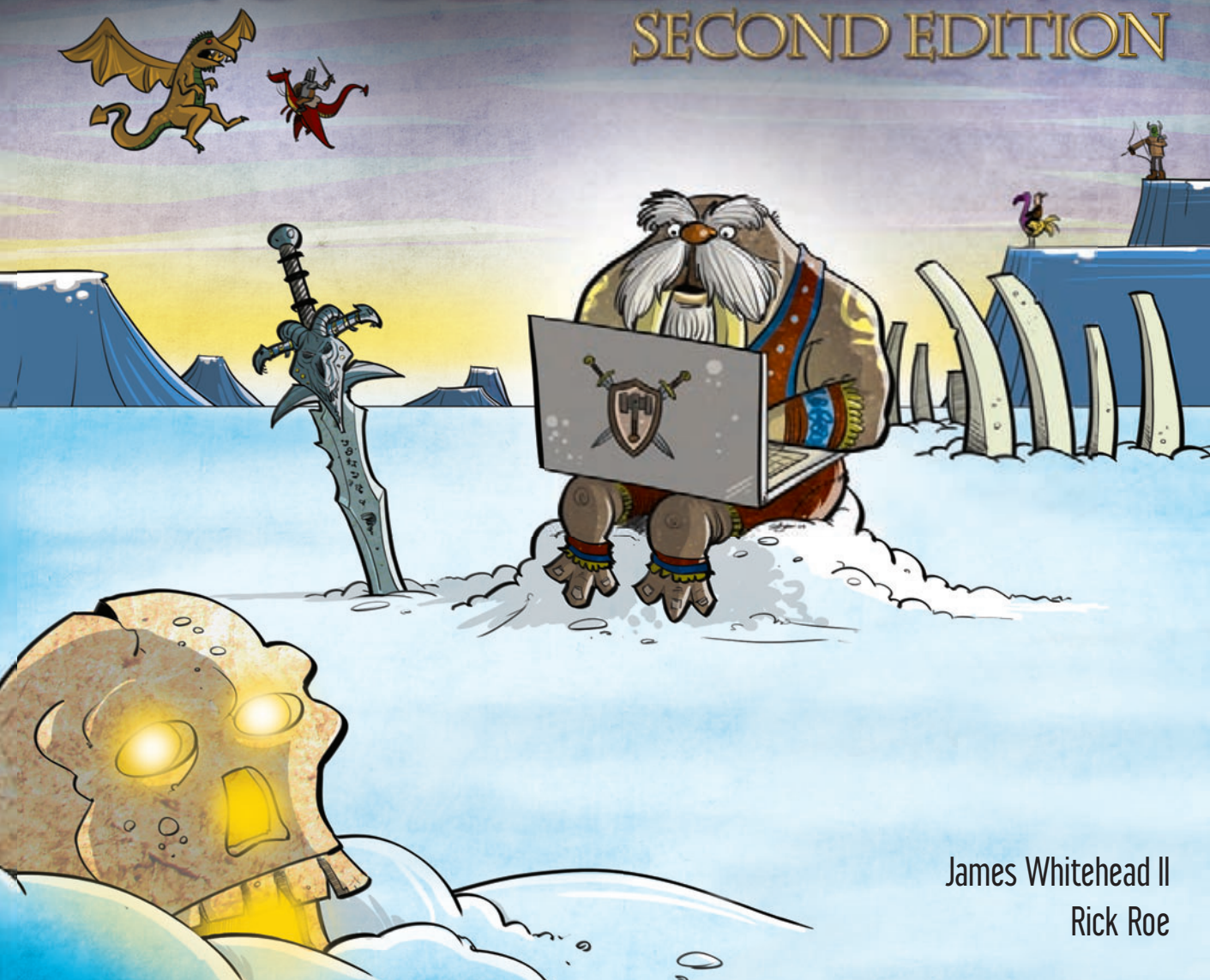


A Guide and Reference for Creating WoW Addons

# WORLD WARCRAFT<sup>®</sup> PROGRAMMING

SECOND EDITION



James Whitehead II  
Rick Roe



# **World of Warcraft® Programming**





# **World of Warcraft® Programming**

---

**A Guide and Reference for Creating  
WoW Addons**

**Second Edition**

James Whitehead II  
Rick Roe



**WILEY**

Wiley Publishing, Inc.

**World of Warcraft® Programming: A Guide and Reference for Creating WoW Addons, Second Edition**

Published by  
Wiley Publishing, Inc.  
10475 Crosspoint Boulevard  
Indianapolis, IN 46256  
[www.wiley.com](http://www.wiley.com)

Copyright © 2010 by Wiley Publishing, Inc., Indianapolis, Indiana

Published simultaneously in Canada

ISBN: 978-0-470-48128-8

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, (978) 750-8400, fax (978) 646-8600. Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, (201) 748-6011, fax (201) 748-6008, or online at <http://www.wiley.com/go/permissions>.

