Figure 1.1	The layers of NeXTSTEP 1
Figure 2.1	In procedural programming, the functions are kept separate from the data they operate on 8
Figure 2.2	An object is a collection of data (instance variables) along with the functions (methods) that can access the data $9$
Figure 2.3	Accessing an instance variable through one of the methods 9
Figure 2.4	Once a class is defined, it can be used to create instances 11
Figure 2.5	A subclass inherits the methods and instance variables defined in the superclass 14
Figure 2.6	A message expression has two parts 18
Figure 2.7	Polymorphism allows identically named methods in more than one class 19
Figure 2.8	The higher classes are more generalized than the lower classes 21
Figure 2.9	The interface file declares the instance variables and methods which the class contains 31
Figure 2.10	The implementation file contains the code for the methods defined in the class' interface file 34
Figure 2.11	The class object has two message dispatch tables that contain the addresses of the instance and class methods 37
Figure 2.12	Objective-C searches for the appropriate method in the dispatch table 39
Figure 2.13	Dynamic binding defers associating the receiver to the method until runtime 40
Figure 2.14	self is the current object and super is the superclass 43
Figure 2.15	Objective-C starts at the <b>Object</b> class to allocate the memory for a newly created instance 45
Figure 2.16	The contents of <b>theWindow</b> and <b>name</b> are completely external to <b>theDocument</b> 48
Figure 2.17	An object should free the memory block an instance variable is pointing to before freeing the instance variable 50
Figure 3.1	Object-oriented design is composed of activities rather than steps 55
Figure 3.2	AbstractShape has no collaborators 64
Figure 3.3	The <b>Rectangle</b> class has no collaborators 65
Figure 3.4	The <b>Square</b> class has no collaborators 65
Figure 3.5	The <b>List</b> class has no collaborators 66
Figure 3.6	In a message diagram, the classes are depicted as boxes, and the lines and their directions depict the messages 69
Figure 3.7	The <b>Object</b> class is always the root class of an Objective-C application 70
Figure 4.1	The major classes in the Application Kit 100
Figure 4.2	The Common Classes hierarchy 102
Figure 4.3	The CRC card for the <b>Menu</b> class 106
Figure 4.4	The CRC card for the <b>Window</b> class 107
Figure 4.5	The CRC card for the <b>Application</b> class 107

## xvi Figures

- Figure 4.6 The message diagram for **AppKitDemo** 111
- Figure 4.7 AppKitDemo in execution 114
- Figure 4.8 AppKitDemo with a Quit option 119
- Figure 5.1 The NeXTSTEP development cycle 125
- Figure 5.2 Creating a new project with ProjectBuilder 127
- Figure 5.3 The Files accessory view of ProjectBuilder 127
- Figure 5.4 The Attributes accessory view of ProjectBuilder 129
- Figure 5.5 The Build accessory view 129
- Figure 5.6 The initial screen in InterfaceBuilder 130
- Figure 5.7 The File Window contains the resources 131
- Figure 5.8 The Palettes Window contains more than one palette 132
- Figure 5.9 InterfaceBuilder automatically creates menu options for the Main Menu 132
- Figure 5.10 Adding a menu option to the Main Menu 133
- Figure 5.11 Adding a panel to the application 134
- Figure 5.12 Placing a textfield in the Info panel 134
- Figure 5.13 Displaying the Attributes Inspector for the Info panel 135
- Figure 5.14 Editing the title of a panel 136
- Figure 5.15 Editing the text of a textfield 137
- Figure 5.16 Editing the text of a menu option 137
- Figure 5.17 Making a connection to the Main Window 139
- Figure 5.18 Displaying an already existing connection. 140
- Figure 5.19 Switching to **Test Mode** in InterfaceBuilder 141
- Figure 5.20 Building an application in ProjectBuilder 144
- Figure 5.21 The components of an application 147
- Figure 6.1 The framework for a NeXTSTEP application 151
- Figure 6.2 Clicking on the **Hide** menu option sends a **hide:** message to **NXApp** (the target) 153
- Figure 6.3 Some sample buttons 155
- Figure 6.4 **ControlDemo** during execution 158
- Figure 6.5 The components of **ControlDemo** 159
- Figure 6.6 Some sample sliders 161
- Figure 6.7 The granularity of a slider 162
- Figure 6.8 **ControlDemo** with a slider and a button 164
- Figure 6.9 Some sample textfields 165
- Figure 6.10 A converter application with two textfields 166

