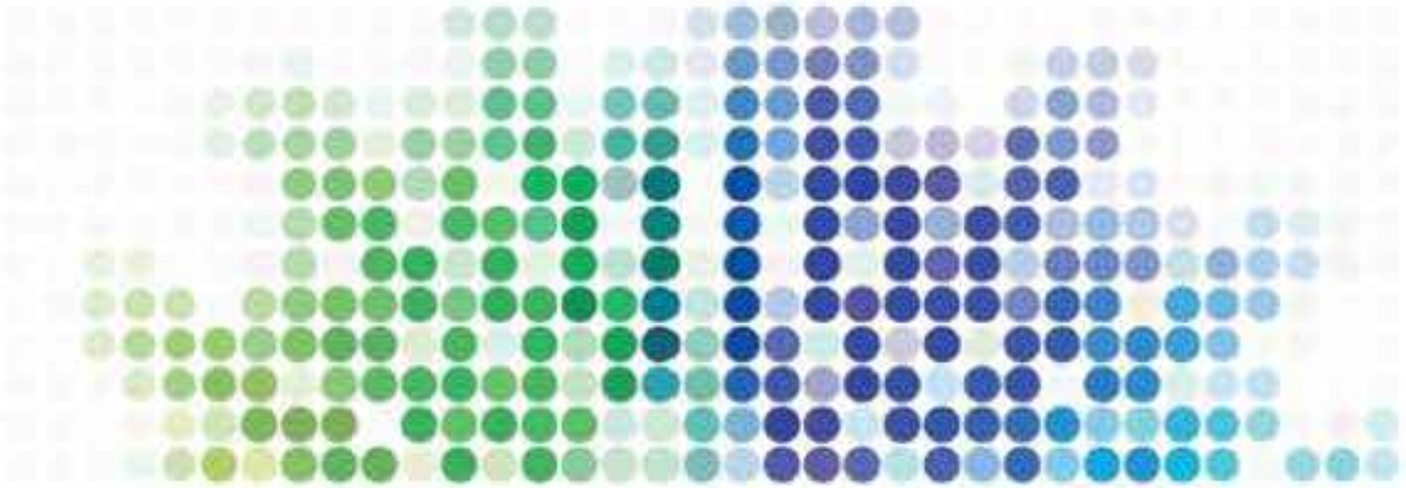

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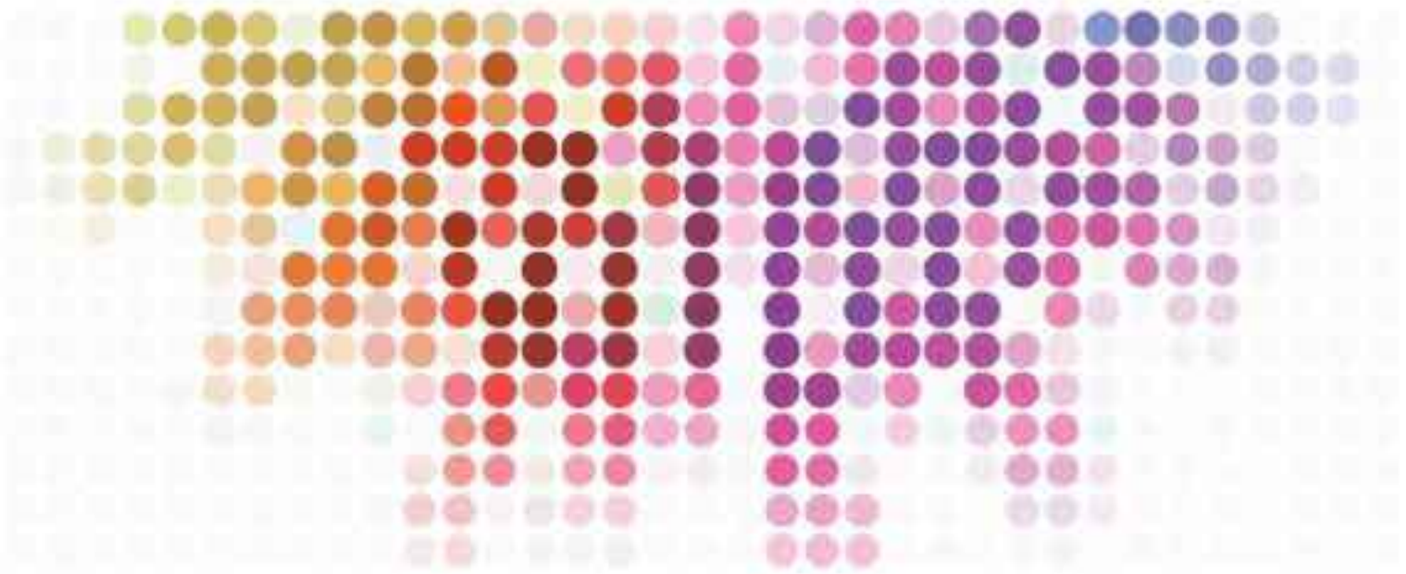