**Limit of Liability/Disclaimer of Warranty:** The publisher and the author make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation warranties of fitness for a particular purpose. No warranty may be created or extended by sales or promotional materials. The advice and strategies contained herein may not be suitable for every situation. This work is sold with the understanding that the publisher is not engaged in rendering legal, accounting, or other professional services. If professional assistance is required, the services of a competent professional person should be sought. Neither the publisher nor the author shall be liable for damages arising herefrom. The fact that an organization or Web site is referred to in this work as a citation and/or a potential source of further information does not mean that the author or the publisher endorses the information the organization or Web site may provide or recommendations it may make. Further, readers should be aware that Internet Web sites listed in this work may have changed or disappeared between when this work was written and when it is read.

For general information on our other products and services please contact our Customer Care Department within the United States at (877) 762-2974, outside the United States at (317) 572-3993 or fax (317) 572-4002.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

**Library of Congress Control Number:** 2009933378

**Trademarks:** Wiley and the Wiley logo are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates, in the United States and other countries, and may not be used without written permission. All other trademarks are the property of their respective owners. Wiley Publishing, Inc. is not associated with any product or vendor mentioned in this book.



## About the Authors

**James Whitehead II** is the author of a number of popular addons for World of Warcraft, including LightHeaded, TomTom, Clique, PerfectRaid, and many other small but useful addons. He has been an active member of both the WoW UI and Lua communities since the World of Warcraft Beta began and has been writing addons ever since. When he actually has time to play the game, you can find him playing one of his many characters on the Emerald Dream (EU) server.

Jim currently resides in Oxford, England where he is pursuing his DPhil (PhD) in Computer Science at the Computing Laboratory. In his spare time he enjoys all things rowing, hacking on his Android phone, knitting, crocheting, and spending time with his friends.

**Rick Roe**—known in the WoW UI community as the zany goblin tinker Gazmik Fizzwidget—is the author of several popular addons including Feed-O-Matic and FactionFriend, as well as TrackMenu and a couple of others so useful that Blizzard made them obsolete by rolling their functionality into the default UI. When not slaving away for their goblin master, Rick’s alter egos can often be found adventuring on Cenarius US.

Rick currently resides in Vancouver, Washington, with his wife and cats. His time outside of Azeroth is split between working to finish a computer science degree at Washington State University and building Mac and iPhone applications as an independent software developer.



# About the Technical Editors

**Daniel Stephens**—more widely known in the WoW addon community as Iriel—was the Blizzard WoW UI Forum’s first MVP. He has been helping others develop addons for several years, creating a few of his own along the way. His addons include DevTools (recently rolled into the base WoW UI) and he has made significant contributions to secure handlers and a number of other utilities. As somewhat of an altaholic, he has characters spread all over the realms, but considers Silver Hand (US) his original WoW home.

Daniel lives in the San Francisco bay area with his wife, cats, and camera. He spends his “not free” time doing systems design, architecture, and occasionally development work.

**Esteban Santana Santana**, known online as MentalPower, is both Lead Developer for the Auctioneer AddOns Package and one of the Administrators of Norganna’s AddOns. He’s been part of the WoW UI community since mid-2005 and has helped many people via the IRC channels and the various game and UI-related forums. When he logs into World of Warcraft, you can find him on the US-Alleria realm trying to level his various characters on the Emerald Dream guild.

Esteban currently resides in Carolina, Puerto Rico, and is a jack-of-all-trades IT person for Liberty Cablevision. In his spare time, he enjoys thrashing his buddies in a good game of Rock Band on the Xbox 360.





**Acquisitions Editor**

Scott Meyers

**Contributing Author**

Nevin Flanagan

**Project Editor**

Maryann Steinhart

**Technical Editors**

Daniel Stephens

Rick Roe

Esteban Santana Santana

**Production Editor**

Rebecca Anderson

**Copy Editor**

Kim Cofer

**Editorial Director**

Robyn B. Siesky

**Editorial Manager**

Mary Beth Wakefield

**Associate Director of Marketing**

David Mayhew

**Production Manager**

Tim Tate

**Vice President and Executive  
Group Publisher**

Richard Swadley

**Vice President and Executive  
Publisher**

Barry Pruett

**Associate Publisher**

Jim Minatel

**Project Coordinator, Cover**

Lynsey Stanford

**Proofreaders**

Josh Chase and Nelson Kim, Word  
One

**Indexer**

J & J Indexing

**Cover Image**

Scott Johnson, FrogPants Studios  
LLC

**Cover Designer**

Michael E. Trent





# Acknowledgments

James and Lee Whitehead, thank you for walking alongside your children as we journey down the winding road of life; we're blessed to have the two of you in our lives. Michelle Hastings, thank you for being such a role model of strength and determination for your little brother.

