxes

Labels

- Placed near (above, below, left, or right) a widget to provide additional information on the purpose
- Advantage
  - Aides in command recognition
- Disadvantage
  - Uses display space
  - Terse wording may be a poor indicator of command purpose

Label Example



Label

Combo box

Label

Style: Italic

Size: Regular

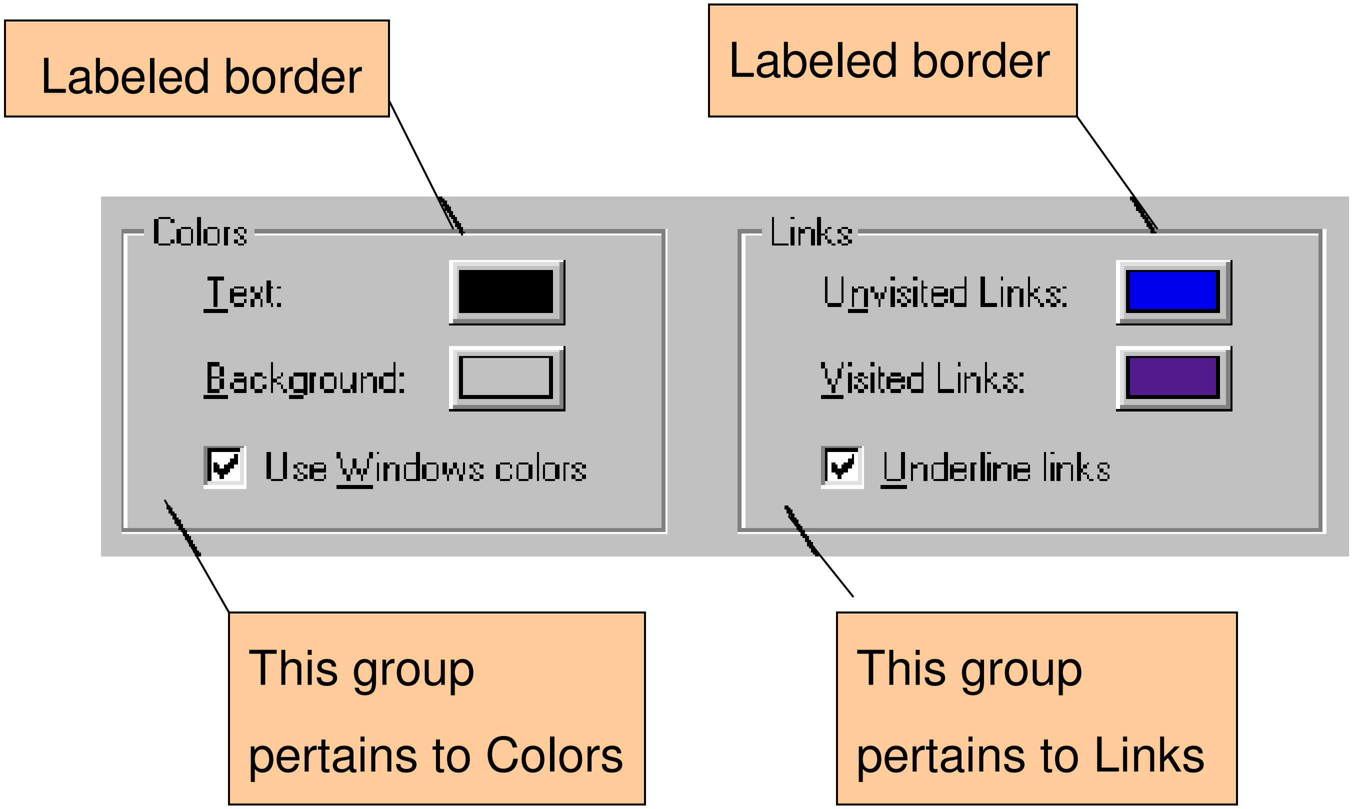
Color:

Modal button

Borders and Labeled Borders

- Placed around a collection of widgets
- Use to create ‘groups’
- Advantage
  - Grouping reduces *cognitive load*
    - E.g., 3 groups, each with 4 items
    - With borders around groups: user identifies 1 of 3 groups, then 1 of 4 items within group (two-step process)
    - Without borders: user identifies 1 of 12 items (this is harder!)
- Disadvantage
  - Uses display space
  - Group ‘boundaries’ may not be obvious
- Labels may be added to improve group identification

Labeled Borders



Labeled border

Labeled border

Colors

Text:

Background:

☑ Use Windows colors

Links

Unvisited Links:

Visited Links:

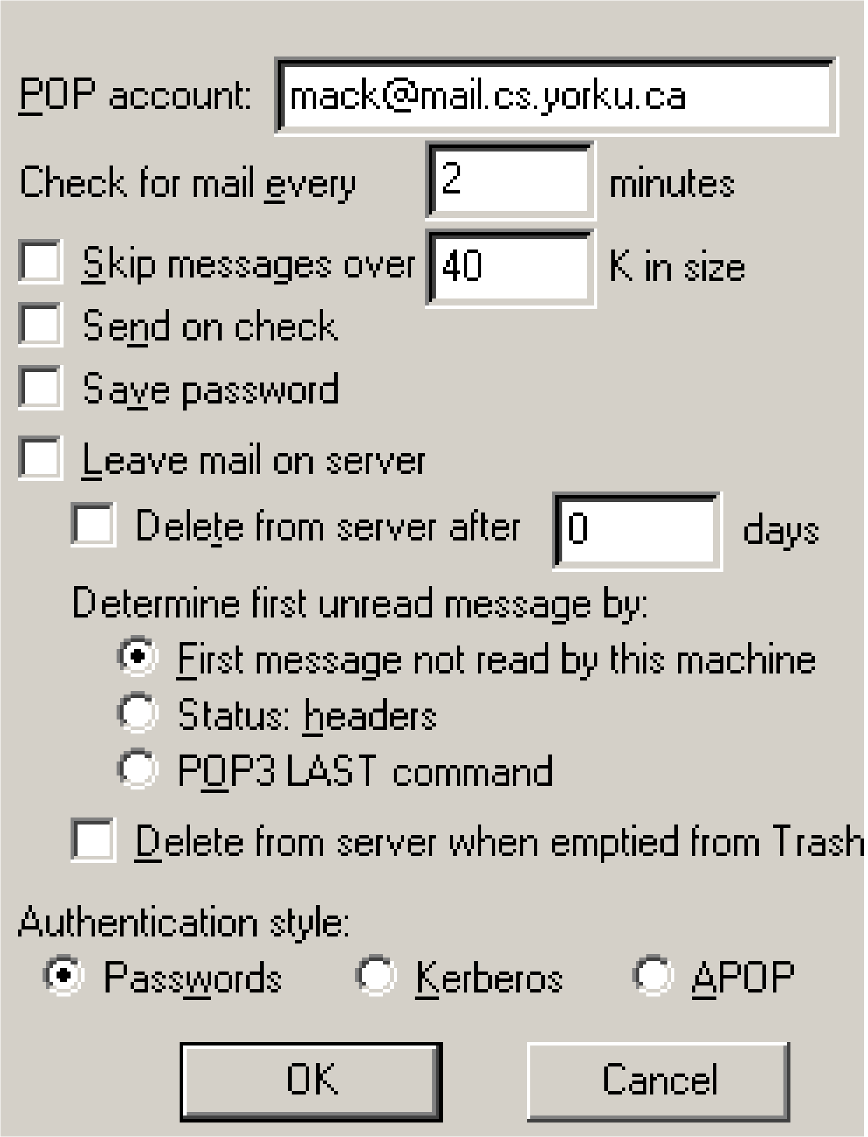
☑ Underline links

This group pertains to Colors

This group pertains to Links

Design Opportunity

Could the organization of these option widgets be improved using borders to create groups?



POP account: mack@mail.cs.yorku.ca

Check for mail every 2 minutes

□ Skip messages over 40 K in size

□ Send on check

□ Save password

□ Leave mail on server

□ Delete from server after 0 days

Determine first unread message by:

● First message not read by this machine

○ Status: headers

○ POP3 LAST command

□ Delete from server when emptied from Trash

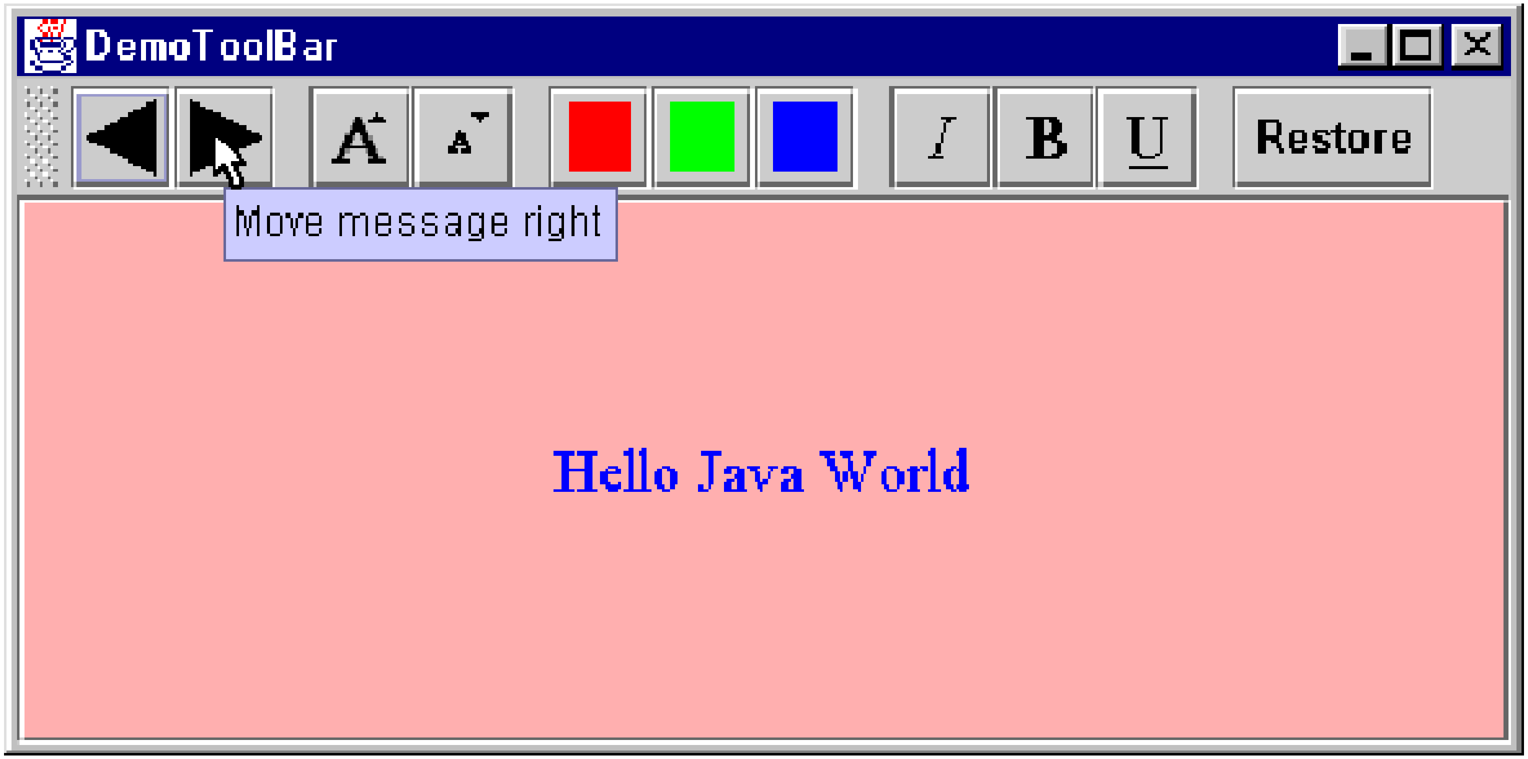
Authentication style:

● Passwords ○ Kerberos ○ APOP

Tool Tips

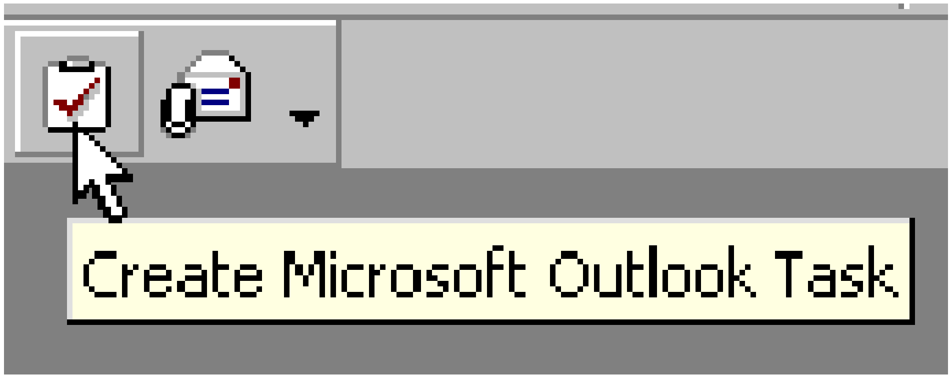
- A tool tip is a small text field that pops up when the cursor pauses over a GUI component
- The text provides a terse supplementary description of the command associated with, or the purpose of, the component
- Advantage
  - Aides in command recognition
  - Does not consume screen space until shown
- Disadvantage
  - Terse wording may be inadequate
  - Frequent cycles of appear/disappear (i.e., animation) annoying to some users

Tool Tip Example



Tool Tip Example (2)

- From MS PowerPoint…



Create Microsoft Outlook Task

?

Message Boxes

- A message box is popup window that presents a text message to the user
- Output only (except for confirmation to close the box)
- Purpose
  - Notify the user of a problem (e.g., invalid choice)
  - Notify the user of potentially destructive outcome (e.g., overwrite a file)
  - Provide information

Message Boxes (2)

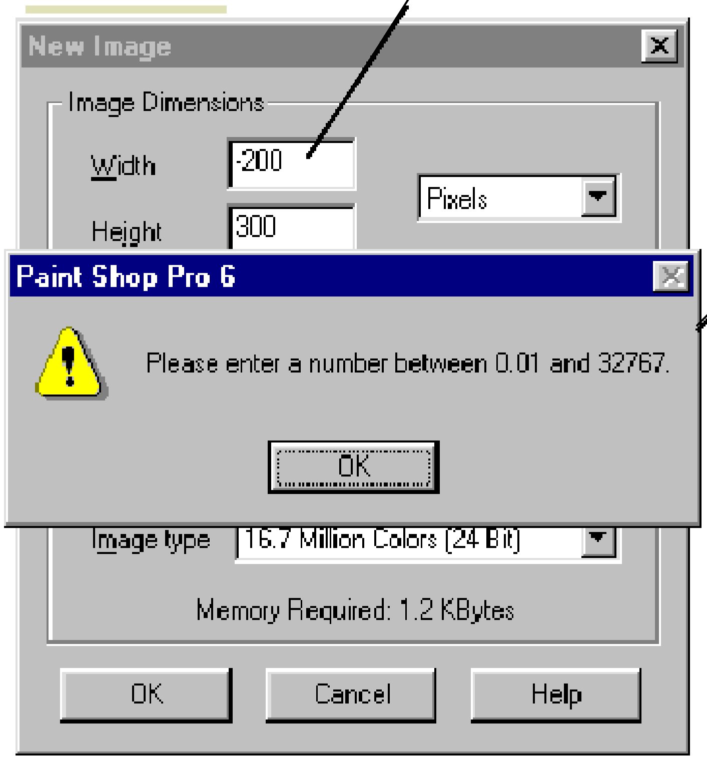
- Advantage
  - Comprehensive messages are possible (unlike tool tips)
- Disadvantage
  - Slows interaction (because underlying thread is halted until confirmation is received)

Example

Message box

Invalid input

Message box



New Image

Image Dimensions

Width: -200

Height: 300

Pixels

Paint Shop Pro 6

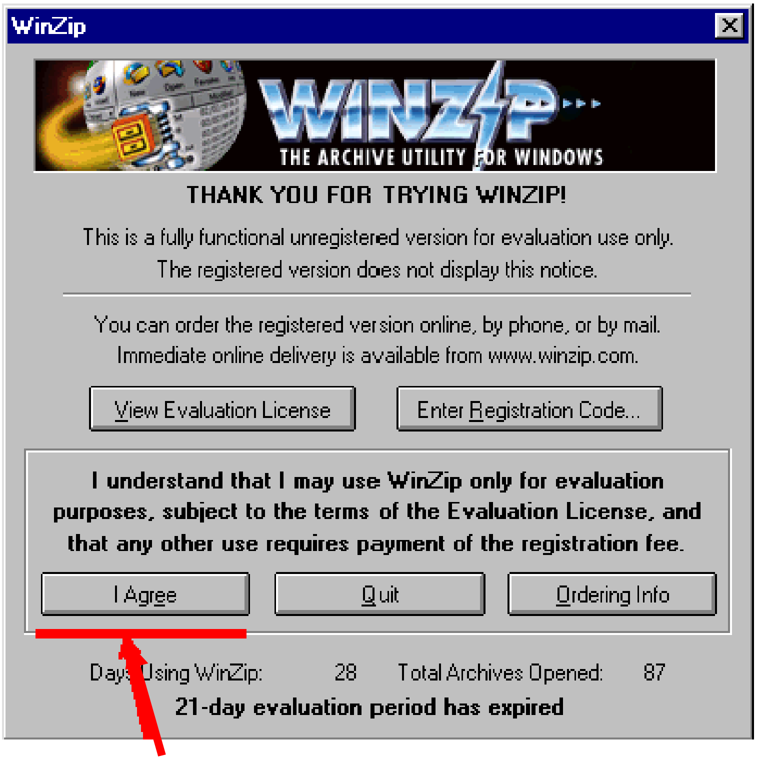
Please enter a number between 0.01 and 32767.

Image type: 16.7 Million Colors (24 Bit)

Memory Required: 1.2 KBytes

Confirmation and Error Prevention

- Most dialog or message boxes require the user to make a choice or acknowledge a message
- Many don’t have close boxes (user cannot choose other widgets while dialog/alert box is active)
- Three error prevention techniques
  1. Require an explicit button click or key press before proceeding (i.e., there is **no default** action by pressing Enter)
  2. Sound an **alarm tone** for invalid input (usually annoying)
  3. Change the position of buttons from one invocation to the next (**prevent**s “**errors due to habit**!”)
- E.g., Winzip (next slide)



THANK YOU FOR TRYING WINZIP!

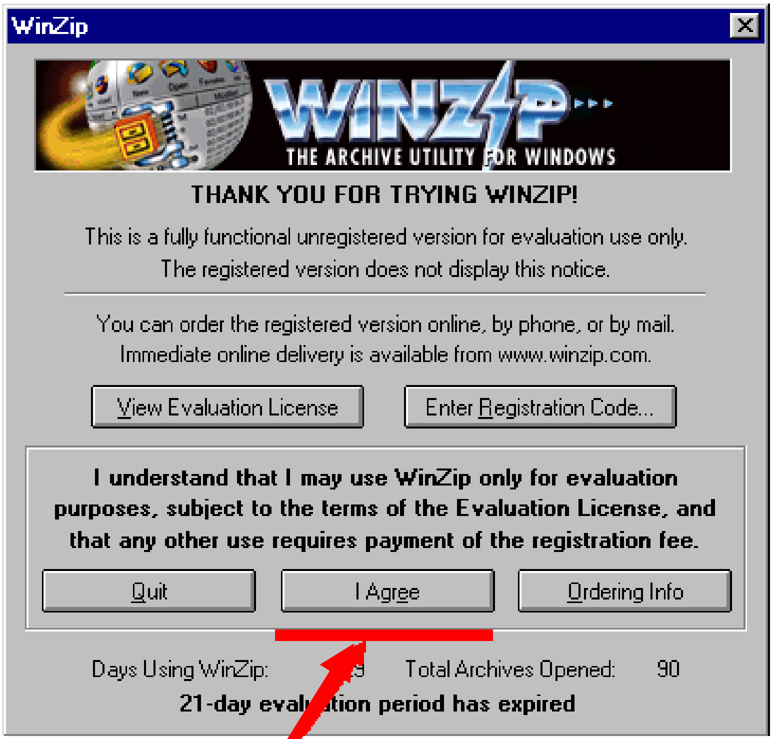
This is a fully functional unregistered version for evaluation use only. The registered version does not display this notice.

