Contents

Preface xi What You Will Learn xii The Right Frame of Mind xiv How to Use This Book xv Conventions xvi Before You Begin xvii

Look at Data 1

1

- 1.1 Why Look at Data? 2
- 1.2 What Makes Bad Figures Bad? 5
- 1.3 Perception and Data Visualization 14
- 1.4 Visual Tasks and Decoding Graphs 23
- 1.5 Channels for Representing Data 26
- 1.6 Problems of Honesty and Good Judgment 27
- 1.7 Think Clearly about Graphs 29
- 1.8 Where to Go Next 31

2 Get Started 32

- 2.1 Work in Plain Text, Using RMarkdown 32
- 2.2 Use R with RStudio 35
- 2.3 Things to Know about R 38
- 2.4 Be Patient with R, and with Yourself 48
- 2.5 Get Data into R 49

- 2.6 Make Your First Figure 51
- 2.7 Where to Go Next 52

3 Make a Plot 54

4

5

- 3.1 How Ggplot Works 54
- 3.2 Tidy Data 56
- 3.3 Mappings Link Data to Things You See 56
- 3.4 Build Your Plots Layer by Layer 59
- 3.5 Mapping Aesthetics vs Setting Them 63
- 3.6 Aesthetics Can Be Mapped per Geom 66
- 3.7 Save Your Work 68
- 3.8 Where to Go Next 71

Show the Right Numbers 73

- 4.1 Colorless Green Data Sleeps Furiously 74
- 4.2 Grouped Data and the "Group" Aesthetic 74
- 4.3 Facet to Make Small Multiples 76
- 4.4 Geoms Can Transform Data 80
- 4.5 Frequency Plots the Slightly Awkward Way 82
- 4.6 Histograms and Density Plots 85
- 4.7 Avoid Transformations When Necessary 88
- 4.8 Where to Go Next 91

Graph Tables, Add Labels, Make Notes 93

- 5.1 Use Pipes to Summarize Data 94
- 5.2 Continuous Variables by Group or Category 102
- 5.3 Plot Text Directly 115
- 5.4 Label Outliers 121
- 5.5 Write and Draw in the Plot Area 124

- 5.6 Understanding Scales, Guides, and Themes 125
- 5.7 Where to Go Next 131
- 6

7

Work with Models 134

- 6.1 Show Several Fits at Once, with a Legend 135
- 6.2 Look Inside Model Objects 137
- 6.3 Get Model-Based Graphics Right 141
- 6.4 Generate Predictions to Graph 143
- 6.5 Tidy Model Objects with Broom 146
- 6.6 Grouped Analysis and List Columns 151
- 6.7 Plot Marginal Effects 157
- 6.8 Plots from Complex Surveys 161
- 6.9 Where to Go Next 168

Draw Maps 173

- 7.1 Map U.S. State-Level Data 175
- 7.2 America's Ur-choropleths 182
- 7.3 Statebins 189
- 7.4 Small-Multiple Maps 191
- 7.5 Is Your Data Really Spatial? 194
- 7.6 Where to Go Next 198

8 Refine Your Plots 199

- 8.1 Use Color to Your Advantage 201
- 8.2 Layer Color and Text Together 205
- 8.3 Change the Appearance of Plots with Themes 208
- 8.4 Use Theme Elements in a Substantive Way 211
- 8.5 Case Studies 215
- 8.6 Where to Go Next 230

x . Contents

Acknowledgments 233 Appendix 235 1 A Little More about R 235 2 Common Problems Reading in Data 245 3 Managing Projects and Files 253 4 Some Features of This Book 257 References 261 Index 267