Robert Whitehead, thank you for always being yourself and making sure I don't stray far from who I am. Gregory Whitehead, thank you for being there for me whenever I need to "geek" out, I don't know many people that can get as excited as I do about silly things. Tom Harper, thank you for what you give me every single day. Everything about you makes me feel like the luckiest person alive.

Jamie Anderson, Edward Wilman, Amelia Earl, Rhianedd Jewell, Erika Nitsch, Daniel Jordan, and all my other friends at Oxford, thank you for keeping me busy, for helping me make excuses, and for being such a bad influence.

To Karen Hobson and everyone at WowInterface who have put up with me for five years now, thank you for all of your efforts in organizing all three books. To Mike, Kevin, Tom, Jacob, Sam, and everyone at Blizzard, thank you for creating such an amazing game and supporting us in our documentation efforts. To everyone at Wiley who helped bring these books into existence, thank you for your efforts to provide resources for the WoW user interface community. To Rick, thank you for stepping in when we needed you the most; your work has been instrumental in making this book what it is today. To Daniel, Nevin, and Esteban, thank you for all of your help in shaping the edges of this edition.

Finally, thank you to the World of Warcraft user interface community for everything you do.

— Jim

I'd first like to thank my coauthor, Jim, for offering me the opportunity to "graduate" from tech editing on the first edition to authoring on this second version. Crazy as the schedules and deadlines may have been, I'm still happier having been able to write my part instead of worrying about mucking with someone else's work in order to satisfy my nitpicky tendencies. Thanks also for all your infrastructure work—without your website and database I'd have been a scribe without paper.

To Daniel and Esteban fell the unenviable task of performing the role I did on the first edition—catching all the silly code errors and obtuse explanations we dumb authors make—and with it my sympathy and gratitude. I can but hope I haven't made your work too hard.

Thanks to Karen for playing den mother to the rowdy WoW UI community and giving us all a place to hook up; if it weren't for your efforts I'd never have found my way into this project. Thanks as well to Scott, Maryann, and everyone at Wiley for making the project happen!

Thanks (again) to Daniel and Jim not just for your work on the book but for providing development tools without which my tasks would've been a whole lot harder. And of course, thanks to my family, Karen, Doug, and Brad, for putting up with me for a couple decades and making me the person I am, and to my wonderful wife Anne: I can't imagine life without you, much less without the loving support you give for whatever crazy ideas I set myself to.

Finally, a very special thank you to Mike, Jacob, Sam, and Tom at Blizzard, without whose patience and willingness to answer oblique questions outside a normal work schedule we wouldn't have been able to figure out several important chunks of the API we're documenting. Next time I'm in SoCal, your drinks are on my tab.

— Rick



# Contents at a Glance

<b>Introduction</b>	<b>xxxvii</b>
<b>Part I Learning to Program</b>	<b>1</b>
<b>Chapter 1 Programming for World of Warcraft</b>	<b>3</b>
<b>Chapter 2 Exploring Lua Basics</b>	<b>13</b>
<b>Chapter 3 Basic Functions and Control Structures</b>	<b>39</b>
<b>Chapter 4 Working with Tables</b>	<b>53</b>
<b>Chapter 5 Advanced Functions and Control Structures</b>	<b>77</b>
<b>Chapter 6 Lua Standard Libraries</b>	<b>91</b>
<b>Chapter 7 Learning XML</b>	<b>111</b>
<b>Part II Programming in World of Warcraft</b>	<b>123</b>
<b>Chapter 8 Anatomy of an Addon</b>	<b>125</b>
<b>Chapter 9 Working with Frames, Widgets, and Other Graphical Elements</b>	<b>143</b>
<b>Chapter 10 Saving Time with Frame Templates</b>	<b>171</b>
<b>Chapter 11 Exploring the World of Warcraft API</b>	<b>187</b>
<b>Chapter 12 Interacting with Widgets</b>	<b>207</b>