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For Denise
10 in 27. WOW!

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About the Author

George Peck has been involved in various IT pursuits for over 35 years. His consulting and training firm, The Ablaze Group (AblazeGroup.com), recently celebrated 20 years in business. He has trained, consulted, and developed custom software for large and small organizations throughout the United States, Canada, the United Kingdom, and Puerto Rico.

George works with a variety of Business Intelligence (BI) toolsets. In addition to being an accredited trainer for Tableau, he consults on Tableau and Tableau Server, as well as SAP BusinessObjects and Alteryx products. George is the bestselling author of nine other BI books published by McGraw-Hill, including multiple editions of *Crystal Reports: The Complete Reference* and a previous edition of *Tableau: The Official Guide.*

In addition to his software endeavors, George is a broadcaster and voice actor. His voice may be heard on national radio, TV and web commercials, promotions, and documentaries. He programs his own eclectic music radio station and hosts a regular jazz radio program on FM radio and online from Denver, Colorado. He may be reached via e-mail at Author@TableauBook.com.

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Contents at a Glance

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Acknowledgments

One would think that writing a tenth book would be easier than the first. One would think. Still, there's an incredible amount of effort involved, including lots of help from some very generous people.

Once again, Francois Ajenstat at Tableau was always there when I had a nagging question or request. You do set the Tableau Software record for fast e-mail response! Elissa Fink at Tableau provided unparalleled enthusiasm and support. Let's hug again soon! And, of course, thanks to Christian Chabot, Chris Stolte, and Pat Hanrahan for coming up with a great idea and founding a wonderful company.

This is my tenth book with various incarnations of the same publisher, starting with Osborne and progressing through McGraw-Hill Education. I clearly remember that day all those years ago when I interrupted a voiceover session to plan my first book project with Wendy Rinaldi. And, here we still are. Who knew how far we'd go? Thanks again to Lisa McCoy, Paul Tyler, and Janet Walden for turning occasional incoherence into understandable prose. Jean Bodeaux and Patty Mon were great again. And I'm looking forward to more work with James Kussow. It was great to "meet" Howie Severson—great work!

Finally, and most importantly, I give my tenth bit of thanks to Denise. It's got to be special that we've been in business together for 20-plus years and married for more than 27. As I always say, "There are no VISIBLE bruises."

George Peck
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August 2015

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Introduction

Tableau 9 is the latest version of the leading data visualization toolset that lets you visualize virtually any kind of data. By connecting Tableau to a variety of databases and data sources, you can answer questions about trends, exceptions, and hidden insights as quickly as you can frame them. At first glance, Tableau appears simpler and quicker to learn than many legacy Business Intelligence tools. And it is. Yet, there's "a lot under the hood" that may not be apparent at first glance. This book is your complete resource to learn not only quick initial visualization options, but also the deeper fine points to really maximize your use of Tableau 9.

There are several approaches you may prefer to use with *Tableau 9: The Official Guide* to maximize your learning. The book is logically organized to start with more straightforward, quick approaches to data visualization, progressing to more complex concepts as chapters progress. If you are just starting out with Tableau, you may prefer to start with Chapter 1 and proceed in order. If there is a particular topic or feature you want to concentrate on, simply locate the appropriate chapter and begin reading. The index will also help you quickly hone in on specific topics you are interested in. There's also TableauBook.com, the companion website that features helpful videos and finished Tableau 9 workbooks that will aid you in learning this powerful tool (videos and companion workbooks are referenced in appropriate chapters). TableauBook.com also includes a complete formula language reference in PDF format that will aid you in mastering Tableau's built-in formula language. For more information, see the "Companion Online Content: Workbooks, Formula Language Reference, Code Samples, and Videos" section at the end of this introduction.

