O'REILLY®

Practical Tableau

100 TIPS, TUTORIALS, AND STRATEGIES
FROM A TABLEAU ZEN MASTER

Ryan Sleeper

O'REILLY®

Practical Tableau

Whether you have some experience with Tableau software or are just getting started, this manual goes beyond the basics to help you build compelling, interactive data visualization applications. Author Ryan Sleeper, one of the world's most qualified Tableau consultants, complements his web posts and instructional videos with this guide to give you a firm understanding of how to use Tableau to find valuable insights in data.

Over five sections, Sleeper—recognized as a Tableau Zen Master, Tableau Public Visualization of the Year author, and Tableau Iron Viz Champion—provides visualization tips, tutorials, and strategies to help you avoid the pitfalls and take your Tableau knowledge to the next level.

Practical Tableau sections include:

- **Fundamentals:** Get started with Tableau from the beginning
- **Chart types:** Use step-by-step tutorials to build a variety of charts in Tableau
- **Tips and tricks:** Learn innovative uses of parameters, color theory, how to make your Tableau workbooks run efficiently, and more
- **Framework:** Explore the INSIGHT framework, a proprietary process for building Tableau dashboards
- **Storytelling:** Learn tangible tactics for storytelling with data, including specific and actionable tips you can implement immediately

"*Practical Tableau* covers the entire role of an analyst, from the nuts and bolts of building charts to bringing it all together in rich and interactive applications. It is the perfect companion for anyone at any stage of their Tableau journey."

—Andy Cotgreave
Technical Evangelism Director, Tableau, and coauthor of *The Big Book of Dashboards*

Ryan Sleeper is founder and principal at Playfair Data, where he delivers onsite expert training and inspirational talks to individuals and teams who want to learn or improve their mastery of Tableau. For the past eight years, he has been consulting and working with well-known brands across a variety of industries, helping them achieve and surpass their organizational goals.

US $44.99 CAN $59.99
ISBN: 978-1-491-97731-6

Twitter: @oreillymedia
facebook.com/oreilly

Practical Tableau

100 Tips, Tutorials, and Strategies from a Tableau Zen Master

Ryan Sleeper

Beijing • Boston • Farnham • Sebastopol • Tokyo

O'REILLY®

Practical Tableau
by Ryan Sleeper

Printed in the United States of America.

Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.

O'Reilly books may be purchased for educational, business, or sales promotional use. Online editions are also available for most titles (*http://oreilly.com/safari*). For more information, contact our corporate/institutional sales department: 800-998-9938 or *corporate@oreilly.com*.

Editor: Virginia Wilson
Production Editor: Melanie Yarbrough
Copyeditor: Jasmine Kwityn
Proofreader: Kim Cofer
Indexer: Ellen Troutman-Zaig
Interior Designer: David Futato
Cover Designer: Karen Montgomery
Illustrator: Rebecca Demarest

April 2018: First Edition

Revision History for the First Edition
2018-04-03: First Release

See *http://oreilly.com/catalog/errata.csp?isbn=9781491977316* for release details.

978-1-491-97731-6

[LSI]

This book is dedicated to my grandmothers, Nancy Boyd and Ruth Sleeper

Table of Contents

Foreword

It's more important than ever before to be fluent in the language of data. Our world is full of an ever-increasing amount of data in the form of tables, spreadsheets, and databases about our businesses, our interactions, our cities, our environment, our personal health. The topics and applications are endless.

When it comes to quickly and effectively processing data to find and share impactful stories, there's no software quite like Tableau. It allows you to drag and drop your data onto a digital canvas that brings it to life. In addition, Tableau gives you the ability to share what you create with your audience so they can come to understand as well.

And there's no resource quite like this book as you embark on the journey from beginner to expert and develop your skills working with data using Tableau. Ryan Sleeper is a true master of the art and science of data visualization, and he has created an amazing resource of practical tutorials that start with the basics, move to more advanced topics, and include often missed but critically important design tips along the way.

Ryan has earned the coveted title of Tableau Zen Master not only by becoming an expert in the software, but also by graciously and effectively helping others to build their skills as well. His award-winning Tableau Public visualizations have enlightened and delighted people all over the world on topics such as baseball player valuation, the cost of living, traffic patterns, and stock valuations, to name just a few.

So in picking up this book, you're setting off on a journey to learn from the best. The combination of Tableau's powerful software and Ryan's clear and concise way of explaining how to use it mean each step along the way will be a pleasure.

I wish you all the best. The world in which we live—our communities and our planet itself—are depending on each one of us becoming not just fluent in the language of data, but eloquent.

— Ben Jones
Director of Outreach Programs
Tableau Software
@DataRemixed

Preface

Eight years ago, my then-boss asked our team of three analysts to try using a "new" tool called *Tableau*. All three of us did the first thing that came naturally and attempted to replicate our existing Excel reports in Tableau. I found that transitioning from Excel-based reporting was not always seamless, but have since realized that it was because I did not have a go-to resource to help me connect the dots between my existing reporting knowledge and what I was learning in Tableau. I'm grateful I stuck with Tableau because over time I realized how flexible and powerful the software is.

As of 2018, Tableau has been named a leader in the Gartner Magic Quadrant for Business Intelligence and Analytics Platforms for six consecutive years. Tableau works because it helps you unlock the benefits of visualizing data:

- Reduced time to insight
- Increased accuracy of insights
- Improved engagement

Tableau has made it possible for me to find thousands of insights in data that have led to tangible actions and real returns for the dozens of globally known brands I have consulted for. In addition to the value added during my day job, I have had the honor of being named a Tableau Zen Master twice, won Tableau's Iron Viz Championship in 2013, and authored the Tableau Public Visualization of the Year in 2015.

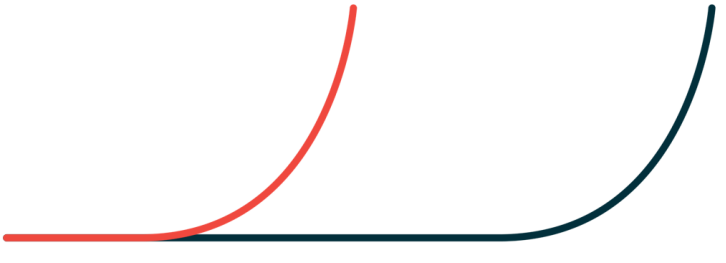
The data visualization tips, tutorials, and strategies contained in this book are the 100 ideas that made this all possible.

This Book's Purpose

When I started using Tableau, there weren't many resources available for learning the tool. There were (and still are) a lot of individual posts and videos on the web, but I found it challenging to tie everything together in a way that helped me get the most

out of Tableau. I have an MBA and a master's in sport business management, as well as undergraduate degrees in marketing and psychology. Before I began my career, I had not taken a single class about data or analytics. This made it even more challenging to get started with Tableau, and despite all of my previous accomplishments, I would say that my learning curve looked like this:

The long, flat line before I started to figure things out represents about two years of self-teaching and growing pains. In many ways, this experience makes me uniquely qualified to help you reduce your own learning curve. *I wrote this book because it's the one I wish I had when I started using Tableau*. My hope is that this selection of topics, combined with my firsthand knowledge of potential pitfalls, and the practical style of communication, will make your learning curve look like this:



This Book's Audience

This book is best for a "201-level" Tableau user. Most Tableau users have some foundational "101-level" knowledge, but do not have the need for extremely technical "601-level" skills. After all, Tableau's mission is to help you see and understand your data as easily as possible. This book is targeted specifically at helping you build on the foundational knowledge and take your applications of Tableau to the next level. That being said, I have two big caveats:

- Part I covers the core concepts that I find most important when using Tableau. The chapters in that part make it possible for a brand-new Tableau user to learn how to use Tableau with this book alone. For more experienced users, it also offers a review of basic concepts to ensure they have the prerequisites required to build on their knowledge in later chapters.
- Beyond technical "how-tos," this book also offers a strategic framework for data visualization and discusses storytelling techniques. Furthermore, many of the tips and tricks in *Practical Tableau* were invented by me personally, and may be considered advanced. It is my belief that there is something for every Tableau user in this book, regardless of experience level.

This Book's Structure

Practical Tableau is organized into five parts:

Part I
: The chapters in this part help you get started from scratch using Tableau. By the end of Part I, you will have the ability to use Tableau immediately and the foundational prerequisites to apply the "201-level" material.

Part II
: Part II consists of step-by-step tutorials that walk you through how to build a variety of charts in Tableau. More importantly, each tutorial also explains uses for each chart type in a business context, which helps you choose the right tool for the job in your analyses. Many of the chart types explained here are not available "out-of-the-box" through Tableau's "Show Me" functionality, so you are sure to add some advanced approaches to your Tableau toolbelt. For the charts that are easy to create with Show Me, there are often innovative twists added to take the standard charts to the next level.

Part III
: The various topics covered in this part will help ensure you're known as the Tableau guru at your office. This part covers everything from innovative uses of parameters, working with dates, color theory, making your Tableau workbooks run efficiently, designing for mobile devices, and much more.

Part IV
: These chapters discuss the INSIGHT framework for data visualization. The INSIGHT framework is a proprietary process that has been used in the construction of hundreds of Tableau dashboards. Following a strategic framework helps you align the requirements of diverse end users to maximize the effectiveness of your data visualization.

Part V

The book concludes by outlining tangible tactics for storytelling with data. Regardless of how good you become at the technical aspects of Tableau, without some attention to the intangible aspects of data visualization, you will not be as successful as you can be. This part discusses data visualization theory and the psychological components of communicating with data. You will learn specific and actionable tips that you can begin implementing in your work immediately.

O'Reilly Safari

Safari (formerly Safari Books Online) is a membership-based training and reference platform for enterprise, government, educators, and individuals.

Members have access to thousands of books, training videos, Learning Paths, interactive tutorials, and curated playlists from over 250 publishers, including O'Reilly Media, Harvard Business Review, Prentice Hall Professional, Addison-Wesley Professional, Microsoft Press, Sams, Que, Peachpit Press, Adobe, Focal Press, Cisco Press, John Wiley & Sons, Syngress, Morgan Kaufmann, IBM Redbooks, Packt, Adobe Press, FT Press, Apress, Manning, New Riders, McGraw-Hill, Jones & Bartlett, and Course Technology, among others.

For more information, please visit *http://oreilly.com/safari*.

How to Contact Us

Please address comments and questions concerning this book to the publisher:

O'Reilly Media, Inc.
1005 Gravenstein Highway North
Sebastopol, CA 95472
800-998-9938 (in the United States or Canada)
707-829-0515 (international or local)
707-829-0104 (fax)

We have a web page for this book, where we list errata, examples, and any additional information. You can access this page at *http://bit.ly/practical-tableau*.

To comment or ask technical questions about this book, send email to *bookquestions@oreilly.com*.

For more information about our books, courses, conferences, and news, see our website at *http://www.oreilly.com*.

Find us on Facebook: *http://facebook.com/oreilly*

Follow us on Twitter: *http://twitter.com/oreillymedia*

Watch us on YouTube: *http://www.youtube.com/oreillymedia*

Acknowledgments

No one achieves anything remarkable in a community without the support of that community, and I am certainly no exception to that rule. What I have found most unique about my experience with Tableau is its relentlessly kind and selfless community. I would not have been able to write this book without the knowledge shared and the inspiration provided by Tableau's user community. While some of these users are mentioned throughout the chapters of *Practical Tableau*, there are far too many individuals to name that have helped me along the way. If you have answered somebody's question on Tableau's user forums, posted a visualization to Tableau Public, attended a user group meeting, or wrote a blog post about Tableau: thank you.

Thank you, Ben Jones, Director of Outreach Programs at Tableau. Ben inspired me very early in my career and gave me the confidence to push the Tableau envelope. Quite simply, I would not have had the opportunity to write this without Ben Jones and Tableau Public.

Thank you to my family for helping me develop a worldview that motivated me to do something like this and for your support along the way; even if at times I had trouble explaining exactly what I do.

Special thanks to my wife, Amy, for allowing me to share some of our private life through data visualization and letting me disappear to the coffee shop almost every Saturday and Sunday for quite a while to document the ideas you're about to read.

PART I

Fundamentals

CHAPTER 1

How to Learn Tableau: My Top Five Tips

Tableau's mission is to help people see and understand their data, and I can tell you that after you've mastered a few of the fundamentals, it is an extremely easy way to do just that. For basic analyses, such as looking at a measure such as sales, and slicing and dicing that measure by a dimension such as region, I'm not sure anything could be easier than Tableau. However, there can be a substantial learning curve required to get exactly what you want out of the software. In fact, for me personally it has been a career-long education spanning eight years using Tableau. While I've been through some growing pains and experienced some frustration learning the tool, I mostly view my lack of perfection as good news. The challenge keeps my job interesting and I continue to get excited discovering innovative solutions to complex problems that have led to several successful visualizations.

This chapter shares my top tips for how to learn Tableau, whether you have a budget of $0 or $5,000.

Tip #5: Follow the Community

Cost: $0

The first of my top five tips is to follow the Tableau community. I have learned several software programs during my career in digital analytics and data visualization, and bar none, Tableau has the most selfless community of the bunch. The great thing about following the community is that you can tailor the list of users you focus on to align with your own uses of Tableau. Perhaps you want to follow users sharing advanced technical know-how, members of the community who are applying Tableau in your own industry, or users more focused on design and user experience.

I've put together a Twitter list, Data Viz Heroes, that might be a good starting point for you. These are just a few of my favorite users to learn Tableau from. Remember,

this is not a comprehensive list of every outstanding Tableau user, but a short list of users whose style aligns with how I want to use the software.

Some of these users have created aggregated learning resources from several users in the community. One of my favorites is the Data + Science Tableau Reference Guide, maintained by Jeffrey Shaffer (@HighVizAbility). If you can't quite find what you're looking for, there is an active community of Tableau users answering specific questions on the community forums.

Lastly, get involved with a local Tableau User Group. This is a free resource where you can meet local Tableau users and learn from what others are doing. Many of my Data Viz Heroes often speak at these meetings. These user groups are all over the world—use this handy Tableau User Group map to find the one closest to you and reach out to the leader to get involved.

Tip #4: Take a Training Class

Cost: $13–$6,000 per day

No matter how many blog posts you've read, sometimes you just need to talk to somebody who can help you connect the dots between what you are learning. Attending a Tableau training or data visualization workshop can help you take your skills a significant step forward in a short amount of time. Tableau training comes in many shapes and sizes, and as with the tip about following the community, you should choose your Tableau training based on what you are hoping to get out of the software at this point in your development.

If you would like a recorded training, I recommend the resources available at O'Reilly's Safari Books Online, Udemy, Pluralsight, or Playfair Data TV. Several of these recorded trainings are taught by qualified instructors, including my Data Viz Heroes.

If you are in need of in-person training, you can attend a one-day training at Tableau's annual customer conference, a group training conducted by Tableau, an on-site training conducted by Tableau, or an on-site training conducted by a third-party trainer. I attended a group training conducted by Tableau during my second year using the software, and a condensed "analyst" training at a Tableau conference in my third year using it. I can personally attest to the value that attending an in-person training provides.

I'd be a bad consultant if I didn't mention my Tableau training offering and encourage you to get in touch if you are interested in my personal training services.

Tip #3: Read Up

Cost: $35–$45

There are simply some good books on Tableau available to learn from. This is a great starting point for learning Tableau, and one we sometimes take for granted. When I started using Tableau ("Back in my day…."), there was only one book that I can remember, and it was a very short one. There are now dozens of such resources available. I'm obviously biased toward the book you are currently reading, but among several other great options, here are two that I vouch for:

- *Tableau Your Data!* by Dan Murray (Wiley)

  This book is possibly the best all-around—ahem, non–*Practical Tableau*—resource for getting started with Tableau. It provides some of the basic fundamentals, but also discusses more advanced features and Tableau Server.

- *Communicating Data with Tableau* by Ben Jones (O'Reilly)

  In my opinion, Ben's book is the best second step, as it is more strategic and provides some ways to think about your approach to data visualization after you have the fundamentals down. It also offers several hands-on walkthroughs for different applications of Tableau.

Tip #2: Practice

Cost: $0

There is no substitute for on-the-job training with your own data and unique business problems. The more challenges you come across and push through to an eventual solution, the more unique tools you get to add to your toolbelt to solve increasingly complex problems that emerge. This may sound obvious, so I will offer an extra tip to help you get the most out of your practice: start a weekly internal meetup.

I call mine Tableau Tuesday. During Tableau Tuesday, a group of 5–10 internal Tableau users get together to train, share case studies of our own work, and/or work collaboratively through challenging situations. These Tableau Tuesday events lead to valuable discussion and ensure that the entire team is continuously learning.

Tip #1: Tableau Public

Cost: $0

I credit Tableau Public as the primary reason for my personal success with Tableau, and thus, it is my number one tip for how to learn Tableau. Tableau Public is a free tool that has almost all of the same functionality as Tableau Desktop (Personal). You can currently connect to and explore Excel, text files, and Google Sheets with up to 15 million rows.

The only catch with Tableau Public is that your files have to be saved to the web, and external audiences can potentially find your work. For this reason, it is not a suitable option for private business data. I actually view this as a positive. This forces you to find topics and data outside of your normal work environment. As I described in my Tableau customer story, Tableau Public is my sandbox to try new approaches to data visualization that in a business setting may not be as appreciated. The cool thing is, these "attempts to fly" are often eventually figured out, and frequently make it into my daily corporate work.

You can also download many of the workbooks you find on Tableau Public. This provides an amazing bevy of dashboards that you can use as a learning resource by downloading, looking under the hood, and reverse engineering. There is an option for the publisher to disallow this feature, but there are still thousands of downloadable dashboards—including every single one of mine. I previously had just one dashboard that was not downloadable, *The Cost of Attending the Baseball Championship Series*, and that was because it included stadium data of Kauffman Stadium in Kansas City and Citi Field in New York worth thousands of dollars to create. Well, I'm proud to report that even the 2015 Tableau Public Visualization of the Year is now available to download for free!