<b>Chapter 13</b>	<b>Responding to Game Events</b>	<b>243</b>
<b>Chapter 14</b>	<b>Tracking Damage with CombatTracker</b>	<b>267</b>
<b>Part III</b>	<b>Advanced Addon Techniques</b>	<b>283</b>
<b>Chapter 15</b>	<b>Taking Action with Secure Templates</b>	<b>285</b>
<b>Chapter 16</b>	<b>Binding Keys and Clicks to Addon Code</b>	<b>309</b>
<b>Chapter 17</b>	<b>Creating Slash Commands</b>	<b>337</b>
<b>Chapter 18</b>	<b>Responding to Graphic Updates with OnUpdate</b>	<b>351</b>
<b>Chapter 19</b>	<b>Altering Existing Behavior with Function Hooking</b>	<b>359</b>
<b>Chapter 20</b>	<b>Creating Custom Graphics</b>	<b>373</b>
<b>Chapter 21</b>	<b>Responding to the Combat Log and Threat Information</b>	<b>387</b>
<b>Chapter 22</b>	<b>Creating Scroll Frames</b>	<b>413</b>
<b>Chapter 23</b>	<b>Creating Dropdown Menus</b>	<b>431</b>
<b>Chapter 24</b>	<b>Scanning and Constructing Tooltips</b>	<b>451</b>
<b>Chapter 25</b>	<b>Taking Protected Action in Combat</b>	<b>463</b>
<b>Chapter 26</b>	<b>Creating Unit Frames with Group Templates</b>	<b>501</b>
<b>Part IV</b>	<b>Reference</b>	<b>537</b>
<b>Chapter 27</b>	<b>API Reference</b>	<b>539</b>
<b>Chapter 28</b>	<b>API Categories</b>	<b>1025</b>
<b>Chapter 29</b>	<b>Widget Reference</b>	<b>1121</b>
<b>Chapter 30</b>	<b>Events Reference</b>	<b>1277</b>
<b>Part V</b>	<b>Appendixes</b>	<b>1303</b>
<b>Appendix A</b>	<b>Best Practices</b>	<b>1305</b>
<b>Appendix B</b>	<b>Utilizing Addon Libraries</b>	<b>1329</b>
<b>Appendix C</b>	<b>Tracking History Using Version Control Systems</b>	<b>1339</b>
<b>Appendix D</b>	<b>Addon Author Resources</b>	<b>1349</b>
<b>Index</b>		<b>1357</b>



# Contents

<b>Introduction</b>	<b>xxxvii</b>
<b>Part I      Learning to Program</b>	<b>1</b>
<b>Chapter 1   Programming for World of Warcraft</b>	<b>3</b>
Customizing the User Interface	3
What Is an Addon?	4
What Can Addons Do?	4
Exploring Your AddOns Directory	7
Blizzard Addons	8
Custom Addons	10
Creating Your First Addon: HeyThere	10
Creating Files and Directories	10
Loading and Testing the Addon	11
Summary	12
<b>Chapter 2   Exploring Lua Basics</b>	<b>13</b>
Downloading and Installing Lua	14
Downloading and Installing WowLua	14
Using Lua on the Web	15
Downloading and Installing a Lua Interpreter	16
Microsoft Windows	16
Mac OS X	16
Using the Lua Interpreter	17
Running Commands	18
Understanding Error Messages	18

Using History to Make Changes	19
Quitting the Interpreter	19
Microsoft Windows	19
Mac OS X	19
Working with Numbers	20
Basic Arithmetic Operations	20
Scientific Notation	21
Hexadecimal Notation	21
Understanding Floating Point	22
Understanding Values and Variables	23
Exploring Values and Their Types	23
Primitive Types	23
Using the type() Function	23
Using Variables	24
Valid Variable Names	25
Assigning Variables	25
Assigning Multiple Variables	26
Comparing Values	26
Working with Strings	27
Comparing Strings	27
Concatenating Multiple Strings	28
Converting Numbers to Strings	28
Converting Strings to Numbers	29
Quoting Strings	29
Single Quote (')	29
Double Quote (")	30
Bracket Quote ([ ])	30
Escaping Special Characters	31
Getting a String's Length	32
Boolean Values and Operators	33
Using the and Operator	33
Using the or Operator	34
Negation Using the not Operator	34
Understanding the nil Value	35
Exploring Scope	35
Blocks	36
Chunks	37
Summary	37
<b>Chapter 3 Basic Functions and Control Structures</b>	<b>39</b>
Using Functions	39
Creating a Function	39
Local Functions	40



Function Arguments and Returns	41
Converting Celsius to Fahrenheit	41
Empty Arguments	42
No Return Values	42
Functions as Lua Values	42
Making Decisions with the if Statement	43
Simple Conditionals	43
Complex Expressions	44
Extended Conditionals	44
Displaying a Personalized Greeting	45
Repeating Actions with the while Statement	46
Computing Factorials	46
Differences Between while and repeat	47
Looping with the Numeric for Statement	48
Computing Factorials	50
Evaluation of Loop Conditions	50
Variable Scope in for Loops	50
Summary	51
<b>Chapter 4    Working with Tables</b>	<b>53</b>
Storing Data Using Tables	53
Creating and Indexing Tables	54
Clearing an Element from a Table	54
Shortcuts for String Keys	55
Creating Populated Tables	55
Using Tables as Arrays	56
Creating an Array	57
Getting the Length of an Array	57
Adding Elements to an Array	58
Removing Elements from an Array	60
Sorting the Elements of an Array	61
Using Tables as Namespaces	61
Creating a Namespace of Utility Functions	62
Adding Functions to a Namespace	62
Storing an Existing Function	62
Defining a New Function	63
Object-Oriented Programming with Tables	63
Creating a Non-Object-Oriented Counter	63
Using Tables as Simple Objects	64
Using : to Call Object Methods	65
Defining Functions Using :	66
Making a Better Counter	67