Chapter 1: Introduction to Tableau 9

Chapter 1 is a great overall introduction to Tableau concepts, including the user interface, general data visualization concepts, and quick ways to start getting immediate value from Tableau. If you're just beginning to explore Tableau 9, this is your starting point.

Chapter 2: Basic Visualization Design

More involved visualization approaches are introduced in Chapter 2. You'll find definitions and in-depth coverage of the differences between dimensions and measures and how Tableau determines which is which. You'll be introduced to Show Me, the quick way to create lightning-fast charts. Choosing different types of chart marks, color options, and Tableau formatting is discussed. And Chapter 2 is where you can learn how to create shared axis and dual axis charts and Tableau's unique approach to analyzing more than one measure with Measure Names and Measure Values.

Chapter 3: Connecting to Data

Chapter 3 is all about connecting to data. Whether you need to analyze data in a traditional relational database, such as Microsoft SQL Server; if you want details on Tableau 9's new features for easy analysis of Microsoft Excel spreadsheets; or you are looking for insight into "big data" from cloud-based data sources, such as Google Big Query, this is the chapter to head to. Connecting to data sources, joining multiple tables, and powerful Tableau data blending are all covered here. Providing a complete customized view of your data sources, as well as extracting traditional data into fast, in-memory Tableau Data Extracts, rounds out Chapter 3.

Chapter 4: Top 10 Chart Types

In honor of late-night TV host David Letterman wrapping up his storied career in 2015, Chapter 4 features the Top 10 chart types. Although Tableau will create far more than just 10 types of charts, this chapter concentrates on some of the most popular types of charts, such as bar and pie charts, to more esoteric bullet graphs and box/whisker plots. This chapter is chock-full of visual best practice notations to help you create the most meaningful and audience-friendly visualizations.

Chapter 5: Interacting with the Viewer

Chapter 5 starts with a complete discussion of Tableau filters, an essential part of any visual analysis requirements. Filter interactivity via quick filters follows. More flexible viewer interactivity options are covered via parameters. And the chapter ends with worksheet-based actions, features that allow worksheets to change appearance and display other related worksheets based on viewer clicks and hovers.

Chapter 6: Advanced Charting, Calculations, and Statistics

When you're ready to customize your Tableau 9 worksheet data beyond what comes from your data source, head to Chapter 6. Here, you'll learn how to group data in a custom form with groups and save selected sets of data for reuse in the entire workbook. Binning measures for histogram charts is also covered here. But the real power to customize Tableau comes in calculated fields, which Chapter 6 also discusses. New Tableau 9 approaches for calculating custom data are discussed extensively, as are new Tableau 9 level-of-detail expressions. You'll also learn table calculations and all Tableau's built-in statistical and forecasting options in this chapter.

Chapter 7: Tableau Maps

Chapter 7 delves into Tableau's rich geographic mapping capabilities. You'll learn how to immediately determine which data fields can be mapped and how to customize your data source to permit mapping of additional fields. Creating custom geographic roles and using widely available background map servers are discussed. This chapter wraps up with a compelling example of Tableau's ability to create your own custom x/y coordinate system for plotting data over your own background image.

Chapter 8: Creating Dashboards and Stories

The word "dashboard" has long ago moved from the image of something you see when you get in a car to a combined single view of visualized data. Chapter 8 teaches you how to create Tableau dashboards—combinations of more than one worksheet in the same physical space. Complete coverage of various dashboard design approaches appears first, followed by flexible approaches to dashboard interactivity. The chapter wraps up with details on Tableau stories, step-by-step guided analytics that lead your audience through a screen-by-screen progression of visual analysis.