I unlocked this dashboard for two reasons, which I'll relate here because they illustrate the spirit of Tableau Public. Steve Wexler of Data Revelations wrote a post called "In Praise of Tableau Public." In the post, Steve describes all of the things that I love about Tableau Public. Then I came to a line that said, "Unless you indeed have proprietary data please, please, please don't stop your workbooks from being downloaded." That's three pleases. It reminded me of how important Tableau Public is as a resource for people to learn from and have discussions around approaches to data visualization.

Second, after the announcement that this viz received the honor of Tableau Public Viz of the Year, I was immediately asked personally from a new user for the original copy so they could see how it was created. It simply didn't feel right to keep the dashboard locked. My hope is that Tableau users of any experience level have the opportunity to learn from Tableau Public dashboards so they can incorporate innovations into their own work and continue pushing the envelope in their own ways.

That's it my for my top five tips for how to learn Tableau. Trust me when I say that *everybody* is learning! The key is to be persistent. Tableau is user-friendly enough and has so many resources available that anybody who is committed can become an expert.

CHAPTER 2

Which Tableau Product Is Best for Me?

I always say that there are five to ten topics that I wish somebody had told me the first day I used Tableau. The next several chapters address those topics, and will help you start using Tableau immediately! The first thing you need to know is what products you should download to get started. Tableau is growing at a rapid pace and there are still regular updates to all of its products, as well as the product ecosystem itself, making product selection a potentially confusing topic for a beginner.

It helps to understand that Tableau is a *brand*, and not a specific *product*. When somebody asks you to "download Tableau," they could be talking about Tableau Reader, Tableau Public, Tableau Desktop (Personal), Tableau Desktop (Professional), Tableau Server, Tableau Online, and so on.

This chapter provides an introduction to Tableau's product ecosystem so you can make the choice that best suits your individual requirements.

Which Tableau Product Is Best for Me?

The decision on which Tableau product to download comes down to four key attributes:

Connectivity
: What data sources do you need to access?

Distribution
: Who do you want to see your dashboard and how will you share it with them?

Automation
: Do you need your work to update automatically on a refresh schedule?

Security
: Do you require an on-premise level of security or can your work be saved in the cloud?

From here, I will share a brief synopsis of each product, how each answers the four questions just mentioned, and who might get the best use out of each product.

Tableau Desktop: Personal

Tableau Desktop: Personal is the entry point for the paid development versions of the software. It allows you to keep your workbooks private, but connection and distribution options are limited.

Connectivity	Excel, text files, Access, statistical files, shape files, spatial files, and Tableau files
Distribution	Offline or Tableau Public
Automation	Not available
Security	As good as your personal computer/server's security
Best for	Those that only need to connect to flat data files; those that need the most cost-effective version that will keep their data private

Tableau Desktop: Professional

Tableau Desktop: Professional is similar to Tableau Desktop: Personal in that it is a development version of Tableau. Both the Personal and Professional versions have all of the same development capabilities, but the Professional version provides full access to every data type and distribution channel currently available in the software.

Connectivity	All possible connections in Tableau
Distribution	Offline, Tableau Server, or Tableau Public (all possible distribution options in Tableau)
Automation	Not available
Security	As good as your personal computer/server's security
Best for	Those that need to connect to data in databases; those that need the capability to publish to Tableau Server

Tableau Reader

Tableau Reader is a free download that allows you to open "packaged workbooks," which are Tableau workbooks that are saved in a special way by Tableau Desktop users so the data and visualizations are in the same file. Tableau Reader allows you to open and interact with Tableau workbooks, but not develop them. Development capabilities could be considered an obvious fifth key attribute, but as Tableau Reader is the only product listed that does not provide these capabilities, I have not listed it

as a key consideration. This product works much like a PDF viewer, where a developer of a document saves it in a certain way so that it can be opened by a PDF reader.

Connectivity	*.twbx* files only (packaged workbooks)
Distribution	Offline
Automation	Not available
Security	As good as your personal computer/server's security
Best for	People that need an affordable way to view and interact with colleagues' Tableau workbooks

Tableau Public

Tableau Public is another free download, but this product actually provides development capabilities. The catch is that the workbooks have to be saved to Tableau's public cloud, making this an unsuitable choice for proprietary business data.

Connectivity	Excel, text files
Distribution	Cloud (Public)
Automation	Not available
Security	Limited; your workbooks are potentially accessible by anyone on the web, but you are able to restrict the ability for someone to download your files
Best for	Journalists; sharing publicly available data (and Tableau know-how) with the world; practicing Tableau for free; trying the software

Tableau Online

Tableau Online is similar to Tableau Server, but it is hosted via a third-party partner of Tableau. This product still has the advantages of cloud distribution and automatic refreshes, but it is hosted off premise, which can result in security challenges for certain organizations. Like Tableau Server, Tableau Online requires additional per-user licensing, even if those users already have access to Tableau Desktop.

Connectivity	Workbooks that have been published to Tableau Online and that you have been granted access to
Distribution	Cloud
Automation	Available via data refresh schedules
Security	As good as Tableau's third-party host
Best for	Those that need to access/distribute workbooks in the cloud; those that want to automate workbook refreshes; those that want to edit workbooks in the cloud (limited capability); those that are OK having their data and workbooks hosted off premise

Tableau Server

Tableau Server provides a central repository for all of your Tableau workbooks that can be accessed by your business users via a web browser. Tableau Server also has the advantage of data refresh capabilities as well as a way for your organization to keep its data and workbooks on premise in the case that your organization requires that level of security. Tableau Server requires additional user licenses, even if you already have a Tableau Desktop license:

Connectivity	Workbooks that have been published to Tableau Server and that you have been granted access to
Distribution	On-premise or cloud
Automation	Available via data refresh schedules
Security	As good as your on-premise or server host's security
Best for	Those that need to access/distribute workbooks in the cloud; those that want to automate workbook refreshes; those that want to edit workbooks in the cloud (limited capability); those that need to keep their data and workbooks on premise

Tableau consistently invests in research and development, so it is a good idea to keep an eye out for updates and new products at Tableau's product page. Also, if you are part of a nonprofit organization and just getting started with any of the paid products mentioned here, be sure to ask Tableau for special pricing!

CHAPTER 3

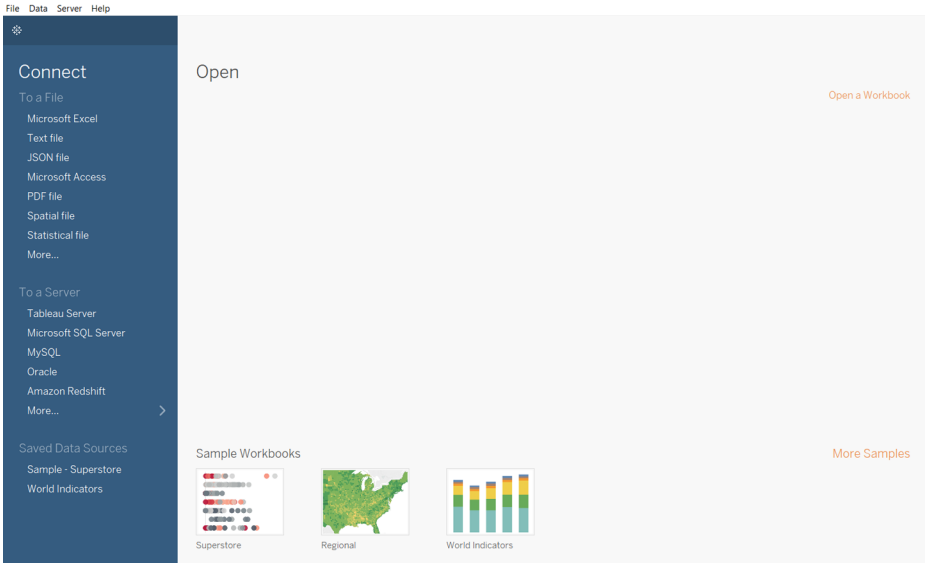
An Introduction to Connecting to Data

Once you have chosen the best Tableau product for you, it is time to start finding insights in your data! Much like Tableau's suite of products, data connections come in many shapes and sizes. As of this writing, Tableau Desktop: Personal has seven different types of data connections, and Tableau Desktop: Professional adds another *63* native ways to connect to data. That doesn't even count the ability to access web data through customized connectors or Open Database Connectivity (ODBC).

As you can imagine from the breadth of connection options, you can connect to almost any type of data in Tableau and if you don't see the connection you are looking for, somebody is likely working on a customized solution that will help. I could write an entire book on the different data connections alone, but they all work similarly and are fairly intuitive. So for the purposes of this chapter, I will show you how to get started with one connection type and a few of the ways you can prepare to work with the data.

An Introduction to Connecting to Data in Tableau

When you open Tableau, you will see a screen that looks like this, where you have the option to choose your data connection:

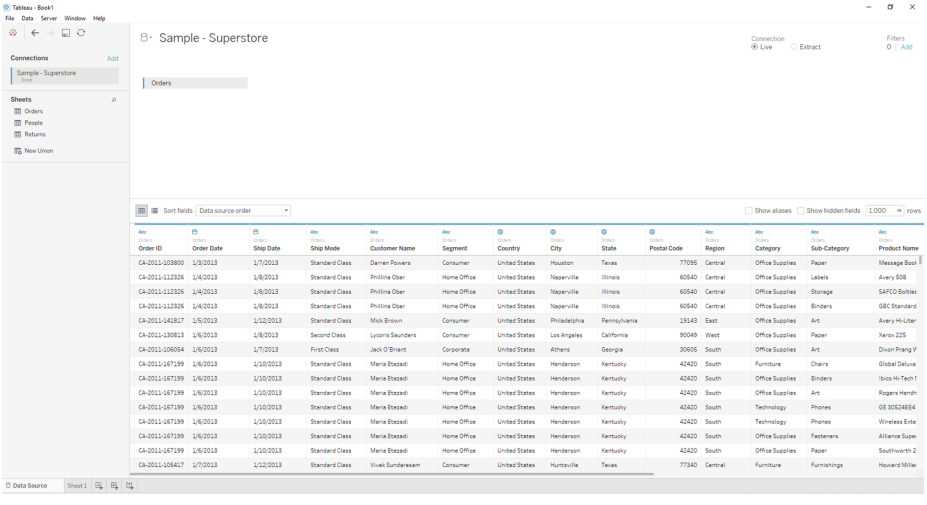


The options under the navigation heading "To a File" can be accessed with Tableau Desktop: Personal. All possible data connections, including to data that resides on a server, can be accessed with Tableau Desktop: Professional.

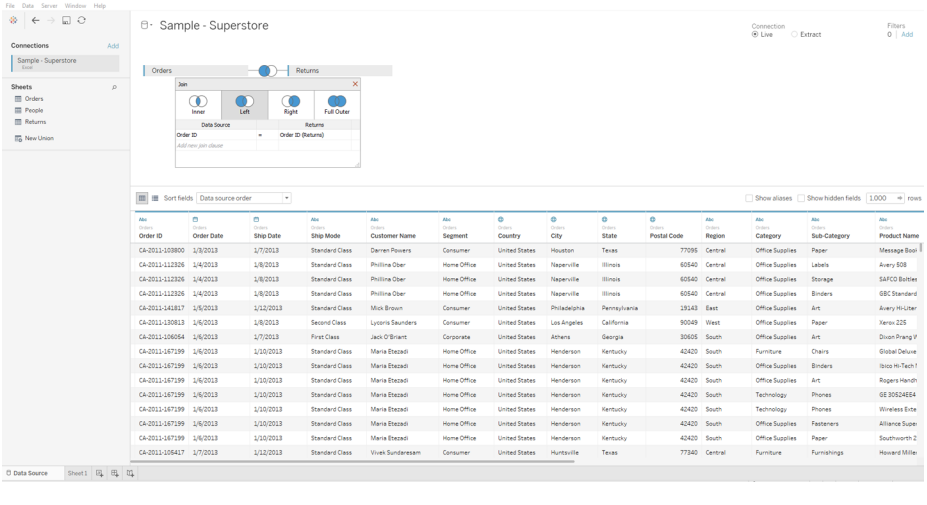
At the bottom of the left navigation, there are a couple of data sources that come with every download of Tableau. The first, Sample – Superstore, is actually an Excel file, so you can connect to it whether you are using Tableau Desktop: Personal or Tableau Desktop: Professional. I like to train with this data source because it is the most common data source used in online tutorials and during Tableau's own training. To start using it, click it.

The Sample – Superstore data source will be used for every tutorial in this book unless noted otherwise.

After clicking a saved data source, you are immediately thrown into the authoring interface. We discuss getting a lay of the land in Chapter 5, but I actually want to take a step back to show you what happens when you normally connect to a new data source. To get to the data editing interface, click the Data Source tab in the lower-left corner of the authoring interface. You should be taken to a screen that looks like this:



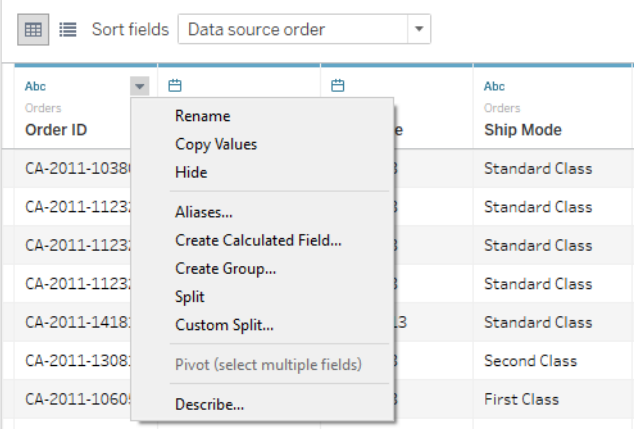
This is the screen you will be presented with when connecting to an Excel or database connection. In Tableau, the Excel workbook is treated as a database and the individual tabs are treated as individual tables within that database. For this reason, you can join tabs to each other if they have at least one field in common. When you join tables, you are appending additional fields to your data source based on shared fields. To do so, simply drag the table (i.e., tab) that you want to join into the data editing interface and tell Tableau what the two tabs have in common. Here's what the Sample – Superstore dataset looks like after I dragged the Returns table into the view and set up a *left* join on Order ID (this means that every field that has a matching Order ID in the table on the right will be appended to the table on the left):



You can even do cross-database joins, even if the data comes from different types of data connections. To do this, you would click Add to the right of Connections, connect to your additional data source, and set up a join just as pictured in the previous image.

If you're working with multiple tables that all have the same column headers, it may make more sense to union, or stack, the tables instead of joining them. Maybe you've got twelve months of web analytics data in one Excel file, but each month's data lives on a separate tab. To union the twelve tabs, you would drag "New Union" from the left navigation onto the data editing interface, then drag the tables that you want to union into the box that appears. When you create a union in Tableau, a column will be added that tells you what sheet the data came from.

After you've retrieved the data you want to work with, there are a few more options for preparing each column. To access them, click the down arrow next to the data type icon for each column:



The options are:

Rename
: Allows you to rename the field.

Copy Values
: When nothing is selected, places the value in the first row on your clipboard (preselecting rows before choosing this option will copy your selection).

Hide
: Hides the entire column.

Aliases
: Allows you to assign new names to individual dimension members.

Create Calculated Field
: Allows you to create a new field before you start using it within Tableau.

Create Group
: Allows you to group different dimension members. This can be handy for quick data clean-up.

Split
: Tableau will look at the dimension members in your column and guess the most appropriate way to split them into multiple columns.

Custom Split
: The same as Split, but you determine how to separate the dimension members.

Pivot
: When you have multiple columns selected, you can transpose them. Note you can only do one data pivot per data source.

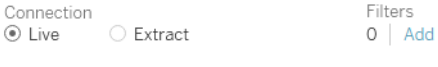
Describe
: Gives you additional information about the field.

When going through this process for quantitative fields, the string functions are not available, and one additional option is available: Create Bins. This creates equally sized bins, which can be used to make histograms. We will discuss how to make histograms in Chapter 28.

Lastly, you can also change the data type of a column by clicking the data type icon at the top of the column.

It's important to note that any changes you make to the data at this point creates metadata and has no impact on your underlying data source. This means you can make rapid progress in Tableau without the risk of messing up your existing infrastructure.

Another notable task that you may choose to do when connecting to a new data source is to either extract or filter the data source. By default, most data source connections will be live with no filters; these options can be seen in the upper-right corner of the data editor:



Live connections are advisable when you are working with large datasets and/or datasets held on powerful, in-memory databases. Live connections also offer the best security in most large organizations.

Extracts create a snapshot of your data at whatever point they are created. They are typically faster than a live data connection, especially when connecting to a live database. Just remember that extracts have to be refreshed periodically so that you are working with the latest data possible. From within Tableau Desktop, extracts can be refreshed by navigating to Data in the top navigation, hovering over the data source you want to refresh, then hovering over Extract, and clicking Refresh. If you eventually use Tableau Server or Tableau Online, you will see an option to automate the refresh process when you publish from Tableau Desktop.

The final option discussed in this chapter is the ability to filter the entire data source before you start working with it in Tableau. These filters can be created with any combination of fields by clicking the Add button under Filters. This is an easy opportunity to make your workbooks more efficient because you have the ability to filter out the data you don't need for your analysis. For example, if your analysis is about this year's data, don't pull in the last ten years of data! Or maybe you are building the workbook for a stakeholder that is only responsible for one division and they're not allowed to see the performance of other divisions. Adding a filter in this scenario not only makes the data processing more efficient, it will help you manage security to ensure data does not fall into the wrong hands.

With all of these choices, you should be able to set up your data exactly as you wish before you start working with it. However, if you are trying to transition existing Excel reports or working with irregularly shaped data, you may benefit from reading on into Chapter 4, before you get seriously down to work.