Extending Tables with Metatables	68
Adding a Metatable	68
Defining Metamethods	69
Defining Basic Arithmetic Using <code>__add</code> , <code>__sub</code> , <code>__mul</code> , and <code>__div</code>	70
Defining Negation Using <code>__unm</code>	71
Creating Meaningful Output with <code>__tostring</code>	71
Concatenating Tables Using <code>__concat</code>	72
Exploring Fallback Tables with <code>__index</code>	72
Catching Creation of Keys with <code>__newindex</code>	74
Bypassing Metatables	75
<code>value = rawget(tbl, key)</code>	75
<code>rawset(tbl, key, value)</code>	76
Summary	76
<b>Chapter 5 Advanced Functions and Control Structures</b>	<b>77</b>
Multiple Return Values	77
Converting Hex to RGB	77
Assigning Multiple Values	78
Missing Return Values?	79
Multiple Return Values in World of Warcraft	79
Using a Dummy Variable	80
Using the <code>select()</code> Function	81
Accepting a Variable Number of Arguments	81
Declaring a <code>Vararg</code> Function	82
Using <code>select()</code> with . . .	83
Generic for Loops and Iterators	84
Syntax of Generic for	84
Traversing the Array Part of a Table	85
Traversing an Entire Table	86
Clearing a Table	86
Using Other Iterators	87
Sorting an Array of Table Data	87
Define Example Data	88
Default Sort Order	88
Creating a Comparison Function	88
Creating a More Complex Sort Function	89
Summary	90
<b>Chapter 6 Lua Standard Libraries</b>	<b>91</b>
Table Library	92
<code>str = table.concat (table [, sep [, i [, j]])</code>	92
<code>table.insert (table, [pos,] value)</code>	92
<code>max = table.maxn (table)</code>	93

value = table.remove (table [, pos])	93
table.sort (table [, comp])	93
String Utility Functions	94
Formatting New Strings	95
Pattern Matching	98
Character Classes	98
Pattern Items	100
Pattern Captures	101
Pattern Anchors	102
Pattern Examples	102
Pattern Matching Functions	102
string.gmatch(s, pattern)	103
string.gsub(s, pattern, repl [, n])	103
string.match(s, pattern [, init])	104
string.find(s, pattern [, init [, plain]])	104
Math Library	105
World of Warcraft Additions to Lua	108
Function Aliases	109
Summary	110
<b>Chapter 7 Learning XML</b>	<b>111</b>
XML as a Markup Language	111
XML's Relationship to HTML	112
Components of XML	112
XML Tags	113
XML Elements	113
XML Attributes	113
XML Entities	114
Creating Well-Formed XML	114
Validating an XML Document	115
Example Schema Definition	115
Example XML Document	116
Exploring the Schema	116
XML in World of Warcraft	117
Using a GradientType	118
Exploring Blizzard's XML User Interface Customization Tool	119
Summary	121
<b>Part II Programming in World of Warcraft</b>	<b>123</b>
<b>Chapter 8 Anatomy of an Addon</b>	<b>125</b>
Exploring an Addon's Files and Folders	125
Table of Contents (.toc) File	125
## Interface:	126

## Title:	127
## Notes:	128
## Dependencies; ## RequiredDeps:	128
## OptionalDeps:	129
## LoadOnDemand:	129
## LoadsWith:	129
## DefaultState:	130
## LoadManager:	130
## SavedVariables:	130
## SavedVariablesPerCharacter:	131
X-Label Directives	131
Addon Categories	131
XML Files	132
Lua Script Files	133
Media Files	133
Music	133
Graphics	133
Localizing Your Addons	134
Valid Locales	135
Reasons for Providing Localization	135
Encouraging Users to Contribute	136
Implementing Localization	136
Add a File for Each Locale	136
Create a Global Table Containing the Base Strings	136
Using the Localization Table	137
Adding New Locales	137
Handling Partial Translations	138
Introducing Frames, Widget Scripts, and Events	138
Frames, FontStrings, and Textures	138
Displaying Text with FontStrings	139
Showing Graphics and Colors with Textures	139
Anchoring Objects On-Screen	139
Responding to Interaction with Widget Scripts	139
Responding to Game Events	139
Loading of an Addon	141
Summary	142
<b>Chapter 9 Working with Frames, Widgets, and Other Graphical Elements</b>	<b>143</b>
Introducing BagBuddy	143
Creating an Addon Skeleton	144
Creating a Frame	144
Parenting	145