You can order the registered version online, by phone, or by mail. Immediate online delivery is available from www.winzip.com.

I understand that I may use WinZip only for evaluation purposes, subject to the terms of the Evaluation License, and that any other use requires payment of the registration fee.

Days Using WinZip: 28 Total Archives Opened: 87

21-day evaluation period has expired



THANK YOU FOR TRYING WINZIP!

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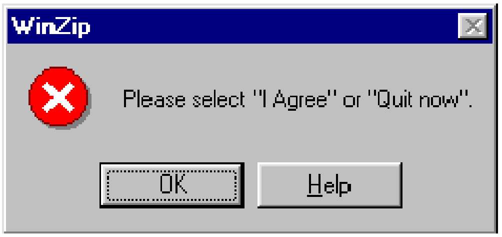
I understand that I may use WinZip only for evaluation purposes, subject to the terms of the Evaluation License, and that any other use requires payment of the registration fee.

Days Using WinZip: 29 Total Archives Opened: 90

21-day evaluation period has expired

Button positions change from one invocation to next

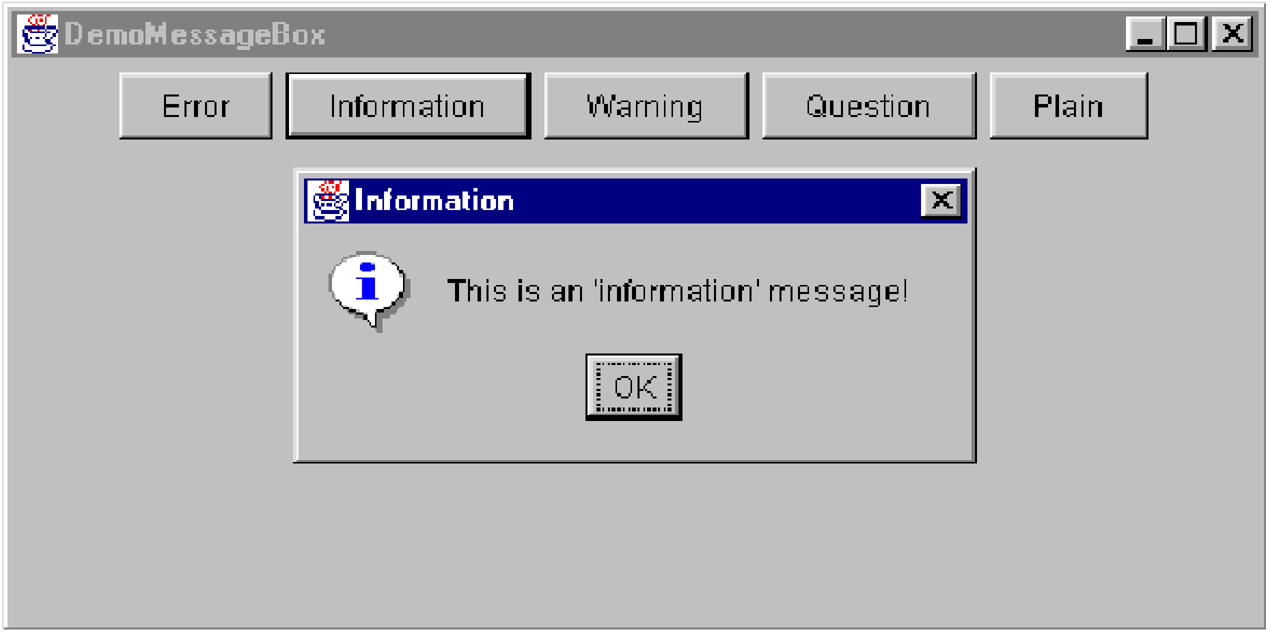
Hitting ENTER produces…



Please select "I Agree" or "Quit now".

Example Program

DemoMessageBox.java



This is an 'information' message!

Text Fields and Text Areas

- Text Field: single-line input/output of text
- Text Area: multi-line input/output of text
- Design challenges
  - Validating input
  - Navigating

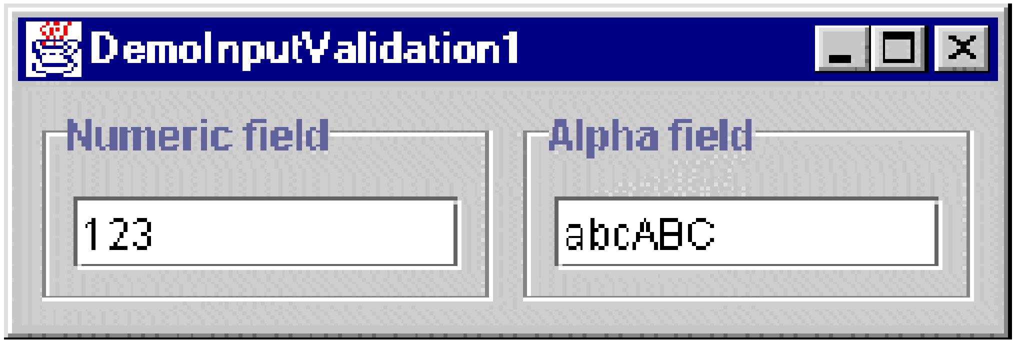
Validating Input

- Input data must be in the format required by the application
- Examples:
  - Numeric field with value in certain range
  - Postal or zip code
  - Date/time formats
- Invalid input must be corrected before proceeding
- If invalid input, can present a popup message, generate audio alarm, etc.

Example Program

DemoInputValidation1.java

DemoInputValidation2.java



Numeric field

123

Alpha field

abcABC

Navigating

- The process of moving from one component to the next
- The currently active component has focus (identified with
- I-beam cursor or special highlighting)
- E.g., completing a form with numerous fields
- Navigation possibilities
  - Clicking with mouse pointer
    - Should accept and validate entry in current field and advance focus to the selected field
    - Sequence determined by user, not the application
  - Tab or Enter
    - Should accept and validate entry and go to the ‘next’ field
    - Sequence determined by application, not the user

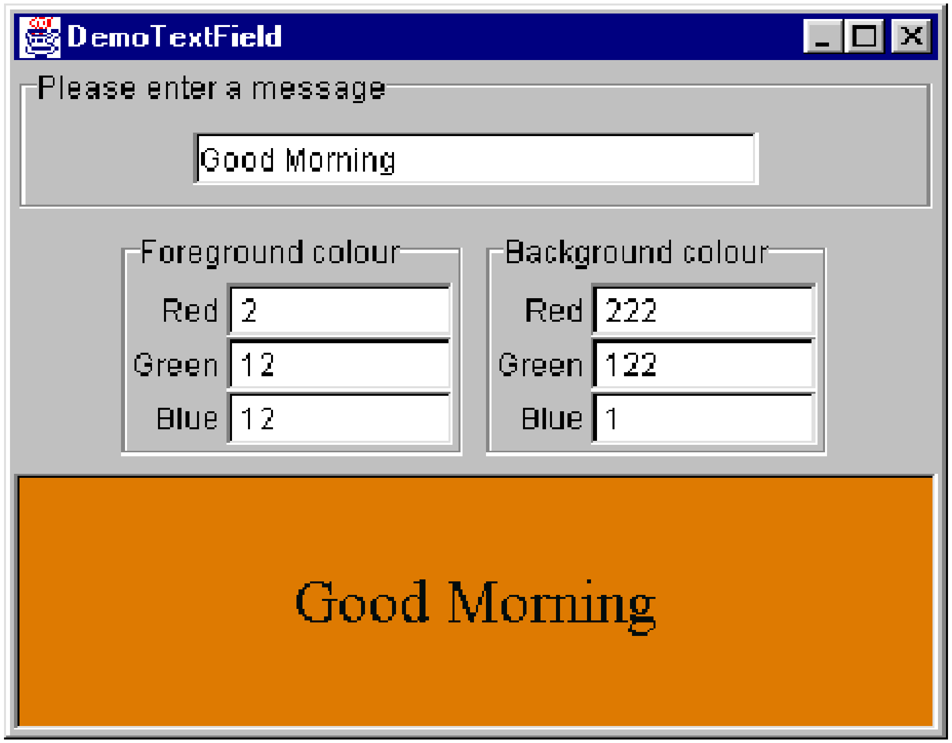
Design Guideline

- A user should be able to interact with a graphical user interface using…
  - mouse only
  - keyboard only
  - combination of mouse and keyboard
- A tall order
  - E.g., text input via a mouse is difficult (but not impossible!)

Example Program

DemoTextField.java

DemoTextField2.java



DemoTextField

Please enter a message

Good Morning

Foreground colour

Red 2

Green 12

Blue 12

Background colour

Red 222

Green 122

Blue 1

Good Morning

Editable Combo Boxes

- Like a combo box, except allows the user to directly type in an entry
- Much more complicated due to…
  - Validating input
  - Navigation

Example Program

DemoComboBox2.java

Same as DemoComboBox.java, except uses an editable combo box to specify font size.