CHAPTER 4

Shaping Data for Use with Tableau

The next thing I wish I knew when I first started using Tableau is that there is an optimal way to shape data for use with the software. I'll never forget the day I was introduced to Tableau. The boss walked in and asked three of us in the office to try out this new tool she had heard of for creating data visualizations. The first thing every one of us tried to do is connect to an existing Excel report and re-create it in Tableau. After all, this was supposed to be intuitive—perhaps even *magical*—software, right? We quickly found out that nothing worked as we expected, we couldn't figure out how to make a single chart, and we had to fight the temptation to immediately revert back to our familiar Excel experience.

It's fun to look back, and this now seems like a simple problem to solve, but the scenario I experienced my first time with Tableau is not uncommon. In fact, it's both the most common Tableau adoption scenario that I come across—and the most difficult: first-time users connecting to an existing Excel report without any consideration to the format of the data.

Most existing Excel reports are not set up to work well with Tableau, and if this is the first data source that a first-time user attempts to work with, they are setting themselves up to fail. But don't despair—I can personally attest to what it's like to start using Tableau without any data or visualization software experience. I've always said that there are three or four key things to know when getting started with Tableau, and sometimes you just need somebody to share them with you so you can connect the dots and get started.

Shaping Data for Use with Tableau

This topic is easiest to illustrate, so take a look at the first image, which is meant to be similar to a typical report in Excel:

Sweet Excel Table					
	Q1	Q2	Q3	Q4	Total
Sales	$	$	$	$	$$$$
Profit	$	$	$	$	$$$$
Orders	#	#	#	#	####

There is a title along the top, a column header for each quarter, and a row for each KPI (Sales, Profit, and Orders). In addition, there is a total for each row on the right-hand side of the table.

The format of this report poses several problems for Tableau which, upon connecting, will try to interpret the data source, classify the fields, and set up your workspace:

- There is a title in the first row. The first two rows are critical for Tableau to interpret the data source, so we've immediately gotten off on the wrong foot.
- The column headers are quarters, which will cause Tableau to create a field for each quarter, when in fact the quarters should all be consolidated into one field for date/quarter.
- The KPIs are running down the first column so, by default, Tableau will not interpret these KPIs as unique fields.
- There is a total in the right column. As Tableau totals fields for you, not only is this unnecessary, it will likely lead to double-counting.

The ideal format for Tableau looks like this:

Quarter	Sales	Profit	Orders
Q1	$	$	#
Q2	$	$	#
Q3	$	$	#
Q4	$	$	#

Each column now represents a unique field, so the layout is vertical instead of horizontal. The title and totals have also been removed.

With the data in this shape, Tableau will be able to look at the first row to determine the fields and the second row to classify the data (i.e., type; discrete versus continuous; dimension versus measure). We will discuss the ways Tableau classifies data in the next few chapters.

As one additional tip, if your dataset includes a date field that is not in a traditional date format (as we've shown here with quarters), I recommend adding a column that looks like an actual date. In this case, I've added a column for quarter as date, and chosen the first date in each quarter as the entries:

Date	Quarter	Sales	Profit	Orders
1/1/2018	Q1	$	$	#
4/1/2018	Q2	$	$	#
7/1/2018	Q3	$	$	#
10/1/2018	Q4	$	$	#

Note that I've put the dates in my local (i.e., US) format, but this tip is also true for Tableau users outside of the United States using varying date formats. Your local version of Tableau should recognize the date format that you're used to.

Dates are a special data type in Tableau and by having dates in a date format that the software recognizes, the full functionality of date fields is unlocked.

Finally, if data reshaping is required for you to work with a dataset in Tableau, you can reshape it prior to connecting—which is my personal preference—or use Tableau's data interpreter and data pivot tools when you connect. Regardless of the method you choose, putting some thought into the shape of your data will help you get off to a strong start with your analyses in Tableau.

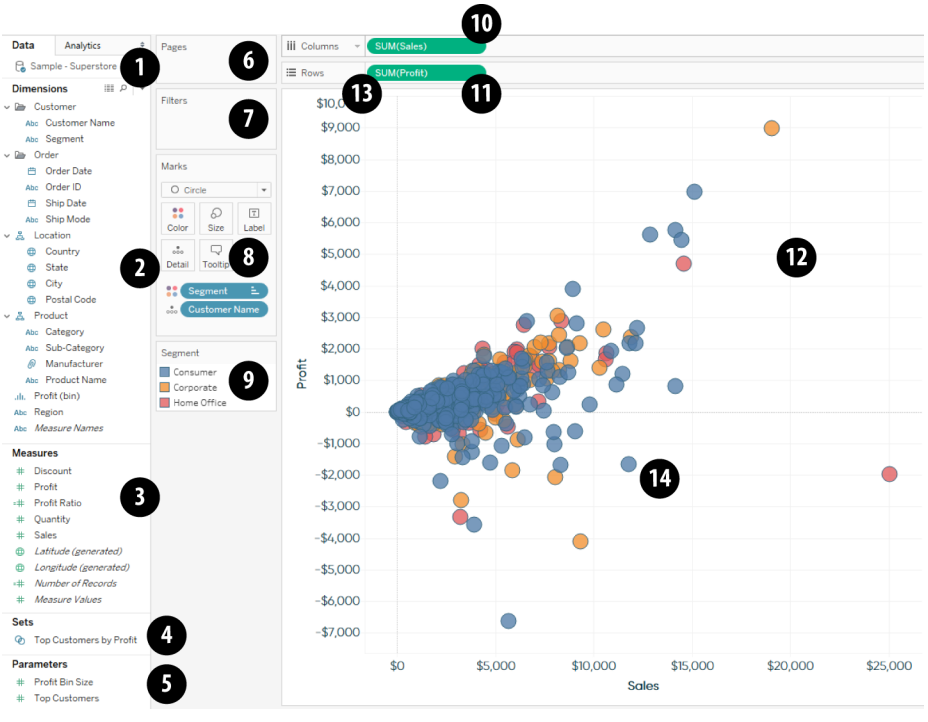
CHAPTER 5

Getting a Lay of the Land

This chapter provides an overview of the Tableau interface, terminology, and a couple of preliminary things I like to do whenever I start working with a new dataset. While this is certainly not an exhaustive list, it will help you get started authoring in Tableau immediately and will provide a foundation for what's to come.

Tableau Terminology

To walk through some of the most important Tableau terminology, we will use the following key followed by names and definitions:



1. *Data Sources*: Displays all of the data connections in the workbook. Note that only one data connection (Sample – Superstore) is being displayed in this example, but you can connect to more than one data source at a time.
2. *Dimensions area of the Data pane*: A list of all of the fields in the data source classified as dimensions (discussed in the next chapter).
3. *Measures area of the Data pane*: A list of all the fields in the data source classified as measures (discussed in the next chapter).
4. *Sets area of the Data pane*: If the data source you are using contains at least one set, or if you have created one or more sets, they will show up here.
5. *Parameters area of the Data pane*: If the workbook you are using contains at least one parameter, or if you have created one or more parameters, they will show up here.
6. *Pages Shelf*: The Pages Shelf allows you to "flip" through a "page" for each dimension member and/or add animation to a view. For example, you can put a dimension for Month of Order Date onto the Pages Shelf and have the view rotate through one month of data at a time.

7. *Filters Shelf*: Any dimension or measure that you filter a view by will be displayed here.
8. *Marks Card (Marks Shelf)*: Each square in this area is called a Marks Card, which are called that because they influence the marks on the view. Each Marks Card resides on the Marks Shelf. Note that depending on the chart type you are creating, additional cards will show up, such as for Shape or Path.
9. *Legend*: There are several different legends that will appear here to show how the marks are encoded, including Color (pictured), Size, and Shape.
10. *Columns Shelf*: Fields placed here will create columns on the view.
11. *Rows Shelf*: Fields placed here will create rows on the view.
12. *Worksheet/View*: Each tab in a Tableau workbook is called a worksheet and the area that displays a data visualization is a view.
13. *"Pill"*: The slang term for fields being used on a worksheet. This term is used due to the oblong shape dimensions and measures inherit once they are placed on a shelf or Marks Card.
14. *Mark*: Each data point on the view.
15. *Show Me* (not pictured): When you click Show Me in the upper-right corner of the authoring interface, you will see thumbnails for 24 different chart types. If you are using a combination of dimensions and measures required to create each respective chart, the thumbnail will be in color; otherwise it will be grayed out. Clicking a full-color thumbnail will draw that visualization with the combination of fields you are using. Show Me provides a nice shortcut to creating several useful chart types, but this book will primarily focus on creating charts manually. I hope that by not relying on Show Me, you'll gain a better understanding of how each visualization in Tableau is created.

I will close this chapter by sharing two things that I like to do when I open a new dataset in Tableau: view the underlying data and view the number of records.

View the Underlying Data

If I am working with a new dataset that has been provided to me, I like to get a general feel for the types of data each field provides. You can easily view this in a tabular form in Tableau in a few different ways:

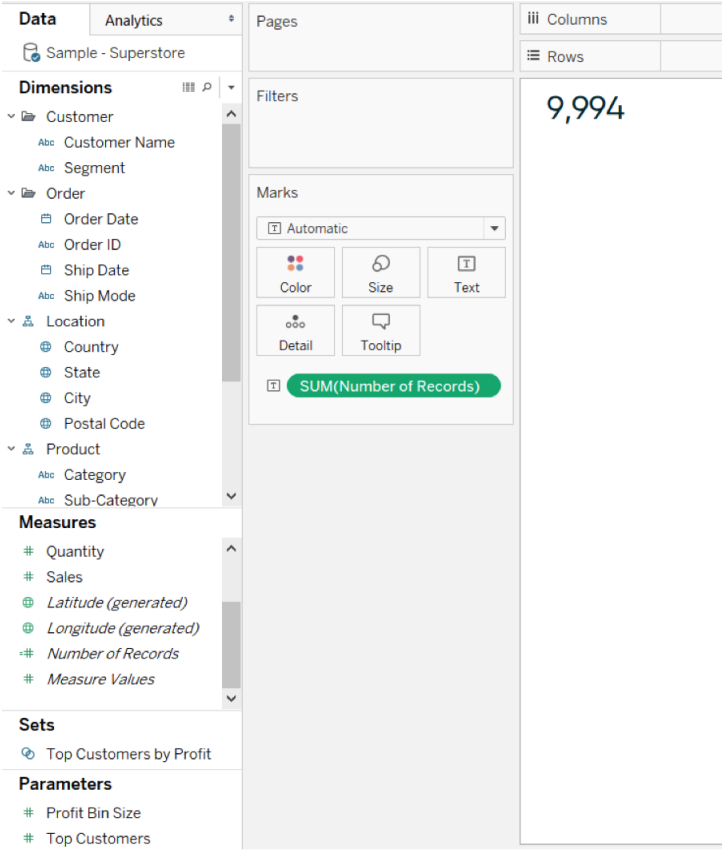
- Right-click the data connection in the data window and choose View Data.
- Click Data in the top navigation, hover over the data connection, and choose View Data.
- Click the first tab in the bottom of the worksheet view.

Whichever method is used, this provides a snapshot of the data so that you can get a general feel for the types of data that are available, if some fields contain nulls, what fields may be most useful to "slice and dice" your measures, and so on.

If you want to look at one field at a time, a handy trick is to right-click that field on the Dimensions/Measures area of the Data pane and choose Describe. A window will pop up to provide you with helpful information about the respective field.

View the Number of Records

If you look at the bottom of the list of measures on the Measures area of the Data pane, you will see a field called Number of Records. This is a special field that Tableau automatically generates for you, which is indicated by the italic formatting. Number of Records is actually a calculated field that simply equals 1. What this does is adds a column with an entry of 1 to each row of your data, so Tableau can count the number of records in the dataset. To view how many records are in your dataset, on a blank worksheet, drag the Number of Records field to the Text Marks Card:



I like to do this when I am getting started with a new dataset for two reasons:

- This provides a quick quality assurance check. For example, if the number of records is lower than you expected, you may need to ensure you haven't filtered the dataset or that the data provider gave you the correct output.
- Having a ballpark idea of the number of records in a dataset can provide a clue on whether I need to take extra steps to keep the workbook running efficiently. If I find that I am working with a very large dataset, I may consider additional ways to aggregate the data and/or keep the size of the data in mind when creating calculated fields (as some are more efficient than others). Efficiency tips are covered in Chapter 58.

After I've got a feel for the size of the data and the type of data I have available, I start creating views and doing some discovery analytics, which we will discuss in future chapters.

CHAPTER 6

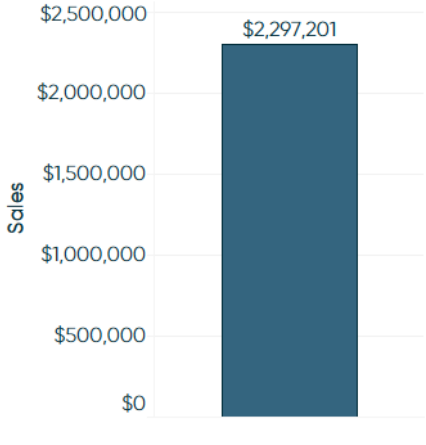
Dimension Versus Measure

When you connect to data, Tableau will classify each field as a dimension or a measure. Tableau will then group the fields by their dimension or measure classification on the lefthand side of the workspace. Having a good understanding of the differences between dimensions and measures makes it much easier to work with the data in Tableau.

What Is a Measure?

According to Tableau's Knowledge Base, a measure is a field that is a dependent variable; that is, its value is a function of one or more dimensions. Tableau treats any field containing numeric (quantitative) information as a measure.

Consider the following bar chart, created in Tableau with the Sales measure from the Sample – Superstore dataset:

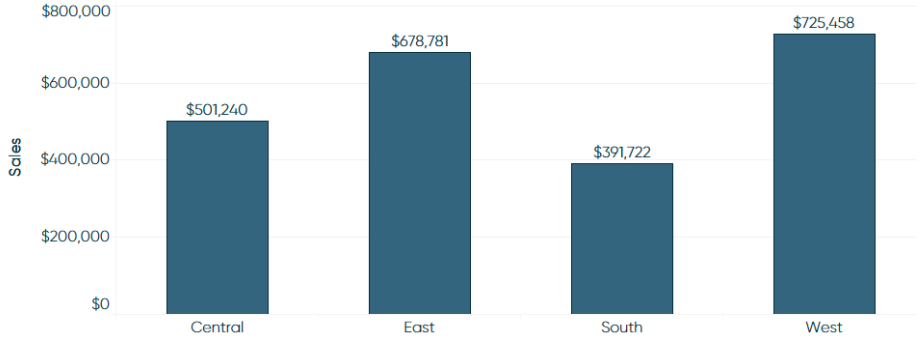


Sales is quantitative, so by default, Tableau will guess that the field is a measure. It can be considered a dependent variable, because a measure by itself does not provide much value. The value of $2,297,201 is meaningless by itself. It is dependent on context that comes in the form of being broken down by dimensions.

What Is a Dimension?

According to Tableau's Knowledge Base, a dimension is a field that can be considered an independent variable. By default, Tableau treats any field containing qualitative, categorical information as a dimension.

Here is the same Sales measure from before, broken down by the dimension of Region:



Now that our sales total has been broken down by region, we are able to start gaining insights from the data. One insight that emerges is that the South region has relatively low sales compared to the other regions. This is a descriptive insight that materialized only when we combined measures and dimensions together.

Generally, the measure is the number; the dimension is what you "slice and dice" the number by.

That being said, there can be exceptions to this rule, so it helps to understand how Tableau treats these types of fields. Consider a business that has unique numerical order IDs for each sale (i.e., order 1 is assigned the number 1, order 2 is assigned the number 2, etc.). Looking at the definition just provided, Tableau will classify this Order ID field as a measure the first time you connect to a dataset containing the field. However, Order ID is a dimension because we would "slice and dice" a measure, such as Sales, by Order ID to see how much revenue we brought in per order.

Another rule of thumb I follow is that if it doesn't make sense to sum up a number, it is likely a dimension. That's the case with the hypothetical Order ID field just men-

tioned. There would never be any value in adding up all of our Order ID numbers to get the total, and sure enough, this field should be a dimension instead of a measure.

One more case that comes to mind where Tableau can misclassify fields is when you have a field that should be a measure, that has the word NULL in the first entry under the column header in your data. The word NULL would be seen as a string value to Tableau, and thus qualitative, which would cause Tableau to classify the field as a dimension.

The good news is that any field that is misclassified can easily be reclassified by right-clicking the field from within the Dimensions or Measures area of the Data pane and choosing "Convert to dimension" or "Convert to measure" as appropriate. The same thing can be achieved by dragging and dropping the field into the Dimensions or Measures area of the Data pane.

An understanding of how dimensions and measures work in Tableau, combined with the basic data preparation just mentioned (when applicable), will make it easier to create visualizations moving forward.

CHAPTER 7
Discrete Versus Continuous

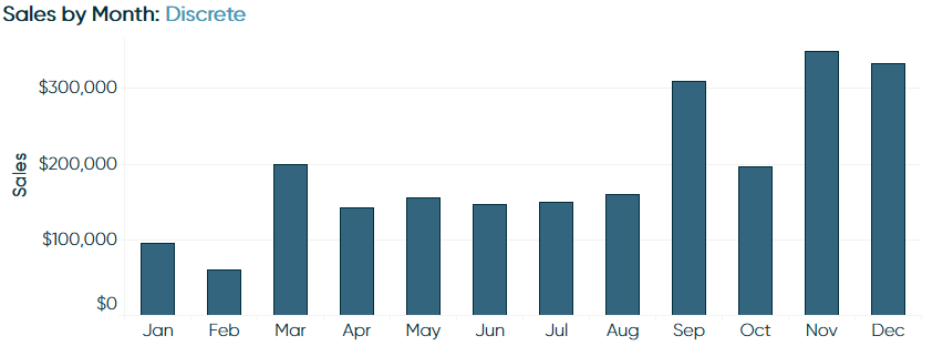
The second big way Tableau classifies each field you are using is as discrete or continuous. This classification has an impact on what types of visualizations you can create as well as how they will look, so having a good grasp on what this distinction means is core to your understanding of how Tableau looks at your data.