Figures xvii Figure 6.11 ControlDemo with a button, a slider, and a textfield 167 Figure 6.12 The slider is the textfield's target and the textfield is the slider's target 168 Figure 6.13 A sample form 169 Figure 6.14 ControlDemo with all the controls 171 Figure 6.15 **ControlDemo** with the button as the form's target 172 Figure 6.16 The windowWillClose: method in action 180 Figure 6.17 Money with six textfields and a button 182 The CRC card for the MoneyConverter class 184 Figure 6.18 Figure 6.19 The message diagram for Money 185 Figure 6.20 The hierarchy graph for **Money** 185 Figure 6.21 Adding fields to a form 186 Figure 6.22 Labeling the form with the appropriate fields 187 Figure 6.23 Subclassing Object to create MoneyConverter 188 Figure 6.24 Adding the moneyForm outlet to the Converter class 189 Figure 6.25 Adding the **convert:** method 190 Figure 6.26 Instantiating the MoneyConverter class 191 Figure 6.27 Connecting the objects in **Money.nib** 191 Figure 6.28 Connecting to the form instead of to the formcell 192 Figure 6.29 Adding an arrow icon to the button 194 Figure 6.30 Generating the template files with the Unparse command 194 Figure 6.31 Setting the moneyconverter as the delegate of the Main Window 198 Figure 6.32 Determining the size of a window with the Size Inspector 199 Figure 6.33 Parsing in a class updates the outlets and actions for the class in InterfaceBuilder 200 Figure 6.34 Setting the moneyconverter as the delegate of the application object 201 Figure 6.35 Using the autosizing features in the Size Inspector 204 Figure 6.36 Setting the autosizing characteristics of the button and the form 205 Figure 7.1. Coordinates in the base system and screen system 210 Figure 7.2. A view's location inside its window 213 Figure 7.3. Drawing order of views in a window 215 Figure 7.4. A view's frame rectangle can be outside of its superview's 216 Figure 7.5. Drawing a shape with PostScript 224 Figure 7.6. Execution of a typical PostScript command 225 Figure 7.7. Execution of square outline.ps 226

Figure 7.8. Execution of **black\_square.ps** 227

## xviii Figures

Execution of circle.ps 228

A sample wraps function 236

An example of instance drawing 238

Producing a shadow effect in PostScript 231

How **pswraps** fits in the program structure 235

Correct and incorrect use of instance drawing 241

Rotating the axes 230

Figure 7.9.

Figure 7.10.

Figure 7.11.

Figure 7.12.

Figure 7.13.

Figure 7.14.

Figure 7.15.

Figure 7.16.	Updating a view in response to the user's actions 244
Figure 7.17.	A preliminary interface for <b>Shapes</b> 245
Figure 7.18.	A more refined interface for <b>Shapes</b> 246
Figure 7.19.	The CRC card for the <b>ShapeView</b> class 247
Figure 7.20.	The CRC card for the <b>SquareView</b> class 247
Figure 7.21.	The CRC card for the <b>CircleView</b> class 248
Figure 7.22.	The message diagram for <b>Shapes</b> 251
Figure 7.23.	The hierarchy graph for <b>Shapes</b> 252
Figure 7.24.	Instantiating the <b>SquareView</b> class 254
Figure 7.25.	Creating a matrix of two sliders 255
Figure 7.26.	The user interface with the sliders labeled 256
Figure 7.27.	Grouping objects with a box 257
Figure 7.28.	The user interface with the controls defined 259
Figure 7.29.	Making the connections in <b>Shapes.nib</b> 260
Figure 8.1	The precedence order for building the registration table 285
Figure 8.2	Using <b>NXUpdateDefault</b> () to update a default's value in the registration table 288
Figure 8.3	The views in a Preferences panel is controlled by a popuplist 289
Figure 8.4	InterfaceBuilder doesn't allow connections between <b>.nib</b> files since this would violate encapsulation 291
Figure 8.5	An object can appear as an instance in one <b>.nib</b> file and as the <b>File's Owner</b> in another <b>.nib</b> file 291
Figure 8.6	A switchbutton is more appropriate than a textfield for options that only have two possible values 298
Figure 8.7	The CRC card for the <b>PrefsController</b> class 304
Figure 8.8	The CRC card for the <b>SwitchView</b> class 304
Figure 8.9	The updated CRC card for the MoneyConverter class 305
Figure 8.10	The message diagram for Money 308
Figure 8.11	The updated class hierarchy graph for Money 309