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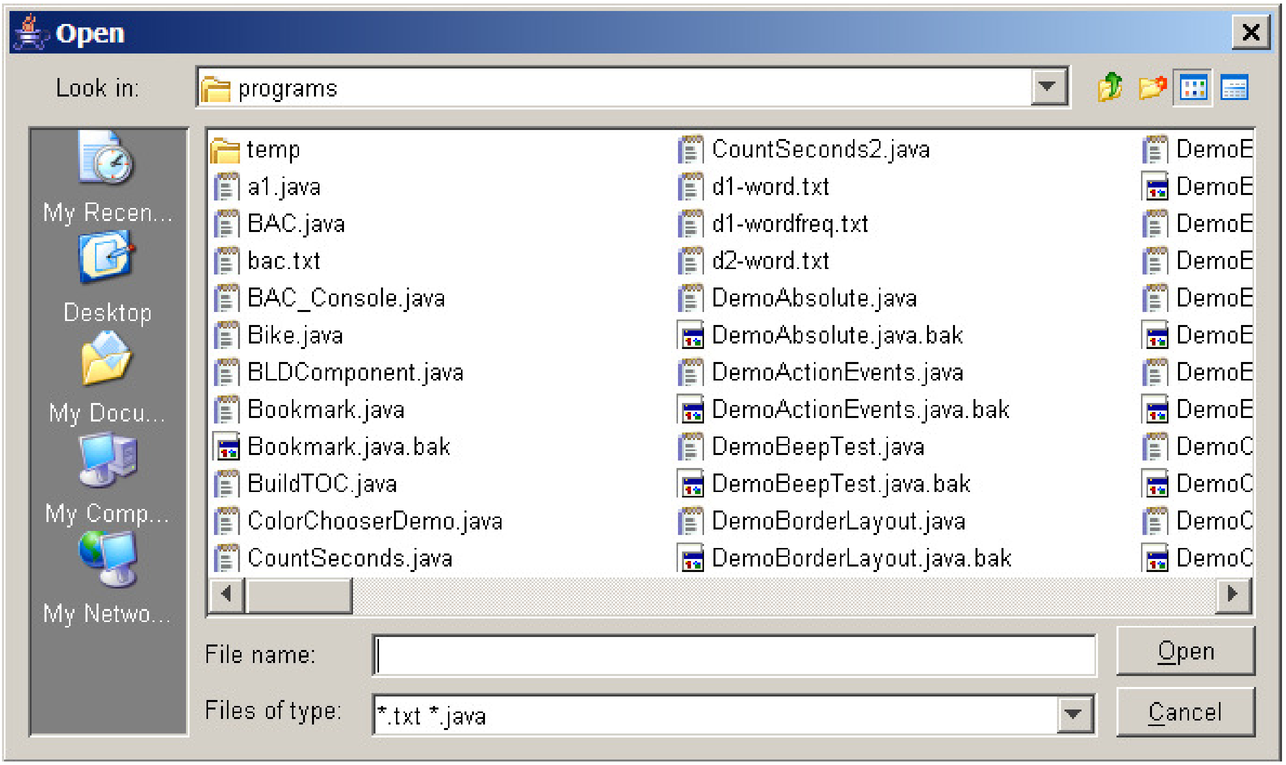
Dialog Boxes

- File Chooser
- Color Chooser
- Custom dialogs

File Chooser Example Program

DemoFileMenu.java

Shown earlier



Look in: programs

temp
a1.java
BAC.java
bac.txt
BAC_Console.java
Bike.java
BLDComponent.java
Bookmark.java
Bookmark.java.bak
BuildTOC.java
ColorChooserDemo.java
CountSeconds.java
CountSeconds2.java
d1-word.txt
d1-wordfreq.txt
d2-word.txt
DemoAbsolute.java
DemoAbsolute.java.bak
DemoActionEvents.java
DemoActionEvents.java.bak
DemoBeepTest.java
DemoBeepTest.java.bak
DemoBorderLayout.java
DemoBorderLayout.java.bak
DemoE
DemoE
DemoE
DemoE
DemoE
DemoE
DemoE
DemoE
DemoC
DemoC
DemoC
DemoC

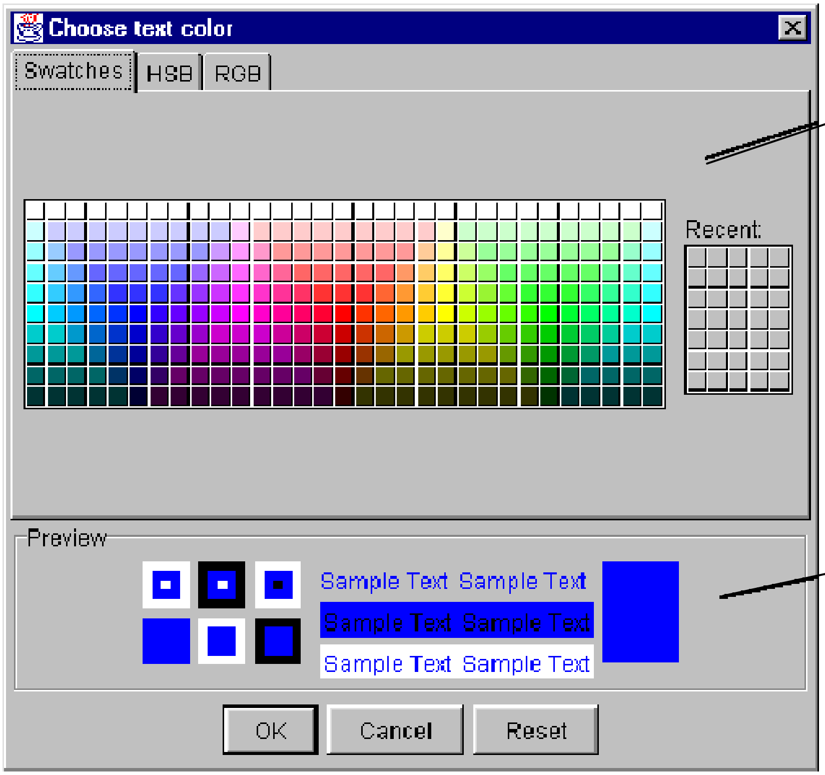
File name:

Files of type: *.txt *.java

Color Chooser Example Program

DemoMenu2.java

Shown earlier

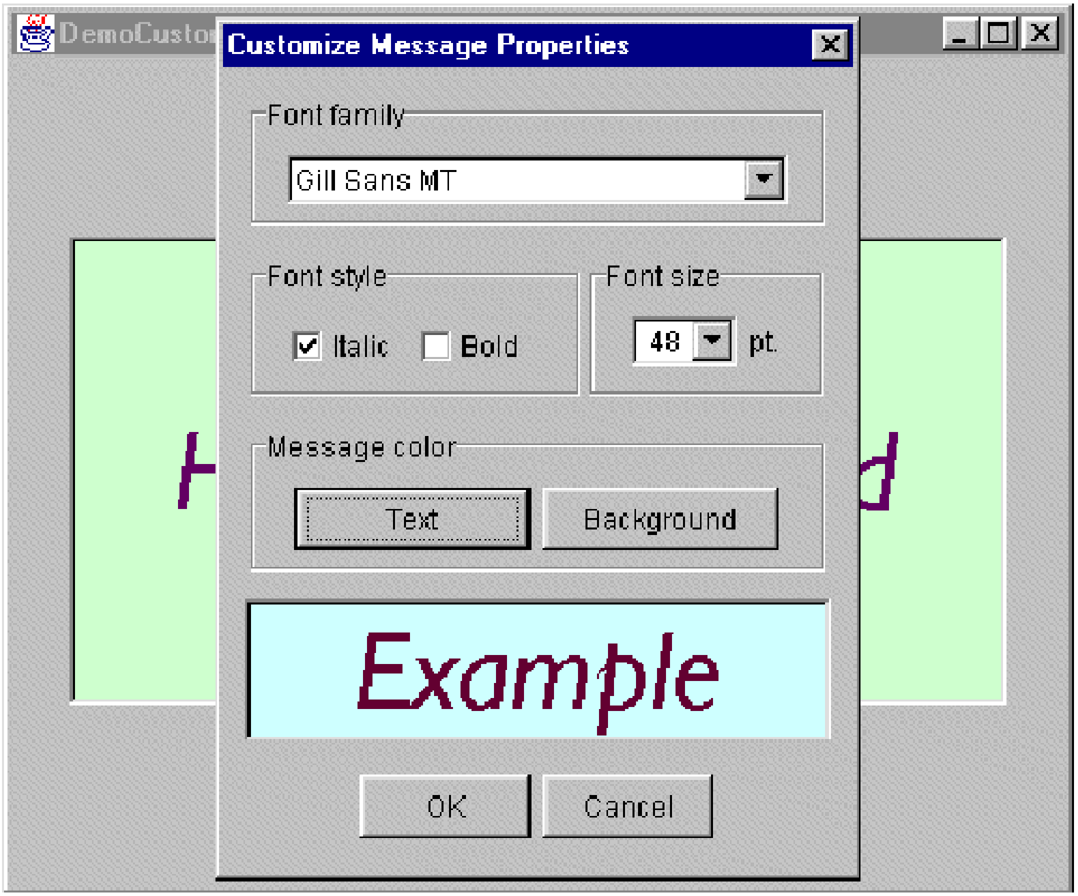


Tabbed pane

Preview panel

Custom Dialog Boxes

DemoCustomDialog.java



Customize Message Properties

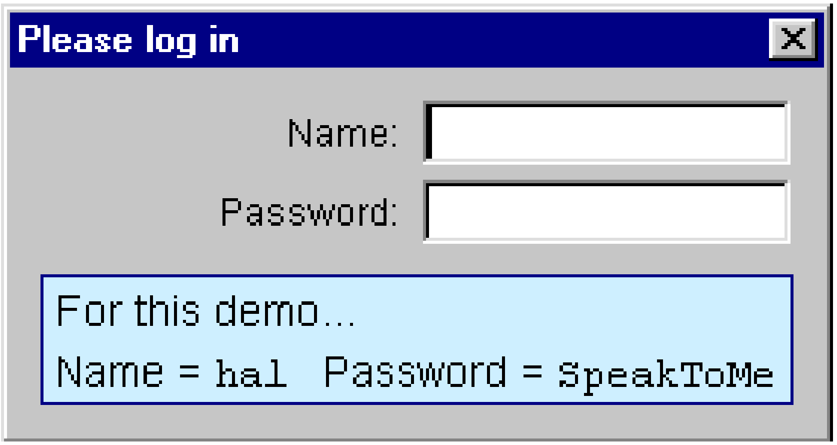
Font family: Gill Sans MT

Font style: ☑ Italic ☐ Bold

Font size: 48 pt.