It is easy to know if a field is being used as discrete or continuous based on its color. Blue indicates that a field is discrete, while green indicates that a field is continuous. If your first guess was that these colors represented whether a field was a dimension or measure, you are not alone. The thought that blue represents dimensions and green represents measures is the most common myth in Tableau. It's easy to understand why because, by default, dimensions are categorized as discrete variables, and thus have a small blue icon in front of them in the Dimensions area of the Data pane. Measures are categorized as continuous variables, so they are prefaced with a green icon in the Measures area of the Data pane.

I assure you that the color-coding identifies discrete versus continuous fields and not dimensions versus measures. Measures can actually be used as discrete fields or continuous fields, and the same is true for some dimensions, such as dates.

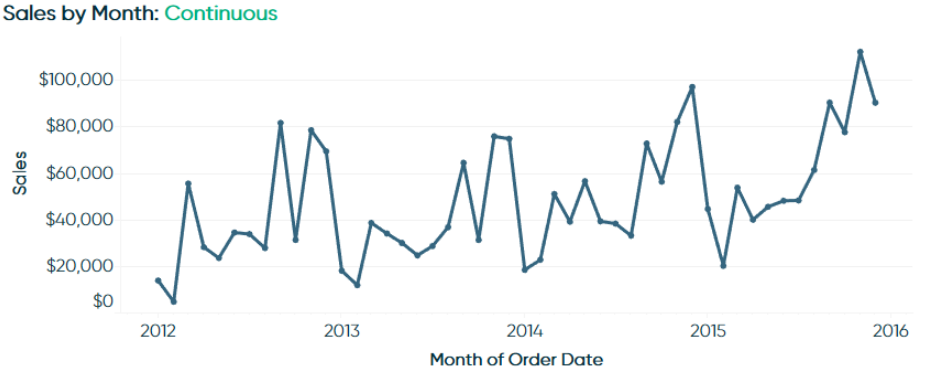
So what does this mean for your visualizations? I will illustrate using two rules of thumb I have when considering if a field should be used as discrete or continuous: *Discrete fields draw headers; continuous fields draw axes*.

Take a look at the following visualizations that look at sales by month. In the first chart, I am using date as a *discrete* field:



Notice that there is a *discrete* header for each month.

In the second chart, I am using the same exact data, but I have changed the Date dimension from discrete to *continuous*:



As you can see, I now have a *continuous* axis of time. Since the axis is continuous, I cannot change the order of the dates; they follow a chronological order from oldest date on the left to most recent date on the right. On the other hand, when the Date dimension is being used as discrete (as pictured in the first image), I am able to change the order of the dates. For example, I could sort the bars in descending order, with the month with the highest sales first, and the month with the lowest sales last. Which brings me to my second rule when determining whether I should use a field as discrete or continuous:

Discrete fields can be sorted; continuous fields cannot

So how might you use this in the real world? If you know that you want to look at a trend over a continuous period of time, you would want to use a continuous date, which will be colored green on the view. If your analysis requires you to have discrete

marks that can be sorted, you would use the field as discrete, which will be colored blue on the view.

This date example is just one of many possibilities, but remembering the two rules outlined in this chapter will help you understand how the use of discrete and continuous fields are impacting the data visualizations you create in Tableau.

CHAPTER 8

Five Ways to Make a Bar Chart/An Introduction to Aggregation

Now that we've gone through some fundamental topics, such as dimension versus measure and discrete versus continuous, and you have an overview of the authoring interface, you're ready to start creating visualizations in Tableau. This chapter shares five different ways to create a bar chart and provides an introduction to the topic of aggregation.

Perhaps the most important lesson from this chapter is a line I hear myself saying almost every day: *there is always more than one way to do the same thing in Tableau*. You will find your own techniques, form your own habits, and hear different opinions—and they likely will all have merit. You truly can take multiple paths to get to the same end result in Tableau. We are about to discuss *five* different ways to create a bar chart, and it's not even a comprehensive list!

Five Ways to Create a Bar Chart in Tableau

Option #1

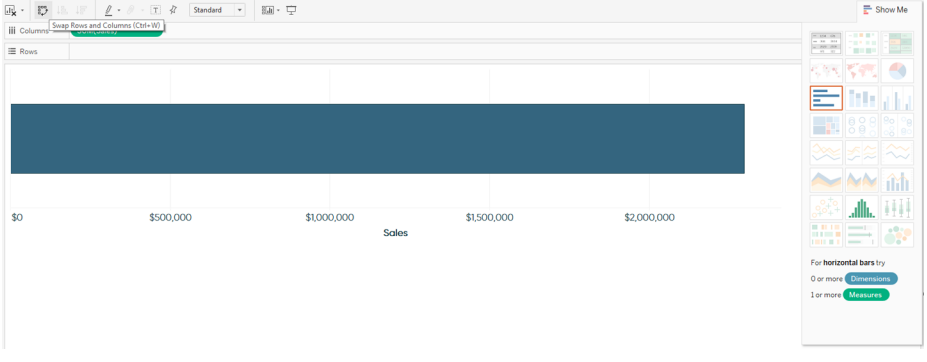
The easiest way to start a bar chart in Tableau is to simply double-click the measure you want to visualize from the Measures area of the Data pane. Let's double-click the Sales measure. By default, this will place a continuous pill for Sales on the Rows Shelf, which creates a vertical bar.

Option #2

You could have got to this same place by left-clicking and dragging the Sales measure from the Measures area of the Data pane to the Rows Shelf.

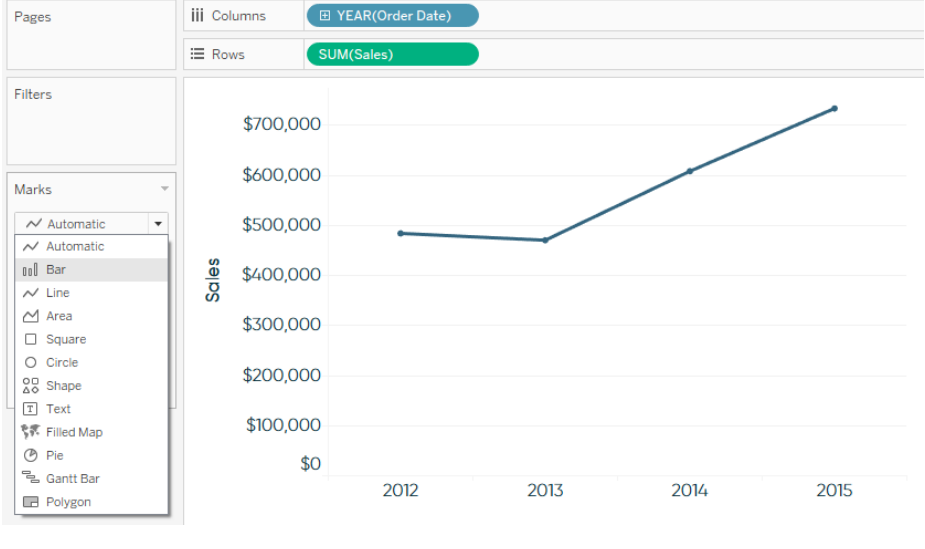
Option # 3

"Pre-select" the Sales measure by clicking it, then click "horizontal bars" in the Show Me options. This creates a different orientation than the first two approaches because the Sales measure is placed on the Columns Shelf instead of the Rows Shelf. If you prefer the vertical orientation, you can click the Swap icon (pictured here), use the Ctrl-W shortcut, or drag and drop the Sales measure from the Columns Shelf to the Rows Shelf:



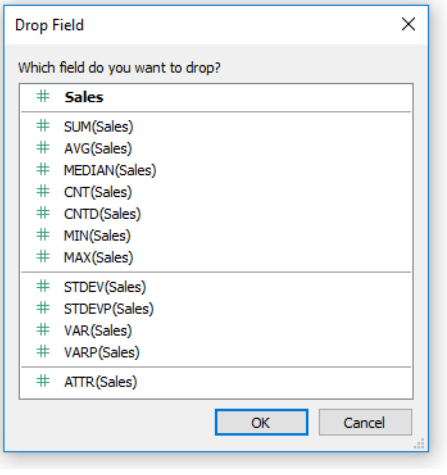
Option #4

You can change the mark type on an existing view to Bar. Let's say you are looking at the Sales measure by Year of Order Date as a line graph. You can convert the line graph to a bar chart by changing the mark type on the Marks Shelf from Automatic (line) to Bar:



Option #5

Similar to option #2, but if you *right*-click and drag the Sales measure from the Measures area of the Data pane to the Rows Shelf, you will be presented with the option to choose the data aggregation before the bar chart is created:



An Introduction to Aggregation in Tableau

By default, every measure on a view in Tableau is aggregated in some way. It can be easy to not notice this when you're getting started because the default aggregation is SUM, and that works for most situations. Look back at the views created through the five approaches in the previous section; the Sales measure is preceded by the word SUM to show you how the field is being aggregated. There are several other aggregation options in Tableau, and the choice will influence your analysis. Here is a list of some of the options and the results you can expect to see for each choice (using the Sales measure):

SUM

All of the sales added up together

AVG

All of your sales added up, divided by the number of records

MEDIAN

When sorted, the sales amount for the record in the exact middle of your data

CNT

A count of all records with sales

CNTD
: A count of distinct sales amounts

MIN
: The smallest sales value in your data

MAX
: The largest sales value in your data

Knowing that there are always multiple approaches to the same solution in Tableau and having an understanding of aggregation will help tremendously as we start working with different visualizations and creating calculated fields in future chapters.

CHAPTER 9

Line Graphs, Independent Axes, and Date Hierarchies

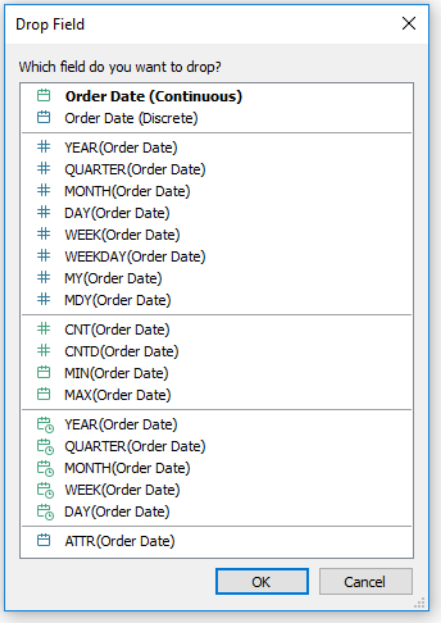
In the previous chapter, I shared five different ways to make a bar chart in Tableau. This chapter walks you through how to build another key data visualization: the line graph. For all the fancy visualizations I enjoy building with Tableau, at the end of the day, bar charts and line graphs are two of the most effective options available. While we're at it, we'll touch on some related topics, including date hierarchies and independent axes, so you can master this foundational graph.

How to Make a Line Graph in Tableau

A line graph is similar to a bar chart in Tableau in that you are looking at one or more measures with the option to "slice and dice" it by one or more dimensions. The important distinction between the bar chart and line graph is that the line graph should include an element of time. Let's build out a line graph using the Sample – Superstore dataset using Order Date as our element of time.

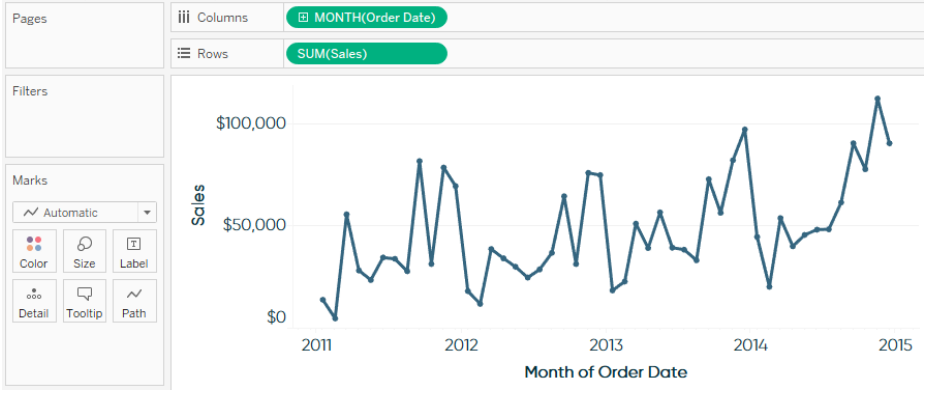
First, use any of the five methods discussed in Chapter 35 to create a bar chart that adds SUM(Sales) to the Rows Shelf. I'm going to simply double-click the Sales measure to start the view.

At this point, you could also double-click your element of time (Order Date) to start a line graph, but there is a better way. As with measures, dates also have an aggregation and can be used as continuous or discrete fields. The choices you make for these two classifications has an impact on how the visualization will look. Fortunately, it is easy to see all of the options if instead of double-clicking the Order Date dimension, you right-click and drag it to the Columns Shelf. Before Tableau generates the visualization, you will see the following options:



As you can see, each option has a blue or green icon next to it. Remember, the blue color coding in Tableau indicates discrete, while green color coding indicates continuous. The choice of whether you select a discrete or continuous option should be based on what type of visualization you want to create. Let's say that we want to look at a *continuous* trend over time, which means we can ignore the blue options for now.

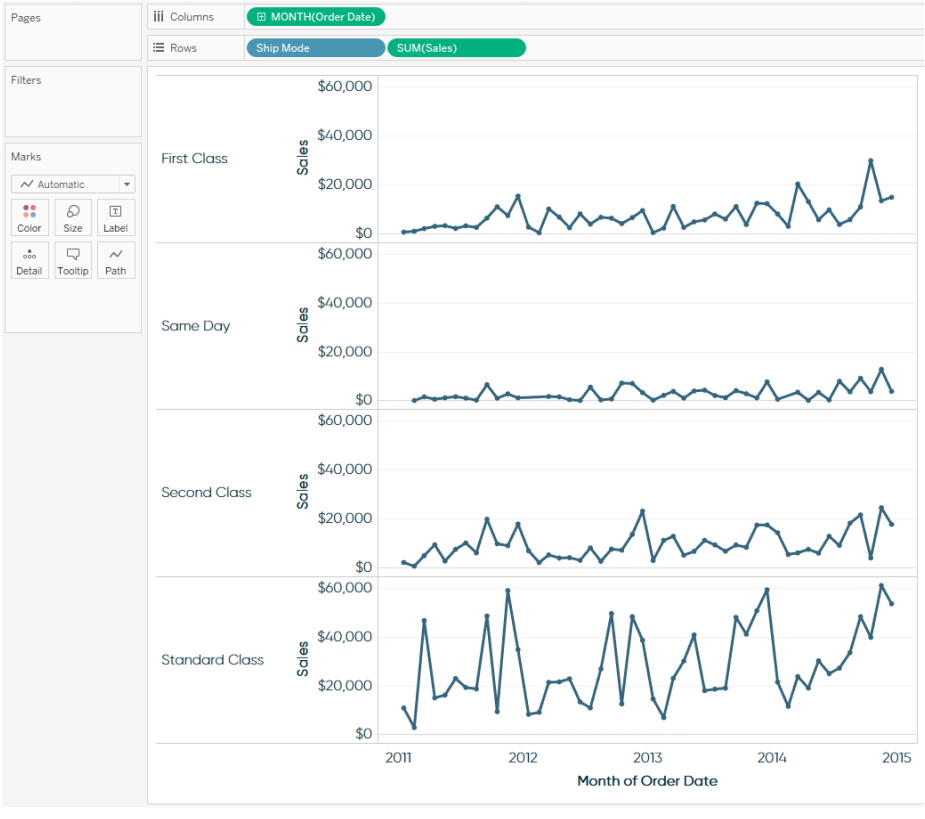
The next choice we have is how granular we want the continuous trend to be. This is called the DatePart and includes options such as year, quarter, month, week, and day. For this analysis, let's say we want to see a monthly trend over time. With these two requirements in mind, we know that we should pick the choice with a green icon with an aggregation of Month, which is the fourth choice from the bottom. After making this selection, the line graph looks like this:



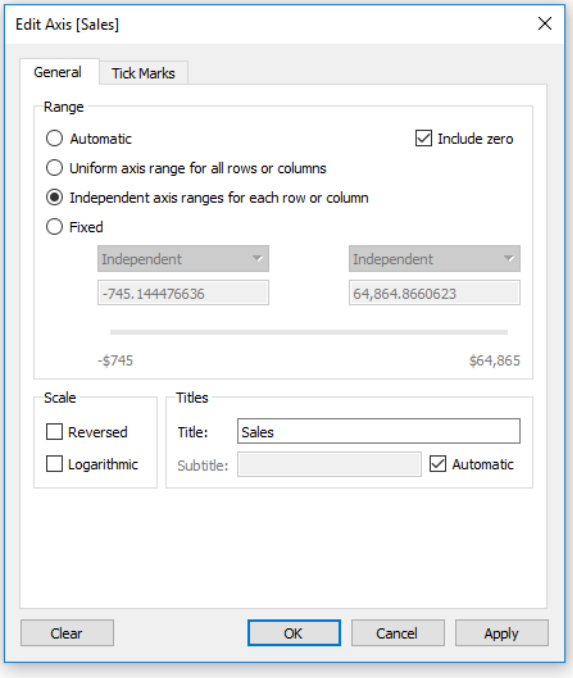
The small circles on each data point are called "markers" can be added by clicking on the Color Marks Card and choosing one of the "Markers:" options under Effects.