Giving Objects Sizes	146
Absolute Dimensions	146
Relative Dimensions	146
Anchoring Objects	147
Sticky Anchors	148
SetAllPoints	148
Anchor Examples	148
Using Lua to Create Frames	149
Adding Layers of Textures and Font Strings	150
Layering Frames and Graphics	150
Frame Strata	150
Frame Levels	151
Graphical Layers	152
BagBuddy Frame Design	153
Finding Graphics	155
TexBrowser AddOn	155
ArtBrowser on Wowprogramming.com	155
Adding Textures	155
Defining BagBuddy's Background Textures	157
Coloring Textures	158
Using Solid Colors	158
Creating a Gradient	159
Adding the Portrait Texture	160
Creating Textures in Lua	162
Creating Text using FontStrings	164
Further Customization	165
Using Font Definitions	165
Creating FontStrings in Lua	166
Understanding Object Visibility	166
Finding Existing Frames	167
Summary	167
The Code	168

**Chapter 10 Saving Time with Frame Templates 171**

Understanding Templates	171
Advantages of Using Templates	173
Naming Elements Using \$parent	173
Setting Keys Using the parentKey Attribute	174
Creating a Template for BagBuddy's Item Buttons	174
Setting Button Textures	175
Creating New Frames with Your Template	176
Exploring Font Definitions	177
Altering a Font Definition	178

Investigating UIPanelTemplates	179
UIPanelButtonTemplate	180
UIPanelCloseButton	180
UIPanelScrollBarTemplate	181
InputBoxTemplate	181
UICheckButtonTemplate	182
TabButtonTemplate	183
UIRadioButtonTemplate	183
Summary	183
The Code	184
<b>Chapter 11 Exploring the World of Warcraft API</b>	<b>187</b>
Understanding the WoW API	187
Normal APIs	188
Library-like APIs	188
FrameXML Functions	189
Protected Functions	189
Unit Functions Up Close	190
Querying Item Information for BagBuddy	193
Scanning Bags with the Container API	193
Querying Detailed Item Information	194
Item Identifiers	195
Using the Item API	197
Writing a Bag Scanner	198
Sorting the Player's Inventory	199
Displaying the Inventory	199
Testing the Update Function	200
Finding the Right API Functions	201
Exploring the API Categories	201
Examining the FrameXML Code	202
Looking at Another Addon	203
Asking for Help!	203
Summary	203
The Code	204
<b>Chapter 12 Interacting with Widgets</b>	<b>207</b>
Making BagBuddy's Buttons Interactive	207
Setting Frame Scripts via XML	208
Using the function Attribute	209
Setting Frame Scripts Using Lua	209
Showing Item Tooltips Using OnEnter and OnLeave	210
Adding Clickable Buttons to BagBuddy	212
Introducing the OnClick Handler	212

Creating a Close Button Using Templates	213
Creating Clickable Filter Buttons	214
Creating the Filter Buttons Dynamically	216
Adding Custom Tooltips	217
Making the Filter Buttons Clickable	217
Updating the Results	218
Navigating Multiple Pages	219
Adding XML Definitions for Buttons and Status Text	220
Writing OnClick Handlers for Navigation Buttons	221
Altering the Update Function for Pages	221
Enabling and Disabling Navigation Buttons	222
Creating and Updating Status Text	223
Final Changes to Support Navigation	224
Adding a Name Filter to BagBuddy	224
Creating an EditText	225
Filtering by Name	226
Exploring Widget Types	227
Button	227
CheckButton	228
ColorSelect	228
EditText	229
GameTooltip	229
MessageFrame	229
Minimap	229
Model	230
ScrollingMessageFrame	231
ScrollFrame	231
SimpleHTML	231
Slider	232
StatusBar	232
Summary	233
The Code	233
<b>Chapter 13 Responding to Game Events</b>	<b>243</b>
Understanding Events	243
Registering for Events	244
Responding to Events with OnEvent	244
Query Events	246
Tracking Changes to Inventory for BagBuddy	246
Examining the BAG_UPDATE Event	246
Tracking New Inventory Items	246
Writing a New Sorting Function	248
Altering BagBuddy_Update	248

Adding an OnEvent Handler	249
Cleaning Up	250
Adding a Slash Command	251
Storing Data with SavedVariables	251
Registering a New Saved Variable	252
Saved Variables and ADDON_LOADED	252
Using Items from BagBuddy	253
Finding the Right Event Using /eventtrace	254
Summary	255
The Code	255
<b>Chapter 14 Tracking Damage with CombatTracker</b>	<b>267</b>
Defining Specifications	267
CombatTracker User Experience	267
Finding the Right Game Events	268
PLAYER_REGEN_DISABLED	268
PLAYER_REGEN_ENABLED	268
UNIT_COMBAT	269
Creating the Addon's Skeleton	269
Defining CombatTracker's XML Frame	270
Defining a Backdrop	271
Adding a Font String	272
Testing CombatTrackerFrame	272
Adding Script Handlers to CombatTrackerFrame	273
Adding Functions to CombatTracker.lua	275
CombatTracker_OnLoad(frame)	275
CombatTracker_OnEvent	276
PLAYER_REGEN_ENABLED	276
PLAYER_REGEN_DISABLED	277
UNIT_COMBAT	277
CombatTracker_UpdateText()	277
CombatTracker_ReportDPS()	278
Testing CombatTracker	278
Frame Dragging	279
Right-Click Reporting: Part I	279
Testing Combat Tracking	280
Right-Click Reporting: Part II	280
Summary	281
<b>Part III Advanced Addon Techniques</b>	<b>283</b>
<b>Chapter 15 Taking Action with Secure Templates</b>	<b>285</b>
Why Are Secure Templates Necessary?	285
Protected Frames	286
Controlling Secure Frames Using Attributes	288



