Tableau Desktop Help

This PDF contains the complete documentation for Tableau Desktop. View this document electronically to take advantage of search and bookmarks. You can also print this document for hard copy reference. Please download the updated PDF regularly.

Version 9.3; Last Updated 8/28/2018

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Welcome to Tableau Desktop

This Online Help system from Tableau Software® contains the complete product documentation for using Tableau Desktop on Windows.

Version: 9.3 | Updated on 8/28/2018

What's New in Tableau Desktop

Browse summaries of new features in version 9.3 or in previous versions (9.0 through 9.2).

What's New in Tableau Desktop 9.3

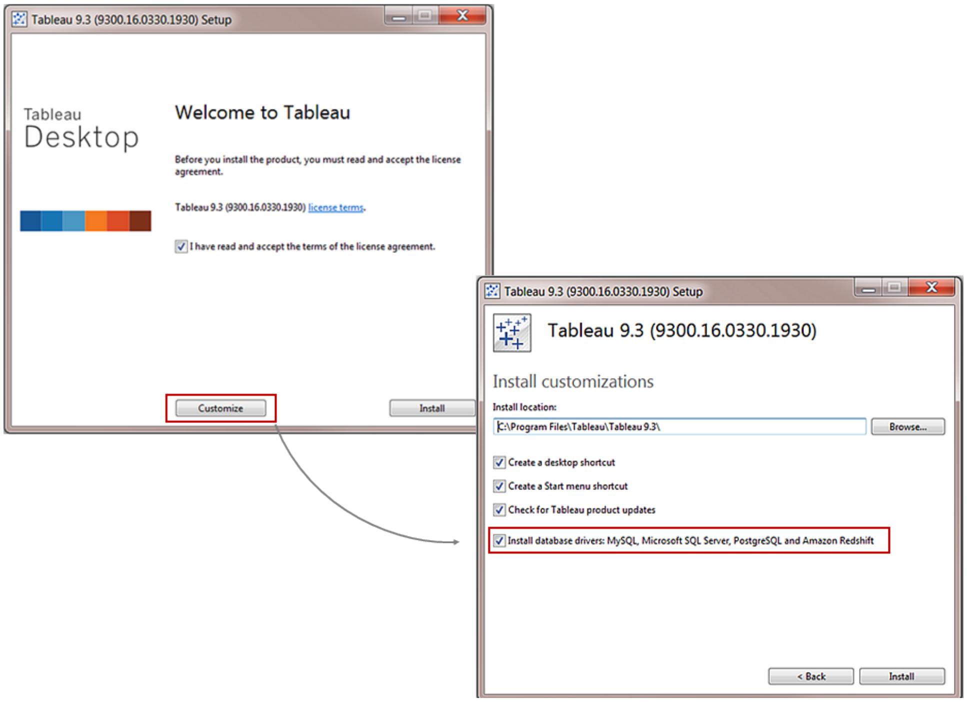
Desktop installer improvements

To streamline the install experience for Tableau Desktop for Windows, the four most common database drivers are now included as part of the setup process and are automatically installed by default. The following drivers are included:

- MySQL (version 5.3.4)
- Microsoft SQL Server (version 2008 R2)
- PostgreSQL (version 9.3.400)
- Amazon Redshift (version 1.2.1)

Note: Microsoft Visual C++ Redistributable is also automatically installed as a prerequisite for MySQL.

To view the list of drivers, or to clear the option to install these drivers, accept the license agreement on the installer page, and then click **Customize**.



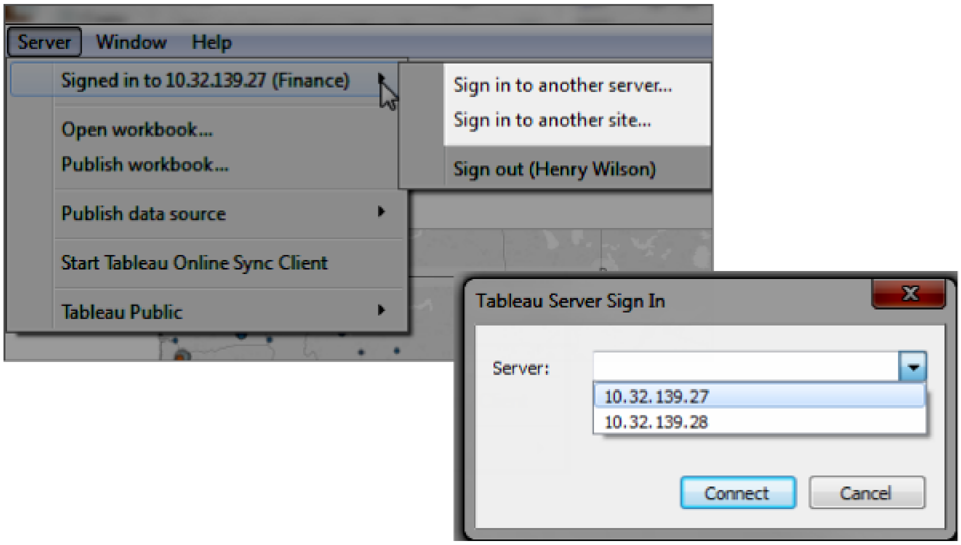
You can clear the option to install the drivers in either the user interface or from the command line.

If you want to perform a quiet install for Tableau Desktop 9.3, use the installer (.exe) file. The installer package (.msi) is included as part of the installer file and can no longer be extracted separately.

For more information about how to perform a quiet install of Tableau Desktop, see Performing a Quiet Installation of Tableau desktop or Tableau Reader in the Tableau Knowledge Base.

Stay connected to Tableau Server or Tableau Online

When you connect to Tableau Server or Tableau Online, Tableau Desktop saves each connection from session to session if you don't sign out. Next time you launch Tableau Desktop, you are signed in to your most recent server connection. You can also sign into different servers and easily switch between your available server and site connections.



For more information, see **Quick Start: Stay Connected with Automatic Sign-In** on page 177.

Forecasting improvements

Forecasting in Tableau Desktop has been improved in the following ways:

- You can now forecast values ordered by an integer dimension. Formerly it was only possible to forecast measures that are ordered by time. For more information, see **Forecasting When No Date is in the View** on page 1101.
- Automatic selection of the best season length for a forecast has been improved. For more information, see the **Seasonality** section in **How Forecasting Works in Tableau** on page 1092.
- Tableau forecasting will now skip null or missing values when estimating model parameters. However, the nulls remain in the series so the indexes of the values remain the same. For example, for a daily time series that is missing weekend days, the algorithm computes the model, potentially with parameters for a weekly cycle, but without using the missing values. But because the missing values are in the series, the cycle length is still seven days.

  Due to this change:

  - Forecasting now supports irregular time series without zero fill. So no error will result if you do not select **Fill in missing values with zeros** in the Forecast Options dialog box.
  - The **Fill in missing values with zeros option** is no longer selected by default in the Forecast Options dialog box.

New data source support for Tableau functions and aggregations

For Tableau 9.3, more functions and aggregations are available for more data sources:

- The PERCENTILE function and aggregation are now available for Cloudera Hive, Hortonworks Hadoop Hive, and EXASolution data sources.
- The MEDIAN function and aggregation are now available for Cloudera Hive, Hortonworks Hadoop Hive, and EXASolution data sources.
- Regular expression functions (beginning with REGEXP_) are now available for HP Vertica, Pivotal Greenplum, and Teradata (version 14.1 and above) data sources. See **Additional Functions** on page 1457. In addition, REGEXP_MATCH is now supported for Impala 2.3.0 and higher in Cloudera Hadoop data sources.
- The SPLIT function is now supported for Impala 2.3.0 and higher in Cloudera Hadoop data sources. Split functionality in the Data source pane is also now supported for Impala 2.3.0 and higher in Cloudera Hadoop data sources. See **Quick Start: Split a Field into Multiple Fields** on page 64.

Add color to sheets in sorter view

To make it easier to identify or group worksheets, you can now add color to the sheet tabs in the sheet sorter.

Workbook updates to use published data source

When you publish a data source to Tableau Server or Tableau Online, the workbook you're publishing it from is updated to connect to the published data source. At the same time the local data source is closed. To continue using the local data source, clear the **Update workbook to use the published data source** check box in the **Publish data source to Tableau Server** dialog box.

If you click **Undo** after publishing a data source, Tableau will revert to using the local data source, but it will not "un-publish" the data source.

Tableau does not replace the local data source when you publish a cube (multidimensional) data source.

For more information, see **Publish a Data Source** on page 1208.

Union your data

In your Tableau data source, you can now append rows of data from one table to another table thereby creating unions. If columns in the union do not align correctly, you can merge the columns whose names don't match. For more information, see **Union Your Data** on page 354.

Data grid enhancements

From the grid on the Data Source page, you can now do the following:

- See extract data and extract-only calculations, including data from the Web Data Connector
- Review data after applying extract filters and aggregating extracts
- Create groups and bins
- Join on pivot columns
- Join on merged columns
- See sheet and table name information for unioned tables

Zooming improvements for maps

Zooming in map views just got easier. You can now scroll to zoom in and out of a point on a map.

WMS Support for Web Mercator

Tableau now supports WMS servers that use Web Mercator. For more information, see **Supported Spatial Reference Systems** on page 939in the Use WMS Servers topic.

New default tool for maps

When you click and drag in a map view, you can now automatically select marks with the rectangular tool. This is a change in behavior to Tableau Desktop version 9.2, where clicking and dragging in a map view would automatically allow you to pan across the view instead.

View tools remain active

When you select a tool from the view toolbar (the pan tool, zoom area tool, radial tool, rectangular tool, or lasso tool), it remains active until you select to use another tool. The same is true if you use keyboard shortcuts to switch between tools. This is a change in behavior to Tableau Desktop version 9.2, where a tool would revert back to the default after one use.

The last tool you select will be saved with the workbook and available when you reopen it or publish it to the web.

Totals are no longer included in color encoding

Totals are no longer color encoded by default when you add them to the view.

To include totals in color encoding, click **Color** on the Marks card and then select **Edit Colors**. In the Edit Colors dialog box, select **Include Totals**.

Default

	Region			
Sub-Category	Central	East	South	W
Accessories	$7,252	$11,196	$7,005	$1
Appliances	-$2,639	$8,391	$4,124	$
Art	$1,195	$1,900	$1,059	$
Binders	-$1,044	$11,268	$3,901	$1
Bookcases	-$1,998	-$1,168	$1,339	-$
Chairs	$6,593	$9,358	$6,612	$
Copiers	$15,609	$17,023	$3,659	$1
Envelopes	$1,778	$1,812	$1,465	$
Fasteners	$237	$264	$174	
Furnishings	-$3,906	$5,881	$3,443	$
Labels	$1,073	$1,129	$1,041	$
Machines	-$1,486	$6,929	-$1,439	-
Paper	$6,972	$9,015	$5,947	$1
Phones	$12,323	$12,315	$10,767	$
Storage	$1,970	$8,389	$2,274	$
Supplies	-$662	-$1,155	$2	
Tables	-$3,560	-$11,025	-$4,623	$
Grand Total	$39,706	$91,523	$46,749	$10

Totals included in color encoding

	Region				
Sub-Category	Central	East	South	West	Grand Tot..
Accessories	$7,252	$11,196	$7,005	$16,485	$41,937
Appliances	-$2,639	$8,391	$4,124	$8,261	$18,138
Art	$1,195	$1,900	$1,059	$2,374	$6,528
Binders	-$1,044	$11,268	$3,901	$16,097	$30,222
Bookcases	-$1,998	-$1,168	$1,339	-$1,647	-$3,473
Chairs	$6,593	$9,358	$6,612	$4,028	$26,590
Copiers	$15,609	$17,023	$3,659	$19,327	$55,618
Envelopes	$1,778	$1,812	$1,465	$1,909	$6,964
Fasteners	$237	$264	$174	$275	$950
Furnishings	-$3,906	$5,881	$3,443	$7,641	$13,059
Labels	$1,073	$1,129	$1,041	$2,303	$5,546
Machines	-$1,486	$6,929	-$1,439	-$619	$3,385
Paper	$6,972	$9,015	$5,947	$12,119	$34,054
Phones	$12,323	$12,315	$10,767	$9,111	$44,516
Storage	$1,970	$8,389	$2,274	$8,645	$21,279
Supplies	-$662	-$1,155	$2	$626	-$1,189
Tables	-$3,560	-$11,025	-$4,623	$1,483	-$17,725
Grand Total	$39,706	$91,523	$46,749	$108,418	$286,397

New Snowflake data connector

Use the Snowflake connector to connect to a Snowflake data warehouse. For more information, see **Snowflake** on page 1386.

Data preview for Web Data Connectors

When you connect using a Web Data Connector, Tableau now opens on the Data Source page so that you can prepare your data (for example, change data types or hide columns) before you start your analysis.

Kerberos support for PostgreSQL and Teradata

Kerberos support has been added for PostgreSQL and Teradata connections. For more information, see **PostgreSQL** on page 1367 or **Teradata** on page 1393. For information about configuring Tableau Server for Kerberos, see Kerberos in the Tableau Server Help.

OAuth support for Salesforce in Tableau Desktop

You can now use OAuth when you connect to Salesforce in Tableau Desktop. After you provide your Salesforce credentials and allow Tableau access to the data, Salesforce.com creates an OAuth access token that is used to connect to the data. Instead of having to embed your credentials in data sources or workbooks, you can use the access token.

Initial SQL support added to more data sources

Oracle, Pivotal Greenplum, and Microsoft SQL Server now support initial SQL statements.

Initial SQL parameter support

For data source connections that support initial SQL, you can now perform parameter substitution for a set of useful parameters, such as ServerUser and WorkbookName. For more information, see **Run Initial SQL** on page 344.

Added in Version 9.2

Google Analytics query enhancements

By default, Tableau returns all data in a Google Analytics query to avoid returning sampled data. See **Quick Start: Query All Data from Google Analytics** on page 80.

Recent colors save to the application

From any Color drop-down control, you can select a recently used color. Up to eight recently used colors save to the application and are available in any workbook.

Data grid enhancements

The following functionality is now available from the grid on the Data Source page:

- Sort columns and rows
- Double-click the name of the column to rename the field
- Reset the name of a single column or select multiple columns to reset the column names at once
- Create calculations based on existing fields in the data source
- Copy values in the data source using Ctrl+C.

For more information, see **Quick Start: Data Grid Enhancements** on page 36.

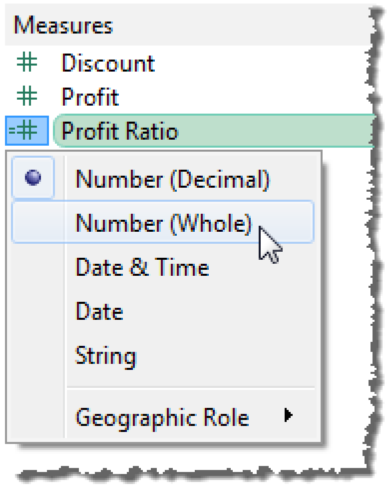
Data Interpreter enhancements

The Data Interpreter now detects subtables in your Excel data. For more information, see **Excel** on page 1270.

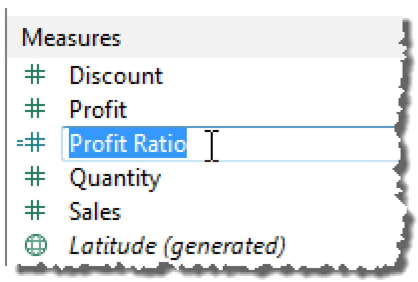
Data pane enhancements

The following functionality is now available in the Data pane:

- Click the icon to the left of a field in the Data pane to change the field's data type or geographic role:



- Click a field and hold down the mouse button to rename the field:

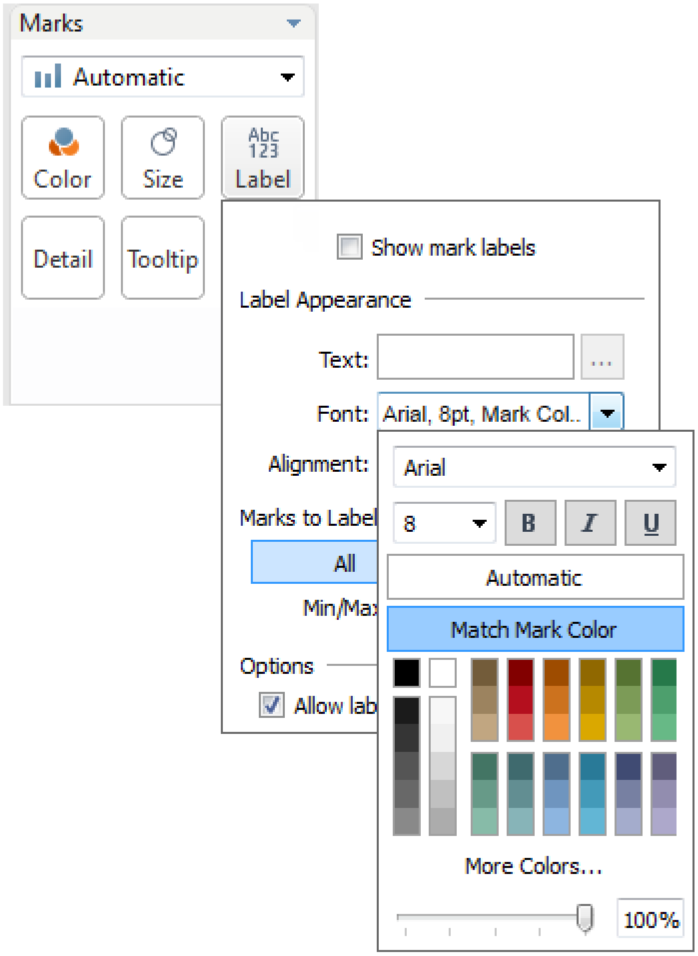


- Enhanced Search options in the Data pane. Click the search icon at the top of the Data pane or press Ctrl + F (Command-F on a Mac) to initiate a search. As you type in the search box, search now filters the contents of the Data pane to show all fields that contain the typed string. Search remains open until you click the search icon or press Ctrl + F again.
- The zones apportioned for Dimensions, Measures, Parameters, and Sets in the Data pane automatically size so that scroll bars are not shown unless there are more fields than can be displayed in the available space.

See **Data Types** on page 181, **Rename Fields** on page 225, and **Find Fields** on page 225.

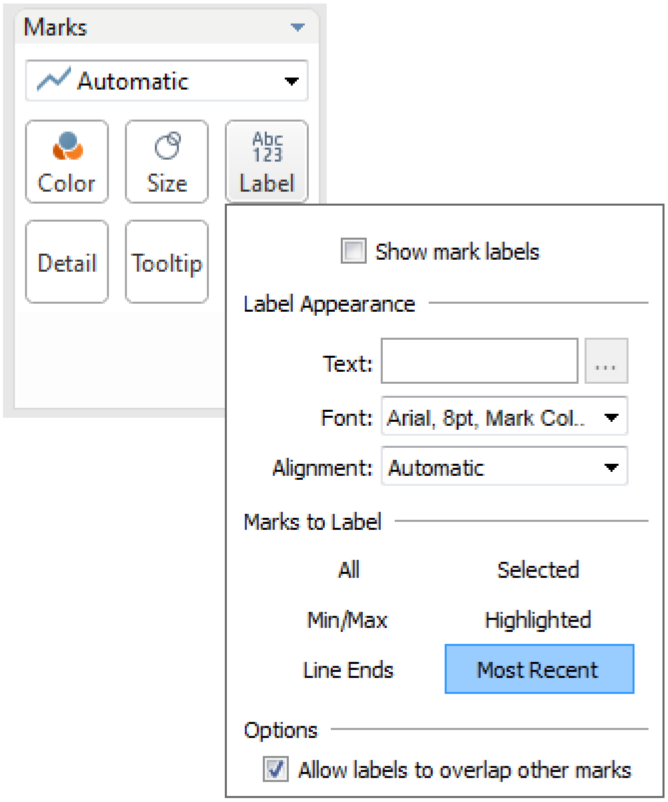
Match mark label color to mark color

You can select to closely match the color of each label to the color of its mark. See **Select label color.** on page 839 in the Format Mark Labels topic.



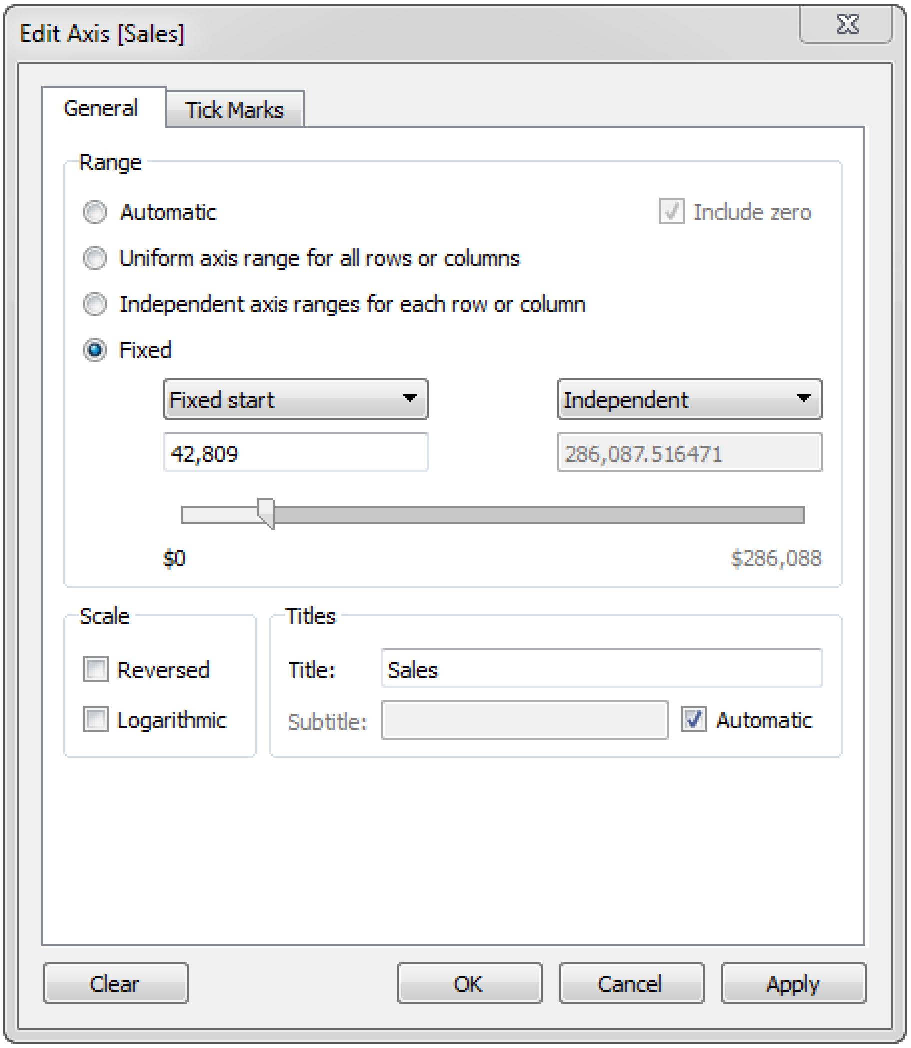
Label most recent marks

When there is a date field in the view, you can select to label the most recent marks in the view. Labels are based on the level of detail of fields in the view. See **Show and Hide Mark Labels** on page 826.



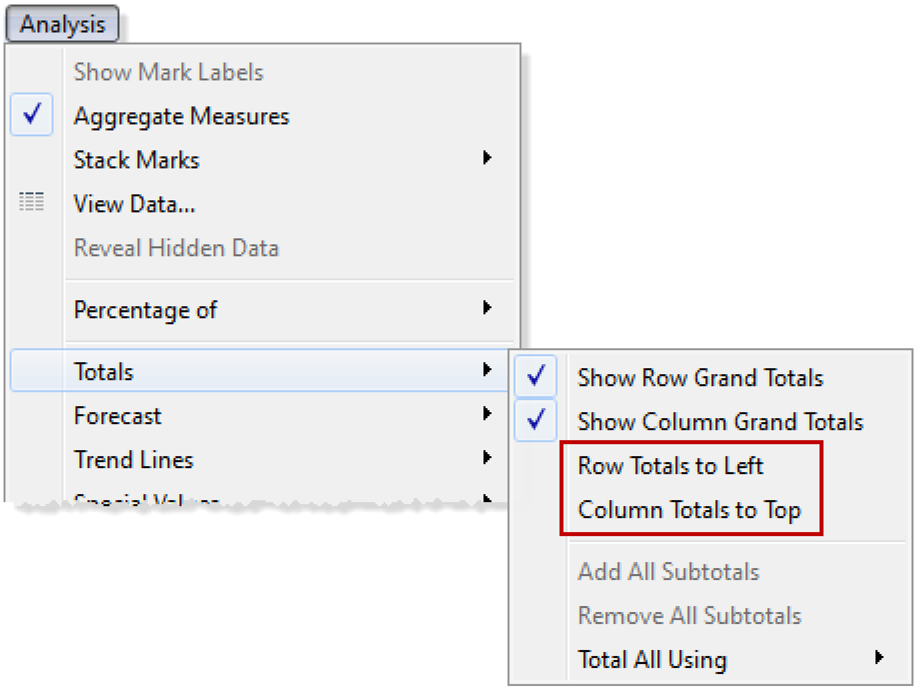
Fix one or both ends of an axis

You can specify the values for the start or end of an axis. See **Change the axis range** on page 706 in the Edit Axes topic.



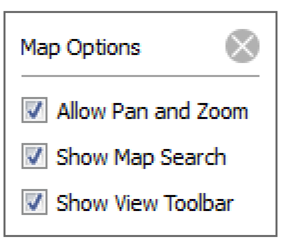
Move totals to the top or left of the view

You can select to show totals at the top or left of the view. See **Move Totals** on page 1160.



New Map Options dialog box

Use the new Map Options dialog box to customize how your audience interacts with your map view. Use the Map Layers pane (previously the Map Options pane) to customize the appearance of your map. See **Customize How People Interact with your Map** on page 910.



Support for Mapbox maps

You can now connect to Mapbox maps in Tableau. See **Use Mapbox Maps** on page 942.

SAP HANA column labels

By default, the SAP HANA column names now display the column label, rather than the column name.

Query improvements

The following query improvements have been added for Tableau 9.2.

- **Filtering on categorical aggregates**

  You can now create a filter that aggregates a measure and use it as a domain filter.

- **Numerical bins and combined fields in level of detail expressions**

  You can now refer to a numerical bin or a combined field in a level of detail expression.

- **MIN and MAX supported for boolean data type**

  These aggregations can now be used with boolean fields.

- **Additional optimizations**

  Tableau can now detect “always false” predicates and avoid issuing queries for them. For known domains such as boolean, we short circuit to return {true, false} or {true, false, null}. Other rewrites include folding case expressions with constant results to IN SET or NOT IN set.

Show Quick Filter has changed to Show Filter

In Tableau 9.2, the option to Show Quick Filter for a field has changed to Show Filter. For more information, see **Show Filters in the View** on page 645.

Added in Version 9.1

The following new features and enhancements have been added to Tableau Desktop for version 9.1.

- **Product Updates below**
- **Single Sign-On for SAP HANA on the next page**
- **Web Data Connector on the next page**
- **SAP Prompts on the next page**
- **Bin Size Optimization on the next page**
- **Auto-complete Availability on the next page**
- **Confidence Intervals for Reference Lines on the next page**
- **Measure Distance with the Radial Tool on the next page**
- **Turn Off Pan and Zoom on page 18**

Product Updates

To ensure that you always have the most up-to-date features, security resolutions, and corrected issues, Tableau Desktop includes a product update feature. See **Turn Product Updates Off or On** on page 1481.

Single Sign-On for SAP HANA

When SAP HANA is configured to support single sign-on (SSO), after you sign in to the SAP HANA server, you can access data, and publish data sources and workbooks to Tableau Server, without having to re-enter your user name and password. See **Quick Start: SAP HANA Single Sign-On** on page 60. **Note:** Tableau Desktop requires SAP HANA driver version 1.00.85 and later to support SSO for SAP HANA.

Web Data Connector

You can use a web data connector to connect to data that is accessible over HTTP and that doesn't already have a connector. You can create your own web data connector or use one that has been created by someone else. See **Web Data Connector** on page 1403.

SAP Prompts

With SAP HANA and SAP Netweaver Business Warehouse, you can prompt for a variable when a workbook is opened. See **SAP HANA** on page 1375 or **SAP NetWeaver Business Warehouse** on page 1378.

Bin Size Optimization

When you create discrete bins from a continuous measure, Tableau can compute an optimal bin size. See **Create Discrete Bins from a Continuous Measure** on page 868.

Auto-complete Availability

You can now take advantage of auto-completion for formulas in additional locations where you can create formulas—for example, when you add conditions or limits to filters, or when you create a set based on a condition. See (for example) **Adding Conditions to Filters** on page 617.

Confidence Intervals for Reference Lines

You can now add and configure confidence intervals (bands) for a reference line. See **Adding Reference Lines** on page 1119. You can no longer add confidence intervals for reference distributions.

Measure Distance with the Radial Tool

Use the Radial tool to measure approximate distances between your data and the locations or landmarks in a map view. For more information see, **Measure Distances Between Data Points and Locations in a Map** on page 912.

Turn Off Pan and Zoom

You can turn off pan and zoom to control how your audience interacts with your map view or background image. For more information see, **Customize How People Interact with your Map** on page 910

Added in Version 9.0

The following new features and enhancements have been added to Tableau Desktop for version 9.0.

- **New start page experience below**
- **Pivot below**
- **Split fields into multiple fields below**
- **Metadata area on the next page**
- **Data Interpreter on the next page**
- **New data sources and enhancements to existing data sources on the next page**
- **Analytics pane on page 20**
- **Recalculated lines on page 21**
- **New calculation features on page 21**
- **Story point formatting on page 22**
- **Advanced selection tools on page 22**
- **Map search on page 22**
- **Configurable tooltip behavior on page 22**

New start page experience

The start page in Tableau Desktop is a central location from which you can connect to your data, access most recently used workbooks, and explore content produced by the Tableau community. For more information, see **Start Page** on page 263.

Pivot

Pivot your Microsoft Excel and text file data sources from crosstab format to columnar format. For more information, see **Pivot Data (from Columns to Rows)** on page 411.

Split fields into multiple fields

Split existing string fields into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.

SPLIT is also available as a Tableau function, for use in calculated fields. For more information, see **String Functions** on page 1418.

Metadata area

Perform bulk management tasks, like hiding multiple fields at once, using the metadata area. For more information, see **Data Source Page** on page 267.

Data Interpreter

Detect and remove unique formatting and extraneous information in your Excel data sources. For more information, see **Excel** on page 1270.

New data sources and enhancements to existing data sources

New: Amazon Aurora

Use the Amazon Aurora connector to connect to an Amazon Aurora data source. For more information, see **Amazon Aurora** on page 1289.

New: Spark on Azure HDInsight

Use the Spark SQL connector to connect to a Spark on Azure HDInsight data source. For more information, see **Spark SQL** on page 1389.

New: Microsoft Azure SQL Database

Connect to Microsoft Azure SQL Database data using the Microsoft SQL Server connector. For more information, see **Microsoft SQL Server** on page 1348

New: Google Cloud SQL

Use the Google Cloud SQL connector to connect to a Google Cloud SQL database instance. For more information, see **Google Cloud SQL** on page 1321.

New: Microsoft Azure SQL Data Warehouse

Connect to Microsoft Azure SQL Data Warehouse data using the Microsoft SQL Server connector. For more information, see **Microsoft SQL Server** on page 1348.

New: Amazon EMR

Use the Amazon EMR connector to connect to an Amazon Elastic MapReduce (EMR) database. For more information, see **Amazon EMR** on page 1292.

New: Spark SQL

Use the Spark SQL connector to connect to a Spark SQL cluster (requires Apache Spark 1.2.1 or later). For more information, see **Spark SQL** on page 1389.

New: Statistical File

Use the Statistical File connector to connect to SAS (*.sas7bdat), SPSS (*.sav), and R (*.rdata, *.rda) data files. For more information, see **Statistical File** on page 1279.

Enhanced: MapR Hadoop Hive

MapR Hadoop Hive now supports connectivity for the Mac.

Enhanced: MySQL

SSL encryption is supported. Mac drivers are now included in the TableauDrivers.dmg file. For more information, see **MySQL** on page 1354.

Enhanced: Salesforce

The Salesforce connector now supports more flexible joins. You can create joins on any string fields in addition to fields that are constrained references between tables. For more information, see **Salesforce** on page 1371.

Enhanced: SAP NetWeaver Business Warehouse (BW)

The SAP NetWeaver Business Warehouse connector has been updated to include support for variables. For more information, see **SAP NetWeaver Business Warehouse** on page 1378.

Tableau Data Extracts

Tableau Data Extracts are no longer listed on the Connect pane. Use Other Files to connect to a Tableau Data Extract. For more information, see **Other Files** on page 1281.

Windows Azure Marketplace

To connect to Windows Azure Marketplace, use the OData connector. Workbooks created in earlier versions of Tableau that used the Windows Azure Marketplace DataMarket connector will work as expected. For more information, see **OData** on page 1356.

Analytics pane

The Analytics pane, on the left side of the Tableau workspace, provides quick and easy access to common analytic objects in Tableau. You can drag reference lines, forecasts, trend lines, and other objects into your view from the Analytics pane.

For more information, see **Analytics Pane** on page 272.

Recalculated lines

Recalculated lines help you gain insight into how a subset of your data compares to the overall data in your view. For more information, see **Marks and Data Analysis** on page 841.

New calculation features

The following features were added to Tableau Desktop to enhance the experience of creating and using calculated fields.

Non-modal calculation editor

The calculation editor has been redesigned to provide interactive editing, intelligent formula-completion, and drag-and-drop support. The calculation editor is now also available when you're editing a view in Tableau Server or Tableau Online.

For more information, see **Create or Edit a Calculated Field** on page 1005.

Ad-hoc calculations

Ad-hoc calculations are calculations that you can create and update on a shelf in the view. Ad-hoc calculations can be useful for testing a hunch, trying a what-if scenario, or debugging a complex calculation.

For more information, see **Ad-Hoc Calculations** on page 1014.

Auto-completion for formulas

As you type a formula, either in the calculation editor or in an ad-hoc calculation, Tableau displays a list of options for completing the formula.

For more information, see **Auto-Completion for Formulas** on page 1012.

Level of detail expressions

Level of detail expressions support aggregation using dimensions other than those in the view. With level of detail expressions, you can attach one or more dimensions to any aggregate expression.

For more information, see **Level of Detail Expressions** on page 1064.

Functions for regular expressions

Four new functions have been added to the calculation language to support regular expressions.

For more information, see functions beginning with REGEXP in **Additional Functions** on page 1457.

Functions for hexagonal binning

Hexagonal binning is a technique for clustering data in a two-dimensional plane. Two new functions have been added to the calculation language to support hexagonal binning. These functions support binning data in a single dimension using histograms, or by a geographic level of detail in a map.

For more information, see functions beginning with HEXBIN in **Number Functions** on page 1409.

Story point formatting

You can now re-size the captions in your story, change the shading and font of the navigator, and select to fit a dashboard to the exact size of a story in your workbook. For more information, see **Format a Story** on page 989.

Advanced selection tools

Use the Radial, Rectangular, and Lasso tools on the view toolbar to select multiple marks in the view. For more information, see **View Toolbar** on page 844.

Map search

Use map search to find locations on a map view so you can quickly explore and inspect data. For more information, see **Set Map Search Options** on page 906.

Configurable tooltip behavior

Show tooltips instantly as you move the mouse over the marks in a view or configure tooltips to display only after resting the mouse on a mark. For more information, see **Tooltip Properties** on page 474.

Quick Starts

Quick Starts are one-page articles that are designed to give you just the basics for a particular feature. This topic lists the Quick Start categories for Tableau Desktop. You can find Quick Starts for other Tableau products here:

- Tableau Online

Use Quick Starts to quickly review how a feature might be used and to find links to more detailed information.

Quick Starts about Data Sources and Connections

The first step to analyzing data in Tableau is connecting to a data source.

Quick Starts in this section help you get up and running with specific data sources, and also introduce working with extracts of your data as opposed to working with a live connection, explain ways to keep your data fresh, introduce working with your data in the grid on the Data Source page, and talk about ways to package and publish your data for others to see or work with.

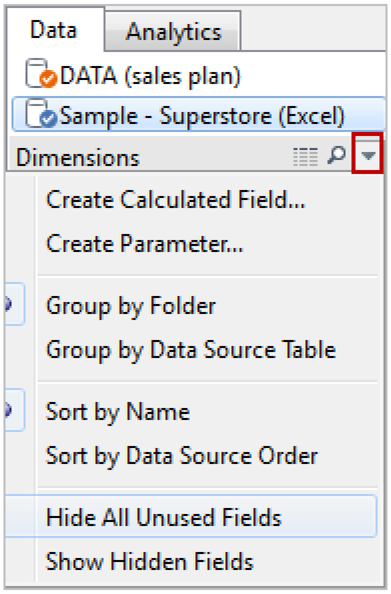
Quick Start: Aggregated Extracts

You can optimize your extracts by only including the data you need. Specfically, you can exclude columns, create filters to limit the number of rows, aggregate data, and roll up dates.

1 Hide Unused Fields

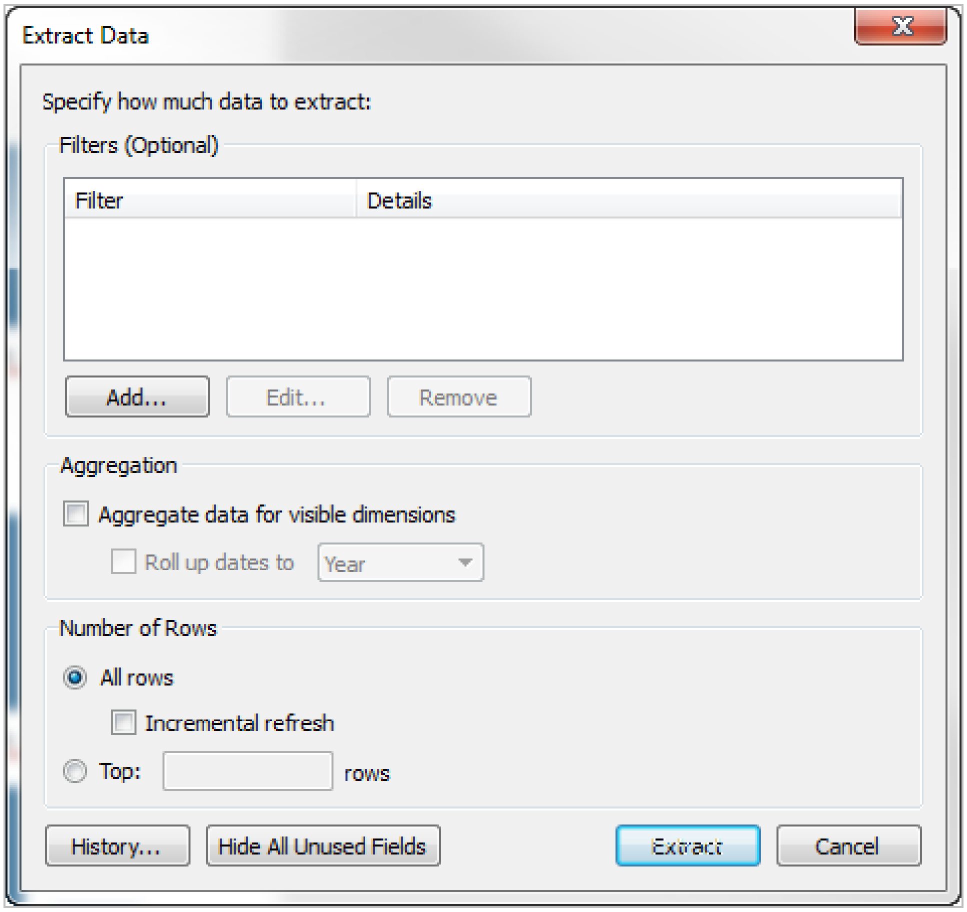
Hidden fields are not included when you create an extract. By hiding unnecessary fields before you create an extract, you make the extract smaller and improve performance.

Click the drop down to the right of Dimensions on the **Data** pane and choose **Hide All Unused Fields**.



2 Define Filters for the Extract

Right-click the data source and choose **Extract Data**.



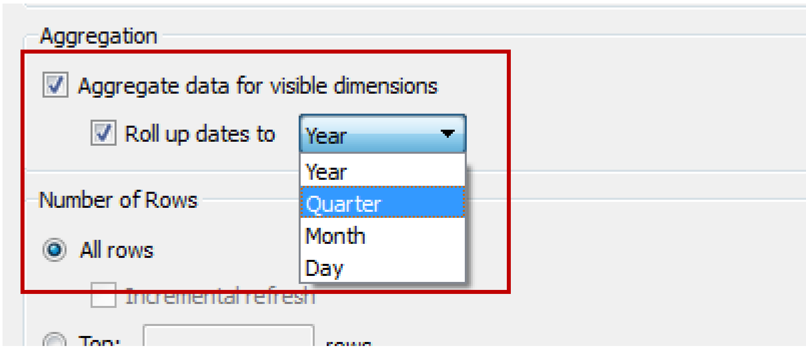
In the dialog box, optionally define one or more filters to limit how much data gets extracted.

Global filters are automatically added as filters on the extract.

3 Aggregate Data for Visible Dimensions

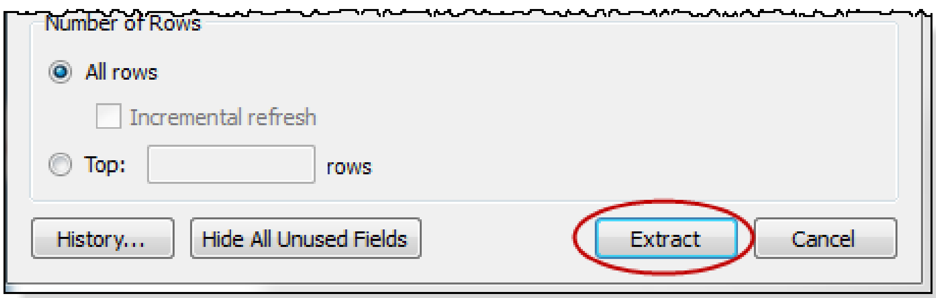
After defining any filters, choose **Aggregate data for visible dimensions**. This aggregates the data using the default aggregation for measures.

If the extract contains Date fields, you can also choose **Roll up dates** to adjust date granularity thereby further minimizing the size of the extract.



4 Click Extract

When ready, click **Extract** and specify a location for the extract (TDE) file. The extract will only contain the visible fields and the data will be aggregated as you specified.



Refresh the Extract at any time by choosing **Data** > **Refresh All Extracts**.

Quick Start: Automatically Update Workbook to Use Published Data Source

Publishing a data source is now as easy as clicking **Publish data source** on the **Server** menu. When you publish a data source, by default your workbook is updated to use the published data source.

Use the published data source (default)

When you publish a data source to Tableau Server or Tableau Online, the publishing process replaces the local version of the data source in your workbook with the published version. This new automated process replaces the manual four-step process you had to follow to update your workbook to use a published version of the data source, rather than the local version.

In addition to streamlining the publishing process, this new functionality also makes it easy for you to keep your workbook data refreshed. Simply schedule the extract for periodic refreshes, and your workbook will be automatically updated with the refreshed data.

Use the local data source

If you need to, you can continue to use the local data source, rather than a published data source. For example, you may want to use a local data source if the purpose of your workbook is to manage the data source.

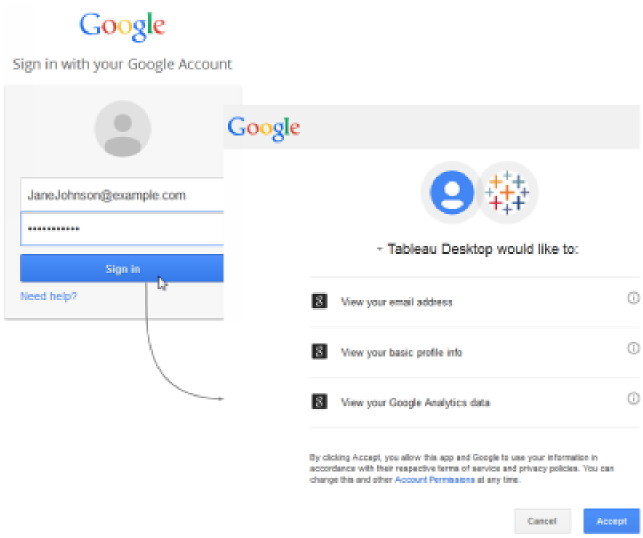
- If the data source has not yet been published, when you publish the data source to Tableau Server or Tableau Online, clear the **Update workbook to use the published data source** check box.
- If the data source has been published and your workbook has been updated to use the published data source, click the **Undo** button to go back to the local data source. Note that this action does not remove the data source from the server.

Quick Start: Connect to Google Analytics

Google Analytics is a service that provides website owners data and detailed statistics about visitors to their website. As a website owner who subscribes to Google Analytics, you can use Tableau Desktop to connect directly to your Google Analytics data, analyze, and obtain rich insights about your website.

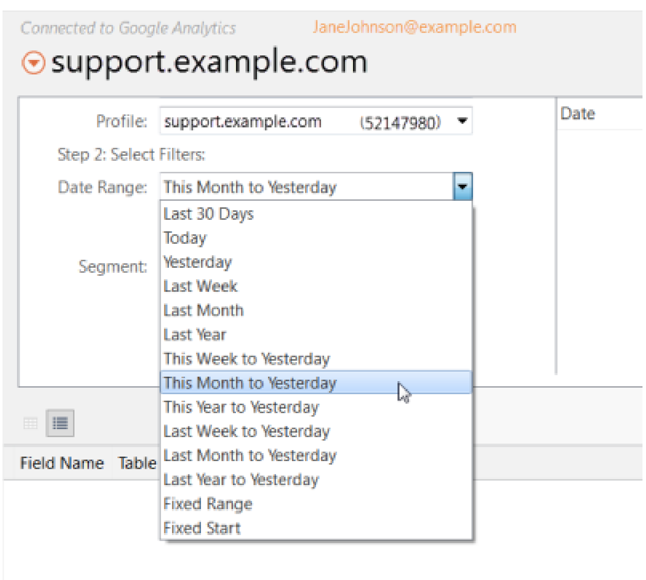
1 Sign in to Google

On the start page, under **Connect**, click **Google Analytics**. Then, sign in to Google Analytics with the email and password associated with your Google Analytics account. To complete the initial connection process, click **Accept** to let Tableau Desktop access your Google Analytics account.



2 Select a date range

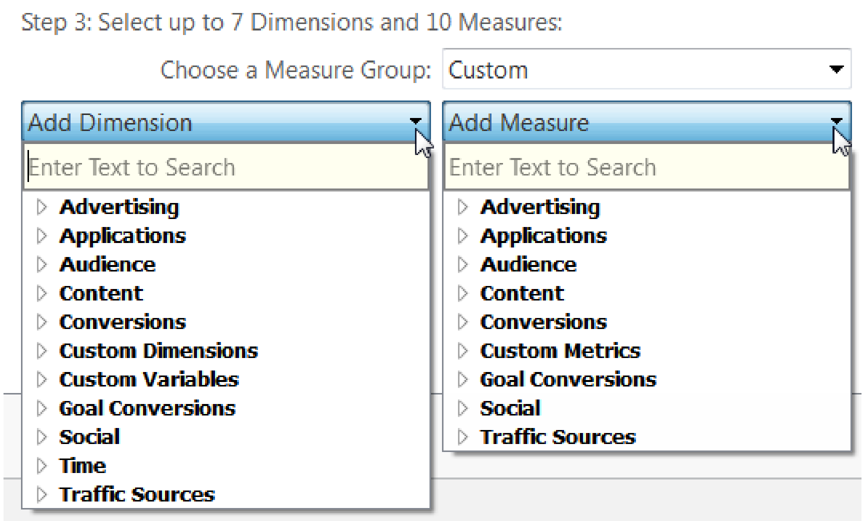
Select from a list of preset date ranges to limit your data.



Google Analytics can provide complete data only up to the previous full day. For example, if you choose **Last 30 days**, data will be retrieved for the last 30-day period ending yesterday.

3 Select dimensions and measures

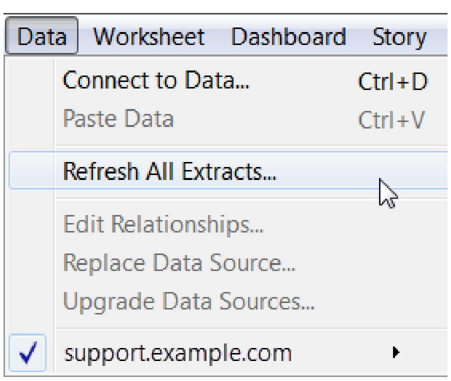
You can select up to seven dimensions and ten measures. When selecting measures, you can use a predefined measure group or customize your own group.



Some dimensions and measures cannot be used together. For more information, see Google Analytics Dimensions & Metrics Reference on the Google developer website.

4 Extract data

After completing the steps in the top area of the data source page, Tableau creates an extract of your data.



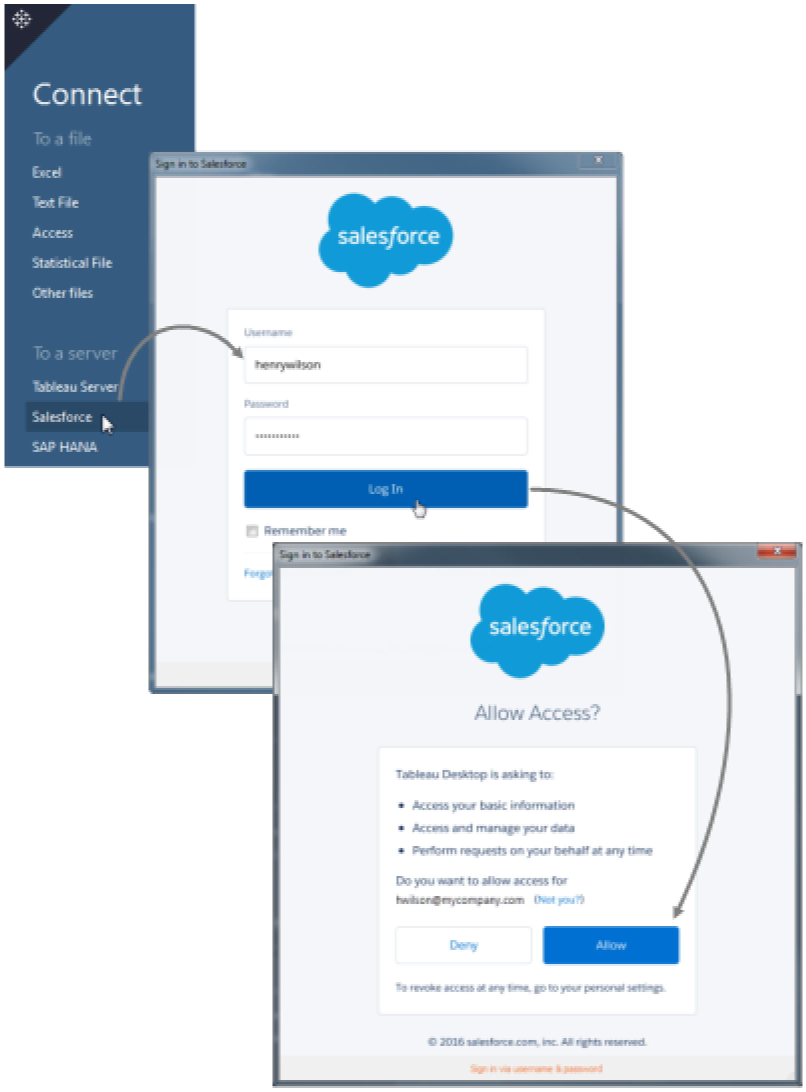
To update your extract you can perform a full or incremental extract refresh.

Quick Start: Connect to Salesforce

Salesforce.com is a web-based customer relationship management (CRM) application. You can use Tableau Desktop to directly connect to Salesforce.com so that you can analyze and answer questions about your accounts, contacts, and opportunities, for example. In addition to Salesforce.com, you can use Tableau Desktop to connect to Force.com and Database.com.

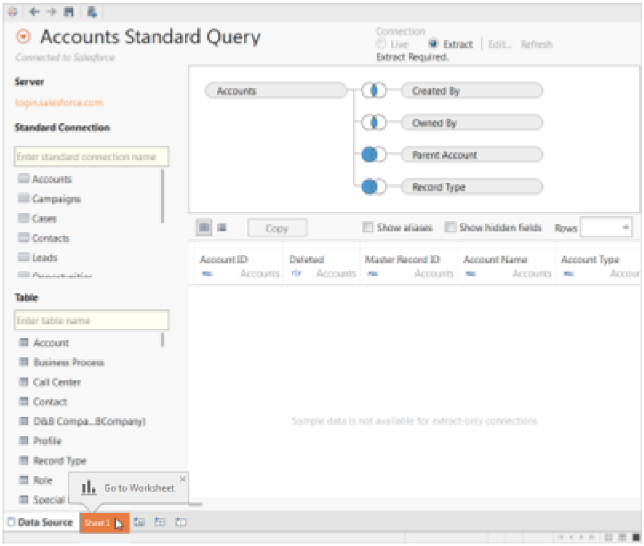
1 Log in to Salesforce

On the start page, under **Connect**, click **Salesforce**. Enter the user name and password for your Salesforce account, and then click **Log In**. Then, in the Allow Access dialog box, click **Allow**.



2 Use built-in queries

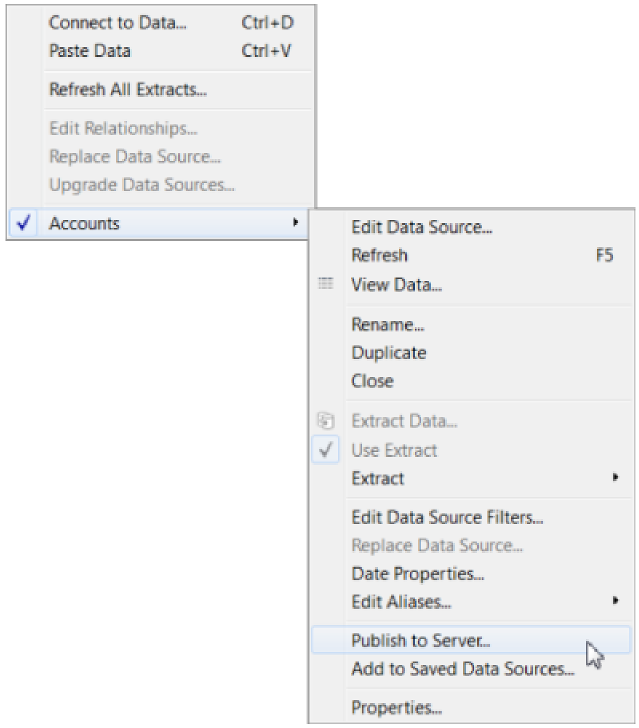
Connect to your Salesforce data using one of the built-in queries under **Standard Connection**. These queries contain commonly used tables and joins.



Alternatively, you can create your own custom query.

3 Extract data

After you connect to Salesforce and complete the data source page by selecting or creating a query, click the sheet tab to start your analysis. When you click the sheet tab, Tableau creates an extract of your data. **Note:** Because of limitations in Salesforce, the extract process can take a very long time, depending on the query.



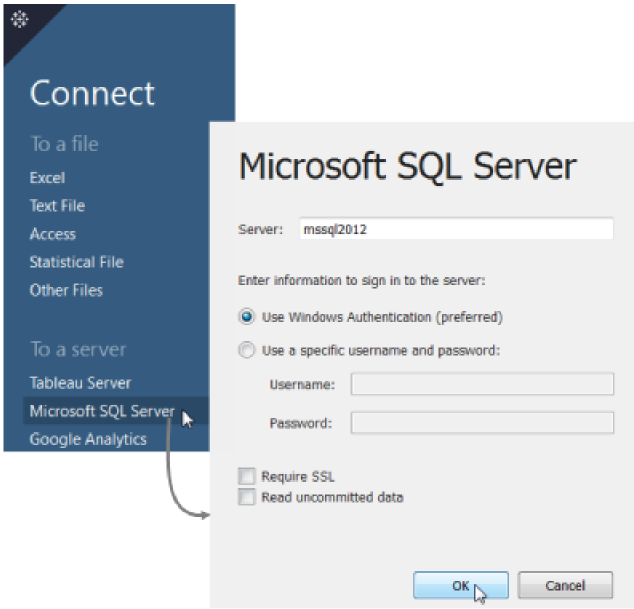
After the initial extract of your Salesforce data is created, we recommend that you publish the extract to Tableau Server and use the extract for any subsequent connections. To update your extract, you can perform a full or incremental extract refresh.

Quick Start: Connect to Your Data

In any analytics project, preparing your data for analysis is just as important as the analysis itself. Tableau makes it easy for you to connect and bring your data into Tableau, combine, and quickly review the data source before you begin analysis.

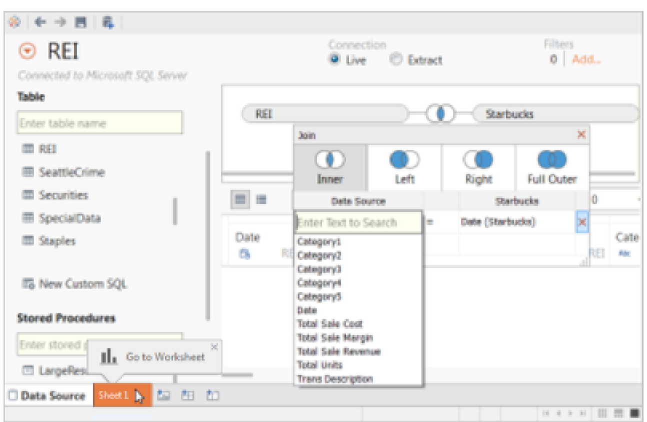
1 Connect to your data

On the start page, under **Connect**, click a file or database type, and then enter the authentication information to connect.



2 Combine data (joins)

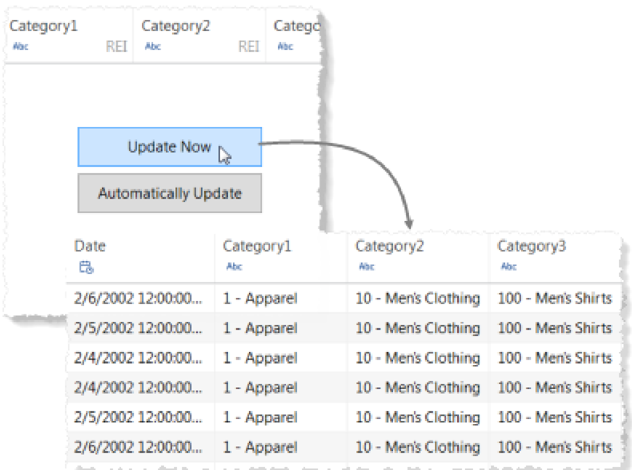
Select the file or database or schema. Then click and drag associated sheets, tables, or stored procedures to join sets. Otherwise, click the join icon to define the join type and clause. Choose from inner, left, right, and full outer. If you don't want to join your data, click the sheet tab to start your analysis.



The data that you drag into the top area of the data source page will be the data source from which you will build your view. Tableau never changes the underlying data.

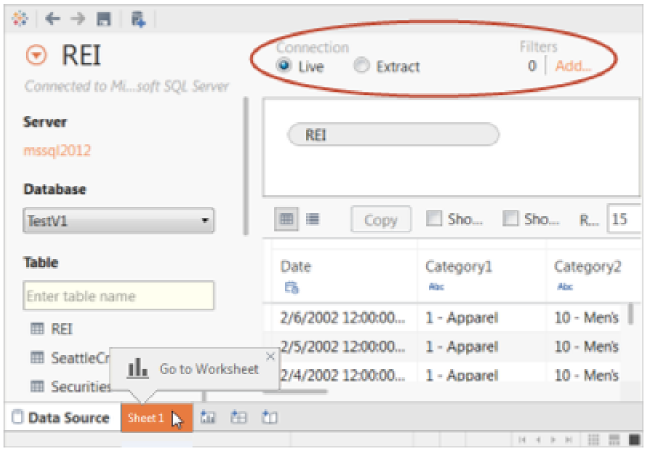
3 Review the data and change data types

Click **Update Now** to review the first 1,000 rows of the data source (or enter the number you want to see in the **Rows** text box). Every time you make changes to the joins, click **Update Now**. If you want changes in the joins to be automatically reflected in the grid, click **Automatically Update**.You can then make other modifications, such as changing the data type or renaming a column.



4 Connection options and data source filters

At the top of the data source page, select a live or extract connection to the data source. You can also edit your extract and add data source filters. Click the sheet tab to start your analysis.



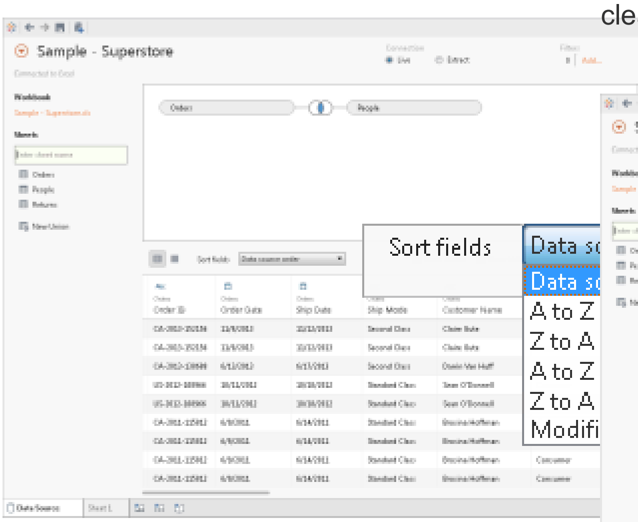
Quick Start: Data Grid Enhancements

The following enhancements made to the grid on the **Data Source** page help you better see the data in your data source and prepare it for analysis.

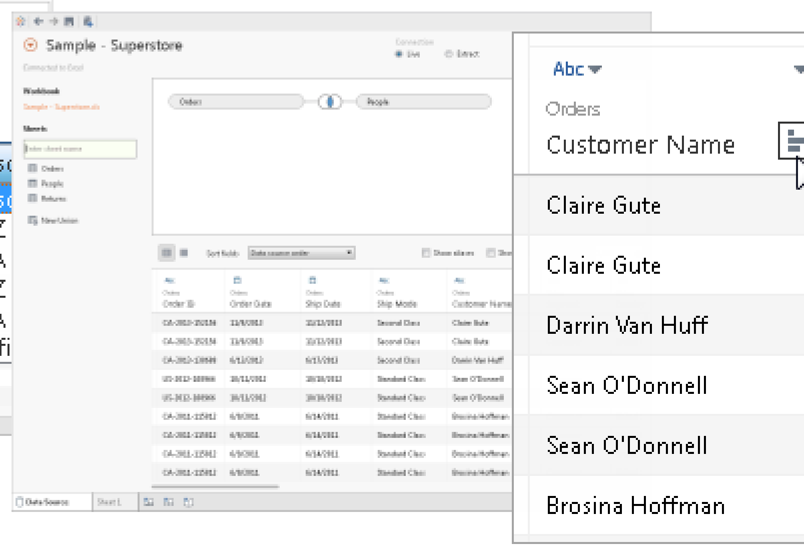
A Sort columns and rows

Sort columns: Sort columns in the grid and metadata grid by selecting a sort option from the **Sort fields** drop-down list. Sort the columns by table or data source order.

Sort rows: Sort rows by clicking the sort button. Click the sort button once to sort rows in ascending order, click the sort button again to sort rows in descending order, and then click the sort button a final time to clear the sort.



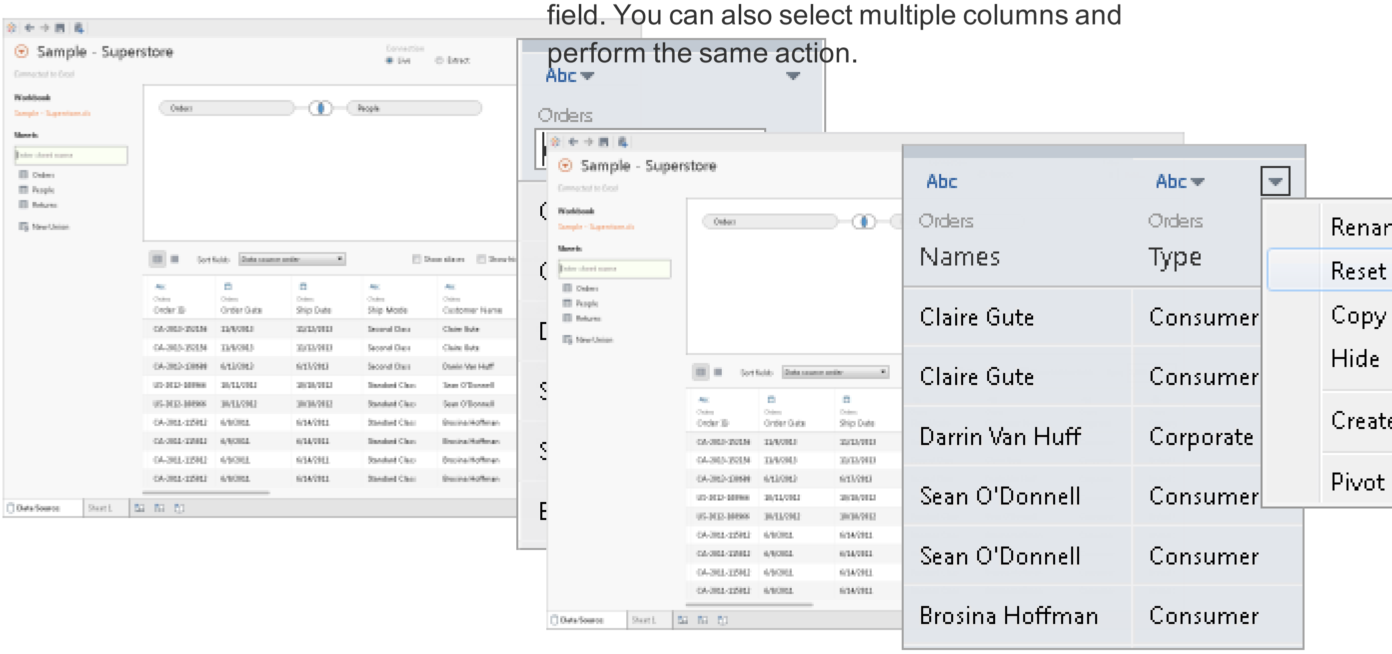
A **Modified** sort state can occur when some tasks cause new columns to be added to the grid.



B Change or reset field names

Rename column: Double-click the name of the column to rename the field.

Reset name: If you've renamed a field, click the column drop-down menu, and then select **Reset Name** to revert back to the original name of the field. You can also select multiple columns and perform the same action.



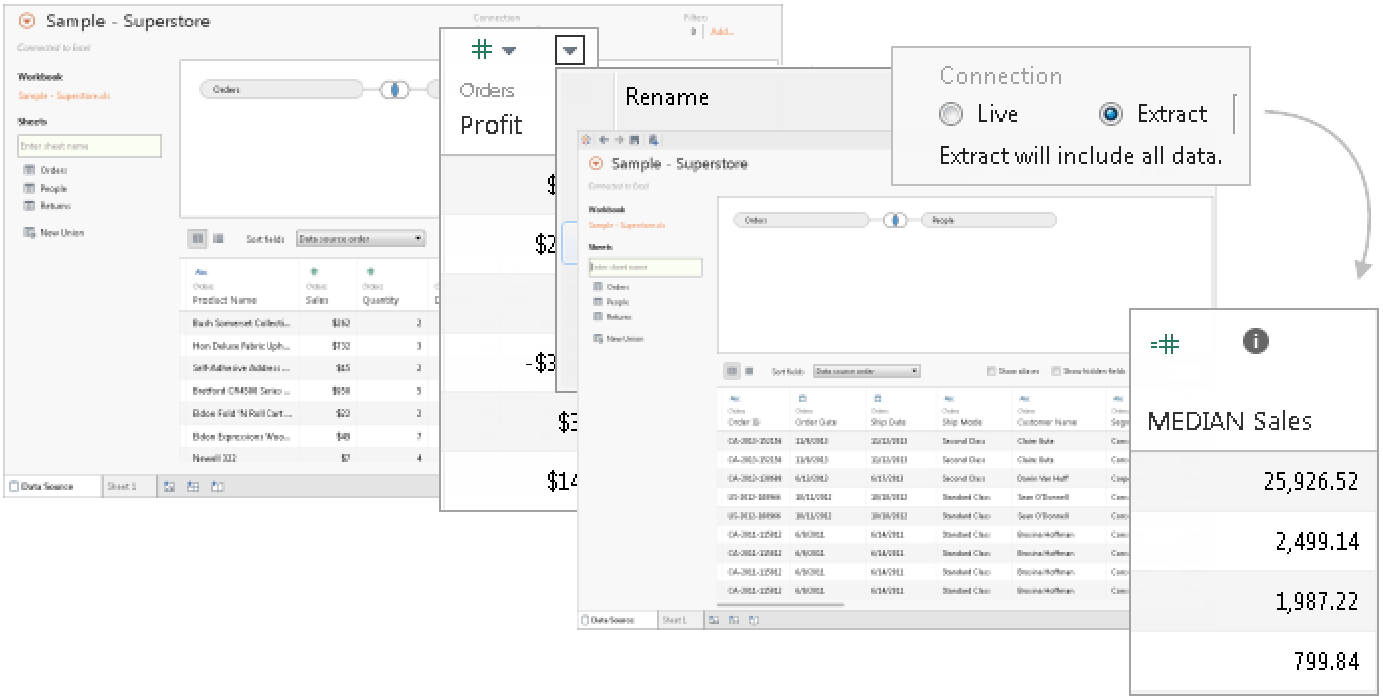
Original name indicates the name specified in the underlying data. You can use the **Revert** command to reset field names that have changed as a result of naming improvements Tableau has automatically made to the data source. For more information, see Field Type Detection and Naming Improvements.

C Create new columns and see extract data

Create new calculations: Create new calculations, groups, or bins based on existing fields in the data source. Click the column drop-down arrow and select one of the respective options.

If you create an aggregate calculation, the values displayed in the grid are not meaningful until the calculation is used in context of the view's level of detail.

See extract data: For the Web Data Connector, file- and relational-based data sources in Extract mode, you can see extract data in the grid, including extract only calculations like MEDIAN.



When in Extract mode, the row order of the values in the data source might be different than the row order of values in Live mode.

D Copy values

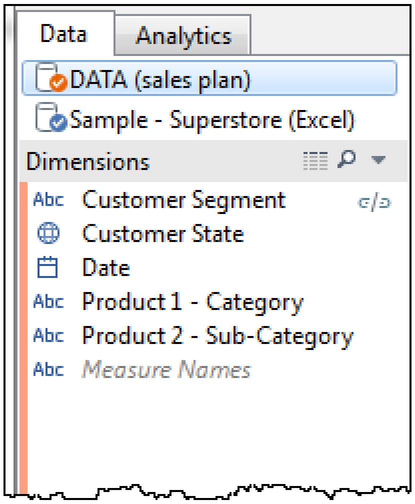
Copy values: Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.

Quick Start: Data Blending

Combine data from multiple data sources onto a single sheet using data blending. The **Data** pane includes a list of all the data sources you're connected to. Relationships between the data sources are automatically created--or you can define custom relationships.

1 Connect to Multiple Data Sources

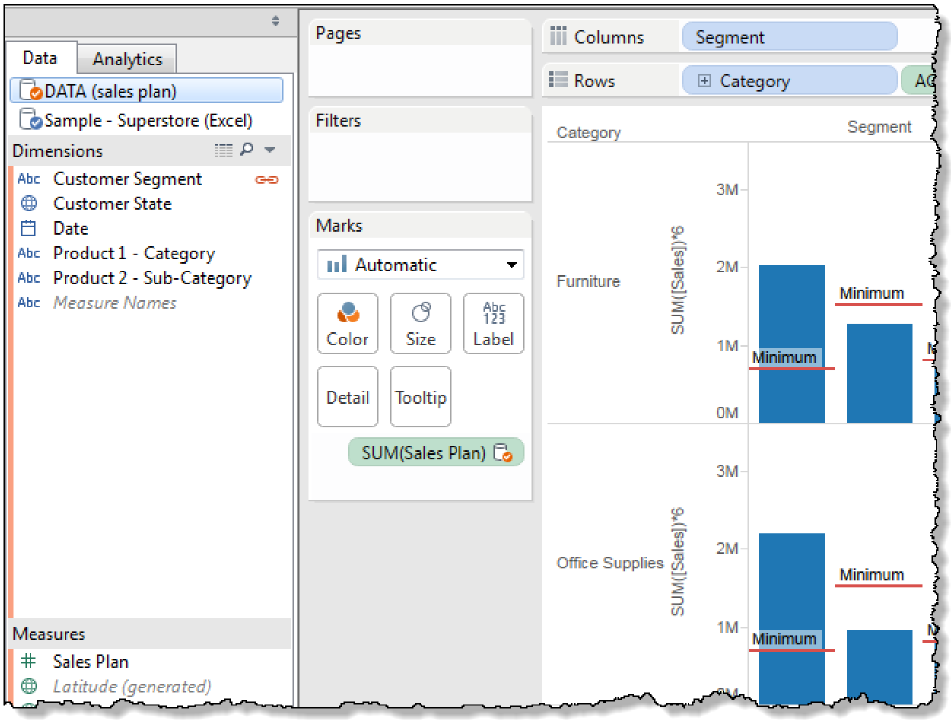
Select **Data** > **Connect to Data** and connect to a data source. Then connect to a second data source. The data sources are shown in a drop-down list at the top of the **Data** pane.



After you add a field to the view, the **Data** pane shows the secondary data source with a colored bar down the left side. If you don't see such a bar, it means that Tableau has not yet determined which data source is the primary data source. As you start adding fields to the view the bar will appear.

2 Use Fields From Both Data Sources

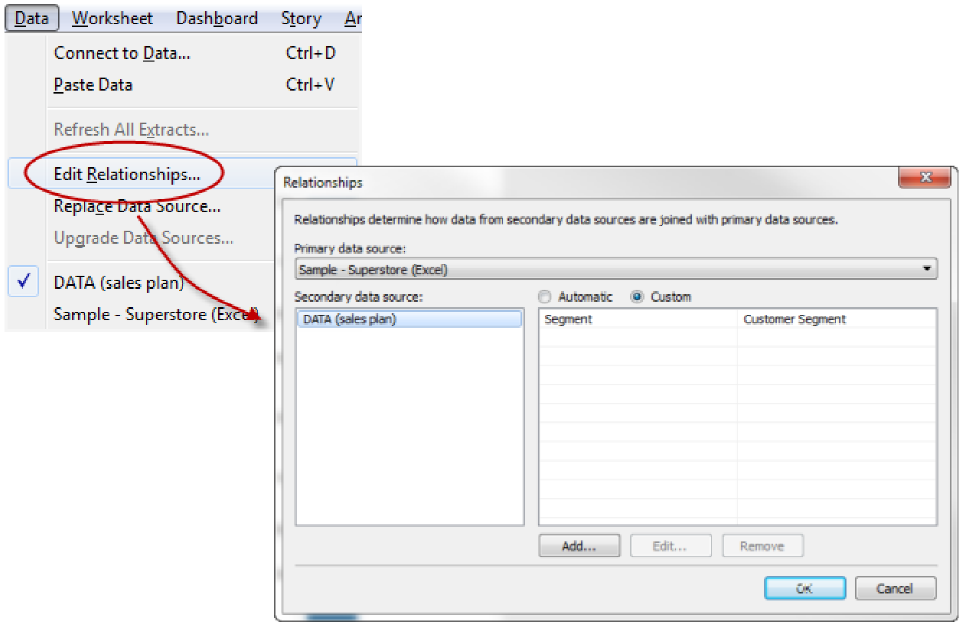
When you drag a field from a secondary data source into the view, Tableau automatically creates relationships between the data sources (if it can). The related fields are marked with a Link icon in the **Data** pane.



In this view, the bars are created using the Sales values from the primary connection (Superstore Sales) while the reference lines show the Sales Plan values from the secondary connection (Sales Plan).

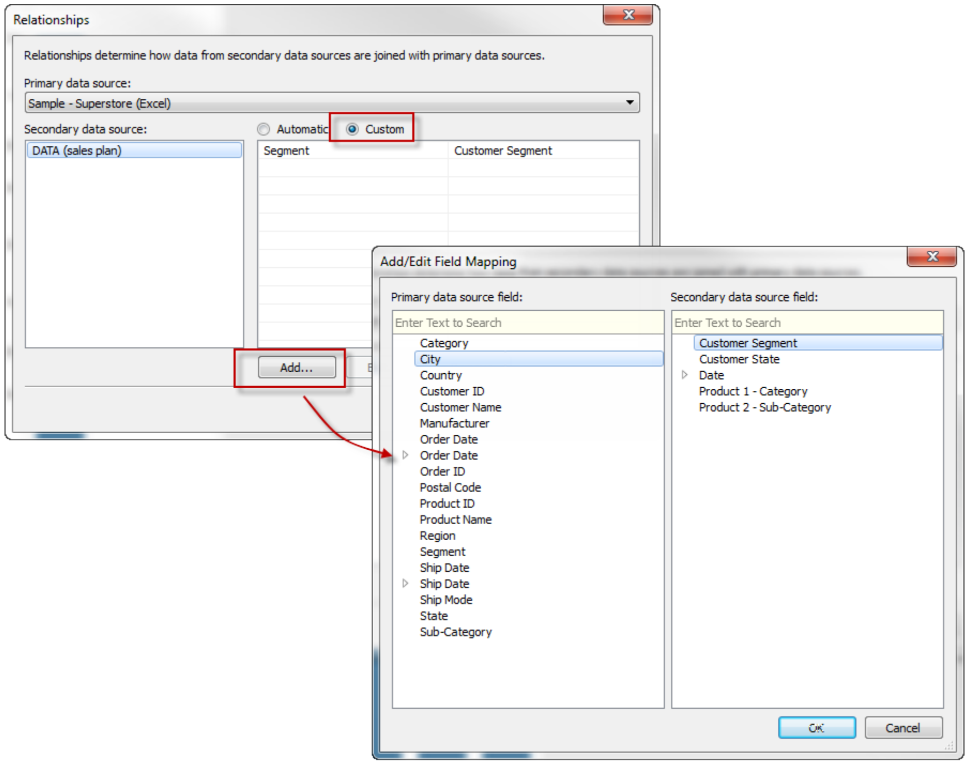
3 Create Custom Relationships

Relationships are automatically created based on field names. But you can define custom relationships by choosing **Data** > **Edit Relationships**.



4 Edit and Define Relationships

In the Relationships dialog box, select the primary data source in the drop-down at the top of the dialog box. Then select the secondary data source. Automatic relationships are shown, but you can select **Custom** and then click **Add** to link pairs of fields from the respective data sources.

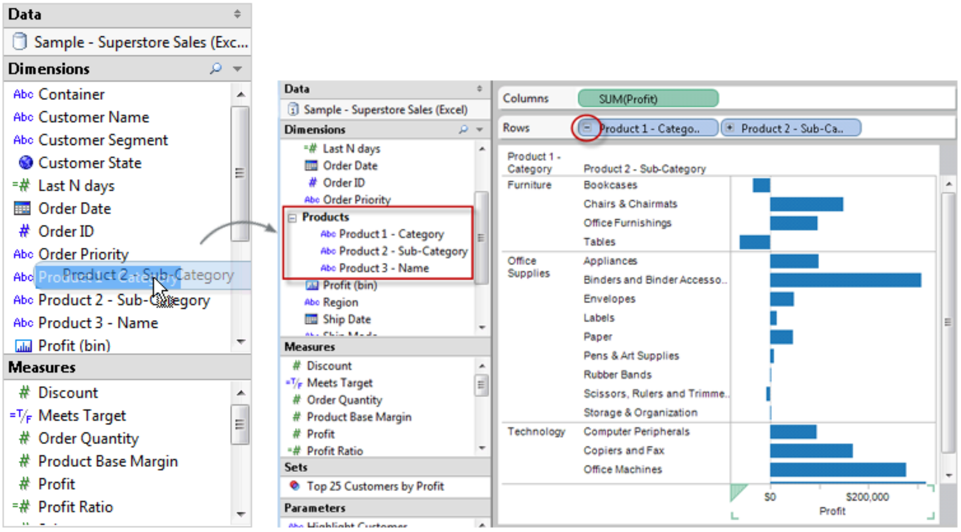


Quick Start: Hierarchies

When you connect to a data source, Tableau automatically separates date fields into hierarchies so you can easily break down the view by year, quarter, month, etc. You can also create your own custom hierarchies. For example, if you have a set of fields named Region, State, and County, you can create a hierarchy from these fields so that you can quickly drill down between levels.

Drag and Drop Fields in the Data Pane

Create hierarchies simply by dragging fields on top of other fields in the **Data** pane. After that you can reorder the levels of the hierarchy by dragging and dropping.



When you drag a member of the hierarchy to the view, you can use the plus and minus (+/-) buttons to drill through the levels.

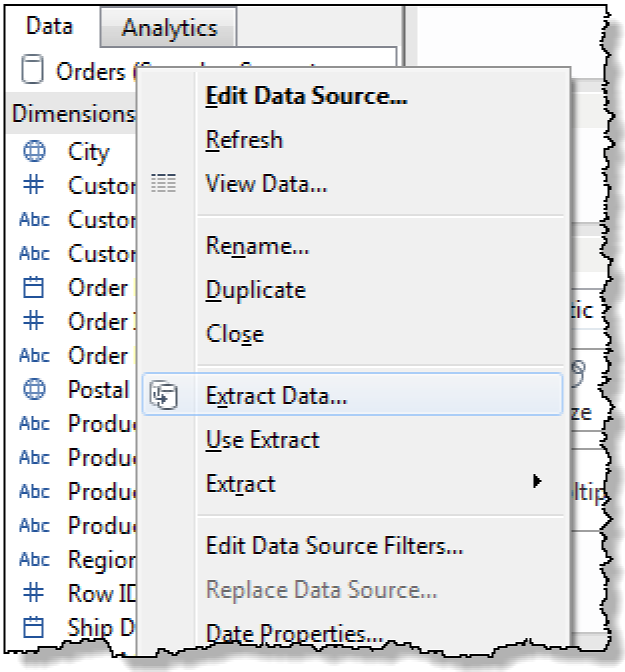
Note: You can also create hierarchies by selecting multiple fields in the **Data** pane, right-clicking and selecting **Create Hierarchy**.

Quick Start: Incremental Extract Updates

When you import all or some of your data into Tableau's data engine, you create a data extract. After you create the initial extract, you can set up an incremental refresh so that importing new data doesn't require you to rebuild the entire extract. An incremental refresh can be defined by the values in a specified column. For example, if you've created an extract that has date values, you can define the incremental refresh to only add new rows if there are additions in the date column.

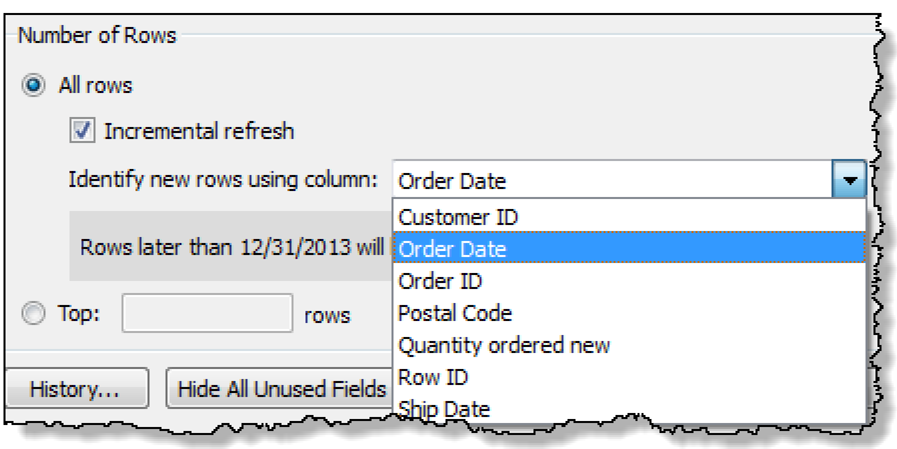
1 Create an Extract

Right-click the data source (or control-click on a Mac) and choose **Extract Data** to create the initial extract. You must do a full extract before you can set up an incremental refresh.



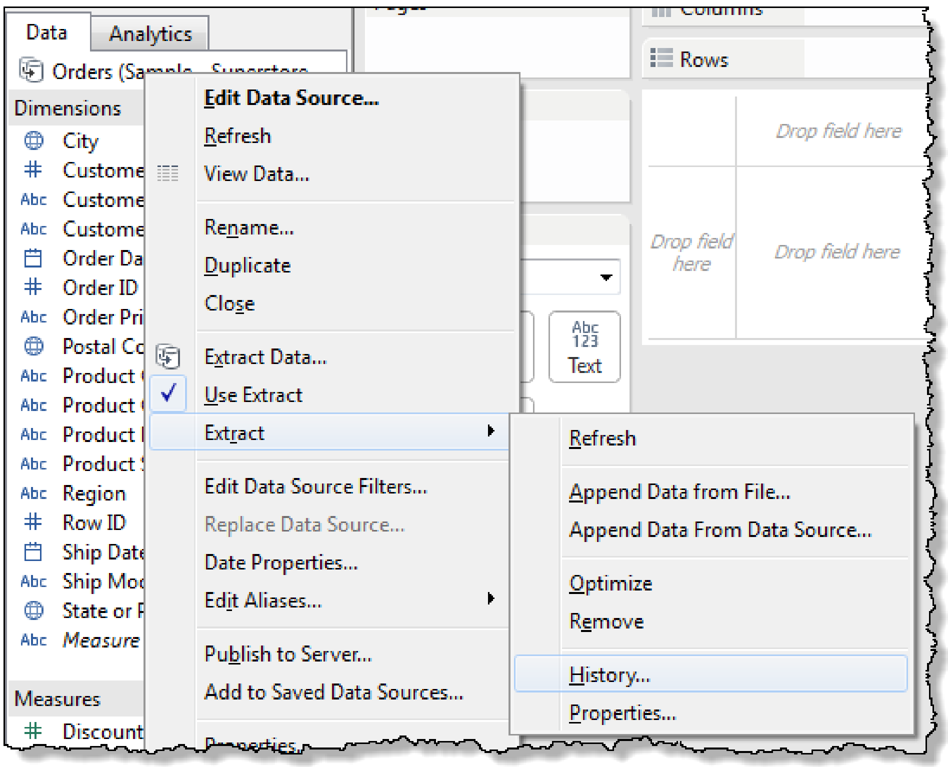
2 Configure the Incremental Refresh

After the data is imported, open the extract dialog box again and choose **Incremental refresh**. Select the column you want to use to identify new records from the drop-down. When finished, click **Extract**.



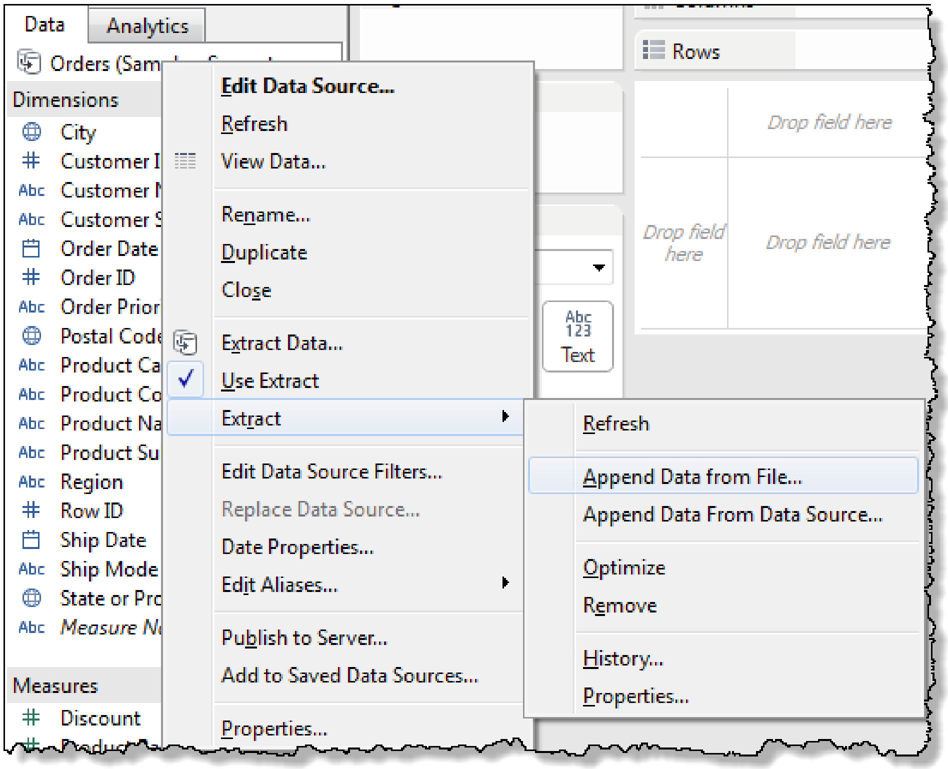
3 View Extract History

You can see a list of the updates that have been made since the initial extract by right-clicking the extract data source and choosing **Extract** > **History**.



4 Add Data from a File

If you regularly receive updates in a CSV or Excel file, you can add data to the extract directly from the local file by right-clicking the extract data source and choosing **Extract** > **Append Data from File**.



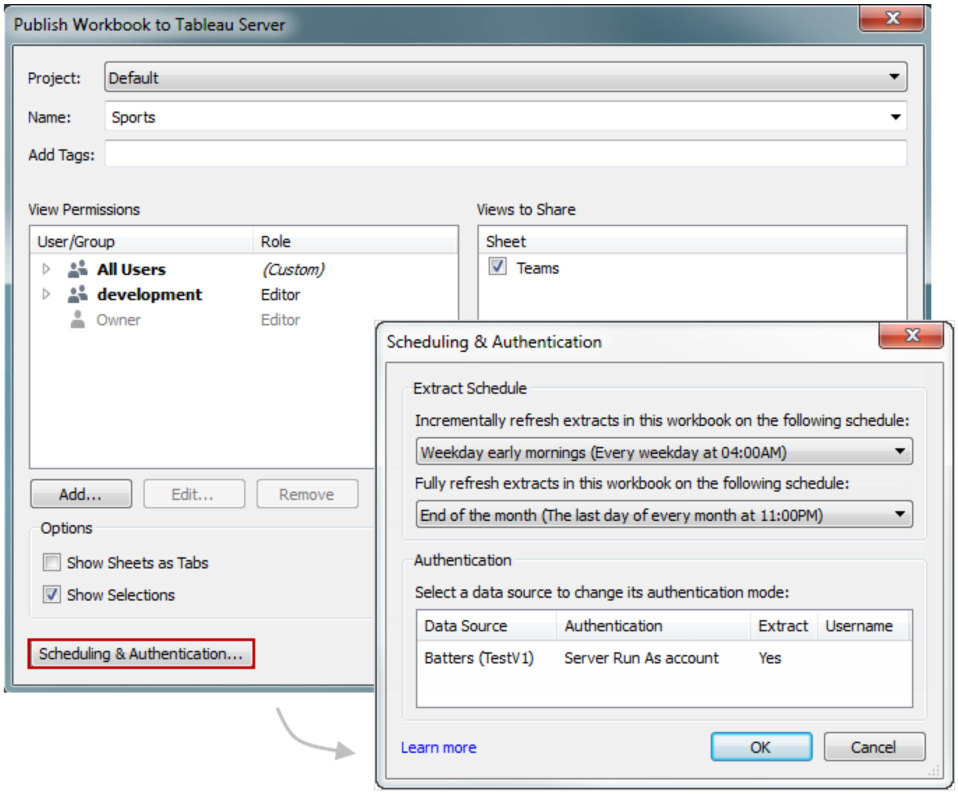
The local file must have the same columns as the original data source.

Quick Start: Manage Incremental Extracts

When you publish a workbook that has an incremental extract, you can associate it with up to two refresh tasks that Tableau Server will handle for you: An incremental refresh of the extract and a full refresh. After you publish the workbook, you or a Tableau Server administrator can modify any tasks that are associated with the workbook. You can also delete tasks or add more.

1 Publish and Assign a Schedule

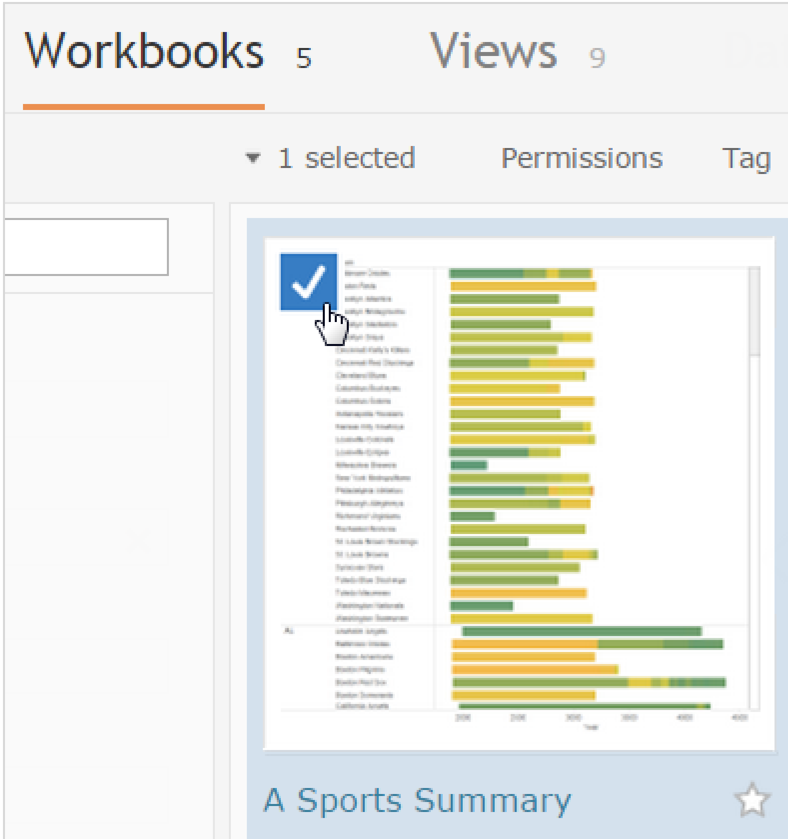
In Tableau Desktop, after you create a workbook that uses an extract, go to **Server** > **Publish Workbook**, and click **Scheduling & Authentication**. Next, choose schedules for your refreshes and click OK.



After you publish in Tableau Desktop and choose your refresh schedules,Tableau Server handles the refresh tasks for you.

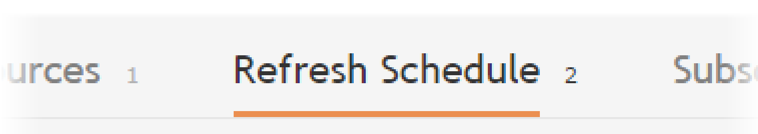
2 Select the Workbook

To modify a workbook's scheduled task, sign in to Tableau Server and on the **Workbooks** page, select the workbook:

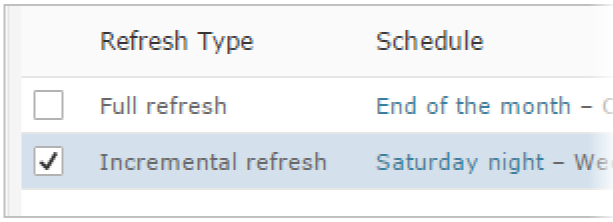


3 Access the Refresh Schedule

Click **Refresh Schedule**.

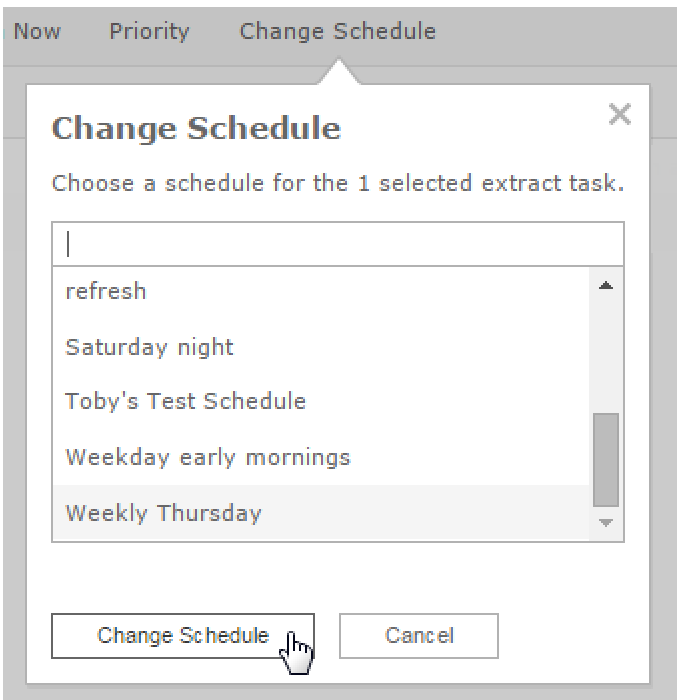


Select the check box for the refresh task you want to modify:



4 Edit, Delete, or Add More Tasks

Select the action you want to take—for example, **Change Schedule**—and make your selection. You can also delete the task, change its priority, or add more refresh tasks.



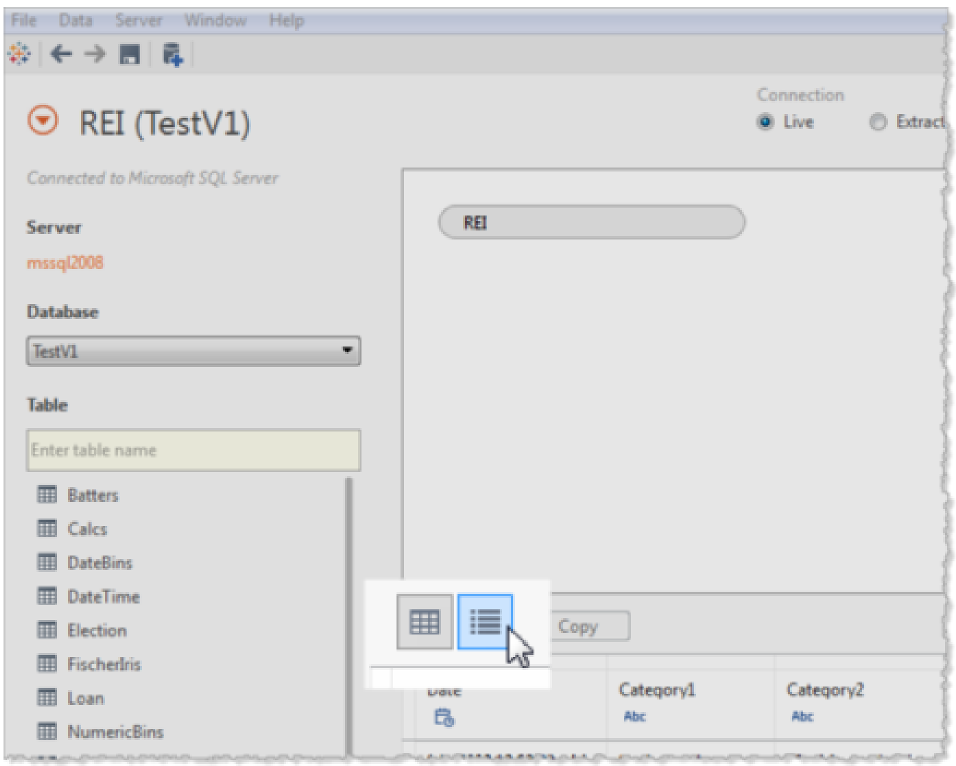
Quick Start: Manage Metadata

Use the metadata area to quickly examine and change the structure of the Tableau data source. You can use the metadata area to review the columns in your data and their data types, do routine management tasks such as renaming a column, hiding a column, changing the data type of a column, and changing the geographical role of the column.

Note: Metadata management tasks vary when working with a multi-dimensional data source.

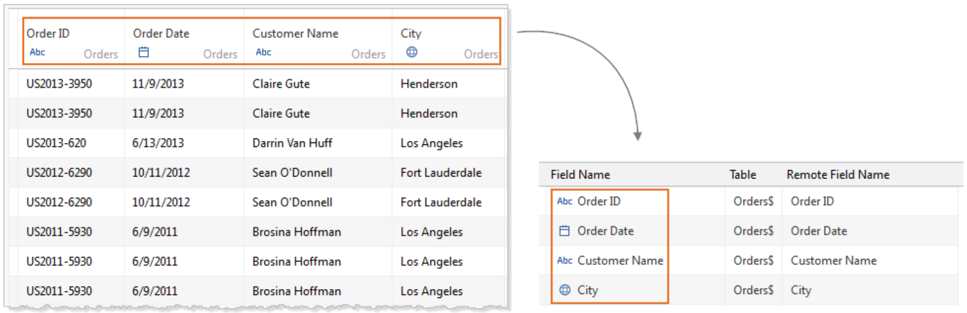
1 Go to the metadata area

After you have set up your data source, click the metadata area button. If you are connected to a cube (multidimensional) data source, the metadata area is shown by default. For other data source types, such as Salesforce or Tableau data extracts (TDE), the default view will vary.



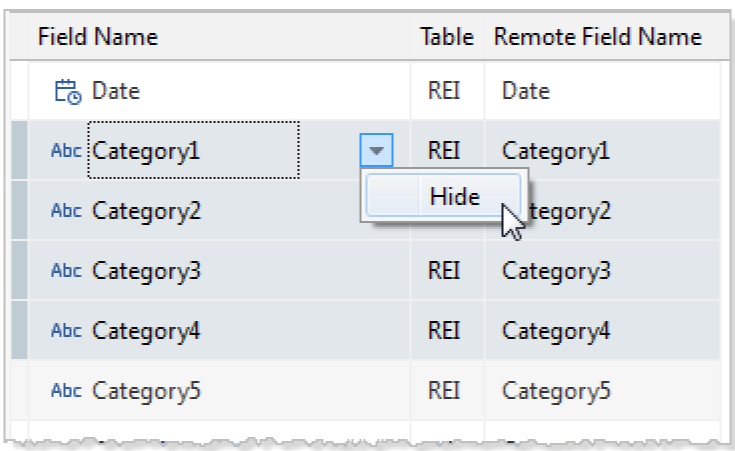
2 Review metadata

The columns of the data source are represented as rows in the metadata area. Each row shows the data type of the column, the column name in the Tableau data source, the name of the table in the underlying data from which the column comes, and the name of the column in the underlying data.



3 Manage metadata

Depending on the type of data you're connected to, you can perform routine management tasks like hiding multiple columns at once or quickly renaming columns. For example, to hide multiple columns at once, press the CTRL or Command key, select the columns you want to hide, click the drop-down arrow next to a column name, and then select **Hide**. Changes that you make in the metadata area of the data source do not modify your underlying data.

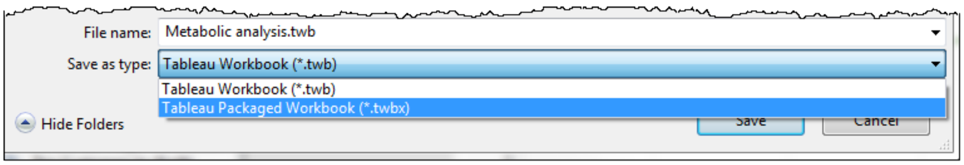


Quick Start: Packaged Workbooks

Often, workbooks reference files that are stored on your local computer. These files might be Excel or Access files you used as data sources, Tableau extracts, background image files. You can now save copies of these local files along with your workbook in a single file called a **packaged workbook**. Packaged workbooks make it easy to share your work with others.

1 Save As a Packaged Workbook

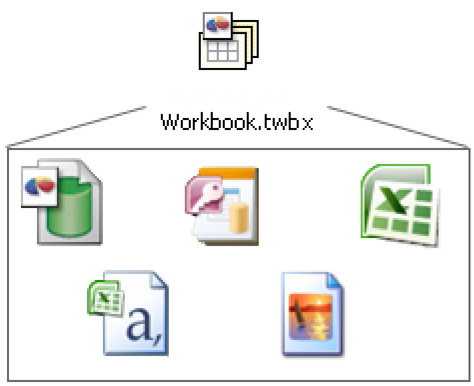
Choose **File** > **Save As** and choose Packaged Workbook as the type.



The file extension for packaged workbooks is .twbx.

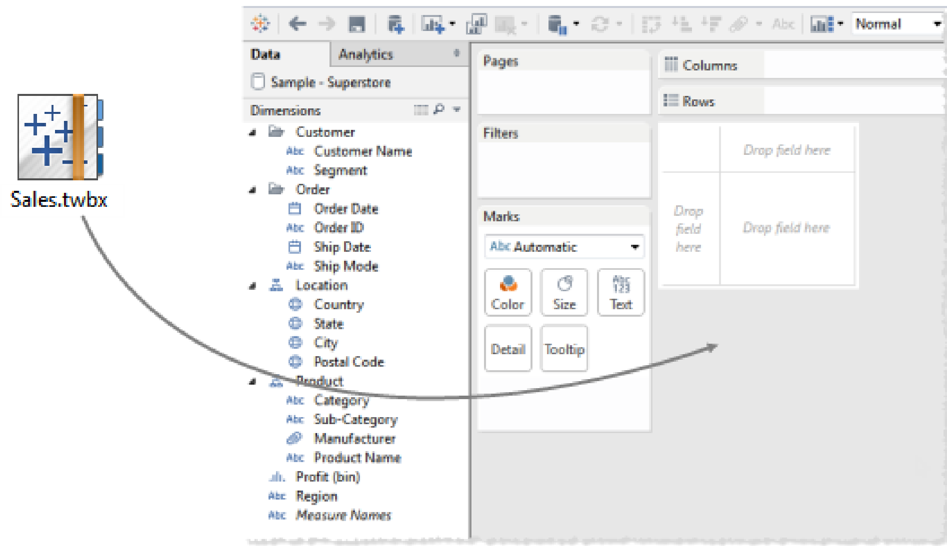
2 Share Your Work with Others

A packaged workbook is a single file that contains a copy of all of the referenced local files, so you can easily share it using email, a shared file system, or by publishing to Tableau Server.



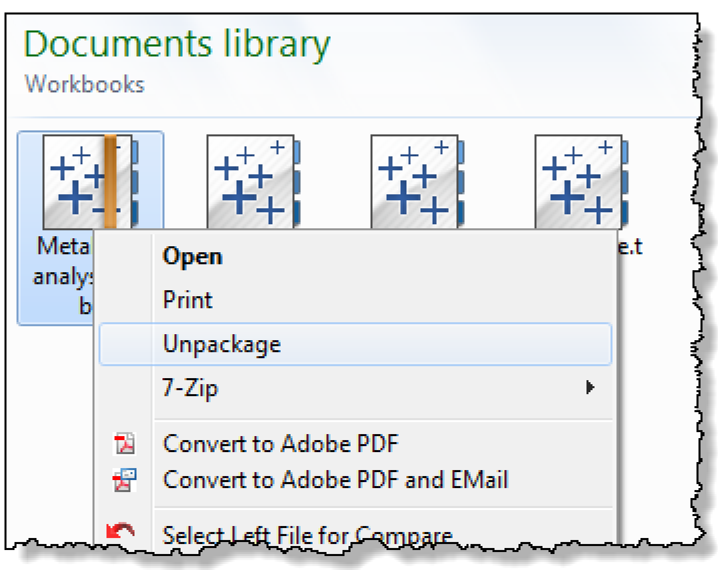
3 Opening Packaged Workbooks

To open a packaged workbook in Tableau Desktop, double-click the file on your computer, or drag and drop the file onto the running application.



4 Unpackaging Workbooks

You can access the packaged files at anytime by unpackaging the workbook. Right-click the packaged workbook file on your PC (or control-click on a Mac) and select **Unpackage**.

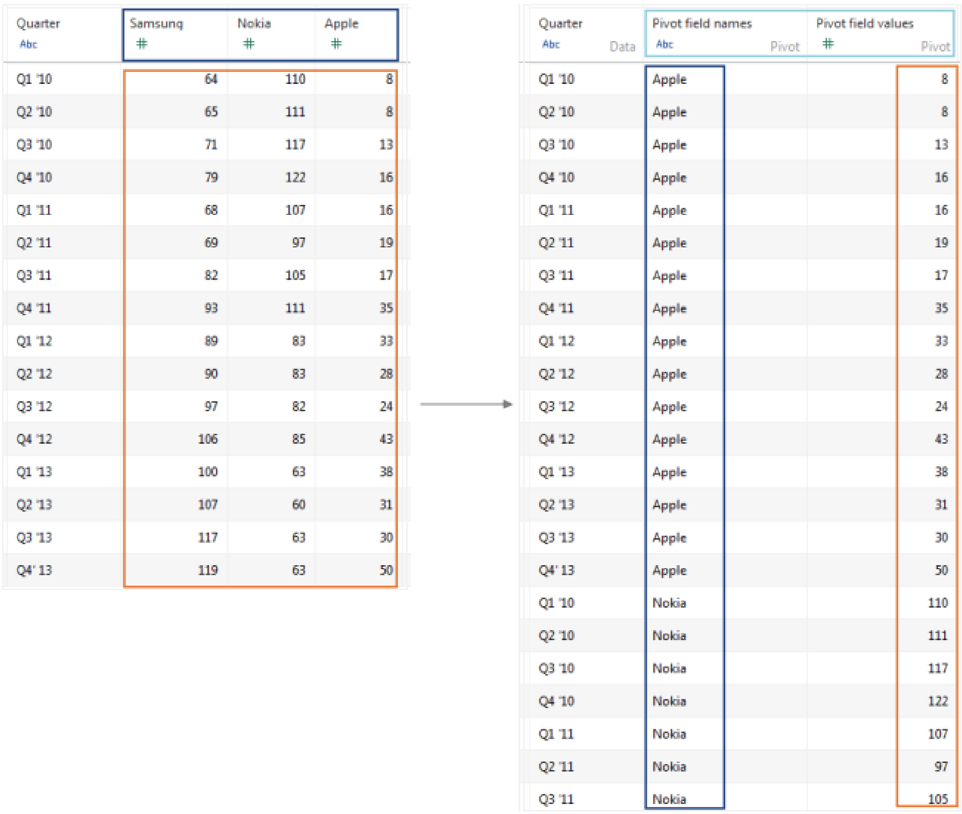


Unpackaging gives you an unpackaged workbook file (twb) along with a folder containing all of the referenced files.

Quick Start: Pivot Data (from Columns to Rows)

Sometimes, analyzing data that is stored in a crosstab format can be difficult in Tableau. When working with this type of data, you can pivot your data from crosstab format into columnar format.

For example, suppose you have the number of devices sold by quarter for three vendors in three separate fields. You can pivot your data so that the vendor is in one field and the number of devices sold is in another field.

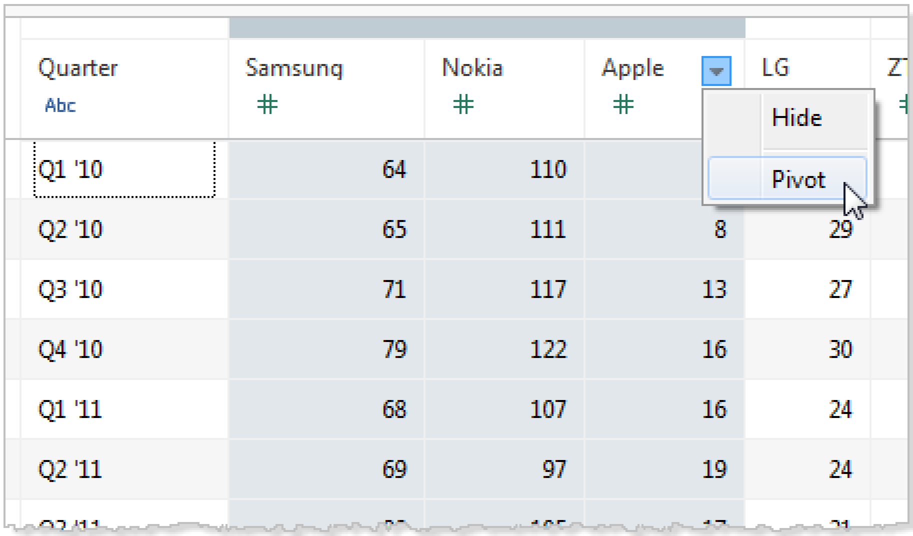


Quarter	Samsung	Nokia	Apple
Q1 '10	64	110	8
Q2 '10	65	111	8
Q3 '10	71	117	13
Q4 '10	79	122	16
Q1 '11	68	107	16
Q2 '11	69	97	19
Q3 '11	82	105	17
Q4 '11	93	111	35
Q1 '12	89	83	33
Q2 '12	90	83	28
Q3 '12	97	82	24
Q4 '12	106	85	43
Q1 '13	100	63	38
Q2 '13	107	60	31
Q3 '13	117	63	30
Q4' 13	119	63	50

Quarter	Pivot field names	Pivot field values
Q1 '10	Apple	8
Q2 '10	Apple	8
Q3 '10	Apple	13
Q4 '10	Apple	16
Q1 '11	Apple	16
Q2 '11	Apple	19
Q3 '11	Apple	17
Q4 '11	Apple	35
Q1 '12	Apple	33
Q2 '12	Apple	28
Q3 '12	Apple	24
Q4 '12	Apple	43
Q1 '13	Apple	38
Q2 '13	Apple	31
Q3 '13	Apple	30
Q4' 13	Apple	50
Q1 '10	Nokia	110
Q2 '10	Nokia	111
Q3 '10	Nokia	117
Q4 '10	Nokia	122
Q1 '11	Nokia	107
Q2 '11	Nokia	97
Q3 '11	Nokia	105

1 Pivot the data

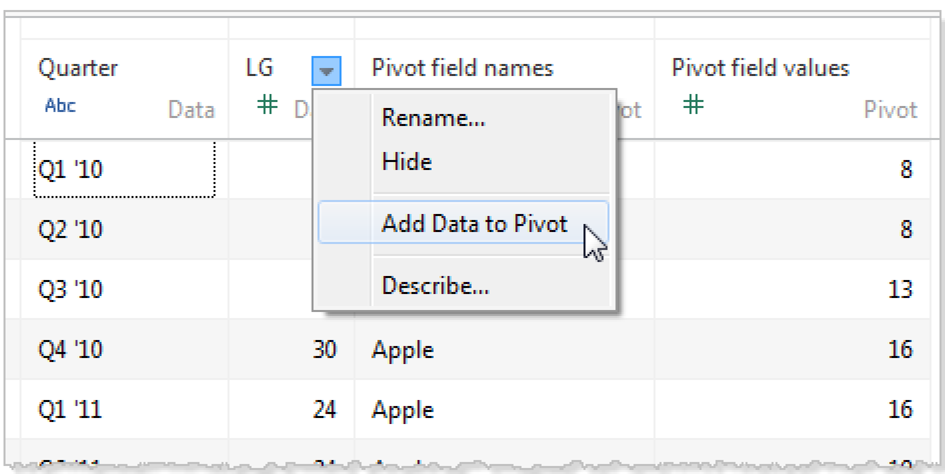
After you have set up the data source, in the grid, select two or more columns. Click the drop-down arrow next to the column name, and then select **Pivot**. New columns called "Pivot field names" and "Pivot field values" are created and added to the data source. The new columns replace the original columns that you selected to create the pivot.



Pivot is available only for non-legacy Microsoft Excel and text file data sources.

2 Add to the pivot

To add more data to the pivot, select another column, click the drop-down arrow next to the column name, and then select **Add to Pivot**. Make sure that the pivot columns and values look as expected before you begin your analysis.



To remove a pivot, click the drop-down arrow next to the name of a pivot column, and then select **Remove Pivot**.

Quick Start: Publish a Data Source to Tableau Online

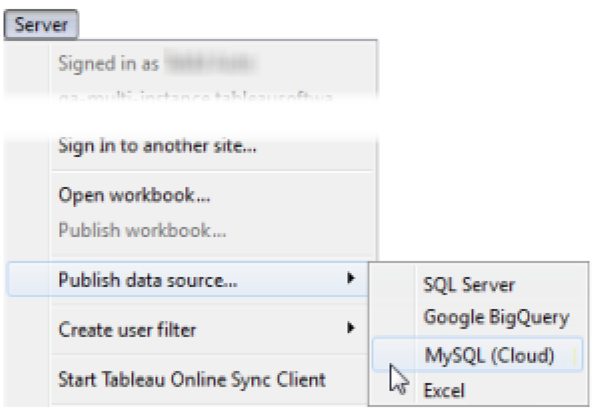
You can publish data sources so that other Tableau Desktop users can connect to your data, and to have updates you make to the published data source flow to all workbooks that rely on it.

If you want to publish to Tableau Server, see Quick Start: Publish a Data Source to Tableau Server.

1Sign in and initiate publishing

1. If you're not already signed in to the server you want to publish to, select **Server** > **Sign In**, and enter your server name and user name and password.

2. Select **Server** > **Publish Data Source**. If your workbook is connected to multiple data sources, select the data source you want to publish.

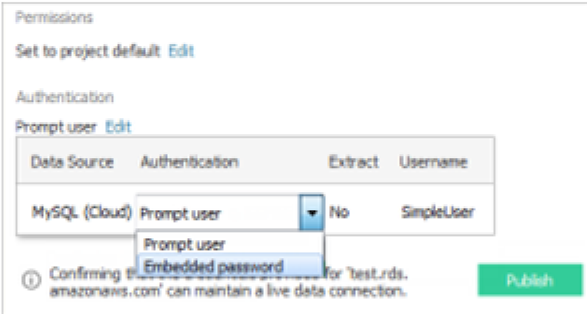


3. In the **Publish data source to Tableau Server** dialog box, do the following:
   - Select the project you want to publish to and enter the data source name.
   - Add a description and tags that will help other users find your data source

2 Select the authentication type

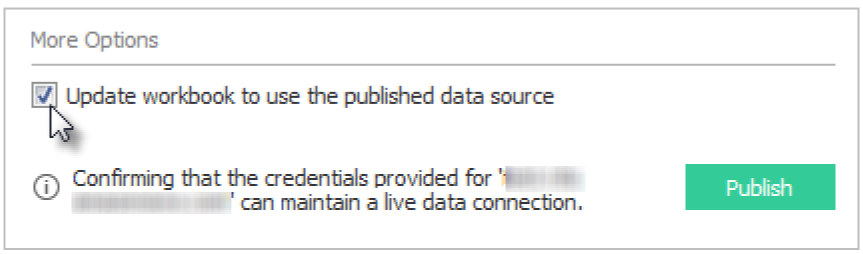
The options available for accessing the data source depend on the type of data you publish and whether you are publishing to Tableau Server or Tableau Online.

Information appears at the bottom of the dialog box to let you know whether you need to take further action, such as adding Tableau Online to your data provider's authorized list.



3 Use the published data source

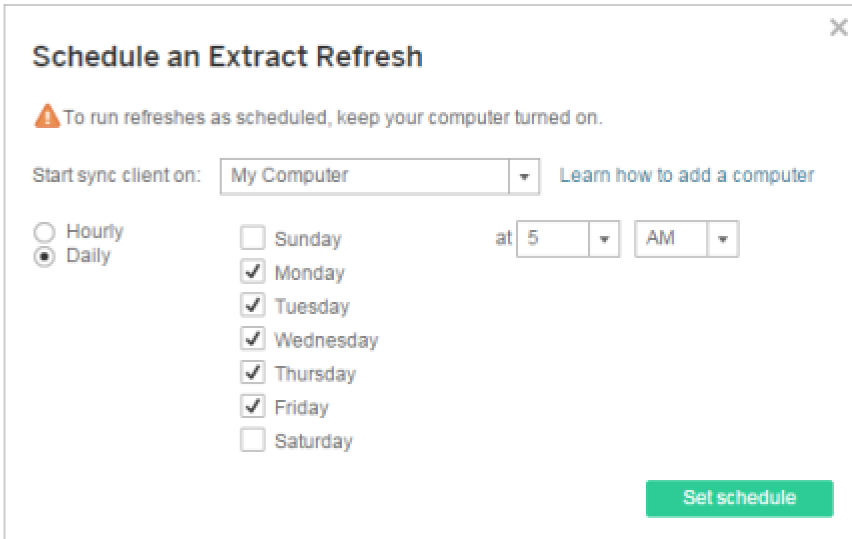
By default, when you publish, Tableau updates the workbook you're publishing from to use the published data source and closes the local data source. You can clear this check box if you want the workbook to continue to use the local data source.



For more information, see Quick Start: Automatically Update Workbook to Use Published Data Source.

4Set up a refresh schedule

As you publish an extract of a data source that Tableau Online cannot reach directly, such as one that you maintain inside your organization's firewall, you are prompted to start the Tableau Online sync client and set up a scheduled refresh for that data source. Select the computer on which you want to run the sync client (usually you'll select **My Computer**).



See also

- Publish Data Sources and Workbooks
- Publish a Data Source
- Allow Direct Connections to Data Hosted on a Cloud Platform (Tableau Online)
- Keep Data Fresh (Tableau Online)

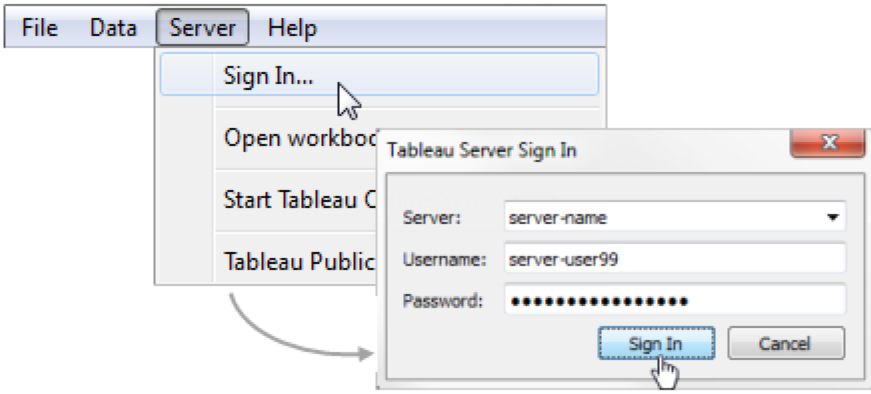
Quick Start: Publish a Data Source to Tableau Server

You can publish data sources so that other Tableau Desktop users can connect to your data, and to have updates you make to the published data source flow to all workbooks that rely on it.

If you want to publish to Tableau Online, see **Quick Start: Publish a Data Source to Tableau Online** on page 56.

1Sign in to the server

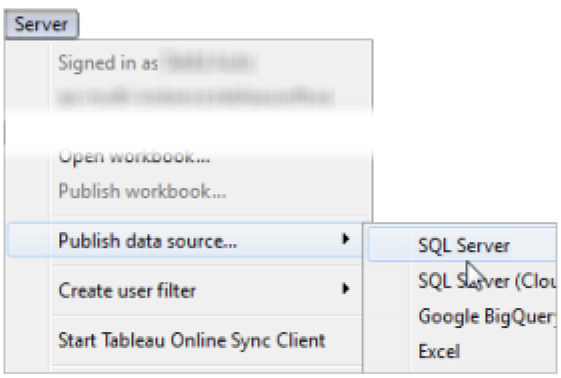
If you're not already signed in to the server you want to publish to, select **Server** > **Sign In**, and enter your server name and user name and password.



2 Start the publishing process

1. Select **Server** > **Publish Data Source**.

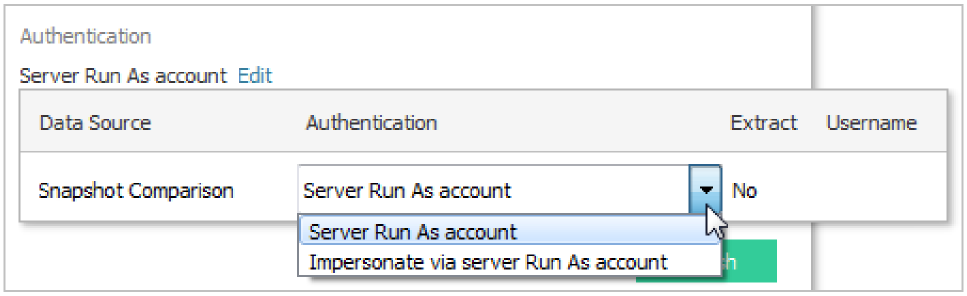
   If your workbook is connected to multiple data sources, select the data source you want to publish from the submenu.



2. In the **Publish data source to Tableau Server** dialog box, do the following:
   - Select the project you want to publish to and enter the data source name.
   - Add a description and tags that will help other users find your data source

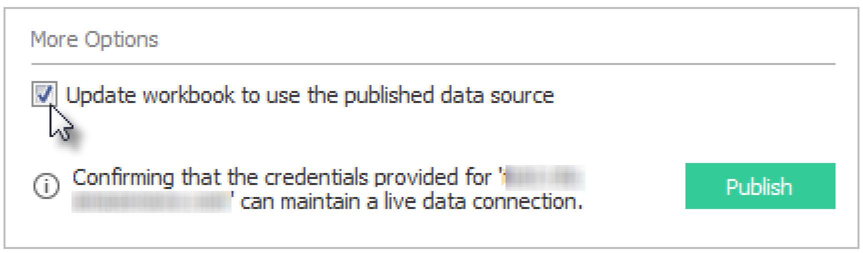
3 Select the authentication type

The options available for accessing the published data source depend on the type of data you publish. The following image shows options for a SQL Server data source



4Use the published data source

By default, when you publish, Tableau updates the workbook you're publishing from to use the published data source and closes the local data source. You can clear this check box if you want the workbook to continue to use the local data source.



For more information, see **Quick Start: Automatically Update Workbook to Use Published Data Source** on page 26.

See also

- Publish Data Sources and Workbooks
- Publish a Data Source

Quick Start: SAP HANA Single Sign-On

When SAP HANA is configured to support single sign-on (SSO), after you sign in to the SAP HANA server, you can access data, and publish data sources and workbooks to Tableau Server, without having to re-enter your user name and password. And, you can publish a data source or workbook so that other users with SSO can access the published data sources and workbooks without having to enter their user names and passwords.

Important: Your environment must correctly configured to support SSO for SAP HANA:

- Tableau Desktop requires SAP HANA driver version 1.00.85 and later.
- Tableau Server must be configured to support SSO for SAP HANA. For information, see

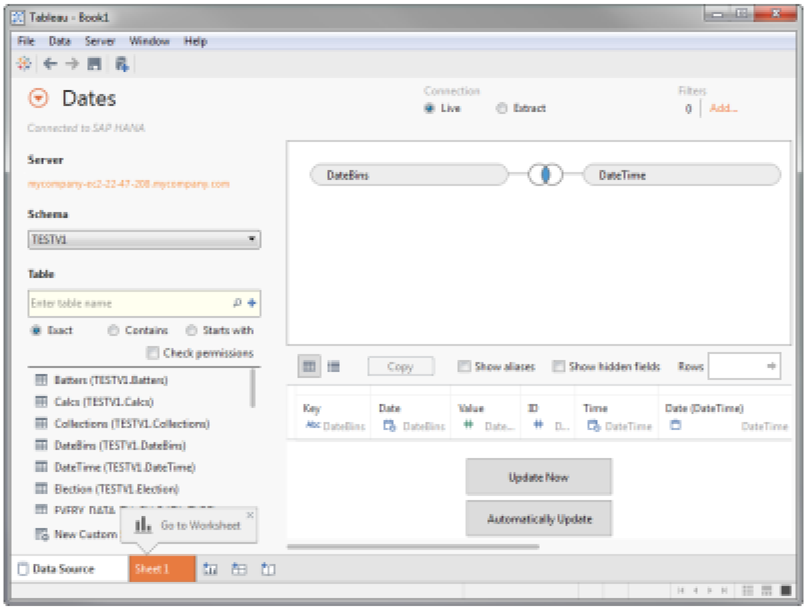
Configure SAP HANA for Single Sign-On in the Tableau Server Help.

1 Connect to SAP HANA using SSO

On the start page in Tableau Desktop, under **Connect**, select **SAP HANA**, specify a server name, select **Use Windows Authentication**, and then click **OK**.

2 Create a data source or a workbook

After you connect to SAP HANA data, you can set up a data source and publish it to Tableau Server for others to use. You can also create a view and publish the workbook to Tableau Server.

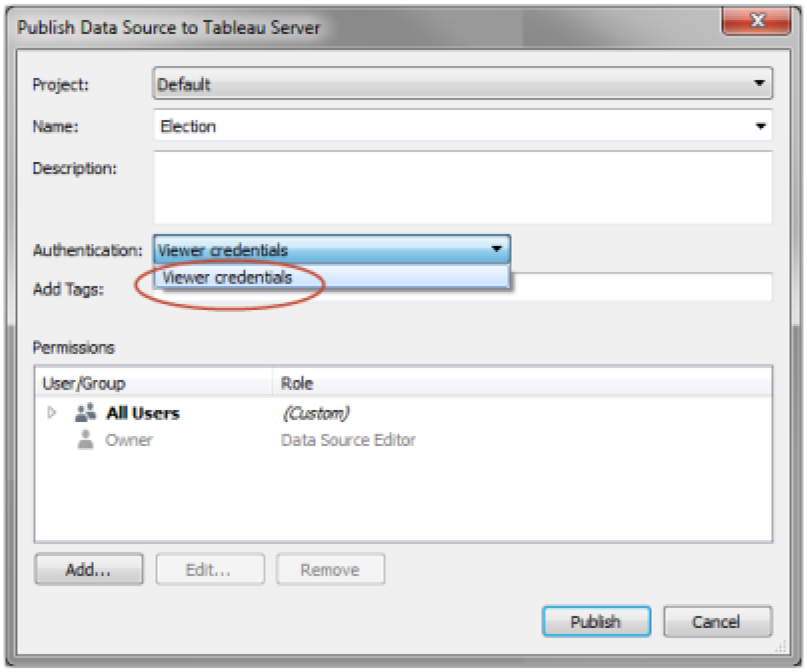


3Publish to Tableau Server with SSO enabled

In an SSO environment, users don’t have to enter their credentials to access a data source or a workbook if you publish it to Tableau Server with the correct authentication mode.

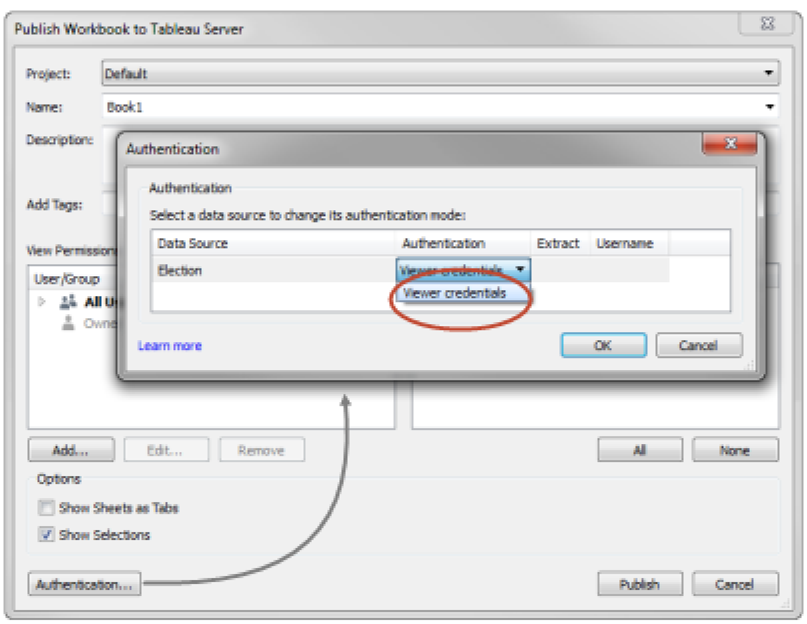
Data Source

To enable SSO when you publish a data source to Tableau Server, select **Data** > **Publish to Server**, and then set **Authentication** to **Viewer credentials**.



Workbook

To enable SSO when you publish a workbook to Tableau Server, select **Server** > **Publish Workbook**, click **Scheduling & Authentication**, and then set **Authentication** to **Viewer credentials**.



Quick Start: Split a Field into Multiple Fields

Sometimes, it is easier to analyze a string fields if its values are separated into multiple fields. Use the Split and Custom Split commands to split string values from one field into multiple fields.

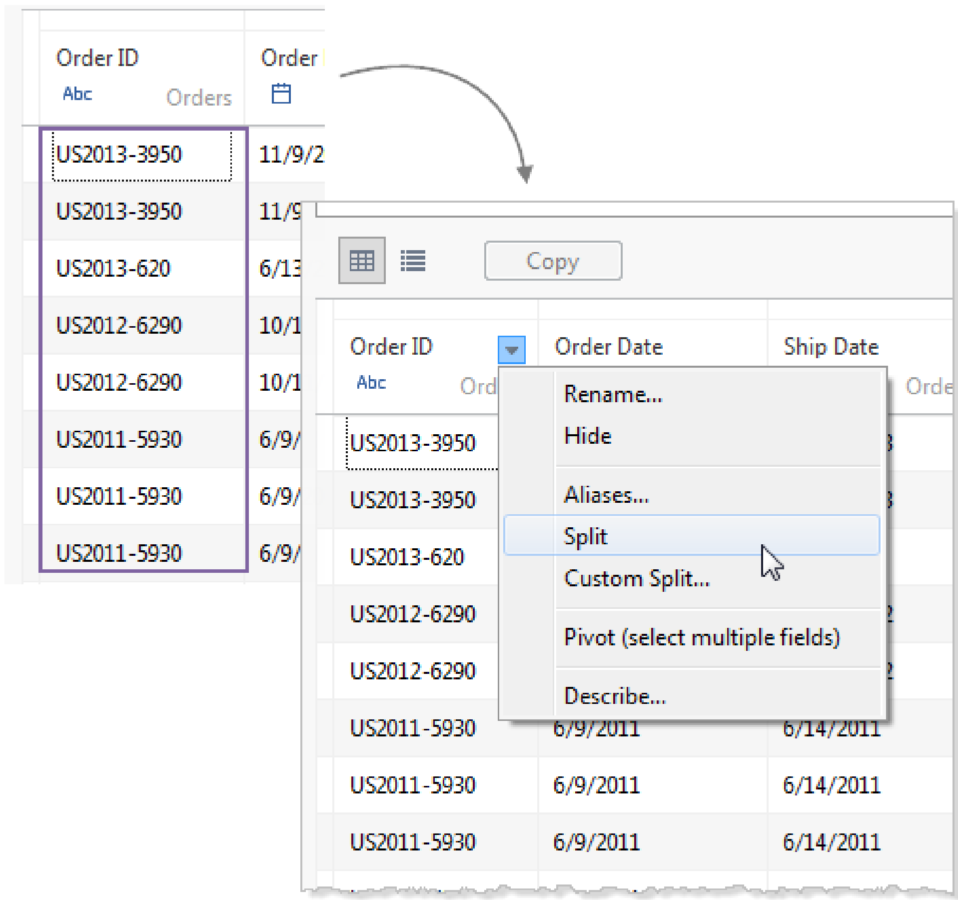
1 Split the field

After you have set up the data source, you can have Tableau automatically split the field based on a common separator or do a custom split of a field by specifying the common separator and the number of fields.

Note: The split and custom split commands are available for the following data sources types: Tableau data extracts, Microsoft Excel, Text, Salesforce, OData, Microsoft Azure Market Place, Google Analytics, HP Vertica, Oracle, MySQL, PostgreSQL, Teradata, Amazon Redshift, Aster Data, Google Big Query, Cloudera Hadoop Hive, Hortonworks Hive, and Microsoft SQL Server.

Split fields automatically

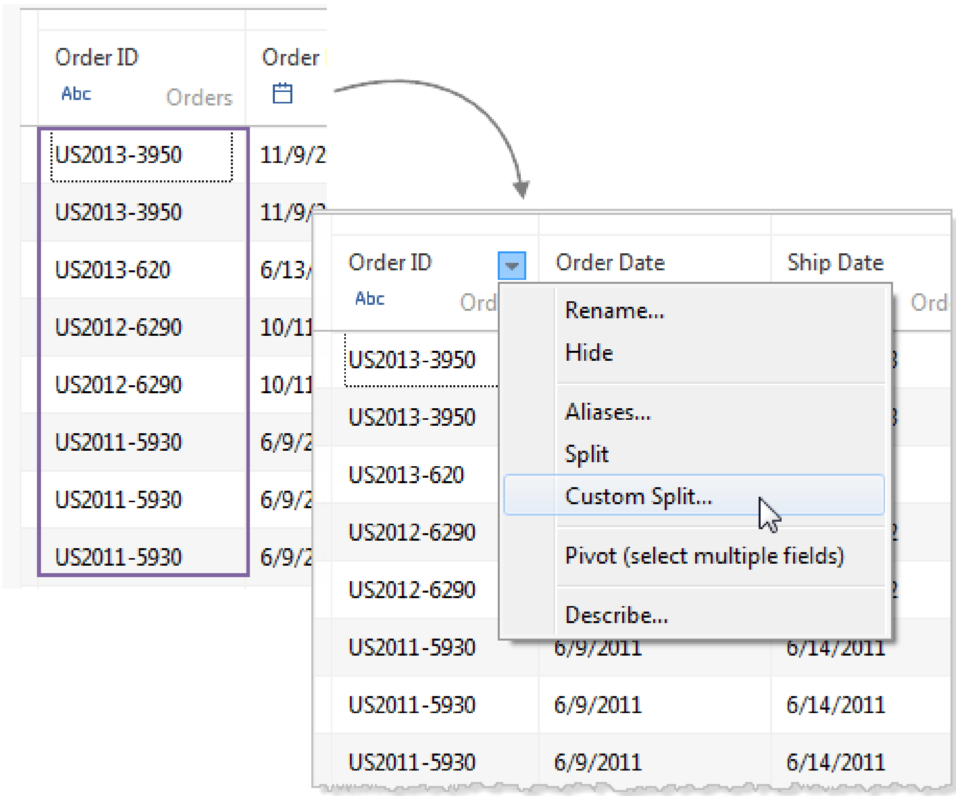
In the grid, click the drop-down next to the column name. Select **Split**.



If Tableau cannot identify a common separator among the string values you are prompted to create a custom split.

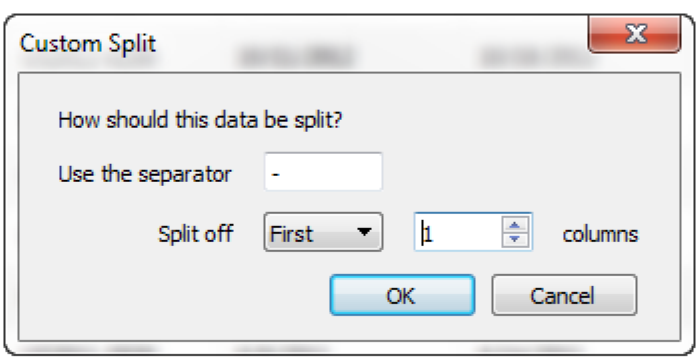
Use a custom split

In the grid, click the drop-down arrow next to the column name of the column you want to split. Select **Custom Split**.



In the **Custom Split** dialog box, specify the following:

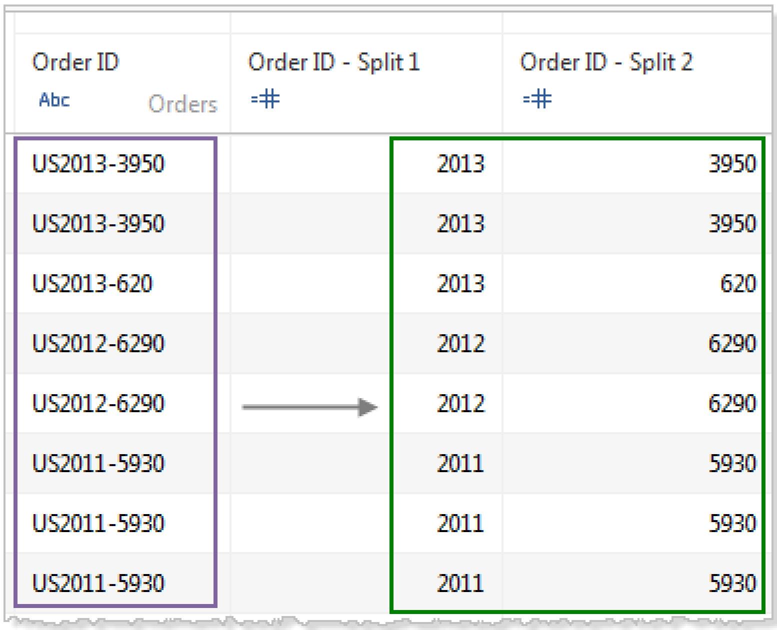
1. In the **Use the separator** box, enter the separator by which to separate the values in the field. The separator can be a character or a combination of characters or phrases.
2. Under **Split off**, select whether to split the string values for every instance (**All**) of the separator, the first (**First**) *n* instances of the separator, or the last *n* instances (**Last**) of the separator.
3. Enter the number of fields you want to generate from the split.



2 Review the results

New fields are created and added to the data source as calculated fields. If the new fields do not look as expected, you can undo the changes. After you verify that the split values look as expected, begin your analysis by clicking the sheet tab.

> **Note:** You can also make modifications to the new split fields by editing the calculated fields from the Data pane in the sheet tab.



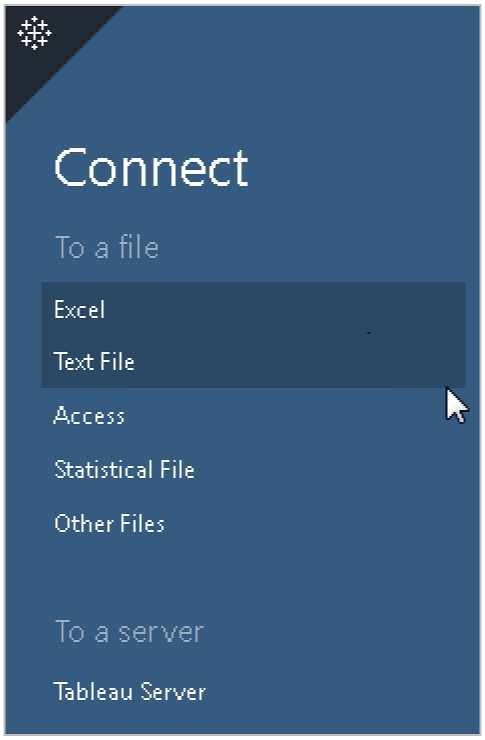
Order ID Abc Orders	Order ID - Split 1	Order ID - Split 2
US2013-3950	2013	3950
US2013-3950	2013	3950
US2013-620	2013	620
US2012-6290	2012	6290
US2012-6290	2012	6290
US2011-5930	2011	5930
US2011-5930	2011	5930
US2011-5930	2011	5930

Quick Start: Union Tables

When you create joins, you combine two or more tables of data by adding fields (columns). With unions, you can combine two or more tables of data by appending values (rows) from one table to another. You can union Excel or text file-based tables that share the same fields. That is, to union two or more disparate tables, the related fields in each table must have matching field names and data types. For example, to union two single-field tables that contain customer names, both field names must be called "Customer Name" and both field data types must be string.

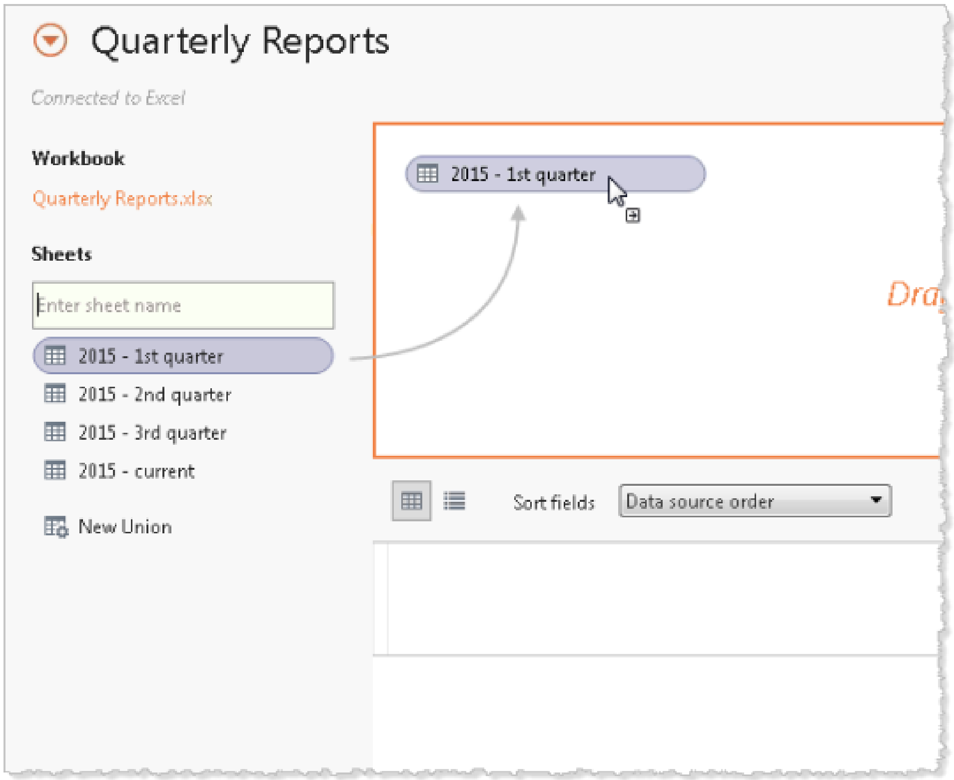
1 Connect to your Excel or text file data

On the start page, under **Connect**, click **Excel** or **Text File** to connect to your Excel or text field-based data.



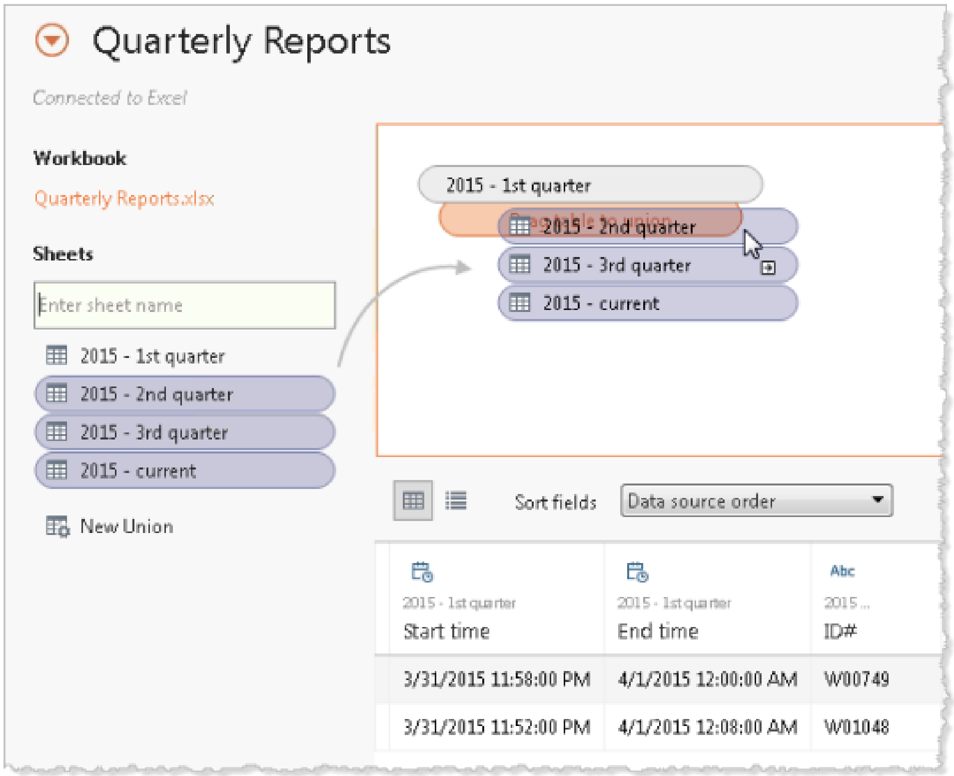
2 Drag a table to the canvas

Drag a table to the canvas. You can also drag **New Union** from the left pane to the canvas.



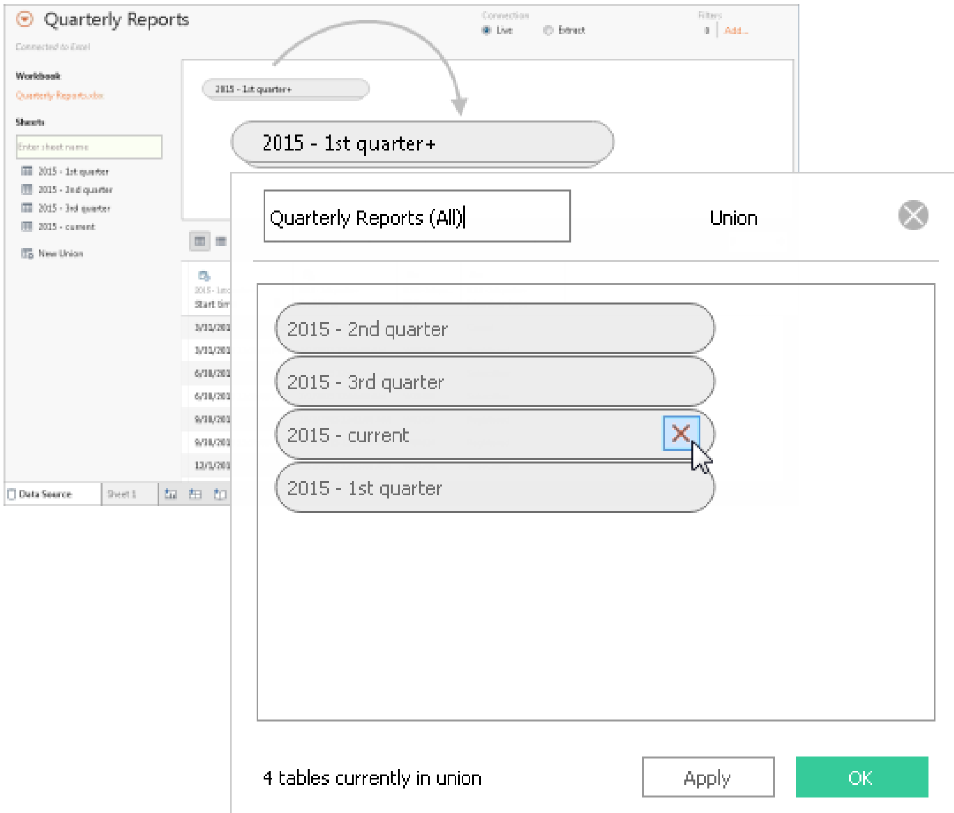
3 Union tables

Select a table on the left pane and drag it directly below the first table on the canvas. To add multiple tables to a union at the same time, in the left pane, press **Shift**, select the tables you want to union, and then drag them to the first table.



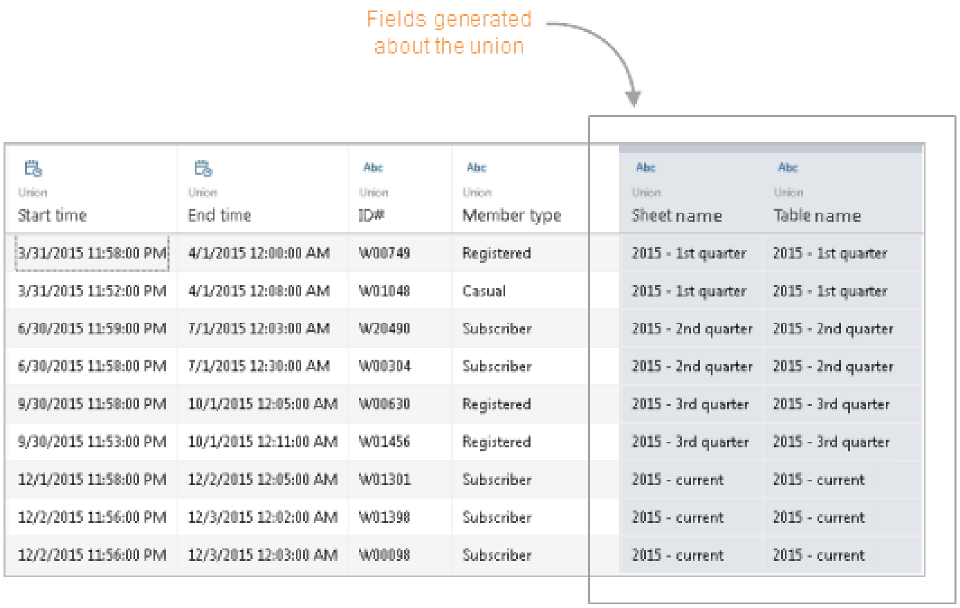
4 Customize the union

Click the union drop-down arrow and then select **Customize union** to rename the union, or add or remove tables in the union.


Quarterly Reports
Workbook
Sheets
2015 - 1st quarter+
Quarterly Reports (All)
Union
2015 - 2nd quarter
2015 - 3rd quarter
2015 - current
2015 - 1st quarter
4 tables currently in union
Apply
OK

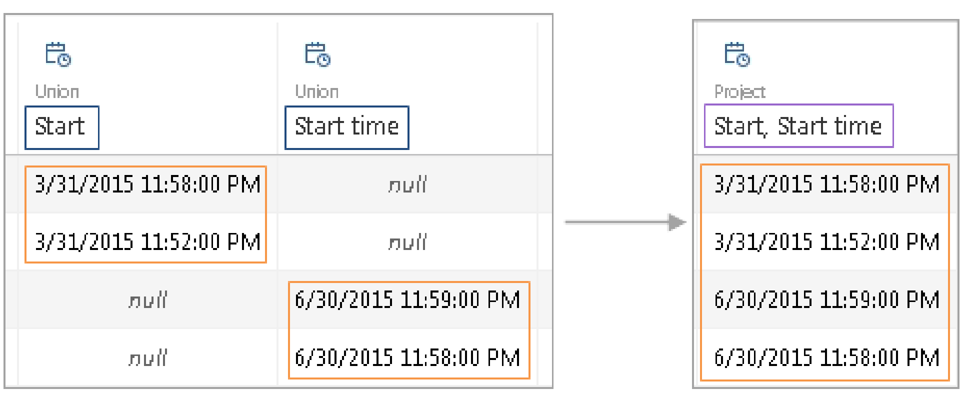
After you have unioned the tables, additional fields are automatically generated to help identify where in the original data the values in the union are coming from. Review these values and the other values in the grid.

Continue to prepare your data source for analysis by joining other tables to the union table and making general modifications to the fields in the grid, such as pivot and split. When finished, click the sheet tab to start your analysis.



Troubleshoot unions

If you notice some fields with null values, it could be because field names in the unioned table do not match. In this case, you can merge the non-matching fields by selecting two or more columns in the grid, clicking the column drop-down arrow, and then selecting **Merge mismatched fields**. When you use this option, a new field called is added to the Tableau data source. **Note:** You can also create a calculation to merge fields or combine fields by modifying the underlying Excel or text data.

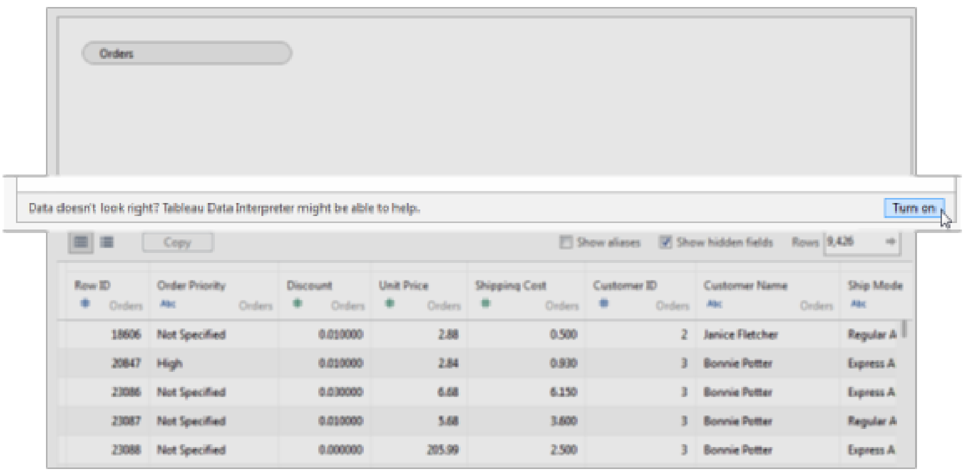


Quick Start: Use Data Interpreter to Prepare Your Excel Data Source for Analysis

Sometimes, the format of the data in your Microsoft Excel data makes it difficult to analyze in Tableau. For example, your Excel data might include sub-tables, hierarchical headers, extraneous headers and footers, or blank rows and columns. The Data Interpreter draws out sub-tables and removes some of that extraneous information to help prepare your data source for analysis.

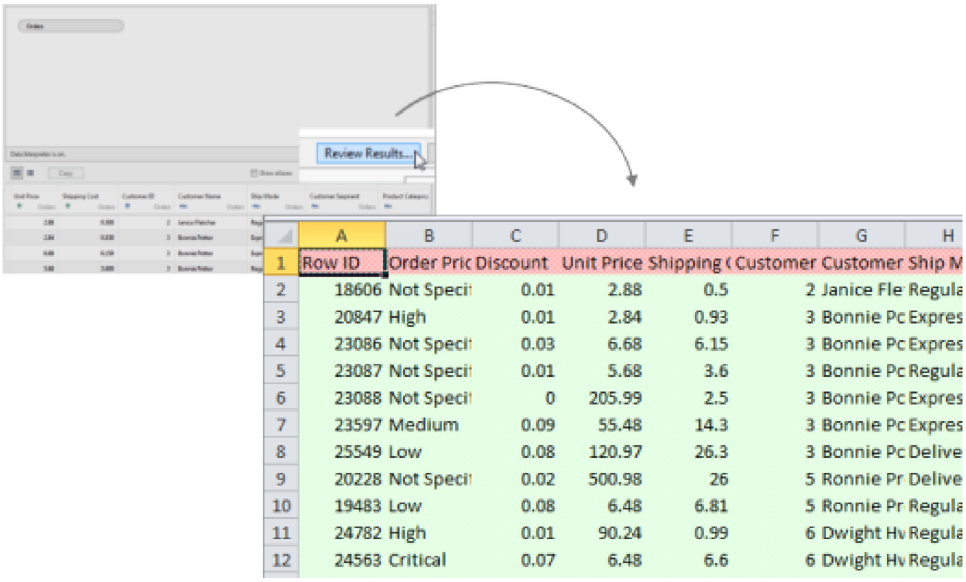
1 Turn on the Data Interpreter

After you have connected to your Excel data and set up the data source, if Tableau detects sub-tables, unique formatting, or some extraneous information, the Data Interpreter option becomes available. Click **Turn on** to turn on the Data Interpreter.



2 Review results

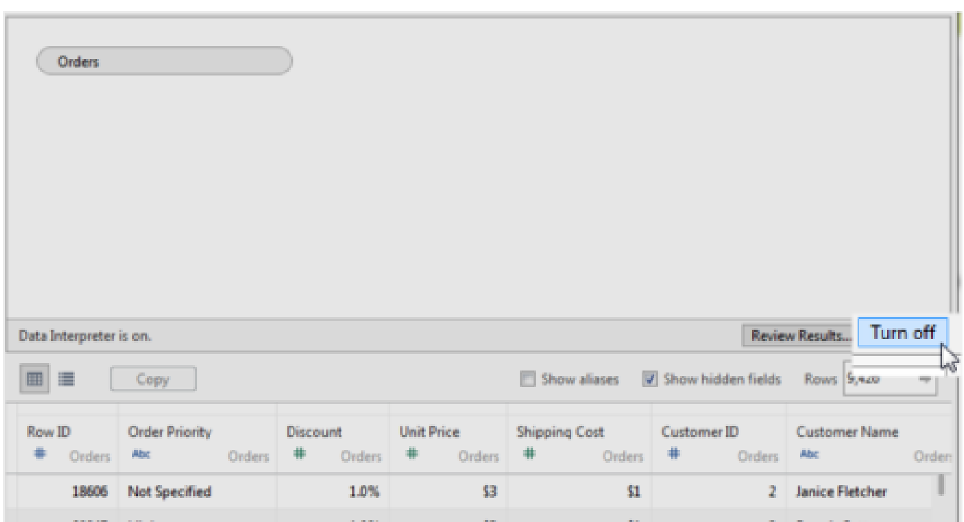
The Data Interpreter draws out sub-tables and removes the extraneous information from your Tableau data source and automatically updates the grid with its interpretation. You can also click the **Review results** button to see a copy of the data source. The data source copy contains annotation definitions and annotations that describe how your data was interpreted.



	A	B	C	D	E	F	G	H
1	Row ID	Order Pric	Discount	Unit Price	Shipping (	Customer	Customer	Ship M
2	18606	Not Speci	0.01	2.88	0.5	2	Janice Fle	Regula
3	20847	High	0.01	2.84	0.93	3	Bonnie Pc	Expres
4	23086	Not Speci	0.03	6.68	6.15	3	Bonnie Pc	Expres
5	23087	Not Speci	0.01	5.68	3.6	3	Bonnie Pc	Regula
6	23088	Not Speci	0	205.99	2.5	3	Bonnie Pc	Expres
7	23597	Medium	0.09	55.48	14.3	3	Bonnie Pc	Expres
8	25549	Low	0.08	120.97	26.3	3	Bonnie Pc	Delive
9	20228	Not Speci	0.02	500.98	26	5	Ronnie Pr	Delive
10	19483	Low	0.08	6.48	6.81	5	Ronnie Pr	Regula
11	24782	High	0.01	90.24	0.99	6	Dwight Hv	Regula
12	24563	Critical	0.07	6.48	6.6	6	Dwight Hv	Regula

3 Begin your analysis

If you like the interpretations made by the Data Interpreter, you can begin your analysis by clicking the Sheet tab. Alternatively, you can click the **Turn off** button to use the original data source.



Quick Start: Use Initial SQL Parameters

You can pass parameters to your data source in an initial SQL statement. There are several reasons why this is useful:

- You can configure impersonation using the **TableauServerUser** or **TableauServerUserFull** parameters.
- If your data source supports it, you can set up row-level security (for example, for Oracle VPD or SAP Sybase ASE) to make sure that users see only the data that they are authorized to see.
- You can provide more details in logging, for example, the Tableau version or the workbook name.

Note: If you use the **TableauServerUser**, **TableauServerUserFull**, or **WorkbookName** parameter in an initial SQL statement, you will create a dedicated connection that can't be shared. This will also restrict cache sharing, which can enhance security, but may also slow performance.

Supported parameters

Parameter	Description	Example of returned value
TableauServerUser	The user name of the current server user. Use when setting up impersonation on the server. Returns an empty string if the user is not signed in to Tableau Server.	asmith
TableauServerUserFull	The user name and domain of the current server user. Use when setting up impersonation on the server. Returns an empty string if the user is not signed in to Tableau Server.	domain.lan\asmith
TableauApp	The name of the Tableau application.	Tableau Desktop Professional Tableau Server
TableauVersion	The version of the Tableau application.	9.3
WorkbookName	The name of the Tableau workbook. Use only in workbooks with an embedded data source.	Financial-Analysis

Examples

The following examples show different ways you can use parameters.

- This example sets the security context on Microsoft SQL Server:

  ```
  EXECUTE AS USER = [TableauServerUser] WITH NO REVERT;
  ```

- This example can be used to help set up row-level security for Oracle VPD:

  ```
  begin
   DBMS_SESSION.SET_IDENTIFIER([TableauServerUser]);
  end;
  ```

- This example shows how, on a DataStax data source, you can use parameters to add detail to logging or to set up a session variable to keep track of the data:

  ```
  SET TABLEAUVERSION [TableauVersion];
  ```

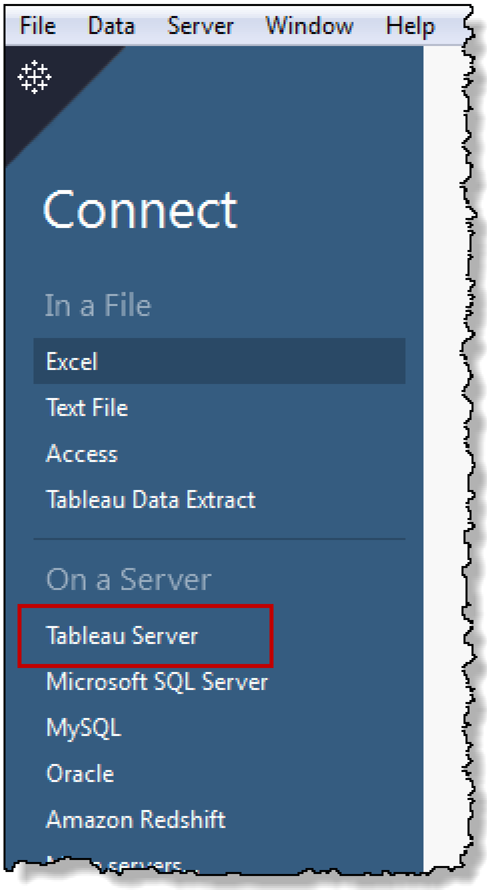
  Note: Oracle PL/SQL blocks require a trailing semicolon to terminate the block. Consult Oracle documentation for the proper syntax.

Quick Start: Use Tableau Server Data Sources

You may be able to use Tableau Server data sources that were created by an administrator or another workbook author. Because the data extract and any required database connection information or database drivers are stored within the data source on the server, using a Tableau Server data source is a fast way to quickly connect to data and start authoring. Tableau Server data sources can also contain a layer of workbook customizations such as calculations. Although you cannot alter customized fields that come with the data source, you can create additional customizations. You can also create a local copy of the data source, update or enhance it, and then republish it.

1 Connect to Tableau Server

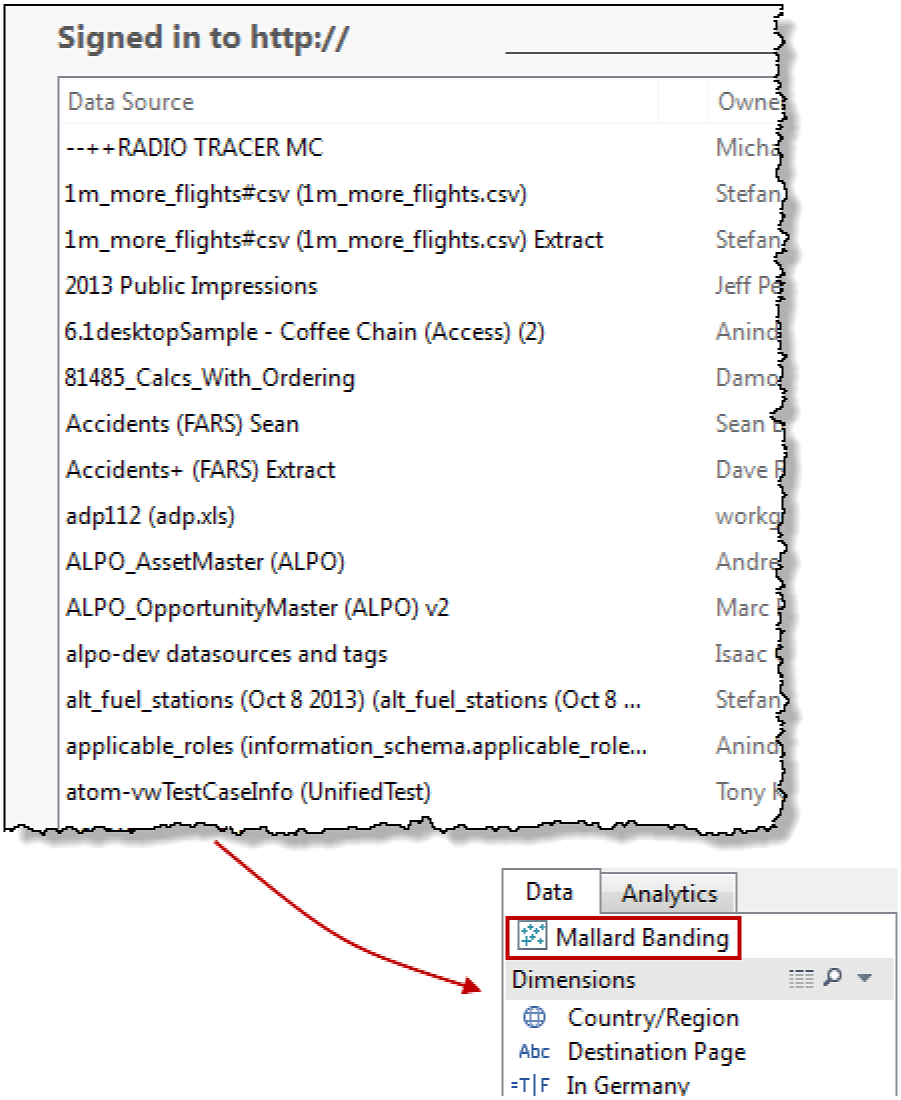
On the start page in Tableau Desktop, under Connect, click Tableau Server, and then specify a server name and provide any necessary sign-in information.



You may need to provide a user name and a password, depending on how Tableau Server is authenticating users.

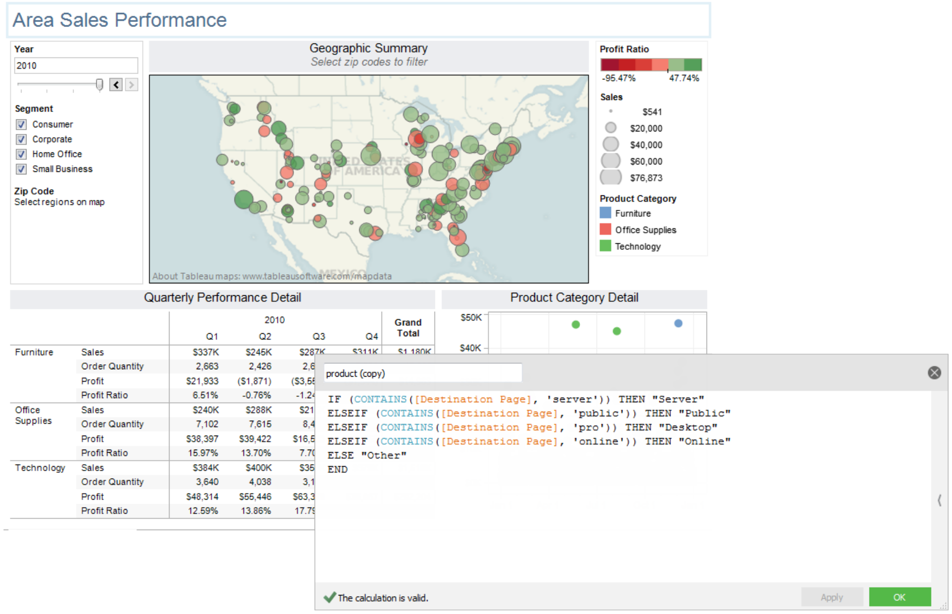
2 Select your Data Source

After you log in to Tableau Server, select a data source. It will load in the **Data** pane with a Tableau Server icon.



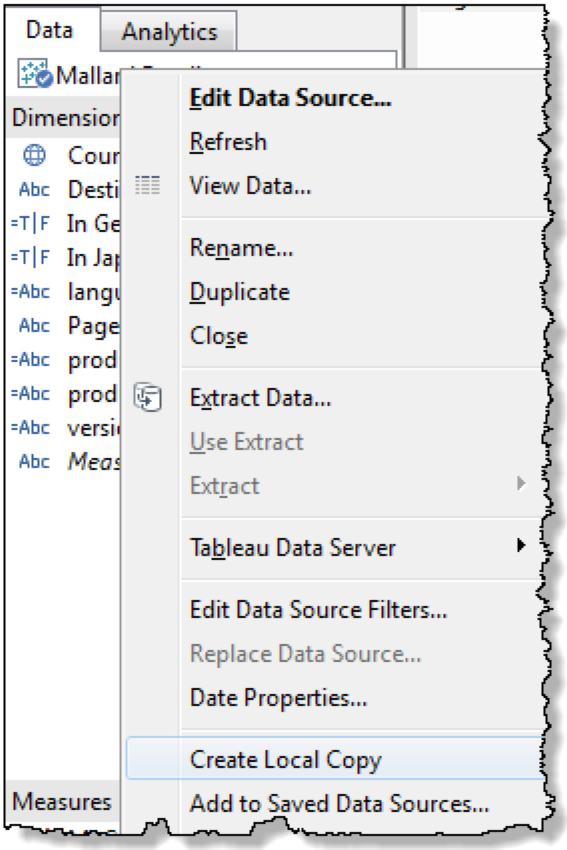
3 Create and Customize the View

Create one or more views in Tableau Desktop. You won't be able to modify customizations that came with the data source, such as calculations, groups, and sets, but you can add new customizations of your own.



4 Publish a Modified Version of the Data Source

To create a data source that adds your customizations to the original, right-click the data source (or control-click on a Mac) and select **Create Local Copy**. A local, writeable copy of the data source is created.

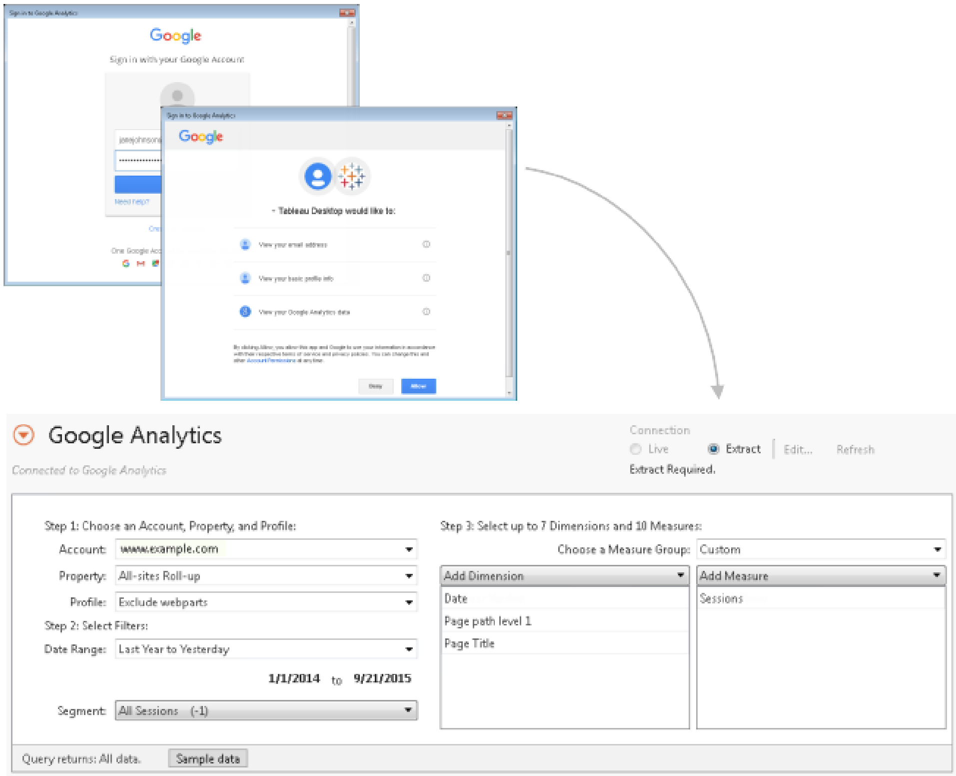


Quick Start: Query All Data from Google Analytics

When working with Google Analytics (GA) data, GA can restrict the amount of data that it returns from a query and provide sampled data instead. Performing analysis on sampled data can skew results and cause inaccurate inferences about the entire data set. In version 9.2, Tableau has made enhancements to GA queries to avoid returning sampled data by taking a single GA query, creating multiple queries from it, and then combining the results from the queries to bypass the query restrictions that cause sampling to occur.

1 Connect to GA data

From Tableau Desktop, on the start page and under **Connect**, click **Google Analytics**. Sign in to Google, select a date range, and then select the necessary dimensions and measures to create your query.

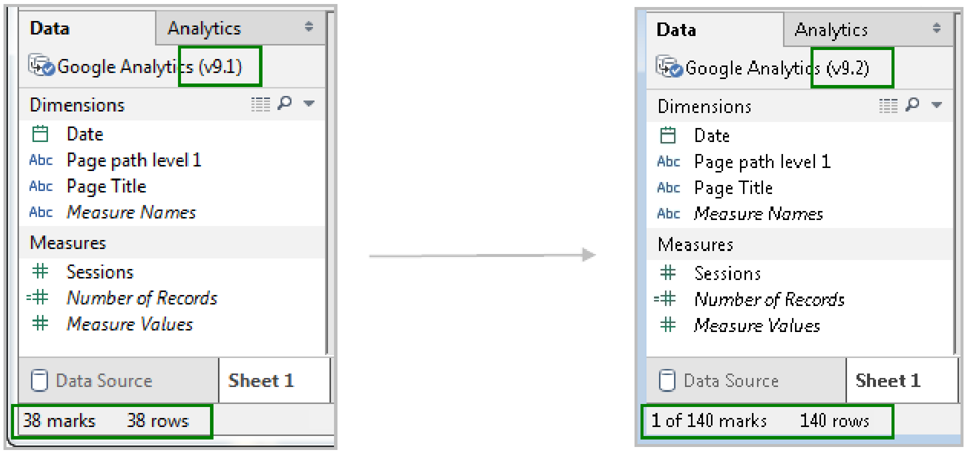


2 Compare queries

Tableau detects that your GA query might return sampled data, and, by default, returns all data instead.

If the GA query stays within the boundaries of the query restrictions, GA doesn't return sampled data and you do not see the above message.

The image below compares the same Google Analytics data set in version 9.1 and 9.2. The query in version 9.1 returns sampled data while the query in version 9.2 returns all data.



3 Troubleshoot issues with returning all data

If your query continues to return sampled data, consider the following:

- **Missing date dimension** – You must use the date dimension in your query to return all data.
- **Too much data** – Your query might contain too much data. Reduce the date range. **Note:** The minimum date range is one day.
- **Non-aggregatable dimensions and measures** – Some dimensions and measures cannot be separated into multiple queries. If you suspect a problematic dimension or measure in your query, hover over the **All data** button to see the tooltip that shows which dimensions or measures to remove from your query. For more information about these types of dimensions and measures, see Sampled Data from Google Analytics.
- **Legacy workbooks** – Workbooks created in Tableau Desktop 9.1 and earlier cannot return all data. Open the legacy workbook in Tableau Desktop 9.2, and save the workbook.

4 Return sampled data instead

In some cases when workbook performance is critical or there are specific dimensions and measures you want to use in your query that are not supported by Tableau's default query process, use sampled data instead. To return sampled data, click the **Sample data** button.

Quick Starts about Visual Analysis

There are many features and techniques you can use as you explore your data in Tableau. Some of these are easiest to get through from the Analytics pane, and others become available after you've gotten a little deeper into your data.

The following Quick Starts highlight specific chart types, introduce specific tools, and explain ways to group and filter data.

Quick Start: Advanced Selection Tools

Tableau has a set of advanced selection tools that display in the view toolbar in the upper left corner of the view. Use the advanced selection tools to select multiple marks in the view.

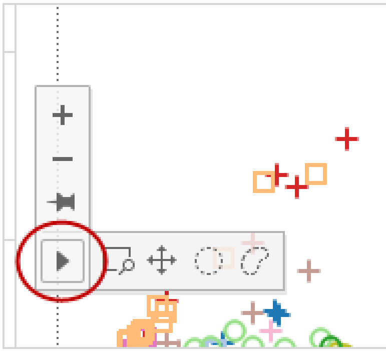
1 Show the View Toolbar

By default, the view toolbar displays when you hover over a map view. To display the view toolbar in another view, right-click anywhere in the view and select **Show View Toolbar**.

> The **Show View Toolbar** settings also apply to the view in Tableau Server and Tableau Online.

2 Open the Selection Tool Menu

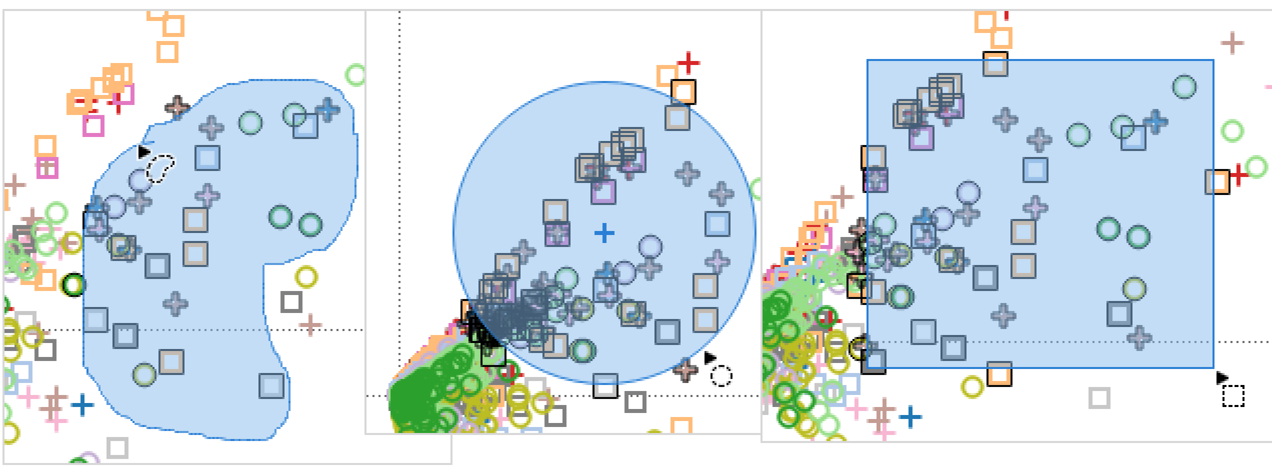
Hover over the arrow on the view toolbar.



3 Pick a Selection Tool

Pick one of the following selection tools.

Lasso **Radial** **Rectangular**



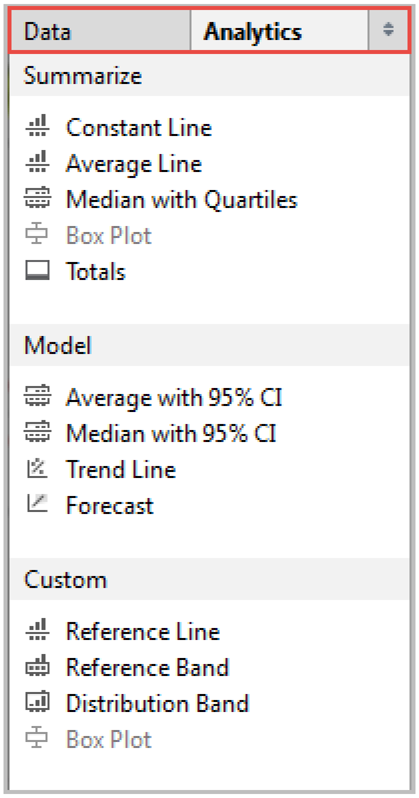
Click and drag across the view to select marks.

Quick Start: Analytics Pane

The Analytics pane provides quick and easy access to common analytic objects in Tableau. You can drag reference lines, forecasts, trend lines, and other objects into your view from the Analytics pane, which appears on the left side of the workspace.

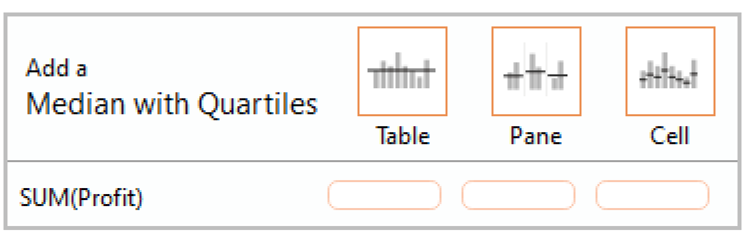
1 Analytics at Your Fingertips

Toggle between the Data pane and the Analytics pane by clicking one of the tabs at the top of the Side Bar:



2 Add an Analytics Object

To add an object from the Analytics pane, drag it into the view. When you drag an object from the Analytics pane, Tableau shows the possible destinations for that object in a drop target area in the upper left section of the view—drop the object somewhere in this area.



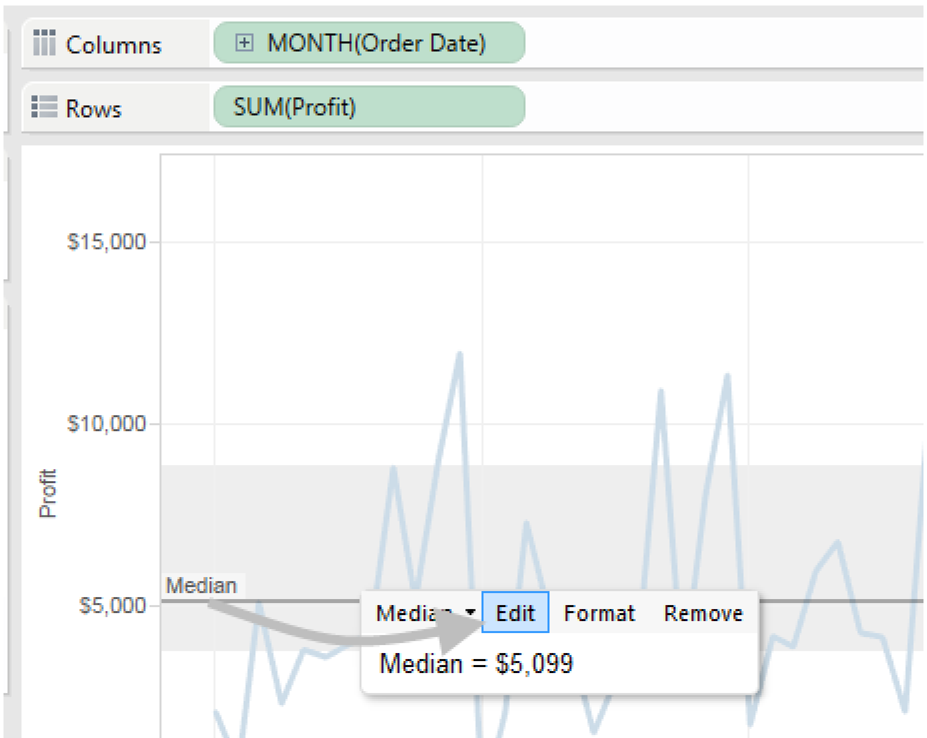
The terms Table, Pane and Cell define the scope for the object.

> There isn't anything you can add to a view from the Analytics pane that you couldn't add by some other means—for example, reference lines and bands, and box plots are available when you edit an axis, and trend lines and forecasts are available from

the Analysis menu. The Analytics pane just makes the process easier by offering drag-and-drop access for the various options.

3 Edit an Analytics Object

To edit an object you have added from the Analytics pane, click the object and choose **Edit**.



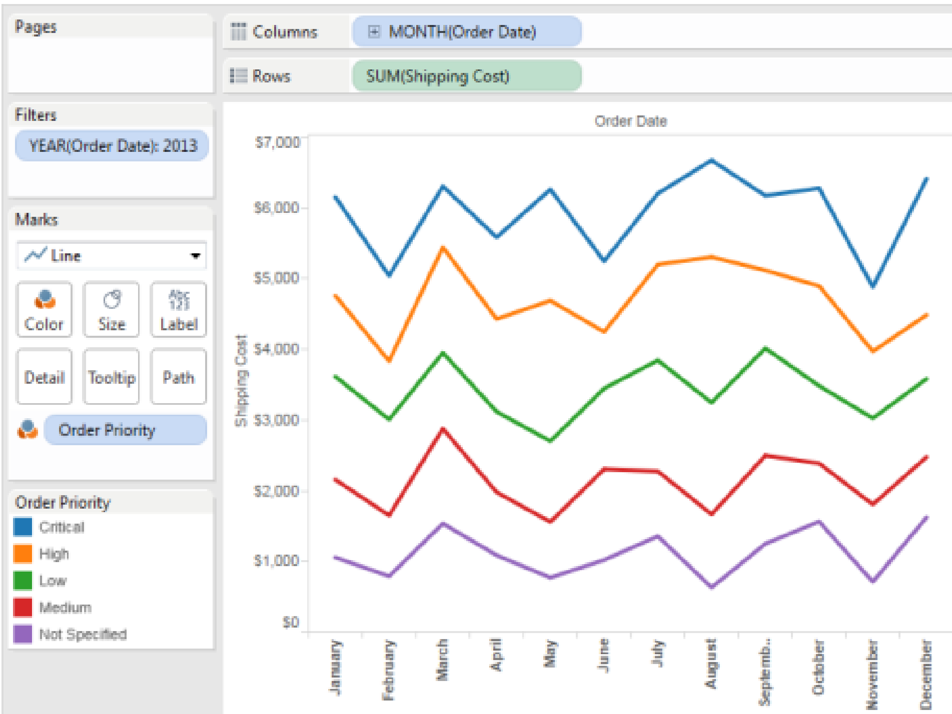
To edit a distribution band, you must click on the outer edge--clicking in the middle of the band has no effect.

Quick Start: Area Charts

An area chart is a line chart where the area between the line and the axis are shaded with a color. These charts are typically used to represent accumulated totals over time and are the conventional way to display stacked lines. Follow the steps below to create an area chart.

1 Build a Stacked Line Chart

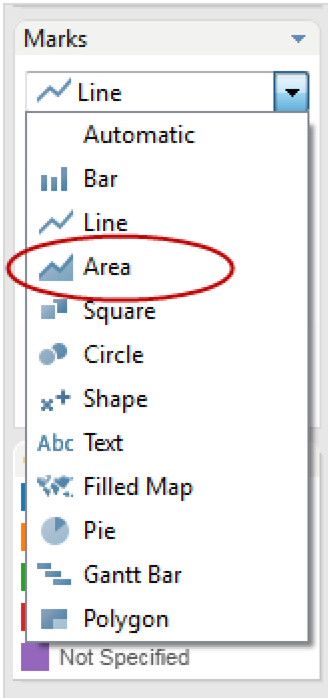
Drag a dimension to the Columns shelf and a Measure to the Rows shelf. Then drag another dimension to **Color** on the Marks card. Select **Analysis** > **Stack Marks** > **On** to stack the lines.



This example shows the sum of total shipping costs by order priority.

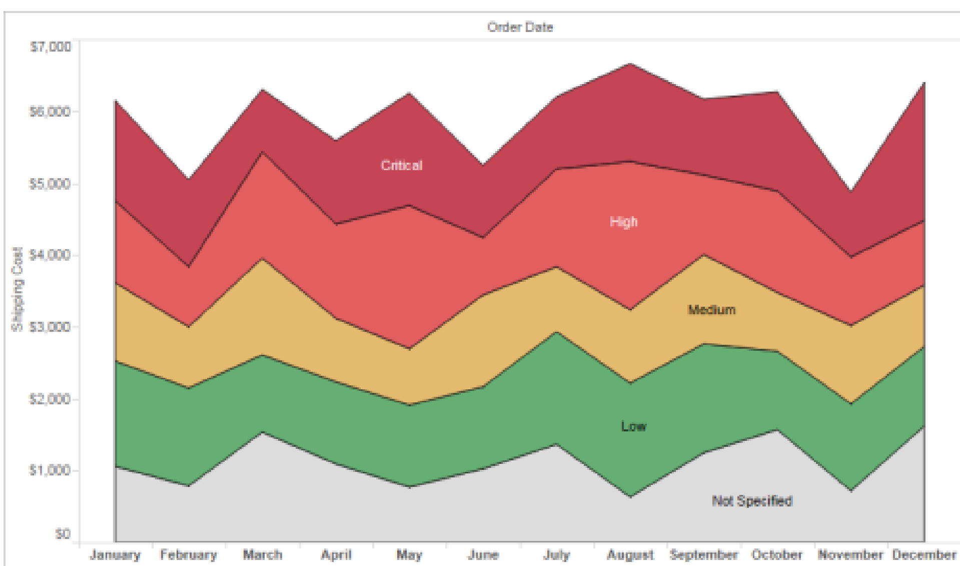
2 Select the Area Mark Type

The Automatic mark type will show this type of view as lines. On the **Marks** card, select **Area** to show the data as an area chart.



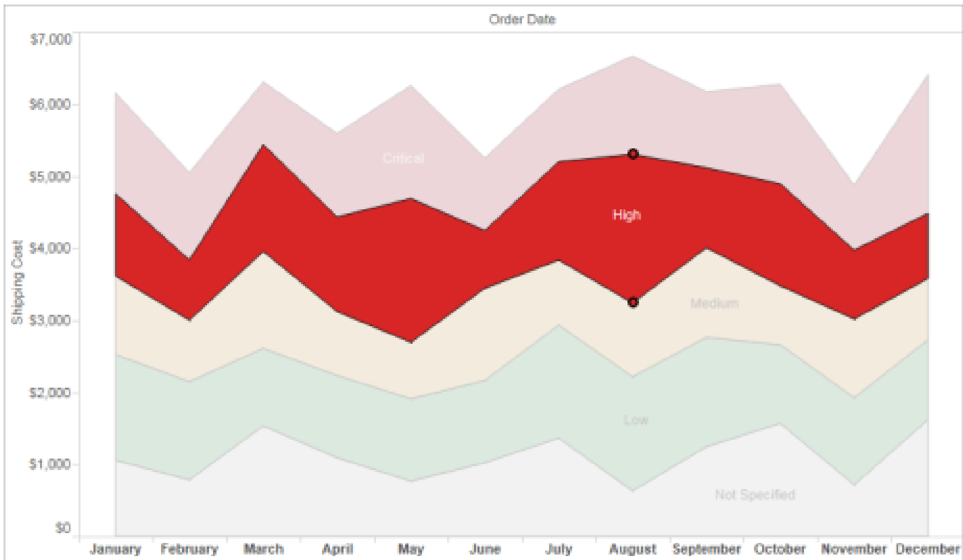
3 Adding Formatting

You can add formatting to an area chart. For example, you can edit the color legend and turn on mark labels and borders.



4 Highlight the Areas

You can also use highlight actions with area charts. For example, selecting a color in the legend will highlight the entire area instead of just the line.

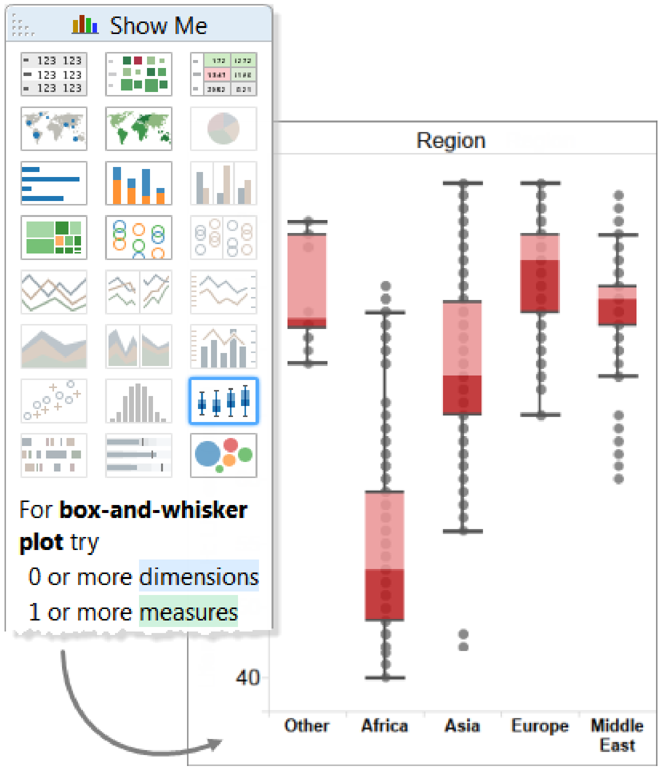


Quick Start: Box Plots

A box plot, also known as a box-and-whiskers plot, is a graphical display type well known to statisticians. Box plots provide quick insight into the distribution of data.

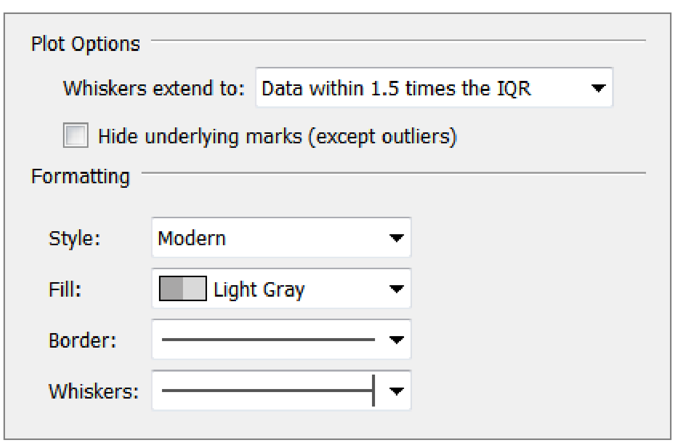
1 Use Show Me

Use Show Me to create a box plot.



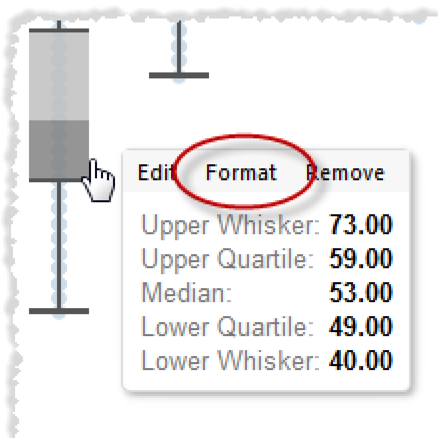
2 Set Box Plot Options

To change the appearance of a box plot, select the box plot in the view, and then click **Edit**. Set the whisker distance, specify whether to show individual marks, and select the style of the box plot.



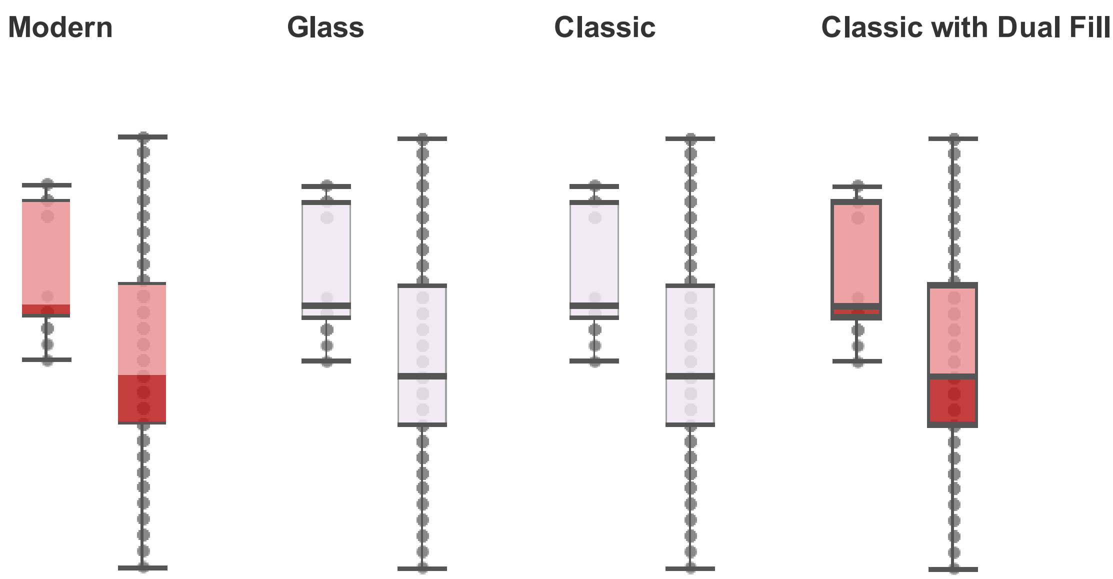
3 Format a Box Plot Style

To format a Box Plot already in the view, select the box plot in the view, and then click **Format**.



Box Plot Styles

Tableau offers a range of different box plot styles to choose from.

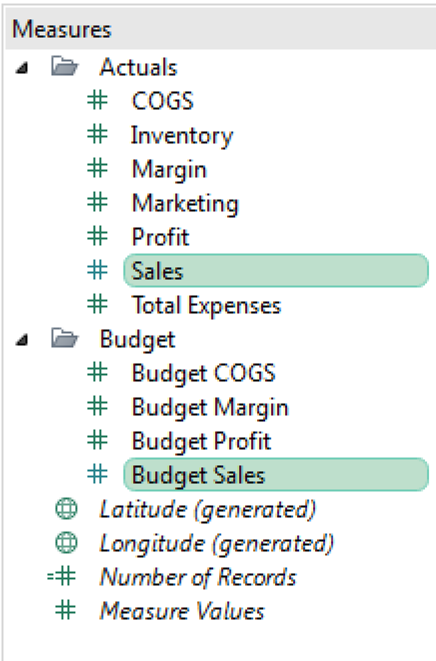


Quick Start: Bullet Graphs

A bullet graph is a variation of a bar graph developed to replace dashboard gauges and meters. A bullet graph is useful for comparing the performance of a primary measure to one or more other measures. Below is a single bullet graph showing how actual sales compared to estimated sales. Follow the steps below to learn how to create a bullet graph.

1 Select two Measures to Compare

Hold down the Ctrl key (⌘ on the Mac) on your keyboard and select two measures in the Data pane.



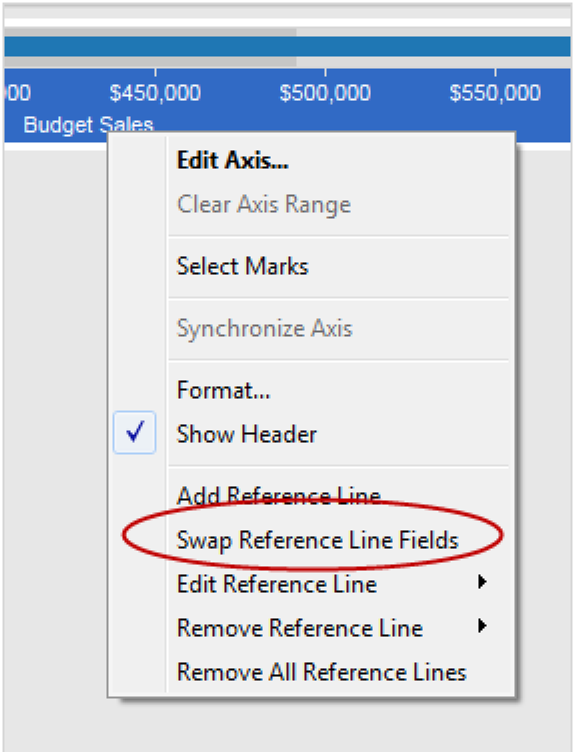
2 Click Show Me on the Toolbar

In **Show Me**, click the **Bullet Graph** view type.

Two types of reference lines are added: a line to indicate a target or goal, and a distribution to show ranges of performance.

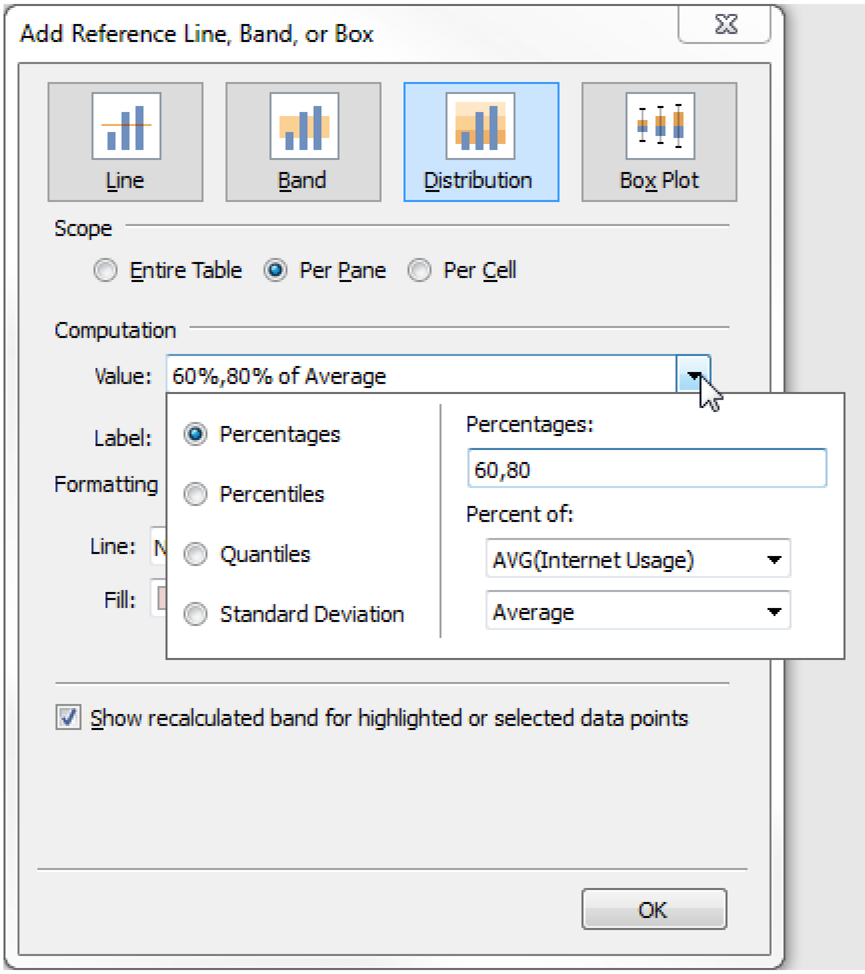
3 Swap Reference Line Fields

Sometimes you may want to swap the reference lines fields. For example, the actual sales is shown as a reference distribution instead of a bar. To swap the two measures, right-click (control-click on the Mac) the axis and select **Swap Reference Line Fields**.



4 Refine by Editing the Reference Lines

Right-click (control-click on the Mac) the axis in the view and select **Edit Reference Line**, and then select one of the reference lines to modify.



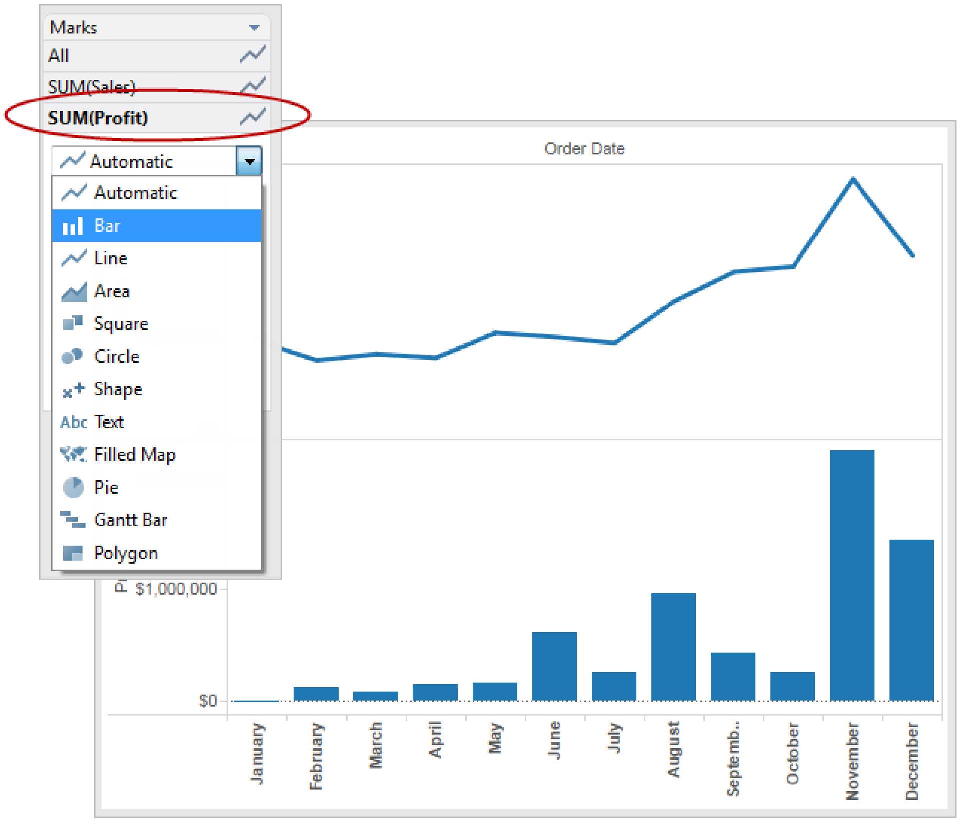
Add a measure to **Detail** to make it available as the target measure.

Quick Start: Combination Charts

Combination charts are views that use multiple mark types in the same sheet. For example, you may show sum of profit as bars with a line across the bars showing sum of sales. You can also use combination charts to show multiple levels of detail in the same view. For example, you can have a line chart with individual lines showing average sales over time for each customer segment, then you can have another line that shows the combined average across all customer segments.

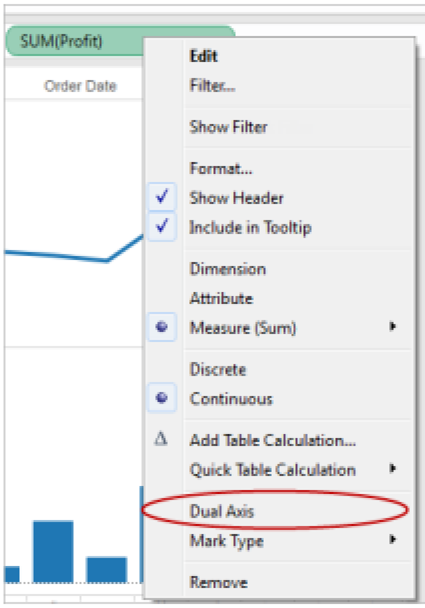
1 Customize Marks

Click one of the measure names on the **Marks** card, and then select a mark type that is different than the other measure on the **Marks** card.



2 Layer Multiple Panes

Right-click a measure on the **Rows** or **Columns** shelf and select **Dual Axis**. The two mark types are now layered on top of each other.

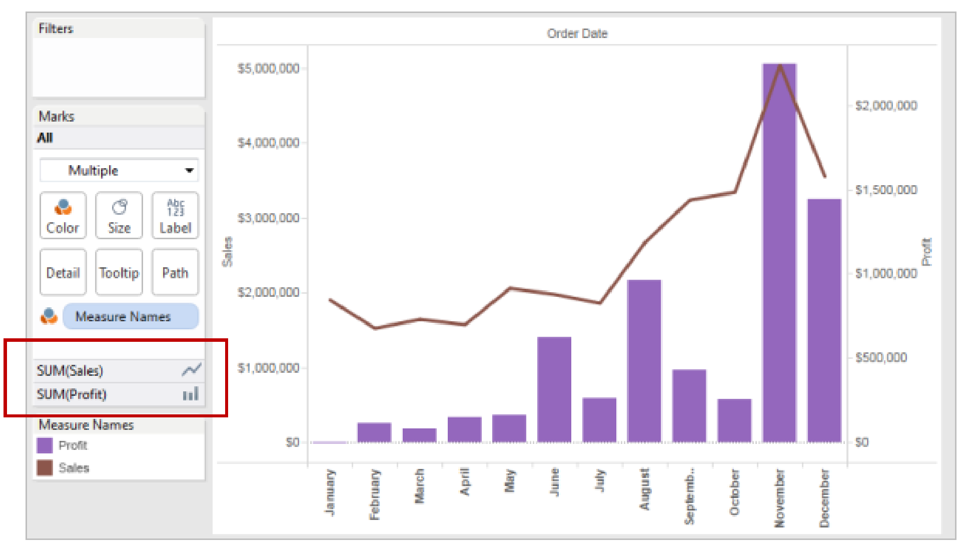


Some marks can be hidden behind others. To move the marks forward or backward, right-click (control-click on a Mac) an axis in the view and select **Move Marks to Back** or **Move Marks to Front**.

---

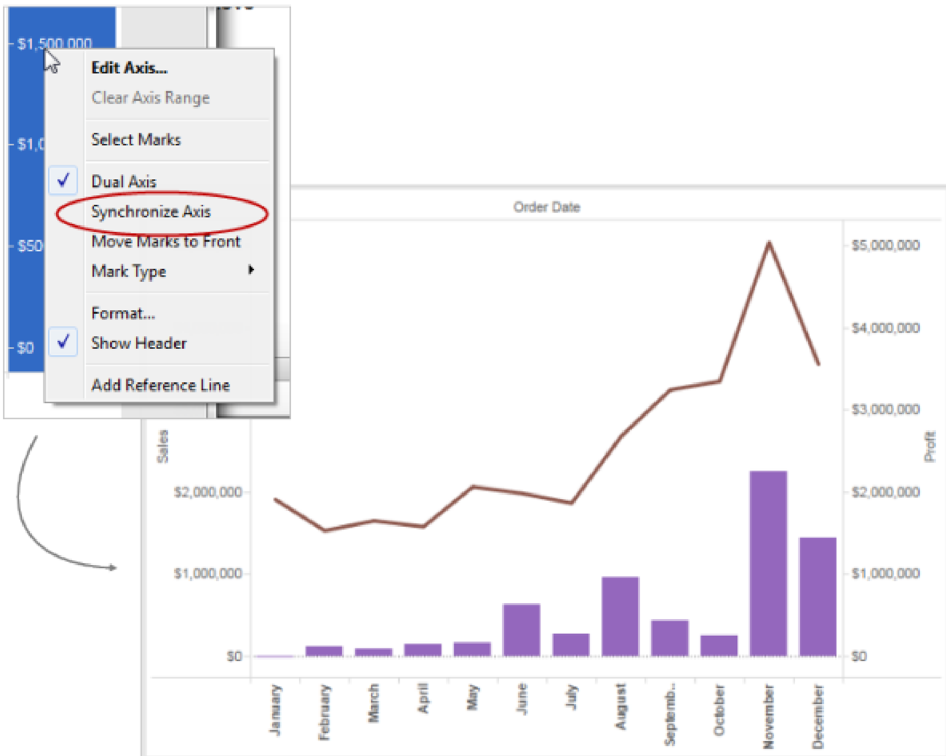
3 Switch Between Panes

To switch between the layered panes, on the **Marks** card, select a measure name. For each pane you can change the mark type, colors, shapes, sizes, and other options.



4 Synchronize the Axes

Right-click the secondary axis in the view and select **Synchronize Axis** to keep the two axes on the same scale.

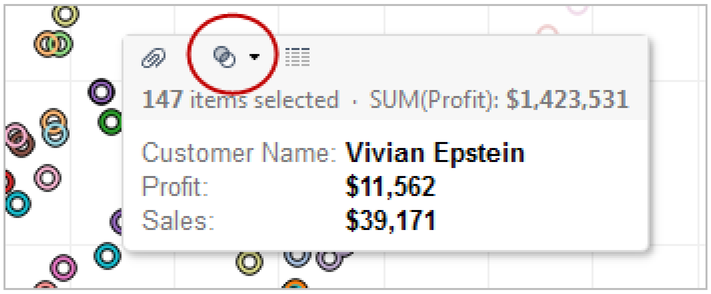


Quick Start: Combine and Compare Sets

Sets are subsets of your data that meet certain conditions. A set can be based on a computed condition, such as a set that contains only customers with sales over a certain threshold. Computed sets update as your data changes. Alternatively, a set can be based on specific data points in your view. Follow the steps below to create a new set, add and remove data from sets, and combine sets.

1 Create a Set

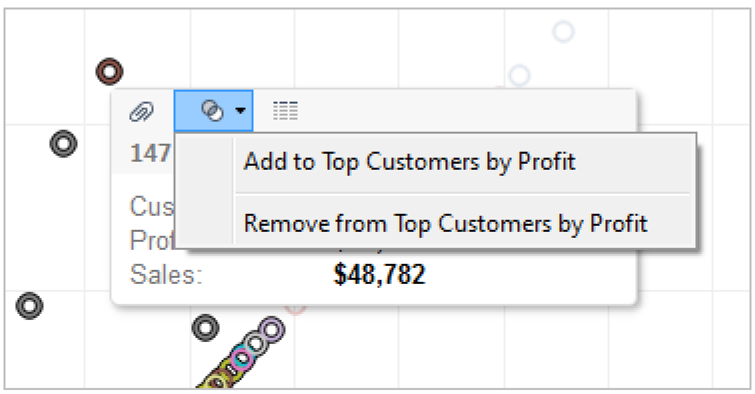
There are many ways to create a set. To create a set with specific data points, select the marks in the view and then select **Create Set** on the tooltip. Alternatively, right-click (control-click on Mac) a dimension in the **Data** pane and select **Create Set** to create a computed set. Complete the **Create Set** dialog box.



The new set displays in the **Sets** area at the bottom of the **Data** pane.

2 Add and Remove from Sets

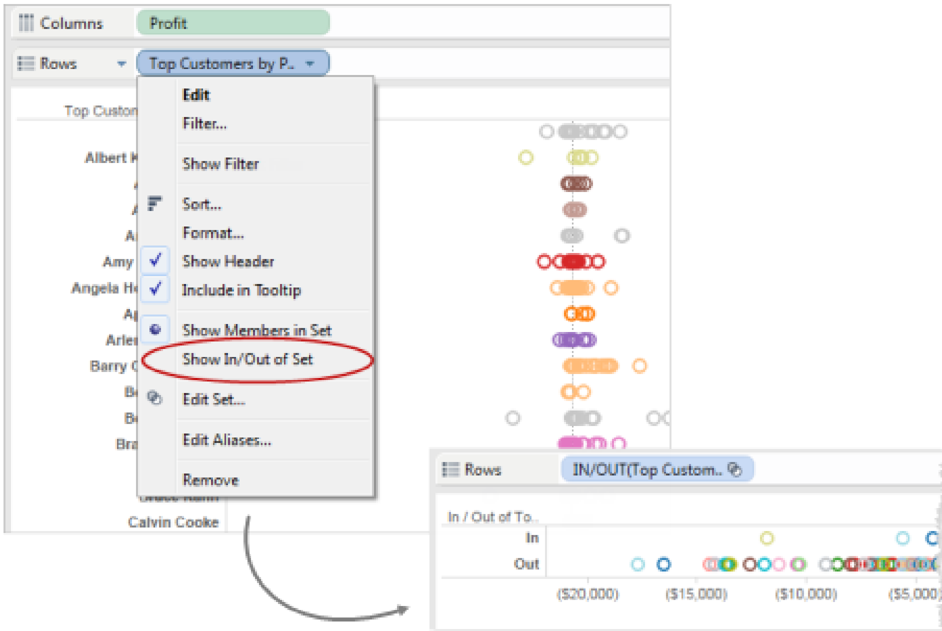
If you created a set using specific data points, you can add more data to or subtract data from the set. After you select marks in the view, click the **Sets** drop-down menu on the tooltip and click **Add to** or **Remove from** to add or remove data from a particular set.



You can only add and remove from sets that share the same dimensions as the selected mark.

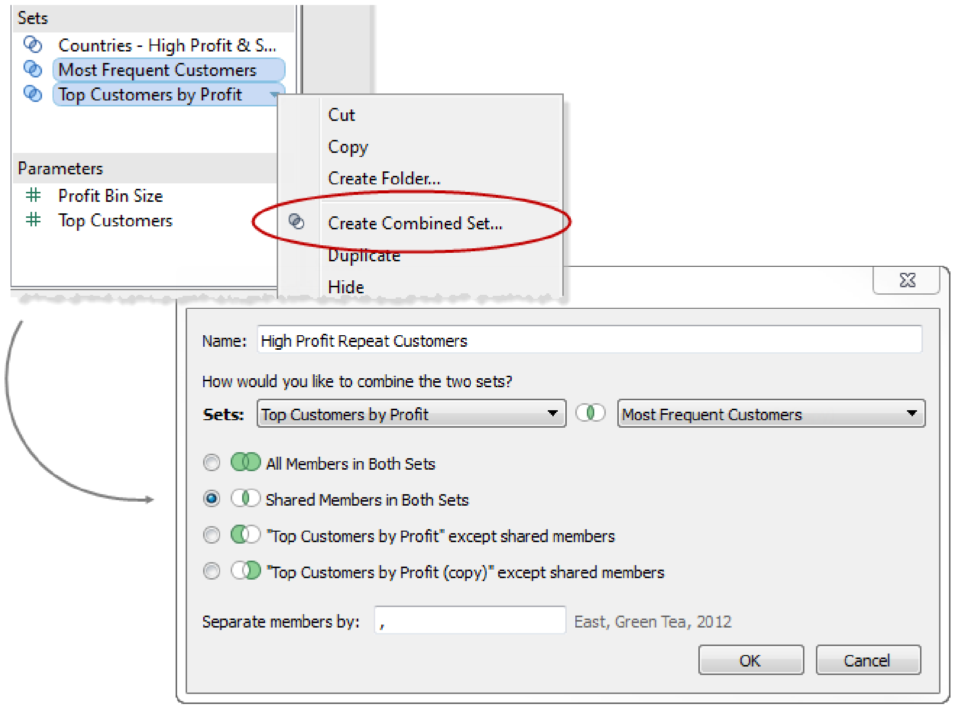
3 Compare In/Out Values

Instead of looking at the individual members of a set, you can instead compare the members that are in the set to the ones that are not. To show in/out values in a set, right-click (control-click on Mac) a set in the view and select **Show In/Out of Set**.



4 Create Combination Sets

To combine multiple sets into a new combination set, right-click (control-click on Mac) two sets in the **Data** pane and select **Create Combined Set**. In the **Create Set** dialog box, specify how you want to combine the two sets.

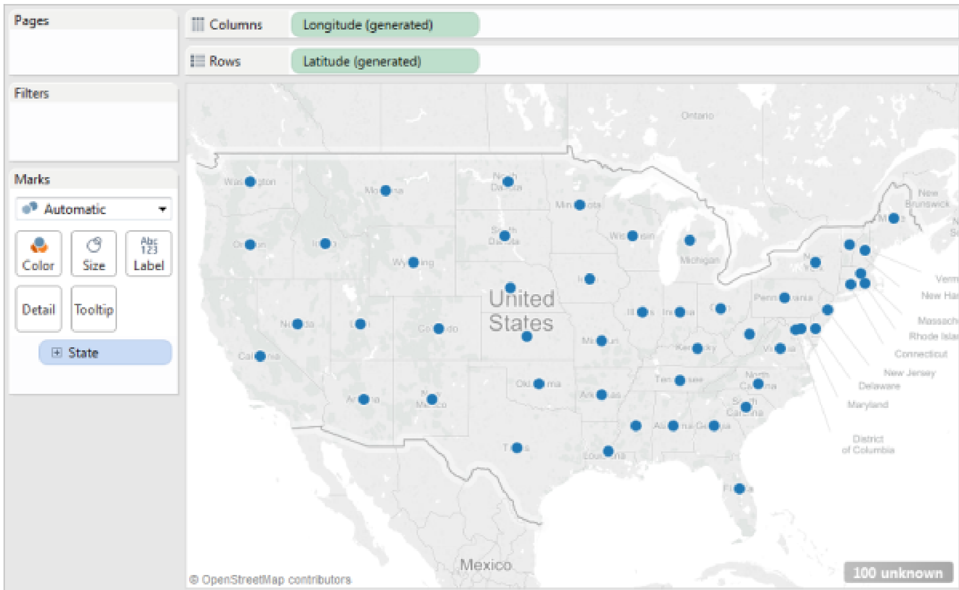


Quick Start: Filled Maps

When mapping data in Tableau, a mark is shown for each location. The mark can be a shape such as a circle, square, pie, etc. Alternatively, you can fill the polygon for the geographic region with a color based on a data value. For example, you can fill states with a color based on how profitable they are.

1 Build a Map View

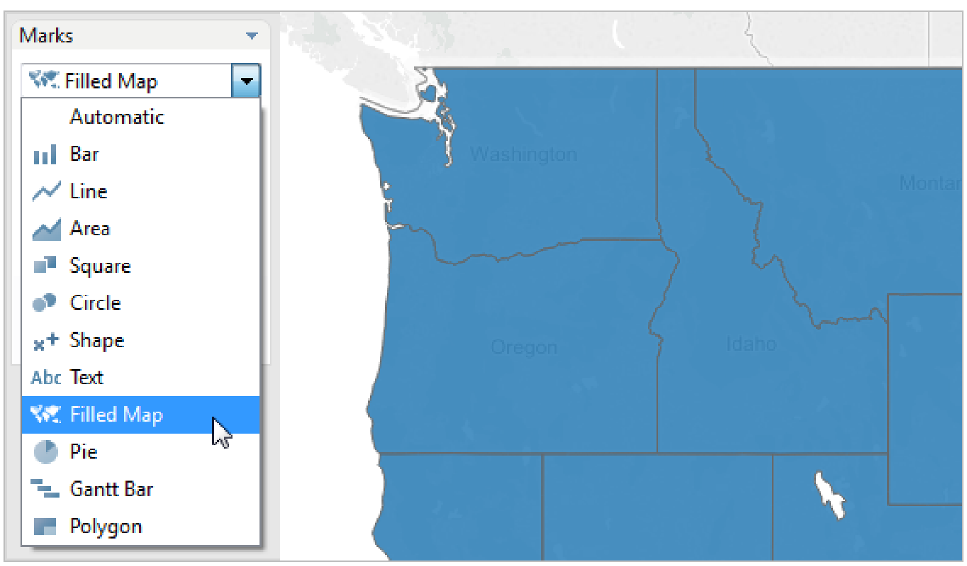
Double-click a geographic field such as State, Area Code, Zip Code, etc.



The generated **Latitude** and **Longitude** fields are moved to the **Rows** and **Columns** shelves and the geographic field is moved to **Detail** on the **Marks** card.

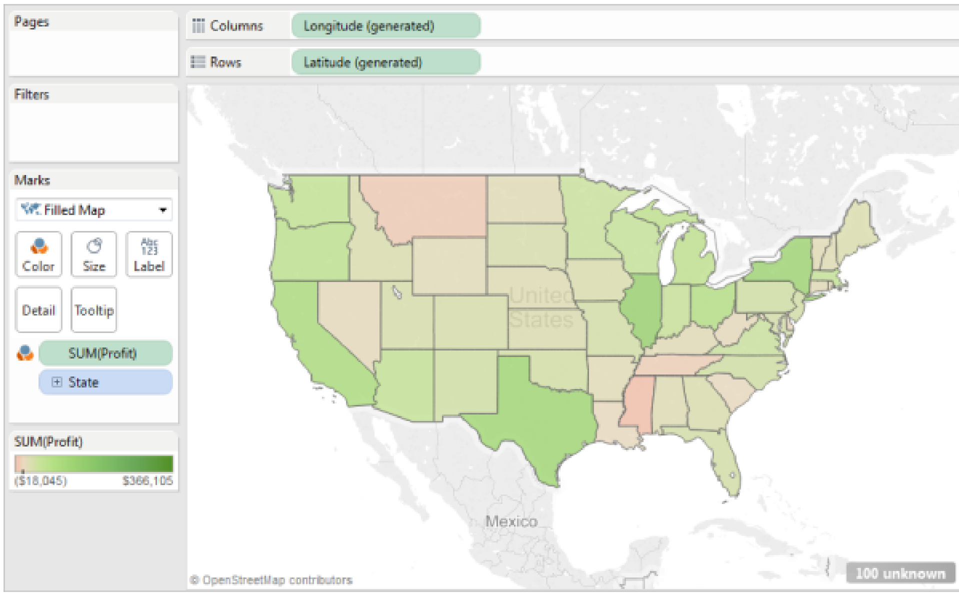
2 Select the Filled Map Mark Type

The Automatic mark type will show this type of view as circles over a map. On the Marks card, click the Mark Type drop-down menu and select **Filled Map** to color the geographic areas.



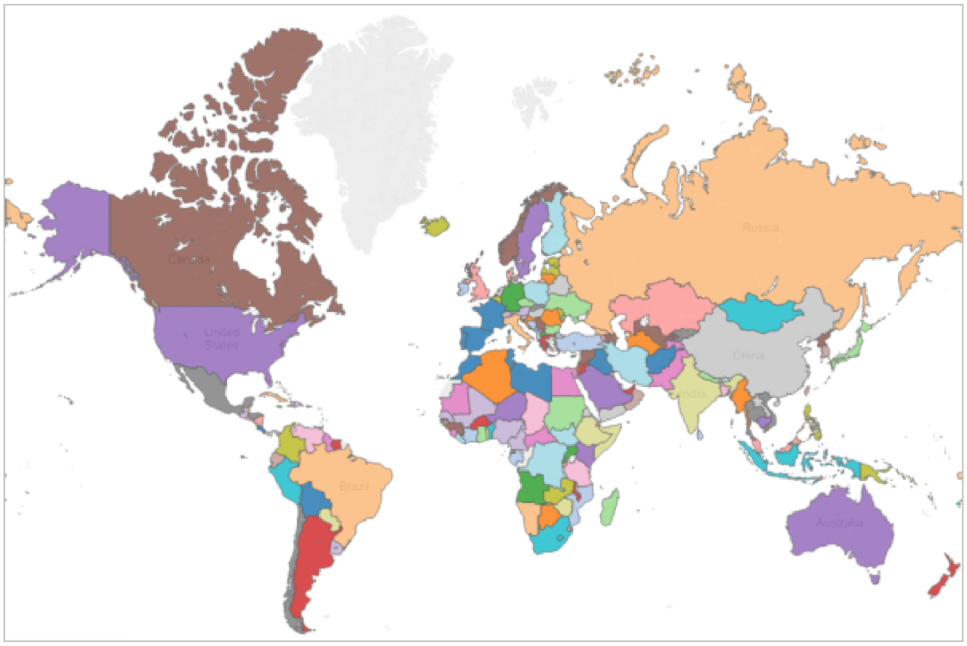
3 Drag a Field to the Color Shelf

Define how the locations are colored by dragging another field to **Color** on the **Marks** card.



4 Worldwide Regions

Filled maps are available at the country and state/province level worldwide.

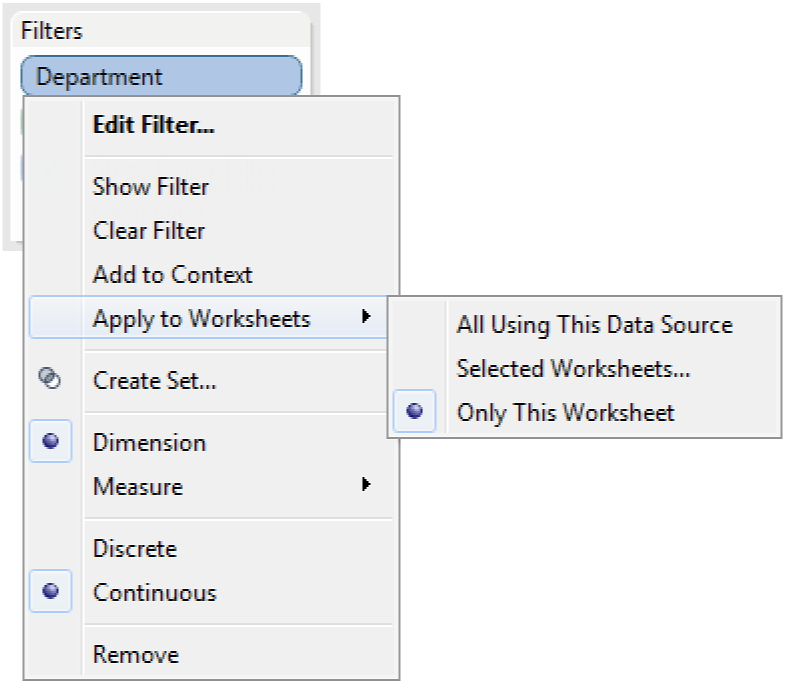


Quick Start: Filter Selected Sheets

Filters specify the data to include or exclude from a view. When you add a filter to a worksheet or dashboard, you can specify whether to apply the filter to just the worksheet, a selection of sheets, an entire dashboard, or to all sheets in the workbook.

1 Filter a Single Worksheet

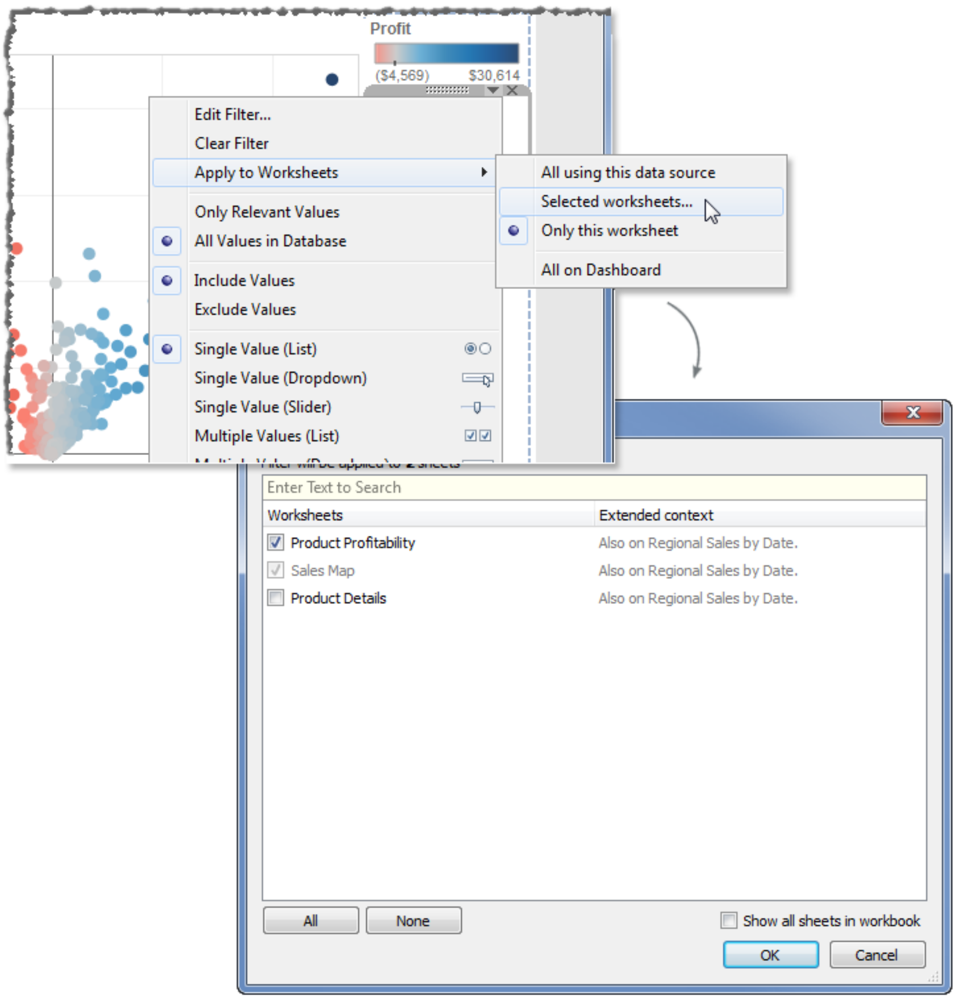
When the filter applies to just a single worksheet, changes to the filter do not affect any other sheets in the workbook. Right-click (control-click on Mac) a field on the **Filters** shelf and select **Apply to Worksheets** > **Only This Worksheet**.



By default, filters on worksheets apply only to the current worksheet.

2 Filter Selected Worksheets

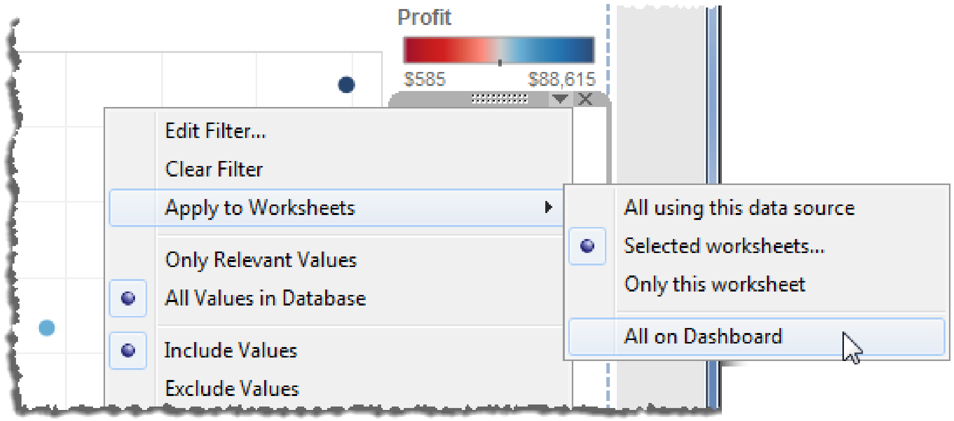
A filter can be applied to multiple worksheets that use the same data source. When the filter is updated on one sheet, it is also applied to all of the selected sheets. Right-click (control-click on Mac) a field on the **Filters** shelf and select **Apply to Worksheets** > **Selected worksheets**.



Filter options are also available on each filter card menu.

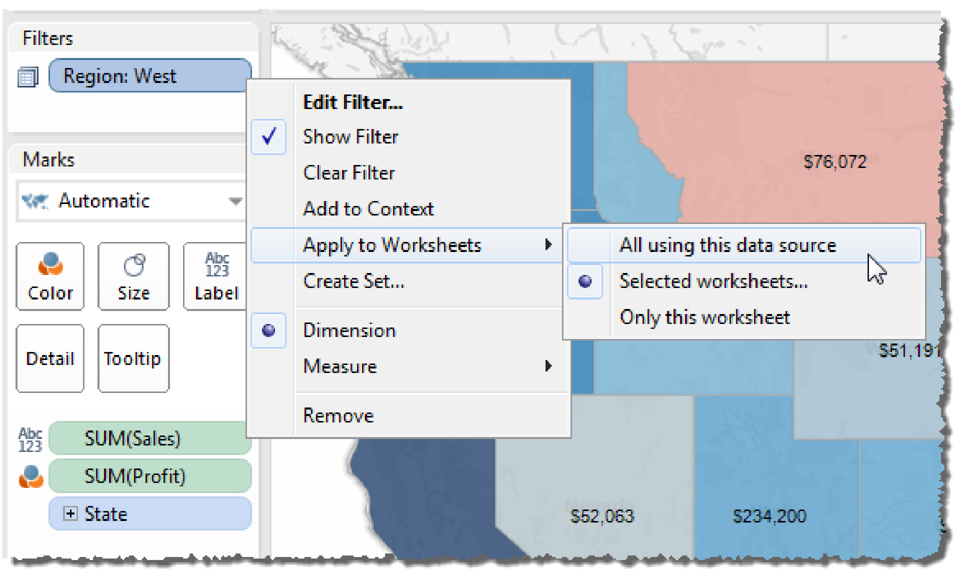
3 Filter All Worksheets on a Dashboard

A variation of filtering selected sheets is to apply a filter to all the worksheets on a dashboard. Open the filter menu from a filter card on a dashboard and select **Apply to Worksheets** > **All on dashboard**. This option applies the filter to all sheets in the dashboard that use the same data source.



4 Filter All Sheets in a Workbook

A filter can also affect all worksheets in the workbook that connect to the same data source. This filter option is sometimes referred to as a global filter because it applies to the entire workbook. Right-click (control-click on Mac) a field on the **Filters** shelf and select **Apply to Worksheets** > **All using this data source**.

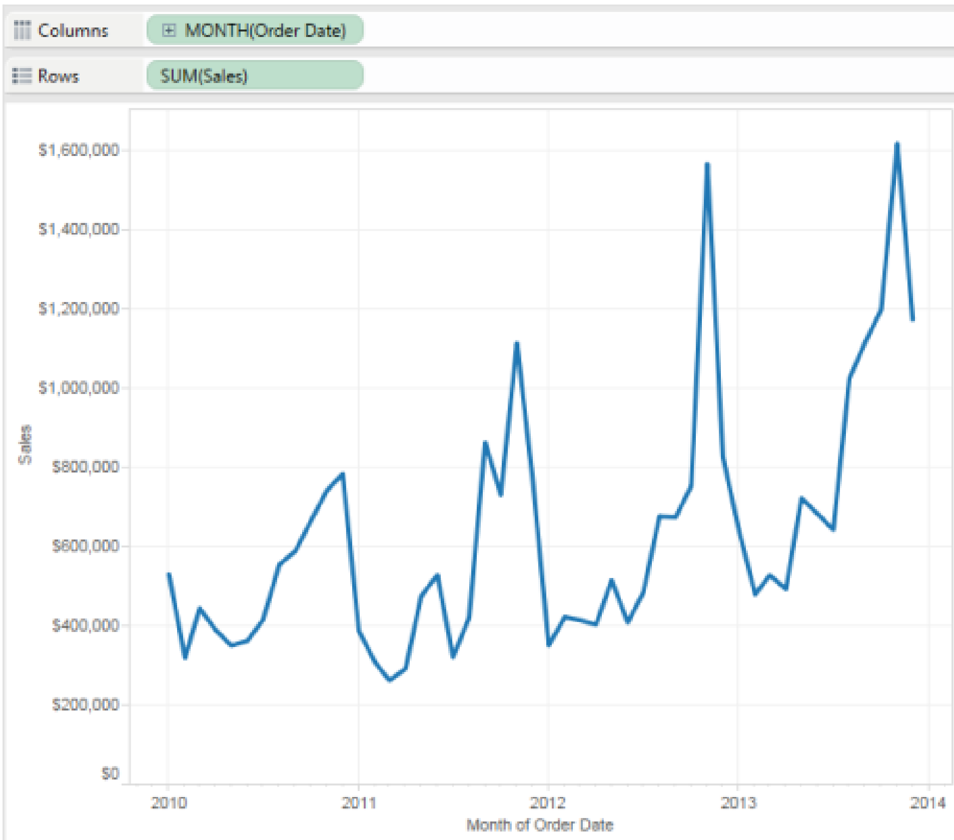


Quick Start: Forecasting

Forecasting is a calculation that predicts future trends based on current trends and data. Follow the steps below to add a forecast to your view.

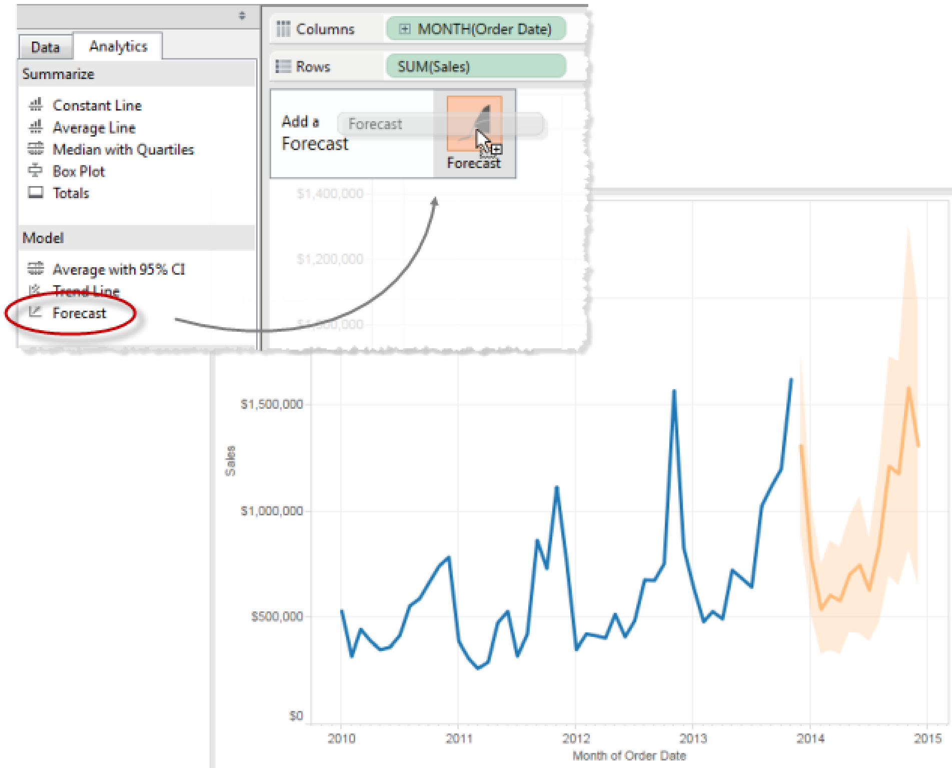
1 Build the View

Build a view that shows a measure over time. The date or time field can be discrete or continuous. For example, the view below shows sales by Month and Year.



2 Add a Forecast to the View

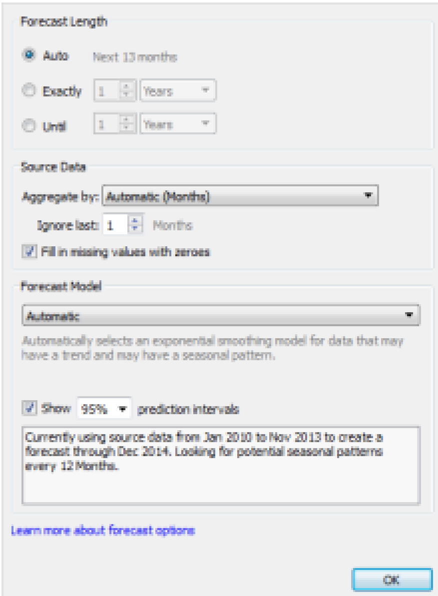
To add a forecast to the view, drag **Forecast** from the **Analytics** pane and drop it on **Forecast** in the view. The time axis is extended and estimated values are shown.



You can also add a forecast to the view by selecting **Analysis** > **Forecast** > **Show Forecast**.

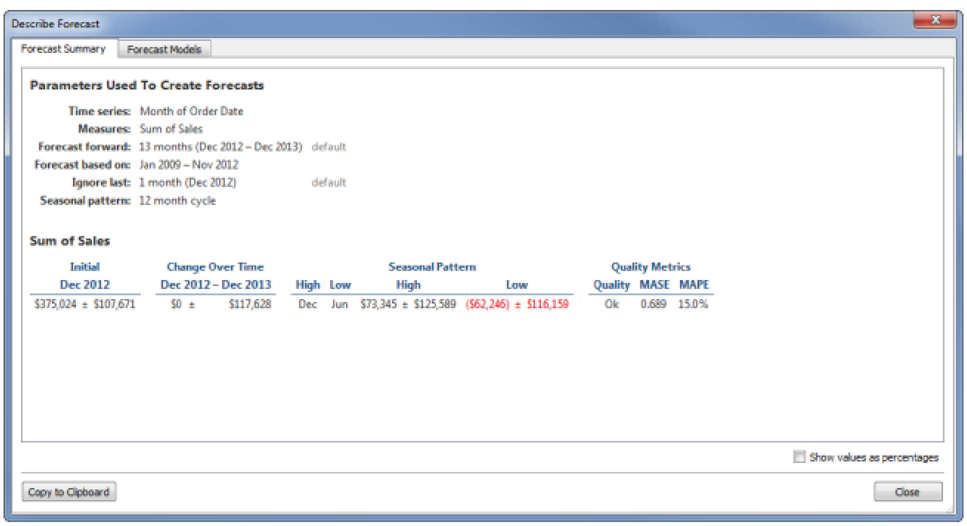
3 Change the Forecast Options

You can modify the forecast options by selecting **Analysis** > **Forecast** > **Forecast Options**. In the **Forecast Options** dialog box, you can specify how far into the future to estimate, the date part that the forecast is based on, and the forecasting model to use.



4 View Forecast Details

To view the forecast model and the parameters used to create the forecast, select **Analysis** > **Forecast** > **Describe Forecast**.

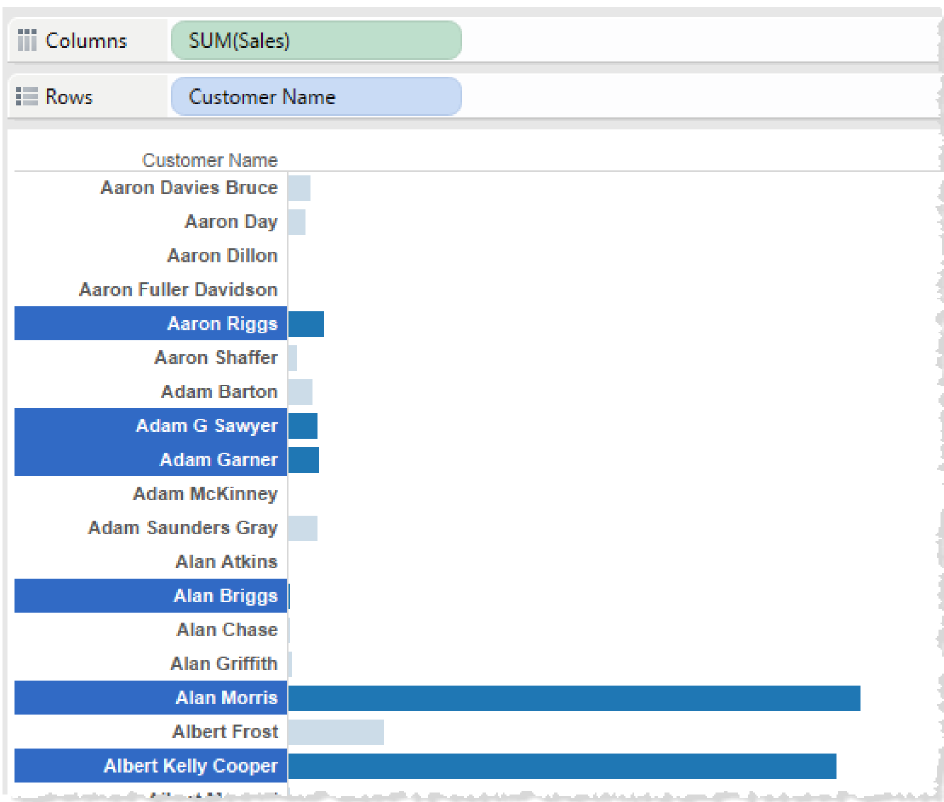


Quick Start: Groups

Sometimes you will want to group several dimension members into categories that don’t already exist in your data. For example, when looking at a list of customers, you may want to group them by outside information, such as the type of customer they are: regular, employee, etc.

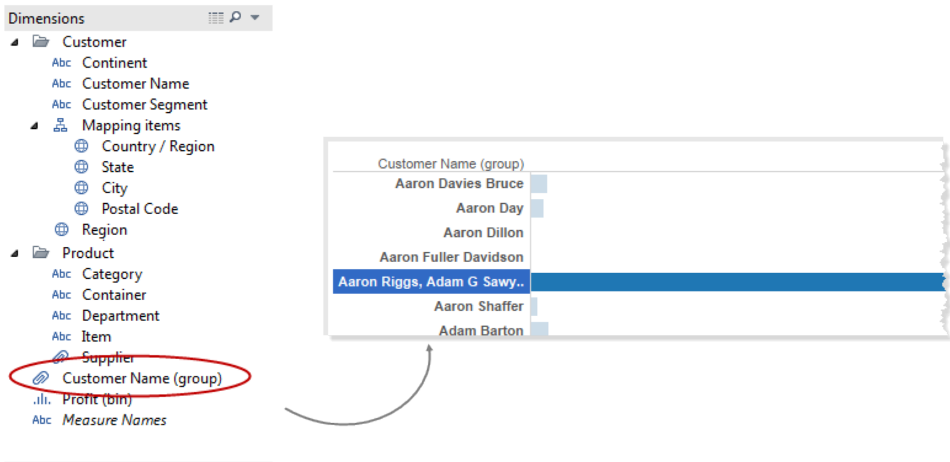
1 Select the Members to Group

Select one or more members that you want to group.



2 Click Group on the Toolbar

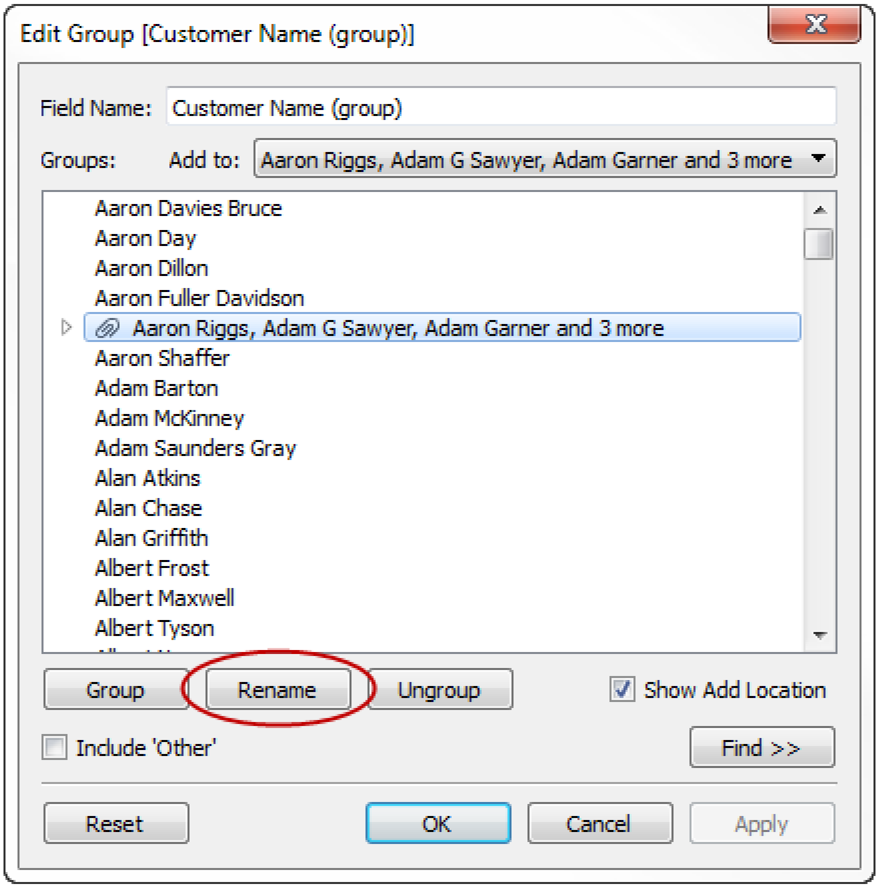
Click the **Group Members** icon on the toolbar. 



The members are grouped into a single member in the view and the new group field is shown in the Data pane.

3 Edit the Name of the Group

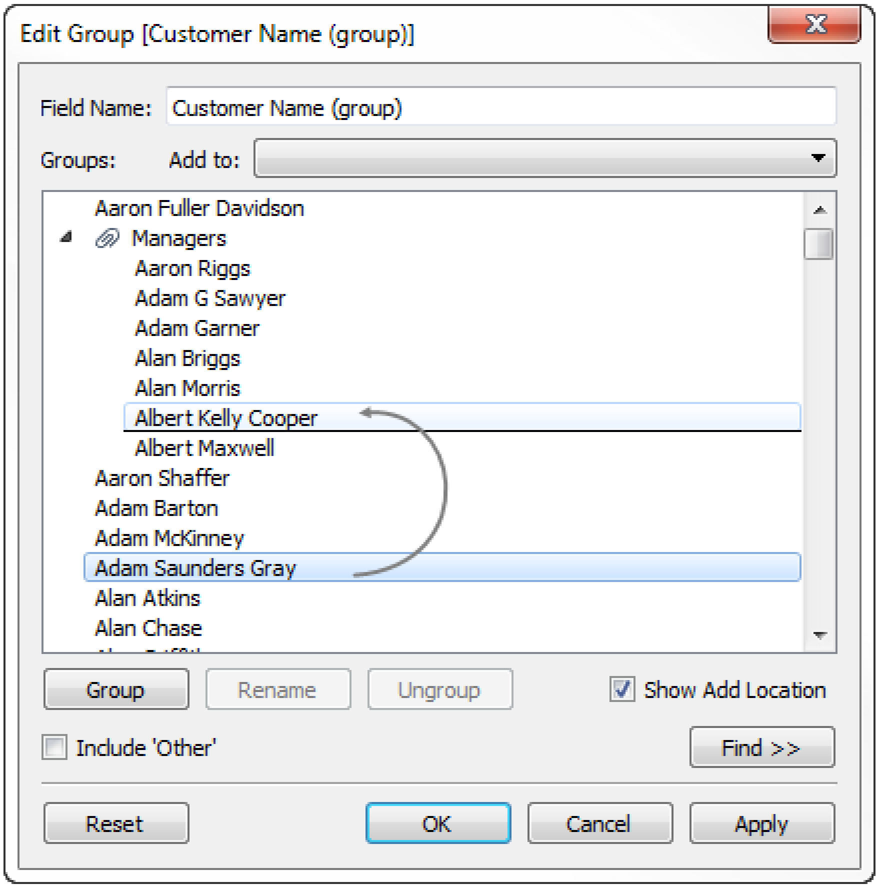
In the Data pane, right-click (control-click on Mac) the grouped field and select **Edit Group**. Select the group and then click, **Rename** .



You can also rename the name of the field itself using the text box at the top of the dialog box.

4 Add and Remove Members

In the **Edit Group** dialog box, add and remove members by dragging and dropping the selected members in the list to and from the group.



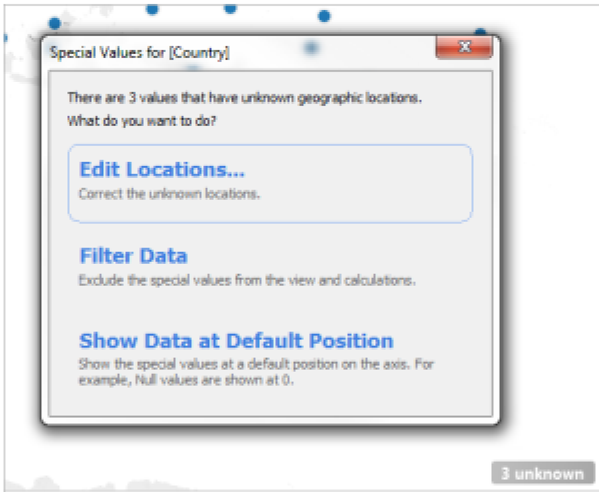
To quickly add members to a group, right-click (control-click on Mac) a member in the **Edit Group** dialog box and select **Add To**, then select the group you want to add them to.

Finding Members

If you are working with a dimension that has a lot of members, you can search and select members that match a specific criteria using the **Find** button in the **Edit Group** dialog box.

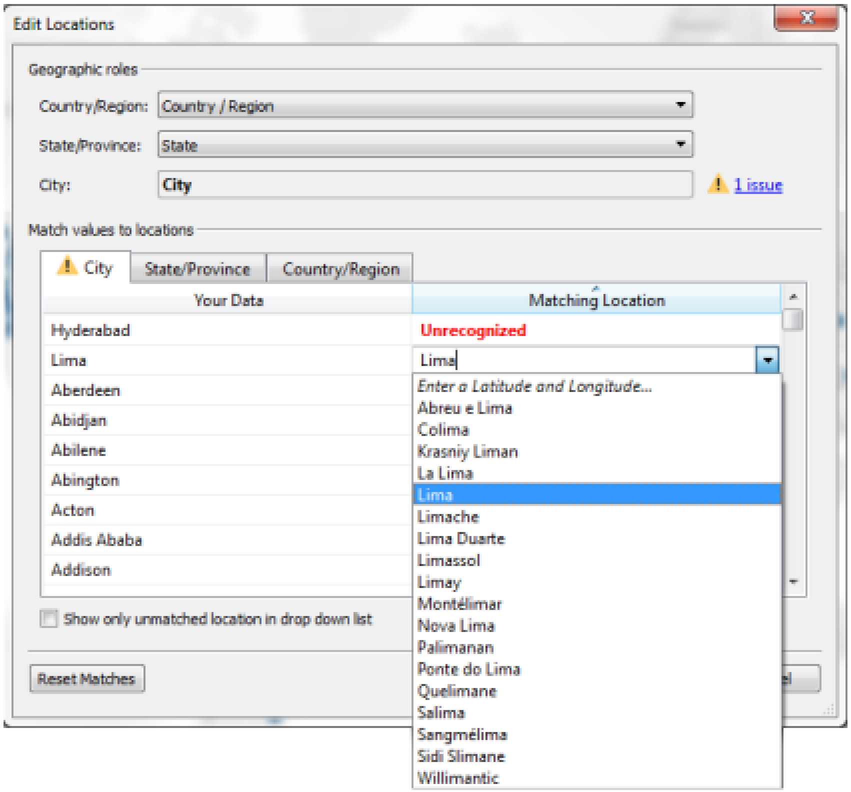
Quick Start: Null Values

Null values along an axis are indicated in the lower right corner of the view. Click the indicator to open a dialog box that will help you decide how to handle these values. The options available in the dialog box depend on the type of data in the view. The options for geographic data, numbers, and dates are described below.



Unknown Geographic Locations

If you are mapping data using the built-in geographic roles in Tableau, you may have some unrecognized locations that cannot be mapped. To edit these locations, click **Edit Locations** in the **Special Values** dialog box. In the **Edit Locations** dialog box, match your data to known locations. For example, your data may include “Mass” instead of “Massachusetts” as a state name.

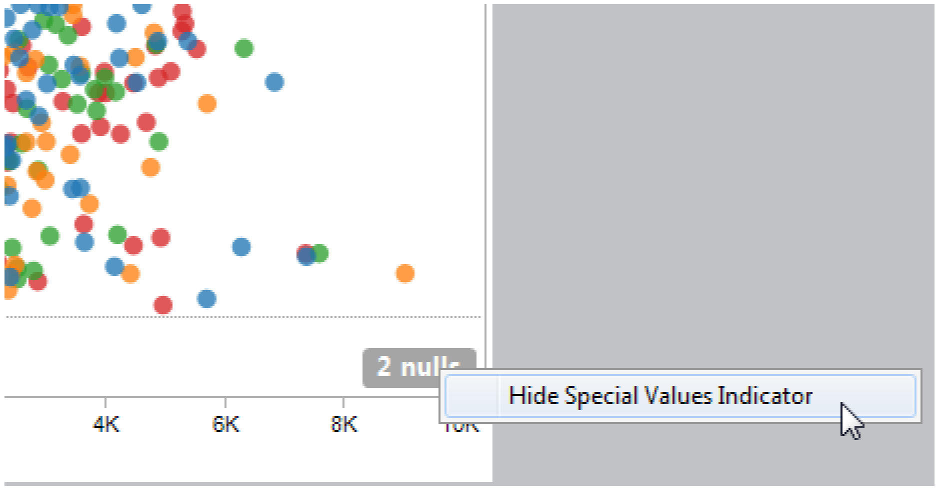


Null Numbers and Dates

If a numeric or date axis contains null values, you can choose to filter the data, which removes null values from the view and all calculations, or show them at a default position. The default positions are described in the following table.

Type of Data	Default Position
Numbers	0
Dates	12/31/1899
Negative Value on a Log Axis	1
Unknown Geographic Locations	(0, 0)

By default, the values are shown with the indicator in the lower right corner of the view and are included in calculations. Right-click (control-click on Mac) the indicator to hide it.

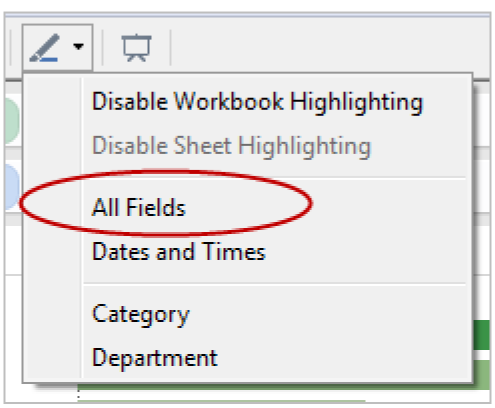


Quick Start: Highlight Actions

Highlight related data in a variety of other views based on your selection in the current view. Highlight Actions are particularly useful on a dashboard where the highlight provides rich visual interaction between the views on the sheet.

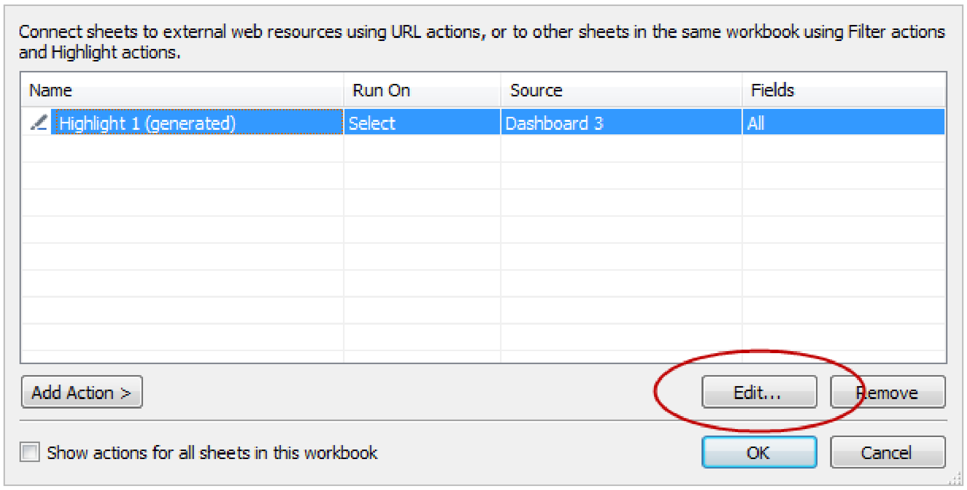
1 Turn on Highlighting

To turn on highlighting in a dashboard, click the **Highlight** icon on the toolbar and select an option. Select **All Fields** to highlight all fields in the view, **Dates and Times** to highlight dates and times in the view, or select a specific field in the view to highlight.



2 Refine the Highlight Action

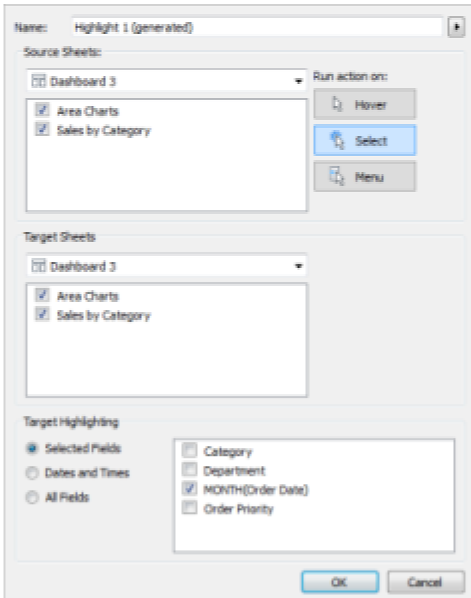
Select **Dashboard** > **Action** to open the **Actions** dialog box.. Select an action and then click **Edit**.



Any action you create displays in the **Actions** dialog box. You can add Filter, Highlight, or URL actions.

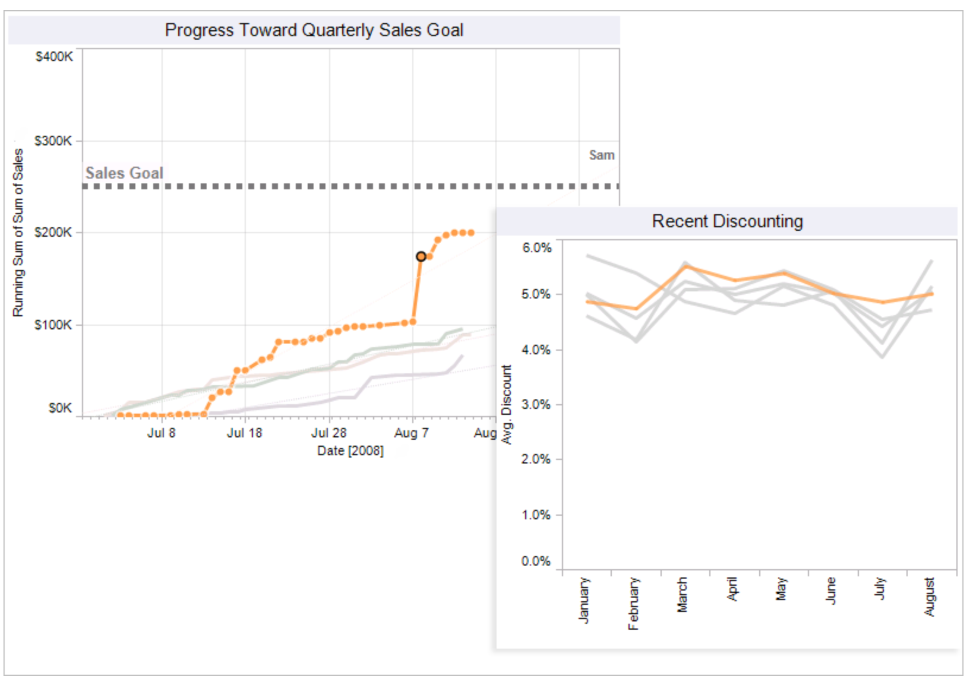
3 Specify the Action Settings

In the **Edit Highlight Action** dialog box, select the source sheets, target sheets, and the fields to highlight. You can also select whether to run the action when you hover, select, or right-click (control-click on Mac) the source sheet. When finished, click **OK**.



4 See it in Action

In your dashboard, hover, select, or right-click (control-click on Mac) the source view to see the related data highlighted in the target views.



A selection in the source view highlights the related information in all of the target views.

Quick Start: Measure Distance in Maps with the Radial Tool

While you explore data in Tableau maps, you might have questions about how the data relates to its surroundings.

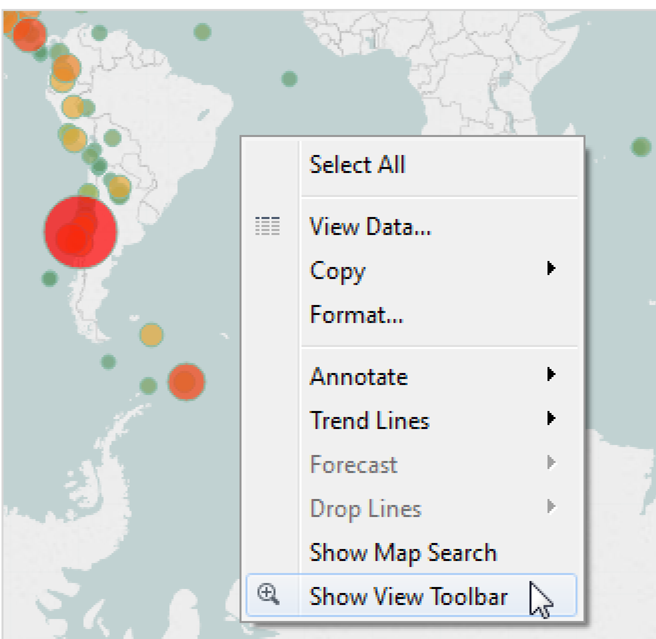
For example, you might wonder how many earthquakes have occurred within 25 miles of a city, or how many public transit stops are within a kilometer of a popular tourist destination.

You can use the Radial tool to measure approximate distances between your data and the locations or landmarks in your map view.

1 Show the View Toolbar

The Radial tool button is located on the view toolbar, which appears in the top-left corner of the view when you hover over a map. If the view toolbar doesn't appear in the view, it is hidden, and you can choose to show it.

To show the view toolbar, right-click (control-click on Mac) anywhere in the view and select **Show View Toolbar**.

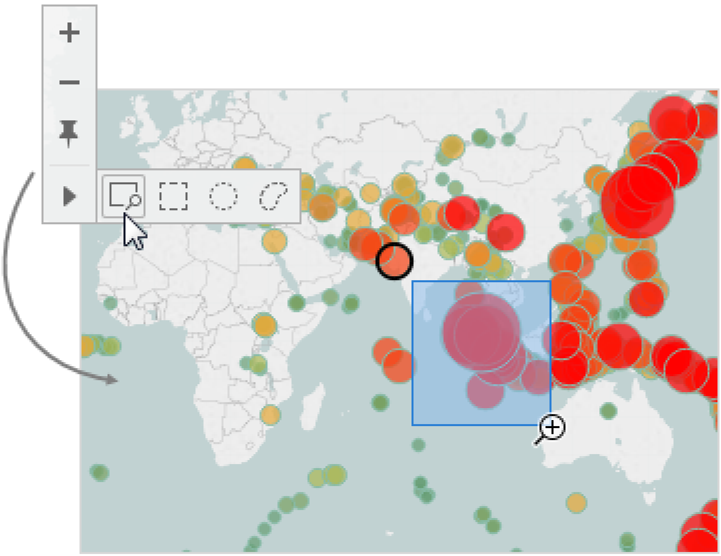


You can also use keyboard shortcuts to navigate the view and select marks. For more information, see **Keyboard Shortcuts** on page 1476.

2 Zoom In to an Area or Location

Before you can measure distance in your map view using the Radial tool, you need to first zoom in to a particular area or location in the map.

To zoom in, click the **Zoom In** button on the view toolbar. To zoom quickly to an area of the view, double-click the area on the map.

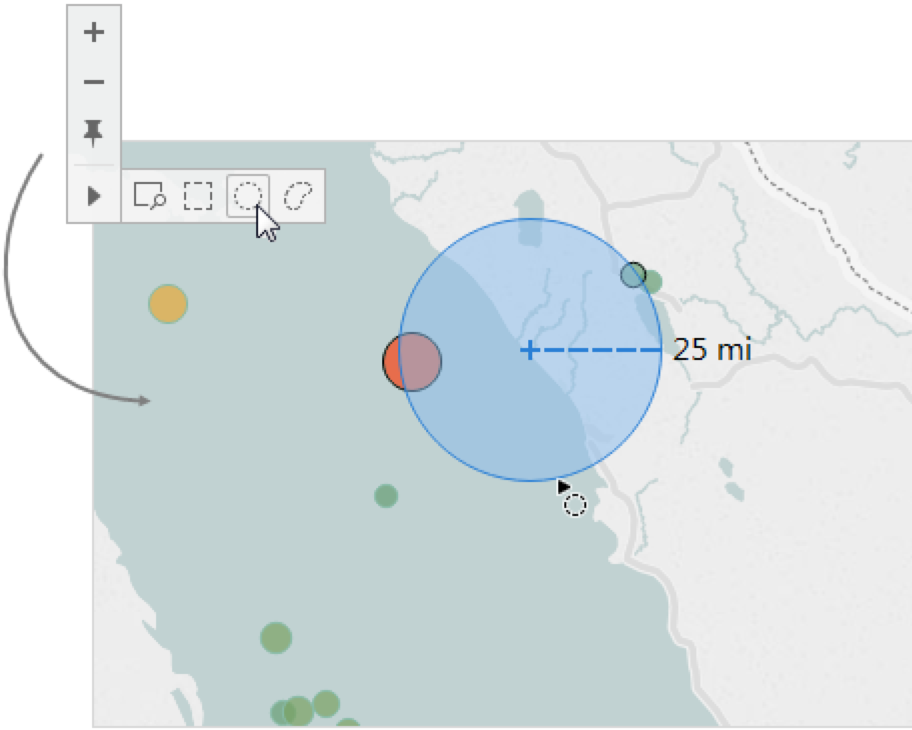


You might need to zoom in several times before you can measure distance with the Radial tool. For more information, see the **Measurement Accuracy** on page 916 section of the Measure Distances between Data Points and locations in a Map topic.

3 Select the Radial Tool

To select the Radial tool, hover over the arrow on the view toolbar and click the Radial tool button. Next, click a location, landmark, or area on the map that you want to measure from, and then drag across the view.

As you drag, the Radial tool selects the marks that are within the radius of the circle. In the example below, the radius is 25 miles. This means that the two marks selected are within approximately 25 miles of the chosen location.



Units of Measurement

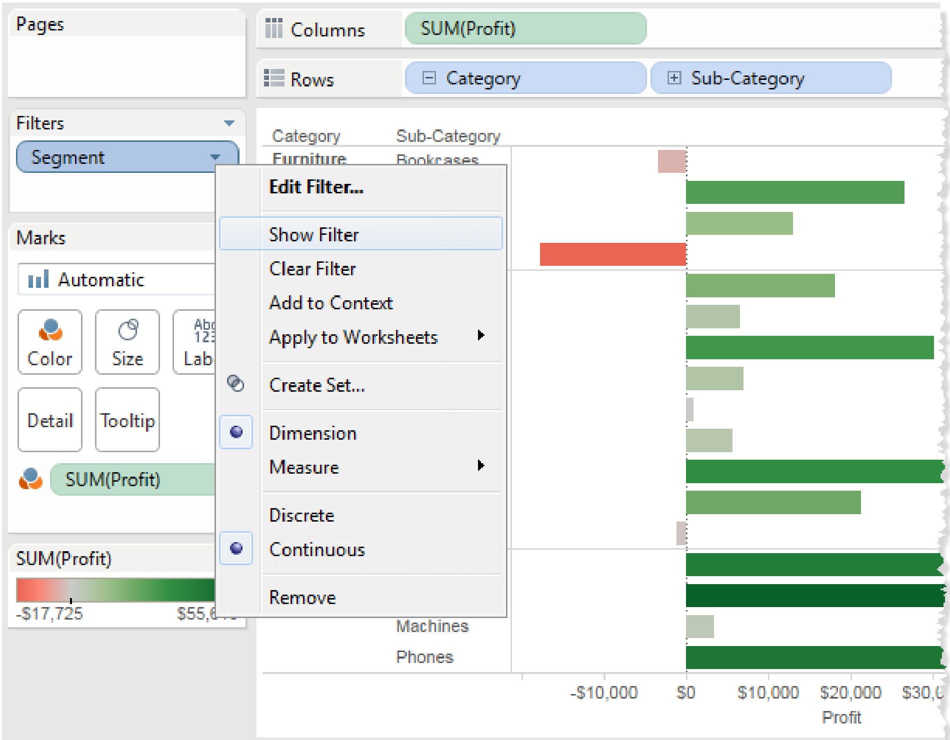
By default, your workbook locale determines which units the Radial tool uses to measure distance. If your workbook locale is set to a country that uses the Imperial system, such as the United States or the United Kingdom, the Radial tool measures distance in feet and miles. If your workbook locale is set to a country that uses the Metric system, such as Brazil, the Radial tool measures distance in meters and kilometers.

Quick Start: Filter Modes

When you show a categorical filter in the view, you can choose a filter mode that best fits your data.

1 Show a filter in the view

Right-click a field (control-click on Mac) and select **Show Filter**.



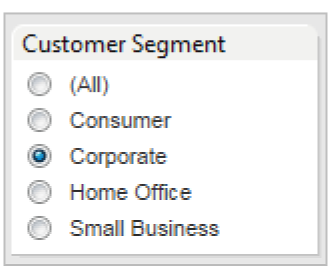
You can show filters for any field, whether the field is in the view or not.

2 Select a filter mode

On the filter drop-down menu, select one of the following seven filter modes.

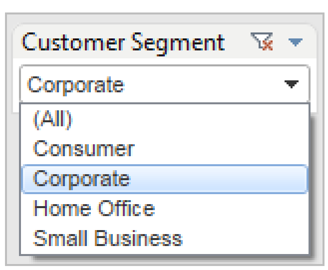
Single Value (List)

Select one value at a time in a list.



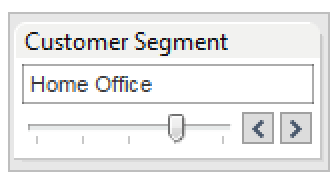
Single Value (Dropdown)

Select a single value in a drop-down list.



Single Value (Slider)

Drag a horizontal slider to select a single value.

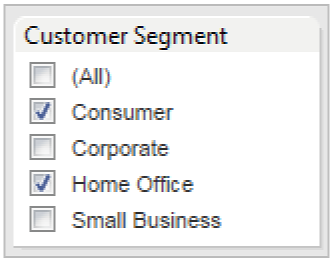


Multiple Values (List)

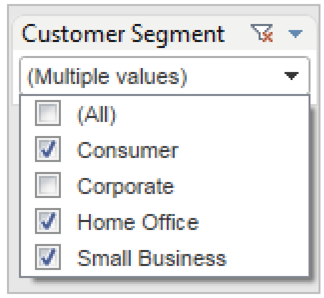
Multiple Values (Drop-down)

Multiple Values (Custom List)

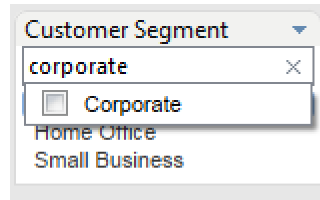
Select one or more values in a list.



Select one or more values in a drop-down list

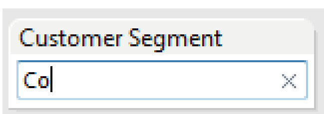


Search and select one or more values.



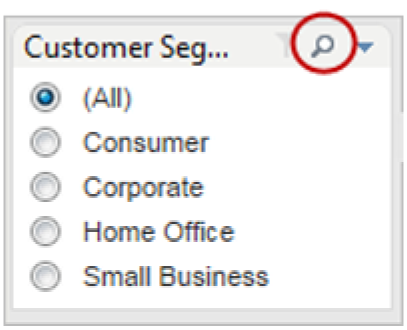
Wildcard Match

Select values containing the specified characters.



3 Search filter values

Some filter modes support search so you can quickly find and select values. To search a filter shown in the view, click the **Search** icon in the title area of the filter in the view, and then type the value you want to find. The matching results display below the search box where you can select or clear them.



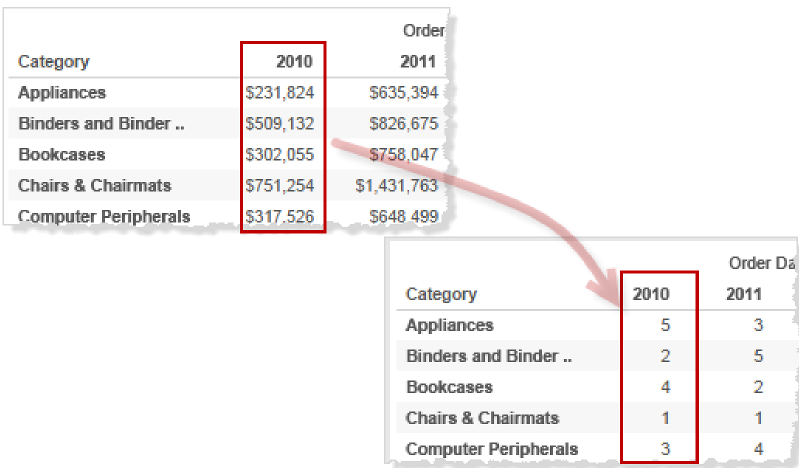
Use the **(All)** option to quickly select and clear all values in the list.

Quick Start: Rank and Percentile

Rank

Use rank when you are interested in seeing the order of values in a list. For example, you could apply a rank table calculation to a table to see which product category ranked highest in sales over a four-year period.

Right-click a field (or control-click on a Mac) and choose **Add Table Calculation**. Then choose **Rank** as the **Calculation Type** and **Table (Down)** as the value for **Running along**.



		Order
Category	2010	2011
Appliances	$231,824	$635,394
Binders and Binder ..	$509,132	$826,675
Bookcases	$302,055	$758,047
Chairs & Chairmats	$751,254	$1,431,763
Computer Peripherals	$317,526	$648,499

		Order Da
Category	2010	2011
Appliances	5	3
Binders and Binder ..	2	5
Bookcases	4	2
Chairs & Chairmats	1	1
Computer Peripherals	3	4

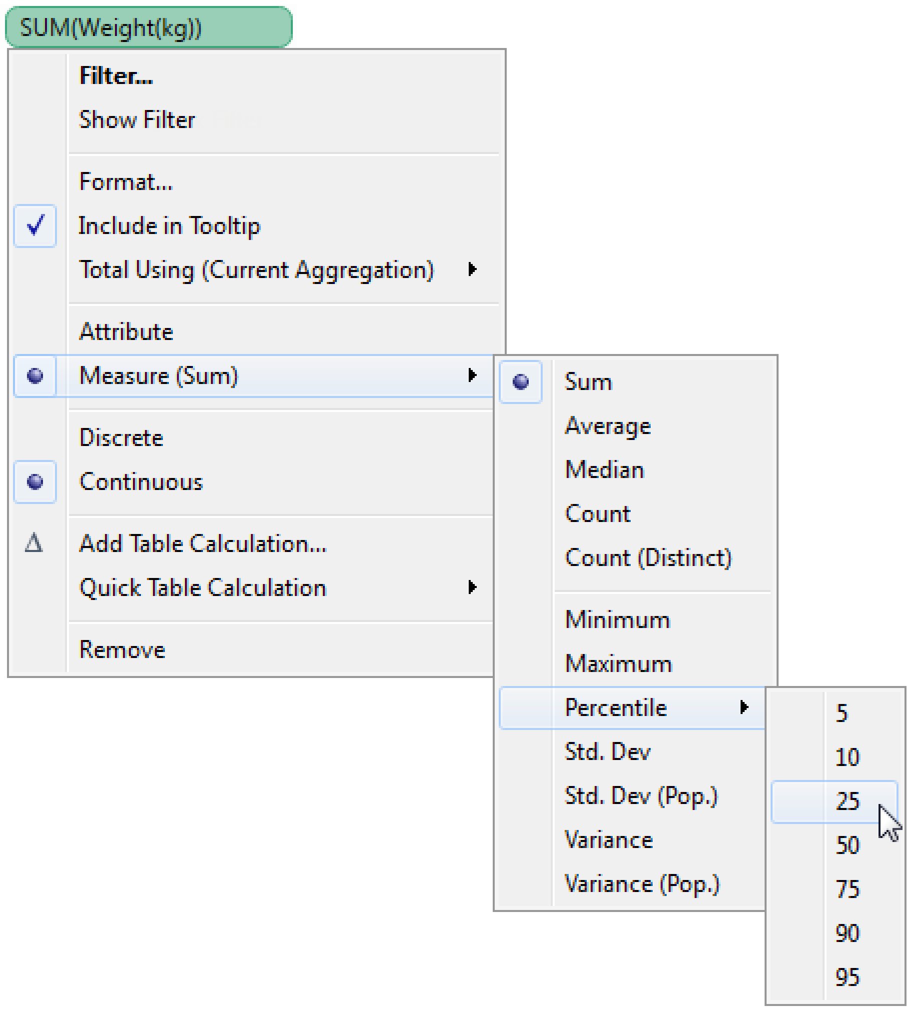
Tableau supports a range of ranking options, so you can specify how to rank data that contains duplicate values. For example, if you had a set of five values, and three of them were the same (10, 15, 15, 15, 24), you could configure the table calculation to rank them in any of the following ways:

- 1, 2, 2, 2, 5 (Competition ranking)
- 1, 4, 4, 4, 5 (Modified competition ranking)
- 1, 2, 2, 2, 3 (Dense ranking)
- 1, 2, 3, 4, 5 (Unique ranking)

Ranking functions that support these options are also available for use in calculated fields (for example, DENSE_RANK, MODIFIED_RANK).

Percentile

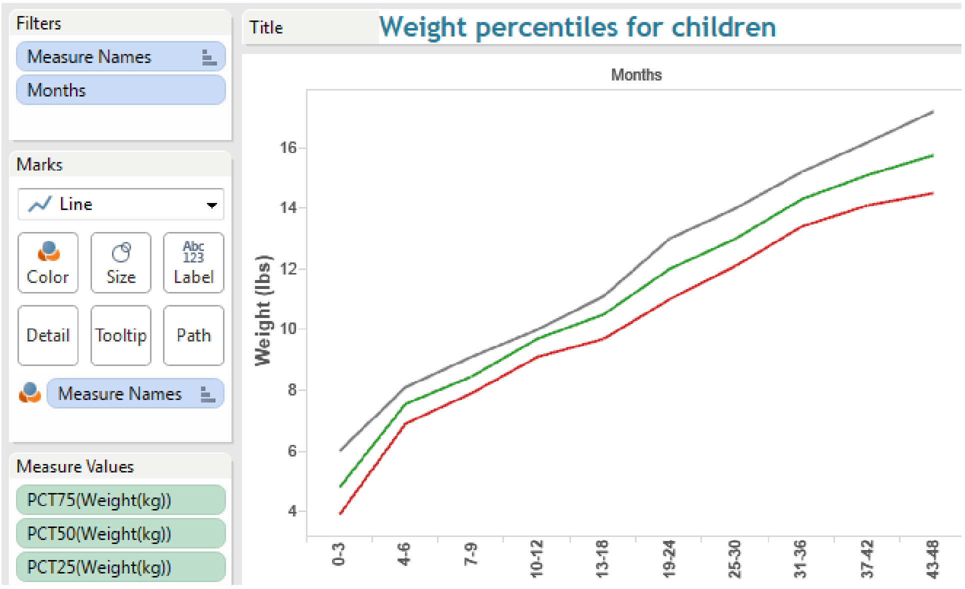
Percentile is available as an aggregation and as a table calculation. To use one of the built-in percentile aggregations, right-click a measure in the view and select **Measure** > **Percentile** and then choose one of the numeric options.



The Percentile aggregation requires an extract.

If none of the numerical values listed is what you want, you can right-click a measure in the view and choose **Add Table Calculation** to configure a custom percentile.

You can compute multiple percentiles on the same measure to show different percentiles simultaneously. The view below shows Weight at three different percentages, to display a range of percentiles over time.

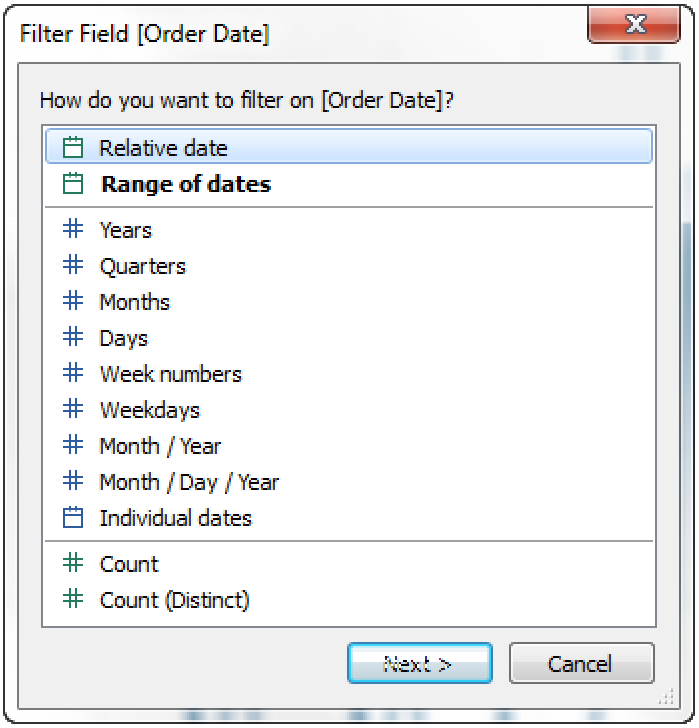


Quick Start: Relative Date Filters

Create filters to show a date period that is relative to when you open the view. For example, create dynamic filters to only show the current week, the year to date, or the past 10 days. Relative date filters make it easier to create lasting views that you can publish and share.

1 Drag a Date Field to the Filter Shelf

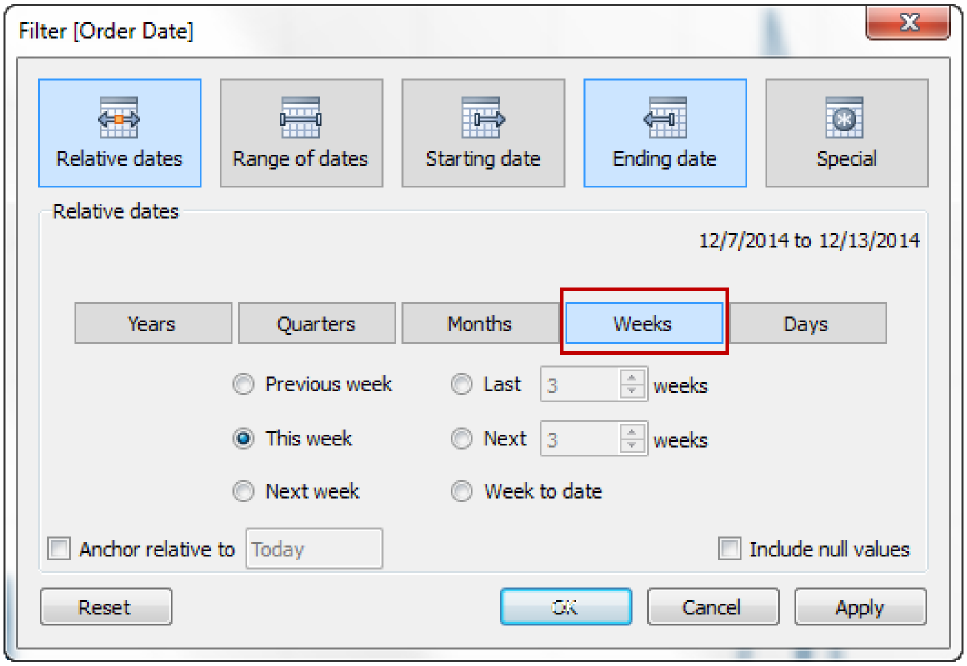
Drag a field from the **Data** window to the Filter shelf and click **Relative date** in the Filter Field dialog box.



Then click **Next**.

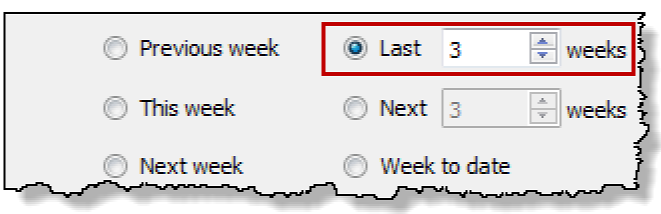
2 Select a Time Unit

In the Filter dialog box, select the unit of time you want to base your filter on. For example, to filter to only show the last three weeks, select Weeks.

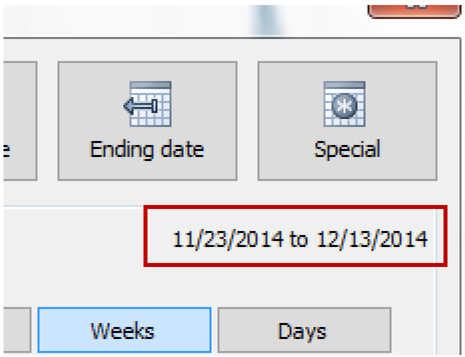


3 Define the Date Period

Use the options in the lower part of the Filter dialog box to specify which weeks to include in the view. To show the last three weeks click **Last** and then select the number **3**.

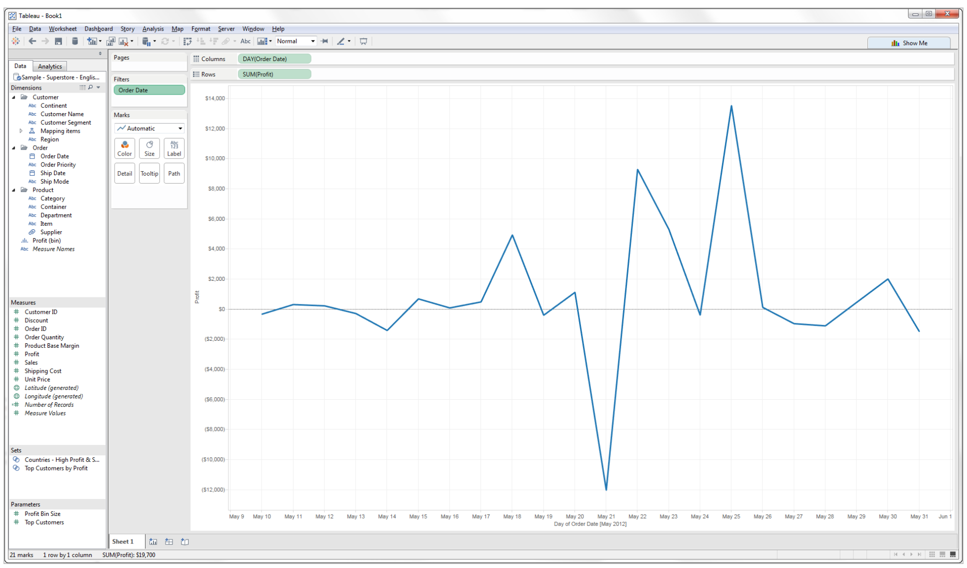


Date periods include the current unit of time. For example, if you select the last three weeks Tableau will include the current week and the two previous weeks. The range of time that you have selected is displayed in the upper right of the Filter dialog box—for example "11/23/2014 to 12/13/2014."

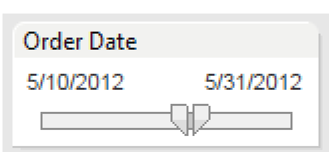


4 Watch the View Update

The filter will now update depending on the current date.



Relative date filters, once created, can be displayed in the view as filter cards.

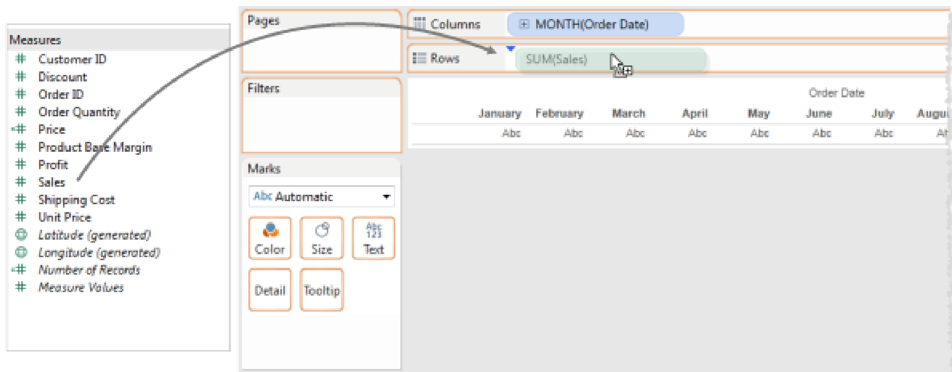


Quick Start: Secondary Axes

In addition to blending multiple measures on the same axis, you can add a secondary axis, or dual axis to a view to better compare measures of different scales. Follow the steps below to add and remove a secondary axis.

1 Drag a Measure to the View

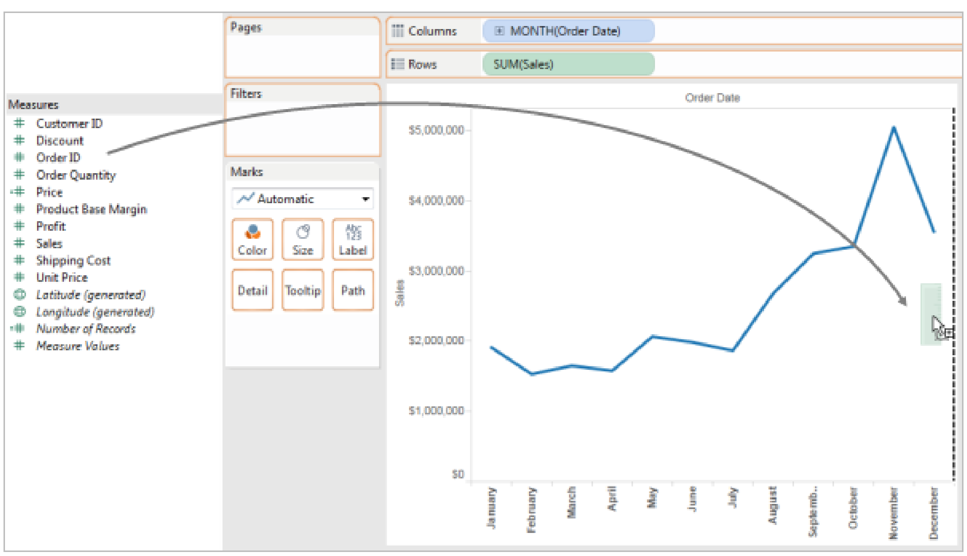
Drag a continuous field from the Data pane to the view.



When you add a measure or continuous field to the view, an axis is created.

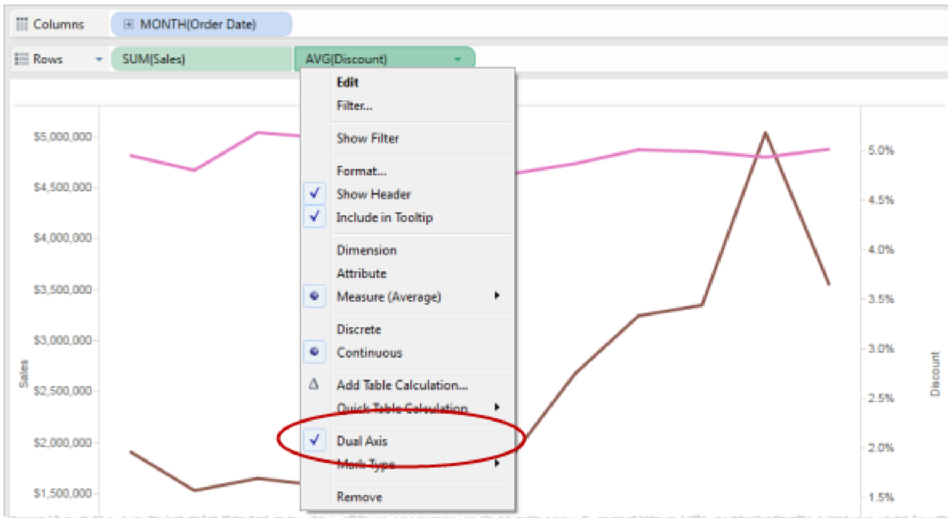
2 Add a Second Measure to the View

Drag a second measure to the view, but this time drag it to the far right side of the view. A dashed line and a ruler icon displays when you hover over the right side of the view.



3 Remove the Secondary Axis

To remove a secondary axis at anytime, right-click (control-click on Mac) the secondary field on the **Rows** or **Columns** shelf and deselect **Dual Axis**.



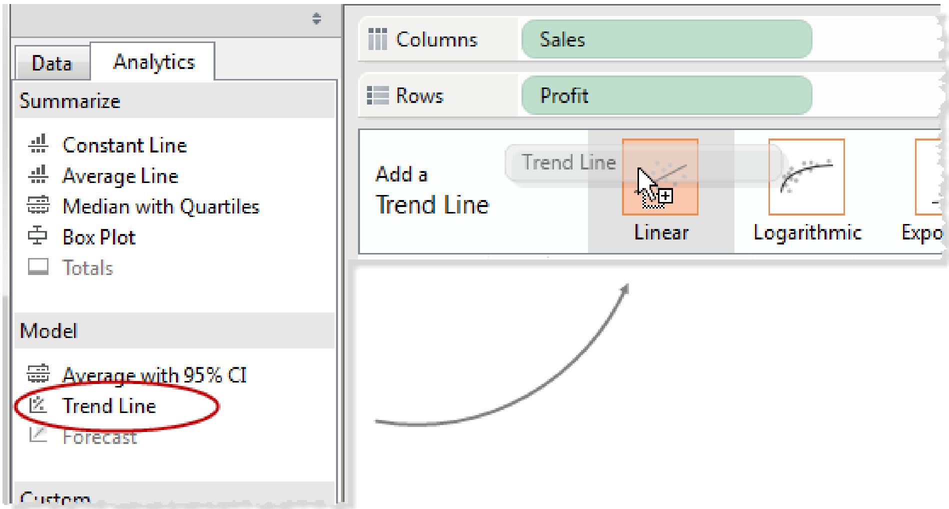
To edit each axis individually, right-click (control-click on Mac) one of the fields and select **Edit**. There you can specify the scale, tick marks, title, and more.

Quick Start: Trend Lines

Trend lines, also known as best fit lines, are computed lines that predict data trends. Follow the instructions below to learn how to add trend lines to your view.

1 Add a Trend Line

From the **Analytics** pane, drag the **Trend Line** model to the view and drop it on a model type.

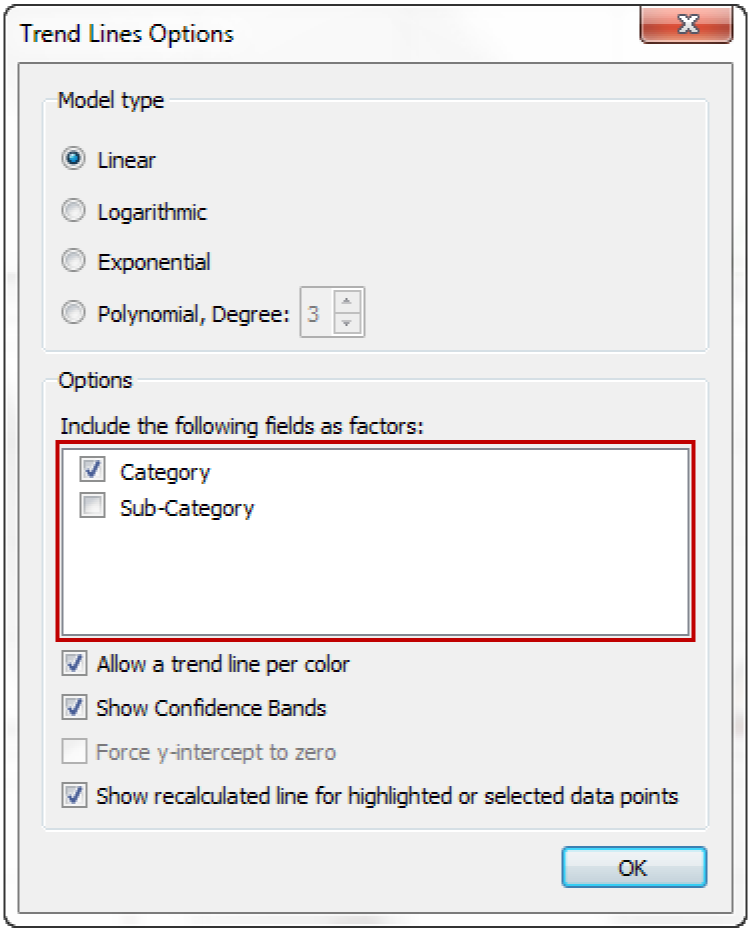


You can select one of the following model types to add to the view.

To remove a trend line, drag the trend line off the view, or select it in the view and click **Remove**.

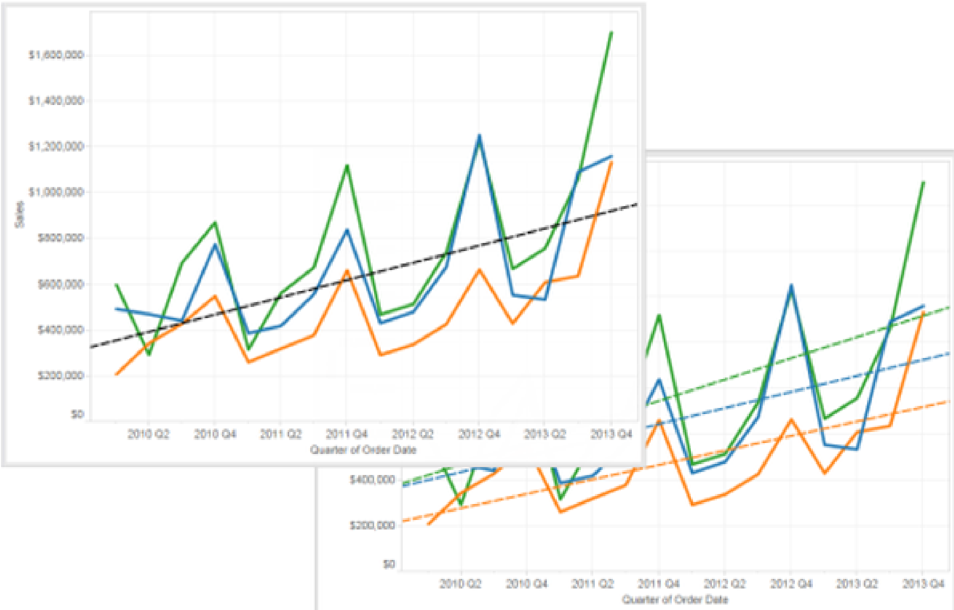
2 Exclude Fields from the Trend Line

To edit a trend line, click it and select **Edit**. In the **Trend Lines Options** dialog box, if the trend is considering multiple factors, you can clear any dimensions that you don't want to include as factors in the trend line model.



3 Specify Additional Options

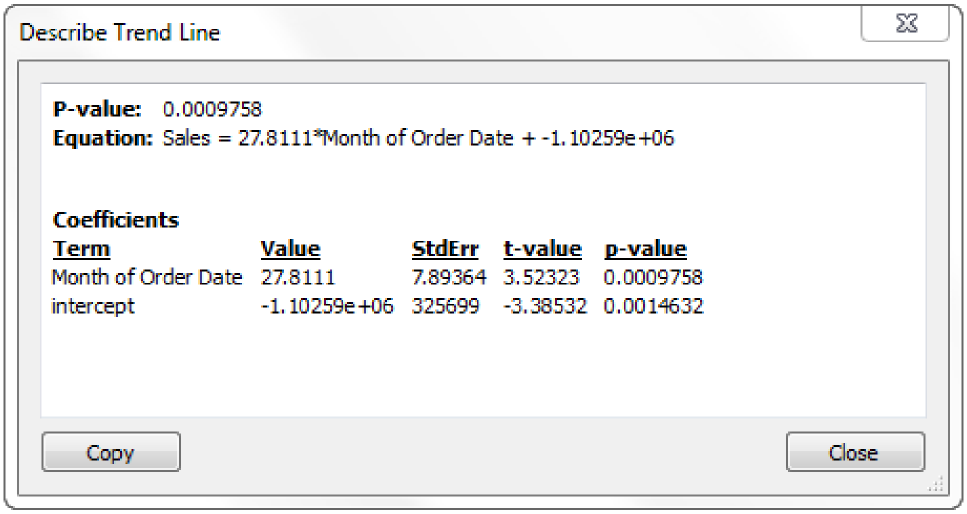
Another option in the **Edit Trend Lines** dialog box is **Allow a trend line per color**. When you have color encoding in your view, you can use this option to add a single trend line that models all of the data and ignores the encoding.



By default, trend lines are shown with upper and lower 95% confidence lines. In a view with multiple trend lines, these confidence lines can make the view "noisy" and difficult to read. If this is the case, clear the **Show Confidence Bands** option.

4 Describe the Trend Line

After you add trend lines, you can use the Describe feature to display statistics on the trend line. For example, you can see the formula as well as r-squared and p values. To view a description of a single trend line, right-click the trend line in the view and select **Describe Trend Line**.



To view a description of the entire trend line model, select **Analysis** > **Describe Trend Model**.

Quick Start: Turn Off Pan and Zoom in Maps

Sometimes you want to control how your audience interacts with your map view.

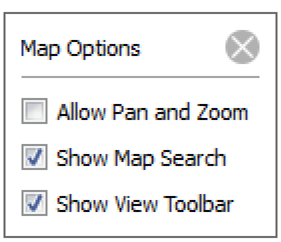
For example, if your audience is using a mobile device to explore your workbook, you might want to turn off pan in your map view so they can move from sheet to sheet with ease.

Similarly, if your map view is zoomed in to a particular city, you might want to ensure that people won't zoom out.

In cases like these, you can turn off pan and zoom in a map view, as well as in a background image.

1 Clear the Allow Pan and Zoom Option

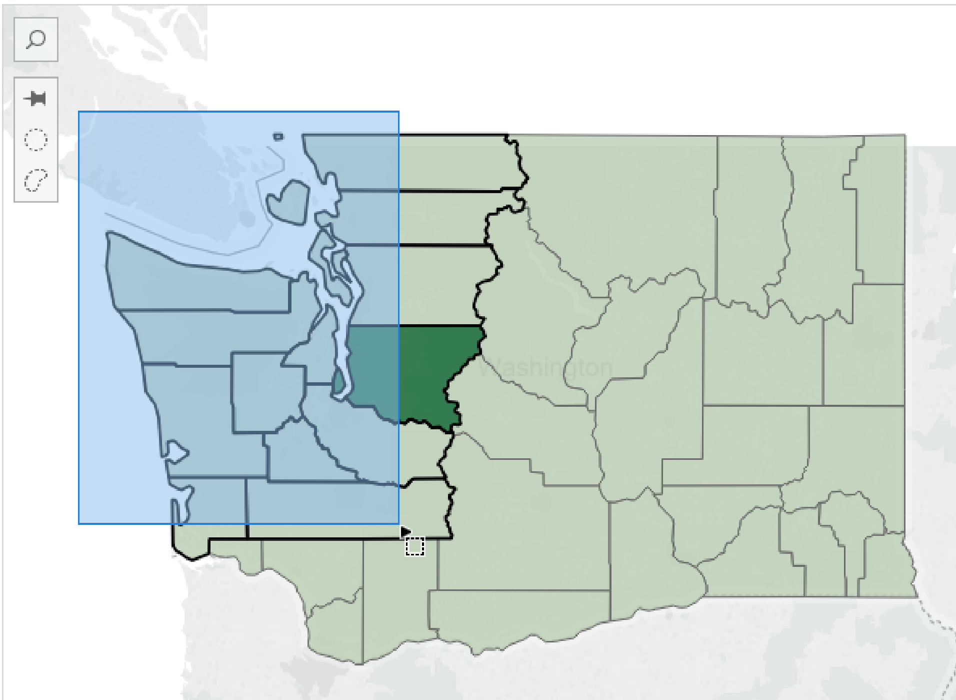
To turn off pan and zoom in your map view or background image, select **Map** > **Map Options**, and then clear **Allow Pan and Zoom**.



In a dashboard, select the map view first, and then select **Map** > **Map Options** > **Allow Pan and Zoom** to clear the check mark.

2 Review the changes to the view toolbar

When you turn off pan and zoom in a map view or background image, the pan tool and all zoom controls are removed from the view toolbar. Keyboard shortcuts for zooming in and out of the view, or panning, no longer work. For more information about the view toolbar and default tools, see **View Toolbar** on page 844 and **Select Marks** on page 845.



You can still use the view toolbar to select marks in the view, lock the map in place, or automatically zoom the map to all of your data. You can also click the map search icon to search for locations in the view.

Quick Start: Use Mapbox Maps

You can use Mapbox maps to create map views in Tableau.

For example, if you have a Mapbox map that fits your data or corporate style, you can connect to it in Tableau Desktop and use it as a background map.

You can add a Mapbox GL map or a classic Mapbox map. For this example, learn how to add a classic Mapbox map. For information on how to add a Mapbox GL map, see **Use Mapbox Maps** on page 942.

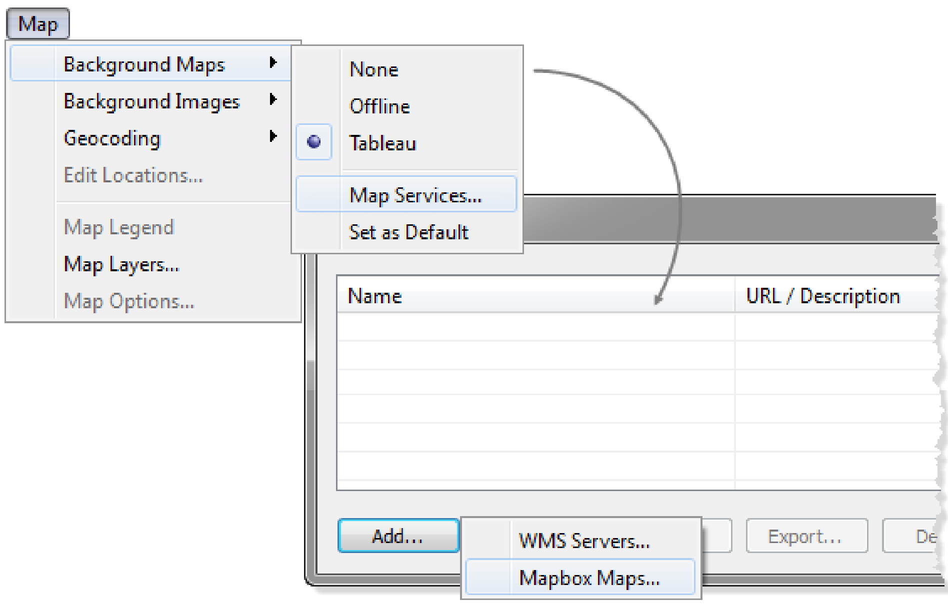
When you use a Mapbox map in one of your views, you can publish that view to Tableau Server, Tableau Online, or Tableau Public so your audience can view your data and your Mapbox map without needing to have a Mapbox account.

Connect to your Mapbox map

1 Open the Add Mapbox Map dialog box

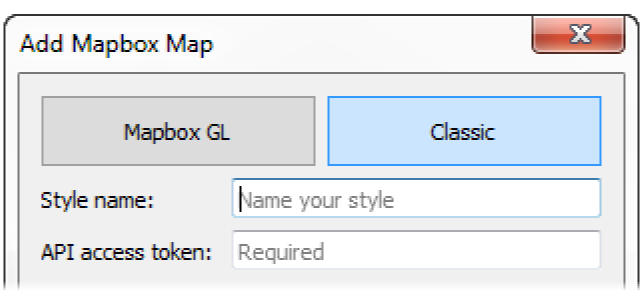
Click **Map** > **Background Maps** > **Maps Services**. This opens the Map Services dialog box.

In the Map Services dialog box, click **Add** > **Mapbox Maps**. This opens the Add Mapbox Map dialog box.



2 Enter a style name and API access token

In the Add Mapbox Map dialog box, click **Classic**. Give the map a style name, and then enter the API access token for the classic Mapbox map you want to add.



3 Add custom layers or choose a preset style

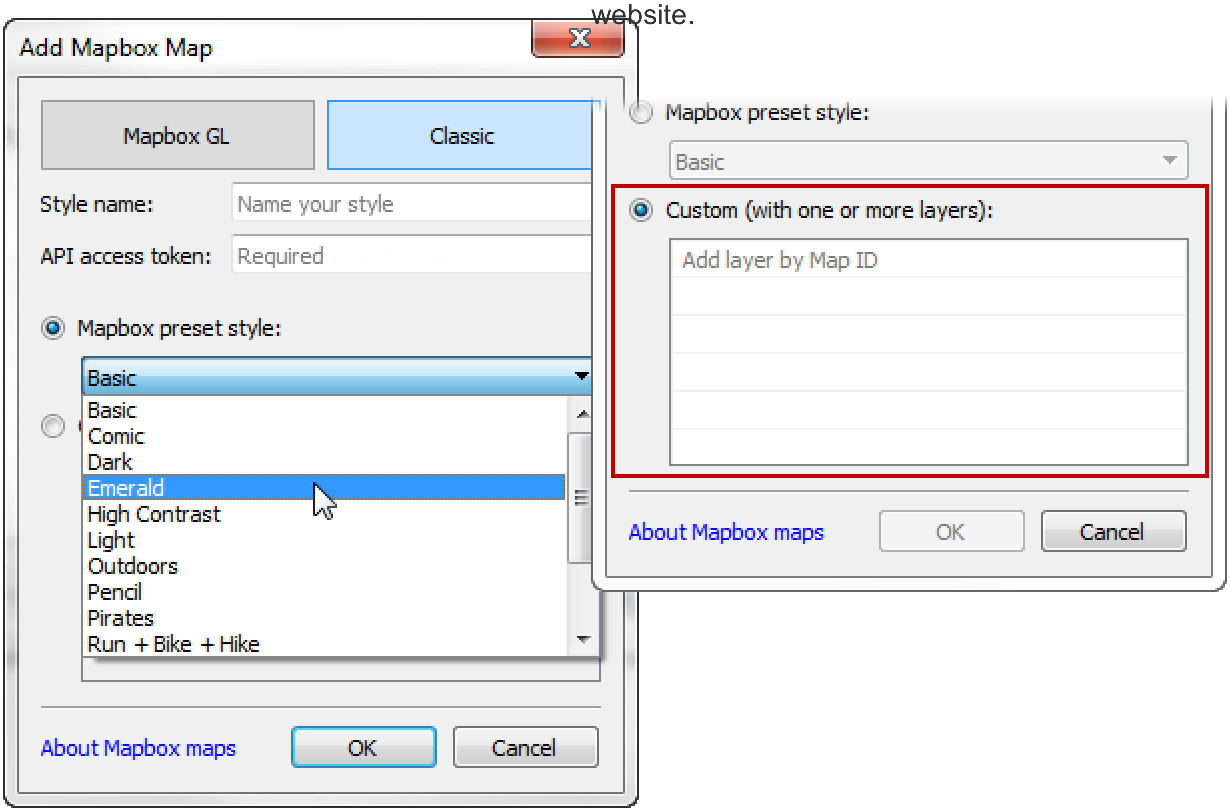
You can choose to add one or more map layers, or you can choose to use a Mapbox preset style.

To use a Mapbox preset style:

In the Add Mapbox Map dialog box, click **Mapbox preset style**, and then select a preset style from the drop-down menu.

To add one or more map layers:

In the Add Mapbox Map dialog box, click **Custom**, and then enter one or more map IDs. For more information about map IDs, see the Mapbox API help on the Mapbox website.



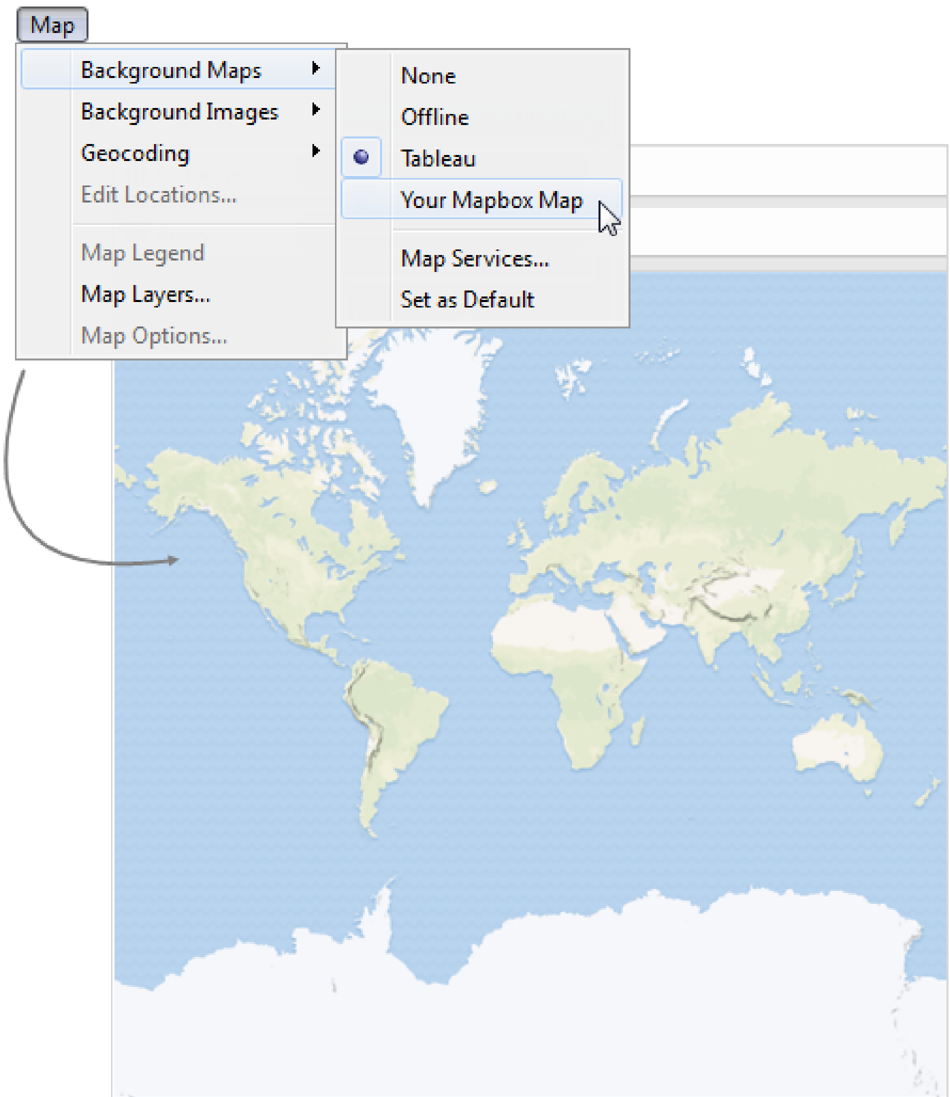
When finished, click **Okay** to exit the Add Mapbox Map dialog box, and then click **Close** to return to the view.

You can add as many Mapbox maps as you want to a workbook. Each Mapbox map you add appears as a background map in the **Background Maps** menu.

Use your Mapbox map

1 Build the map view

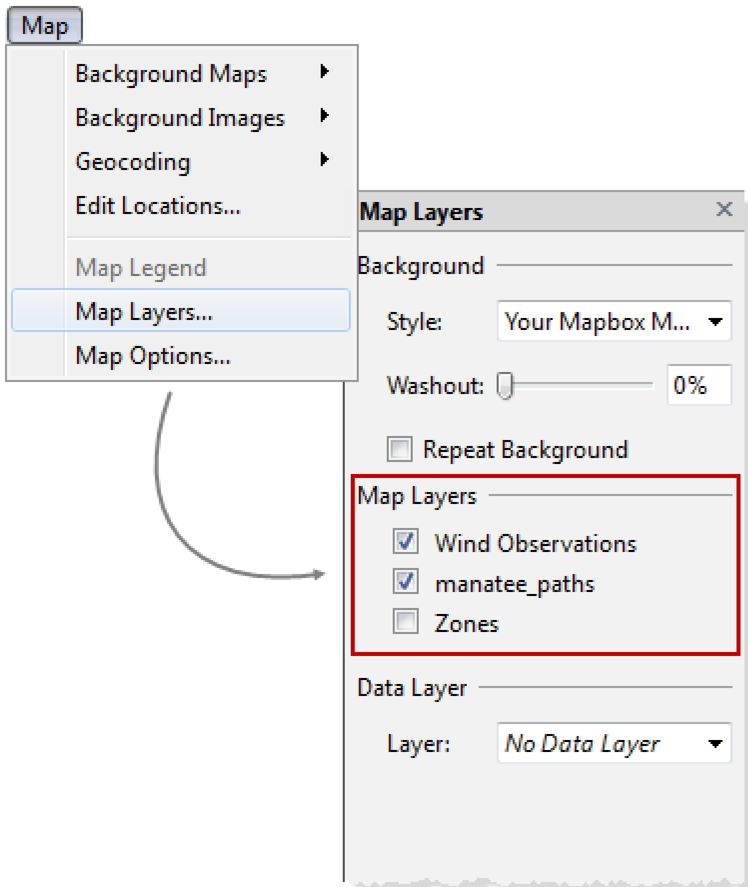
Select **Map** > **Background Maps**, select the Mapbox map you added from the list, and then build a map view. For more information about how to build map views, see **Build a Map View** on page 897.



2 Select which map layers appear in the view

Once you are connected to your Mapbox map, you might want to add or subtract map layers from the view.

To toggle between custom Mapbox layers, click **Map** > **Map Layers**, and then under the **Map Layers** section, select the layers you want to appear in the view.



By default, all map layers appear in the view when you first add a Mapbox map to your workbook.

Save your Mapbox map as a Tableau Map Source

After you add a Mapbox map to your workbook, it will be saved with the workbook and available to anyone with whom you share the workbook. You can also save a Mapbox map as a Tableau Map Source (.tms) that you can share with others so they can quickly connect to it and use it in their own workbooks.

1. Select **Map** > **Background Maps** > **Map Services**.
2. In the Map Services dialog box, select the Mapbox map you want to save, and then click **Export**.
3. In the Export Connection dialog box, enter a name for the file, choose a location for the file, and then click **Save**.

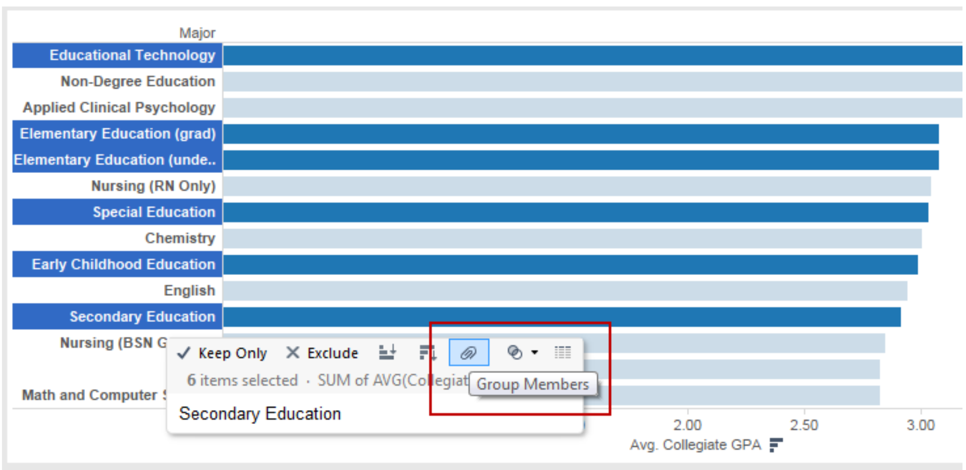
For more information, see **Save a Map Source** on page 947.

Quick Start: Visually Grouping Data

Groups combine dimension members into categories. For example, if you are looking at college student data you may have a dimension that contains majors. You can use groups to combine several majors to create departments or schools. There are many ways to create groups in Tableau. Here are three options.

1 Select Headers

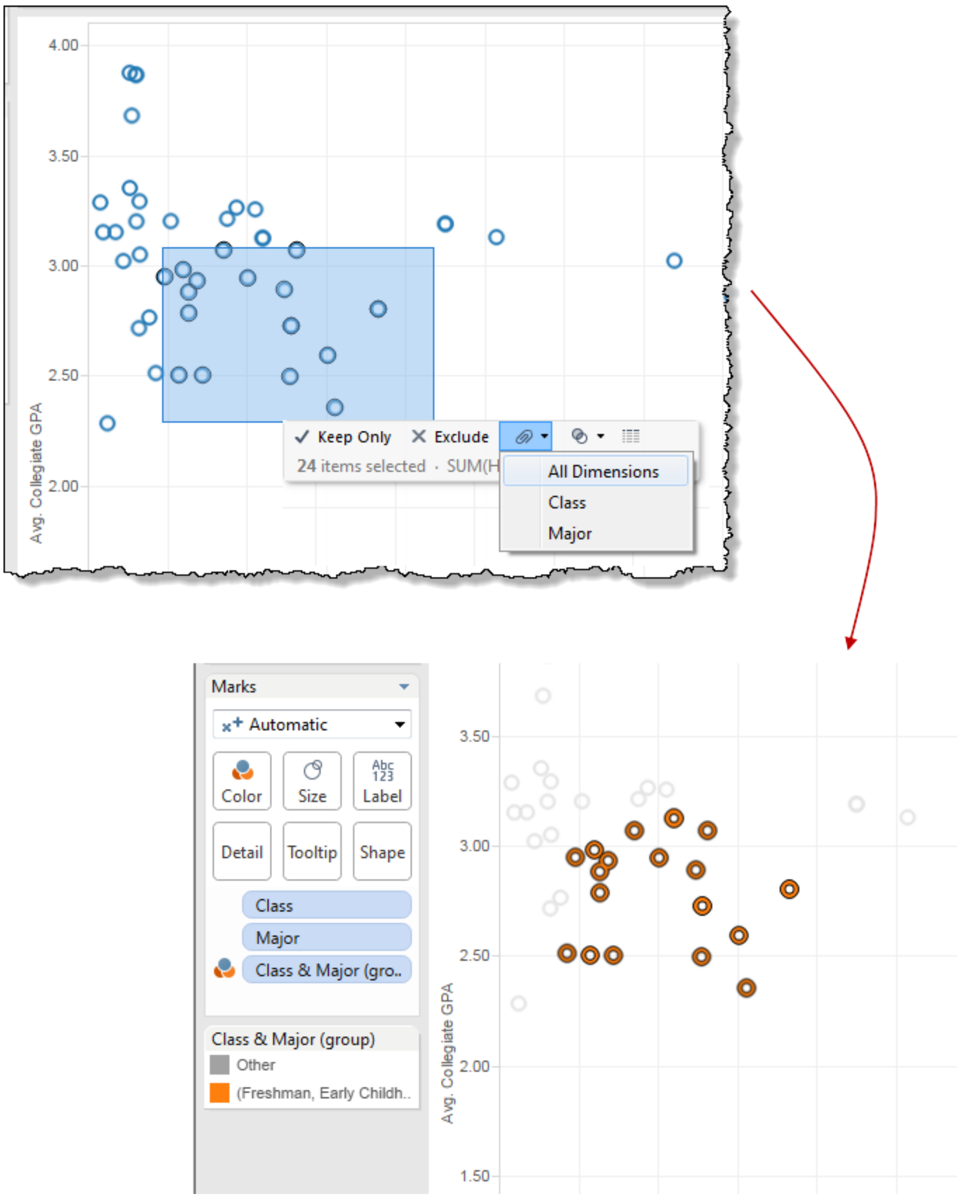
One way to create a group is by selecting multiple headers in a table or values in a legend and then clicking the Group option (which looks like a paperclip) in the tooltip. This method is useful for fixing simple errors in your data or answering “what if.?” questions.



The group's name is automatically based on the last header or value selected. To rename the group, right-click it in the **Data** pane (control-click on a Mac) and choose **Rename**.

2 All Dimensions

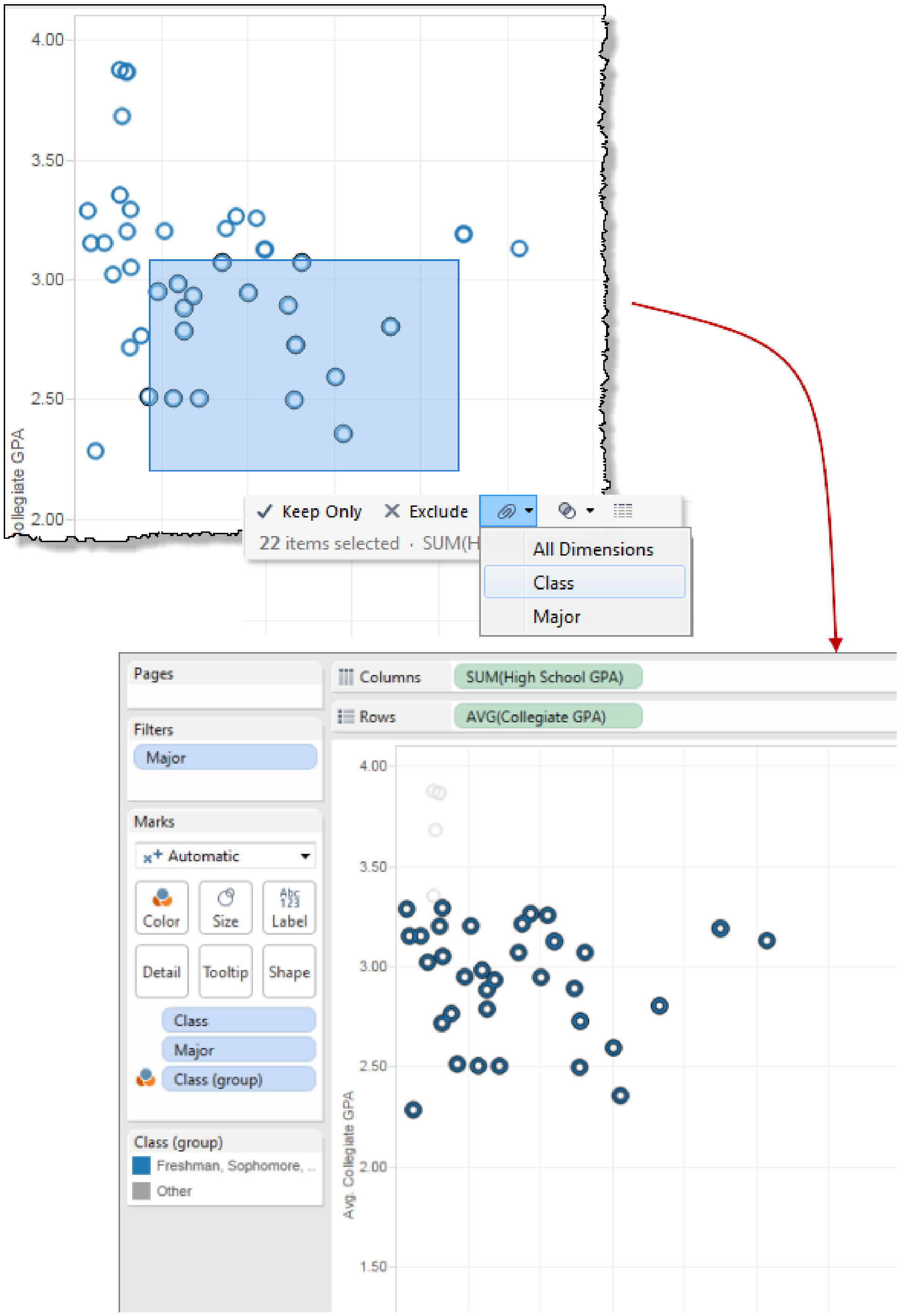
Another way to create groups is by selecting marks in the view and then selecting **All Dimensions** from the Group menu on the tooltip. A new group field is created automatically and placed on the color shelf. The group combines and aggregates the selected marks into one category and assigns all other values to an Other category. If the selected marks` represents multiple dimensions (for example, Class and Major), you can either group on all dimensions or on a specific dimension.



Grouping on all dimensions creates a category that includes each relevant combination of Class and Major. These combinations are grouped into a single category and everything else is put in the Other category.

3 Specified Dimensions

Grouping selected marks on a specific dimension and then selecting a specific dimension from the Group menu on the tooltip creates a group based on that dimension. In this example, the specified dimension is Class and the selected marks contain Class values including Freshman, Sophomore, Junior, and Senior (that is, all Class values except Graduate). All qualifying marks are grouped into a category and all non-qualifying marks are assigned to the Other category.



The marks assigned to the group need not all be within the selection you used when you created the group. This is because the group is based on values for the dimension, not the marks you selected.

Quick Starts about Calculations

After you master the basics of building views in Tableau, you can modify the fields that Tableau extracts from your data source to dig deeper with your analysis. You can create new fields that don't exist in your data source to explore new dimensions and find facts.

Use the calculation editor for customizing and creating fields, or, to stay in the flow and change course quickly, create ad hoc calculations that you can easily save and reuse.

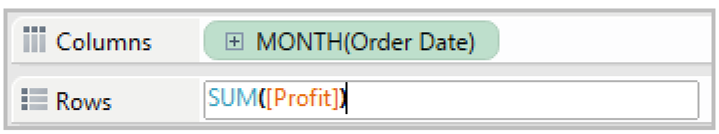
The following Quick Start topics are designed to get you started using calculations.

Quick Start: Ad-Hoc Calculations

Ad-hoc calculations are calculations that you can create and update as you work with a field on a shelf in the view. Ad-hoc calculations, also known as type-in or in-line calculations, can be useful for testing a hunch, trying a what-if scenario, or debugging a complex calculation.

1 Double-Click to Start Editing an Existing Field

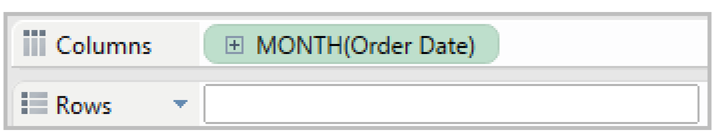
Double-click on an existing field in the view to start editing.



Ad-hoc calculations are supported for fields on the **Rows**, **Columns**, **Marks**, and **Measure Values** shelves; they are not supported for fields on the **Filter** or **Pages** shelves.

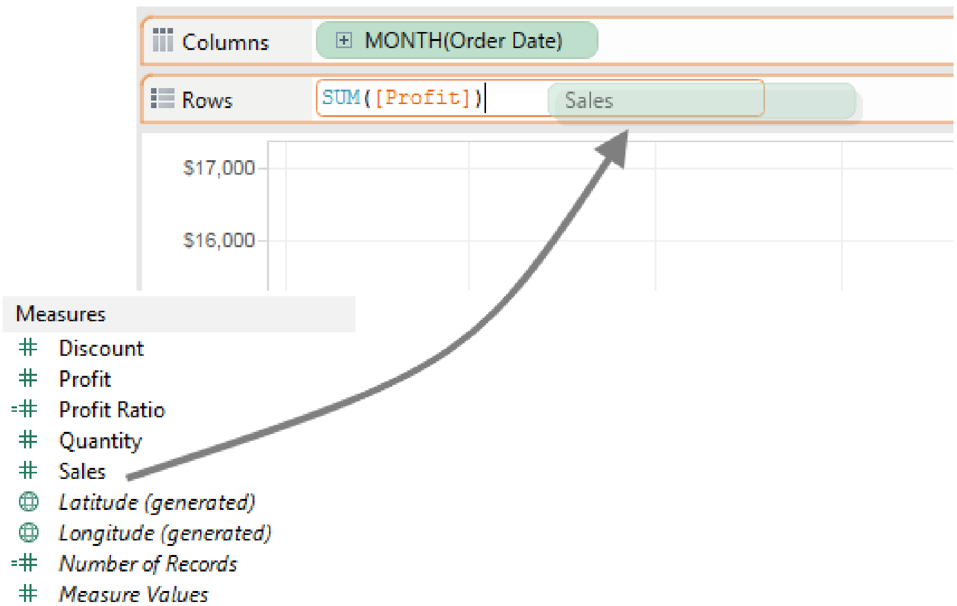
2 Double-Click to Create a New Calculation

Alternatively, you can double-click on an empty shelf or on an empty part of a shelf to create a new ad-hoc calculation.



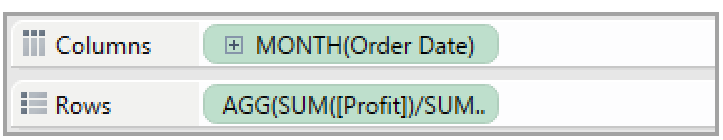
3 Type or Drag Content to the Calculation

Type to update the expression, or drag new fields into the expression from the **Data** pane or elsewhere in the view.



4 Commit the Calculation to Update the View

When you're satisfied with the expression, press Enter or Tab, or click outside the expression to commit the expression and update the view.



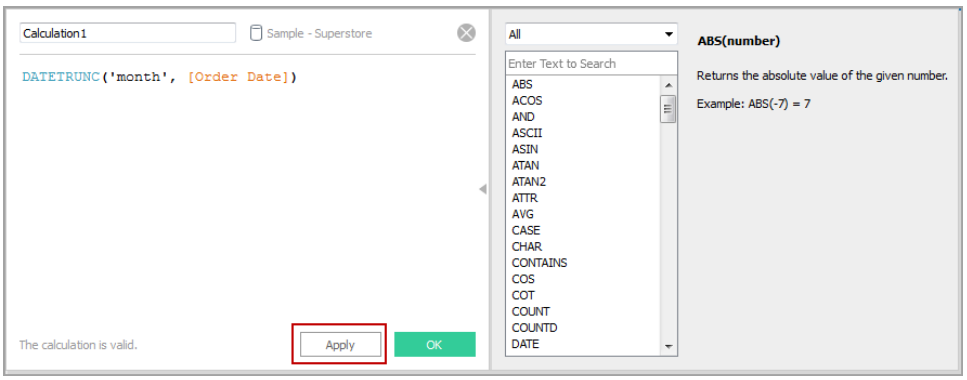
Ad-hoc calculations are not named, but are saved when you close the workbook. If you want to save an ad-hoc calculation for use in other workbook sheets, copy it to the **Data** pane. Tableau will prompt you to name it.

Quick Start: New and Improved Calculation Editor

The calculation editor in Tableau Desktop has been redesigned to provide interactive editing, intelligent formula-completion, and drag-and-drop support. The editor is now also available when you're editing a view in Tableau Server or Tableau Online.

1 Interactive Editing

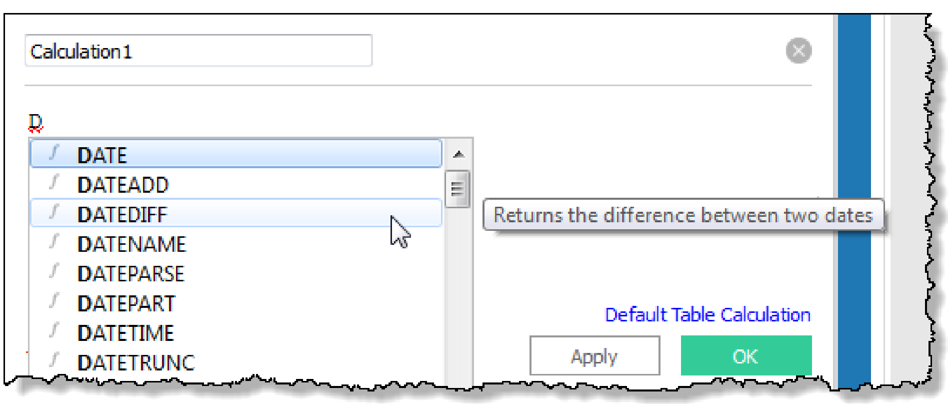
To open the calculation editor, click the drop down to the right of Dimensions on the **Data** pane and choose **Create Calculated Field**. The calculation editor is now non-modal, which means you can work in your view and work with a calculation at the same time. If you edit a field that's in the view and then click **Apply**, the view changes immediately and the editor remains open.



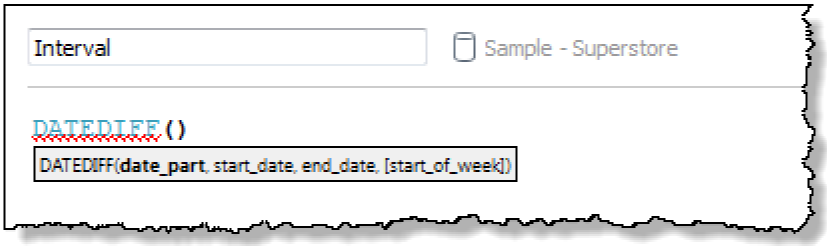
2 Auto-Completion for Formulas

As you work on a formula in the calculation editor, Tableau displays a list of options for completing the formula.

As you scroll the list, using mouse or keyboard, Tableau shows a short description when the current item is a function:



Click a keyword in the list or press Enter to select it. If the keyword is a function, Tableau displays syntax information so you know how to proceed:



3 Drag and Drop Between Editor and View

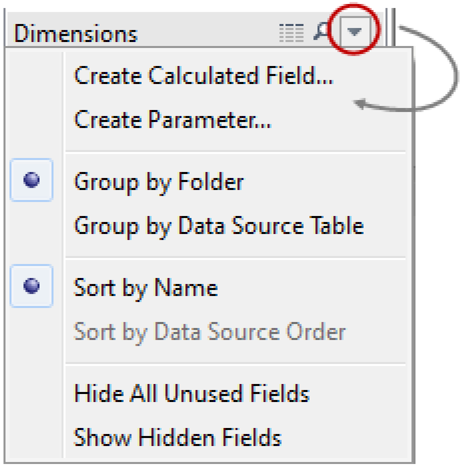
You can drag fields from the **Data** pane or from any of the shelves in the Tableau workspace into the calculation editor, or drag part or all of a calculation from the editor to the **Data** pane or to a shelf.

Quick Start: Creating Calculated Fields - Cubes

Tableau supports calculated fields on multidimensional data sources. There are two kinds of calculated fields: calculated measures and calculated dimensions. When you define a new calculated field, you create a new field in your data source based on existing measures in the data source as well as standard functions and operators. The steps below explain how to create calculated measures using Tableau formulas.

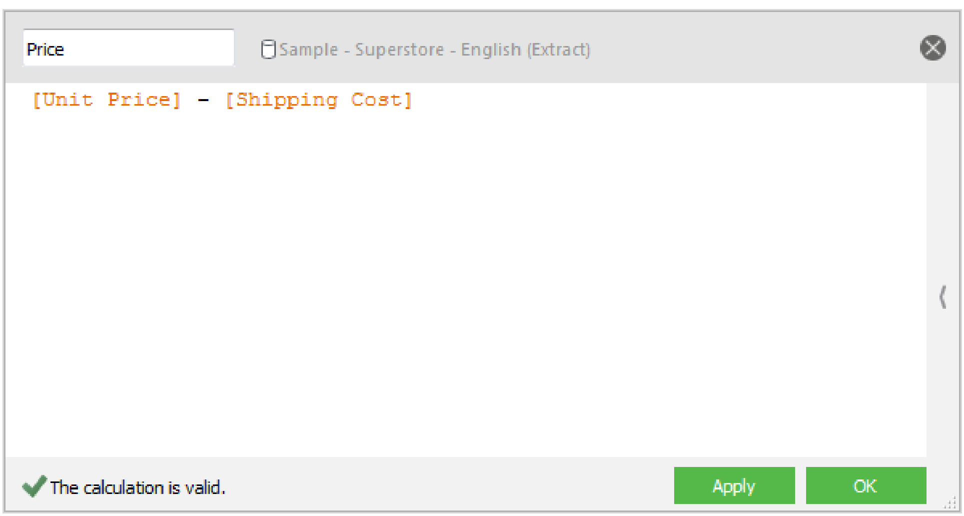
1 Open the Calculated Field Dialog Box

Click **Analysis** > **Create Calculated Field**.



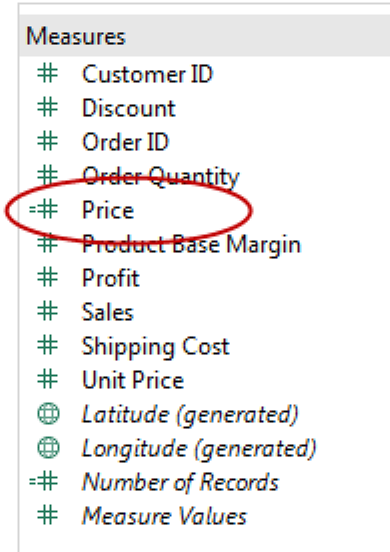
2 Define a Formula

In the **Calculated Field** dialog box, give the new field a name and define a formula.



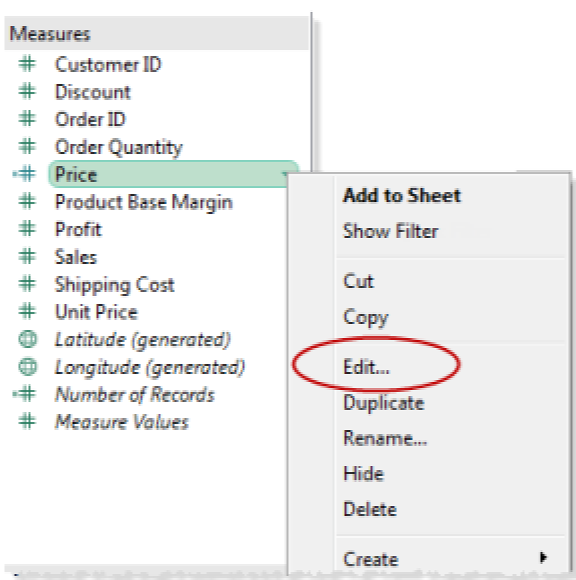
3 Use the New Field

Check that the formula is valid, and then click **OK** to save the new field. It will save to **Measures** on the **Data** pane.



4 Edit the Formula

If you need to change the formula for a calculated field, right-click (control-click on the Mac) the field in the data pane and select **Edit**. Keep in mind that the changes you make will affect any worksheets that use the new field.

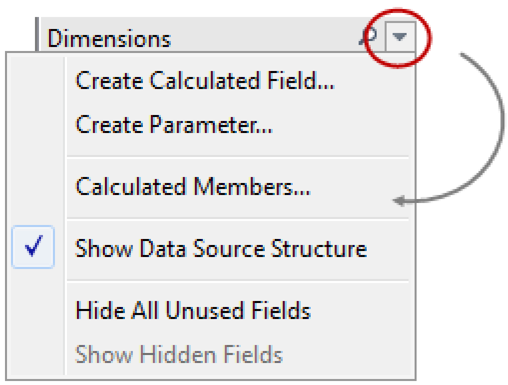


Quick Start: Creating Calculated Members with MDX

Rather than use Tableau formulas to create new fields, you can also create calculated members using Multidimensional Expressions (MDX). With MDX you can create more complex calculations and reference both existing measures and dimensions. Calculated members can either be new measures or new dimension members depending on the hierarchy that you choose. Follow the steps below to learn how to create calculated members using MDX.

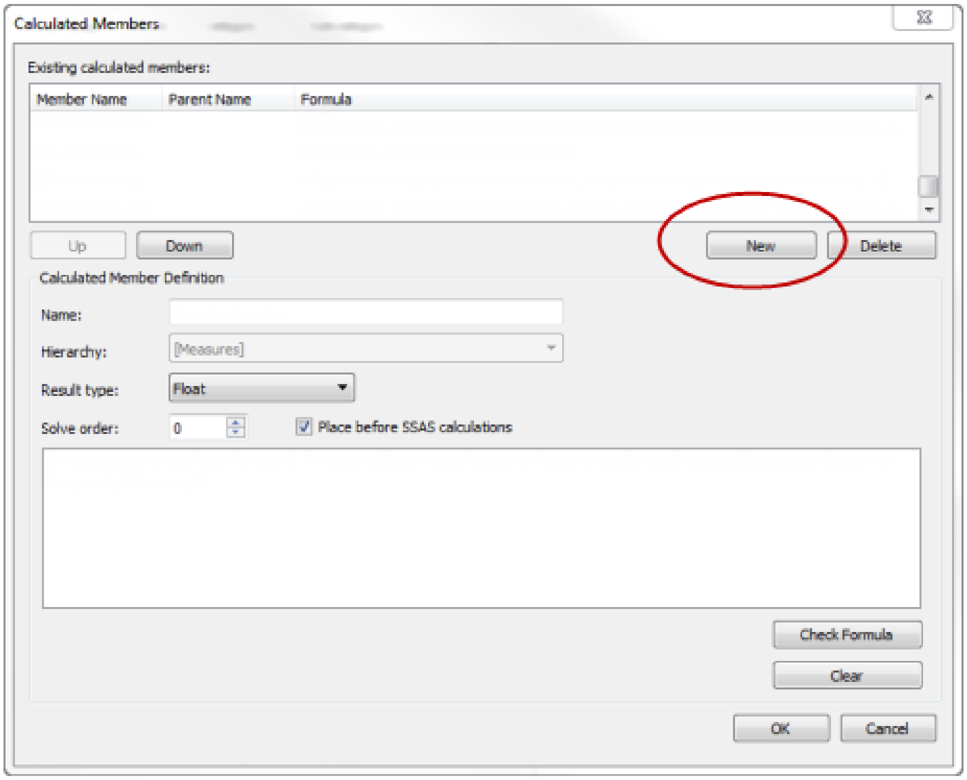
1 Open the Calculated Members Dialog Box

Click the Dimensions drop-down menu and select **Calculated Members**.



2 Create a New Calculated Member

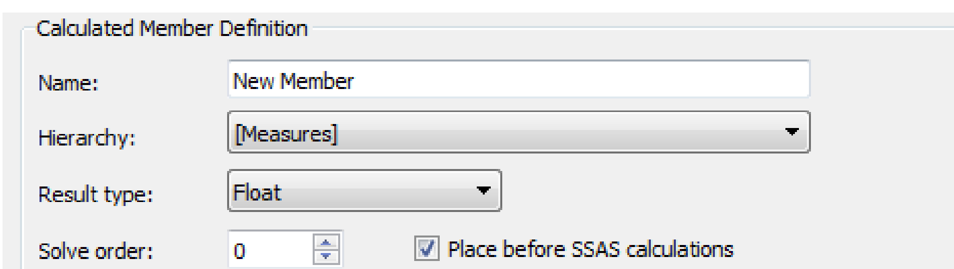
In the Calculated Member dialog box, click **New**.



3 Specify a Calculated Member Definition.

Name the new member and select its location in the hierarchy. For calculated dimension members, specify a parent member. For calculated measure members, specify a result type.

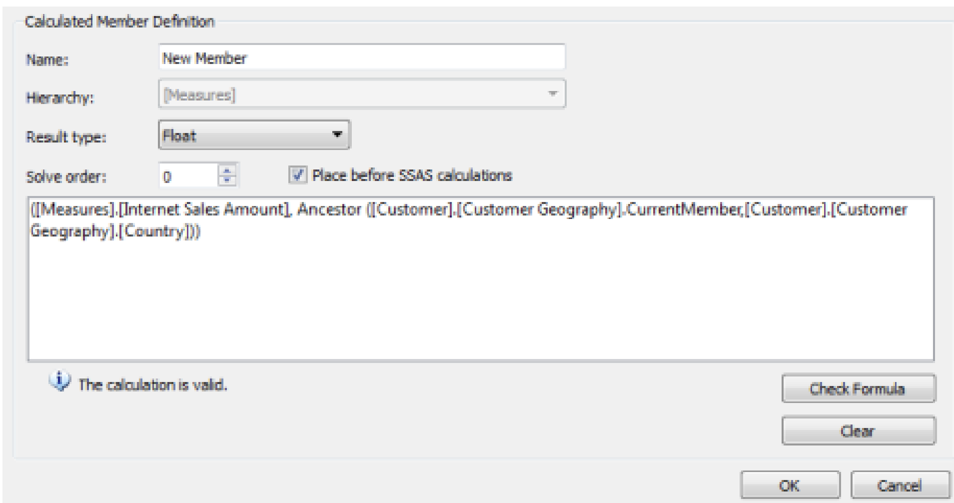
Finally select a solve order for the member.



> **Note:** Sometimes a single cell in your data source can be defined by two different formulas. The solve order defines the precedence given to each formula. Formulas with a lower solve order are solved first. The default solve order is zero.

4 Define a Formula

Type a formula that defines the new member and click **Check Formula** to validate. When finished, click **OK**. The new member displays in the Data pane under the parent member and hierarchy you specified.

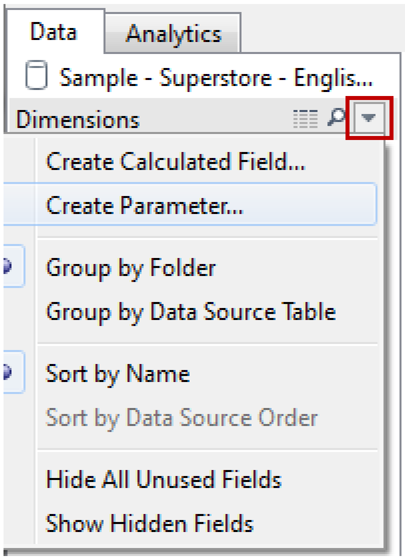


Quick Start: Parameters

Parameters are dynamic values that can replace constant values in calculations. For example, you can create a calculated field that returns true if Sales is greater than $500,000 and otherwise return false. Then you can replace the constant value of “500,000” in the formula with a parameter that users can change dynamically using a parameter control.

1 Create a Parameter

Click the drop down to the right of Dimensions on the **Data** pane and choose **Create Parameter**



2 Define the Parameter

Specify the following properties to define the parameter:

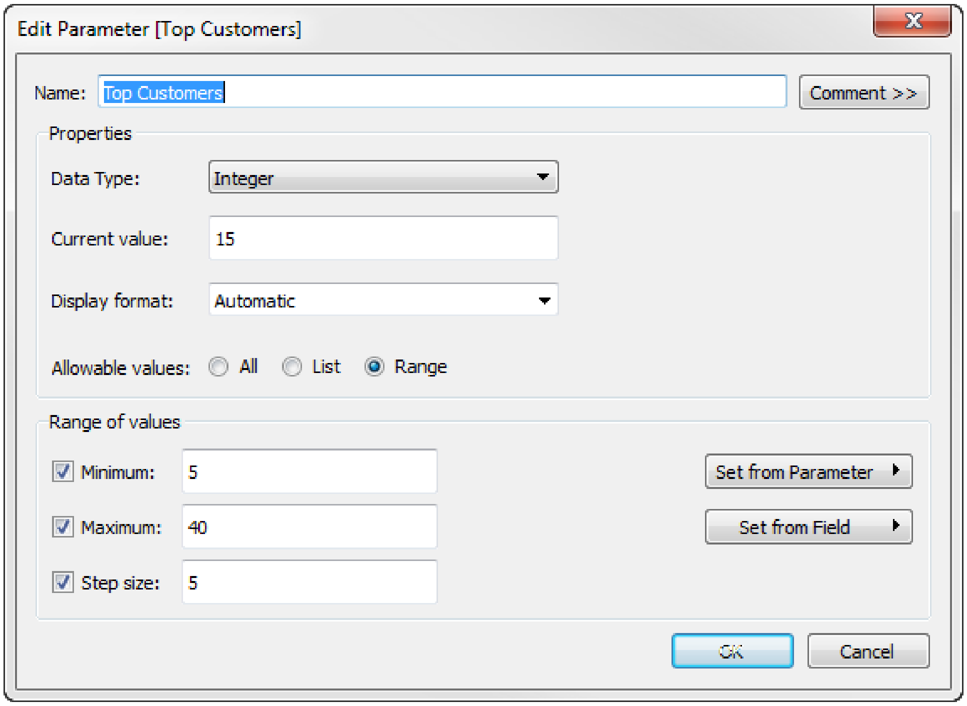
Name - A descriptive name for the parameter.

Data type - Parameters can be integers, floating point numbers, strings, Boolean values, dates, or date/times.

Current Value - An initial value for the parameter.

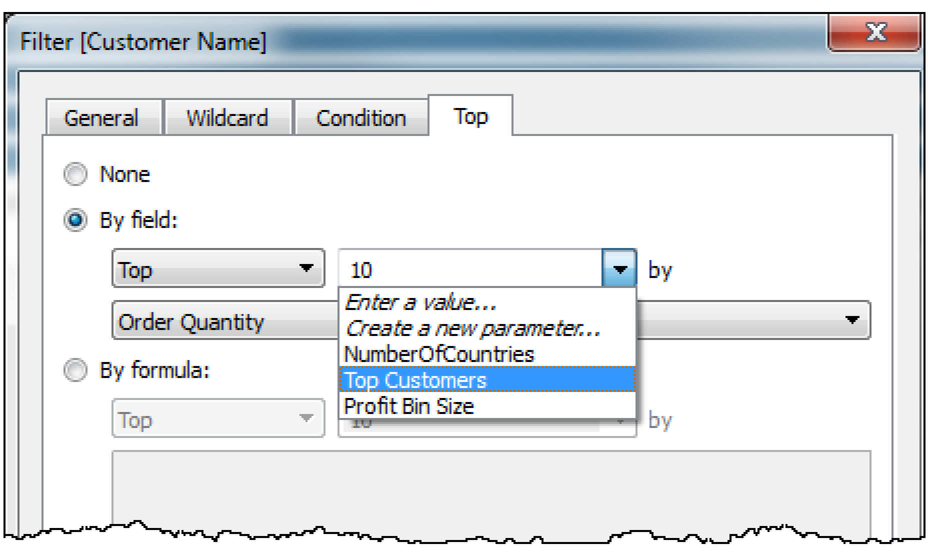
Display format - How to format the values.

Allowable values - The type of control to be used for selecting values. Parameters can be defined a text field (All), a List, or a Range of defined values.



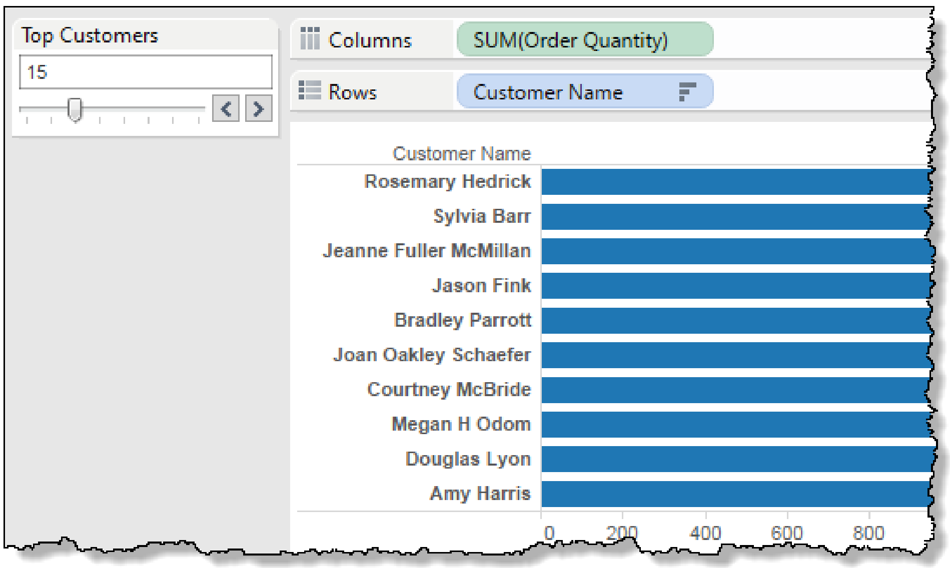
3 Use the Parameter in a Calculation

Replace the constant value in a calculated field or filter with the parameter. You can double-click the parameter in the list to add it to the formula.



4 Show the Parameter Control

Parameters are global across the entire workbook and are shown at the bottom of the **Data** pane. Right-click a parameter and select **Show Parameter Control** to display a card where users can modify the parameter value.



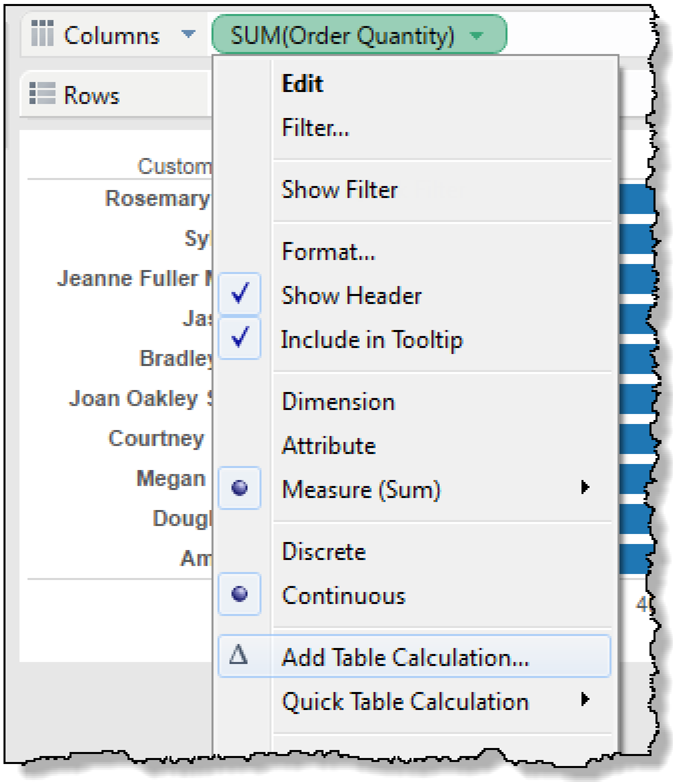
You can move a parameter control to different locations in the view.

Quick Start: Table Calculations

Table Calculations are computations that are applied to the values in the entire table and are often dependent on the table structure itself. For example, in a sales environment, you can use table calculations to compute the running total of sales across a specified date range or to compute each product's contribution to the total sales in a quarter.

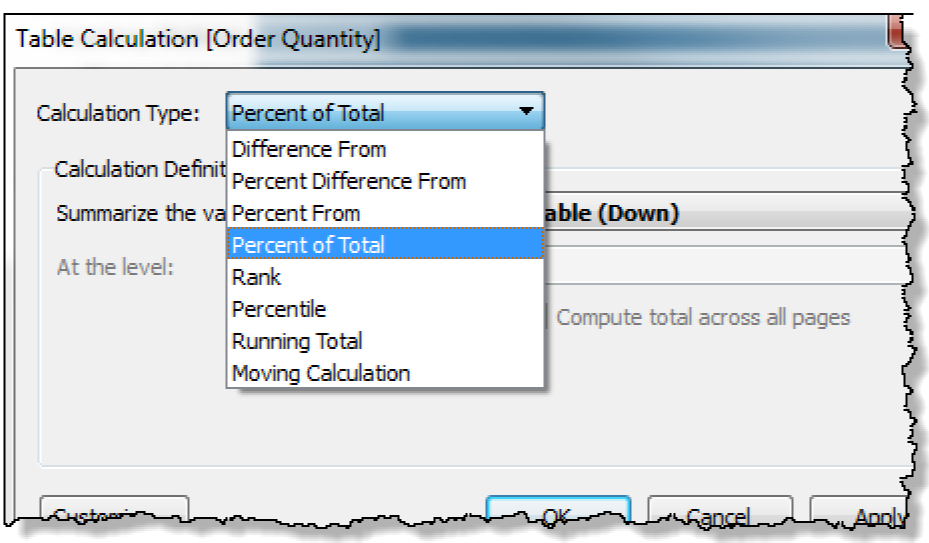
1 Open the Table Calculation Dialog Box

Right-click a measure in the view (control-click on a Mac) and select **Add Table Calculation**.



2 Choose a Calculation Type

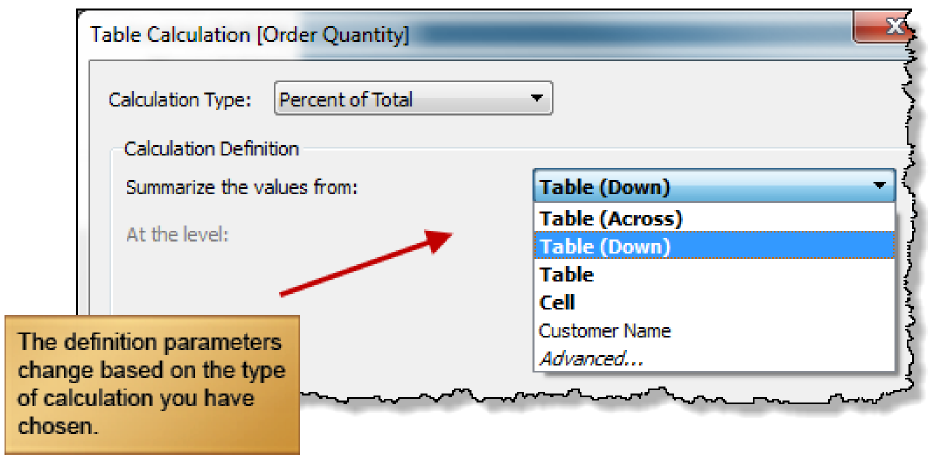
In the Table Calculation dialog box, choose the type of calculation you want to apply.



- **Difference From** - show absolute change.
- **Percent Difference From** - show rate of change.
- **Percent From** - show as % of other specified value.
- **Percent of Total** - show values as % of the total.
- **Rank** - rank values numerically
- **Percentile** - compute percentile values
- **Running Total** - show a cumulative total.
- **Moving Calculation** - smooth short fluctuations to identify long term trends.

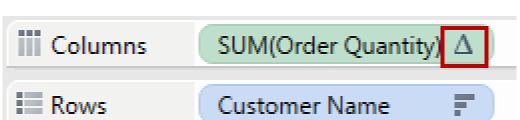
3 Define the Calculation

In the bottom half of the Table Calculation dialog box, define the calculation using the drop-down lists. The options vary for different types of calculations.



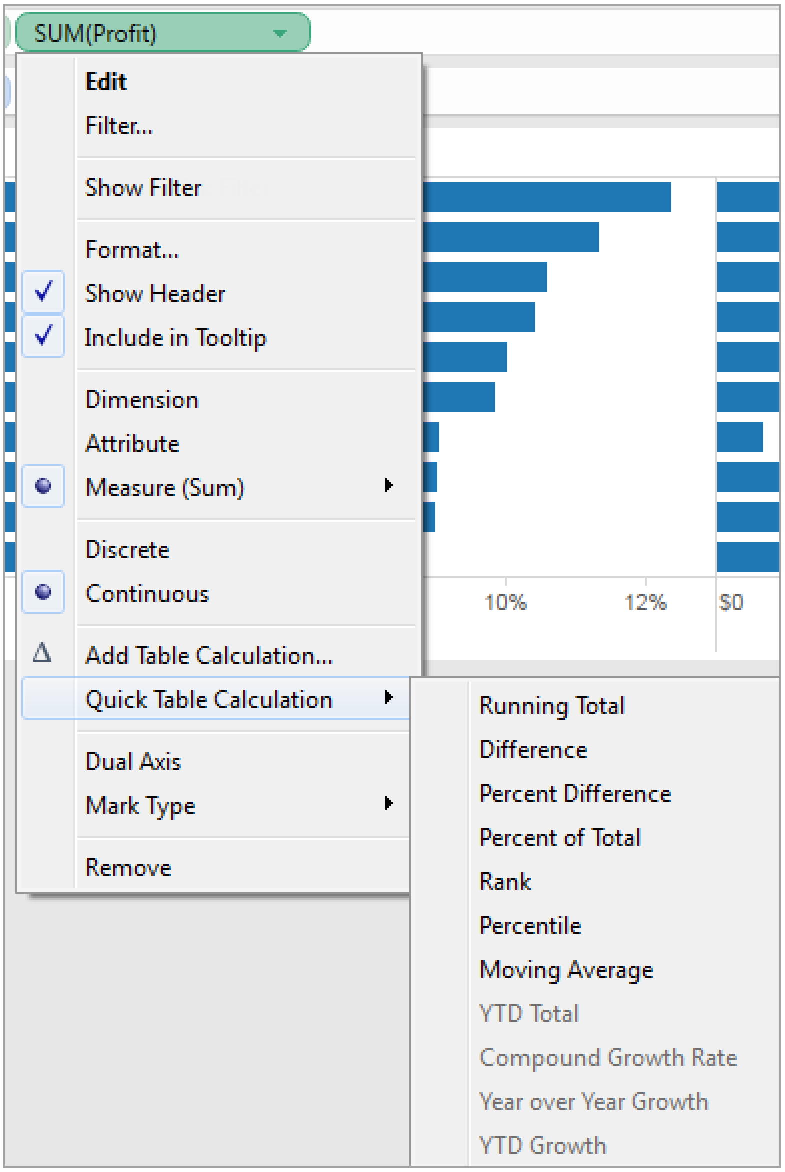
4 See the Calculation in Tableau

When you are finished defining the calculation, click **OK**. The original measure is now marked as a table calculation.



The "Quick" Alternative: Using Quick Table Calculations

Tableau offers common table calculations that you can apply to your view quickly without having to go through the steps for defining the calculation. Right-click a measure in the view, choose **Quick Table Calculation**, and select one of the available calculation types.



Quick Start: Computing Totals

Tableau supports grand totals and subtotals for both relational and multidimensional data sources.

Grand Totals

Grand totals can be computed for rows or for columns.

Row Grand Totals

For Rows: Choose **Analysis** > **Totals** > **Show Row Grand Totals**.