Independent Axes in Tableau

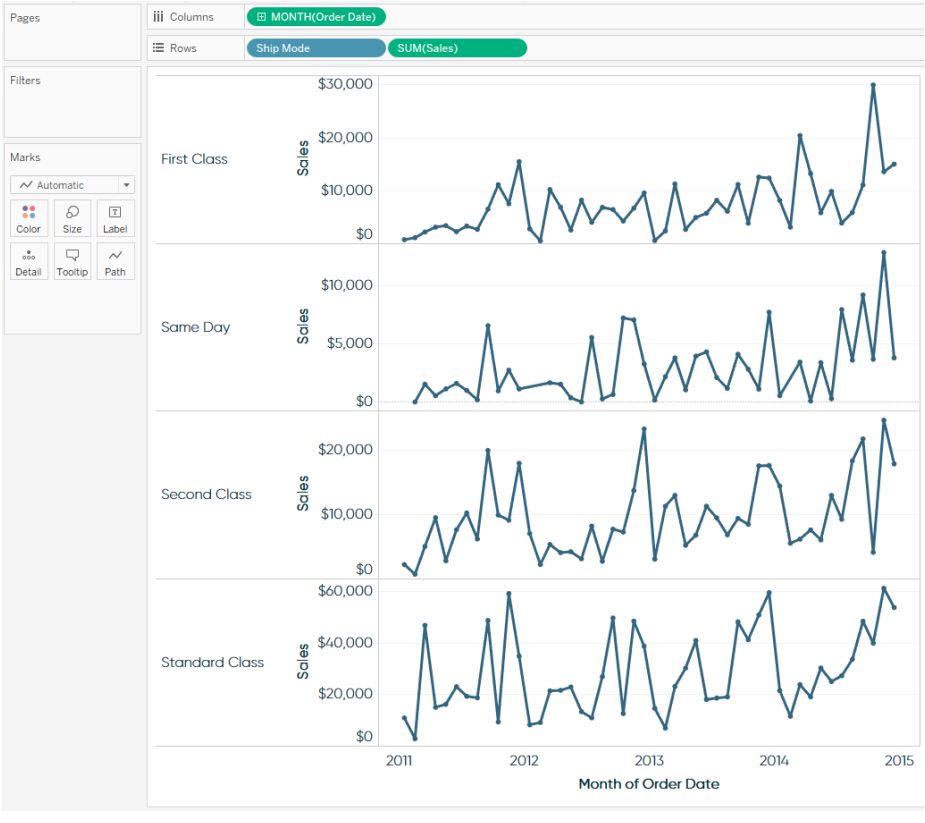
The line graph created in the previous section can now be sliced and diced by additional dimensions by simply dragging them to the Columns Shelf or Rows Shelf and dropping them in front of the continuous fields on the view (currently MONTH(Order Date) or SUM(Sales)). To demonstrate how axes work across multiple columns or rows in Tableau, I will drag the Ship Mode dimension to the Rows Shelf:



Notice that, by default, each row shares the same axis range from $0 to approximately $60,000, which is the largest range across all four ship modes. This default setting where the axes share the same range is helpful because it provides an apples-to-apples comparison across the four rows. However, it can be difficult to see the trends for each individual row. If you would like the four axes to have their own axis range, right-click any of the axes and choose "Edit axis." You will be presented with a dialog box where you can choose "Independent axis ranges for each row or column":

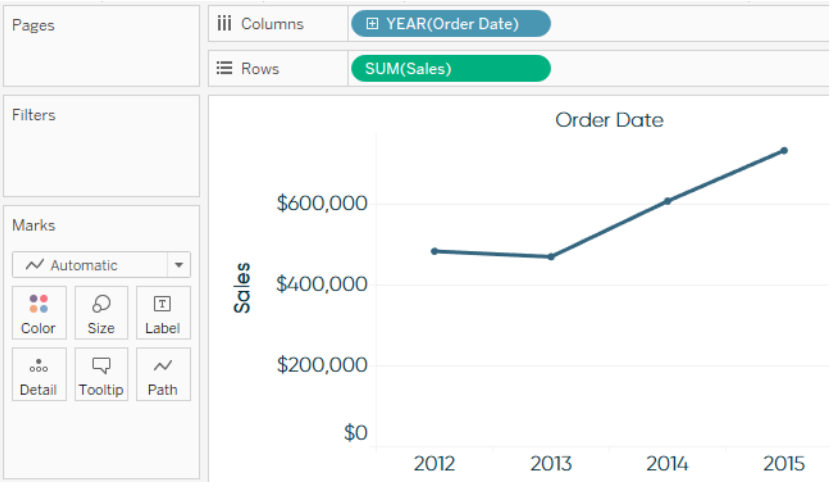


Upon making this selection, you will see your trend graph change so that each row has its own unique range:



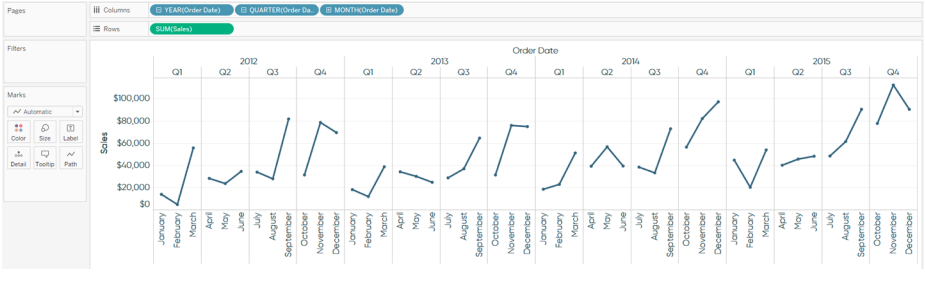
Date Hierarchies in Tableau

For the final section in this chapter, let's take a step back by building the line graph again, this time by first double-clicking the Sales measure and Order Date dimension. At this point, your line graph should look similar to this:

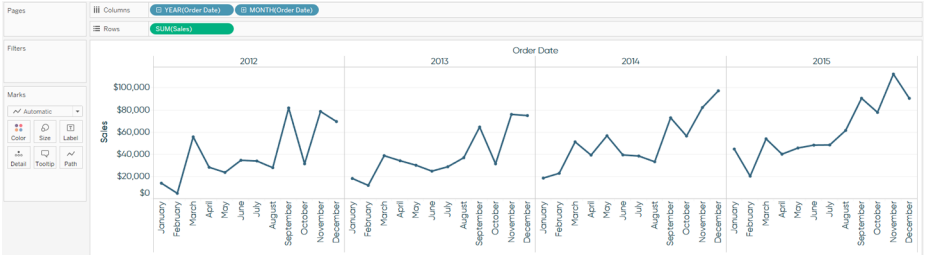


The blue YEAR(Order Date) pill is telling us that date is being aggregated by year and being used as a *discrete* field. When dates are being used as discrete fields, you will see a + sign on the field, which indicates this field has a hierarchy. Dates are one of the few special dimensions in Tableau that automatically receive a hierarchy, and it goes in this order: Year > Quarter > Month > Day.

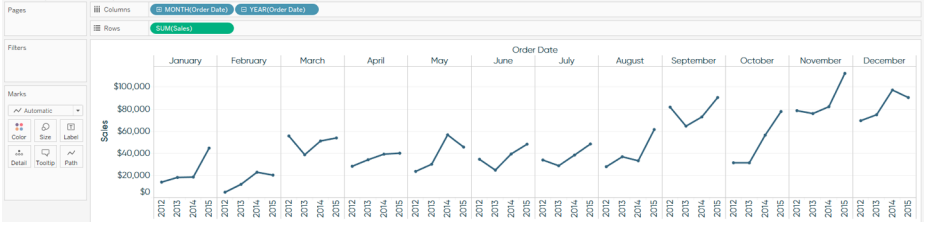
To utilize the hierarchy, simply click the + sign on the field. The field will expand to the next level of the hierarchy and provide a different view. Here's how this same view looks if I click the + on Year, then click the + on Quarter:



You can also drill back "up" by clicking the – sign that appears on fields where the + has already been clicked. What's nice about these fields is that, because they are discrete, they can be moved around into different orders to quickly create different analyses. The fields are processed in order, so with the last line graph pictured, the Sales measure is first cut by Year, then Quarter, then Month. To demonstrate a couple of possibilities, let's first remove Quarter from the view, leaving us with Year and Month:



At this point, we have a pretty standard analysis, where our years and months go in chronological order from oldest to most recent. This creates a seasonal analysis where you can compare four calendar years to each other. Look what happens when you simply change the order of Year and Month by dragging the Month pill in front of the Year pill:



The fields are processed in order, so now the Sales measure is first cut by Month, then Year. This completely changes the analysis into a four-year trend per month.

While line graphs may seem simple on the surface, they are extremely powerful visualizations, and Tableau provides the flexibility to use them for many different analyses.

CHAPTER 10

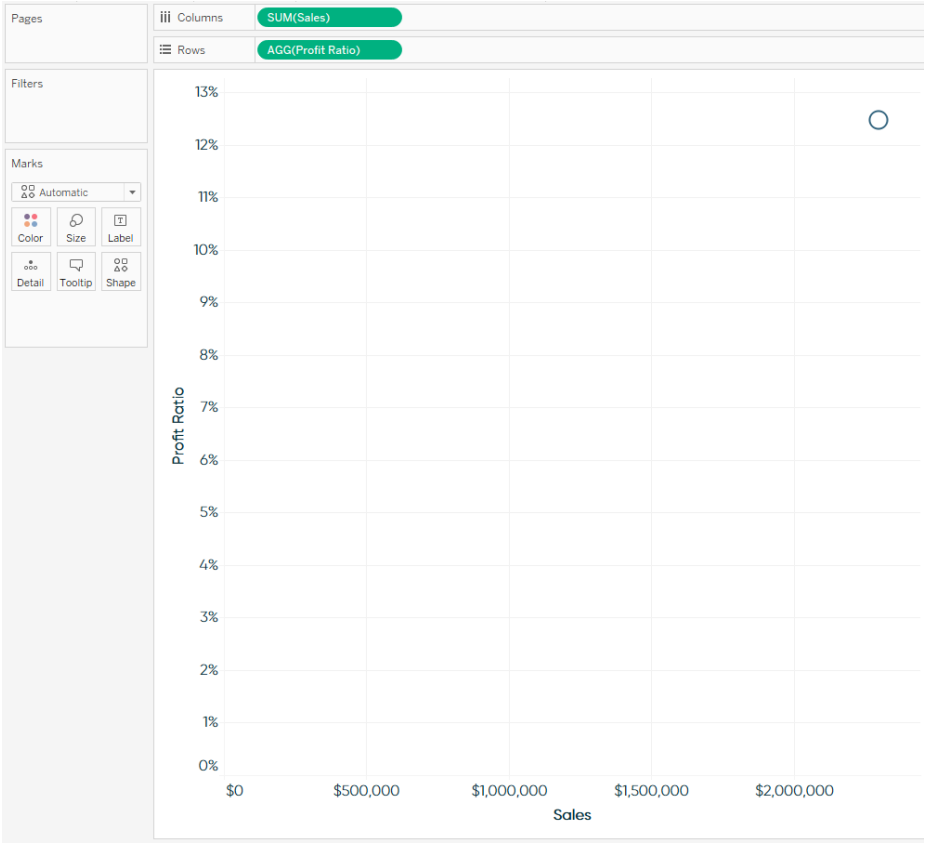
Marks Cards, Encoding, and Level of Detail

The Marks Cards in Tableau provide some of the most powerful functionality in the program because they allow you to modify a view's design, visualization type, user experience, and granularity of analysis all in one place. This chapter provides an overview of the Marks Cards available in the authoring interface as well as an introduction to the concept of a view's *level of detail*.

In Chapter 5, you saw that the default location of the Marks *Shelf* (or Shelves), which contain the Marks *Cards*, are located on the left side of the view to the right of the Data pane and under the Filters Shelf. The Marks Shelf and Marks Cards include the word "marks" because they change the marks, or data points, on a view.

An Explanation of Level of Detail

To help illustrate how each Marks Card impacts the marks on a view, we will be using this simple scatter plot looking at Profit Ratio and Sales:

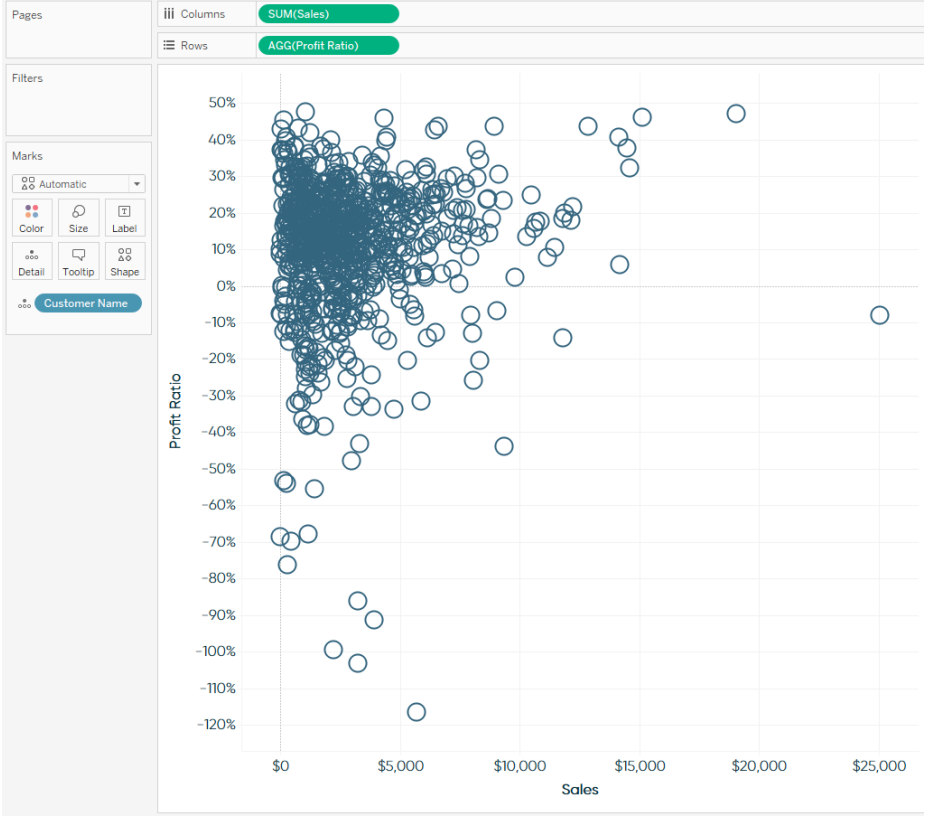


As you can see on the Marks Shelf, there are six different Marks Cards: Color, Size, Label, Detail, Tooltip, and Shape. Note that the Shape Marks Card is not available for every view, but appeared because we are creating a scatter plot in this example. To help explain what each of these cards does, I'm going to start a little out of order and discuss the Detail Marks Card first.

I'm starting with the Detail Marks Card because level of detail is a critical aspect of analyzing data in Tableau, but it took me a while when I started using Tableau to realize its importance. It's not a difficult concept, but just one of those that wasn't explained to me early on. Once you wrap your head around the topic of level of detail, your authoring in Tableau will feel much more fluid and it will be easier to use the powerful level of detail expressions functionality in Chapter 16.

The first thing you need to know is that every visualization has a level of detail. It helps me to think about level of detail as the most granular level where the analysis takes place. Consider the preceding scatter plot. At this point, we are not slicing and

dicing the Profit Ratio and Sales measures by any dimension. For that reason, you see just a single mark, which represents the intersection of Profit Ratio and Sales for every record combined in the Sample – Superstore dataset. As you add dimensions to the view, the analysis becomes more granular, so the level of detail changes. For example, if we wanted to do this Profit Ratio versus Sales comparison at the customer level, we can drag and drop the Customer Name dimension from the Dimensions area of the Data pane to the Detail Marks Card, which results in the following:

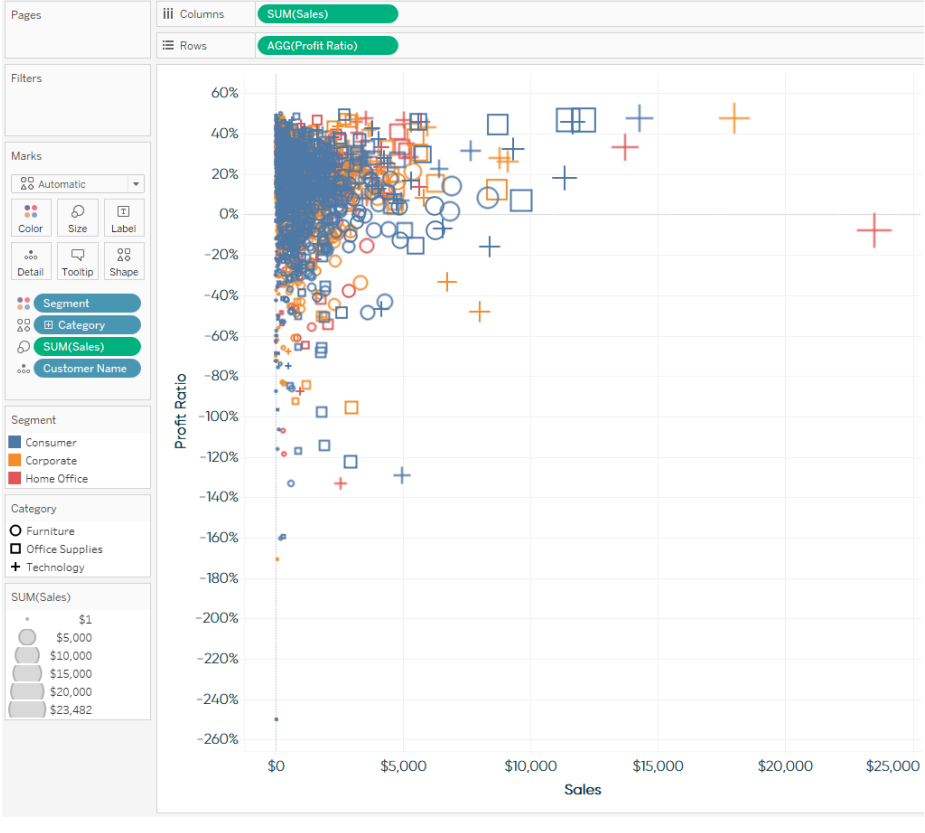


We have changed the most granular level of the analysis from the entire file to customer. Another handy feature of Tableau is you can look in the lower-left corner of the worksheet for a summary of the view. When we changed the level of detail for this scatter plot, the mark count changed from 1 (the entire file) to 793 (the number of customers).