Chapter 9: Working with Tableau Server

Once you've designed worksheets, dashboards, and stories in Tableau 9 Desktop, you may want to share them on the Web for the world, or just your particular organization, to view. Chapter 9 covers all web-based sharing options, including Tableau Public, Tableau Online, and Tableau Server. How to publish worksheets to these various choices is covered, as are techniques for filtering data at view time to only show various members of your audience data that is relevant to them. Innovative approaches to keeping web-based data current are illustrated here. If you are tasked with implementing Tableau Server in your organization, this chapter concludes with a rich section on various management techniques, including user maintenance and permissions assignment.

Chapter 10: Custom Programming Tableau and Tableau Server

Chapter 10 is just for programmers. Tableau continues to provide more custom integration options with each successive release of its software, and these latest APIs are covered here. The Tableau Server JavaScript API permits you to design your own custom interface for integration into your own custom portal or a web-based application. The Tableau Server REST API permits you to programmatically add, modify, and maintain Tableau Server content, as well as manage users, projects, and permissions. Chapter 10 wraps up with a sample application that demonstrates how to build your own Tableau Data Extracts without using Tableau Desktop.

Companion Online Content: Workbooks, Formula Language Reference, Code Samples, and Videos

TableauBook.com is your resource for associated online content. Most chapters reference a Tableau packaged workbook that may be downloaded to illustrate examples demonstrated in the chapter, as well as additional examples that may not be included in the chapter. Most workbooks contain annotations that explain concepts demonstrated in the workbook. Because these samples are packaged workbooks, they are entirely self-contained and don't require you to connect to any external databases or resources.

A complete formula language reference, including helpful examples of all functions and discussion of R integration with Tableau 9, is available on TableauBook.com. And Chapter 10 references sample code for the Tableau Server JavaScript API, REST API, and the Tableau Data Extract API. Download these samples to duplicate the examples illustrated in the chapter.

Visit TableauBook.com to watch videos that are referenced throughout the book. These helpful videos include narration by the author, as well as step-by-step illustrations on key concepts in each chapter. If you are viewing the enhanced e-book version, videos are embedded right in the text.

And finally, any updates or corrections will also be posted on TableauBook.com. As "dot" versions (for example, Tableau 9.1) are released, new features will be noted in electronic documents and, possibly, videos on the website.

Note *The videos are also available for viewing or download at www.mhprofessional .com/pecktableau9/.*

Tableau Desktop: Windows and Mac

Since version 8.2, Tableau Desktop has been released in both Windows and native Mac OS X versions. Tableau 9 continues this direction. When you purchase a Tableau Desktop license, you are able to use either Windows or Mac versions, as the license key code is recognized, regardless of computer operating system. And if you own both a Windows and Mac computer, you may install on both computers, as the Tableau license agreement permits this.

The look, feel, and behavior of Tableau Desktop are largely identical with both Windows and Mac versions. Drop-down menu options are virtually identical, as are context menus and dialog boxes. The differences between Windows and Mac versions lie in two primary areas:

- **Mac connects to fewer data sources** Because of operating system differences, Tableau Desktop for Mac connects to fewer data sources than its Windows counterpart. You'll notice a smaller set of available sources and servers on the Connect screen. If you have a Windows version of Tableau Desktop available, you can connect to any data source and extract data to a Tableau Data Extract (this is covered in Chapter 3). The extract can then be used by Tableau for Mac. Or, if you have Tableau Server installed in your organization, you may publish the data source to Tableau Server from Tableau Desktop for Windows. Because Tableau Server is also Windows based, it will connect to all supported data sources and act as a "proxy" data server to Tableau for Mac, enabling a live connection to an otherwise unsupported data source. Saving data connections to Tableau Server is discussed in Chapter 9.

- **Keyboard shortcuts are different** Tableau Desktop shortcut key combinations generally follow operating system standards. As such, you'll encounter some different keyboard shortcuts with Windows and Mac versions. Most common differences include right-click context menus and right-click drag functionality. If you have configured your Mac mouse secondary click option, right-click mouse options to display context menus will behave identically to Windows. Otherwise, use CONTROL-click to display context menus on Mac. Right-click drag options behave differently in Tableau for Mac as well. Whereas Windows permits you to drag a dimension or measure to a shelf with the right mouse button held down, you'll need to use OPTION-drag on Mac for similar behavior. Other keyboard shortcuts differ as well. Tableau online help contains a complete list of both Windows and Mac shortcut key combinations.