Using Secure Templates	288
Defining Behaviors for Action Buttons	289
Casting a Spell	289
Looking Under the Hood	290
Specifying Units to Affect	291
Other Types and Their Uses	291
Making Simple Choices	296
Working with Modified Attributes	296
Delegating Attribute Responsibility	298
Choosing an Action by Hostility	298
Applying Action Buttons in Practice	299
Modifying an Existing Frame	299
A Complex Action Button	300
Understanding Taint and Working Safely Around Secure Code	302
Enabling Taint Logging	303
Execution Taint	304
Variable Taint	305
Creeping Taint	307
Summary	308
<b>Chapter 16 Binding Keys and Clicks to Addon Code</b>	<b>309</b>
Defining Bindings in XML	310
Creating Your Own Binding Actions	312
Binding Keys to Actions	314
Building a Simple Binding UI	315
Defining Basic Behaviors	318
Using SetBinding()	321
Working with Existing Bindings	324
Displaying an Action's Bindings	325
Understanding Binding Storage	326
Binding Keys to Secure Actions	327
Working with Click Bindings	328
Creating Secure Bindings in XML	329
Summary	329
The Code	330
BindingTest	330
ClickBindingTest	334
<b>Chapter 17 Creating Slash Commands</b>	<b>337</b>
Creating Basic Slash Commands	337
Tokenizing Strings	339
Tokenizing with Patterns	341
Setting Up the Patterns	341

Preparing for the Tokenization	342
Parsing the Formula	343
Using a Command Table	345
Summary	347
The Code	347
SlashCalc	347
<b>Chapter 18 Responding to Graphic Updates with OnUpdate</b>	<b>351</b>
Understanding Graphic Updates	351
Delaying Code Using OnUpdate	352
Grouping Events to Avoid Over-Processing	354
Grouping Multiple Events	355
Repeating Code with OnUpdate	356
Considering Performance with OnUpdate Scripts	357
Summary	357
<b>Chapter 19 Altering Existing Behavior with Function Hooking</b>	<b>359</b>
What Is Function Hooking?	359
Modifying Return Values	360
Using a Variable Argument Function	361
Using Utility Functions capture() and release()	361
Hooking Widget Scripts	362
Hooking a Function Securely	364
Hooking Scripts Securely	365
Deciding When to Hook	365
Understanding the Hook Chain	365
You Can't Rely on Order	366
There Is No "Unhook"	366
Hooking Hits Performance	366
Finding Alternatives	367
Designing an Addon: MapZoomOut	367
Creating a Timer Frame	368
Initial Setup	368
Create the Function Hook	369
Writing the Timer Code	369
Final Setup	370
Testing MapZoomOut	370
Summary	370
The Code	371
MapZoomOut	371
<b>Chapter 20 Creating Custom Graphics</b>	<b>373</b>
Common Rules for Creating Graphics	373
The GIMP	374

Create a New Image	374
Adding Graphical Components	375
Saving Textures	376
Adobe Photoshop	376
Create a New Image	376
Adding Graphical Components	377
Creating an Alpha Channel	377
Saving an Image	378
Paint Shop Pro	379
Creating a New Image	380
Adding Graphical Components	380
Creating an Alpha Channel	381
Saving an Image	382
Testing Your Texture	383
No Button Appears	384
A Green Box Appears	384
XML Texture Definition	384
Lua Texture Definition	385
Summary	385
<b>Chapter 21 Responding to the Combat Log and Threat Information</b>	<b>387</b>
Understanding the Combat Log	387
Event Arguments	387
Combat Sub-Events	388
Combat Event Prefix	389
Bit Fields and Spell Schools	389
Combat Event Suffix	390
Spell-Only Suffixes	393
Special Combat Events	395
Unit GUIDs	396
Format of GUIDs	397
Unit Flags	398
COMBATLOG_OBJECT_TYPE_MASK	398
COMBATLOG_OBJECT_CONTROL_MASK	398
COMBATLOG_OBJECT_REACTION_MASK	399
COMBATLOG_OBJECT_AFFILIATION_MASK	399
COMBATLOG_OBJECT_SPECIAL_MASK	399
Using CombatLog_Object_IsA	400
Writing CombatStatus	401
Creating the Basic Addon Structure	401
Initializing CombatStatus	402
Updating Pet Mappings	405
Storing Damage and Healing Information	405
Taking “Snapshots” of Damage and Healing	407