		Continent					
Container	Department	Africa	Asia	Europe	North America	South America	Grand Total
Jumbo Box	Furniture	$46,239	$157,241	$75,163	($1,358)	$4,731	$278,833
	Technology	$12,783	$37,662	$18,627	$46,609	$24,851	$140,531
Jumbo Drum	Furniture	$85,769	$250,496	$61,124	$119,529	$51,796	$577,977
	Office Supplies	$7,894	$43,400	$17,333	$27,538	$38,669	$134,232
	Technology	$170,958	$316,764	$40,826	$198,078	$82,310	$808,936
Large Box	Furniture	$8,434	$147,055	$19,328	$53,560	$41,627	$270,004
	Office Supplies	($3,964)	$1,278	$5,763	($56,751)	($15,325)	($32,961)
	Technology	$16,079	$97,707	$101,492	$179,650	$122,807	$538,766
Medium Box	Furniture	$20,189	$19,064	$7,644	$44,942	$3,920	$96,376
	Office Supplies	$318	$23,778	$5,045	$8,098	$2,079	$39,319
	Technology	$4,505	$119,792	$8,181	$49,947	$53,027	$236,167
Small Box	Furniture	$4,843	$17,992	$7,750	$28,253	$14,546	$73,540
	Office Supplies	$143,447	$697,153	$88,570	$531,999	$311,863	$1,788,075
	Technology	$46,321	$551,146	$147,000	$390,937	$202,191	$1,345,595
Small Pack	Furniture	$7,753	$31,674	$5,325	$29,157	$6,499	$80,367
	Office Supplies	$6,011	$15,672	$1,543	$3,837	$1,022	$28,096
	Technology	$9,994	$84,756	$16,800	$46,690	$38,398	$197,930
Wrap Bag	Furniture	$530	$8,394	$5,652	($3,137)	$1,876	$14,037
	Office Supplies	$7,770	$27,015	$4,869	$8,586	$6,040	$54,257
	Technology	$1,292	$25,071	$4,716	$12,391	$3,936	$47,406

Column Grand Totals

For Columns: Choose **Analysis** > **Totals** > **Show Column Grand Totals**.

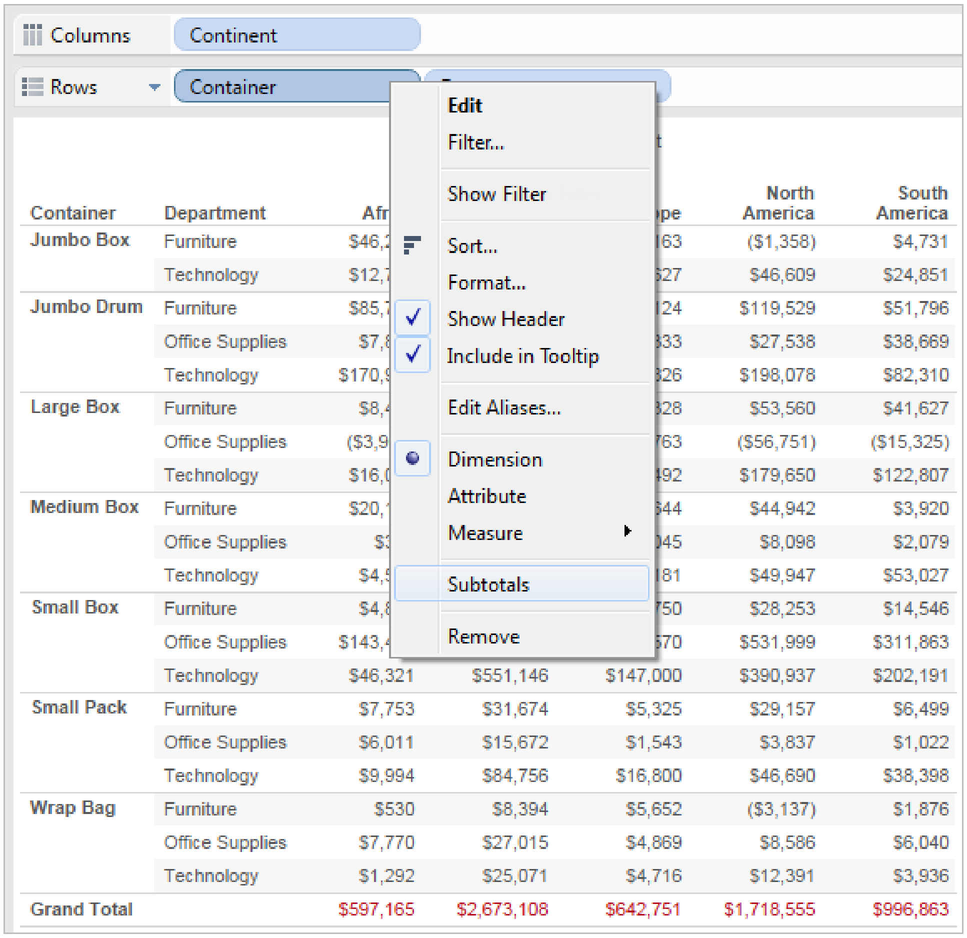
		Continent				
Container	Department	Africa	Asia	Europe	North America	South America
Jumbo Box	Furniture	$46,239	$157,241	$75,163	($1,358)	$4,731
	Technology	$12,783	$37,662	$18,627	$46,609	$24,851
Jumbo Drum	Furniture	$85,769	$250,496	$61,124	$119,529	$51,796
	Office Supplies	$7,894	$43,400	$17,333	$27,538	$38,669
	Technology	$170,958	$316,764	$40,826	$198,078	$82,310
Large Box	Furniture	$8,434	$147,055	$19,328	$53,560	$41,627
	Office Supplies	($3,964)	$1,278	$5,763	($56,751)	($15,325)
	Technology	$16,079	$97,707	$101,492	$179,650	$122,807
Medium Box	Furniture	$20,189	$19,064	$7,644	$44,942	$3,920
	Office Supplies	$318	$23,778	$5,045	$8,098	$2,079
	Technology	$4,505	$119,792	$8,181	$49,947	$53,027
Small Box	Furniture	$4,843	$17,992	$7,750	$28,253	$14,546
	Office Supplies	$143,447	$697,153	$88,570	$531,999	$311,863
	Technology	$46,321	$551,146	$147,000	$390,937	$202,191
Small Pack	Furniture	$7,753	$31,674	$5,325	$29,157	$6,499
	Office Supplies	$6,011	$15,672	$1,543	$3,837	$1,022
	Technology	$9,994	$84,756	$16,800	$46,690	$38,398
Wrap Bag	Furniture	$530	$8,394	$5,652	($3,137)	$1,876
	Office Supplies	$7,770	$27,015	$4,869	$8,586	$6,040
	Technology	$1,292	$25,071	$4,716	$12,391	$3,936
Grand Total		$597,165	$2,673,108	$642,751	$1,718,555	$996,863

Subtotals

Subtotals can be turned on for a selected dimension or for all qualifying dimensions.

Subtotals for a Selected Dimension

When Grand Totals are on for a dimension in the view, right-click the dimension (or control-click on a Mac) and then choose **Subtotals** to turn on subtotals for the selected dimension.



Subtotals for All Relevant Dimensions

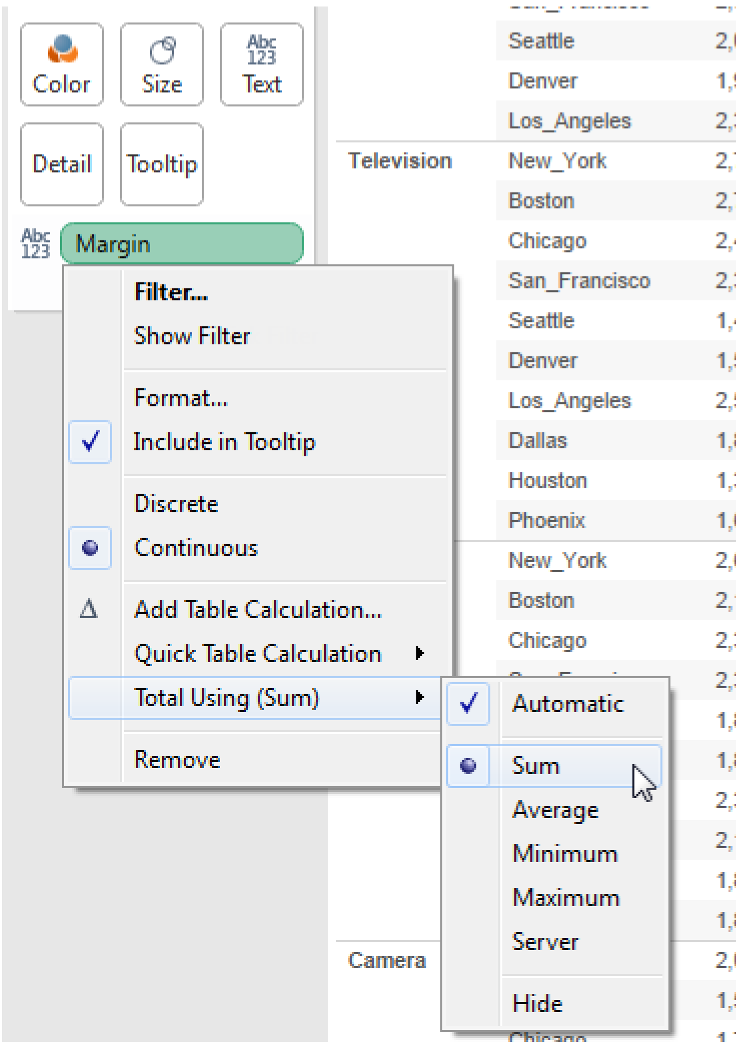
To turn on subtotals for all relevant dimensions, choose **Analysis** > **Totals** > **Add All Subtotals**.

Container	Department	Africa	Asia	Europe	North America	South America
		Continent				
Jumbo Box	Furniture	$46,239	$157,241	$75,163	($1,358)	$4,731
	Technology	$12,783	$37,662	$18,627	$46,609	$24,851
	Total	**$59,022**	**$194,903**	**$93,789**	**$45,251**	**$29,582**
Jumbo Drum	Furniture	$85,769	$250,496	$61,124	$119,529	$51,796
	Office Supplies	$7,894	$43,400	$17,333	$27,538	$38,669
	Technology	$170,958	$316,764	$40,826	$198,078	$82,310
	Total	**$264,621**	**$610,659**	**$119,283**	**$345,145**	**$172,775**
Large Box	Furniture	$8,434	$147,055	$19,328	$53,560	$41,627
	Office Supplies	($3,964)	$1,278	$5,763	($56,751)	($15,325)
	Technology	$16,079	$97,707	$101,492	$179,650	$122,807
	Total	**$20,550**	**$246,039**	**$126,583**	**$176,458**	**$149,109**
Medium Box	Furniture	$20,189	$19,064	$7,644	$44,942	$3,920
	Office Supplies	$318	$23,778	$5,045	$8,098	$2,079
	Technology	$4,505	$119,792	$8,181	$49,947	$53,027
	Total	**$25,011**	**$162,634**	**$20,870**	**$102,988**	**$59,026**
Small Box	Furniture	$4,843	$17,992	$7,750	$28,253	$14,546
	Office Supplies	$143,447	$697,153	$88,570	$531,999	$311,863
	Technology	$46,321	$551,146	$147,000	$390,937	$202,191
	Total	**$194,612**	**$1,266,291**	**$243,320**	**$951,189**	**$528,600**
Small Pack	Furniture	$7,753	$31,674	$5,325	$29,157	$6,499
	Office Supplies	$6,011	$15,672	$1,543	$3,837	$1,022
	Technology	$9,994	$84,756	$16,800	$46,690	$38,398
	Total	**$23,758**	**$132,102**	**$23,669**	**$79,684**	**$45,919**
Wrap Bag	Furniture	$530	$8,394	$5,652	($3,137)	$1,876
	Office Supplies	$7,770	$27,015	$4,869	$8,586	$6,040
	Technology	$1,292	$25,071	$4,716	$12,391	$3,936
	Total	**$9,592**	**$60,480**	**$15,237**	**$17,840**	**$11,852**
Grand Total		$597,165	$2,673,108	$642,751	$1,718,555	$996,863

Totals on Multidimensional Data Sources

When you turn on grand totals or subtotals using the above instructions, the computation is peformed on the server. If you are using a multidimensional data source, it is sometimes impossible for the server to compute totals accurately. In this case you can specify that the computation be performed locally using the data that you see in the table.

To do this, right-click the measure being totaled and select **Total Using**. Then select an aggregation from the sub-menu.



Quick Starts about Dashboards and Stories

After you create your data visualization, there are many ways to use it. For example, you might want to compare it with other visualizations of the same data to see how different conclusions jump out from different ways of looking at the data.

You might want to share your findings. You can present your visualization to your team, share it with the public, or even arrange visualizations into a sequence to support a narrative. Dashboards and stories are excellent tools for analyzing and presenting data.

- A **dashboard** is a collection of several worksheets and supporting information shown in a single place so that you can compare and monitor a variety of data simultaneously.
- A **story** is a sheet that contains a sequence of worksheets or dashboards that work together to convey information.

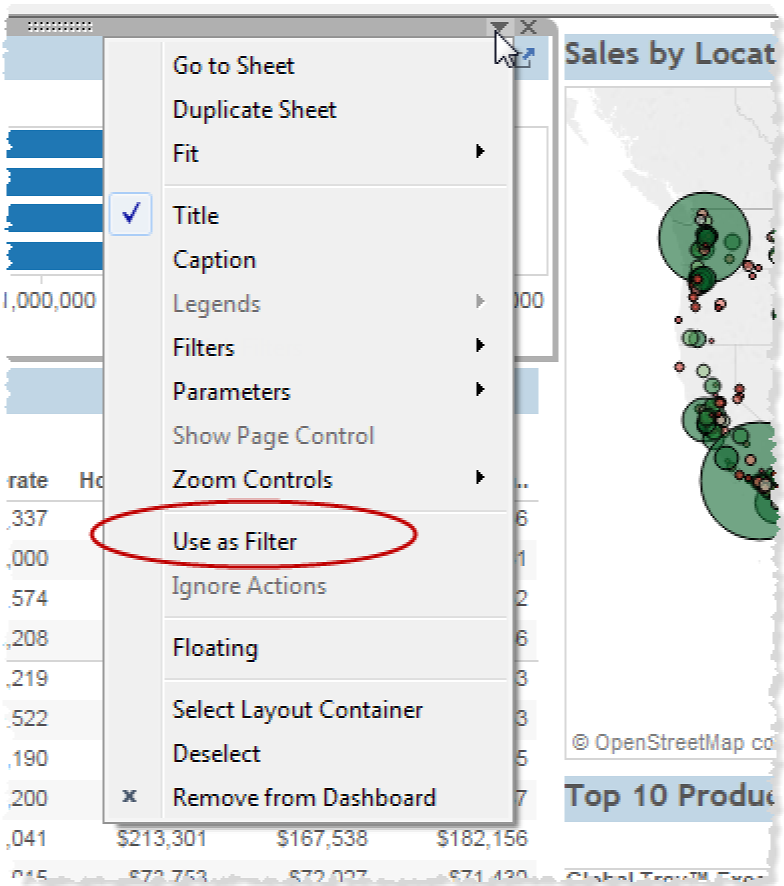
The following Quick Starts give you a glimpse into the power of presentation. To learn even more, see the **Dashboards** on page 949 and **Stories** on page 981 sections of the documentation.

Quick Start: Filter Actions

Use the Filter Actions filter to show related information between a source sheet and one or more target sheets. This type of action works well when you are building guided analytical paths through a workbook or in dashboards that filter from a master sheet to show more details.

1 Select a View to Use as a Filter

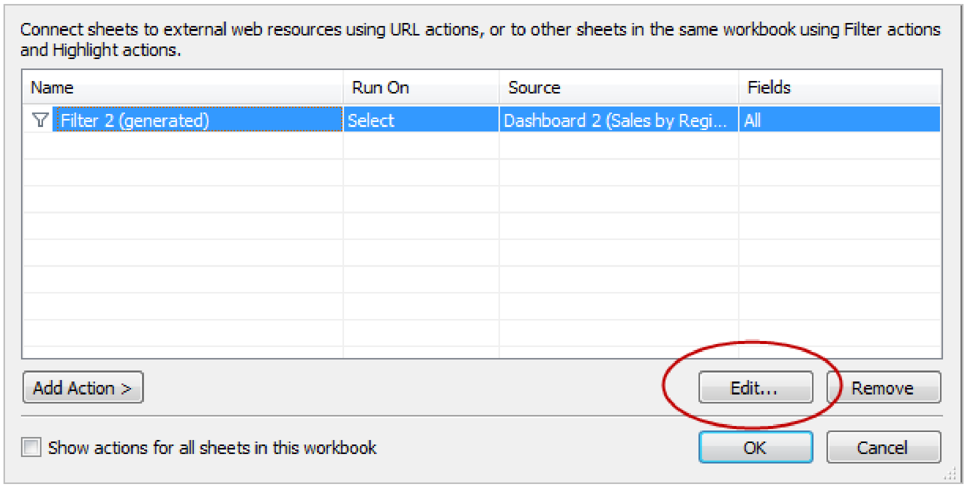
On a dashboard, click the drop-down menu of a sheet and select **Use as Filter**.



A filter action is created so when you select a mark in the view the rest of the dashboard updates to show only related data.

2 Edit the Action

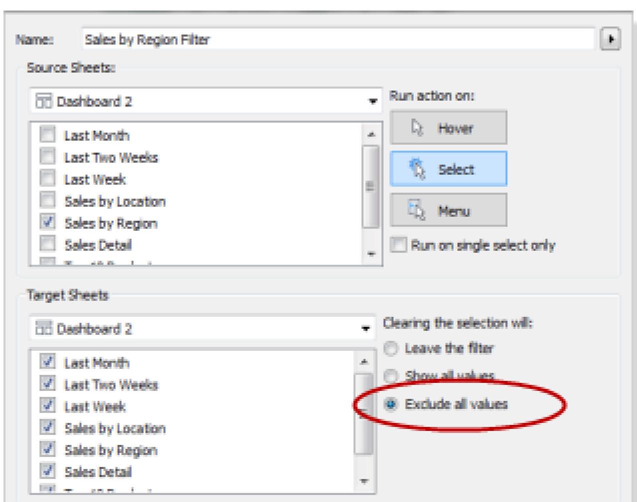
Select **Dashboard** > **Actions** to open the **Actions** dialog box. Select an action and then click **Edit**.



Any action you create displays in the **Actions** dialog box. You can add Filter, Highlight, or URL actions.

3 Specify the Action Settings

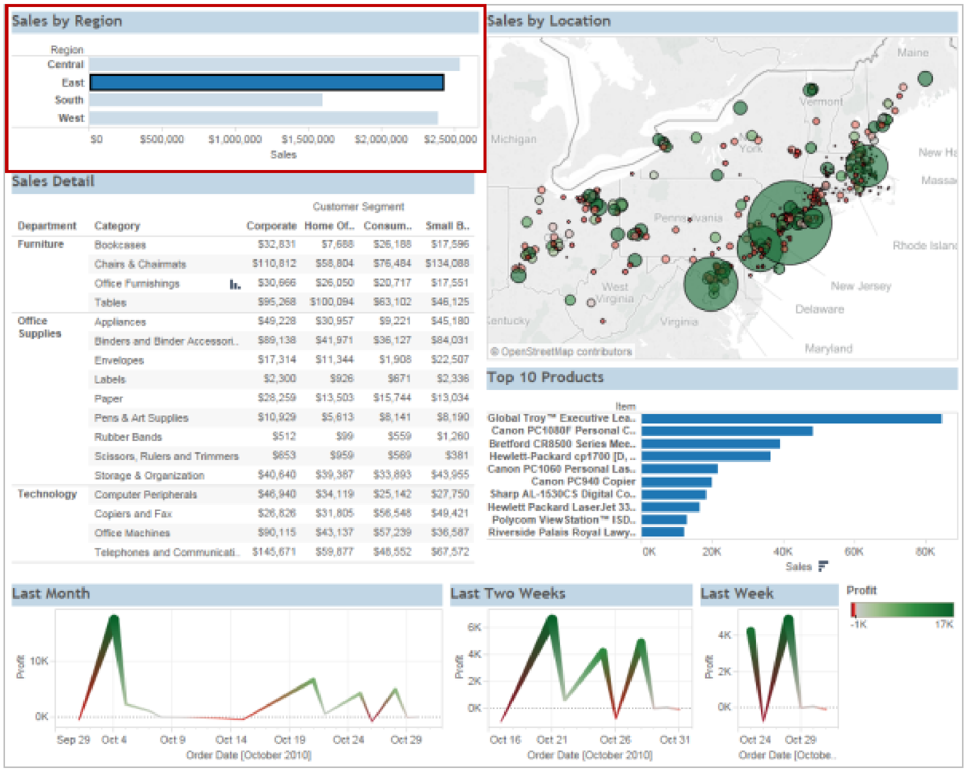
In the **Edit Filter Action** dialog box, select the source sheets, target sheets, and the fields to filter. You can also select whether to run the action when you hover, select, or right-click the source sheet. When finished, click **OK**.



To remove the filter when you deselect the data in the source sheet, select **Exclude All Values** in the **Clearing the Selection Will** section.

4 See it in Action

Hover, select, or right-click the source sheet and watch the other sheets update to show related data.



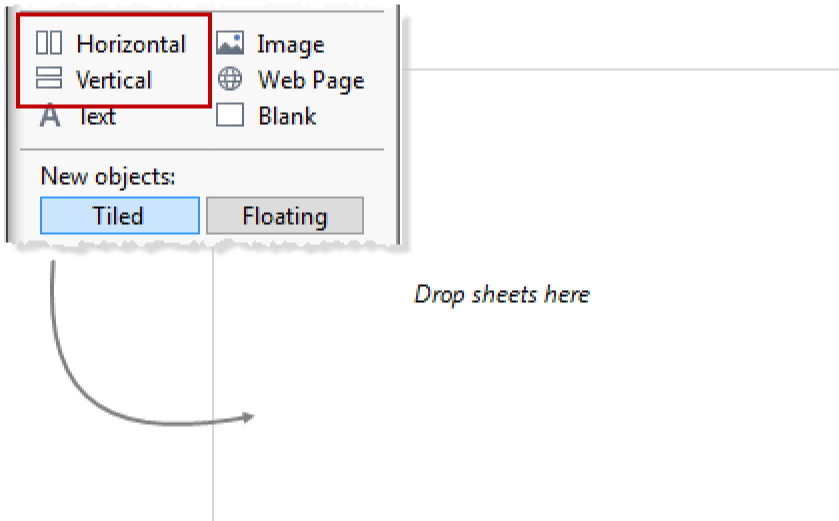
In this example, when you select the **East** region in the top sheet, the rest of the sheets filters to show sales information for this region.

Quick Start: Layout Containers

Layout containers help you organize sheets and other objects on a dashboard. These containers create an area in the dashboard where objects automatically adjust their size and position based on the other objects in the container. For example, a dashboard with a filter action that changes the size of a view will automatically adjust the other views when the filter is applied.

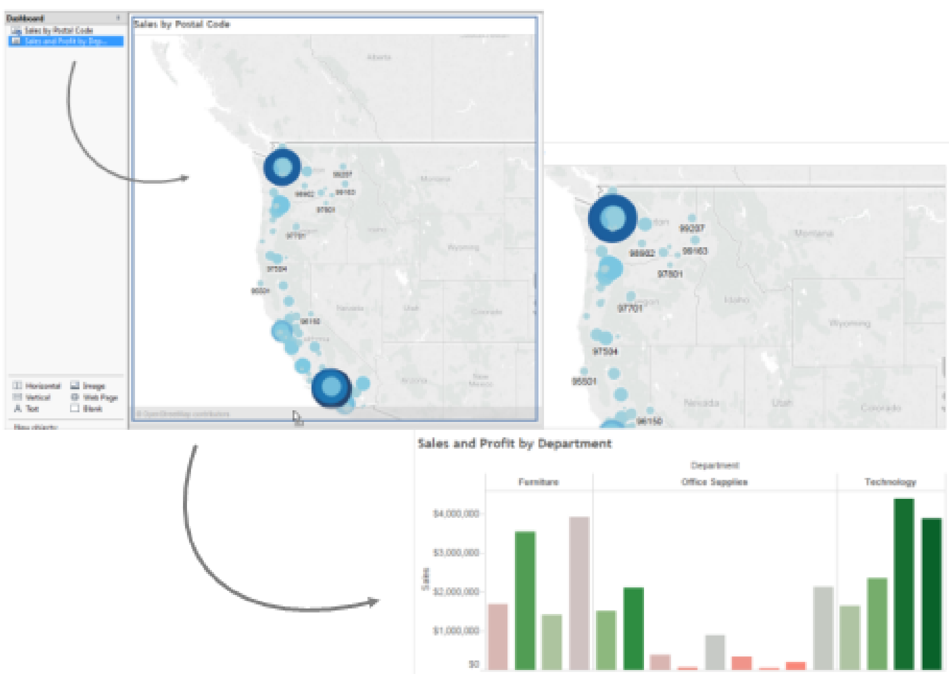
1 Add a Layout Container

Create a new dashboard and drag a horizontal or vertical layout container to the view.



2 Add Sheets

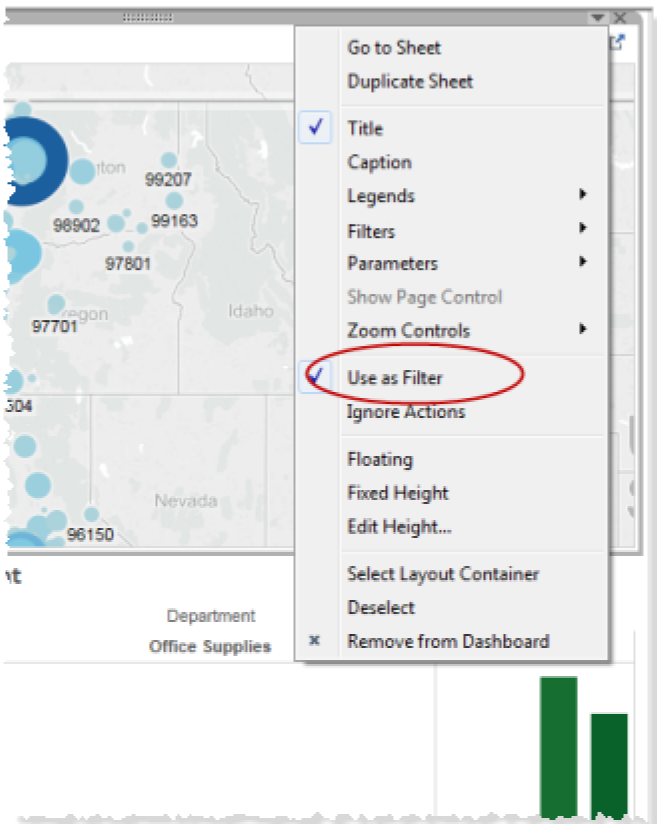
Drag sheets into the layout container. A gray rectangle indicates where the sheet will be placed in the layout container.



The corresponding quick filters and legends are automatically added with each sheet.

3 Create and Edit a Filter Action

To have the views automatically resize depending on what is selected in the view, create a filter action. To create a filter action in the dashboard, click the drop-down menu of a sheet and select **Use as Filter**. Next, go to **Dashboard** > **Actions** and edit the generated filter action you just created. In the **Edit Filter Action** dialog box, select **Exclude all values**.



4 Watch Objects Move and Resize

Click a mark in the view with the filter applied to it to update the other view. In the example, when a mark is selected in the map view, the bar chart updates to display the profit and sales for that mark; when no marks are selected in the map view, the map automatically expands to fill the dashboard.

With mark selected **No selection**

Remove a Layout Container

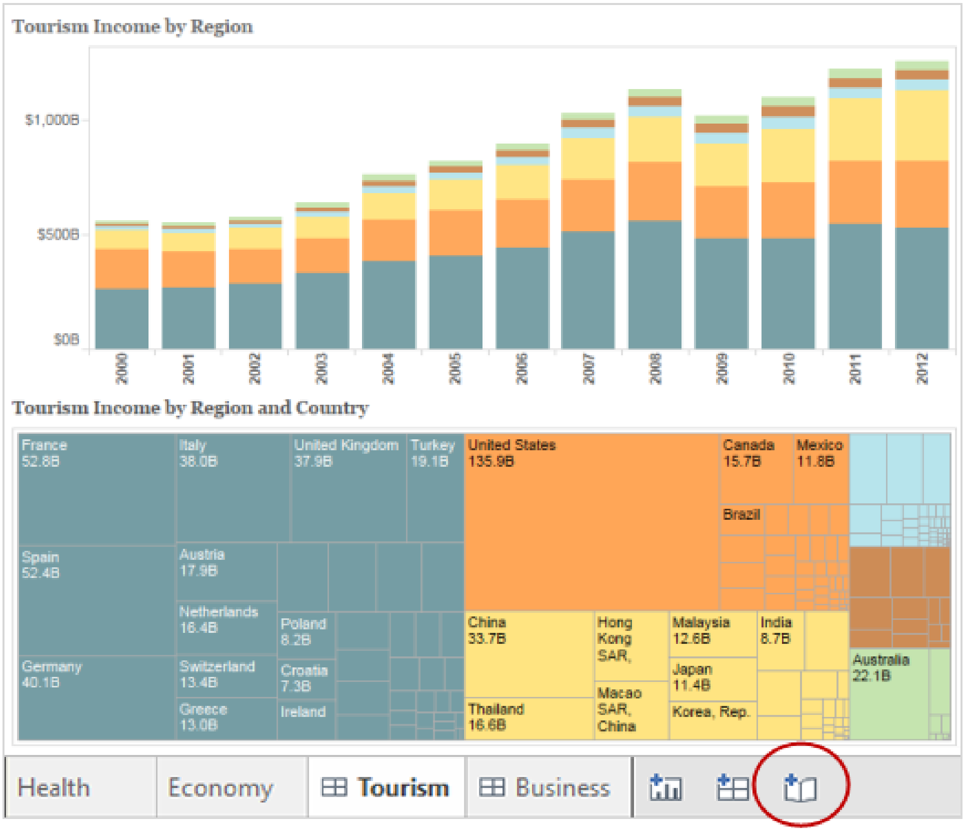
To remove a layout container, click the drop-down menu of a sheet and select **Select Layout Container**. The layout container is highlighted blue. Click the layout container drop-down menu and select **Remove from Dashboard**. The container and all of its contents are removed.

Quick Start: Stories

A story is a sheet that contains a sequence of worksheets and dashboards that work together to convey information. Use stories to make your case more compelling by showing how facts are connected, and how decisions relate to outcomes. You can then publish your story to the web, or present it to an audience.

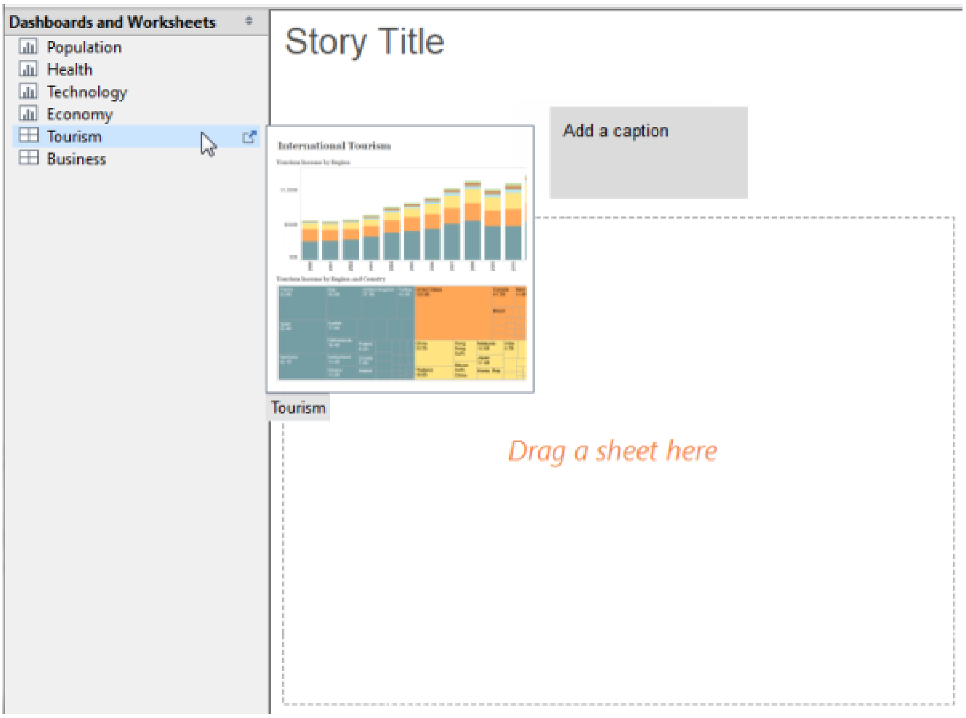
1 Create a New Story

To create a story, click the  (new story) tab.



2 Add the First Story Point

To create the first point in your story, drag a worksheet or dashboard to the story and drop it in the center of the view. Add a caption, and then customize your story point.



Hover over a worksheet or dashboard to see a preview before adding it to your story.

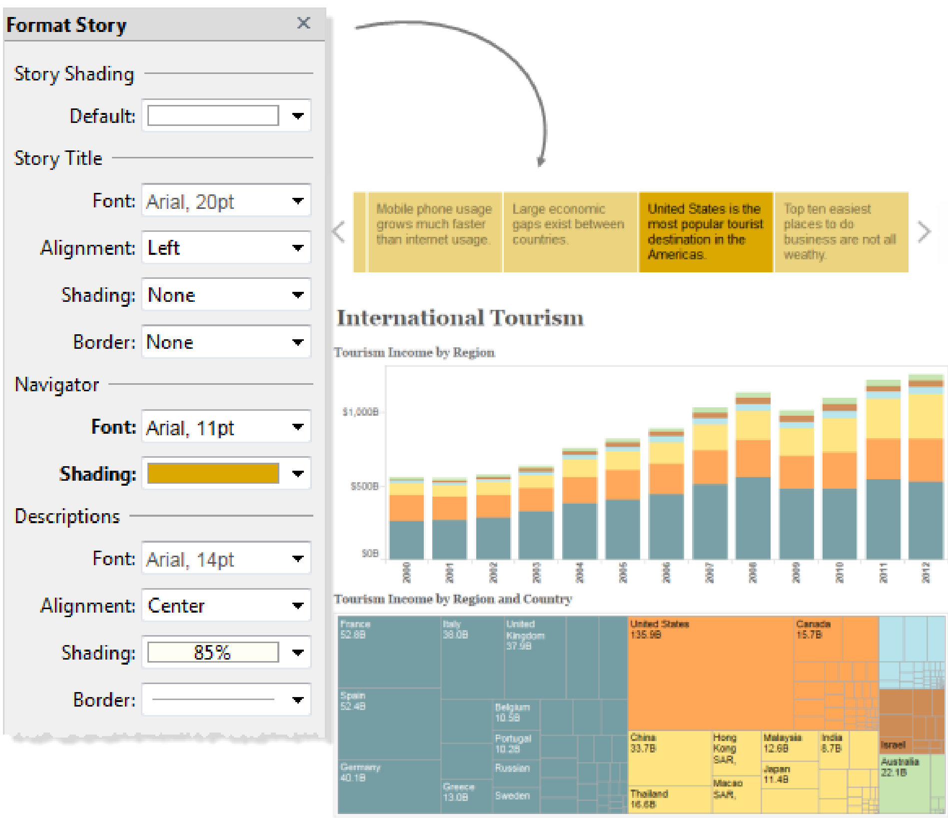
3 Add More Story Points to Build Your Story

To add a new story point based on a different sheet, click **New Blank Point**. To use the same sheet in the next story point, click **Duplicate**.

Use the navigator to move through the story.

4 Format Your Story

To format your story, click **Format** > **Story**. In the **Format Story** pane, you can change the background colors for the story and the navigator bar, and change the appearance of the story title, the captions in the navigator, and the descriptions.



Publish Your Stories to the Web

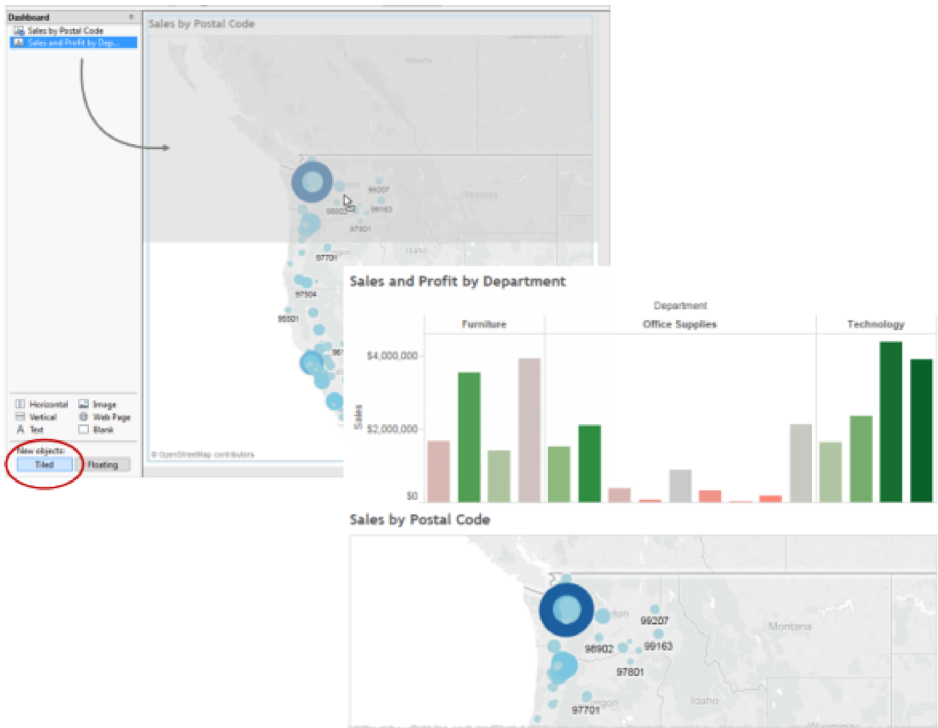
You can save your workbook that contains the story to Tableau Public or publish it to Tableau Server and Tableau Online.

Quick Start: Tiled and Floating Dashboard Layouts

A dashboard is a collection of worksheets and objects on a single sheet so you can compare and monitor a variety of data simultaneously. Dashboard objects can be tiled or floating. Tiled objects are arranged in a grid while floating objects can be layered on top of other objects.

1 Add a Sheet as Tiled

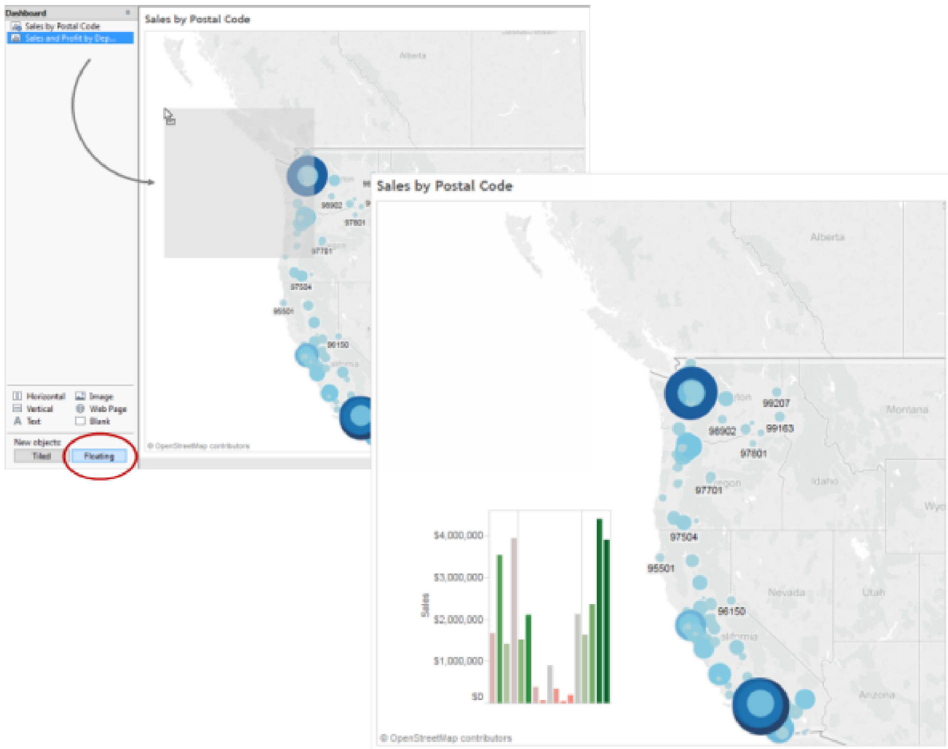
To add a sheet to the tiled layout, click **Tiled** and then drag a sheet to the view.



Adding a tiled sheet places it in a layout container and arranges it into a grid.

2 Add a Sheet as Floating

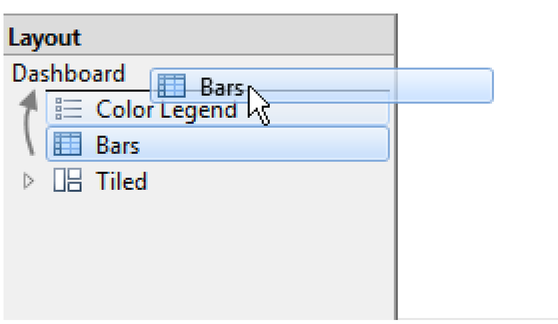
To add a sheet to the floating layout, click Floating and then drag a sheet to the view.



Adding a floating sheet places it on top of the other objects in the dashboard.

3 Reorder Floating Objects

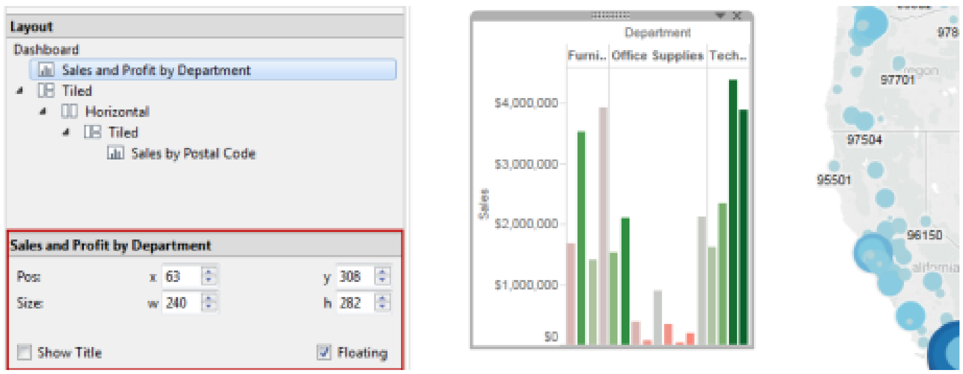
You can change the order of floating objects by rearranging the sheets in the **Layout** area of the **Dashboard** pane. Objects at the top of the list display in the front, while objects at the bottom of the list display in the back.



Right-click (control-click on the Mac) an object in the layout area to show/hide legends and filters, go to sheet, and more.

4 Resize Floating Objects

When you select an object in the dashboard, the size and position properties are shown at the bottom of the **Dashboard** pane. You can make small adjustments to the size and position as well as toggle between whether it is floating or tiled.



Holding the shift key while dragging an object toggles whether it is floating or tiled.

Quick Starts about Using Tableau Server

Tableau Server is an online solution for sharing, distributing, and collaborating on content created in Tableau.

You can create views in Tableau Desktop and then publish them to Tableau Server.

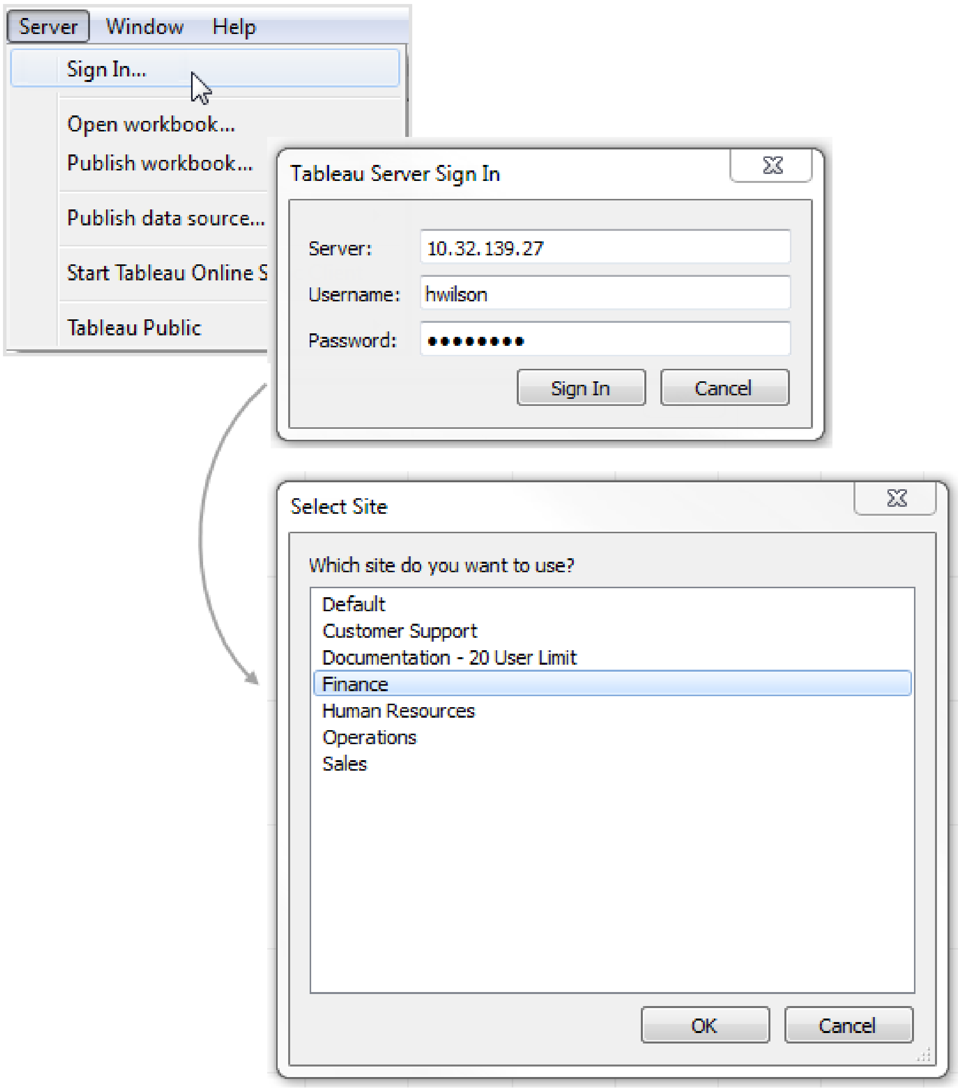
Quick Start: Stay Connected with Automatic Sign-In

When you connect to Tableau Server or Tableau Online, Tableau Desktop keeps you signed in from session to session, if you don't sign out. Next time you launch Tableau Desktop, you are automatically signed in to your most recent server connection. As you sign in to different servers and sites, you can easily switch between your available server and site connections.

> **Note:** Automatic sign-in is available for servers configured for Windows Authentication only, and must be enabled by a server administrator in the server's **Settings** page, under **Connected clients**. Automatic sign-in is not available for servers that use Kerberos or SAML authentication.

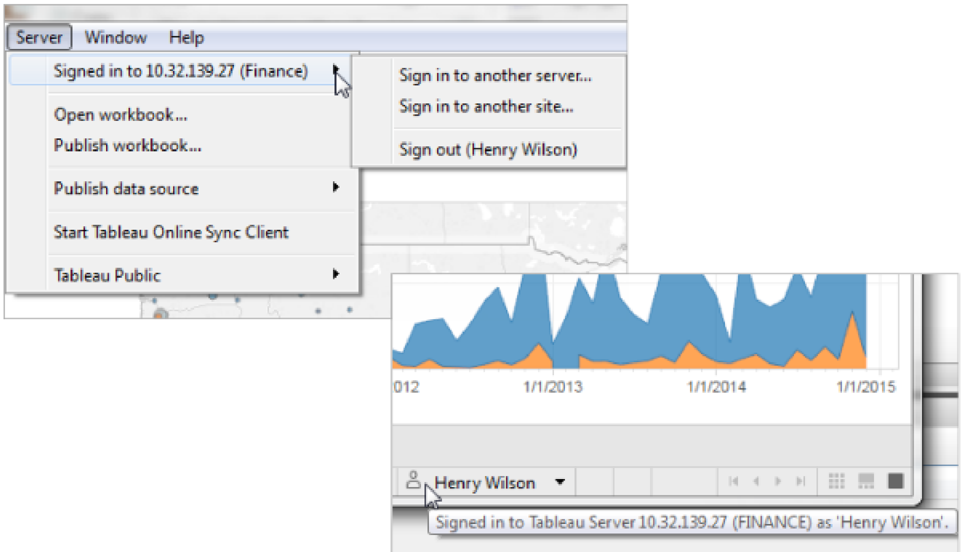
1 Sign in

Launch Tableau Desktop and then sign in to Tableau Server or Tableau Online. If you have access to multiple sites on the server, select the site you want to use.



2 Launch Tableau Desktop again

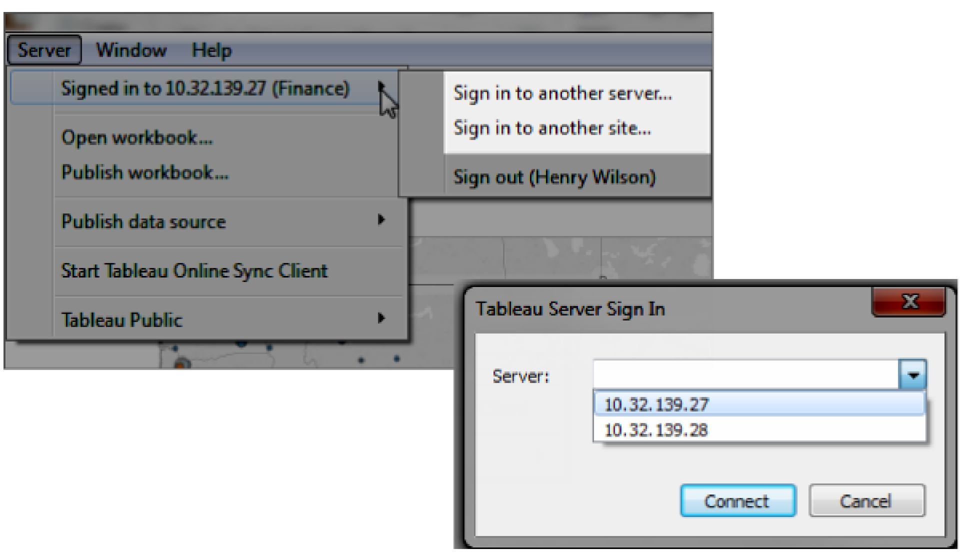
Next time you launch an instance of Tableau Desktop, you are signed in to your most recent server connection – no need to enter your credentials. You can see the server and site you are signed into, as well as who you are signed in as in two places. The **Server** menu shows the server and site that you are signed in to. **Sign out** shows you are signed in as. If you hover



Hover over the user name in the status bar to see the currently signed in user, the server, and the site.

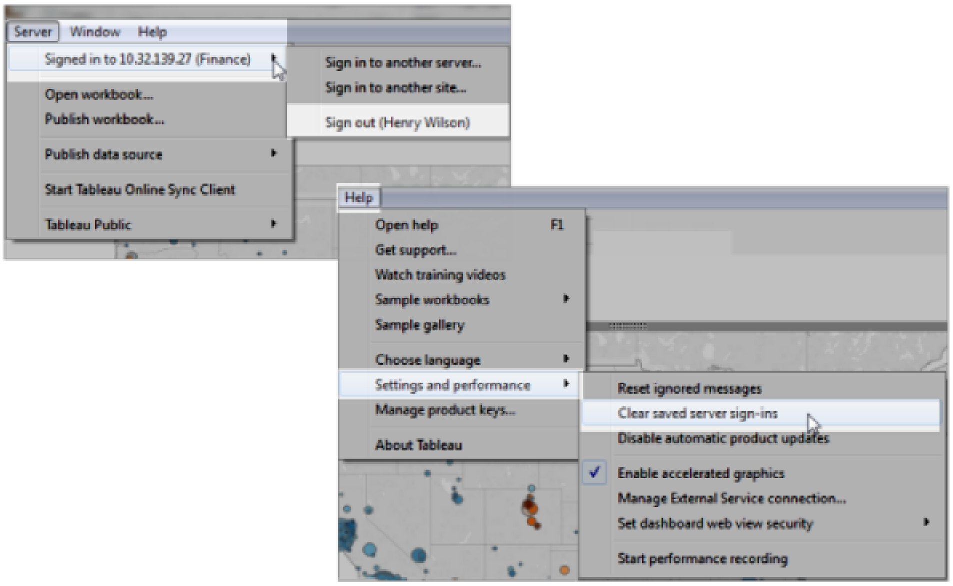
3 Switch servers, switch sites

To switch servers, on the **Server** menu, click **Sign in to another server**, and then enter the server name and your sign-in credentials, or select a different server name from the drop-down menu. To switch sites, on the **Server** menu, click **Sign in to another site**, and then select the site.



4 Sign out or clear all saved connections

Click **Server > Sign out** to clear your sign-in credentials for the current connection. To clear all sign-in credentials, click **Help > Settings and performance > Clear saved server sign-ins**.



More about automatic sign-in

- When you sign in to a server, your server authentication token is stored in secure storage on your computer. This token is used to authenticate you every time you connect to the server.
- If you are signed in to a server or site when you close Tableau Desktop, your sign-in credentials are saved. Also, when you switch sites or servers, Tableau Desktop saves your sign-in credentials.
- When you click **Sign Out** on the **Server** menu, Tableau Desktop deletes your sign-in credentials for that connection. To delete credentials for every server and site you have previously signed into, click **Help > Settings and performance > Clear saved server sign-ins**.
- If you have access to a single-site server, or you have access to only one site on a server you are signing in to, **Sign in to another site** will not be available.

Tableau Concepts

Why are some fields dimensions and others measures?

What effect will adding a filter have on my view?

Why is the background color blue for some fields, and green for others?

The topics in this section attempt to clarify these and other questions about what you can see and experience as you use Tableau Desktop.

If you're new to Tableau Desktop, also consider working through the **Build-It-Yourself Exercises** on page 539, and check out the Free Training Videos on the Tableau website.

Data Types

All fields in a data source have a data type. The data type reflects the kind of information stored in that field, for example integers (410), dates (1/23/2015) and strings (“Wisconsin”). The data type of a field is identified in the Data pane by one of the icons shown below.

Data type icons in Tableau

Icon	Data type
Abc	Text (string) values
	Date values
	Date & Time values
#	Numerical values
T|F	Boolean values (relational only)
	Geographic values (used with maps)

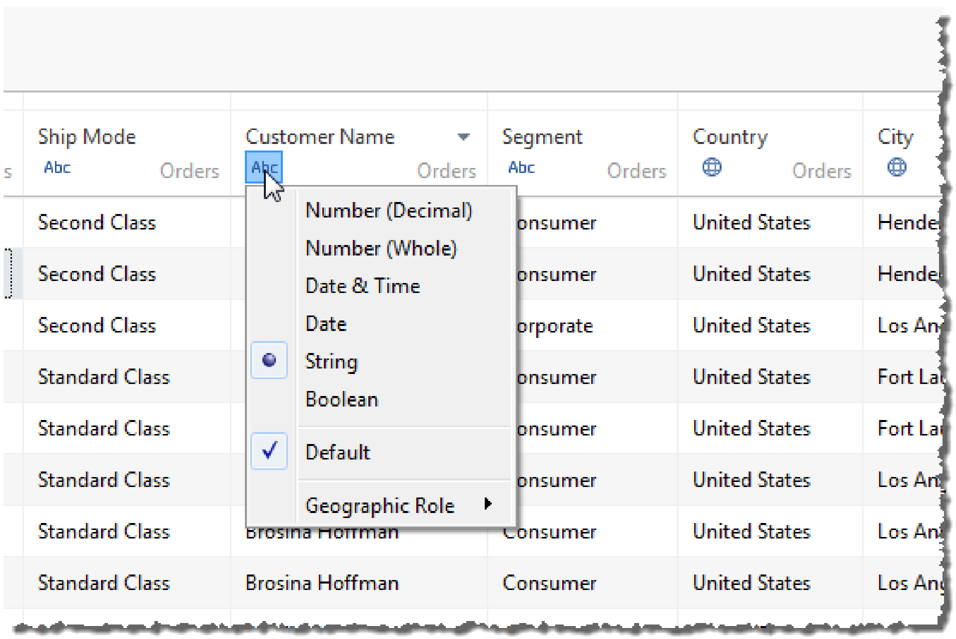
You can change the data type for a field either on the **Data Source** page or in the **Data** pane.

Change the data type for a field in the Data Source page

Sometimes Tableau incorrectly interprets the data type of a field. For example, Tableau might interpret a field that contains dates as an integer data type, rather than a date data type.

You can change the data type for a field that was part of the original data source (as opposed to a calculated field created in Tableau) on the **Data Source** page.

1. Click the field type icon for the field (as shown in the table above).
2. Choose a new data type from the drop-down list:

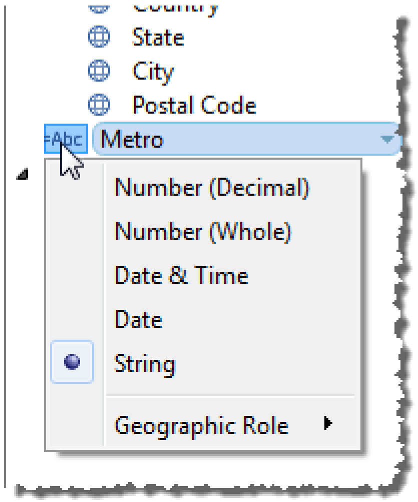


> **Tip**: Be sure to change data types before you create an extract. Otherwise, your data may not be accurate. For example, if a floating-point field in the original data source is interpreted as an integer by Tableau, and you create your extract before you change the field's data type, the resulting floating-point field in Tableau will have some of its precision truncated.

For information on changing data types on the **Data Source** page, see **Data Source Page** on page 267.

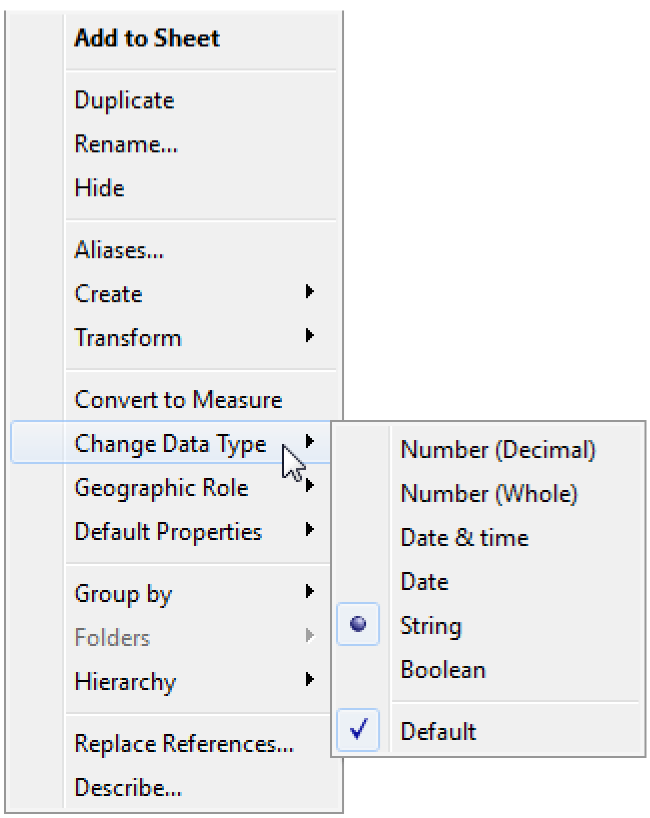
Change the data type for a field in the Data pane

To change the data type of a field in the **Data** pane, click the icon to the left of the field name, and then choose a new data type from the drop-down list.



Change the data type for a field in the view

To change a field's data type in a view, right-click (control-click on a Mac) the field in the **Data** pane, choose **Change Data Type**, and then select the appropriate data type from the drop-down list.



> **Note:** Sometimes the data in your database is more precise then Tableau can model. When you add these values to the view, a precision warning appears in the right corner of the status bar. See **Precision Warnings** on page 1474.

Mixed data types in data from files

Most columns in a Microsoft Excel, Microsoft Access, or CSV (comma-separated value) file contain values that are all of the same data type (Booleans, dates, numbers, or text). When you connect to the file, Tableau creates a field in the appropriate area of the **Data** pane for each column. Dates and text values are dimensions, and numbers are measures.

However, files that you connect to might include columns that have a mixture of data types, such as numbers and text, or numbers and dates. When you connect to the file, the mixed-value column is mapped to a field with a single data type in Tableau. Therefore, a column that contains numbers and dates might be mapped as a number data type (making it a measure) or it might be mapped as a date data type (in which case Tableau treats it as a dimension.)

Tableau determines how to map mixed-value columns to data types by the data types of the first 10,000 rows in an Excel data source, and the first 1,024 rows in a CSV data source. For example, if most of the first 10,000 rows are text values, the entire column is mapped to use the text data type.

> **Note:** Empty cells also create mixed-value columns because their formatting is different from text, dates, or numbers.

When Tableau determines a data type for each field, if the values in a field don't match that data type, Tableau handles the field in one of several different ways, depending on the data type. For example, sometimes Tableau populates those fields with Null values, as shown in the following table:

Mapped data type	Treatment of other data types in the field.
Text	Dates and numbers are treated as text. Nulls are not created.
Dates	Text is treated as Null. A number is treated as the day in numeric order from 1/1/1900.
Numbers	Text is treated as Null. A date is treated as the number of days since 1/1/1900.
Boolean	Text, dates, and numbers are treated as Null.

If using fields that are based on mixed-value columns introduces difficulties when yanalyzing your data, you can do one of the following:

- Format empty cells in your underlying data source so that they match the data type of the column.
- Create a new column that does not contain the mixed values.

Field Types

When you connect to a new data source, Tableau assigns each field in the data source to either the Dimensions area or the Measures area of the Data pane, depending on the type of data the field contains. If a field contains categorical data (such as names, dates, or geographical data), Tableau assigns it to the Dimensions area. If a field contains numbers, Tableau assigns it to the Measures section.

So is it correct to say that a dimension is a field that contains categorical data, such as names, dates, or geographical data, and that measure is a field that contains numbers? Those assertions are accurate enough as a starting point, but as you work in Tableau, remember that you control the definition of a field in the view. Most fields can be used as either a dimension or as a measure, and can be either continuous or discrete, according to the requirements of the user.

Tableau's initial assignment of fields to either the Dimensions area or the Measures area establishes a default. When you click and drag a field from the Data pane to a view, Tableau continues to provide a default definition for the field. If you are dragging a field from the Dimensions area, the resulting field in the view will be discrete (with a blue background). If you are dragging a field from the Measures area, the resulting field will be continuous (with a green background).

> **Note**: If you want to be able to tell Tableau how to categorize a view you drag to the view, so as to override the default, right-click it (Control-click on a Mac) before you drag it to the view and Tableau will prompt you to specify how you want the field to be used in the view when you drop it.

By default, dimensions are discrete and measures are continuous, but in fact all four combinations are possible:

discrete dimensions	Product Name
continuous dimensions (possible only with Date dimensions)	⊞ QUARTER(Order Date)
discrete measures	SUM(Profit)

continuous measures	SUM(Profit)

Note: With a cube (multidimensional) data source, the options for changing data roles are limited. You can change some measures from continuous to discrete, but in general, you cannot change data roles for fields in cube data sources.

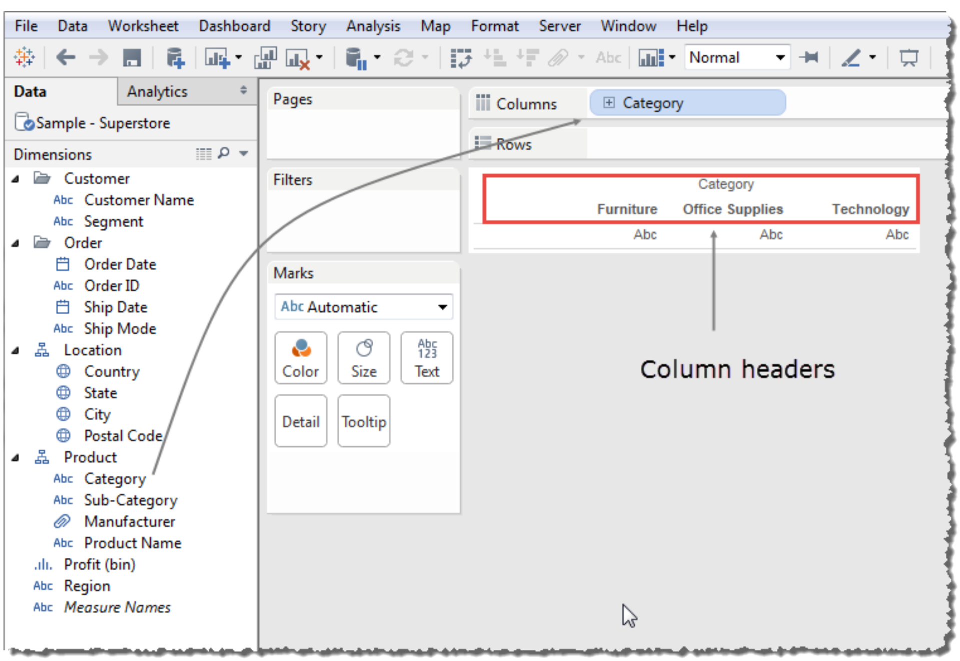
Dimensions and Measures

When you connect to a data source, Tableau assigns each field in the data source as playing one of two possible data roles: dimension or measure. What effect do these assignment have when you start working with data in Tableau?

Dimensions

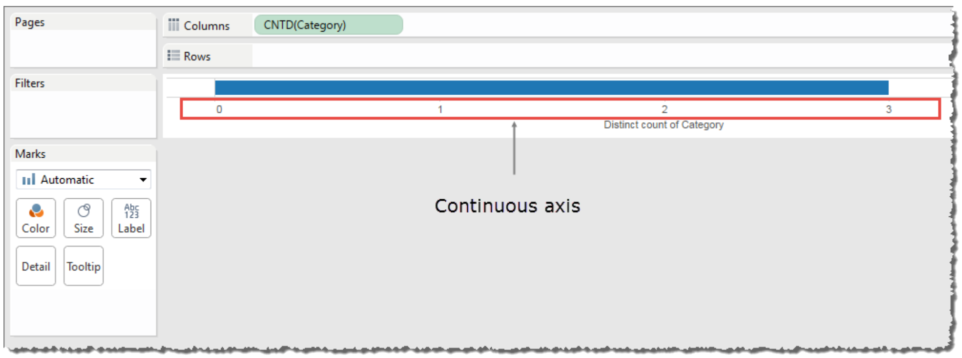
When you first connect to a data source, Tableau assigns any fields that contain discrete categorical information (for example, fields where the values are strings or Boolean values) to the **Dimensions** area in the **Data** pane.

When you click and drag a field from the **Dimensions** area to **Rows** or **Columns**, Tableau creates column or row headers.



Any field you drag from the **Dimension** area will initially be discrete when you add it to a view, with a blue background. For this reason, it might be easy to assume (incorrectly, as it turns out) that a field's background color indicates whether it is a dimension or a measure. But Date dimensions can be either discrete or continuous, and all measures can be discrete or continuous. A field's background color indicates whether it is discrete (blue) or continuous (green).

After you drag a dimension to **Rows** or **Columns**, you can change the field to a measure just by clicking the field and choosing **Measure**. Now the view will contain a continuous axis instead of column or row headers, and the field's background will become green:



If you want to make a dimension continuous (without first converting it into a measure), your options are limited. This is only possible with Date dimensions, which can be discrete or continuous but are always dimensions, and with numeric dimensions. You cannot convert dimensions containing strings or Boolean values.

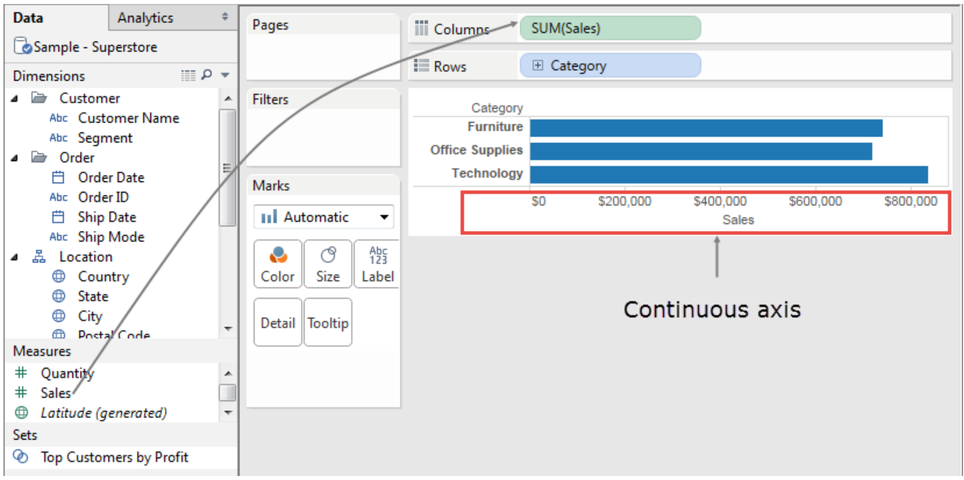
Tableau does not aggregate dimensions. If you want a field's values to be aggregated, that field must be a measure. When you convert a dimension into a measure, Tableau will always prompt you to assign it an aggregation (Count, Average, etc.). Aggregation means collecting multiple values (individual numbers) into a single number by, for example, counting the number of individual values, averaging them, or displaying the smallest individual value for any row in the data source. For a discussion of the different types of aggregation Tableau can perform, see **Aggregations** on page 245.

In Tableau queries, dimensions in the view are expressed in SQL as "Group By" clauses.

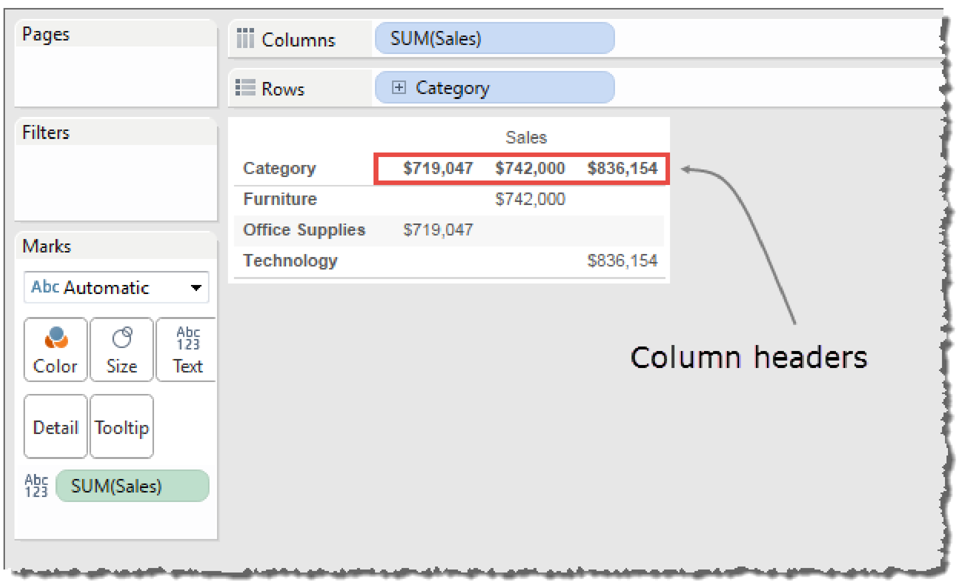
Measures

When you first connect to a data source, Tableau assigns any fields that contain quantitative, numerical information (that is, fields where the values are numbers) to the **Measures** area in the **Data** pane.

When you drag a field from the Measures area to **Rows** or **Columns**, Tableau creates a continuous axis.



Any field that you drag from the Measures area will initially be continuous when you add it to the view, and so its background will be green. But if you then click the field and choose **Discrete**



But Tableau continues to aggregate values for the field, because even though the field is now discrete, it is still a measure, and Tableau will always aggregate measures. You can take the process one step further and convert the measure to a dimension if you like. Only then will Tableau stop aggregating its values. See **Convert a Measure to a Dimension** on the next page for an example of this process.

Visual identification of dimensions and measures in a view

If you are looking at a view in Tableau Desktop and you're not sure whether a field is a measure or a dimension, a quick visual cue is that measures are aggregated:

and dimensions are not:


.

But there are exceptions:

- If the entire view is disaggregated, then by definition no field in the view is aggregated. See **Disaggregating Data** on page 254.
- If you are using a multidimensional data source, fields are aggregated in the data source and measures fields in the view do not show that aggregation.

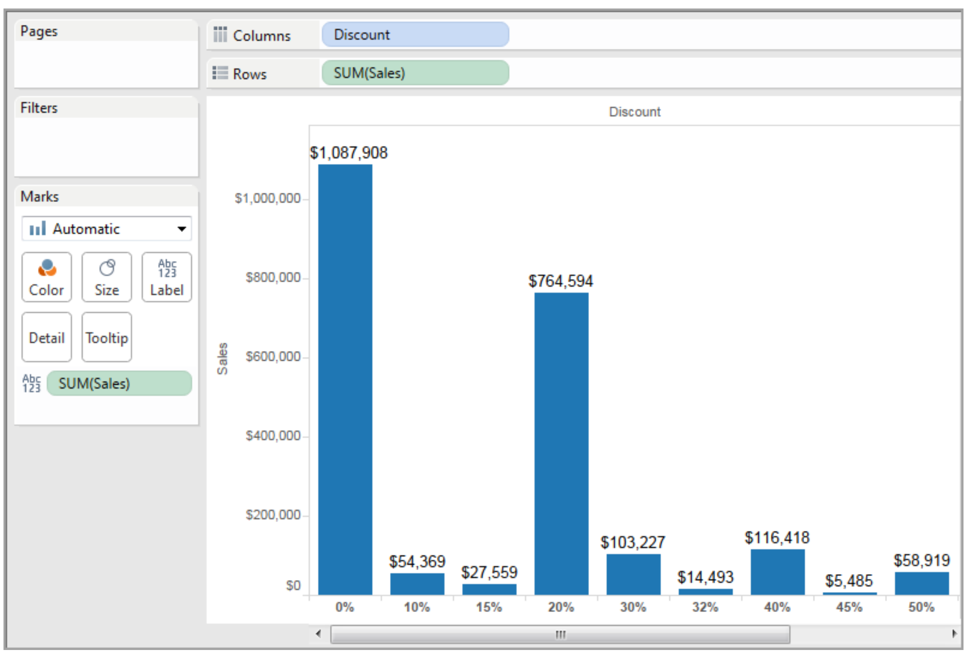
Convert a Measure to a Dimension

You can convert a field in a view from a measure to a dimension.

Or, if you want the change to affect all future uses of the field in the workbook, you can convert a field in the **Data** pane from a measure to a dimension.

Convert a measure in the view into a discrete dimension

You can drag a field from the **Measures** area in the **Data** pane but then use it as a dimension in the view. For example, suppose you want to know the aggregated sales totals for each possible discount rate. The view you are aiming for looks like this:



The **Discount** field contains numeric data, so when you connect to the data source, Tableau assigns it to the **Measures** area in the **Data** pane. In the **Sample - Superstore** data source, which is included with Tableau Desktop, the values for **Discount** range from 0% to 80%.

Here are the steps to create the view shown above:

1. Drag **Sales** to **Rows** and **Discount** to **Columns**. Tableau shows you a scatter plot—this is the default chart type when you put one measure on **Rows** and another on **Columns**.

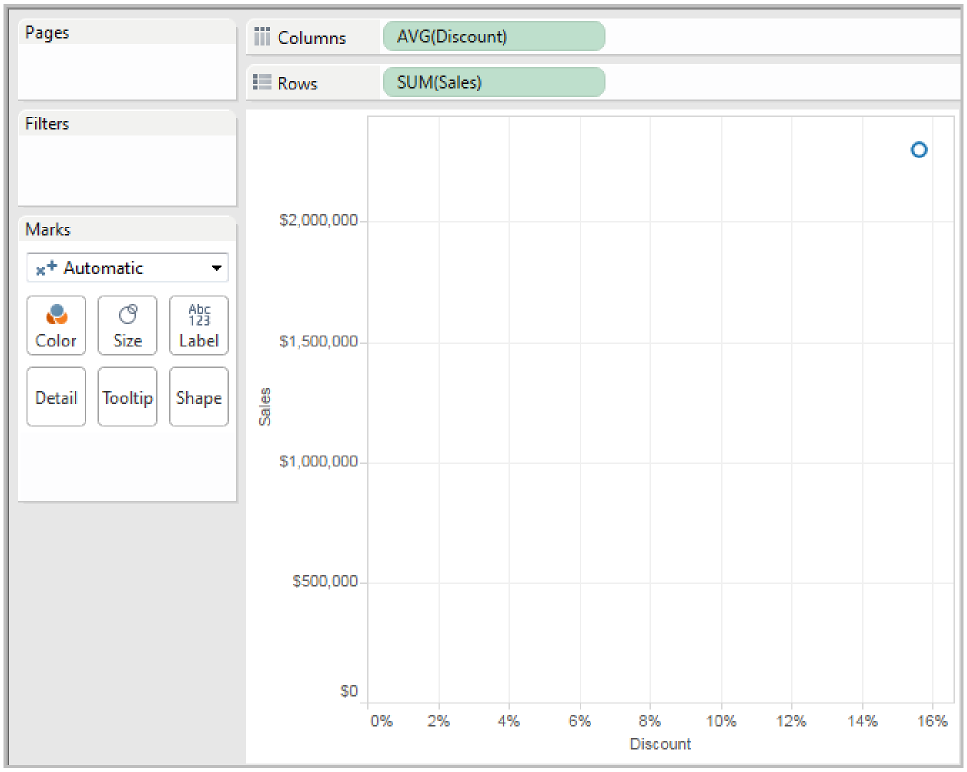
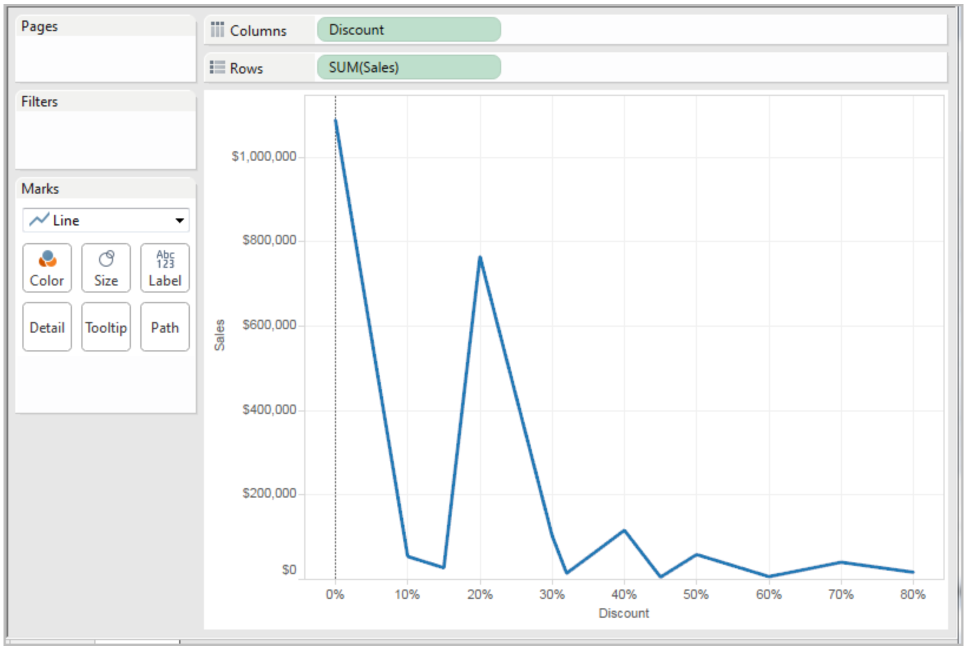


Tableau aggregates **Discount** as AVG, and **Sales** as SUM. The fields are both continuous, so along the bottom and left side of the view Tableau displays axes (and not column or row headers).

2. To treat **Discount** as a dimension, click it (on the **Columns** shelf) and choose **Dimension**. Tableau no longer aggregates the values for **Discount**, so what you see now is a line. But the values for **Discount** are still continuous, so Tableau still shows continuous axes for both fields:



3. To complete the process, click **Discount** again and choose **Discrete** from the context menu. The transformation of **Discount** is now complete. You now see the bar chart as in the initial image at the beginning of this topic. Across the bottom, you now see column headers (0%, 10%, 20%, etc.) instead of an axis.

   Let's review how we got to this point:

Action	Result
Convert **Discount** from a measure to a dimension...	Sales values are no longer aggregated according to discount rate, resulting in a line chart instead of a scatter plot.
Convert **Discount** from continuous to discrete...	Tableau shows headers at the bottom of the view, instead of a continuous axis.

   The only thing left to do is to drag **Sales** to Label and then format the labels for readability.

The resulting chart is somewhat useful because there are there are only 12 unique values for **Discount** in the data source. Had there been a unique value for each row, which would not have been unusual for a numeric field, the number of individual bars in the resulting view would have been equal to the number of rows in the data source, which would probably not result in a useful visualization.

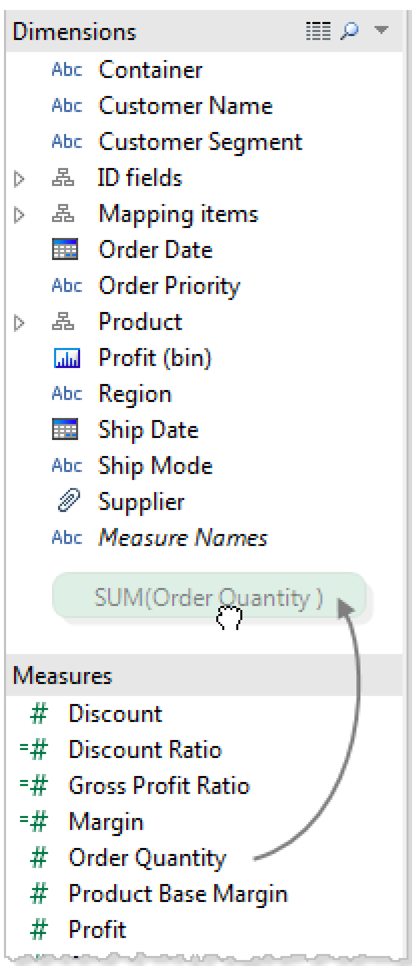
Converting a measure in the Data pane into a dimension

When you first connect to a data source, Tableau assigns most fields that contain quantitative, numerical information (that is, fields where the values are numbers) to the Measures area in the Data pane. The exception is for fields where the name suggests the data type, such as Year or Month (which Tableau would identify as Date dimensions) or fields containing words like "ID" and "Key," which Tableau would categorize as dimensions, even when they are numeric.

However, you might decide that some of these fields that Tableau has catgorized as measures should actually bedimensions. Postal codes are a classic example—they often consist entirely of numbers, but the information is categorical and not continuous—you would never want to aggregate postal codes by adding or averaging them. Similarly, a field containing individuals' ages may be categorized as a measure by default in Tableau because it contains numeric data. In some cases you may want to add or average ages, but you might also want to look at each individual age as a bin or category, in which case you want Tableau to create headers for this field rather than an axis. If this is how you want to use age in your view, you can convert the field to a dimension.

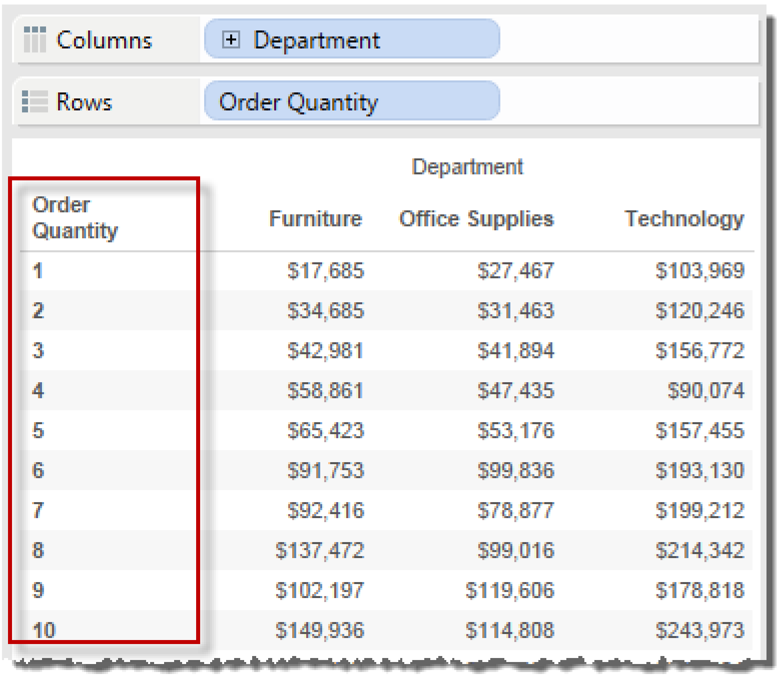
To convert a measure to a dimension in the **Data** pane, do either of the following.

- Click and drag the field from the measures area of the **Data** pane and drop it into the dimensions area.



- Right-click (control-click on a Mac) the measure in the **Data** pane and select **Convert to Dimension**.

If you place a field that you converted from a measure to a dimension on a shelf, it now produces headers instead of an axis.



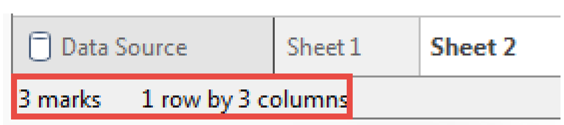
	Department		
Order Quantity	Furniture	Office Supplies	Technology
1	$17,685	$27,467	$103,969
2	$34,685	$31,463	$120,246
3	$42,981	$41,894	$156,772
4	$58,861	$47,435	$90,074
5	$65,423	$53,176	$157,455
6	$91,753	$99,836	$193,130
7	$92,416	$78,877	$199,212
8	$137,472	$99,016	$214,342
9	$102,197	$119,606	$178,818
10	$149,936	$114,808	$243,973

Dimensions and the Level of Detail

As you add dimensions to **Rows** or **Columns**, the number of marks in the view increases. To understand why adding dimensions increases the number of marks in the view, do the following:

1. Drag **Segment** to **Columns**.

   The status bar at the bottom of the Tableau window shows you that there are now three marks in the view:

   Those marks just contain placeholder text, `Abc`, because you are only building the view's structure at this point.

2. Drag **Region** to **Columns**.

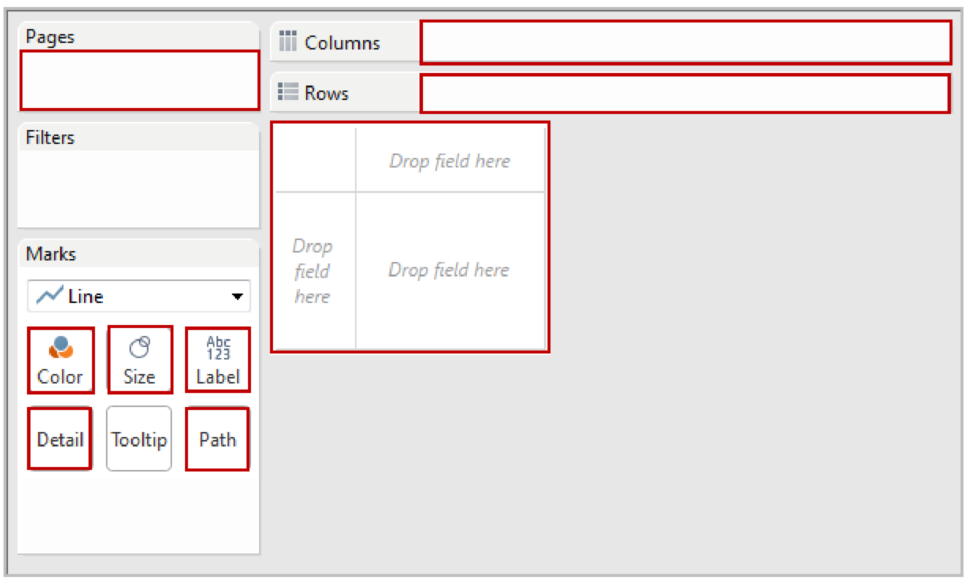
Now there are 12 marks. Three values in **Segment** multiplied by four values in **Region** is 12.

3. Drag [**Ship Date**] to **Rows**.

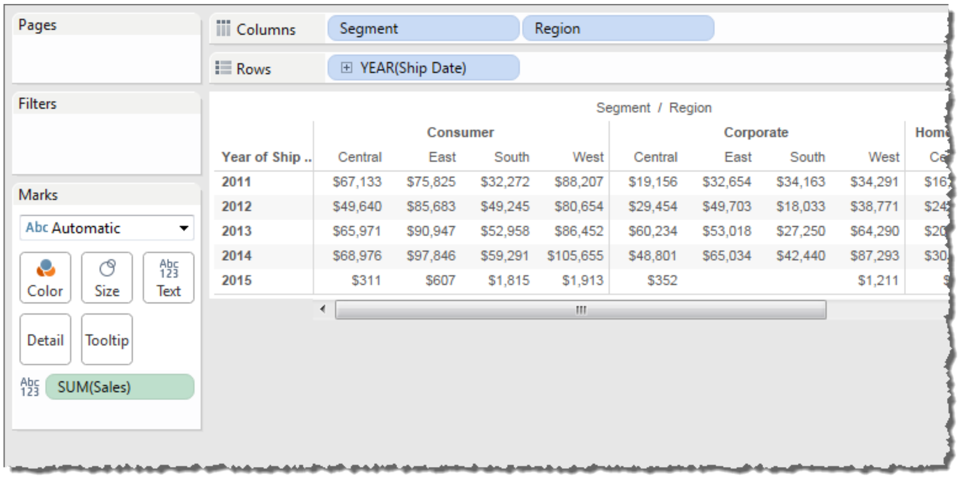
   The total is now 57 marks (three segments by four regions by five years is 60, but there are three combinations of the dimensions in the view for which there is no data in the data source).

   We could continue adding dimensions to **Rows** and **Columns** and observe as the number of total marks continues to increase. Dragging a dimension to a location on the Marks card such as Color or Size will also increase the number of marks, though it will not increase the number of headings in the view. The process of adding dimensions to the view to increase the number of marks is known as setting the *level of detail*.

   Adding a dimension to any of the following locations in Tableau affects the level of detail:

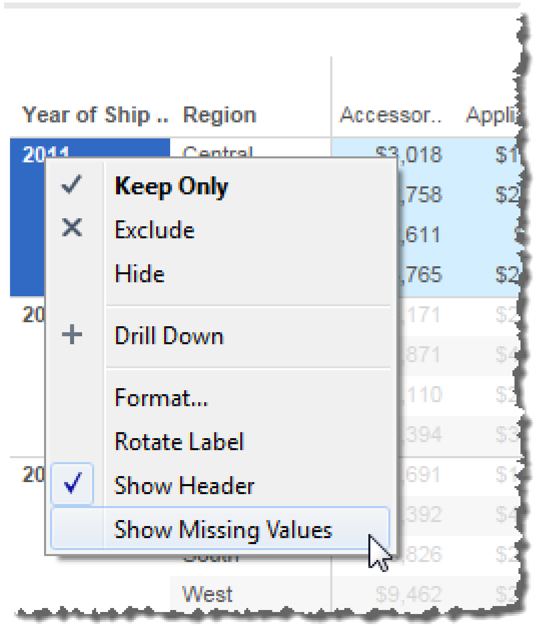


4. The view now contains 57 separate instances of `Abc`—the view is all structure and no content. Rectify this by dragging **Sales** to Text. The view can now be considered complete:



Notes

- In some cases, adding a measure to the view can increase the number of marks in the view. For example, if you dropped **Sales** on **Rows** in the view above, the number of marks would be 57. But if you then also dropped **Profit** on **Rows**, the number of marks would increase to 114. But this is not the same as changing the view's level of detail.
- The number of marks in the view is not guaranteed to correspond to the number you would get by multiplying the number of dimension values in each of the dimensions that make up the level of detail. There are multiple reasons why the number of marks could be lower. To increase the number of marks in this view from 57 to 60 in the view above, right-click (Control-click on a Mac) on one of the Date headers in the view and the date or bin headers and choose **Show Missing Values**.



See **Missing Values** on page 865.

Continuous and Discrete

Continuous and *discrete* are mathematical terms. Continuous means "forming an unbroken whole, without interruption"; discrete means "individually separate and distinct."

In Tableau, fields can be either continuous or discrete. When you drag a field from the **Measures** area to **Columns** or **Rows**, the values are continuous by default and Tableau creates an axis. When you drag a field from the **Dimensions** area of the **Data** pane to **Columns** or **Rows**, the values are discrete by default and Tableau creates column or row headers. Let's consider why this is so.

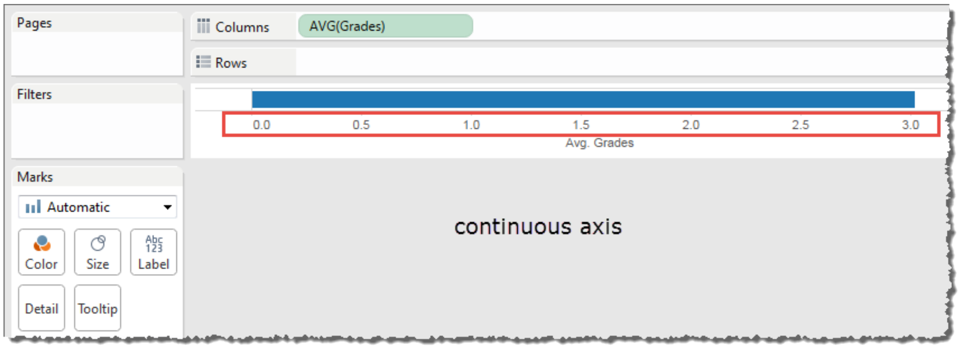
Continuous fields produce axes

If a field has values that are numbers that can be added, averaged, or otherwise aggregated, Tableau assigns that field to the **Measures** area of the **Data** pane when you first connect to a data source. Tableau is assuming that the values are continuous.

Tableau displays an axis when you drop a continuous field on **Rows** or **Columns**. An axis is a measuring line that shows values between a minimum and a maximum. Rulers and analog thermometers are examples of physical objects that display axes.

Tableau must be able to show a range of actual and potential values, because in addition to the initial values in the data source, it is always possible that new values will emerge as you work with a continuous field in the view.

While there are value labels on a continuous axis (0, 0.5, ... 3.0 in the following image), actual marks don't have to align with these labels as they would with column headers. For example, in the following image, the blue bar actually extends to a value of 3.02 on the horizontal axis, not 3 exactly.



The number of potential values for continuous fields is impossible to anticipate. For example, if you have a field named **Grades** and the initial values are 1, 3, 3.5, 3.6, and 4, that's five distinct values. But if you drop **Grades** on **Rows**, Tableau automatically aggregates that value as SUM (which you would then immediately change to AVG, because it's more logical to average grades than to add them), and that would then create a sixth value (3.02) that didn't exist until you added the field to the view. And if you then applied a filter that eliminated two of the initial values, the average would change as well, so that would be yet another value. And then if you changed the aggregation, ... You get the idea. The number of potential values is, if not infinite, then certainly immense.

The fact that a field contains numbers does not automatically indicate that those values are continuous. Postal codes are the classic example: though they are often composed entirely of numbers, they are actually string values which should never be added or averaged. If Tableau assigns such a field to the **Measures** area, you should drag it up to the **Dimensions** area.

Discrete fields create headers

If a field contains values that are names, dates, or geographical locations—anything other than numbers—Tableau assigns that field to the **Dimensions** area of the **Data** pane when you first connect to a data source. Tableau is treats the values as discrete.

Tableau creates headers when you drop a discrete field on **Columns** or **Rows**. The individual values for a discrete field become the row or column headings. (Because such values are never aggregated, no new field values are created as you work with your view, so there is no need for an axis).

Recognizing the difference

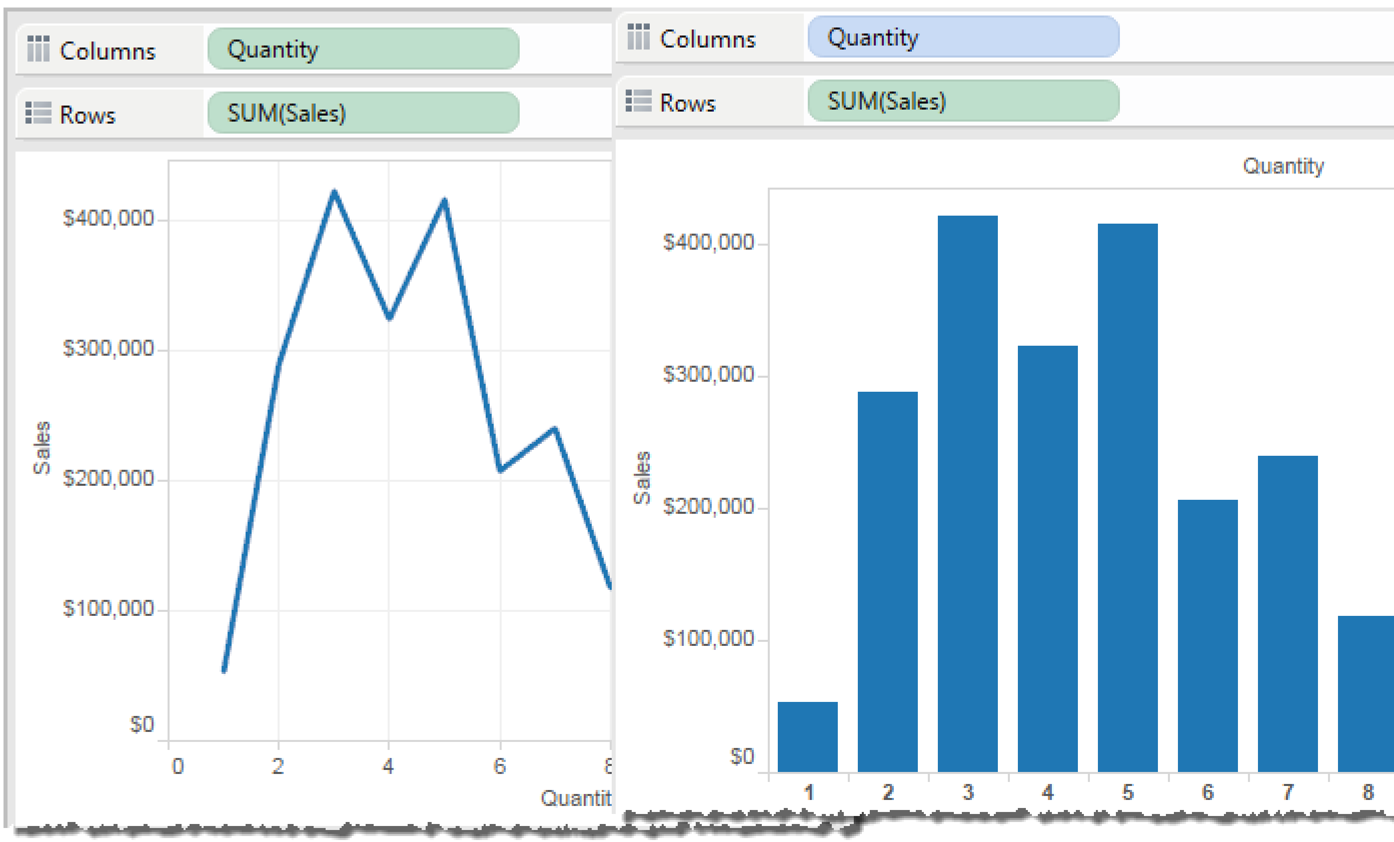
If a field is continuous, the background color is green; if it is discrete, the background color is blue. Background color does not indicate dimension vs. measure—it indicates continuous vs. discrete.

What tells you whether a field in the view is a measure or a dimension is whether it is aggregated.

On the left below you see a view where **Quantity**, which was dragged from the **Measures** area of the **Data** pane, has been converted from a measure to a dimension but is still continuous, with an axis along the bottom of the view. We know that the field is continuous because of the axis and because the background is green. We know that it is a dimension because it is not aggregated.

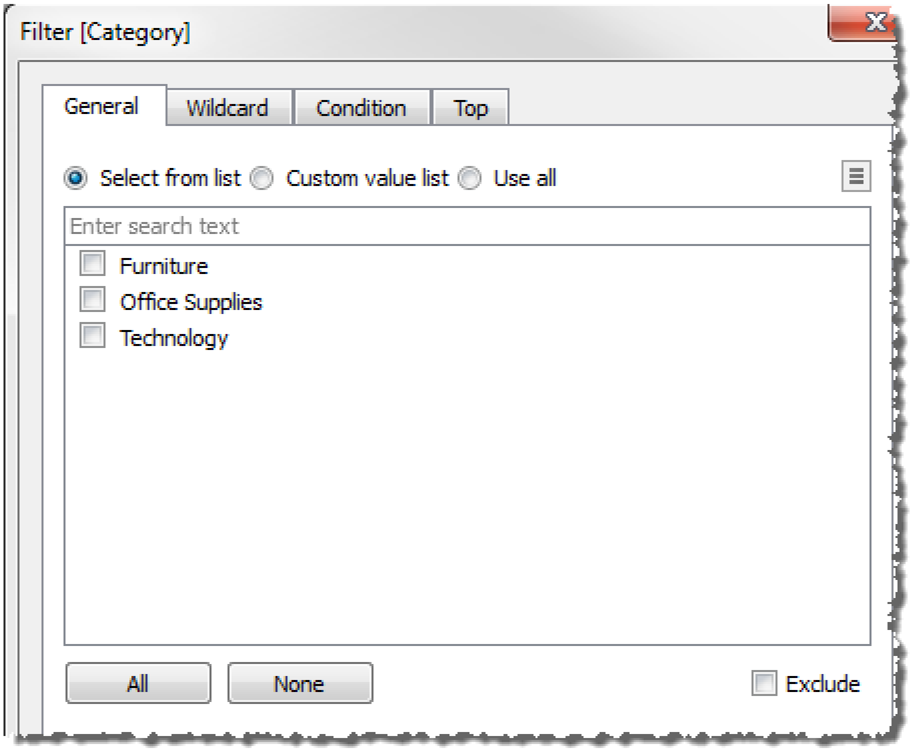
On the right, you see a view where that view has been further modified by clicking **Quantity** on the **Columns** shelf and choosing **Discrete**. Now there are headers along the bottom of the view, instead of an axis.

Continuous **Discrete**



Implications for filters

When you drop a discrete field on the **Filters** shelf, Tableau prompts you to choose which "members" of the discrete fieldshould be included in the view.



When you drop a Date field on Filters, the result can be a discrete filter or a continuous filter. See **Filter Dates** on page 635.

When you drop a continuous measure on Filters, Tableau first prompts you to choose an aggregation for the filter, and then prompts you to specify how the continuous range of values is to be filtered.

When you drop a continuous dimension on Filters (other than a Date), Tableau prompts you to specify how the continuous range of values is to be filtered.

For more on filtering various types of fields, see **Drag Fields to the Filters Shelf** on page 612.

Implications for Color

When you drop a discrete field on Color, Tableau displays a categorical palette and assigns a color to each value of the field.

When you drop a continuous field on Color, Tableau displays a quantitative legend with a continuous range of colors.

For details, see **Color Properties** on page 451.

Convert Fields between Discrete and Continuous

You can convert measures from discrete to continuous or from continuous to discrete. And you can convert date dimensions and other numeric dimensions to be either discrete or continuous.

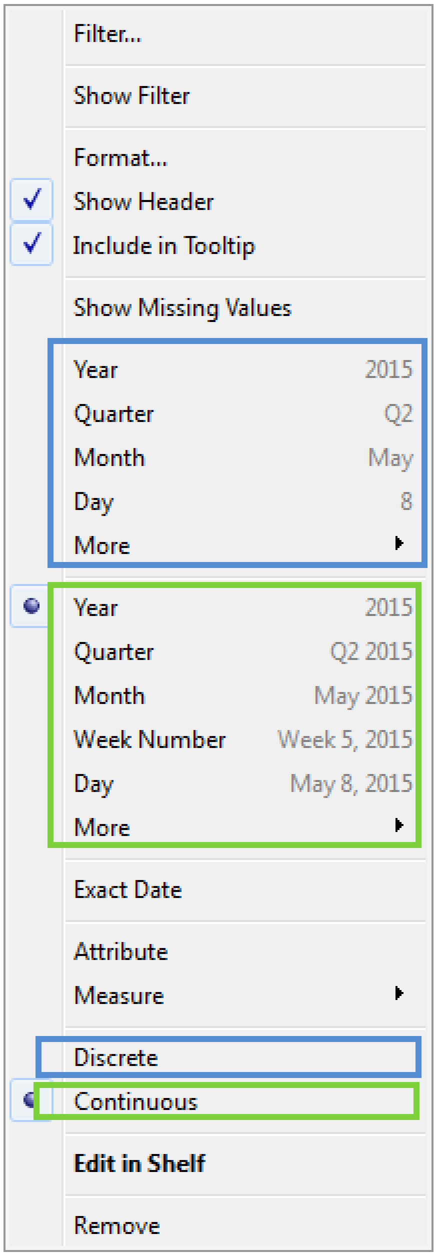
Convert measures

You can convert measures from discrete to continuous or from continuous to discrete. Click the field and choose **Discrete** or **Continuous**. The field is green when it is continuous, and blue when it is discrete.

For measures in the **Data** pane, right-click the field and choose **Convert to Discrete** or **Convert to Continuous**. The color of the field changes accordingly.

Convert date fields

You can convert Date fields between discrete and continuous. Click any Date field in the view and choose one of the options on the context menu to change it from discrete to continuous or from continuous to discrete:



Click any of the options in the blue areas to configure the field as a discrete date.
Choosing one of these options creates what is known as a "date part."

Click any of the option in the green areas to configure the field as a continuous date.
Choosing one of these options creates what is known as a "truncated date."

To convert a Date field in the **Data** pane (and thus to determine the default result when you drag it into a view), right-click the field and choose **Convert to Discrete** or **Convert to Continuous**.

Tableau's Order of Operations

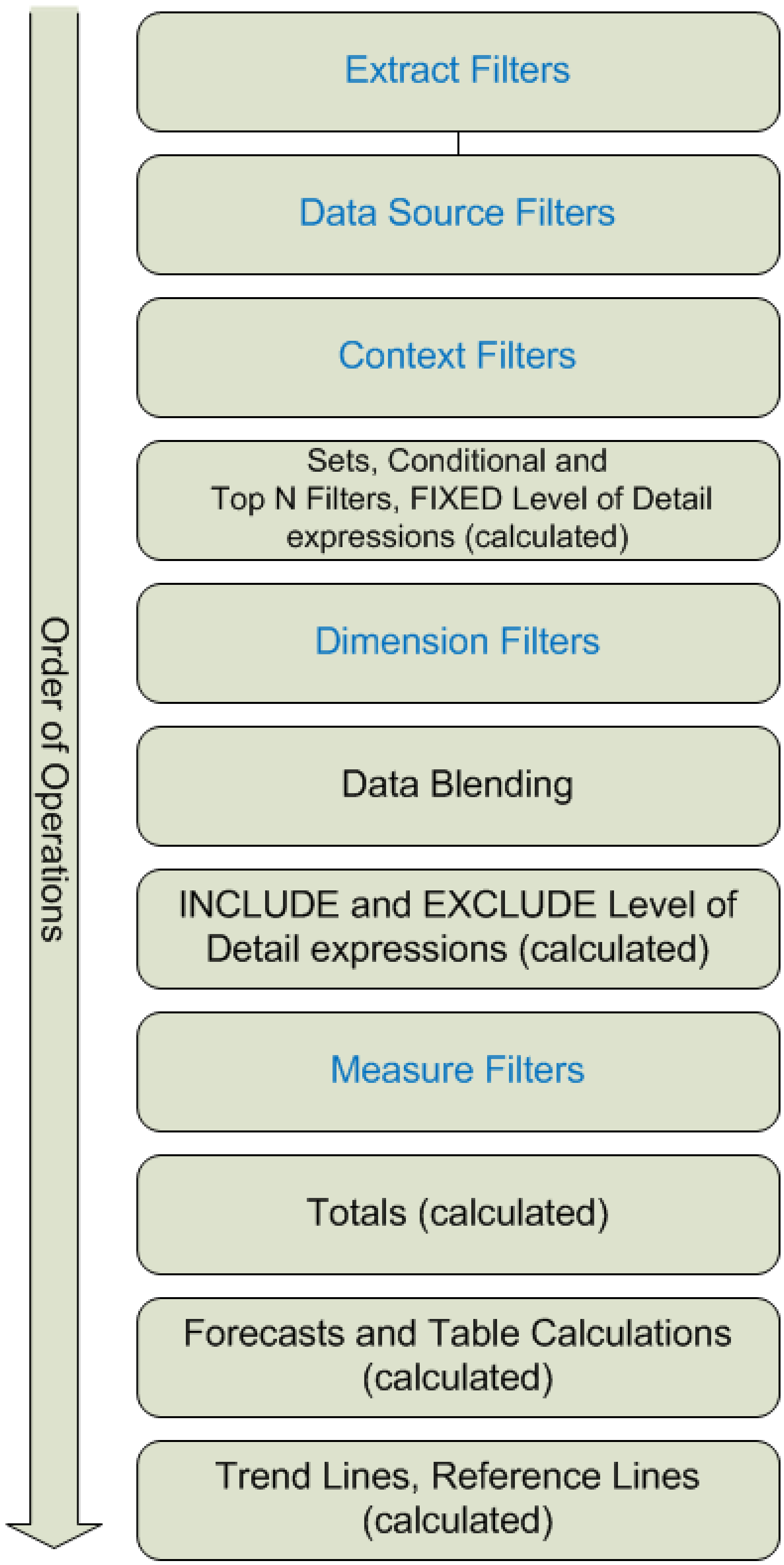
The order of operations in Tableau, sometimes called the query pipeline, is the order in which Tableau performs various actions. (Actions are also known as operations).

Many operations apply filters, which means that as you build a view and add filters, those filters always execute in the order established by the order of operations.

Sometimes, you might expect Tableau to execute filters in one order, but the order of operations dictates that they be executed in a different order, which gives you unexpected results. When this happens, you can sometimes change the order in which operations are executed in the pipeline.

This topic provides two scenarios for updating a view to correct problems resulting from the order of operations: converting a dimension filter to a context filter, and converting a table calculation to a FIXED level of detail expression.

The Tableau order of operations includes all the elements in the following illustration. Filters are shown in blue; other operations, which are mostly calculations, are shown in black.


Order of Operations
Extract Filters
Data Source Filters
Context Filters
Sets, Conditional and
Top N Filters, FIXED Level of Detail
expressions (calculated)
Dimension Filters
Data Blending
INCLUDE and EXCLUDE Level of
Detail expressions (calculated)
Measure Filters
Totals (calculated)
Forecasts and Table Calculations
(calculated)
Trend Lines, Reference Lines
(calculated)

Example 1: Convert a Dimension Filter to a Context Filter

This and the following example use the **Sample – Superstore** data source provided with Tableau Desktop.

In this example, the view addresses the following question: Who are the top 10 customers, by total sales, in New York City?

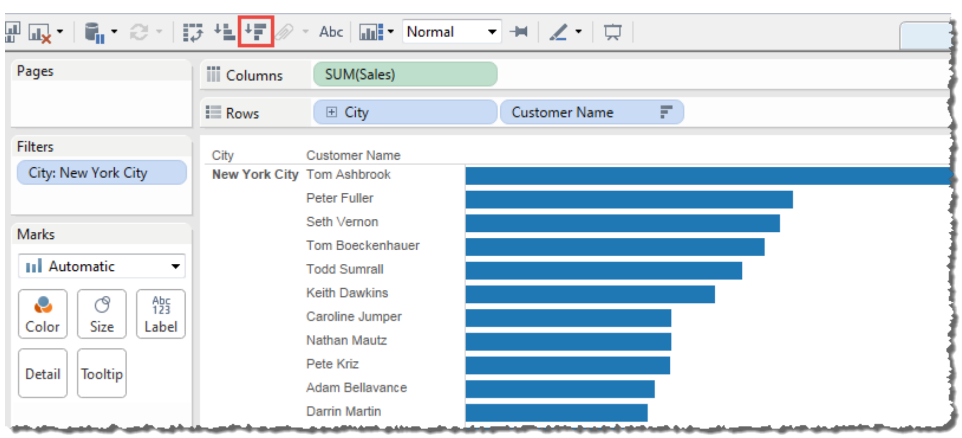
The view contains two dimension filters, one that you create on the **General** tab in the Filters dialog box, and the other on the **Top N** tab. The problem is that these filters are executing simultaneously, whereas you would like to general filter to be applied before the top n filter, so that the top n filter can act on the results as previously filtered by the general filter. The solution is to redefine one of the filters as a context filter so that a clear order of precedence is established.

Here are the steps for building this view.

1. Drag **Sales** to **Columns**.
2. Drag **City** and **[Customer Name]** to **Rows**.
3. Drag **City** from the **Data** pane again, this time to **Filters**. On the **General** tab in the Filter dialog box, set the filter to show just a single value: New York City. Do this by clicking **None** and then choosing **New York City**.

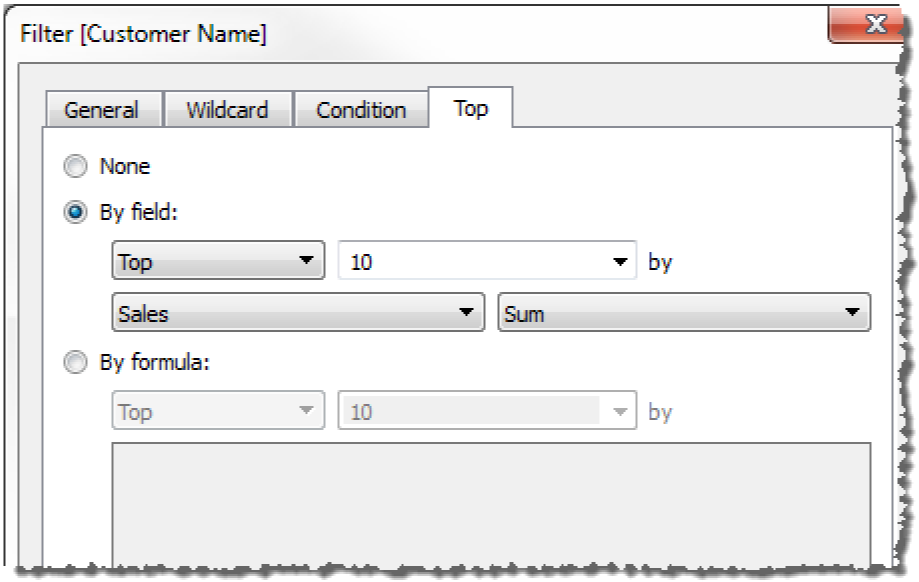
   This creates a general dimension filter.

4. Click the **Sort Descending** button () on the toolbar. Your view now looks like this:

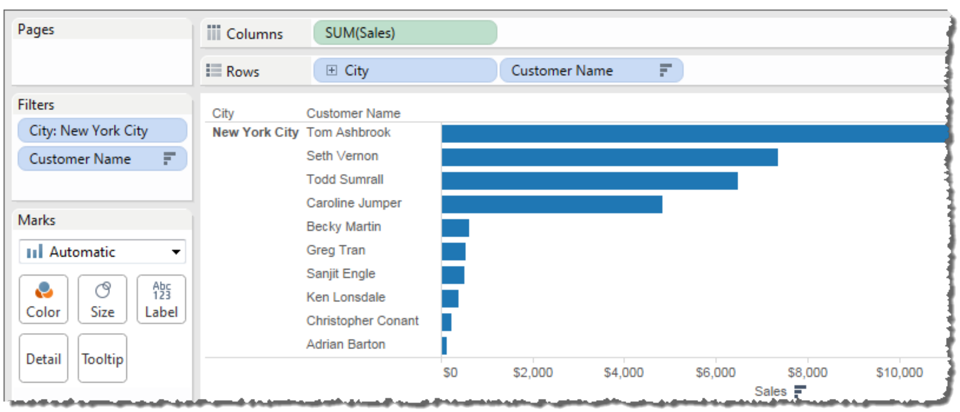
   

   Note the first few names in the list: Ashbrook, Fuller, Vernon, etc.

5. Now drag **[Customer Name]** from the **Data** pane to **Filters**, and create a Top 10 Filter, to show only the top 10 customers by total sales:

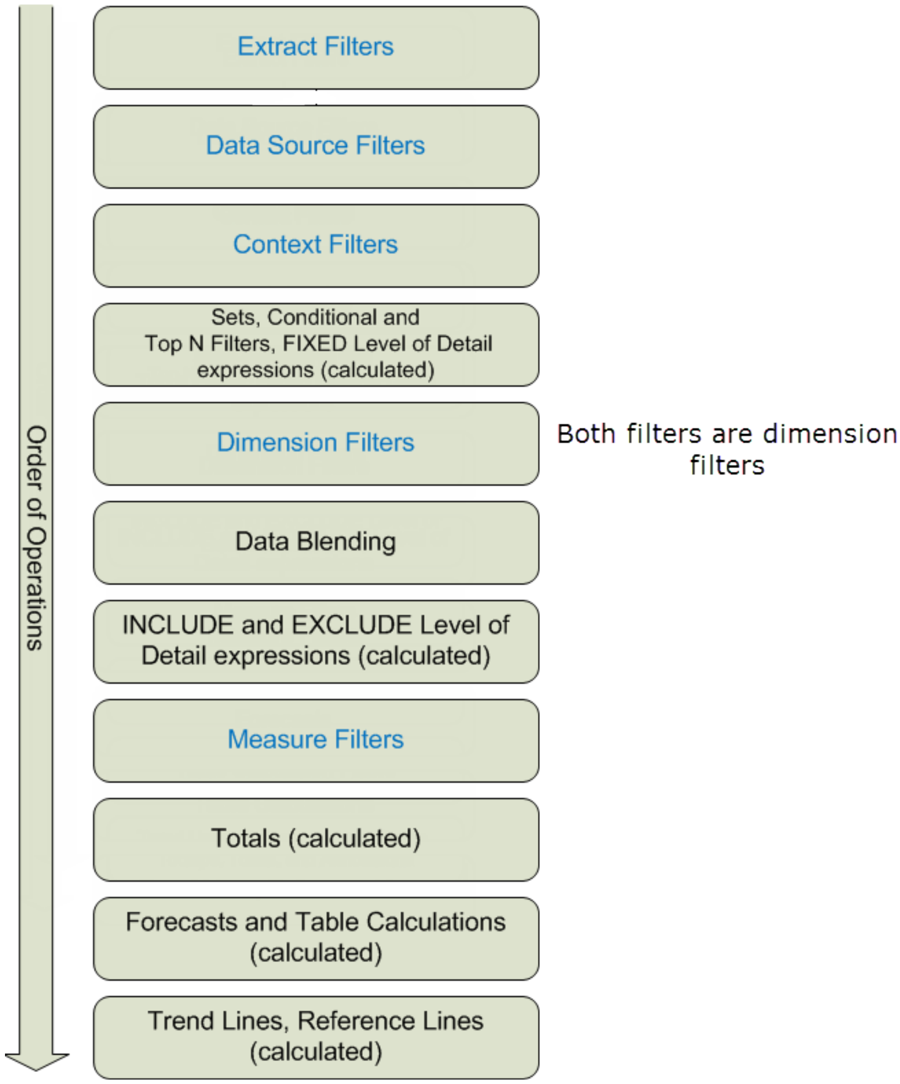


After you apply this second filter, the view looks right, but notice that the names shown are no longer the same as before:



What happened to Peter Fuller, formerly in second place? The goal was to show the top 10 customers in New York City, but now the view is actually showing the top 10 customers overall.

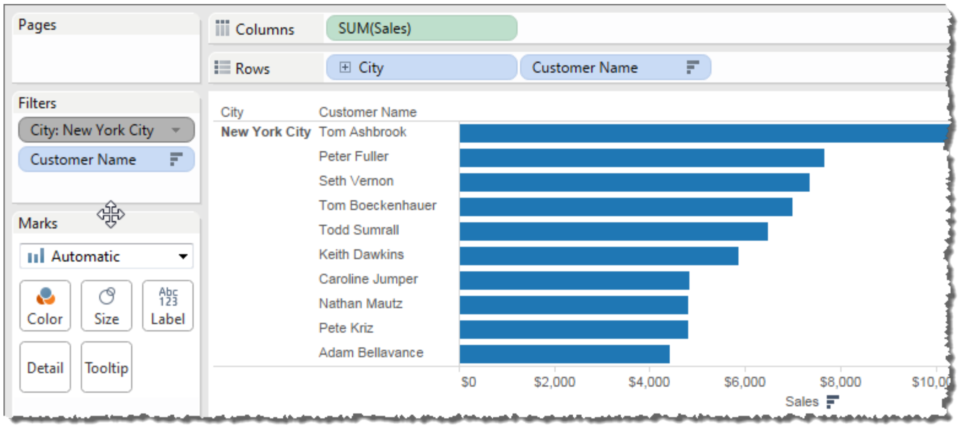
The problem is that top and general dimension filters are applied simultaneously—they are both dimension filters, and they appear in the same place in the Tableau order of operations:



The solution is to add the general dimension filter (on **City**) to context—that is, by turning it into a context filter, which is executed before any other filter that you create in a worksheet.

For details, see **Context Filters** on page 659.

6. Right-click **City** on the **Filters** shelf (Control-click on a Mac) and choose **Add to Context**. As a context filter, this filter now takes precedence over the dimension filter, and so the view now shows what it's supposed to:



Example 2: Convert a Table Calculation to a FIXED Level of Detail Expression

In this example, the view addresses the following question: What is the percent of total sales by product sub-category?

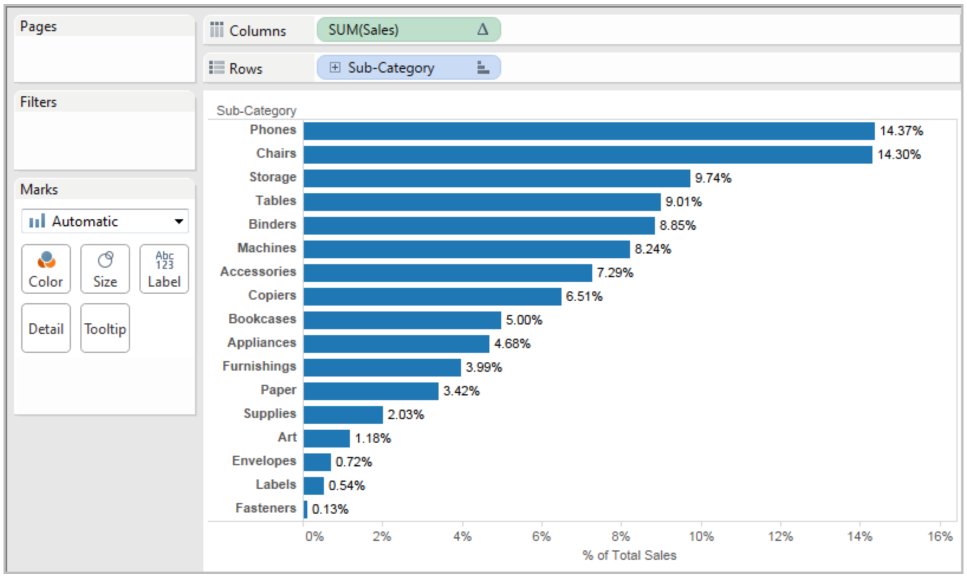
The view contains a dimension filter and a table calculation. Tableau applies the dimension filter before executing the table calculation. To invert the order of these operations, use a FIXED level of detail expression instead of a table calculation.

Here are the steps for building this view.

1. In a new worksheet, drag **Sales** to **Columns**.
2. Drag **Sub-Category** to **Rows**.
3. Right-click **SUM(Sales)** on **Columns** and select a quick table calculation – **Percent of Total**.
4. Click the **Sort Descending** button () on the toolbar to sort the categories from most to least.
5. Click the **Show Mark Labels** button (

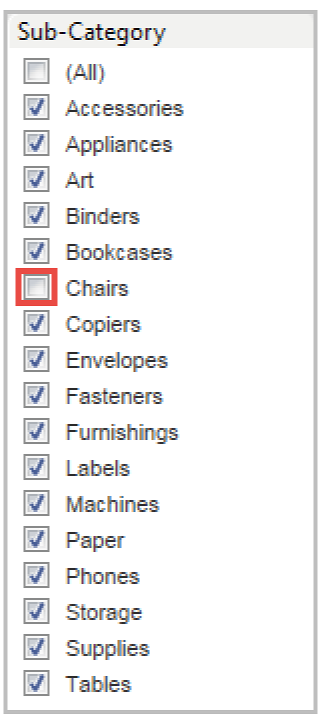
) on the toolbar to display measure values in the view.

   Your view now looks like this:



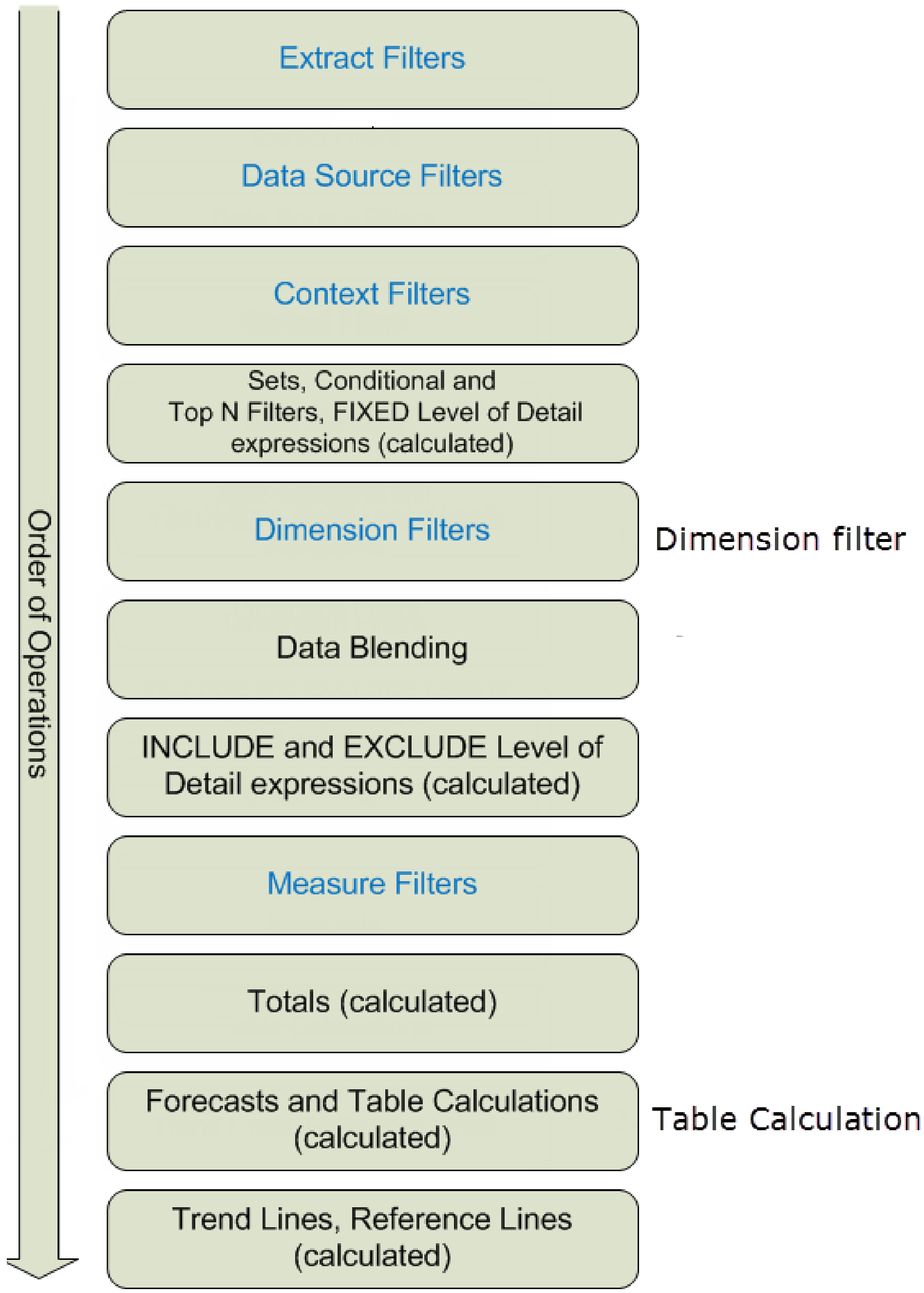
Note the percentages for the first few items: 14.37%, 14.30%, etc.

6. Right-click **Sub-Category** on **Rows** and choose **Show Filter**.
7. Clear the check mark for **Chairs** in the filter.



In the view, the percentages are now different—the highest percentage is now over 16%. In some cases, this may be just the result that you want (that is, for percentages to be recalculated as you work with the quick filter). But in other cases you may want the percentages to hold steady even as you filter items in or out. That's what we want in this case.

In the order of operations, a dimension filter is applied before a table calculation:



To have Tableau calculate the percentages before it acts on the quick filter, you create a FIXED level of detail expression, and then use that instead of the table calculation.

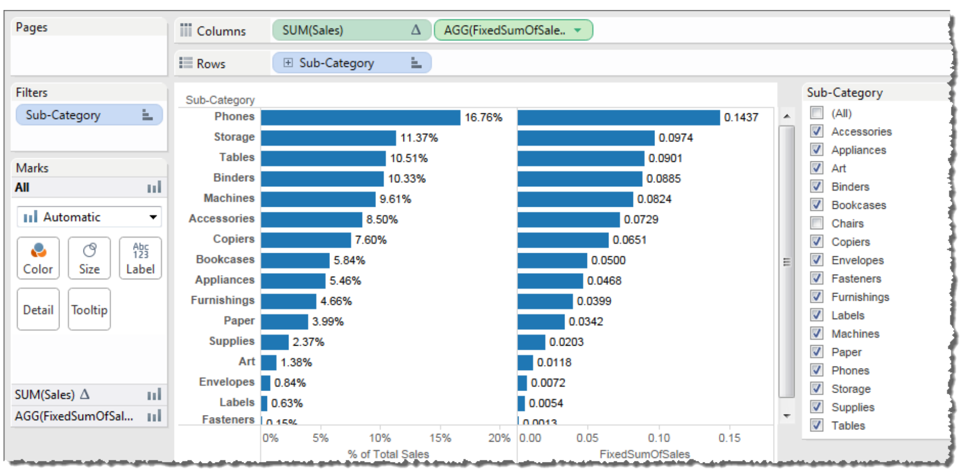
FIXED level of detail expressions compute a value using the specified dimensions, without reference to the dimensions in the view. In this case you'll use it to establish percentages for the various sub-categories—percentages that won't be affected by your general dimension filter. Why? Because FIXED level of detail expressions are computed before dimension filters are applied.

For details, see **Level of Detail Expressions** on page 1064.

8. The FIXED level of detail expression must divide the sum of **Sales** (for a particular measure value) by the total sum of **Sales** for the view. Because the numerator is aggregated, the denominator must be as well, so the expression you write is:

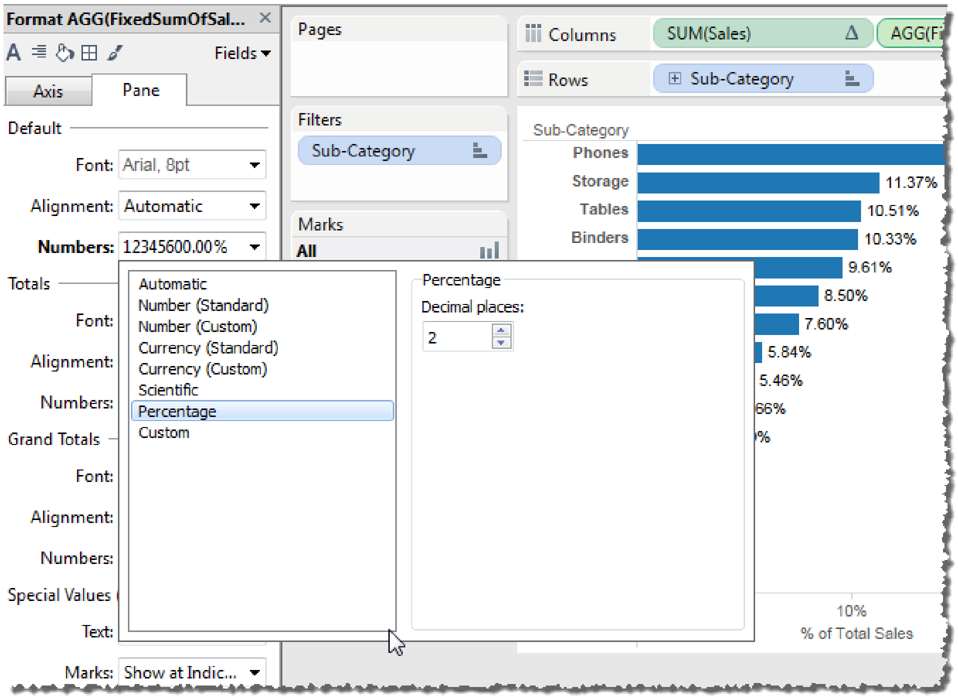
```
SUM([Sales])/SUM({FIXED : SUM([Sales])})
```

9. Save that expression as **FixedSumOfSales** and then drag it from the **Data pane** to **Columns**, dropping it to the right of the existing **SUM(Sales)** field that uses the table calculation. (Keep them both in the view for comparison.) Here is what your view now looks like:

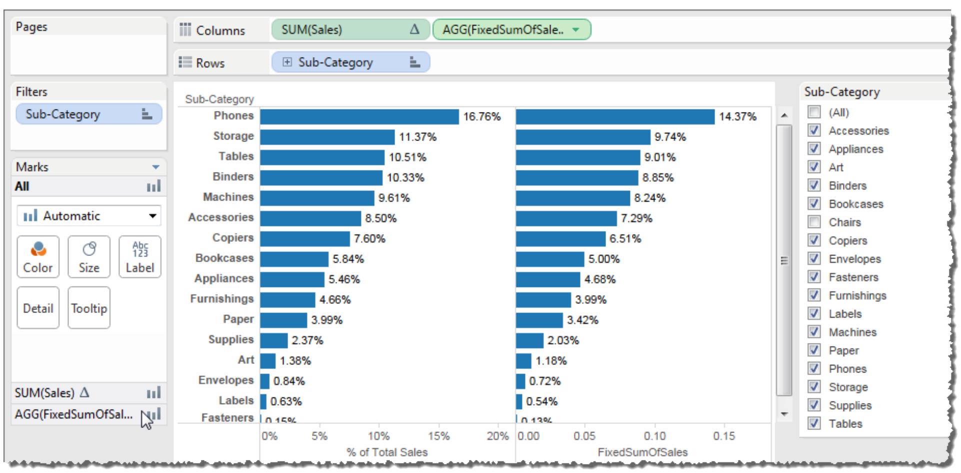


The percentage numbers in the chart on the right are now consistent, regardless of which fields you select or don't select with the quick filter. All that remains is to format the values for **FixedSumOfSales** so that they show as percentages.

10. Right-click **FixedSumOfSales** on **Columns** and choose **Format**. In the **Format** pane, choose **Numbers** and then **Percentage**:



This gives you the final view:



As you select or clear items in the **Sub-Category** quick filter, the percentages in the bar chart on the left change, but the percentages in the bar chart on the right do not.

Understanding Data Fields

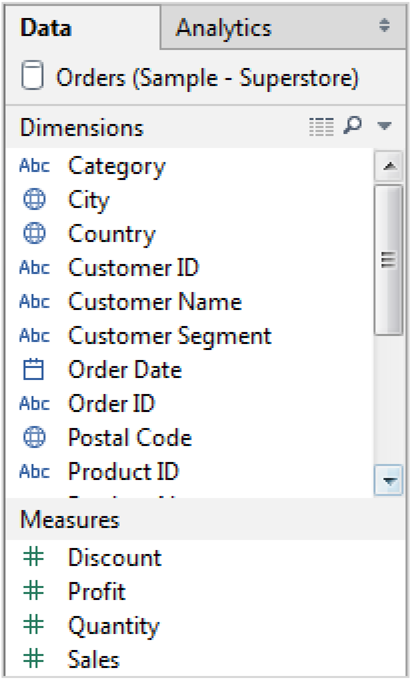
The data in all data sources are categorized into fields such as Customer, Sales, Profit, Temperature, etc. These fields are made from the columns in your data source. When you connect to a data source with Tableau, the fields are displayed along the left side of the workbook in the Data pane. The fields are what you will use to build views of your data. Each field is automatically assigned a data type (such as integer, string, and date) and a pair of data roles.

Understanding the Data Pane

All data sources contain fields. In Tableau, these fields appear in the Data pane. For cube (multidimensional) data sources, the fields are determined by the dimensions and measures of a cube. In Tableau, cube data sources are supported only in Windows. For relational data sources, the fields are determined by the columns of a table or view. Each field contains a unique attribute of the data such as customer name, sales total, product type, and so on. For example, some of the fields of an Excel worksheet are shown below.

	A	K	L	
1	Row ID	Product Sub-Category	Product Container	Product Name
2	18606	Labels	Small Box	Avery 49
3	20847	Pens & Art Supplies	Wrap Bag	SANFORD Liquid Accent
4	23086	Paper	Small Box	Xerox 1968
5	23087	Scissors, Rulers and Trimmers	Small Pack	Acme® Preferred Stainle
6	23088	Telephones and Communication	Small Box	V70
7	23597	Paper	Small Box	Xerox 194
8	25549	Office Machines	Jumbo Drum	Canon S750 Color Inkjet
9	20228	Chairs & Chairmats	Jumbo Drum	Global Troy™ Executive
10	19483	Paper	Small Box	Xerox 1930
11	24782	Appliances	Small Box	Kensington 6 Outlet Mas
12	24563	Paper	Small Box	Xerox 21
13	24564	Pens & Art Supplies	Wrap Bag	*Staples* Highlighting M
14	24565	Telephones and Communication	Wrap Bag	Accessory34
15	21866	Paper	Small Box	Xerox 1933
16	20876	Bookcases	Jumbo Box	Sauder Forest Hills Libra
17	20877	Tables	Jumbo Box	Riverside Furniture Stan
18	22241	Envelopes	Small Box	Park Ridge™ Embossed

After you connect to your data and set up the data source with Tableau, the data source fields appear on the left side of the workbook in the Data pane.



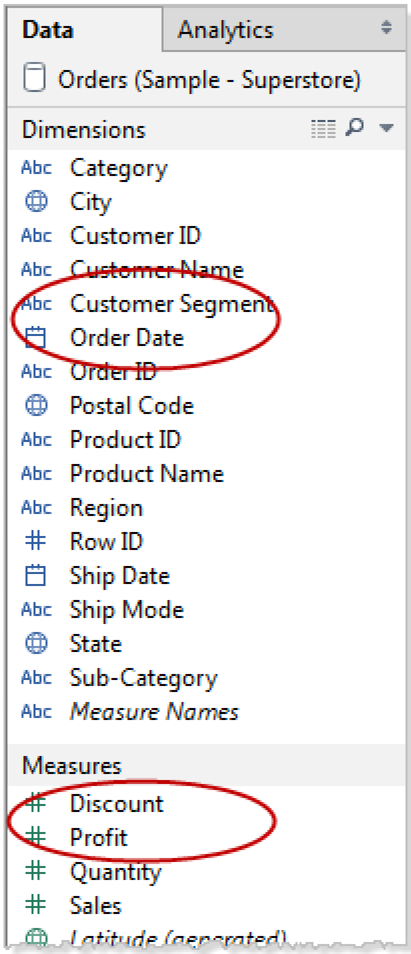
The Data pane organizes fields into different areas:

- **Dimensions** – Fields that typically hold discrete qualitative data. Examples of dimensions include dates, customer names, and customer segments.
- **Measures** – Fields that typically hold numerical data that can be aggregated. Examples of measures include sales, profit, number of employees, temperature, frequency, and pressure.
- **Sets** – An additional area that stores custom fields based on existing dimensions and criteria that you specify. Named sets from an MS Analysis Services server or from a Teradata OLAP connector also appear in Tableau in this area of the Data pane. You can interact with these named sets in the same way you interact with other custom sets in Tableau.
- **Parameters** – An additional area that stores parameters that you have created. Parameters are dynamic variables that can be used as placeholders in formulas.

Note: For cube data sources, fields are explicitly defined as dimensions or measures when the database is created. For relational data sources, Tableau automatically organizes the fields. By default, fields containing text, date or boolean values are dimensions, while fields containing numerical values are measures.

The Data pane for an Excel worksheet (a relational database) is shown below. The **Discount** and **Profit** fields contain numbers and appear as measures in the Data pane. The **Customer**

Segment field contains text and the **Order Date** field contains dates. These fields appear as dimensions in the Data pane.

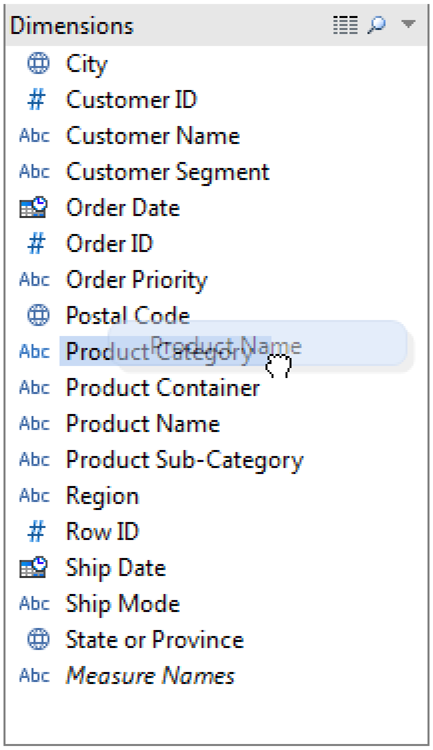


> **Note:** By default the field names defined in the data source are displayed in the Data pane. You can rename fields as well as member names.

Hierarchies (For Relational Databases)

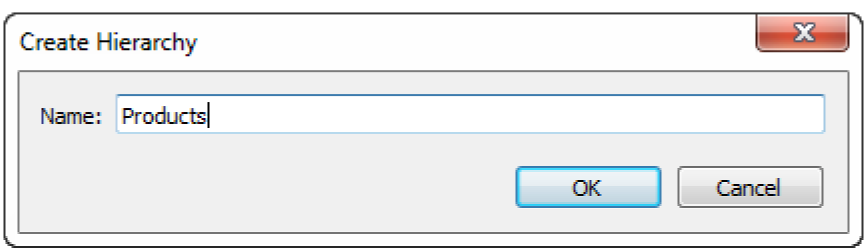
Unlike cube (multidimensional) data sources, relational data sources don't have built-in hierarchies. However, often relational data sources have related dimensions that have an inherent hierarchy. For example, a data source may have fields for Country, State, and City. These fields could be grouped into a hierarchy called Location. You can assemble relational hierarchies by dragging and dropping in the Data pane.

1. Drag a field in the Data pane and drop it directly on top of another field.

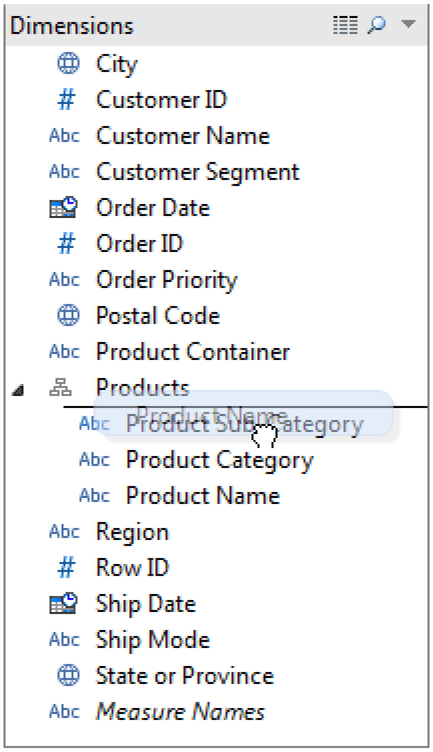


> **Note:** When you want to create a hierarchy from a field inside a folder, right-click (control-click on a Mac) the field and then select **Create Hierarchy**.

2. When prompted, enter a name for the relational hierarchy and click **OK**.



3. Drag any additional fields into the hierarchy. You can also re-order fields in the hierarchy by dragging them to a new position.



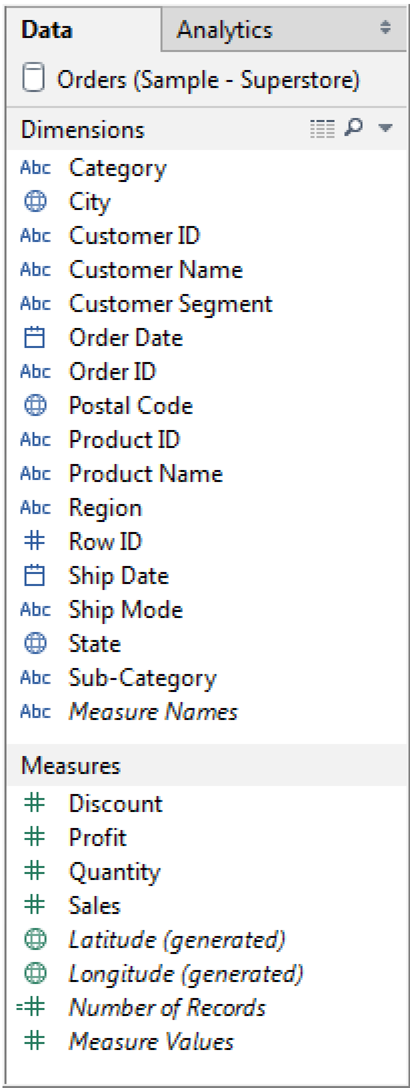
Hierarchies support single-click navigation up and down the levels. When you use the fields in the view, a plus button displays on the field so you can drill down and up in the hierarchy.

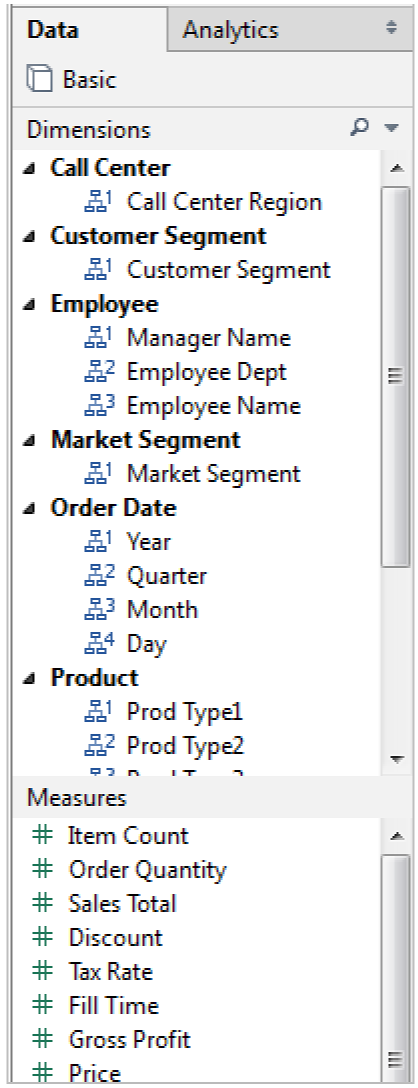
Relational and Cube Data

The Data pane for a relational and cube data source are shown below. Note that the panes look essentially the same for both data sources in that the fields are organized into dimensions and measures. However, the cube data source contains hierarchies for dimensions. For example, notice that the Employee dimension in the cube Data pane contains hierarchical members such as Manager Name and Employee Dept.

> **Note:** In Tableau, cube (multidimensional) data sources are supported only in Windows.

Relational **Cube**





You can expand or collapse the various hierarchies in both relational and cube Data panes by

clicking the arrow. You can hide the Data pane all together by clicking the minimize button in the upper-right corner of the Data pane.

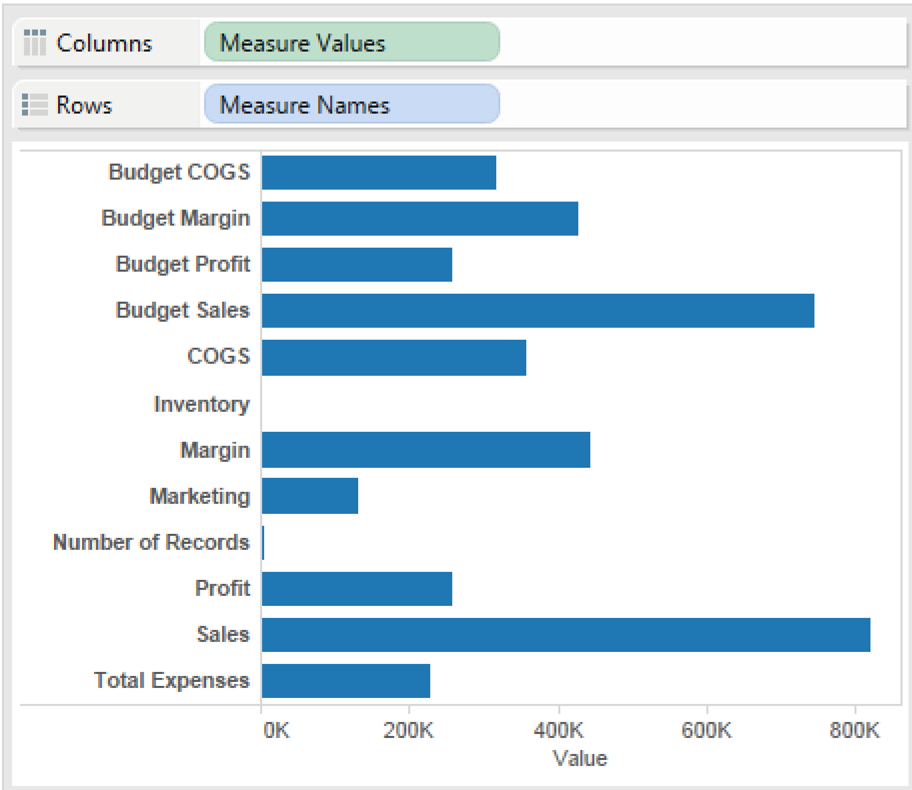
Measure Values and Measure Names

The Data pane contains a few fields that are not part of your data, two of which are **Measure Values** and **Measure Names**.

The **Measure Values** field always appears at the bottom of the **Measures** area of the **Data** pane and contains all the measures of your data collected into one field.

The **Measure Names** field always appears at the bottom of the **Dimensions** area of the **Data** pane and contains all the names of the measures collected into a single dimension.

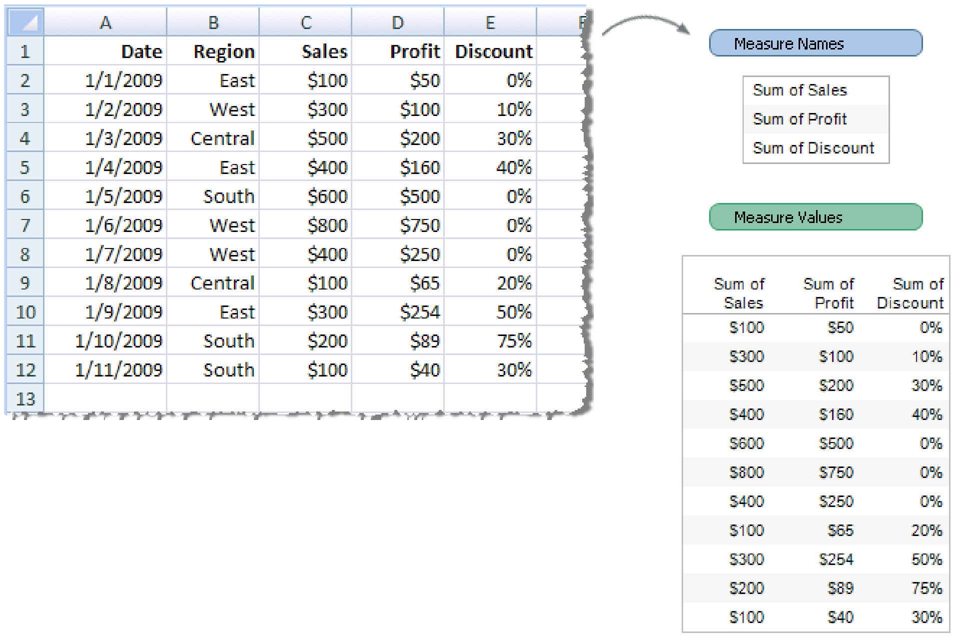
Tableau automatically creates these fields so that you can build certain types of views that involve multiple measures. In particular, use these fields if you want to display multiple measures in the same pane simultaneously. As shown below, creating a view with **Measure Values** and **Measure Names** is one way to display all the data in your data source.



Where do these fields come from?

When you connect to a data source, Tableau automatically fields to contain all of the measure names and measure values.

For example, below is a simple data source that contains three measures. From this data source, Tableau creates the fields shown on the right.



	A	B	C	D	E
1	Date	Region	Sales	Profit	Discount
2	1/1/2009	East	$100	$50	0%
3	1/2/2009	West	$300	$100	10%
4	1/3/2009	Central	$500	$200	30%
5	1/4/2009	East	$400	$160	40%
6	1/5/2009	South	$600	$500	0%
7	1/6/2009	West	$800	$750	0%
8	1/7/2009	West	$400	$250	0%
9	1/8/2009	Central	$100	$65	20%
10	1/9/2009	East	$300	$254	50%
11	1/10/2009	South	$200	$89	75%
12	1/11/2009	South	$100	$40	30%
13					

Sum of Sales	Sum of Profit	Sum of Discount
$100	$50	0%
$300	$100	10%
$500	$200	30%
$400	$160	40%
$600	$500	0%
$800	$750	0%
$400	$250	0%
$100	$65	20%
$300	$254	50%
$200	$89	75%
$100	$40	30%

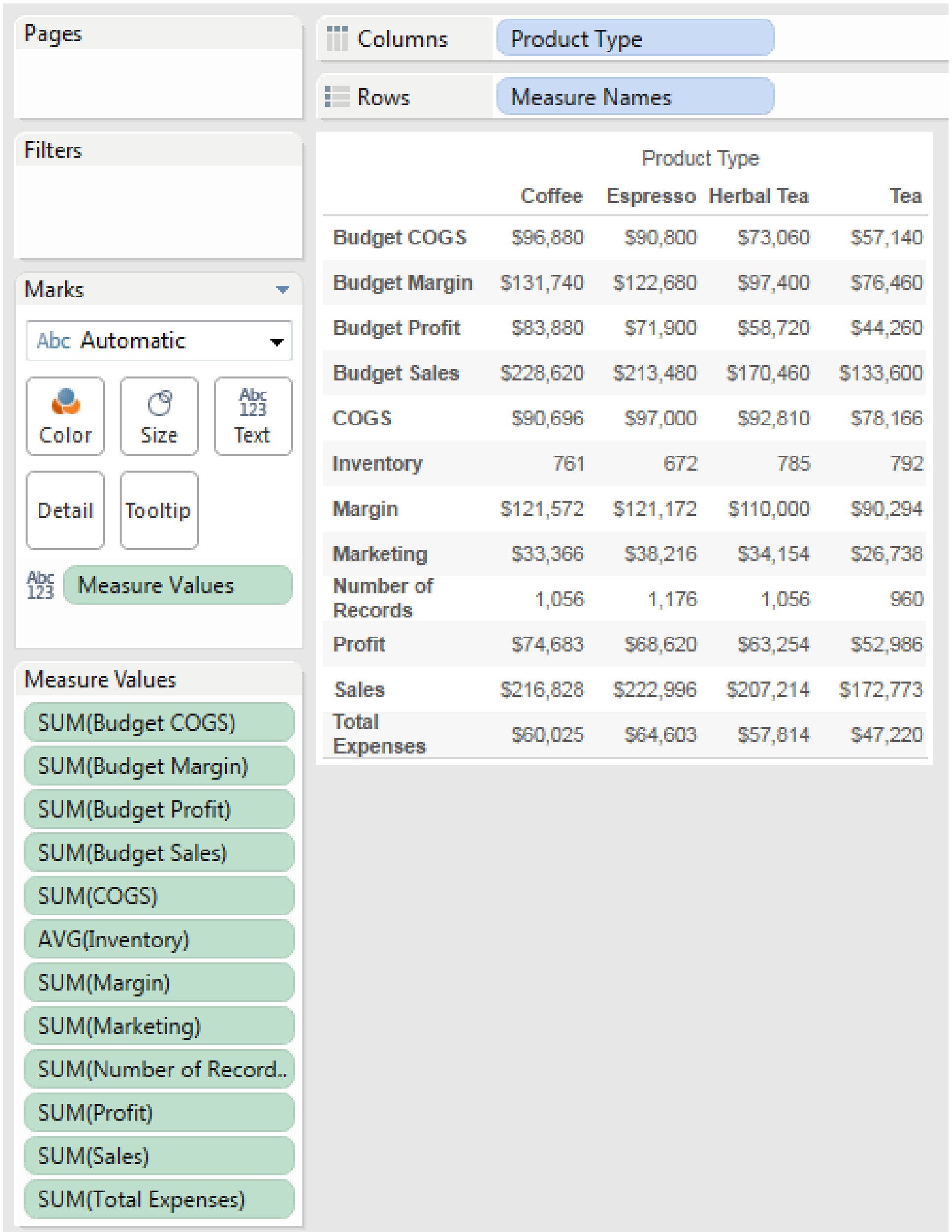
Common uses

Create a details table

Use a details table to show all of the measure values for specified categories.

For example, the text table below shows financial measures for each product type. When you use the **Measure Names** and **Measure Values** fields, the Measure Values card automatically opens below the Marks card. You can use this card to quickly add and remove measures from the view.

Drag measures to or from the Measure Values card to add them to or remove them from the view.



	Product Type			
	Coffee	Espresso	Herbal Tea	Tea
Budget COGS	$96,880	$90,800	$73,060	$57,140
Budget Margin	$131,740	$122,680	$97,400	$76,460
Budget Profit	$83,880	$71,900	$58,720	$44,260
Budget Sales	$228,620	$213,480	$170,460	$133,600
COGS	$90,696	$97,000	$92,810	$78,166
Inventory	761	672	785	792
Margin	$121,572	$121,172	$110,000	$90,294
Marketing	$33,366	$38,216	$34,154	$26,738
Number of Records	1,056	1,176	1,056	960
Profit	$74,683	$68,620	$63,254	$52,986
Sales	$216,828	$222,996	$207,214	$172,773
Total Expenses	$60,025	$64,603	$57,814	$47,220

Blend measures on a single axis

To learn how to blend measures on a single axis, see **Blended Axes** on page 858.

Number of Records

In addition to the Measure Names and Measure Values fields, the Data pane contains a **Number of Records** field that is also not part of the underlying data. This field represents the number of rows in the data source. It is useful when you are working with a data source that is primarily categorical resulting in very few measures.

Latitude and Longitude (generated)

If you have defined any fields to be geographic fields, that is, they can be used with maps, Tableau automatically geocodes your data and includes **Latitude (generated)** and **Longitude (generated)** fields. You can use these fields to overlay your data on live maps.

Data Pane Features and Functions

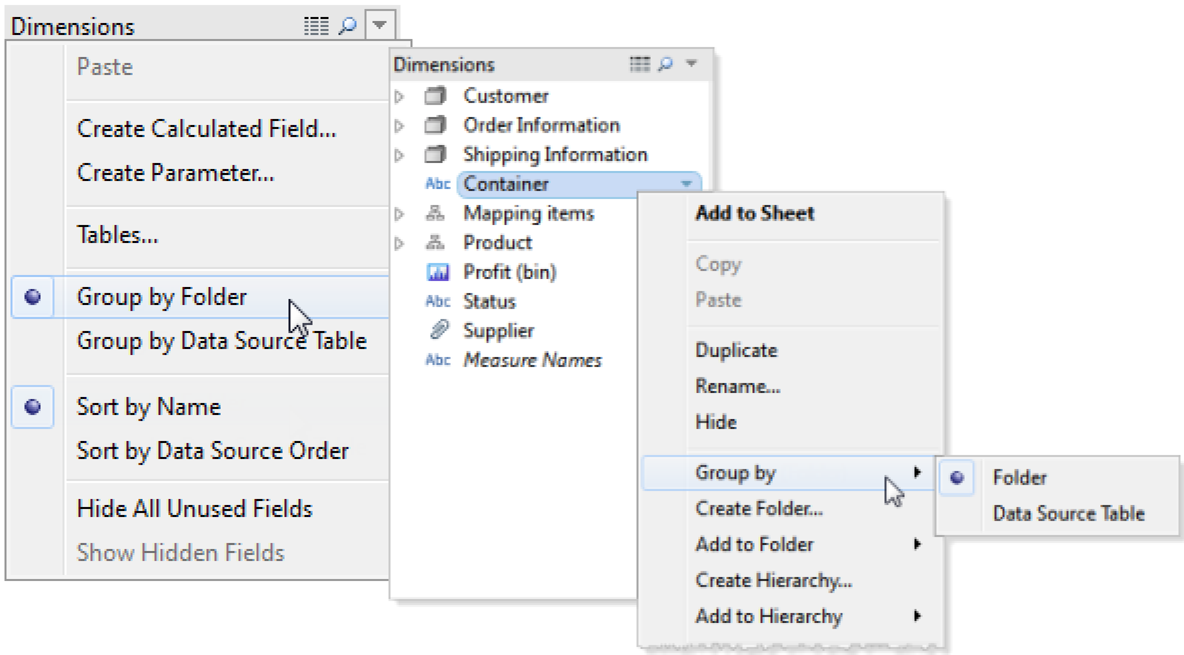
The Data pane has many features and functions to help you organize your data fields, find specific fields, and hide others.

Organize the Data Pane

You can reorganize the items in the Data pane from its default layout using folders or through sorting.

Folders

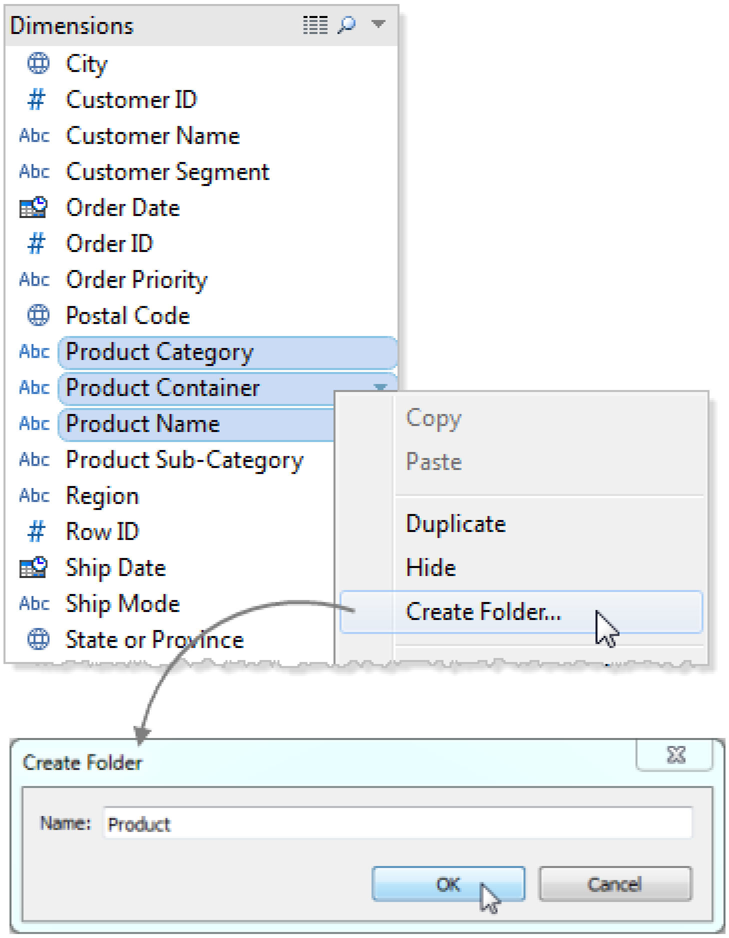
To make data sources with many fields easier to work with, you can organize the Data pane items into folders. Items like fields, parameters, and sets can be grouped into folders. The **Group by Folder** option can be accessed from the Data pane menu. Alternatively, you can also access this option from the field context menu.



When you connect to a single table in your data source, grouping by folder is enabled by default. When you connect to a data source with multiple tables, grouping by table is enabled. When the **Group by Data Source Table** option is selected, the dimensions and measures are grouped according to the database table they belong to. This is especially useful when you have several joined tables.

To group fields into folders:

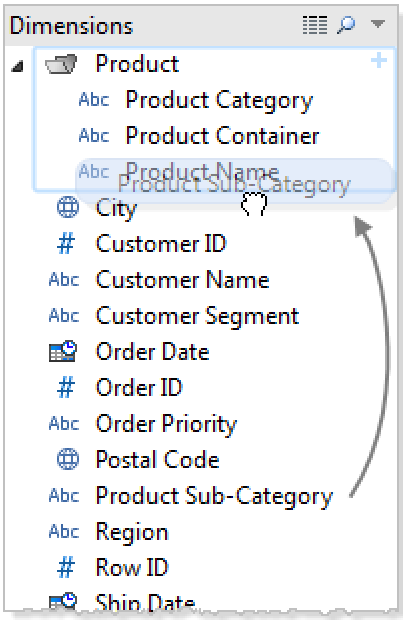
1. In the Data pane, select the fields you want to group together or right-click (control-click on Mac) an empty area in the Data pane.
2. Select **Create Folder**.
3. When prompted, name the new folder.



After you create a folder structure, you can drag fields from one folder to another or duplicate a field you want to have available in more than one folder.

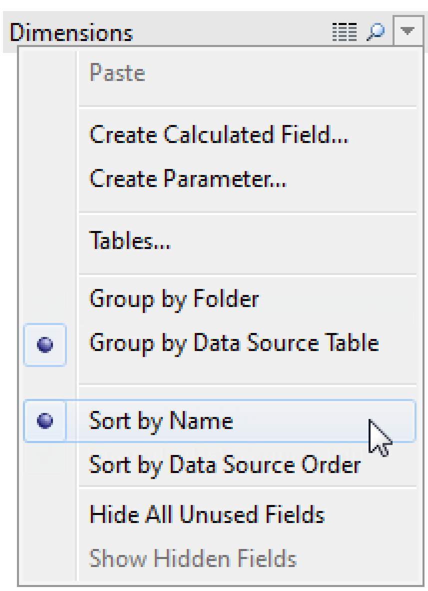
To add a field to a folder:

- Drag a field on top of the folder name to add the field to the folder. If the folder is expanded, you can drag the field into the general area of the folder.



Sort

When organizing the Data pane with or without folders, you can have Tableau sort the items. These **Sort by** options are also located in the Data pane menu.



You can sort by one of the following options:

- **Sort by Name** – lists the dimensions and measures in alphabetical order according to their field aliases.

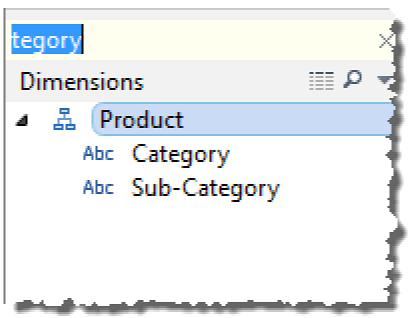
- **Sort by Data Source Order** – lists the dimensions and measures in the order they are listed in the underlying data source.

Find Fields

You can search for fields in the Data pane. When there are many fields in your data source it can be difficult to find a specific one like “Date” or “Customer” or “Profit,” or to find all fields that end in "xyz." To find a field, do the following:

Click the **Find Field** icon at the top of the Data pane (**Ctrl + F** in Windows, **Command-F** on a Mac) and enter the name of the field you want to search for. You can also enter a string of characters, to search for all field names that contain that string.

As you type in the search box, search filters the contents of the Data pane to show all fields that contain the typed string.



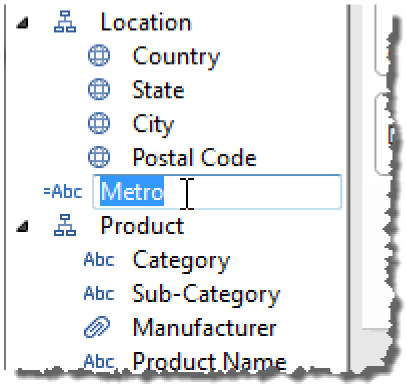
Search remains open until you click the **Find Field** icon or press **Ctrl + F** again.

Rename Fields

You can rename fields in the Data pane. For example, you could rename a field named **Customer Segment** in the data source to be **Business Segment** in Tableau. You can also rename user-created fields. Renaming a field does not change the name of the field in the underlying data source, rather it is given a special name that appears only in Tableau workbooks. The changed field name is saved with the workbook as well as when you export the data source. You can rename any type of field: dimensions, measures, sets, or parameters.

Rename a Field

1. Click field name in the Data pane and hold the mouse button down until the field name is shown in an edit box:



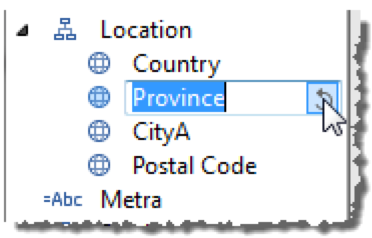
You can also press F2 or Ctrl + Enter to make the field name editable.

2. Type the new name for the field and press Enter.

The field displays with the new name in the Data pane.

Revert to the Default Field Name

If the field you renamed was from the original data source you can click the field name in the Data pane and hold the mouse button down until the field name is shown in the box. At the right of the edit field is a small circular arrow that you can click to restore the original data source field name:



To revert the names of multiple fields that were in the original data source, select them all, right-click, and then choose **Reset Names**.

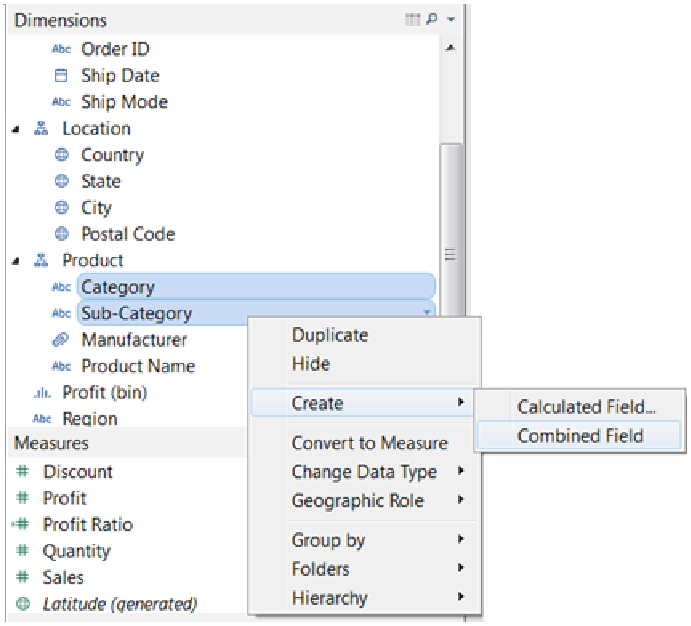
Combine Fields

Combine fields to create a cross product of members from different dimensions. You can combine dimensions if you want to encode a data view using multiple dimensions.

To combine the fields, select multiple dimensions in the Data pane and then right-click (control-click on a Mac) the fields and select **Create** > **Combined Field**.

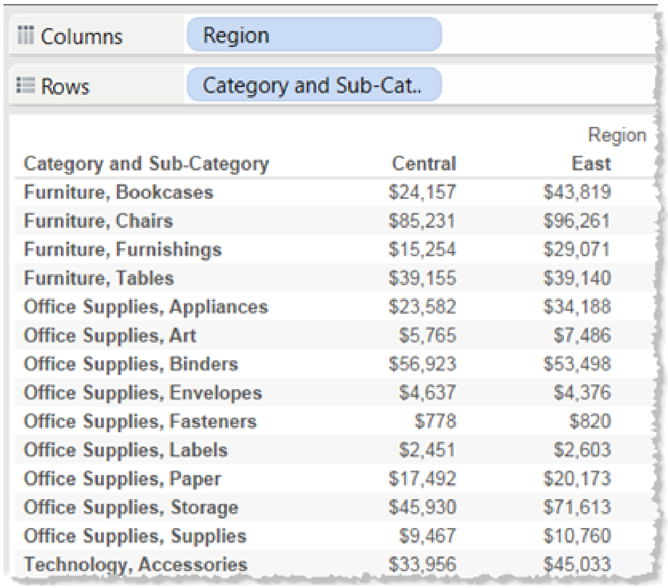
> **Note:** For cube (multidimensional) data sources, you must select levels from different hierarchies. In Tableau, cube data sources are supported only in Windows.

For example, the selections shown below will produce a new field that consists of the Category and Sub-Category dimensions.



The two dimensions are combined into a new dimension. The name of the field is automatically created from the names of the original fields. Right-click (control-click on a Mac) the new field and select **Rename** to change the name.

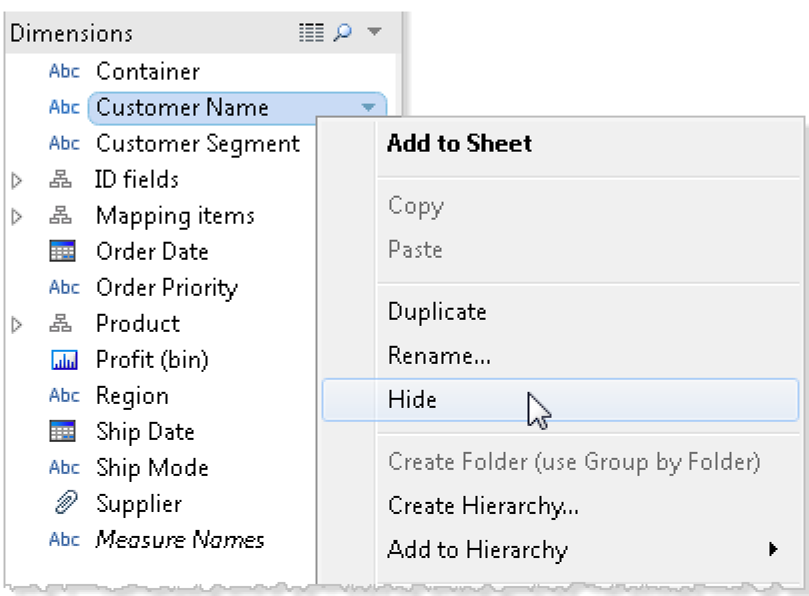
When you use the new field in a view, a header is created for each combination of the two original dimensions. For example, the view below shows the members of the combined Category and Sub-Category fields.



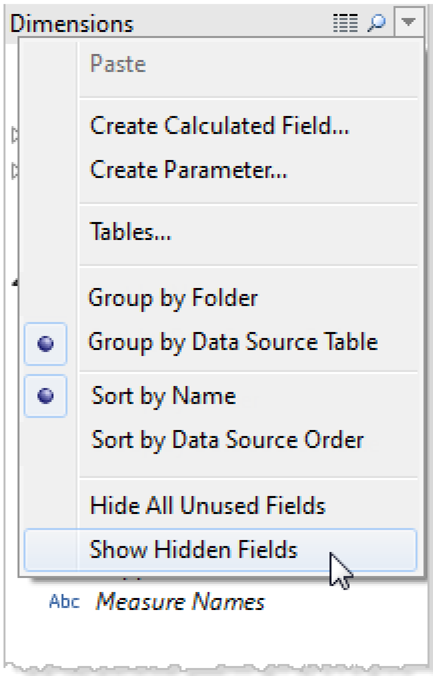
Note: For cube data sources, to choose to display the fully qualified name, right-click (control-click on a Mac) the combined field in the Data pane and select **Qualify Member Names**.

Hide or Unhide Fields

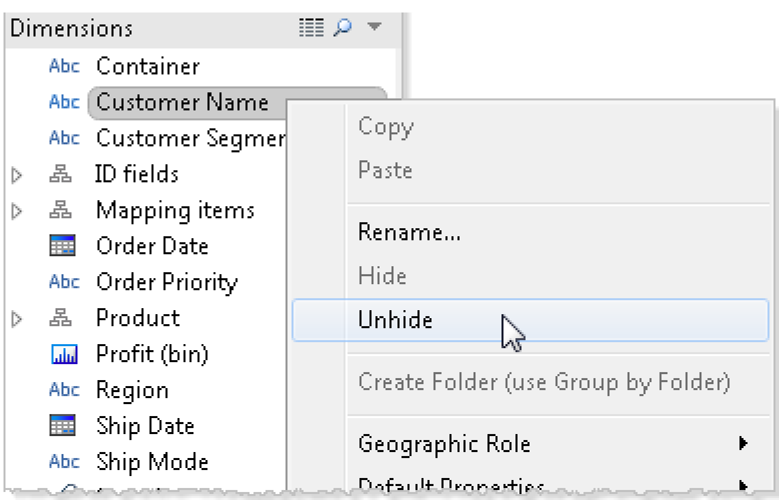
You can selectively hide or show fields in the Data pane. To hide a field, right-click (control-click on a Mac) the field and select **Hide**.



When you want to change your fields from hidden to visible, select **Show Hidden Fields** on the Data pane menu.



The hidden fields are shown in gray in the Data pane. You can then select one or more hidden fields, right-click (control-click on a Mac) and select **Unhide**.



Select **Hide All Unused Fields** on the Data pane menu to quickly hide all of the fields that are not being used in the workbook.

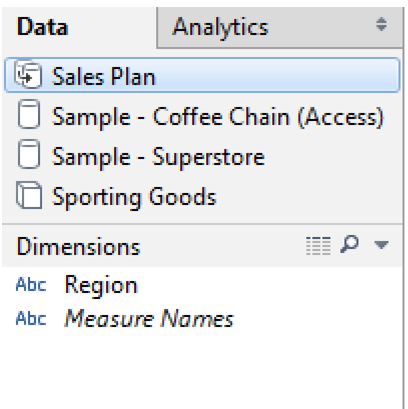
> **Note:** Hiding fields can be a good way to decrease the size of a data extract file because hidden fields are automatically excluded from the extract.

Add Calculated Fields to the Data Pane

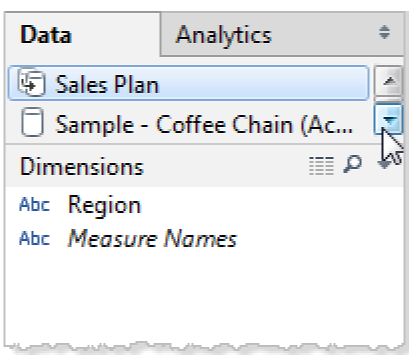
You can create calculated fields that appear in the Data pane. These new computed fields can be used like any other field. Select **Create Calculated Field** on the Data pane menu. Alternatively, select **Analysis** > **Create Calculated Field**.

Navigating Data Sources in the Data Pane

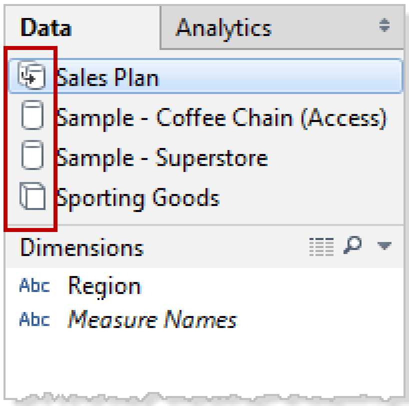
The top of the Data pane lists all of the data sources in a given workbook. Simply select the data source you want to use and the Data pane updates to show the corresponding fields in that data source.



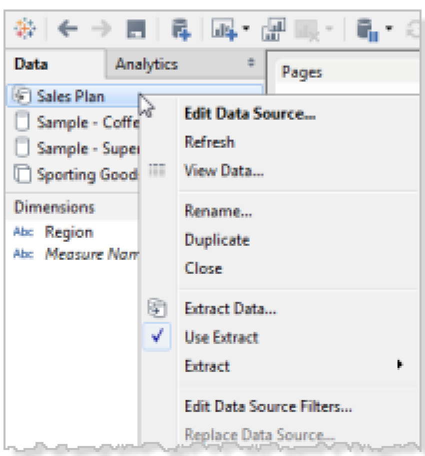
You can resize the data source list area in the Data pane to save space. When you resize to a limited vertical height, you can scroll down to a data source.



Each data source has an icon to indicate its type. For example, the icon can indicate whether the data source is relational, cube (multidimensional), or an extract. In Tableau, cube data sources are supported only in Windows.



You can right-click (control-click on a Mac) the data source to access the commands that are on the Data menu. For example, you can right-click (control-click on a Mac) a data source and rename, export, or close it.



Editing Field Properties

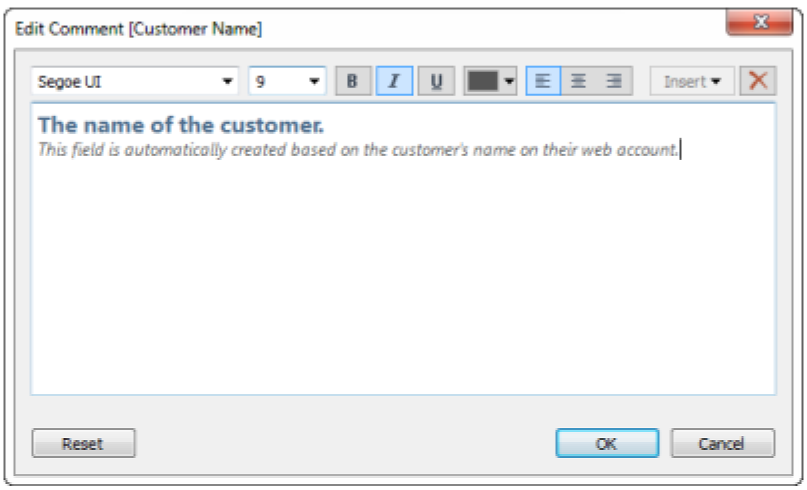
When you drag fields to shelves, the data is represented as marks in the view. You can specify settings for how the marks from each field will be displayed by setting mark properties. For example, when you place a dimension on the color shelf, the marks will be colored by the values within that dimension. You can set the Color property so that anytime you use that dimension on the color shelf your chosen colors are used. Using field properties, you can set the aliases, colors, shapes, default aggregation, and so on.

Comments

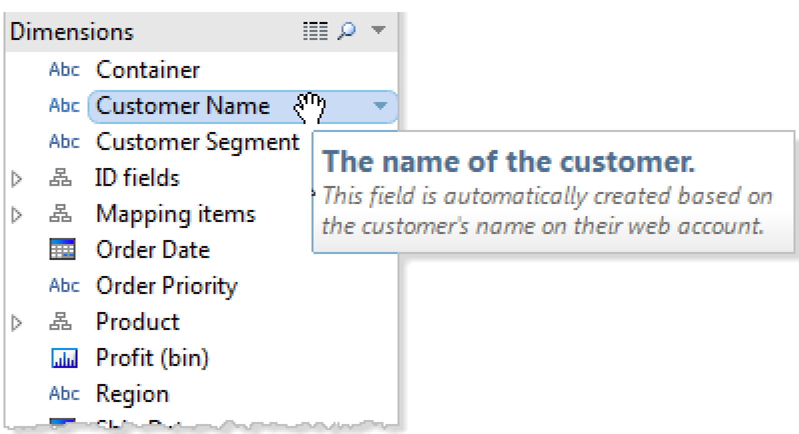
Fields can have comments that describe them. The comments display in a tooltip in the Data pane and in the Calculated fields dialog box. Field comments are a good way to give more context to the data in your data source. Comments are especially useful when you are building a workbook for others to use.

Adding a Comment to a Field

1. Right-click (control-click on a Mac) a field in the Data pane and select **Default Properties** > **Comment**.
2. Write a comment in the subsequent dialog box. Comments support rich text formatting that will be represented in the tooltip.



3. When finished, click **OK**.



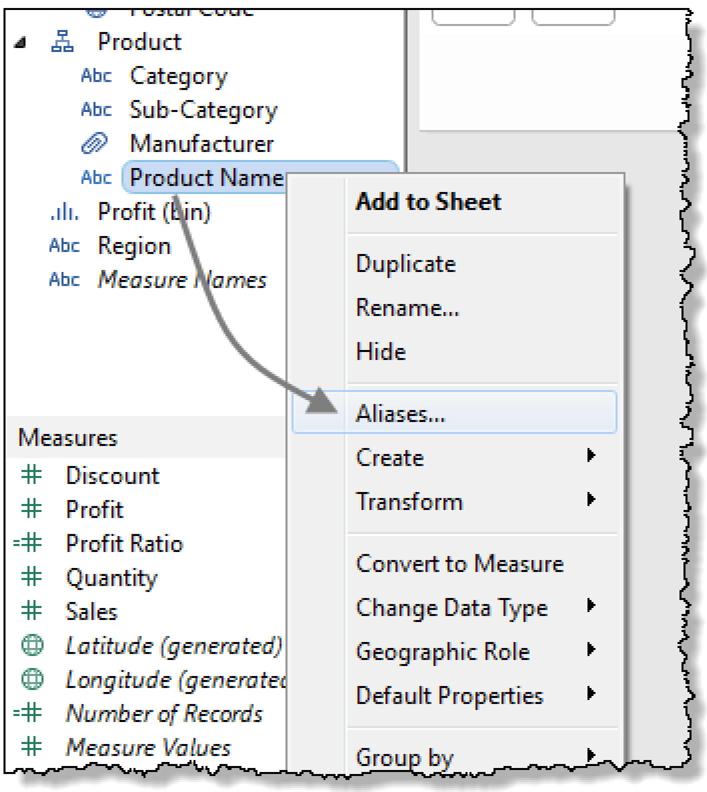
Aliases

Aliases are alternate names for specific values within a dimension. For example, you may want to assign aliases for the values of the “Customer Segment” dimension. Perhaps you want the “Consumer” members of this field to display as “Home Consumer” in all views.

Aliases can be created for the members of most dimensions in the Data pane. You cannot, however, define aliases for continuous dimensions and dates, and they do not apply to measures. The method for creating aliases depends on the type of data source you are using.

Aliases with a Relational Data Source

To create an alias for a dimension in a relational data source, right-click (control-click on Mac) a field name and select **Aliases**

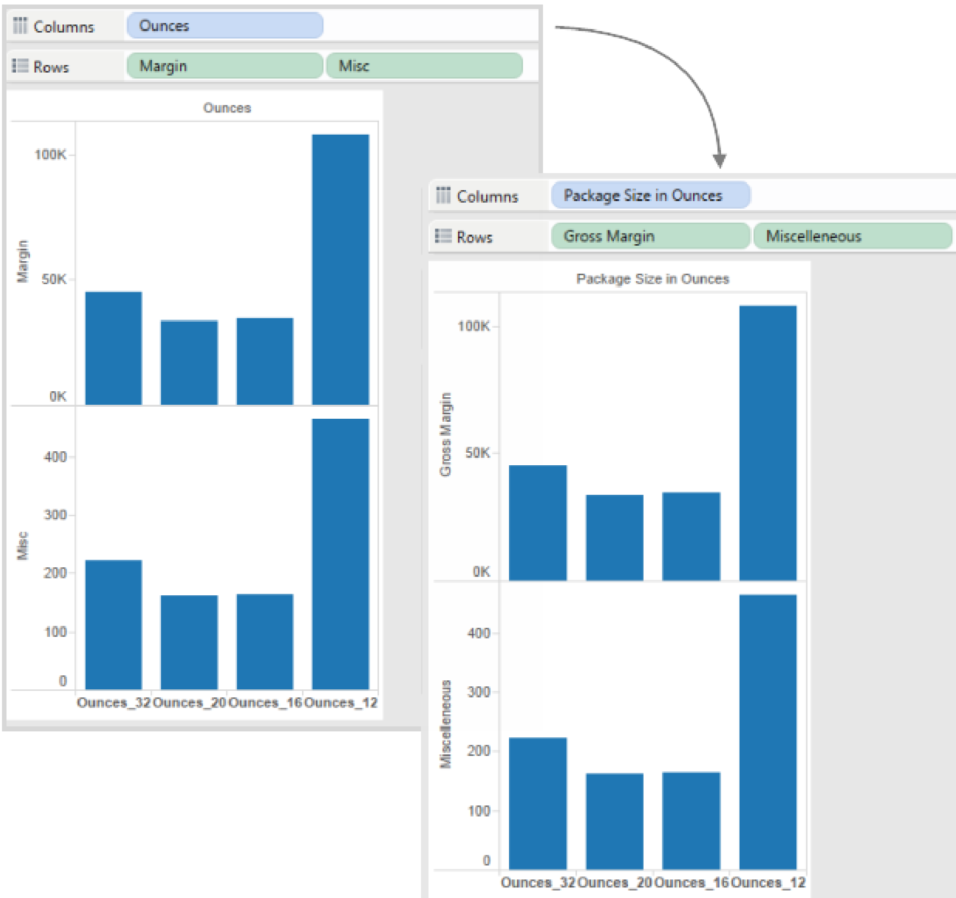


A dialog box opens allowing you to define aliases for each value within the selected dimension. You can reset the member names back to their original names by clicking the **Clear Aliases** button in the bottom right corner of the Edit Aliases dialog box.

Aliases with a Cube Data Source

Aliases for cube databases are created on the server by the server administrator and can be activated in Tableau using the **Alias File** option on the **Data** menu. Please talk to your database administrator to find out whether your database has aliases available. Aliases are not support by Microsoft Analysis Services databases.

By default the alias for every member of every dimension is initially defined to be the original member name. For example, the figure below shows a bar chart built from an Essbase database. By default, the original member names are displayed (example on the left). As you can see, these names are not very intuitive. By selecting **Data** > **Aliases File** and selecting an appropriate alias file set up by the database administrator, meaningful names are displayed in the headers.



Note: In Tableau, cube (multidimensional) data sources are supported only in Windows.

Example – Editing Aliases

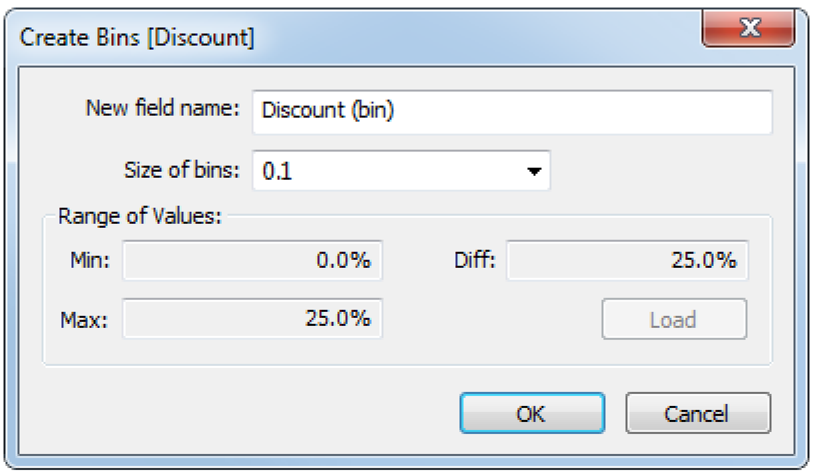
This example shows how you can use aliases to rename specific field values within a dimension. You might want to do this to show labels in your view that are more relevant to your users or your analysis than what Tableau shows by default.

In this example, suppose you have a data source that contains a measure called Discount. Discount contains values from 0 to .25 that you want to analyze by grouping them into three categories: low discount, medium discount, and high discount. To create the categories, you can use bins.

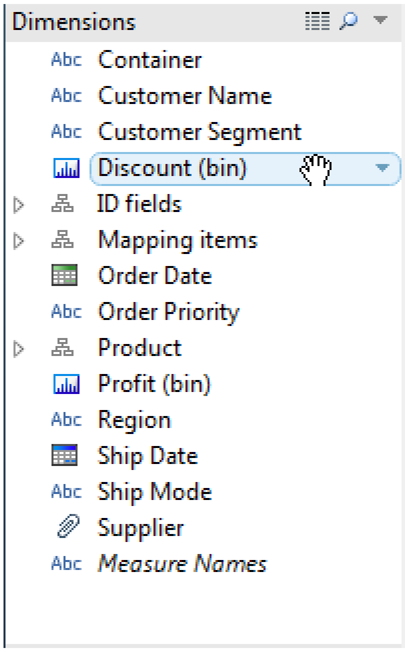
For more information about how to create bins, see **Create Discrete Bins from a Continuous Measure** on page 868.

1. In a worksheet, under **Measures**, right-click (control-click on a Mac) **Discount**, and then select **Create** > **Bins**.
2. In the Create Bins dialog box, set **Size of bins** to **0.1**. This creates three bins. The first bin contains the values 0% to 9%, the second bin contains the values 10% to 19%, and the third bin contains the values 20% and greater.

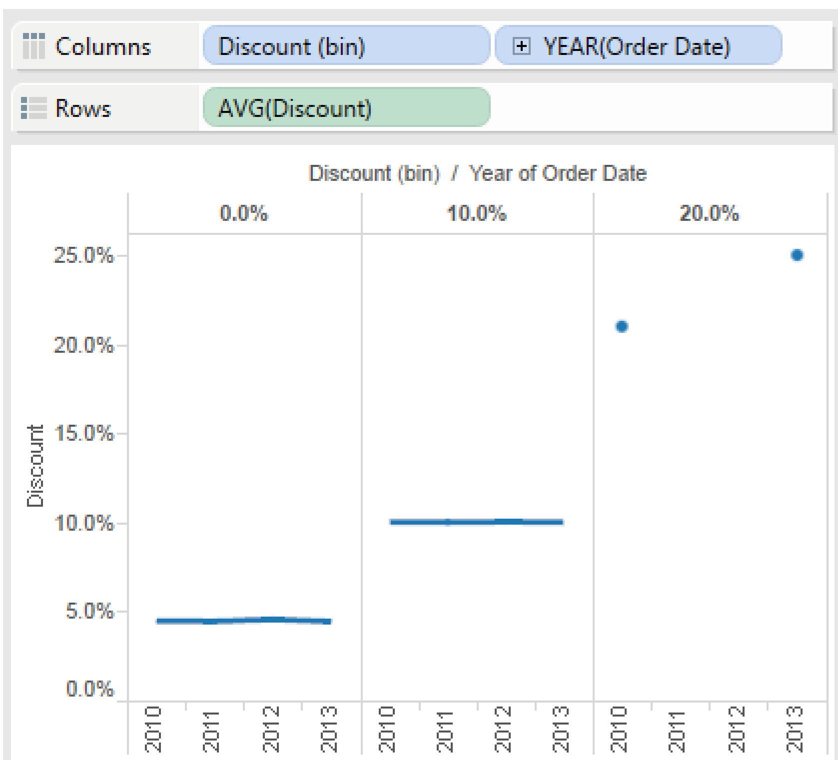
   The **Create Bins** dialog box for this field is shown below.

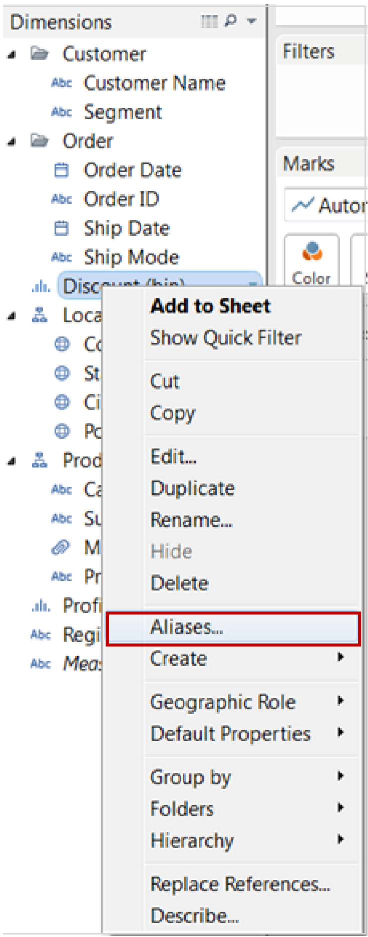
   The new binned field is named **Discount (bin)** and appears in the **Dimensions** area of the **Data** pane.



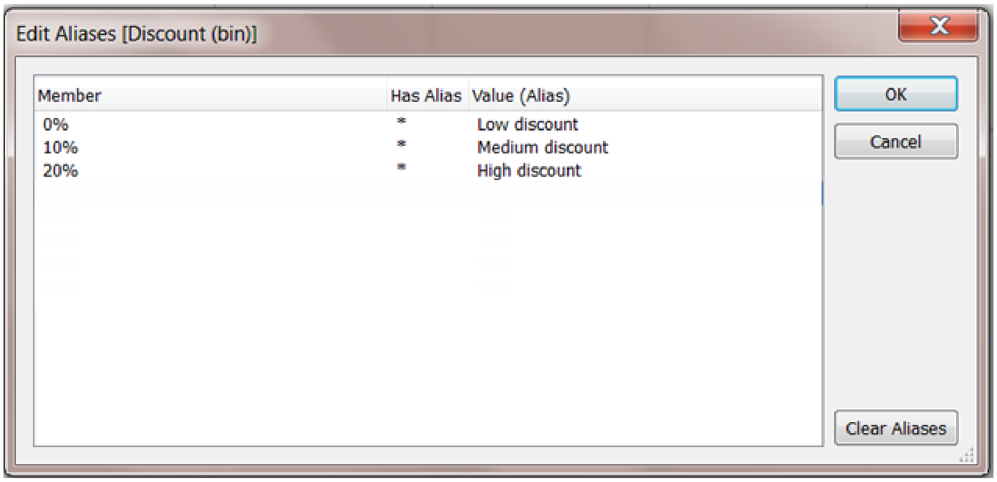
3. Place **Discount (bin)** on the **Rows** or **Columns** shelf. The default aliases for the bins are defined by the lower limit of the bin's numerical range as shown below.



4. To make this view easier to understand, you can define aliases such as “Low discount,” “Medium discount,” and “High discount” to replace the default column headings "0.0%," "10.0%," and "20.0%." To do so, right-click **Discount (bin)** in the **Data** pane, and then select **Aliases**.



5. In the Edit Aliases dialog box, assign an alias to every member of **Discount (bin)**. For example, for the member originally labeled "0.0%," assign a label “Low discount.”



6. To change an alias, right-click **Discount (bin)** in the **Data** pane, and then select **Aliases**.

   In the Edit Aliases dialog box, click the alias that you want to change, and then enter the new name. Use the Tab key to move from one value to the next.

   To restore the original aliases, click **Clear Aliases**. You can also sort the members or their aliases by clicking the appropriate column header.

Colors

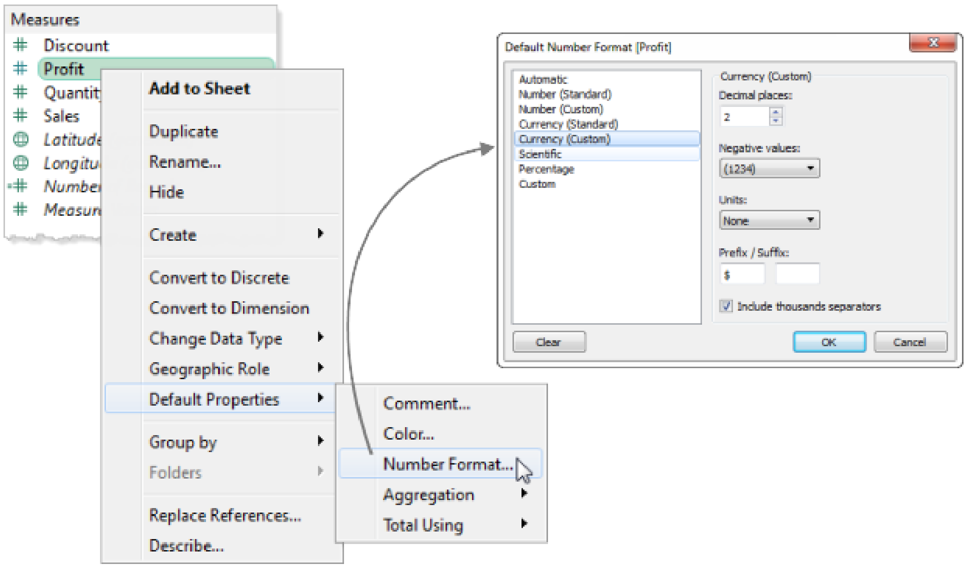
When you use a dimension to color encode the view, default colors are assigned to the field’s values. Color encodings are shared across multiple worksheets that use the same data source to help you create consistent displays of your data. For example, if you define the Western region to be green, it will automatically be green in all other views in the workbook. To set the default color encodings for a field, right-click (control-click on Mac) the field in the Data pane and select **Default Properties** > **Color**.

Shapes

When you use a dimension to shape encode the view, default shapes are assigned to the field’s values. Shape encodings are shared across multiple worksheets that use the same data source to help you create consistent displays of your data. For example, if you define that Furniture products are represented with a square mark, it will automatically be changed to a square mark in all other views in the workbook. To set the default shape encodings for a field, right-click (control-click on Mac) the field in the Data pane and select **Default Properties** > **Shape**.

Formats

You can set the default number format for date and number fields. For example, you may want to always show the Sales values as currency using the U.S. dollar sign and two decimal places. On the other hand, you may want to always show Discount as a percentage. To set the default formats, right-click (control-click on Mac) a date or number field and select either **Date Format** or **Number Format** on the Default Properties menu. A dialog box opens where you can specify a default format.



Sort

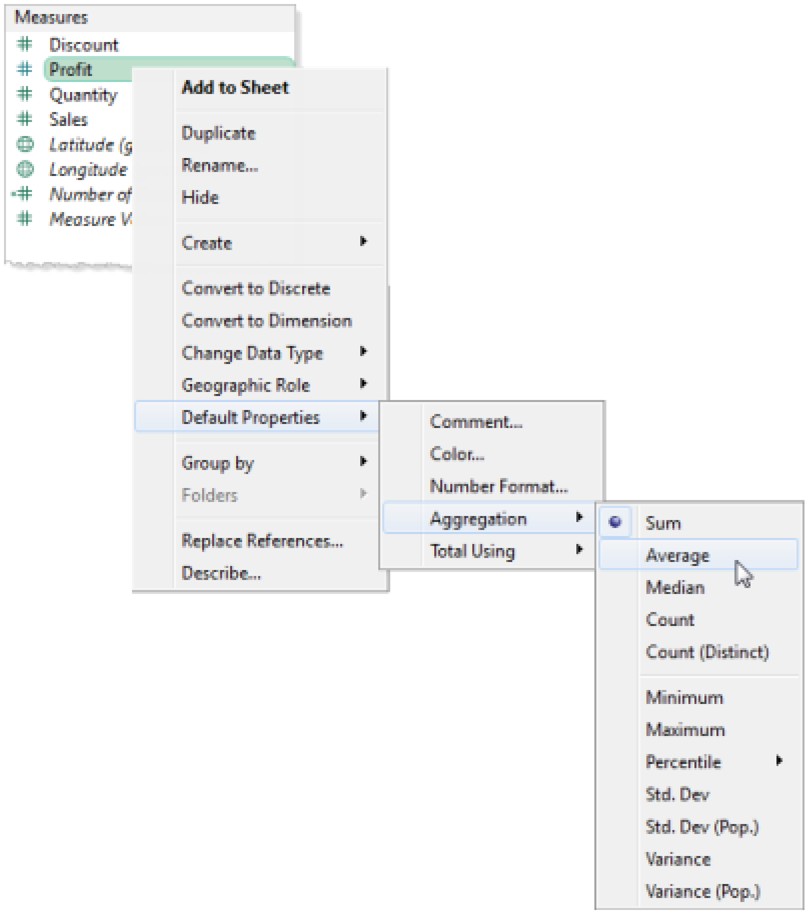
You can set a default sort order for the values within a categorical field so that every time you use the field in the view, the values will be sorted correctly. For example, let's say you have an Order Priority field that contains the values High, Medium, and Low. When you place these in the view, by default they will be listed as High, Low, Medium because they are shown in alphabetical order. You can set a default sort so that these values are always listed correctly. To set the default sort order, right-click (control-click on a Mac) a dimension and select **Default Properties** > **Sort**. Then use the sort dialog box to specify a sort order.

> **Note:** The default sort order also controls how the field values are listed in a filter in the view.

Aggregation

You can also specify a default aggregation for any measure. The default aggregation will be used automatically when the measure is first totaled in the view.

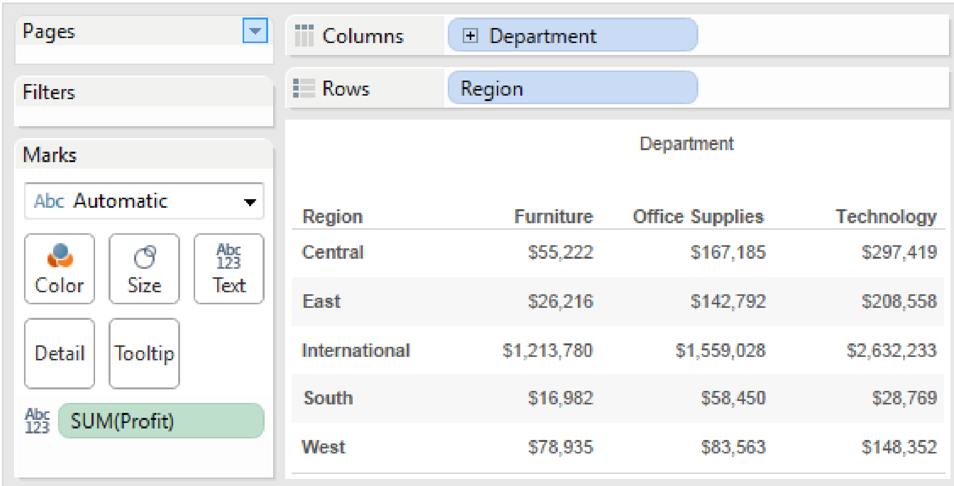
1. Right-click (control-click on a Mac) any measure in the Data pane and select **Default Properties > Aggregation**.
2. On the Aggregation list, select an aggregation.



Whether you are specifying the aggregation for a field on a shelf or the default aggregation in the Data pane, you can select from several aggregations. See **Aggregations** on page 245 to learn about each type of aggregation.

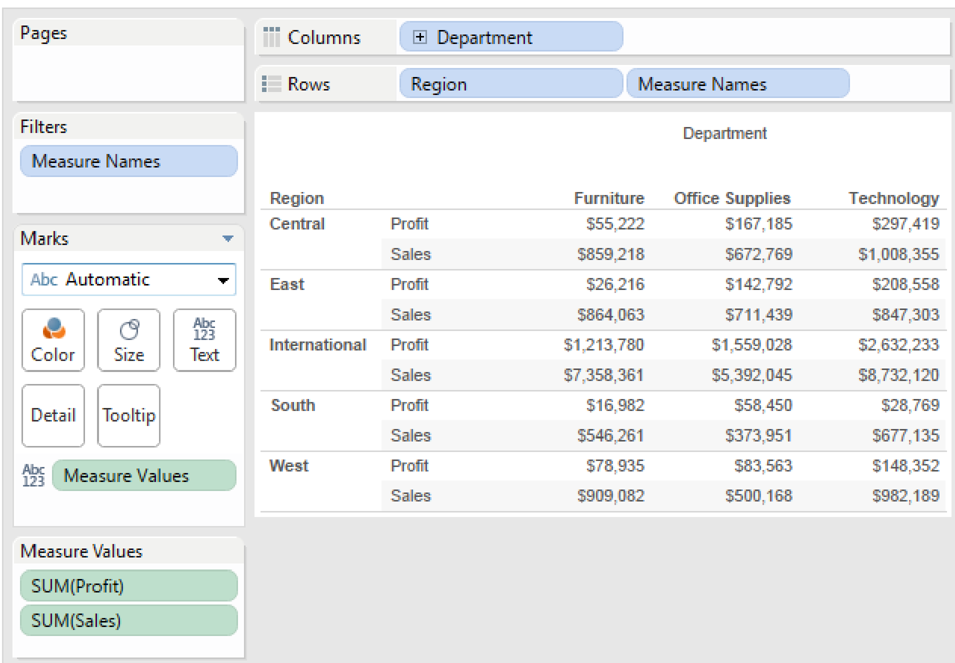
Measure Names

There are times that you will want to show multiple measures in a view and so you will use the **Measure Values** and the **Measure Names** fields. When you use Measure Names all of the measure names appear as row or column headers in the view. However, the headers include both the measure name and the aggregation label. So if you are showing the summation of profit the header displays as SUM(Profit). You can change the names so that they do not include the aggregation label by editing the member aliases of the Measure Names field. This feature becomes particularly useful when you are working with a text table that shows multiple measures. For example, suppose you have a text table containing the aggregated profit of each product department by region.



	Department		
Region	Furniture	Office Supplies	Technology
Central	$55,222	$167,185	$297,419
East	$26,216	$142,792	$208,558
International	$1,213,780	$1,559,028	$2,632,233
South	$16,982	$58,450	$28,769
West	$78,935	$83,563	$148,352

Now suppose you want to show both the Profit and the Sales for each department and region. When you add the Sales measure to the text table, the measures are combined and the Measure Values field is placed on Text. Additionally, the Measure Names field is added to the Rows shelf.



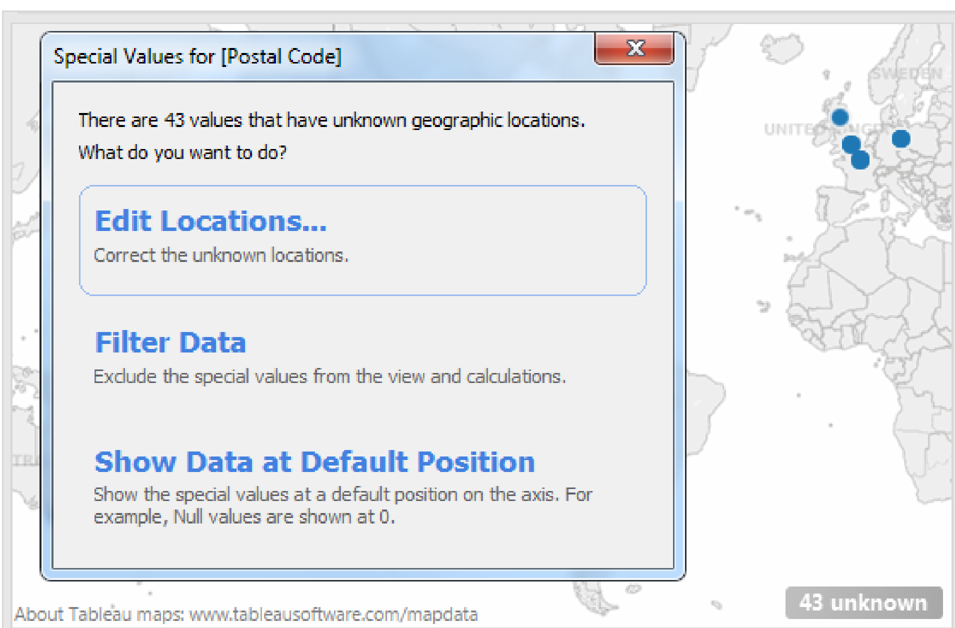
		Department		
Region		Furniture	Office Supplies	Technology
Central	Profit	$55,222	$167,185	$297,419
	Sales	$859,218	$672,769	$1,008,355
East	Profit	$26,216	$142,792	$208,558
	Sales	$864,063	$711,439	$847,303
International	Profit	$1,213,780	$1,559,028	$2,632,233
	Sales	$7,358,361	$5,392,045	$8,732,120
South	Profit	$16,982	$58,450	$28,769
	Sales	$546,261	$373,951	$677,135
West	Profit	$78,935	$83,563	$148,352
	Sales	$909,082	$500,168	$982,189

Notice how the header names removed the aggregation label by default. You may want to include the aggregations or call it "Total Profit" and "Total Sales." To change the measure names, right-click (control-click on Mac) the Measure Names field on the Rows shelf and select **Edit Aliases**. Make the changes and click **OK**.

		Department		
Region		Furniture	Office Supplies	Technology
Central	Total Profit	$55,222	$167,185	$297,419
	Total Sales	$859,218	$672,769	$1,008,355
East	Total Profit	$26,216	$142,792	$208,558
	Total Sales	$864,063	$711,439	$847,303
International	Total Profit	$1,213,780	$1,559,028	$2,632,233
	Total Sales	$7,358,361	$5,392,045	$8,732,120
South	Total Profit	$16,982	$58,450	$28,769
	Total Sales	$546,261	$373,951	$677,135
West	Total Profit	$78,935	$83,563	$148,352
	Total Sales	$909,082	$500,168	$982,189

Special Values

Some data requires special handling in Tableau. Specifically null values, unrecognized or ambiguous geographic locations, negative or zero values when working with a logarithmic scale, and negative or zero values when working with treemaps. When your data contains these special values, Tableau cannot plot them in the view. Instead, an indicator displays in the lower right corner of the view. Click the indicator to see more options for how to handle these values.



Null Numbers and Dates and Negative Values on Log Axes

When you drag a measure or continuous date to the view, the values are shown along a continuous axis. If the field contains null values or there are zero or negative values on a logarithmic axis, Tableau cannot plot them. Instead, these values are shown using an indicator in the lower right corner of the view. Click the indicator and choose from the following options:

- **Filter Data** - exclude the null values from the view using a filter. When you filter data, the null values are also excluded from any calculations used in the view.
- **Show Data at Default Position** - show the data at a default location on the axis. The null values will still be included in calculations. The default position depends on the data type. The table below defines the defaults.

Type of Data	Default Position
Numbers	0
Dates	12/31/1899
Negative Values on a Log Axis	1
Unknown Geographic Location	(0,0)

Unknown Geographic Locations

When working with maps and geographic fields, any unknown or ambiguous locations display in the indicator in the lower right corner of the view. Click the indicator and choose from the following options:

- **Edit Locations** - correct the locations by mapping your data to known locations.
- **Filter Data** - exclude the unknown locations from the view using a filter. The locations will not be included in calculations.
- **Show Data at Default Position** - show the values at the default position of (0, 0) on the map.

Zero and Negative Values in Treemaps

When working with treemaps, any null or zero values display in the indicator in the lower right corner of the view. Click the indicator and choose from the following options:

- **Filter Data** - exclude the unknown locations from the view using a filter. The locations will not be included in calculations.
- **Use Absolute Values** - use the absolute value to determine the size of the corresponding area in the view. For example, both values of 5 and -5 are shown as the same size.

If you don’t know how to handle the values, you can choose to leave the special values indicator. Generally, you should continue to show the indicator so that you know there is data that is not being shown in the view. However, to optionally hide the indicator, right-click (control-click on a Mac) it and select **Hide Indicator**.

Aggregations

Sometimes it is useful to look at numerical data in an aggregated form such as a summation or an average. The mathematical functions that produce aggregated data are called aggregation functions. Aggregation functions perform a calculation on a set of values and return a single value. For example, a measure that contains the values 1, 2, 3, 3, 4 aggregated as a sum returns a single value: 13. Or if you have 3,000 sales transactions from 50 products in your data source, you might want to view the sum of sales for each product, so that you can decide which products have the highest revenue.

You can use Tableau to set an aggregation only for measures in relational data sources. Multidimensional data sources contain aggregated data only.

> **Note**: Using floating-point values in combination with aggregations can sometimes lead to unexpected results. For details, see **Data Types** on page 1407.

Tableau provides a set of predefined aggregations that are shown in the table below. You can set the default aggregation for any measure that is not a calculated field that itself contains an aggregation, such as `AVG([Discount])`. See **How to Set the Default Aggregation for a Measure** on page 249. You can also set the aggregation for a field already in the view. See **Aggregating Data** on page 250.

Aggregation	Description	Result for measure that contains 1, 2, 2, 3
Attribute	Returns the value of the given expression if it only has a single value for all rows in the group, otherwise it displays an asterisk (*) character. Null values are ignored. This aggregation is particularly useful when aggregating a dimension. To set a measure in the view to this aggregation, right-click (control-click on Mac) the measure and choose **Attribute**. The field then changes to show the text ATTR: 	N/A
Dimension	Returns all unique values in a measure or dimension.	3 values (1, 2, 3)
Sum	Returns the sum of the numbers in a measure. Null values are ignored.	1 value (8)

Aggregation	Description	Result for measure that contains 1, 2, 2, 3
Average	Returns the arithmetic mean of the numbers in a measure. Null values are ignored.	1 value (2)
Median	Returns the median of the numbers in a measure. Null values are ignored. This aggregation is not available for workbooks created before Tableau Desktop 8.2 or that use legacy connections. It is also not available for connections using any of the following data sources: • Access • Amazon Redshift • Cloudera Hadoop • HP Vertica • IBM DB2 • IBM Netezza • Microsoft Excel • Microsoft SQL Server • MySQL • Teradata • Text files If you are connected to a workbook that uses one of these types of data sources, Median is unavailable and Tableau shows the message "Requires extract." To use this aggregation, extract your data. See **Extract Your Data** on page 379.	1 value (2)
Count	Returns the number of rows in a measure or a dimension. When applied to a dimension, Tableau creates a new temporary column that is a measure because the result of a count is a number. You can count numbers, dates, booleans, and strings. Null values are ignored in all cases.	1 value (4)
Count (Distinct)	Returns the number of unique values in a measure or dimension. When applied to a dimension, Tableau creates a new temporary column that is a measure because the result of a count is a number. You can count numbers, dates, booleans, and strings. Null	1 value (3)

Aggregation	Description	Result for measure that contains 1, 2, 2, 3
	values are ignored in all cases. This aggregation is not available for workbooks: • Created before Tableau Desktop 8.2 and that use Microsoft Excel or Text File data sources. • That use legacy connections. • That use Microsoft Access data sources. If you are connected to a workbook that uses one of these data sources, Count (Distinct) is unavailable and Tableau shows the message "Requires extract." To use this aggregation, extract your data. See **Extract Your Data** on page 379.	
Minimum	Returns the smallest number in a measure or continuous dimension. Null values are ignored.	1 value (1)
Maximum	Returns the largest number in a measure or a continuous dimension. Null values are ignored.	1 value (3)
Percentile	Returns the value at the specified percentile for the measure. When you select this aggregation, you must choose from a submenu offering a range of percentile values: 5, 10, 25, 50, 75, 90, 95. When you set this aggregation on a field in the view, the field shows PCT and the percent value assigned. For example: PCT95(BMI) If you want to use a percentage value other than the ones listed, use the PERCENTILE function in a calculation and specify the percentile you want. See **Aggregate Functions** on page 1434. This aggregation is available for: • Non-legacy Microsoft Excel and Text File connections. • Extracts and extract-only data source types (for example, Google Analytics, OData, or	1 value. The value for PCT50 would be 2 for the given data.

Aggregation	Description	Result for measure that contains 1, 2, 2, 3
	Salesforce). • Sybase IQ 15.1 and later data sources. • Oracle 10 and later data sources. • Cloudera Hive and Hortonworks Hadoop Hive data sources. • EXASolution 4.2 and later data sources. If you are not connected to a workbook that uses one of these types of data sources, Percentile is unavailable and Tableau shows the message "Requires extract." In this case, if you want to use the Percentile aggregation, consider creating an extract. See **Extract Your Data** on page 379.	
Std. Dev	Returns the standard deviation of all values in the given expression based on a sample population. Null values are ignored. Returns a Null if there are fewer than 2 members in the sample that are not Null. Use this function if your data represents a sample of the population.	1 value (0.8165)
Std. Dev (Pop.)	Returns the standard deviation of all values in the given expression based on a biased population. Assumes that its arguments consist of the entire population. Use this function for large sample sizes.	1 value (0.7071)
Variance	Returns the variance of all values in the given expression based on a sample. Null values are ignored. Returns a Null if there are fewer than 2 members in the sample that are not Null. Use this function if your data represents a sample of the population.	1 value (0.6667)
Variance (Pop.)	Returns the variance of all values in the given expression based on a biased population. Assumes that its arguments consist of the entire population. Use this function for large sample sizes.	1 value (0.5000)

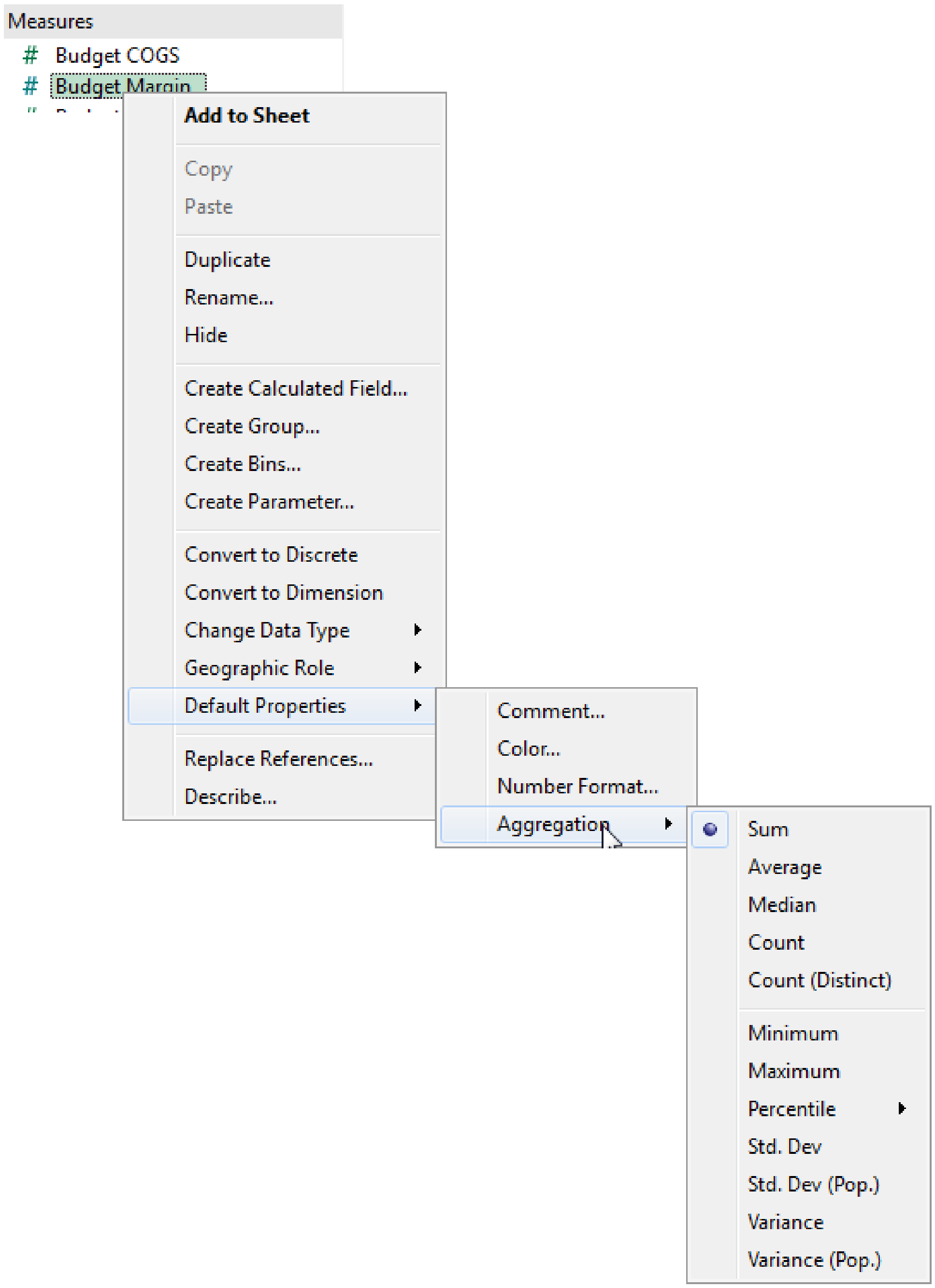
Aggregation	Description	Result for measure that contains 1, 2, 2, 3
Disaggregate	Returns all records in the underlying data source. To disaggregate all measures in the view, select **Aggregate Measures** from the Analysis menu (to clear the check mark). Tableau allows you to view data in disaggregated form (relational databases only). When data are disaggregated, you can view all of the individual rows of your data source. For example, after discovering that the sum of sales for rubber bands is $14,600, you might want to see the distribution of individual sales transactions. To answer this question, you need to create a view that shows individual rows of data. That is, you need to disaggregate the data (see **Disaggregating Data** on page 254). Another way to look at disaggregated data is to view the underlying data for all or part of a view. See **View Data** on page 852.	4 values (1, 2, 2, 3)

You can also define custom aggregations as described in **Aggregate Calculations** on page 1022. Depending on the type of data view you create, Tableau will apply these aggregations at the appropriate level of detail. For example, Tableau will apply the aggregation to individual dimension members (the average delivery time in the East region), all members in a given dimension (the average delivery time in the East, West, and Central regions), or groups of dimensions (the sum of sales for all regions and for all markets).

How to Set the Default Aggregation for a Measure

You can set the default aggregation for any measure that is not a calculated field that itself contains an aggregation, such as `AVG([Discount])`. A default aggregation is a preferred calculation for summarizing a continuous or discrete field. The default aggregation is automatically used when you drag a measure to a view. To change the default aggregation, right-click (control-click on Mac) a measure in the Data pane and select **Default Properties** > **Aggregation** and then select one of the options.

> **Note**: You can use Tableau to aggregate measures only with relational data sources. Multidimensional data sources contain aggregated data only.

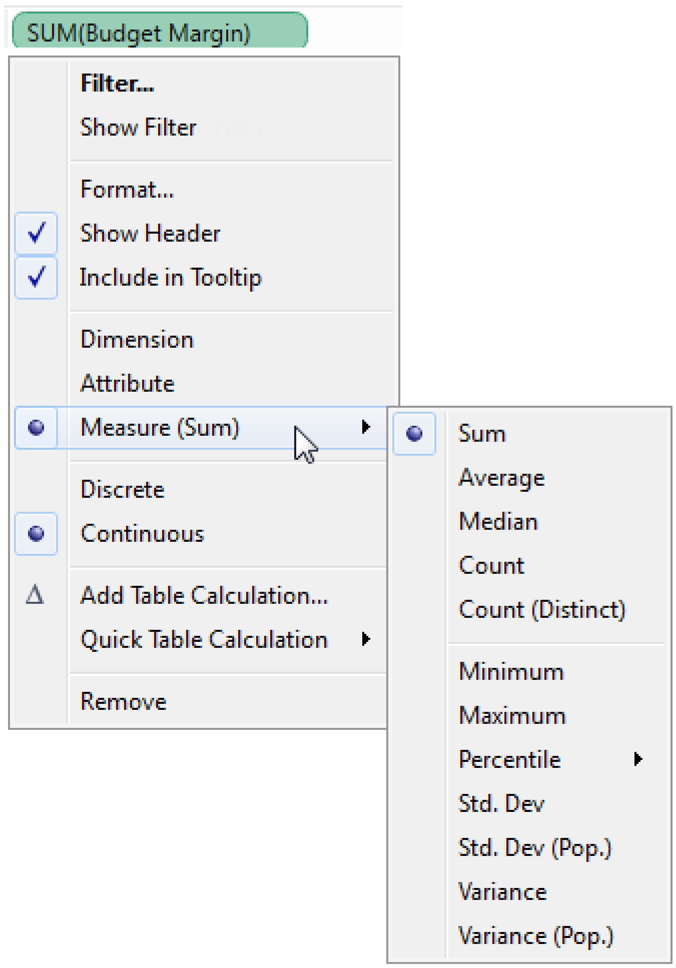


Aggregating Data

When you place a measure on a shelf, Tableau automatically aggregates the data, usually by summing it. You can easily determine the aggregation applied to a field because the function always appears in front of the field's name when it is placed on a shelf. For example, **Sales** becomes **SUM(Sales)**.

You can aggregate measures using Tableau only for relational data sources. Multidimensional data sources contain aggregated data only. In Tableau, multidimensional data sources are supported only in Windows.

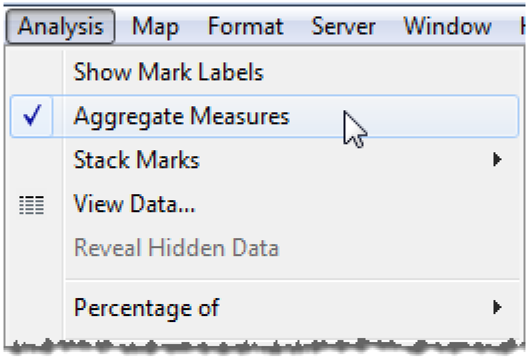
You can change the aggregation of a field by selecting a different function from the field's context menu. As shown below, all of the predefined aggregations are available from this menu.



Aggregating Measures

You can assign a different aggregation to every measure you place on a shelf. For example, you can aggregate **Sales** as a summation, **Profit** as a maximum, and **Discount** as an average.

You can change the aggregation state for all the measures on a worksheet by selecting the **Analysis** > **Aggregate Measures** menu item.

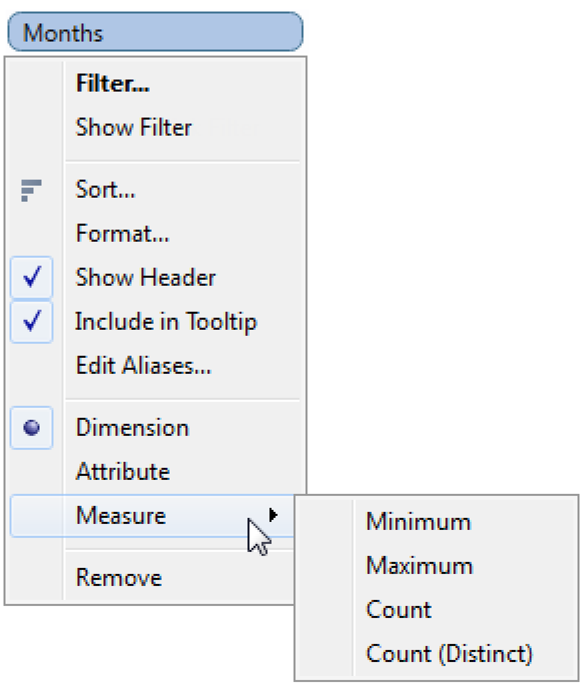


When all measures are disaggregated you see a mark for each row in the view. You cannot select specific marks to Keep Only, Exclude, or create a Set when all measures are disaggregated.

Aggregating Dimensions

A dimension can be aggregated as a measure using **Minimum**, **Maximum**, **Count**, or **Count (Distinct)**. When you aggregate dimensions, you create a new temporary measure column, so the dimension is now viewed as a measure.

> **Count (Distinct)** is not supported for Microsoft Access, Microsoft Excel, and Text File data sources. If you are connected to one of these types of data sources, the **Count (Distinct)** aggregation is unavailable and shows the remark "Requires extract.")



Another way to view a dimension is to treat it as an Attribute. Do this by choosing **Attribute** from the context menu for the dimension. When you aggregate a dimension as an attribute, it is treated like a label instead of partitioning the data. The Attribute aggregation has several uses such as ensuring a consistent level of detail when blending multiple data sources, providing a way to aggregate dimensions when computing table calculations, which require an aggregate expression, and finally it can increase query performance because it is computed locally.

Tableau computes Attribute using the following formula:

```
IF MIN([dimension]) = MAX([dimension]) THEN MIN([dimension]) ELSE
"*" END
```

The formula is computed in Tableau after the data is retrieved from the initial query. The asterisk (*) is actually a visual indicator of a special type of Null value that occurs when there are multiple values. See **Troubleshoot Data Blending** on page 376 to learn more about the asterisk.

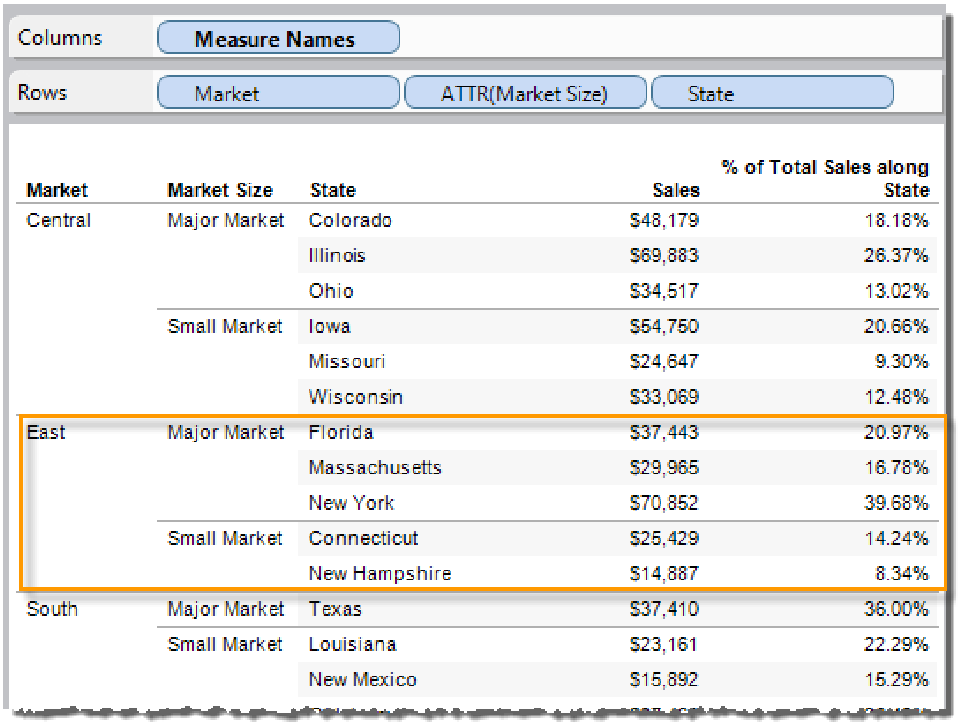
Below is an example of using Attribute in a table calculation. The table shows sales by market, market size, and state. Suppose you wanted to compute the percent of total sales each state contributed to the market. When you add a Percent of Total **Quick Table Calculations** on page 1042 that computes along State, the calculation computes within the red area shown below. This is because the Market Size dimension is partitioning the data.

Columns: Measure Names

Rows: Market | Market Size | State

Market	Market Size	State	Sales	% of Total Sales along State
Central	Major Market	Colorado	$48,179	31.58%
		Illinois	$69,883	45.80%
		Ohio	$34,517	22.62%
	Small Market	Iowa	$54,750	48.68%
		Missouri	$24,647	21.92%
		Wisconsin	$33,069	29.40%
East	Major Market	Florida	$37,443	27.08%
		Massachusetts	$29,965	21.67%
		New York	$70,852	51.25%
	Small Market	Connecticut	$25,429	63.07%
		New Hampshire	$14,887	36.93%
South	Major Market	Texas	$37,410	100.00%
	Small Market	Louisiana	$23,161	34.82%
		New Mexico	$15,892	23.89%

When you aggregate Market Size as an Attribute, the calculation is computed within the Market (East, in this case), and the Market Size information is used purely as a label in the display.



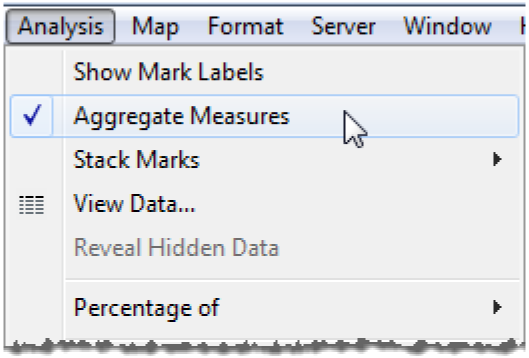
Market	Market Size	State	Sales	% of Total Sales along State
Central	Major Market	Colorado	$48,179	18.18%
		Illinois	$69,883	26.37%
		Ohio	$34,517	13.02%
	Small Market	Iowa	$54,750	20.66%
		Missouri	$24,647	9.30%
		Wisconsin	$33,069	12.48%
East	Major Market	Florida	$37,443	20.97%
		Massachusetts	$29,965	16.78%
		New York	$70,852	39.68%
	Small Market	Connecticut	$25,429	14.24%
		New Hampshire	$14,887	8.34%
South	Major Market	Texas	$37,410	36.00%
	Small Market	Louisiana	$23,161	22.29%
		New Mexico	$15,892	15.29%

Disaggregating Data

Disaggregating your data allows you to view every row of the data source which can be useful when you are analyzing measures that you may want to use both independently and dependently in the view. For example, you may be analyzing the results from a product satisfaction survey with the Age of participants along one axis. You can aggregate the **Age** field to determine the average age of participants or disaggregate the data to determine at what age participants were most satisfied with the product.

> **Note:** If your data source is very large, disaggregating the data can result in a significant performance degradation.

You can disaggregate all measures in the view by selecting **Analysis** > **Aggregate Measures**.

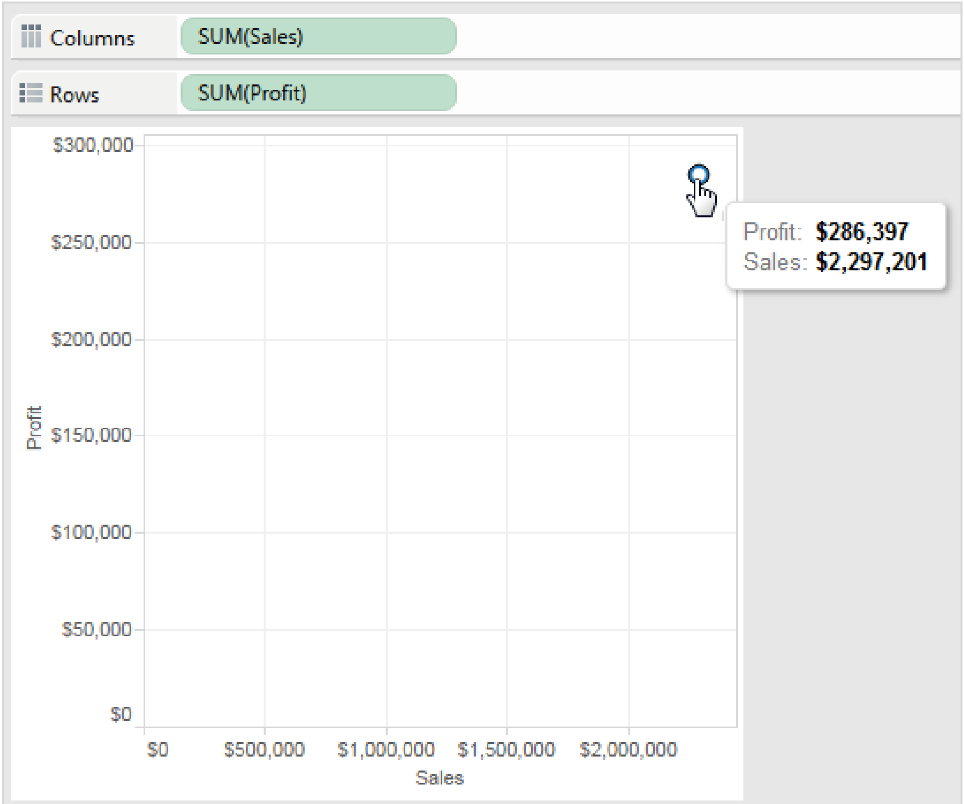


Example – Scatter Plots and Aggregation

If you place one measure on the **Rows** shelf and another measure on the **Columns** shelf, you are asking Tableau to compare two numerical values. Typically, Tableau chooses a scatterplot as the default visualization in such cases. The initial view can be disappointing—a single mark, showing the sum for all values for the two measures. There are various ways to develop such a scatterplot: **you can use dimensions to add detail**, you can add additional measures and/or dimensions to the Rows and Columns shelves to create multiple one-mark scatter plots in the view, or you can **disaggregate the data**. (Or you can use any combination of these options.) This topic looks at these alternatives, and uses the **Sample-Superstore** data source. To create the initial view, follow these steps:

1. Place the **Sales** measure on the **Columns** shelf.
2. Place the **Profit** measure on the **Rows** shelf.

The measures are automatically aggregated as sums. The default aggregation (SUM) is indicated in the field names. The values shown in the tooltip show the sum of sales and profit values across every row in the data source.



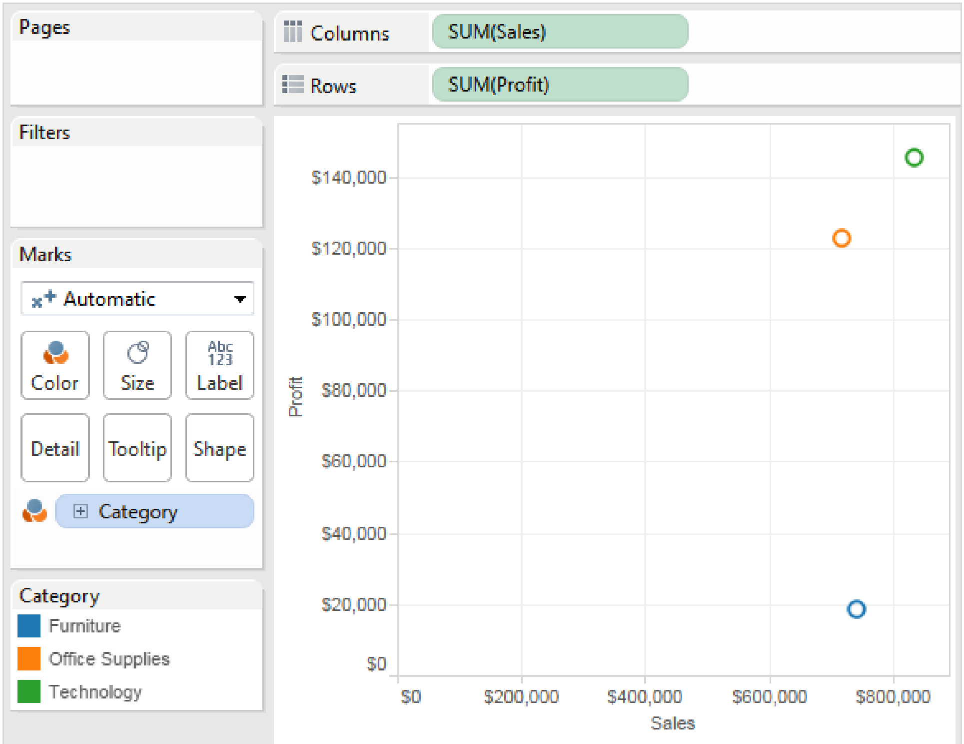
Follow the steps below to use dimensions to add detail to the view and to disaggregate data.

Using Dimensions to Add Detail

Follow these steps to develop the scatter plot view you created above by adding dimensions to show additional levels of detail.

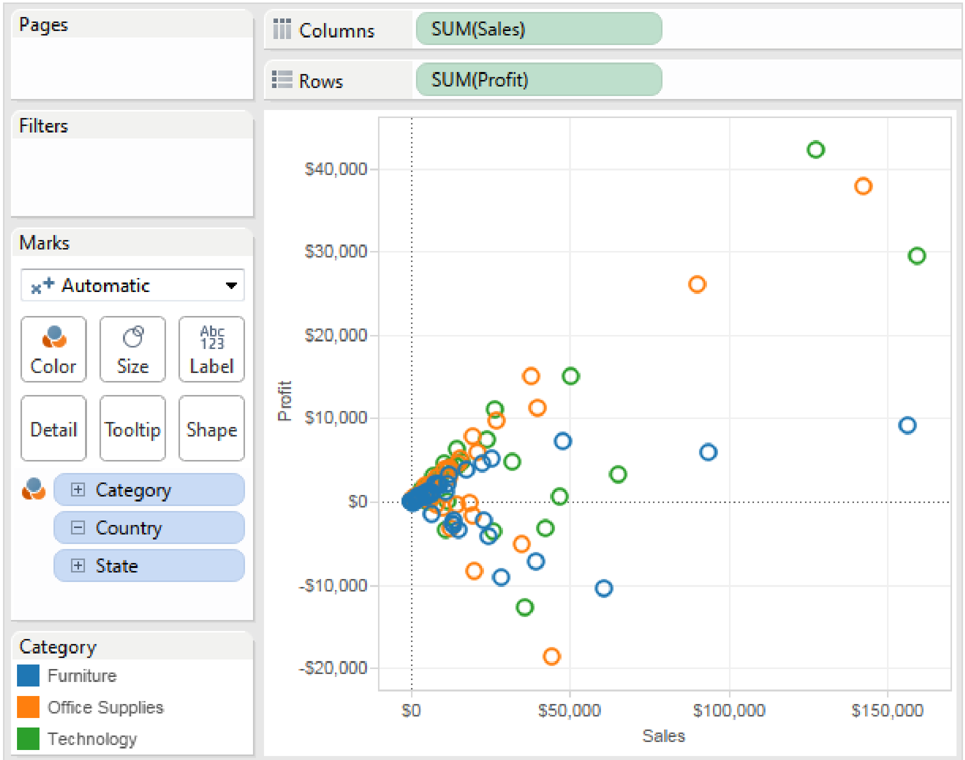
1. Drag the **Category** dimension to **Color** on the Marks card.

   This separates the data into three marks—one for each dimension member—and encodes the marks using color.



2. Drag the **State** dimension to **Detail** on the Marks card.

   Now there are many more marks in the view. The number of marks is equal to the number of distinct states in the data source multiplied by the number of categories.



Although more marks are now displayed, the measures are still aggregated. So regardless of whether there is one row in the data source where State = North Dakota and Category= Furniture, or 100 such rows, the result is always a single mark.

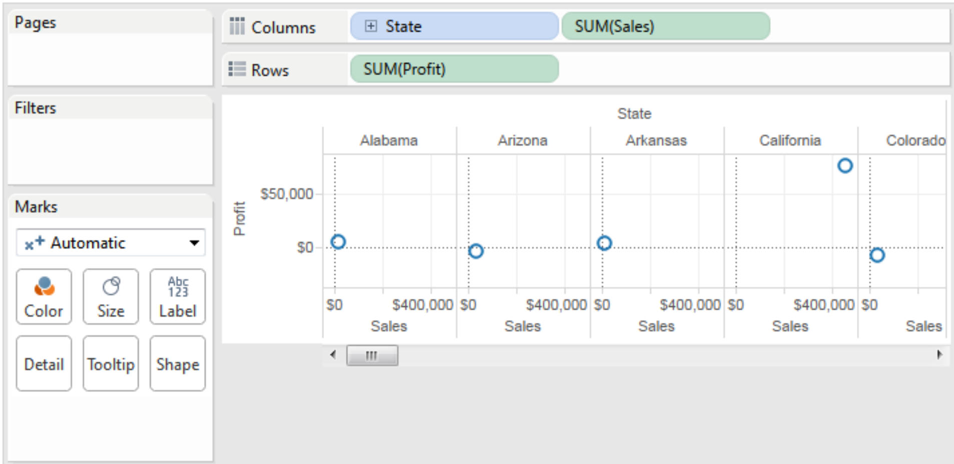
Maybe this process is developing the view in a direction you find useful, or maybe you prefer to go in a different direction—for example, by adding a time dimension to the view, or by introducing trend lines or forecasting.You decide what questions to ask.

Adding More Fields to the Rows and Columns Shelves

Revert to the original one-mark view and follow these steps to develop the scatter plot view by adding fields to the **Rows** and **Columns** shelves.

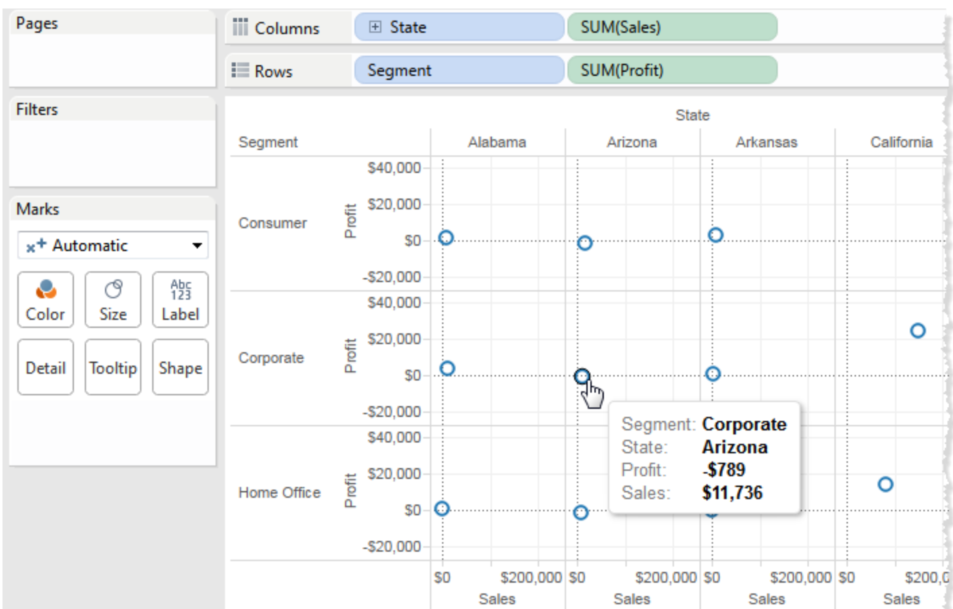
1. Drag the **State** dimension to the **Columns** shelf.

   Even if you drop **Continent** to the right of **SUM(Sales)**, Tableau moves it to the left of **SUM(Sales)**. This is because you cannot insert a dimension within a continuous axis. Instead, your view shows a separate axis for each member of the dimension.



2. Drag the **Segment** dimension to the **Rows** shelf.

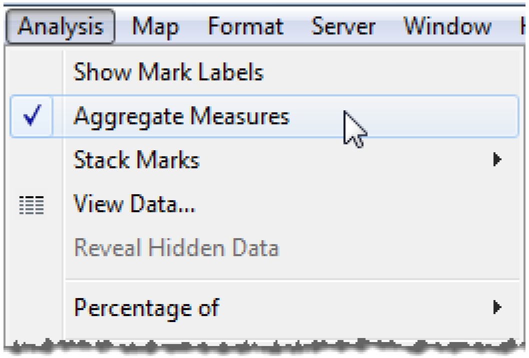
   You now have a view that provides an overview of Sales and Profit across states and customer segments. It can be interesting to hover over the marks in the view to see tooltip data for various segments:



Disaggregate Data

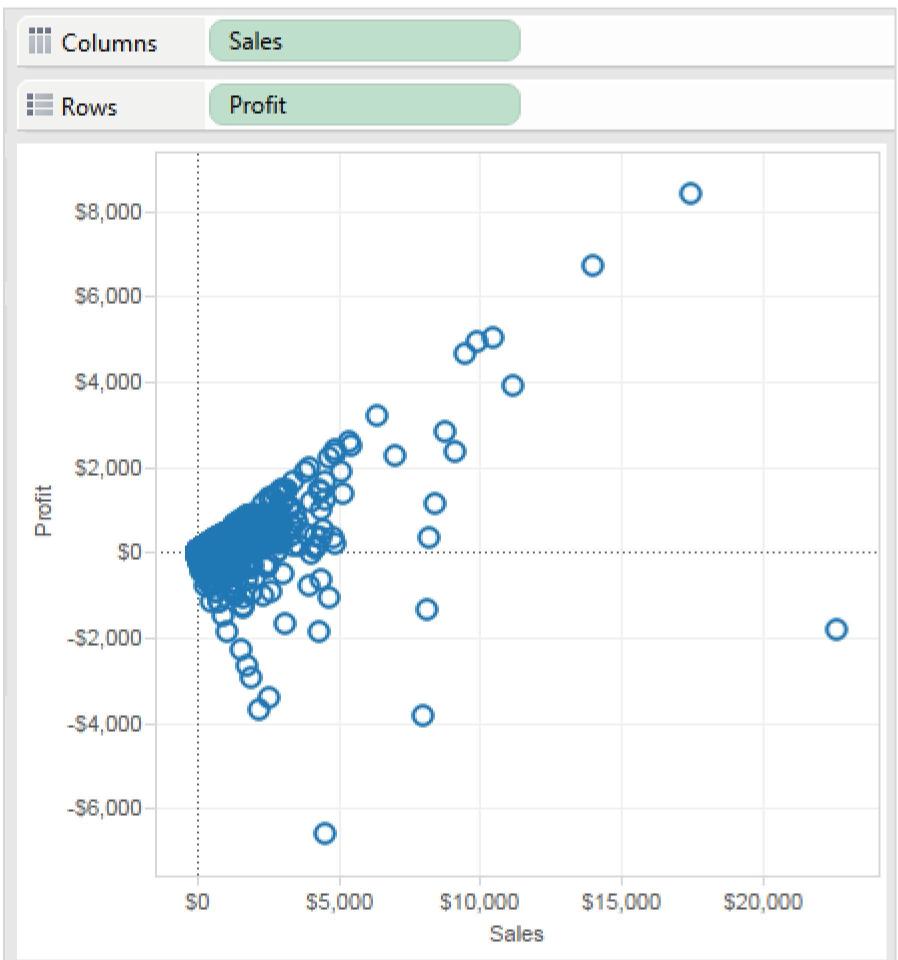
Another way to modify your original one-mark scatter plot to display more marks is by disaggregating the data.

Select **Analysis >Aggregate Measures**.



What you have actual done is to dis-aggregate the data, because this command is a toggle that was originally selected (check mark present). Tableau aggregates data in your view by default.

Now you see a lot of marks--one for each row in your original data source:



When you disaggregate measures, you no longer are looking at the average or sum for the values in the rows in the data source. Instead, the view shows a mark for every row in the data source. Disaggregating data is a way to look at the entire surface area of the data. It's a quick way to understand the shape of your data and to identify outliers. In this case, the disaggregated data shows that for many rows in the data, there is a consistent relationship between sales income and profit—this is indicated by the line of marks aligned at a forty-five degree angle.

Getting Started

Welcome to Tableau Desktop. Learn more about the product and what it can do. Then explore the Tableau workspace to get familiar with the environment. Finally, follow a step-by-step tutorial that guides you through connecting to data and building your first view.

Tutorial: Get Started with Tableau Desktop

Tableau Desktop makes exploring your data and sharing your insights easy. If you're new to it, though, it can be difficult to get started.

If this is true for you, check out the Get Started with Tableau Desktop tutorial.

The Get Started with Tableau Desktop tutorial walks you through the features and functions of Tableau Desktop. You'll learn how to connect to data; build, present, and share some useful views; and apply key features along the way.

The Tableau Environment

This section introduces you to the Tableau environment including how to open and close the application, the workspace in general, and how your work is organized and stored.

Opening and Closing the Application

The first thing to understand is how to open and close the application.

Open Tableau

Open Tableau Desktop by doing any of the following:

- Double-click the Tableau icon on your desktop.
- Select **Start** > **All Programs** > **Tableau**.
- Double-click a Tableau workbook or bookmark file. Tableau files are typically stored in the My Tableau Repository folder, which is located in your My Documents folder.
- Drag a data source such as an Excel or Access file onto the Tableau icon or the application window. Tableau automatically connects to the data source.

Close Tableau

When you are done working in Tableau, save your work and close the application. For more information on saving your work, see **Saving Your Work** on page 1245.

Close the application by doing one of the following:

- Click the **Close** icon located in the right corner of the application title bar.

- Select **File** > **Exit**.

> **Note:** If your workbook has not been saved, you will be asked whether you want to save it.

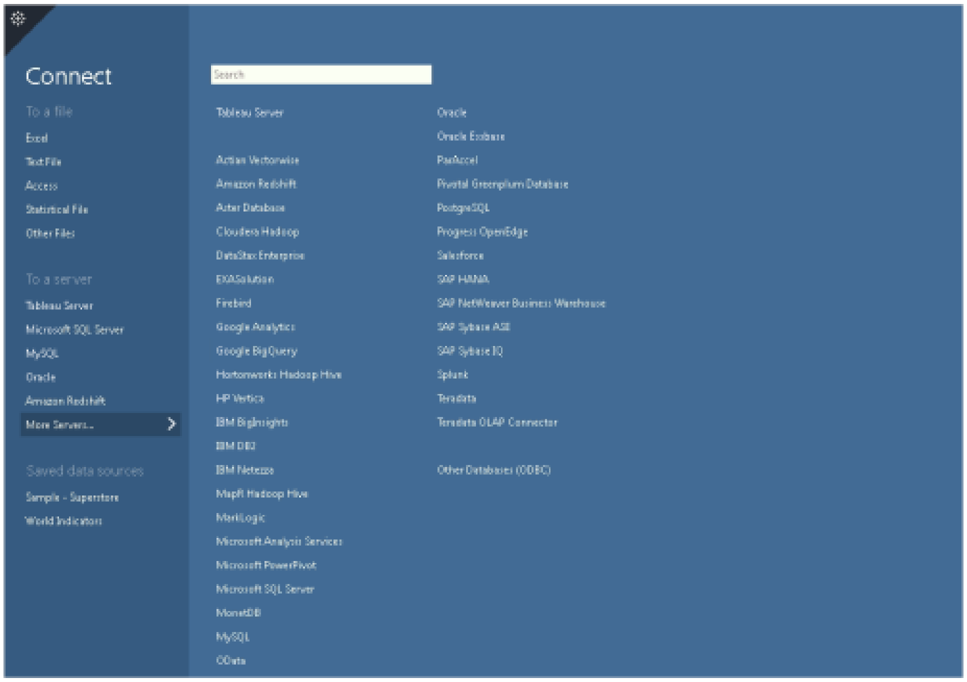
Start Page

The start page in Tableau Desktop is a central location from which you can connect to your data, access most recently used workbooks, and explore content produced by the Tableau community.

The start page consists of three panes: **Connect**, **Open**, and **Discover**.

Connect

Connect to data and opened saved data sources.



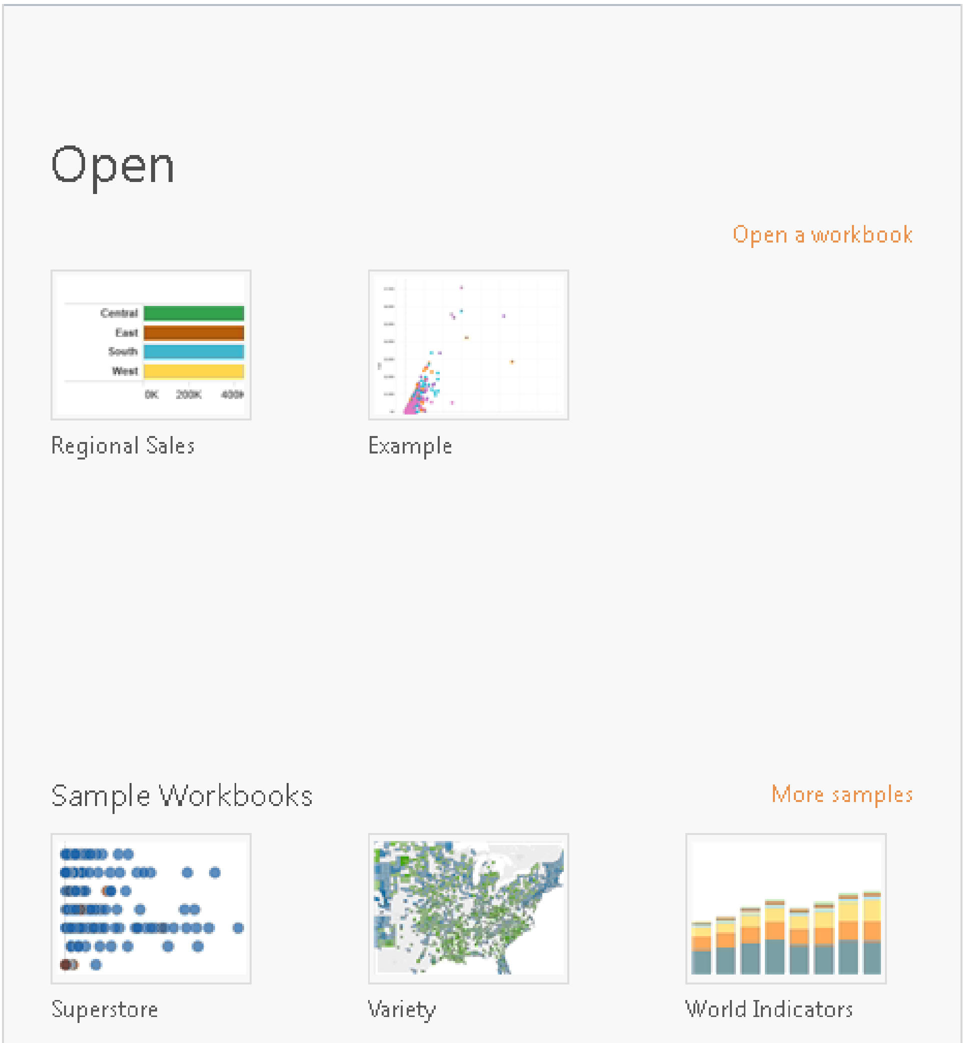
On the **Connect** pane, you can do the following:

- **Connect to data:** Under **To a file** connect to data stored in Microsoft Excel files, Text Files, Access files, Tableau data extract files, and statistical files, such as SAS, SPSS, and R. Under **To a server**, connect to data stored in databases like Microsoft SQL Server or Oracle. The server names listed under this section will change based on how often you connect to a specific server.

- **Open saved data sources:** Quickly open data sources that you have previously saved to your My Tableau Repository directory. By default, you have been provided with some sample saved data sources that you can use to explore Tableau Desktop functionality. To follow along with examples in the Tableau Desktop Help documentation and supplemental Knowledge Base articles, use the Sample – Superstore data source.

Open

Open recent workbooks, pin workbooks, and explore sample workbooks.

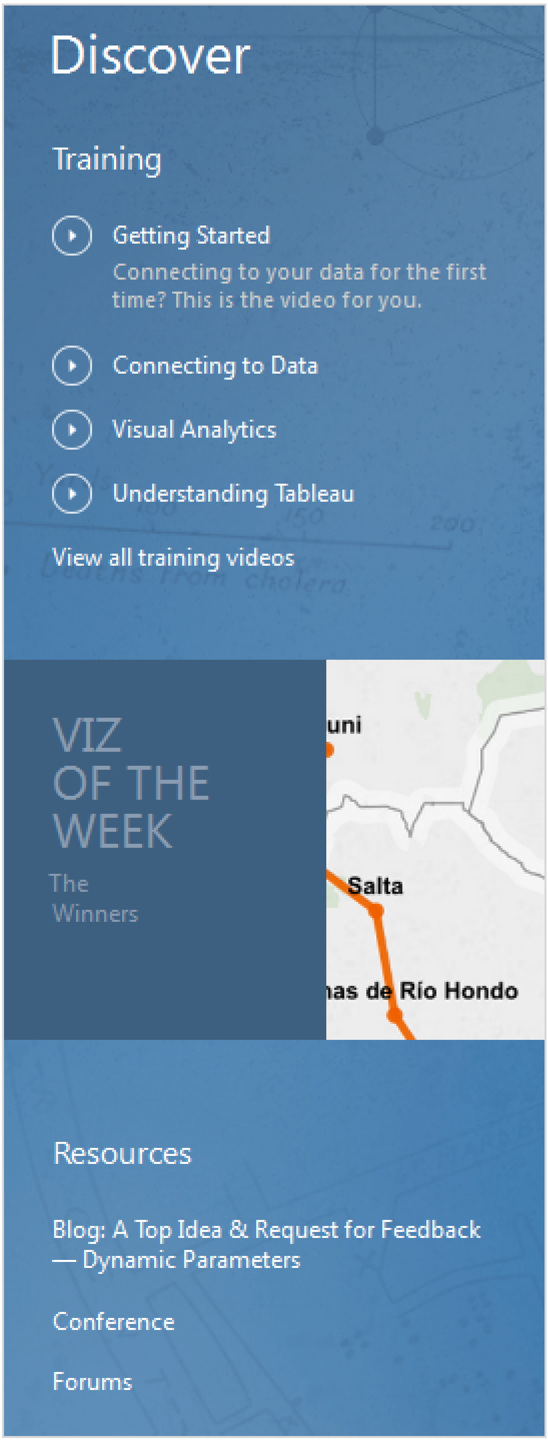


On the **Open** pane, you can do the following:

- **Access recently opened workbooks:** When you open Tableau Desktop for the first time, this pane will be empty. As you create and save new workbooks, the nine most recently opened workbooks display here. Click the workbook thumbnail to open a workbook, or if you don't see a workbook thumbnail, click the **Open a workbook** link to find other workbooks that are saved to your computer.
- **Pin workbooks:** You can pin workbooks to the start page by clicking the pin icon that appears in the top-left corner of the workbook thumbnail. Pinned workbooks will always show on the start page even if they weren't opened recently. To remove a recently opened or pinned workbook, hover over the workbook thumbnail, and then click the "x". The workbook thumbnail is removed immediately but will show again with your most recently used workbooks the next time you open Tableau Desktop.
- **Explore sample workbooks:** Open and explore sample workbooks.

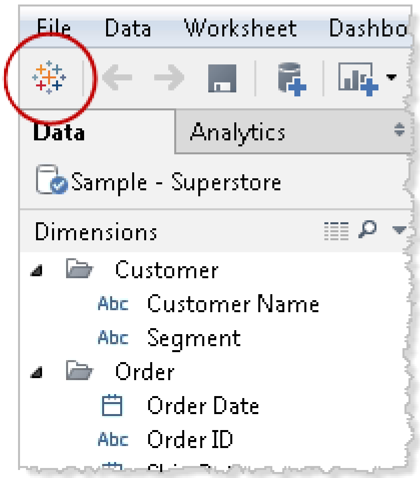
Discover

See popular views in Tableau Public, read blog posts and news about Tableau, and access training videos.



Navigating Back to the Start Page

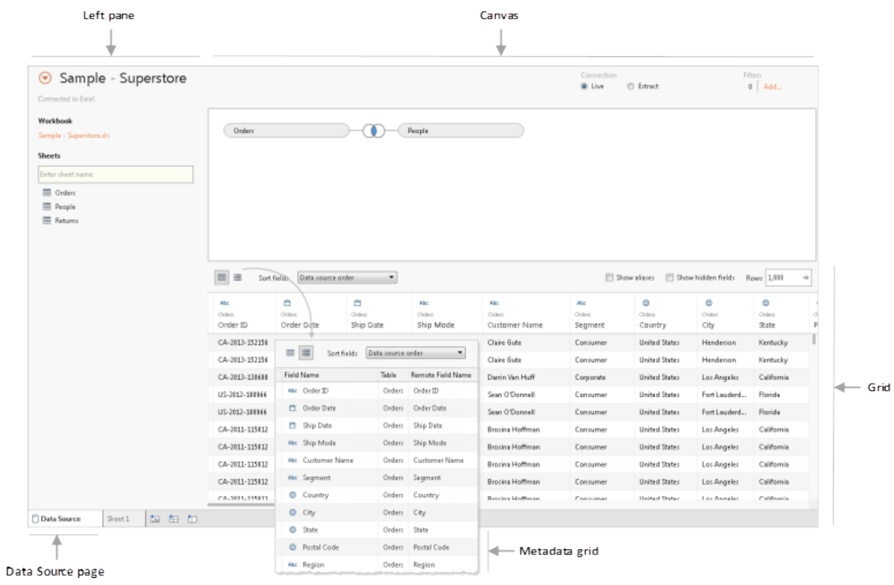
When Tableau Desktop is already open, you can navigate back to the start page by clicking the Tableau icon in the upper-left corner of the Tableau Desktop workspace.



Data Source Page

Before or during your analysis, you may want to make changes to the Tableau data source. You can do that on the Data Source page. Tableau takes you to the Data Source page after you establish the initial connection to your data. You can also access the Data Source page by clicking the **Data Source** tab from any location in the workbook.

Although the look of the page and the options available vary depending on the type of data that you are connected to, the Data Source page generally consists of four main areas: left pane, canvas, grid, and metadata grid.



Left pane

The left pane of the Data Source page displays details about the data that Tableau Desktop is connected to. For file-based data, the left pane might display the file name and the worksheets in the file. For relational data, the left pane might display the server, the database or schema, and the tables in the database. The left pane does not display for cube (multidimensional) data.

Canvas

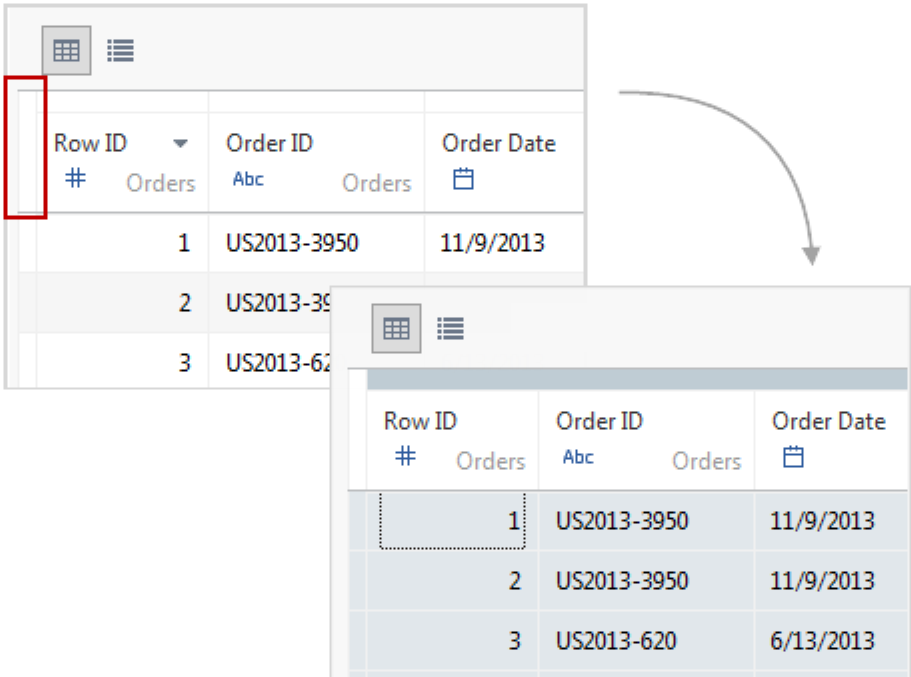
When connected to most relational and file-based data, you can drag one or more tables to the canvas area to set up your Tableau data source.

When connected to cube data, the top of the Data Source page displays the available catalog or queries and cubes to select from to set up your Tableau data source.

Grid

Use the grid to review the fields and the first 1,000 rows of the data contained in the Tableau data source. You can also use the grid to make general modifications to the Tableau data source like sorting or hiding fields; renaming fields or resetting field names; creating calculations; changing the column or row sort; or adding aliases. For the Web Data Connector, file- and relational-based data sources in Extract mode, you can see extract data in the grid, including extract only calculations.

To select multiple fields in the grid, click a column, and then drag the mouse to select more columns. To select all fields, click the area in the upper-left corner of the grid like in the example, below.



Note: The grid does not display for cube (multidimensional) data.

Metadata grid

Depending on the type of data that you are connected to, click the metadata grid button to navigate to the metadata grid. The metadata grid displays the fields in your data source as rows so that you can quickly examine the structure of your Tableau data source and perform routine management tasks, such as renaming fields or hiding multiple fields at once.

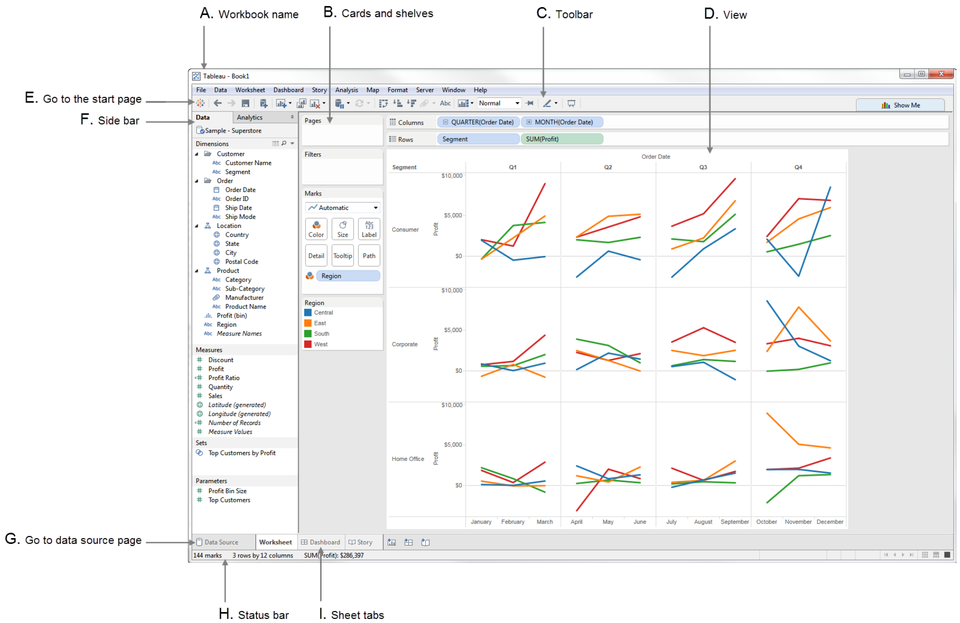
When connected to cube or some extract only data, the metadata grid displays by default.

The Tableau Workspace

The Tableau workspace consists of menus, a toolbar, the Data pane, cards and shelves, and one or more sheets. Sheets can be worksheets, dashboards, or stories.

Worksheets contain shelves and cards that you can drag and drop data fields on to build views.

Note: The image below shows the Tableau workspace for a worksheet. The workspace for creating dashboards or stories is quite different. For information on the dashboard or story workspace, see **Add Views to a Dashboard** on page 949 or **The Story Workspace** on page 982.



A. Workbook name.

B. Cards and shelves.

C. Toolbar.

D. View.

E. Go to the start page. For more information, see **Start Page** on page 263.

F. Side Bar. The side bar provides two panes: the **Data** pane and the **Analytics** pane. For more information, see **The Side Bar** below.

G. Go to the data source page. For more information, see **Data Source Page** on page 267.

H. Status bar.

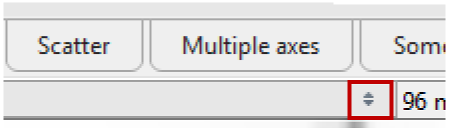
I. Sheet tabs.

The Side Bar

The Side Bar provides two panes: the Data pane and the Analytics pane.

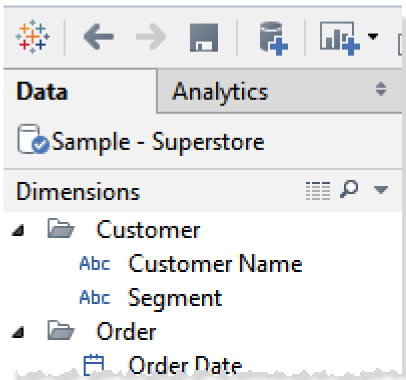
You can hide and show the Side Bar by clicking the minimize button  in the upper right corner. The Data pane collapses to the bottom of the workbook. Click the minimize button again to show the Data pane.

To open the Side Bar again, look in the lower left corner of the Tableau window for the same button:



Data Pane

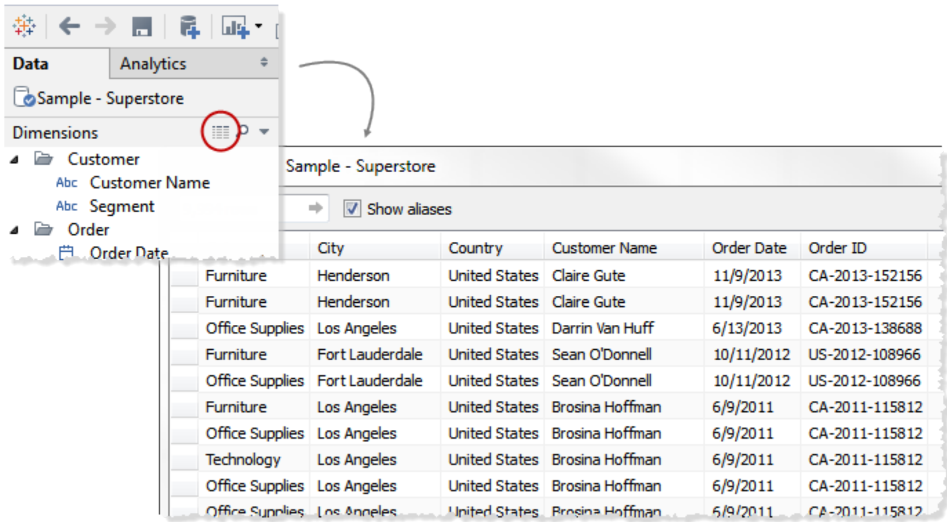
Data fields appear in the Data pane on the left side of the workspace. You can toggle between the Data pane and the Analytics Pane:



Current data sources are listed at the top of the Data pane. Right-click (control-click on Mac) a data source to view a context menu for the data source. For more information, see **Edit Data Sources** on page 414.

Below the data sources are the fields available in the currently selected data source are listed. You can search for fields in the Data pane by clicking the magnifying class icon and then typing in the text box. Right-click (control-click on Mac) the fields in the Data pane to access important commands.

Click the **View Data** icon at the top of the Data pane to see the underlying data. For more information, see **View Data** on page 852 to learn more about viewing the underlying data in a workbook.



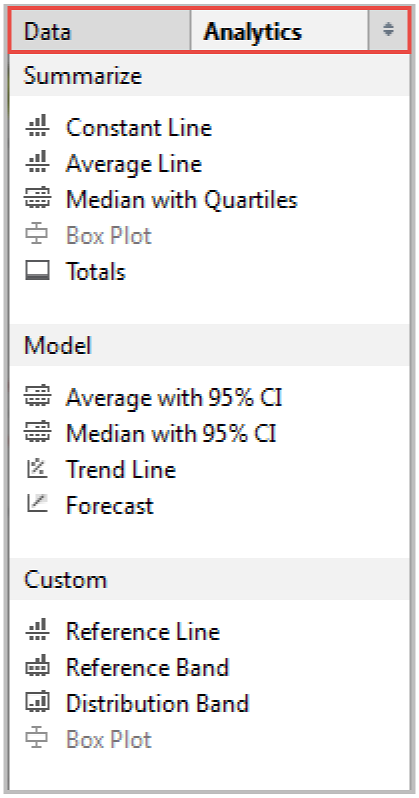
The Data pane is organized into several areas:

- **Dimensions** - fields that contain category data such as text and dates. For more information, see **Dimensions and Measures** on page 186.
- **Measures** - fields that contain numbers that can be aggregated. For more information, see **Dimensions and Measures** on page 186.
- **Sets** - subsets of data that you define. For more information, see **Sets** on page 750.
- **Parameters** - dynamic placeholders that can replace constant values in calculated fields and filters. For more information, see **Parameters** on page 1161.

By default, Tableau treats all relational fields containing numbers as measures. However, you might decide that some of these fields should be treated as dimensions. For example, a field containing ages may be categorized as a measure by default in Tableau because it contains numeric data. However, if you want to look at each individual age rather than an axis you can convert the **Age** field to a dimension. To do this, drag the **Age** measure and drop it into the Dimensions area in the Data pane. Now if you drag the **Age** field to the **Rows** or **Columns** shelf it will create column headers (1, 2, 3, etc.) instead of a continuous axis. For information on converting measures to dimensions—or dimensions to measures—see **Dimensions and Measures** on page 186.

Analytics Pane

The Analytics pane provides quick and easy access to common analytic features in Tableau. You can drag reference lines, box plots, trend lines forecasts, and other items into your view from the **Analytics** pane, which appears on the left side of the workspace. Toggle between the **Data** pane and the **Analytics** pane by clicking one of the tabs at the top of the Side Bar:

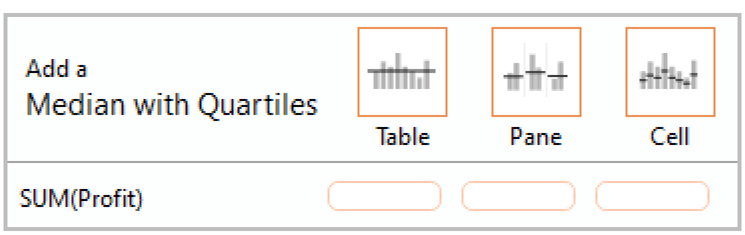


There isn't anything you can add to a view from the **Analytics** pane that you couldn't add by some other means—for example, reference lines and bands are available when you edit an axis, and trend lines and forecasts are available from the Analysis menu. The **Analytics** pane just makes the process easier by offering drag-and-drop access for the various options.

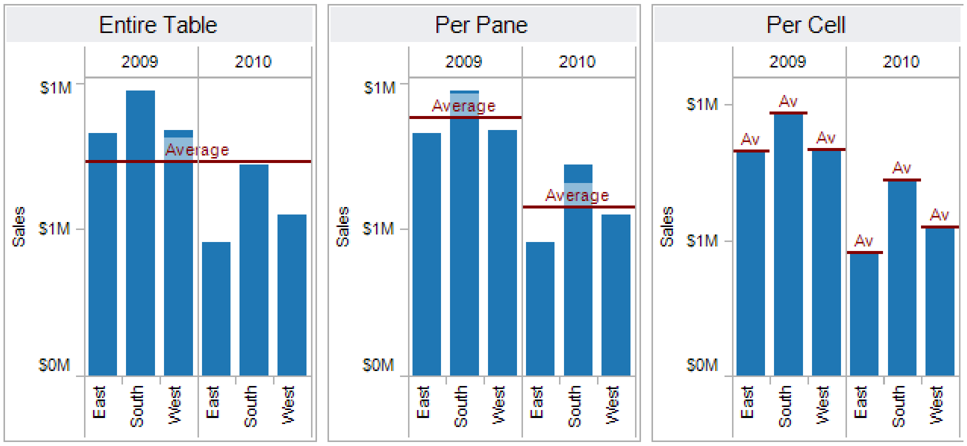
Add Analytics Pane Item

To add an item from the **Analytics** pane, drag it into the view. When you drag an item from the **Analytics** pane, Tableau shows the possible destinations for that item in a drop target area in the upper left section of the view—drop the item somewhere in this area. The range of choices varies depending on the type of item and the current view.

In a simple case, the drop target area would offer these three options:



The terms **Table**, **Pane** and **Cell** define the scope for the item:

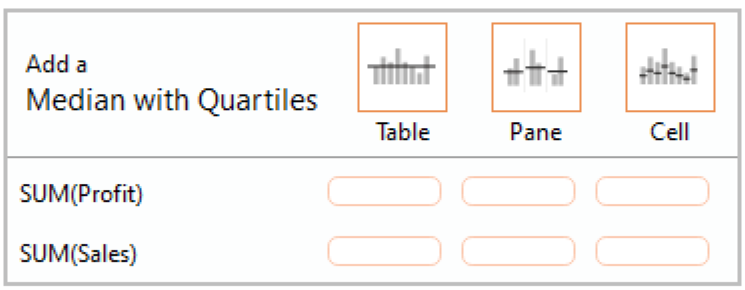


Adds a reference line to the entire table across all panes.

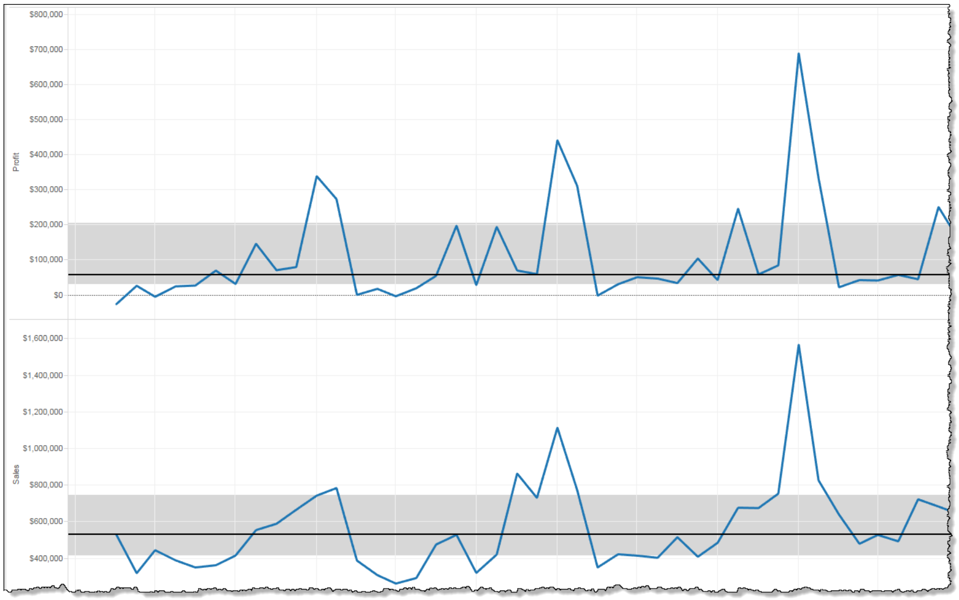
Adds a reference line on a per pane basis. Computed reference lines are recalculated for each pane in the view.

Adds a reference line within each cell. Computed reference lines are recalculated for each cell in the view.

For a more complicated view—for example, if the view contained a line chart with multiple or dual axes—Tableau would show you a drop target area that looked like this:



If you dropped the item in one of the three larger boxes in the header at the top of the drop target area--for example, the Table box--a separate median with quartiles would be added for each axis:



But if you drop the item in any of the six lower boxes aligned with a specific measure, the median with quartiles would only be added on the corresponding axis, with the specified scope.

Delete Analytics Pane Item

You can delete an item you just added from the Analytics pane by clicking Undo. You can also drag items off the view to delete them.

You can also click on an item and choose **Remove** from the tooltip.

> **Note**: Some **Analytics** pane items (**Median with Quartiles** and **Average with 95% CI**) actually add both a reference line and a reference distribution. Unless you are using Undo, you would need to delete these items separately.

Edit Analytics Pane Item

To edit an item you have added from the Analytics pane, click on the item and choose **Edit** from the tooltip. For additional editing options, see the section for a particular item type under Analytics Pane Item Definitions, below.

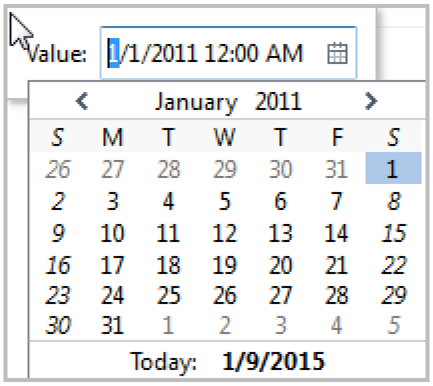
Analytics Pane Items

The following items can be dragged from the **Analytics** pane and dropped in the view.

Constant Line

Adds one or more constant lines to the view. You can add a constant line for a specific measure, for all measures, or for date dimensions. When you add a constant line, Tableau displays a Value prompt where you specify the value for the constant:

For a date value, the Value prompt is a calendar control:



You can click on a resulting constant line and choose **Edit**, **Format**, or **Remove**. Choosing **Edit** opens the Edit Reference Line dialog box. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. Another way to edit a line is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**.

Average Line

Adds one or more average lines to the view. You can add an average line for a specific measure or for all measures.

You can click on a resulting average line and choose a different aggregation, such as Total or Sum. You can also choose **Edit**, **Format**, or **Remove**. Choosing **Edit** opens the Edit Reference Line dialog box. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. Another way to edit a line is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**.

Median with Quartiles

Adds one or more sets of median lines and distribution bands to the view. You can add a median with quartiles for a specific measure or for all measures.

The distribution bands are computed as quartiles; the middle two quartiles are shaded.

You can click on a resulting median line or distribution and choose **Edit**, **Format**, or **Remove**. Median lines and distributions must be edited, formatted, or removed separately. Choosing **Edit** opens the Edit Reference Line dialog box. You must click on the outer edge of a distribution band to see the options--clicking in the middle of the band has no effect. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. Another way to edit a line or distribution is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. A submenu will offer you two choices: **Quartiles** and **Median**.

For information on distribution types, including quartiles, see **Basic Reference Distributions** on page 1127.

Box Plot

Adds one or more box plots to the view. You can add box plots for a specific measure or for all measures. The scope for a box plot is always **Cell** (and never **Table** or **Pane**).

Click or hover over any of the horizontal lines in the box plot to see statistical information about the whiskers, quartiles, and median.

You can also choose **Edit**, **Format**, or **Remove** when you click on a line. Choosing **Edit** opens the Edit Reference Line dialog box. Another way to edit a box plot is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**.

> **Note**: Box Plot appears twice in the Analytics pane. For the Box Plot option in the Summarize section, Tableau will automatically add a box plot for the specified target. For the Box Plot option in the Custom section, Tableau will open the Edit Reference Line, Band, or Box dialog box after you specify a target.

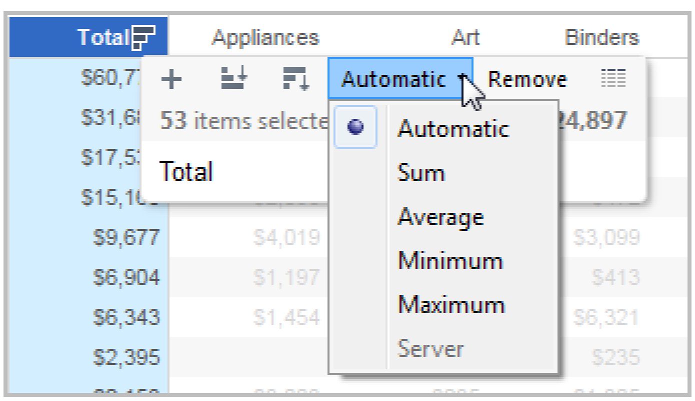
Totals

Adds totals to the view. When you add totals, the drop options are **Subtotals**, **Column Grand Totals**, and **Row Grand Totals**.

For details, see **Totals** on page 1146.

To remove totals, click the relevant column or row header and choose **Remove**.

You can also click on a totals column or row header after adding totals and set the aggregation for that row or column from the tooltip:



Average with 95% CI

Adds one or more sets of average lines with distribution bands; the distribution bands are configured at a 95% confidence interval. You can add these items for a specific measure or for all measures.

The confidence interval distribution bands shade the region in which the population average will fall 95% of the time.

You can click on a resulting average line or distribution and choose **Edit**, **Format**, or **Remove**. Choosing **Edit** opens the Edit Reference Line dialog box. The average lines and distributions must be edited, formatted, or removed separately. You must click on the outer edge of a distribution band to see the options--clicking in the middle of the band has no effect. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. Another way to edit a line or distribution is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. A submenu will offer you two choices: **Average** and **95% Confidence Interval**.

You can also remove lines and bands by dragging them off the view.

Median with 95% CI

Adds one or more sets of median lines with distribution bands; the distribution bands are configured at a 95% confidence interval. You can add these items for a specific measure or for all measures.

The confidence interval distribution bands shade the region in which the population median will fall 95% of the time.

You can click on a resulting median line or distribution and choose **Edit**, **Format**, or **Remove**. Choosing **Edit** opens the Edit Reference Line dialog box. The median lines and distributions must be edited, formatted, or removed separately. You must click on the outer edge of a distribution band to see the options--clicking in the middle of the band has no effect. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. Another way to edit a line or distribution is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. A submenu will offer you two choices: **Median** and **95% Confidence Interval**.

You can also remove lines and bands by dragging them off the view.

Trend Line

Adds one or more trend lines to the view. When you add trend lines, the drop options identify the trend line model types available in Tableau: **Linear**, **Logarithmic**, **Exponential**, and **Polynomial**. For some views, only a subset of these options is available.

For details, see **Trend Line Model Types** on page 1187

click on a trend line to remove or edit it, or to see a statistical definition. You can also remove a trend line by dragging it off the view.

Forecast

Adds a forecast to the view. Forecasting is only possible when there is at least one date and one measure in the view.

Forecasting is not supported for views based on multidimensional data sources. In addition, the view cannot contain any of the following:

- Table calculations
- Disaggregated measures
- Percent calculations
- Grand Totals or Subtotals
- Date values with aggregation set to Exact Date

A time series containing null values also imposes constraints.

For details, see **Forecasting** on page 1091.

To remove, edit, or read a description of the current forecast, go to the Analysis menu and choose **Forecast**.

Reference Line

You can add reference lines for a specific measure or for all measures.

After you drag a reference line from the **Analytics** pane and drop it on a target, Tableau automatically opens Edit Reference Line dialog box. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. To return to this dialog box later, right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. You can also click on the line and choose **Edit**, **Format**, or **Remove**.

Reference Band

You can add reference bands for a specific measure or for all measures.

After you drag a reference band from the **Analytics** pane and drop it on a target, Tableau automatically opens Edit Reference Line dialog box.. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. To return to this dialog box later, right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. You can also click on the band and choose **Edit**, **Format**, or **Remove**. You must click on the outer edge of a reference band to see the options--clicking in the middle of the band has no effect.

Distribution Band

You can add reference distributions for a specific measure or for all measures.

After you drag a reference distribution from the **Analytics** pane and drop it on a target, Tableau automatically opens Edit Reference Line dialog box. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144. To return to this dialog box later, right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**. You can also click on the distribution and choose **Edit**, **Format**, or **Remove**. You must click on the outer edge of a distribution band to see the options--clicking in the middle of the band has no effect.

Box Plot

You can add box plots for a specific measure or for all measures.

After you drag a box plot from the Custom section of the **Analytics** pane and drop it on a target, Tableau automatically opens Edit Reference Line dialog box. For details, see **Editing Reference Lines, Bands, Distributions, or Boxes** on page 1144.The scope for a box plot is always **Cell** (and never **Table** or **Pane**).

Click any of the horizontal lines in the box plot to see statistical information about the whiskers, quartiles, and median.

You can click on a resulting box plots and choose **Edit**, **Format**, or **Remove**. Choosing **Edit** opens the Edit Reference Line dialog box. Another way to edit a box plot is to right-click (control-click on Mac) the relevant axis and choose **Edit Reference Line**.

Toolbar

Tableau's toolbar contains commands such as Connect to data, New Worksheet, and Save. In addition, the toolbar contains analysis and navigation tools such as Sort, Group, and Highlight. You can hide or display the toolbar by selecting **Window** > **Show Toolbar**.

The toolbar helps you quickly access common tools and actions. The table below explains the functions of each toolbar button.

Toolbar Button	Description
	**Tableau icon**: navigates to the start page. For more information, see **Start Page** on page 263.
	**Undo**: reverses the most recent action in the workbook. You can undo an unlimited number of times, back to the last time you opened the

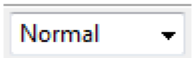
Toolbar Button	Description
	workbook, even after you have saved. For more information see **Undo and Redo** on page 849.
	**Redo**: repeats the last action you reversed with the Undo button.You can redo an unlimited number of times.
	**Save**: saves the changes made to the workbook. For more information, see **Saving Your Work** on page 1245.
	**Connect**: opens the Connect pane where you can create a new connection or open a saved connection from your repository. For more information, see **Connect to Your Data** on

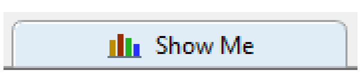
Toolbar Button	Description
	page 342.
	**New Worksheet**: creates a new blank worksheet. Use the drop-down menu to create a new worksheet, dashboard, or story. For more information, see **Creating New Sheets** on page 299.
	**Duplicate Sheet**: creates a new worksheet containing the exact same view as the current sheet. For more information, see **Duplicating Sheets** on page 301.
	**Clear**: clears the current worksheet. Use the drop-down menu to clear specific parts of the view such as filters, formatting, sizing,

Toolbar Button	Description
	and axis ranges.
	**Automatic Updates**: controls whether Tableau automatically updates the view when changes are made. Use the drop-down list to automatically update the entire sheet or just use filters. For more information, see **Automatic Updates** on page 1472.
	**Run Update**: runs a manual query of the data to update the view with changes when automatic updates are turned off. Use the drop-down menu to update the entire sheet or just use filters.

Toolbar Button	Description
	**Swap**: moves the fields on the Rows shelf to the Columns shelf and vice versa. The Hide Empty Rows and hide Empty Columns settings are always swapped with this button.
	**Sort Ascending**: applies a sort in ascending order of a selected field based on the measures in the view. See **Sorting** on page 723.
	**Sort Descending**: applies a sort in descending order of a selected field based on the measures in the view. See **Sorting** on page 723.
	**Group Members**: creates

Toolbar Button	Description
	a group by combining selected values. When multiple dimensions are selected, use the drop-down menu to specify whether to group on a specific dimension or across all dimensions. For more information, see **Groups** on page 736.
	**Show Mark Labels**: switches between showing and hiding mark labels for the current sheet. For more information, see **Mark Labels** on page 826.
	**View Cards**: shows and hides specific cards in a worksheet. Select each card that you want to hide or show

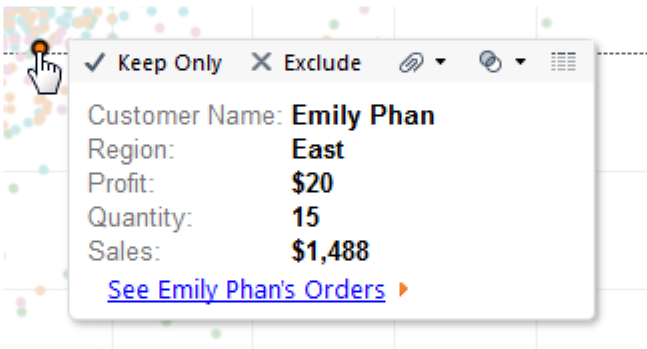
Toolbar Button	Description
	on the drop-down menu.
	**Fit Selector**: specifies how the view should be sized within the application window. Select Normal fit, Fit Width, Fit Height, or Entire View.
	**Fix Axes**: switched between a locked axis that only shows a specific range and a dynamic axis that adjusts the range based on the minimum and maximum values in the view. For more information, see **Edit Axes** on page 706.
	**Highlight**: turns on highlighting for the selected sheet. Use the options on the drop-down

Toolbar Button	Description
	menu to define how values will be highlighted. For more information, see **Highlight Toolbar Button** on page 775.
	**Presentation Mode**: switches between showing and hiding everything except the view (i.e., shelves, toolbar, Data pane). For more information, see **Reorganizing the Workspace** on page 294.
	**Show Me**: displays alternative ways to look at the data. The types of views available are dependent on the fields already in the view as well as any selections in the Data

Toolbar Button	Description
	pane. For more information, see **Show Me** on page 531

Tooltips

Tooltips are additional data details that display when you rest the pointer over one or more marks in the view. Tooltips also offer convenient tools to quickly filter marks, view underlying data, group data, and create sets. Tooltips consist of a body, action links, and commands.



Body

The body of a tooltip contains details about a specific mark or a selection of multiple marks. For example, in a bar chart showing sales by region, the tooltip body may include the actual sales amount and the region name. The default tooltip is based on the fields used in the view. You can customize what is shown in the tooltip by dragging fields to Tooltip on the marks card. Click **Tooltip** on the marks card to further customize the tooltip including how the text is formatted. Alternatively, you can select **Worksheet > Tooltip**. See **Format Tooltips** on page 692 to learn more about formatting the body of the tooltips.

Action Links

If the sheet has any actions, the action links will be listed below the body of the tooltip. An action adds context and interactivity to your data through filters, highlighting, and links to external resources. See **Actions** on page 768 to learn more about adding actions to your workbook.

Commands

The bottom of the tooltip lists commands for quickly filtering data and viewing the underlying data. For example, you can use the tooltip to quickly remove an outlier in a scatter plot. Each of the commands are described below.

- **Keep Only** - creates a filter that removes all other data. See **Select Data to Filter** on page 608 to learn more.
- **Exclude** - creates a filter that removes the selected data. See **Select Data to Filter** on page 608 to learn more.
- **Group Members** - creates a group based on the selection. If the selection contains multiple dimensions, you can group on one dimension or all dimensions. See **Groups** on page 736 to learn more.
- **Create Set** - creates a new set containing the selected members. You can create a new set or add members to an existing set. See **Sets** on page 750 to learn more.
- **View Data** - opens a window displaying the data. You can view the summarized data or the underlying data.See **View Data** on page 852 to learn more.

These commands are visible by default. You can disable the commands in the Edit Tooltip dialog box.

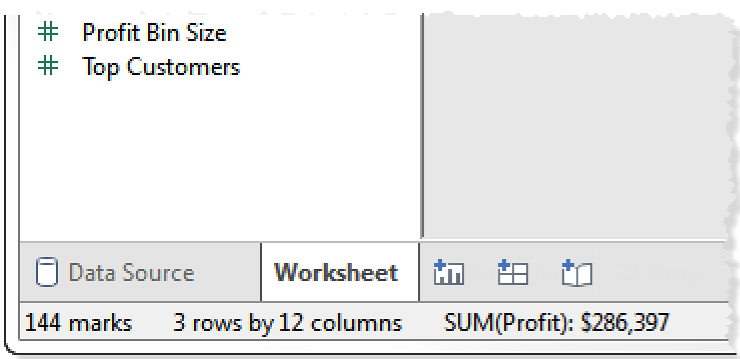
Disable tooltip commands

1. Click Tooltip on the Marks card or select **Worksheet** >**Tooltip**.
2. In the Edit Tooltip dialog box, clear the **Include command buttons** check box in the bottom left corner.

Tooltip settings apply to the active worksheet and can be different for each sheet in the workbook.

Status Bar

The status bar is located at the bottom of the Tableau workspace. It displays descriptions of menu items as well as information about the current view. For example, the status bar below shows that the view has 144 marks shown in 3 rows and 12 columns. It also shows that the SUM(Profit) for all the marks in the view is $286,397.



You can hide the status bar by selecting **Window** > **Show Status Bar**.

Occasionally, Tableau will display warning icons in the bottom right corner of the status bar to indicate errors or warnings. Below are the possible warning icons and what they mean.

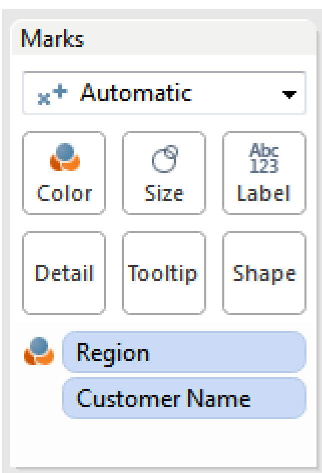
Warning Icon	Description
	**Cancel Query Indicator**: When you cancel multiple queries, an indicator appears to show you how many queries are still running on the database and using resources. See **Abandoned Queries** on page 1474 for more information about managing these queries.
	**Precision Warning**: Some fields are more precise in the database than Tableau can model.

Warning Icon	Description
	When you add these fields to the view a precision warning is displayed in the status bar. See **Precision Warnings** on page 1474 for more information about this warning.
	**Special Values Indicator**: If your data contains null values, unknown geographic locations, or negative or zero values on a logarithmic axis; the values are shown with an indicator in the lower right corner of the view. Click the indicator for

Warning Icon	Description
	options for handling these values. See **Special Values** on page 242 to learn more about this indicator and how to handle these values.

Cards and Shelves

Every worksheet contains a variety of different cards that you can show or hide. Cards are containers for shelves, legends, and other controls. For example, the Marks card is where you control mark properties. It contains the mark type selector along with controls for Color, Size, Label, Detail, Tooltip, Shape, and Angle. The controls that are available depend on the mark type.



Cards can be shown and hidden as well as rearranged around the worksheet.

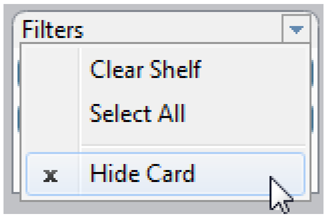
The following list describes each card and its contents.

- **Columns Shelf** – contains the Columns shelf where you can drag fields to add columns to the view. See **Columns and Rows Shelves** on page 504.
- **Rows Shelf** – contains the Rows shelf where you can drag fields to add rows to the view.

See **Columns and Rows Shelves** on page 504.

- **Pages Shelf** – contains the Pages shelf where you can split a view into several pages based on the members of a dimension or the values in a measure. See **Pages Shelf** on page 507.
- **Filters Shelf**– contains the Filters shelf; use this shelf to specify the values to include in the view. See **Filters Shelf** on page 512.
- **Measure Values Shelf** – contains the Measure Values shelf; use this shelf to blend multiple measures on a single axis. This shelf is only available when there is a blended axis in the view. See **Blended Axes** on page 858.
- **Color Legend** – contains the legend for the colors in the view and is only available when there is at least one field on Color. See **Color Properties** on page 451.
- **Shape Legend** – contains the legend for the shapes in the view and is only available when there is at least one field on Shape. See **Shape Properties** on page 476.
- **Size Legend** – contains the legend for the size of the marks in the view and is only available when there is at least one field on Size. See **Size Properties** on page 466.
- **Map Legend** – contains the legend for the symbols and patterns on a map. The map legend is not available for all map providers.
- **Filters** – a separate filter card is available for every filter applied to the view. Use these cards to easily include and exclude values from the view. See **Show Filters in the View** on page 645.
- **Parameters** – a separate parameter card is available for every parameter in the workbook. The parameter card contains controls for changing the parameter values. See **Parameter Controls** on page 1168.
- **Marks** – controls the mark properties in the view. There is a mark type selector where you can specify the mark type (e.g., bar, line, area, etc.). In addition, the Marks card contains controls for Color, Size, Label, Text, Detail, Tooltip, Shape, Path, and Angle. The availability of these controls is dependent on the fields in the view and the mark type.
- **Title** – contains the title for the view. Double-click this card to modify the title.
- **Caption** – contains a caption that describes the view. Double-click this card to modify the caption.
- **Summary** – contains summary of each of the measures in the view including the Min, Max, Median, Sum, and Average.
- **Current Page** – contains the playback controls for the Pages shelf and indicates the current page that is displayed. This card is only available when there is at least one field on the Pages shelf.

Each card has a menu that contains common controls that apply to the contents of the card. For example you can use the card menu to show and hide the card. Access the card menu by clicking on the arrow in the upper right corner of the card.

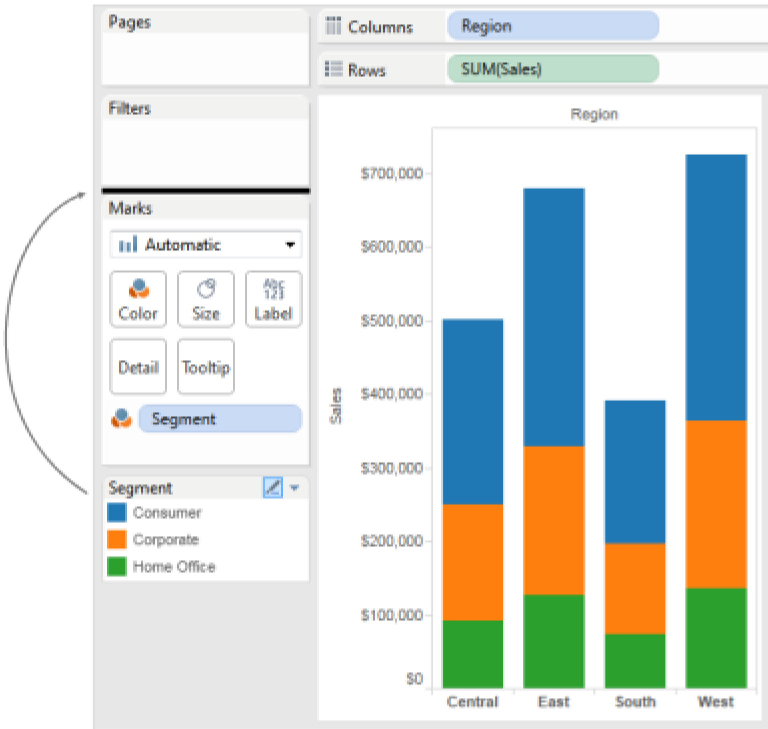


Reorganizing the Workspace

Every worksheet contains a variety of cards, shelves, legends, and so on. You can reorganize the workspace by rearranging cards, hiding and showing specific parts of the workspace, and hiding everything but the view using Presentation Mode.

Rearranging Cards

A worksheet contains several cards that contain shelves, legends, and other controls. Each card can be rearranged to create a custom workspace. To move a card, point the cursor at the title area of the card you want to move. When the cursor becomes the move symbol , click and drag the card to a new position. As you drag the card around the worksheet, the possible positions for it are highlighted with a black bar.



You can restore the worksheet windows to their default state by selecting **Reset Cards** on the Show/Hide Cards toolbar control.

Showing and Hiding Parts of the Workspace

Just about everything in the workspace can be turned on and off so you can avoid cluttering the worksheet with unnecessary cards, shelves, etc.

- To show and hide the toolbar or status bar, select **Window** and then select what you want to hide.
- To show and hide the window on the left side, which is either the Data pane (for worksheets), the Dashboard pane (for dashboards), or the Dashboards and Sheets pane (for stories); click the Minimize button in the upper right corner of the pane. The pane is minimized to the bottom left corner of the workbook. Click the same button again to restore the pane.
- To show or hide a card click **Show/Hide Cards** on the toolbar and then select the card you want to show or hide.

You can restore the worksheet windows to their default state by selecting **Reset Cards** on the **Show/Hide Cards** toolbar control.

Presentation Mode

Sometimes you may want to use Tableau to present your findings. Rather than hiding each card or shelf one at a time, you can switch to presentation mode. Presentation mode hides everything on the sheet except for the view and its associated legends, filter cards, parameter controls, and worksheet tabs.

- To switch in and out of presentation mode, click the Presentation Mode button on the toolbar or select **Window > Presentation Mode**.

Use the presentation mode controls in the bottom right corner to move between sheets and more. Each presentation mode control is described below.

	Show Filmstrip - shows the sheets as thumbnails at the bottom of the workspace.
	Show Tabs - shows the sheet tabs at the bottom of the workspace.
	Previous/Next Sheet - advances forward or backward through the sheets in a workbook.
	Enter/Exit Full Screen - switches between expanding the workbook to fill the entire screen and showing it in a window.
	Exit Presentation Mode - returns the workbook to showing the entire workspace including the menus, toolbar, and the Data pane.

Language and Locale

Tableau Desktop is localized into several languages.

When you first run Tableau, it recognizes your computer locale and uses the appropriate language if it is supported. If you are using an unsupported language, the application defaults to English.

You can configure Tableau to display the user interface (menus, messages, etc.) by choosing **Help** > **Choose Language**. After you change this setting, you'll need to restart the application for the changes to take effect. You do not need to change this setting for every workbook.

To configure date and number formatting, choose **File** > **Workbook Locale**. By default, the locale is set to **Automatic**, which means the locale will match the locale when the workbook is opened. This can be useful if you are authoring a workbook that will be viewed in many different languages and you want the dates and numbers to update accordingly. When you select a specific locale, the workbook will not change regardless of who opens it.

Tableau checks the following, in order, to determine the workbook locale:

- Workbook Locale (explicit setting)
- Windows Locale
- Tableau Language

If none of the above is set, then the workbook locale defaults to English.

Day of the Week Sorting

If you are working in a language for which Tableau does not provide a local version, set your workbook locale to assure that Tableau can sort the days of the week in the correct chronological order. Otherwise, Tableau will sort the names of the days alphabetically. If none of the supported locales is appropriate, you can sort the days of the week manually. See **Manual Sorting** on page 734.

Workbooks and Sheets

Tableau uses a workbook and sheet file structure, much like Microsoft Excel. A workbook contains sheets, which can be a worksheet, a dashboard, or a story.

A worksheet contains a single view along with shelves, legends, and the Data pane.

A dashboard is a collection of views from multiple worksheets.

A story contains a sequence of worksheets or dashboards that work together to convey information.

Within a workbook, you can create new sheets, clear an entire worksheet, duplicate sheets, hide or show a worksheet, and delete a sheet. Tableau has several ways to view and organize the sheets in your workbook.

Sharing workbooks between Tableau Desktop on Windows and on the Mac

When working in Tableau Desktop on the Mac, all sheets and workbooks will be fully functional for viewing and editing when opened in Tableau Desktop for Windows. The reverse is also true for workbooks created in Tableau Desktop on Windows.

However, Tableau Desktop on Windows is able to connect to additional data sources that may not be compatible when opened in Tableau Desktop on the Mac.

For more information about opening a Windows workbook that contains data sources that are not supported in Tableau Desktop on the Mac, see **Open an existing workbook in Tableau Desktop on the Mac** on the next page in the Workbooks topic.

Workbooks

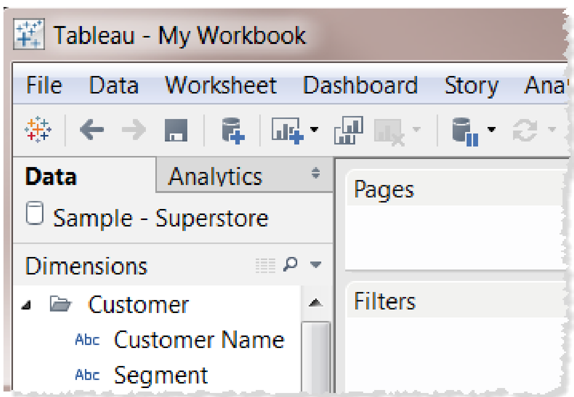
Tableau workbook files are much like Microsoft Excel workbooks. They contain one or more sheets, which can be worksheets, dashboards, or stories. They allow you to organize, save, and share your results. The workbook is the container for all of your work in Tableau.

When you open Tableau, a blank workbook is automatically created. You can also create a new workbook by selecting **File** > **New** or by pressing Ctrl + N on your keyboard (Command-N on Mac) .

You can open an existing workbook by doing one of the following:

- Click the thumbnail image of the workbook on the start page. The start page shows workbooks that you've recently opened.
- Select **File** > **Open** and navigate to the location of your workbook using the Open dialog box. Tableau workbooks have a .twb or .twbx file extension.
- Double-click on any workbook file in the Windows explorer.
- Drag any workbook file onto the Tableau desktop icon or onto the running application.

When you open a workbook, the workbook name is displayed in the application title bar.

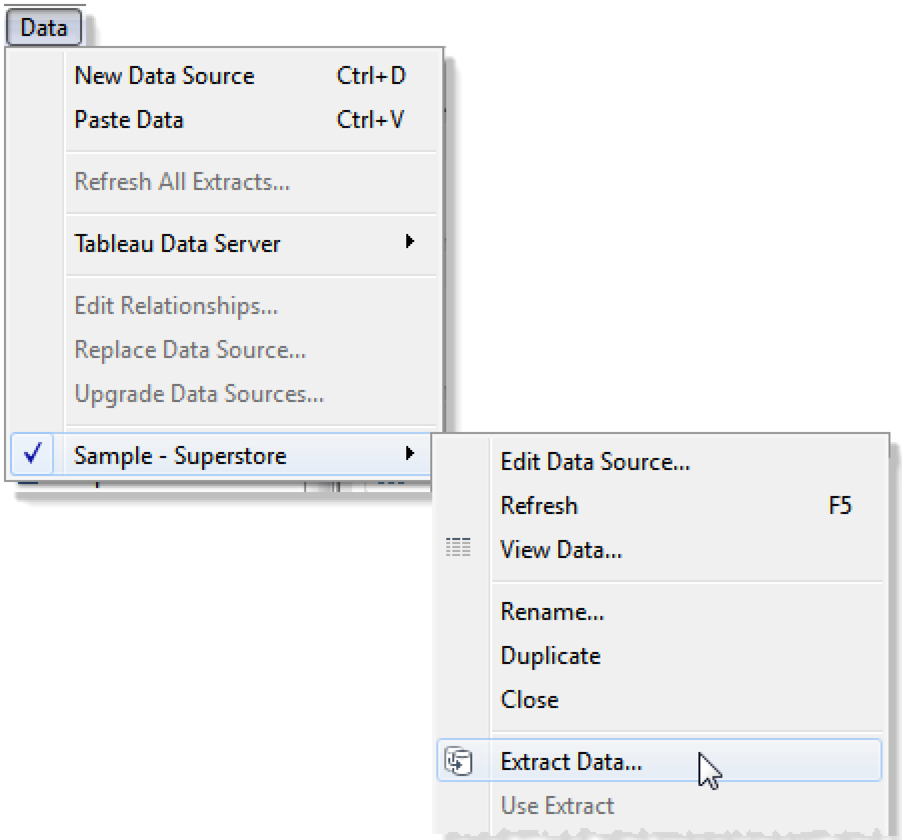


You can open multiple workbooks simultaneously. Each workbook is shown in its own application window.

Open an existing workbook in Tableau Desktop on the Mac

When working in Tableau Desktop on the Mac, you might want to open a Windows workbook that contains data sources that are not supported in Tableau Desktop on the Mac. To do so, follow the steps below:

1. In Tableau Desktop on Windows, save the workbook as an extract. To create and save an extract, on the **Data** menu, select a data source, and then select **Extract Data**.



2. Open the Tableau Extract (.tde file) you saved in Tableau Desktop on your Mac.

> **Note:** When opening a workbook with Microsoft Excel or text files from Tableau version 8.1 or earlier, you will be prompted to upgrade the workbook. If the workbook is unable to upgrade, create an extract of the workbook in Windows, then open the extract on your Mac.

Sheets

Each workbook can contain different types of sheets: views (also known as worksheets), dashboards, and stories. A worksheet is where you build views of your data by dragging and dropping fields onto shelves. A dashboard is a combination of several views that you can arrange for presentation or to monitor. A story is a sequence of views or dashboards that work together to convey information. The sheets display along the bottom of the workbook as tabs. In this section you'll learn how to create, open, duplicate, hide, and delete sheets. You'll also learn how to organize sheets in a workbook.

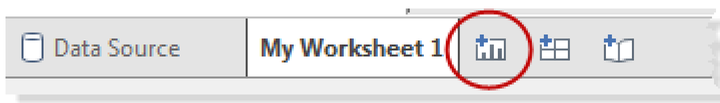
Creating New Sheets

There are several ways to create new sheets in a workbook. Follow the steps below to create a worksheet, a dashboard, or a story. You can create as many sheets in a workbook as you like.

Create New Worksheets

Create a new worksheet by doing one of the following:

- Select **Worksheet** > **New Worksheet**
- Click the **New Worksheet** tab at the bottom of the workbook.

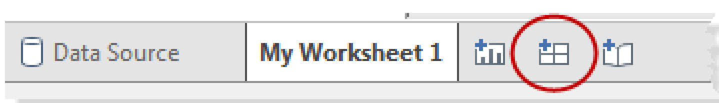


- Click the New Worksheet  icon on the toolbar and then choose **New Worksheet**.
- Press Ctrl + M on your keyboard.

Create New Dashboards

Create a new dashboard by doing one of the following:

- Select **Dashboard** > **New Dashboard**.
- Click the New Dashboard tab at the bottom of the workbook.

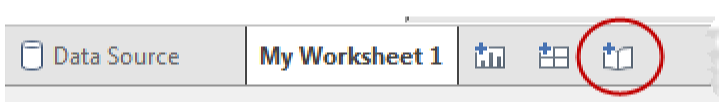


- Click the New Worksheet  icon on the toolbar and then choose **New Dashboard**.

Create New Stories

Create a new story by doing one of the following:

- Select **Story** > **New Story**.
- Click the New Story tab at the bottom of the workbook.



- Click the New Worksheet  icon on the toolbar and then choose **New Story**:

Tableau automatically generates sheet names. The first worksheet is named Sheet 1, the second worksheet is named Sheet 2, and so on. The same is true for dashboards (Dashboard 1, Dashboard 2, etc.) and stories (Story 1, Story 2, etc.) To rename a sheet, right-click the sheet tab (control-click on Mac) and select **Rename Sheet**. Alternatively, double-click the name of the sheet on the sheet tab and type a new name.

Undo, Redo, and Clearing Sheets

Every Tableau workbook contains a history of steps you have performed on the worksheets, dashboards, and stories in that workbook. To move backward through the history click **Undo**  on the toolbar or press Ctrl + Z on your keyboard. Similarly, move forward through the history by clicking **Redo**  on the toolbar or by pressing Ctrl + Y on your keyboard.

You can remove all fields, formatting, sizing, axis ranges, filters, sorts, and context filters in the sheet by clicking **Clear**  on the toolbar. You can also use the Clear drop-down list on the toolbar to clear specific aspects of the view such as clear all formatting, sizing, filters, sorts, etc.

Using the clear commands on the toolbar does not clear the history. If you decide that you didn't want to clear the sheet, click the **Undo** button.

Duplicating Sheets

Duplicating a sheet allows you to easily make a copy of a worksheet, dashboard, or story. You can then modify the sheet without losing the original version. To duplicate the active sheet, right-click the sheet tab (control-click on Mac) and select **Duplicate Sheet**.

A crosstab (sometimes referred to as a Pivot Table) is a table that summarizes data in rows and columns of text. It is a convenient way to display the numbers associated with the data view.

To quickly create a cross-tab from a view, right-click the sheet tab (control-click on Mac) and select **Duplicate as Crosstab**. You can also select **Worksheet** > **Duplicate as Crosstab**. This command inserts a new worksheet into your workbook and populates the sheet with a cross-tab view of the data from the original worksheet. (Dashboards and stories cannot be duplicated as crosstabs.)

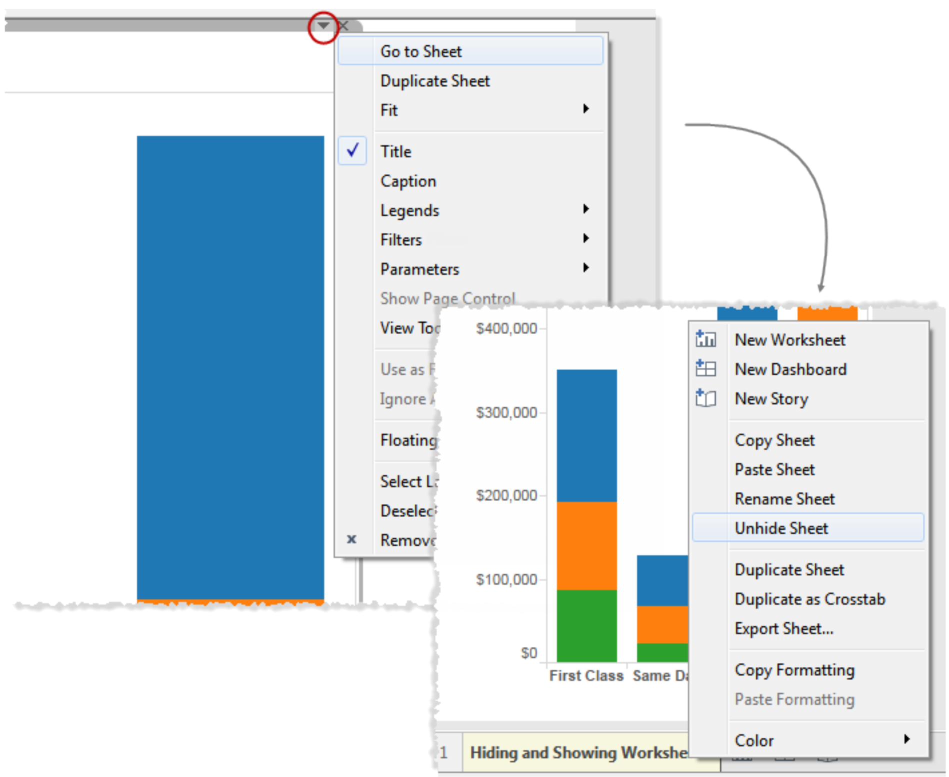
There are other ways to see the numbers behind the data views. For example, you can mouse-over any mark to display the associated numbers in a tooltip. Click the **View Data** command at the bottom of the tooltip to view underlying data. You can copy and paste the data into Excel or another application.

Hiding and Showing Worksheets

A worksheet that is used in a dashboard or story cannot be deleted, but it can be hidden. You may want to hide a worksheet if you are sharing the dashboard or story with others and don't want to clutter the workbook with all the supporting worksheets. To hide a worksheet, right-click the worksheet tab (control-click on Mac) for any worksheet that is used in a dashboard or story and select **Hide Sheet**.

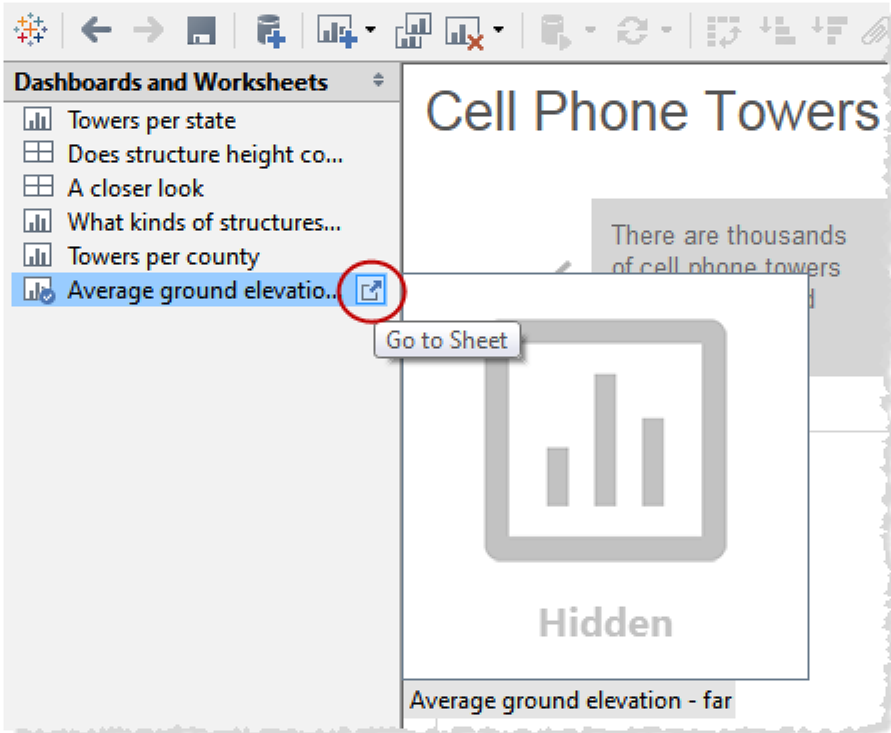
Dashboards

You can show a hidden sheet from a dashboard that uses it by choosing **Go to Sheet** on the dashboard view menu. The hidden sheet is shown until you switch to another sheet. While the hidden sheet is showing, you can right-click the sheet tab (control-click on Mac) and select **Unhide** to unhide it permanently.



Stories

As you create stories, you can see the workbook's dashboards and views in the Dashboards and Worksheets area. To view a hidden dashboard and worksheet, hover over the icon to the right of the sheet name and click to go to the underlying sheet.



Though you can now see the sheet, it is still officially hidden, which is indicated by the blue background:

The sheet will not show if you publish the workbook, or after you close and reopen it. To unhide the sheet, right-click it (control-click on Mac) and choose **Unhide Sheet**.

If a story uses a hidden dashboard which in turn uses a hidden worksheet, to see that hidden worksheet you must first go to the hidden dashboard from the story, and then go to the hidden worksheet from the dashboard.

Deleting Sheets

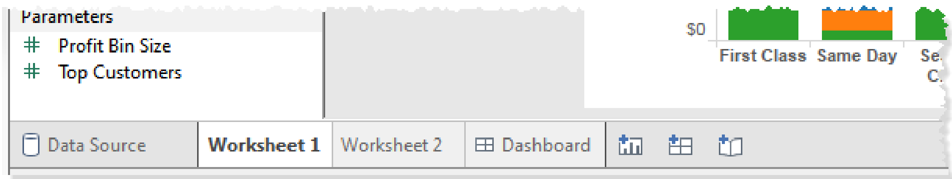
Deleting a sheet removes it from the workbook. To delete the active sheet, right-click (control-click on Mac) the sheet in the sheet tab along the bottom of the workbook and select **Delete Sheet**. Worksheets used in a dashboard or story cannot be deleted, but they can be hidden. For more information, see **Hiding and Showing Worksheets** on the previous page.

> There must always be at least one worksheet in a workbook.

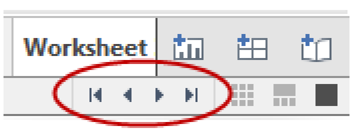
There are three ways to navigate and view the sheets in a workbook: the tabs at the bottom of the workbook, the filmstrip, and the sheet sorter. The tabs are useful for quickly navigating between a small number of sheets. If your workbook has a large number of sheets, you may find that the sheet sorter makes it easier to navigate them all.

Sheet tabs

Each sheet is represented as a tab along the bottom of the workbook. Select any tab to open the corresponding worksheet.



In the bottom right corner of the application window, there are several controls that you can use to advance through each sheet or quickly jump to the first or last sheet in the workbook. These controls are only available when there are too many sheet tabs to show across the bottom of the application window.



You can also navigate between sheets using the window menu or move through the multiple worksheets by pressing Ctrl + F6, or pressing the Right or Left Arrow keys on your keyboard.

> To navigate through multiple worksheets, a worksheet tab at the bottom of the workbook must be selected.

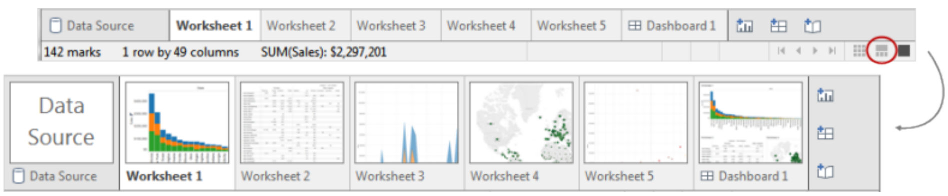
> Navigating within a story is a different matter—there, you use the Navigator to move between story points. See **Updating a Story** on page 994.

Filmstrip

Similar to the sheet tabs, the filmstrip displays along the bottom of the workbook. However, instead of sheet names, the filmstrip shows a thumbnail image of each sheet. The filmstrip is useful when you are using Tableau to present your analysis and works well when you are working in Presentation mode.

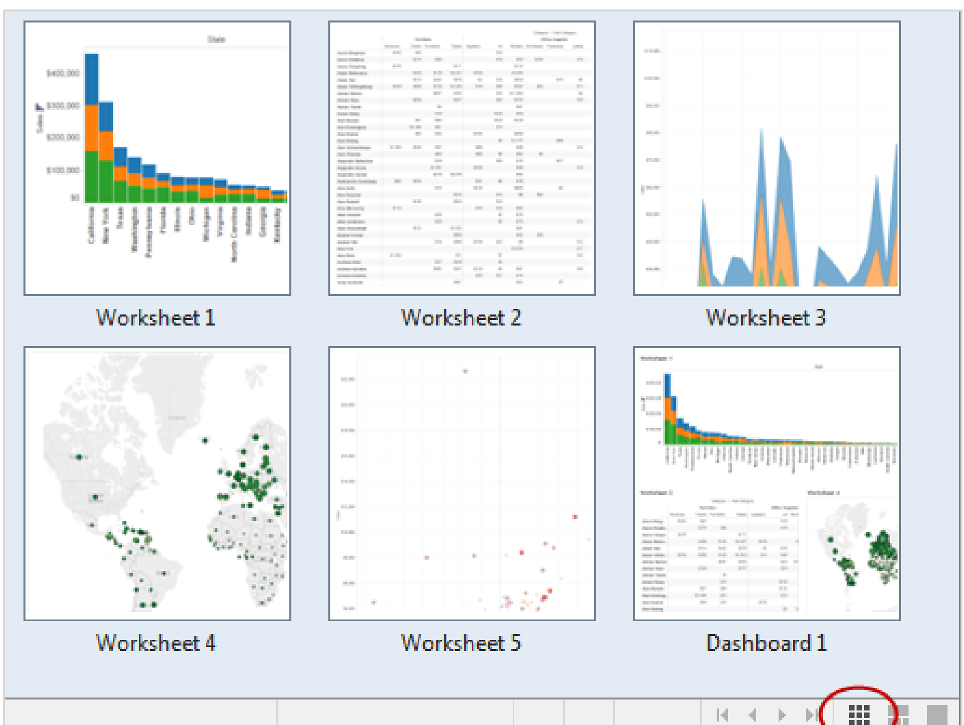
Open the filmstrip by clicking the arrows on the bottom right corner of the workbook. Just like with the tabs, select the thumbnail image for the sheet you want to open. You can right-click the images to specify commands that apply to each sheet.

> **Note:** When viewed from a Retina display, workbooks that are created on a standard resolution device will show only the first thumbnail in the filmstrip in high resolution. To display all thumbnails in the filmstrip in high resolution, resave the workbook on a computer with Retina display.



Sheet sorter

The sheet sorter shows all sheets in a workbook as thumbnail images on a single page and is similar to the slide sorter in Microsoft Power Point. The sheet sorter is useful when you have a large number of sheets in a workbook. Open the sheet sorter by clicking the sheet sorter tab in the upper right corner of the workbook.



From the sheet sorter you can drag and drop to reorder the sheets, create new sheets, and duplicate or delete existing sheets. Right-click a sheet (Control-click on the Mac) to see these commands. You can also right-click (Control-click on the Mac) to refresh the thumbnail image of a particular sheet or **Refresh All Thumbnails** at once.

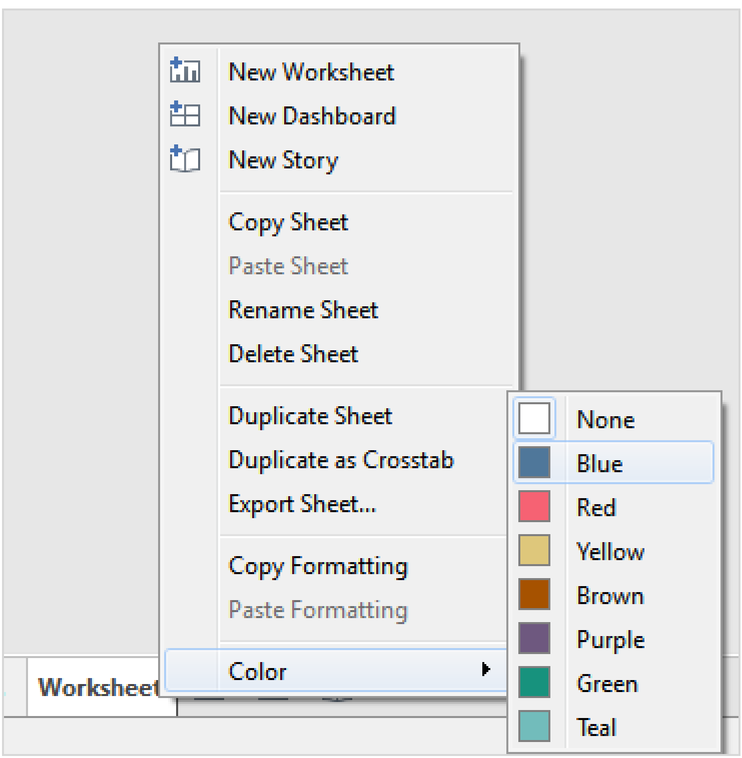
Sheet commands

Use sheet commands to manage and organize your worksheets. For example you can create new sheets, duplicate sheets, copy formatting, apply color, or delete the sheet entirely.

You can access sheet commands on the right-click menu in the worksheet, sheet sorter, or the filmstrip view. To apply commands to multiple sheets at once, press the Ctrl key, and then select the sheets.

To make it easier to identify and group sheets, you can assign a color to sheets. You can select from seven different colors. Selecting **None** clears the color.

To assign a color to sheets, select one or more sheets, right-click the sheets (Control-click on the Mac), select **Color**, and then pick a color.



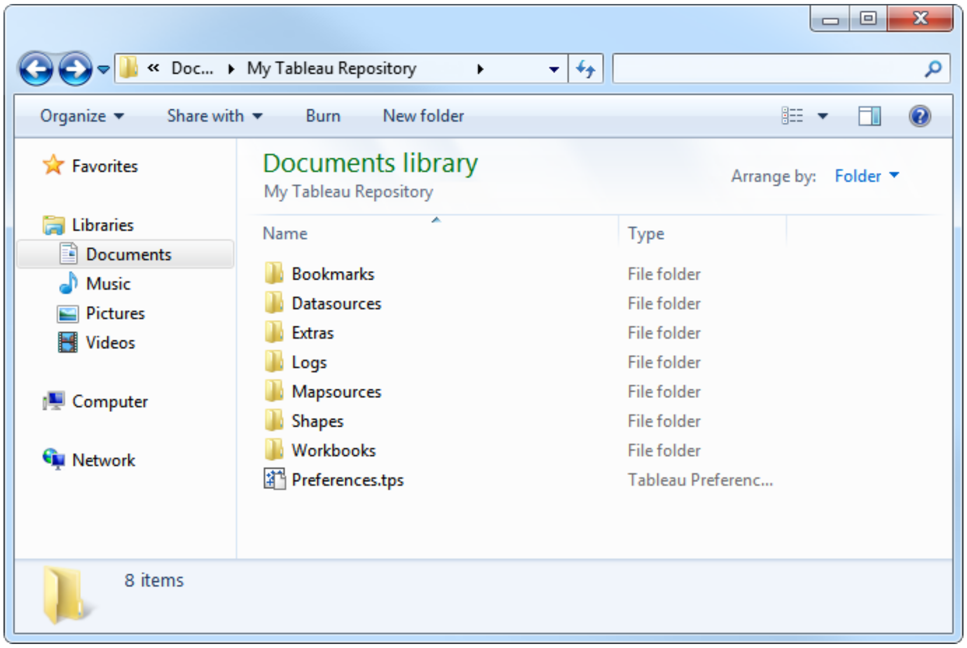
The color strip appears on the bottom of the tab or sheet as shown below.

Files and Folders

You can save your work using several different Tableau specific file types: workbooks, bookmarks, packaged data files, data extracts, and data connection files. Each of these file types are described below.

- **Workbooks (.twb)** – Tableau workbook files have the .twb file extension. Workbooks hold one or more worksheets, plus zero or more dashboards and stories.
- **Bookmarks (.tbm)** – Tableau bookmark files have the .tbm file extension. Bookmarks contain a single worksheet and are an easy way to quickly share your work. For more information, see **Bookmarks** on page 1249.
- **Packaged Workbooks (.twbx)** – Tableau packaged workbooks have the .twbx file extension. A packaged workbook is a single zip file that contains a workbook along with any supporting local file data sources and background images. This format is the best way to package your work for sharing with others who don't have access to the data. For more information, see **Packaged Workbooks** on page 1247.
- **Data Extract (.tde)** – Tableau data extract files have the .tde file extension. Extract files are a local copy of a subset or entire data source that you can use to share data, work offline, and improve database performance.
- **Data Source (.tds)** – Tableau data source files have the .tds file extension. Data source files are shortcuts for quickly connecting to data sources that you use often. Data source files do not contain the actual data but rather the information necessary to connect to the data source as well as modifications you've made in the Data pane such as default properties, calculated fields, groups, and so on. For more information, see **Export Data Sources** on page 417.
- **Packaged Data Source (.tdsx)** – Tableau packaged data source files have the .tdsx file extension. A packaged data source is a zip file that contains the data source file (.tds) described above as well as any local file data sources such as Extract files (.tde), text files, Excel files, Access files, and local cube files. Use this format to create a single file that you can then share with others who may not have access to the original data stored locally on your computer. For more information, see **Export Data Sources** on page 417.

These files can be saved in the associated folders in the My Tableau Repository directory, which is automatically created in your My Documents folder when you install Tableau. Your work files can also be saved in other locations, such as your desktop or a network directory.



Changing the Repository Location

You can specify a new location for the Tableau repository if you are not using the default location in your Documents folder. For instance, if you are required to have your data on a network server instead of on your local machine, you can point Tableau at the remote repository.

1. Select **File > Repository Location**.
2. Select a new folder that will act as the new repository location in the Select a Repository dialog box.
3. Restart Tableau so that it uses the new repository.

Changing the repository location does not move the files contained in the original repository. Instead, Tableau creates a new repository where you can store your files.

Learning to Use Tableau

The purpose of this section is to get you started with Tableau by presenting a simple example. The exercises takes you through all the basic steps you would use for your own work.

Open Tableau

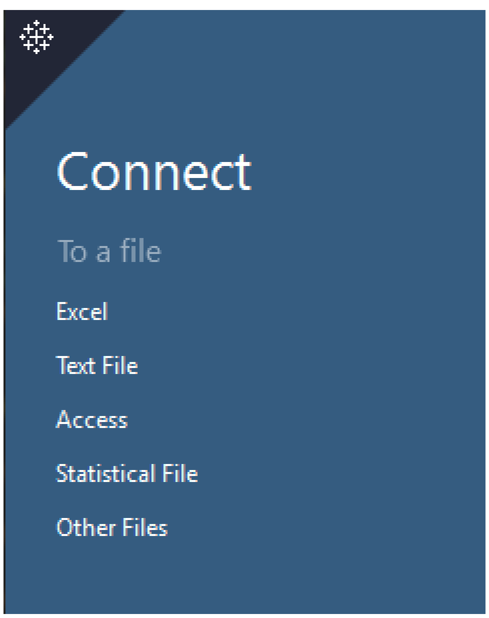
You can open Tableau by selecting **All Programs** > **Tableau 9.3** on the Windows Start menu or by double-clicking the desktop shortcut.

Tableau opens to the start page. The start page contains recently used workbooks, saved data connections, sample workbooks, and some other getting started resources. Although the start page shows when you first open Tableau, you can always return to the start page after you have started working in the worksheet by clicking the start page tab in the upper-right corner of the workbook.

Connect to Data

The first step to getting started with Tableau Desktop is to connect to the data you want to explore. There are several types of data you can connect to and several ways to connect to your data. For example, you can connect to your through the start page, the toolbar, or the Data menu. This example shows you how to connect to your Microsoft Excel data from the start page.

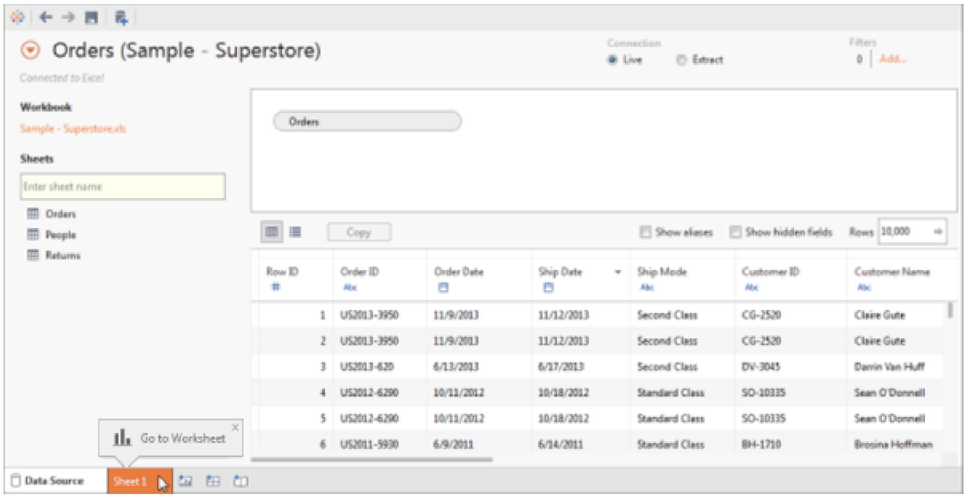
1. On the start page, under **Connect**, click **Excel**. The Connect pane lists the different types of data you can connect to.



2. In the Open dialog box, navigate to an Excel file on your computer and open it.

   The Excel data for this example is located in the "Datasources" directory of your Tableau Repository. By default, your Tableau Repository is created in your My Documents folder when Tableau Desktop is installed.

After you have connected to the Excel data, the Data Source page displays the sheets in your data. You can then drag these sheets to the canvas and combine them to form the data source from which you will build your view. To learn how to join data, see the **Join Your Data** on page 349 . If there are more than 1 million rows in the data source, you will need to filter the data.



3. At the top of the Data Source page, select how you want to connect to the data and the data source filters you want to apply. You can select from the following options:

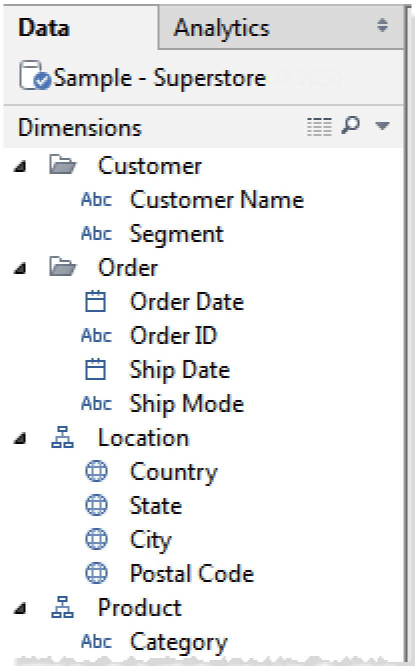
   - **Live** – Creates a direct connection to your data. The speed of your data source will determine performance.
   - **Extract** – By default, this option imports the entire data source into Tableau fast data engine as an extract. The extract is saved with the workbook. If you prefer to import a subset of the data, click the **Edit** link. This option requires you specify what data you want to extract using filters.
   - **Add** - Add data source filters to limit the visibility of fields contained in the workbook.

4. At the bottom of the Data Source page, preview the data in your data source. You can also make the following modifications:

   - Hide or rename the column. Click the header drop-down arrow, and select **Hide** or **Rename**.
   - Change the data type or geographic role. Click the data type icon in the header, and select the default data type for the column.

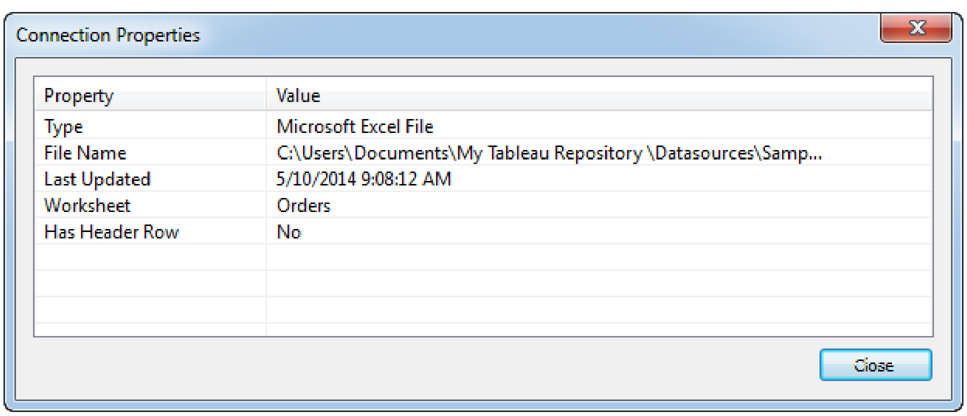
5. Click the sheet tab to begin your analysis.

Once connected, the columns from the data source (e.g., Customer Name, Order Date, and Sales) are shown as fields on the left side of the workbook in the Data pane. Each column is shown as a separate field that you can drag and drop to start exploring your data.



The fields are organized into two sections: dimensions and measures. Dimensions typically hold categorical data such as product types and dates, while measures hold numeric data such as sales and profit. An important concept to understand in Tableau is that you can build views of your data by dragging fields from the Data pane to the shelves in the view.

You can display information about the data source by selecting the data source on the **Data** menu and then selecting **Properties**. The properties of an example data source are shown below.



Building Views (Manually)

You can build data views by dragging fields from the Data pane and dropping them onto the cards and shelves that are part of every Tableau worksheet.

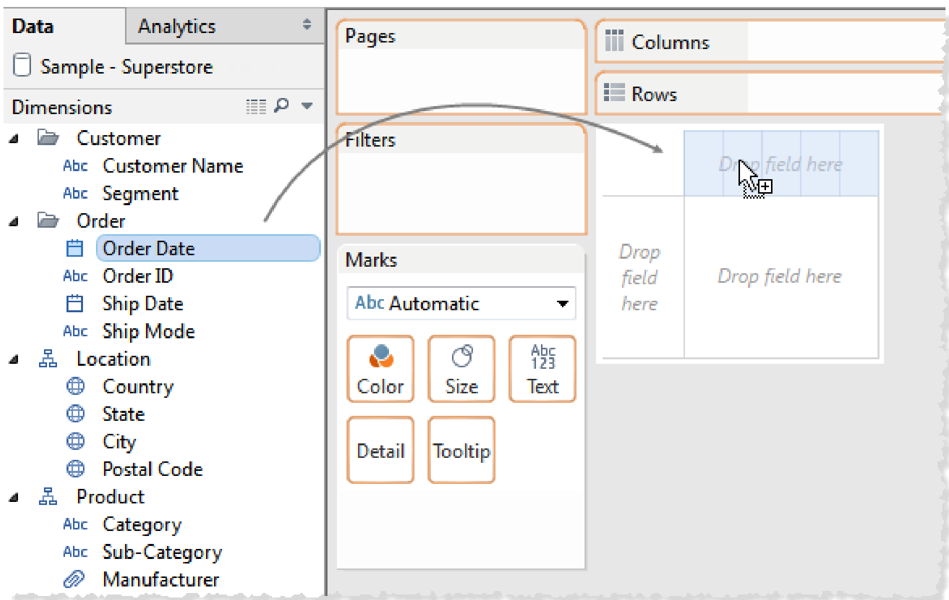
This section presents five data views using the Sample-Superstore Sales data source that is installed with the application.

Example 1 – Basic View

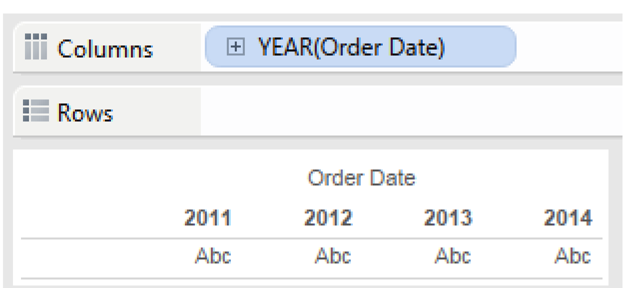
In this example, you will build a basic view that shows yearly profits. Follow the steps below to build this view.

1. From the dimensions area of the **Data** pane, drag the **Order Date** field to the **Columns** area of the view.

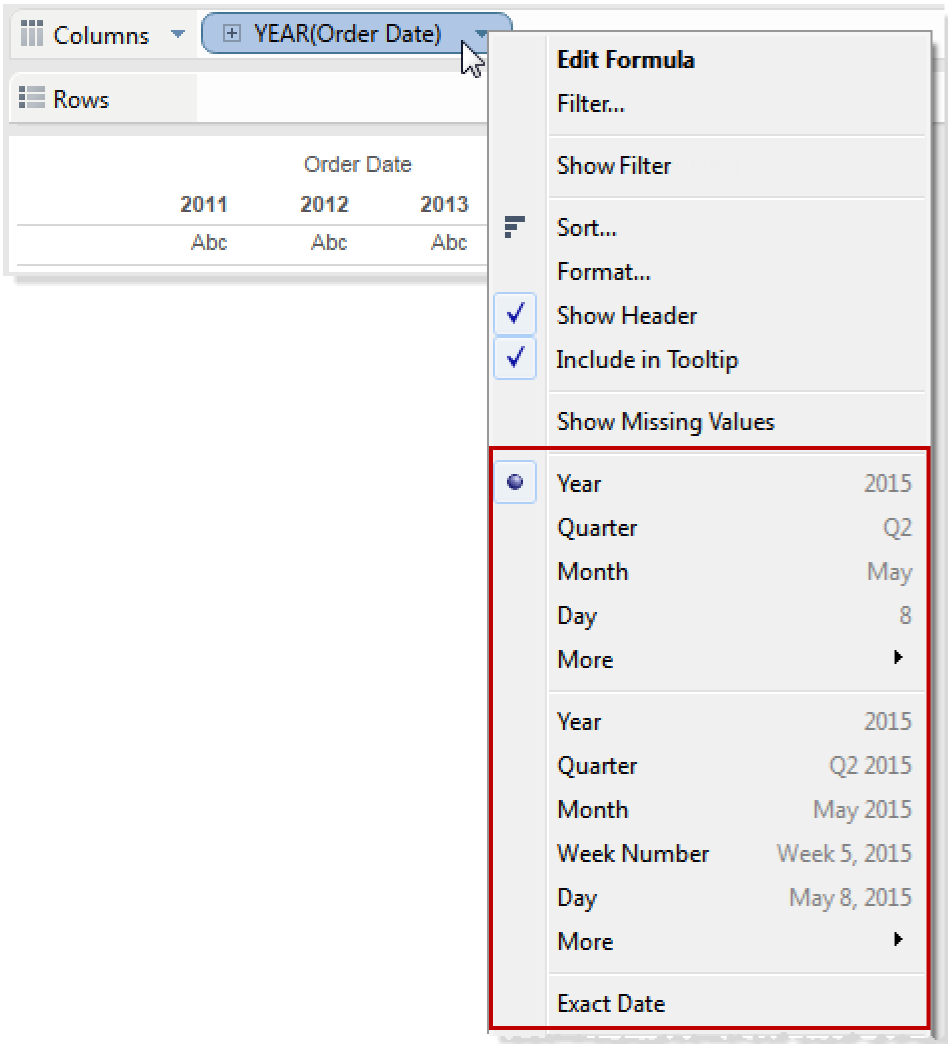
   When you place a field in the Columns area of the view it is also added to the Columns shelf. You can also drag directly to these shelves. When you drag a field over a shelf, a blue arrow indicates that the shelf can accept the field.



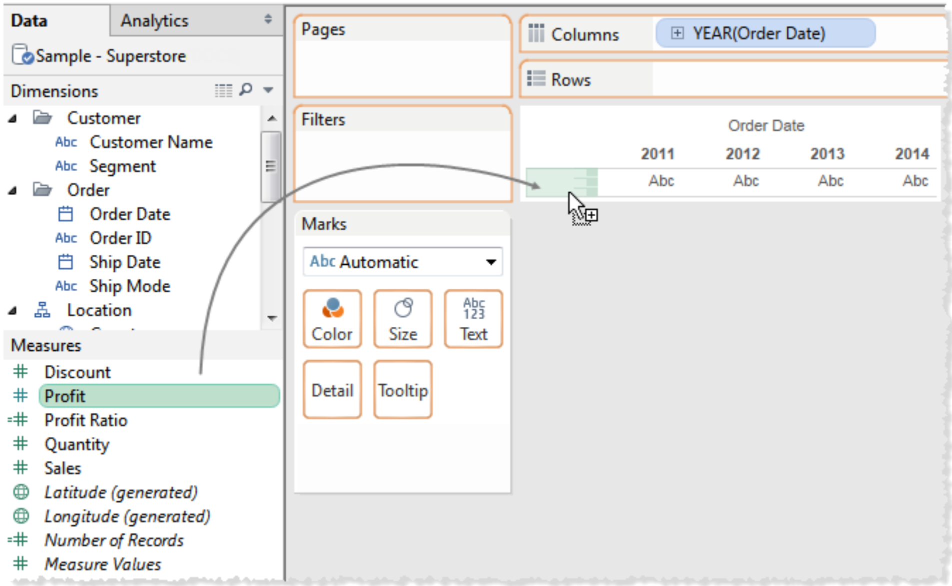
The resulting table has four columns and one row. Each column header represents a member of the Order Date field (2011, 2012, 2013, and 2014). Each cell contains an "Abc" label, which indicates that the current mark type for this view is text.



Notice that the field is colored blue indicating that it is discrete. Also, the field name changed to YEAR(Order Date) because year is the default date level for this field. The default date level is determined by the highest level that contains more than one distinct value (for example, multiple years and multiple months). That means that if Order Date contained data for only one year but had multiple months, the default level would be month. You can change the date level using the field menu.

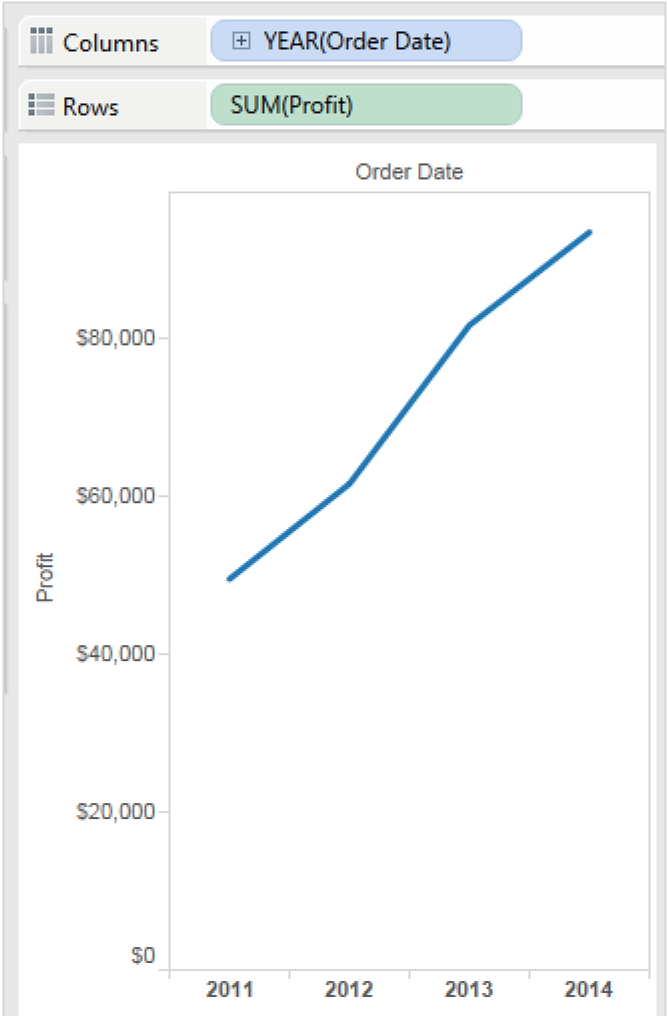


2. From the Measures area of the **Data** pane, drag the **Profit** field to the **Rows** area of the view.



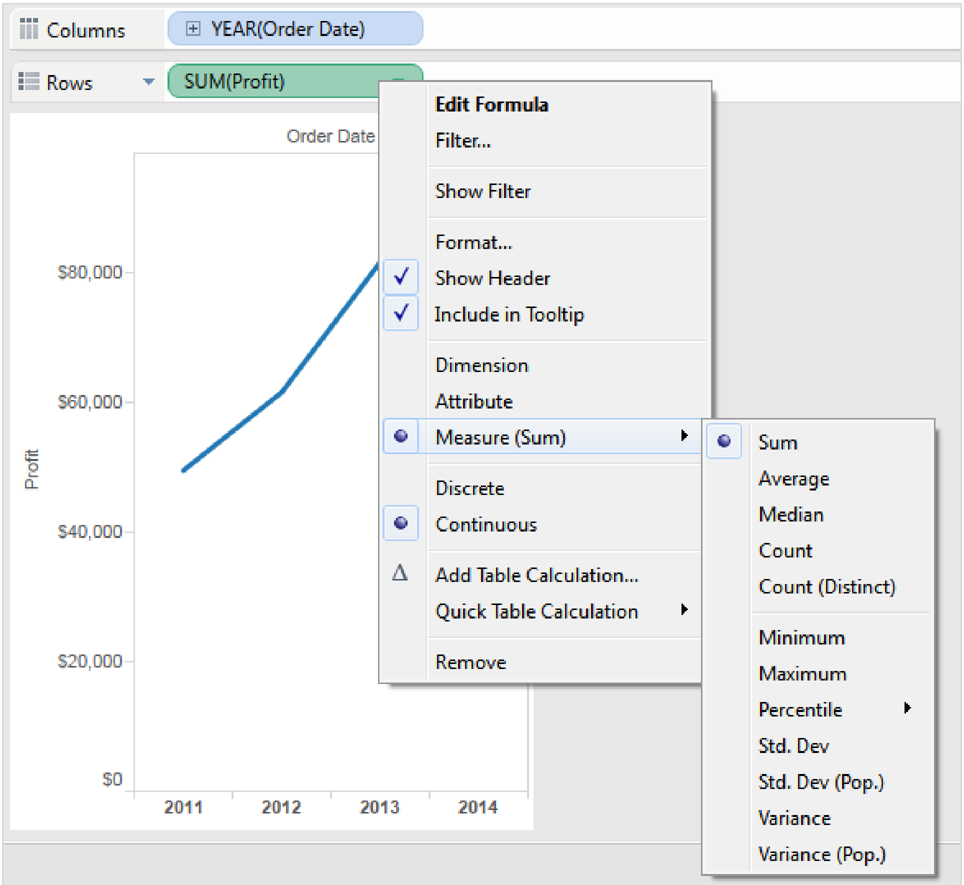
The table is automatically transformed into a line chart and a vertical axis is created for the measure. A line is used as a great way to compare data over time, and allow you to visually compare data and identify trends effectively.

The line chart shows profit over time. Each point along the line shows the sum of profit for the corresponding year.



The Profit field is colored green, indicating that it is continuous. Also the field name changed to SUM(Profit). That's because the default aggregation for measures in a relational database is

SUM. You can change the aggregation using the field menu.

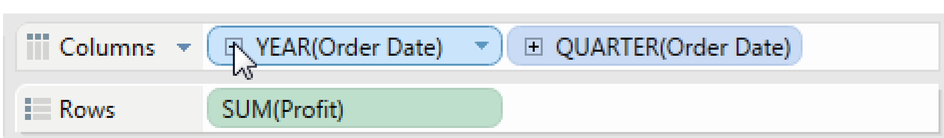


Example 2 – Nested Table

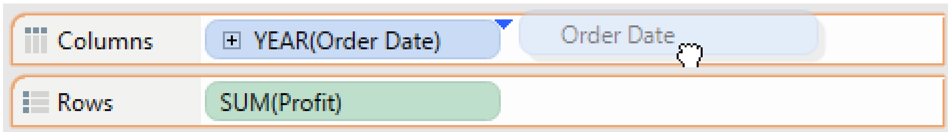
In this example you will modify the view from **Example 1 – Basic View** on page 312 to show quarters in addition to years. Follow the steps below to build this view.

Show Order Date by quarters using one of the following methods:

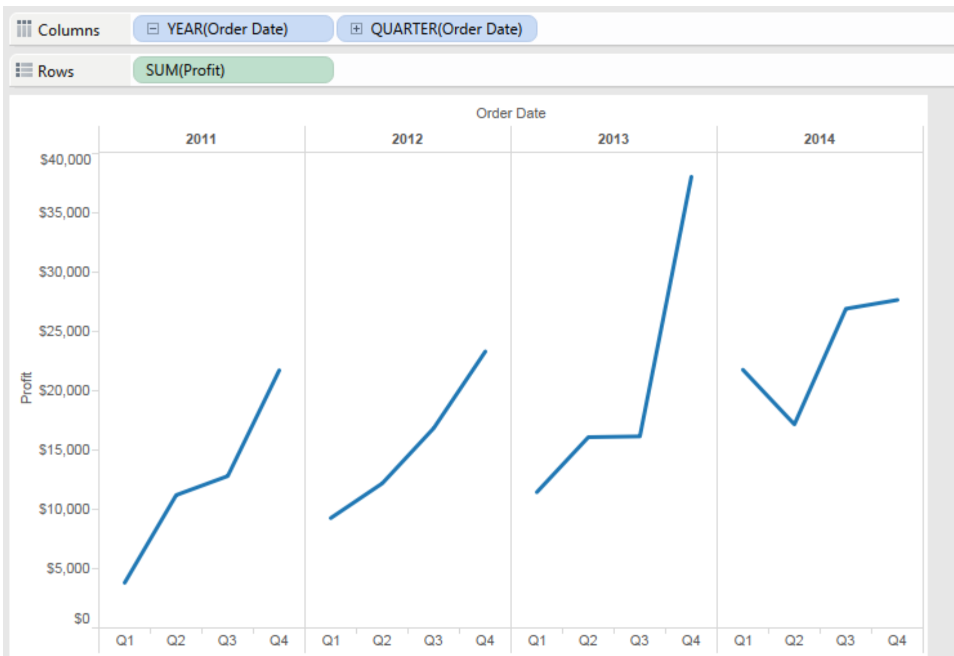
- Drill down the Year(Order Date) field by clicking the plus button ⊞ on the left side of the field.



- Drag the **Order Date** field from the Data pane and drop it on the **Columns** shelf to the right of the Year(Order Date) field.



The new dimension divides the view into separate panes for each year. Each pane has columns for the quarters of the given year. This view is called a nested table because it displays multiple headers, with quarters nested within years.

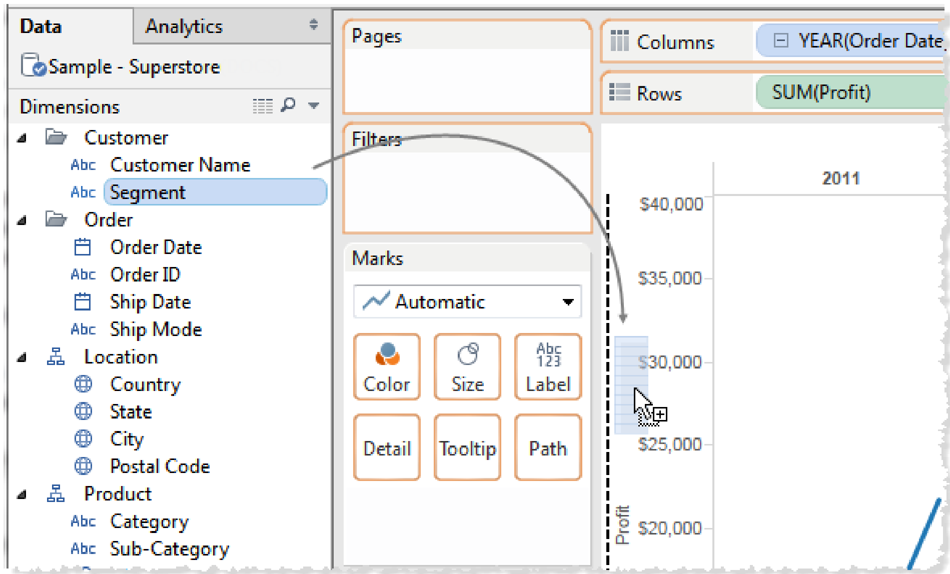


Example 3 – Small Multiples

In this example you will modify the view from **Example 2 – Nested Table** on the previous page to show quarterly profit by year and customer segment.

Drag the **Segment** dimension from the **Data** pane and drop it just to the left of the Profit axis in the view.

The field is added to the Rows shelf and row headers are created. Each header represents a member of the Segment field.



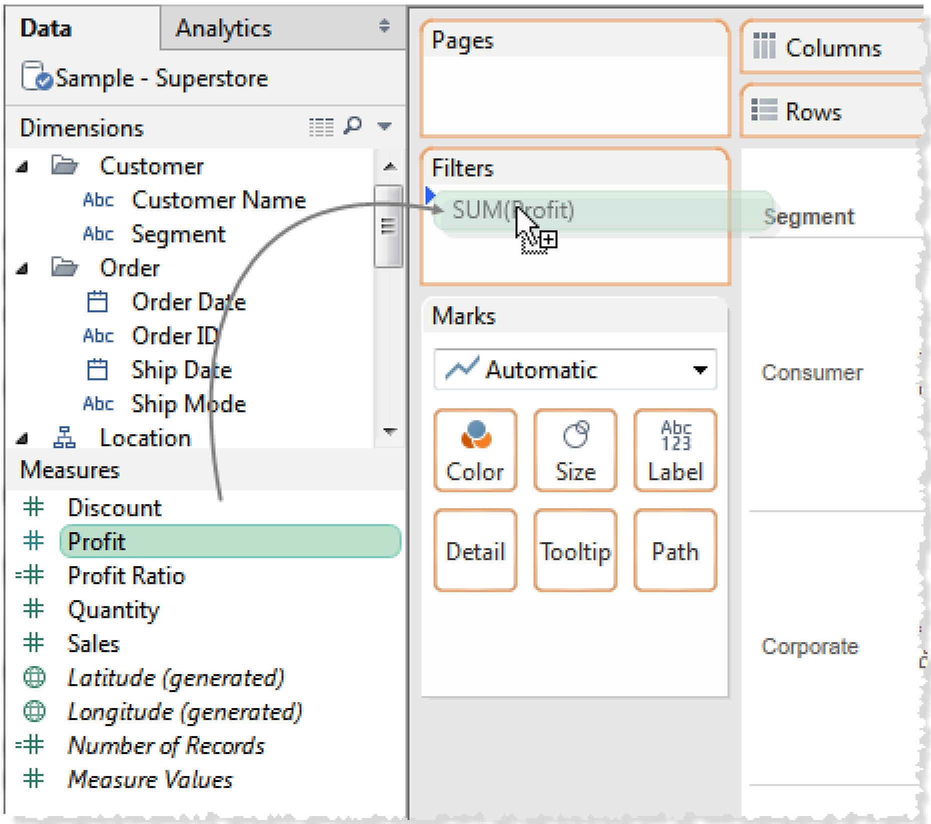
Note: Tableau does not allow you to place a dimension to the right of a measure on either the Rows or Columns shelves.

The new dimension divides the view into 12 panes: one for each combination of year and segment. This view is a more complex example of a nested table and is often referred to as a small multiples view.

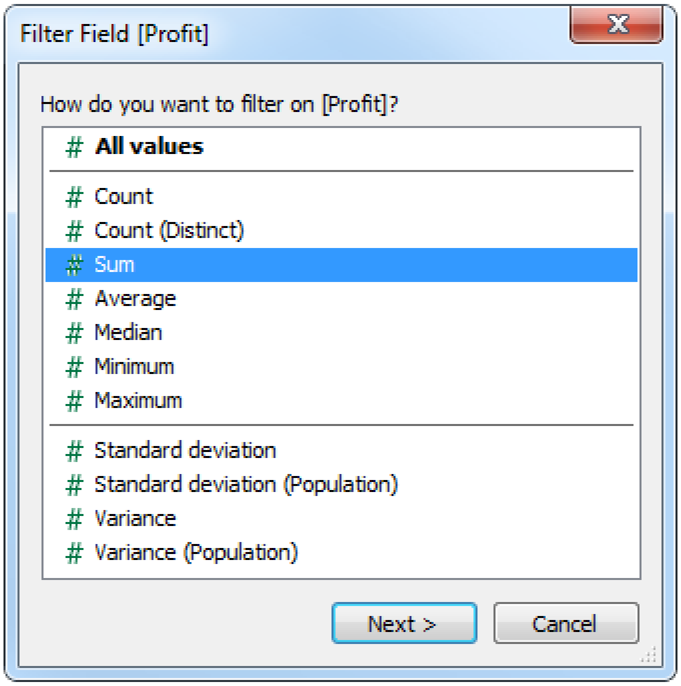
Example 4 – Filter Data

In this example you will modify the view from **Example 3 – Small Multiples** on page 317 to only show data for orders in 2012 and 2013 and that made a profit.

1. Drag the **Profit** measure from the **Data** pane and drop it on the **Filters** shelf.

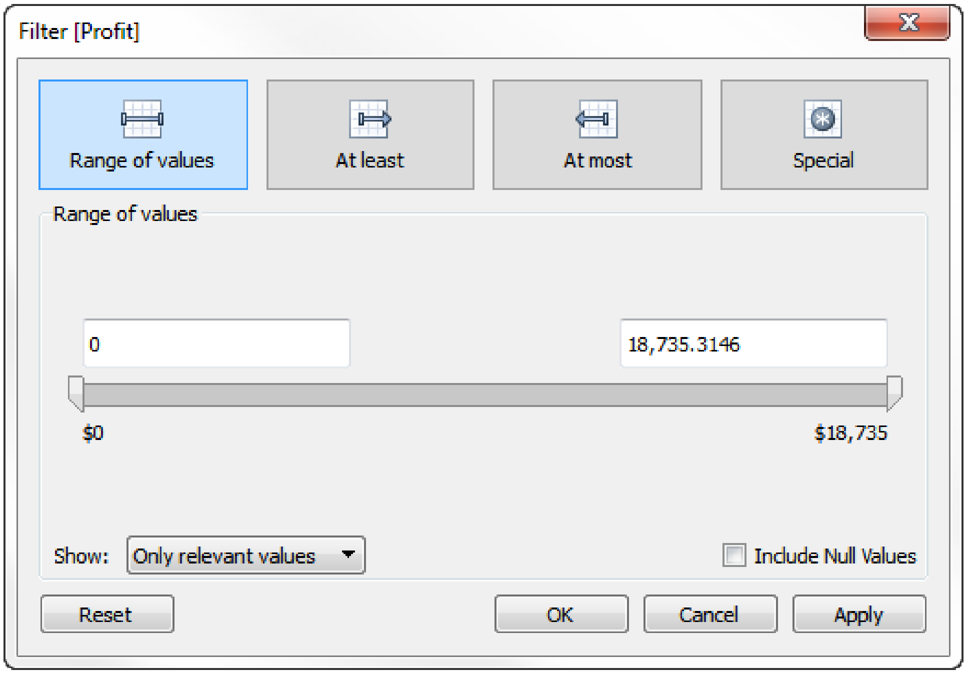


2. Select the aggregation you want to use for the filter. For this example, select **SUM** to create a filter on the SUM of the profit data.



Filtering aggregated data means that the selected aggregation function (sum, average, etc.) is applied to the data and then it is filtered. Filtering disaggregated data (All values) means that the individual data rows are filtered before any aggregation function is applied. Aggregations do not apply to cube (multidimensional) data because in those databases, the data has already been aggregated in the database.

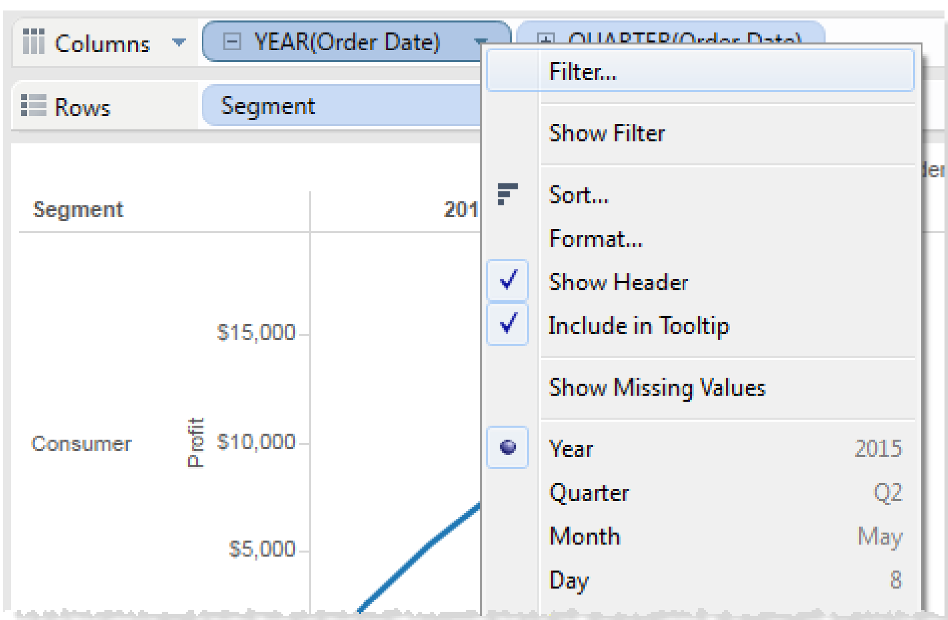
3. In the Filter dialog box, use the sliders or type in the text box to change the lower limit on the range of values to 0.