CHAPTER 1

Introduction to Tableau 9

Electronic data is everywhere. Whether it's a traditional corporate database that maintains information about a company's Enterprise Resource Planning system, the keywords that are trending on social media sites, or a portable personal device that keeps track of your workout routine, seemingly endless amounts of data are becoming available for analysis. But what good are mountains of data if there aren't nimble tools able to make sense of it all? Enter the Data Visualization tool. Designed to present data visually (as opposed to more traditional text), these leading-edge tools are allowing more and more people to make meaningful sense of the vast amounts of data available to them.

Tableau fits squarely into this data visualization/dashboard realm. Whereas standard business intelligence tools for corporate and enterprise reporting abound, newer visualization tools, such as Tableau, are just coming of age. Now in its ninth major release, Tableau continues to sit at the leading edge of this growing segment of information technology.

Download *At www.tableaubook.com, download and open the* Chapter 1 - First Workbook.twbx *file to see examples that relate to this chapter.*

What Is Tableau?

Tableau Software has its roots in the Stanford University Computer Science Department, in a Department of Defense–sponsored research project aimed at increasing people's ability to rapidly analyze data. Chris Stolte, a Ph.D. candidate, was researching visualization techniques for exploring relational databases and data cubes. Stolte's Ph.D. advisor, Professor Pat Hanrahan, a founding member of Pixar and chief architect for Pixar's

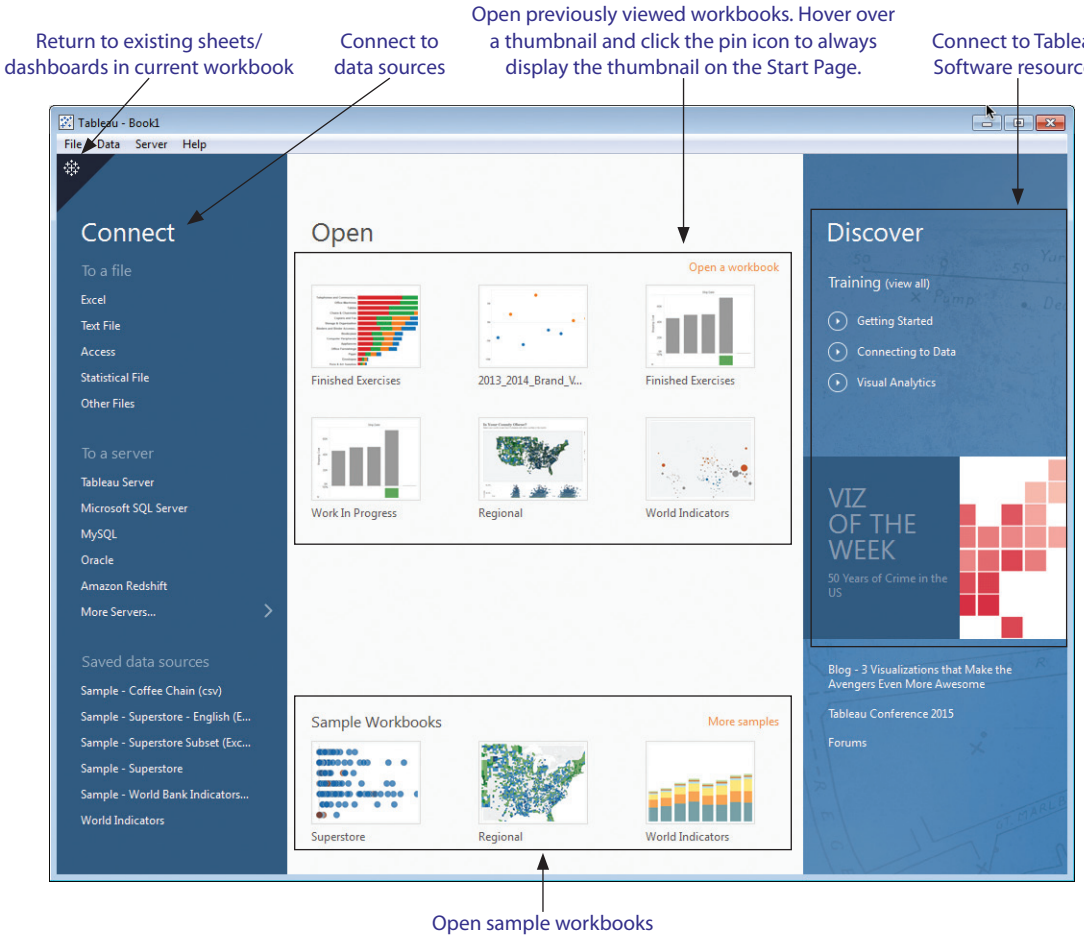
RenderMan, was the worldwide expert in the science of computer graphics. Chris, Pat, and a team of Stanford Ph.D.s realized that computer graphics could deliver huge gains in people's ability to understand databases. Their invention, VizQL, brought together these two computer science disciplines for the first time. VizQL lets people analyze data just by building drag-and-drop pictures of what they want to see. With Christian Chabot on board as CEO, the company was spun out of Stanford in 2003.