Writing an OnUpdate Function	408
Responding to Events	408
COMBAT_LOG_EVENT_UNFILTERED	409
PARTY_MEMBERS_CHANGED	409
UNIT_PET	409
PLAYER_REGEN_DISABLED	409
PLAYER_REGEN_ENABLED	410
Creating the Frame Display	410
Updating the Frame Display	410
Future Additions	412
Summary	412
<b>Chapter 22 Creating Scroll Frames</b>	<b>413</b>
Using Scroll Frames	414
Adding a Scroll Child	415
Manipulating a ScrollFrame	416
Adding Scroll Bars	417
Creating Faux Scroll Frames	419
Adding Scroll Bars	422
Scrolling with the Mouse Wheel	423
Problems with Slider Precision	423
Summary	424
The Code	424
ScrollFrameTest	424
MacroIconTest	426
<b>Chapter 23 Creating Dropdown Menus</b>	<b>431</b>
Creating a Basic Dropdown	431
Adding a Toggle Button	432
Creating a Dropdown Frame	433
Initializing the Dropdown	433
Adding Buttons to the Dropdown	433
Calling UIDropDownMenu_Initialize()	434
Toggling the Dropdown Menu	434
Testing the Dropdown	435
Creating Multilevel Dropdowns	436
Adding Functionality to Dropdowns	437
Customizing Text Elements	438
Function Menu Items	440
CheckBox Menu Items	440
ColorPicker Menu Items	441
Using Dropdowns for Selection	443
Automating Menu Creation with EasyMenu	445
Creating Dynamic Menus	447
Summary	449

<b>Chapter 24</b>	<b>Scanning and Constructing Tooltips</b>	<b>451</b>
	Understanding the Tooltip System	451
	Different Types of Tooltips	452
	Contextual Tooltips	452
	Static Tooltips	453
	Tooltip Contents	453
	Custom Text in a Tooltip	453
	Game Element Tooltips	455
	Adding Information to the Tooltip	458
	Loading the Tooltip with Item Information	458
	Getting Information from Tooltips	460
	Accessing Individual Tooltip Lines	460
	Checking Soulbound Status	461
	Using Global Strings for Localization	461
	Replacing a Script Instead of Hooking a Script	461
	Summary	462
<b>Chapter 25</b>	<b>Taking Protected Action in Combat</b>	<b>463</b>
	Snippets: The Basis of Secure Action	463
	How Can Addon Code Be Secure?	463
	Writing a Snippet	464
	Secure Handler Frames	464
	Handler Template Reference	466
	Integrating a Click Handler with a Secure Action Button	468
	Preserving State and Controlling Information	473
	Private Global Environments	474
	Secure API Functions	475
	The control Object	476
	Frame Handles	477
	Allowed Actions	479
	Additional or Changed Actions	479
	Wrapping Frame Scripts	482
	A Simple Click Wrapper	483
	Using a Post-Hook	484
	Script Wrapper Reference	485
	Triggered Changes	486
	State Drivers	486
	State Responders	487
	Responding to Show/Hide	487
	Responding to Attribute and State Changes	488
	State Conditionals	490
	Target Specifiers and Unit Conditions	491
	State Variables	492
	Unit Conditions	492
	General Conditions	493

Summary	496
The Code	496
BlessedMenus	496
<b>Chapter 26 Creating Unit Frames with Group Templates</b>	<b>501</b>
Configuring a SecureGroupHeader	501
Configuration Options	502
Initial Configuration Function	505
Creating SquareUnitFrames	506
Constructing the Template	506
Creating a Header Template	508
Setting Name and Status Bars	509
Nudging Frame Levels	511
Responding to Events and Clicks	511
Targeting the Unit on Left-Click	511
Moving the Header	512
Health Update Events	513
Power Update Events	514
Responding to Name Changes	516
Enhancing SquareUnitFrames	516
Highlighting Units on Mouseover	516
Showing the Targeted Unit	517
Displaying Threat Levels	518
Showing Dead Players	519
Displaying Unit Names	521
Adding Pets to SquareUnitFrames	523
Creating a SecureGroupPetHeaderTemplate	526
Summary	526
The Code	526
SquareUnitFrames	526
<b>Part IV Reference</b>	<b>537</b>
<b>Chapter 27 API Reference</b>	<b>539</b>
API Reference Conventions	539
Function Signatures	539
Optional Arguments	540
Argument Choices	540
Argument and Return Listings	540
Common API Flags	541
API Meta-Types	542
1nil	542
actionID	542
ah-list-type	543