Note that adding dimensions in other places on the view will also change the level of detail, but the Detail Marks Card is available to make the analysis more granular without changing the structure of the view if needed.

An Introduction to Encoding

The Color, Size, and Shape Marks Cards all allow you to "encode" the marks on a view. Encoding marks adds depth to an analysis by mapping marks to colors, sizes, and/or shapes. Here's how the scatter plot view looks if we put Segment on the Color Marks Card, Sales on the Size Marks Card, and Category on the Shape Marks Card:



There are now three different legends corresponding with the encoding that was just added. For consistency, this encoding will conveniently carry through on other views as they are created. For example, if I color a new view by the Segment dimension, Consumer will still be identified as blue, Corporate will still be identified as orange, and Home Office will still be identified as red. These colors can be changed by clicking the color legend and mapping new colors.

These three Marks Cards can also be used to change all the marks on the view instead of mapping to a specific dimension. Instead of placing a dimension on the Marks Cards, click each card to experiment with changing the color, size, or shapes for all of

the marks at the same time. Simple changes to the Marks Cards can substantially improve the design of a data visualization.

Label and Tooltip Marks Cards

The Label and Tooltip Marks Cards can both be used to add written information to a view. The difference is that whatever information is added as a label will show up on the view itself, while any information added to the tooltips will only show up when an end user hovers over marks on the view.

This is an important distinction that should be considered when you are authoring in Tableau. For example, if your visualization will be printed or copied and pasted as a screenshot, you would want to add the information to Label to ensure the information is shown on the view. On the other hand, if you know your end users will be interacting with Tableau, you may opt to save some on-screen real estate by providing the information through tooltips.

As with the other Marks Cards, labels and tooltips can be customized with specific information by dragging and dropping fields onto the Label and Tooltip Marks Cards, respectively. You can click into each of these two Marks Cards to toggle them on and off, change the formatting, and even type in additional information.

The six Marks Cards introduced in this chapter can dramatically improve the depth, design, and user experience of your visualizations. Utilizing this functionality will not only help your analyses, it will make your final product more effective with end users.

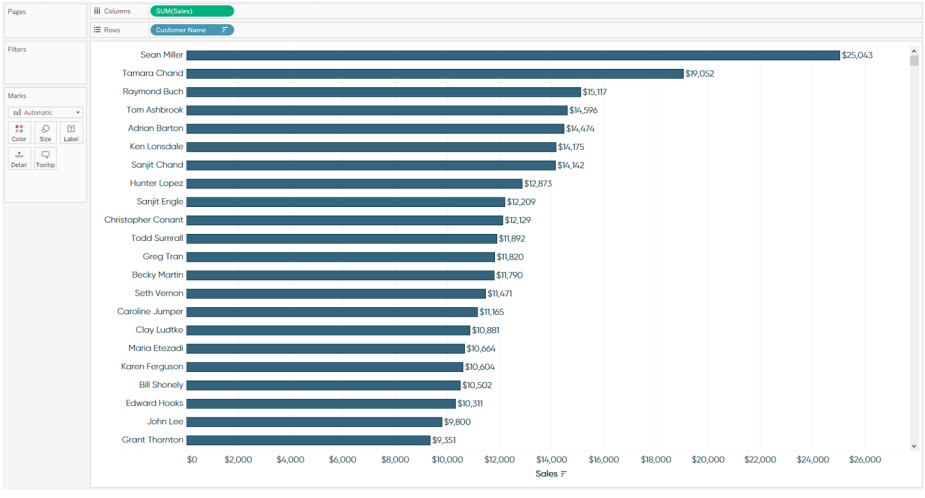
CHAPTER 11

An Introduction to Filters

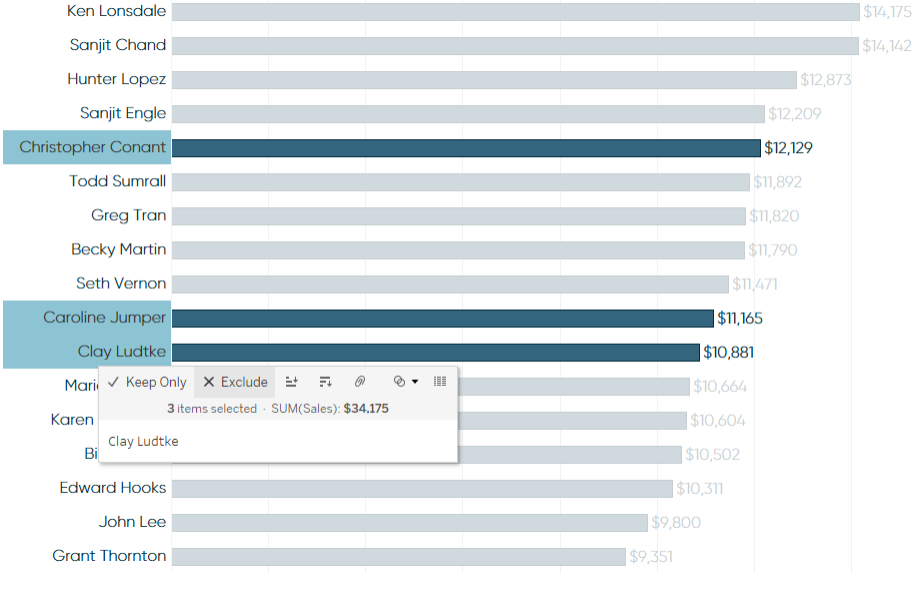
Tableau provides the ability to filter individual views or even entire data sources on dimensions, measures, or sets (see Chapter 15). This filtering capability can serve a variety of purposes, including minimizing the size of the data for efficiency purposes, cleaning up underlying data, removing irrelevant dimension members, and setting measure or date ranges for what you want to analyze. What's more, most of these filters can be manipulated by you and your end users—a powerful tactic for finding stories in the data. This chapter offers an introduction to filters in Tableau, including extract filters, data source filters, dimension filters, and measure filters.

Dimension Filters in Tableau

For this chapter, we will start with the most granular filters (dimension filters and measure filters) and then work our way out to the more "macro" filters. To help illustrate dimension filters and measure filters, we will use this simple bar chart, which is showing the sales per customer from the Sample – Superstore dataset in descending order (the customer names are sorted in descending order by sum of Sales; one way to achieve this is by clicking the sort descending icon found immediately above the Columns Shelf):

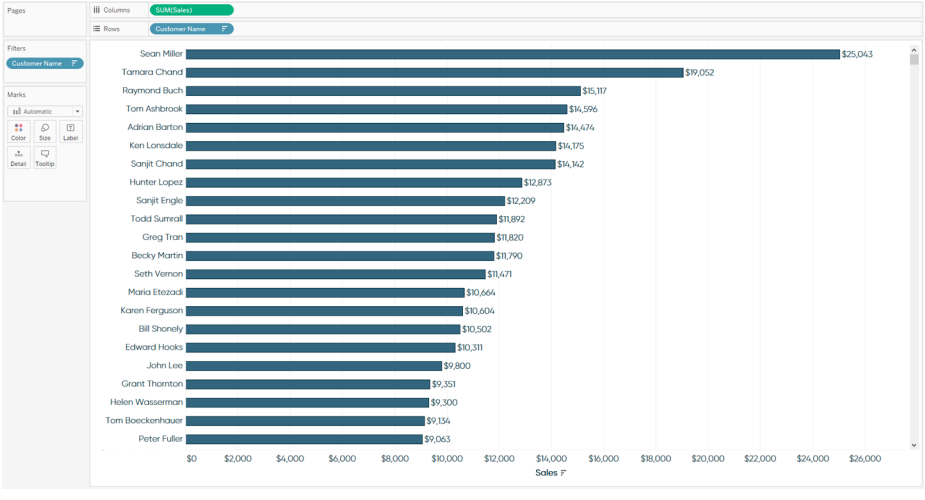


The first, and most basic way to filter out marks on a view, is to select the marks, and then choose to keep or exclude them. Let's say that our boss has an extreme aversion to names that start with the letter "C", so we want to make sure we remove those customers from the report. To do so, you can go through the list of customers, and use multiselect (Ctrl-Click on a PC) to highlight them. After selecting the names that you want to filter, hover over one of the dimension members (in this case, customer names), and click Exclude:

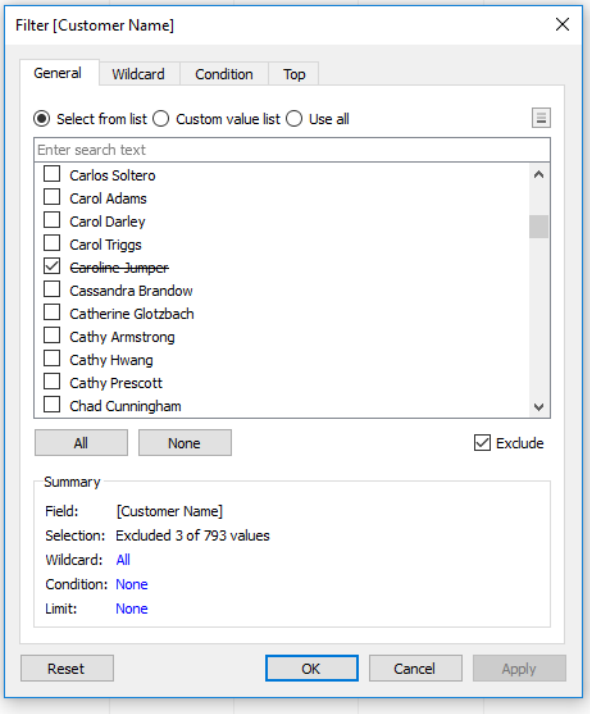


Note that there is also an option to Keep Only, which would do exactly what it sounds like, and *keep only* the selected names on the view.

After choosing Exclude, notice that the Customer Name dimension is added to the Filters Shelf in the upper-left corner of the view:

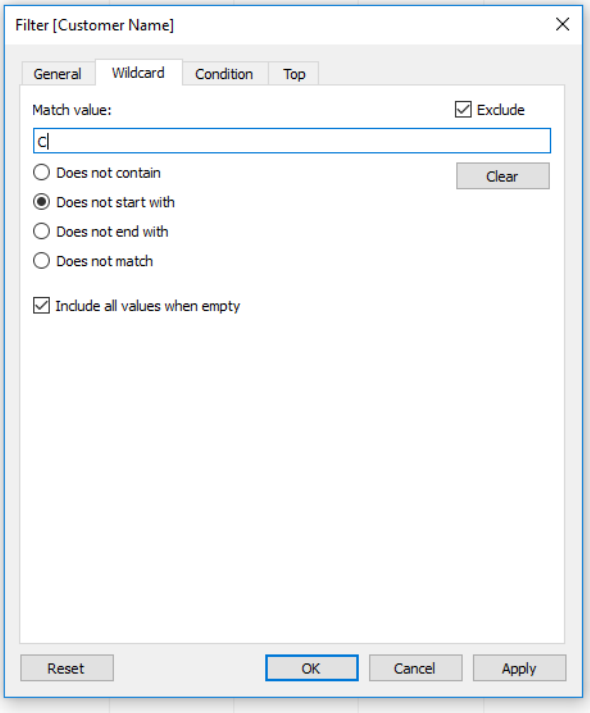


That's because Tableau created a dimension filter for you when you excluded the Customer Name dimension members from the view. You could have got to this same point by dragging the Customer Name dimension from the Dimensions area of the Data pane to the Filters Shelf and manually setting up the dimension filter. Let's take a look under the hood at the options for manually setting up a dimension filter by right-clicking the Customer Name filter and choosing Edit Filter:



Notice that Tableau created an "Exclude" dimension filter for us when we chose to exclude the three names that start with the letter "C" from the view, as indicated by the box for "Exclude" being checked. There is a summary box at the bottom of the filter that is telling us the criteria for our filter. We currently are excluding 3 of 793 total marks, or customer names, from the view. This manual selection of individual dimension members is the most precise form of filtering, but can also be quite tedious. This is especially true when filtering on the Customer Name dimension, which has 793 individual dimension members.

Fortunately, there are three other tabs at the top of our dimension filter dialog box, which help us refine the filter criteria. Instead of manually selecting all names that start with the letter "C", I'll navigate to the "Wildcard" tab and leverage the "Does not start with" function:

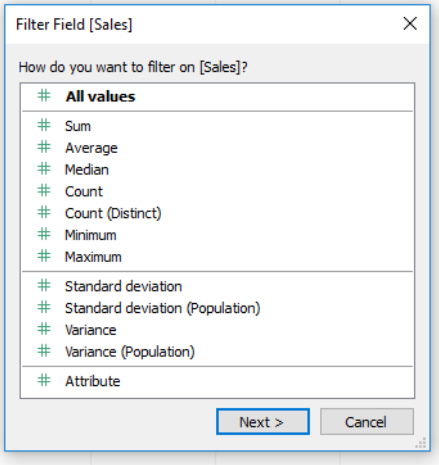


After applying this logic, I am left with 726 of 793 customers—and none whose first names start with "C" so our boss can rest easy! After adding any criteria to one of the four tabs, you can always navigate back to the Summary card on the General tab to see all the rules in the filter. Each rule acts as an AND statement, meaning that the dimension members must meet all criteria to be included or excluded from the view.

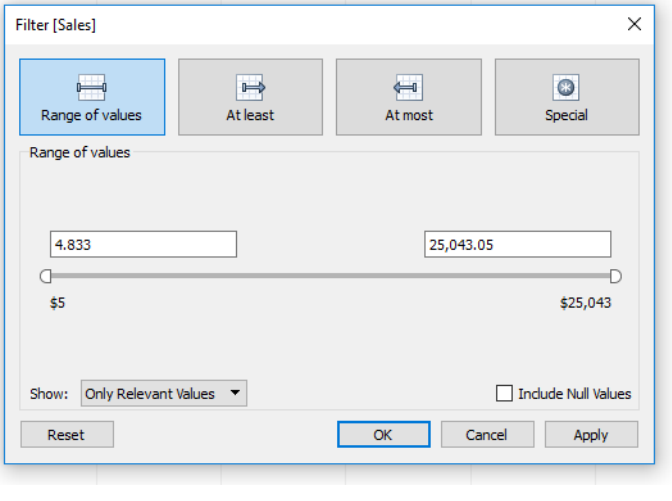
There are two additional tabs that can be used to add rules to a dimension filter. The Condition tab allows you to add quantitative thresholds that must be met and the Top tab allows you to focus only on the Top or Bottom dimension members based on a measure of your choosing.

Measure Filters in Tableau

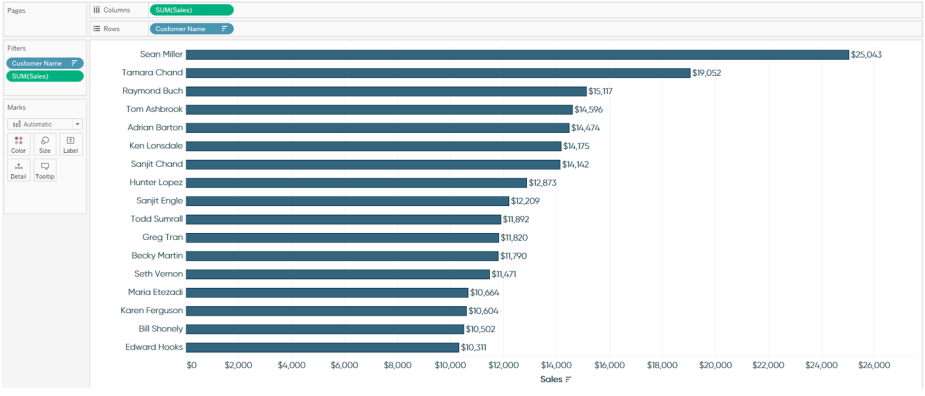
Measure filters are similar to dimension filters, but the filtering options are different between the two. To illustrate, drag the Sales measure from the Measures area of the Data pane to the Filters Shelf. The first difference you'll notice is that before you select the measure filter criteria, you are asked to choose the aggregation of the measure:



I will choose Sum, which is the default for most measures. After making the choice of aggregation, you can choose to filter on a range of values, a minimum threshold, or a maximum threshold:



"Range of values" provides the most flexibility and is the best (and only) choice if you want you and your end users to be able to control both the bottom end and top end of the range. For now, I'll change just the bottom end of the range to be $10,000. After changing the low end to $10,000 and clicking OK, my view looks like this:



Note that I now have two filters on the Filters Shelf; one dimension filter and one measure filter. All of the filters that you place here will act as a condition in an AND statement. So at this point, in order for a customer name to be shown on the view, it must not start with the letter "C" and sales must be between $10,000 and $25,043.05.

Note that you can add additional dimension or measure filters, even if the fields are not used to generate the view.

More Options with Filters

Sometimes, you want a filter to be permanent and do not have any interest in changing its criteria. Other times, you would like to change the criteria or even let your end users decide what is filtered on the view. Any filter can be shown to you and your end users for easy manipulation by simply clicking a filter from the Filters Shelf and choosing Show Filter. Upon doing so, you will see the filter appear in the upper-right corner of the view. If you're not happy with the default format of the filter, you can click the down arrow in the upper-right corner of the filter being shown on the view and change it. Dimension filters have seven different formats to choose from and measure filters have three different formats.