Although Tableau 9 improves on the previous eight major releases of the software, the core approach to visual design remains the same: connect to a desired data source, and drag various data fields to desired parts of the Tableau screen. The result is a simple visualization that can then be enhanced and modified by dragging additional data fields to different destinations in the workspace. Beyond this simple visualization approach, Tableau's *Show Me* feature allows quick choices of predefined visualizations by just selecting relevant data fields and clicking a thumbnail. For more advanced requirements, Tableau features a complete formula language, as well as more robust data connection options.

There are two primary Tableau benefits you'll want to keep in mind as you explore the tool:

- **Visualization of data** Tableau excels at displaying data visually. Whether it's a simple bar chart or a more complex dual-axis, multimark visualization, Tableau's core purpose is to help you draw conclusions from your data visually. Although Tableau can mimic a traditional spreadsheet by analyzing data with rows and columns of numbers, you'll be wasting Tableau's potential if this is your primary focus.
- **Speed of analysis** Analyzing data in Tableau is incredibly fast (assuming you present Tableau with a well-performing data source). Once you master the basic paradigm of the Tableau Data pane, shelves, and cards, you can literally answer your "what if" and "how" questions as quickly as you can think of them. What used to take traditional Business Intelligence (BI) tools hours to reveal can be discovered in Tableau in seconds or minutes.

When you first start Tableau, you are presented with the *Start Page*. The largest portion of the Start Page is reserved for thumbnails of recent workbooks you have used. Simply click any one of these to open the workbook (like Microsoft Excel, Tableau's format for storing data on your disk drive is in a *workbook,* with a .twb or .twbx file extension). You may also open sample workbooks included with Tableau by clicking the desired thumbnail at the bottom of the Start Page.



Opening Existing Workbooks

You may open two types of existing Tableau workbooks. Click an existing thumbnail on the Start Page, or use File | Open.

- **Standard Tableau Workbook (.twb file)** This workbook contains worksheet and dashboard definitions only. Any data sources and external files (custom background images, image files in dashboards, and so forth) are not saved in the .twb file. For example, if the workbook connects to two data sources (such as a standard SQL database server and an Excel file located in a folder on your C drive) and references an image located on a network drive, another Tableau user who opens the workbook will need to be able to connect to the same SQL database, will need to have the same Excel file on their C drive, and must be able to access the image file located on the same network drive.

- **Tableau Packaged Workbook (.twbx file)** A packaged workbook is a self-contained workbook with any necessary external files embedded in it. It contains worksheet and dashboard definitions, as well as file-based data sources, image files, custom shapes, and any other external files necessary to interact with any sheet or dashboard. If the workbook is based on a file-based data source (such as an Excel workbook or text file), the file is copied and embedded in the .twbx file. Any external files referenced in the workbook, such as background images, images added to dashboards, and custom shape files, are also copied and embedded in the .twbx file.