Password Dialog

DemoPassword.java



For this demo...

Name = hal   Password = SpeakToMe

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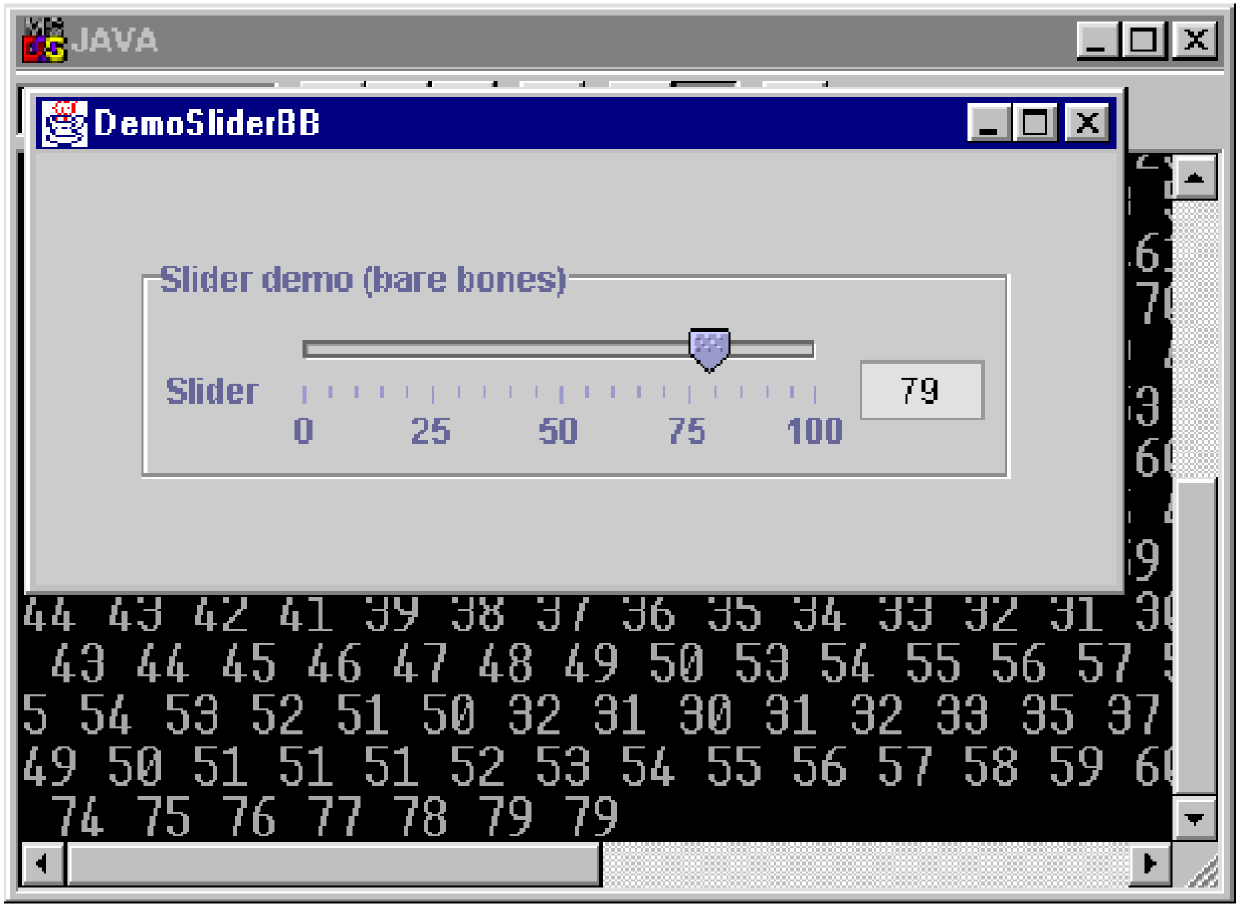
Sliders

- Input control to establish a setting for a pseudo-continuous variable
- Examples
  - RGB values in a color chooser
  - Time delays for animations

Example Program

Bare Bones!

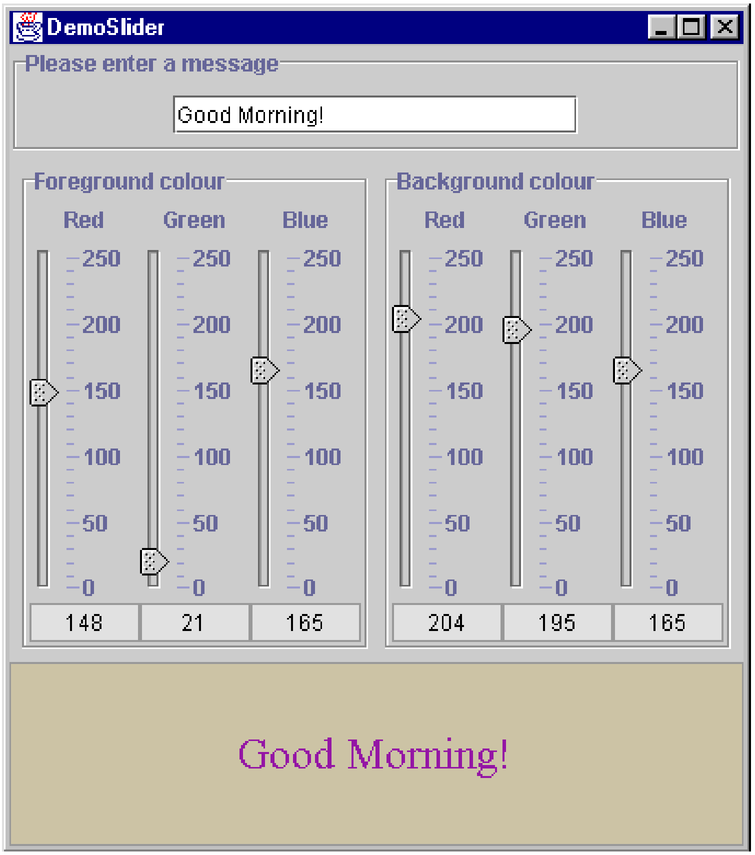
DemoSliderBB.java



```
44  43  42  41  39  38  37  36  35  34  33  32  31  30
 43  44  45  46  47  48  49  50  53  54  55  56  57  5
5  54  53  52  51  50  32  31  30  31  32  33  35  37
49  50  51  51  51  52  53  54  55  56  57  58  59  60
 74  75  76  77  78  79  79
```

Example Program

DemoSlider.java



DemoSlider

Please enter a message

Good Morning!

Foreground colour

Red	Green	Blue
148	21	165

Background colour

Red	Green	Blue
204	195	165

Good Morning!

Outline

- What is a widget?
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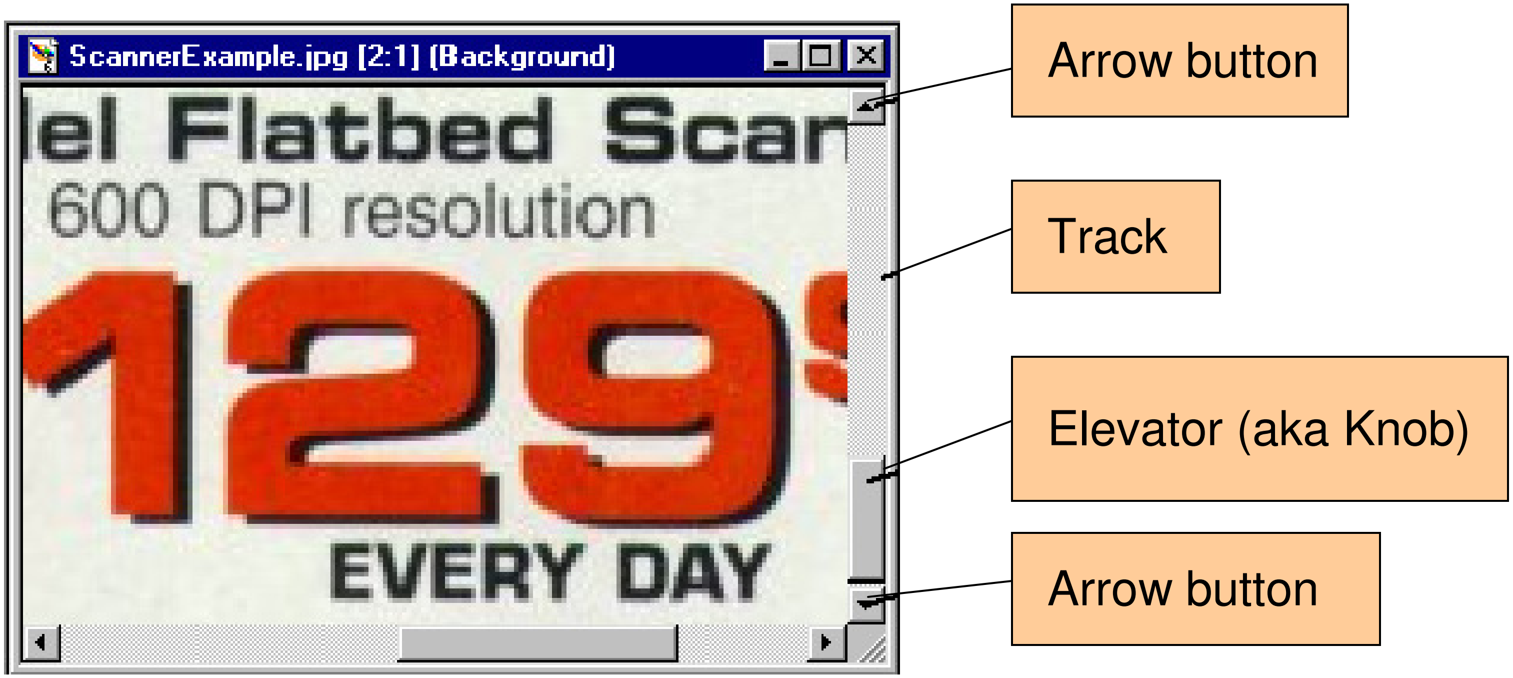
Scrollbars