Lastly, dimension and measure filters are applied to only the worksheet you added it to by default. However, filters can be changed to apply to additional individual worksheets, every worksheet that shares the data source, or as of Tableau 10, even all related data sources. This provides the ability to make filters "global" so that changing their criteria in one place filters the views throughout the workbook. To change the worksheets that a filter is applied to, click the filter on the Filters Shelf, hover over Apply to Worksheets, and make your selection.

Macro Filters

Dimension and measure filters are the most granular form of filtering in Tableau, and will be used most regularly. Occasionally though, you may want to apply a filter at a higher level, such as the data source or extract. This type of "macro" filter provides the benefit of reducing the size of the dataset, one of my top five efficiency tips for working with data in Tableau (listed in Chapter 58).

To add this type of filter, navigate to the data source editor by doing one of the following:

- Right-click the data source from the Data Window and choose Edit Data Source.
- Click Data in the top navigation, hover over the data source of interest, and choose Edit Data Source.
- Click the Data Source tab at the bottom of the authoring interface. Once there, you will see an option to add filters to the live data source or data extract in the top-right corner. After you choose a dimension or measure to use as a filter, the filter dialogs will look very familiar to the filters introduced to this point, only now, the filters will be applied to the entire data source before you create individual views.

CHAPTER 12

An Introduction to Calculated Fields

Possibly the most powerful feature of Tableau is its ability to allow authors to create new data from existing data through calculated fields. Calculated fields can be used to create new dimensions such as segments, or new measures such as ratios. They can also be used with any data type, a multitude of functions and aggregations, as well as logical operators, making the calculated results virtually limitless. This chapter will introduce calculated fields by walking you through how to create two new measures and one new dimension in the Sample – Superstore dataset.

Why Use Calculated Fields?

You may be wondering what's with all the praise regarding calculated fields? After all, I've also suggested that it's best to prepare your data as much as possible before it gets to Tableau, and that data should include all of the required fields for your analysis. Right?

There are many reasons to leverage the calculated fields functionality in Tableau. Here are just a few:

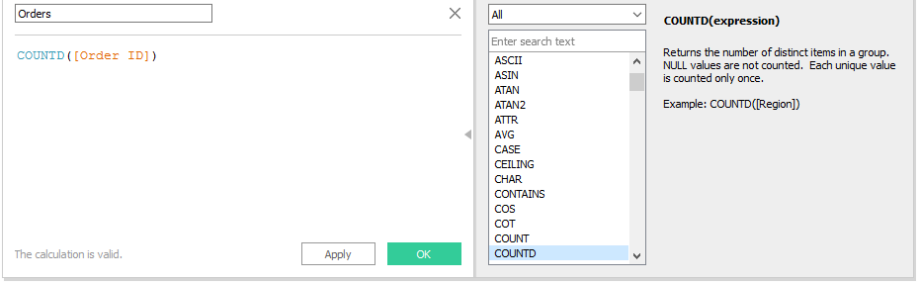
- To segment your data in new ways on the fly
- To prove a concept such as a new dimension or measure before making it a permanent field in the underlying data
- To filter out unwanted results for better analyses
- To take advantage of the power of parameters (introduced in Chapter 14), putting choice in the hands of your end users
- To calculate ratios across many different variables in Tableau, saving valuable database processing and storage resources

To bring the concept of calculated fields to life, let's pretend we are working with the Sample – Superstore dataset, and want to evaluate the average order value (AOV) for the product sub-categories we manage compared to the rest of the company. AOV is defined as total sales revenue divided by the number of orders. While this dataset has Order ID as a dimension, it does not have the number of orders as a measure, which is the denominator for the AOV calculation.

To isolate the number of orders, I will first create a calculated field to count the number of orders. The formula to count the distinct number of orders will be COUNTD of the Order ID dimension. To start a calculated field, you can do one of the following:

- Click the down arrow in the upper-right corner of the Dimensions area of the Data pane and pick Create Calculated Field.
- Right-click a blank space on the left sidebar and choose Create Calculated Field.
- Click Analysis in the top navigation and choose Create Calculated Field.
- Right-click one of the fields you want to use as part of your calculated field, hover over Create, and choose Calculated Field.

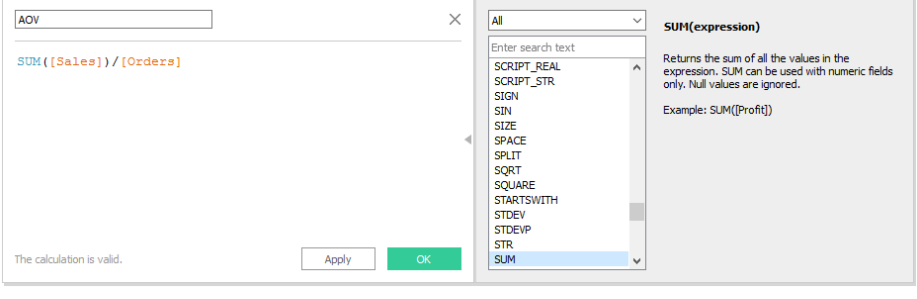
For this first calculated field, because I know that I need the Order ID as part of my calculated field, I will start the calculated field by right-clicking the Order ID dimension on the Dimensions area of the Data pane, hovering over Create, and clicking "Calculated field." This opens a new dialog box where I can enter the formula for my calculated field:



On the righthand side of the calculated field dialog box there is a definition of the COUNTD expression. Any time you see a blue color-coding when creating a calculated field, you can click the blue-colored word to get a definition and example of that particular function; this is a great way to learn the syntax. If you do not see the "fly-out" window, click the sideways arrow found on the middle-right of the calculated field dialog box. After clicking the OK button, you will see a new measure for Orders

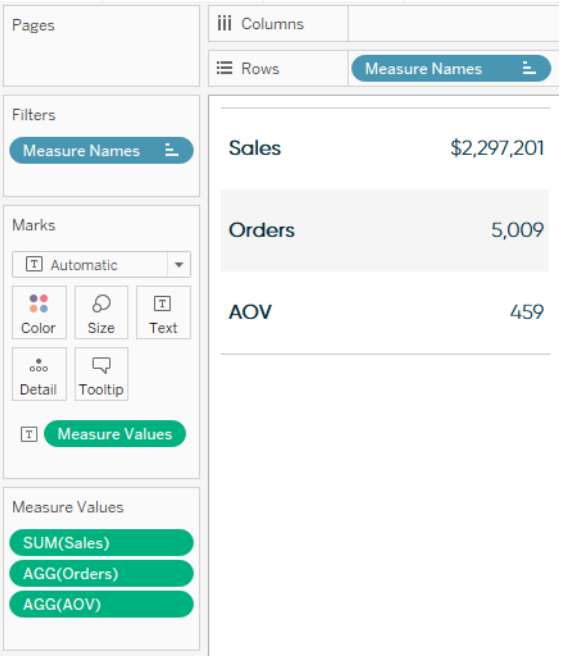
appear on the Measures area of the Data pane—a brand-new measure that we can now use throughout the workbook!

Now that I have my Orders measure, which is the denominator of the AOV calculation I'm after, I can create another calculated field to calculate the total sales revenue divided by the number of orders. To start this calculated field, I will right-click a blank space in the left sidebar and choose Create Calculated Field. I'm presented with a blank calculated field dialog box where I can enter my formula for AOV:



Notice this time that the measure of Sales is aggregated as SUM, but Orders appears to have no aggregation. That's because Orders already has an aggregation of COUNTD in the underlying calculated field that we created in the previous step. Tableau does not allow you to mix aggregated and nonaggregated fields within a calculated field. If you create an invalid calculated field, Tableau will display a red indicator at the bottom of the dialog box that reads "The calculation contains errors." You can click the error message to be provided with a clue for what may be wrong with your calculation.

Also remember that even when Tableau says that a calculation is valid, that's in terms of the syntax, and not in terms of the result you are looking for. To quality check a calculated field and ensure it's properly calculating the result, I like to put the raw "ingredients" on the view and calculate the answer manually. In the case of this tutorial, I would create a quick table showing Orders, Sales, and the newly created AOV measure. I would then divide the sales amount by the number of orders to make sure the correct answer is reflected as AOV:



Based on this image, it looks like Tableau has calculated the correct answer: $2,297,201 in total sales divided by 5,009 total orders equals an average order value of $459. By default, calculated fields do not receive number formatting. In the case of AOV, which should be displayed as a currency, you can change this by right-clicking the calculated field on the Measures area of the Data pane, hovering over "Default properties," and clicking "Number format."

More on Aggregating Calculated Fields

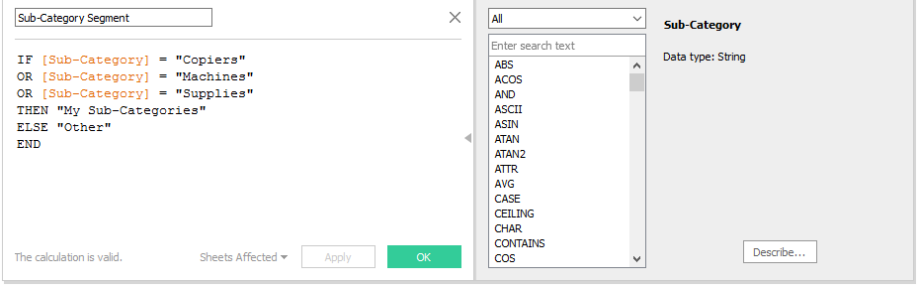
Aggregation, introduced in Chapter 8, is an important concept to consider when creating calculated fields. A calculated field for SUM([Profit]) / SUM([Sales]) will give you a very different answer than [Profit] / [Sales], even though both formulas are valid. If you do not provide the aggregation within the calculated field, Tableau will calculate the equation for every record in your analysis, then aggregate the answers for all of the rows together when the calculated field is added to the view. It is critical to quality check calculated fields and ensure you are seeing expected results before integrating the new measures in your work.

To this point, we've created a new measure for Orders and used the Orders measure within a second new calculated field for AOV. Now let's put the new fields to work by answering our business question:

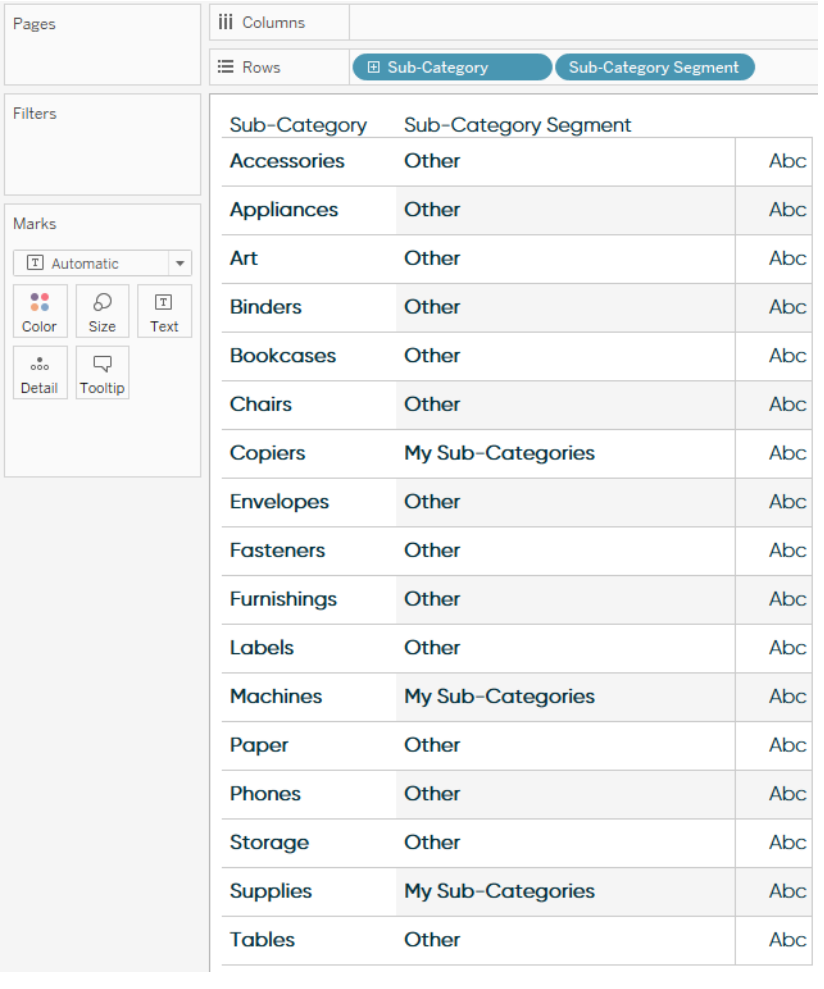
What is the AOV of the product sub-categories I manage compared to everything else?

For the purposes of this illustration, I'll pretend that I manage the Copiers, Machines, and Supplies sub-categories. To answer this question, we will create a third calculated field, this time creating a new Sub-Category Segmentation dimension.

This calculation is slightly different in that we will be incorporating IF/THEN logic to create a segmentation: one segment for the sub-categories I manage (Copiers, Machines, and Supplies) and the other segment for every other sub-category. The formula looks like this:

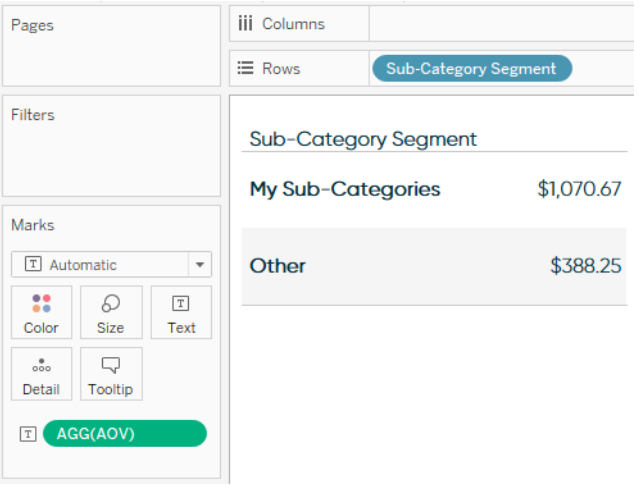


All this calculation is saying is that if the dimension member of Sub-Category matches copiers, machines, or supplies, I want the data to be classified as "My Sub-Categories." If the dimension member is anything other than those three, I want the data to be classified as "Other." To quality check a dimension calculation such as this one, I like to first place the original dimension on the Rows Shelf, followed by the newly created calculated field to make sure the dimension members are being properly calculated:



As you can see, my three sub-categories are classified as "My Sub-Categories" in the second column, and everything else is classified as "Other."

I'm now ready to answer my business question by putting the AOV calculated field on the view, then slice and dice the measure by the Sub-Category Segment dimension:



The answer clearly shows the AOV for the product sub-categories that I manage is much higher than the AOV for all of the other sub-categories—maybe it's time I ask for a bonus!

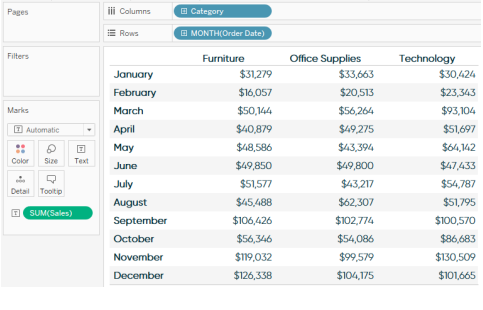
CHAPTER 13

An Introduction to Table Calculations

Tableau comes with several preset calculations that you can compute with the numbers on a view, including running total, difference, percent difference, percent of total, moving average, and more. These predefined calculations are called table calculations because they compute the result based on a virtual table that includes only the numbers on the view. Table calculations provide several benefits, including:

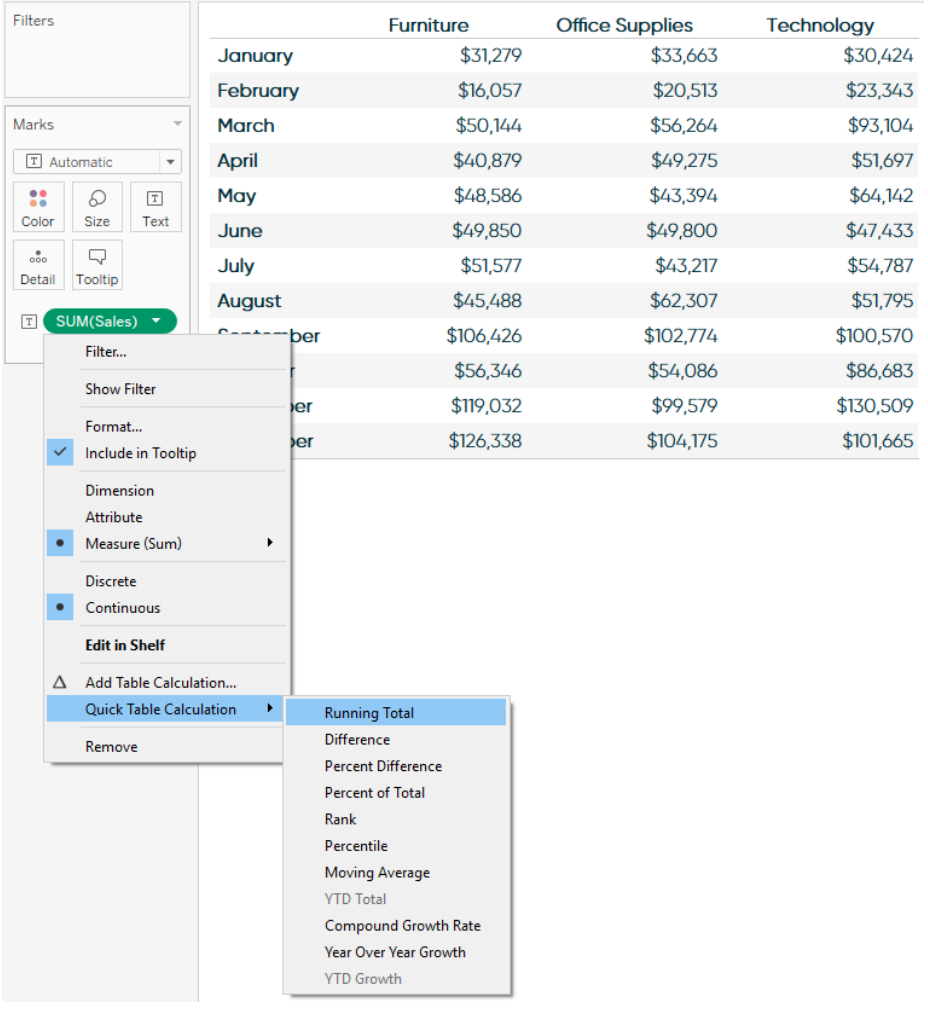
- A fast way to create advanced calculations even without knowing the underlying syntax
- Table calculations can be saved for future use as calculated fields, and because calculated fields can be edited, this is a great way to learn the syntax and the different functions available in Tableau
- Efficient processing—table calculations are computed on a very small subset of the data source, making them an efficient solution for calculating results