Caution *If your workbook connects to an external traditional or cloud database, Tableau will not be able to include the data source in the packaged workbook. You may be warned about this and prompted to extract the data source into a local Tableau Data Extract, which is then embedded in the .twbx file. If you want the workbook to be usable in Tableau Reader, you* must *do this, as Tableau Reader will not connect to external data sources (extracting data is discussed in Chapter 3).*

Creating New Workbooks

If you want to create a new workbook, you must first connect to a *data source* (types of data sources Tableau works with include industry-standard databases such as Oracle or Microsoft SQL Server, cloud-based data such as Google Analytics, Microsoft Excel spreadsheets, text files, and so forth). Unlike spreadsheet or word processing programs, Tableau must connect to some existing data before you can create a visualization. Predefined data connections, known as *saved data sources,* will appear on the lower left side of the Start Page. These "pointers" to an existing data source can be selected by simply clicking them. If you want to connect to a different data source, click the desired data source type within the To A File or To A Server section under the left Connect column on the Start Page. Once you've connected to a data source, the Data Source page will appear, where more specific data choices (such as adding and joining tables) are made. Once you've made any data source adjustments, click the Sheet 1 tab at the bottom of the screen to display the Tableau workspace where you can drag and drop desired data fields.

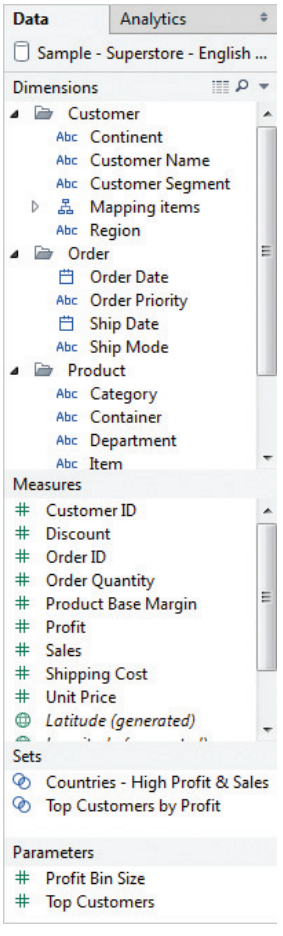
Note *Detailed discussion of the Data Source page and data connections can be found in Chapter 3.*

Tableau User Interface

Once you've made data source choices, click the desired worksheet tab at the bottom of the Tableau screen. You'll notice that Tableau shares the "multiple worksheets within a workbook" paradigm of Microsoft Excel. A workbook can contain one or more worksheets,

with each worksheet denoted by a tab at the bottom of the screen. As with most other standard software applications, you'll see a series of drop-down menus and a toolbar. Also, many Tableau functions can be selected from pop-up context menus that will appear when you right-click with your mouse (CONTROL-click with Mac).

The left side of a Tableau worksheet contains the Data pane, which divides fields in your data source into dimensions and measures. You'll find a blank visualization containing a single column, row, and center area, each labeled "Drop field here." The remainder of the worksheet consists of a series of shelves and cards, where you can drag fields to control certain behavior and the appearance of your worksheet.



The Data Pane

Since all Tableau visualizations start with connection to a data source, the first area you'll need to become familiar with is the *side bar*. Comprising the left portion of the workspace, the side bar changes based on selection of either the Analytics pane (discussed in Chapter 6) or the *Data pane*. When you select the Data pane, fields from your data source appear, ready for you to drag and drop to relevant parts of the worksheet. In particular, the Data pane is broken down into two sub-windows: Dimensions and Measures. *Dimensions* are non-number fields that categorize data. *Measures* are numeric fields that are aggregated as sums, averages, and so forth for each occurrence of the categorized dimension. For example, if you want to create a bar chart showing total sales for each continent, the continent dimension will be used to create a separate bar for each continent, with the size of the bar being determined by the sum of the sales measure.

Note *More details on the Data pane, including how to reorganize dimensions and measures, along with detailed discussion of various data types, are available in Chapter 3.*

Shelves and Cards

Once you've connected to data and evaluated available dimensions and measures in the Data pane, you'll need to decide where to drag desired dimensions and measures. You may choose to drag directly on the visualization area where prompted to "Drop field here." You may also choose to drop on a particular shelf or card. To create a vertical bar chart using the sales-by-continent example discussed previously, you would simply drag the continent