- Ubiquitous in Graphical User Interfaces
- Parts of a scrollbar



Arrow button

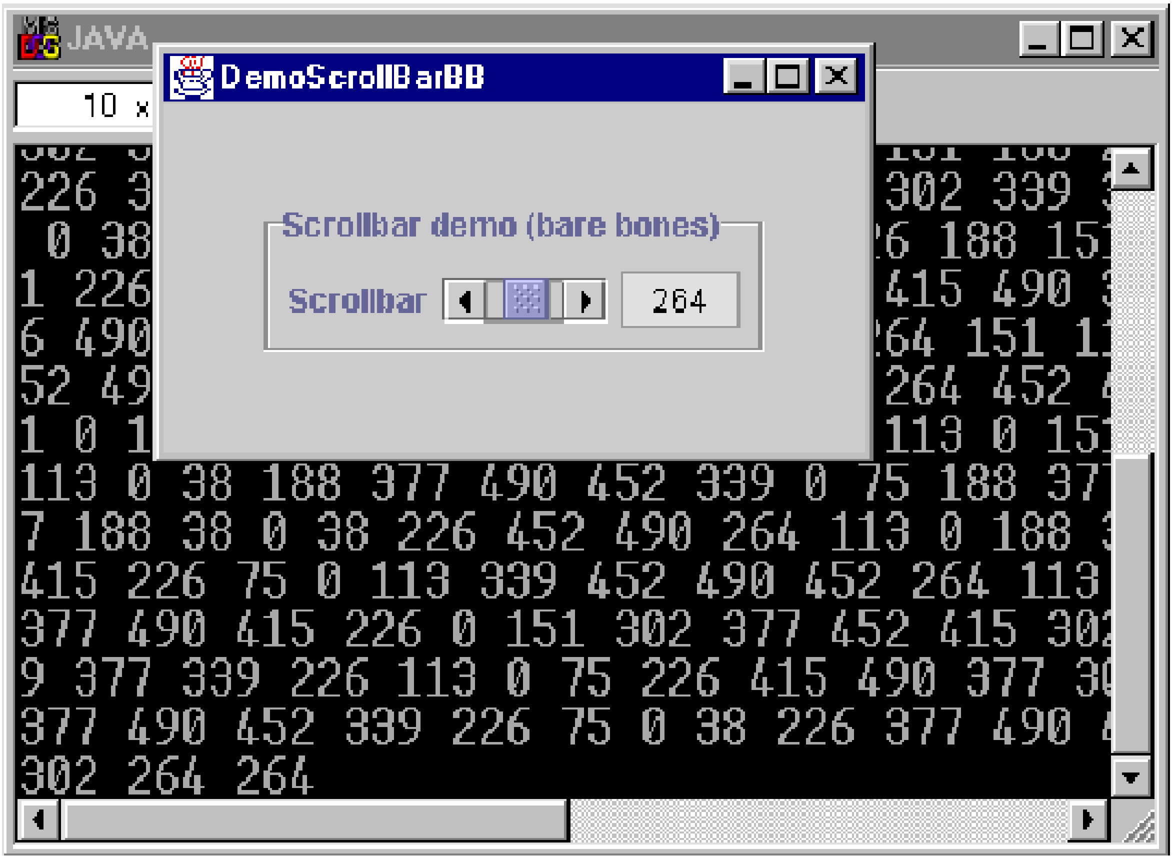
Track

Elevator (aka Knob)

Arrow button

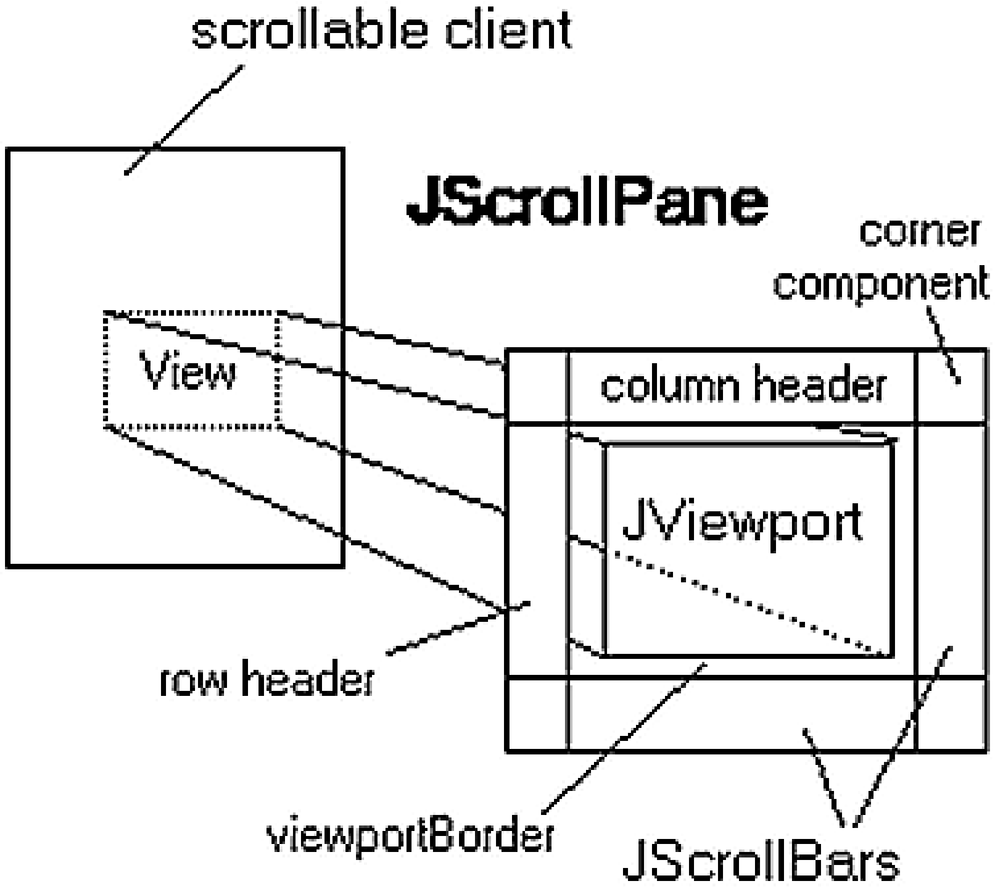
Example Program

DemoScrollBarBB.java



```
226 3                                   302 339 3
 0 38                                  26 188 151
1 226                                   415 490 3
6 490                                  264 151 11
52 49                                   264 452 4
1 0 1                                   113 0 151
113 0 38 188 377 490 452 339 0 75 188 377
7 188 38 0 38 226 452 490 264 113 0 188 3
415 226 75 0 113 339 452 490 452 264 113
377 490 415 226 0 151 302 377 452 415 302
9 377 339 226 113 0 75 226 415 490 377 30
377 490 452 339 226 75 0 38 226 377 490 4
302 264 264
```