To help introduce table calculations and how to use them, we will be using this simple crosstab:



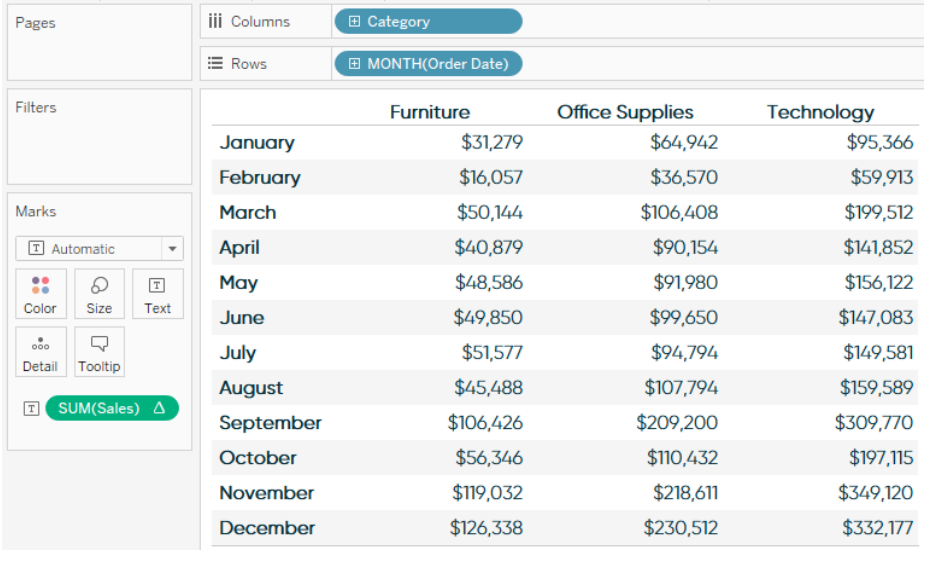
	Furniture	Office Supplies	Technology
January	$31,279	$33,663	$30,424
February	$16,057	$20,513	$23,343
March	$50,144	$56,264	$93,104
April	$40,879	$49,275	$51,697
May	$48,586	$43,394	$64,142
June	$49,850	$49,800	$47,433
July	$51,577	$43,217	$54,787
August	$45,488	$62,307	$51,795
September	$106,426	$102,774	$100,570
October	$56,346	$54,086	$86,683
November	$119,032	$99,579	$130,509
December	$126,338	$104,175	$101,665

Table calculations are added to measures, so in order to add a table calculation, click a measure that's on the view. The fastest way to add a table calculation is to hover over Quick Table Calculation and choose an option:



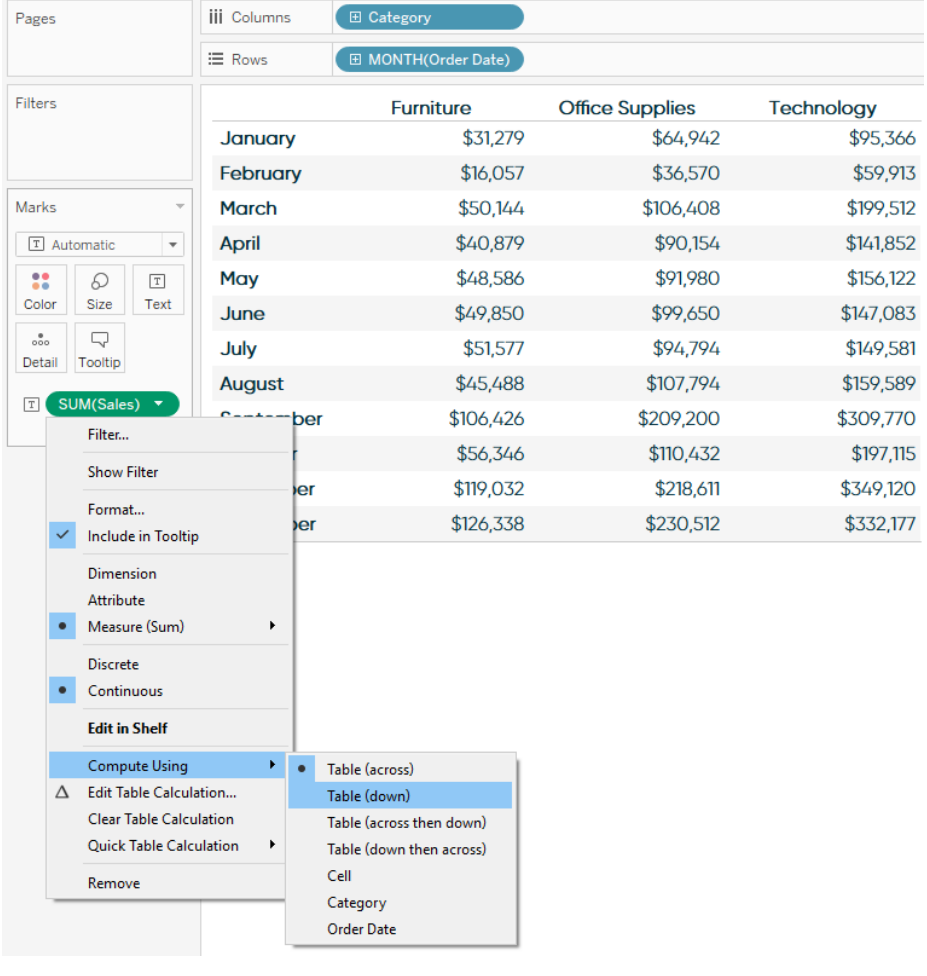
	Furniture	Office Supplies	Technology
January	$31,279	$33,663	$30,424
February	$16,057	$20,513	$23,343
March	$50,144	$56,264	$93,104
April	$40,879	$49,275	$51,697
May	$48,586	$43,394	$64,142
June	$49,850	$49,800	$47,433
July	$51,577	$43,217	$54,787
August	$45,488	$62,307	$51,795
ber	$106,426	$102,774	$100,570
	$56,346	$54,086	$86,683
er	$119,032	$99,579	$130,509
er	$126,338	$104,175	$101,665

Here's how the view looks after choosing the Running Total table calculation:



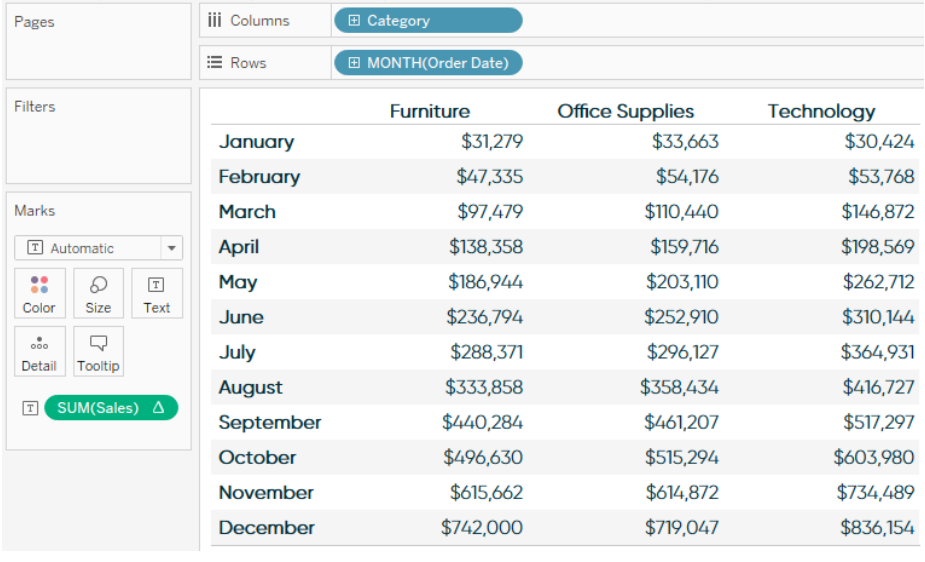
	Furniture	Office Supplies	Technology
January	$31,279	$64,942	$95,366
February	$16,057	$36,570	$59,913
March	$50,144	$106,408	$199,512
April	$40,879	$90,154	$141,852
May	$48,586	$91,980	$156,122
June	$49,850	$99,650	$147,083
July	$51,577	$94,794	$149,581
August	$45,488	$107,794	$159,589
September	$106,426	$209,200	$309,770
October	$56,346	$110,432	$197,115
November	$119,032	$218,611	$349,120
December	$126,338	$230,512	$332,177

Table calculations are defined by how they are (a) partitioned (or grouped), and (b) addressed (or how they are computed). Notice in the example here the running total is being computed from left to right, which is the default *addressing*. This would mean that, by default, the table calculation is being addressed by the Product Category dimension. This leaves the Month dimension as the *partitioning* field. For a running total calculation, this doesn't make a lot of sense. It is easy to change the addressing by changing how the table calculation is being computed. To do this, click the measure with the table calculation again, now identified with a delta symbol, hover over Compute Using, and change how the calculation should be computed (or addressed):



	Furniture	Office Supplies	Technology
January	$31,279	$64,942	$95,366
February	$16,057	$36,570	$59,913
March	$50,144	$106,408	$199,512
April	$40,879	$90,154	$141,852
May	$48,586	$91,980	$156,122
June	$49,850	$99,650	$147,083
July	$51,577	$94,794	$149,581
August	$45,488	$107,794	$159,589
[illegible]ber	$106,426	$209,200	$309,770
[illegible]	$56,346	$110,432	$197,115
[illegible]er	$119,032	$218,611	$349,120
[illegible]er	$126,338	$230,512	$332,177

Here's how the crosstab looks after changing the addressing/"Compute Using" to Table (down):



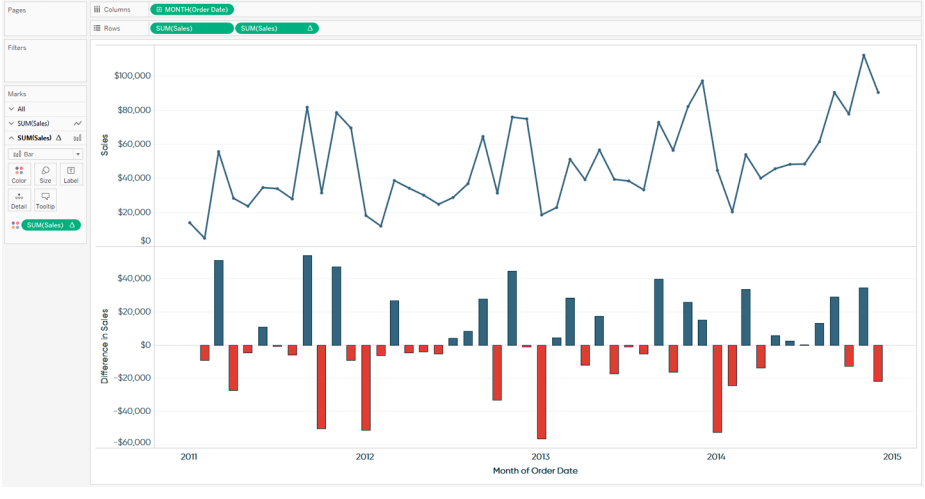
	Furniture	Office Supplies	Technology
January	$31,279	$33,663	$30,424
February	$47,335	$54,176	$53,768
March	$97,479	$110,440	$146,872
April	$138,358	$159,716	$198,569
May	$186,944	$203,110	$262,712
June	$236,794	$252,910	$310,144
July	$288,371	$296,127	$364,931
August	$333,858	$358,434	$416,727
September	$440,284	$461,207	$517,297
October	$496,630	$515,294	$603,980
November	$615,662	$614,872	$734,489
December	$742,000	$719,047	$836,154

Now that the addressing field has been changed to Month and the partitioning field has been changed to Product Category, my result makes a lot more sense for my analysis. I can look at each Product Category column, and look down across months to see how the sales built up throughout the year.

There are many different options available within table calculations that can be accessed by clicking a measure with a table calculation and choosing "Edit table calculation." For just a few possibilities, see one of Tableau's most popular posts, Top 10 Tableau Table Calculations.

I mentioned in the introduction to this chapter that one of the benefits of table calculations is that they provide a way to learn the syntax. To do so, simply double-click a measure with a table calculation to see the underlying formula. This code can be copied into a calculated field so you can take a closer look.

Lastly, even though they are called table calculations, table calculations do not literally have to be used on a table, or crosstab, view. Here is one example I regularly use to add value to a basic monthly line graph:



Notice that the first row is a basic monthly trend, while the second Sales pill has a delta symbol, indicating there is a table calculation being applied. This time, I am using the second row to show the month-over-month *difference* in sales—another of the quick table calculation options available in Tableau.

To create this visualization, I started by simply making a line graph showing the sum of Sales by continuous Month of Order Date. I then placed a second occurrence of the Sales measure on the Rows Shelf, which created a second row with the exact same trend. Now that there were two independent pills for the Sales measure, I was able to add a table calculation for month-over-month difference (the second option under "Quick table calculation") to the second pill only.

Each measure also gets its own set of Marks Cards, which means they can be edited independently. After changing the second row so the mark type is bar and the marks are colored by the month-over-month change, the result is the visualization just shown. Now in addition to a typical monthly sales trend, I've provided the month-over-month difference values and visualization, which allows the end user to quickly compare the spikes and drops across months; this value-add is made possible through Tableau table calculations.

CHAPTER 14

An Introduction to Parameters

As you make your way through *Practical Tableau*, and especially Part III, there is one functionality that you will hear about over and over again: parameters. Parameters are user-generated values that are not attached to a dataset, and due to their flexibility, are the solution to several of the handiest tricks in Tableau. Other than filters, parameters are also one of the most powerful tactics in Tableau for transferring control from the author to the end user. As discussed in Part IV, providing this type of user interaction not only improves the engagement with your dashboards, but it improves the retention of insights and improves the likelihood that they will be shared.

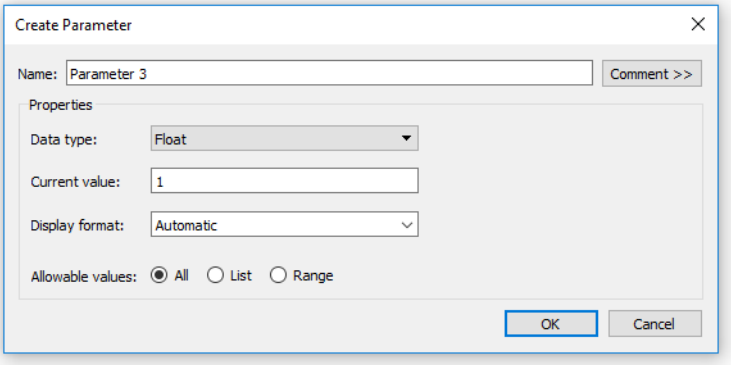
This chapter will use a simple algebra example to illustrate how to create a parameter, how to allow end users to control the parameter you've created, and how parameters work.

An Introduction to Parameters in Tableau

For this tutorial, imagine that you want to set up a simple equation for 2 multiplied by *X*, where *X* is the parameter, and the end user gets to choose the value of *X*. Tableau will then display the answer of 2 multiplied by *X* based on the parameter selection.

For this introduction, it does not matter what dataset you are following along with, but for consistency with the rest of *Practical Tableau*, I will be building a parameter in the Sample – Superstore dataset. There are several ways to create a new parameter in Tableau, including (a) clicking the down arrow in the top-right corner of the Dimensions area of the Data pane and choosing "Create parameter" or (b) right-clicking in a blank space on the Data pane Shelf and choosing "Create parameter." Once you have

done this, you will be presented with a dialog box where you can design the parameter:



Instead of "Parameter 3," named that by default in the Sample – Superstore dataset because there are already two other parameters, I will change the name to "Algebra Parameter." By default, the data type for a new parameter is Float, which means any number including decimals, but there are five additional data types to choose from:

Integer
: Any whole number (i.e., no decimals)

String
: Text

Boolean
: True or false

Date
: Date without a timestamp

Date & Time
: Date with a timestamp

The data type you choose for the parameter depends on your use case. For this 2 multiplied by *X* example, let's say that we eventually want the parameter to include only whole numbers, so I will change the data type from Float to Integer.

Within the parameter creation dialog box, you also have the ability to designate the allowable values for the parameter. The entries that you choose at this step will eventually determine what choices you and the end users have for the parameter in the final product. The choices are all or any integer, a specific list of integers, or a range of integers. I will choose Range so that I can set a minimum and maximum number as