Figure 8.12	Adding header files to a project by dragging them from the Workspace 311
Figure 8.13	Setting the class of the File's Owner 311
Figure 8.14	Editing the entries in a popuplist 312
Figure 8.15	The Preferences panel with the switchview 313
Figure 8.16	Connecting all the objects in <b>Prefs.nib</b> 313
Figure 8.17	Enabling the <b>Preferences</b> menu option 315
Figure 8.18	Connecting the objects in <b>Money.nib</b> 316
Figure 8.19	Centering a view in its superview's coordinate system 329
Figure 8.20	Drawing a bezeled line 330
Figure 9.1	A regular coordinate system vs. a flipped coordinate system 338
Figure 9.2	The key window and the main window may or may not be the same window 343
Figure 9.3	The search order when a target is not explicitly set 345
Figure 9.4	A text object can grow beyond the boundaries of its superview 346
Figure 9.5	The components of a scrollview 347
Figure 9.6	A typical savepanel 351
Figure 9.7	A typical openpanel 357
Figure 9.8	Retrieving the selected filename(s) 360
Figure 9.9	A preliminary interface for <b>Words</b> 368
Figure 9.10	The CRC card for the <b>Document</b> class 369
Figure 9.11	The CRC card for the <b>TextController</b> class 370
Figure 9.12	The CRC card for the <b>SavePanel</b> class 370
Figure 9.13	The CRC card for the <b>OpenPanel</b> class 371
Figure 9.14	The CRC card for the <b>Window</b> class 371
Figure 9.15	The message diagram for Words 374
Figure 9.16	The hierarchy graph for the custom classes in <b>Words</b> 374
Figure 9.17	Adding a <b>Command-w</b> keyboard alternative to the <b>Close</b> menu option 375
Figure 9.18	Making the connections in Words.nib 379
Figure 9.19	Adding a scrollview to <b>Document.nib</b> 381
Figure 9.20	Connecting the objects in <b>Document.nib</b> 382
Figure 9.21	Double-clicking on a file from the Workspace sets off a complex series of events 403
Figure 9.22	Adding an icon and changing the extension for an application's documents 405
Figure 9.23	Changing the application's icon 406
Figure 9.24	Setting <b>Words</b> as the default application for <b>.word</b> documents 407
Figure 10.1	The on-line help for the keyboard in the Preferences application 412

## xx Figures

- Figure 10.2 Enabling **Developer Mode** in Edit 413
- Figure 10.3 Inserting a link in a document 414
- Figure 10.4 Displaying and editing a link 415
- Figure 10.5 Inserting a marker in a file 416
- Figure 10.6 The **New.rtf** file after it has been modified 420
- Figure 10.7 The **New.rtf** file with the links and marker 421
- Figure 10.8 The **Open.rtf** file with the links and marker 422
- Figure 10.9 The **Save.rtf** file with the links and marker 423
- Figure 10.10 Attaching help to the **New** menu option 424
- Figure A.1 The NeXTSTEP login window 431
- Figure A.2 The initial screen after logging in 432
- Figure A.3 NeXTSTEP windows and icons 433
- Figure A.4 Displaying a submenu 434
- Figure A.5 Miniaturizing a window 435
- Figure A.6 Display the contents of a folder and selecting a file 436
- Figure A.7 Scrolling through the **README.rtf** file 437
- Figure A.8 The title bar contains the filename and the path 438
- Figure A.9 To close a window, click on the close button, located in the upper right hand of the title bar 439
- Figure A.10 Double-click a word to select it 440
- Figure A.11 Copying and pasting the text 440
- Figure A.12 To get our attention, NeXTSTEP places the alert panel above the other windows 441
- Figure A.13 Edit displays a savepanel to ask us where to save the file 442
- Figure A.14 To recycle a folder, drag the folder to the Recycler icon 443
- Figure A.15 Displaying the contents of the Recycler 443
- Figure A.16 Renaming the folder from NewFolder to JunkContainer 444
- Figure A.17 Recovering the **junk** folder from the Recycler 445
- Figure B.1 Using the implicit Expansion Dictionary 448
- Figure B.2 Adding an entry to the Expansion Dictionary 450
- Figure B.3 Using an entry from the Expansion Dictionary 450
- Figure B.4 Edit displays only the name of the method when the method is contracted 453
- Figure B.5 Indexing an unindexed target in Librarian 455
- Figure B.6 The initial screen of HeaderViewer (the Browser view) 458
- Figure B.7 The Find Control Options panel of HeaderViewer 461

Figure B.8	The List view of HeaderViewer 462
Figure B.9	Appending the current directory in Terminal by dragging from the Workspace 469
Figure D.1	Searching an entire folder for a given string 503
Figure D.2	Including debugging information in ProjectBuilder 505
Figure D.3	Clicking on the <b>Debug</b> button in ProjectBuilder produces a gdb shell window 506
Figure D.4	The Gdb panel in Edit 507
Figure D.5	Click on <b>self</b> to display its contents 515
Figure D.6	The value of <b>popUpButton</b> 's and <b>switchView</b> 's <b>window</b> outlets should be identical since they refer to the same window 516
Figure D.7	Comparing the value of <b>switchView</b> 's <b>accessoryView</b> outlet against <b>truncateSwitch</b> 517
Figure D.8	Checking the values of the <b>rate</b> array in the moneyconverter 520

xxii Figures