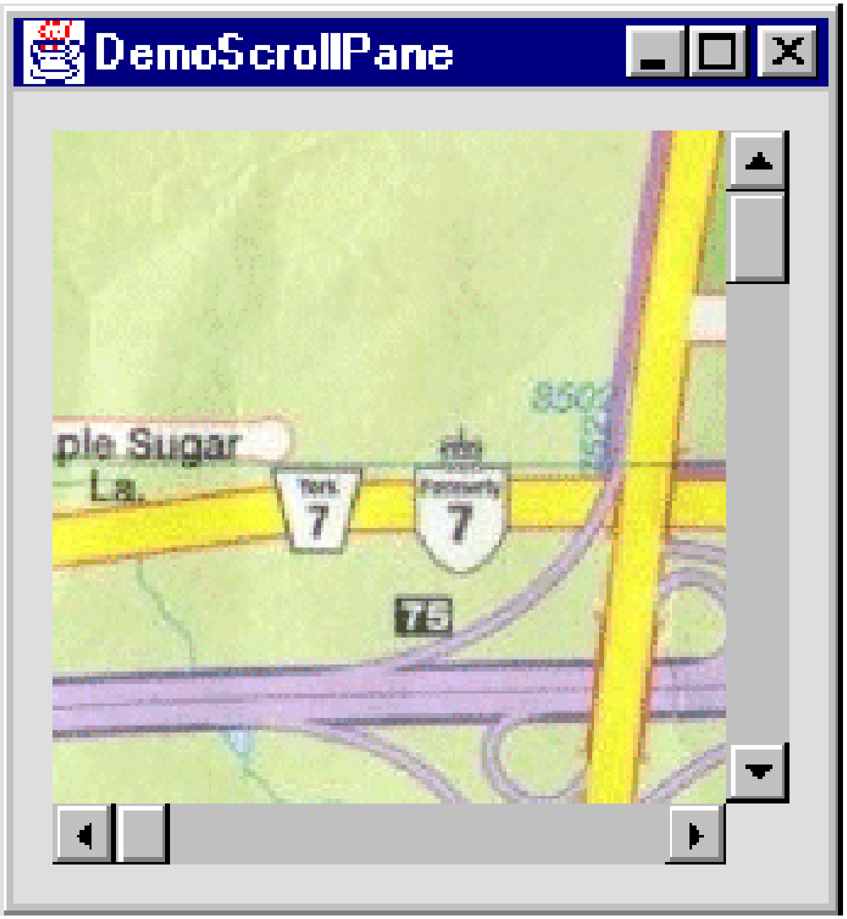
Viewports and Scrollable Clients



Source: JScrollPane API Specification

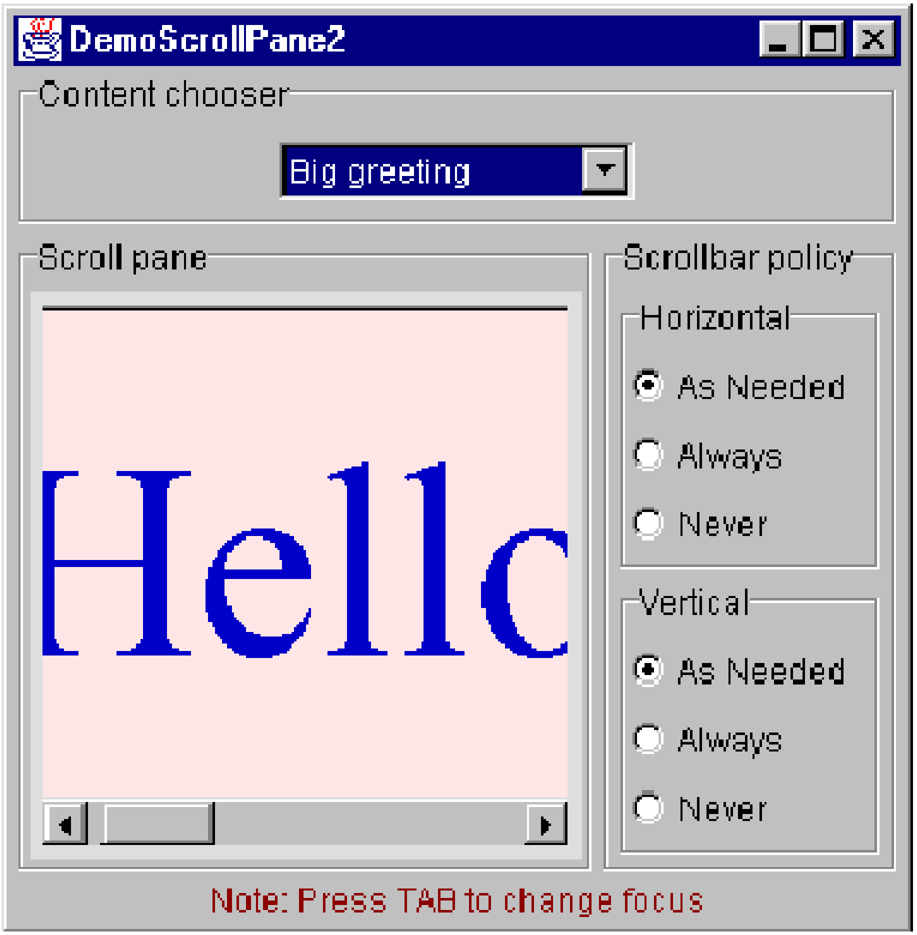
Example Program

DemoScrollPane.java



Example Program

DemoScrollPane2.java



DemoScrollPane2

Content chooser

Big greeting

Scroll pane

Hello

Scrollbar policy

Horizontal

● As Needed
○ Always
○ Never

Vertical

● As Needed
○ Always
○ Never

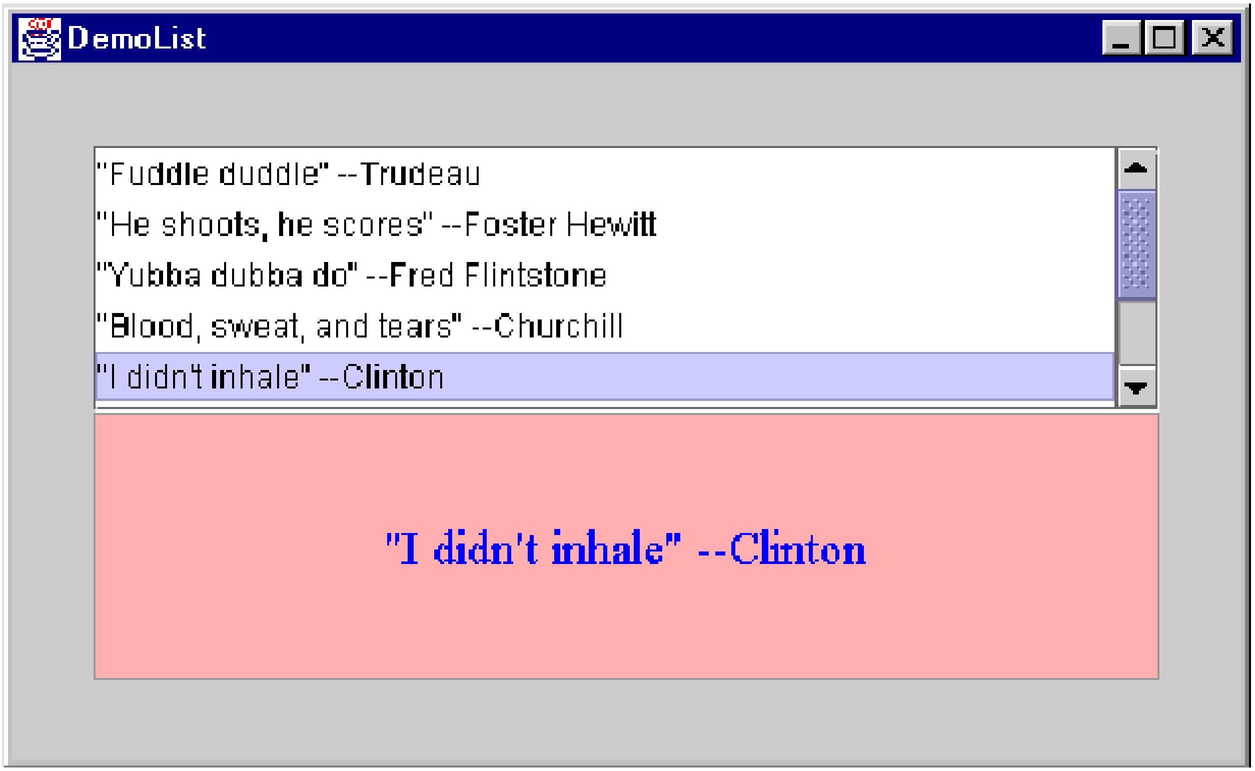
Note: Press TAB to change focus

More Widgets

- JList
- JTable
- JTabbedPane

Example Program

DemoList.java

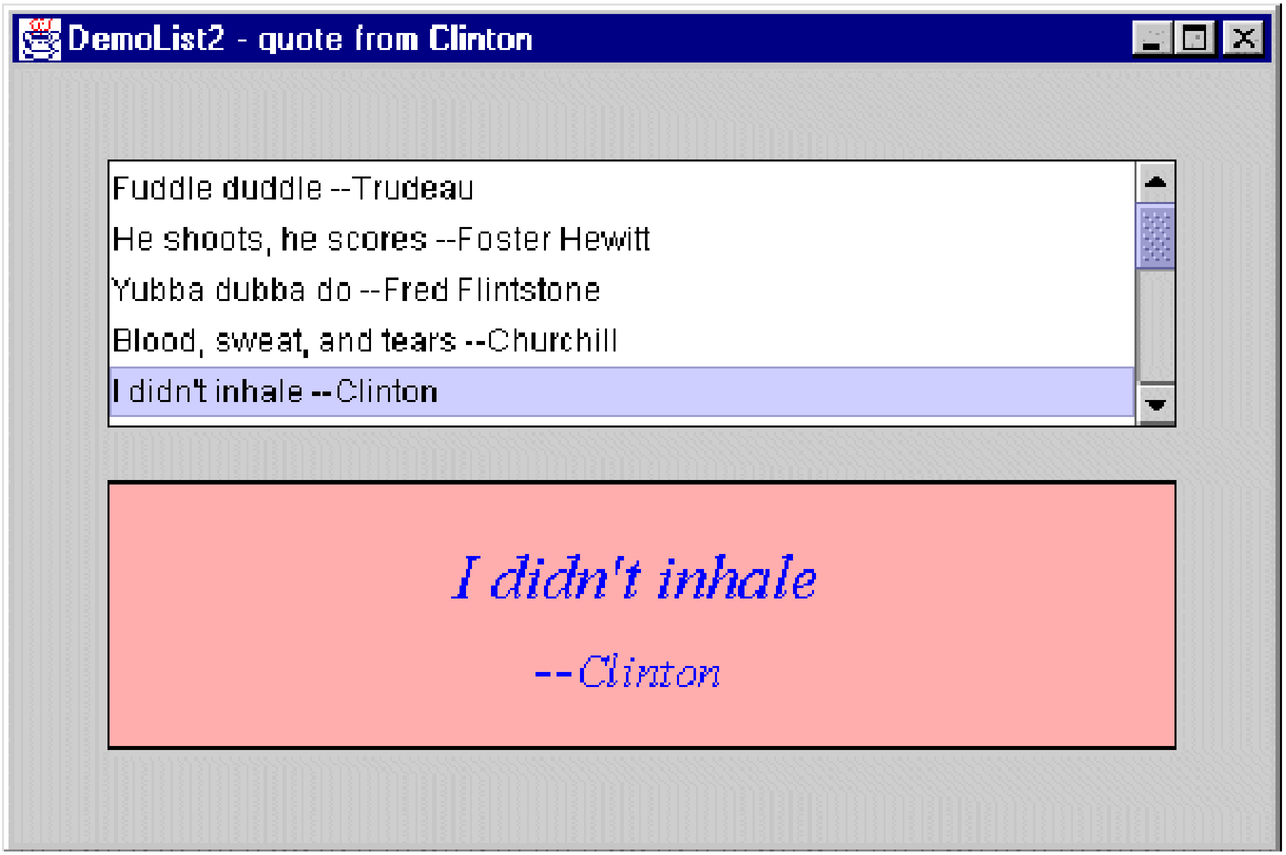


"Fuddle duddle" --Trudeau
"He shoots, he scores" --Foster Hewitt
"Yubba dubba do" --Fred Flintstone
"Blood, sweat, and tears" --Churchill
"I didn't inhale" --Clinton

"I didn't inhale" --Clinton

Example Program

DemoList2.java



Fuddle duddle --Trudeau

He shoots, he scores --Foster Hewitt

Yubba dubba do --Fred Flintstone

Blood, sweat, and tears --Churchill

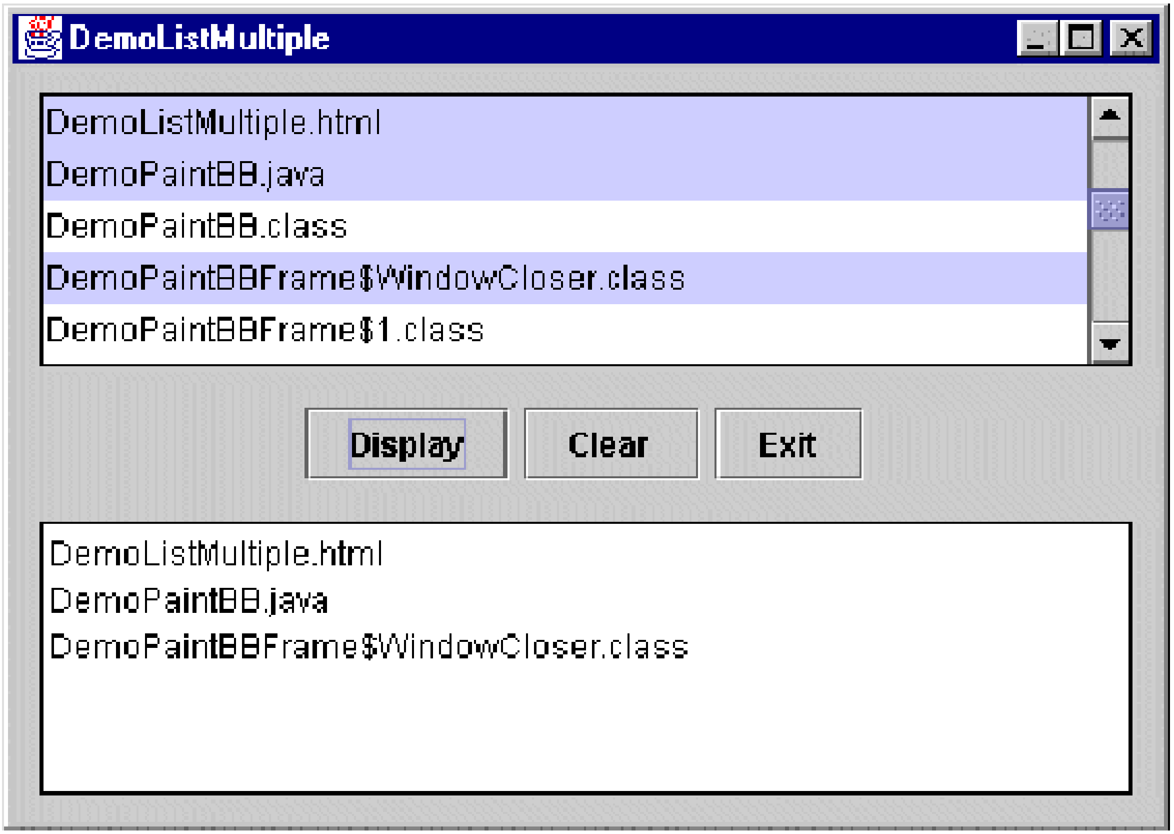
I didn't inhale --Clinton

I didn't inhale

--Clinton

Example Program

DemoListMultiple.java

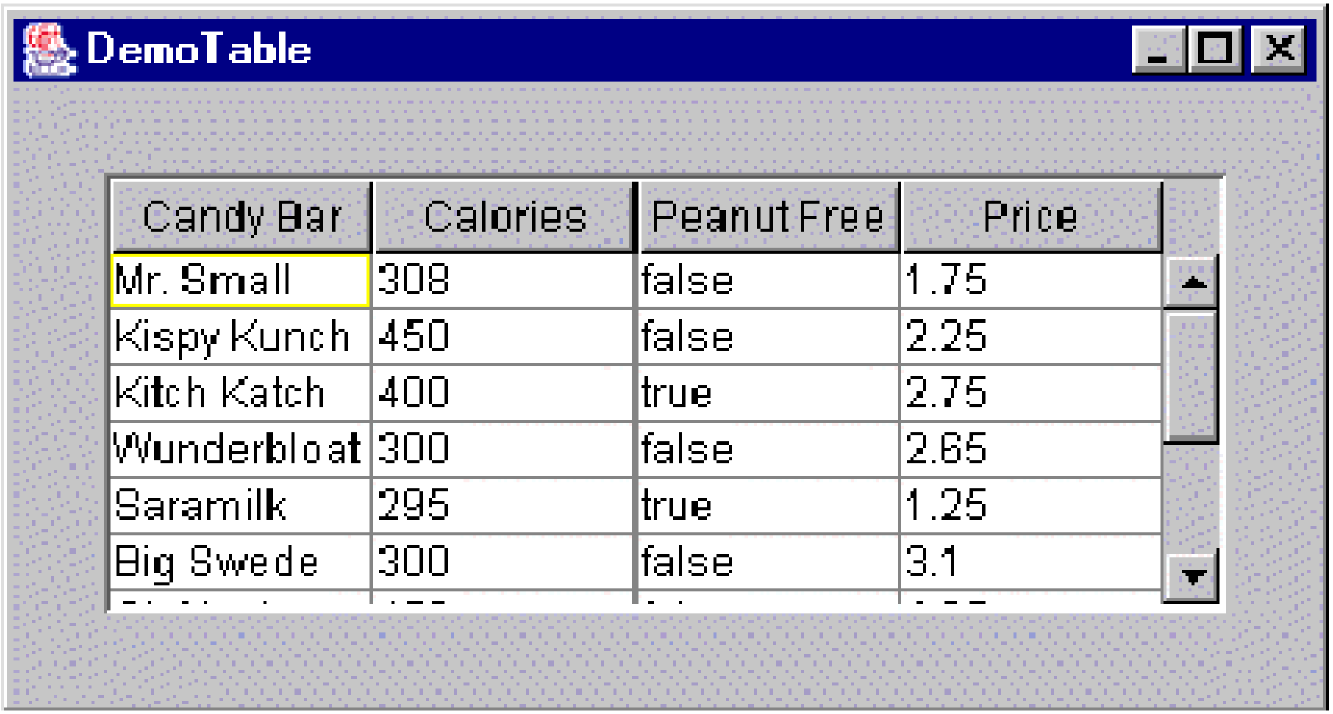


```
DemoListMultiple.html
DemoPaintBB.java
DemoPaintBB.class
DemoPaintBBFrame$WindowCloser.class
DemoPaintBBFrame$1.class
```

```
DemoListMultiple.html
DemoPaintBB.java
DemoPaintBBFrame$WindowCloser.class
```

Example Program

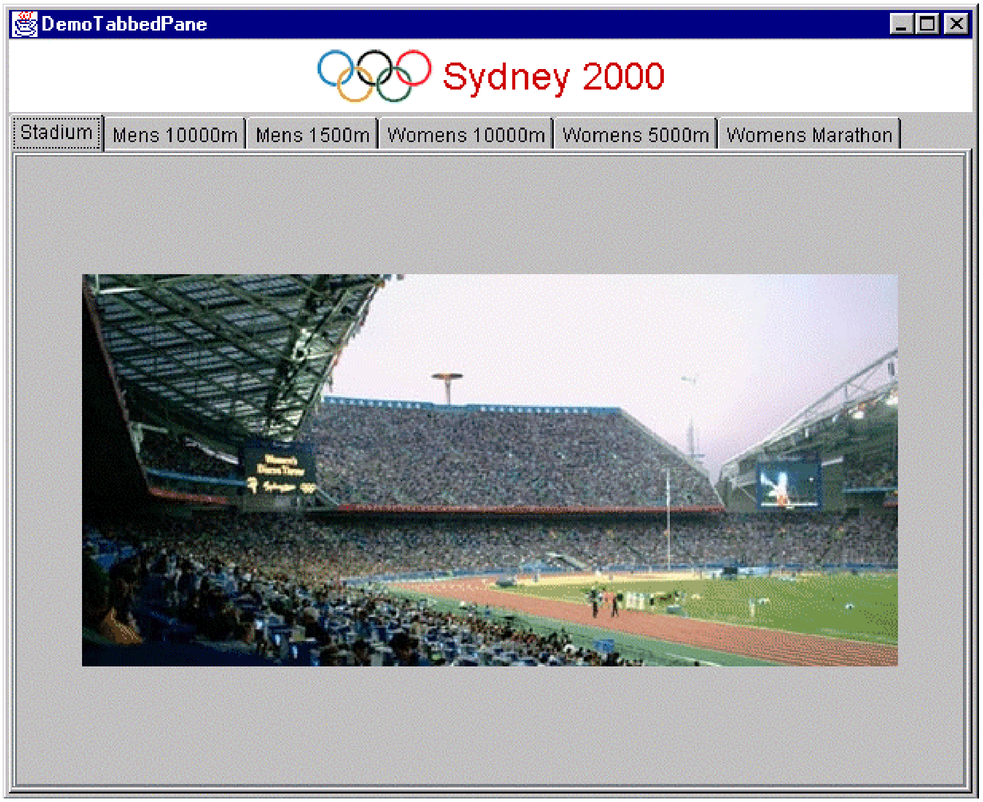
DemoTable.java



Candy Bar	Calories	Peanut Free	Price
Mr. Small	308	false	1.75
Kispy Kunch	450	false	2.25
Kitch Katch	400	true	2.75
Wunderbloat	300	false	2.65
Saramilk	295	true	1.25
Big Swede	300	false	3.1

Example Program

DemoTabbedPane.java


DemoTabbedPane
Sydney 2000
Stadium
Mens 10000m
Mens 1500m
Womens 10000m
Womens 5000m
Womens Marathon