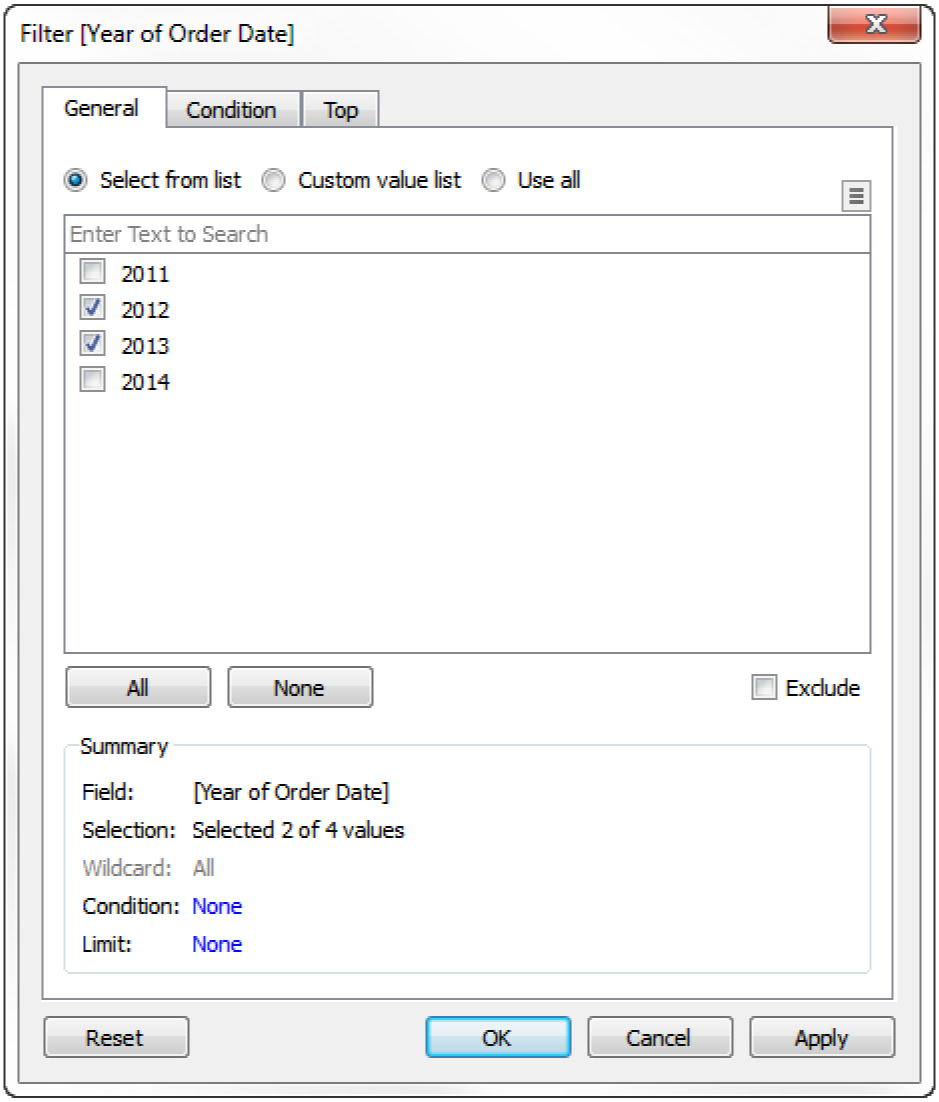
4. When finished, click **OK**.

   The view updates to show only orders that had a SUM(Profit) over $0. No new axes were created because the field was not added to the Rows or Columns shelves.

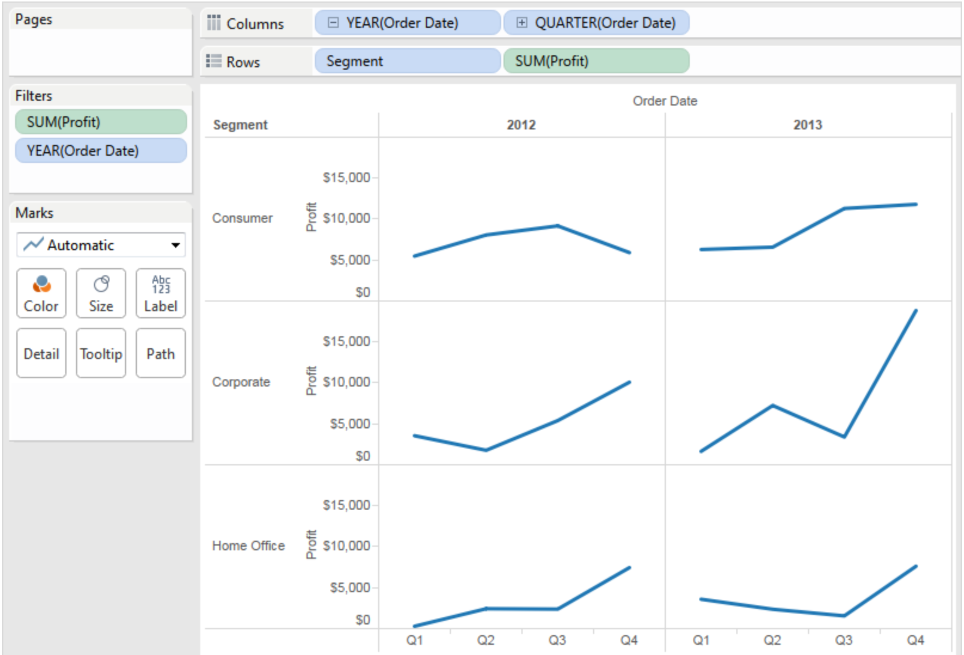
5. Click the **Year(Order Date)** field menu, and select **Filter**.



6. In the Filter dialog box, deselect all years except **2012** and **2013** ,and then click **OK**.



The SUM(Profit) is calculated only for data rows where profit is greater than or equal to $0 and Order Date is 2012 or 2013.

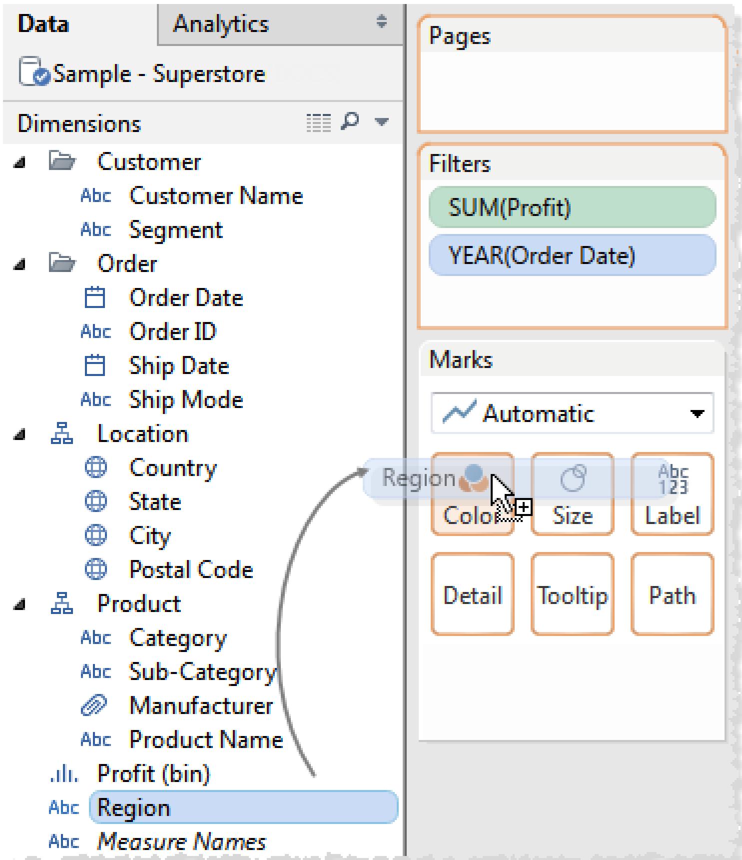


Example 5 – Color Encoding

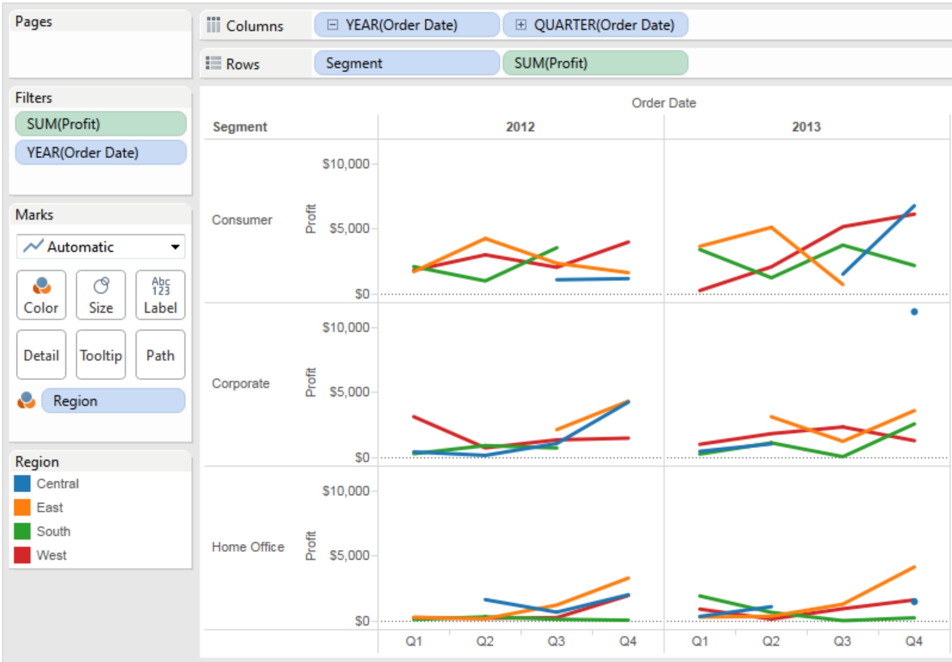
In this example you will modify the view from **Example 4 – Filter Data** on page 319 to color the marks by region. Follow the steps below to build this view.

Drag the **Region** dimension from the **Data** pane and drop it on **Color**.

Placing a dimension on Color separates the marks according to the members in the dimension, and assigns a unique color to each member. The color legend displays each member name and its associated color.



Each pane now has four lines, one for each region. This view now shows profit for each customer segment and region for 2012 and 2013 orders with a positive profit.



Building Views (Automatically)

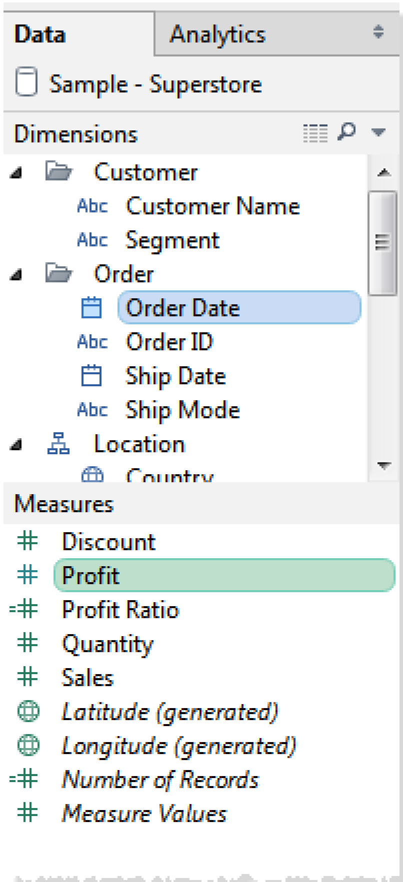
Rather than building views by dragging and dropping fields, you can use Show Me™ to create views automatically.

This section presents two examples using the Sample-Superstore data source that comes with the application.

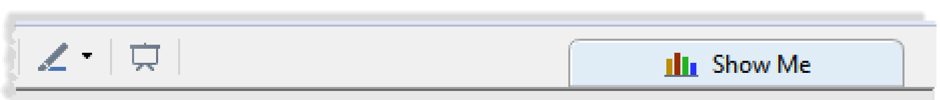
Example 1 – Show Me with Two Fields

In this example, you will create a line chart that displays profit as a function of time. Follow the steps below to create this view.

1. Select **Order Date** and **Profit** in the Data pane. Hold the Control key (Ctrl) on your keyboard to select multiple fields.



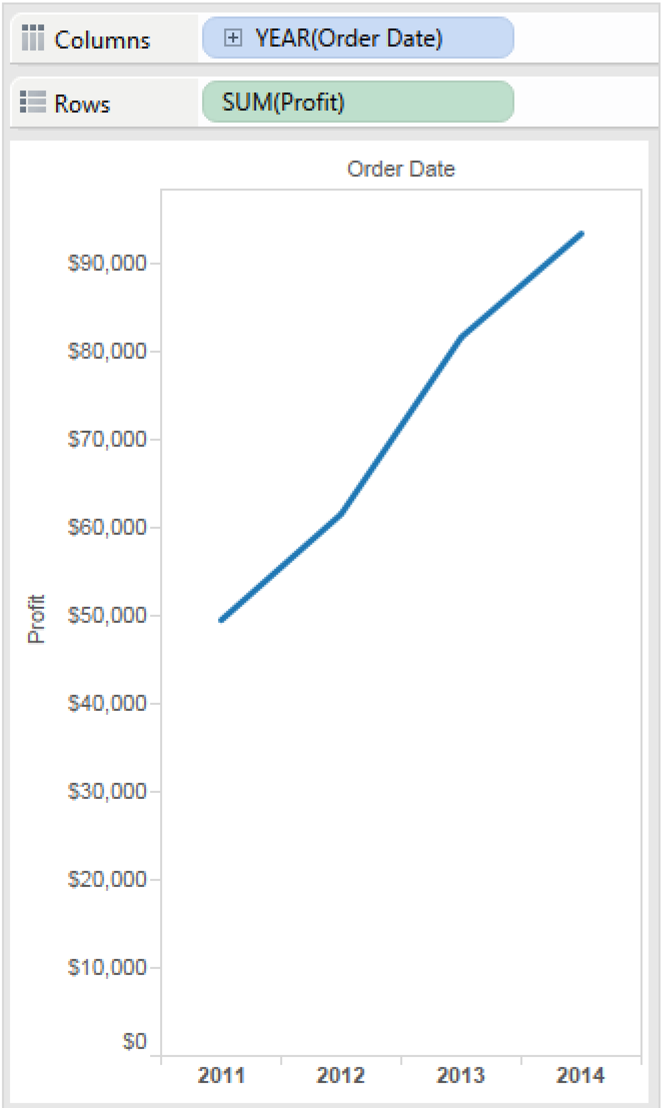
2. Click **Show Me** on the toolbar.



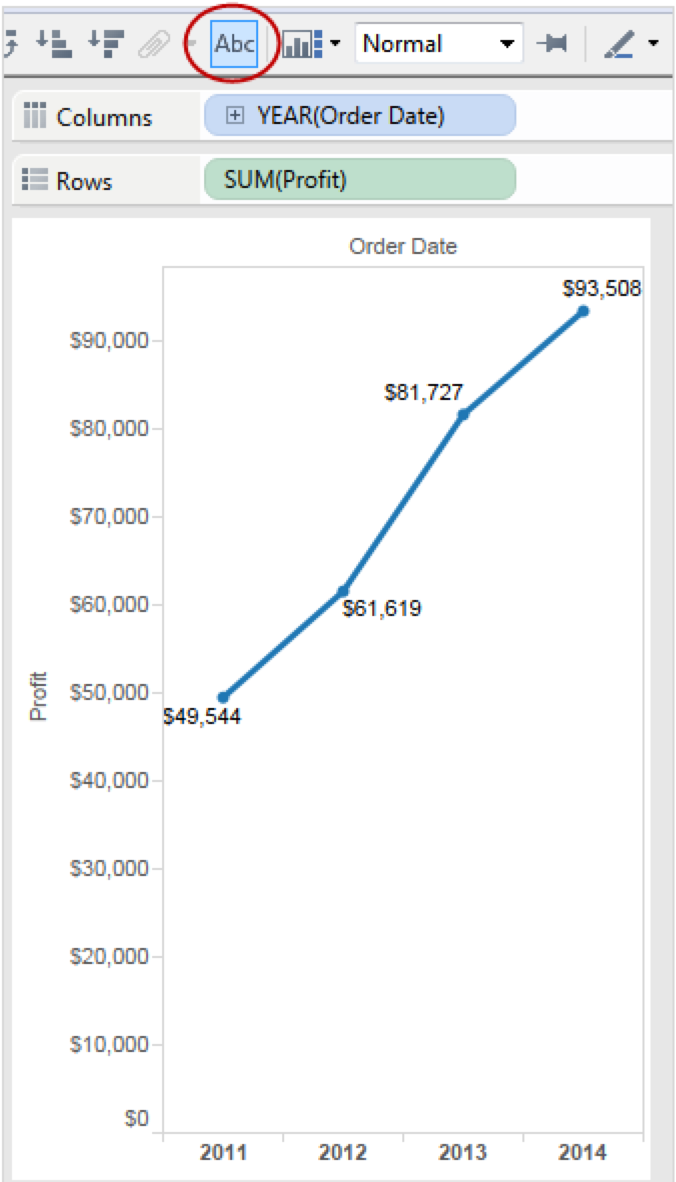
3. In the Show Me pane, select the type of view you want to create.

Because a date dimension and a measure are selected, Tableau suggests you build a line view, which is generally the best way to look at measures over time.

The view below shows SUM(Profit) over time. Each point on the line represents the sum of profit for the corresponding year.



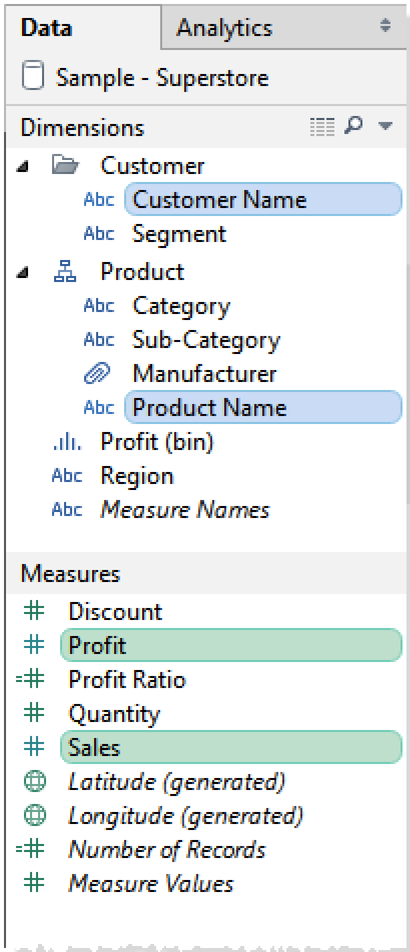
You can see the values for each year by turning on Mark Labels. Click the **Mark Labels** button on the toolbar.



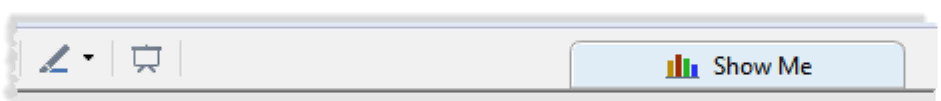
Example 2 – Show Me with Many Fields

In this example you will use Show Me to build a scatter plot that shows sales versus profit for each product and customer.

1. Select **Sales**, **Profit**, **Product Name**, and **Customer Name** in the Data pane. Hold the Control key (Ctrl) on your keyboard to select multiple fields.

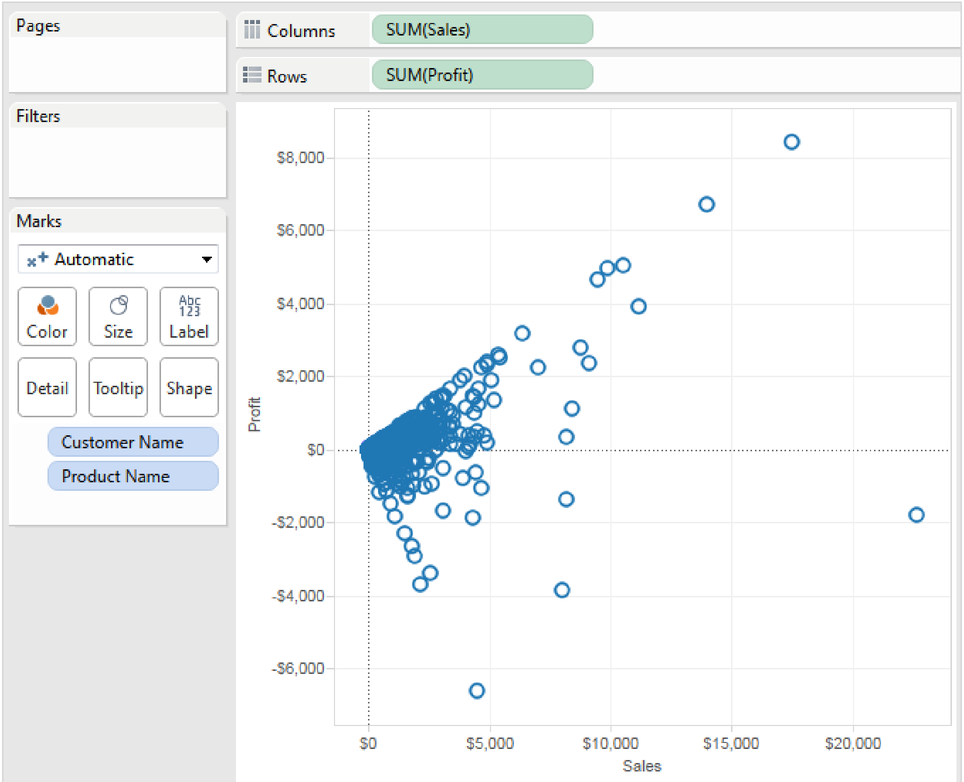


2. Click **Show Me** on the toolbar.



3. In the Show Me pane, select the scatter view.

Show Me automatically creates a scatter plot with the fields you selected. You can now manually start dragging fields to further refine the view.



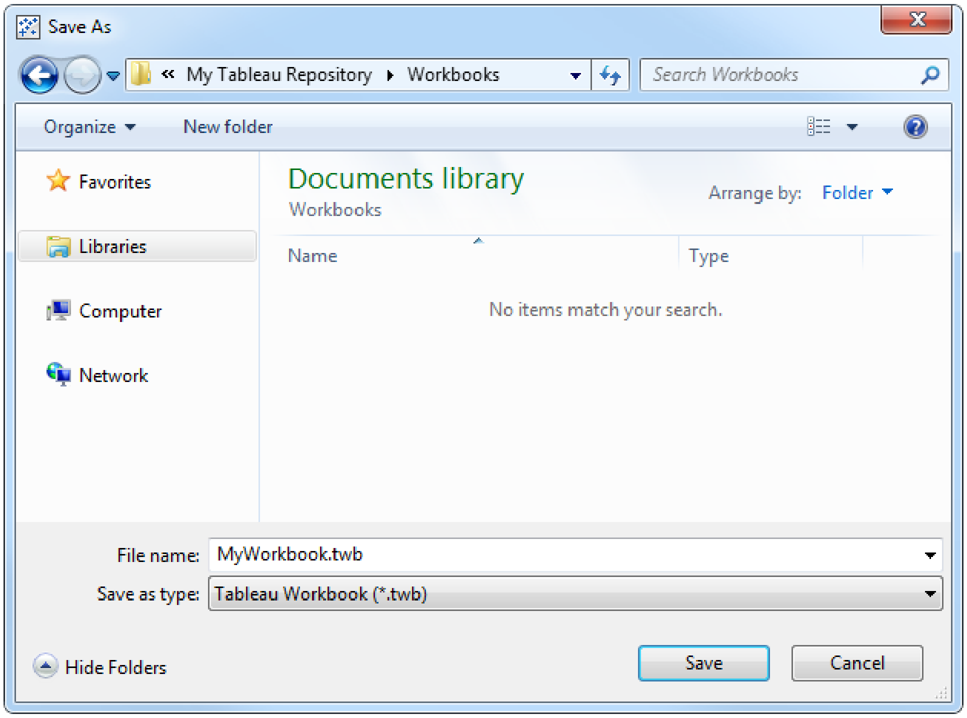
Save Your Work

After you have created all the desired views of your data, you should save the results in a Tableau Workbook. Saving a Tableau workbook allows you to save all your worksheets for later use. It also allows you to share your results using a convenient file. Follow the steps below to save your workbook.

1. Select **File** > **Save** or press Ctrl + S on your keyboard.
2. Browse to a file location to save the workbook.

   By default, Tableau saves workbooks in the Workbooks folder in My Tableau Repository.

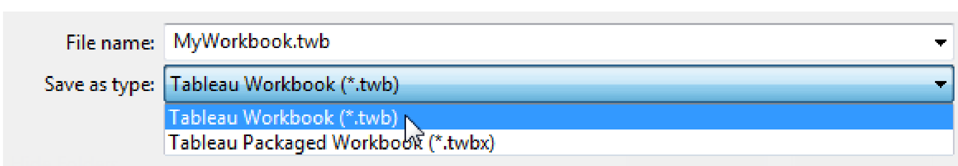
3. Specify a file name for the workbook.



4. Specify a file type. You can select from the following options:

   Tableau Workbook (.twb) – Saves the all the sheets and their connection information in a workbook file. The data is not included.

   Tableau Packaged Workbook (.twbx) – Saves all the sheets, their connection information and any local resources (e.g., local file data sources, background images, custom geocoding, etc.).



5. When finished, click **Save**.

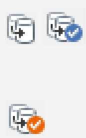
Visual Cues and Icons in Tableau Desktop

Tableau provides many visual cues to help you evaluate the type of data that's displayed in the Data pane and the state of a data view.

Data Sources in the Data Pane

The following table explains each of the icons used to describe the type of data sources in the Data pane. Each icon in the table can be modified by one of two indicators.

- A blue check mark indicates that the data source is the primary data source in the workbook.
- An orange check mark indicates that the data source is the secondary data source in the workbook.

Visual Cue	Description
	The workbook is directly connected to a relational data source or file.
	The workbook is connected to a cube (multidimensional) data source. In Tableau, cube data sources are supported only in Windows.
	The workbook is connected to an extract that still references the underlying data.
	The workbook is connected to a data source that has been published to Tableau Server.

Fields in the Data Pane

The following table explains each of the icons displayed in the Data pane. Each icon in the table can be modified by one of four indicators.

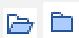
- Blue icons indicate that the field is discrete. Abc
- Green icons indicate that the field is continuous. #
- Icons preceded by the equal sign (=) indicate that the field is a user-defined calculation or

a copy of another field. =Abc

- Icons with an exclamation mark on them indicate that the field is invalid. !

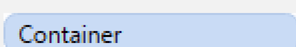
Visual Cue	Description
Abc =Abc Ab!	The field contains text values.
# =# #!	The field contains numeric values.
=#	The field is a calculation defined on the server.
	The field contains only date values.
	The field contains both date and time values.
	The field contains geographical data and has been assigned a geographic role. Use these fields when building map views. See **Maps** on page 871.

Visual Cue	Description
	The field contains geographical data from an active custom geocoding file. See **Custom Geocoding** on page 919.
T|F =T|F	The field contains boolean (true or false) values.
	The field is a calculation that is defined in the database by an administrator. These fields are marked with a cylinder icon and are not available for all data sources.
	The field is a user-defined set. See **Sets** on page 750.
	The field is a server named set.
	The field is a set that was automatically created as a result of an action.
	The field is a user filter, used when publishing to the web. See **User Filtering** on page 1228.
	The field is a numeric bin. See **Create Discrete Bins from a Continuous Measure** on page 868.
 	The field is a group. See **Groups** on page 736.
 	The field is a relational hierarchy. See **Hierarchies (For Relational Databases)** on page 214.

Visual Cue	Description
	A folder that contains one or more fields. Folders are used to organize fields in the Data pane. See **Organize the Data Pane** on page 221.
	The field is an attribute of a cube (multidimensional) data source. In Tableau, cube data sources are supported only in Windows.
	The field is a varying attribute of a cube (multidimensional) data source.
	The field is a level in a multidimensional hierarchy. Levels greater than five are shown without numbers.
	The field is a hierarchy in a dimension that contains multiple hierarchies.
	The field is blended with a field from another data source. See **Add a Secondary Data Source** on page 361
	The field is not blended with a field from another data source. See **Add a Secondary Data Source** on page 361

Fields on Shelves

Fields placed on shelves use a combination of icons, colors, and text styles as visual cues.

Visual Cue	Description
	A blue field on a shelf indicates a discrete field. In most cases, addiing a dimension to a shelf results in a blue field. Blue fields are discrete—they contain a finite number of values. Adding a blue field to a shelf creates headers. See **Headers** on page 423.
	A green field on a shelf indicates a continuous field. In most cases, adding a measure to a shelf results in a green field. Green fields are continuous—they contain an infinite number of values. Adding a green field to a shelf creates an axis. See **Axes**

Visual Cue	Description
	on page 426.
Order Priority	The Sort icon indicates a field that has either a computed or manual sort order applied. See **Computed Sorting** on page 723.
Σ Call Center	The sigma icon indicates a calculation filter in a multidimensional (cube) data source. See **Calculation Filters: Multidimensional Data Source** on page 666.
MySet	The Venn diagram icon indicates a set. See **Sets** on page 750.
MySet	An field name shown in italics indicates a filtered set.
Region	A gray field on the Filters shelf indicates a context filter. See **Context Filters** on page 659.
SUM(Sales) Δ	The delta icon indicates that the field is a table calculation. See **Table Calculations** on page 1029.
⊟ Country / Region ⊞ State	The plus and minus controls appear when the field is part of a hierarchy that you can traverse.
SUM(Sales)	The arrow icon indicates that a forecast is being displayed for the field. This icon is also used on the Forecast Indicator field, which is an automatic field used to distinguish between actual and forecast values. See **Forecasting** on page 1091.
Status	The field is from a secondary data source. See **Blend Your Data** on page 361.

Visual Cue	Description
Last Sale Price	The field is assigned to a specific worksheet.
Segment	The field is assigned to all worksheets with the same data source.
Internet Sales Amount ⚠	The field is incompatible with one or more other fields in the view.

Fields on the Marks card

Fields placed on the Marks card use specific icons to describe how they appear in the view. See **Mark Properties** on page 451.

Visual Cue	Description
Sales	The field is applied to Color on the Marks card.
Sales	The field is applied to Size on the Marks card.
Abc 123 Sales	The field is applied to Label on the Marks card.
Department	The field is applied to Shape on the Marks card.
⊞ YEAR(Order ..	The field is applied to Path on the Marks card. Path is only available when the Line or Polygon mark type is selected from the Marks drop-down menu. See **Path Properties** on page 483.

Sheets in the Dashboards and Worksheets pane

The following table explains each of the icons used to describe the type of sheet that can be placed in a story. A blue check mark indicates that a sheet is being used in one or more story points.

Visual Cue	Description
	The sheet is a worksheet.
	The sheet is a dashboard.

Connect to Your Data

Before you can build a view and analyze your data, you must first connect Tableau to your data. Tableau Desktop supports connecting to a wide variety of data, stored in a variety of places. For example, your data might be stored on your computer in a spreadsheet or a text file, or in a big data, relational, or cube (multidimensional) database on a server in your enterprise. Or, you might connect to public domain data available on the web such as U.S. Census Bureau information, or to a cloud database source, such as Google Analytics, Amazon Redshift, or Salesforce.

When you launch Tableau Desktop, the data connections that are available to you are listed on the **Connect** pane, which is the left pane on the **Start** page. File types are listed first, then common server types. Click **More Servers** to see the complete list of data connections you can use. The data connections supported by your copy of Tableau Desktop are determined by the version you purchased. For more information, see the list of Data Connections on the Tableau website.

After you've connected to data sources, you can save the connections to have them show up under the **Saved data sources** section on the **Connect** pane.

You supply different information for each data connection that you want to make. For example, for most data connections, you'll need to supply a server name and your sign-in information. With some data connections, you can **Run Initial SQL** on page 344 statements, and SSL-enabled servers require that you select the **Require SSL** check box when you connect. The following sections discuss the specific information you need to provide for each data source you want to connect to.

Connect to your specific data source

Select from the following topics for information about how to connect to your data.

Quick Starts - short, simple introductory guides that introduce key concepts or list basic steps to accomplish a task

Quick Start: Connect to Your Data on page 33

Quick Start: Connect to Google Analytics on page 27

Quick Start: Query All Data from Google Analytics on page 80

Quick Start: Connect to Salesforce on page 30

Quick Start: SAP HANA Single Sign-On on page 60

Quick Start: Use Tableau Server Data Sources on page 76

Data source connection reference

Connectors are listed in the order that they appear on the **Connect** pane.

Tip: You can quickly create a data source in Tableau by copying and pasting data using the clipboard. For more information, see **Create a Data Source with Clipboard Data** on page 347.

Run Initial SQL

When connecting to some databases, you can specify an initial SQL command to run when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. This initial SQL is different than a custom SQL connection, which defines a relation (table) to issue queries against.

You can use this command to:

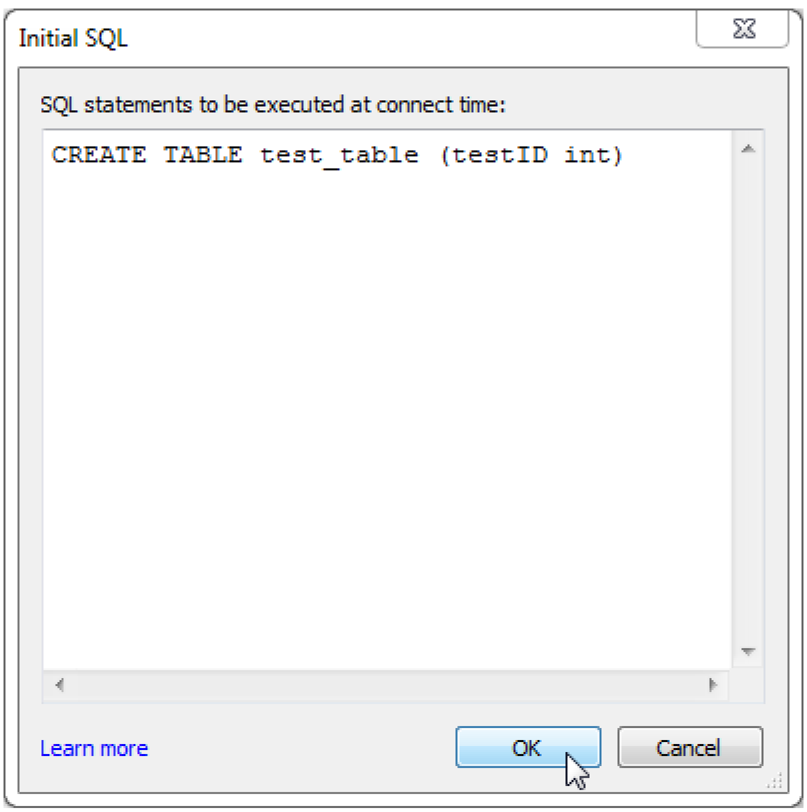
- Set up temporary tables to use during the session.
- Set up a custom data environment.

You have the option to add an initial SQL command in the Server Connection dialog box or on the Data Source page.

Note: If your data source supports running an initial SQL statement, an **Initial SQL** link appears in the lower-left corner of the Server Connection dialog box. For information about your data source, see **Connector Examples** on page 1270.

To use initial SQL

1. In the Server Connection dialog box, click **Initial SQL**. Or, on the Data Source page, select **Data** > **Initial SQL** or **Data** > **Query Banding and Initial SQL** depending on the database you connect to.
2. Enter the SQL command into the Initial SQL dialog box.



Note: Tableau does not examine the statement for errors. This SQL statement is simply sent to the database when you connect.

Your software license may restrict you from using initial SQL with your connection. If you publish to Tableau Server, the server must be configured to allow Initial SQL statements. By default, the server software is configured to allow these statements to run when the workbook is loaded in a web browser. Administrators can disable the functionality on the **Data Connections** tab of the Tableau Server Configuration utility. If the server does not allow initial SQL statements, the workbook opens, but the initial SQL commands are not sent.

Parameters in an initial SQL statement

You can pass parameters to your data source in an initial SQL statement. There are several reasons why this is useful:

- You can configure impersonation using the **TableauServerUser** or **TableauServerUserFull** parameters.
- If your data source supports it, you can set up row-level security (for example, for Oracle VPD or SAP Sybase ASE) to make sure that users see only the data that they are authorized to see.
- You can provide more details in logging, for example, the Tableau version or the workbook name.

The following parameters are supported in an initial SQL statement:

Parameter	Description	Example of returned value
TableauServerUser	The user name of the current server user. Use when setting up impersonation on the server. Returns an empty string if the user is not signed in to Tableau Server.	asmith
TableauServerUserFull	The user name and domain of the current server user. Use when setting up impersonation on the server. Returns an empty string if the user is not signed in to Tableau Server.	domain.lan\asmith
TableauApp	The name of the Tableau application.	Tableau Desktop Professional Tableau Server
TableauVersion	The version of the Tableau application.	9.3
WorkbookName	The name of the Tableau workbook. Use only in workbooks with an embedded data source.	Financial-Analysis

Examples

The following examples show different ways you can use parameters in an initial SQL statement.

- This example sets the security context on Microsoft SQL Server:

  ```
  EXECUTE AS USER = [TableauServerUser] WITH NO REVERT;
  ```

- This example shows how, on a DataStax data source, you can use parameters to add detail to logging or to set up a session variable to keep track of the data:

  ```
  SET TABLEAUVERSION [TableauVersion];
  ```

- This example can be used to help set up row-level security for Oracle VPD:

  ```
  begin
   DBMS_SESSION.SET_IDENTIFIER([TableauServerUser]);
  end;
  ```

  Note: Oracle PL/SQL blocks require a trailing semicolon to terminate the block. Consult Oracle documentation for the proper syntax.

Defer execution to the server

You can defer an initial SQL statement so that it is executed only on the server. One reason to defer execution to the server is if you don't have permission to execute the commands that set up impersonation. Use <ServerOnly></ServerOnly> tags to enclose the commands to be executed only on the server.

Example:

```
CREATE TEMP TABLE TempTable(x varchar(25));

INSERT INTO TempTable VALUES (1);

<ServerOnly>INSERT INTO TempTable Values(2);</ServerOnly>
```

Security and impersonation

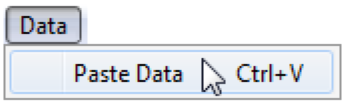
If you use the **TableauServerUser**, **TableauServerUserFull**, or **WorkbookName** parameter in an initial SQL statement, you will create a dedicated connection that can't be shared with other users. This will also restrict cache sharing, which can enhance security, but may also slow performance.

Create a Data Source with Clipboard Data

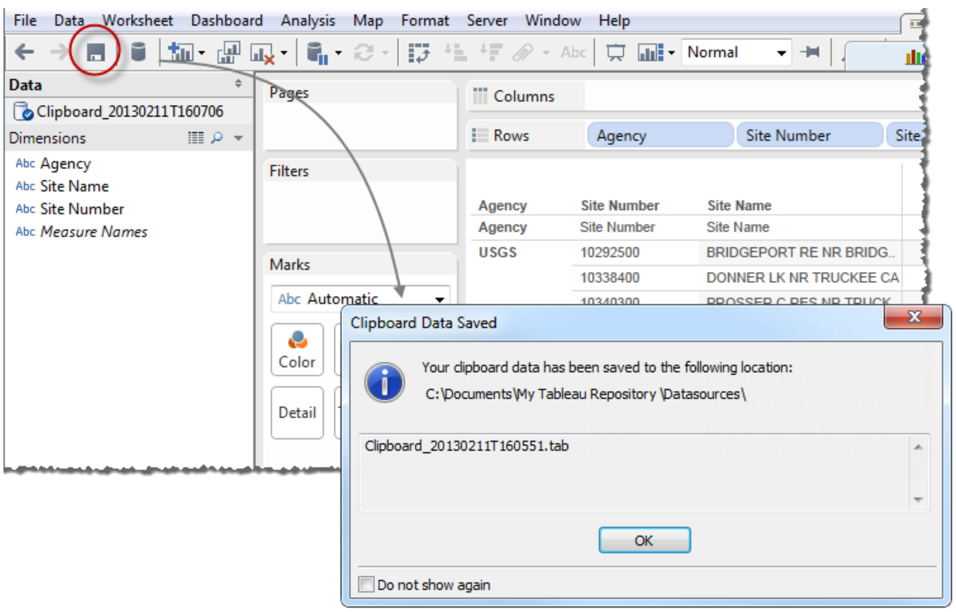
Sometimes you want to pull in data from an outside source for some quick analysis. Rather than create a whole data source and then connect in Tableau, you can copy and paste the data directly into your sheet. Tableau automatically creates a data source that you can begin analyzing. When you save the workbook, the data source is saved as a tab delimited text file into your Tableau Repository.

You can copy and paste data from a variety of office applications including Microsoft Excel and Microsoft Word. You can also copy and paste HTML tables from web pages. Tables that are copied as comma separated values or tab delimited can be pasted into Tableau. **Note:** Not all applications use these formats when copying.

1. Select the data you want and copy it to the clipboard.
2. Open Tableau Desktop and select **Data** > **Paste Data**.



3. Select **File** > **Save** to save the data source. When you save the workbook the data source is automatically put into your repository. If you save as a packaged workbook the data sources is saved with the workbook instead.



Create and Manage Data Sources

After you connect to your data, use the Data Source page to prepare your data for analysis. The configurations that you make on this page creates the data source that Tableau uses to interpret and interact with your data.

There are many optional configurations that you can make before you begin your analysis. The topics in this section describe how to use these configurations in order to optimize your data source for analysis.

Join Your Data

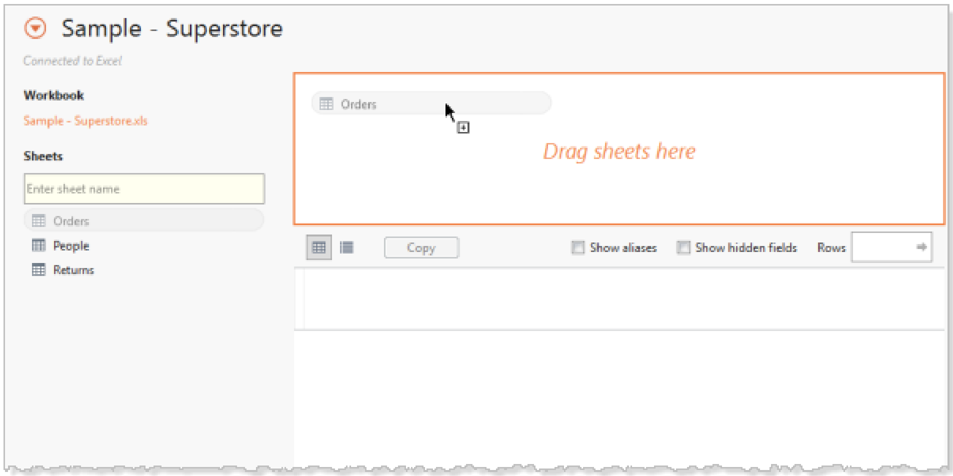
Many relational data sources are made up of a collection of tables that are related by specific fields (columns). For example, suppose you are analyzing data for a publisher. The publisher might have a table for authors that contains the first name, last name, and phone number of its clients. The publisher might have another table for titles that contains the price, royalty, and title of published books. In order to analyze these two tables together, you can join the two tables using a common field such as Author ID to answer questions like, how much was paid in royalties for a particular author. When you combine these tables using a join, you can view and use the data from both tables in your analysis.

When working with relational databases (for example, PostgreSQL) or files (for example, a text file), you can combine data that exists across multiple tables or files by creating joins. Using joins to combine tables allow you to analyze data that have a relationship with each other.

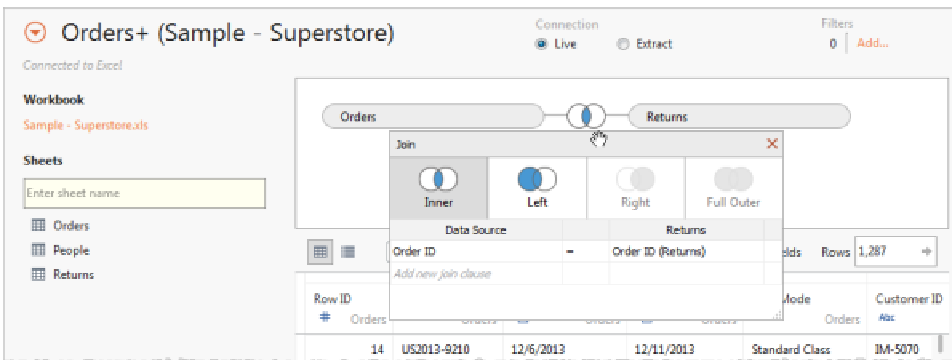
> **Note:** The tables you can join and the different join types you can use depend on the database or file your workbook is connected to.

To join

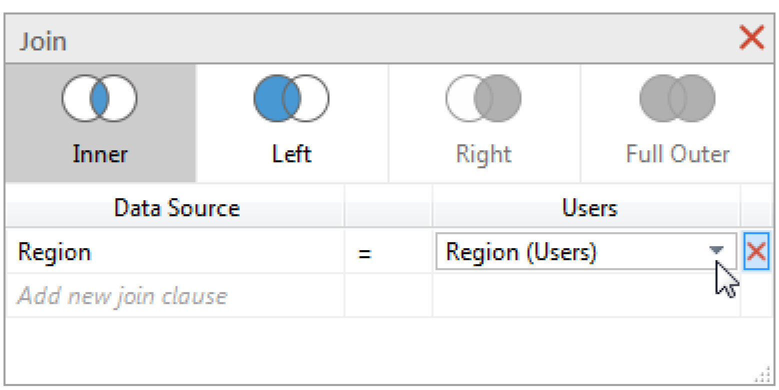
1. Connect to data and create your data source according to the examples in **Connect to Your Data** on page 342.
2. After you select the file, database, or schema, double-click or drag a table to the canvas of the Data Source page.



3. Double-click or drag another table to the canvas. The join dialog box opens.

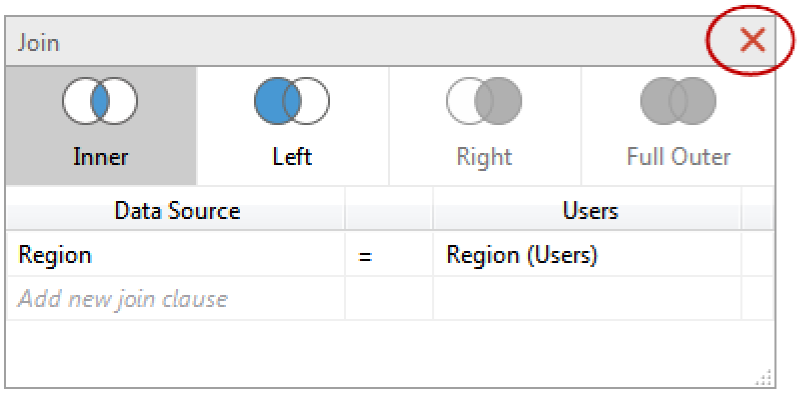


4. Add one or more join conditions by selecting a field from one of the available tables used in the data source, a join operator, and a field from the added table. Inspect the join condition to make sure it reflects how you want to connect the tables.



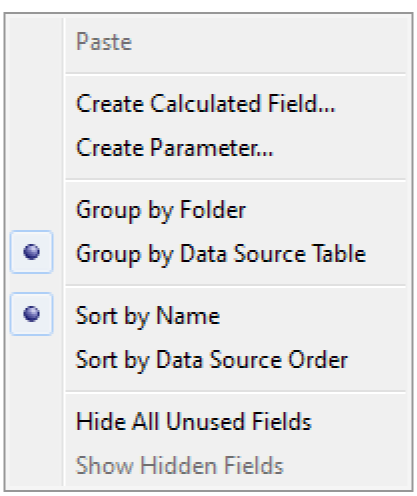
For example, in a data source that has a table of order information and another for users information, you could join the two tables based on the Region field that exists in both tables. Select the type of join.

5. When finished, click the "x" icon to close the Join dialog box.



Note: You can delete an unwanted join condition by click the red "x" that displays when you hover over the right-side of the condition.

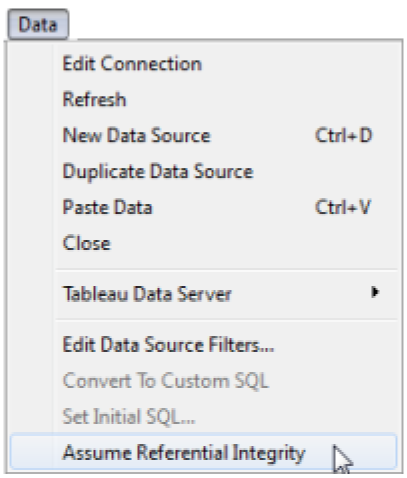
When you have joined tables in your data source, the Data pane is automatically organized to use the **Group by table** command. You can turn this feature off or change how the Data pane is sorted by selecting one of the **Sort by** options on the Data pane menu. This option is only available if you have connected to the database live. If you have imported the data, the fields are no longer grouped by table.



Note: When you connect to multiple tables you are essentially connecting to a denormalized view of the data source. This means that in some cases, queries are run against all tables and it is possible for some measures to be over-counted. For example, suppose you have an employees table and an orders table. However you keep the employee salary measure in the orders table. The salary will be counted for each order the employee made. Use the MIN aggregation to remove the double counting.

Assuming Referential Integrity

In some cases, you can improve query performance by selecting the option to **Assume Referential Integrity** from the **Data** menu. When you use this option, Tableau will include the joined table in the query only if it is specifically referenced by fields in the view.



Using this setting is appropriate when you know that your data has referential integrity (see definition below) but your database is not enforcing or cannot enforce referential integrity. If you have the option of configuring referential integrity in your database that is a better option than using this setting because it can improve performance both in the database and in Tableau. The **Assume Referential Integrity** option in Tableau can only affect performance on Tableau's end. If your data does not have referential integrity and you turn on this setting, query results may not be reliable.

To understand what referential integrity is, imagine connecting to sales data that has two tables: Sales and Product Catalog. These two tables are shown below:

Sales

Product ID (Foreign Key)	Sale Amount	Transaction Date

Product Catalog

Product ID (Primary	Product Name

1	100	10/1/2012
1	2000	10/2/2012
2	50	9/30/2012
3	10	8/21/2012

Key)	
1	10 Inch Tablet
2	Smart Phone
3	Desk Lamp
4	Memory Stick

Because all products that are sold must have a listing in the Product Catalog, every row in the Sales table has a matching row in the Product Catalog table. When these two tables are joined on Product ID, you end up with a table that looks like this:

Product ID	Product Name	Product ID	Sale Amount	Transaction Date
1	10 Inch Tablet	1	100	10/1/2012
1	10 Inch Tablet	1	2000	10/2/2012
2	Smart Phone	2	50	9/30/2012
3	Desk Lamp	3	10	8/21/2012

Now let's say you build a view to look at Sale Amount by Region. By default, dragging the Sale Amount field to the view may create a query like this:

```
SELECT SUM([Sales Amount] FROM [Sales] S INNER JOIN [Product Cata-
log] P ON S.ProductID = P.ProductID
```

By selecting **Assume Referential Integrity**, you tell Tableau that the joined tables have referential integrity. In other words, you are confirming that the Sales table will always have a matching row in the Product Catalog table. Because that is true, Tableau doesn't need any information from the Product Catalog table in order to return these results. When you drag the Sales Amount field into the view, Tableau can simplify the query to:

```
SELECT SUM([Sales Amount]) FROM [Sales]
```

This simplified query can often return quicker results because it removes the join operation. This option impacts only inner joins and does not affect data sources with a single table.

Union Your Data

In addition to joining tables and blending data, another way to draw data from different locations is to union the data. You can use the union option when you need to combine two or more tables from your Excel workbook or text file data from the same folder by appending values (rows) from one table to another.

For best results, the tables that you combine must have the same structure. That is, each table must have the same number of fields, and related fields must have matching field names and data type.

For example, suppose you have the following customer purchase information stored in three tables, separated by month. The table names are "May2016," "June2016," and "July2016."

May2016

Day	Customer	Purchases	Type
4	Lane	5	Credit
10	Chris	6	Credit
28	Juan	1	Credit

June2016

Day	Customer	Purchases	Type
1	Lisa	3	Credit
28	Isaac	4	Cash
28	Sam	2	Credit

July2016

Day	Customer	Purchases	Type
2	Mario	2	Credit
15	Wei	1	Cash
21	Jim	7	Cash

A union of the these tables creates a single table that contains all rows from all tables.

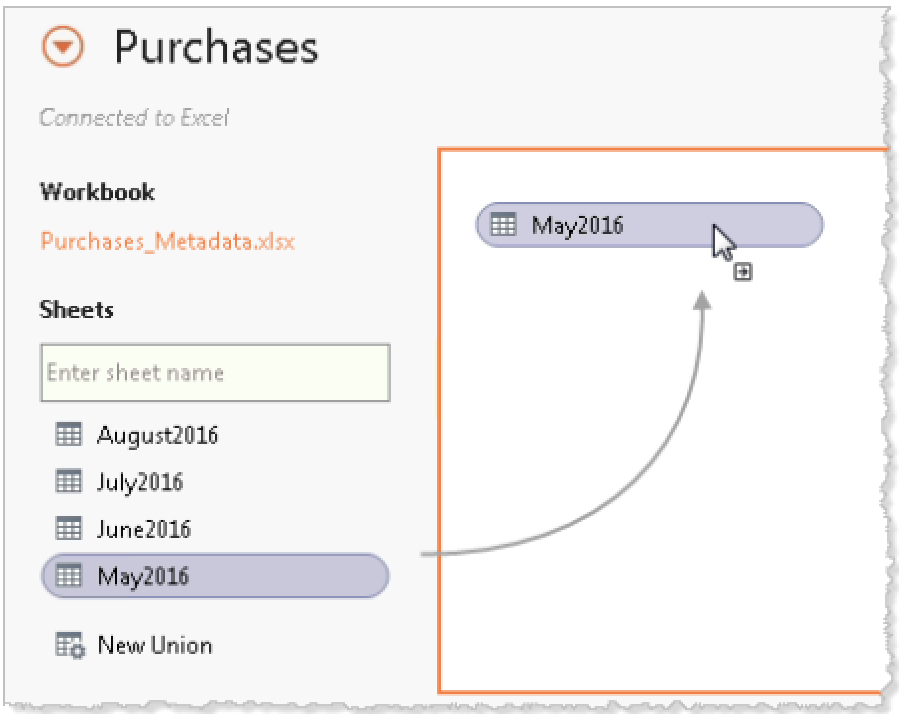
Union (of May2016, June2016, and July2016)

Day	Customer	Purchases	Type
4	Lane	5	Credit
10	Chris	6	Credit
28	Juan	1	Credit
1	Lisa	3	Credit
28	Isaac	4	Cash
28	Sam	2	Credit

Day	Customer	Purchases	Type
2	Mario	2	Credit
15	Wei	1	Cash
21	Jim	7	Cash

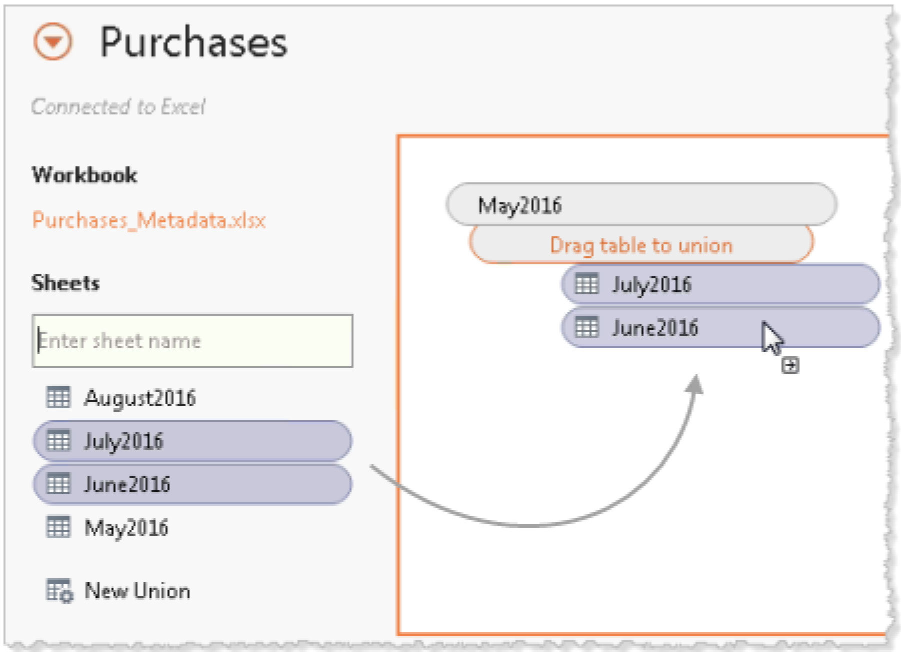
To union

1. On the Data Source page, drag a table from the left pane to the canvas.



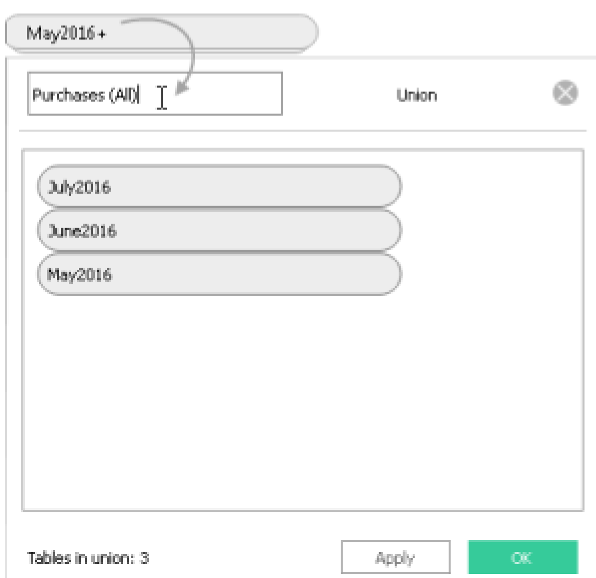
2. Select another table from the left pane and drag it directly below the first table on the canvas. To add multiple tables to a union at the same time, press **Shift** or **Ctlr**, select the

tables you want to union in the left pane, and then drag them directly below the first table.



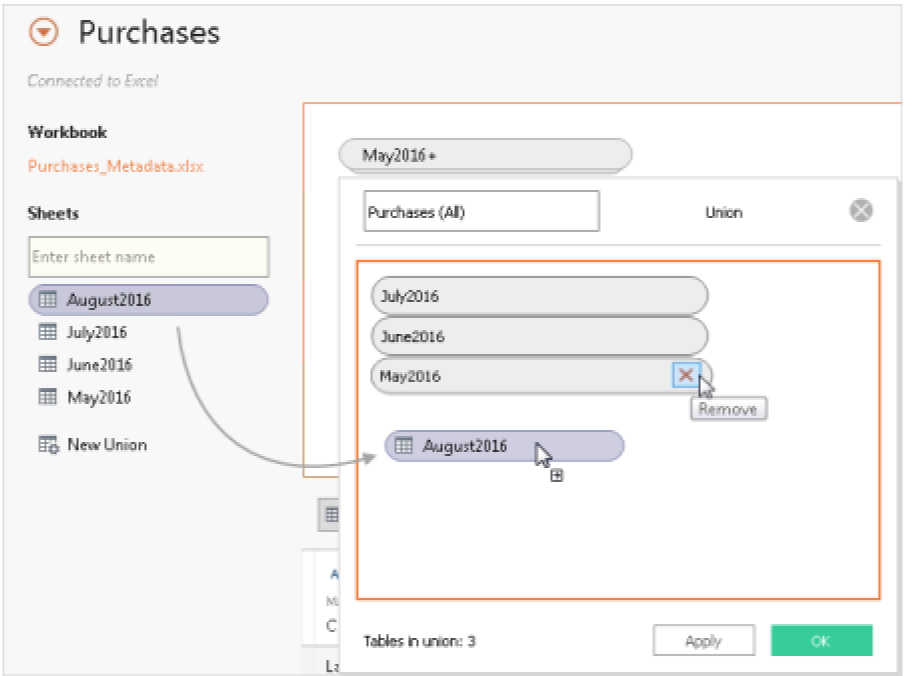
To rename a union

1. Click the union drop-down arrow and then select **Customize union**.
2. Enter a new name for the union.



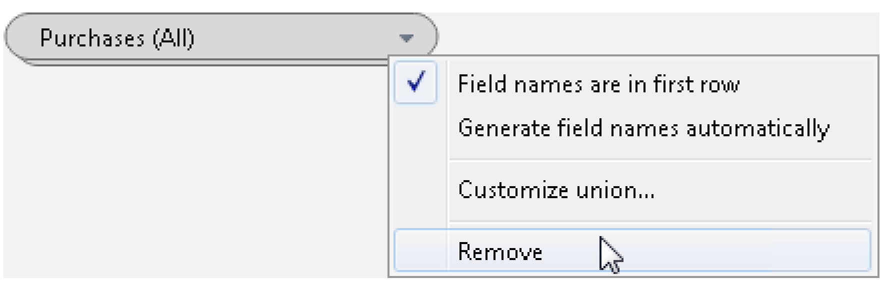
To add or remove tables in the union

1. Click the union drop-down arrow and then select **Customize union**.
2. You can drag additional tables that you want to union from the left pane, or hover over a table until the remove icon displays and then click the icon to remove the table.



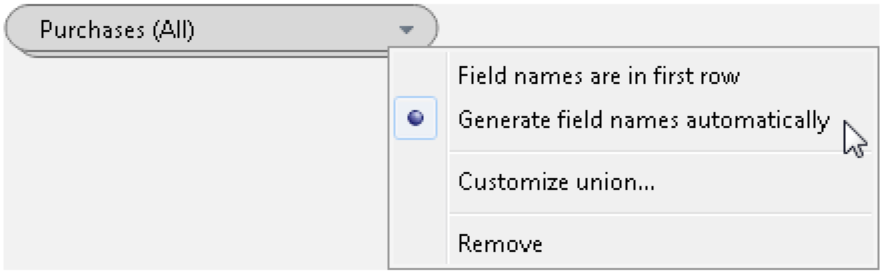
To remove a union

- Click the union drop-down arrow and select **Remove**.



Matching field names or field ordering

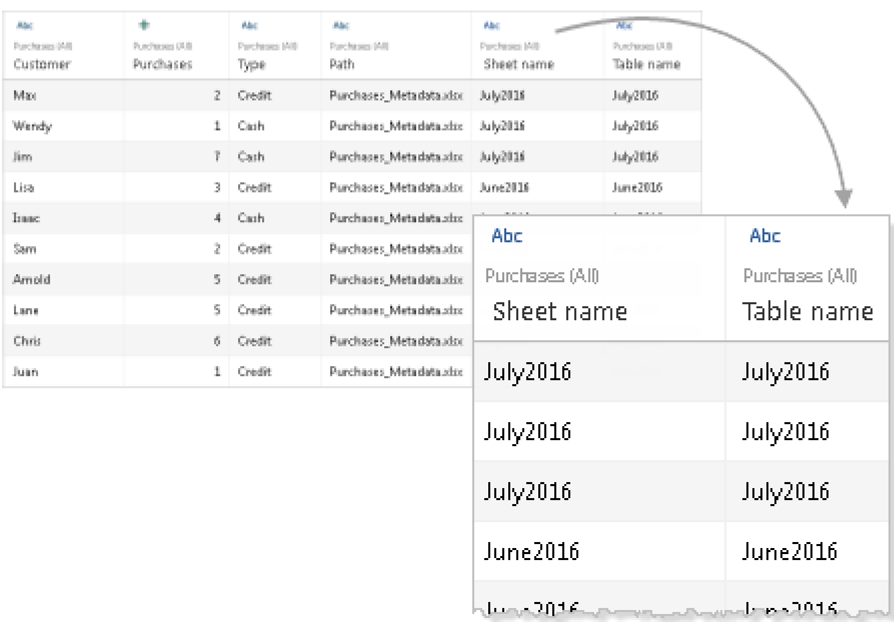
Tables in a union are combined by matching field names. If there are no matching field names (or your tables do not contain column headers), you can tell Tableau to combine tables based on the order of the fields in the underlying data by creating the union and then selecting **Generate field names automatically** option from the union drop-down menu.



Metadata about unions

After you create a union, additional fields about the union are generated and added to the grid. The new fields provide information about where the original values in the union come from, including the sheet and table names. These fields are useful when unique information that is critical to your analysis is embedded in the sheet or table name.

For example, the tables used in the example above have unique month and year information stored in the table name instead of in the data itself. In this case, you can use the **Table name** field that is generated by the union to access this information and use it in your analysis.



If a named range is used in a union, null values display under the **Sheet name** field.

> **Note:** You can use the fields generated by a union, **Sheet name** and **Table name**, as join keys. You can use a unioned table in a join with another table or unioned table.

Merge mismatched fields in the union

When field names in the union do not match, fields in the union contain null values. You can merge the non-matching fields into a single field using the merge option to remove the null values. When you use the merge option, the original fields are replaced by a new field that displays the first non-null value for each row in the non-matching fields.

You can also create your own calculation or modify the underlying Excel or text data to combine the non-matching fields.

For example, suppose a fourth table, "August2016", is added to the underlying data. Instead of the standard "Customer" field name, it contains an abbreviated version called "Cust."

August2016

Day	Cust.	Purchases	Type
7	Maria	2	Credit
9	Kathy	1	Credit
18	Vijay	7	Cash

A union of these tables creates a single table that contains all rows from tables, with several null values. You can use the merge option to combine the related customer fields into a single field.

Union (with null values)

Da-y	Cus-tomer	Purchas-es	Typ-e	Cus-t.
4	Lane	5	Cre-dit	null
10	Chris	6	Cre-dit	null
28	Juan	1	Cre-dit	null
1	Lisa	3	Cre-dit	null
28	Isaac	4	Cas-h	null
28	Sam	2	Cre-	null

Union (with columns that have been merged)

Da-y	Purchas-es	Typ-e	Cus-tomer, Cust.
4	5	Cre-dit	Lane
10	6	Cre-dit	Chris
28	1	Cre-dit	Juan
1	3	Cre-dit	Lisa
28	4	Cas-	Isaac

Day	Customer	Purchases	Type	Cust.
			dit	
2	Mario	2	Credit	null
15	Wei	1	Cash	null
21	Jim	7	Cash	null
7	null	2	Credit	Maria
9	null	1	Credit	Kathy
18	null	7	Cash	Vijay

Day	Purchases	Type	Customer, Cust.
		h	
28	2	Credit	Sam
2	2	Credit	Mario
15	1	Cash	Wei
21	7	Cash	Jim
7	2	Credit	Maria
9	1	Credit	Kathy
18	7	Cash	Vijay

After you merge fields, you can use the field generated from the merge in a pivot or split, or use the field as a join key. You can also change the data type of the field generated from a merge.

To merge mismatched fields

1. Select two or more columns in the grid.
2. Click the column drop-down arrow, and then select **Merge mismatched fields**.

To remove a merge

- Click the column drop-down arrow of the merged field and select **Remove merge**.

At a glance: Working with unions

- A unioned table can be used in a join.
- A unioned table can be used in a join with another unioned table.
- The fields generated by a union, **Sheet name** and **Table name**, can be used as the join key.

- If a named range is used in union, null values display under the **Sheet name** field.
- The field generated from a merge can be used in a pivot or split.
- The field generated from a merge can be used as a join key.
- The data type of the field generated from a merge can be changed.

Blend Your Data

If the data you are connected to is stored in tables on different databases, you can use data blending to combine the data in the Tableau data source.

Data blending is when you combine data from multiple data source types in a single worksheet. The data is joined on common dimensions. Data Blending does not create row level joins and is not a way to add new dimensions or rows to your data. Refer to **Join Your Data** on page 349 to learn how to create those types of joins. Instead, data blending should be used when you have related data in multiple data sources that you want to analyze together in a single view. For example, you may have Sales data collected in an Oracle database and Sales Goal data in an Excel spreadsheet. To compare actual sales to target sales, you can blend the data based on common dimensions to get access to the Sales Goal measure.

To blend your data, you must first define common dimensions between the primary and secondary data sources. For example, when blending Actual and Target sales data, the two data sources may have a Date field in common. The Date field must be specified as a linking field. If the two dimensions don’t have the same name, you can define a custom relationship that creates the correct mapping between fields.

For each data source that is used on the sheet, a query is sent to the database and the results are processed. Then all the results are left joined on the common dimensions. The join is done on the member aliases of the common dimensions so if the underlying values aren’t an exact match, you can fix it up in Tableau.

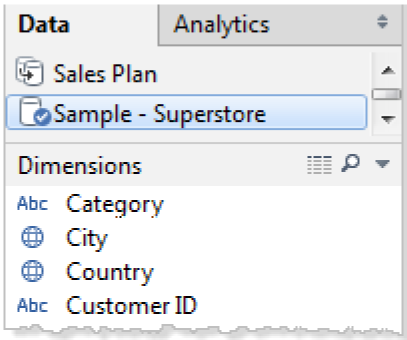
With a left join, the view uses all data rows from the primary data source but only those data rows from the secondary data source that have values for fields that are in the view or for fields that are designated as linking fields. So changing the linking field, or designating multiple linking fields, can actually pull in different or additional data rows from the secondary data source, thereby changing the values returned by aggregations.

In general, a good test to see whether data can be blended smoothly is to drag the dimensions from the primary data source into a text table on one sheet. Then on another sheet, drag the same fields from the secondary data source into a text table. If the two tables match up then the data is most likely going to blend correctly.

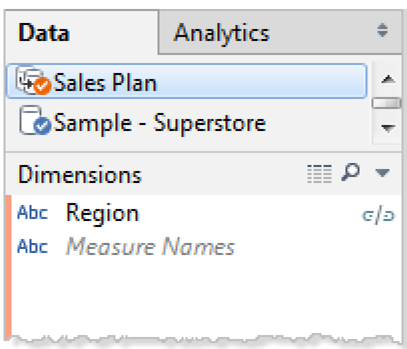
Add a Secondary Data Source

Sometimes you may have data in two separate data sources that you want to analyze together on a single worksheet. While you can analyze several data sources together on the same worksheet, each worksheet must have a primary data source.

The primary data source is the connection that you first use in the view. After you drag fields to the view, the primary data source is marked with a blue check mark.



If you switch to another data source, you'll notice that the Data pane is marked with an orange color to indicate that if you use fields from this data source, it will become the secondary data source.



Cube (multidimensional) data sources cannot be used as the secondary data source. They can only be used as the primary data source.

To add a secondary data source

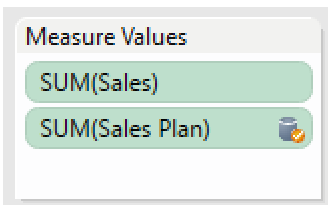
1. Connect to the primary data source and build a view.
2. When you need additional data from a separate data source, select **Data** > **New Data Source**.
3. Follow the steps in **Edit Data Sources** on page 414 to connect to the secondary data source.
4. On the worksheet where you need the secondary data, select the new data source.

Notice that the Data pane is colored orange to indicate that it is a secondary data source.

Tableau automatically identifies fields in the secondary data source that also exist in the primary data source. These are potential linking fields are marked with a broken link icon . Click these link icons next to the fields that you want to blend. The icon is now orange and connected . You can also define your own custom relationships to handle columns that don't have matching names. For more information, see **Define Relationships** below.

5. Drag the fields from the secondary data source into the view.

   The fields in the view that are from the secondary data source are marked with an orange check mark to indicate that they are from the secondary data source.



To remove a secondary data source

- Right-click (control-click on a Mac) the secondary connection at the top of the Data pane and select **Close**.

Define Relationships

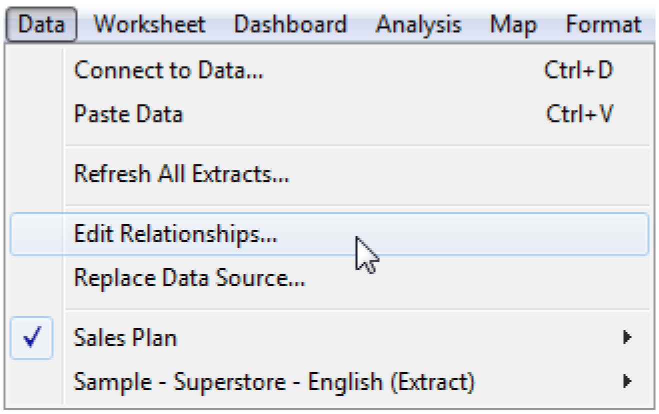
Tableau automatically recognizes when a field from the primary data source also exists in a secondary data source. These fields are marked with a gray broken link icon in the Data pane to indicate that they are potential linking fields. When you click the broken link icon, the link becomes orange and is connected. An automatic relationship is created between the two data sources. The relationship allows you to blend data from both data sources on a single sheet. You must have a linked field in order to use data from the secondary data source. For example, a workbook may have two connections: Superstore Sales and Sales Plan. These two connections have related information including the columns for Customer Segment and Customer State. The data from Sales Plan (the secondary data source) cannot be used (blended) until one of those common fields has been linked.

You can modify the automatic relationships or create new custom relationships by selecting **Data** > **Edit Relationships**.

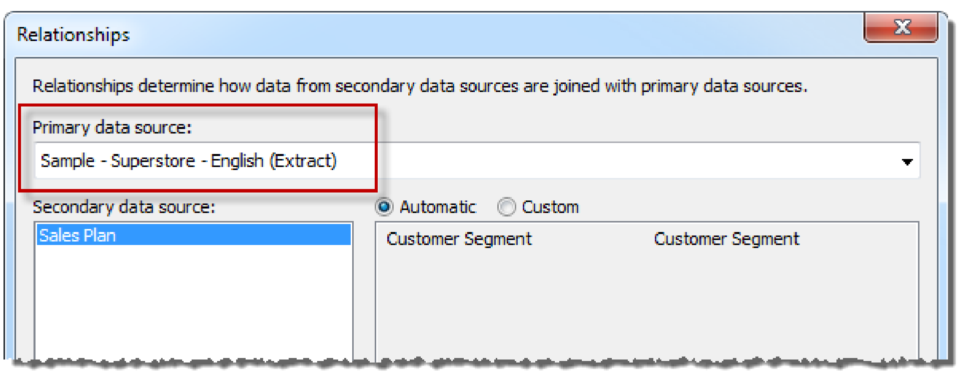
Note: Changes you make in the Edit Relationships dialog box only affect field relationships and do not redefine the primary and secondary data source in workbook views.

The Relationships dialog box lets you select a primary data source using the drop-down list at the top. Then you can select a secondary data source in a list on the left side of the dialog box. The right side of the dialog box lists any relationships that have been added.

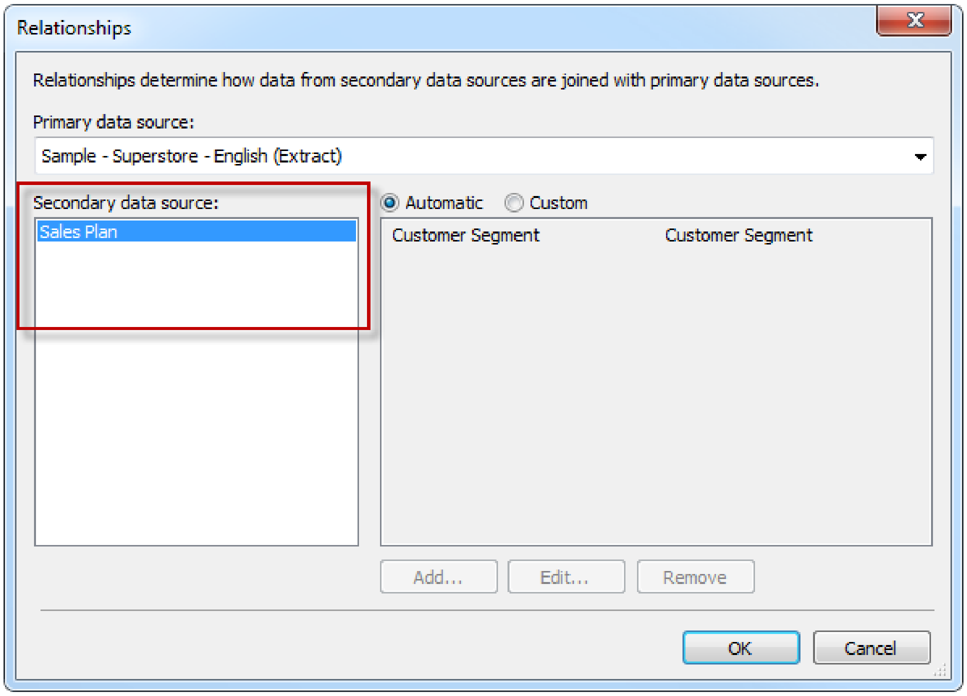
1. Select **Data** > **Edit Relationships** to open the Relationships dialog box.



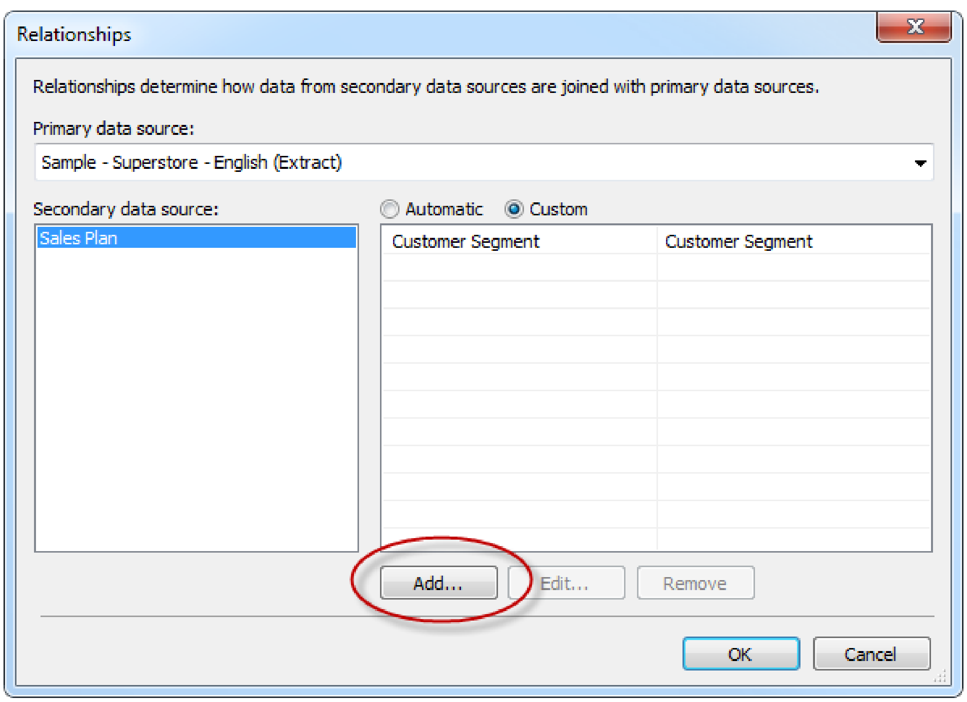
2. Make sure that the primary data source is selected from the drop-down list.



3. Select a secondary data source from the list on the left.

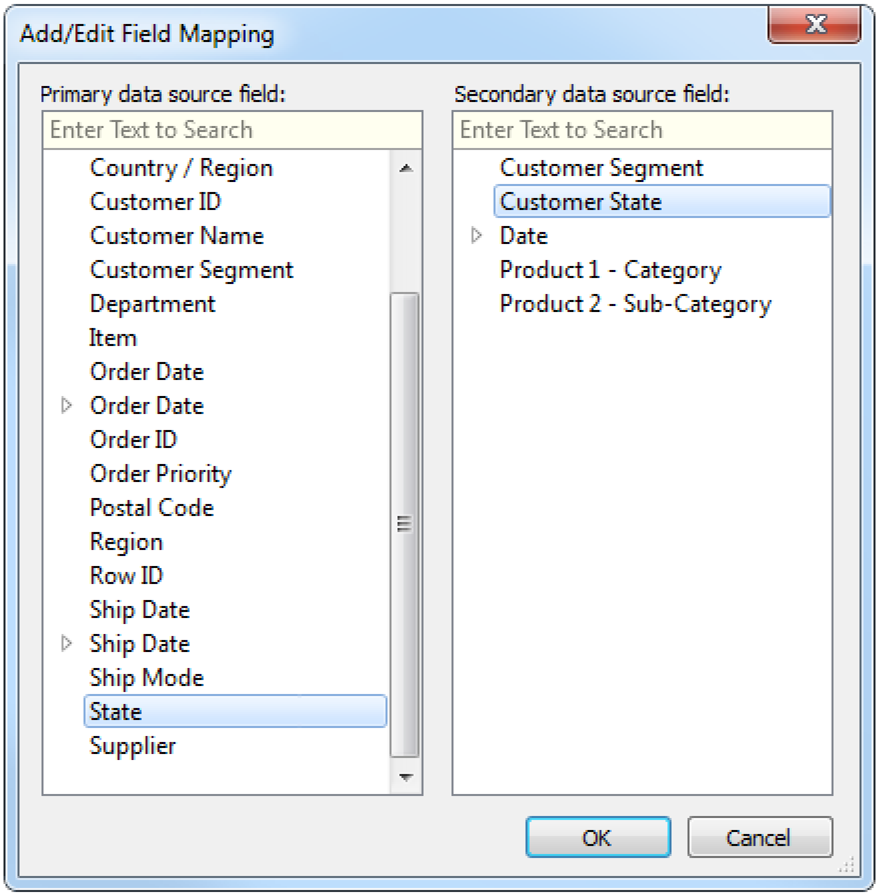


4. Select **Custom** at the top of the relationships list.
5. Click the **Add** button or select an existing relationship and click the **Edit** button.



6. Select a field in the primary data source and map it to matching field in the secondary

data source. In this example, the primary data source has a field called "State" while the secondary data source has a field called "Customer State." These two fields can be mapped together to create a relationship even though they don't have the same name.



7. When finished, click **OK**.
8. Add and Remove as many relationships as necessary, and when finished, click **OK** again.

   The related fields are shown in the secondary data source as potential linking fields. Click the link icon next to these fields in the data pane to make the links active. Linked fields

   are indicated with an orange and connected link icon in the Data pane. When the related field from the primary data source is used in the view, the link becomes active automatically.

The relationship matches values based on the member aliases. You can fix up fields that don’t match by editing the aliases. For example, when mapping a State Name field in the primary data source to a State Abbreviation field in the secondary data source, “AK” will not map correctly to “Alaska”. You’ll have to modify the aliases in one of the data sources.

Resolve Discrepancies Between Two Data Sources

When you blend two data sources, discrepancies occur if the fields you use to blend the two data sources do not align exactly. You can resolve this problem by creating a primary group.

For example, suppose **State** is a field present in both data sources: Data source A (the primary data source) and data source B.

Suppose that **Region** is a field in data source B, but **Region** is not a field in data source A. All states in data source B are associated with a region. However, there are some states in data source A that are not included in data source B. This means that there will be nulls when you blend **Region** (from data source B) and **State** (from data source A) in the view.

To fix the discrepancies, you can create a primary group and use it to align the data. In certain circumstances, you can also use the primary group to eliminate the need for the secondary data source.

Example: Blend two data sources and create a primary group

1. Download and open the PopulationByState workbook available from Tableau Public.
    1. Go to https://public.tableau.com/profile/publish/PopulationByState_2/Sheet1#!/publish-confirm.
    2. Click **Download Workbook** in the upper right corner.

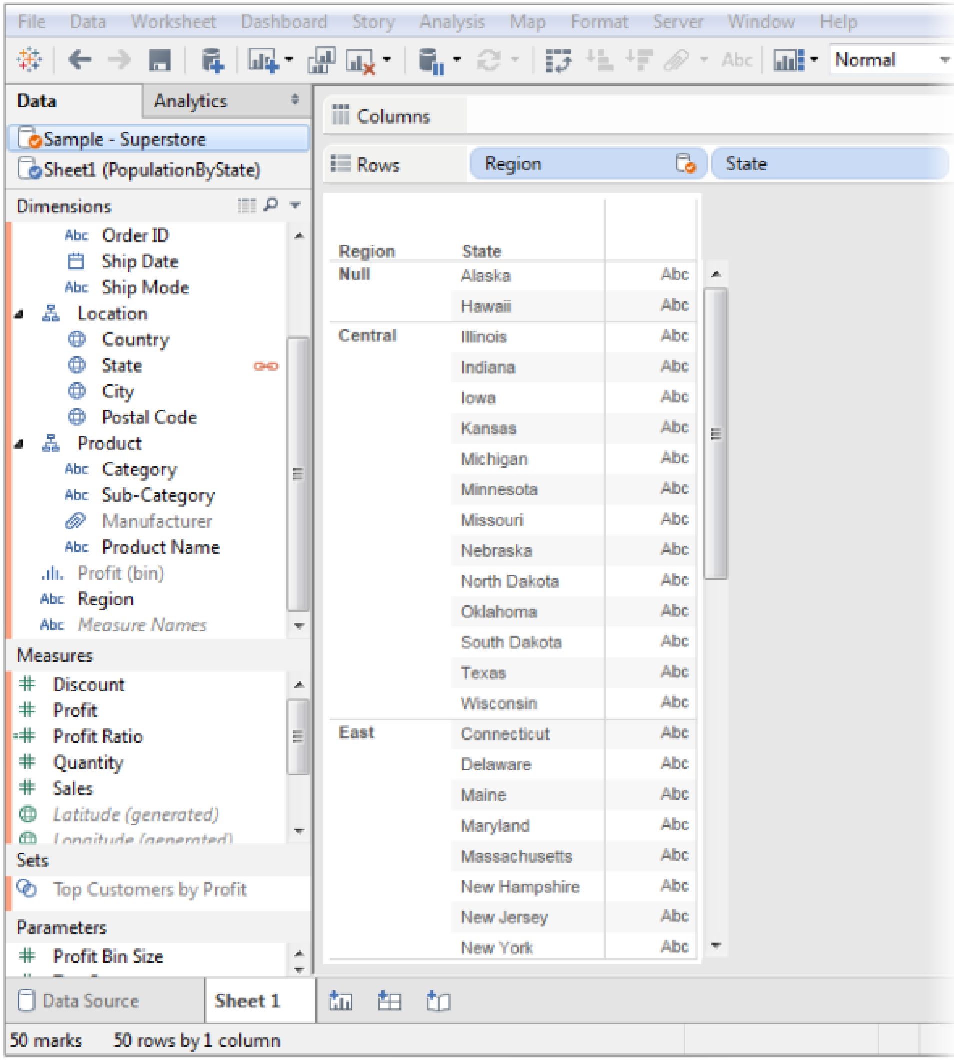
    In the workbook, **State** has been dragged to the **Rows** shelf, making it the first field in the view, and establishing the PopulationByState data source as the primary data source for the worksheet.

2. In Tableau Desktop, select **Data** > **New Data Source** to connect to the secondary data source.

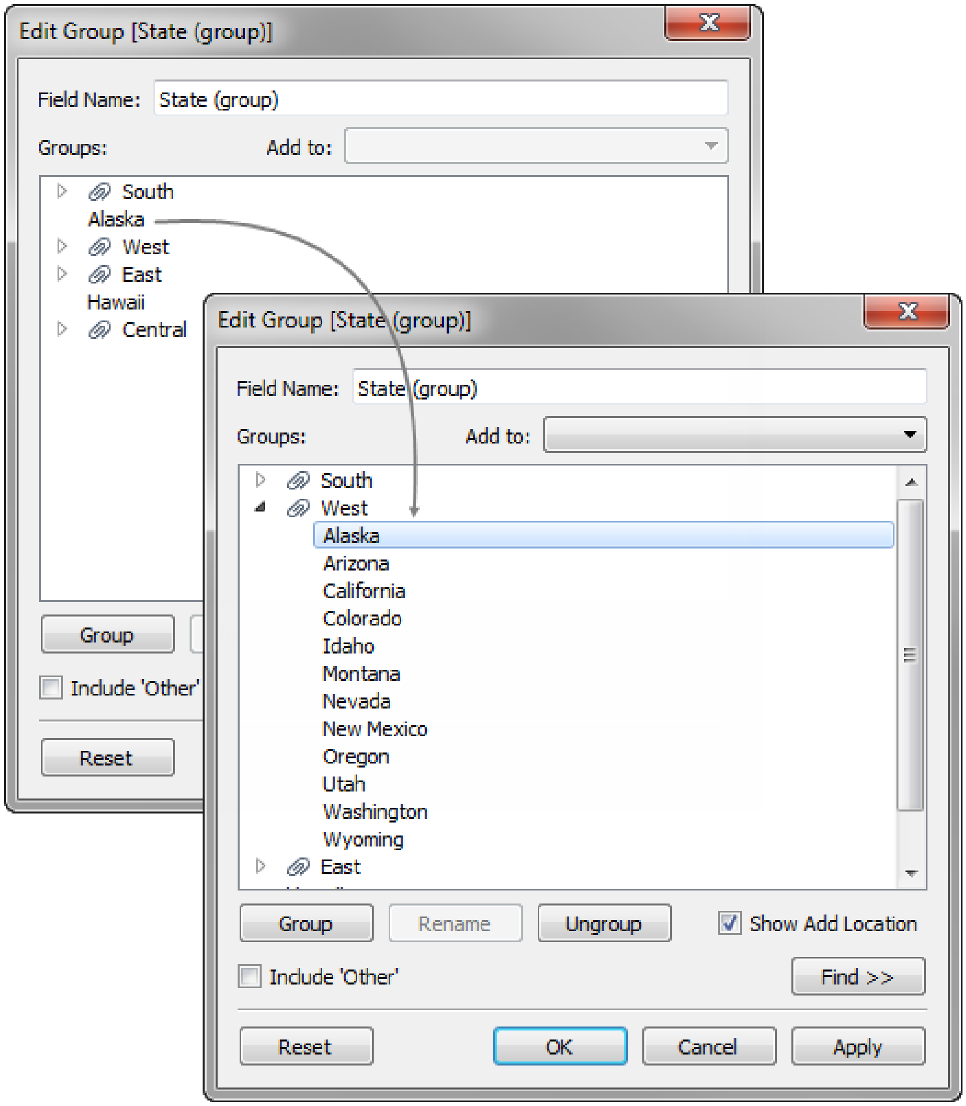
    For this example use Sample - Superstore, under Saved Data Sources.

3. In the **Data** pane, with Sample – Superstore selected, drag the **Region** dimension to the **Rows** shelf and place it in front of **State**.

    The view shows the regions from the secondary data source and all the states associated with those regions. There are two states from the primary data source that are not associated with a specific region. These two states are assigned to a "null" region.

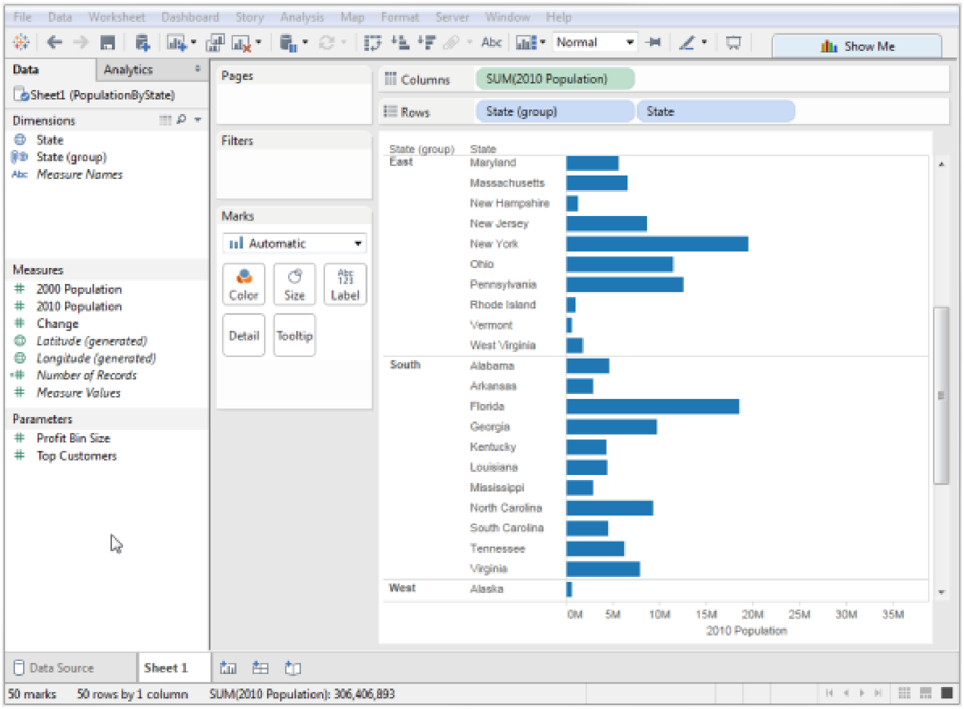


4. Right-click **Region** on the **Rows** shelf and select **Create Primary Group**.
5. To align the data, assign the states in the Null region to the correct region:
   - Drag Alaska to the West region group.
   - Drag Hawaii to the West region group.



6. Click **OK** to close the Edit Group dialog box. In the **Data** pane, select PopulationByState. Note the new group listed in the population data set: **State (group)**.
7. Drag the **State (group)** dimension over **Region** on the **Rows** shelf to replace it.
8. Drag the **2010 Population** measure to the **Columns** shelf to see the population data set based on the regions in the Sample - Superstore data set.

Optional: You can now close the secondary data source, Sample – Superstore, and then publish the workbook without the secondary data source. This is because the field you were using from the secondary data source has been replaced by the primary group that you created in the primary data source.



Other resources

To watch a video that shows how to use the **Create Primary Group** command, go to Cleaning Data by Bulk Re-aliasing.

For more information about data blending, see Data Blending with Summarized Data in the Tableau Knowledge Base.

Edit Primary Aliases

Use the **Edit Primary Aliases** command to manage aliases for a field in the primary data source using a secondary data source. There must be a field in the secondary data source that contains aliases for a field in the primary data source.

For example, if you have a primary data source that uses codes as values for a particular field, and a secondary data source that associates brief explanations with those codes, you can alias the primary field such that your view will display the brief descriptions instead of the codes.

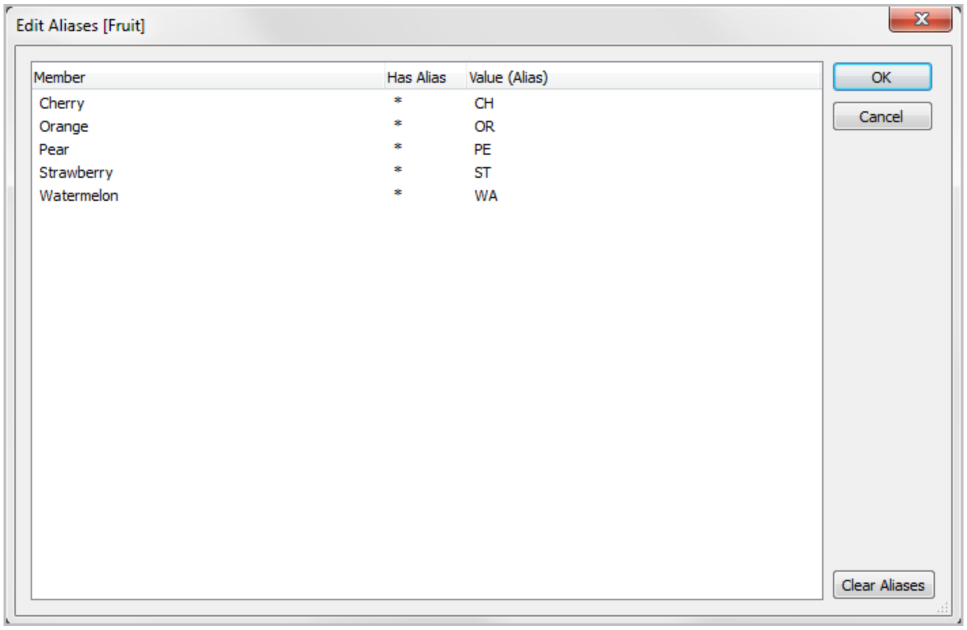
Once you have used the secondary source to provide aliases for the primary data source, you can close the secondary data source.

To use this command, do the following:

1. Link the two data sources if they are not already linked.
2. Add the field that you are aliasing from the primary data source to the view.
3. Add the field from the secondary data source that contains the aliases to the view—this

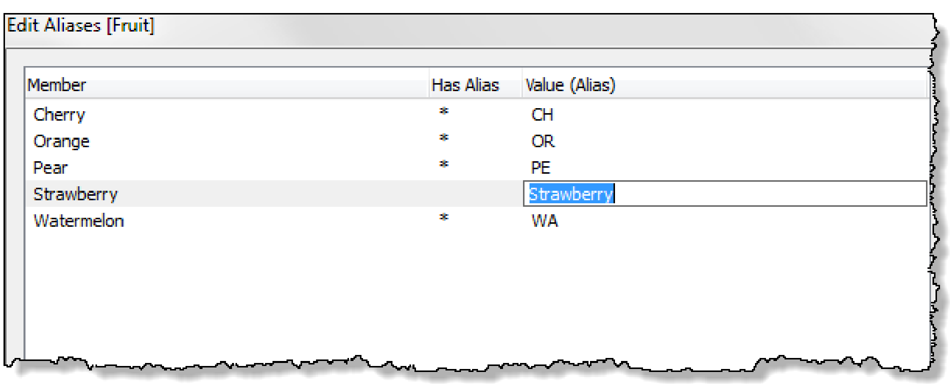
cannot be the field that you are using to link the two data sources.

4. Right-click (control-click on a Mac) the field from the secondary data source and choose **Edit Primary Aliases** to open the Edit Aliases dialog box.



Ideally, all fields in the primary data source field have a matching alias field in the secondary data source field. In this case, there is an asterisk in the **Has Alias** column for all fields.

However, if there was no value in the secondary data source to match a value in the primary data source, or if an more than one value in the primary data source has the same alias in the secondary data source, then you will not see an asterisk next to those values in the **Has Alias** field. To edit the aliases in to assure that each value in the primary data source has a unique alias, right-click a row in the **Value (Alias)** column and you will be able to type a new value:



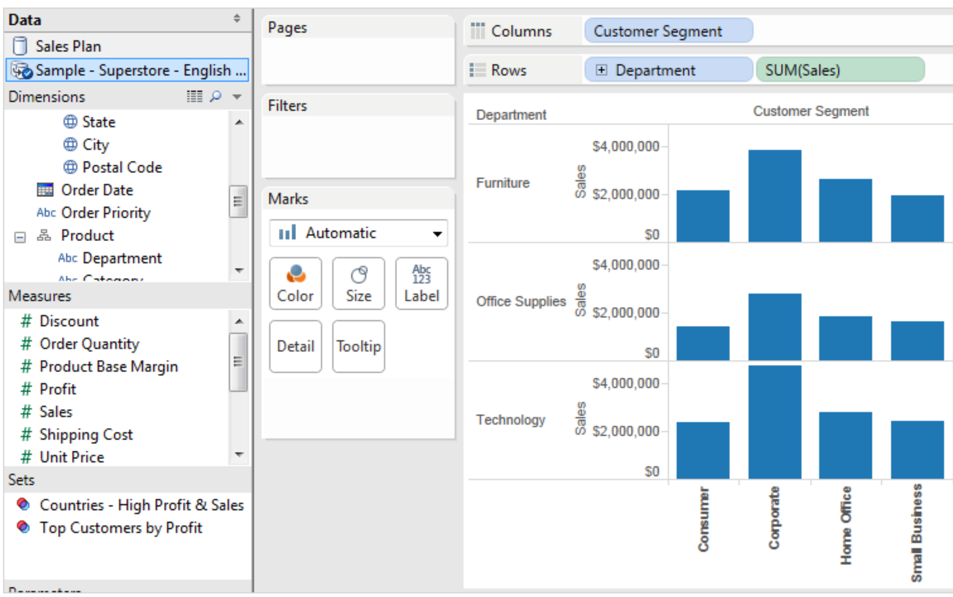
Click **OK** when your work is complete. Now when you build a view using the field from the primary data source, the values shown are from the alias field in the secondary data source.

To watch a video demonstrating the use of the **Edit Primary Aliases** command, and of the **Create Primary Group** command, go to Cleaning Data by Bulk Re-aliasing.

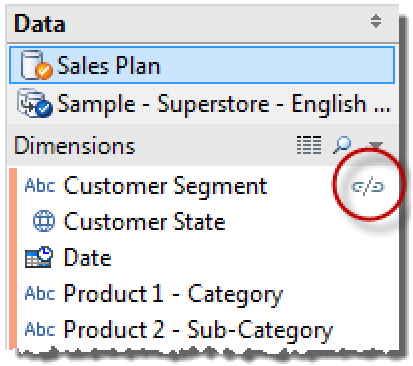
Example–Data Blending

This example demonstrates how to blend data from two data sources: a version of the Superstore sample data source that comes with Tableau Desktop and an auxiliary SQL Server data source that contains forecasted sales information. Follow along with this example to blend data from both of these data sources to create a single view showing actual vs. planned sales.

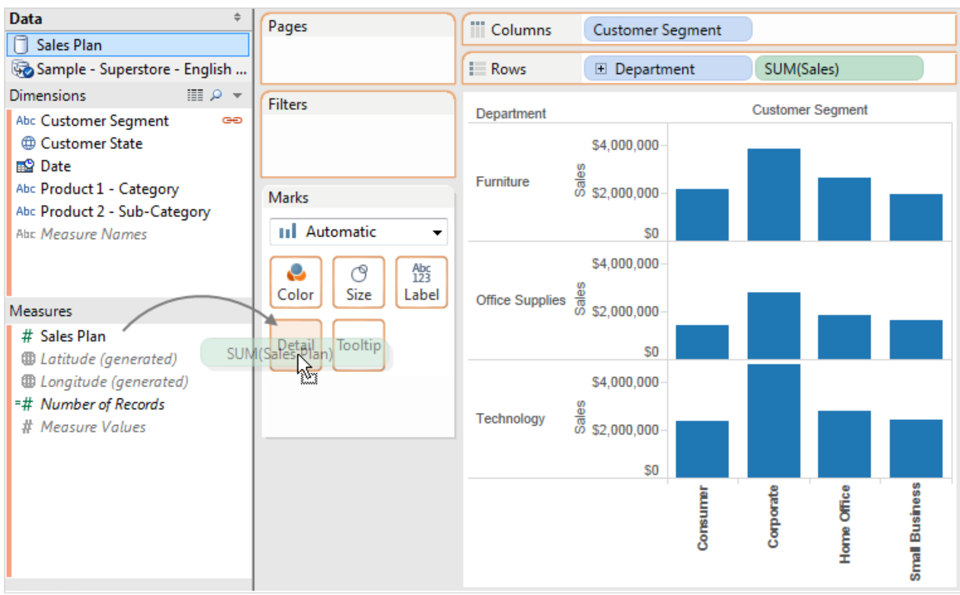
1. Connect to your data and set up the data source.
2. Build your view. In this example, the view shows Sales by Customer Segment and Department.



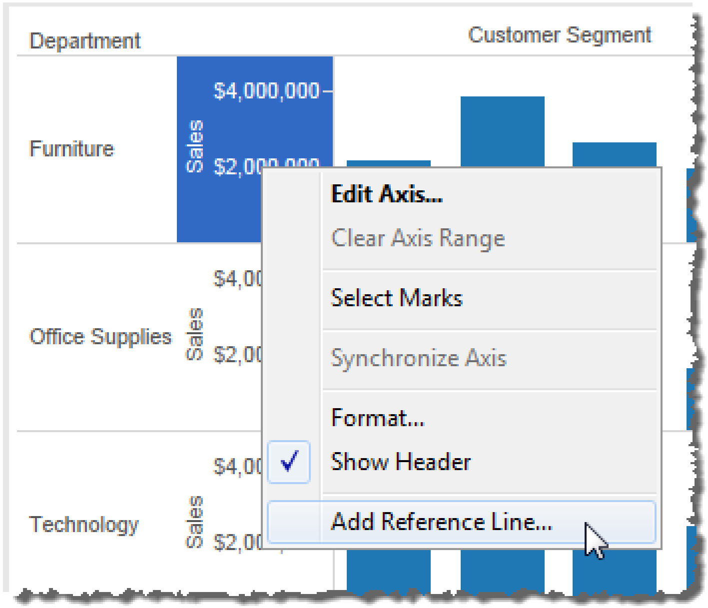
3. Select **Data** > **New Data Source** and connect to your secondary data source. This examples uses a data source called Sales Plan.
4. Switch to the secondary data source, and then click the link icon next to the field you to blend the data on. For this example, the field being blended on is Customer Segment.



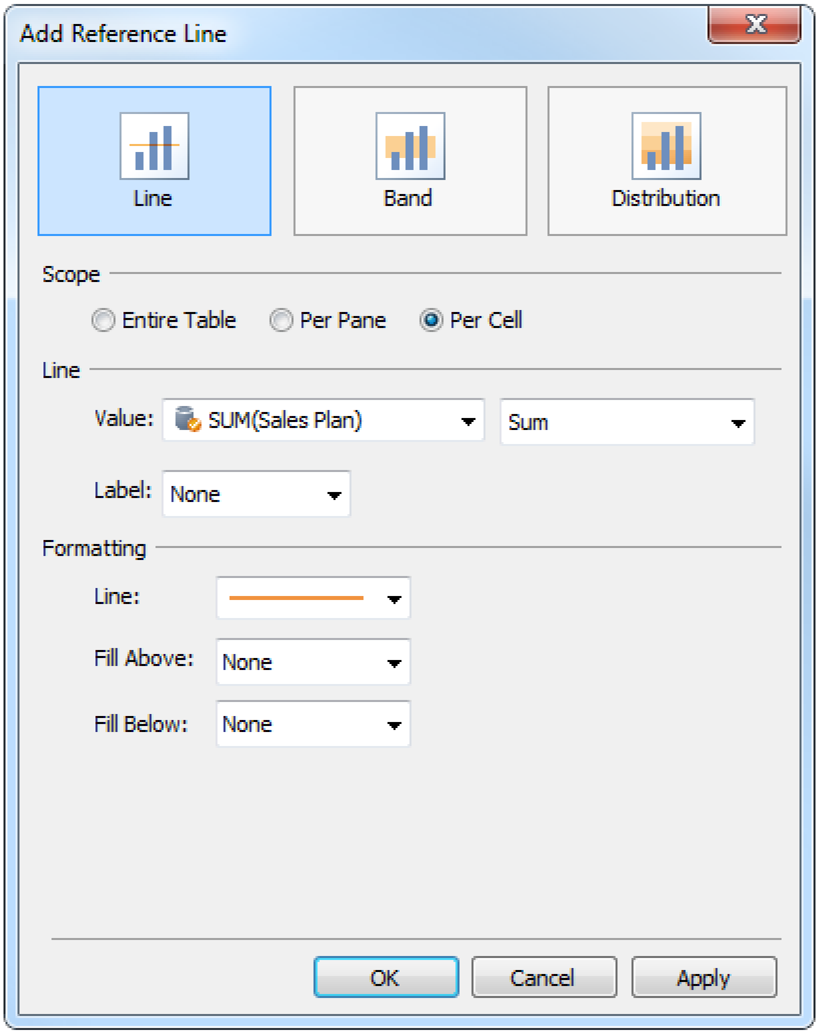
5. Drag a field from the secondary data source to **Detail** on the Marks card. For this example, the Sales Plan field is used.



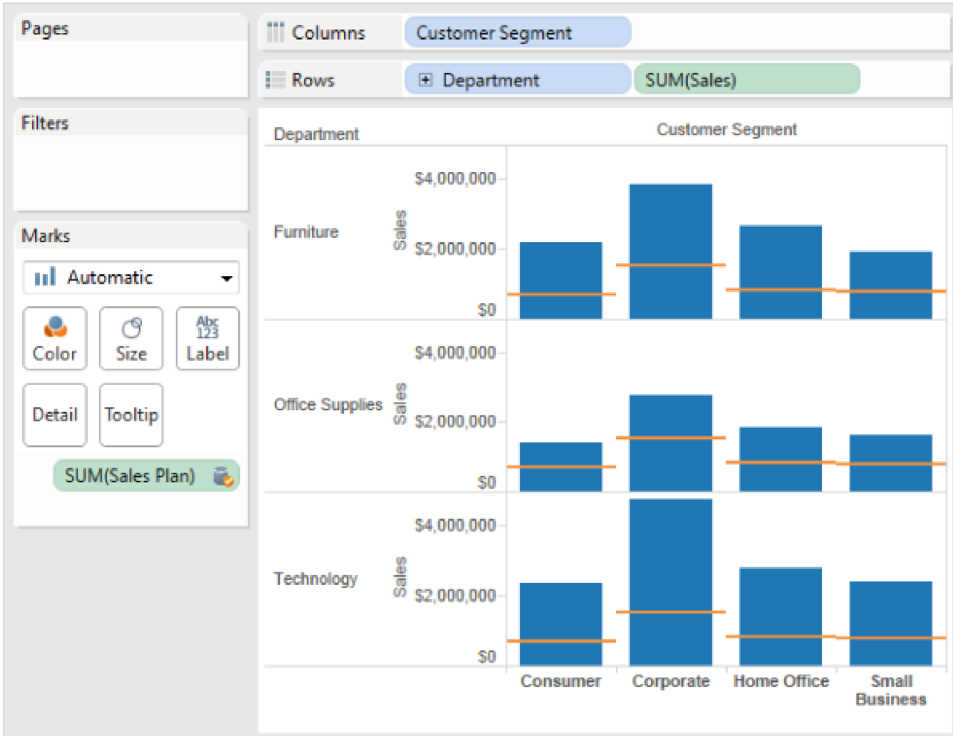
6. Right-click (control-click on a Mac) the y-axis, and select **Add Reference Line**.



7. In the Add Reference Line dialog box, add a reference line that shows the sum of the field you used in step 5. For this example, the reference line is created configured for the SUM (Sales Plan) per cell. When finished, click **OK**.



8. The sheet is now pulling data from the secondary data source to show how actual sales compare to the planned sales.



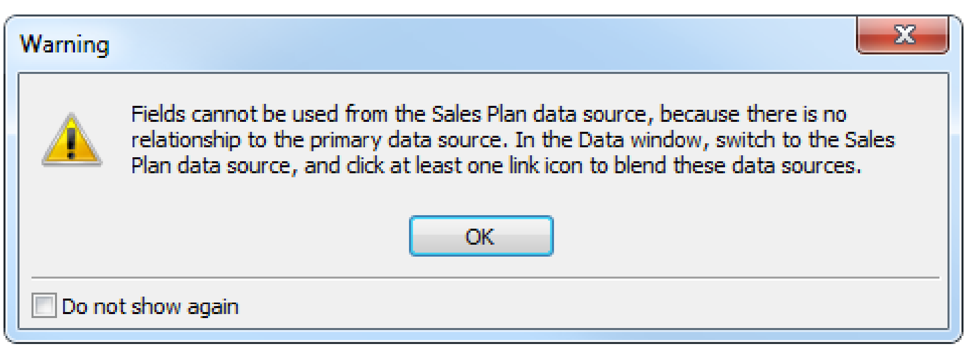
Troubleshoot Data Blending

When you integrate data from multiple data sources, you may run into some of these common issues:

Warning: No Relationship to the Primary Data Source

When you drag a field from a secondary data source to the view, you may see a warning that says:

Fields cannot be used from the *[name of secondary data source]* data source, because there is no relationship to the primary data source. In the Data pane, switch to the *[name of secondary data source]* data source, and click at least one link icon to blend these data sources.

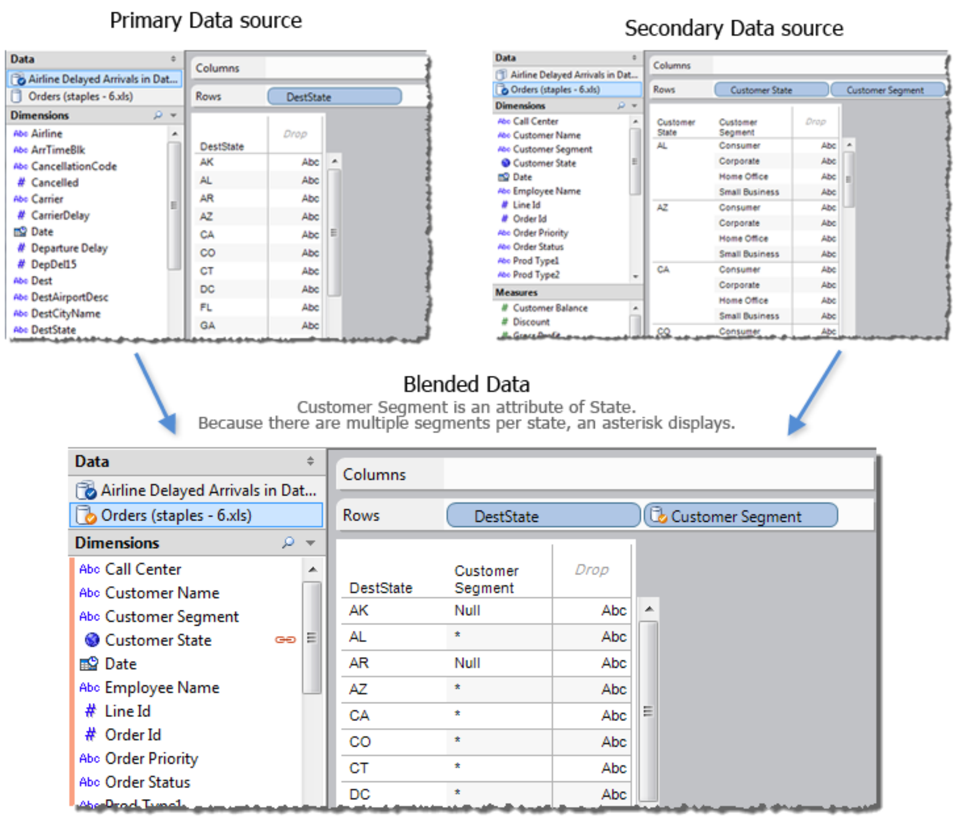


This warning occurs when you have no active links in the secondary data source. For example, if you have two data sources with the related dimensions State and Date, at least one of these fields must have the active orange link icon next to it in the secondary data source. You can activate a link by clicking the link icon in the Data pane or by using the related field from the primary data source in the view.

The secondary data source may not have any relationships to the primary data source. Look in the Data pane for the link icon. Tableau automatically links fields that have the same name. If your fields do not have the same name you'll have to create a custom relationship. For more information, see **Define Relationships** on page 363.

Asterisks Show in the View

When you relate secondary data, make sure that there is only one matching member in the secondary dimension for each mark. If there are multiple matching members you will see an asterisk in the view. For example, say you have two data sources. The primary data source has a state field that contains state abbreviations. The secondary data source also contains a state field along with a customer segment field. Each state may have multiple customer segments (for example, CA has Consumer and Corporate). When you relate the two data sources on state, you've created a relationship where state can have multiple customer segment values. When that happens you will see an asterisk in the view.



All secondary fields are aggregated. Dimensions are aggregated as Attributes (ATTR), which means that if there's only one member it will show the member value but if there are multiple members it will show an asterisk.

Nulls Appear After Blending Data

Nulls can sometimes appear for some records when you use data blending. This happens when no corresponding record exists in the secondary data source for some records in the primary data source or if the data types for some records in the two data sources are different. You can resolve this problem by inserting data in the secondary data source such that all records in the primary data source have a match, and then verifying that the data types in the data sources match. For example, when joining on State, if Database 1 has values all 50 U.S. states and Database 2 has values for only 30 U.S. states, add values for the remaining 20 U.S. states to Database 2 before blending the data.

This problem can happen because data blending works by performing a left join on the linking field, which means that Tableau will take all the data in the left table (the primary data source) and match the data in the right table (the secondary data source). The join result will be null for the secondary data source when no match exists for a particular member of the primary data source.

Using a Cube (Multidimensional) Data Source

When blending data in Tableau, cube data sources cannot be used as secondary data sources. These types of databases can only be used as the primary data source.

Extract Your Data

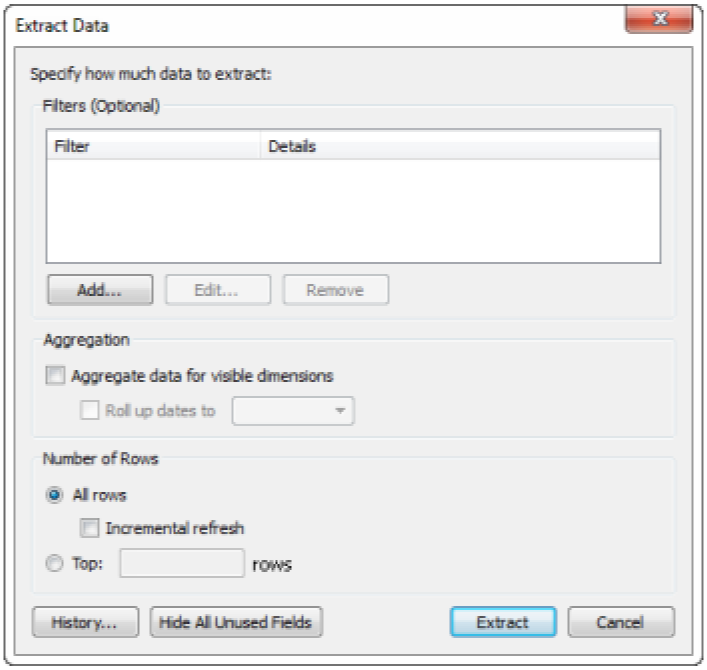
Extracts are saved subsets of a data source that you can use to improve performance or to take advantage of Tableau functionality that is not available in the underlying data. When you extract your data to create an extract, you can reduce the total amount of data by defining filters and limits. After you create an extract you can refresh it with data from the original data. When refreshing the data, you have the option to either fully refresh the data, which replaces all of the extract contents, or you can incrementally refresh the extract, which only adds rows that are new since the previous refresh.

Extracts can:

- Improve performance. For file based data sources such as Excel or Access, a full extract takes advantage of the Tableau data engine. For large data sources, a filtered extract can limit the load on the server when you only need a subset of data.
- Take advantage of Tableau functionality that is not available in the original data source, such as the ability to compute Count Distinct.
- Provide offline access to your data. If your data source is not available (for example, because you are traveling), you can extract the data to a local data source.

To create an extract

1. On the Data Source page, select a data source on the **Data** menu and then select **Extract Data** to open the Extract Data dialog box.

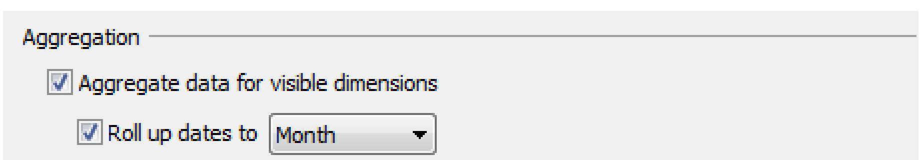


2. Optionally define filters to limit the data that will be extracted. Any fields that are hidden in the Data pane will be automatically excluded from the extract. Click the **Hide All Unused Fields** button to quickly remove them from the extract.

   To add filters, click the **Add** button under the Filters list.

3. Specify whether to **Aggregate data for visible dimensions**. When you select this option the measures are aggregated using their default aggregation. Aggregating the data can minimize the size of the extract file and increase performance.

   When you choose to aggregate the data you can also choose to **Roll up dates** to a specified date level such as Year, Month, etc.



The examples below show how the data will be extracted for each aggregation option.

<table>
<tr>
<td>Original Data</td>
<td>
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>1</td><td>Date</td><td>Region</td><td>Sales</td></tr>
<tr><td>2</td><td>1/1/2009</td><td>South</td><td>$500</td></tr>
<tr><td>3</td><td>1/1/2009</td><td>West</td><td>$200</td></tr>
<tr><td>4</td><td>1/1/2009</td><td>West</td><td>$100</td></tr>
<tr><td>5</td><td>1/1/2009</td><td>East</td><td>$300</td></tr>
<tr><td>6</td><td>1/2/2009</td><td>South</td><td>$600</td></tr>
<tr><td>7</td><td>1/2/2009</td><td>South</td><td>$400</td></tr>
<tr><td>8</td><td>1/2/2009</td><td>East</td><td>$100</td></tr>
<tr><td>9</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Each record is shown as a separate row. There are 7 rows in the data source.</td>
</tr>
<tr>
<td>Aggregate Data
(no roll up)</td>
<td>
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>1</td><td>Date</td><td>Region</td><td>Sales</td></tr>
<tr><td>2</td><td>1/1/2009</td><td>East</td><td>$300</td></tr>
<tr><td>3</td><td>1/1/2009</td><td>South</td><td>$500</td></tr>
<tr><td>4</td><td>1/1/2009</td><td>West</td><td>$300</td></tr>
<tr><td>5</td><td>1/2/2009</td><td>East</td><td>$100</td></tr>
<tr><td>6</td><td>1/2/2009</td><td>South</td><td>$1,000</td></tr>
<tr><td>7</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Records with the same date and region have been aggregated into a single row.There are 5 rows in the data source.</td>
</tr>
<tr>
<td>Aggregate Data
(roll up dates to Month)</td>
<td>
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>1</td><td>Date</td><td>Region</td><td>Sales</td><td></td></tr>
<tr><td>2</td><td>1/1/2009</td><td>East</td><td>$400</td><td></td></tr>
<tr><td>3</td><td>1/1/2009</td><td>South</td><td>$1,500</td><td></td></tr>
<tr><td>4</td><td>1/1/2009</td><td>West</td><td>$300</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Dates have been rolled up to the Month level and records with the same region have been aggregated into a single row.There are 3 rows in the data</td>
</tr>
</table>

		source.

4. Select the number of rows you want to extract. You can extract all or the top N rows. Tableau first applies any filters and aggregation and then extracts the number of rows from the filtered and aggregated results.

   The number of rows options depend on the type of data source you are extracting from. For example, not all data sources support sampling so that option is not always available.

5. When finished, click **Extract**.
6. In the subsequent dialog box, select a location to save the extract into and give the file a name. Then click **Save**.

   > **Note:** If the Save dialog does not display, see the **Troubleshooting extracts** section, below.

Troubleshooting extracts

- **Creating an extract takes a long time:** Depending on the size of your data set, extracting the data can take a long time. However, after you have extracted the data and saved it to your computer, performance will improve.
- **Extract is not created:** If your data set contains a really large number of columns (e.g., in the thousands), in some cases Tableau might not be able to create the extract. If you encounter problems, consider extracting fewer columns or restructuring the underlying data.
- **Save dialog does not display *or* extract is not created from a .twbx:** If you follow the above procedure to extract data from a packaged workbook, the Save dialog does not display. When an extract is created from a packaged workbook (.twbx), the extract file is automatically stored in the package of files associated with the packaged workbook. To access the extract file that you created from the packaged workbook, you must unpackage the workbook. For more information, see **Packaged Workbooks** on page 1247 to unpackage the packaged workbook.

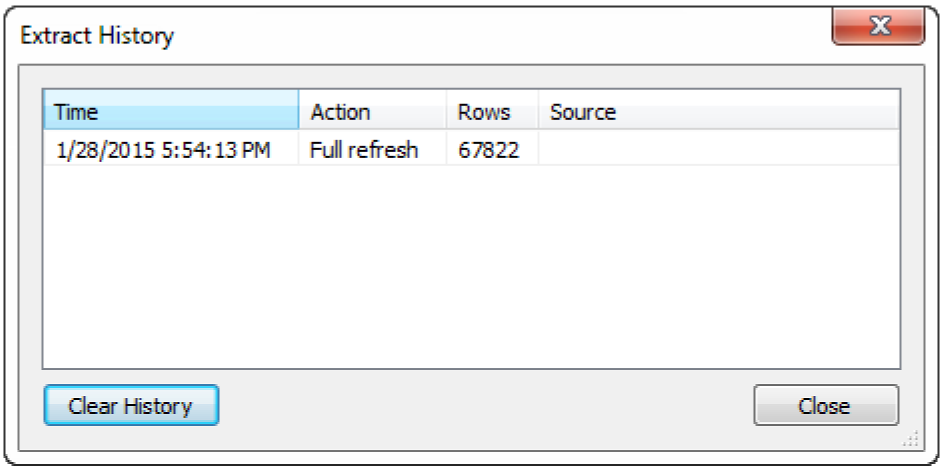
Use Extracts

After you create an extract, the current workbook begins using the extract. However, the extract connection is not saved with the workbook until the next time you save. That means, if you close the workbook without saving first, the workbook will connect to the original data source the next time you open it.

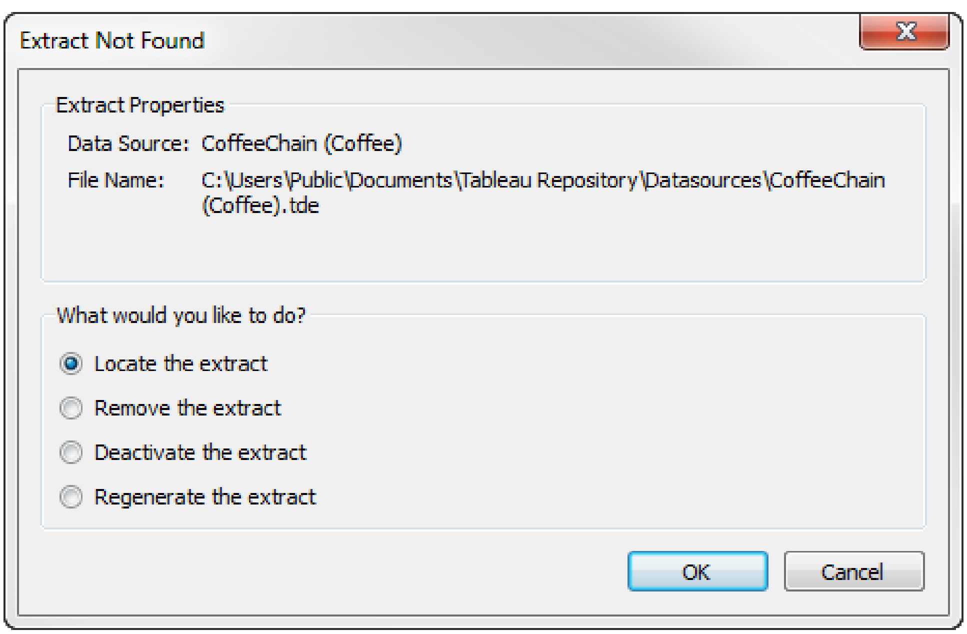
You may want to create an extract with a sample of the data so you can set up the view and then switch to the whole data source, thus avoiding long queries every time you place a field on the shelf. You can toggle between using the extract and using the entire data source by selecting a data source on the **Data** menu and then selecting **Use Extract**.

You can remove an extract at anytime by selecting a data source on the **Data** menu and then selecting **Extract** > **Remove**. When you remove an extract you can choose to Remove the extract from the workbook only or Remove and delete the extract file, which will delete the extract from your hard drive.

You can see when the extract was last updated and other details by selecting a data source on the **Data** menu and then selecting **Extract** > **History**.



If you open a workbook that was saved with an extract and the relevant extract file (.tde) is missing, Tableau prompts you for what to do next:



The options are:

- **Locate the extract**

  Select this option if the extract exists but not in the location where Tableau originally saved it. Click **OK** to open an Open File dialog box where you can specify the new location for the extract file.

- **Remove the extract**

  Select this option if you have no further need for the extract. This is equivalent to closing the data source. All open worksheets that reference the data source are deleted.

- **Deactivate the extract**

  Use the original data source from which the extract was created, instead of the extract.

- **Regenerate the extract**

  Recreates the extract. All filters and other customizations you specified when you originally created the extract are automatically applied.

Refresh Extracts

When the underlying data changes, you can refresh the extract by selecting a data source on the **Data** menu and then selecting **Extract** > **Refresh**. Extracts can be configured to be fully refreshed, replacing all of the data with what's in the underlying data source, or incrementally refreshed, adding just the new rows since the last refresh.

Full Refresh

By default, extracts are fully refreshed. That means that every time you refresh the extract, all of the rows are replaced with the data in the underlying data source. While this kind of refresh ensures you have an exact copy of what is in the underlying data source, it can sometimes take a long time and be expensive on the database depending on how big the extract is.

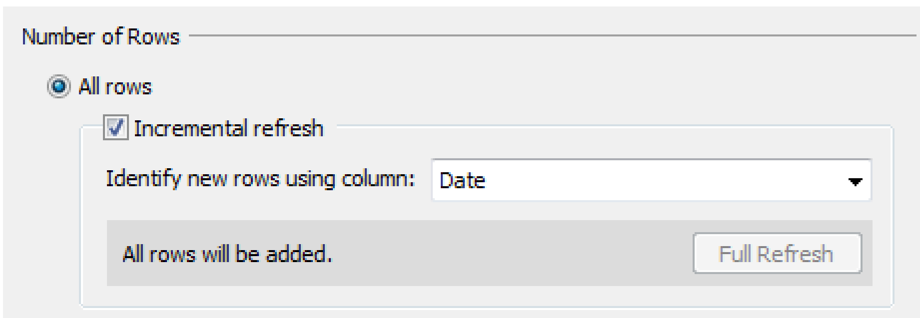
If the extract is not set up for incremental extract, selecting to refresh the extract will fully refresh the extract. If you're publishing the data source to Tableau Server, you can specify the type of refresh in the Scheduling & Passwords dialog box. Most data sources support an incremental refresh.

Incremental Refresh

Rather than refreshing the entire extract, you can set it up to only add the rows that are new since the last time you extracted data. For example, you may have a data source that is updated daily with new sales transactions. Rather than rebuild the entire extract each day, you can just add the new transactions that occurred that day. Then once a week you may want to do a full refresh just to be sure you have the most up to date data.

Follow the steps below to set up an extract to be incrementally refreshed.

1. Select a data source on the **Data** menu and then select **Extract**.
2. In the Extract Data dialog box, select **All rows** as the number of Rows to extract. Incremental refresh can only be defined when you are extracting all rows in the database. You cannot increment a sample extract.
3. Select **Incremental refresh** and then specify a column in the database that will be used to identify new rows. For example, if you select a Date field, refreshing will add all rows whose date is after that last time you refreshed. Alternatively, you can use an ID column that increases as rows are added to the database.



> **Note:** Tableau Data Engine stores time values with a precision of up to 3 decimal places. If you specify a datetime or timestamp column for **Identify new rows using column**, and your database uses a higher precision than Tableau, you can end up with duplicate rows after an incremental refresh. For example, if the database has two rows, one with a datetime value of `2015-03-13 17:30:56.502352` and one with a datetime value of `2015-03-13 17:30:56.502852`, Tableau will store both rows using a datetime value of `2015-03-13 17:30:56.502` thereby creating duplicate rows.

4. When finished, click **Extract**.

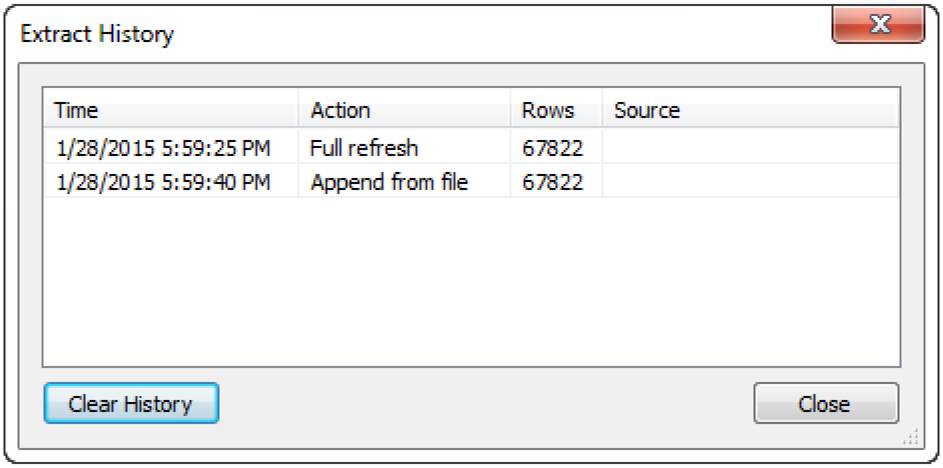
The steps above can be used to define a new extract or configure an existing extract for incremental refresh. If you are editing an existing extract, the last refresh is shown so you can be sure you are updating the extract with the correct data.

If you publish the data source to Tableau Server you can specify a schedule for incremental refresh as well as full refresh in the Schedules & Passwords dialog box.

Extract History

You can see a history of when the extract was refreshed by selecting a data source on the **Data** menu and then select **Extract** > **History**.

The Extract History dialog box shows the date and time for each refresh, whether it was full or incremental, and the number of rows that were added. If the refresh was from a file, it also shows the source file name.



Add Data to Extracts

There are two ways you can add new data to an extract: from a file or from a data source. However, to add new data, the columns in the file or data source must match the columns in the extract.

Add data from a file

You can add new data to an extract from a file-based data source. Use this option when the file type of the extract is the same as the file type of the data that you want to add. Alternatively, you can add data from a Tableau data extract (.tde) file. For example, you may have text files that are generated for a task that is performed every day. To add each day's worth of information to your extract whose original data source is also a text file, use the **Append Data from File** command.

To add data from a file

1. On the **Data** menu, select a data source, and then select **Extract** > **Append Data from File**.
2. Browse to and select the file that has the new data.

   > **Note:** By default, the file format of the extract's original data source is used. To add data from a Tableau data extract, click the file format drop-down list, and then select **Tableau Data Extract (.*tde)**.

3. When finished, click **OK**.

Add data from a data source

You can also add new data to an extract from another data source in the workbook. Use this option when the file type of the extract is different from the file type of the data you want to add. For example, you created an extract from a data warehouse that has the past ten years worth of data. However, new data has been kept in an Excel workbook. You can add new data to the extract by using the **Append Data from Data Source** command.

> **Note:** Joins or custom SQL should be specified in the data source before adding data to the extract.

To add data from a data source

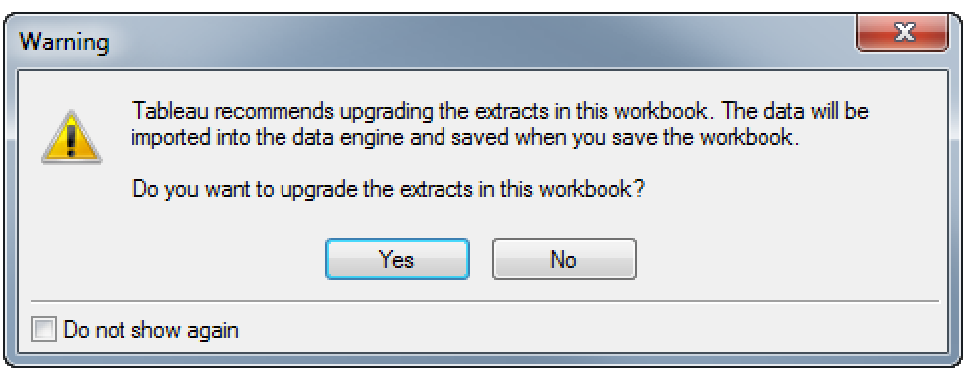
1. On the **Data** menu, select a data source, and then select **Extract** > **Append Data from Data Source**.
2. In the dialog box, select the data source that you want to append.
3. When finished, click **OK**.

Using either option will add new rows to the extract. To see a summary of the number of rows that were added, select a data source on the **Data** menu and then select **Extract** > **History**.

> **Note:** When you refresh this extract, the data will be replaced with the data from the original data source.

Upgrade Legacy Extracts

If you have data extracts that were created before version 6.0, you should upgrade the extracts to use the data engine. When you open the workbook, you are given the option to upgrade the extracts.



You can also upgrade the extracts by selecting a data source on the **Data** menu and then selecting **Upgrade Extract**.

Optimize Extracts

To improve performance when working with extracts you can optimize the extract. Optimizing an extract creates secondary structure in the extract that speed up future queries.

Optimize the extract by selecting a data source on the **Data** menu and then selecting **Extract** > **Optimize**.

The following types of optimizations are made:

Materialized Calculated Fields

Calculated fields are computed in advance and stored in the extract. In future queries, Tableau can look up the already computed value rather than running the computation again. The following types of calculated fields ARE NOT materialized:

- Calculations that use unstable functions such as NOW() and TODAY()
- Calculations that use external functions such as RAWSQL and R
- Table calculations

In addition, if the formula for a materialized calculation changes or the calculation is deleted from the data source, the materialized calculation is dropped from the extract until the extract is optimized again.

Acceleration Views

When a workbook contains filters that are set to show only relevant values, computing the available values for that filter can be an expensive query. For these filters, Tableau must evaluate the other filters in the workbook first and then compute the relevant values based on their filter selections. To speed up these queries, a view can be created that computes the possible filter values and caches them for faster lookup later.

Update Server Data Sources that Are Using Extracts

You have the following options for updating data sources that are using extracts that have been published to Tableau Server or Tableau Online:

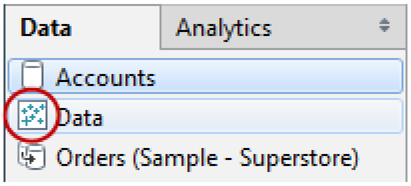
- You can add the data source or a workbook that connects to it to a refresh schedule in Tableau Server or Tableau Online (cloud-based data sources only).
- You can update the data source in Tableau Desktop and then republish it.
- You can add to or refresh the data source on Tableau Server or Tableau Online, from Tableau Desktop, without first adding to or refreshing the extract in Tableau Desktop.

The remainder of this topic describes the third option.

Update Server Extracts From Tableau Desktop

Before you attempt to update a data source on Tableau Server or Tableau Online that is using an extract, verify that Tableau Desktop is connected to the published data source on Tableau

Server, as indicated by the Tableau Server icon next to the data source name in the Data pane:



To update the server data source, right-click (control-click on a Mac) the data source in the Tableau Desktop Data pane, select **Tableau Data Server**, and choose one of the following options:

- **Edit Server and Site Path**

  If you have changed the location of the data source in Tableau Server or Tableau Online, choose this option to point Tableau Desktop to the new, correct location.

- **Refresh from Source**

  Refreshes the extract (full or incremental) using the data in the original data source.

  This command is available only for extracts that include a connection to the original data source. If you connected directly to a Tableau Data Extract file (.tde) and then published it, the connection to the original data source is not included and this option is therefore unavailable.

- **Append from Data Source**

  Updates the extract from another open (and compatible) data source. If you connected directly to a Tableau Data Extract file (.tde) and then published it, the connection to the original data source is not included and this option is therefore unavailable.

Note: If you see the Tableau Data Server option, but the commands in the submenu are unavailable, the data source exists on the server, but is not an extract.

It is also possible to update an extract on Tableau Server using a command-line utility. See **Tableau Data Extract Command-Line Utility** below.

Tableau Data Extract Command-Line Utility

You can automate extract refresh tasks using the Tableau Data Extract Utility. This is a command-line utility that comes with Tableau Desktop, through which you can refresh published data sources or append data to them from a file.

Note: The Tableau Data Extract Utility is available only with Tableau Desktop on Windows.

Run the utility

1. Open the Command Prompt as an administrator and change to the Tableau Desktop bin directory. For example:

   `cd C:\Program Files\Tableau\Tableau 9.3\bin`

2. Use either of the following commands, adding parameters described in the tables below.
   - `tableau refreshextract`
   - `tableau addfiletoextract`

> **Note:** When using the utility, always specify `tableau` on the command line or in scripts, never `tableau.exe`.

Syntax and parameters for the tableau refreshextract command

Use `tableau refreshextract` to refresh an extract on Tableau Server or Tableau Online. Refreshing an extract updates an existing extract with any modifications that have been made to the data source since the last refresh.

To see help for this command, at the Windows command prompt, type the following command:

```
tableau refreshextract --help
```

Using parameters

- All options have a full form that you use with a double hyphen (for example, `--server`).
- Some options also have a short form that you use with a single hyphen (for example, `–s`).
- If the value for an option contains spaces, enclose it in quotation marks.

tableau refreshextract command options

Short Form	Full Form	Description
	`--source-username <user name>`	A valid user name for the data source connection. Use this option with `--source-password`, or use `--original-file` instead of the user name and password options.

		Note: You must provide the user name and password when refreshing a published extract, even if the data source was originally published with embedded credentials.
	`--source-password "<pass-word>"`	The password for the data source user.

	`--original-file <path and file name>`
	or
	`--original-file <path and folder name>`
		Path and file name for the data source to be refreshed on the server. For example: `--original-file c:\folder\file.csv`
		To refresh a multi-file data source, pass the path to a folder that contains the data files. For example: `--original-file c:\folder`.
		If the file is on a network share, use the UNC format for the path: `\\server\path\filename.csv`

	`--force-full-refresh`	If the data source is set up for incremental refreshes, use this option to force a full extract refresh. If this option is not included, an incremental refresh is performed. Not all data sources support incremental refresh.
`-s <server http address>`	`--server <URL>`	The URL for the Tableau server on which the data is published. For Tableau Online, specify `https://online.tableau.com`.
`-t <site id>`	`--site <siteid>`	In a multiple-site environment, specifies the site to which the command applies. For Tableau Online, use this argument if your user name is associated with more than one site. For Tableau Server, if you do not specify a site, the default site is assumed.

		The site id is independent of the site name, and it is indicated in the URL when you view the site in a browser. For example, if the URL for the page you see after signing in to Tableau Online is `https://online.tableau.com/t/vernazza/views` the site id is *vernazza*.
	`--datasource <datasource>`	The name of the data source, as published to Tableau Server or Tableau Online.
	`--project <projectname>`	The project to which the data source belongs. If this option is not included, the default project is assumed.
`-u <user name>`	`--username <username>`	Valid Tableau Server or Tableau Online user.
`-p "<password>"`	`--password "<password>"`	The password for the specified Tableau Server or Tableau Online user.
	`--proxy-username <username>`	The user name for a proxy server.
	`--proxy-password "<password>"`	The password for a proxy server.
`-c "<path and file name>"`	`--config-file "<path and file name>"`	Path and file name information for a file containing configuration options for the command. Always enclose the path in double quotation marks. For more information, see **Using a config file** on page 396 below.

Sample tableau refreshextract command

The following command refreshes an extract named CurrentYrOverYrStats that has been published to Tableau Server on-premises. This command specifies the following:

- The name of your Tableau Server.
- Server user name and password.
- Project name.
- The name of the data source to refresh, along with the data source username and password.

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
refreshextract --server https://our_server_name --username
OurServerSignIn --password "OurServerPwd" --project "New
Animations" --datasource "CurrentYrOverYrStats" --source-
username OurDatabaseSignIn --source-password
"OurDatabasePassword"
```

The following command refreshes an extract named CurrentYrOverYrStats that has been published to Tableau Online. This command specifies the following:

- Tableau Online user and password.
- Tableau Online site and project names.
- The data source, which in this case is hosted by a cloud-based data source provider (for example, Salesforce.com), and the username and password to sign in to the hosted data source.

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
refreshextract --server https://online.tableau.com --
username email@domain.com --password "OurServerPwd" --site
vernazza --project "New Animations" --datasource
"CurrentYrOverYrStats" --source-username database_
user@hosted_datasource_provider.com --source-password "db_
password"
```

To refresh an extract of file-based data source, provide the path to the original file from which you created the extract. If the file is on a network share, use the UNC format instead of a mapped drive.

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
refreshextract --server https://online.tableau.com --
username email@domain.com --password "OurServerPwd" --site
vernazza --project "New Animations" --datasource
"CurrentYrOverYrStats" --original-file
"\\server\path\filename.csv"
```

Syntax for tableau addfiletoextract

Use `tableau addfiletoextract` to append file content to an extract that has been published to Tableau Server or Tableau Online. This command combines the two files.

If you want simply to update an existing extract with the latest changes, use the `refreshextract` command instead. Using `addfiletoextract` to update an existing extract will duplicate data instead.

To see help for this command, at the Windows command prompt, type the following command:

```
tableau addfiletoextract --help
```

All options have a full form that you use with a double hyphen (for example, `--server`). Some options also have a short form that you use with a single hyphen (for example, `-s`). If the value for an option contains spaces, enclose it in quotation marks.

tableau addfiletoextract command options

Short Form	Full Form	Description
	`--file <path and file name>`	Path and file name information for the data file containing data to append. The file can be from Excel, Access, a Tableau data extract, or a delimited text file. It cannot be password protected. Use UNC format if the file is on a network share. For example, `\\server\path\filename.csv`
`-s <server http address>`	`--server <URL>`	The URL for the Tableau server on which the data is published. For Tableau Online, specify `https://online.tableau.com`.
`-t <site id>`	`--site <site id>`	In a multiple-site environment, specifies the site to which the command applies. For Tableau Online, you must include this argument if your user name is associated with more than one site. For Tableau Server, if you do not specify a site, the default site is assumed.

	--datasource <datasource>	The name of the data source, as published to Tableau Server or Tableau Online.
	--project <projectname>	The project to which the data source belongs. If this option is not included, the default project is assumed.
-u <username>	--username <username>	Valid Tableau Server or Tableau Online user.
-p "<password>"	--password "<password>"	The password for the specified Tableau Server or Tableau Online user.
	--proxy-username <username>	The user name for a proxy server.
	--proxy-password "<password>"	The password for a proxy server.
-c "<path and filename>"	--config-file "<path and filename>"	Path and file name information for a file containing configuration options for the command. Always enclose the path in double quotation marks. For more information, see **Using a config file** on the next page below.

Sample tableau addfiletoextract command

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
addfiletoextract --server https://our_server_name --username
OurServerSignIn --password "OurServerPwd" --project "New
Animations" --datasource "CurrentYrOverYrStats" --file
"C:\Users\user1\Documents\DataUploadFiles\AprMay.csv"
```

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
addfiletoextract --server https://online.tableau.com --
username email@domain.com --password "OurServerPwd" --site
vernazza --project "New Animations" --datasource
"CurrentYrOverYrStats" --file
"C:\Users\user2\Documents\DataUploadFiles\AprMay.csv"
```

Using a config file

You can use a plain text editor, such as Notepad or Text Edit, to create a config (configuration) file that you can use with `tableau refreshextract` or `tableau addfiletoextract`. A config file can be useful if you expect to update the same data source regularly over time. Instead of having to type the same options each time you run a command, you specify the config file. A config file also has the advantage of not exposing user names and passwords on the command line.

Create the config file

For example, say you created a file called config.txt and saved it to your Documents folder. And in the file, you included the parameter information shown below.

For an extract published to Tableau Server:

```
server=https://our_server_name
username=OurServerSignIn
password=OurServerPwd
project=New Animations
datasource=CurrentYrOverYrStats
```

For an extract from a hosted data source, published to Tableau Online, where **server** is **https://online.tableau.com**:

```
server=https://online.tableau.com
username=email@domain.com
password=OurPassword
project=New Animations
datasource=CurrentYrOverYrStats
source-username=database_user@hosted_datasource_provider.com

source-password=db_password
```

Reference the Config File from the Command Line

After you create the config file, you run the `tableau refreshextract` or `tableau addfiletoextract` command, pointing to the config file as the only option you use on the command line, and enclosing the config file's path in double quotation marks. The syntax is as follows:

```
tableau refreshextract --config-file "<path>"
```

For example, to refresh the extract specified in the sample in the **Create the config file** above section, you would run the following command (making sure that you are working in the bin directory for your version of Tableau Desktop):

```
C:\Program Files\Tableau\Tableau 9.3\bin>tableau
refreshextract --config-file
"C:\Users\user1\Documents\config.txt"
```

Syntax Differences for Config Files

The syntax for specifying options inside a config file differs from the syntax you use on the command line in the following ways:

- Option names do not begin with dashes or hyphens.
- You use an equals sign (with no spaces) to separate option names from option values.
- Quotation marks are not necessary (or allowed) around values, even when they include spaces (as for the `project` option in the example shown earlier).

Use Windows Task Scheduler to Refresh Extracts

You can use Windows Task Scheduler, in combination with the Tableau Data Extract Command-Line Utility, to automate regular updates to Tableau Desktop data sources from within your corporate firewall. You can configure a task to occur once per day, week, or month, or after a specific system event. For example, run the task when the computer starts.

To learn more, see the Task Scheduler How To... page in the Microsoft TechNet library.

Tableau Data Extract API

Starting in Tableau 9.1, the Tableau Data Extract API is incorporated into the Tableau SDK. You can use the Tableau SDK to create an extract and publish it to Tableau Server. The SDK supports Windows, Linux, and the Mac, using C, C++, Java, and Python.

For more information, see the Tableau SDK documentation.

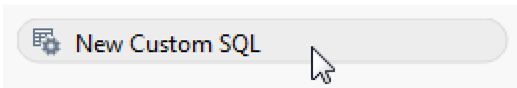
Connect to a Custom SQL Query

For most relational data sources you can connect to a specific query rather than the entire data source. Often this can be useful when you know exactly the information you need and you understand how to write SQL queries.

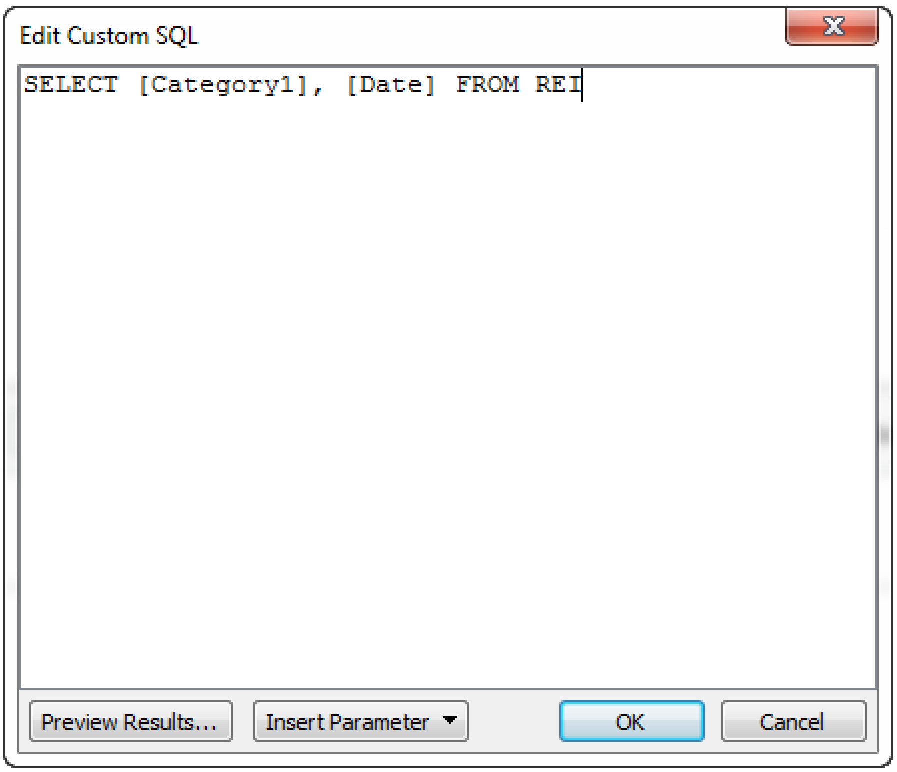
> **Note:** For Excel and text file data sources, this option is available only in workbooks that were created before Tableau Desktop 8.2 or when using Tableau Desktop on Windows with the legacy connection. To connect to Excel or text files using the legacy connection, connect to the file, and in the Open dialog box, click the **Open** drop-down menu, and then select **Open with Legacy Connection**.

To connect to a custom SQL query

1. After connecting to your data, double-click the **New Custom SQL** option on the Data Source page.



2. Type or paste the query into the text box.



3. When finished, click **OK**.

When you finish the connection, only the relevant fields display in the Data pane.

If your SQL query references duplicate columns, you may get errors when trying to use one of the columns in Tableau. This will happen even if the query is valid. For example, consider the following query:

```
SELECT * from authors, titleauthor where authors.au_id = titleau-
thor.au_id
```

The query is valid, but the **au_id** field is ambiguous because it exists in both the “authors” table and the “titleauthor” table. Tableau will connect to the query but you will get an error anytime you try to use the **au_id** field. That’s because Tableau doesn’t know which table you are referring to.

To edit a custom SQL query

1. On the data source page, in the canvas, hover over the custom SQL table until the edit button displays.
2. Click the edit button.
3. In the dialog box, edit the custom SQL query.

Using Parameters in a Custom SQL Query

You can use parameters in a custom SQL query statement to replace a constant value with a dynamic value. You can then update the parameter in the workbook to modify the connection. For example, you may connect to a custom SQL query that provides web traffic data for a particular page that is specified by a pageID. Instead of using a constant value for the pageID value in the SQL query, you can insert a parameter. Then after finishing the connection, you can show a parameter control in the workbook. Use the parameter control to switch out the pageID and pull in data for each page of interest without having to edit or duplicate the connection.

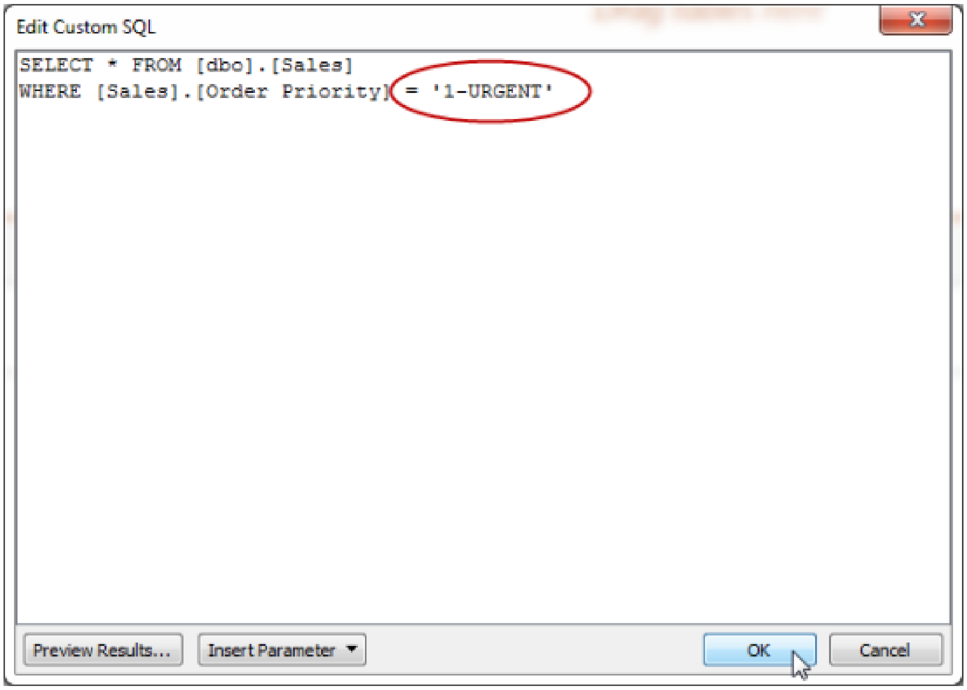
You can create a parameter directly from the Custom SQL dialog box or use any parameters that are part of the workbook. If you create a new parameter, it becomes available for use in the workbook just like any other parameter. See **Parameters** on page 1161 to learn more.

To add a parameter to a custom SQL query

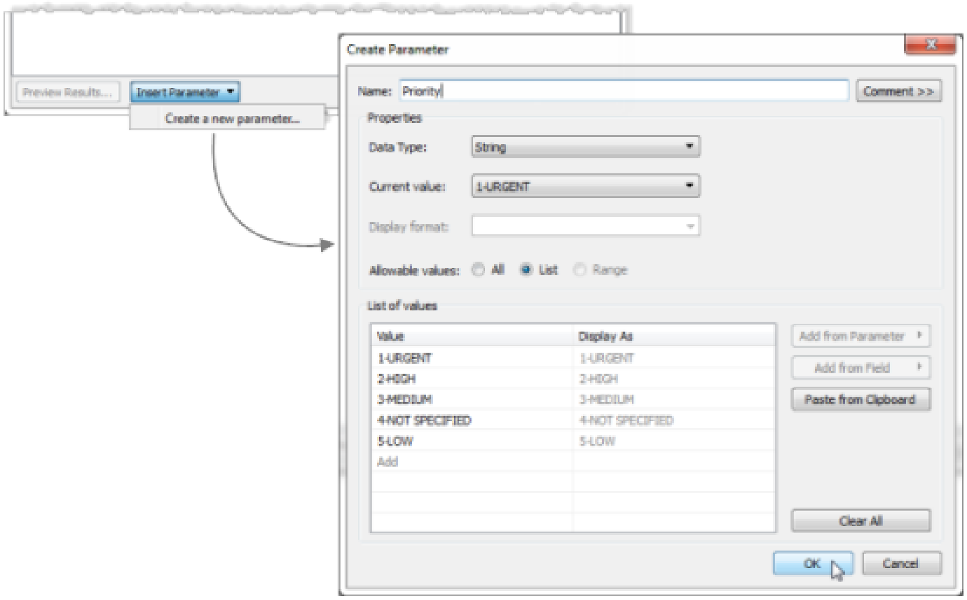
1. On the data source page, in the canvas, hover over the table until the edit icon displays, and then click the edit button.
2. At the bottom of the dialog box, click **Insert Parameter**.
3. Select a constant value in the SQL statement and then, from the **Insert Parameter** drop-down menu select the parameter you want to use instead. If you have not created a parameter yet, select **Create a new parameter**. Follow the instructions in **Creating Parameters** on page 1161 to create a parameter.

> **Note:** Parameters can only replace literal values. They cannot replace expressions or identifiers such as table names.

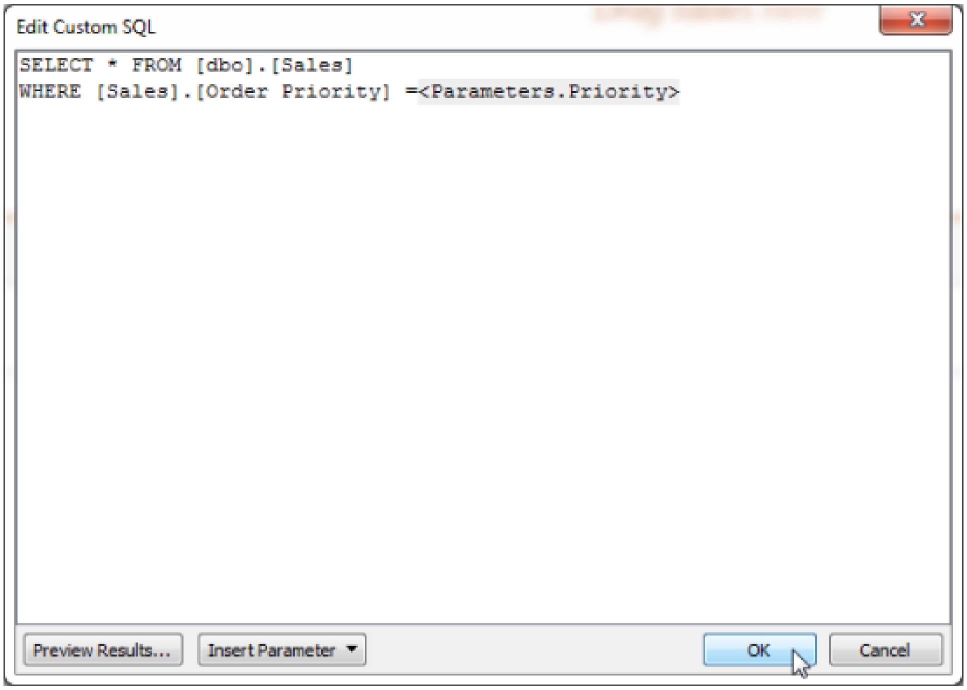
The workbook in the example below connects to a Custom SQL query that returns all orders with that are marked as Urgent priority. In the SQL statement, the order priority is the constant value. If you want to change the connection to see the High priority orders, you would have to edit the data source.



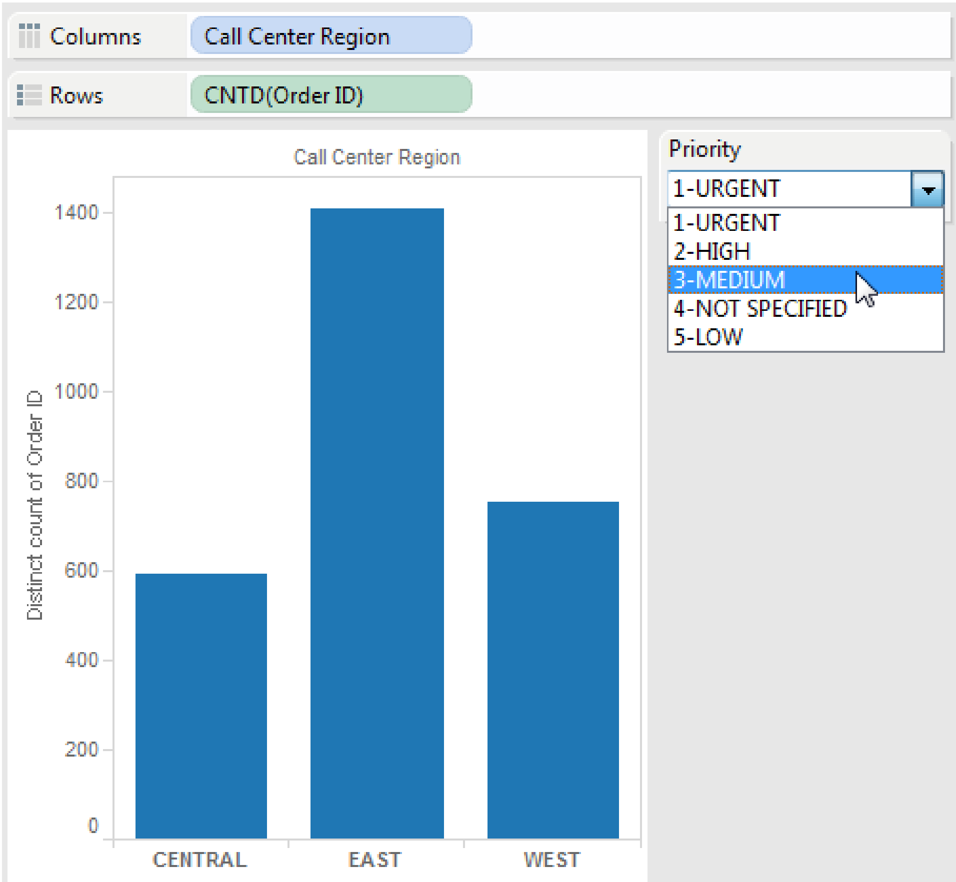
Instead of creating and maintaining many variations of the same query, you can replace the constant order priority value with a parameter. The parameter should contain all of the possible values for Order Priority.



After you create a parameter, you can insert it into the SQL statement to replace the constant value.



After you finish editing the connection, the new parameter is listed in the Parameters area at the bottom of the Data pane and the parameter control displays on the right side of the view. As you select different values, the connection updates.

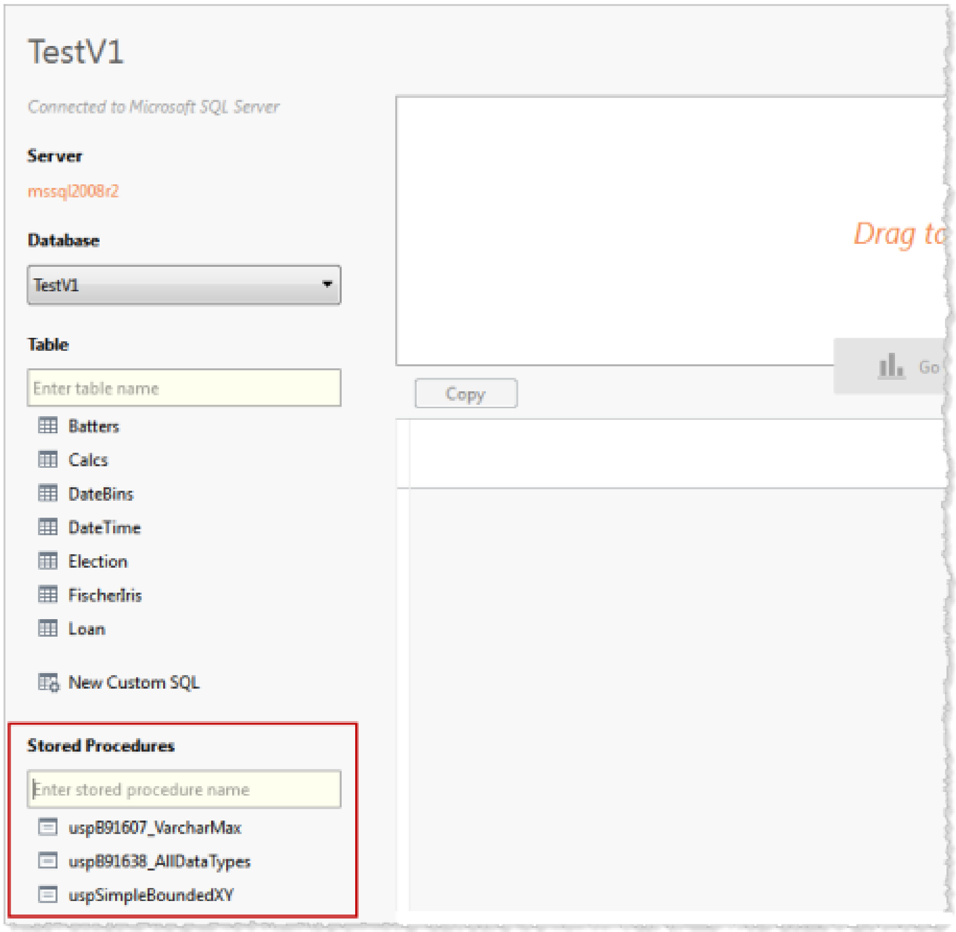


Note: If you are using an extract, you must refresh the extract in order to reflect changes to the parameter. Publishing a data source that uses Custom SQL parameters includes the parameters. The parameters are transferred to any workbooks that connect to the data source.

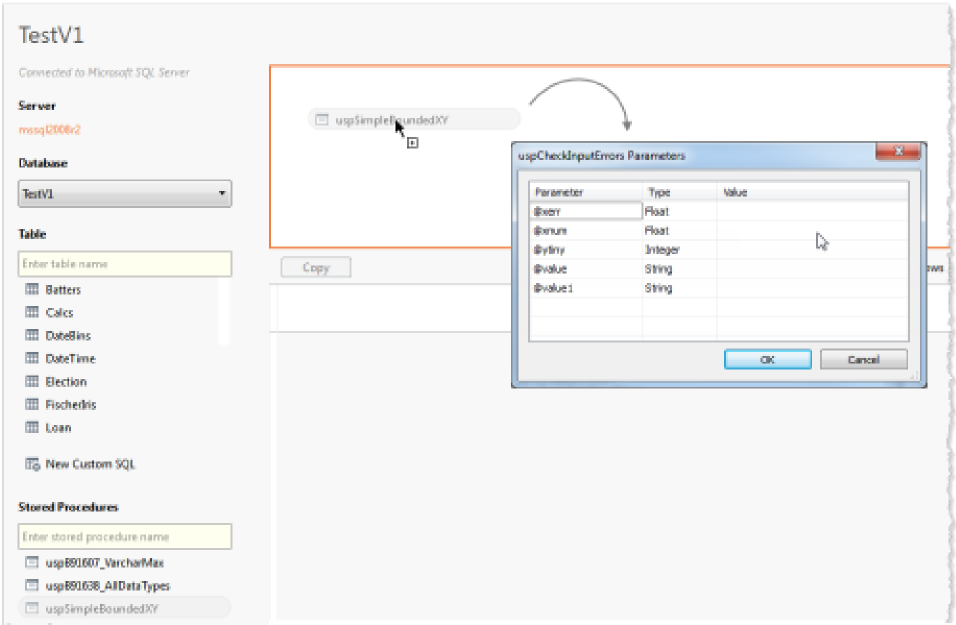
Use a Stored Procedure

A stored procedure is a subroutine available to applications that access a relational database system. When you connect to a SAP Sybase ASE, Microsoft SQL Server, or Teradata database with Tableau, you can use a stored procedure to define the connection.

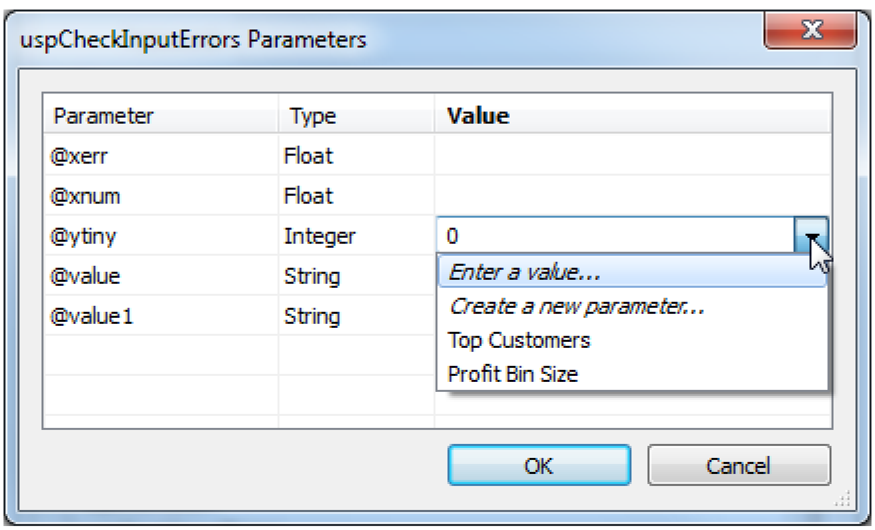
When you are creating a data source using one of these data types, available procedures are listed under **Stored Procedures** .



From the left pane, drag the procedure to the canvas or double-click one of the listed procedures. If parameters are available in the procedure, the Parameters dialog box automatically displays:



Instead of entering a value, you can use an existing Tableau parameter, or create a new Tableau parameter for the value:



If you then expose the Tableau parameter in the view, users are able to change the value of the parameter in the procedure interactively.

Notes on Stored Procedures

If you use stored procedures to define a data source for Tableau, keep the following in mind:

- If a stored procedure returns more than one result set, Tableau reads the first one and ignores the rest.
- If a stored procedure has output parameters, Tableau filters out the stored procedure.
- Stored procedures that have parameters of a non-scalar type are excluded.
- Result set columns that don't have matching types in Tableau (such as varbinary, geometry, and hierarchyid) are logged. If all result set columns map to unknown data types, Tableau displays a message:

  "The result set... has no usable columns."
- Stored procedures that return no result sets are listed on the data source page but fail if selected.
- If no value is provided for a parameter that the stored procedure requires, an error occurs. Tableau cannot determine in advance whether parameters are required.
- Tableau does not perform any transaction management for stored procedures. That is, stored procedure writers must not depend on Tableau to start transactions before invoking stored procedures, or to commit them afterward.
- Column names must be unique for stored procedures to work. If two columns have the same name, or if no name is provided, the procedure can result in an error message:

  "InsertData: unbound column error"
- If there are multiple queries in a stored procedure (for example, to read values from another table or to hold temporary combinations) each of the queries must return the same sets of columns in the same order (same names and data types). To ensure that column order and names match in the query results, you may need to explicitly `CAST` to ensure the data type is correct, for example `CAST(Username as VARCHAR(20))`, and explicitly name the columns. If a stored procedure does not follow these guidelines, an error message can result:

  "InsertData: unbound column error"
- If there are multiple queries in a stored procedure (for example, to read values from another table or to hold temporary combinations) and the procedure is generating an error, try adding `SET NOCOUNT ON` to the top of the procedure.This prevents the message which shows the count of number of rows affected by a Transact-SQL statement from being returned as part of the result set for a query.

In addition, the following constraints apply for specific databases.

Stored Procedure Constraints for Teradata Databases

The following constraints apply for stored procedures on Teradata databases.

- Values must be provided for every parameter. If the user does not provide a value for one or more parameters, Tableau displays a Teradata database error stating there are too few values provided for the stored procedure.

Stored Procedure Constraints for SQL Server Databases

The following constraints apply for stored procedures on SQL Server databases.

- If the result set for a stored procedure contains columns of type IMAGE or TEXT, the stored procedure will fail with an "Incorrect syntax" error message.
- If the total width of the result set (number of bytes in each row) exceeds 8060, the stored procedure fails. This can occur with very wide tables (hundreds of columns) or with tables having large text columns, intended to hold thousands of characters of text.
- Tableau does not display stored procedures from schema "sys".
- If the user does not provide a value for one or more parameters that the procedure requires, Tableau displays a SQL Server database error in the form "The procedure requires a value for parameter @x but one was not provided."
- Stored procedures that contain multiple queries should follow the guidelines listed in Notes on Stored Procedures (above).
- Tableau Desktop does not support the Microsoft SQL Server TIME data type. When fields of this type are included in a stored procedure on a Microsoft SQL Server database Tableau Desktop will not import them.

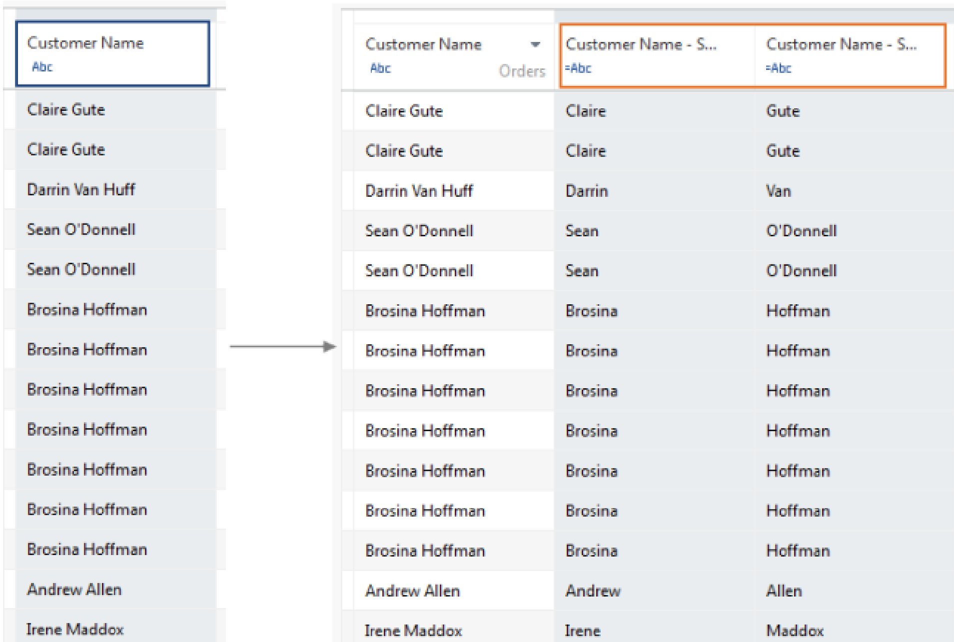
Stored Procedure Constraints for SAP Sybase ASE Databases

The following constraints apply for stored procedures on SAP Sybase ASE databases.

- The database must have a properly configured remote server.
- If the user does not provide a value for one or more parameters that the procedure requires, Tableau displays a Sybase ASE database error in the form "The procedure requires a value for parameter @x but one was not provided."

Split a Field into Multiple Fields

If you have string fields in your data that contain multiple units of information, for example, the first and last name of a customer, it might be easier to analyze the data if you split the values in that field into separate fields. You can use split or custom split options in Tableau to separate the values based on a separator or a repeated pattern of values present in each row of the field. In this example, the common separator is a space character ( ).



Customer Name Abc
Claire Gute
Claire Gute
Darrin Van Huff
Sean O'Donnell
Sean O'Donnell
Brosina Hoffman
Brosina Hoffman
Brosina Hoffman
Brosina Hoffman
Brosina Hoffman
Brosina Hoffman
Brosina Hoffman
Andrew Allen
Irene Maddox

Customer Name Abc Orders	Customer Name - S... =Abc	Customer Name - S... =Abc
Claire Gute	Claire	Gute
Claire Gute	Claire	Gute
Darrin Van Huff	Darrin	Van
Sean O'Donnell	Sean	O'Donnell
Sean O'Donnell	Sean	O'Donnell
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Brosina Hoffman	Brosina	Hoffman
Andrew Allen	Andrew	Allen
Irene Maddox	Irene	Maddox

The new fields created by the split or custom split are added to the data source as calculated fields.

Notes: Splits and custom splits are supported for the following data source types: Tableau data extract (TDE), Microsoft Excel, text, Salesforce, OData, Microsoft Azure Market Place, Google Analytics, HP Vertica, Oracle, MySQL, PostgreSQL, Teradata, Amazon Redshift, Aster Data, Google Big Query, Cloudera Hadoop Hive, Hortonworks Hive, and Microsoft SQL Server. Splits and custom splits are based on the SPLIT string function. For more information, see **String Functions** on page 1418.

Split fields automatically

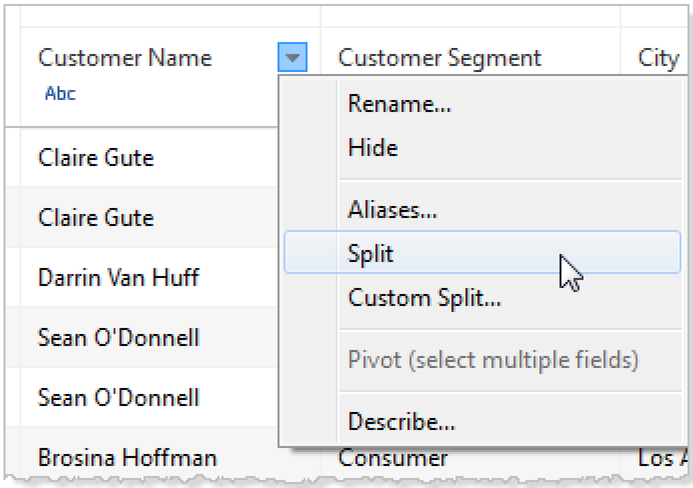
A string field can be split automatically based on a common separator that Tableau detects in the field.

Depending on the data source type, a split can automatically separate a field's values in up to ten new fields. The data type of the new fields generated by the split can vary depending on the pattern combination that Tableau detects in the separator that is used to split the original field.

Note: In some cases, if the split takes too long to generate new fields or Tableau cannot find a common separator, a custom split dialog box displays. For more information, see the **Custom split** on page 409 section.

To split a field automatically

1. On the Data Source page, in the grid, click the drop-down arrow next to the field name.
2. Select **Split**.



Note: You can also use the split option from the Data pane. In the Data pane, right-click the field you want to split, and then select **Transform** > **Split**.

If you do not like the results of the split, you can go to the Data pane and edit the calculated fields that are created by the split. Alternatively, you can click undo in the Tableau Desktop toolbar or remove the split.

To remove fields created by a split

1. On the Data Source page, in the grid, click the drop-down arrow next to the field name.
2. Select **Delete**.
3. Repeat steps 1-2 to remove all the fields created by the split.

Alternatives to automatic split

Sometimes, using automatic split is not the best option. The following are example of cases when you should not split fields automatically:

- **Values contain different number of separators:** Fields cannot be split automatically if the number of separators varies from value to value. For example, suppose a field has the following values:

  jsmith| accounting | north

dnguyen | humanresources

lscott | recruiting| west

karnold |recruiting |west

In cases like this, consider using a custom split. For more information, see the **Custom split** below section.

- **Values contain mixed separators:** Fields cannot be split automatically if the separator types are different. For example, suppose a field contains the following values:

  smith.accounting

  dnguyen-humanresources

  lscott_recruiting

  karnold_recruiting

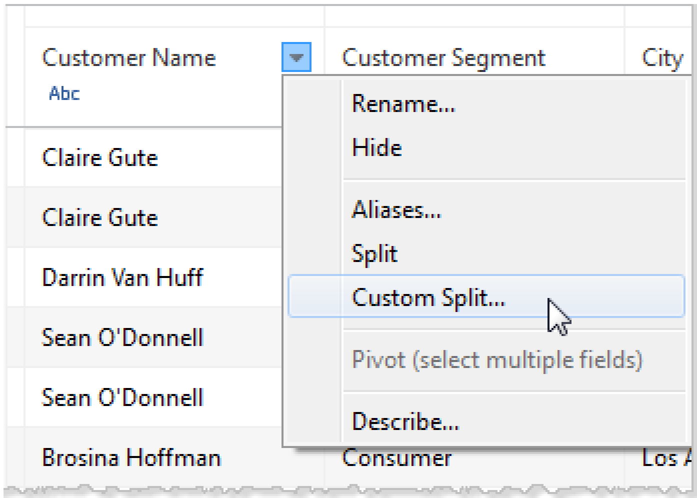
  In cases like this, consider using regular expressions to create new fields. For more information, see **Additional Functions** on page 1457.

Custom split

You can use the custom split option to specify a common separator for the split. Like the split option, a custom split can separate a field’s values in up to ten new fields. In addition, you can choose to split the values at the first n occurrences of the separator, the last n occurrences of the separator, or at all occurrences of the separator. The data type of the new fields generated by the custom split always results in a string data type.

To use a custom split

1. On the Data Source page, in the grid, click the drop-down arrow next to the field name.
2. Select **Custom Split**.



Note: You can also access the custom split option from the Data pane. In the Data pane, right-click the field you want to split, and then select **Transform** > **Custom Split**.

If you do not like the results of the split, you can go to the Data pane and edit the calculated fields that are created by the split. Alternatively, you can click undo in the toolbar or remove the split.

To remove fields created by a custom split

1. On the Data Source page, in the grid, click the drop-down arrow next to the filed name.
2. Select **Delete**.
3. Repeat steps 1-2 to remove all the fields created by the custom split.

At a glance: Working with splits and custom splits

The following is a list of additional notes you might need to know about splits and custom splits.

- New fields generated from a split or custom split cannot be used as keys to join tables, but can be used to blend data sources.
- New fields generated from a split or custom split cannot be used in a pivot.
- Split and custom split options are not supported for sets, groups, parameters, and bins.
- Microsoft SQL Server only allows up to four split fields.
- To generate more than ten new fields, consider using a split or custom split on the field that was previously generated by a split or custom split.

Troubleshooting splits and custom splits

The following is a list of issues you might experience when using splits and custom splits:

- **Split and custom split options missing for a supported data source type:** Split and custom split options are available only for fields that are a string data type.
- **Null values or empty cells:** After creating a split or a custom split, new fields might contain null values or no values at all. Null values or empty cells occur when there are no values for all of the expected new fields.
- **Data has been removed:** Tableau might use portions of the field's values as a separator. If a portion of a field's values is used as a separator, those values no longer appear in the new fields. For example, suppose a field contains the following values:

  ZIP-98102

  ZIP-98109

  ZIP-98119

  ZIP-98195

  In this case, the split will create a new field with the following values:

  98102

  98109

  98119

  98195

  The split will not create a separate field for “ZIP-“ because the split uses it as a separator.

Pivot Data (from Columns to Rows)

Analyzing data that is stored in a crosstab format can be difficult in Tableau. When working with data in this format, you can pivot the data in your Microsoft Excel and text file data sources from crosstab format into columnar format.

For example, suppose your data source contains sales values by year.

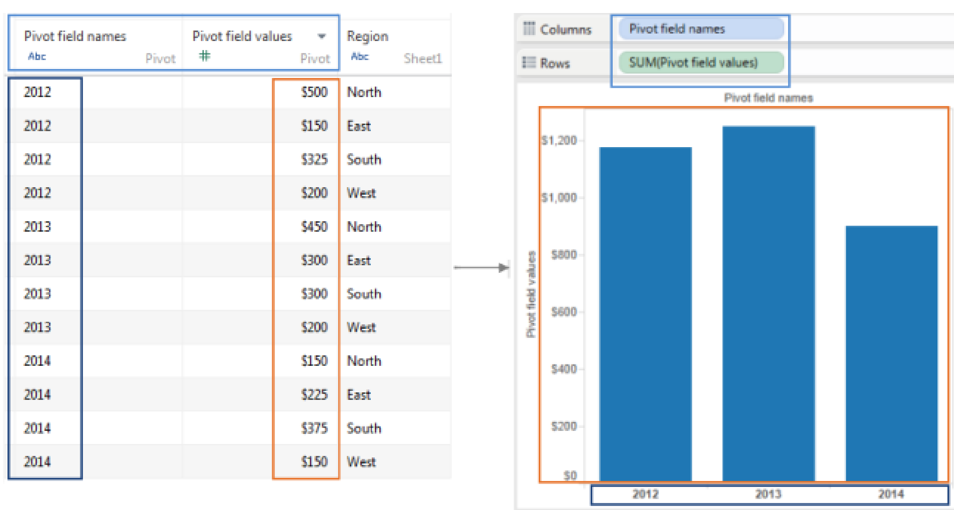
Region	2012	2013	2014
North	500	450	150
East	150	300	225

Region	2012	2013	2014
South	325	300	375
West	200	200	150

The following image shows the example data source in the grid (left) and a view that you can create with the example data source (right).

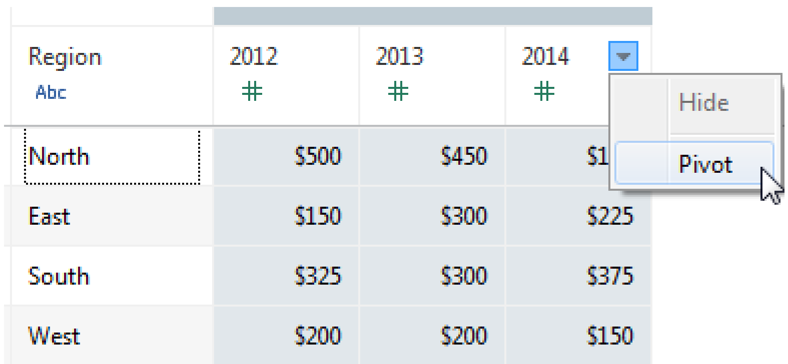
Although you see a breakdown of sales by year, suppose you want to show all sales values by year, irrespective of the region. To do this with the example data source, use pivot to automatically change the format of the existing fields so that all year values are contained in one field and all sales values are contained in another.

The following image shows the example data source in the grid after using pivot (left) and a view that you can create with the pivot fields (right).



To pivot fields

1. On the Data Source page, in the grid, select two or more fields to pivot.
2. Click the drop-down arrow next to the field name, and then select **Pivot**.



The original fields in the data source are replaced with new fields called "Pivot field names" and "Pivot field values." You can always rename the new pivot fields. If you decide that using pivot does not help, you can undo the changes or remove the pivot. Alternatively, you can change the data type of the pivot field to adjust how the data is interpreted.

To add more fields to a pivot

1. On the Data Source page, in the grid, click the drop-down arrow next to the field name.
2. Select **Add Data to Pivot**.

To remove a pivot

1. On the Data Source page, in the grid, click the drop-down arrow next to the field name.
2. Select **Remove Pivot**. All new pivot fields are removed and the original fields are restored.

At a glance: Working with pivots

- Pivot option is available from the grid and metadata grid.
- Only one pivot is allowed per data source in the workbook.
- Pivot fields can be used as the join key.
- Pivot option cannot be used in calculated fields.

Troubleshooting pivots

- **Red fields in the view and fields with exclamation points in the Data pane**: Because the original fields are replaced with new pivot fields, any references to the original fields in the view will no longer work and cause fields to become red in the view or show a red exclamation point next to the field in the Data pane.
- **Null values in the grid:** If all of the original fields used in the pivot are removed, for example in an extract refresh, null values display in the pivot fields.

Edit Data Sources

At anytime during your analysis you can edit the data source used in the workbook. You might want to edit the data source to:

- **Specify a new location for the data source.** For example, suppose the name or location of a data source you were using has changed and is no longer available using the previous connection information. In this case, you can direct the workbook to the correct location without losing your work.
- **Apply analyses created using one data source to another data source**. Suppose you create a workbook containing several views involving markets, products, sales, and profits and you want to apply the analyses to a new data source. Instead of recreating each view, you can edit the original data connection and specify a new data source.
- **Add and remove tables.**
- **Create custom SQL queries for supported data sources.**
- **Use stored procedures for supported data sources.**

To edit the data source

1. On the **Data** menu, select a data source, and then select **Edit Data Source**.
2. On the data source page, make the changes to the data source.

   For example, if you are using a **Microsoft Excel** data source, you can specify a new file by clicking the Excel file name under **Workbook**. Alternatively, you can select a different table to analyze.

Replace Field References

When you successfully connect to a new data source, all worksheets in the workbook that previously referred to the original data source now refer to the new data source. If the new data source does not have the same field names as the original workbook, the fields become invalid and are marked with an exclamation point . You can quickly resolve the problem by replacing the field's references.

For example, say you have a workbook connected to a data source that contains a Product Category field. Then you edit the data source to point to a new data source that has all the same data but instead of Product Category, the field name has been changed to Product Type. The Product Category field remains in the Data pane but is marked as invalid. To make the field valid, you can replace the references, which means you can map the invalid field to a valid field in the new data source (for example, Product Category corresponds to Product Type).

To replace field references

1. Right-click (control-click on a Mac) the invalid field in the Data pane and then select **Replace References**.
2. In the Replace References dialog box, select a field from the new data source that corresponds to the invalid field.

Duplicate the Data Source

Sometimes you'll want to make changes to a data source such as add more tables, hide and show fields, set field defaults, and so on. When you make these changes it affects all sheets that use the data source. You can duplicate the data source so that you can make the changes without affecting the existing sheets.

To duplicate a data source

- On the **Data** menu, select a data source , and then select **Duplicate**.

When you duplicate a data source, the duplicate source name has "(copy)" appended to the end.

Rename the Data Source

When you connect to a data source, you are given the option to give it a name for use in Tableau Desktop.

To rename the data source

- On the **Data** menu, select **Rename**.

Naming a connection is useful when you have a single workbook connected to many data sources. The name you assign can help you keep track of the specifics of the connection. You can also review the connection properties by selecting a data source on the **Data** menu, and then selecting **Properties**.

Replace Data Sources

There are times when you may want to update a workbook or sheet to use a different data source. Rather than rebuild your workbook using the new connection, you can replace the data source.

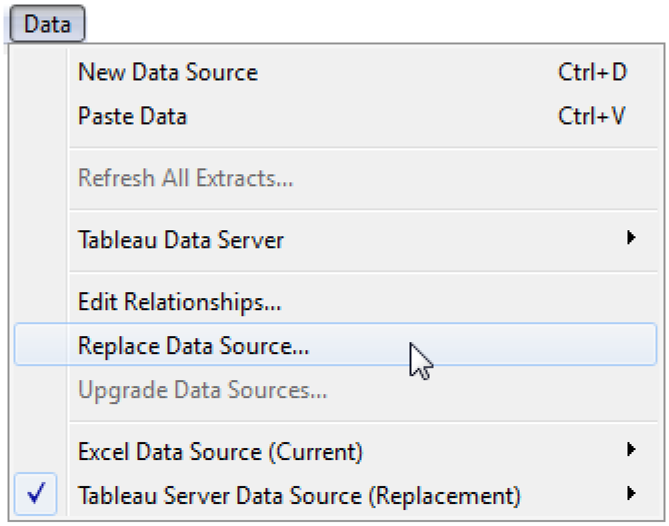
You can only replace one data source with another when both data sources are relational data sources, or when both data sources are cube (multidimensional) data sources. In Tableau, cube data sources are supported only in Windows.

The two data sources do not have to be identical, however, any differences will affect the sheets in the workbook. Any fields, groups, sets, and calculated fields that don't exist in the new data source (or have a different name) are removed from the Data pane. If these fields were used by any sheets in the workbook, they will remain in the Data pane but will be marked invalid. Additionally, you may see changes to custom sets, groups, and calculated fields that depend on the missing fields. For information about how to replace field references to correct invalid fields, see **Edit Data Sources** on page 414.

Replacing a data source does not merge or edit the data sources. Rather, replacing a data source simply redirects fields in the worksheet to map to corresponding fields in the new data source. To successfully replace a data source, any fields in the original data source (for example, calculated, groups, sets, and parameters), should also exist in the new data source. If not, then you may want to manually copy and paste these fields to the new data source before replacing the old one.

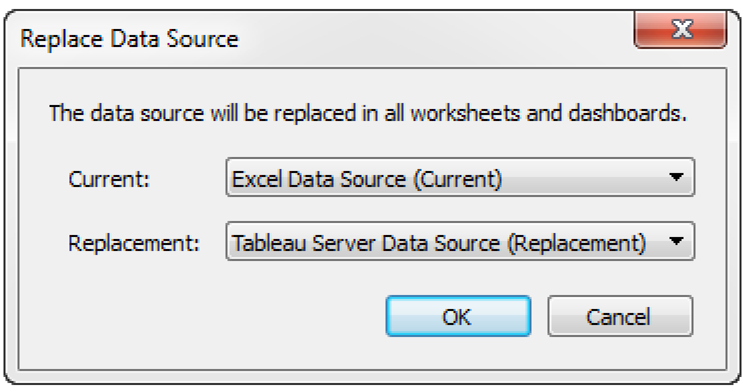
Follow the steps below to replace a data source:

1. Open a workbook that connects to the *old* data source.
2. Select **Data** > **New Data Source** and then connect to the *new* data source.
3. Select **Data** > **Replace Data Source**.



You will only be able to see the **Replace Data Source** command when you are on a worksheet tab—not when you are on the Data Source page. You will only be able to select it when there is at least one field in the view.

4. In the Replace Data Source dialog box, select the **Current** data source and the **Replacement** data source.



5. When finished, click **OK**.

All worksheets, dashboards, and stories that used the original data source are updated to use the new data source. Click **Undo** on the toolbar to revert the change and return to your original data source.

Export Data Sources

At any time while connected to a data source, you can export data source information as a shortcut that allows you to quickly connect to the data source in the future. You might want to do this if you often connect to the same data source multiple times or if you've added joined tables, default properties, or custom fields, such as groups, sets, calculated fields, and binned fields, to the Data pane.

Note: You can also save custom fields by saving the workbook or by creating a bookmark file.

You can export the data source in one of the following two formats:

Data Source (.tds) - contains just the information you need to connect to the data sources such as data source type, location, and custom fields. If you connect to local file data sources (Excel, Access, text, extracts), the file path is stored in the data source file.

Data source files contain the following types of information:

- data source type
- data source connection information specified in the data source page (for example, server, port, location of local files, and tables)
- groups
- sets
- calculated fields
- bins
- default field properties (for example, number formats, aggregation, and sort order)

Packaged Data Source (.tdsx) - contains all the information in the Data Source (.tds) file as well as any local file data sources (Excel, Access, text, and extracts). This file type is a single zipped file and is good for sharing a data source with people who may not have access to the original data that is stored locally on your computer.

After you export, the data sources are available on the **Connect** pane.

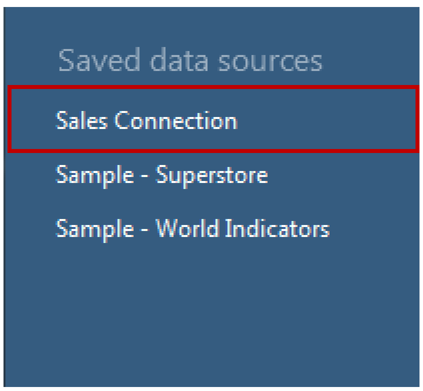
By default, the data source files are stored in the Datasources folder of the Tableau Repository. Data source files stored in another location do not display on the **Connect** pane. You can connect to data source files by selecting **File** > **Open** and navigating to the file. You can also connect by dragging the data source file onto Tableau Desktop icon or onto the running application.

Note: If you move a local file data source that is referenced by a .tds file, you will be prompted to locate or replace the original data source when you try to open the data source file. To avoid saving a specific file path, save the data source as a TDSX file, which packages a copy of the original local file data source with the .tds file. If you choose to replace the original data source, the replacement data source must be of the same type (for example, Excel or MySQL) as the original.

To export a data source

1. On the **Data** menu, select a data source, and then select **Add to Saved Data Sources**.
2. Complete the **Add to Saved Data Sources** dialog box by specifying a file name and selecting the type of data source file.

The new .tds or .tdsx file is listed in the Saved data sources section of the **Connect** pane.



Refresh Data Sources

If the underlying data changes—for example, if new fields or rows are added, data values or field names are changed, or data is deleted, Tableau will reflect those changes the next time you connect to the data source. However, because Tableau Desktop queries the data and does not import the data, you can immediately update Tableau to reflect the data modifications without disconnecting, provided the changes have been saved in the underlying data first.

If you are connected to a data source that has been modified, you can immediately update Tableau Desktop with the changes by selecting a data source on the **Data** menu and then selecting **Refresh**.

If a field that is used in a Tableau worksheet is removed from the underlying data of the data source and then the data source is refreshed, a warning message displays indicating that the field will be removed from the view and the worksheet will not display correctly because of the missing field.

Upgrade Data Sources

If you have workbooks that were created before Tableau Desktop 8.2 and that use Microsoft Excel or text file data sources, or you are using the Excel or text file legacy connection, you might have the option to upgrade the data sources in your workbook. By upgrading your Excel and text file data sources you can take advantage of better data interpretation and compatibility on the Mac.

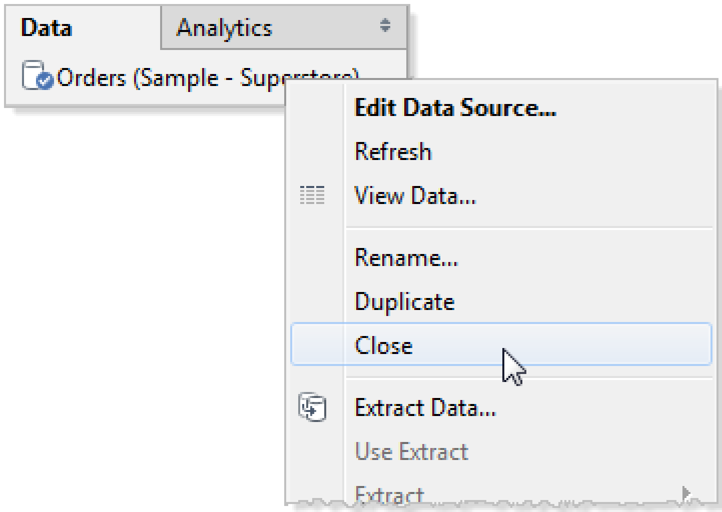
After upgrading these data sources, there may be changes to your workbook. For example, you may notice some fields have turned red, field names have changed, field types have changed, or the data values have changed. Resolve these changes before saving the workbook. Once the workbook is saved, the changes cannot be undone. If you encounter any of these types of changes, see Resolving Data Source Upgrade Issues in the Tableau Knowledge Base for specific examples of these changes and how to resolve them.

In some cases, the data source cannot be upgraded and you see a message indicating which data sources could not be upgraded. In these cases, do not save the workbook. See Resolving Data Source Upgrade Issues in the Tableau Knowledge Base to review alternative options that will allow you to continue using the workbook even when the Excel and text file data sources cannot be upgraded. Alternatively, close and reopen the workbook without upgrading the data sources.

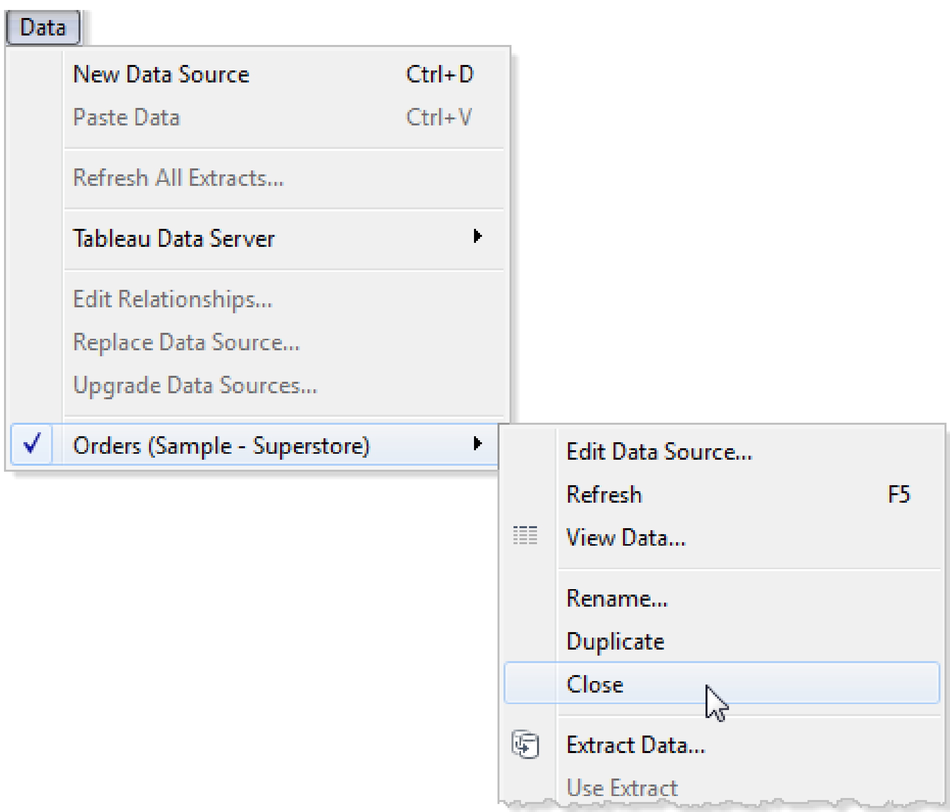
Close Data Sources

You can close a data source at any time. Doing so does not modify the data source. Instead, it disconnects Tableau from the data so that you can no longer query it. Additionally, the data source is cleared from the Data pane and all open worksheets associated with the data source are cleared. If you accidentally close a data source, use the Undo button to reopen. Close a data source by doing one of the following:

- Right-click (control-click on a Mac) the data source at the top of the Data pane and select **Close**.



- Select a data source on the **Data** menu and then select **Close**.



Building Data Views

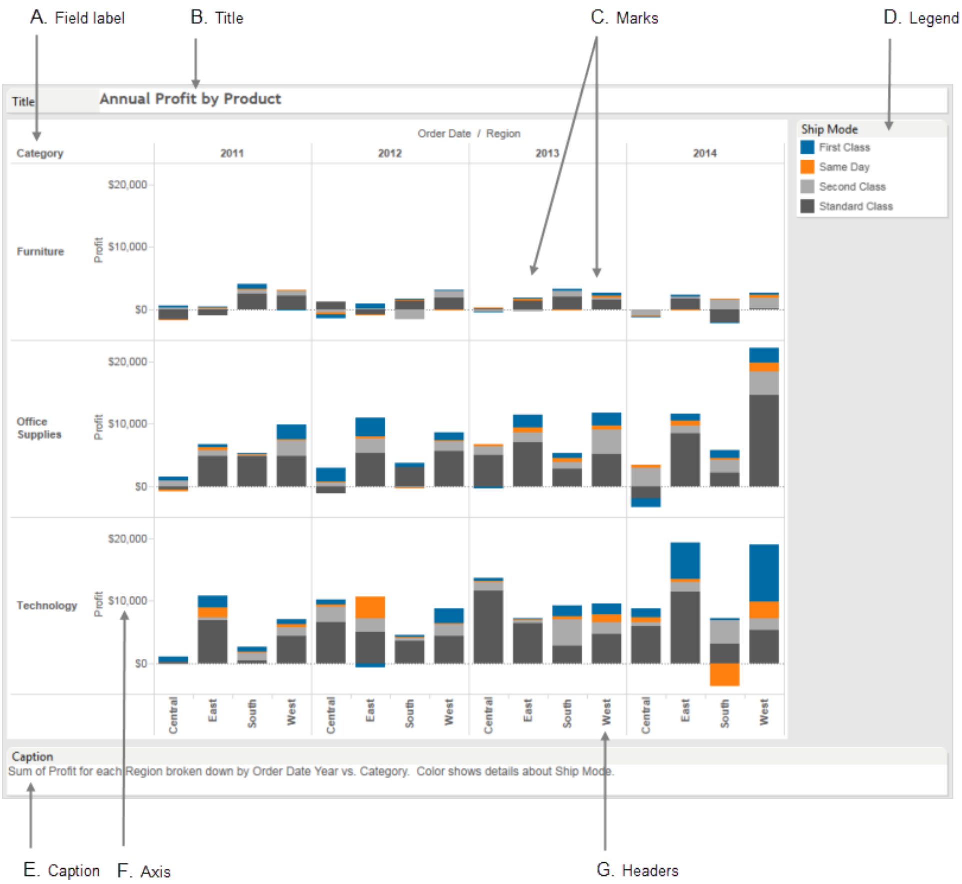
This section discusses the basics of using Tableau to build views of your data. You will learn how to build views manually or automatically. The section concludes with a set of build-it-yourself exercises that show how you can create basic views and then enhance them to add more information and generate insight.

Parts of the View

This section describes the basic components of the views you can create in Tableau. The parts of a view can be categorized as either table components, which are part of every view, or optional components, which can be turned on or off.

Table Components

Data views are displayed in a table on every worksheet. A table is a collection of rows and columns, and consists of the following components: Headers, Axes, Panes, Cells, and Marks. In addition to these, you can optionally show Titles, Captions, Field Labels, and Legends.



A. Field label

B. Title

C. Marks

D. Legend

E. Caption

F. Axis

G. Headers

Headers

Headers are created when you place a dimension or discrete field on the **Rows** shelf or the **Columns** shelves. The headers show the member names of each field on the shelves. For example, in the view below the column headers show the members of the **Order Date** field and the row headers show the members of the **Sub-Category** field.

Columns: YEAR(Order Date)

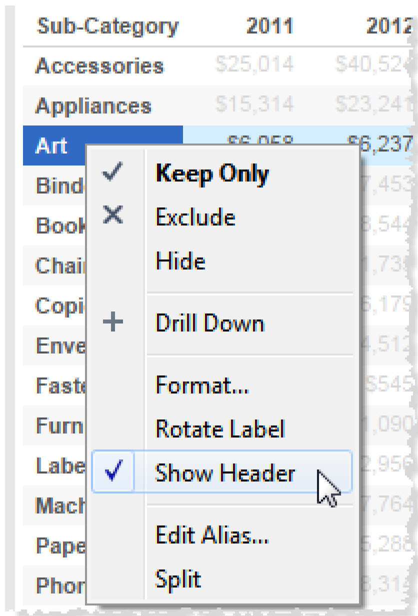
Rows: Sub-Category

Sub-Category	Order Date 2011	2012	2013	2014
Accessories	$25,014	$40,524	$41,896	$59,946
Appliances	$15,314	$23,241	$26,050	$42,927
Art	$6,058	$6,237	$5,910	$8,914
Binders	$43,488	$37,453	$49,485	$72,986
Bookcases	$20,037	$38,544	$26,275	$30,024
Chairs	$77,242	$71,735	$83,919	$95,554
Copiers	$10,850	$26,179	$49,599	$62,899
Envelopes	$3,856	$4,512	$4,730	$3,379
Fasteners	$661	$545	$960	$858
Furnishings	$13,826	$21,090	$27,874	$28,915
Labels	$2,841	$2,956	$2,827	$3,861
Machines	$62,023	$27,764	$55,907	$43,545
Paper	$14,835	$15,288	$20,638	$27,718
Phones	$77,391	$68,314	$78,660	$105,643
Storage	$50,329	$45,048	$58,632	$69,834
Supplies	$14,394	$1,952	$14,278	$16,049
Tables	$46,088	$39,150	$60,833	$60,894

You can show and hide row and column headers at anytime.

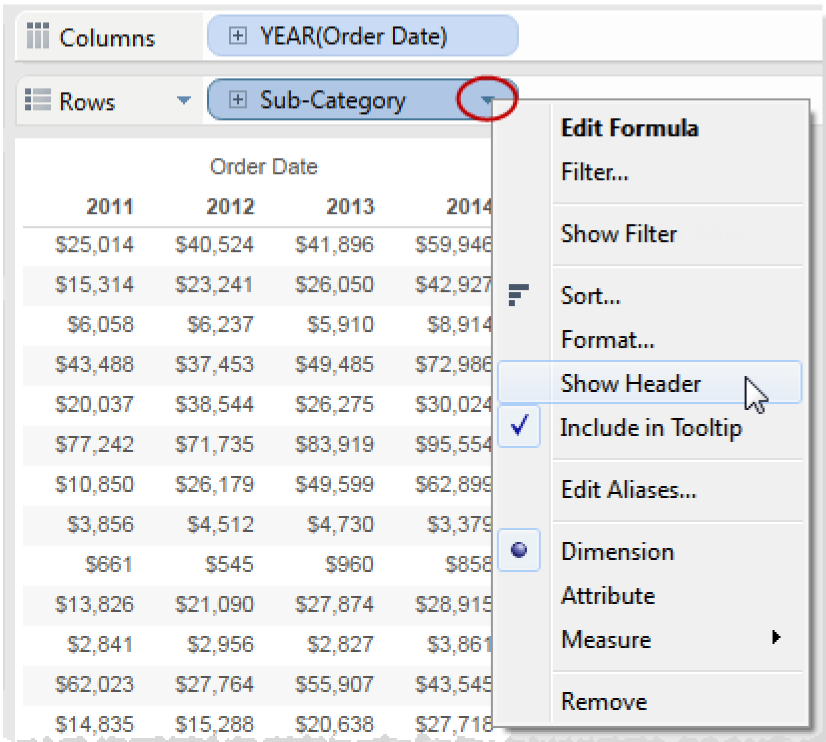
To hide headers:

- Right-click (control-click on Mac) the headers in the view and select **Show Header**.

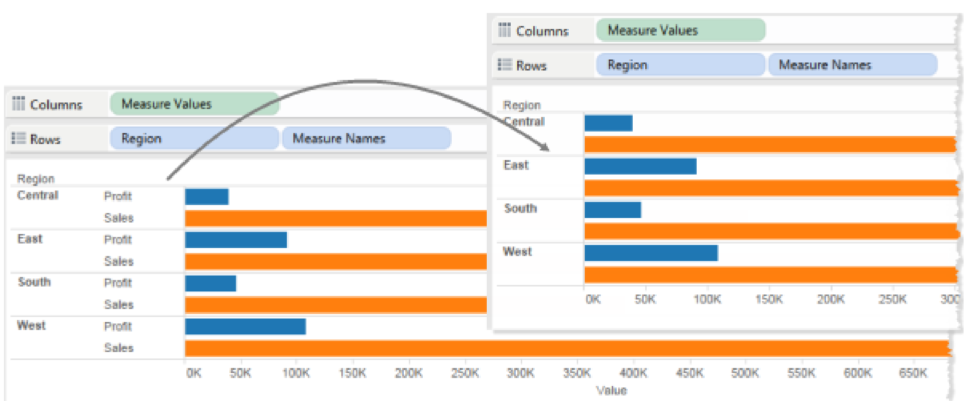


To show headers:

- Select the field in the view whose headers you want to show and select **Show Header** on the field menu.

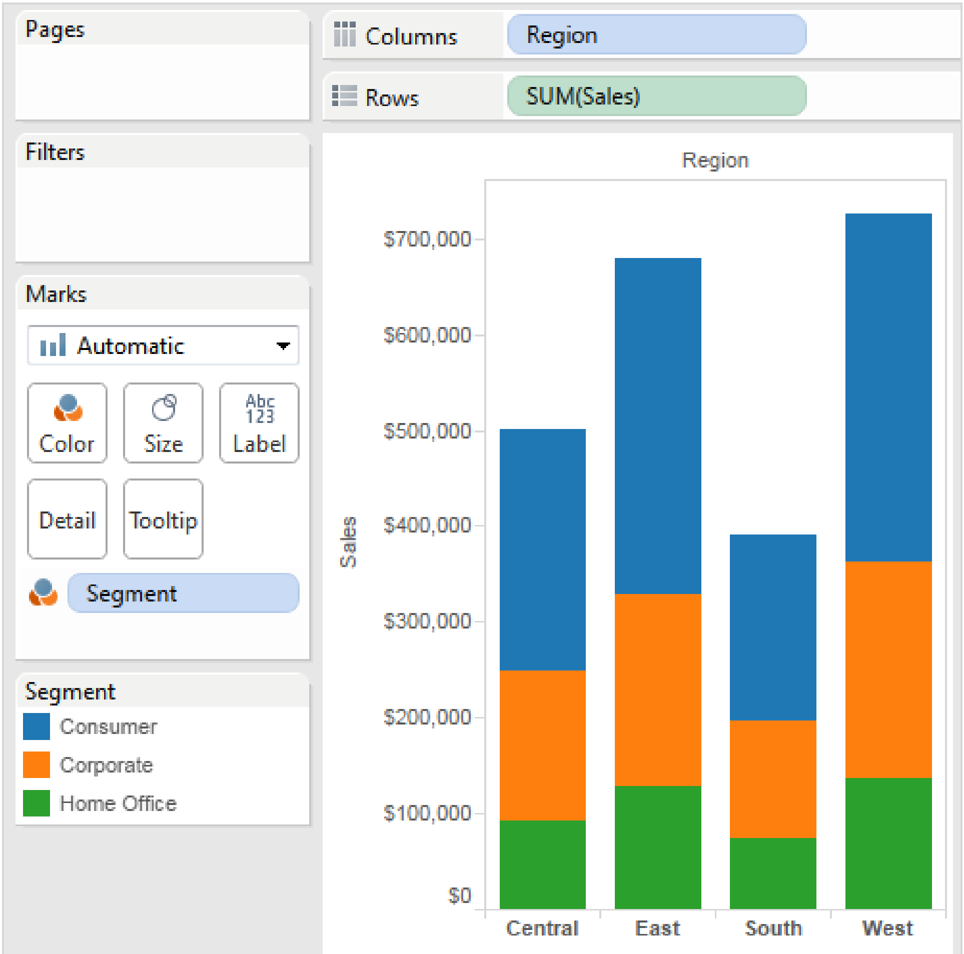


Hiding headers can be useful when you are working with multiple measures. For example, the view below shows both the sales and profit for each region along a single axis. You can see the view looks cluttered with the Measure Names headers showing. Because Measure Names is also indicated by the mark color, you can hide the excess headers to clean up the view.



Axes

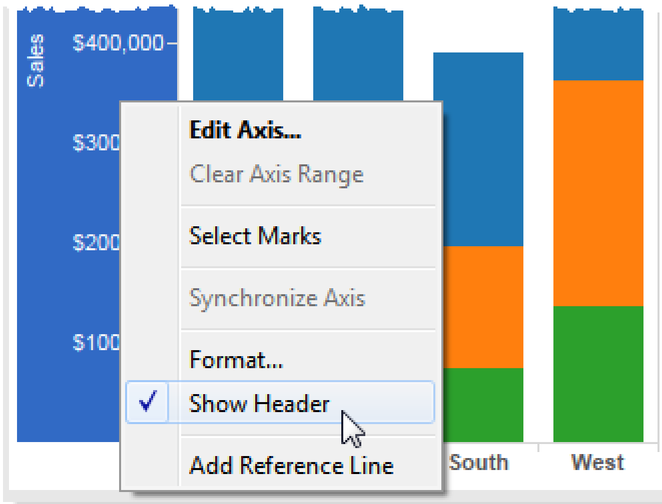
Axes are created when you place a measure or continuous field on the **Rows** or **Columns** shelves. By default, the values of the measure field are displayed along a continuous axis.



You can show and hide axes at anytime.

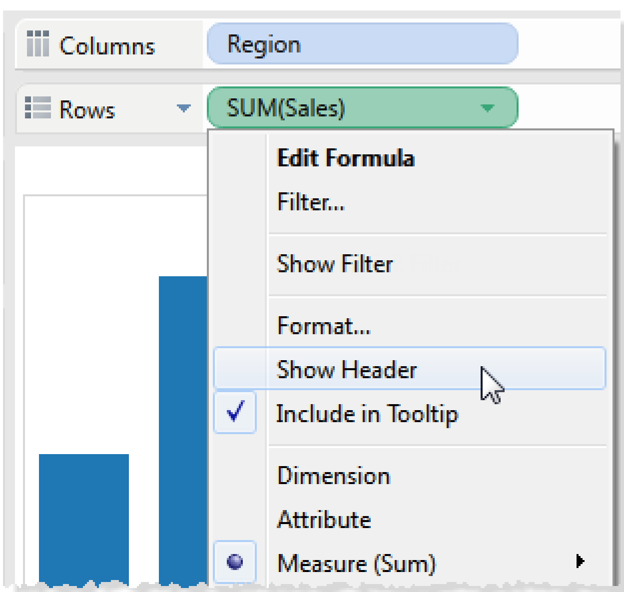
To hide axes:

- Right-click (control-click on Mac) the axis in the view and select **Show Header**.



To show axes:

- Right-click (control-click on Mac) the measure in the view whose axis you want to show and select **Show Header** on the field menu.



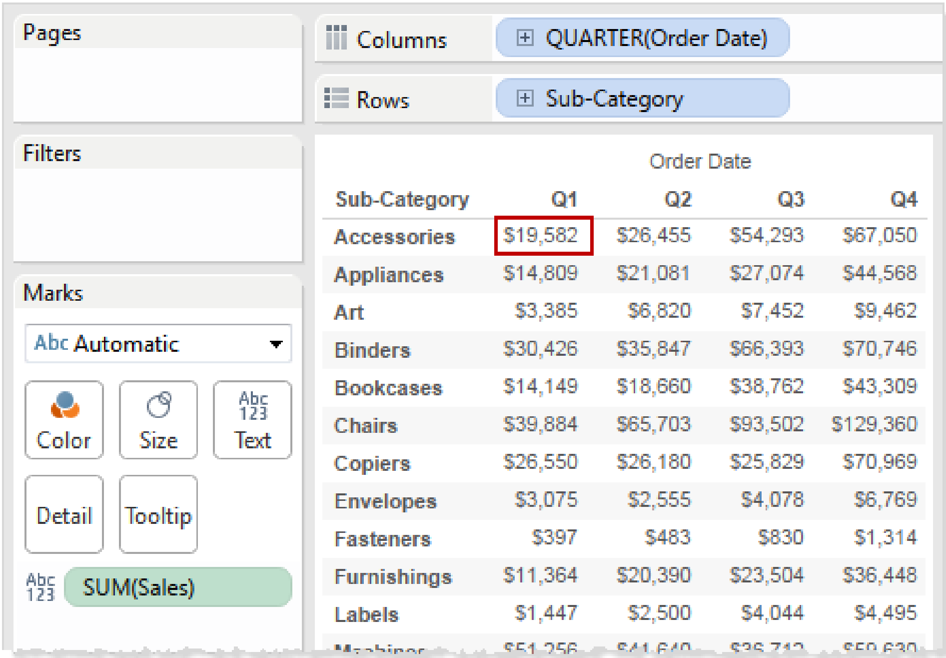
Panes

Panes are created by the intersection of rows and columns in a table. An example of a pane is highlighted in the view below.

> **Note:** Tableau can display up to 1 million panes. If your view contains more than 1 million panes, you will need to filter your data so there are fewer panes in the view. For more information on filtering, see **Filtering** on page 608.

Cells

Cells are the basic components of any table you can create in Tableau. For a text table, the cell is the intersection of a row and a column, and is where the text is displayed. For example, one of the 68 cells is highlighted in the view below.

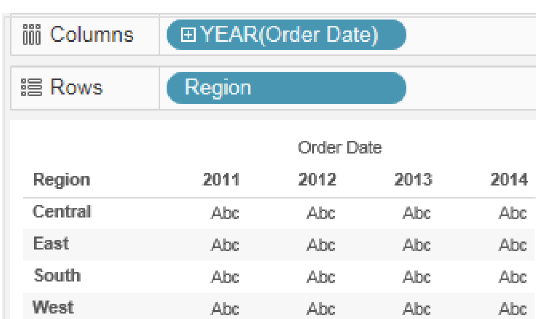


Sub-Category	Q1	Q2	Q3	Q4
Accessories	$19,582	$26,455	$54,293	$67,050
Appliances	$14,809	$21,081	$27,074	$44,568
Art	$3,385	$6,820	$7,452	$9,462
Binders	$30,426	$35,847	$66,393	$70,746
Bookcases	$14,149	$18,660	$38,762	$43,309
Chairs	$39,884	$65,703	$93,502	$129,360
Copiers	$26,550	$26,180	$25,829	$70,969
Envelopes	$3,075	$2,555	$4,078	$6,769
Fasteners	$397	$483	$830	$1,314
Furnishings	$11,364	$20,390	$23,504	$36,448
Labels	$1,447	$2,500	$4,044	$4,495

For other view types such as bar charts and scatter plots, identifying the cell is not always possible or useful.

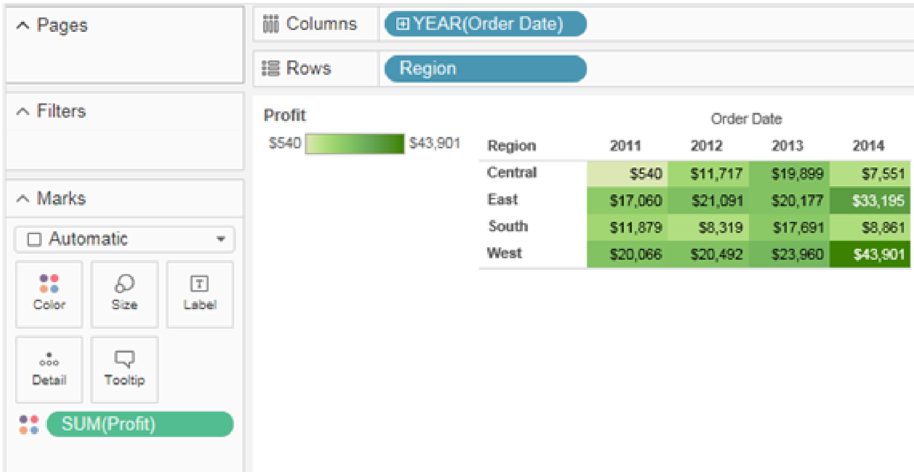
Marks

When you drag fields to the view, the data are displayed using marks. Each mark represents the intersection of all of the dimensions in the view. For example, in a view with **Region** and **Year** dimensions, there is a mark for every combination of those two dimensions (East 2011, East 2012, West 2011, West 2012, etc.).



Region	2011	2012	2013	2014
Central	Abc	Abc	Abc	Abc
East	Abc	Abc	Abc	Abc
South	Abc	Abc	Abc	Abc
West	Abc	Abc	Abc	Abc

Marks can be displayed in many different ways including lines, shapes, bars, maps, and so on. You can show additional information about the data using mark properties such as color, size, shape, labels, etc. The type of mark you use and the mark properties are controlled by the Marks card. Drag fields to the Marks card to show more data. For example, the same view above is shown again below but this time with **Profit** on Color. With this additional information, it is clear that the West region had the highest profit in 2014.

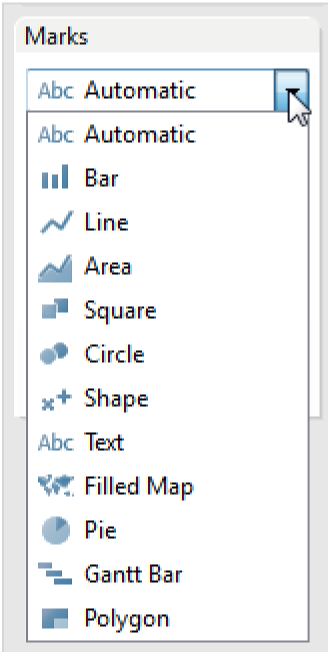


Control the marks in the view using the Marks card. Use the drop-down menu to specify the type of mark to show. Drag fields to the Marks card and use the drop-down controls to add more information to the view and control the color, shape, size, labels, and number of marks in the view.

For information about how to move marks in a view, see **Move Marks** on page 484.

Mark Types

Mark types are available from the Marks card drop-down menu at the top of the Marks card. After selecting a mark type, you can further modify the marks by adding fields to Color, Size, Shape, and so on. The available mark properties are dependent on the type of mark you select.

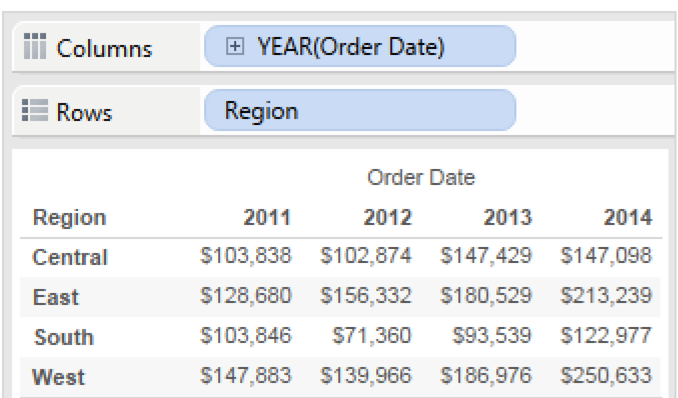


Automatic Mark

When the Marks card drop-down menu is set to **Automatic**, Tableau automatically selects the best mark type for your data view. The mark type that is automatically selected is determined by the inner fields on the **Rows** and **Columns** shelves. The icon in the Marks card drop-down menu indicates which type of mark was automatically selected. The mark types below are automatically selected for the following scenarios.

Text

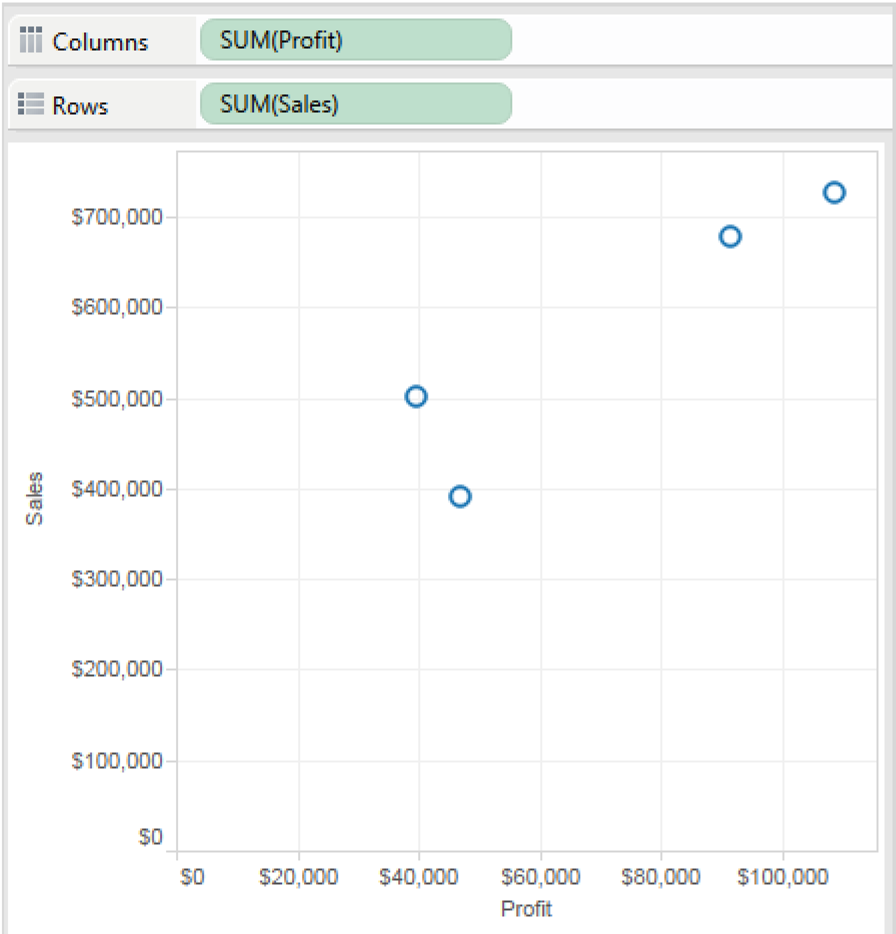
The Text mark type is automatically selected when there are dimensions as inner fields on both the **Rows** and **Columns** shelves.



Region	2011	2012	2013	2014
Central	$103,838	$102,874	$147,429	$147,098
East	$128,680	$156,332	$180,529	$213,239
South	$103,846	$71,360	$93,539	$122,977
West	$147,883	$139,966	$186,976	$250,633

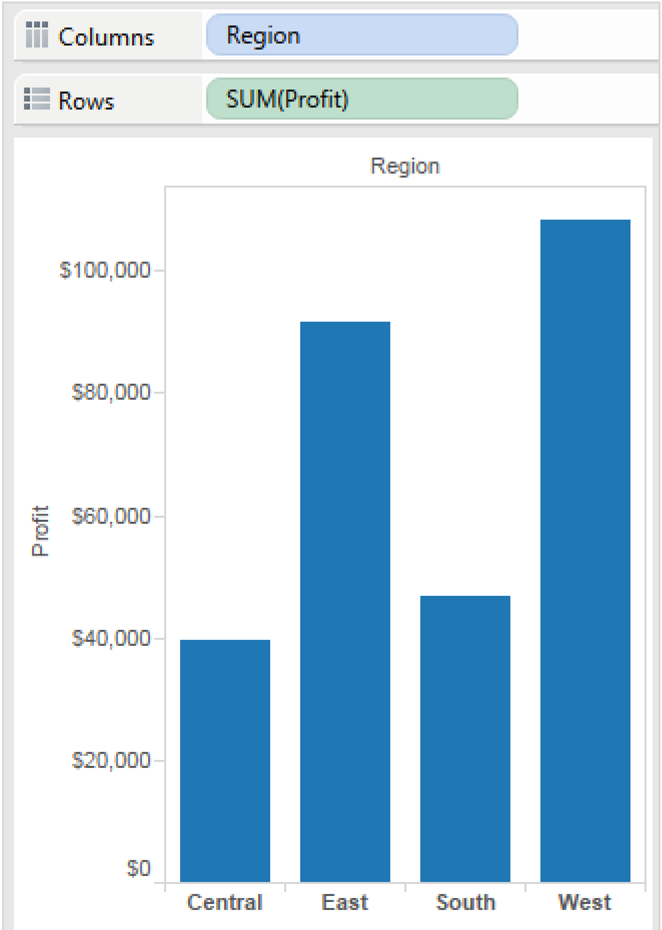
Shape

The Shape mark type is selected when there are measures as inner fields on both the **Rows** and **Columns** shelves.



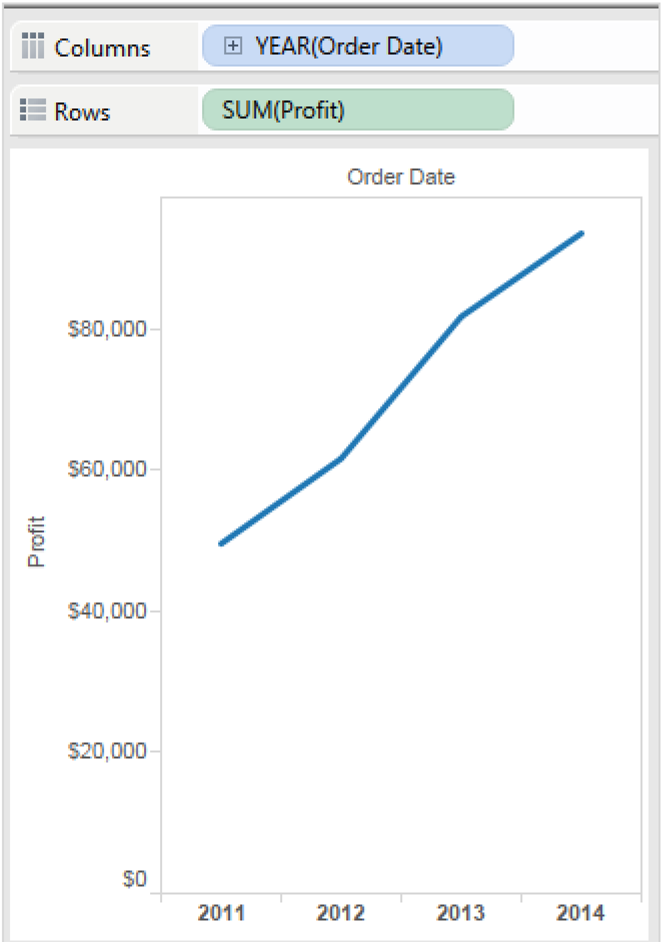
Bar

The Bar mark type is selected when there is a dimension and a measure as inner fields on **Rows** and **Columns** shelves.



Line

The Line mark type is selected when there is a date field and a measure as the inner fields on the **Rows** and **Columns** shelves.



Note: You can override the default selection and use any mark type that provides insight into your data. However, you should exercise some caution when manually selecting a mark type because the resulting view might hide important information about your data.

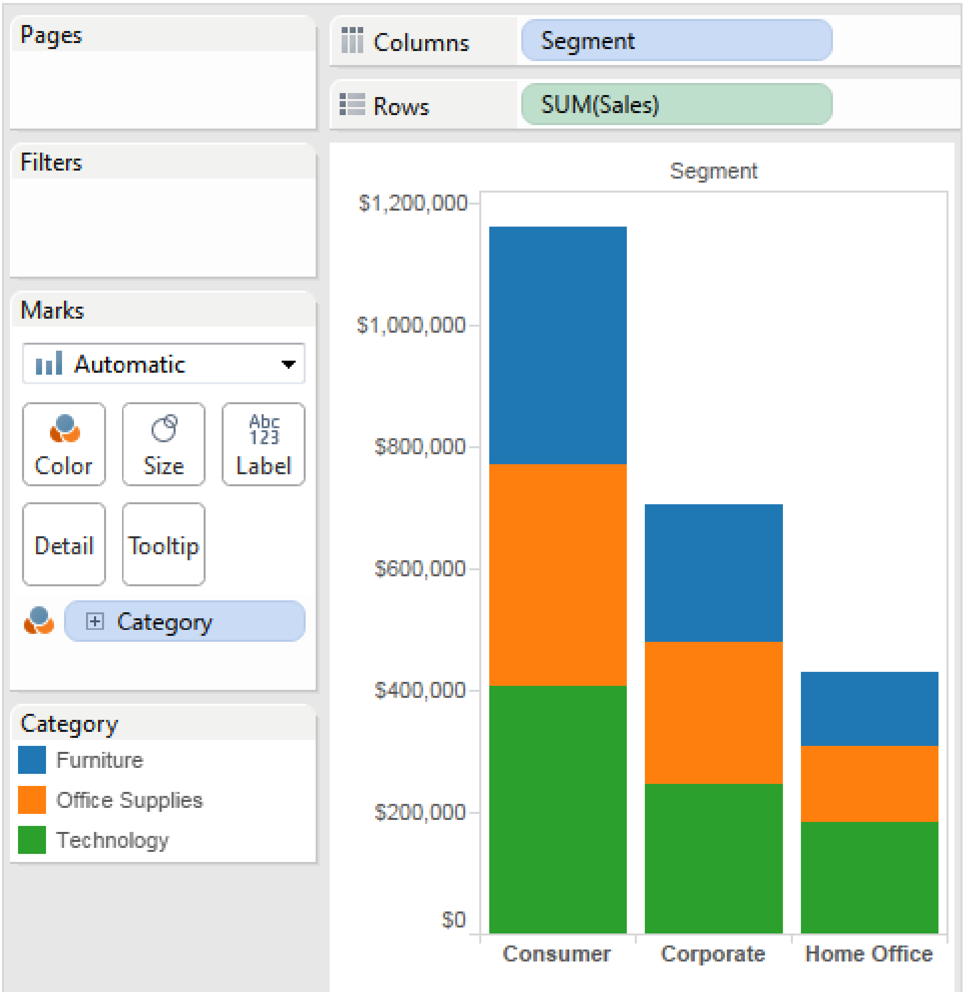
Bar Mark

The Bar mark type is useful when you want to compare measures across categories, or when you want to break data down into stacked bars. Tableau displays your data using bars when:

- The Marks card drop-down menu is set to **Automatic**, and you place a dimension and a measure as the inner fields on the **Rows** and **Columns** shelves. If the dimension is a date dimension, the Line mark is chosen instead.
- You select **Bar** from the Marks card drop-down menu.

Marks are automatically stacked.

The data view shown below displays a dimension as the columns of the table, and a measure as the rows of the table. It is also color-encoded by a dimension (**Category**). Because the Marks card drop-down menu is set to **Automatic**, data is displayed using bars.



To try some hands-on exercises for building bar charts, see **Build a Bar Chart** on page 539.

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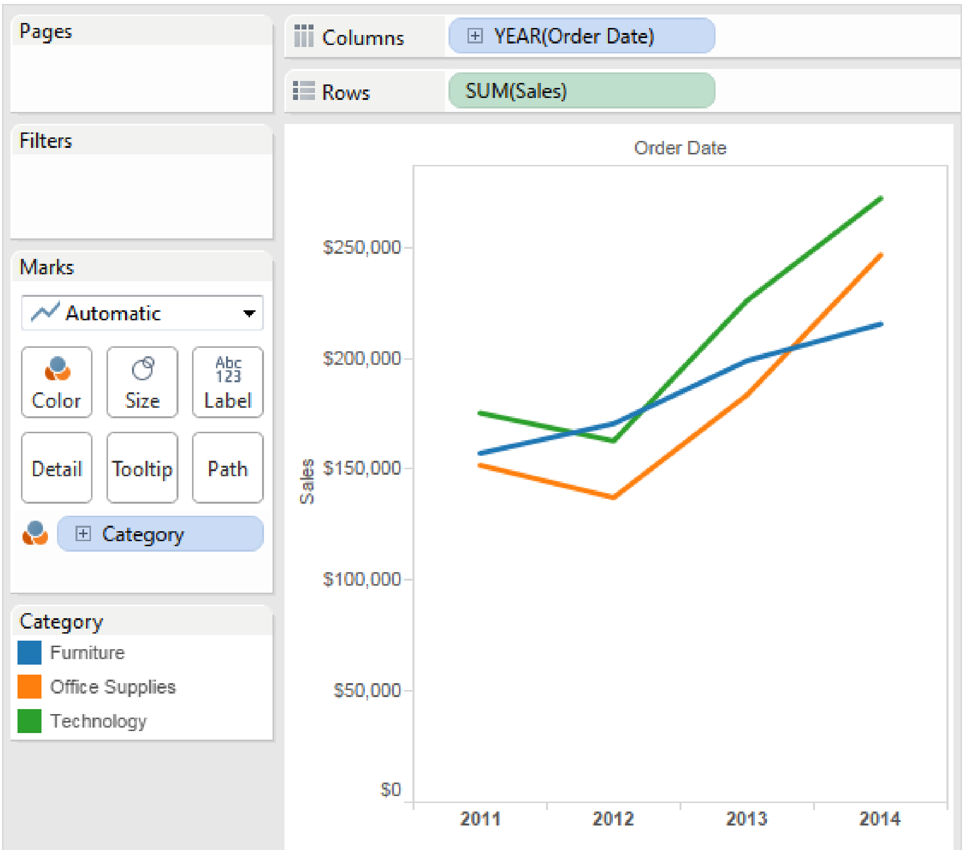
Line Mark

The line mark type is useful when you want to see trends in data over time, your data are ordered, or interpolation makes sense. Tableau displays data using lines when:

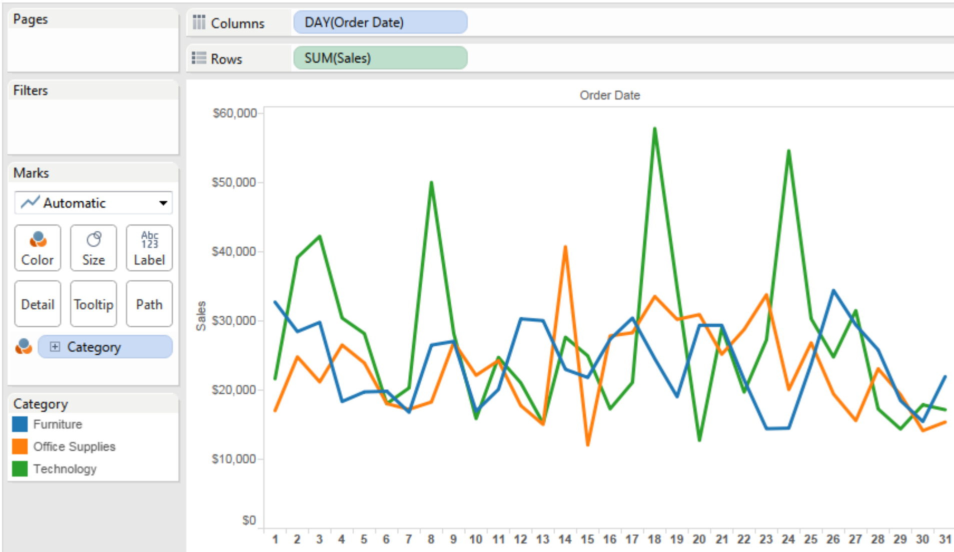
- The Marks card drop-down menu is set to **Automatic**, and you place one or more measures on either the **Columns** shelf or the **Rows** shelf, and then plot the measures against a date dimension or a continuous dimension.

- You select **Line** from the Marks card drop-down menu.

The data view shown below displays a date dimension as the columns of the table and a measure as the rows of the table.



As the density of data increases, trends are often easier to see when using lines. This view shows 93 data points.



To try some hands-on exercises for building line charts, see **Building Line Charts** on page 551.

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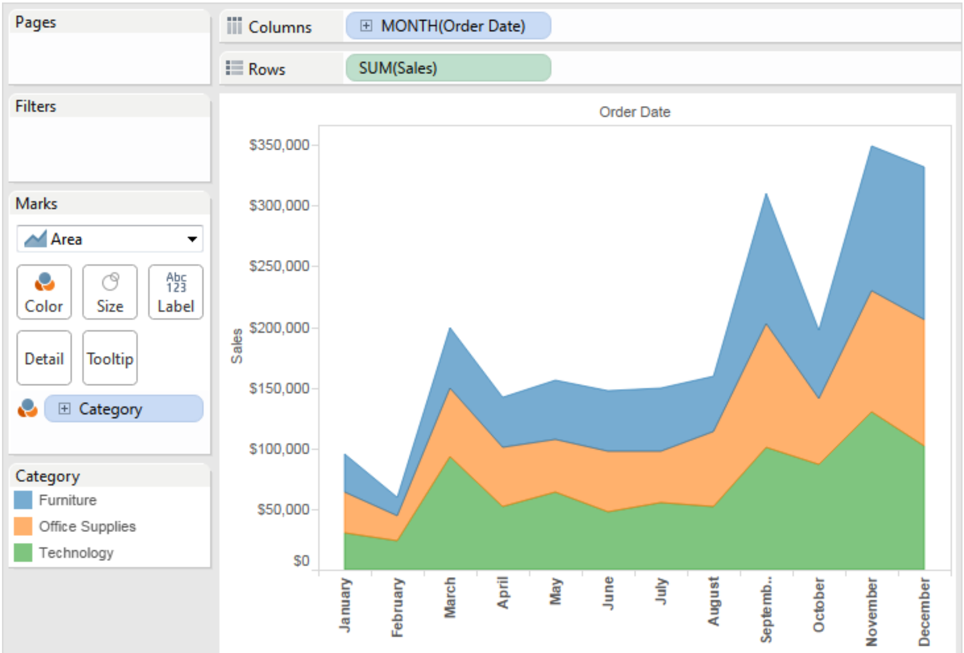
Area Mark

The Area mark type is useful when you have a view where the marks are stacked and do not overlap. For more information about stacked marks, see **Stack Marks** on page 485. In an area chart, the space between each line and the next line is filled with a color. This type of chart is not the best way to show specific values along the line but it can clearly show the total values so you can get an idea of how a dimension is contributing to an overall trend. Tableau displays your data using areas when:

- The Marks card drop-down menu is set to **Automatic** with one or more measures plotted against a date dimension or continuous dimension. The **Analysis** > **Stack Marks** option must also be selected.

The view below shows a date dimension on the **Columns** shelf and a measure on the **Rows** shelf. Each line represents the sales for a product category. The lines have been stacked so that they do not overlap.

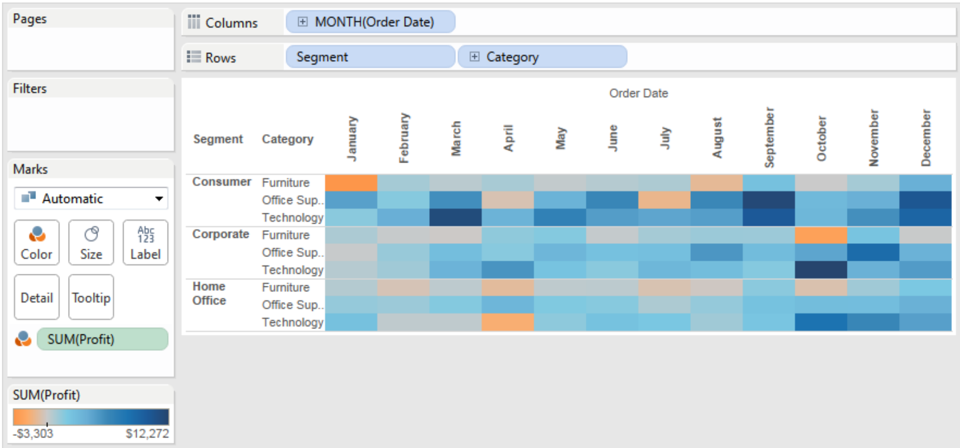


Note: You can add labels, edit the color legend, and highlight areas. In addition, you can turn on color effects, such as mark borders. For more information, see **Mark Properties** on page 451.

Square Mark

The square mark type is useful when you want to clearly see individual data points. When you select Square from the Marks card drop-down menu, Tableau displays your data using squares.

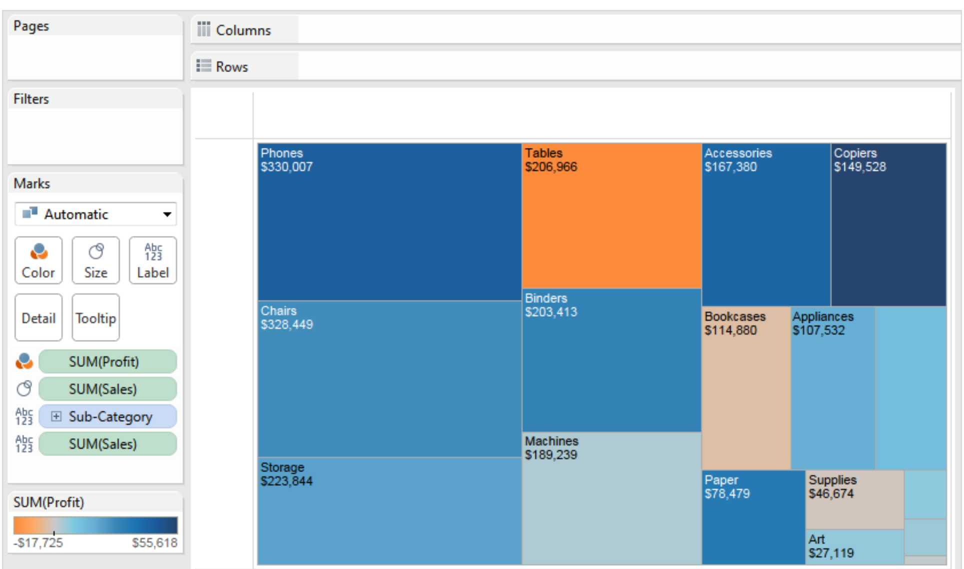
The data view shown below displays several dimensions on both the rows and columns shelves. If the Marks card drop-down menu was set to **Automatic**, the data would be displayed using text. By manually selecting **Square**, you create a completely different view. In particular, by placing a measure on **Color**, you can use square marks to create a heat map. To try some hands-on exercises for building heat maps, see **Build a Heat Map** on page 562.



> **Note:** To reproduce this view, you may need to select **Format** > **Cell Size** > **Square Cell**, and then adjust the size of the squares using the **Size** slider on the Marks card.

When you add additional levels of detail by placing a dimension on **Detail**, **Color**, **Shape**, **Size**, or **Text** on the Marks card, the squares are shown side-by-side and wrap to fill the cell. If the application window is too small to show all of the squares, an ellipses is shown to indicate that there are more values than can be shown.

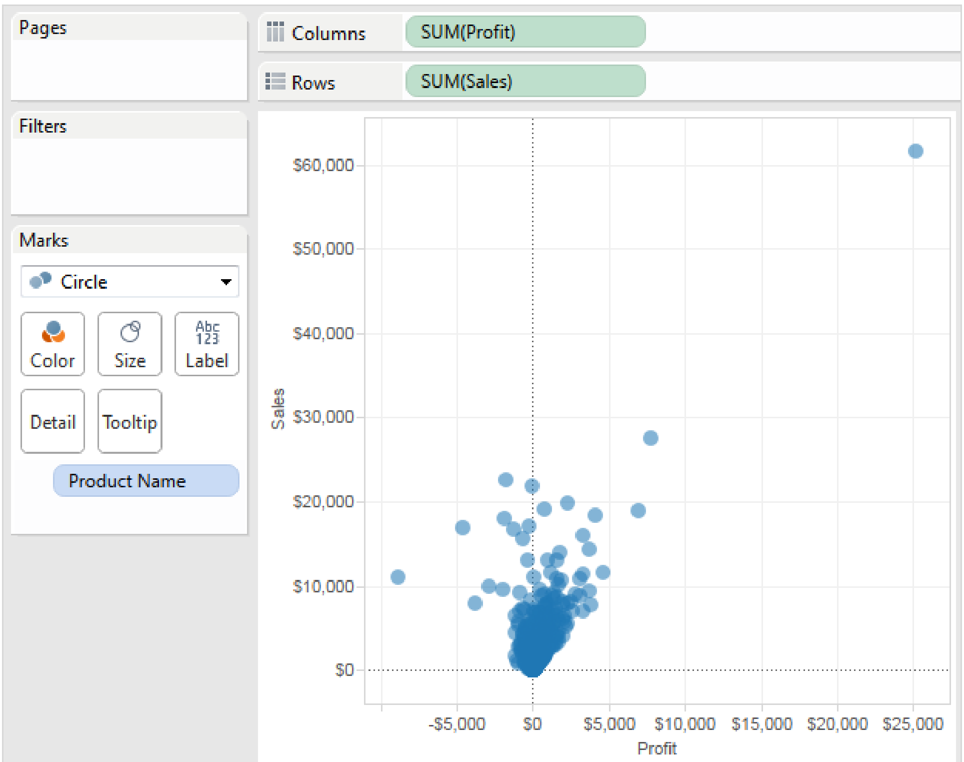
You can also use the square mark to create treemaps. A treemap displays hierarchical data as a set of nested rectangles. To try a hands-on exercise for building a treemap, see **Build a Treemap** on page 585.



Circle Mark

When you select **Circle** from the Marks card drop-down menu, Tableau displays your data using filled circles.

If the mark type was set to **Automatic**, Tableau would display the data using a shape (that is, an open circle).

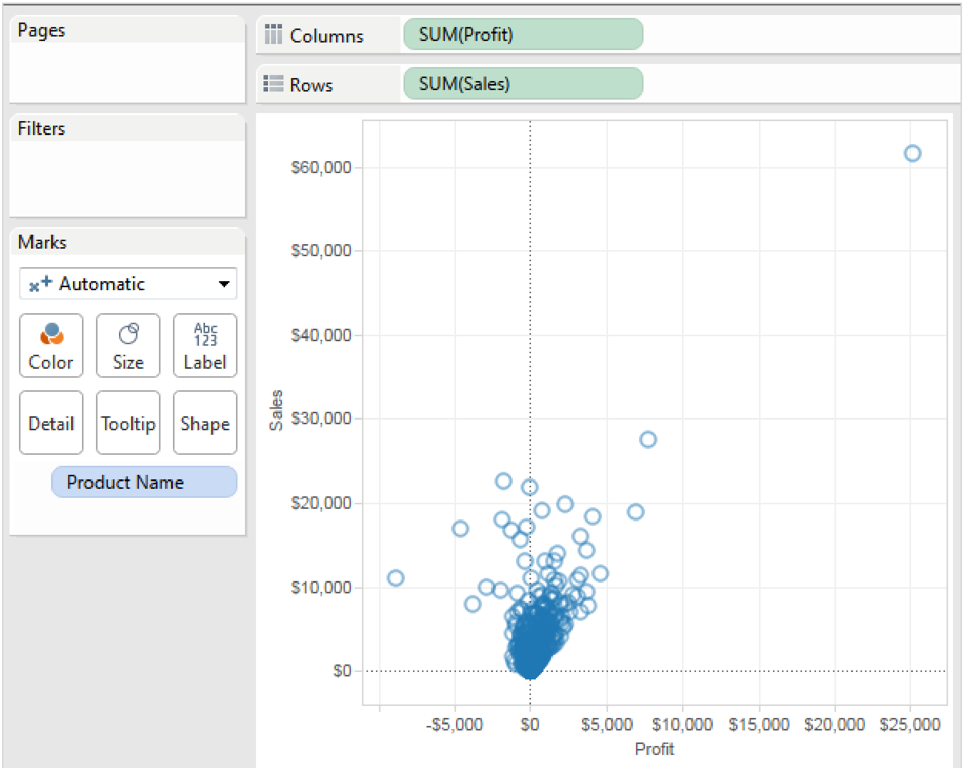


Shape Mark

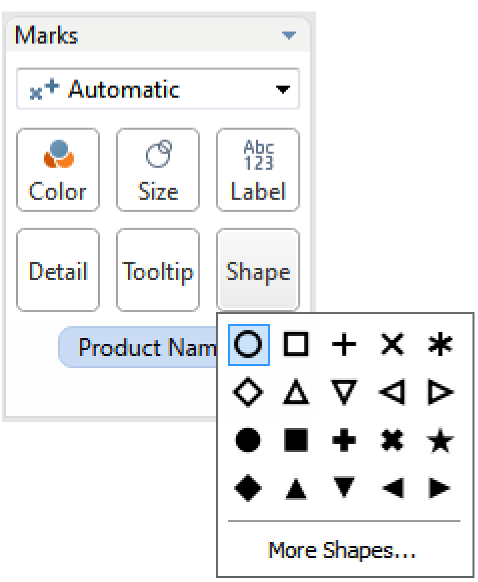
The shape mark type is useful when you want to clearly see individual data points while also viewing categories associated with those points. Tableau displays your data using a shape when:

- The Marks card drop-down menu is set to **Automatic**, and you place one or more measures on both the **Rows** and the **Columns** shelves.
- You select **Shape** from the Marks card drop-down menu.

The view shown below displays the data from two measures. Because the Marks card drop-down menu is set to **Automatic**, the data are displayed using a shape.

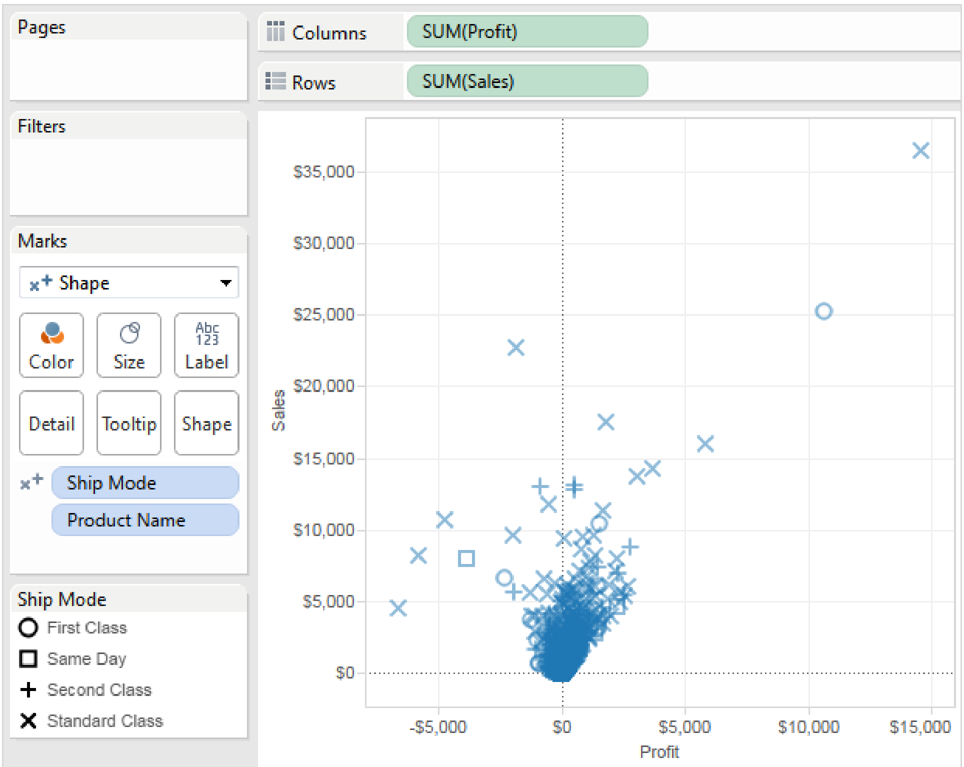


By default, the shape used is an open circle. To select a different shape, click **Shape** on the Marks card. Twenty unique shapes are available:



To add more data to the view, you can place a field on **Shape** on the Marks card. Tableau separates the marks according to the values in the field. If the field is a dimension, each member is assigned a unique shape. If the field is a measure, the measure is automatically binned into distinct buckets and each bucket is assigned a unique shape. The shape legend displays how shapes are distributed.

As shown below, the **Ship Mode** dimension is placed on **Shape** on the Marks card to encode each mark with information about how the order was shipped.

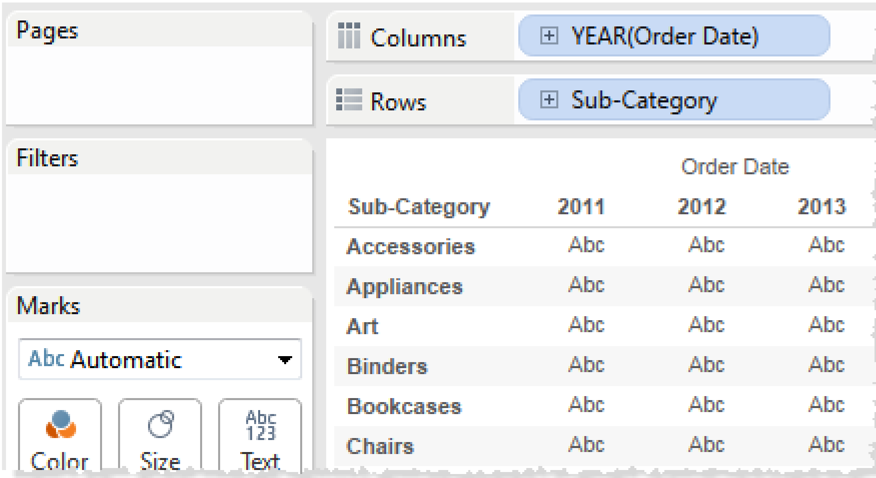


Text Mark

The Text mark type is useful when you want to display the numbers associated with one or more dimension members. This type of view is often called a text table, a cross-tab, or a pivot table. Tableau displays your data using text when:

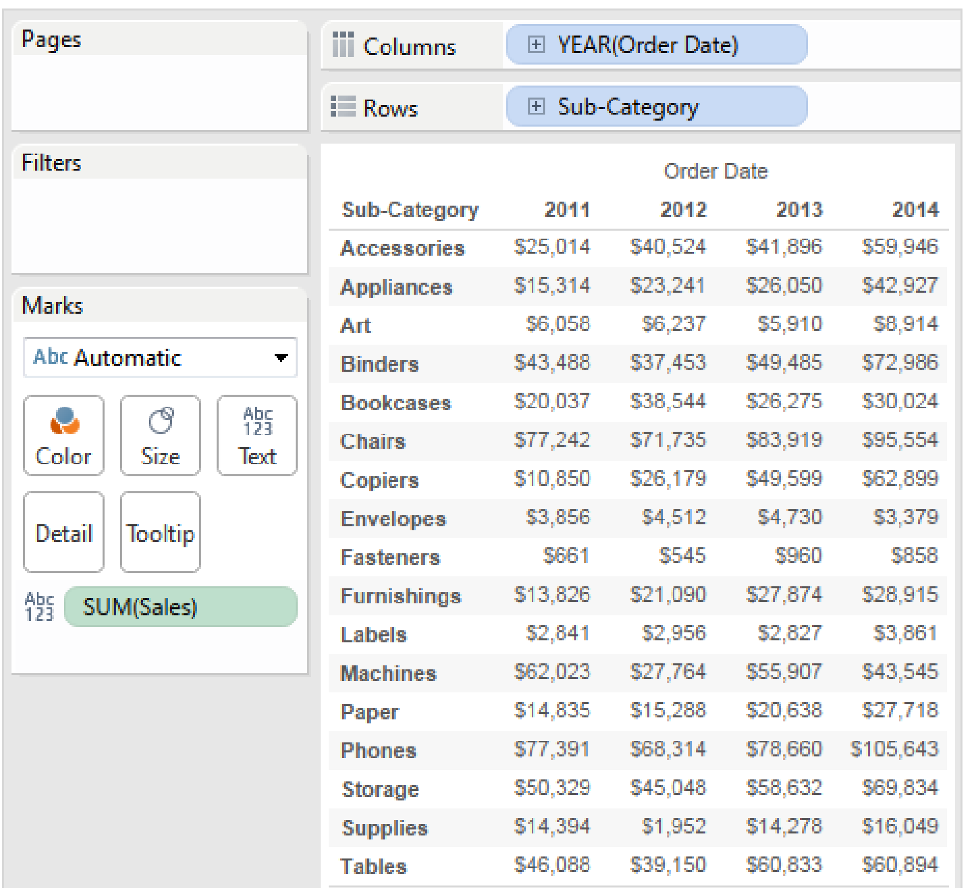
- The Marks card drop-down menu is set to **Automatic**, and you place one or more dimensions as the inner fields on both the **Rows** and the **Columns** shelves.
- You select **Text** from the Marks card drop-down menu.

Initially, the data are displayed using the Abc icon.



Sub-Category	2011	2012	2013
Accessories	Abc	Abc	Abc
Appliances	Abc	Abc	Abc
Art	Abc	Abc	Abc
Binders	Abc	Abc	Abc
Bookcases	Abc	Abc	Abc
Chairs	Abc	Abc	Abc

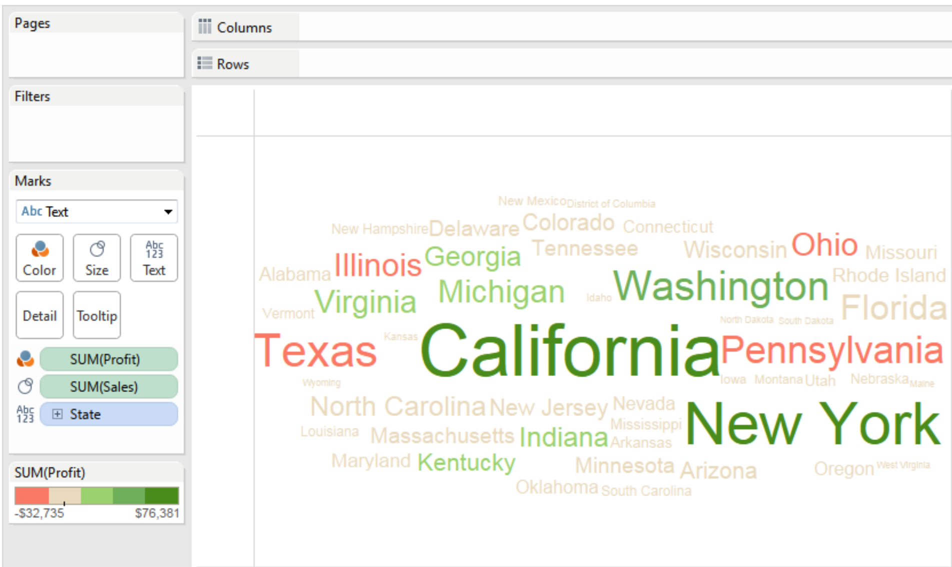
To complete the view, you must place a field (typically a measure) on **Text** on the Marks card. In the view below, the **Sales** measure, which is aggregated as a summation, is used to complete the table.



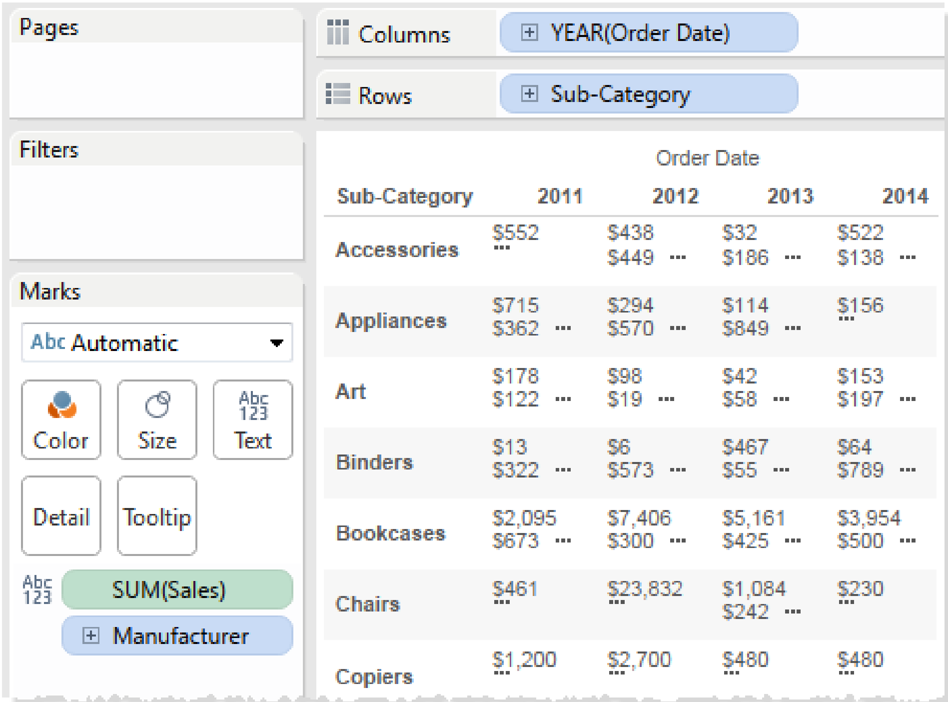
Sub-Category	2011	2012	2013	2014
Accessories	$25,014	$40,524	$41,896	$59,946
Appliances	$15,314	$23,241	$26,050	$42,927
Art	$6,058	$6,237	$5,910	$8,914
Binders	$43,488	$37,453	$49,485	$72,986
Bookcases	$20,037	$38,544	$26,275	$30,024
Chairs	$77,242	$71,735	$83,919	$95,554
Copiers	$10,850	$26,179	$49,599	$62,899
Envelopes	$3,856	$4,512	$4,730	$3,379
Fasteners	$661	$545	$960	$858
Furnishings	$13,826	$21,090	$27,874	$28,915
Labels	$2,841	$2,956	$2,827	$3,861
Machines	$62,023	$27,764	$55,907	$43,545
Paper	$14,835	$15,288	$20,638	$27,718
Phones	$77,391	$68,314	$78,660	$105,643
Storage	$50,329	$45,048	$58,632	$69,834
Supplies	$14,394	$1,952	$14,278	$16,049
Tables	$46,088	$39,150	$60,833	$60,894

Note: To create a cross-tab of any data view, select **Worksheet** > **Duplicate as Cross-tab**.

When you add additional levels of detail by placing a dimension on **Detail**, **Color**, **Shape**, **Size**, or **Text** on the Marks card, the values are shown side-by-side and wrap to fill the cell. Allowing the text to stack up makes it possible to create word cloud visualizations like the one shown below.



If the application window is too small to fill all of the text, the cell displays an ellipses to indicate that there are more values than can fit.



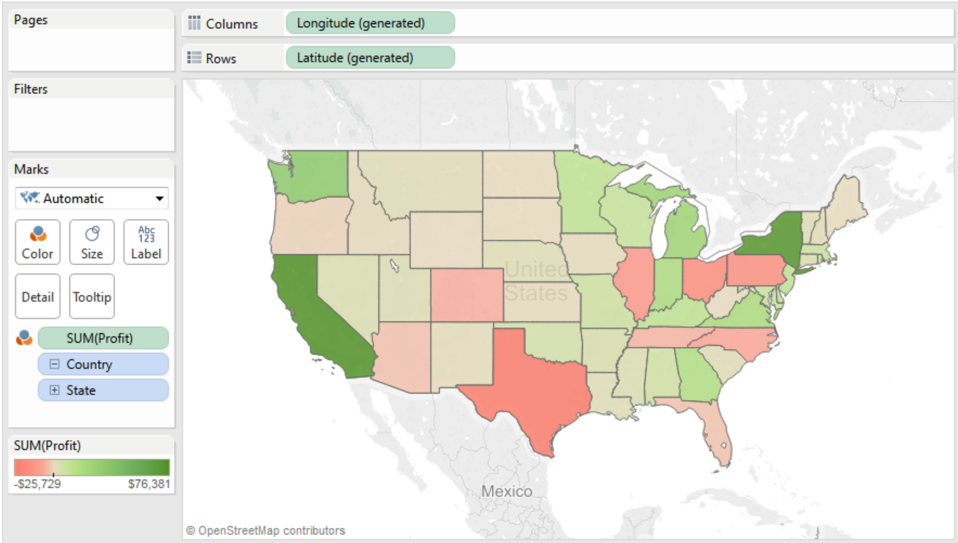
To try some hands-on exercises for building text tables, see **Build a Text Table** on page 544.

Filled Map Mark

The Filled Map mark type uses geocoding to fill a polygon with a color based on data. The primary use of the filled map mark type is for creating choropleth maps (also known as thematic maps or data maps). The area to be filled is defined by the geographic fields used in the view. Tableau displays data using a filled map when:

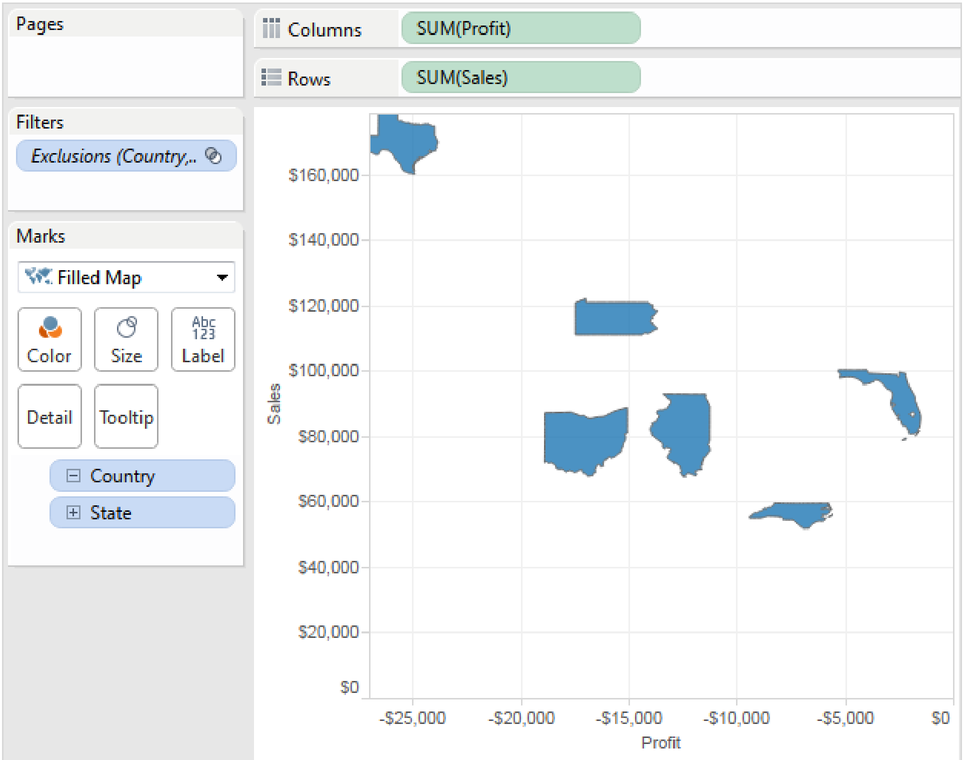
- A geographic dimension is on **Detail** on the Marks card, along with **Latitude** and **Longitude** on the **Rows** and **Columns** shelves. A measure or continuous dimension is added to **Color** on the Marks card.
- You select **Filled Map** from the Marks card drop-down menu.

The data view below shows a map with the **State** geographic dimension on **Detail** on the Marks card. The **Profit** measure is on **Color** on the Marks card.



The polygon for each state is filled with a color based on the profit for that state. The profit in Texas is low (in fact, negative) while the profit in California is high.

You can also use the Filled Map mark type when you are plotting two measures against each other. By default, placing measures on both the **Rows** and **Columns** shelves creates a scatter plot. However, adding a geographic dimension allows you to change the mark type to Filled Map. Each mark becomes the area defined by the geographic field. For example, the view below shows **Sales** versus **Profit** for a selection of states. Rather than showing a round mark with a label for each state, the view uses the Filled Map mark type to draw the outline of each state. While this works well for recognizable areas, it is not the best choice for areas that are similar in shape or difficult to recognize.



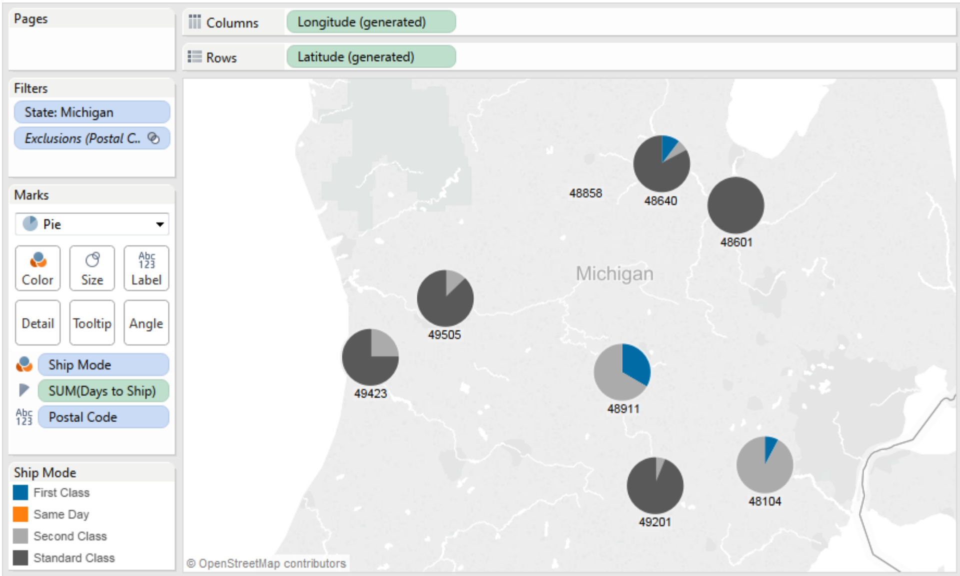
Pie Mark

You can use the Pie mark to show proportions. Although generally this type of information can be better shown using stacked bar charts, there are cases where pie marks can be very effective—for example, when trying to convey the percentage allocation of marketing expenses by state where the spending of geographically close states are very relevant.

Tableau will never use the Pie mark as an automatic mark type, but you can select **Pie** from the Marks card drop-down menu.

When you select the Pie mark type, an additional target named Angle is displayed on the Marks card. The Angle target determines the angular measure of the pie wedges. For example, if you place a measure such as **Sales** on **Angle** on the Marks card, the 360 degrees of the pie corresponds to the total sum of sales, and each wedge is divided by the values of the field on **Color** on the Marks card.

The view below shows the time it took to ship products by various ship modes. The data overlays a map and shows data by state. We can see that standard class shipping takes the longest in most areas.



To try some hands-on exercises for pie charts, see **Build a Pie Chart** on page 582 and **Build a Map View** on page 599.

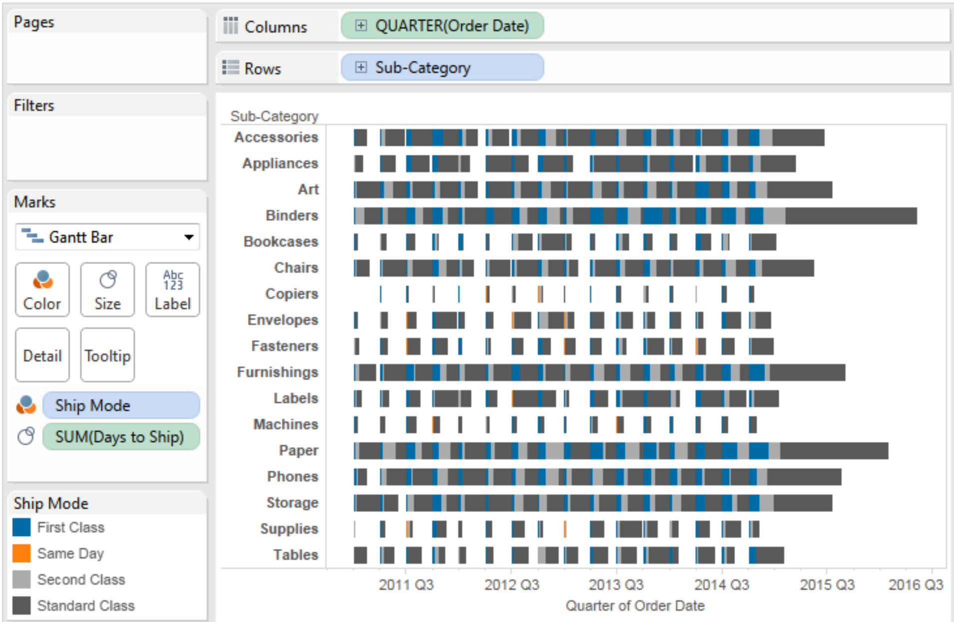
Gantt Bar Mark

The Gantt Bar mark type is useful for viewing dates, project plans, or the relationships between different quantitative variables. Tableau displays your data using Gantt bars when:

- The Marks card drop-down menu is set to **Automatic** and you place one or more dimensions on either the **Columns** shelf or the **Rows** shelf, and then plot the dimensions against a continuous quantity.
- You select **Gantt Bar** from the Marks card drop-down menu.

The distinguishing characteristic of Gantt Bars is that the length of every mark is proportional to the measure placed on **Size** on the Marks card.

The view below displays a dimension as a function of a continuous date. If the Marks card drop-down menu is set to **Automatic**, the data would be displayed using bars. Selecting **Gantt Bar** and adding additional fields will display a view like the following.



In particular, placing the **Days to Ship** measure on **Size** on the Marks card causes every bar in the view to be drawn with a length that indicates the delivery time of an order. Additionally, placing the **Ship Mode** dimension on **Color** on the Marks card causes each bar to be colored according to the ship mode.

To try a hands-on exercise for building a Gantt Bar chart, see **Build a Gantt Chart** on page 576.

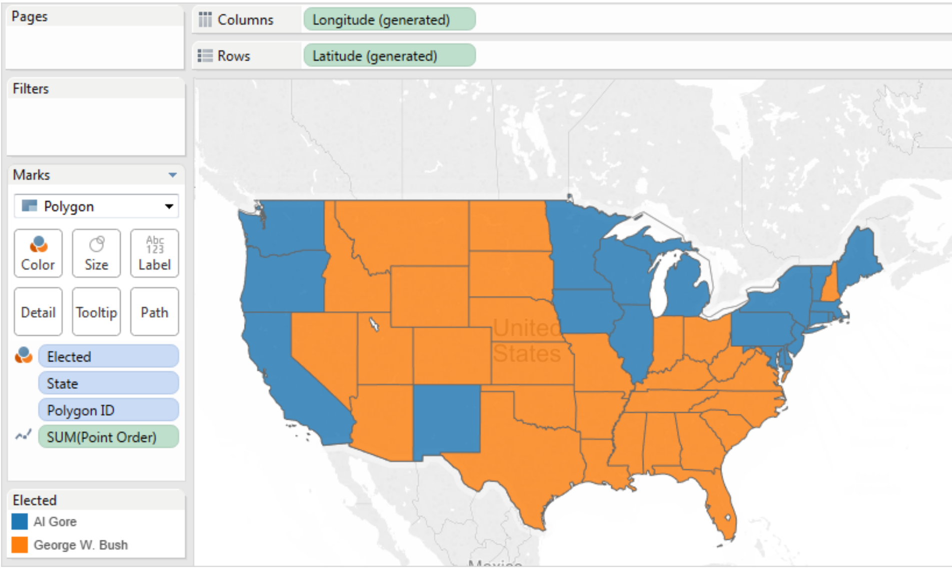
Polygon Mark

Polygons are points connected by lines enclosing an area. The polygon mark type is useful when you want to connect points to create data areas. Tableau displays data using polygons when you select Polygon from the **Mark** menu.

> The polygon mark is not commonly used and often requires a specially constructed data source.

The view shown below comes from a specially constructed data source that holds geographic and election data. It displays the 48 contiguous US states as a function of latitude and longitude and color-encodes each state by the 2000 presidential election results.

If **Mark** is set to Automatic, the data will be displayed using a shape. Manually selecting Polygon and adding additional fields to the view causes a different view to be created.



Every state is considered to be a polygon in the data source. The **PolygonID** field on the **Detail** target is distinct for each US state. You can remove states from the view by filtering this field.

Additionally, you can specify the drawing order of the lines that constitute each polygon by placing a field on the **Path** target. In this example, the **PointOrder** measure is used to draw each state.

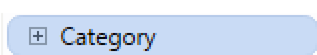
Mark Properties

You can control the mark properties using the Marks card. For example, you can control the colors, size, shape, etc. of the marks in the view. Drag fields to each property to encode the marks using your data. Click each property on the marks card to open a drop-down control where you can further tune the mark properties.

Color Properties

All marks have a default color, even when there are no fields on **Color** on the **Marks** card. For most marks, blue is the default color; for text, black is the default color.

When you drop a field on **Color** on the **Marks** card, Tableau applies different colors to marks, based on the field's values. The effect of color-encoding your data view depends on whether the field you drop on **Color** is discrete, as indicated by a blue background:



, or continuous, as indicated by a green background:

. Typically, dimensions are discrete and measures are continuous.

For discrete fields, Tableau assigns a categorical palette, and for continuous fields, a quantitative palette.

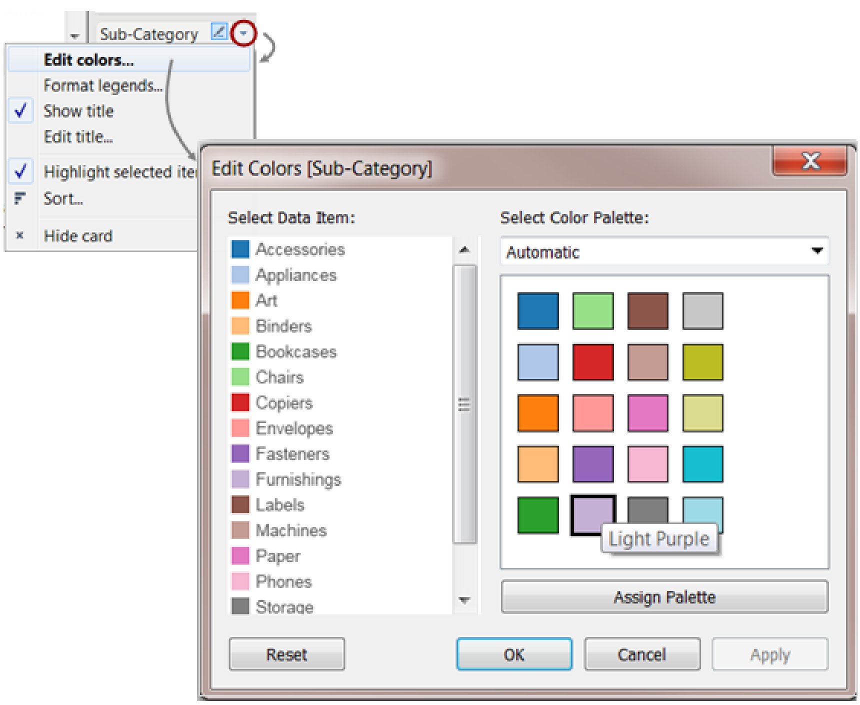
You can also use the **Color** drop-down control on the Marks card to specify other color properties such as transparency, borders, and halos. For more information, see **Configure color effects** on page 456.

> **Note:** Color selections for a field are shared across multiple worksheets that use the same data source. For example, if you assign the color orange to the West value for the **Region** field in one worksheet, West will automatically be orange in all other worksheets in the workbook. To set the default color for a field, right-click (control-click on Mac) the field in the **Data** pane, and then select **Default Properties** > **Color**.

Categorical palettes

When you drop a field with discrete values (typically a dimension) on **Color** on the **Marks** card, Tableau uses a categorical palette and assigns a color to each value of the field. Categorical palettes contain distinct colors that are appropriate for fields with values that have no inherent order, such as departments or shipping methods.

To change colors for values of a field, click in the upper-right corner of the color legend to open a context menu, and then select **Edit colors**; or just double-click the legend to open the Edit Colors dialog box.



To change the color for a value

1. Click a value on the left, under **Select Data Item**.
2. Click a new color in the palette on the right. You can hover over a swatch to identify the color.
3. Repeat for as many values that you want to change.
4. Click **OK** to exit the Edit Colors dialog box.

Select a different palette

The **Select Color Palette** drop-down list in the Edit Colors dialog box provides color palettes that you can use for discrete fields. The list contains both categorical and ordinal palettes.

At the top of the list are categorical palettes, such as *Tableau 20*. As noted above, categorical palettes are appropriate for discrete fields with no inherent order.

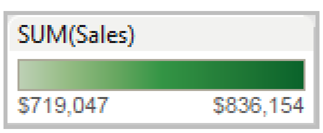
At the bottom of the list are ordinal palettes such as *Orange*. Ordinal palettes contain a range of related colors and are appropriate for fields that have an associated order, such as dates or numbers.

After you select a palette, click **Assign Palette** to automatically assign the new palette colors to the members in the field.

To return to the Automatic palette and the default color assignments, click **Reset** in the Edit Colors dialog box.

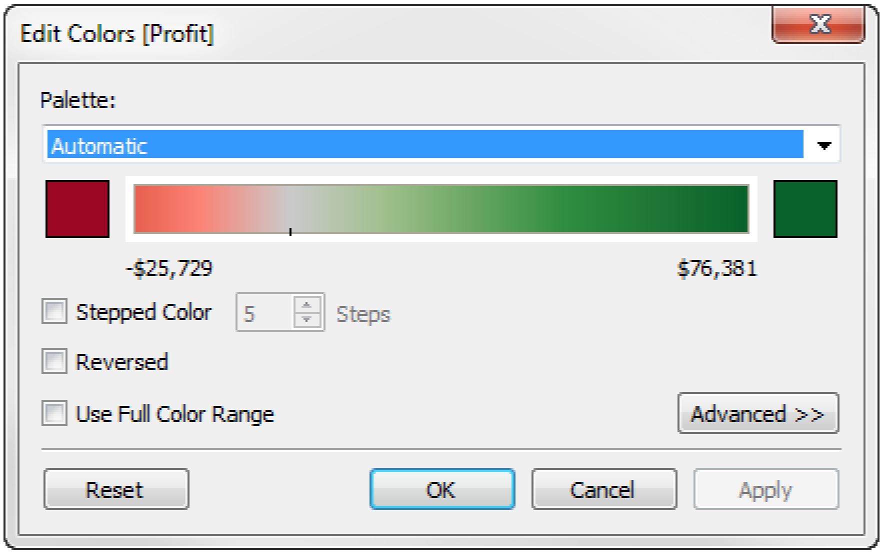
Quantitative palettes

When you drop a field with continuous values on the **Marks** card (typically a measure), Tableau displays a quantitative legend with a continuous range of colors.



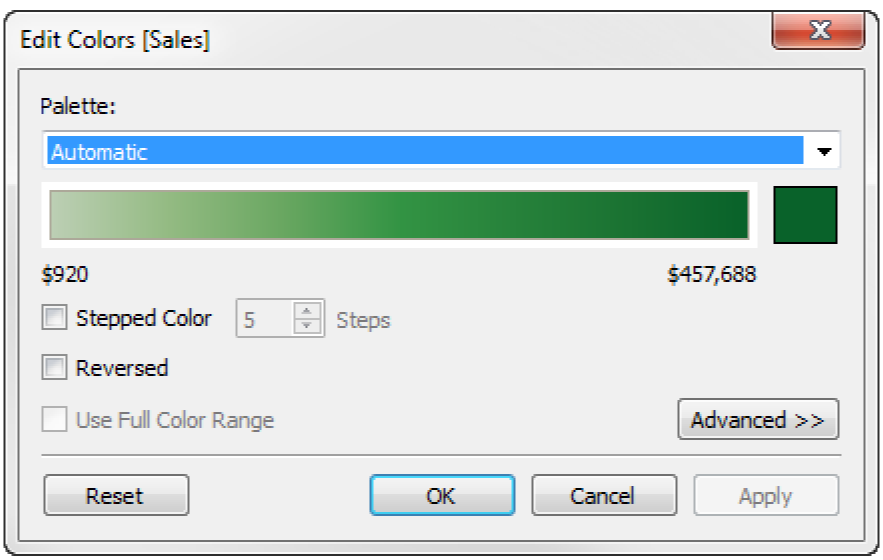
You can modify the colors used in the range, the distribution of color, and other properties. To edit colors, click in the upper right of the color legend to open a context menu, and select **Edit colors**—or just double-click the legend to open the Edit Colors dialog box.

When there are both negative and positive values for the field, then the default range of values will use two color ranges and the Edit Colors dialog box for the field has a square color box on either end of the range. This is known as a diverging palette.



Edit Colors dialog box for a diverging palette

When all values are positive, then the default range of values will use a single color range and the Edit Colors dialog box for the field has a square color box only at the right end of the range. This is known as a sequential palette.



Edit Colors dialog box for a sequential palette

You can specify whether Tableau uses a diverging or a sequential palette for a continuous field on **Color**, and also configure the range of colors for the field's values.

The **Palette** drop-down list provides a range of color palettes from which you can choose. There are two types of quantitative palettes available for continuous fields:

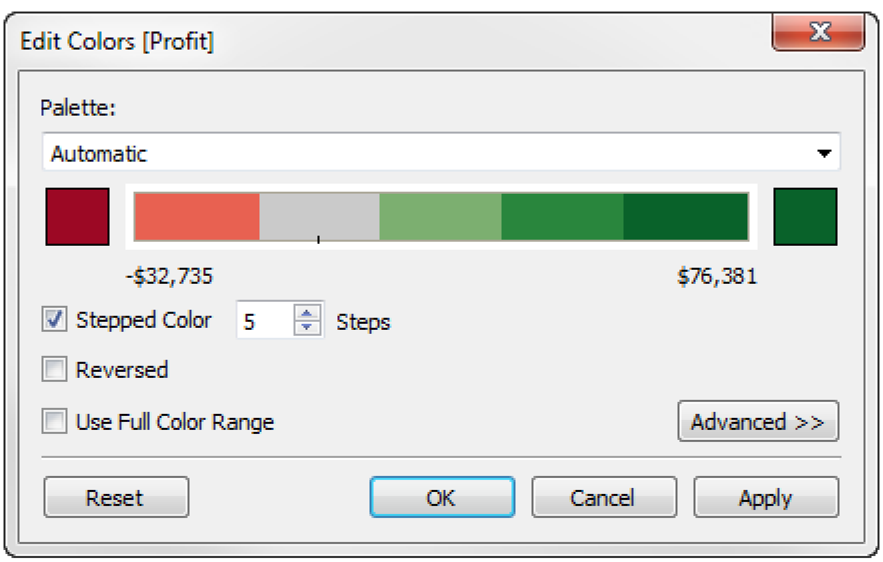
- All palettes with *Diverging* in the name are diverging quantitative palettes—for example, *Orange-Blue Diverging*. You can choose a diverging palette for any continuous field—it isn't necessary for the range of values to contain both positive and negative numbers. To change the colors for a diverging palette, click one of the square color boxes at either end of the palette spectrum to open a color configuration dialog box, which is part of your computer's operating system.
- All other palettes, both those with *Sequential* in the name, such as *Brown Sequential*, as well as palettes with neither *Diverging* nor *Sequential* in the name, such as *Green Light* and *Area Brown*, are sequential quantitative palettes. To change the colors for a sequential palette, click the square color box at the right end of the palette spectrum to open the color configuration dialog box, which is part of your computer's operating system.

Options for quantitative palettes

The following options are available in the Edit Colors dialog box for a continuous field.

Stepped Color

Click **Stepped Color** to group values into uniform bins, where each bin is associated with a color. Use the spin control to specify how many steps (bins) to create. For example, for a range of values from 0 to 100 you could specify five steps, to sort values into five bins (0-20, 20-40, etc.).



If a diverging color palette is selected, the point where the palette transitions between colors is shown on the color ramp with a small black tick mark. When the number of steps is odd, the mark is placed in the middle of the transitional step. When the number of steps is even, the mark is placed at the boundary between the steps where the color changes.

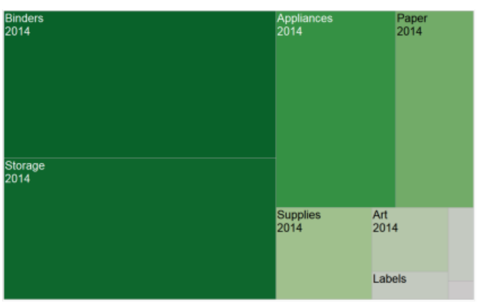
Reversed

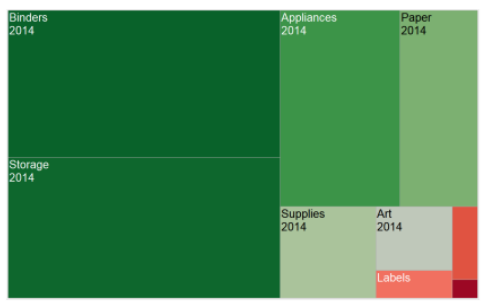
Click **Reversed** to invert the order of colors in the range. For example, if you want lower values to have a darker intensity in a sequential palette, reverse the palette. For a diverging palette, reversing the color palette means swapping the two colors in the palette, in addition to inverting the shades within each color range.

Use Full Color Range

With a diverging (two-color) palette, you can select to **Use Full Color Range**. Tableau assigns both the starting number and the ending number a full intensity for both color ranges. So if the range is from -10 to 100, the color representing negative numbers will be adjusted to change in shade much more quickly than the color representing positive numbers. If you do not select **Use Full Color Range**, Tableau assigns the color intensity as if the range of values was from -100 to 100, so that the change in shade is the same on both sides of zero. This means there will be much less change on the negative side, where actual values only range from -10 to 0, than on the positive side, where values range from 0 to 100.

The image on the left below shows a red-green diverging color palette for values from -858 to 72,986. Without using the full color range, -858 (associated with the small box at the lower right of the chart) shows as gray, because -858 is only about 1% as far to the negative side as 72,986 is to the positive side. When the full color range is used, as in the image on the right, -858 shows as a dark red, equal in intensity to the maximum positive value.





Limit the color range

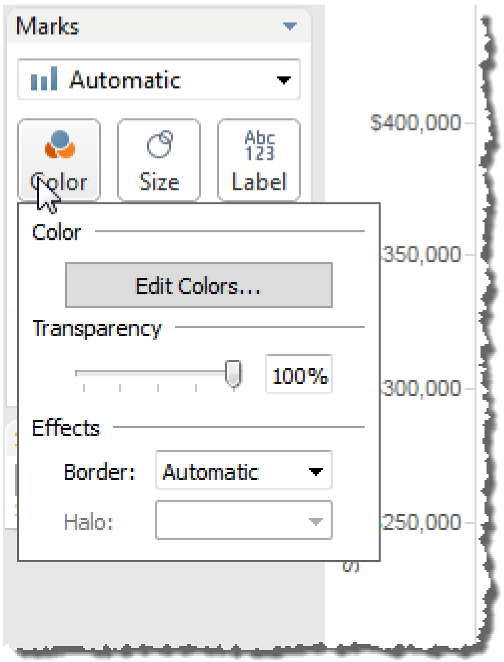
When you click **Advanced** in the Edit Colors dialog box, you can choose to specify the start, end, and center RGB values for the range by selecting the check box and typing a new value into the field. The **Start** value is the lower limit in the range, the **End** value is the upper limit, and the **Center** value is where the neutral color is located on a diverging color palette.

Reset the color range

To return to the Automatic palette and the default color assignments, click **Reset** in the Edit Colors dialog box.

Configure color effects

Click the **Color** drop down on the **Marks** card to configure additional **Color** settings not related to the actual colors shown.



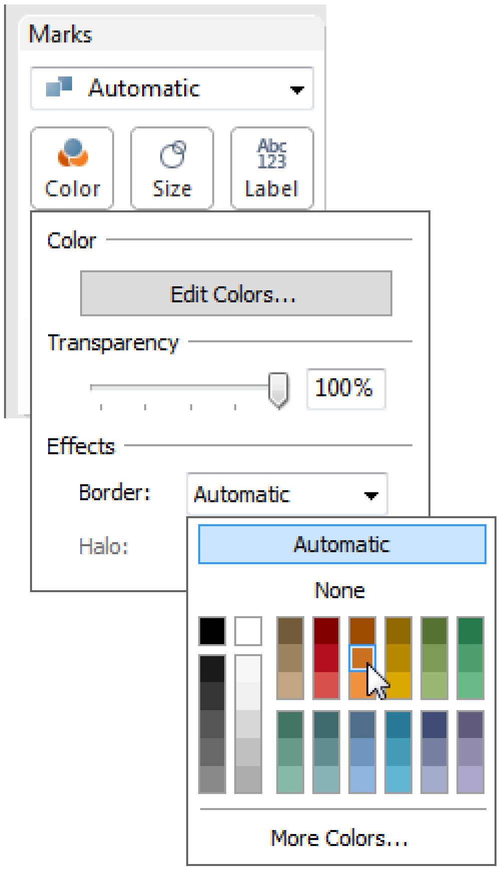
Transparency

Modify the transparency of marks by moving the slider.

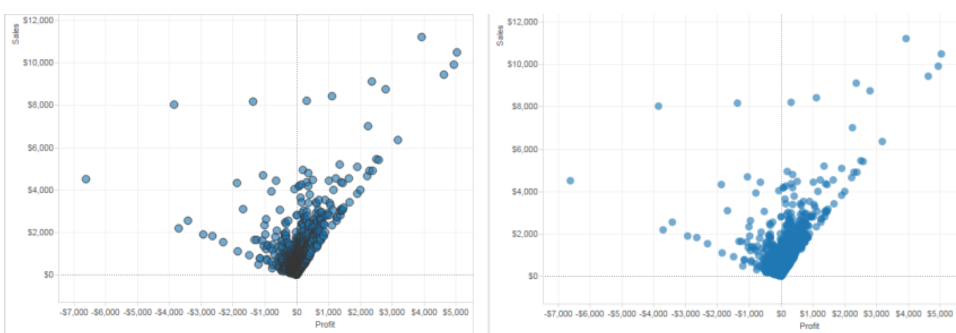
Adjusting transparency is especially useful in dense scatter plots or when you are looking at data overlaying a map or background image. As you slide the slider toward the left, marks become more transparent.

Mark borders

By default, Tableau displays all marks without a border. You can turn on mark borders for all mark types except text, line, and shape. On the **Color** drop-down control, select a mark border color.



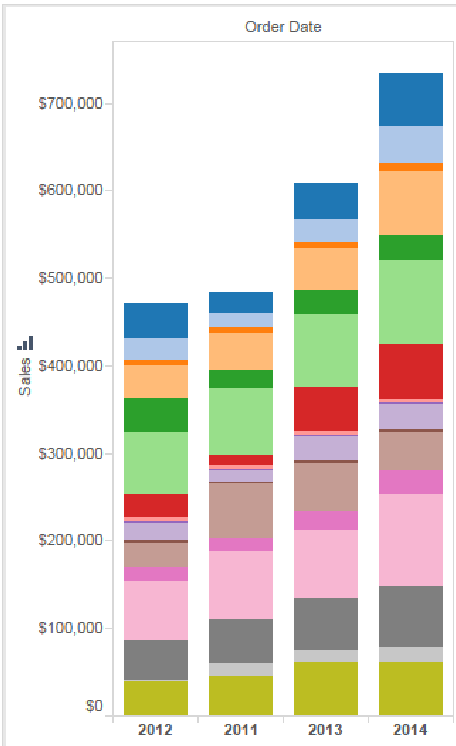
Borders can be useful for visually separating closely spaced marks. For example, the views below show a scatterplot with mark borders turned on (left) and turned off (right). When borders are turned on, marks are easier to distinguish in areas where they are tightly clustered.

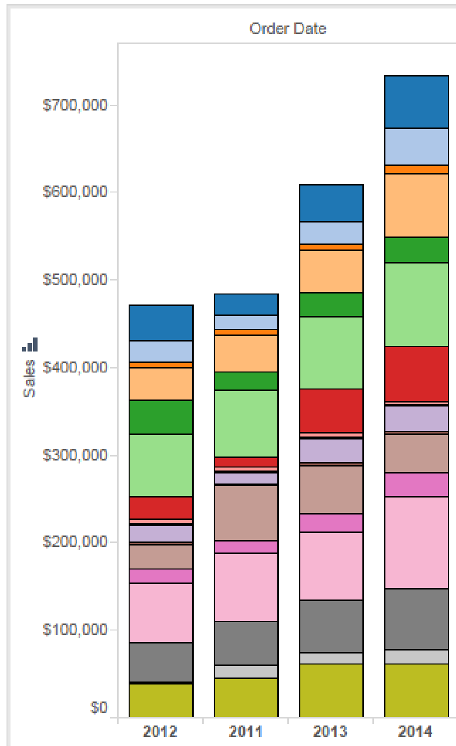


Note: You can also use transparency to show the density of marks.

When you are viewing a large number of color-encoded small marks, it is usually better to leave mark borders off. Otherwise borders can dominate the view, making it difficult to see the color encoding.

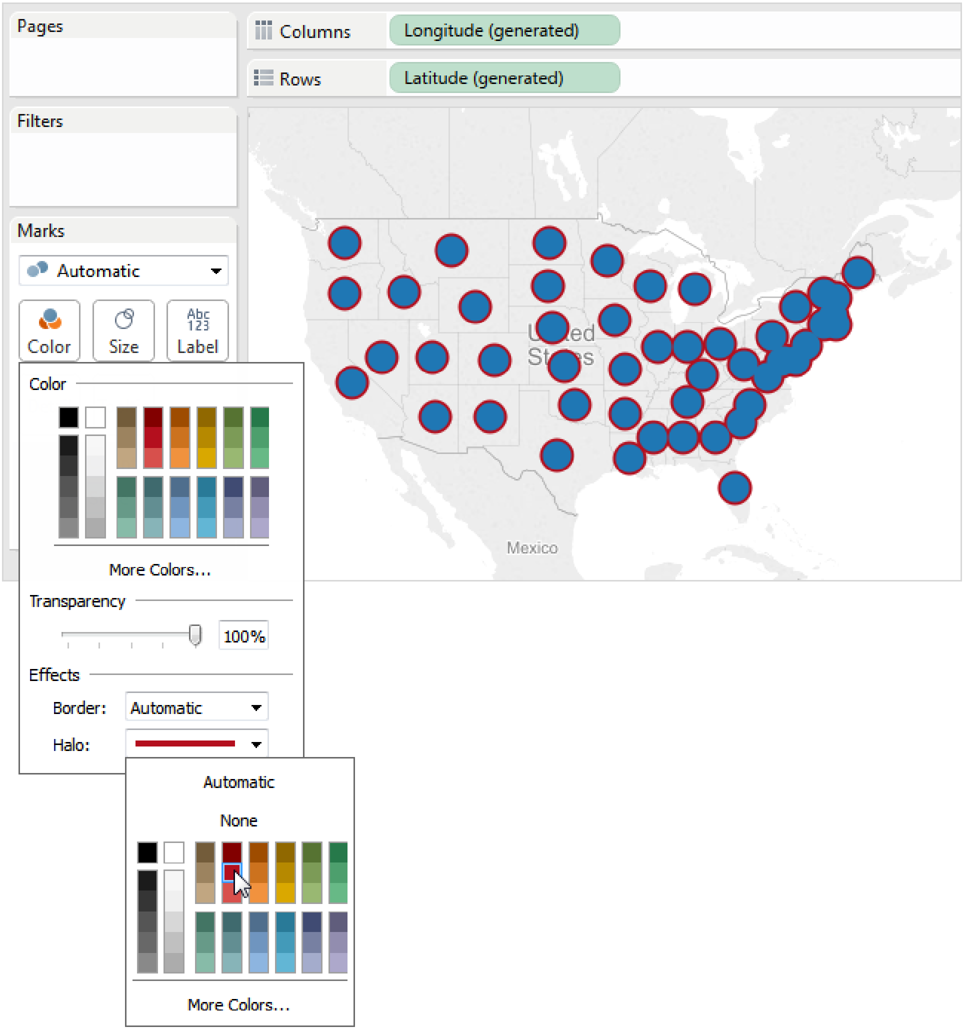
For example, the views below show bars that are segmented by a large number of color-encoded dimension members. With mark borders turned on (right), some of the narrower marks are difficult to identify by color. With borders turned off (left), the marks are easy to distinguish.





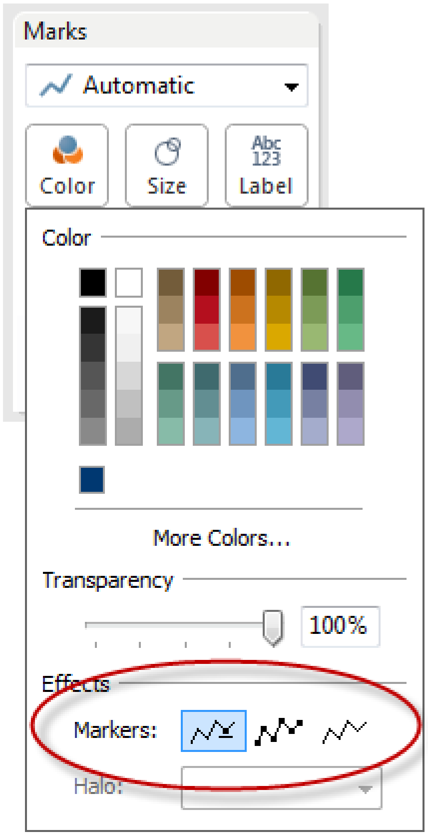
Mark halos

To make marks more visible against a background image or map, surround each mark with a solid contrasting color called a halo. Mark halos are available when you have a background image or a background map. On the **Color** drop-down control, select a mark halo color.



Markers

When you are using the Line mark type, you can add a marker effect to show or hide points along the line. You can show selected points, all points, or no points. On the **Color** drop-down control, select a marker in the **Effects** section.



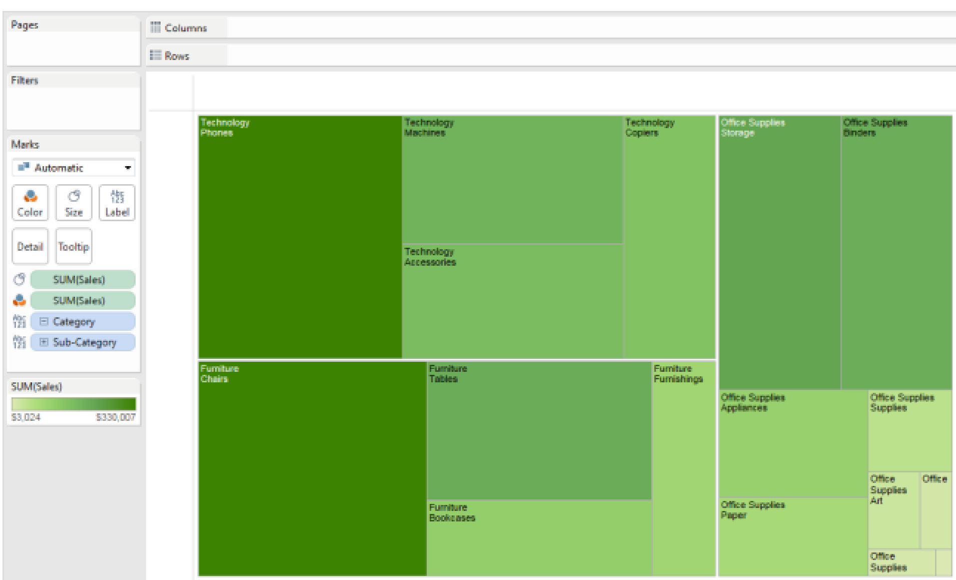
Example – Multiple Fields on Color

If you drop one field on Color and then drop a different field on Color, the second field replaces the first field. This can lead to the impression that it is not possible to color-encode more than one field in a view. But for some chart types, including treemaps and bullet graphs, there can be good reasons for putting multiple fields on color. You use one field to set the hue, and the other to show gradations within that hue.

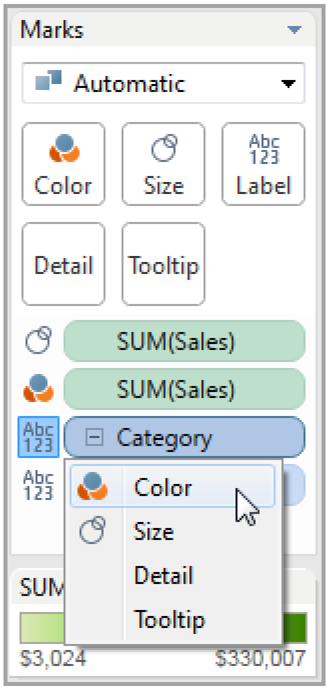
Follow these steps, using the Sample - Superstore data source, to build a treemap with two fields on Color.

1. Drag **Category** and **Sub-Category** to **Columns**.
2. Drag **Sales** to Size.
3. Click the Treemap option in Show Me.

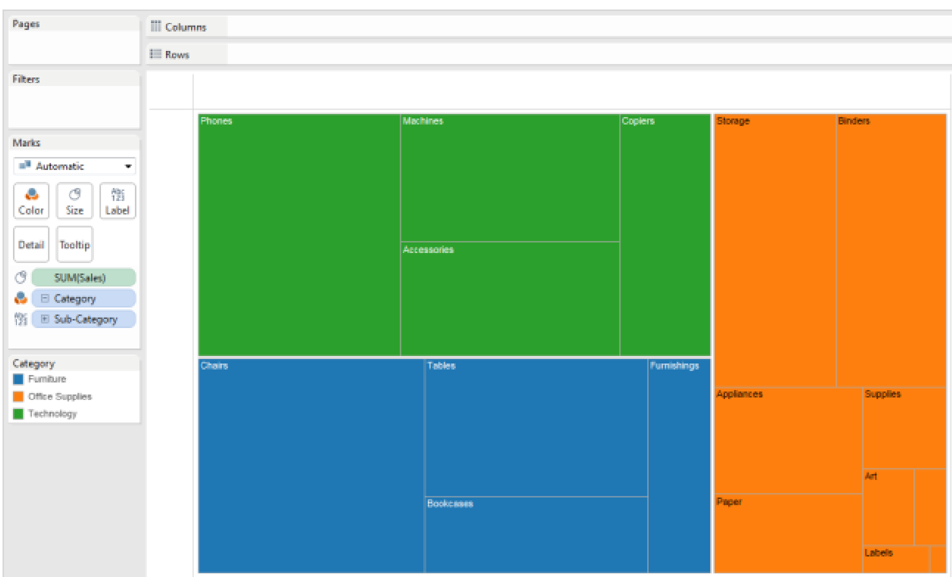
Tableau transfers all fields to the Marks card, putting **SUM(Sales)** on both Size and Color, and both **Category** and **Sub-Category** on Label:



4. Click the Label icon to the left of **Category** on the Marks card and choose **Color**:



Category replaces **SUM(Sales)** on Color. The marks are still sized by the sum of **Sales**, but now they are colored by **Category**:



5. Click the Label icon to the left of **Sub-Category** on the Marks card and choose **Color**.

Tableau uses distinct, categorical colors for the first field, **Category**, and a range of sequential shades to distinguish values for the second field, **Sub-Category**:

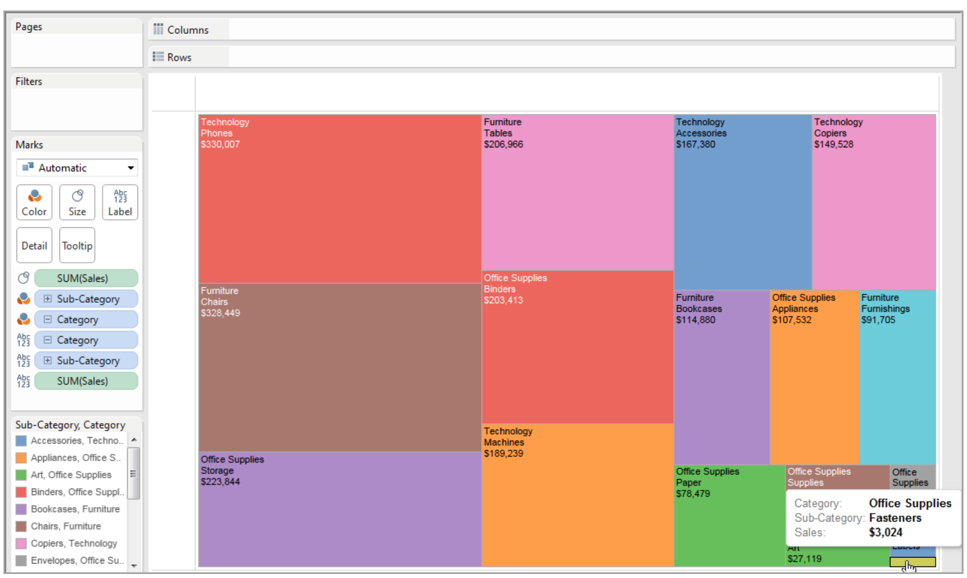
The size of the individual rectangles is still determined by **Sales**, per **Category** and **Sub-Category**.

The two fields on Color (**Category** and **Sub-Category**) are related within a hierarchy, so if you swap their positions on the Marks card, moving **Sub-Category** to be above **Category**, the effect is the same as if you had removed **Category** from the view altogether. The treemap changes to show a uniquely colored rectangle for each **Sub-Category**:

When the two fields on Color are not related within a hierarchy, you would be able to switch the order of the fields on the Marks card so that the field that had been used for categorical colors was used for sequential shades, and vice-versa.

If you aren't satisfied with the colors that Tableau has chosen, double-click the color legend to adjust them.

6. Make the view more readable by adding **Category**, **Sub-Category**, and **Sales** to Label. Users can hover to see tooltips for any rectangle that is too small to show text by default.



Size Properties

The Size property allows you to encode data by assigning different sizes to the marks in a data view. Depending on whether you use a discrete or continuous field, you will add either categorical or quantitative size encodings.

Categorical Sizes

When you place a discrete field on **Size** on the Marks card, Tableau separates the marks according to the members in the dimension, and assigns a unique size to each member. Because size has an inherent order (small to big), categorical sizes work best for ordered data like years or quarters.

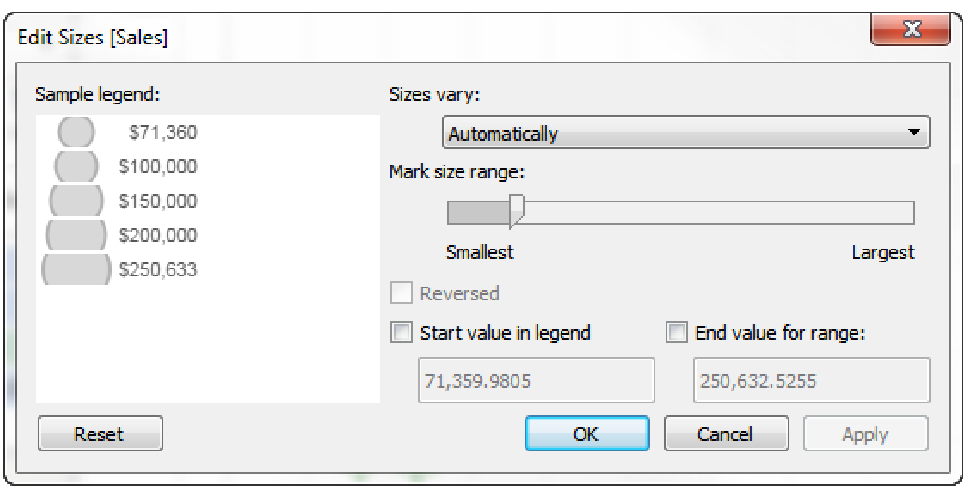
Size-encoding data with a discrete field separates the marks in the same way as the Detail property does, and then provides additional information (a size) for each mark. For more information about the Detail property, see **Detail Properties** on page 472. When you add categorical size encoding to a view, Tableau displays a legend showing the sizes assigned to each member in the field on the Size target. You can modify how these sizes are distributed using the Edit Sizes dialog box.

To edit categorical sizes:

1. Double-click the legend or select **Edit Sizes** from the legend's menu. For more information on legends, see **Legends** on page 494.
2. In the Edit Sizes dialog box, use the slider to adjust the sizes assigned to each member.

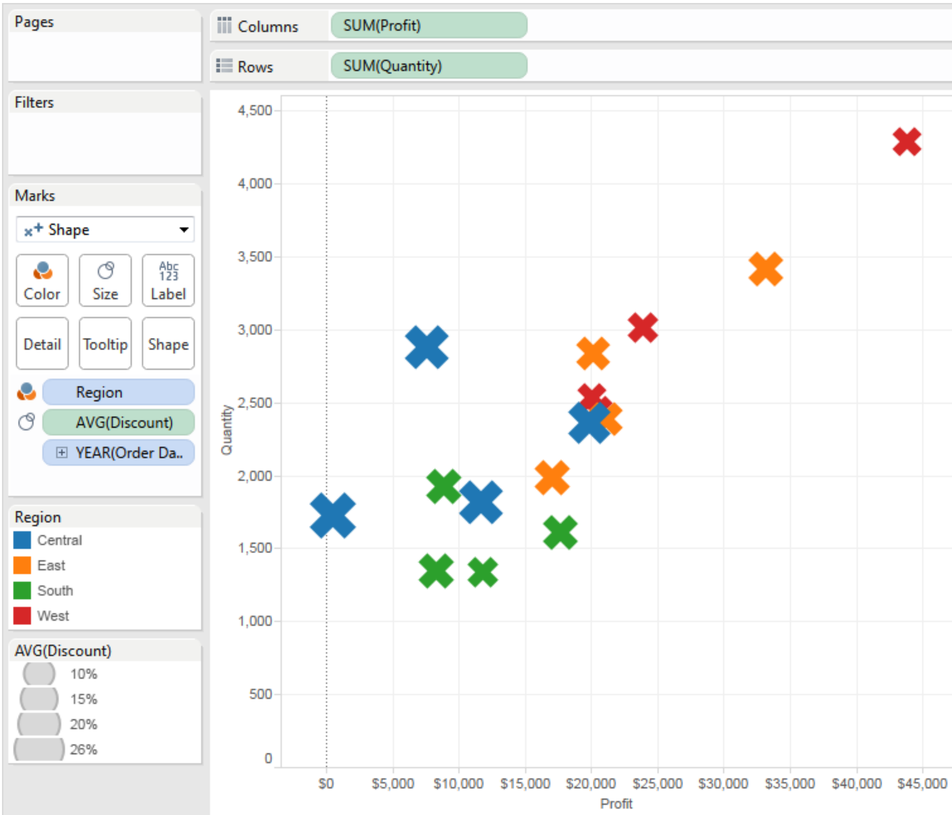
   In the Edit Sizes dialog box, sizes are displayed on the left and a size range slider is shown on the right. The sizes assigned to each member are distributed across the specified range.

   You can also select **Reversed** to assign the largest mark to the smallest value and the smallest mark to the largest value.



3. When finished, click **OK**.

The view below shows profit and order quantity broken out by region and order date. The discount customers received with each order is indicated by the size of the mark.



Quantitative Sizes

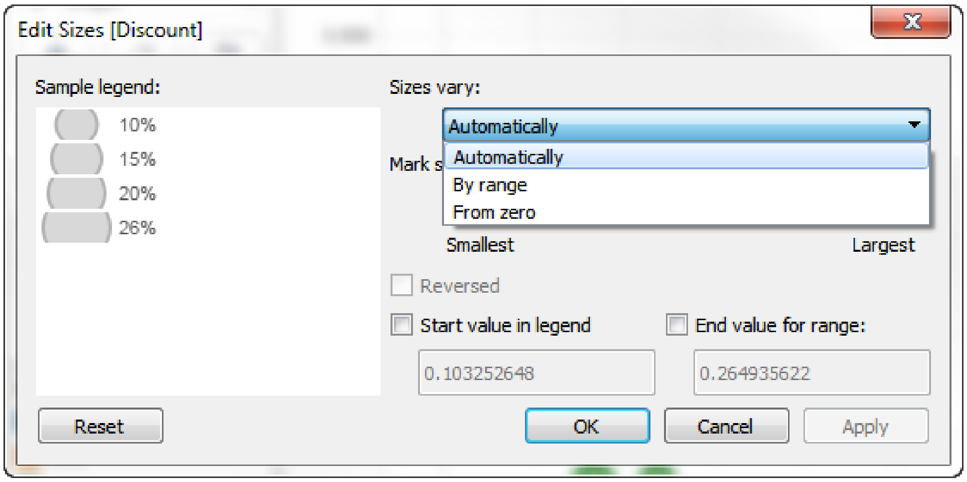
When you place a continuous field on **Size** on the Marks card, Tableau draws each mark with a different size using a continuous range. The smallest value is assigned the smallest sized mark and the largest value is represented by the largest mark.

When you add quantitative size encoding to the view, Tableau displays a legend showing the range of values over which sizes are assigned. You can modify how these sizes are distributed using the Edit Sizes dialog box.

To edit quantitative sizes:

1. Double-click on the size legend or select **Edit Size** from the legend's menu to open the Edit Sizes dialog box.
2. Select one of the following ways to vary the sizes:
    - **Automatically** - Selects the mapping that best fits your data. If the data is numeric and does not cross zero (all positive or all negative), the 'From zero' mapping is used. Otherwise, the 'By range' mapping is used.

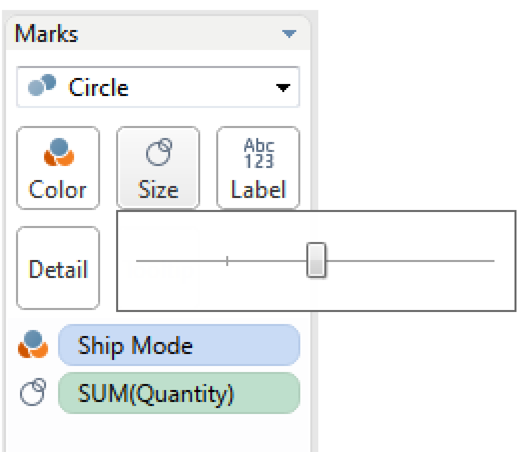
- **By range** - Uses the minimum and maximum values in the data to determine the distribution of sizes. For example, if a field has values from 14 to 25, the sizes will be distributed across this range.
- **From zero** - Sizes are interpolated from zero, assigning the maximum mark size to the absolute value of the data value that is farthest from zero.



3. Use the range slider to adjust the distribution of sizes. When the **From zero** mapping is selected from the **Sizes vary** drop-down menu, the lower slider is disabled because it is always set to zero.
4. Select **Reversed** to assign the largest mark to the smallest value and the smallest mark to the largest value. This option is not available if you are mapping sizes from zero because the smallest mark is always assigned to zero.
5. To modify the distribution of sizes, select the **Start value in legend** and **End value for range** checkboxes and type beginning and end values for the range.
6. When finished, click **OK**.

The view below analyzes the time it takes to ship products based on their ship mode, order date, and the size of order. The size of each mark represents the order quantity while the color represents the ship mode. You can see that most products ship within one or four days. However, larger orders tend to take approximately four to six days and are shipped Standard Class. Curiously, there are a couple of small Same Day orders that were not delivered same day.

You can also change the size of the marks using the slider on the Size drop-down control on the Marks card.



The Size slider affects different marks in different ways, as described in the following table.

Mark Type	Description
Circle, Square, Shape, Text	Makes the mark bigger or smaller.
Bar, Gantt Bar	Makes bars wider or narrower.

Mark Type	Description
Line	Makes lines thicker or thinner.
Polygon	You cannot change the size of a polygon.
Pie	Makes the overall size of the pie bigger and smaller.

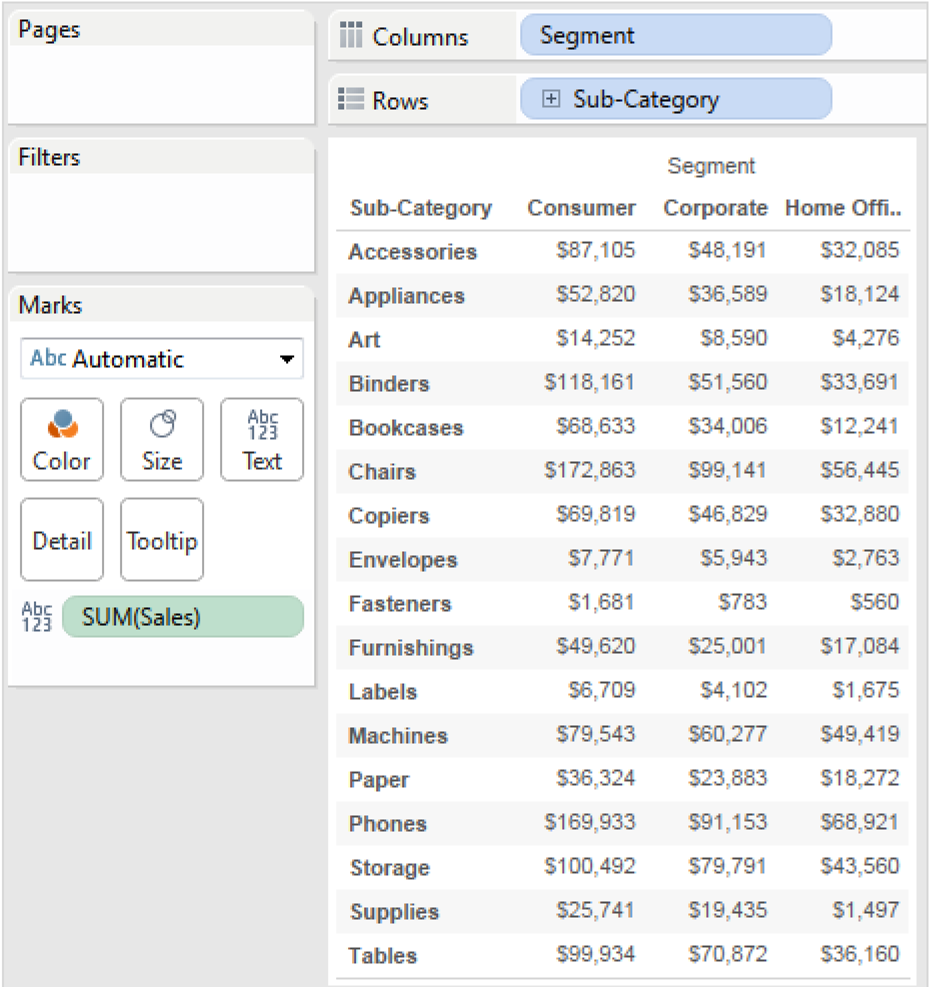
The size of your data view is not modified when you change marks using the Size slider. However, if you change the view size, the mark size might change to accommodate the new formatting. For example, if you make the table bigger, the marks might become bigger as well.

Label/Text Properties

The Label property allows you to encode data by assigning text labels to the marks. When working with a text table, this property is called Text, which allows you to view the numbers associated with a data view. The effect of text-encoding your data view depends on whether you use a dimension or a measure.

- Dimension – When you place a dimension on **Label** or **Text** on the Marks card, Tableau separates the marks according to the members in the dimension. The text labels are given by the dimension member names.
- Measure – When you place a measure on **Label** or **Text** on the Marks card, the text labels are given by the measure values. The measure can be either aggregated or disaggregated. However, dis-aggregating the measure is generally not useful because it often results in overlapping text.

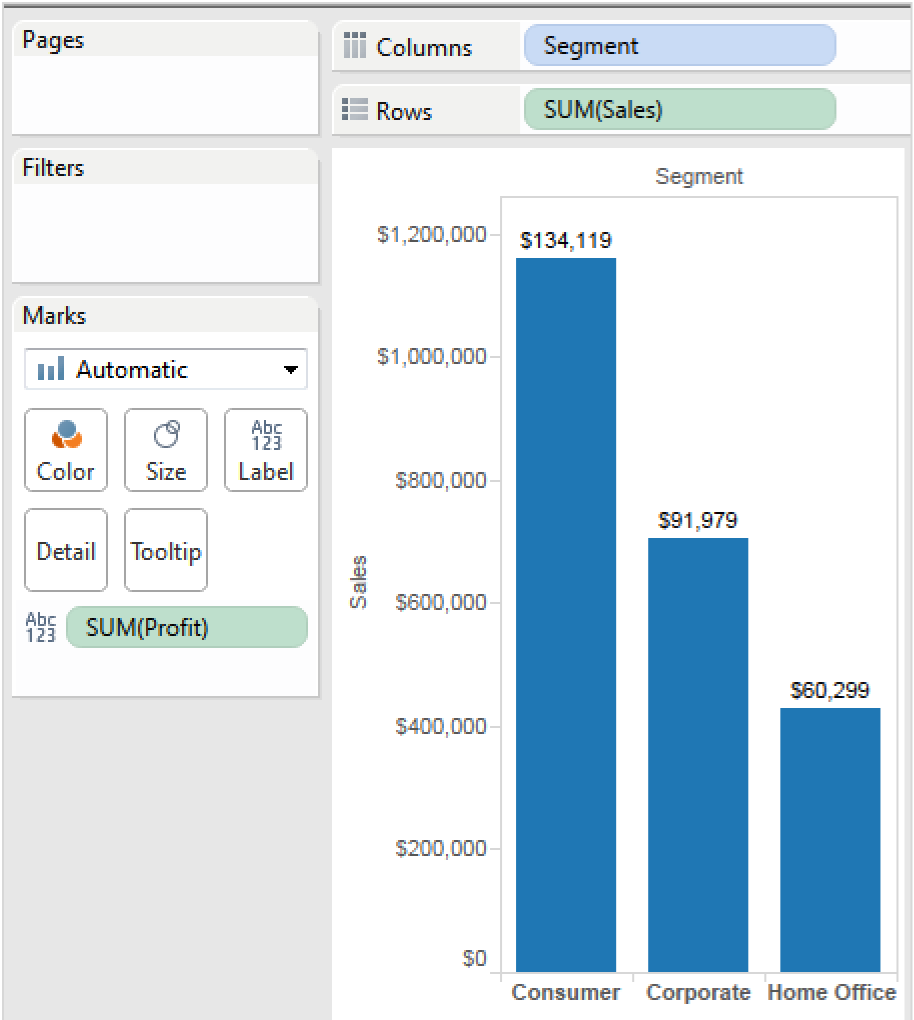
Text is the default mark type when dimensions are the inner fields for both the **Rows** shelf and the **Columns** shelf. This type of view is called a text table, which is also referred to as cross-tab or a PivotTable.



	Segment		
Sub-Category	Consumer	Corporate	Home Offi..
Accessories	$87,105	$48,191	$32,085
Appliances	$52,820	$36,589	$18,124
Art	$14,252	$8,590	$4,276
Binders	$118,161	$51,560	$33,691
Bookcases	$68,633	$34,006	$12,241
Chairs	$172,863	$99,141	$56,445
Copiers	$69,819	$46,829	$32,880
Envelopes	$7,771	$5,943	$2,763
Fasteners	$1,681	$783	$560
Furnishings	$49,620	$25,001	$17,084
Labels	$6,709	$4,102	$1,675
Machines	$79,543	$60,277	$49,419
Paper	$36,324	$23,883	$18,272
Phones	$169,933	$91,153	$68,921
Storage	$100,492	$79,791	$43,560
Supplies	$25,741	$19,435	$1,497
Tables	$99,934	$70,872	$36,160

Note: You can display text labels with other mark types by dragging a field to the Label target on the Marks card. For more information on showing and hiding marks, see **Mark Labels** on page 826.

In the view below, the heights of the bars are given by the **Sales** measure and the labels show the aggregation (SUM) of the **Profit** measure.

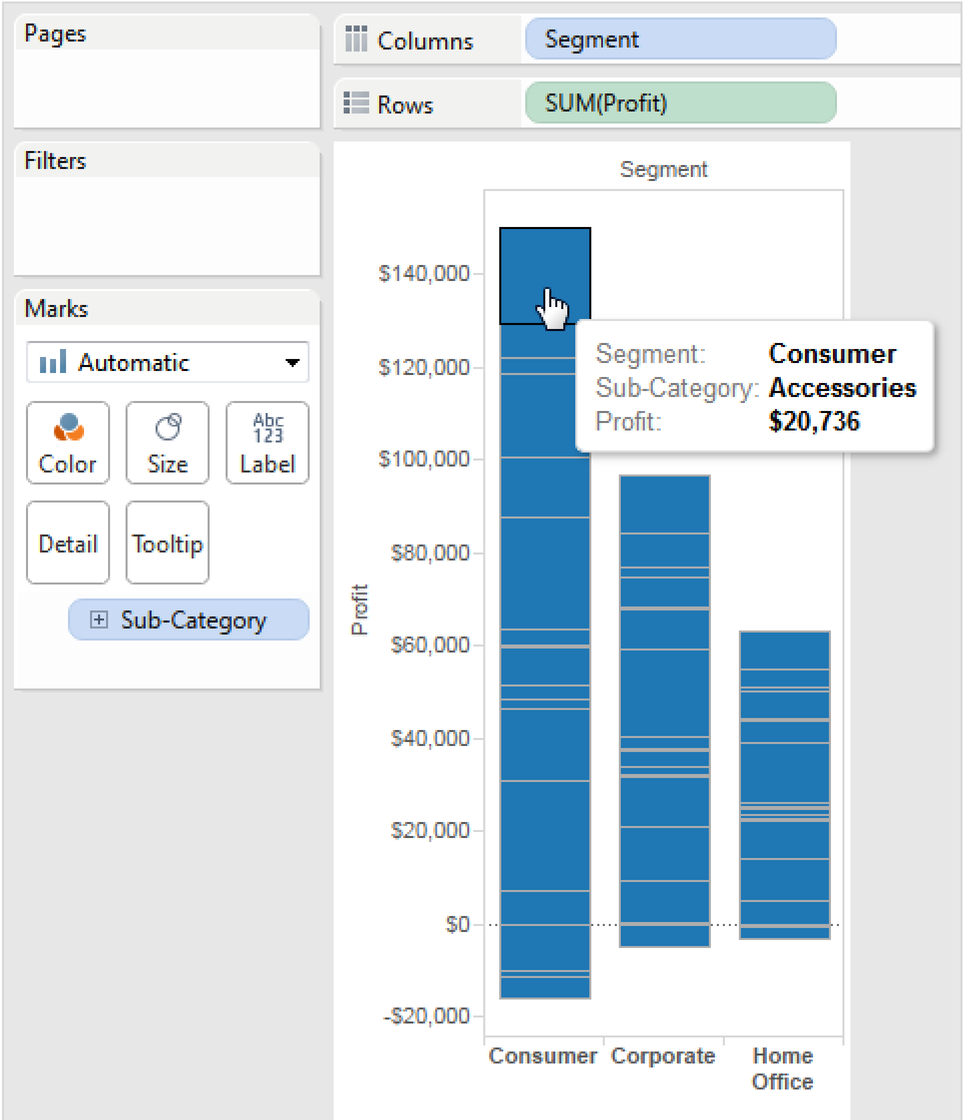


Detail Properties

Whenever you place a dimension on the **Rows** or **Columns** shelf, Tableau uses the categorical members of the dimension to create table headers. The headers show how Tableau is sorting the underlying row data into specific categories. For example, the **Segment** dimension separates the data source rows into four levels of detail: Consumer, Corporate,and Home Office.

Drop a dimension on **Detail** on the Marks card to separate the marks in a data view according to the members of a dimension. Unlike dropping a dimension on the **Rows** or **Columns** shelf, dropping it on **Detail** on the Marks card is a way to show more data without changing the table structure.

In the view below, the bars are separated into segments according to the members of the **Sub-Category** dimension. The size of each segment reflects the contribution to the profit for a particular member. For example, the Accessories sub-category in the Consumer market has a profit of $20,736.



You can place any number of dimensions on **Detail** on the Marks card. In fact, placing all dimensions on this shelf is one way to display all the rows of your data source.

> **Note:** The Detail property works only if the measures that contribute axes to the table are aggregated. If the measures are disaggregated, then it isn't possible to separate the marks into additional levels of detail because all levels of detail are already shown.

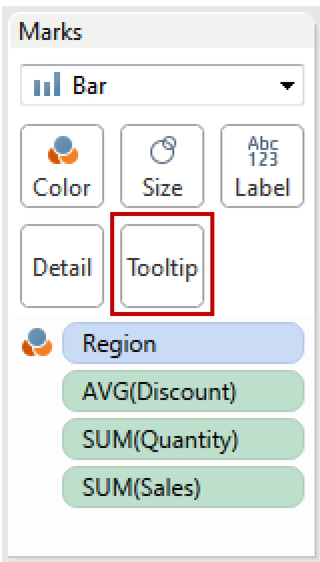
Placing a measure on **Detail** has no effect because measures do not contain members. However, you can place measures on this shelf if you want to export their values to Microsoft Access, copy their values to the Clipboard, or use the values in actions.

Tooltip Properties

Tooltips are data details that are displayed when you hover over one or more marks in the view. Tooltips are also convenient for quickly filtering or removing a selection, or viewing underlying data. You can edit a tooltip to include both static and dynamic text. You can also modify which fields are included in the automatic tooltip.

Add a tooltip

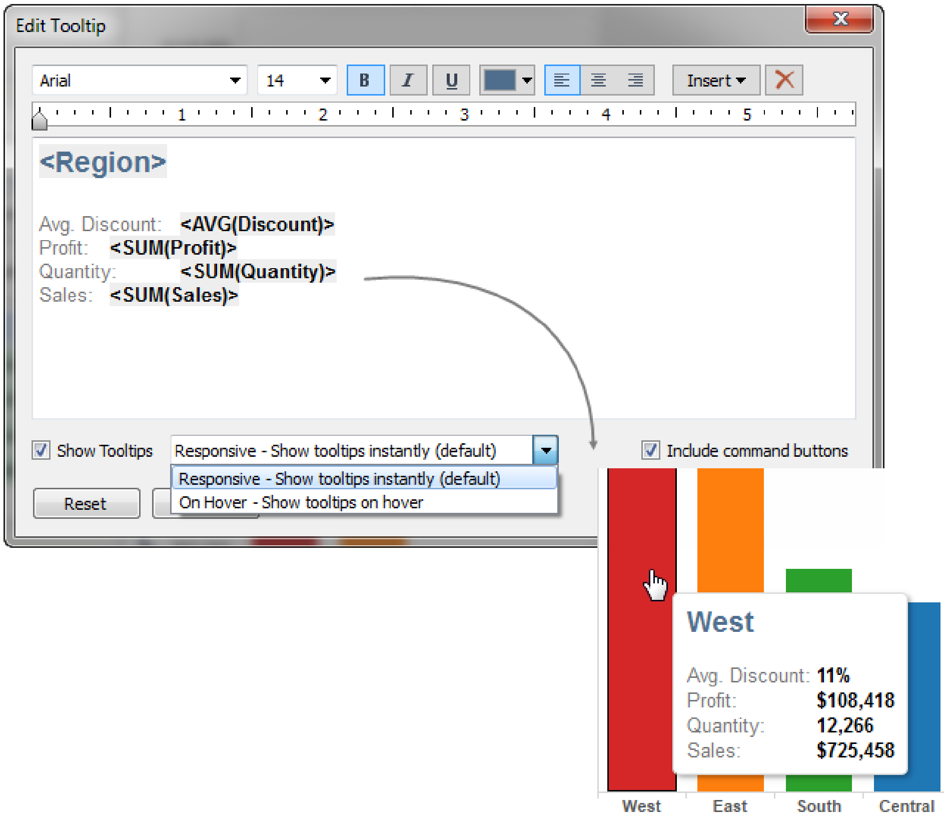
1. Drag a field to **Tooltip** on the Marks card.
2. Click **Tooltip** on the Marks card to open the Edit Tooltip dialog box. Here, you can add additional text, rearrange the tooltip contents, and insert more fields.



> **Note:** Dimensions are added to the tooltip using the ATTR aggregation, which means the tooltip may sometimes display as an asterisk. The asterisk indicates that there are multiple dimension members that apply to the mark you are pointing at. For example, a mark may represent the aggregated sales for all regions. Adding the Region field to the tooltip results in an asterisk because the mark represents more than one region. To avoid showing an asterisk, add the dimension to Detail on the Marks card or use it elsewhere in the view to ensure the marks are at the same level of detail.

Tooltip Options

Once you open the Edit Tooltip dialog box, there are several options that you can choose from to format the tooltips in your view and configure their behavior. You can choose from the options below.

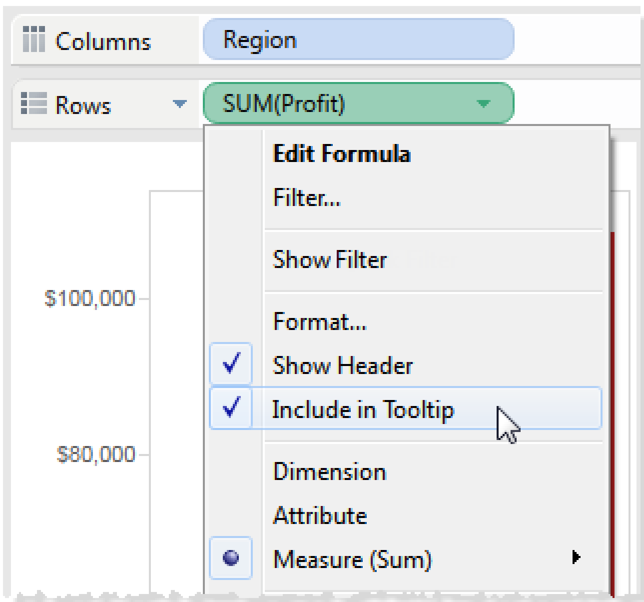


- **Format tooltips:** Tooltips are specified on a per-sheet basis and can be formatted using the tools along the top of the Edit Tooltip dialog box.
- **Adding dynamic text:** Use the **Insert** menu at the top of the dialog box to add dynamic text such as field values, sheet properties, and more. The **All Fields** command on the **Insert** menu adds all field names and values that are used in the view to the tooltip for any mark in the view.
- **Show tooltips:** Tooltips are shown by default. If you prefer to hide automatic tooltips, clear the **Show Tooltips** check box.
- **Configure tooltip behavior:** Next to the **Show Tooltips** check box, you can configure the tooltip behavior. There are two options:
  - **Responsive**: This option means that tooltips appear instantly as you move the cursor over the marks in the view. This is the default for all views.

    When responsive is selected, the tooltips appear without command buttons. You must click a mark in the view first to see the command buttons.
  - **On Hover**: This option means that tooltips appear only after you rest the cursor on a mark. However, with this option, command buttons appear on the tooltip

without any further action from you (unless you specify otherwise in the Edit Tooltips dialog box).

- **Show commands:** Select the **Include command buttons** check box to add **Keep Only**, **Exclude**, and **View Data** buttons to the bottom of the tooltip. These command buttons are available both in Tableau Desktop and when the view is published to the web or viewed on a mobile device.
- **Add or remove fields:** To add and remove fields when using the automatic tooltip, right-click (control-click on Mac) the field on one of the shelves in the view and select **Include in Tooltip**.



> **Note:** The **Include in Tooltip** option is only available if you have not customized the tooltip. If you have customized the tooltip, you can return to the automatic tooltip by clicking **Tooltip** on the Marks card and then clicking **Reset** in the Edit Tooltip dialog box.

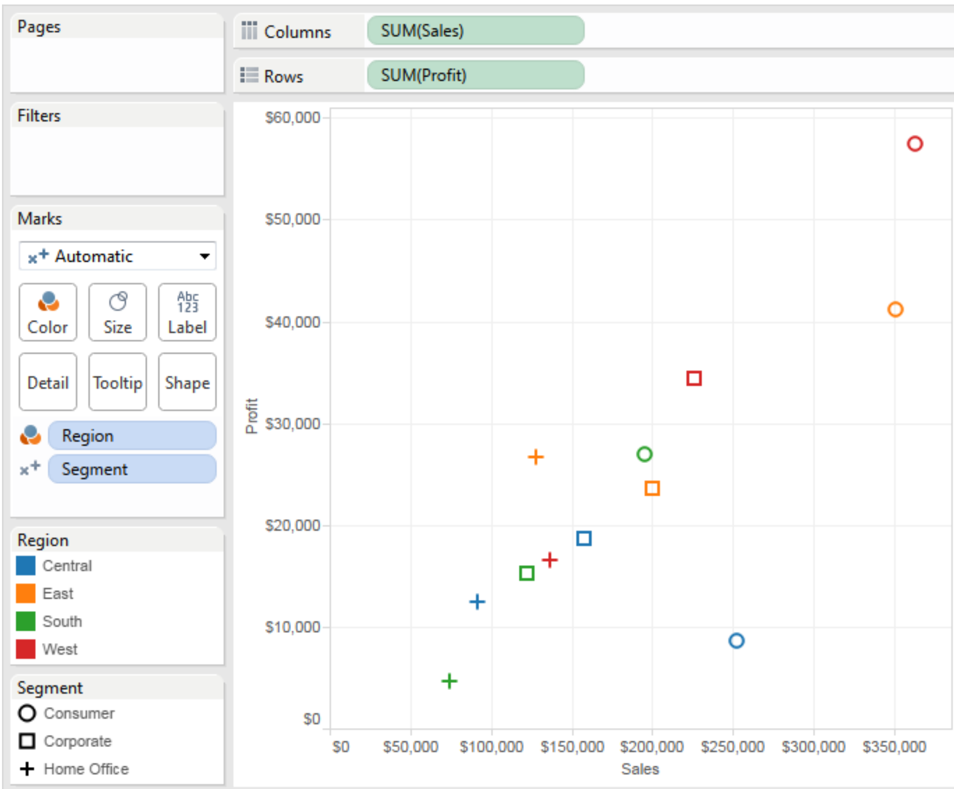
Shape Properties

The Shape property allows you to encode data by assigning different shapes to the marks in a data view.

When you place a dimension on **Shape** on the Marks card, Tableau separates the marks according to the members in the dimension, and assigns a unique shape to each member. Tableau also displays a shape legend, which shows each member name and its associated shape. When you place a measure on **Shape** on the Marks card, the measure is converted to a discrete measure.

Shape-encoding data separates the marks in the same way as the Detail property does, and then provides additional information (a shape) for each mark. Shape is the default mark type when measures are the inner most fields for both the **Rows** shelf and the **Columns** shelf.

In the view below, the marks are separated into different shapes according to the members of the **Customer Segment** dimension. Each shape reflects the customer segment's contribution to profit and sales.

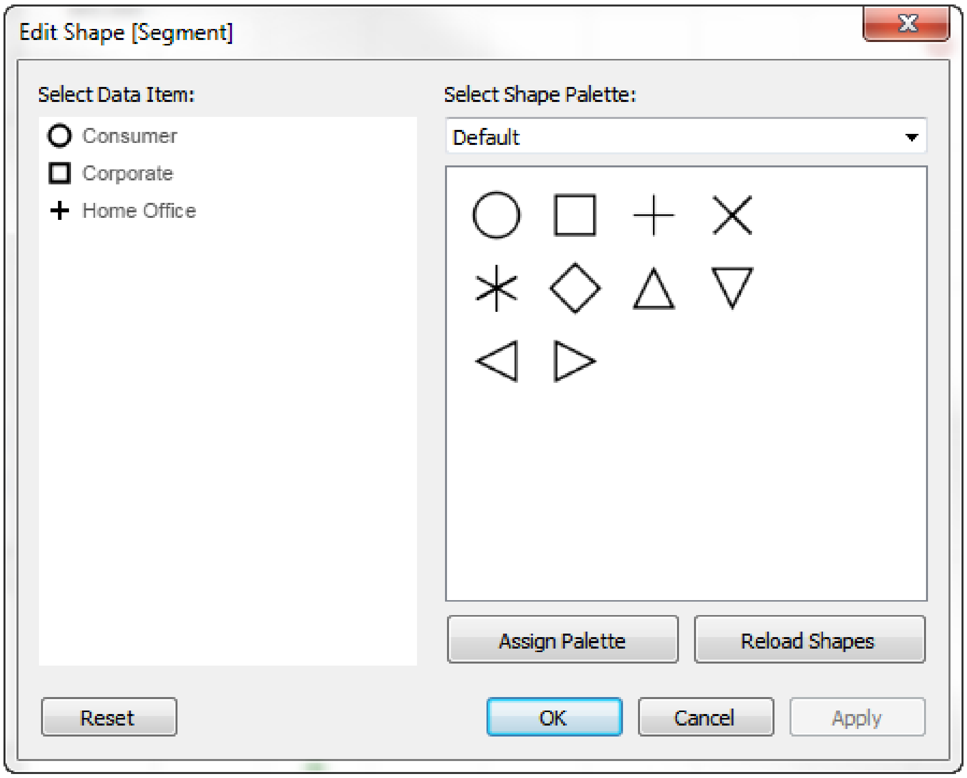


Editing Shapes

By default, ten unique shapes are used to encode dimensions. If you have more than 10 members, the shapes repeat. In addition to the default palette, you can choose from a variety of shape palettes, including filled shapes, arrows, and even weather symbols.

1. Click **Shape** on the Marks card, or select **Edit Shape** on the legend's card menu.
2. In the Edit Shape dialog box, select a member on the left and then select the new shape in the palette on the right. You can also click **Assign Palette** to quickly assign the

shapes to the members of the field.



Select a different shape palette using the drop-down menu in the upper right.

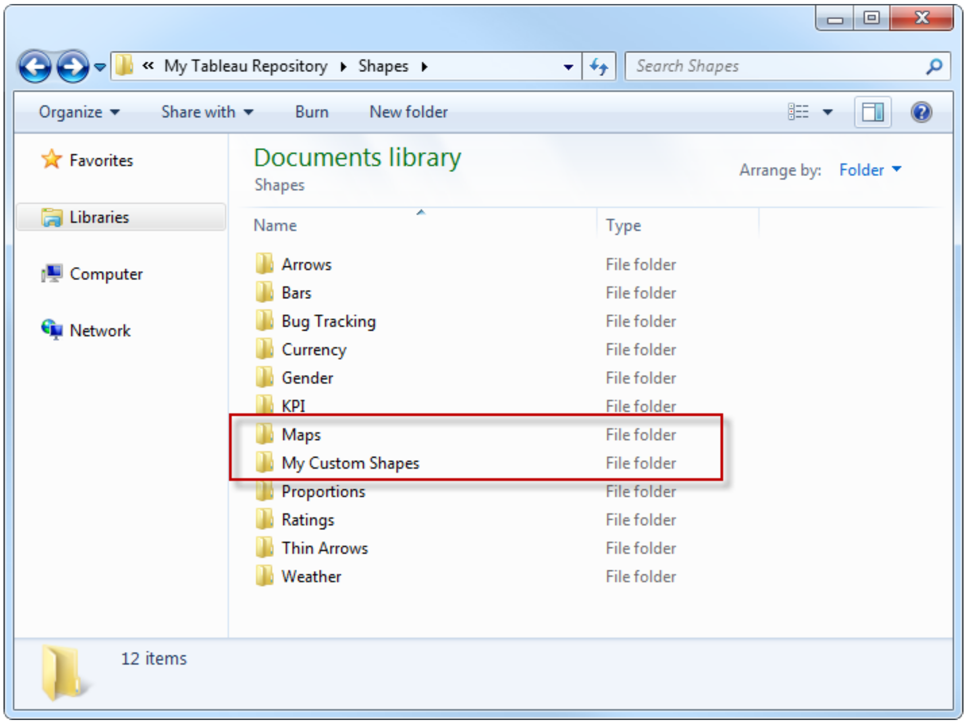
Note: Shape encodings are shared across multiple worksheets that use the same data source. For example, if you define Furniture products to be represented by a square, they will automatically be squares in all other views in the workbook. To set the default shape encodings for a field, right-click (control-click on Mac) the field in the **Data** pane and select **Default Properties** > **Shape**.

Custom Shapes

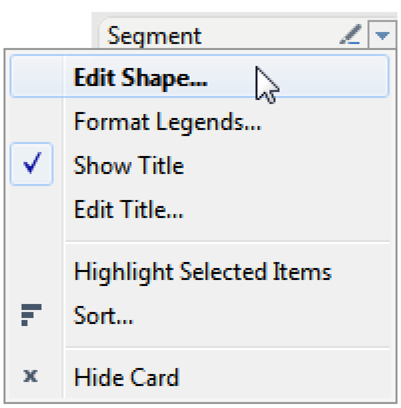
You can add custom shapes to a workbook by copying shape image files to the Shapes folder in your Tableau Repository, which is located in your Documents folder. When you use custom shapes, they are saved with the workbook. That way the workbook can be shared with others.

1. Create your shape image files. Each shape should be saved as its own file and can be in any of several image formats including bitmap (.bmp), portable network graphic (.png), JPEG, graphics interchange format (.gif).
2. Copy the shape files to a new folder in the My Tableau Repository\Shapes folder in your Documents folder. The name of the folder will be used as the name of the palette in

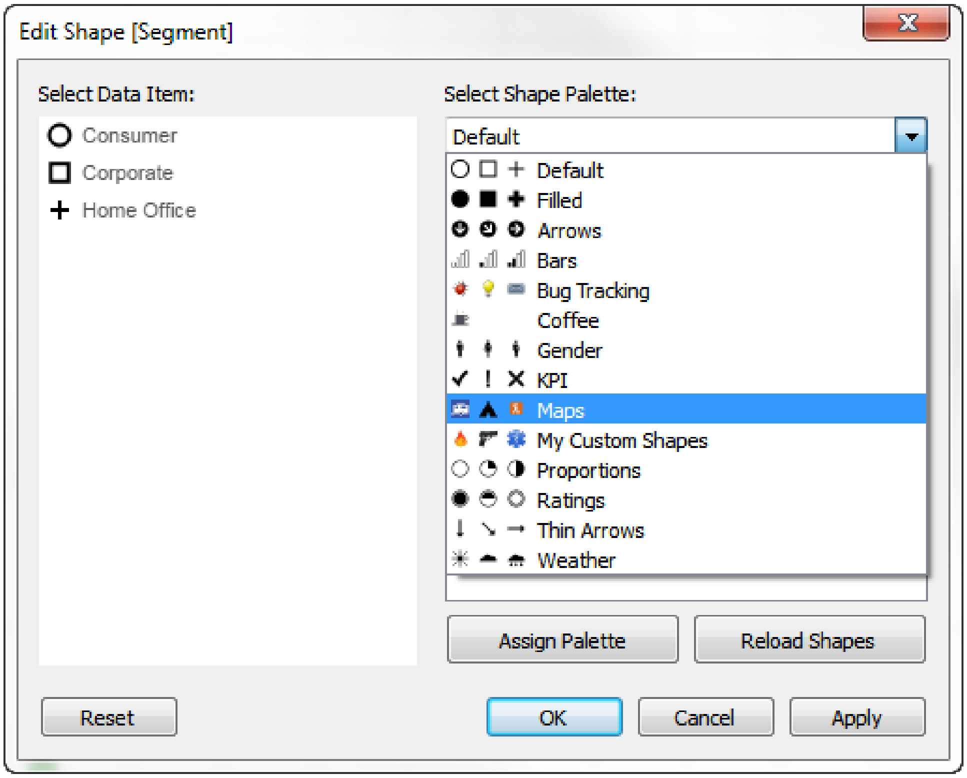
Tableau. In the example below, two new palettes are created: Maps and My Custom Shapes.



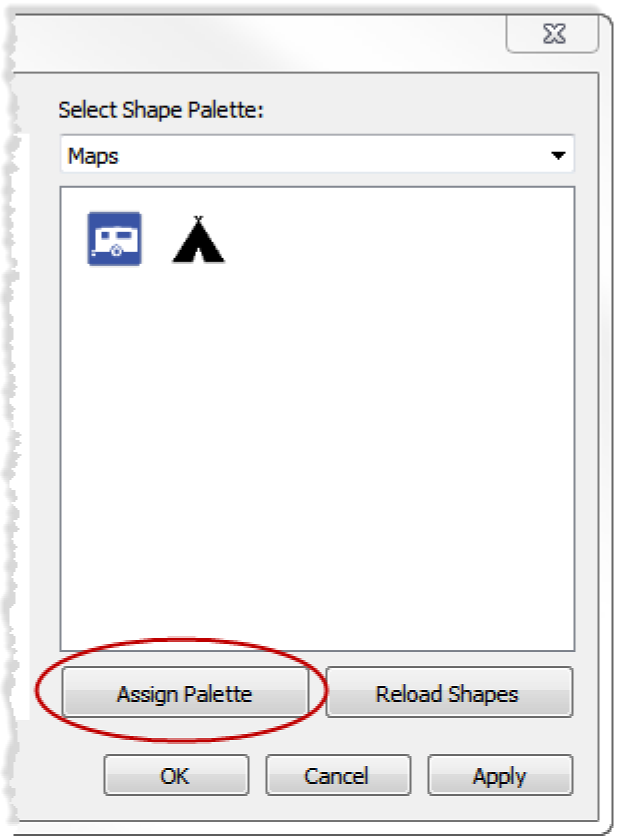
3. In Tableau, right-click (control-click on Mac) the shape legend, and choose **Edit Shape**.



4. Choose the new custom palette in the drop-down list. If you modified the shapes while Tableau was running, you may need to click **Reload Shapes**.

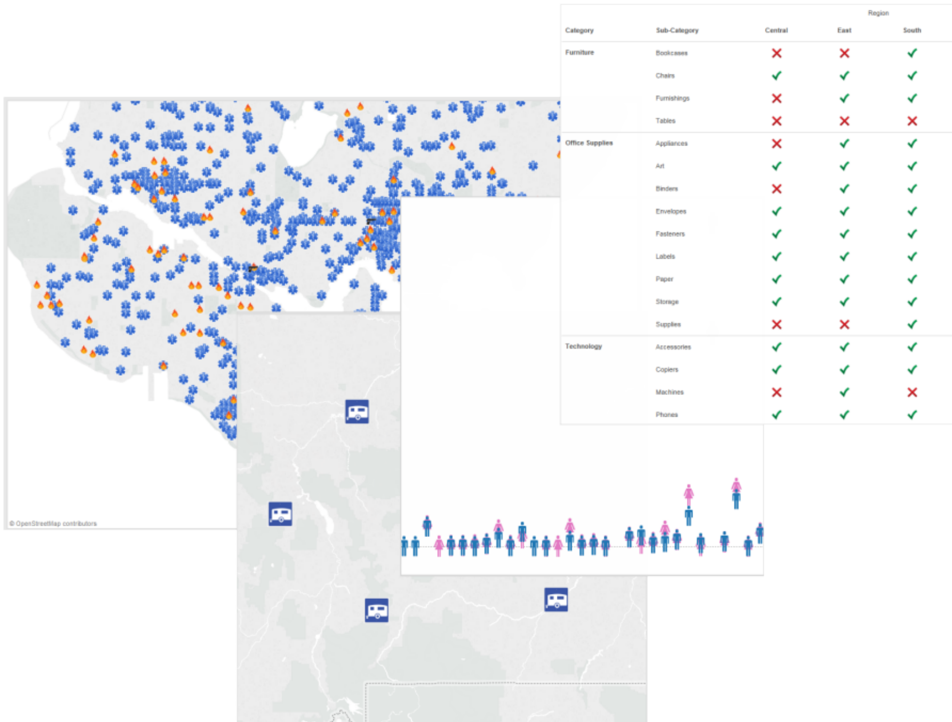


5. You can either assign members shapes one at a time, or click **Assign Palette** to automatically assign the shapes to the members.



Note: You can return to the default palette by clicking the **Reset** button. If you open a workbook that uses custom shapes that you don't have, the workbook will show the custom shapes because the shapes are saved as part of the workbook. However, you can click **Reload Shapes** in the Edit Shapes dialog box to use the ones in your repository instead.

Below are some examples of views that use both the default and custom shape palettes.



Tips for Creating Custom Shapes

When you create custom shapes there are a few things that you can do to improve how your shapes look and function in the view. If you are creating your own shapes, we recommend following general guidelines for making icons or clip art.

- **Suggested Size** - Unless you plan on using Size to make the shapes really large, you should try to make your original shape size close to 32 pixels by 32 pixels. However, the original size is dependent on the range of sizes you want available in Tableau. You can resize the shapes in Tableau by clicking Size on the Marks card, or by using the cell size options on the **Format** menu.
- **Adding Color Encoding** - If you plan to also use Color to encode shapes, you should use a transparent background. Otherwise, the entire square of the image will be colored rather than just the symbol. GIF and PNG file formats both support transparency. GIF files support transparency for a single color that is 100% transparent, while PNG files support alpha channels with a range of transparency levels available on every pixel in the image. When Tableau color encodes a symbol, the amount of transparency for each pixel will not be modified, so you can maintain smooth edges.
- **File Formats** - Tableau does not support symbols that are in the Enhanced Meta File format (.emf). The shape image files can be in one of the following formats: .png, .gif, .jpg, .bmp, and .tiff.

Path Properties

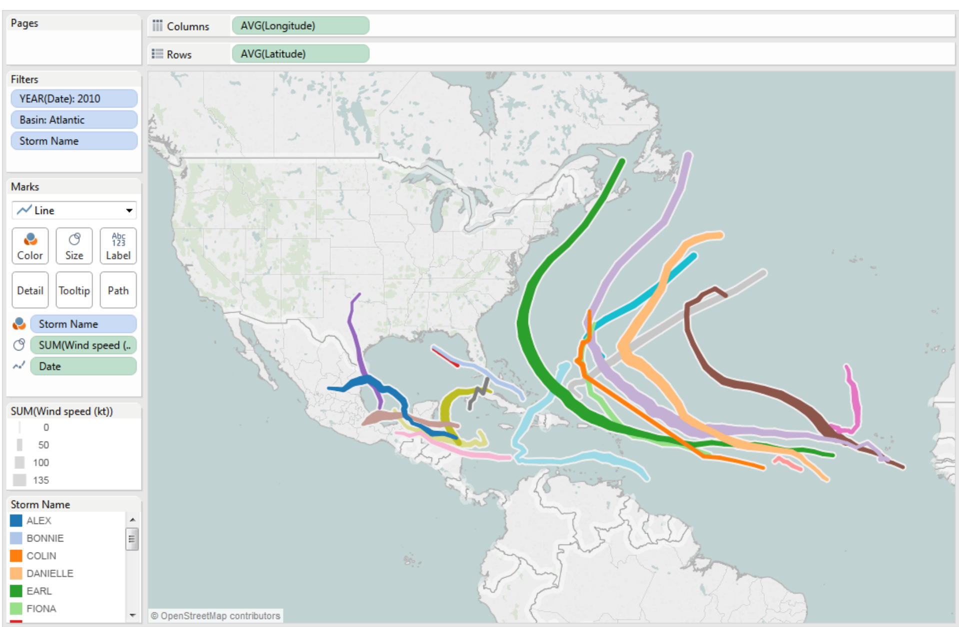
The Path property allows you to encode data by connecting marks using a particular drawing order. You can path-encode your data using either a dimension or a measure.

- Dimension – When you place a dimension on **Path** on the Marks card, Tableau connects the marks according to the members in the dimension. If the dimension is a date, the drawing order is given by the date order. If the dimension holds words such as customer names or product types, the drawing order is given by the order of the members in the data source. You can change the order by which data points are connected by changing the sort order of the members. Fore more information, see Sorting.
- Measure – When you place a measure on **Path** on the Marks card, Tableau connects the marks according to the values of the measure. The measure can be aggregated or disaggregated.

The Path property is available only when you select the **Line** or **Polygon** mark type from the Marks card drop-down menu. Fore more information, see **Mark Types** on page 431 .

To create a useful path-encoded view, your data table should contain at least one measure. This is because you cannot create a path that connects only categorical data (dimensions).

The view below was created using storm data from the Atlantic basin in 2010. The view uses line marks with the path determined by the date of the storm. This lets you see the path of the storm. By placing the continuous date on **Path** on the Marks card, you specify that the lines are to be drawn in chronological order.



Move Marks

In a dual-axis view that contains many marks, some marks can become hidden behind others, making it difficult to see details in your view. Tableau provides a **Move Marks** option to move selected marks forward or backward, depending on the axis that you select.

To move marks forward or backward, right-click on one of your axes and select one of the following options:

- **Move Marks to Front**
- **Move marks to Back**

Example - Move marks forward

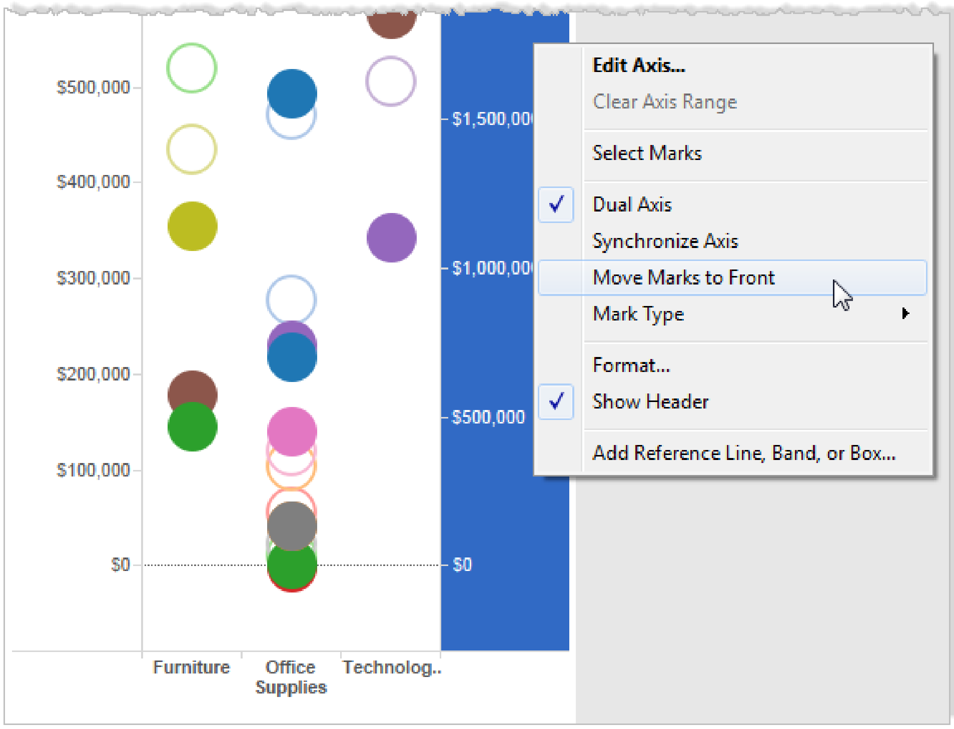
In this example, suppose you have a view that uses the **Circle** mark type on a dual axis and shows department **Sales** and **Profit** for each **Category**.

The shape of each mark represents **Sales** and **Profit**, while **Category** is encoded as **Color**. The right axis represents the **Sales** mark, while the left represents the **Profit** mark.

Because the profit marks are in front, it is difficult to see the **Sales** marks in the **Office Supplies** category.

To move the **Sales** marks in front of the **Profit** marks, do the following:

1. Right-click on the **Sales** axis.
2. Select **Move Marks to Front** from the context menu.

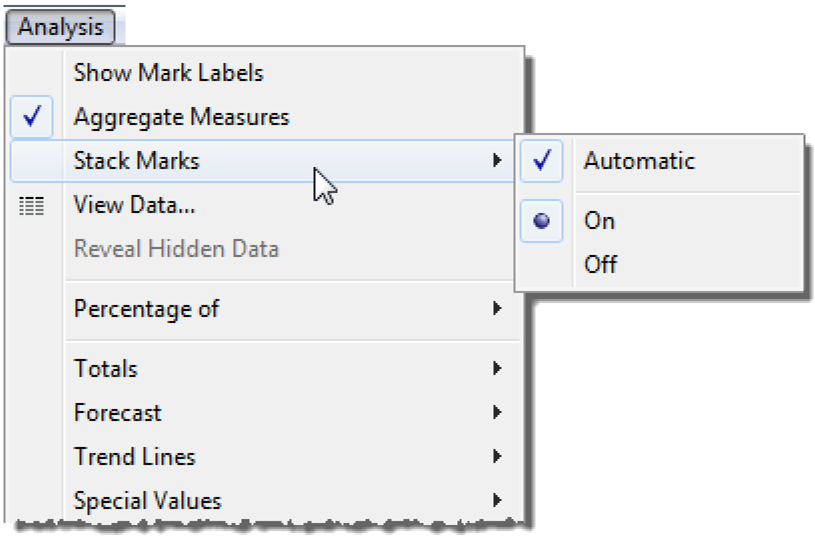


By moving the **Sales** mark to the front, you can now see that rubber bands are below $100,000 in sales, whereas they were nearly invisible before.

Stack Marks

Stacking marks is relevant when your data view includes numeric axes. That is, at least one measure has been placed on the **Rows** or **Columns** shelves. When marks are stacked, they are drawn cumulatively along an axis. When marks are not stacked, they are drawn independently along an axis. That is, they are overlapping.

Stacking marks is particularly useful for bar charts which is why Tableau automatically stacks bars. You might find that stacking marks is useful for other marks such as lines as well. You can control whether marks are stacked or overlapping in any given view by selecting the **Analysis** > **Stack Marks** menu item. You can either allow Tableau to automatically select whether the marks are stacked or you can specify **On** or **Off**. The default setting is **Automatic**. When you are in automatic mode, the Stack Marks menu shows whether stacked marks is on or off.

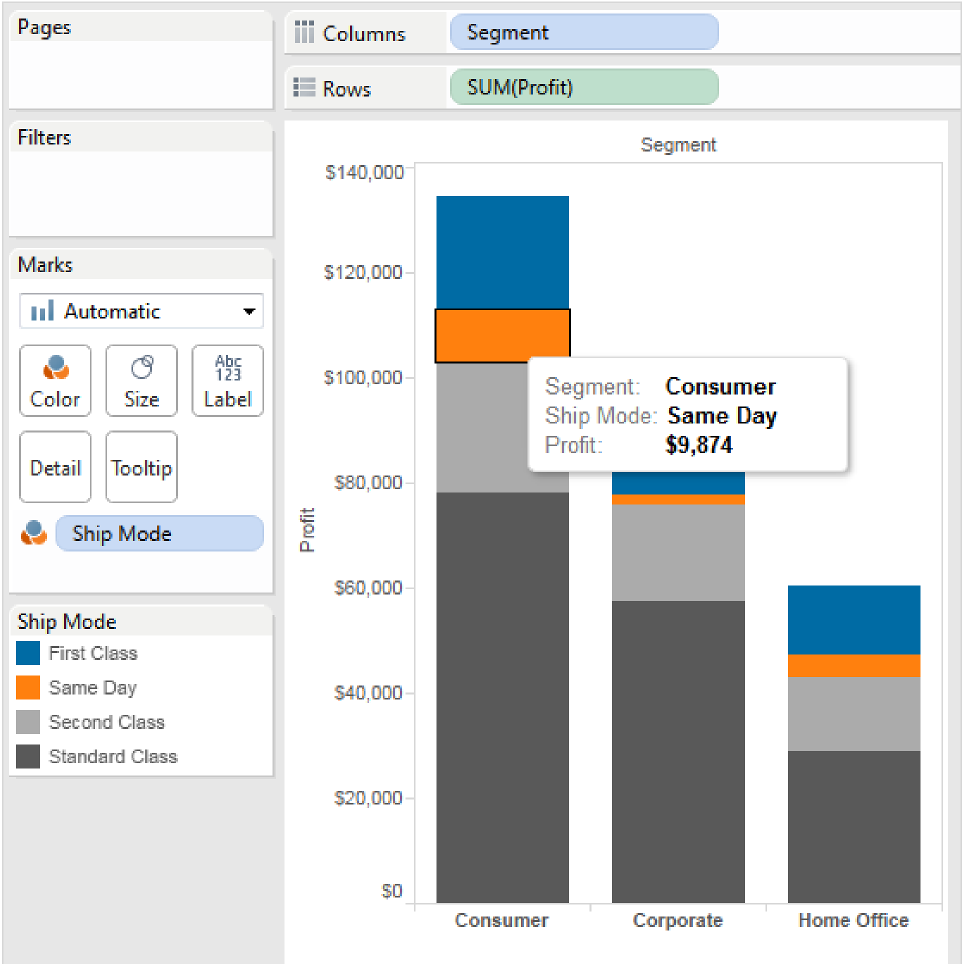


Selecting **On** or **Off** on the **Stack Marks** menu,switches into manual mode. Your selection remains throughout any changes you make to the view.

The following examples illustrate stacking marks.

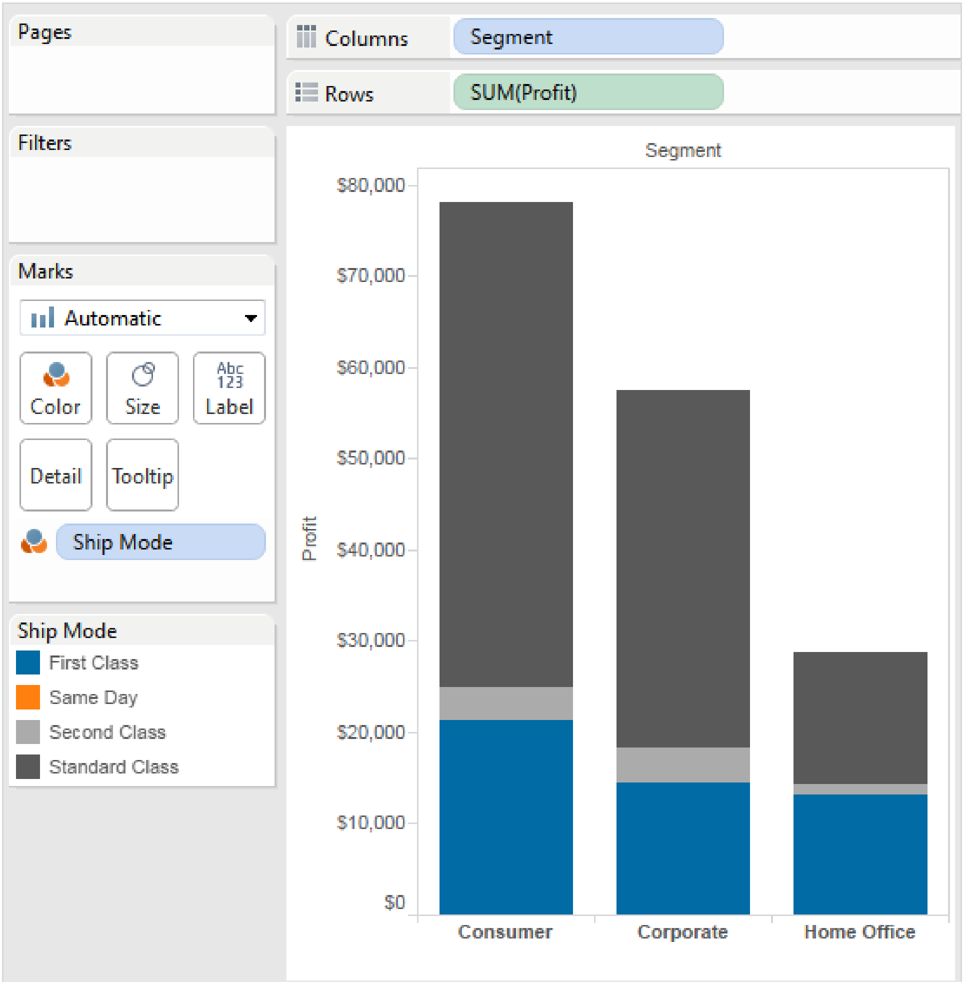
Example – Stacking Bars

Consider the stacked bars view shown below. It was created by placing a dimension on the **Columns** shelf, placing a measure on the **Rows** shelf, and color-encoding the data by a dimension (that is, dropping a dimension on **Color** on the Marks card).



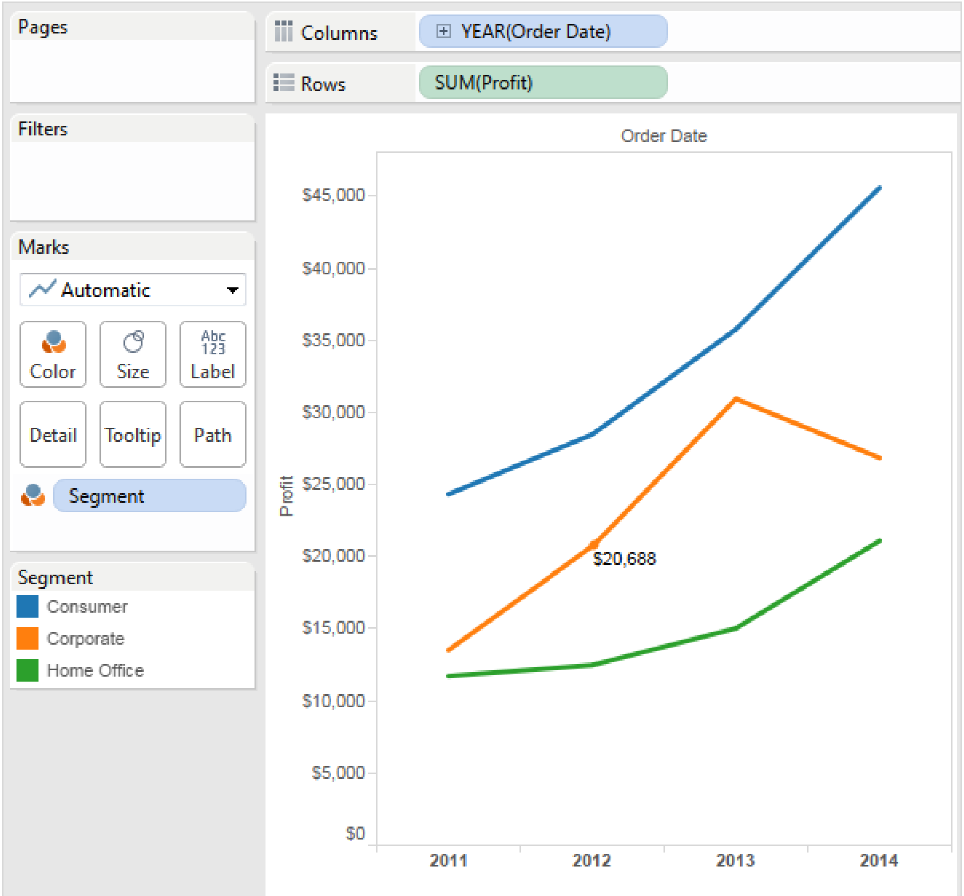
Because the mark type is a bar, Tableau automatically stacks the marks. This means that the marks are drawn cumulatively and the height of each stacked segment within each bar represents the value for that segment. For example, the sum of the profit for products shipped with Same Day shipping (orange bar segment) in the Consumer market is $9,874.

If you un-stack the marks, they all start from the horizontal axis. As shown below, you can still view the individual bar segments. Be aware, however, because un-stacked marks overlap, it is possible to create a view where bar segments are not visible. For example, in the view below, Same Day shipping (orange bar segment) is no longer visible in the view for any market.



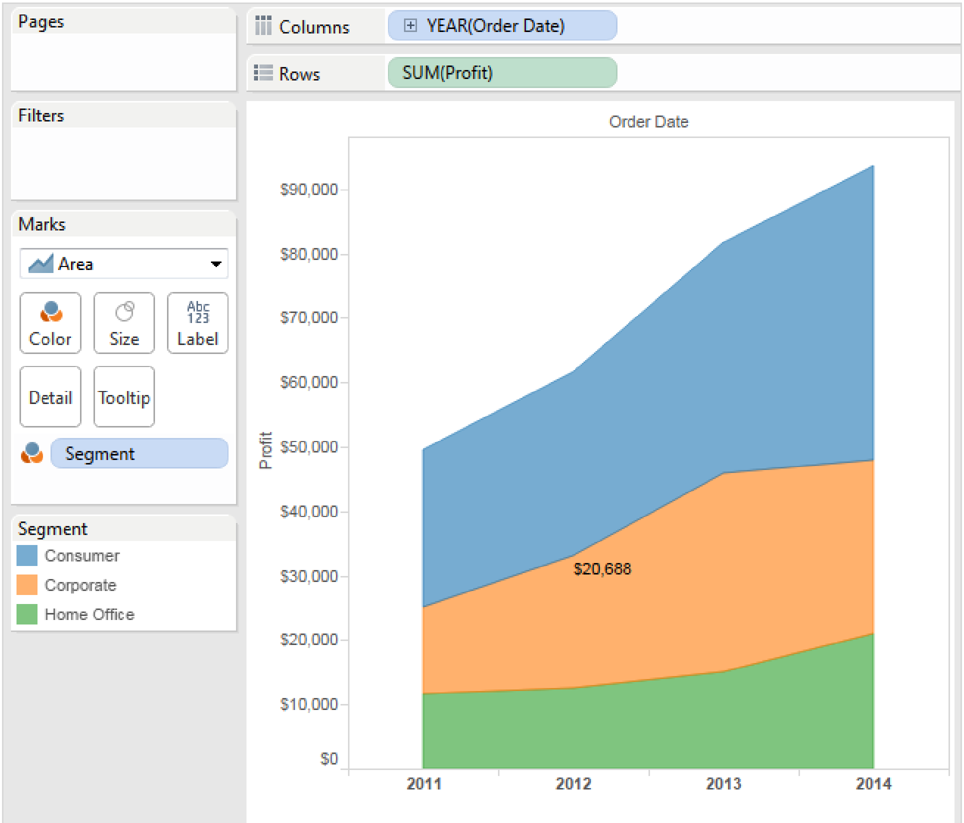
Example – Stacking Lines

Consider the data view shown below. It was created by placing a date dimension on the **Columns** shelf, placing a measure on the **Rows** shelf, and color-encoding the data by a dimension (that is, dropping a dimension on **Color** on the Marks card). Because the mark type is Line, the marks are not automatically stacked. Instead, they are drawn independently from the horizontal axis.



Interpret any data point by reading the associated values from the horizontal and vertical axes. For example, in the year 2012, the Corporate (orange) sales totaled $20,688. That is, the space between that data point and the horizontal axis is equal to the sum of the sales for the Corporate market.

Now, stack the marks by selecting the **Analysis** > **Stack Marks** > **On** menu item. Tableau automatically switches to the Area mark type.



In this view, the lines are no longer independent of each other. Instead, they are drawn cumulatively. The stacking order is given by the order of the dimension members in the data source. This order is reflected in the color legend, from bottom to top.

Therefore, the stacked Home Office (green) area is the same as its un-stacked version because it's at the bottom of the stacking list. The stacked Corporate (orange) area is derived by adding its un-stacked values to the un-stacked Home Office values. The stacked Consumer (blue) area is derived by adding its un-stacked values to the stacked Corporate data.

The vertical axis gives the new scale for the stacked marks. Interpret the filled area as the sum of the profit.

For example, notice that the label for the 2012 Corporate data still shows the profit as $20,688. The interpretation is that the space between the Corporate data and the Home Office data yields the sum of the profit for the Corporate market.

Titles

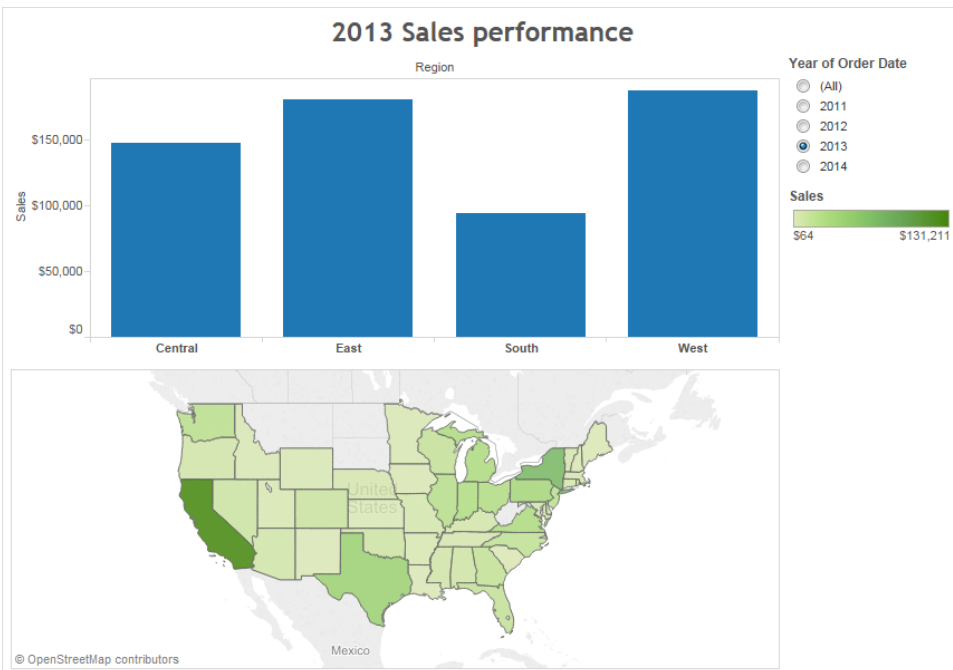
You can add a title to any worksheet or dashboard. For stories, a title is displayed by default but can be removed.

The title for any kind of sheet is displayed on a Title card.

Show and Hide Titles

For a worksheet, select **Worksheet** > **Show Title** or click the View Cards  icon on the toolbar, and then select the **Title** card.

On a dashboard, select **Dashboard** > **Show Title**.



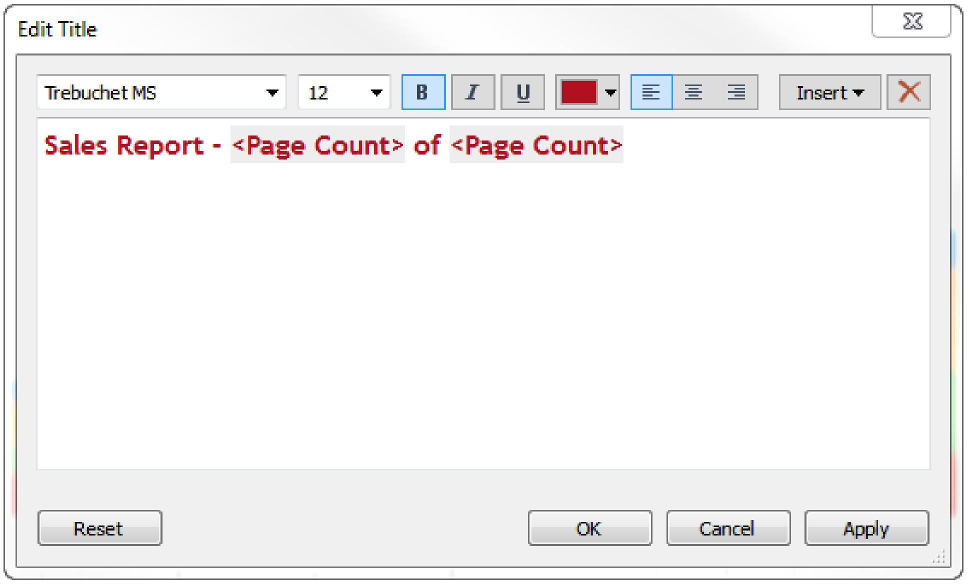
By default, the title is the name of the sheet. Edit the title to change the text and include dynamic values such as page number and sheet name.

For a story, select **Story** > **Show Title** to add or remove a check mark. Story titles are displayed by default.

Edit Titles

1. Right-click (control-click on Mac) the title and select **Edit Title** or double-click the title itself.
2. In the Edit Title dialog box, type a new title. Use the Insert menu to add automatic text

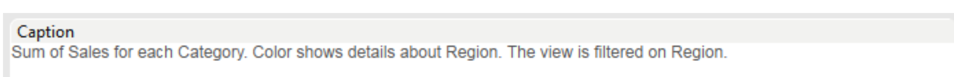
such as page number, sheet name, parameter values, and so on. Use the formatting options along the top of the dialog box to change the font, color, style, and alignment.



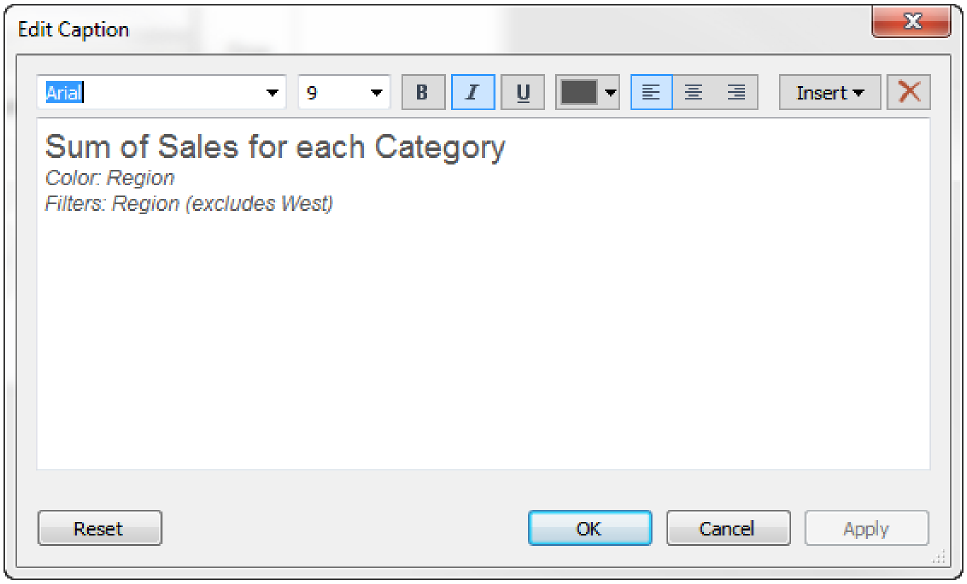
Reset the title back to the default by clicking **Reset** in the Edit Title dialog box.

Captions

All views can have a caption that is either automatically generated or manually created. The caption is displayed on the Caption card. To show the caption, select it on the **View Cards** toolbar menu  or select **Worksheet** > **Show Caption**.



The caption is automatically generated by default. However, you can edit the caption by double clicking the Caption card. In the Edit Caption dialog box, you can use change the font, size, color, and alignment and style.

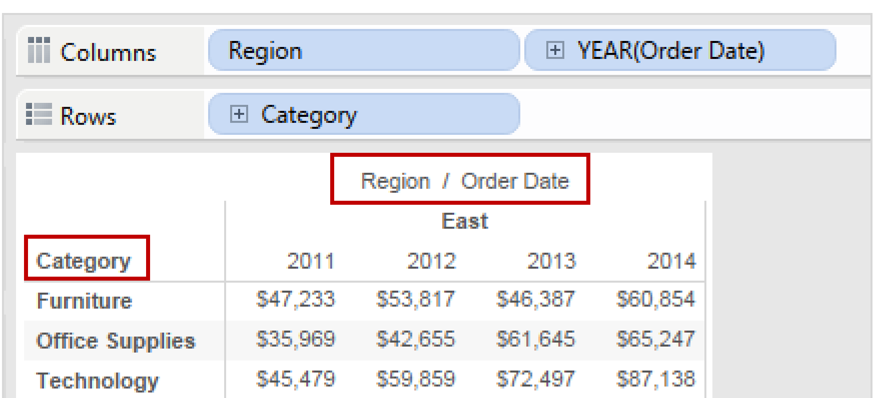


Use the Insert menu to add automatic text such as page number, sheet name, and field and parameter values.

The caption can optionally be included when printing, printing to PDF, and publishing to Tableau Server. When you export the view as an image to another application like Microsoft PowerPoint, you can optionally include the caption.

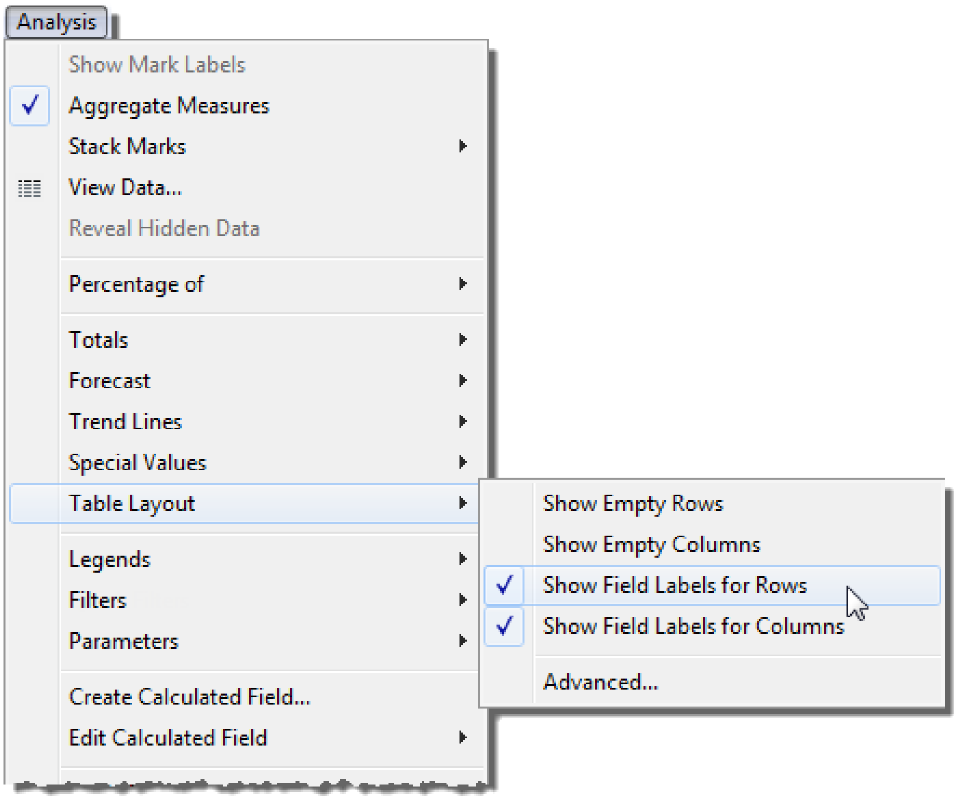
Field Labels

Placing discrete fields on the rows and column shelves creates headers in the view that display the members of the field. For example, if you place a field containing products on the rows shelf, each product name is shown as row headers. In addition to showing these headers, you can show field labels, which are labels for the headers. In this example, the rows are labeled **Category**, thus indicating that the discrete category names are members of the **Category** field.



Field labels apply only to discrete fields. When you add continuous fields to the view, Tableau creates an axis. The axis is labeled with a header.

By default, field labels are shown. You can hide or show field labels at anytime by selecting **Analysis** > **Table Layout** > **Show Field Labels for Rows** or **Show Field Labels for Columns**.

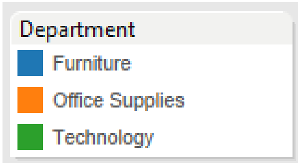


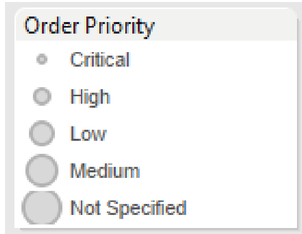
You can format the fonts, alignment, shading, and separators for field labels.

Legends

When you add fields to Color, Size, and Shape on the Marks card, a legend displays to indicate how the view is encoded with relation to your data.

Color Legend **Size Legend** **Shape Legend**





Not only do legends help you understand encodings, you can also use legends to sort, filter, and highlight specific sets of data.

Building Views Manually

Building views in Tableau can be really easy if you understand some basic concepts of how it all works.

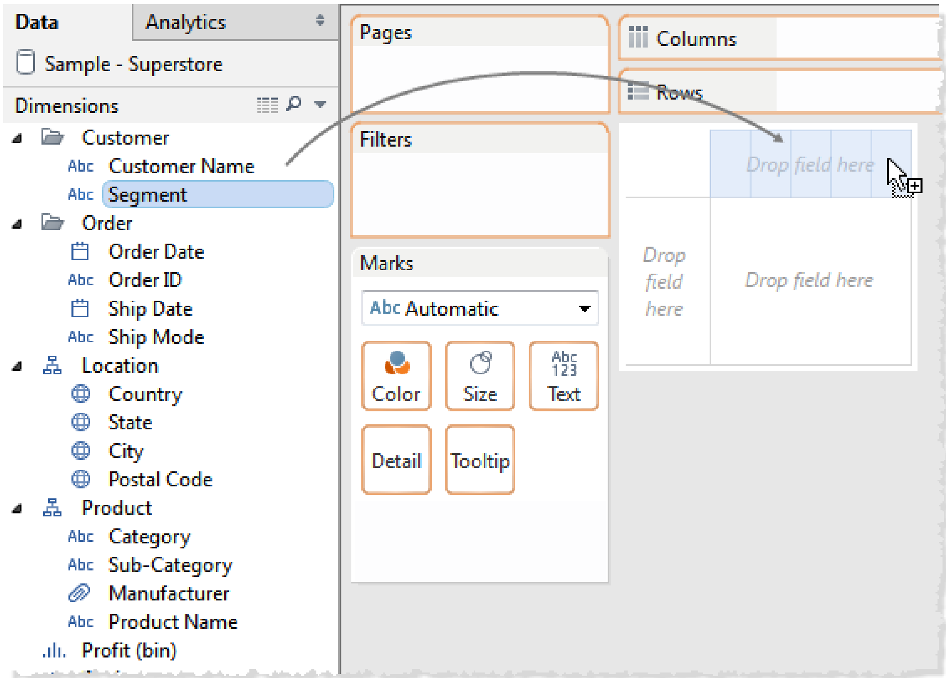
To try some hands-on exercises for building views, see **Build-It-Yourself Exercises** on page 539.

Dragging Fields

You can build views of your data by dragging fields from the Data pane to the view. You can drag fields to a variety of active areas in the view or place them on the shelves and cards that are part of every worksheet.

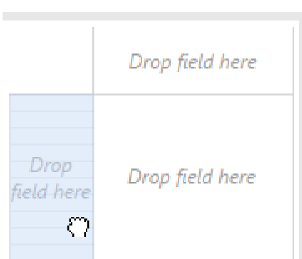
The Basics

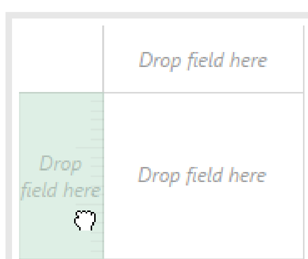
When you begin creating a new data view on a blank worksheet, you can drag a field from the **Data** pane and drop it directly into the view, rather than to a shelf.

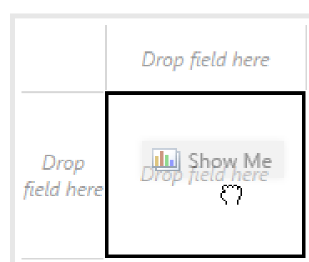


While dragging fields you can hover over the different areas in the view to see how the field will be incorporated into the structure of the view. For example,dimensions typically add a row and column headers to the view, while measures add continuous axes. Below are some examples of how fields can be added to the view.

Dimensions add headers	Measures add axes	Show Me automatically adds the field according to best practices

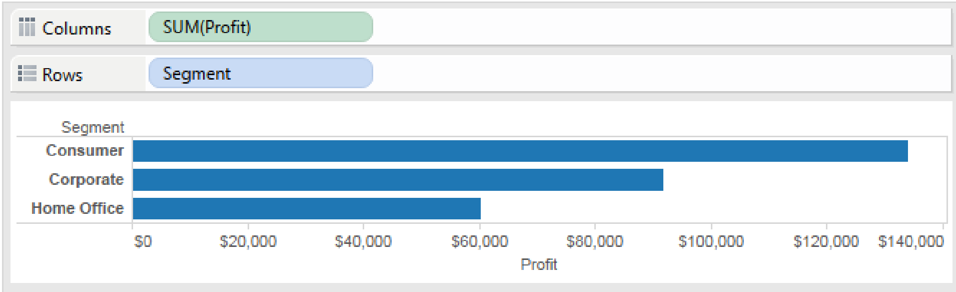






For a more advanced discussion of dimensions and measures, see **Dimensions and Measures** on page 186.

When you drop a field on one of the active areas in the view, the field is added to the view and also to one of the shelves or cards. For example, in the view below the **Segment** dimension was added to the **Rows** shelf and the **Profit** measure was added to the **Columns** shelf—and automatically aggregated so that the values in the data are summed.



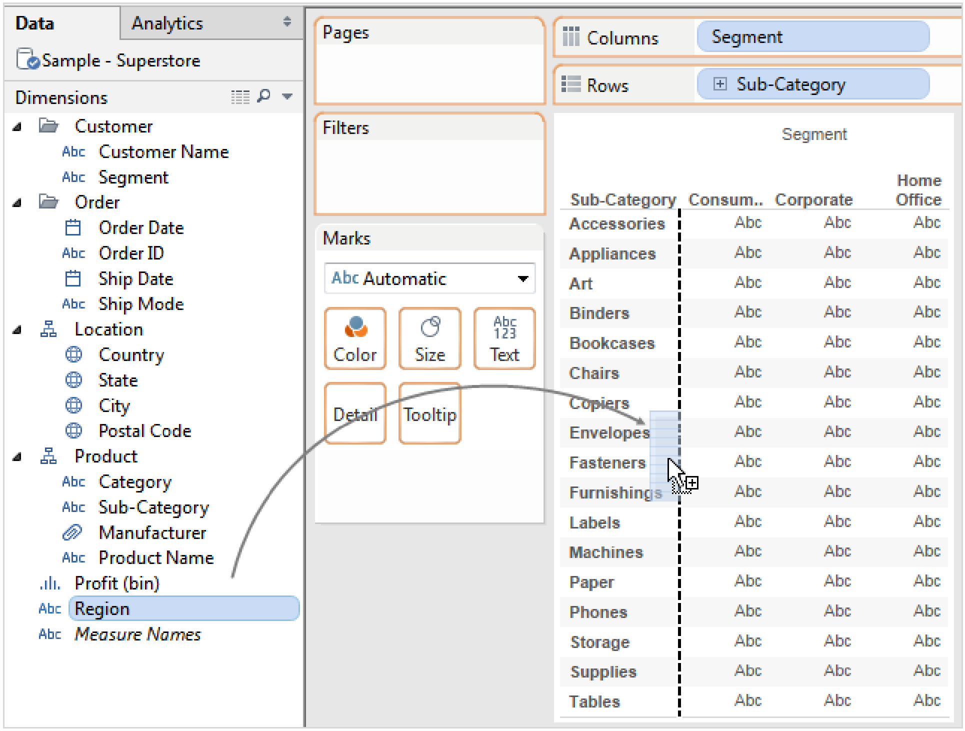
You can, of course, also drag fields directly to the shelves instead of to the active areas in the view. You can also drag fields from one shelf to another shelf. To remove a field from a shelf, drag it off the worksheet or select **Remove** from the field's menu (available when you right-click (control-click on Mac) a field in the view. To quickly remove multiple fields from a shelf, right-click (control-click on Mac) the shelf and select **Clear Shelf**.

Adding More Fields

You can add as many fields as necessary by dragging and dropping them on the different areas of the view. Once there are more fields in the view there are some extra options available. For example you can replace fields by dropping them on existing headers and axes in the view. Or, instead of replacing a field you can add measures to an existing axis. Finally, you can rearrange the rows and columns in the view.

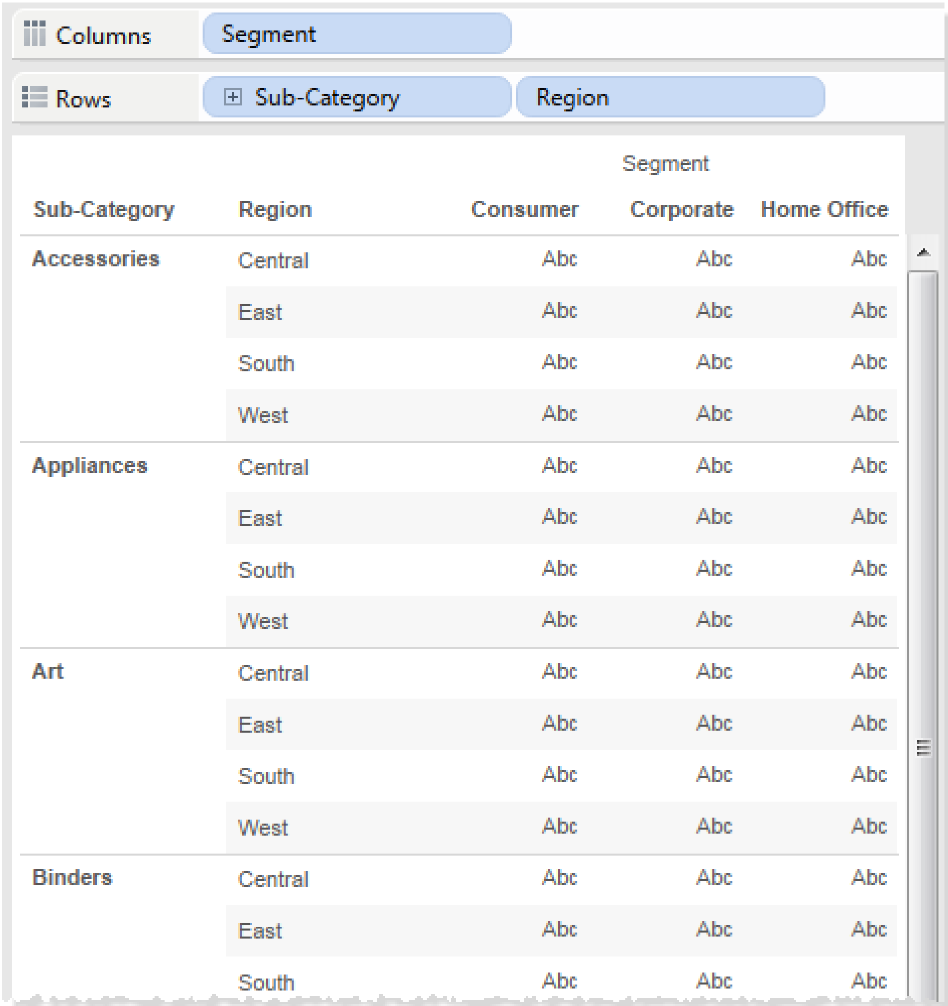
Adding Headers Using Dimensions

You can add headers to a view by dragging a dimension and dropping it to either side of an existing header, or to the left of an axis. For example, in the view below you can add the **Region** dimension by dragging it and dropping it to the right of the Sub-Category names.



As you hover over the view, a dotted black line indicates active areas where you can add headers.

If you drop **Region** there, it adds a column for Region along the top of the table, and slices the data so that you see results for each region within each sub-category.

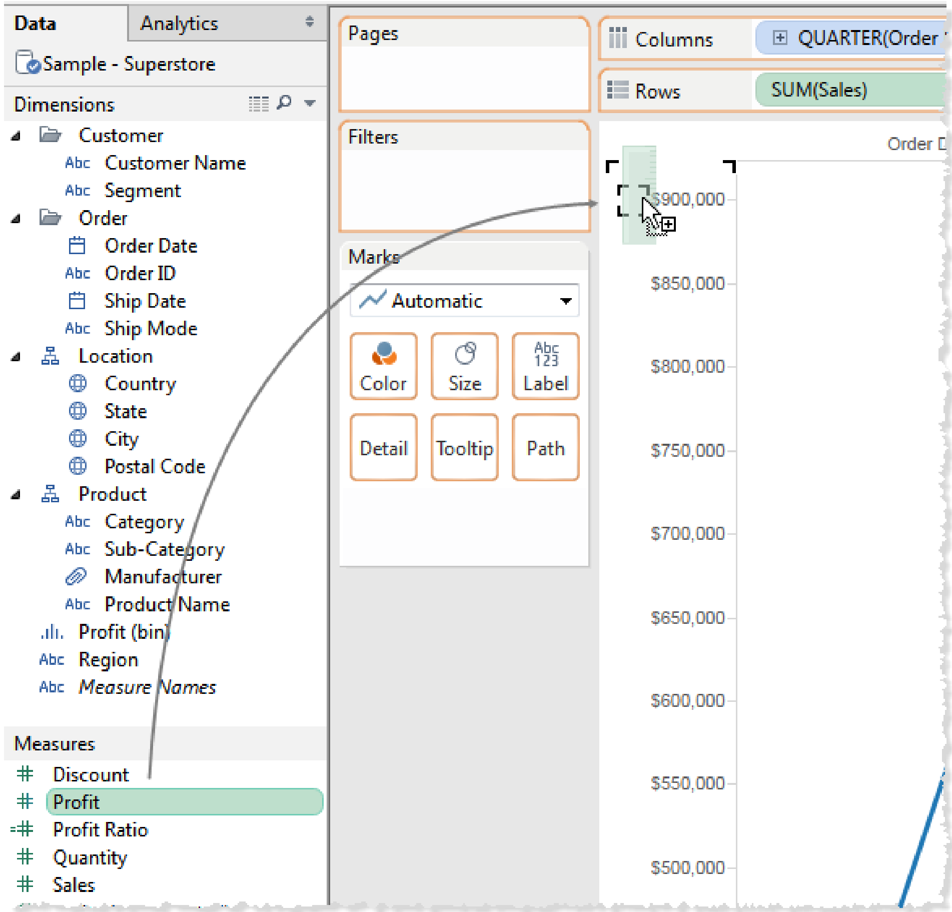


Adding Axes Using Measures

You can add axes by dragging a measure and dropping it on an active area in the view. If an axis already exists in the view you can replace the existing axis, blend the new measure with the existing axis, or add a secondary axis.

Replace the Existing Axis

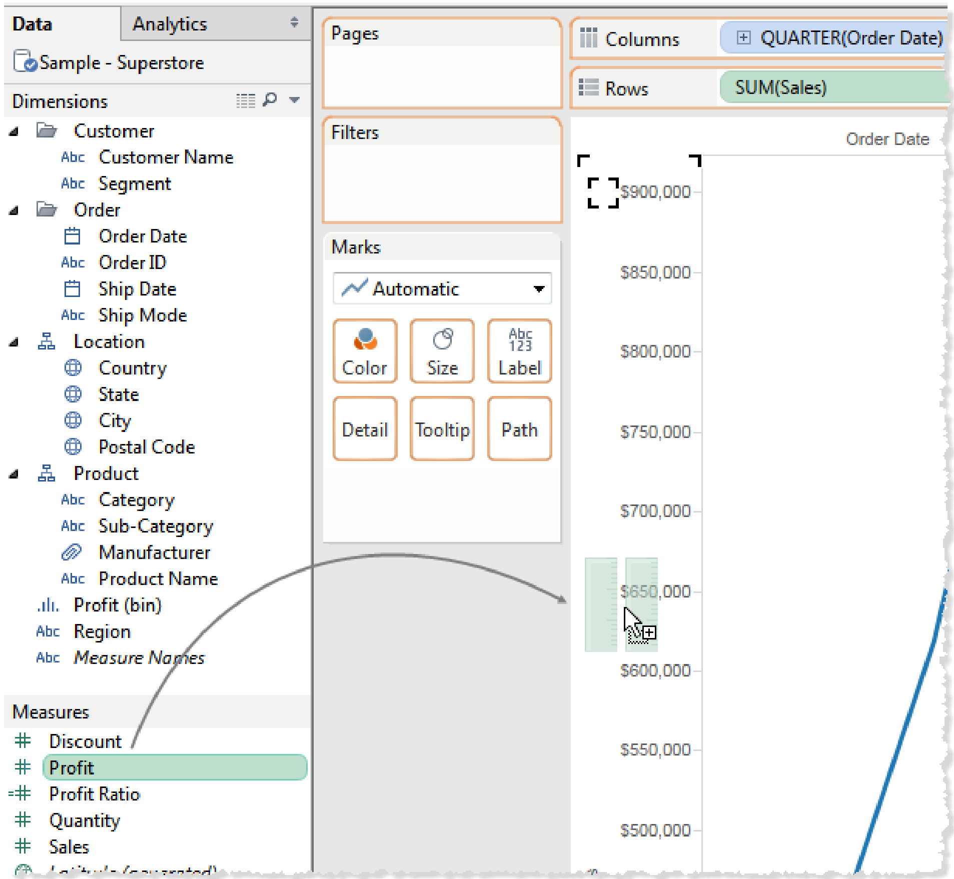
Drag the new measure to the top left portion of the axis in the view. A small square drop zone appears and a single axis icon displays to indicate that a single axis will be left when you drop the measure. In this case you are replacing one measure (**Sales**) with another (**Profit**).



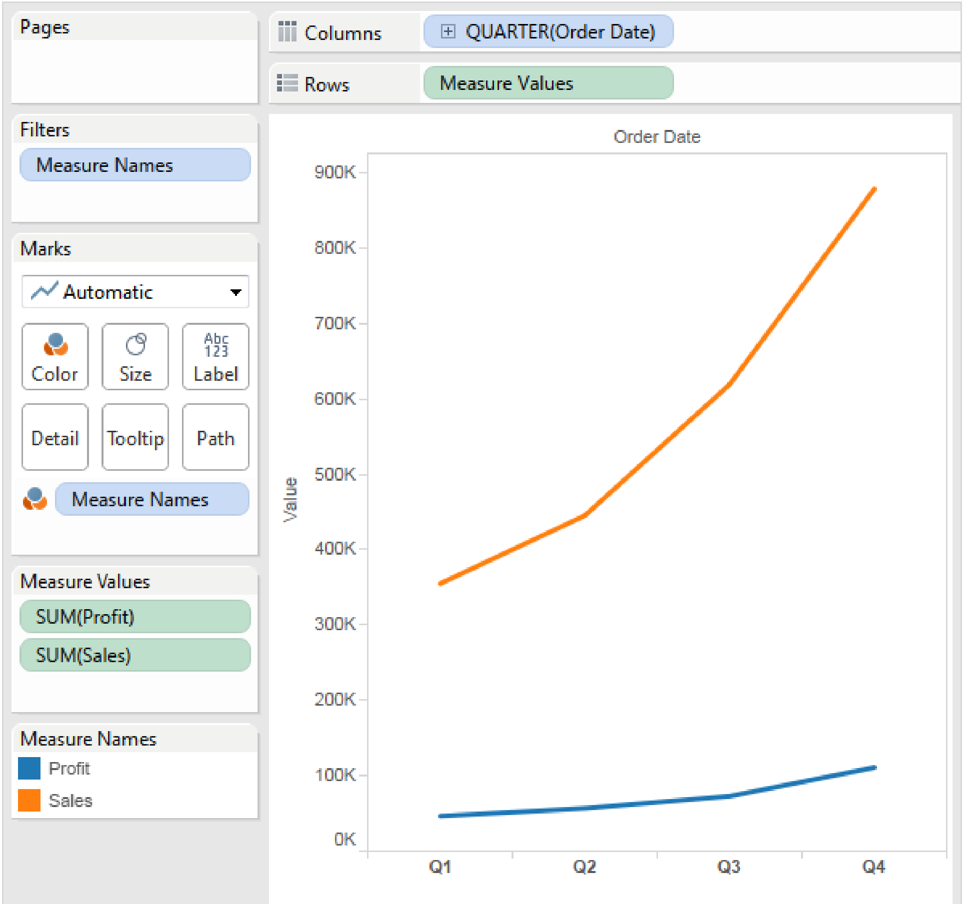
Blend the Measures on Single Axis

You can show multiple measures on a single axis by dragging the new measure directly on top of the existing axis. Blending measures uses the Measure Names and Measure Values fields. For more information, see **Measure Values and Measure Names** on page 217.

In the image below you are adding a second measure (**Profit**) to the existing measure (**Sales**) on the axis.

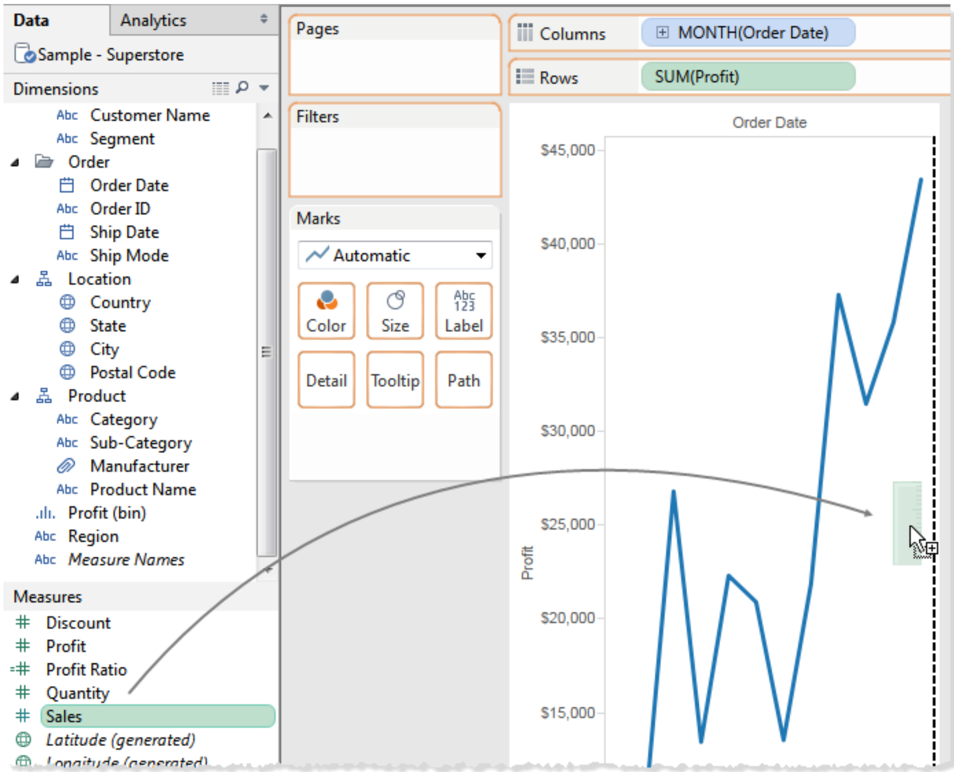


The result is a view with both measures plotted along a single axis. In this case, Sales is shown in orange and Profit is shown in blue.

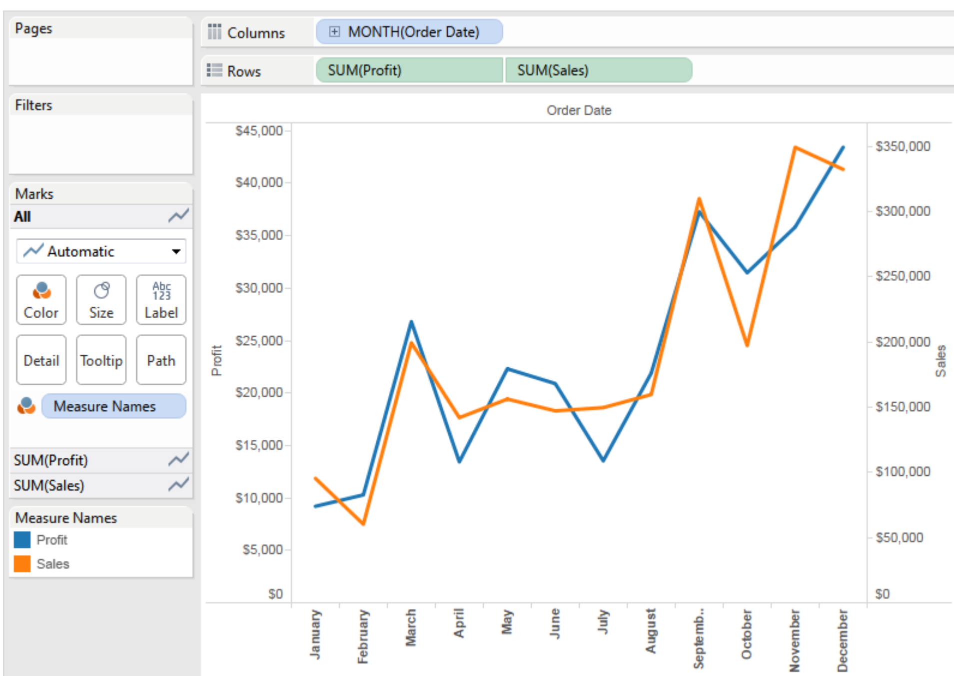


Add a Dual Axis

Drag the field to the right side of the view to add the measure as a dual axis. Dual Axes are useful when you want to compare two fields that have different scales. In this case, blending the two axes would distort the view. Instead you can add a dual axis.



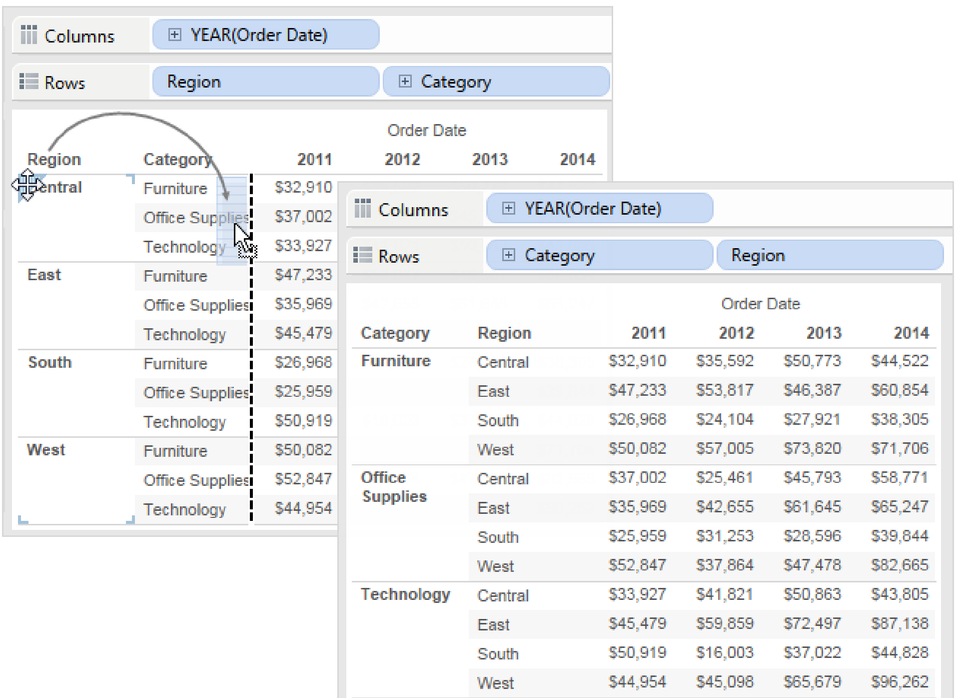
The result is a dual axis view where the Profit axis corresponds to the blue line and the Sales axis corresponds to the orange line.



You can add up to four axes to the view: two on the Columns shelf and two on the Rows shelf. To turn a measure into a dual axis, right-click (control-click on Mac) a field on the **Rows** or **Columns** shelf and select **Dual Axis**.

Rearrange the Rows and Columns

Finally, you can rearrange the rows and columns in the view by dragging the selection border for headers or an axis.



Shelves and Cards

Every worksheet in Tableau contains shelves and cards. By placing fields on shelves or cards, you can create the rows and columns of a data view, exclude data from the view, create pages, and control mark properties. You should experiment placing fields on different shelves and cards to find the optimal way to look at your data. Tableau can also help you determine the best way to display your data using Show Me. See **Building Views Automatically** on page 530.

Columns and Rows Shelves

The **Columns** shelf creates the columns of a table, while the **Rows** shelf creates the rows of a table. You can place any number of fields on these shelves.

When you place a dimension on the **Rows** or **Columns** shelves, headers for the members of that dimension are created. When you place a measure on the **Rows** or **Columns** shelf, quantitative axes for that measure are created. As you add more fields to the view, additional headers and axes are included in the table and you get an increasingly detailed picture of your data.

In the view shown below, the members of the **Segment** dimension are displayed as column headers, while the **Profit** measure is displayed as a vertical axis.

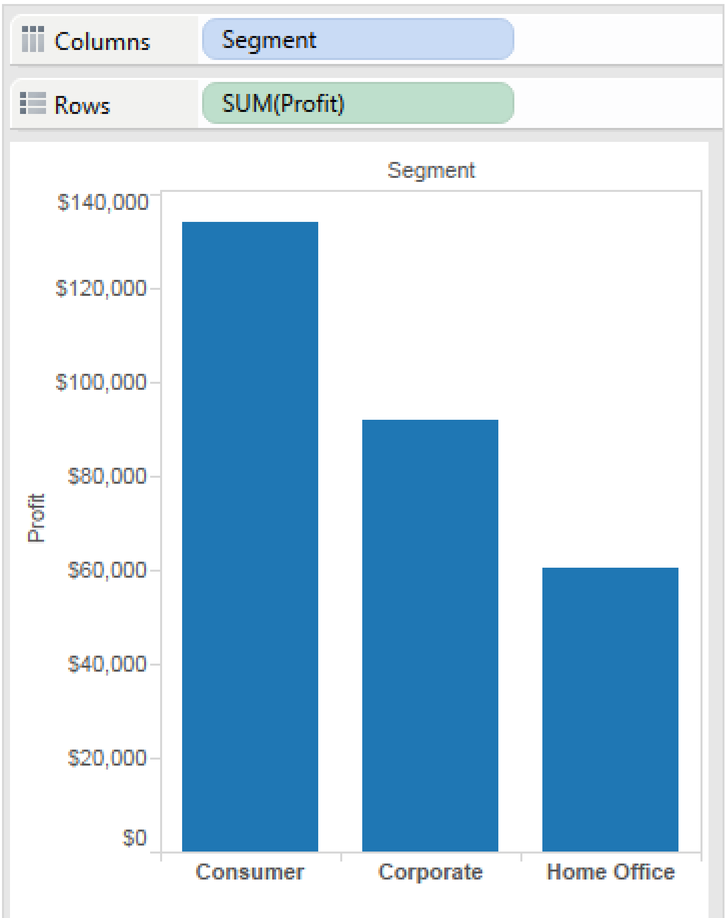
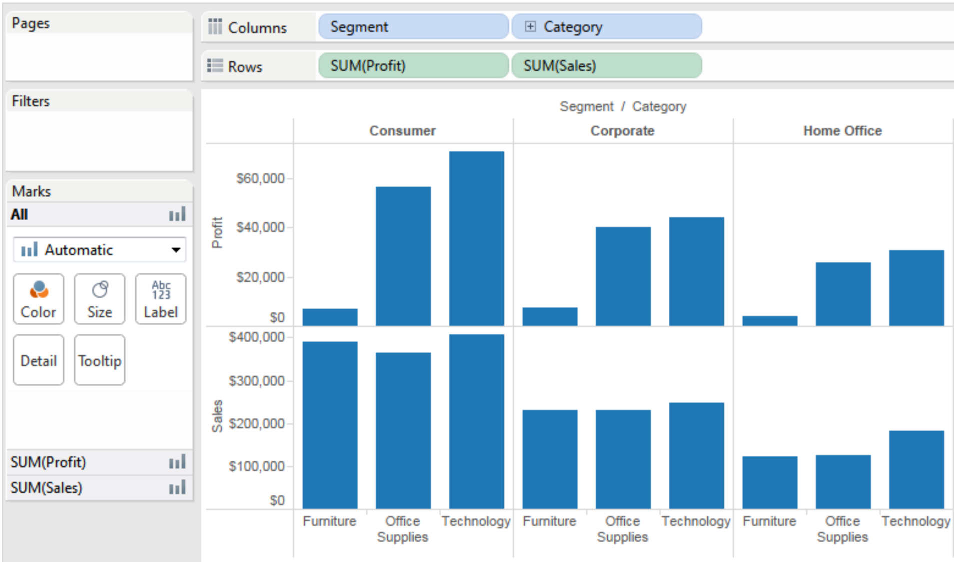


Tableau displays data using marks, where every mark corresponds to a row (or a group of rows) in your data source. The inner fields on the **Rows** and **Columns** shelves determine the default mark type. For example, if the inner fields are a measure and a dimension, the default mark type is a bar. You can manually select a different mark type using the Marks card drop-down menu. For more information, see **Mark Types** on page 431.

Adding more fields to the **Rows** and **Columns** shelves adds more rows, columns, and panes to the table.



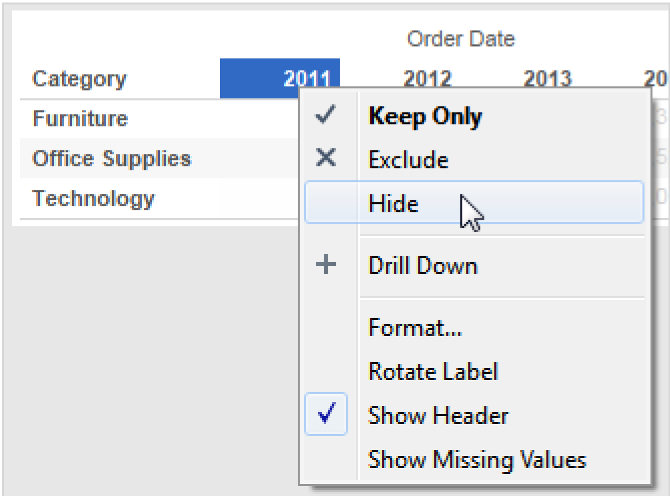
Hide Rows and Columns

Generally you will add dimensions and measures to create the rows and columns of the table and you'll either include all data or add filters to only show a subset. However, when you filter data it is also excluded from calculations and other computations performed on the summarized data in the table. Instead of filtering the data, you can hide the row or column so it doesn't display in the view but it is still included in calculations.

Hiding columns is especially useful when using table calculations that compare to previous or next. In that case, there is always a row or column that doesn't show data because there is no data to compare to. You can simply hide the empty column without modifying the table calculation. For example, when calculating year-over-year growth, the first year doesn't have a previous year to compare to, so the column is left blank. Filtering the first year will remove it from the view but it will also remove it from the calculation so now the second year doesn't have a previous year to compare to and is left blank. Instead of filtering, you can hide the column that you don't want to show without changing the calculation.

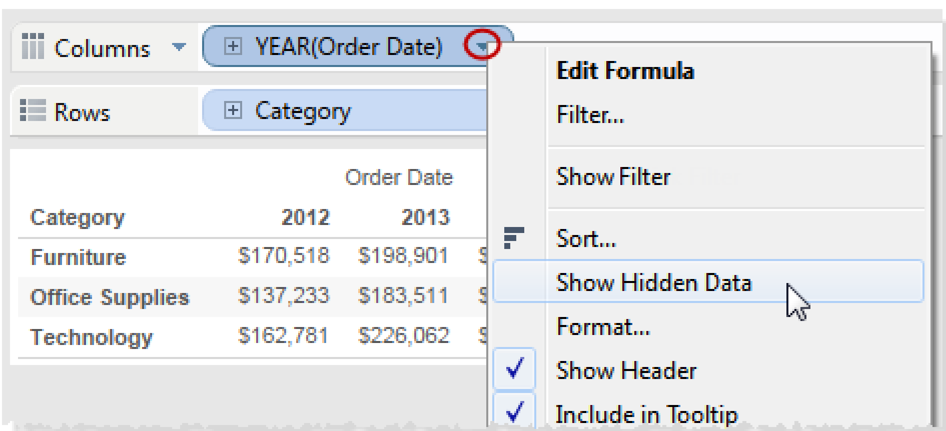
To hide a row or column:

Right-click (control-click on Mac) the row or column you want to hide, and then select **Hide**.



To show hidden data:

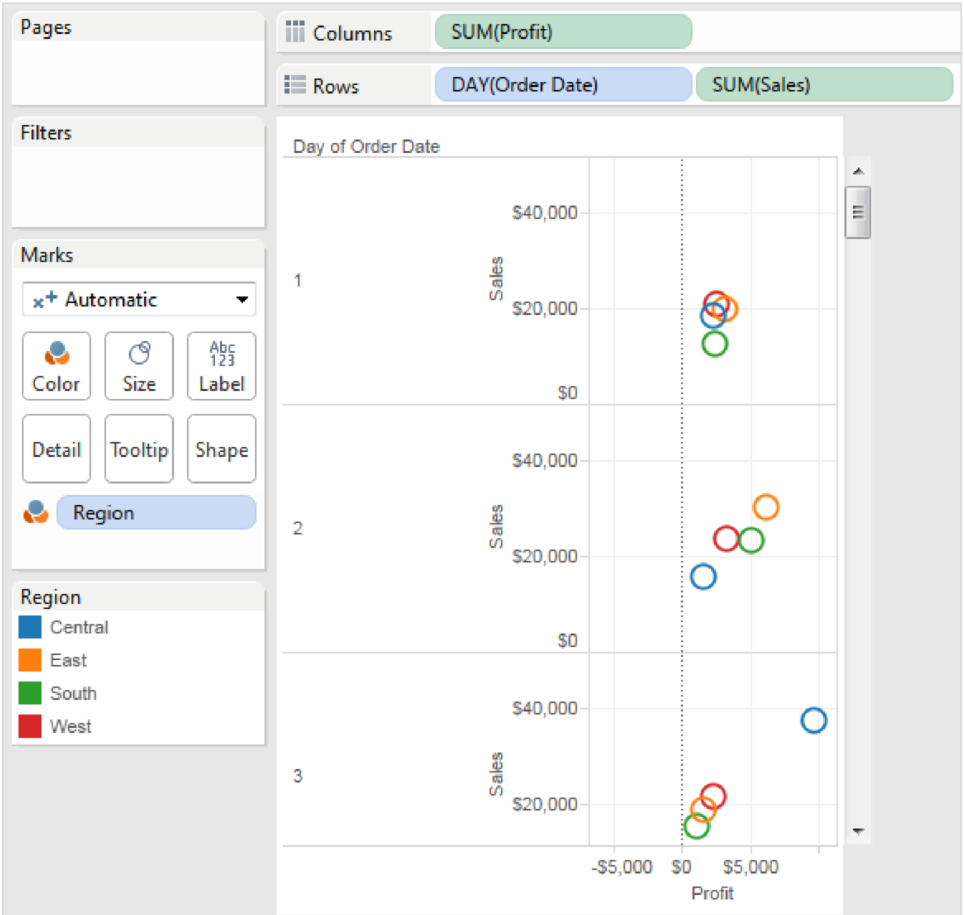
Open the field menu for a field that has hidden columns or rows and select **Show Hidden Data**.



Pages Shelf

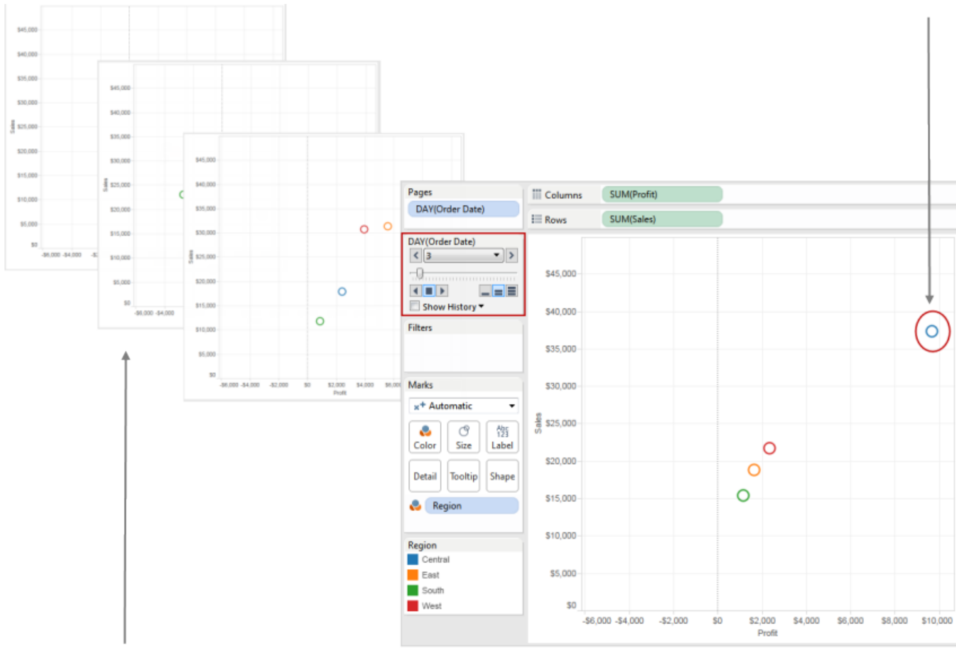
The **Pages** shelf lets you break a view into a series of pages so you can better analyze how a specific field affects the rest of the data in a view. When you place a dimension on the **Pages** shelf you are adding a new row for each member in the dimension. When you place a measure on the **Pages** shelf, Tableau automatically converts the measure into a discrete measure.

The **Pages** shelf creates a set of pages, with a different view on each page. Each view is based on a member of the field you placed on the **Pages** shelf. You can easily flip through the views and compare them on a common axis, using the controls that get added to the view when you move a field to the **Pages** shelf. For example, the view below shows the **Profit** vs. **Sales** by **Region** for each day throughout the month. The image below shows days 1, 2, and 3. You would have to scroll down to see other days in the month.



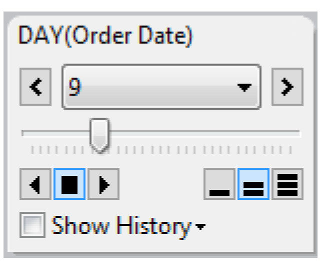
To make this view more user-friendly, move **DAY(Order Date)** to the **Pages** shelf and use the associated control to flip through the pages (one for each day). You can quickly discover hidden insights. In this example, it is interesting that the 19th is an especially big day in terms of sales and profit in the Western region.

Discover hidden insights and outliers.



The data for each day is displayed as a separate page.

When you add a field to the **Pages** shelf, a page control is automatically added, just below the **Pages** shelf:

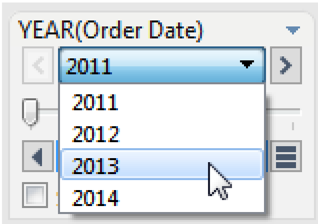


Use this control to navigate through the pages. There are three ways to navigate through the pages in a view:

- Jump to a specific page
- Manually advance through the pages
- Automatically advance through pages

Jump to a specific page

Select the member or value you want to view from the drop-down list to display a specific page.



Manually Advance through the pages

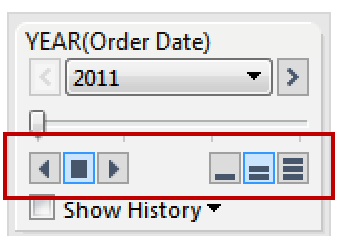
You can manually advance through the sequence of pages by doing any of the following:

- Use the forward and back buttons on either side of the drop-down list to navigate through the pages one at a time.
- Use the Page Slider to quickly scroll forward and backward in the sequence of pages.
- Use any of the following keyboard shortcuts to scroll forward and backward in the sequence of pages.

F4	Starts and stops forward playback
SHIFT + F4	Starts and stops backward playback
CTRL + .	Skip forward one page
CTRL + ,	Skip backward one page

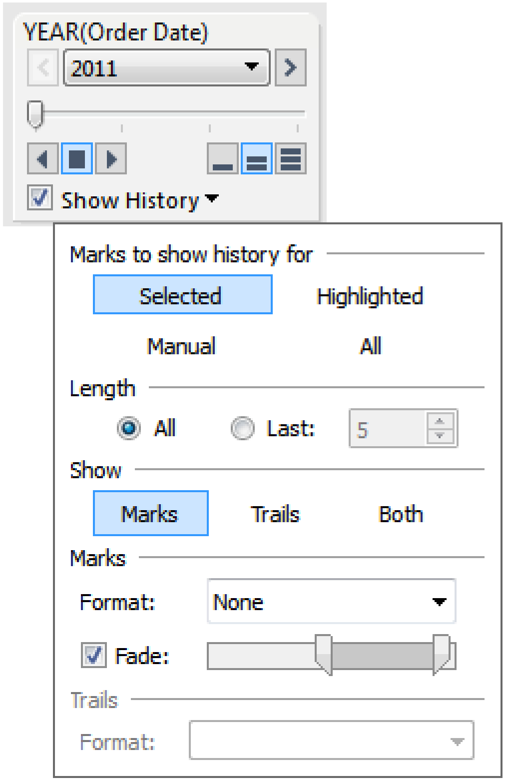
Automatically Advance through the pages

Use the playback controls to watch a slide show of the pages in the view. You can play forward or backward, and stop the playback at any time. You can control the speed of playback with the speed controls in the bottom right corner of the control. The smallest bar indicates the slowest playback speed.



Page History

Show page history using the Show History check box. With page history, marks from previous pages are shown on the current page. Open the drop-down control for history to specify what marks to show and when to show them.



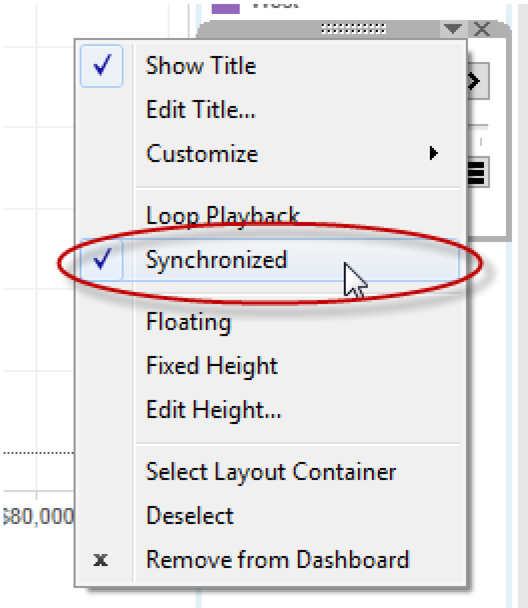
The history drop-down control has the following options:

- **Marks to show history for** – select whether you want to show history for just selected marks, highlighted marks, marks that you've manually selected to show history for, or all marks. To manually show history for marks, right-click (control-click on Mac) the mark in the view and select an option on the Page History menu.
- **Length** – select the number of pages to show in the history.
- **Show** – specify whether to show the historical marks, a line tracing through the previous values (trails), or both.
- **Marks** – format the historical marks including the color and how much to fade them if the color is set to automatic, the marks will either use the default mark color or the color encoding on the Color shelf.
- **Trails** – format the lines that are drawn through the historical marks. This option is only available if Trails is selected in the Show options.

Page trails may not display if there are multiple marks per color on a page. Make sure that the level of detail for the view is less than or equal to the level of detail on the **Pages** shelf and on the Color target. Also, trails are only supported for discrete mark types such as squares, circles, or shapes. They are not supported when the mark type is Automatic.

Pages on Dashboards

When a dashboard contains multiple views that use the same field on the **Pages** shelf, you can control all of the views with a single page control by selecting the **Synchronized** option. This option is only available on the page control shown on a dashboard.



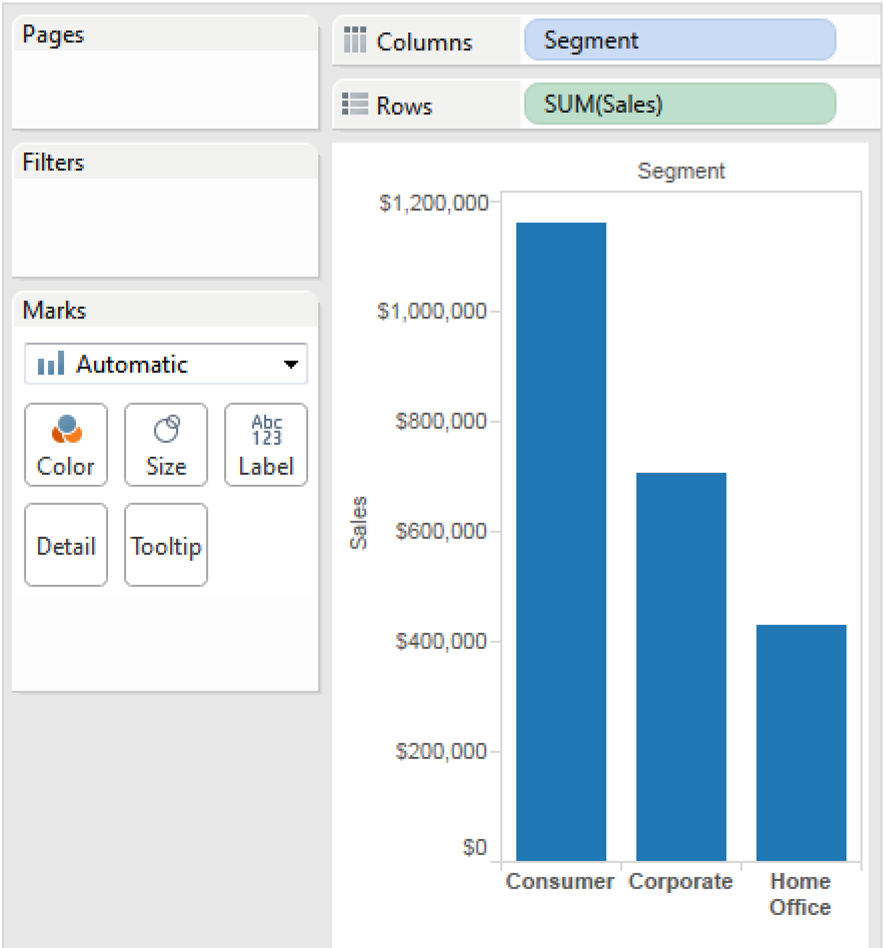
Filters Shelf

The Filters shelf allows you to specify which data to include and exclude. For example, you might want to analyze the profit for each customer segment, but only for certain shipping containers and delivery times. By placing fields on the Filters shelf, you can create such a view.

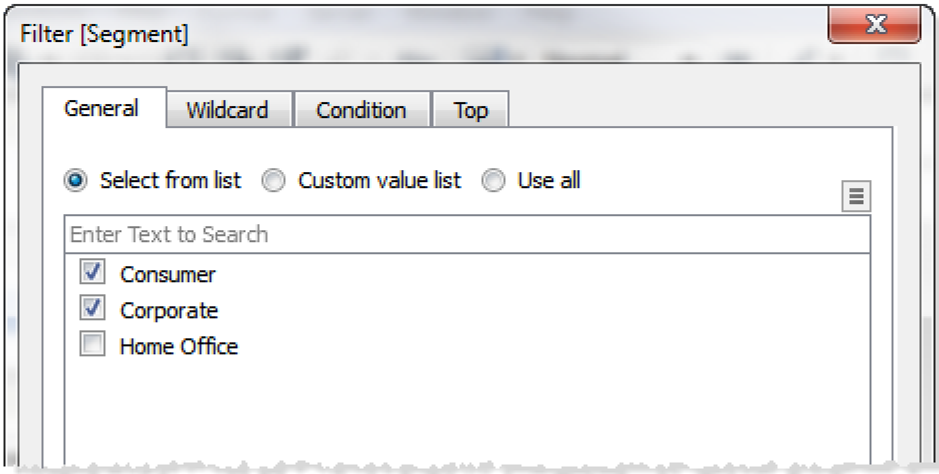
> **Note:** This section presents a brief overview of filtering. For more information on filtering, see **Filtering** on page 608.

You can filter data using measures, dimensions, or both at the same time. Additionally, you can filter data based on the fields that make up the columns and rows of the table. This is called an internal filter. You can also filter data using fields that don't contribute headers or axes to the table. This is called an external filter. All filtered fields display on the Filters shelf.

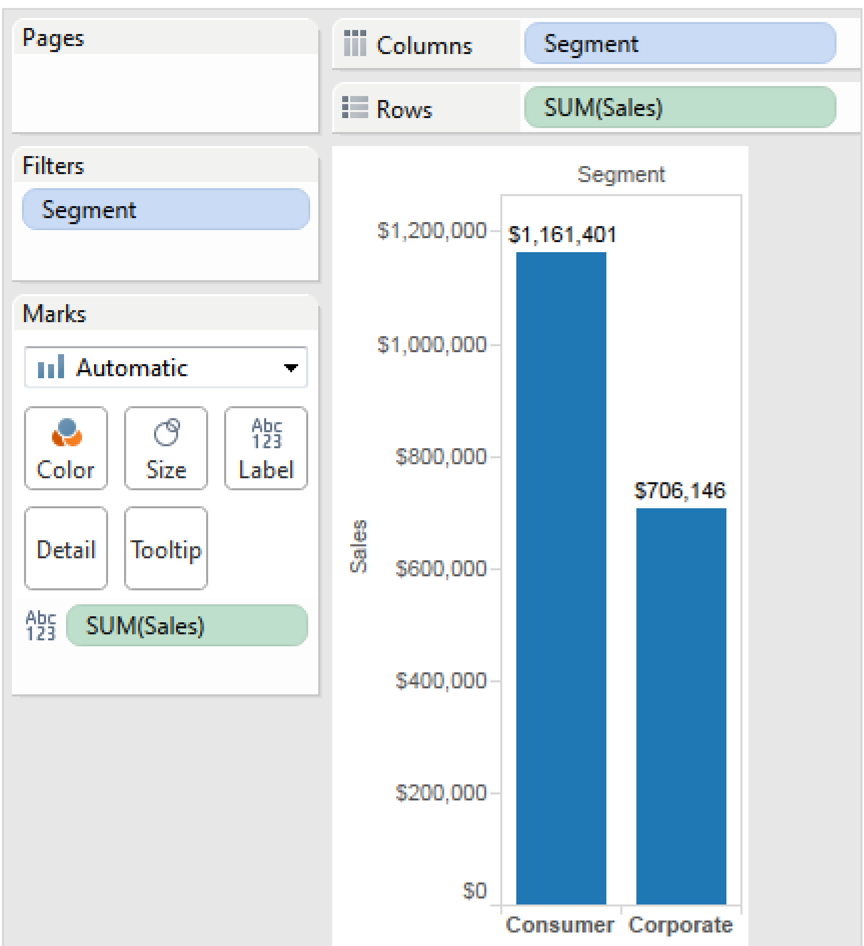
To illustrate the basic concepts of filtering, consider the following view.



Suppose you are not interested in the Home Office data. You can remove this column from the view by filtering the **Segment** dimension. To do so, select **Filter** on the field menu or drag the **Segment** dimension to the **Filters** shelf. The Filter dialog box opens. By default all members are selected. Clear the check box for **Home Office** to exclude it from the view. All selected members will be included.

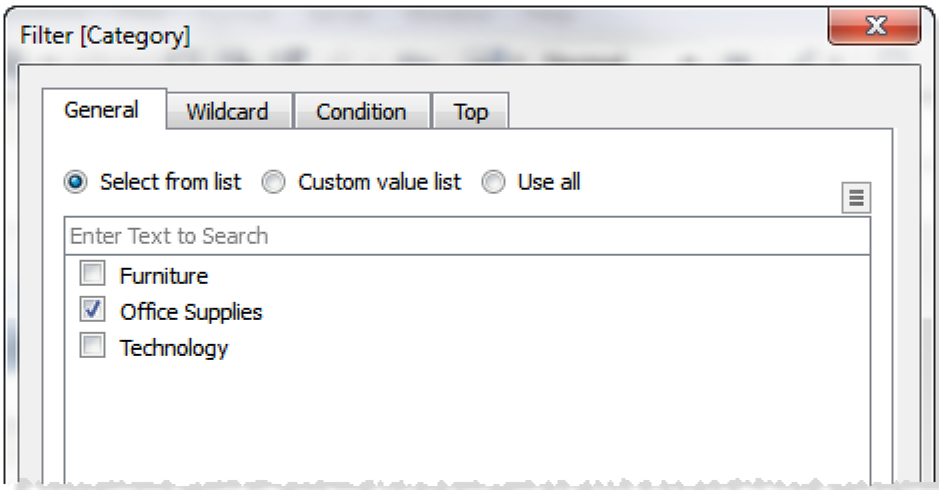


As shown below, the view updates and the Home Office column is removed. The filter is indicated by the **Segment** field on the **Filters** shelf.

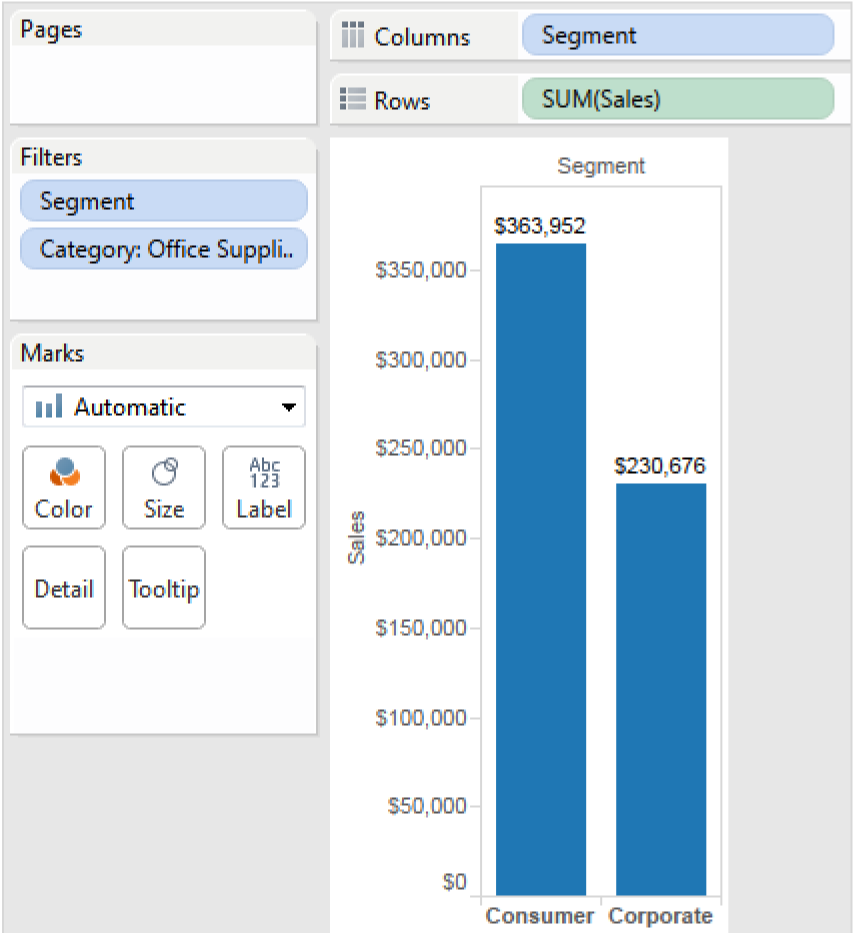


Suppose you want to only view sales for a category of the products. Even though the **Category** field is not used on the **Rows** and **Columns** shelves or on the Marks card, you can still add a filter. Drag the **Category** dimension to the **Filters** shelf. This is an example of an external filter because Category is not part of the view.

The Filter dialog box automatically opens. By default, none of the members are selected. Select the members you want to keep as part of the view. All cleared members are excluded.



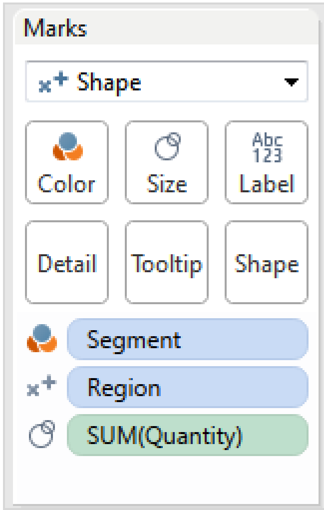
The modified data view is shown below. The mark label shows that the sum of the sales for the Consumer segment has decreased to $363,952. This number is derived by summing all the rows in the data source that are associated with the Corporate market and are part of the Office Supplies category.



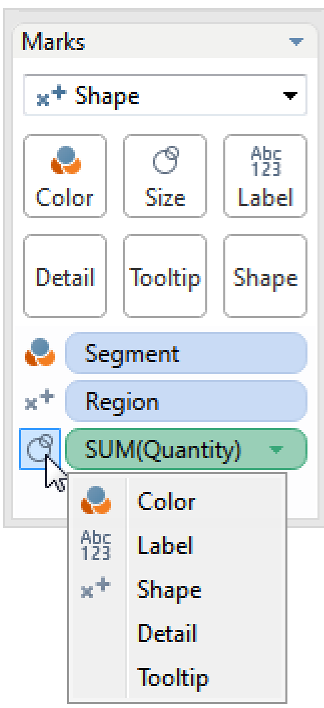
The order of fields placed on the Filters shelf does not affect the data view because the filters are independent. In other words, the result of filtering by customer segment, and then by container is the same as filtering by container and then by customer segment.

Marks Card

The Marks card is where you drag fields to control mark properties such as type, color, size, shape, and so on. The fields on the Marks card are listed at the bottom of the card. Each field has an icon next to it to identify the mark property it is setting. For example, the Marks card shown below has three fields: Segment is on Color, Region is on Shape, and Quantity is on Size. For more information, see **Marks** on page 430, **Mark Types** on page 431, and **Mark Properties** on page 451.



After a field has been added to the Marks card, you can click the icon next to the field to change the property it is controlling. The Detail and Tooltip properties don't display with an icon. However, you can click the white space where the icon would display to access the menu.



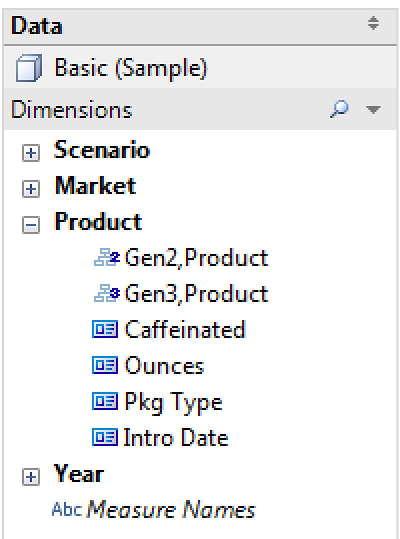
Many properties can have multiple fields. For example, you can add multiple fields to Label, Detail, Tooltip, and Color. Size and Shape can only have one field at a time.

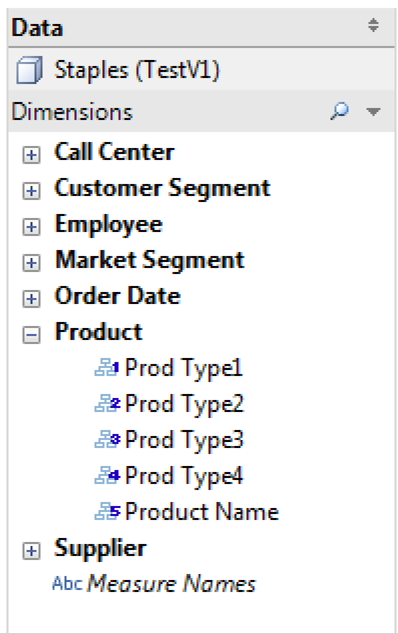
Note: By default, dragging a new field to **Color** replaces the existing fields. To add a new field to color without replacing the existing field, hold the SHIFT key on your keyboard while dragging a new field to **Color** on the Marks card.

Multidimensional Hierarchies

In Tableau, multidimensional data sources are supported only in Windows.

Multidimensional data sources contain hierarchies. For example, your database might contain a Product dimension that includes members such as product family, product department, and so on organized into a hierarchy, or you might have a Time dimension that includes years, quarters, and months.





Drilling Down and Up in a Hierarchy

One of the most useful ways to navigate hierarchies is to drill down or drill up. For example, if you are examining the sales totals for various years, you can then drill down and view sales for all of the months within each year. Alternatively, if you are examining sales totals for all months, you can then drill up and view the sales for each year.

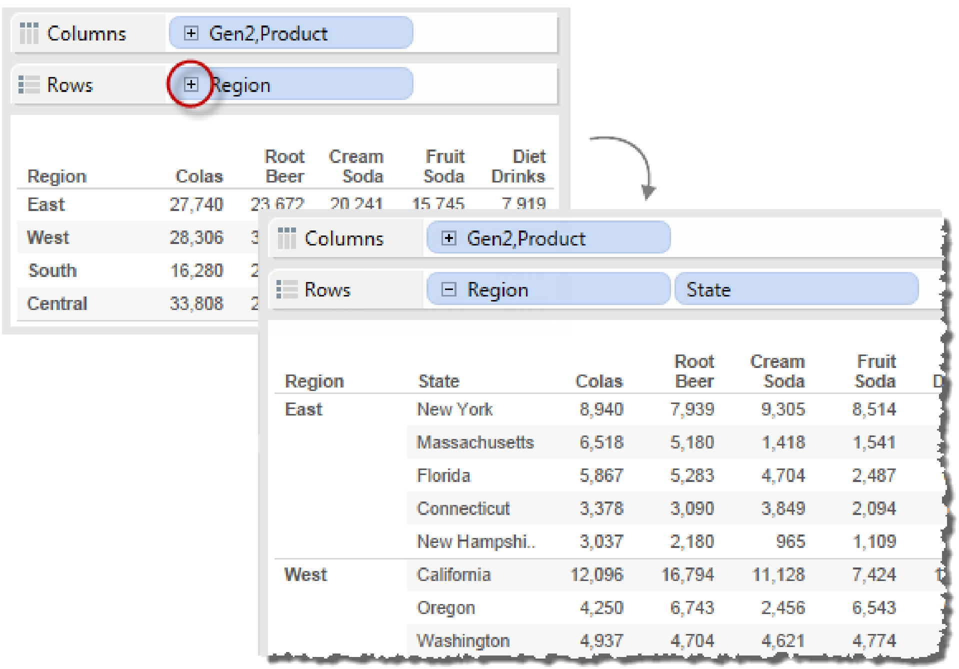
You can drill down and drill up in Tableau by clicking on fields placed on shelves, or by selecting a hierarchy header in the table. These two methods are described below.

Using Fields on Shelves

You can drill down or drill up by clicking on a dimension that is placed on any shelf. If the dimension is on the Rows or Columns shelf, drilling down shows more data (more headers) in the table, while drilling up shows less data in the table.

You can click on the plus/minus control that appears on any hierarchical dimension on any shelf. If a dimension member shows the plus sign, then its children are not already showing and you can drill down at least one level. If a dimension member shows the minus sign, then its children are already showing and you can drill up.

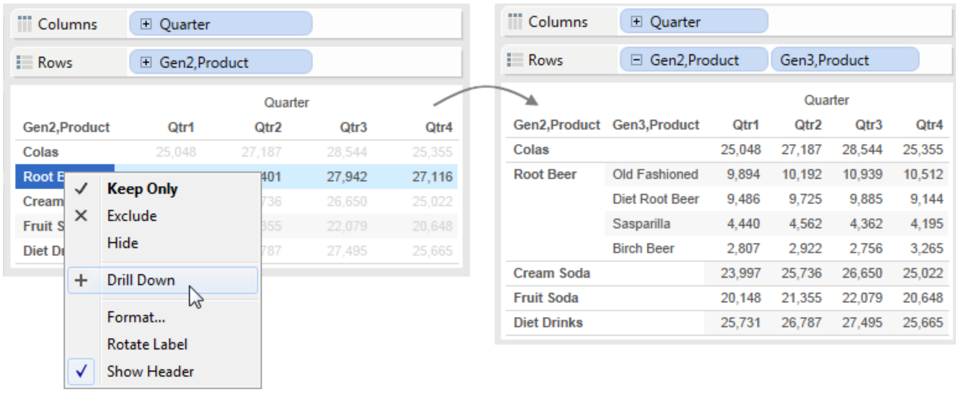
The following figure demonstrates drilling down one level in the hierarchy for the Region dimension to expose the states within each region.



Using Headers

To drill down and drill up for individual dimension members in a hierarchy, right-click (control-click on Mac) a table header and select **Drill Down** or **Drill Up** from the context menu. This is often referred to as non-uniform drill down because you expose only the members of interest instead of exposing all the members of a given level.

For example, the following figure illustrates drilling down into the Root Beer member of the Gen2,Product dimension. Note that new row headers are displayed in the table and that Gen3,Product, which is the next generation in the hierarchy, is automatically displayed.



One reason to use non-uniform drill down is if your data source has a ragged hierarchy (asymmetric layout). You also might want to view the children for just the member of interest.

> Drilling down and drilling up results in filtering the data.

Building Views with Oracle Essbase

When Tableau is connected to an Oracle Essbase data source, there are three important features that you should know about:

Generations and Levels

In Tableau, you can work with either the generations or the levels of a dimension. The generations of a dimension are all members that are an equal distance from the root of the dimension. The levels are all members that are an equal distance from the leaves of the dimension. For balanced dimensions, you'll typically want to work with generations. However, if your dimension is ragged, then it may make more sense to navigate using levels.

By default, the generations of each dimension are listed in the Data pane. When you drag a dimension to a shelf, all generations that are ancestors of the selected generation (all generations that are above it in the hierarchy) are automatically included in the placement.

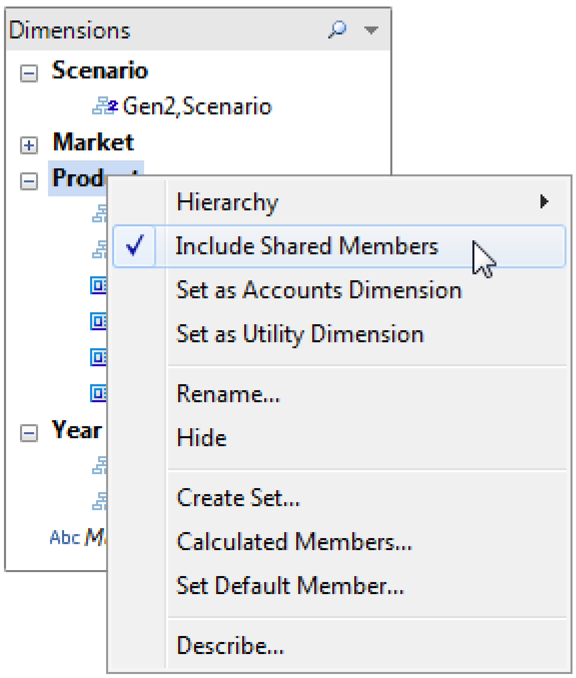
If you would rather navigate using the levels of a dimension, right-click the name of the dimension and then select **Hierarchy** > **Levels**.

> If you are using the same dimension in multiple worksheets, you can use levels in one worksheet and generations in another worksheet simultaneously. Furthermore, you can mix generations and levels from different dimensions in the same worksheet.

Shared Members

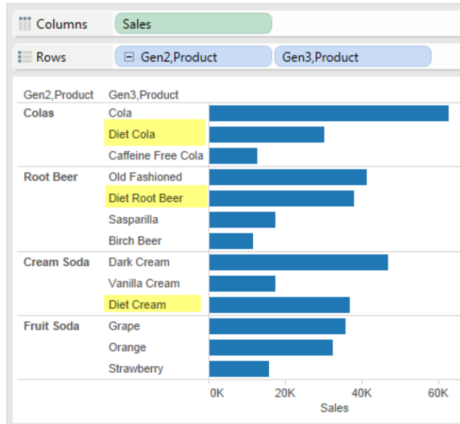
Shared members are dimension members that appear in more than one place in a hierarchy. For example, Diet Coke might be part of the product generation. But it might be shared by both the diet colas branch and the colas branch of the product hierarchy above it. In the database, however, the data about Diet Coke is stored just once.

By default, Tableau includes shared members in all generations (or levels) of a dimension. This means that a shared member might appear multiple times in a table. If you choose to exclude shared members, they will appear only once in a table. By default, shared members are included for all dimensions. To exclude shared members for a given dimension hierarchy, right-click the dimension name in the Data pane and select **Include Shared Members** from the menu.



The figure below shows part of a data view where shared members are included (left) and excluded (right). Notice that diet drinks are shared members.

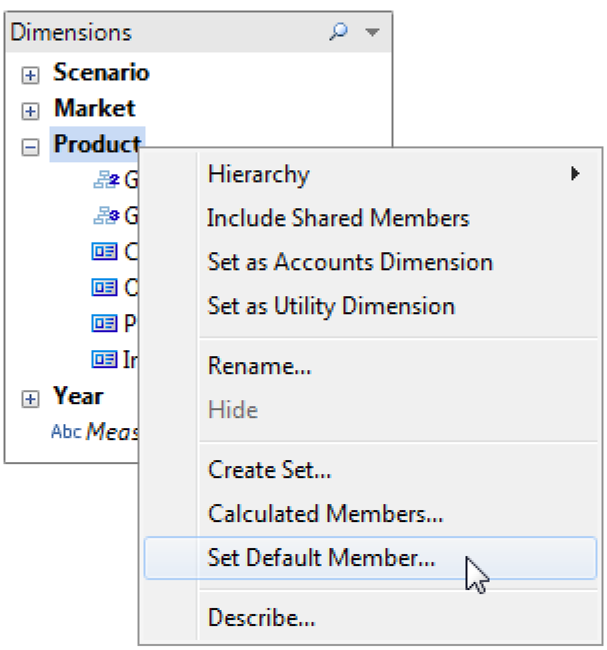
Includes Shared Members	**Does Not Include Shared Members**
The diet drinks are listed in both the Diet Drinks hierarchy and their respective drink hierarchies.	The diet drinks are only listed once, in their respective drink hierarchies.



Setting the Default Member

All multidimensional data sources have default members that are set when the data source is first built. If you find that you are creating filters all the time to look at the same specific data, you may find it useful to change the default member. For example, if you are the regional manager for the Western region in a company and you only want to look at your region's numbers, you can set the default member to the Western region.

To change the default member in Tableau, right-click a dimension hierarchy and select **Set Default Member**.



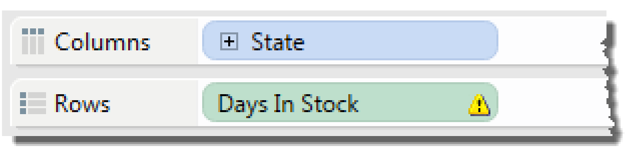
In the subsequent dialog box, select from the following options:

- Default member defined on cube – uses the default member that was defined when the cube was built. This is the default setting in Tableau.
- (All) member for the hierarchy – uses the ALL member for the selected hierarchy as the default member.
- Selected member – uses the member that you select in the bottom half of the dialog box as the default member.

The default member determines how you view the cube and so is much more powerful than applying filters. All fields will be calculated based on the default member you select. In addition, these default member settings are saved with the connection.

Building Views with Microsoft Analysis Services

When you build views in Tableau using a Microsoft Analysis Services Cube it is possible to have measures and dimensions that don't make a lot of sense when placed in the view together. For example, you may have a measure for Sales Quota. It won't make sense to place that measure against a dimension containing products if products don't have sales quotas. Tableau helps you figure out the dimensions and measure that can be used together in meaningful ways by highlighting unrelated dimensions and measures in gray. So in the last example, when we place Sales Quota onto a shelf, the products dimensions are highlighted in gray. Highlighted dimensions are not disabled and can still be added to the view. When you add an incompatible measure to the view, the measure is marked with a caution symbol.

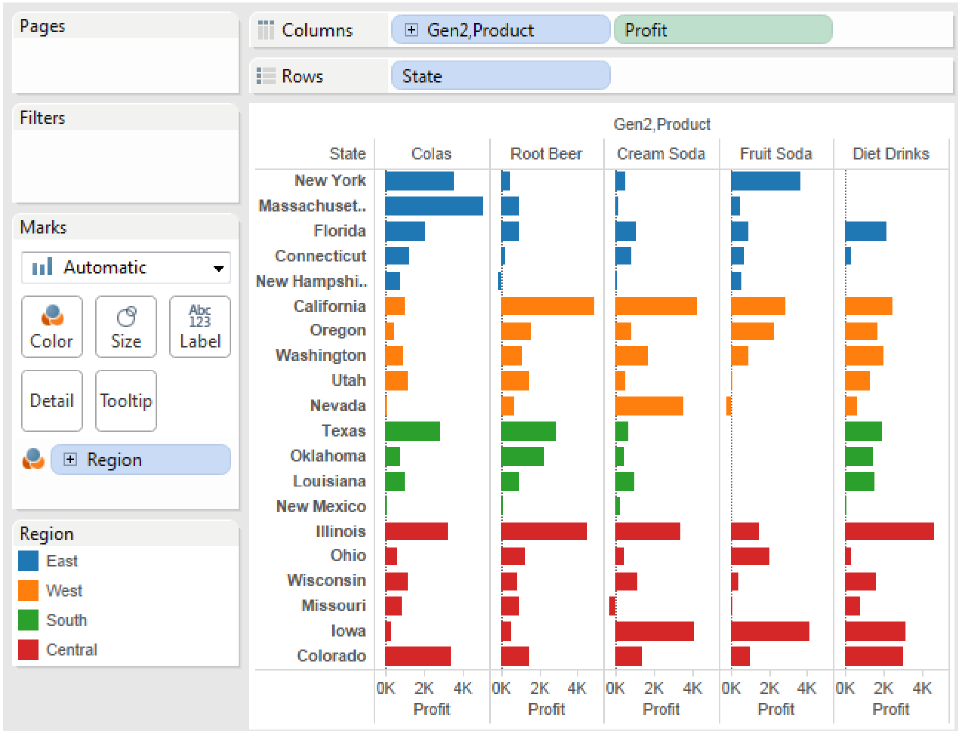


Perfect Pivoting

In Tableau, perfect pivoting refers to working with hierarchies in these ways:

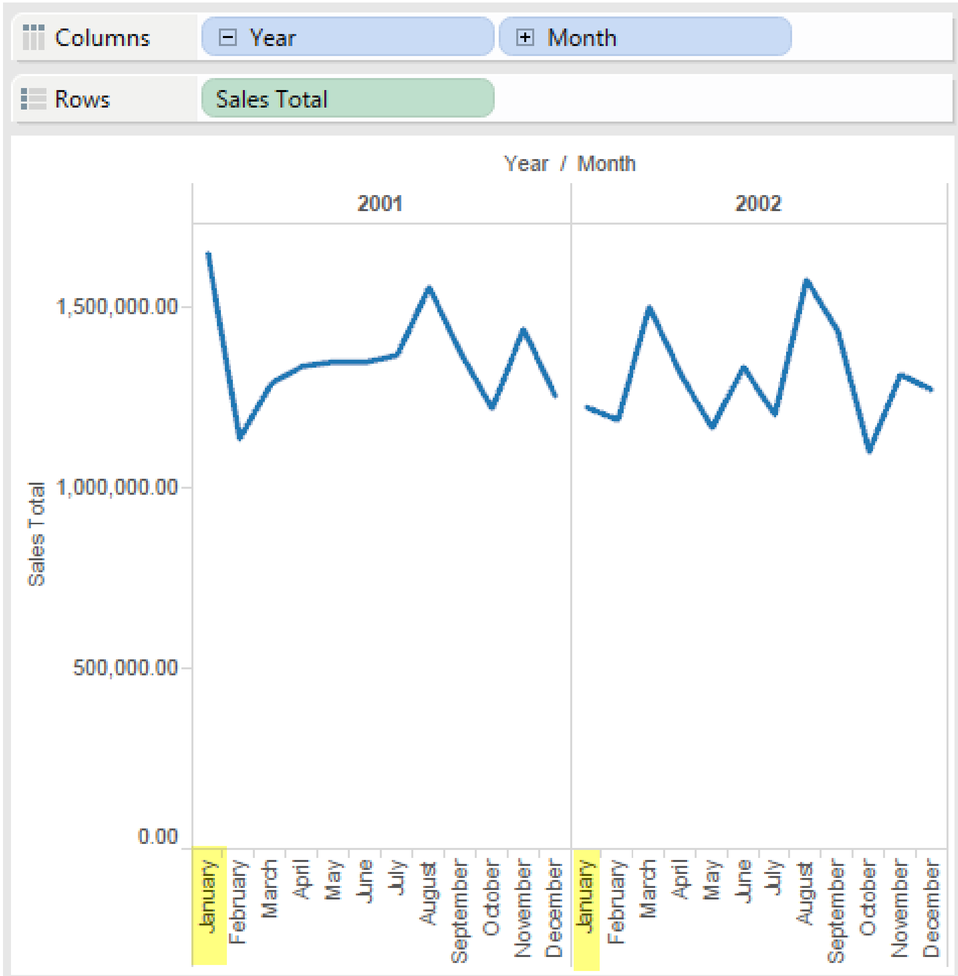
- Using varying levels of detail including skipping levels (for example, Country and City, but not State).
- Using varying levels of detail on different worksheet shelves simultaneously (for example, Product Family on the Columns shelf and Product Department on Color).
- Using varying levels of detail out of order (for example, Quarter before Year).

For example, in the following view the Market hierarchy is broken up to show the State level as Rows and the Region level as Color.

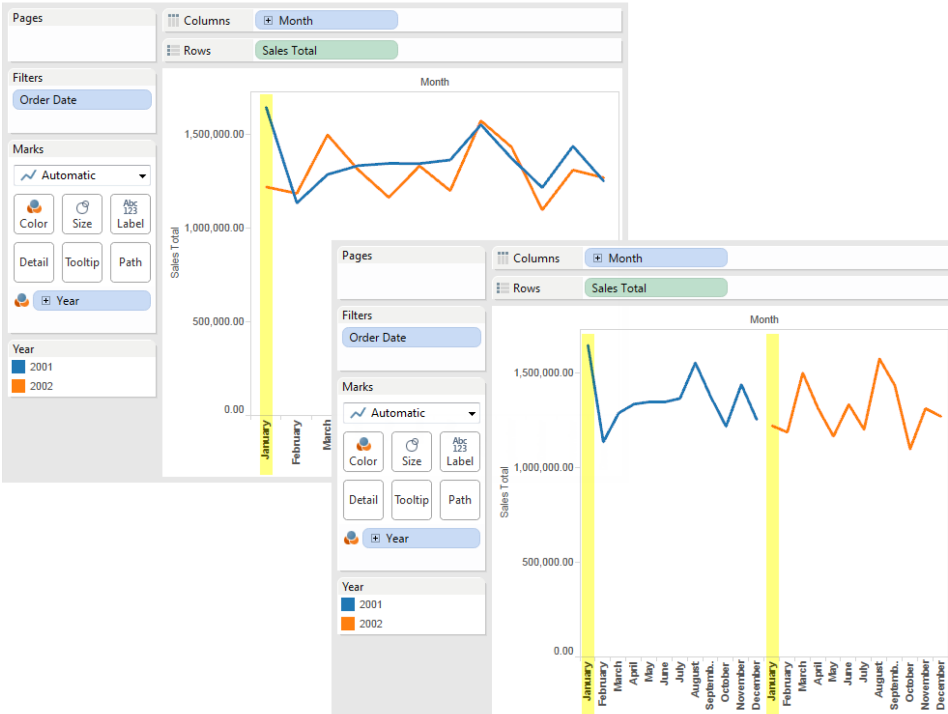


Defining Unique Values

Sometimes, when you are building views in Tableau, a field will have multiple members with the same name. For example, you may have a view showing the average profit by month over several years. The month January appears multiple times (once for each year).



While the name, January, is repeated, each instance of January can either be considered similar or unique. If you consider them similar, they will appear in the same column if you decided to move the Year field to the Color. However, if you consider them unique, they will be treated as two different values.



It is generally okay to consider repeated names within date and time fields (like in the previous example) similar but if there are repeated names in the Customer Name field, you won't want to consider the two customers as the same person.

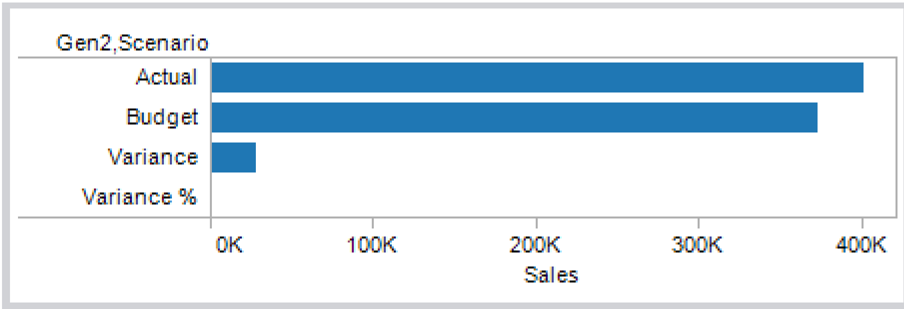
To define how you want Tableau to determine whether repeated values are unique, right-click (control-click on Mac) on the dimension and select one of the following on the **Unique Values** context menu:

- By Key: each member is considered unique based on the key given it by the system administrator when the database is set up. Members with the same name but different keys are treated as unique values.
- By Name: each member is considered unique based on the member name. Members with the same name (regardless of their keys) are treated as if they are the same.

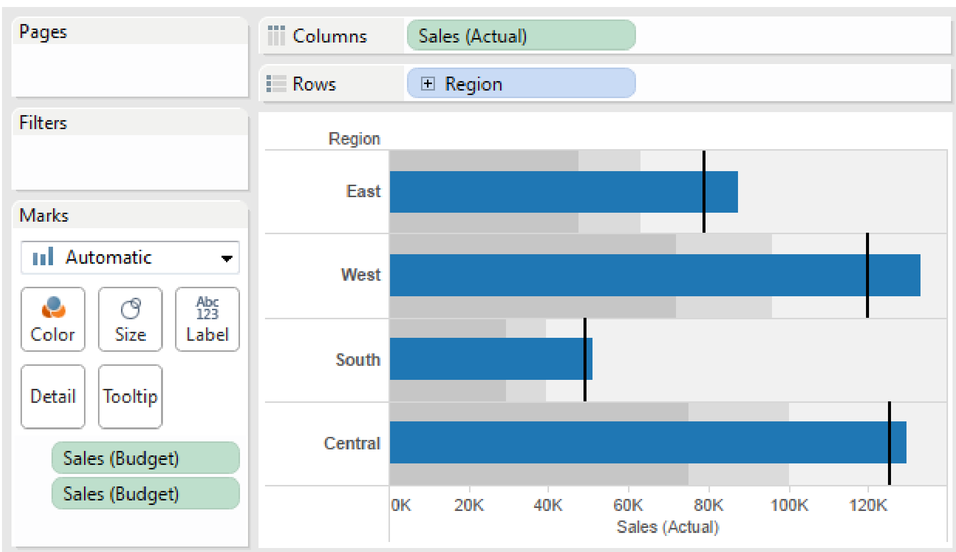
By default, unique date and time values are determined by name and all other values are determined by key.

Utility Dimensions

Oracle Essbase databases sometimes have special dimensions used to model comparative values such as Actual vs. Budgeted or Current Year vs. Previous Years. These dimensions are the utility dimensions and are often set up as Scenario or Years. For example, the members of a Scenario dimension are shown below.



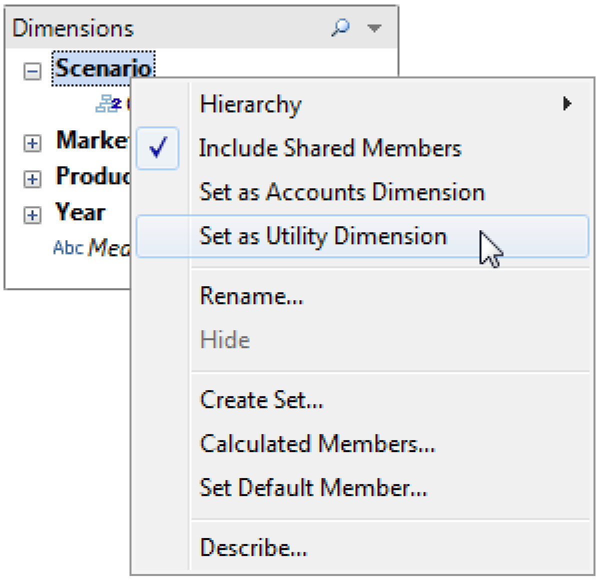
In the above view, you can see Actual Sales, Budgeted Sales, and so on. However, what if you wanted compare Actual Sales to Budgeted Sales in a bullet graph? In that case you need to set the Scenario dimension to be used as the utility dimension. When you set a dimension as the utility dimension you can then specify which member of the utility dimension to use for each measure in the view. For example, below is a bullet graph showing actual sales to budgeted sales by region.



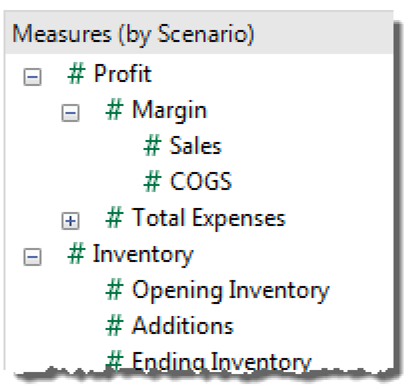
You can see that the Sales measure is used twice in the view: once to show actual and once to show budgeted.

To use a dimension as the utility dimension:

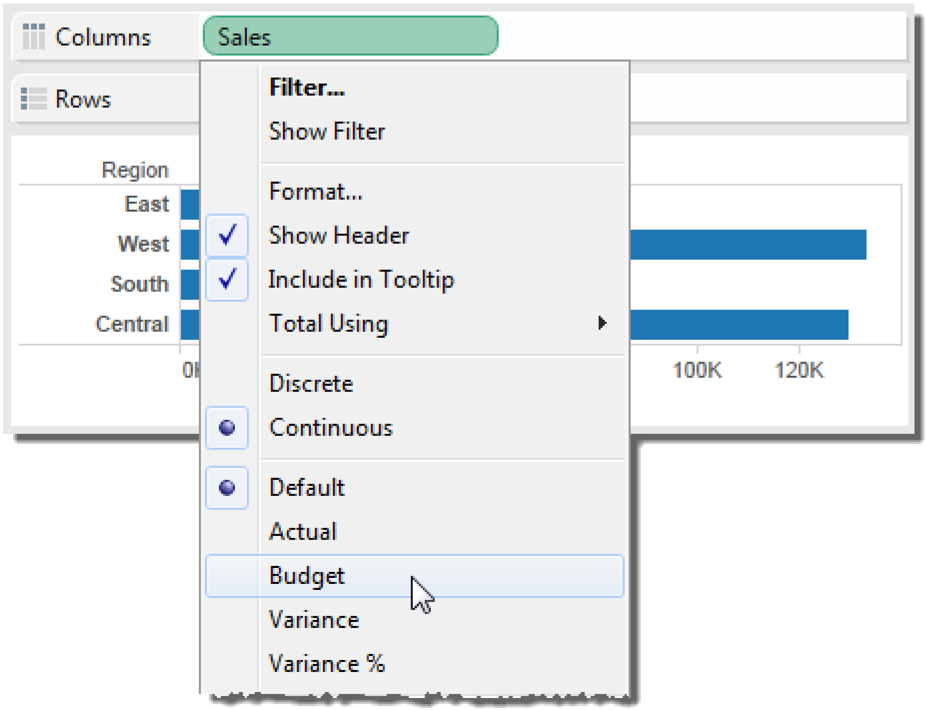
1. Right-click the dimension in the Data pane and select **Set as Utility Dimension**.



The dimension is hidden in the Data pane and can no longer be used as a dimension field in the view. The Measures area of the Data pane indicates that there is a utility dimension.

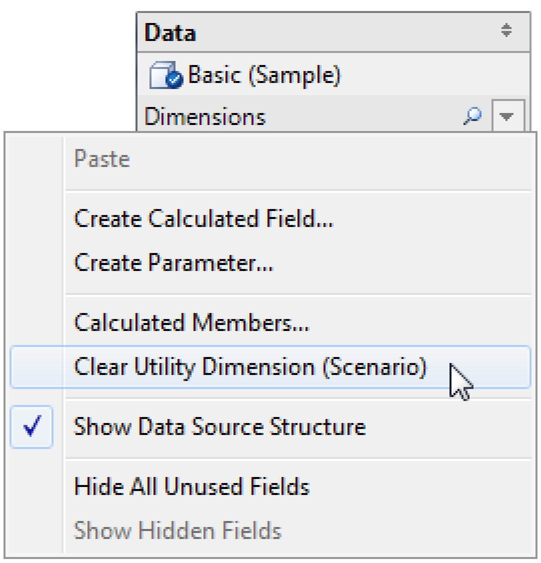


2. Drag a measure to the view.
3. Open the field menu for the measure in the view and select the member of the utility dimension you want to anchor the measure to.



To remove a utility dimension:

Open the drop-down menu at the top of the Data pane and select **Clear Utility Dimension**.



When you remove the utility dimension, measures that reference it in the view are no longer valid.

Working with Large Views

Placing dimensions with a large number of dimensions on a shelf may take a long time and generally won’t be very useful when they are added. In some cases, you may be presented with a dialog box giving you the option to filter the members before adding it to the shelf.

If you are building a view that involves a large amount of data, you may find it easier to turn off automatic updates, build the view, and then resume updates. Turning off automatic updates queues the queries instead of sending a separate query to the database every time you drag a field. See **Automatic Updates** on page 1472.

Follow the steps below to pause automatic updates while building the view.

1. Turn off automatic updates by clicking the **Pause Automatic Updates** button  on the toolbar.
2. Place all desired fields on shelves.
3. Specify filters to restrict the data to the members of interest.
4. Turn on automatic updates by clicking the **Resume Automatic Updates** button on the toolbar.

Any time a query is taking too long, you can cancel the query by clicking **Cancel** in the progress dialog box.

Building Views Automatically

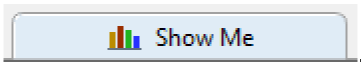
Tableau contains a suite of tools designed to help you quickly create useful views. Two situations in which you would want to create views automatically are when you want:

- Better Insight – People often have difficulty mapping data to views that address their analytical or presentation needs. Tableau contains built-in rules that are used to examine data and suggest ways of looking at it. In this way the software acts as a tour guide for producing useful views of data.
- Time Savings – Building data views manually can sometimes be time consuming. Using Tableau’s automatic features can help you work faster by giving you a starting view that you can further refine manually.

Automatically generate views using Show Me or Double-Click.

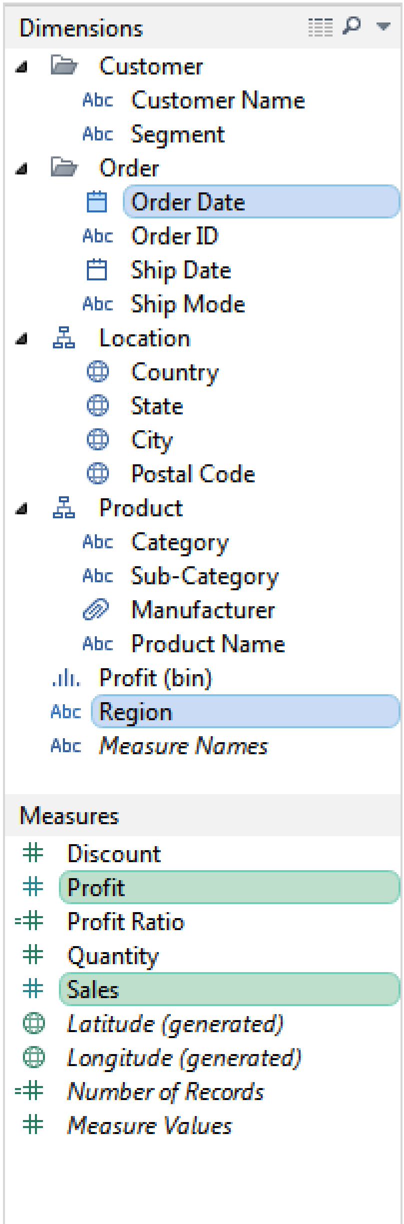
Show Me

Show Me creates a view based on the fields already used in the view and any fields you've selected in the Data pane. Open Show Me by clicking **Show Me** on the toolbar



. When you use Show Me simply select fields you want to analyze in the Data pane and then select the type of view you want to create. Tableau automatically evaluates the selected fields and gives you the option of several types of views that would be appropriate for those fields. Further, Show Me highlights the visualization type that best matches the data.

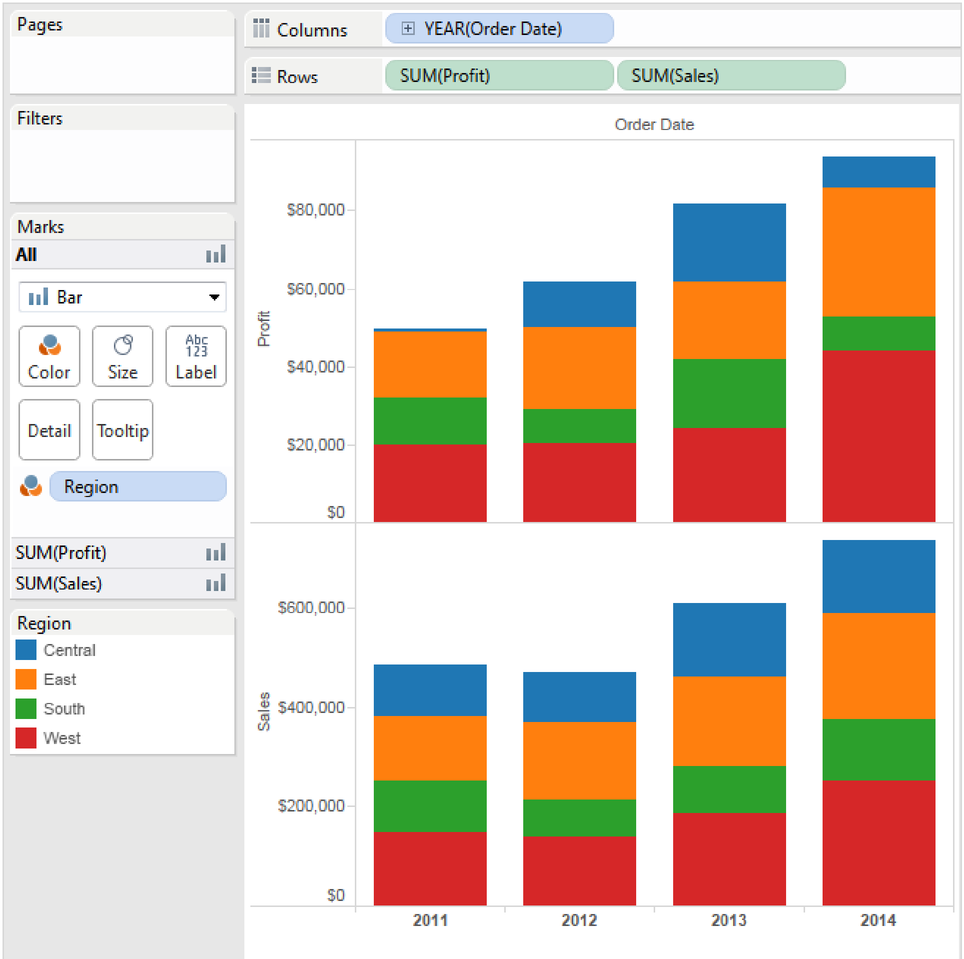
1. Select fields in the **Data** pane that you want to analyze. Hold the Ctrl key to make multiple selections.



2. Click **Show Me** on the toolbar and then select the type of view you want to create.

Any view type that is not gray will generate a view of your data. As you hover over each view type, the description at the bottom shows the minimum requirements. In this example, Stacked Bars is selected.

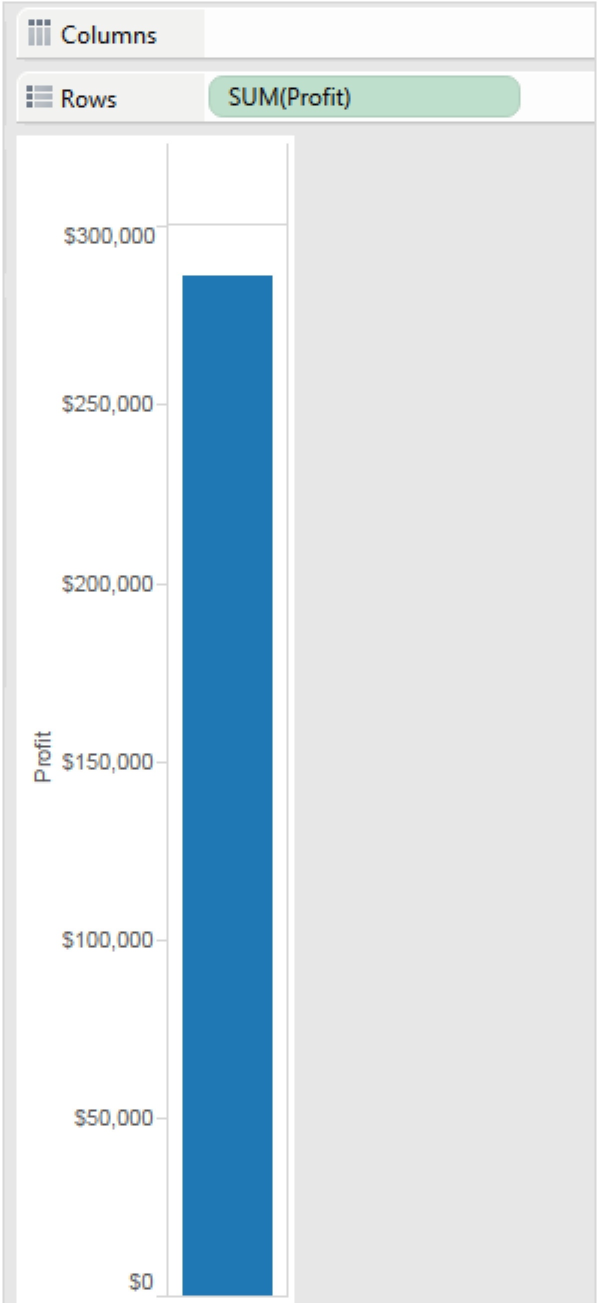
3. View the Result. Tableau automatically creates a view of the data.



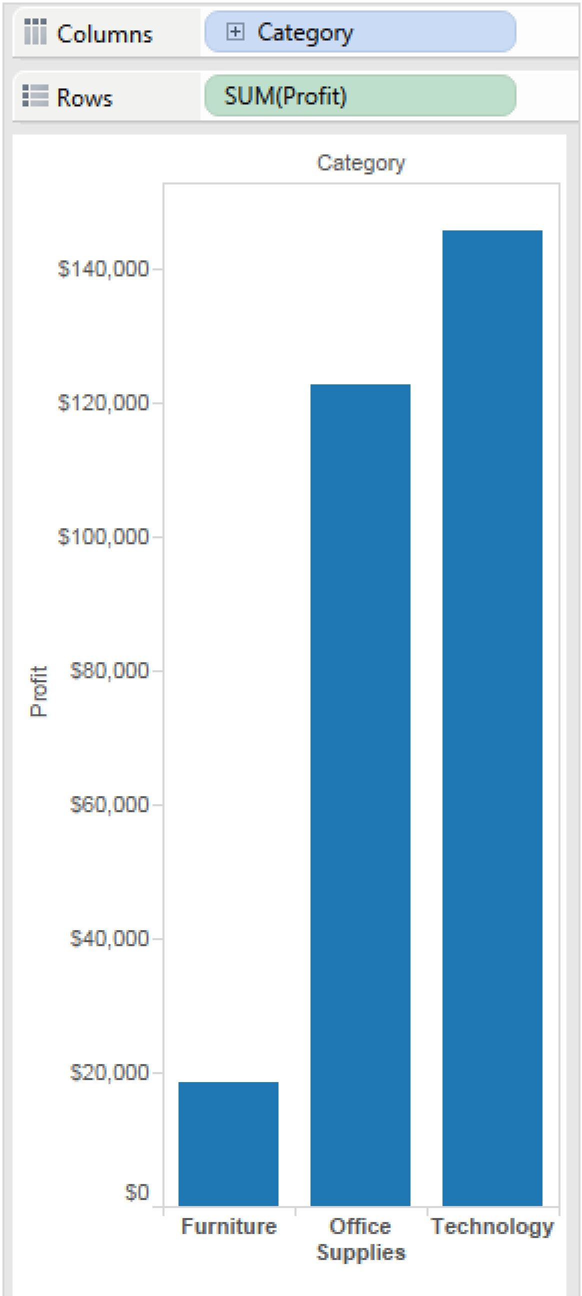
Add to Sheet: Double-Click

Tableau supports an additional method for automatically generating views of data called Automatic Double-Click. To use this method, double-click fields in the Data pane you are interested in. Tableau automatically adds each field to the view. That is, each double-click results in an additional field added to a shelf in an intelligent way. Like Show Me!, this function leverages Tableau's ability to make an intelligent "best guess" of how the data should be displayed. Double-clicking sometimes creates a view that you can use without further modification. More often, it can provide a starting point, which you can then modify to get the ideal result.

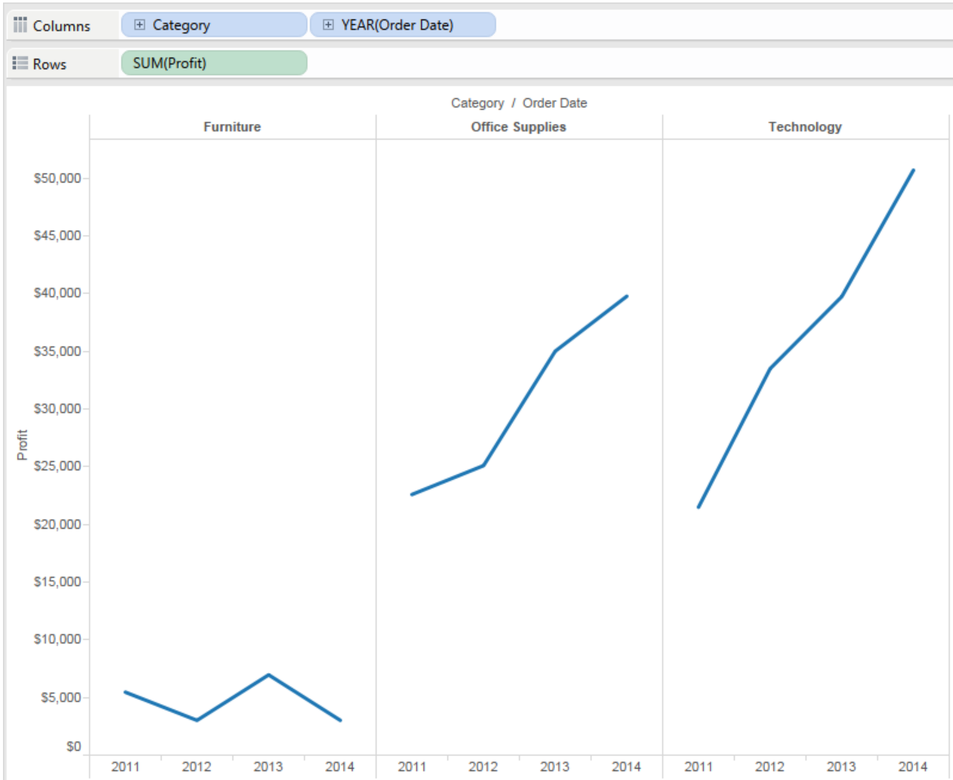
1. Double-clicking the **Profit** measure in the **Data** pane automatically adds that field to the view in an intelligent way.



2. Double-clicking the **Category** dimension in the **Data** pane automatically adds that field to the view based on the fact that Profit is already on the Rows shelf.



3. Double-clicking the **Order Date** dimension in the **Data** pane automatically adds that field to the **Columns** shelf based on the placement of other fields in the view. As you double-click fields they are successively added to the view. The order in which you click fields determines the type of view created.



The following table describes some of the rules used in creating automatic views by double-clicking fields in the **Data** pane.

Text Table	Adding a dimension first produces a text table (or cross-tab). All subsequent clicks on fields result in refinement of the text table.
Bars	Adding a measure first and then a dimension produces a bar view. All subsequent clicks result in refinement of the bar view, unless a date dimension is added, at which time the view is changed to a line.
Line	Adding a measure and then a date dimension produces a line view. All subsequent clicks result in refinement of the line view.
Continuous Line	Adding a continuous dimension and then a measure produces a continuous line view. Subsequent dimensions result in refinement of the continuous line view. Subsequent measures add quantitative axes to the view.
Scatter	Adding a measure and then another measure produces a scatter view. Subsequent dimensions result in refinement to the scatter view. Subsequent measures will create a scatter matrix.
Maps	Adding a geographic field produces a map view with latitude and longitude as axes and the geographic field on the Level of Detail shelf. Subsequent dimen-

	sions add rows to the view while subsequent measures further refine the map by adding size and color encoding.

Build-It-Yourself Exercises

This section includes detailed exercises that guide you through the steps involved in building some common types of data views. All exercises use the **Sample - Superstore** data source, which is included with Tableau Desktop.This collection of exercises is just a sample of the many types of data views that you can create in Tableau.

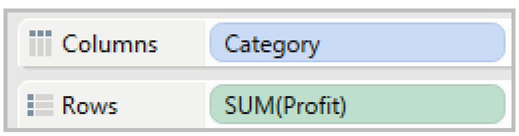
Build a Bar Chart

Use bar charts to compare data across categories. You create a bar chart by placing a dimension on the **Rows** shelf and a measure on the **Columns** shelf, or vice versa.

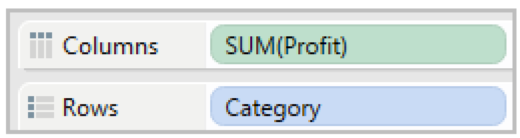
A bar chart uses the **Bar** mark type. Tableau selects this mark type when the data view matches one of the two field arrangements shown below. You can add additional fields to these shelves.

For more information about the **Bar** mark type, see **Bar Mark** on page 435.

Creates Vertical Bars



Creates Horizontal Bars



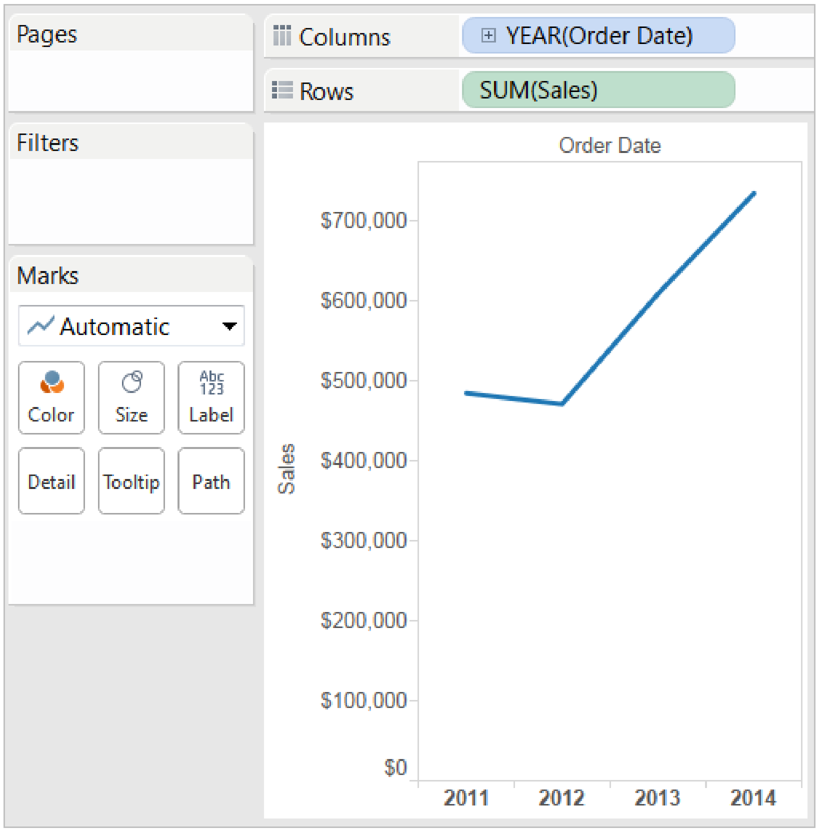
To create a bar chart that displays total sales over a four-year period, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Order Date** dimension to **Columns**.

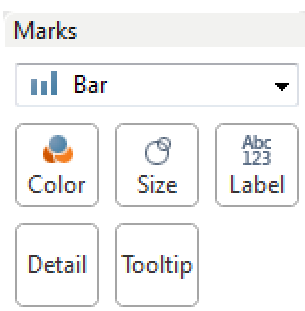
   The data is aggregated by year and column headers appear.
3. Drag the **Sales** measure to **Rows**.

   The measure is aggregated as a sum and an axis is created. The column headers move to the bottom of the view.

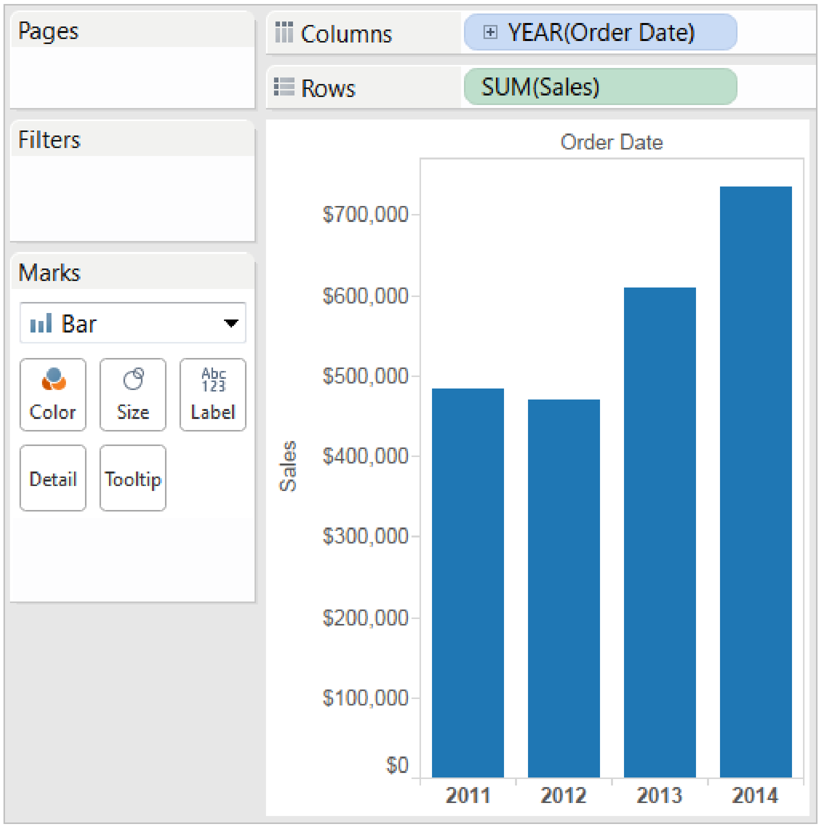
   Tableau uses **>Line** as the mark type because you added the date dimension.



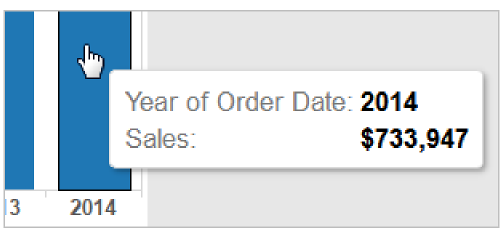
4. On the **Marks** card, select **Bar** from the drop-down list.



The view changes to a bar chart.

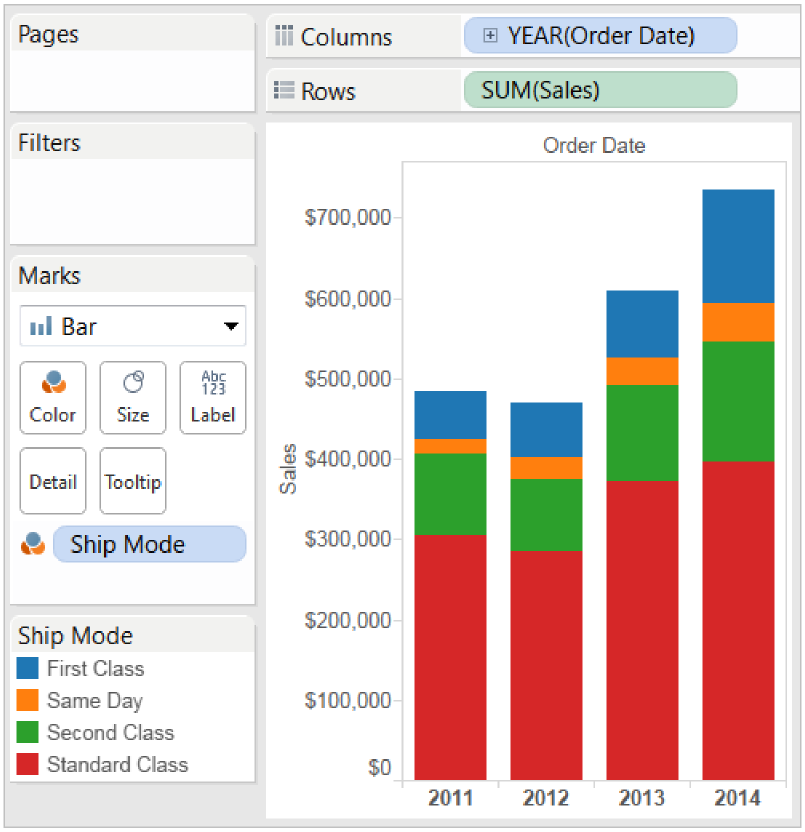


The marks (which are bars in this case) are vertical because the axis is vertical. The length of each mark represents the sum of the sales for that year. For example, the sum of the sales in 2014 is $733,947, which you can verify by hovering over that column.

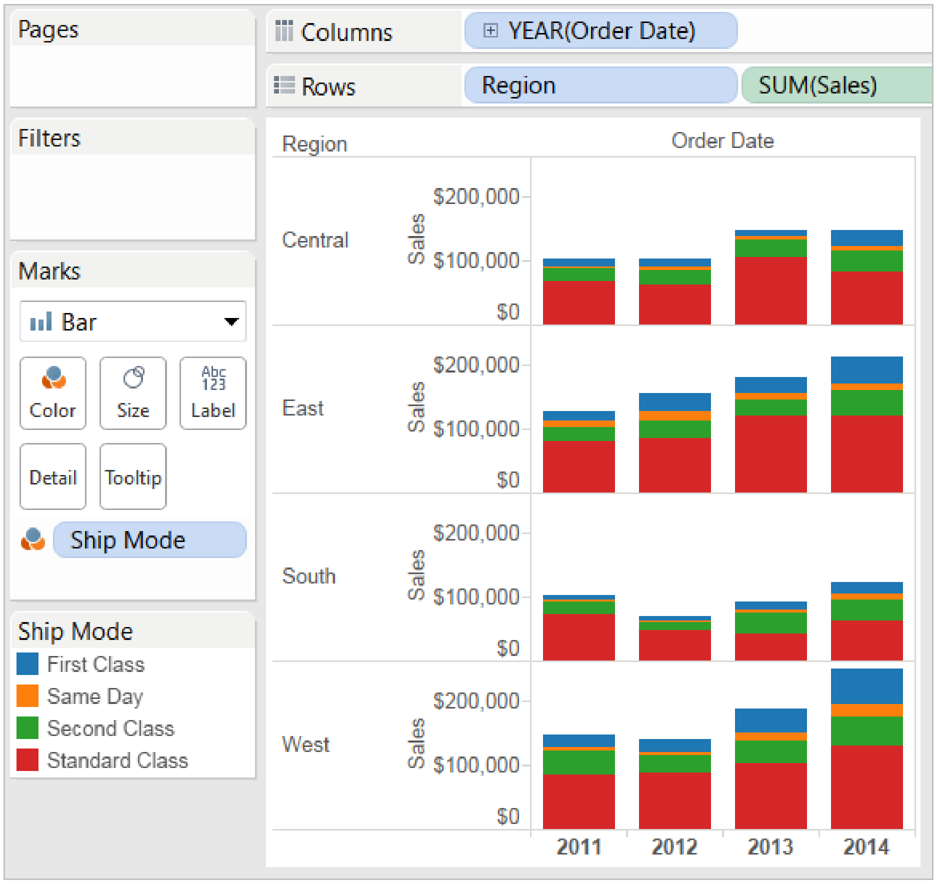


7. Drag the **Ship Mode** dimension to **Color** on the **Marks** card.

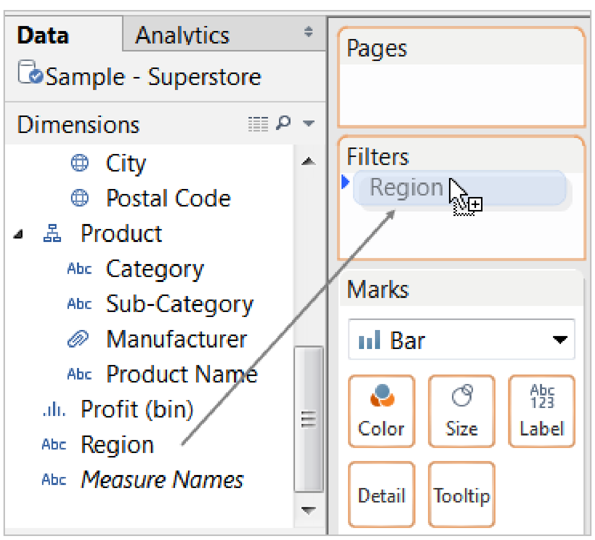
   The view shows how different shipping modes have contributed to total sales over time. The ratios look consistent from year to year.



8. Drag the **Region** dimension to **Rows**, and drop it to the left of **Sales** to produce multiple axes for sales by region.

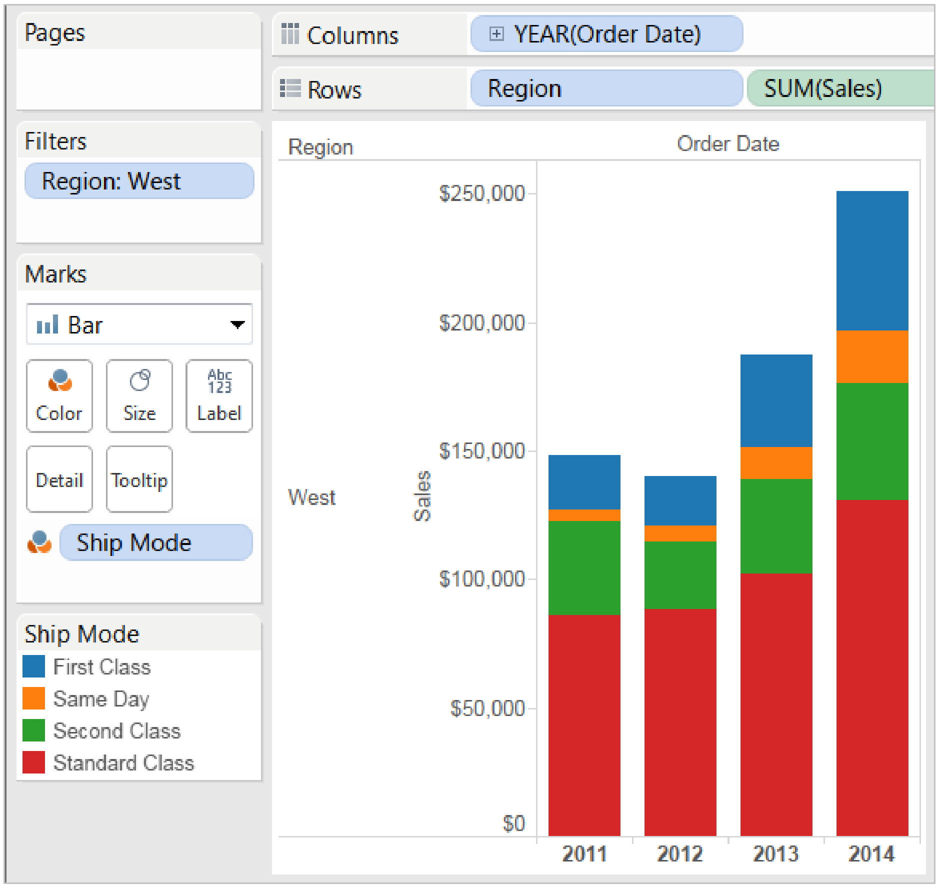


9. To view data in the West region only, you can filter out the other regions. To do this, drag the **Region** dimension again, this time from the **Data** pane to the **Filters** shelf.



10. In the Filter [Region] dialog box, clear the **Central**, **East**, and **South** check boxes, and

then click **OK**.



This view gives you insight into your data—for example, how the ship mode changed in the West over the four-year period.

Build a Text Table

In Tableau, you typically create text tables (also called cross-tabs or pivot tables) by placing one dimension on the **Rows** shelf and another dimension on the **Columns** shelf. You then complete the view by dragging one or more measures to **Text** on the **Marks** card.

A text table uses the text mark type. Tableau uses this mark type automatically if the view is constructed using only dimensions (assuming the mark type is set to **Automatic**). For more information about the text mark type, see **Text Mark** on page 443.

To create a text table that shows sales totals by year and category, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Order Date** dimension to **Columns**.

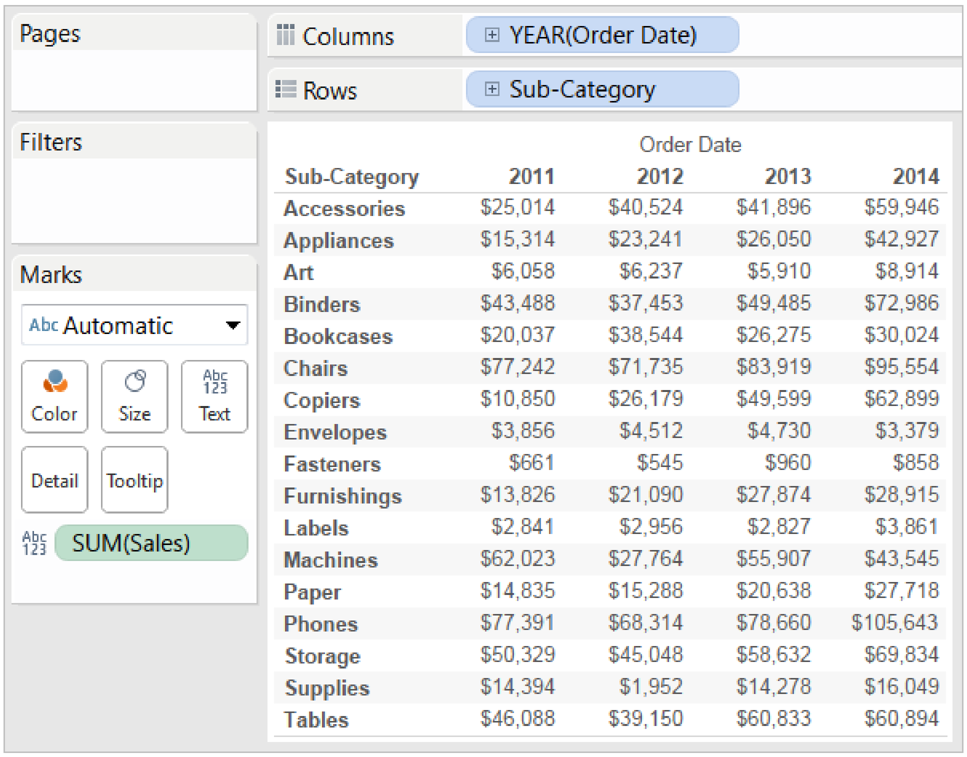
Tableau aggregates the date by year and creates column headers.

3. Drag the **Sub-Category** dimension to **Rows**.

   Tableau creates row headers. Columns with headers plus rows with headers means that a valid table structure now exists. Now you can add a measure to the view to see actual data.

4. Drag the **Sales** measure to **Text** on the **Marks** card.

   Tableau aggregates the measure as a sum.

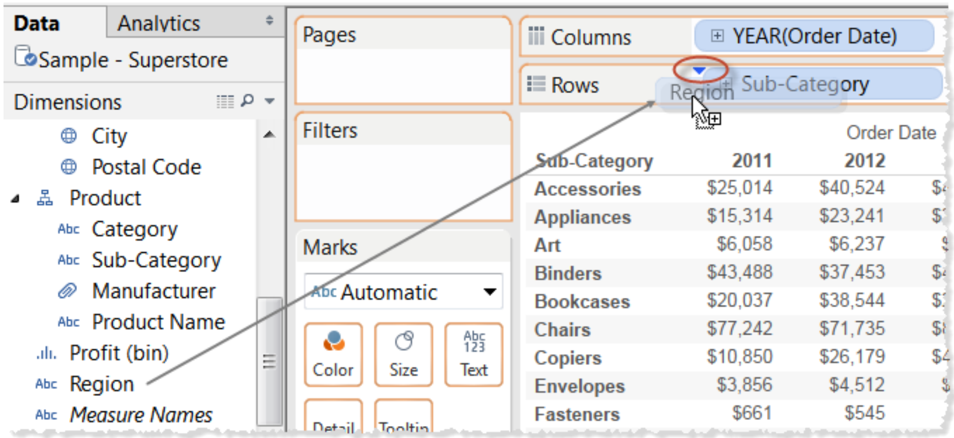


	Order Date			
Sub-Category	2011	2012	2013	2014
Accessories	$25,014	$40,524	$41,896	$59,946
Appliances	$15,314	$23,241	$26,050	$42,927
Art	$6,058	$6,237	$5,910	$8,914
Binders	$43,488	$37,453	$49,485	$72,986
Bookcases	$20,037	$38,544	$26,275	$30,024
Chairs	$77,242	$71,735	$83,919	$95,554
Copiers	$10,850	$26,179	$49,599	$62,899
Envelopes	$3,856	$4,512	$4,730	$3,379
Fasteners	$661	$545	$960	$858
Furnishings	$13,826	$21,090	$27,874	$28,915
Labels	$2,841	$2,956	$2,827	$3,861
Machines	$62,023	$27,764	$55,907	$43,545
Paper	$14,835	$15,288	$20,638	$27,718
Phones	$77,391	$68,314	$78,660	$105,643
Storage	$50,329	$45,048	$58,632	$69,834
Supplies	$14,394	$1,952	$14,278	$16,049
Tables	$46,088	$39,150	$60,833	$60,894

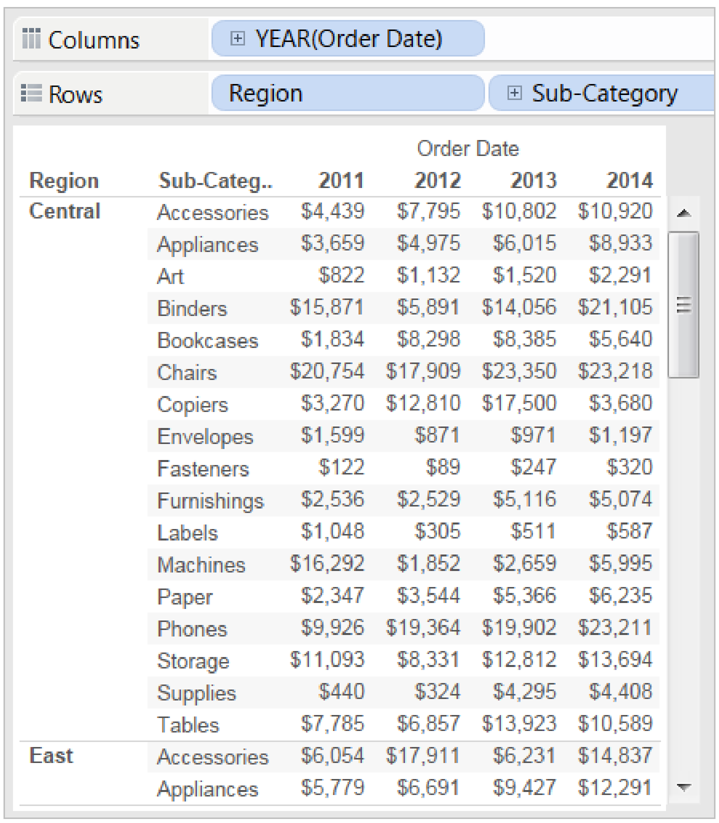
   Tableau uses text as the mark type. Each cell in the table displays the sum of the sales for a particular year and sub-category.

   We can see that the chairs and phones sub-categories had the highest sales in every year.

5. Drag the **Region** dimension to **Rows** and drop it to the left of **Sub-Category**. ((A small triangle will appear to indicate that the new field will be inserted to the left of the existing field.)

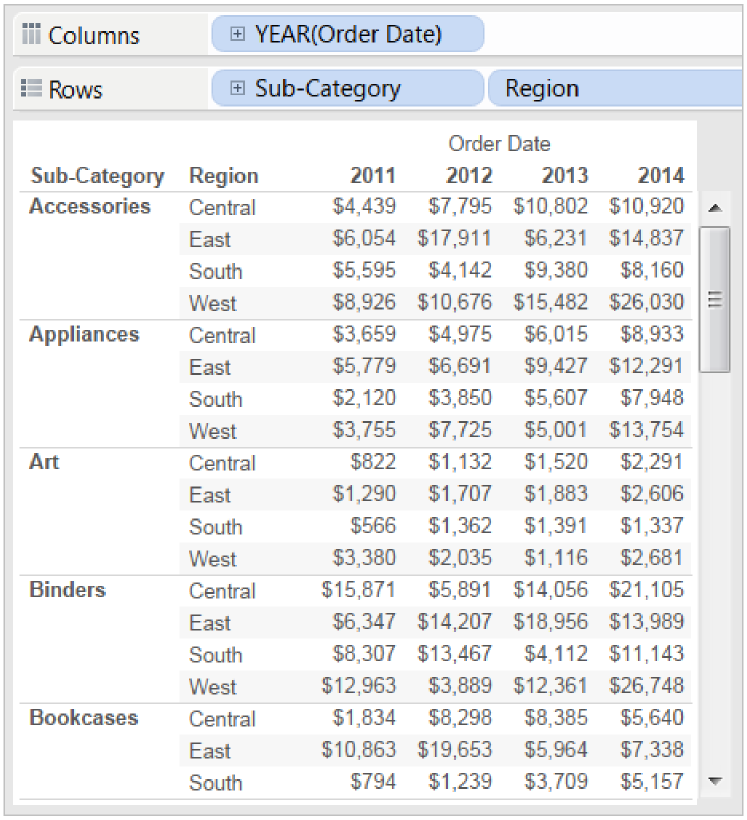


The view now breaks out sales by region, in addition to year and sub-category.



Region	Sub-Categ..	2011	2012	2013	2014
Central	Accessories	$4,439	$7,795	$10,802	$10,920
	Appliances	$3,659	$4,975	$6,015	$8,933
	Art	$822	$1,132	$1,520	$2,291
	Binders	$15,871	$5,891	$14,056	$21,105
	Bookcases	$1,834	$8,298	$8,385	$5,640
	Chairs	$20,754	$17,909	$23,350	$23,218
	Copiers	$3,270	$12,810	$17,500	$3,680
	Envelopes	$1,599	$871	$971	$1,197
	Fasteners	$122	$89	$247	$320
	Furnishings	$2,536	$2,529	$5,116	$5,074
	Labels	$1,048	$305	$511	$587
	Machines	$16,292	$1,852	$2,659	$5,995
	Paper	$2,347	$3,544	$5,366	$6,235
	Phones	$9,926	$19,364	$19,902	$23,211
	Storage	$11,093	$8,331	$12,812	$13,694
	Supplies	$440	$324	$4,295	$4,408
	Tables	$7,785	$6,857	$13,923	$10,589
East	Accessories	$6,054	$17,911	$6,231	$14,837
	Appliances	$5,779	$6,691	$9,427	$12,291

Regions are listed alphabetically. You can drop **Region** to the right of **Sub-Category**to organize the view first by sub-category, and then by region.



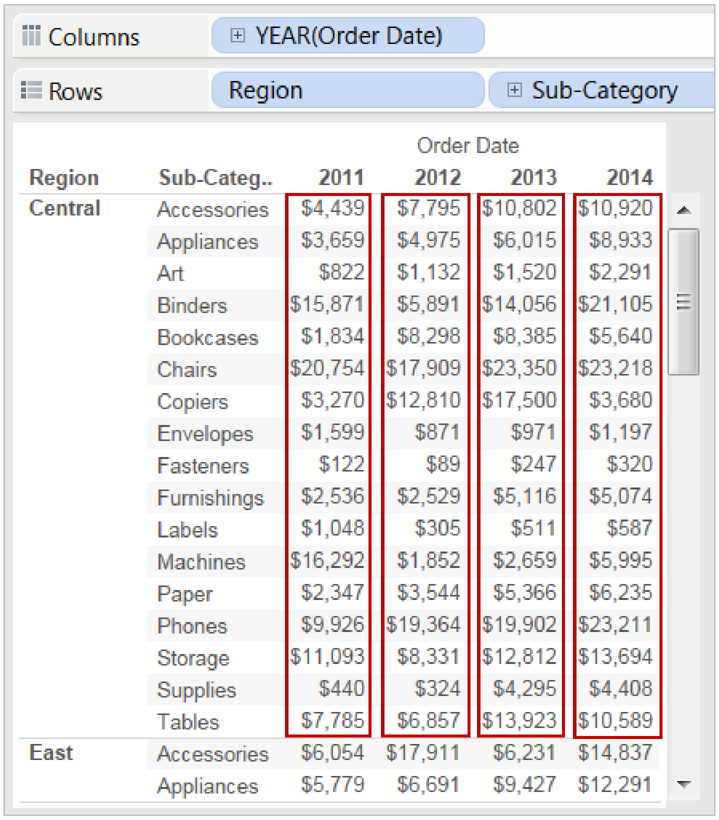
		Order Date			
Sub-Category	**Region**	**2011**	**2012**	**2013**	**2014**
Accessories	Central	$4,439	$7,795	$10,802	$10,920
	East	$6,054	$17,911	$6,231	$14,837
	South	$5,595	$4,142	$9,380	$8,160
	West	$8,926	$10,676	$15,482	$26,030
Appliances	Central	$3,659	$4,975	$6,015	$8,933
	East	$5,779	$6,691	$9,427	$12,291
	South	$2,120	$3,850	$5,607	$7,948
	West	$3,755	$7,725	$5,001	$13,754
Art	Central	$822	$1,132	$1,520	$2,291
	East	$1,290	$1,707	$1,883	$2,606
	South	$566	$1,362	$1,391	$1,337
	West	$3,380	$2,035	$1,116	$2,681
Binders	Central	$15,871	$5,891	$14,056	$21,105
	East	$6,347	$14,207	$18,956	$13,989
	South	$8,307	$13,467	$4,112	$11,143
	West	$12,963	$3,889	$12,361	$26,748
Bookcases	Central	$1,834	$8,298	$8,385	$5,640
	East	$10,863	$19,653	$5,964	$7,338
	South	$794	$1,239	$3,709	$5,157

You can use a table calculation to show percentages of total instead of raw dollar values. First, you must determine how to frame the calculation.

In this case, there are three dimensions in the view: **Order Date**, **Sub-Category**, and **Region**.

You could show percentages of total for a single dimension, but that can be unwieldy. For example, if you show percentages just by region, the percentages would be calculated across the two remaining dimensions: **Sub-Category** (there are 17 sub-categories) and **Year(Order Date)** (there are 4 years). So you would be dividing the total 17 x 4 = 68 ways. That would make for some tiny percentages.

Instead, show percentages using two dimensions: **Year(Order Date)** and **Region**. Then the percentages are calculated on the remaining dimension, **Sub-Category**, that is, you calculate percent of total within each red box in the following image.

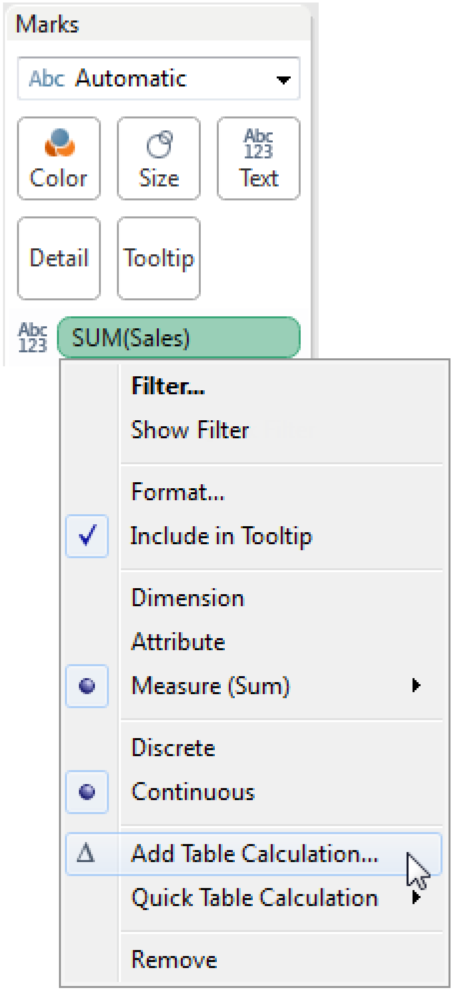


		Order Date			
Region	**Sub-Categ..**	**2011**	**2012**	**2013**	**2014**
Central	Accessories	$4,439	$7,795	$10,802	$10,920
	Appliances	$3,659	$4,975	$6,015	$8,933
	Art	$822	$1,132	$1,520	$2,291
	Binders	$15,871	$5,891	$14,056	$21,105
	Bookcases	$1,834	$8,298	$8,385	$5,640
	Chairs	$20,754	$17,909	$23,350	$23,218
	Copiers	$3,270	$12,810	$17,500	$3,680
	Envelopes	$1,599	$871	$971	$1,197
	Fasteners	$122	$89	$247	$320
	Furnishings	$2,536	$2,529	$5,116	$5,074
	Labels	$1,048	$305	$511	$587
	Machines	$16,292	$1,852	$2,659	$5,995
	Paper	$2,347	$3,544	$5,366	$6,235
	Phones	$9,926	$19,364	$19,902	$23,211
	Storage	$11,093	$8,331	$12,812	$13,694
	Supplies	$440	$324	$4,295	$4,408
	Tables	$7,785	$6,857	$13,923	$10,589
East	Accessories	$6,054	$17,911	$6,231	$14,837
	Appliances	$5,779	$6,691	$9,427	$12,291

The dimensions that you use to frame your calculation are called the *addressing fields*, and the fields in which you run your calculation are the *partition fields*.

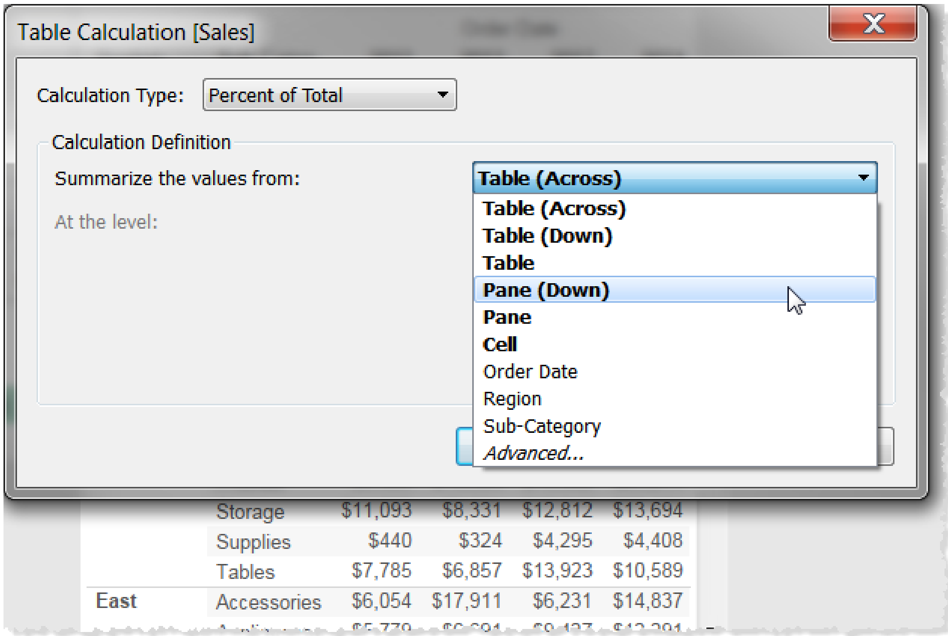
For more information on these concepts, see **Addressing and Partitioning** on page 1034.

6. To create a table calculation to show percentages, right-click (control-click on Mac) the **SUM(Sales)** field on the **Marks** card, and then select **Add Table Calculation**.



7. In the Table Calculation dialog box, set **Calculation Type** to **Percent of Total**.

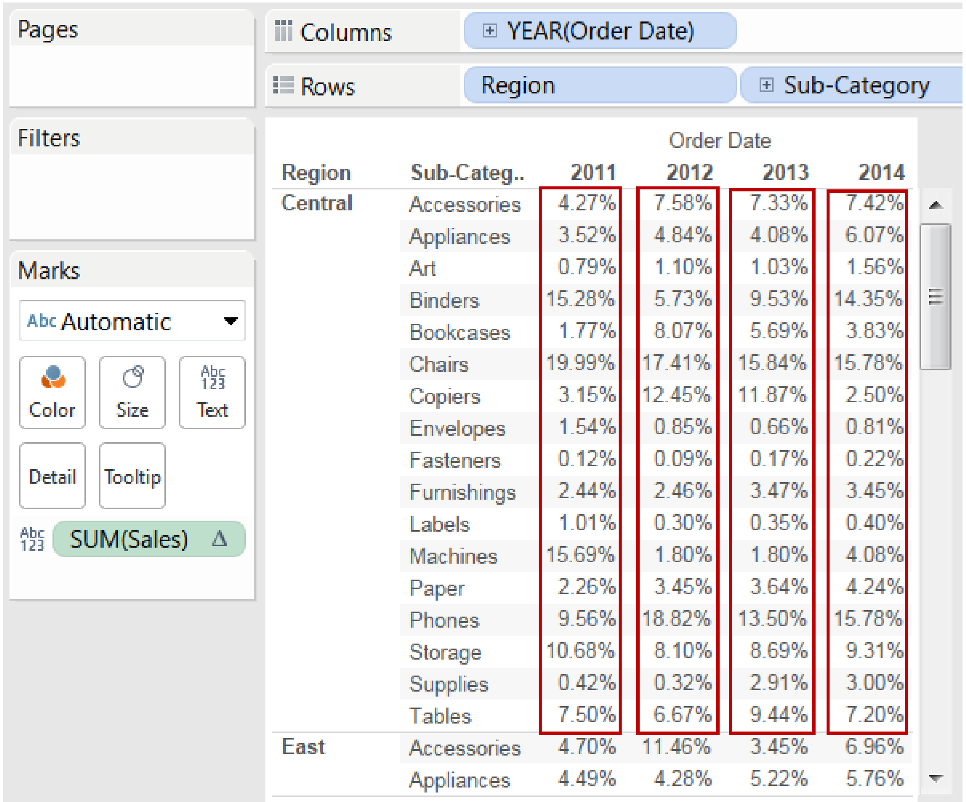
   The options in the dialog box change depending on the type of calculation you choose.



For more information, see Using Table Calculations in the Tableau Knowledge Base.

8. For the Calculation definition, select **Pane (Down)**, and then click **OK** to close the Table Calculation dialog box.

   Now we see percentages calculated within each sub-category, duplicated for each year within each region. The numbers within each red box add up to 100%.



Region	Sub-Categ..	2011	2012	2013	2014
		Order Date			
Central	Accessories	4.27%	7.58%	7.33%	7.42%
	Appliances	3.52%	4.84%	4.08%	6.07%
	Art	0.79%	1.10%	1.03%	1.56%
	Binders	15.28%	5.73%	9.53%	14.35%
	Bookcases	1.77%	8.07%	5.69%	3.83%
	Chairs	19.99%	17.41%	15.84%	15.78%
	Copiers	3.15%	12.45%	11.87%	2.50%
	Envelopes	1.54%	0.85%	0.66%	0.81%
	Fasteners	0.12%	0.09%	0.17%	0.22%
	Furnishings	2.44%	2.46%	3.47%	3.45%
	Labels	1.01%	0.30%	0.35%	0.40%
	Machines	15.69%	1.80%	1.80%	4.08%
	Paper	2.26%	3.45%	3.64%	4.24%
	Phones	9.56%	18.82%	13.50%	15.78%
	Storage	10.68%	8.10%	8.69%	9.31%
	Supplies	0.42%	0.32%	2.91%	3.00%
	Tables	7.50%	6.67%	9.44%	7.20%
East	Accessories	4.70%	11.46%	3.45%	6.96%
	Appliances	4.49%	4.28%	5.22%	5.76%

Pane (Down) is the appropriate choice because it specifies that the calculation should be performed from top to bottom within each pane of the table. The table has two vertical dimensions, so **Table (Down)** would have calculated the percent of total from top to bottom for the entire table, ignoring the **Region** dimension.

The pane is always the finest level of detail for the relevant direction (across or down). If you had three dimensions on the vertical axis, you might have had to use field names to define the calculation, because only the dimension furthest to the left on the **Rows** shelf (defined as Table) and the dimension furthest to the right (defined as Pane) could be captured with the structural options.

These concepts can be daunting. One solution is to use trial-and-error to see the results of different definitions for table calculations. But you should have a clear idea of what result you want, so that you can recognize it when you see it.

Building Line Charts

Line charts connect individual data points in a data view. They provide a simple way to visualize a sequence of values and are useful when you want to see trends over time, or to forecast future values. For more information about the line mark type, see **Line Mark** on page 436.

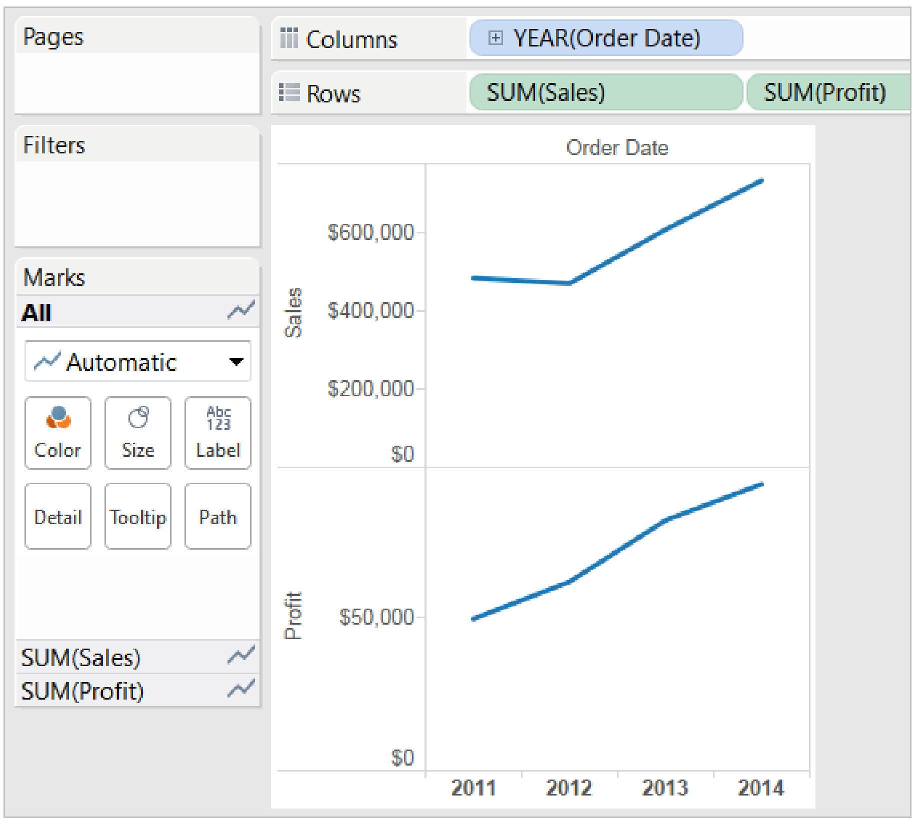
To create a view that displays the sum of the sales and the sum of the profit for all years, and then uses forecasting to determine a trend, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Order Date** dimension to **Columns**.

   Tableau aggregates the date by year, and creates column headers.
3. Drag the **Sales** measure to **Rows**.

   Tableau aggregates **Sales** as SUM and displays a simple line chart.
4. Drag the **Profit** measure to **Rows** and drop it to the right of the **Sales** measure.

   Tableau creates separate axes along the left margin for **Sales** and **Profit**.



Notice that the scale of the two axes is different—the **Sales** axis scales from $0 to $700,000, whereas the **Profit** axis scales from $0 to $100,000. This can make it hard to see that sales values are much greater than profit values.

When you are displaying multiple measures in a line chart, you can align or merge axes to make it easier for users to compare values.

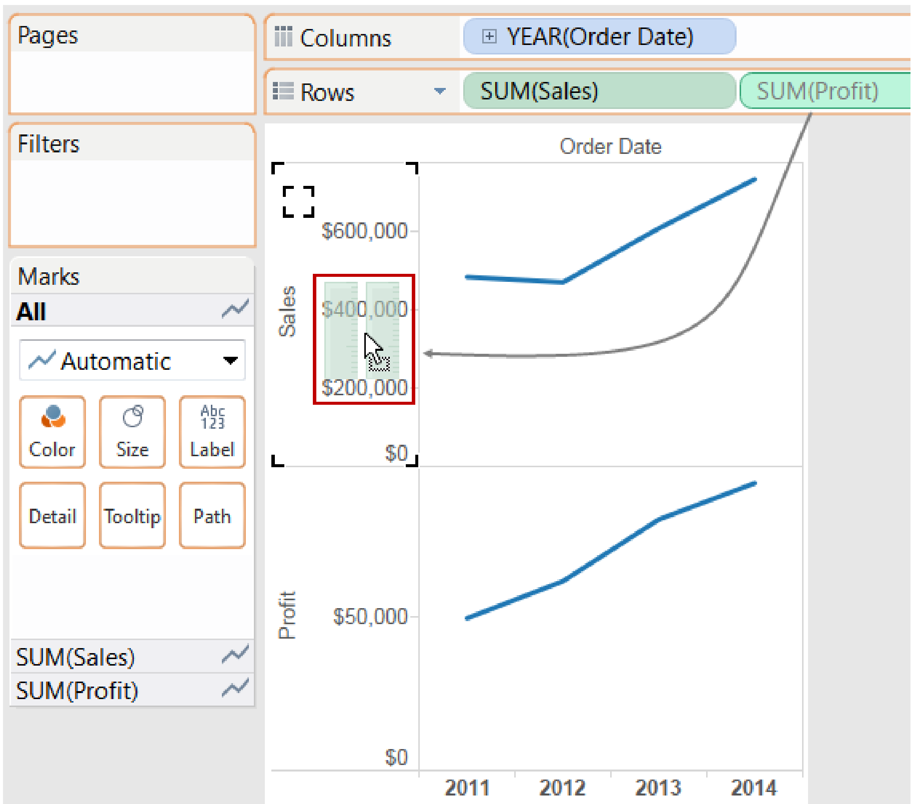
For more information about aligning the axes, see **Dual Axes** on page 859.

For more information about enforcing a single axis across multiple measures, see **Blended Axes** on page 858.

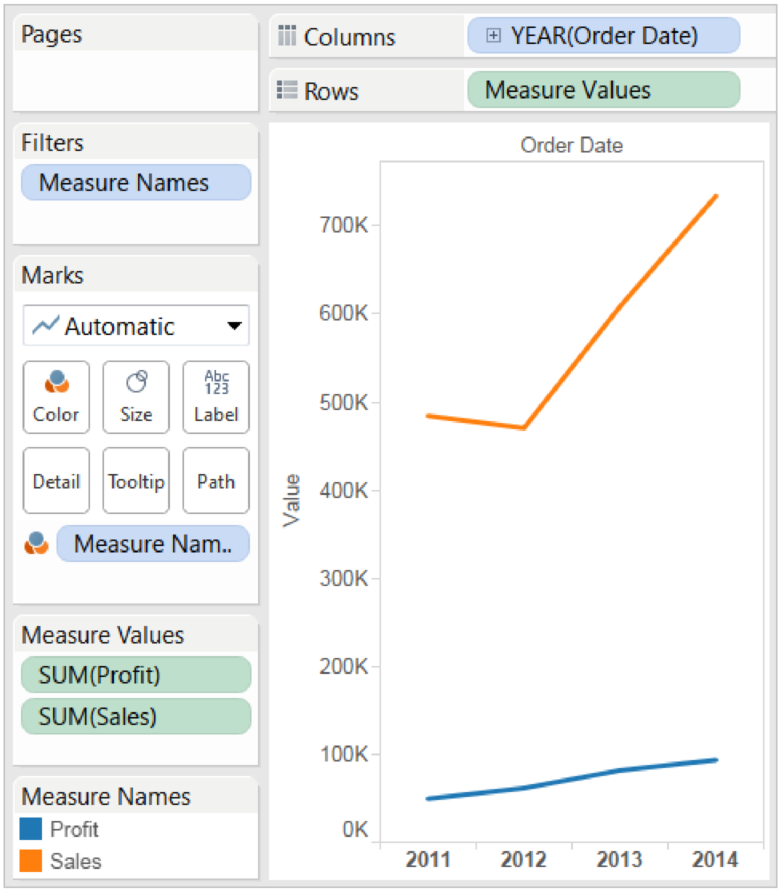
With either of these options, you can create a combination chart to change the mark type for one of your measures.

For more information, see **Combination Charts** on page 862.

5. Drag the **SUM(Profit)** field from **Rows** to the **Sales** axis to create a blended axis. The two pale green parallel bars (shown in the red box) indicate that **Profit** and **Sales** will use a blended axis when you release the mouse button.

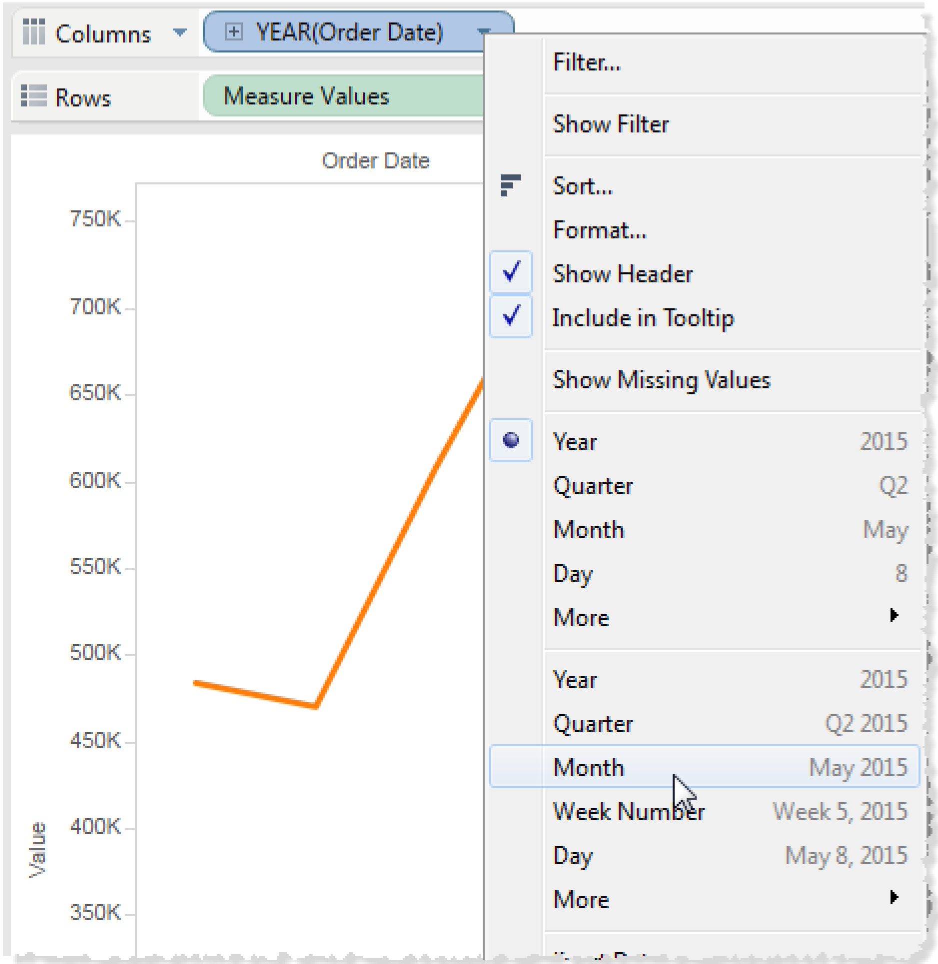


The view updates to look like this:

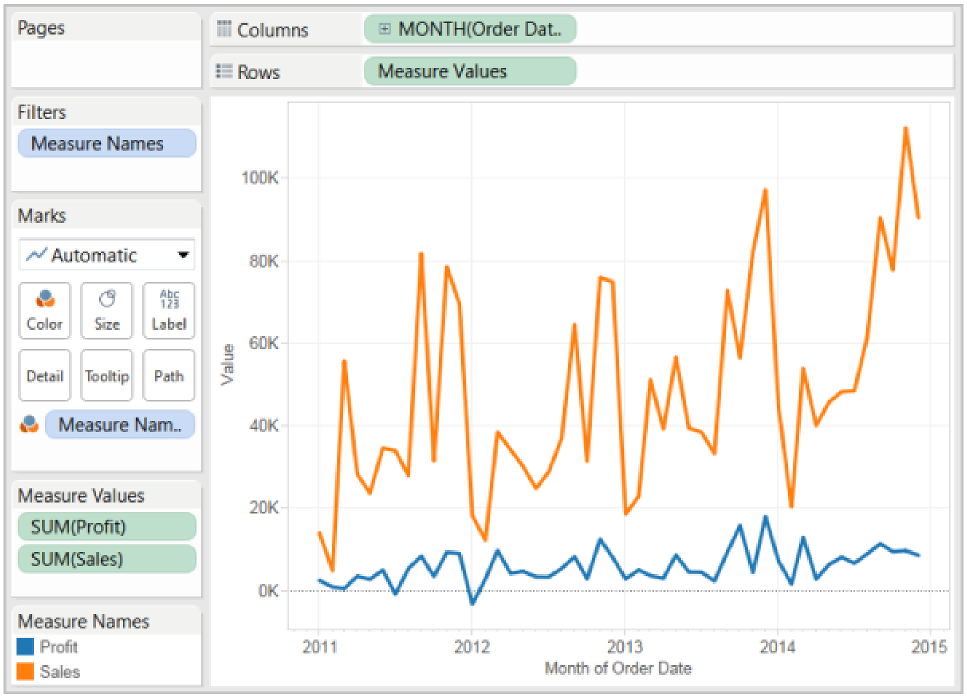


The view is rather sparse because we are looking at a summation of values on a per-year basis.

6. Click the drop-down arrow in the **Year(Order Date)** field in the view and select **Month** in the lower part of the content menu to see a continuous range of values over the four-year period.

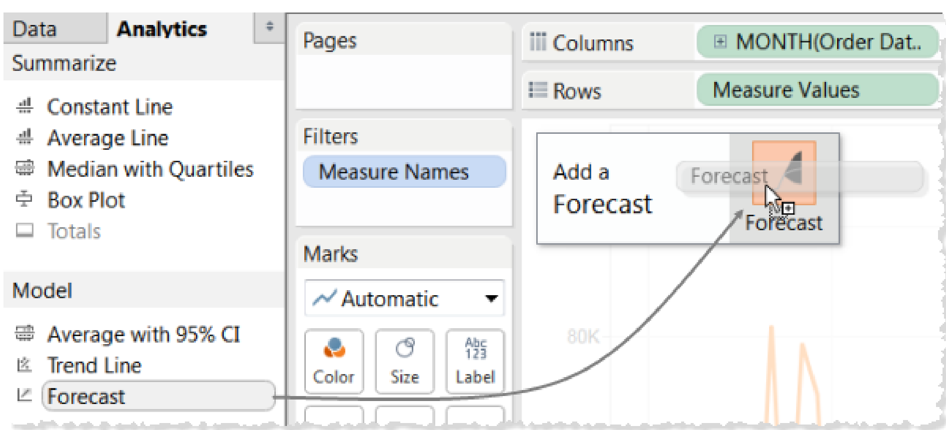


The resulting view is a lot more detailed than the original view:

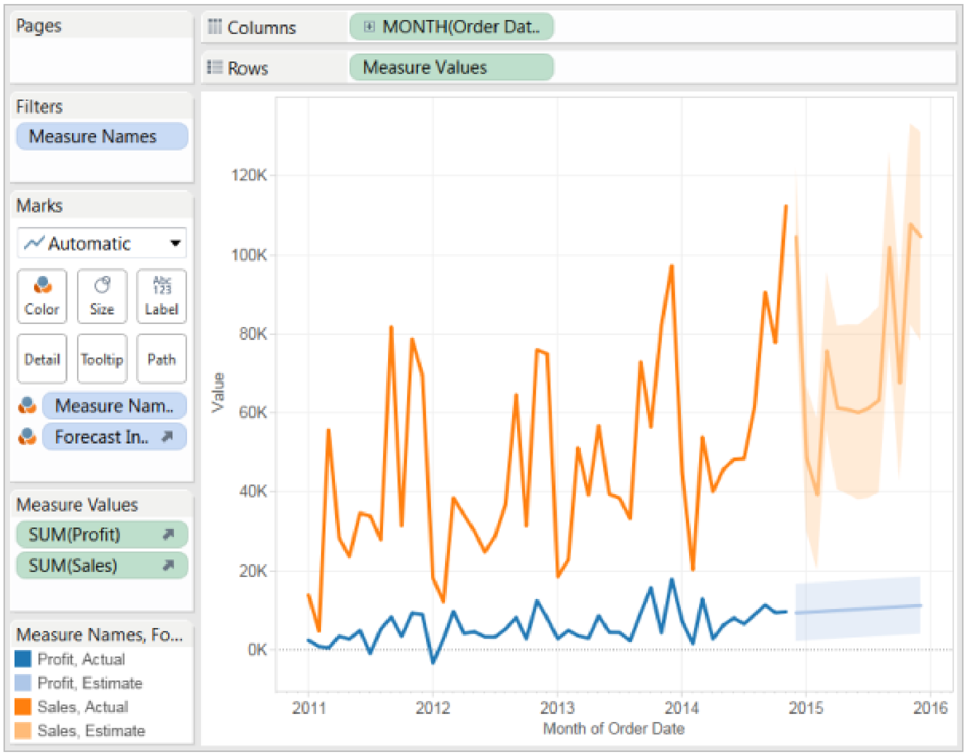


Notice that the values seem to go much higher just before the end of each year. A pattern like that is known as *seasonality*. If we turn on the forecasting feature in the view, we can see whether we should expect that apparent seasonal trend continuing into the future.

7. To add a forecast, drag the **Forecast** model from the **Analytics** pane to the view, and then drop it on **Forecast**.



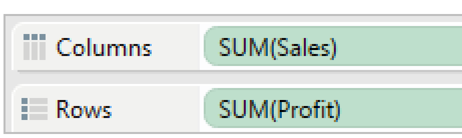
We then see that, according to Tableau forecasting, the seasonal trend does continue into the future:



Build a Scatter Plot

Use scatter plots to visualize relationships between numerical variables.

In Tableau, you create a scatter plot by placing at least one measure on the **Columns** shelf and at least one measure on the **Rows** shelf. If these shelves contain both dimensions and measures, Tableau places the measures as the innermost fields, which means that measures are always to the right of any dimensions that you have also placed on these shelves. The word "innermost" in this case refers to the table structure.

Creates Simple Scatter Plot	**Creates Matrix of Scatter Plots**
	

A scatter plot can use several mark types. By default, Tableau uses the shape mark type. Depending on your data, you might want to use another mark type, such as a circle or a square. For more information, see **Mark Types** on page 431.

To use scatter plots and trend lines to compare sales to profit, follow these steps:

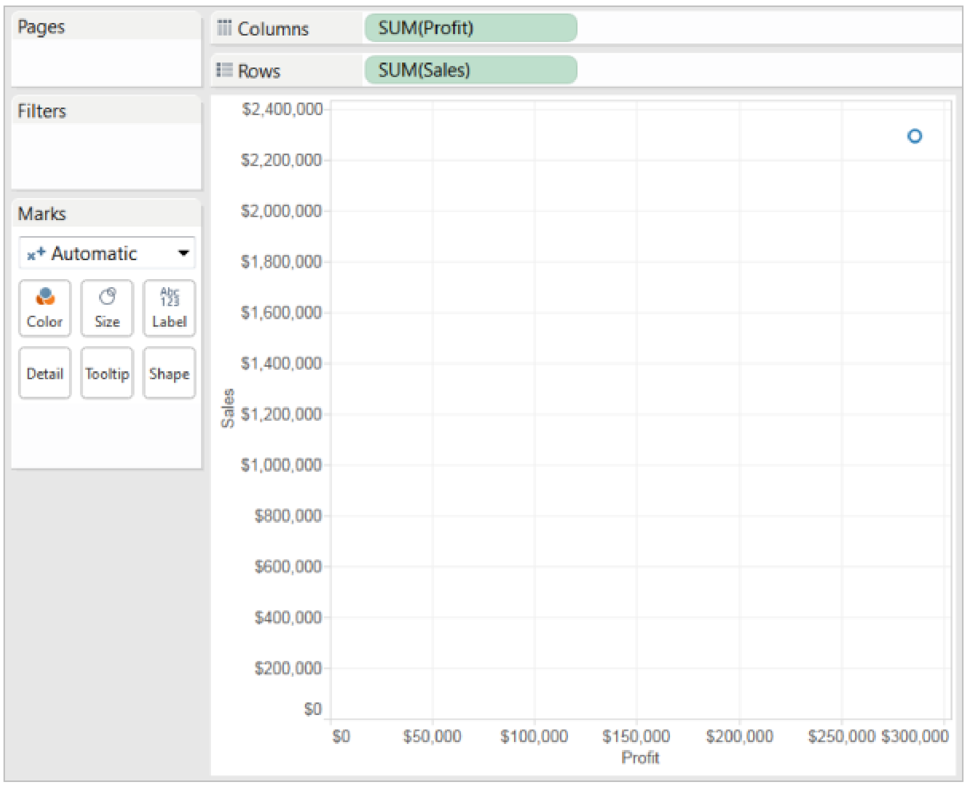
1. Open the **Sample - Superstore** data source.
2. Drag the **Profit** measure to **Columns**.

   Tableau aggregates the measure as a sum and creates a horizontal axis.
3. Drag the **Sales** measure to **Rows**.

   Tableau aggregates the measure as a sum and creates a vertical axis.

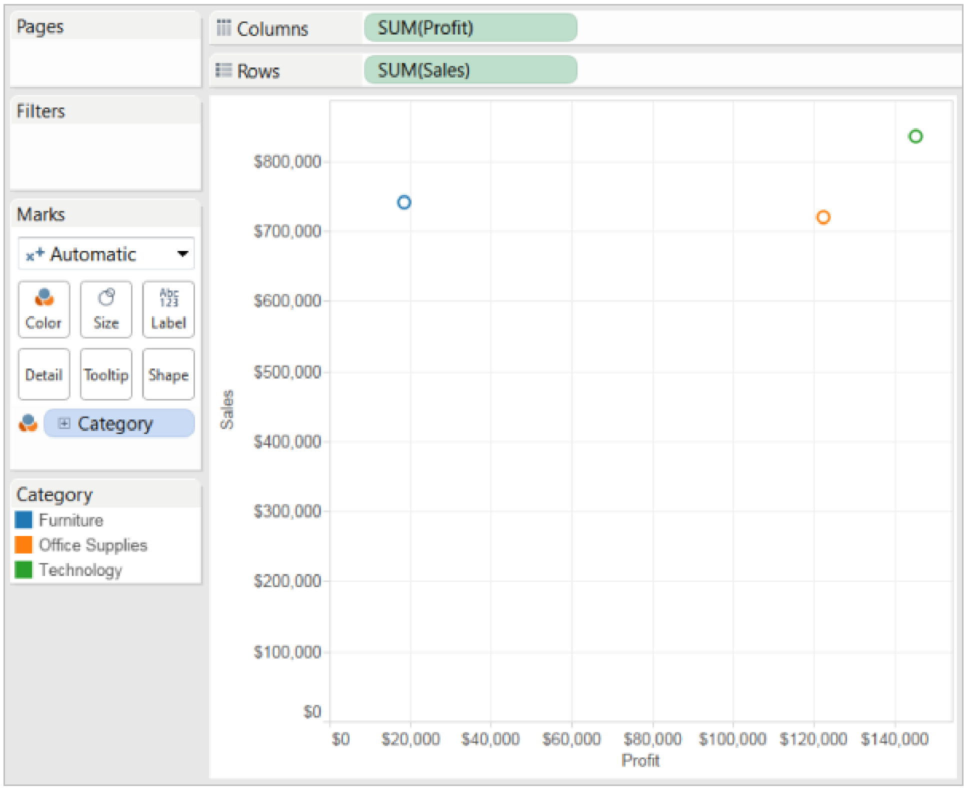
   Measures contain continuous numerical data. When you plot one number against another, you are comparing two numbers; the resulting chart is analogous to a Cartesian chart, with x and y coordinates.

   Now you have a one-mark scatter plot:

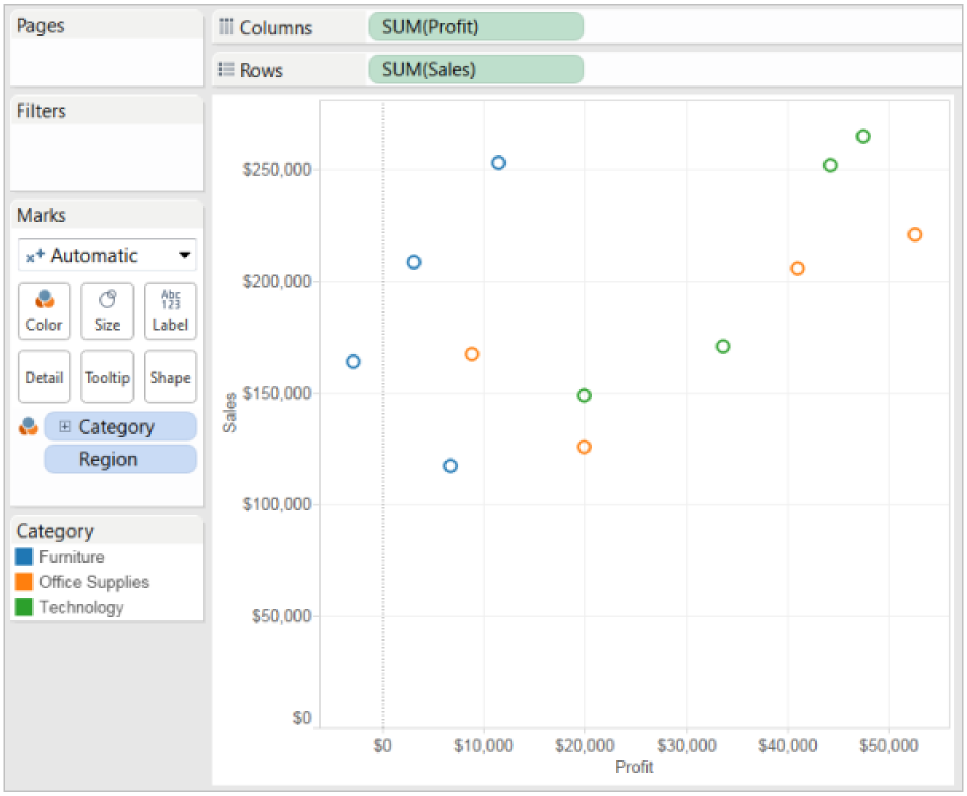
4. Drag the **Category** dimension to **Color** on the Marks card.

   This separates the data into three marks—one for each dimension member—and encodes the marks using color.

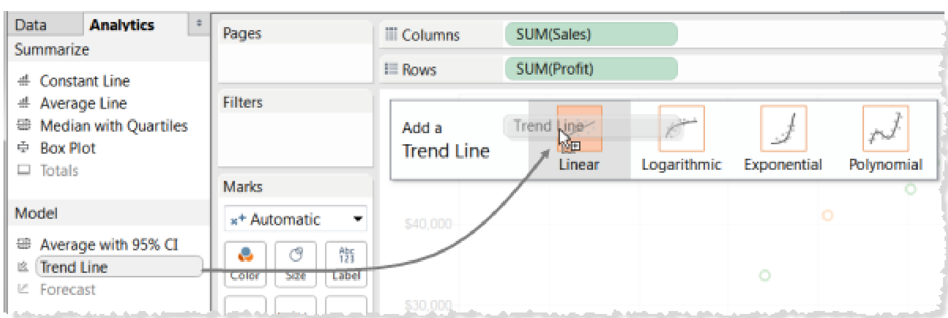


5. Drag the **Region** dimension to **Detail** on the **Marks** card.

   Now there are many more marks in the view. The number of marks is equal to the number of distinct regions in the data source multiplied by the number of departments. (If you're curious, use the **Undo** button on the toolbar to see what would have happened if you'd dropped the **Region** dimension on **Shape** instead of **Detail**.)



6. To add trend lines, drag the **Trend Line** model from the **Analytics** pane to the view, and then drop it on the model type.

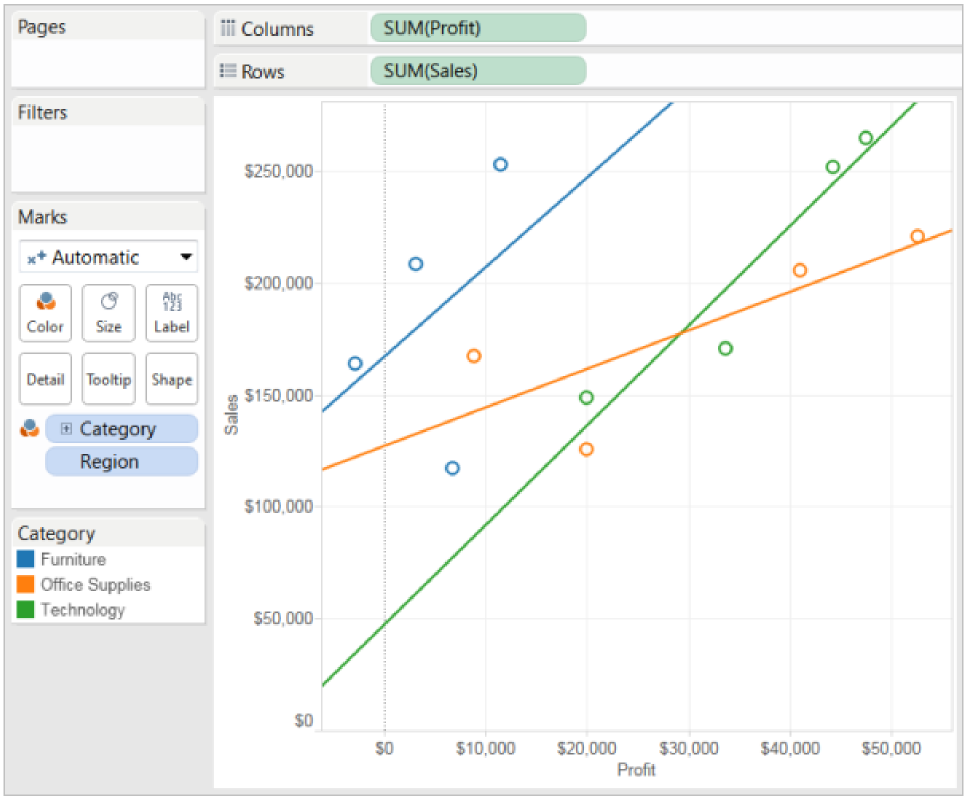


A trend line can provide a statistical definition of the relationship between two numerical values. To add trend lines to a view, both axes must contain a field that can be interpreted as a number—by definition, that is always the case with a scatter plot.

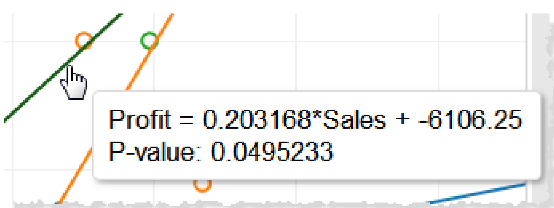
Tableau adds three linear trend lines—one for each color that you are using to distinguish the three categories. Tableau also shows the confidence bands for each trend line.

7. To declutter the view, remove the confidence bands: right-click (control-click on Mac) in

the view and choose **Trend Lines** > **Edit Trend Lines**. In the Trend Line Options dialog box, clear the **Show Confidence Bands** check box, and then click **OK**.



8. Hover the cursor over the trend lines to see statistical information about the model that was used to create the line:



For more information, see **Assessing Trend Line Significance** on page 1191. You can also customize the trend line to use a different model type or to include confidence bands. For more information, see **Adding Trend Lines** on page 1185.

See Also

Example – Scatter Plots and Aggregation on page 255

Build a Heat Map

Use heat maps to compare categorical data using color.

In Tableau, you create a heat map by placing one or more dimensions on the **Columns** shelf and one or more dimensions on the **Rows** shelf. You then select **Square** as the mark type and place a measure of interest on the **Color** shelf.

You can enhance this basic heat map by setting the size and shape of the table cells.

To create a heat map to explore how profit varies across regions, product sub-categories, and customer segments, follow these steps:

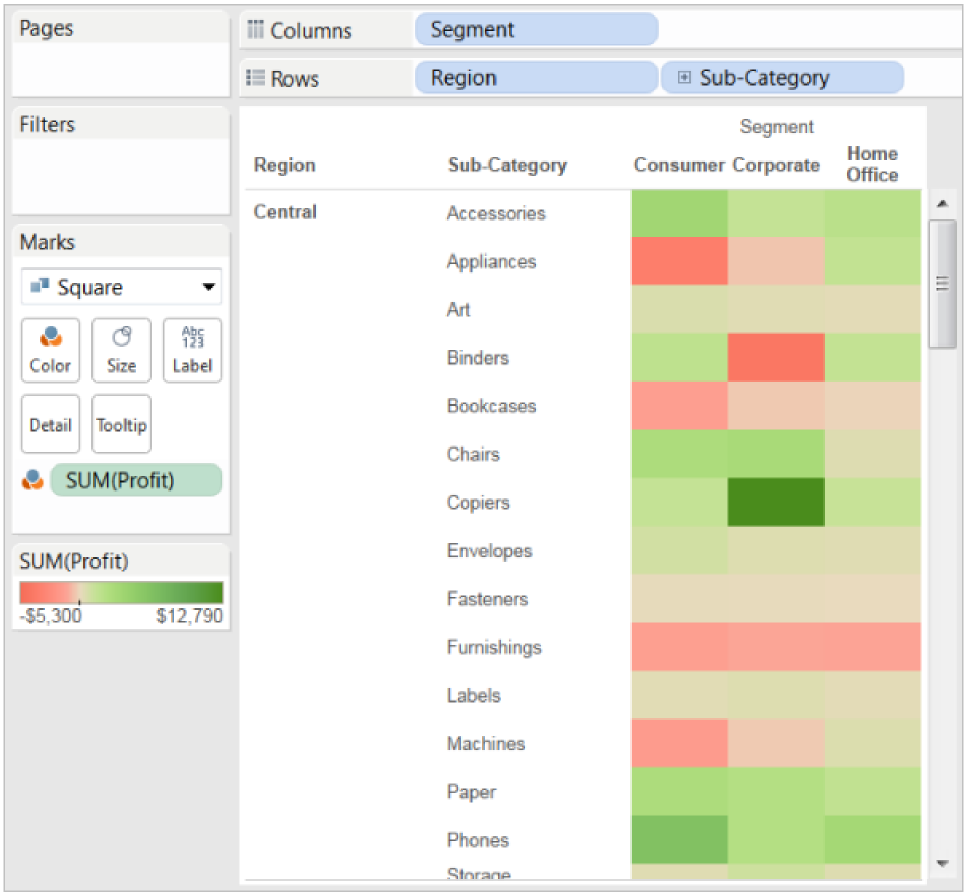
1. Connect to the **Sample - Superstore** data source.
2. Drag the **Segment** dimension to **Columns**.

   Tableau creates headers with labels derived from the dimension member names.
3. Drag the **Region** and **Sub-Category** dimensions to **Rows**, dropping **Sub-Category** to the right of **Region**.

   Now you have a nested table of categorical data (that is, the **Sub-Category** dimension is nested within the **Region** dimension).
4. Drag the **Profit** measure to **Color** on the **Marks** card.

   Tableau aggregates the measure as a sum. The color legend reflects the continuous data range.
5. Optimize the view format:

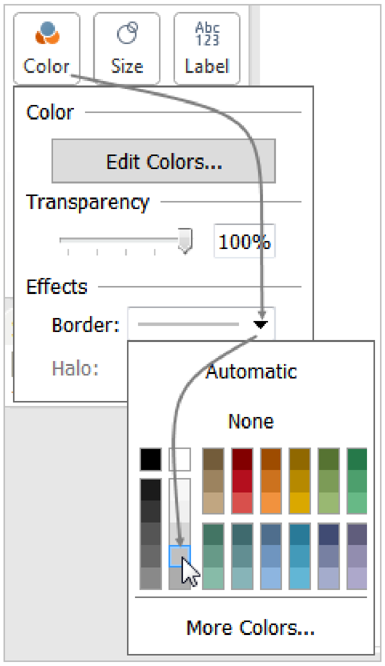
   - On the **Marks** card, select **Square** as the mark type.
   - Make the columns wider by pressing Ctrl + Right arrow. Hold down Ctrl and continue pressing the Right arrow key until the headings for **Segment** are displayed in full:
   - Increase the mark size by pressing Ctrl + Shift + B. Hold down Ctrl + Shift and continue to press B until the squares are large enough.



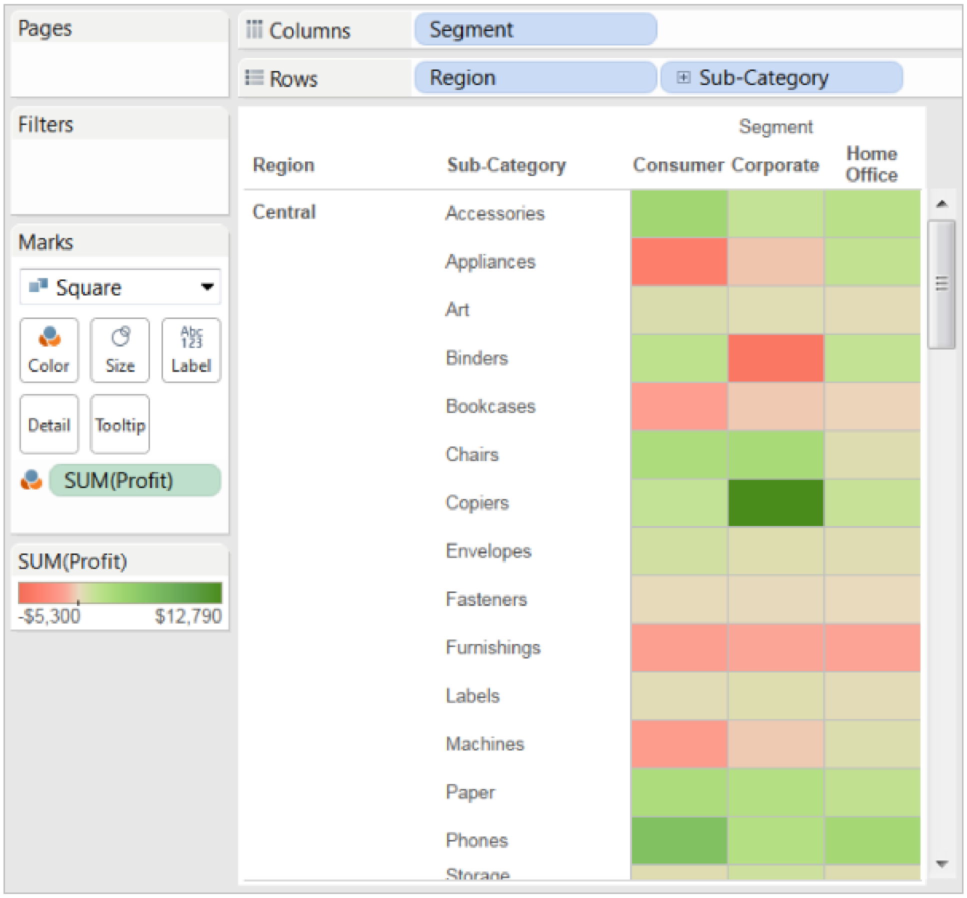
In this view, you can see data for only the Central region. You must scroll down to see data for other regions.

In the Central region, copiers are shown to be the most profitable sub-category, and binders and appliances the least profitable.

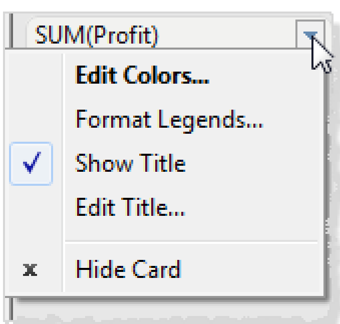
6. Click **Color** on the **Marks** card to display configuration options. In the **Border** drop-down list, select a medium gray color for cell borders, as in the following image:



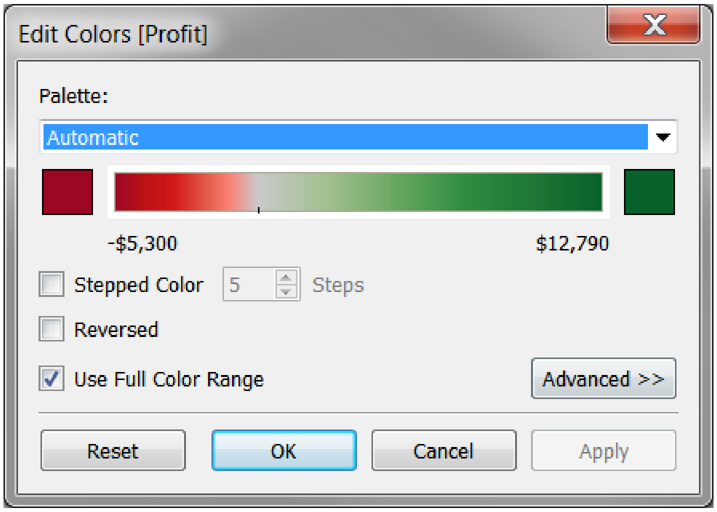
Now it's easier to see the individual cells in the view:



7. To make the colors more distinct, hover over the **SUM(Profit)** color legend, and then click the drop-down arrow that appears. The following menu appears:

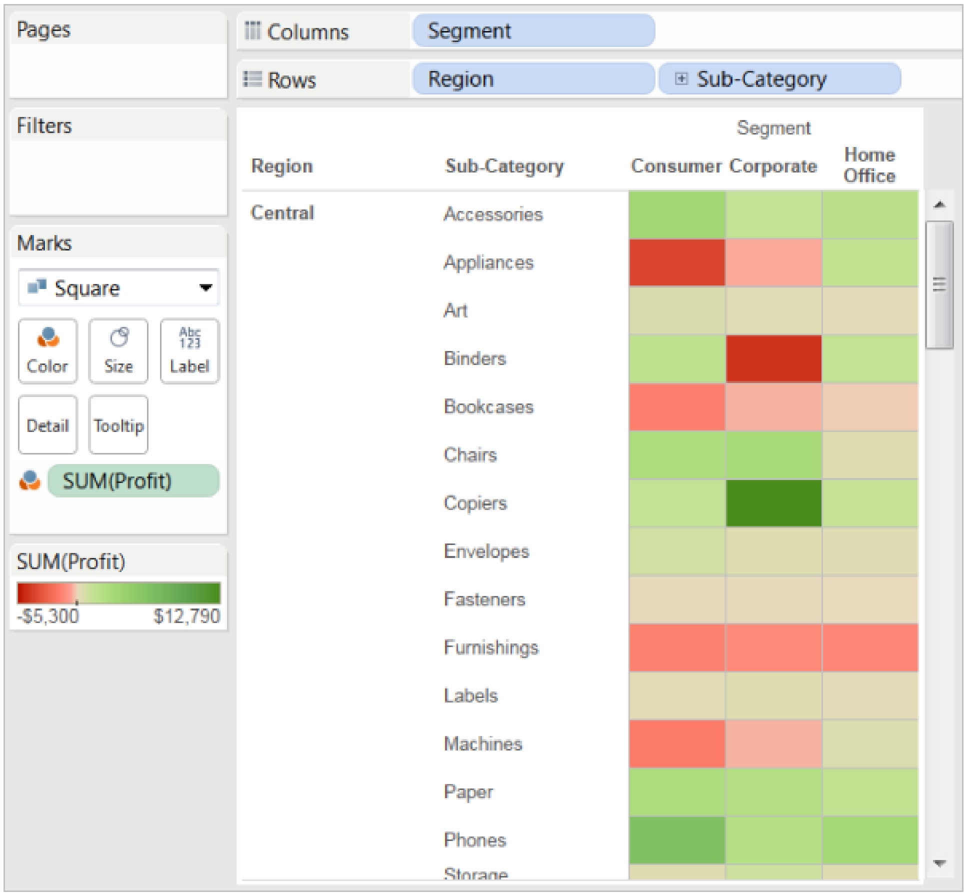


8. Click **Edit Colors**. In the Edit Colors dialog box, and then select **Use Full Color Range**:



When you select this option, Tableau assigns the starting number a full intensity and the ending number a full intensity. If the range is from -10 to 100, the color representing negative numbers changes in shade much more quickly than the color representing positive numbers.

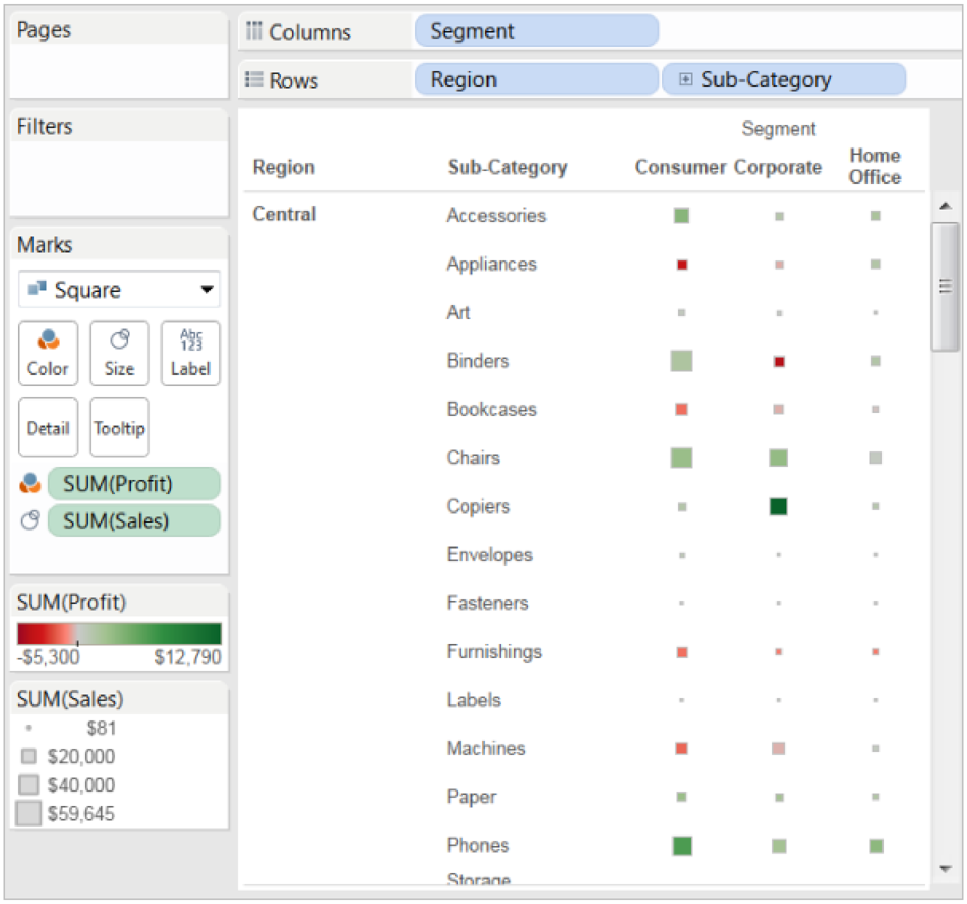
When you do not select **Use Full Color Range**, Tableau assigns the color intensity as if the range was from -100 to 100, so that the change in shade is the same on both sides of zero. The effect is to make the color contrasts in your view much more distinct:



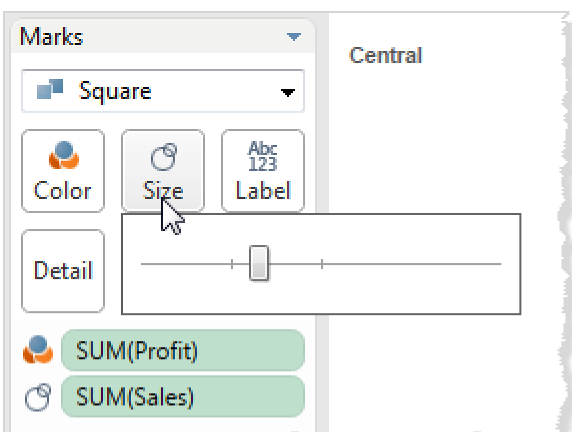
(For more information about color options, see **Color Properties** on page 451.)

9. Drag the **Sales** measure to **Size** on the **Marks** card to control the size of the boxes by the Sales measure. You can compare absolute sales numbers (by size of the boxes) and profit (by color).

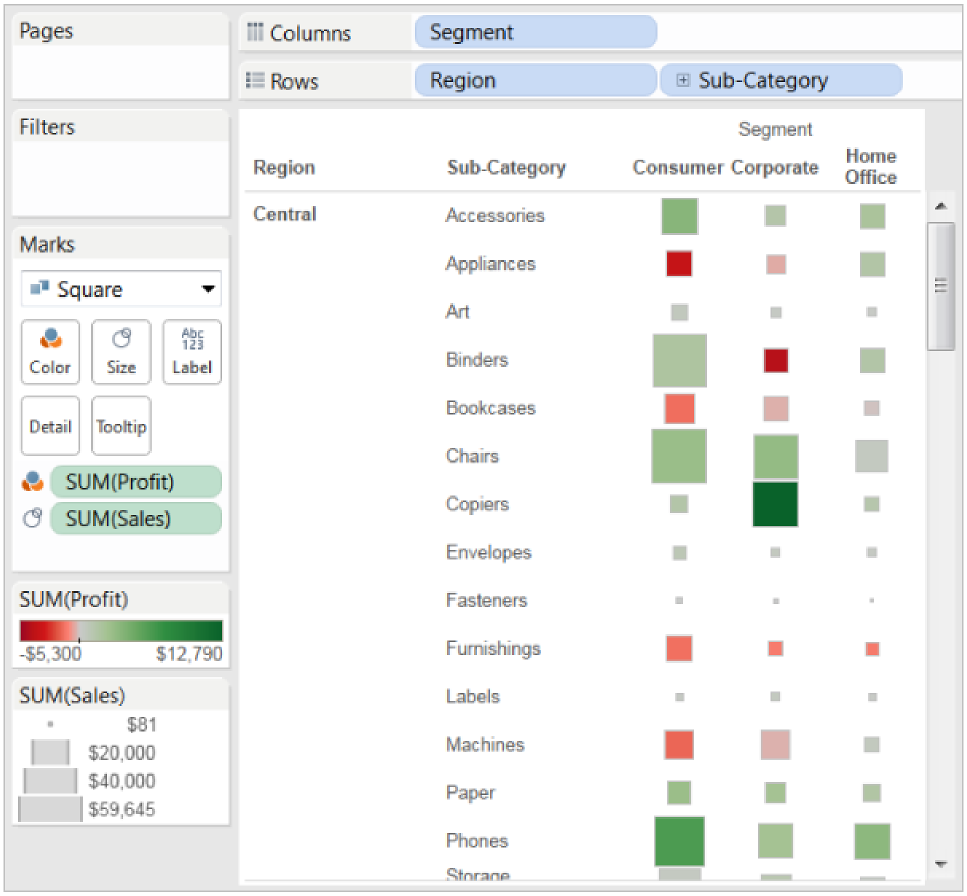
   Initially, the marks look like this:



10. To enlarge the marks, click **Size** on the **Marks** card to display a size slider:



11. Drag the slider to the right until the boxes in the view are the optimal size. Now your view is complete:



12. Use the scroll bar along the right side of the view to examine the data for different regions.

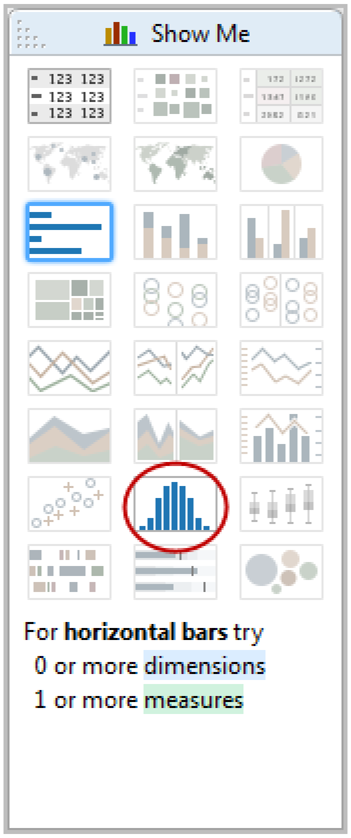
Build a Histogram

A histogram is a chart that displays the shape of a distribution. A histogram looks like a bar chart but groups values for a continuous measure into ranges, or bins.

In Tableau you can create a histogram using Show Me, or by first creating bins from a continuous measure. This topic describes the Show Me method.

To create a histogram using Show Me, follow these steps:

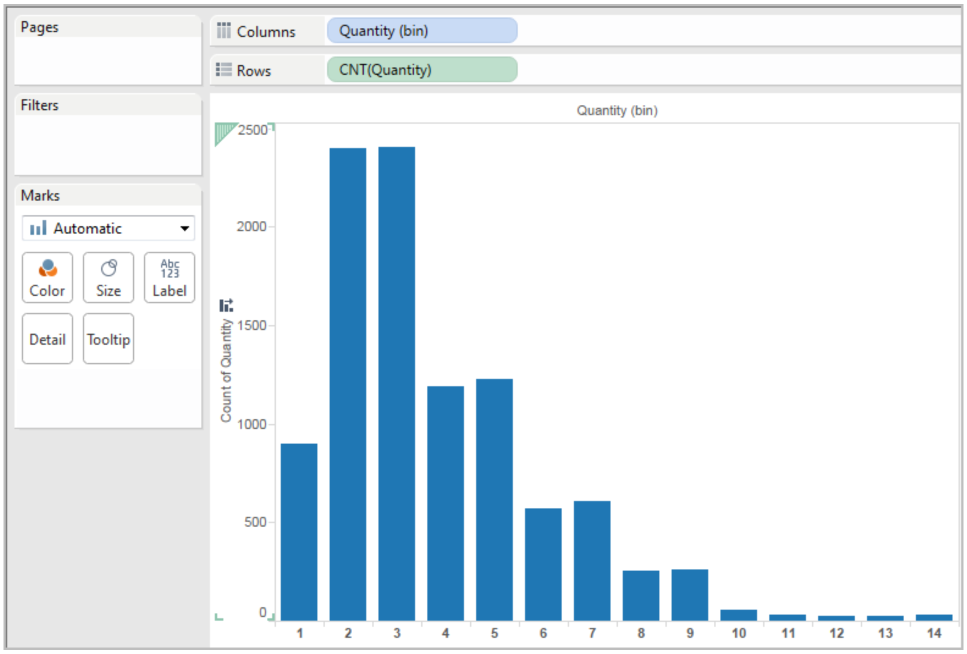
1. Connect to the **Sample - Superstore** data source.
2. Drag **Quantity** to **Columns**.
3. Click the histogram icon in Show Me:



Histogram is only available when the view contains a single measure—and no dimensions.

Three things happen after you click the histogram icon:

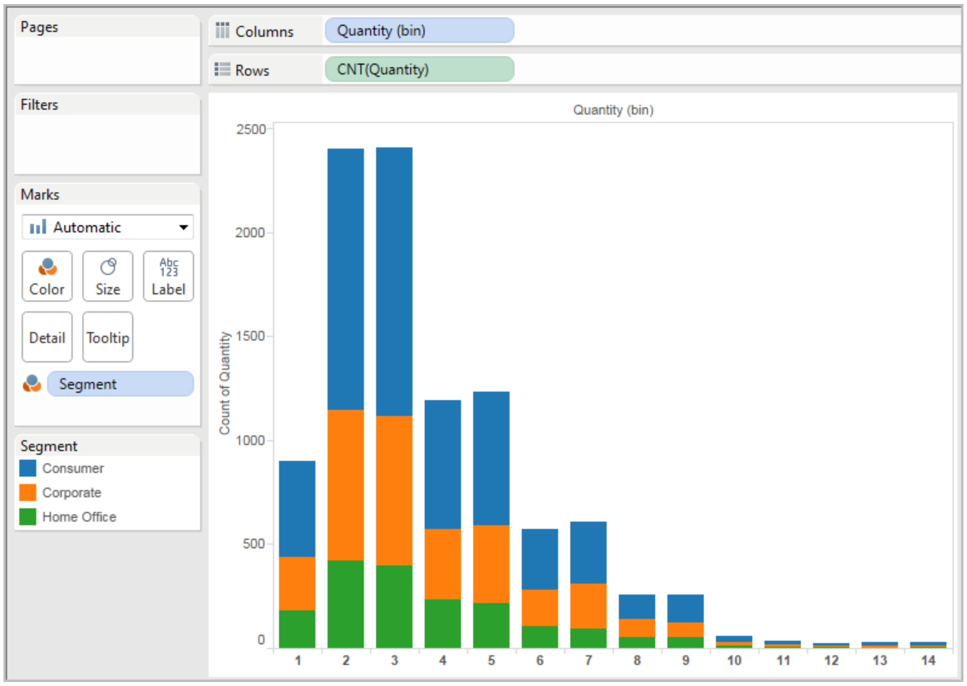
- The view changes to show vertical bars, with a discrete x-axis (1 – 14) and a continuous y-axis (0 – 2,500).
- The **Quantity** measure you placed on the **Columns** shelf, which had been aggregated as SUM, is replaced by a **Quantity (bin)** dimension.
- A **CNT(Quantity)** field is created and added to the **Rows** shelf.



The **Quantity** measure captures the number of items in a particular order. The histogram shows that about 900 orders contained a single item (the first bar), that about 2,400 contained two items (the second bar), and so on.

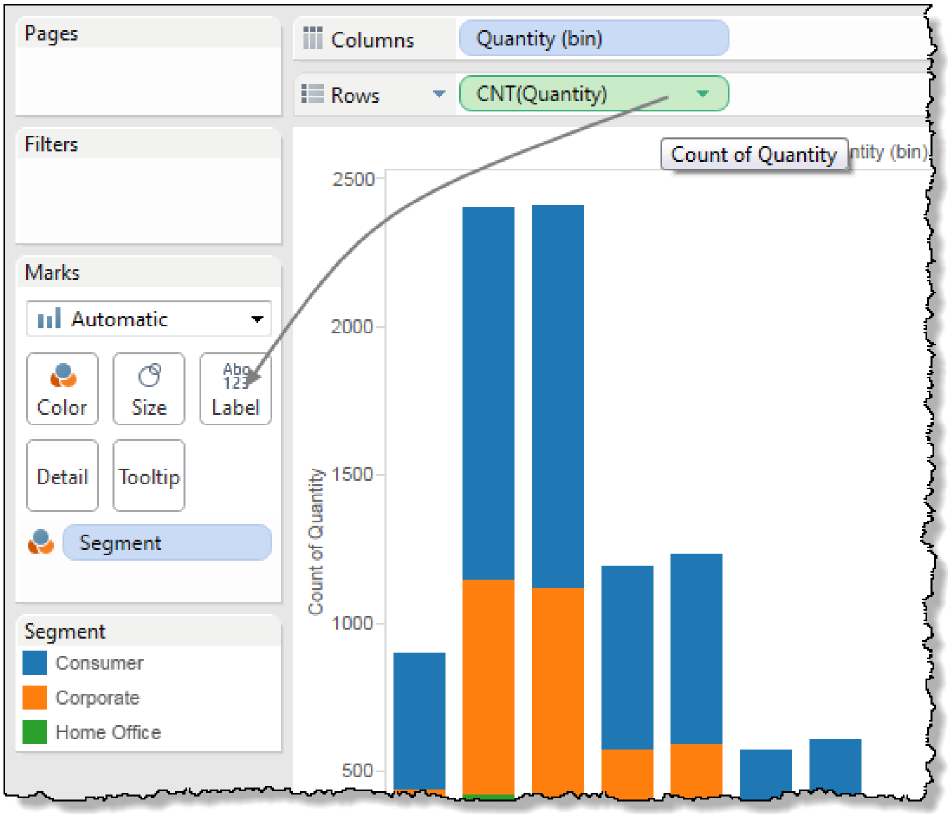
Let's take this view one step further and add **Segment** to **Color** to see if we can detect a relationship between the customer segment (consumer, corporate, or home office) and the quantity of items per order.

4. Drag **Segment** to **Color**.



The colors aren't showing a clear trend. Let's show the percent of each bar belonging to each segment.

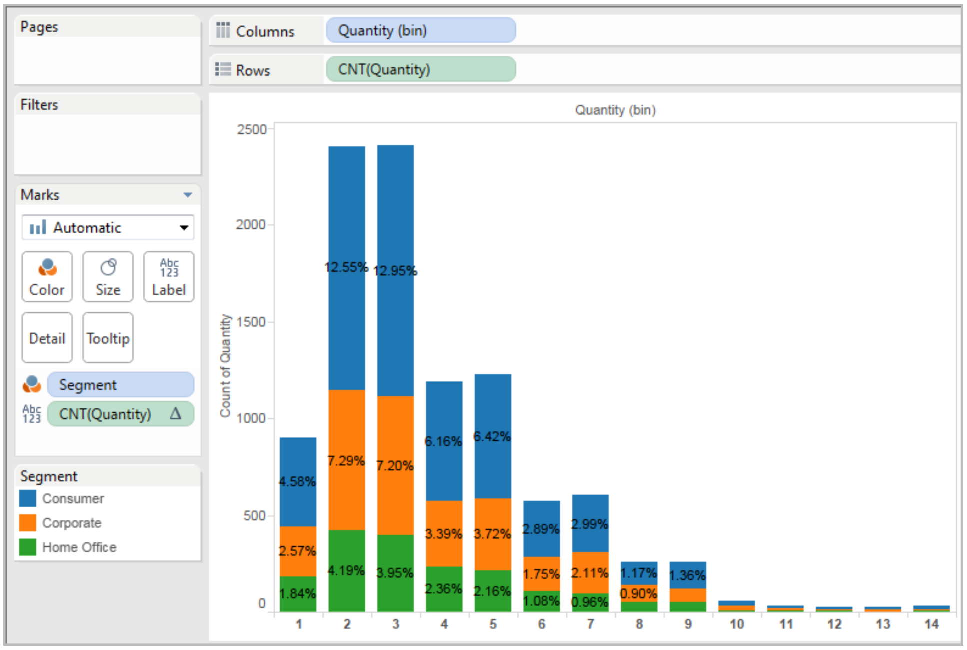
5. Hold down the Ctrl key and drag the **CNT(Quantity)** field from the **Rows** shelf to **Label**.



Holding down the Ctrl key copies the field to the new location without removing it from the original location.

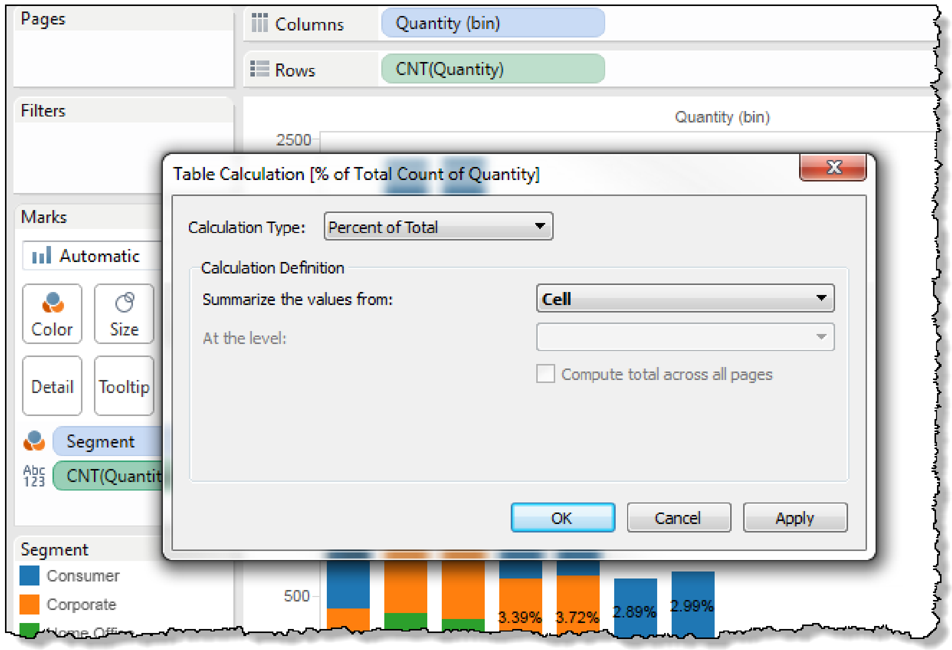
6. Right-click (control-click on a Mac) the **CNT(Quantity)** field on the **Marks** card and select **Quick Table Calculation** > **Percent of Total**.

   Now each colored section of each bar shows its respective percent of the total quantity:

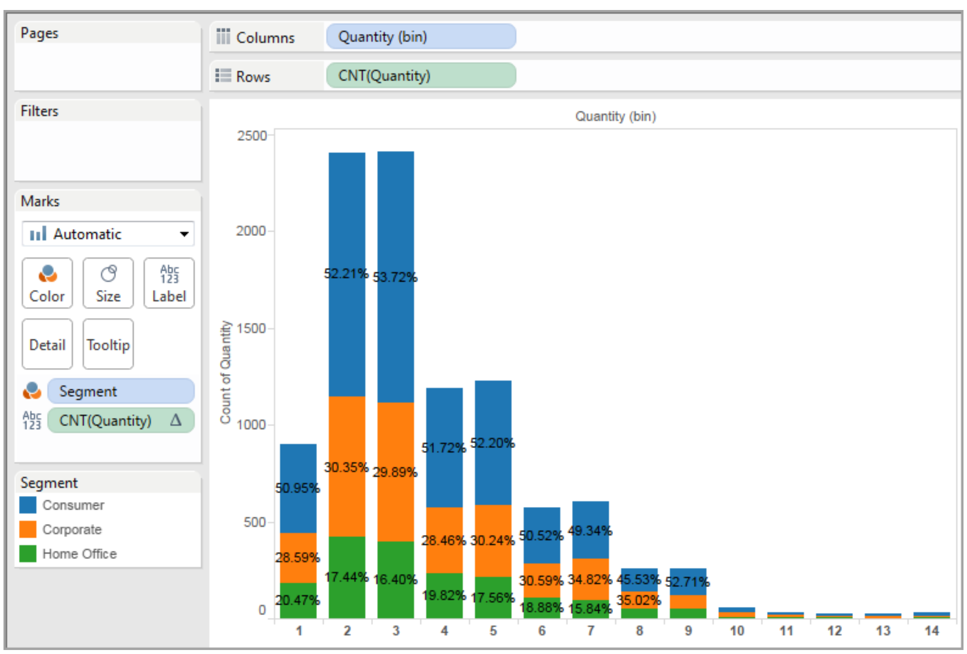


But we want the percentages to be on a per-bar basis.

7. Right-click the **CNT(Quantity)** field on the **Marks** card again and select **Edit Table Calculation**.
8. In the Table Calculation dialog box, change the value of the **Summarize the values from** field to **Cell**.



Now we have the view that we want:



There is still no evidence that the percentages by customer segment show any trend as the number of items in an order increases.

For information on how to create a binned dimension from a continuous measure, see **Create Discrete Bins from a Continuous Measure** on page 868. If you create a binned dimension, place it on **Columns**, and then place the initial measure that you used as the basis for the binned dimension on **Rows**. Set the aggregation to **Count (Distinct)** to create a histogram.

Build a Gantt Chart

Use Gantt charts to show the duration of events or activities.

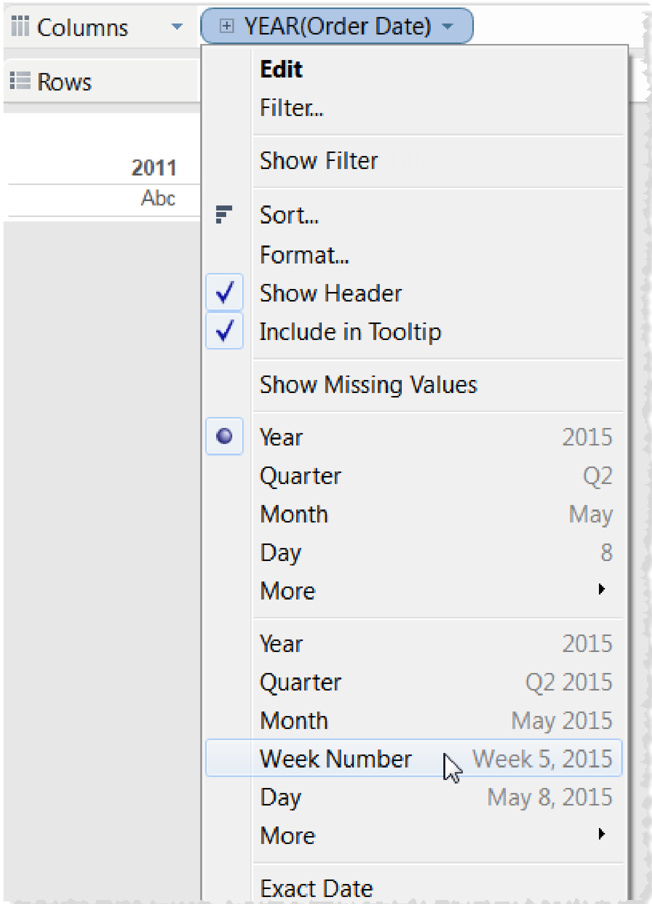
In a Gantt chart, each separate mark (usually a bar) shows a duration. For example, you might use a Gantt chart to display average delivery time for a range of products.

For more information about the Gantt bar mark type, see **Gantt Bar Mark** on page 449.

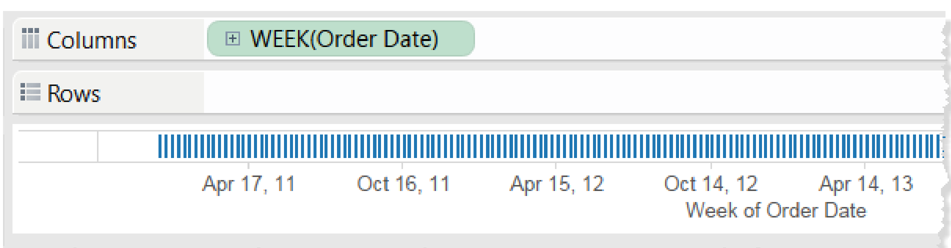
To create a Gantt chart that shows how many days elapse on average between order date and ship date, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Order Date** dimension to **Columns**.

   Tableau aggregates the dates by year and creates column headers with labels for the years.
3. On the **Columns** shelf, click the **Year (Order Date)** drop-down arrow, and then select **Week Number**.

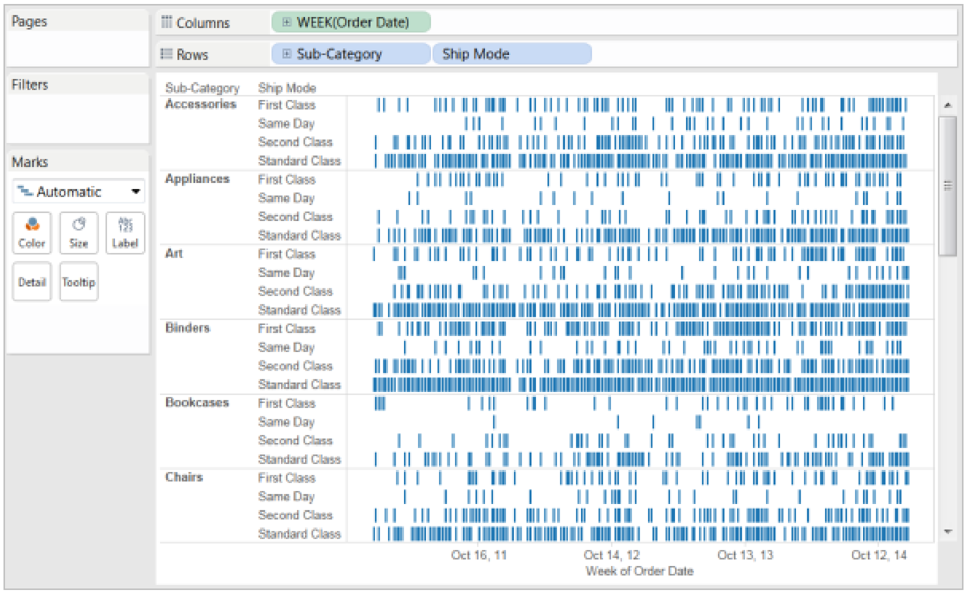


The column headers change. Individual weeks are indicated by tick marks because there are 208 weeks in a four-year span—too many to show as labels in the view.



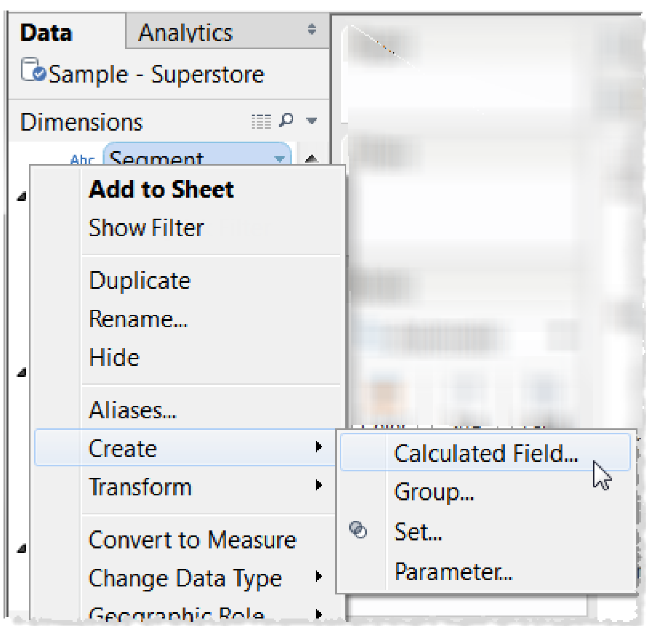
4. Drag the **Sub-Category** and **Ship Mode** dimensions to the **Rows** shelf. Drop **Ship Mode** to the right of **Sub-Category**.

   This builds a two-level nested hierarchy of dimensions along the left axis.



Next, we'll size the marks according to the length of the interval between the order date and the ship date. To do this, create a calculated field to capture that interval.

5. Right-click (Control-click on Mac) on an empty space in the **Data** pane and select **Create** > **Calculated Field**.



6. In the calculation dialog box, name your calculated field **OrderUntilShip**.

7. Clear any content that's in the **Formula** box by default.

8. In the **Formula** box, enter the following formula and then click **OK**:

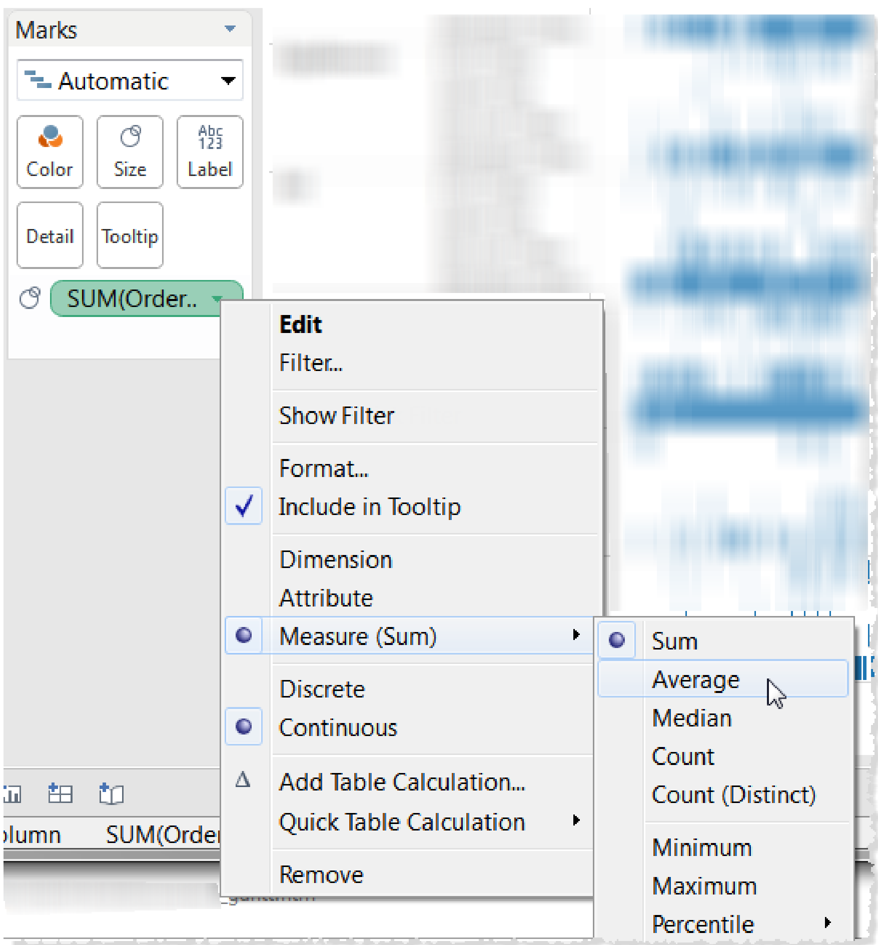
```
DATEDIFF('day',[Order Date],[Ship Date])
```

The formula creates a custom measure that captures the difference between the **Order Date** and **Ship Date** values, in days.

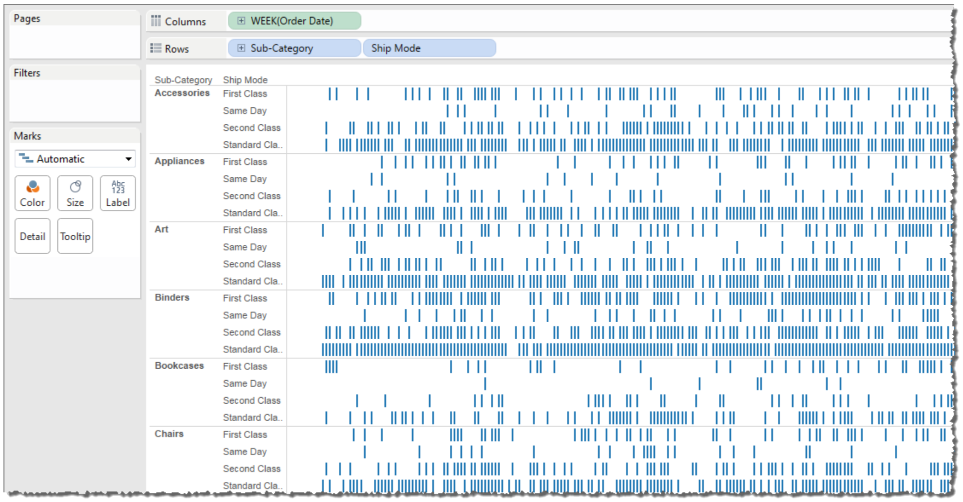
9. Drag the **OrderUntilShip** measure to **Size** on the **Marks** card.

The default aggregation for **OrderUntilShip** is **Sum**, but in this case it makes more sense to average the values.

10. Right-click (Control-click on Mac) the **SUM(OrderUntilShip)** field on the **Marks** card, and then select **Measure (Sum)** > **Average**.

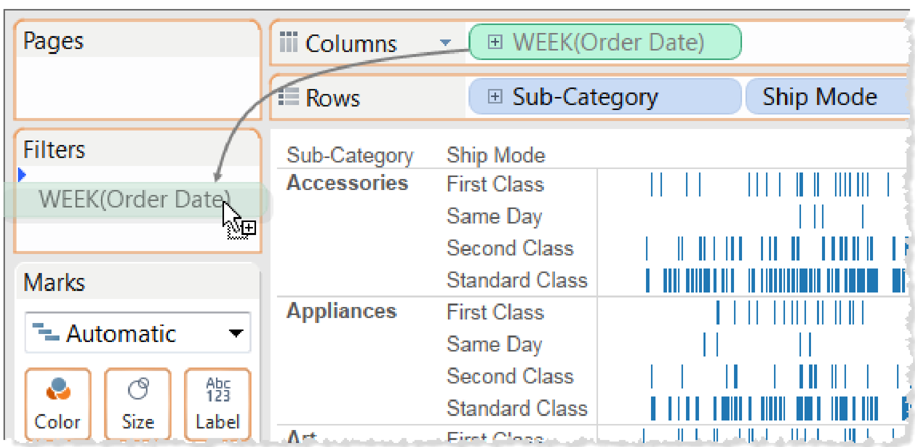


The view is coming along. But there are too many marks squeezed into the view.



We can make our data more readable by filtering down to a smaller time window.

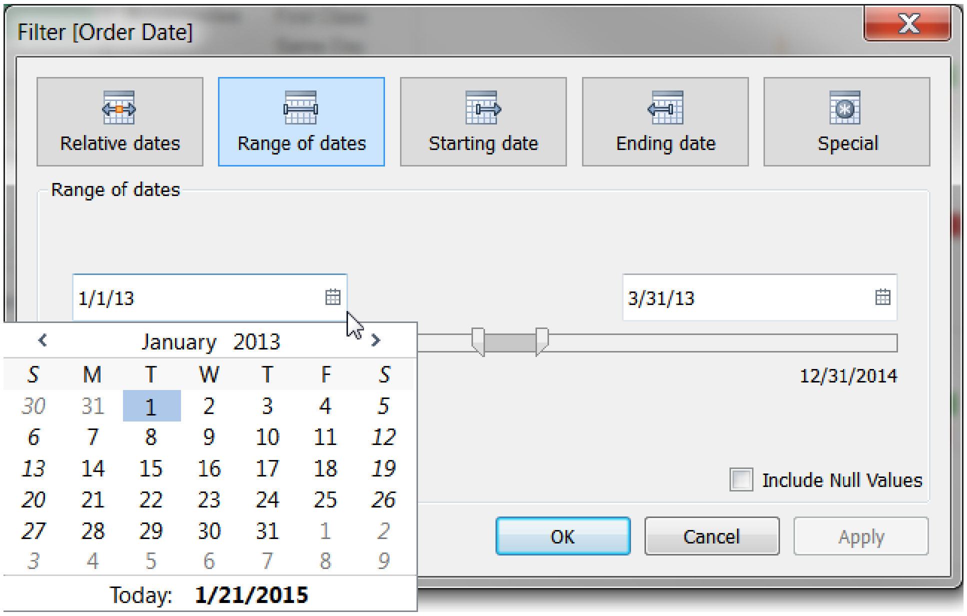
11. Hold down the Ctrl key and drag the **Week(Order Date)** field from the **Columns** shelf to the **Filter** shelf.



By holding down the Ctrl key, you tell Tableau that you want to copy the field to the new location, with whatever customizations you have added, without removing it from the old location.

The Filter Field dialog box opens.

12. Click **Range of Dates** and then click **Next**.

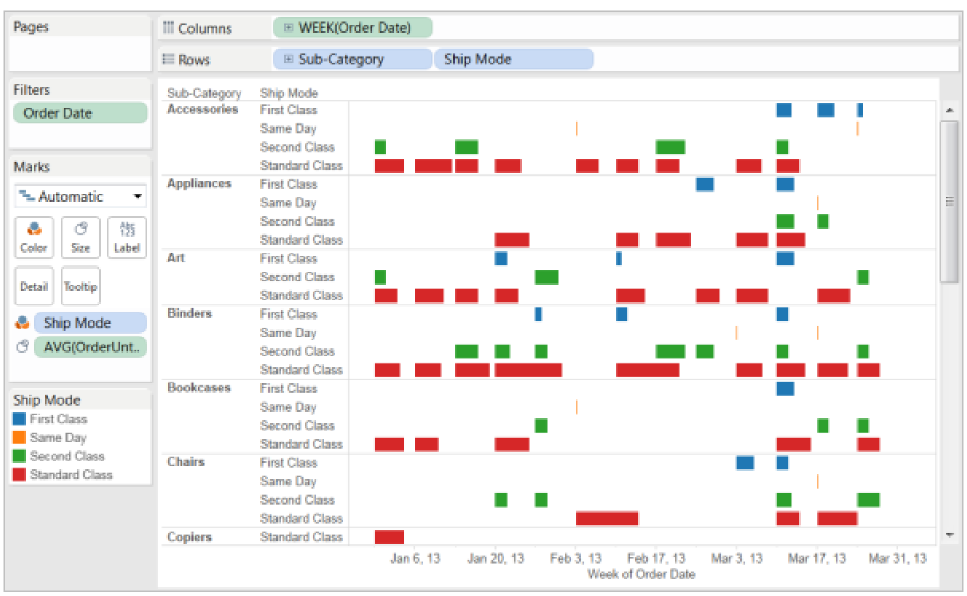


13. Set the range to a three-month time interval, such as 1/1/2013 to 3/31/2013, and then click **OK**.

    It can be difficult to get the exact date using the sliders—it's easier just to enter the numbers you want directly into the date boxes or use the calendar to select the dates.

14. Drag the **Ship Mode** dimension to **Color** on the **Marks** card.

    Now your view shows you all sorts of information about the lag between order times and ship times.



For example, you can see which ship modes are more prone to longer lag times, whether lag times vary by category, and whether lag times are consistent over time.

Note: If you publish this view to Tableau Server, you can include Quick Filters that let users interact with the view by varying the time window, or filtering out various sub-categories or ship modes. For more information, see **Publish Data Sources and Workbooks** on page 1201.

Build a Pie Chart

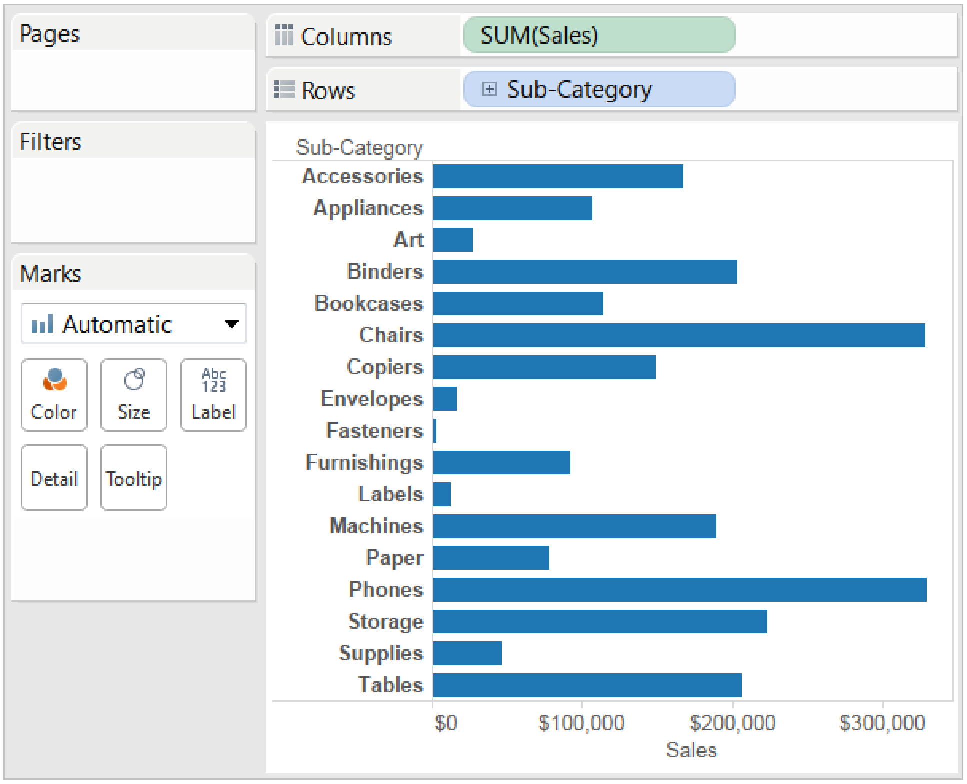
Use pie charts to show proportions.

To create a pie chart view that shows how different product categories contribute to total sales, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Sales** measure to **Columns**.

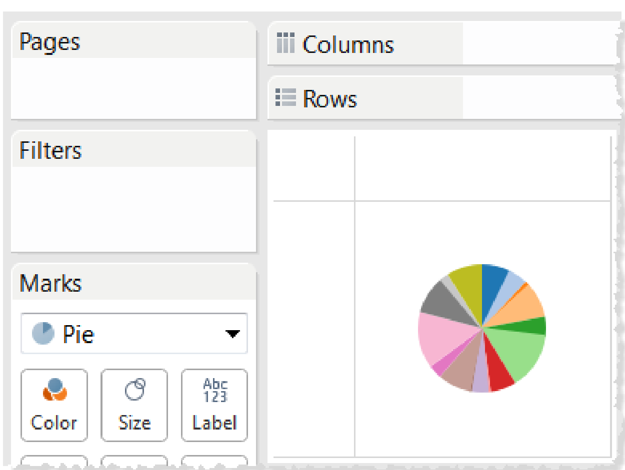
   Tableau aggregates the measure as a sum.
3. Drag the **Sub-Category** dimension to **Rows**.

   The default chart type is a bar chart.

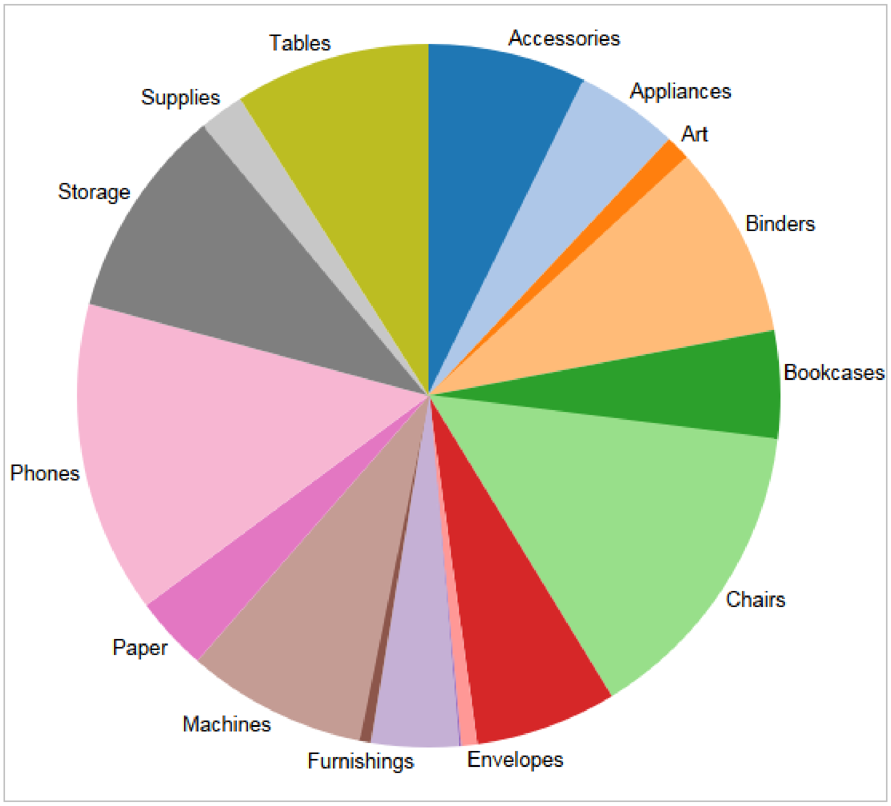


4. Select the pie chart type from Show Me.

The result is a rather small pie:



5. To make the chart bigger, hold down Ctrl + Shift and press B several times.
6. To add labels, press and hold the Ctrl key as you drag the **Sub-Category** dimension from the **Data** pane to **Label** on the **Marks** card.



7. If you don't see labels, press Ctrl + Shift + B to make sure most of the individual labels are visible.

You can make a pie chart interactive in a dashboard. For more information, see **Actions and Dashboards** on page 784.

Note: Pie charts can also be used as a mark type in a visualization. For more information, see **Pie Mark** on page 448.

Build a Treemap

Use treemaps to display data in nested rectangles. You use dimensions to define the structure of the treemap, and measures to define the size or color of the individual rectangles. Treemaps are a relatively simple data visualization that can provide insight in a visually attractive format.

To create a treemap that shows aggregated sales totals across a range of product categories, follow the steps below.

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Sub-Category** dimension to **Columns**.

   A horizontal axis is created showing product categories.

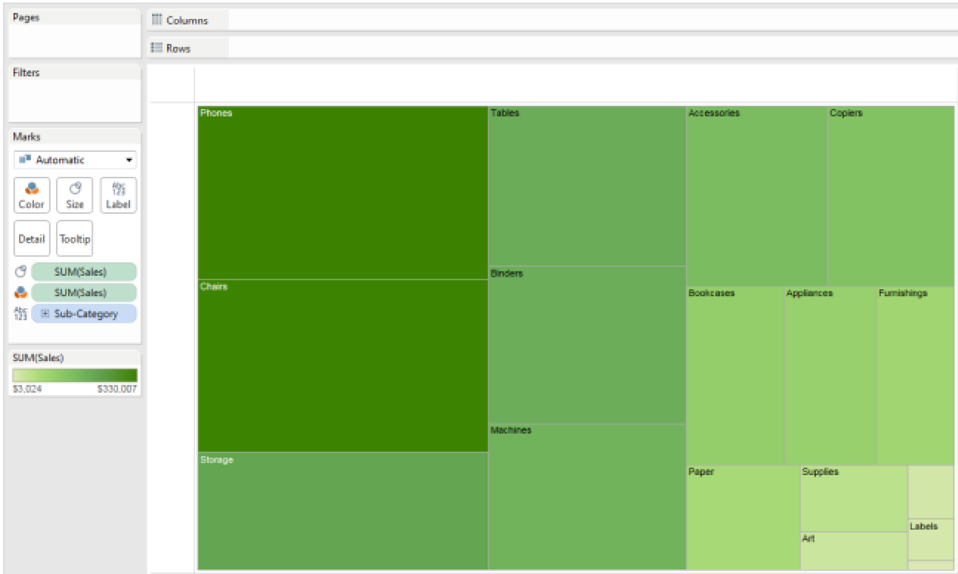
3. Drag the **Sales** measure to **Rows**.

   Tableau aggregates the measure as a sum and creates a vertical axis.

   Tableau displays a bar chart—the default chart type when there is a dimension on the **Columns** shelf and a measure on the **Rows** shelf.

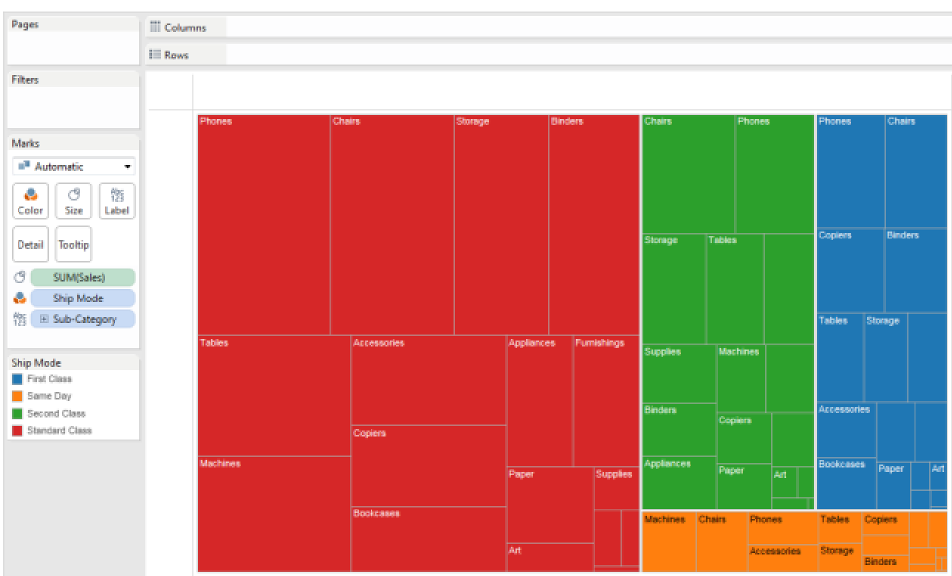
4. Select the treemap chart type from Show Me:

   Tableau displays the following treemap:



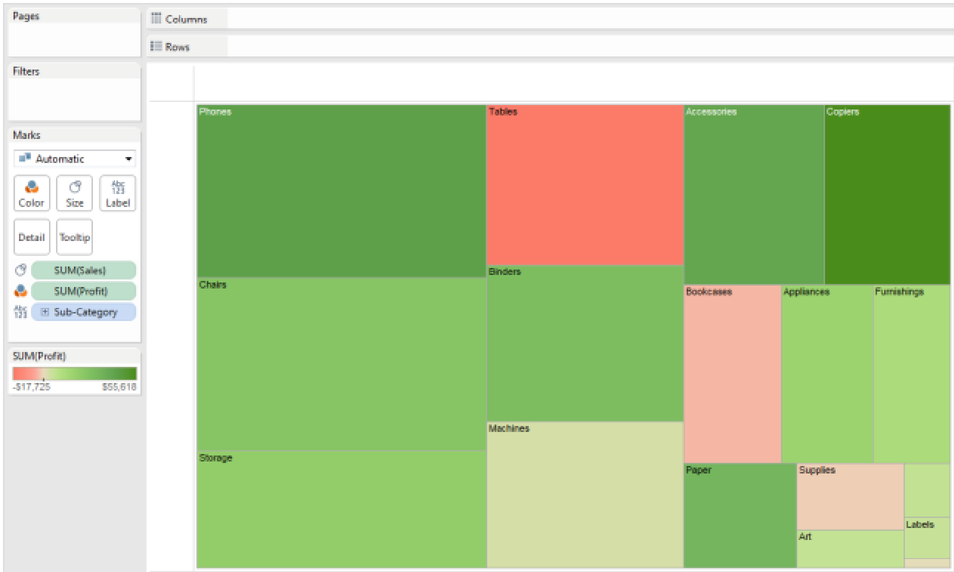
In this treemap, both the size of the rectangles and their color are determined by the value of **Sales**—the greater the sum of sales for each category, the darker and larger its box.

5. Drag the **Ship Mode** dimension to **Color** on the **Marks** card. In the resulting view, **Ship Mode** determines the color of the rectangles—and sorts them into three separate areas accordingly. **Sales** determines the size of the rectangles:



6. Try another option to modify the treemap: click the **Undo** button to remove **Ship Mode** from view.

7. Drag the **Profit** measure to **Color** on the **Marks** card. Now **Profit** determines the color of the rectangles, and **Sales** determines their size:



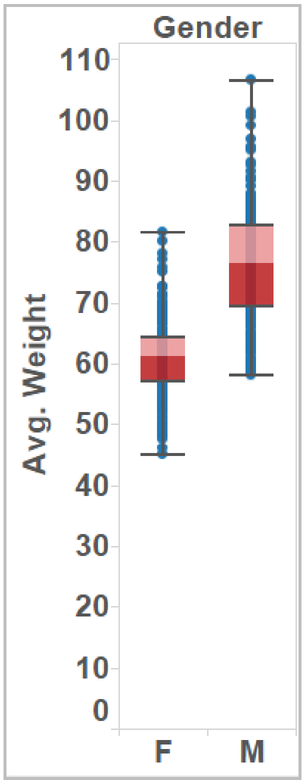
With treemaps, **Size** and **Color** are the crucial elements. You can place measures on **Size** and **Color**, but placing a measure anywhere else has no effect. Treemaps can accommodate any number of dimensions, including one or even two on **Color**. But beyond that, adding dimensions only breaks the map into an ever greater number of smaller rectangles. For information on how to place two dimensions on **Color** in a treemap, see **Example – Multiple Fields on Color** on page 461.

Build a Box Plot

Use box plots, also known as a box-and-whisker plots, to show the distribution of values along an axis.

Boxes indicate the middle 50 percent of the data (that is, the middle two quartiles of the data's distribution).

You can configure lines, called *whiskers*, to display all points within 1.5 times the interquartile range (in other words, all points within 1.5 times the width of the adjoining box), or all points at the maximum extent of the data, as shown in the following image:



To create a box plot that shows discounts by region and customer segment, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Segment** dimension to **Columns**.

   The measure is aggregated as a sum and row headers appear, identifying three customer segments.
3. Drag the **Discount** measure to **Rows**.

   Tableau creates a vertical axis and displays a bar chart—the default chart type when there is a dimension on the **Columns** shelf and a measure on the **Rows** shelf.
4. Drag the **Region** dimension to **Columns**, and drop it to the right of **Segment**.

   Now you have a two-level hierarchy of dimensions from left to right in the view, with regions (listed along the bottom) nested within segments (listed across the top).
5. Click the box-and-whisker plot chart type in **Show Me**.

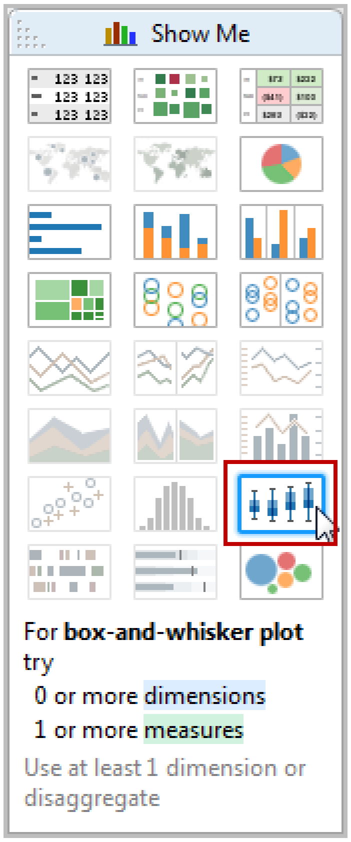
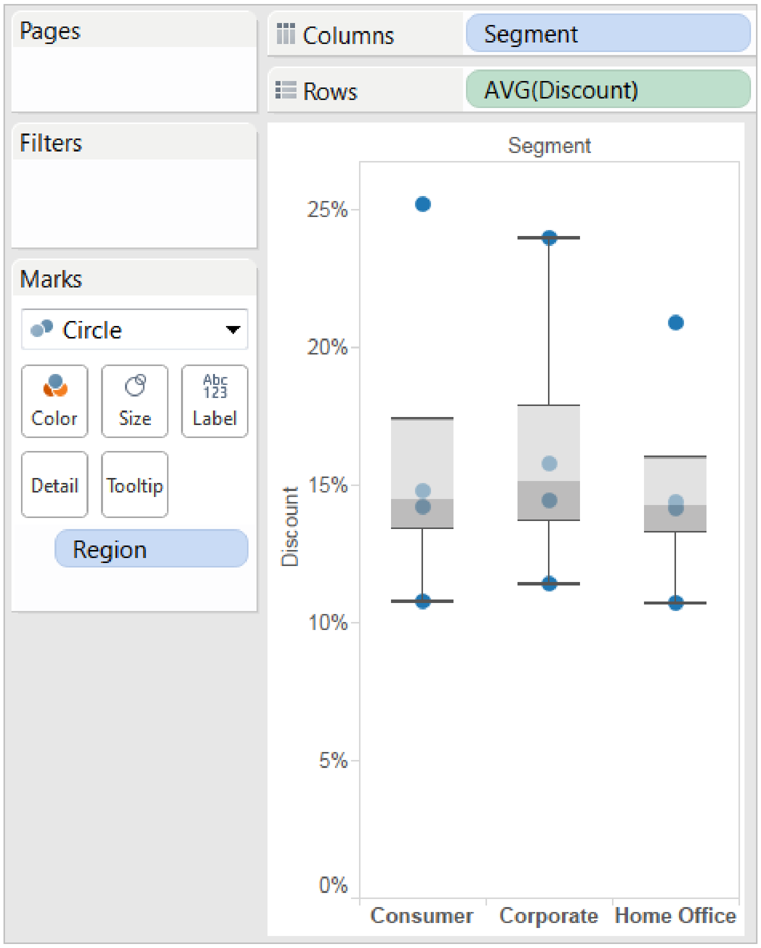
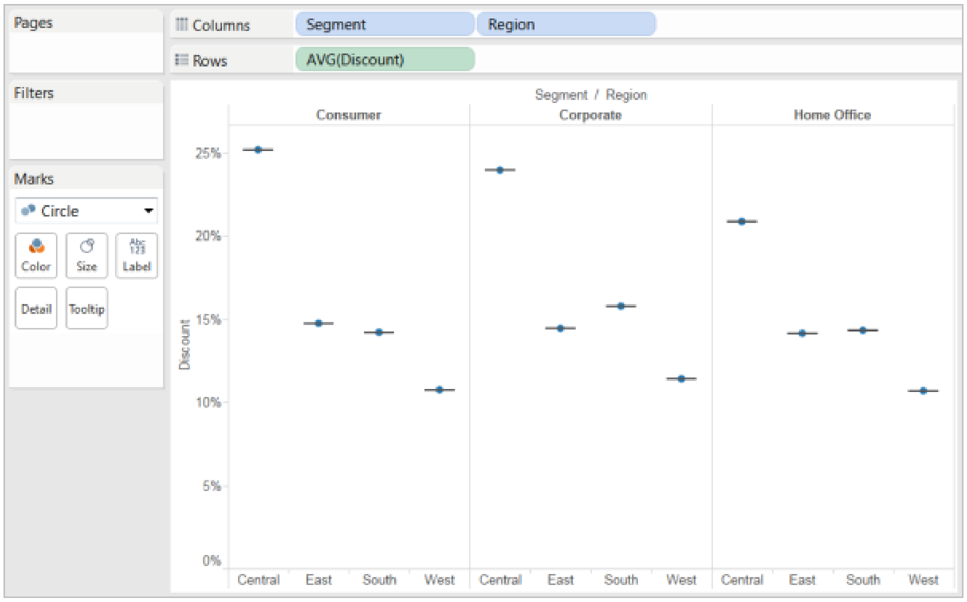


Tableau displays the following box plot:



Notice that there are only a few marks in each box plot. Also, Tableau reassigned **Region** from the **Columns** shelf to the **Marks** card. When you changed the chart type to a box plot, Tableau determined what the individual marks in the plot should represent. It determined that the marks should represent regions. We'll change that.

6. Drag **Region** from the **Marks** card back to **Columns**, to the right of **Segment**.



The horizontal lines are flattened box plots, which is what happens when box plots are based on a single mark.

Box plots are intended to show a distribution of data, and that can be difficult when data is aggregated, as in the current view.

7. To disaggregate data, select **Analysis** > **Aggregate Measures**.

   This command turns aggregation on or off, and because data is aggregated by default in Tableau, the first time you select this command, it disaggregates the data.

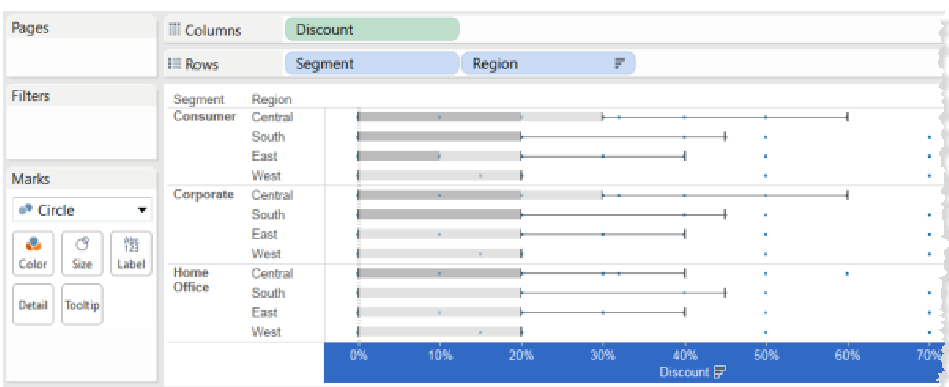
   For more information, see **Disaggregating Data** on page 254.

   Now, instead of a single mark for each column in the view, you see a range of marks, one for each row in your data source.

The view now shows the information we want to see. The remaining steps make the view more readable and appealing.

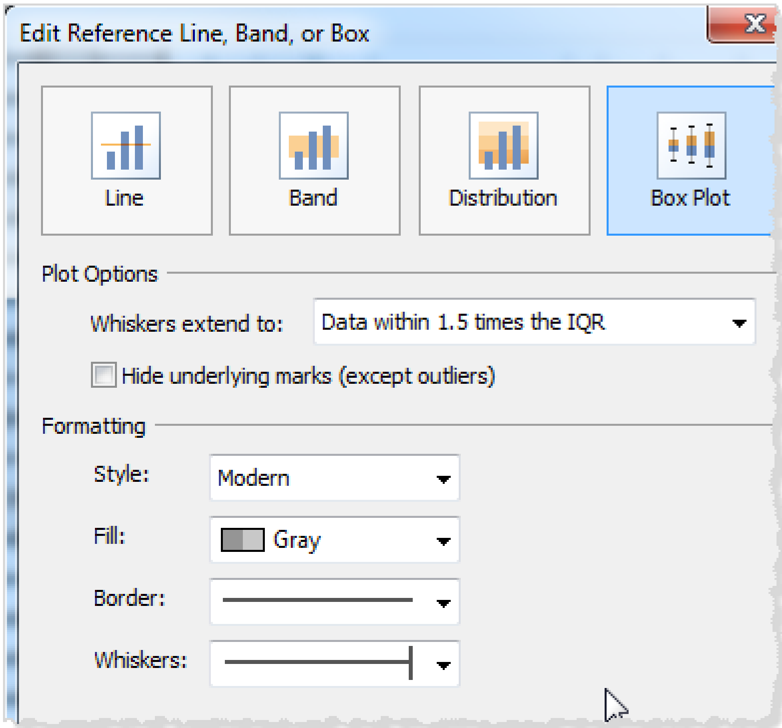
8. Click the **Swap** button to swap the axes:

The box plots now flow from left-to-right:



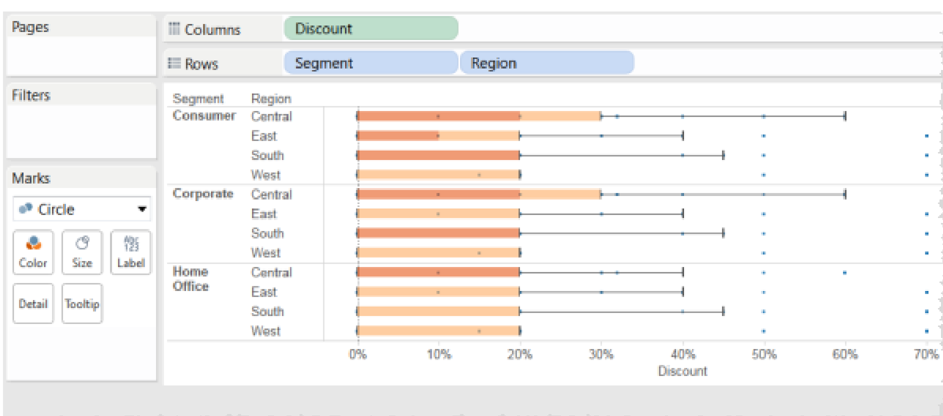
9. Right-click (control-click on Mac) the bottom axis and select **Edit Reference Line**.

10. In Edit Reference Line, Band, or Box dialog box, in the **Fill** drop-down list, select an interesting color scheme.



For more on these options, see **Adding Box Plots** on page 1141.

Now your view is complete:



You can see that the discount was the same for all segments in the West. You can also see that the interquartile range (from the 25th percentile to the 75th percentile) for discount was greatest in the Central region for the consumer and corporate segments.

For more information about box plots, see **Reference Lines, Bands, Distributions, and Boxes** on page 1114.

Build a Packed Bubble Chart

Use packed bubble charts to display data in a cluster of circles. Dimensions define the individual bubbles, and measures define the size and color of the individual circles.

To create a basic packed bubble chart that shows sales and profit information for different product categories, follow these steps:

1. Connect to the **Sample - Superstore** data source.
2. Drag the **Category** dimension to **Columns**.

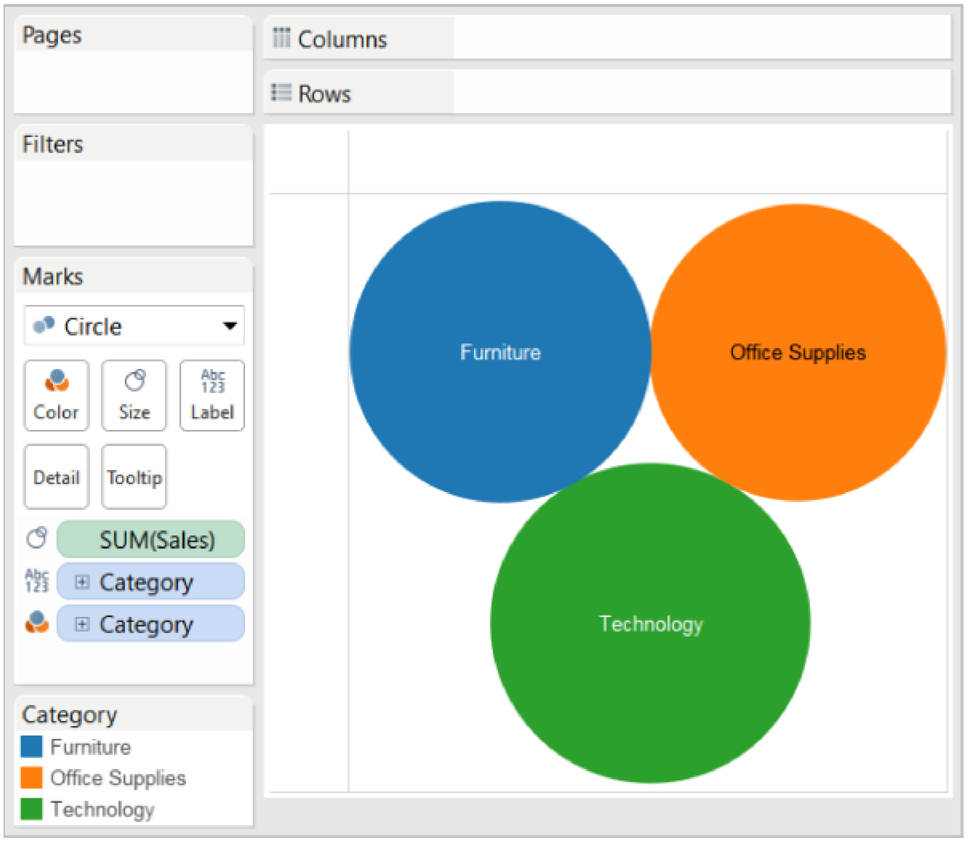
   A horizontal axis displays product categories.
3. Drag the **Sales** measure to **Rows**.

   The measure is aggregated as a sum and a vertical axis appears.

   Tableau displays a bar chart—the default chart type when there is a dimension on the **Columns** shelf and a measure on the **Rows** shelf.
4. Click the packed bubbles chart type in **Show Me**:

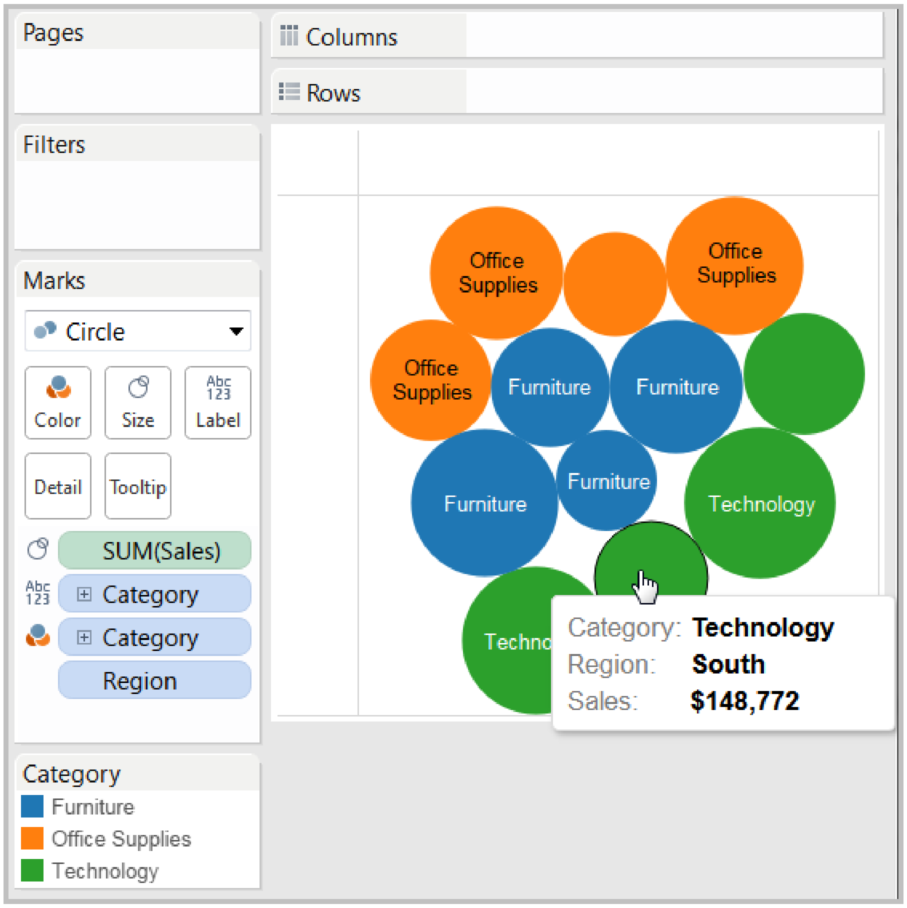
   

   Tableau displays the following packed bubble chart:



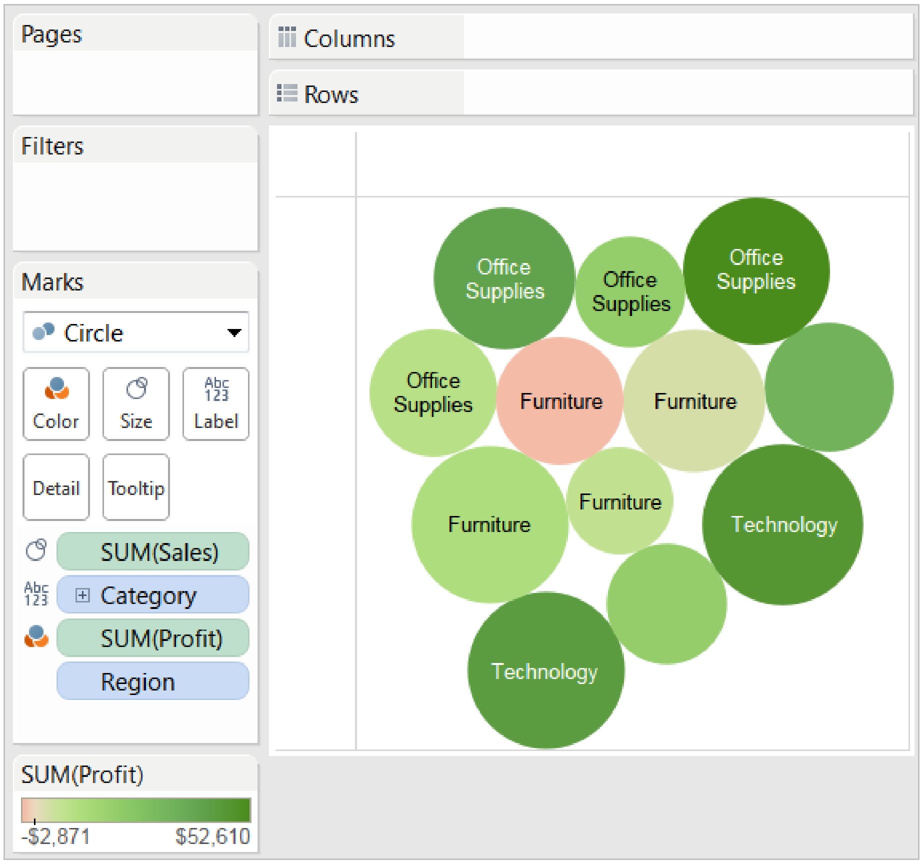
5. Drag **Region** to **Detail** on the **Marks** card to include more bubbles in the view.

   In this example, Tableau doesn't have the space to display labels for all the bubbles. You can hover over any bubble, however, to see a tooltip that displays the label information.

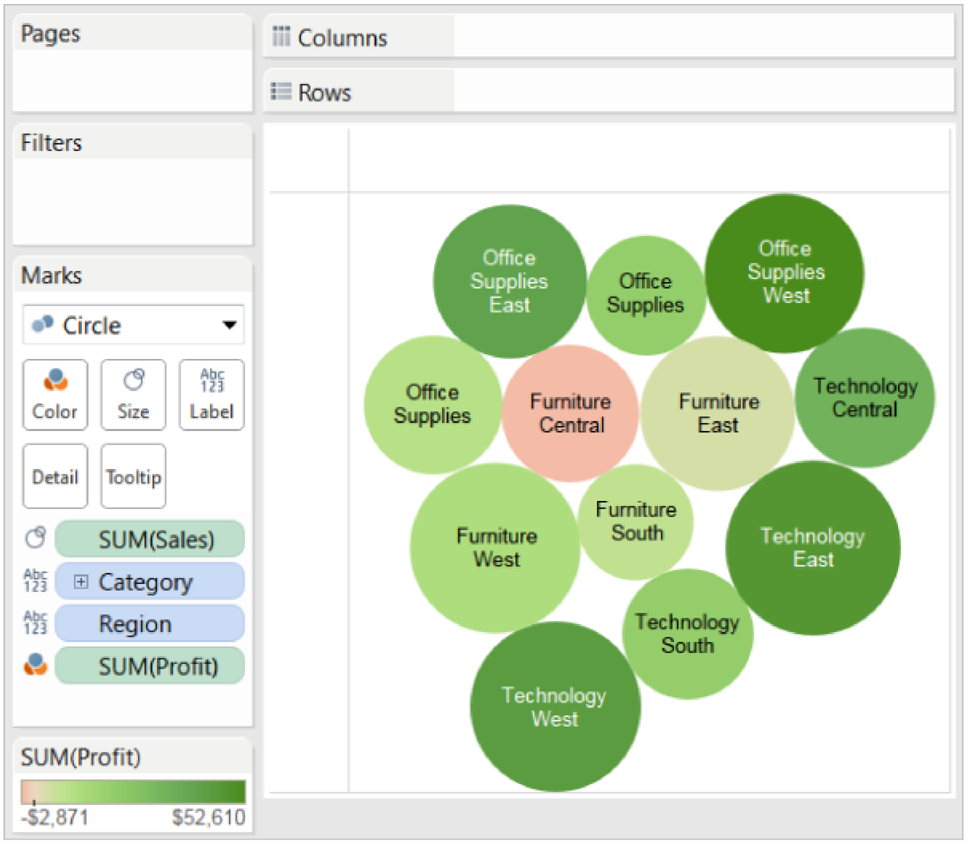


Next we'll add another layer of information to the view.

6. Drag **Profit** to **Color** on the **Marks** card:



7. Drag **Region** to **Label** on the **Marks** card to clarify what each bubble represents.



The size of the bubbles shows the sales for different combinations of region and category. The color of the bubbles shows the profit (the darker the green, the greater the profit).

For information about formatting mark labels, see **Show and Hide Mark Labels** on page 826.

To further develop this view, you might edit the colors for **Profit** to show negative profit in a different color, or create a calculated field to shows profit divided by sales (that is, profit margin) and then drop that on **Color** instead of absolute profit. For more information, see **Color Properties** on page 451.

Build a Map View

Use map views to display and analyze geographic data. To create map views, add geographic fields to the view, and then add measures or continuous dimensions to the **Marks** card.

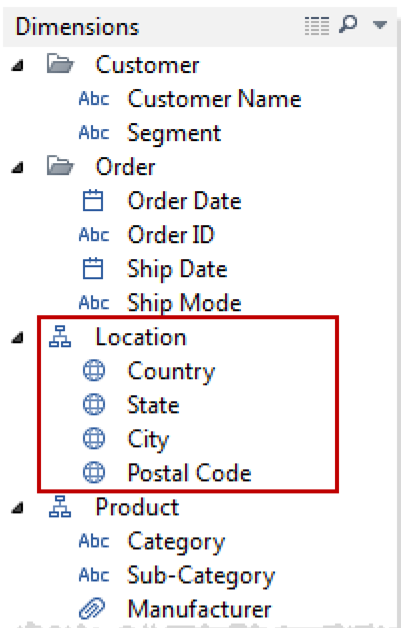
The first exercise in this topic shows you how to create a map view and customize your map appearance. The second exercise in this topic shows you how to create a map view with pie marks.

Build a map view

This exercise demonstrates how to create a custom map view that shows the amount of sales by U.S. city.

1. Connect to the **Sample – Superstore** data source.
2. In the **Data** pane, double-click the **City** dimension. Tableau adds **Country**, **State**, and **City** to **Detail** on the **Marks** card and creates a map view.

   Because Tableau assigns the **Country**, **State**, **City**, and **Postcode** dimensions a geographic role, a map view is created when you double-click one of these dimensions:



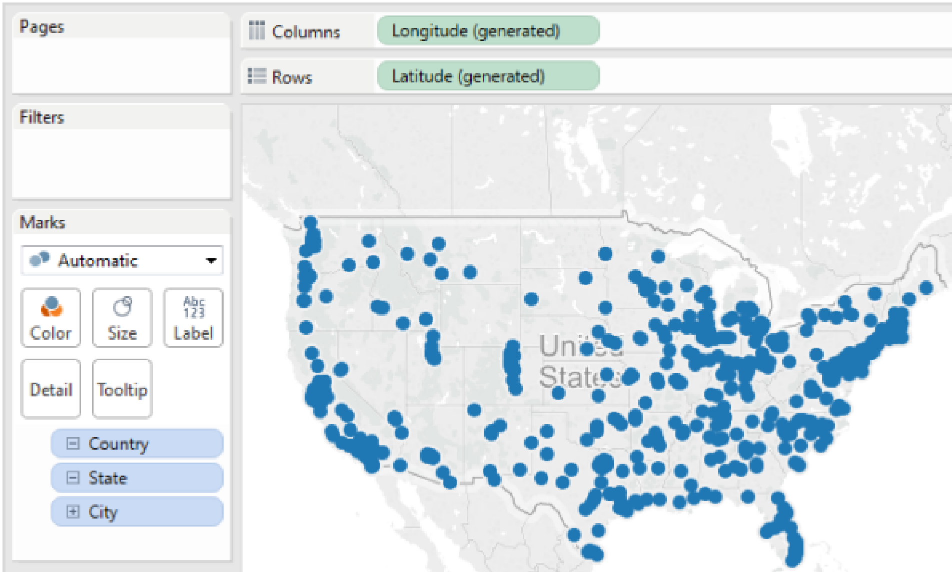
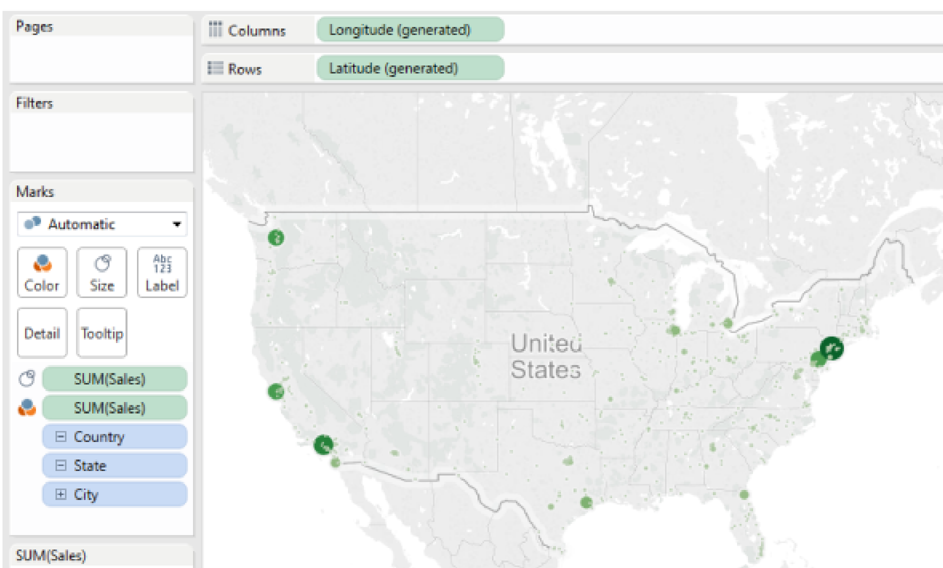


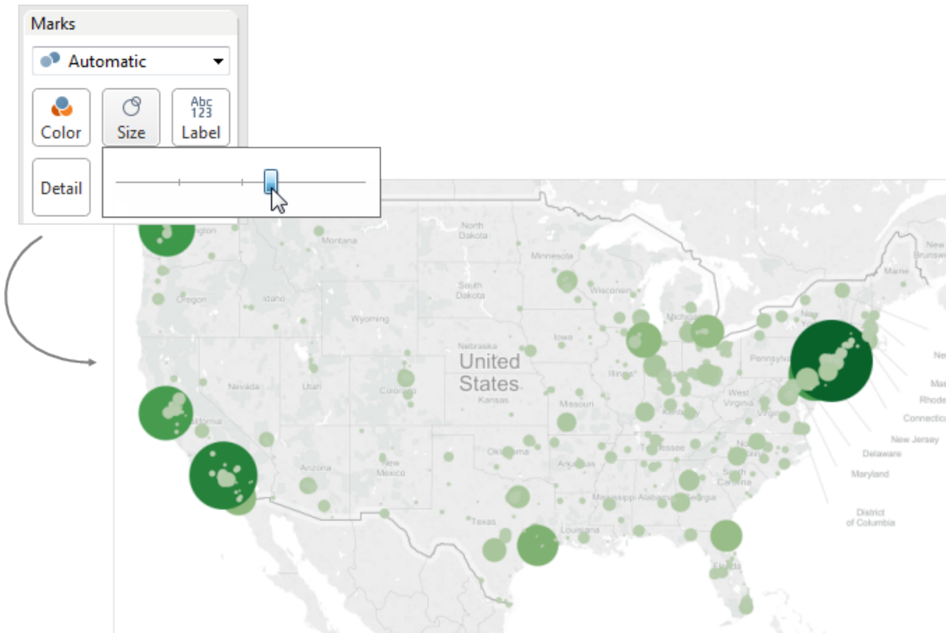
Tableau looks for geographic fields in any data source. For more information on how Tableau interprets geographic data in data sources, see **Assign Geographic Roles** on page 888.

3. From **Measures**, drag **Sales** to **Color** on the **Marks** card. The marks in the view color according to the amount of sales in each city.
4. From **Measures**, drag **Sales** to **Size** on the **Marks** card. The marks in the view resize according to sales in each city.



5. To adjust the size of the marks in the view, click **Size** on the **Marks** card, and then drag

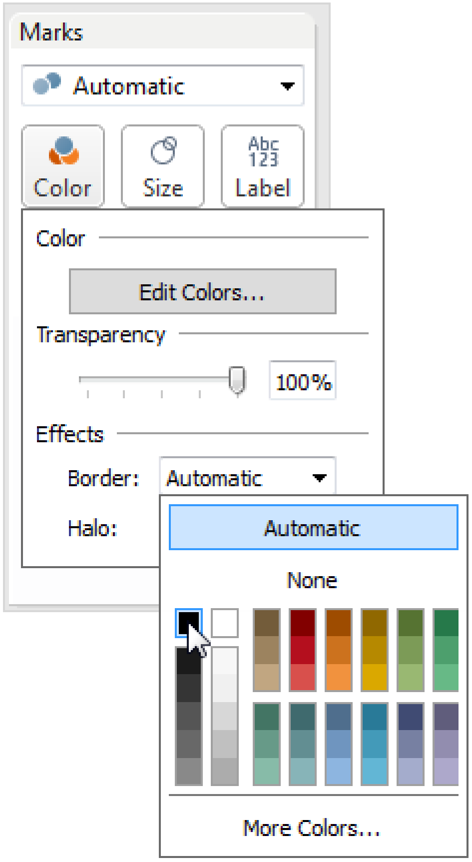
the slider to the right.



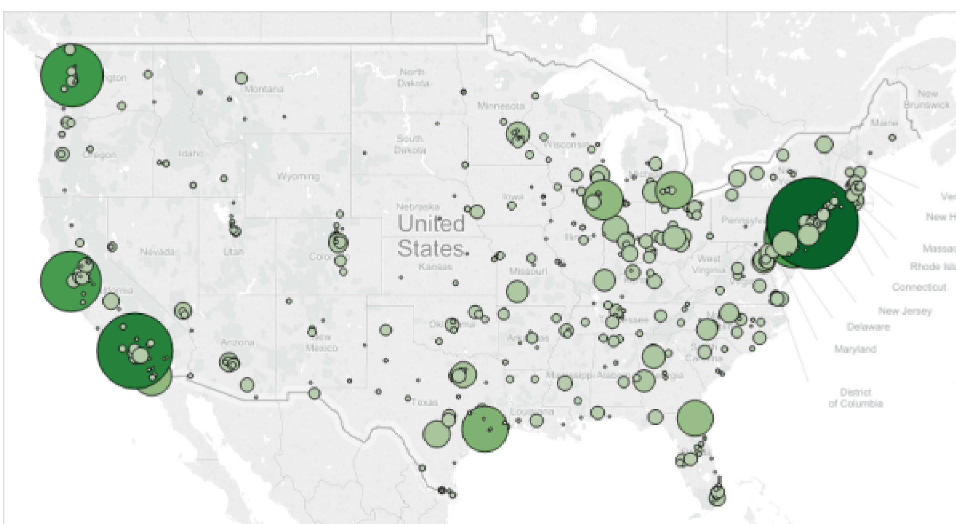
The marks in the view are now larger and easier to inspect, though they overlap. Overlapping marks make it difficult to see a difference in the size of some marks.

To make the map view easier to analyze, you can add a border to the marks in the view.

6. To add a border to the marks in the view, on the **Marks** card, click **Color**, and then click the **Border** drop-down list to select a color.



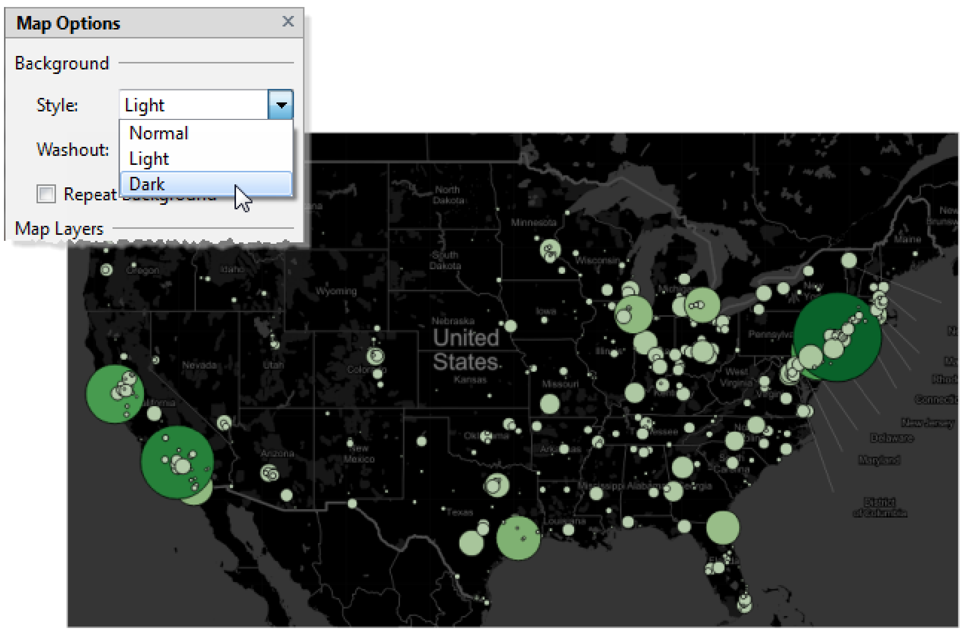
The marks in the view update to display the selected border:



After you plot your data on a map view, you can configure the background map style, map layers, and data layers using the **Map Layers** pane.

7. To open the **Map Layers** pane, select **Map** > **Map Layers**. In the **Map Layers** pane, click the **Style** drop-down list, and then select **Dark**.

   The background map changes from light to dark.

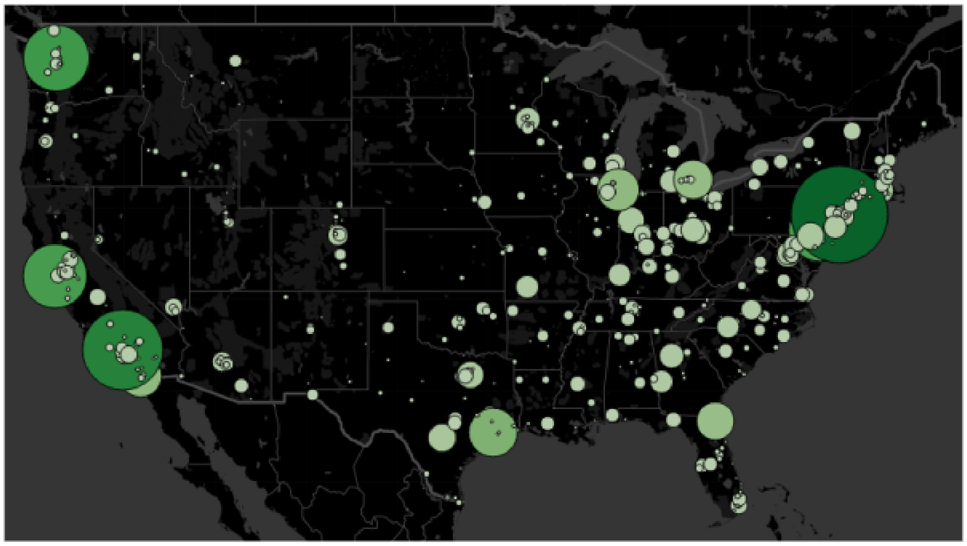


   You can now add or subtract map layers to provide context to your data, or to simplify the view.

8. In the **Map Layers** pane, clear the **Country/Region Names** and **State/Province Names** map layers to simplify the map view.

   The country/region and state/province names are removed from the view.

Your view is now complete. Your map view shows total sales for each city in your data source across the United States. The size and the color of each mark corresponds to the total sales for that city.



For more information about creating map views, see **Maps** on page 871.

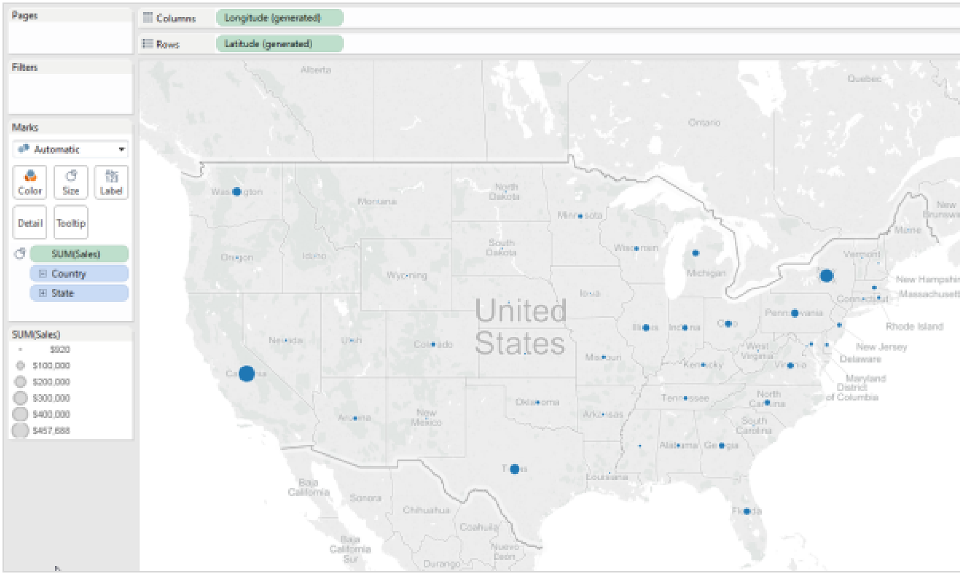
Build a map with pie marks

In this exercise, you will create a map with a pie mark on each state. The overall size of the mark represents sales, and the size of each section represents the sales for each ship mode (First Class, Same Day, Second Class, Standard Class).

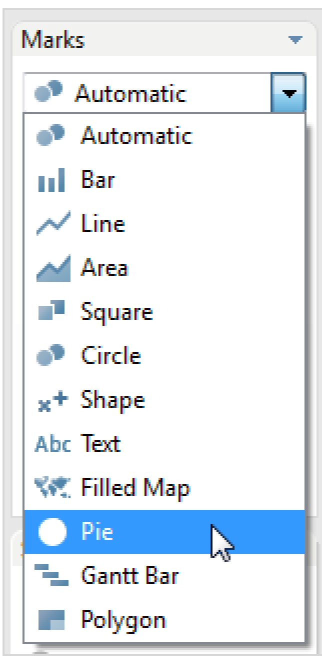
1. Connect to the **Sample - Superstore** data source.
2. In the **Data** pane, double-click the **State** dimension.

   Tableau adds **Country** and **State** to **Detail** on the **Marks** card.
3. From **Measures**, drag **Sales** to **Size** on the **Marks** card.

   The marks in the view resize according to sales in each city.

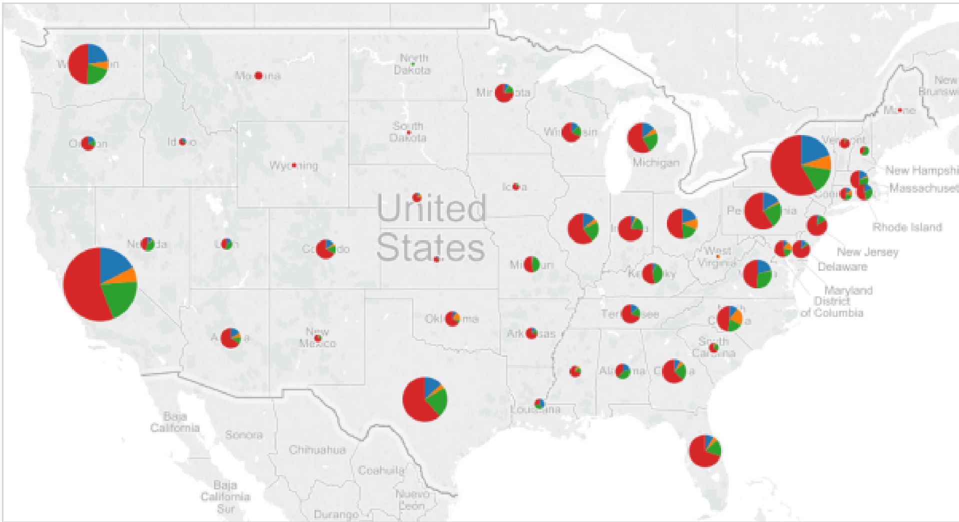


4. On the **Marks** card, click the **Mark Type** drop-down list, and then select **Pie**.



5. From **Dimensions**, drag **Ship Mode** to **Color** on the **Marks** card.
6. To make the marks in the view larger, on the **Marks** card, click **Size**, and then drag the slider to the right.

Your view is now complete. Your map view shows pie chart marks for each state. The size of each pie corresponds to the total sales for that state, and the slices of the pie show what proportions of the total were provided by each of the four available ship modes.



North Dakota
South Dakota
Michigan
United States
West Virginia
New Mexico
New Jersey
Delaware
Maryland
District of Columbia
Rhode Island
Baja California
Sonora
Chihuahua
Coahuila
Nuevo León
Baja California Sur
Durango

Do More with Views

This section describes the many ways you can enhance basic views.

Filtering

There are many different ways to exclude certain values or a range of values for a field in Tableau. You can:

- Drag a field to the Filters shelf. See **Drag Fields to the Filters Shelf** on page 612.
- Select marks or headers in the view and then select **Exclude**. See **Select Data to Filter** below.
- Implement a filter when creating an extract. See **Extract Your Data** on page 379.
- Create a data source filter. See **Data Source Filters** on page 657
- Create a Context Filter. See **Context Filters** on page 659.
- Show a filter in the view. See **Show Filters in the View** on page 645.

Other activities, including creating a level of detail expression or adding a table calculation, can filter your data, even though these activities are not specifically about filtering.

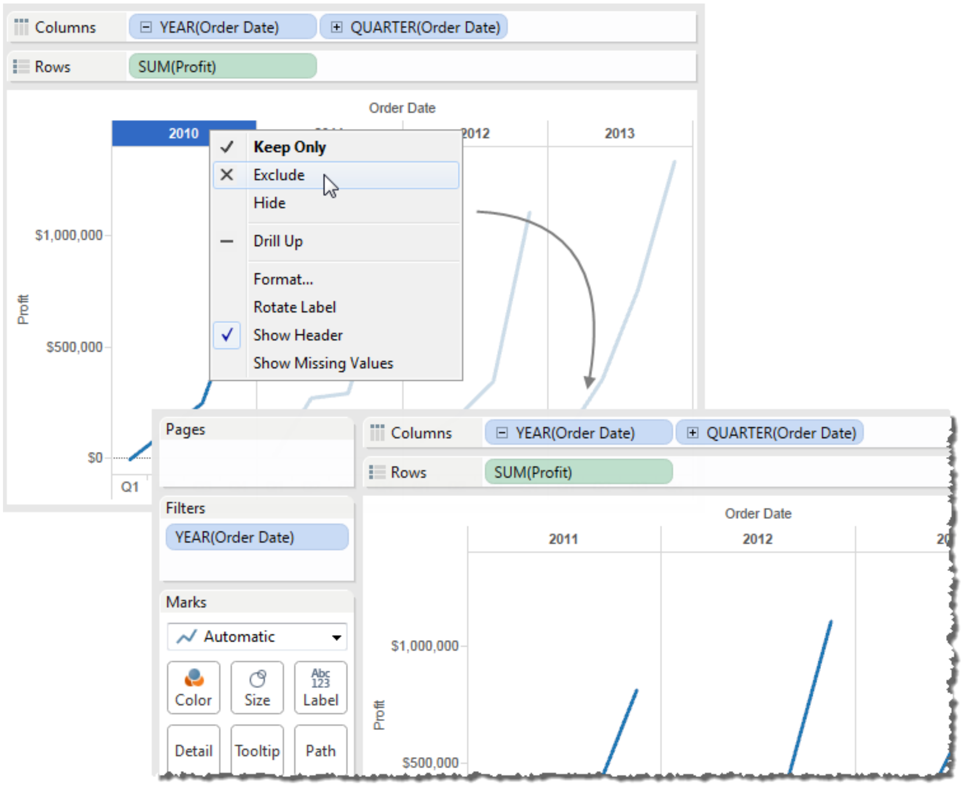
Filtering order of operations

If you implement different types of filters in your workbooks, filters are executed in the following order:

1. Extract filters
2. Data source filters
3. Context filters
4. Filters on dimensions (whether on the Filters shelf or in filter cards in the view)
5. Filters on measures (whether on the Filters shelf or in filter cards in the view)

Select Data to Filter

You can filter data by selecting headers or marks in the view and then selecting **Keep Only** or **Exclude** on the right-click (Control-click on a Mac) context menu or the tooltip. The dimension members are removed from the view and the filtered fields are added to the Filters shelf.

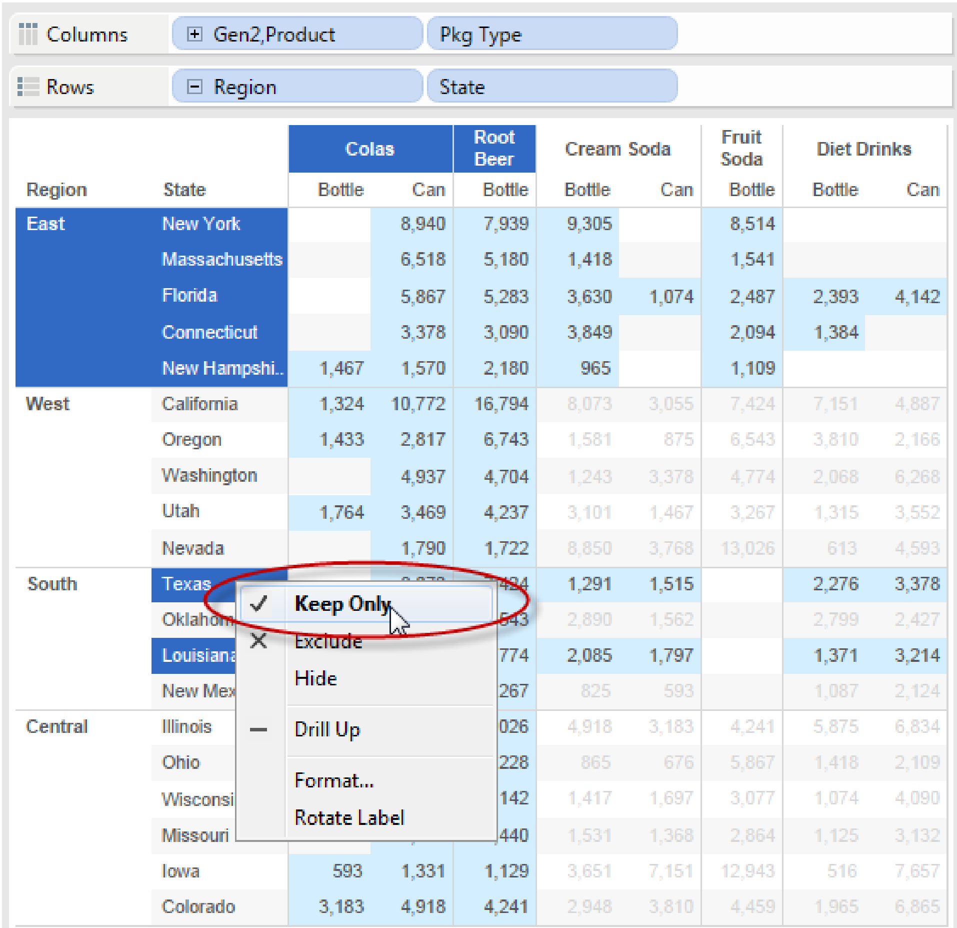


Selecting Headers

When you select a table header that is part of a hierarchy, all of the next level headers are also selected automatically. For example, the view shown below consists of two unrelated dimensions placed on the **Columns** shelf, and two levels of the same hierarchy placed on the Rows shelf.

The selected row headers include the East member of the **Region** dimension, and the Texas and Louisiana members of the **State** dimension. When East is selected, all members from the next (inner) level in the hierarchy are automatically selected.

The selected column headers include the Colas and Root Beer members of the **Gen2, Product dimension**. When these outer dimensions are selected, the inner dimension members from **Pkg Type** are not automatically selected. This is because the **Gen2, Product** and **PkgType** dimensions are unrelated.



Selecting **Keep Only** keeps all selected headers as shown below. The Product field is filtered to show Colas and Root Beer and the Market field is filtered to show the Eastern region as well as Texas and Louisiana in the Southern region.

Columns: Gen2,Product | Pkg Type
Rows: Region | State

Region	State	Colas Bottle	Colas Can	Root Beer Bottle
East	New York		8,940	7,939
	Massachusetts		6,518	5,180
	Florida		5,867	5,283
	Connecticut		3,378	3,090
	New Hampshire	1,467	1,570	2,180
South	Texas		8,073	7,424
	Louisiana		2,660	4,774

Selecting **Exclude** excludes all selected headers as shown below. The Product field is filtered to show Cream Soda, Fruit Soda, and Diet Drinks. The Market field is filtered to show the Western and Central regions along with the remaining states in the Southern region.

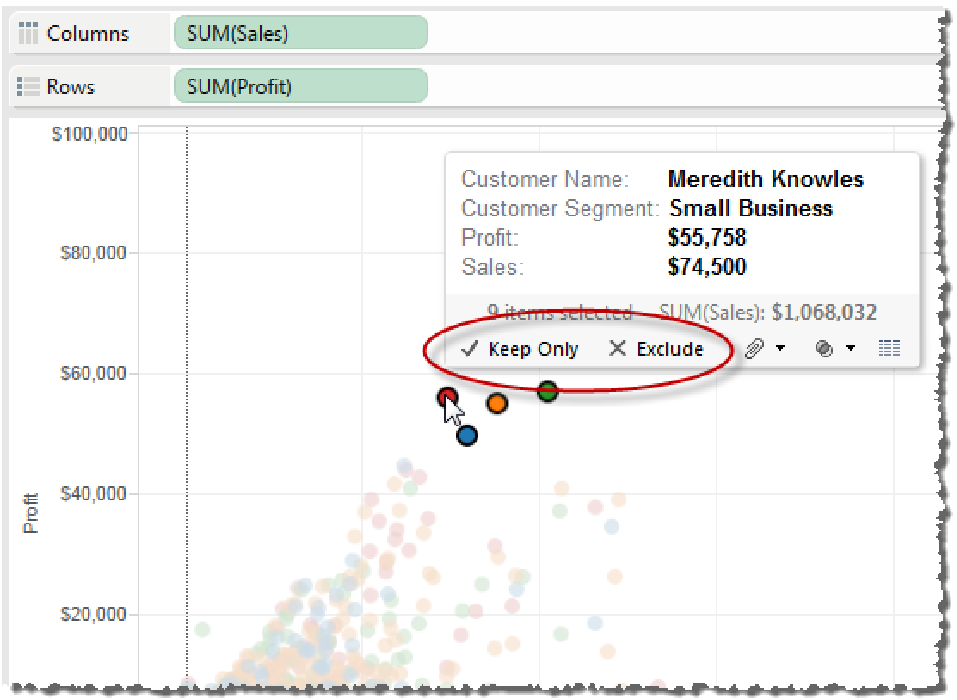
Columns: Gen2,Product | Pkg Type
Rows: Region | State

Region	State	Cream Soda Bottle	Cream Soda Can	Fruit Soda Bottle	Diet Drinks Bottle	Diet Drinks Can
West	California	8,073	3,055	7,424	7,151	4,887
	Oregon	1,581	875	6,543	3,810	2,166
	Washington	1,243	3,378	4,774	2,068	6,268
	Utah	3,101	1,467	3,267	1,315	3,552
	Nevada	8,850	3,768	13,026	613	4,593
South	Oklahoma	2,890	1,562		2,799	2,427
	New Mexico	825	593		1,087	2,124
Central	Illinois	4,918	3,183	4,241	5,875	6,834
	Ohio	865	676	5,867	1,418	2,109
	Wisconsin	1,417	1,697	3,077	1,074	4,090
	Missouri	1,531	1,368	2,864	1,125	3,132
	Iowa	3,651	7,151	12,943	516	7,657
	Colorado	2,948	3,810	4,459	1,965	6,865

Selecting Marks

Instead of selecting headers to filter, you can filter individual marks in a view. This method is useful when you are looking at a scatter plot and you want to focus on a set of outliers or remove them so you can better focus on the rest of the data. Select individual marks or click and drag to select several marks. Then right-click and select **Keep Only** or **Exclude** or click the filter options on the tooltip.

> The filtering options are not available if a Wildcard Match filter is already specified for the same field. Refer to **Filter Dimensions** below to learn more about Wildcard Match filters.



Drag Fields to the Filters Shelf

Another way to create a filter is to drag a field directly to the Filters shelf. When you add a field to the Filters shelf, the Filter dialog box opens so you can define the filter. The Filter dialog box differs depending on whether you are filtering a dimension, measure, or date field.

Filter Dimensions

Dimensions contain discrete categorical data so filtering this type of field generally involves selecting the values to include or exclude. You can create a basic categorical filter or you can define conditions and limits to create a more complex filter definition.

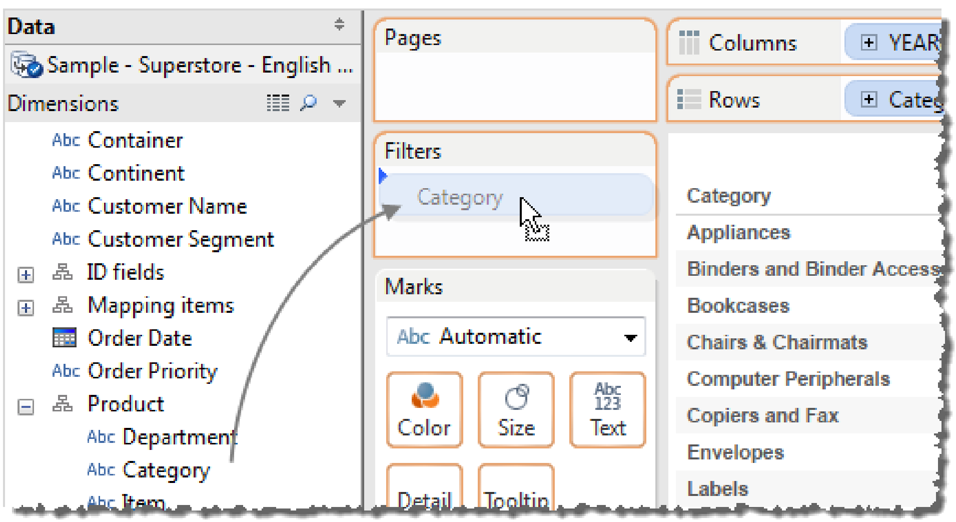
In this topic, you can learn about:

- **Basic Categorical Filters** below
- **Adding Wildcard Match to Filters** on page 616
- **Adding Conditions to Filters** on page 617
- **Adding Limits to Filters** on page 619

You can also follow a step by step example to learn how to filter dimensions.

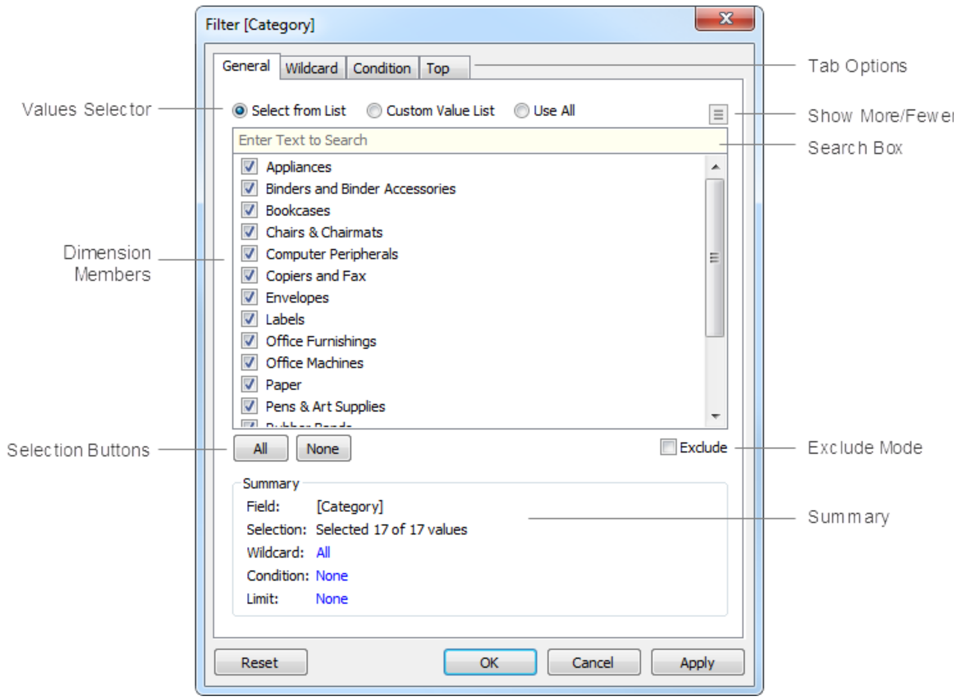
Basic Categorical Filters

1. Drag a field from the Data pane to the Filters shelf. You can also right-click (Control-click on a Mac) a field on any shelf and select **Filter**.



2. Use the General Tab in the Filter dialog box to select the values you want to include or

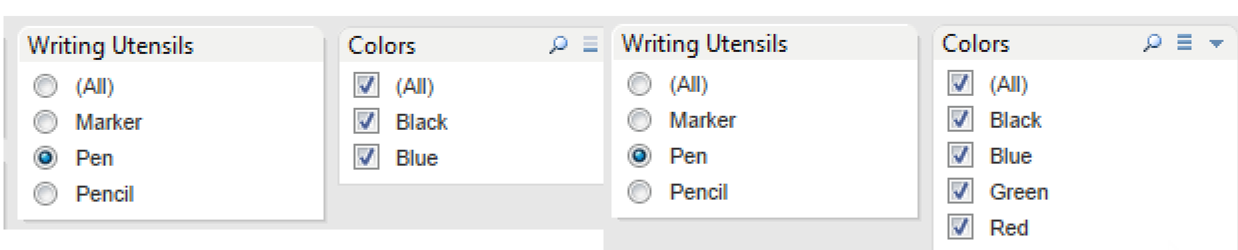
exclude.



Each option on the General tab is described below:

Show More/Fewer - The contents of the Filter dialog box is affected by the filters that are already set in the view. For example, two filters are shown below: Writing Utensils and Colors. When the Colors filter is set to Show Fewer Values, selecting Pen in the writing utensils filter modifies the Colors filter to only show Black and Blue. That's because the underlying data only contains black and blue pens. When the Colors filter is set to Show More Values, all colors in the underlying data are always shown regardless of what Writing Utensil is selected. The Show More/Fewer option includes and excludes data from displaying in the Filter so you can find what you are looking for quicker.

Colors is set to Show Fewer Values **Colors is set to Show More Values**



Because the data only contains black and blue pens, the Colors filter only shows values that pass the Writing Utensils filter.

All colors in the data are shown regardless of what is selected in the Writing Utensils filter. In this case, changing the filter to exclude Red will have no affect on the view because there are no red pens in underlying data.

Values Selector - Use the Values drop-down list to choose a method of selecting values. Depending on the data source you are using and the type of dimension you are filtering, you can select from the following options:

- **Select from List** - select from a list of the values (requires a database query to get the values).
- **Custom Value List** - type explicit dimension member names into a text box to define a filter without querying the database. Use this option when you are using a large data source and queries are slow. If you know the dimension members you are interested in, you can type them into the text box or copy and paste them from another application. Make sure that each member is on its own line in the text box.
- **Use All** - select all of the members in the data source. Sometimes you will want to define a condition or limit filter that is based on all the data, even if that data changes over time. Rather than selecting specific members to include or exclude from the filter, the Use All option always includes every member in the database as the input to the condition or limit.

Search Box - When you are working with a field that has a lot of members, you may want to search the values and quickly select the ones you are looking for. As you type into the search box, matching values show below the search box. Select the values you want. Each search adds to the selection.

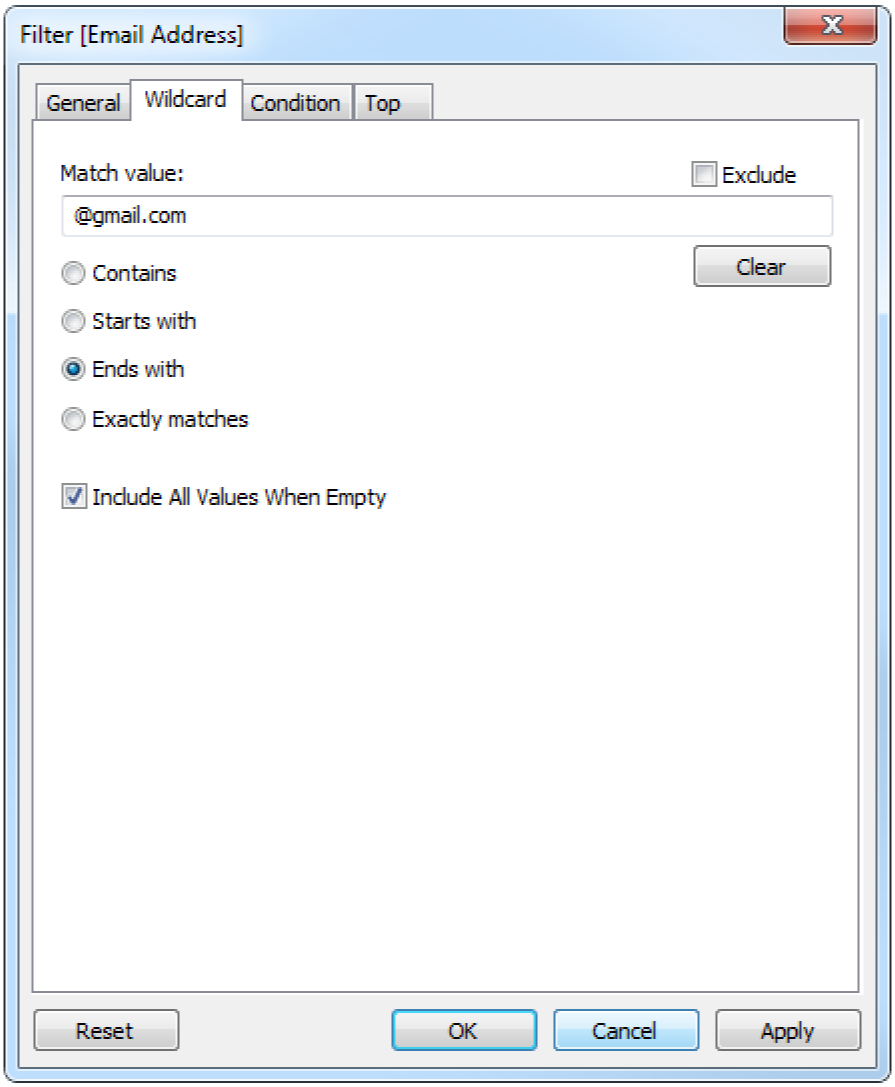
Dimension Members - Select members from the list when using the Select from List mode. When in Custom Value List mode this area displays the list of dimension members you have typed in manually.

Selection Controls - These selection controls are available for multidimensional data sources and help you quickly select entire levels. Located at the top of the dialog box, the numbers indicate each level. The color shows what values are selected. The default color means no values are selected for that level, blue means all members on that level are selected, and gray means some members are selected.

Exclude Mode - By default, selected members when defining a filter will be included and deselected members will be excluded. However, sometimes it is easier to define what you don’t want instead of all of the values you do want to show. Select the **Exclude** option in the upper right corner of the dialog box to make your selections excluded from the filter instead of included.

Adding Wildcard Match to Filters

Use the Wildcard Tab in the Filter dialog box to define a pattern to filter on. For example, when filtering on email addresses you may want to only include emails from a specific domain. You can define a wildcard filter that ends with "@gmail.com" to only include Google email addresses.



Each option on the Wildcard tab is described below:

Match Value - type a pattern that you want to match dimension members to.

Match Type - Select one of the options below for how to match the pattern.

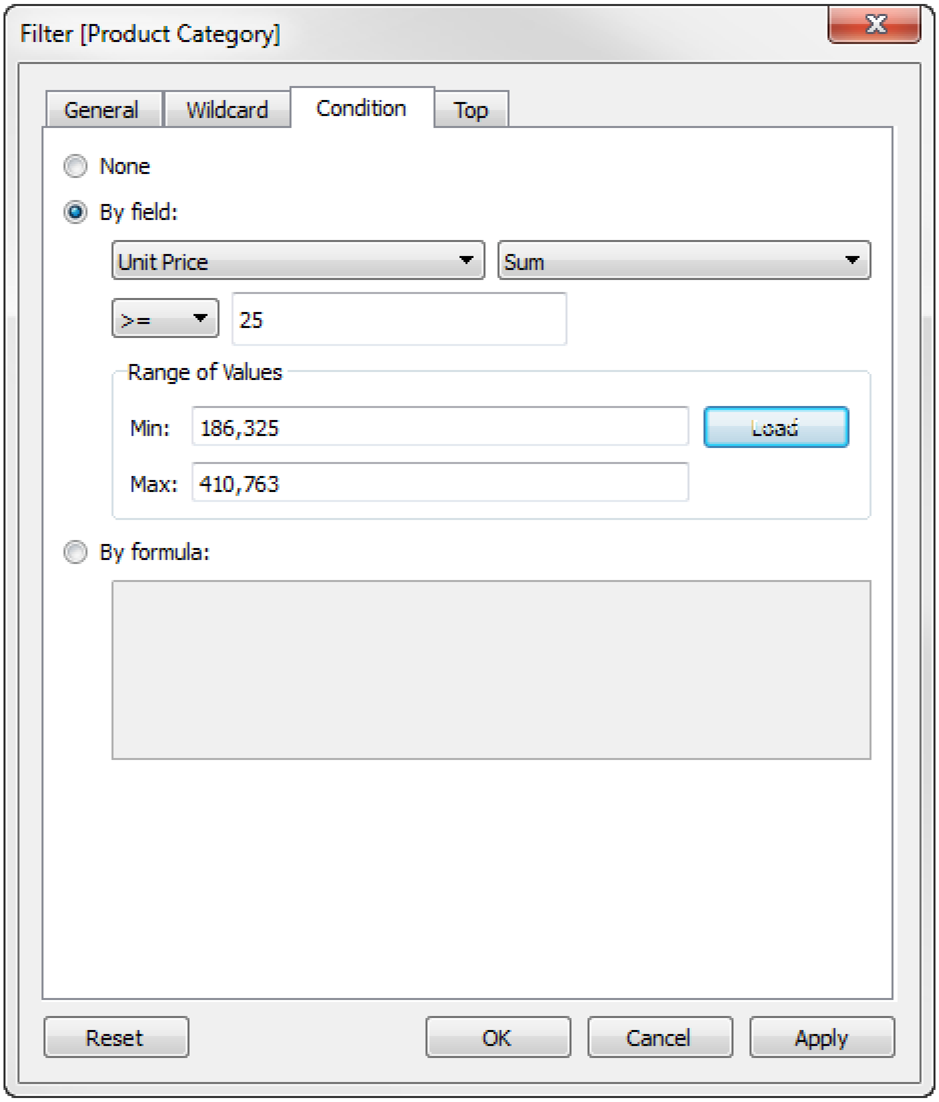
- **Contains** - returns all members that contain the match value anywhere in the string.
- **Starts with** - returns members that have the match value at the beginning of the string.
- **Ends with** - returns member that have the match value at the end of the string.
- **Exactly matches** - returns the members that contain only the match value and nothing else.

Exclude - By default, members that are returned are included in the filter. The reverse this behavior, select the Exclude option. Matched values are excluded from the filter instead.

Include all values when empty - When this option is selected, the filter includes all dimension members when the match value couldn't be found at all. This option is selected by default. When cleared, the filter can potentially return zero results and result in a blank sheet.

Adding Conditions to Filters

Use the Condition Tab in the Filter dialog box to define rules to filter by. For example, in a view showing the average Unit Price for a collection of products, you may want to only show the Products that have an average unit price that is greater than or equal to $25. You can use the built-in controls to write a condition or you can write a custom formula.



Each option on the Condition tab is described below:

None - select this option if you do not want to add a condition to the filter. This is the default setting.

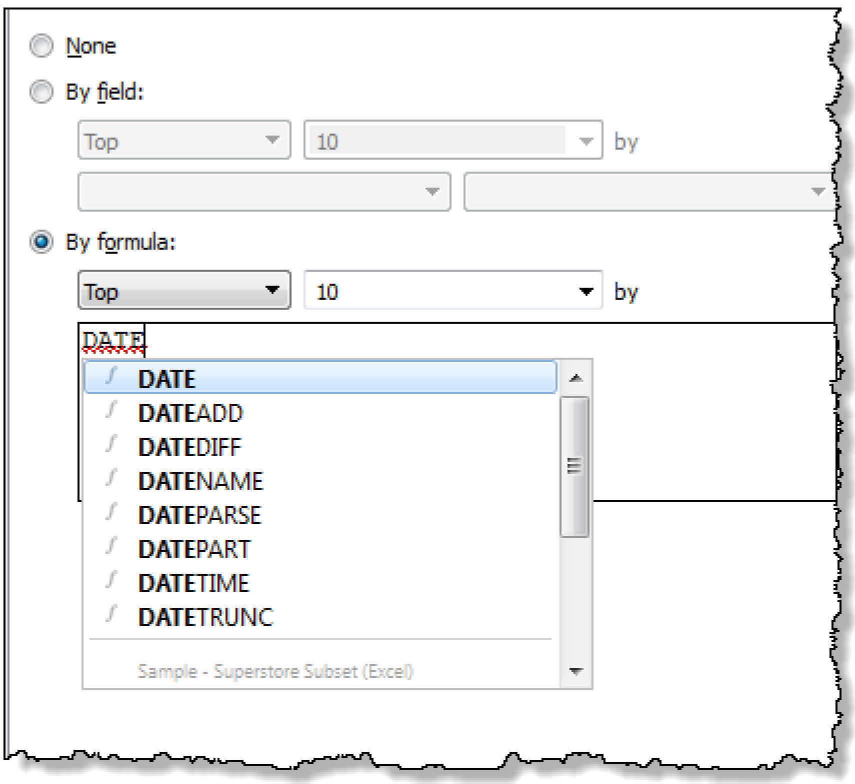
By Field - select this option to specify a condition based on existing fields in the data source. Use the first two drop-down menus to select the field and aggregation you want to base the condition on. Then select a condition operator such as greater than, equal to, etc. Finally, type a criteria value into the text box. For example, to create the condition described above, select Unit Price and AVG from the first two drop-down menus. Then select the greater than or equal to symbol (>=) from the operator list and type 25 into the final text box.

> You can use the **Range of Values** box to load the entire range of values for the selected field in the data source. The example above would not make sense if all the records in

the data source had an average unit price under $25. Using the **Range of Values** box helps you decide a value that makes sense based on the records in your data source. Click **Load** to view the range of values for the selected field.

By formula - select this option for more advanced filter conditions. You can type a custom formula into the text box.

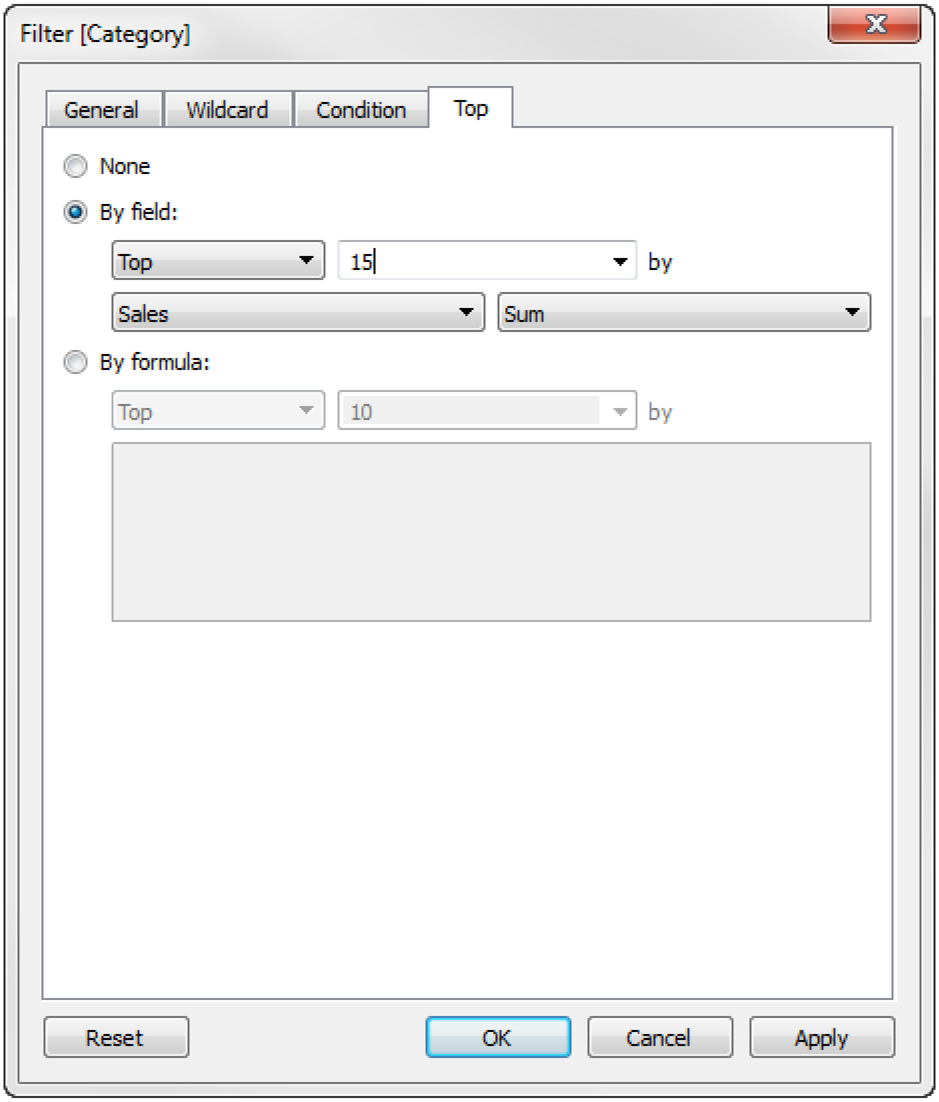
Note: From within the formula text box, you can take advantage of the auto-completion feature. For example, if you start typing `DATE...`, Tableau shows you all keywords in the calculation language that begin with those letters:



See **Auto-Completion for Formulas** on page 1012.

Adding Limits to Filters

Use the Top tab in the Filter dialog box to define a formula that computes the data that will be included in the view. For example, in a view that shows the average Time to Ship for a collection of products, you can decide to only show the top 15 products by Sales. Rather then having to define a specific range for Sales (e.g., greater than $100,000), you can define a limit that is relative to the other members in the field.



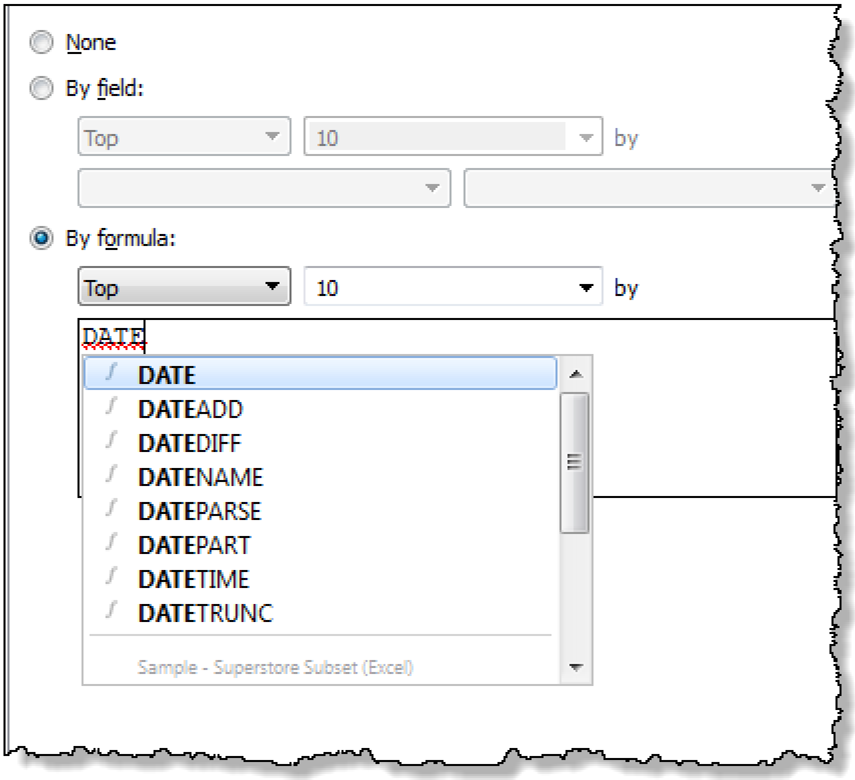
The following options are available on the Top tab.

None - select this option if you do not want to add a limit to the filter. This is the default setting.

By Field - select this option to add a simple limit based on an existing field in the data source. First select the limit range using the first two drop-down lists. For example you can select Top 10 or Bottom 20. Finally select the field and aggregation to base the limit on. So if you wanted to filter based on the Top 10 Sales, select Top and 10 from the first two drop-down lists and then select Sales and SUM from remaining lists.

By formula - select this option for more advanced filter limits. Select the limit range using the first two drop-down lists (e.g. Top 10 or Bottom 20). Then you can type a custom formula into the text box.

Note: From within the formula text box, you can take advantage of the auto-completion feature. For example, if you start typing `DATE...`, Tableau shows you all keywords in the calculation language that begin with those letters:

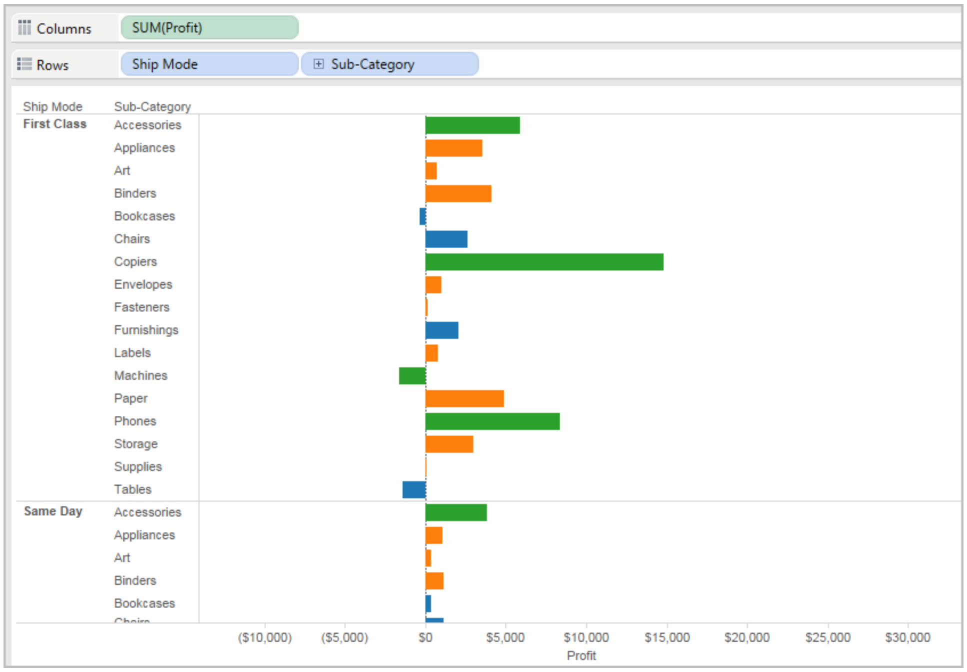


See **Auto-Completion for Formulas** on page 1012.

Example - Filtering Dimensions

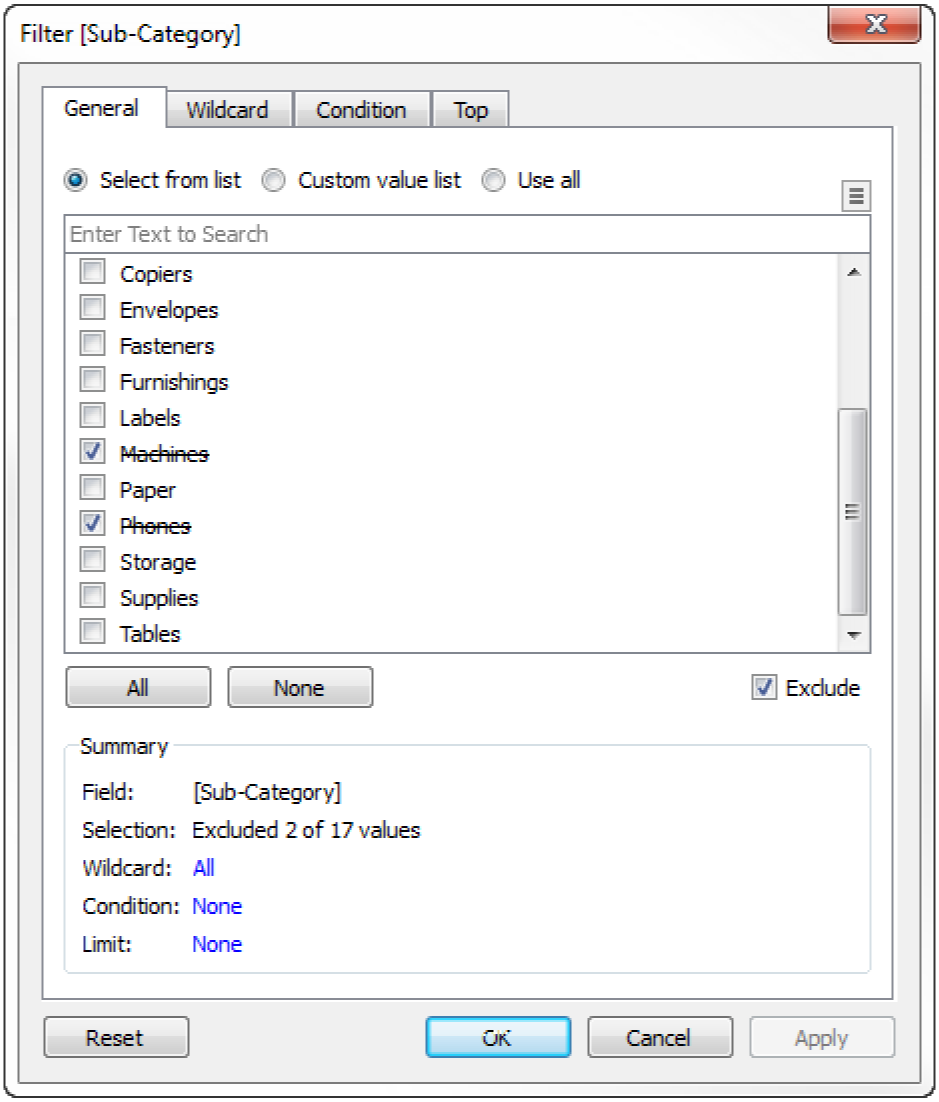
This example filters headers and color encodings in a bar chart using the **Filter** dialog box. To filter the data, follow the steps below.

1. Create the initial view shown below. It was created using the Sample - Superstore data source provided with Tableau Desktop. The view shows the profitability for three product departments broken down by their Ship Mode and Sub-Category.

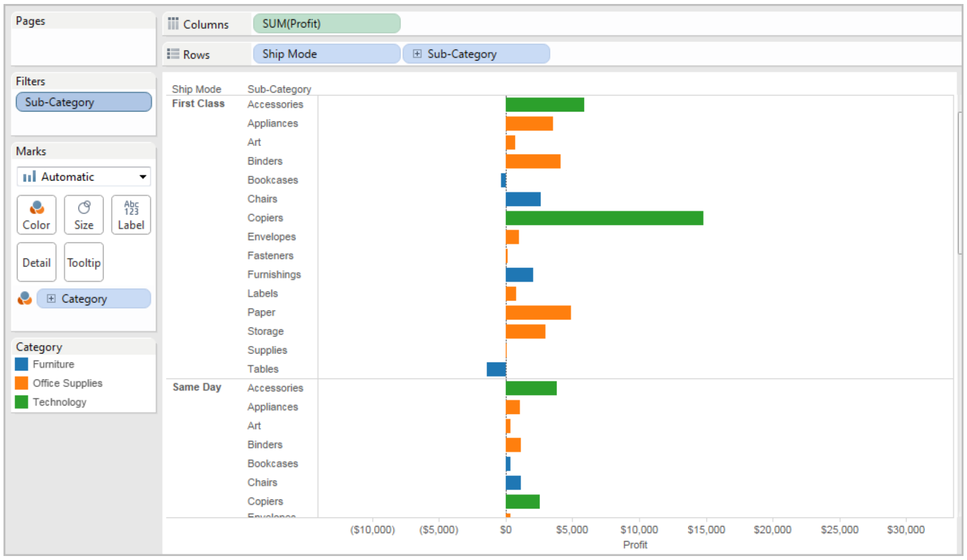


2. Create a basic filter on the **Sub-Category** dimension that excludes the Home Office segment.

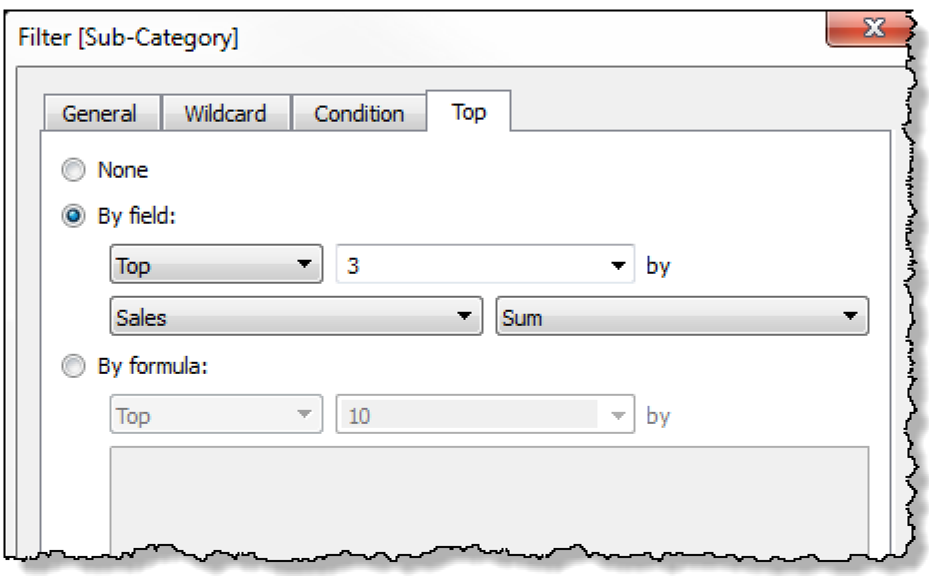
   Drag the **Sub-Category** dimension to the Filters shelf to open the Filter dialog box. Click the **None** button at the bottom of the list to deselect all segments. Then select the **Exclude** option in the lower right corner of the dialog box. Finally, select **Machines** and **Phones**. When finished click **OK**.



3. The view updates to omit **Machines** and **Phones** sub-categories.



4. Now refine the filter by adding a limit. Right-click (Control-click on a Mac) the Sub-Category field on the Filters shelf and select **Filter**. The Filter dialog box opens again. Leave the selections on the General tab as they are.
5. Switch to the **Top** tab and select By Field. Select Top 3 from first two drop-down lists. Then select Sales and Sum from the remaining drop-down lists. When finished click **OK**.

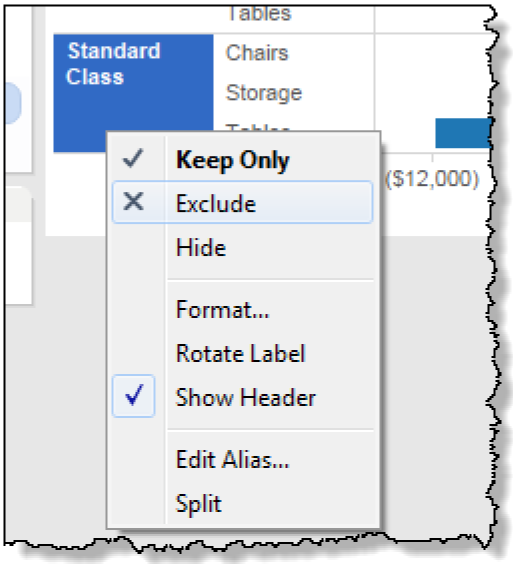


The Top formula is computed after the selections on the General tab, which mean first Tableau filters out sales of machines and phones, and then identifies the top 3 of the remaining sub-cagegories by sales.

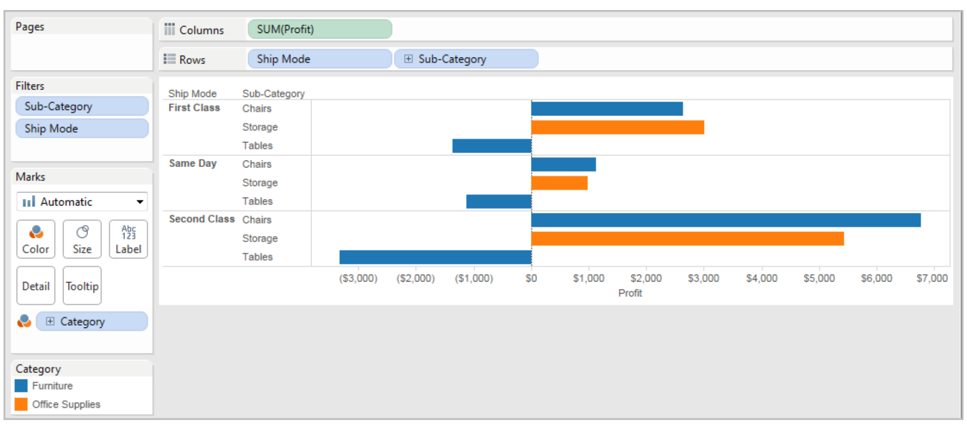
6. Add one last filter, on Ship Mode, to exclude orders that were shipped via Standard

Class.

Right-click the **Standard Class** row header and select **Exclude**. The Standard Class ship mode is removed from the view.



The final view is shown below. The view is filtered on two separate fields, which are shown on the Filters shelf. To verify which values have been excluded, right-click a field on the Filters shelf to open the **Filter** dialog box.



Filter Measures

Measures contain quantitative data so filtering this type of field generally involves selecting a range of values that you want to include. There are four types of quantitative filters: Range of Values, At Least, At Most, and Special.

If you have a large data source, filtering measures can lead to a significant degradation in performance. It is sometimes much more efficient to filter by creating a set containing the measure and then apply a filter to the set.

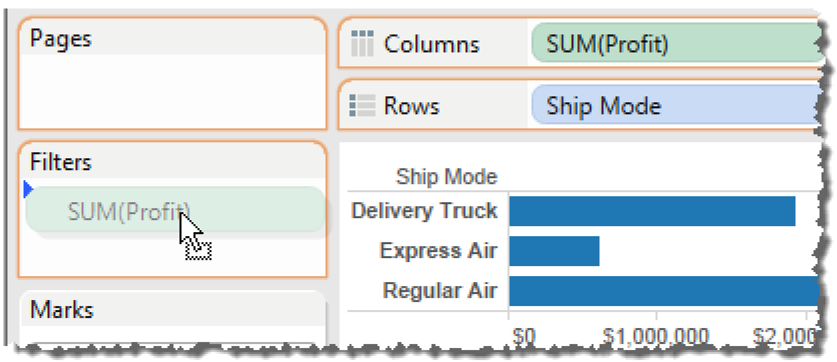
In this topic, you can learn about:

- **Basic Quantitative Filters** below
- **Showing and Hiding Values in the Filter Dialog Box** on page 630

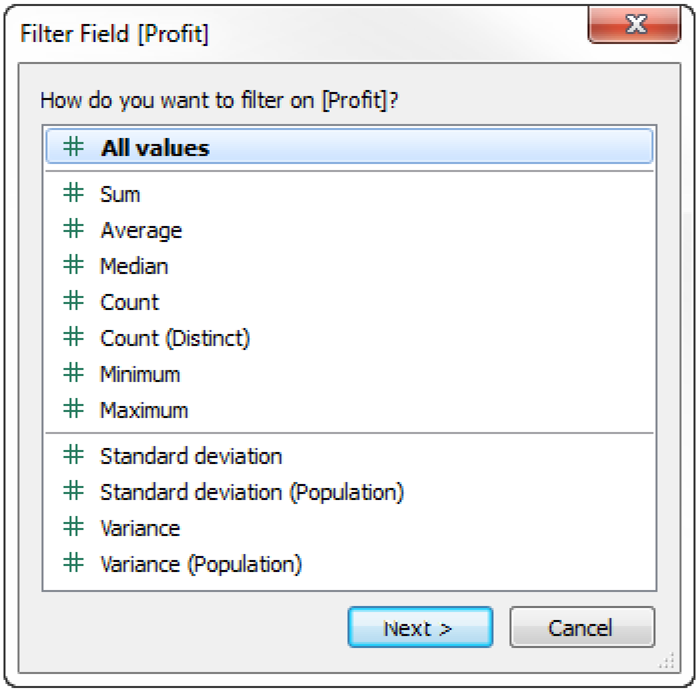
You can also follow a step by step example to learn how to filter measures.

Basic Quantitative Filters

1. Open the Filter dialog box by dragging a measure to the **Filters** shelf.

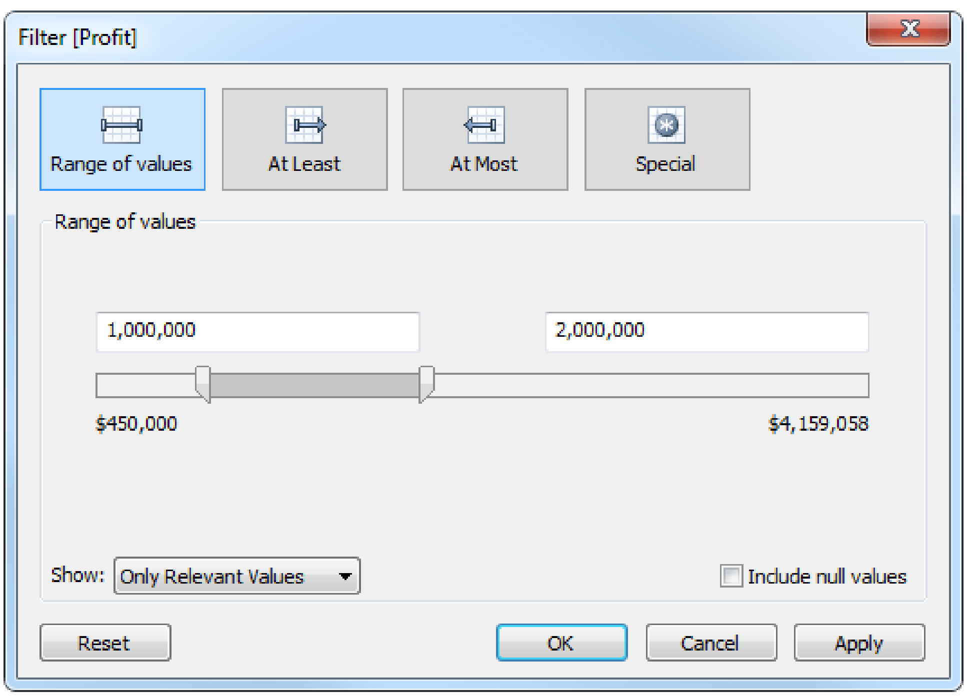


2. The Filter Field dialog box opens, prompting you to specify an aggregation. When finished, click **Next**.

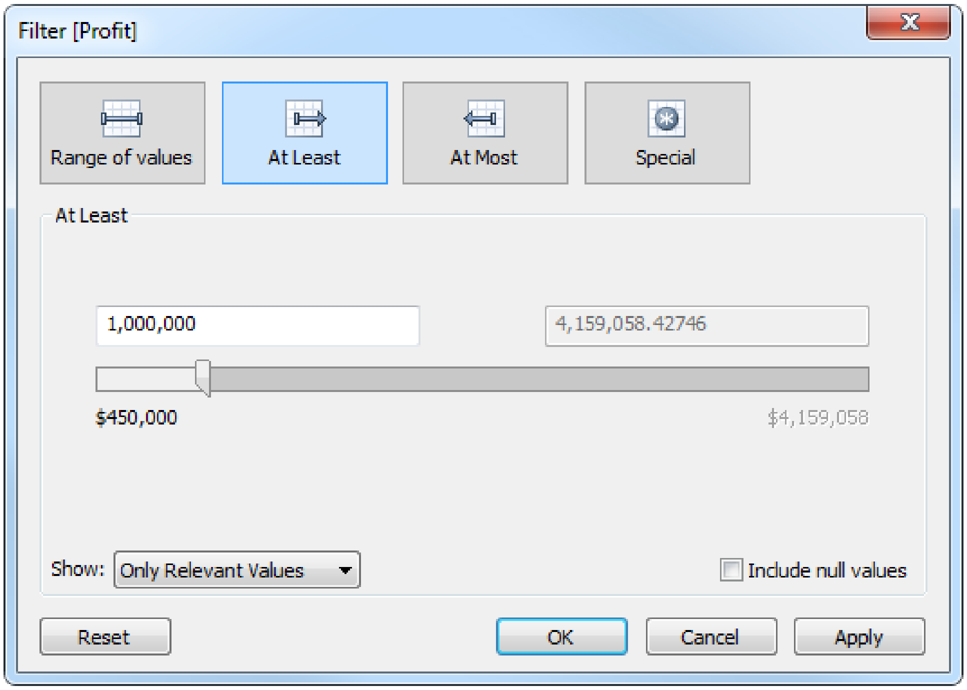


3. The Filter dialog box opens. There are four types of quantitative filters: Range of Values, At Least, At Most, and Special. Each of these types of filters are described below:

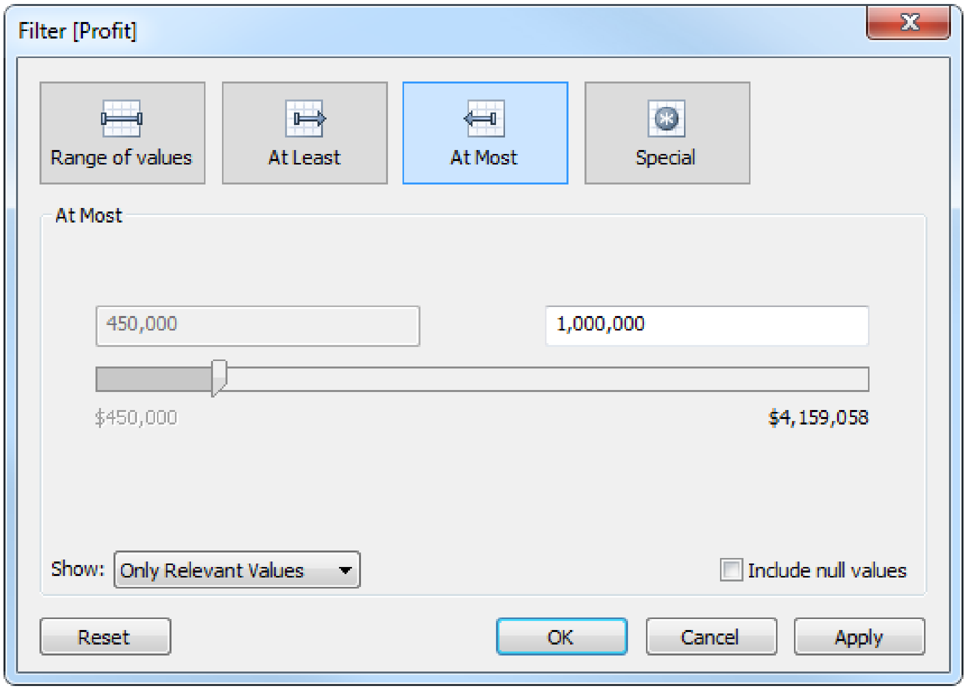
- **Range of Values** - Specify the minimum and maximum values of the range to include in the view. The values you specify are included in the range.



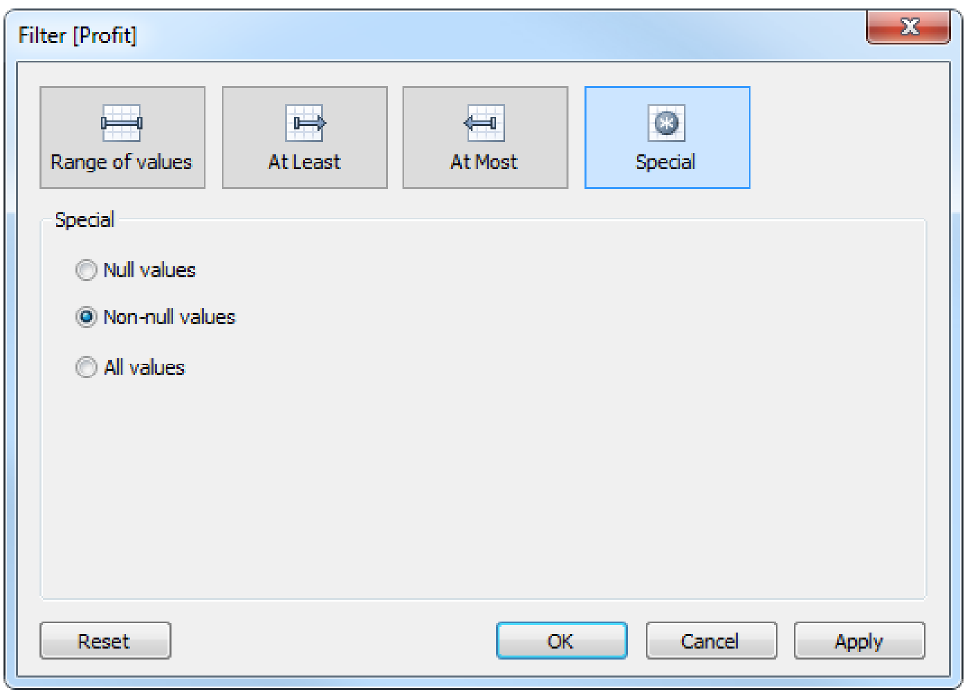
- **At Least** - Include all values that are greater than or equal to a specified minimum value. This type of filter is useful when the data changes often so specifying an upper limit may not be possible.



- **At Most** - Include all values that are less than or equal to a specified maximum value. This type of filter is useful when the data changes often so specifying a lower limit may not be possible.



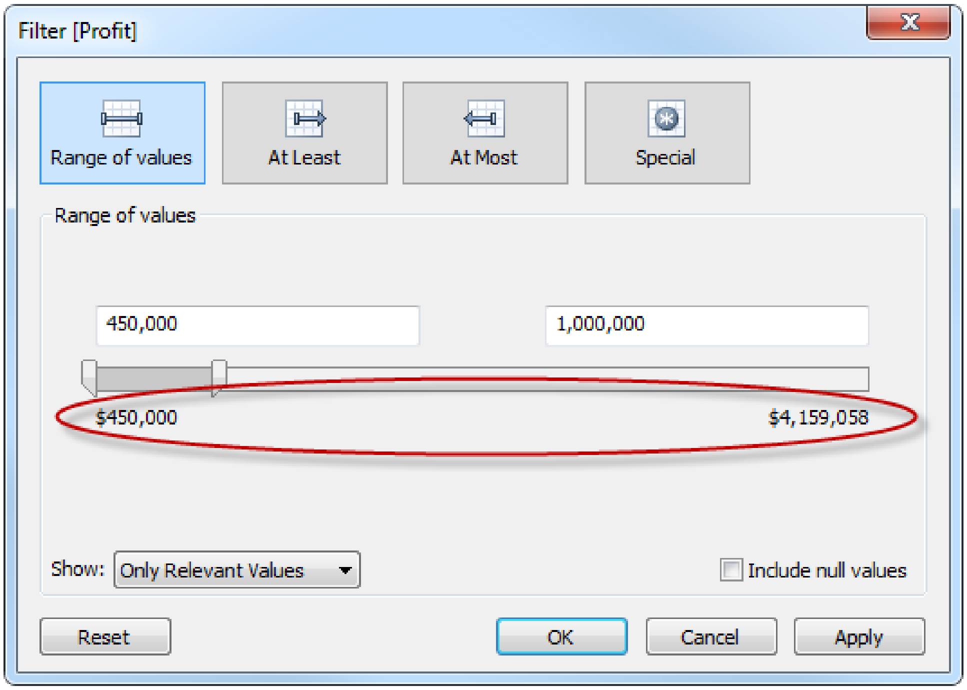
- **Special** - This special type of filter helps you filter on Null values. Include only **Null values**, **Non-null values**, or **All Values**.



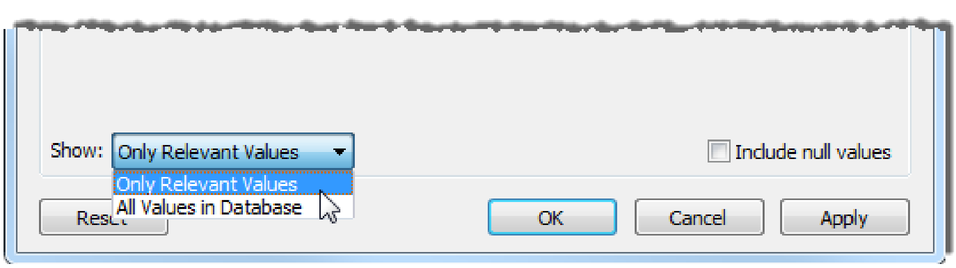
4. When finished defining the filter click **OK**.

Showing and Hiding Values in the Filter Dialog Box

The filter dialog box shows the minimum and maximum values for the field below the range slider. These numbers give you context when you are deciding the range of values to include in the filter.



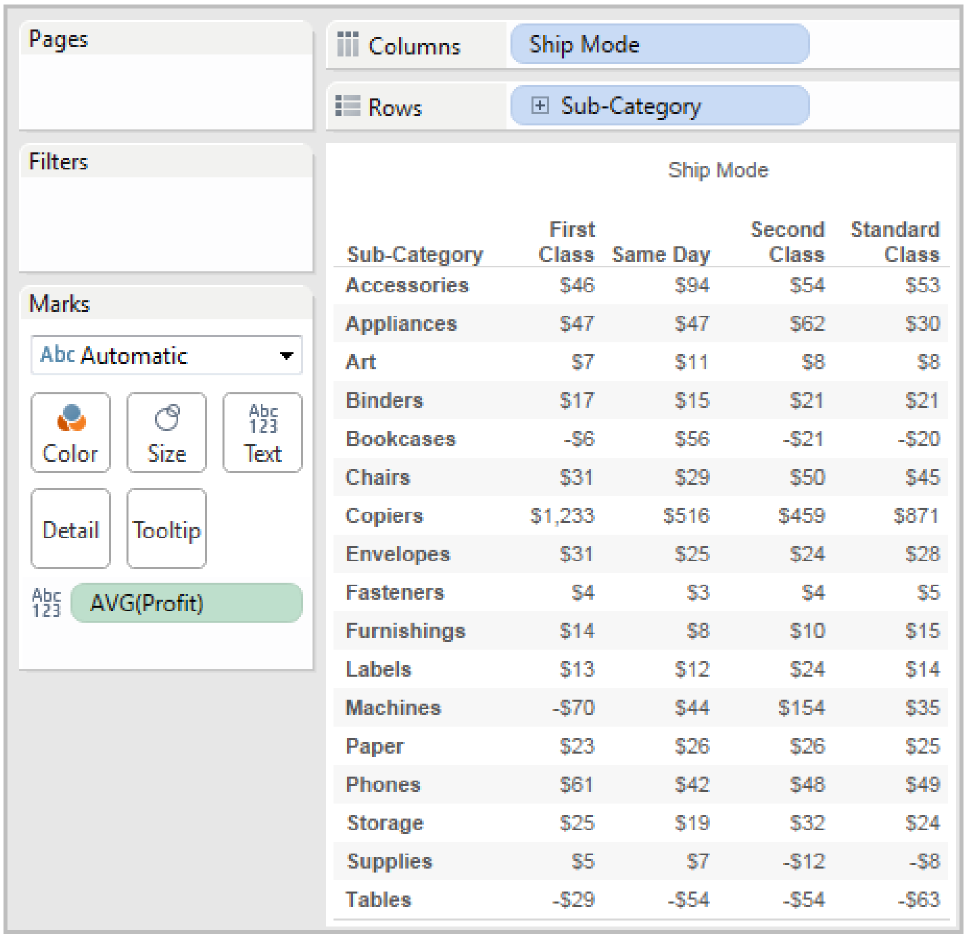
These minimum and maximum values are affected by the other filters set on the view. For example, a database may include records with sales ranging from $0 to $89K. If you created a filter on the Sales field the minimum and maximum values shown in the filter dialog box would indicate this range. However, let’s say you then filter the view to only show Office Supply products, which sell for between $0 and $25K. By default the filter dialog box will consider that filter and only show the office supplies range. You can use the **Show** menu in the bottom left corner of the dialog box to switch between **Only Relevant Values** and **All Values in the Database**. These options only affect the range that is shown in the filter dialog box and don't change how the filter will be applied to the view.



Example – Filtering Measures

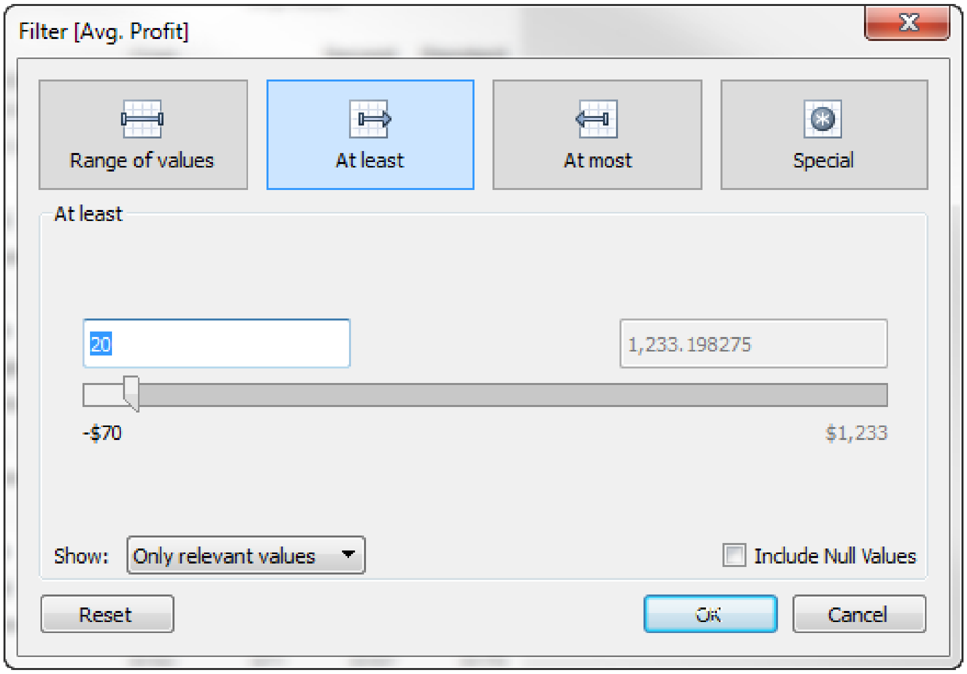
This example filters a text table using an aggregated measure, and then filters the table using the same measure in a disaggregated state.

1. Create the initial view shown below using the **Sample - Superstore** data source. The text table is shown below.



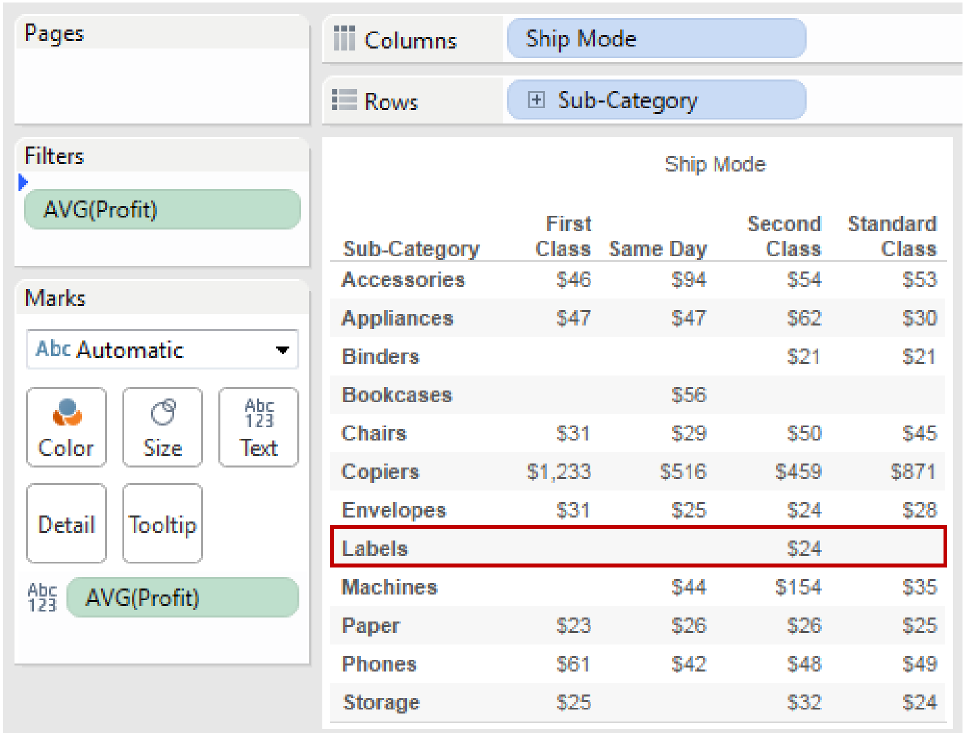
Sub-Category	First Class	Same Day	Second Class	Standard Class
Accessories	$46	$94	$54	$53
Appliances	$47	$47	$62	$30
Art	$7	$11	$8	$8
Binders	$17	$15	$21	$21
Bookcases	-$6	$56	-$21	-$20
Chairs	$31	$29	$50	$45
Copiers	$1,233	$516	$459	$871
Envelopes	$31	$25	$24	$28
Fasteners	$4	$3	$4	$5
Furnishings	$14	$8	$10	$15
Labels	$13	$12	$24	$14
Machines	-$70	$44	$154	$35
Paper	$23	$26	$26	$25
Phones	$61	$42	$48	$49
Storage	$25	$19	$32	$24
Supplies	$5	$7	-$12	-$8
Tables	-$29	-$54	-$54	-$63

2. Filter the data to only show orders with an average profit per transaction of $20 or more. Drag **Profit** from the **Data** pane to the Filter shelf. In the "How do you want to filter on [Profit]?" dialog box, click **Average** and then click **Next**.
3. In the Filter dialog box, click **At least** at the top and then enter 20 in the field on the left, as shown.

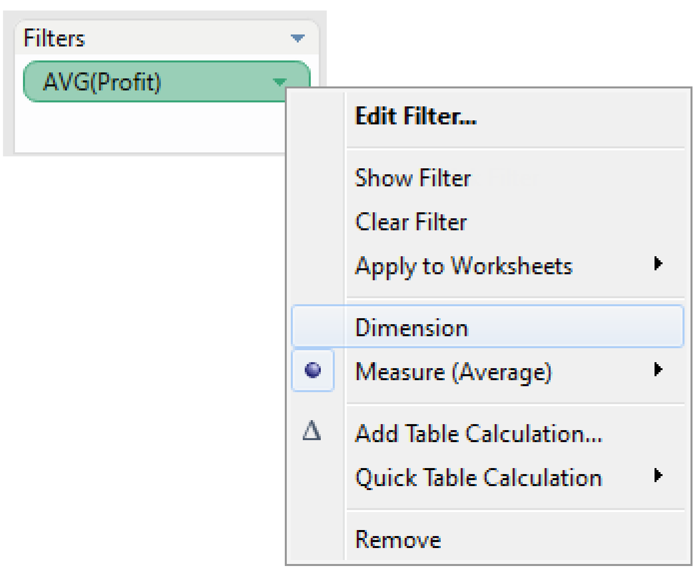


4. Click **OK**.

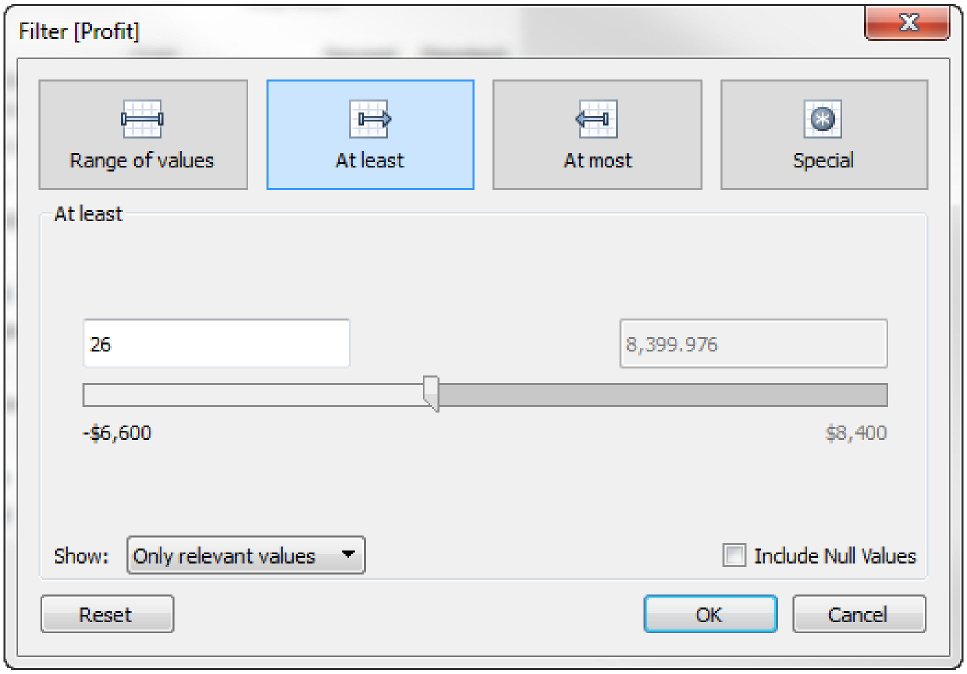
   Comparing this view with the original, unfiltered view is straightforward because the measure and the filter are using the same aggregation (AVG). For example, the Labels sub-category values for every ship mode except Second Class are removed from the view because the average profit for this subcategory in the other ship modes is less than $20.



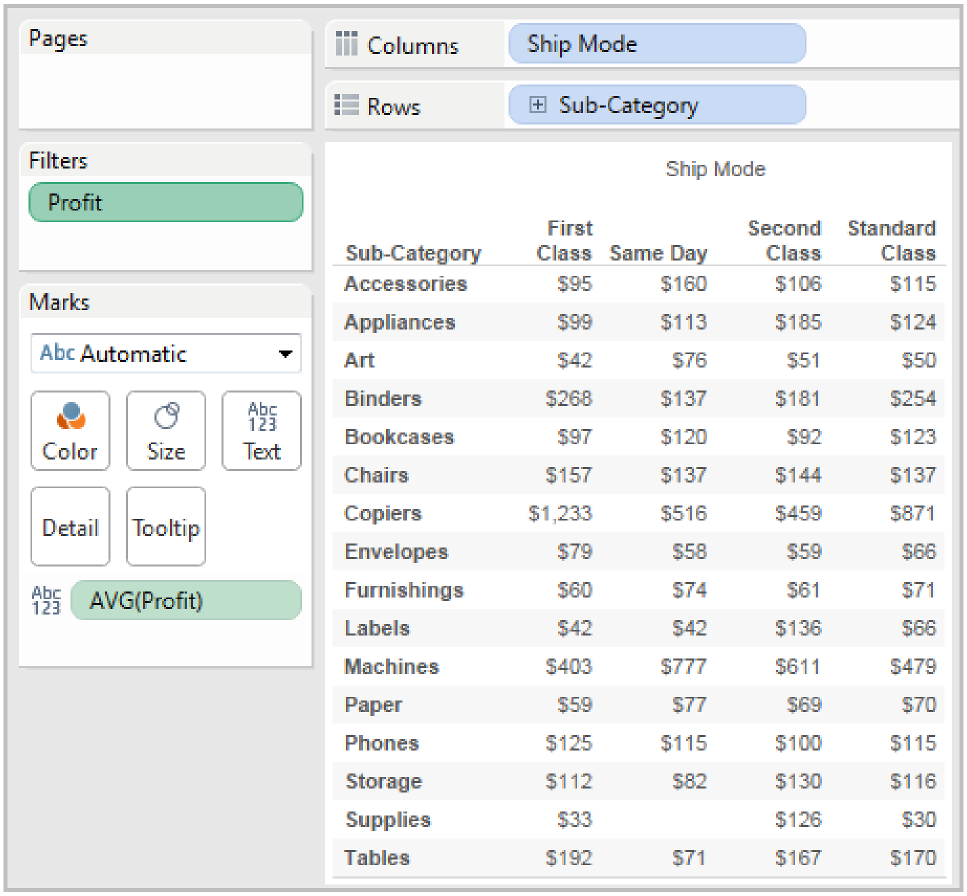
5. The result is different if you filter the same view using a disaggregated measure. Suppose you want to filter the view using the disaggregated **Profit**measure. To do this, select **Dimension** on the context menu of the AVG(Profit) field on the Filters shelf.



The **Filter** dialog box opens automatically. It now shows profit values for individual rows, rather than average values. The lowest (-$6,600) and highest ($8,400) values shown are different than before because they are the lowest and highest values in the data source, rather than the lowest and highest average values per ship mode and sub-category. Specify a new lower limit of `26`.



The final view is shown below. The values shown are still averages; the difference is that the filter is acting on individual values. The result is that only one category (supplies shipped the same day) now has an average value of less than $26.



Sub-Category	First Class	Same Day	Second Class	Standard Class
Accessories	$95	$160	$106	$115
Appliances	$99	$113	$185	$124
Art	$42	$76	$51	$50
Binders	$268	$137	$181	$254
Bookcases	$97	$120	$92	$123
Chairs	$157	$137	$144	$137
Copiers	$1,233	$516	$459	$871
Envelopes	$79	$58	$59	$66
Furnishings	$60	$74	$61	$71
Labels	$42	$42	$136	$66
Machines	$403	$777	$611	$479
Paper	$59	$77	$69	$70
Phones	$125	$115	$100	$115
Storage	$112	$82	$130	$116
Supplies	$33		$126	$30
Tables	$192	$71	$167	$170

Filter Dates

Date fields are a special kind of dimension that Tableau often handles differently than standard categorical data. This is especially true when you are creating date filters. Date filters are extremely common and fall into three categories: Relative Date Filters, which show a date range that is relative to a specific day; Range of Date Filters, which show a defined range of discrete dates; and Discrete Date Filters, which show individual dates that you've selected from a list.

In this topic, you can learn about:

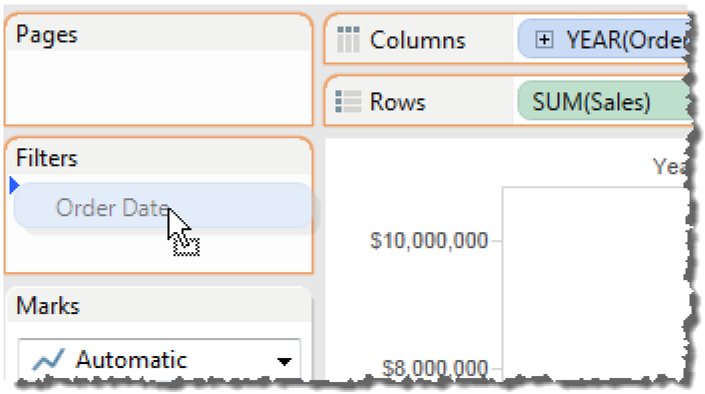
- **Relative Date Filters** below
- **Range of Dates** on page 638
- **Discrete Date Filters** on page 640
- **Other Types of Date Filters** on page 642

You can also follow a step by step example to learn how to filter date fields.

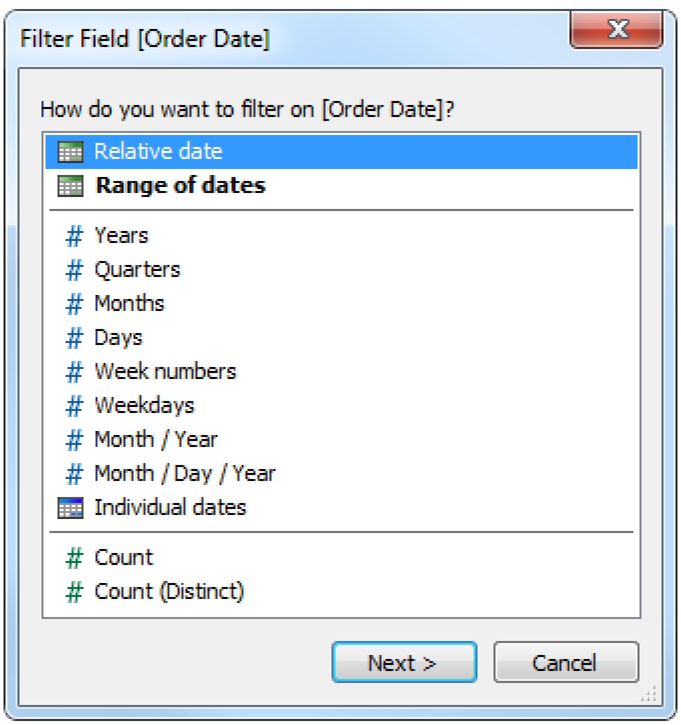
Relative Date Filters

A relative date filter lets you define a range of dates that updates based on the date and time you open the view. For example, you may want to see Year to Date sales, all records from the past 30 days, or bugs closed last week. Relative date filters can also be relative to a specific anchor date rather than today. Follow the steps below to create a relative date filter.

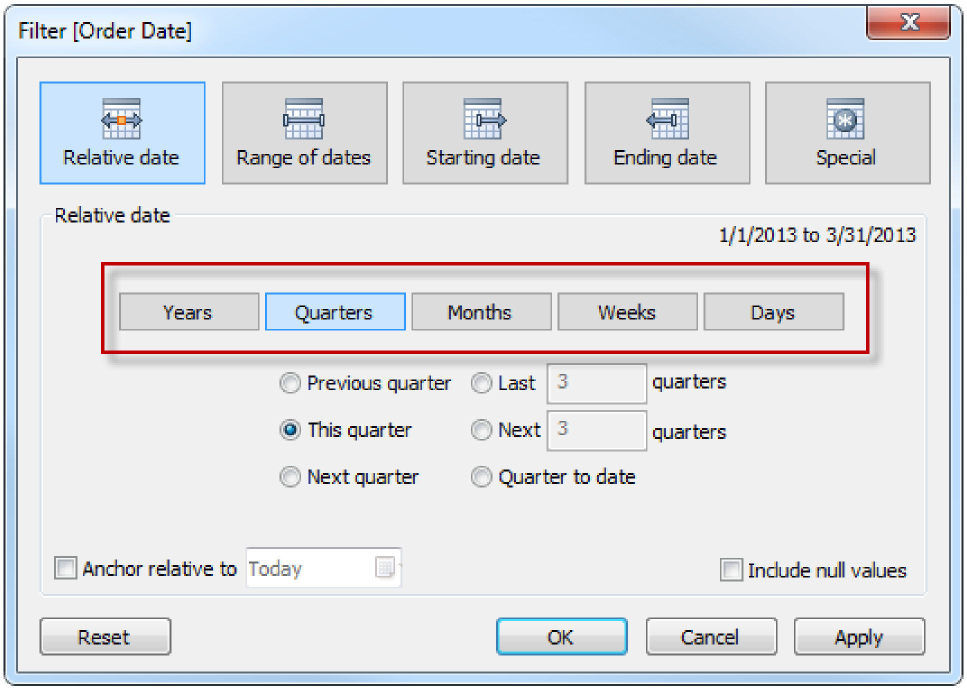
1. Drag a date field from the Data pane and drop it on the Filters shelf.



2. In the Filter Field dialog box, select **Relative date** and then click **Next**.

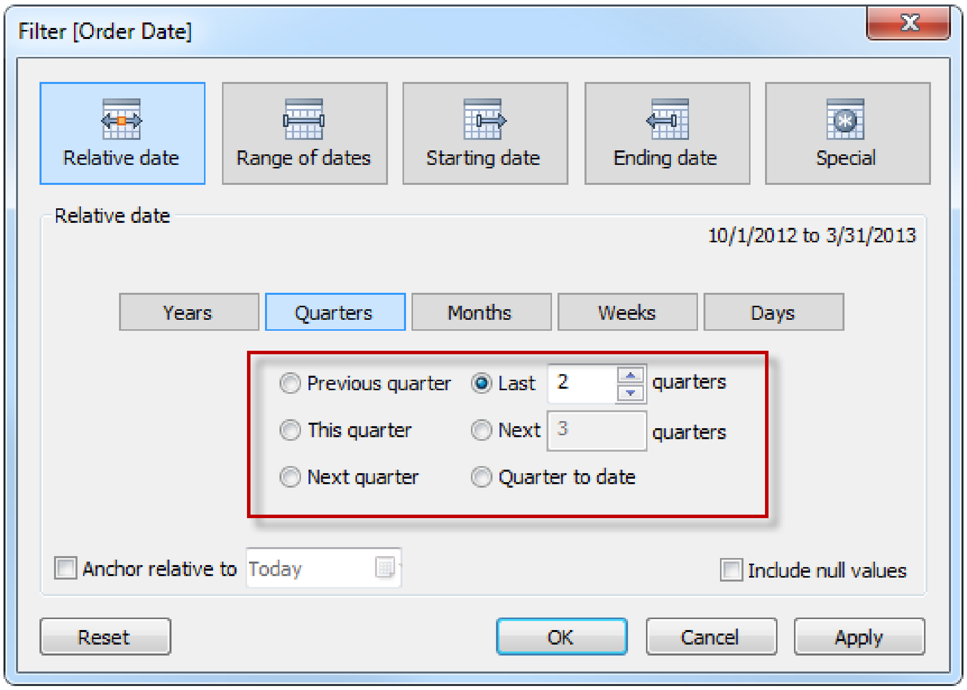


3. The Filter dialog box opens showing the Relative to Now options. Select a unit of time to filter by. For example, to filter to show the last 2 quarters, select Quarters as the time unit.



4. Use the rest of the controls to define the date filter. You can select from a variety of common options including current, previous, and next. By default, the filter is relative to today. To make the filter relative to an alternate date, select the **Anchor relative to** option in the bottom left corner and select the date to anchor to.

   The date period includes the current unit of time. For example, selecting Last 2 Quarters will include the current quarter and the previous quarter.

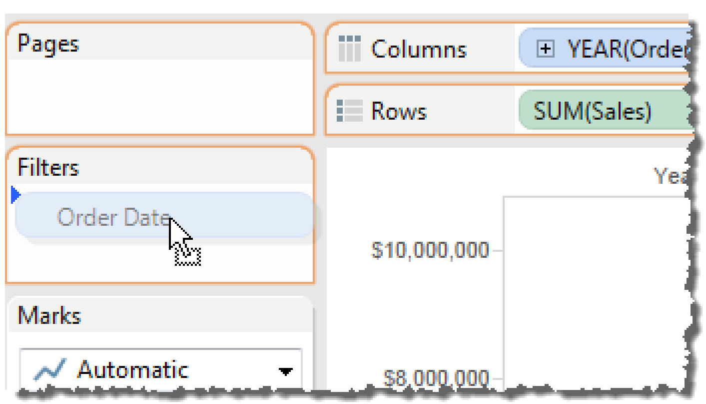


5. When finished, click **OK**.

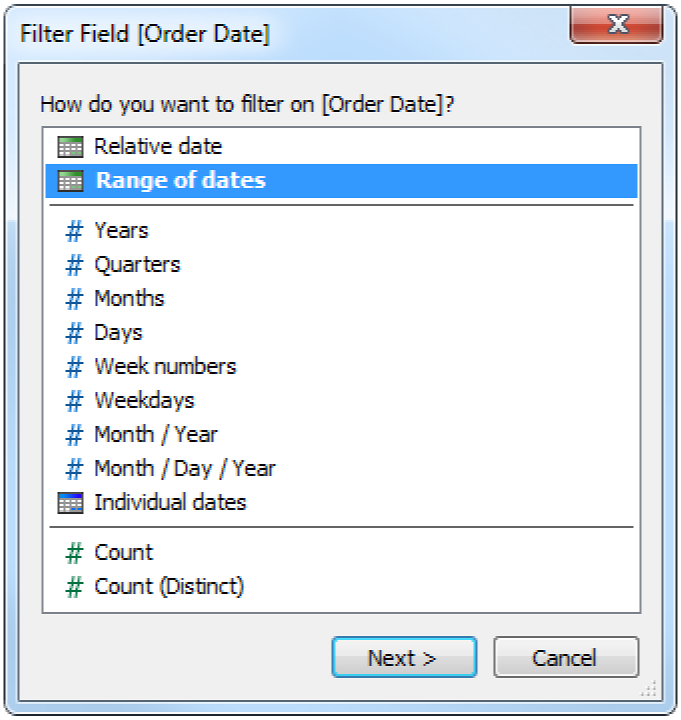
Range of Dates

Use this type of filter to define a fixed range of dates. For example, you may want to see all orders placed between March 1, 2009 and June 12, 2009. Follow the steps below to create a Range of Dates filter.

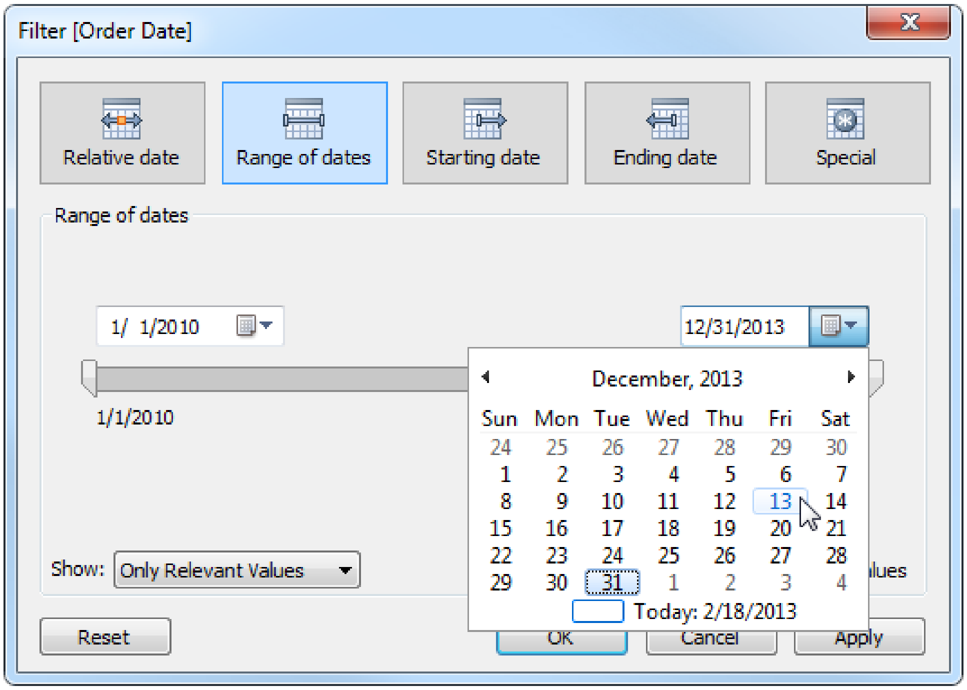
1. Drag a date field from the Data pane and drop it on the Filters shelf.



2. In the Filter Field dialog box, select **Range of Dates** and then click **Next**.



3. The Filter dialog box opens showing the Range of Dates options. Use the slider or the drop-down date controls to select minimum and maximum dates for the range you want to include. The range is inclusive, which means that the minimum and maximum dates are included in the filter.



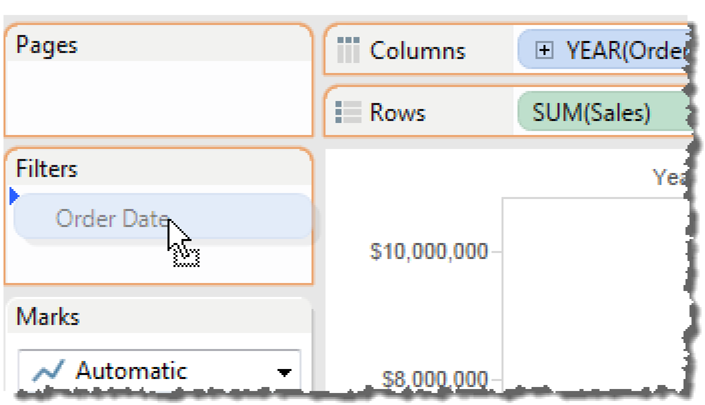
4. When finished, click **OK**.

If the field also includes Time you can select the Show Times option to further refine your filter range.

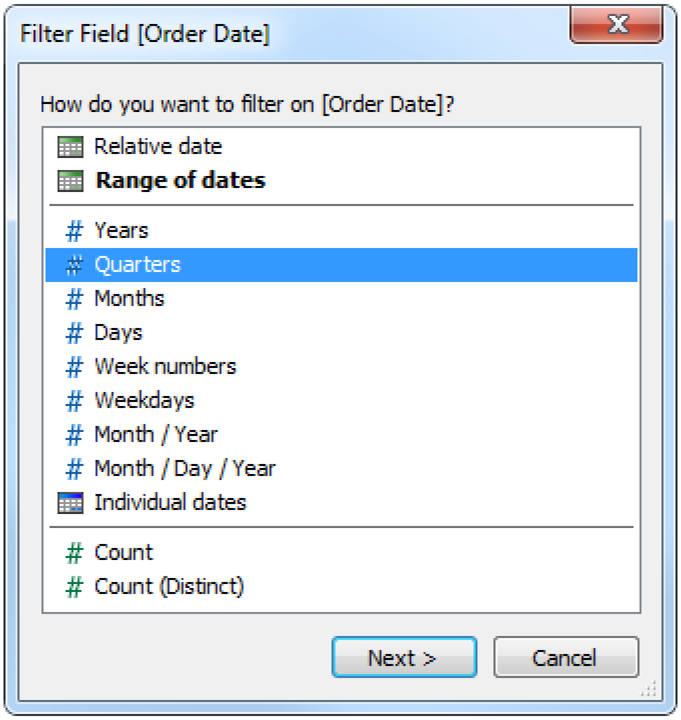
Discrete Date Filters

Sometimes you may want to filter to include specific individual dates or entire date levels. This type of filter is called a Discrete Date Filter because you are defining discrete values instead of a range. Follow the steps below to create a discrete date filter.

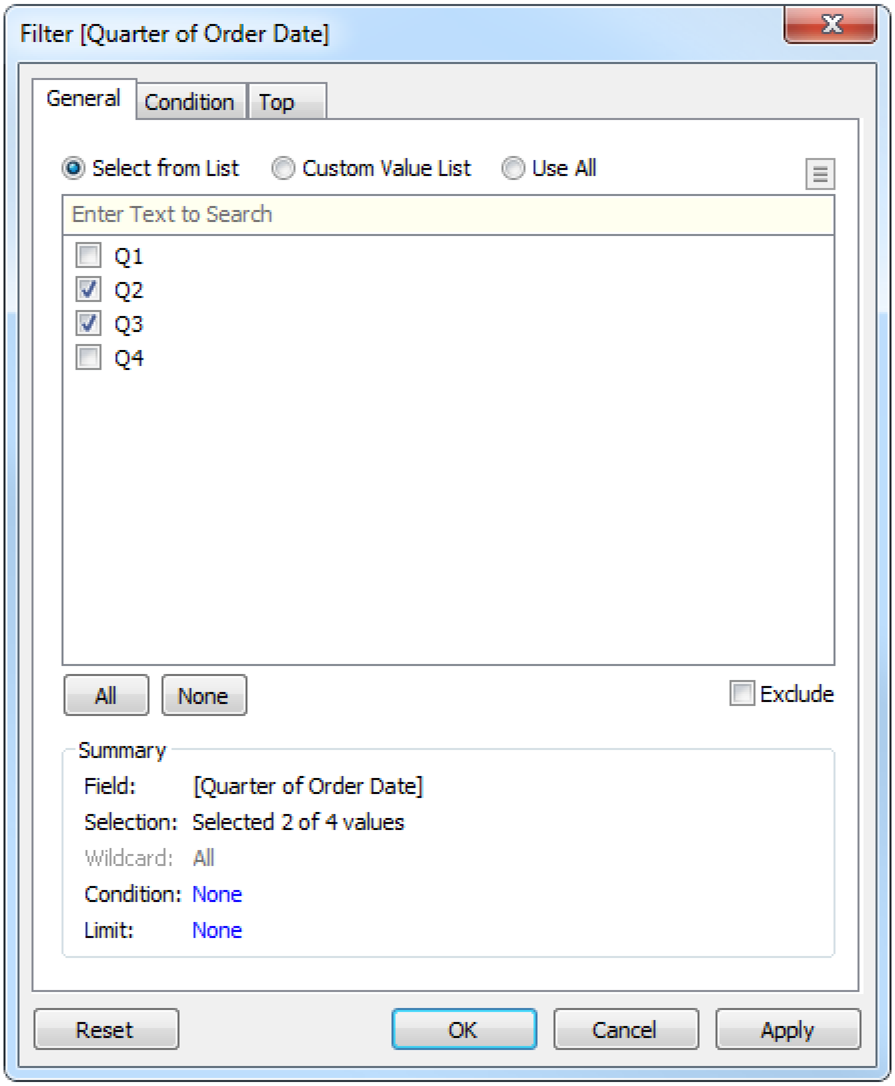
1. Drag a date field from the Data pane and drop it on the Filters shelf.



2. In the Filter Field dialog box, select a date level or select **Individual dates** and then click **Next**.



3. In the Filter dialog box, select the dates you want to include.



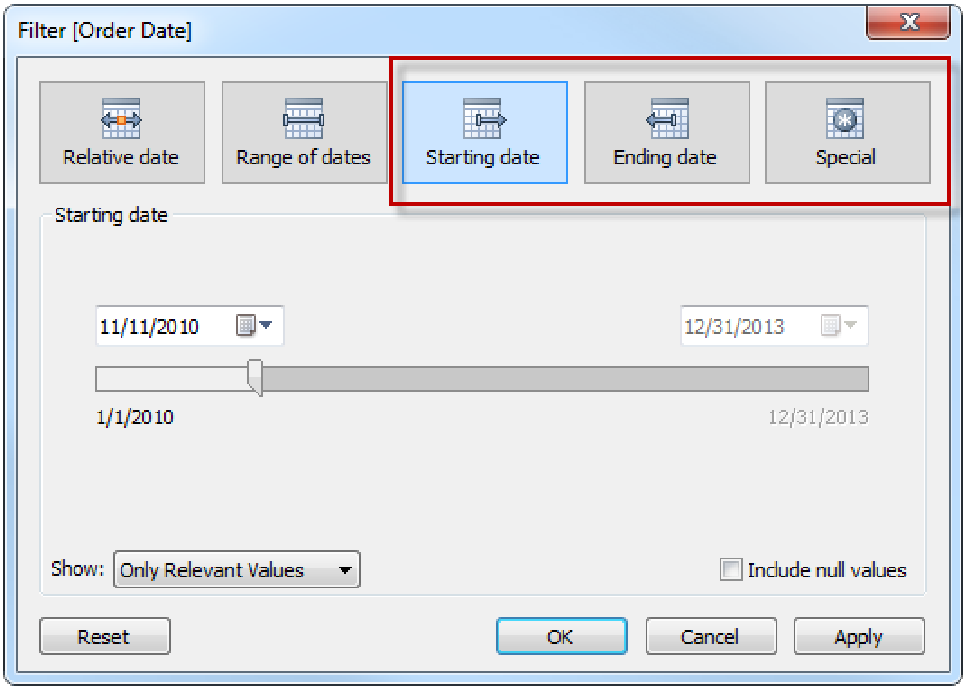
4. When finished, click **OK**.

Other Types of Date Filters

You can also filter dates by defining just a **Starting date** or an **Ending date**. These filters are useful when you want to define an open ended range.

In addition, you can create Special filters that include only **Null dates**, **Non-null dates**, or **All dates**.

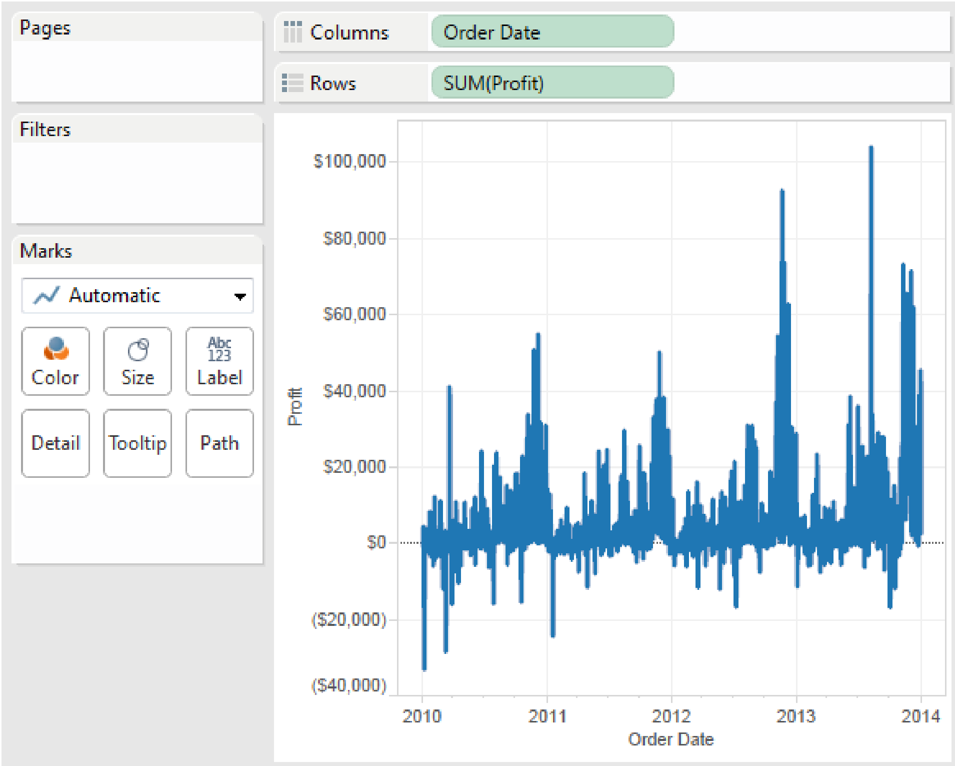
Use the options at the top of the Filter dialog box to define these types of filters.



Example - Filtering Dates

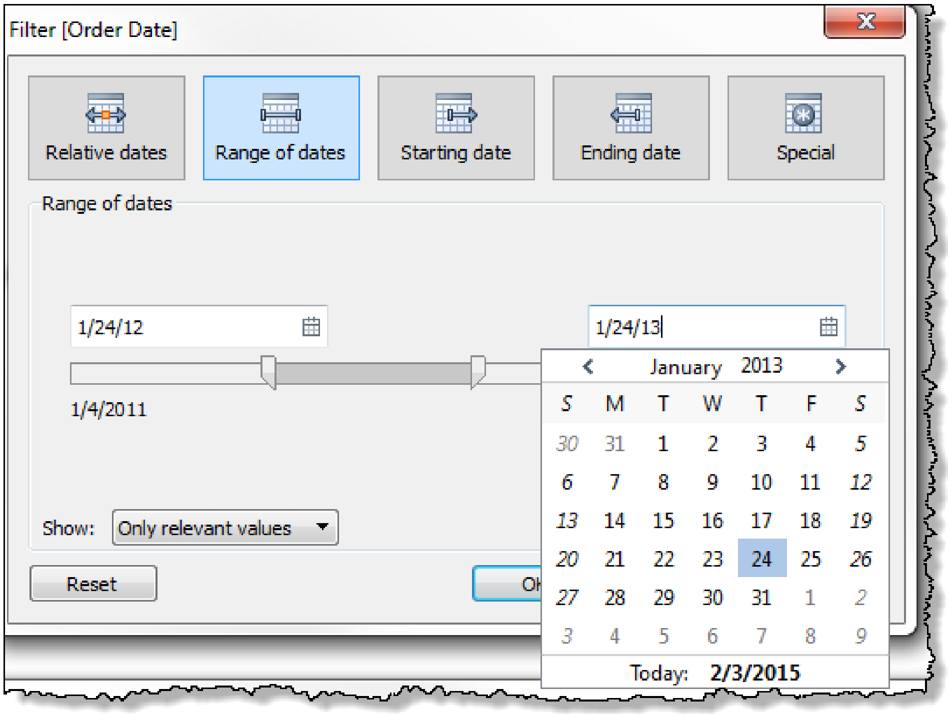
This example filters a line graph, to show the profit over a specific range of time. The steps are as follows:

1. Create the initial view shown below. It was created using the **Sample - Superstore** data source. Place **[Order Date]** on the **Columns** shelf and select **Exact Date** as the aggregation. Then place **Profit** on the **Rows** shelf.

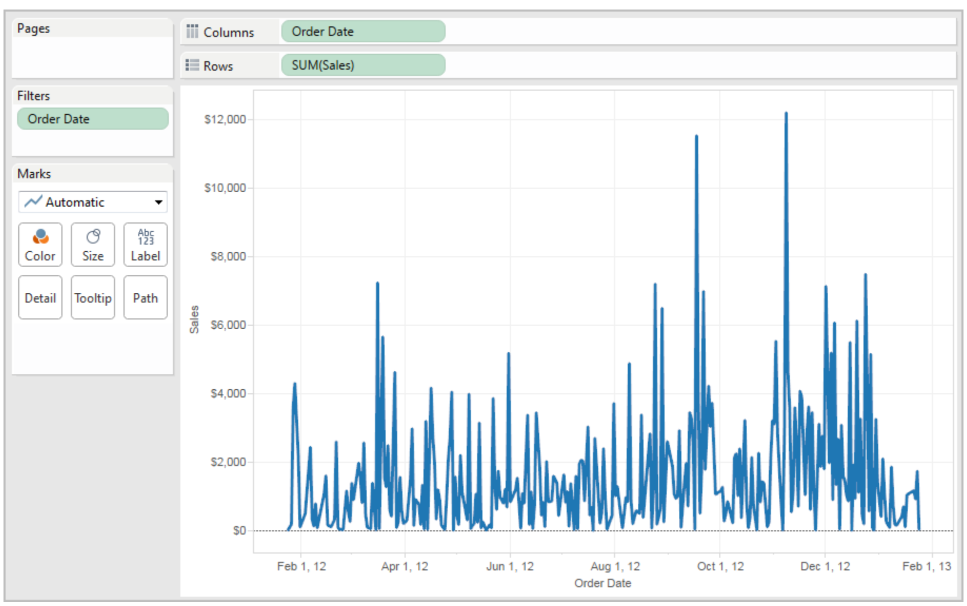


2. Now filter the view to include only orders that were place between two specific dates. Drag **Order Date** field to the Filters shelf, select **Range of Dates** in the Filter Field dialog box, and click **Next**.

   In the Filter dialog box, use the drop-down date controls to specify a new lower limit of January 24, 2012 and an upper limit of January 24, 2013.



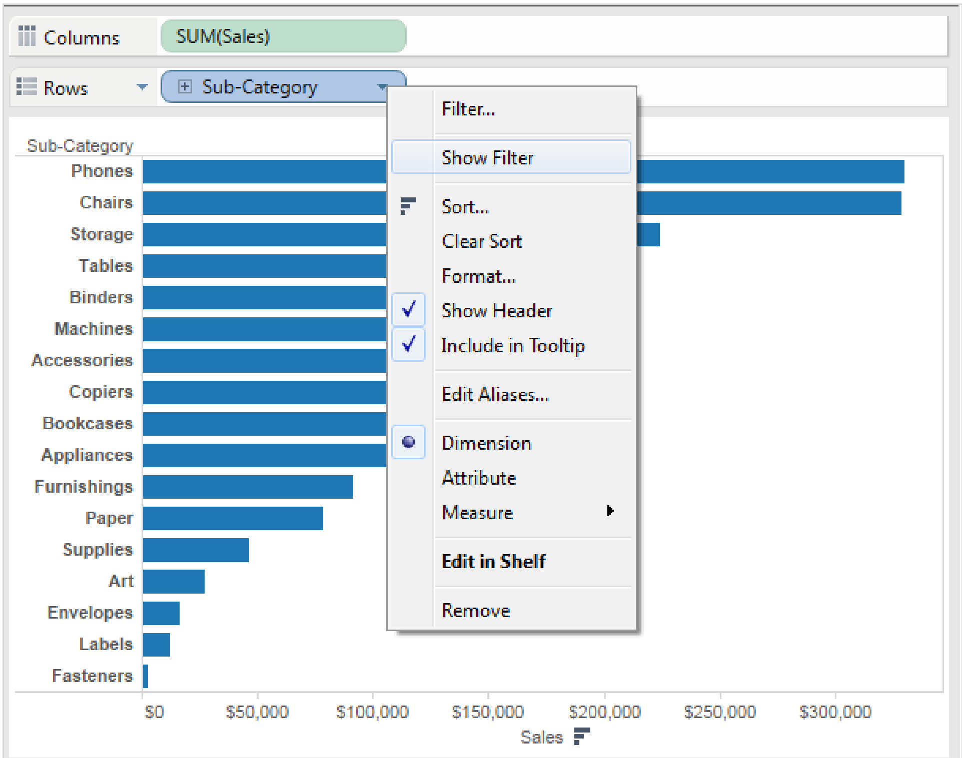
The resulting filtered view is shown below.



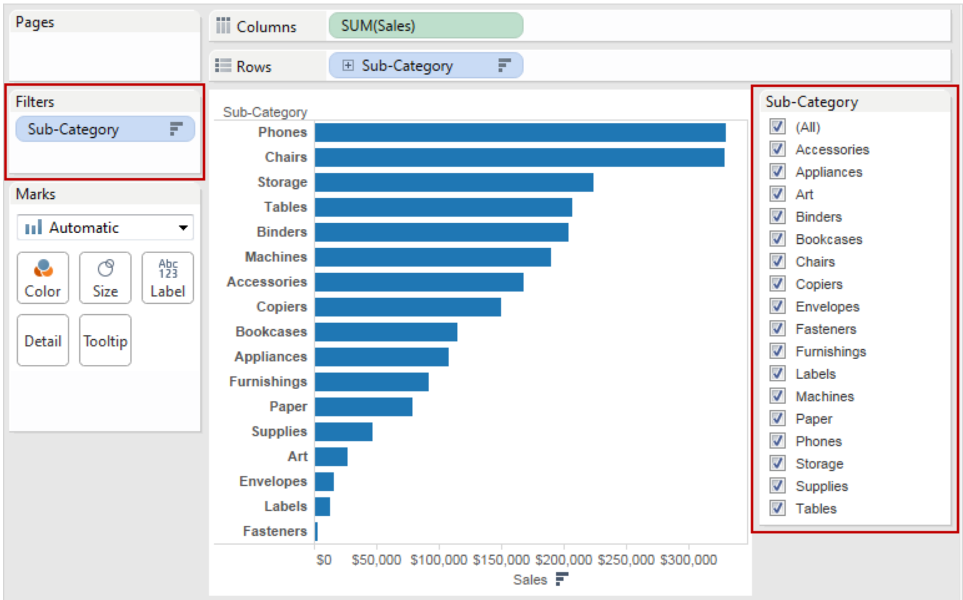
Show Filters in the View

You can quickly add and modify filters by showing them in the view. When you show a filter in the view, a smaller representation of the Filter dialog box appears as a card in the view. Use the card to quickly include or exclude data in the view.

1. Right-click (control-click on Mac) the field you want to filter in the view and select **Show Filter**.



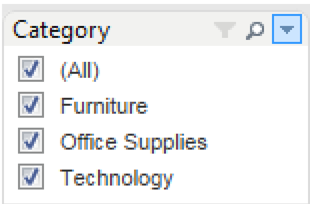
The field is automatically added to the Filters shelf (if it is not already being filtered), and a card appears in the view.



Note: You can add a quick filter for a field that is not currently used in the view. To do so, right-click (control-click on Mac) the field in the Data pane and select **Show Filter**. The field is automatically added to the **Filters** shelf.

Set Options for Filters in the View

After you show a filter there are many different options that let you control how the filter works and appears. You can access these options by clicking the drop-down menu in the upper right corner of the filter card in the view.



Some options are available for all types of filters, and others depend on whether you're filtering a categorical field (dimension) or a quantitative field (measure). Finally, you can customize how filters appear in the view, in dashboards, or when published to Tableau Server.

In this topic, you can learn about:

- **General Filter Options** below
- **Categorical Filter Options** on the next page
- **Quantitative Filter Options** on page 651
- **Customizing Filters** on page 652

General Filter Options

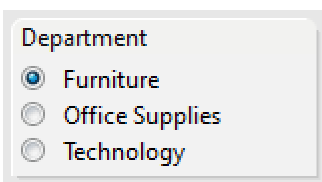
- **Edit Filter** - This option opens the main Filter dialog box so you can further refine the filter by adding conditions and limits.
- **Clear Filter** - Removes the filter from the Filters shelf and removes the filter card in the view.
- **Apply to Sheets** - Specifies whether the filter should apply to only the current sheet or be shared across multiple sheets. For more information, see **Sharing Filters** on page 655.
- **Customize** - Select from a list of customization options. For more information, see **Customizing Filters** on page 652.
- **Show Title** - Specifies whether to show the title on the filter card.
- **Edit Title** - By default the title of the filter is the name of the field being filtered. Use this option to modify the title. Click **Reset** to return to the default title.
- **Only relevant values** - Specifies which values to show in the filter. When you select this option other filters are considered and only values that pass these filters are shown. For example, a filter on State will only show the Eastern states when a filter on Region is set. You can use the toggle at the top of the filter card to switch between this option and the

All Values in Database option.

- **All values in database** - Specified which values to show in the filter. When you select this option all values in the database are shown regardless of the other filters on the view.
- **All values in context** - When one of the filters in the view is a context filter, select this option on a different filter to only display values that pass through the context filter. For more information, see **Context Filters** on page 659.
- **Include** - When this option is selected, the selections in the filter card are included in the view.
- **Exclude** - When this option is selected, the selections in the filter card are excluded from the view.
- **Filter Modes** - Select from several different filter modes. The modes differ depending on whether the filter is for a dimension or measure. For more information, see **Categorical Filter Options** below and **Quantitative Filter Options** on page 651.
- **Hide Card** - Hides the filter card but does not remove the filter from the Filters shelf.

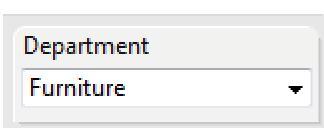
Categorical Filter Options

- **Single Value (List)** - Displays the values of the filter as a list of radio buttons where only a single value can be selected at a time. An “All” option can be added to the list to let you quickly select all values without switching to a multiple values list.

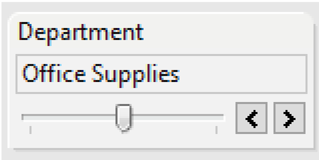


> **Note**: When you expose a filter for Measure Values or Measure Names as a single value list, selecting All will automatically convert the filter to a multiple values list. For information on Measure Values and Measure Names, see **Measure Values and Measure Names** on page 217.

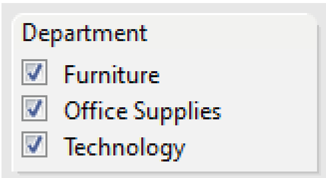
- **Single Value (Dropdown)** - Displays the values of the filter in a drop-down list where only a single value can be selected at a time.



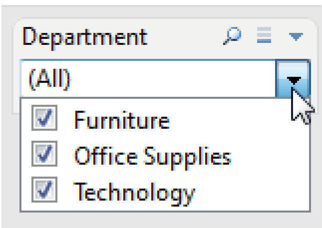
- **Single Value (Slider)** - Displays the values of the filter along the range of a slider. Only a single value can be selected at a time. This option is useful for dimensions that have an implicit order such as dates.



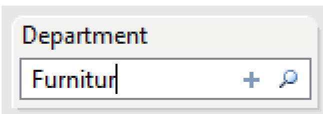
- **Multiple Values (List)** - Displays the values in the filter as a list of check boxes where multiple values can be selected.



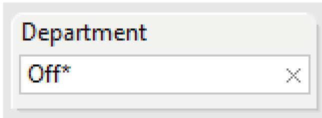
- **Multiple Values (Dropdown)** - Displays the values of the filter in a drop-down list where multiple values can be selected.



- **Multiple Values (Custom List)** - Displays a text box where you can type a few characters and search for the value. Alternatively, you can type or paste a list of values into the text box to create a custom list of values to include.



- **Wildcard Match** - Displays a text box where you can type a few characters. All values that match those characters are automatically selected. You can use the asterisk character as a wildcard character. For example, you can type “tab*” to select all values that begin with the letters “tab”. Pattern Match is not case sensitive. If you are using a multidimensional data source, this option is only available when filtering single level hierarchies and attributes.

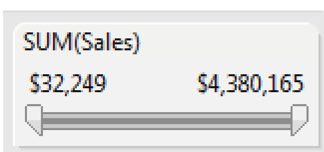


Quantitative Filter Options

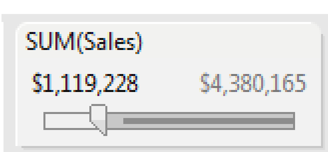
- **Range of Values/Dates** - shows the filtered values as a pair of sliders that you can adjust to include or exclude more values. Click on the upper and lower limit readouts to enter the values manually.

  The darker area inside the slider range is called the data bar. It indicates the range in which data points actually lie in the view. Use this indicator to determine a filter that makes sense for the data in your data source. For example, you may filter the Sales field to only include values between $200,000 and $500,000 but your view only contains values between $250,000 and $320,000. The range of data you can see in the view is indicated by the data bar while the sliders show you the range of the filter.

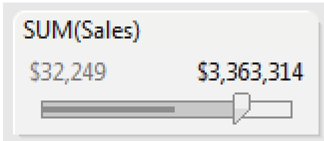
  > Data bars only show in filters where the filtered field is also used in the view (e.g., on Columns, Rows, or on the Marks card, and son on) and are at the same aggregation level as the field on the Filters shelf. For example, a filter on SUM (Sales) will only display data bars if the SUM(Sales) field is used in the view. It won't show if AVG(Sales) is used in the view. Even though in both scenarios, the filtered field, Sales is used in the view; in the latter case the aggregation is different than the aggregation of the filter.

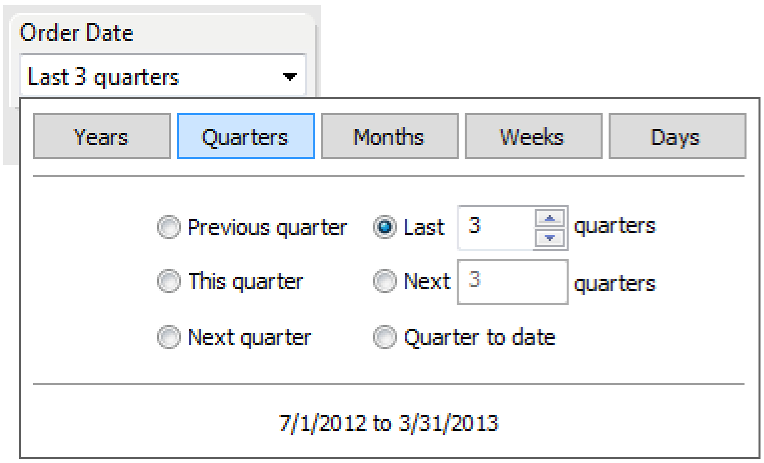
- **At Least/Starting Date**- shows a single slider with a fixed minimum value. Use this option to create a filter using an open ended range.

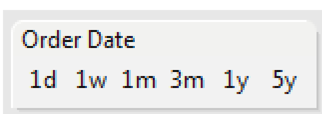
- **At Most/Ending Date** - shows a slider with a fixed maximum value. Use this option to create a filter using an open ended range.



- **Relative to Now** - shows a control where you can define a dynamic date range that updates based on when you open the view. The option is only available for filters on continuous date fields.

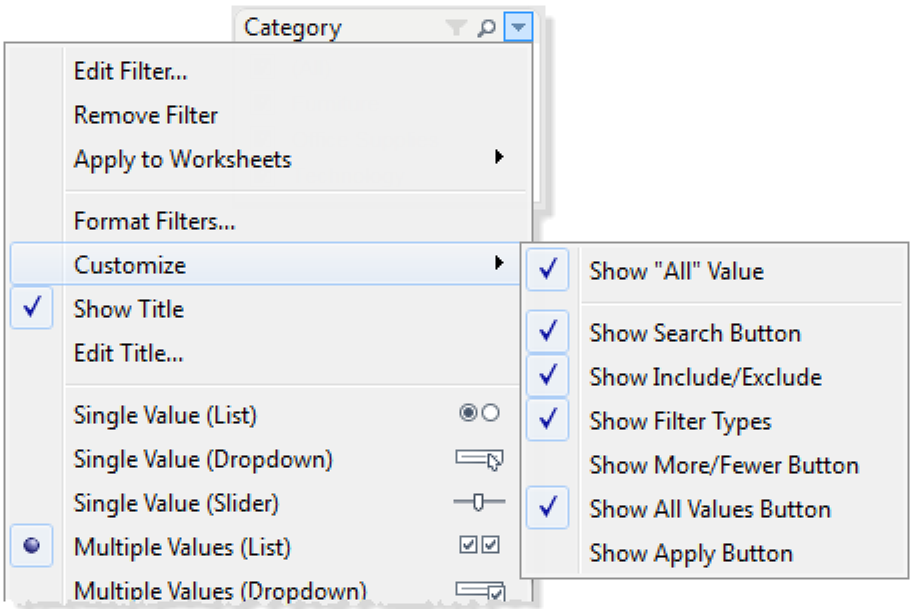


- **Browse Periods** - shows common date ranges such as past day, week, month, three months, one year, and five years. This option is only available for filters on continuous date fields.



Customizing Filters

You can control how a filter appears on the sheet, in dashboards, or when published to Tableau Server. Customize filters by selecting **Customize** on the filter card menu.



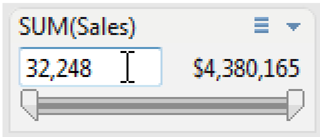
Not all of the following options are available for views published to Tableau Server.

Then select from the following options:

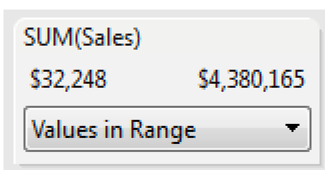
- **Show "All" Value** - toggles whether to show the "All" option that displays by default in multiple values and single value lists.
- **Show Search Button** - toggles whether to show the search button at the top of the filter.
- **Show Include/Exclude** - toggles whether to show the Include Values and Exclude Values commands on the filter card menu. When shown, users can switch the filter between include and exclude modes.
- **Show Filter Types** - toggles whether to let users change the type of quick filter shown. For example, when shown, a user can change a multiple values list to a compact list.
- **Show More/Fewer Button** - toggles whether to show the More/Fewer button at the top of the filter.
- **Show All Values Button** - toggles whether to display the Show All Values button on the filter card.
- **Show Apply Button** - toggles whether to show the Apply button at the bottom of the filter. When shown, changes to the filter are only applied after you click the button. Pending changes are indicated with a green color. This option is only available in multiple

values lists and dropdowns.

- **Show Readouts** - controls whether the minimum and maximum values are displayed as text above a range of values. The readouts can be used to manually type a new value instead of using the sliders.



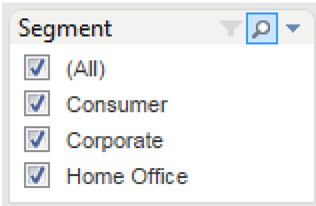
- **Show Slider** - controls whether the slider displays. When this option is cleared, the filter only displays the readouts.
- **Show Null Controls** - shows a drop-down list that lets you control how the filter handles null values. You can select from the following options:
  - **Values in Range** - the filter only includes values within the specified range.
  - **Values in Range and Null Values** - the filter includes values within the specified range as well as null values.
  - **Null Values Only** - the filter includes only null values.
  - **Non-Null Values Only** - the filter includes only values that are not null.
  - **All Values** - the filter includes all values. Use this option to quickly reset the selected range to include all values.



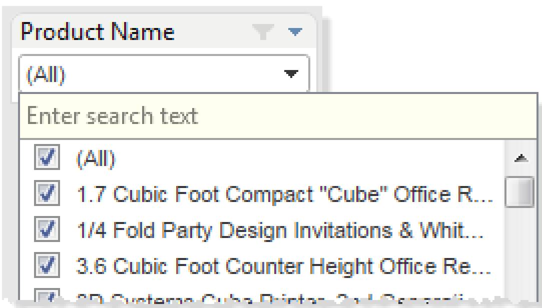
Search Filters in the View

Sometimes a categorical filter can contain a lot of values. You can use the Search option to quickly find and select the values you want. To open the search field, click the Search icon in the upper right corner of the filter card. Then start typing a keyword or search term. Matching values that contain the specified characters will show directly below the search field where you can select or deselect them as needed.

By default, search will return all values that contain the search term. You can use the asterisk character as a wildcard to restrict the results to values that begin with or end with the specified characters. For example, searching for “Bl*” will find all values that start with the characters B and l. Search is not case sensitive.



Search is also available when using a drop-down filter mode. Use the search box at the top of the drop-down list to type keywords or search terms. The results are shown directly below where you can select or deselect them as needed.



Sharing Filters

When you add a filter to a worksheet, by default it only applies to the current worksheet. Sometimes you may want to apply the filter to other worksheets in the workbook.

You can select specific sheets to apply the filter to or apply it globally to all worksheets that use the same data source. For example, you may have a filter that only includes a specific region or product of interest. Rather than adding this filter every time you create a new worksheet, you can simply create the filter once and then apply it to all worksheets using the same data source.

Note: Filters cannot be applied across multiple data sources.

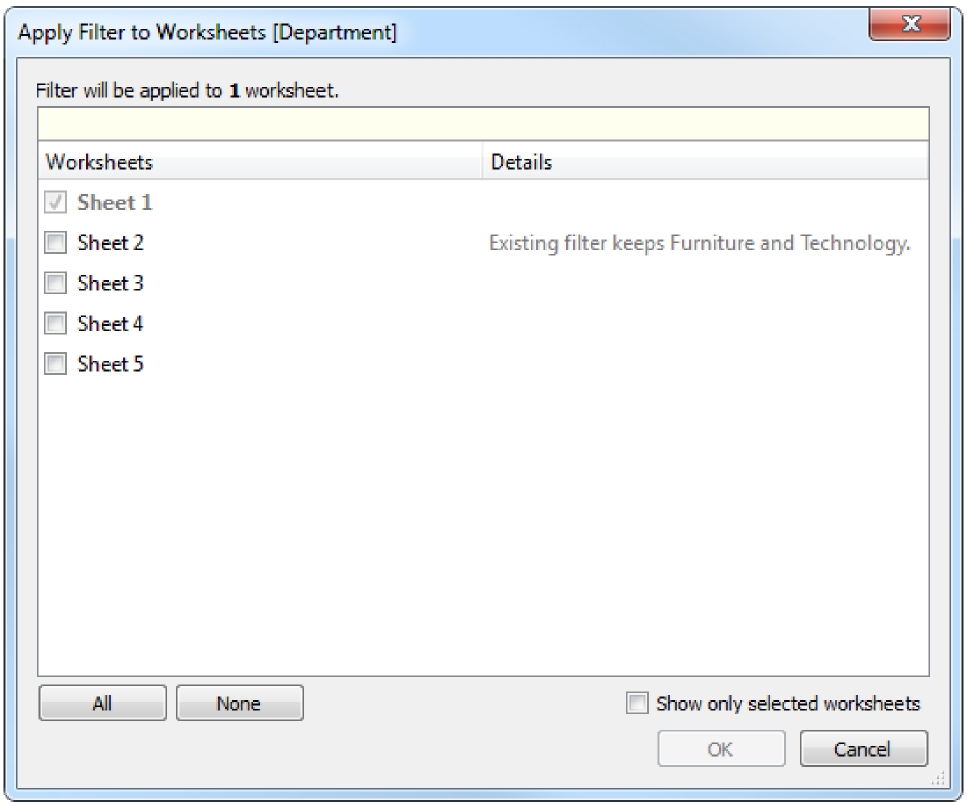
1. On the Filters shelf, right-click the field you want to apply to other worksheets and select **Apply to Worksheets**.
2. Select one of the following options:

- **All Using This Data Source** - applies the filter to all worksheets that use the current data source connection. Filters that use this option are global across the workbook.

  Filters that apply to all worksheets are marked with a data source icon . The filter is automatically created on any new worksheets you create after you drag a field to the view. Any changes you make to the filter affects all of the worksheets.

Note: If blending multiple data sources in a view, the **All Using This Data Source** option applies to the filter if it is the primary data source.

- **Selected Worksheets** - opens a dialog box where you can select from a list of worksheets that use the same connection. Select the worksheets to apply the filter to. If any of the sheets already contain a filter on the same field, the Apply Filter to Worksheets dialog box will provide details about the filter. If you select the sheet, the current filter will override any existing filter selections.



Filters that apply to a selection of worksheets are marked with the worksheet icon . Any changes you make to the filter affect all of the selected worksheets.

- **Only This Worksheet** - only applies to the current worksheet. This option is selected by default when you create new filters. Filters that are local to the current sheet are shown without any additional icons.

If you apply a filter to all sheets or selected sheets and then change the setting to apply the filter to just the current sheet, the filters are not removed from all other sheets. Rather, the filters are disconnected and they are all made local to their respective worksheets. You can go to each sheet and remove the filter or modify selections.

Note: In previous versions of Tableau Desktop, the **All Using This Data Source** option was called Make Global and the **Only This Worksheet** option was Make Local.

Data Source Filters

You can create filters on a data source, thereby reducing the amount of data in the data source.

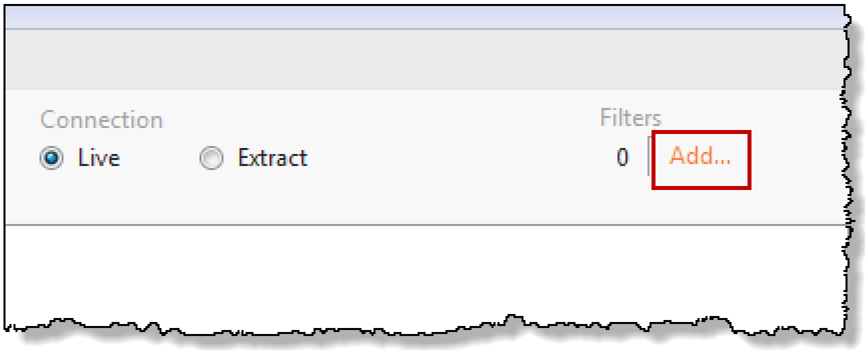
If you create an extract from a data source that already has data source filters in place, those filters are automatically recommended as Extract filters, and will appear in the Extract dialog. Those recommended filters are not required to be part of the Extract filter list, and can safely be removed without affecting the existing set of Data source filters.

Data source filters can be useful for restricting the data users can see when you publish a workbook or data source. When you publish a data source to Tableau Server, the data source and any associated files or extracts are transported in entirety to the Server. As you publish a data source you can define access permissions for downloading or modifying the data source, and you can also choose the users and groups who can remotely issue queries through Tableau Server against that data source. When users have query permission and no download permission, you can share a rich data model having calculated fields, aliases, groups, sets and more—but only for querying.

Furthermore, users who query this Data Server data source will never be able to see or modify any data source filters present on the originally published data source, but all of the users' queries will be subject to those data source filters. This is a great way to offer a restricted subset of your data, for example by filtering dimensions for specific users and groups, or by defining data source filters based on a fixed or relative date range. This is often useful for data security, and it also allows you to manage performance of the remote database which Tableau Server will ultimately query on a user's behalf. For systems that rely heavily on partitions or indexing, data source filters may yield tremendous control over the performance of queries issued by Tableau.

Create a Data Source Filter

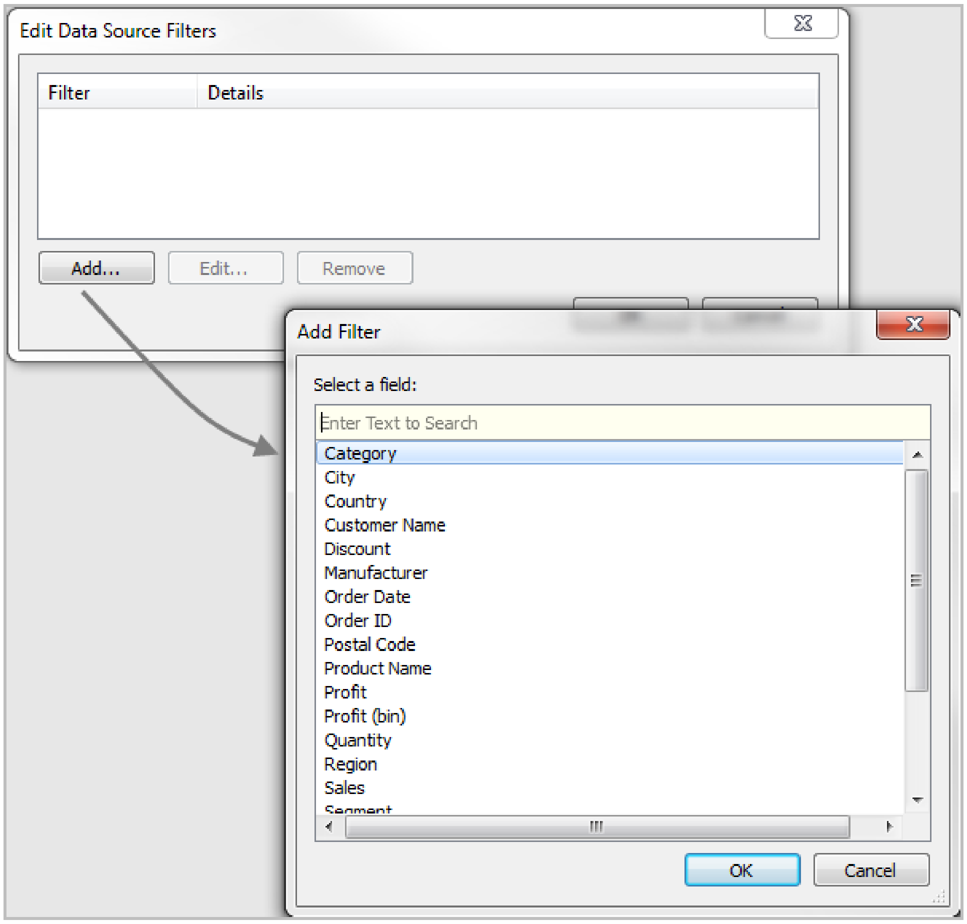
To create a data source filter from the Data Source page, click **Add** in the Filters section in the upper-right corner of the page:



To create a data source filter on a worksheet, right-click (control-click on a Mac) the data source and choose **Edit Data Source Filters**.

Whether you start from the Data Source page or from a worksheet, you see an Edit Data Source Filter dialog box, listing any existing data source filters.

1. Click **Add** to open an Add Filter dialog box listing all fields in the data source.



2. Click to select a field to filter; then specify how the field should be filtered, just as you would for a field on the Filters shelf.

   To add an additional data source filter, repeat the process

Context Filters

By default, all filters that you set in Tableau are computed independently. That is, each filter accesses all rows in your data source without regard to other filters. However, you can set one or more categorical filters as context filters for the view. You can think of a context filter as being an independent filter. Any other filters that you set are defined as dependent filters because they process only the data that passes through the context filter.

You may create a context filter to:

- Improve performance – If you set a lot of filters or have a large data source, the queries can be slow. You can set one or more context filters to improve performance.
- Create a dependent numerical or top N filter – You can set a context filter to include only the data of interest, and then set a numerical or a top N filter.

For example, suppose you're in charge of breakfast products for a large grocery chain. Your task is to find the top 10 breakfast products by profitability for all stores. If the data source is very large, you can set a context filter to include only breakfast products. Then you can create a top 10 filter by profit as a dependent filter, which would process only the data that passes through the context filter.

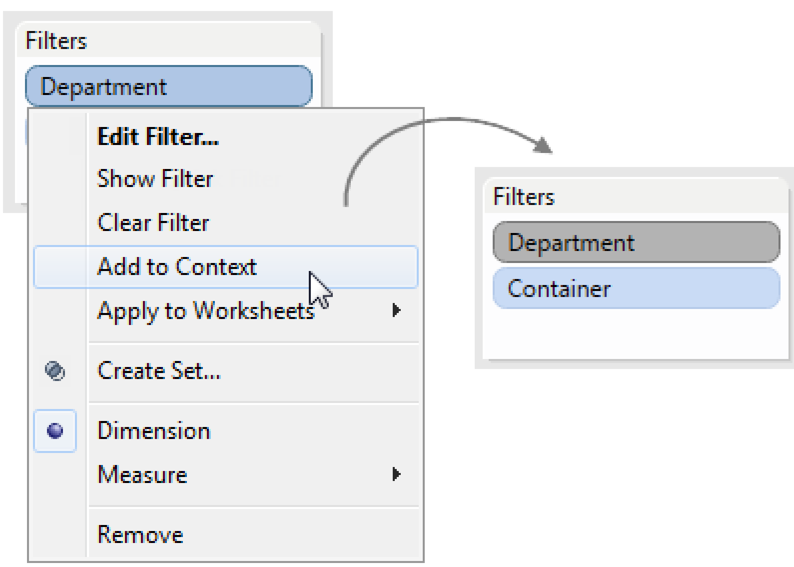
> **Note**: As of Tableau 9.0, context filters no longer create temporary tables, except for generic ODBC data sources and customized data sources.

Create Context Filters

To create a context filter, select **Add to Context** from the context menu of an existing categorical filter. The context is computed once to generate the view. All other filters are then computed relative to the context. Context filters:

- Appear at the top of the Filters shelf.
- Are identified by a gray color on the Filters shelf.
- Cannot be rearranged on the shelf.

As shown below, the **Department** dimension is set to be the context for a view. The **Container** filter is computed using only the data that passes through **Department**.



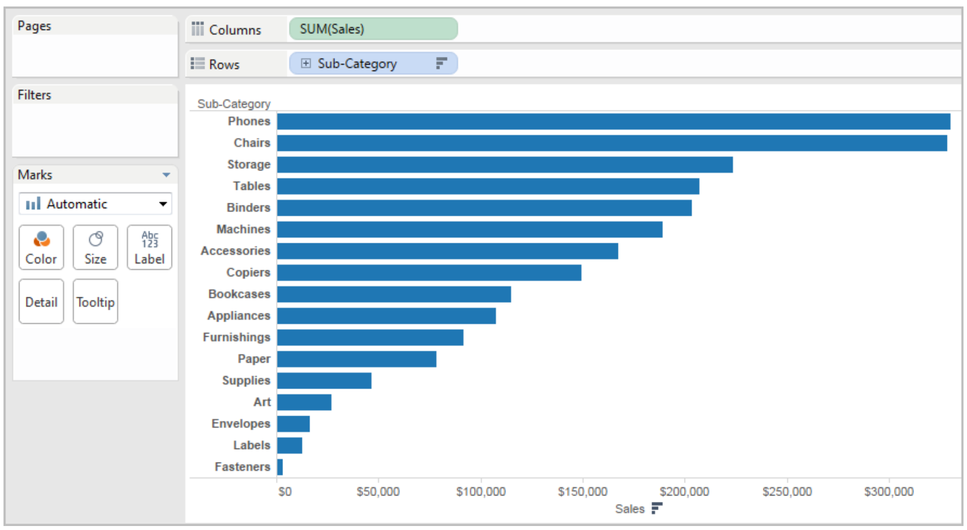
You can modify a context filter by:

- Removing the field from the Filters shelf – If other context filters remain on the shelf, a new context is computed.
- Editing the filter – A new context is computed each time you edit a context filter.
- Selecting **Remove from Context** – The filter remains on the shelf as a standard filter. If other context filters remain on the shelf, a new context is computed.

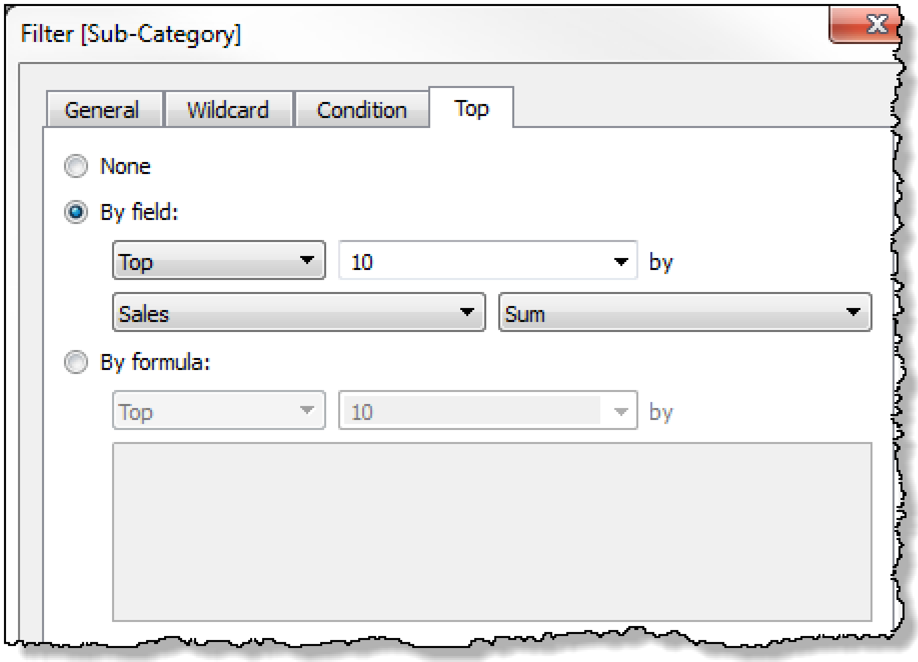
Example – Context Filters

This example walks you through how to create a context filter. First you'll filter a view to show the top 10 products by sales. Then you'll create a context filter on product category so you can see the top 10 furniture products.

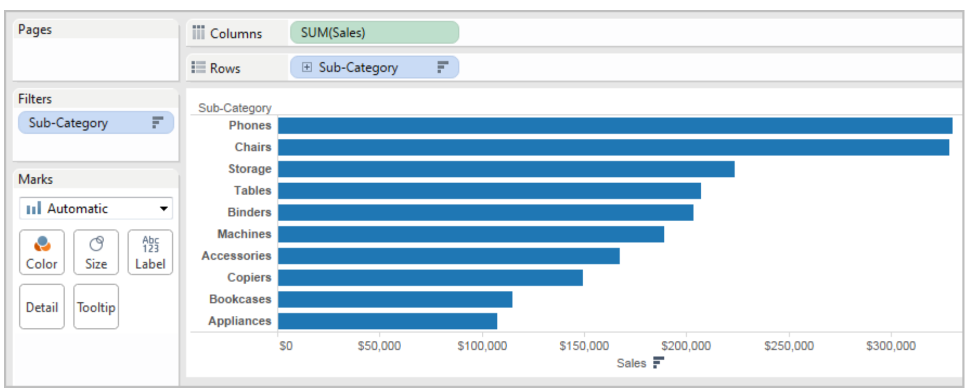
1. Use the **Sample - Superstore** data source to create the initial view shown below. The view shows the sales for all sub-categories, sorted with the highest sale at the top.



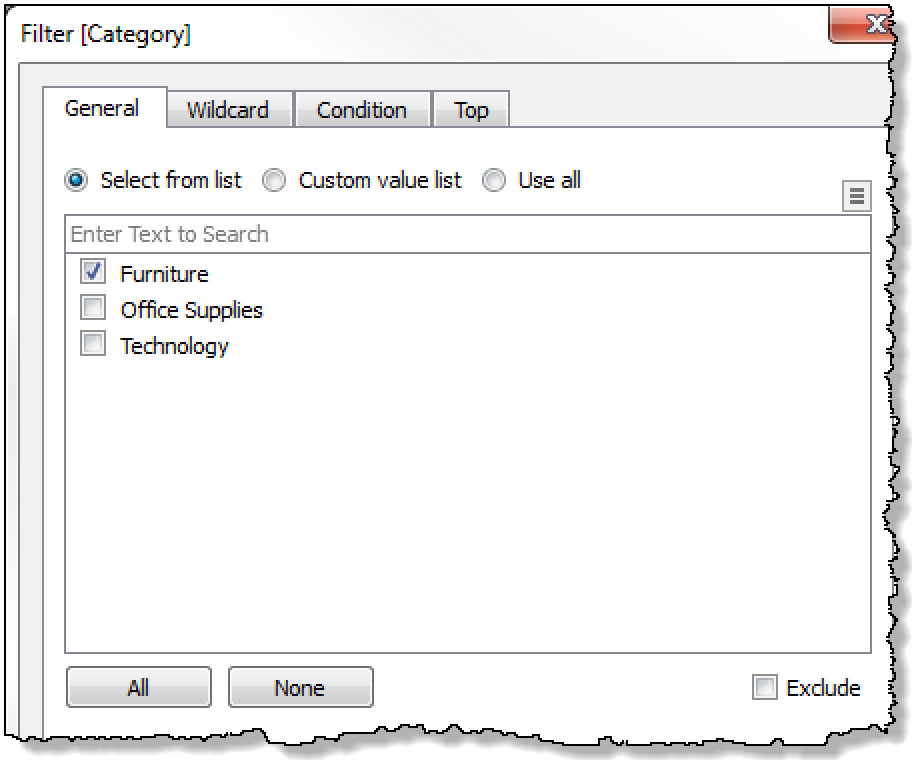
2. Now create a Top 10 filter to just show the top selling products. You can create this filter by dragging the **Sub-Category** field to the Filters shelf. In the Filter dialog box, switch to the **Top** tab and define a filter that is Top 10 by Sum of Sales. See **Adding Limits to Filters** on page 619 to learn more about defining a Top N filter.



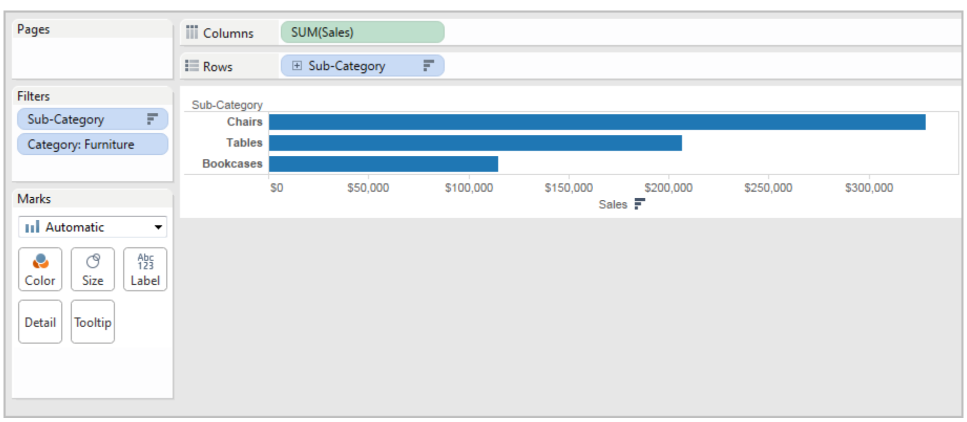
3. When you click **OK**, you'll see that the view is filtered to show the top 10 product sub-categories in terms of sales.



4. Now, let's add another filter to only show only furniture products. Drag the **Category** field to the Filters shelf and select only **Furniture**. When finished, click **OK**.



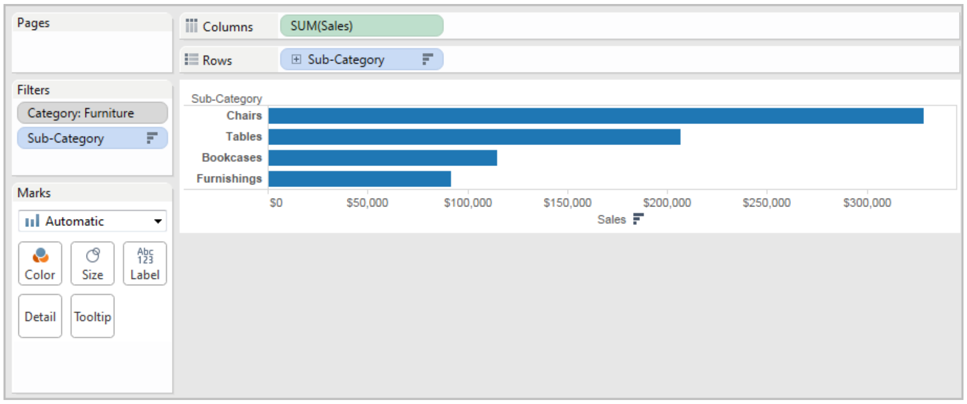
5. The view is filtered but instead of 10 products, it now only shows 3. This is because by default all filters are evaluated separately and the view shows the intersection of the results. So this view shows that three of the top 10 overall products are furniture products.



6. To find out what the top 10 furniture products are we need to make the Department filter a context filter. Right-click the field on the Filters shelf and select **Add to Context**.

7. The filter is marked as a context filter and the view updates to show the top four furniture

products. Why not 10? Because only four of the sub-categories contain furniture. But we now know that the Top 10 filter is being evaluated on the results of that context.



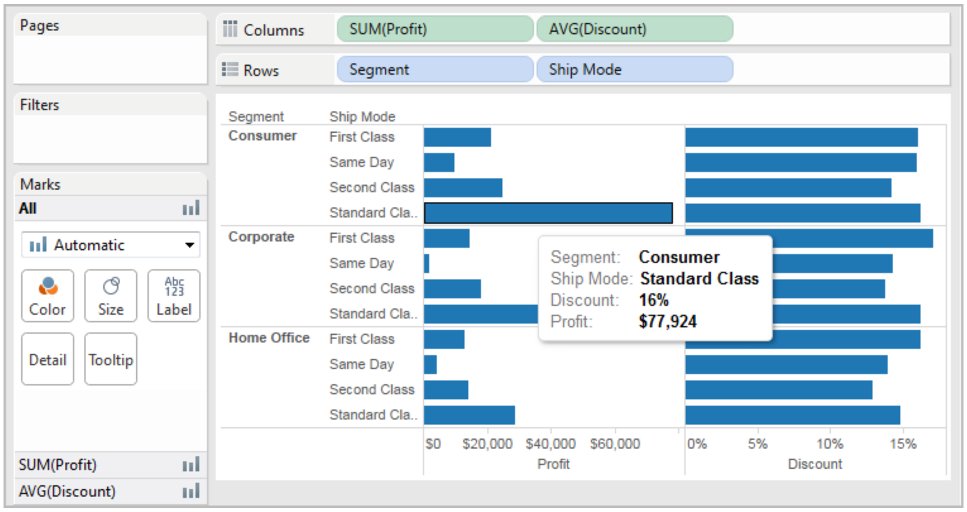
Calculation Filters

With a calculation filter, Tableau performs a calculation on the selected dimension members. By definition, a calculation filter exists when:

- The dimension is used only on the Filters shelf (that is, the dimension does not appear on other shelves).
- The filter is defined to include multiple values.

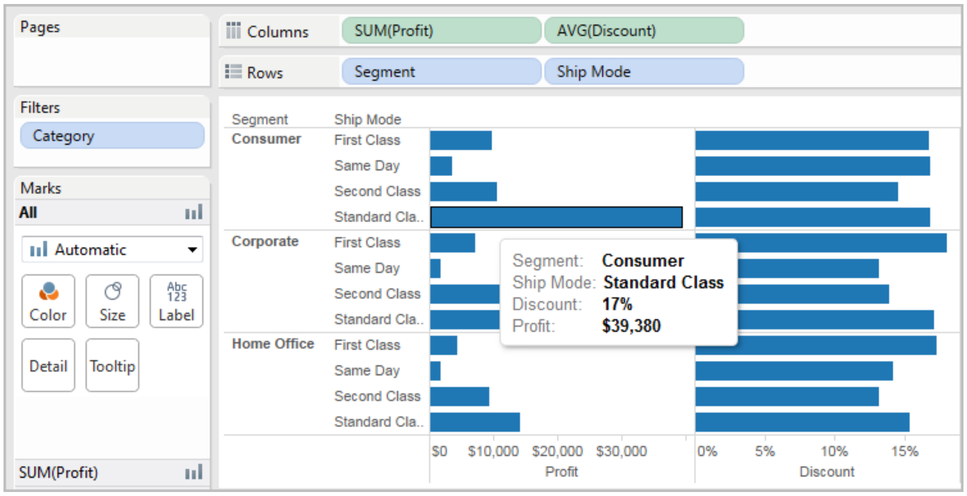
The calculation that is performed depends on the data source. For relational data sources, as shown below, the calculation matches the aggregation for each measure used in the view. For multidimensional data sources, as shown in **Calculation Filters: Multidimensional Data Source** on page 666, the calculation is always a summation. In Tableau, multidimensional data sources are supported only in Windows.

Consider the following view.



On the **Columns** shelf, the **Profit** measure is aggregated as a summation and the **Discount**measure is aggregated as an average. These measures are displayed with the **Segment** and **Ship Mode** dimensions (on the **Rows** shelf). A filter that limits the view to two members of the **Category** dimension is applied to the data:

Tableau automatically applies the appropriate calculation to the members of the filter based on the aggregation of each measure. Therefore, a summation is performed for **Profit** and an average is performed for **Discount**. The updated view is shown below. Notice how the bars, as well as the tooltip on one of the marks, have changed as a result of the filtering.



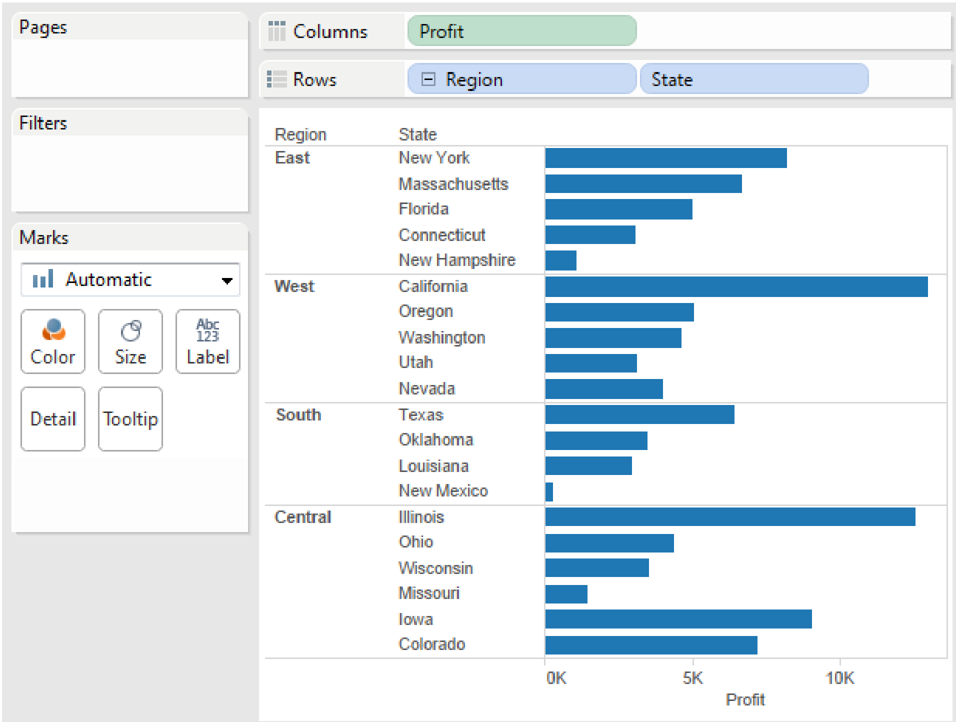
Calculation Filters: Multidimensional Data Source

In Tableau, multidimensional data sources are supported only in Windows.

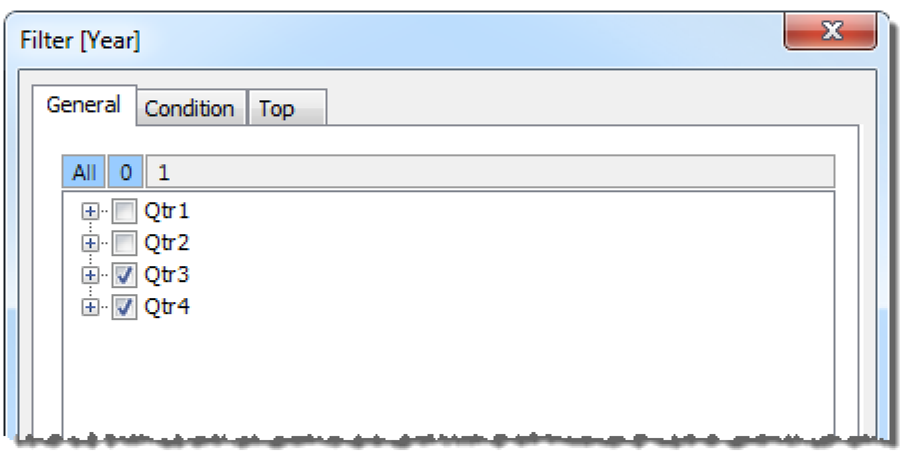
You can think of a calculation filter as “slicing” the cube’s data through the specified dimensions. Therefore, a calculation filter for a multidimensional data source is sometimes referred to as a slicer.

Because the aggregation for this arbitrary slice was not defined when the cube was created, Tableau automatically performs a summation. Fortunately, measures are usually aggregated as a summation. Therefore, applying a calculation filter produces a sum of a group of sums, which is a calculation that is useful and easy to interpret.

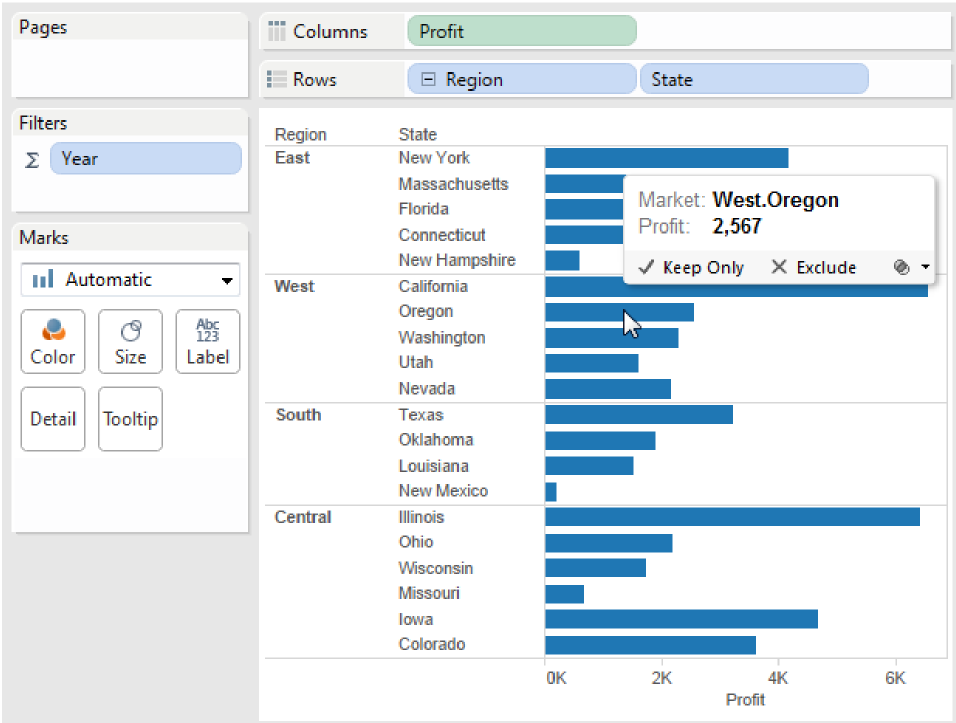
For example, consider the view shown below, which shows profit by region and state.



An external filter that consists of the Q3 and Q4 members of the **Quarter** dimension is applied to the data.



For example, tin the view below the profit for Oregon is now $2,567. This number was calculated by summing the data for Qtr3 and Qtr4.



Formatting

Formatting is an important part of both your analysis and presentation. You can format almost everything you see on a worksheet including the fonts, shading, alignment, borders, and graph lines. For example, in a text table you may want to add banded shading to help you visually separate consecutive groups of rows or columns. In a scatter view with reference lines you may want to change the line thickness and color. All of these settings can be changed using the Format window.

Most often you will want to specify format settings for the entire worksheet, all rows, or all columns. However, Tableau also allows you to format individual parts of the view as well. For example, you can format specific fields, resize the cells and the table, and edit individual axes.

Worksheet Level Formatting

Most commonly you will want to specify format settings at the worksheet level. For example, you may want to use a specific font for mark labels, remove all the borders in a text table, or add shading to every other column in a view. These format settings can be specified using the Format window.

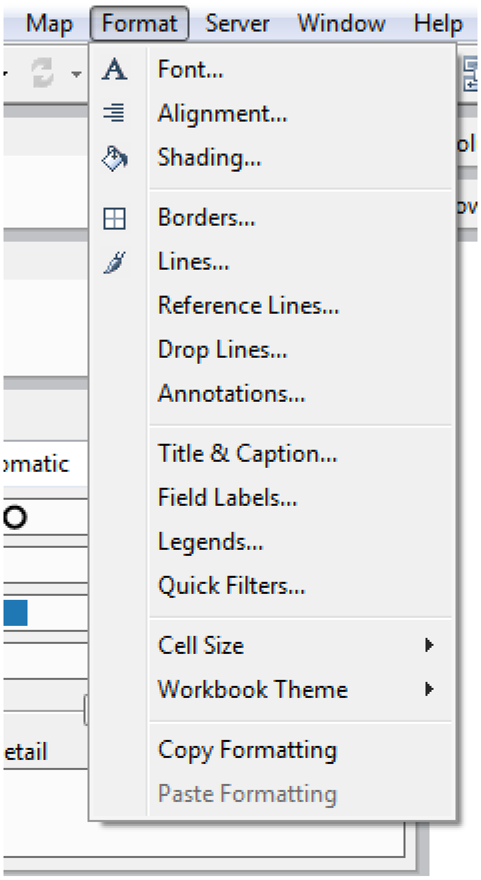
The Format window, when opened, replaces the Data pane on the left side of the worksheet. There you can use a series of drop-downs to specify format settings for either the entire sheet, all rows, or all columns.

Opening the Format Pane

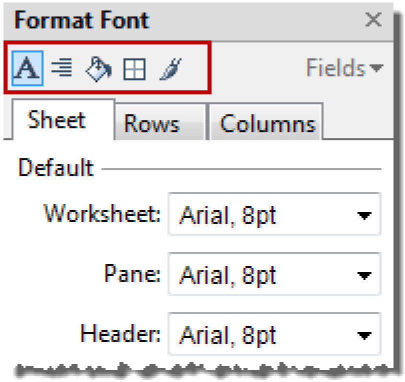
Use the Format menu to open the **Format** pane.

To open the Format pane

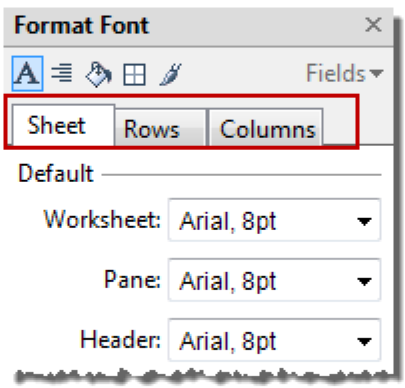
Select **Format** and then select the part of the view you want to format.



The **Format** pane opens on the left side of the workbook, replacing the **Data** pane. At the top of the **Format** pane, there is a toolbar where you can quickly switch between each of the types of format settings available.



The **Format** pane also contains three tabs: Sheet, Rows, and Columns. Switch between these tabs to apply formatting to the entire sheet, just the rows, or just the columns.

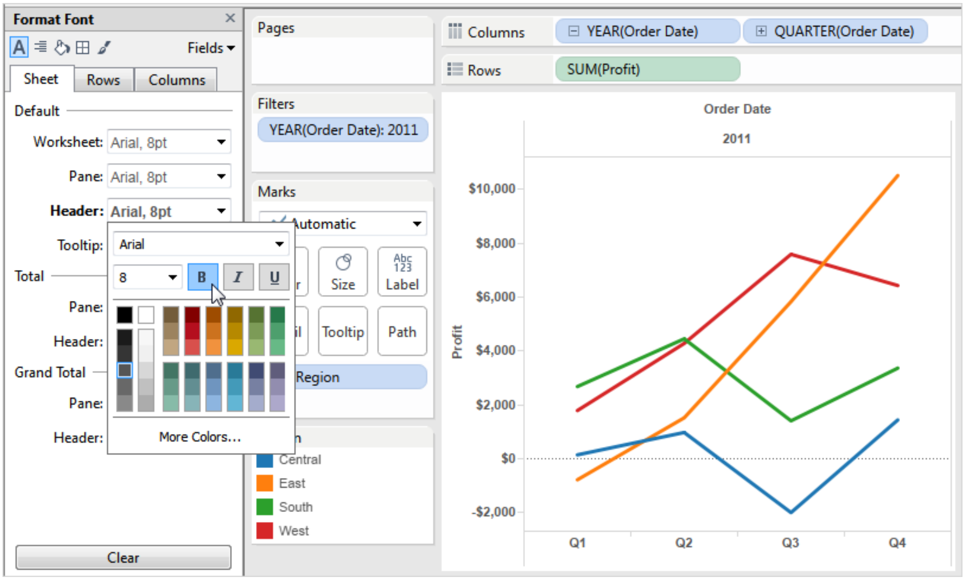


Format Fonts

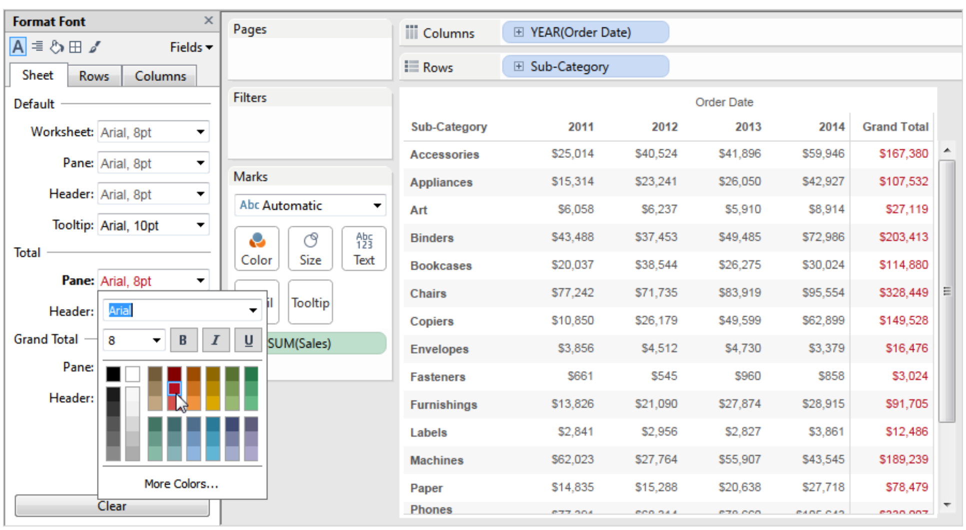
In the **Format** pane , select the Font icon  on the toolbar to see the Font format settings. You can specify font properties for the entire worksheet, just the rows, or just the columns.

Sheet Font Settings

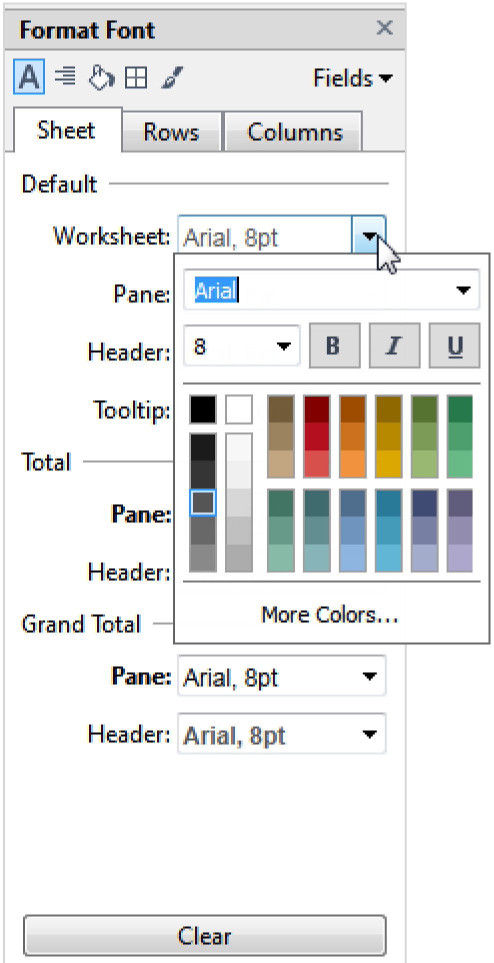
For the entire worksheet, you can specify the font, style, size, and color for both the pane text and header text. For example, in the view below, the header text is set to be bold.



If you have totals or grand totals in the view, you can specify special font settings so that these values can stand out from the rest of the data. This is particularly useful when you are working with a text table. The view below shows a text table in which the grand totals are formatted to be dark red.

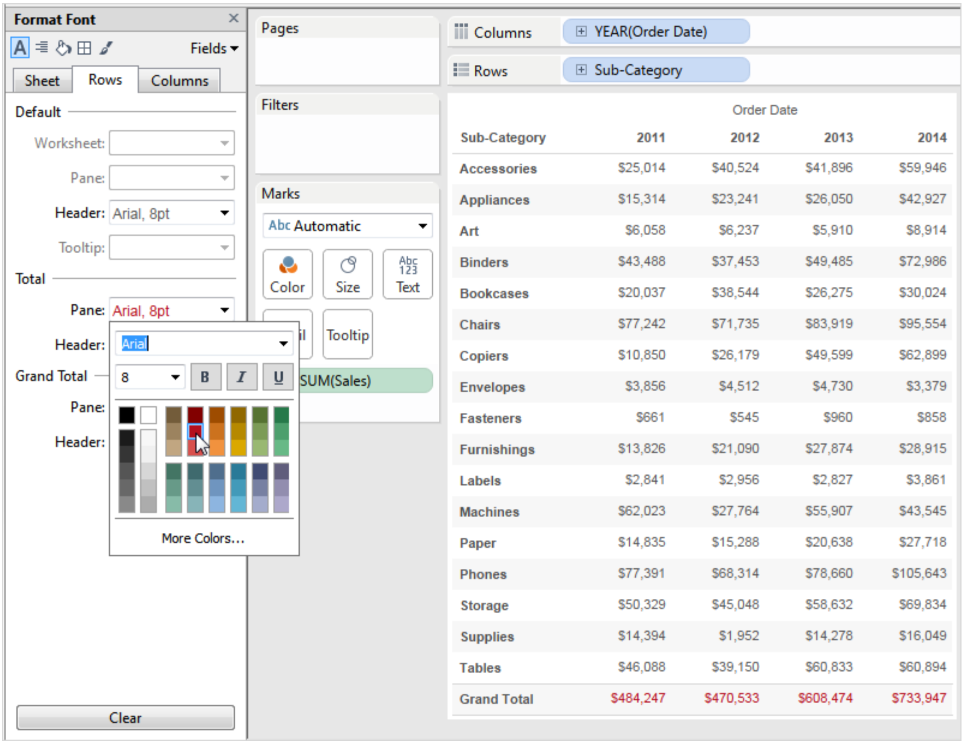


Finally, you can use the Worksheet drop-down to specify the properties of all text in the worksheet.



Row and Column Font Settings

Switch to the **Rows** or the **Columns** tabs to specify font properties for just the rows or just the columns. Here you have the same options as you do for the Sheet in that you can modify the font, style, size, and color for both the pane text and the header text. In the view below the Grand Totals are formatted red for just the rows.



Note: Sometimes the settings don't make sense for particular views and are unavailable. For example, in the view above, the default pane text is in both rows and columns. Specifying font properties on a row or column level does not make sense, to change the pane text, switch back to the **Sheet** tab.

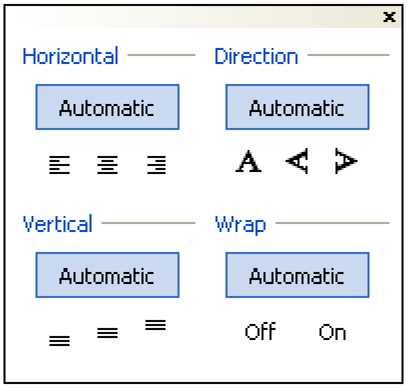
Format Alignment

From the **Format** menu, choose **Alignment** to see Format Alignment options. You can specify alignment properties for rows, columns, or the entire worksheet.

Use the drop-down menus on the **Format Alignment** pane to specify text alignments for either panes or headers. For each text areas you can specify the following alignment options:

- Horizontal - controls whether text aligns to the left side, right side, or in the center.
- Vertical Alignment - controls whether text aligns at the top, middle, or bottom.
- Direction - rotates the text so that it runs horizontally, top-to-bottom, or bottom-to-top.
- Wrap - controls whether long headers and pane text wrap to the next line or are abbreviated.

  Note: If cells are not large enough to show more than one row of text, turning on wrapping will have no visible effect. If this happens, you can hover the cursor over a cell until a double-sided arrow appears, and then click and drag down to expand the cell size.



Format Shading

In the **Format** pane, select the Shading command  on the toolbar to see the Shading format settings. The shading settings control the background color of the pane and headers for normal areas, totals, and grand totals. In addition, you can add row or column banding.

Row and Column Banding Settings

Sometimes, rather than selecting a single background color for of a pane or header, you may want to alternate the color from row to row or column to column at varying intervals. This kind of shading is called banding. Banding is particularly useful when you are working with a text table. Adding alternating shading can help your eye to distinguish between consecutive rows or columns.

In the **Format** pane, the banding settings allow you to select a color, the size, and level at which you want to apply the banding. Each of these properties is described below.

- Selecting a Color - select the color you want the bands to be using the drop down for either the pane or the header areas.
- Selecting a Band Size - the size refers to the frequency of bands. For example, rather than shade every other row, you may want to shade every three rows. Slide the size selector right and left to specify the band size.
- Selecting a Level - when you have nested tables where you have multiple dimensions on

the rows and columns shelves, you may want to add banding at a particular level.

Slide the level selector right and left to specify the banding level.

Format Borders

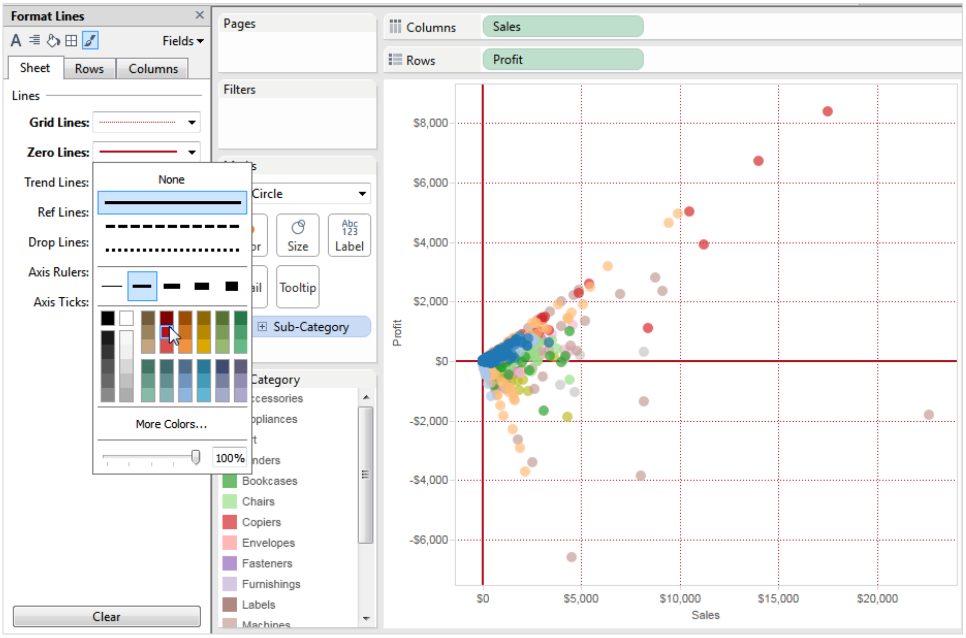
In the Format window, select the Borders command on the toolbar to see the Borders format settings. Borders are the lines that surround the table, pane, cells, and headers in a view. You can specify the border style, width, and color for the cell, pane, and header areas. Additionally, you can format the row and column dividers.

Row and Column Divider Settings

Row and column dividers serve to visually break up a view and are most commonly used in nested text tables. You can modify the style, width, color, and level of the borders that divide each row or each column using the row and column divider drop-downs. The level refers to the header level you want to divide by.

Format Lines

In the **Format** pane, select the Lines command on the toolbar to see the Lines format settings. The lines settings control the lines that are part of the graph, such as grid lines and zero lines, as well as lines that help you inspect data, such as trend lines, reference lines and drop lines. You can specify the style, width, and color for each of these lines. Additionally, you can specify font, alignment, and shading settings for reference line and drop line labels. For example, in the view below, the grid lines and zero lines are turned on.

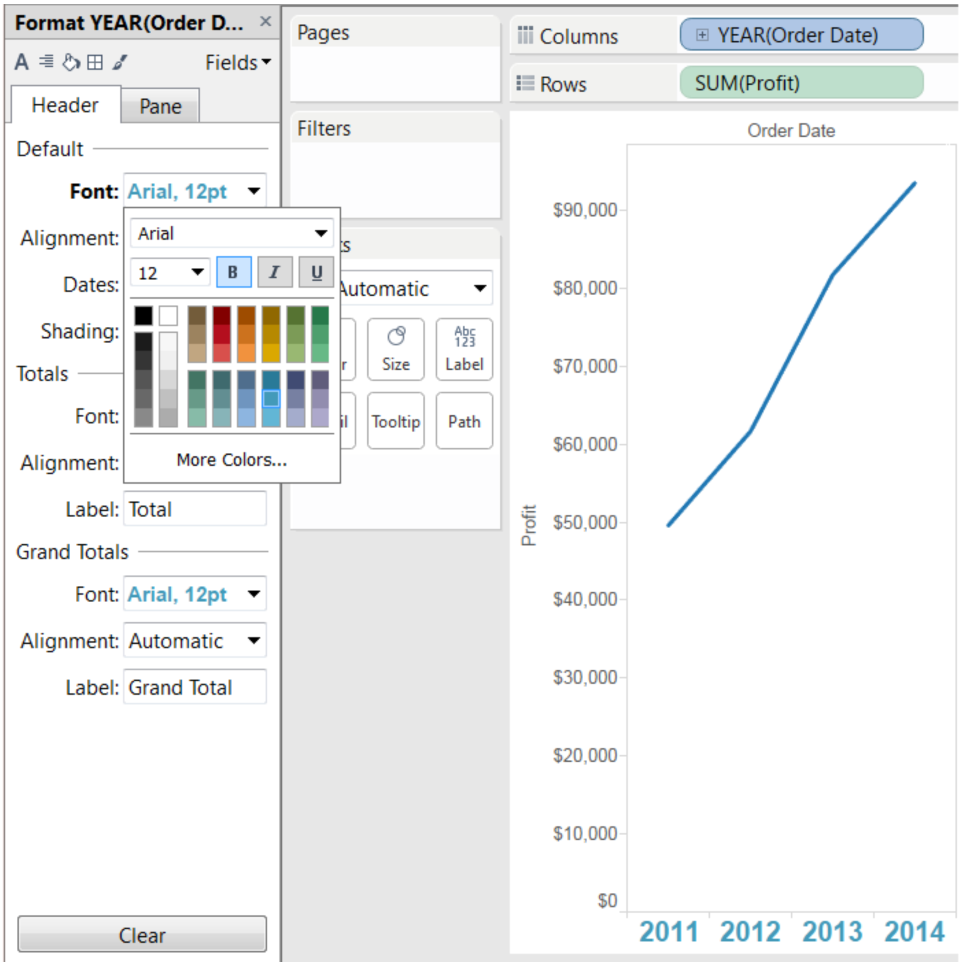


Formatting Specific Parts of the View

Although you will more commonly want to apply format settings on a large scale such as the entire worksheet, all rows, or all columns, sometimes you may want to format specific parts of the view. To specify individual format settings, right-click (control-click on Mac) a specific part of the view and select **Format**.

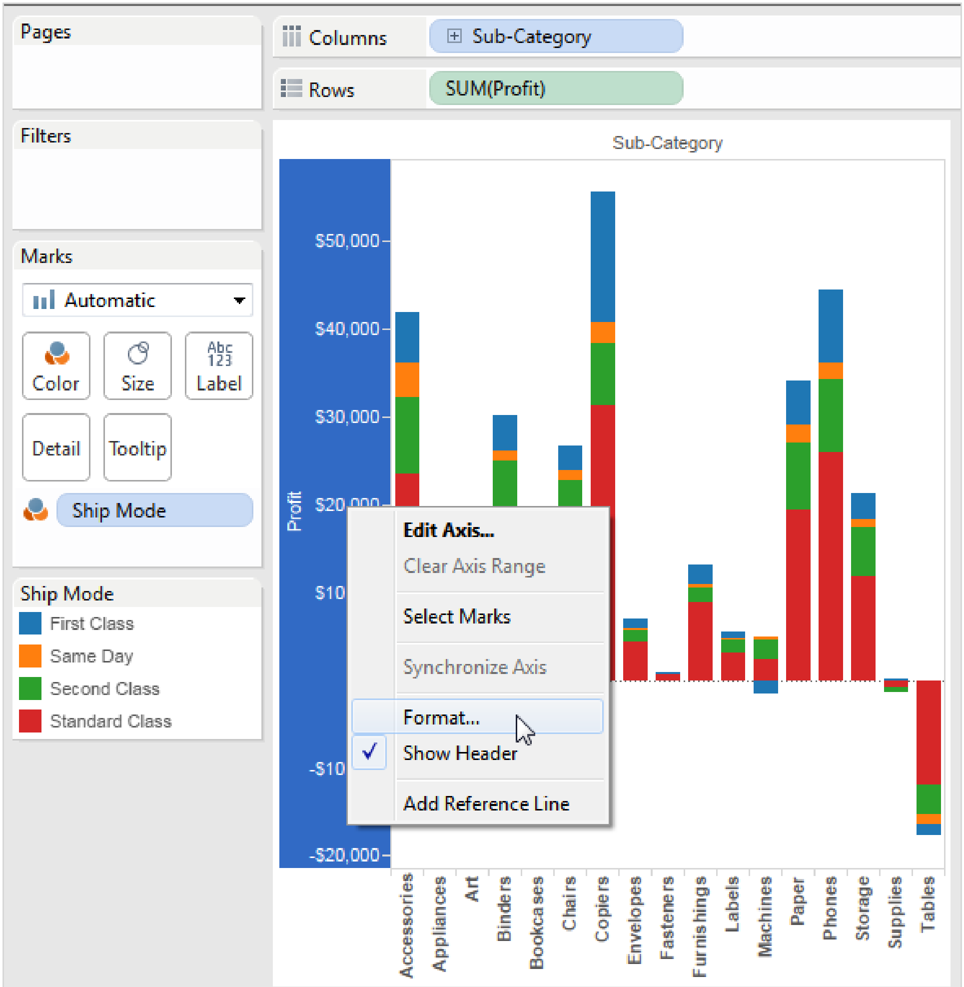
Format Fields

Rather than formatting all rows or all columns in a worksheet, you can specify format settings that only apply to a specific field in the view. For example, in the view below, the Year(Order Date) field has been formatted so that the headers are 12pt, bold, and blue. Notice that the header values along the Profit axis are not affected.



To format a specific field:

1. Right-click (control-click on Mac) the part of the view you want to format and select **Format**.



The **Format** pane opens containing settings relevant to the selected field.

2. Make changes in the **Format** pane as necessary.

   For discrete fields, such as Region or Customer Name , you can specify font and alignment properties for both header and pane areas. For continuous fields, such as Profit or Sales, you can format font properties for the pane and axis as well as number, format and tick mark colors. For more information about other axis options, see **Edit Axes** on page 706. The view is updated as you make changes so you can quickly see the colors and formats that work with your view.

   > **Note:** You can also click the **Fields** drop-down list in the **Format** pane to select other fields in the view to format.

3. When finished, click the ‘x’ in the upper right corner of the **Format** pane to return to the **Data** pane.

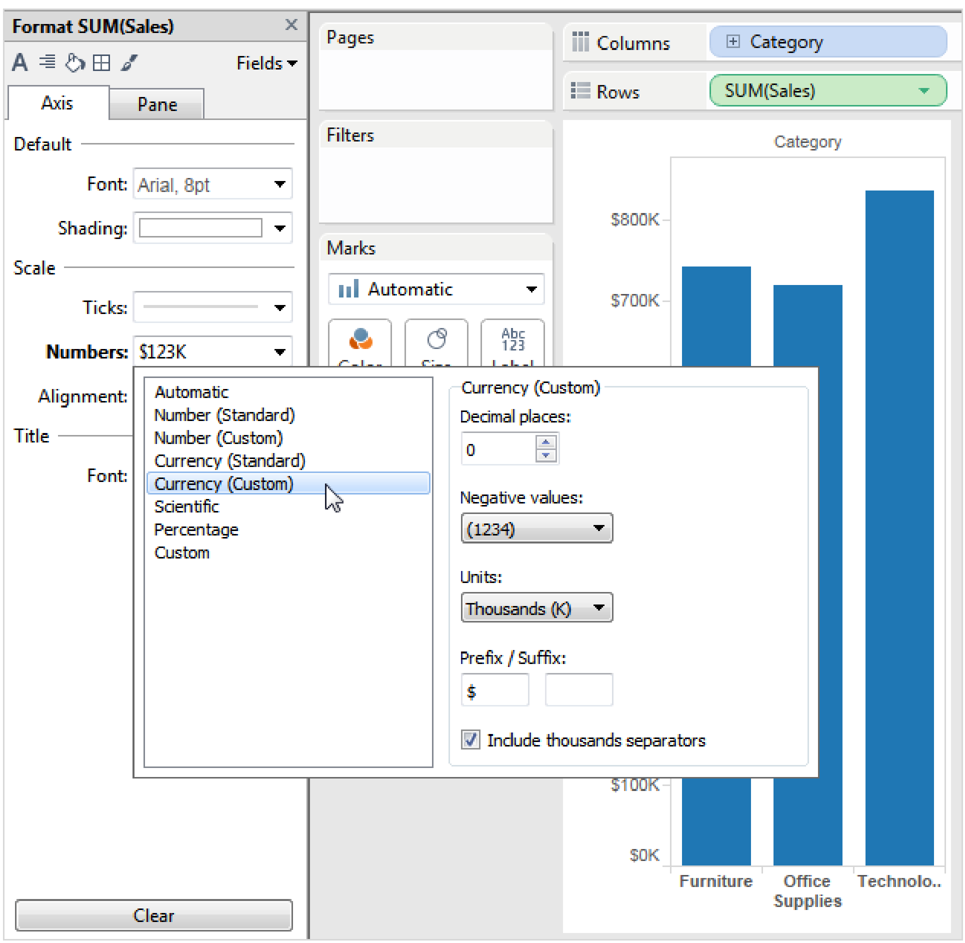
Format Numbers

When you format a measure, you can specify the number format for both the axis and the pane text. You can select from a set of standard formats, such as number, currency, scientific, and percentage; or you can define a custom number format using Microsoft Excel style format codes.

To specify a number format

1. Right-click (control-click on Mac) a measure or axis in the view and select **Format**.
2. In the **Format** pane, click the **Numbers** drop-down menu.
3. Select a number format.

   Some formats require additional settings. For example, if you select **Currency (Custom)**, you must also specify the number of decimal places, how to treat negative values, the units, a prefix or suffix, and whether to include thousands separators.



Here are the number formats and associated options available in Tableau.

Number Format	Format Options
Automatic: format is automatically selected based on either the format specified by the data source or the data contained in the field.	None.
Number (Standard): format is based on locale selected.	Locale: number format changes based on the geographical location selected.
Number (Custom): format is customized to your choice.	Decimal Places: the number of decimal places to display. Negative Values: how negative values are displayed. Units: the number is

Number Format	Format Options
	displayed using the specified units. For example, if the number is 20,000 and the units are thousands, the number will be displayed as 20K. Prefix/Suffix: characters that precede and follow each displayed number. Include thousands separators: whether the number shows separators every thousand (example: 100,000 vs. 100000).
Currency (Standard): format and currency	Locale: currency format based on the

Number Format	Format Options
symbol is based on locale selected.	geographical location selected.
Currency (Custom): format and currency symbol is customized to your choice.	Decimal Places: the number of decimal places to display. Negative Values: how negative values are displayed. Units: the number is displayed using the specified units. For example, if the number is 20,000 and the units are thousands, the number is displayed as 20K. Prefix/Suffix: characters that precede and follow each displayed number.

Number Format	Format Options
	Include thousands separators: whether the number shows separators every thousand (example: 100,000 vs. 100000).
Scientific: numbers are displayed in scientific notation.	Decimal: the number of decimal places to display.
Percentage: numbers are displayed as a percentage with the percent symbol. The value of 1 is interpreted as 100% and 0 as 0%	Decimal: the number of decimal places to display.
Custom: format is based entirely on what is specified in the format options.	Custom: type in the format you want to use. This format can be specified by an Excel style number

Number Format	Format Options
	code.

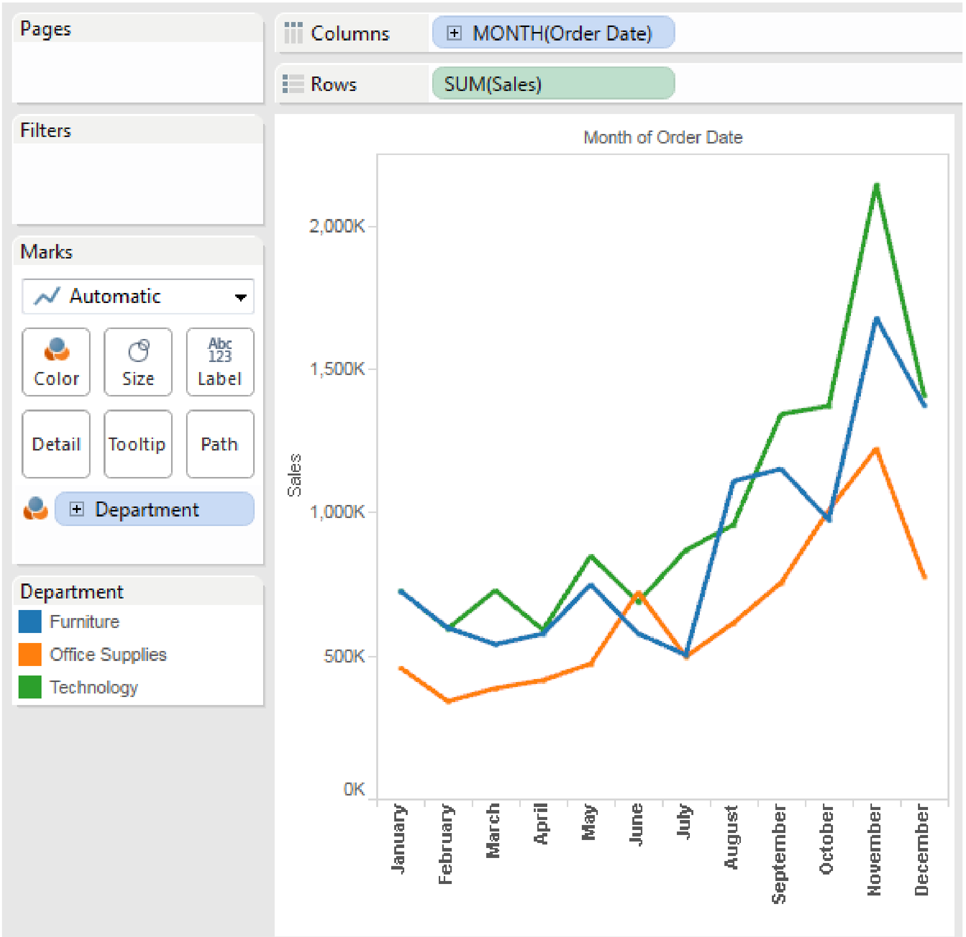
To set the default number format for a specific field

- Right-click (control-click on Mac) the field in the **Data** pane and select **Default Properties** > **Number Format**. In the subsequent dialog box you can specify a number format to be used whenever the field is added to the view. The default number format is saved with the workbook. It is also exported when you export the connection information.

> **Note:**Formatting numbers using the **Format** pane overrides any number formatting applied elsewhere.

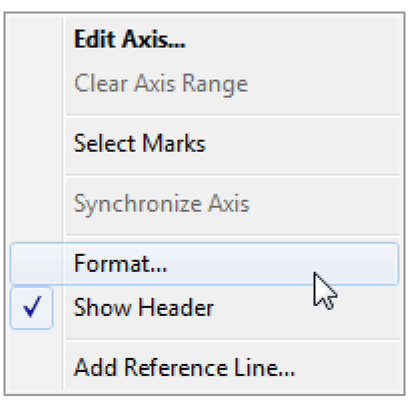
Format a measure as currency

The view in the following image shows sales over time. Notice that the sales figures are not formatted as monetary values.



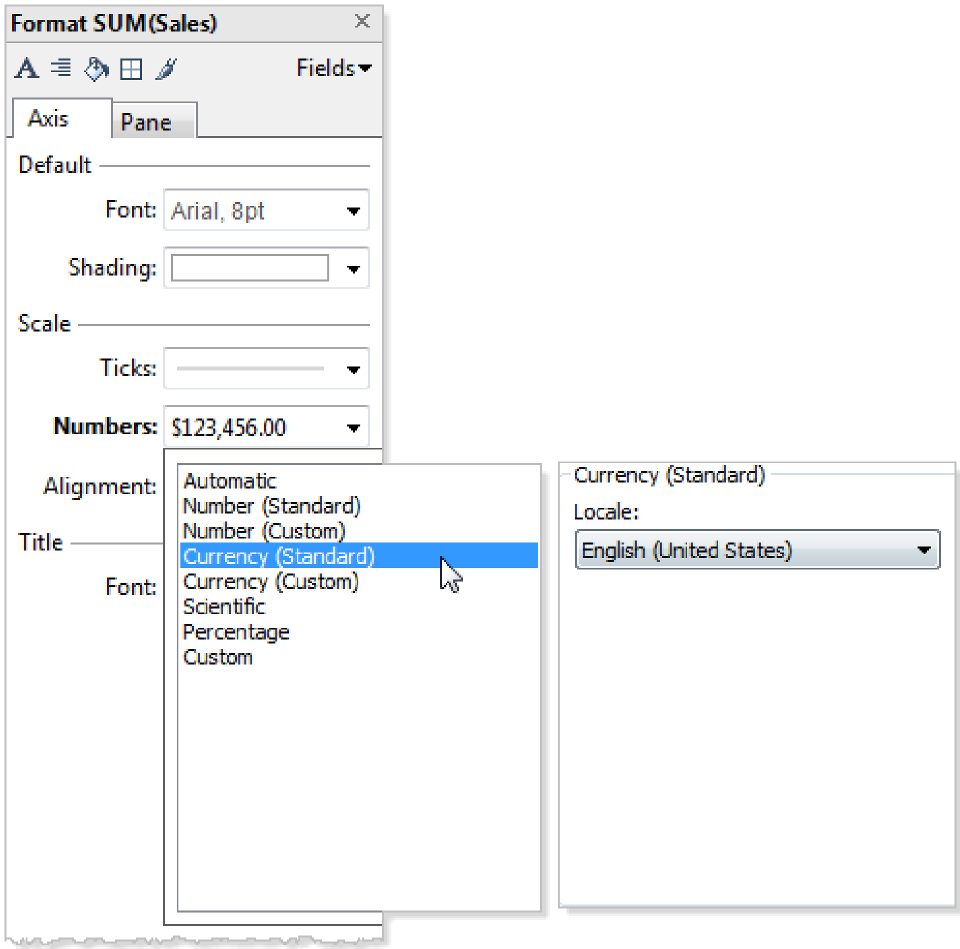
The following steps show how to format the numbers as currency.

1. Right-click the **Sales** axis along the left side of the view and choose **Format**.



2. On the **Axis** tab in the **Format** pane, under **Scale**, select the **Numbers** drop-down list, and then select one of the following:

- **Currency (Standard)** to add a dollar sign and two decimal places to the figures.



- **Currency (Custom)** to specify the number of decimal places, how to show negative values, the units, whether to include a prefix or suffix, and whether to include a separator character.

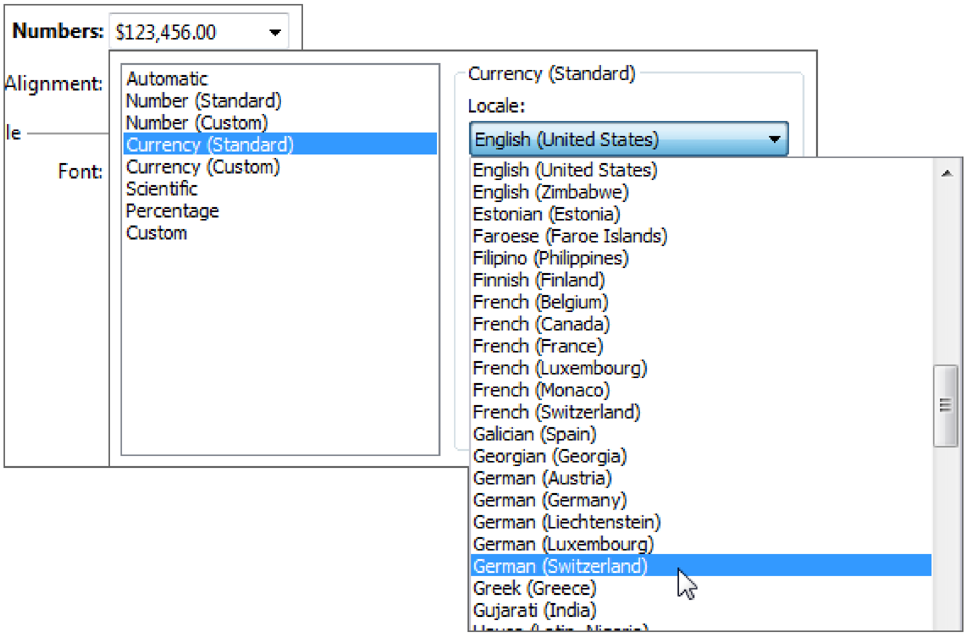
Specify a different locale for number formats

By default, Tableau uses your computer's locale and language settings to format numbers. But you can explicitly set a locale from the **Format** pane.

The following steps show how to set Swiss German currency, using the same view as in the previous section.

1. Right-click the **Sales** axis and select **Format**.
2. On the **Axis** tab, under **Scale**, select the **Numbers** drop-down list and then select **Currency (Standard)**.

3. In the **Locale** drop-down list, items appear in a **Language (Country)** format. For this example, select **German (Switzerland)**.

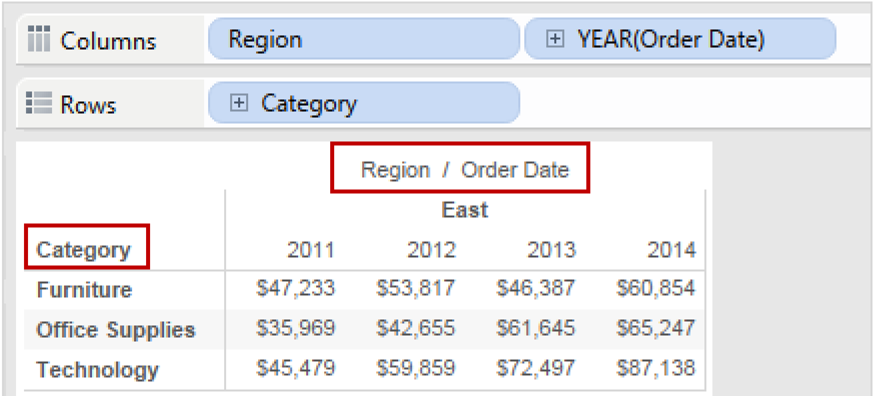


The view updates to show the sales figures in Swiss Francs, formatted for the German language.

Tip: You can change the default currency setting so that every time you drag the **Sales** measure to a view it uses the settings you want. In the **Measures** pane, right-click the **Sales** (or other monetary measure), and select **Default Properties** > **Number Format**. Then format the field as shown above.

Format Field Labels

Field labels are row and column headings that indicate the data fields used to create the Table. By default, field labels are shown but you can choose to hide them. When field labels are showing they display in three different parts of the view: rows, columns, and the corner. The view below shows an example of each of these types of field labels.



You can format the font, shading, alignment, and separators for each of these types of field labels.

To format field labels:

1. Select **Format** > **Field Labels** or right-click (control-click on Mac) a field label in the view and select **Format**.
2. In the **Format** pane, specify the settings of the font, shading, and alignment field labels.

> **Note:** When you have multiple dimensions on the rows or columns shelves the field labels will be displayed adjacent to each other in the table. Each field label is separated from the others with a forward slash symbol. Specify a different separator in the Format window.

Format Legends

When you encode the marks using the color and size shelves, a legend card displays in the worksheet. You can format the legend font, shading, border, and alignment. You can also edit the titles that display on each legend.

To format legends:

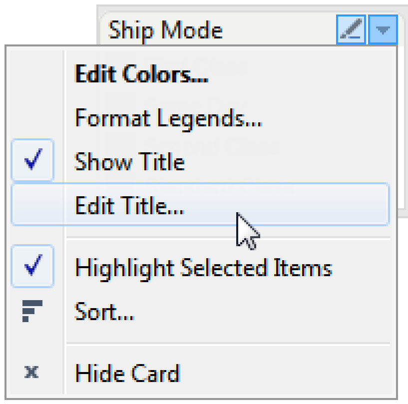
1. Select **Format** > **Legends** or right-click (control-click on Mac) the legend and select **Format**.
2. In the **Format** pane, specify settings for the title and body of the legends.

By default, legend objects have transparent backgrounds. To change the opacity or legend color, follow the procedure listed above.

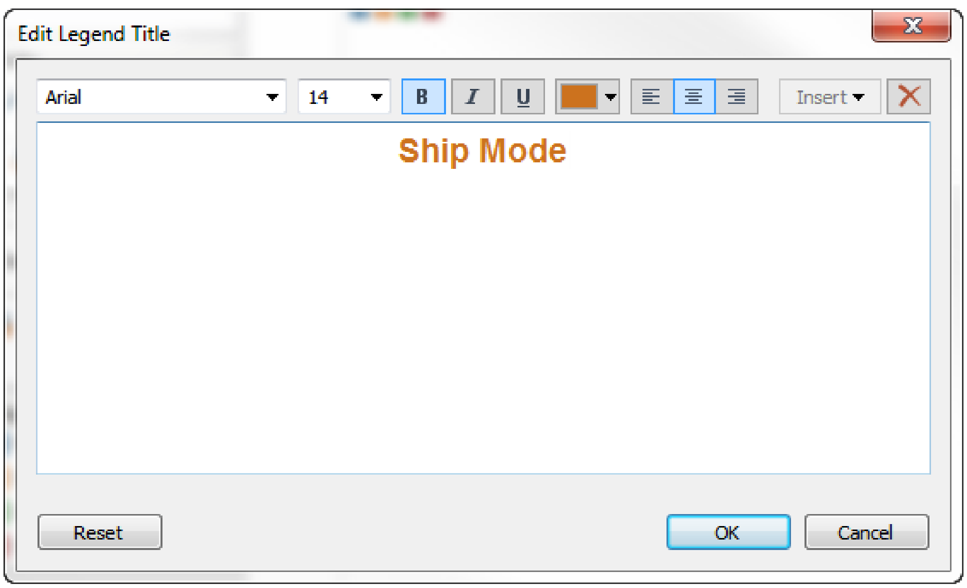
> **Note:** The legend format settings apply to all legends associated with a sheet. You cannot format individual legends separately.

To edit legend titles:

1. On the legend's menu, select **Edit Title**.



2. In the subsequent dialog box, type a new name for the legend and format it using the formatting options along the top of the dialog box. When finished, click **OK**.



Note: You can click the **Reset** button in the Edit Title dialog box to return to the default title.

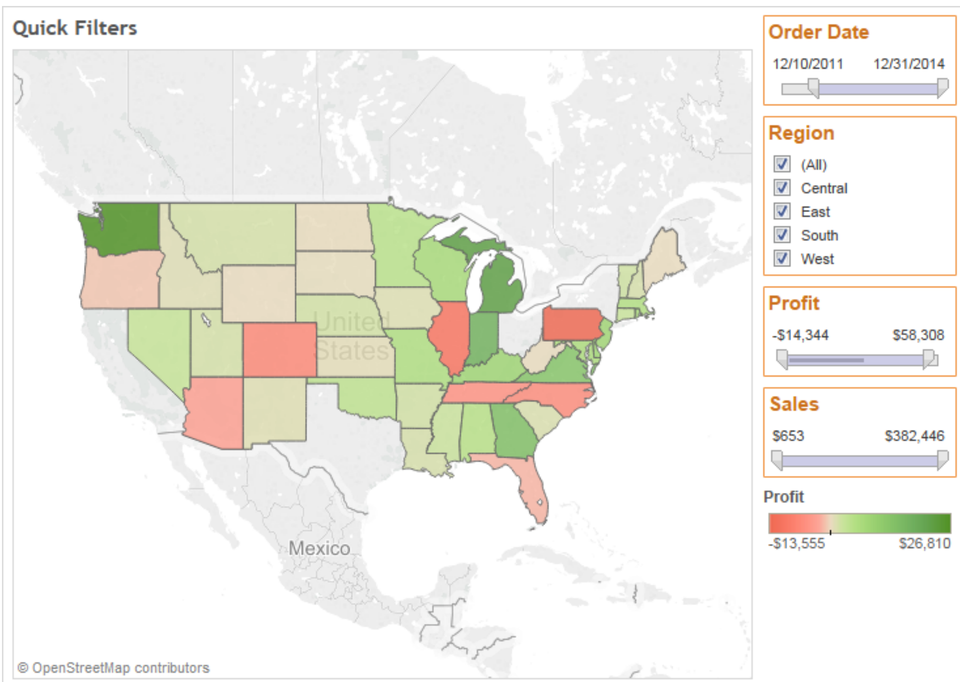
Format Filters in the View

The filters on your worksheet can be formatted to use a different font, style, color, background color, font size, and border. Formatting filters allows you to better integrate them into your dashboard or worksheet style. The format settings you specify apply to all filters.

To format filters:

1. Select **Format** > **Filters**.
2. In the **Format** pane, specify the following options:
    - **Title**: You can modify the **Font** and **Alignment** of the filter titles. The title formatting only displays when the filters are used on dashboards or when published to the web.
    - **Body**: You can modify the body **Font**, **Shading**, and **Border** of the filters. These settings display on both worksheets, dashboards, and when published to the web.

The filters in the dashboard below have custom formatting with orange titles and borders and a bold body font.



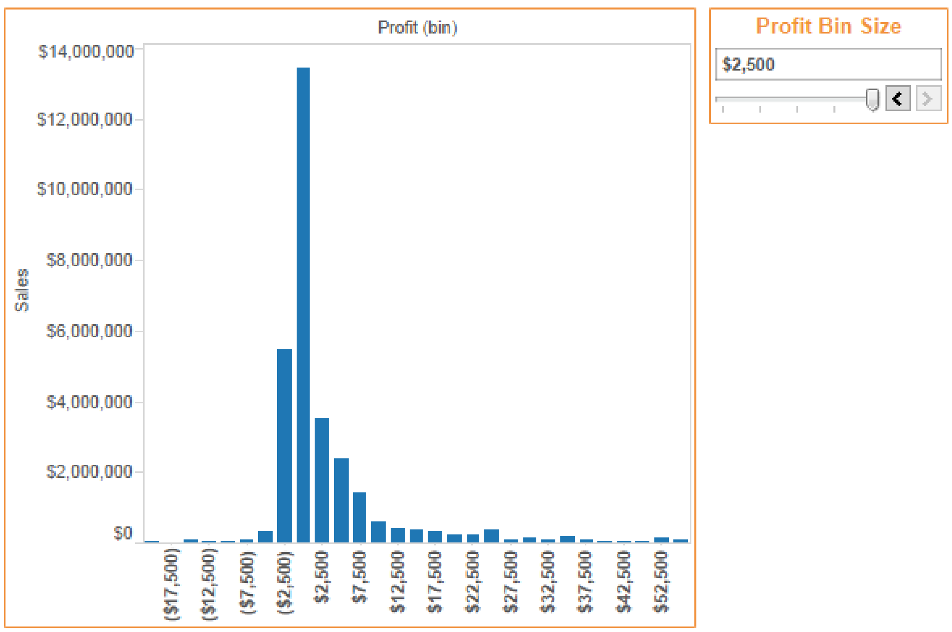
Format Parameters

The parameter controls on your worksheet can be formatted to use a different font, style, color, background color, font size, and border. Formatting parameters allows you to better integrate the parameter controls into your dashboard or worksheet style. The format settings you specify apply to all filters in the view.

To format parameters:

1. Select **Format** > **Parameters**.
2. In the Format window on the left side of the workbook, specify the following options:
    - **Title**: You can modify the **Font** and **Alignment** of the parameters titles. The title formatting only displays when the parameter controls are shown on dashboards or when published to the web.
    - **Body**: You can modify the body **Font**, **Shading**, and **Border** around of the parameters. These settings display on both worksheets, dashboards, and when published to the web.

The Profit Bin Size parameter control in the dashboard below has custom formatting with a centered orange title, orange border, and a bold body font.



Format Titles and Captions

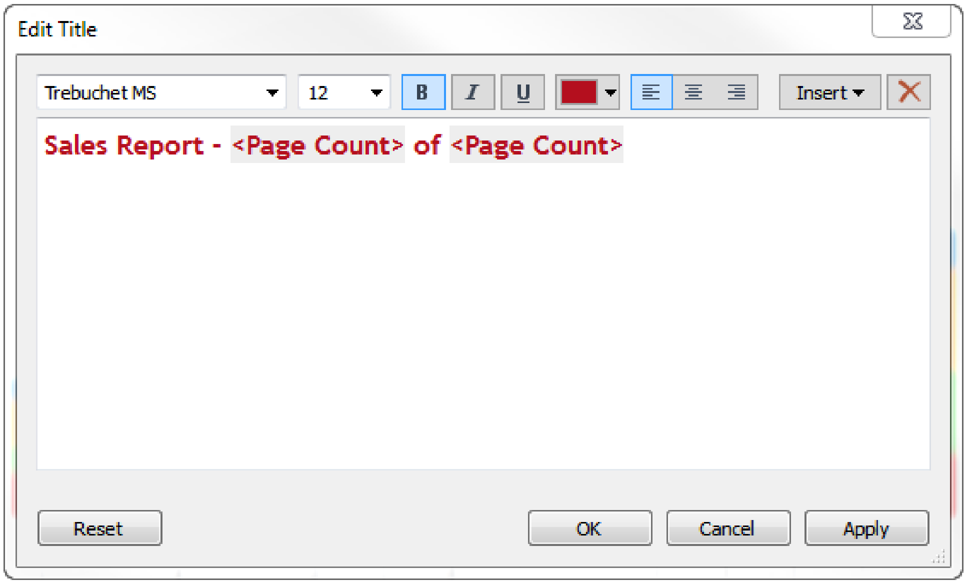
You can add titles and captions to any sheet. After you add a title or caption you can edit and format the text as well as the shading and border.

If the title is not showing, to go the menu for the current sheet type (Worksheet, Dashboard, or Story) and choose **Show Title**.

To edit titles and captions

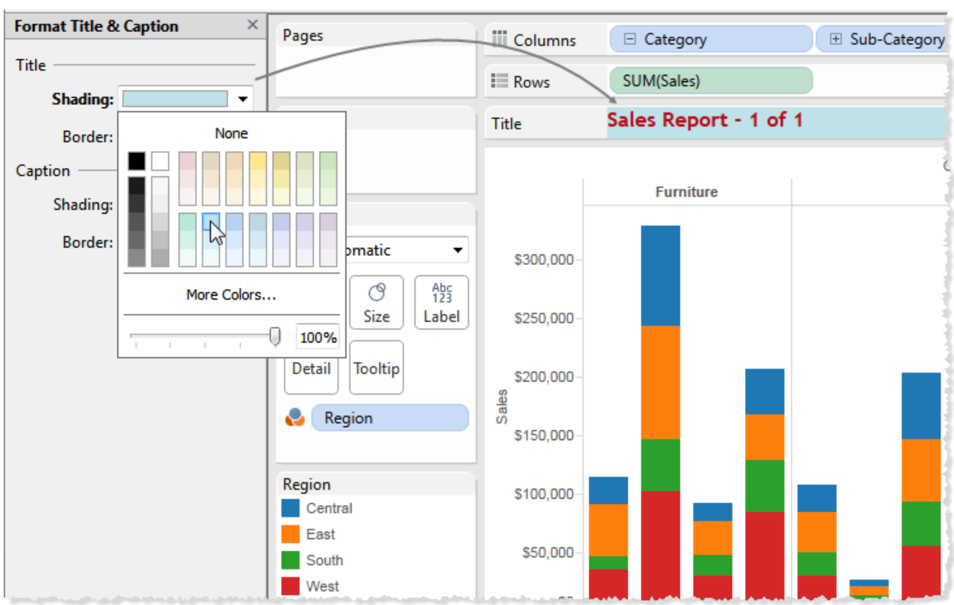
1. Double-click the title.

2. In the Edit Title dialog box, modify the text and format the font, size, style, color, and alignment. Use the Insert menu to add dynamic text such as sheet properties and field values. When finished, click **OK**.



To format title and caption borders and shading

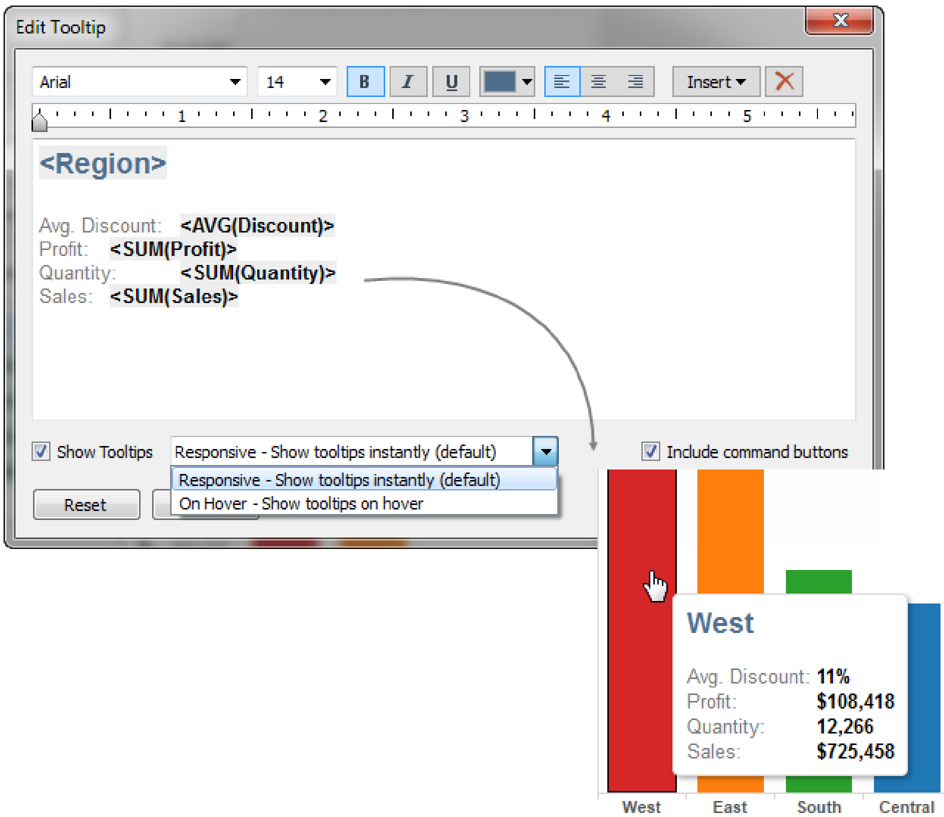
1. Right-click (control-click on Mac) the title or caption and select **Format**.
2. In the **Format** pane, use the drop-down controls to add shading and a border.



Format Tooltips

Tooltips are additional data details that display when you rest the pointer over one or more marks in the view. Tooltips also offer convenient tools to quickly filter or remove a selection or view underlying data. You can edit the tooltip to include both static and dynamic text. You can also modify which fields are included in the automatic tooltip.

You can edit tooltips by selecting **Worksheet** > **Tooltip**. Tooltips are specified for each sheet and can be formatted using the formatting tools along the top of the Edit Tooltip dialog box. use the Insert menu at the top of the dialog box to add dynamic text such as field values, sheet properties, and more.

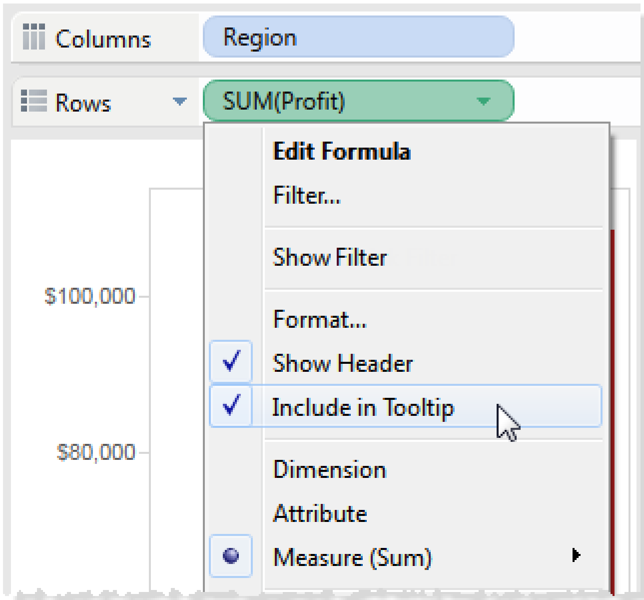


The **All Fields** option on the Insert menu adds all field names and values that are used in the view. Inserting the All Fields parameter will automatically update the tooltip as you change the view. You can exclude unnecessary fields from the All Fields option.

Select the **Include command buttons** option to show filtering and view data options in the tooltip. For example, including command buttons will add **Keep Only**, **Exclude**, and **View Data** buttons to the bottom of the tooltip. These command buttons are available both in Tableau Desktop and when the view is published to the web or viewed on a mobile device.

To remove a field from the automatic tooltip:

- Right-click (control-click on Mac) the field on one of the shelves in the view and select **Include in Tooltip**.



You can show a field in the tooltip using the same menu option.

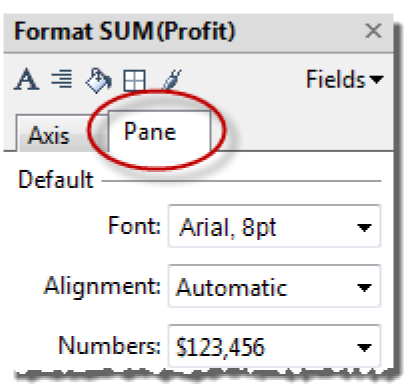
Format Null Values

When a measure contains null values, they are usually plotted in a view as zero. However, sometimes that changes the view and you'd rather just suppress null values altogether. You can format each measure to handle null values in a unique way.

To format null values for a specific field:

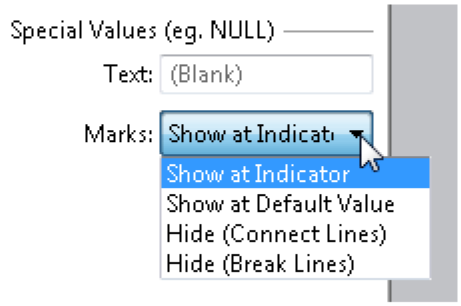
1. Right-click the field in the view that has the null values (Control-click on a Mac) and choose **Format**.

   Go to the **Pane** tab.



2.
3. In the Special Values area, optionally specify whether to show the null values using an

indicator in the lower right corner of the view, plot them at a default value (e.g., zero for number fields), hide the values but connect lines, or hide and break lines to indicate that null values exist.



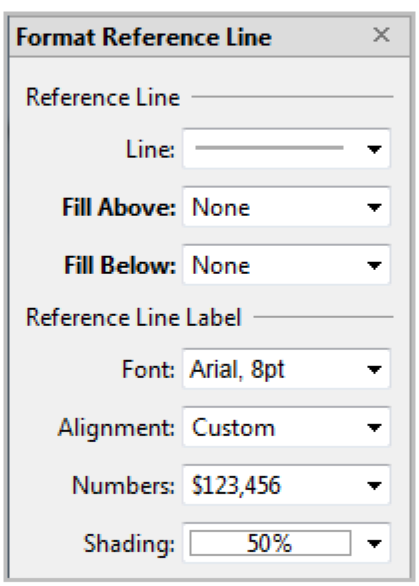
4. If you specify text in the Text field, it will appear in the view for null values when mark labels are turned on. See **Mark Labels** on page 826.

Format Reference Lines, Bands, and Boxes

Tableau lets you format the reference lines, bands, and boxes you add to an axis in the view. You can change the style, width, and color of these lines as well as the font properties of the label.

To format a specific reference line:

1. Right-click (control-click on Mac) on the line, band, or box and select **Format**. For example:



2. You can specify formatting properties associated with reference lines, bands, or

distributions. For example, you can change the line style and color as well as the label font properties.

3. When finished, click **OK**.

Many of the formatting options in the Format window are also available when adding and editing reference lines, bands, and boxes.

Copying and Pasting Formatting

After you format a worksheet you can copy the format settings to one or more other worksheets. When you copy the formatting from a worksheet, it copies all of the format settings specified by the Format window. However, this command does not copy manual sizing, zoom settings, default label orientation, etc. Also, formatting applied to individual reference lines and annotations is not copied with this command.

To copy and paste formatting between worksheets:

1. Select the worksheet from which you want to copy formatting.
2. Right-click (control-click on Mac) the worksheet tab and select **Copy Formatting**.
3. Select the worksheet you want to paste the formatting into.
4. Right-click (control-click on Mac) the worksheet tab and select **Paste Formatting**.

> You can also copy and paste formatting by selecting **Copy Formatting** on the Format menu.

Format Color

You can format color for font, shading, borders, lines, and marks.

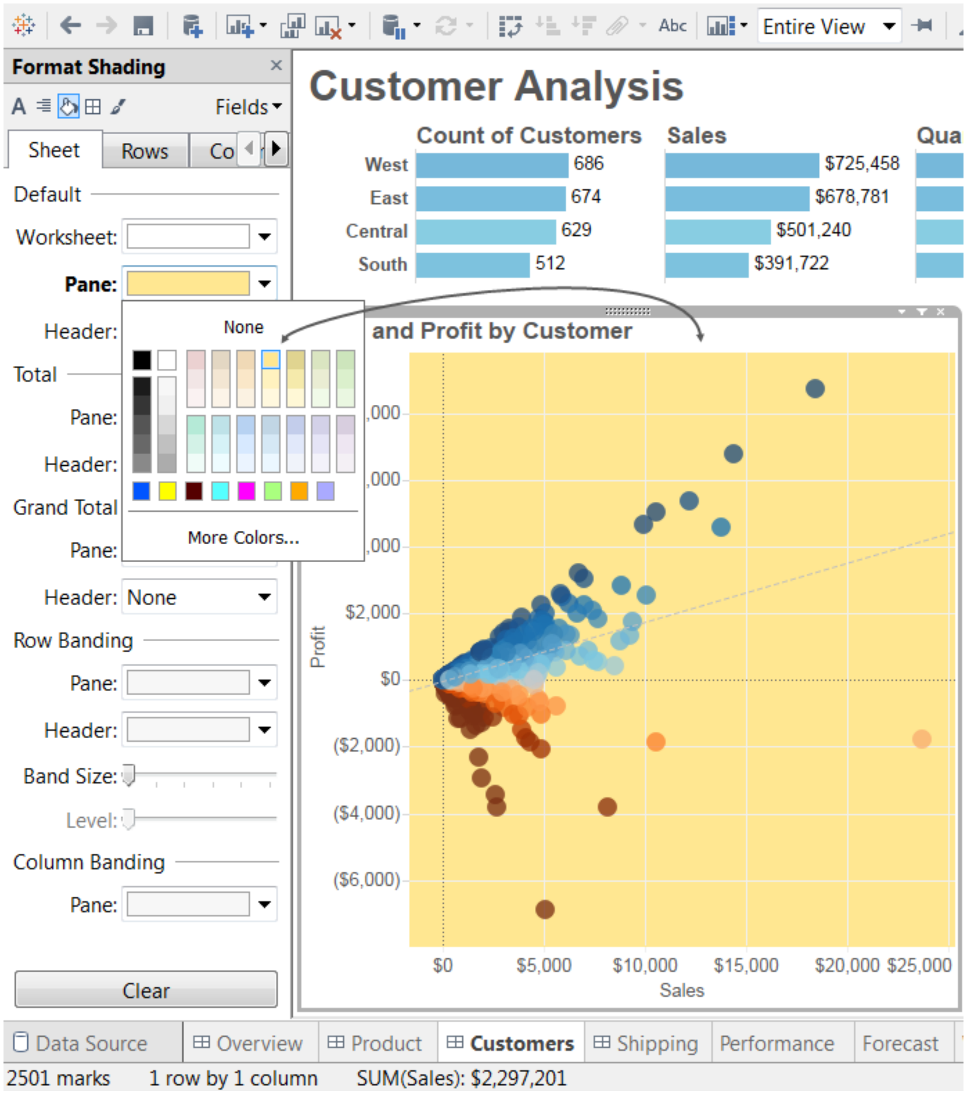
To format color for a particular item, right-click it in the view and select **Format**. The Format pane opens on the left to reveal a full list of relevant formatting options.

For information about using the Format pane, see **Opening the Format Pane** on page 669.

Assign Color

To assign color: Select an item’s drop-down menu in the Format pane.

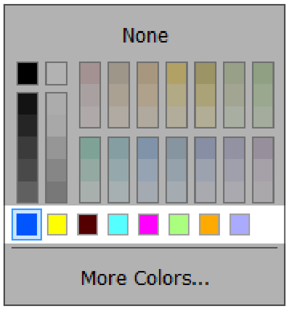
For example, to format shading for a worksheet pane, select **Format** > **Shading**, and choose the drop-down menu next to **Pane**.



Saved Colors

Tableau automatically saves up to eight recently used colors. These are accessible from the bottom of any color drop-down control and remain available across sessions.

Note: Colors already included in the default palette do not appear in the saved colors area.

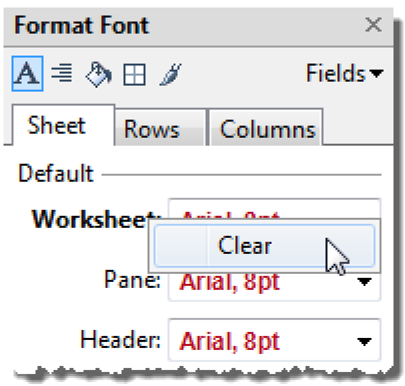


Clearing Formatting

Any time you make changes to a setting in the Format window, the label of the setting is bold to indicate that it is not the default.

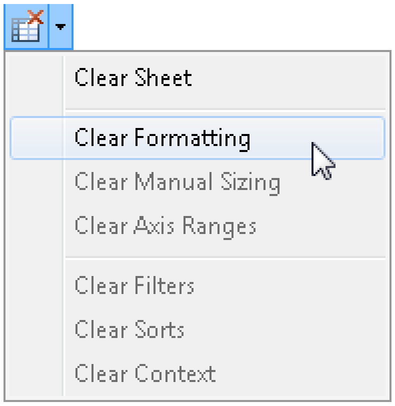
To clear individual settings in the Format window:

In the Format window, right-click (control-click on Mac) the label of the setting you want to clear and select **Clear**.

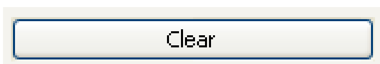
- 

To clear all custom formatting in the worksheet:

- On the toolbar, click the clear menu and select Clear Formatting on the drop-down.



You can also click the Clear button at the bottom of the Format window to clear all format settings currently showing in the Format window.



Workbook Themes

The default formatting follows best practices for displaying information graphically and improves how the graphics look when exported to the web, PowerPoint, PDF, or Office documents. This default formatting is controlled by the workbook theme. All workbooks created using the latest version of Tableau use the Default workbook theme. However, older Tableau workbooks may use the classic theme. You can upgrade older workbooks to use the default theme.

To upgrade workbook themes:

1. Open the workbook using Tableau Desktop.
2. Select **Format** > **Workbook Theme** > **Default**.
3. Save the workbook.

Resizing the Table

Tableau allows you to change the size of the rows, columns, and cells that compose a table. The best way to resize your table depends on the view type and the table components you want to resize.

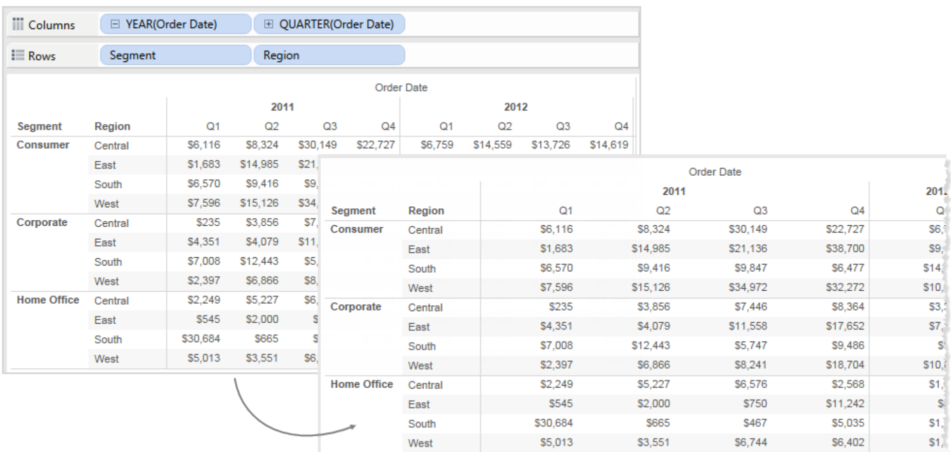
Resizing Rows and Columns

Sometimes the rows and columns are not quite wide or tall enough. You can either resize rows and columns using the cell size commands on the Format menu or by manually dragging the header and axis borders in the view.

Using the Cell Size Commands

By selecting **Format** > **Cell Size** and then the **Taller**, **Shorter**, **Wider**, or **Narrower** menu items you can resize row and columns.

For example, suppose you want to increase the width of the columns and the height of the rows for the view shown below. You can use the **Taller** and **Wider** menu items or the keyboard shortcuts Ctrl + up arrow and Ctrl + right arrow. The views below use both these commands to make the view more readable.



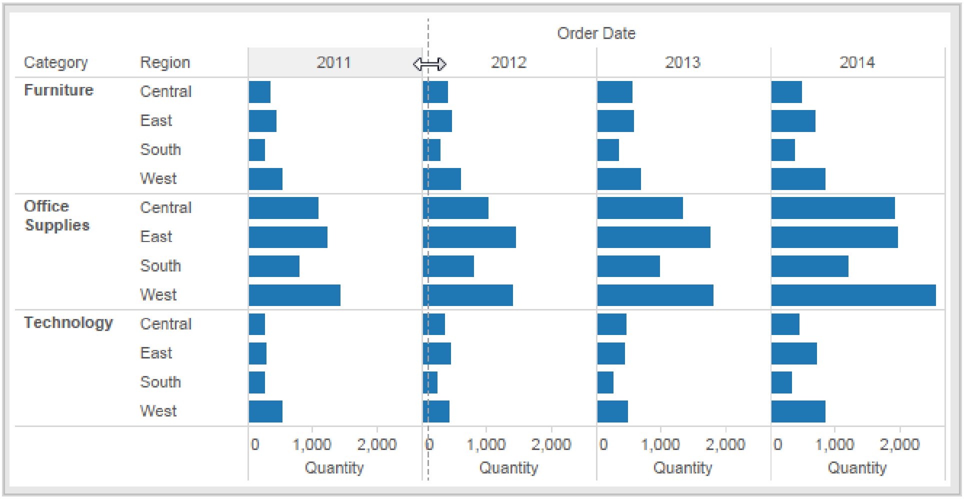
> **Note:** For a given field, all members will have the same width and the same height. That is, you cannot resize individual field members.

Manually Resizing Rows and Columns

To manually resize the widths or heights of row and column headers or axes:

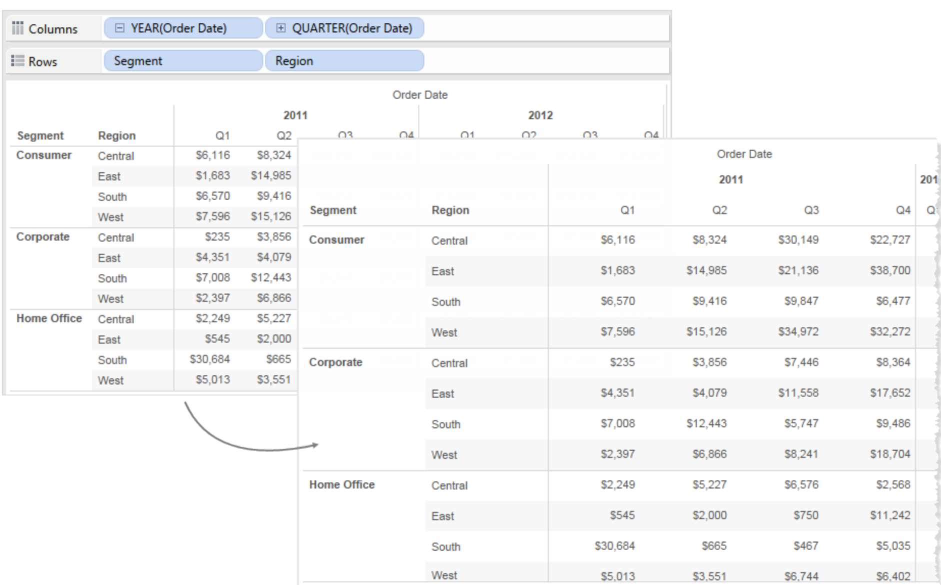
1. Place your cursor over the vertical or horizontal border of a header or axis.

2. When you see the resize cursor, click and drag the border left and right or up and down.



Resizing the Entire Table

You can increase or decrease the size of the entire table by selecting **Bigger** or **Smaller** on the **Format** > **Cell Size** menu. For example, to increase the width of the columns and the height of the rows for the view shown below, you can select **Format** > **Cell Size** > **Bigger** until the view is of the desired size. This option increases both the width and height of the panes in an intelligent way. Notice that the size of the row headers increase horizontally when you resize the table.



For the view shown below, you can select **Format** > **Cell Size** > **Smaller** to decrease the size of the table.

Resizing Cells

Any table you can create in Tableau has the cell as its basic component. For a text table, the cell is what you would expect. It is the intersection of a row and a column, and is where the text is displayed. For more information, see **Cells** on page 429.

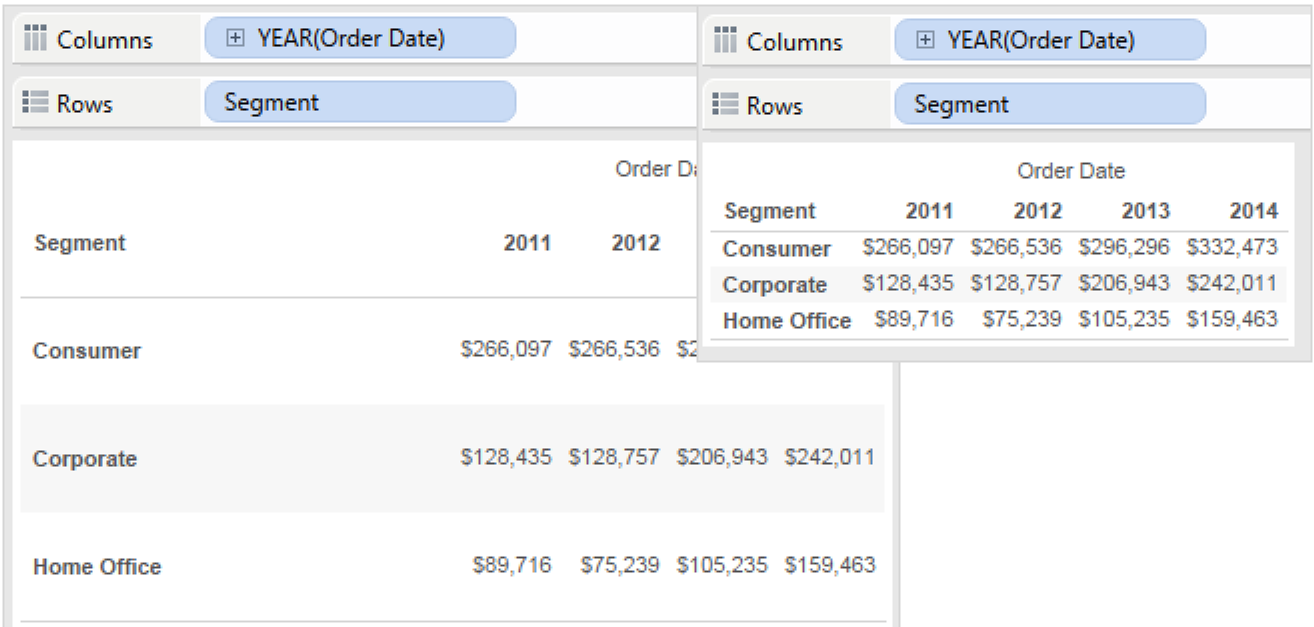
However, depending on the view you construct, identifying the cell is not always possible or useful, such as in the case of a scatter plot.

Manipulating cells to enhance your data view is useful when dimensions are the inner fields on both the **Rows** and **Columns** shelves. In this case, there are two shortcuts you can select on the **Format** > **Cell Size** menu:

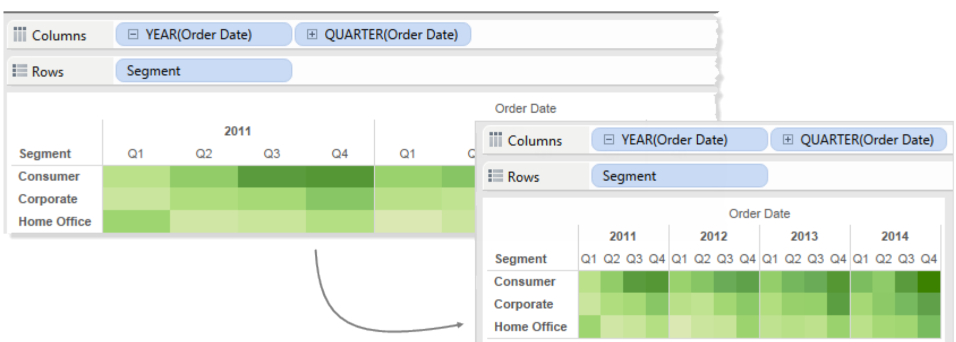
- **Square Cell** – Adjusts the view so the cell has a 1:1 aspect ratio. This results in a square cell, which is particularly useful for heat maps.
- **Text Cell** – Adjusts the view so the cell has a 3:1 aspect ratio. This is particularly useful for text tables.

For example, you can see the text table below with **Square Cell** and **Text Cell** applied. Text Cell enforces a cell aspect ratio of 3:1 and results in a compact table that is easy to read.

Square Cell **Text Cell**



The heat map shown below is modified by selecting **Square Cell** on the **Format** > **Cell Size** menu. This enforces a cell aspect ratio of 1:1 and results in a compact table that is easy to analyze. You can also use the **Size** slider on the Marks card to adjust the size of each mark.



After changing the cell size, you can use **Ctrl+B** and **Ctrl+Shift+B** to decrease or increase the table size while maintaining the cell aspect ratio.

Reordering Rows and Columns

The members in the view may not always be ordered exactly how you want them. You can reorder the rows and columns by clicking and dragging a header to a new position. Moving columns and rows around is equivalent to manually sorting.

Including and Excluding Rows and Columns

Sometimes you will want to restrict certain members of a field from displaying. To easily exclude a row or column, right-click (control-click on Mac) the header and select **Exclude** on the context menu. Excluding a row or column creates a filter.

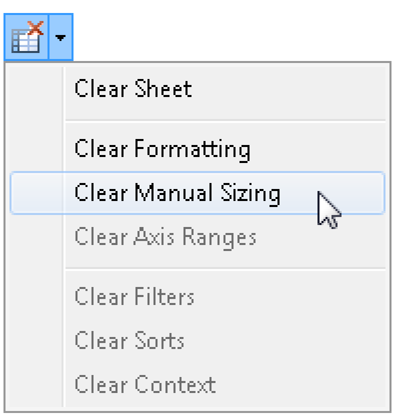
Resize Keyboard Shortcuts and Commands

Every view you build in Tableau will be different and require different sizing techniques. Using the keyboard shortcuts to resize rows and columns as well as the entire table makes building views more efficient. The table below defines some keyboard shortcuts and menu commands for common sizing actions.

Command	Keyboard Shortcut	Menu Command
Taller	CTRL + Up	Format > Cell Size > Taller
Shorter	CTRL + Down	Format > Cell Size > Shorter
Wider	CTRL + Right	Format > Cell Size > Wider
Narrower	CTRL + Left	Format > Cell Size> Narrower
Bigger	CTRL + SHIFT + B	Format > Cell Size > Bigger
Smaller	CTRL + B	Format > Cell Size > Smaller

Clearing Manual Sizing

You can clear the custom sizing at any time using the Clear command on the toolbar. Select **Clear Manual Sizing** on the Clear drop-down.



You can also revert to the last saved state by selecting **File** > **Revert to Saved**. This option discards all unsaved changes including manual sizing.

Miscellaneous Table Options

In addition to the standard formatting, there are some other settings that define the table structure. You can modify these settings by selecting **Analysis** > **Table Layout** > **Advanced** to open the Table Options dialog box. There you can specify the aspect ratio, the default number format, row and column attributes, and the default label orientation for labels along the bottom of the view. These settings apply to the whole view, however, some can be overridden by the changes made in the Format window.

Setting Aspect Ratio

The aspect ratio refers to the ratio of the pane width to the pane height. You can choose to constrain the aspect ratio to a specified amount or not constrain it at all. An unconstrained axis range can be useful because it means that the axes don't have to be the same length. Anytime you manually resize a row or column, you are unconstraining the aspect ratio. The aspect ratio setting only applies to views containing continuous axes on both the row and column shelves. Nominative axes are not affected by the aspect ratio settings.

Setting Default Number Format

You can define the number of decimal places to display by default for numbers in the view. If you select Automatic, Tableau automatically decides the number of decimal places based on the data in the field. If you select Manual, you can decide to show up to 16 decimal places.

Setting Row Attributes

Select from the following Row attributes:

- Maximum levels of row labels: determines the number of fields that can be added to the Rows shelf before the headers are combined on the same level.
- Maximum levels of horizontal row labels: determines the number of fields that can be placed on the Rows shelf before headers are automatically oriented vertically rather than horizontally.

Setting Column Attributes

Select from the following column attributes:

- Maximum levels of column labels: determines the number of fields that can be placed on the Columns shelf before Tableau begins to combine the labels.
- Show innermost level at bottom of view when there is a vertical axis: displays the innermost level of column headers at the bottom of the view (as opposed to the top) when a vertical axis is added to the view.
- Default orientation of labels at bottom of view: determines whether labels at the bottom of the view are oriented horizontally or vertically by default. You can toggle between the horizontal and vertical options by pressing Ctrl + L on your keyboard.

Edit Axes

When you add a measure to the Columns or Rows shelf, you add an axis to the view. An axis shows data points that lie within a range of values.

For each axis you can specify the range, scale, and tick mark properties. Axis formatting options are available in the **Edit Axis** dialog box.

> **Note**: When you select an axis, the marks associated with the axis are not selected so that you can edit and format the axis without modifying the marks. To select the marks, right-click the axis and select **Select Marks**. You can also select each mark individually. For more information about how to select marks in a view, see **Select Marks** on page 845.

In this topic, you can learn how to do the following:

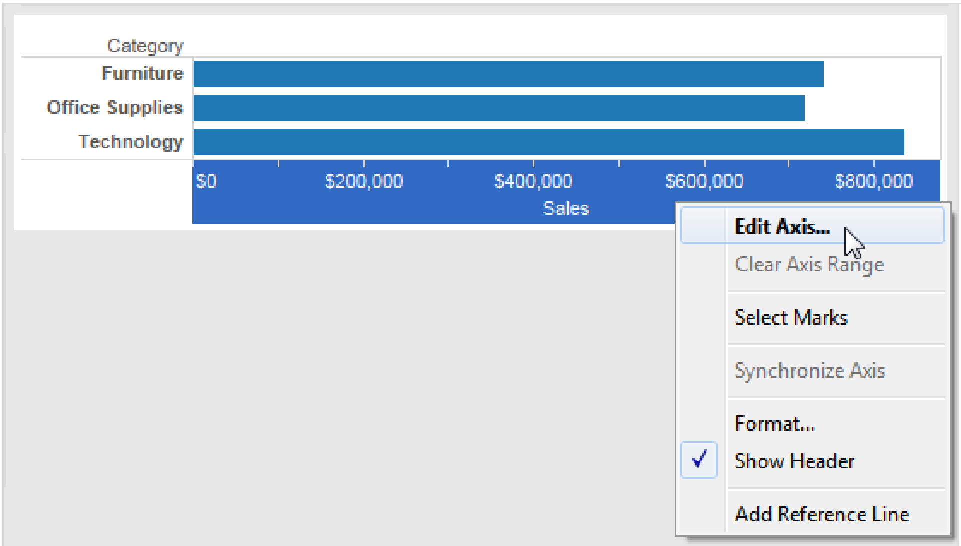
- **Change the axis range** below
- **Change the axis appearance** on page 708
- **Format tick marks** on page 711

Change the axis range

You can limit the axis range to focus the view to where the data points lie. For example, you may have a view showing the Profit over four years. The automatic axis may range from 0 to $400,000 but your profits never went below $300,000. You could adjust the Axis Range so that it starts at $300,000 thus focusing on where the data points actually lie.

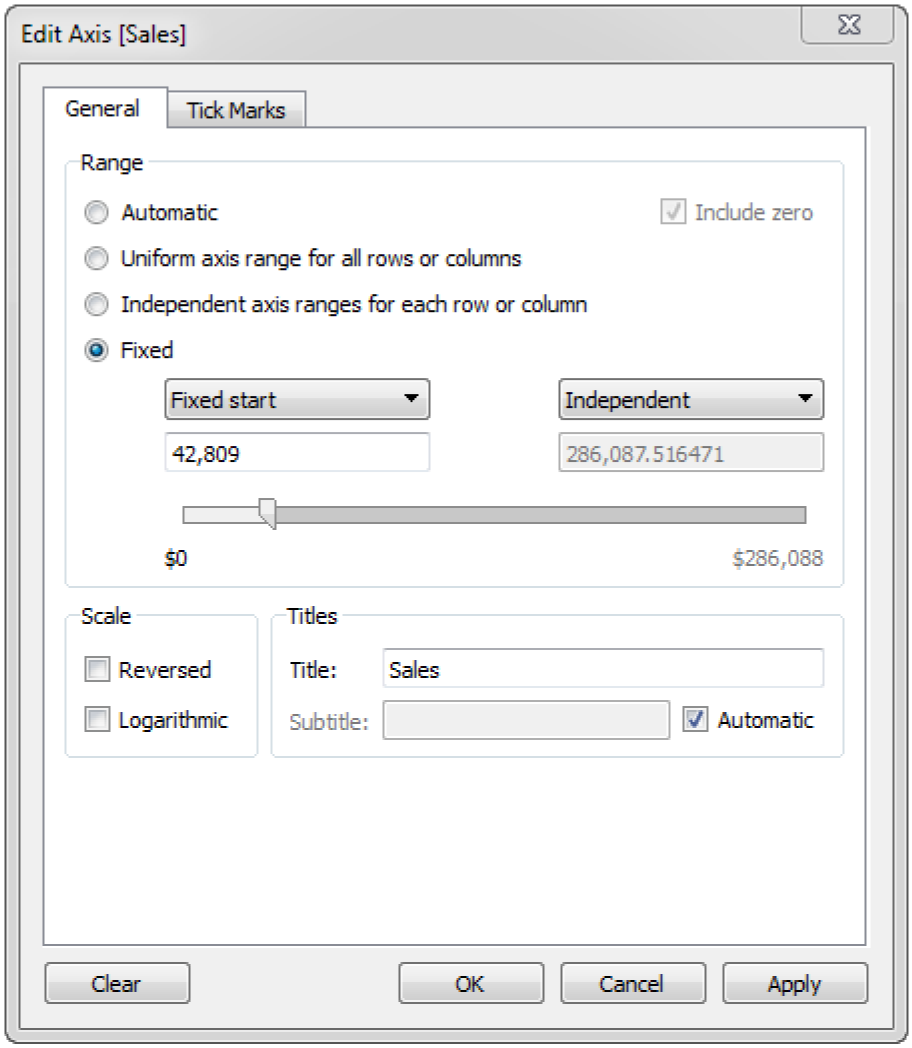
To change the axis range:

1. Right-click (control-click on Mac) on the axis that you want to edit and select **Edit Axis**.



2. In the **Edit Axis** dialog box, select one of the following options:
   - **Automatic.**Automatically bases the axis range on the data used in the view.
   - **Uniform axis range for all rows or columns.**Sets the axis range uniformly to the maximum data range for all panes in the view.
   - **Independent axis ranges for each row or column.** Makes the axis range independent. The axis range varies for each pane in the view, depending on the range of data in each pane.
   - **Fixed.** Specifies to start and/or end the axis at a specific value. You can fix both ends of the axis or only one end. When you fix both ends of the axis, the axis range is determined by the values you specify. When you fix only one end of the axis, you

must set the other end of the axis as automatic, uniform, or independent.

- 

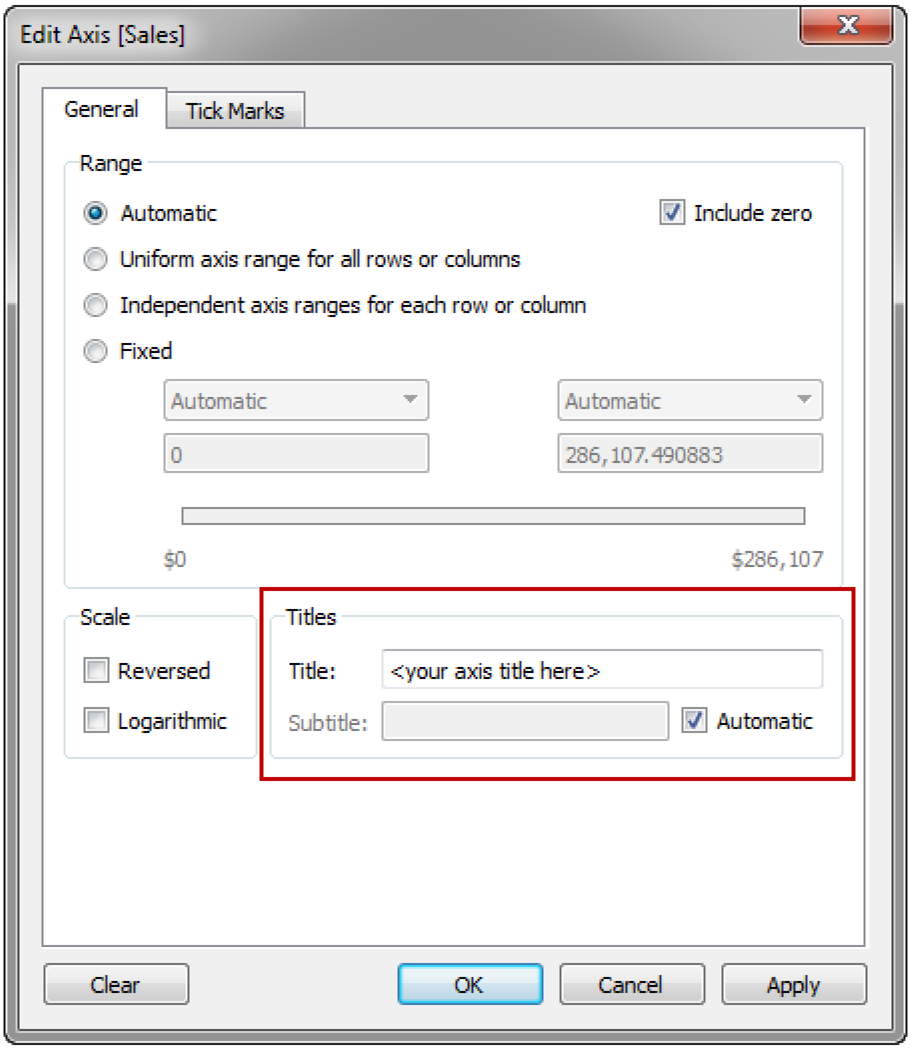
3. You can also specify whether to include zero. When you clear the **Include zero** check box, the axis range adjusts to show only the range of values in the data.
4. When you have finished, click **OK**.

Change the axis appearance

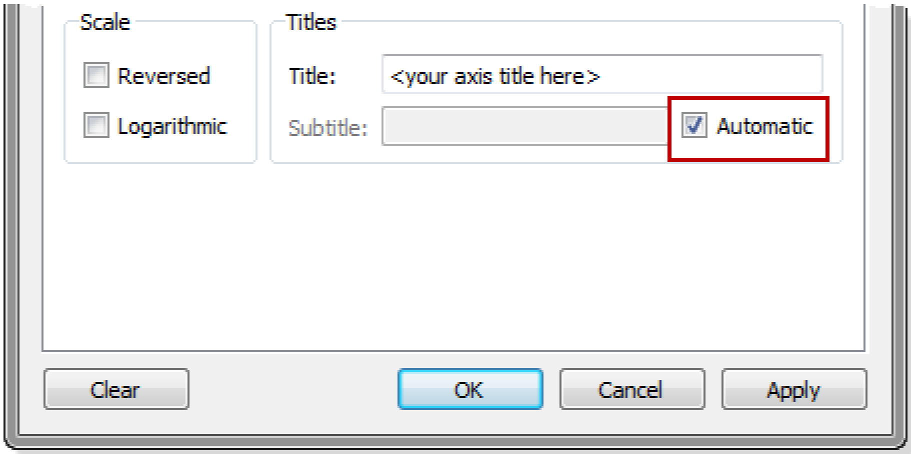
Every axis has a title that is automatically generated based on the fields in the view. You can specify a custom axis title and add a subtitle using the Edit Axis dialog box. In addition, you can specify the scale of the axis such as whether to use a logarithmic scale and whether to reverse the axis.

To change the axis title:

1. Right-click (control-click on Mac) on the axis that you want to edit and select **Edit Axis**.
2. In the Edit Axis dialog box, type a new title in the **Title** text box.



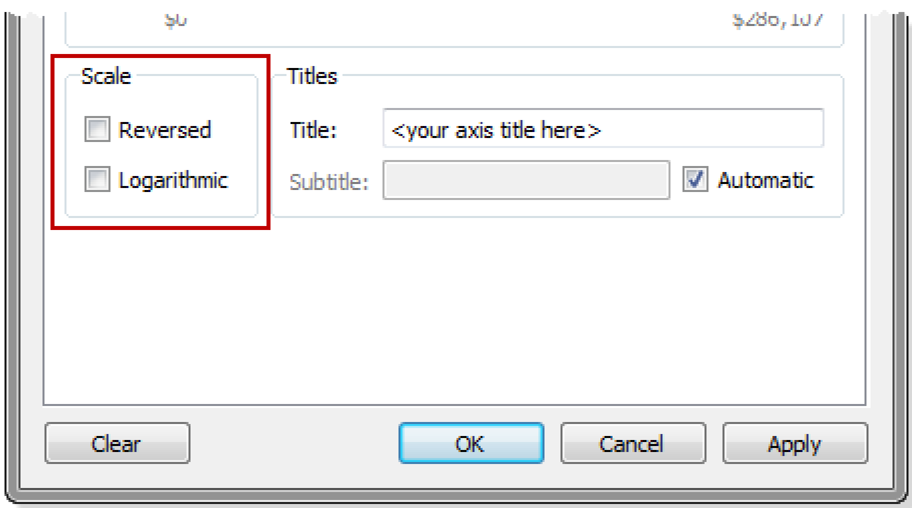
3. Clear the **Automatic** check box to add a custom subtitle.



4. When finished, click **OK**.

To change the axis scale:

1. Right-click (control-click on Mac) the axis you want to edit and select **Edit Axis**.
2. In the bottom left of the Edit Axis dialog box, optionally select one of the following options:
    - **Reversed**- select this option to reverse the order of values on the axis.
    - **Logarithmic** - select this option to use a logarithmic scale on the axis.



3. When finished, click **OK**.

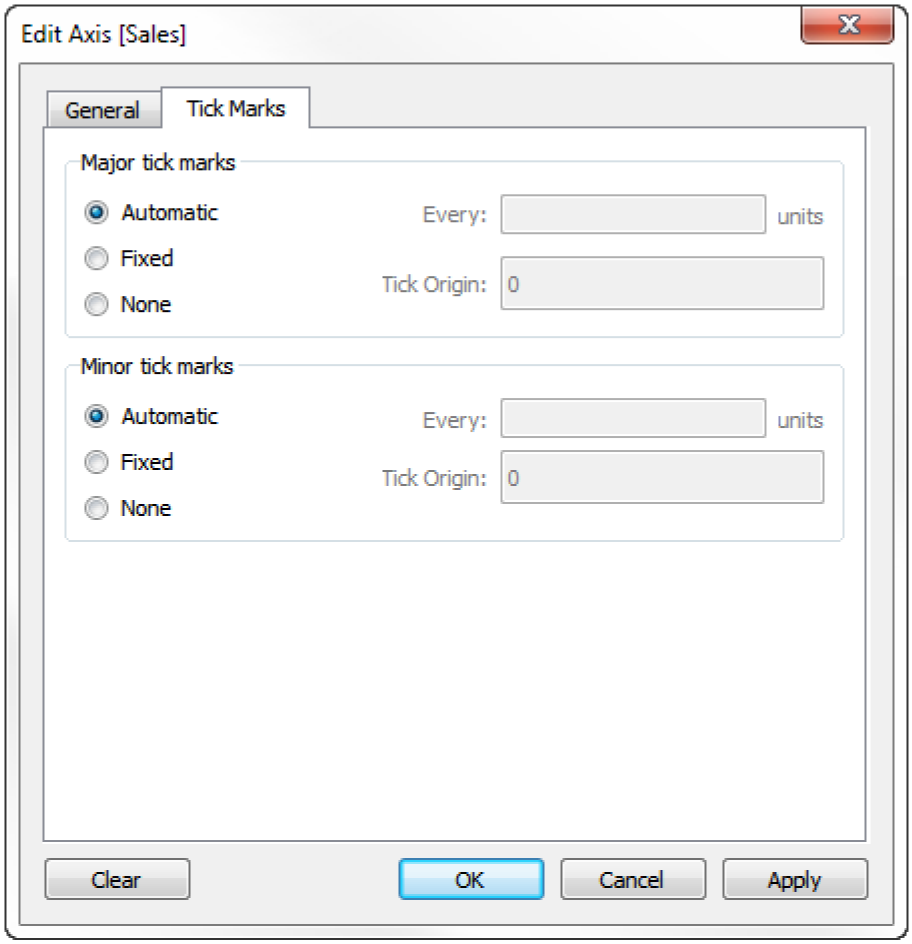
Format tick marks

You can specify how often the tick marks are displayed along the axis. Tableau allows you to modify both the Major and Minor tick marks. Major tick marks are accompanied by unit labels while Minor tick marks simply represent smaller increments between the major marks. You can choose to use automatic or fixed tick marks or have none at all.

To format tick marks:

1. Right-click (control-click on Mac) the axis you want to edit and select **Edit Axis**.
2. In the Edit Axis dialog box, select the **Tick Marks** tab.
3. For both **Major** and **Minor tick marks**, select from one of the following options:
   - **Automatic** - select this option to automatically show tick marks based on the data in the view.
   - **Fixed** - select this option to specify how often the tick mark should display and the starting value.

- **None** - select this option to hide the tick marks completely.



4. When finished, click **OK**.

Example – Change the Axis Range

In this example you will build three views using the same data. However, each view will use a different axis range format. These views use the **Sample-Superstore** data source to display the aggregated total sales for three product categories over the course of four years.

In this topic, you can learn how to:

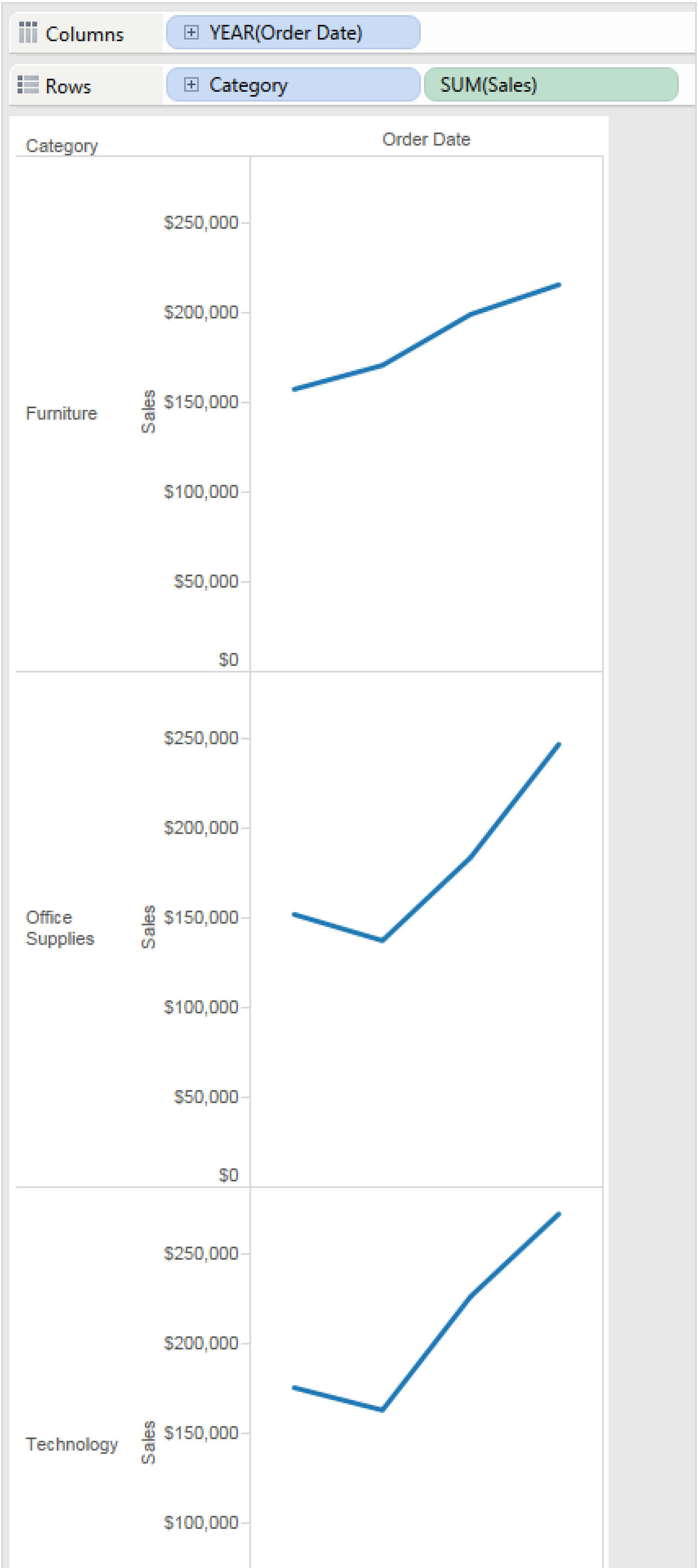
- Build a view with a uniform axis range
- Build a view using independent axis ranges
- Build a view using a fixed axis range
    - Fix both ends of the axis
    - Fix one end of the axis

View 1- Build a view with a uniform axis range

A uniform axis range means that the same range is applied to each row or column in your view. The range is automatically generated based on the underlying data values.

1. Place the **Order Date** dimension on the **Columns** shelf and the **Category** dimension on the **Rows** shelf.
2. Place the **Sales** measure on the **Rows** shelf.

   The measure is automatically aggregated as a summation and an axis is added to the view. By default the view uses a uniform axis range. Notice that the axis range is the same, from zero to 250,000 for each product category.

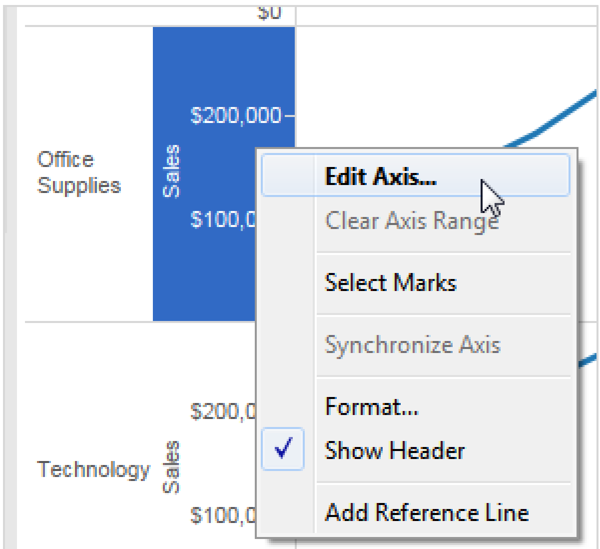


Columns
YEAR(Order Date)
Rows
Category
SUM(Sales)
Category
Order Date
Furniture
Office Supplies
Technology
Sales
$250,000
$200,000
$150,000
$100,000
$50,000
$0

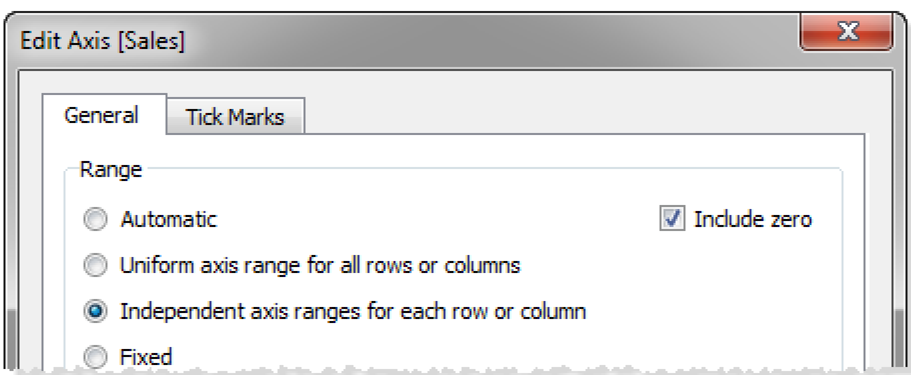
View 2 - Build a view using independent axis ranges

When you use an independent axis range, each row or column will have its own axis range based on the underlying data values.

1. Right-click (control-click on Mac) the SUM(Sales) axis in the view and select **Edit Axis**.



2. In the Edit Axis dialog box, select **Independent axis ranges for each row or column**.



3. When finished, click **OK**.

The axis range for each product category are now independent from each other. The Technology and Office Supplies categories still range from zero to 250,000, but the Furniture category ranges from zero to a little over 200,000.


Columns
YEAR(Order Date)
Rows
Category
SUM(Sales)
Category
Order Date
Furniture
Sales
$200,000
$150,000
$100,000
$50,000
$0
Office Supplies
Sales
$250,000
$200,000
$150,000
$100,000
$50,000
$0
Technology
Sales
$200,000
$100,000
$0
2011
2012
2013
2014

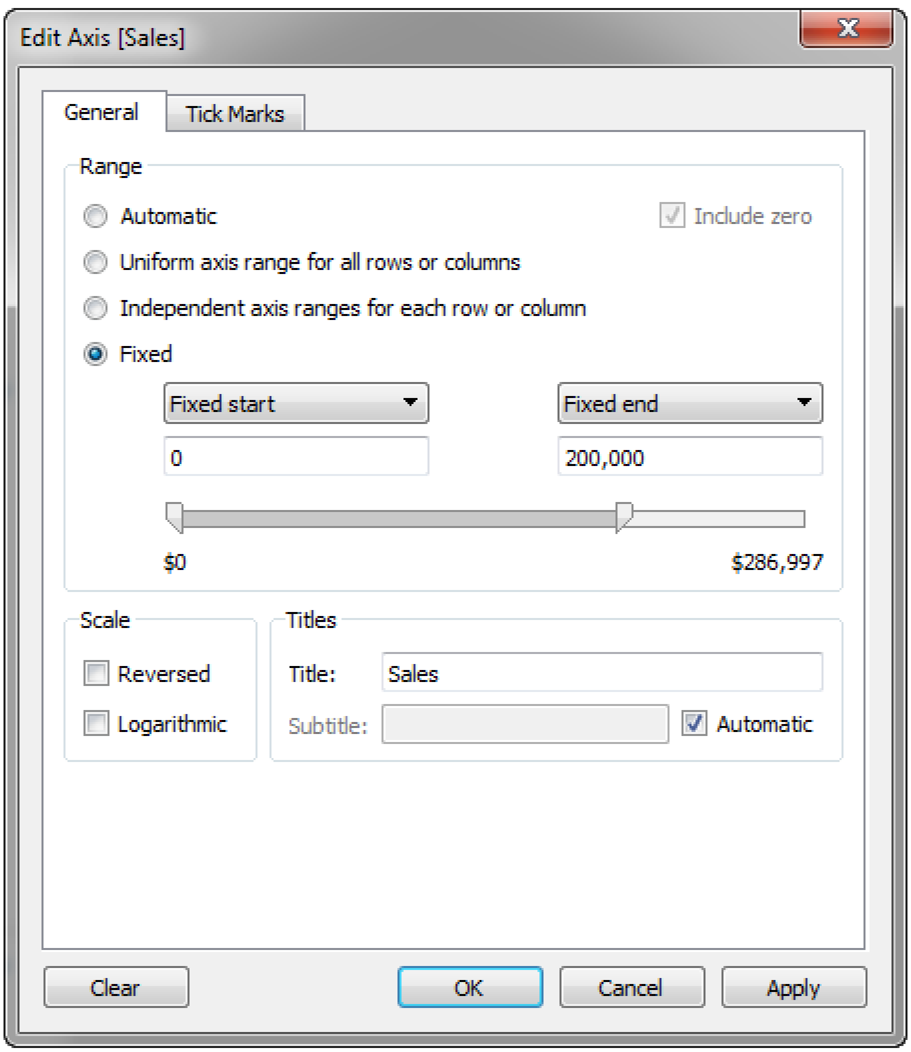
View 3 - Build a view using a fixed axis range

You can fix one or both ends of an axis in order to customize how much of the data you can see in the view.

The first example shows how to fix both ends of the axis. The second shows how to fix only one end of the axis, and then define the axis range for all panes in the view.

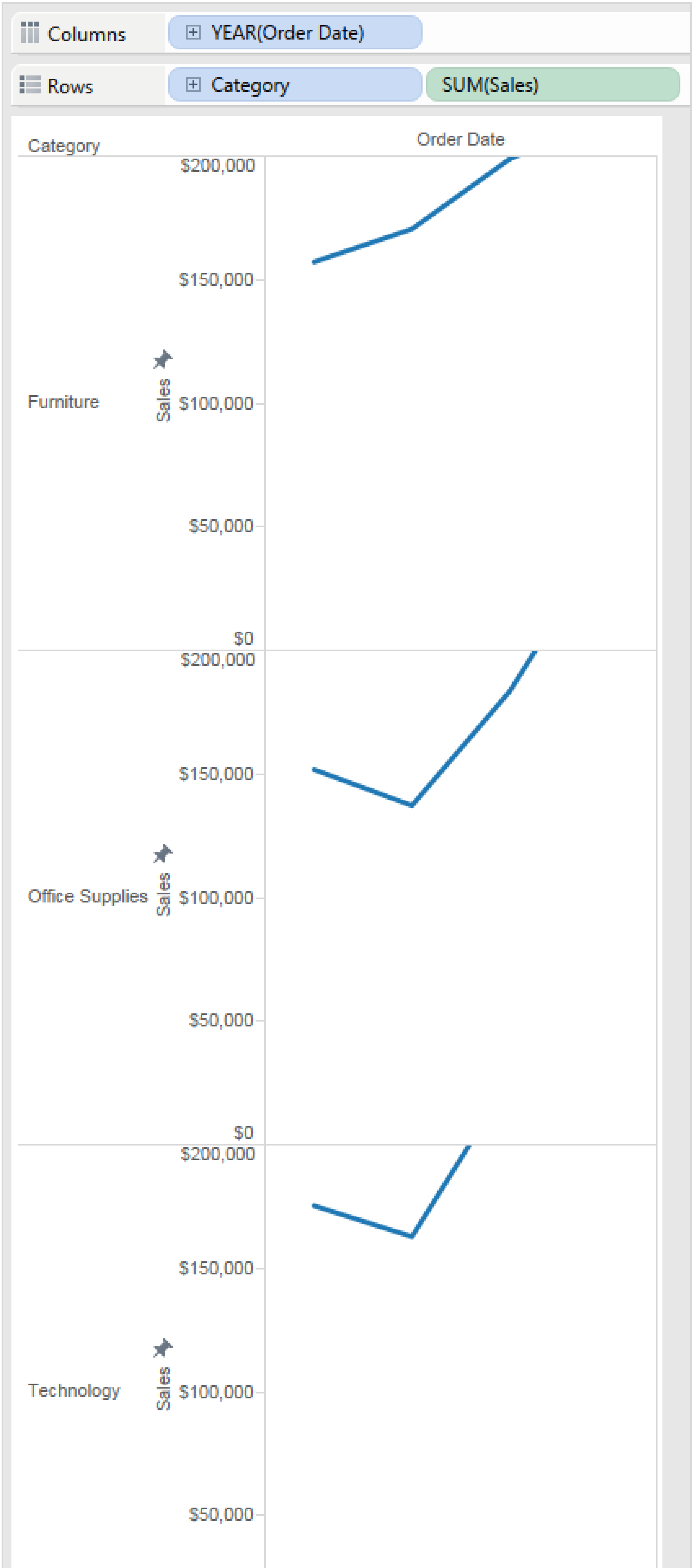
Fix both ends of the axis

1. Right-click (control-click on Mac) the **SUM(Sales)** axis in the view and select **Edit Axis**.
2. In the Edit Axis dialog box, select **Fixed**, and then define **Start** and **End** values either by typing into the text boxes or by dragging the sliders toward each other. For this example, type **0** for **Start** and **200,000** for **End**.



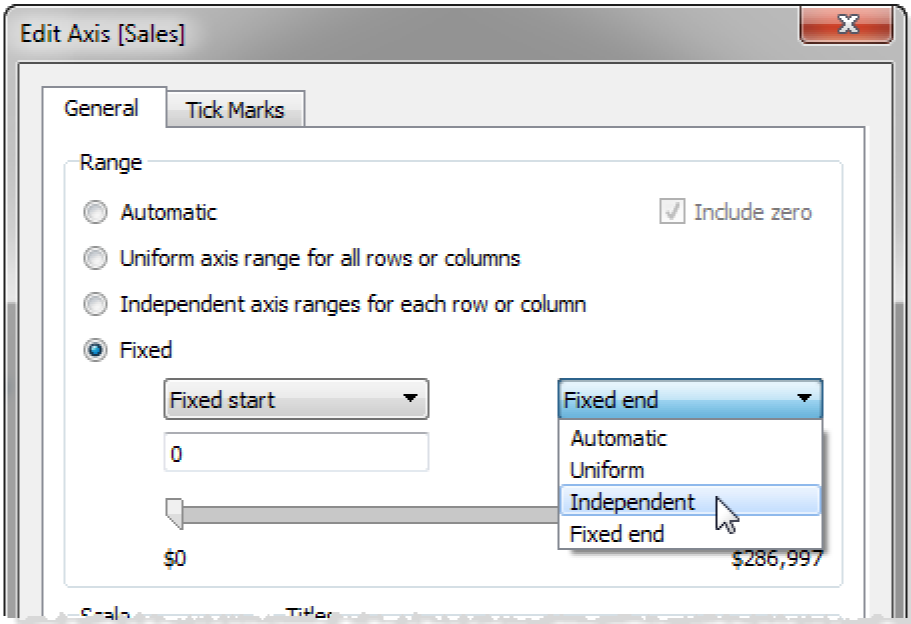
3. Click **OK**.

In the following image, notice that the categories only display up to $200,000 in sales. The axes are marked with a pin symbol , which indicates that you have limited the axis range and that some data might not be displayed.


Columns
YEAR(Order Date)
Rows
Category
SUM(Sales)
Category
Order Date
Furniture
Office Supplies
Technology
Sales
$200,000
$150,000
$100,000
$50,000
$0

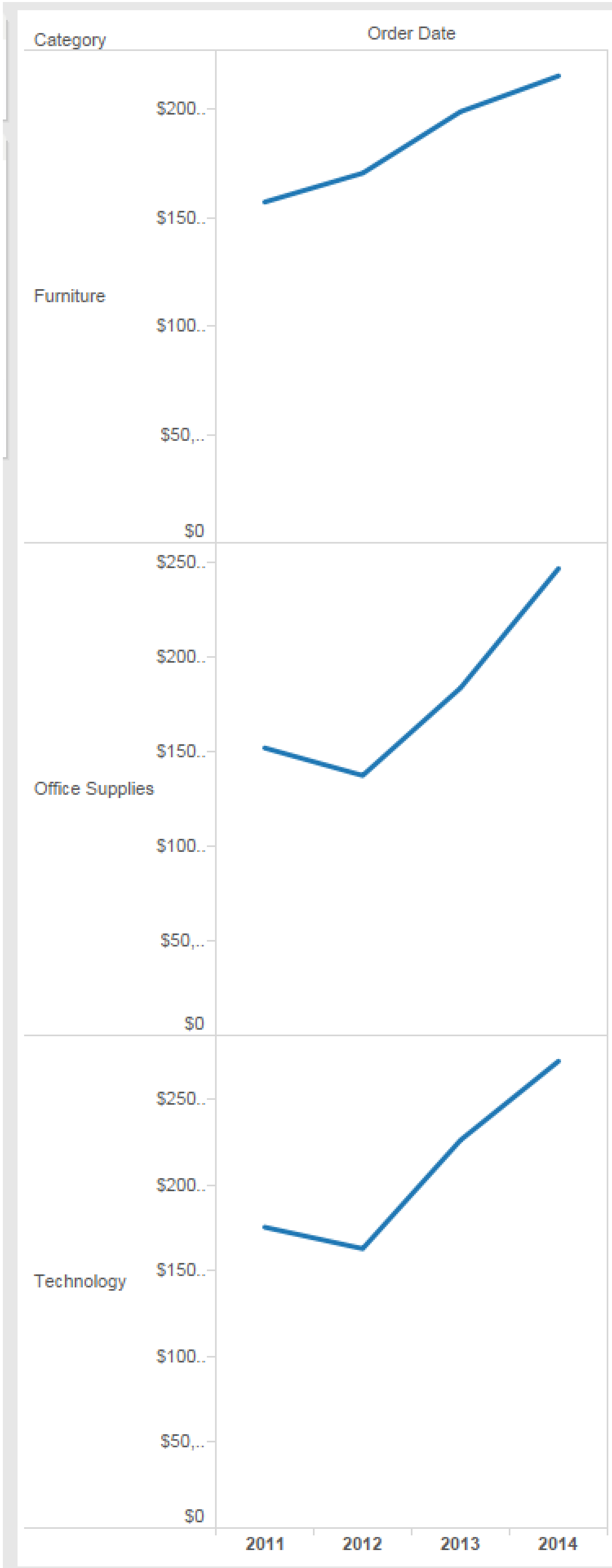
Fix one end of the axis

1. Right-click (control-click on Mac) the **SUM(Sales)** axis in the view and select **Edit Axis**.
2. In the Edit Axis dialog box , select **Fixed**, click the **Fixed End** drop-down menu, and then select **Independent**.



3. Click **OK**.

In the following image, notice that the categories now have slightly different axis ranges. For example, Office Supplies has an axis range from 0 to 250,000 dollars, while Furniture only has a range from 0 to 200,000 dollars.



Category
Order Date
Furniture
$200..
$150..
$100..
$50,..
$0
Office Supplies
$250..
$200..
$150..
$100..
$50,..
$0
Technology
$250..
$200..
$150..
$100..
$50,..
$0
2011
2012
2013
2014

For more information about the difference between automatic, uniform, and independent axis ranges, see **Change the axis range** on page 706.

Sorting

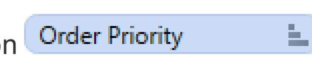
In Tableau, sorting a data view means arranging dimension members in a specified order. Tableau supports computed sorting and manual sorting.

Computed Sorting

You might want to sort customers by alphabetical order, or sort a product line from lowest sales to highest sales. Both of these sorts are “computed sorts” because they use programmatic rules that you define to sort the field.

About Computed Sorting

Sorting dimensions in a computed manner follows these rules:

- You can sort any discrete field after it has been placed on a shelf (except the **Filters** shelf).
- Each dimension that appears on a worksheet can be sorted independently of any other dimension.
- The shelf location of the dimension determines the component of the data view that’s sorted. For example, if the dimension resides on the Columns shelf, the columns of the data view are sorted for that field. If the dimension resides on the **Color** shelf, the color encodings are sorted.
- Sorts are computed based on the values of the filters and sets in the view. Refer to **Groups** on page 736 for more information.
- Sorted fields are identified by a sort icon 

on the right side of the field.

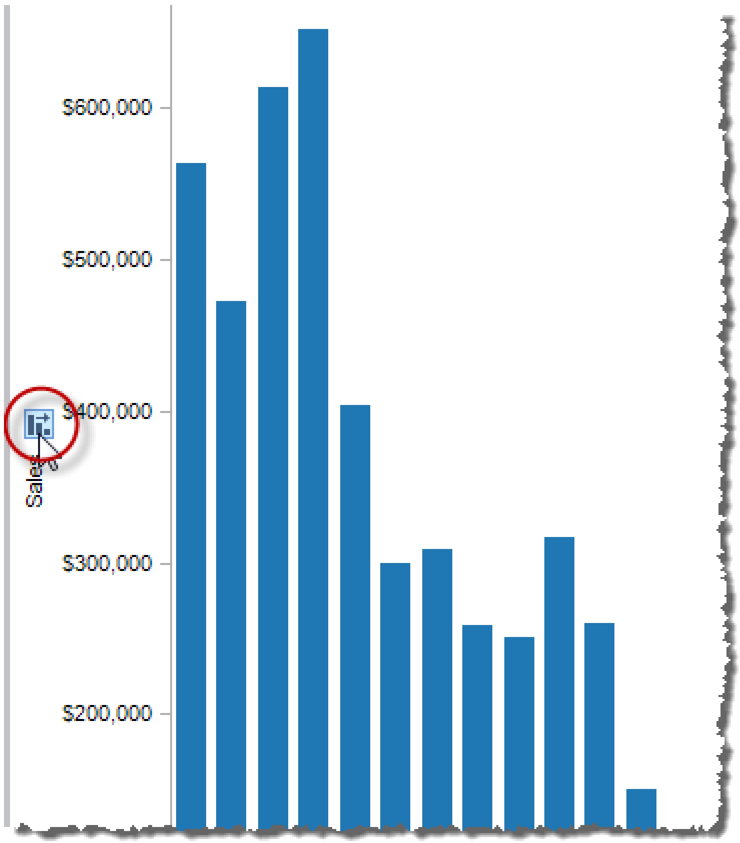
Continuous fields are automatically sorted from lowest number to highest number (as indicated by the axes) and you cannot manually change the sort. However, you can reverse the order of an axis using field specific formatting.

How to Sort Data (Computed Sorts)

Computed sorts can be applied either directly on an axis in the view or using the sort dialog box to apply computed sorts to specific fields in the view.

Sorting on an Axis

A quick way to create a computed sort is to use the sort buttons on an axis. The sort buttons on an axis will automatically create a sort that makes sense for the view you've created. The sort will be computed, which means it will update correctly if the underlying data changes.
When you hover over an axis with your cursor, a sort icon displays. Click it once to sort Ascending, again to sort Descending, and a third time to clear the sort.

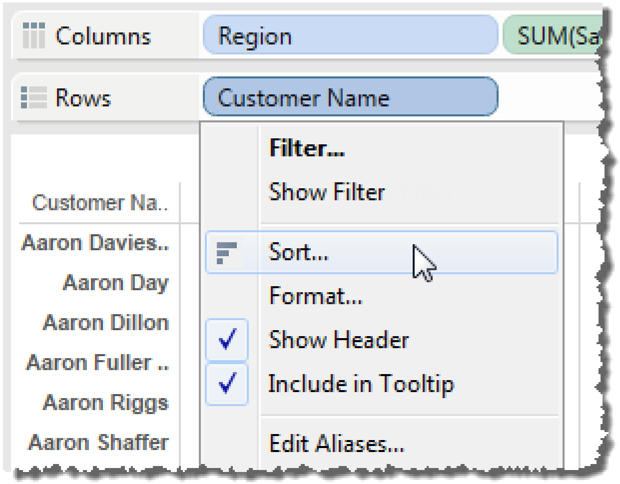


Sorting Specific Fields

You can sort a specific field using the Sort dialog box.

1. Open the Sort dialog box.

   Right-click (control-click on Mac) on the field that you want to sort and select **Sort** from the context menu.



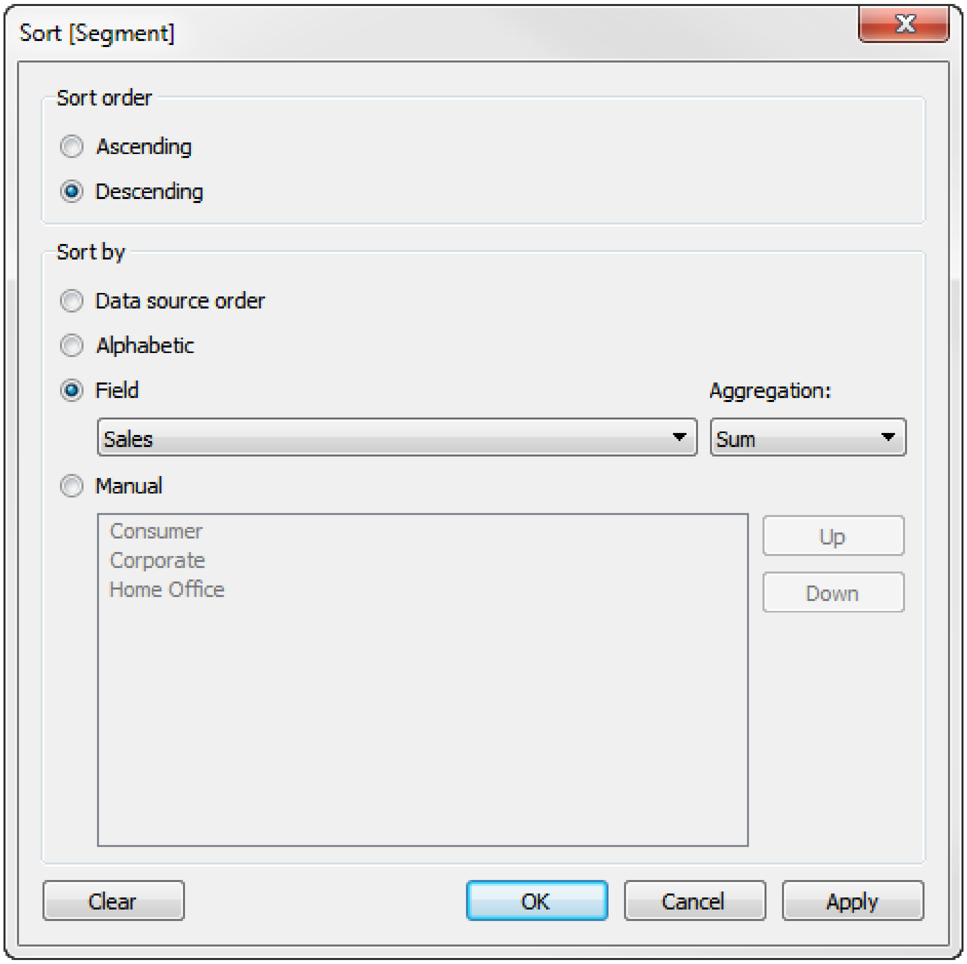
2. Specify the sorting options.

   Complete the **Sort** dialog box by specifying the following criteria:

   - Sort order - Displays the sort results in ascending or descending order.
   - Sort by – Sort by one of these three options:
     - **Data source order** - the order that the data source naturally orders the data. Generally for relational data sources, this tends to be in alphabetical order. If you are using a cube, this order is the defined hierarchal order of the members within a dimension.
     - **Alphabetic** - the order of the letters in the alphabet.
     - **Field** - order the data based on the associated values of another field. For example, you could order several products by their total sales values.

       When working with a relational data source and sorting by another field, you must also specify the aggregation function to use. This option is not available for multidimensional data sources because aggregations are defined when the cube is created and cannot be modified in Tableau. In Tableau, multidimensional data sources are supported only in Windows.

A typical scenario is to sort one or more dimensions by a measure. For example, the **Sort** dialog box shown below is configured to sort the members of the Customer Segment field in descending order and by the sum of the Sales measure. The results will be displayed so that the member with the highest sales is displayed first, the member with the second highest sales is displayed second, and so on.



You should keep the following rules in mind when interpreting the sort results:

- Tableau computes the sort across the entire table using the specified criteria. Refer to **Example – Sorting a Text Table** below for an example.
- Sorts do not break the dimension hierarchy. Sorted fields are always displayed within the ordered context already set forth by the fields on the Rows and Columns shelves. This means that Tableau will not rearrange any of the headers of the fields that appear before (to the left of) the sorted field.

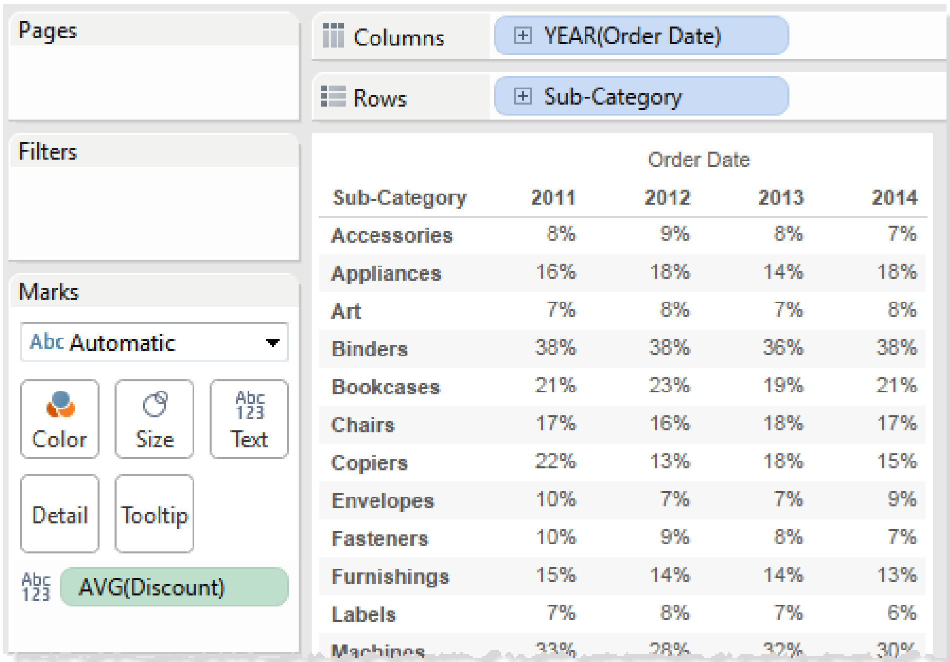
  If you want to break the dimension hierarchy when sorting a multidimensional data source, place only the hierarchy level that you want sorted on the Rows or Columns shelf.

Example – Sorting a Text Table

Using the **Sample-Superstore** data source, this example sorts the rows and columns of a text table to determine which products and years have the highest average discounts. To create the view, follow the steps below:

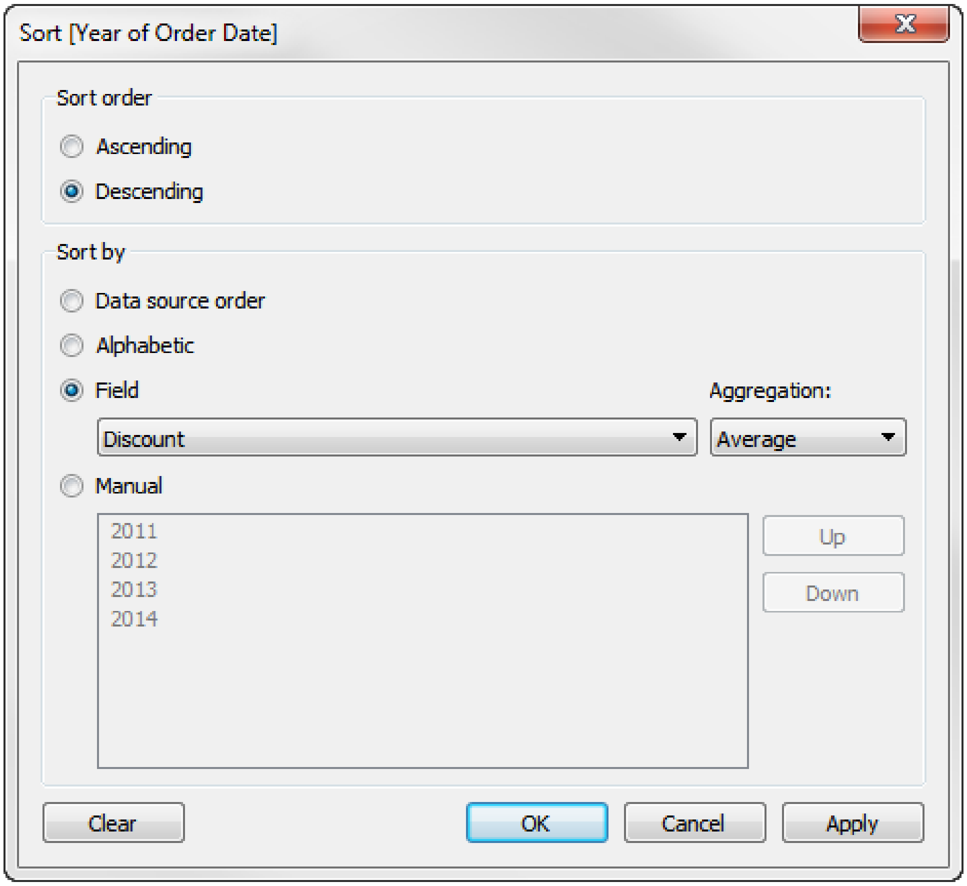
1. Place the **Order Date** dimension on the **Columns** shelf and the **Sub-Category** dimension on the **Rows** shelf.

   Complete the text table by placing **Discount** on **Text**. By default, the table is sorted in alphabetical order.

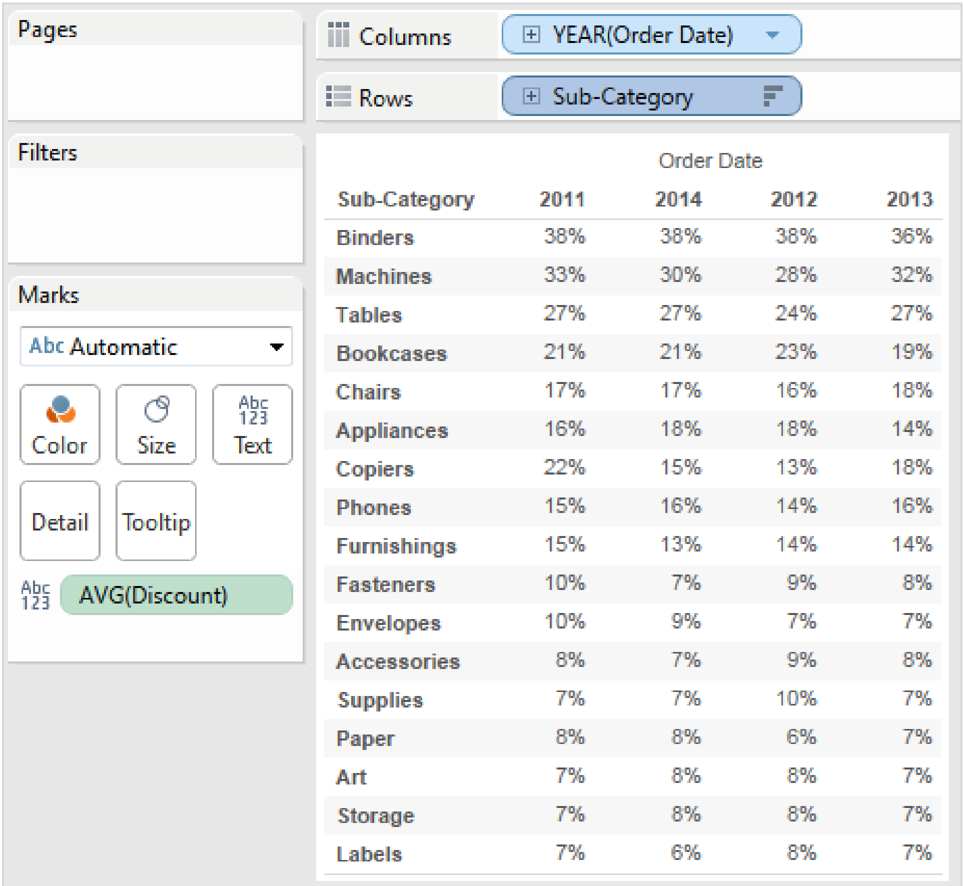
   

2. Sort the fields.

   Right-click (control-click on Mac) **Order Date** and select **Sort**. In the Sort dialog box, do the following:
   - For Sort Order, select **Descending**.
   - For Sort by, select **Field**, and then select the following:
     - For Field, select **Discount**
     - For Aggregation, select **Average**
   - When finished click **OK**, and then apply the same sort to **Sub-Category**.

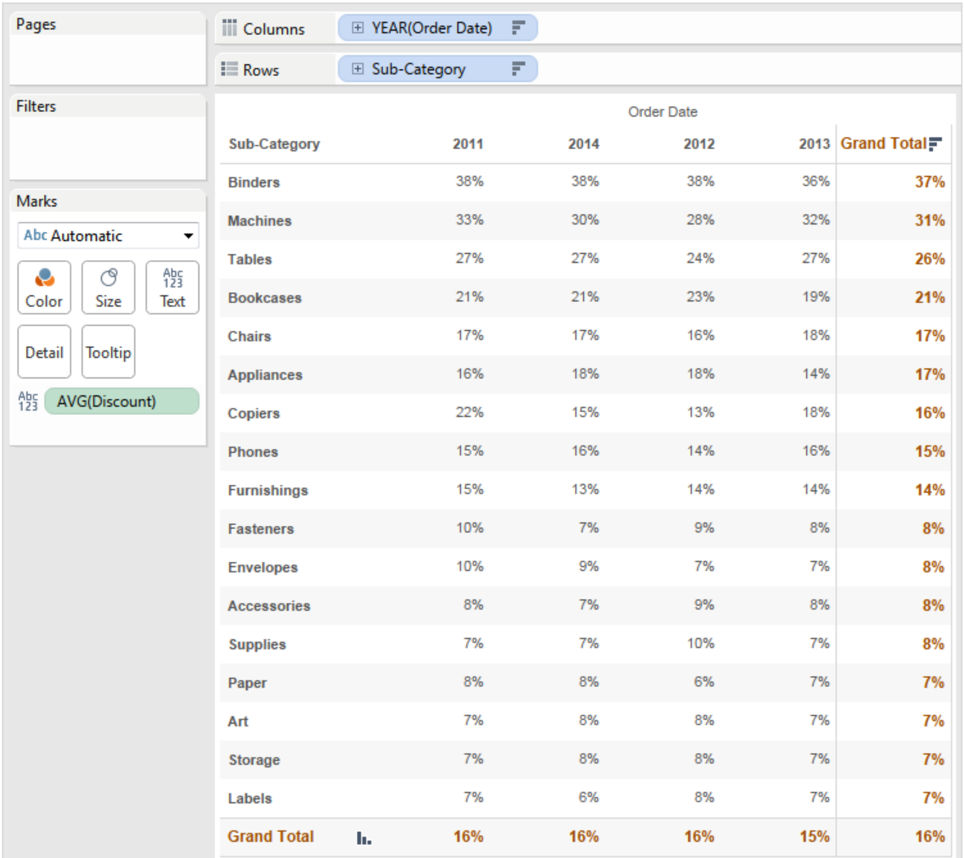


The view is shown below. Binders are the top row in the table because it has the largest average discount across all years, while Labels are at the bottom in the table because that sub-category has the smallest average discount across all years. Similarly, 2011 is the left most column because it has the largest average discount for all products, while 2013 is the right most column because it has the smallest average discount for all products.



	Order Date			
Sub-Category	2011	2014	2012	2013
Binders	38%	38%	38%	36%
Machines	33%	30%	28%	32%
Tables	27%	27%	24%	27%
Bookcases	21%	21%	23%	19%
Chairs	17%	17%	16%	18%
Appliances	16%	18%	18%	14%
Copiers	22%	15%	13%	18%
Phones	15%	16%	14%	16%
Furnishings	15%	13%	14%	14%
Fasteners	10%	7%	9%	8%
Envelopes	10%	9%	7%	7%
Accessories	8%	7%	9%	8%
Supplies	7%	7%	10%	7%
Paper	8%	8%	6%	7%
Art	7%	8%	8%	7%
Storage	7%	8%	8%	7%
Labels	7%	6%	8%	7%

At first glance, it's not clear if the data has been correctly sorted, because Tableau computes the sort across the entire table using the specified criteria. By turning grand totals on for both columns and rows, using the Analysis menu, you can see that the sort was performed correctly. For more information on how to turn on grand totals, see **Totals** on page 1146.



Sub-Category	2011	2014	2012	2013	Grand Total
Binders	38%	38%	38%	36%	37%
Machines	33%	30%	28%	32%	31%
Tables	27%	27%	24%	27%	26%
Bookcases	21%	21%	23%	19%	21%
Chairs	17%	17%	16%	18%	17%
Appliances	16%	18%	18%	14%	17%
Copiers	22%	15%	13%	18%	16%
Phones	15%	16%	14%	16%	15%
Furnishings	15%	13%	14%	14%	14%
Fasteners	10%	7%	9%	8%	8%
Envelopes	10%	9%	7%	7%	8%
Accessories	8%	7%	9%	8%	8%
Supplies	7%	7%	10%	7%	8%
Paper	8%	8%	6%	7%	7%
Art	7%	8%	8%	7%	7%
Storage	7%	8%	8%	7%	7%
Labels	7%	6%	8%	7%	7%
Grand Total	16%	16%	16%	15%	16%

Example – Sorting a Hierarchy

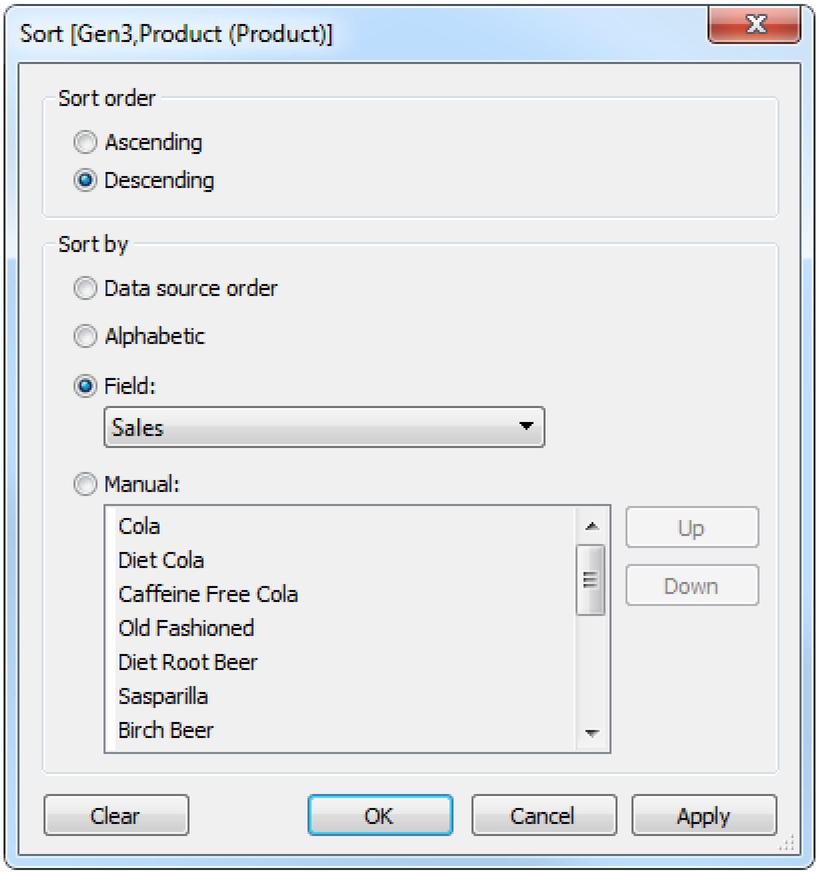
This example uses a multidimensional data source to sort the rows of a bar chart in order to determine which beverages have the highest sales. To create the view, follow the steps below.

1. Place the **Sales** measure on the Columns shelf and the **Gen2,Product** dimension on the Rows shelf.

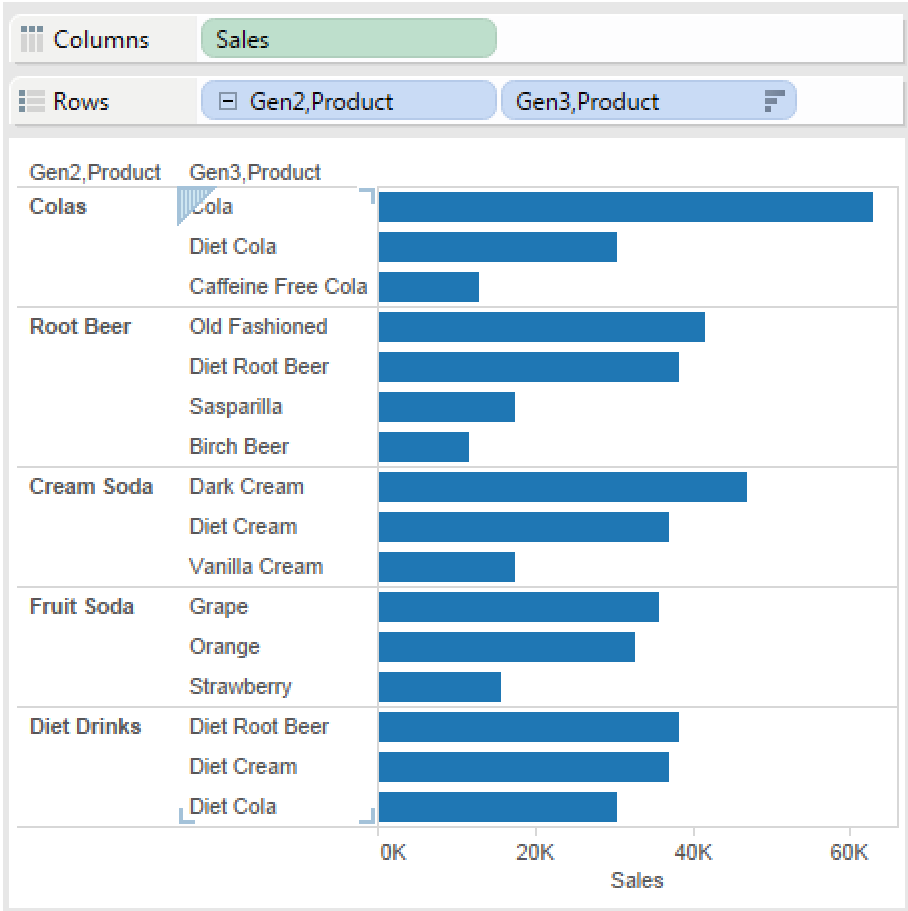
   Drill down one level in the hierarchy to display **Gen3,Product**.

2. Sort **Gen3,Product** in descending order by the **Sales** measure.

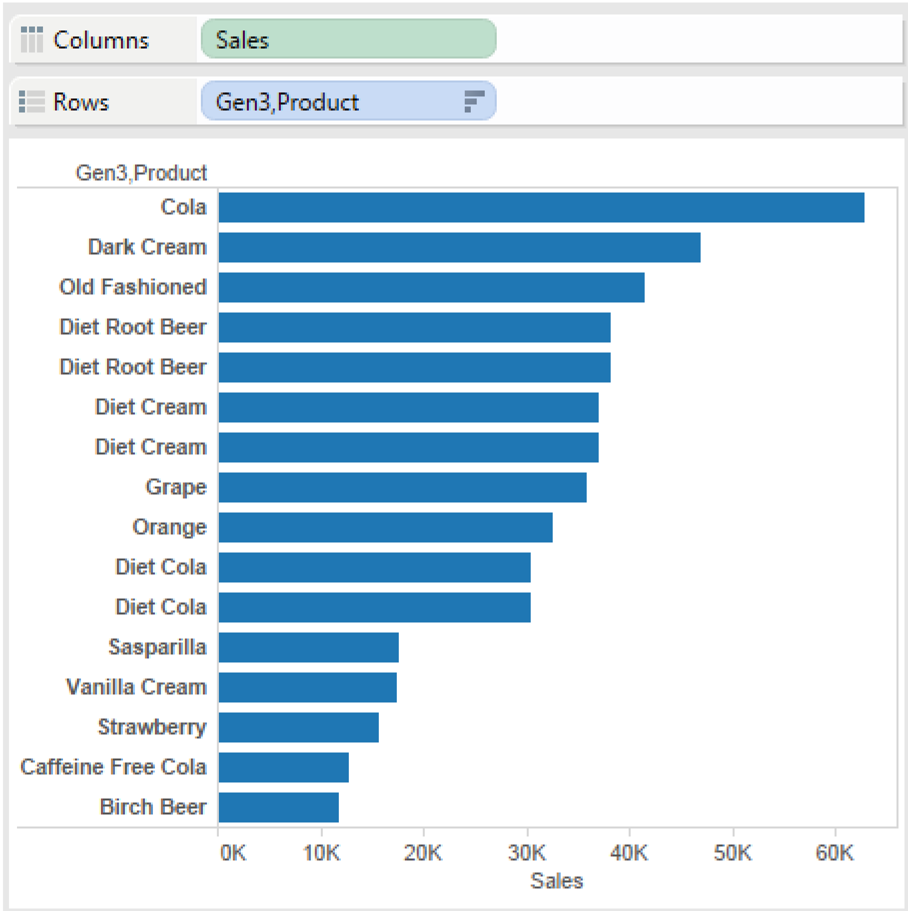
   Right-click (Control-click on Mac) on Gen3,Product and select **Sort** from the field's context menu. In the Sort dialog box, select **Descending** as the Sort order and sort by the **Sales** field.



The view is shown below. Notice that the **Gen3,Product** members are sorted within each parent member. For example, Cola, Diet Cola, and Caffeine Free Cola are sorted only within the Colas level. Tableau does not rearrange headers that appear before the sorted field.



3. If you want to order dimension members without regard to its parent, you should remove Gen2,Product from the Rows shelf. The sorted data are shown below.



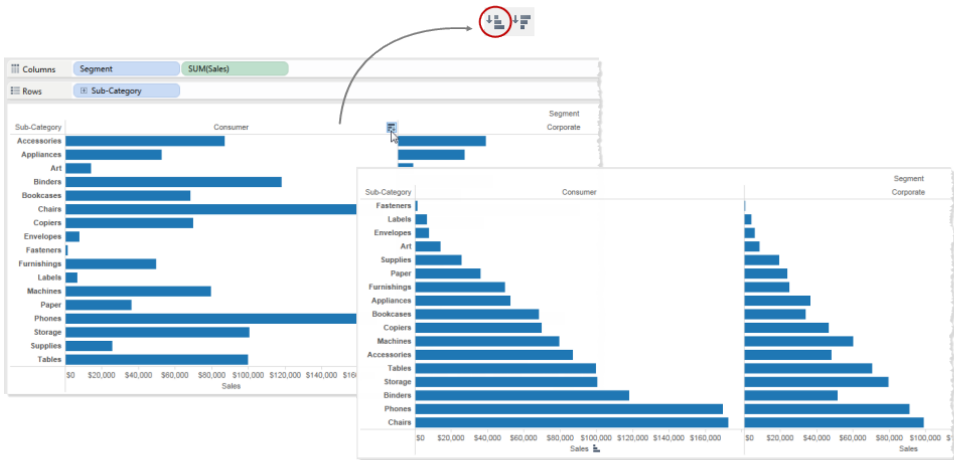
Manual Sorting

Manual sorting allows you to rearrange the order of dimension members in the table by dragging them in an ad-hoc fashion, giving precise control over how items appear next to one another in tables and in legends. It also gives you control over the order in which data is drawn on the screen. This control is useful when comparing specific pieces of data or interpreting overlapping data. Manual sorts can only be applied to discrete fields including a discrete measure.

There are two ways to manually sort the data in a view. You can either select items in the view and use the Sort toolbar buttons or you can drag and drop headers in the view.

Sorting Using the Toolbar and Tooltips

The two sort buttons on the toolbar and in tooltips manually sort a selection either in ascending or descending order based on the other fields in the view. For example, the view below shows sales by product category and customer segment. When you select the Corporate Market column, thus selecting all of the products in that segment, the quick sort buttons sorts the product field by SUM(Sales), which is the measure in the view.

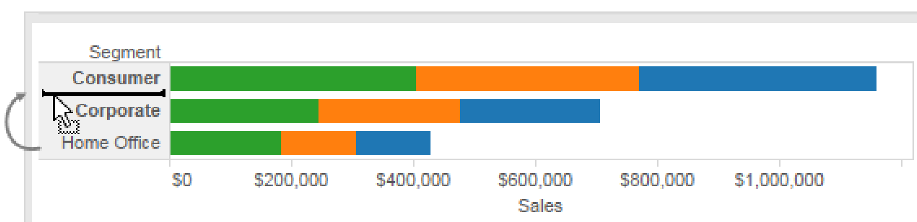


An easy way to anticipate how a selection will be sorted is to make a selection in the view and hover over the ascending or descending sort buttons on the toolbar. The tooltip for each button describes how the selection will be sorted.

Using the quick sort buttons on the toolbar or in the tooltip creates a manual sort which you can always modify using the sort dialog box. Right-click (control-click on Mac) a sorted field (indicated with bold text) and select **Sort** to open the Sort dialog box.

Sort by Drag and Drop

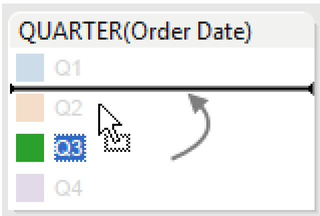
1. Select the dimension member you want to move. This can be any dimension member that appears in a row or column header of a table, or in a legend like the color legend.
2. Drag the member to the desired location within that row, column or legend.



Example- Manually Sorting Drawing Order

Changing the drawing order of a field allows you to see obscured data in your views in cases where data of one color or shape obscure data of another color or shape. For instance, if you can't see red marks in a scatter plot because they are obscured by green marks, you can change the drawing order so that the red points are drawn on top of the green points (and vice versa).

Change the drawing order of a field by re-arranging the order of dimension members in a legend. For instance, if you want to place red items in front of green items in a view, select the red legend entry and move it higher on the list of items shown in the legend. The marks are drawn in the view according to the order in the legend, from bottom to top. Also you can toggle back and forth between layered field items by dragging any one of the fields from top to bottom or from bottom to top.



Sorting the drawing order is not restricted to color legends. You can reorder shape legends as well. If you have multiple valid legends, the drawing order is defined first by shape, then by color. For example, suppose you have both a shape legend and a color legend. If you have a red circle on top of a green square, moving the green above the red in the color legend will not necessarily move the green square on top of the red circle. It depends on the order in the shape legend first. If circles are above squares in the shape legend, no amount of reordering the color legend will get that square on top of the circle. Instead, move the square shape above the circle shape first and then reorder the color legend.

Groups

A group is a combination of dimension members that make higher level categories. For example, if you are working with a view that shows average test scores by major, you may want to group certain majors together to create major categories. English and History may be combined into a group called Liberal Arts while Biology and Physics may be grouped as Science Majors. Groups are useful for both correcting data errors (e.g., combining CA, Calif., and California into one) as well as answering "what if" type questions (e.g., "What if we combined the East and West regions?).

Creating Groups

You can create a group by selecting headers in the view or selecting marks. You can also create a group from a dimension in the **Data** pane. Regardless of how you create a group, a new group field is added to the **Data** pane. You can use the group field like other fields in the view, adding it to the Columns or Rows shelves, to the Marks card, or to the Filters shelf. When you create a group by selecting headers or marks in the view, the view is updated to use the grouped field.

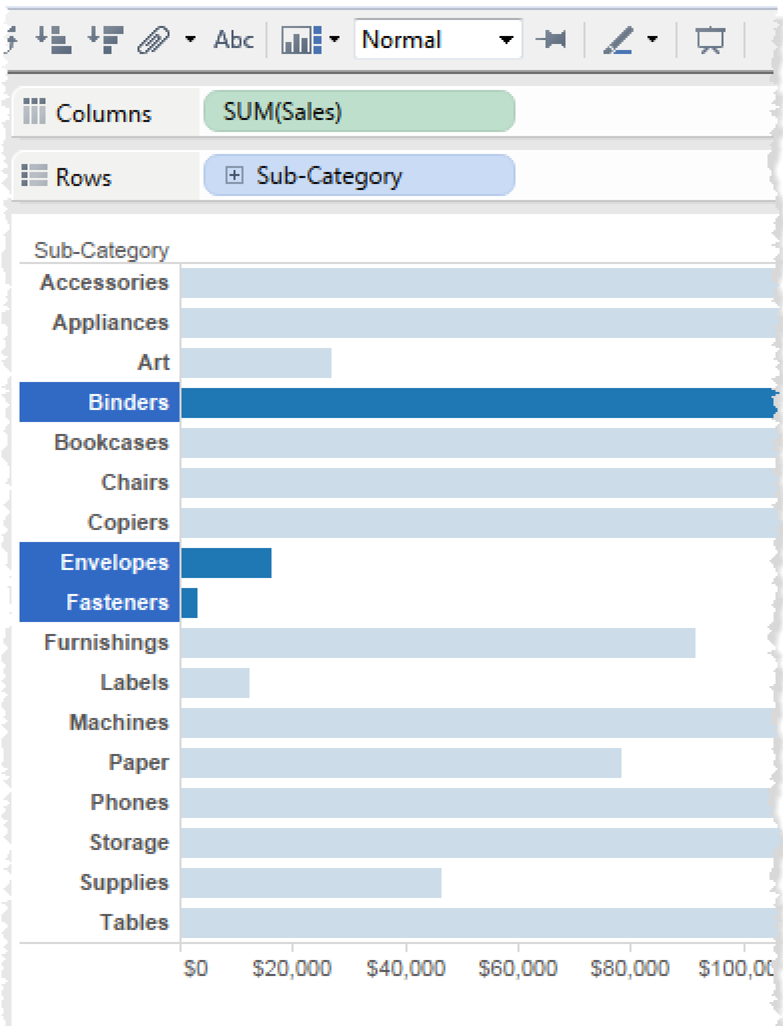
Correct Data Errors or Combine Dimension Members

If you are using groups to correct data errors (for example, to combine "CA" and "California") or to combine dimensions members (for example, to combine "East" and "West" regions), the easiest option is to select headers in the view.

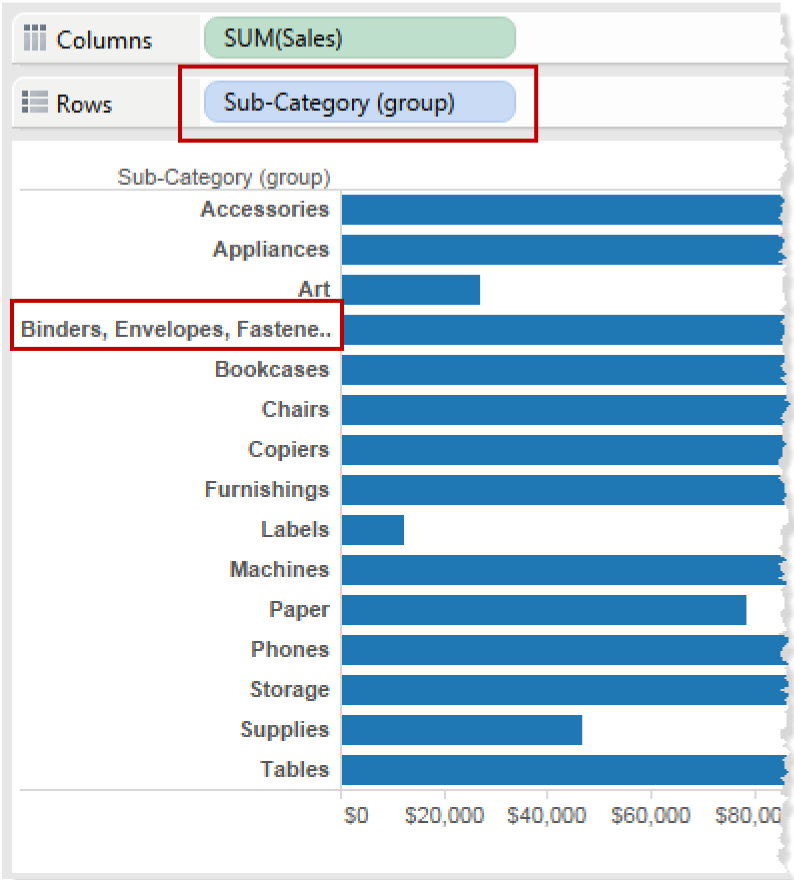
1. Press and hold the **CTRL** or **Shift** key on the keyboard to multi-select headers in the view.

2. Click the **Group** button  on the toolbar.

   Alternatively, you can right-click and select **Group** or click the **Group** icon on the tooltip.



The selected members are combined into a single member. In this example, the view now shows the SUM(Sales) across all binders, envelopes and fasteners as a single mark. A default is automatically constructed using the combined member names.The dimension on the Rows or Columns shelf is replaced with the new grouped field.



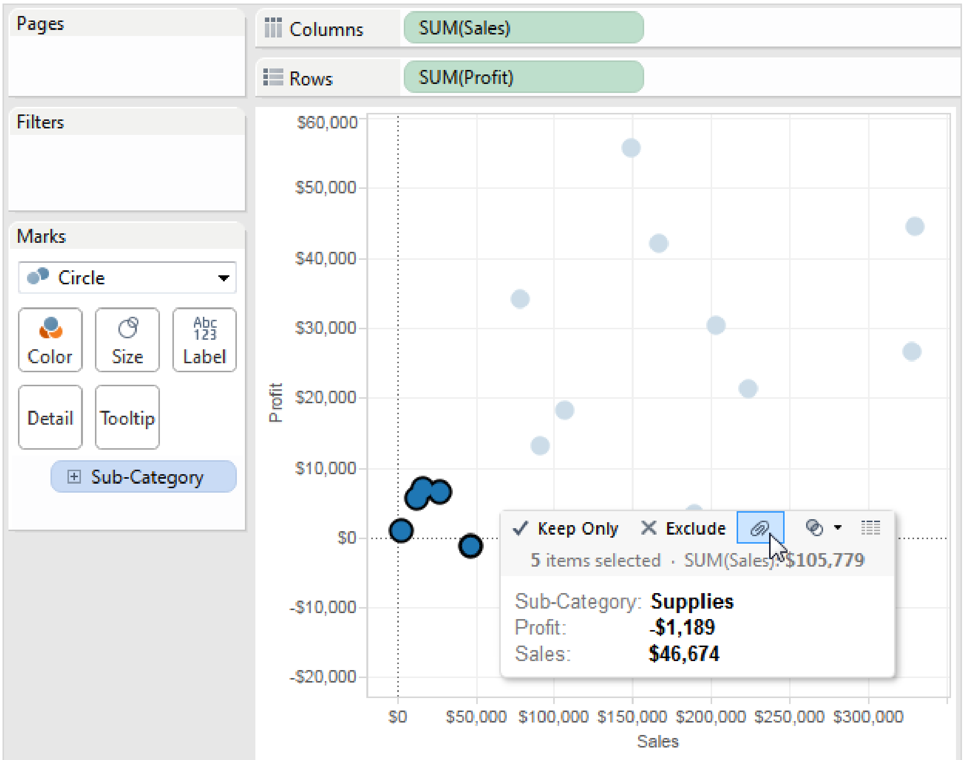
Color a View Using Groups

In addition to correcting data errors and combining dimensions, you can visually identify groups of related marks by selecting marks directly. This technique is especially useful when working with a scatter plot or a view that doesn't have headers that you can select when defining the group.

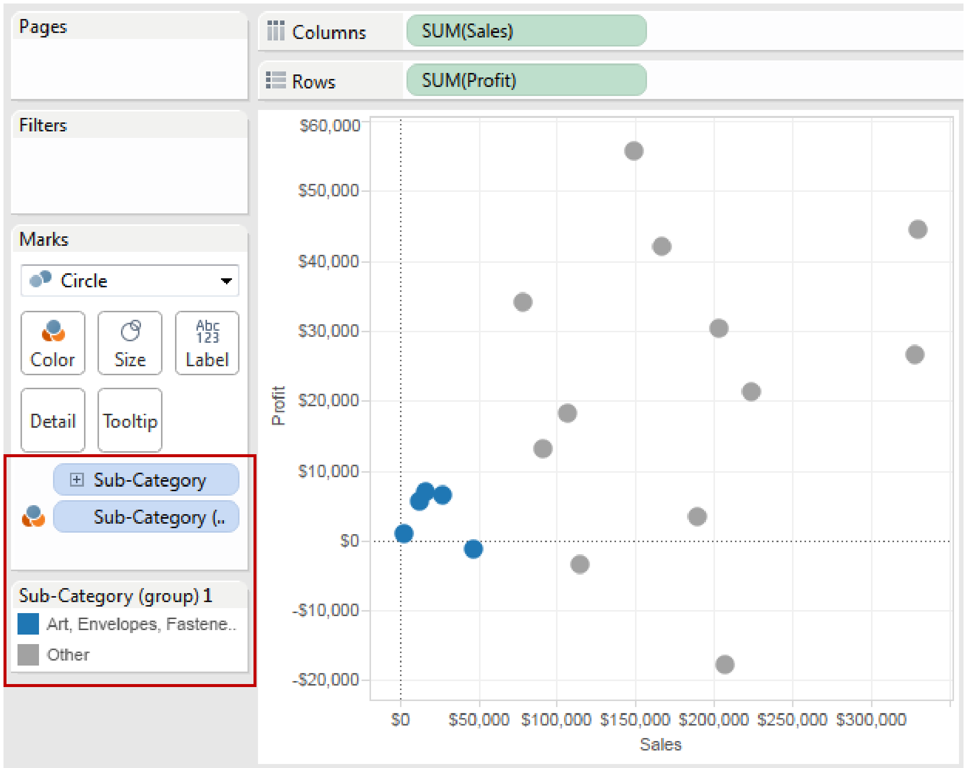
1. Press and hold the **CTRL** or **Shift** key on the keyboard to select one or more marks in the view.

2. Click the **Group** button  on the toolbar.

Alternatively, you can right-click and select **Group** or click the **Group** icon on the tooltip.

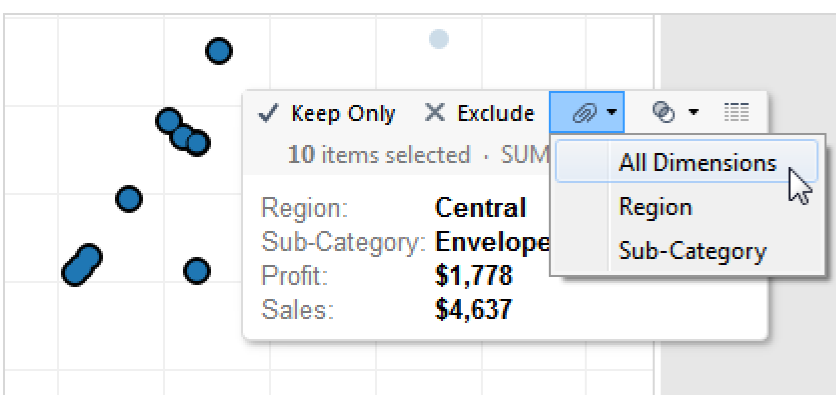


The selected marks are grouped and all other members are combined into an "Other" category. The new group field is automatically added to Color. For more information about grouping fields using Other, see **Including an Other Group** on page 746



Note: If there were already fields on **Color**, they are moved to **Detail** and replaced with the group field.

When you create groups by selecting marks, it's possible that the marks will represent multiple dimensions. For example, you may have a scatter plot that shows the Sales vs. Profit by Region and Category. In this case, a selection of marks will represent members of both the Region and Category dimensions. When the selection represents multiple dimensions, the **Group** menu lets you choose to group on **All Dimensions** or on a particular dimension.

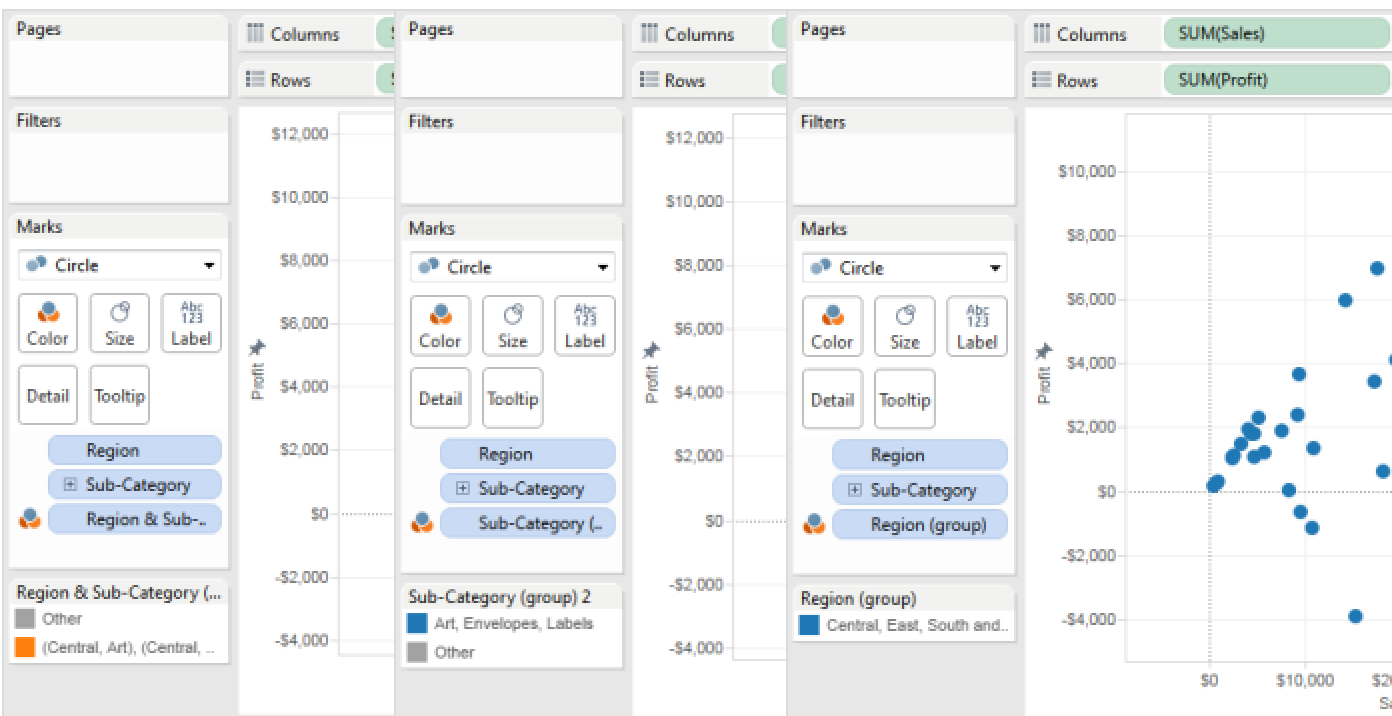


In the example above, the 10 selected marks represent a region and the following sub-category combinations .

- Central, Art
- Central, Envelopes
- Central, Labels
- East, Envelopes
- East, Labels
- South, Art
- South, Envelopes
- South, Labels
- West, Envelopes
- West, Labels

The views below show the results of grouping these measures on All Dimensions, Sub-Category, and Region.

All Dimensions	**Sub-Category**	**Region**

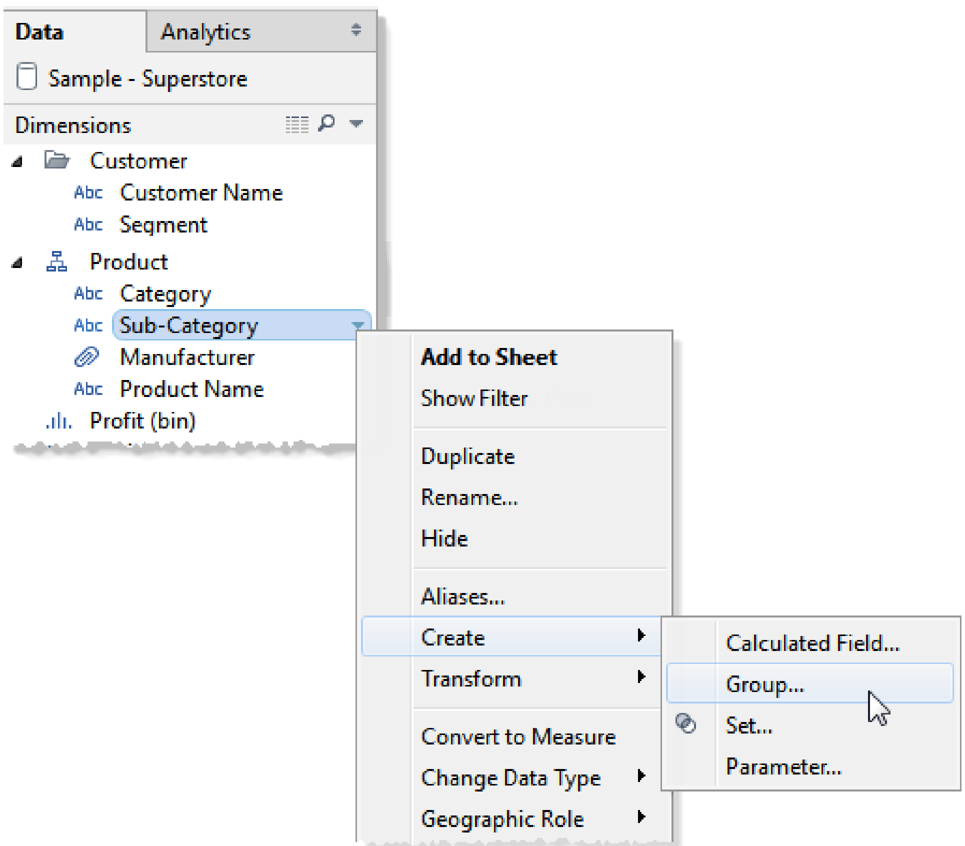


The 10 marks are combined and the rest of the marks are added to an "Other" category.	All marks associated with any of the three sub-categories are combined and everything else is added to an "Other" category.	All marks associated with the four regions are combined and everything else is added to an "Other" category.

Create Groups From a Dimension in the Data Pane

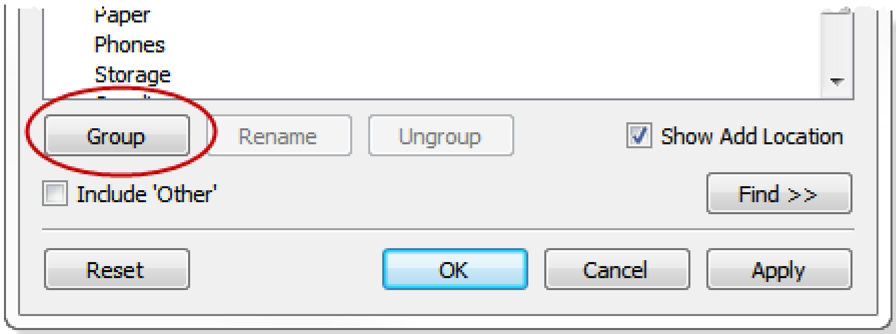
Whenever you create a group, a group field is added to the **Data** pane. When you create a group by selecting headers or marks in the view, the new group field is also added to the view either on the Rows or Columns shelf or to Color on the Marks card. Instead of creating a group by selections in the view, you can create a group directly from a dimension in the **Data** pane.

1. Right-click (control-click on Mac) a dimension in the **Data** pane and select **Create** > **Group**.

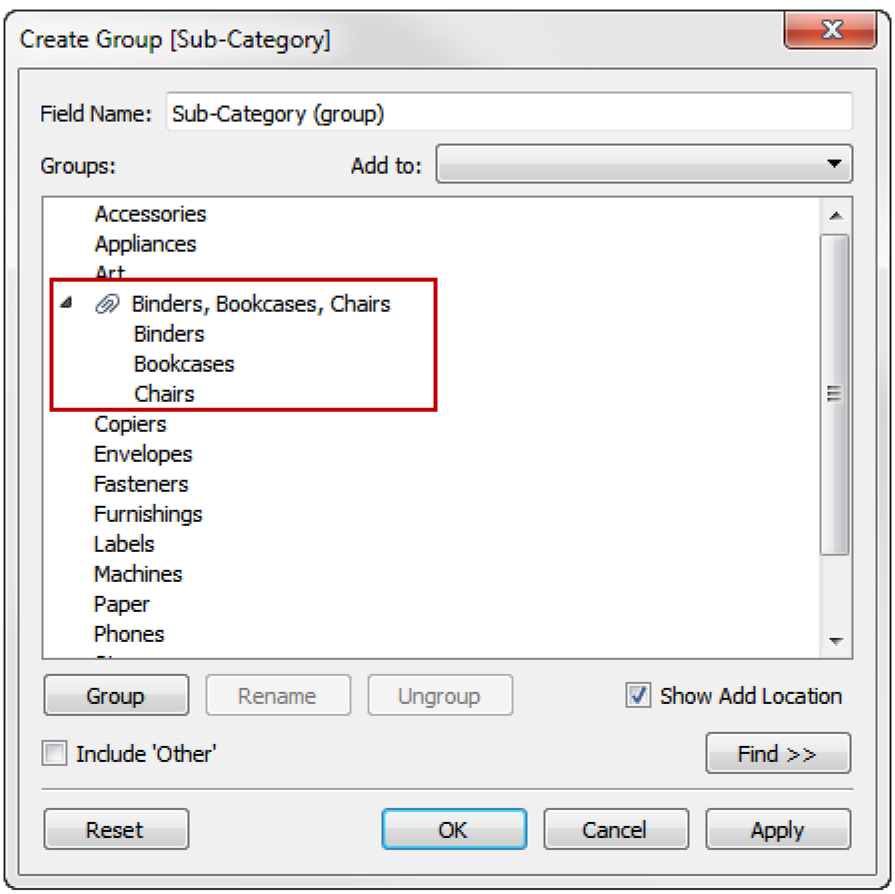


2. In the Create Group dialog box, select several members that you want to group. Press and hold the **CTRL** key on your keyboard to select multiple members.

3. Click the **Group** button at the bottom of the dialog box.



The selected members are combined into a single member. A default name is automatically constructed using the combined member names. Rename the group by selecting it in the list and clicking the **Rename** button at the bottom of the dialog box. You can search for members using the Find options. For more information, see **Finding Members in Group Dialog Box** on page 748.



Note: To add to or remove members from a group, right-click the grouped field in the Data pane and select **Edit Group**. In the Edit Group dialog box you can also change the default name of the group and combine fields into new groups. Refer to **Editing an Existing Group** below to learn more. Alternatively, you can ungroup members by selecting them in the view and clicking the Ungroup button on the toolbar or tooltip.

Editing an Existing Group

After you have created a grouped field, you can add and remove members from the groups, create new groups, change the default group names, and change the name of the grouped field. Some of these changes can be made directly in the view while others require you to open the Edit Group dialog box.

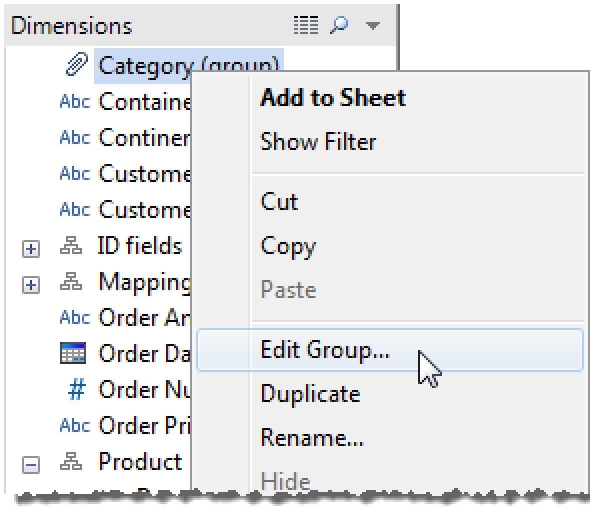
Edit Groups Directly in the View

You can add and remove members from an existing group and create new groups by selecting marks directly in the view. Do one of the following:

- **Add to an Existing Group** - Select one or more marks you want to add to an existing group. Then hold **SHIFT** or **CTRL** on your keyboard to also select at least one member of the group you want to add to. Click the **Group** button on the toolbar or tooltip.
- **Remove from an Existing Group** - Select one or more marks you want to ungroup. Then click the Ungroup button on the toolbar or tooltip. Make sure that the selection only contains members from one group at a time.
- **Create a new group** - Select one or more marks that you want to create a new group with. Then click the Group button on the toolbar or tooltip.

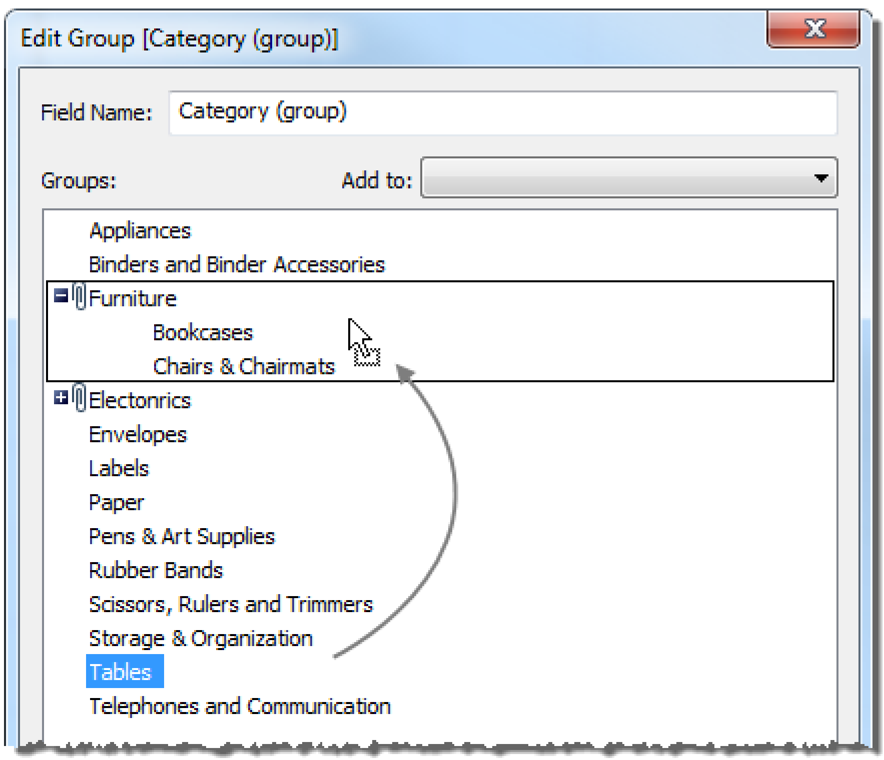
Open the Edit Group Dialog Box

While editing groups directly in the view is useful for rapidly defining ad hoc groups, you can more finely control the members of each group using the Edit Group dialog box. Right-click (control-click on Mac) the grouped field in the Data pane or in the view and select Edit Group.



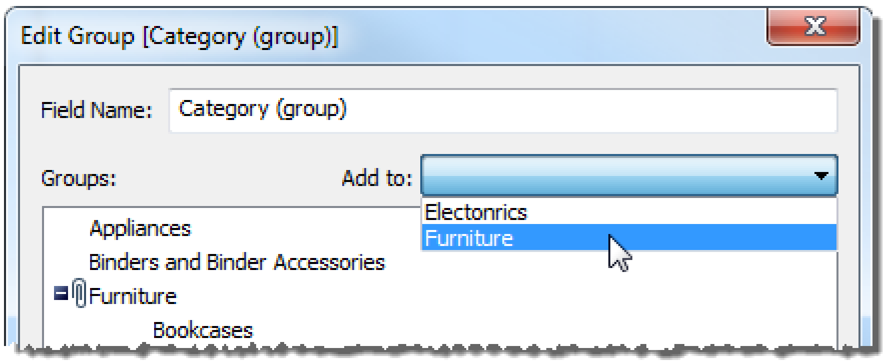
Then do one of the following:

- Select one or more members and drag and drop them into the existing group. This method works best if you are working with a dimension that has few members.



- Select one or more members, right-click (control-click on Mac) and select **Add To**. In the subsequent dialog box, select the group you want to add the selected members to and click **OK**.

- Select one ore more members and select the group in the **Add to** drop down list at the top of the dialog box.

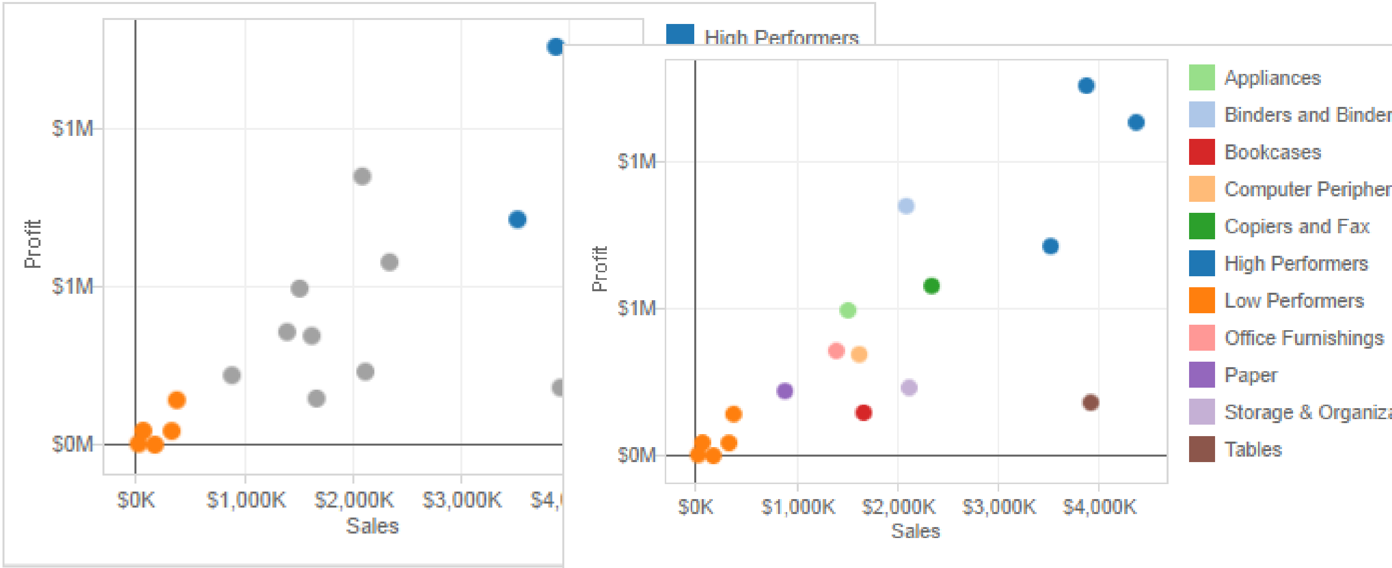


Note: Rename a group by selecting the group in the Edit Group dialog box and then clicking the Rename button.

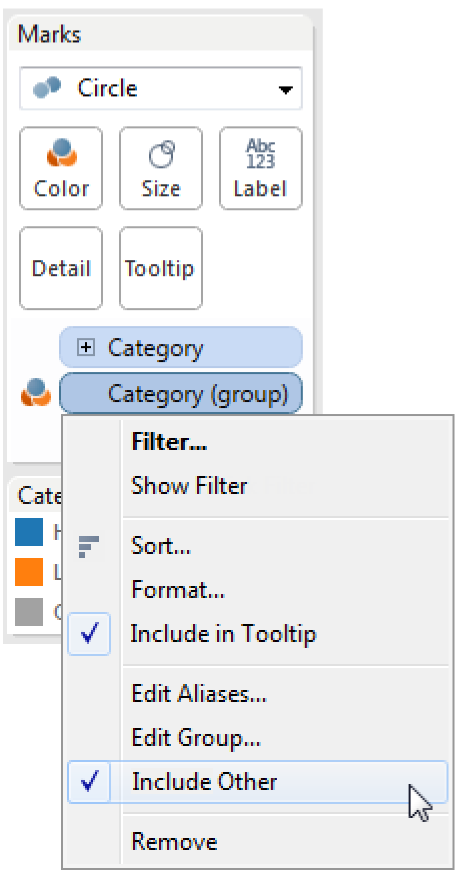
Including an Other Group

When you create groups in Tableau, you have the option to **Include Other**. When you include an other category, the groups you have defined are shown and all other dimension members are combined into an "Other" category. This option is useful for highlighting certain groups or comparing specific groups against everything else. For example, you may have a grouped field that combines product categories based on their sales performance. You may want to highlight High Performers and Low Performers and group all the other categories into an "Other" category.

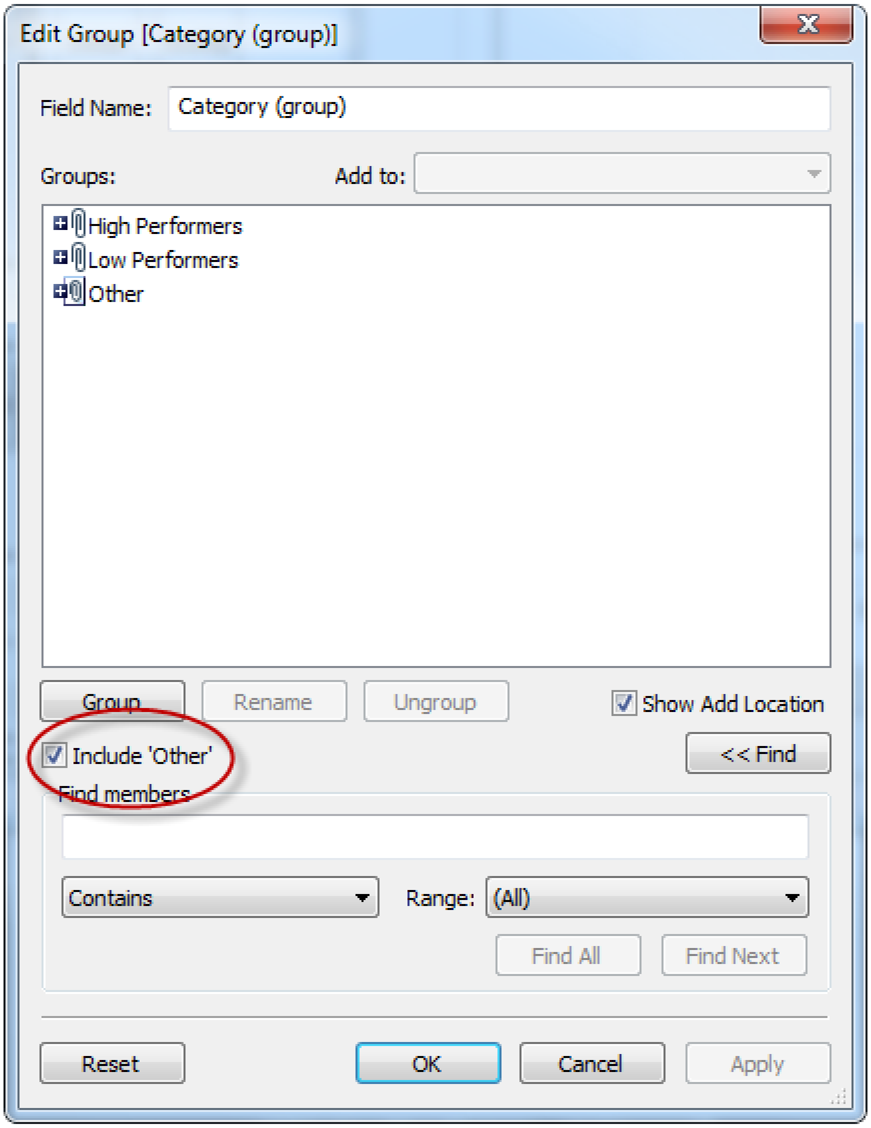
Includes Other	**Does Not Include Other**



Define whether to include the other category by selecting the **Include Other** option on the field menu.



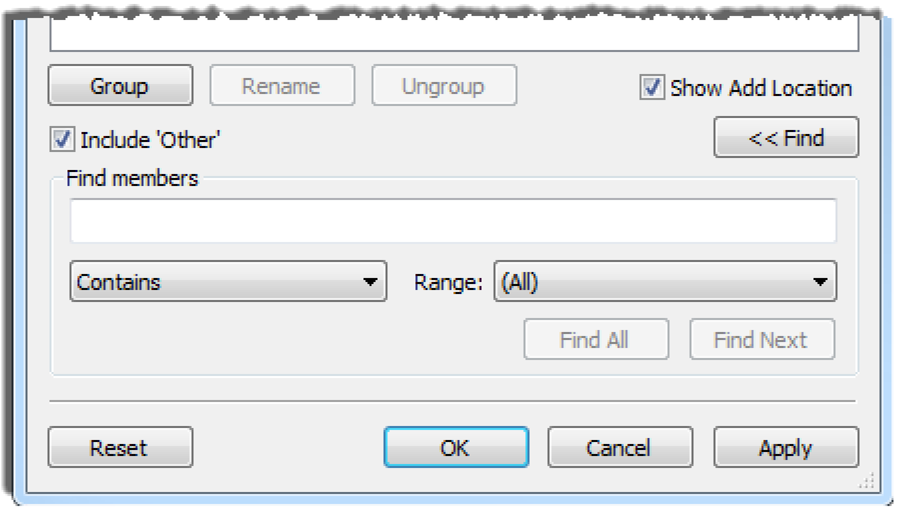
Alternatively, you can right-click (control-click on Mac) the field in the Data pane or on the sheet and select **Edit Group**. Then select the **Include Other** option near the bottom of the Edit Group dialog box.



Finding Members in Group Dialog Box

When you create groups from a large dimension with many members, use the Find option to quickly select the members you are looking for and add them to an existing group.

1. Show the find options by clicking the **Find** button at the bottom of the dialog box.

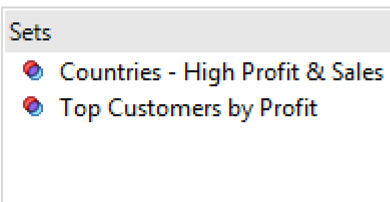


2. Type all or part of the member name into the text box and select an appropriate result criteria from the drop-down menu. You can select whether to find members that start with, contain, or are an exact match to the search term.
3. Select a Range to search in. You can select to search all members, or within specific groups.
4. Click **Find All** to select all the matching members or select **Find Next** to manually navigate through each of the search results.
5. When you have found and selected the members of interest, you can quickly add them to an existing group by selecting the group on the **Add to** drop-down menu at the top of the dialog box.

Sets

Sets are custom fields that define a subset of data based on some conditions. A set can be based on a computed condition, for example, a set may contain customers with sales over a certain threshold. Computed sets update as your data changes. Alternatively, a set can be based on specific data point in your view. You can use sets to compare and ask questions about a subset of data. For example, in a scatter plot showing product sales, you may select the products with the most sales and add them to a set. You may then create another set that contains the products with the highest return rates. With these two sets you can ask questions like "What percent of my total sales is from high returned products?" Or you may go further and compare the two sets to each other to create a new set that contains only high sales products that are also returned frequently.

Tableau displays sets at the bottom of the Data pane and labels them with the set icon .



When you drag a set to the view, you can choose to aggregate the members using In/Out mode or to list all of the individual members of the set. See Using Sets to learn more about these modes.

If you are connected to a multidimensional data source, you may see additional sets that were created in your data source. These sets are also listed in the Sets area of the Data pane but are indicated with the server named set icon . A server named set can be used in the same way as any other sets you create in Tableau.

Sets can be automatically generated as a result of an action. These sets are indicated by the action set icon . See **Actions** on page 768.

Finally, when working with workbooks connected to Tableau Server or Tableau Online, User Filters display in the Sets area of the Data pane using the user filter set icon user . See **User Filtering** on page 1228.

If you are connected to a relational data source, creating a set that is based on a continuous date field will use the exact dates instead.

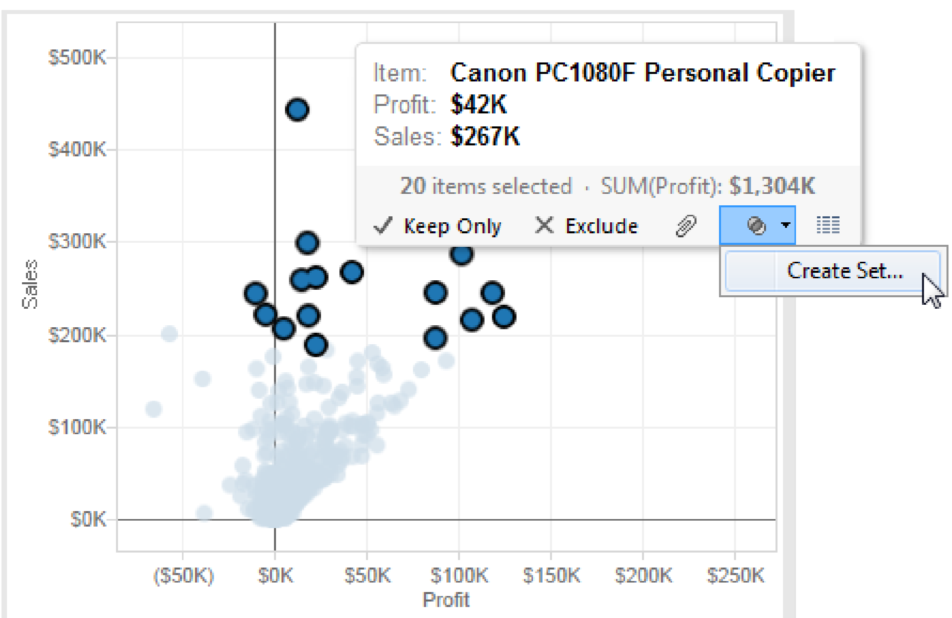
Creating a Set

There are many ways to create and edit sets in Tableau. To create a set, select marks or headers in the view or right-click (control-click on Mac) a field in the **Data** pane. You can also create a set that is based on a filter you've already defined. Regardless of how you create the set, it is either constant or computed. A constant set contains a specified list of members based on one or more dimensions. For example, a constant set might contain the specific names of products that you are keeping an eye on. A computed set is dynamic and the members change as the underlying data changes. For example, a computed set may contain the top 5 products by total sales. As the sales data changes, the companies included in the set will also change.

Constant Sets

The members of a constant set are fixed and do not change. To create a constant set, you need to select the members you want to include. A constant set can be based on a single dimension or multiple dimensions.

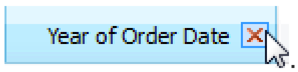
1. Select one or more marks or headers in the view.
2. Right-click (control-click on Mac) and select **Create Set** or click the **Create Set** option on the tooltip.



3. In the Create Set dialog box, type a name for the set.

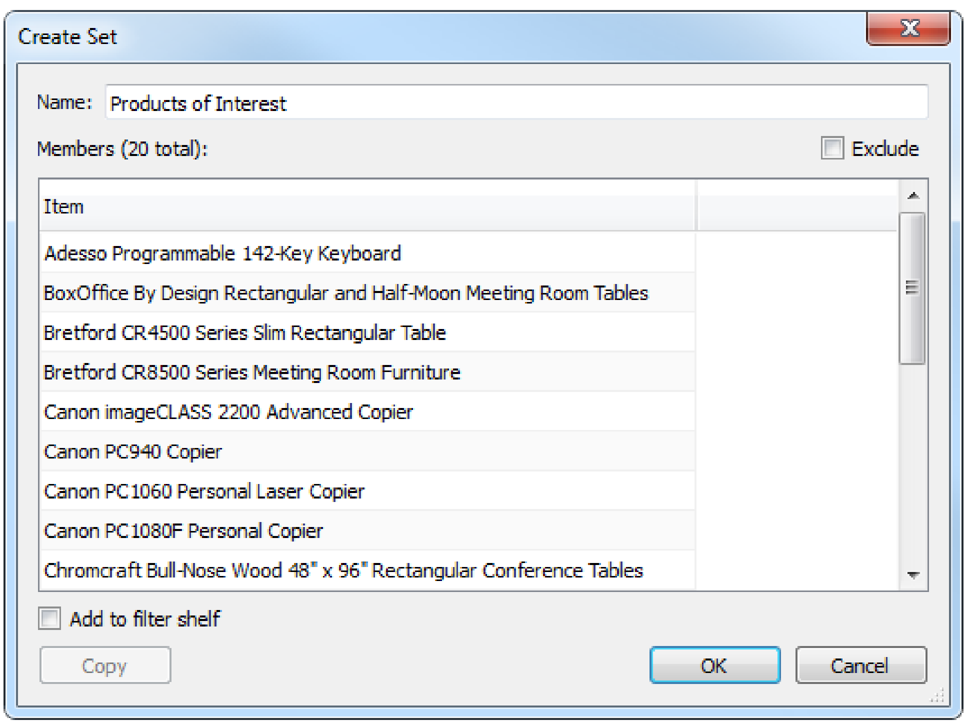
4. Optionally complete any of the following:

   - By default, the set includes the members listed in the dialog box. You can select the option to **Exclude** these members instead. When you exclude, the set will include all of the members you didn't select.
   - Remove any dimensions that you don't want to be considered by clicking the red "x" icon that displays when you hover over a column heading

     .

   - Remove any specific rows that you don't want to include in the set by clicking the red "x" icon that displays when you hover over the row .
   - If the marks you selected represent multiple dimensions, each member of the set will be a combination of those dimensions. You can specify the character that separates the dimension values.
   - Select **Add to Filters shelf** to automatically move the set to the Filters shelf once it is created.

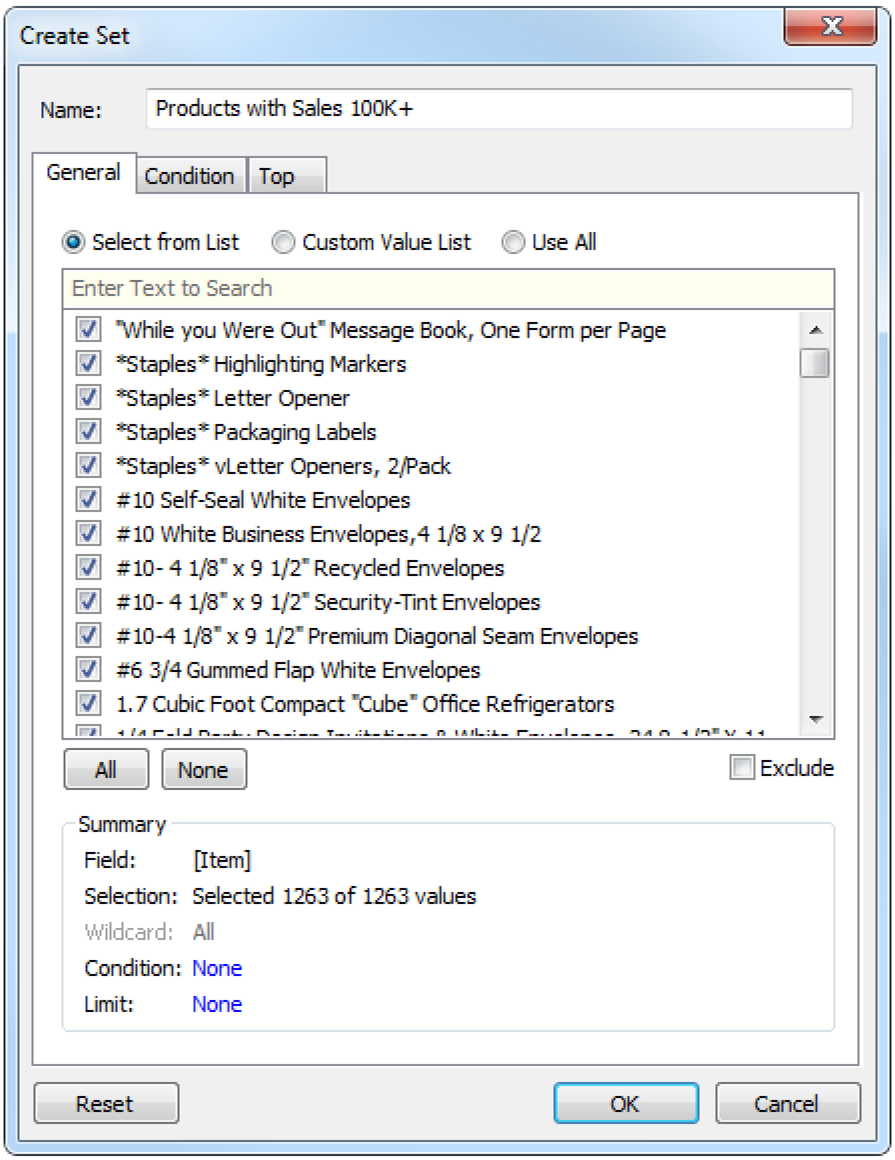


5. When finished, click **OK**.

Computed Sets

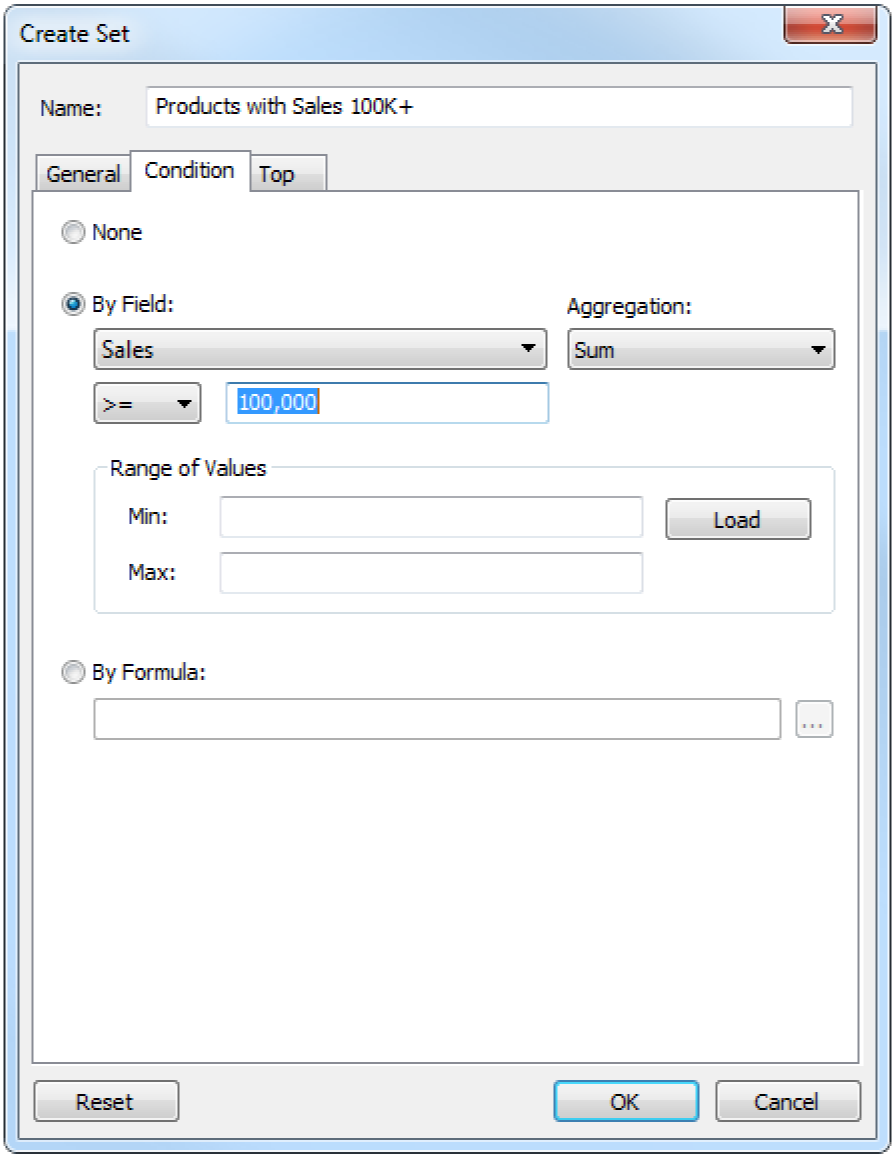
The members of a computed set are dynamic and change when the underlying data changes. Computed sets can only be based on a single dimension.

1. Right-click (control-click on Mac) dimension in the Data pane.
2. Select **Create Set**.
3. In the Create Set dialog box, type a name for the set.
4. On the General tab in the Create Set dialog box, select one or more values that will be considered when computing the set. You can alternatively select the **Use All** option to always consider all members even when new members are added or removed.



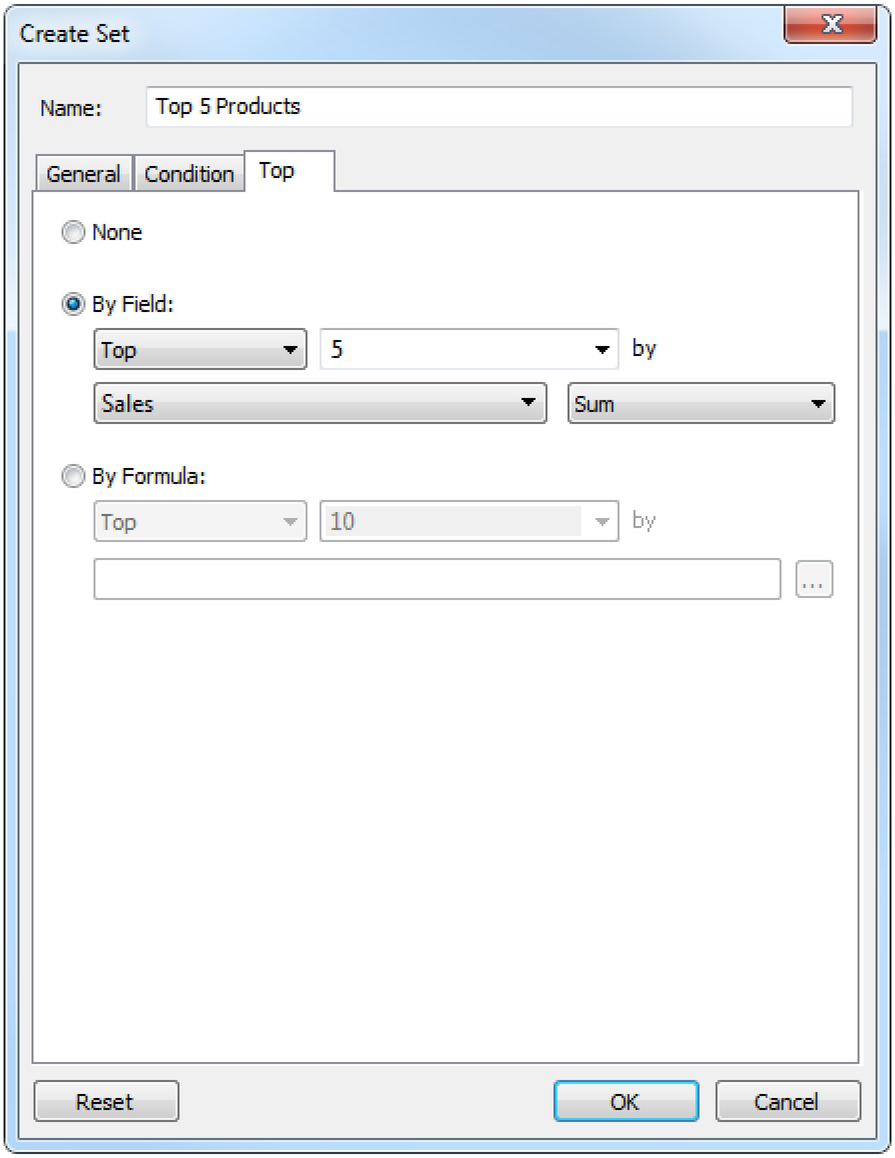
5. Define how to compute the members by adding conditions and limits:

- **Condition**: Use the Condition tab to define rules that determine what members to include in the set. For example, you may specify a condition that is based on the total sales that only includes products with sales over $100,000.



Set conditions work the same as filter conditions. See **Adding Conditions to Filters** on page 617 to learn more.

- **Top**: Use the Top tab to define limits on what members to include in the set. For example, you may specify a limit that is based on total sales that only includes the top 5 products based on their sales.



Set limits work the same as Filter limits. See **Adding Limits to Filters** on page 619 to learn more.

6. When finished, click **OK**.

Using Sets

After you create a set, it displays at the bottom of the Data pane in the Sets area. You can then drag sets into the view like any other field. For example, you can drag the set to the Filter shelf to quickly filter the view to only show the members of the set. Alternatively, you can drag the set to the Marks card or the Rows and Columns shelves. When you drag a set to the view, you can choose to show the members of the set or aggregate the members into In/Out categories.

Show In/Out of Set

In most cases, when you drag a set to the view, Tableau displays the set using the In/Out mode. This mode separates the set into two categories: In, which contains the members in the set; and Out, which contains any members that are not part of the set. For example, in a set defined as the top 25 customers, the top customers would be part of the In category and all other customers would be part of the Out category. Using the In/Out mode makes it easy to compare the members in the set to everything else. You can use this mode to answer questions like "What percent of my total revenue comes from members of this set?"

Switch a set to use In/Out mode by selecting **Show In/Out of Set** on the field menu.

When a set is in In/Out mode, the field on the shelf is prefaced by the text, "IN/OUT" followed by the set name.

> **Note:**In/Out mode is not available in workbooks created before version 8.2 that use Microsoft Excel or text file data sources, workbooks that use the legacy connection, or workbooks that use Microsoft Access data sources.

Show Members in Set

As an alternative to showing the set using In/Out mode, you can list the members in the set. Showing the members in the set automatically adds a filter to the view that includes only the members of the set.

Switch a set to list the individual members by selecting **Show Members in Set** on the field menu.

> **Note:** To display the fully qualified member names for cubes, right-click the set in the Data pane and select **Qualify Member Names**.

Combining Sets

You can combine two sets to compare the members. When you combine sets you create a new set containing either the combination of all members, just the members that exist in both, or members that exist in one set but not the other. Combining sets allows you to answer complex questions to understand cohorts of data. For example, to determine the percentage of customers who purchased both last year and this year, you can combine two sets containing the customers from each year and return only the customers that exist in both sets. Another example would be to determine what products sell the most but also have the highest return rate.

To combine two sets, they must be based on the same dimensions. That is, you can combine a set containing the top customers with another set containing the customers that purchased last year. However, you cannot combine the top customers set with a top products set. In the latter case, the one set is based on the Customer dimension while the other is based on the Product dimension.

1. Select two sets in the Data pane that you want to combine.
2. Right-click (control-click on Mac) the sets and select **Create Combined Set**.
3. In the Create Set dialog box, type a name for the new combined set.
4. Verify that the two sets you want to combine are selected in the two drop-down menus.
5. Select one of the following options for how to combine the sets:
    - **All Members in Both Sets** - the combined set will contain all of the members from both sets.
    - **Shared Members in Both Sets** - the combined set will only contain members that exist in both sets.
    - **Except Shared Members** - the combined set will contain all members from the specified set that don't exist in the second set. These options are equivalent to subtracting one set from another. For example, if the first set contains Apples, Oranges, and Pears and the second set contains Pears and Nuts; combining the first set except the shared members would contain just Apples and Oranges. Pears is removed because it exists in the second set.
6. Optionally specify a character that will separate the members if the sets represent multiple dimensions.
7. When finished, click **OK**.

Note: This functionality is not available in workbooks created before version 8.2 that use Microsoft Excel or text file data sources, workbooks that use the legacy connection, or workbooks that use Microsoft Access data sources.

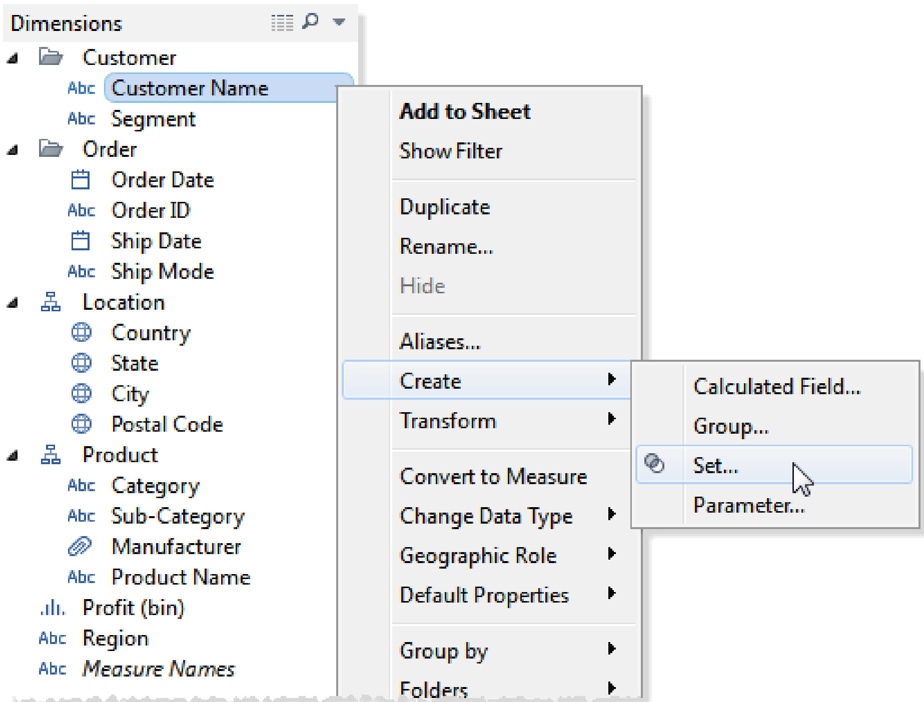
Examples of Sets

There are many ways you can use sets to answer complex questions and compare cohorts of data. Below are some examples of ways you can use sets to define and compare subsets of data.

How do members of a set contribute to the total?

You may have all kinds of questions surrounding how the members in a set contribute to the overall total. For example, what percent of total sales come from repeat customers? You can answer these types of questions using the IN/OUT mode for set. The example below uses sales data to calculate the percent of total sales from customers who have purchased at least 20 times.

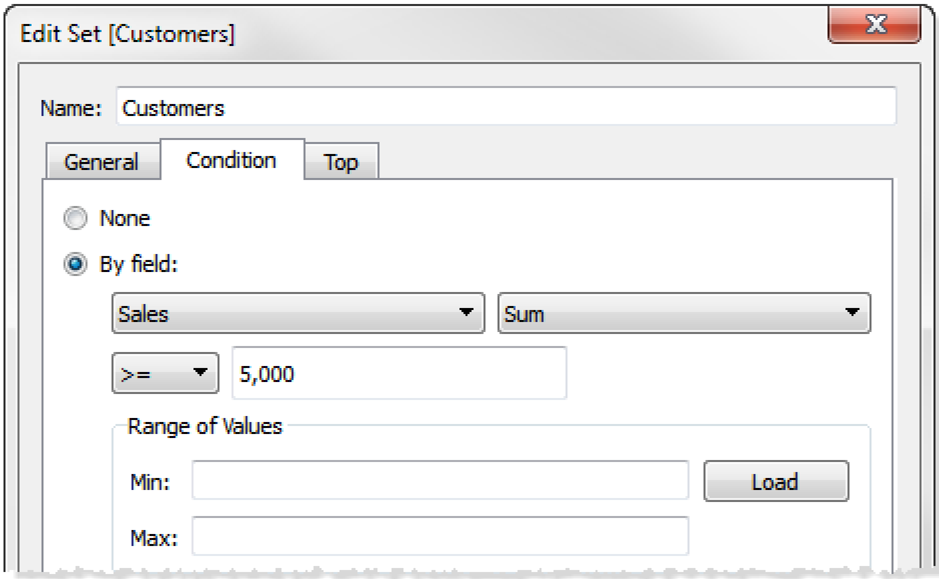
1. Right-click (control-click on Mac) the **Customer Name** dimension in the Data pane and select **Create** > **Set**.



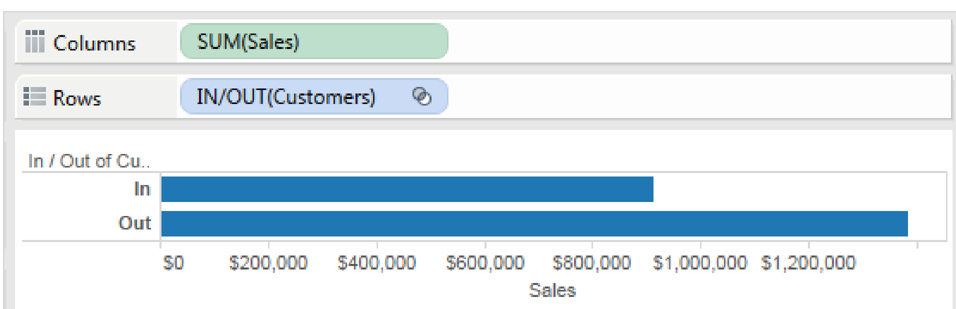
2. In the Create Set dialog box, type a name for the set. In this example, we'll call the set, "Customers"

3. Select the **Use All** option so the condition always applies to all values even when new customers are added.

4. On the Condition tab, click **By Field**, and then define a condition that only includes customers when **Sum** of **Sales** is greater than or equal to **5,000**.

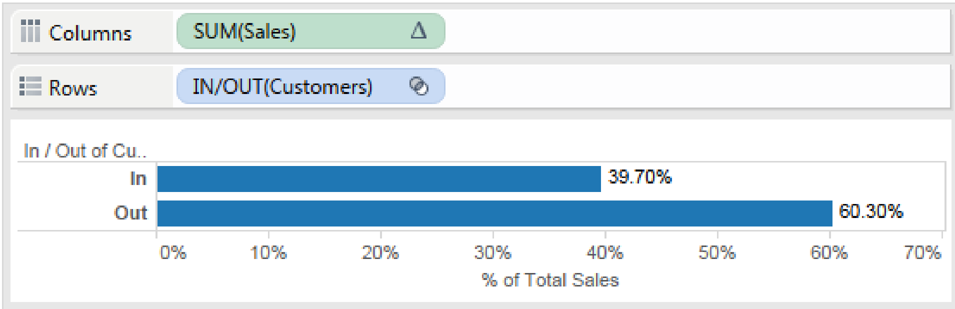


5. When finished, click **OK**.
6. Drag the new set from the **Sets** area at the bottom of the **Data** pane to the **Rows** shelf.
7. From Measures, drag **Sales** to the **Columns** shelf. The view now shows the total sales for customers who have purchased more than $5,000 dollars of product and the total sales for all other customers.



8. Finally, on the field menu for **Sales**, select **Quick Table Calculation** > **Percent of Total**.

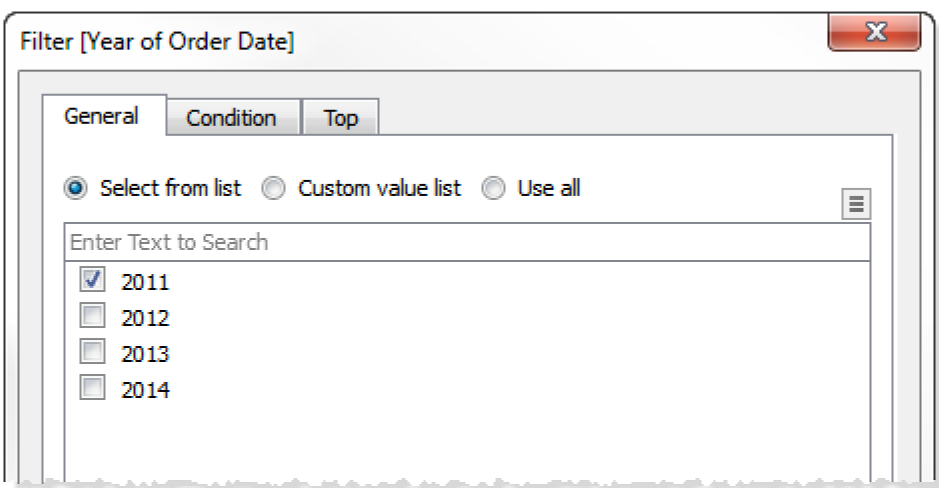
The view now shows that customers with sales greater than or equal to 5,000 make up about 39% of the overall sales.



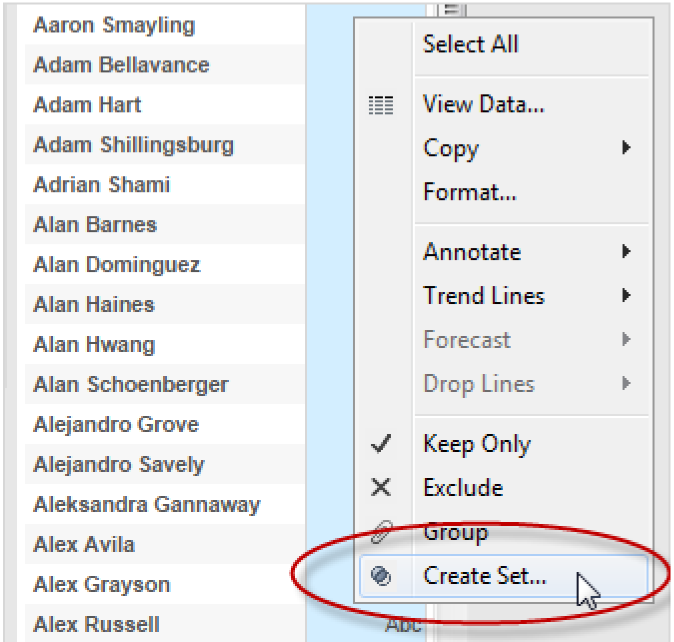
How many members of a set exist in another set?

Another common use of sets is to compare subsets of data or cohorts. For example, you may wonder how many customers that purchased last year also purchased this year. Or if a customer purchased a specific product, what other products did they buy? You can answer these types of questions by creating multiple sets and combining them. The example below uses sales data to determine how many customers that purchased in 2010 also purchased in 2011.

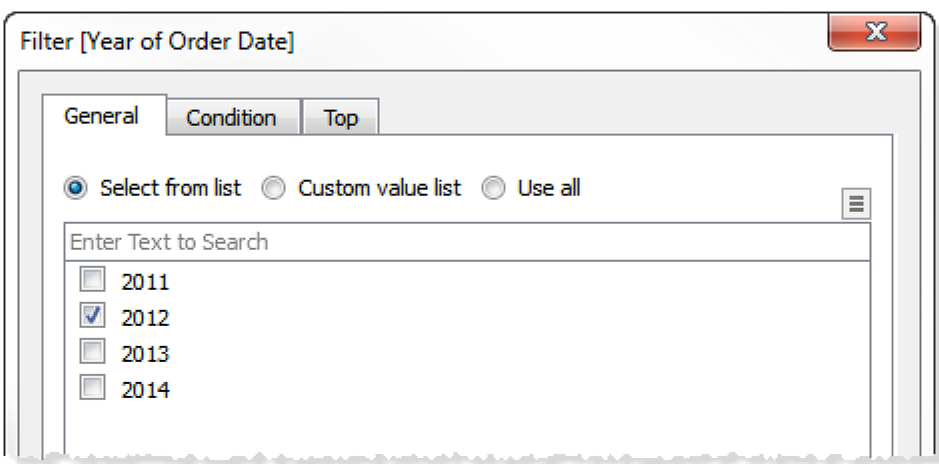
1. Drag the **Customer Name** field to the Rows shelf.
2. Drag the **Order Date** field to the Filters shelf.
3. In the Filter Field dialog box, select **Years** and click **Next**.
4. In the Filter dialog box, select **2011** and click **OK**.



5. Back in the view, press CTRL + A on your keyboard to select all of the customers.
6. Right-click (control-click on Mac) the selection and select **Create Set**.



7. In the Create Set dialog box that opens, type a name for the set. In this example, we'll call the set "Customers (2011)".
8. When finished, click **OK**.
9. Right-click (control-click on Mac) **Order Date** on the **Filters** shelf and select **Edit Filter**.
10. In the Filter dialog box, change the filter to only include **2012** instead of **2011**, and then click **OK**.



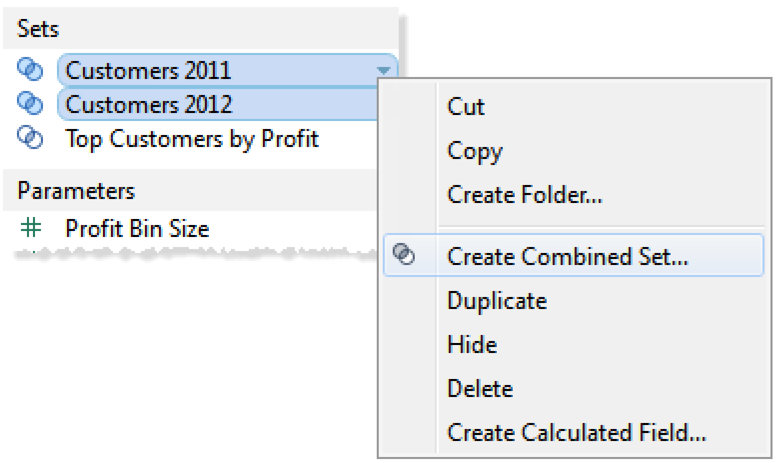
11. Again, press CTRL + A on your keyboard to select all of the customers.
12. In the view, right-click (control-click on Mac) the selection and select **Create Set**.

13. In the Create set dialog box that opens, type a name for the set. This set will be called "Customers (2012)".

14. When finished, click **OK**.

15. In the **Data** pane, select both the **Customers 2011** and **Customers 2012** by holding the Ctrl key on your keyboard as you select.

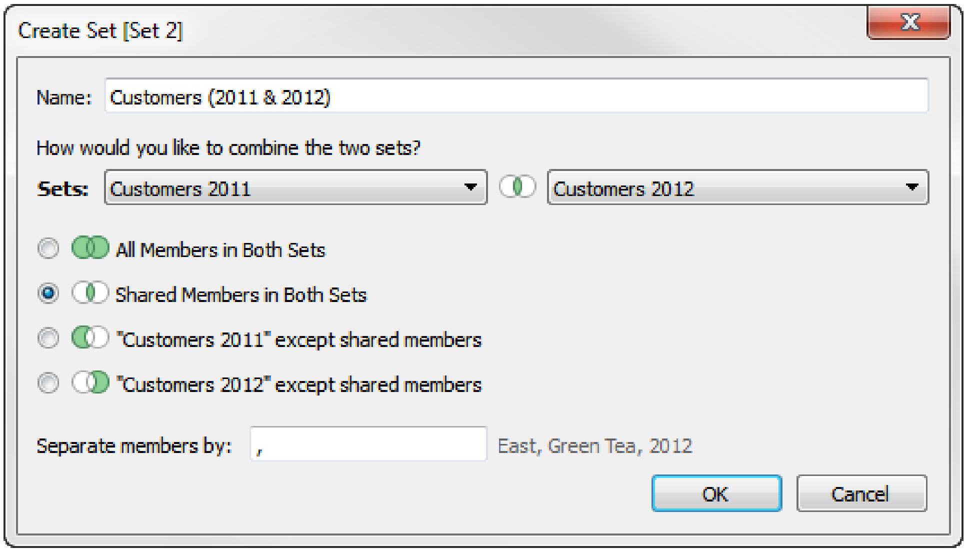
16. Right-click (control-click on Mac) the selection and select **Create Combined Set**.



17. In the Create Set dialog box, type a name for the new set. In this example, we'll call the set "Customers (2011 & 2012)".

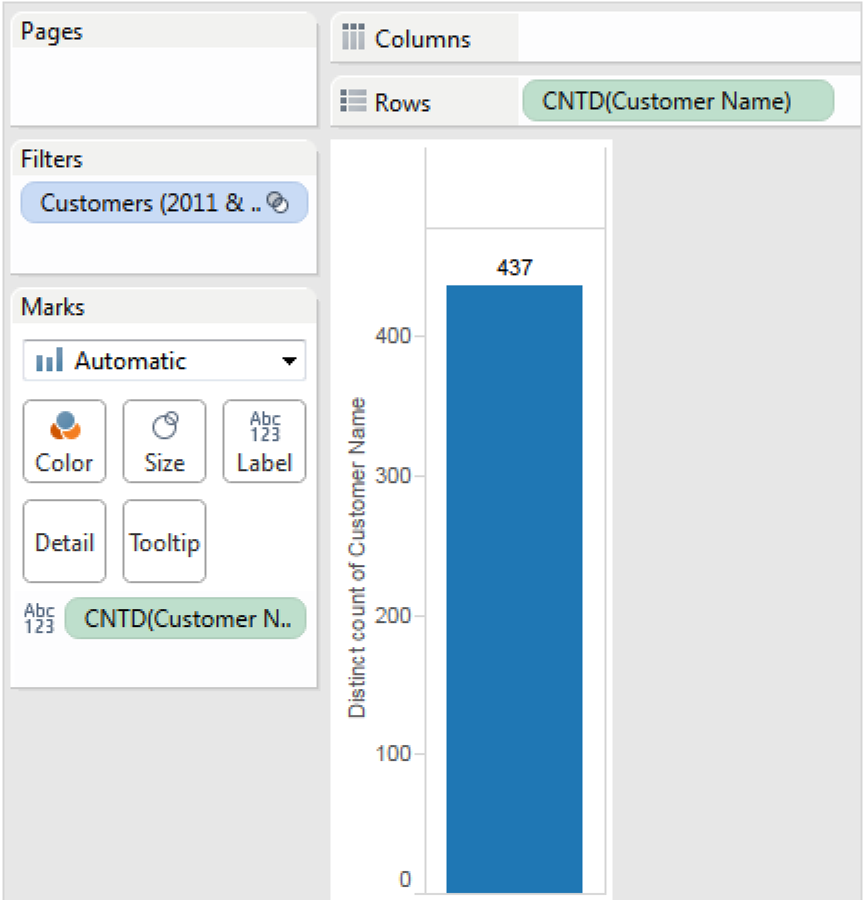
18. Make sure the correct two sets are selected in the drop-down menus.

19. Select the option to include **Shared Members in Both Sets**.



20. When finished, click **OK**.
21. At the bottom of the workbook, click the New Worksheet tab.

22. In the new worksheet, drag the **Customer Name** dimension to the **Rows** shelf.
23. Click the Customer Name field menu and select **Measure** > **Count (Distinct)**.
24. Finally, from the **Sets** area of the **Data** pane, drag the **Customers (2011 & 2012)** field to the **Filters** shelf. You can see that 437 customers purchased products in both 2011 and 2012.

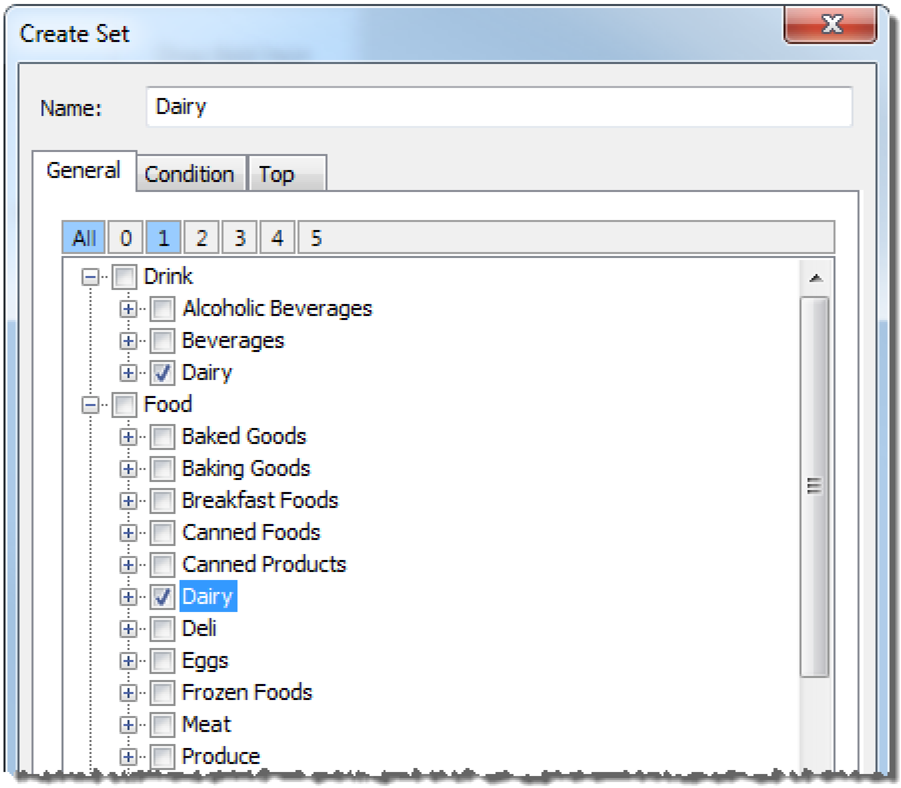


Hierarchical Sets and Descendants

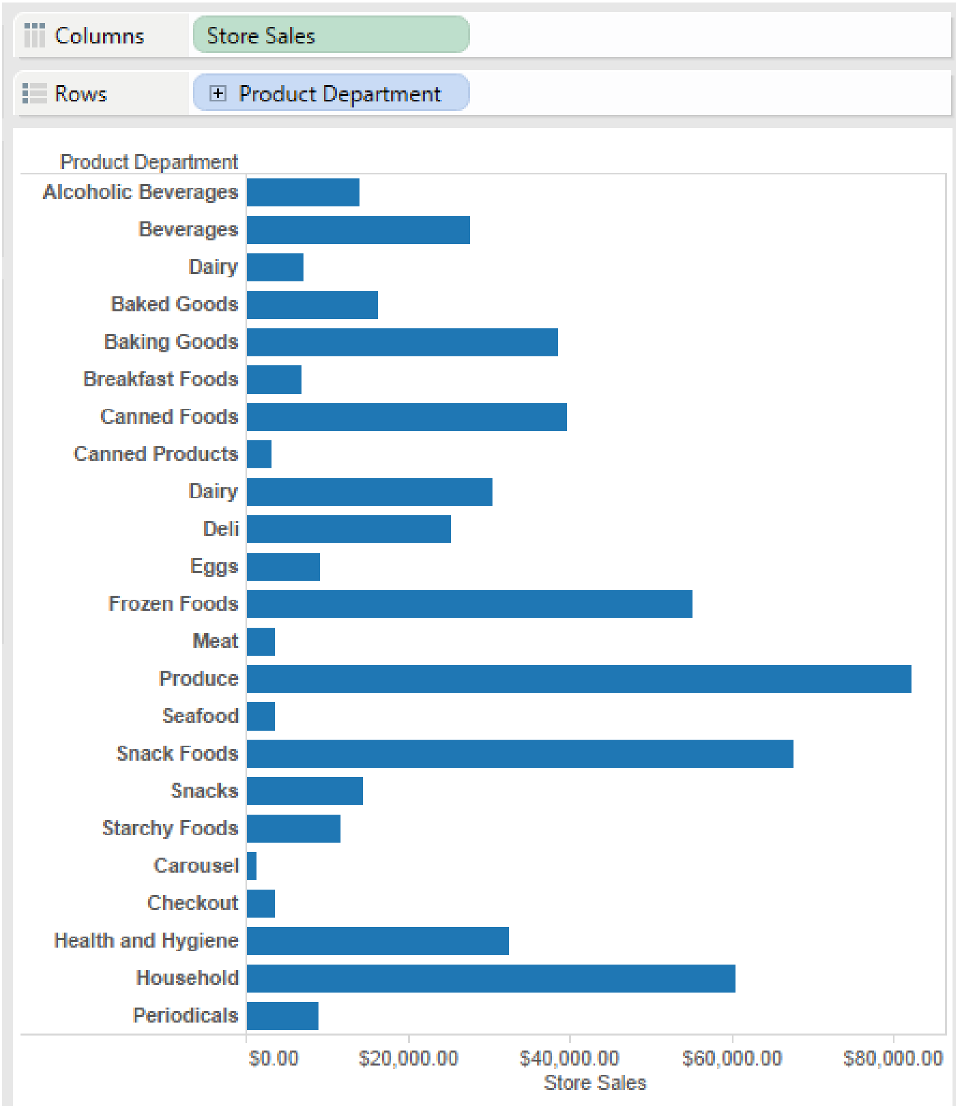
A hierarchical set filters data to the selected members and all of their descendants. They are unique to multidimensional (cube) data sources and are defined within the data source prior to connecting to Tableau Desktop.

When you create sets in Tableau from a cube data source, descendants and any hierarchical structures are automatically included with the selected members.

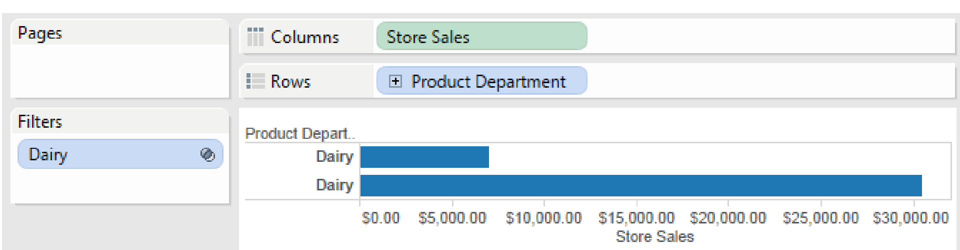
For example, a set named **Dairy** is created from the **Product** hierarchy. As shown below, it includes only the Dairy product department.



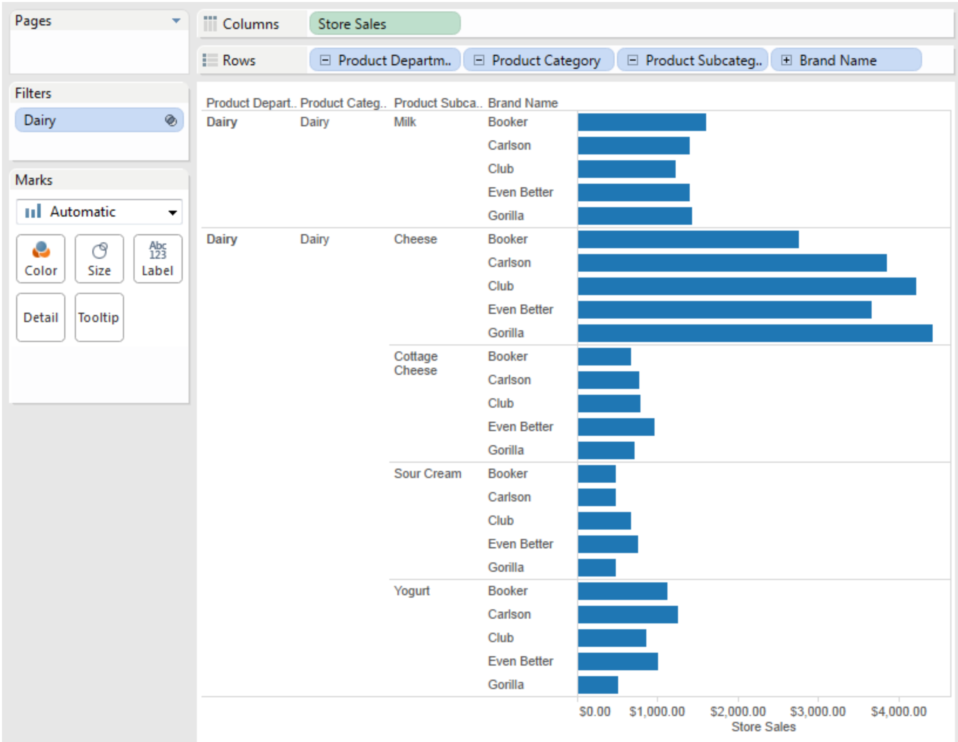
Consider the following view. The **Product Category** dimension is placed on the **Rows** shelf and the **Store Sales** measure is placed on the **Columns** shelf.



If you place the **Dairy** set on the **Filters** shelf, you can see that the view is filtered to include only the Dairy product categories.



As shown below, you can drill down into **Product Department** to reveal the **Product Category**, **Product Subcategory**, and **Brand Name** levels. As these descendants are revealed, row headers are added to the view. This is because a set filter allows you to view the levels of detail contained within the filtered members.



Actions

Tableau allows you to add context and interactivity to your data using actions. Link to web pages, files, and other Tableau worksheets directly from your analytical results. Use the data in one view to filter data in another as you create guided analytical stories. Finally, call attention to specific results using highlighting.

For example, in a dashboard showing home sales by neighborhood you could use actions to help you quickly see relevant information for a selected neighborhood. Select a neighborhood in one view which then highlights the related houses in a map view, filters a list of the houses sold, and opens a web page showing census data for the neighborhood.

> **Note:** Actions behave differently in workbooks that use cube data sources. Cube data sources do not accept actions from relational or other cube data sources. For example, suppose you have a workbook that contains a view that uses a MySQL data source, a second view that uses a cube data source A, and a third view that uses a cube data source B. Actions in a view that use the MySQL data source will not affect the views that use the cube data sources. However, actions in the view that use the cube A data source can affect the view that uses the MySQL data source. The view that uses the cube B data source will not be affected in this case.

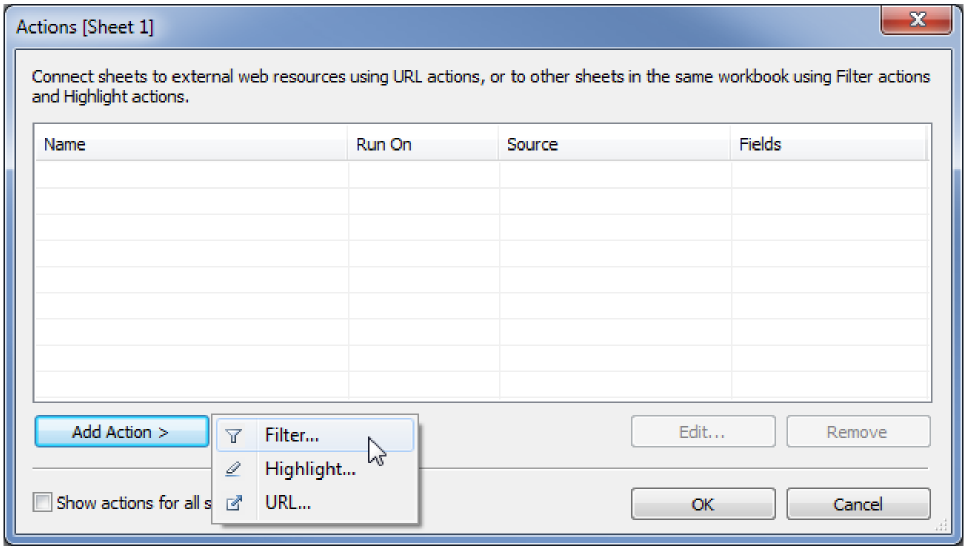
There are three kinds of actions in Tableau: Filter, Highlight, and URL actions.

Filter Actions

Filter actions are a way to send information between worksheets. Typically a filter action is used to send information from a selected mark to another sheet showing related information. For example, when looking at a view showing the sales price of houses, you may want to be able to select a particular house and show all comparable houses in a different view. You could define a filter action to accomplish this task. First you need to decide what comparable means. In this case, say that comparable houses are houses with a similar sale price and square footage. A filter action to show comparable houses can be defined by selecting a destination worksheet and defining filters on sales price and square footage.

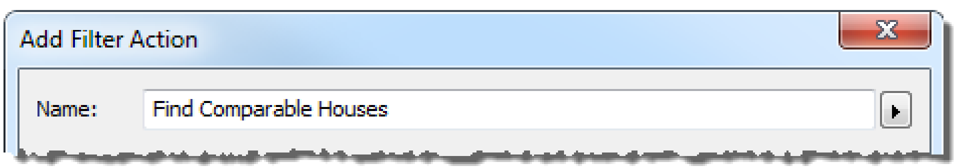
Filter actions work by sending the data values of the relevant source fields as filters to the destination sheet. If you launch the filter action described in this example from a house that sold for $450,000, the destination sheet will have a filter to only show houses that sold for the same amount.

1. On a worksheet, select **Worksheet** > **Actions**. From a dashboard, select **Dashboard** > **Actions**.
2. In the Actions dialog box, click **Add Action** and then select **Filter**.

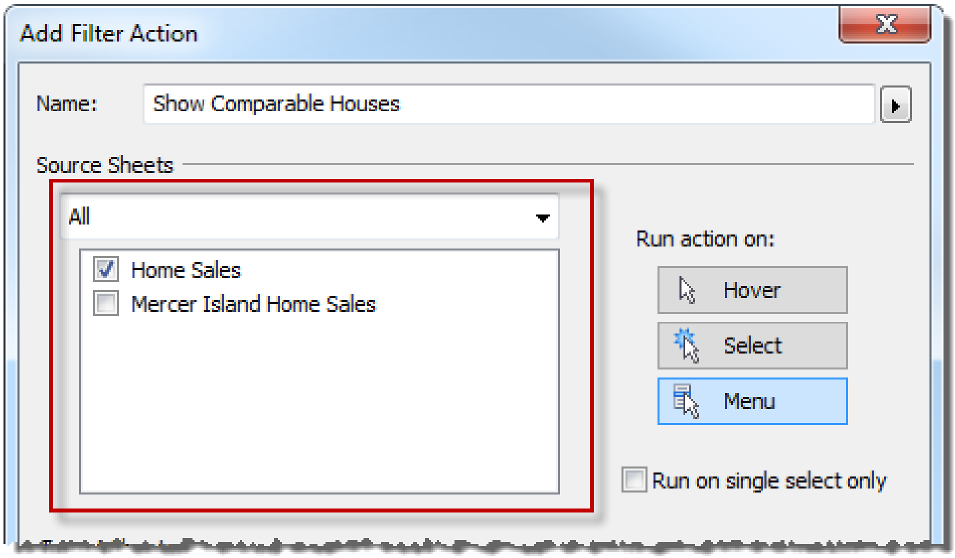


3. In the subsequent dialog box specify a name for the Action.

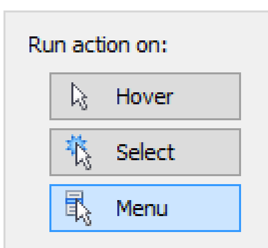
   Use a name that defines the action. If you choose to run the action using the menu the name is the option that shows on the menu. For example, when sending housing information from one sheet to a map, the name could be “Map all comparable houses sold in February” You can use variables in the name that will be filled in based on the values of the selected field.



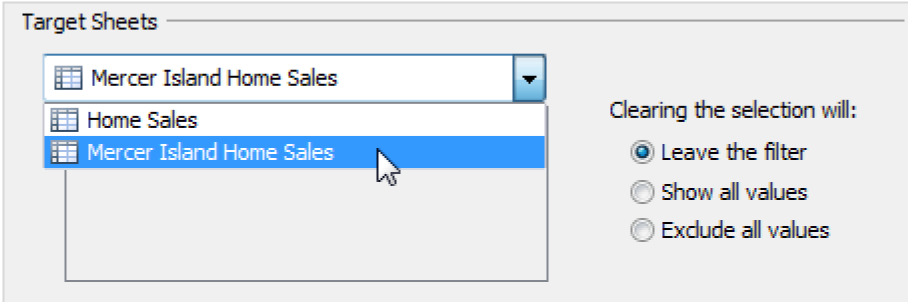
4. Use the drop-down list to select a source sheet or data source. When you select a data source or dashboard sheet you can further refine by selecting the individual sheets you want to launch the action from.



5. Then select how you want to launch the action. Select one of the following options:
   - **Hover** - rest the pointer over a mark in the view to run the action. This option works well for highlight and filter actions within a dashboard.
   - **Select** - click on a mark in the view to run the action. This option works well for all types of actions.
   - **Menu** -right-click (control-click on Mac) a selected mark in the view and then select an option on a the context menu. This option works well for filter and URL actions.



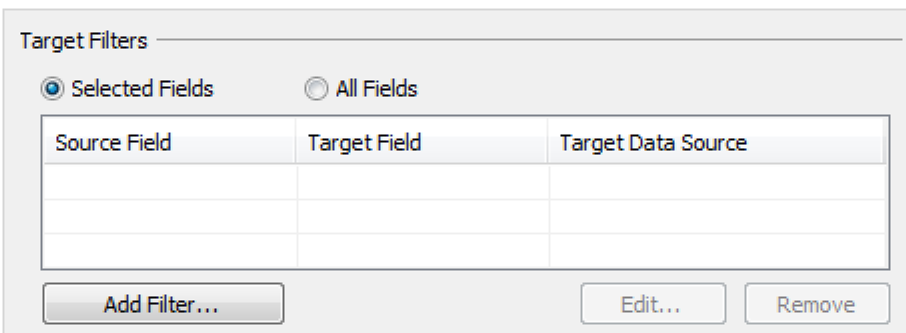
6. Use the second drop-down list to select a target sheet. When you select a dashboard sheet you can further refine the target by selecting one or more sheets within the dashboard.



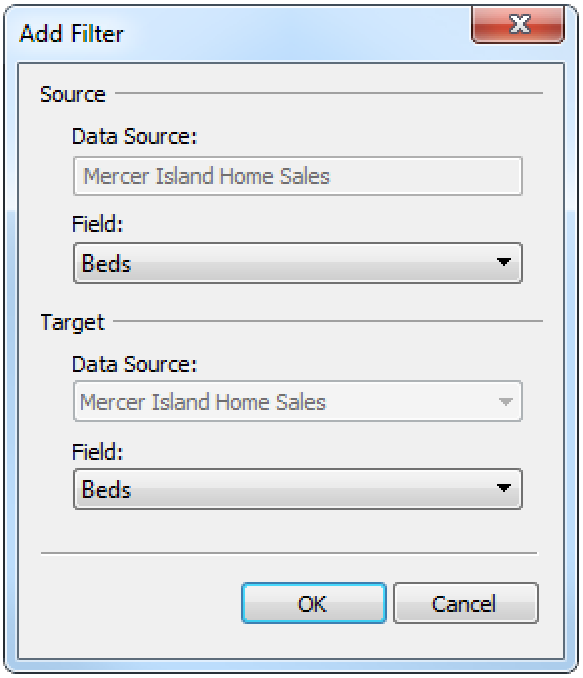
7. Specify what to do when the select is cleared in the view. You can select from the following options:

   - **Leave the filter** - leaves the filter on the target sheets. The target views in the dashboard will show the filtered results.
   - **Show all values** - changes the filter to include all values.
   - **Exclude all values** - changes the filter to exclude all values. This option is useful when you are building dashboards that only show some sheets if a value in another sheet is selected.

8. Setup one or more filters to specify the data that you want to show on the target sheets. You can filter on **All Fields** or define filters on **Selected Fields**.
9. If you are defining filters for specific fields click **Add Filter**.



10. In the Add Filter dialog box, select a source and target data sources and fields. When you run the action from a specific mark on the source sheet, a filter is added to the target sheet that only includes values for the target field that match the values of the source field. In the comparable houses sheet link example, the Source Field is Beds and the Target Field is Beds. That means when you launch the sheet link for a house that has three bedrooms, the destination worksheet will only show houses that also have three bedrooms.



11. When finished, click **OK** three times to close all open dialog boxes and return to the view.

If you are connected to a relational data source, you can add sheet links across data sources even if the field names are not exactly the same. One data source may have a field titled Latitude while another has a Lat field. Using the drop down lists in this dialog box, you can associate the Latitude field to the Lat field. When using a multidimensional data source, the destination sheet must use the same data source as the source sheet. Moreover, the source field names must match the destination field names. In Tableau, multidimensional data sources are supported only in Windows.

The fields available in the Target Field drop-down list are dependent on what you selected as the Source Field. Only fields with the same data type as the source field can be selected as a destination field.

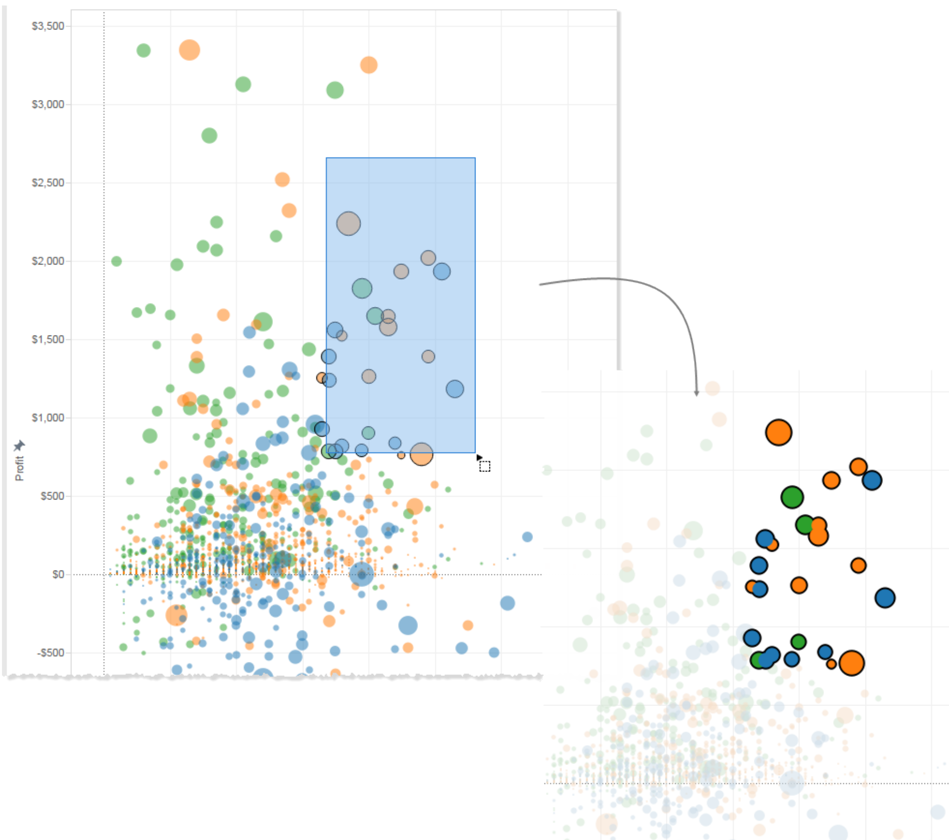
Highlight Actions

Highlight actions allow you to call attention to marks of interest by coloring select marks and dimming all others. You can highlight marks in the view by selecting the marks you want to highlight, use the color legend to select related marks, or create an advanced highlight action.

Selecting Marks to Highlight

When you select a mark in the view all other marks are dimmed to draw attention to the selection. Selection is saved with the workbook and can be included in stories or when publishing. The simplest way to add highlighting to a view is to select the marks you want to highlight.

You can select multiple marks by holding down the Ctrl key on your keyboard (Command key on Mac) while you select each mark. You can also use one of the advanced selection tools to select marks within a specific shape. For more information on how to use advanced selection tools, see **Select Marks** on page 845.

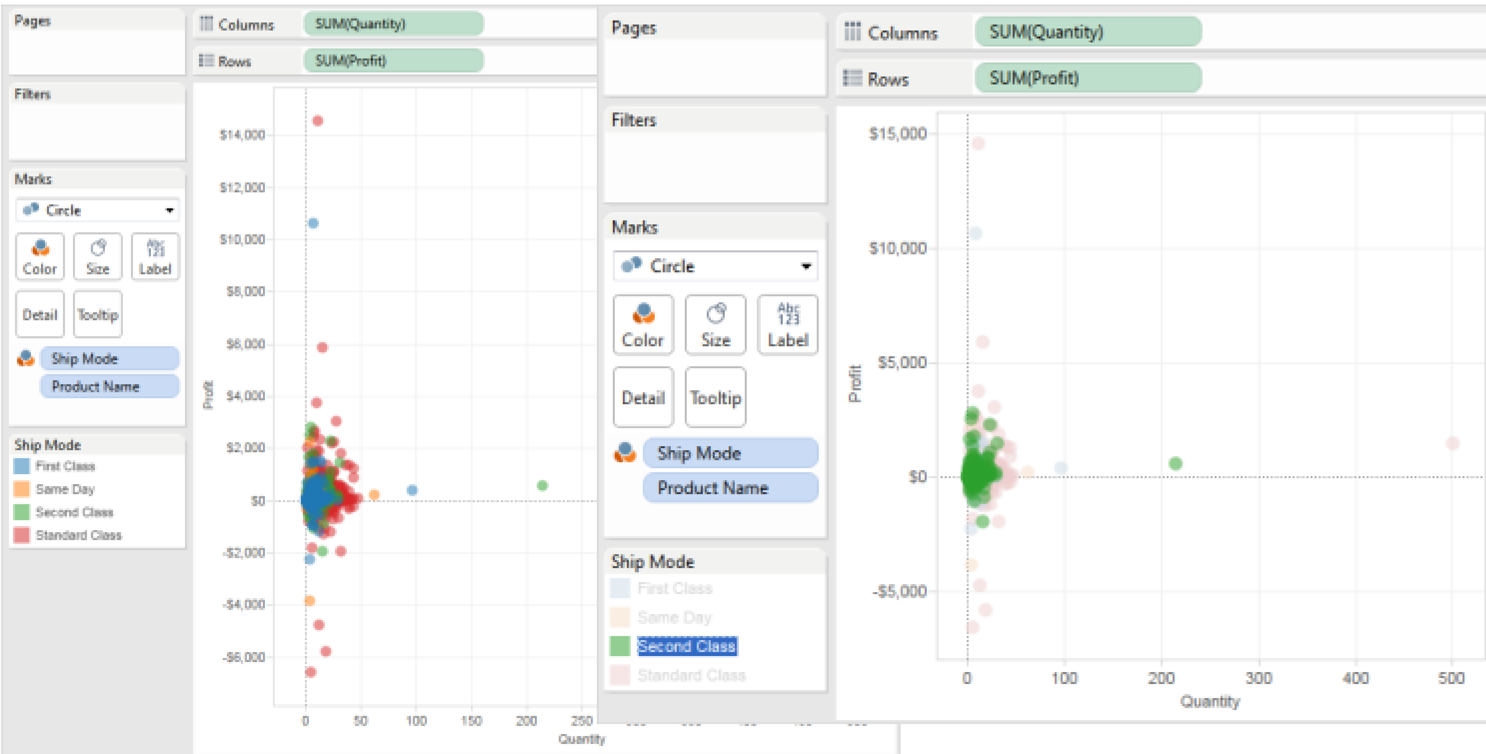


Color Legend Highlighting

Color legend highlighting is a powerful analytical mode for the color legend that allows you to focus on select members in the view. When you turn on color legend highlighting the marks associated with the selected items in the color legend are colored while all other marks are gray.

For example, the views below show the relationship between order quantity and profit for several products. The view on the left uses the normal color legend, all marks are colored based on their shipping mode. The view on the right uses legend highlighting to call out the products that were delivered via Second Class.

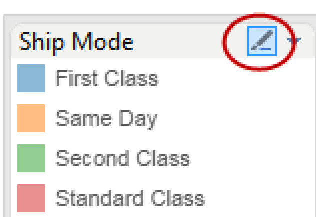
Normal Color Legend **Color Legend Highlighting Enabled**



You can easily switch between legend highlighting and normal modes using the color legend card menu. Then, if you like how a view is highlighted, you can assign the highlight colors to the color palette. The old colors are replaced with the highlight colors.

To turn on color legend highlighting

1. Click the **Highlight** button at the top of the color legend or select **Highlight Selected Items** on the color legend card menu.



2. Select an item in the color legend.

Once legend highlighting is turned on, you can quickly focus on specific data in the view by selecting different items in the color legend. When color legend highlighting is turned on a Highlight Action is created and can be modified in the Actions dialog box.

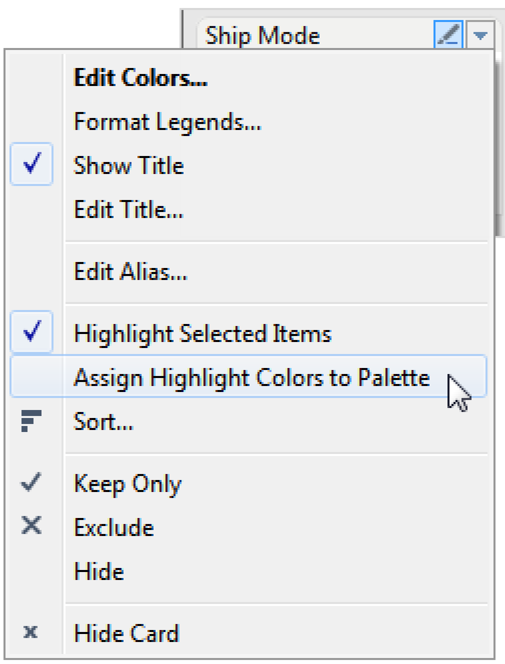
To turn off color legend highlighting

- Click the **Highlight** button at the top of the color legend or select **Highlight Selected Items** on the color legend card menu.

When you turn color legend highlighting off the action is removed from the Actions dialog box.

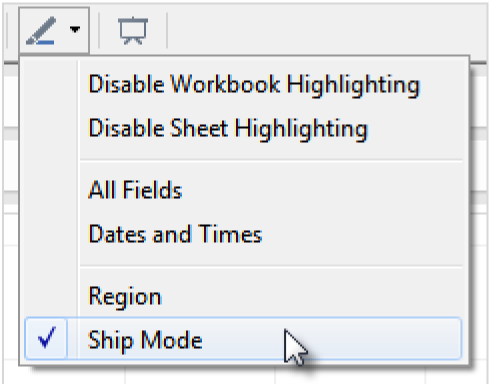
If you like how the view is highlighted and want to keep a specific member highlighted even when you turn off legend highlight mode, you can assign the highlight colors to the existing color palette. The original color legend is discarded and the highlight colors become the new color palette for the legend.

To assign the highlight colors to the color palette, select **Assign Highlight Colors to Palette** on the color legend card menu.



Highlight Toolbar Button

Another way to add a highlight action is using the highlight button in the toolbar.Similar to the color legend highlighting, the toolbar button lets you highlight a collection of related marks in the view. To turn on highlighting, select the fields you want to use for highlighting on the toolbar menu. Then select a mark in the view to see the related data.

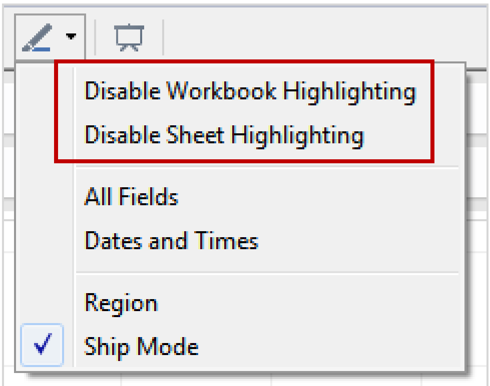


For example, the view below shows **Sales** vs. **Profit** by **Region**. If you select to turn on highlighting for **Ship Mode**, when a mark is selected, all other marks that were shipped via that mark's ship mode are highlighted. In this case you can quickly see all products from across the United States that were shipped via Second Class.

The toolbar menu also lets you highlight on **All Fields** or **Dates and Times**. **All Fields** will consider all fields when determining matching records; **Dates and Times** considers all date and time fields.

When you use the Highlight toolbar button an action is created in the Actions dialog box. You can modify the action to create more advanced highlighting behavior. For more information about editing actions, see **Quick Start: Filter Actions** on page 165

Finally, you can use the toolbar button to disable highlighting across the entire workbook or for just the active sheet.

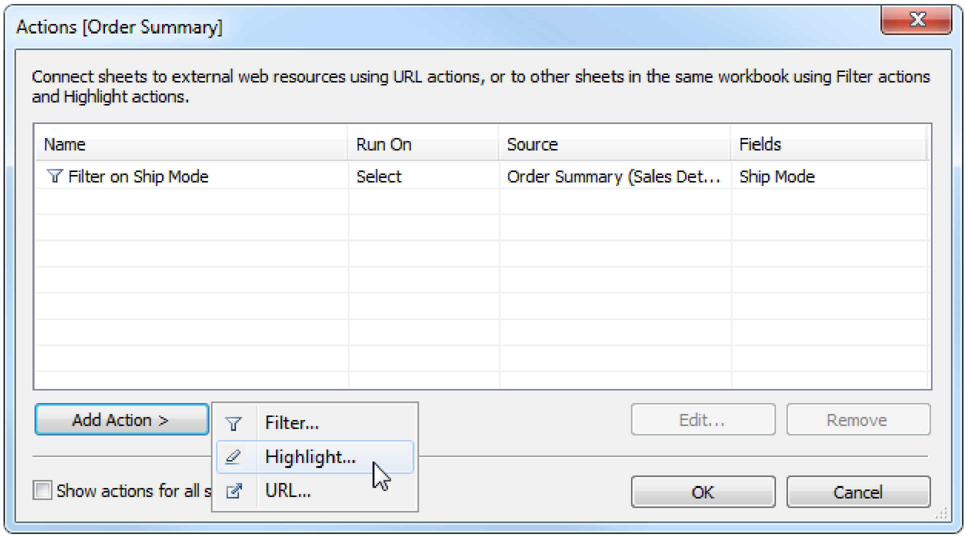


Creating Advanced Highlight Actions

You can define more advanced highlight actions using the Actions dialog. There you can specify source and target sheets along and the fields you want to use for highlighting. Follow the steps below to create a Highlight Action.

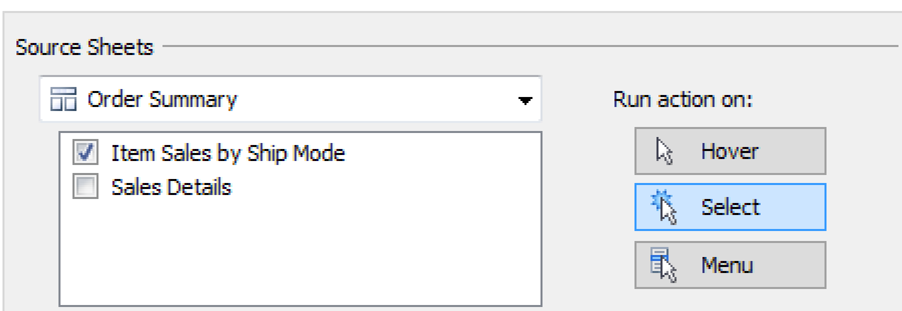
To create a highlight action:

1. On a worksheet select **Worksheet > Actions**. From a dashboard, select **Dashboard > Actions**.
2. In the Actions dialog box click the **Add Action** button and then select **Highlight**.



3. Give the action a name that will identify it in the Actions dialog. Try to make it descriptive. For example, *Highlight Products Shipped by Delivery Truck*. You can use variables in the name that will be filled in based on the values of the selected field.

4. Use the drop-down list to select the Source sheet or data source. If you select a data source or a dashboard sheet you can further select individual sheets within them.

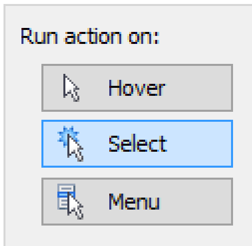


5. Select how you want to launch the action. You can select from the following options:

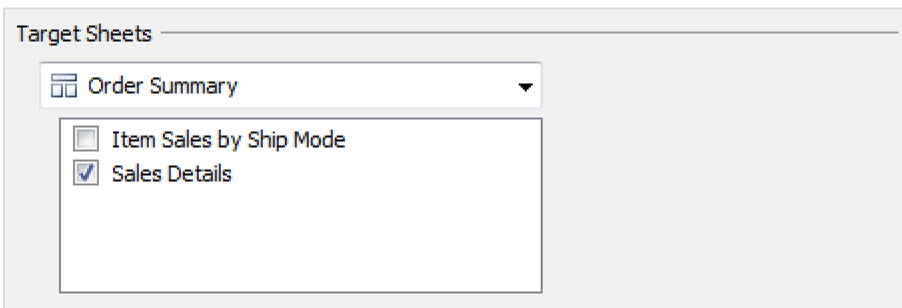
   - **Hover** - rest the pointer over a mark in the view to run the action. This option works well for highlight and filter actions within a dashboard.
   - **Select** - click on a mark in the view to run the action. This option works well for all

types of actions.

- **Menu** - right-click (control-click on Mac) a selected mark in the view and then select an option on a the context menu. This option works well for filter and URL actions.



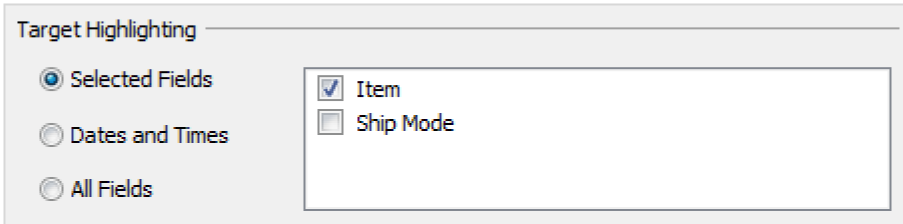
6. Select a Target sheet. If you select a dashboard you can further select individual sheets within the dashboard.



7. Select the fields you want to use for highlighting. Select from the following options:

   - **Selected Fields** - marks in the target sheet are highlighted based on select fields. For example, highlighting using the Ship Mode field will result in an action that highlights all marks in the target sheet that have the same ship mode as the selected mark in the source sheet.
   - **Dates and Times** - marks in the target sheet are highlighted when their date and time match those of the marks selected in the source sheet. All dates and time fields are considered when determining a match.
   - **All Fields** - marks in the target sheet are highlighted when they match the marks

selected in the source sheet. All fields are considered when determining a match.



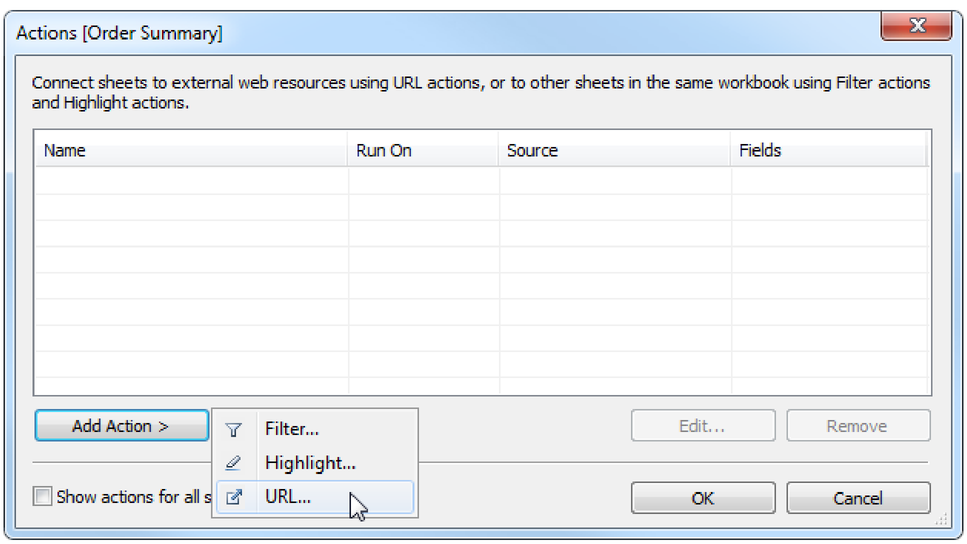
8. When finished, click **OK** twice to close the dialog boxes and return to the view.

URL Actions

A URL action is a hyperlink that points to a Web page, file, or other web-based resource outside of Tableau. You can use URL actions to link to more information about your data that may be hosted outside of your data source. To make the link relevant to your data, you can substitute field values of a selection into the URL as parameters.

To add a hyperlink:

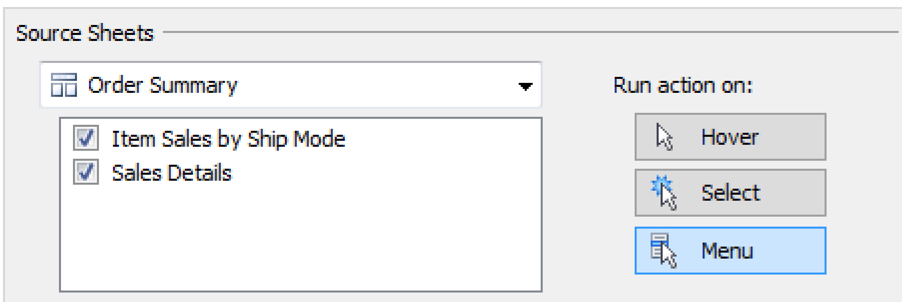
1. On a worksheet, select **Worksheet > Actions**. From a dashboard, select **Dashboard >Actions**.
2. In the Actions dialog box, click **Add Action** and then select **URL**.



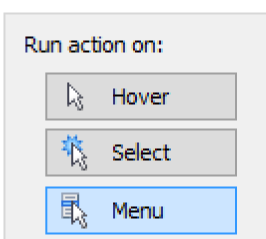
3. In the subsequent dialog box, specify a name for the link.

   Make the name descriptive of the action. If you choose to run the action using the menu, the name you specify here becomes the option that shows on the menu. For example, when linking to more product details, the name could be "Show More Details." You can use variables in the name, which will be filled in based on the values of the selected field.

4. Use the drop-down list to select a source sheet or data source. If you select a data source or dashboard you can select individual sheets within it.



5. Select the fields you want to use for highlighting. Select from the following options:
   - **Hover** - rest the pointer over a mark in the view to run the action. This option works well for highlight and filter actions within a dashboard.
   - **Select** - click on a mark in the view to run the action. This option works well for all types of actions.
   - **Menu** - right-click (control-click on Mac) a selected mark in the view and then select an option on a the context menu. This option works well for filter and URL actions.



6. Specify the URL. You can use any URL that your browser can recognize including web pages, FTP resources, and files.

Just as you can use variables in the name of the URL, you can also use field values and filter values as parameters in the URL. That means that you can send information about each selected mark or filter setting to a given website.

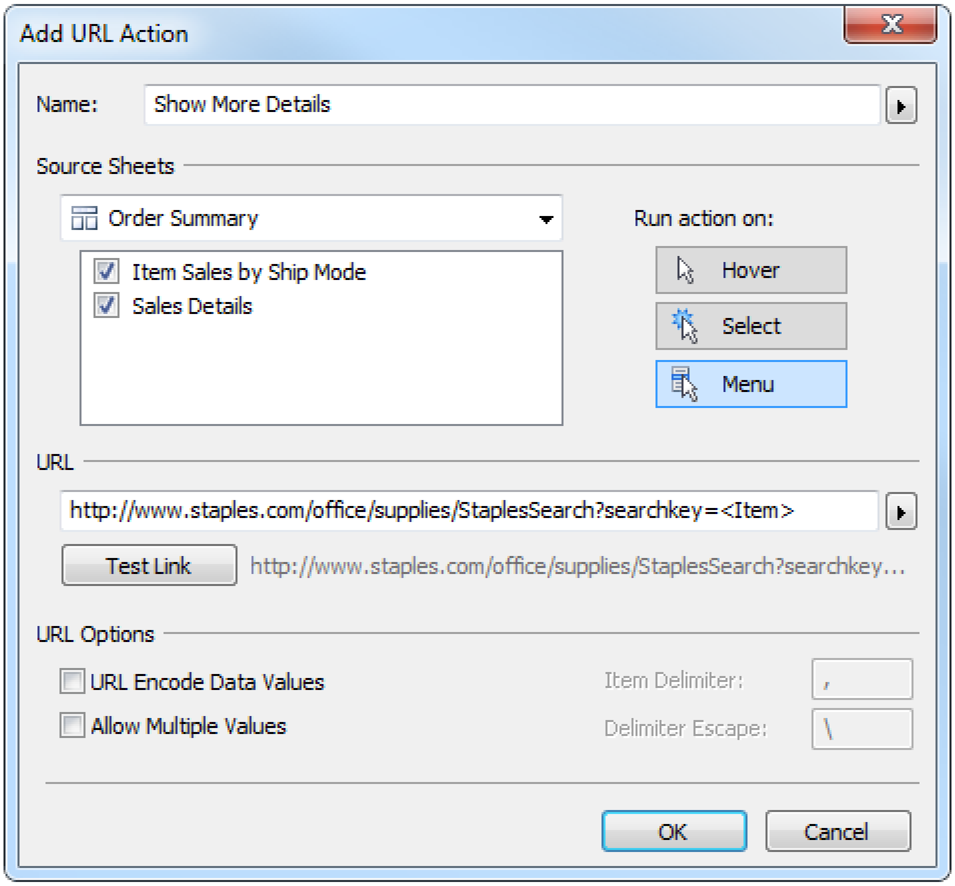
> In the URL you specify, include the appropriate prefix to ensure that the resulting hyperlink directs to the correct location. For example, if your URL links to a web page, include the `http://` prefix. If you publish workbooks to a Tableau Server, and your URL includes a protocol other than `http`, `https`, `gopher`, `news`, `ftp`, or `mailto`, you will need a server administrator to add the protocol to the server's whitelist. For more information, see tabadmin set options in the Tableau Server help.

When using a URL action to point to an external file (rather than a web page), use the universal naming convention (UNC) path for the URL action. A UNC path is a full path of a resource or file that is stored on the computer. A UNC path includes the computer name, drive letter, path to the file, and file name. For example, for a file D:\myfile.txt, specify the following UNC path: \\workstation1\d$\myfile.txt, where "workstation1" is the computer name in your company domain.

7. (Optional) Select any of the following options:

   - **URL Encode Data Values** - select this option if your data contains values that use characters that are not allowable in a URL. For example if one of your data values contains an ampersand, such as "Sales & Finance," the ampersand must be translated into characters that your browser understands (URL encoded) if you want to include that value in the URL.
   - **Allow Multiple Values** - select this option if you are linking to a webpage that can take lists of values as parameters in the link. For example, say you select several products in a view and you want to see each product's details hosted on a webpage. If the server can load multiple product details based on a list of identifiers (product ID or product name), you could use multi-select to send the list of identifiers as parameters.

     When you allow multiple values, you must also define the item delimiter, which is the character that separates each item in the list (for example, a comma). You must also define the Delimiter Escape, which is used if the delimiter character is used in a data value.



8. When finished, click **OK** twice to close the dialog boxes and return to the view.

URL actions can also point to a web page object in a dashboard. Refer to **Actions and Dashboards** on the next page to learn more about how actions work with dashboards.

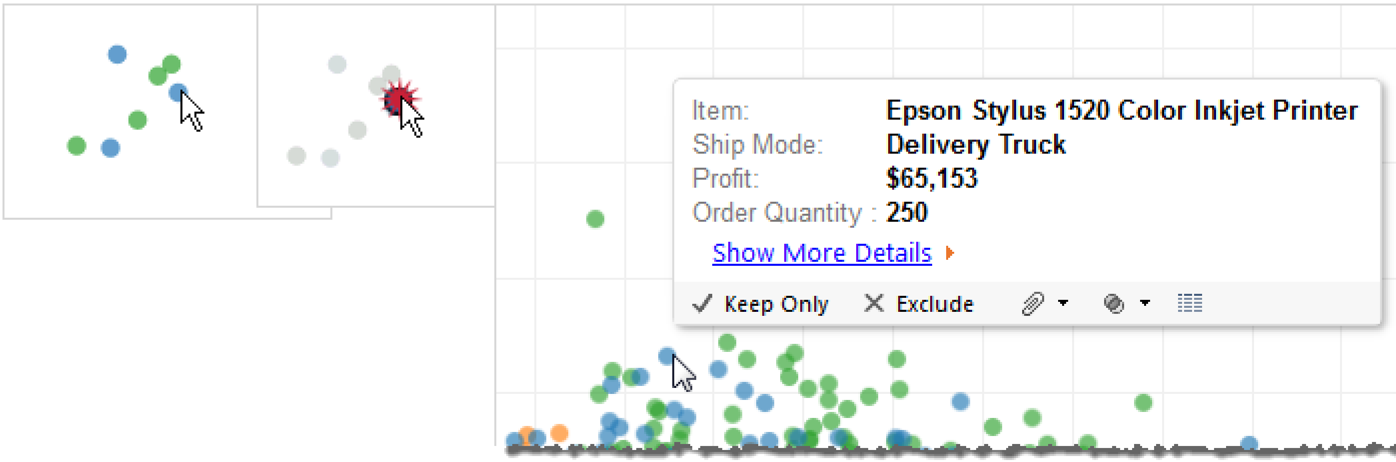
Running Actions

Depending on how the action is created, you can run an action using one of the following three methods:

- **Hover** - rest the pointer over a mark in the view to run the action. This option works well for highlight and filter actions within a dashboard.
- **Select** - click on a mark in the view to run the action. This option works well for all types of actions.

- **Menu** - right-click (control-click on Mac) a selected mark in the view and then select an option on a the context menu. This option works well for filter and URL actions.

Hover **Select** **Menu**



Links are not always visible for every worksheet and mark. Because links are mapped to specific fields in the data source, links will only be available for the worksheets that use the mapped fields. For example, if you add a hyperlink that uses both Latitude and Longitude as parameters in the link, the link will only be available to worksheets that use Latitude and Longitude in the view. Additionally, the link is only available on marks and headers that contain relevant values.

Actions and Dashboards

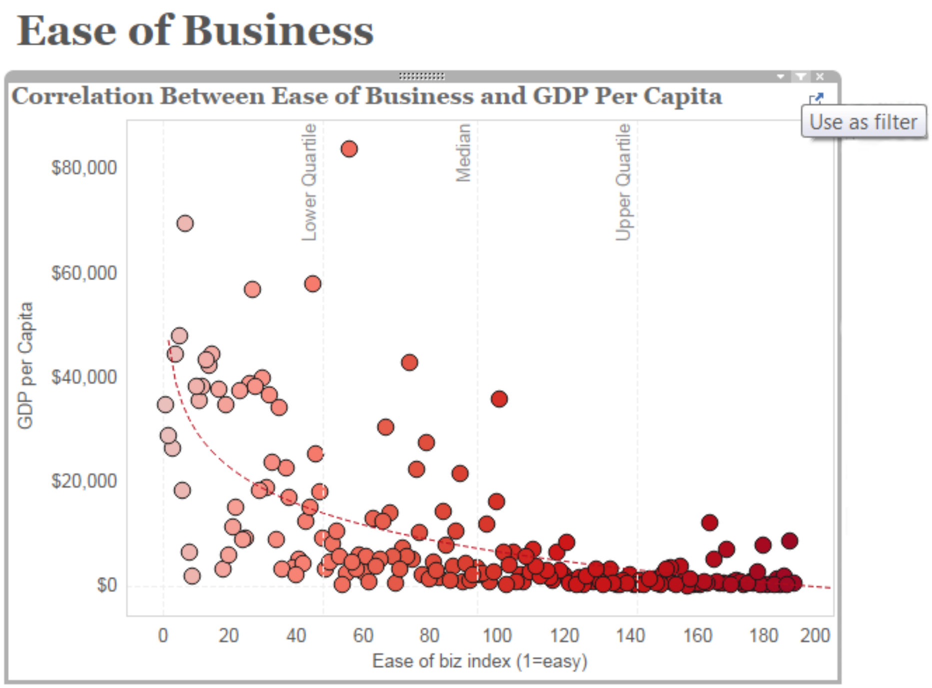
Actions often have special behavior when the source or destination is a dashboard. Filter and Highlight actions can affect other views in the dashboard and URL actions can update a webpage object so you don't have to open your web browser. Finally, you can create simple Filter and Highlight actions using special menu options so you don't have to open the Actions dialog box.

Example: Filter Actions in a Dashboard

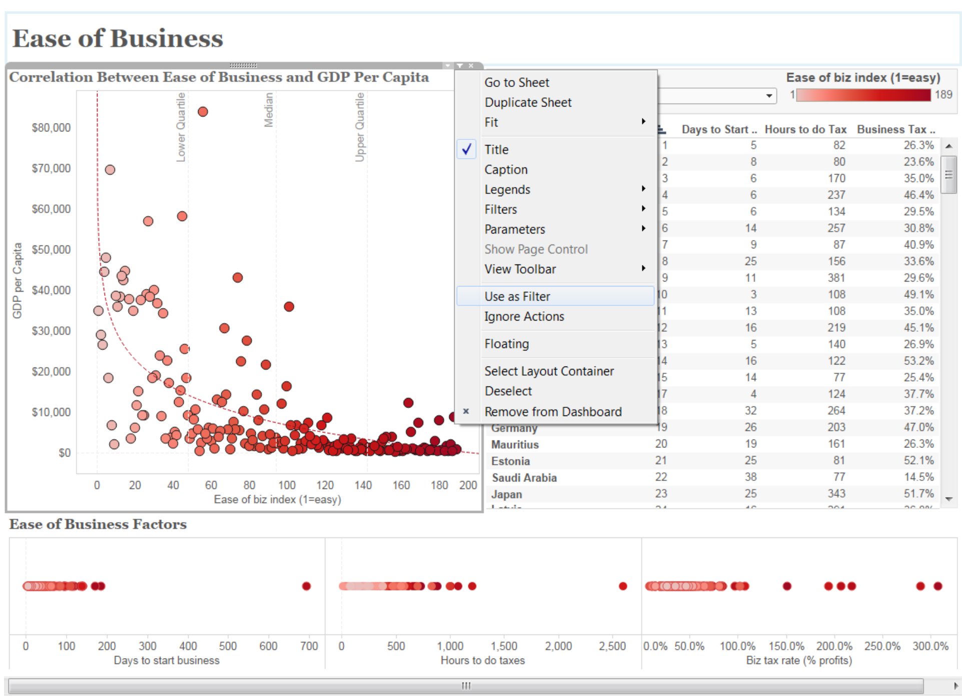
This example shows how to create a filter action in a dashboard. The example shows a Sales dashboard with three views. Using the **Use as Filter** option you can set one of the views to act as a filter on all the other views in the dashboard. In this case the bar chart in the upper right is filtering the map view and the text table to show more details about the selected region.

> **Note:** The **Use as Filter** command can only apply to one view at a time. A filter action is created that you can modify in the Actions dialog box.

Set a view to act as a filter by selecting the filter button.



You can also select the drop-down arrow and choose **Use as Filter**.

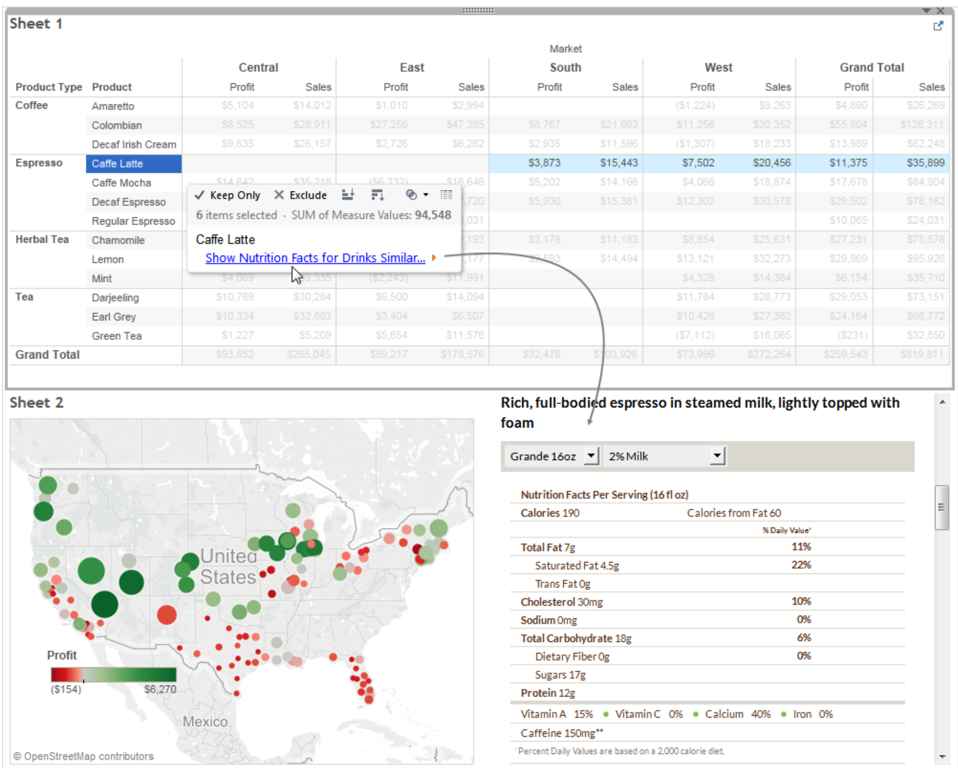


You can also use filter actions to filter the data on a dashboard when the data comes from multiple data sources. For information about how to use filter actions to filter across multiple data sources, see Clearing the Dashboard with Actions in the Tableau Knowledge Base.

For more information about filter actions, see **Filter Actions** on page 768.

Example: URL Actions in a Dashboard

This example shows how a URL action works with a web page object in a dashboard. Below is a dashboard showing sales information by product for several stores in a coffee franchise. Included in the dashboard is a web page object that shows nutritional information for a particular drink. The text table has a URL action that points to that web page. When you launch the action the web page automatically updates within the dashboard rather than opening a web browser. For more information about URL actions, see **URL Actions** on page 780



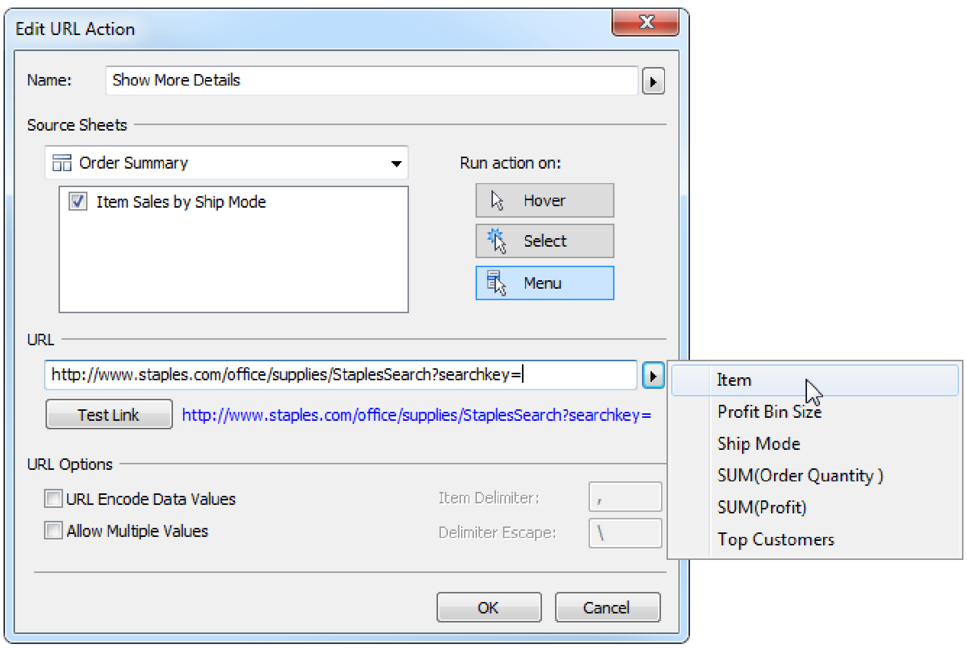
Using Field and Filter Values in Actions

When you add an action in Tableau you often want to use values from your data as parameters in the name of the action as well as the action itself. Using fields as variables in the action name makes the menu item that launches the action specific to the selected mark. More commonly, using field and filter values as parameters in the URL of a URL action allows you to send information about a specific data point or filter setting to the destination webpage.

Using Field and Filter Values in URLs

Tableau lets you add field, filter information, and parameter values as variables into URL actions so when you follow the link the values of those fields and filters are included. For example, when linking to an online mapping service, you can insert the address field into the URL so launching the link from a specific data point shows the address associated with that record on a map.

1. In the Add URL Action dialog box, begin typing the URL for the link.
2. Place the cursor where you want to insert a field, parameter, or filter value.
3. Click the arrow to the right of the text box and select the field, parameter, or filter you want to add to the URL. The field, parameter, or filter name is added to the URL between angle brackets.You can continue adding field and filter values parameters as many times as you need to create the URL.



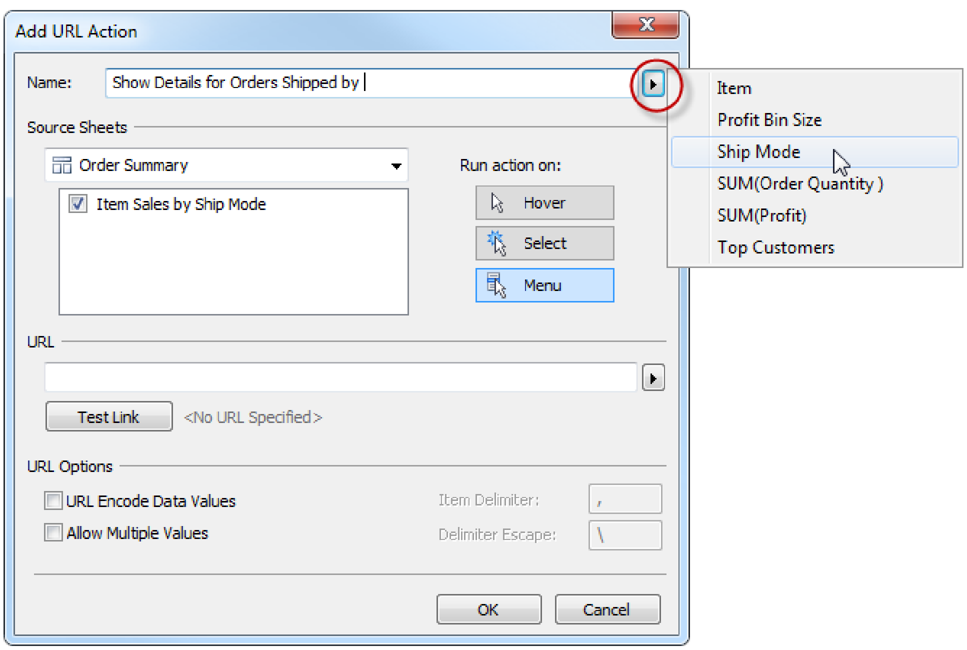
Note: The list of available fields only includes non-aggregated fields. To use aggregated field values as a parameter in a link, you must first create a calculated field and then use the name of that field in the link. The calculated field must also be used in the view in order for the link to be available. A good way to use these fields is by placing them on the Level of Detail shelf.

When inserting parameter values, the Display As value is what is sent with the URL action. To send the actual value instead, you should add the character `~na` after the parameter name. For example, you may have a parameter that includes IP addresses. The Actual Value strings for the parameter include values such as 10.1.1.195 while the Display As strings include more friendly values such as `Computer A (10.1.1.195)`. Inserting the parameter into the URL like this: `http://<IPAddress>/page.htm` will send the display values so the final destination URL would be `http://Computer A (10.1.1.195)/page.htm`. Obviously, that is not likely to create a valid URL. To send the actual value, the parameter in the URL should look like this: `http://<IPAddress~na>/page.htm`.

Using Field and Filter Values in Action Names

In addition to using field, parameter, and filter values in URLs, you can use this information as variables in the action names. The name of the action displays on the context menu when an action is launched using the menu. Using field and filter variables in the name is useful in making the action specific to the selected mark. In a view showing real estate information, you could name a URL action that points at satellite images from an online mapping service, "Show satellite image of <Address>." When you right-click (control-click on Mac) a specific mark, the <Address> tag is replaced with the location value associated with that mark.

1. In the Add Action dialog box, begin typing the name for the action.
2. Place the cursor where you want to insert the field or filter value.
3. Click the arrow to the right of the text box and select the field or filter you want to add as a variable. The field or filter name is added between angle brackets.



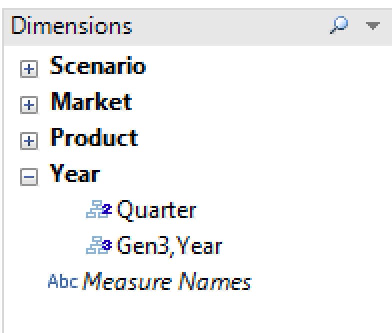
Dates and Times

How you work with dates in Tableau depends on whether you are using a relational or cube (multidimensional) data source. This section discusses the differences.

Dates in Cube (Multidimensional) Data Sources

In Tableau, cube (multidimensional) data sources are supported only in Windows.

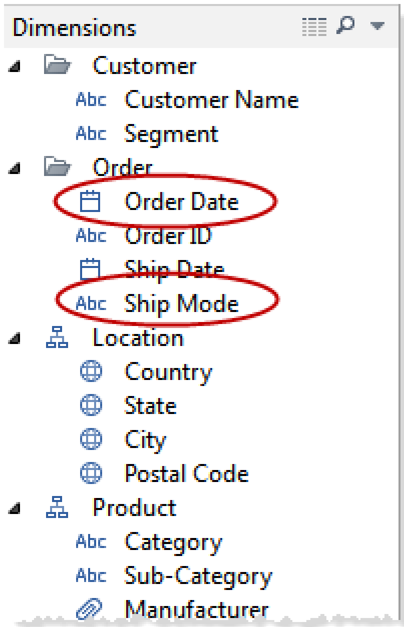
For cube data sources, dates dimensions are usually organized into hierarchies that contain levels such as year, quarter, and month. In addition, some multidimensional data sources have time intelligence enabled, which makes it possible to look at data levels different ways, such as Months by Year, Months by Quarter, Weekends, etc. These levels are represented as attributes of the hierarchy. Hierarchies and attributes are defined when the cube is created and you cannot modify them in Tableau. For example, the **Year** dimension from an Oracle Essbase data source is shown below.



When you place a multidimensional date on a shelf, the field is treated like any other dimension. For example, you can drill down, drill up, and so on.

Dates in Relational Data Sources

For relational data sources, dates and times are automatically placed in the Dimensions area of the **Data** pane and are identified by the date or date-time icon. For example, the Order Date and Ship Date dimensions from an Excel data source are shown below.

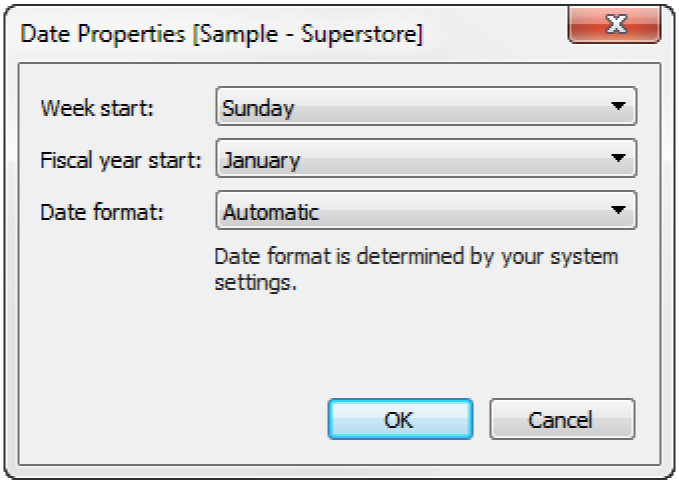


When you place a relational date on a shelf, the field name is automatically modified to reflect the default date level. Tableau defines the default date level to be the level at which there are multiple instances. For example, if the date field includes multiple years, the default level is year. However, if the date field contains data for just one year but includes multiple months, then the default level is month.

If you don’t want Tableau to automatically select a date level and would rather have a date dimension be a continuous field, you can right-click (control-click on Mac) the field in the **Data** pane and select **Convert to Continuous**. The dimension then turns green in the **Data** pane; now when you use that dimension in a view, it will be continuous. You can easily revert back by selecting **Convert to Discrete** from the field’s context menu in the **Data** pane. You can also convert a field in the view to continuous while it is on a shelf by selecting **Continuous** on its context menu (which you can see when you right-click (control-click on Mac) the field). The field on the shelf turns green but the field in the **Data** pane is still discrete.

Date Properties for a Data Source

You can set date properties for a data source. To do so, right-click (control-click on Mac) a data source in the **Data** pane and choose Date Properties:



The options in the Date Properties dialog box are:

- **Week start** - Specifies which day is considered the first day of the week. You can override the **Week start** value you set at the data source level by including a `start_of_week` value with certain date functions (`DATEDIFF`, `DATENAME`, `DATEPART`, and `DATETRUNC`). See **Date Functions** on page 1422.

  The initial value for this setting is in some cases determined by your data source. If the data source does not initialize the start-of-week day, then Tableau consults the system's locale settings.The day which is considered the first day of the week varies from region to region. For example, Sunday is the first day of the week in the US, while Monday is the first day in the EU.

  This setting is disabled for cubes because this information is defined when cube designer creates the date/time dimension.

  After a data source is created, the **Week start** value does not automatically change if for any reason the default start-of-week setting changes in the host operating system (for example, if the data source is uploaded to Tableau Server in a different country). Calendar controls reflect the workbook locale rather than the data source's **Week start** setting. The exception is that a week trunc start of week that shows the week number in it will use the data source's **Week start** setting in order to provide a consistent week number value in the calendar.

- **Fiscal year start** - Specifies which month is considered the first month of the fiscal year. To specify whether a date dimension uses the standard calendar (Jan. 1 - Dec. 31) or the fiscal calendar, right-click (control-click on Mac) the field in the Data pane and select **Default Properties** > **Calendar Type** and then select **Standard Calendar** or **Fiscal Calendar**. For any date field in the view, you can then specify whether to use the standard calendar or the fiscal calendar. For details, see **Fiscal Dates** on page 800.

- **Date format** - Specifies the default format for data dimensions, as displayed, for example, in tooltips.To override the default date format for a date dimension, right-click (control-click on Mac) the field in the Data pane and select **Default Properties** > **Date Format** and then select one of the available formats.

Day of the week sorting

If you are working in a language for which Tableau does not provide a local version, set your workbook locale to assure that Tableau can sort the days of the week in the correct chronological order. Otherwise, Tableau will sort the names of the days alphabetically. For information on setting the locale, see **Language and Locale** on page 296.

If none of the supported locales is appropriate, you can sort the days of the week manually. See **Manual Sorting** on page 734.

Supported date formats

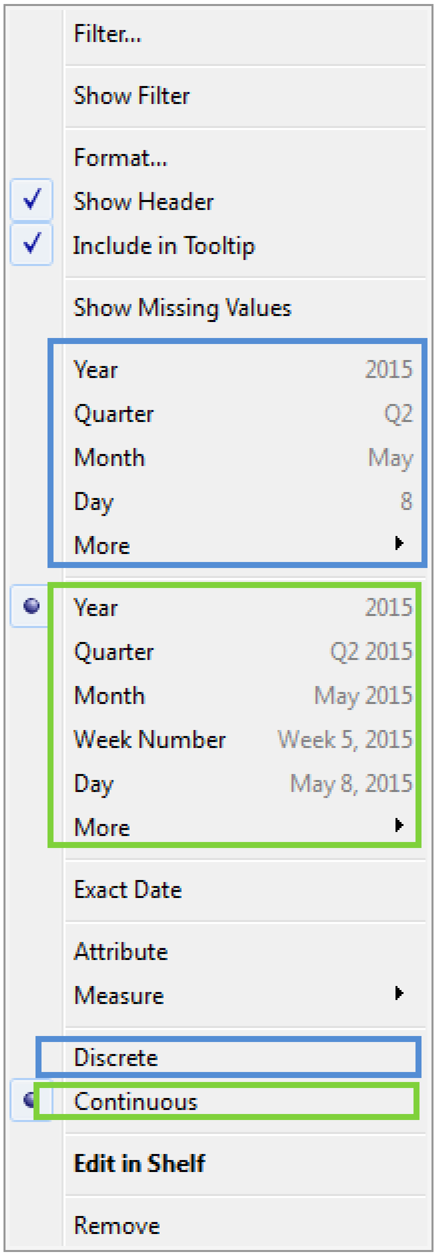
When working with dates, Tableau retrieves date formats automatically from the data source.

For a list of supported date formats, see the table of supported date format symbols in **Custom Date Formats** on page 804.

Changing Date Levels

For both relational and multidimensional data sources, you can change the date level using the field's context menu after dragging it to a shelf. For cube (multidimensional) dates, the levels available in the context menu are given by the levels defined in the date hierarchy. For relational dates, you can select between the discrete date levels at the top of the menu or the continuous date at the bottom. A preview of each date level is shown. Below is the field menu for a relational date with the discrete Year level selected.

> In Tableau, cube (multidimensional) data sources are supported only in Windows.



Click any of the options in the blue areas to configure the field as a discrete date.
Choosing one of these options creates what is known as a "date part."

Click any of the option in the green areas to configure the field as a continuous date.
Choosing one of these options creates what is known as a "truncated date."

When you select a particular level, Tableau asks the data source to perform a computation on the date field. For example, suppose a particular row in your data source has a date entry of 01/23/07. The year is 2007, the quarter is 1 because January falls in the first quarter, and the week number is 4 because January 23rd falls in the fourth week. How the date level is computed depends on the configured Date Properties for the data source. See **Date Properties for a Data Source** on page 791.

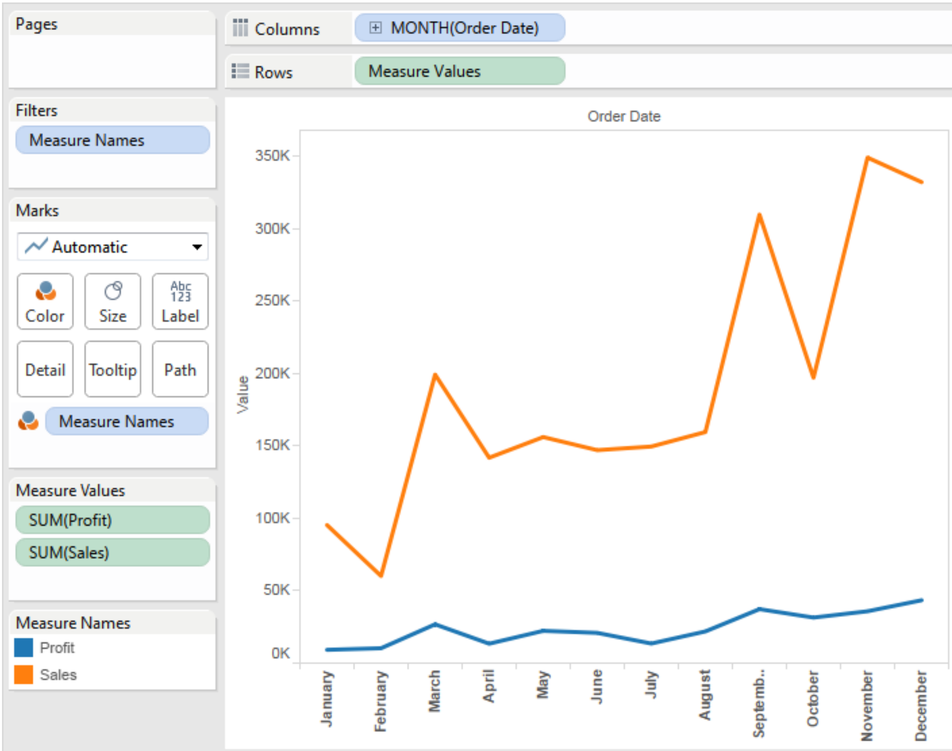
Note: Some date levels might not make sense for your relational data source. For example, if the date format does not include time information such as hour, minute, or second, then selecting one of these options will not add any data to your view.

You can work with dates at varying levels of detail simultaneously. You do this by clicking the ⊞ control on a date field in the view. This is known as drilling into a date. For example, if you drill into a discrete (blue) date field **YEAR(Order Date)**, Tableau adds a second field to the right of the initial date, **QUARTER(Order Date)**, as in the image below. You can continue drilling down until you reach the finest available granularity for the date field.

You can also drag date fields to the **Rows** or **Columns** shelf multiple times in order to nest them and to drill down into them at varying levels of detail.

For example, the view shown below drills down from the year level to display the quarter level as well.

By removing one of the date fields from the Columns shelf, and then selecting **Month** from the remaining date field’s context menu, you can display the data for each month across all years.



To display even finer granularity, select Month from the lower, continuous section of the field's context menu.

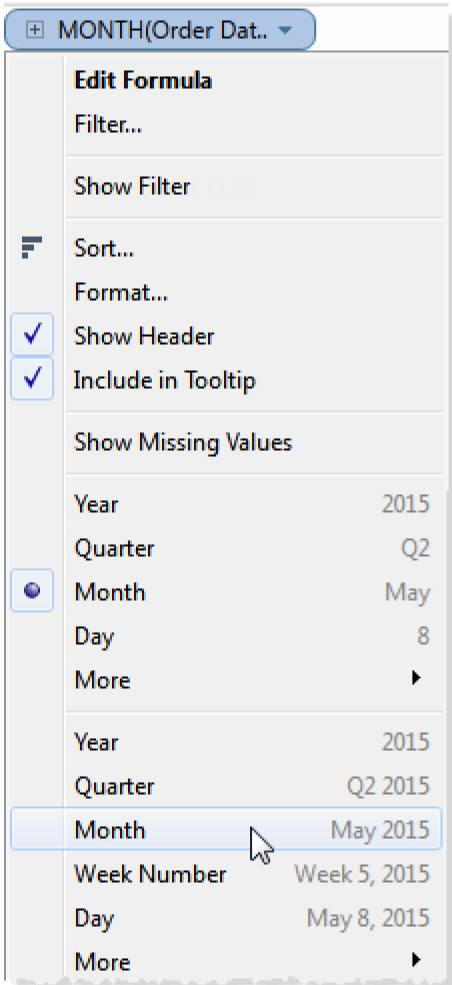
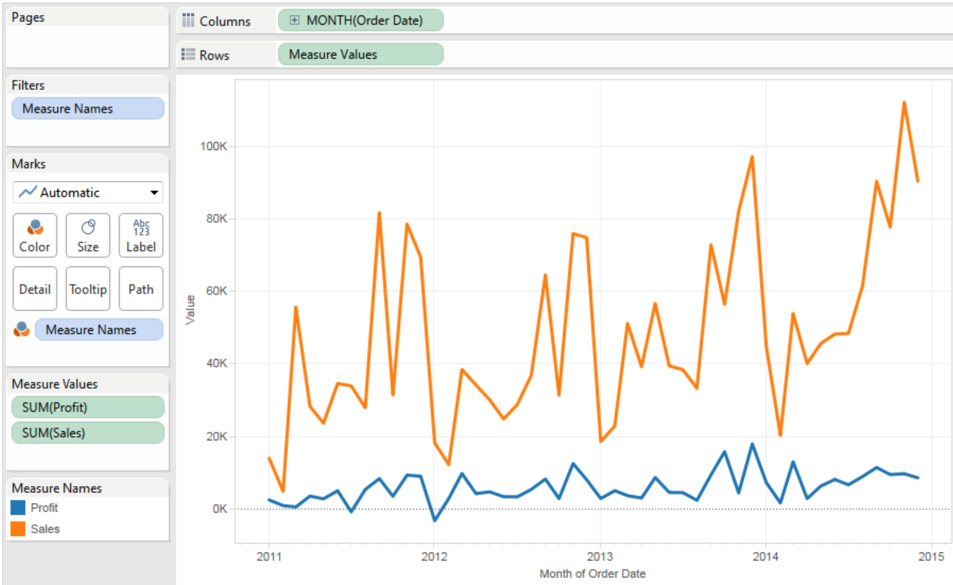


Tableau then displays the dates across the range of available years, at a month-by-month level of granularity.



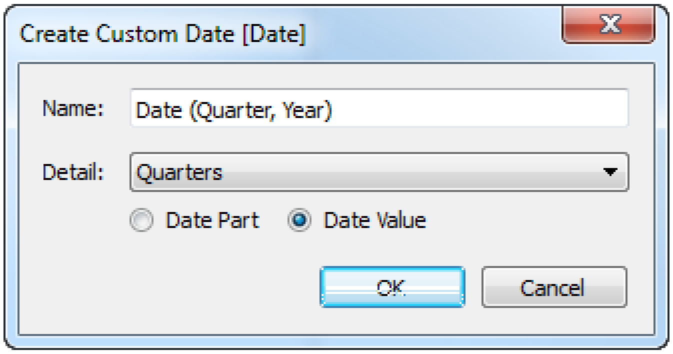
Custom Dates

You might want to create a custom date if you always use a date at a specific level, or if you want to create calculations that rely on a binned or truncated date.

You can create a custom date by working in the **Data** pane or by using the `DATEPART` and `DATETRUNC` functions in a calculated field.

The custom date you create becomes a new field in the **Data** pane.

1. Right-click (Control-click on Mac) a date field in the **Data** pane and select **Create** > **Create Custom Date**.
2. In the Create Custom Date dialog box, type a name for the custom date, such as Date (Quarter, Year).
3. From the **Detail** list, select the level you want to show the date at.
4. Specify whether you want the custom date to be discrete (select **Date Parts**) or continuous (select **Date Value)**.



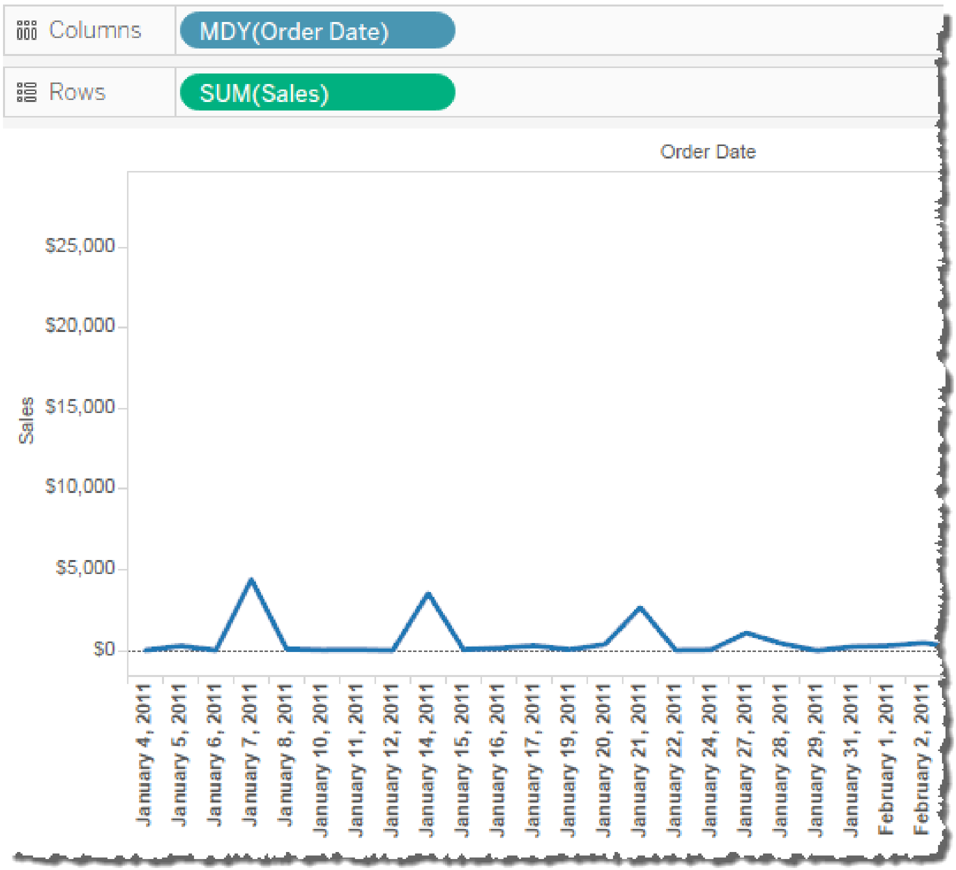
5. When you are finished, click **OK**.

Example - format column headers as Month, Day, Year

To format column headers as Month, Day, Year (for example, January 1, 2011), follow the steps below. This example uses the Sample - Superstore data source provided with Tableau Desktop.

1. Drag **[Order Date]** to **Columns**.
2. Drag **Sales** to **Rows**.
3. Right-click (Control-click on a mac) **[Order Date]** on the **Columns** shelf and choose **More** > **Custom**.
4. In the Custom Date dialog box, choose **Month / Day /Year** from the **Detail** drop-down list.

The view now has the column headers in the correct format:



Fiscal Dates

In some situations, a date field needs to be expressed in terms of an organization's fiscal year. Calendar years run from January 1st until December 31st, but an organization's fiscal year might start in a different month. For example, a company's fiscal year might run from June 1st through May 31st. In such cases, it's appropriate to display some date values in a view using fiscal equivalents (Fiscal Year, Fiscal Quarter, and Fiscal Week Number) rather than their calendar equivalents.

To set the fiscal year start month for a data source, follow these steps:

1. Right-click (Control-click on Mac) the data source in the **Data** pane to open the Date Properties dialog box.

2. Set the **Fiscal year start** field to the appropriate month.

This change sets the fiscal year for all date dimensions in the data source.

You can set the fiscal year start month for an individual date value to be different from the fiscal year start date for the data source. To do this, right-click (Control-click on Mac) the date dimension in the **Data** pane and select **Default Properties** > **Fiscal Year Start**.

Note: Date functions do not take account of the configured fiscal year start. See **Date Functions** on page 1422.

Whether a given level of a date dimension is affected by the use of the Fiscal Calendar depends on the specific case.

Date Level	When Converted to Fiscal
Year	Reflects the fiscal year. For example, if **Fiscal year start** is set to April, the year for the date June 1, 2004 would be shown as FY 2005.
Quarter	The Quarter reflects the fiscal quarter. For example, if **Fiscal year start** is set to April, the quarter for the date June 1, 2004 would be Q1.
Month	No change in behavior. The calendar month is the same as the fiscal month.
Day	No change in behavior. The calendar day is the same as the fiscal day.
Hour	No change in behavior. The calendar hour is the same as the fiscal hour.
Minute	No change in behavior. The calendar minute is the same as the fiscal minute.
Second	No change in behavior. The calendar second is the same as the fiscal second.
Week Number	The Week Number reflects the fiscal week number. For example, if **Fiscal year start** is set to April, the week number for the date April 1, 2004 would be 1.
Weekday	No change in behavior. The calendar weekday is the same as the fiscal weekday.
MM/YYYY	No change in behavior. This date format always displays calendar dates, even when a fiscal year has been assigned.
M/D/Y	This date format always displays Calendar dates, even when a fiscal year has been assigned.

The only date levels that explicitly indicate that the fiscal calendar is in use are the Year and Quarter level. Specifically, fiscal years and quarters are shown with the FY prefix. This is not true for fiscal quarters or week numbers, however, which are not shown with any special fiscal markings.

Fiscal year designations for any given date dimension are applied to all instances of the field in the Tableau workbook. Fiscal dates can only be applied to dimensions in a relational data source.

Fiscal year formatting is applied to all date formats that include a year, or a year and a quarter. In particular, if you apply a custom date format, and only use the “y” and “q” placeholders, then `FY` will be prepended to each year.

Date Truncations

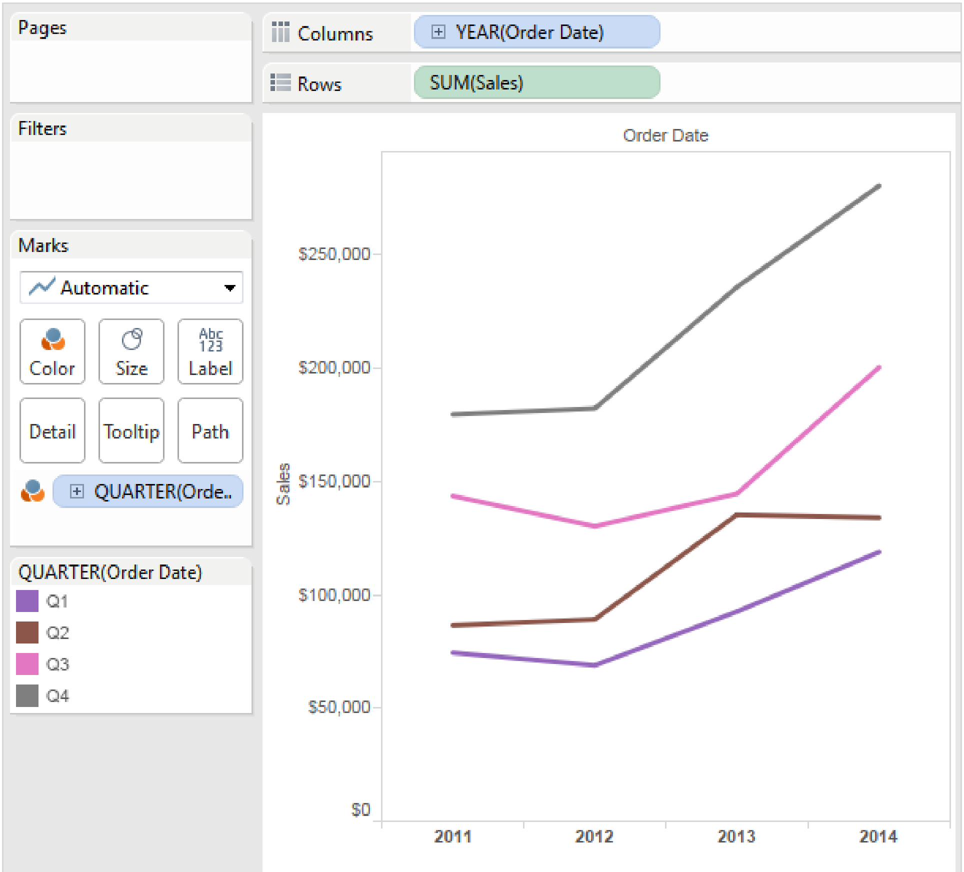
When a date dimension is using a fiscal calendar, only the following date parts and truncations will reflect the fiscal calendar:

Date part or truncation	When using a fiscal calendar
Year date part	Reflects the fiscal year. For example, if **Fiscal year start** is set to April, the year for the date June 1, 2004 would be shown as FY 2005.
Quarter date part	Reflects the fiscal quarter. For example, if **Fiscal year start** is set to April, the quarter for the date June 1, 2004 would be Q1.
Week Number date part	Reflects the fiscal week number. For example, if **Fiscal year start** is set to April, the week number for the date April 1, 2004 would be 1.
Year date truncation	Truncates to the start of the fiscal year. For example, if **Fiscal year start** is set to May, the date June 1, 2004 would become May 1, 2004.
Quarter date truncation	Truncates to the start of the fiscal quarter. For example, if **Fiscal year start** is set to July, the date June 1, 2004 would become April 1, 2004.

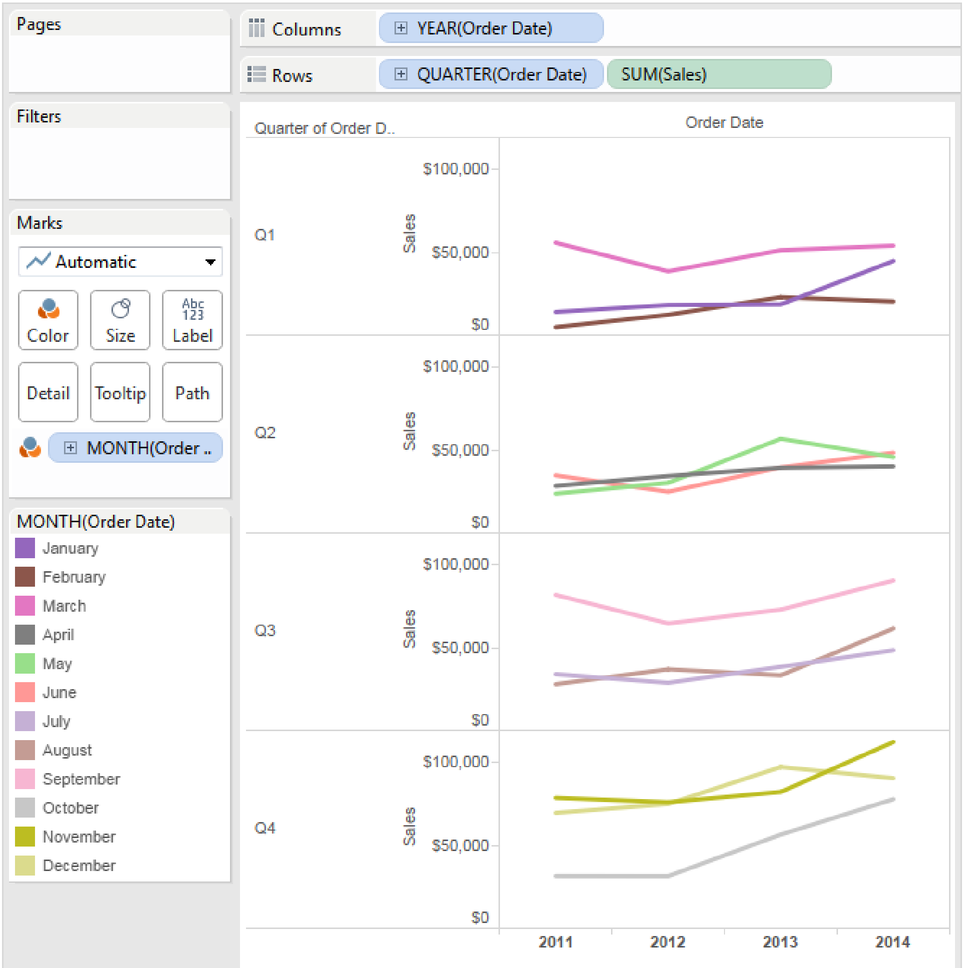
Perfect Pivoting with Dates

You can perfect pivot dates by placing different date levels on different worksheet shelves simultaneously. Place the date field on a variety of shelves and then select the desired date level from the fields’ context menus.

For example, the following line chart displays years as column headers and then color-encodes the marks by quarter.



You can separate the marks by month and by quarter as shown below.



Custom Date Formats

There are different ways to format dates in Tableau.

- To format a date field in the view, right-click (Control-click on a Mac) the field and choose **Format**.
- To format a date field in the **Data** pane, right-click the field and choose **Default Properties** > **Date Format**.
- To format date properties for a data source, right-click a data source in the **Data** pane and choose **Date Properties**. Then in the Date Properties dialog box, choose **Date format**.

When you format dates, Tableau presents a list of available formats. In most cases, the last item in the list is **Custom**. You specify a custom date using a set of format symbols, which are listed in the table below.

The date formats in the table are supported when your workbook is connected to a Tableau data extract or has a live connection to a data source that also supports the date format. (Refer to your data source's documentation to verify that the date format you want is supported.)

Tableau retrieves date formats from the data source. Tableau Server can also retrieve date formats from the Run As user account on the server that is running Tableau Server.

> **Note:** The following date formats might not be the same as those used with the DATEPARSE() function. See Understanding the DATEPARSE function for details.

Supported Date Format Symbols

Use the following symbols to construct a custom date format.

Symbol	Description
(:)	Time separator. In some locales, a different character is used to represent the time separator. The time separator separates hours, minutes, and seconds when time values are formatted. The actual character used as the time separator in formatted output is determined by your system settings.
(/)	Date separator. In some locales, oa different character is used to represent the date separator. The date separator separates the day, month, and year when date values are formatted. The actual character used as the date separator in formatted output is determined by your system settings.
c	Display the date as `ddddd` and display the time as `ttttt`, in that order. Display only date information if there is no fractional part to the date serial number; display only time information if there is no integer portion.
d	Display the day as a number without a leading zero (1 31).
dd	Display the day as a number with a leading zero (01 31).
ddd	Display the day as an abbreviation (Sun Sat).
dddd	Display the day as a full name (Sunday Saturday).
ddddd	Display the date as a complete date (including day, month, and year), formatted according to your system's short date format setting. The default short date format is `m/d/yy`.
dddddd	Display a date serial number as a complete date (including day, month, and year) formatted according to the long date setting recognized by your system. The default long date format is `mmmm dd, yyyy`.
aaaa	The same as dddd, only it's the localized version of the string.

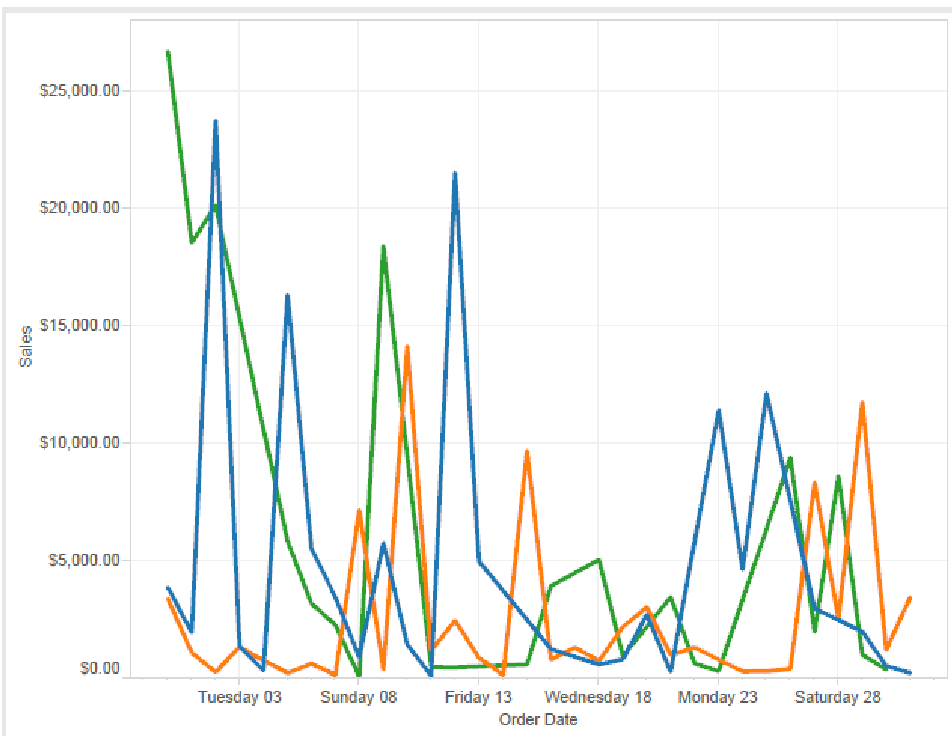
w	Display the day of the week as a number (1 for Sunday through 7 for Saturday).
ww	Display the week of the year as a number (1 54).
m	Display the month as a number without a leading zero (1 12). If `m` immediately follows `h` or `hh`, the minute rather than the month is displayed.
mm	Display the month as a number with a leading zero (01 12). If `m` immediately follows `h` or `hh`, the minute rather than the month is displayed.
mmm	Display the month as an abbreviation (Jan Dec).
mmmm	Display the month as a full month name (January December).
oooo	The same as mmmm, but localized.
q	Display the quarter of the year as a number (1 4).
y	Display the day of the year as a number (1 366).
yy	Display the year as a 2-digit number (00 99).
yyyy	Display the year as a 4-digit number (100 9999).
h	Display the hour as a number without leading zeros (0 23).
Hh	Display the hour as a number with leading zeros (00 23).
N	Display the minute as a number without leading zeros (0 59).
Nn	Display the minute as a number with leading zeros (00 59).
S	Display the second as a number without leading zeros (0 59).
Ss	Display the second as a number with leading zeros (00 59).
000	Display milliseconds. Use a period character as a separator before specifying milliseconds.
t t t t t	Display a time as a complete time (including hour, minute, and second), formatted using the time separator defined by the time format recognized by your system. A leading zero is displayed if the leading zero option is selected and the time is before 10:00 A.M. or P.M. The default time format is `h:mm:ss`.
AM/PM	Use the 12-hour clock and display an uppercase AM with any hour before noon; display an uppercase PM with any hour between noon and 11:59 P.M.
am/pm	Use the 12-hour clock and display a lowercase AM with any hour before noon; display a lowercase PM with any hour between noon and 11:59 P.M.

A/P	Use the 12-hour clock and display an uppercase A with any hour before noon; display an uppercase P with any hour between noon and 11:59 P.M.
a/p	Use the 12-hour clock and display a lowercase A with any hour before noon; display a lowercase P with any hour between noon and 11:59 P.M.
AMPM	Use the 12-hour clock and display the AM string literal as defined by your system with any hour before noon; display the PM string literal as defined by your system with any hour between noon and 11:59 P.M. AMPM can be either uppercase or lowercase, but the case of the string displayed matches the string as defined by your system settings. The default format is AM/PM.

Custom Date Format Examples

Specifying a custom format yyyy-MM-dd HH:mm:ss.000 would produce dates in the format 2015-05-10 11:22:16.543. Such a format might be appropriate for scientific data.

Specifying a format DDDD DD would produce dates that show the Weekday and the Day, as shown below.



Support for Japanese era-based date formats

Starting with version 9.3, Tableau supports Japanese emperor-era-based date (Wareki) formats. Here's how to apply an era-based date format to a field in your view:

1. Set your workbook locale to Japanese.
2. Right-click the field in the view for which you want to set a date format.
3. Choose **Format**.
4. In the **Format** pane, from the **Dates** drop-down list, select a format.

If the format that you want isn't listed, you can construct your own date format. To do this, choose **Custom format** in the **Dates** box, then type your format using the Tableau date placeholders. The following era-based year placeholders are available:

Symbol	Description
g	Short era name (such as H for the Heisei era).
gg	Era name (such as 平成).
ggg	Long era name (for Japanese, this is currently the same as the regular era name).
e	Era-based year, such as 1 for the first year of an era.
ee	Era-based year, such as 01 for the first year of an era. If there is only one digit, then the era-based year will have a zero added to the front.

If your workbook locale is not Japanese, you can create a custom date format, then insert the language code !ja_JP! in front of your format, so that it looks like this:

```
!ja_JP! gg ee"年"mm"月"dd"日"
```

The language code forces the date to be treated as if it is a Japanese date.

Era-based dates are not fully supported by the Tableau Server browser view. In particular, if you publish a workbook that contains a quick filter, the e and g placeholders will not be filled in:

To avoid this issue, do not show era-based dates in quick filters if your workbook will be viewed in a browser.

Using literal text in a date format

You may want your date format to include some words or phrases, such as **Fiscal Quarter q of yyyy**. However, if you type that text directly into the Tableau format box, it may treat the letters like date parts:

Quarter of Order Date
Fi01/1/2010al 1uarter 1 of 2010
Fi04/1/2010al 2uarter 2 of 2010
Fi07/1/2010al 3uarter 3 of 2010
Fi010/1/2010al 4uarter 4 of 2010

To prevent Tableau from doing this, put double quotes around the letters and words that should not be treated as date parts: **“Fiscal Quarter” q “of” yyyy**.

If you want a literal quote inside of a quoted section, insert this code: `“\””`. For example, the format **“Fiscal “\”” Quarter”** would be formatted as **Fiscal “ Quarter**.

Using Week-Based Placeholders in Custom Date Formats

If your workbook has a European locale, Tableau allows you to format dates using ISO-8601 weeks and years. The week and year numbering in an ISO-8601 calendar is different from a standard Gregorian calendar. Here’s how January 2nd, 2011 would be represented:

Calendar System	Week Number	Year Number
Standard Gregorian	1	2011
ISO-8601	53	2010

When formatting dates, it’s important to ensure that your month, week and year numbers all come from the same calendar system. Otherwise, the date might not make sense. There are two ways to do this:

- Let Tableau guess which calendar system you want to use for each placeholder. For example, if you type `mm yyyy` (a month followed by a year), Tableau uses the standard Gregorian year. In this case, it makes sense to use that year with a month number.
- In your format string, place an annotation after each week (ww) or year (yyyy) placeholder, to indicate what kind of placeholder it should be:

Annotation	Calendar to Use	Example Format String
[Y]	ISO-8601	ww[Y] yyyy[Y]
[y]	Standard Gregorian	ww[y] yyyy[y]

Important: To get correct ISO-8601 week numbering, you must set your data source start of week to Monday. (For information on how to do this, see **Date Properties for a Data Source** on page 791.) Otherwise, Tableau will number weeks using your data source start of week setting.

Note: ISO week numbering will not occur if you are using a fiscal year that doesn't start in January, regardless of the locale you choose.

Sample format strings for the date December 31, 2013

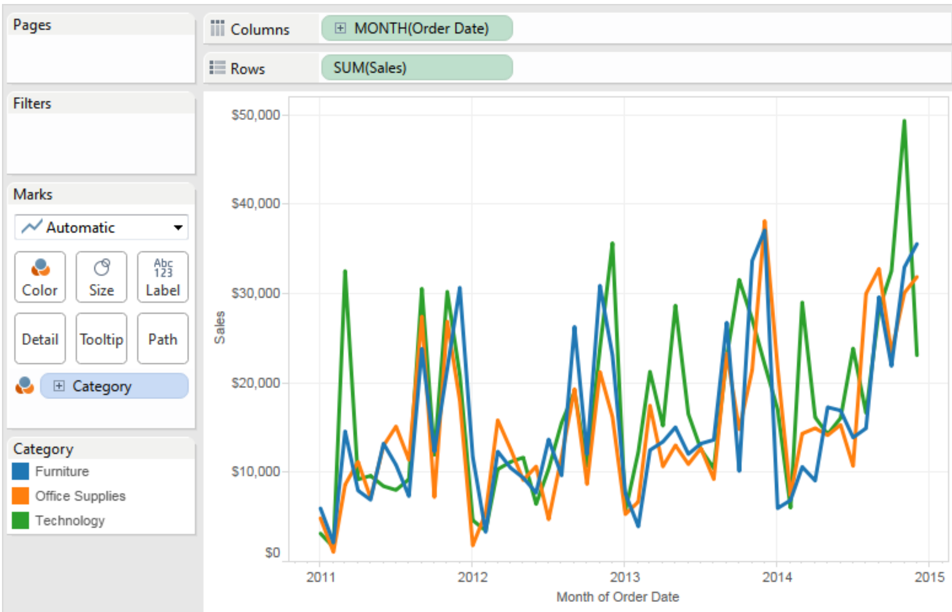
Here are sample format strings for the date December 31, 2013, where m stands for a month or day-of-month placeholder. Time placeholders, such as hours, minutes, and seconds, don't influence whether or not a year is week-based or year-based.

Format string	Formatted output
yyyy	2013
yyyy[Y]	2014
yyyy ww	2014 1
yyyy mm	2013 12
ww yyyy	1 2014
mm yyyy	12 2013
ww yyyy[y]	1 2013
mm yyyy[Y]	12 2014
yyyy mm ww	2013 12 1
mm yyyy ww	12 2013 1
ww mm yyyy	1 12 2013
ww mm yyyy[Y]	1 12 2014
ww yyyy mm	1 2014 12 (format is ambiguous)
ww yyyy[y] mm	1 2013 12
ww yyyy mm yyyy	1 2014 12 2013
ww yyyy yyyy mm	1 2014 2013 12
yyyy mm ww yyyy	2013 12 1 2014

Continuous Dates

You can treat a date as a continuous quantity after placing the field on a shelf. You do this by selecting one of the Continuous date options on the field's context menu (lower list of date levels). Continuous dates draw a quantitative axis for the date values.

For example, the view below displays the sales as a function of a continuous order date and is color-encoded by department. As you can see, the color of the **Order Date** field changes from blue to green after it is converted to a continuous quantity.



Treating dates as a continuous quantity is particularly useful when you use Gantt bars or want to see trends using line charts as shown above.

By default, date dimensions are discrete fields for which Tableau automatically selects a date level when it is placed on a shelf. To make a date dimension continuous by default, right-click (control-click on Mac) the field in the **Data** pane and select **Convert to Continuous**. The field turns green and is automatically converted to a continuous field when you drag it to a shelf. To revert to discrete again, right-click (control-click on Mac) the field in the **Data** pane and select **Convert to Discrete**.

Annotations and Mark Labels

Annotations call attention to specific marks, points, or areas in a view. An annotation, sometimes called a call-out, is most commonly displayed as a text box with a line pointing to a specific point or mark. You can also add an area annotation, which calls out several marks or a region of the view. Additionally, you can use mark labels to call out marks of interest or more commonly to label the view to make it more understandable. You can show mark labels for all the marks in the view, or selectively show and hide individual labels.

Annotations

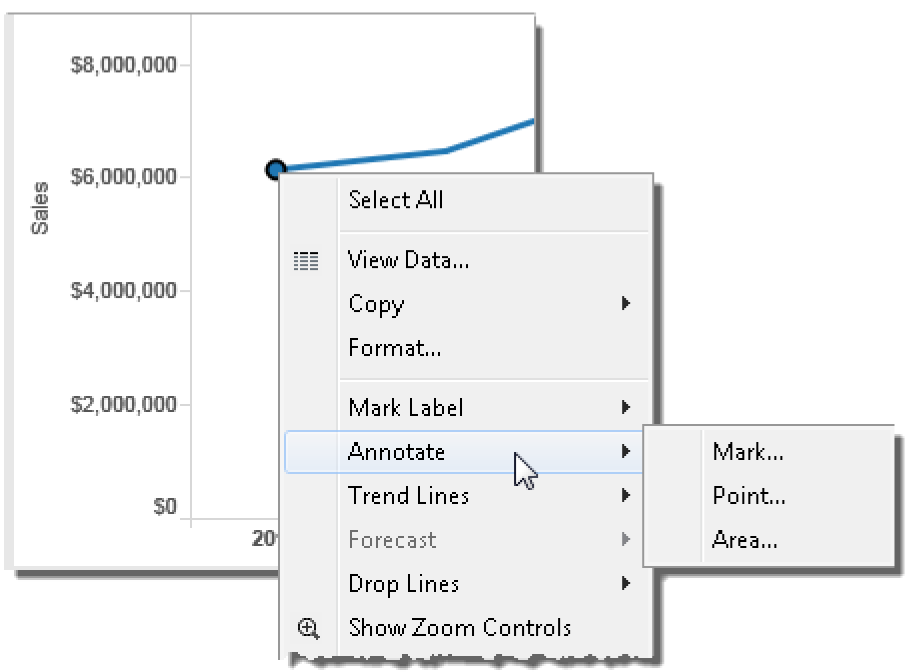
In Tableau there are three kinds of annotations: mark, point, and area. After you add an annotation, you can edit, re-position, format, and remove it.

Adding Annotations

Annotations are an important part of publishing and sharing a view. Use annotations to call out a specific mark, a specific point such as a value on the axis or a reference line, or an area such as a cluster of scatter marks.

To add an annotation:

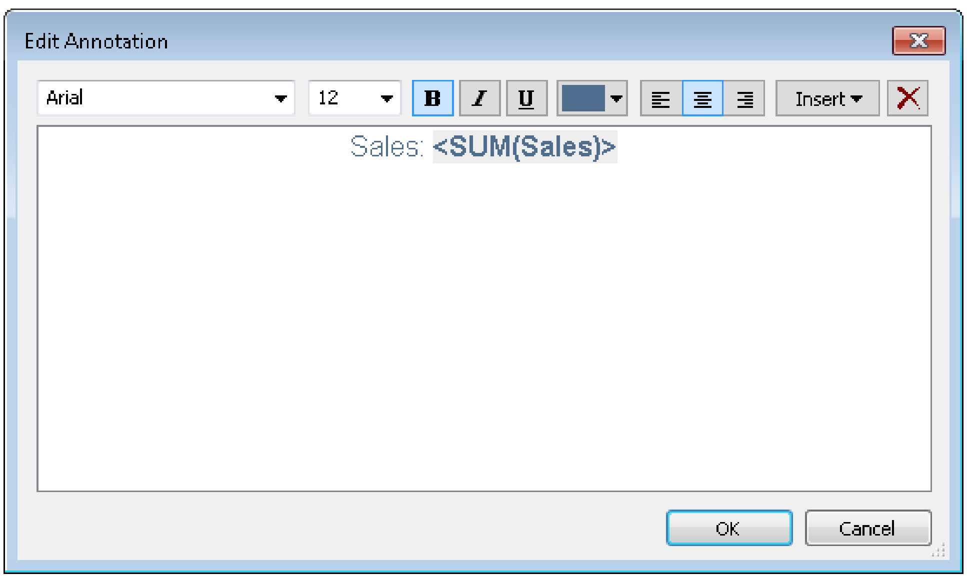
1. Right-click (Control-click on Mac) the view where you want to add an annotation and select **Annotate**.



2. On the sub-menu select one of the following types of annotations:
   - **Mark** - select this option to add an annotation that is associated with the selected mark. This option is only available if a mark is selected.
   - **Point** - select this option to annotate a specific point in the view.
   - **Area** - select this option to annotate an area in the view such as a cluster of outliers or a targeted region of the view.

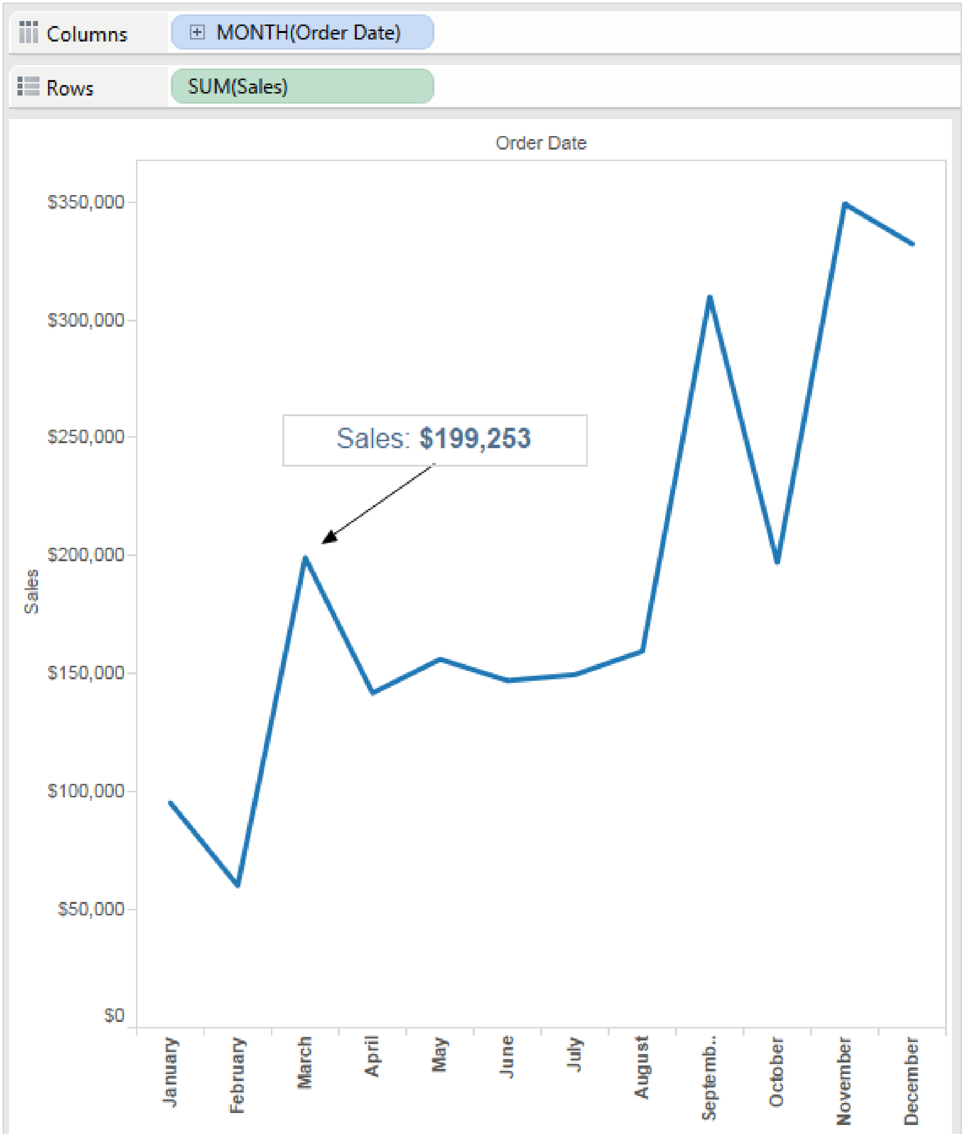
3. In the Edit Annotation dialog box, type the text you want to show in the annotation.

   Use the **Insert** menu to insert dynamic variables into the annotation text. For example, the annotation can display data values that update as the underlying data changes. The dynamic variables that are available are dependent on whether you are annotating a mark, point, or area. Only relevant variables are available for each of these types of annotations. For example, mark annotations can include dynamic data about that specific data point such as dimension and measure values. Point annotations don't refer to a specific data point but rather a place in the view. For that reason, point annotations can only include dynamic information about that point, such as measure values along the axes. Finally, when adding area annotations, only data relevant to the entire sheet is available, such as title and sheet name.

   Insert the **All Values** option using the Insert menu to show the data from the fields in the view. As you add more detail to the view, this text is updated to show the live data.

4. When finished, click **OK**.

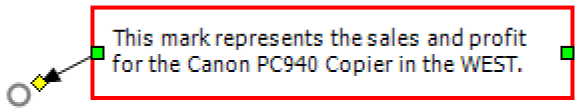


Rearranging Annotations

After you add an annotation, you can move it around, resize it, adjust the line, and move the text. Each type of annotation can be rearranged and modified in different ways. This section discusses how to rearrange, resize, and modify each type of annotation.

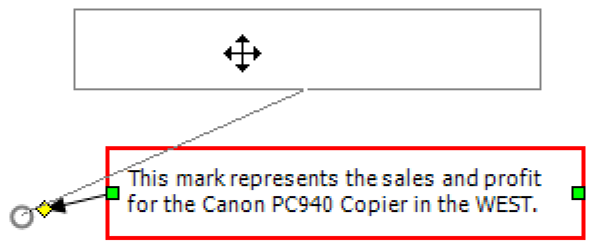
Mark Annotations

When you select a mark annotation the body and line are selected and several resize handles display. Use these handles to resize the body and line.



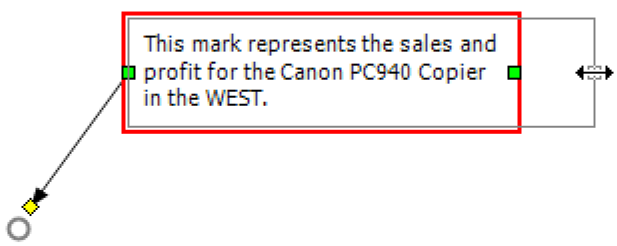
To reposition the body

- Click and drag the body of the selected annotation to a new position.



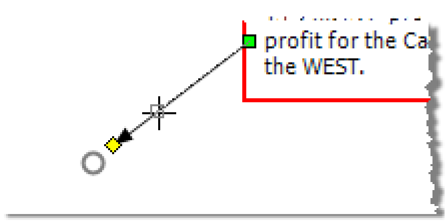
To resize the body

- Click and drag the body resize handle left and right. The text and height are automatically adjusted to fit the width of the body.



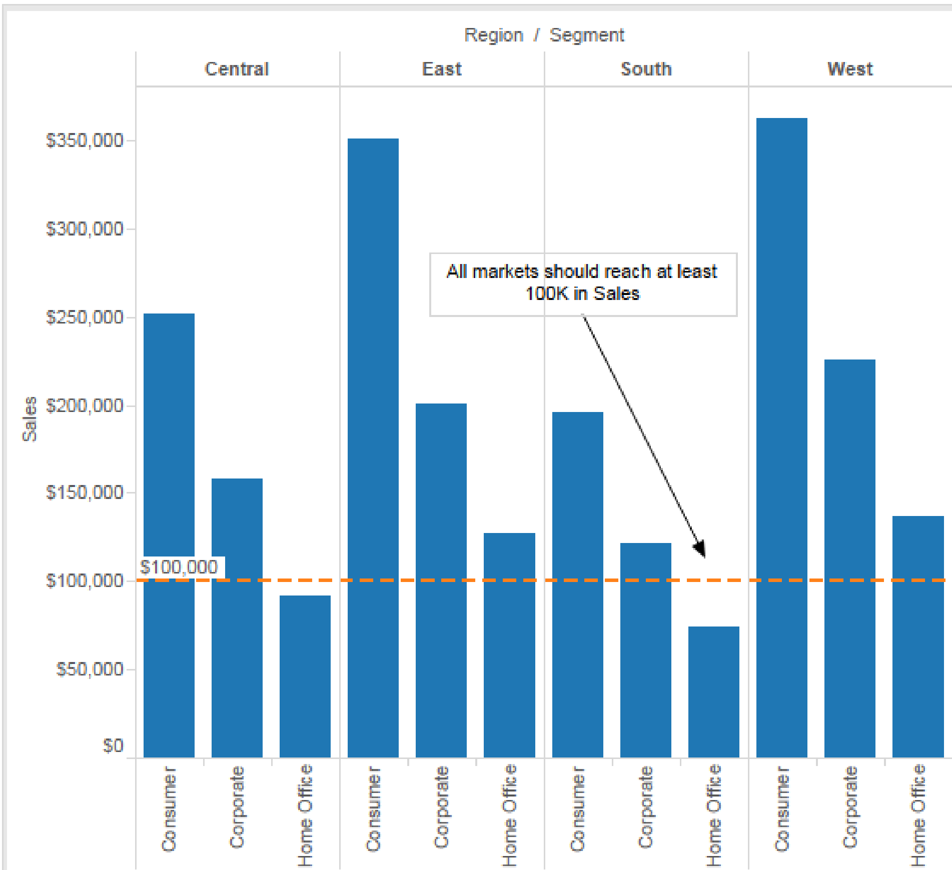
To resize the line

- Click and drag the line resize handle



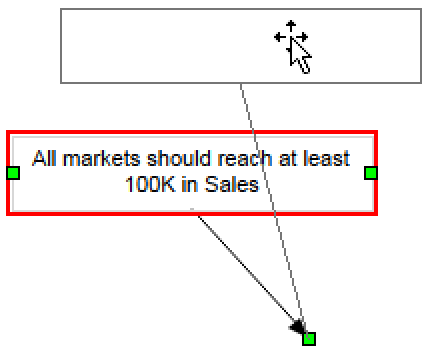
Point Annotations

A point annotation marks a specific point in the view such as a reference line or a value on an axis. Point annotations display as text with a line. When you select a point annotation, several resize handles display. Use these handles to reposition and resize the body and line.



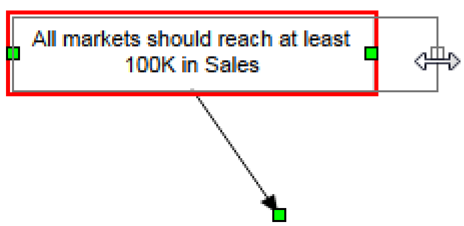
To reposition the body:

- Click and drag the body of the selected annotation to a new position. As you move the body, the line is automatically resized so that it continues to point at the specific point you selected.



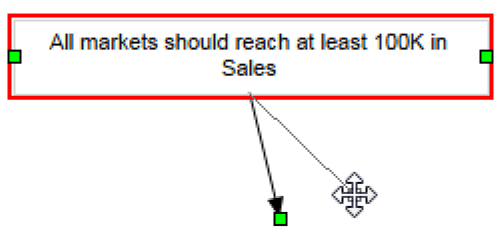
To resize the body:

- Click and drag the side resize handles left and right. The text and height are automatically adjusted to fit the width of the body.



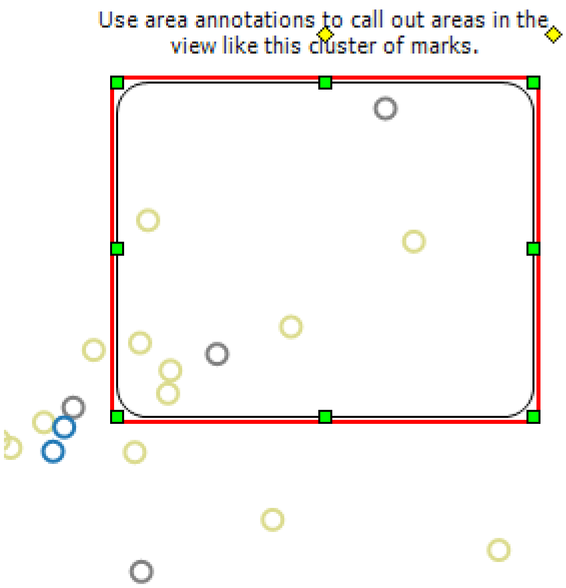
To move the line end point:

- Click and drag the end point of the line so that it points at a new location.



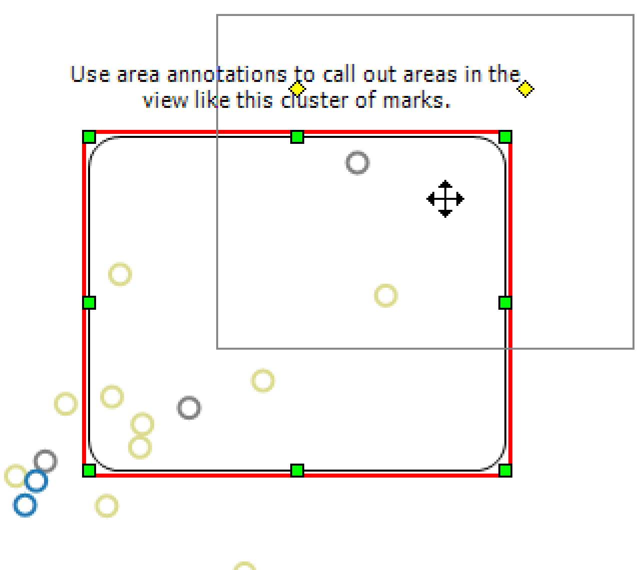
Area Annotations

An area annotation is a way to highlight or call out an area in the view. Area annotations are not associated with any particular mark, in fact, these annotations are commonly used to call out several marks. When you select an area annotation, several resize handles and two text handles display. Use these handles to reposition and resize the box and text.



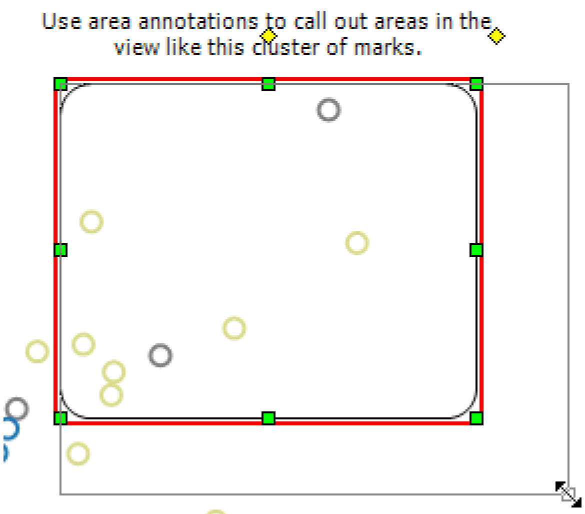
To reposition the box

- Click and drag the box of the selected annotation to a new position.



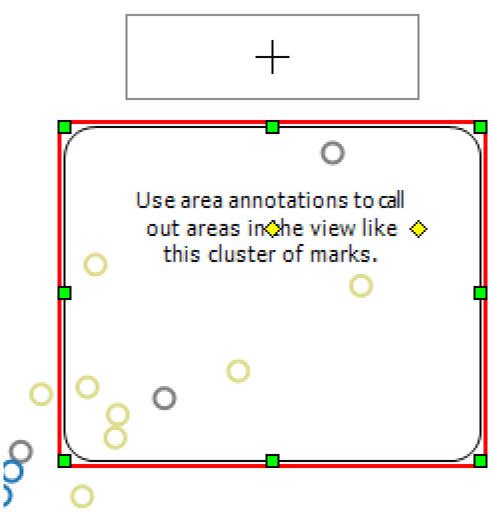
To resize the box

- Click and drag one of the box resize handles



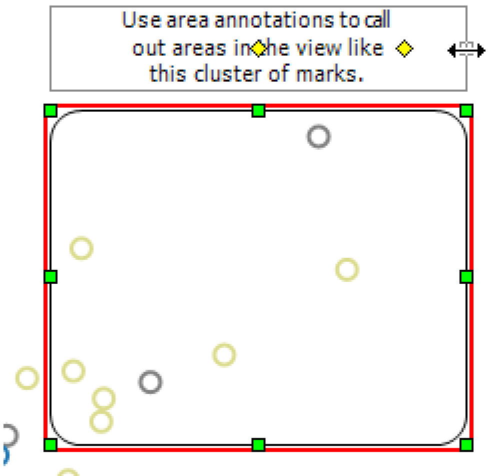
To reposition the text

- Click and drag the center text handle to a new position.



To resize the text width

- Click and drag the right text handle ◇ left and right. The text height is automatically adjusted to fit the width.

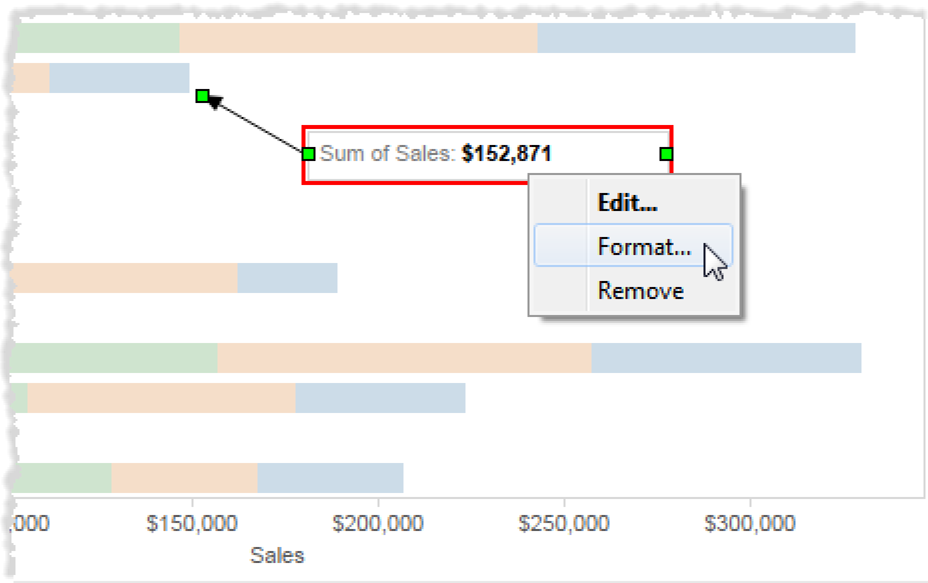


Formatting Annotations

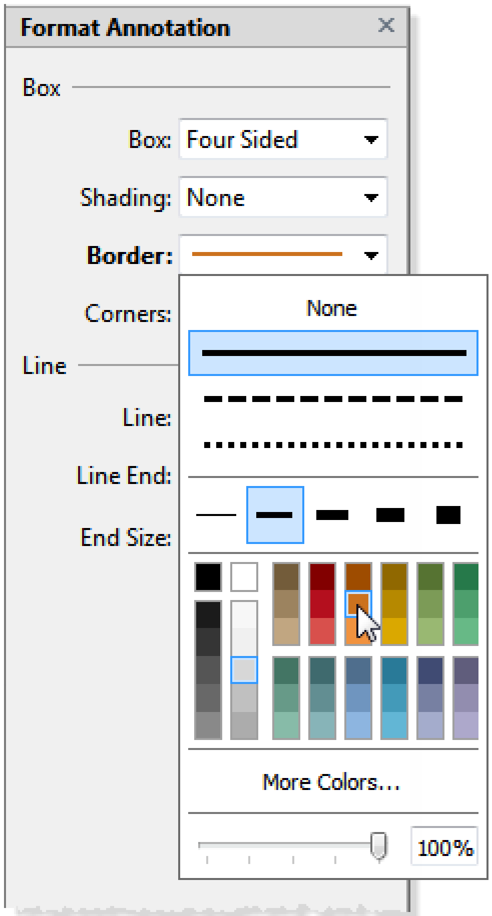
For each annotation you can modify the text, body, and line. For example, you can specify whether the body should be a box, a single edge, or not shown at all. Additionally, you can specify whether the lines on mark and point annotations end with an arrow, dot, or a simple line.

To format annotations:

1. Select one or more annotations, right-click (control-click on Mac) one of the selected annotations, and select **Format**. The **Format** pane opens showing the relevant settings.

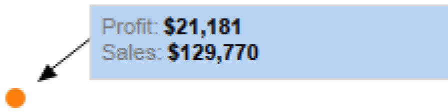
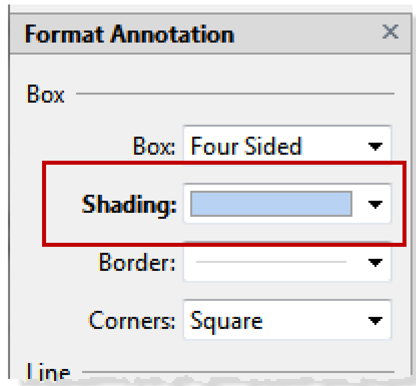
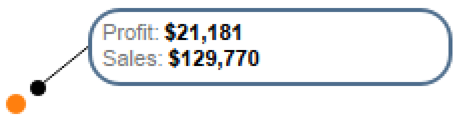
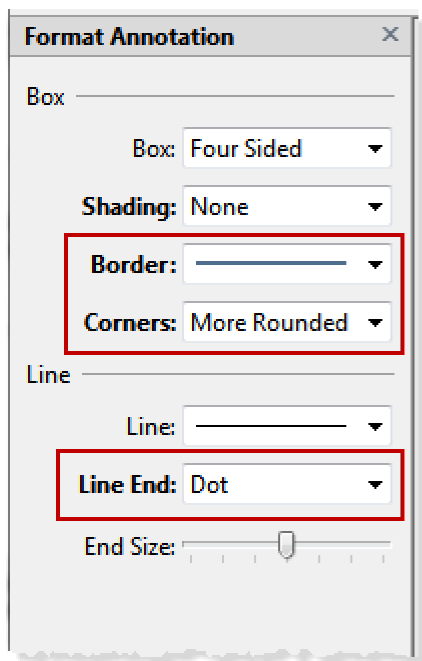


2. In the **Format** pane, use the drop-downs to specify font properties, text alignment, line style, and shading.

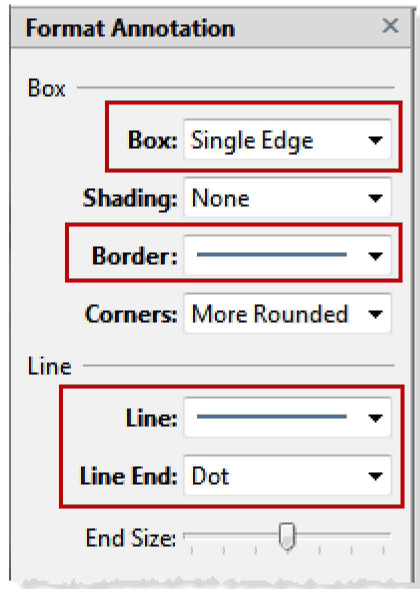


Example Formatting Options

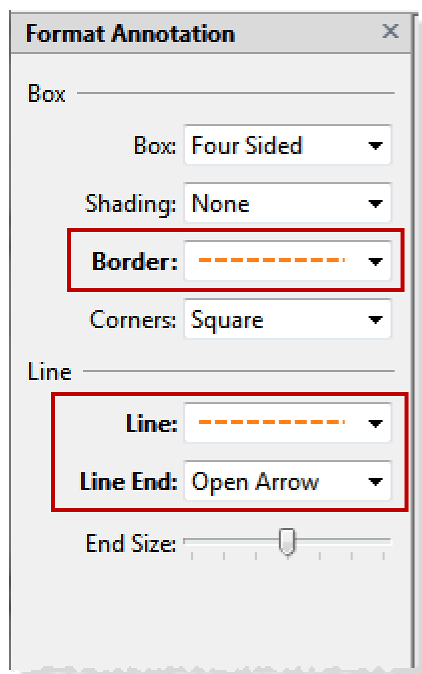
Annotation Style	Format Window Settings
	Default format settings for point and mark annotations.

Annotation Style	Format Window Settings
	
	

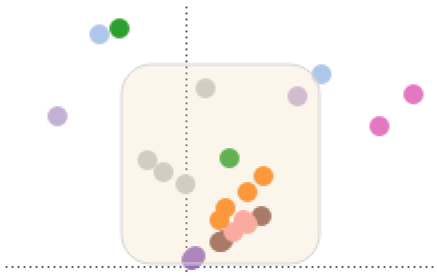
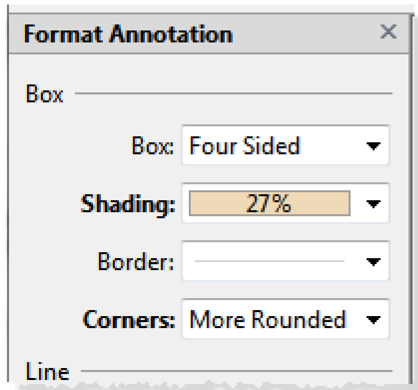
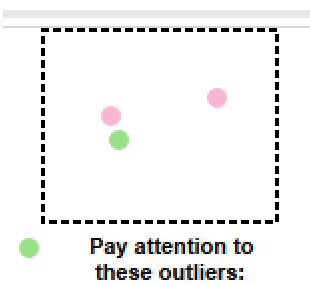
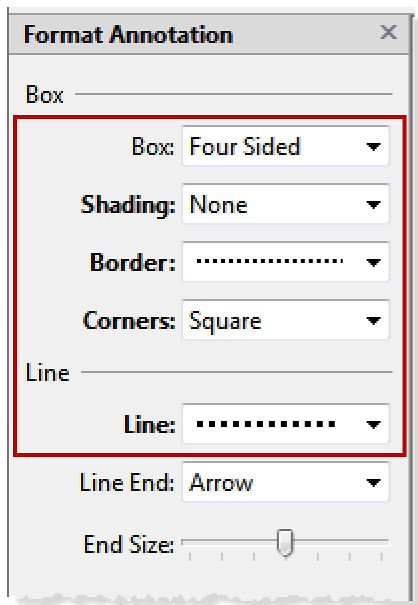
<table>
<tr><th>Annotation Style</th><th>Format Window Settings</th></tr>
<tr><td>


</td><td>


</td></tr>
<tr><td>


</td><td>


</td></tr>
</table>

<table>
<tr><th>Annotation Style</th><th>Format Window Settings</th></tr>
<tr><td>
Annotate areas in the view like this cluster of marks.</td><td>
</td></tr>
<tr><td>
</td><td>
</td></tr>
</table>

Removing Annotations

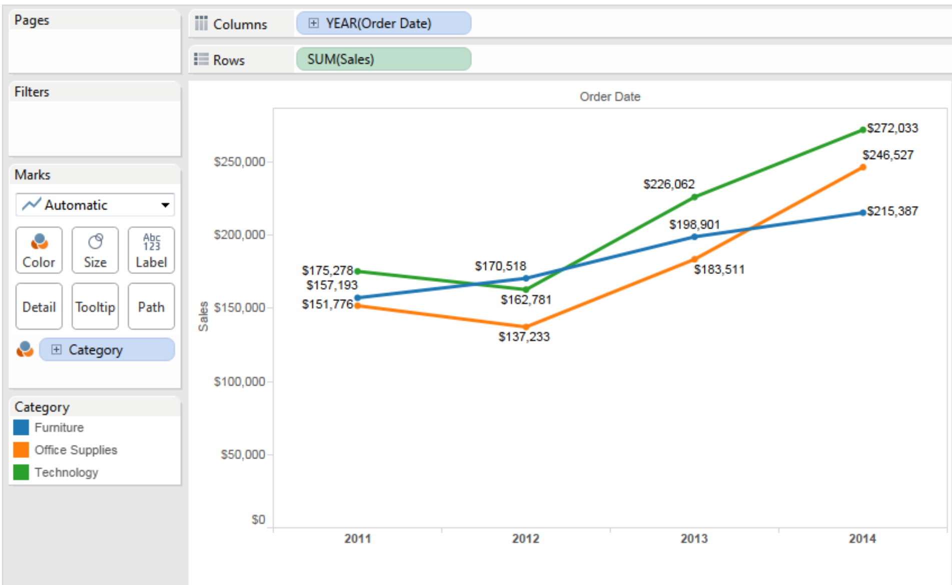
At any time you can remove one or more annotations.

To remove an annotation:

1. Select one or more annotations to remove.
2. Right-click (Control-click on Mac) one of the selected annotations and select **Remove** or press the Delete key on your keyboard.

Mark Labels

Mark labels are values shown next to each data point in a view. For example, in a view that shows product category sales over time as a line, you can turn on mark labels so the sales values display next to each point along the lines. Alternatively, mark labels don't have to be measure values. In the same example, you could turn on mark labels that display the name of each product category next to each line.



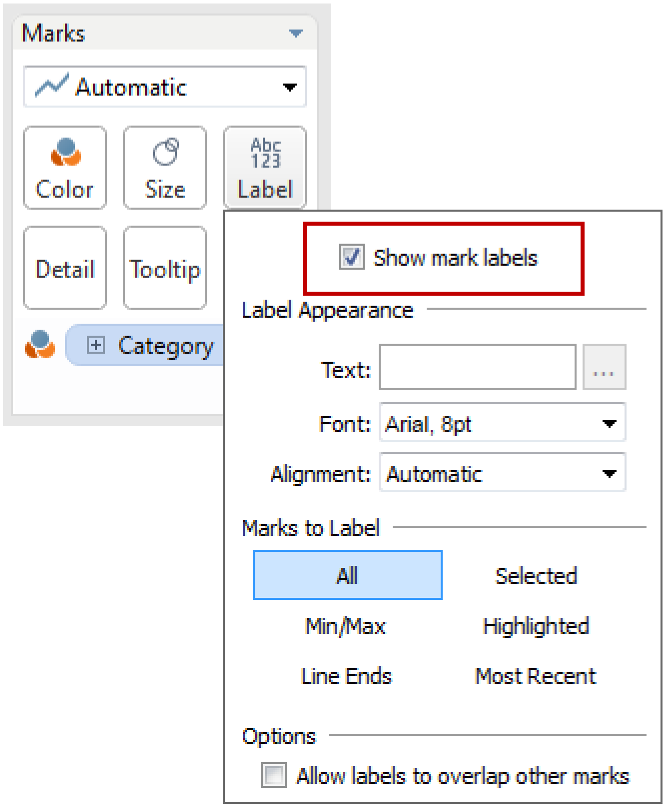
Mark Labels can be turned on for all marks, selected marks, highlighted marks, the minimum and maximum values, or just the line ends in a line chart. Additionally, you can turn on mark labels for an individual marks. This section discusses the following topics:

Show and Hide Mark Labels

To add context to your views, you can show mark labels.

To show or hide mark labels:

- Click **Label** on the **Marks** card, and then select **Show mark labels**.



Label only specific marks

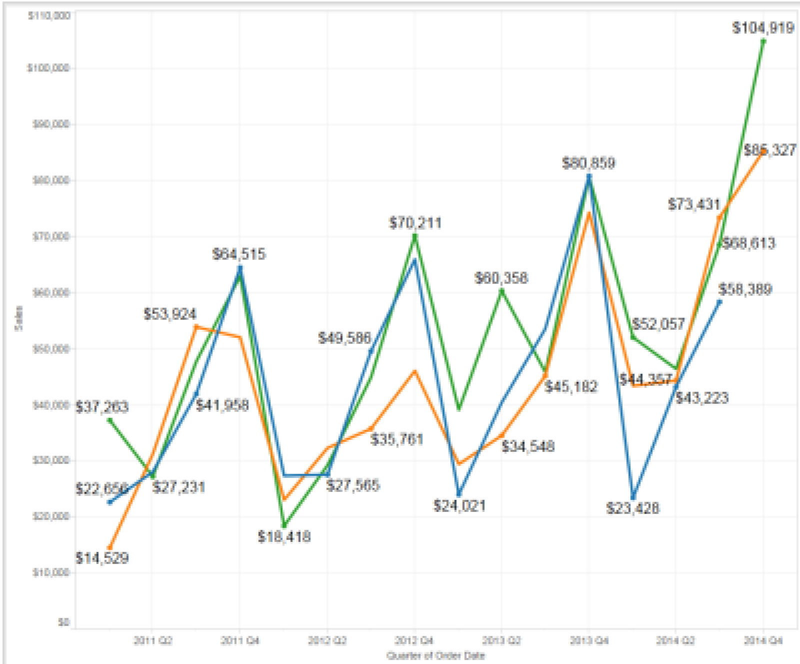
After you show mark labels in a worksheet, you can specify which marks to label.

To specify which marks you want to label:

- Click **Label** on the **Marks** card, and then make a selection from the following options under the **Marks to Label** section:

  All

  Label all marks in the view.

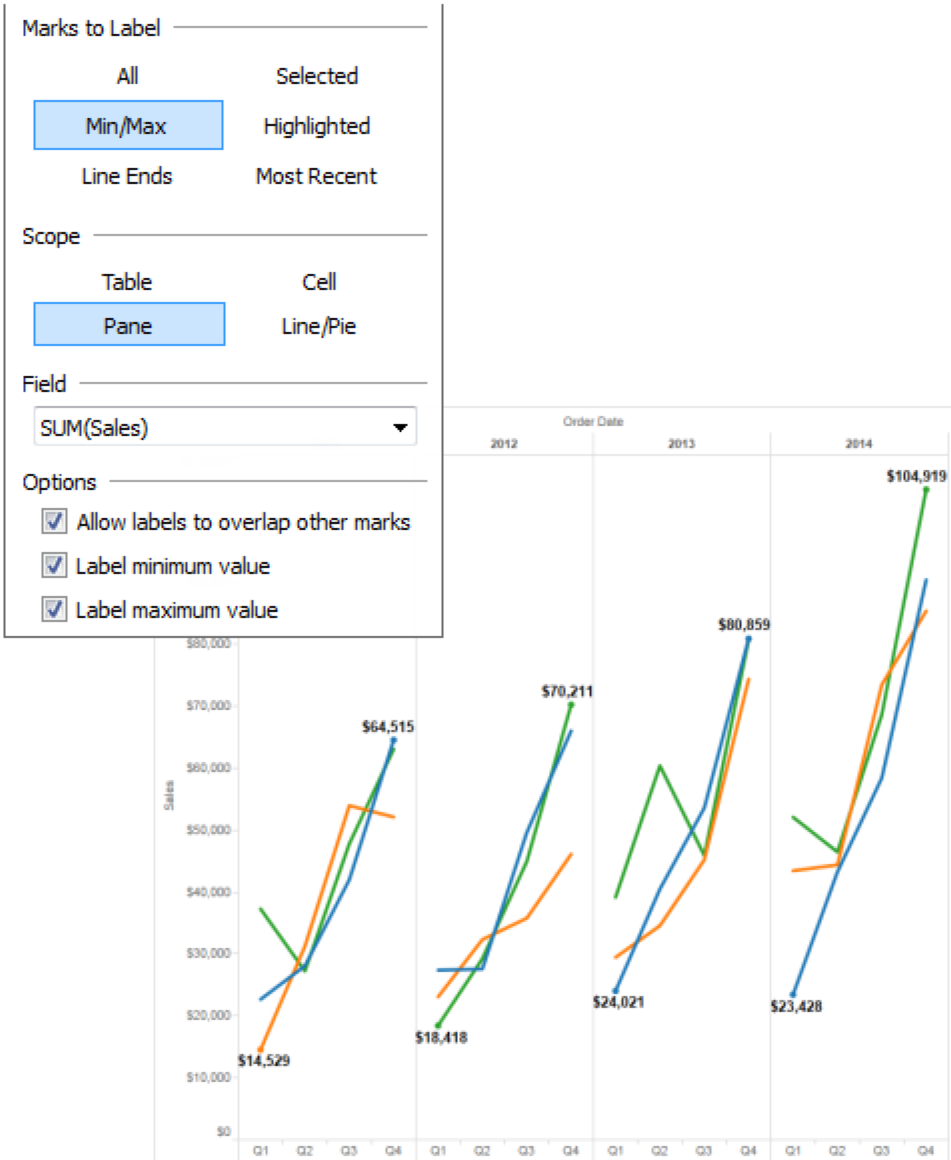


Min/Max

Label only the minimum and maximum values for a field in the view. When you select this option, you must specify a scope and field to label by.

For example, the image below shows the mark labels scoped to Pane, and specifies to show the minimum and maximum sum of sales values. This means that the minimum and maximum sales are labeled for each pane in the view. In this case, there are four panes in the view.

You can also label only the minimum or only the maximum values.

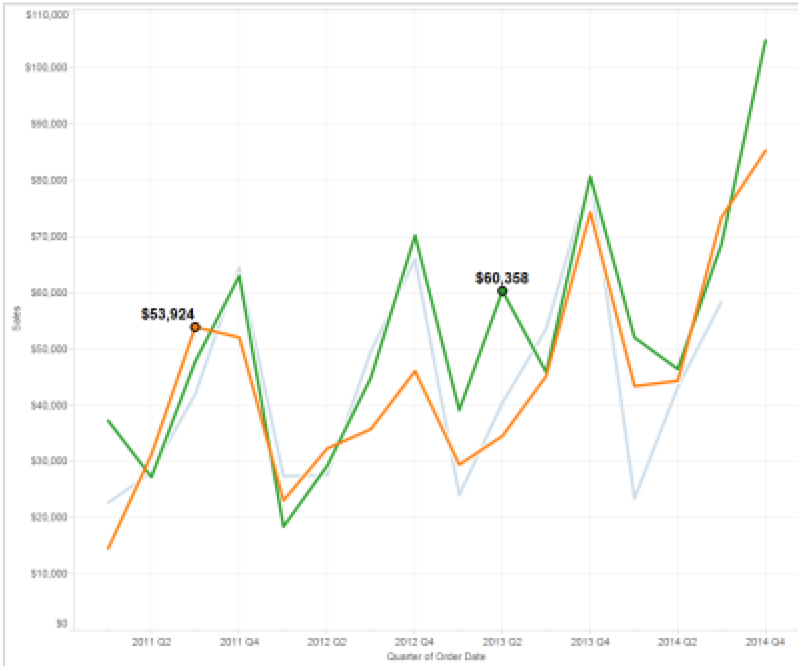


Line Ends

You can label the start or the end of all lines in the view, or both.

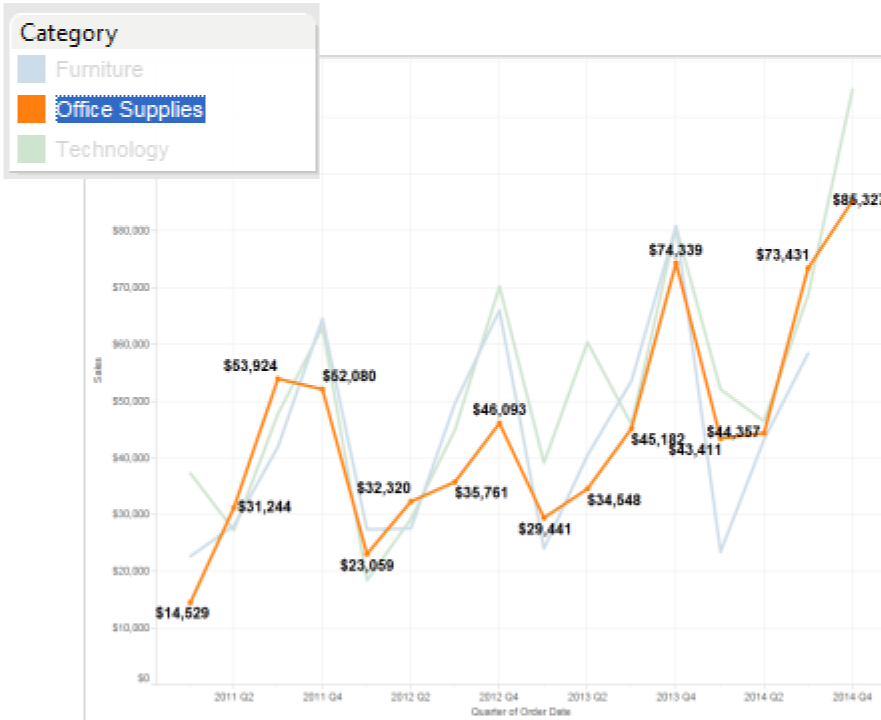
Selected

Label only the selected marks in the view. Labels appear when you select one or more marks in the view.



Highlighted

Label only the highlighted marks in the view. Labels appear when you select a member in a legend (for example, Office Supplies, in the following image), or when you select one or more marks in the view.

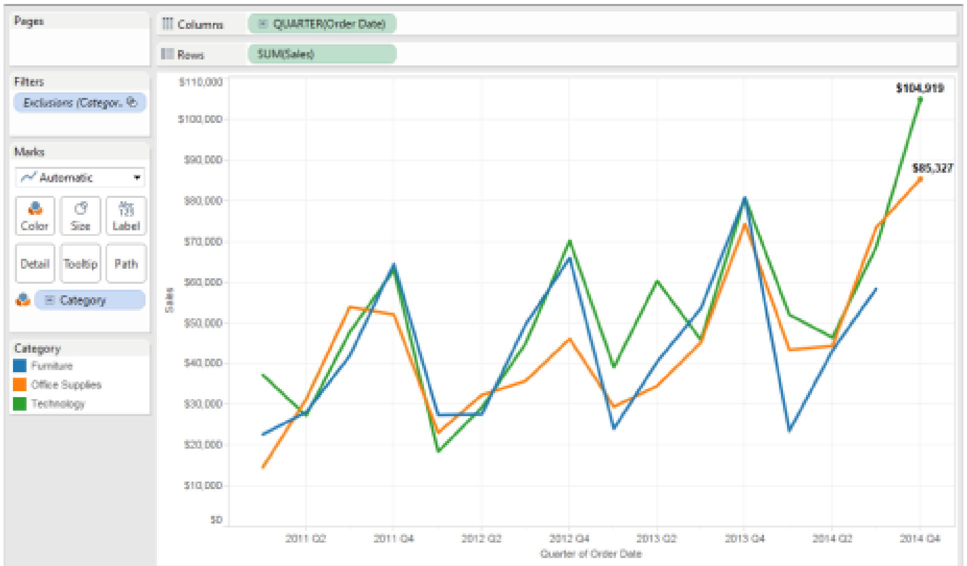


Most Recent

Label the most recent marks in the view. When there is a time or date field in the view, you can label all marks that correspond to the most recent date or time in the view. When you select this option, you can specify a scope for the labels in the view.

Marks labeled are determined by the level of detail of the view.

For example, the following image shows labels for each category, because the **Category** field is on **Color** on the Marks card. There is no label for the Furniture category, because the most recent mark in that category is excluded from the view.



Select to overlap other marks

By default, mark labels do not overlap other marks or labels in the view. You can show all labels in the view, even the ones that overlap other marks and labels.

To select to overlap other marks:

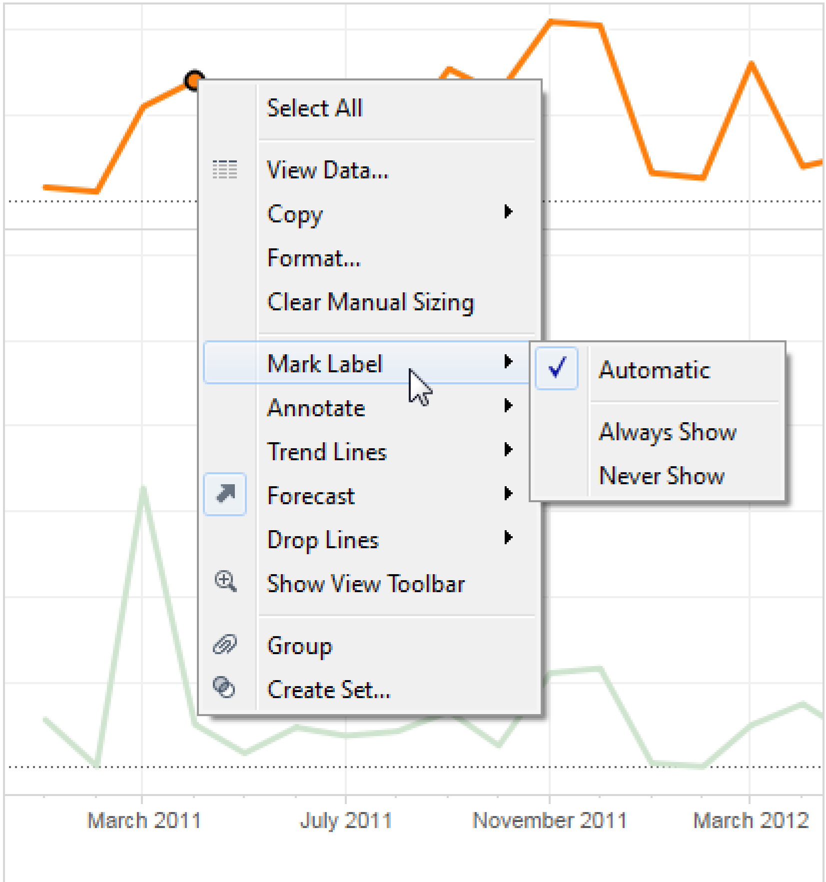
- Click **Label** on the **Marks** card, and then select **Allow Labels to overlap other marks** under the **Options** section.

Show and Hide Individual Mark Labels

Rather than showing all mark labels or dynamically showing labels based on the view, you might want to show labels for a selection of individual marks. You can use mark labels to call out the values of specific marks of interest, as well as hide overlapping mark labels.

To show or hide individual mark labels:

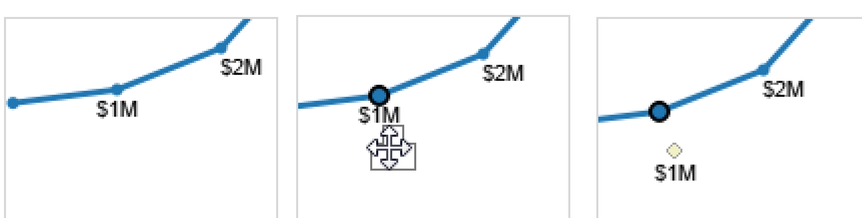
- Right-click (control-click on Mac) the mark you want to show or hide a mark label for, select **Mark Label**, and then select one of the following options:
  - **Automatic** - select this option to turn the label on and off depending on the view and the settings in the Label drop-down menu.
  - **Always Show** - select this option to show the mark label even when it would otherwise be hidden (based on the settings in the Label drop-down menu).
  - **Never Show** - select this option to hide the mark label even when it would otherwise be shown (based on the settings in the Label drop-down menu).



Move Mark Labels

After you show a mark label in a view, you can reposition it to best fit your view and presentation. For example, in a stacked bar chart, the mark labels are automatically placed in the center of each bar. However, you may want to stagger the labels so that the longer ones don't overlap.

1. Select the mark whose mark label you want to move.
2. Click and drag the move handle to a new location.



Edit Mark Labels with Aliases

Another way to modify mark labels is to edit the aliases of a field. An alias is an alternative name assigned to a dimension member, or to a field name. Tableau gives you the ability to display and edit aliases for data sources that support this feature. When you edit the aliases you can change the names of the members in a field, thus modifying the mark labels displayed in a the view.

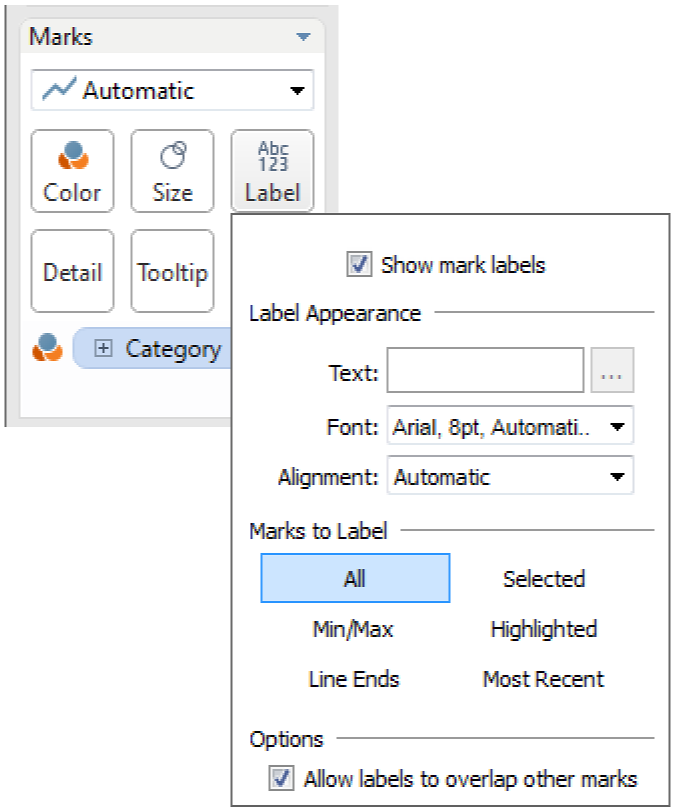
Format Mark Labels

When you select to show mark labels in the view, there are several formatting options to help you adjust the appearance of the labels. These options are available in the **Label** drop-down menu.

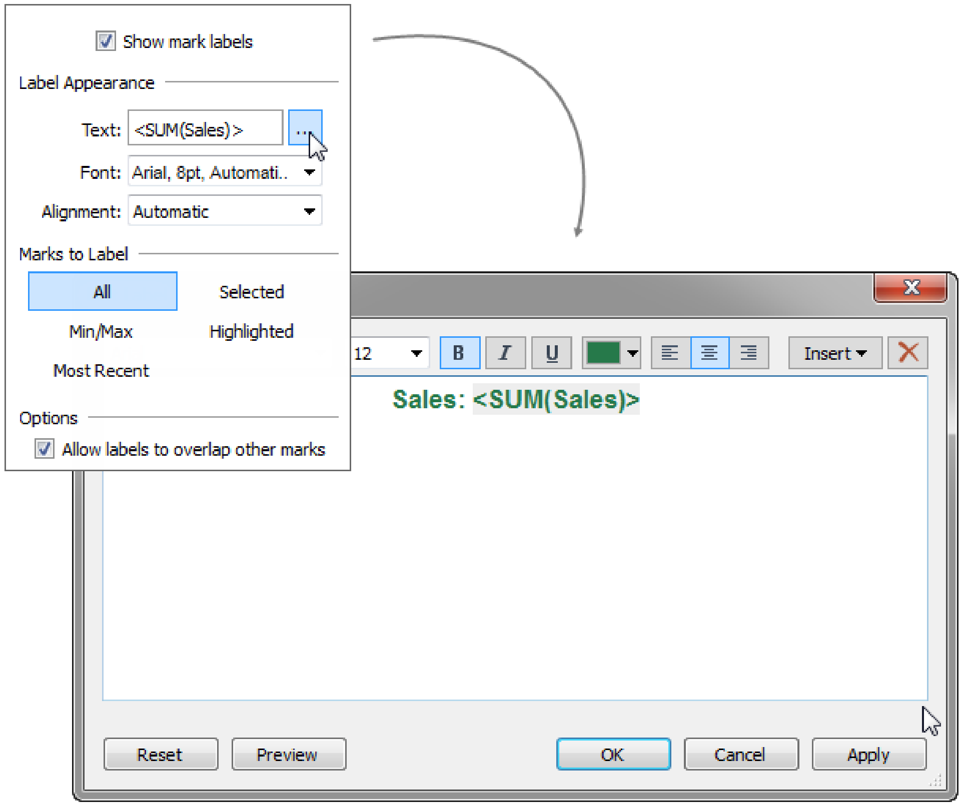
You can use the **Label** drop-down menu to adjust the label appearance, as well as specify which labels appear in the view. You can customize the text, adjust the font properties, and set an alignment for all labels.

For more information about specifying which labels appear in the view, see **Show and Hide Mark Labels** on page 826.

1. Open the **Label** drop-down menu.
   - On the **Marks** card, click **Label**.



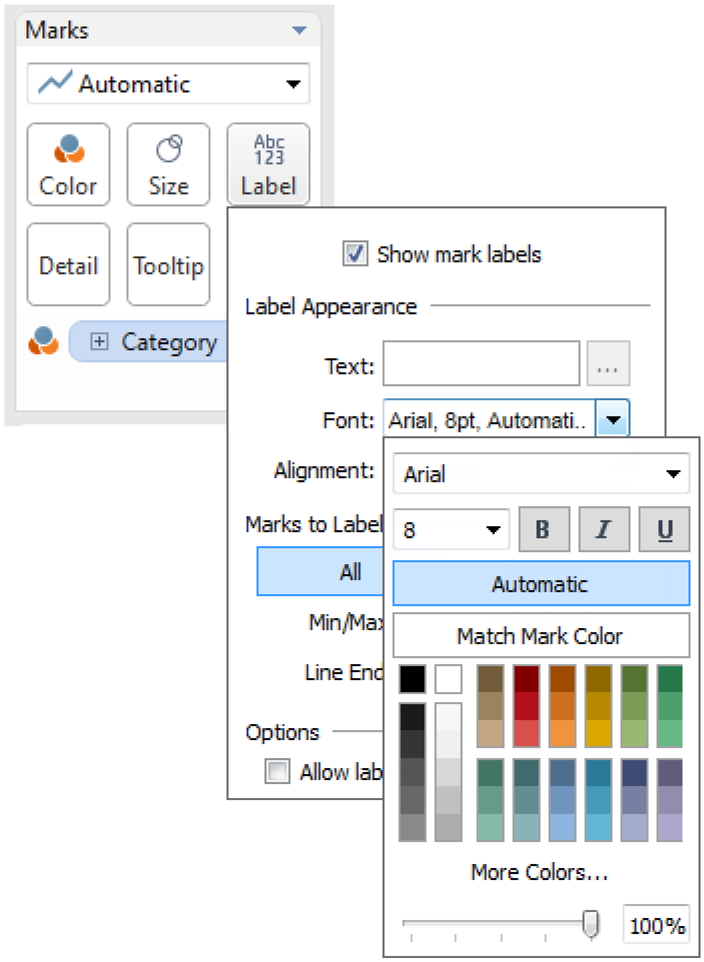
2. Change the text for all labels in the view.
   - On the **Label** drop-down menu, click the **Edit Text** icon. This opens the Edit Label dialog box where you can customize the label text.



3. Customize the appearance of the font for all labels in the view.

   - On the **Label** drop-down menu, click the **Font** drop-down arrow. This opens the **Font** drop-down menu.

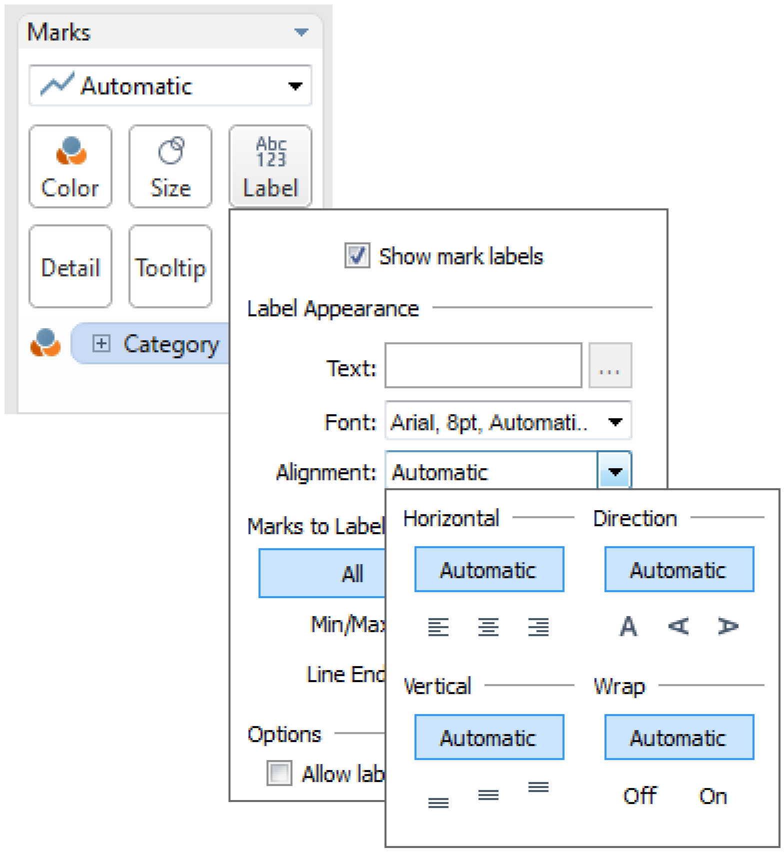
     In the **Font** drop-down menu, you can choose a font type and size, select to bold, italicize, or underline the font, adjust the transparency of the labels, and select a color for the labels. For more information, see Select Label Color.



4. Change the alignment, direction, and text wrap for all labels in the view.

- On the **Label** drop-down menu, click the **Alignment** drop-down arrow. This opens the Alignment drop-down menu.

  In the Alignment drop-down menu, you can select a horizontal and vertical alignment, and a direction for all labels. You can also choose to wrap the text for all labels in the view.



5. Select label color.

By default, when you choose to show mark labels, the label colors automatically appear black or white in the view. However, you can choose to customize the color of the labels.

- On the **Label** drop-down menu, click the **Font** drop-down arrow. This opens the **Font** drop-down menu.

  In the **Font** drop-down menu, you can select a specific color for all the mark labels in the view, or you can choose to closely match each label to the color of its mark.

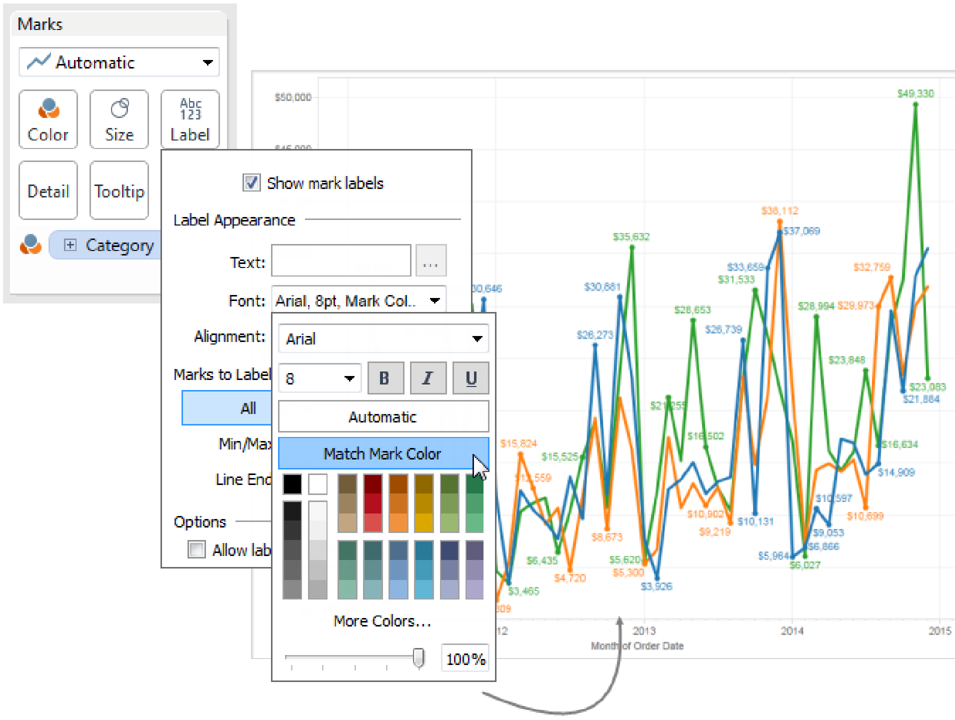
  - **Select a specific color:**

    To select a specific color, click a color in the **Font** drop-down menu.

    If you would like to create a custom color for the mark labels, click **More Colors**, and then create a color in the **Select Color** dialog box that opens.

  - **Match label colors to the mark colors:**

To closely match each label to the color of its mark, click **Match Mark Color** in the font drop-down menu.



Inspecting Data

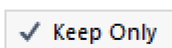
Once you have created a view, Tableau offers a selection of dynamic data inspection tools that help you isolate the data of interest and then continue to explore and analyze. For example, if you have a dense data view, you can focus on a particular region, select a group of outliers, view the underlying data source rows for each mark, and then view a summary of the selected marks including the average, minimum, and maximum values.

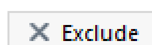
Marks and Data Analysis

Selecting marks in the view can help you gain insight into how a subset of your data compares to the overall data in your view. For example, you can view the underlying data of selected marks using tooltips, or compare the average sales of the selected marks to the overall average sales of the marks in the view using recalculated lines.

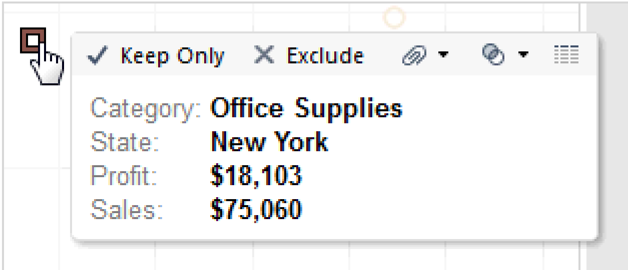
Data Analysis Options in Tooltips

When you select one or multiple marks in a view, several options for inspecting your data are available in the tooltip that appears. Tooltips provide additional information about the marks in your view, and provide the following data analysis options:

- Keep only the selected marks in the view. For more information, see **Select Data to Filter** on page 608. 

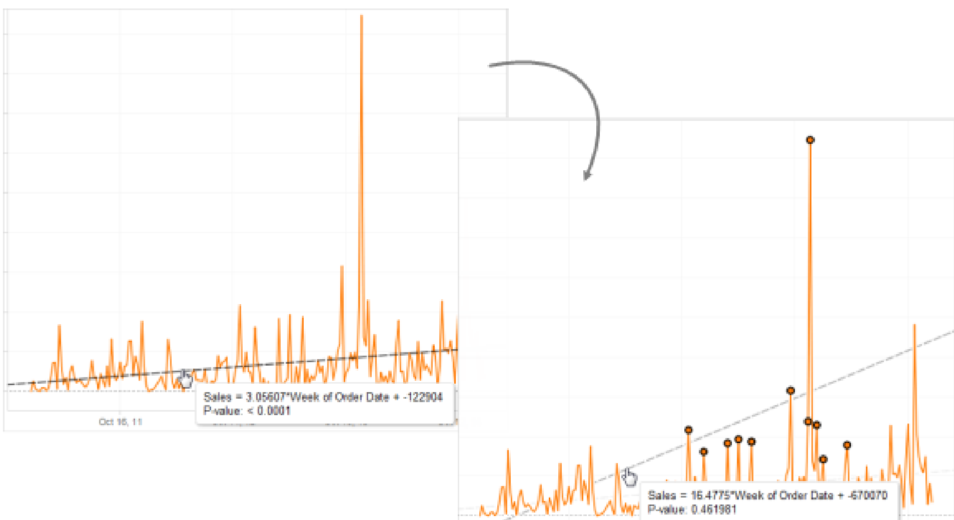
- Exclude the selected marks from the view. 

- Create a group based on the selected marks. For more information, see **Groups** on page 736. 
- Create a set that contains the selected marks. For more information, see **Sets** on page 750. 
- View the underlying data of the marks selected. For more information, see **View Data** on page 852. 



Data Comparison with Recalculated Lines

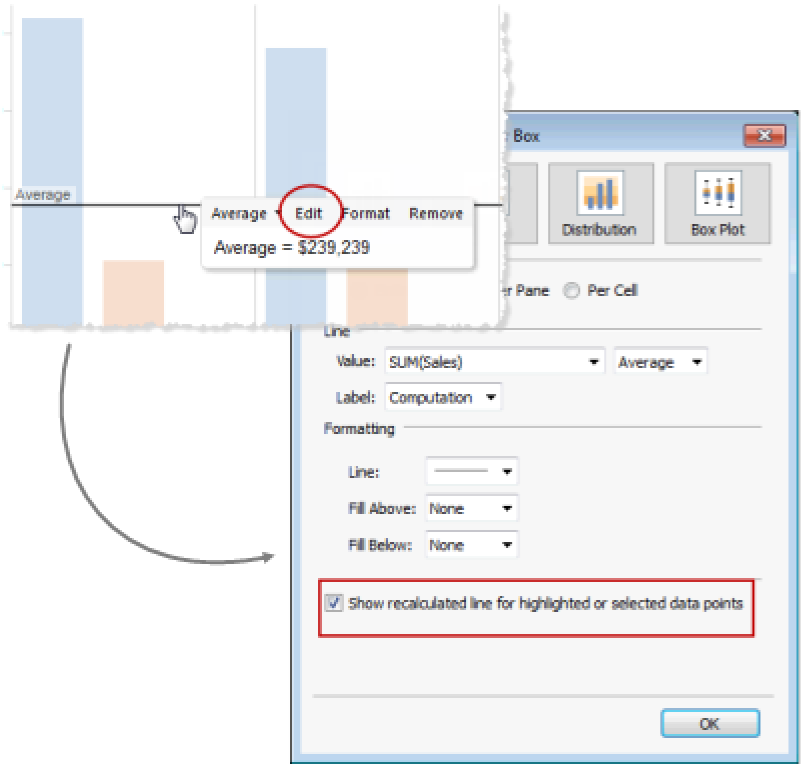
If there is an analytics object in your view, such as an average line, constant line, trend line, reference line or distribution line or band, selecting one or multiple marks in the view lets you instantly compare the analytical data for the selected marks to all data in the view. For example, selecting marks in a view that contains a trend line creates a second, recalculated trend line, the value of which is determined by the selected marks only, so you can compare that trend to the overall trend.



Recalculated lines are displayed by default when you select marks in a view that already contains analytics objects. If you don't want recalculated lines to be created you can choose to not show them.

To not show recalculated lines:

1. Select an analytics object in the view, such as a trend line, and click **Edit**.
2. In the **Edit** dialog box, clear **Show recalculated line for highlighted or selected data points**.



Alternatively, you can right-click (control-click on Mac) an analytics object in the view and clear **Show Recalculated Line**.

When you return to the view and select or highlight marks, recalculated lines will not appear. For more information about how to highlight marks, see **Selecting Marks to Highlight** on page 772.

Recalculated Lines and Highlight Actions

Recalculated lines also work with highlighting actions, both in worksheets and dashboards. For example, if you create a highlight action in a dashboard, selecting marks in one sheet will highlight marks in the other sheets in the dashboard. If those other sheets have trend lines, reference lines, or other analytics objects, recalculated lines will appear as the views update.

Related Topics:

Analytics Pane on page 272

Select Marks on the next page

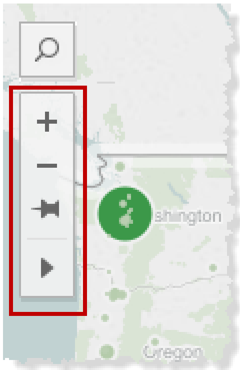
Tooltips on page 288

Highlight Actions on page 772

View Toolbar

The view toolbar appears in the upper-left corner of the view and lets you select marks, zoom in and out, and pan in the view. By default, the view toolbar appears when you hover over a map view, but you can also show the view toolbar in other types of views, such as scatter plots or box plots.

For more information about showing and hiding the view toolbar in map views, see **Customize How People Interact with your Map** on page 910.



Show the view toolbar

- In a worksheet or dashboard, right-click (control-click on Mac) anywhere in the view, and then select **Show View Toolbar**.

Set when the view toolbar appears in the view

- Select **Worksheet** > **Show View Toolbar** (in a dashboard, select a view, then select **Worksheet** > **Show View Toolbar**), and then select one of the following options:
  - **Automatic** –The toolbar appears only when you hover over a map view.
  - **Show on hover** – The toolbar appears when you hover over the selected view. You can select this option for any type of view.
  - **Hide** –The toolbar does not appear in the selected view.

Hide the view toolbar

- In a worksheet or dashboard, right-click (control-click on Mac) anywhere in the view, and then select **Hide View Toolbar**.

Note: If the view toolbar is hidden, you can still use keyboard shortcuts to select marks, zoom, and pan. For more information, see **Keyboard Shortcuts** on page 1476.

Select Marks

You can select marks in the view to inspect your data. When you select a mark or a subset of marks in the view, you can see information about the marks in the tooltip that appears. You can also quickly filter the marks you select from the view, as well as view their underlying data. For more information, see **Tooltips** on page 288.

Select marks

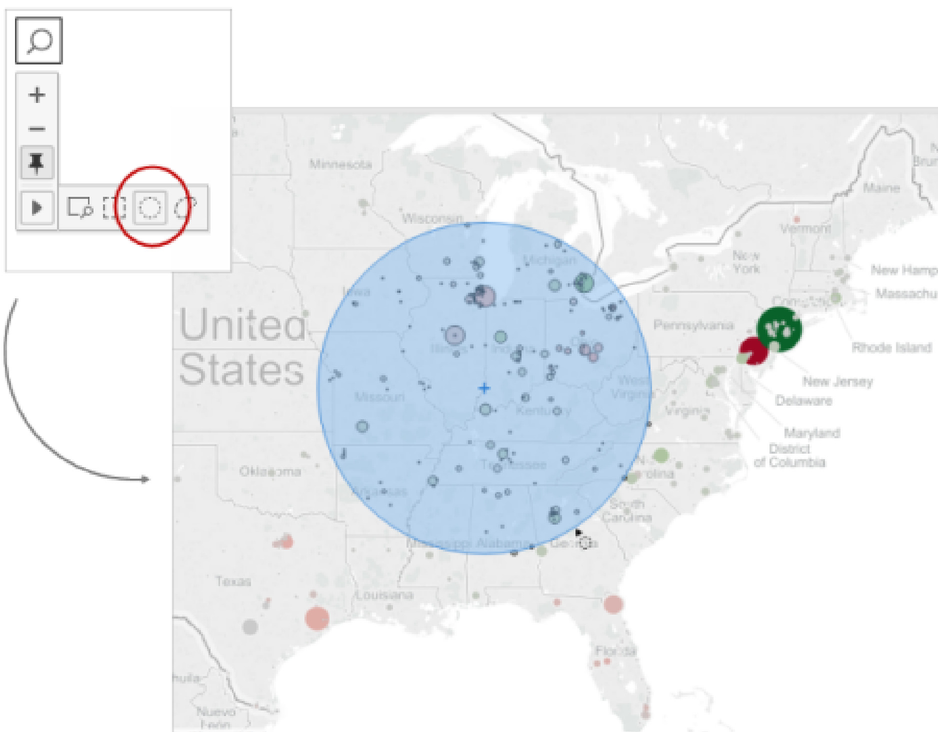
Click an individual mark to select it. After you select a mark, hold down the Ctrl key (Command key on Mac) to add more marks to a selection.

To select multiple marks using the default selection tool, click and drag across the view. In most views, the Rectangular selection tool is the default tool.

You can also use the Radial, Rectangular, and Lasso tools on the view toolbar to select multiple marks. For more information about the view toolbar, see **View Toolbar** on page 844.

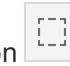
Radial selection tool

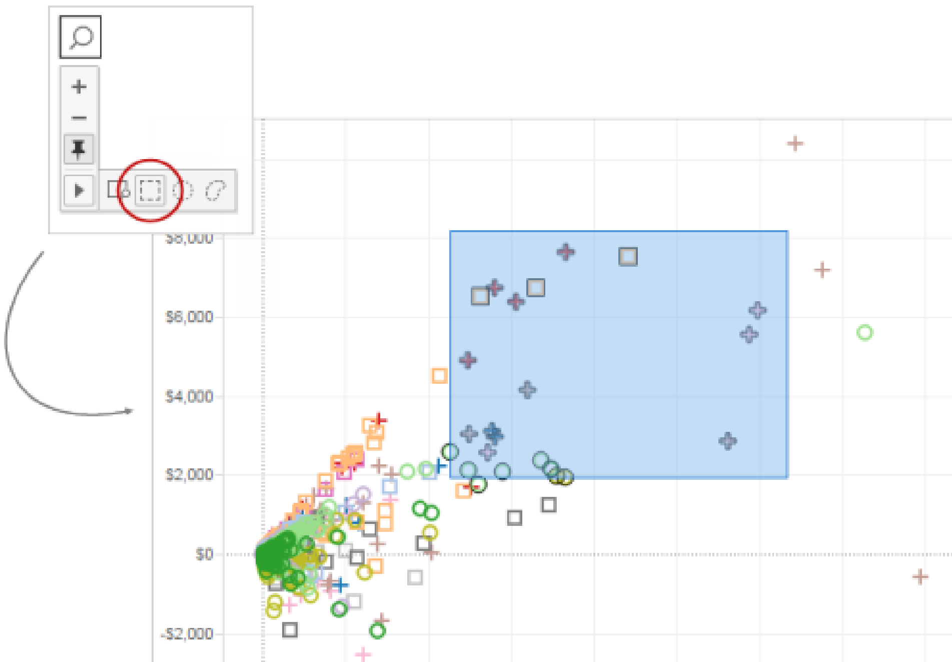
The Radial tool selects marks within a circular area. To use the Radial tool, hover over the arrow on the view toolbar, click the Radial tool button , and then click and drag across the view.



You can also measure distance in a map view with the Radial tool. For more information, see **Measure Distances Between Data Points and Locations in a Map** on page 912.

Rectangular selection tool

The Rectangular tool selects marks within a rectangular shape. To use the Rectangular tool, hover over the arrow on the view toolbar, click the Rectangular tool button , and then click and drag across the view.

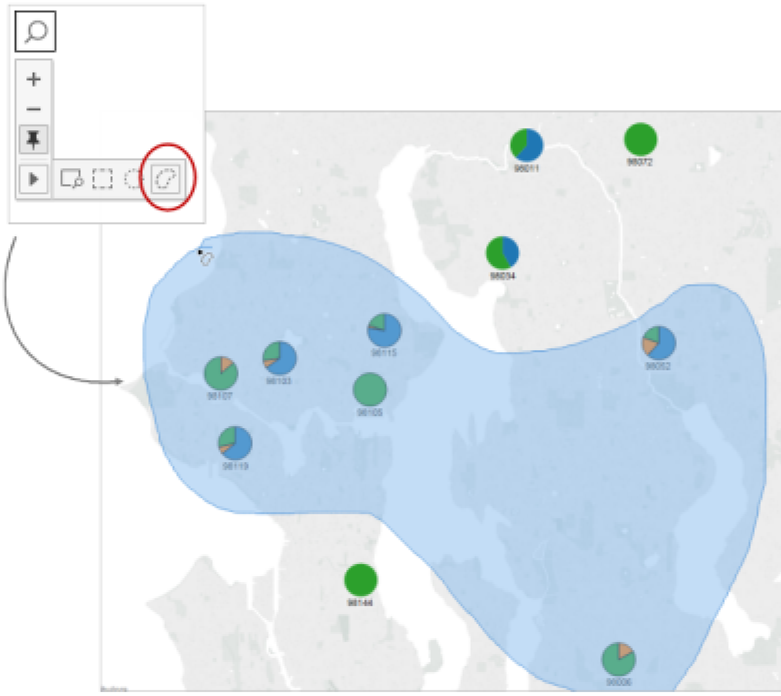


> **Note:** The Rectangular tool is the default tool in most views, and may not appear in the view toolbar. In this case, you can drag across the view to use the rectangular tool.

Lasso selection tool

With the Lasso tool, you can select multiple marks by drawing a freehand shape around them. This tool is useful when you want to include only certain marks, and exclude others around them.

To use the Lasso tool, hover over the arrow on the view toolbar, click the Lasso tool button , and then draw a freehand shape around the marks you want to select.



Pan and Zoom

The pan tool and zoom controls help you interact with the view and inspect your data. They are located in the upper-left corner of the view, on the view toolbar. For more information, see **View Toolbar** on page 844.

You can use the zoom controls to zoom in and out, zoom to a specific area, and fix or reset the axes in the view. Use the pan tool to move quickly around the view.

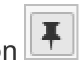
Zoom in and out

On the view toolbar, click the Zoom In button  to zoom in and the Zoom Out button  to zoom out. If the view toolbar is hidden, double-click the view to zoom in; to zoom out, hold down Shift, and then double-click the view.

Zoom to a specific area

To zoom in to a specific area of the view, click the Zoom Area tool button  on the view toolbar, and then drag to create the zoom area. If the view toolbar is hidden, hold down Ctrl + Shift (Command-Shift on Mac) to use the Zoom Area tool.

Reset the view

After you zoom in or out, the axes in the view are fixed to a specific range. To quickly reset the axes so they automatically zoom the view to all of your data, click the Reset Axes button  on the view toolbar.

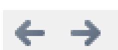
Pan

To pan, do one of the following:

- Hold down Shift, and then drag across the view.
- On the view toolbar, hover over the arrow, select the Pan tool , and then click and drag across the view.

Undo and Redo

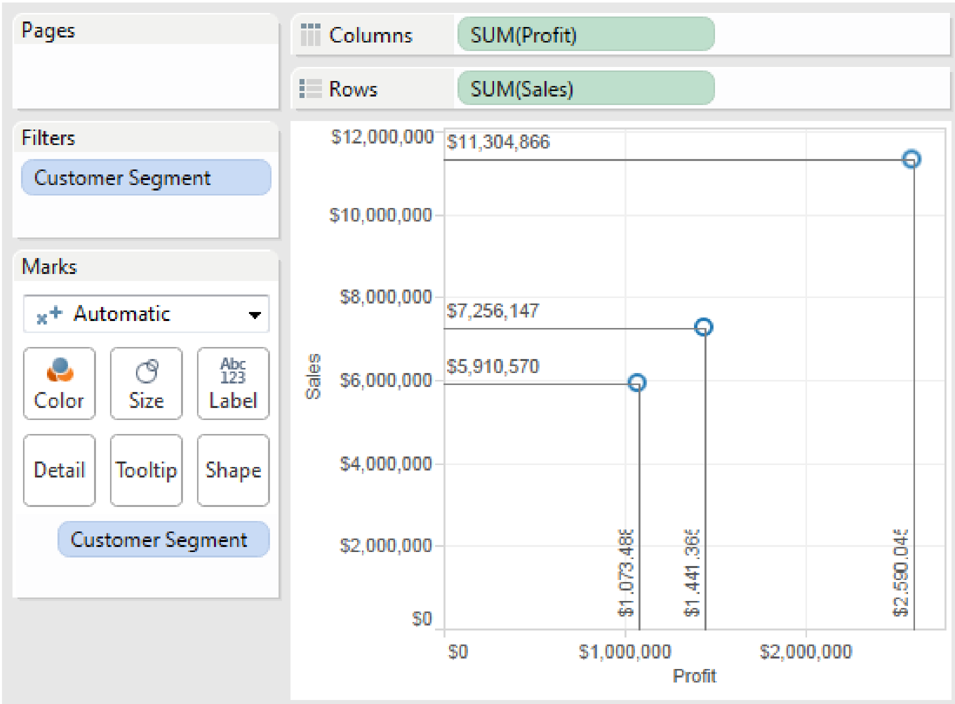
You can perform unlimited undo and redo of your actions. You can undo almost all actions in Tableau by pressing the **Undo** button on the toolbar. Likewise, you can redo almost all actions by pressing the **Redo** button on the toolbar.



In this regard, every workbook behaves like a web browser. You can quickly return to a previous view. Or you can browse all the views of a data source that you have created. Tableau saves the undo/redo history across all worksheets until you exit. The history is not saved between sessions.

Drop Lines

Drop lines are most useful for distinguishing marks and calling out their position in the view. For example, in a view that is dense with scatter marks, you can turn on drop lines to show the position of a particular data point. When you add drop lines a line is extended from the marks to one of the axes. You can choose to show drop lines all the time or only when a mark is selected.



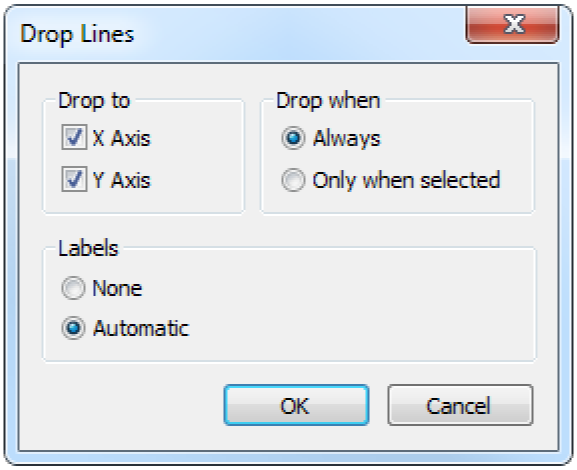
> **Note:** Drop lines do not display when you publish a view to Tableau Server or Tableau Online.

To add drop lines to the view, right-click (control-click on Mac) the pane and select **Drop Lines** > **Show Drop Lines**.

By default, drop lines are set to only show when the mark is selected. You can change this setting and specify other options in the Drop Lines dialog box.

Right-click (Control-click on Mac) the pane and select **Drop Lines** > **Edit Drop Lines** to open the Drop Lines dialog box.

In the Drop Lines dialog box select an axis to draw the line to, whether to always show the drop lines, and whether to show labels.

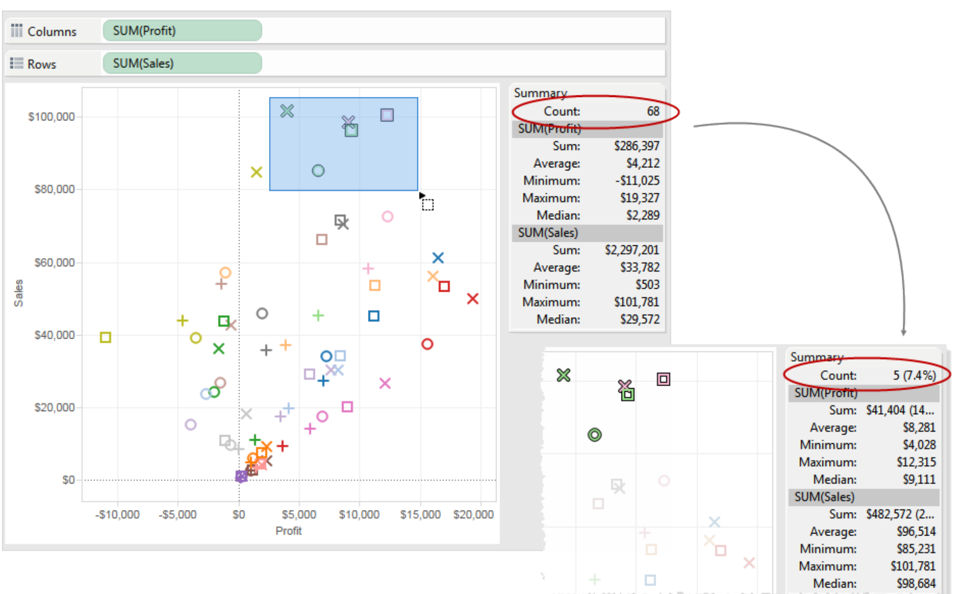


Summary Card

The summary card is a really quick way to view information about a selection or the entire data source. You can hide or show the Summary Card by selecting it on the View Cards toolbar

menu  . You can also select **Worksheet** > **Show Summary**.

When you select data in the view, the Summary Card updates to show you information only for the data within the selection:



By default, the Summary Card shows Sum, Average, Minimum, Maximum, and Median values for the data in the view. The summary card values update to show these values for the current selection of data points. (Average is computed by summing all relevant values and then dividing by the total number of values. Median is computed by sorting values from lowest to highest and then selecting the middle value.) The Count value at the top of the card indicates the number of marks in the view or selection.

You can use the drop-down menu for the Summary Card to show additional statistics:

- **Standard Deviation**

  A measure of data spread around its average, measured in the same units as the data itself. The sample standard deviation is an unbiased estimate of the population standard deviation given a slight correction. This standard deviation includes the correction.

- **First Quartile**

  A measure of location which is commonly used with other quartiles to provide a robust measure of spread. Robust in this case means not as sensitive to outliers as the standard deviation. The first quartile is the 25th percentile, typically the lower line in a boxplot

- **Third Quartile**

  A measure of location which is commonly used with other quartiles to provide a robust measure of spread. Robust in this case means not as sensitive to outliers as the standard deviation. The third quartile is the 75th percentile, typically the upper line in a boxplot.

- **Skewness**

  A measure of the tendency of your data to have extreme values to one side. Positive skewness means the extreme values are to the right, while negative skewness means the extreme values are to the left.

- **Excess Kurtosis**

  A measure of the tendency of your data to have more extreme or outlying values than a normal distribution. A normal distribution has a kurtosis of 3 so this value is kurtosis minus three.

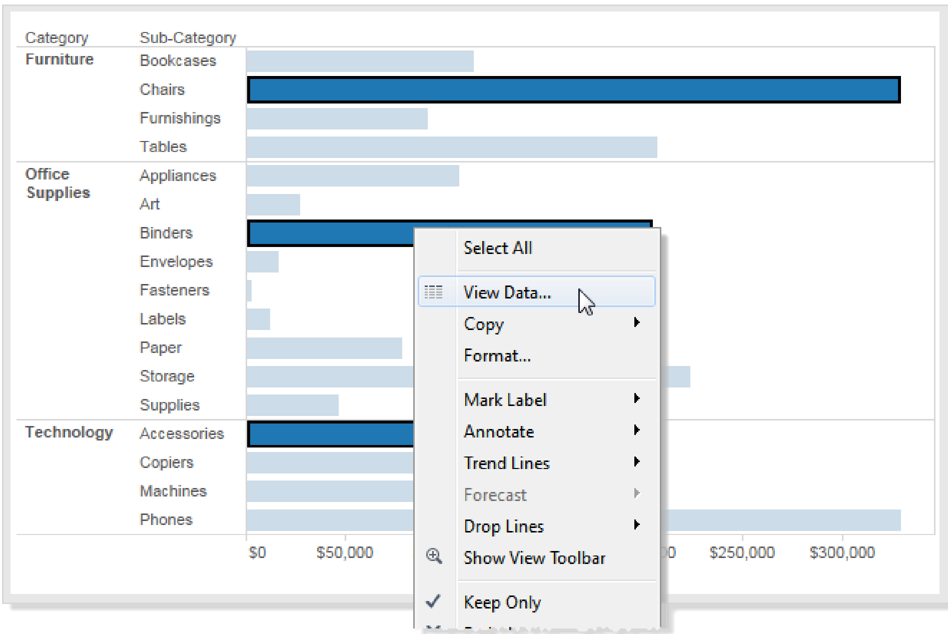
View Data

The View Data command lets you display the values for all rows in the data source that underlie a set of marks in the view. It also shows you the summary data based on the aggregations in the view. You can view data to verify the aggregated value associated with a mark, or to isolate and export the individual rows associated with data of interest, such as outliers.

You can view data for a selection of marks, for the fields in the Data pane, and when you’re connecting to data.

The View Data command works with all relational and multi-dimensional databases except Oracle Essbase and SAP® Business Information Warehouse databases. While you can view data with the Microsoft Analysis Services and the Teradata OLAP connector multi-dimensional databases, the database must be drill-through enabled; in addition there are some restrictions to the data you can see.

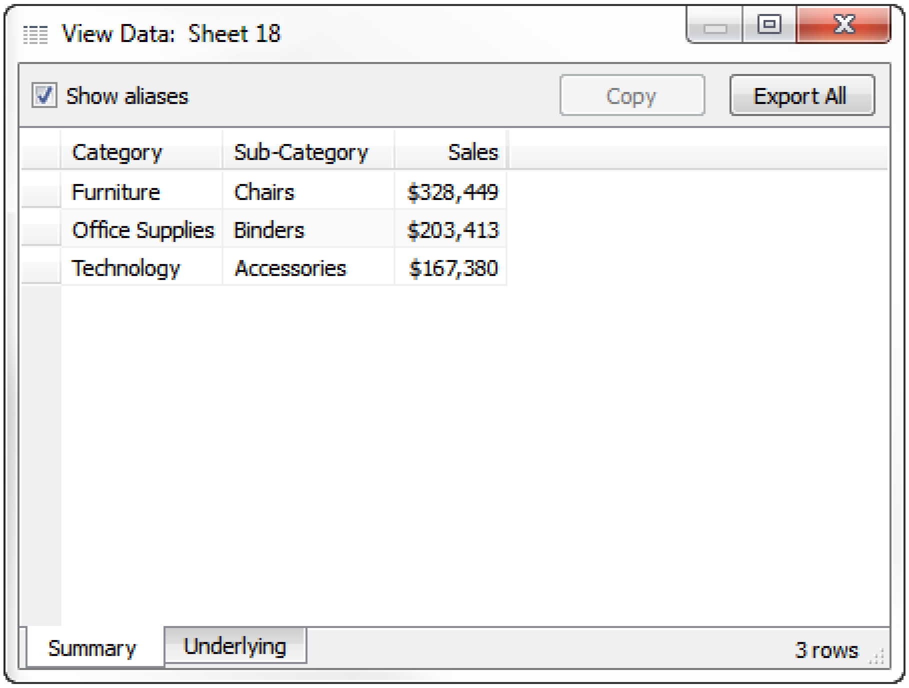
In the view below, sales for two product dimensions (**Department** and **Container**) are displayed as a bar chart. Suppose you wanted to view data for the largest marks in each pane. To do this, you would select those marks, right-click (control-click on Mac) in the table, and select **View Data** on the context menu. Alternatively, you could select the **Analysis** > **View Data** menu item.



Viewing data may not return any records if you are using a field that contains floating point values as a dimension. This is due to the precision of the data source and mainly occurs when you are connected to Microsoft Excel, Microsoft Access, or text files.

Summary Data

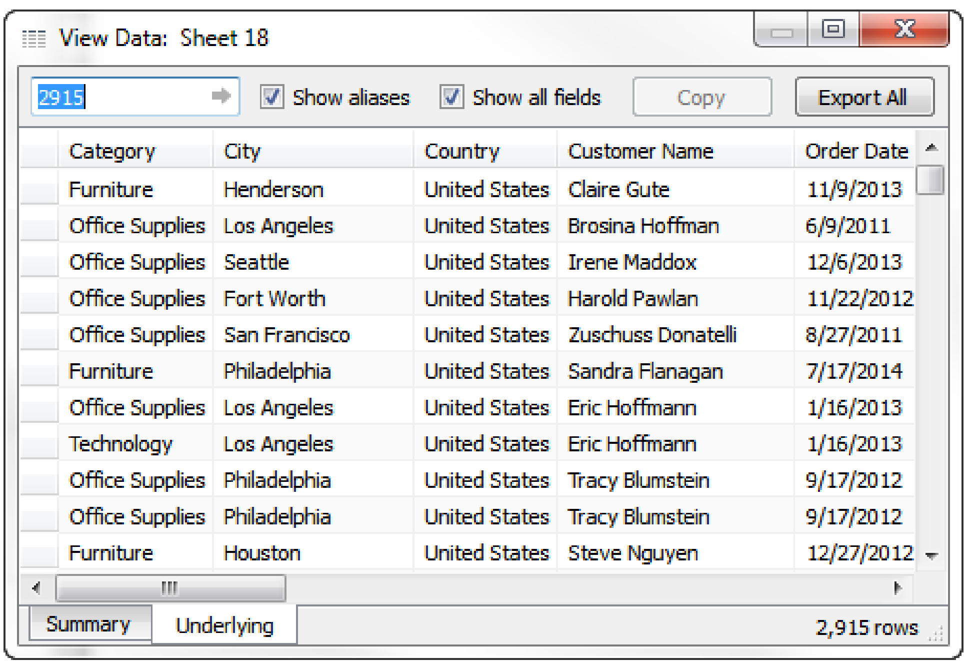
Summarized data is shown on the **Summary** tab. Summarized data is a text table of the aggregated data for the fields shown in the view.



Category	Sub-Category	Sales
Furniture	Chairs	$328,449
Office Supplies	Binders	$203,413
Technology	Accessories	$167,380

Underlying Data

Underlying data for the selected marks are displayed on the **Underlying** tab. In the lower right of the dialog box you can see the number of rows in the underlying data.



Category	City	Country	Customer Name	Order Date
Furniture	Henderson	United States	Claire Gute	11/9/2013
Office Supplies	Los Angeles	United States	Brosina Hoffman	6/9/2011
Office Supplies	Seattle	United States	Irene Maddox	12/6/2013
Office Supplies	Fort Worth	United States	Harold Pawlan	11/22/2012
Office Supplies	San Francisco	United States	Zuschuss Donatelli	8/27/2011
Furniture	Philadelphia	United States	Sandra Flanagan	7/17/2014
Office Supplies	Los Angeles	United States	Eric Hoffmann	1/16/2013
Technology	Los Angeles	United States	Eric Hoffmann	1/16/2013
Office Supplies	Philadelphia	United States	Tracy Blumstein	9/17/2012
Office Supplies	Philadelphia	United States	Tracy Blumstein	9/17/2012
Furniture	Houston	United States	Steve Nguyen	12/27/2012

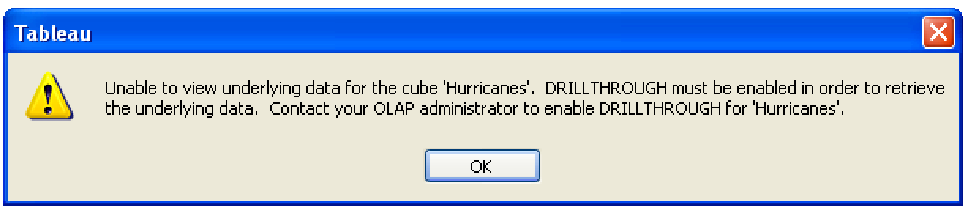
Sort the data by clicking one or more column headers. To restore the original sort order, click the header repeatedly until it is no longer highlighted with a sort arrow.

By default, **Show all fields** is selected. Clear this option to only show the columns used on shelves (or fields referenced by a calculation used on a shelf) in the current worksheet.

If you want to export one or more data source rows, select the data points of interest by selecting the row and then clicking **Copy** to copy the selected data.

View Data (Microsoft Analysis Services)

View Data with a Microsoft Analysis Services database works almost the same way it does with relational data sources. The difference is that a Microsoft Analysis Services cube is generally set up and configured by an administrator who decides whether it is enabled for drill-through and the fields that a user is allowed to see. That means that when you try to view data using a database that is not enabled, you may get an error message alerting you that the cube is not enabled for drill-through.



In addition, Microsoft Analysis Services databases limit viewing data to a single mark at a time. More precisely, viewing the data (which uses MDX drill-through) is not an option when the selection of mark(s) is defined by more than one value of a dimension.

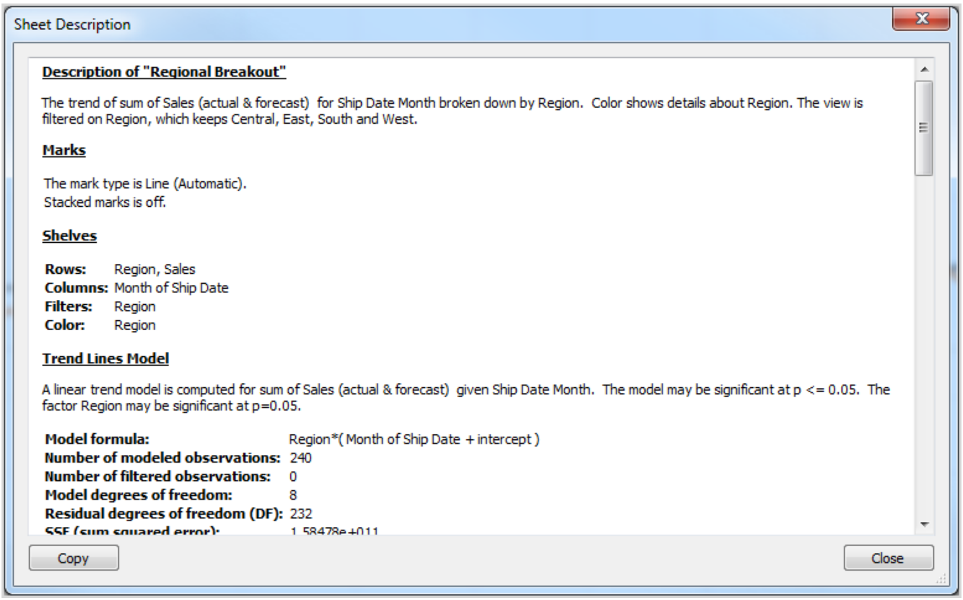
When you are viewing underlying data for a field, the **Show all fields** option is checked and disabled by default. With a Microsoft Analysis Services database, only the fields specified by the administrator are shown, so you cannot choose to include all data source fields in the dialog box.

Describing the View

Occasionally you may want to succinctly summarize an analysis you have completed on a worksheet. You might then want to remind yourself of what it shows (the filters that are applied, etc.), and finally, you may want to share a summary of the analysis with someone else.

When you choose **Worksheet** > **Describe Sheet**, you can view a description of the workbook, data source, fields and layout of the current worksheet. This summary includes the Caption in the first line, but provides other important summary information. This information can be copied and exported to other applications using the Clipboard.

Note: If you have Trend Lines turned on, the Describe Sheet dialog box includes information about the trend line model. For more information, see **Assessing Trend Line Significance** on page 1191. If you have Forecasting turned on, the Describe Sheet dialog box includes information about estimated data. For more information, see **Forecast Descriptions** on page 1106.

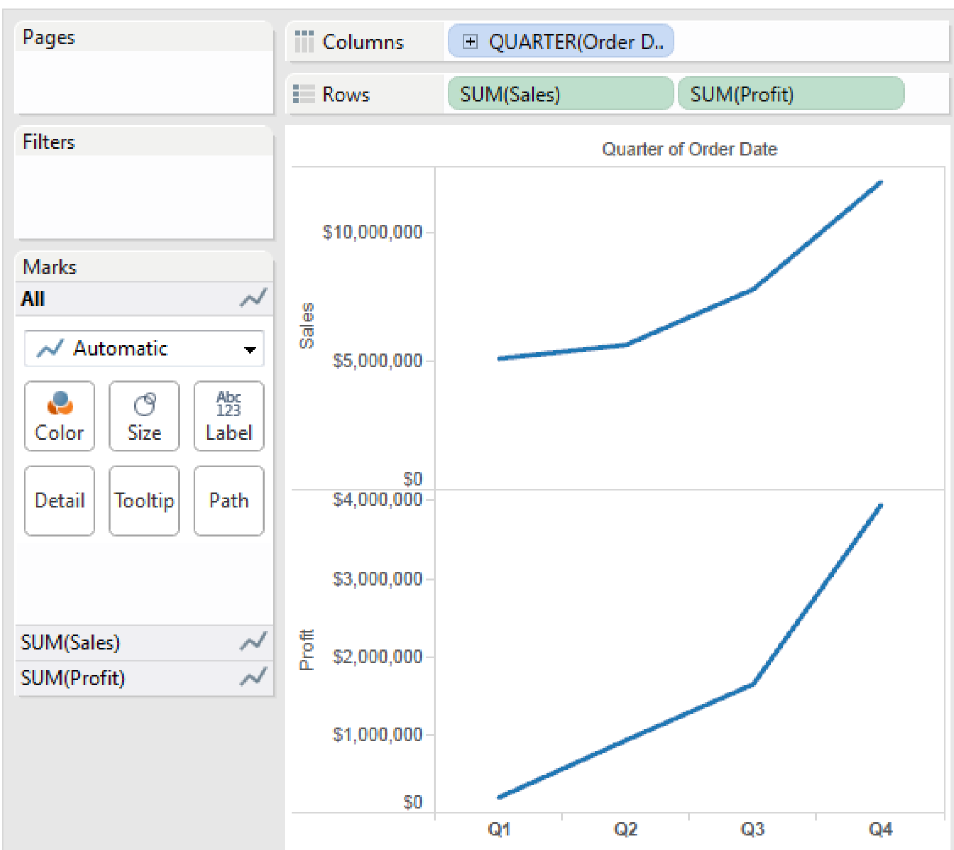


Using Multiple Measures

There are lots of different ways to compare multiple measures in a single view. For example, you can create individual axes for each measure or you can blend the two measures to share an axis and finally, you can add dual axes where there are two independent axes layered in the same pane. In any of these cases you can customize the marks for each axis to use multiple mark types and add different levels of detail. Views that have customized marks are called combination charts.

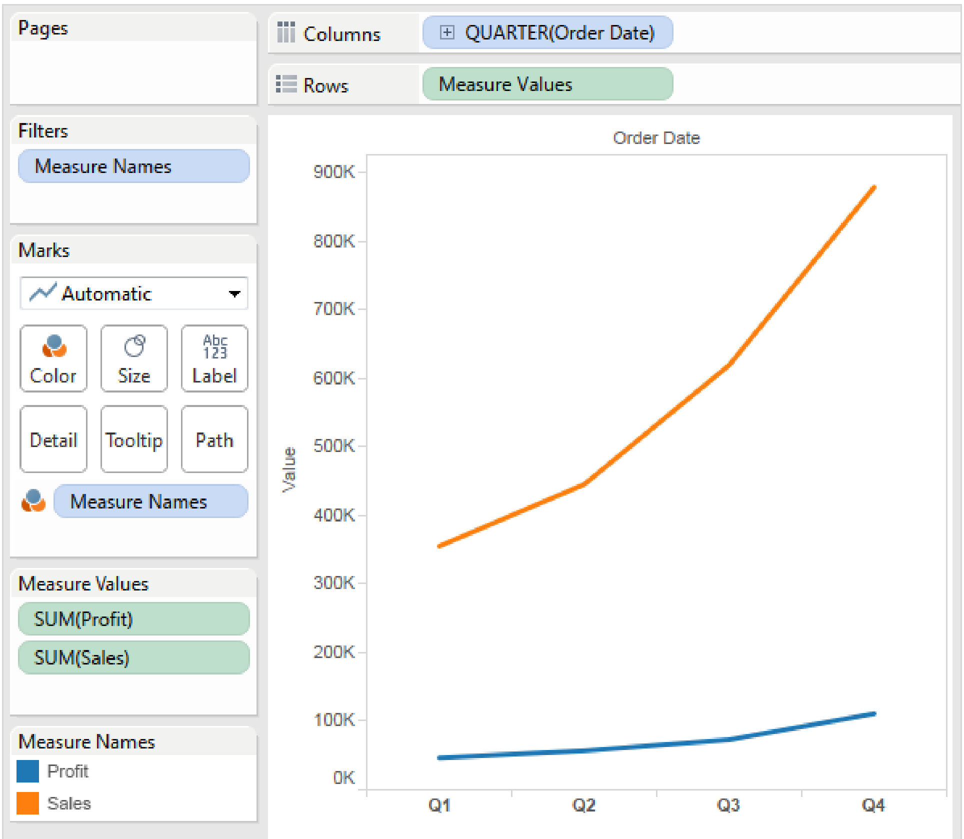
Individual Axes

Add individual axes for each measure by dragging measures to the **Rows** and **Columns** shelves. Each measure on the Rows shelf adds an additional axis to the rows of the table. Each measure on the Columns shelf adds an additional axis to the columns of the table. For example, the view below shows quarterly sales and profit. The Sales and Profit axes are individual rows in the table and have independent scales.

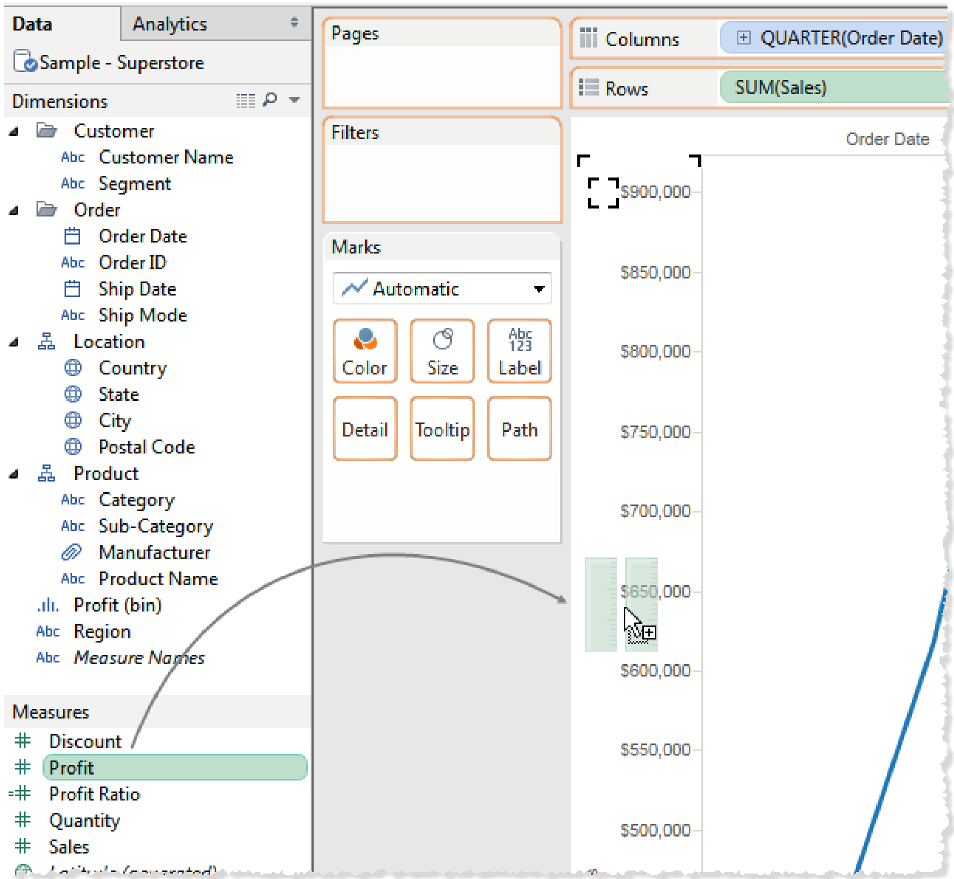


Blended Axes

Measures can share a single axis so that all the marks are shown in a single pane. Instead of adding rows and columns to the view, when you blend measures there is a single row or column and all of the values for each measure is shown along one continuous axis. For example, the view below shows quarterly sales and profit on a shared axis.



To blend multiple measures, simply drag one measure or axis and drop it onto an existing axis.



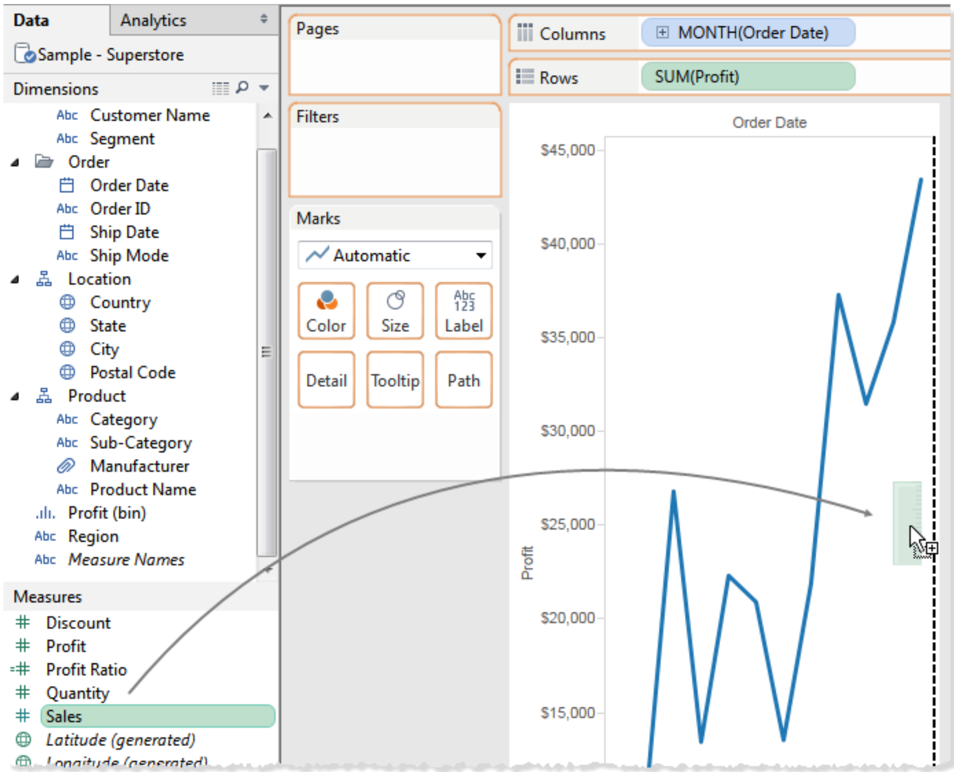
Blending measures uses the **Measure Names** and **Measure Values** fields, which are generated fields that contain all of the measure names in your data source and all of the measure values. The shared axis is created using the **Measure Values** field. The **Measure Names** field is added to **Color** on the Marks card so that a line is drawn for each measure. Finally, the **Measure Names** field is filtered to only include the measures you want to blend.

Note: Blending axes is most appropriate when comparing measures that have a similar scale and units. If the scales of the two measures are drastically different, the trends may be distorted.

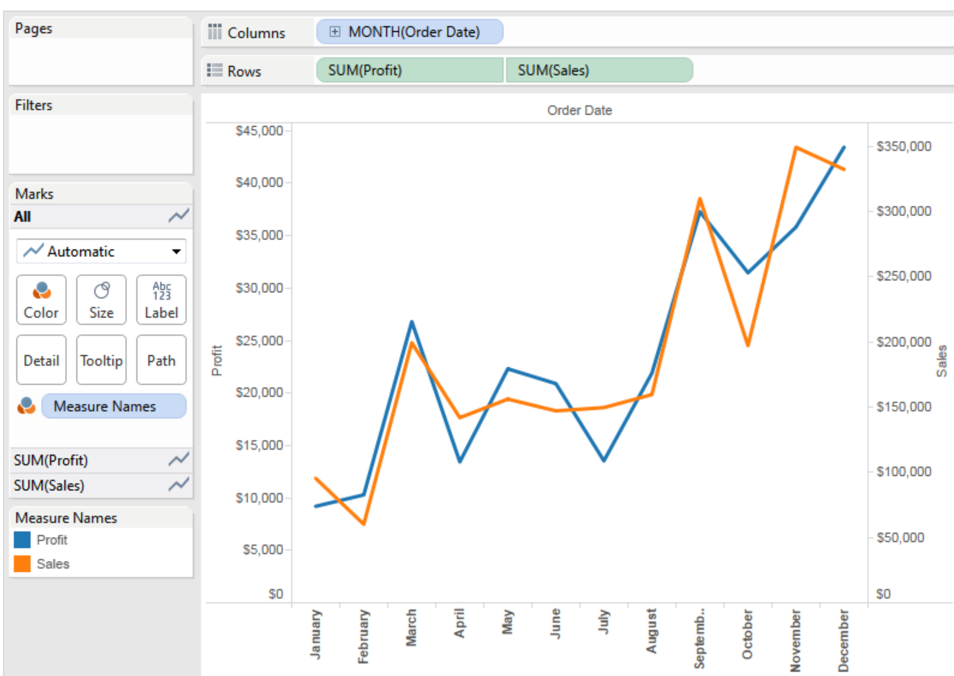
Dual Axes

You can compare multiple measures using dual axes, which are two independent axes that are layered on top of each other.

Dual axes are useful when you have two measures that have different scales. To add a measure as a dual axis, drag the field to the right side of the view and drop it when you see a black dashed line appear. You can also right-click (control-click on Mac) the measure on the Columns or Rows shelf and select **Dual Axis**.



The result is a dual axis view where the Profit axis corresponds to the blue line and the Sales axis corresponds to the orange line.



You can add up to four layered axes: two on the Columns shelf and two on the Rows shelf.

Synchronize Axes

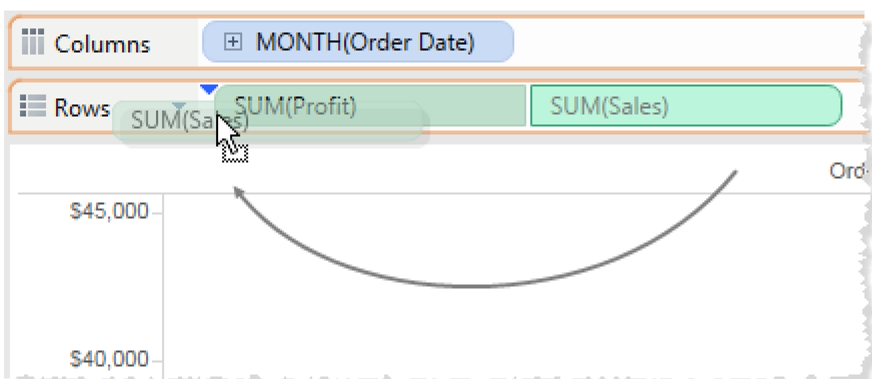
To align the two axes in a dual axis to have the same scale, right-click (control-click on Mac) the secondary axis, and select **Synchronize Axis**. This aligns the scale of the secondary axis to the scale of the primary axis

In this example, the Sales axis is the secondary axis and the Profit axis is the primary axis.

> **Note:** To synchronize axes, the data types for both measures must be the same. If the data types for your measures are different, see the section below.

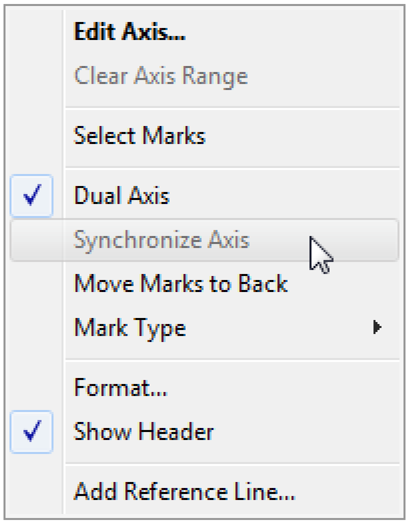
If you would like to change which axis is the primary, and which axis is the secondary, select the field on the Columns or Rows shelf that is the secondary, and drag it in front of the primary field on the shelf until you see a blue triangle appear.

In this example, you can select the **SUM(Sales)** field on the **Rows** shelf, and drag it in front of the **SUM(Profit)** field. The Sales axis is now the primary and the Profit axis is the secondary.



Synchronizing axes with measures that are different data types

The **Synchronize Axis** option ensures that you make a scaled and correct comparison. However, sometimes this option may not be available (grayed out). This is because the data type of one of the axes is different from the other.



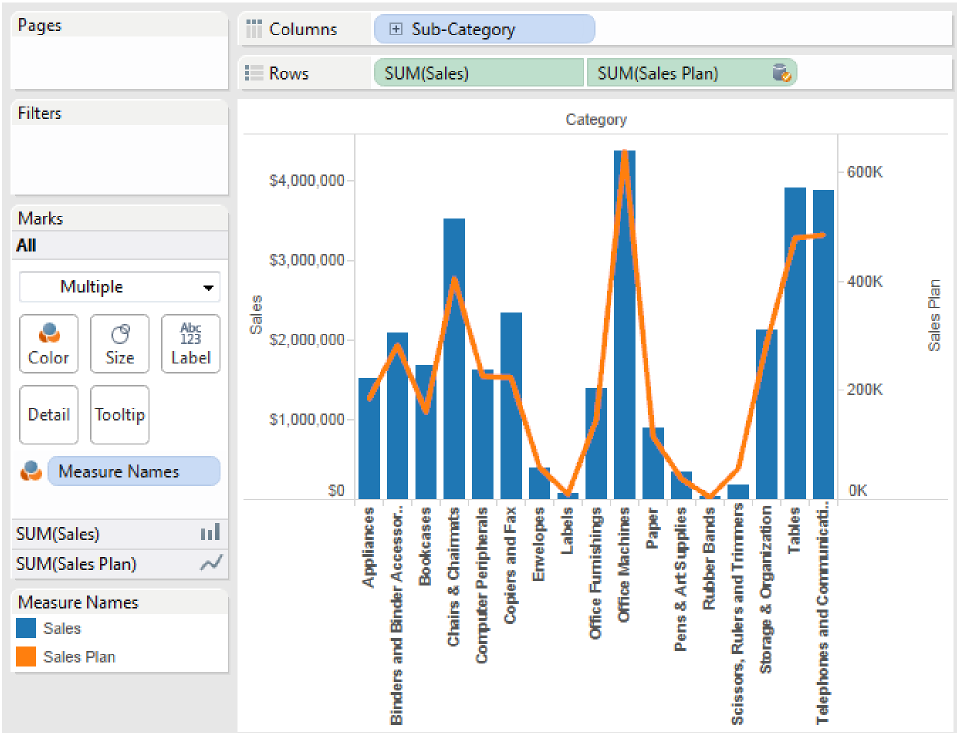
To resolve this issue, you must change the data type of one of the axes. To follow along, use the Superstore workbook.

1. Right-click in the **Data** pane and select **Create Calculated Field**.
2. Create a calculated field that changes the data type of a measure, like in one of the following examples:
   `float ([Number of Records])`
   or
   `Int ([Profit])`
3. Replace the measure on the view with the appropriate calculation you created in step 2.
4. Right click the secondary axis, and then select **Synchronize Axis**. The option is now available.

Combination Charts

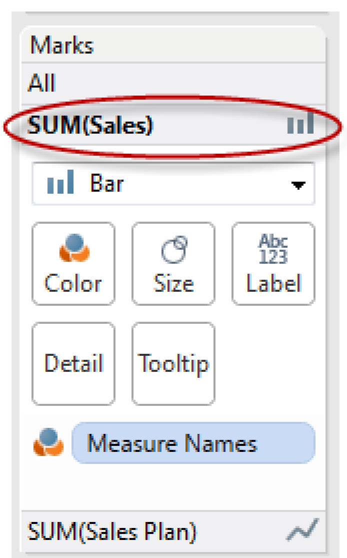
When working with multiple measures in a view, you can customize the mark type for each distinct measure. For example, you can create a view with a line showing a target amount across several months and a bar chart showing the actual attainment for the months. These measures can be displayed as individual axes, blended axes, or dual axes.

Because each measure can have customized marks, you can customize the level of detail, size, shape, and color encoding for each measure too.



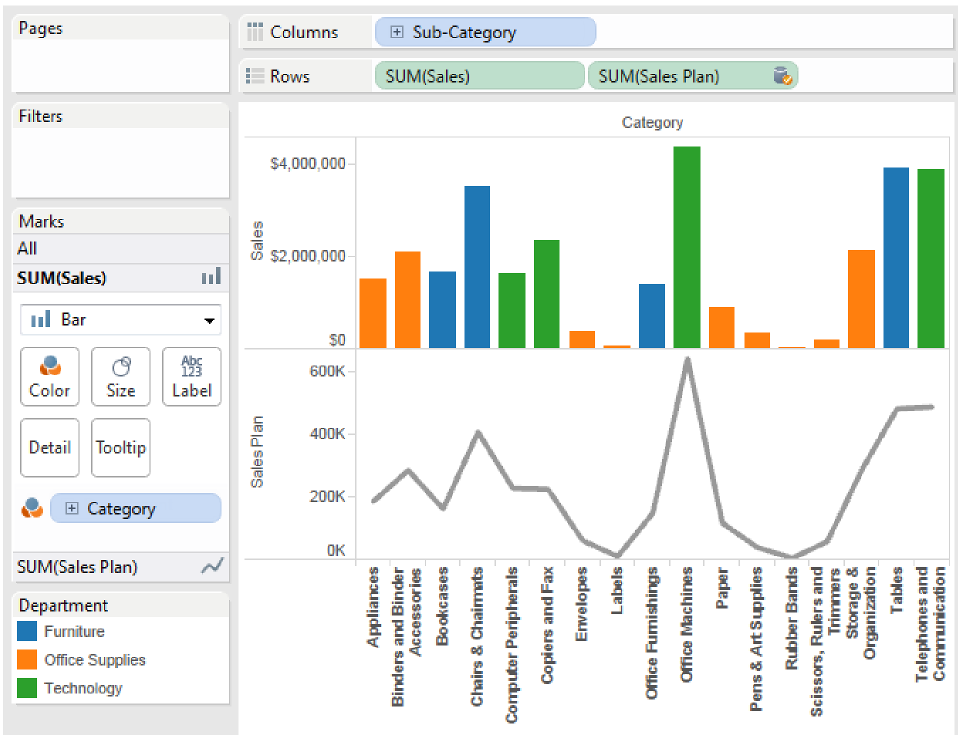
To customize the marks for a measure:

1. Select the Marks card for the measure that you want to customize. There is a Marks card for each measure on the Rows and Columns shelves.



2. Select a new mark type for the measure. Any changes to the mark type, shape, size, color, detail and other mark properties will be applied to the selected measure. For

example, in the view below the **SUM(Sales)** Marks card is active. The Mark Type has been changed to **Bar** and when **Category** is placed on **Color** on the **Sum (Sales)** Marks card, the encoding and level of detail is only applied to the SUM(Sales) marks. The SUM(Sales Plan) is not broken down by Category.



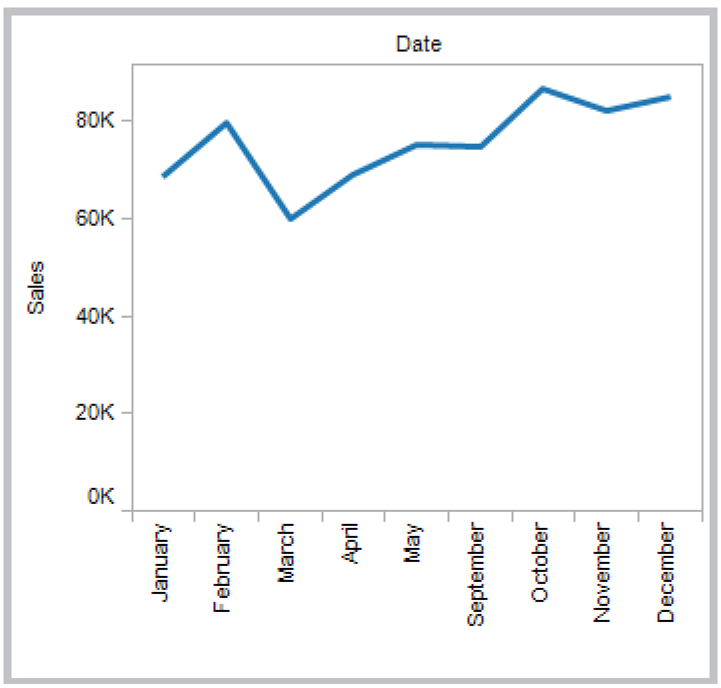
Select the **All** Marks card to modify properties for all measures at once.

Missing Values

When you're working with dates or numeric bins, Tableau only shows the values that are represented in your data. If your data does not contain the complete range of values, the missing values will not be shown. For example, your data may contain data for January through May and September through December. However, there was no data recorded for June, July, and August. If you create a line chart in Tableau, the missing months will not be shown. You can optionally show the missing months to make it clear that there was no data recorded during that time.

Missing Values Hidden (Default)

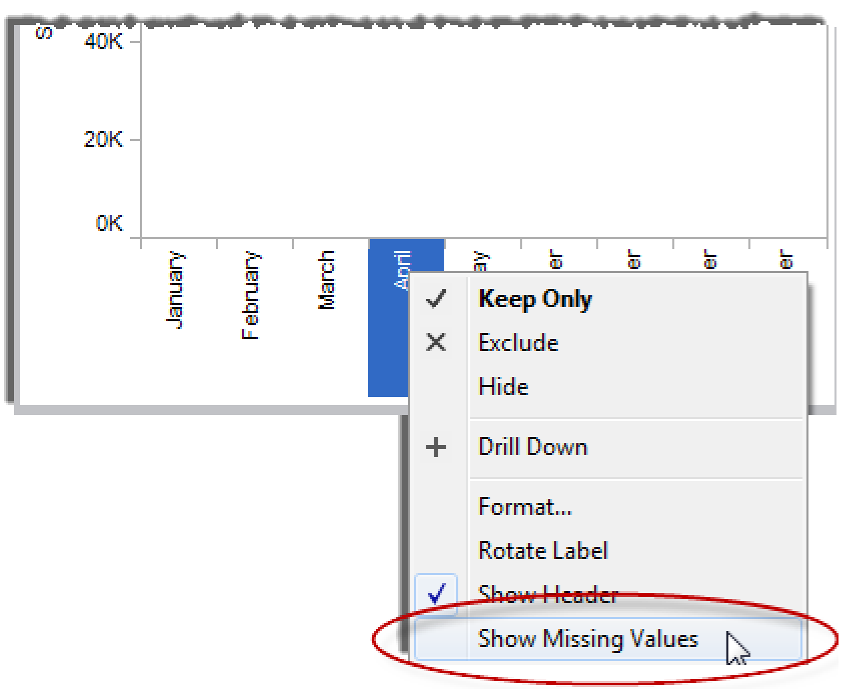
By default, missing values in a date range or numeric bins are not shown.



Missing Values Shown

You can show the missing values to indicate incomplete data.

To show missing values in a range, right-click (control-click on Mac) the date or bin headers and select **Show Missing Values**.

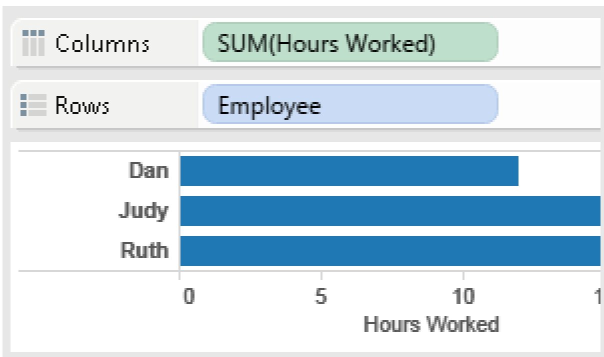


Show and Hide Empty Rows and Columns

When you are working with fields that are not dates or numeric bins, Tableau hides missing values by default. For example, you may be showing workers and the number of hours worked in a particular month. If a worker didn't work at all that month, there may not be a row in the database for that worker. When you drag the Worker field to the Rows shelf, the workers that didn't work are hidden by default. You can show the empty rows by selecting **Analysis** > **Table Layout** > **Show Empty Rows**. Similarly, show the empty columns by selecting **Analysis** > **Table Layout** > **Show Empty Columns**.

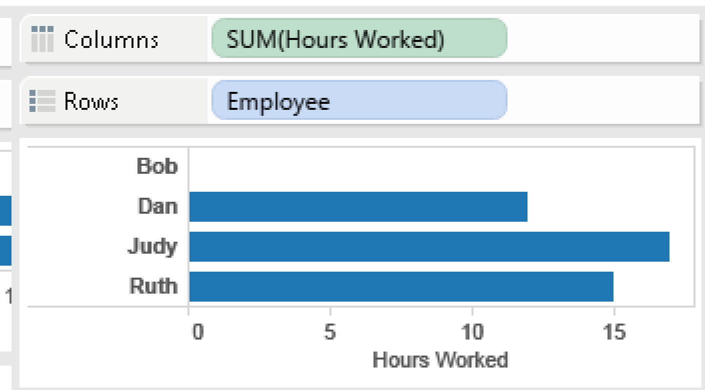
Empty Rows Hidden (default)

Bob did not work in January so there are no records in the database for him. By default he is not listed.



Empty Rows Shown

Even though Bob did not work in January, he is listed but no marks are drawn.



Create Discrete Bins from a Continuous Measure

Sometimes it's useful to convert a continuous measure (or a numeric dimension) into discrete bins.

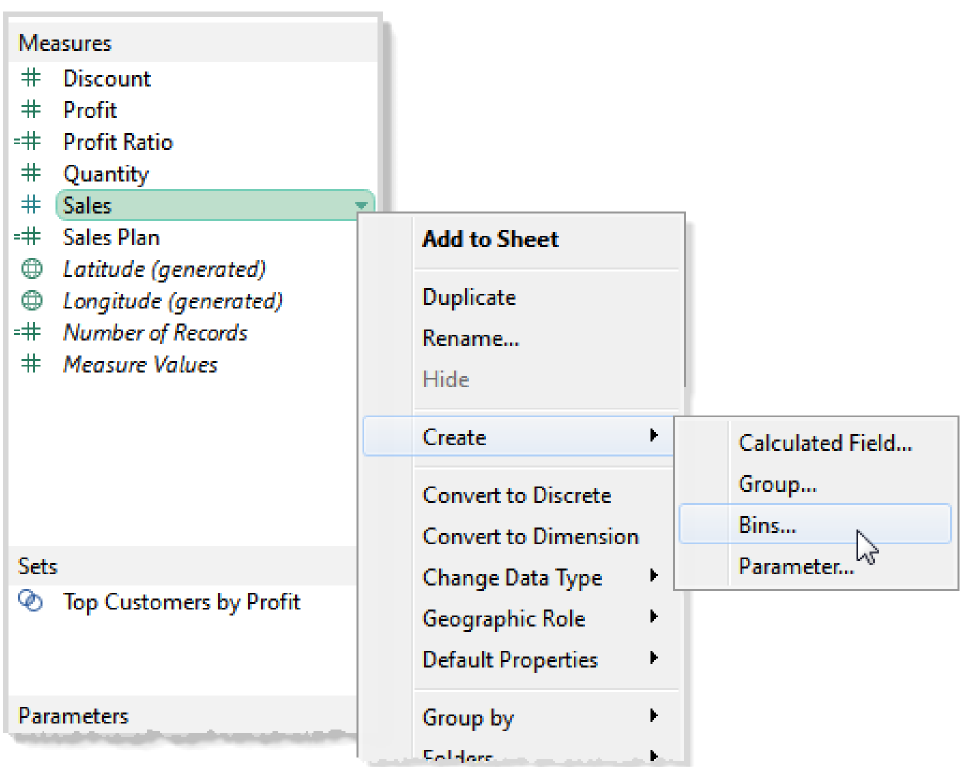
For example, suppose you create a view with **Profit** on **Rows** and **State** on **Columns**. We could consider the **State** field as a set of bins—each profit value is sorted into a bin corresponding to the state from which the value was recorded. But if you want to bin **Profit** values without reference to a dimension, we can create a numeric bin, with each bin corresponding to a range of values so that each profit value is sorted into a bin.

> **Note:** You can bin data only for relational data sources. This feature is not supported for cube (multidimensional) data sources.

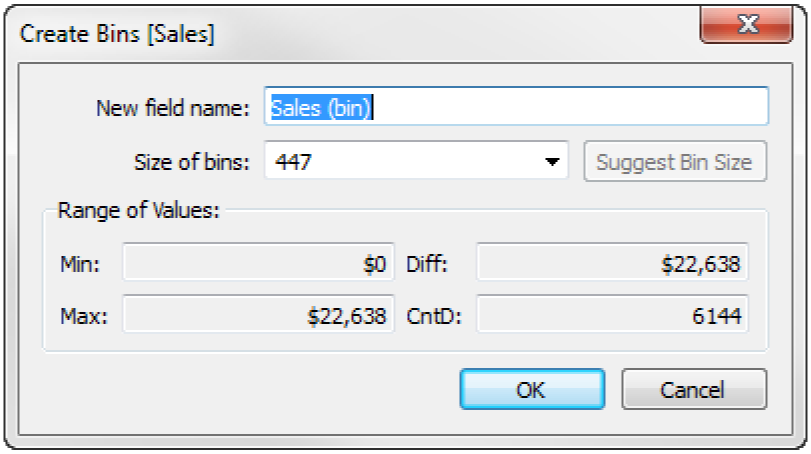
When you bin a measure you create a new dimension. That's because you are creating a field with a limited and discrete set of possible values out of a field with an unlimited, continuous range of values.

Create a Binned Dimension:

1. In the **Data** pane, right-click (control-click on Mac) a measure and select **Create** > **Bins**.



2. In the Create Bins dialog box, accept the proposed **New field name** or specify a different name for the new field.



3. Either enter a value in the **Size of bins** field or have Tableau calculate a value for you.

   If Tableau can perform the optimizing calculation quickly enough (in less than 1.5 seconds), the value you see initially in **Size of bins** is Tableau's estimate of the optimal bin size.

   If Tableau cannot perform the optimizing calculation quickly, the **Size of bins** field defaults to 10. In this case you can click **Suggest Bin Size** to have Tableau perform the optimizing calculation.

   The formula that Tableau uses to calculate an optimal bin size is

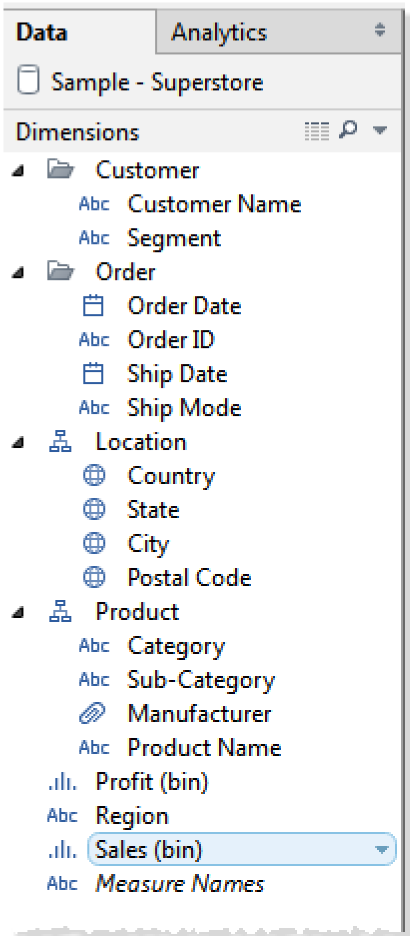
   $$\text{Number of Bins} = 3 + \log_2(n) * \log(n)$$

   In the formula, *n* is the number of distinct rows in the table. The size of each bin is determined by dividing the difference between the smallest and the largest values by the number of bins.

The four read-only fields in the lower part of the Create Bins dialog box show you the data that Tableau uses to suggest a bin size. You can also consider these values if you want to set a bin size manually. The values are:

Min	The field's minimum value.
Max	The field's maximum value.
Diff	The difference between the field's minimum and maximum values.
CntD	The number of distinct values (rows) in the data.

After you click **OK** to dismiss the Create Bins dialog box, a new binned field appears in the **Dimensions** area of the **Data** pane.



When you add a binned dimension to the view, each bin acts as an equal-sized container that summarizes data for a specific range of values. Column or row headers are created, where each bin label designates the lower limit of the range of numbers that is assigned to the bin. Note that the lower limit is inclusive.

Create a Histogram

If you create a binned dimension, place it on **Columns**, and then place the initial measure that you used as the basis for the binned dimension on **Rows** and set the aggregation to **Count**, the result is a histogram. This is the same sequence of actions that Tableau performs for you when you create a histogram from Show Me. See **Build a Histogram** on page 569 in the Build-It-Yourself Exercises section for information on creating a histogram using Show Me.

Maps

This section discusses the basics of building map views in Tableau. In this section you will learn how to assign geographic roles to fields in your data, and then build a map view and customize its appearance. Also, you will learn how to navigate and find locations in your map view, as well as create new geographic roles by custom geocoding your data.

If you're new to building maps in Tableau, you can follow the steps in **Build a Map View** on page 599 to learn how to create maps using sample data that comes with Tableau.

In addition to the following topics, you can learn more about maps by watching the Maps and Images training videos from the On Demand Training and Tutorials page on the Tableau website.

Create Tableau Maps from Shapefiles

If you work with shapefile data, you can use a Geographic Information System (GIS) such as QGIS or ArcGIS to convert the data into a text file that you can import into Tableau Desktop. You can then connect to that text file and build a map view in Tableau.

In this topic:

Create Tableau polygons from shapefiles using QGIS

If you have shapefile data, you can use QGIS Desktop to convert it to a CSV file for use in Tableau Desktop.

For example, if you have shapefile data for U.S. counties, you can use QGIS Desktop to convert the shapefile to CSV files that you can then connect to in Tableau Desktop. You can create Tableau polygons for all the counties in the United States using the data in the CSV files.

Follow the steps below to learn how to use QGIS Desktop to convert shapefile data to text files and then create Tableau polygons.

Before you start

Before you follow the steps in this section, the coordinates in your shapefile should already be in the form of decimal latitude and longitude units, specifically using EPSG: 4326, WGS 84.

Additionally, this procedure requires you to use QGIS Desktop, an open source GIS that supports many different shapefile formats. To download this software, go to the QGIS website.

> **Note:** If you are using Windows, install QGIS Standalone Installer Version 2.14 (64-bit).

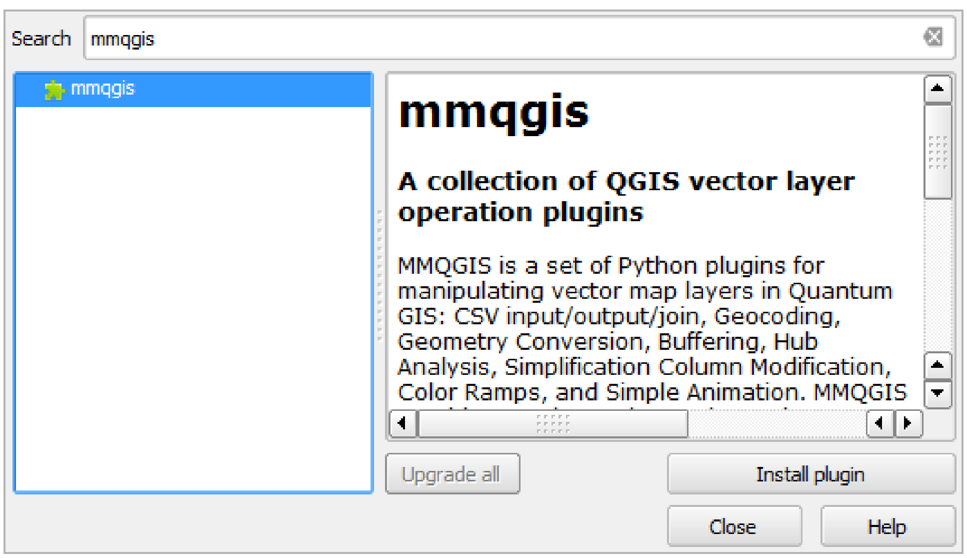
Disclaimer: Clicking this link will take you away from the Tableau website. Although we make every effort to ensure these links to external websites are accurate, up to date, and relevant, Tableau cannot ensure the accuracy or freshness of pages maintained by external providers. Contact the external site for answers to questions regarding its content.

: Download shapefile data

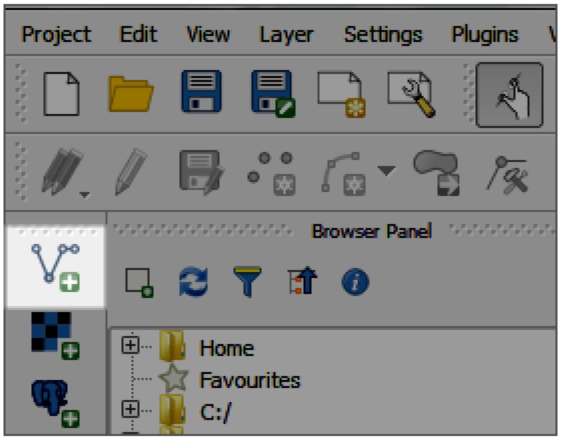
1. Go to the United States Census Bureau website and click `cb_2015_us_county_500k.zip` to download the file.
2. Extract the shapefiles to a folder on your computer. In this example, the folder is named US Counties and is saved on the Desktop.

: Use QGIS Desktop to convert shapefiles to CSV file format

1. Open QGIS Desktop.
2. Select **Plugins** > **Manage and Install Plugins**.
3. In the Plugins dialog box, do the following:
   - In the search bar at the top, search for **mmqgis**.
   - Select the `mmqgis` plugin that appears, and click **Install plugin**.

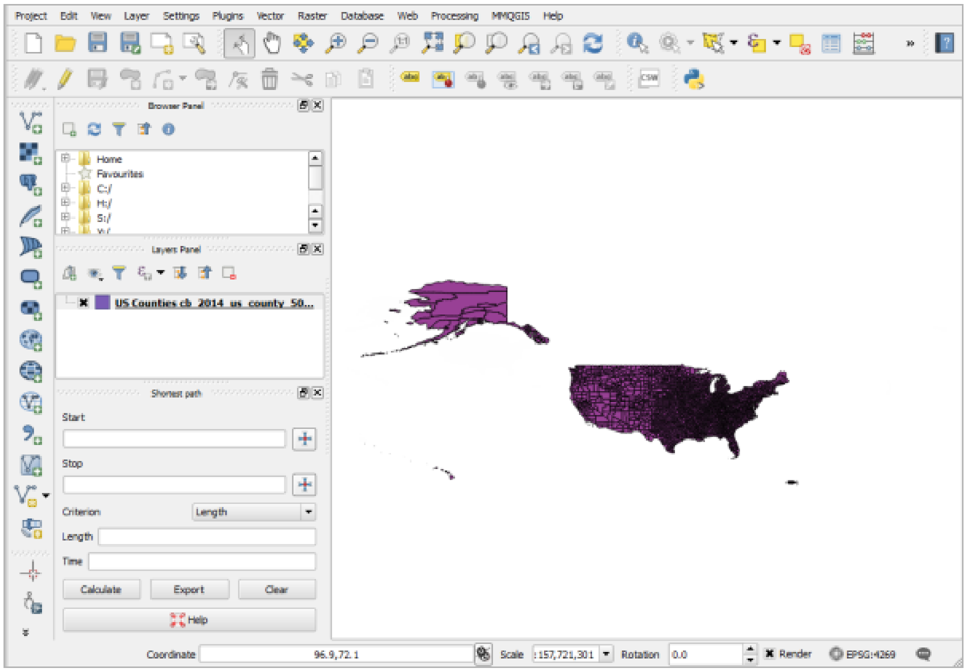


   - Click **Close**.
4. On the left side of the workspace, click the **Add Vector Layer** icon.



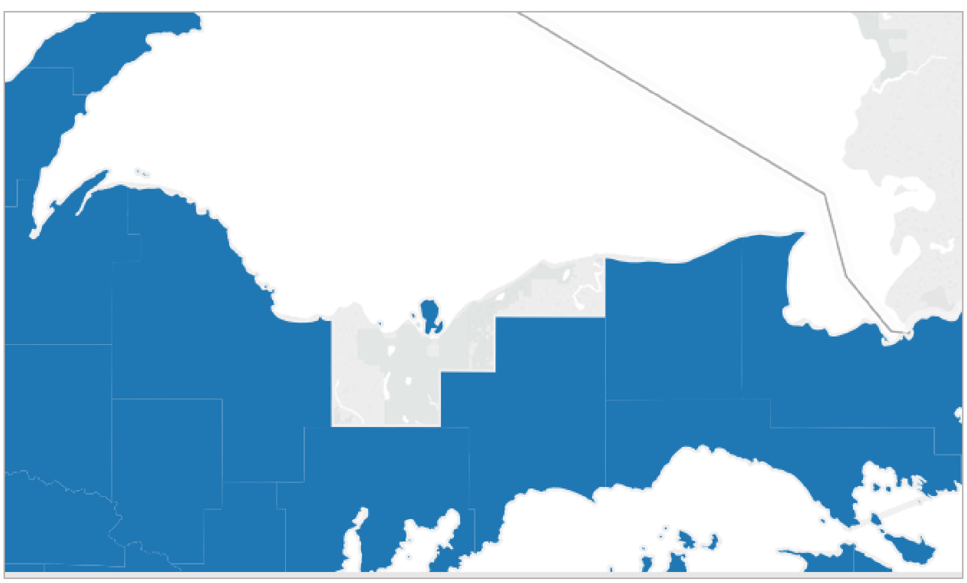
5. In the Add vector layer dialog box, do the following:
   - Under **Source type**, click **Directory**.
   - Under **Source**, click **Browse**, and then navigate to and select the **US Counties** folder.
   - Click **Open**.
6. If the Select vector layers to add dialog box appears, select **cb_2015_us_county_500k**, and then click **OK**.

   The polygons in the shapefile are plotted on the canvas and a layer is added to the Layers Panel.



7. Select **Vector** > **Geometry Tools** > **Multipart to Singleparts**.

   This breaks any multiple polygons in the shapefile into single polygons so that Tableau can read and plot them properly on a map view. If you skip this step, certain locations in your map view might not plot correctly because Tableau does not recognize that they might be separate polygons. For example, in the image below, some of the Wisconsin counties along Lake Superior are not plotted properly.

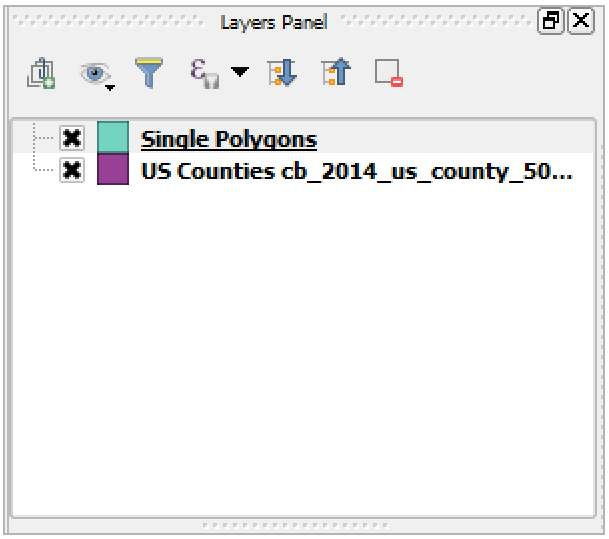


8. In the Multipart to singleparts dialog box, do the following:

- For **Input line or polygon vector layer**, make sure **US Counties cb_2015_ us_county_500k any** is selected.
- For **Output shapefile**, click **Browse**.

  In the new dialog box that opens, name the file **Single Polygons** and save it on your computer.
- Click **OK**, and then click **Close** to return to the QGIS workspace.

The Single Polygons layer is added to the Layers Panel.



9. Select **MMGIS** > **Import/Export** > **Geometry Export to CSV File**.
10. In the Export Geometry to CSV dialog box, do the following:
    - For **Source Layer**, make sure that **Single Polygons** is selected.
    - For **Output Nodes CSV File**, click **Browse**.

      In the subsequent dialog box that opens, name the file **nodes.csv** and save it to a location on your computer.
    - For **Output Attributes CSV File**, click **Browse**.

      In the subsequent dialog box that opens, name the file `attributes.csv` and save it in the same location that you saved the `nodes.csv` file.
    - For **Line Terminator**, select **LF**. This ensures that any spaces are removed from cells in the CSV file.
    - Click **OK**.

The two CSV files, `nodes.csv` and attributes.csv, are saved to the location you chose.

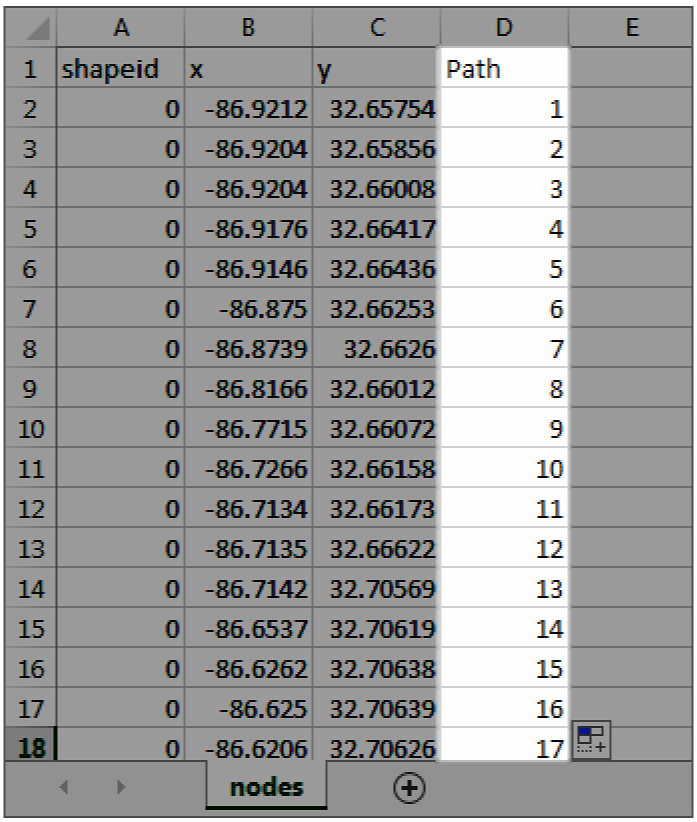
: Prepare the Nodes CSV file for Tableau

1. Open the `nodes.csv` file you saved.

> **Note**: The CSV file used in this example contains approximately 1,037,335 rows of data. Due to worksheet size limits, you might not be able to open this file in older versions of Microsoft Excel.

2. Add a new column called **Path**, which lists a sequence of numbers from **1** to however many records are in the file.

   For this example, there are 1048575 records. For shortcuts on adding a sequence of numbers in Microsoft Excel, see the Microsoft Office Support website.



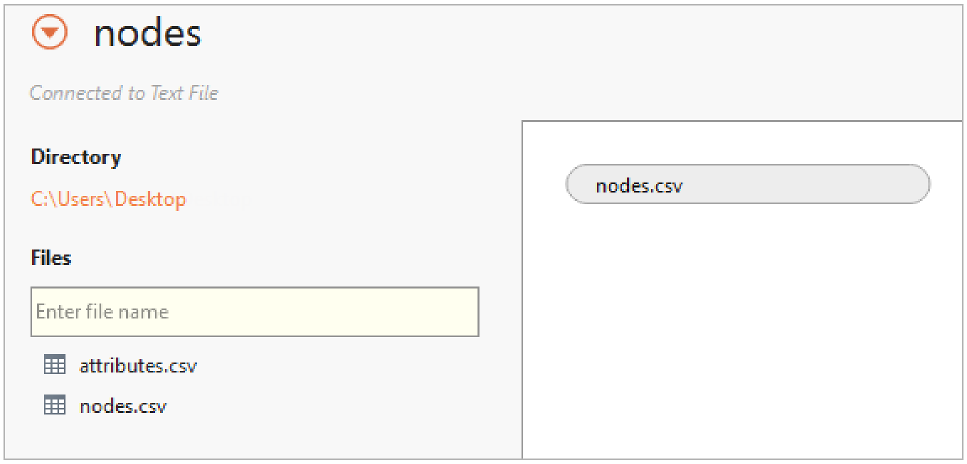
	A	B	C	D	E
1	shapeid	x	y	Path	
2	0	-86.9212	32.65754	1	
3	0	-86.9204	32.65856	2	
4	0	-86.9204	32.66008	3	
5	0	-86.9176	32.66417	4	
6	0	-86.9146	32.66436	5	
7	0	-86.875	32.66253	6	
8	0	-86.8739	32.6626	7	
9	0	-86.8166	32.66012	8	
10	0	-86.7715	32.66072	9	
11	0	-86.7266	32.66158	10	
12	0	-86.7134	32.66173	11	
13	0	-86.7135	32.66622	12	
14	0	-86.7142	32.70569	13	
15	0	-86.6537	32.70619	14	
16	0	-86.6262	32.70638	15	
17	0	-86.625	32.70639	16	
18	0	-86.6206	32.70626	17	

3. Save and close the file.

: Connect to CSV files in Tableau and prepare your fields for creating map views

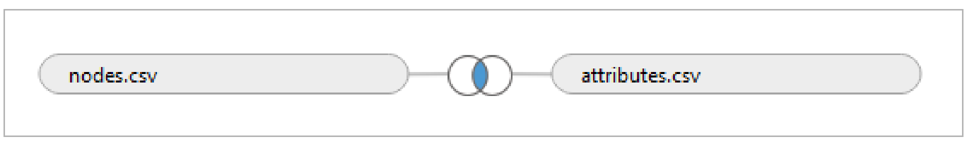
1. Open Tableau Desktop.
2. On the **Connect** section of the start page, click **Text File**.
3. Select the **nodes.csv** file that you created with QGIS.

The `nodes.csv` file is added to the top of the canvas on the data source page. If you saved the `nodes.csv` and `attributes.csv` files in the same place, they both appear in the left pane.

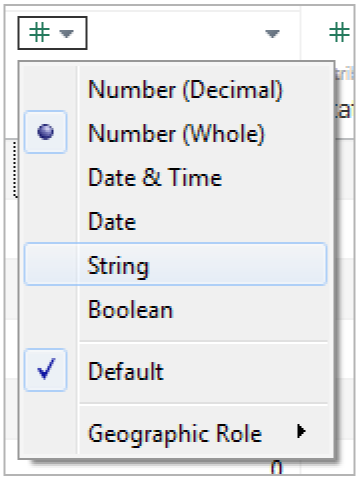


4. From the left pane, drag `attributes.csv` to the top of the canvas, to the right of the `nodes.csv` file.

   Tableau creates an inner join between the two data sources because they have a field in common: **Shapeid.**



5. In the grid on the bottom half of the workspace, click **Update Now** to view your data.
6. In the grid, for the **Shapeid (Attributes)** and **Shapeid** columns, click the data type icon and select **String**.



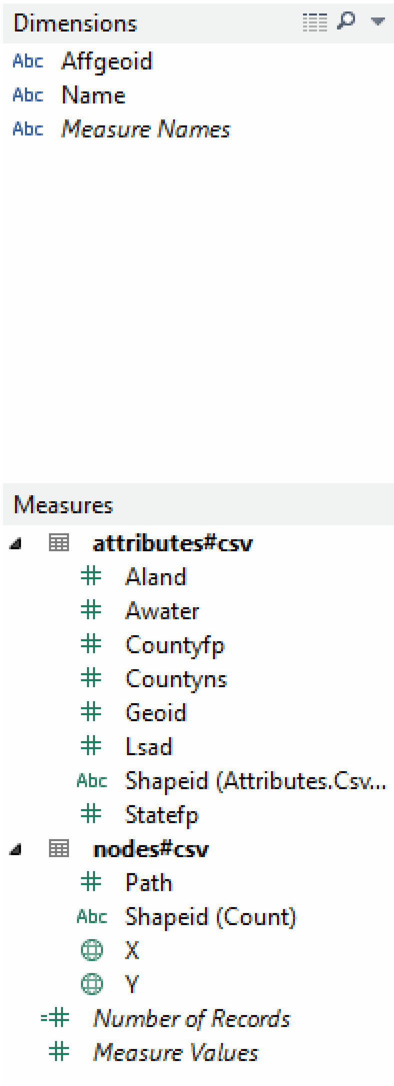
Important: If you do not change both **Shapeid** columns to be string data types, the join between the two data sources breaks.

7. In the grid, for the **X** column, click the data type icon and select **Geographic role** > **Longitude**.
8. For the **Y** column, click the data type icon and select **Geographic role** > **Latitude**.
9. Click **Sheet 1**.

: Build the map view

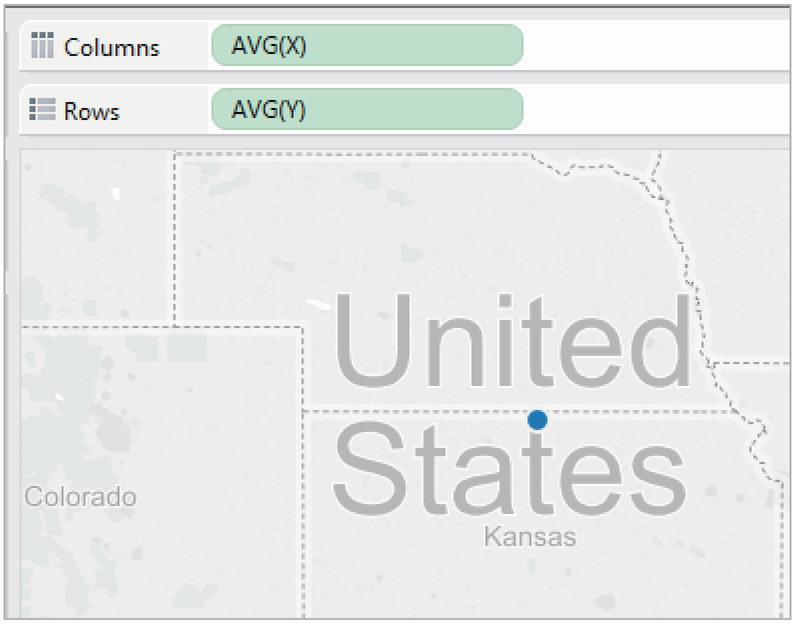
1. From the **Measures** pane, under nodes#csv, drag **Shapeid(Count)** and **Path** up to the **Dimensions** part of the **Data** pane.

   This converts the two fields from measures to dimensions and ensures that Tableau treats these fields as discrete locations.



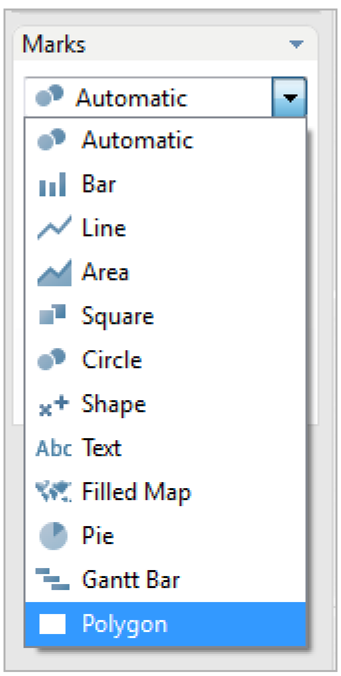
2. From **Measures**, under nodes#csv, drag the **X** field to the **Columns** shelf, and the **Y** field to the **Rows** shelf.

   Tableau adds an aggregation to each field on the **Columns** and **Rows** shelves and creates a map view with one mark.



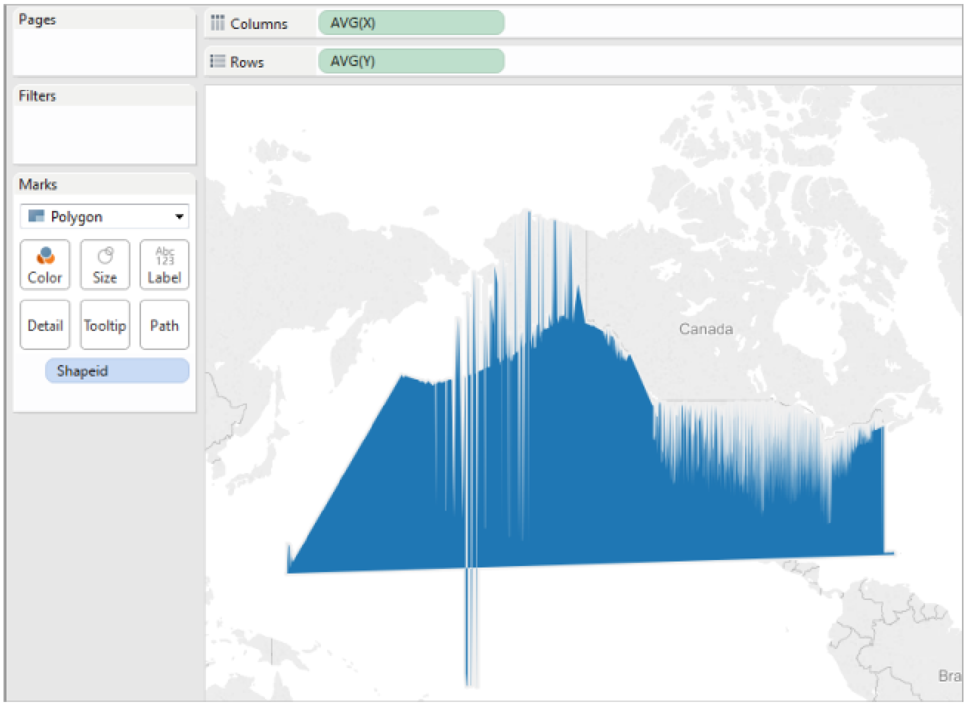
3. On the **Marks** card, click the **Mark Type** drop-down arrow and select **Polygon**.

   This ensures that you can create a polygon map, instead of a point data map.



4. From **Dimensions**, drag **Shapeid** to **Detail** on the **Marks** card.

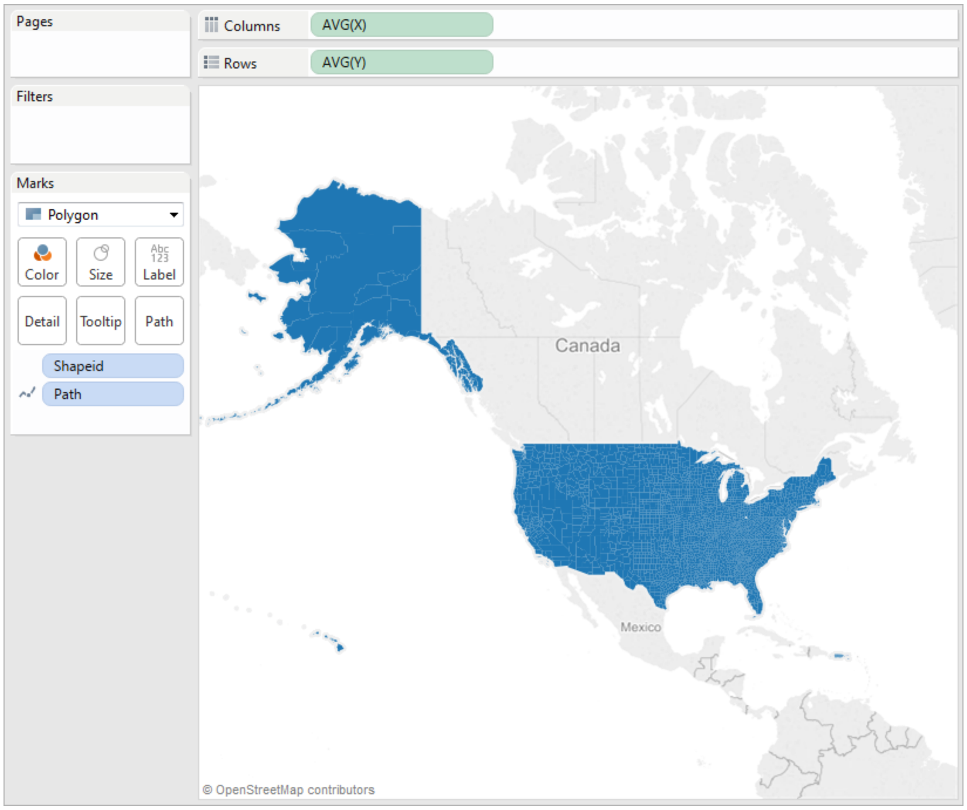
The view temporarily updates to look like the following. Next, you tell Tableau where and in which order to plot each of the polygons.



5. From **Dimensions**, drag the **Path** field to **Path** on the **Marks** card.

> **Note**: If you do not see the Path option on the Marks card, check that the mark-type is set to **Polygon**, not Automatic or Filled Map. See step 3.

The view updates to a legible map of the United States, with a separate polygon for every county. By adding the field **Path**, which is the column you manually created in the `nodes.csv` file, you tell Tableau which order to draw the polygons on the map.



You can zoom in and out of the map view, adjust the color of the marks, and even customize the background map. You can also blend additional data, such as sales data, to one of the CSV files to perform additional analyses on your location data. For more information about blending geographic data, see **Data Blending vs. Custom Geocoding** on page 929.

Add point data from shapefiles using QGIS

You can also use QGIS Desktop to convert point data from shapefile to CSV file format, and then add that point data on a map in Tableau.

Follow the steps below to learn how to use QGIS Desktop to convert shapefile data to text files and then use that data to create a point data map in Tableau. For information on how to download QGIS Desktop, see the **Before you start** on page 871 section.

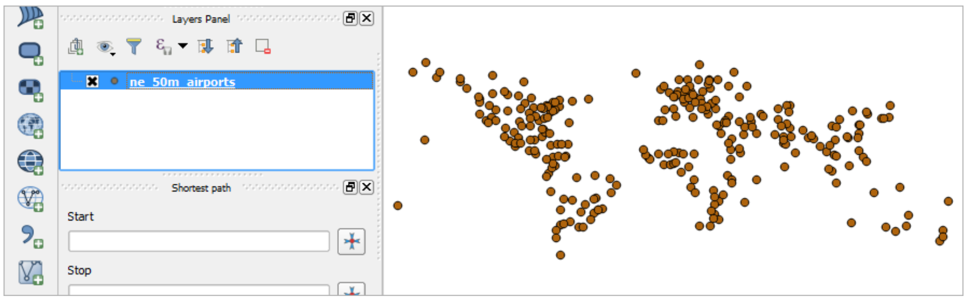
: Download shapefile data

1. Go to the Natural Earth website and download the Airports data.
2. Extract the shapefiles to a folder on your computer. In this example, the folder is named Airports and is saved on the Desktop.

: Use QGIS Desktop to convert shapefiles to CSV file format

1. Open QGIS Desktop.
2. On the left side of the workspace, click the **Add Vector Layer** icon.
3. In the Add vector layer dialog box, do the following:
   - Under **Source type**, click **Directory**.
   - Under **Source**, click **Browse**, and then navigate to and select the airports folder.
   - Click **Open**.

   The points in the shapefile are plotted on the canvas and a layer is added to the Layers Panel (highlighted in blue).



4. In the Layers Panel, right-click the airports layer, then click **Save As**.
5. In the Save vector layer as dialog box, do the following:
   - For **Format**: Select **Comma Separated Value**.
   - Click **Browse** to select the location where you want to save the file, and then click **OK**.

: Connect to the CSV file in Tableau and build the map view

1. Open Tableau Desktop.
2. On the **Connect** section of the start page, click **Text File**.
3. Select the airports CSV file that you created with QGIS.

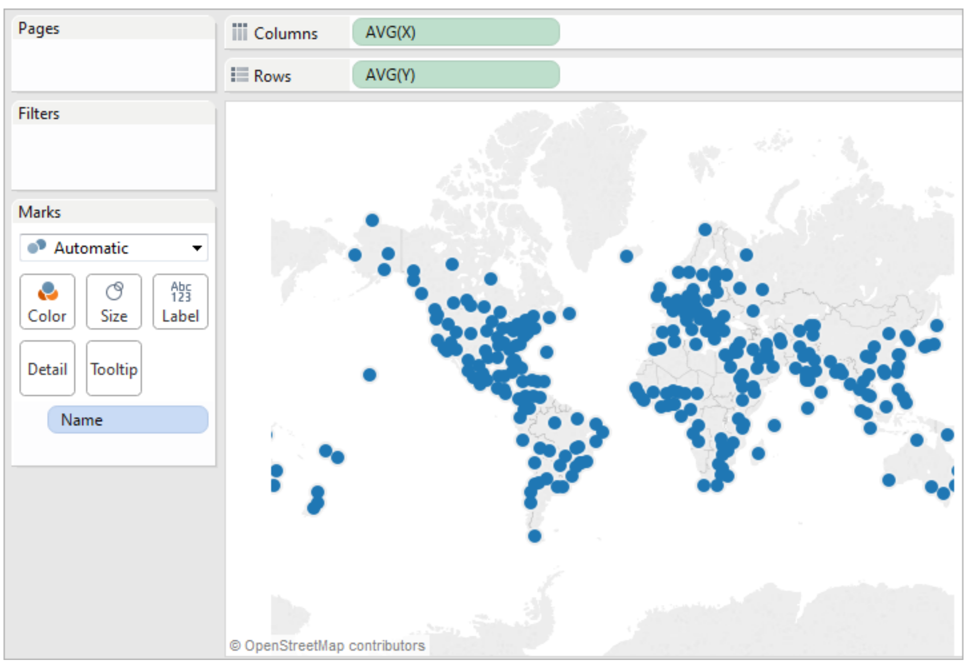
   The `airports.csv` file is added to the top of the canvas on the Data Source page.
4. In the grid, for the **X** column, click the data type icon and select **Geographic role** > **Longitude**.

test2.csv X	test2.csv Y	test2.csv Scalerank	test2.csv Featurecla	test2.csv Type	test2.csv Name
113.935	22.315	2	Airport	major	Hong Kong Int'l
121.231	25.077	2	Airport	major	Taoyuan
4.764	52.309	2	Airport	major	Schiphol

5. For the **Y** column, click the data type icon and select **Geographic role** > **Latitude**.
6. Click **Sheet 1**.
7. On **Measures**, double-click the **X** (Longitude) and **Y** (Longitude) fields to add them to the **Columns** and **Rows** shelves.

   A map with a single point appears.
8. From **Dimensions**, drag **Name** to **Detail** on the **Marks** card.

   Every airport listed in the **Name** field is displayed as a point on the map because each airport corresponds to a latitudinal and longitudinal value.



Create Tableau polygons from shapefiles using ArcGIS

You can also use ArcGIS to convert shapefiles to a text file format that can be imported into Tableau Desktop as a polygon layer.

Note: The ArcGIS method requires a licensed version of ArcGIS (ArcView, ArcEditor, or ArcInfo) and the ET GeoWizards tool for ArcGIS. The software installs as a toolbar in ArcMap and the functionality required for preparing the shapefile is covered under their free features.

: Prepare the shapefile

1. In an ArcMap view that contains the polygon shapefile layer of interest, verify that the polygon is in a geographic coordinate system using decimal latitude and longitude units, such as GCS NAD 1983. If it is in a projected coordinate system, use ArcToolbox to project the shapefile to a geographic coordinate system.
2. Launch the ET GeoWizards tool in ArcMap and follow the step-by-step wizard to output a **Polygon to Point** feature. Be sure that the output points are the **Vertices** only.

: Prepare the Tableau data source

1. Open the .DBF of the output shapefile into a program such as Excel. At a minimum, the file must contain the following fields for correct import into Tableau:

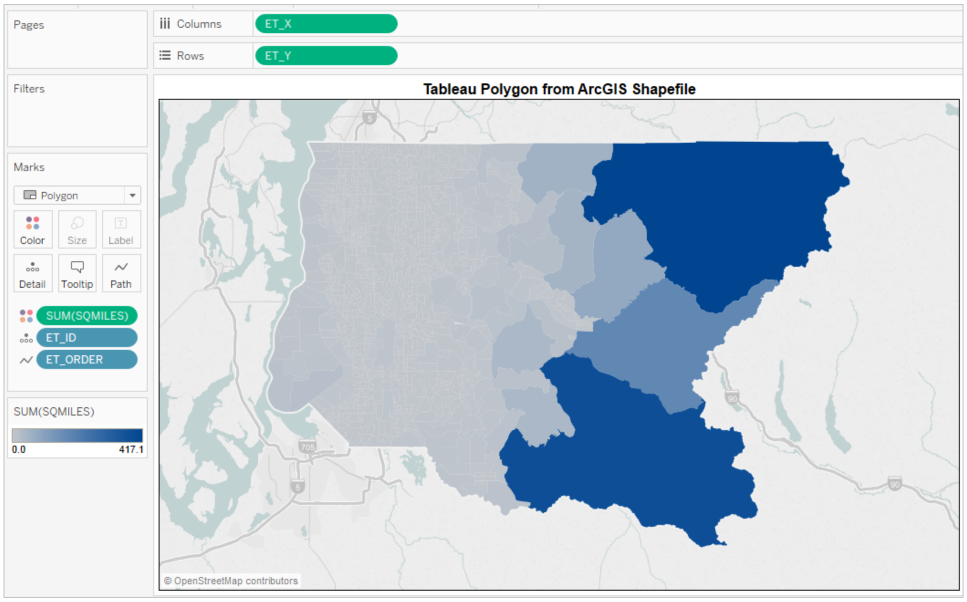
   [ID] or [ET_ID] Either of these two fields can be used for the **Level of Detail** shelf.
   [ET_X] This field corresponds to the longitude coordinate of the record.
   [EY_Y] This field corresponds to the latitude coordinate of the record.
   [ET_ORDER] This field contains the draw order of the points and is used in the **Path** shelf for the polygon.

   You can change the header names here to be more informative to the Tableau user.

   Save the updated file to a data source supported in Tableau, such as in Excel or Access format.

ET_ID	ET_X	ET_Y	ET_ORDER
2	-122.75632	48.99688	0.9938
2	-122.75604	48.99951	0.9965
3	-123.09055	49.00198	0.0000
3	-123.03539	49.00215	0.3163
3	-123.03018	48.99286	0.3774
3	-123.02784	48.98869	0.4049
3	-123.02236	48.97890	0.4692
3	-123.02158	48.97752	0.4783
3	-123.02146	48.97730	0.4797
3	-123.02152	48.97727	0.4801
3	-123.02809	48.97394	0.5224
3	-123.04097	48.97731	0.5987
3	-123.05199	48.97623	0.6622
3	-123.06072	48.97539	0.7125
3	-123.06295	48.97546	0.7253
3	-123.06400	48.97549	0.7313
3	-123.08383	48.97614	0.8451
3	-123.08395	48.97790	0.8553
3	-123.08450	48.98654	0.9049
3	-123.08814	48.99583	[illegible]
4	-121.52410	48.99896	[illegible]
4	-121.39554	48.99985	[illegible]

2. Refer to the remaining steps in the Creating Polygon-Shaded Maps article to complete the view you want in Tableau.

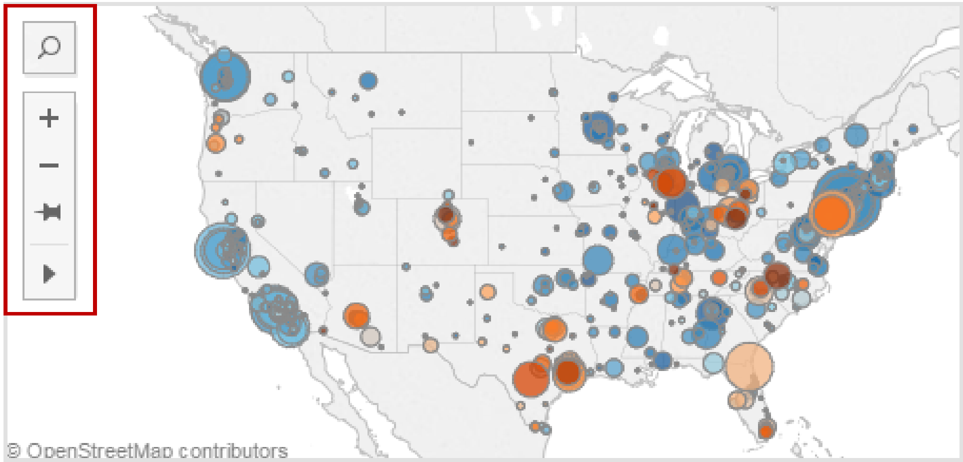


Disclaimer: This information refers to a third-party product as an example. This example is not an endorsement of this product over any other competing products.

Please note that while we make every effort to keep references to third-party content accurate and up to date, the information we provide here might change without notice as the third-party product changes.

Explore Data in Maps

Tableau maps can help you quickly find locations and analyze data worldwide. There are many ways you can explore and interact with map views. You can zoom in and out, pan, and select marks with the view toolbar, and even search for locations worldwide with map search.



If you don't see the view toolbar or the map search icon, or if you can't pan or zoom, it's probably because the workbook author has chosen to customize how others can interact with the view.

The workbook author can choose to hide the view toolbar and the map search icon so they do not appear in the view. Similarly, the workbook author can choose to turn off pan and zoom to control how you interact with the view.

For more information, see Customize How People Interact with your Map.

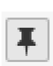
Select marks, pan, and zoom

You can use the view toolbar in the upper left corner of the view to select marks, pan, and zoom in and out of a map view. For more information, see Select Marks and Pan and Zoom.

Search for locations

You can use the map search icon  to search for locations in your map view. For more information, see Set Map Search Options.

Return to the initial view

After exploring you can return to the initial view of your map. To do so, click the reset axes button  on the view toolbar.

Assign Geographic Roles

Tableau often automatically assigns geographic roles to your location data. However, sometimes Tableau might not recognize your data as geographic. For example, if your data contains postcodes, they might be interpreted as numerical or string data, instead of geographic data. If this happens, you must assign a geographic role to each of the relevant fields.

A *geographic role* associates each value in a field with a latitude and longitude value. When you assign a geographic role to a field, Tableau assigns latitude and longitude values to each location in your data based on data that is already built in to the Tableau map server (Tableau Map Service).

Because there is a lot of location data built in to the Tableau map server, Tableau recognizes a lot of standard geographic data, such as state and city names, ZIP codes and postcodes, country borders and second-level administrative divisions, such as U.S. counties, and can plot them on a map. Assigning a geographic role based on the type of location (such as state versus postcode) helps insure that your data is plotted correctly on your map view.

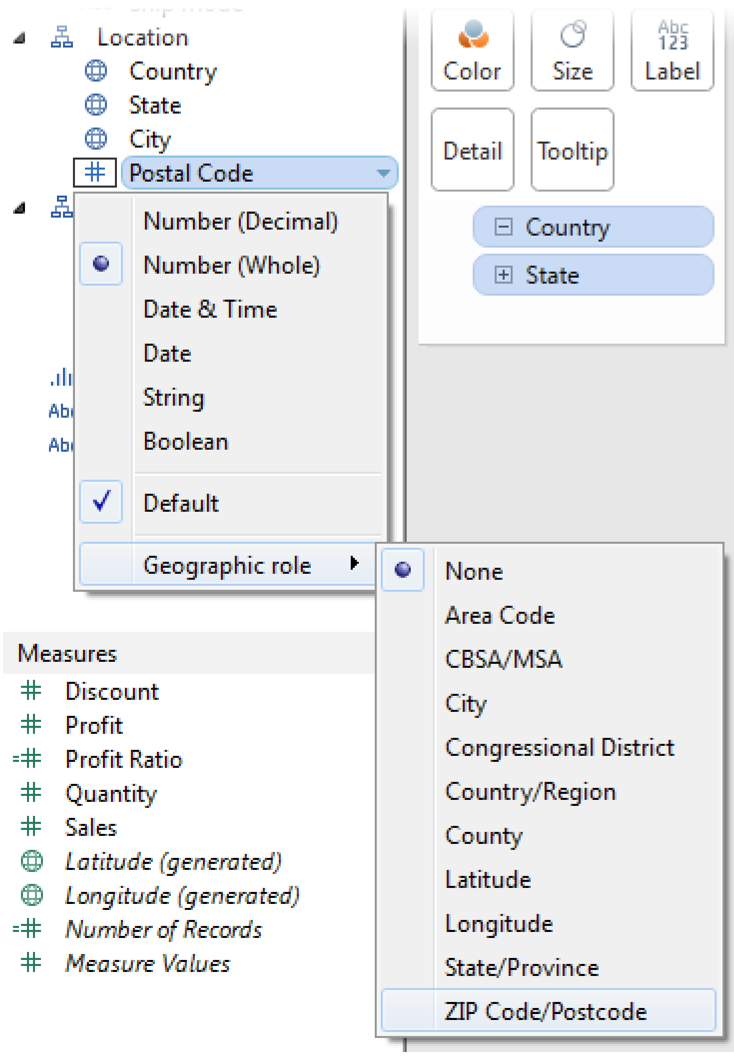
You can tell that a geographic role is assigned to a field in the **Data** pane because fields with geographic roles have globe icons next to them.

When a field is assigned a geographic role, Tableau creates a map view when you add the field to **Detail** on the **Marks** card. In other words, Tableau *geocodes* the information in that field.

Assign a geographic role to a field

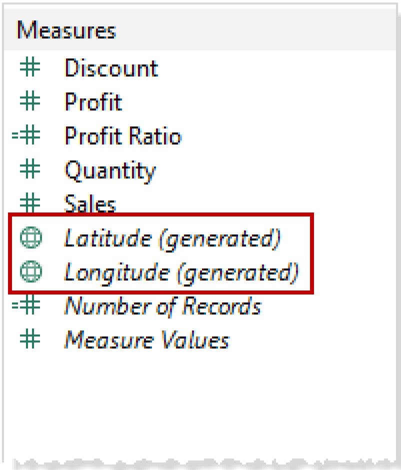
To manually assign a geographic role to a field:

- Click the icon next to the field in the **Data** pane, select **Geographic Role**, and then select the geographic role you want to assign to the field.



When you assign a geographic role to a field, Tableau adds two fields to the **Measures** area of the **Data** pane: Latitude (generated) and Longitude (generated).

These fields contain latitude and longitude values and are assigned the Latitude and Longitude geographic roles. If you double-click each of these fields, Tableau adds them to the Columns and Rows shelves and creates a map view using the Tableau background map.



Types of geographic roles

The following table describes the geographic roles available in Tableau. Many of the roles are international, but some are limited to the U.S. only.

If your location data does not fit into one of these roles, you may have to import custom geocoding to plot the data on a map.

For more information, see **Custom Geocoding** on page 919.

For Tableau Desktop version 8.2 and later

Geographic Role	Description
Area Code	U.S. telephone area codes; numbers only.
CBSA/MSA	U.S. Core Based Statistical Areas, which includes Metropolitan Statistical Areas, as defined by the U.S. Office of Management and Budget.
City	Worldwide cities with population of 15,000 or more. Names are in English, French, German, Spanish, Brazilian-Portuguese, Japanese, Korean, and Chinese.
Congressional District	U.S. congressional districts.
Country/Region	Worldwide countries, regions, and territories. Names are in English, French, German, Spanish, Brazilian-Portuguese, Japanese, Korean, and Chinese. Tableau also recognizes, FIPS 10, ISO 3166-1 alpha 2,

	and ISO 3166-1 alpha 3. Names are included in various forms, including long, short, and various abbreviations.
County	Second-level administrative divisions for select countries. For example, U.S. counties, French départements, German kriese, etc. **Note:** Second-level administrative division definitions vary by country. In Tableau, all second-level administrative divisions are geocoded with the County geographic role. For more information, see the **County-equivalents recognized by Tableau** on the next page section.
Latitude	Latitude in decimal degrees. Only available for numeric fields.
Longitude	Longitude in decimal degrees. Only available for numeric fields.
State/Province	Worldwide state, province, and other first-level administrative divisions. Names are in English, French, German, Spanish, Brazilian-Portuguese, Japanese, Korean, and Chinese. **Note:** Some names are available only in their local form.
ZIP Code/Postcode	ZIP codes and postcodes for select countries. For example, U.S. five-digit zip codes, Australian four-digit postcodes, German five-digit postcodes, etc. For more information, see the **ZIP codes and postcodes recognized by Tableau** on page 894 section.

For Tableau Desktop version 7.0, 8.0, and 8.1

Role Name	Description
Area Code	U.S. telephone area codes; numbers only.
CBSA/MSA	U.S. Core Based Statistical Areas, which includes Metropolitan Statistical Areas, as defined by the U.S. Office of Management and Budget.
City	Worldwide cities with population of 15,000 or more. Names are in English, French, and German.
Congressional District	U.S. congressional districts.
Country/Region	Worldwide countries, regions, and territories. Names are in English,

	French, and German. Tableau also recognizes, FIPS 10, ISO 3166-1 alpha 2, and ISO 3166-1 alpha 3. Names are included in various forms, including long, short, and various abbreviations.
County	U.S. counties and county-equivalents by name. Independent cities are included with their names followed by city.
Latitude	Latitude in decimal degrees. Only available for numeric fields.
Longitude	Longitude in decimal degrees. Only available for numeric fields.
State/Province	Worldwide state, province, and other first-level administrative divisions. Names are in English, French, and German. Official abbreviations available for the following countries: Australia, Brazil, Canada, Germany, Poland, Switzerland, U.K., and U.S. **Note**: Some names are available only in their local form.
ZIP Code/Post-code	ZIP codes and postcodes for select countries. For example, U.S. five-digit zip codes, Australian four-digit postcodes, German five-digit postcodes, etc.

For information about map data providers and status, see About Tableau Maps on the Tableau website.

County-equivalents recognized by Tableau

The following table lists second level administrative divisions (county-equivalents) from several countries that Tableau recognizes. If your data source contains a field with any of these county-equivalents, you can assign the **County** geographic role to it.

If you data source contains county-equivalents that are not listed in the following table, you might have to import custom geocoding to plot the data on a map. For more information, see **Custom Geocoding** on page 919.

Country	County-equivalent	Version Added	Version Updated
Argentina	Departamentos.	8.2.3	

Australia	Local Government Authorities (LGAs).	8.2.2	8.3.1
Belgium	Arrondissements.	9.0	
Brazil	Municipios.	8.2.3	
Chile	Departamentos.	9.0	
China	Prefectures, Counties, Leagues, County-level Cities, Prefecture-level Cities and Divisions.	9.0	
Denmark	Kommunes.	8.3.1	
Finland	Seutakanta - sub-regions.	9.1	
France	Départements.	8.2	
Germany	Kreise, including Landkreise and Kreisefrei Städte.	8.2.4	
India	Districts.	9.3	
Italy	Provinces and metropolitan cities.	9.0	
South Africa	Municipalities.	8.3.1	
Spain	Provincias.	8.2	
Sweden	Sveriges kommuner - municipalities (including LAU level 2 codes).	9.1	
UK	Counties, Unitary Authorities and Local Authority Districts, including ONS and GSS codes.	8.2	
U.S	County, including five-digit county codes.		

ZIP codes and postcodes recognized by Tableau

The following table lists zip codes and postcodes from several countries that Tableau recognizes. If your data source contains a field with any of these postcodes, you can assign the **Zip code/Postcode** geographic role to it.

If you data source contains postcodes that are not listed in the following table, you might have to import custom geocoding to plot the data on a map. For more information, see **Custom Geocoding** on page 919.

Country	**Available in Tableau versions**
Australia	7.0 and later
Albania	9.3 and later
Andorra	9.3 and later
Austria	9.3 and later
Belarus	9.3 and later
Belgium	9.3 and later
Bosnia and Herzegovina	9.3 and later
Bulgaria	9.3 and later
Canada *Forward Sortation Area; first three characters of the six-character Canadian postal code.*	7.0 and later
Croatia	9.3 and later
Cyprus	9.3 and later
Czech Republic	9.3 and later
Denmark	9.3 and later
Estonia	9.3 and later
Finland	9.3 and later
Former Yugoslav Republic of Macedonia	9.3 and later
France	7.0 and later
Germany	7.0 and later
Gibraltar	9.3 and later
Greece	9.3 and later

Hungary	9.3 and later
Iceland	9.3 and later
Italy	9.3 and later
Japan *Three-digit postcodes.* ***Note:*** *Japanese seven-digit postcodes are not supported.*	9.2 and later
Latvia	9.3 and later
Liechtenstein	9.3 and later
Lithuania	9.3 and later
Luxembourg	9.3 and later
Malta	9.3 and later
Monaco	9.3 and later
Montenegro	9.3 and later
Netherlands	9.3 and later
New Zealand	7.0 and later
Norway	9.3 and later
Poland	9.3 and later
Portugal	9.3 and later
San Marino	9.3 and later
Serbia	9.3 and later
Slovakia	9.3 and later
Slovenia	9.3 and later
Spain	9.3 and later

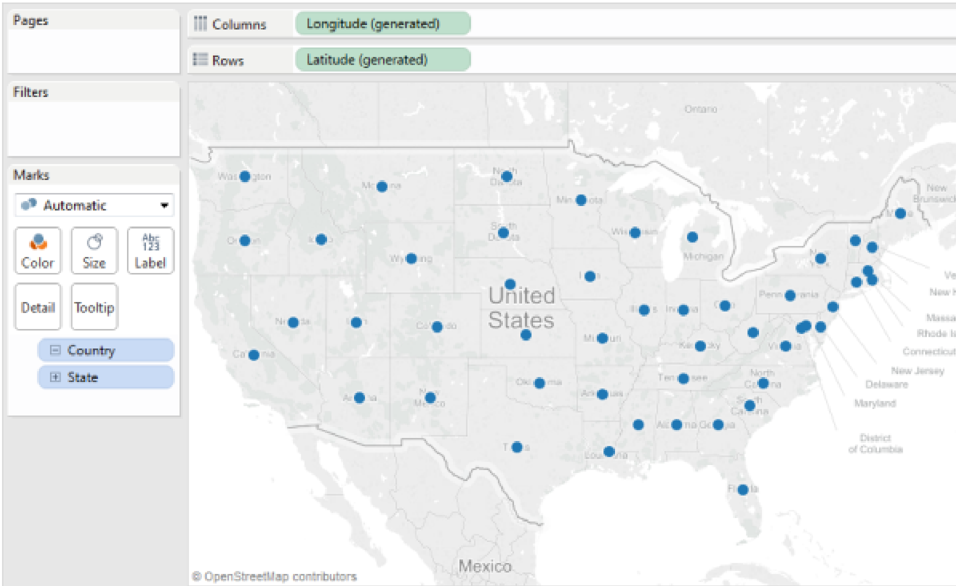
Sweden	9.3 and later
Switzerland	9.3 and later
Turkey	9.3 and later
U.K. *Outcodes; first segment of the five- to seven-character U.K. postcode.*	7.0 and later
U.S.	7.0 and later
Vatican City	9.3 and later

Continue to **Build a Map View** below.

Build a Map View

When creating a map view, Tableau automatically adds the generated **Latitude** and **Longitude** fields to the **Rows** and **Columns** shelves and places a selected geographic field on **Detail** on the **Marks** card.

The marks in the view correspond to the field on **Detail**. For example, if the **State** field is used in the view, there is a single mark for each state in your data. As you add more geographic fields to **Detail** on the **Marks** card, the marks in the view will be broken down by the members of those fields.



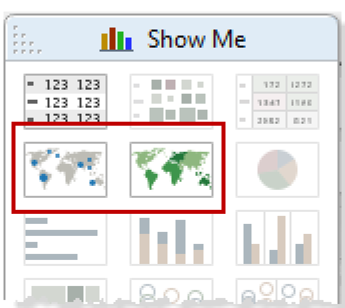
To Build a Map View

To create map views, add geographic fields to the view, and then add measures or continuous dimensions to the **Marks** card. To follow a step by step example of how to create map views using sample data that comes with Tableau, see **Build a Map View** on page 599.

Add geographic fields to the view

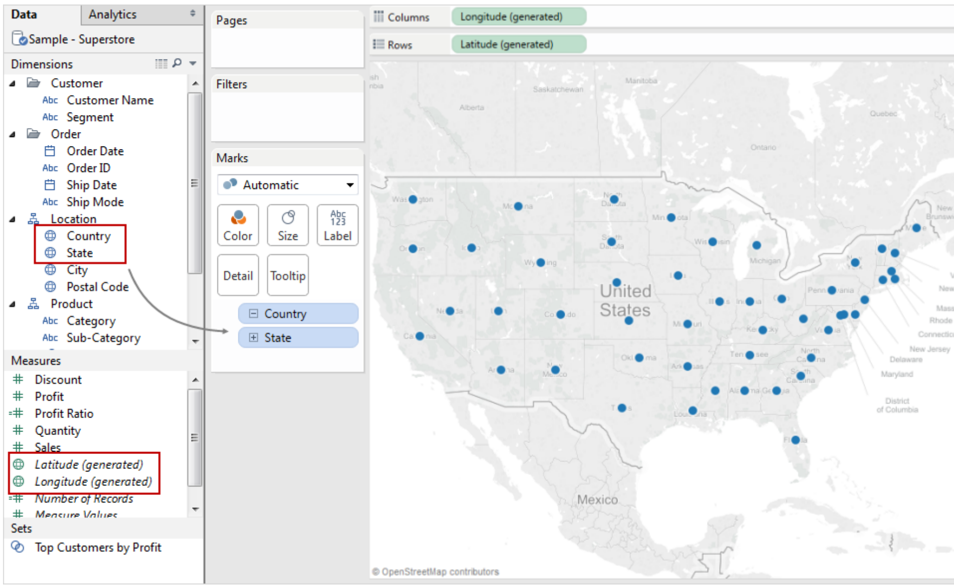
To add geographic fields to the view, do one of the following:

- Double-click a geographic field in the **Data** pane. A globe icon indicates fields that have been geocoded. For more information, see **Assign Geographic Roles** on page 888.
- Select a geographic field in the **Data** pane, and then select one of the map views in Show Me.



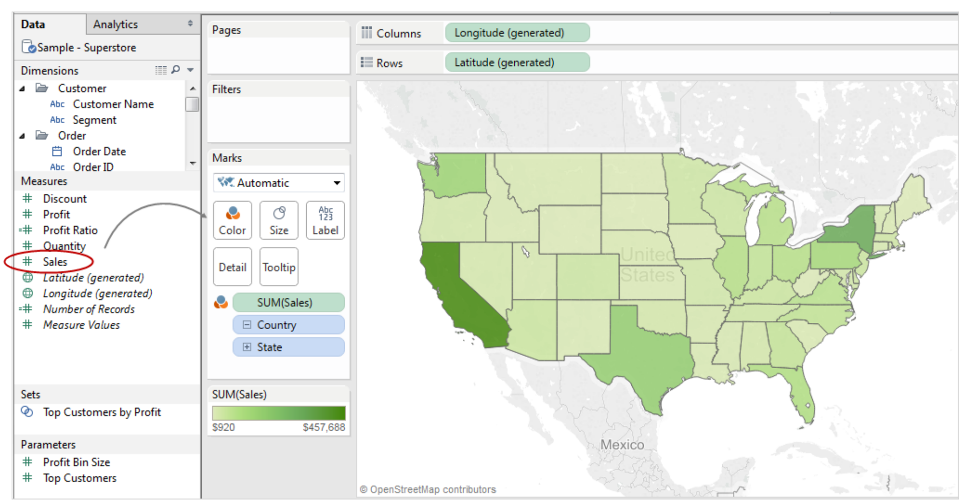
- In the **Data** pane, double-click the measures **Latitude (generated)** and **Longitude**

(generated), and then drag a geographic field to **Detail** on the **Marks** card.



Add fields to the marks card

To complete a map view, from the **Data** pane, drag measures or continuous dimensions to the **Marks** card. For example, the following map shows the sum of sales for each state. The **Sales** field has been placed on **Color** on the **Marks** card, so each state is colored based on the sum of its sales. When creating a map view, placing a measure on **Color** on the **Marks** card causes the mark type to automatically update to the Filled Map mark type. For more information, see **Filled Map Mark** on page 446.



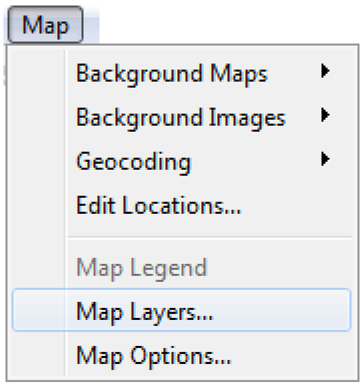
Continue to **Set Map Layers** on the next page.

Set Map Layers

When you create a map view there are several options to help you control the appearance of the map. These options are available in the **Map Layers** pane.

To open the Map Layers pane:

- Select **Map** > **Map Layers**.

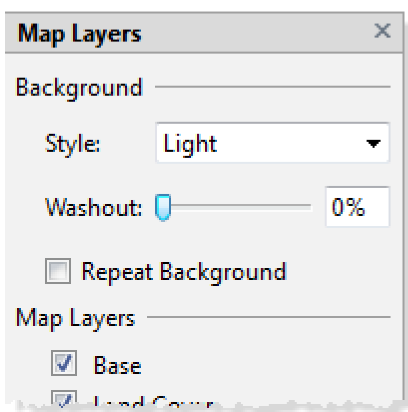


Use the **Map Layers** pane to modify how the map appears. You can change the map background, hide and show map layers, such as street names and country borders, and add data layers.

Select a Map Background

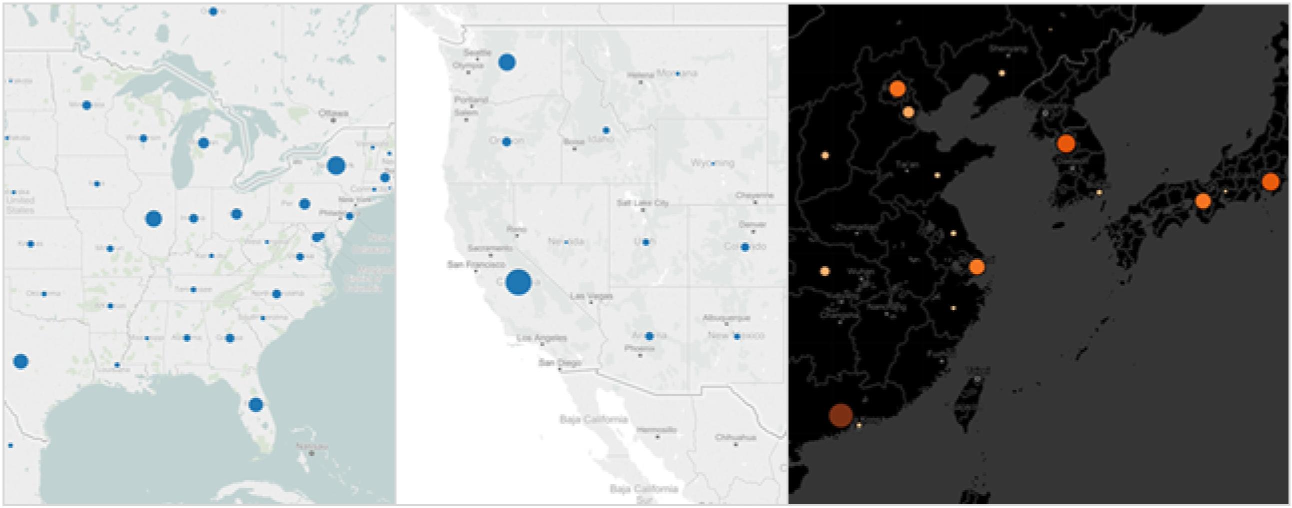
To change the map background :

- Click the **Style** drop-down menu in the **Map Layers** pane, and then select a background style.

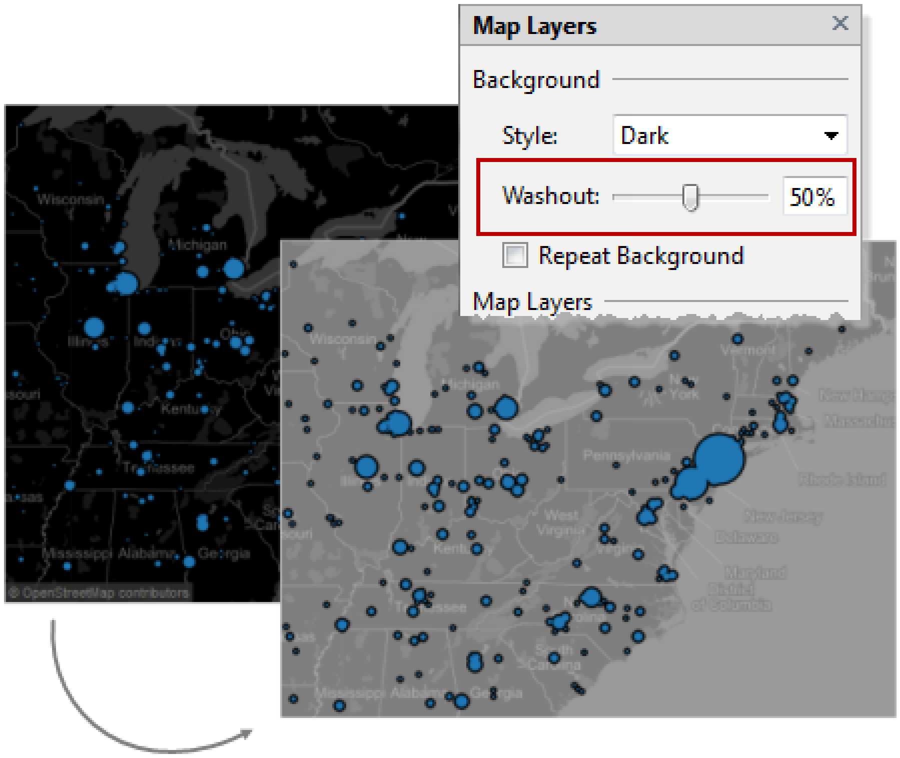


The three background styles available are listed below.

Normal **Light** **Dark**



In addition to the background map style, you can use the **Washout** slider to control the intensity, or luminance, of the background map. The farther the slider moves to the right, the more faded the map becomes.



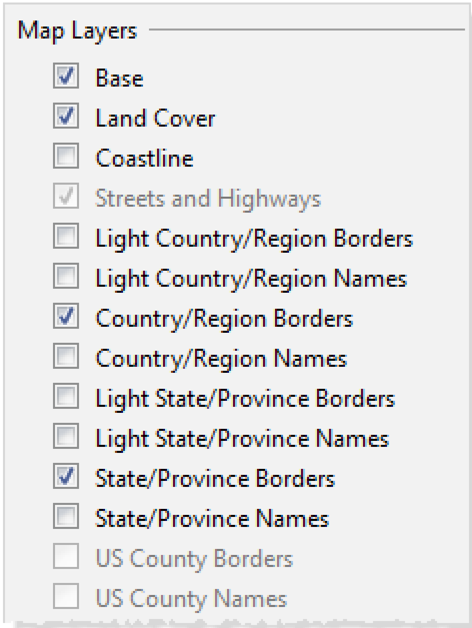
Finally, you can select whether to repeat the background. When the **Repeat Background** option is selected, the background map may show the same area multiple times depending on where the map is centered.

Add or Remove Map Layers

Tableau maps provide several layers that can mark points of interest on the map. For example, you can overlay streets and highways, county boundaries, and more on the map to give your data context.

To add or subtract map layers from your map view:

- Select **Map** > **Map Layers**, and then click one or multiple map layers in the **Map Layers** section of the **Map Layers** pane.



Note: Some map layers are only visible at specific zoom levels.

The map layers are described in the table below.

Layer Name	Description
Base	Shows the base map including water and land areas.
Land Cover	Shades wilderness areas and parks to give the map more depth.
Coastlines	Displays coastlines.
Streets and Highways	Marks freeways and highways as well as small city streets. This layer includes the highway and street names as well.
Light Country/Region Borders	Shows a light gray outline of country/region borders and names.
Light Country/Region Names	Shows country and region names in a light gray.
Country/Region Borders	Highlights country and region borders in a darker gray.

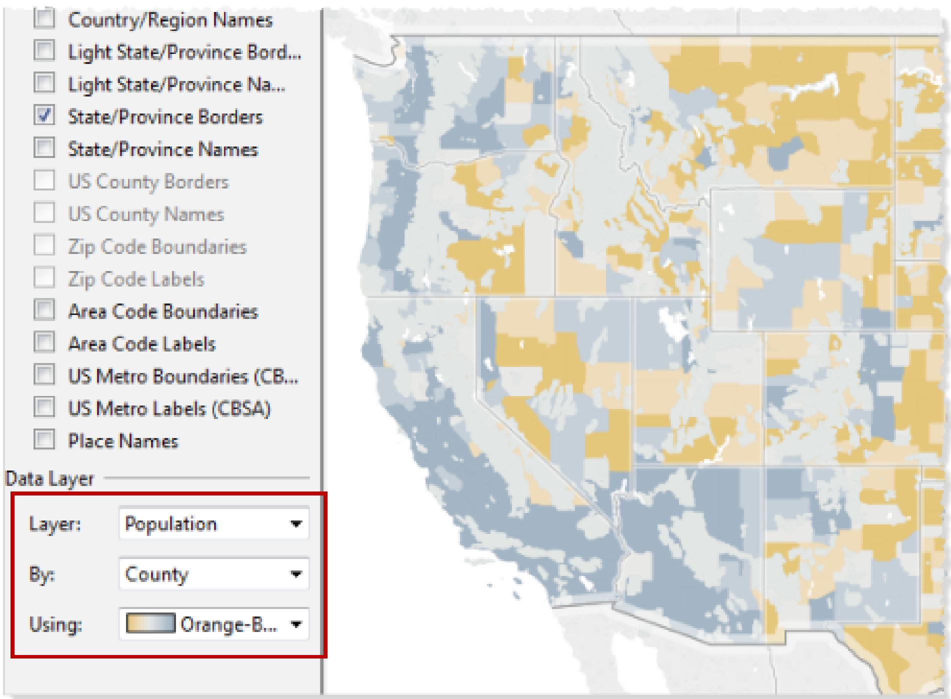
Layer Name	Description
Country/Region Names	Highlights country and region names in a darker gray.
Light State/Province Borders	Shows a light gray outline of state borders and names.
Light State/Province Names	Shows state and province names in a light gray.
State/Province Borders	Highlights state and province borders in a darker gray.
State/Province Names	Highlights state and province names in a darker gray.
US County Borders	Highlights U.S. county borders.
US County Names	Highlights U.S. county names.
Zip Code Boundaries	Marks U.S. zip code boundaries. You must zoom in to see this layer.
Zip Code Labels	Shows labels for U.S. zip codes. You must zoom in to see this layer.
Area Code Boundaries	Marks the U.S. area code boundaries. You must zoom in to see this layer.
Area Code Labels	Shows labels for the U.S. area codes. You must zoom in to see this layer.
US Metro Boundaries (CBSA)	Marks U.S. Metropolitan Statistical Areas and Micropolitan area boundaries.
US Metro Labels (CBSA)	Shows labels for the U.S. Metropolitan Statistical Areas and Micropolitan areas.
Place Names	Displays the names of places from country/region names and borders to city names, bodies of water, parks, universities, and more. This layer is dependent on the zoom level.

Add Data Layers

In addition to map layers, you can turn on a variety of predefined data layers that show census information.

To add a data layer to your map view:

- Select **Map** > **Map Layers**
- In the **Data Layer** section at the bottom of the **Map Layers** pane, do the following:
  - Click the **Layer** drop-down menu and select a data layer.
  - Click the **By** drop-down menu to layer the data by **State**, **County**, **Zip Code** or **Block Group**.
  - Click the **Using** drop-down menu to select a color scheme.



Once you select a data layer, it is added as shading to the map and a legend is shown to explain the colors of the layers.

To hide or show the map legend in a worksheet:

- Select **Map** > **Map Legend**.

Set Default Map Layer Options

If you find that you have a set of map or data layers you would always like to show, or that you always want a certain background map style when you create new workbooks or sheets, you can set the selected map layer options as the default.

To set default map layer options:

1. Select the options you want to show by default.
2. At the bottom of the **Map Layers** pane, click **Make Default**.

Reset Map Layer Options

If you find that you want to reset the map layer options to their default settings, you can clear any selected map layer options.

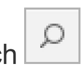
To reset map layer options:

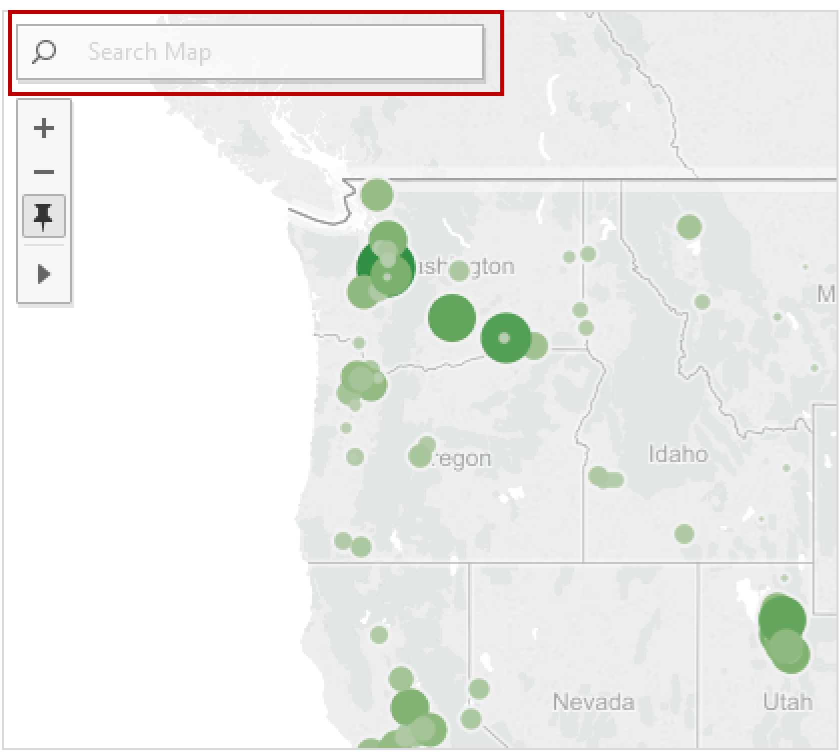
- At the bottom of the **Map Layers** pane, click **Reset**.

> **Note:** Resetting map layer options returns the Map Layers pane to the default settings you configured. If you have not configured any default settings, the Map Layers pane will return to the original settings.

Set Map Search Options

Map search helps you find locations in a map view so you can quickly explore and inspect data.

The map search icon appears in the top left corner of the view. When you click the search  icon, a search box appears.



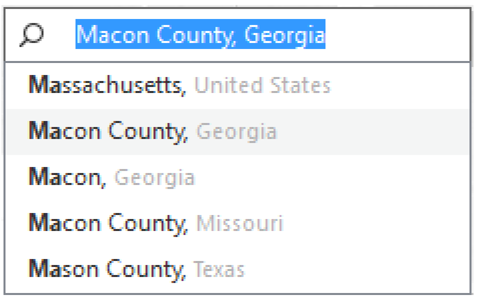
When you begin to type in the search box, map search suggests possible locations that are in your map view. The suggestions are based on location names and text in your data source.

For more information about how map search makes suggestions, see **How Map Search Ranks Results** below.

You can search for the following location types:

- Continent
- Country
- State or province
- County
- City
- Postcode

Select a location from the list of suggestions to pan and zoom to that location on the map.



Hide Map Search

By default, the map search icon appears in the top left corner of the view. When you publish a view to Tableau Server or Tableau Online, or share the view through Tableau Reader, the map search icon remains in the view. If you do not want viewers to search for locations in your map view, you can hide the map search icon.

For more information about showing and hiding map search, see **Customize How People Interact with your Map** on page 910.

How Map Search Ranks Results

When you type a location in the search box, map search suggests up to five locations that might match your search. Map search ranks suggestions by the following criteria, in order:

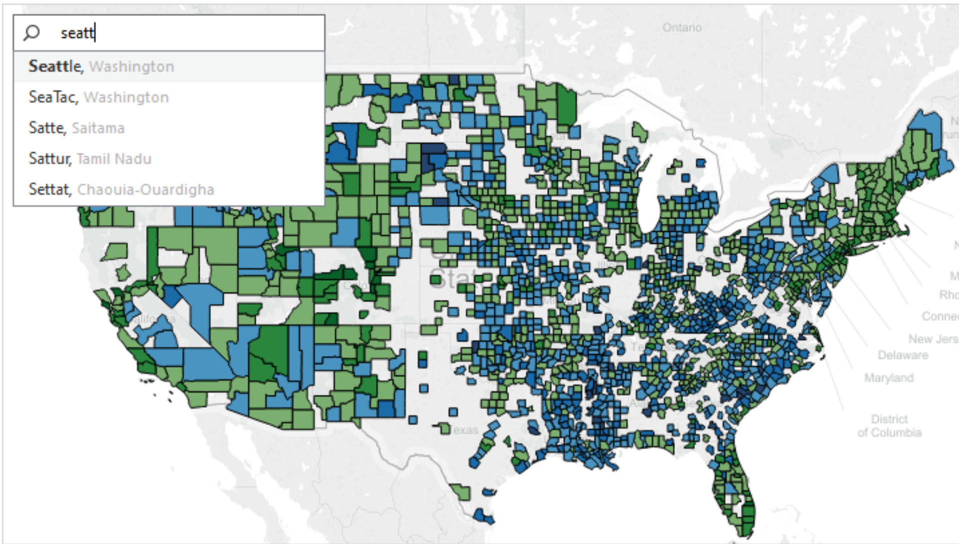
1. The locations are stored in your data source
2. The locations match your search text

Map search ranks locations that match what you type, but that are not stored in your data source, lower on the suggestion list.

This section describes how map search ranks possible matches for your searches, and provides examples.

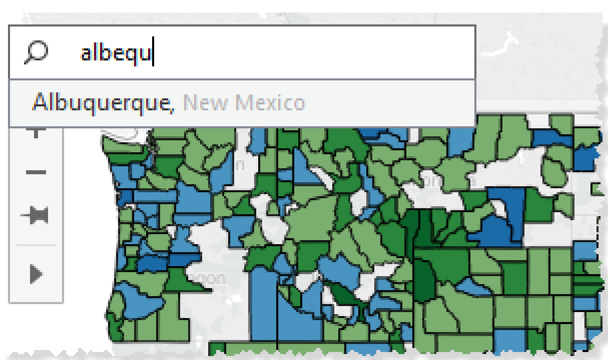
Closest match based on search text

Map search uses text-based ranking to suggest five locations you might want to find. Text-based ranking measures how similar two strings of text are to one another. For example, if you start to type **seatt** in the search box, map search measures that string of text and compares it to similar location names to make suggestions, listed from most to least likely match.



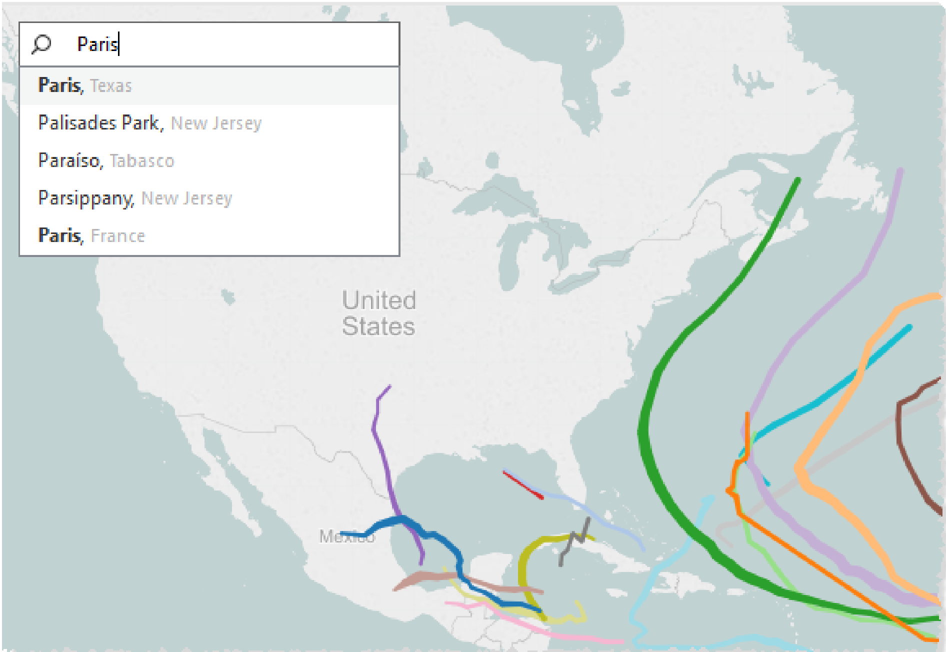
Closest match to misspelled location names

When text in the search box contains a misspelled location name, map search suggests locations that have *a low text difference* from the search text. For example, if you type **albequ** in the search box, map search suggests **Albuquerque, New Mexico**.

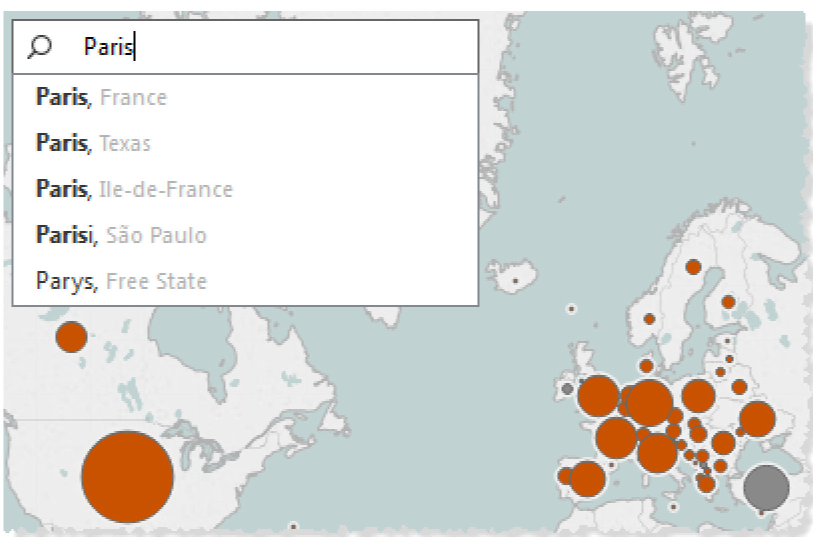


Match within the workbook data bounds

Map search ranks locations that are within the data bounds of your workbook higher in the suggestion list than locations that are not in your data source. For example, if your data source contains U.S. storm data, a search for **Paris** returns **Paris, Texas** as the most likely match, because Paris, Texas is within the data bounds of the U.S.



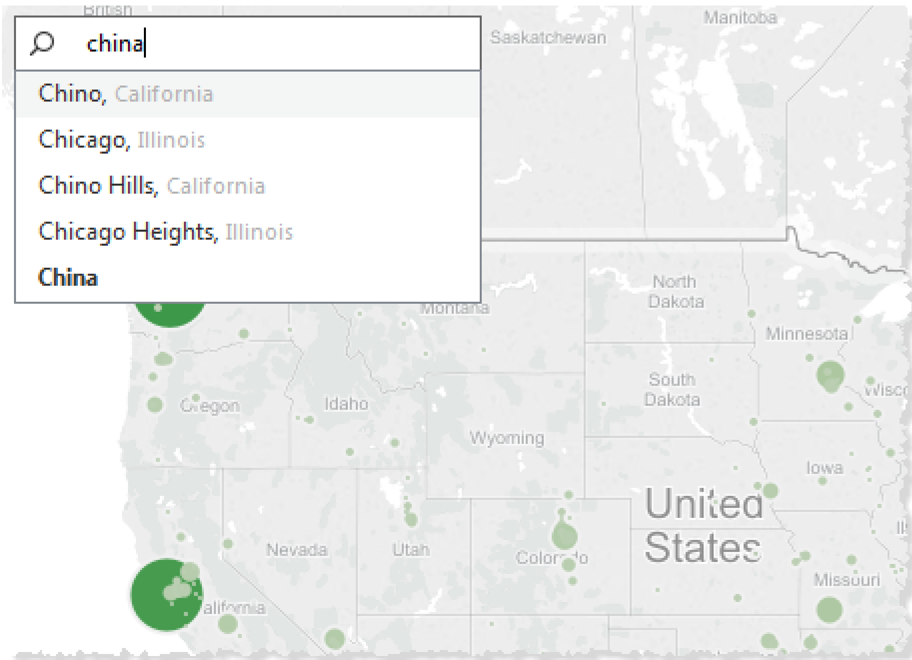
By contrast, when your data source contains international data, map search suggests the most prominent locations that match your search text. For example, if your data source contains data for both European and U.S. populations, a search for **Paris** returns **Paris, France** as the most likely match, because Paris, France is the most probable Paris.



If map search finds no matching location in your data source, it suggests the most probable set of locations that match your text. For example, if your data source contains sales data in the United Kingdom, a search for **Paris** also returns **Paris, France** as the most likely match.

Exact match for location not in the workbook

If you search for a location that is not within the data bounds of your workbook, but that does exist as an exact text match, the location appears fifth in the search result list. For example, if your data source contains U.S. sales data, a search for **china** returns **China** as the last result.



Customize How People Interact with your Map

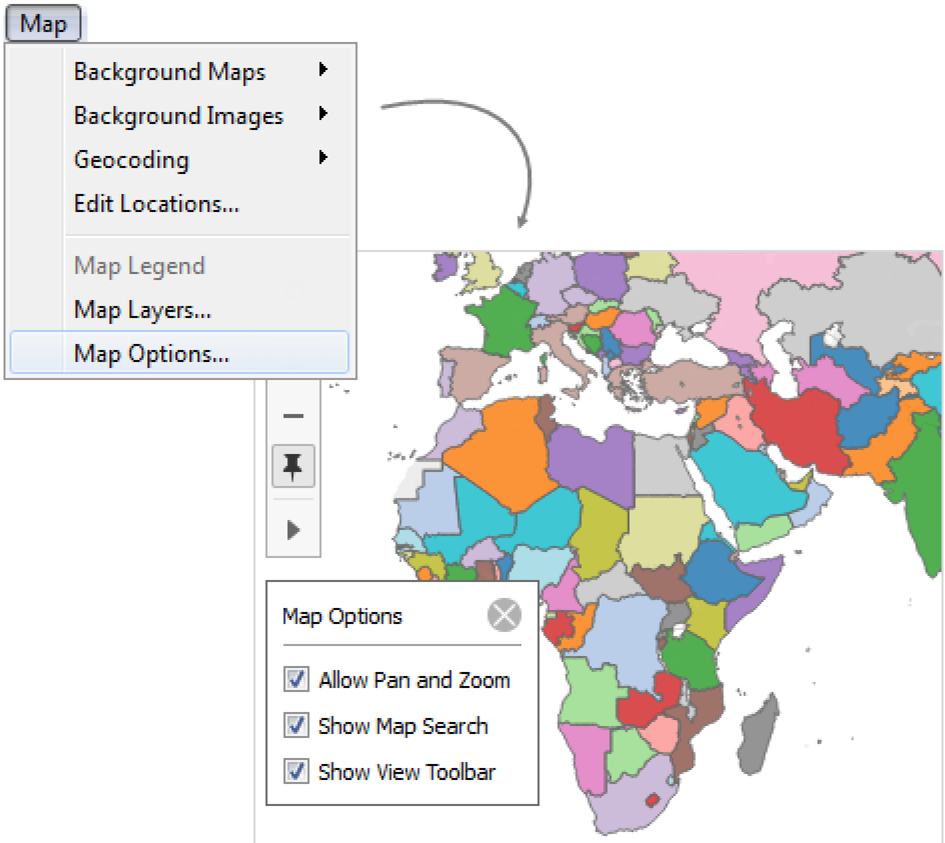
When you create a map view, there are several default ways you can explore and interact with the view. You can zoom in and out of the view, pan, select marks, and even search for locations worldwide with map search.

However, sometimes you want to limit some of the ways your audience can interact with your map.

You can customize how your audience interacts with your view in several ways using the **Map Options** dialog box.

To open the Map Options dialog box:

- Select **Map** > **Map Options**



Hide map search

You can hide the map search icon so your audience cannot search for locations in your map view.

To hide the map search icon:

- Select **Map** > **Map Options**, and then clear **Show Map Search** in the Map Options dialog box.

> **Note:** When you hide the map search icon, you also hide the locate me button for views published on the web. For more information about the locate me button, see Interact with Maps in the Tableau Online Help.

Hide the view toolbar

You can hide the view toolbar in a map view so your audience cannot lock the map in place or zoom the map to all of your data.

To hide the view toolbar:

- Select **Map** > **Map Options**, and then clear **Show View Toolbar** in the Map Options dialog box.

> **Note:** When you hide the view toolbar, you can still use keyboard shortcuts to zoom in and out of the view, pan, and select marks. For more information, see **View Toolbar** on page 844.

Turn off pan and zoom

You can turn off pan and zoom in your map view, as well as in background images, so your audience cannot pan, or zoom in or out of the view.

To turn off pan and zoom:

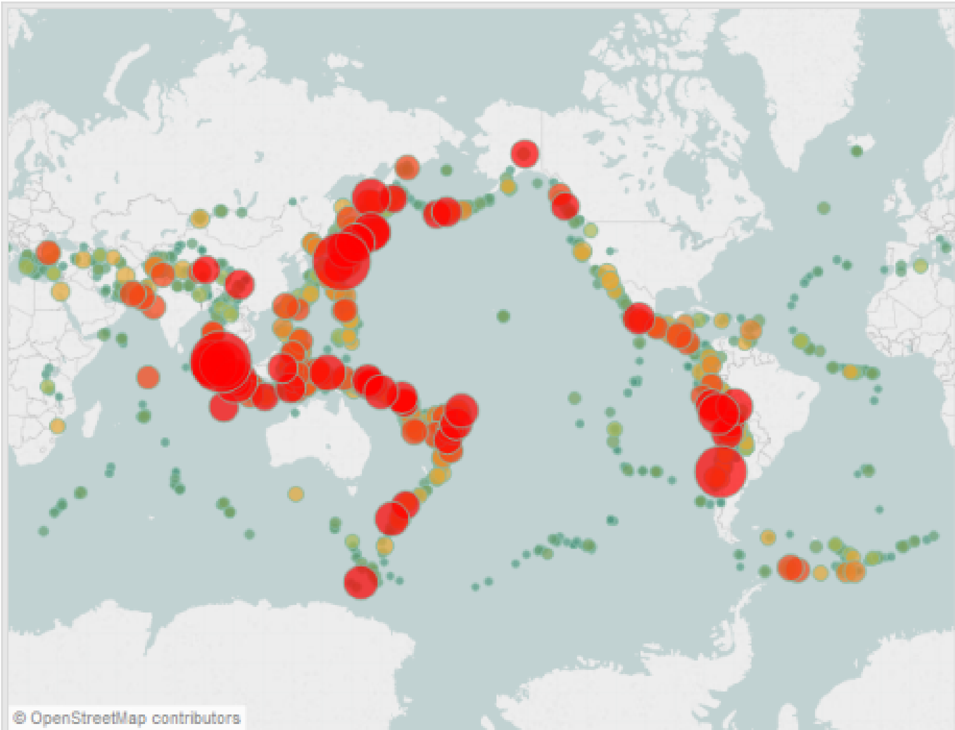
- Select **Map** > **Map Options**, and then clear **Allow Pan and Zoom** in the Map Options dialog box.

When you turn off pan and zoom, the pan tool and all zoom controls are removed from the view toolbar, and the rectangular tool becomes the default tool. Keyboard shortcuts for zooming in and out of the view, or panning, no longer work. If the map search icon is not hidden, you can still navigate the view by searching for locations with the map search box.

Measure Distances Between Data Points and Locations in a Map

While exploring data in a map view, you might have questions about how that data relates to its surrounding geography, locations, or landmarks. To answer these types of questions, you can use the Radial tool to measure approximate distances in your map view.

The following view shows the number of earthquakes, of magnitude 6.0 and higher, that have occurred around the world in the past 10 years.



At a global scale, this view is very powerful, but you or your audience might want to zoom in and explore certain areas more closely. For example, maybe you want to see how many earthquakes have occurred in Taiwan in the past 10 years, specifically within 100 miles of its capital, Taipei.

To do so, you can use the Radial tool to find all the earthquakes within approximately 100 miles of the capital city.

Follow the steps below to learn how to measure distance with the Radial tool.

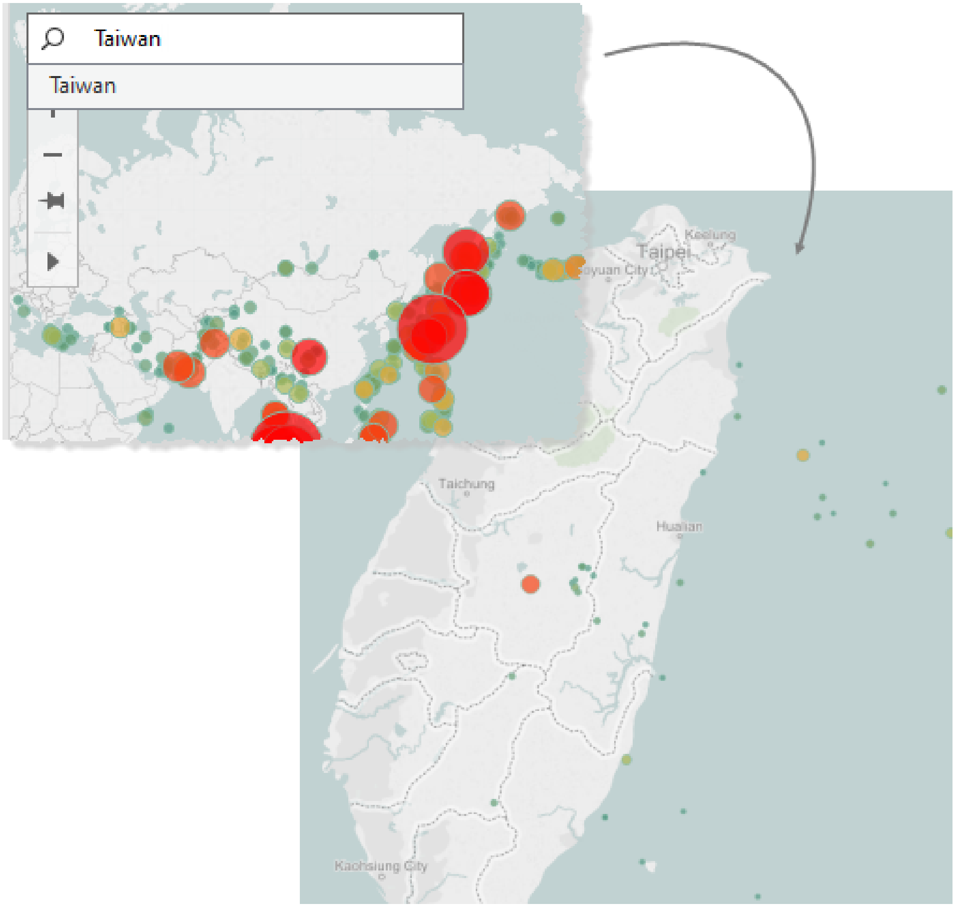
Step 1: Zoom in to an area or location

The first step to measuring distance in maps with the Radial tool is to zoom in to an area or location in the map view. For more information about how to zoom in and out of the view, see **Pan and Zoom** on page 848.

You can also use map search to quickly navigate to a location in your map.

For more information about how to use map search, see **Set Map Search Options** on page 906.

> **Note:** Due to the map projection, you can only measure distance at higher zoom levels. This means that you must zoom in several times before you can measure distance with the Radial tool. For more information, see the **Measurement Accuracy** on page 916 section.

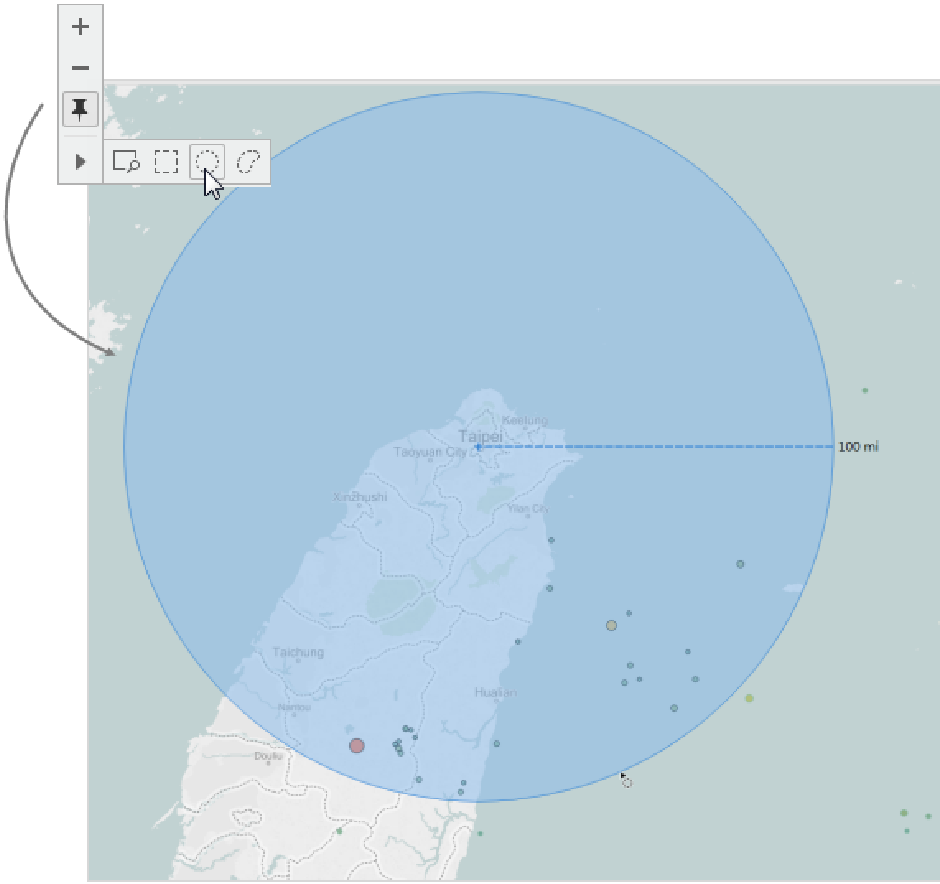


Step 2: Select the Radial tool

After you have zoomed in to a particular area or location in your view, select the Radial tool on the view toolbar, and then click and drag across the view. The measured distance appears to the right of the circle that is drawn when you drag across the view.

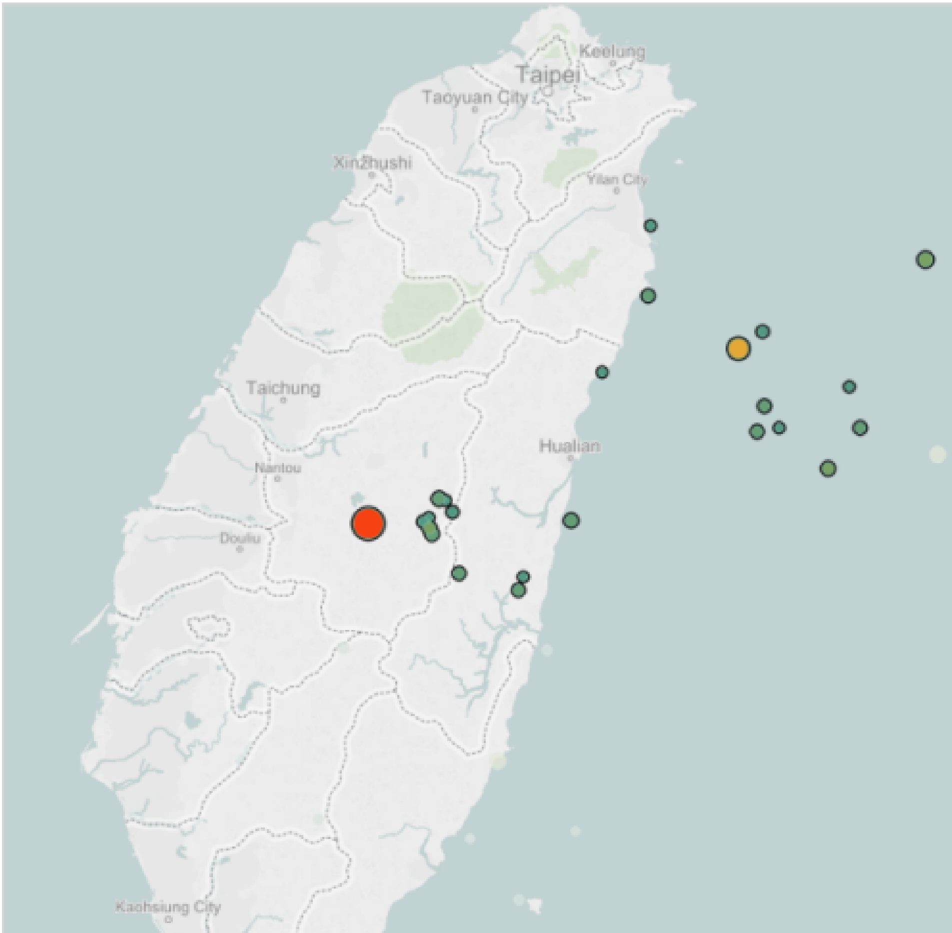
For more information about how to use the Radial tool, see **Select Marks** on page 845.

> **Note:** If you do not see a measured distance, you need to zoom in further to a location or area in the view.



Note: If the view toolbar is hidden, press **S** on your keyboard to use the Radial tool.

As you drag, the Radial tool selects marks that are located within the radius of the circle. In this example, the radius is 100 miles, and it is centered over Taipei. This means that, according to this data, all of the selected earthquakes (25) have occurred within approximately 100 miles of Taipei in the past 10 years.



Measurement Accuracy

By default, Radial tool measurements have a small margin of error because, in the map projection, distances become exaggerated and stretch as you move away from the equator. This means that the Radial tool can only measure approximate distances.

The Radial tool can measure distance more accurately the closer you are to the equator, and the further you zoom in to the view.

> **Note:** By design, the Radial tool does not display a measured distance when you are zoomed too far out of the view, because the measurement might be inaccurate.

Units of Measurement

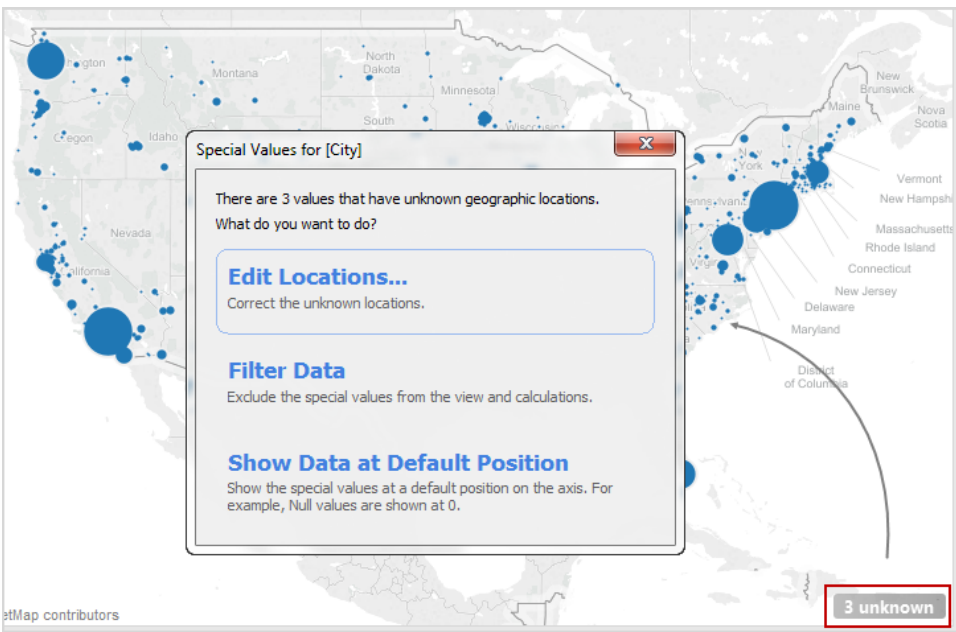
By default, your workbook locale determines which units the Radial tool uses to measure distance. If your workbook locale is set to a country that uses the Imperial system, the Radial tool measures distance in feet and miles. If your workbook locale is set to a country that uses the Metric system, the Radial tool measures distance in meters and kilometers.

Edit Locations

Sometimes Tableau will not recognize one or more of the location names in your data. When this happens those values are marked as **unknown** in the lower right corner of the view. This often happens because your data values may be spelled incorrectly or use an abbreviation that Tableau does not recognize. When this happens, you can edit the unknown location names to map to known locations.

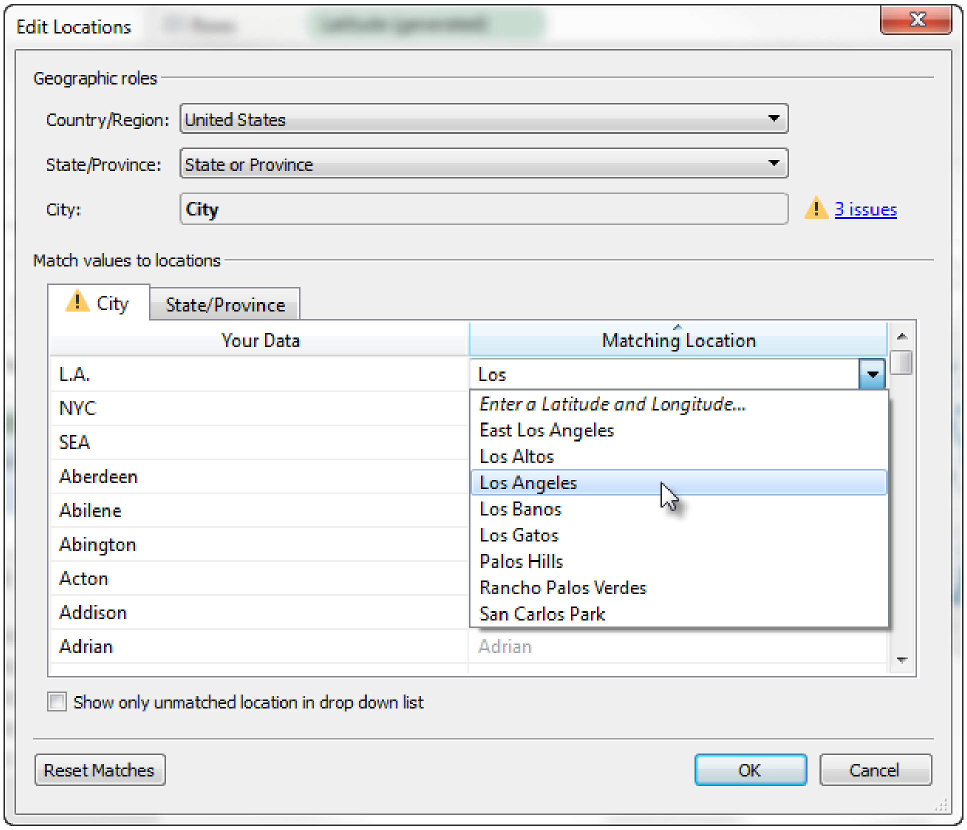
To edit unknown location names

1. In the bottom right corner of the view, click the special values indicator. This opens the Special Values dialog box.
2. In the Special Values dialog box, select **Edit Locations**.



> **Note:** If the special values indicator is not visible, you can also select **Map** > **Edit Locations**.

3. In the Edit Locations dialog box, click on one of the **Unrecognized** cells to match a known location to your unknown data. When you click on an unrecognized cell, a search box appears. As you begin typing in the search box, Tableau generates a list of possible locations. Select a location from the list.

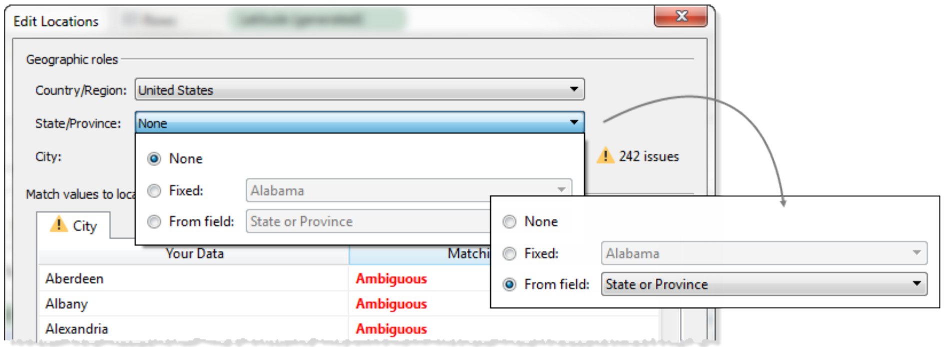


Alternatively, you can select **Enter Latitude and Longitude** from the drop-down menu to manually map the value to a location on the map.

Note: When you type a latitude and longitude, enter the values in decimal format.

Ambiguous Locations

Both unrecognized and ambiguous locations can be listed in the Edit Locations dialog box. You can usually fix ambiguous locations by specifying the **Country/Region** and/or **State/Province** options in the **Geographic Roles** section of the Edit Locations dialog box. For example, if you have several cities that are ambiguous, you can specify a State/Province to fix them.



Restrict Locations in the List

By default, all possible locations are listed in the drop-down menu. To restrict the list to locations that have not yet been matched to your data, select the **Show only unmatched locations in drop-down list** option in the bottom left corner of the Edit Locations dialog box

Custom Geocoding

Tableau Desktop recognizes a set of geographic roles that can be used to automatically geocode your data and create map views. For example, Tableau Desktop recognizes country names, state/province names, city names, and area codes. For more information, see **Assign Geographic Roles** on page 888.

If your geographic data does not fit into the built-in geographic roles, you can create new geographic roles and assign them to the geographic fields in your data. For example, if your data contains country, state/province, and street address data, Tableau Desktop will aggregate your data to the country and state/province level, but will not recognize the street address data as a geographic role. In this case, you can create a custom geographic role for the street address data.

Continue on to the following topics to learn how to create new geographic roles by creating and importing a custom geocoding file that defines the hierarchies and locations of your geographical data into Tableau.

Example - Importing Numeric Postcodes

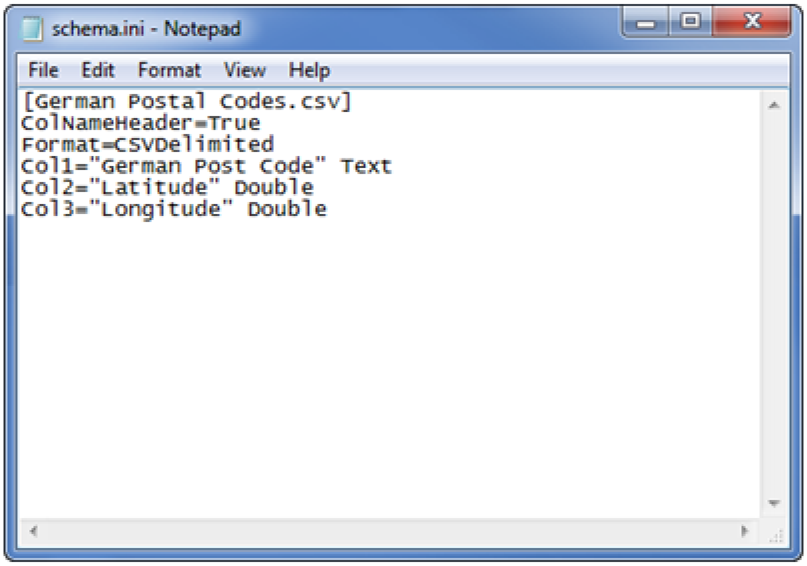
This example demonstrates how to custom geocode data in Tableau. Follow the steps below to import numeric postcodes into Tableau and create a new postcode geographic role.

1. Create a .csv file. For more information, see **Create an Import File** on page 922.

	A	B	C	D
1	German Post Code	Latitude	Longitude	
2	99998	51.2125	10.5625	
3	99996	51.28335	10.575	
4	99994	51.24165	10.675	
5	99991	51.15	10.55557	
6	99988	51.175	10.2917	
7	99986	51.14443	10.4389	
8	99976	51.2477	10.32917	
9	99974	51.2428	10.4501	
10	99958	51.09585	10.7583	
11	99955	51.17273	10.80151	
12	99947	51.14538	10.62537	
13	99898	50.8333	10.5833	
14	99897	50.8	10.6167	
15	99894	50.86305	10.5944	
16	99891	50.8854	10.459	

Note: To add German Postcodes to the existing Country hierarchy, include a column for Country (Name) in the .csv file.

2. Save the .csv file in a folder on your local computer.
3. Create a schema.ini file. For more information, see **Create a schema.ini File** on page 925.



4. Save the file as **schema.ini** in the same folder as the .csv file.

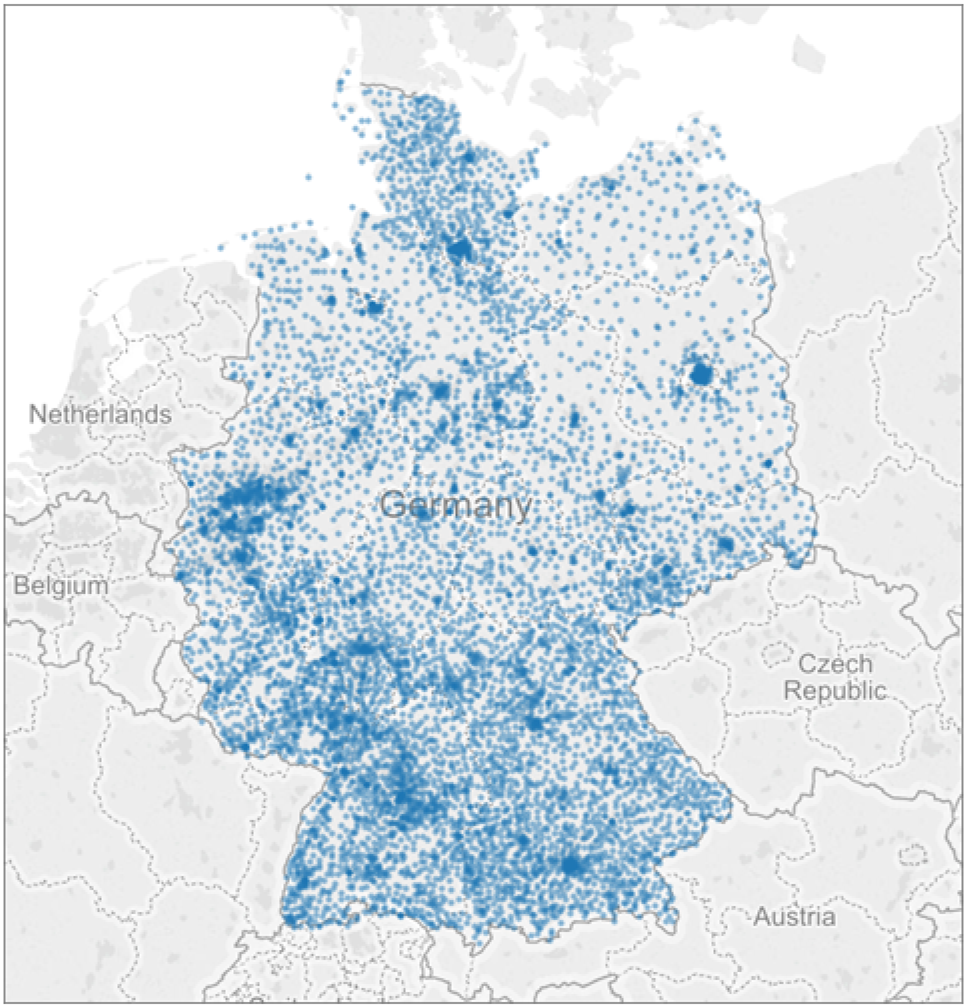
5. Import the custom geocoding files into Tableau. For more information, see **Import Custom Geocoding** on page 927.

6. Assign the new geographic role to a field. For more information, see **Assign Geographic Roles** on page 888.

7. Plot the postcodes on a map.

   After assigning a new geographic role to a field, drag the field to a map view to plot the data. For more information on how to create map views, see **Build a Map View** on page 897.

   The German postcodes will be placed in your map view. Each mark in the view represents a postcode, whose location was specified in the custom geocoding data you imported.



Create an Import File

A custom geocoding file is a .csv file. The contents of the custom geocoding file differ depending on whether you are extending an existing geographic hierarchy, or adding a new role to Tableau.

However, the following applies to all custom geocoding files:

- The .csv file must contain the Latitude and Longitude columns.
- Latitude and Longitude values must be real numbers. Make sure to include at least one decimal place when specifying these values.

In this topic, you can learn how to create an import file to:

- Extend an existing geographic role
- Add a new geographic role

Note: A numeric field in your data should be treated as a text field on import (for example, some post codes). If you are importing numeric fields in to Tableau, you need to create a schema.ini file to tell Tableau that the numeric field you want to import should be treated as a text field. For more information, see **Create a schema.ini File** on page 925.

Extend an Existing Role

The built-in geographic roles in Tableau contain hierarchies that can be extended to include locations relevant to your data. For example, the existing hierarchy of Country > State/Province may not contain all of the states or provinces in your data. You can extend this level to include missing states or provinces. The import file for this type of geocoding should contain every level of the hierarchy above the level you are extending. For example, the existing State/Province hierarchy has a column for Country and State/Province, along with Latitude and Longitude.

	A	B	C	D
1	**Country (Name)**	**State/Province**	**Latitude**	**Longitude**
2	England	United Kingdom	51.5000	0.1167
3	Scotland	United Kingdom	55.9500	3.1833
4	Wales	United Kingdom	51.4833	3.1833
5	Northern Ireland	United Kingdom	54.6000	5.9167

In the import file, the names of the columns define the geographic roles. When extending an existing role, the column names must match the existing geographic roles in the hierarchy that you are extending. This will ensure that the new locations are added to the proper roles and hierarchies. For more information on how to organize hierarchies in your import file, see **Built-In Hierarchies** on the next page.

Once you have created your import file, save the file as a Comma Delimited (.csv) file (Windows Comma Separated if on a Mac) in a folder on your computer.

Add New Roles

To add new geographic roles to the existing geographic hierarchy in Tableau, format your import file to include the new roles along with their parent roles.

When adding new roles to an existing hierarchy, the import file for those roles needs to contain the columns for each level in the existing hierarchy. For more information on the columns to include in each geographic hierarchy, see **Built-In Hierarchies** on the next page.

Below is an example of an import file containing airport codes. Importing the file below would add the geographic roles Airport (ICAO), Airport (IATA), and Airport (City) to the existing Country (Name) hierarchy. Notice that the column name for country matches the existing Country (Name) geographic role.

	A	B	C	D	E	F
1	**Airport (ICAO)**	**Airport (IATA)**	**Airport (City)**	**Country (Name)**	**Latitude**	**Longitude**
2	AYGA	GKA	GOROKA	PAPUA NEW GUINEA	-6.08167	145.39167
3	AYLA	LAE	LAE	PAPUA NEW GUINEA	0	0
4	AYMD	MAG	MADANG	PAPUA NEW GUINEA	-5.20694	145.78861
5	AYMH	HGU	MOUNT HAGEN	PAPUA NEW GUINEA	-5.82611	144.29611
6	AYNZ	LAE	NADZAB	PAPUA NEW GUINEA	-6.56972	146.72611
7	AYPY	POM	PORT MORESBY	PAPUA NEW GUINEA	-9.44333	147.22
8	AYRB	RAB	RABAUL	PAPUA NEW GUINEA	0	0
9	AYWK	WWK	WEWAK	PAPUA NEW GUINEA	-3.58361	143.66917
10	BGAM	N/A	ANGMAGSSALIK	GREENLAND	0	0
11	BGAS	N/A	ANGISSOQ	GREENLAND	0	0
12	BGAT	N/A	APUTITEQ	GREENLAND	0	0

Once you have created your import file, save the file as a Comma Delimited (.csv) file (Windows Comma Separated if on a Mac) in a folder on your computer.

Continue to **Import Custom Geocoding** on page 927.

Built-In Hierarchies

When extending an existing role or adding a new role, your custom geocoding import file should contain every level of the hierarchy above the level you are extending or adding. Below is a list of built-in hierarchies and how they should be organized in your import file.

Built-In Hierarchy	Columns to Include in the .csv File (in order; left to right)
Country (Name)	Country (Name) Latitude Longitude
Country (Name), State/Province	Country (Name) State/Province Latitude Longitude
Country (Name), State/Province, City	Country (Name) State/Province City Latitude Longitude
Country (Name), State/Province,	Country (Name)

County	State/Province County Latitude Longitude
Country (Name), ZIP Code/Post-code	Country (Name) ZIP Code/Postcode Latitude Longitude
Country (Name), Area Code	Country (Name) Area Code Latitude Longitude
Country (Name), CBSA	Country (Name) CBSA Latitude Longitude

In addition to the Country (Name) column, you can optionally include the following columns: Country 2 char (ISO 3166-1), Country 3 char (ISO 3166-1), and Country (FIPS 10). If you include these columns, they should be just to the right of the Country (Name) column in any order.

Latitude and Longitude values must be real numbers instead of integers. That is, make sure to include at least one decimal place when specifying these values.

Note: The highest level in the hierarchy is Country and cannot be extended to include higher levels such as Continent, etc.

Create a schema.ini File

Sometimes when you attempt to import custom geographic information in Tableau using a .csv file, you may see a ".csv could not be used because it does not contain a unique column" error message.

This is because your .csv file might contain numerical data, such as numeric postcodes. Tableau will only accept text fields for new geographic roles. However, you can create a schema.ini file to tell Tableau that the numeric field you want to import should be treated as a text field.

A schema.ini file is a Microsoft configuration file associated with the Microsoft JET engine. It tells JET how to interpret the contents of text files, including data structure, date formats, and other settings. For example, creating a schema.ini file that specifies that the numeric postcodes in your import file should be treated as text will allow you to plot the postcodes on a map.

To create a schema.ini file:

1. Open a text file.
2. In the text file, using the following syntax, specify the names and data types for each column in your import file:

   ```
   [YOURCSVFILENAME.csv]
   ColNameHeader=True
   Format=CSVDelimited
   Col1="Name of 1st Column Header in your .csv file"
   Dataype
   Col2="Name of 2nd Column Header in your .csv file"
   Dataype
   Col3="Name of 3rd Column Header in your .csv file"
   Dataype
   Col4="Name of 4th Column Header in your .csv file"
   Dataype
   ```

   For example, if your import (.csv) file contained the columns **German Post Code**, **Latitude**, and **Longitude**, and was named **German Postal Codes.csv**, your schema.ini file would look like the following:

   ```
    [German Postal Codes.csv]
   ColNameHeader=True
   Format=CSVDelimited
   Col1="German Post Code" Text
   Col2="Latitude" Double
   Col3="Longitude" Double
   ```

3. Save the file as **schema.ini** in the same folder as your.csv file.

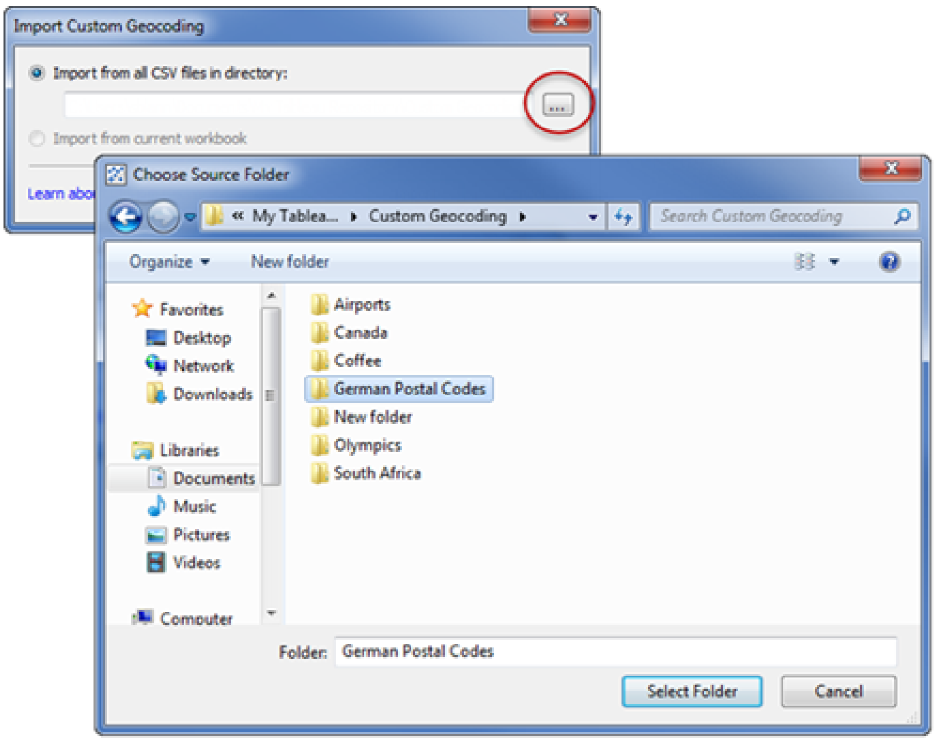
You're now ready to import your .csv and schema.ini files into Tableau.

Continue to **Import Custom Geocoding** on the next page.

Import Custom Geocoding

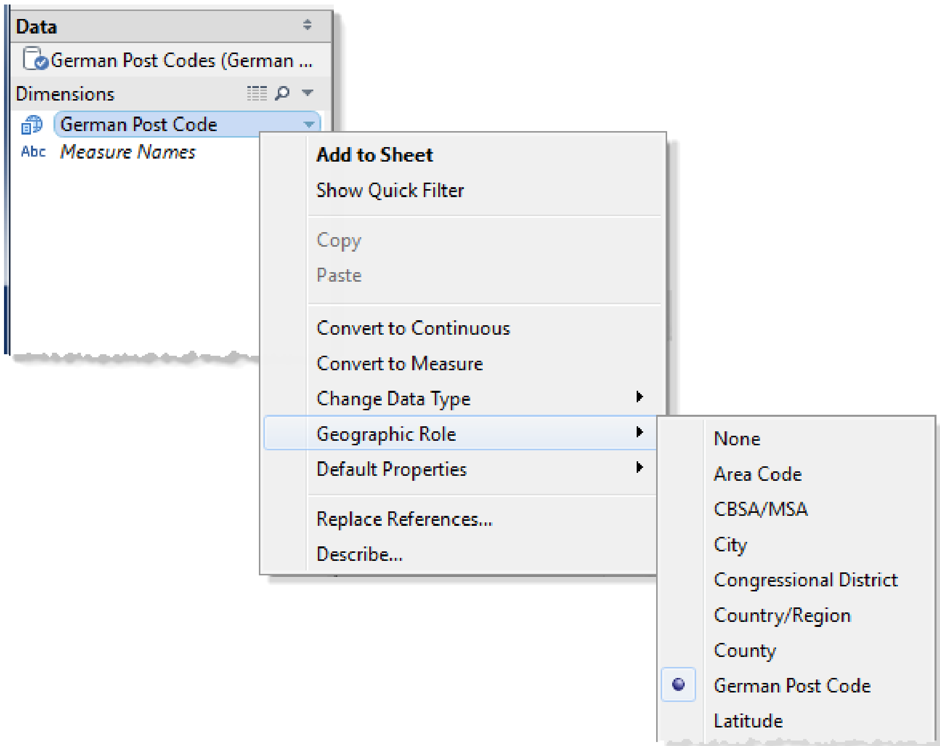
Once you have created a .csv file with custom geocoding you can import that file into Tableau. Follow the steps below to import a new geographic role.

1. Click **Map** > **Geocoding** > **Import Custom Geocoding**.
2. In the Import Custom Geocoding dialog box, click the button to the right of the text field to browse to the folder your import file is saved in. All files in the folder will be imported into Tableau.



3. When finished, click **Import**.

The custom geocoding data is imported into the workbook and the new geographic roles become available. To assign a new geographic role to a field, right-click the field in the Data pane,select **Geographic Role**, and then select the role you want to assign it. For more information on assigning geographic roles, see **Assign Geographic Roles** on page 888.



Continue to **Custom Geocoding Data** below.

Custom Geocoding Data

When you import custom geocoding, the data is stored in the Local Data folder in your Tableau Repository. To import custom geocoding, your Tableau Repository must be on a local hard drive. The custom geocoding is then available for all workbooks.

Save custom geocoding files in a separate folder on your local computer. If you have several different sets of custom geocoding files, save each of them under their own folder names.

You can remove the custom geocoding stored in your Tableau Repository by clicking **Map** > **Geocoding** > **Remove Custom Geocoding**. This will not remove the geocoding from a packaged workbook, but it will remove it from the Local Data folder in your Tableau Repository.

When you save your workbook as a packaged workbook, the custom geocoding data is packaged with the workbook. When you open a packaged workbook you can import the custom geocoding from that workbook into your own Tableau Repository.

> **Note:** Importing a new custom geocoding file will replace any custom geographic roles previously imported into Tableau.

Data Blending vs. Custom Geocoding

If you have geographic locations in your data that are not automatically geocoded in Tableau, there are two ways to plot them on a map view–data blending and custom geocoding. Both data blending and custom geocoding allow you to plot your own locations on a map. Data blending is easier to set up and you can work with data from any data source. Custom geocoding lets you add to existing roles, and create hierarchies. Custom geocoding can be easier to use once it is set up and imported.

This topic explains the difference between blending geographic information with another data source and importing custom geocoding data into Tableau.

The following is a quick comparison of data blending and custom geocoding.

Capability	Data Blending	Custom Geocoding
Plot your own locations on a map view	Yes	Yes
Use any data	Yes	No, text files only
Add new geographic roles	No	Yes
Add to an existing geographic role	No	Yes
Create new geographic hierarchies	No	Yes
Can be reused for other workbooks	No	Yes

Data Blending

Data blending is the easiest way to plot your data on a map view. Data blending works great if you are adding a single level of geographic information with a latitude and longitude. You can use any data source, unlike Custom geocoding where you can only use text files. You can share the geographic data source with other workbooks on Tableau Server. You can also speed up your map performance by creating an extract that contains only your geocoding data.

The following is a high-level procedure for blending geographic data. For a more detailed example, see **Example–Blend Geographic Data** on the next page.

To blend geographic data

1. Create a data source that defines your geographic data.
2. In Tableau Desktop, connect to the original data you want to map, and then connect to the data source that defines your geographic data.
3. Blend the two data sources together. For more information, see **Blend Your Data** on

page 361.

4. Plot the data on a map view.

Custom Geocoding

Custom geocoding is a more flexible way to plot your data on a map. Custom geocoding is available for all workbooks on a computer once the custom geocoding data is imported. The custom geocoding data will be copied into any packaged workbook (.twbx) or published workbook that uses a custom geographic role. This will make the workbooks about 40 MB larger.

If you upgrade Tableau Desktop, you may need to refresh your custom geocoding to take advantage of any fixes made to the geocoding data in Tableau.

In custom geocoding, you can use additional columns to define larger geographic locations. For instance, if you are creating a set of US census tracts, you may need to define which US county they fall in. You can include additional columns to define larger geographic locations in the import file.

You can also use multiple files for multiple geographic roles that have a matching relationship, meaning they share larger geographic data, such as country or state/province. Once the custom geocoding data is imported, you will see additional geographic roles that can be assigned to your geographic data.

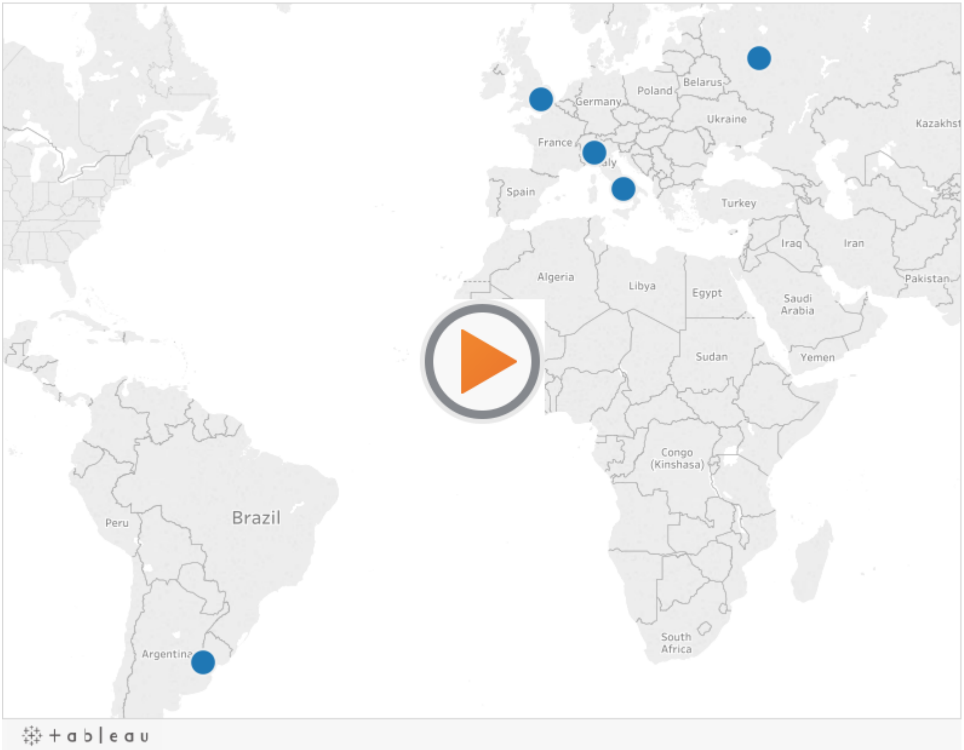
Finally, custom geocoding lets you add additional places to an existing geographic role, such as adding new cities to the city role. It also allows you to define a hierarchy of geographic roles that extends the built-in hierarchies (e.g. census tracts in counties) or defines a new hierarchy (e.g. sub-territories in territories).

For more information about custom geocoding, see **Custom Geocoding** on page 919. Additionally, you can learn how to custom geocode data by watching the Custom Geocoding training video on the Tableau website.

Example–Blend Geographic Data

This example demonstrates how to blend geographic data in Tableau using two small sample data sources. Follow the steps in this topic to learn how to create a file that defines your geographic data, blend two data sources, and build the map view below using the two data sources.

The embedded view below shows famous theaters around the world, and was created by blending geographic data with another data source. Hover over the marks in the view to see information about each theater. If you would like to follow along with the steps in this topic, click **Download** in the view below, and then select **Tableau Workbook**. This will open the view in Tableau Desktop.



To display all collapsed content, click the (**Expand all**) button at the top of the page.

Step 1: Create a file that defines your geographic data

When you have a data source that contains geographic information that is not automatically geocoded in Tableau, the first step is to create a second data source that defines the latitudinal and longitudinal values for that information. You will later connect to this file in Tableau Desktop and blend it with your original data source.

Create a second data source with the following information:

- **Geographic name column**: This column includes any geographic information you want to plot on a map view and typically matches a geographic column name in your original data. For example, if your original data source has a column called Street Address, your second data source should also have a column called Street Address. The data in this column would then be all of the street addresses you want to plot on a map view.

  If the column does not match a geographic column name in your original data source, you may need to edit the relationships between your two data sources in Tableau Desktop. For more information, see Step 3.

  Finally, this column should not match the names of any geographic roles already in Tableau, such as **County**, **Area Code**, or **CBSA/MSA**.

Note: The data in these columns can be strings or numbers. However, if your locations are numbers, especially numbers with leading zeros (for example, 00501), make sure the data type of the field is set to **String** in Tableau. For more information, see **Data Types** on page 181.

- **Latitude and Longitude columns**: The values in these columns need to be in decimal degrees (for example, 47.651808, -122.356881).

Below is an example of an original data source with geographic locations, and a second data source that defines those geographic locations.

Original data source

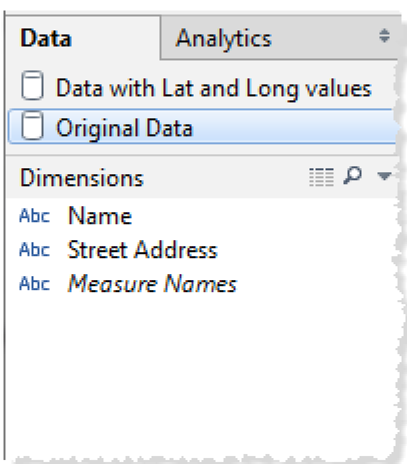
	A	B
1	**Name**	**Estimated Seats**
2	La Scala	3,000
3	Teatro di San Calo	1,397
4	Teatro Colon	2,500
5	The Royal Opera House	2,256
6	The Bolshoi	2,200

Second data source

	A	B	
1	**Street Address**	**latitude**	**lon**
2	Via Filodrammatici, 2 20121 Milan, Italy	45.46731	9.
3	Via San Carlo, 98 80132 Naples, Italy	40.83832	1
4	Cerrito 628 Buenos Aires Ciudad Autónoma de Buenos Aires	-34.6011	-5
5	Bow St London WC2E 9DD	51.5137	-0
6	Theatre Square, 1 Moscow 125009	55.76016	37

Step 2: Connect to the data sources

1. Connect to the original data source.
2. Connect to the data source that defines your geographic data.

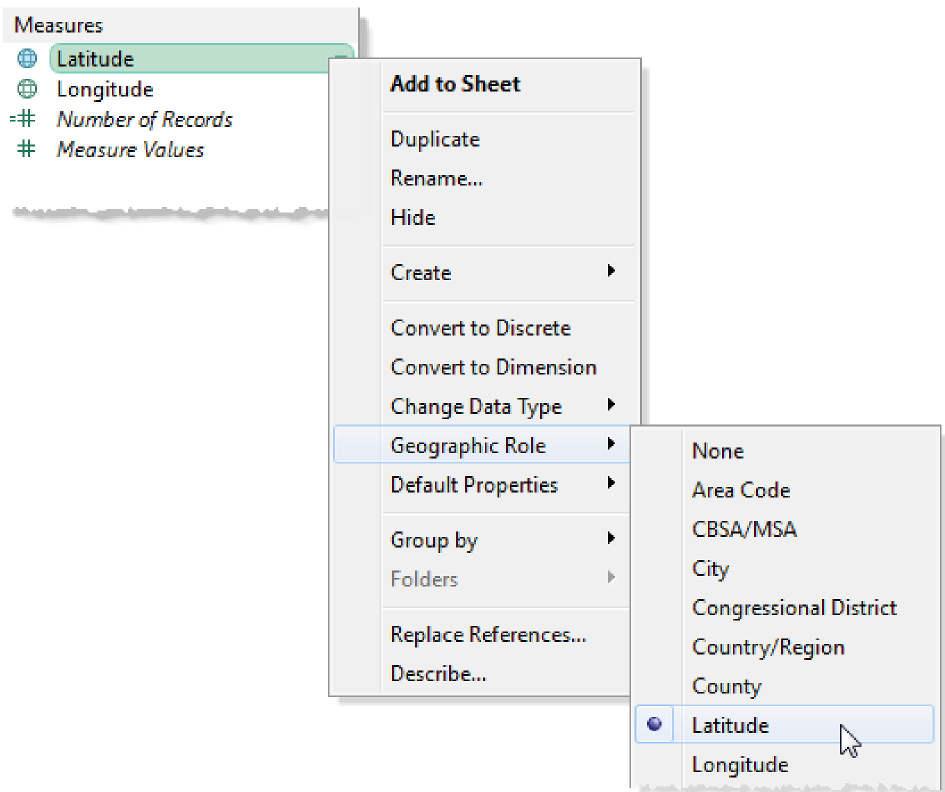


Step 3: Edit Relationships

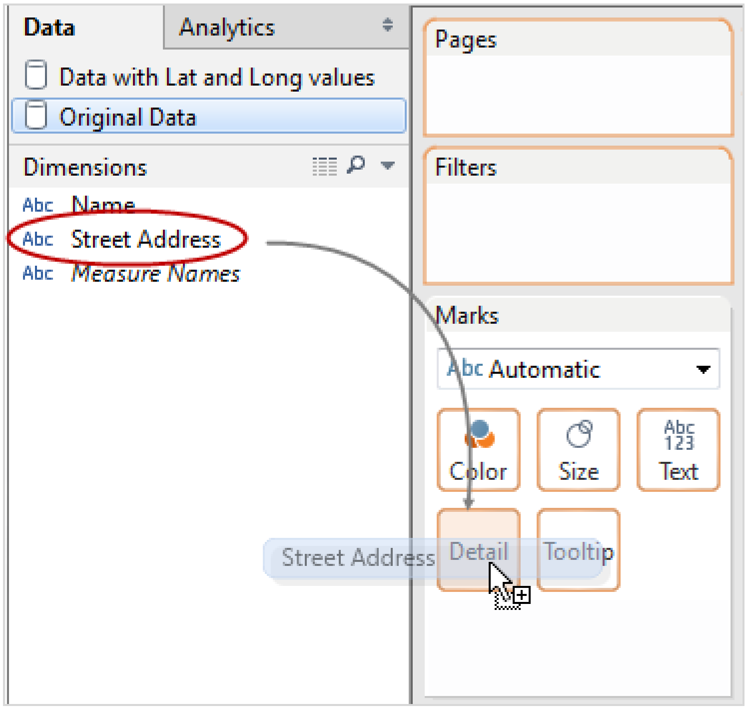
(Optional) If the two data sources share the same column names, your data should blend automatically when you add fields to the view. However, if the file you created to define your geographic data does not share the same column name as the geographic data in your original data source, you will need to create a relationship between those two fields using the **Edit Relationships** option. For information about how to edit relationships, see **Define Relationships** on page 363.

Step 4: Plot the data on a map view

1. In the **Data** pane, select the second data source that defines your geographic data. Under **Measures**, assign the **Latitude** geographic role to the **Latitude** field and the **Longitude** geographic role to the **Longitude** field. For more information, see **Assign Geographic Roles** on page 888.

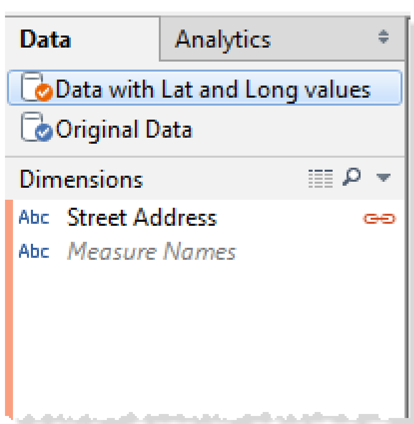


2. In the **Data** pane, select the original data source, and then drag the field you want to plot on a map to **Detail** on the **Marks** card.



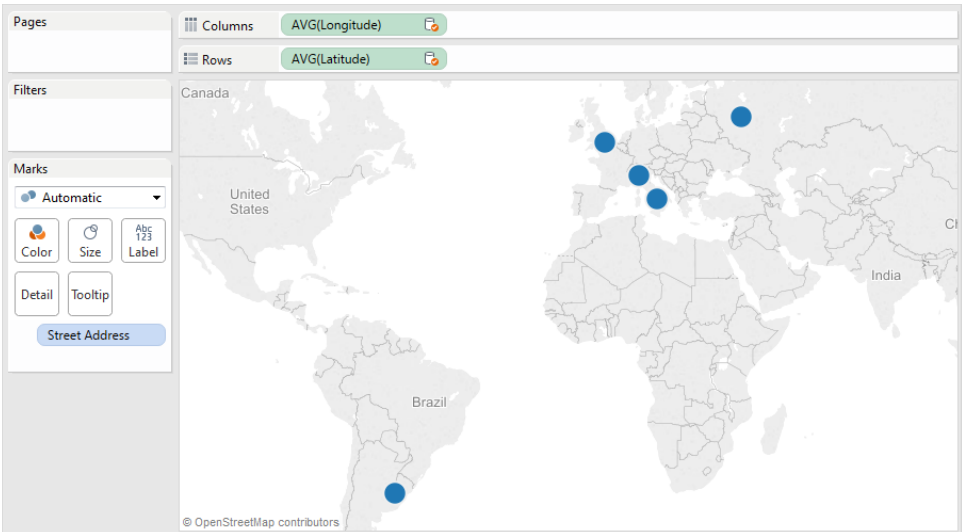
Note: This field should have a data type of String, and should be a dimension. For more information on how to change the data type of a field, see **Data Types** on page 181.

3. In the **Data** pane, select the second data source , and then double-click **Latitude** and **Longitude** to add them to the **Columns** and **Rows** shelves.



The link icon indicates that the **Street Address** field is blended with the **Street Address** field in the original data source. A broken link icon indicates that the **Street Address** field is not blended with the **Street Address** field in the original data source.

The view is now complete. Each mark represents an address from the original data source.



Background Maps

Tableau comes with a set of online and offline maps that you can access to create map views.

In addition, Tableau supports connecting to a Web Map Server (WMS) or to a Mapbox map so you can create custom maps that are specific to your industry.

You can specify the map background, import new Tableau map sources, or export a Tableau map source to share with others.

To select a new background map:

- Select **Map** > **Background Maps** and then select the map you want to use as a background map in the view.

By default, Tableau Desktop connects to an online map provider. You can also select to connect to an offline map that ships with the product, or you can add a WMS server or Mapbox map.

The three background maps that come with Tableau are described below.

None	Displays data between latitude and longitude axes.
Offline	Stores the images that make up the map in a cache with your Internet Explorer Temporary Internet Files for improved performance and offline access. For more information, see **Map Storing** on page 948.
Tableau	Connects to the Tableau background map. By default, all map views connect to this background map, unless you specify otherwise.

The Tableau background map

The Tableau background map includes updated map and demographic data, as well as stylistic improvements. It has taken the place of the Tableau classic background map. Any map view created with an earlier version of Tableau Desktop, and with a connection to the Tableau classic background map, will automatically connect to the Tableau background map when opened in Tableau Desktop version 9.0 or later.

> **Note:** If you create a map view with data layers in Tableau Desktop version 8.3 or earlier using the Tableau classic background map, and then open that view in Tableau Desktop 9.0 or later, the color of the data layers may appear differently due to data layering and color ramp (color palette) improvements made to the Tableau background map.

Use Web Map Service (WMS) Servers

Tableau can connect to map servers with the Web Map Service (WMS) protocol. WMS is a standard protocol for requesting and receiving geographically referenced imagery.

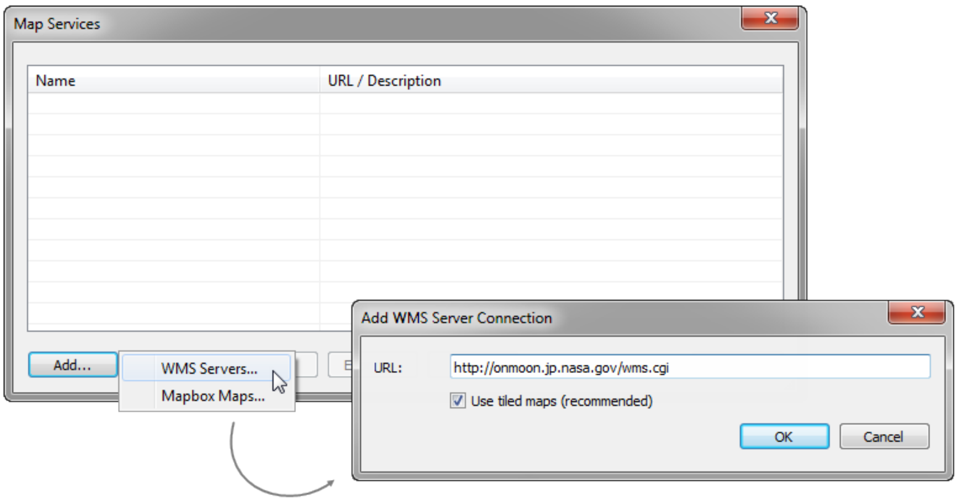
In Tableau Desktop, you can connect to any WMS server that supports the WMS 1.0.0, 1.1.0, or 1.1.1 standards.

In this topic

- Connect to a WMS server in Tableau Desktop
- Use a WMS background map to build a map view in Tableau
- Save a WMS server as a Tableau map source
- Performance considerations for WMS servers in Tableau
- Supported Spatial Reference Systems for WMS servers

Connect to a WMS server

1. Select **Map** > **Background Maps** > **Map Services**.
2. In the Map Services dialog box, click **Add** > **WMS Servers**.
3. In the Add WMS Servers dialog box, type the URL for the server you want to connect to in Tableau, and then click **OK**.



You can add as many map servers as you want to a workbook. Each WMS server you add appears as a background map in the **Background Maps** menu.

Save a WMS server as a Tableau map source

After you add a WMS server to your workbook, it is saved with the workbook and available to anyone you share the workbook with. You can also save a WMS server as a Tableau Map Source (.tms) file, which you can share with others so they can quickly connect to it and use it in their own workbooks.

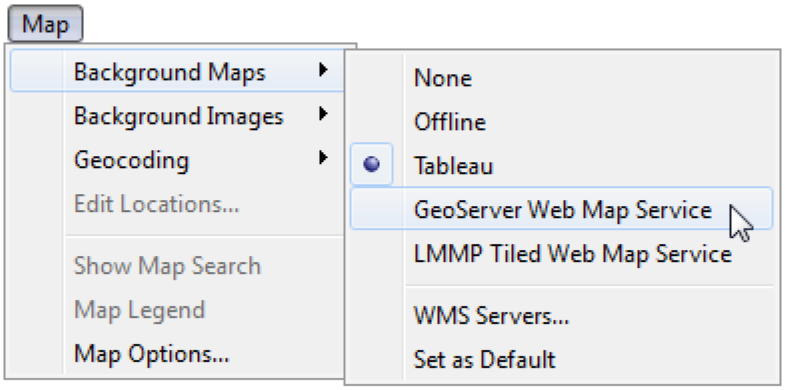
For more information about how to save a map as a Tableau map source, see **Save a Map Source** on page 947.

Use a WMS background map

After you connect to a WMS server, you can create a map view using the WMS background map that Tableau creates.

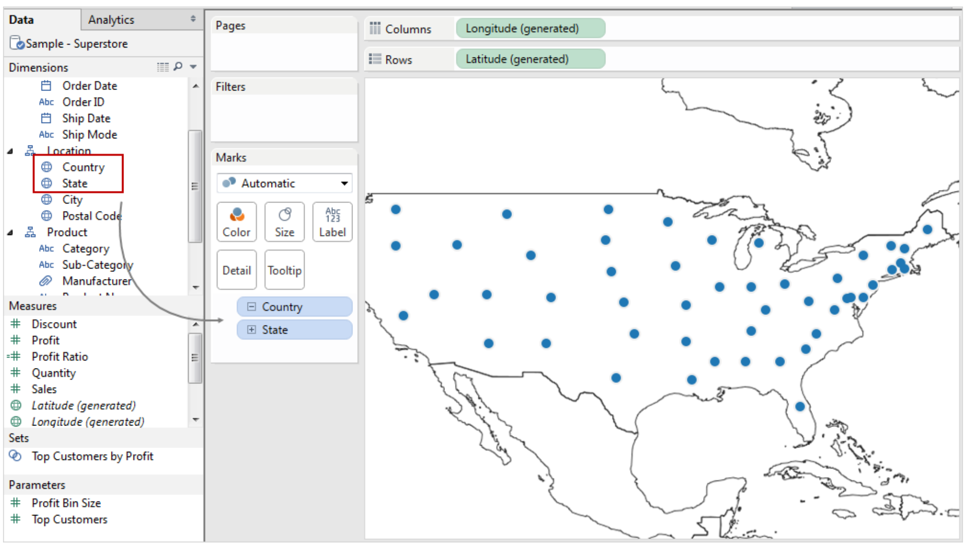
To create a map view using a WMS server:

1. In Tableau, select **Map** > **Background Maps**, and then select a WMS background map to use in the view.



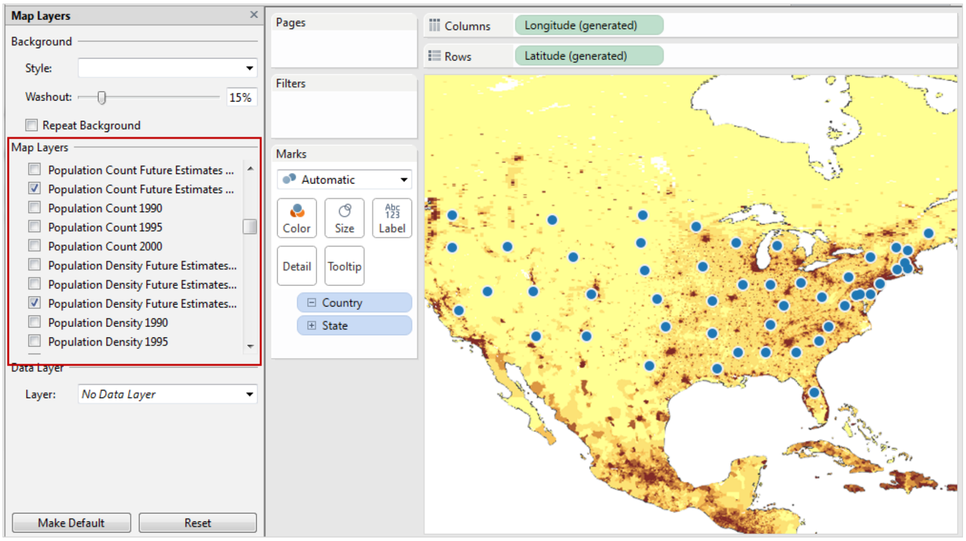
2. Add a geographic field to the view.

   For more information, see **Build a Map View** on page 897.



3. Select **Map** > **Map Layers**, and then select the map layers you want to show in the view.

   For more information, see **Set Map Layers** on page 900.



Performance considerations

The content, speed, and performance of a WMS server is reliant on the network and WMS provider. If your Internet connection is interrupted or if you're working behind a restrictive firewall, you can use the Offline background map that comes installed with Tableau Desktop to avoid any performance issues while you build your map view. You can switch back to your WMS server at any time.

> **Note:** With the offline background map, you might only be able to access up to four levels of zoom. For more information, see **Use the Offline Background Map** on page 946.

Supported Spatial Reference Systems

Tableau automatically supports the following list of Spatial Reference Systems (SRS) / European Petroleum Survey Group (EPSG) codes. WMS servers must support at least one of the following spatial reference systems to be compatible with Tableau mapping features.

Supported SRS/EPSG Codes in Tableau:

3857 - WGS 84 / Pseudo-Mercator [DEFAULT]

4326 - WGS 84

4269 - NAD83

3824 - TWD97

3889 - IGRS

4019 - Unknown datum based on the GRS 80 ellipsoid

4023 - MOLDREF99

4030 - Unknown datum based upon the WGS 84 ellipsoid

4031 - Unknown datum based upon the GEM 10C ellipsoid

4046 - RGRDC 2005

4075 - SREF98

4081 - REGCAN95

4126 - LKS94 (ETRS89)

4130 - Moznet

4140 - NAD83(CSRS98)

4148 - Hartebeesthoek94

4151 - CHTRF95

4152 - NAD83(HARN)

4163 - Yemen NGN96

4166 - Korean 1995

4167 - NZGD2000

4170 - SIRGAS 1995

4171 - RGF93

4172 - POSGAR

4173 - IRENET95

4176 - Australian Antarctic

4180 - EST97

4189 - REGVEN

4190 - POSGAR 98

4258 - ETRS89

4283 - GDA94

4319 - KUDAMS

4612 - JGD2000

4617 - NAD83(CSRS)

4619 - SWEREF99

4627 - RGR92

4640 - RRAF 1991

4645 - RGNC 1991

4659 - ISN93

4661 - LKS92

4667 - IKBD-92

4669 - LKS94

4670 - IGM95

4674 - SIRGAS 2000

4686 - MAGNA-SIRGAS

4687 - RGPF

4693 - Nakhl-e Ghanem

4694 - POSGAR 94

4702 - Mauritania 1999

4737 - Korea 2000

4742 - GDM2000

4747 - GR96

4749 - RGNC91-93

4755 - DGN95

4756 - VN-2000

4757 - SVY21

4758 - JAD2001

4759 - NAD83(NSRS2007)

4761 - HTRS96

4762 - BDA2000

4763 - Pitcairn 2006

4764 - RSRGD2000

4765 - Slovenia 1996

102100 - WGS 84 Web Mercator (Auxiliary Sphere)

Use Mapbox Maps

If you have access to Mapbox maps, you can add them to your workbooks or use them to create map views in Tableau Desktop.

When you publish a view that uses Mapbox maps to Tableau Server, Tableau Online, or Tableau Public, your audience can view your data and your Mapbox map without having a Mapbox account.

Add a Mapbox map to your workbook

You can add a Mapbox map to your workbook and use it as a background map.

After you add a Mapbox map to your workbook, the map is saved with the workbook and available to anyone with whom you share the workbook. You can also save a Mapbox map as a Tableau Map Source (.tms) file that you can share with others so they can quickly connect to it and use it in their own workbooks. For more information, see **Save a Map Source** on page 947.

1. Select **Map** > **Background Maps** > **Map Services**.
2. In the Map Services dialog box, select **Add** > **Mapbox Map**.
3. In the Add Mapbox Map dialog box, you can add a Mapbox GL map or a classic Mapbox map. To do so, you need the following from your Mapbox account:
   - API access token
   - Username
   - One or more map IDs
   - Style URL (Mapbox GL maps Only)

   For more information about any of the above items, see the Access Tokens, Maps, and Styles sections of the Mapbox API Help.

Add a Mapbox GL map

To add a Mapbox GL map, click **Mapbox GL** in the Add Mapbox Map dialog box, and then do the following:

Note: Mapbox GL is selected by default.

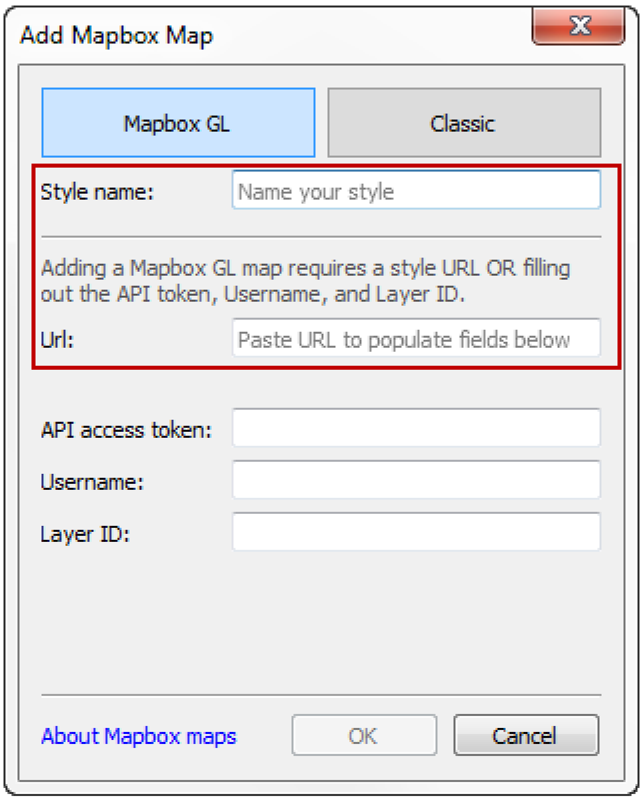
- For **Style name**, enter a name for the Mapbox map. This name can be anything you want, and will appear in the Background maps menu after you add the map.
- For **Url**, enter a style URL for the Mapbox map you want to add.

  This URL contains the style ID for your Mapbox map, your access token, and your username. It might look similar to the following:

```
https://api.mapbox.com/styles/v1/<username>/<styleid
>?access_token=<access token>
```

When you add the correct style URL to this field, the **API access token**, **Username**, and **Layer ID** fields automatically populate.

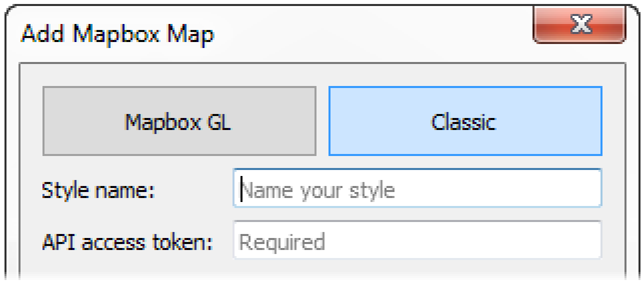
If you don't have a style URL for the Mapbox map, you must enter a Mapbox access token, username, and layer (map) ID to add your Mapbox map.



Add a classic Mapbox map

To add a classic Mapbox map, click **Classic** in the Add Mapbox Map dialog box, and then do the following:

- For **Style name**, enter a name for the Mapbox map. This name can be anything you want, and will appear in the Background maps menu after you add the map.
- For **API access token**, enter the API access token for the Mapbox map you want to add.



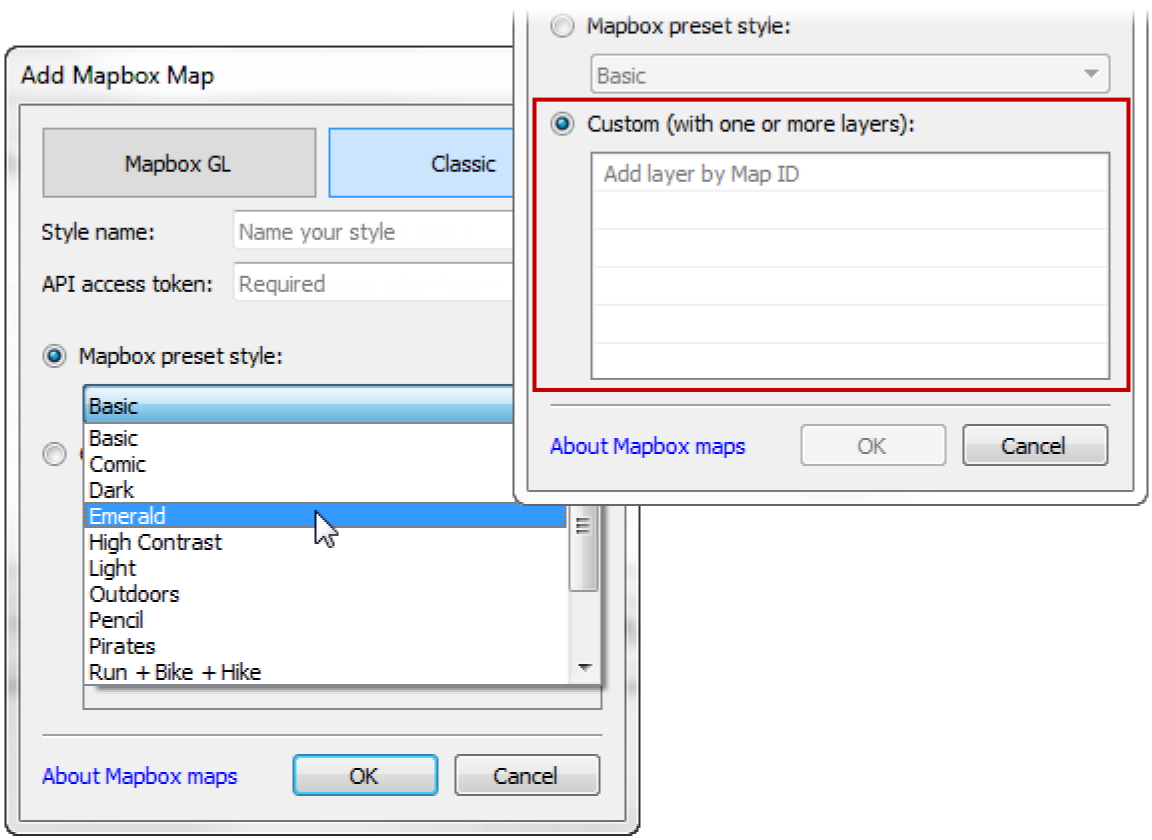
- Choose a Mapbox preset style, or add one or more custom map layers:

To use a Mapbox preset style:

Click **Mapbox preset style**, and then select a style from the drop-down menu.

To add one or more map layers:

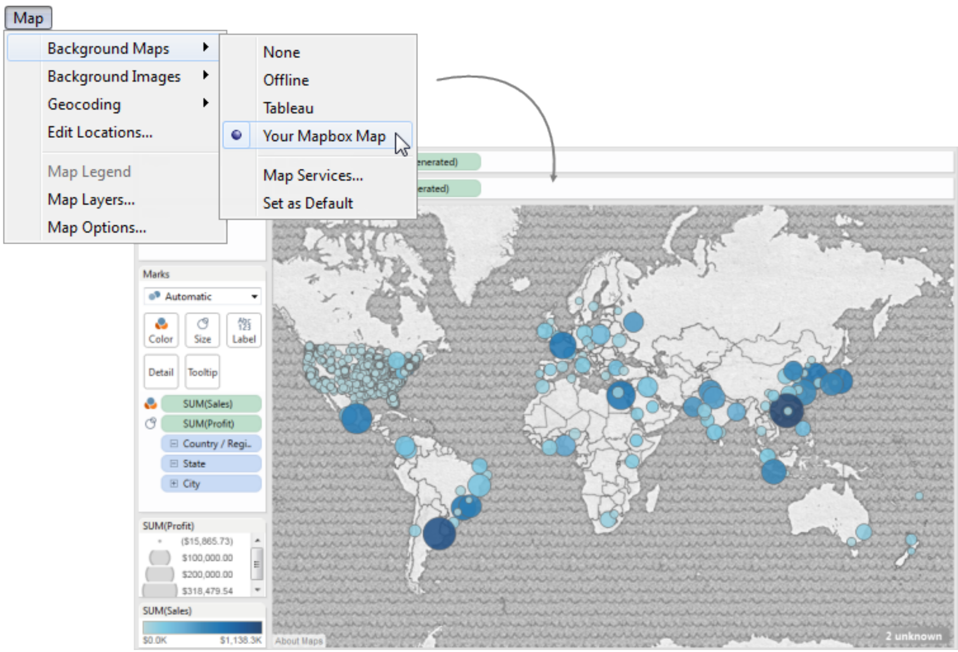
Click **Custom**, and then enter one or more map IDs in the space indicated.



4. When finished, click **OK** to exit the Add Mapbox Map dialog box, and then click **Close** to return to the view.

Create a map view using a Mapbox map

To create a map view using a Mapbox map, select **Map** > **Background Maps**, and then select the Mapbox map you want to use. Next, build the map view. For information, see **Build a Map View** on page 897.



Add or subtract map layers from the view

If you chose to add one or more custom layers by map ID when you connected to your Mapbox map in Tableau, you can add or subtract those layers from the view using the **Map Layers** pane. For more information, see **Add or Remove Map Layers** on page 902 in the Set Map Layers topic.

By default, all map layers appear in the view when you first add a Mapbox map to a workbook.

Note: When you use a Mapbox preset style, you can't toggle the layers within the map.

For example, if you use the Mapbox Streets map, you can't toggle streets, labels, building footprints, or administrative boundaries like you can with the Tableau map service. This is because Tableau only receives the image tiles that make up the Mapbox map.

Map layers are different from data layers in Tableau. Data Layers are pre-built tiles that include demographic information by various levels, like State, County, and Block Group. Data layers and Mapbox are independent of one another in Tableau. For more information about how data layers work, see **Set Map Layers** on page 900.

Use the Offline Background Map

You can create and inspect data in a map view offline using the offline background map that comes with Tableau.

To use the offline background map:

- Select **Map** > **Background Maps** > **Offline**

The offline background map uses map images stored in the cache. There are several actions, however, that require Tableau to retrieve a map image that may not be in the cache. If the new map image is not stored in the cache, you won't be able to load the map until you reconnect to the online map that comes with Tableau. For more information, see **Map Storing** on page 948.

You may need to reconnect to the online map if you would like to do one or more of the following:

- **Turn layers on or off** - if you decide to turn on a layer that isn't stored in the cache, Tableau will need to connect to retrieve the necessary information.
- **Zoom in or out** - zooming in or out on a map requires different map images. If the images at the specified zoom level don't exist in the cache, Tableau will need to retrieve the updated maps.
- **Pan** - panning sometimes requires new map images. If you are working offline and don't have the necessary map images and legends stored in the cache, the new images and legends will not load.

To reconnect to the Tableau online map:

- Select **Map** > **Background Maps** > **Tableau**

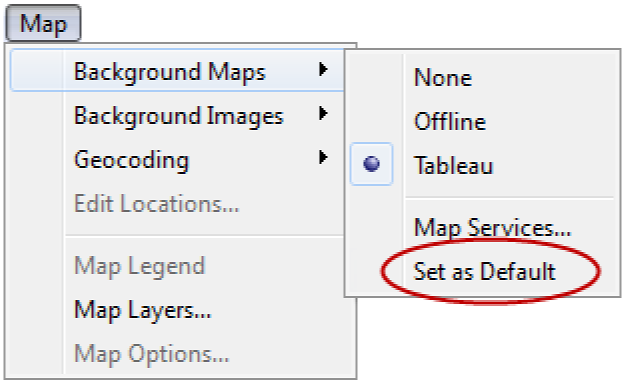
Set a Default Background Map

By default, all map views connect to the Tableau background map. If you do not want your map view to connect to the Tableau background map, you can specify a different background map as the default.

To specify a default background map:

1. Select **Map** > **Background Maps**, and then select the background map that you want to make the default.
2. Select **Map** > **Background Maps** > **Set as Default** to set the selected background map to the default.

   The background map is automatically saved as a Tableau Map Source (.tms) and placed in the Mapsources folder of your My Tableau Repository. It is now the default background map for all new workbooks.



Save a Map Source

After you add a Mapbox map or WMS server to your workbook, you can save it as a Tableau map source (.tms).

Saving a Mapbox map or WMS server as a Tableau Map Source allows you to share your map with others so they can quickly import it into their own workbooks and use it to create new map views. For more information about importing a Tableau Map Source into a workbook, see **Import a Map Source** below.

1. Select **Map** > **Background Maps** > **Map Services**. This opens the Map Services dialog box.
2. Select the map that you want to save as a Tableau map source, and then click **Export**. This opens the Export Connection dialog box.
3. Type a name for the file, choose a location, and then click **Save**.

The Tableau map source includes any default map layer settings you have specified in the workbook. For example, the map source will include any custom set of map layers you have specified to show by default. For more information, see **Set Default Map Layer Options** on page 905 in the Set Map Layers topic.

> **Note:** If you change the default settings for the map layer options, you should export the map again to include the new settings in the Tableau map source file.

Import a Map Source

You can import a Tableau Map Source (.tms) that someone has shared with you into a workbook, and then use it to create custom map views.

1. Select **Map** > **Background Maps** > **Map Services**. This opens the Map Services dialog box.
2. Click **Import**. This opens the Import Connection dialog box.
3. Navigate to the saved Tableau map source file (.tms) that you want to import, select it, and then click **Open**. This closes the Import Connection dialog box and adds the Tableau map source to the list of maps in the Map Services dialog box.

   If you want to edit the newly added Tableau map source, select it from the list, and then click **Edit**. Otherwise, click **Close** to return to the view.

You can import as many Tableau map sources as you want into a workbook. Each Tableau map source you add appears as a background map in the **Background Maps** menu and is automatically selected as the default background map until another Tableau map source is imported, until you connect to a WMS server or Mapbox map, or until you select to use a different background map.

> **Note:** When you create a new map view, the background map that is selected in the **Background Maps** menu is used to create the map for that view.

Map Storing

When you create map views using the online map provider, Tableau stores the images that make up the map in a cache. That way, as you continue your analysis you don’t have to wait for the maps to be retrieved. In addition, by storing the maps, you can do a certain amount of work when you are offline. For more information, see **Use the Offline Background Map** on page 946.

The cache for the maps are stored with your temporary internet files and can be cleared at any time by deleting the temporary files from your browser.

Stored map images and legends remain valid for about thirty days. After that time, Tableau will not use the stored image; instead, it will require you to reconnect and fetch an updated map. This is to prevent the map images from becoming outdated.

Dashboards

A dashboard is a collection of several worksheets and supporting information shown in a single place so you can compare and monitor a variety of data simultaneously. For example, you may have a set of views that you review every day. Rather than flipping through each worksheet, you can create a dashboard that displays all the views at once.

Similar to worksheets, dashboards are shown as tabs at the bottom of the workbook and update with the most recent data from the data source. When you create a dashboard, you can add views from any worksheet in the workbook. You can also add a variety of supporting objects such as text areas, web pages, and images. From the dashboard, you can format, annotate, drill-down, edit axes, and more.

Each view you add to the dashboard is connected to its corresponding worksheet. That means when you modify the worksheet, the dashboard is updated and when you modify the view in the dashboard, the worksheet is updated.

Create Dashboards

You can create a dashboard in much the same way you create a new worksheet. After you create a dashboard you can add and remove views and objects.

Select **Dashboard** > **New Dashboard**.

Alternatively, click the New Dashboard tab along the bottom of the workbook.

A new tab for the dashboard is added along the bottom of the workbook. Switch to the new dashboard to add views and objects.

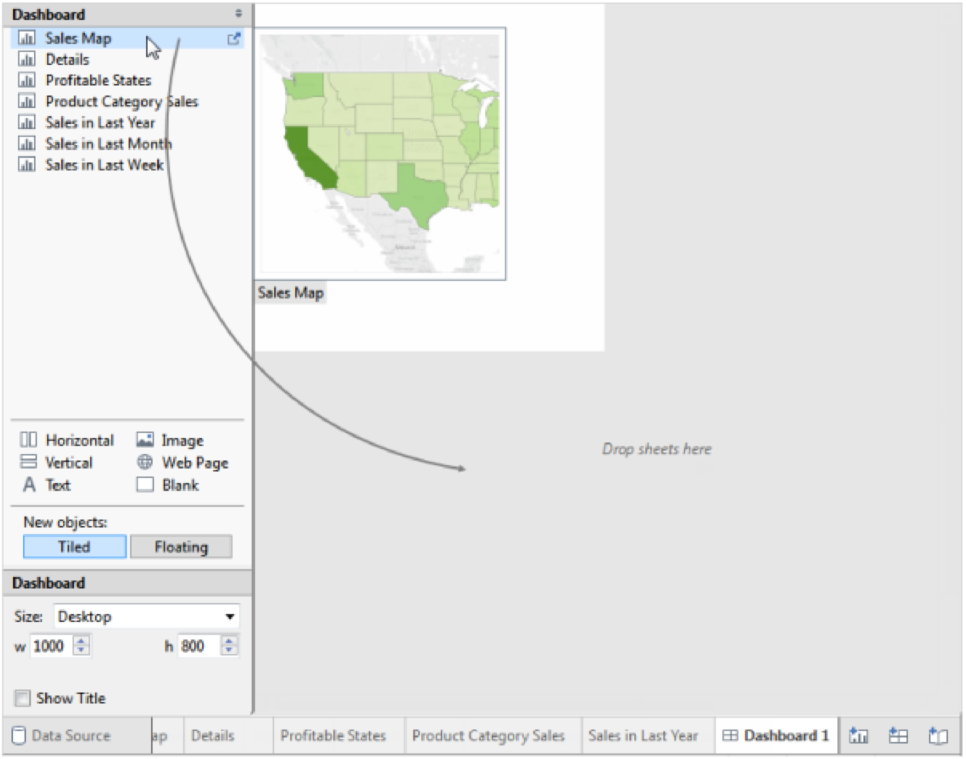
Add Views to a Dashboard

When you open a dashboard, the Dashboard window replaces the Data pane on the left side of the workbook. The Dashboard window lists the worksheets that are currently in the workbook. As you create new worksheets, the Dashboard window updates so you always have all worksheets available when adding to a dashboard.

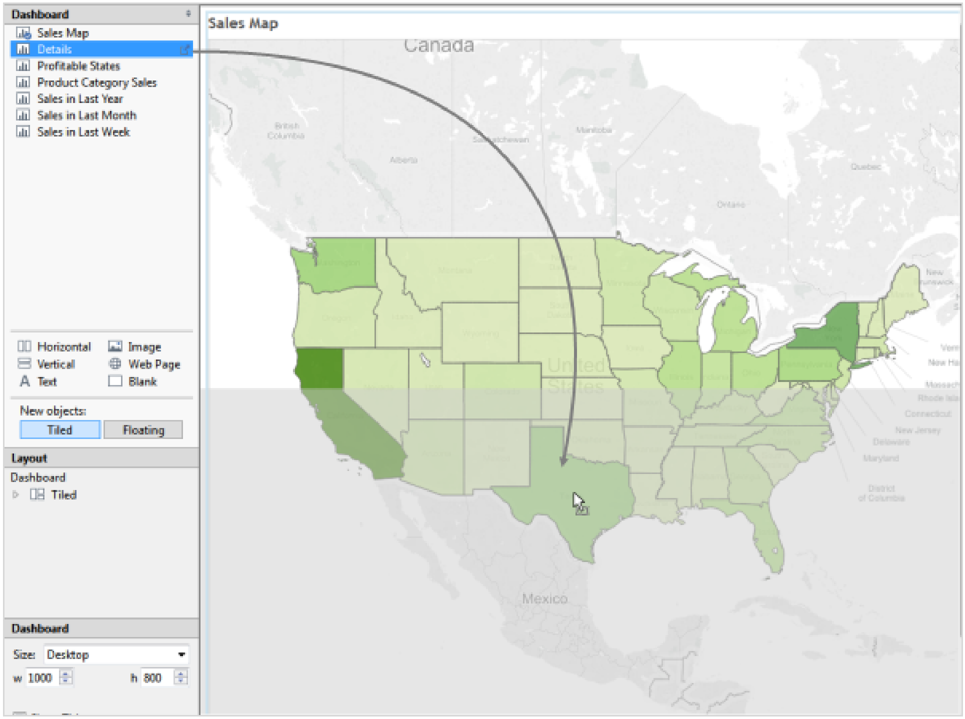
Jump to **Example: Add interactivity** on page 951 to find out how your views can interact with each other on a dashboard.

To add a view to a dashboard:

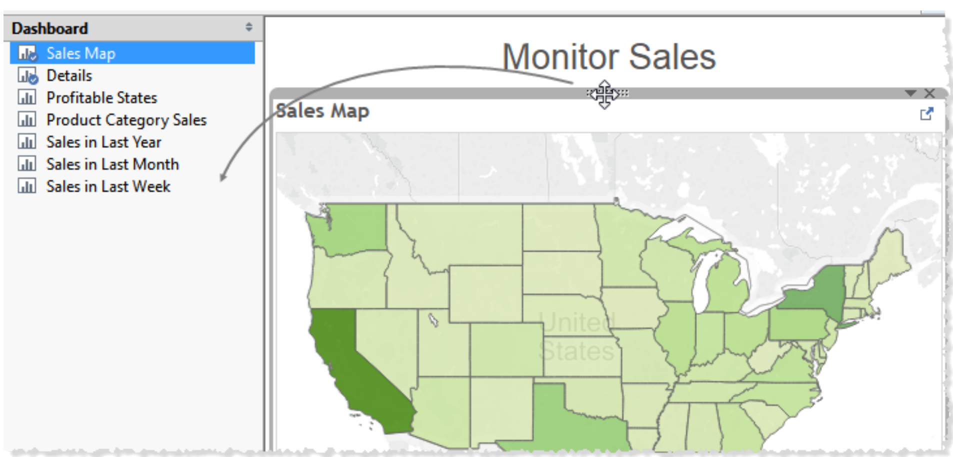
Click and drag a worksheet from the Dashboard window to the dashboard on the right.



Continue to drag as many of the worksheets to the dashboard as you like. Notice as you drag worksheets around the dashboard, a gray shaded area indicates the various places you can drop it.



After a view is added to the dashboard, the worksheet is marked with a check mark in the Dashboard window. Also, any legends or filters that are turned on for the sheet are automatically added to the dashboard.



By default, dashboards use a Tiled layout, which means that each view and object is arranged into a single layered grid. You can change the layout to Floating to allow views and objects to overlap. See **Organize Dashboards** on page 964 to learn more about these layouts.

Example: Add interactivity

With large or complex data sources, it may be difficult to review detailed views. To see these views more clearly, you can create an interactive dashboard to limit the data shown.

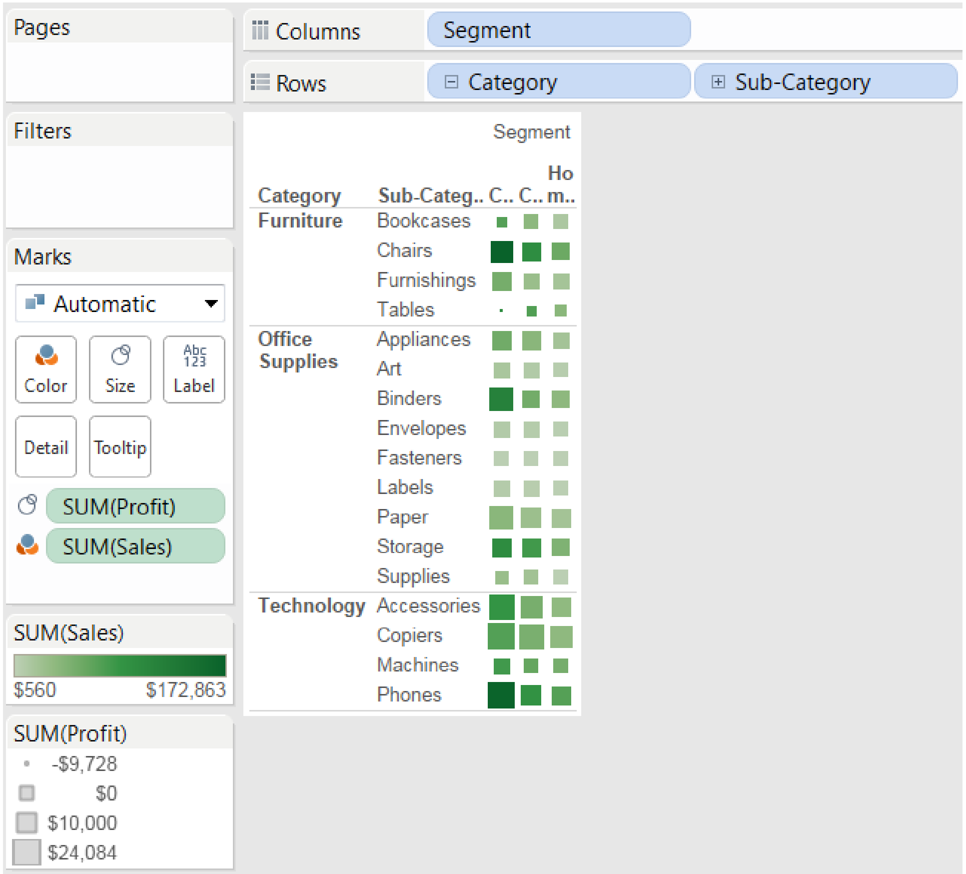
This example leverages Tableau's interactive features by using one overview worksheet to filter the customer-level detail of interest. This takes three steps.

Step 1: Create an overview worksheet

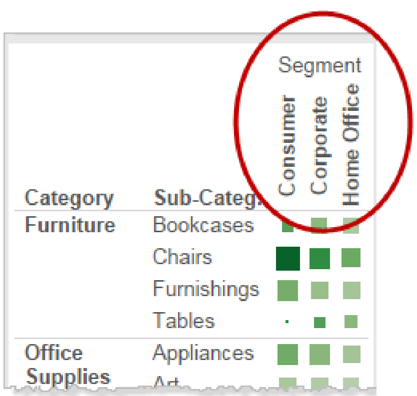
A simple and easy way to display categorical outliers is by using a heat map.

1. Connect to the **Sample - Superstore** data source.
2. Select **Worksheet** > **New Worksheet**.
3. Hold down the Ctrl key, select **Category**, **Sub-Category**,**Customer Segment**, **Sales**, and **Profit**, and then click **Show Me**.
4. In the Show Me dialog box, select the Heat Map chart.

The Show Me function creates a heat map:



5. Right-click one of the Segment labels at the top, and select **Rotate Label** so that the labels display more clearly.

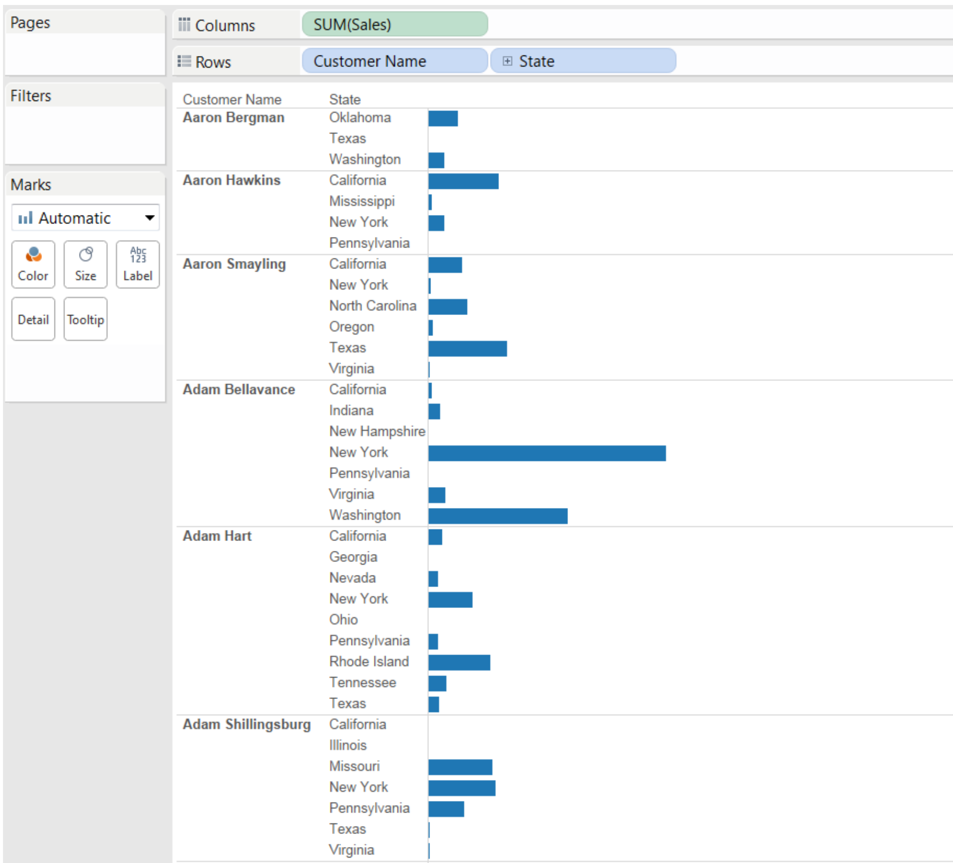


6. Right-click the sheet tab, select **Rename Sheet**, and type **Heat Map**.

Step 2: Create a detail worksheet

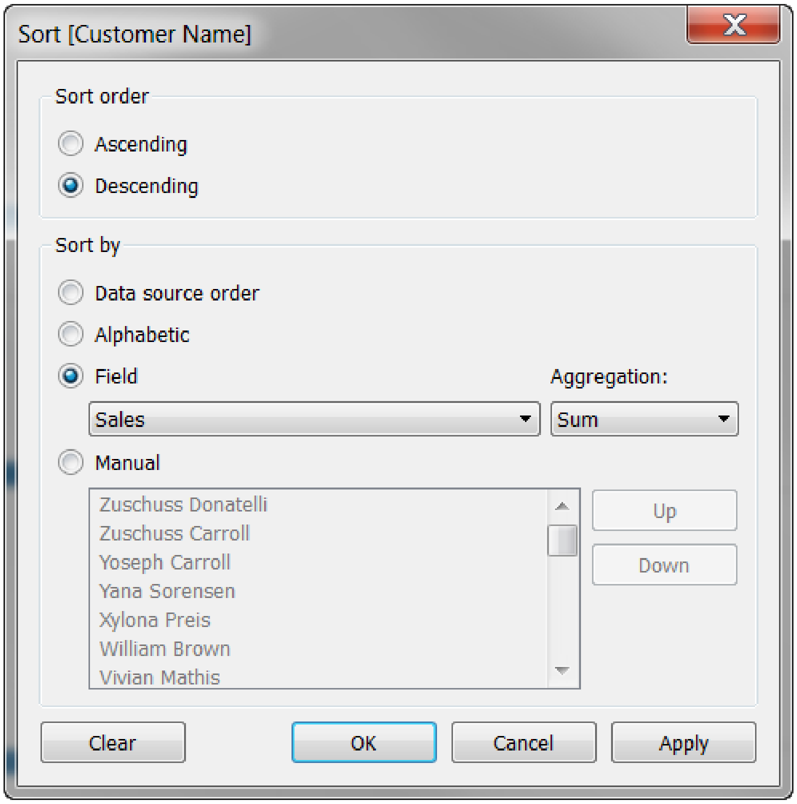
In this example, you can drill into customer-based detail. One way to do this is to focus on the top customers in sales.

1. Select **Worksheet** > **New Worksheet**.
2. From the **Dimensions** pane, drag the **Customer Name** and **State** fields to the **Rows** shelf.
3. From the **Measures** pane, drag **Sales** onto the **Columns** shelf.

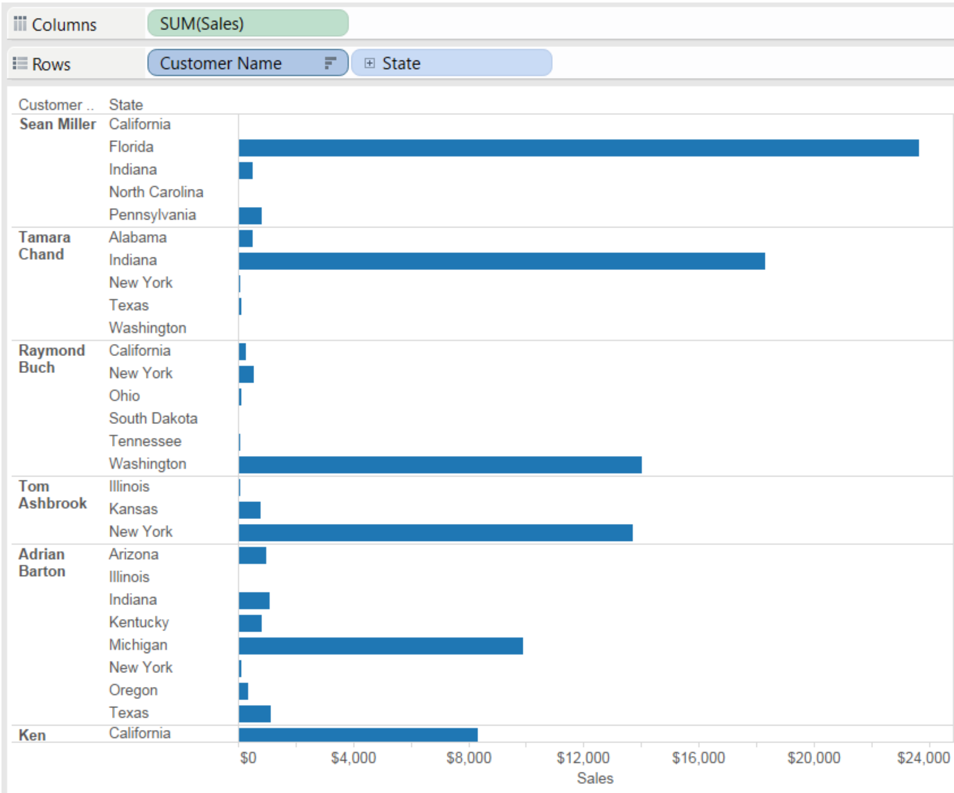


4. On the **Rows** shelf, right-click **Customer Name** and select **Sort**.

5. In the Sort dialog box, do the following tasks:
   - Under **Sort order**, select **Descending**.
   - Under **Sort by**, select **Field**. Keep the default settings of **Sales** and **Sum**.
   - Click **OK**.



Now you have a long bar chart of every customer from **Sample - Superstore**, along with how much they have spent. Your view updates to look like this:

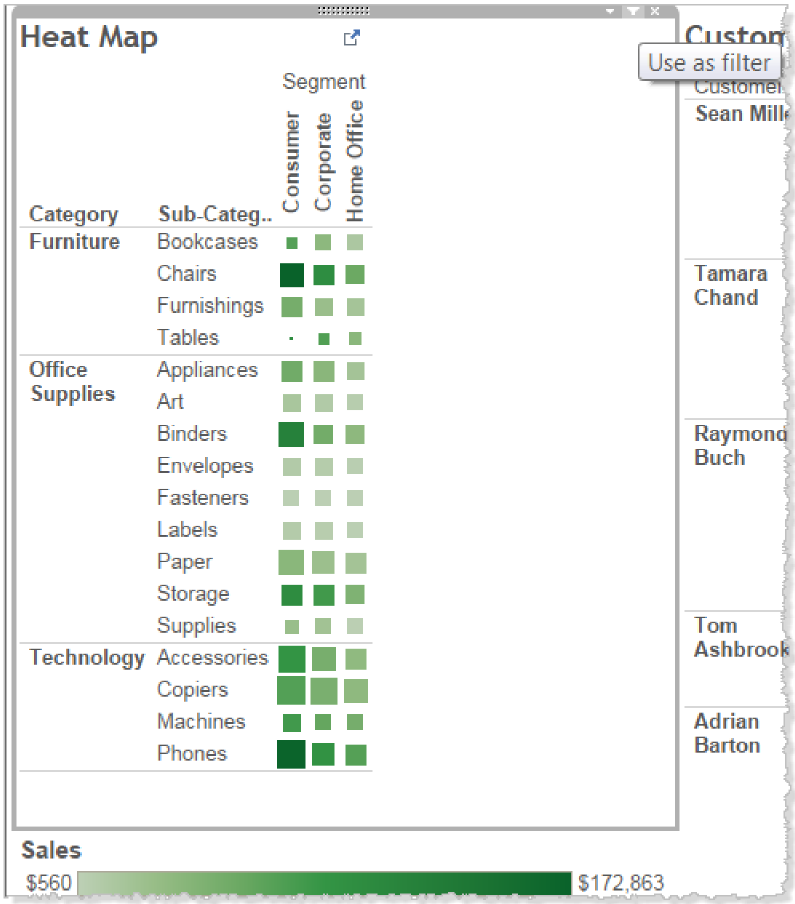


6. Right-click the sheet tab, select **Rename Sheet**, and type **Customer Details**.

Step 3: Create the dashboard

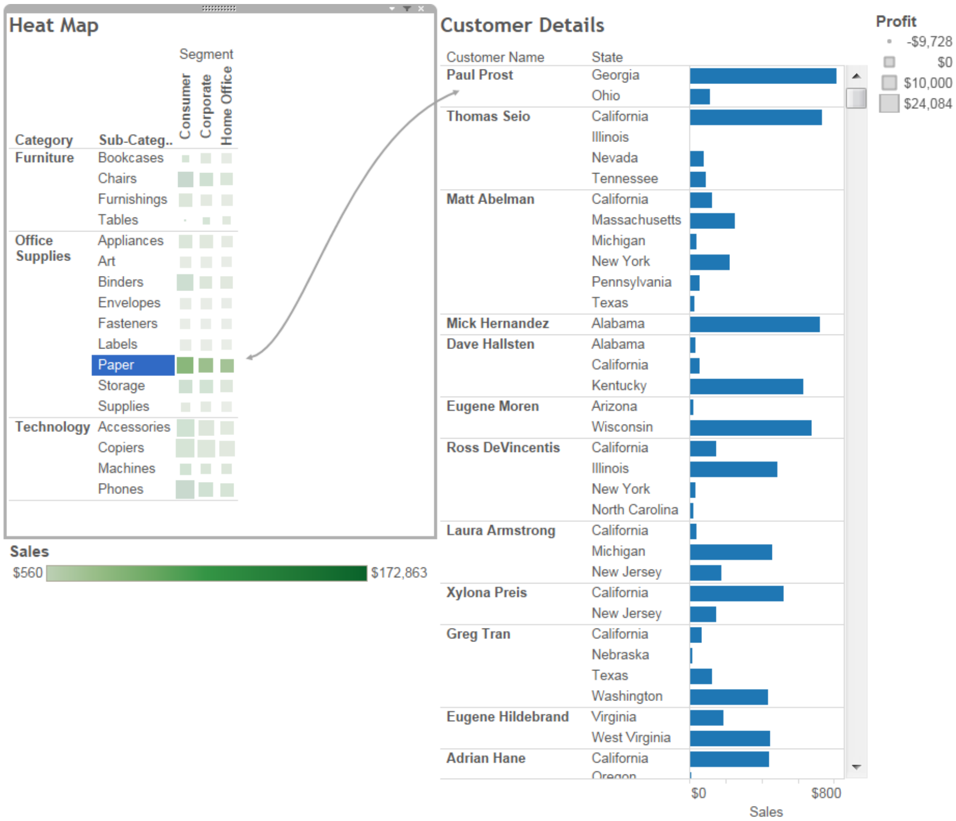
Next, create a dashboard that filters the customer list to only the results you want.

1. Select **Dashboard** > **New Dashboard**.
2. Drag the color legend on the right to the bottom of the Heat Map so that it is easy to read.
3. Select the **Use as Filter** icon on the Heat Map. Customer Details are now filtered based on your selections in the Heat Map.



4. Click any label on either axis in the heat map to see the Customer Details view refresh to display data about your selection.

   Answer questions like, "Who buys the most paper, and in which state?" (Paul Prost, in Georgia.)



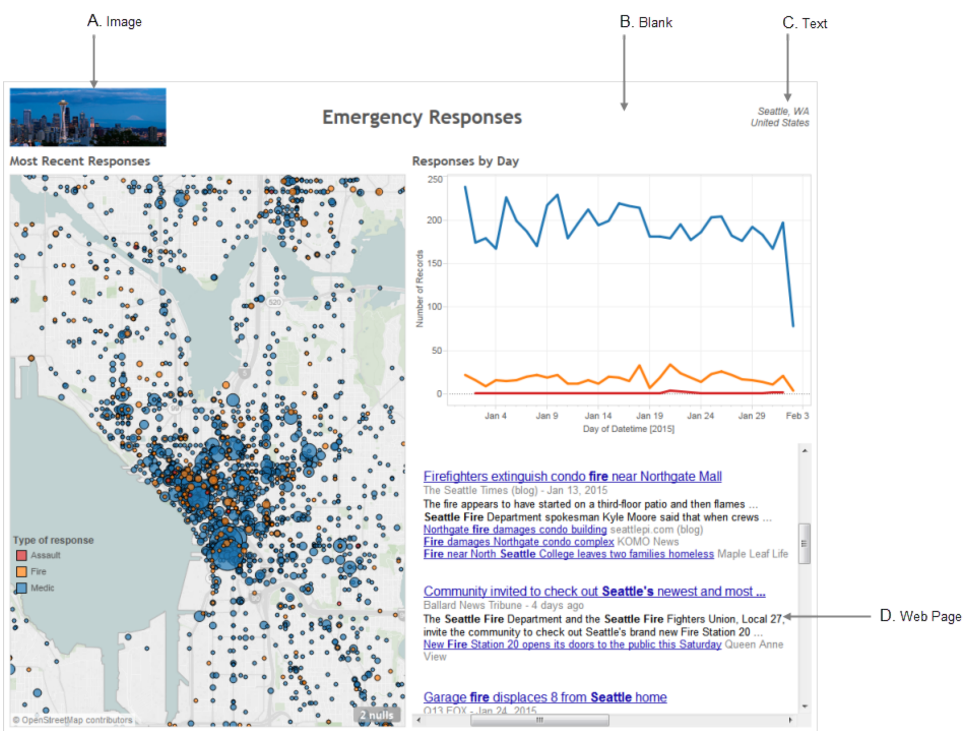
Add Dashboard Objects

Dashboards are used to monitor and analyze a collection of related views and information. A dashboard object is an area in the dashboard that can contain supporting information that is not a Tableau view. For example, you can add a text area to include a detailed description. Or you may want to add a web page that is the destination of your hyperlinks. Dashboard objects are listed in the **Dashboard** pane. You can add text, images, web pages, and blank areas.

To add a dashboard object:

- Drag a dashboard object from the **Dashboard** pane and drop it on the dashboard.

Here is a dashboard that uses many different types of dashboard objects. Descriptions of the objects are listed below.



A. Image

You can add static image files to the dashboard. For example you may want to add a logo or descriptive diagram. When you add an image object you are prompted to select an image from your computer. You can also type a URL for an image that is hosted online. When you add an image to a dashboard, you can customize how the image displays by selecting an option on the image's menu. For example, you can select whether to **Fit Image**, which scales the image to the size of image object on the dashboard. You can also select whether to **Center Image**, which aligns the image to the center of the image object on the dashboard. Finally, you can **Set URL**, which turns the image into an active hyperlink on the dashboard. If you are designing a dashboard that will be viewed on a Retina display, see **Display High Resolution Images** on page 964 for more information.

B. Blank

The blank object lets you add blank areas to your dashboard so you can get the layout just right. Resize the blank object by clicking and dragging the edges of the area.

C. Text

The text object allows you add a block of text to the dashboard. This is useful for adding captions, descriptions, and even copyright information. The text object will automatically resize to best fit where you place it in the dashboard. However you can also resize the text area manually by dragging the edges of the text object. By default, text objects are transparent. To change this, right-click (control-click on Mac) the text object in the dashboard, and select **Format**.

D. Web Page

The web page object allows you to embed a web page into your dashboard so you can combine your Tableau content with information from other applications. The web page object is especially useful when you have hyperlinks set up using the Data > Hyperlinks command. If your views include hyperlinks to web pages, you can display those pages in a dashboard by adding a web page object. The links then open in the dashboard instead of in a browser window.

When you add a web page object you are asked to specify a URL. If you will publish the dashboard to a server, a best practice is to to use the **https://** protocol with URL actions.

If you use http:// in the URL action, and the server on which you publish the dashboard runs through https://, browsers will not be able to display the http:// page that the URL action points to.

When printing the Dashboard to PDF, the contents of the web page are not included.

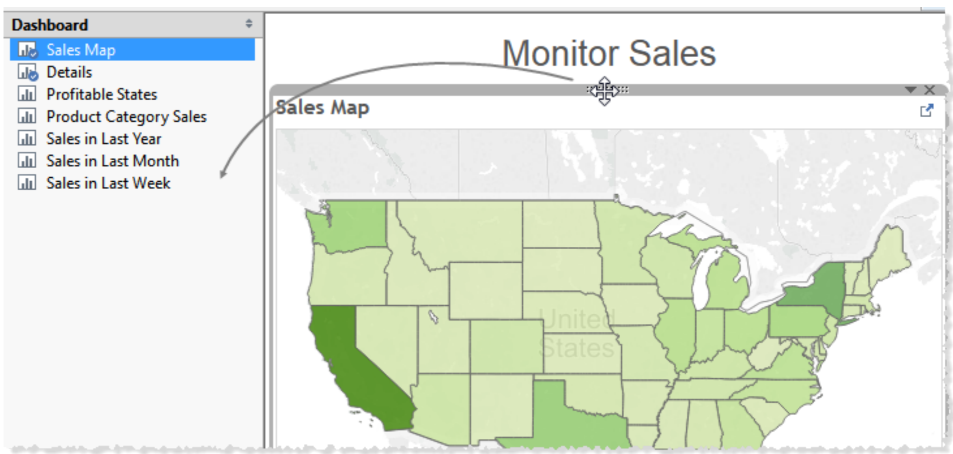
> By default, dashboards use a Tiled layout, which means that each object is arranged into a single layered grid. You can change the layout to Floating to allow views and objects to overlap. See **Organize Dashboards** on page 964 to learn more about these layouts.

Remove Views and Objects from a Dashboard

After you add a worksheet or object to a dashboard, you can remove it in a number of different ways including dragging it out of the dashboard, using the context menus in the Dashboard window, or using the dashboard view menu.

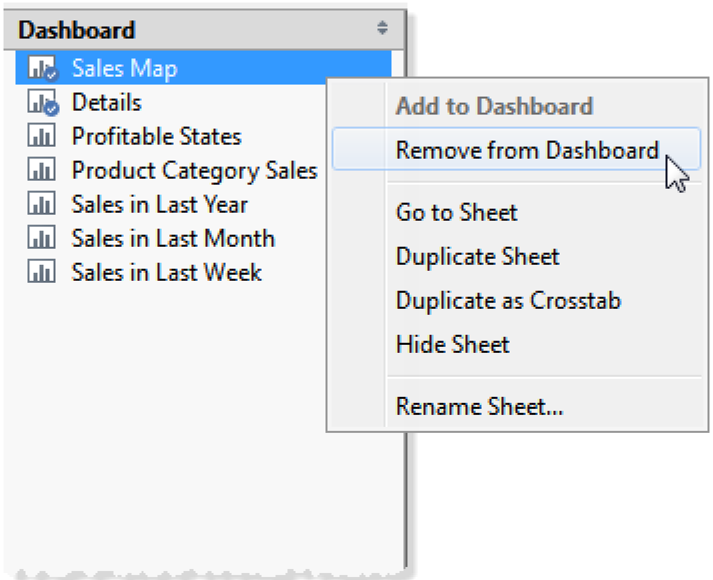
To remove a view or object by dragging:

1. Select the view you want to remove from the view.
2. Click the move handle at the top of the view and drag it off the dashboard.



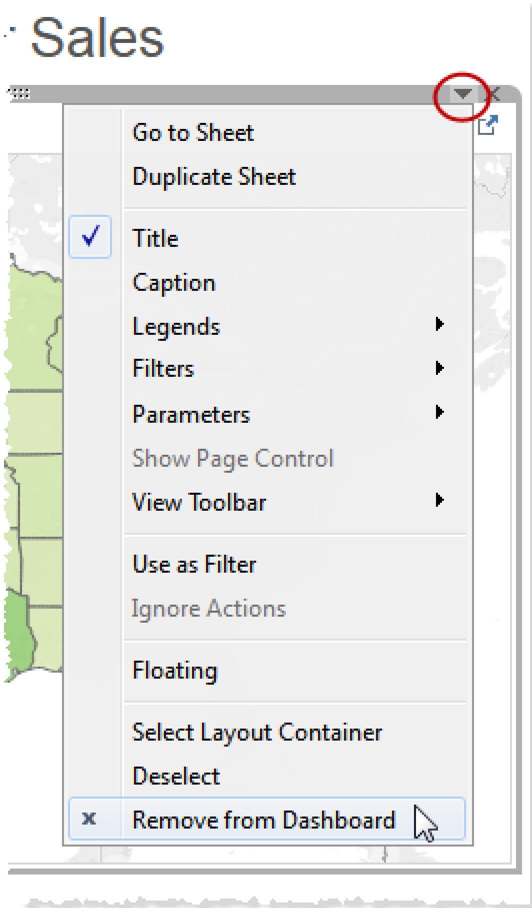
To remove a worksheet using the Dashboard window:

- Right-click (control-click on Mac) the worksheet in the Dashboard window and select **Remove from Dashboard**.



To remove a worksheet or object using the dashboard view menu:

1. Select the view or object in the dashboard you want to remove.
2. Either select **Remove from Dashboard** on the dashboard view menu or click the "x" icon in the upper right corner of the selected object.



Dashboard Web View Security Options

A **Web Page** object allows you to embed a web page into your dashboard. By default, when you add a **Web Page** object to a dashboard, there are several web view security options enabled to improve the functionality and security of the embedded web page.

To adjust the default web view security options

- Select **Help** > **Settings and Performance** > **Dashboard Web View Security**, and then clear one or more of the options listed below.
  - **Enable JavaScript.** When selected, enables JavaScript support in the web view.

    Note: Clearing this option may cause some web pages that require JavaScript to function improperly in the dashboard.

  - **Enable Plug-ins.** When selected, enables any plug-ins the web page uses, such as an Adobe Flash or Quick Time player.

- **Block Pop-ups.** When selected, blocks pop-ups.
- **Enable URL Hover Actions.** When selected, enables URL hover actions. For more information, see **URL Actions** on page 780.

Note: Any changes you make to the security options will apply to all web page objects in your workbook, including new web page objects you create, and all subsequent workbooks you open in Tableau Desktop. To see your changes, you may need to save and reopen the workbook.

Display High Resolution Images

By default, high-resolution images that you use in a dashboard display in standard resolution. The default configuration ensures that images maintain the same size when viewed on either standard resolution or Retina displays. To take advantage of high-resolution images in a dashboard that are intended to be viewed on a Retina display, use the @2x naming convention.

To display a high resolution image on a dashboard:

1. Navigate to the high-resolution image on your computer with Retina display.
2. Rename your high-resolution image to include the @2x modifier by using <*image-name*>@2x<*file-extension*> format. For example, logo@2x.png.
3. In your workbook, click and drag an image object and drop it on the dashboard. You are prompted to select an image from your computer.
4. Select the image you just renamed using the @2x naming convention and then click **Open**.

Note: EMF image file formats are not compatible with Tableau Desktop on the Mac.

Organize Dashboards

You can organize your dashboards in a variety of ways to highlight important information, tell a story, or add interactivity for your viewers. For example, you can:

- Rearrange or hide views and items.
- Specify the size and position of each view or item on the dashboard.
- Specify a tiled or floating layout for the dashboard.
- Use layout containers so that your dashboards dynamically adjust and resize based on the data showing. For example, if your dashboard has filtered data that results in a variable view size.
- Enable viewers to display individual worksheets on the dashboard by creating a sheet

selector control. For information about how to create a sheet selector for a dashboard, see Creating a Sheet Selector for a Dashboard.

Tiled and Floating Layouts

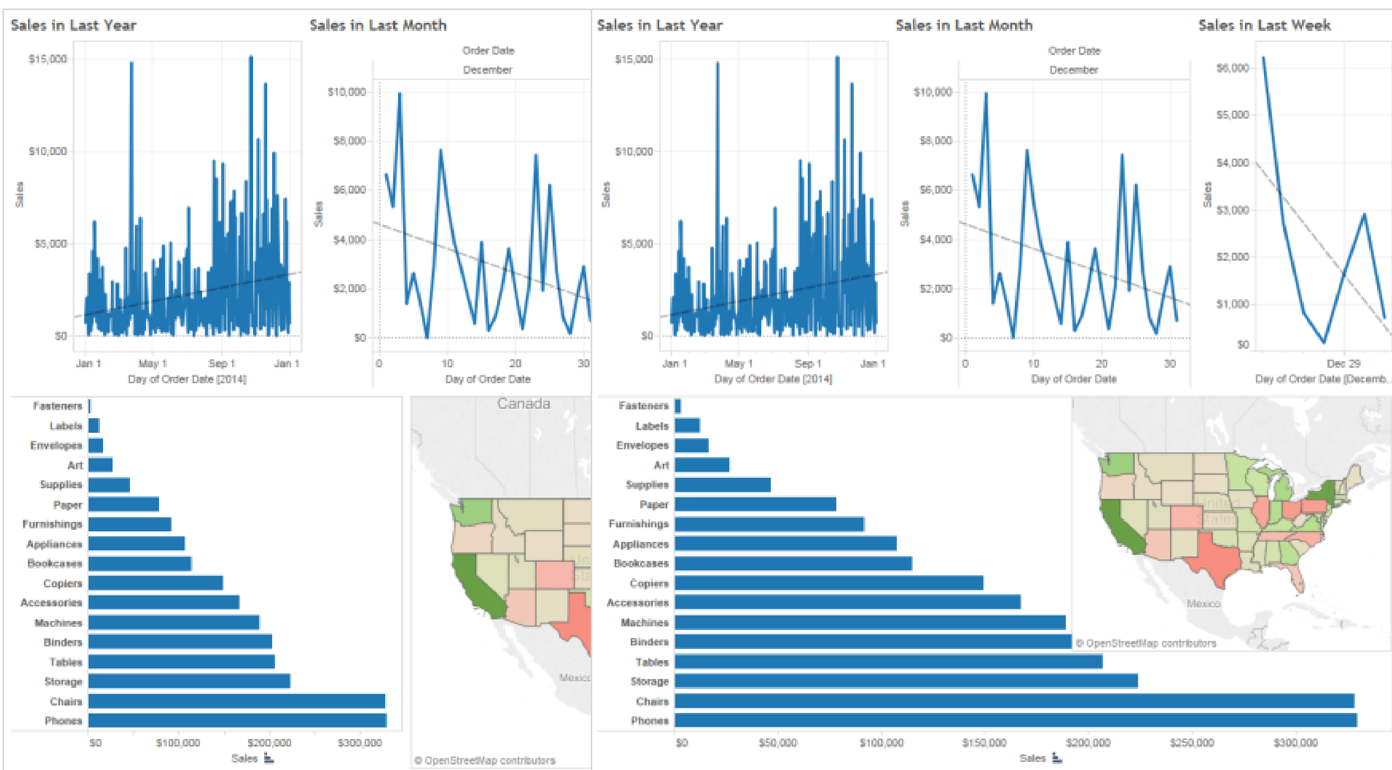
Each object in a dashboard can use one of two types of layouts: tiled or floating. Tiled objects are arranged in a single layer grid that adjust in size based on the total dashboard size and the objects around it. Floating objects can be layered on top of other objects and can have a fixed size and position.

Tiled Layout

All objects are tiled on a single layer. The top three views are in a horizontal layout container.

Floating Layout

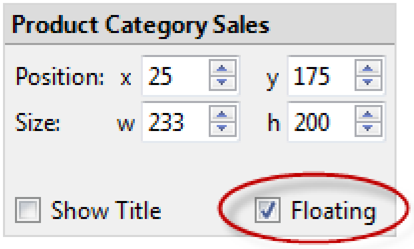
While most objects are tiled on this dashboard, the map view and its corresponding color legend are floating. They are layered on top of the bar chart, which uses a tiled layout.



Switch Between Layouts

By default, dashboards are set to use the Tiled layout. All views and objects are added as tiled. To switch an object to floating, do one of the following:

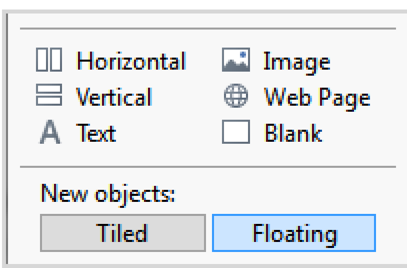
- Select a view or object in the dashboard and then select the **Floating** option at the bottom of the **Dashboard** pane.



- Hold down **Shift** on your keyboard while dragging a new sheet or object to the view. Alternatively, select an existing view or object in the dashboard and hold **Shift** while dragging the object to a new location in the dashboard.

Similarly, you can convert a floating object back to tiled in the same ways listed above.

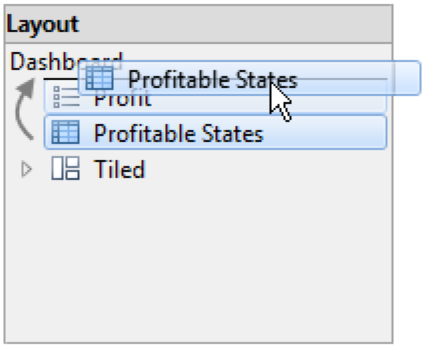
To change the default for the whole dashboard, click the **Floating** button in the middle of the **Dashboard** pane. When the dashboard is set to Floating layout, any new sheets and objects are added as floating.



Reorder and Resize Floating Objects

All of the items in a dashboard are listed in the Layout section of the **Dashboard** pane. The Layout section displays tiled objects and any floating objects in a hierarchy.

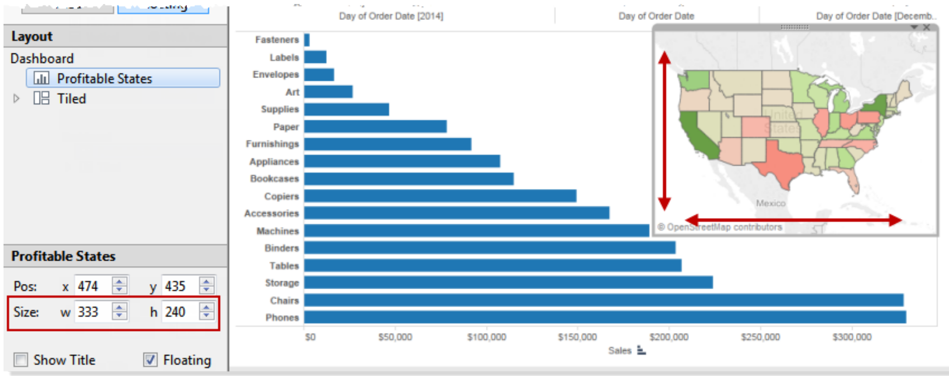
Click, hold, and drag items in the hierarchy to change the order that they are layered in the dashboard. Items shown at the top of the list are in the front while items at the bottom of the list are in the back. **Note:** Tiled layout items cannot be reordered.



Right-click (control-click on Mac) items in the **Layout** section of the **Dashboard** pane to customize the object and hide and show parts of the worksheet. See **Show and Hide Parts of a Worksheet** on page 973.

Use the **Position** field at the bottom of the **Dashboard** pane to specify exact location for floating objects. Define the position in pixels as an offset from the top left corner of the dashboard. The **x** and **y** values specify the location of the top left corner of the object. For example, to place an object in the top left corner of the dashboard, you would specify x = 0 and y = 0. If you wanted to move the object to the right 10 pixels, you would change the x value to 10. Similarly, to move it down 10 pixels you would change the y value to 10. The values you enter can be positive or negative but must be whole numbers.

Use the **Size** field at the bottom of the **Dashboard** pane to specify the exact dimensions for floating objects. Define the size in pixels where **w** equals the width of the object and **h** equals the height of the object. You can also resize floating objects by clicking and dragging an edge or corner of the selected object in the dashboard.



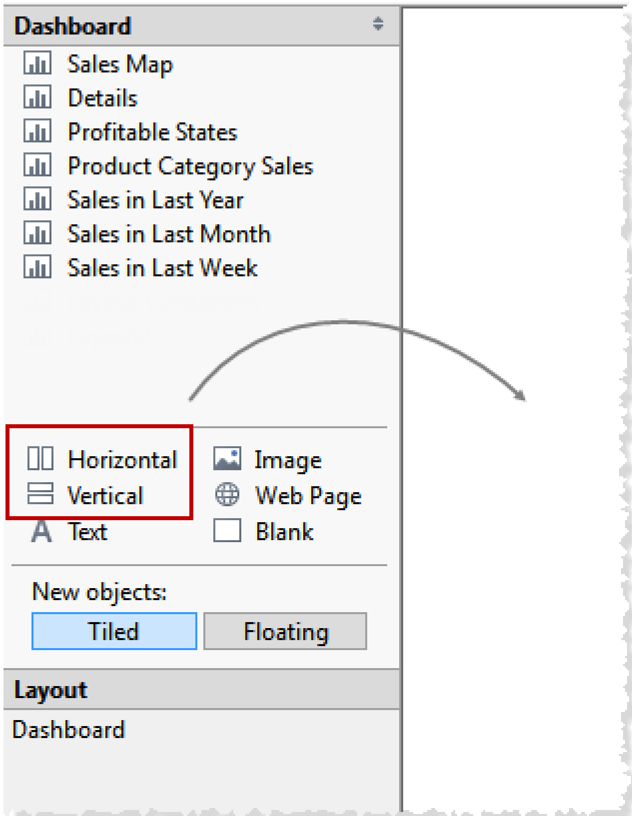
Layout Containers

After you create a dashboard you can add sheets and other objects to the dashboard. One type of dashboard object is a layout container. Layout containers help you organize sheets and other objects on a dashboard. These containers create an area in the dashboard where objects automatically adjust their size and position based on the other objects in the container. For example, a dashboard that has a master-detail filter that changes the size of the target view can use a layout container to automatically adjust the other views when the filter is applied.

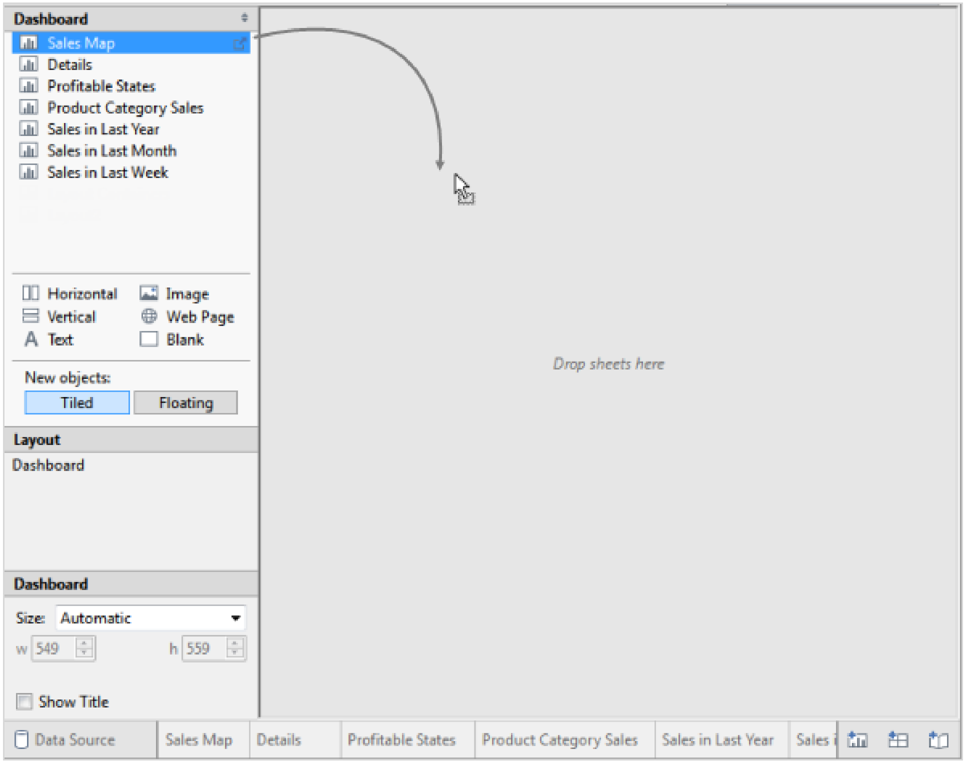
Adding Layout Containers

Add a Horizontal Layout Container to automatically adjust the width of dashboard objects. Add a Vertical Layout Container to automatically adjust the height of dashboard objects.

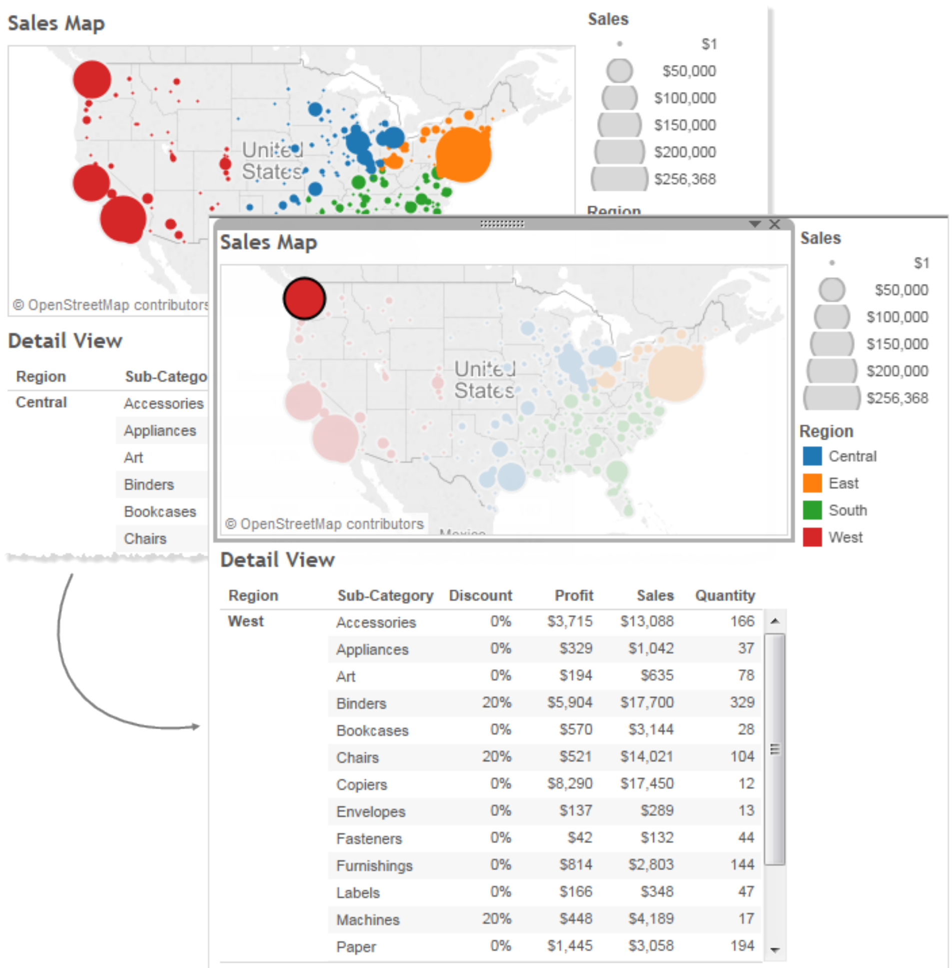
1. Drag a horizontal or vertical layout container to the dashboard.



2. Add sheets and objects to the layout container. As you hover over the layout container, a blue box indicates that the object is being added to the flow of the layout container.



3. Watch as the objects move and resize. For example, in the dashboard below, a filter is applied that causes the text table to get shorter. Because both views are in a vertical layout container, the map automatically resizes into the new space.



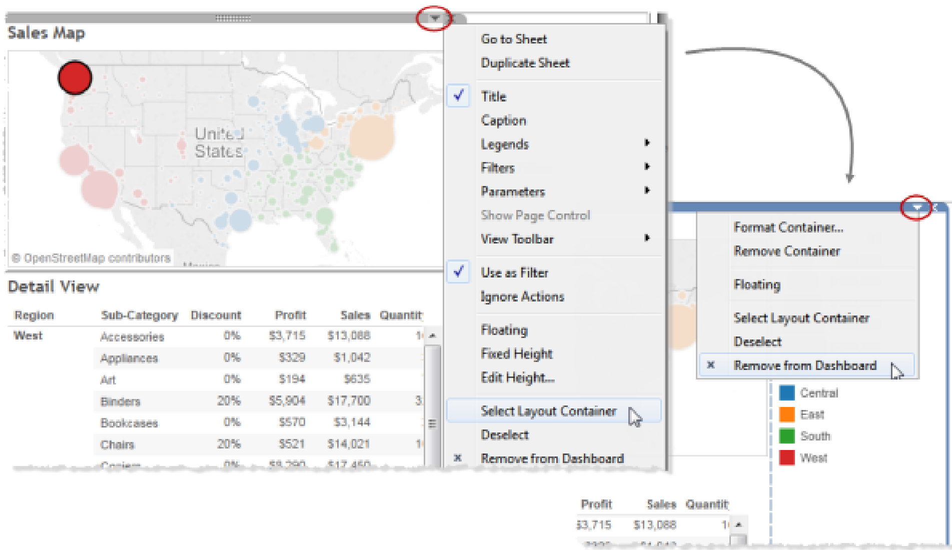
You can add as many layout containers as you want and you can even add layout containers within other containers.

Removing Layout Containers

When you remove a layout container, it and all of its contents are deleted from the dashboard.

1. Select an object in that layout container you want to delete.
2. Open the drop-down menu in the upper right corner of the selected object and select **Select Layout Container**.
3. Open the drop-down menu for the selected layout container and select **Remove from**

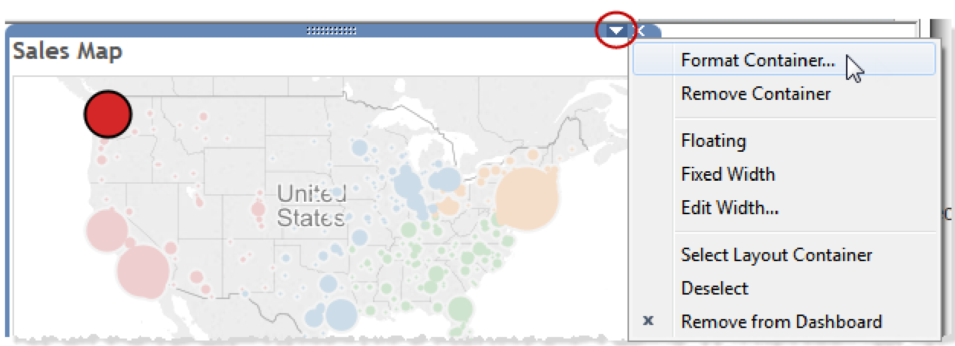
Dashboard.



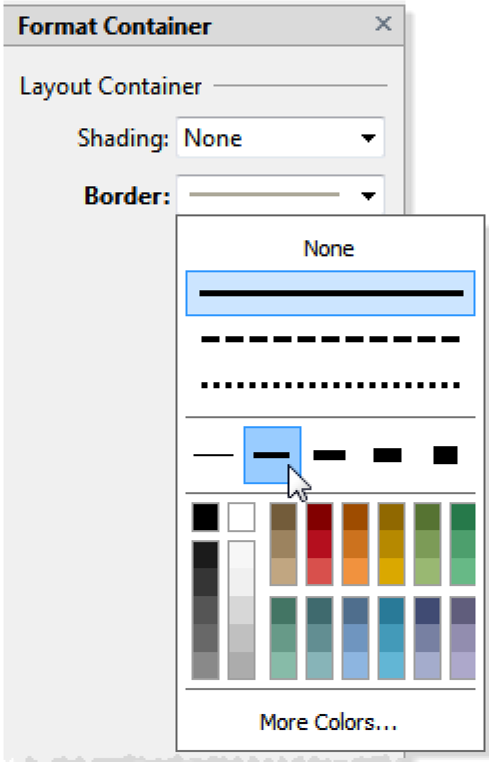
Formatting Layout Containers

You can specify shading and border style for layout containers so that you can visually group objects in the dashboard. By default, layout containers are transparent and have no border style.

1. Open the drop-down menu for the layout container you want to format and select **Format Container**.



2. In the Format Container window, specify the color and opacity from the Shading control.
3. Specify a line style, thickness, and color for the border from the Border control.



Scaling Layout Containers

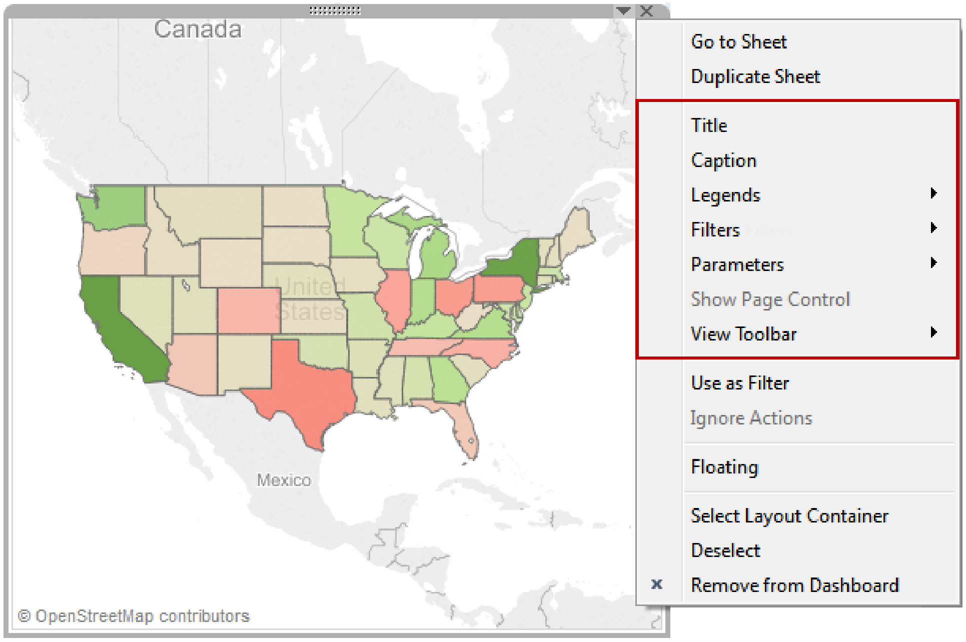
Layout containers are useful for all kinds of dashboards and give you increased control for how the objects automatically flow in the dashboard as you apply filters. Also, use layout containers when comparing multiple bar charts or bullet graphs. In this case, the bar heights are automatically adjusted so that the bars in both sheets stay aligned.

Show and Hide Parts of a Worksheet

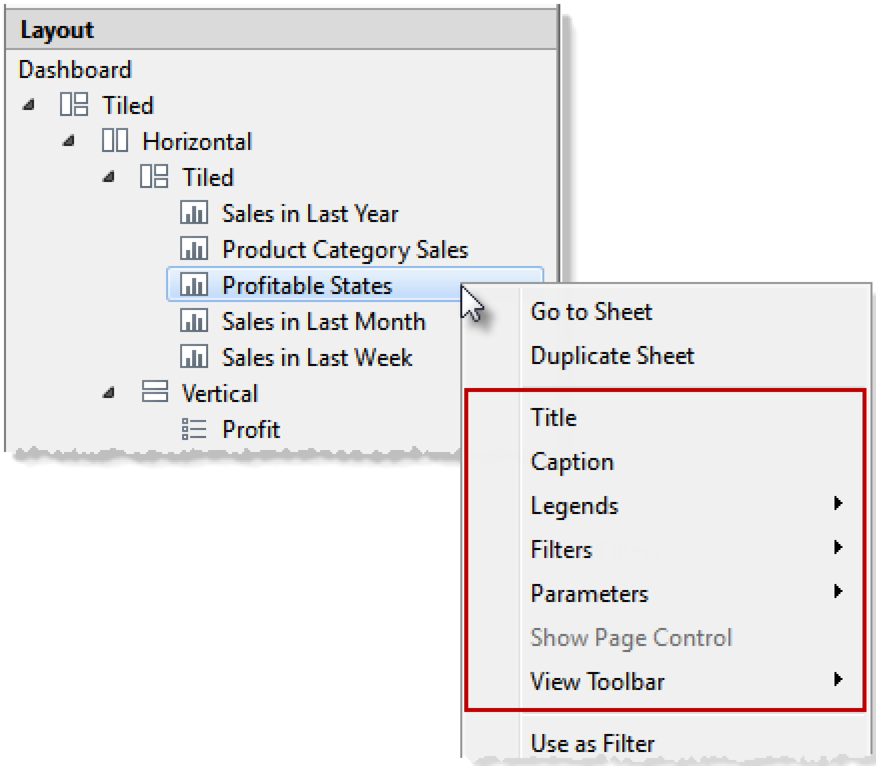
As you drag worksheets to the dashboard, the view from the worksheet and its legends and filters are automatically displayed. However, you may want to hide some parts of the worksheet such as legends, titles, captions, and filters. You can show and hide these parts of the worksheet using the drop-down menu in the upper right corner of the views in the dashboard.

1. Select a view in the dashboard.
2. Click the drop-down menu in the upper right corner of the selected view and select the items you want to show. For example, you can show the title, caption, legends, and a

variety of filters.



Alternatively, you can right-click (control-click on Mac) an item in the **Layout** section of the **Dashboard** pane to access all of these same commands.

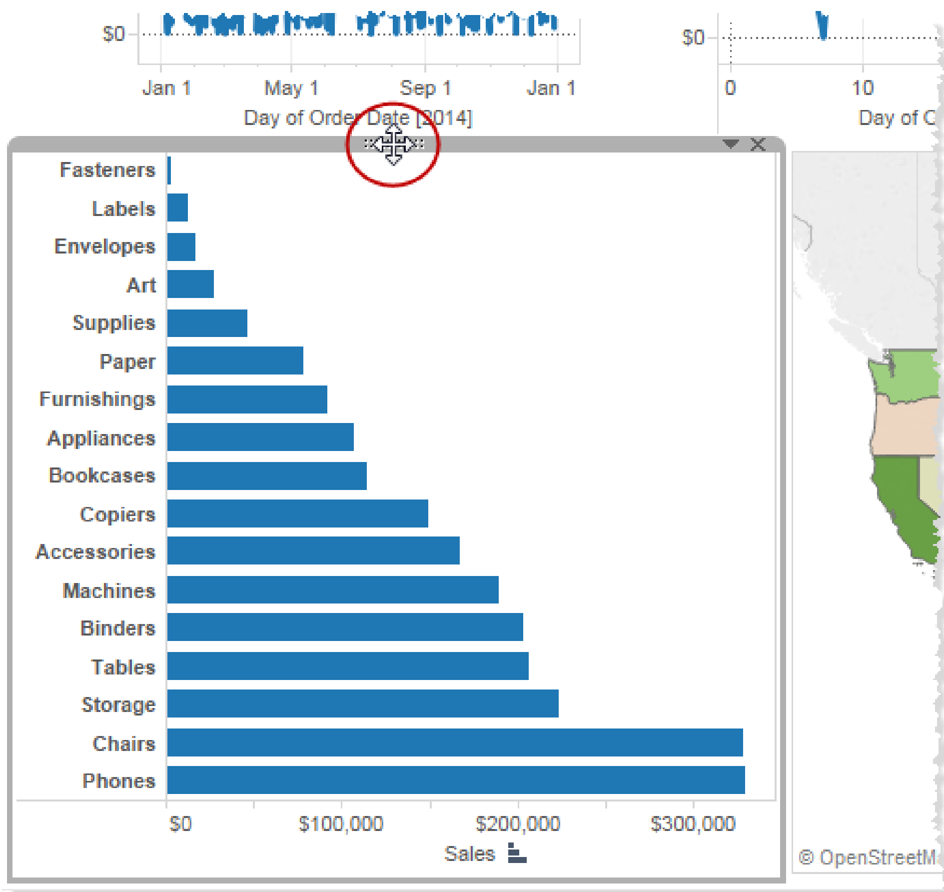


Filters are only available for the fields used in the original view.

Rearrange Dashboard Views and Objects

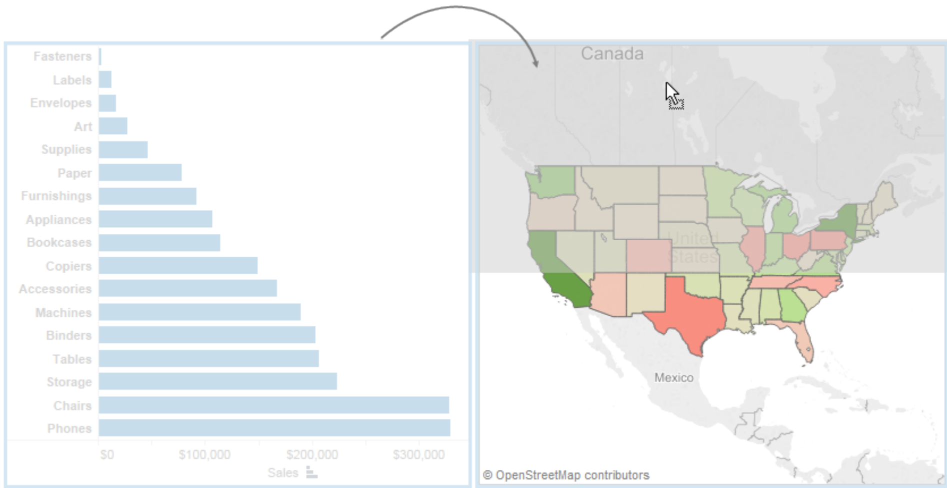
Rearrange the views, objects, legends, and filters in a dashboard in a way that best fits your analysis or presentation. You can rearrange the parts of a dashboard using the move handle at the top of a selected view, legend, or filter.

1. Select the view or object that you want to move.
2. Click and drag the move handle at the top of the selected item to a new location.



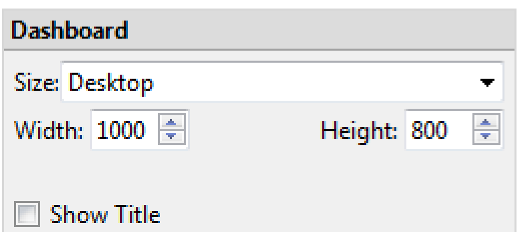
3. Drop the view or object in a new location.

   As you drag objects around the dashboard, the areas where you can drop them are shaded in gray.



Set the Dashboard Size

You can specify the overall size of the dashboard using the Dashboard area at the bottom of the Dashboard window. The Dashboard area displays when you've deselected all items in the dashboard. By default, the dashboard is set to the Desktop preset, which is 1000 pixels by 800 pixels. Select a new size using the drop-down menu.



You can select from the following options:

- **Automatic** - the dashboard automatically resizes to fill the application window.
- **Exactly** - the dashboard always remains a fixed size. If the dashboard is larger than the window the dashboard becomes scrollable.
- **Range** - the dashboard scales between the specified minimum and maximum sizes, after which scroll bars or white space will display.
- **Presets** - select from a variety of fixed size presets such as Letter, Small Blog, and iPad. If you select a preset that is larger than the window, the dashboard becomes scrollable.

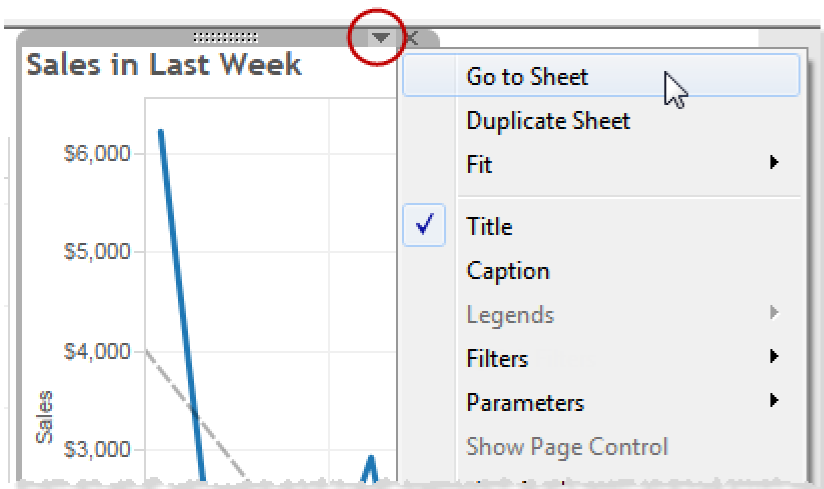
Understanding Dashboards and Worksheets

The views in a dashboard are connected to the worksheets they represent. That means when you make changes to the worksheet, the dashboard is updated and subsequently, many changes you make to the dashboard affect the worksheet. This interaction is important to remember when you are annotating, formatting, and resizing the views in your dashboard.

While dashboards are an easy way to summarize and monitor at a glance, you can go back and edit the original view by jumping to a selected worksheet. Additionally, you can duplicate worksheets directly from the dashboard to perform in-depth analysis without affecting the dashboard. Finally, you can hide worksheets that are used in dashboards so they are not shown in the filmstrip, sheet sorter, or in the tabs along the bottom of the workbook.

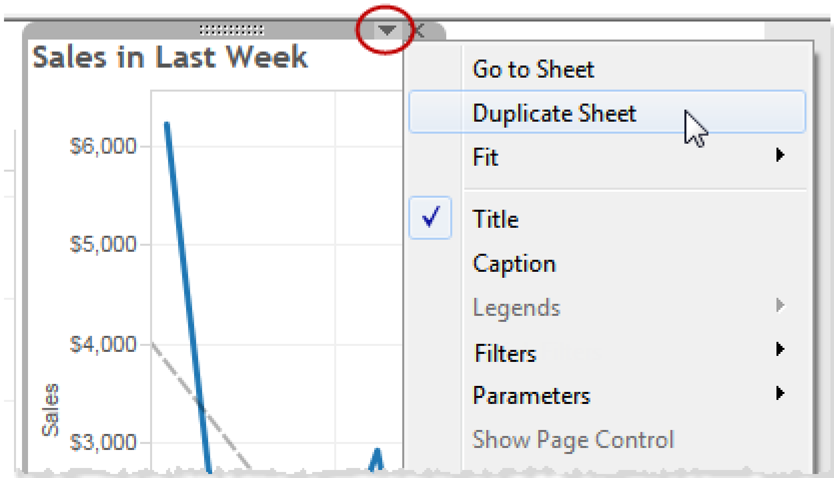
Go to Sheet

1. Select the view you want to see full size.
2. Select **Go to Sheet** on the dashboard view menu.



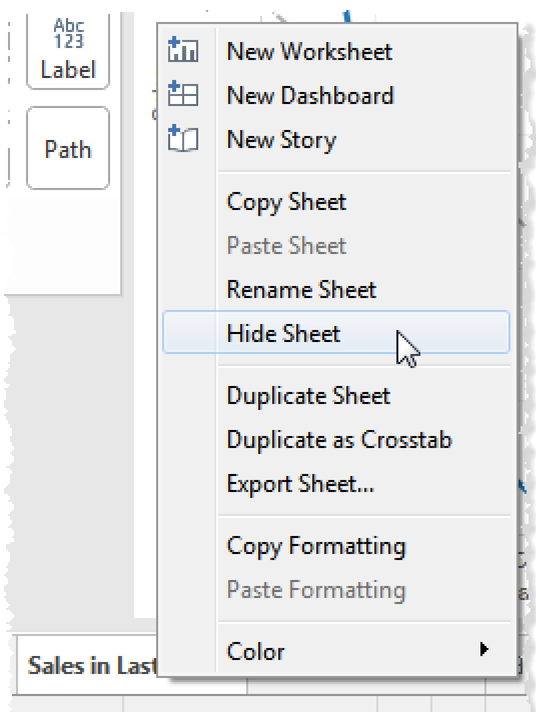
Duplicate Sheet

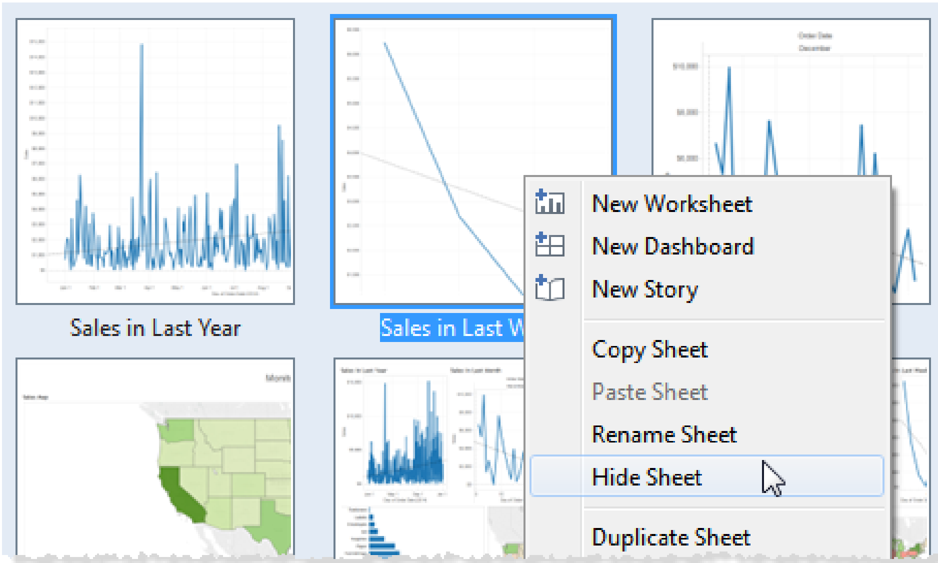
1. Select the view you want to duplicate.
2. Select **Duplicate Sheet** on the dashboard view menu



Hide Sheet

Right-click (control-click on Mac) the worksheet tab at the bottom of the workbook and select **Hide Sheet**.





Show Hidden Sheets

1. Open the dashboard that uses the hidden sheet.
2. Select the hidden sheet in the dashboard and then select **Go to Sheet** on the dashboard view menu.

Alternatively, you can right-click (control-click on Mac) the hidden sheet in the **Dashboard** pane and select **Go to Sheet**. The sheet opens and its tab appears along the bottom of the workbook once again.

Stories

A **story** is a sheet that contains a sequence of worksheets or dashboards that work together to convey information. You can create stories to show how facts are connected, provide context, demonstrate how decisions relate to outcomes, or simply make a compelling case.

A story is a sheet, so the methods you use to create, name, and otherwise manage worksheets and dashboards apply to stories. For more information, see **Sheets** on page 299. At the same time, a story is also a collection of sheets, arranged in a sequence. Each individual sheet in a story is called a **story point**.

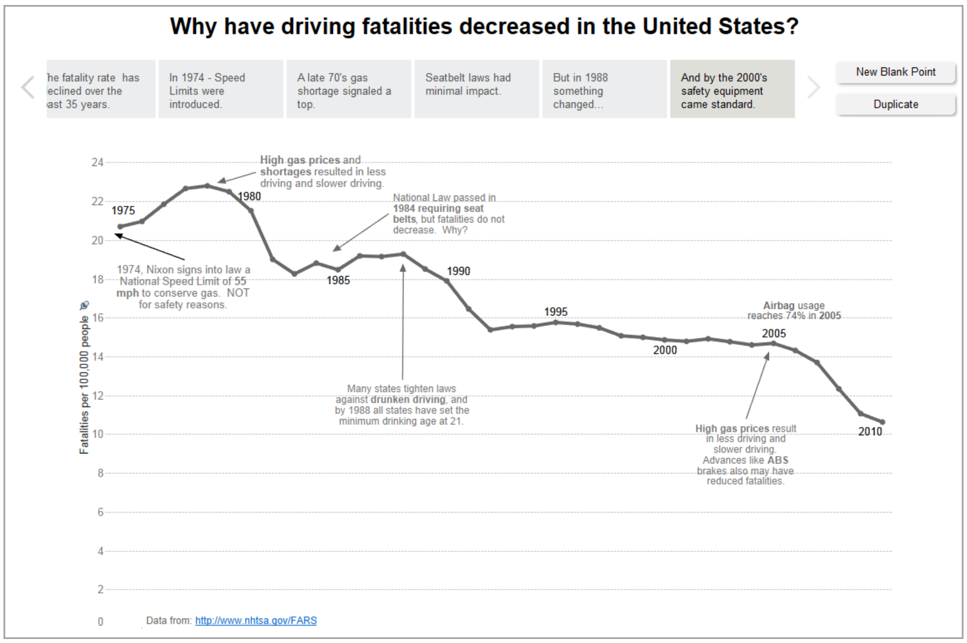


Tableau stories are not collections of static screen captures—your story points remain connected to the underlying data and change as the data changes—or as the views and dashboards that you use in your story change. When you share a story —for example, by publishing a workbook to Tableau Server or Tableau Online—users can interact with the story to reveal new findings or ask new questions of the data.

There are many different ways to use stories. For example:

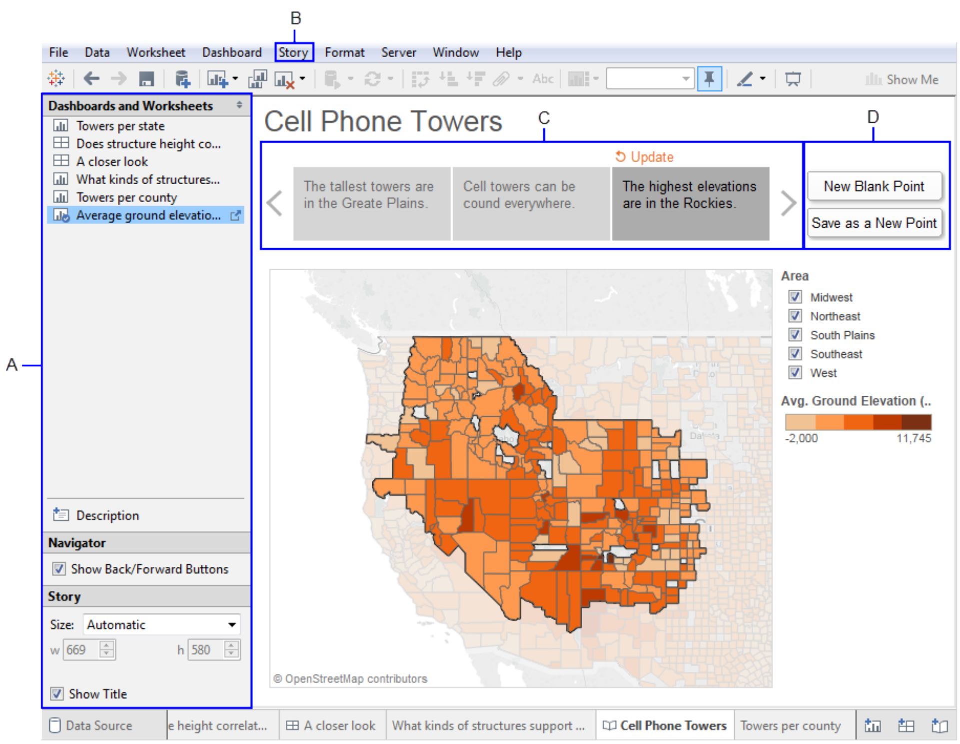
- **Use stories for collaborative analysis**: You can use stories to assemble a sequenced analysis, for yourself or for collaboration with your colleagues. Visualize the effects of data changes over time, or perform what-if analysis.
- **Use stories as presentation tools**: You can use stories to present a narrative to an audience. Just as dashboards provide spatial arrangements of views that work together,

stories present sequential arrangements of views or dashboards that create a narrative flow for your audience.

There are different ways to build a story. For example, each story point in a story can be based on a different worksheet or dashboard. Conversely, each story point can be based on a single worksheet or dashboard, which you customize for each story point, perhaps adding more information in each new story point. Often you will want to combine these approaches, using new sheets for some story points, and customizing the same sheet for other story points.

The Story Workspace

As you work on a story, you can use the following controls, elements, and features. Descriptions are listed below.



A. The Dashboards and Worksheets pane

In the Dashboards and Worksheets pane you can do the following.

- Drag dashboards and worksheets to your story.
- Add a description to a story point.

- Select to show or hide the navigator buttons.
- Configure the story size.
- Select to show the story title.

B. The Story Menu

When you select the Story menu, you can do the following.

- Open the Format Story pane.
- Copy the current story point as an image.
- Export the current story point as an image.
- Clear the entire story.
- Show or hide the navigator buttons and the story title.

C. The Navigator

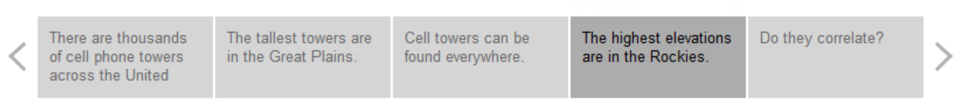
The navigator serves as a way to edit, organize, and annotate all the points in your story. You can also move through the story using the navigator buttons.

Navigator buttons

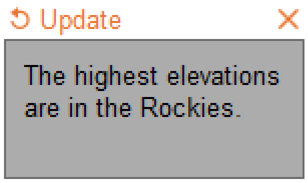
Click the forward arrow on the right of the navigator to move forward one story point , and the backward arrow on the left of the navigator to move back one story point. You can also use the slider that appears when you hover over the navigator to quickly scroll through all the points in the story, and then select one to view or edit.

Story Points

The current story point in the navigator highlights a different color to indicate it is selected.



When you add or make changes to a story point, you can choose to update the story point to save the changes, revert any changes, or delete the story point. For more information, see **Customizing a Story Point** on page 987.



D. Options for Adding a New Story Point

After you create a story point, you have several different options for adding another point. To add a new story point, you can do the following.

- Add a new blank point.
- Save the current story point as a new point.
- Duplicate the current story point.

For more information on these options, see **Creating a Story** below.

Creating a Story

You create a story from existing worksheets and dashboards.

To create a story:

1. Click the **New Story** tab.

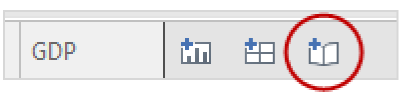
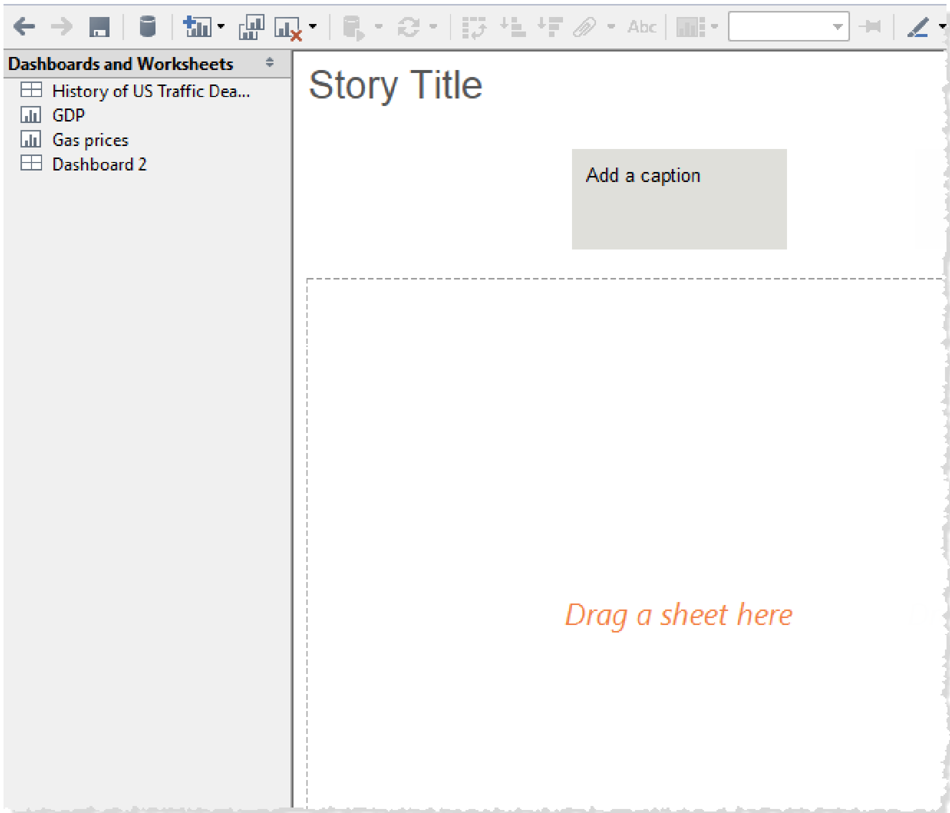
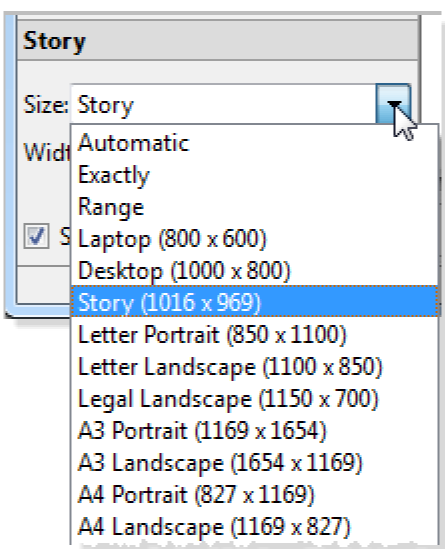


Tableau opens a new story as your starting point:

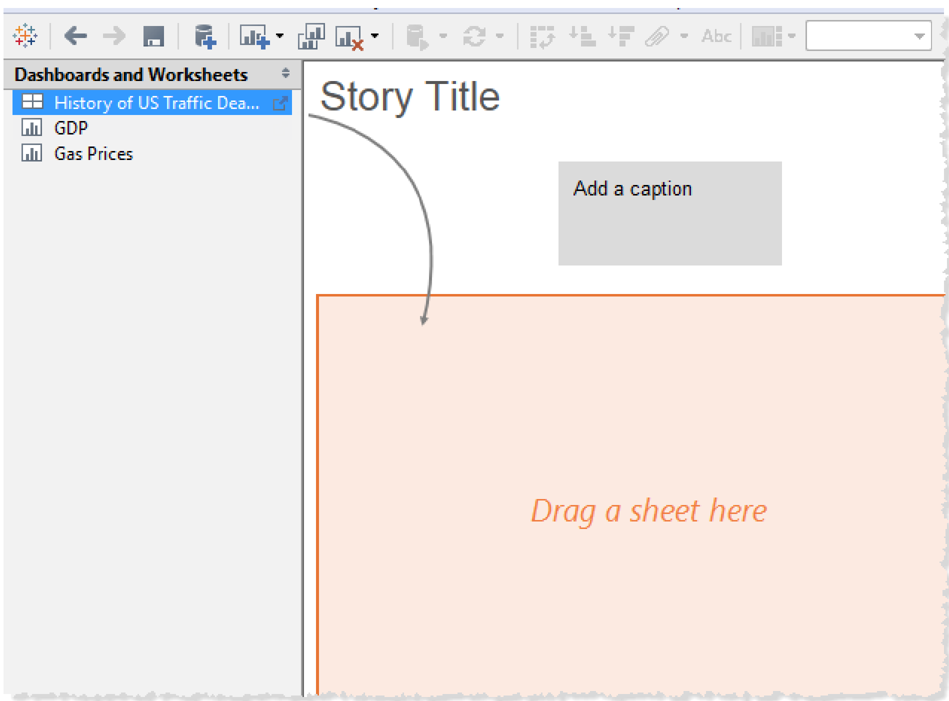


2. In the lower-left corner of the screen, choose a size for your story. Choose from one of the predefined sizes, or set a custom size, in pixels:



> **Note:** Choose a size with your target platform in mind, rather than on the platform on which you are creating the story.

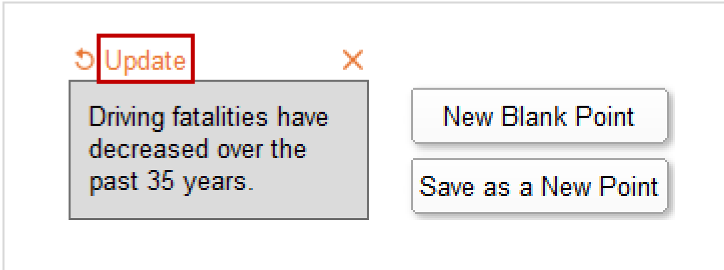
3. To add a title to your story, double-click **Story Title** to open the Edit Title dialog box. You can type your title in the dialog box, as well as choose a font, color, and alignment. Click **Apply** to view your changes.
4. Drag a sheet from the **Dashboards and Worksheets** area to the story, and drop it into the center of the view:



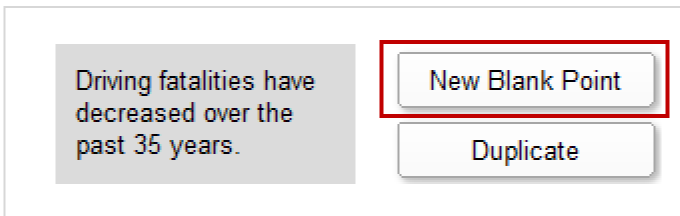
5. Click **Add a Caption** to summarize the story point.

> **Note:** You can add descriptions and annotations within each story point if you want to provide more information.

6. Customize the story point. For more information, see **Customizing a Story Point** on the next page.
7. Click **Update** above the navigator box to save your changes to the story point:



8. Add another story point. There are several way to add an additional story point:
    - Click **New Blank Point** if you want to use a different sheet for the next story point.



    - Click **Duplicate** if you want to use the current story point as the starting point for a new story point. Then customize the view or worksheet in the second story point to make it different in some way from the original.
    - Click **Save as a New Point**. This option only appears when you begin customizing a story point. After you do so, the **Duplicate** button becomes the **Save as a New Point** button. Click **Save as a New Point** to save your customizations as a new story point. The original story point remains unchanged.
9. Continue adding story points until your story is complete.

Customizing a Story Point

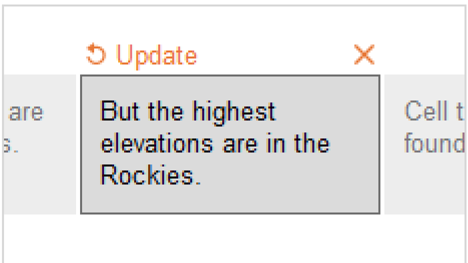
You can customize a story point in any of the following ways:

- By selecting a range of marks
- By filtering a field in the view
- By sorting on a field in the view
- By zooming in or panning on a map
- By adding a description box
- By adding annotations
- By changing the value of a parameter in the view

- By editing a dashboard text object
- By drilling down or up in a hierarchy in the view

After you modify a story point, do one of the following:

- Click **Update** to save your changes.
- Click the (circular arrow) to revert the story point to its previous state.



> **Note:** When you drag a sheet from the **Dashboards and Worksheets** pane to a story point, that sheet remains connected to the original sheet. If you modify the original sheet, your changes will automatically be reflected on the story points that use it. Changes you make in a story point do not automatically update the original sheet, however.

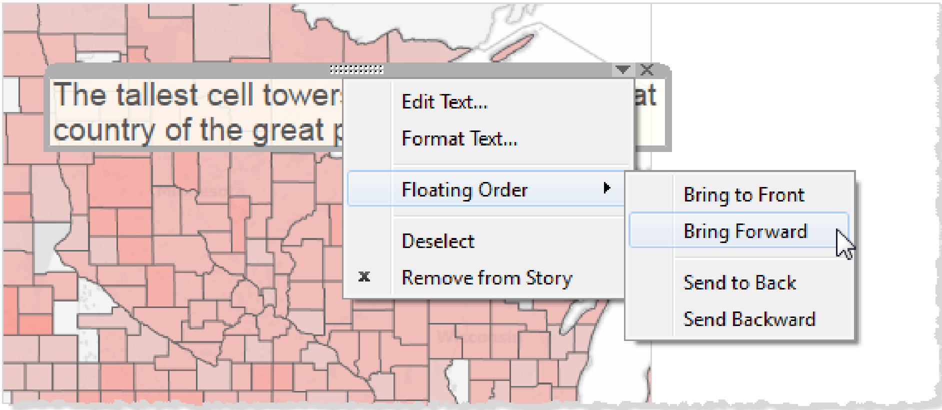
Adding a Description

You can add descriptions to a story point. To add a description, double-click **Description** in the **Dashboards and Worksheets** pane. You can add as many descriptions to a story point as you want.

Note that descriptions:

- Do not attach to marks, points, or areas in the story point. You can position them wherever you like.
- Exist only on the story point where you add them. They do not affect the underlying sheet nor any other story point in the story.

After you add a description box, click it to select and position it. When you select a description box, you can open the menu by clicking the drop-down arrow:



Use the commands on this drop-down menu to edit the description, format the description text, set its floating order relative to any other description boxes it may overlap, deselect it, or remove it from the story point.

Format a Story

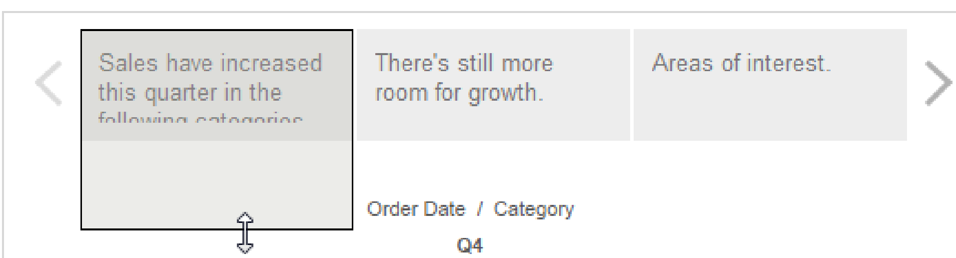
You can format a story in any of the following ways.

Re-size Captions

Sometimes the text in one or more of your captions is too long to fit inside the height of the navigator. In this case, you can re-size the captions vertically and horizontally.

1. In the navigator, select a caption.
2. Drag the border left or right to resize the caption horizontally, down to resize vertically, or select a corner and drag diagonally to resize the caption both horizontally and vertically.

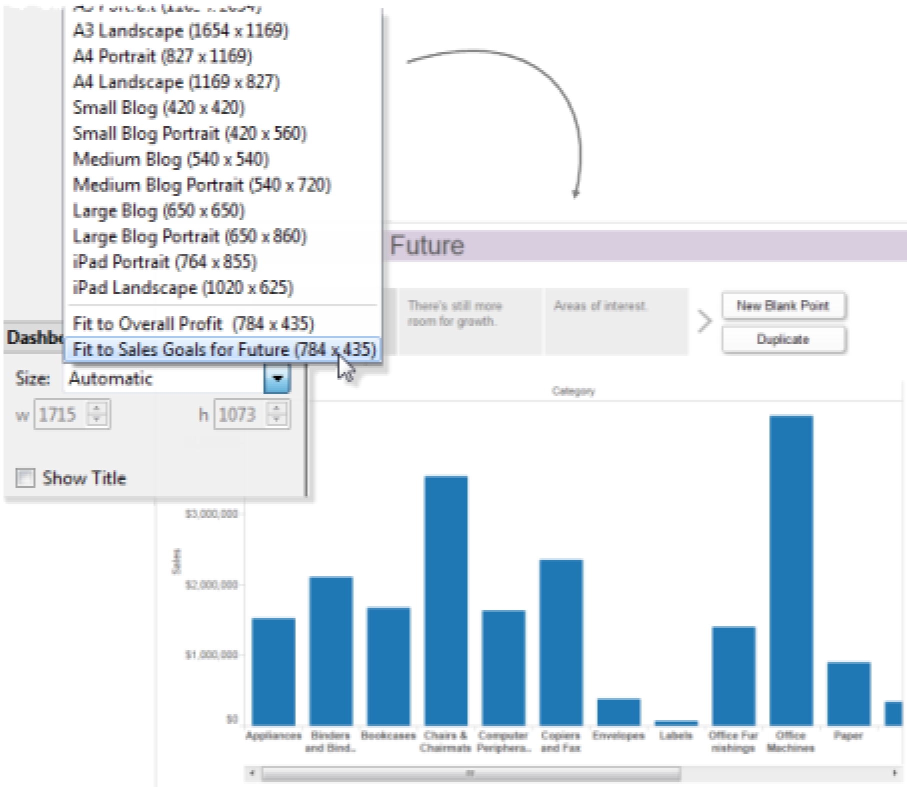
   All captions in the navigator update to the new size.



> **Note:** When resizing a caption, you can only select the left, right, or bottom border of the caption.

Fit a Dashboard to a Story

You can fit a dashboard to the exact size of a story. For example, if your story is exactly 800 by 600 pixels, you can shrink or expand a dashboard to fit inside that space. To fit a dashboard to a story, in the dashboard, click the **Dashboard Size** drop-down menu and select the story you want the dashboard to fit inside.

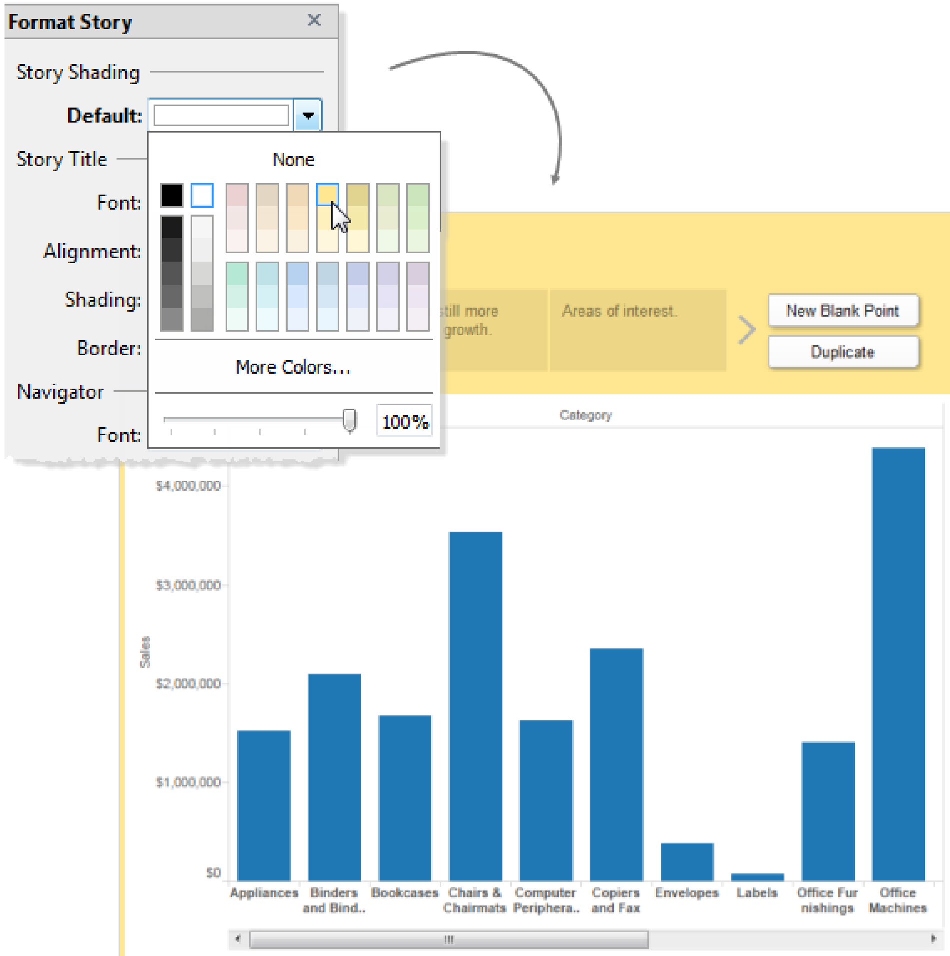


Format Story Pane

To open the **Format Story** pane, select **Format** > **Story**. In the **Format Story** pane, you can format any of the following parts of the story.

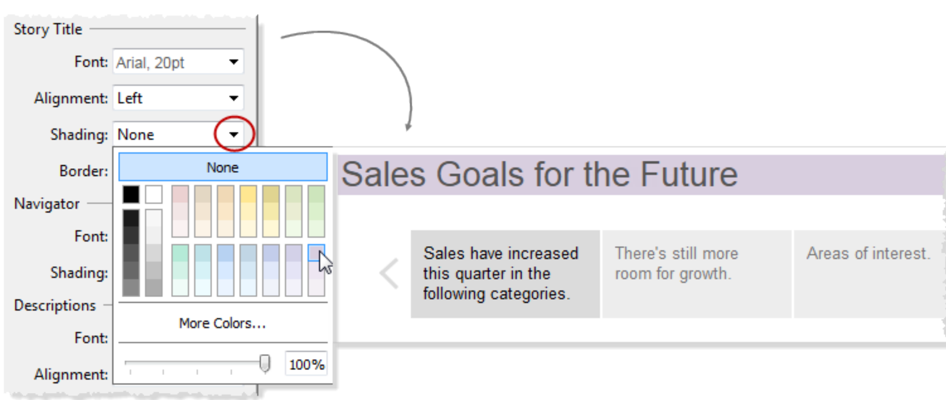
Story Shading

To select a shading for your story, in the **Format Story** pane, click the **Story Shading** drop-down control. You can select a color and transparency for the story.



Story Title

You can adjust the font, alignment, shading, and border of the story title. To format the title, click one of the drop-down controls in the **Story Title** section of the **Format Story** pane.

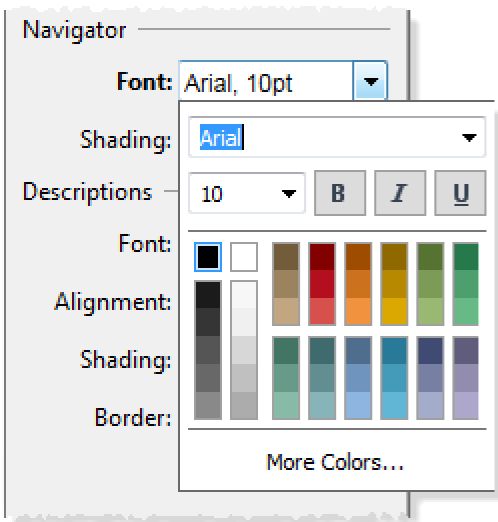


The Navigator

You can adjust the font and shading of the navigator in the **Navigator** section of the **Format Story** pane.

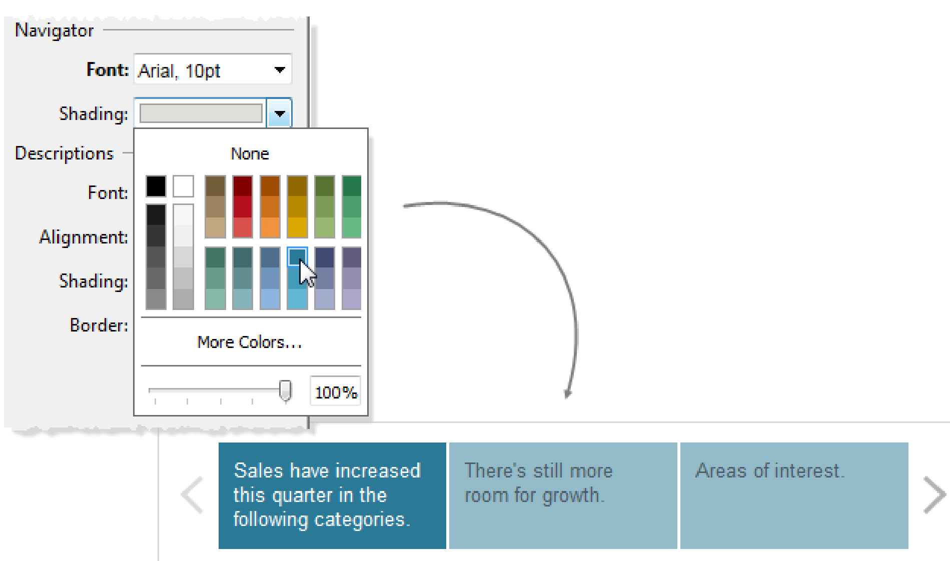
Font

To adjust the navigator font, click the **Font** drop-down control. You can adjust the style, size and color of the font.

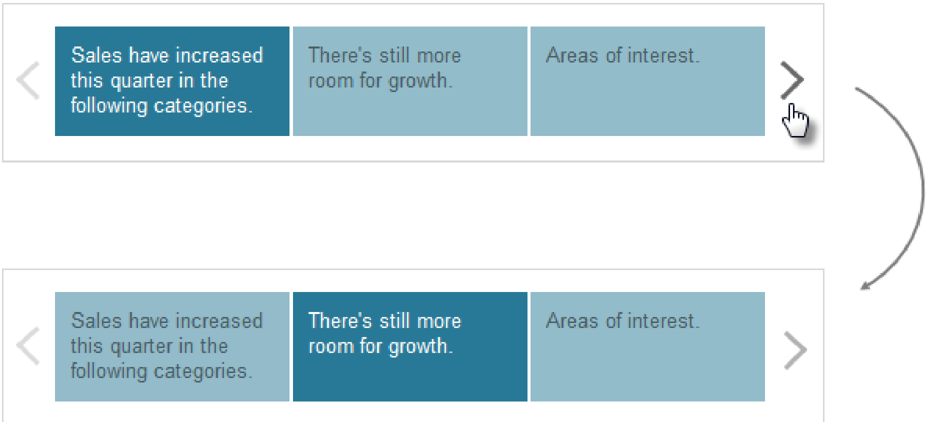


Shading

To select a shading for the navigator, click the **Shading** drop-down control. You can select a color and transparency for the navigator.



As you move through the navigator, the caption color and font updates to indicate the currently selected story point.



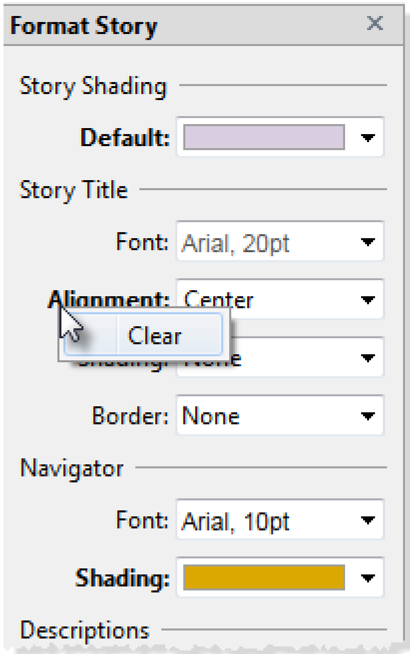
Descriptions

If your story contains any descriptions, you can format all the descriptions in the **Format Story** pane. You can adjust the font and add shading and border to the description.

Clear All Formatting

To reset the story to the default format settings, click the **Clear** button at the bottom of the **Format Story** pane.

To clear a single format setting, right-click (control-click on Mac) the format setting you want to undo in the **Format Story** pane, and then select **Clear**. For example, if you want to clear the alignment of the story title, right-click (control-click on Mac) **Alignment** in the **Story Title** section, and then select **Clear**.



Updating a Story

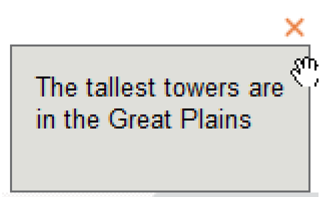
You can update a story in any of the following ways.

Revising an Existing Story Point

To revise an existing story point, click it in the navigator, and then make changes. For more information, see **Customizing a Story Point** on page 987. You can even replace the underlying sheet by dragging a different sheet from the **Dashboards and Worksheets** area onto the story pane.

Deleting a Story Point

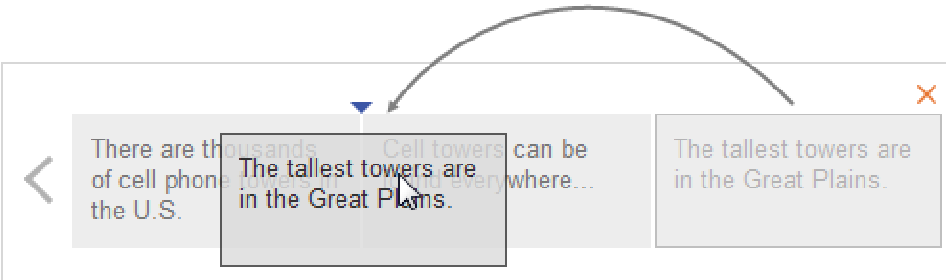
To delete a story point, click it in the navigator, and then click the ✕ (delete icon) just above the box.



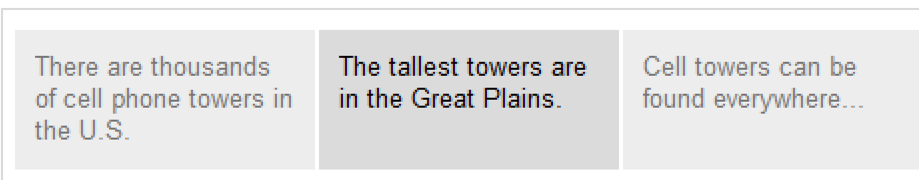
If you delete a story point by accident, click the Undo button to restore it.

Inserting a Story Point

To insert a new story point somewhere other than at the end of a story, add a story point, then drag it to the desired location in the navigator and drop it.



The story point is inserted at the specified location:



Alternatively, if you are dragging a sheet into the story, you can just drop it in the navigator between two existing story points.

Rearranging Story Points

You can use the navigator to drag and drop story points within a story as needed.

Presenting a Story

To present a story, use presentation mode. To switch in and out of presentation mode, click the Presentation Mode button  on the toolbar. To exit Presentation Mode, press **Esc** or select the Presentation Mode button in the bottom right corner of the view. For more information on Presentation Mode, see **Reorganizing the Workspace** on page 294 .

You can also publish a workbook that contains a story to Tableau Server, Tableau Online, or save it to Tableau Public. For more information on publishing workbooks, see **Publish Data Sources and Workbooks** on page 1201. Once you publish a story, the user can then open the story and navigate from story point to story point, or interact with stories just as they would interact with views and dashboards. Web users cannot, however, author stories, or permanently modify published stories.

Example – Earthquake Trend Story

This example shows how you can use Tableau to tell a story with data. The story described below considers the question: Are serious earthquakes becoming more common, or is it just that some strong earthquakes in recent years are creating that impression?

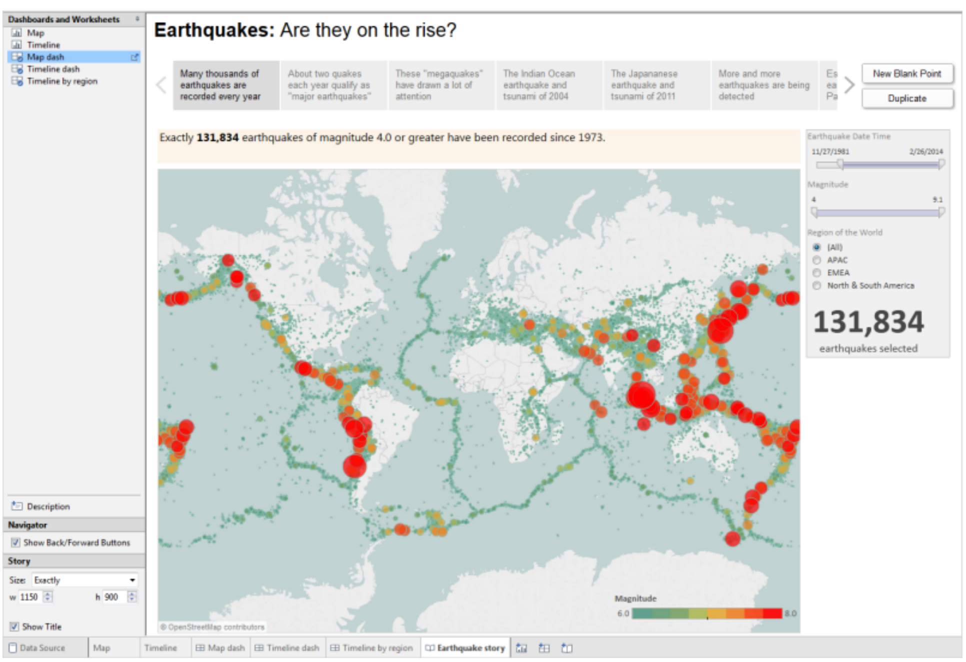
This story is available on Tableau Public: https://public.tableau.com/profile/tableau.docs.team#!/vizhome/EarthquakeTrendStoryExample/Earthquakestory

The story was built from three simple dashboards:

- A map of earthquakes recorded around the world since 2004.
- A line chart showing the number of earthquakes recorded, by year, since 1973 (timeline).
- A different version of same timeline visualization, with earthquakes broken out by region, and with trend lines added.

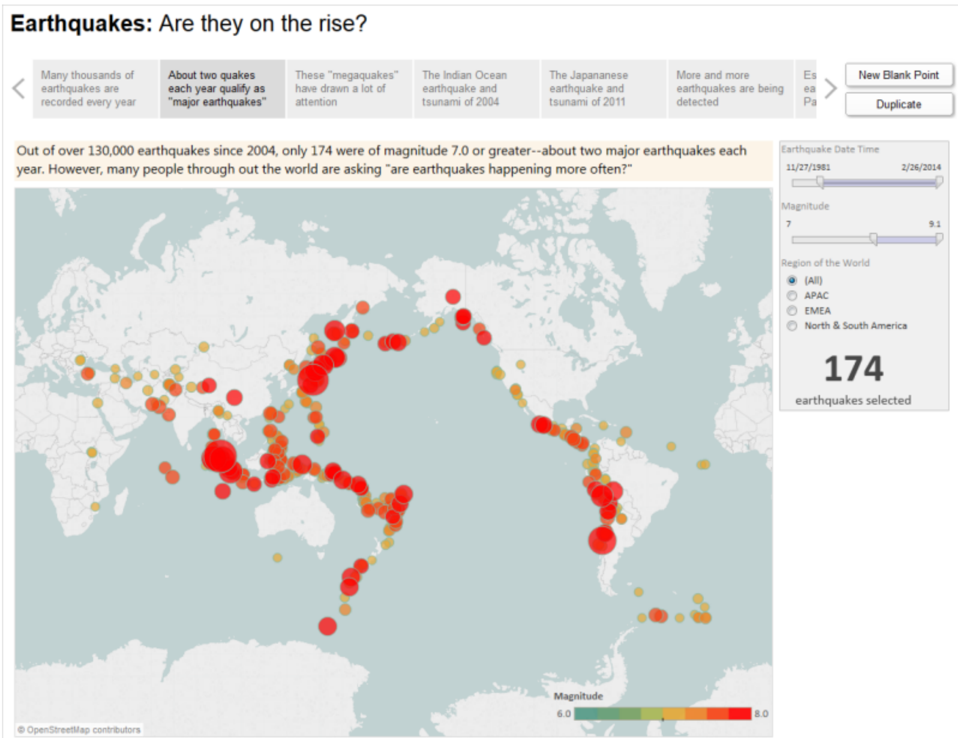
Story Point 1

The first story point shows the map with all data included—all earthquakes, across the entire planet.



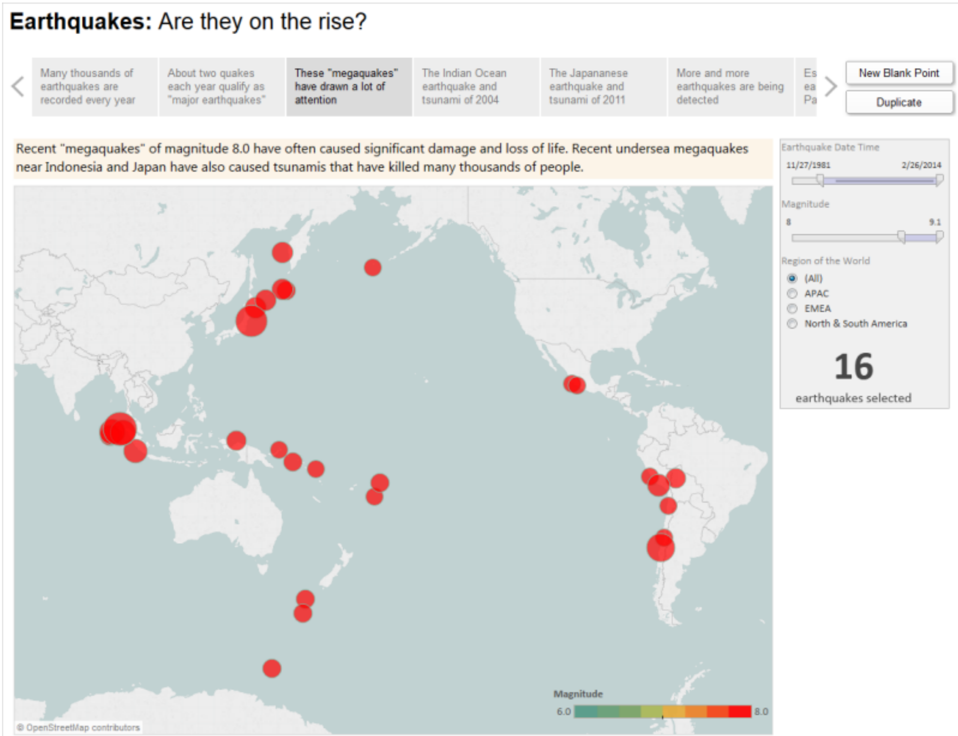
Story Point 2

The second story point compresses the time frame and filters out smaller earthquakes—everything below magnitude 7. The map pans to show the Pacific "Ring of Fire," where the majority of the large earthquakes occurred.



Story Point 3

In story point 3, the magnitude filter is adjusted to show only "megaquakes" (megathrust earthquakes of magnitude 8 or greater). The words work with the pictures to move the narrative forward.

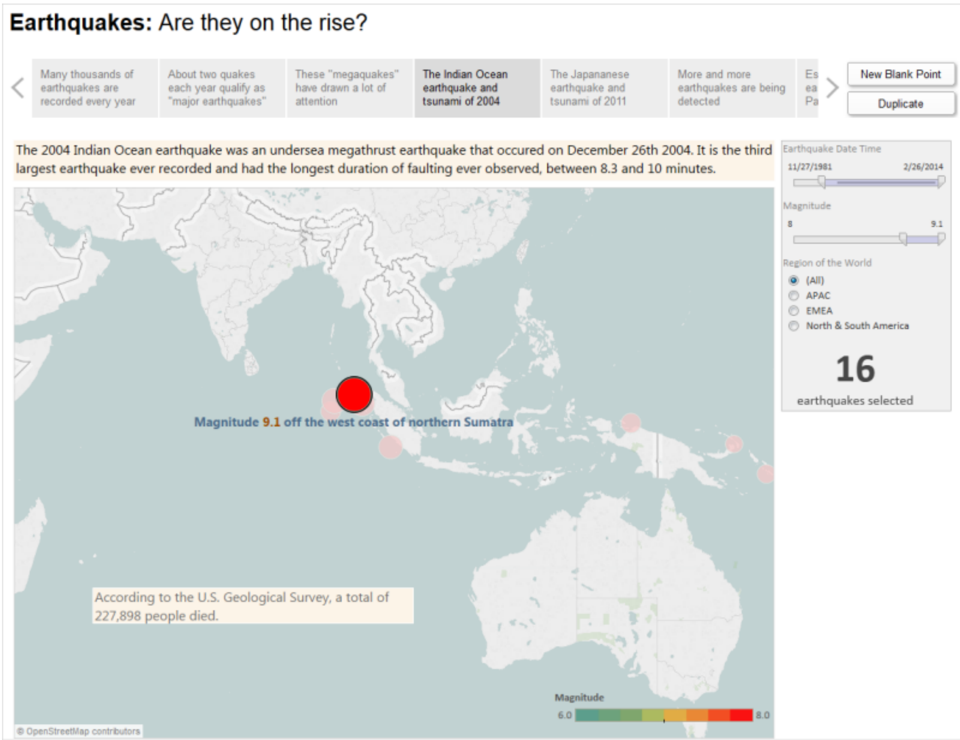


Story Points 4 and 5

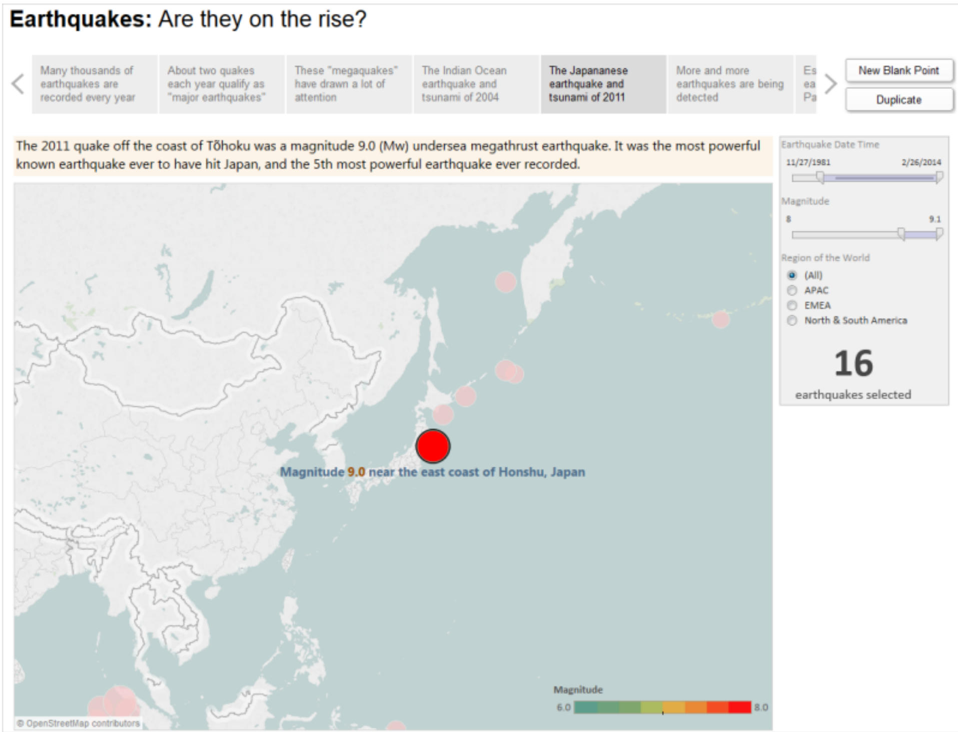
Story points 4 and 5 revisit the two most deadly earthquakes in recent history: the 2004 Indian Ocean earthquake and tsunami, and the 2001 Japanese earthquake and tsunami. You can view them below.

The first five story points have all used the same underlying dashboard—the author is creating a compelling visual story just by filtering the data and zooming and panning the map.

Story Point 4

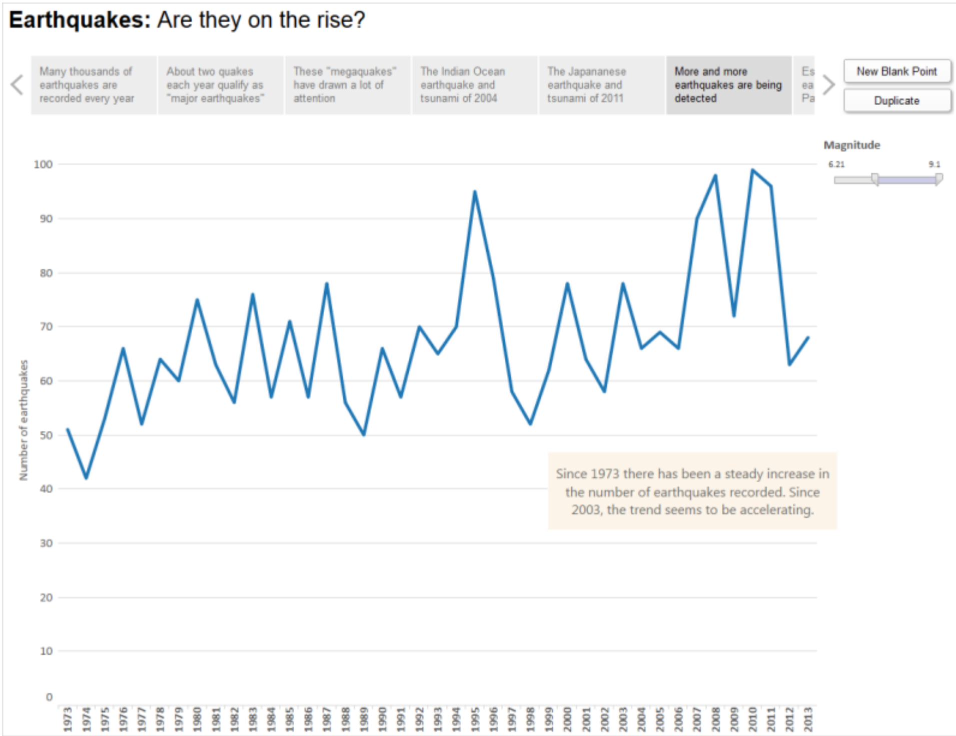


Story Point 5



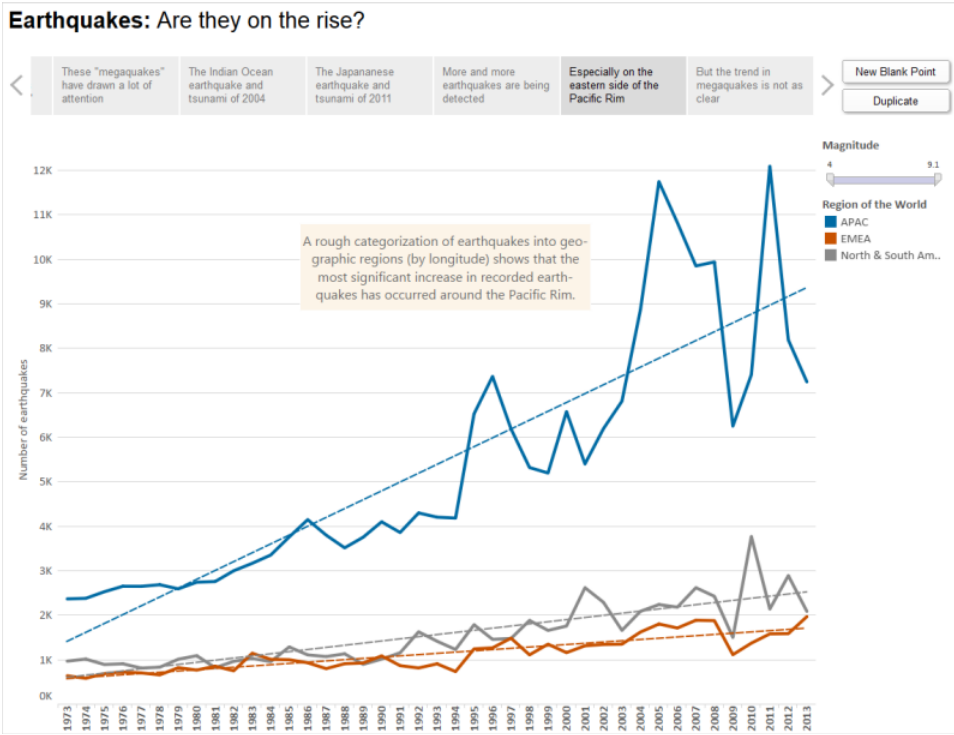
Story Point 6

Story point 6 uses a line chart to show that more quakes are being reported over time since 1973—a three-fold increase.

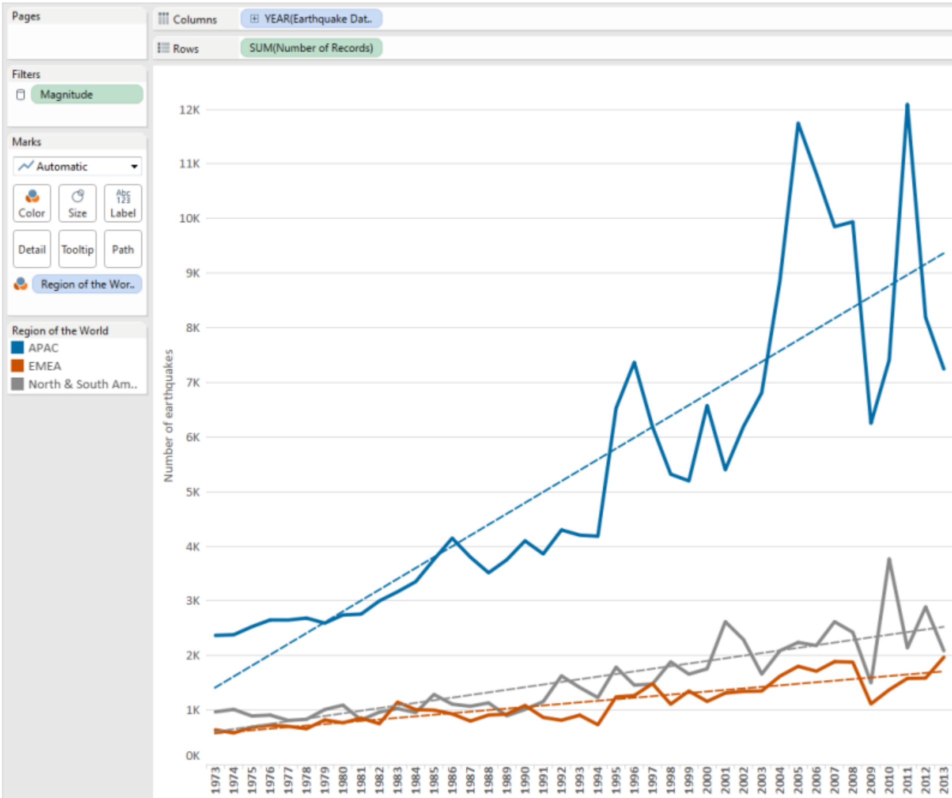


Story Point 7

Story point 7 adds two kinds of detail to the simple line chart from story point 6: it breaks out earthquakes by region, and it adds trend lines, which reduce the variability in the data.

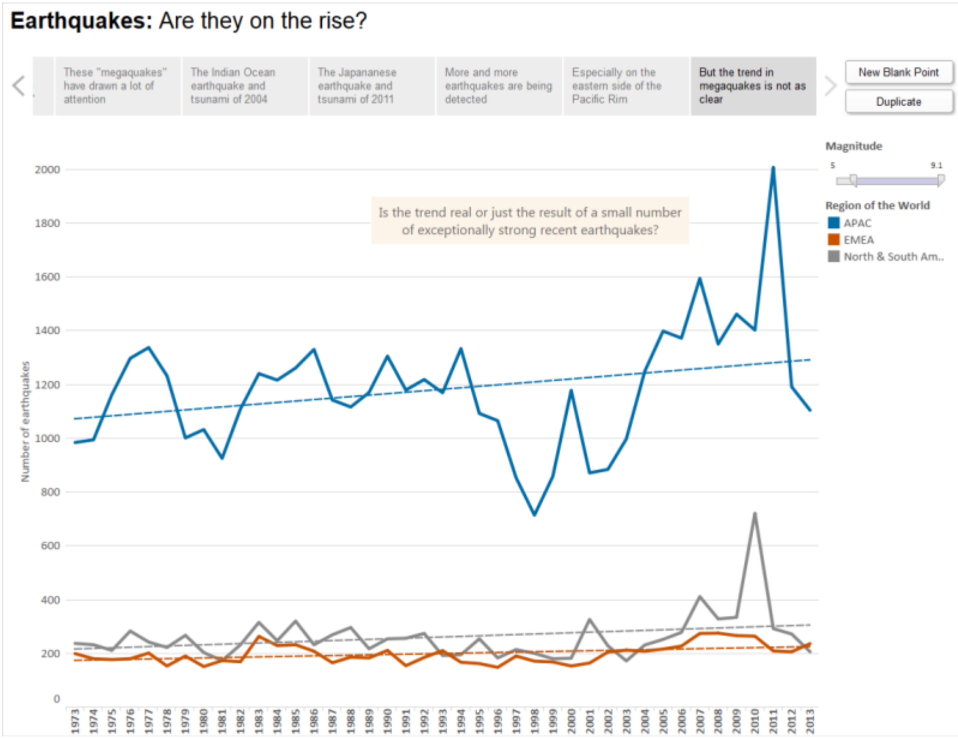


Specifically, the author has duplicated his original worksheet and then dragged region to color and added a trend line. Here is what the underlying worksheet looks like:



Story Point 8

The final story point filters out weaker earthquakes and shows that what appeared to be a very clear trend is maybe not so clear. Yes, more earthquakes have been reported in recent years, especially in the Asia-Pacific region, but could that just be natural variation? Can we be confident that the trend will continue into the future?



Earthquakes: Are they on the rise?
These "megaquakes" have drawn a lot of attention
The Indian Ocean earthquake and tsunami of 2004
The Japananese earthquake and tsunami of 2011
More and more earthquakes are being detected
Especially on the eastern side of the Pacific Rim
But the trend in megaquakes is not as clear
New Blank Point
Duplicate
Magnitude
5
9.1
Region of the World
APAC
EMEA
North & South Am..
Is the trend real or just the result of a small number of exceptionally strong recent earthquakes?
Number of earthquakes

Advanced Analysis

Now that you understand the basics of building views in Tableau, become an advanced user by learning how to create custom calculations, use the built in statistics tools, leverage dynamic parameters, and more.

Calculations

To extract meaningful results from your data, it is sometimes necessary to modify the fields that Tableau extracts from your data source. Tableau provides a calculation editor for customizing and creating fields, and also supports ad-hoc calculations that you create on shelves as you work in a view.

You can create a new calculated field called **Profit** that is the difference between the **Sales** and **Cost** fields. You could then apply an aggregation (like a summation) to this new field in order to view total profit over time. You could then display the numbers as percentages and turn on grand totals to see how these percentages vary from category to category. Finally, you could bin the new field and display the data as a histogram.

> You can use all of the following calculations if you are using a relational data source, however, multidimensional data sources do not support aggregations and binned data.

Calculated Fields

If your underlying data doesn't include all of the fields you need to answer your questions, you can create new fields in Tableau and then save them as part of the data source. For example, you could create a new calculated field called **Profit** that calculates the difference between the **Sales** and the **Cost** fields, or you could create a formula that sorts values for the **Sales Budget** field depending on whether they are under budget or over budget.

You created calculated fields in Tableau by defining a formula that is based on existing fields and other calculated fields, using standard functions and operators.You can create calculated fields using the calculation editor, or by double-clicking a field on a shelf and building an ad-hoc calculation.

You can create calculated field with Tableau Desktop or in Tableau web editing environments in products like Tableau Server and Tableau Online.

Create or Edit a Calculated Field

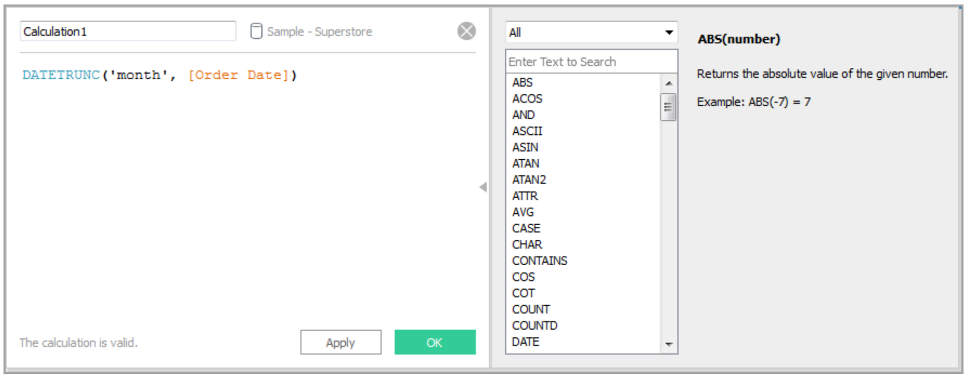
Use the calculation editor to create or modify a calculated field.

To display all collapsed content, click the (**Expand all**) button at the top of the page.

Create a Calculated Field

To open the calculation editor, click the drop down to the right of Dimensions on the **Data** pane and choose **Create Calculated Field**.

You can also choose **Analysis** > **Create Calculated Field**, or right-click (control-click on Mac) in the **Data** pane and choose **Create Calculated Field**.



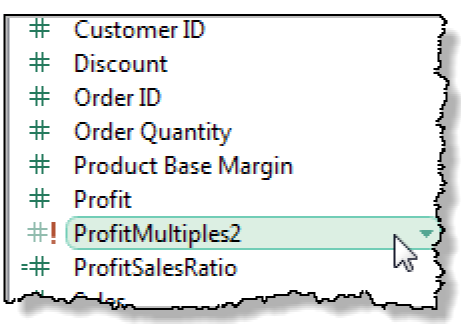
See **Create Formulas in Tableau** on page 1010 for information on how to bring the different element that make up a formula into the calculation editor.

When the workbook is connected to multiple data sources, the current data source is listed next to the calculation name box in the upper left--in the image above, the current data source is **Sample - Superstore**. As you work in the editor, any fields that you that are not from the current data source are shown with the data source prepended to the field name. For example: [DS1].[Sales].

Click **Apply** in the calculation editor to save the field as currently defined and add it to the **Data** pane without closing the editor; click **OK** to save the calculation and close the editor.

Calculations that return a string or date are saved as dimensions, and calculations that return a number are saved as measures.

Tableau will allow you to save an invalid calculation; however, a red exclamation point appears next to it in the **Data** pane:



Until you correct an invalid calculated field, you will not be able to drag it into the view.

Edit a Calculated Field

To edit a calculated field, right-click (control-click on Mac) it in the **Data** pane and select **Edit**.

You can only edit calculated fields--that is, named fields created in Tableau (as opposed to named fields that were part of the original data source).

Drag and Drop Options with the Calculation Editor

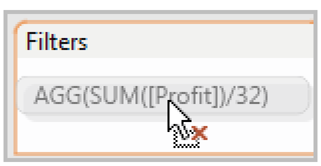
You can work on a calculation in the editor and do other things in Tableau at the same time. Here is an example of the kind of workflow that is possible with the calculation editor:

1. Start by creating or editing a view.
2. Open the calculation editor and begin working on a calculated field.
3. Drag all or part of your formula to a shelf, dropping it on an existing field, to see how it changes the view.
4. Double-click the field you just dropped on the shelf to open it as an ad-hoc calculation (see **Ad-Hoc Calculations** on page 1014 for details). Then tweak the calculation.
5. Drag the ad-hoc calculation back to the calculation editor and drop it on the original formula in the calculation editor, thereby replacing the original formula.

You can also drag all or part of a formula to the Data pane to create a new field.

As you drag formula content to a shelf, card, or pane, Tableau provides visual feedback:

- A red X indicates that you cannot drop the expression at the current location:



- If you drop an expression that you have dragged from the calculation editor onto a field in the view, the expression replaces that field. If the resulting expression is not valid, the resulting field will be red. You can then edit the expression to make it a valid field.
- If you drag in a field from a secondary data source, it comes with fully qualified name and default aggregation. For example, with a secondary data source named DS1, here is how fields might appear when dragged into the calculation editor:

```
[DS1].[Sales]
```

```
SUM([DS1].[Sales])
```

```
ATTR([DS1].[Customer Name])
```

For purposes of calculations, the primary data source is whichever data source is currently displayed in the **Data** pane.

It is not possible to drag numeric bins, generated latitude and longitude fields, **Measure Names**, or **Measure Values** into the calculation editor.

Copy and Paste Calculated Fields

Calculated fields are available to all sheets that use the same data source in a single workbook. To copy and paste calculated fields between workbooks, right-click the field in the **Data** window of the source workbook and choose **Copy**. Then iright-click in the **Data** window in the destination workbook and choose **Paste**. You can copy and paste all custom defined fields, including calculated fields, ad hoc groups, user filters, and sets.

Working in the Calculation Editor

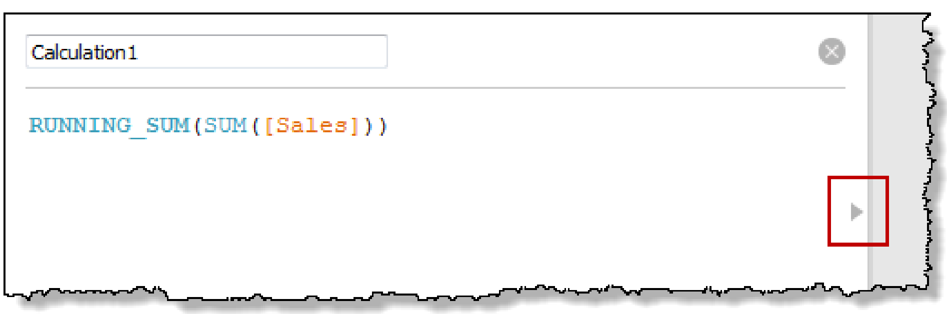
When you use the calculation editor, the result must always be a calculated field—that is, a user-created named field (as opposed to a named field that was part of the original data source). If you are editing an existing calculated field, then that field is updated when you click **OK** or **Apply**. If you are creating a new calculated field, or wish to save your modifications as a new field, type a new field name in the box at the top of the calculation editor before clicking **OK** or **Apply**. Ad-hoc calculations, by contrast, do not need to be named. See **Ad-Hoc Calculations** on page 1014.

Customizing the Calculation Editor

You can customize the calculation editor in the following ways:

- **Collapse the function list and help area**

  To provide maximum space for working on your formula, you can collapse (close) the function list and the help area on the right side of the calculation editor by clicking the angle control that is between the working area and the function list:

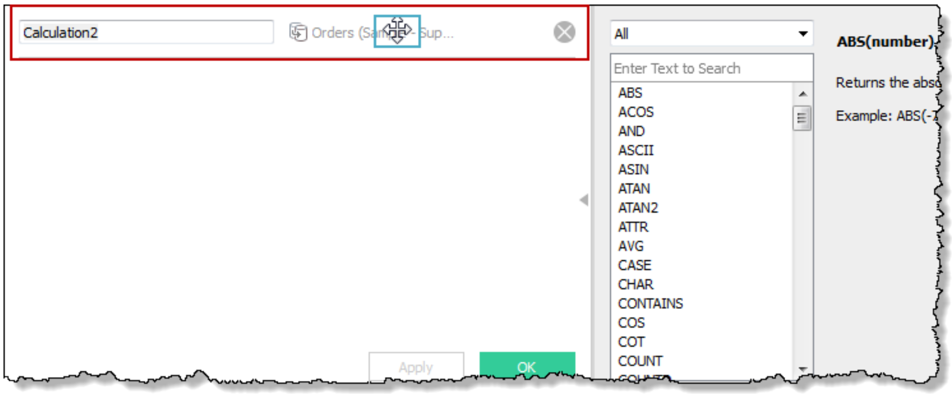
  

  Click the same control (which now faces left) to reopen the function list and help area.

- **Resize or move the calculation editor**

  You can resize the calculation editor by dragging from any of its corners.

You can move the editor by clicking in the upper-left section (anywhere in the box shown in red, below) until you see the four-way arrow cursor (outlined in blue), and then dragging:



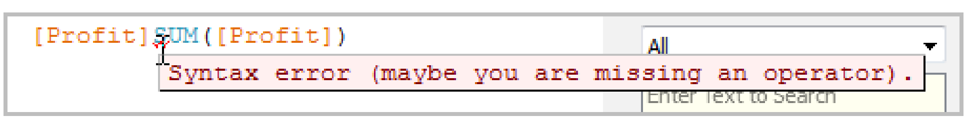
The editor is initially displayed within the view, but you can move it outside the view--for example, to a second monitor. Moving the calculation editor does not move Tableau Desktop, and moving Tableau Desktop does not move the editor.

- **Resize text**

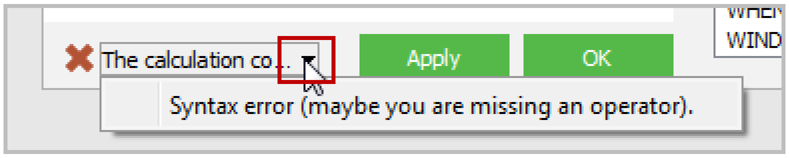
  To increase text size in the calculation editor, hold down the Ctrl key and scroll the mouse button upward. To decrease text size, hold down Ctrl and scroll the mouse button downward. All text in the editor is resized—you cannot resize only selected text. Text size persists until you close the editor. The next time you open the editor, text is at the default size.

Visual Feedback in the Calculation Editor

The calculation editor has built-in coloring and validation to help you avoid syntax errors. As you create a formula, syntax errors are underlined with a red line. Hover over the error to see a suggestion for resolving it:



Feedback on formula validity is also displayed at the bottom of the calculation editor. A green check mark indicates that the formula is valid; a red X indicates that it is not. You can click the drop down box to see details:

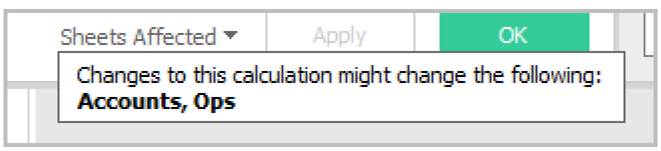


When you are writing formulas, any part that displays in bold indicates that it will be computed locally within Tableau on the aggregated results. Any normal weight text will be computed at the database level.

> **Note**: If you are connected to a Microsoft Analysis Services data source, the calculation editor contains a "Run before SSAS" check box. Choose this option to execute the Tableau calculation before any Microsoft Analysis Services calculations. For information on connecting to Microsoft Analysis Services data sources, see **Microsoft Analysis Services** on page 1345

Sheets Affected

As you edit a calculated field, you can click **Sheets Affected** in the editor's status bar to see which other sheets are using the field, which will be updated when you commit your changes:



The **Sheets Affected** drop-down is only shown if the field you are editing is also being used in other sheets.

Create Formulas in Tableau

You create formulas from the following elements:

- **Functions**

  Tableau functions are listed on the right in the calculation editor. Use the drop-down list above the function list to filter functions by category. You can also type in the **Enter Text to Search** area to find functions that match the characters that you type. By default all functions are displayed. Certain functions are only available with specific data sources. See **Additional Functions** on page 1457 for details. For complete help on Tableau functions and other keywords, see **Functions, Operators, & Data Types** on page 1407.

  Click a function in the function list to view a brief description and an example on the right. Double-click a function in the list to include it at the cursor location in the current formula.

  Functions are colored light blue in formulas.

> **Note**: Autocomplete is available in the calculation editor. For details, see **Auto-Completion for Formulas** on the next page.

- **Fields**

  You can incorporate a field in a formula by dragging it from the **Data** pane and dropping it in the calculation editor.

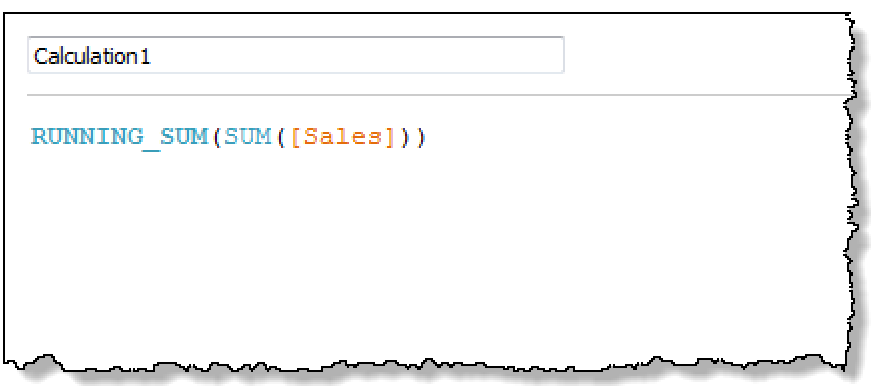
  You can also drag a field from a shelf in the view to the calculation editor. The result will not necessarily be the same as when you drag a field from the **Data** pane. For example, if you drag the **Sales** field from the **Data** pane to the calculation editor, this is what you will see:

  `[Sales]`

  But if you drag **Sales** to the **Rows** shelf and then drag it from there to the calculation editor, the field will have changed as a result of being aggregated in the view:

  `SUM([Sales])`

  You may also choose to modify a field on a shelf before dragging it to the calculation editor. For example, if you have dragged **Sales** to the **Rows** shelf and then added a quick table calculation to the field, you can drag the modified field to the calculation editor to see how the field is expressed in the Tableau calculation language, and to make further modifications. This is what you might see:



  You can also drag part or all of an ad-hoc calculation from a shelf to the calculation editor. In addition to the various drag-and-drop options, you can also just type a field name in the calculation editor. Field names that include special characters or spaces must be delimited with square brackets--for example, `SUM([Store Profit])`. For field names that actually include bracket characters, just type two additional brackets. For example, to specify a field named “Store Profit]” you would type `[Store Profit]]]`; two of the brackets say "include the bracket character in the field name," and the third bracket delimits the field name. For information on ad-hoc calculations, see **Ad-Hoc Calculations** on page 1014.

Fields are colored orange in formulas.

- **Operators**

  Type any necessary operators into your formula. All standard operators such as addition (+), subtraction (–), multiplication (*), and division (/) are supported.

  Operators are colored black in the formula.

- **Parameters**

  Parameters are placeholder variables that can be inserted into calculations to replace constant values. When you use a parameter in a calculation, you can then expose a parameter control in a view or dashboard to allow users to dynamically change the value.

  For details, see **Parameters** on page 1161.

  Parameters are colored purple in formulas.

- **Comments**

  To add a comment to a calculation, type two forward slash characters into the formula pane.

  For example:

  ```
  Sales * Profit //John’s calculation
  ```

  In this example `//John’s calculation` is a comment.

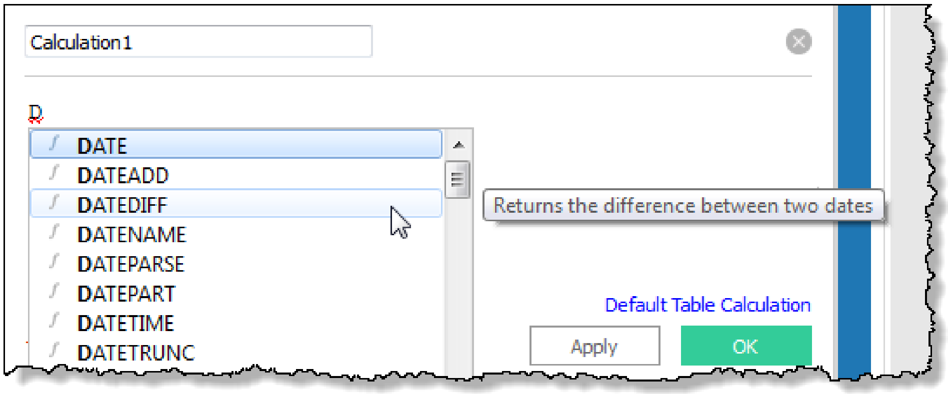
  A comment starts at the two forward slashes (//) and goes to the end of the line. A multiline comment can be written by starting each line with two forward slashes (//).

  Comments are colored green in the formula.

Auto-Completion for Formulas

As you type a formula, either in the calculation editor or in an ad-hoc calculation, Tableau displays a list of options for completing the formula.

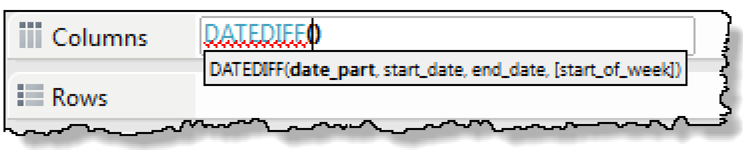
As you scroll the list, using mouse or keyboard, Tableau shows a short description when the current item is a function:



When the current item is a field, set, or bin, and that keyword has a comment attached, that comment will appear as the description.

For information on adding field comments, see **Comments** on page 232.

Click a keyword in the list or press Enter to select it. If the keyword is a function, Tableau displays syntax information when you select it:



As you type, the list of suggested keywords is organized into the following categories, in the following order:

- Functions, dimensions, measures, parameters, sets, and bins that *begin* with the string you have typed so far, from the current data source, sorted alphabetically.
- Functions, dimensions, measures, parameters, sets, and bins that *contain* the string you have typed so far, from the current data source, sorted alphabetically.
- If the workbook connects to multiple data sources, dimensions, measures, sets, and bins from the secondary data sources that *begin* with or *contain* the string you have typed so far are displayed, sorted by data source and sorted alphabetically within each data source.

Typing certain characters will either turn off auto-completion or cause it to behave differently:

- Auto-completion will not offer suggestions as you type a quoted string.
- Auto-completion will not offer suggestions if you begin by typing a number.
- If you begin by typing an open square bracket, [, auto-completion shows fields, parameters, sets, and bins, but not functions.

Auto-Completion with Multiple Data Sources

If the workbook is using multiple data sources, auto-completion behaves as follows:

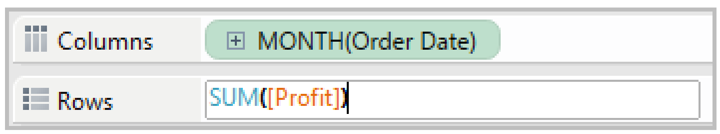
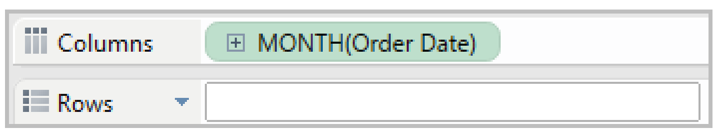
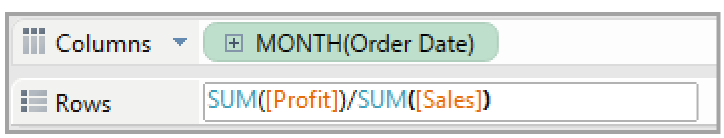
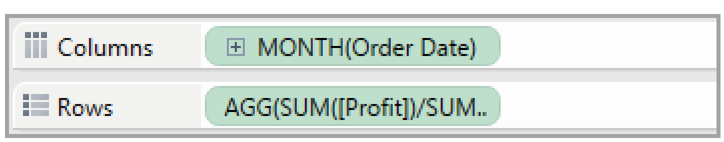
- If the selected field is from a secondary source, auto-completion adds the field with its aggregation and fully qualified name. For example:

  `ATTR([secondaryDataSource].[sate])`

- Matches from secondary sources are only shown if there is an explicit blend relationship set with the currently active sheet.
- Fields that are being used to blend the two data sources are only shown once in the search results (the field shown is from the primary data source).

Ad-Hoc Calculations

Ad-hoc calculations are calculations that you can create and update as you work with a field on a shelf in the view. Ad-hoc calculations are also known as type-in or in-line calculations.

Double-click on an existing field to start editing.	
You can also double-click on an empty shelf or on an empty part of a shelf to create a new calculation.	
Type to update the expression, or drag new fields into the expression from the **Data** pane or elsewhere in the view.	
Press Enter, Tab, or click outside the expression to commit the expression, close the calculation, and update the view.	

Press Ctrl+Enter (or Command+Enter on a Mac) to commit the expression and update the view without closing the calculation.	

Ad-hoc calculations are supported on the **Rows**, **Columns**, **Marks**, and **Measure Values** shelves; they are not supported on the **Filters** or **Pages** shelves.

Errors in ad-hoc calculations are underlined in red. Hover over the error to see a suggestion for resolving it.

> **Note**: Ad-hoc calculations are not named, but are saved when you close the workbook. If you want to save an ad-hoc calculation for use in other workbook sheets, copy it to the **Data** pane. You will be prompted to name the calculation. {On server it just deposits it w/o rename prompt.} Once you name an ad-hoc calculation, it is the same as a calculation you created with the calculation editor, and is available on other sheets in the workbook. See **Create or Edit a Calculated Field** on page 1005

Multi-Line Ad-Hoc Calculations

As you're typing an ad-hoc calculation, you can press Shift+Enter to start a new line. However, only the current line is ever visible in an ad-hoc calculation, so this can be confusing for anyone viewing or editing the calculation who has no way of knowing that it contains multiple lines.

The first line of a multi-line ad-hoc calculation can be a comment that serves as a title for the calculation. This is the only line that is visible on the shelf after the calculation is committed:

```
//City and State

[City] + ', ' + [State]
```

Ad-Hoc Calculations and Aggregation

If Tableau determines that the expression you enter is a measure (that is, returns a number), it automatically adds an aggregation to the expression when you commit the expression. For example, if you type `DATEDIFF('day',[Ship Date],[Order Date])` in an ad-hoc calculation and then press Enter, what you will see is the following:

```
SUM(DATEDIFF('day',[Ship Date],[Order Date]))
```

If you use a field that is already an aggregated field (for example, SUM([Profit])) in an ad-hoc calculation, the result is an aggregate calculation. For example, when you commit an ad-hoc calculation `SUM([Profit])/SUM([Sales])`, the result is:

```
AGG(SUM([Profit])/SUM([Sales]))
```

For more information on aggregate calculations, see **Aggregate Calculations** on page 1022.

Ad-Hoc Calculations for Insight and Experimentation

Typically you create ad-hoc calculations on-the-fly to do things like

- Test a hunch
- Try a what-if scenario
- Debug a complex calculation

Managing Ad-Hoc Calculations

Use the following keystrokes to manage ad-hoc calculations.

- Double-click in an existing field on the **Rows**, **Columns**, **Marks**, or **Measure Values** shelf to open it as an ad-hoc calculation.
- Double-click elsewhere on any of these shelves to create a new ad-hoc calculation from scratch.
- Press Esc to cancel an ad-hoc calculation.
- Press Enter to commit an ad-hoc calculation, which updates the view and closes the ad-hoc calculation. Press Ctrl+Enter to commit the change and update the view without closing the ad-hoc calculation.
- If there is a field to the right of the current ad-hoc calculation on the same shelf, pressing Tab opens that field as an ad-hoc calculation. If there is no field to the right of the current ad-hoc calculation on the shelf, pressing Tab opens a new ad-hoc calculation. Shift+Tab has the same functionality, except it moves to the left.
- When you double-click a named field on a shelf to edit it, you are not changing the original named field.

In addition, the following rules govern the use of ad-hoc calculations.

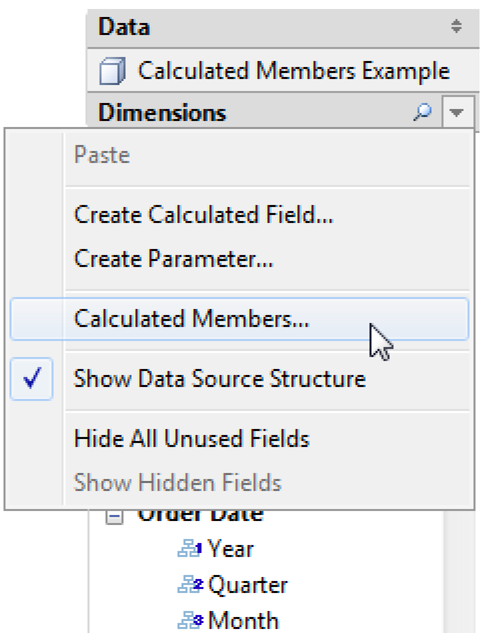
- Only one ad-hoc calculation can be open at a time.
- If a field that has a geographic role or a fiscal year setting associated with it is added to an ad-hoc calculation, the ad-hoc calculation inherits that role or setting.
- The right-click context menu for an ad-hoc calculation supports the same options that would be available for any other field in the view of the same type, including the ability to change aggregation, show a filter, or format.
- Ad-hoc calculations are not available when you create groups, sets, hierarchies, or parameters.
- Ad-hoc calculations are valid for creating trend lines, forecasts, and reference lines, bands, and distributions.

How to Create a Calculated Member

If you are using a multidimensional data source, you can create calculated members using MDX formulas instead of Tableau formulas. A calculated member can be either a calculated measure, which is a new field in the data source just like a calculated field, or a calculated dimension member, which is a new member within an existing hierarchy. For example, if a dimension Product has three members (Soda, Coffee, and Crackers) you can define a new calculated member Beverages that sums the Soda and Coffee members. When you then place the Products dimension on the **Rows** shelf it displays four rows: Soda, Coffee, Crackers, and Beverages.

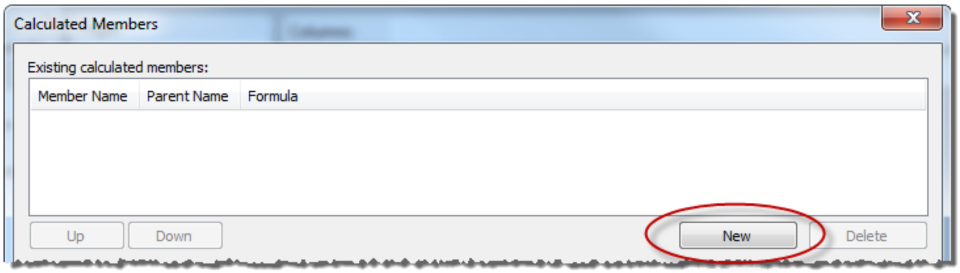
Defining Calculated Members

You can define a calculated dimension member by selecting **Calculated Members** from the Data pane menu. In the Calculated Members dialog box that opens, you can create, delete, and edit calculated members.

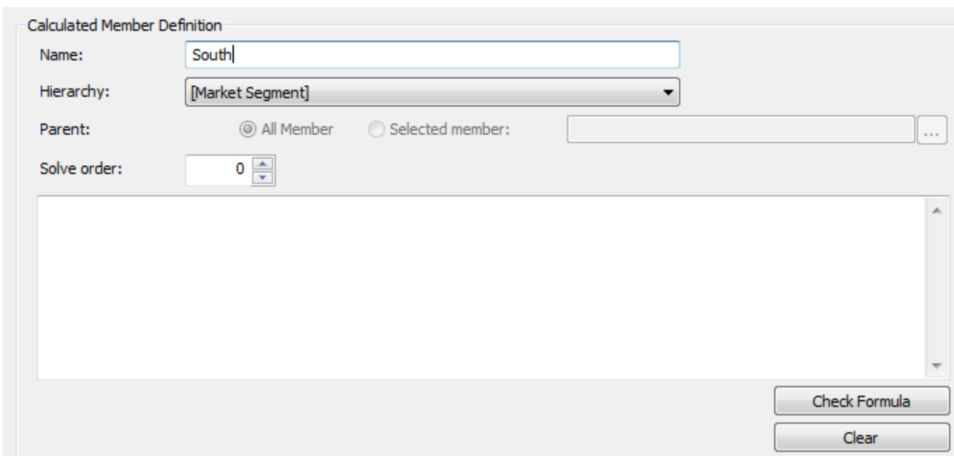


To create a new calculated member do the following:

1. Click New to add a new row to the list of calculated members at the top of the dialog box.



2. Type a Name for the new calculated member in the Member Definition area of the dialog box.



3. Specify the **Parent** member for the new calculated member. **All Member** is selected by default, however, you can choose **Selected Member** to browse the hierarchy and select a specific parent member.
4. Give the new member a solve order.

   Sometimes a single cell in your data source can be defined by two different formulas. The solve order defines the precedence given to each formula. Formulas with a lower solve order are solved first. The default solve order is zero.
5. If you are connected to a Microsoft Analysis Services data source, the calculation editor contains a **Run before SSAS** check box. Choose this option to execute the Tableau calculation before any Microsoft Analysis Services calculations. For information on connecting to Microsoft Analysis Services data sources, see **Microsoft Analysis Services** on page 1345
6. Type or paste an MDX expression into the large white text box.
7. Click **Check Formula** to verify that the formula is valid.

8. When finished, click **OK**.

The new member displays in the **Data** pane either in the Measures area, if you chose [Measures] as the parent member, or in the Dimensions area under the specified parent member. You can use the new member just like any other field in the view.

Example – Creating a Calculated Field

This example shows how to create a calculated field using Tableau formulas and then use the new field in a data view.

1. Connect to the **Sample - Superstore** data source, which is included with Tableau Desktop.

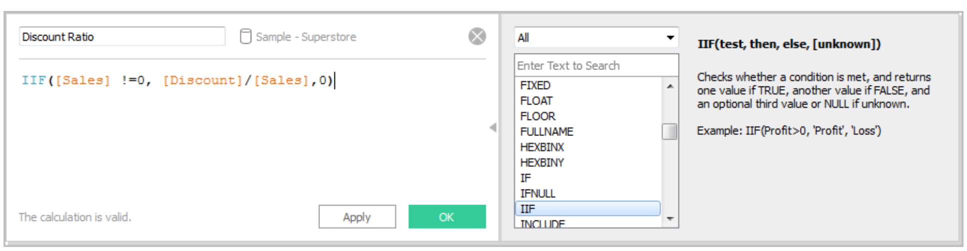
2. Click the drop down to the right of Dimensions on the **Data** pane and select **Create Calculated Field** to open the calculation editor.

   See **Create Formulas in Tableau** on page 1010 for information on how to bring the different element that make up a formula into the calculation editor.

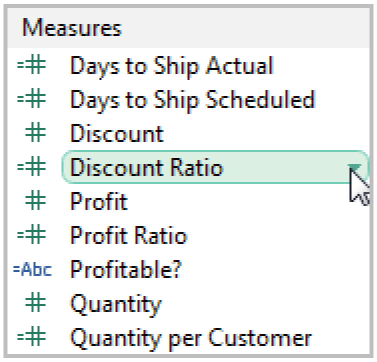
3. Name the new field **Discount Ratio** and create the following formula:

   ```
   IIF([Sales] !=0, [Discount]/[Sales],0)
   ```

   Build the formula by first double clicking the **IIF** statement from the function list and then either dragging the fields from the **Data** pane or typing them in the editor. You must type the operators (`!=` and `/`) manually.The `IIF` statement is used to avoid dividing by zero. For information on the `IIF` statement, see **Logical Functions** on page 1428.



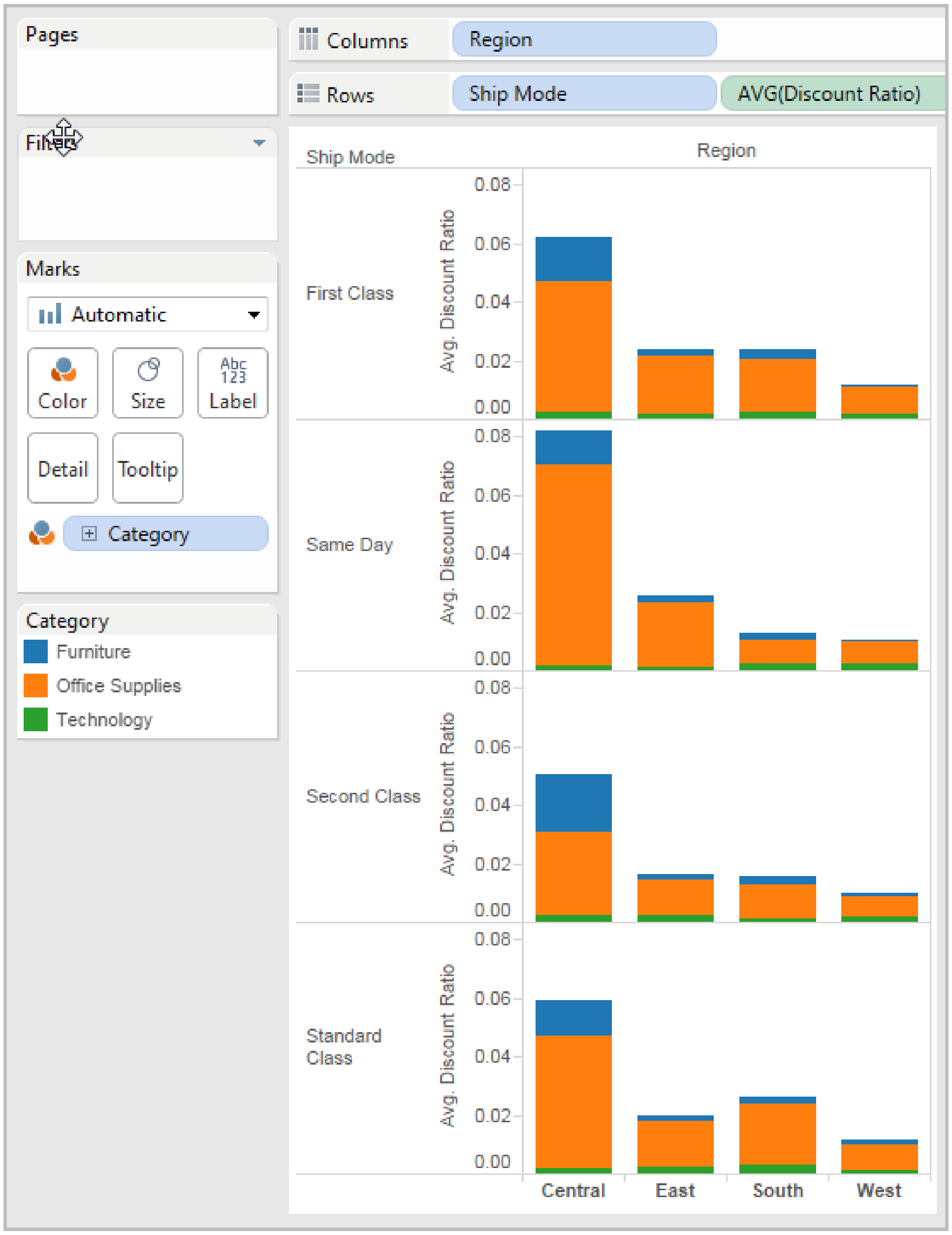
4. Click **OK** to add the new field to the Measures area in the **Data** pane. The new field is listed under Measures instead of Dimensions because the calculation returns a number.



5. Use the calculation in a new view.

   Place **Region** on the **Columns** shelf, **Ship Mode** on the **Rows** shelf, and **Category** on Color in the Marks card. Then place the new calculated field, **Discount Ratio**, on the **Rows** shelf.

6. Change the aggregation for **Discount Ratio** for the field in the view from Sum to Average. To do this, right-click (Control-click on a Mac) the **Discount Ratio** field on the **Rows** shelf and choose **Measure** > **Average**. Here is what the view should now look like:



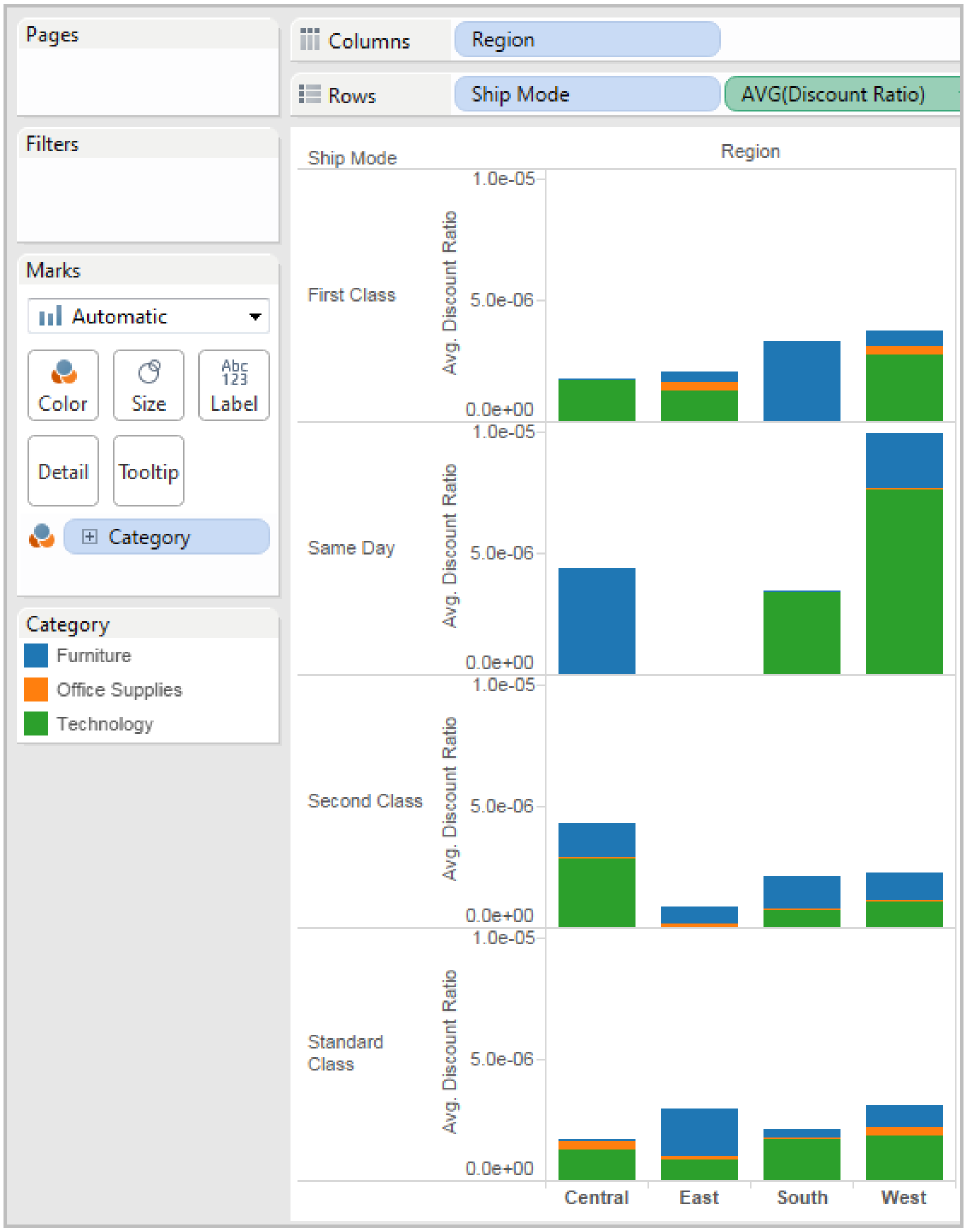
7. But now you learn that there has been a change in company policy. You must edit the calculation to compute discount ratio only for sales over $2000.

   Right-click **Discount Ratio** in the **Data** pane and select **Edit**.

   In the calculation editor, change the formula to compute discount ratio only for sales over $2000:

```
IIF([Sales] > 2000, [Discount]/[Sales], 0)
```

The view automatically updates after you click **OK** to dismiss the calculation editor.



Aggregate Calculations

Aggregate functions allow you to summarize data. As described in **Aggregations** on page 245, Tableau includes a variety of predefined aggregations such as summation and variance. An aggregate calculation allows you to define aggregations other than these predefined choices.

About Aggregate Calculations

Suppose you want to analyze the overall gross margin for every product in your data source. One way to do this is to create a new calculated field called **Margin** that is equal to the profit divided by the sales. Then you could place this measure on a shelf and use the predefined summation aggregation. In this scenario, **Margin** is defined as follows:

```
Margin = SUM([Profit]/ [Sales])
```

This formula calculates the ratio of profit and sales for every row in the data source, and then sums the numbers. That is, the division is performed before the aggregation. However, this is almost certainly not what you would have intended because summing ratios is generally not useful.

Instead, you probably want to know the sum of all profits divided by the sum of all sales. That formula is shown below.

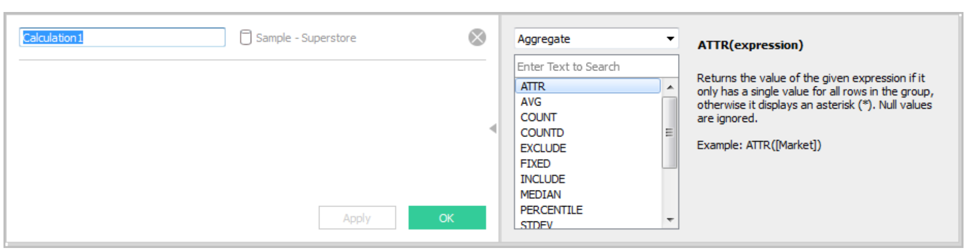
```
Margin = SUM( [Profit]) / SUM([Sales])
```

In this case, the division is performed after each measure is aggregated. An aggregate calculation allows you to create formulas like this.

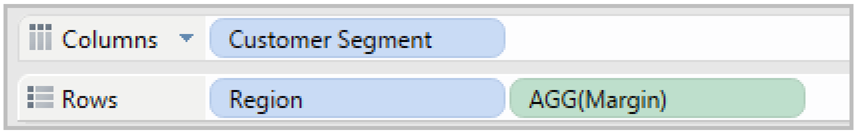
How to Create an Aggregate Calculation

When a calculation uses an aggregate function, it's called an aggregate calculation. You create an aggregate calculation by defining a new calculated field as described in **Create or Edit a Calculated Field** on page 1005. The formula will contain one or more aggregate functions. You can easily pick an aggregate function in the calculation editor by selecting the **Aggregate** category from the Functions menu as shown below.

These functions are identical to the predefined aggregate functions listed in **Aggregations** on page 245.



The aggregate calculation appears with the letters **AGG** in front of it when it is placed on a shelf.



When you create an aggregate calculation, no further aggregation of the calculation is possible. Therefore, the field's context menu does not offer any aggregation choices. However, you can disaggregate the field.

The rules that apply to aggregate calculations are:

- For any aggregate calculation, you cannot combine an aggregated value and a disaggregated value. For example, `SUM(Price)*[Items]` is not a valid expression because `SUM(Price)` is aggregated and `Items` is not. However, `SUM(Price*Items)` and `SUM(Price)*SUM(Items)` are both valid.
- Constant terms in an expression act as aggregated or disaggregated values as appropriate. For example: `SUM(Price*7)` and `SUM(Price)*7` are both valid expressions.
- All of the functions can be evaluated on aggregated values. However, the arguments to any given function must either all be aggregated or all disaggregated. For example: `MAX(SUM(Sales),Profit)` is not a valid expression because `Sales` is aggregated and `Profit` is not. However, `MAX(SUM(Sales),SUM(Profit))` is a valid expression.
- The result of an aggregate calculation is always a measure.
- Like predefined aggregations, aggregate calculations are computed correctly for grand totals. Refer to **Grand Totals** on page 1149 for more information.

Aggregate Calculations in a Disaggregated State

If an aggregate calculation is disaggregated, the calculation is modified in a way that depends on the functions used. Every function has a disaggregated substitute, as shown below.

Aggregation Function	Disaggregated Substitute
AVG(data)	data
COUNT(data)	IIF(ISNULL(data),0,1)
COUNTD(data)	IIF(ISNULL(data),0,1)
MAX(data)	data
MIN(data)	data
STDEV(data)	Null
STDEVP (data)	IIF (ISNULL (data), Null, 0)

Aggregation Function	Disaggregated Substitute
`SUM(data)`	`data`
`VAR(data)`	`Null`
`VARP (data)`	`IIF (ISNULL (data), Null, 0)`

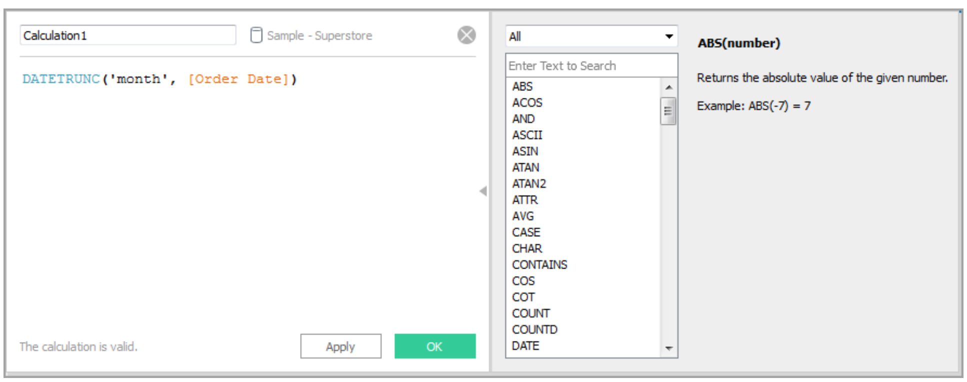
Note that `STDEV` and `VAR` are Null because those functions return Null if there are fewer than two elements in a group that are not Null, and each group has size 1 when it is disaggregated. See **Aggregations** on page 245 for descriptions of the aggregation functions.

Therefore, if you define an aggregate calculation called `Margin` that is equal to `SUM(Profit)/SUM(Sales)` and then disaggregate the data, it is interpreted as `Profit/Sales`.

Example – Aggregate Calculation

This example shows how to create an aggregate calculation called Margin, and use the new field in a data view.

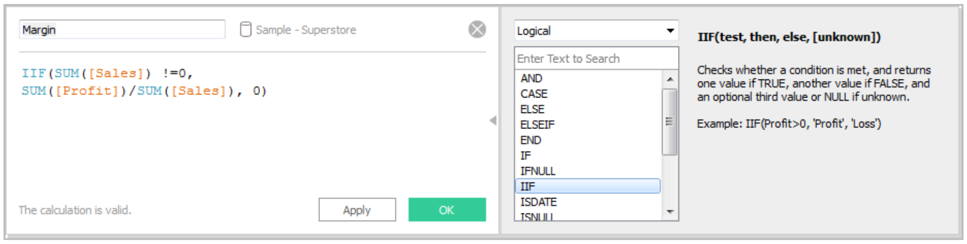
1. Connect to the **Sample - Superstore** data source, which is included with Tableau Desktop.
2. Click the drop down to the right of Dimensions on the **Data** pane and choose **Create Calculated Field** to open the calculation editor.

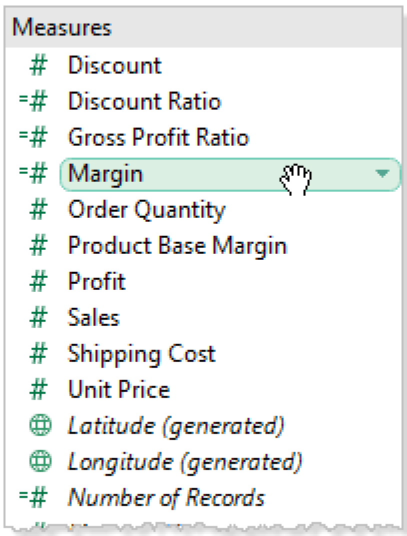
   See **Create Formulas in Tableau** on page 1010 for information on how to bring the different element that make up a formula into the calculation editor.
3. Name the new field **Margin** and create the following formula:

   ```
   IIF(SUM([Sales]) !=0, SUM([Profit])/SUM([Sales]), 0)
   ```
4. Build the formula by first double clicking the **IIF** statement from the function list and then either dragging the fields from the **Data** pane or typing them in the editor. You must type the operators (`!=` and `/`) manually.The `IIF` statement is used to avoid dividing by zero.

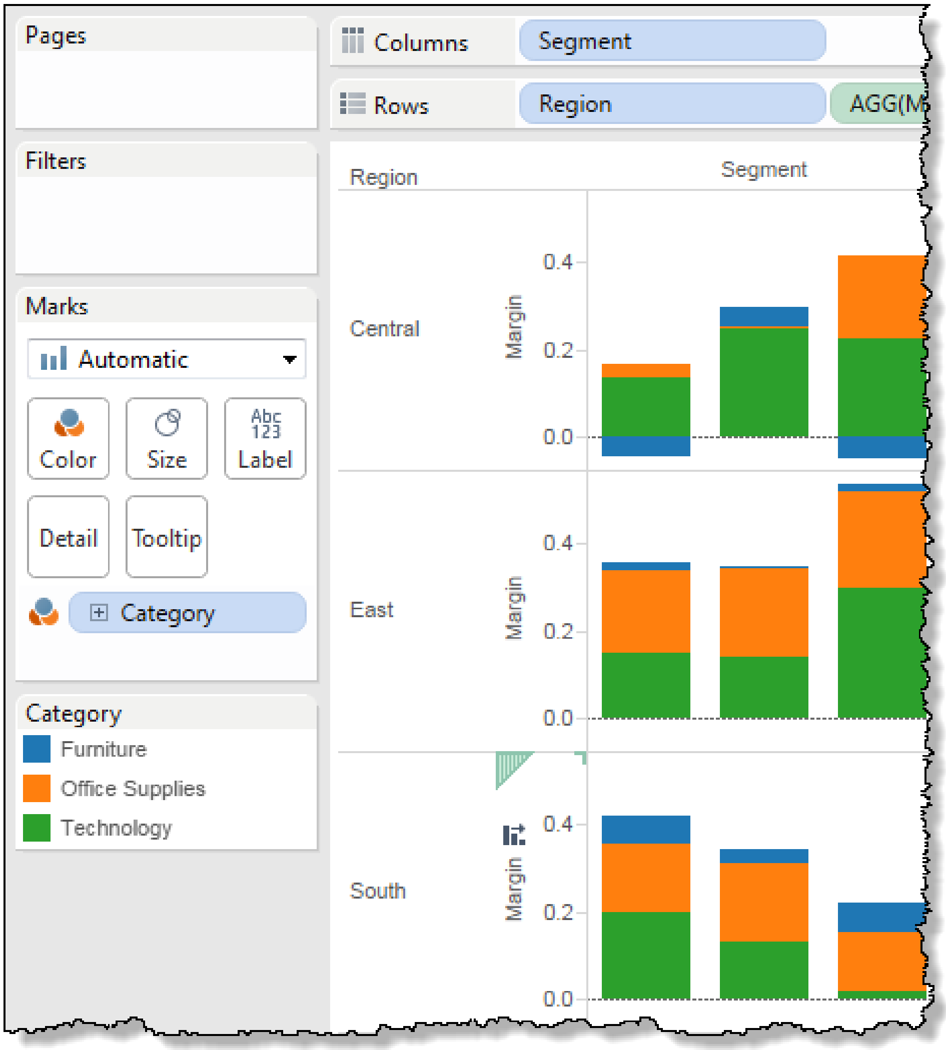
For information on the `IIF` statement, see **Logical Functions** on page 1428.



The new calculated field displays in the **Measures** area of the **Data** pane where you can use it like any other measure.

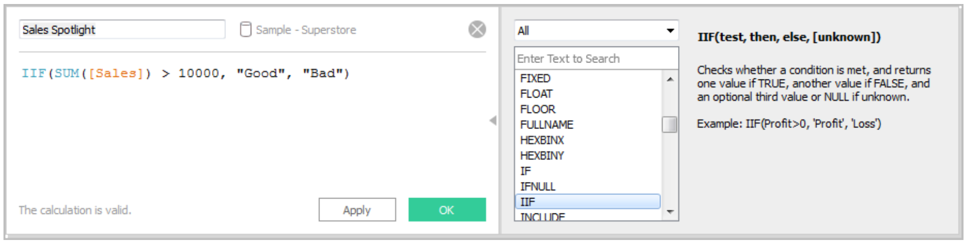


When **Margin** is placed on a shelf, its name is automatically changed to **AGG(Margin)**, which indicates that it is an aggregate calculation. As a result, the field's context menu does not include any aggregation choices because it is not possible to aggregate a field that is already aggregated.

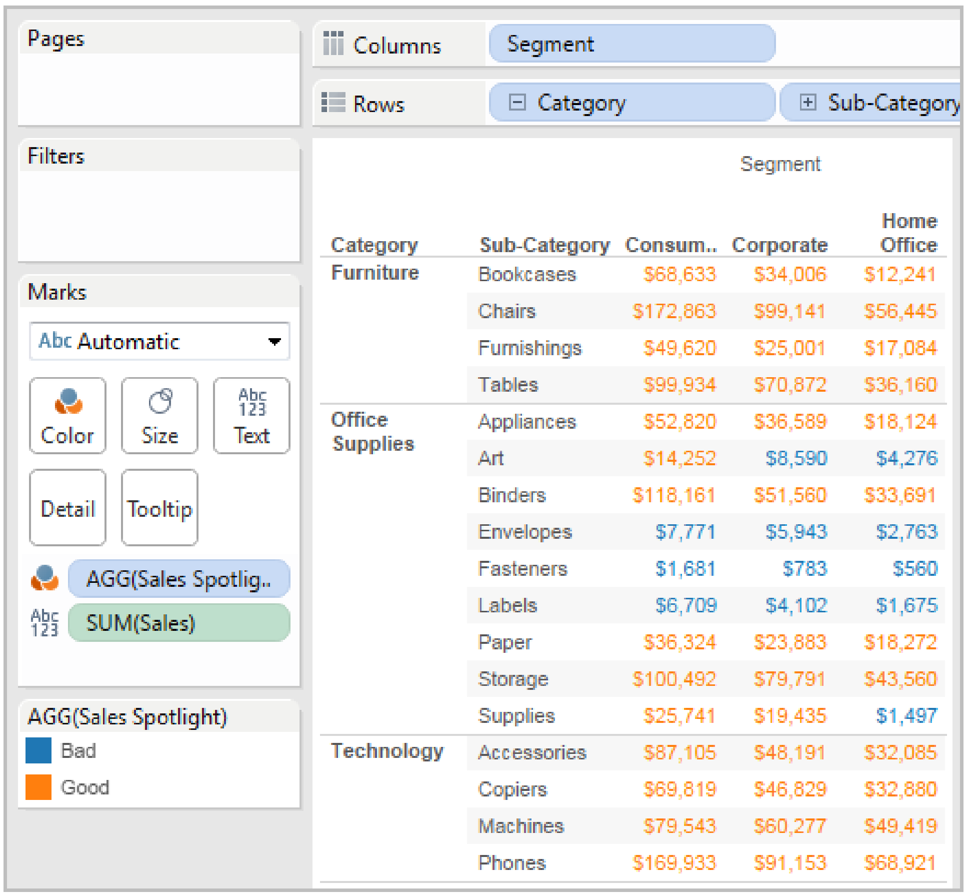


Example - Spotlighting Using Calculations

Spotlighting is a technique for showing discrete thresholds based on the values of a measure. For instance, you might want to color-code sales so that those over 10,000 appear green and those below 10,000 appear red. A spotlighting calculation is just a special case of a calculation that results in a discrete measure. A discrete measure is a calculation that is a dependent variable (and therefore a measure), but which results in a discrete result (as opposed to a continuous result). Thus the name discrete measure. Here is an example:



The formula in this example defines a discrete measure named **Sales Spotlight**. Discrete measures always appear with a blue **abc** icon in the **Data** pane. **Sales Spotlight** is classified as a measure in Tableau because it is a function of another measure; it is discrete because it produces discrete values (“Good” and “Bad”). Here is an example of this categorical measure in use:

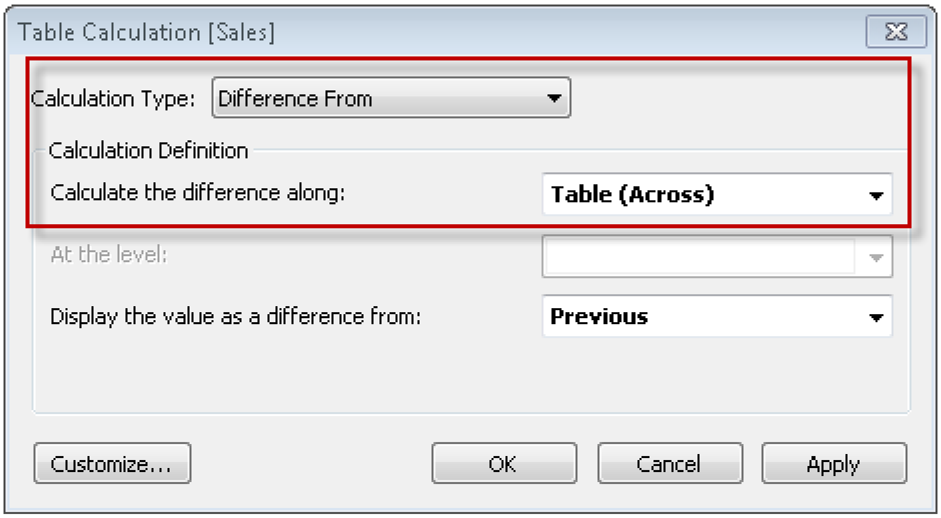


Here, **Sales Spotlight** is on Color in the Marks card. It appears with the **AGG** prefix because it is an aggregate calculation. Values above 10,000 and below 10,000 are assigned different colors.

Table Calculations

Understanding Table Calculations

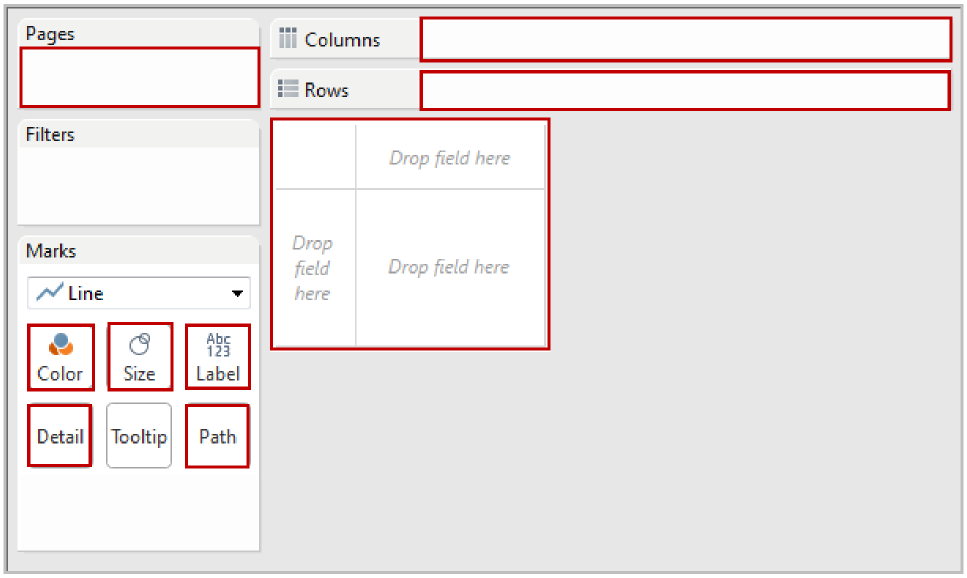
Table calculations are computations that are applied to the values in the table. These computations are unique in that they use data from multiple rows in the database to calculate a value. To create a table calculation, you need to define both what values you want to compute and what values to compute along. These are defined in the Table Calculation dialog box using the Calculation Type and Calculate Along drop-down menus.



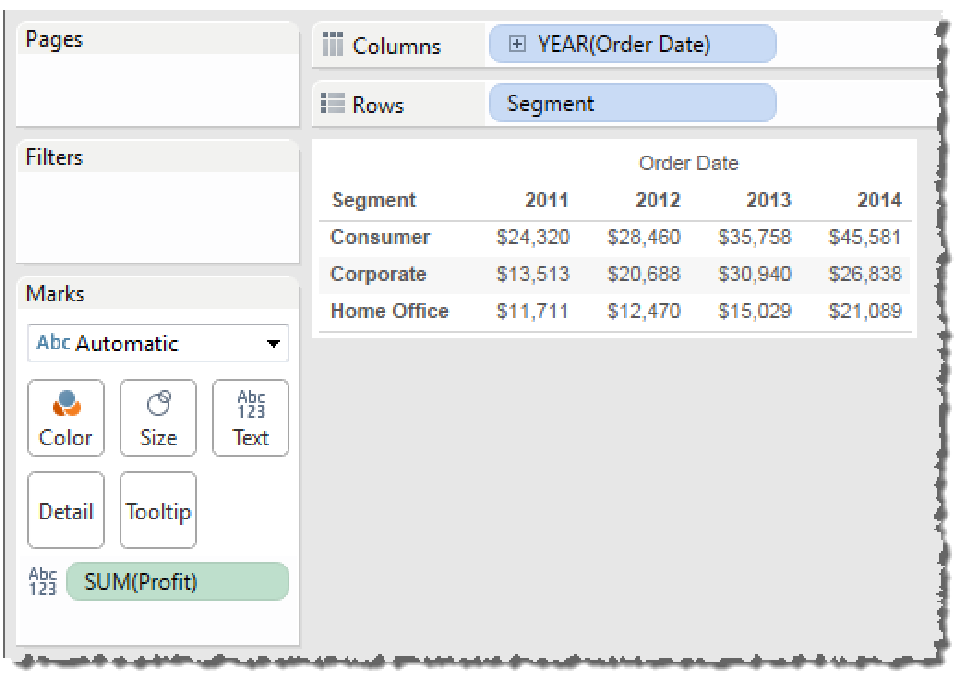
The definition of what to compute along has two parts: addressing fields and partitioning fields.

What is a Table Calculation?

For any Tableau view, there is a virtual table that is determined by the dimensions in the view. This table is not to be confused with the tables in your data source. Specifically, the virtual table is determined by the dimensions within the “level of detail,” which means the dimensions on any of the following shelves or cards in aTableau worksheet:



A table calculation is a transformation you apply to the values of a single measure in your view, based on the dimensions in the level of detail. Consider this simple view:



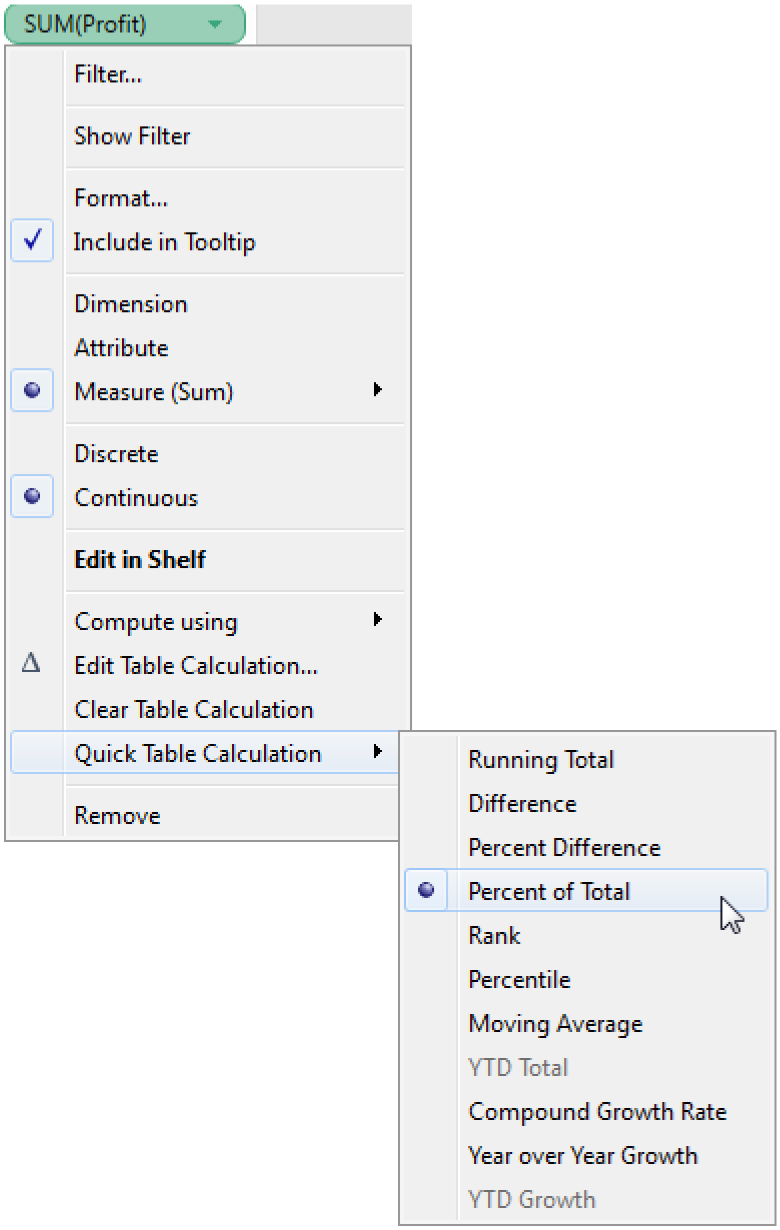
In this view, the dimensions are **Order Date** (with values aggregated up to **YEAR**) on **Columns**, and **Segment** on **Rows**. The individual cells in the table show the value of the **Profit** measure for each combination of **Order Date** and **Segment**. There are four years' worth of **Order Date** data, and three **Segments**; multiply these numbers to get 12 individual cells, each showing a **Profit** value.

Suppose you want to see not absolute dollar values, but the percentage of the total profit that each of these 12 individual profit values contributes to the total profit, so that when all the cell values are added, they total 100%. To do this, you can add a table calculation. Here's how.

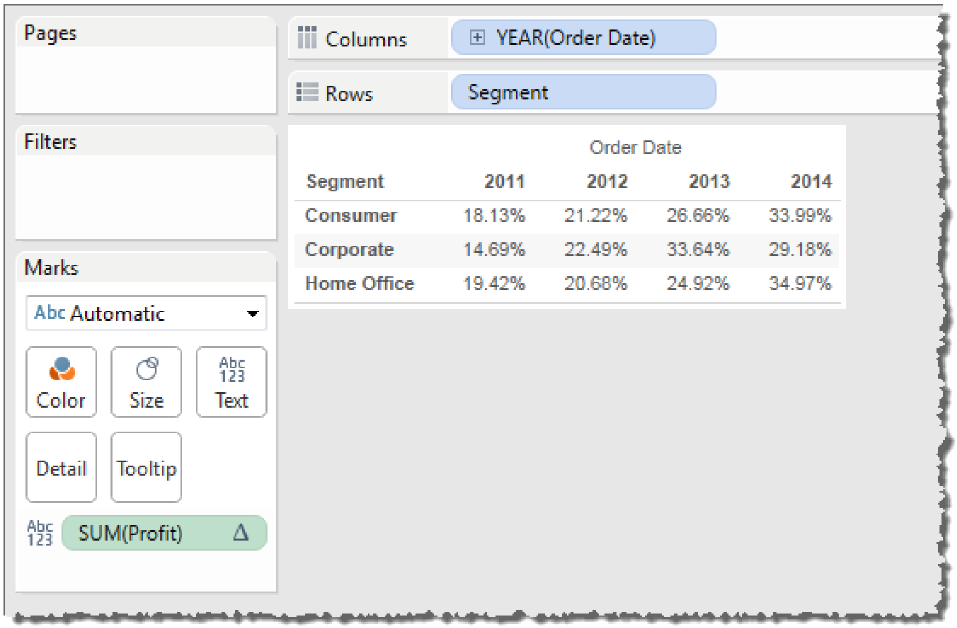
1. You always add a table calculation to a measure in the view. In this case there is only one measure in the view—**SUM(Profit)**—so when you right-click that measure on the Marks card (Control-click on a Mac) you will see two options that mention table calculations:

   - **Add Table Calculation**
   - **Quick Table Calculation**

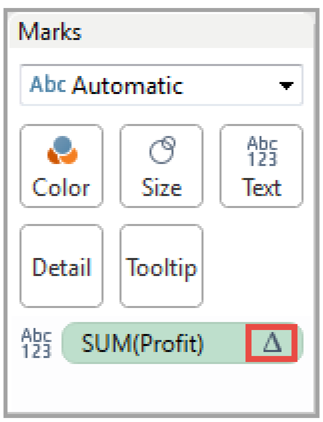
   If you choose **Quick Table Calculation**, you will see a range of options:



2. **Percent of Total** looks right. Choose that, and the view updates to show percentages, instead of absolute dollar values:



Notice the triangle icon that now appears next to **SUM(Profit)** on the Marks card:

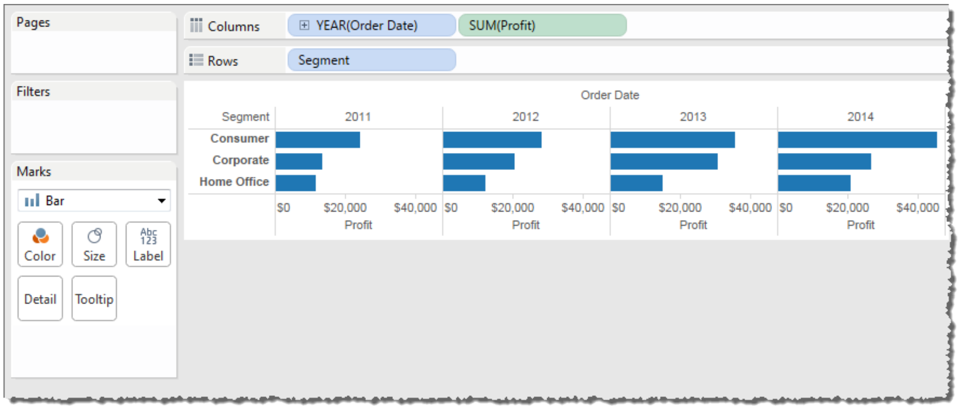


This indicates that a table calculation is currently being applied to this measure.

3. But what about when the view is not a text table? Are table calculations still an option? They are.

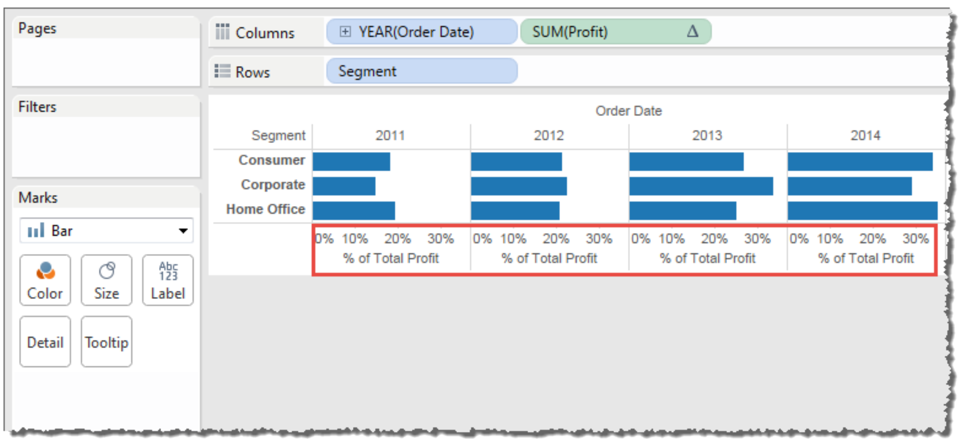
   Back up one step (click the Undo button on the toolbar) to remove the quick table calculation.

4. Now use Show Me to change the chart type to horizontal bars:



You might not be as likely to refer to this view as a "table," but the dimensions in the level of detail are the same, so the view's virtual table is the same.

5. You can now apply the exact same table calculation as before—right-click **SUM(Profit)**, choose **Quick Table Calculation**, and then **Percent of Total**. The view changes to show percentages along the horizontal axis, instead of dollar values:

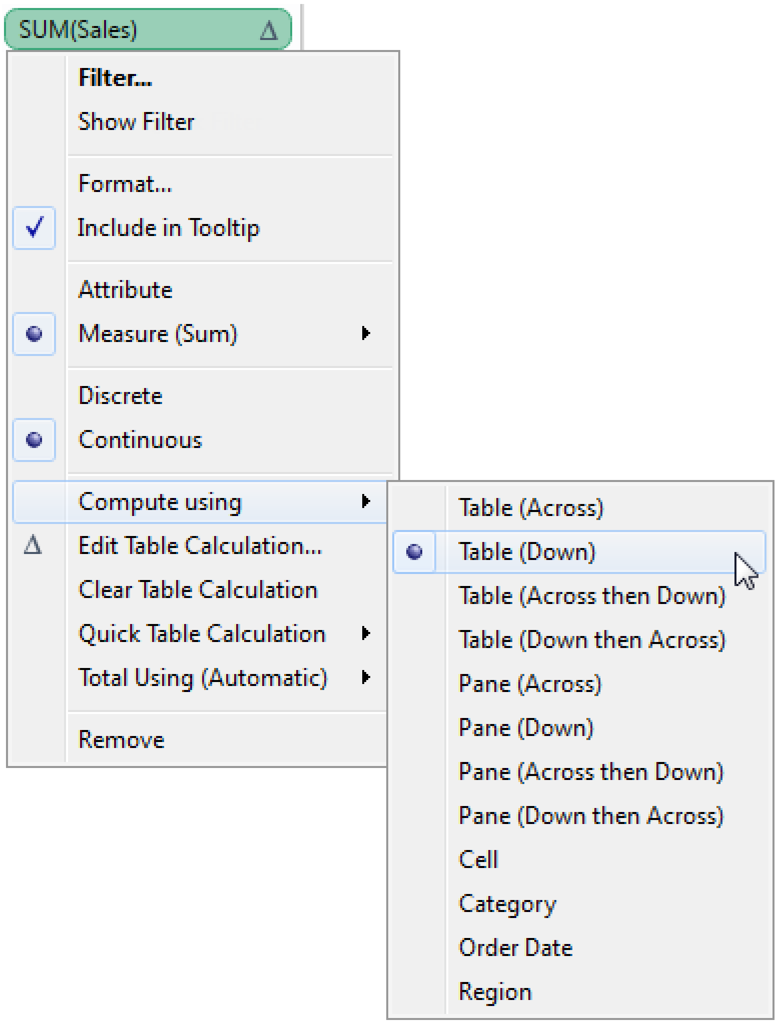


> **Note**: When you are learning about table calculations, or experimenting with different options, a text table is usually going to provide more intuitive insight than other chart types.

Addressing and Partitioning

Table calculations are performed on a single measure in the view. The dimensions that define the part of the table you are applying the calculation to (computing along) are called *addressing* fields, and the dimensions that define how to group the calculation are called *partitioning* fields. In the example of a running sum of product sales across several years, the addressing field is the Date field, and the partitioning field is the product field. When you define the addressing for a table calculation, all the other dimensions are used for partitioning.

You specify addressing when you create or edit a table calculation, in the Table Calculation dialog box. To update addressing for a field in the view that already has a table calculation, right-click the field and choosing one of the options under **Compute using**. For example:



Addressing can be relative to the table structure (options beginning with **Table**, **Pane**, or **Cell**) or to a specific field (such as **Category**, **Order Date**, or **Region**). Addressing options based on table structure are described below.

Table (Across)

This option sets the addressing to compute along the entire table moving horizontally through each partition. For example, the view below shows quarterly sales by region and product category. When a calculation addressing is set to **Table (Across)**, the dimensions that span horizontally across the table are the addressing fields (in the view below, **Category** and **Region**). All the other dimensions (**Year**, **Quarter**) are partitioning. The addressing dimensions are shown in orange, while partitioning dimensions are shown in blue.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that each partition will be the combination of **Year** and **Quarter**. Any calculation that is performed is scoped to the partition. For example, if the calculation is percent of total, the calculation will be performed on the numbers within each of the orange boxes.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Partition
1
2
...

Table (Down)

This option sets the addressing to compute along the entire table moving vertically through each partition. For example, the view from above is shown below with the addressing set to compute along **Table (Down)**. The fields that span vertically (**Year**, **Quarter**) are now the addressing fields and the rest of the fields are partitioning (**Category**, **Region**). The addressing fields are shown in orange while partitioning fields are shown in blue.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that each partition is the combination of Category and Region.

Year of Order Date	Quarter of Order Date	Category / Region Furniture Central	 East	 South	 West	 Office Supplies Central	 East	 South	 West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Partition 1 2 ...

Table (Across then Down)

This option sets the addressing to compute across the entire table horizontally and then down the table vertically. This means that both the fields that span across the table and down the table are addressing fields.

Year of Order Date	Quarter of Order Date	Category / Region Furniture Central	 East	 South	 West	 Office Supplies Central	 East	 South	 West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that the entire table is the partition. The computation will compute across, move to the next row and continue to compute across, and so on.

Year of Order Date	Quarter of Order Date	Category / Region Furniture Central	 East	 South	 West	 Office Supplies Central	 East	 South	 West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Partition 1

Pane (Across)

This option sets to compute across the pane horizontally. The fields that span across the pane horizontally are the addressing fields. However, the fields that separate the panes are now partitioning fields. In the example below **Category** becomes a partitioning field along with **Year** and **Quarter**. **Region** is the addressing field.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that the combination of **Year**, **Quarter**, and **Category** is the partition.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	1 $54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	2 $71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Pane (Down)

This option sets the addressing to compute down the table within the pane. The fields that separate the pane (**Category**, **Year**) are partitioning fields. In addition, **Region** becomes a partitioning field and **Quarter** is the addressing field.

Year of Order Date	Quarter of Order Date	Furniture Central	Furniture East	Furniture South	Furniture West	Office Supplies Central	Office Supplies East	Office Supplies South	Office Supplies West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that the combination of **Year**, **Category**, and **Region** is the partition.

Year of Order Date	Quarter of Order Date	Furniture Central	Furniture East	Furniture South	Furniture West	Office Supplies Central	Office Supplies East	Office Supplies South	Office Supplies West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Pane (Across then Down)

This option sets the addressing to compute across within the pane, then move to the next row and continue to compute across. The addressing fields are both the fields that run across the table horizontally and down the table vertically (**Region**, **Quarter**). The partitioning fields are the fields that define the pane (**Category**, **Year**).

Year of Order Date	Quarter of Order Date	Furniture Central	Furniture East	Furniture South	Furniture West	Office Supplies Central	Office Supplies East	Office Supplies South	Office Supplies West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that the combination of **Category** and **Year** make up the partition.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Cell

This option sets the addressing to the individual cells in the table. All fields become partitioning fields. This option is generally most useful when computing a percent of total calculation.

		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

That means that the partition is the combination of **Category**, **Region**, **Year**, and **Quarter**.

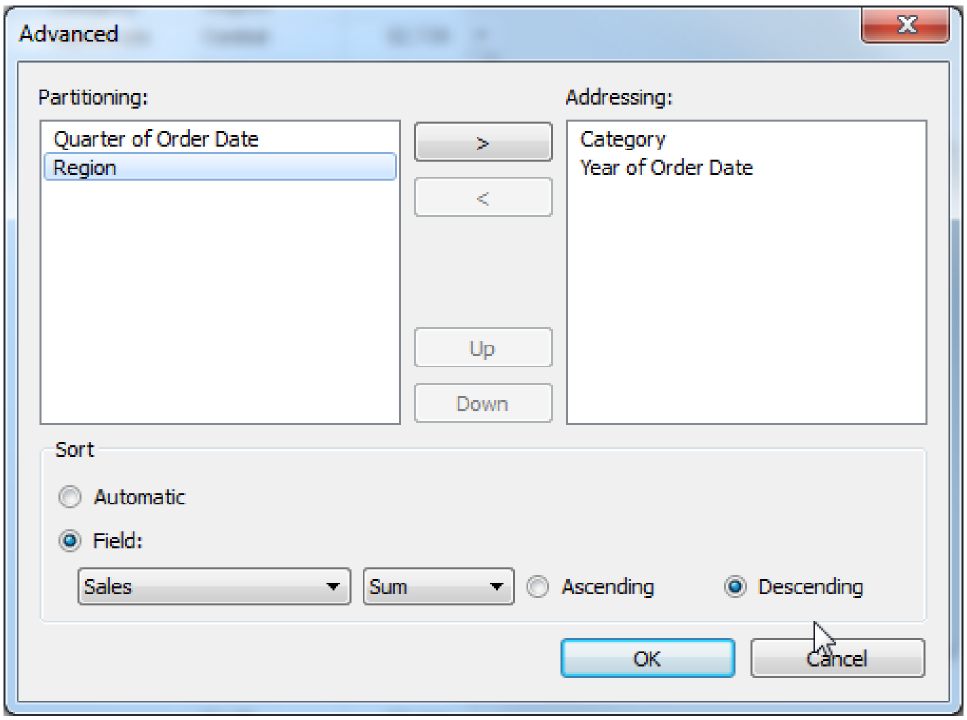
		Category / Region							
		Furniture				Office Supplies			
Year of Order Date	Quarter of Order Date	Central	East	South	West	Central	East	South	West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Individual Fields

The individual dimensions in the view are listed below the option above in the Table Calculation dialog box. Use them to set the addressing to compute using the field you specify. The benefit of this option is that you get absolute control over how the calculation will be computed—if you change the orientation of your view, the table calculation will continue using the same fields for addressing and partitioning. Be careful though, because, addressing on an individual field means that when you rearrange the table, the calculation may no longer match the table structure.

Advanced

The advanced option lets you specify multiple fields to act as the addressing fields. When you select Advanced, a dialog box opens where you can specify one or more fields to act as addressing fields. Then you can specify how to order those fields.



For example, in the view below the addressing fields are set to **Category** and **Year**. These are ordered by **SUM(Sales)**, in descending order (from greatest to least). That means that the combination of **Quarter** and **Region** create the partition. Q1 Central exists four times in the table, and that is the partition.

Year of Order Date	Quarter of Order Date	Furniture: Central	Furniture: East	Furniture: South	Furniture: West	Office Supplies: Central	Office Supplies: East	Office Supplies: South	Office Supplies: West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,4[illegible]	[illegible]	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Partition 1

Because the order is set to **SUM(Sales)**, the calculation is computed based on their **SUM (Sales)** values from highest to lowest.

Year of Order Date	Quarter of Order Date	Furniture: Central	Furniture: East	Furniture: South	Furniture: West	Office Supplies: Central	Office Supplies: East	Office Supplies: South	Office Supplies: West
2008	Q1	$54,839	$41,843	$54,162	$98,604	$69,738	$20,531	$38,466	$85,317
	Q2	$71,341	$56,705	$103,741	$103,660	$43,070	$38,547	$65,251	$108,219
	Q3	$104,219	$78,408	$91,407	$56,204	$70,649	$29,540	$80,171	$68,221
	Q4	$43,478	$107,494	$89,127	$85,453	$64,378	$44,255	$23,944	$52,238
2009	Q1	$41,344	$77,462	$29,104	$66,449	$62,809	$58,498	$28,940	$47,086
	Q2	$78,894	$64,045	$163,505	$69,963	$46,951	$21,775	$66,439	$50,694
	Q3	$157,720	$39,988	$75,475	$82,548	$65,696	$53,205	$72,427	$43,299
	Q4	$74,210	$77,246	$49,308	$44,382	$87,564	$65,831	$34,448	$87,042

Quick Table Calculations

You can add common table calculations to your view using the Quick Table Calculations menu item on the field context menus. These quick calculations are predefined table calculations based on the most common scenarios.

To add a quick table calculation:

1. Right-click (Control-click on a Mac) the measure you want to use in the table calculation and select **Quick Table Calculation**.
2. On the sub-menu select one of the following options:
   - Running Total
   - Difference
   - Percent Difference
   - Percent of Total
   - Rank
   - Percentile

- Moving Average
- Year to Date (YTD) Total
- Compound Growth Rate
- Year over Year Growth
- Year to Date (YTD) Growth

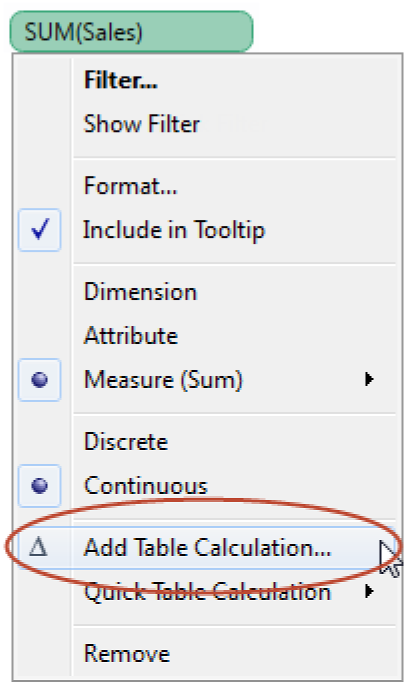
After adding a quick table calculation to the view, you can edit its definition by selecting **Edit Table Calculation** from the field's context menu.

Defining Basic Table Calculations

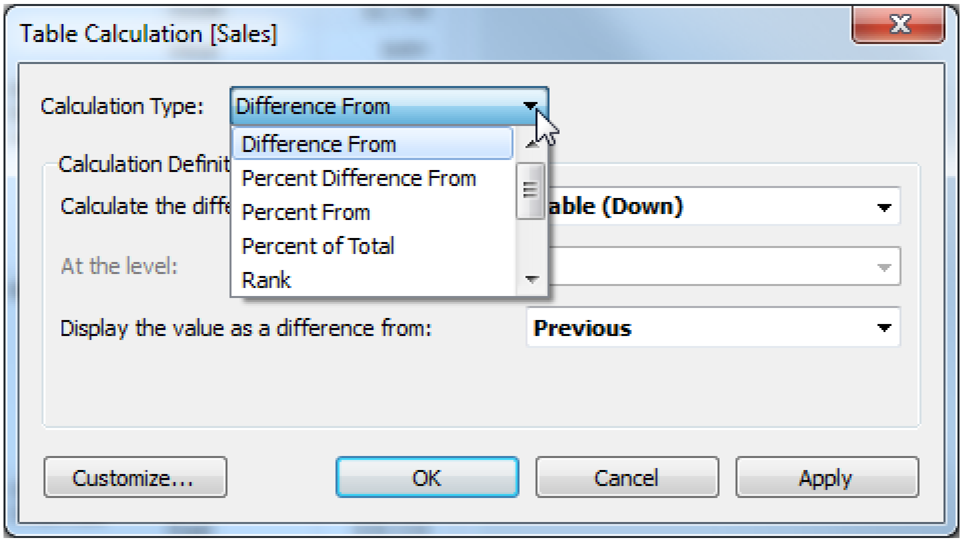
When you add a Table Calculation to the view, you need to specify the parameters that define the formula used in the computation. All of these parameters are set in the Table Calculation dialog box.

To manually define a table calculation:

Right-click (Control-click on a Mac) the measure you want to use in the computation and choose **Add Table Calculation**.

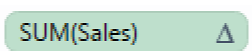
1. 

2. In the Table Calculation dialog box, select one of the types of calculations from the drop-down menu at the top.



Define the formula using the drop-down lists further down in the dialog box. Learn more about how to define each type of calculation by selecting it from the **Calculation Type** field.

When finished, click **OK**. The measure is now marked as a table calculation (the triangle symbol) and all the relevant values in the view are computed using the table calculation.

3. 

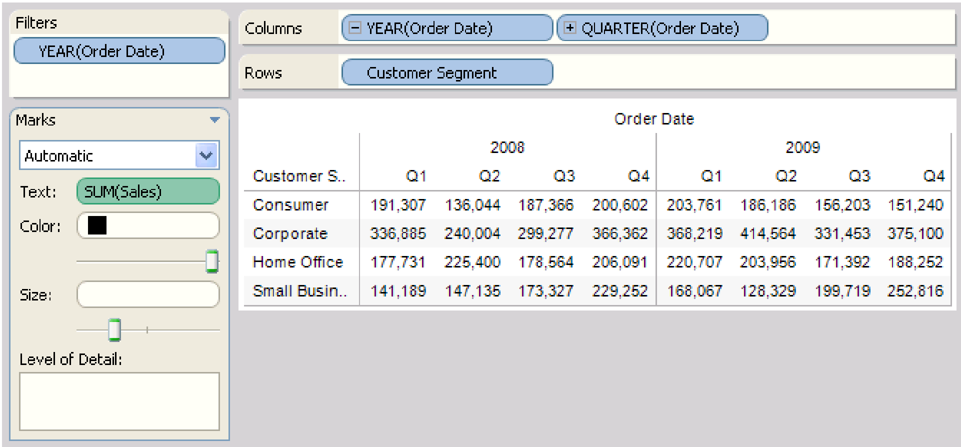
Difference From Calculation

Use this type of calculation to compute the difference between two specified values in the table along a certain dimension. For example, compute the difference between 2006 and 2007 quarterly sales for four different customer segments.

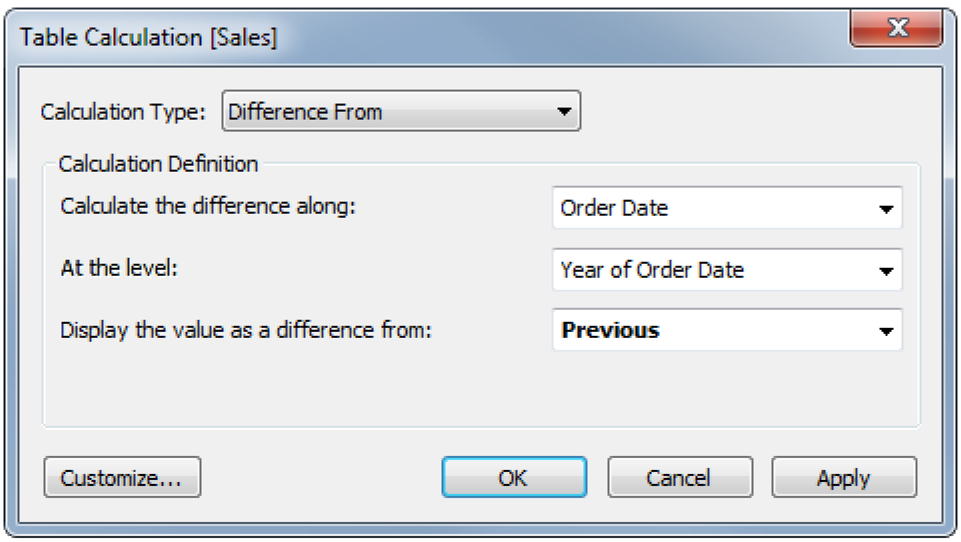
To define a Difference From calculation, specify a dimension or table structure to compute across, the dimension level to use in the computation (this is only required if you are computing across a dimension), and a value to compare the current value to. The following is an example of a Difference From calculation.

Example: Difference From Calculation

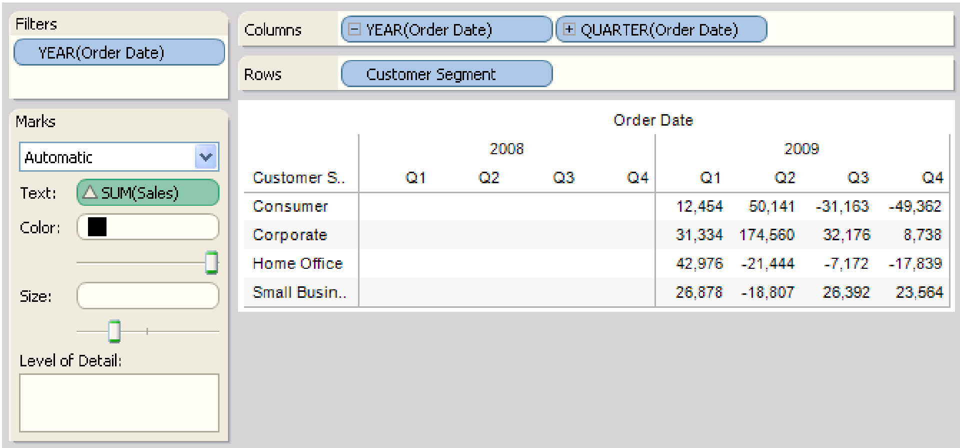
The table below shows the 2006 and 2007 quarterly sales numbers for several different customer segments of a superstore.



To compute the difference between 2008 and 2009 sales, use the following values in the Table Calculation dialog box.

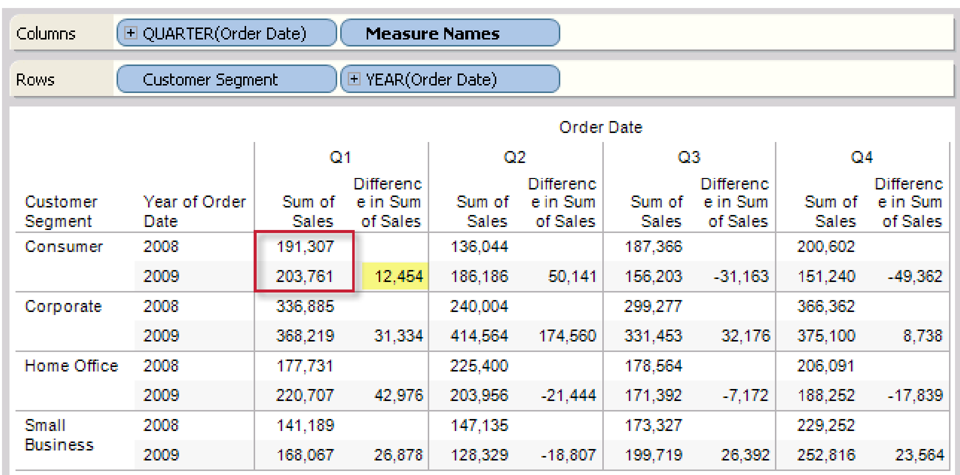


The difference is calculated along the **Order Date** dimension at the level of year because we are comparing 2008 sales to 2009 sales. The table now displays the difference between each quarter in 2009 and the corresponding quarter in the previous year. Notice that there are no values for 2008. That's because there are no previous years to compute the difference from. You can hide that column without affecting the calculation.



	Order Date							
	2008				2009			
Customer S..	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Consumer					12,454	50,141	-31,163	-49,362
Corporate					31,334	174,560	32,176	8,738
Home Office					42,976	-21,444	-7,172	-17,839
Small Busin..					26,878	-18,807	26,392	23,564

The view below may be more clear. It shows both the Difference From calculation and the **Total Sales** (before the computation). You can see that in the first quarter of 2009 the total sales was $203,761 while in the same quarter in 2008 the total sales was $191,307. The difference between these two values is $12,454.



		Order Date							
		Q1		Q2		Q3		Q4	
Customer Segment	Year of Order Date	Sum of Sales	Difference in Sum of Sales	Sum of Sales	Difference in Sum of Sales	Sum of Sales	Difference in Sum of Sales	Sum of Sales	Difference in Sum of Sales
Consumer	2008	191,307		136,044		187,366		200,602	
	2009	203,761	12,454	186,186	50,141	156,203	-31,163	151,240	-49,362
Corporate	2008	336,885		240,004		299,277		366,362	
	2009	368,219	31,334	414,564	174,560	331,453	32,176	375,100	8,738
Home Office	2008	177,731		225,400		178,564		206,091	
	2009	220,707	42,976	203,956	-21,444	171,392	-7,172	188,252	-17,839
Small Business	2008	141,189		147,135		173,327		229,252	
	2009	168,067	26,878	128,329	-18,807	199,719	26,392	252,816	23,564

To add a Difference From calculation to your view quickly, right-click the measure you want to use in the computation and select **Quick Table Calculations** > **Difference**. This quick calculation computes the difference between values across rows where each difference is calculated against the previous value. See **Quick Table Calculations** on page 1042.

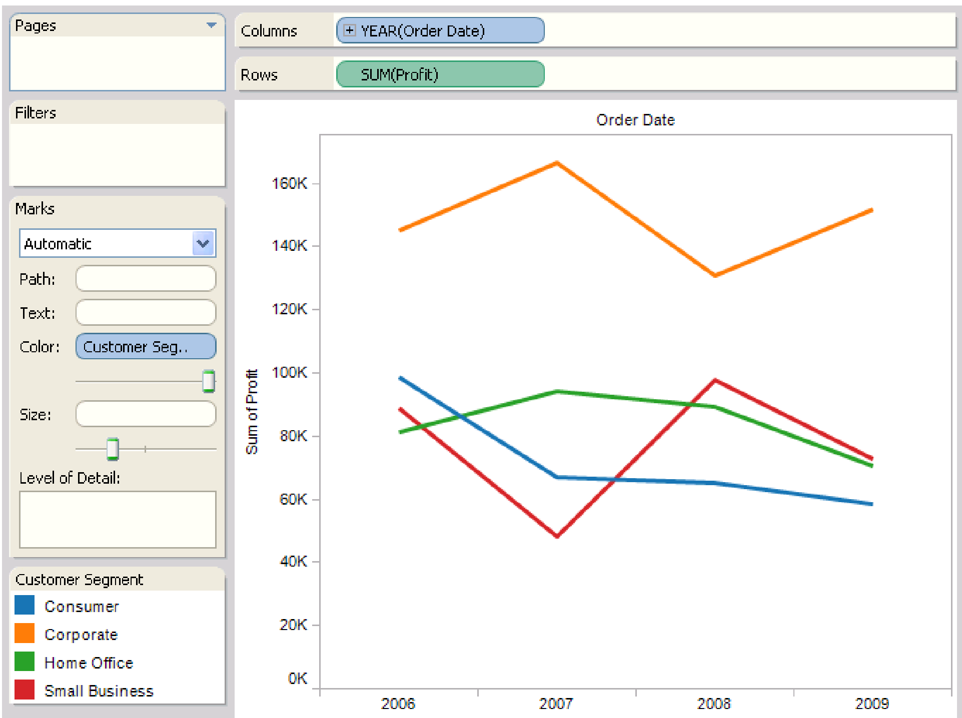
Percent Difference From Calculation

Use this type of calculation to display the rate of change between two specified values in the table by computing the difference as a percentage. A common use of this type of calculation is to compute the percent gain year over year (CAGR).

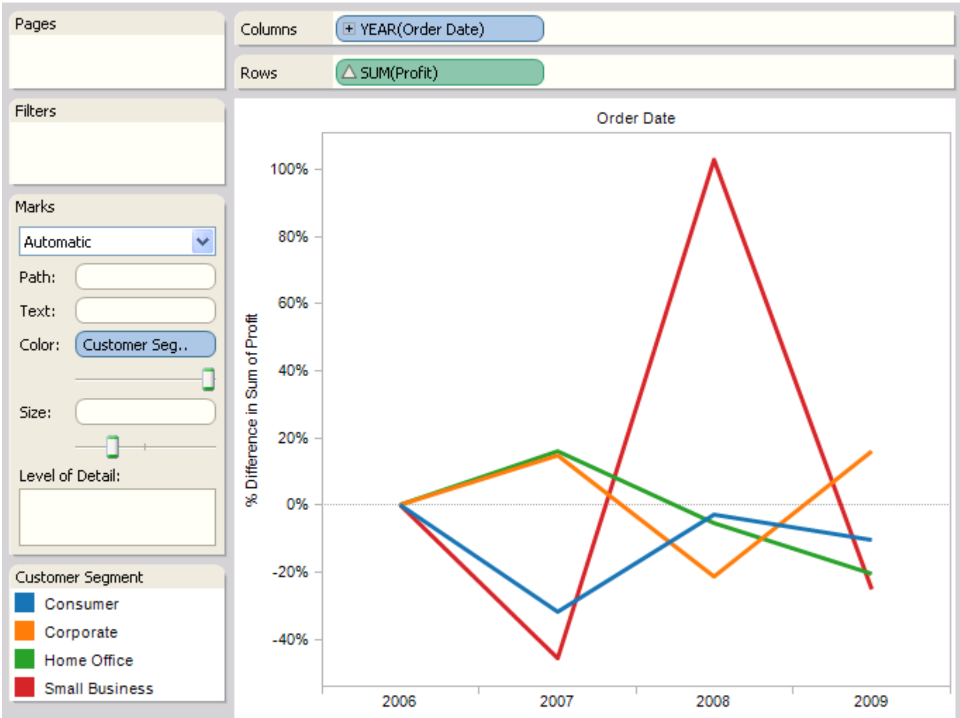
To define a Percent Difference From calculation specify a dimension or table structure to compute across, the dimension level to use in the computation (this is only required if you are computing across a dimension), and a value to compare the current value to. The following is an example of a Percent Difference calculation.

Example: Percent Difference From Calculation

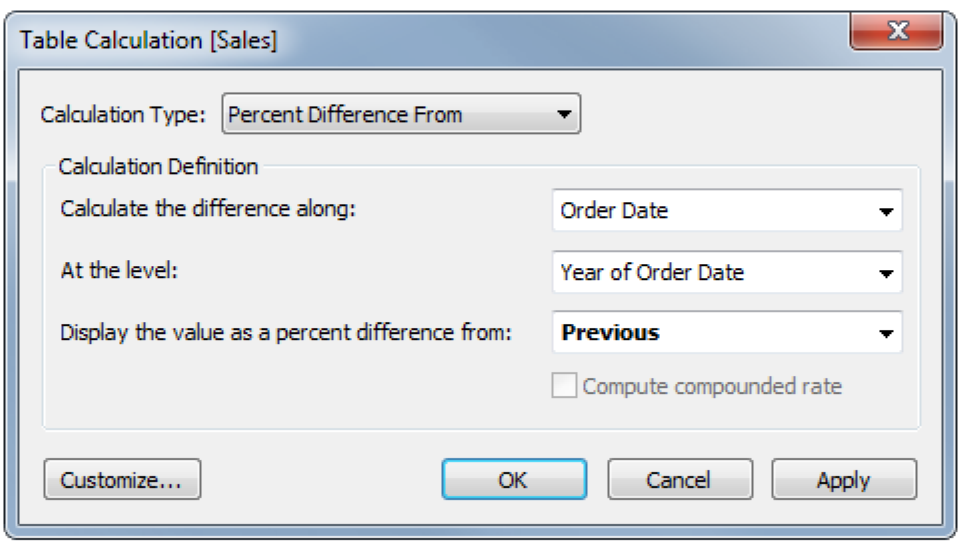
The table below shows the profit for several customer segments over four years. Looking at the view, we can see that there was a drop in profit in the Small Business and Consumer segments in 2007.



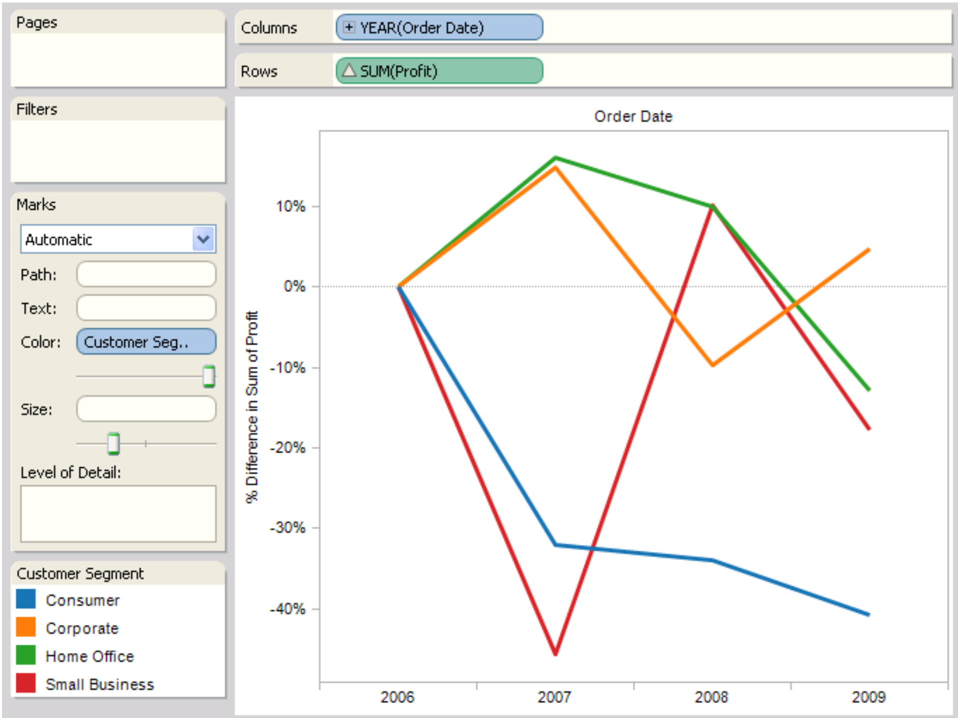
When we view this same view using a Percent Difference From calculation, it becomes clear that Small Business segment rebounded quite dramatically in 2008.



To define a Percent Difference From calculation, select **Percent Difference From** in the **Calculation Type** field in the Table Calculation dialog box.



The difference is calculated along the **Order Date** dimension at the Year level because we are comparing year over year profit. Each value in the view is a percent difference from the previous year. The view below shows each year as a difference of 2006 Profit.



Percent Difference From calculations are commonly used to calculate compound growth rates and year over year growth. To quickly add these calculations, right-click the measure you want to use in the view and select **Percent Difference** from the Quick Table Calculation sub-menu. See **Quick Table Calculations** on page 1042.

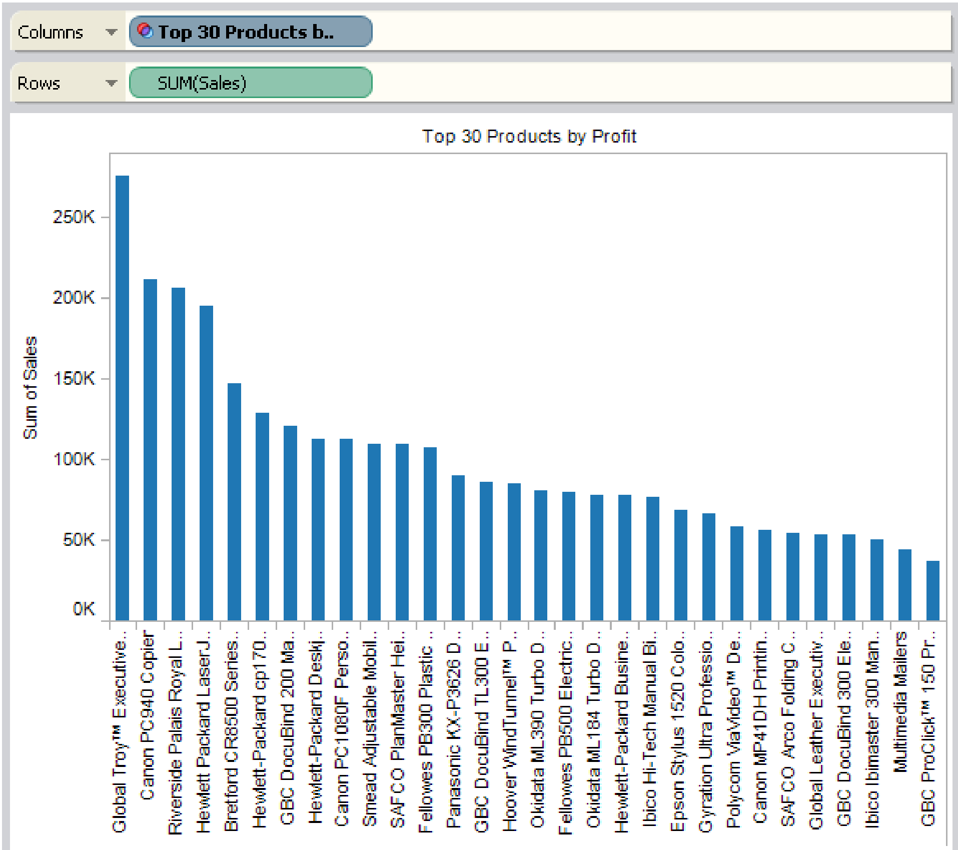
Percent From Calculation

A Percent From calculation is similar to a Percent Difference From calculation in that you can use it to compute the change between two values as a percentage. However, this type of calculation computes an absolute change. For example, use the Percent From calculation to compare the sales performance of several products.

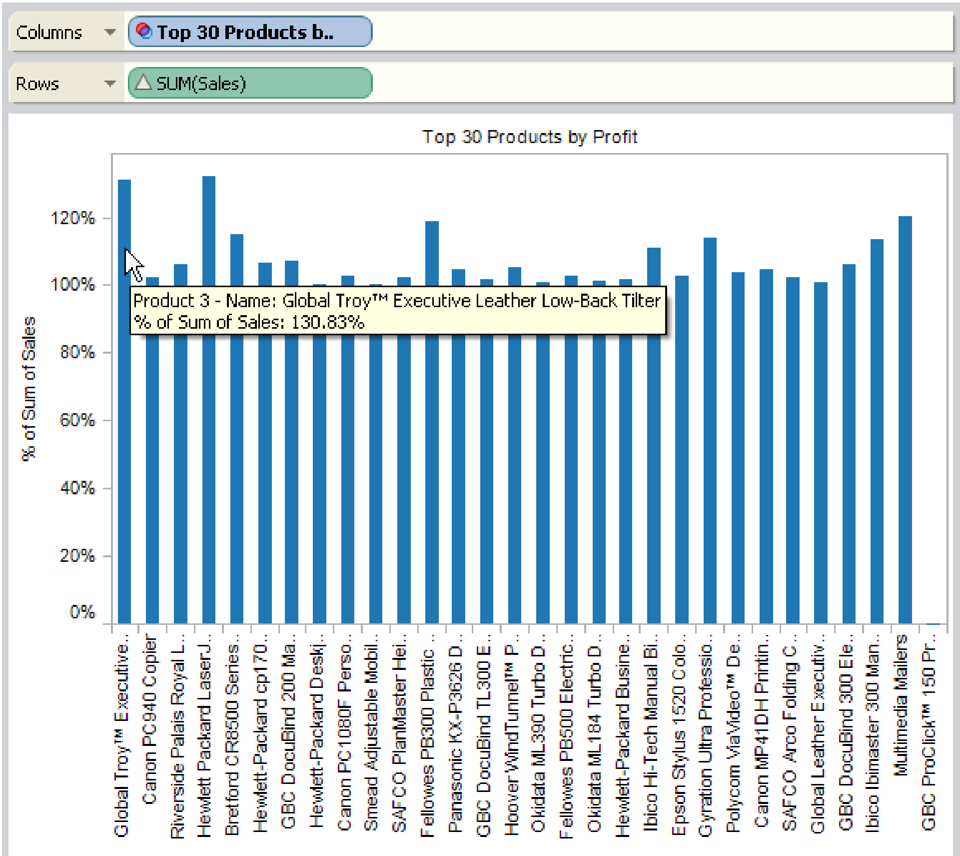
To define a Percent From calculation, specify a table structure or dimension to calculate the percentage from. If you select a dimension, you also need to select a level. Finally, you need to select a value that each value in the table will be displayed as a percentage of. The following is an example of a Percent From calculation.

Example: Percent From Calculation

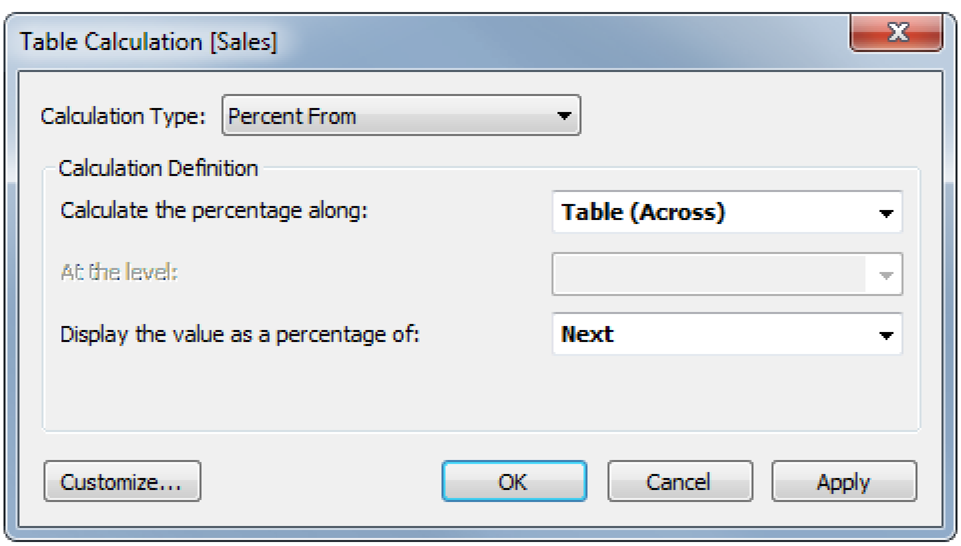
The view below shows the sales of the top thirty products by profit at a superstore. You can see that the top selling product is the Global Troy Executive Leather chair.



While it is generally clear how each product is performing when compared to the next in terms of sales, you can use a Percent From calculation to compute just how much better each product is from the next. The view below has this type of calculation placed on Detail on the Marks card. The tooltip for each product shows the value of the mark expressed as a percentage of the next product in the view. For example, you can examine the tooltip for the Global Troy Executive Leather chair and see that it is 130% of the sales for the next item—the Canon Copier.



This table calculation was computed using the definition shown in the dialog box below. The percentage is calculated across the rows, and each product is displayed as a percentage of the next product.



Rank Calculation

Use this type of calculation to compute rankings for a set of values.

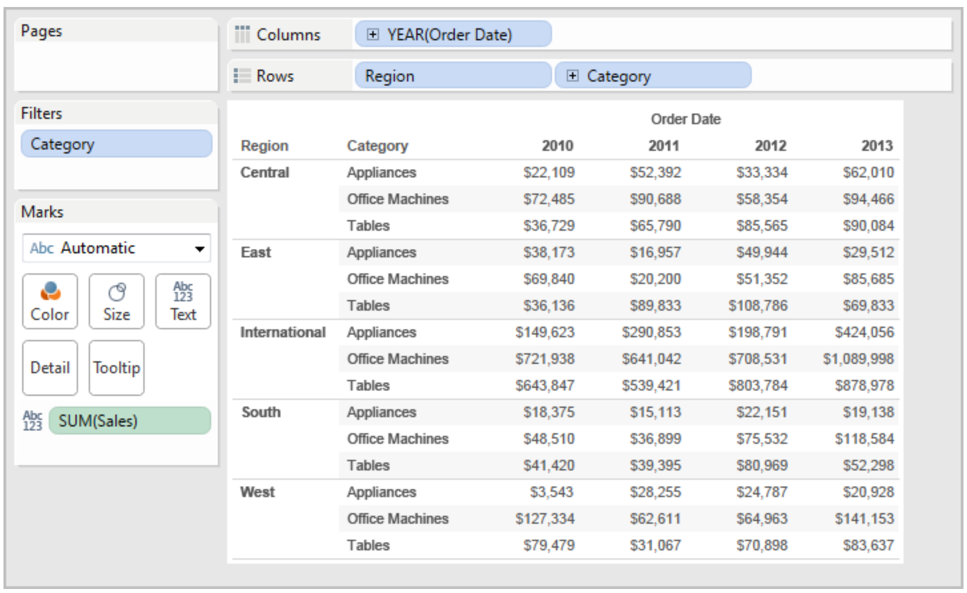
To define a Rank calculation, specify a dimension or table structure to compute across, the dimension level to use in the computation (this is only required if you are computing across a dimension), and a value to compare the current value to.

Tableau ignores nulls in rank calculations. They appear as blank rows.

The following is an example of a Rank calculation.

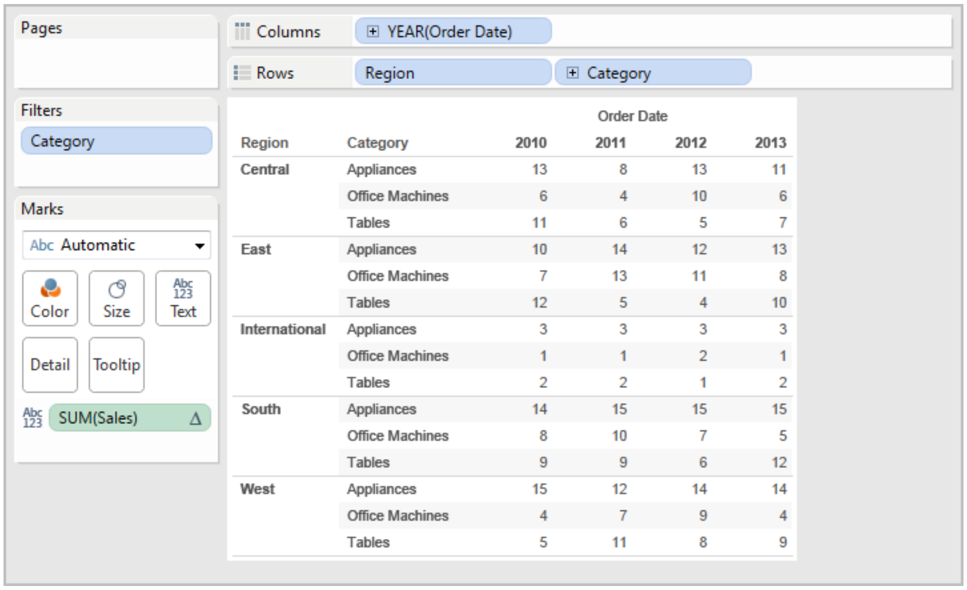
Example: Rank Calculation

The view below shows sales over a four-year period by region and category.



Region	Category	2010	2011	2012	2013
Central	Appliances	$22,109	$52,392	$33,334	$62,010
	Office Machines	$72,485	$90,688	$58,354	$94,466
	Tables	$36,729	$65,790	$85,565	$90,084
East	Appliances	$38,173	$16,957	$49,944	$29,512
	Office Machines	$69,840	$20,200	$51,352	$85,685
	Tables	$36,136	$89,833	$108,786	$69,833
International	Appliances	$149,623	$290,853	$198,791	$424,056
	Office Machines	$721,938	$641,042	$708,531	$1,089,998
	Tables	$643,847	$539,421	$803,784	$878,978
South	Appliances	$18,375	$15,113	$22,151	$19,138
	Office Machines	$48,510	$36,899	$75,532	$118,584
	Tables	$41,420	$39,395	$80,969	$52,298
West	Appliances	$3,543	$28,255	$24,787	$20,928
	Office Machines	$127,334	$62,611	$64,963	$141,153
	Tables	$79,479	$31,067	$70,898	$83,637

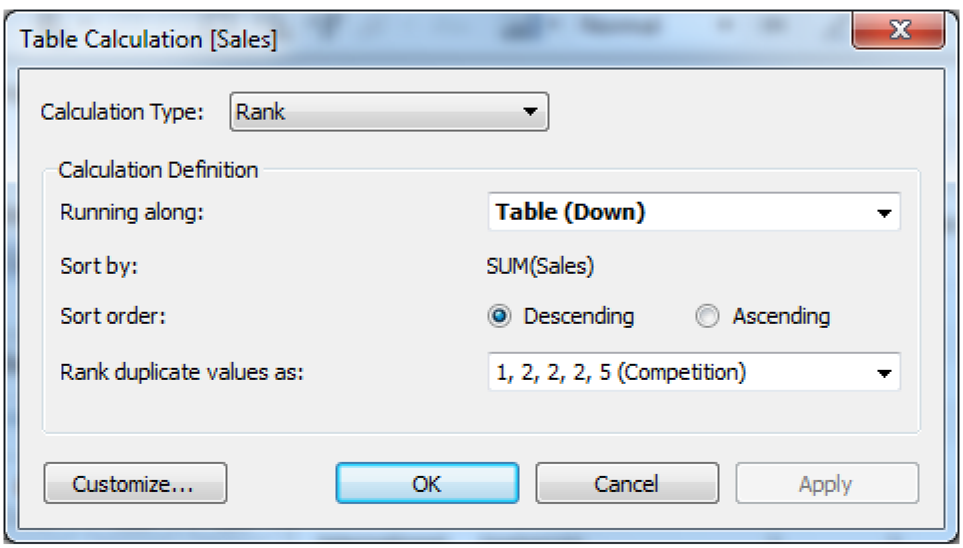
We would like to know how different categories rank from year to year, without regard to region. That is, we would like to rank the 15 values in each row to generate the following result.



To obtain this view, follow these steps:

1. Click the SUM(Sales) field in the view and select **Add Table Calculation**.
2. In the Table Calc [Sales] dialog box, select **Rank** from the **Calculation Type** drop-down.

   The Table Calc [Sales] dialog box now shows fields relevant for ranking:



3. Select **Table (Down)** from the **Running along** field.
4. Choose **OK**.

Ranking Duplicate Values

One issue with Rank calculations is that there may be more than one cell in the relevant row or column with the same value. What would happen, for example, if Tables in the Central region and Appliances in the South region both had sales of exactly $36,729? Tableau lets you specify how to handle such cases by including a **Rank duplicate values as** field in the Table Calculation dialog box when you set **Calculation Type** to Rank.

The choices are listed below. The number sequence at the beginning of each option (for example, 1, 2, 2, 2, 5) shows how the option would rank a hypothetical set of values 10, 15, 15, 15, 20:

Option	Result
1, 2, 2, 2, 5 (Competition)	Duplicate values are all given the same rank, which is the next number in the ranking sequence.The next value after the duplicate values is computed by adding 1 to the number of values already computed.
1, 4, 4, 4, 5 (Modified Competition)	Duplicate values are all given the same rank, which is computed by adding the number of values before the duplicate values to the number of duplicate values. The next value after the duplicate values is computed by adding 1 to the number of values already computed.
1, 2, 2, 2, 3 (Dense)	Duplicate values are all given the same rank, which is the next number in the ranking sequence. The next value after the duplicate values is computed as though the duplicate values were a single value.
1, 2, 3, 4, 5 (Unique)	Duplicate values are given unique rankings, according to the direction in which the ranking is being computed.

Tableau also provides a set of table calculation functions that let you create calculated fields that rank values. See **Table Calculation Functions** on page 1441.

> You can add a Rank calculation to your view quickly using the Quick Table Calculations menu. Right-click (Control-click on Mac) the measure you want to use in the calculation and select **Quick Table Calculations** > **Rank**. By default, this quick calculation will add a competition rank calculation across the rows in the view. See **Quick Table Calculations** on page 1042.

Percentile Calculation

Use this type of calculation to compute percentiles for a set of values.

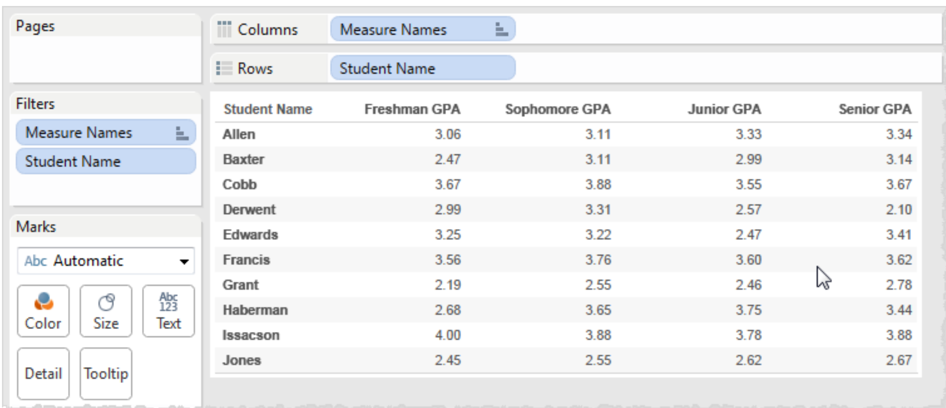
To define a Percentile calculation, specify a dimension or table structure to compute across, the dimension level to use in the computation (this is only required if you are computing across a dimension), and a value to compare the current value to.

Tableau ignores nulls in percentile calculations. They appear as blank rows in a cross-tab and do not count towards the total number of items used in the calculation (%).

The following is an example of a Percentile calculation.

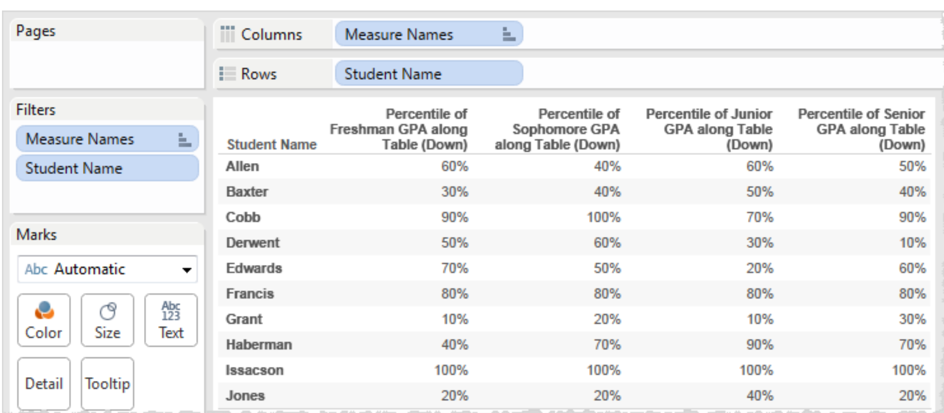
Example: Percentile Calculation

A school administrator is looking at four-year GPAs for a group of students:



Student Name	Freshman GPA	Sophomore GPA	Junior GPA	Senior GPA
Allen	3.06	3.11	3.33	3.34
Baxter	2.47	3.11	2.99	3.14
Cobb	3.67	3.88	3.55	3.67
Derwent	2.99	3.31	2.57	2.10
Edwards	3.25	3.22	2.47	3.41
Francis	3.56	3.76	3.60	3.62
Grant	2.19	2.55	2.46	2.78
Haberman	2.68	3.65	3.75	3.44
Issacson	4.00	3.88	3.78	3.88
Jones	2.45	2.55	2.62	2.67

The administrator wonders how the students' performance has changed over time, relative to each other. To find out, the administrator applies a Percentile table calculation to the grades for each year, to obtain the following result:

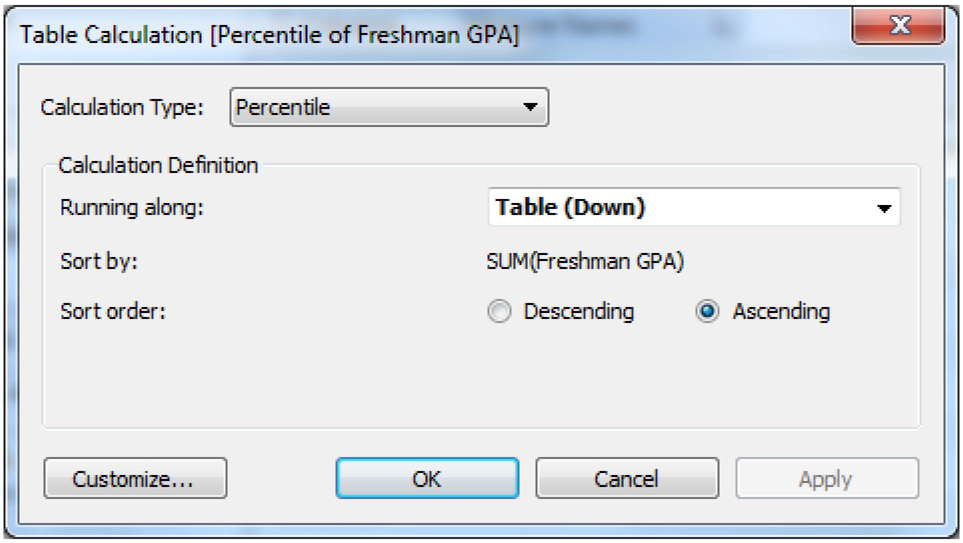


Student Name	Percentile of Freshman GPA along Table (Down)	Percentile of Sophomore GPA along Table (Down)	Percentile of Junior GPA along Table (Down)	Percentile of Senior GPA along Table (Down)
Allen	60%	40%	60%	50%
Baxter	30%	40%	50%	40%
Cobb	90%	100%	70%	90%
Derwent	50%	60%	30%	10%
Edwards	70%	50%	20%	60%
Francis	80%	80%	80%	80%
Grant	10%	20%	10%	30%
Haberman	40%	70%	90%	70%
Issacson	100%	100%	100%	100%
Jones	20%	20%	40%	20%

The administrator can now observe that despite some fluctuations, the students' performance was relatively stable relative to each other during the four years.

To obtain this view, the administrator had to apply a Percentile table calculation to each of four measures: Freshman GPA, Sophomore GPA, Junior GPA, and Senior GPA. For each of these measures the administrator followed these steps:

1. Click the measure in the view and select **Add Table Calculation**.
2. In the Table Calc dialog box, select **Percentile** from the **Calculation Type** drop-down.
3. The dialog box now shows fields relevant for Percentile:



4. Select **Table (Down)** from the **Running along** field.
5. Select **Ascending** from the **Sort Order** field.
6. Click **OK**.

You can add a Percentile calculation to your view quickly using the Quick Table Calculations menu. Right-click (Control-click on a Mac) the measure you want to use in the calculation and select **Quick Table Calculations** > **Percentile**. By default this quick calculation will add a percentile calculation across the rows in the view. See **Quick Table Calculations** on page 1042.

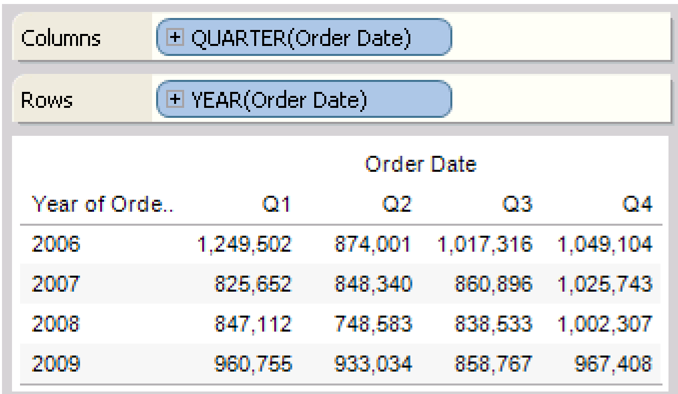
Running Total Calculation

Use the Running Total calculation to compute a cumulative total across a dimension or table structure. For example, you can use this type of calculation to calculate the cumulative sales for each quarter for several years.

When you define a running total calculation, you need to specify an aggregation to use when summarizing the values. For example, the most common aggregation will be sum so you can see the summation of values, but sometimes you may want to use average or another aggregation. You also need to specify the dimension to compute a running total across. This can either be an actual dimension in the data source or a table structure like rows or columns. Finally, you need to specify when to restart the at zero and begin totaling again. The following is an example of a Running Total calculation.

Example - Running Total Calculation

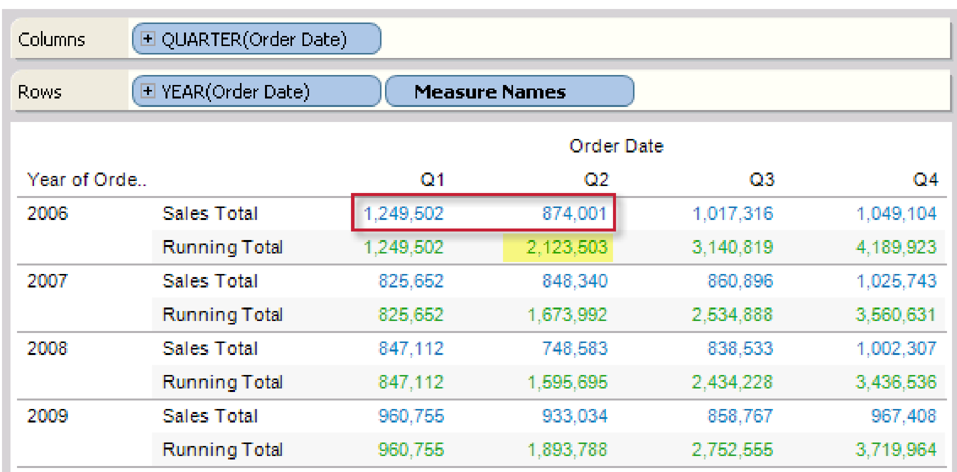
The view below shows the total quarterly sales from 2006 to 2009.


Columns QUARTER(Order Date)

Rows YEAR(Order Date)

	Order Date			
Year of Orde..	Q1	Q2	Q3	Q4
2006	1,249,502	874,001	1,017,316	1,049,104
2007	825,652	848,340	860,896	1,025,743
2008	847,112	748,583	838,533	1,002,307
2009	960,755	933,034	858,767	967,408

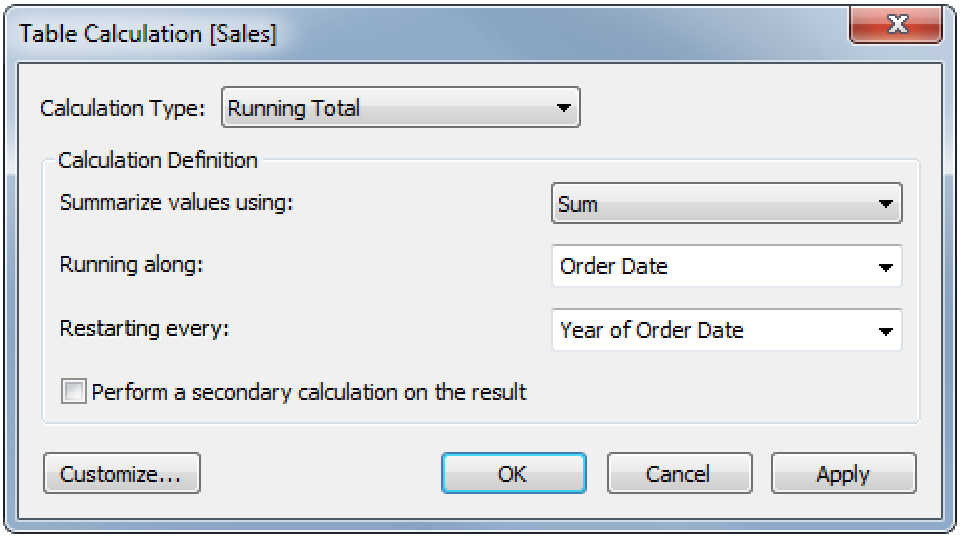
While it is useful to see each quarter's sales, you may also want to see the cumulative totals for each quarter in the year. To create this kind of view we can add a Running Total calculation. The view below shows the running totals for each quarter restarting at zero for each year. That means that the Quarter 4 shows the total sales for that year.


Columns QUARTER(Order Date)

Rows YEAR(Order Date) Measure Names

		Order Date			
Year of Orde..		Q1	Q2	Q3	Q4
2006	Sales Total	1,249,502	874,001	1,017,316	1,049,104
	Running Total	1,249,502	2,123,503	3,140,819	4,189,923
2007	Sales Total	825,652	848,340	860,896	1,025,743
	Running Total	825,652	1,673,992	2,534,888	3,560,631
2008	Sales Total	847,112	748,583	838,533	1,002,307
	Running Total	847,112	1,595,695	2,434,228	3,436,536
2009	Sales Total	960,755	933,034	858,767	967,408
	Running Total	960,755	1,893,788	2,752,555	3,719,964

This calculation was defined by the formula shown below. We are summarizing values as a sum along the **Order Date** dimension restarting at zero every Year.



You can add a Running Total calculation to your view easily using the Quick Table Calculations menu. Right-click (Control-click on Mac) the measure you want to use in the calculation and select **Quick Table Calculations** > **Running Total**. See **Quick Table Calculations** on page 1042.

For additional examples, see Running Total Table Calculations in the Tableau Knowledge Base.

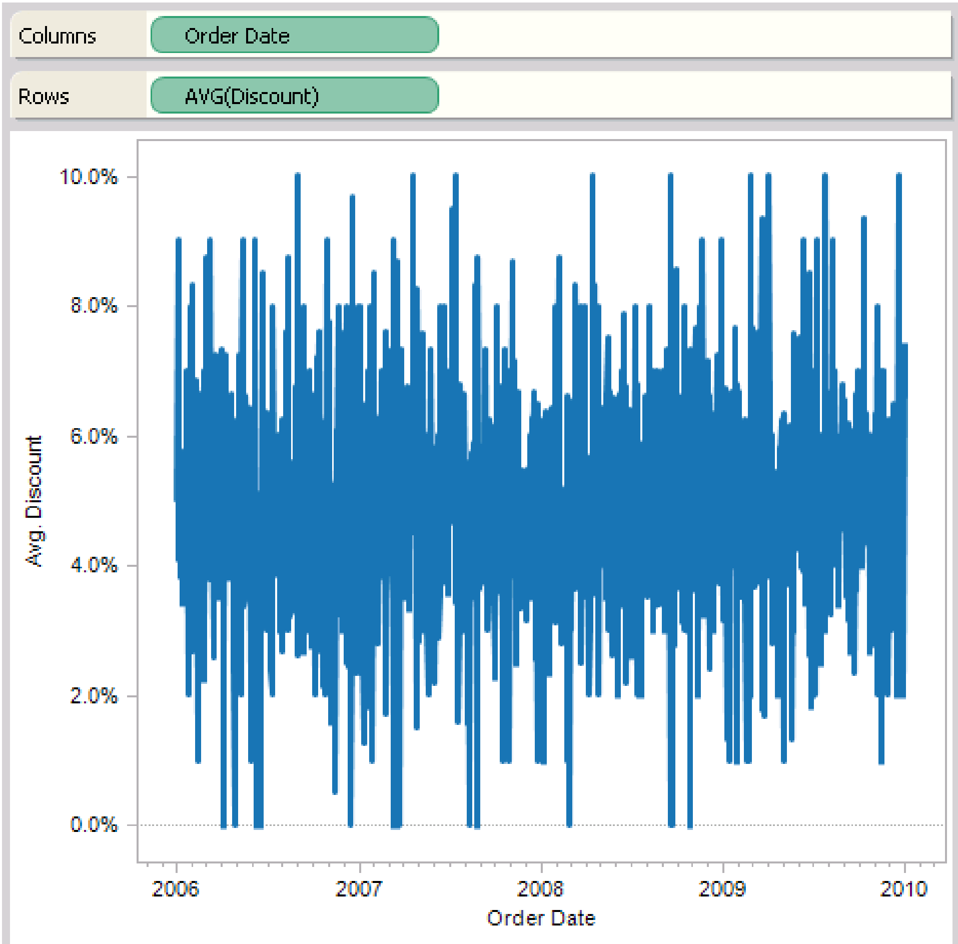
Moving Calculation

A moving calculation is typically used to smooth short term fluctuations in your data so that you can see long term trends. A good example is when you are looking at securities data. There are so many fluctuations every day that it is hard to see the big picture through all the daily ups and downs. You can use a moving calculation to define a range of values to summarize using an aggregation of your choice.

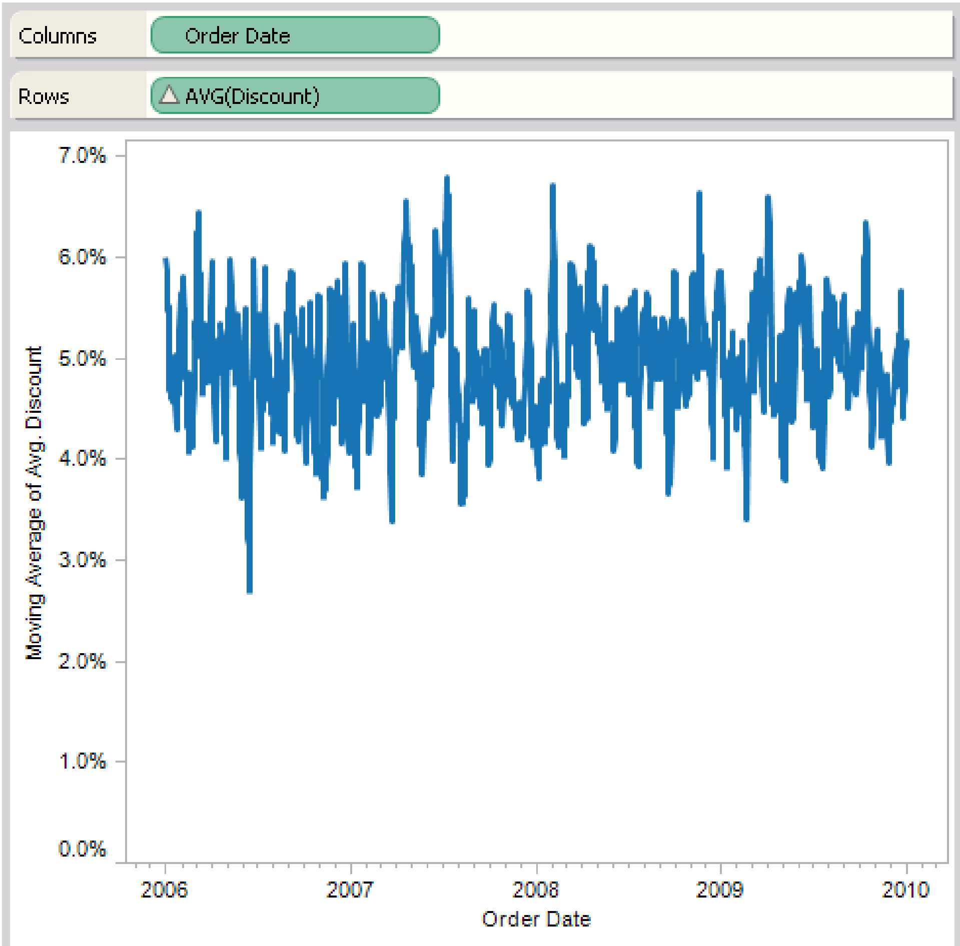
When you define a moving calculation you must first specify the aggregation you want to use when summarizing that data. The most common aggregation for this type of calculation is an average. Next you need to specify the dimension to summarize across. You can select a table structure such as Rows or Columns or an actual field in your data source. Once you have selected a dimension, define the number of values before the current value and the number of values after the current value to include in the summary. You can also decide whether to include the current value using the checkbox on the right. The following is an example of a Moving Calculation.

Example - Moving Calculation

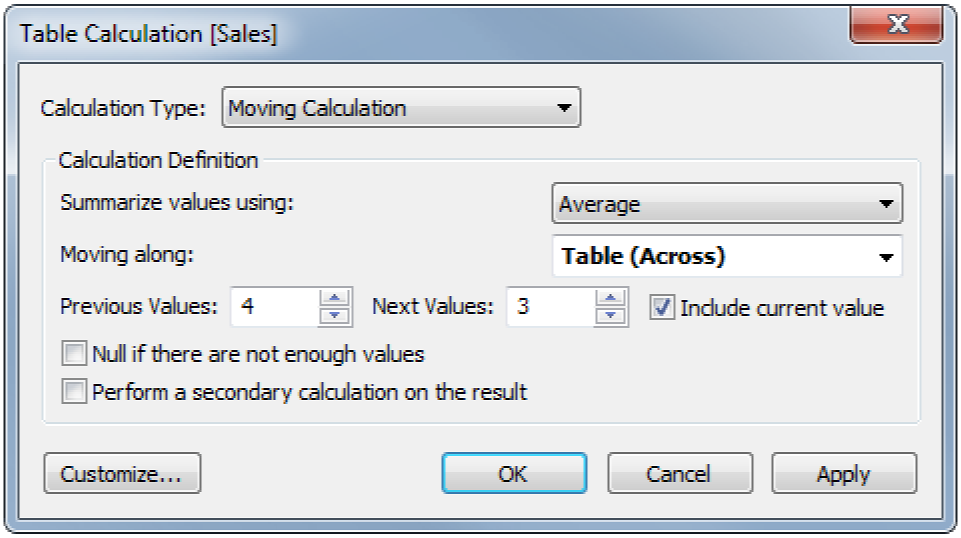
The view below shows the discounts given at a superstore along a continuous date axis. As you can see, it is very difficult to see any kind of trend in this view.



However, if you add a Moving Average, the view becomes much more manageable.



This calculation was defined by the formula shown below. The values are summarized as an average along the rows in the view. Each value is an average of the seven days surrounding the current value (four days before and three days after). Note that we have opted to include the current value.

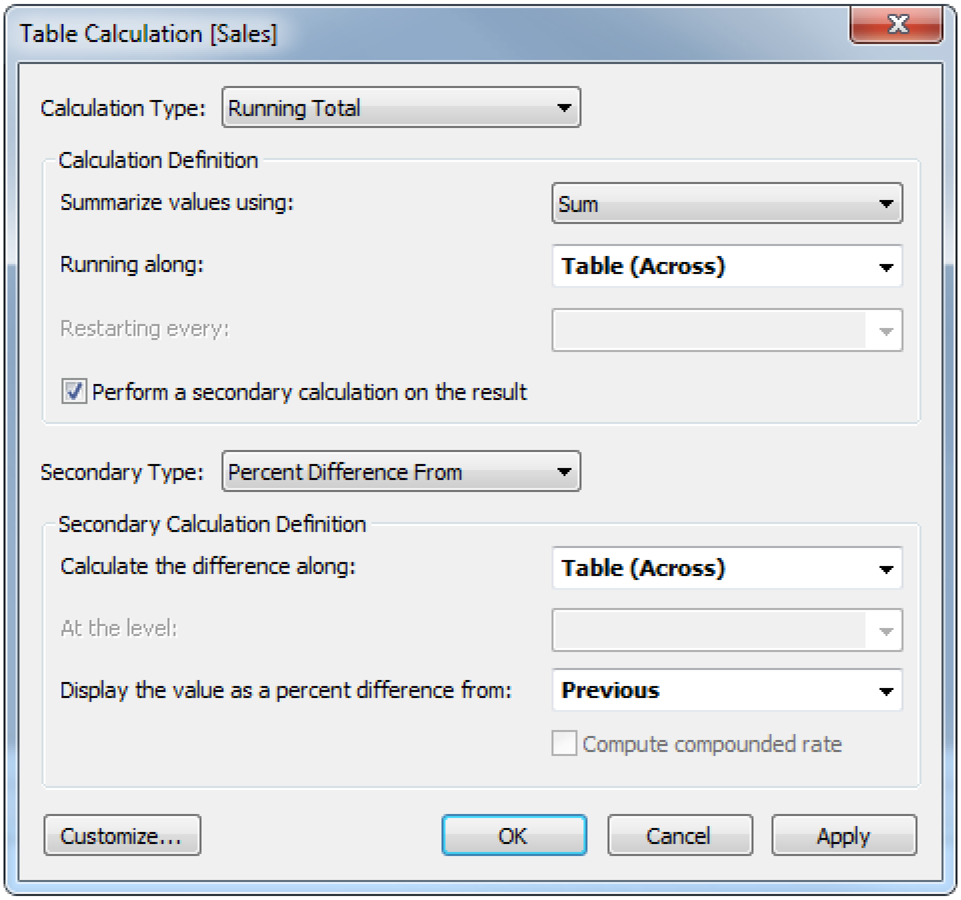


You can add a Moving Average to your view quickly using the Quick Table Calculations menu. Right-click (Control-click on Mac) the measure you want to use in the calculation and select **Quick Table Calculations** > **Moving Average**. By default this quick calculation will add a moving average across the rows in the view, summarizing the previous two values including the current value. Refer to **Quick Table Calculations** on page 1042.

Secondary Table Calculations

Table calculations can be very useful when you want to perform a calculation that applies to all of the data in the table. Most of the time you will only need to add a single calculation. However, you may sometimes want to combine two calculations so that you perform one and then perform the next on the results. For example, when calculating the Year to Date Growth, you first need to calculate the cumulative totals and then calculate the percent difference each total is from the previous year.

You can add a secondary calculation when the **Calculation Type** is Running Total or Moving Calculation. Select **Perform secondary calculation** on the result in the Table Calculation dialog box.



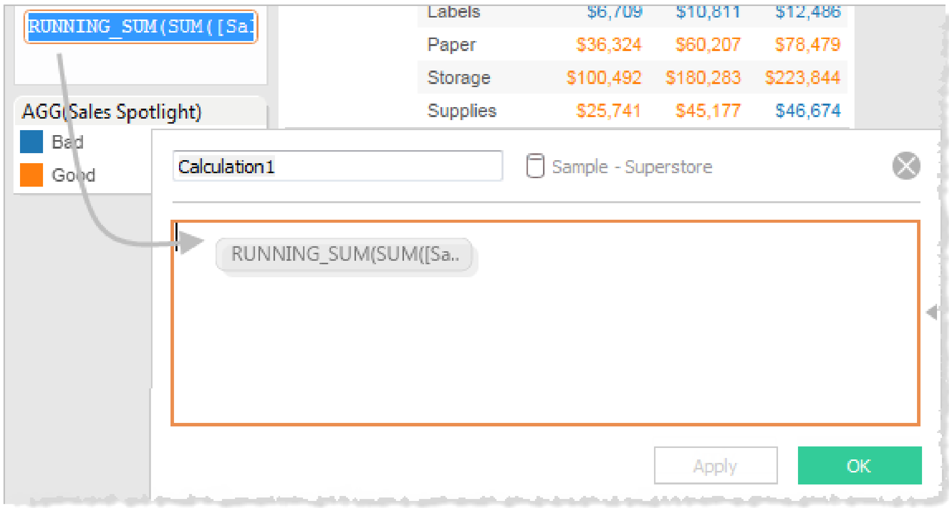
Customizing Table Calculations

Table calculations are a special type of calculated field that computes on the local data in Tableau. While you can use the built-in table calculations such as Percent of Total, Difference From, Running Total, and so on; the functions required to define these calculations are also available for use in your own custom calculated fields. Customizing table calculations allows you to compute values such as the difference in number of orders this quarter versus an average quarter, total sales for regions that have above average margin, time since first click on a website, average temperature based on the last three days weighted at 10%, 40%, and 50%, and so much more.

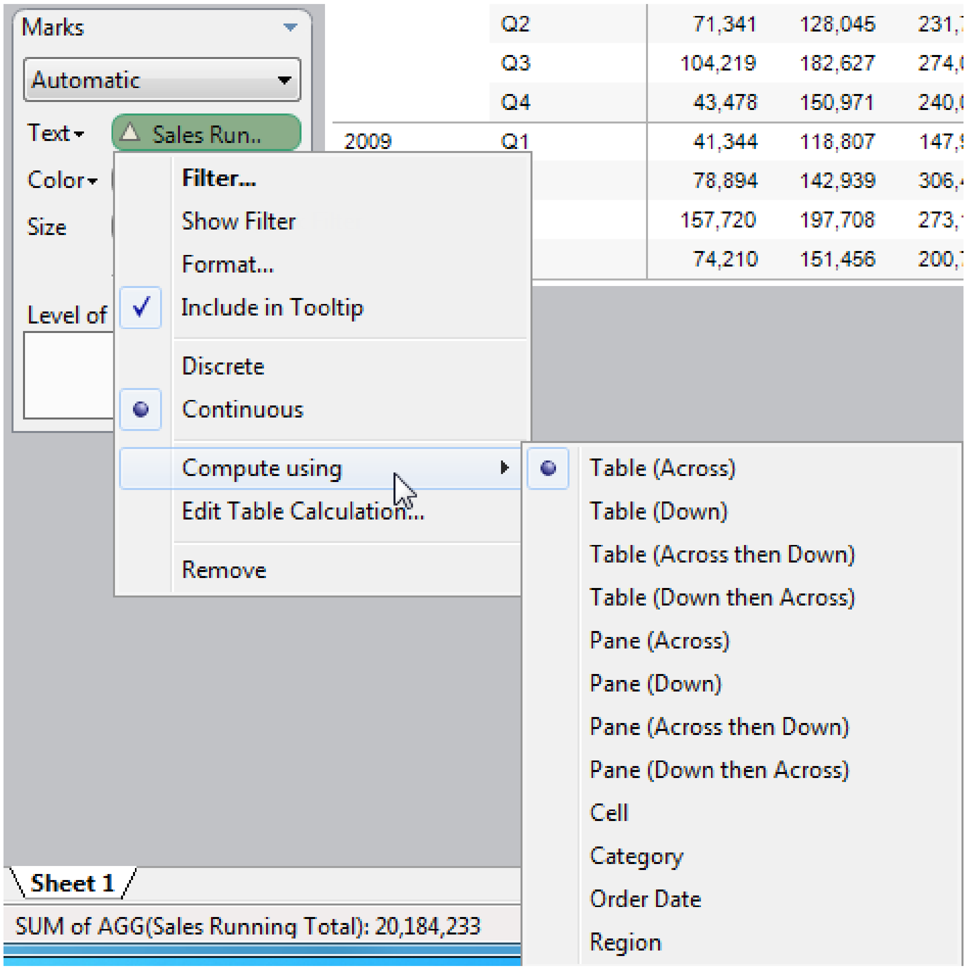
To customize a field in the view to which you have added a table calculation, follow these steps:

1. Open the calculation editor by clicking the drop down to the right of Dimensions on the **Data** pane and choosing **Create Calculated Field**.
2. Double-click the field in the view to which you have added a table calculation. This opens the field as an ad-hoc calculation.
3. Select the entire contents of the ad-hoc calculation and then drag it to the calculation

editor:



To change the addressing for a field with a table calculation, right-click the field and select an option from the **Compute Using** context menu.



Level of Detail Expressions

Level of detail expressions support aggregation at dimensionalities other than the view level. With level of detail expressions, you can attach one or more dimensions to any aggregate expression.

Unlike table calculations, totals, or reference lines, level of detail expressions are computed in the data source. On the plus side, this lets you avoid the overhead of bringing all the data from the database to your computer over the network. With large data sources, this can be a huge performance gain. On the minus side, this can cause Tableau to run more complicated queries (for example, containing many joins), and if the underlying data source is slow, performance can suffer.

Overview: Level of Detail Expressions

Level of detail expressions (which are sometimes also referred to as "LOD Expressions" or "LOD Calculations") are useful for a variety of use cases, including:

- Cohort analysis – comparing data for different subgroups
- Totals or averages across segments
- Aggregates of aggregates
- Binning aggregates

Background: Row Level Expressions and View Level Expressions

In Tableau, expressions referencing **unaggregated** datasource columns are computed for each row in the underlying table. In this case, the dimensionality of the expression is *row level*. An example of a row-level expression is:

```
[Sales] / [Profit]
```

This calculation will be evaluated in each row of the database. For each row, the Sales value in that row will be divided by the Profit value in that row, producing a new column with the result of the multiplication (a profit ratio).

If you create a calculation with this definition, save it with the name [**ProfitRatio**], and then drag it from the **Data** pane to a shelf, Tableau typically aggregates the calculated field for the view:

```
SUM[ProfitRatio]
```

By contrast, expressions referencing **aggregated** data source columns are computed at the dimensionality defined by the dimensions in the view. In this case, the dimensionality of the expression is view level. An example of a view-level expression is:

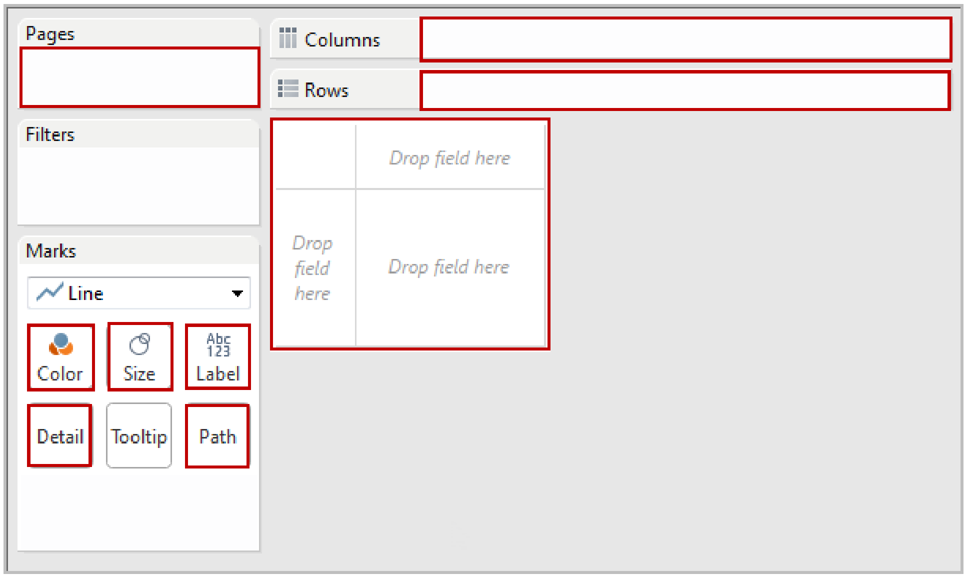
```
SUM(Sales) / SUM(Profit)
```

If you drag this calculation to a shelf (or type it directly on a shelf as an ad-hoc calculation), Tableau encloses it in an AGG function:

AGG(SUM(Sales) / SUM(Profit))

This is what is known as an aggregate calculation. For details, see **Aggregate Calculations** on page 1022.

Dimension and set fields placed on any of the locations highlighted in the following image contribute to the view level of detail:



Before level of detail expressions were supported in Tableau, it was not possible to create calculations at a level of detail other than the view level. For example, if you attempt to save the following expression, Tableau displays the error message: “Cannot mix aggregate and non-aggregate arguments with this function”:

```
[Sales] - AVG([Sales])
```

The user’s intent in this case was to compare store sales for each individual store to the average of sales for all stores. This can now be accomplished with a level of detail expression:

```
[Sales] - {AVG([Sales])}
```

This is what is known as a table-scoped level of detail expression. See **Table-Scoped Level of Detail Expressions** on page 1069

Level of Detail Expression Syntax

A level of detail expression has the following structure:

{[FIXED | INCLUDE | EXCLUDE] <*dimension declaration* > **:** <*aggregate expression*>}

The elements in a level of detail expression are described in the following table.

Element	**Description**
{ }	The entire level of detail expression is enclosed in curly braces.
[FIXED | INCLUDE | EXCLUDE]	The first element after the opening curly brace is one of the following scoping keywords: • **FIXED**

	FIXED level of detail expressions compute values using the specified dimensions without reference to the view level of detail—that is, without reference to any other dimensions in the view. FIXED level of detail expressions also ignore all the filters in the view other than context filters, data source filters, and extract filters. **Example**: `{ FIXED [Region] : SUM([Sales]) }` See **FIXED Level of Detail Expressions** on page 1069. • **INCLUDE** INCLUDE level of detail expressions compute values using the specified dimensions in addition to whatever dimensions are in the view. INCLUDE level of detail expressions are most useful when including a dimension that isn't in the view. **Example**: `{ INCLUDE [Customer Name] : SUM([Sales]) }` See **INCLUDE Level of Detail Expressions** on page 1072. • **EXCLUDE** EXCLUDE level of detail expressions explicitly remove dimensions from the expression—that is, they subtract dimensions from the view level of detail. EXCLUDE level of detail expressions are most useful for eliminating a dimension in the view. **Example**: `{EXCLUDE [Region]: SUM([Sales])}`

	See **EXCLUDE Level of Detail Expressions** on page 1076. In the case of a table-scoped level of detail expression, no scoping keyword is required. See **Table-Scoped Level of Detail Expressions** on the next page The examples in the respective sections on the different types of level of detail expressions are simple examples. For more creative and advanced examples, aligned with real-world use cases, see the Tableau blog. Search for "level of detail expressions" or "LOD."
<dimension declaration>	Specifies one or more dimensions to which the aggregate expression is to be joined. Use commas to separate dimensions. For example: `[Segment], [Category], [Region]`
:	A colon separates the dimension declaration from the aggregate expression.
<aggregate expression>	The aggregate expression is the calculation performed to define the target dimensionality.

Limitations for Level of Detail Expressions

The following limitations and constraints apply for level of detail expressions. Also see **Data Source Constraints for Level of Detail Expressions** on page 1082.

- Level of detail expressions that reference floating-point measures can behave unreliably when used in a view that requires comparison of the values in the expression. For details, see **Data Types** on page 1407.
- Level of detail expressions are not shown on the Data Source page. See **Data Source Page** on page 267.
- Sets cannot be used in the dimension declaration in a level of detail expression.
- With data blending, the linking field from the primary data source must be in the view

before you can use a level of detail expression from the secondary data source. See the Knowledge Base article Data Blending Limitations with COUNTD, MEDIAN, and RAWSQLAGG.

In addition, some data sources have complexity limits. Tableau will not disable calculations for these databases, but query errors are a possibility if calculations become too complex.

Level of Detail Expressions Can Be Dimensions or Measures

When you save a level of detail expression, Tableau adds it to either Dimensions or Measures.

FIXED level of detail expressions can result in measures or dimensions, depending on the underlying field in the aggregate expression. So MIN([Date])} will be a dimension because [Date] is a dimension, and {fixed Store : SUM([Sales])} will be a measure because [Sales] is a measure. When a FIXED level of detail expression is saved as a measure you have the option of moving it to dimensions.

INCLUDE and EXCLUDE level of detail expressions are always measures.

Table-Scoped Level of Detail Expressions

It is possible to define a level of detail expression at the table level without using any of the scoping keywords. For example, the following expression returns the minimum (earliest) order date for the entire table:

```
{MIN([Order Date])}
```

This is equivalent to a FIXED level of detail expression with no dimension declaration:

```
{FIXED : MIN([Order Date])}
```

FIXED Level of Detail Expressions

FIXED level of detail expressions compute a value using the specified dimensions, without reference to the dimensions in the view.

The following examples can be recreated using the **Sample - Superstore** data source.

Example 1

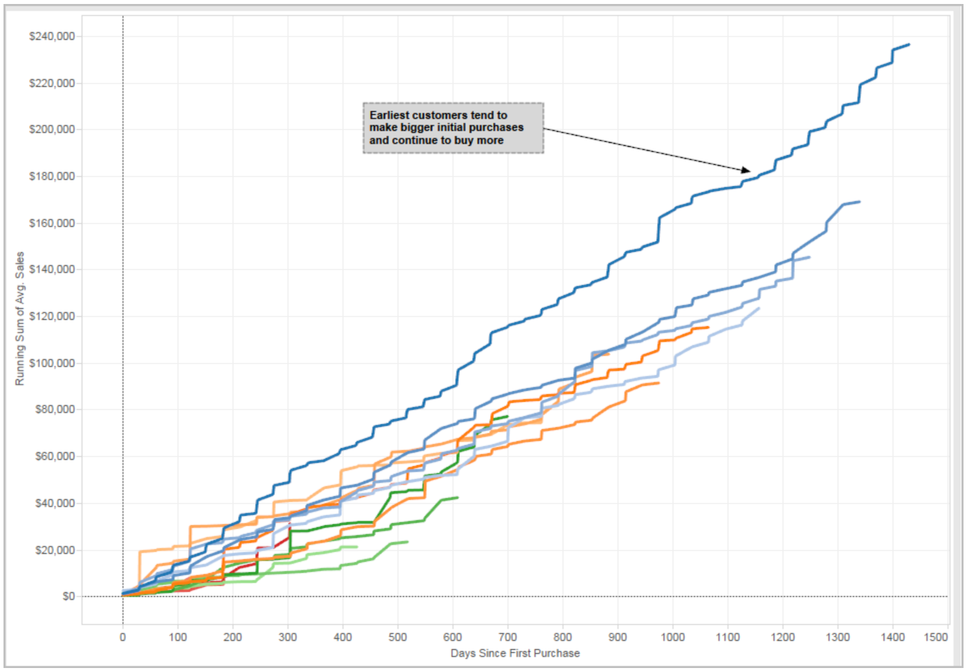
The following FIXED level of detail expression computes the first purchase date for each customer in the data source:

```
{FIXED [Customer Name] : MIN([Order Date])}
```

The resulting field, saved as [**First Purchase Date**], is then used in a second calculated field to compute the interval between a customer’s first purchase date and any subsequent purchase:

```
DATETRUNC('month', [Order Date])-DATETRUNC('month', [First
Purchase Date])
```

By placing this calculated field, saved as [**Days Since First Purchase**], on the **Columns** shelf, and a running total of sales on the **Rows** shelf, you can show customer buying behavior over time, as measured by days since first purchase:

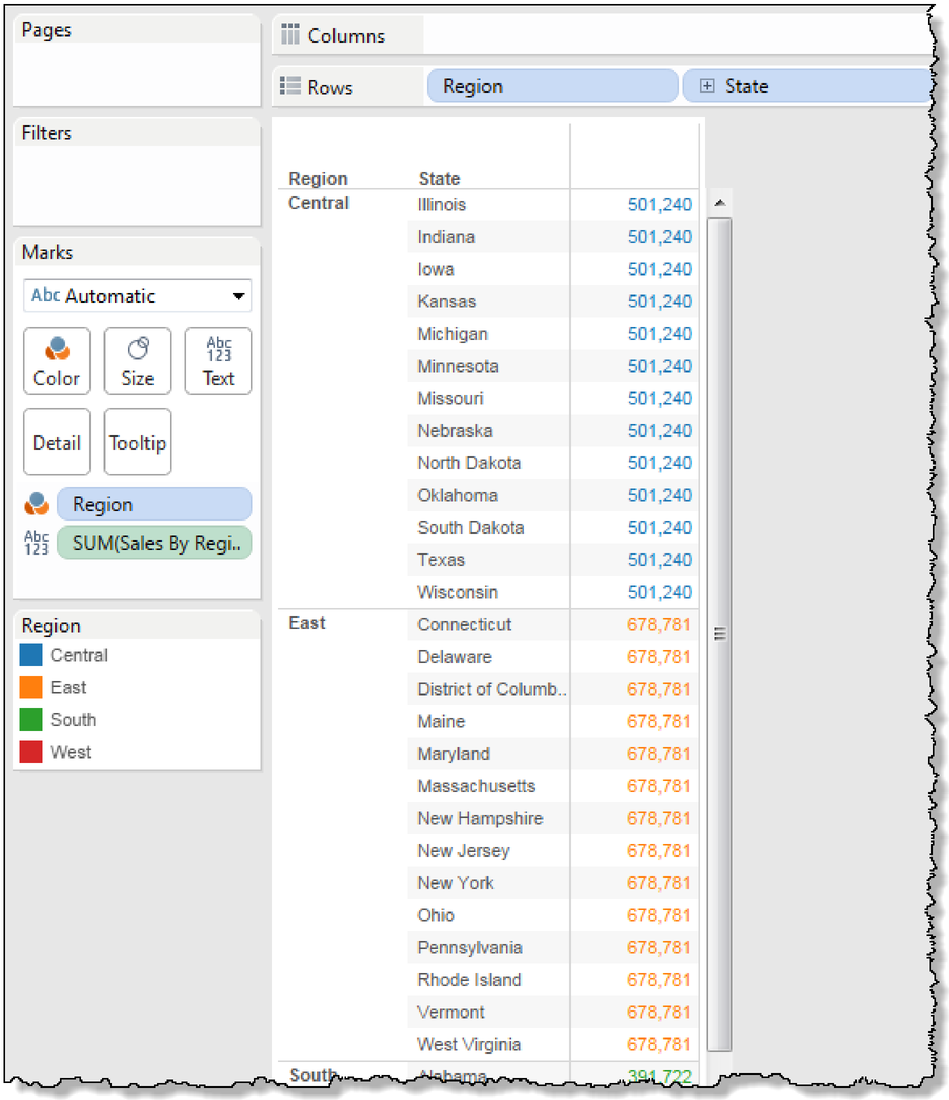


Example 2

The following FIXED level of detail expression computes the sum of sales per region:

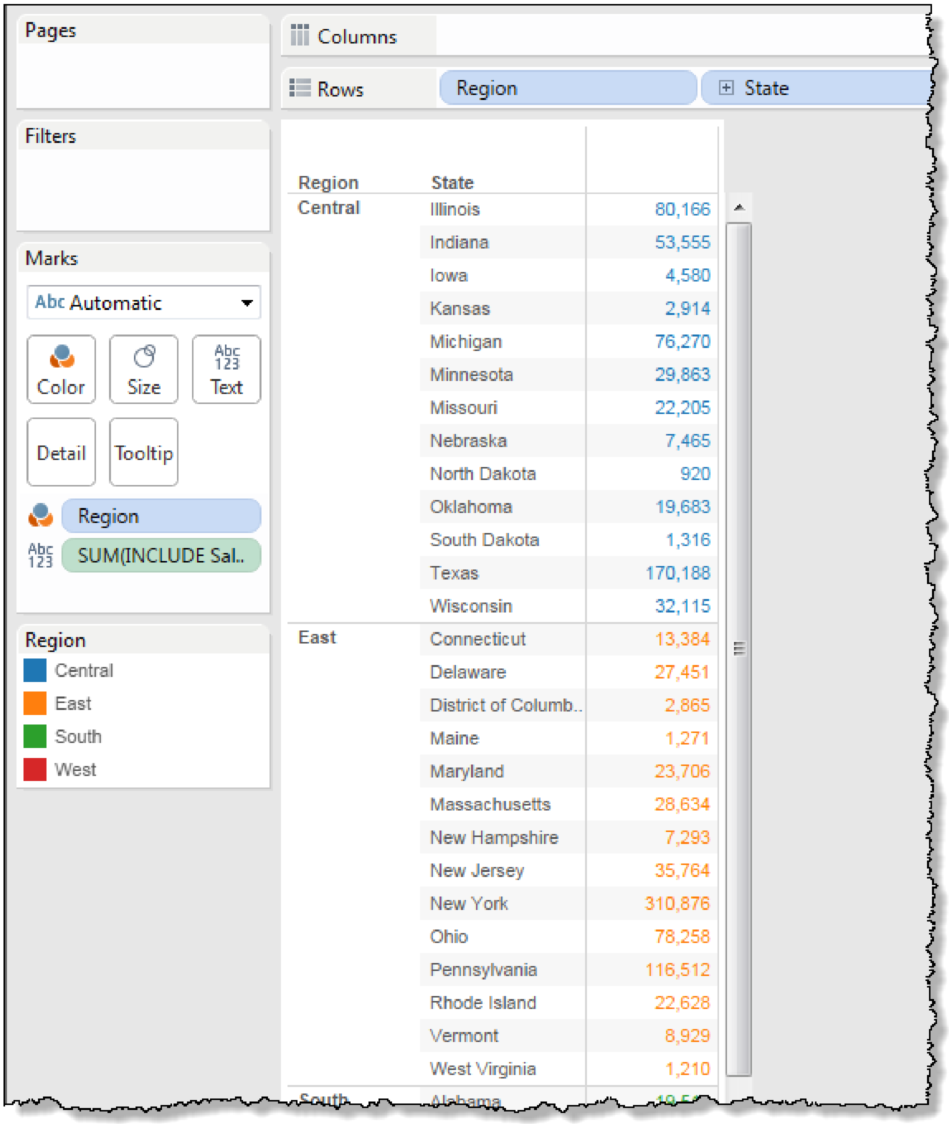
```
{FIXED [Region] : SUM([Sales])}
```

This level of detail expression, named [**Sales by Region**], is then placed on Text to show total sales per region:



The view level of detail is [**Region**] plus [**State**], but because FIXED level of detail expressions do not consider the view level of detail, the calculation only uses the [**Region**] dimension, and so the values for the individual states in each region are identical. See **Level of Detail Expressions and Aggregation** on page 1078 for an explanation of why this is so.

If the INCLUDE keyword had been used in the level of detail expression instead of FIXED, the values would be different for each state, because Tableau would add the dimension in the expression ([**Region**]) with any additional dimensions in the view ([**State**]) in determining values for the expression. The result would be:



INCLUDE Level of Detail Expressions

INCLUDE level of detail expressions compute values using the specified dimensions in addition to whatever dimensions are in the view.

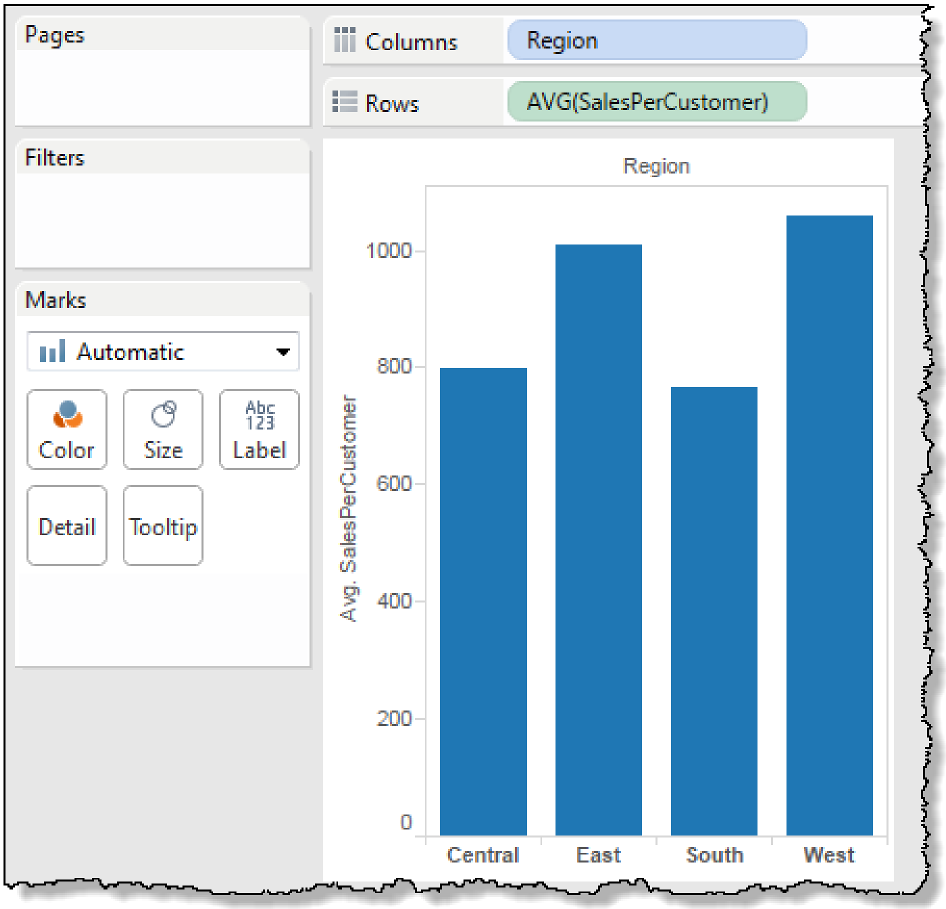
INCLUDE level of detail expressions can be useful when you want to calculate at a fine level of detail in the database and then re-aggregate and show at a coarser level of detail in your view. Fields based on INCLUDE level of detail expressions will change as you add or remove dimensions from the view.

Example 1

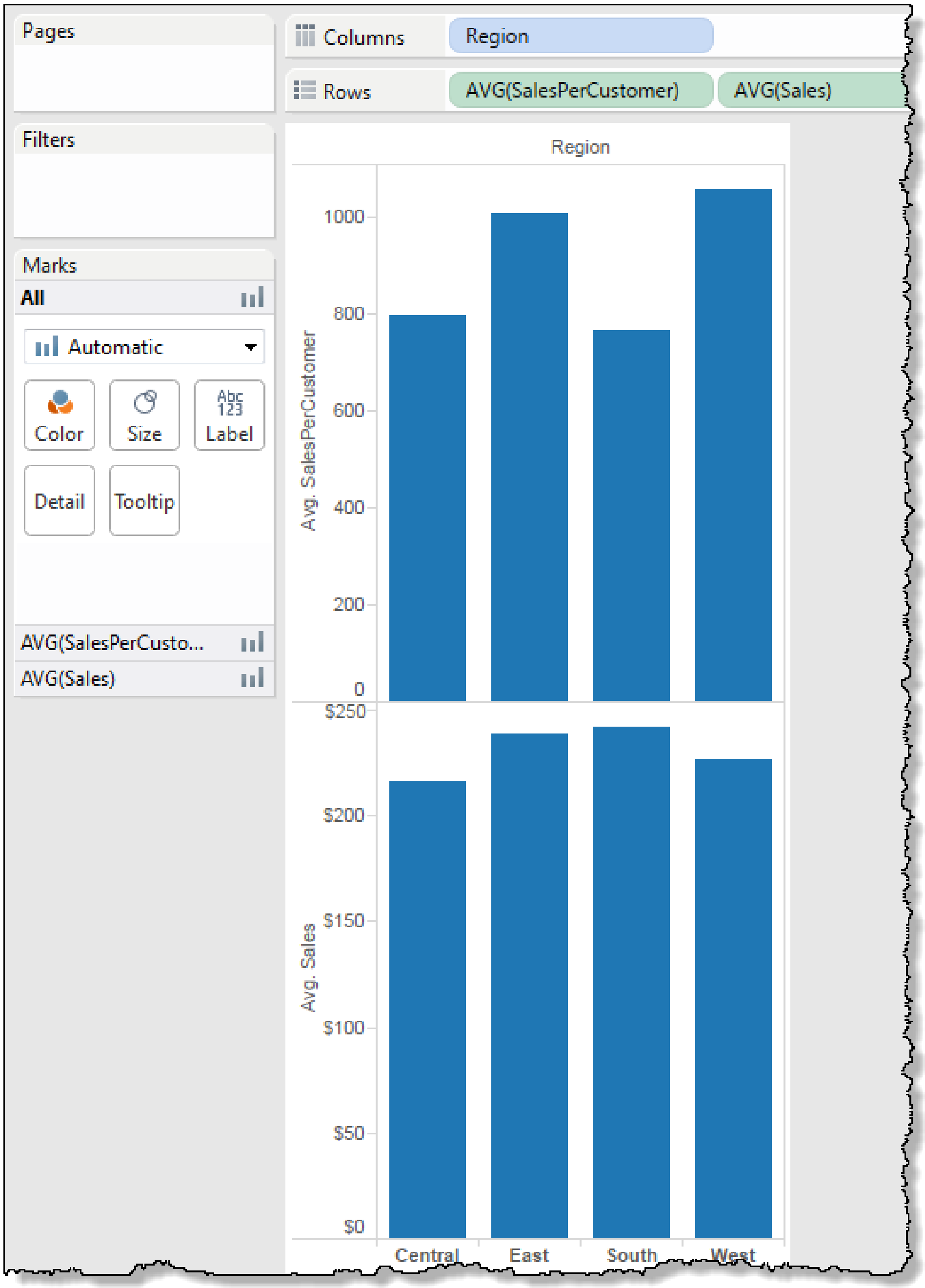
The following INCLUDE level of detail expression computes total sales per customer:

```
{ INCLUDE [Customer Name] : SUM([Sales]) }
```

When that calculation is placed on the **Rows** shelf, aggregated as AVG, and the [**Region**] dimension is placed on the **Columns** shelf, the view shows the average customer sales amount per region:



If the **[Sales]** measure is then dragged to the **Rows** shelf, the result illustrates the difference between the average sale (somewhere between $200 and $250 per region) and the average sale per customer (between $750 and $1100 per region):

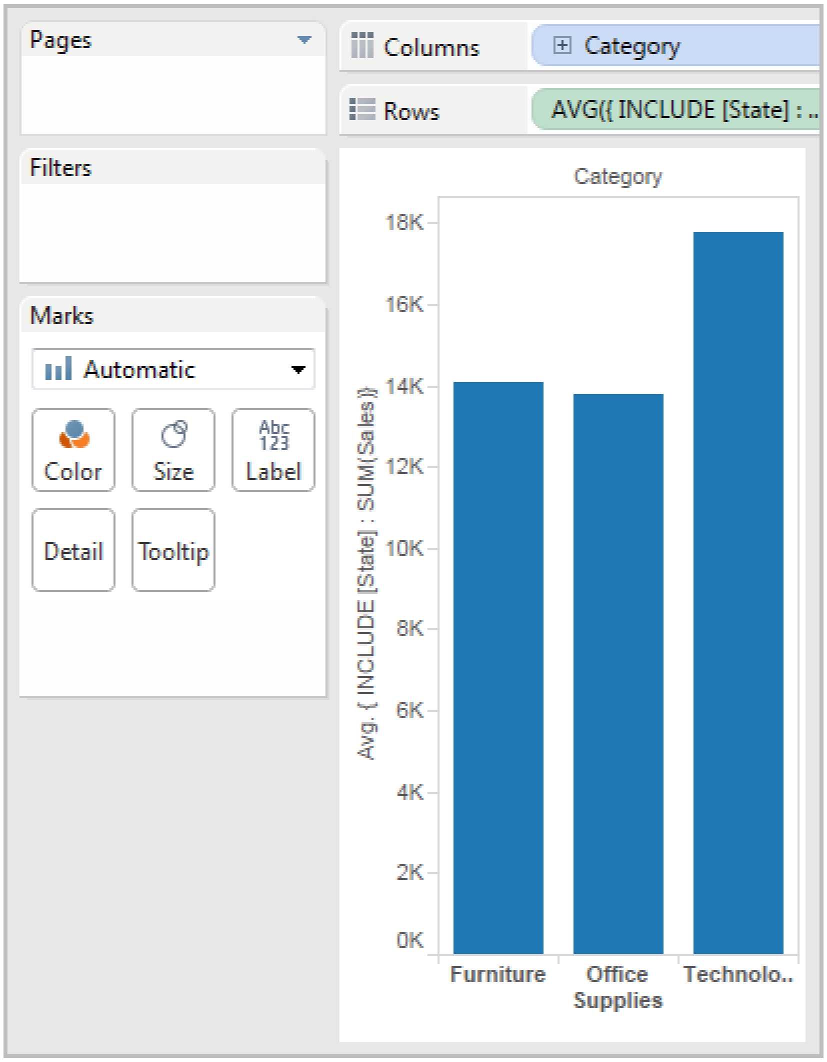


Example 2

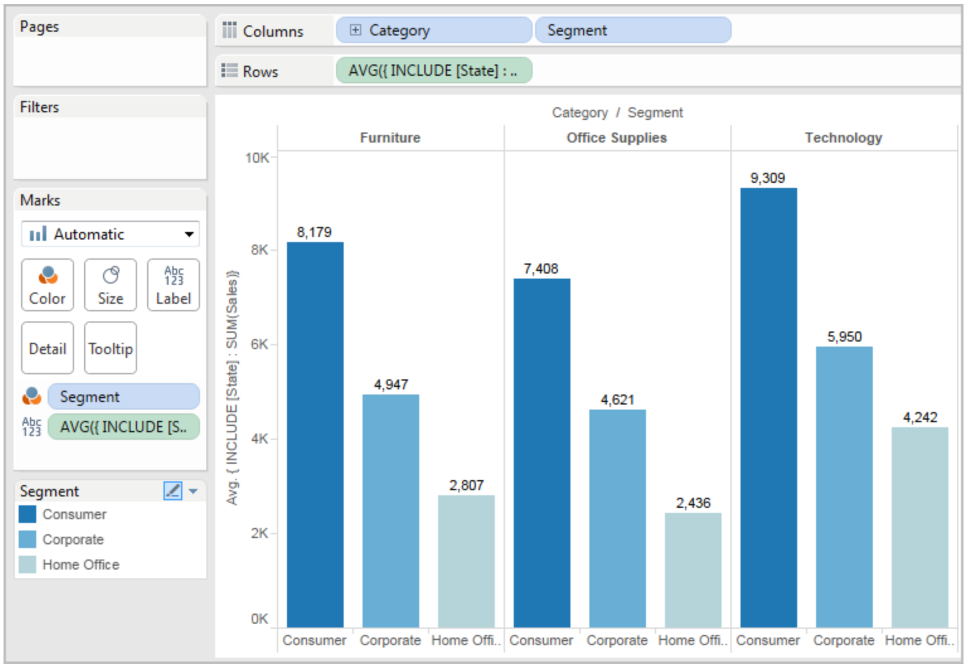
The following INCLUDE level of detail expression calculates sum of sales on a per-state basis:

```
{ INCLUDE [State] : SUM(Sales)}
```

Typed directly on the **Rows** shelf as an ad-hoc calculation, the expression is aggregated as AVG. The resulting view averages the sum of sales by state across categories.



The view can be further enhanced by adding [**Segment**] to **Columns** and then copying the ad-hoc calculation from **Rows** to **Label** (using Ctrl+drag). In the image below we also dragged **Segment** to **Color** and then edited the colors for aesthetic effect. Now we can see how the average sum of sales per state varies across categories and segments.



EXCLUDE Level of Detail Expressions

EXCLUDE level of detail expressions declare dimensions to omit from the view level of detail.

EXCLUDE level of detail expressions are useful for 'percent of total' or 'difference from overall average' scenarios. They are comparable to such features as Totals and Reference Lines.

EXCLUDE level of detail expression cannot be used in row-level expressions (where there are no dimensions to omit), but can be used to modify either a view level calculation or anything in between (that is, you can use an EXCLUDE calculation to remove dimension from some other level of detail expression).

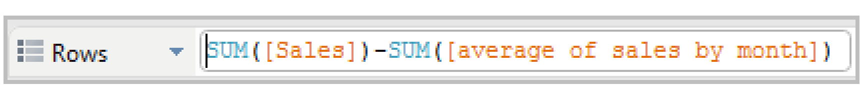
Example 1

The following EXCLUDE level of detail expression computes the average sales total per month and then excludes the month component:

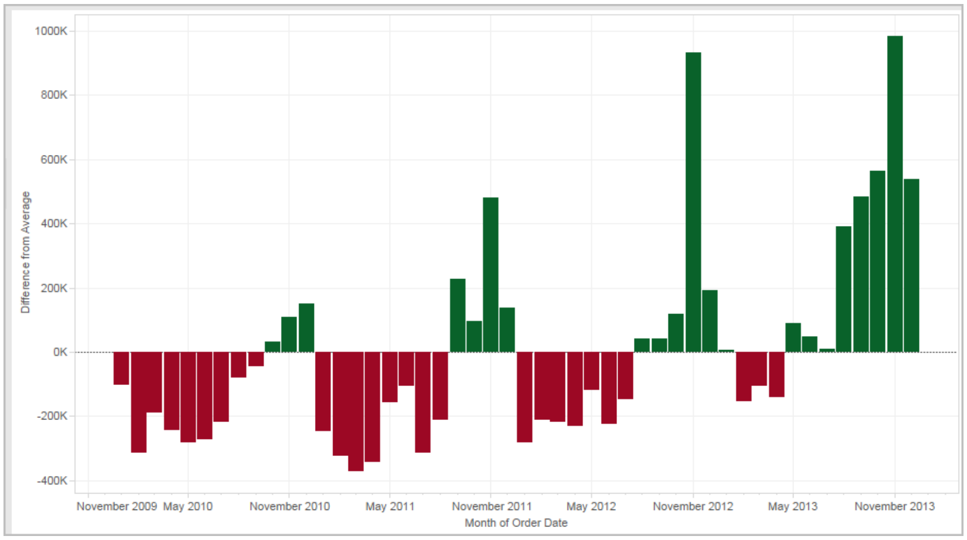
```
{EXCLUDE [Order Date (Month / Year)] : AVG({FIXED [Order Date
(Month / Year)] : SUM([Sales])})}
```

Notice that this is a nested level of detail expression—that is, a level of detail expression within another level of detail expression.

Saved as [**average of sales by month**], the calculation can then be subtracted from the sum of sales per month by means of an ad-hoc calculation on the **Rows** shelf:



With **Month([Order Date])** on the **Columns** shelf, this creates a view that shows the difference between actual sales per month over a four-year period and the average monthly sales for the entire four-year period:



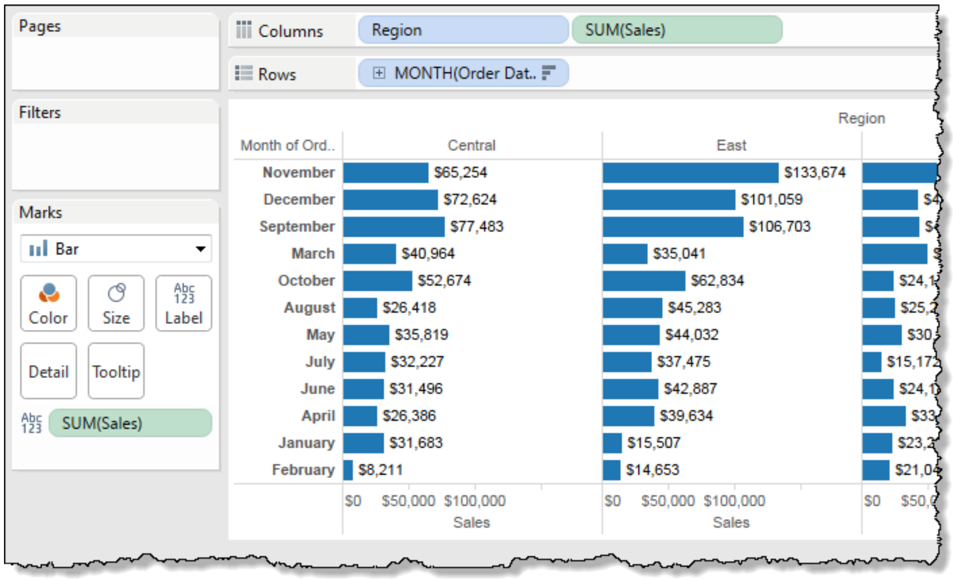
Example 2

The following level of detail expression excludes [**Region**] from a calculation of the sum of [**Sales**]:

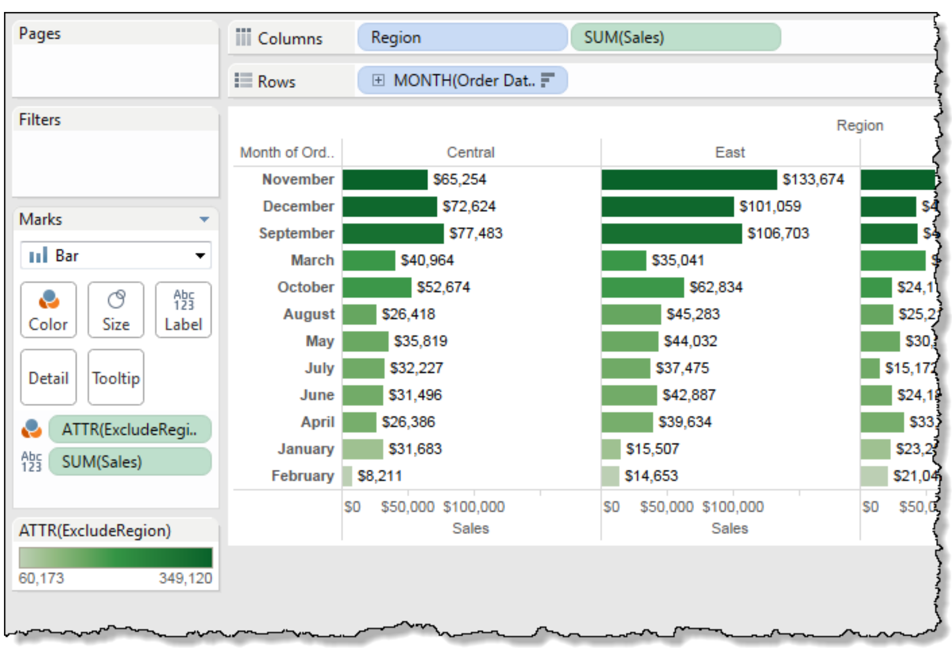
```
{EXCLUDE [Region]: SUM([Sales])}
```

The expression is saved as [**ExcludeSales**].

To illustrate how this expression might be useful, first consider the following view, which breaks out the sum of sales by region and by month:



Dropping [**ExcludeRegion**] on Color shades the view to show total sales by month but without the regional component:



Level of Detail Expressions and Aggregation

The level of detail of the view determines the number of marks in your view. When you add a level of detail expression to the view, Tableau must reconcile two levels of detail—the one in the view, and the one in your expression.

The behavior of a level of detail expression in the view varies depending on whether the expression's level of detail is coarser, finer, or the same as the level of detail in the view. What do we mean by “coarser” or “finer” in this case?

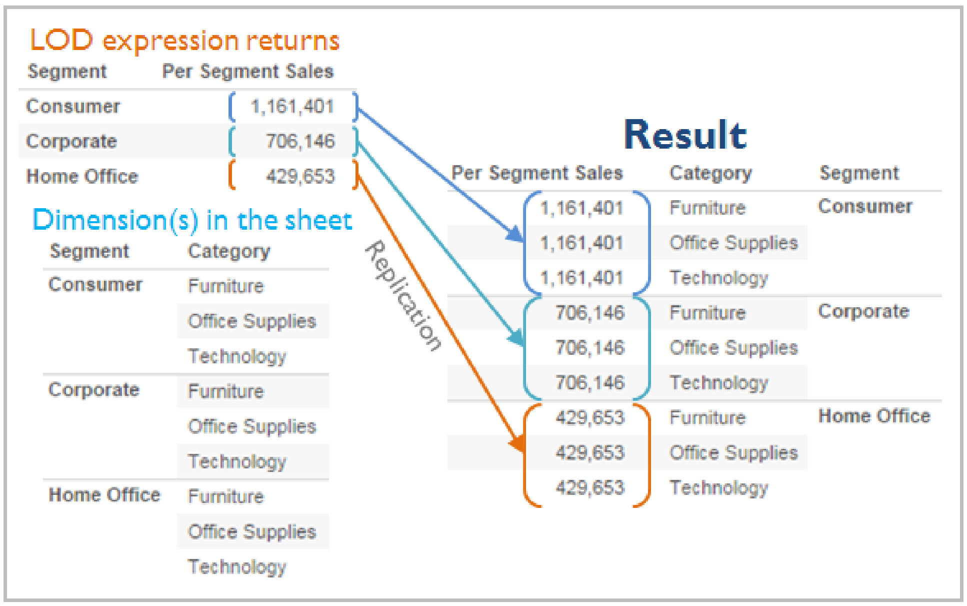
Level of Detail Expression is Coarser Than View Level of Detail

An expression has a coarser level of detail than the view when it references a subset of the dimensions in the view. For example, for a view that contained the dimensions [**Category**] and [**Segment**], you could create a level of detail expression that uses only one of these dimensions:

```
{FIXED [Segment] : SUM([Sales])}
```

In this case, the expression has a coarser level of detail than the view. It bases its values on one dimension ([**Segment**]), whereas the view is basing its view on two dimensions ([**Segment**] and [**Category**]).

The result is that using the level of detail expression in the view causes certain values to be replicated—that is, to appear multiple times.



Replicated values are useful for comparing specific values against average values within a category. For example the following calculation subtracts average sales for a customer from the average sales overall:

```
[Sales] - {FIXED [Customer Name] : AVG([Sales])}
```

When values are being replicated, changing the aggregation for the relevant field in the view (for example, from AVG to SUM) will not change the result of the aggregation.

Level of Detail Expression is Finer Than View Level of Detail

An expression has a finer level of detail than the view when it references a superset of the dimensions in the view. When you use such an expression in the view, Tableau will aggregate results up to the view level. For example, the following level of detail expression references two dimensions:

```
{FIXED [Segment], [Category] : SUM([Sales])}
```

When this expression is used in a view that has only [Segment] as its level of detail, the values must be aggregated. Here's what you would see if you dragged that expression to a shelf:

```
AVG([{FIXED [Segment]], [Category]] : SUM([Sales]])}])
```

An aggregation—in this case, average—is automatically assigned by Tableau. You can change the aggregation as needed.

Adding a Level of Detail Expression to the View

Whether a level of detail expression is aggregated or replicated in the view is determined by the expression type (FIXED, INCLUDE, or EXCLUDE) and whether the expression's granularity is coarser or finer than the view's.

- INCLUDE level of detail expressions will have either the same level of detail as the view or a finer level of detail than the view. Therefore, values will never be replicated.
- FIXED level of detail expressions can have a finer level of detail than the view, a coarser level of detail, or the same level of detail. The need to aggregate the results of a FIXED level of detail depends on what dimensions are in the view.
- EXCLUDE level of detail expressions always cause replicated values to appear in the view. When calculations including EXCLUDE level of detail expressions are placed on a shelf, Tableau defaults to the ATTR aggregation (as opposed to SUM or AVG) to indicate that the expression is not actually being aggregated and that changing the aggregation will have no effect on the view.

Level of detail expressions are always automatically wrapped in an aggregate when they are added to a shelf in the view unless they're used as dimensions. So if you double-click on a shelf and type

```
{FIXED[Segment], [Category] : SUM([Sales])}
```

and then press Enter to commit the expression, what you now see on the shelf is

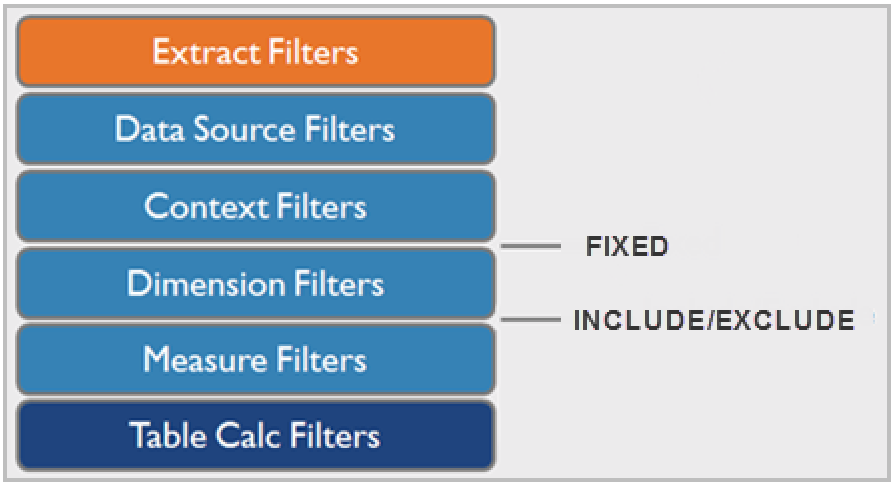
```
SUM({FIXED[Segment], [Category] : SUM([Sales])})
```

But if you double-click into the shelf to edit the expression, what you see in edit mode is the original expression.

If you wrap a level of detail expression in an aggregation when you create it, Tableau will use the aggregation you specified rather than assigning one when any calculation including that expression is placed on a shelf. When no aggregation is needed (because the expression's level of detail is coarser than the view's), the aggregation you specified is still shown when the expression is on a shelf, but it is ignored.

Filters and Level of Detail Expressions

There are several different kinds of filters in Tableau and they get executed in the following order from top to bottom.



The text on the right shows where level of detail expressions are evaluated in this sequence.

Extract Filters (in orange) are only relevant if you're creating a Tableau Extract from a data source. Table calculations filters (dark blue) are applied after calculations are executed and therefore hide marks without filtering out the underlying data used in the calculations.

If you're familiar with SQL, you can think of measure filters as equivalent to the HAVING clause in a query, and dimension filters as equivalent to the WHERE clause.

FIXED calculations are applied before dimension filters, so unless you promote the fields on your Filter shelf to **Context Filters** on page 659, they will be ignored. For example, consider if you have the following calculation on one shelf in a view, along with [**State**] on a different shelf:

```
SUM([Sales]) / ATTR({FIXED : SUM([Sales])})
```

This calculation will give you the ratio of a state's sales to total sales.

If you then put [**State**] on the Filters shelf to hide some of the states, the filter will affect only the numerator in the calculation. Since the denominator is a FIXED level of detail expression, it will still divide the sales for the states still in the view against the total sales for all states—including the ones that have been filtered out of the view.

INCLUDE and EXCLUDE level of detail expressions are considered after Dimension filters. So if you want filters to apply to your FIXED level of detail expression but don't want to use Context Filters, consider rewriting them as INCLUDE or EXCLUDE expressions.

Data Source Constraints for Level of Detail Expressions

For some data sources, only more recent versions support level of detail expressions. Some data sources do not support level of detail expressions at all.

In addition, some data sources have complexity limits. Tableau will not disable calculations for these databases, but query errors are a possibility if calculations become too complex.

Data Source	Support
Actian Vectorwise	Not supported.
Amazon EMR	Supported for Hive 0.13 and later.
Amazon Redshift	Supported.
Aster Database	Supported for version 4.5 and later.
Cloudera Hadoop	Supported for Hive 0.13 and later.
Cloudera Impala	Supported for Impala 1.2.2 and later.
Cubes (multidimensional data sources)	Not supported.
DataStax Enterprise	Not supported.
EXASolution	Supported.
Firebird	Supported for version 2.0 and later.
Generic ODBC	Limited. Depends on the specific data source.
Google Big Query	Not supported.
Hortonworks Hadoop Hive	Supported for Hive 0.13 and later. On version 1.1 of HIVE level of detail expressions that produce cross joins are not reliable. Cross join occur when there is no explicit field to join on. For example, for a level of detail expression `{fixed [Product Type] : sum(sales)}` when the view only contains one dimension [**Ship Mode**], Tableau creates a cross-join. A cross join produces rows

	which combine each row from the first table with each row from the second table.
HP Vertica	Supported for version 6.1 and later.
IBM BigInsights	Supported.
IBM DB2	Supported for version 8.1 and later.
MarkLogic	Supported for version 7.0 and later.
Microsoft Jet-based connections (legacy connectors for Microsoft Excel, Microsoft Access, and text)	Not supported.
Microsoft SQL Server	SQL Server 2005 and later.
MySQL	Supported.
IBM Netezza	Supported version 7.0 and later.
Oracle	Supported version 9i and later.
ParAccel	Supported version 3.1 and later.
Pivotal Greenplum	Supported for version 3.1 and later.
PostgreSQL	Supported version 7 and later.
Progress OpenEdge	Supported.
SAP HANA	Supported.
SAP Sybase ASE	Supported.
SAP Sybase IQ	Supported version 15.1 and later.

Spark SQL	Supported.
Splunk	Not supported.
Tableau Data Extract	Supported.
Teradata	Supported.

Percentages

Any analysis in Tableau can be expressed in terms of percentages. For example, rather than viewing sales for every product, you might want to view each product's sales as a percentage of the total sales for all products.

You calculate percentages by selecting the **Analysis** > **Percentages Of** menu item. When you do this, all measures on the worksheet are displayed as a percentage based on all the table data.

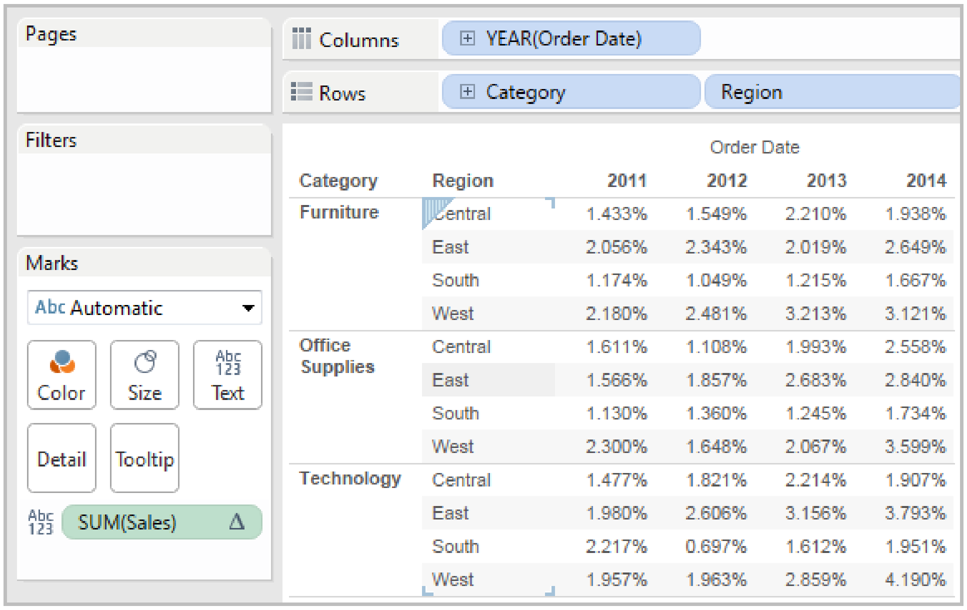
> The percentage options on the Analysis menu correspond to the percentage table calculations. When you select a percentage option, you are actually adding a Percent of Total table calculation. See **Table Calculations** on page 1029 for more information.

About Percentages

There are two factors that contribute to the percentage calculation:

- The aggregation – Percentages are calculated on the basis of the current aggregation for each measure. Refer to **Percentages and Aggregations** on the next page for more information.
- The data to which you compare all percentage calculations – Percentages are a ratio of numbers. The numerator is the value of a given mark. The denominator depends on the type of percentage you want, and is the number to which you compare all your calculations. The comparison can be based on the entire table, a row, a pane, and so on. By default, Tableau uses the entire table. Other percentage calculations are available via the **Percentage of** menu item. Refer to **Percentage Options** on page 1087 for more information.

The figure below is an example of a text table with percentages. The percentages are calculated with the **Sales** measure aggregated as a summation, and are based on the entire table.



Percentages and Aggregations

Percentages are computed on the basis of the aggregation for each measure. Standard aggregations include summation, average, and several others. See **Aggregations** on page 245 for more information.

For example, if the aggregation applied to the **Sales** measure is a summation, then the default percentage calculation (percent of table) means that each number displayed is the SUM(Sales) for that mark divided by the SUM(Sales) for the entire table.

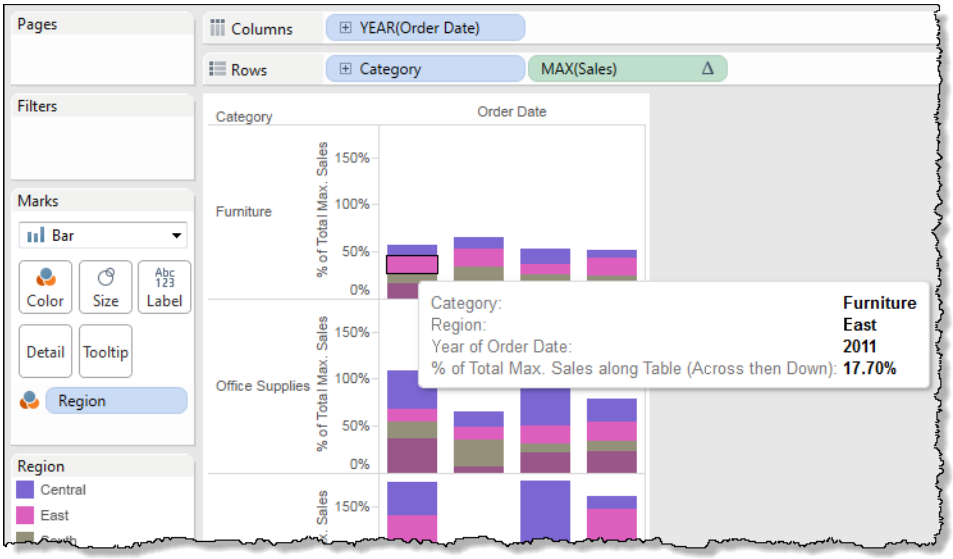
In addition to using predefined aggregations, you can use custom aggregations when calculating percentages. You define your own aggregations by creating a calculated field. Once the new field is created, you can use percentages on the field as you would any other field. See **Aggregate Calculations** on page 1022 for more information.

Percent calculations can also be applied to disaggregated data. In this case, all values are expressed as the percentage of a summation. You cannot choose any other aggregation.

Example – Percentages and Aggregations

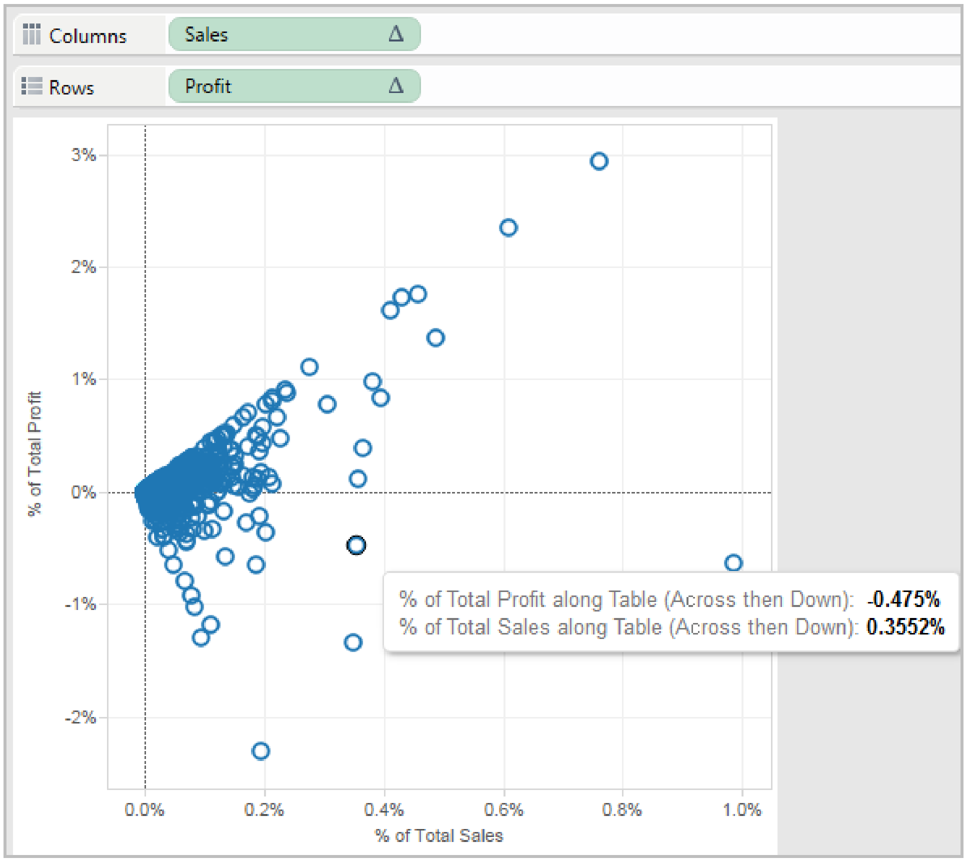
The view below shows a nested bar chart created using two dimensions and a measure that is aggregated as a maximum. Additionally, the data are color-encoded by a dimension and the default percentage calculation has been applied. Notice that the axis labels are modified to reflect the percent calculation.

The tooltip reveals that the maximum sales for furniture in the east in 2011 is 17.70% of the maximum for the entire table. What is the maximum for the table? If you recreate the view you'll see that the maximum occurs in the South, in the Technology category, in the year 2011. The tooltip for this bar segment would reveal a maximum sales of 100%.



The next view displays two disaggregated measures as a scatter plot. Again, the default percentage calculation has been applied as reflected by the modified axis labels.

The tooltip shows that the selected data point constitutes -0.475 percent of total profit and a 0.3552 percent of total sales. Percentage calculations are based on the entire data source.



Percentage Options

Computing a percentage involves specifying a total on which the percentage is based. In Tableau, the default percentage calculation is based on the entire table. However, you can change the default by selecting a different percentage option from the **Analysis** > **Percentage of** menu.

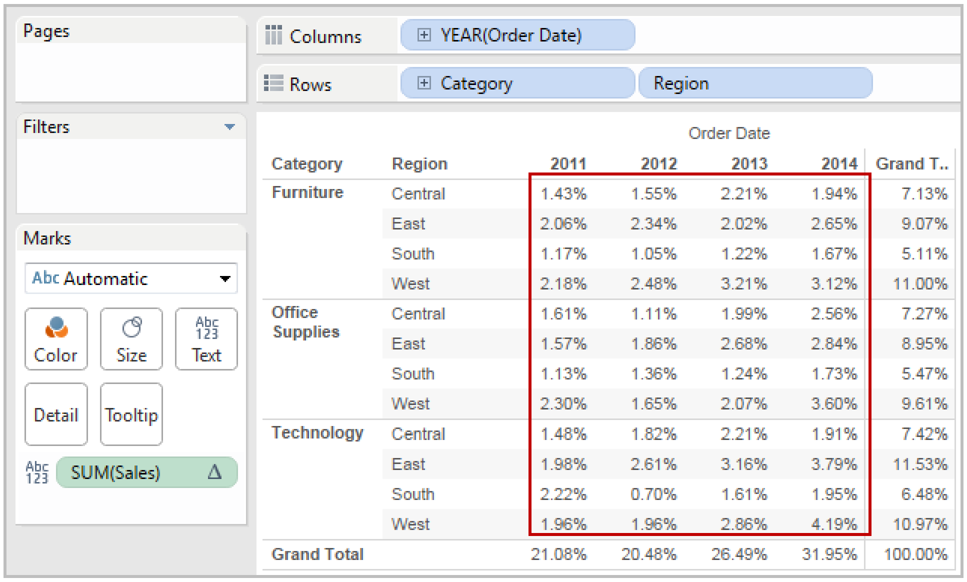
The option you choose is applied uniformly to all measures that appear on a worksheet. For instance, you cannot choose **Percent of Column** for one measure and **Percent of Row** for another.

If you are unsure what the current percentage calculation means, display the grand totals. This provides more information about each row and column. For example, if you select **Percent of Row** while displaying grand totals, you will see that the total for each row is exactly 100%. See **Grand Totals** on page 1149 for more information on grand totals.

The percent calculation options are described in the following sections. In each case, the grand totals are displayed as well.

Percent of Table

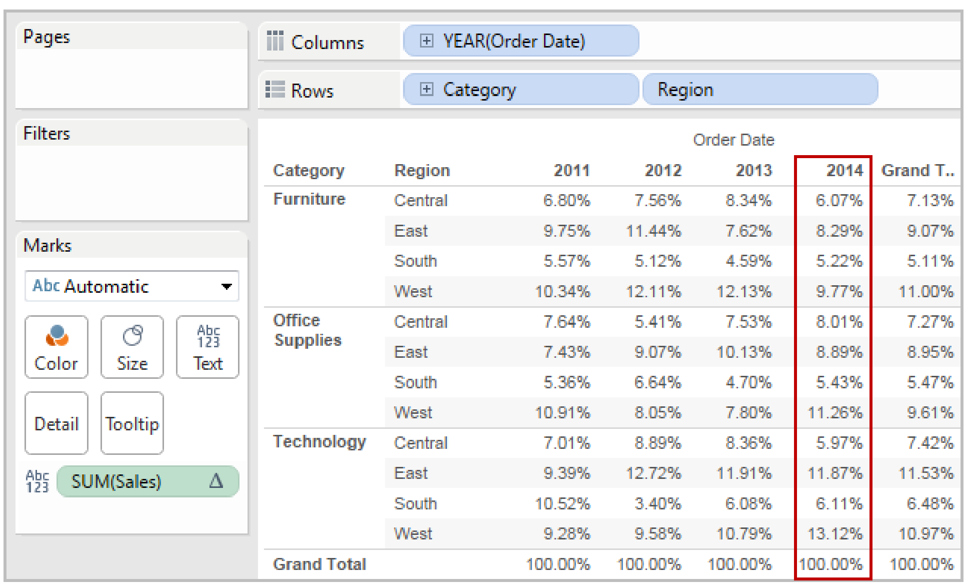
When you select **Percentage of Table**, each measure on the worksheet is expressed as a percentage of the total for the entire worksheet (table). For example, Technology in the East region accounts for 3.79% of total sales in 2014. The grand totals for rows show that 2014 accounts for 31.95% of the total sales. Summing the grand totals for rows or for columns yields 100% of the total.



Category	Region	2011	2012	2013	2014	Grand T..
		Order Date				
Furniture	Central	1.43%	1.55%	2.21%	1.94%	7.13%
	East	2.06%	2.34%	2.02%	2.65%	9.07%
	South	1.17%	1.05%	1.22%	1.67%	5.11%
	West	2.18%	2.48%	3.21%	3.12%	11.00%
Office Supplies	Central	1.61%	1.11%	1.99%	2.56%	7.27%
	East	1.57%	1.86%	2.68%	2.84%	8.95%
	South	1.13%	1.36%	1.24%	1.73%	5.47%
	West	2.30%	1.65%	2.07%	3.60%	9.61%
Technology	Central	1.48%	1.82%	2.21%	1.91%	7.42%
	East	1.98%	2.61%	3.16%	3.79%	11.53%
	South	2.22%	0.70%	1.61%	1.95%	6.48%
	West	1.96%	1.96%	2.86%	4.19%	10.97%
Grand Total		21.08%	20.48%	26.49%	31.95%	100.00%

Percent of Column

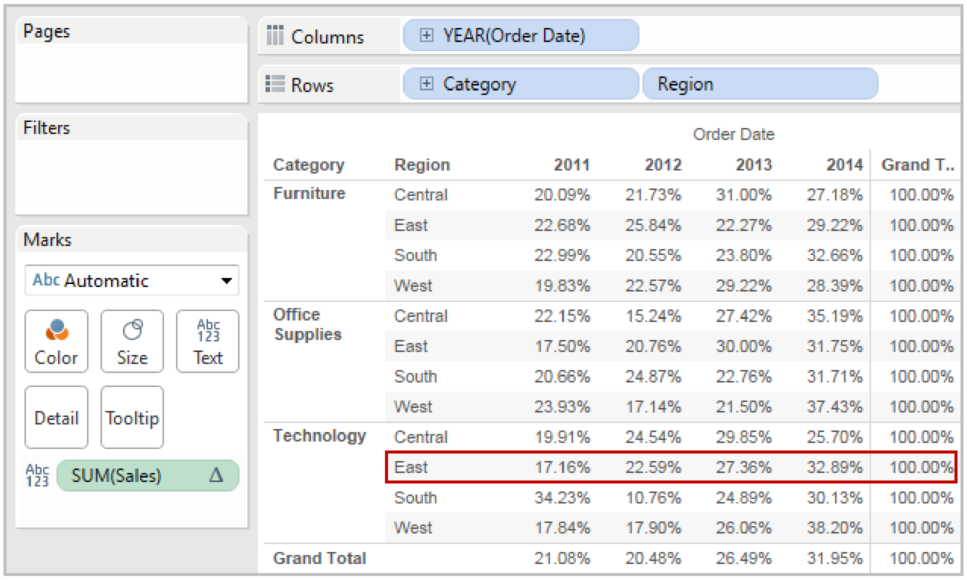
When you select **Percentage of Column**, each measure on the worksheet is expressed as a percentage of the total for the column. For example, Technology in the East region accounts for 11.87% of total sales in the 2014. The column in this case is 2006.



Category	Region	2011	2012	2013	2014	Grand T..
		Order Date				
Furniture	Central	6.80%	7.56%	8.34%	6.07%	7.13%
	East	9.75%	11.44%	7.62%	8.29%	9.07%
	South	5.57%	5.12%	4.59%	5.22%	5.11%
	West	10.34%	12.11%	12.13%	9.77%	11.00%
Office Supplies	Central	7.64%	5.41%	7.53%	8.01%	7.27%
	East	7.43%	9.07%	10.13%	8.89%	8.95%
	South	5.36%	6.64%	4.70%	5.43%	5.47%
	West	10.91%	8.05%	7.80%	11.26%	9.61%
Technology	Central	7.01%	8.89%	8.36%	5.97%	7.42%
	East	9.39%	12.72%	11.91%	11.87%	11.53%
	South	10.52%	3.40%	6.08%	6.11%	6.48%
	West	9.28%	9.58%	10.79%	13.12%	10.97%
Grand Total		100.00%	100.00%	100.00%	100.00%	100.00%

Percent of Row

When you select **Percentage of Row**, each measure on the worksheet is expressed as a percentage of the total for the row. For example, Technology in the East region accounts for 32.89% of total sales in 2014. East is the row in this case.

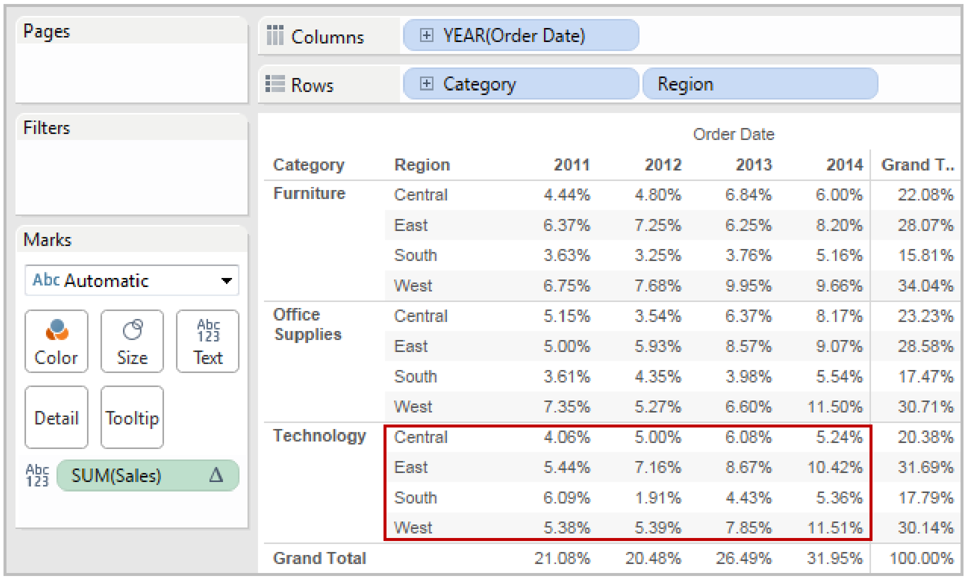


		Order Date				
Category	**Region**	**2011**	**2012**	**2013**	**2014**	**Grand T..**
Furniture	Central	20.09%	21.73%	31.00%	27.18%	100.00%
	East	22.68%	25.84%	22.27%	29.22%	100.00%
	South	22.99%	20.55%	23.80%	32.66%	100.00%
	West	19.83%	22.57%	29.22%	28.39%	100.00%
Office Supplies	Central	22.15%	15.24%	27.42%	35.19%	100.00%
	East	17.50%	20.76%	30.00%	31.75%	100.00%
	South	20.66%	24.87%	22.76%	31.71%	100.00%
	West	23.93%	17.14%	21.50%	37.43%	100.00%
Technology	Central	19.91%	24.54%	29.85%	25.70%	100.00%
	East	17.16%	22.59%	27.36%	32.89%	100.00%
	South	34.23%	10.76%	24.89%	30.13%	100.00%
	West	17.84%	17.90%	26.06%	38.20%	100.00%
Grand Total		21.08%	20.48%	26.49%	31.95%	100.00%

Percent of Pane

When you select **Percentage of Pane**, each measure on the worksheet is expressed as a percentage of the total for the panes in the view. This option is the same as **Percent of Table** when the table consists of only a single pane.

This table consists of several panes. Each pane encompasses one product category and all four years. Therefore, the table is one pane wide and three panes high. In this case it is not possible to verify that the individual values add up to 100% by consulting column or row grand totals.

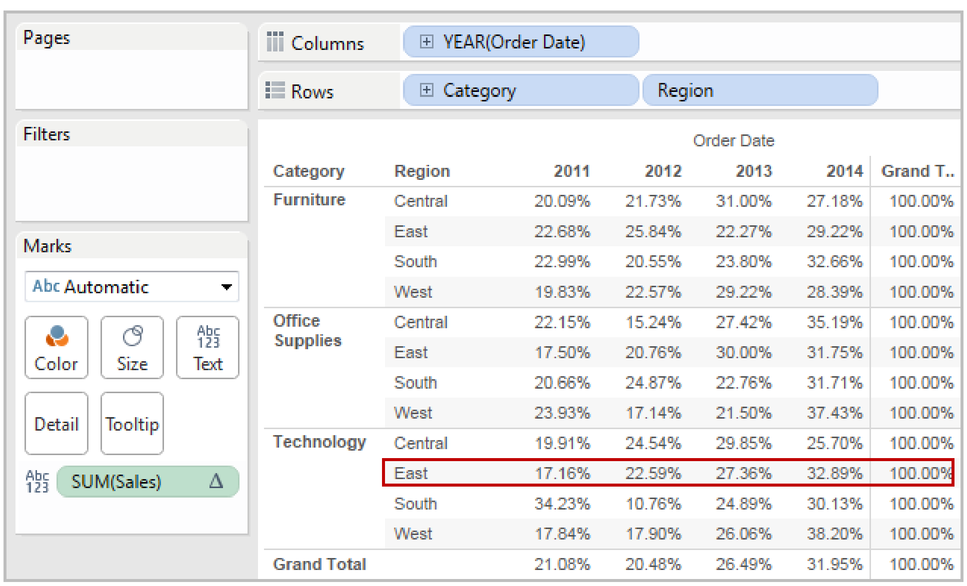


Category	Region	2011	2012	2013	2014	Grand T..
Furniture	Central	4.44%	4.80%	6.84%	6.00%	22.08%
	East	6.37%	7.25%	6.25%	8.20%	28.07%
	South	3.63%	3.25%	3.76%	5.16%	15.81%
	West	6.75%	7.68%	9.95%	9.66%	34.04%
Office Supplies	Central	5.15%	3.54%	6.37%	8.17%	23.23%
	East	5.00%	5.93%	8.57%	9.07%	28.58%
	South	3.61%	4.35%	3.98%	5.54%	17.47%
	West	7.35%	5.27%	6.60%	11.50%	30.71%
Technology	Central	4.06%	5.00%	6.08%	5.24%	20.38%
	East	5.44%	7.16%	8.67%	10.42%	31.69%
	South	6.09%	1.91%	4.43%	5.36%	17.79%
	West	5.38%	5.39%	7.85%	11.51%	30.14%
Grand Total		21.08%	20.48%	26.49%	31.95%	100.00%

Percent of Row in Pane

When you select **Percentage of Row in Pane**, each measure on the worksheet is expressed as a percentage of the total for a given row within a pane. This option is the same as **Percent of Row** when the table is only a single pane wide.

> **Note**: If you place **Measure Names** as the inner dimension on the **Columns** shelf (that is, the dimension farthest to the right), Tableau will return 100% for each mark because you cannot total up the values for multiple measure names. For example, you can't total up the values for SUM(Sales) and SUM(Profit).

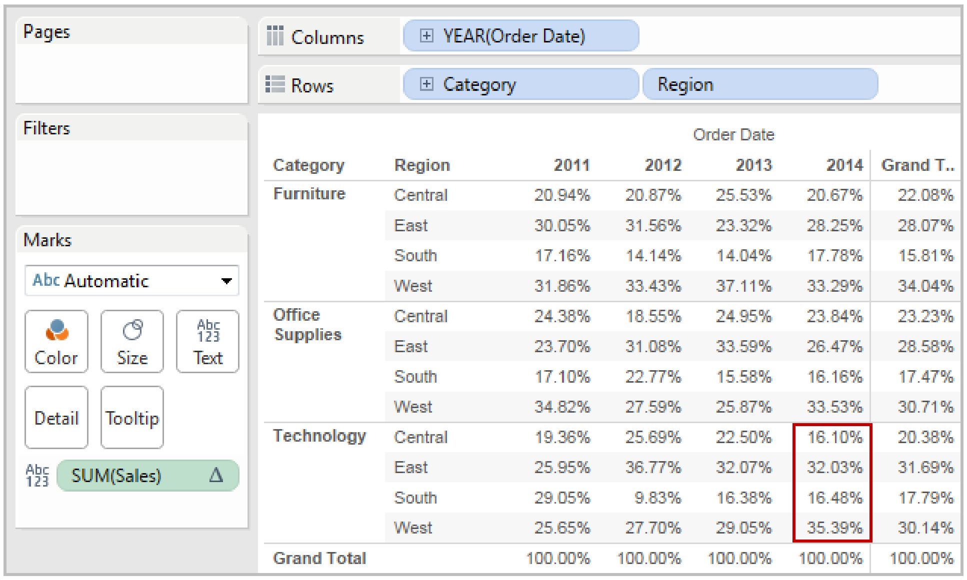


Category	Region	2011	2012	2013	2014	Grand T..
Furniture	Central	20.09%	21.73%	31.00%	27.18%	100.00%
	East	22.68%	25.84%	22.27%	29.22%	100.00%
	South	22.99%	20.55%	23.80%	32.66%	100.00%
	West	19.83%	22.57%	29.22%	28.39%	100.00%
Office Supplies	Central	22.15%	15.24%	27.42%	35.19%	100.00%
	East	17.50%	20.76%	30.00%	31.75%	100.00%
	South	20.66%	24.87%	22.76%	31.71%	100.00%
	West	23.93%	17.14%	21.50%	37.43%	100.00%
Technology	Central	19.91%	24.54%	29.85%	25.70%	100.00%
	East	17.16%	22.59%	27.36%	32.89%	100.00%
	South	34.23%	10.76%	24.89%	30.13%	100.00%
	West	17.84%	17.90%	26.06%	38.20%	100.00%
Grand Total		21.08%	20.48%	26.49%	31.95%	100.00%

Percent of Column in Pane

When you select **Percentage of Column in Pane**, each measure on the worksheet is expressed as a percentage of the total for a given column within a pane. This option is the same as **Percent of Column** when the table is only a single pane high.

> If you place **Measure Names** as the inner dimension on the **Rows** shelf (that is, the dimension farthest to the right on the shelf), Tableau will return 100% for each mark because you cannot total up the values for multiple measure names. For example, you can't total up the values for SUM(Sales) and SUM(Profit).



		Order Date				
Category	Region	2011	2012	2013	2014	Grand T..
Furniture	Central	20.94%	20.87%	25.53%	20.67%	22.08%
	East	30.05%	31.56%	23.32%	28.25%	28.07%
	South	17.16%	14.14%	14.04%	17.78%	15.81%
	West	31.86%	33.43%	37.11%	33.29%	34.04%
Office Supplies	Central	24.38%	18.55%	24.95%	23.84%	23.23%
	East	23.70%	31.08%	33.59%	26.47%	28.58%
	South	17.10%	22.77%	15.58%	16.16%	17.47%
	West	34.82%	27.59%	25.87%	33.53%	30.71%
Technology	Central	19.36%	25.69%	22.50%	16.10%	20.38%
	East	25.95%	36.77%	32.07%	32.03%	31.69%
	South	29.05%	9.83%	16.38%	16.48%	17.79%
	West	25.65%	27.70%	29.05%	35.39%	30.14%
Grand Total		100.00%	100.00%	100.00%	100.00%	100.00%

Forecasting

You can forecast quantitative time-series data using exponential smoothing models in Tableau Desktop. With exponential smoothing, recent observations are given relatively more weight than older observations. These models capture the evolving trend or seasonality of your data and extrapolate them into the future. Forecasting is fully automatic, yet configurable. Many forecast results can become fields in your visualizations.

You can add a forecast to a view when there is at least one date dimension and one measure in the view. Choose **Analysis > Forecast > Show Forecast**. When no date dimension is present, you can add a forecast if there is a dimension field in the view that has integer values. See **Forecasting When No Date is in the View** on page 1101.

When a forecast is showing, future values for the measure are shown next to the actual values.

Forecasting Constraints

Forecasting is not supported for Multidimensional data sources. In Tableau, multidimensional data sources are supported only in Windows.

In addition, the view cannot contain any of the following:

- Table calculations
- Disaggregated measures
- Percent calculations
- Grand Totals or Subtotals
- Date values with aggregation set to Exact Date

How Forecasting Works in Tableau

Forecasting in Tableau uses a technique known as exponential smoothing. Forecast algorithms try to find a regular pattern in measures that can be continued into the future.

You typically add a forecast to a view that contains a date field and at least one measure. However, in the absence of a date, Tableau can create a forecast for a view that contains a dimension with integer values in addition to at least one measure. For details on forecasting using an integer dimension, see **Forecasting When No Date is in the View** on page 1101.

All forecast algorithms are simple models of a real-world data generating process (DGP). For a high quality forecast, a simple pattern in the DGP must match the pattern described by the model reasonably well. Quality metrics measure how well the model matches the DGP. If the quality is low, the precision measured by the confidence bands is not important because it measures the precision of an inaccurate estimate.

Tableau automatically selects the best of up to eight models, the best being the one that generates the highest quality forecast. The smoothing parameters of each model are optimized before Tableau assesses forecast quality. The optimization method is global. Therefore, choosing locally optimal smoothing parameters that are not also globally optimal is not impossible. However, initial value parameters are selected according to best practices but are not further optimized. So it is possible for initial value parameters to be less than optimal. The eight models available in Tableau are among those described at the following location on the OTexts web site: A taxonomy of exponential smoothing methods.

When there is not enough data in the visualization, Tableau automatically tries to forecast at a finer temporal granularity, and then aggregates the forecast back to the granularity of the visualization. Tableau provides prediction bands which may be simulated or calculated from a closed form equation. All models with a multiplicative component or with aggregated forecasts have simulated bands, while all other models use the closed form equations.

Exponential Smoothing and Trend

Exponential smoothing models iteratively forecast future values of a regular time series of values from weighted averages of past values of the series. The simplest model, *Simple Exponential Smoothing*, computes the next level or smoothed value from a weighted average of the last actual value and the last level value. The method is exponential because the value of each level is influenced by every preceding actual value to an exponentially decreasing degree—more recent values are given greater weight.

Exponential smoothing models with trend or seasonal components are effective when the measure to be forecast exhibits trend or seasonality over the period of time on which the forecast is based. *Trend* is a tendency in the data to increase or decrease over time. *Seasonality* is a repeating, predictable variation in value, such as an annual fluctuation in temperature relative to the season.

In general, the more data points you have in your time series, the better the resulting forecast will be. Having enough data is particularly important if you want to model seasonality, because the model is more complicated and requires more proof in the form of data to achieve a reasonable level of precision. On the other hand, if you forecast using data generated by two or more different DGPs, you will get a lower quality forecast because a model can only match one.

Seasonality

Tableau tests for a seasonal cycle with the length most typical for the time aggregation of the time series for which the forecast is estimated. So if you aggregate by months, Tableau will look for a 12-month cycle; if you aggregate by quarters, Tableau will search for a four-quarter cycle; and if you aggregate by days, Tableau will search for weekly seasonality. Therefore, if there is a six-month cycle in your monthly time series, Tableau will probably find a 12-month pattern that contains two similar sub-patterns. However, if there is a seven-month cycle in your monthly time series, Tableau will probably find no cycle at all. Luckily, seven-month cycles are uncommon.

Tableau can use either of two methods for deriving season length. The original temporal method uses the natural season length of the temporal granularity (TG) of the view. Temporal granularity means the finest unit of time expressed by the view. For example, if the view contains either a continuous green date truncated to month or discrete blue year and month date parts, the temporal granularity of the view is month. The new non-temporal method, introduced with Tableau 9.3, uses periodic regression to check season lengths from 2 to 60 for candidate lengths.

Tableau automatically selects the most appropriate method for a given view. When Tableau is using a date to order the measures in a view, if the temporal granularity is quarterly, monthly, weekly, daily or hourly, the season lengths are almost certainly 4, 12, 13, 7 or 24, respectively. So only the length natural to the TG is used to construct the five seasonal exponential smoothing models supported by Tableau. The AIC of the five seasonal models and the three non-seasonal models are compared and the lowest returned. (For an explanation of the AIC metric, see Forecast Descriptions.)

When Tableau is using an integer dimension for forecasting, the second method is used. In this case there is no temporal granularity (TG), so potential season lengths must be derived from the data.

The second method is also used if the temporal granularity is yearly. Yearly series rarely have seasonality, but, if they do, it must also be derived from the data.

The second method is also used for views with temporal granularity of minute or second. If such series have seasonality, the season lengths are likely 60. However, when measuring a regular real world process, the process may have a regular repetition which does not correspond to the clock. So, for minutes and seconds, Tableau also checks for a length different from 60 in the data. This does not mean that Tableau can model two different season lengths at the same time. Rather, ten seasonal models are estimated, five with a season length of 60 and another five with the season length derived from the data. Whichever of the ten seasonal models or three non-seasonal models has the lowest AIC, that model is used to compute the forecast.

For series ordered by year, minute, or second, a single season length from the data is tested if the pattern is fairly clear. For integer ordered series, up to nine somewhat less clear potential season lengths are estimated for all five seasonal models, and the model with the lowest AIC is returned. If there are no likely season length candidates, only the non-seasonal models are estimated.

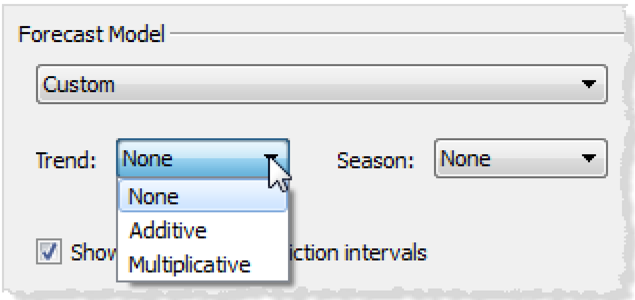
Since all selection is automatic when Tableau is deriving potential season lengths from the data, the default Model Type of “Automatic” in the Forecast Options Dialog Model Type menu does not change. Selecting “Automatic without seasonality” improves performance by eliminating all season length searching and estimation of seasonal models.

The heuristic that Tableau uses to decide when to use season lengths derived from the data depends on the distribution of errors for the periodic regression of each candidate season length. Since the assembly of season length candidates by periodic regression usually produces one or two clear winning lengths if seasonality actually exists in the data, the return of a single candidate indicates likely seasonality. In this case, Tableau estimates seasonal models with this candidate for year, minute and second granularity. The return of less than the maximum of ten candidates indicates possible seasonality. In this case, Tableau estimates seasonal models with all returned candidates for integer ordered views. The return of the maximum number of candidates indicates that errors for most length are similar. Therefore, the existence of any seasonality is unlikely. In this case, Tableau estimates only non-seasonal models for an integer-ordered or yearly ordered series, and only the seasonal models with a natural season length for other temporally ordered views.

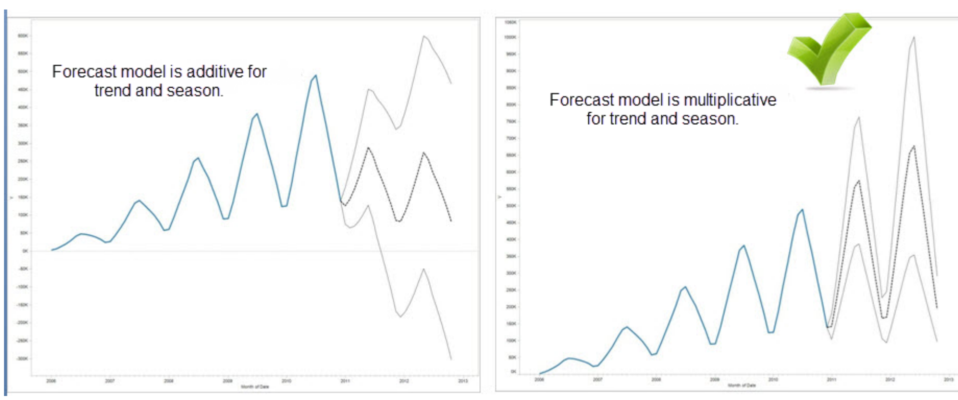
For Model Type “Automatic” in integer-, year-, minute- and second-ordered views, candidate season lengths are always derived from the data whether or not they are used. Since model estimation is much more time consuming than periodic regression, the performance impact should be moderate.

Model Types

In the Forecast Options dialog box, you can choose the model type Tableau users for forecasting. The **Automatic** setting is typically optimal for most views. If you choose **Custom** , then you can specify the trend and season characteristics independently, choosing either **None**, **Additive**, or **Multiplicative**:



An additive model is one in which the contributions of the model components are summed, whereas a multiplicative model is one in which at least some component contributions are multiplied. Multiplicative models can significantly improve forecast quality for data where the trend or seasonality is affected by the level (magnitude) of the data:



Keep in mind that you do not need to create a custom model to generate a forecast that is multiplicative: the **Automatic** setting can determine if a multiplicative forecast is appropriate for your data. However, a multiplicative model cannot be computed when the measure to be forecast has one or more values that are less than or equal to zero.

Forecasting with Time

When you are forecasting with a date, there can be only one base date in the view. Part dates are supported, but all parts must refer to the same underlying field. Dates can be on **Rows**, **Columns**, or **Marks** (with the exception of the Tooltip target).

Tableau supports three types of dates, two of which can be used for forecasting:

- Truncated dates and reference a particular point in history with specific temporal granularity, such as February 2017. They are usually continuous, with a green background in the view. Truncated dates are valid for forecasting.
- Date parts refer to a particular member of a temporal measure such as February. Each date part is represented by a different, usually discrete field (with a blue background). Forecasting requires at least a Year date part. Specifically, it can use any of the following sets of date parts for forecasting:
  - *Year*
  - *Year + quarter*
  - *Year + month*
  - *Year + quarter + month*
  - *Year + week*
  - *Custom: Month/Year, Month/Day/Year*

  Other date parts, such as *Quarter* or *Quarter + month*, are not valid for forecasting. See **Convert Fields between Discrete and Continuous** on page 199 for more details about different date types.
- Exact dates refer to a particular point in history with maximum temporal granularity such as February 1, 2012 at 14:23:45.0. Exact dates are invalid for forecasting.

It is also possible to forecast without a date. See **Forecasting When No Date is in the View** on page 1101.

Granularity and Trimming

When you create a forecast, you select a date dimension that specifies a unit of time at which date values are to be measured. Tableau dates support a range of such time units, including Year, Quarter, Month, and Day. The unit you choose for the date value is known as the *granularity* of the date.

The data in your measure typically does not align precisely with your unit of granularity. You might set your date value to quarters, but your actual data may terminate in the middle of a quarter—for example, at the end of November. This can cause a problem because the value for this fractional quarter is treated by the forecasting model as a full quarter, which will typically have a lower value than a full quarter would. If the forecasting model is allowed to consider this data, the resulting forecast will be inaccurate. The solution is to trim the data, such that the trailing periods that could mislead the forecast are ignored. Use the Ignore Last option in the Forecast Options dialog box to remove—or *trim*—such partial periods. The default is to trim one period.

Getting More Data

Tableau requires at least five data points in the time series to estimate a trend, and enough data points for at least two seasons or one season plus five periods to estimate seasonality. For example, at least nine data points are required to estimate a model with a four quarter seasonal cycle (4 + 5), and at least 24 to estimate a model with a twelve month seasonal cycle (2 * 12).

If you turn on forecasting for a view that does not have enough data points to support a good forecast, Tableau can sometimes retrieve enough data points to produce a valid forecast by querying the datasource for a finer level of granularity:

- If your view contains fewer than nine years of data, by default, Tableau will query the data source for quarterly data, estimate a quarterly forecast, and aggregate to a yearly forecast to display in your view. If there are still not enough data points, Tableau will estimate a monthly forecast and return the aggregated yearly forecast to your view.
- If your view contains fewer than nine quarters of data, by default Tableau will estimate a monthly forecast and return the aggregated quarterly forecast results to your view.
- If your view contains fewer than nine weeks of data, by default, Tableau will estimate a daily forecast and return the aggregated weekly forecast results to your view.
- If your view contains fewer than nine days of data, by default, Tableau will estimate an hourly forecast and return the aggregated daily forecast results to your view.
- If your view contains fewer than nine hours of data, by default, Tableau will estimate an minutely forecast and return the aggregated hourly forecast results to your view.
- If your view contains fewer than nine minutes of data, by default, Tableau will estimate an secondly forecast and return the aggregated minutely forecast results to your view.

These adjustments happen behind the scene and require no configuration. Tableau does not change the appearance of your visualization, and does not actually change your date value. However, the summary of the forecast time period in the Forecast Describe and Forecast Options dialog will reflect the actual granularity used.

Tableau can only get more data when the aggregation for the measure you are forecasting is SUM or COUNT. See **Aggregations** on page 245 for information on available aggregation types and information on how to change the aggregation type.

To Create a Forecast

Forecasting requires a view that uses at least one date dimension and one measure. For example:

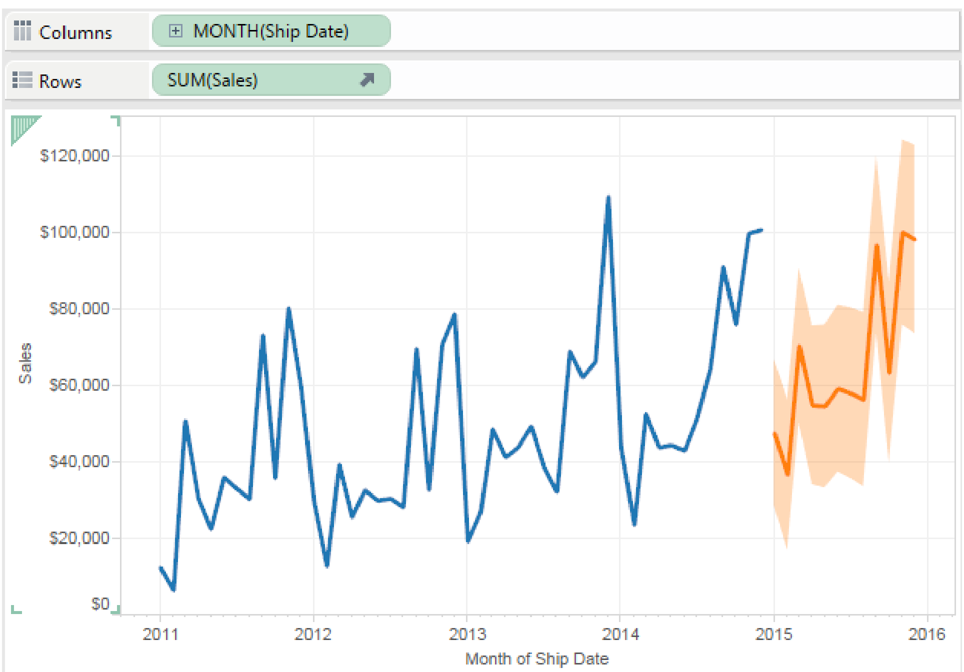
- The field you want to forecast is on the **Rows** shelf and a continuous date field is on the **Columns** shelf.
- The field you want to forecast is on the **Columns** shelf and a continuous date field is on the **Rows** shelf.

- The field you want to forecast on either the **Rows** or **Columns** shelf, and discrete dates are on either the **Rows** or **Columns** shelf. At least one of the included date levels must be Year.
- The field you want to forecast is on the Marks card, and a continuous date or discrete date set is on **Rows**, **Columns** or **Marks**.

Note: You can also create a forecast when no date dimension is present if there is a dimension in the view that has integer values. See **Forecasting When No Date is in the View** on page 1101.

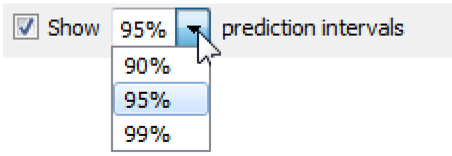
To turn forecasting on, either right-click (control-click on Mac) on the visualization and choose **Forecast > Show Forecast**, or choose **Analysis > Forecast > Show Forecast**.

With forecasting on, Tableau visualizes estimated future values of the measure, in additional to actual historical values. The estimated values are shown by default in a lighter shade of the color used for the historical data:



Prediction Intervals

The shaded area in the image above shows the 95% prediction interval for the forecast. That is, the model has determined that there is a 95% likelihood that the value of sales will be within the shaded area for the forecast period. You can configure the confidence level percentile for the prediction bands, and whether prediction bands are included in the forecast, using the **Show prediction intervals** setting in the Forecast Options dialog box:

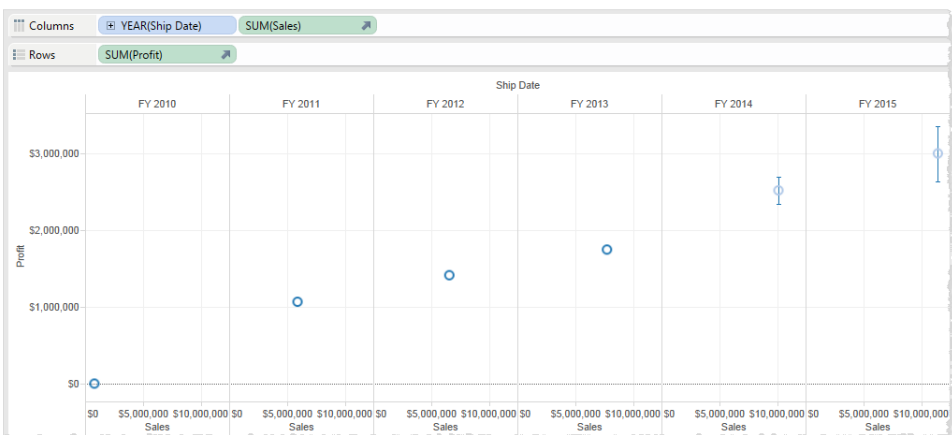


Clear the check box if you do not want to display prediction bands in forecasts. To set the prediction interval, select one of the values or enter a custom value. The lower the percentile you set for the confidence level, the narrower the prediction bands will be.

How your prediction intervals are displayed depends on the mark type of your forecasted marks:

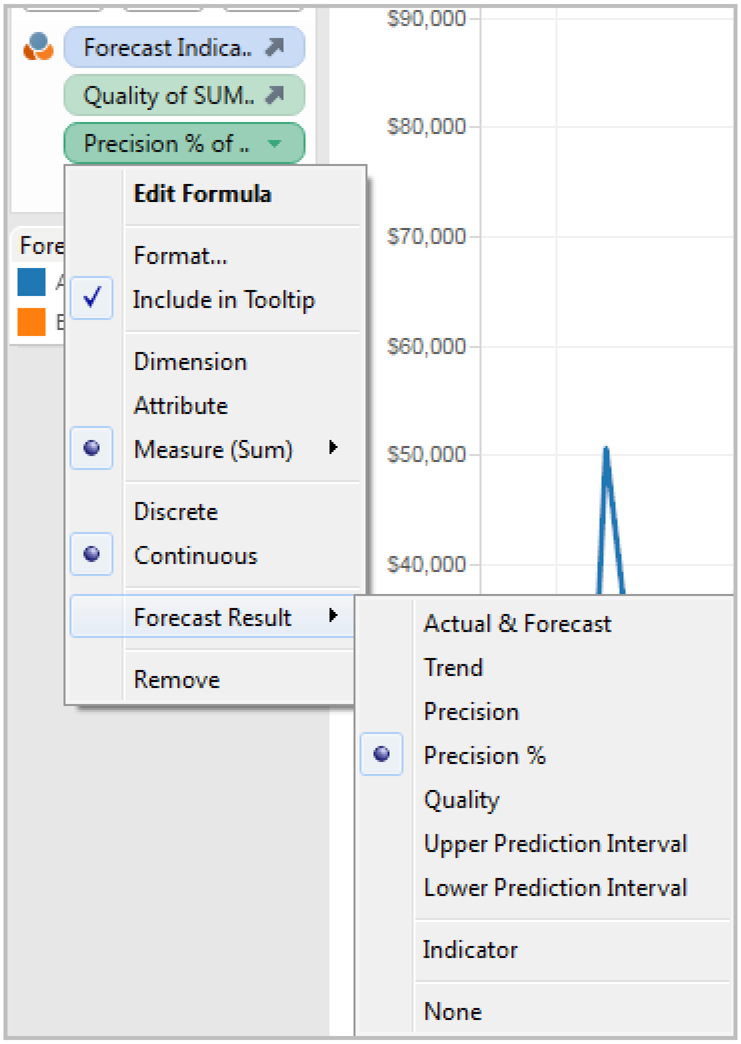
Forecast mark type	Prediction intervals displayed using
Line	Bands
Shape, square, circle, bar, or pie	Whiskers

In the following example, forecast data is indicated by lighter shaded circles, and the prediction intervals are indicated by lines ending in whiskers:



Enhancing Forecasts

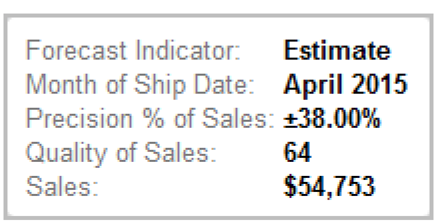
For each forecast value, consider verifying the quality or precision of your forecast by dragging another instance of the forecast measure from the **Data** pane to the Detail shelf on the Marks card and then after right-clicking the field to open the content menu, choosing one of the available options:



For descriptions of these options, see **Forecast Field Results** on the next page.

You can repeat the process to add additional result types for each forecast value. See "Changing the Forecast Result" type in **Forecast Field Results** on the next page for information on changing the result type.

By adding such result types to the Details shelf, you add information about the forecast to tooltips for all marks that are based on forecasted data.

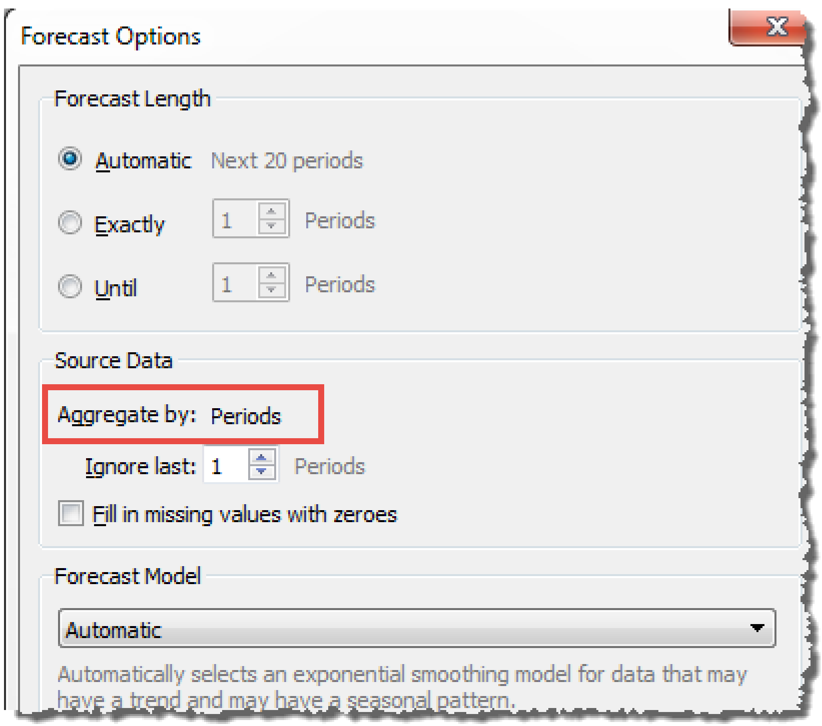


Forecasting When No Date is in the View

If a valid date is not in the view, Tableau will look for a dimension in the view that has integer values. If it finds such a dimension it will use that to forecast additional values for measures in the view. As with a date, when an integer dimension is selected to order the measures to be forecast, it is no longer used to partition the data. If there is more than one such integer dimension, Tableau will go in this order:

- An integer dimension on the Columns shelf. If there is more than one such dimension, it will use the first one (farthest to the left on the shelf).
- An integer dimension on the Rows shelf.
- An integer dimension on the Pages shelf.
- An integer dimension on the Marks card.

When Tableau is using an integer dimension to forecast, the Forecast Option and Forecast Description dialog boxes will automatically specify that forecasting is aggregating by periods:



Forecast Field Results

Tableau provides several types of forecast results. To view these result types in the view, right-click (control-click on Mac) on the measure field, choose **Forecast Result**, and then choose one of the options.

The options are:

- **Actual & Forecast**—Show the actual data extended by forecasted data.
- **Trend**—Show the forecast value with the seasonal component removed.
- **Precision**—Show the prediction interval distance from the forecast value for the configured confidence level.
- **Precision %**—Show precision as a percentage of the forecast value.
- **Quality**—Show the quality of the forecast, on a scale of 0 (worst) to 100 (best). This metric is scaled MASE, based on the MASE (Mean Absolute Scaled Error) of the forecast, which is the ratio of forecast error to the errors of a naïve forecast which assumes that the value of the current period will be the same as the value of the next period. The actual equation used for quality is:

  $$100 * \max(1 - MASE, 0)$$

  The Quality for a naïve forecast would be 0. The advantage of the MASE metric over the more common MAPE is that MASE is defined for time series which contain zero, wheras MAPE is not. In addition, MASE weights errors equally while MAPE weights positive and/or extreme errors more heavily.
- **Upper Prediction Interval**—Shows the value above which the true future value will lie confidence level percent of the time assuming a high quality model. The confidence level percentage is controlled by the Prediction Interval setting in the Forecast Options dialog box. See **Configure Forecast Options** on the next page.
- **Lower Prediction Interval**—Shows 90, 95, or 99 confidence level below the forecast value. The actual interval is controlled by the **Prediction Interval** setting in the Forecast Options dialog box.
- **Indicator**—Show the string **Actual** for rows that were already on the worksheet when forecasting was inactive and **Estimate** for rows that were added when forecasting was activated.
- **None**—Do not show forecast data for this measure.

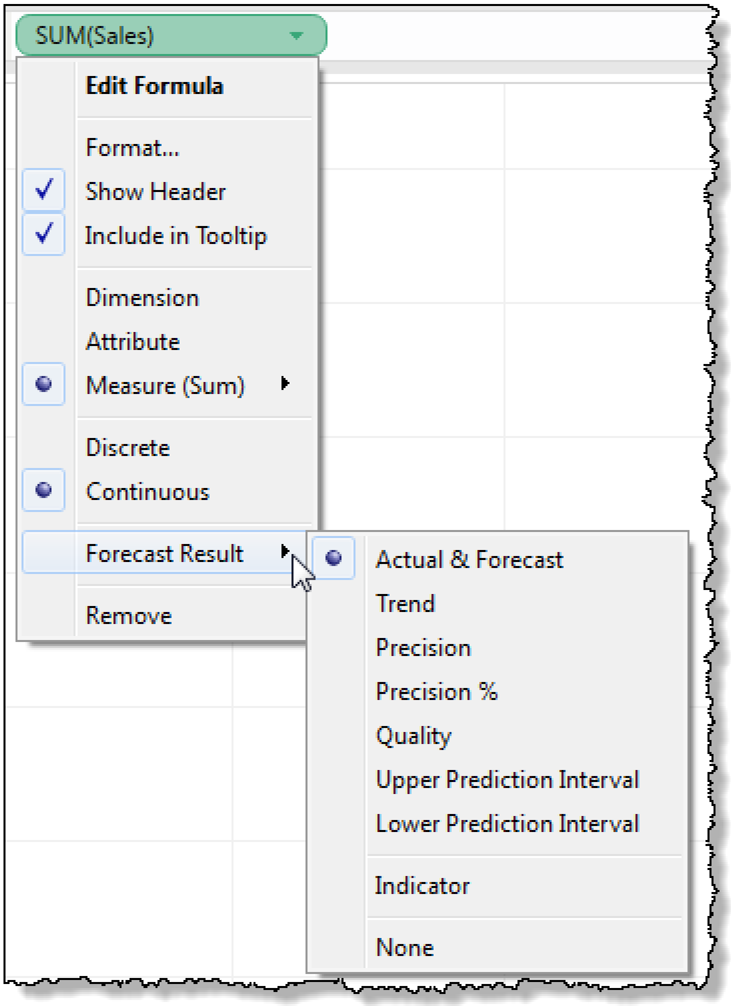
Forecast description information is also included in the worksheet description. See **Describing the View** on page 855.

Forecasting a New Measure

When you add a new measure to a visualization that already has forecasting enabled, Tableau attempts to forecast future values.

Changing the Forecast Result Type

To change the forecast result type for a measure, right-click (control-click on Mac) on the measure field, select **Forecast Result**, and then choose a result type.



Configure Forecast Options

Use the Forecast Options dialog box to configure forecast options, including:

- The length of the forecast
- The range and temporal aggregation of source data from which to generate the forecast

- The forecast model
- Prediction intervals

When forecasting is enabled, you can open the Forecast Options dialog box by choosing **Analysis > Forecast > Forecast Options**.

Forecast Length

The **Forecast Length** section determines how far into the future the forecast extends. Select one of the following:

- **Automatic**: Tableau determines the forecast length based on the data.
- **Exactly**: Extends the forecast for the specified number of units.
- **Until**: Extends the forecast to the specified point in the future.

Source Data

Use the **Source Data** section to specify.

- **Aggregate by**: Specifies the temporal granularity of the time series. With the default value (**Automatic**), Tableau chooses the best granularity for estimation. This will typically match the temporal granularity of the visualization (that is, the date dimension that the forecast is based on). However, it is sometimes possible and desirable to estimate the forecast model at a finer granularity than the visualization when the time series in the visualization is too short to allow estimation.

  > **Note**: When you are using an integer dimension instead of a date dimension for forecasting, the Aggregate by value is always Periods. See **Forecasting When No Date is in the View** on page 1101.

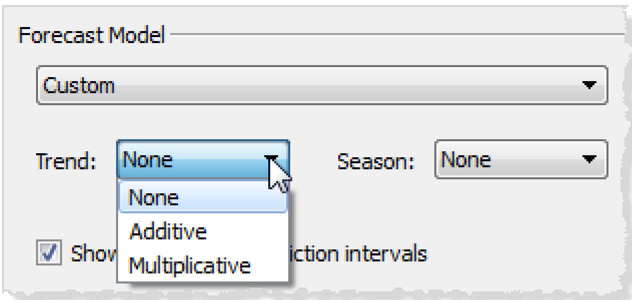
- **Ignore last**: Specifies the number of periods at the end of the actual data that should be ignored in estimating the forecast model. Forecast data is used instead of actual data for these time periods. Use this feature to trim off unreliable or partial trailing periods which could mislead the forecast. When the estimation granularity specified in the **Source Data** section is finer than in the visualization, the trimmed periods are estimation periods. As a result, the trailing actual visualization period may become a forecast period, which is an aggregate of both actual and forecast periods of estimation granularity. In contrast, null values are not filled with zeros and must be filtered to allow forecast.
- **Fill in missing values with zeros**: If there are missing values in the measure you are attempting to forecast, you can specify that Tableau fill in these missing values with zero.

Forecast Model

The **Forecast Model** section specifies how the forecast model is to be produced.

Use the drop down to specify whether Tableau selects what it determines to be the best of all models (**Automatic**), the best of those with no seasonal component (**Automatic without seasonality**), or the model you specify (**Custom**).

When you choose the **Custom** option, two new fields appear in the Forecast Options dialog box, which you use to specify the trend and season characteristics for your model:



The choices are the same for both fields:

- **None**: When you select **None** for Trend, the model does not assess the data for trend. When you select **None** for Season, the model does not assess the data for seasonality.
- **Additive**: An additive model is one in which the combined effect of several independent factors is the sum of the isolated effects of each factor. You can assess the data in your view for additive trend, additive seasonality, or both.
- **Multiplicative** : A multiplicative model is one in which the combined effect of several independent factors is the product of the isolated effects of each factor. You can assess the data in your view for multiplicative trend, multiplicative seasonality, or both.

If there is more than one time series in your visualization, the Custom option forces them all to be forecast using the same custom model. Constraining the models in this way usually results in lower quality models than would be produced by automatic model selection.

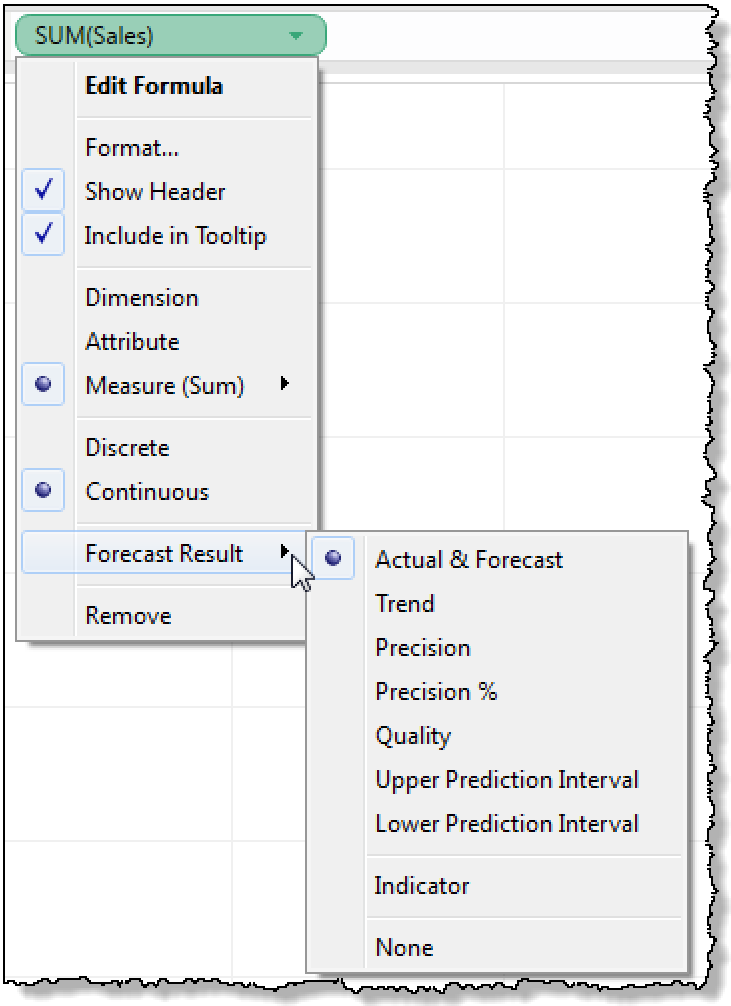
Constraints on Multiplicative Models

- You cannot use a multiplicative model when the measure to be forecast has one or more values that are less than or equal to zero, or even when some of the data points are too close to zero, relative to other data points.
- You cannot specify a model with multiplicative trend and additive season because the result may be numerically unstable.

Prediction Interval

You can set the prediction interval to 90, 95, or 99 percent, or enter a custom value. This value is used in two locations:

- In the prediction bands displayed with a forecast.
- For the prediction interval options (**Upper Prediction Interval** and **Lower Prediction Interval**) that are available as forecast result types for a measure in the view:



Forecast Summary

The text box at the bottom of the Forecast Options dialog box provides a description of the current forecast. The forecast summary updates whenever you change any of the forecast options above. If there is a problem with the forecast, the text box provides an error message that may help you resolve the issue. See **Resolving Forecasting Errors** on page 1111.

Forecast Descriptions

The **Describe Forecast** dialog box describes the forecast models that Tableau computed for your visualization. When forecasting is enabled, you can open this dialog by selecting **Analysis**

> Forecast > Describe Forecast. The information in the Describe Forecast dialog box is read-only, though you can click **Copy to Clipboard** and then paste the screen contents into a writeable document.

The **Describe Forecast** dialog box has two tabs: a **Summary** tab and a **Models** tab.

Describe Forecast – Summary Tab

The **Summary** tab describes the forecast models Tableau has created, as well as the general patterns Tableau discovered in the data.

Options Used To Create Forecasts

This section summarizes the options Tableau used to create forecasts. These options were either picked automatically by Tableau or specified in the Forecast Options dialog box.

- **Time series**—The continuous date field used to define the time series. In some cases this value might not actually be a date. See **Forecasting When No Date is in the View** on page 1101.
- **Measures**—The measures for which values are estimated.
- **Forecast forward**—The length and date range of the forecast.
- **Forecast based on**—The date range of the actual data used to create the forecast.
- **Ignore last**—The number of periods at the end of the actual data that are disregarded--forecast data is displayed for these periods.This value is determined by the **Ignore Last** option in the Forecast Options dialog box.
- **Seasonal pattern**—The length of the seasonal cycle that Tableau found in the data, or None if no seasonal cycle was found in any forecast.

Forecast Summary Tables

For each measure that is forecasted, a summary table is displayed describing the forecast. If the view is broken into multiple panes using dimensions, a column is inserted into each table that identifies the dimensions. The fields in summary forecast tables are:

- **Initial**—The value and prediction interval of the first forecast period.
- **Change From Initial**—The difference between the first and the last forecast estimate points. The interval for those two points is shown in the column header. When values are shown as percentages, this field shows the percentage change from the first forecast period.
- **Seasonal Effect**—These fields are displayed for models identified as having seasonality--that is, a repeating pattern of variation over time. They show the high and low value of the seasonal component of the last full seasonal cycle in the combined time series of actual and forecast values. The seasonal component expresses the deviation from the trend and so varies around zero and sums to zero over the course of a season.

- **Contribution**—The extent to which Trend and Seasonality contribute to the forecast. These values are always expressed as percentages and add up to 100%.
- **Quality**—Indicates how well the forecast fits the actual data. Possible values are GOOD, OK, and POOR. A naïve forecast is defined as a forecast that estimates that the value of the next period will be identical to the value of the current period. Quality is expressed relative to a naïve forecast, such that OK means the forecast is likely to have less error than a naïve forecast, GOOD means that the forecast has less than half as much error, and POOR means that the forecast has more error.

Describe Forecast – Models Tab

The **Models** tab provides more exhaustive statistics and smoothing coefficient values for the Holt-Winters exponential smoothing models underlying the forecasts. For each measure that is forecasted, a table is displayed describing the forecast models Tableau created for the measure. If the view is broken into multiple panes using dimensions, a column is inserted into each table that identifies the dimensions. The table is organized into the following sections:

Model

Specifies whether the components **Level**, **Trend**, or **Season** are part of the model used to generate the forecast. The value for each component is one of the following:

- **None**—The component is not present in the model.
- **Additive**—The component is present and is added to the other components to create the overall forecast value.
- **Multiplicative**—The component is present and is multiplied by the other components to create the overall forecast value.

Quality Metrics

This set of values provides statistical information about the quality of the model.

Value	Definition
RMSE: Root mean squared error	$\sqrt{\left(\frac{1}{n}\right)\sum e(t)^2}$
MAE: Mean absolute error	$\frac{1}{n}\sum \lvert e(t) \rvert$
MASE: Mean absolute scaled error. MASE measures the magnitude of the error compared to the magnitude of the error of a naive one-step ahead forecast as a ratio. A naive forecast assumes that whatever the value is today will be same value tomorrow.	$\frac{\frac{1}{n}\sum \lvert e(t) \rvert}{\frac{1}{(n-1)}\sum_{2}^{n}\lvert Y(t)-Y(t-1)\rvert}$

So, a MASE of 0.5 means that your forecast is likely to have half as much error as a naive forecast, which is better than a MASE of 1.0, which is no better than a naive forecast. Since this is a normalized statistic that is defined for all values and weighs errors evenly, it is an excellent metric for comparing the quality of different forecast methods. The advantage of MASE over the more common MAPE metric is that MASE is defined for time series that contain zero, whereas MAPE is not. Also, MASE weights errors equally, whereas MAPE weights positive and/or extreme errors more heavily.	
MAPE: Mean absolute percentage error. MAPE measures the magnitude of the error compared to the magnitude of your data, as a percentage. So, a MAPE of 20% is better than a MAPE of 60%. Errors are the differences between the response values, which the model estimates, and the actual response values for each explanatory value in your data. Since this is a normalized statistic, it can be used to compare the quality of different models computed in Tableau. However, it is unreliable for some comparisons because it weights some kinds of error more heavily than others. Also, it is undefined for data with values of zero.	$100\frac{1}{n}\sum\left\lvert\frac{e(t)}{A(t)}\right\rvert$
AIC: Akaike information criterion. AIC is a model quality measure, developed by Hirotugu Akaike, that penalizes complex models to prevent overfitting. In this definition, *k* is the number of estimated parameters, including initial states, and *SSE* is the sum of the squared errors.	$n * \log(SSE/n) + 2 * (k+1)$

In the preceding definitions, the variables are as follow:

Variable	**Meaning**
t	Index of a period in a time series.
n	Time series length.
m	Number of periods in a season/cycle.

A(t)	Actual value of the time series at period t.
F(t)	Fitted or forecast value at period t.

Residuals are: e(t) = F(t)-A(t)

Smoothing Coefficients

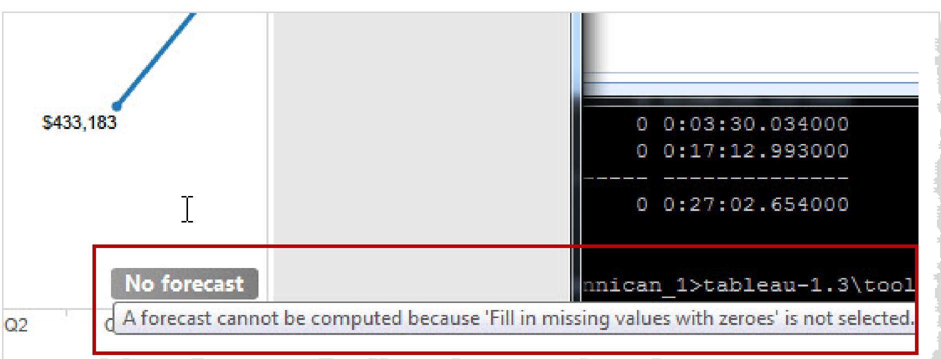
Depending on the rate of evolution in the level, trend, or seasonal components of the data, smoothing coefficients are optimized to weight more recent data values over older ones, such that within-sample one-step-ahead forecast errors are minimized. Alpha is the level smoothing coefficient, beta the trend smoothing coefficient, and gamma the seasonal smoothing coefficient. The closer a smoothing coefficient is to 1.00, the less smoothing is performed, allowing for rapid component changes and heavy reliance on recent data. The closer a smoothing coefficient is to 0.00, the more smoothing is performed, allowing for gradual component changes and less reliance on recent data.

Troubleshooting Forecasting

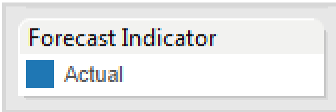
This topic discusses some issues that may arise as you use forecasting in Tableau.

Null Forecasts

A null forecast results when you are using forecasting and modify the view in a manner that is incompatible with forecasting. The most obvious indication that you have a null forecast is that no forecast data is displayed in your view and the text No Forecast is displayed. Hover the cursor over this message to see why Tableau is unable to create a forecast:



Another indication is that the **Forecast Indicator** field on the Marks card shows Actual values, but no Estimate values:



To diagnose a null forecast, open the Describe Forecast dialog box from the Analysis menu (**Analysis > Forecast > Describe Forecast**) to see the error message. Then see **Resolving Forecasting Errors** below for a suggested resolution.

Tableau also displays the error message in the Forecast Options dialog box (**Analysis > Forecast > Forecast Options**).

Because a forecast cannot be computed for a time series with null date values in the middle, actions that filter data, either explicitly or implicitly can trigger a null forecast. The **Keep Only** and **Exclude** commands on tooltips are examples of actions that can filter data implicitly—in some cases, these commands are removed when a forecast is shown. For example, if you have a time series of sales for each quarter from 2008 until 2012 and you exclude the Sales value for the second quarter of 2010, you will get a Null forecast because the time series is irregular. If, instead, you exclude the first quarter of 2008, you have shortened the time series but it remains regular. So, a valid forecast is still possible.

Resolving Forecasting Errors

If Tableau is unable to provide a forecast for your view, the problem can often be resolved by changing the Date value in the view (see **Changing Date Levels** on page 793).

Forecasting errors can result when the aggregation level of the time series (months, weeks, etc.) is either too fine or too coarse for the data to be forecast. This can lead to the "too much data" or "too little data" errors described below. Date aggregation can trigger a "too many Nulls" scenario when forecasting attempts to extract more data from the measure than is possible. For example, if the underlying granularity of the sales data is months but you aggregate by weeks, the result may be a significant number of Null values.

Other problems arise when the view’s aggregation and the aggregation specified for the forecast (using the **Aggregate by** field in the Forecast Options dialog box) are not compatible. Tableau can create a forecast when the forecast aggregation is a finer level of detail than the view's aggregation, but not when it is at a coarser level of detail; even when it is finer, the two values are only compatible if there is a strict hierarchy that Tableau can use (for example, quarters can be evenly divided into three months, but months can't be evenly divided into weeks). Avoid these scenarios by setting **Aggregate by** to Automatic.

The following list shows errors that can be result from invalid forecasts in Tableau, and provides advice on how to resolve them.

Error message	Suggestion for Resolution
A continuous date cannot be derived from the date	Forecasting requires a date field that can be interpreted continuously. If the date field is not explicitly continuous, then

fields in the view.	one of the included date levels must be Year. This error is returned if there are no dates in the view, or if the dates in the view don’t constitute a full hierarchy (for example, the date includes Year and Day, but not Month), or if they constitute a hierarchy that is not supported (for example, Year, Week, Day).
The time series is too short to forecast.	Expand the time series in your view to include more date values. This error is returned if there are fewer than four data points after trimming off unreliable or partial trailing periods which could mislead the forecast.
A forecast cannot be computed for a time series with Null date values.	Eliminate any Null values from the date field or fields in the view, either by filtering the date field or by using a less detailed date granularity (for example, by switching from months to quarters).
A forecast cannot be computed when the view contains multiple distinct date fields.	This error is returned if there are multiple date fields in the view. For example, if both Order Date and Ship Date are in the same view, forecasting is not supported.
The selected 'Aggregate by' value in Forecast Options is not compatible with the visualization.	The date in the view must be compatible with the value of **Aggregate by** in the Forecast Options dialog box. For example, if **Aggregate by** is set to Weeks and the date in the view is set to Months, this error occurs. Change one of the dates so that the two are compatible, or set **Aggregate by** to Automatic.
A forecast cannot be computed because there are too many missing values.	This error is returned if more than 40% of the data is missing. Selecting **Fill in missing values with zeros** in the Forecast Options dialog box will not resolve this error. You must modify the source data or use data from a different source.
There is no measure to forecast.	This error is returned if no measure that can be forecast is present in the view. Forecast measures must be on the Rows or Columns shelf, or on the Marks card.
The measure to forecast must be a number.	Some measures cannot be interpreted numerically and therefore cannot be forecast.
A forecast cannot be com-	The value to be forecast must be a measure, and not a dimen-

puted for a dimension.	sion.
There is too much data to compute a forecast.	Forecasting is not possible when the result set from the query is too large. The limit is about 10,000 rows. To fix the forecast, aggregate the time series value at a higher level (for example, Month instead of Week) or filter the data.
A forecast cannot be computed because the data is divided into too many rows, columns, or colors.	Simplify the view to resolve the error by filtering or removing some of the dimensions.
A forecast cannot be computed because the view contains table calculations.	Create a version of the view that does not contain table calculations.
A forecast cannot be computed because there is a measure on the Filters shelf.	Remove the measure from the Filters shelf.
A forecast cannot be computed because **Aggregate Measures** is not selected.	**Aggregate Measures** is an option on the Analysis menu. See **Aggregating Data** on page 250.
A forecast cannot be computed because the view contains percent calculations.	**Percentage of** is an option on the Analysis menu. See **Percentages** on page 1084.
A forecast cannot be computed because Grand Totals or Subtotals is enabled.	These options are controlled from the **Totals** command in the Analysis menu. See **Totals** on page 1146.
A multiplicative model cannot be computed because the measure to be forecast has one or more values that are less than or equal to zero.	You have created a custom model with Trend or Seasonality set to **Multiplicative**. Change this value, or set the Forecast Model to **Automatic**.
A model with multiplicative trend and additive season is not allowed because it is numerically unstable.	You have created a custom model configured as described in the error message. Change the settings for the custom model, or set the Forecast Model to **Automatic**.

A seasonal model cannot be computed because the time series is too short.	Expand the time series in your view to include more date values.
The selected multiplicative model cannot be computed because some of the data is too close to zero relative to the rest of the data.	You have created a custom model configured as described in the error message. Change the settings for the custom model, or set the Forecast Model to **Automatic**.

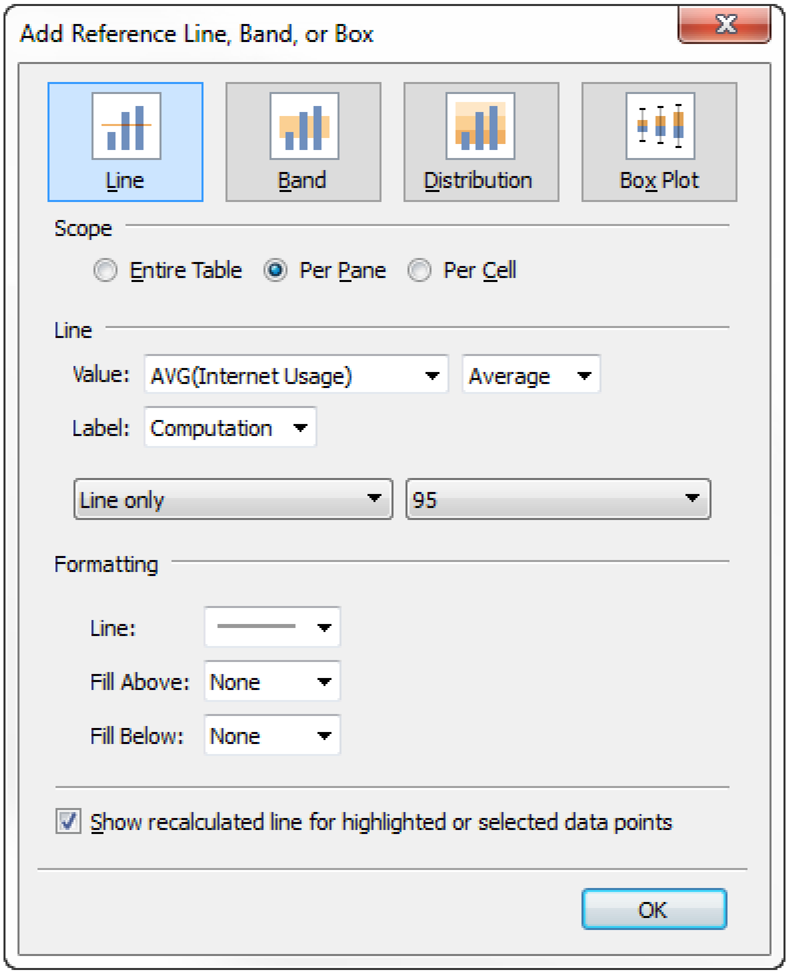
Reference Lines, Bands, Distributions, and Boxes

Add a reference line, band, distribution or box plot to mark a specific value or region on an axis. For example, if you are analyzing the monthly sales for several products, you may want to include a reference line at the average sales mark so you can see how each product performed against the average. Alternatively you may want to shade a particular area along the axis, show a distribution, or show the full range of values, using a box plot.

For information about how to use reference lines to create a control chart, see Using Control Charts.

Note: You can use the Analytics Pane to quickly drag a reference line into the view. See **Analytics Pane** on page 272.

Tableau lets you add an unlimited number of reference lines, bands, distributions, and box plots. Right-click (control-click on a Mac) on an axis and select **Add Reference Line** to open the Add Reference Line, Band, or Box dialog box:

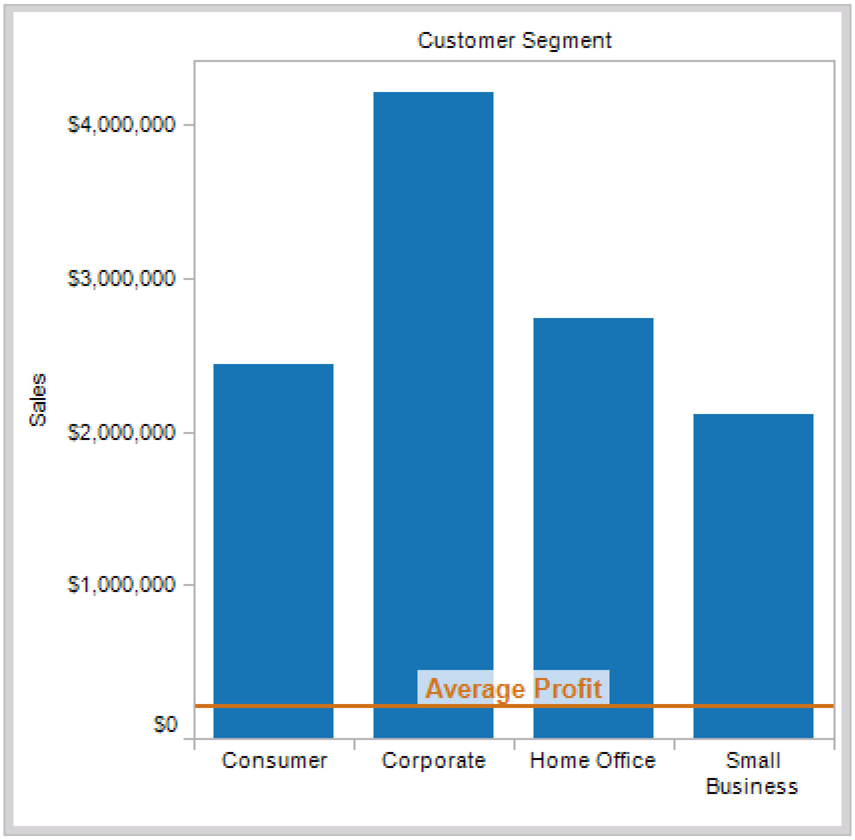


Note: Reference lines, bands, distributions, and boxes are not available when the view is a map using online or offline maps.

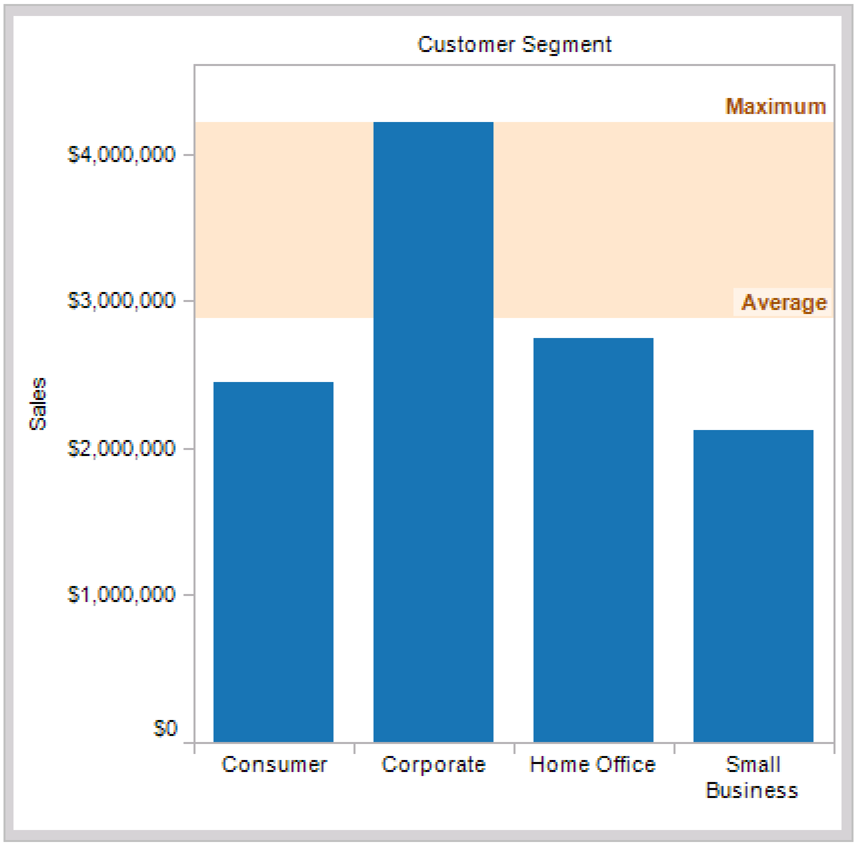
Types of Reference Lines, Bands, and Boxes

Tableau offers four types of reference lines, bands, and boxes:

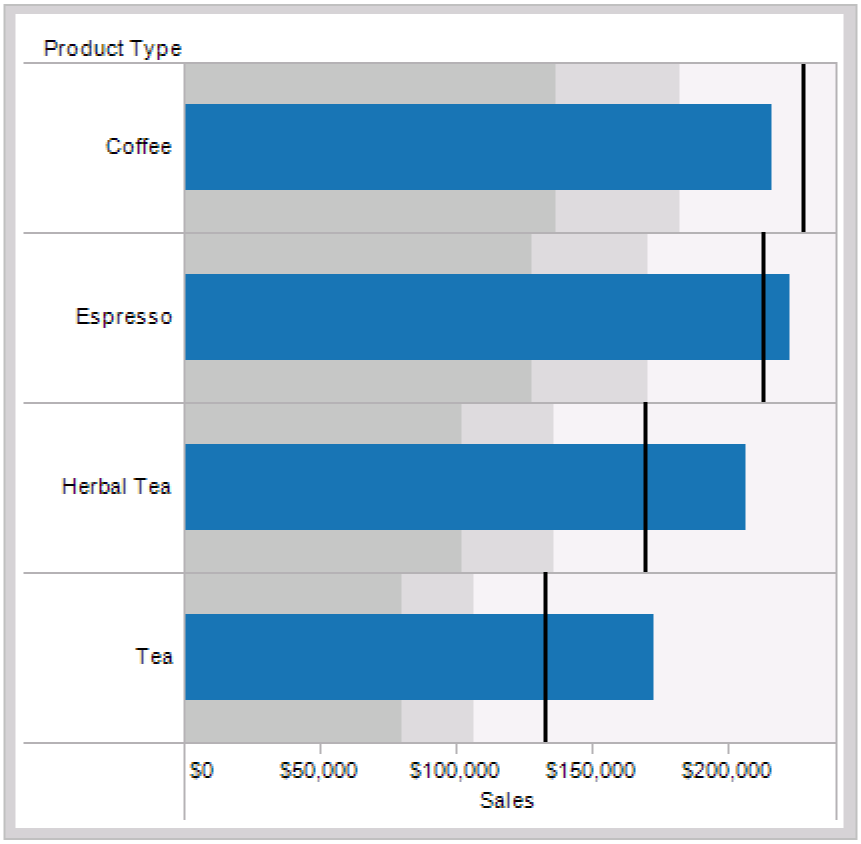
- **Line** - adds a line at a constant or computed value on the axis. Computed values can be based on a specified field. You can also add confidence intervals with a reference line. See **Adding Reference Lines** on page 1119.



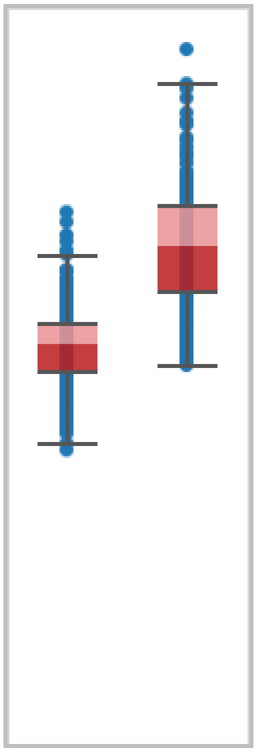
- **Band** - shades an area behind the marks in the view between two constants or computed values on the axis. See **Adding Reference Bands** on page 1124.



- **Distribution** - adds a gradient of shading to indicate the distribution of values along the axis. Distribution can be defined by percentages, percentiles, quantiles, or standard deviation. Reference distributions can be used to create bullet charts. See **Adding Reference Distributions (Bullet Graphs)** on page 1127.



- **Box Plot** - adds a box plot that describes the distribution of values along the axis. Box plots show quartiles and whiskers. Tableau provides different box plot styles, and allows you to configure the location of the whiskers and other details. See **Adding Box Plots** on page 1141.

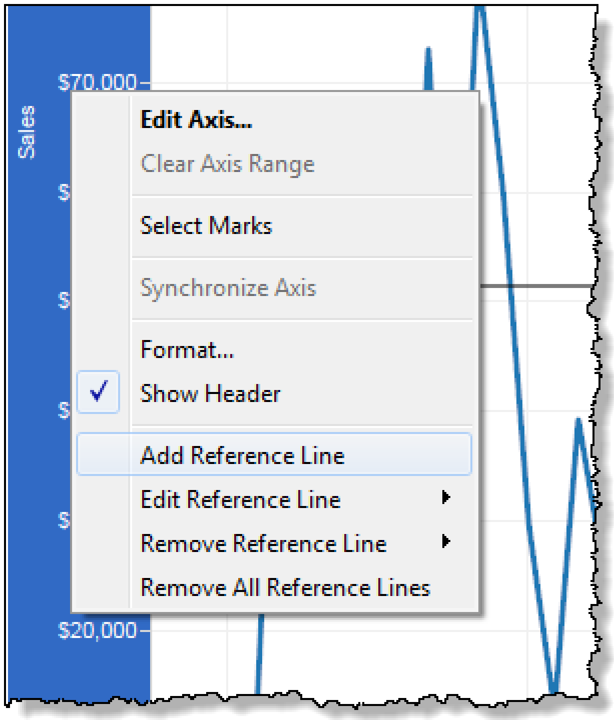


Adding Reference Lines

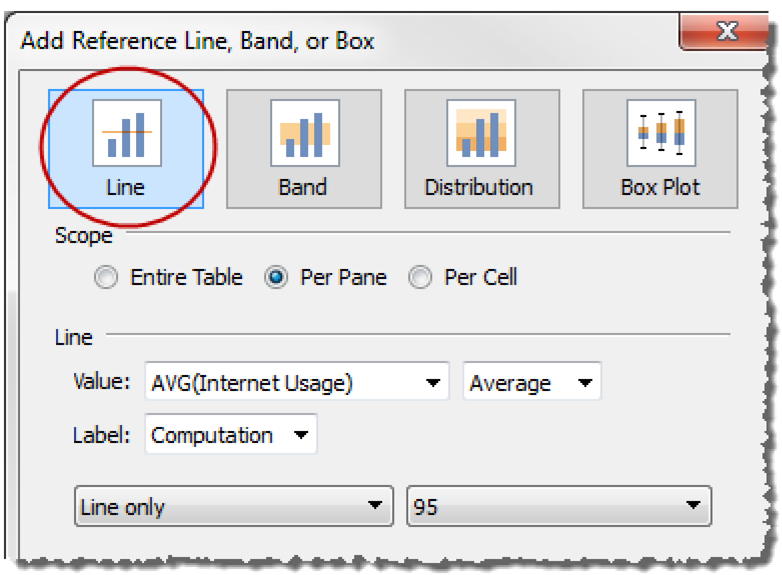
You can add a reference line to any continuous axis.

To add a reference line:

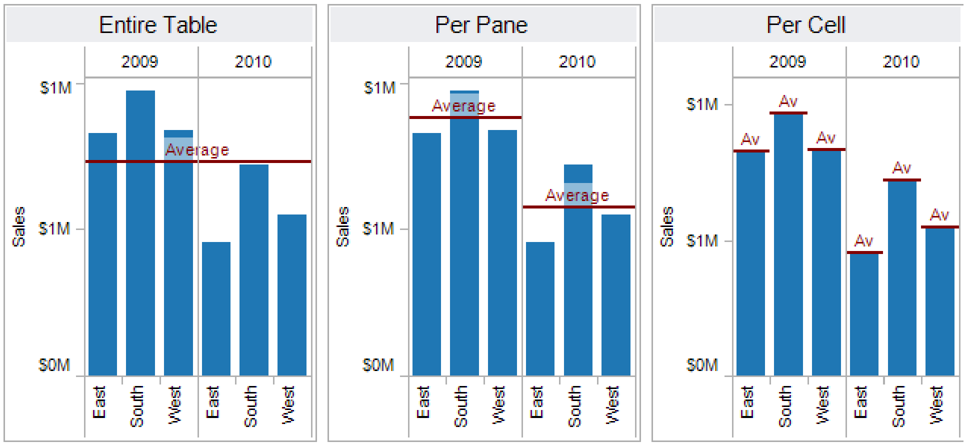
1. Right-click (control-click on Mac) on a quantitative axis and select **Add Reference Line, Band, or Box**.



2. In the Add Reference Line, Band, or Box dialog box, select **Line**.



3. In the Add Reference Line, Band, or Box dialog box, select one of the following scopes:



Adds a reference line to the entire table across all panes.

Adds a reference line on a per pane basis. Computed reference lines are recalculated for each pane in the view.

Adds a reference line within each cell. Computed reference lines are recalculated for each cell in the view.

4. Select a measure from the **Value** field to use as the basis for your reference line. You can also select an existing parameter, or create a new parameter on the fly. See **Creating Parameters** on page 1161.

   You cannot select a measure that isn't currently in the view as the basis for your reference line. If you want to use such a measure, close the Add Reference Line, Band, or Box dialog box and then drag the measure from the Data pane to the Details target on the Marks card. Change the measure's aggregation if necessary. This will not change the view, but it will allow you to use that measure as the basis for your reference line. Now re-open the Add Reference Line, Band, or Box dialog box and resume at step 1, above.

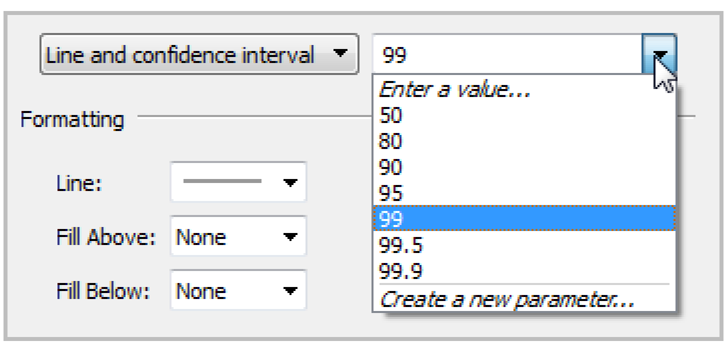
5. Select one of the following aggregations:

   - **Total** - places a line at the aggregate of all the values in either the cell, pane, or the entire view. This option is particularly useful when computing a weighted average rather than an average of averages. It is also useful when working with a calculation with a custom aggregation. The total is computed using the underlying data and behaves the same as selecting one of the totals option the Analysis menu.
   - **Sum** - places a line at the SUM of all the values in either the cell, pane, or entire view.
   - **Constant**- places a line at the specified value on the axis.
   - **Minimum** - places a line at the minimum value.
   - **Maximum** - places a line at the maximum value.

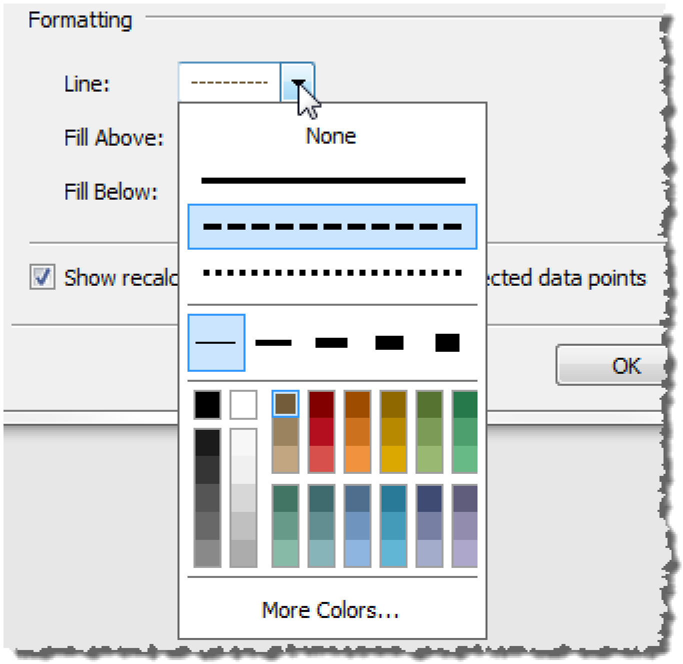
- **Average** - places a line at the average value along the axis.
- **Median**- places a line at the median value.
- 

6. Select how you want to label the line. You can select from the following options:
   - **None** –select this option to not show a label for the reference line.
   - **Value** – select this option to show a label corresponding to the line's value on the axis.
   - **Computation** – select this option to display the name of the measure that is the basis for your reference line and any computation that is performed.
   - **Custom** – select this option to build a custom label in the text box. You can use the menu to the right of the text box to insert values such as the computation or the value.
7. Specify whether to display the line with a confidence interval, just the line, or just the confidence interval.

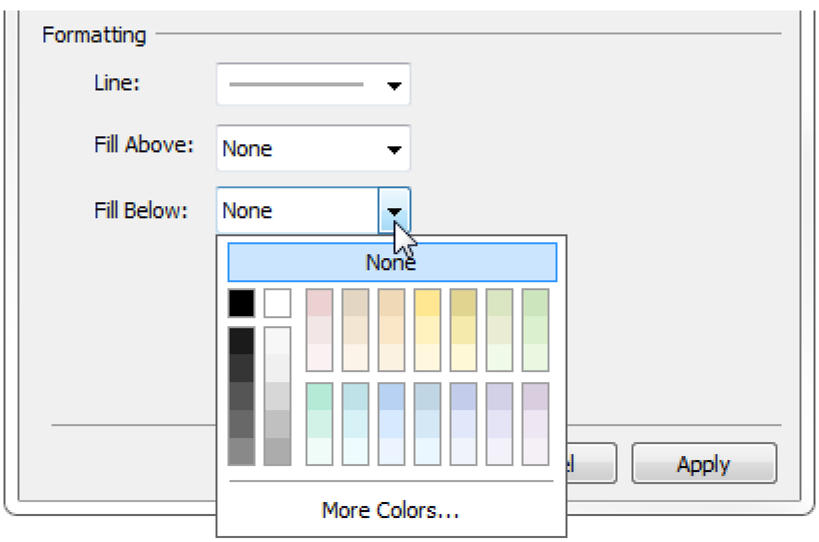
   Confidence interval distribution bands shade the region in which the population average will fall *n* of the time, where *n* is the value you select in the drop-down on the right. You can choose one of the listed numeric values, enter a custom numeric value, select an existing parameter, or create a new parameter on the fly:

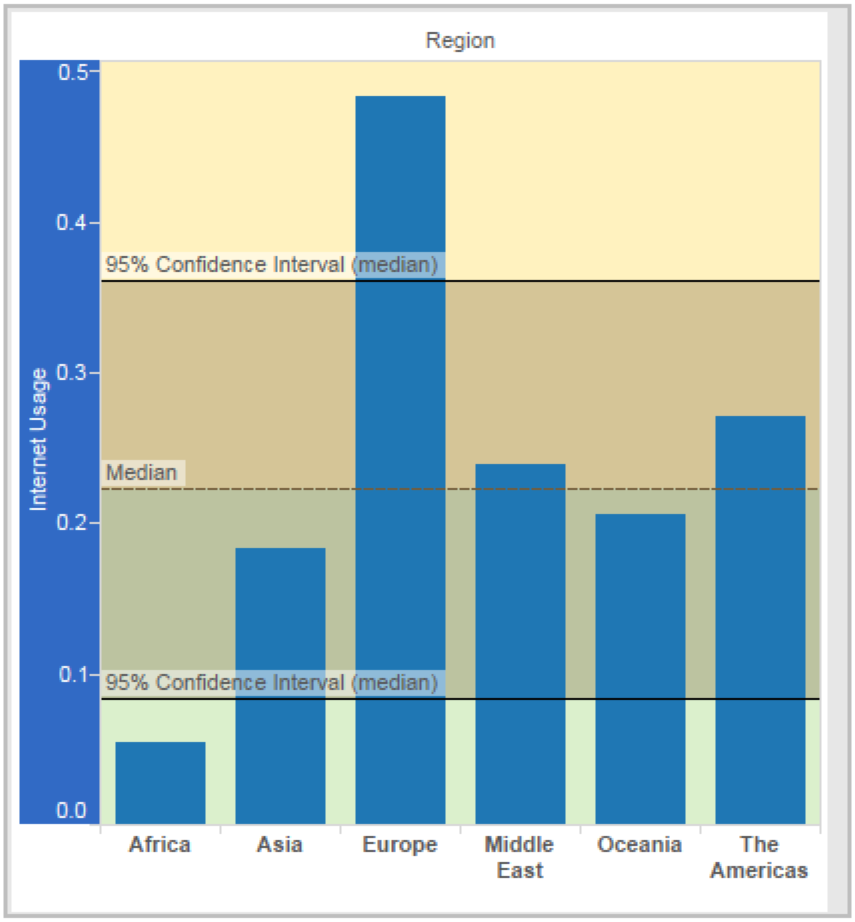
   The higher the value you select, the wider the bands will be.
8. Specify Formatting options for the line. You can change the style, thickness, and color.



9. Optionally, add a Fill color **Above** and **Below** the line.



When you are displaying a line and a confidence interval, the shading will be darker within the confidence interval, and lighter beyond it:



When you are displaying a confidence interval without a line, the fill colors are disregarded, though they are retained and then applied if you decide later to show a line.

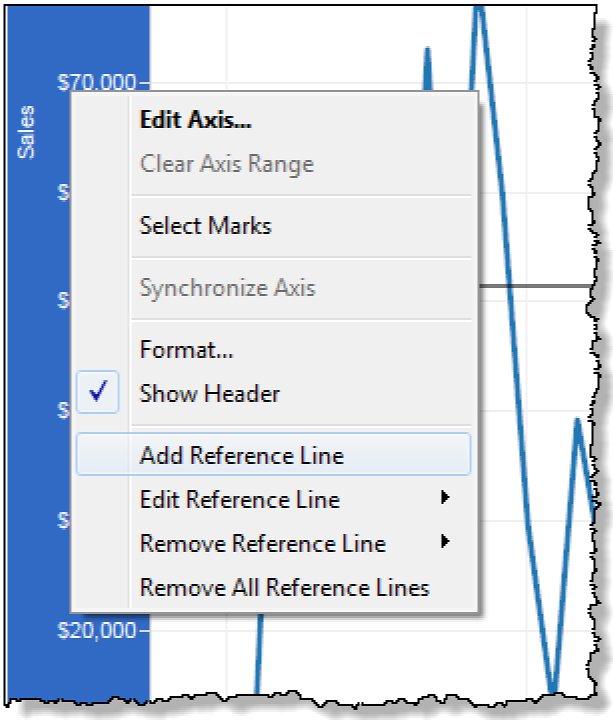
10. Specify whether to **Show recalculated line for highlighted or selected data points**. For more information, see **Marks and Data Analysis** on page 841

Adding Reference Bands

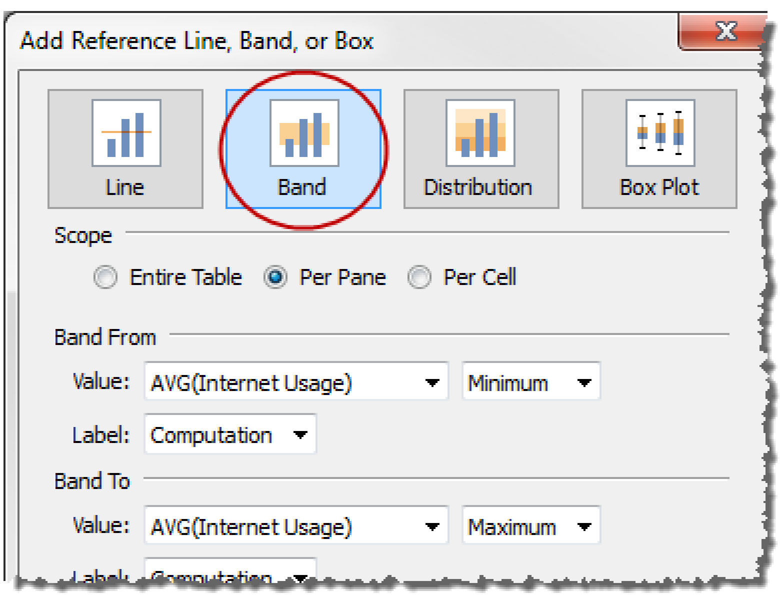
Reference bands are shaded areas behind the marks in the view between two constant or computed values on the axis. You can add reference bands to any continuous axis.

To add a reference band:

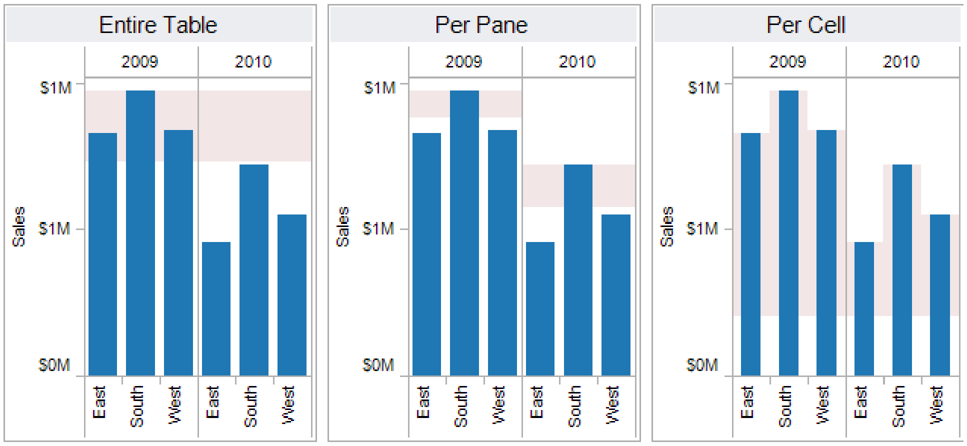
1. Right-click (Control-click on Mac) on a quantitative axis and select **Add Reference Line**.



2. In the Add Reference Line, Band, or Box dialog box, select **Band**.



3. Select one of the following scopes:



Adds a reference band to the entire table across all panes.

Adds a reference band on a per pane basis. Computed reference bands are recalculated for each pane in the view.

Adds a reference band within each cell. Computed reference bands are recalculated for each cell in the view.

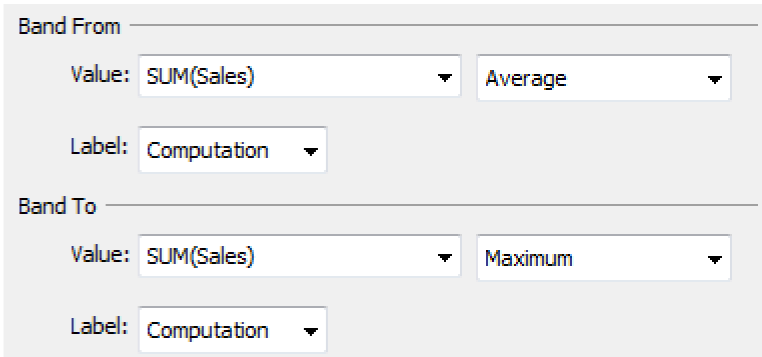
4. Select measures and an aggregation from the Value field—once in the **Band From** area and once in the **Band To** area—to use as the basis for your reference band. You can also select an existing parameter, or create a new parameter on the fly. Just be sure not to select the same measure and aggregation in both areas.

   > You cannot select a measure that isn't currently in the view as the basis for your reference band. If you want to use such a measure, close the Add Reference Line, Band, or Box dialog box and then drag the measure from the Data pane to the Details target on the Marks card. Change the measure's aggregation if necessary. This will not change the view, but it will allow you to use that measure as the basis for your reference band. Now re-open the Add Reference Line, Band, or Box dialog box and resume at step 1, above.

   The following aggregations are available:

   -
     - **Total** - extends the band to a value that is at the aggregate of all the values in either the cell, pane, or the entire view. This option is particularly useful when computing a weighted average rather than an average of averages. It is also useful when working with a calculation with a custom aggregation. The total is computed using the underlying data and behaves the same as selecting one of the totals option the Analysis menu.
     - **Sum** - extends the band to a value that is at the SUM of all the values in either the cell, pane, or entire view.
     - **Constant**- extends the band to a value that is at the specified value on the axis.
     - **Minimum** - extends the band to a value that is at the minimum value.

- **Maximum** - extends the band to a value that is at the maximum value.
- **Average** - extends the band to a value that is at the average value along the axis.
- **Median**- extends the band to a value that is at the median value.

- 

5. Format the reference band. You can mark the two values with a line and/or select a shading color for the band.

6. When finished, click **OK**.
7. Specify whether to **Show recalculated band for highlighted or selected data points**. For more information, see **Marks and Data Analysis** on page 841

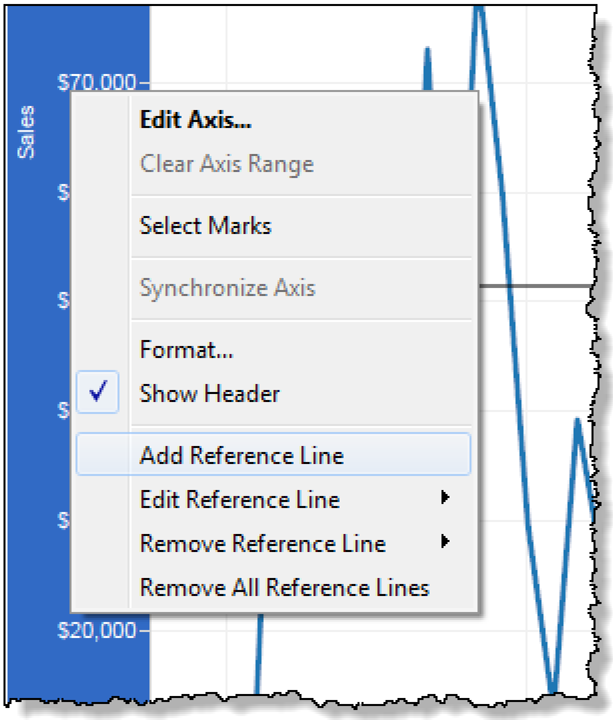
Adding Reference Distributions (Bullet Graphs)

Reference distributions are a special type of reference band. A reference distribution adds a gradient of shading to indicate the distribution of values along the axis. Distributions can be defined by confidence interval, percentages, percentiles, quantiles, or standard deviation. In addition to the shading, you can add a line to mark a constant or computed value along the axis.

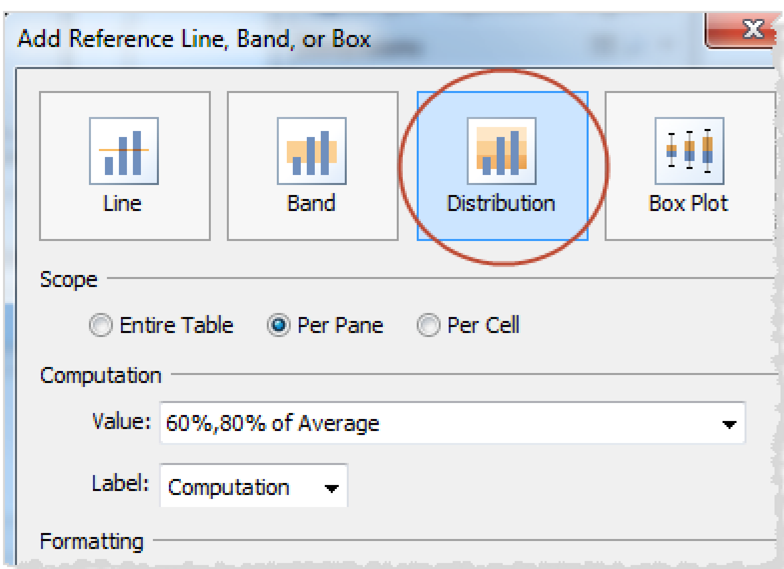
Basic Reference Distributions

To add a reference distribution:

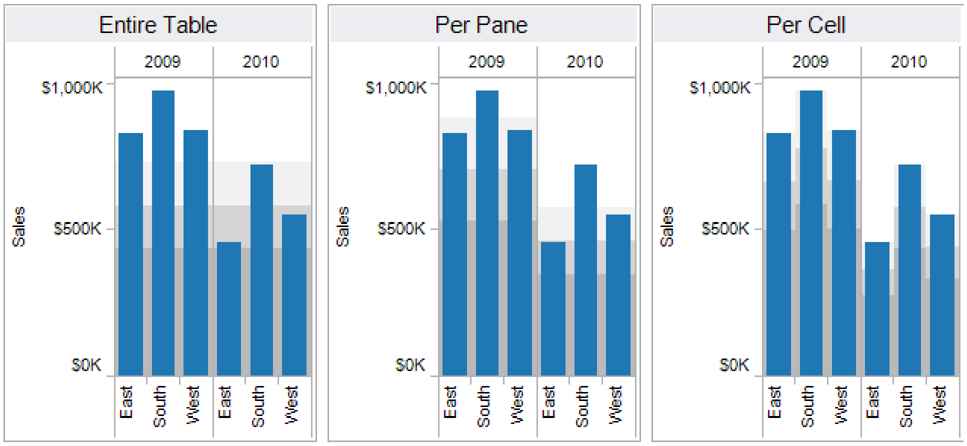
1. Right-click (Control-click on a Mac) on a quantitative axis and select **Add Reference Line**.



2. In the Add Reference Line, Band, or Box dialog box, select **Distribution**.



3. Select one of the following scopes:



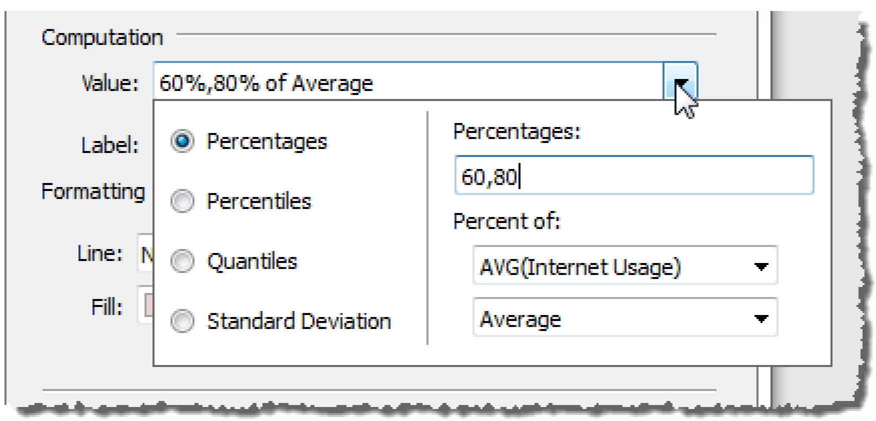
Adds a reference distribution to the entire table across all panes.

Adds a reference distribution on a per pane basis. Computed distributions are recalculated for each pane in the view.

Adds a reference distributions within each cell. Computed distributions are recalculated for each cell in the view.

4. Select the computation that will be used to create the distribution. You can select from the following options:

   - **Percentages** - shades the interval between which lie specified percentages of values. Use a comma to separate multiple percentage values (for example, `60, 80`).



   - **Percentiles** - shades intervals at the specified percentiles. When you select this option, you must also specify two or more numerical values (for example, `60,80` or `25, 50, 75`).
   - **Quantiles** - breaks the view into the specified number of tiles using shading and lines. When you select this computation, you must also specify the number of tiles (from 3 to 10, inclusive). For example, if you select 3, Tableau calculates the boundaries between the first, second and third terciles by calling the general

quantile function and asking for the 33.33 and the 66.66 quantiles. It then shades the three terciles differently.

Tableau uses estimation type 7 in the R standard to compute quantiles and percentiles. For details, see **How Tableau Computes Quantiles** in the Tableau Knowledge Base.

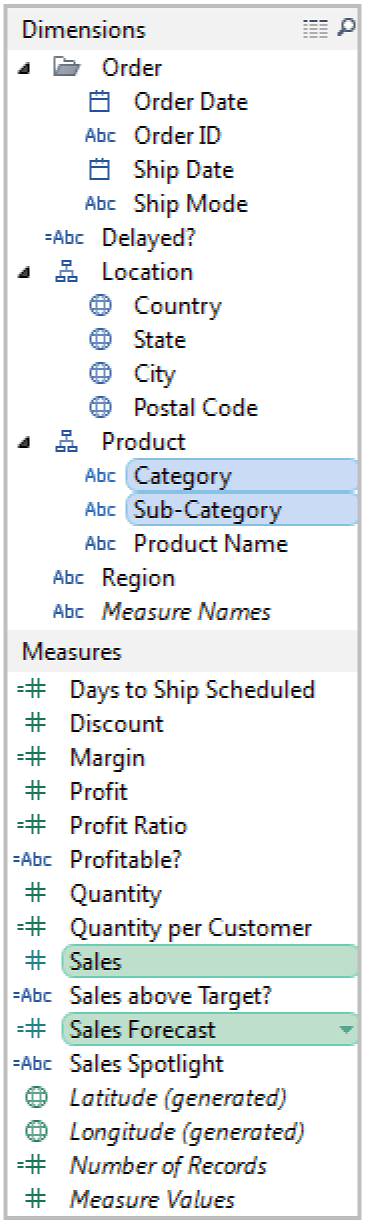
- **Standard Deviation** - places lines and shading to indicated the specified number of standard deviations above and below the mean. When you select this option you must specify the factor, which is the number of standard deviations and whether the computation is on a sample or the population.

5. Specify formatting options. You can format the lines at the distribution boundaries (for example, style, thickness, and color) as well as the fill gradient. Select from a list of predefined gradients. Select Symmetric to use a single color instead of a gradient. You can also specify whether to add additional shading above and below the defined distribution.
6. Specify whether to **Show recalculated band for highlighted or selected data points**. For more information, see **Marks and Data Analysis** on page 841

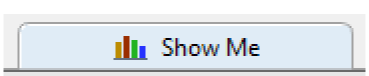
Bullet Graphs

Reference distributions can also be used to create bullet graphs. A bullet graph is a variation of a bar graph developed to replace dashboard gauges and meters. The bullet graph is generally used to compare a primary measure to one or more other measures in the context of qualitative ranges of performance such as poor, satisfactory, and good. You can create a bullet graph by adding two reference lines: a distribution to indicate the qualitative ranges of performance, and a line to indicate the target.

1. Select one or more dimensions, and two measures in the **Data** pane. The bullet graph will compare measure values. For example, budget vs. actual; actual vs. target; etc.

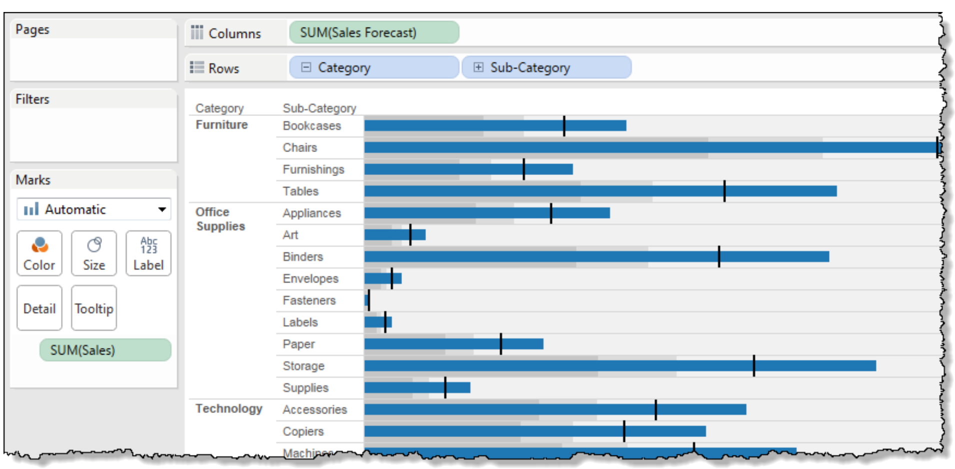


2. Click the **Show Me** button in the toolbar.

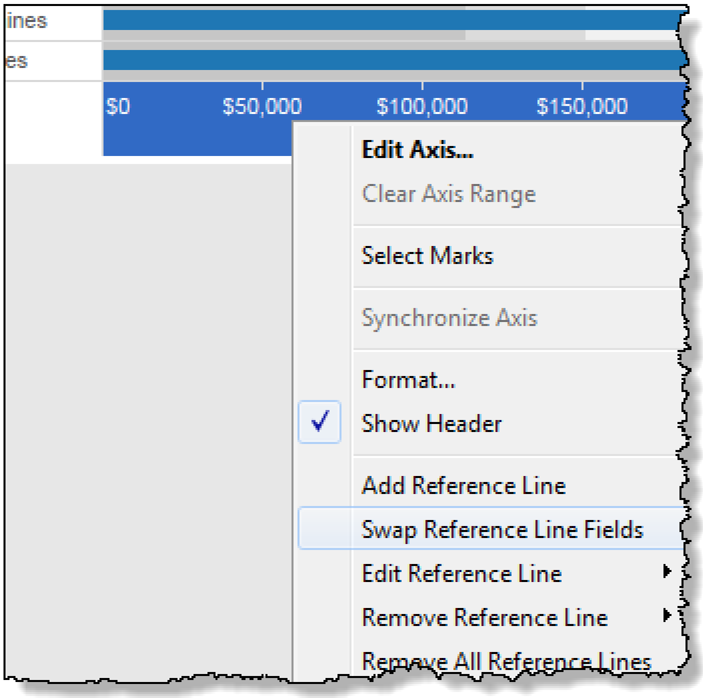


3. Select **Bullet Graph** in the Show Me pane.

Two reference lines are added. By default, Tableau adds a reference distribution that is defined at 60% and 80% of the Average of the measure on Detail. It also adds a reference line that marks the Average of that same measure. The other measure is placed on the Rows shelf.



To quickly swap the two measures, right-click (Control-click on a Mac) on the continuous axis and select Swap Reference Line Fields.



Edit each of the reference lines to change their definitions. For example, you may want to add 100%, or draw a line at a constant value.

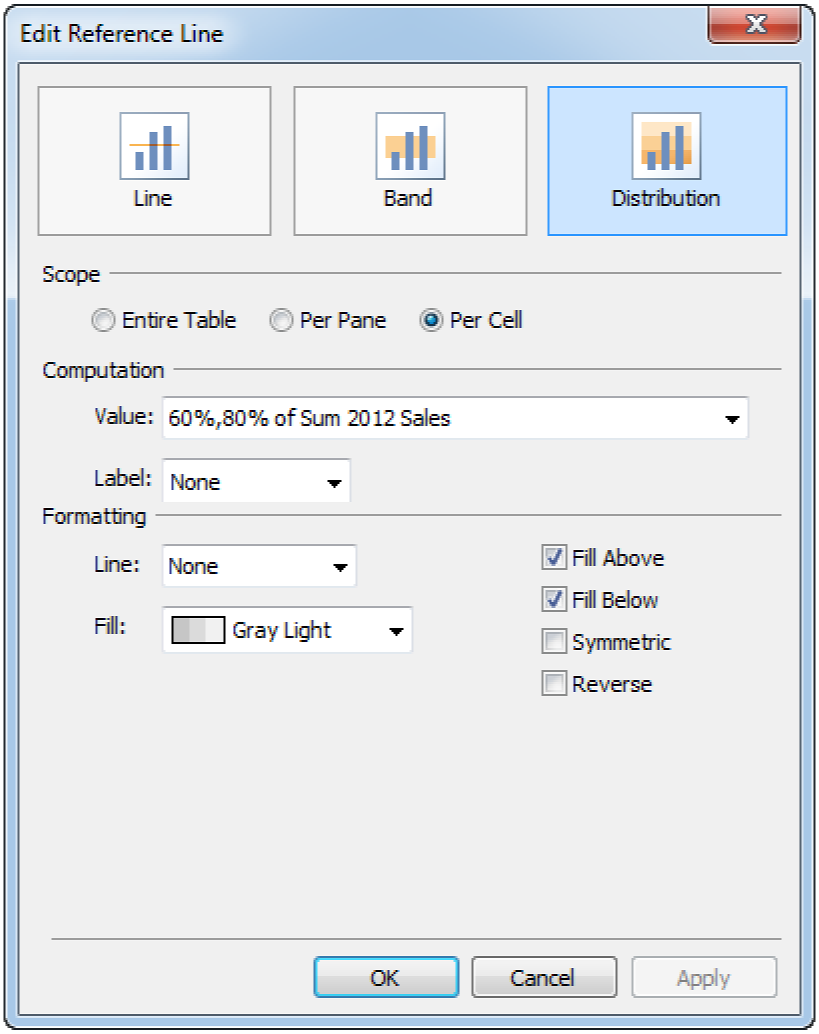
Create a bullet graph manually

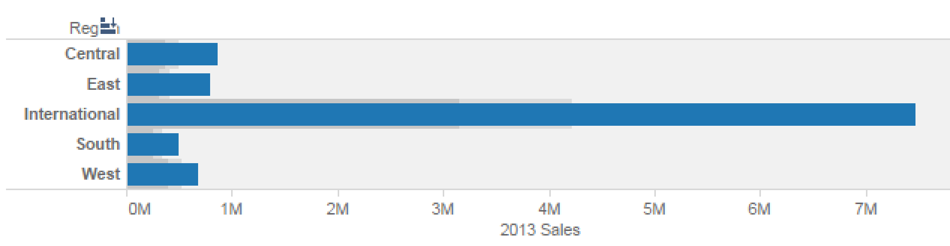
Instead of using Show Me, you can create a manual bullet graph by right-clicking the continuous axis and selecting **Add Reference Line**. Add reference lines for the 60% and 80% thresholds.

Step 1: Add a reference line

In the **Add Reference Line** dialog box, do the following tasks:

1. Select **Distribution** as the reference line type.
2. Under Scope, select **Per Cell**.
3. Under Computation, in the Value drop-down list, click the down arrow, and in the lists under Percent of, select **Sum (2012 Sales)**.
   The Value setting changes to reflect your selections.
4. In the **Label** drop-down list, select **None**.
5. In the Fill drop-down list, select the second square down in the leftmost list, and then select the check boxes for **Fill Above** and **Fill Below**. This selection applies a color scheme called "Gray Dark". This color scheme uses darker gray for the bad values and lighter gray for the good values.
6. Click **Apply** and look at your bar graph to see if you are satisfied with the appearance. If not, change the settings and click **Apply** again.
7. When finished, click **OK**.



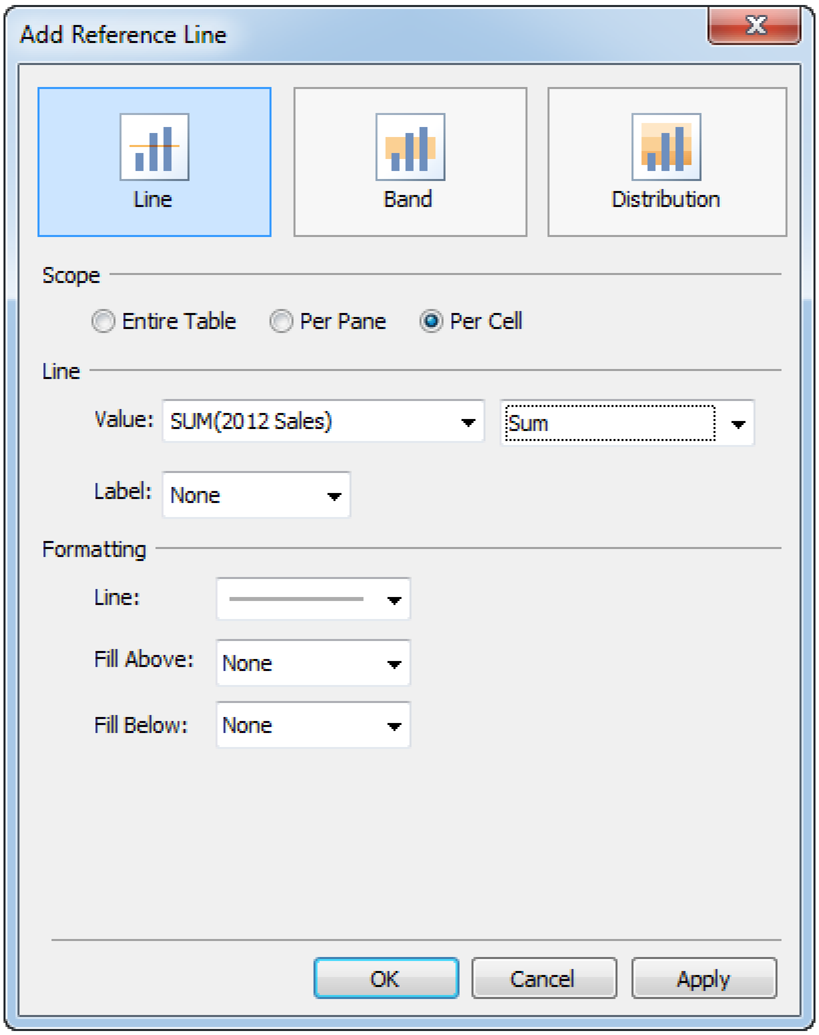


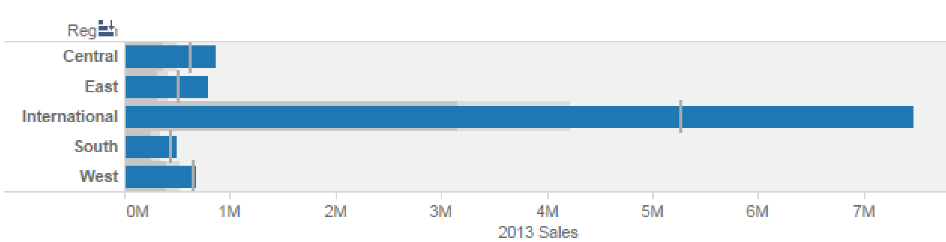
Step 2: The final threshold

Right-click the continuous axis again, and select **Add Reference Line** again to add a reference line for the 100% threshold.

In the **Reference Line** dialog box, do the following tasks:

1. Select **Line** as the type of reference line.
2. Under Scope, select **Per Cell**.
3. Under Line, in the Value drop-down list, select **2012 Sales** and **Sum**.
4. In the **Label** drop-down list, select **None**.
5. When finished, click **OK**.





Create a bullet graph with multiple measures

Manually create bullet graphs with more than two measures. Refer to the Bullet Graph Design Specification by Perceptual Edge for more information.

To follow along, copy and paste the table below into Tableau. If you're unfamiliar with how to do this, see **Create a Data Source with Clipboard Data** on page 347.

Region	Sales	Profit	Sales Quota	Overachievement
Central	900000	15000	1000000	1500000
East	1250000	5000	1100000	1650000
South	1850000	40000	1200000	1800000
West	2100000	6000	1300000	1950000

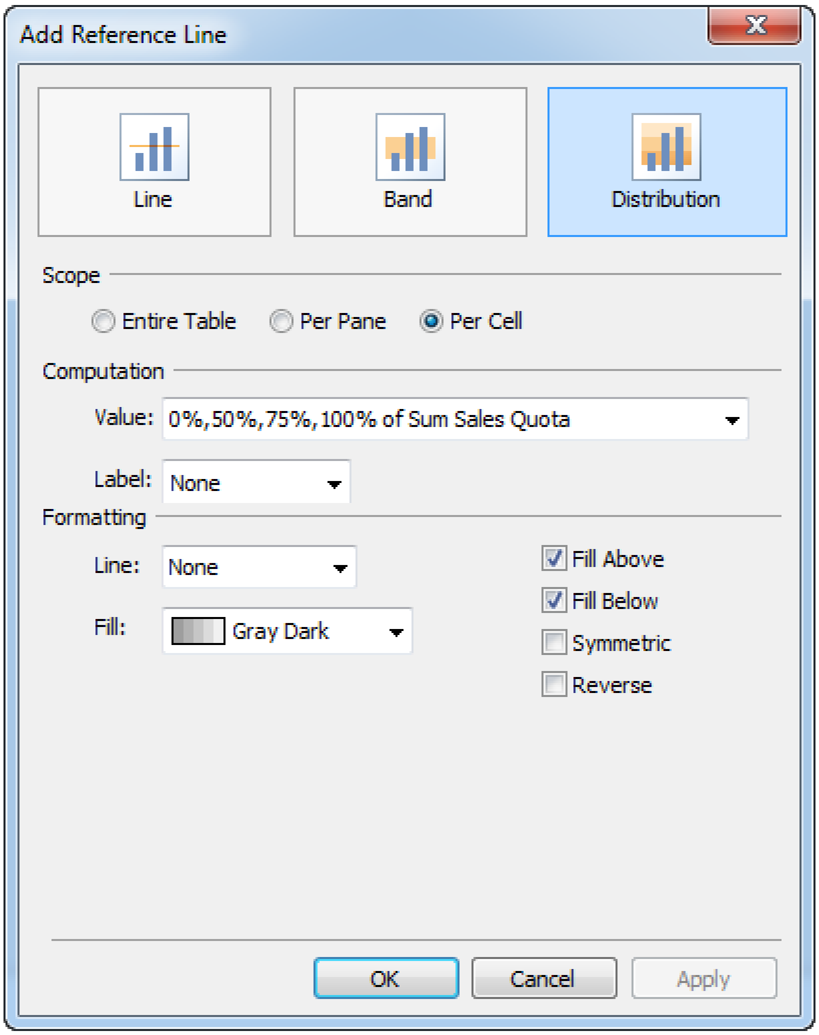
You will create a custom calculation to identify the cost of goods (COGS) for use as the comparative measure in the form of a line graph. Then, you will apply a background fill on the quantitative scale to show 50%, 75%, and 100% of the sales quota, as well as the overachievement goal.

This procedure includes 12 steps. The first part of a bullet graph is a horizontal bar chart against your dimension of choice. In this case, that dimension is **Sales**.

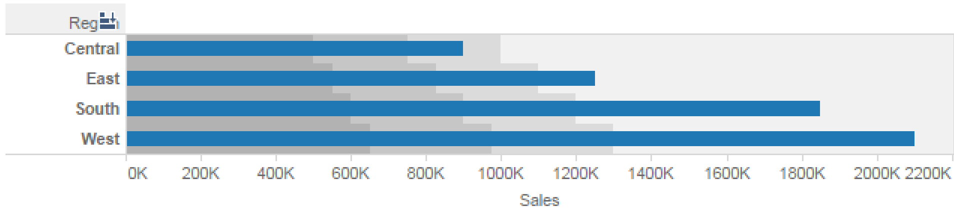
1. Connect to the data source above.
2. From the **Dimensions** pane, drag the **Region** field to the **Rows** shelf.
3. From the **Measures** pane, drag the **Sales** field to the **Columns** shelf.
4. Choose **Analysis** > **Create Calculated Field** to create the COGS measure.
5. In the Calculated Field dialog box, do the following:
    1. Enter **COGS** (for Cost of Goods Sold) into the **Name** field.
    2. In the Formula text box, type `[Sales] - [Profit]`, and then select **OK**.
6. From the **Measures** pane, drag the **Sales Quota** field, **Overachievement** field, and **COGS** field to **Detail** on the Marks card so you can use them for reference lines and bands.
7. Right-click the Sales axis and select **Add Reference Line** so you can use 0%, 50%, 75%, and 100% of the sales quota as reference bands.
8. In the Add Reference Line dialog box, do the following:
    1. Select **Distribution** as the type of reference line.
    2. Under Scope, select **Per Cell**.
    3. Under Computation, click the arrow by the Value drop-down list, and then in the Percentages text box, replace the numbers with **0, 50, 75, 100**.
    4. In the lists for Percent of, select **Sales Quota** and **Sum**, respectively.
    5. In the Label list, select **None**.

6. Under Formatting, in the Fill list, select the second square down in the leftmost list, and then select the check boxes for **Fill Above** and **Fill Below**. This selection applies a color scheme called "Gray Dark." This color scheme uses darker gray for the bad values and lighter gray for the good ones.
7. When finished, select **OK**.

The Add Reference Line dialog should look like this once you're finished:

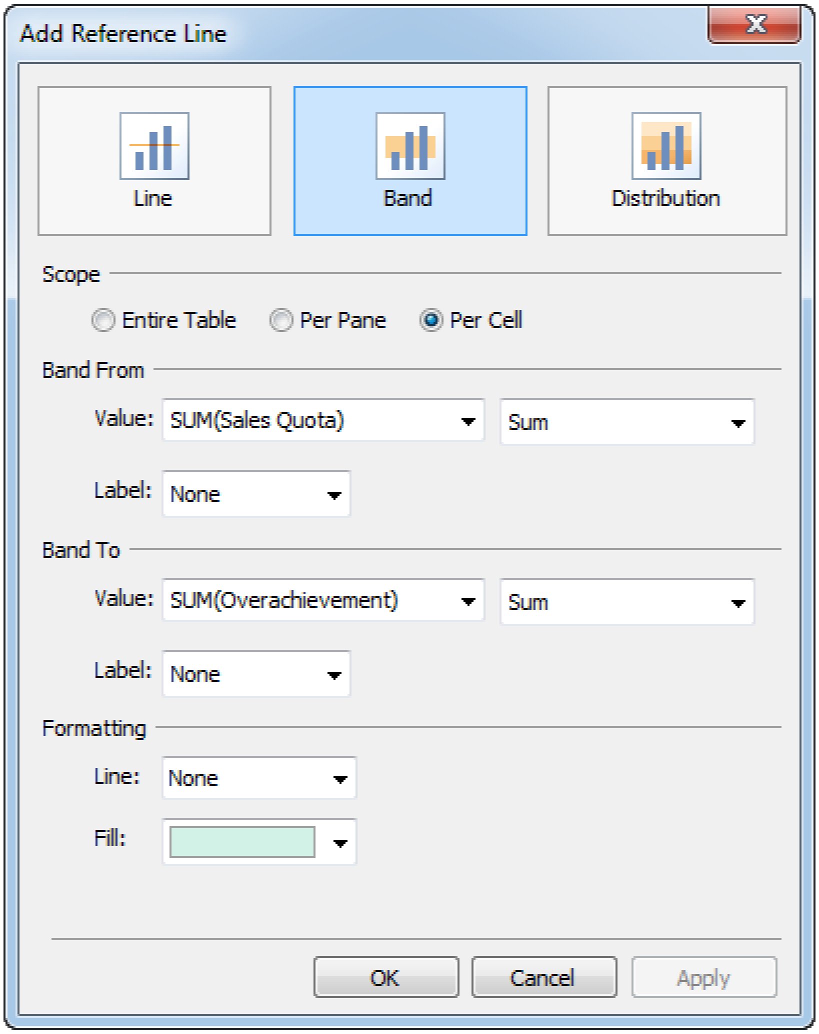


Your view updates to look like this:

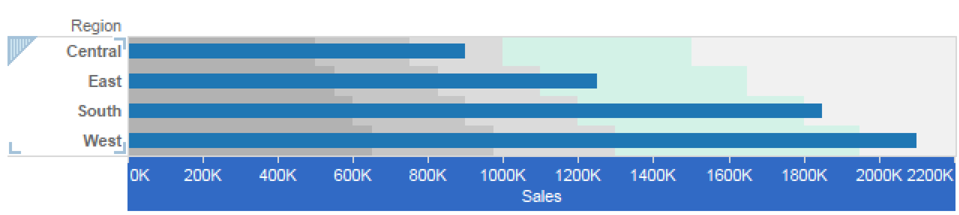


9. Right-click the Sales axis and select **Add Reference Line** to create a band between Sales Quota and Overachievement.
10. In the Add Reference Line dialog box, do the following:
    1. Select **Band** as the type of reference line.
    2. Under Scope, select **Per Cell**.
    3. Under Band From, in the Value drop-down list, select **Sales Quota and** Sum.
    4. In the Label list, select **None**.
    5. Under Band To, in the Value drop-down list, select **Overachievement** and **Sum**.
    6. In the Label list, select **None**.
    7. Under Formatting, in the Line list, select **None**.
    8. In the Fill list, select any pastel color.
    9. When finished, select **OK**.

    The Add Reference Line dialog should look like this once you're finished:



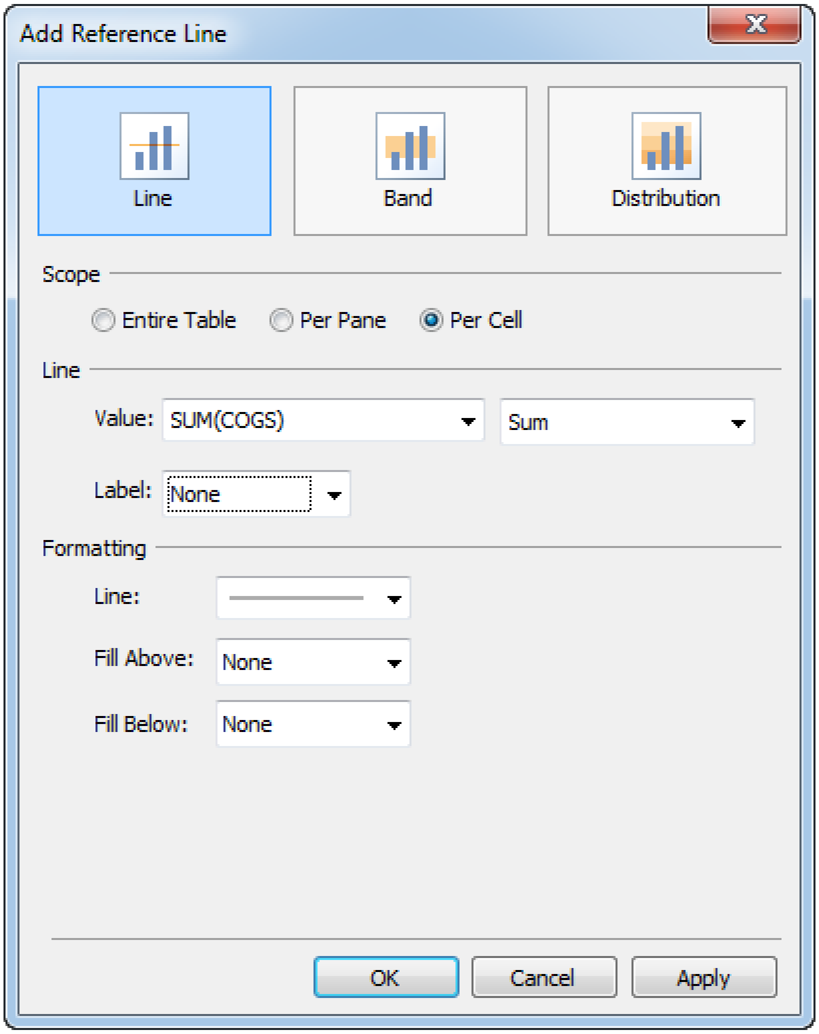
Your view updates to look like this:



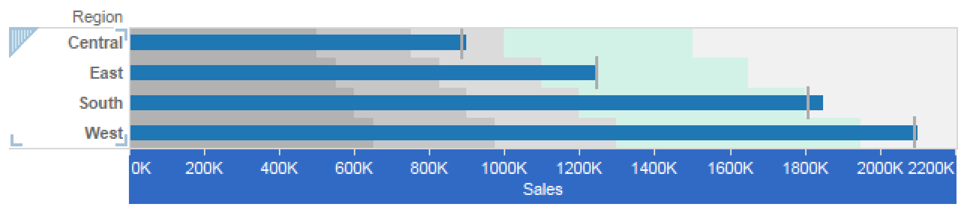
11. Right-click the Sales axis and select **Add Reference Line** to add a COGS reference line.
12. In the Add Reference Line dialog box, do the following:
    1. Select **Line** as the type of reference line.
    2. Under Scope, select **Per Cell**.
    3. Under Line, in the Value drop-down list, select **Sum** and **COGS**.

4. In the Label list, select **None**.
5. Under Formatting, in the Line drop-down list, select the solid line.
6. In the Fill Above list, select **None**.
7. In the Fill Below list, select **None**.
8. When finished, select **OK**.

The Add Reference Line dialog should look like this once you're finished:



Your view now displays your final bullet graph:

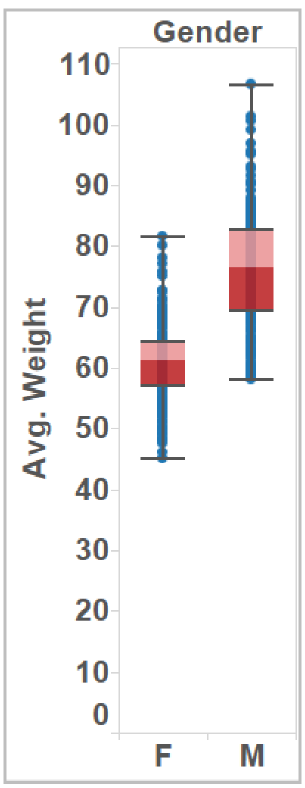


Adding Box Plots

Use box plots, also known as a box-and-whisker plots, to show the distribution of values along an axis.

Boxes indicate the middle 50 percent of the data (that is, the middle two quartiles of the data's distribution).

You can configure lines, called *whiskers*, to display all points within 1.5 times the interquartile range (in other words, all points within 1.5 times the width of the adjoining box), or all points at the maximum extent of the data, as shown in the following image:

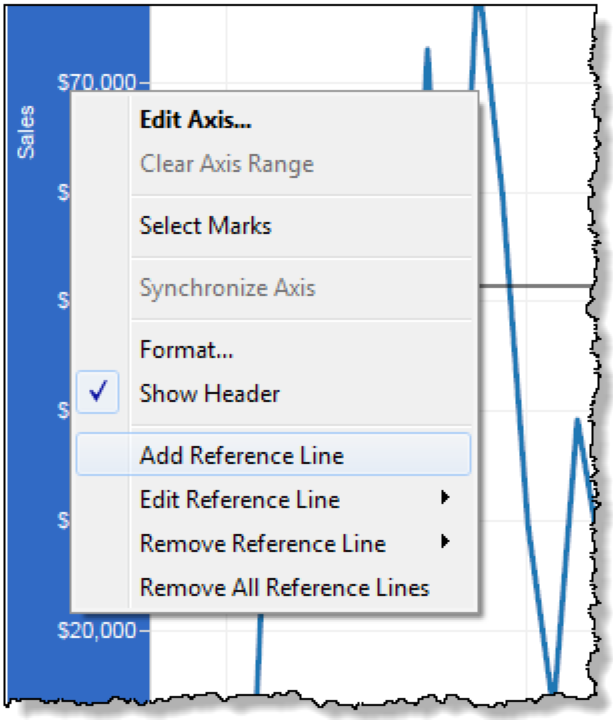


Boxplots are also available from the Show Me pane when you have at least one measure in the view:

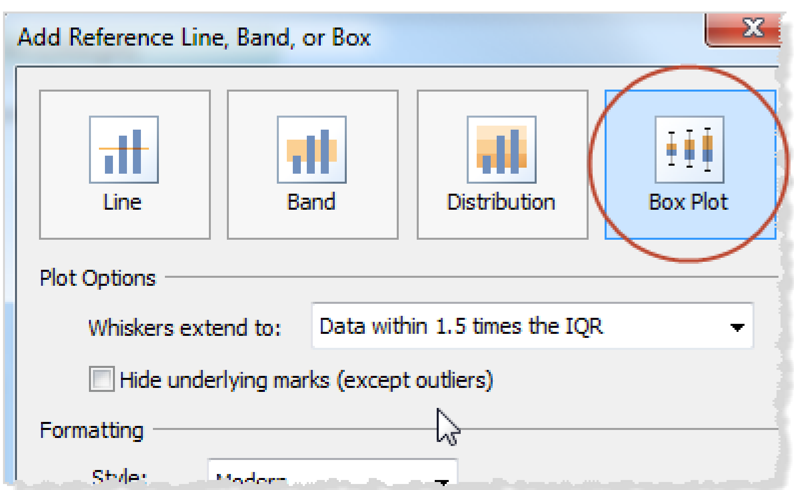
For information on Show Me, see **Show Me** on page 531

To add a box plot:

1. Right-click (Control-click on a Mac) on a quantitative axis and select **Add Reference Line**.



2. In the Add Reference Line, Band, or Box dialog box, select Box Plot.



3. Under Plot Options, specify placement for the whiskers:

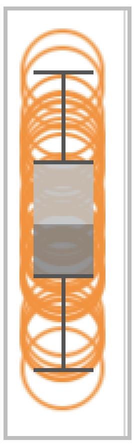
   - **Data within 1.5 times the IQR** - places whiskers at a location that is 1.5 times the interquartile range—that is, 1.5 times further out than the width of the adjoining box. This is also known as a schematic box plot.

- **Maximum extent of the data** - places whiskers at the farthest data point (mark) in the distribution. This is also known as a skeletal box plot.

4. Specify whether to **Hide underlying marks (except outliers)**—that is, whether to hide all marks except those beyond the whiskers.
5. Configure the appearance of the plot by selecting a **Style** , **Fill**, **Border**, and **Whiskers**.

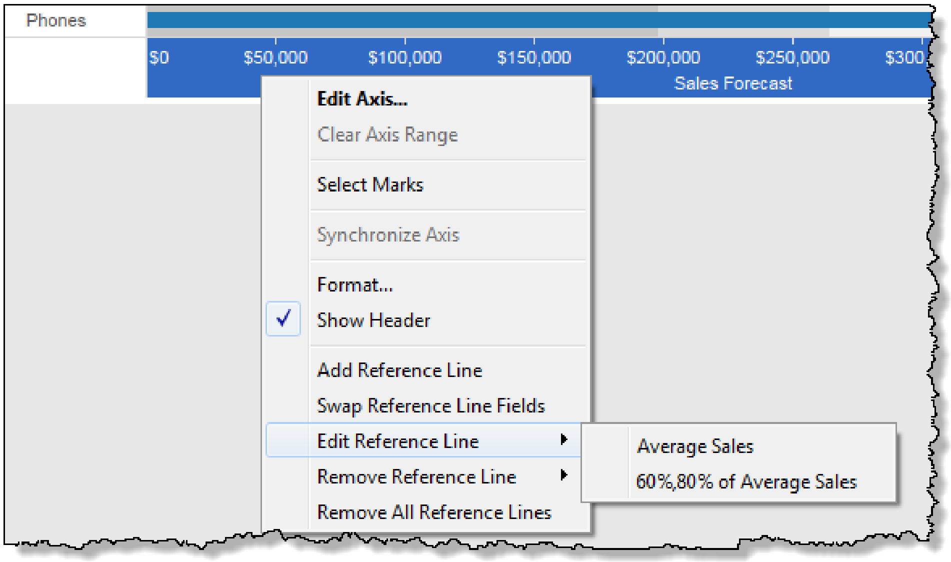
Show Me Vs. Add Reference Line, Band, or Box

The difference between adding a box plot using Show Me and adding a box plot using Add Reference Line is that with Show Me, the box plot is your visualization, whereas with Add Reference Line, Band, or Box, you are adding a box plot to an existing visualization. For example, you could create the following view by first selecting a circle view in Show Me, and then adding a box plot from Add Reference Line:

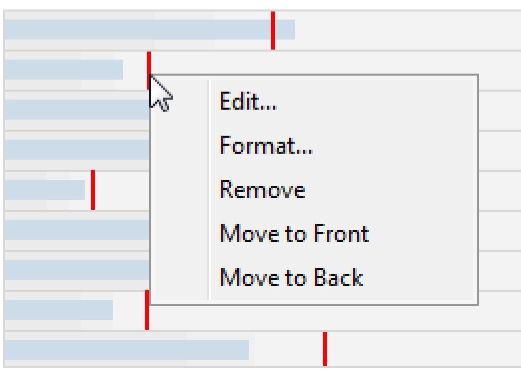


Editing Reference Lines, Bands, Distributions, or Boxes

After you've added a reference line, band, or box, you can edit the definition. To do this, right-click (Control-click on a Mac) the continuous axis and select **Edit Reference Line**. If there are multiple reference lines, bands, or boxes in the view, use the additional menu to select the one you want to edit.



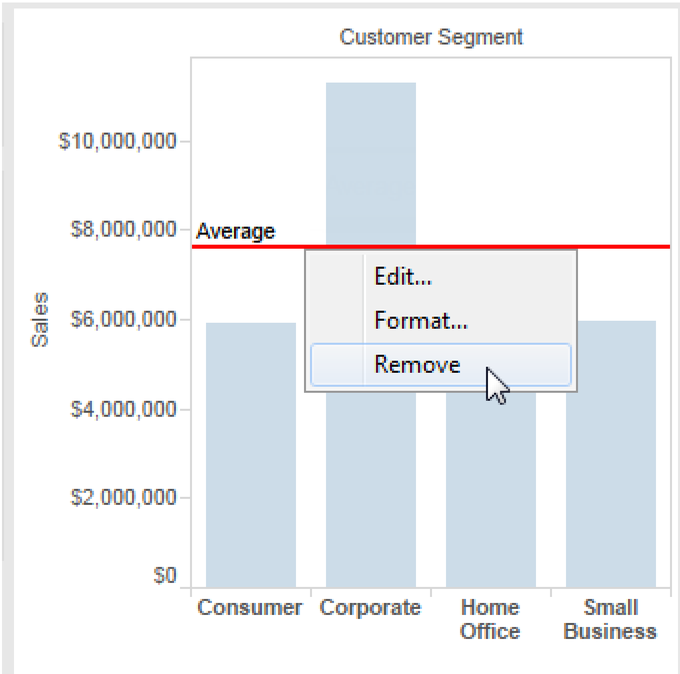
When you have multiple reference lines, bands, or boxes, you may want to change the order they are drawn in the view. To reorder a reference line, right-click (Control-click on a Mac) the line and select **Move to Front** or **Move to Back**.



Removing Reference Lines, Bands, Distributions or Boxes

You can remove an individual reference line, band, or box, or remove them all at once.

To remove an individual reference line, band, or box, right-click (Control-click on a Mac) the reference line, band, or box in the view and select **Remove**. If you are removing a reference band or distribution that doesn't include a line, right-click at the beginning or end of the shaded area. In distributions, you can also right-click between the different shades in the gradient.



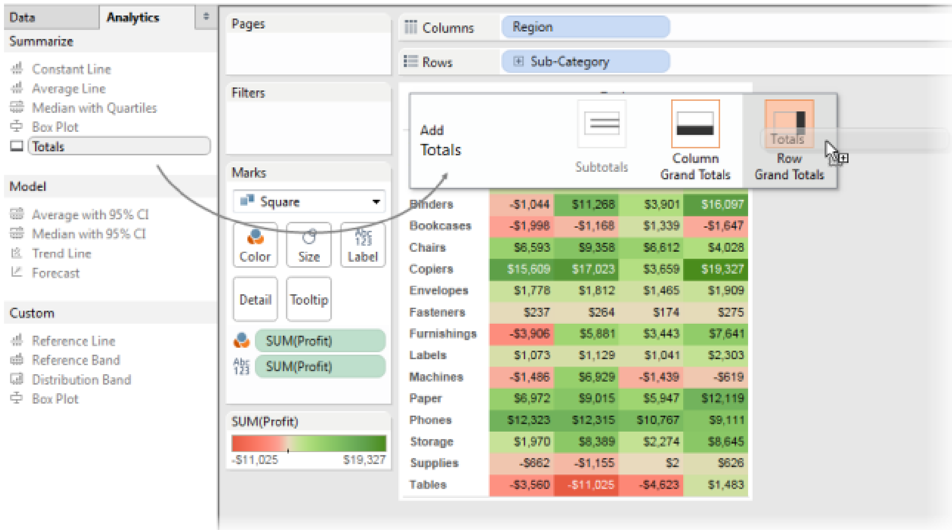
To remove all reference lines, bands, or boxes at once, right-click the continuous axis and select **Remove All Reference Lines**.

Totals

You can automatically compute grand totals and subtotals for the data in a view. By default Tableau uses the underlying data to compute totals. However, if you are using a multidimensional data source you can specify whether to do compute the total on the server using the underlying data or in locally using the data that you see in the table. In Tableau, multidimensional data sources are supported only in Windows.

To add totals to the view:

1. On the left side of the workspace, click the **Analytics** pane.
2. Drag and drop **Totals** onto one of the options in the Add Totals dialog box that appears.



You can also add grand totals and subtotals to the view using the Analysis menu. To do so, select **Analysis** > **Totals**, and then select to add row or column grand totals, or subtotals.

Local vs. Server Computation

If you are using a multidimensional data source, you can specify whether to do the subtotal or total computation on the server using the underlying data in the data source or locally in Tableau using the data that you see in the table.

The default setting is to compute all totals on the server if you are connected to a Microsoft Analysis Services data source, and locally if you are connected to an Essbase data source using the aggregation specified in the cube. However, there are cases when it is not possible for the server to compute the expected subtotals due to filtering or perfect pivoting.

For example, let’s say you have a view showing the sales of Amaretto, Columbian, and Decaf Irish Cream coffees. Then you filter the view to only show Amaretto and Columbian coffee sales. When you turn on subtotals for the Product Type field so you can see the total sales for all Coffees, one of the following will happen:

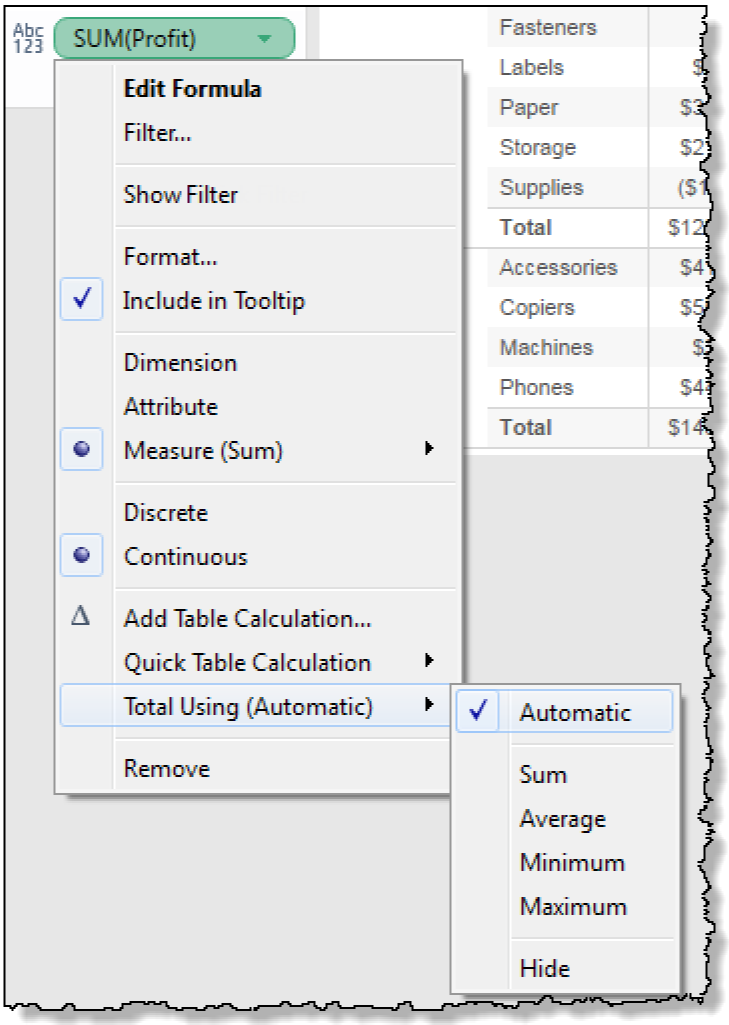
- If the total can be computed using the filter, the correct total will display. In this case Tableau would compute the total sales for all Coffees.
- If the total cannot be computed using the filter, the Totals cells in the view will be empty. In this case you would want to specify a local computation that only includes the values you see in Tableau.

To specify a local computation:

1. Select **Total Using** on the context menu for the measure you are using to calculate the subtotals.

   If you are not displaying totals, this menu item does not appear. See **Show Grand Totals** on the next page.

   Then select an aggregation.



2.

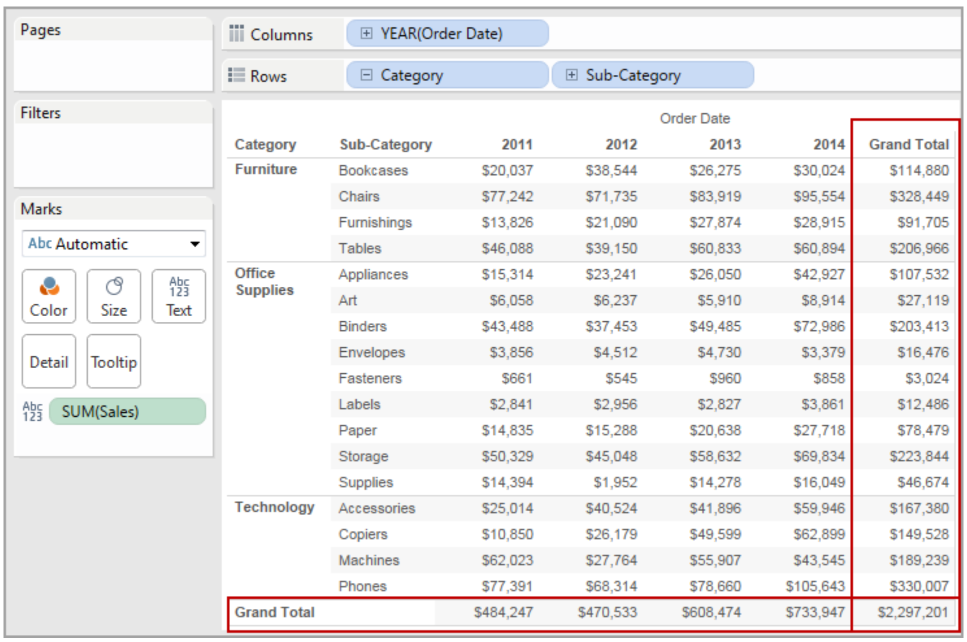
   Hide tells Tableau to not show a total for the field.

An additional value, **Server**, may be available. Server computation is not always available and sometimes the totals will be blank for specific members in the view. When using server computation keep in mind the following information.

- Server computation is only available for ASO cubes.
- Server computation is not available for dynamic hierarchies. That means if the members in the view are part of a dimension or hierarchy that is tagged as dynamic, they cannot be included in the set of values you are using to compute the totals and will show up as blank in the view.
- If you are computing totals for a calculated field whose formula makes assumptions about other calculated members at different levels in the hierarchy, the totals will display as blank in the view.

Grand Totals

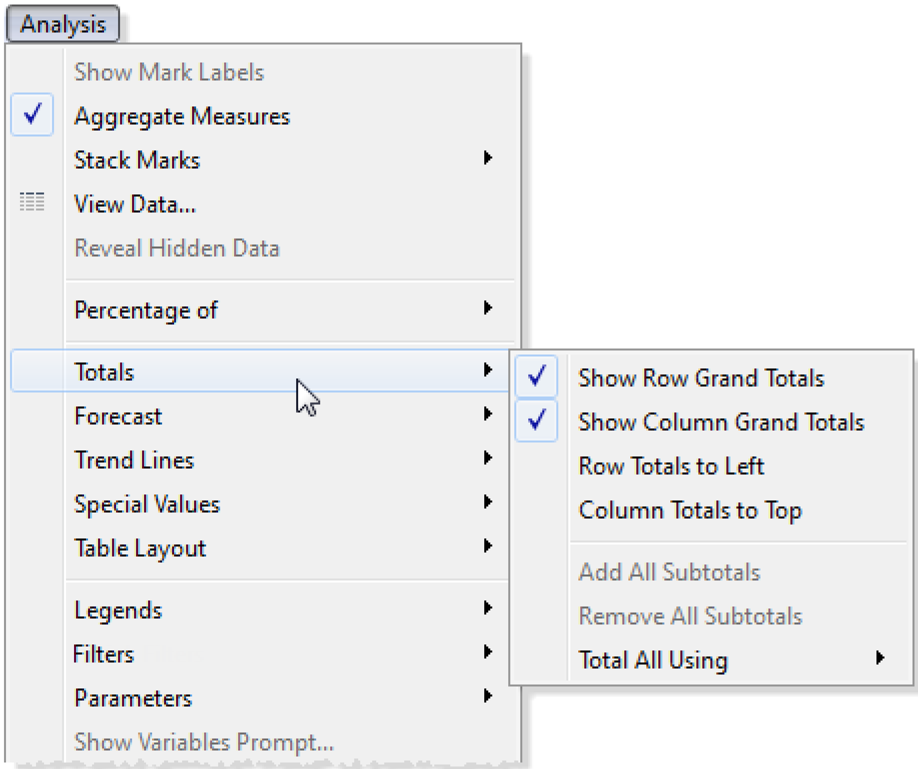
Any view in Tableau can include grand totals. For example, in a view showing the total sales for each department and category for four years, you can turn on grand totals to also see the totals across all products and all years.



Category	Sub-Category	2011	2012	2013	2014	Grand Total
Furniture	Bookcases	$20,037	$38,544	$26,275	$30,024	$114,880
	Chairs	$77,242	$71,735	$83,919	$95,554	$328,449
	Furnishings	$13,826	$21,090	$27,874	$28,915	$91,705
	Tables	$46,088	$39,150	$60,833	$60,894	$206,966
Office Supplies	Appliances	$15,314	$23,241	$26,050	$42,927	$107,532
	Art	$6,058	$6,237	$5,910	$8,914	$27,119
	Binders	$43,488	$37,453	$49,485	$72,986	$203,413
	Envelopes	$3,856	$4,512	$4,730	$3,379	$16,476
	Fasteners	$661	$545	$960	$858	$3,024
	Labels	$2,841	$2,956	$2,827	$3,861	$12,486
	Paper	$14,835	$15,288	$20,638	$27,718	$78,479
	Storage	$50,329	$45,048	$58,632	$69,834	$223,844
	Supplies	$14,394	$1,952	$14,278	$16,049	$46,674
Technology	Accessories	$25,014	$40,524	$41,896	$59,946	$167,380
	Copiers	$10,850	$26,179	$49,599	$62,899	$149,528
	Machines	$62,023	$27,764	$55,907	$43,545	$189,239
	Phones	$77,391	$68,314	$78,660	$105,643	$330,007
Grand Total		$484,247	$470,533	$608,474	$733,947	$2,297,201

Show Grand Totals

You can calculate grand totals by selecting one of the **Grand Totals** options on the **Analysis > Totals** menu. The grand totals are added as an additional row or column to your table.

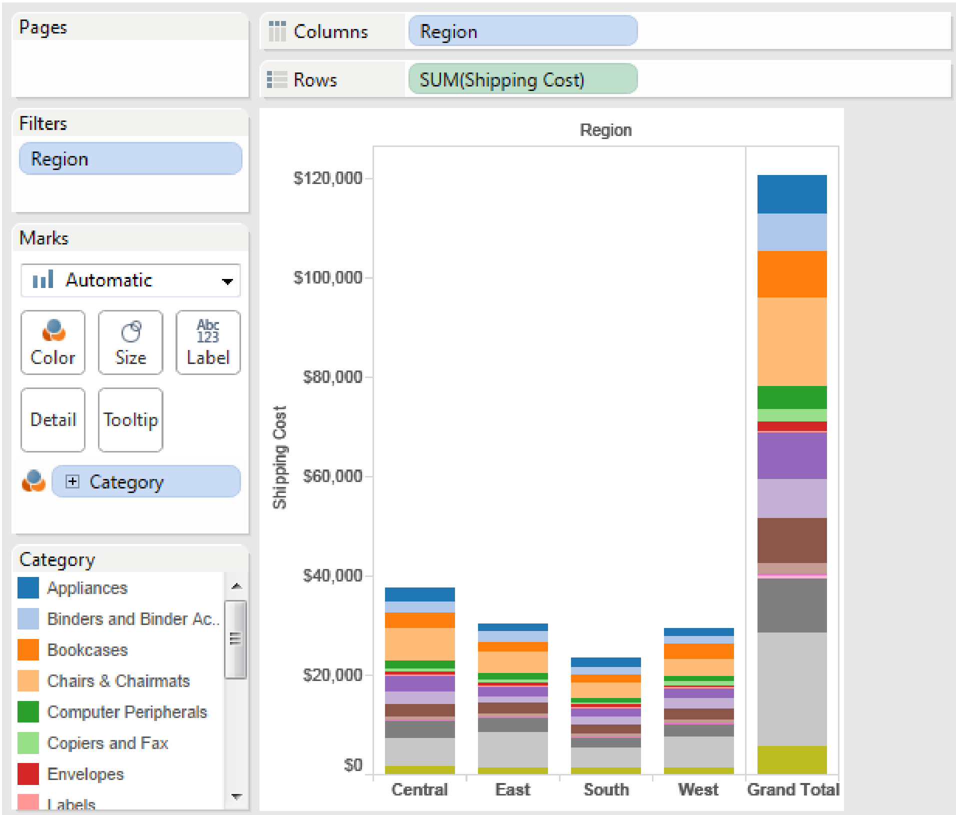


You can also drag total in from the **Analytics** pane. See **Analytics Pane** on page 272.

The following rules dictate whether you can turn on grand totals:

- The view must have at least one header – Headers are displayed whenever you place a dimension on the **Columns** shelf or the **Rows** shelf. If column headers are displayed, you can calculate grand totals for columns. If row headers are displayed, you can calculate grand totals for rows.
- Measures must be aggregated – The aggregation determines the values displayed for the totals. See **Grand Totals and Aggregations** on page 1155 for more information.
- Grand Totals cannot be applied to continuous dimensions.

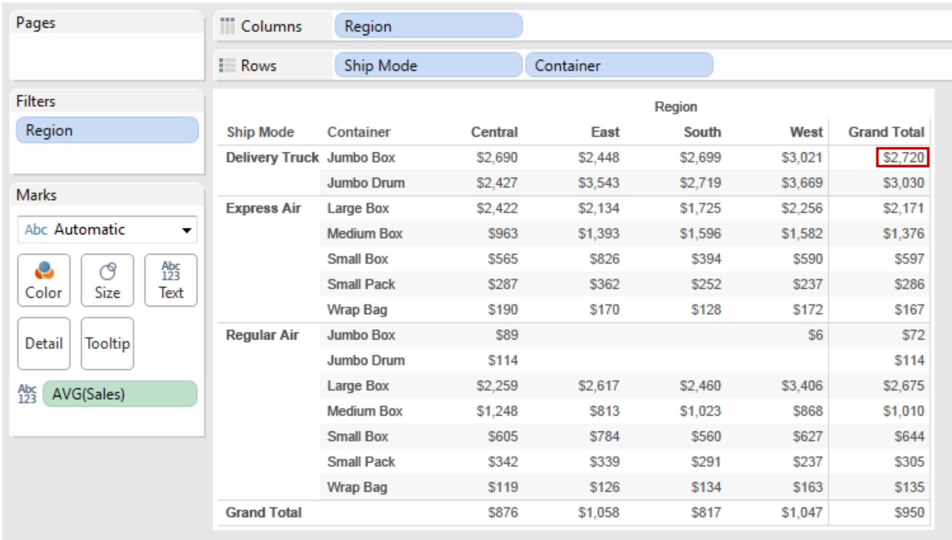
You can also display totals for graphical views of data. In the figure below, only column totals are calculated because the table contains only column headers.



Note: By default totals are computed on the server if you are connected to a Microsoft Analysis Services data source and locally if you are connected to an Essbase data source using the aggregation specified in the cube. Refer to **Local vs. Server Computation** on page 1147 to learn more.

Options for Calculating Grand Totals

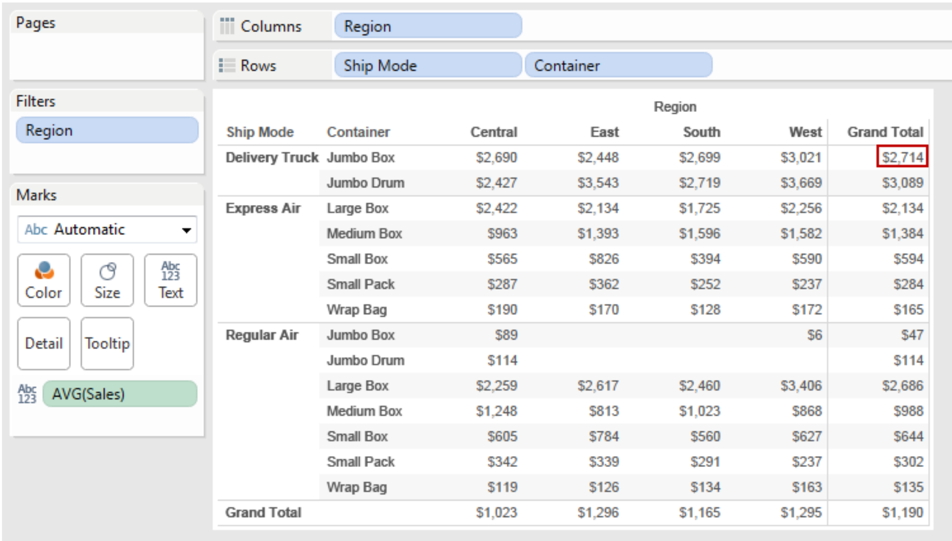
When you first turn on grand totals (see **Show Grand Totals** on page 1149), the totals are computed using disaggregated data in the underlying data source. Consider the following view:



Ship Mode	Container	Central	East	South	West	Grand Total
		Region				
Delivery Truck	Jumbo Box	$2,690	$2,448	$2,699	$3,021	$2,720
	Jumbo Drum	$2,427	$3,543	$2,719	$3,669	$3,030
Express Air	Large Box	$2,422	$2,134	$1,725	$2,256	$2,171
	Medium Box	$963	$1,393	$1,596	$1,582	$1,376
	Small Box	$565	$826	$394	$590	$597
	Small Pack	$287	$362	$252	$237	$286
	Wrap Bag	$190	$170	$128	$172	$167
Regular Air	Jumbo Box	$89			$6	$72
	Jumbo Drum	$114				$114
	Large Box	$2,259	$2,617	$2,460	$3,406	$2,675
	Medium Box	$1,248	$813	$1,023	$868	$1,010
	Small Box	$605	$784	$560	$627	$644
	Small Pack	$342	$339	$291	$237	$305
	Wrap Bag	$119	$126	$134	$163	$135
Grand Total		$876	$1,058	$817	$1,047	$950

The average that you see at the right of the first row under Grand Total is $2720. But if you compute the average for the four values you see in the row ($2690, $2448, $2699, $3021), the result comes to $2714.50, not $2720. The discrepancy is due to the fact that Tableau is averaging the data in the underlying data source. In this case there are more than four numbers to average, perhaps many more. The result is derived by averaging all values that have the properties Ship Mode = Delivery Truck, Container = Jumbo Box, without regard to region.

To see totals that correspond to the numbers you see in your view requires two averaging operations in Tableau: first, values for the individual marks (or cells) in the view must be derived—for example, by averaging all values that have the properties Ship Mode = Delivery Truck, Container = Jumbo Box, and Region = Central. Then the results for each region must be derived, by averaging the results for the individual marks. Fortunately, you do not need to perform two operations. To display a result of this type, from the **Analysis** menu choose **Totals** > **Total All Using** > **Average** . Now the average is performed on the values you see, and not on the disaggregated date in the data source:



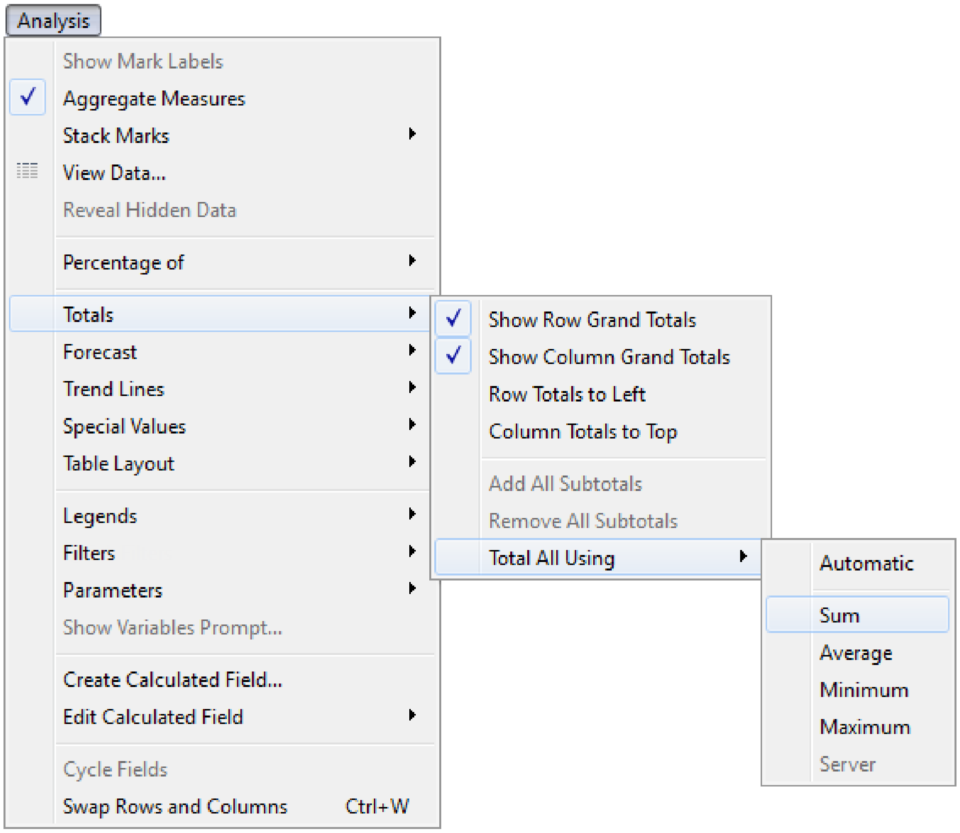
		Region				
Ship Mode	Container	Central	East	South	West	Grand Total
Delivery Truck	Jumbo Box	$2,690	$2,448	$2,699	$3,021	$2,714
	Jumbo Drum	$2,427	$3,543	$2,719	$3,669	$3,089
Express Air	Large Box	$2,422	$2,134	$1,725	$2,256	$2,134
	Medium Box	$963	$1,393	$1,596	$1,582	$1,384
	Small Box	$565	$826	$394	$590	$594
	Small Pack	$287	$362	$252	$237	$284
	Wrap Bag	$190	$170	$128	$172	$165
Regular Air	Jumbo Box	$89			$6	$47
	Jumbo Drum	$114				$114
	Large Box	$2,259	$2,617	$2,460	$3,406	$2,686
	Medium Box	$1,248	$813	$1,023	$868	$988
	Small Box	$605	$784	$560	$627	$644
	Small Pack	$342	$339	$291	$237	$302
	Wrap Bag	$119	$126	$134	$163	$135
Grand Total		$1,023	$1,296	$1,165	$1,295	$1,190

This kind of total is sometimes referred to as a two-pass total, because the average you see in the grand total column is aggregated twice--once to derive the column or row value, and then again across column or rows to derive the grand total.

Configuring Grand Totals

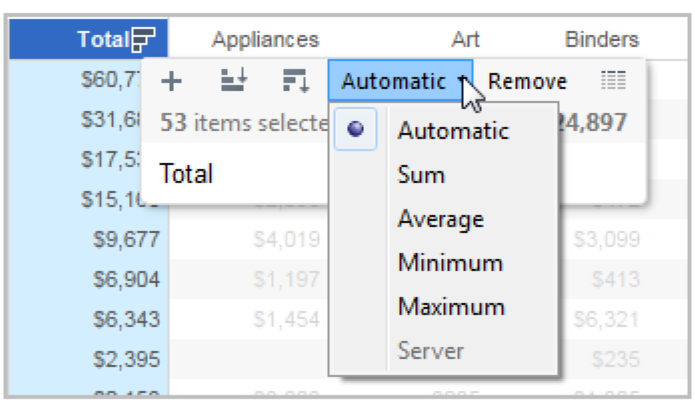
When grand totals are turned on in the view (either Row grand totals or Column grand totals), you can specify how totals should be computed.

To configure grand totals, from the **Analysis** menu choose **Totals** > **Total All Using** to display a submenu:



When you choose **Current Aggregation** from the submenu, totals are computed as they always were in earlier versions of Tableau: with column and row totals based on the configured aggregation for the field. In this case, computations are based on the underlying data, which is disaggregated, and not on the data in the view. See **Options for Calculating Grand Totals** on page 1151. And for details on how Tableau computes totals using the current aggregation, see **Grand Totals and Aggregations** on the next page.

You can quickly set the aggregation for a grand totals by clicking the column or row header and choosing an aggregation from the drop-down list on the tooltip:



When you choose any of the other values (**Sum**, **Average**, **Minimum**, or **Maximum**), all totals are computed using the selected aggregation. The computations are performed on the aggregated data you see in the view.

You can also configure an aggregation for a specific field in the view. To do this, right-click (Control-click on a mac) a field in the view and choose **Total Using**. With the first value, **Automatic**, Tableau uses the currently configured aggregation for the field. If you choose any of the other values (which are other types of aggregation), that aggregation is used for totals.

Grand Totals and Aggregations

When you turn on grand totals, the initial values are computing using the current aggregation for the fields in the view. In this case, totals are based on the underlying data rather than the data in the view.

For example, if you are totaling the **SUM(Profit)** for several products, the grand total will be the sum of the sums of profit. For aggregations such as SUM, you can easily verify the grand total because a summation of a group of sums is still a summation. However, be aware that your results may be unexpected when using other aggregations, especially custom aggregations. For details, See **Configuring Grand Totals** on page 1153. You can verify any calculation such as an aggregation or a grand total by viewing the underlying disaggregated data.

The following table summarizes the standard aggregations and the grand totals that are calculated by default when, from the Analysis menu, **Totals > Total All Using** is set to the default value **Automatic**.

Aggregation	Calculation Description
Sum	Shows the sum of the values shown in the row or column.
Average	Shows the average of the values shown in the row or column.
Median	Shows the median for

Aggregation	Calculation Description
	the values shown in the row or column.
Count; Count Distinct	Shows how many values or distinct values are displayed in the rows and columns in the view.
Minimum	Shows the minimum value shown in the row or column.
Maximum	Shows the maximum value shown in the row or column.
Percentile	Shows the average percentile for all values shown in the row or column.
Standard Deviation	The grand total using standard

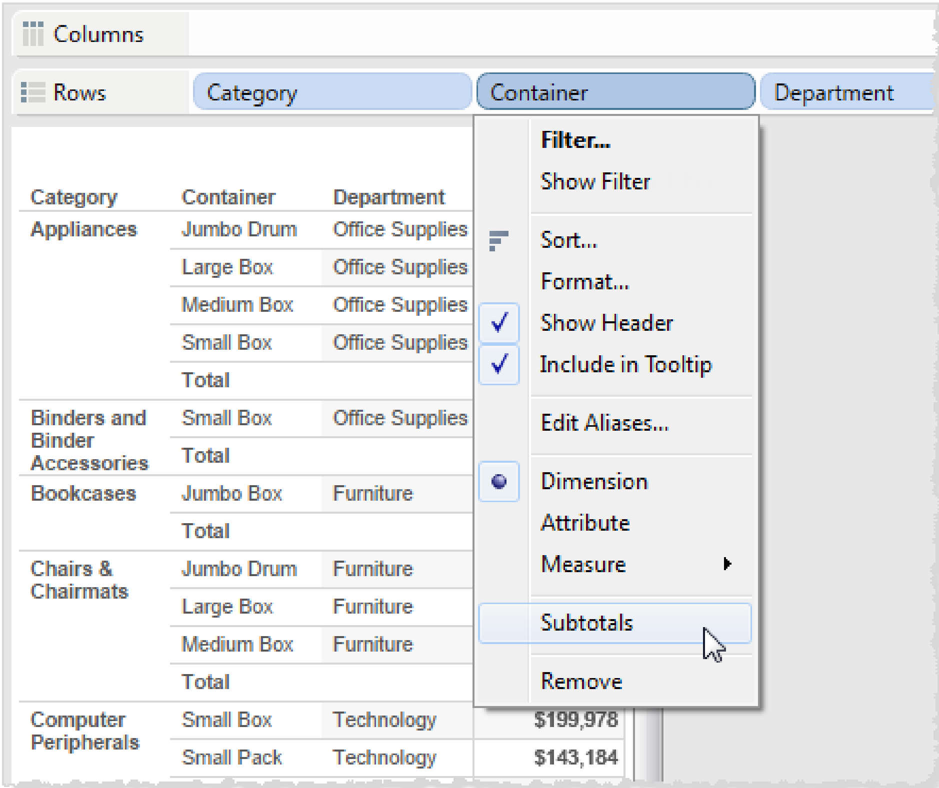
Aggregation	Calculation Description
	deviation is the standard deviation of the values shown in the row or column.
Variance	The grand total using variance is not the variance of the rows and columns in which they reside but rather of the underlying data behind the row or column.

Subtotals

Any data view in Tableau can include subtotals. For example, you may have a view containing the total sales for two product types broken down by specific products. In addition to seeing the sales for each product you may want to see the total sales for each product type.

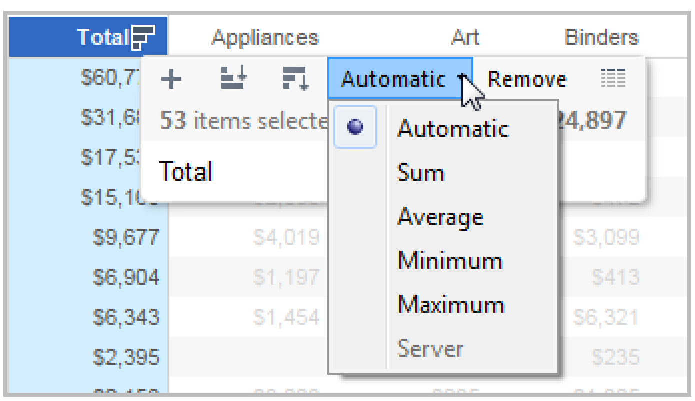
You can add subtotals for all fields or for selected fields. To add subtotals for all fields, choose **Totals > Add All Subtotals** from the **Analysis** menu. You then have the option of turning subtotals off for one or more individual fields. You do this by toggling subtotals off, as per the inststructions below for turning subtotals off for individual fields.

To calculate subtotals for an individual field, right-click (Control-click on a Mac) the field in the view and choose **Subtotals** from the context menu.

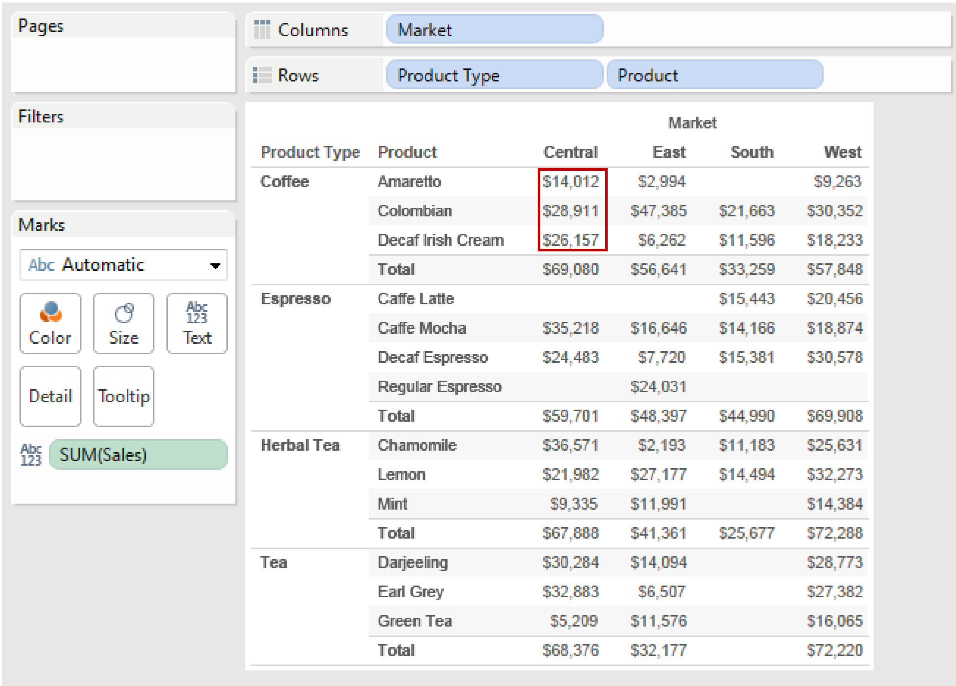


A check mark then appears next to Subtotals on the context menu.

You can quickly set the aggregation for subtotals by clicking the column or row header and choosing an aggregation from the drop-down list on the tooltip:

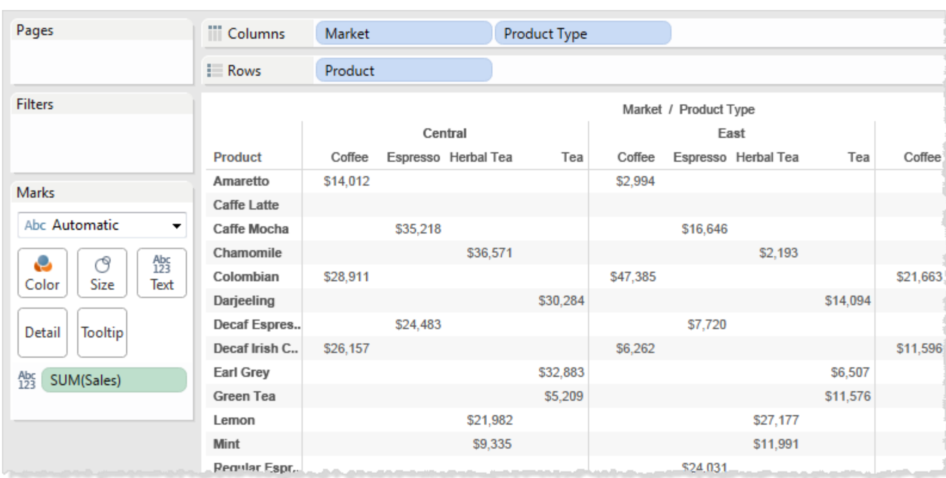


When you turn on subtotals for a specific field, the totals will change based on where that field is in the view. Consider the following example. The view below shows the sales for different product types sold across four different markets. Each product type is broken down by specific products. In addition, subtotals are turned on so that the view shows the total sales for each product type.



Product Type	Product	Central	East	South	West
Coffee	Amaretto	$14,012	$2,994		$9,263
	Colombian	$28,911	$47,385	$21,663	$30,352
	Decaf Irish Cream	$26,157	$6,262	$11,596	$18,233
	Total	$69,080	$56,641	$33,259	$57,848
Espresso	Caffe Latte			$15,443	$20,456
	Caffe Mocha	$35,218	$16,646	$14,166	$18,874
	Decaf Espresso	$24,483	$7,720	$15,381	$30,578
	Regular Espresso		$24,031		
	Total	$59,701	$48,397	$44,990	$69,908
Herbal Tea	Chamomile	$36,571	$2,193	$11,183	$25,631
	Lemon	$21,982	$27,177	$14,494	$32,273
	Mint	$9,335	$11,991		$14,384
	Total	$67,888	$41,361	$25,677	$72,288
Tea	Darjeeling	$30,284	$14,094		$28,773
	Earl Grey	$32,883	$6,507		$27,382
	Green Tea	$5,209	$11,576		$16,065
	Total	$68,376	$32,177		$72,220

Now let's move the Product Type field from the **Rows** shelf to the **Columns** shelf. The view still shows the sales for four different product types; but now, the product types are broken down by market. Because subtotals were turned on for the Product Type, the subtotals are the sum of the sales completed in each market.



	Central				East				
Product	Coffee	Espresso	Herbal Tea	Tea	Coffee	Espresso	Herbal Tea	Tea	Coffee
Amaretto	$14,012				$2,994				
Caffe Latte									
Caffe Mocha		$35,218				$16,646			
Chamomile			$36,571				$2,193		
Colombian	$28,911				$47,385				$21,663
Darjeeling				$30,284				$14,094	
Decaf Espres..		$24,483				$7,720			
Decaf Irish C..	$26,157				$6,262				$11,596
Earl Grey				$32,883				$6,507	
Green Tea				$5,209				$11,576	
Lemon			$21,982				$27,177		
Mint			$9,335				$11,991		
Regular Espr..						$24,031			

By default subtotals are computed on the server if you are connected to an SSAS data source and locally if you are connected to an Essbase data source using the aggregation specified in the cube. That means if you are analyzing the average sales for each product, calculating the subtotals for each product type would result in the average sales of all products within that product type. This is not the case if you perform the computation locally instead of remotely.

Move Totals

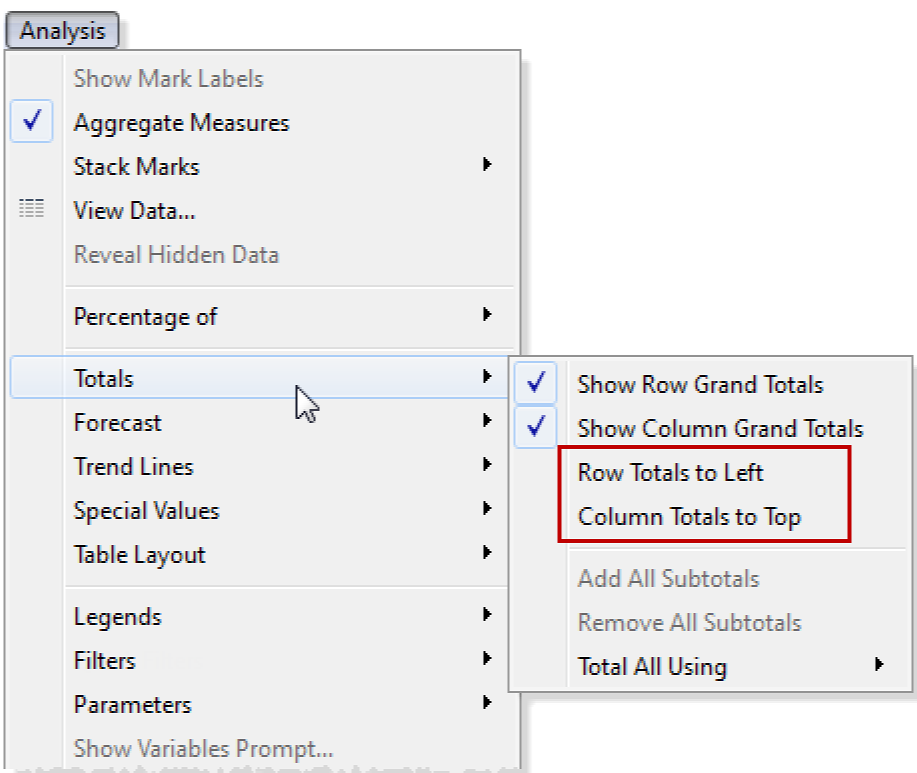
By default, row grand totals and subtotals appear on the right of the view, and column grand totals and subtotals appear at the bottom of the view. You can also select to display totals on the left or top of the view.

To move row totals to the left of the view:

- Select **Analysis** > **Totals**, and then select **Row Totals to Left**.

To move column totals to the top of the view:

- Select **Analysis** > **Totals**, and then select **Column Totals to Top**.



Parameters

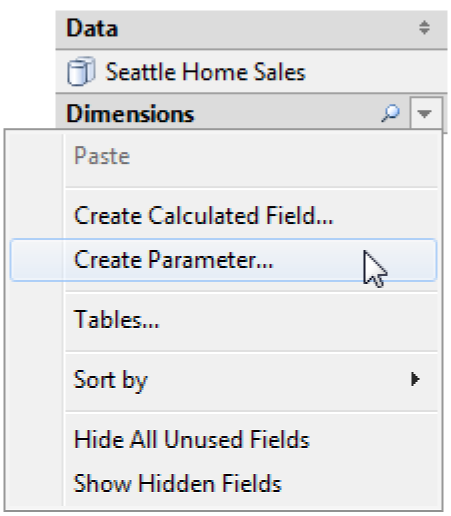
Parameters are dynamic values that can replace constant values in calculations, filters, and reference lines. For example, you may create a calculated field that returns true if Sales is greater than $500,000 and otherwise return false. You can replace the constant value of “500000” in the formula with a parameter. Then using the parameter control you can dynamically change the threshold in your calculation. Alternatively, you may have a filter to show the top 10 products by profit. You can replace the fixed value “10” in the filter to by a dynamic parameter so you can quickly look at the top 15, 20, and 30 products.

Creating Parameters

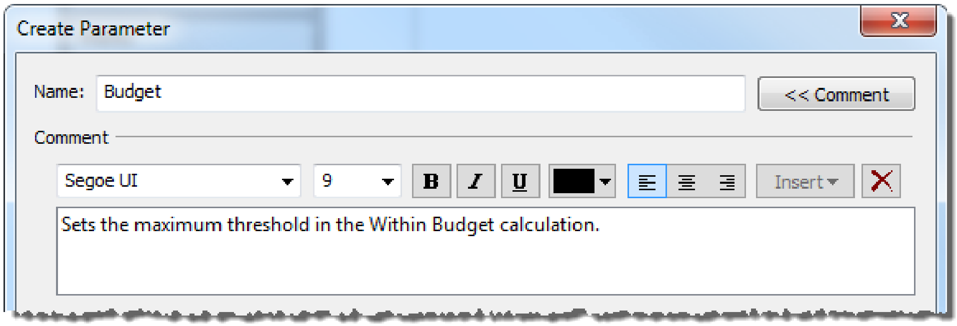
You can create a new parameter based on a selected field in the Data pane, or you can create a new parameter from any location where you can use a parameter (for example, as you add a reference line or create a filter). Follow the instructions below to create a new parameter from the Data pane.

1. In the **Data** pane, right-click (Control-click on a Mac) a field to base the parameter on and select **Create** > **Parameter**.

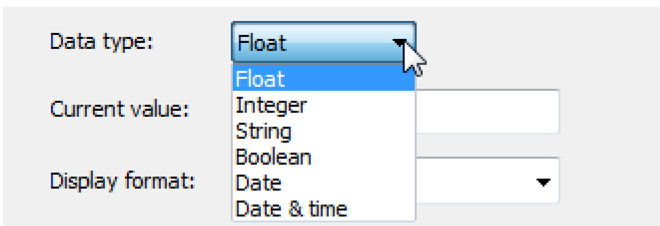
   Alternatively, you can use the drop-down arrow in the upper right corner and select **Create Parameter**.

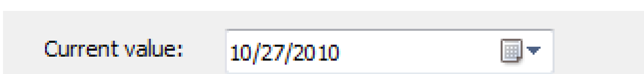
2. In the Create Parameter dialog box, give the field a **Name** and optionally write a **Comment** to describe the parameter.



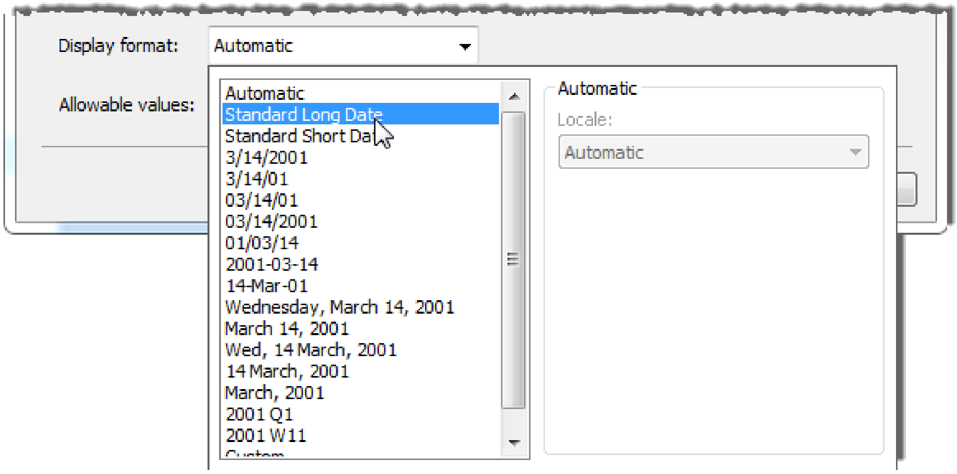
Specify the data type for the values it will accept:

3. 

Specify a current value. This is the default value for the parameter.

4. 

5. Specify the display format to use in the parameter control.

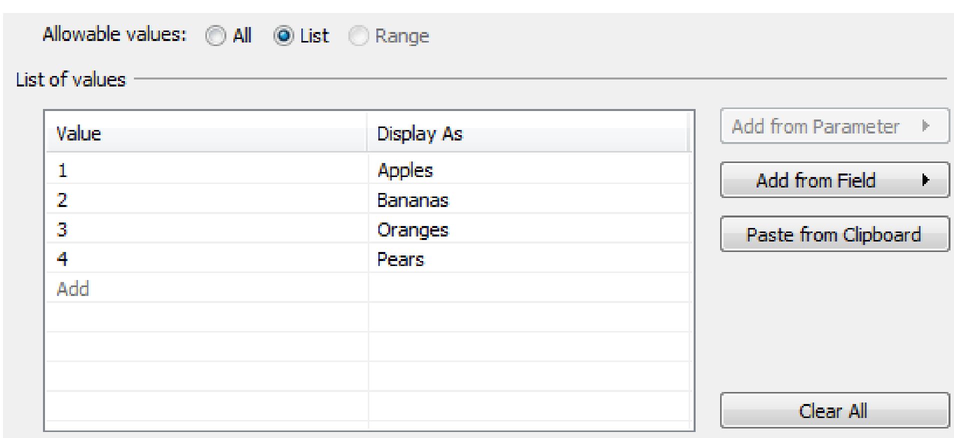


Specify how the parameter will accept values. You can select from the following options:

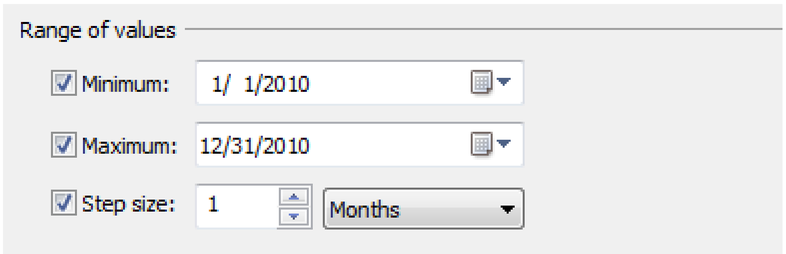
- **All** - the parameter control is a simple type in field.
- **List** - the parameter control provides a list of possible values for you to select from.
- **Range** - the parameter control lets you select values within a specified range.

The availability of these options is determined by the data type. For example, a string parameter can only accept all values or a list. It does not support a range.

If you select List, you must specify the list of values. Click in the left column to type a value. Each value can also have a display alias. You can copy and paste a list of values by clicking **Paste from Clipboard**. Alternatively you can add the members of a field as the list of values by selecting **Add from Field**.

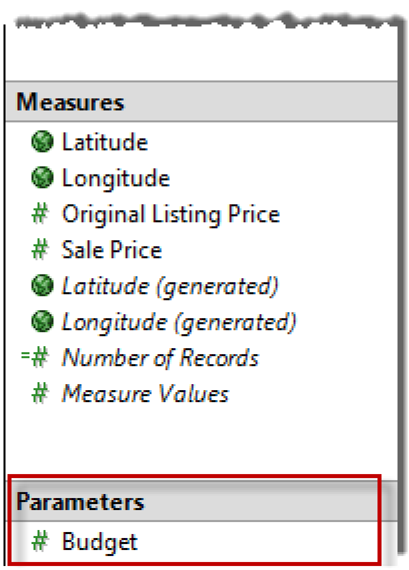
6. 

If you select **Range** you must specify a minimum, maximum and step size. For example, you can define a date range between January 1, 2010 and December 31, 2010, with the step size set to 1 month to create a parameter control that lets you select each month in 2010.



When finished, click **OK**.

The parameter is listed in the Parameters section at the bottom of the **Data** pane.

7. 

It is also available everywhere else you can use a parameter—for example, on the Top tab in the Filter dialog box, or in the Reference Line dialog box. Parameters are global across the workbook and can be used in any worksheet.

Editing Parameters

You can edit parameters from the Data pane or the parameter control. Follow the instructions below to edit a parameter:

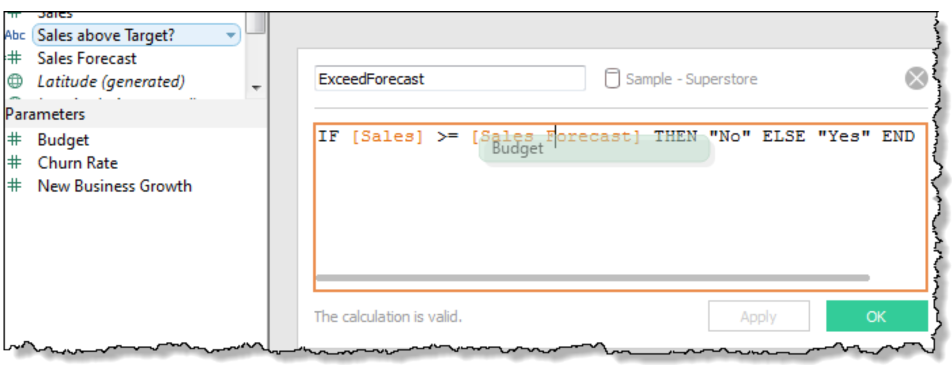
1. Do one of the following:
   - Right-click (Control-click on a Mac) the parameter in the **Data** pane and select **Edit**.
   - Select **Edit Parameter** on the parameter control card menu.
2. In the Edit Parameter dialog box, make the modifications as necessary.
3. When finished, click **OK**. The parameter is updated along with any calculations that use it.

To delete a parameter, right-click it in the Data pane and select **Delete**. Any calculated fields that use the deleted parameter will become invalid.

Using Parameters in Calculations

Parameters give you a way to dynamically modify values in a calculation. Rather than manually editing the calculation (and all dependent calculations), you can use a parameter. Then when you want to change the value, you open the parameter control, change the value, and all of the calculations that use that parameter are updated.

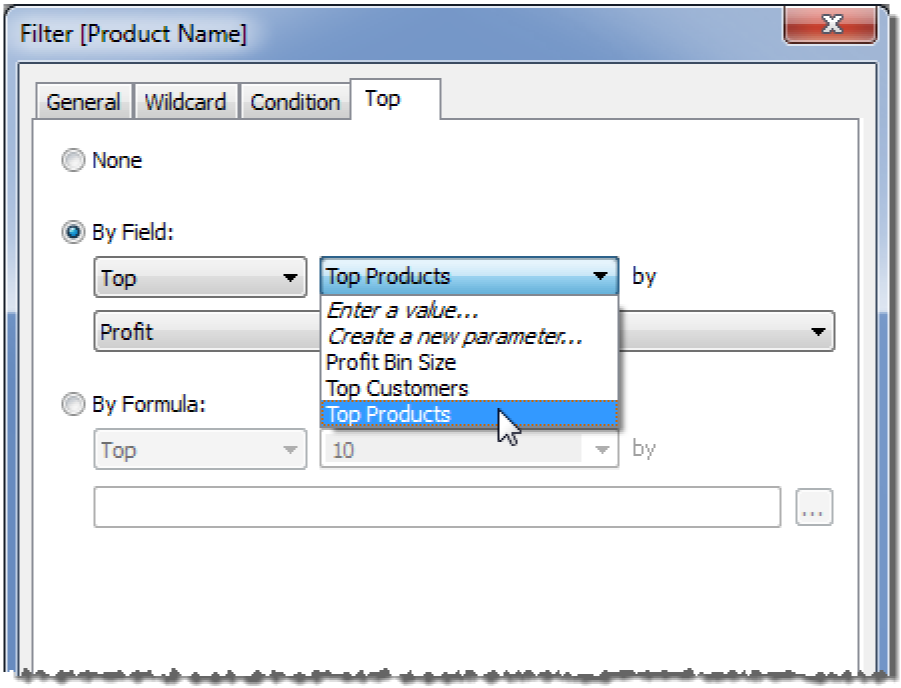
To use a parameter in a calculation, drag the parameter from the Data pane and drop it in the calculation editor, either at a new location in the formula or to replace a part of the current formula:



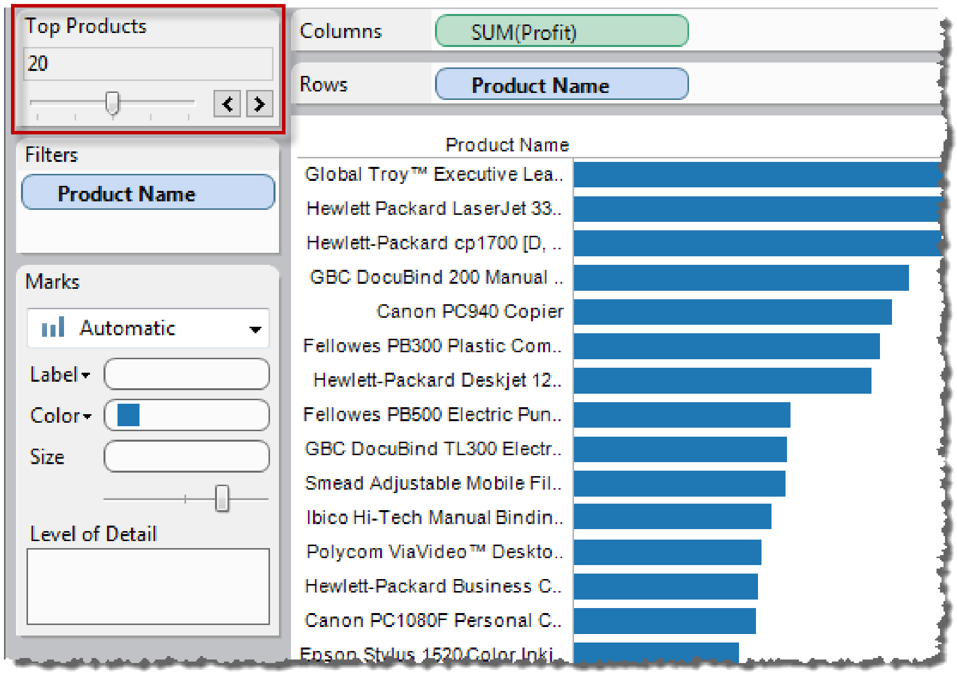
Using Parameters in Filters

Parameters give you a way to dynamically modify values in a TopN filters. Rather than manually setting the number of values you want to show in the filter, you can use a parameter. Then when you want to change the value, you open the parameter control and the filter updates. For example, when creating a filter to show the Top 10 products based on total profit, you may want to use a parameter instead of the fixed “10” value. That way, you can the quickly update the filter to show the top 10, 20, or 30 products.

A list of parameters is available in the drop-down lists on the Top tab of the Filter dialog box. Select the parameter you want to use in the filter.



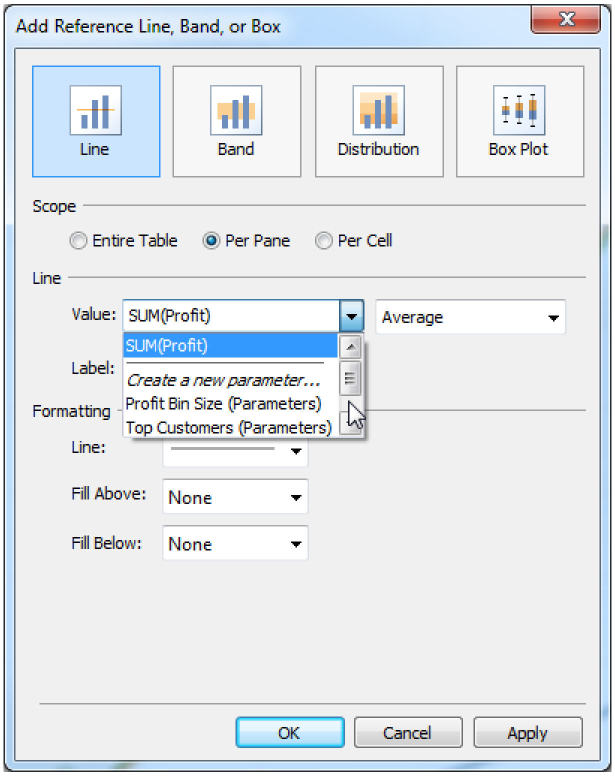
To show the parameter control, right-click the parameter in the **Data** pane and select **Show Parameter Control**. Use the parameter control to modify the filter to show the top 10 products, 15 products, 20 products, and so on.



Using Parameters in Reference Lines

Parameters give you a way to dynamically modify a reference line, band, or box. For example instead of showing a reference line at a fixed location on the axis, you can reference a parameter. Then you can use the parameter control to move the reference line.

A list of parameters is available in the Value drop-down list in the Add Reference Line, Band, or Box dialog box. Select the parameter you want to use.

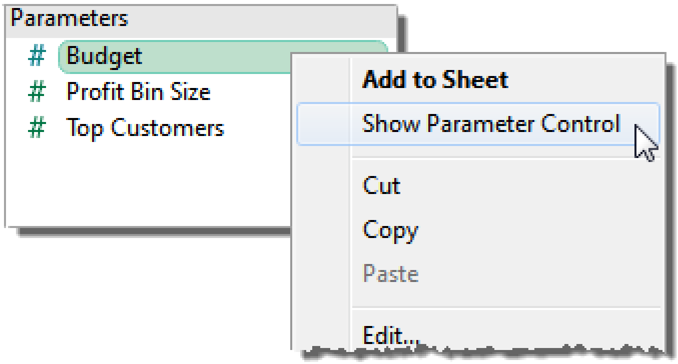


The reference line is drawn at the Current Value specified by the parameter. To open the parameter control, right-click (Control-click on a Mac) the parameter in the **Data** pane and then select **Show Parameter Control**. Use the parameter control to change where the reference line is drawn.

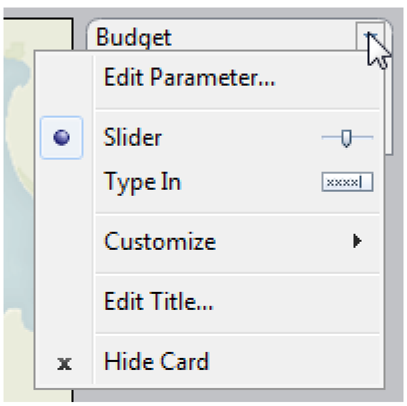
Parameter Controls

The parameter control is a worksheet card that lets you modify the parameter value. Parameter controls are very similar to filter cards in that they contain controls that modify the view. You can open parameter controls on worksheets and dashboards and they are included when you save to the web or publish to Tableau Server.

To open the parameter control, right-click (Control-click) the parameter in the **Data** pane and select **Show Parameter Control**.



Like other cards, parameter controls have a menu that you can open using the drop-down arrow in the upper right corner of the card. Use this menu to customize the display of the control. For example, you can show a list of values as radio buttons, a compact list, a slider, or a type in field. The options available on this menu depend on the data type of the parameter as well as whether it accepts all, a list, or a range of values



Example – Add a Parameter to a Map View

This example uses the World Indicators sample data source to demonstrate the following:

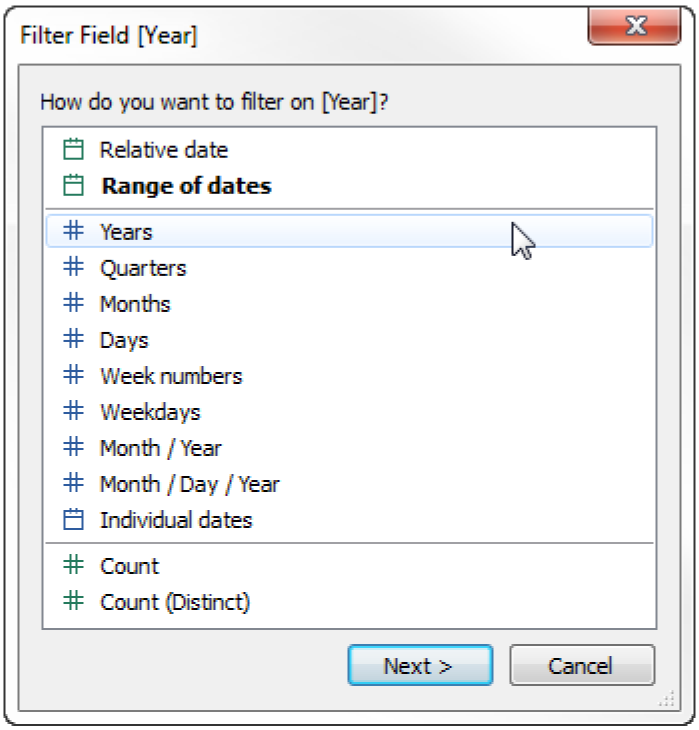
- How to build a map view that shows the birth rate for each country in the world.
- How to create a calculated field that distinguishes countries with a low birth rate from those with a high birth rate.
- How to create and display a parameter so that users can set the threshold for low vs. high birth rate.

Build a map view

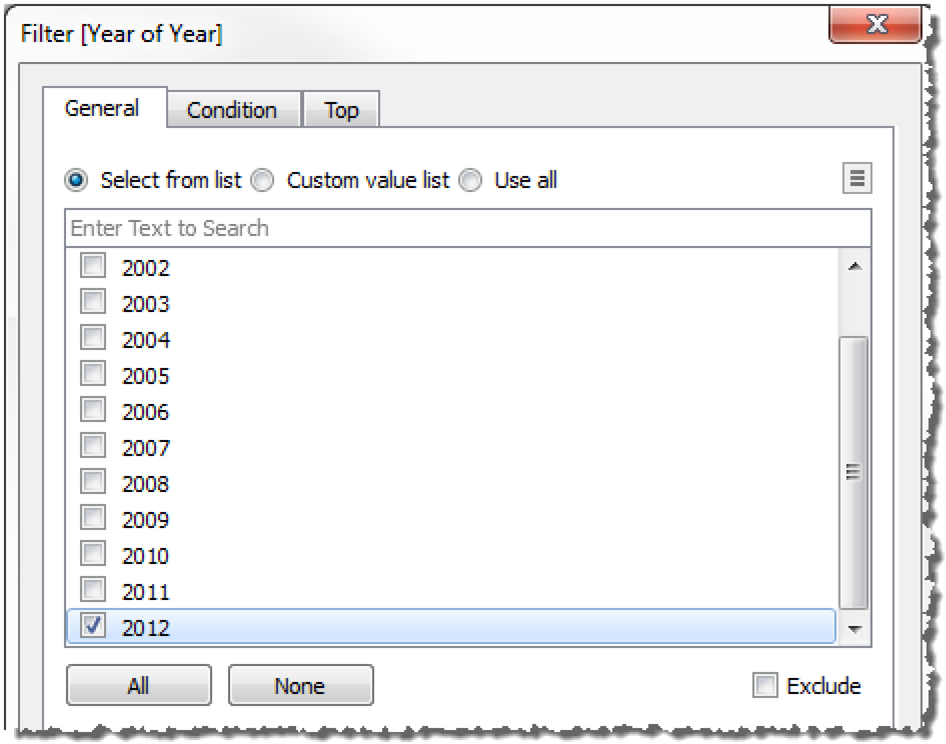
1. Double-click **Latitude** and then **Longitude** in the **Data** pane.

   Tableau puts **Longitude** on **Columns**, **Latitude** on **Rows**, and displays a map of the world.

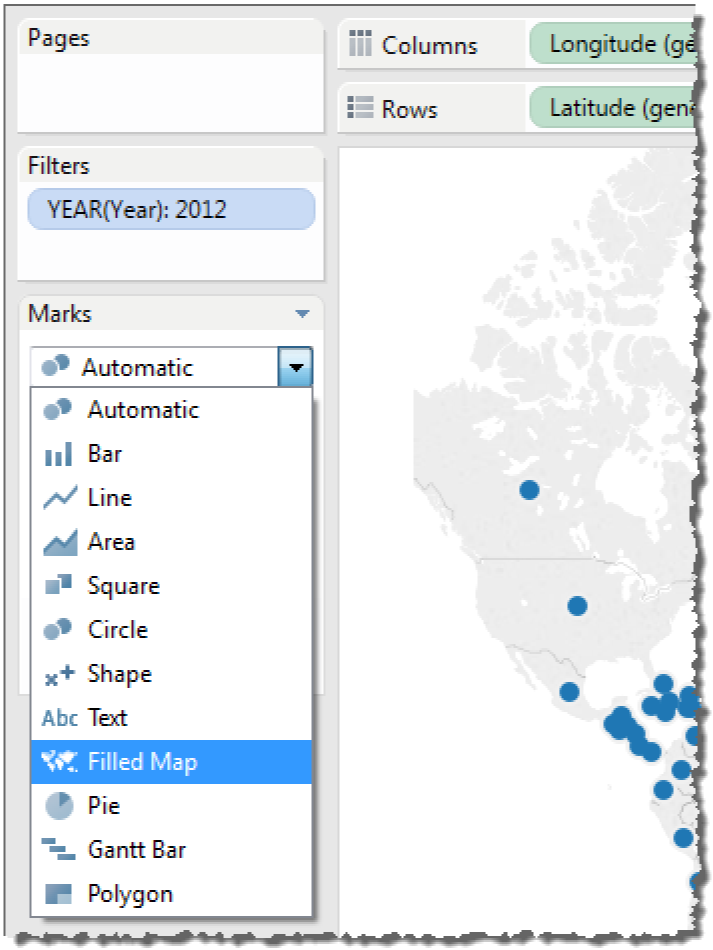
2. Drag the **Year** dimension to **Filters**.
3. In the Filter Field [Year] dialog box, choose **Years** and then click **Next**:



4. In the Filter [Year of Year] dialog box, select **2012** and then click **OK**:

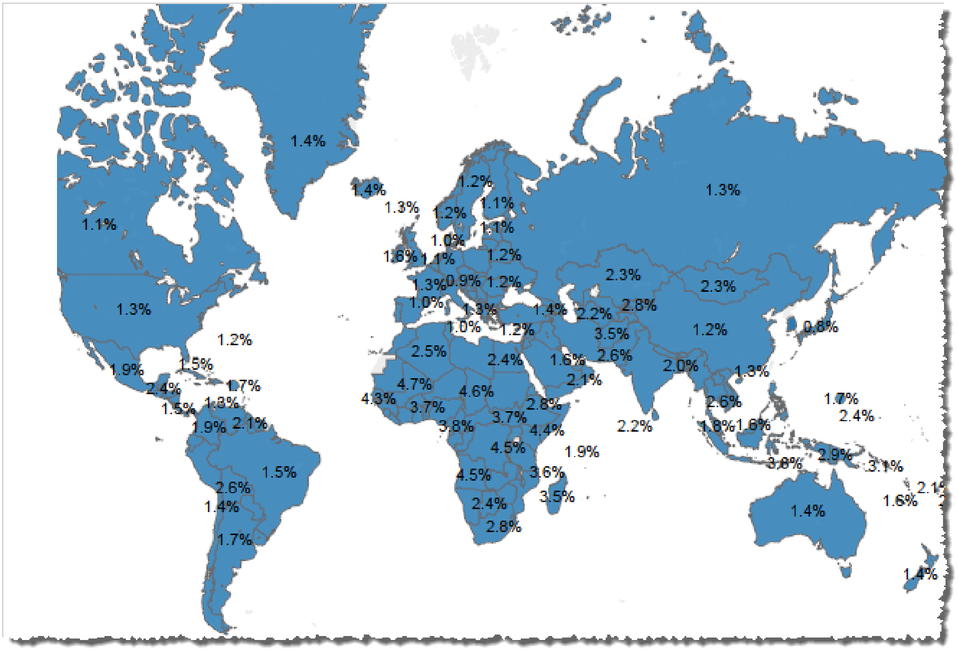


5. Drag the **Country** dimension to **Detail**.
6. Set the Marks type to Filled Map:



7. Drag the **Birth Rate** measure to **Label**.

You now have a map that shows birth rates for countries around the world:



You can zoom the map or hover to see a tooltip for any country.

Create a calculated field to set a threshold

Next, you'll distinguish a low birth rate from a high birth rate.

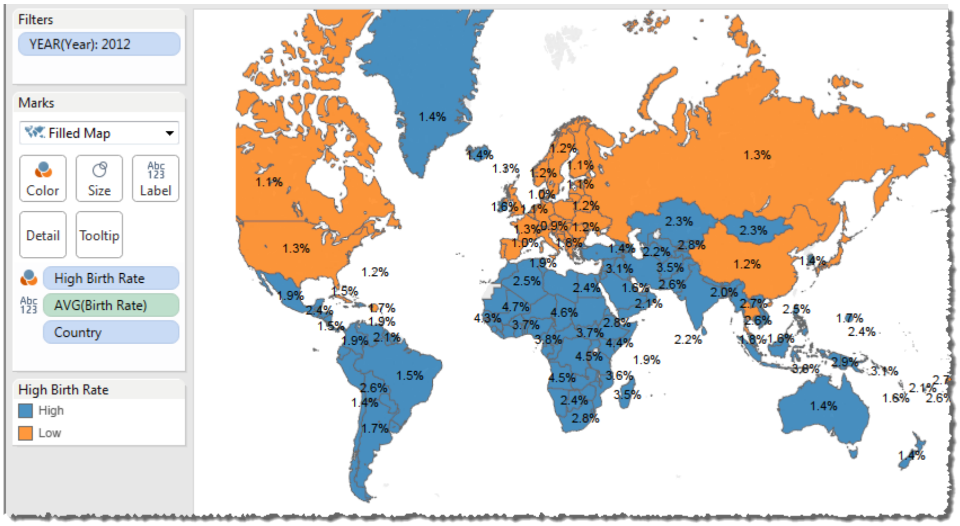
1. Select **Create Calculated Field** from the **Analysis** menu.
2. Name the field `High Birth Rate` and type or paste this calculation in the formula field:

   ```
   IF ([Birth Rate]) >= 0.014 THEN "High" ELSE "Low" END
   ```

   The value 0.014 is equivalent to 1.4%. The range of actual values that we can see on the map range from below 1% up to nearly 5%.

   When you click **OK** to apply and save this calculation, Tableau categorizes it as a dimension.
3. Drag **High Birth Rate** to **Color**.

   The map now shows low birth rate countries in one color and high birth rate countries in another:

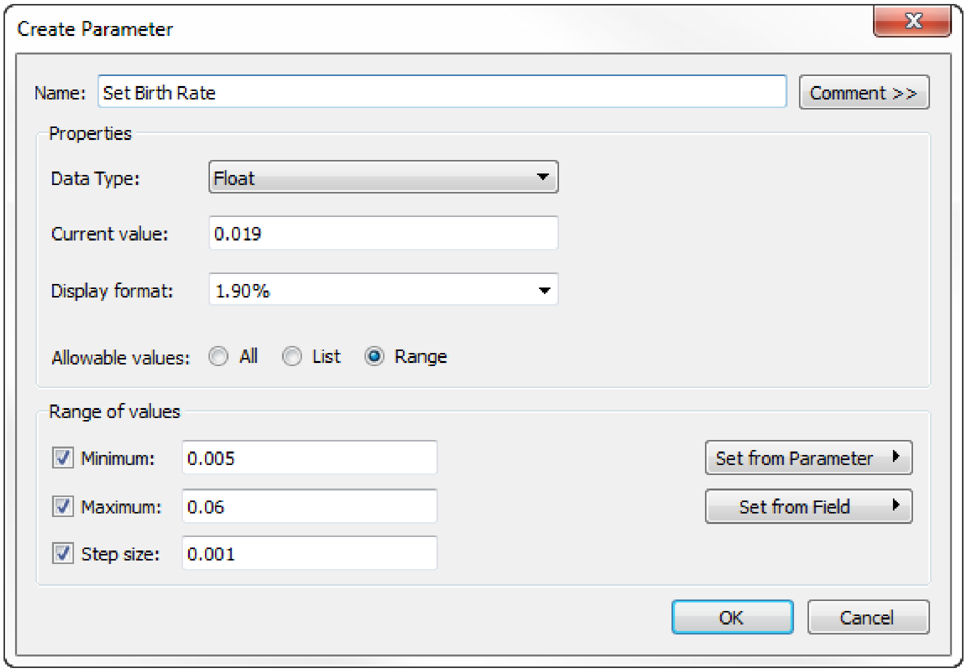


But the definition of high birth rate as anything equal to or greater than 1.4% is arbitrary—that value was chosen because it divided the world's countries about evenly.

Instead, you can let users define that threshold, or to give them a control that they can use to see how changing the threshold changes the map. To do this, you create a parameter.

Create a parameter

1. Right-click (control-click on a Mac) in the **Data** pane and choose **Create Parameter**
2. In the Create Parameter dialog box, name the new parameter `Set Birth Rate` and configure it as shown:



For information on the fields in the Create Parameter dialog box, see **Creating Parameters** on page 1161.

Because the **Data Type** is **Float**, the parameter control, when you display it in the next procedure, will be in the form of a slider. This is because floating point values are continuous—there are an infinite number of possible values.

The **Current value** sets the default for the parameter: 0.019 is 1.9%. The **Range of values** section sets the minimum and the maximum values and the step size—that is, the least amount by which the value can change.

3. Click **OK** when you're done to exit the Create Parameter dialog box.

Create and display the parameter control

Now you must connect the parameter to the **High Birth Rate** field.

1. Right-click **High Birth Rate** in the **Data** pane and choose **Edit**.
2. Replace the hard-coded 0.014 value in the field definition with the parameter name:

```
IF ([Birth Rate]) >= [Set Birth Rate] THEN "High" ELSE "Low"
END
```

3. Right-click the **Set Birth Rate** parameter in the **Data** pane and choose **Show Parameter Control**.

By default, the parameter control is shown on the right. Now you and users of your view can raise or lower this value incrementally to see how changing the definition of "high birth rate" affects the map.

Background Images

Background images are images that you display underneath your data in order to add more context to the marks in the view. A common use of background images is adding custom map images that correspond to a coordinate system in your data. For example, you may have data that corresponds to several floors in a building. You can use background images to overlay that data on the actual floor plan of the building to give more context. Other examples of using background images include showing a model of the sea floor, images of web pages for analyzing web logs, and even levels from video games to visualize player statistics.

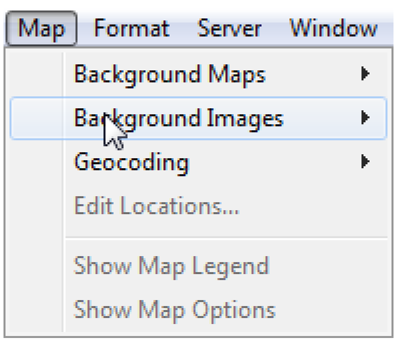
While Tableau allows you to load dynamic maps from the online and offline provider, background images allow you to use your own custom images whether they are special maps or any other image that corresponds to your data.

Adding Background Images

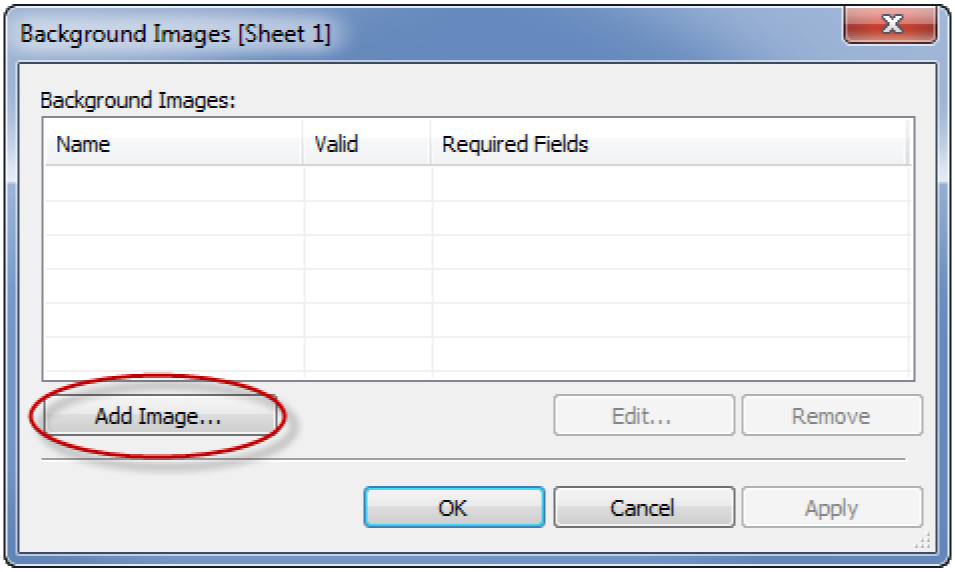
When you add a background image to the view, you need to specify a coordinate system by mapping both the x and y axes to the values of fields in your database. If you are adding a map, the x and y axes should be longitude and latitude expressed as a decimal. However, you can map the axes to any relevant fields based on your own coordinate system.

To add a background image:

1. Select **Map** > **Background Images** and then select a data source.

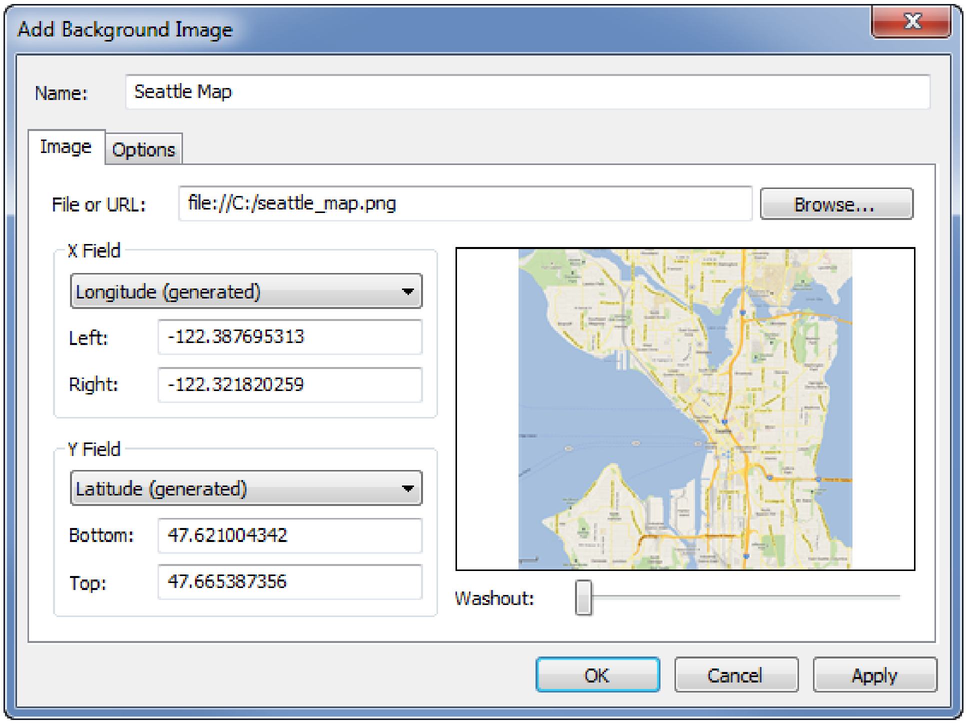


In the Background Images dialog box, click **Add Image**.

2. 

3. In the Add Background Image dialog box do the following:
   - Type a name for the image into the **Name** text box.
   - Click **Browse** to navigate to and select the image you want to add to the background. You can also type a URL to link to an image hosted online.
   - Select the field to map to the x-axis of the image and specify the left and right values. When adding a map, the longitude values should be mapped to the x-axis using decimal values (instead of degrees/minutes/seconds or N/S/E/W).
   - Select the field to map to the y-axis of the image and specify the top and bottom values. When adding a map, the latitude values should be mapped to the y-axis using decimal values (instead of degrees/minutes/seconds or N/S/E/W).

You can adjust the intensity of the image using the Washout slider. The farther the slider moves to the right, the more faded the image will appear behind your data.

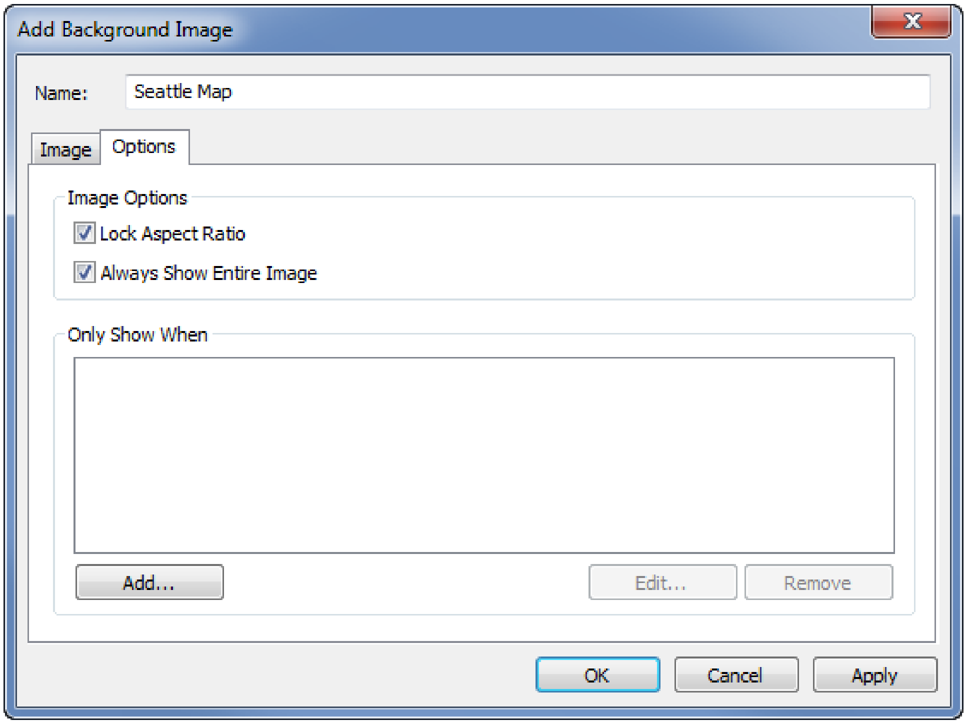
- 

4. You can specify the following options using the **Options** tab:

   - **Lock Aspect Ratio** - select this option to maintain the original dimensions of the image for any manipulations of the axes. Deselecting this option allows the image's shape to be distorted.

   - **Always Show Entire Image** - select this option to avoid cropping the image when the data encompasses only a portion of the image. If you lock both the axis in a view, this option may be negated.

Add conditions for when to show the image. Refer to **Adding Conditions to Filters** on page 617 to learn more about defining conditions.

- 

5. Click **OK**.

When you add the x and y fields to the Rows and Columns shelf in the view, the background image displays behind the data. If the background image does not display, make sure that you are using the disaggregated measures for the x and y fields. To disaggregate all measures, select **Analysis > Aggregate Measures**. To change each measure individually, right-click the field on the shelf and select **Dimension**. Finally, if you've used the generated Latitude and Longitude fields for the x and y fields, you'll need to disable the built in maps before your background image will display. Select **Map > Background Maps > None** to disable the built-in maps.

In order to make the marks in a view more visible when placed on top of a background image, each mark is surrounded by a solid contrasting color called a halo. You can turn mark halos off by selecting **Format** > **Show Mark Halos**.

Setting up the View

After you add a background image, you need to build the view in a way that matches the x and y mappings you specified for the image. That is, the fields you specified as x and y must be on the proper shelves. Follow the steps below to set up the view correctly:

1. Place the field mapped to the x-axis on the **Columns** shelf.

   If you are working with maps, the longitude field should be on the columns shelf. It may seem backward at first, however, the fields on the columns shelf determine the values distributed across the x-axis.

2. Place the field mapped to the y-axis on the **Rows** shelf.

   If you are working with maps, the latitude field should be on the rows shelf. It may seem backward at first, however, the fields on the rows shelf determine the values distributed across the y-axis.

Managing Background Images

You can add several background images to the workbook and then select the image or images to make active on each sheet. The Background Images dialog box lists all of the images, the required fields, and whether they are visible. The visibility is determined based on whether the required fields are used in the current view.

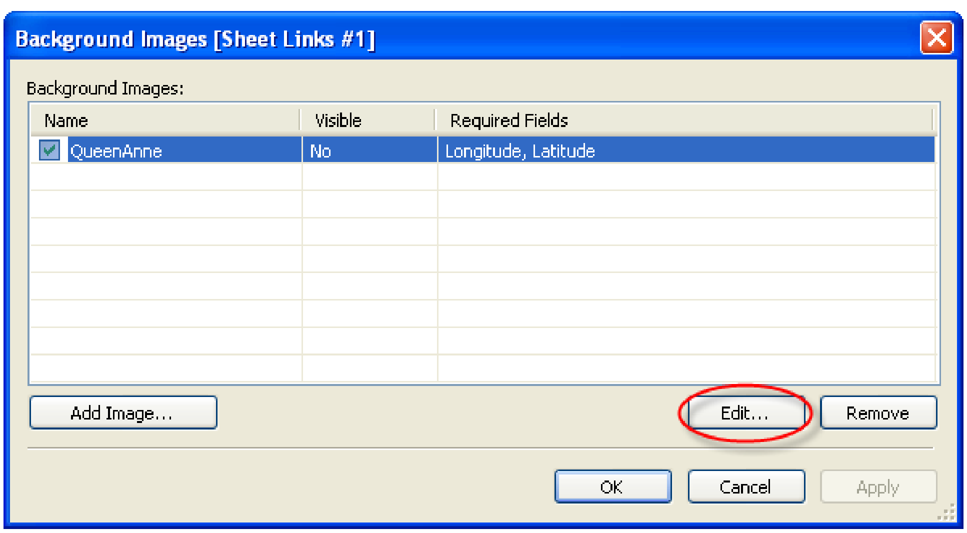
Editing an Image

After adding a background image, you can always go back and edit the x and y field mappings as well as any of the options on the Options tab.

To edit an image:

1. Select **Map** > **Background Images**.

   In the Background Images dialog box, select the image you want to edit and click **Edit** (you can also just double-click the image name).

2. 

3. In the Edit Background Image dialog box, make the changes to the image and click **OK**.

Enabling/Disabling Images

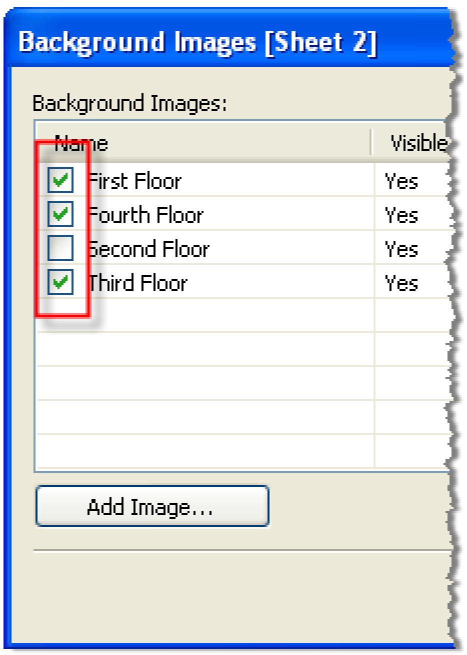
Although you can add multiple images to a workbook, you may want to only use a subset of the images for a particular set of worksheets. For example, you may want to show a map of the entire United States of America on one view, and maps of individual states in other views.

Use the check boxes in the Background Images dialog box to enable and disable the images for the current worksheet. You can show several images by enabling multiple images on a single worksheet. For example, you may have several images that you want to tile in the background to make a larger background image.

To enable or disable a background image:

1. Select **Map** > **Background Images**.

   In the Background Images dialog box, select the check boxes next to the images you want enabled.

2. 

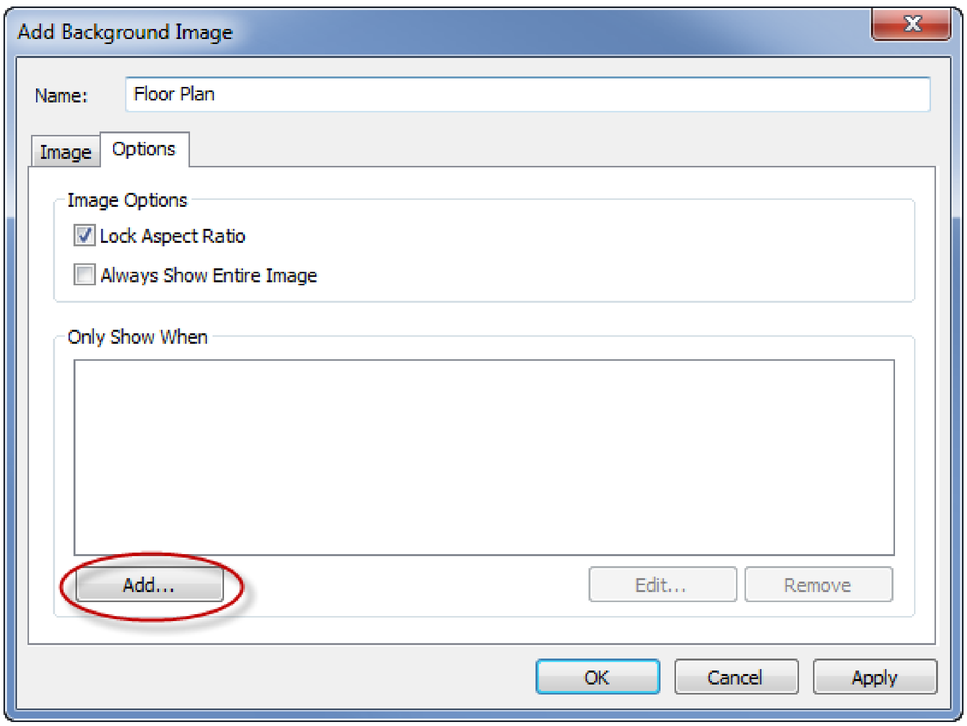
3. Click **OK**.

Adding Show/Hide Conditions

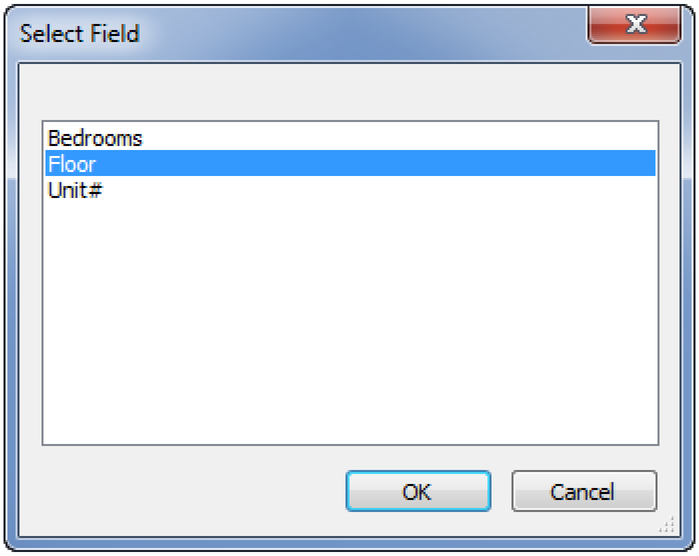
When you add a background image and enable it, the image will be shown automatically on any worksheet that has the required fields used in the view. To avoid showing an image on all the worksheets, you can specify show/hide conditions. Show/Hide conditions are conditional statements that you define to specify when to show the image. For example, you may have a floor plan image for a multi-story building. While each image is associated with the same coordinates (the corners of the building), you do not want to show the first floor map when looking at the third floor information. In this case, you can specify a condition to only show the first floor image when the Floor field is equal to one.

To specify show/hide conditions:

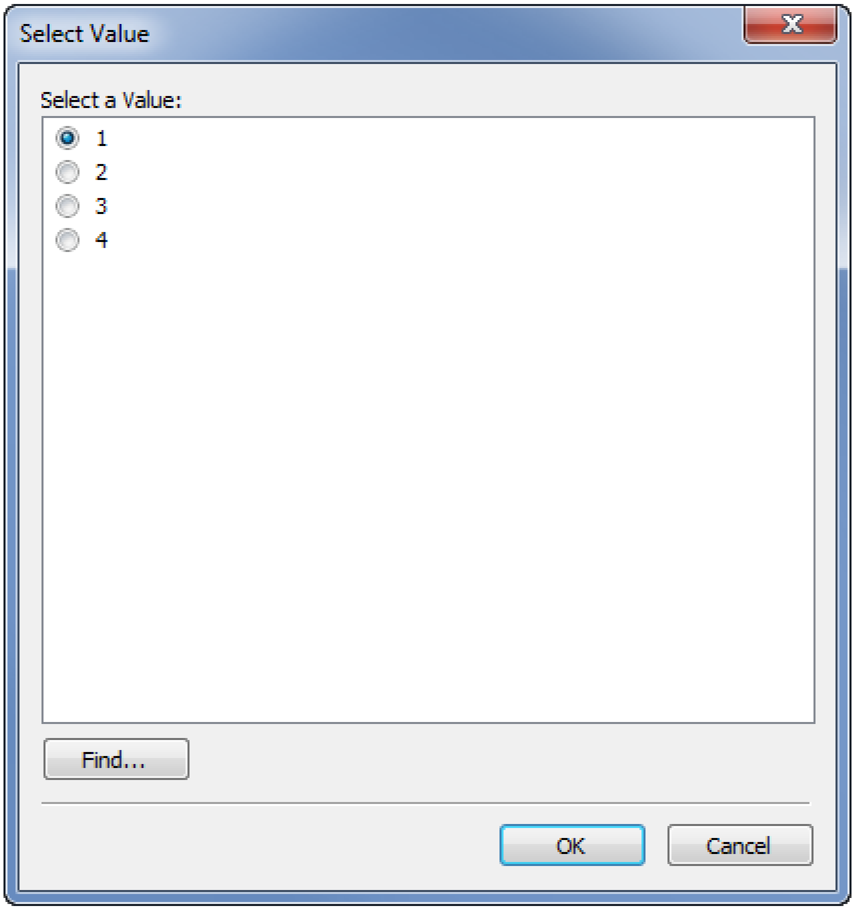
1. Select **Map > Background Images** and then select a data source.
2. In the Background Images dialog box, select the image you want to add a condition to and click **Edit**.
3. In the subsequent dialog box, select the **Options** tab.

   Click the **Add** button at the bottom of the dialog box.
4. 

Select a field to base the condition on. In the example described above, the field is Floor.

5. 

Specify when you want to show the image by selecting a value of the field. For this example, one is selected.

6. 

7. Click **OK**.

   A condition statement is added to the image. In the building floor plan example, the condition statement is Only show the image when Floor is equal to One.

8. Click **OK** twice to close the Background Image dialog boxes and apply the changes.

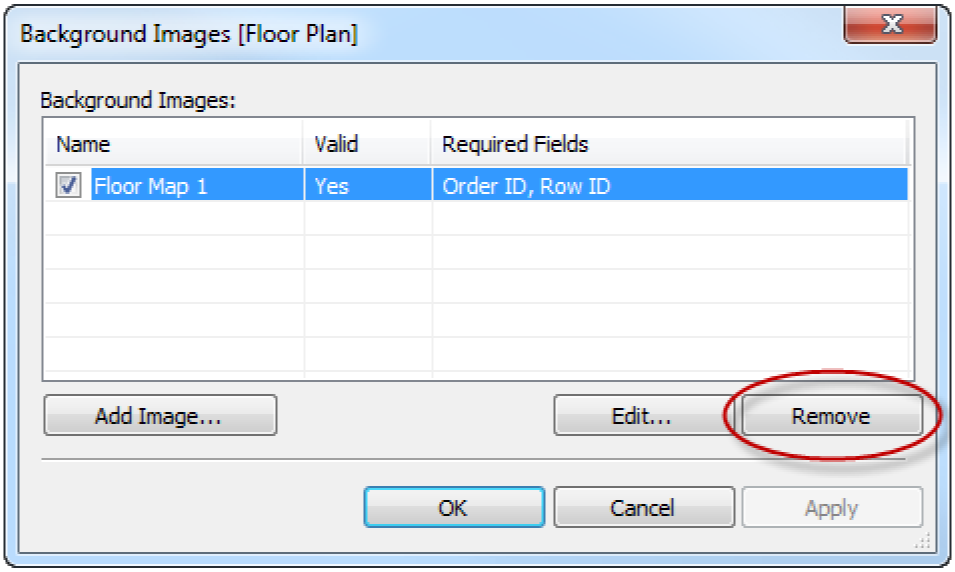
When you add multiple conditions, the background image will only show when all conditions are met. For example, if a background image has two conditions on Property Name and Floor, it will only show when Property is Greenwood Estates and Floor is 3.

Removing an Image

When you no longer want to use a background image you can either disable it or remove it, making it unavailable to all worksheets.

To remove an image:

1. Select **Map** > **Background Images**.
2. In the Background Images dialog box, select the image you want to remove and click **Remove**.



3. Click **OK**.

Trend Lines

Use the Tableau trend line feature to incrementally construct interactive models of behavior. With trend lines you can answer such questions as whether profit is predicted by sales, or whether average delays at an airport are significantly correlated with the month of the year.

Adding Trend Lines

When you add trend lines to the view, you can specify how you want them to look and behave.

Add Trend Lines to the View

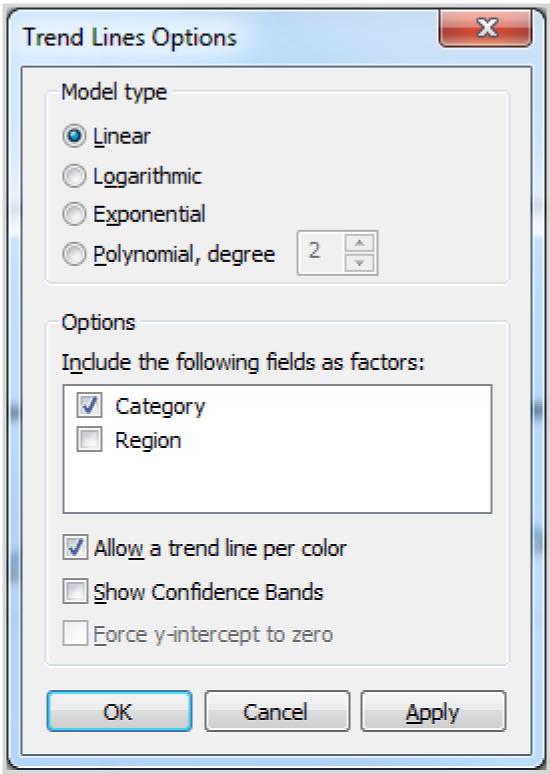
1. Select **Analysis > Trend Lines > Show Trend Lines**, or right-click (Control-click on a Mac) on the pane and choose **Trend Lines > Show Trend Lines**.

   This command adds a linear trend line for each page, pane, and color on the worksheet. You can continue with the steps below to configure trend lines.

   You can also drag a trend line in from the Analytics pane. See **Analytics Pane** on page 272.
2. Select **Analysis > Trend Lines > Edit Trend Lines**, or right-click on the pane and choose **Trend Lines > Edit Trend Lines** to open the Trend Lines Options dialog box.

a. Select either a Linear, Logarithmic, Exponential, or Polynomial model type.

b. For trend models that are considering multiple fields, you can eliminate specific fields you want to exclude as factors in the trend line model. For example, on a view of sales across categories and regions, you may want to see the overall sales trend across all categories, rather than a different line for each region. In this case, you would exclude **Region** as a factor:



For more information on excluding factors, see **Removing Factors from the Model** on page 1189.

c. Decide whether to exclude color, using the **Allow a trend line per color** option. When you have color encodings in your view, you can use this option to add a single trend line that models all of the data, ignoring the color encoding.

d. Decide whether to **Show Confidence Bands**. Tableau confidence bands show upper and lower 95% confidence lines by default when you add trend lines. Confidence lines are not supported for Exponential models.

e. Select whether to **Force the y-intercept to zero**. This option is useful when you know that you want your trend line to begin at zero. This option is available only when both the **Rows** shelf and the **Columns** shelf contain a continuous field, as with a scatterplot.

3. When finished, click **OK**.

When Can't You Add Trend Lines?

To add trend lines to a view, both axes must contain a field that can be interpreted as a number. For example, you cannot add a trend line to a view that has the Product **Category** dimension, which contains strings, on the **Columns** shelf and the **Profit** measure on the **Rows** shelf. However, you can add a trend line to a view of sales over time because both sales and time can be interpreted as numeric values.

For multidimensional data sources, the date hierarchies actually contain strings rather than numbers. Therefore, trend lines are not allowed. Additionally, the ‘m/d/yy’ and ‘mmmm yyyy’ date formats on all data sources do not allow trend lines.

If you have trend lines turned on and you modify the view in a way where trend lines are not allowed, the trend lines do not show. When you change the view back to a state that allows trend lines, they reappear.

> Tableau automatically stacks bar marks in many cases. However, trend lines cannot be turned on for stacked bars. You can turn off stacked marks by clearing the **Analysis** > **Stack Marks** option.

Removing Trend Lines

The easiest way to remove a trend line from a view is just to drag it off. You can also click a trend line and select **Remove**.

To remove all trend lines from the view, choose **Analysis > Trend Lines > Show Trend Lines** to remove the check mark, or right-click (Control-click on a Mac) the pane and choose **Trend Lines > Show Trend Lines** to remove the check mark.

Trend line options are retained for the next time you turn on trend lines. However, if you close the workbook with trend lines turned off, trend line options revert to defaults.

Trend Line Model Types

When you add a trend line to a view, you are building a statistical model. You are answering a question: Do the factors in your view predict a specific value (measure)? More precisely, do the categorical factors in your view split your data into meaningful samples and does the data in those samples allow you to predict values of the response measure given values of the explanatory measure or date? For example, you might be asking whether profit is predicted by time in a view that shows the profit of a company over four years.

Each trend line in the view visually represents a linear regression statistical model. Each model is estimated using data in the same pane and of the same color as the corresponding trend line. Although trend lines may be of type linear, logarithmic, exponential, or polynomial, this does *not* indicate that any of these models is not a linear regression. These types just identify transformations of either the explanatory or response variable in the linear regression formula. The word linear means that the formula is always of the form

```
y = b0 + b1 * x1 + ... + bn * xn
```

In other words, the formula is always linear in its coefficients: `b0 ... bn`.

Model Types

Choose from the following model types. In the following formulas, X represents the explanatory variable, Y to response variable, and (e) (epsilon) represents random error. Random errors are uncorrelated with each other and with the explanatory variable, and have equal variance.

Linear

With the linear model type, no transformations are performed on either the explanatory or response variable. So the formula is

```
Y = b0 + b1 * X + e
```

Logarithmic

With the Logarithmic model type, the explanatory variable is transformed by the natural log before estimation of the model. So the formula is

```
Y = b0 + b1 * ln(X) + e
```

Because a logarithm is not defined for number less than zero, any marks for which the explanatory variable is negative are filtered before estimation of the model. Avoid using a model that discards some data unless you know that the data being filtered out is invalid. The trend line description reports how many marks were filtered before model estimation.

Exponential

With the exponential model type, the response variable is transformed by the natural log before estimation of the model. So the formula is

```
ln(Y) = b0 + b1 * X + e
```

With an exponential model, your response axis does *not* become logarithmic. Instead, the marks plotted in your view are found by plugging in various explanatory values to find values of `ln(Y)`. These values are then exponentiated to plot the trend line. What you see is the exponential model:

```
Y = e ^ (b0 + b1 * X + e)
```

Because a logarithm is not defined for numbers less than zero, any marks for which the response variable is negative are filtered before model estimation.

Polynomial

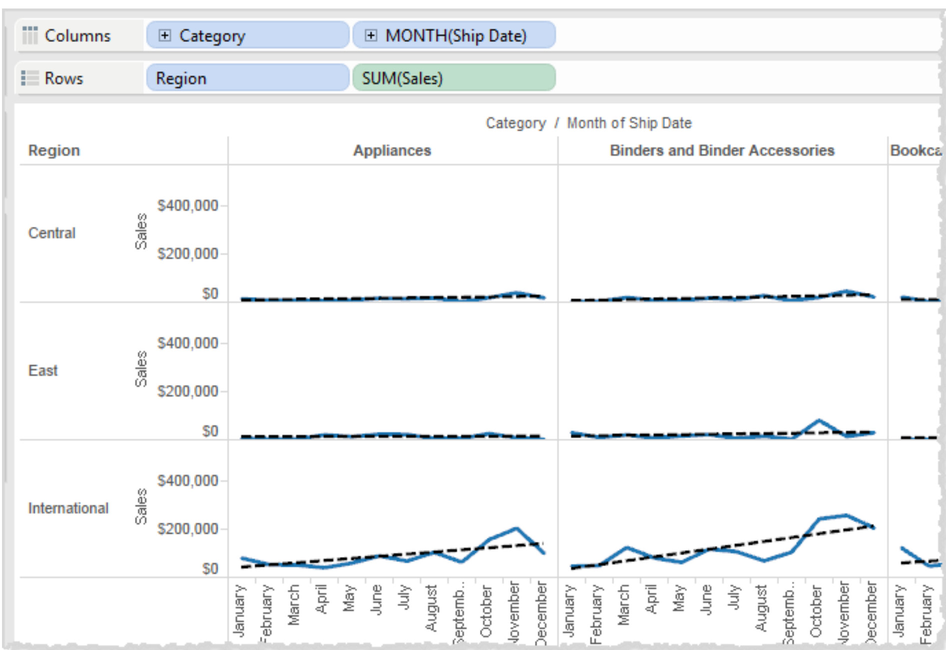
With the polynomial model type, the response variable is transformed into a polynomial series of the specified degree. So the formula is

```
Y = b0 + b1 * X + b2 * X^2 + … + e
```

With a polynomial model type, you also select a **Degree** between 2 and 8. The higher polynomial degrees exaggerate the differences between the values of your data. So if your data increases very rapidly, the lower order terms may have almost no variation compared to the higher order terms, rendering the model impossible to estimate accurately. Also, more complicated higher order polynomial models require more data to estimate. So check the model description of the individual trends line for a red warning message indicating that an accurate model of this type is not possible.

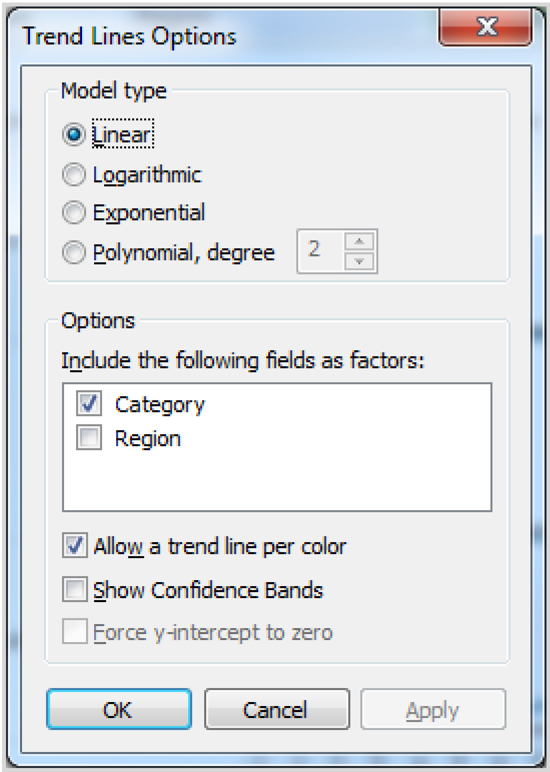
Removing Factors from the Model

You can remove factors from a trend line model in the Trend Lines Options dialog box. Often you will want to remove factors because you want the trend line model to be based on the entire row in the table rather than broken up by the members or values of a field. Consider the following example. The view below shows the monthly sales for various products categories, broken out by region.

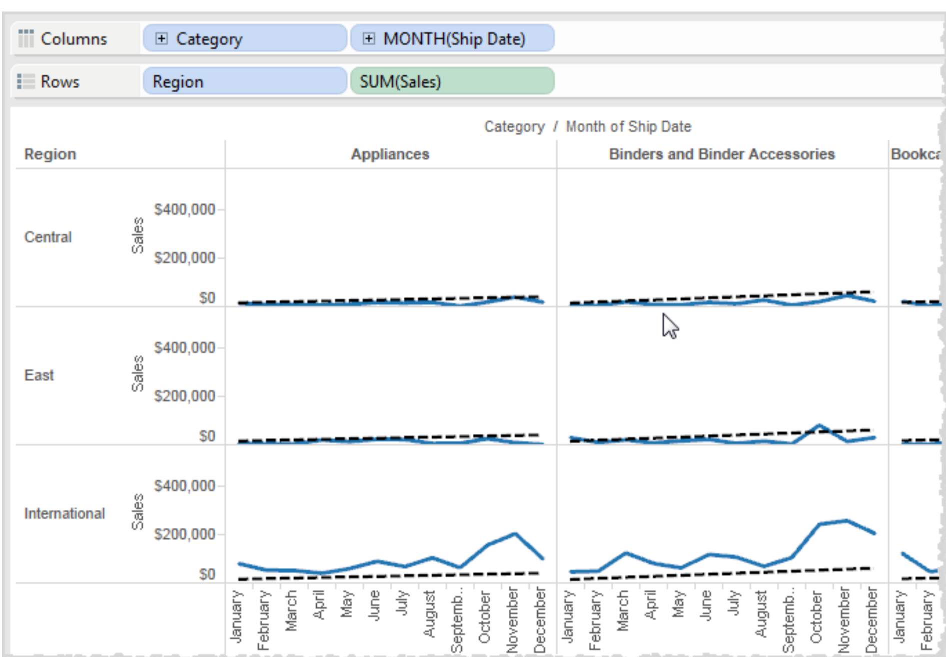


You can see that a separate model is created for each region.

Now remove **Region** as a factor in the model by deselecting it in the Trend Lines Options dialog box.

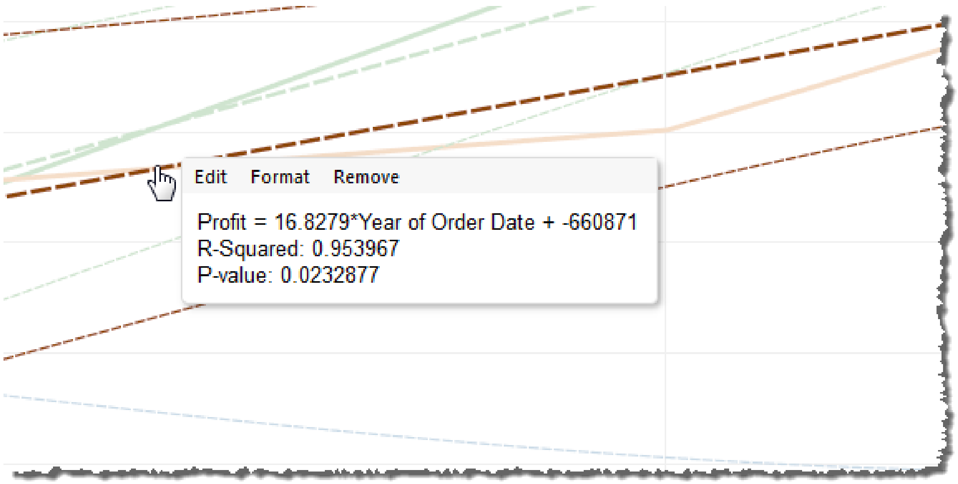


You can see that the trend line model within a category is now the same across all regions. This allows you to compare actual sales against a trend line that is the same for all regions.



Assessing Trend Line Significance

To see relevant information for any trend line in the view, hover the cursor over it:



The first line in the tooltip shows the equation used to compute a value of **Profit** from a value of **Year of Order Date**.

The second line, the R-Squared value, shows the ratio of variance in the data, as explained by the model, to the total variance in the data. For more details, see **Trend Line Model Terms** on page 1196.

The third line, the P-value, reports the probability that the equation in the first line was a result of random chance. The smaller the p-value, the more significant the model is. A p-value of 0.05 or less is often considered sufficient.

Entire Model Significance

Once you've added a trend line to a view, you typically want to know the goodness of fit of the model, which is a measure of the quality of the model's predictions. In addition, you may be interested in the significance of each factor contributing to the model. To view these numbers, open the Describe Trend Model dialog box, right-click (Control-click on a Mac) in the view and select **Trend Lines > Describe Trend Model**.

When you are testing significance, you are concerned with the p-values. The smaller the p-value, the more significant the model or factor is. It is possible to have a model that has statistical significance but which contains an individual trend line or a term of an individual trend line that does not contribute to the overall significance.

Under Trend Lines Model, look for the line that shows the p-value (significance) of the model: The smaller the p-value, the less likely it is that the difference in the unexplained variance between models with and without the relevant measure or measures was a result of random chance.

Describe Trend Model

Trend Lines Model

A linear trend model is computed for sum of Sales given Ship Date Month. The model may be significant at p <= 0.05. The factor Category may be significant at p=0.05.

Model formula:	Category*(Month of Ship Date + intercept)
Number of modeled observations:	204
Number of filtered observations:	0
Model degrees of freedom:	34
Residual degrees of freedom (DF):	170
SSE (sum squared error):	6.32246e+011
MSE (mean squared error):	3.71909e+009
R-Squared:	0.850309
Standard error:	60984.4
p-value (significance):	< 0.0001

Analysis of Variance:

Field	DF	SSE	MSE	F	p-value
Category	32	3.08378e+012	9.6368e+010	25.9117	< 0.0001

Individual trend lines:

Panes		Line		Coefficients				
Row	Column	p-value	DF	Term	Value	StdErr	t-value	p-value
Sales	Appliances	0.0221712	10	Month of Ship Date	11355.9	4200.11	2.70372	0.0221712
				intercept	52856.9	30912	1.70992	0.118073
Sales	Binders and Binder Accessories	0.0048827	10	Month of Ship Date	21028.2	5848.16	3.5957	0.0048827
				intercept	38108.4	43041.3	0.885391	0.396736
Sales	Bookcases	0.0582459	10	Month of Ship Date	12823	5998.1	2.13785	0.0582459

This p-value for a model compares the fit of the entire model to the fit of a model composed solely of the grand mean (the average of data in the data view). That is, it assesses the explanatory power of the quantitative term f(x) in the model formula, which can be linear, polynomial, exponential, or logarithmic with the factors fixed. It is common to assess significance using the "95% confidence" rule. Thus, as noted above, a p-value of 0.05 or less is considered good.

Significance of Categorical Factors

In the Analysis of Variance table, sometimes referred to as the ANOVA table, each field that is used as a factor in the model is listed. For each field, among other values, you can see the p-value. In this case, the p-value indicates how much that field adds to the significance of the entire model. The smaller the p-value the less likely it is that the difference in the unexplained variance between models with and without the field was a result of random chance. The values displayed for each field are derived by comparing the entire model to a model that does not include the field in question.

The following image shows the Analysis of Variance table for a view of quarterly sales for the past two years of three different product categories.

Analysis of Variance:

Field	DF	SSE	MSE	F	p-value
Category	160	1.65811e+012	1.03632e+010	20.9732	< 0.0001
Region	136	2.64345e+012	1.94371e+010	39.3372	< 0.0001

As you can see, the p-values for **Category** and **Region** are both quite small. Both of these factors are statistically significant in this model.

For information on specific trend line terms, see **Trend Line Model Terms** on page 1196.

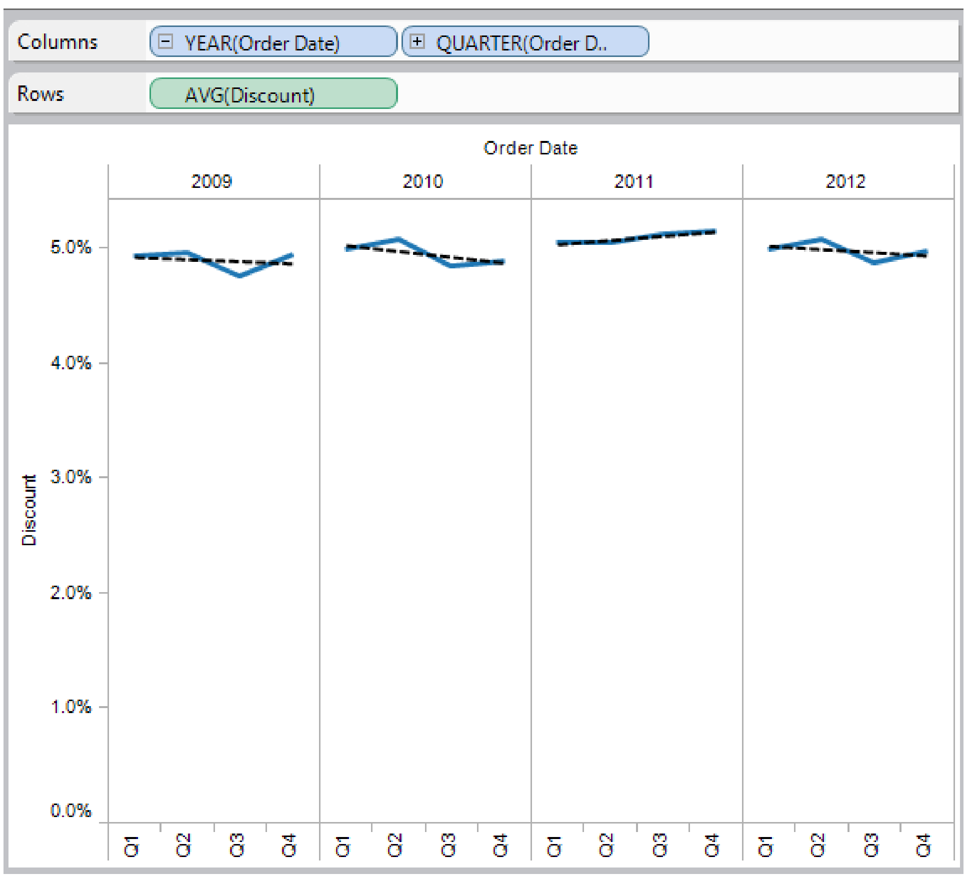
For ANOVA models, trend lines are defined by the mathematical formula:

```
Y = factor 1 * factor 2 * ...factorN * f(x) + e
```

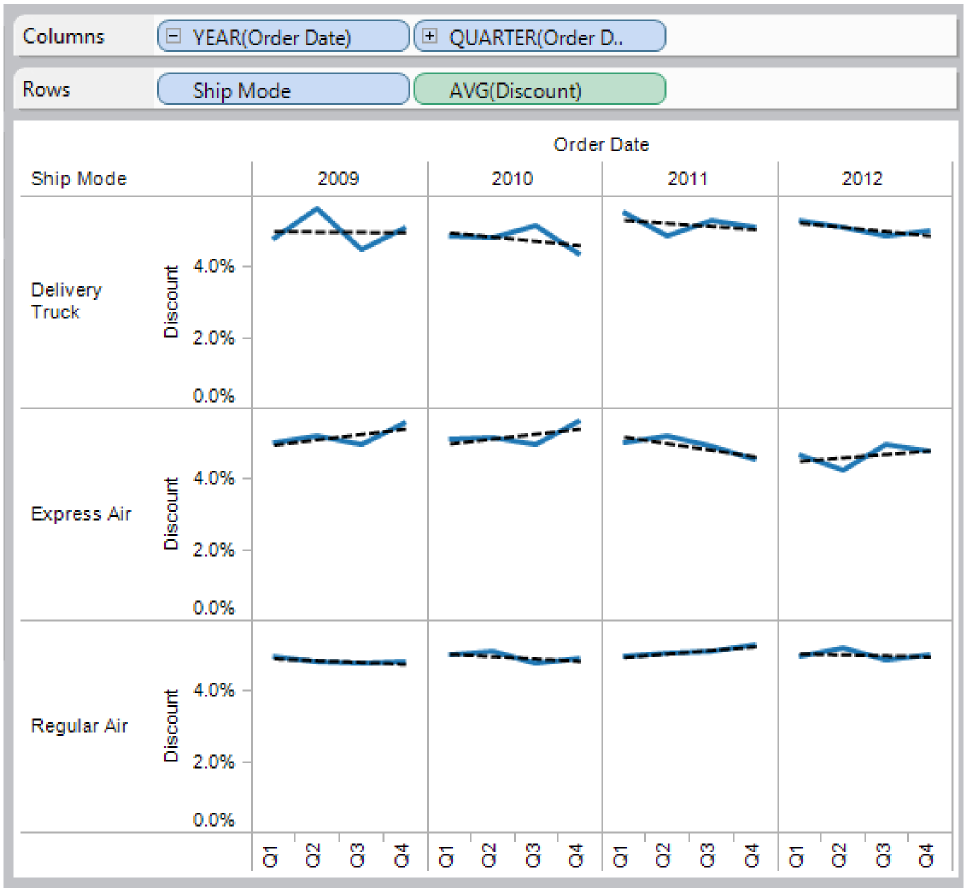
The term `Y` is called the *response variable* and corresponds to the value you are trying to predict. The term `X` is the *explanatory variable*, and e (epsilon) is random error. The factors in the expression correspond to the categorical fields in the view. In addition, each factor is represented as a matrix. The `*` is a particular kind of matrix multiplication operator that takes two matrices with the same number of rows and returns a new matrix with the same number of rows. That means that in the expression `factor 1 * factor 2`, all combinations of the members of factor 1 and factor 2 are introduced. For example, if factor 1 and factor 2 both have three members, then a total of nine variables are introduced into the model formula by this operator.

Answering Questions with Trend Lines

We start with a question: what is causing high discount rates at a superstore? Using trend lines, we can find out which variables correlate with high discounts. The view below shows the average monthly discount rates for all stores over a four-year range.



Our first thought is that discount rates may be high for specific ship modes. When we put the **Ship Mode** field on the **Rows** shelf, we see that there was a spike in discount rates for items shipped by Delivery Truck in 2009.

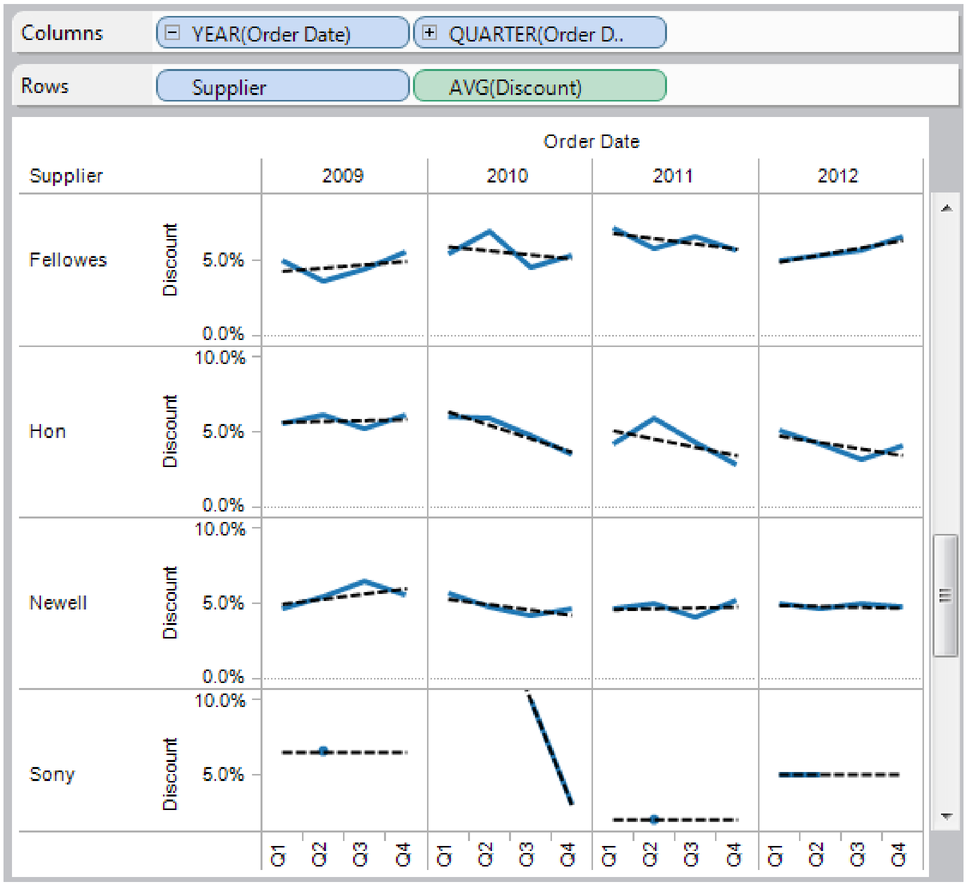


However, in the description of the trend line mode, the Analysis of Variance list shows that the p-value for Ship Mode is 0.22. (To see the description, right-click (Control-click on a Mac) the trend line and choose **Describe Trend Model**). This number is too high to be significant, indicating that we cannot predict discount rates based on ship mode. (It is common to test significance by applying the “95% confidence” rule. This equates to a p-value of 0.05 or less.)

Analysis of Variance:

Field	DF	SSE	MSE	F	p-value
Ship Mode	16	0.000181235	1.133e-005	1.39986	0.222194
Year of Order Date	18	0.00018312	1.017e-005	1.25726	0.295853

The next variable we test is supplier. Suppliers sometimes offer substantial discounts. So we remove **Ship Mode** and drag **Supplier** to the **Rows** shelf.



Now when we open the Describe Trend Model dialog box, we see that the p-value for Supplier is 0.0004, while the p-value for the entire model is less than 0.003. With that, we can be confident in concluding that changes in average discount rates over time are in fact quite different for different suppliers. In other words we can be statistically confident that the different trend lines slopes for each supplier isn't just due to randomness, but rather to a real correlation between a supplier and the slope of this line.

Analysis of Variance:

Field	DF	SSE	MSE	F	p-value
Supplier	126	0.0349464	0.0002774	1.60454	0.0045179
Year of Order Date	100	0.0318394	0.0003184	1.84197	0.000667

In addition to **Supplier**, we notice that the **Year of Order Date** field offers a statistically significant improvement to the model. See Assessing Trend Line Significance for more information.

Assumptions

The p-values reported in Tableau trend lines depend on some assumptions about the data.

The first assumption is that, whenever a test is performed, the model for the mean is (at least approximately) correct.

The second assumption is that the "random errors" referred to in the model formula (see **Trend Line Model Types** on page 1187) are independent across different observations, and that they all have the same distribution. This constraint would be violated if the response variable had much more variability around the true trend line in one category than in another.

Assumptions Required to Compute Trend Lines

The Assumptions required to compute (using Ordinary Least Squares) each individual trend line are:

- Your model is an accurate functional simplification of the true data generating process (for example, no linear model for a log linear relationship).
- Your errors average to zero and are uncorrelated with your independent variable (for example, no error measuring the independent variable).
- Your errors have constant variance and are not correlated with each other (for example, no increase in error spread as your independent variable increases).
- Explanatory variables are not exact linear functions of each other (perfect multicollinearity).

Trend Line Model Terms

When you view the description for a trend line model, there are several values listed. This section discusses what each of these values means.

Model formula

This is the formula for the full trend line model. The formula reflects whether you have specified to exclude factors from the model.

Number of modeled observations

The number of rows used in the view.

Number of filtered observations

The number of observations excluded from the model.

Model degrees of freedom

The number of parameters needed to completely specify the model. Linear, logarithmic, and exponential trends have model degrees of freedom of 2. Polynomial trends have model degrees of freedom of 1 plus the degree of the polynomial. For example a cubic trend has model degrees of freedom of 4, since we need parameters for the cubed, squared, linear and constant terms.

Residual degrees of freedom (DF)

For a fixed model, this value is defined as the number of observations minus the number of parameters estimated in the model.

SSE (sum squared error)

The errors are the difference between the observed value and the value predicted by the model. In the Analysis of Variance table, this column is actually the difference between the SSE of the simpler model in that particular row and the full model, which uses all the factors. This SSE also corresponds to the sum of the differences squared of the predicted values from the smaller model and the full model.

MSE (mean squared error)

The term MSE refers to "mean squared error" which is the SSE quantity divided by its corresponding degrees of freedom.

R-Squared

R-squared is a measure of how well the data fits the linear model. It is the ratio of the variance of the model's error, or unexplained variance, to the total variance of the data.

When the y-intercept is determined by the model, R-squared is derived using the following equation:

$$1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

When the y-intercept is forced to 0, R-squared is derived using this equation instead:

$$1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n} y_i^2}$$

In the latter case, the equation will not necessarily match Excel. This is because R-squared is not well defined in this case, and Tableau's behavior matches that of R instead of that of Excel.

Standard error

The square root of the MSE of the full model. An estimate of the standard deviation (variability) of the "random errors" in the model formula.

p-value (significance)

The probability that an F random variable with the above degrees of freedom exceeds the observed F in this row of the Analysis of Variance table.

Analysis of Variance

This table, also known as the ANOVA table, lists information for each factor in the trend line model. The values are a comparison of the model without the factor in question to the entire model, which includes all factors.

Individual trend lines

This table provides information about each trend line in the view. Looking at the list you can see which, if any, are the most statistically significant. This table also lists coefficient statistics for each trend line. A row describes each coefficient in each trend line model. For example, a linear model with an intercept requires two rows for each trend line. In the Line column, the p-value and the DF for each line span all the coefficient rows. The DF column under the shows the residual degrees of freedom available during the estimation of each line.

Terms

The name of the independent term.

Value

The estimated value of the coefficient for the independent term.

StdErr

A measure of the spread of the sampling distribution of the coefficient estimate. This error shrinks as the quality and quantity of the information used in the estimate grows.

t-value

The statistic used to test the null hypothesis that the true value of the coefficient is zero.

p-value

The probability of observing a t-value that large or larger in magnitude if the true value of the coefficient is zero. So, a p-value of .05 gives us 95% confidence that the true value is not zero.

Commonly Asked Questions

This section describes some commonly asked questions regarding trend lines in Tableau.

How do I change the confidence level used in the model?

Tableau does not enforce a confidence level. It simply reports the significance of the whole model, or of a specific field, by showing the p-value. The p-value will measure the probability of obtaining the same trend result without taking the dimensions into account. For example, a trend of sales per time p-value of 0.05 means that there is 5% chance that the same value could be obtained without taking the time into consideration.

What does it mean if the p-value for the model is significant but the p-value for the specific field in the Analysis of Variance table is not significant?

The p-value in the Analysis of Variance table indicates whether the field adds or detracts from the significance of the entire model. The smaller the p-value the less likely it is that the difference in the unexplained variance between models with and without the field was a result of random chance. The values displayed for each field are derived by comparing the entire model to a model that does not include the field in question. So, for the situation where the p-value for the model is significant but the p-value for the specific field is not, you know that the model is statistically significant, but you cannot be confident that the specific field in question adds anything to it. Consider whether you might not be better off removing the factor from the model.

What does it mean if the p-value for the specific field in the Analysis of Variance table is significant but the p-value for the model is not significant?

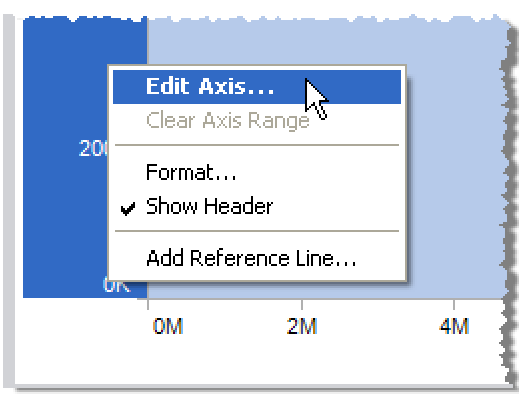
This could happen in a case when there is no "trend" within each pane. For example, the lines are flat, but the mean varies across a given factor.

Log Axes

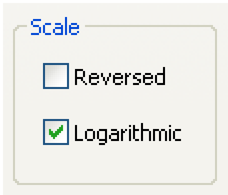
Sometimes you will have a measure that uses a logarithmic scale as opposed to linear. For example, some well known logarithmic scales include the Richter magnitude scale to measure the strength of earthquakes, pH to measure acidity, and the stellar magnitude scale, which measures the brightness of stars. You can edit the axis scale for any measure to be logarithmic using the Edit Axis dialog box. By default the tick marks are drawn at powers of ten, however, you can specify any base that is greater than 1.

To change the scale of an axis:

1. Right-click (Control-click on a Mac) the axis in the view and select **Edit Axis**.



2. In the Edit Axis dialog box, select **Logarithmic** for the axis scale.

3. Select the **Tick Marks** tab.

4. Select one of the following Major Tick mark options:
   - **Automatic** - the major tick marks are drawn at powers of 10.
   - **Fixed** - the major tick marks are drawn at a specified exponent. Type a number into the Powers of text box.
   - **None** - major tick marks are not shown.
5. When finished, click **OK**.

You can also reverse the axis by selecting **Reverse** in the Scale area on the General tab of the Edit Axis dialog box.

> If your data contains negative values Tableau cannot plot them on a logarithmic scale. All values with a negative value will be displayed at 1 on the axis. You can then filter these records to exclude them from the view.

Publish Data Sources and Workbooks

From Tableau Desktop, you can publish workbooks and data sources to Tableau Server or Tableau Online. Use the publishing option to share data analysis with others securely, through any web browser or the Tableau mobile app. Sharing your content by publishing it can also help you to implement centralized, governed data management.

Note: You can also share analyses on Tableau Public, a free cloud service. As the name suggests, these views are publicly accessible. For more information, see public.tableau.com.

In this topic

In other resources

For the steps on how to publish, see either of the following topics:

- **Publish a Data Source** on page 1208
- **Publish a Workbook** on page 1213

Why publish

You can publish data sources and workbooks when you want to widen the audience for your data analysis within your organization. By publishing you can begin to do the following:

- Collaborate and share with others

  Allow people in your organization to view, interact with, download, subscribe to, share, edit, and save published views, even if they do not use Tableau Desktop. Incorporate views into blog posts or websites.

- Enable centralized data management

  Create and publish data models that everyone can use. Centralized data management allows for sharing a single source for your Tableau data. All workbooks connected to the published data reflect updates to it.

- Support mobility

Access your data from a different computer or location, through a web browser or the Tableau Mobile iOS app. Sign in to your organization's Tableau Server from a private network offsite.

What you can publish

Content types you can publish include:

- **Data sources:** You can publish data sources that others can use to build new workbooks. A data source can contain a direct (or live) connection to your database or an extract you can refresh on a schedule.

  For information, see **Best Practices for Published Data Sources** below.

- **Workbooks:** Workbooks contain your views, dashboards, and stories, and data connection. You can include local resources, such as background images and custom geocoding, if they reside in a location that the server or other Tableau users cannot access.

Who can publish

To publish to Tableau Server or Tableau Online, your server or site administrator must grant you the following capabilities:

- A *site role* of **Publisher**, **Viewer (can publish)**, or **Unlicensed (can publish)** on the site you're publishing to.
- **View** and **Save** capabilities on the project into which you publish.

If you use Tableau Desktop and are not sure whether you can publish to a server, or you are having trouble publishing, see your Tableau administrator. If you’re an administrator, see Control Access to Content in the Tableau Server help (or the Tableau Online version) for more information about site roles and permissions.

Best Practices for Published Data Sources

Publishing data sources to Tableau Online or Tableau Server is integral to maintaining a single source for your data. Publishing also enables sharing data among colleagues; including those who don't use Tableau Desktop, but have permission to edit workbooks in the web editing environment.

Updates to a published data source flow to all connected workbooks, whether the workbooks themselves are published or not.

In this topic

- **What makes up a published data source** on the next page
- **Preparing a data source for publishing** on the next page

- **When to publish an extract** on the next page
- **Making sure extracts stay current** on page 1205
- **Additional resources** on page 1205

What makes up a published data source

A Tableau data source consists of the following:

The data connection information that describes what data you want to bring in to Tableau for analysis. When you connect to the data in Tableau Desktop, you can create joins and rename fields on the Data Source tab.

When you publish the data source, the connection information also includes authentication information. For example:

- Whether the credentials for accessing the data are embedded in the connection, so that users can access the data directly.
- Whether users will be prompted to enter their credentials when they attempt to sign in.

An extract, if you decide to create one. Some guidelines for when to create an extract are included below, as well as in the additional resources.

Customization and cleanup that helps you and others use the data source efficiently. When you're working with your view, you can add calculations, sets, groups, bins, and parameters; define any custom field formatting; hide unused fields; and so on.

All of these refinements become part of the metadata contained in the data source that you will publish and maintain.

Information about how to access or refresh the data after it's published. Examples include the path to an Excel file, credentials for accessing data on-premises or in the cloud, OAuth access tokens, and so on.

Preparing a data source for publishing

When you publish a data source, consider these best practices:

- Create the connection for the information you want to bring into Tableau and do any cleanup that will help you and others use the data source efficiently.

  If you read Tableau blogs, you might see this process described as creating your data model.

- If appropriate, create an extract of the data you want to publish. For more information, see the following section, **When to publish an extract** on the next page.

- Develop a data source naming convention.

  After publishing a data source you cannot rename it directly. Instead, you need to publish a new copy with the new name, and then update all workbook connections. A well-considered naming convention can also help other users of the data deduce which data source to connect to.

- Consider designating the following roles among your Tableau users:
  - A data steward (or team) who creates and publishes the data sources in Tableau Desktop that others will use.
  - A data administrator who manages published data sources on the server you publish to (Tableau Server or Tableau Online).

  Central management avoids data source proliferation, so the data published to the server maintains its integrity.

When to publish an extract

Under the following conditions you might be required or choose to publish an extract instead of connecting live.

Publishing data to Tableau Online that it cannot reach directly

Tableau Online in the cloud cannot reach data sources that you maintain on your local network. For these data sources, you must publish an extract and set up a refresh schedule using the Tableau Online sync client.

Some cloud-hosted data sources always require extracts. These include Google Analytics, Salesforce.com, Oracle, OData, and some ODBC data sources. You can set up refresh schedules for some of these data sources directly on Tableau Online; for others you use the sync client.

Web data connector data sources always require extracts. If you connect to the data source using standard user name and password authentication, you can refresh it using the sync client. If you connect to the data source using OAuth authentication, you will need to republish the data source to refresh it. The sync client does not yet support refreshes for data that uses OAuth connections.

For more information, see Get your Data to Tableau Online in the Tableau Online Help.

Limiting access or improving performance

Even if the server supports live connections to your data, an extract might make more sense. For example, for exceptionally large databases, or those that contain fields that aren’t relevant to Tableau analysis, you can extract a subset that includes only the pertinent information. The extract can be easier and faster to work with than connecting live.

In cases where you can use a live connection or an extract that you refresh on a schedule, you might want to experiment with both options to see which works best for you.

Enabling functionality the data source does not inherently support

For example, you want to use the Median function with SQL Server data.

To learn more about creating data extracts, see **Extract Your Data** on page 379.

Making sure extracts stay current

When you publish a data source with an extract, you can refresh it on a schedule. The way you schedule refreshes depends on the data source type and whether you're publishing to Tableau Server or Tableau Online.

For more information, see the following topics:

- Keep Data Fresh in the Tableau Online Help
- Scheduled Refresh Tasks and Subscriptions in the Tableau Server Help

Additional resources

- Data Server—Training video by Tableau, with a helpful overview of data sources and publishing
- Understanding Tableau Data Extracts

  A version-agnostic, three-part series by Gordon Rose on the Tableau blog. It includes an in-depth look at the extract's file structure, guidelines for when to use extracts, and best practices.
- O Extract, Where Art Thou? and TDE or Live? When to Use Tableau Data Extracts (or not)

  Posts by Tableau Zen Master Jonathan Drummey on his blog Drawing with Numbers. Includes tips on extracts, explains the different file types, describes different publishing scenarios. (Read the comments, too.)

  > **Disclaimer:** Tableau cannot guarantee the accuracy of third-party information, and it can change at any time without our knowledge.

Sign in to Tableau Server or Online

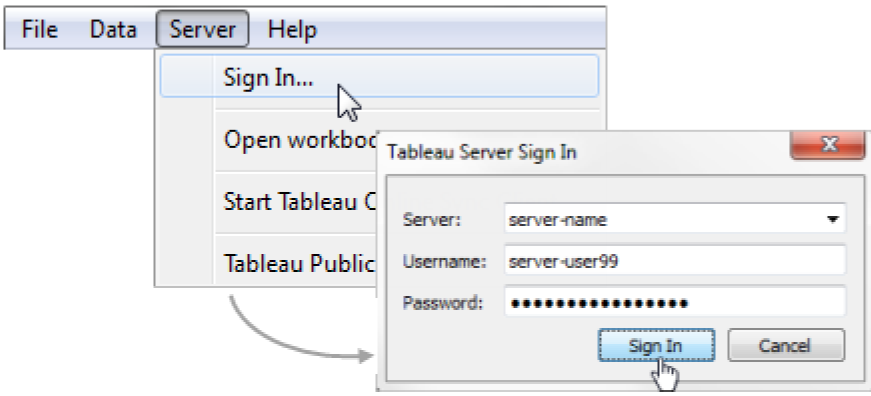
To publish data sources or workbooks, or to access data sources or workbooks that are already published, you need to sign in to your Tableau Server or Tableau Online site. The specific steps you take to sign in depend on the type of authentication your Tableau administrator has configured.

This topic describes the basic sign-in steps, includes variations for different authentication types, and links you to steps for clearing saved server sign-ins.

Basic sign-in steps

- Select **Server** > **Sign In**, and enter your server name, and user name and password.

  For the Tableau Online server name, enter **https://online.tableau.com**.



Variations on signing in to Tableau Server

Note: For Tableau Online, see Sign In to Tableau Online in the Tableau Online Help.

With some Tableau Server configurations your sign-in experience varies from the basic steps. The sections here describe variations for single sign-on (SSO) and special issues related to working in a Kerberos environment.

Active Directory

If Tableau Server is configured to use Active Directory, enter your Windows user name. If you work in a multi-domain environment, and you are not currently on the default domain, enter your Tableau Server user name and password.

SAML or SAP HANA single sign-on

- If Tableau Server is configured to use SAML, your user name and password are managed by a third-party identity provider. When you enter your user name for Tableau Server, you are directed to the sign-in page for the identity provider.
- If Tableau Server is configured for SAP HANA SSO, Tableau connects to the server, and you do not need to provide credentials.

Mutual SSL

If Tableau Server is configured for mutual SSL and you have more than one client certificate, you are prompted to select which certificate to use the first time you connect.

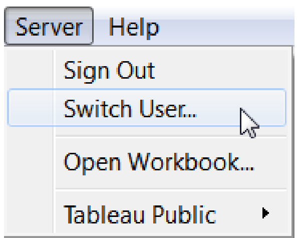
Kerberos environment

If Tableau Server is Kerberos-enabled and you are signed in to your computer using Active Directory credentials, Tableau Desktop connects to the server, and you do not need to provide credentials.

Switching user accounts (typically for testing purposes)

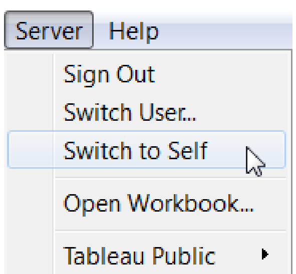
If Kerberos authentication does not succeed, you are prompted to provide a user name and password. If this occurs, and you need to change the user you're signed in as on Tableau Server, complete the following steps:

1. On the Server menu, select **Switch User**.



2. In the Tableau Server Sign In dialog box, provide the new user name and password.

If you sign in as a different user and then need to sign back in using your normal credentials, on select **Server** > **Switch to Self**.



Clearing saved server sign-ins

When you sign in to a server, Tableau Desktop stores your credentials in a secure token that remembers your Tableau Desktop connection with the server. When this token is in place, you can access the server directly, without having to sign in.

- If you want to forget a server connection, select **Server** > **Sign Out**.
- To remove all of you existing server connections, select **Help** > **Settings and performance** > **Clear saved server sign-ins**.

For more information, see **Quick Start: Stay Connected with Automatic Sign-In** on page 177.

If you never want server sign-ins to be saved, a Tableau Server administrator can change the server settings to disallow connected clients. This setting also affects Tableau Mobile and other Tableau clients. For information, see Authentication for Connected Devices in the Tableau Server Help.

> **Note:** Automatic sign-in is available for servers configured for Windows Authentication only. Servers configured for Kerberos or SAML authentication cannot use automatic sign-in.

Publish a Data Source

When you are ready to make a data source available to other Tableau Desktop users, you can publish it to Tableau Server or Tableau Online.

> **Note:** If you haven't yet read about best practices for creating data sources and when to create an extract, see **Best Practices for Published Data Sources** on page 1202.

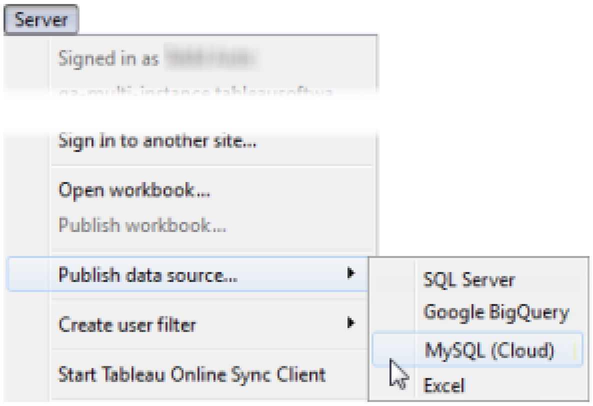
In this topic

Publishing steps

The following steps give an overview of the publishing flow you will use regardless of the type of data or the server you publish to. Below these steps you can find supplemental information for authentication types and using the Tableau Online sync client to refresh extracts of local data sources.

1. Select **Server** > **Publish Data Source**.

   If your workbook is connected to multiple data sources, select the one you want from the submenu.



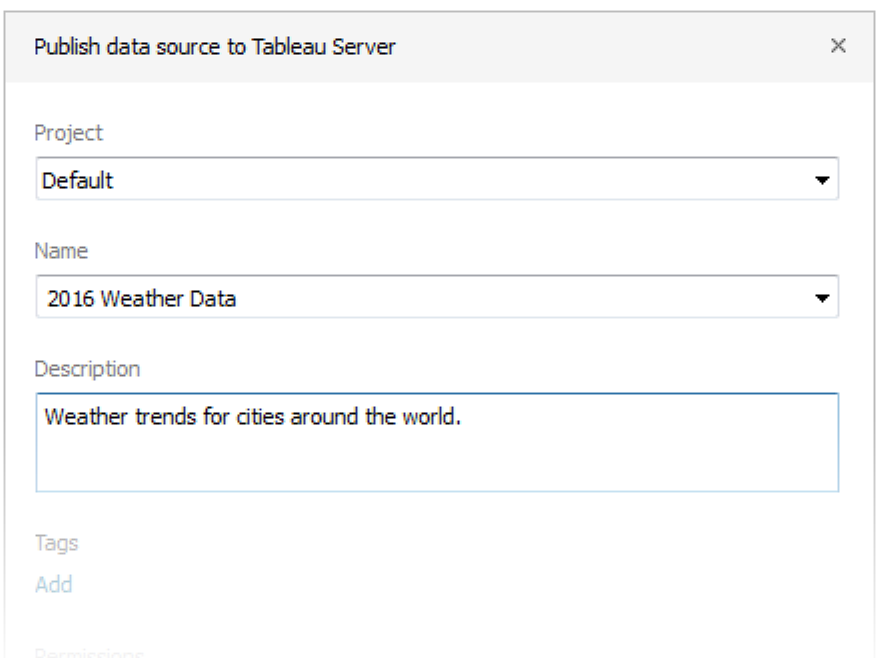
2. If you're not already signed in to Tableau Server or Tableau Online, sign in now.

   How you sign in depends on how your administrator set up your environment. For information, see **Sign in to Tableau Server or Online** on page 1205.

3. In the **Publish data source to Tableau Server** dialog box, do the following:

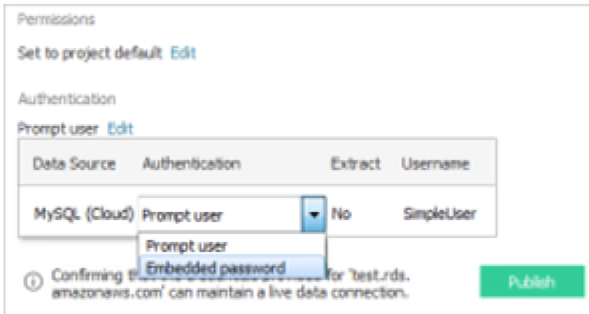
   - Select the project you want to publish to and enter the data source name.
   - Add a description and tags that will help you and other users find it.

     Separate tags using either a comma or a space. To add a tag that contains a space, put it in quotation marks ("sales quotes").



   - Under **Permissions** select **Edit** to change permissions indicated.

- For **Authentication**, if you need to provide credentials to access your data, you can specify how this authentication should be handled when the data is published to the server.

  The options available for accessing the data source depend on the type of data you publish and whether you are publishing to Tableau Server or Tableau Online.

  Information appears at the bottom of the dialog box to let you know whether you need to take further action, such as adding Tableau Online to your data provider's authorized list.

  For more information, see **Authentication types** on the next page later in this topic.

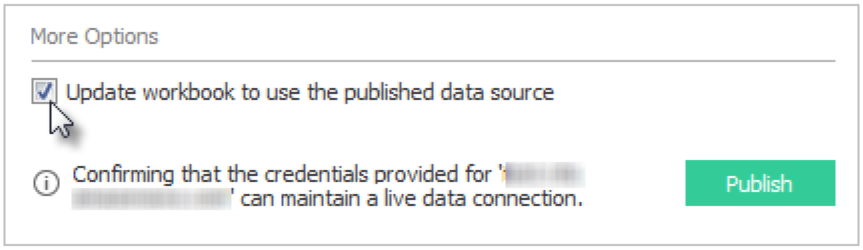
4. If you are publishing file-based data that is on a Windows mapped drive, or use images that will not be available from the server, select **Include External Files**.

   When you include external files, copies of them are put on the server as part of your data source.

   If you do not want to publish the external files to the server, change the connection information so that the data source references a full UNC path. For example, rather than connecting to D:\datasource.xls, you would connect to \\filesrv\datasource.xls.

5. By default, during the publishing process, Tableau updates the workbook connection to use the new published data source. It also closes the local data source.

   To continue using the local data source instead, clear the **Update workbook to use the published data source** check box.



For more information, see **Quick Start: Automatically Update Workbook to Use Published Data Source** on page 26

> **Note:** If you select **Undo** after publishing the data source, Tableau will revert to using the local data source, but the data source will remain published. In addition, Tableau does not replace a local data source when you publish a cube (multidimensional) data source to an on-premises Tableau Server. (Tableau Online does not support publishing cube data sources.)

6. Click **Publish**.
7. (Optional) If you published an extract to Tableau Online, set up a refresh schedule.

   After you click **Publish**, you are redirected to Tableau Online in the web browser. There, you are prompted to set up the refresh schedule. If the extract you published is from a data source that Tableau Desktop cannot reach directly, you schedule refreshes using the sync client.

   For information, see Publishing and Refreshing Extracts on Tableau Online.

Authentication types

When you publish a data source, you will see one or more of the following authentication types:

- **Prompt user**: Users must enter their own database credentials to access the published data.
- **Embedded password**: Your user name and password will be used by everyone who accesses the data.
- **Server run as account**: Tableau Server only. The server's Run As user will authenticate all users.
- **Viewer credentials** or **Publisher credentials**: Tableau Server only. In a Kerberos, SAP HANA, or Impala environment, the user's domain user name and password are used. These are explained in more detail in the sections below this list.
- **Impersonate via embedded account** or **Impersonate via server Run As account**: (Available only when publishing SQL Server data to Tableau Server.) You can embed credentials through which SQL Server creates the connection and then impersonates

the signed-in Tableau Server user. To create the connection you can specify the server's Run As account or a different database user that has the appropriate permissions for impersonation.

For more information, see the topics under SQL Server Impersonation in the Tableau Server Help.

Authentication in a Kerberos environment

This option is available for Tableau Server on-premises only. Select **Viewer credentials** to use the user's domain user name and password to access a Kerberos-enabled Teradata, PostgreSQL, Microsoft SQL Server, or Microsoft Analysis Services data source.

Authentication for SAP HANA or Impala single sign-on

Select **Viewer Credentials** to authenticate users who access the data source in these environments:

- You use single sign-on to SAP HANA and Tableau Server is configured for SAP HANA SSO.
- You use Impala with Cloudera Hadoop, and Tableau Server is configured for single sign-on.

OAuth

If you are publishing a Salesforce.com, Google Analytics, or Google BigQuery data source, see **Embed Credentials to Streamline Signing In to a Published Workbook** on page 1221 for more information.

Publishing with a Web Data Connector

To publish a web data connector data source, you need to *import* the web data connector to the server before you can set up a refresh schedule. You can do this only on Tableau Server.

To refresh web data connector data sources on Tableau Online, you need to use the sync client.

For information, see Web Data Connectors in Tableau Server in the Tableau Server Help or Refreshing Data Using the Sync Client in the Tableau Online Help.

Using hidden fields in workbooks

Workbooks connected to a published data source respect the state of hidden fields in the published the data source.

- If you create a new workbook that uses a published data source with hidden fields, those fields remain hidden in the workbook and cannot be used in calculations, sets, groups, and other object creation.

- If you work with an existing workbook that uses a published data source with hidden fields, those hidden fields are displayed in red in the workbook to indicate that the fields, and therefore the views and calculations that use those fields, are invalid.

You can address this issue in one of the following ways:

- Show (unhide) the relevant fields in the data source, and then republish it.
- Update the relevant workbooks to exclude the hidden fields.

For information, see **Hide or Unhide Fields** on page 228.

See also

- Allow Direct Connections to Data Hosted on a Cloud Platform (Tableau Online)
- Keep Data Fresh (Tableau Online)
- Data Sources (Tableau Server)

Publish a Workbook

When you publish a workbook to Tableau Online or Tableau Server, you can specify which project to add it to, which sheets to make available, which groups can access the workbook, and how they can access the data. You can also add tags that help others find your views.

In this topic

- **Decisions you make during publishing** below
- **Publishing steps** on page 1215

Decisions you make during publishing

This section discusses choices you'll be given as you step through the publishing process. Take these into consideration before you initiate the process.

Sign in to Tableau Server or Tableau Online

To publish, you need to sign in to Tableau Server or Tableau Online. Make sure you know how your administrator set up authentication on your server or site. For more information, see **Sign in to Tableau Server or Online** on page 1205.

Add your workbook or data source to a project

When you publish, you select a project in which you want to put your workbook or data source. Projects serve as containers for workbooks or data sources. Server or content administrators can use them to organize related content, as well as to set permissions on the workbooks and data sources within them. Before you start the publishing project, make sure you know which project you want to publish to.

Set permissions

As the owner of the published workbook, you can specify who can access it from the server and what they can do with it. Alternatively, in many environments, you can use the default permissions, and your administrator will manage content permissions on the server or site. For more information, see **Setting Permissions** on page 1217.

Show or hide sheets when you publish

When you publish a workbook, you can specify which sheets to include. Showing or hiding sheets is useful when you want to publish a dashboard or story without publishing the worksheets that were used to create that dashboard or story.

> **Important:** Hiding sheets is not a security measure. Anyone who has the **Download/Web Save As** permission can access the hidden sheets by opening the workbook on the server or downloading it from the server. Other editing permissions also can allow access to hidden sheets. For more information, see Control Access to Published Content in the Tableau Server Help.

Show sheets as tabs

When you publish a workbook that contains multiple sheets, you can specify how users navigate the published workbook.

- If you selected multiple sheets under **Sheets to Publish** and want to provide tab-based navigation across multiple sheets, select this check box.
- If you want to hide any sheets in the workbook, make sure the **Show Sheets as Tabs** check box is cleared.

  When you select this check box, all sheets are shown, even if you set sheet-level permissions.

Include external files when you publish

If your views contain any information that isn't available to the server, or to other users who access the workbook on the server, include the files that contain that information when you publish.

For example, you might use an Excel, CSV, or other data source local to your computer; image files; and so on.

If you are publishing to Tableau Server, and the workbook references data sources or images on a mapped drive, you can either include external files when you publish, or you can change the connection information so that the workbook references the UNC path to the data source. For example, you could change **D:\datasource.xls** to **\\filesrv\datasource.xls**.

If you are publishing to Tableau Online, and the workbook connects to a data source that Tableau Online cannot connect to directly, select the **Include External Files** check box.

For more information, see Keep Data Fresh in the Tableau Online Help.

Refreshing web data connector extracts

When you publish a workbook with a web data connector data source, you need to *import* the web data connector to the server before you can set up a refresh schedule. You can do this only on Tableau Server. For information, see Web Data Connectors in Tableau Server in the Tableau Server Help.

To use web data connector data sources on Tableau Online, you need to create a local extract and use it with the sync client to refresh the published data source. For information, see Schedule Refreshes Using the Sync Client in the Tableau Online Help.

Publishing steps

1. Select **Server** > **Publish Workbook**.

   If you are not already signed in to a server, the **Tableau Server Sign In** dialog box appears.

2. Complete the sign-in process, as described earlier in **Sign in to Tableau Server or Tableau Online** on page 1213.

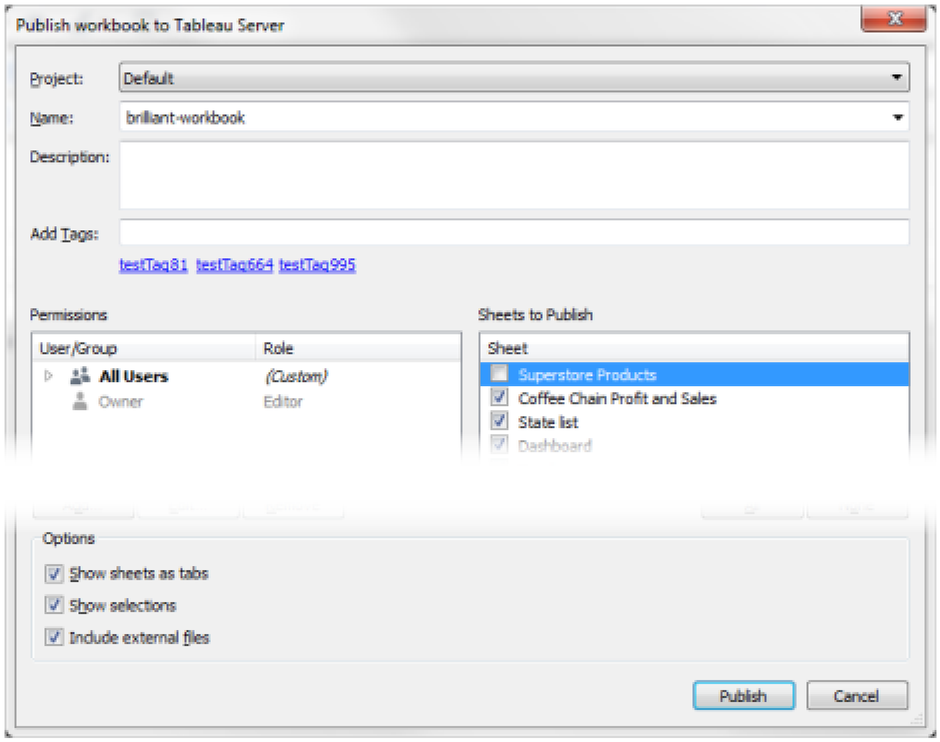
   To sign in to Tableau Online, enter **https://online.tableau.com**.

3. In the **Publish Workbook to Tableau Server** dialog box, specify the following:

   - **Project**: Select the name of the project you want to publish into. The default project on Tableau Server is named Default.
   - **Name**: Provide a name for the workbook in the **Name** text box.

     Use the drop-down list to select an existing workbook to overwrite. To do this, you must have the appropriate permissions on the server.
   - **Description**: Provide a description that will help you and others know what analysis the workbook contains.
   - **Add Tags**: Enter keywords that describe the workbook. Tags help users find related workbooks when they browse the server.

     Separate tags using either a comma or a space. To add a tag that contains a space, put it in quotation marks (e.g., “Sales Quotes”).



4. You can specify permissions to allow or deny access to the workbook on the server.

   By default all users can interact with the workbook. As the publisher, you have all permissions.

5. Under **Sheets to Publish**, select the sheets you want to include in the published workbook.

6. Under **Options**, select the check boxes as appropriate:

   - **Show sheets as tabs** if you selected multiple sheets to publish and want to provide tab-based navigation.

   - **Show Selections** if you want selections you've made in the workbook to be published to the server.

   - **Include External Files** if your views contain any information from files that will not be available to other users who access the workbook on the server.

7. (Optional) Click **Authentication** (or **Scheduling & Authentication** to specify how users can access the data. For more information, see **Embed Credentials to Streamline Signing In to a Published Workbook** on page 1221.

8. (Optional) If the workbook uses extract connections, you can add the workbook to a

refresh schedule. For more information, see **Refreshing Data Inside Workbooks** on page 1226.

9. Click **Publish**.

> **Note:** If you are publishing to a site that saves a revision history of workbooks, workbooks published with identical names will be saved as a revisions of the same workbook.

Setting Permissions

When you publish workbooks and data sources to Tableau Server or Tableau Online, you have the option to specify permissions for groups and specific users. Permissions allow or deny access for a specified object.

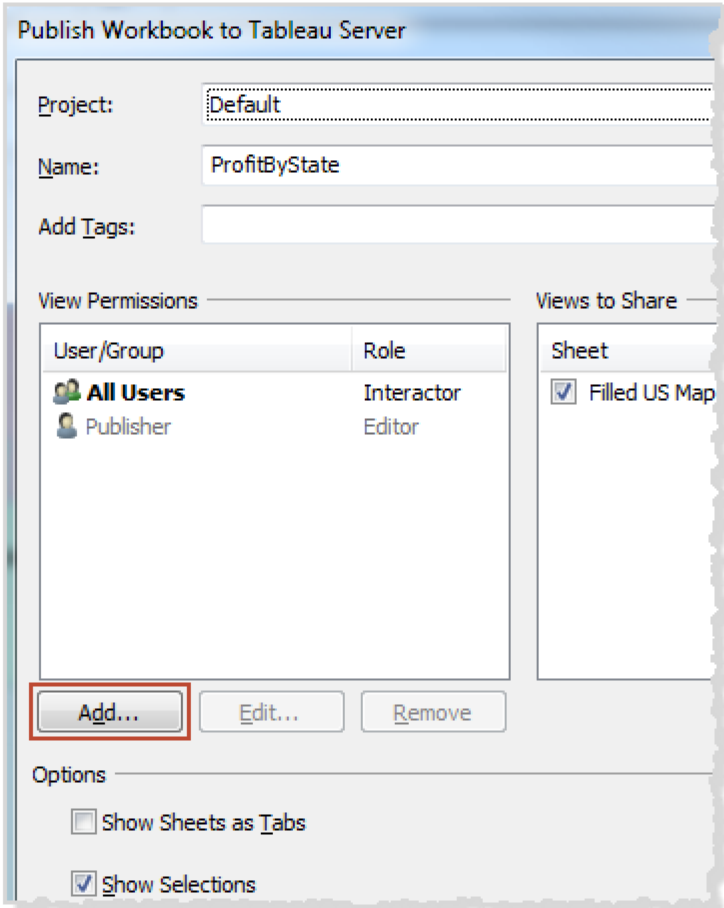
- For workbooks, all users can view published workbooks. As the publisher, you have all permissions.
- For data sources, all users can see the data source on Tableau Server or Tableau Online (and therefore to create new workbooks based on it) and for you, as the publisher, to have all permissions.

Server administrators can change your permissions after you publish. In team environments with central data management, this is a standard practice.

If you are a server or site administrator, or otherwise have a site role that allows changing permissions on published content on the server, see Permissions Reference in the Tableau Server Help for more information.

To set permissions while publishing a workbook

1. In the Publish Workbook to Tableau Server or Publish Data Source to Tableau Server dialog box, click **Add**.



2. In the **Add/Edit Permissions** dialog box, select a user or group.
3. Select a set of permissions from the **Role** list, or specify individual permissions to create a custom set.

   The list of permissions and the available roles vary depending on whether you are publishing a workbook or a data source. For more information, see Permissions Reference in the Tableau Server Help.

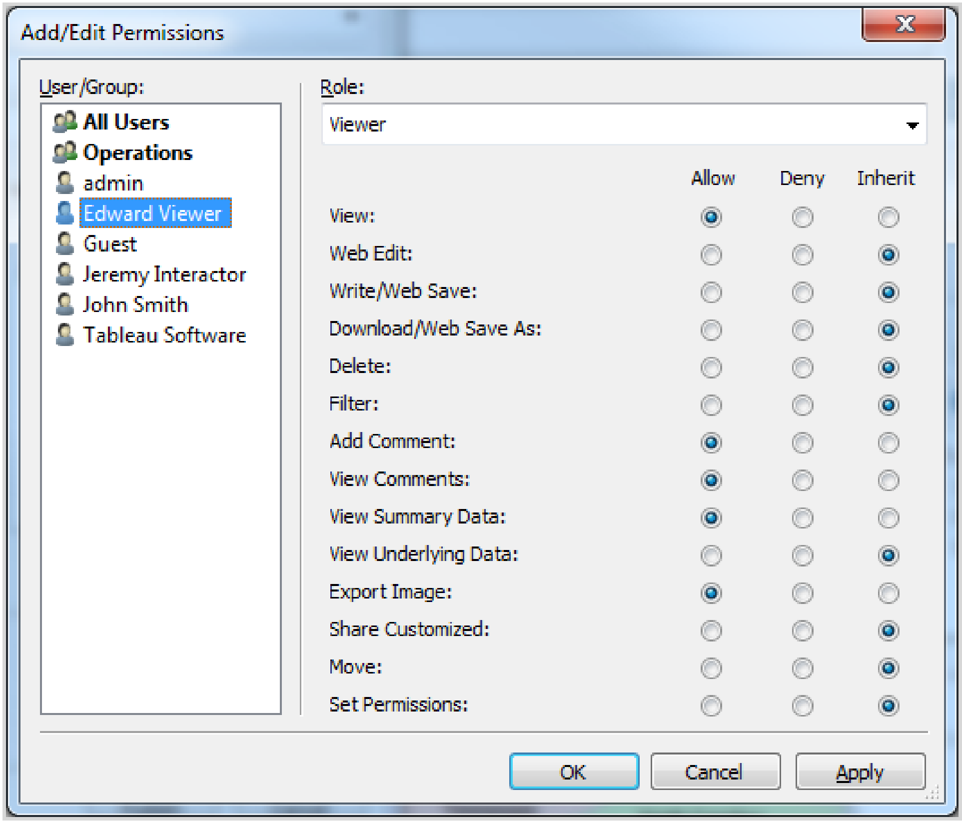


Tableau provides the following pre-set roles when you publish a workbook:

- **Viewer**: Allows the user or group to view the workbook on the server, as well as add and view comments.
- **Interactor**: Allows the user or group to view the workbook on the server, edit workbook views, apply filters, view underlying data, export images, and export data. All other capabilities are inherited from the user's group and project permissions.
- **Editor**: Allows all capabilities to the user or group.

For a data source, the predefined roles are:

- **Data Source Connector**: Allows the user or group to connect to the data source on the server.
- **Data Source Editor**: Allows the user or group to connect to the data source on the server and to publish, edit, download, delete, set permissions, and schedule refreshes for the data source.

If you set a permission to **Inherit**, that permission is determined by the user's group and project permissions.

4. Click **OK**.

Note: If you are adding permissions for multiple users and groups, click **Apply** after specifying permissions for one of them, to continue to the next without having to reopen the dialog box.

Save a Workbook to Tableau Public

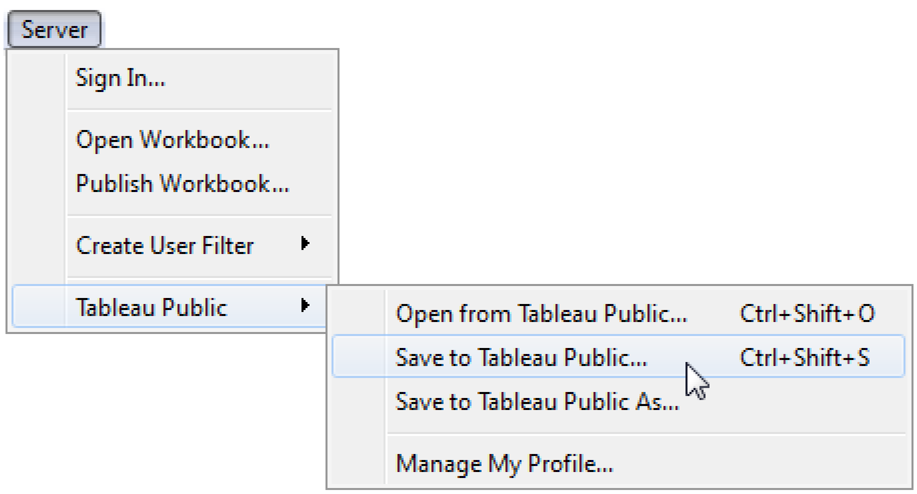
In addition to saving to an internal server, you can also save workbooks to Tableau Public, a free service that lets you publish interactive data to the web. Anyone can interact with data, download it, or create their own visualizations using Tableau Public. For details, see the Tableau Public web site.

You cannot publish a live connection with a workbook when you publish to Tableau Public. Tableau will create an extract of your data source automatically. See **Extract Your Data** on page 379 to learn about extracts.

Note: Follow the same steps to publish workbooks to Tableau Public Premium. Make sure to use your Tableau Public Premium username and password when you sign in.

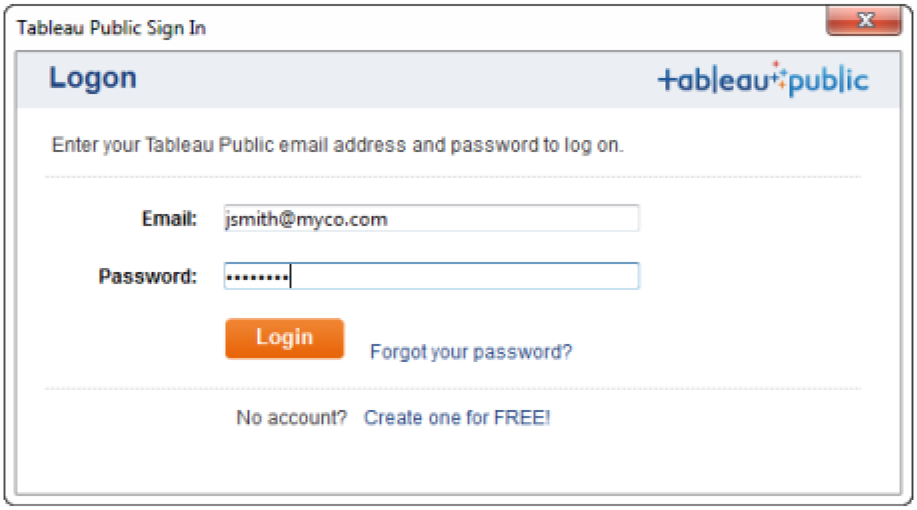
To save a workbook to Tableau Public

1. Select **Server** > **Tableau Public** > **Save to Tableau Public**.



2. When prompted, sign in using your Tableau Public account. If you don’t have one, you

can create one for free.



Workbooks and the underlying data saved to Tableau Public are publicly available. You can manage your content saved to Tableau Public online at public.tableau.com.

Embed Credentials to Streamline Signing In to a Published Workbook

When you publish a workbook to Tableau Server or Tableau Online, that workbook might connect to data on a server that requires anyone who wants to view it to first provide a user name and password (that is, provide credentials).

By default, Tableau prompts people who try to view the workbook on the server for those credentials when they open the workbook.

As the workbook publisher, however, you can allow users to bypass that step and go directly to the workbook. You do this by providing a database user name and password that is always used when a view is opened on the server. This is called *embedding credentials*, and you can only do it if you are the workbook publisher, and your Tableau Server administrator has turned the option on in the Server Settings page.

Note: This procedure does not apply to workbooks that connect to Salesforce, Google Analytics, or Google BigQuery. For information about those data sources, see **Workbooks that connect to Salesforce, Google Analytics, or Google BigQuery** on page 1223 later in this topic.

Workbooks that connect to most data sources

To embed credentials in a published workbook:

1. In the Publish Workbook to Tableau Server dialog box, click the **Authentication** button in the lower left corner.

   The Authentication dialog box lists the data sources used in the workbook that require a user name and password, along with the current user name.

2. Select the data source for which you want to embed credentials, and then select an authentication type. Depending on the data source, choose from one or more of the following options:

   - **Prompt user** Prompt visitors to enter their own database user name and password.
   - **Embedded password** Use the current user name and password to authenticate Tableau Server users when they load the view.
   - **Server Run As account** Use the Server Run As account to authenticate Tableau Server users when they load the view. The Server Run As account is configured by your Tableau Server administrator.
   - **Viewer Credentials** Use in a Kerberos environment. The user's domain user name and password are used to authenticate Tableau Server users automatically when they load the view.

     ### SAP HANA SSO

     If you use single sign-on to SAP HANA and Tableau Server is configured for SAP HANA SSO, select **Viewer Credentials** to authenticate Tableau Server users when they load the view.

     ### Impala and SSO

     If you use Impala with Cloudera Hadoop and Tableau Server is configured for single sign-on, select **Viewer Credentials** to authenticate Tableau Server users when they load the view.

   - **Impersonate via server Run As account** Use the Server Run As account on behalf of a Tableau Server user visiting the view. This option is only available for Microsoft SQL Server data sources that have been configured for impersonation. See Impersonate with a Run As User Account in the Tableau Server Help.
   - **Impersonate via embedded password** Use the current user name and password to authenticate Tableau Server users when they load the view. Tableau Server can be running under any type of account, but it will use these credentials, which you, as the publisher, supply, to connect to the database. This option is only available for Microsoft SQL Server data sources that have been configured for impersonation. See Impersonate with Embedded SQL Credentials in the Tableau Server Help.

Whether you can embed passwords or impersonate is controlled by the Tableau Server administrator. Server administrators control whether publishers can embed passwords in the Server Settings page (**Server** > **Settings** > **General**).

3. Click **OK** to close the Scheduling & Authentication dialog box.

Workbooks that connect to Salesforce, Google Analytics, or Google BigQuery

If you want to embed credentials in a workbook that connects to Salesforce.com, Google Analytics, or Google BigQuery data when you publish it to Tableau Server or Tableau Online, you must follow a different procedure than the one described in this topic.

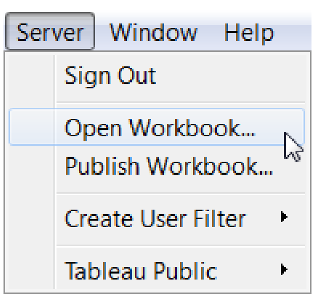
- If you publish to Tableau Server, see Edit Data Source Connections in the Tableau Server Help.
- If you publish to Tableau Online and the workbook connects to Salesforce.com, see Refresh Salesforce Extracts in the Tableau Online Help.
- If you publish to Tableau Online and the workbook connects to Google Analytics or Google BigQuery data, see Refresh Google Data in the Tableau Online Help.

Opening Workbooks from the Server

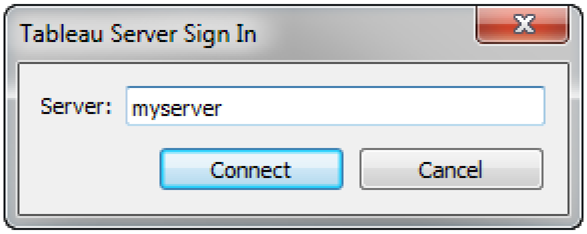
If you have been granted the **Download/Web Save As** permission for a workbook, you can use Tableau Professional to open the workbook from the server. When you open a workbook from the server and make changes, you can either save it to your hard drive or, if you have been allowed the **Write/Web Save** permission, you can republish the workbook to the server.

To open a workbook from the server:

1. Select **Server** > **Open Workbook**.



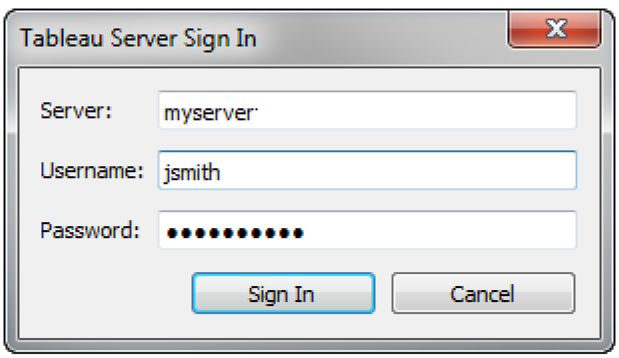
2. If you are not already signed in to Tableau Server, you see the Tableau Server Sign In dialog box.



Enter the server name or URL (for example, sales_server, or https://sales_server) and click **Connect**.

If Tableau Server is Kerberos-enabled and you are on a machine with valid Active Directory credentials, you will connect automatically to the server. In this case, you can skip step 3. If Kerberos authentication fails, you will be prompted to provide a user name and password for authentication.

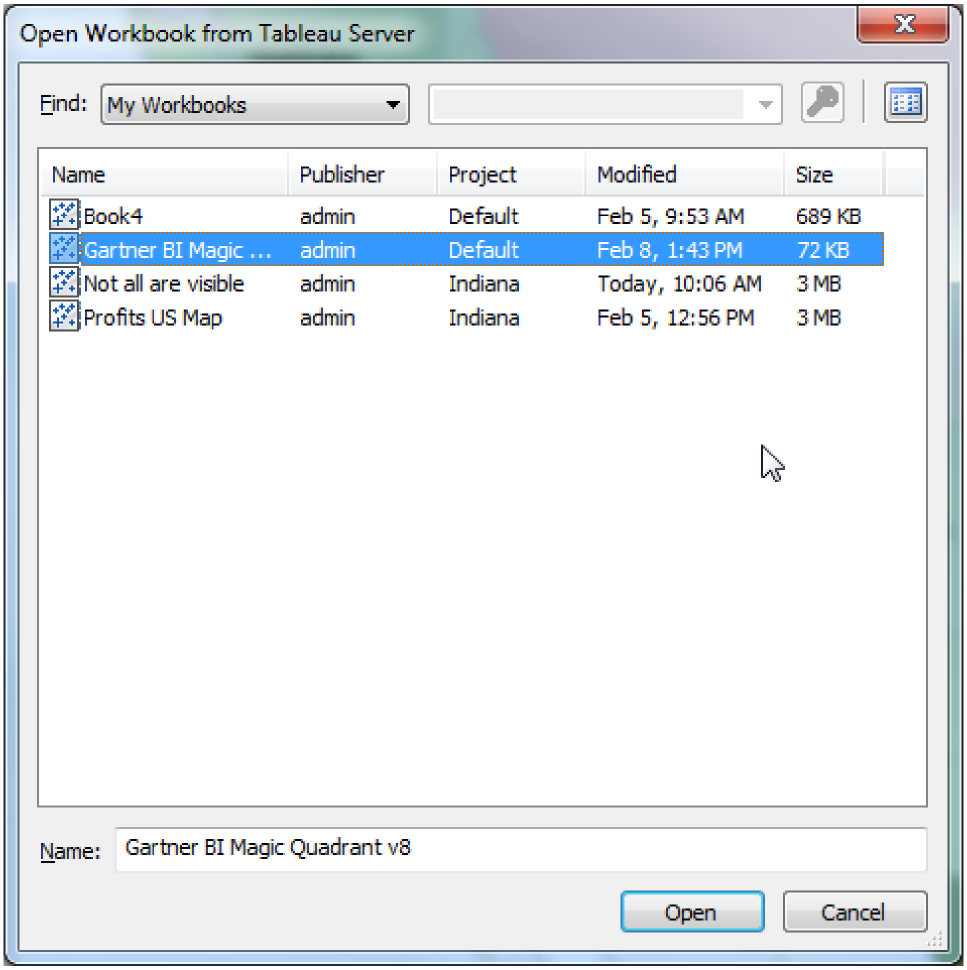
3. Next, enter your user name and password and click **Sign In**.



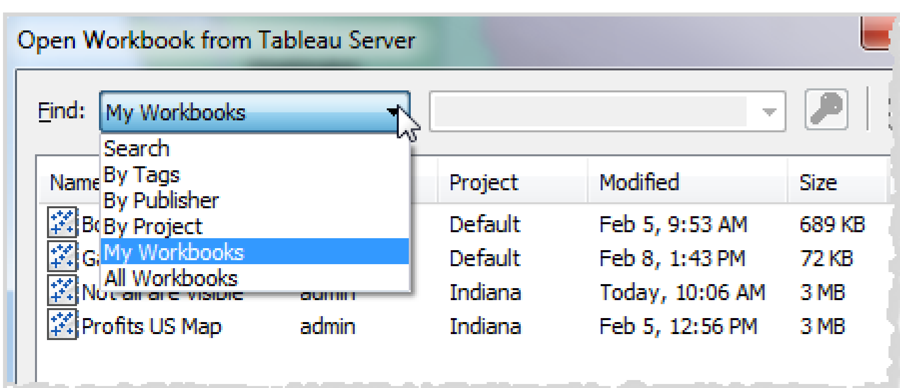
If Tableau Server is configured to use Active Directory, enter your Windows user name (the domain is not required—except in multi-domain environments where the user is not in the default domain); otherwise, enter your Tableau Server user name.

If Tableau Server is configured to use SAML for user authentication, you won't see the above dialog box. Instead, you'll see a sign in prompt from an external identity provider.

4. In the Open Workbook from Tableau Server dialog box, select the workbook you want to open.



You can find workbooks using the **Find** drop-down lists. You can search all workbooks on the server or find by tags, publisher, project, or workbooks that you published.



If you choose **Search** from the drop-down list, you can then enter a search string in the search box to the right. If you type an unquoted string in the search box, Tableau will search for workbook names that begin with the string that you type. If you type a quoted string, Tableau will search for workbook names that contain the string.

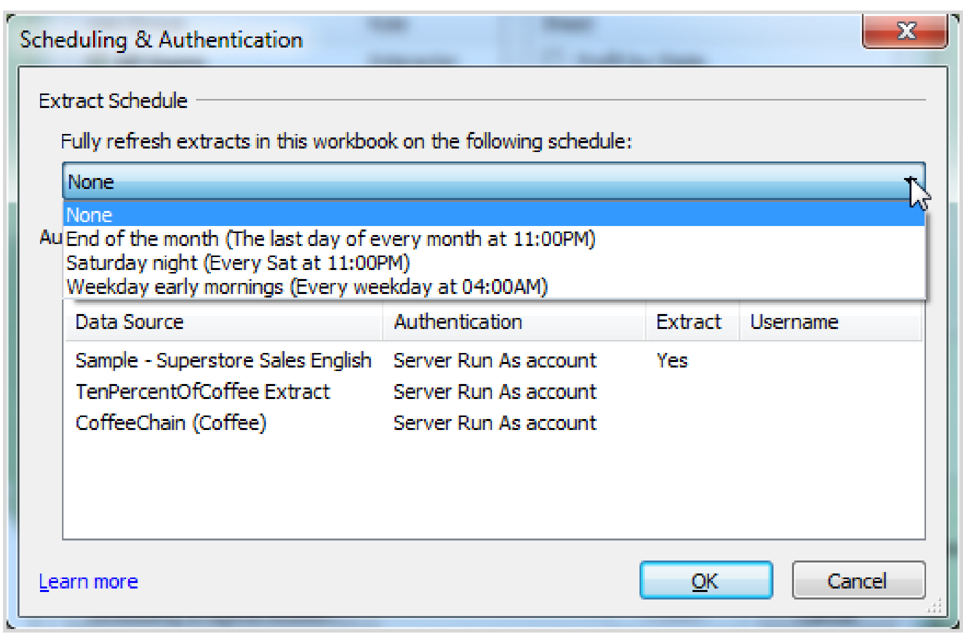
6. Click **Open**.

Refreshing Data Inside Workbooks

When you publish workbooks that connect to extracts you can schedule the extracts to be refreshed automatically. That way you don't have to republish the workbook every time the underlying data has updated and you can still get the performance of a data extract. For example, let's say you have a workbook that connects to a large data warehouse that is updated weekly. Instead of publishing a workbook that queries the live data, you can create an extract including just the data necessary. This increases performance and avoids queries to the live database. Then you can add that workbook to a schedule so that the extract is refreshed at regular intervals with updated data from the data warehouse.

Schedules are created and managed on the server by an administrator. However, an administrator can allow you to add a workbook to a schedule when you are publishing from Tableau Desktop.

1. As you are publishing a workbook, in the Publish Workbook to Tableau Server dialog box, click **Scheduling & Authentication**.
2. In the Scheduling & Authentication dialog box, select a schedule for the workbook:



All data sources that require authentication must have an embedded password so that the extract can be refreshed. This includes data sources that are not extracts. For more information about embedding credentials, see **Embed Credentials to Streamline Signing In to a Published Workbook** on page 1221.

Note: If you have published extracts to Tableau Online, consider using the Tableau Online sync client to keep them fresh. You can schedule refreshes for extracts for which Tableau Online cannot reach the source data directly—for example, data that you maintain on-premises or Oracle data hosted on a cloud platform. You start the Tableau Online sync client by choosing Start Tableau Online Sync Client from the Server menu in Tableau Desktop. For details, see Quick Start: Schedule Refreshes Using Tableau Online Sync in the Tableau Online help.

User Filtering

User filtering is a special kind of filter that allows you to limit the data any given person can see in a published view. For example, in a sales report that gets shared with regional managers, you may want to only allow the Western Regional Manager to see the western sales, the Eastern Regional Manager to see the eastern sales, and so on. Rather than create a separate view for each manager, you can define a user filter that allows each manager to see the data for a particular region.

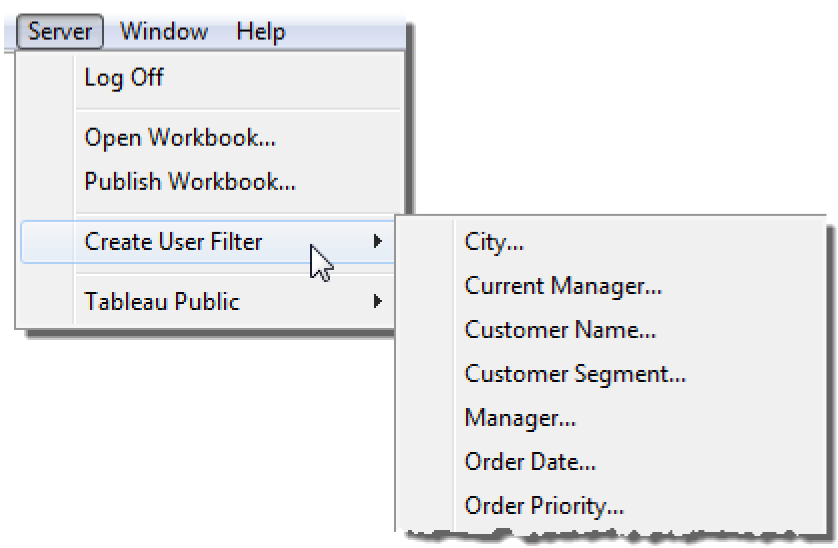
A user filter is defined for an individual field. Users or groups are given permission to see a subset of the members in that field. In the sales report example above, the user filter is defined for the Region field, and each manager is given permission to see a corresponding region.

You can define a user filter for any dimension or multidimensional hierarchy. In addition you can define user filters for sets, binned fields, and groups that you've created. The user list comes from Tableau Server. When you publish to Tableau Server the view is adjusted based on who is signed in and looking at it.

How to Create a User Filter

You can create as many user filters as you like for a given view.

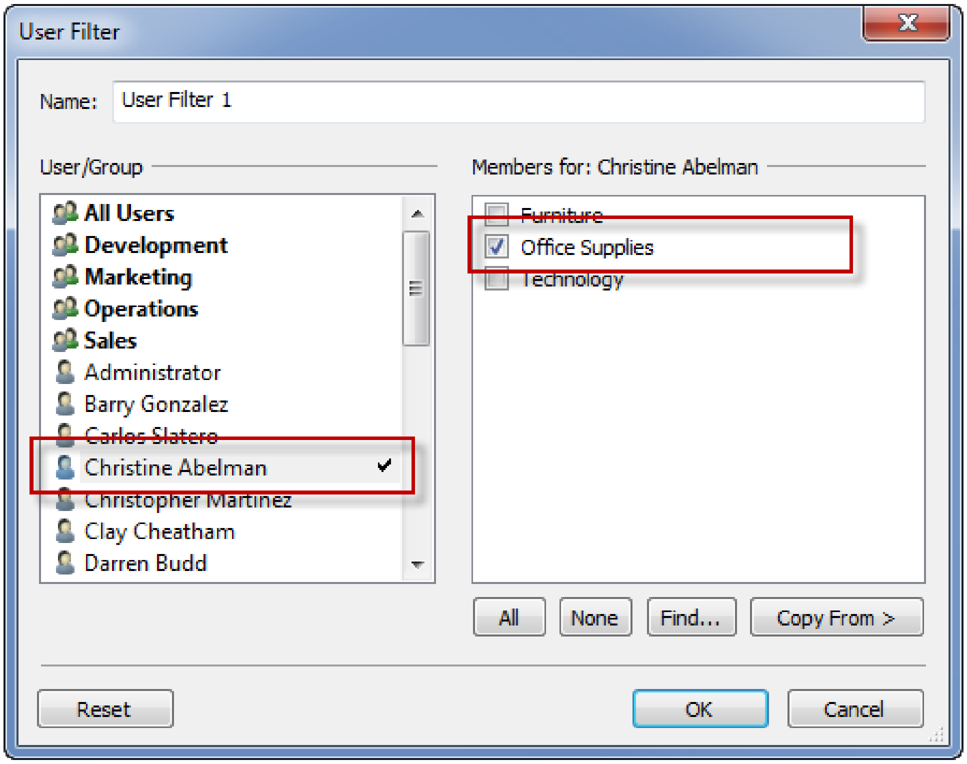
1. Select **Server** > **Create User Filter** and then select a field that you want to filter on. For example, if you are limiting product data, each person can select the Product field.



2. If prompted, sign in to Tableau Server. See **Publish a Workbook** on page 1213 for information about signing in.
3. In the User Filter dialog box, type a **Name** for the set of rules you are creating. For

example, if you are filtering on product information you could name it Products by User.

4. Select a user or group in the list on the left; then on the right select the members of the field that the selected users are allowed to see. Repeat this process as necessary until everyone is assigned the correct set of members. If there are a large number of users and groups, a search box is available on the left side of the dialog box.

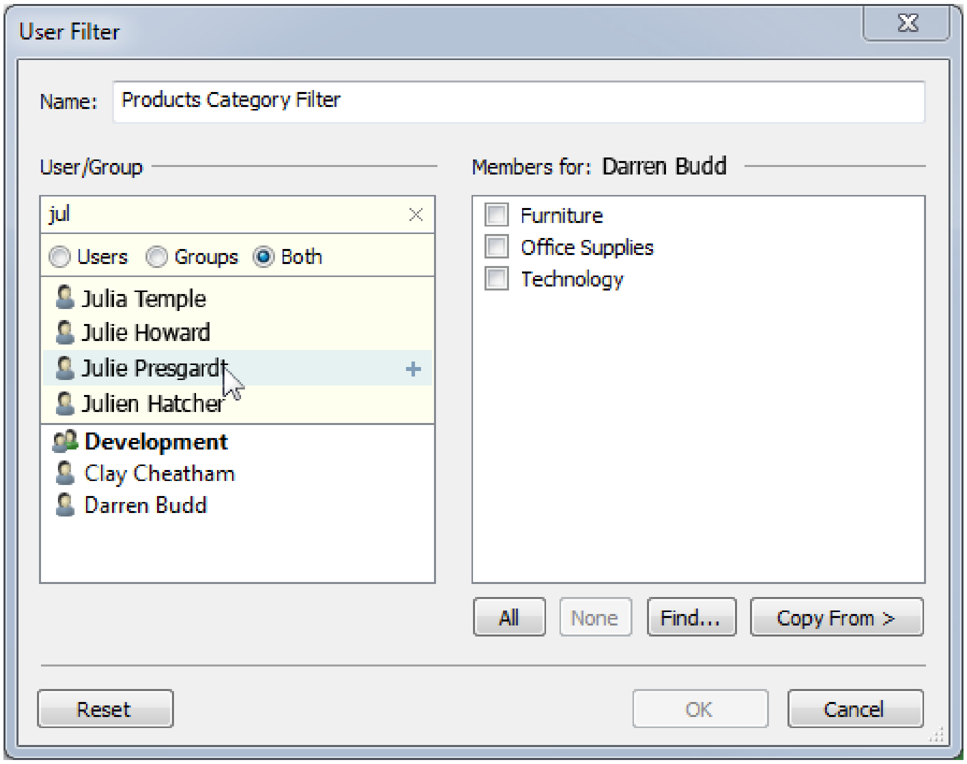


5. When finished, click **OK**.

   The user filter now shows in the Sets area of the Data pane. Drag the new set to the Filters shelf to begin using it in a view. See **Example - Setting User Filters** on page 1235 for a step-by-step example of defining user filters.

Finding Users in the User Filter Dialog Box

When there are many users and groups on the server, a search box is displayed on the left side of the User Filter dialog box. Begin typing the name of a user or group into the text box at the top of the list of users. When ready, press Enter on your keyboard or click the Search icon. Matching names and groups appear in a drop-down list. You can filter the results to only show Users or Groups, or show both User and Groups. Click on a user or group name to add it to the selection. Continue to search and add to the selection until you have the list you need.

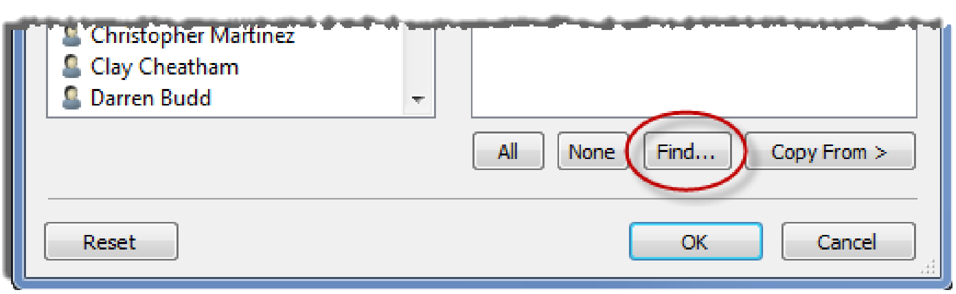


Finding Field Members in the User Filter Dialog Box

Some fields have a large number of members that are difficult to select one by one. You can find and select members easily using the Find dialog.

To find members in the User Filter dialog box:

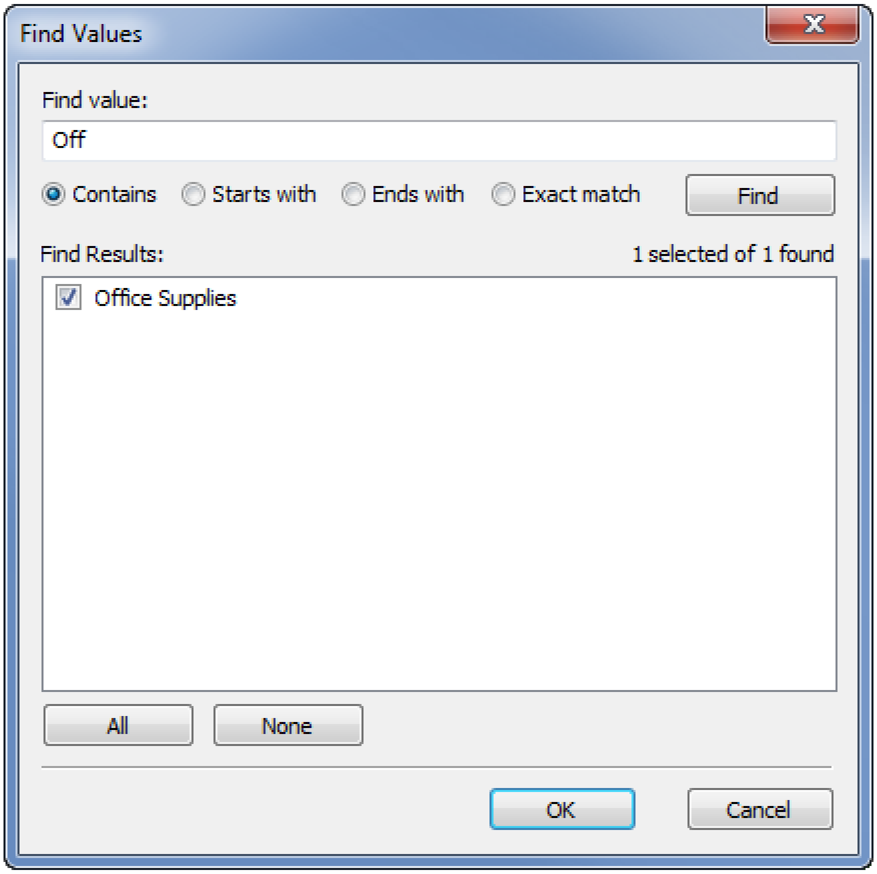
1. Click the **Find** button at the bottom of the list of members.



2. Type all or part of the member name into the **Find value** text box at the top of the Find Values dialog box. Then click **Find**. You can change the search criteria by selecting whether to return members that **Contain**, **Starts with**, or is an **Exact match** for the text

you typed.

3. Select one or more members from the results shown in the bottom half of the dialog box. After you select the members of interest you can continue to search for other members until you have all necessary members selected.



4. When finished, click **OK** to return to the User Filter dialog box.

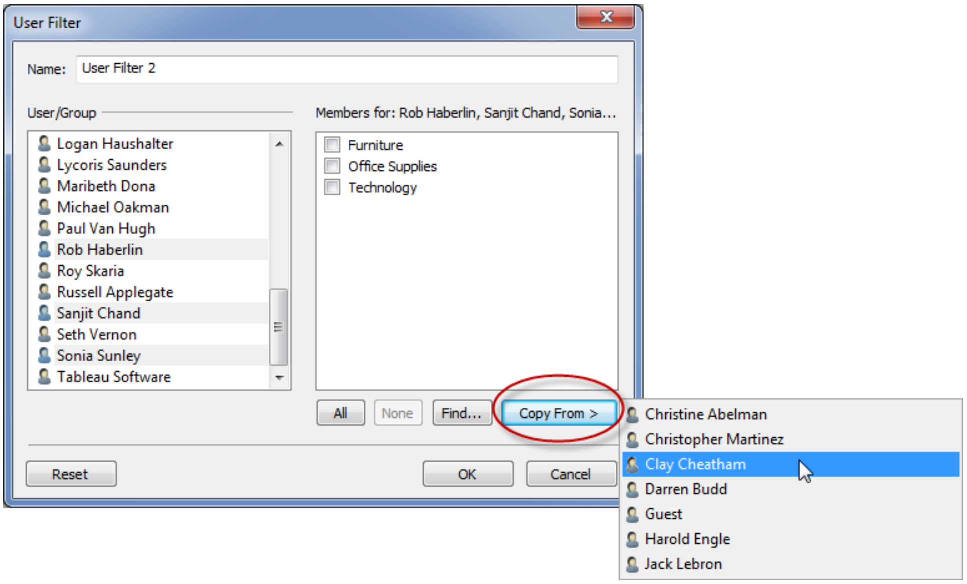
Copying member selections from other users

As you specify which members each user or group can see, you may want to just duplicate the member selections you already set for another user or group. For example, if you specify that the Product Manager can see a list of 50 products and then decide that you want to set the same filter for everyone else on the team, you can simply duplicate the member selection instead of having to select the products again.

To copy a member selection from another user or group:

1. Select the user or group that you want to copy the member selection to.
2. Click the **Copy From** button at the bottom of the member list.

3. Select the user or group that you want to copy the member selection from.



Previewing User Filters

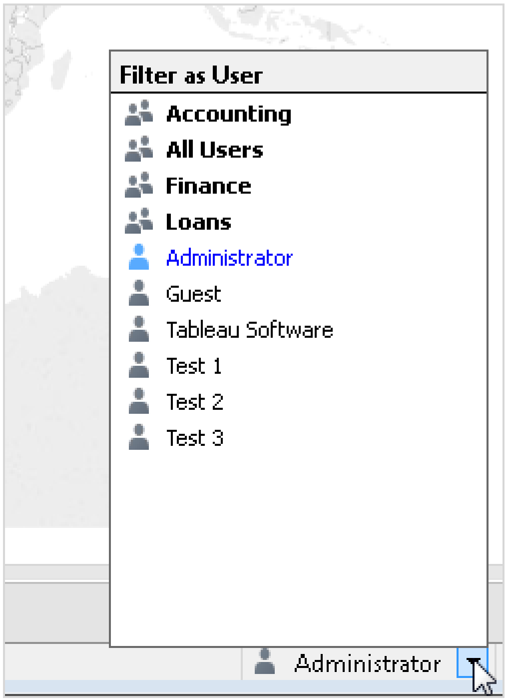
When a workbook contains one or more user filters and you are connected to Tableau Server, the Filter as User menu appears in the bottom right corner of the workbook window. The Filter as User menu allows you to preview what each user or group will see when they look at the view on Tableau Server.

Note: Previewing user filters is not available for connections to Tableau Server data sources.

To preview a user filter

1. Open the Filter as User menu by clicking on the black arrow in the bottom right corner of the workbook window.
2. Select a user or group that you want to preview as.
3. The selected user or group is shown in blue at the bottom of the workbook window and

the view updates to only show the appropriate data.



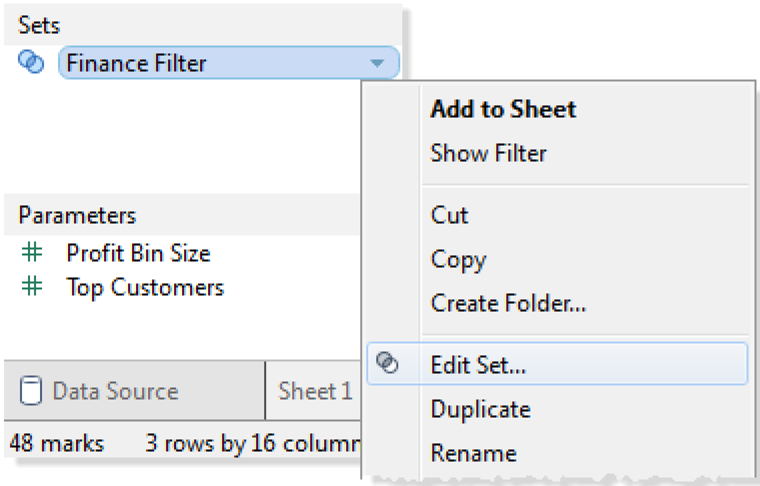
Note: At any time you can return to viewing the workbook as yourself by clicking **Reset** in the top right corner of the Filter as user menu.

Editing User Filters

After you create a user filter you can go back and edit it just like you can edit other sets.

To edit a user filter

1. Right-click (control-click on a Mac) the user filter in the Sets area of the Data pane and select **Edit Set**.



2. If necessary, sign in to Tableau Server. See **Publish a Workbook** on page 1213 for details on signing in to the server.
3. In the User Filter dialog box, make the necessary changes and click **OK**.

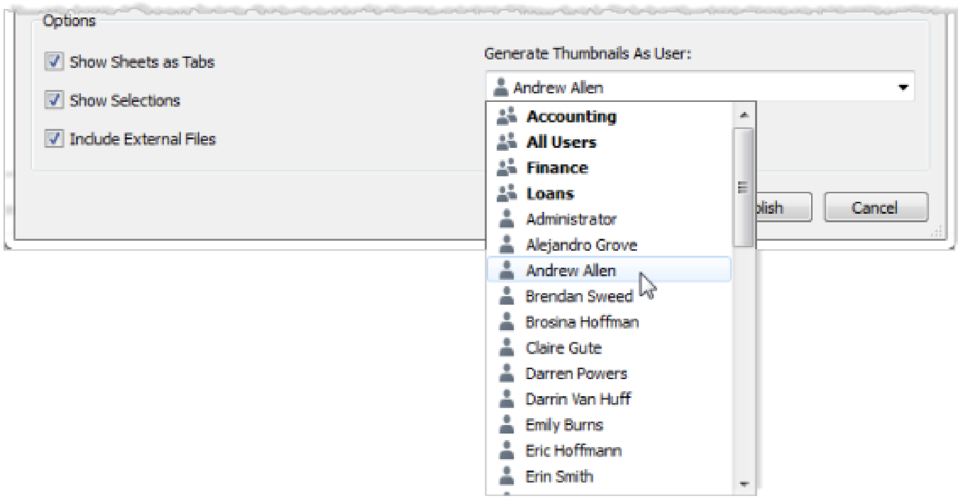
Note: If you modify a user filter while not signed in to the server, the set will only show users and groups that have a user filter specified. Sign in to see all users and modify the user filter.

Publishing with User Filters

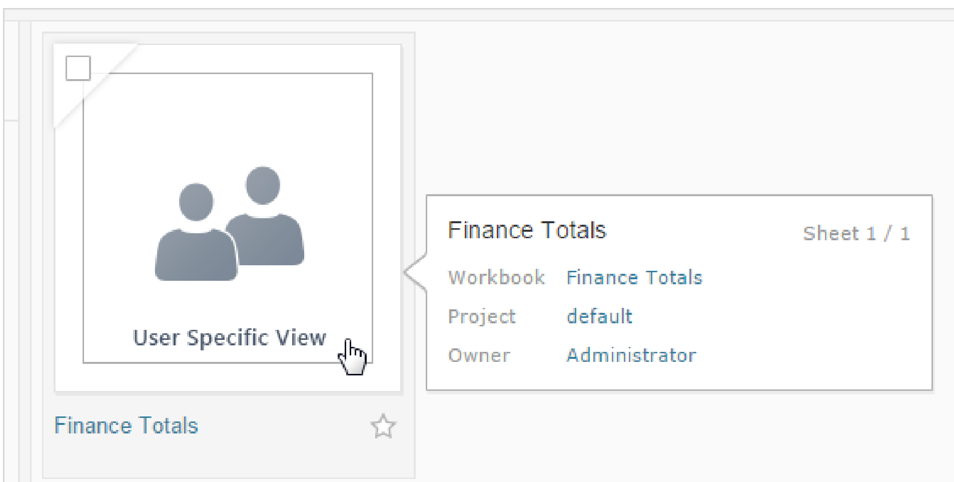
When you publish a workbook, it and its contained sheets are represented with thumbnail images on the server. You can specify what these thumbnail images will look like by selecting to generate thumbnails as a specific user. For example, if you want the thumbnail image to show all three regions of a sales forecast, you can select to generate thumbnails as the manager who is allowed to see all regions.

To specify how to generate the thumbnails

- In the publish dialog box, select a user or group in the **Generate Thumbnails as User** drop-down list.



If the user you select cannot see any data, a “blank” thumbnail is displayed.

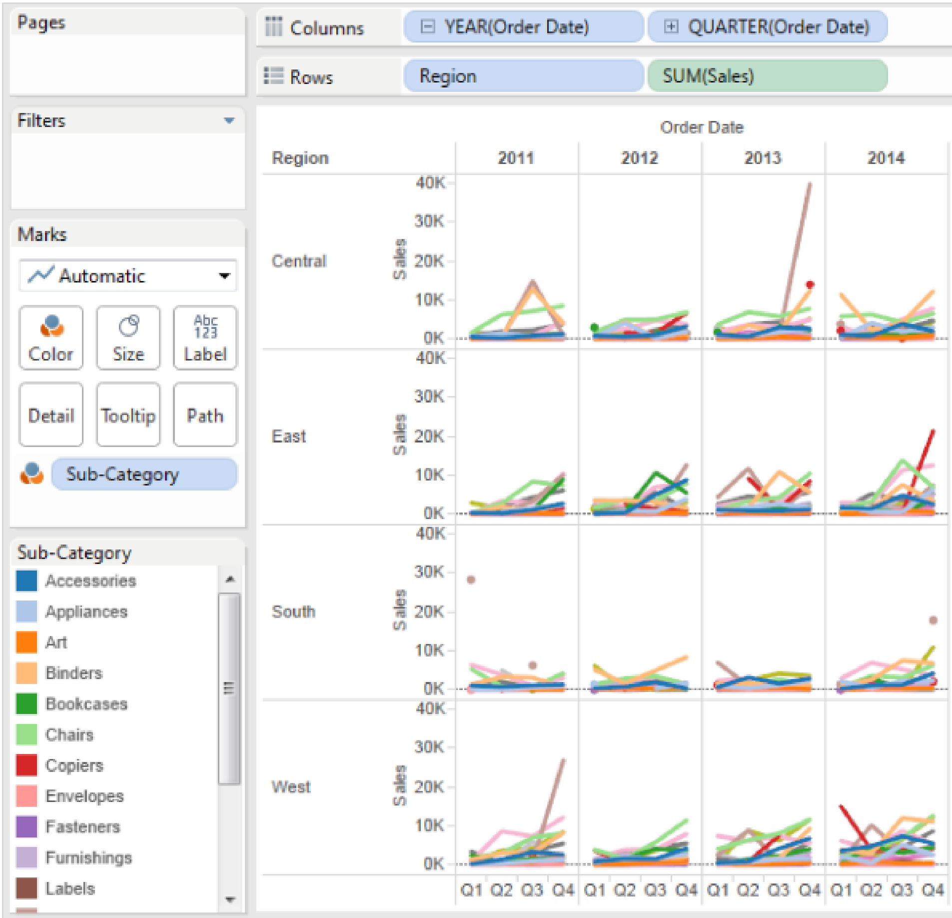


Note: The **Generate Thumbnails as User** option in the publish dialog box is only available when the workbook contains one or more active user filters.

Example - Setting User Filters

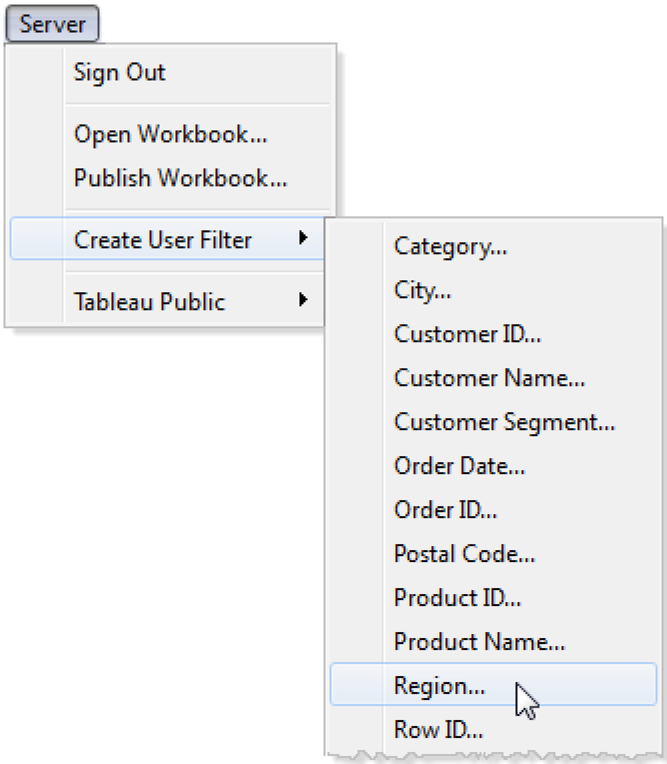
The following example demonstrates how to set user filters on a sales report so that when it is published regional managers will only see data for their respective region.

The sales report is shown below.

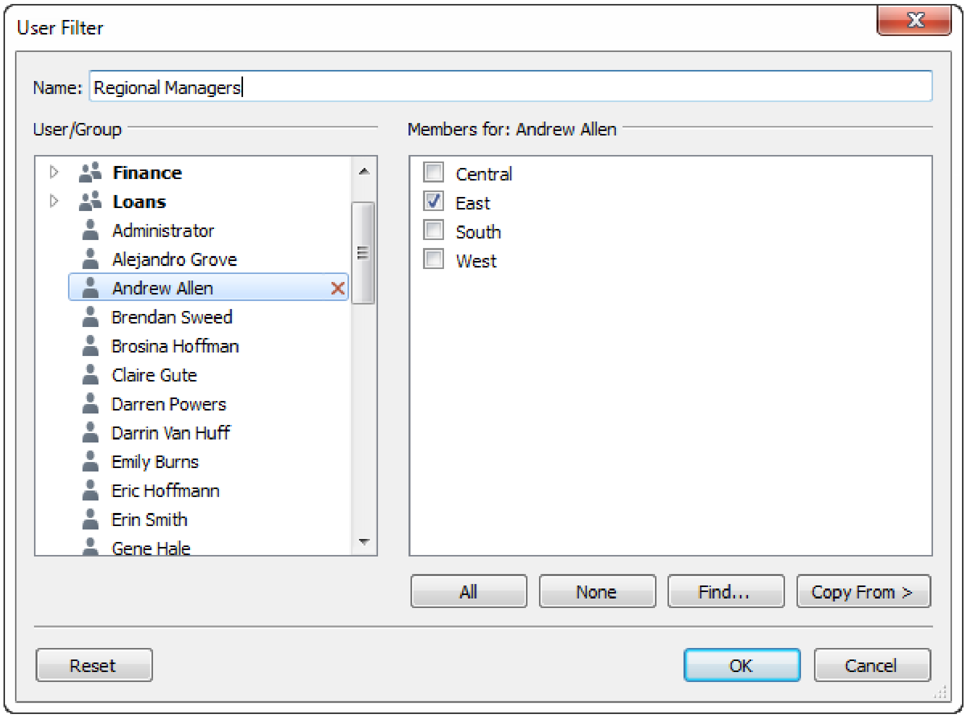


As you can see the view shows the quarterly sales over several years for each region and product category. Now suppose you are going to publish this view to the server so each of the three regional managers can track their sales. However, you want to limit each manager to only see data relevant to their region. To do that you need to set up a user filter.

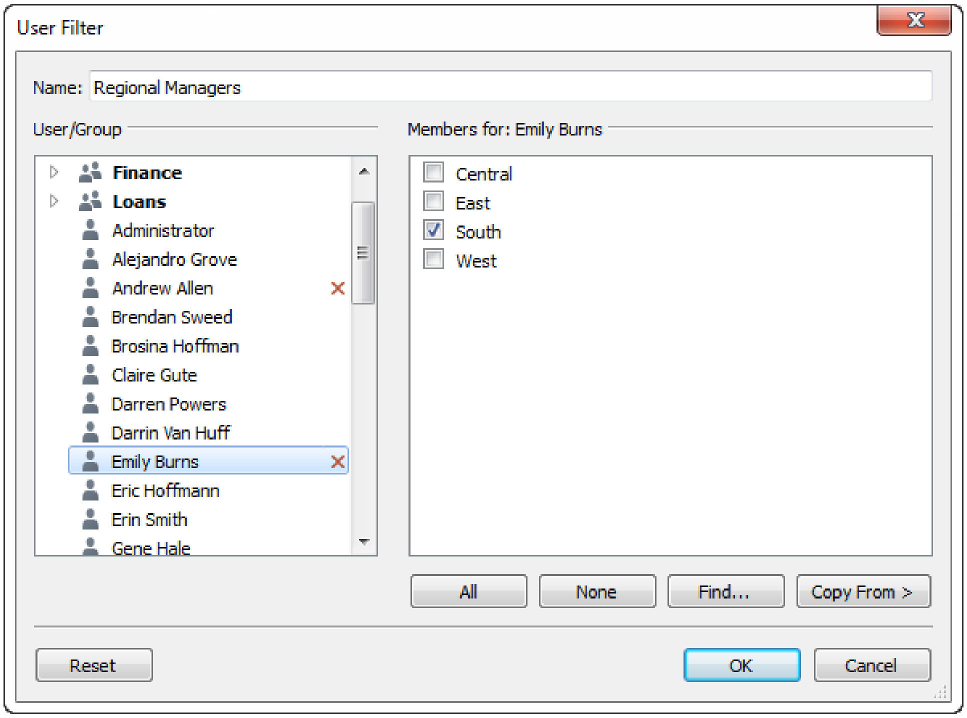
1. Select **Server** > **Create User Filter**. Then select the field you want to use for filtering the view. This example uses **Region**.



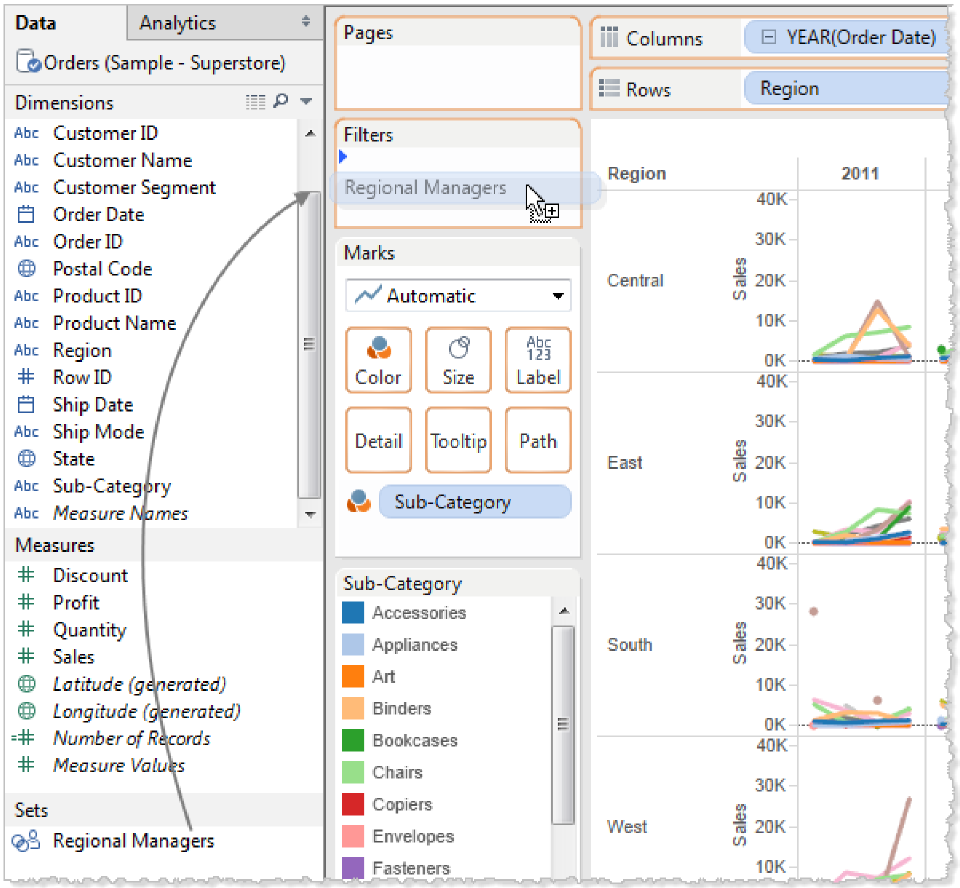
2. If prompted, sign in to Tableau Server. For more information, see **Publish a Workbook** on page 1213 for details on what to do.
3. Type a name for the user filter. In this example, the filter name is Regional Managers. After specifying the filter, the filter display under the **Sets** area of the Data pane.
4. Select one or more users and groups that are allowed to see the different values in the filter. For this example, because Andrew Allen is the eastern regional manager, his name is selected under **User/Group**, and East is selected under **Members for**.



5. Repeat this process as many times as necessary. In this example, there are two managers, each with responsibility for a specific region. If a name is not selected, that person will be unable to able to see data for any of the regions.

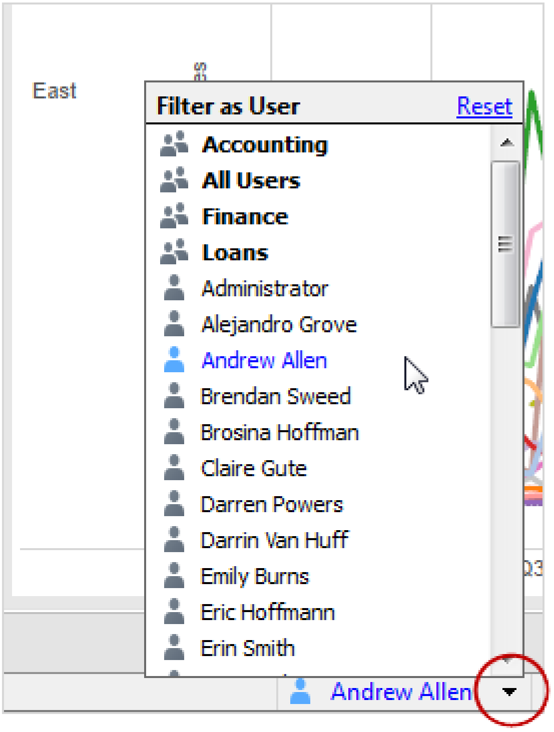


6. When finished, click **OK**. The user filter is now visible under the **Sets** area of the Data pane.
7. Drag the user filter to the **Filters** shelf to apply the filter to the view. The filter becomes a context filter. For more information, see **Filtering** on page 608.



When you apply a user filter to a view, it's possible that you will not see anything. For example, in this case you have not allowed yourself to see any of the three regions. To edit a user filter, right-click (control-click on a Mac) the user filter in the Data pane, and then select **Edit Set**.

At anytime, you can preview what the view will look like for each user using the **Filter as User** menu in the lower-right corner of the workbook. This menu lists all users and groups. Selecting a user or group lets you preview what the selected user will see after the view is published.



Filter Using a List of Users in Your Data Source

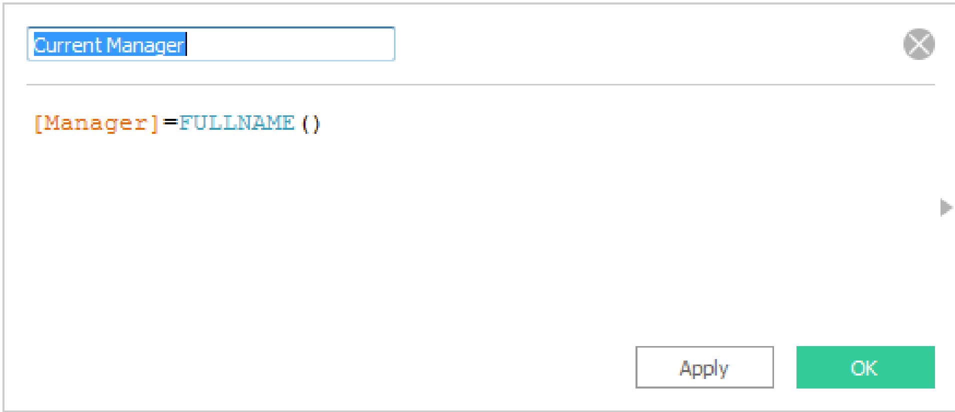
Sometimes there is a field in the data source that contains your users. When this is the case, you can create user filters based on the users in the field rather than having to create a set based on Tableau Server users. For example, in a view showing the sales performance for several employees, you could set a filter that only shows the data for the employee that is currently signed into the server. User filters that are based off of users that are part of your data source can be created using a calculated field and the user functions.

Example of a user filter using users from the data source

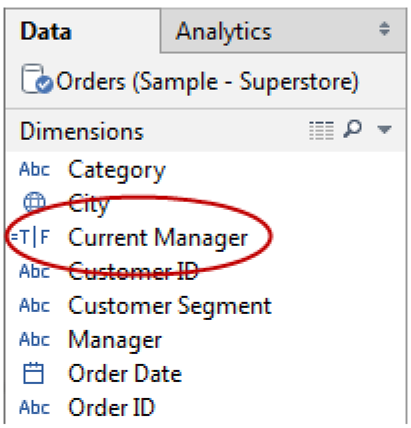
This view shows the annual sales performance for a list of managers. When the view is published, you may only want each manager to see their own sales numbers. In order to do that you need to create a user filter that restricts the manager field to only include the user that is currently signed in.

To create a user filter based on the users in a field

1. If you have not already signed in, select **Server** > **Sign In** to sign in to Tableau Server.
2. Create a calculated field by selecting **Create Calculated Field** on the Data pane menu.
3. In the Calculated Field dialog box , do the following, and then click **OK**:
    1. Name the field.This example uses Current Manager.
    2. Enter a formula similar to the following: `[Manager]=FULLNAME()`



The calculated field displays under the Dimensions area of the Data pane.

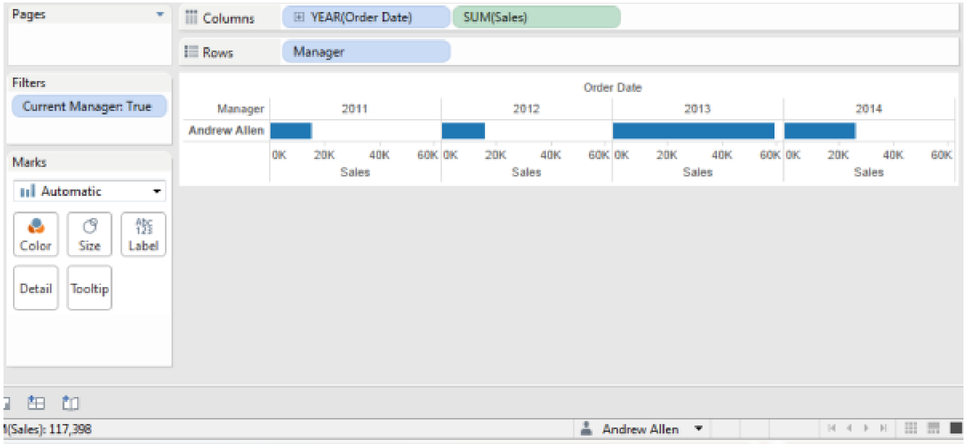


> **Note**: Be sure to verify that manager names in the data source match the names returned by the FULLNAME function in Tableau. If your filter is not working as intended, this may be the reason.

4. Drag the calculated field to the **Filters** shelf.

   If you are not one of the users in the view (in this example one of the managers) the only option in the Filter dialog box will be False. In that case you should select nothing and click **OK**. Then you can preview the view as another user and edit the filter to include **True**. Otherwise, if you are one of the managers you can select **True** so you only include managers who match the current user. You can preview what other users will see using the Filter as User menu in the bottom right corner of the workbook. See **Previewing User Filters** on page 1232 to learn more.

In the example view below, data about Andrew Allen displays as if he was signed in.



Include the User Filter in a Tableau Server Data Source

To include the user filter in a Tableau Server data source, you must create a data source filter before publishing. This data source filter relies on the user filter that you created above, which is based on the users in the field in the data source.

To create a data source filter based on the user filter

1. On the Filter shelf, right-click the user filter, and then select **Apply to Worksheets** > **All Using This Data Source**.
2. In the Data pane, right-click the data source, and then select **Edit Data Source Filters**.
3. Ensure that the user filter you created in step 3 of the above procedure is listed under **Filter**, and then click **OK**. If the user filter is not listed, click **Add**, select the user filter from the list, and then click **OK**.
4. Publish the data source. For more information, see **Publish a Data Source** on page 1208.

Save and Export

After you create views in Tableau, you may want to save or share your work. You can export your work in a number of different formats to be used in different applications such as Microsoft PowerPoint and Microsoft Excel.

Saving Your Work

After you create useful views of your data, you should save the results. Tableau provides three ways for you to save your work:

- Workbooks – Saves all open worksheets.
- Packaged Workbooks– Saves the workbook along with all referenced local file data sources and images into a single file.
- Bookmarks – Saves the current worksheet.

You can share workbooks and bookmarks with your co-workers, provided they can access the relevant data sources. If your co-workers do not have access to the data sources, you can save a packaged workbook.

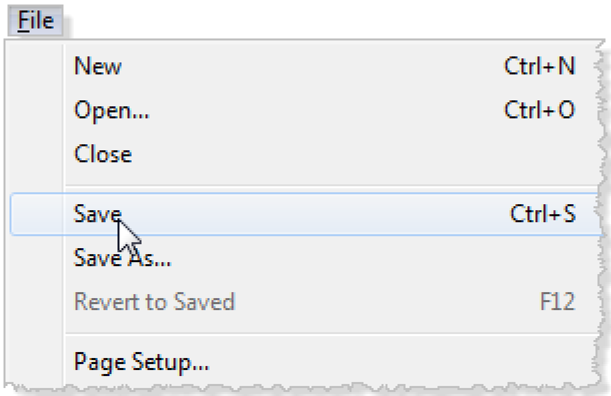
Custom fields such as binned measures, calculated fields, groups, and sets are saved with workbooks and bookmarks.

Workbooks

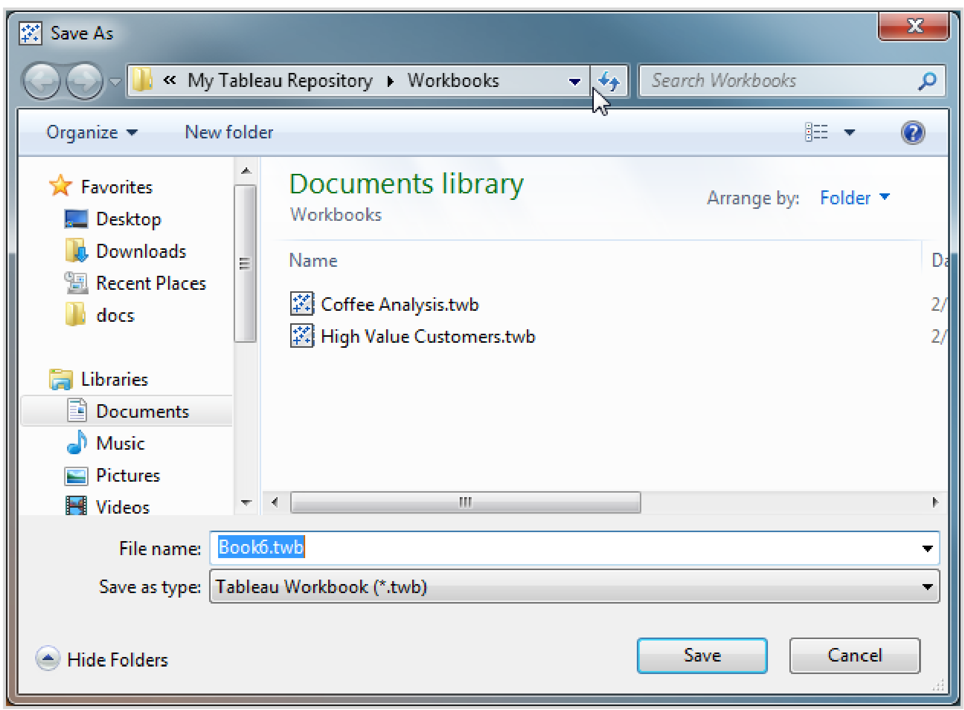
When you open Tableau, it automatically creates a new workbook. Workbooks hold the work you create and consist of one or more worksheets. Each worksheet contains a particular view of your data.

To save a Tableau workbook:

1. Select **File > Save** or type **Ctrl** + **S**.



2. Specify the workbook file name in the **Save As** dialog box.



By default, Tableau saves the file with the .twb extension. The default location is the **Workbooks** folder in the Tableau repository. However, you can save Tableau workbooks to any directory you choose.

Tableau file names cannot include any of the following characters: forward slash (/), backslash (\), greater-than sign (>), less-than sign (<), asterisk (*), question mark (?), quotation mark ("), pipe symbol (|), colon (:), or semicolon (;).

To save an extra copy of a workbook that you already have open, select **File > Save As** and proceed by saving the file with a new name.

Packaged Workbooks

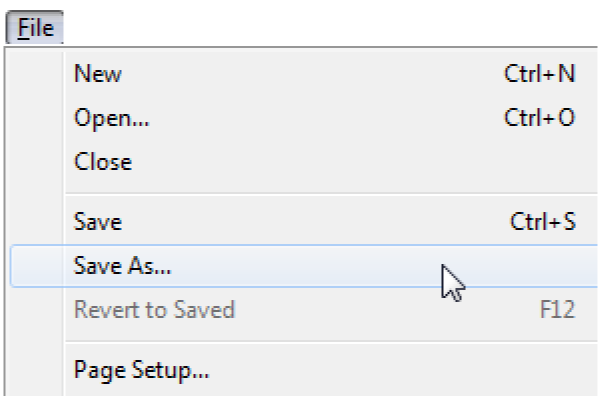
Workbooks often reference external resources. For example, workbooks might reference background images, or local file data sources such as Excel, Access, and Extract files.

When you save a workbook, links to these resources are also saved. The next time you open the workbook, the views are automatically updated with any changes that may have occurred to the data and images. In most cases, you will want to save the workbook in this way. But if you plan to share the workbook with someone who does not have access to the referenced resources, or to publish the workbook to Tableau Server, you might want to save a packaged workbook instead.

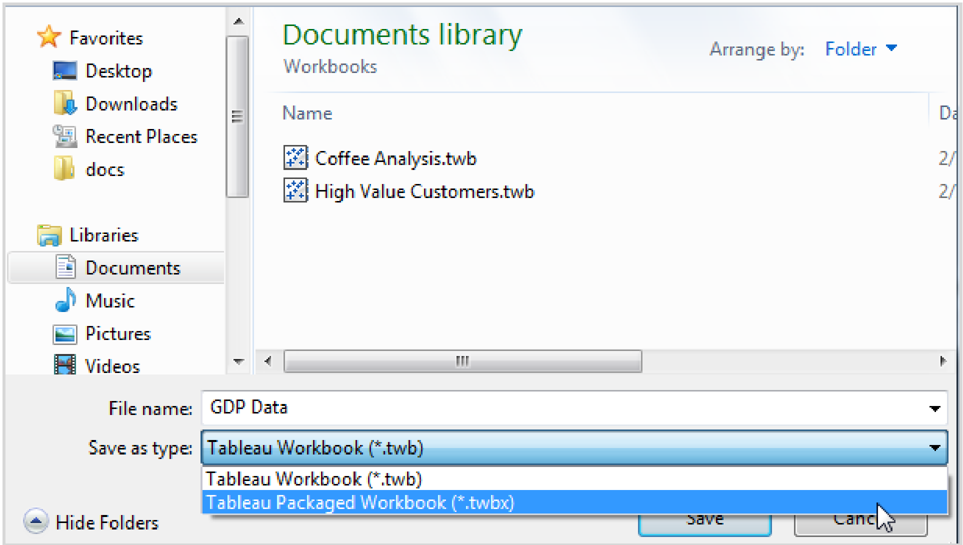
Packaged workbooks contain the workbook along with a copy of any local file data sources and background images. The workbook is no longer linked to the original data sources and images. These workbooks are saved with a .twbx file extension. Other users can open the packaged workbook using Tableau.

To save a packaged workbook:

1. Select **File > Save As**.



2. Specify a file name for the packaged workbook in the Save As dialog box.
3. Select **Tableau Packaged Workbooks** on the Save as type drop-down list.



4. Click **Save**.

The default location is the **Workbooks** folder of the Tableau repository. However, you can save packaged workbooks to any directory you choose.

The following files are included in packaged workbooks:

- Excel Files
- Access Files
- Text Files
- Tableau Data Extract Files
- Local Cube Files
- Background Image Files
- Custom Geocoding

If you are sharing packaged workbooks that contain Microsoft Excel or Access 2007 data sources, the people opening the workbook must either have Microsoft Excel and Access 2007 or the Office 2007 Data Connectivity Components installed on their machines. The data connectivity components are available on the Tableau Tableau Drivers page.

Packaged Workbooks can be unpackaged.

To unpackage a workbook:

- Right-click (Control-click on Mac) the packaged workbook file (.twbx) in Windows Explorer and select **Unpackage**.

When you unpackage a workbook, you will get a regular workbook file (.twb), along with a folder, that contain the data sources and images that were packaged with the workbook.

Bookmarks

You can save a single worksheet as a Tableau bookmark. Bookmarks can be accessed from any workbook using the Bookmarks menu. Bookmarks are convenient when you have worksheets that you use frequently.

To save a Tableau bookmark:

1. Select **Window** > **Bookmark** > **Create Bookmark**.
2. Specify the bookmark file name and location in the Create Bookmark dialog box.

Tableau saves the file with a .tbm extension. The default location is the Bookmarks folder in the Tableau Repository. However, you can save bookmarks to any location you choose. Bookmarks that are not stored in the Tableau repository do not appear on the **Bookmark** menu.

You can organize bookmarks into folders in the same way you organize files or documents. This can be useful when you have a large number of bookmarks to manage. For example, you might organize bookmarks based on employee name, product types, or sales results. You can organize bookmarks by creating a new folder, renaming an existing folder, renaming existing bookmark files, and so on.

Delete bookmarks the same way you would delete any other file on your computer. After you delete a bookmark from the Bookmarks folder in the Tableau Repository, it is removed from the **Bookmarks** menu the next time you start Tableau.

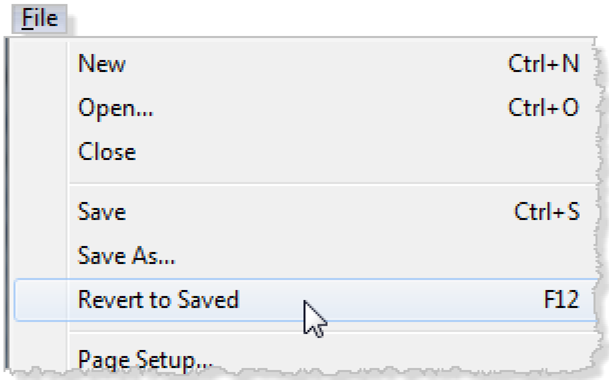
> While bookmarks are generally a snapshot of the worksheet and include the data connection, formatting, etc., a bookmark does not include parameter values and the current page setting on the Pages shelf.

Reverting Workbooks

To revert a workbook is to undo all of the changes you've made to a workbook since you last saved it. You could click through your history using the **Undo** button, but there is an easier way.

To revert to the last saved state of a workbook:

Select **File** > **Revert to Saved**.

1. 

2. Click **Revert** in the warning dialog box.

   Or, just press F12.

> The **Revert to Saved** command is only available for workbooks (.twb) that do not have connections to Extract data sources.

Exporting Your Work

After you have created some data views, you might want to export your results to other applications. Tableau provides several methods for you to export your work:

- Export Data – Copy the data from a view to an Excel worksheet or export as an Access database.
- Export as an Image – Copy images of your views into other applications such as Microsoft Office or PowerPoint. You can also include the images in web pages.

Exporting your results is a convenient way to share your work with coworkers who do not have access to Tableau, or to include your work as part of a presentation or document. You can also use Tableau to present your data.

> **Note:** You can also export selected sheets to incorporate your results into other Tableau workbooks. For information, see **Export and Import Sheets** on page 1259.

Export Data

If you want to export data from Tableau to another application, or create a new data source that contains a portion of the records in your original data source, there are several options in Tableau.

When exporting data, you should keep these rules in mind:

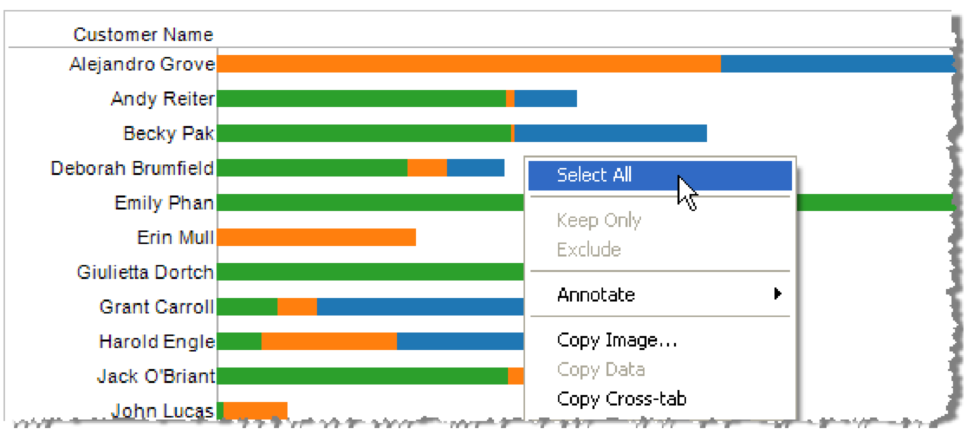
- You can select any portion of a data view to export. If you want to export all data in a view, right-click (control-click on Mac) in the view and choose **Select All**. Copying and exporting to a crosstab always exports all data in the view regardless of what you have selected.
- The fields that are exported to the new data source come from the fields on the worksheet shelves. The exception is fields that are external filters--that is, fields that appear only on the **Filters** shelf.
- If you want to include other fields (either dimensions or measures) with the exported data without changing the basic view, place those fields on the **Level of Detail** shelf.

Copy Records To Clipboard

Typically this function is used to copy records from Tableau into Microsoft Excel. To create an Excel spreadsheet from Tableau data, follow these three steps:

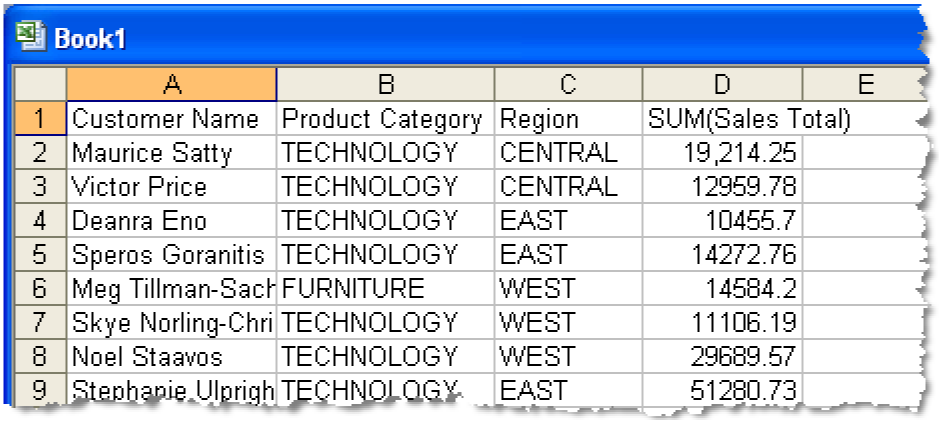
1. Select the desired data in Tableau.

   Right-click (Control-click on Mac) the view and click **Select All**.



2. Select **Worksheet > Copy > Data**, or right-click (control-click on Mac) the view and select **Copy > Data** from the context menu.
3. Open an Excel worksheet and paste the data into a new sheet. Notice that the fields placed on the **Rows**, **Columns**, and **Color** shelves are copied into the sheet. However, the **Customer Segment** field is not copied because it is an external filter (it appears only

on the **Filters** shelf).



Book1

	A	B	C	D	E
1	Customer Name	Product Category	Region	SUM(Sales Total)	
2	Maurice Satty	TECHNOLOGY	CENTRAL	19,214.25	
3	Victor Price	TECHNOLOGY	CENTRAL	12959.78	
4	Deanra Eno	TECHNOLOGY	EAST	10455.7	
5	Speros Goranitis	TECHNOLOGY	EAST	14272.76	
6	Meg Tillman-Sach	FURNITURE	WEST	14584.2	
7	Skye Norling-Chri	TECHNOLOGY	WEST	11106.19	
8	Noel Staavos	TECHNOLOGY	WEST	29689.57	
9	Stephanie Ulprigh	TECHNOLOGY	EAST	51280.73	

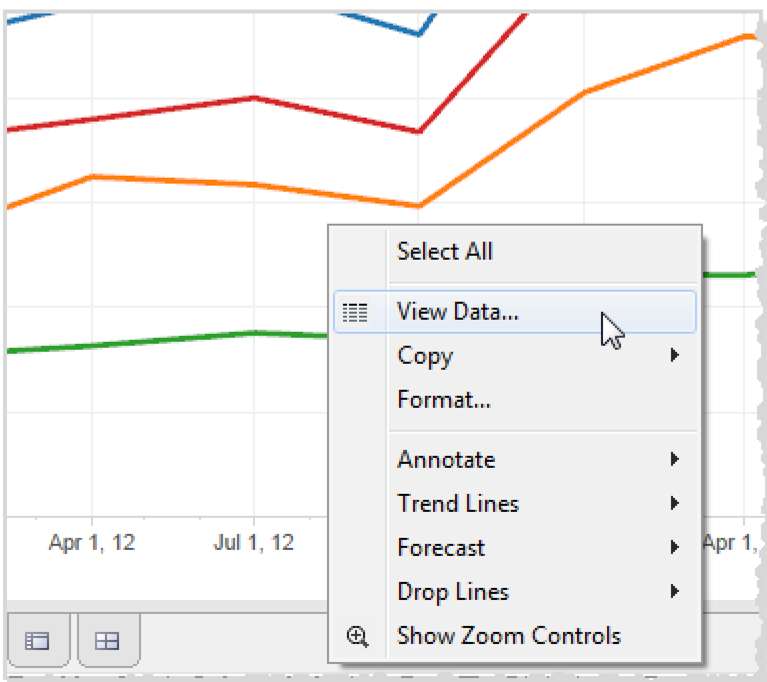
Copy Underlying Records to Clipboard

Copying underlying data can be used to copy the disaggregated data behind a view.

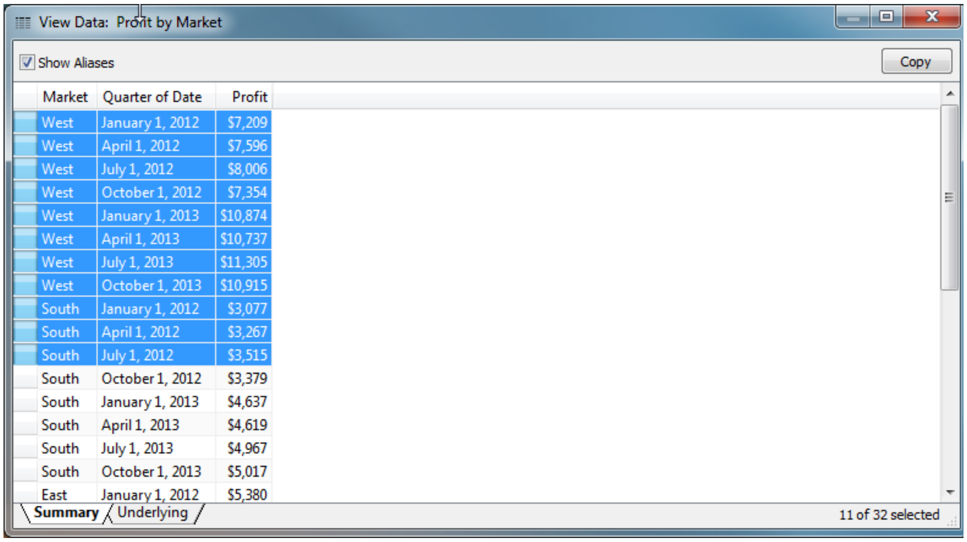
To copy underlying records:

1. Select the desired data in Tableau.

   Right-click (Control-click on Mac) the selected records and select **View Data** on the context menu.

2. 

3. The resulting dialog box shows the Summary data along with the Underlying Data. Select the data you want to copy and then click **Copy** in the upper right corner of the dialog box.



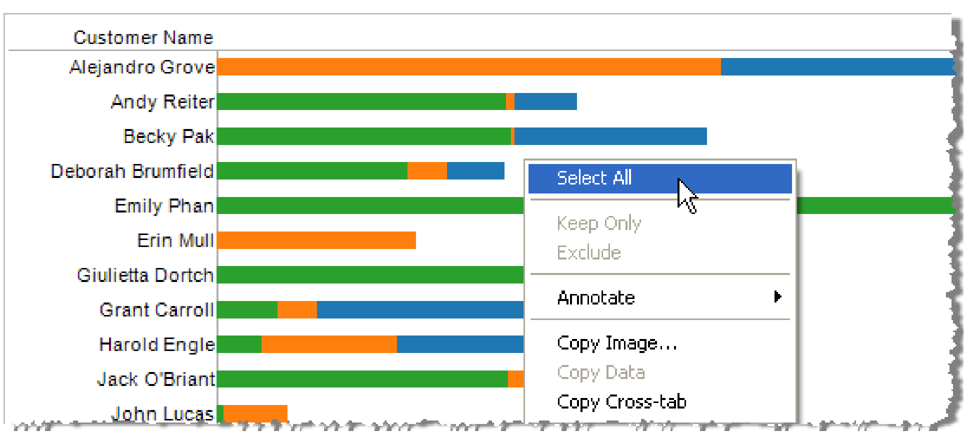
4. Open an Excel worksheet and paste the data into a sheet. Notice that the fields placed on the Rows, Columns and Color shelves are copied onto the worksheet.

	A	B	C	D
1	MarketQuarter	of	DateProfit	
2	CentralJanuary	1,	2012$9,109	
3	CentralOctober	1,	2012$9,215	
4	CentralApril	1,	2012$9,826	
5	CentralJuly	1,	2012$10,112	
6	CentralOctober	1,	2013$13,686	
7	CentralJanuary	1,	2013$13,737	
8	CentralApril	1,	2013$13,888	
9	CentralJuly	1,	2013$14,279	
10	EastJanuary	1,	2012$5,380	
11	EastOctober	1,	2012$5,936	
12	EastJuly	1,	2012$6,346	
13	EastApril	1,	2012$6,499	
14	EastJanuary	1,	2013$8,110	
15	EastOctober	1,	2013$8,809	
16	EastJuly	1,	2013$8,952	
17	EastApril	1,	2013$9,185	
18	SouthJanuary	1,	2012$3,077	

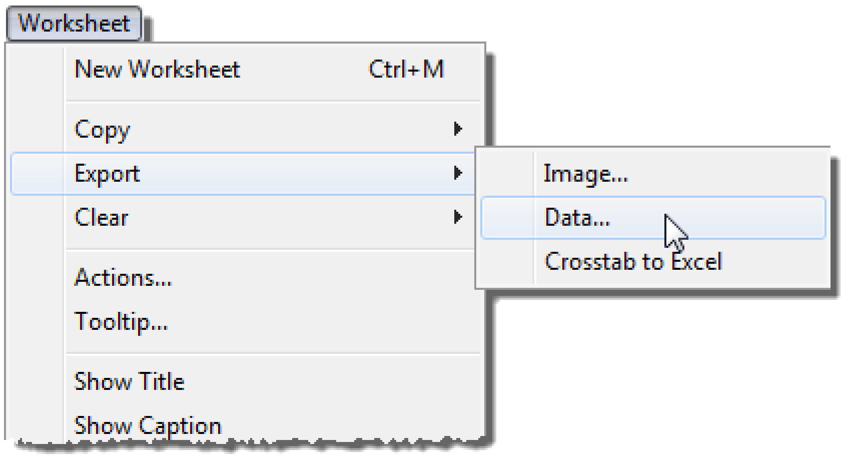
Export Records To Microsoft Access

To create an Access database from Tableau data, follow these steps:

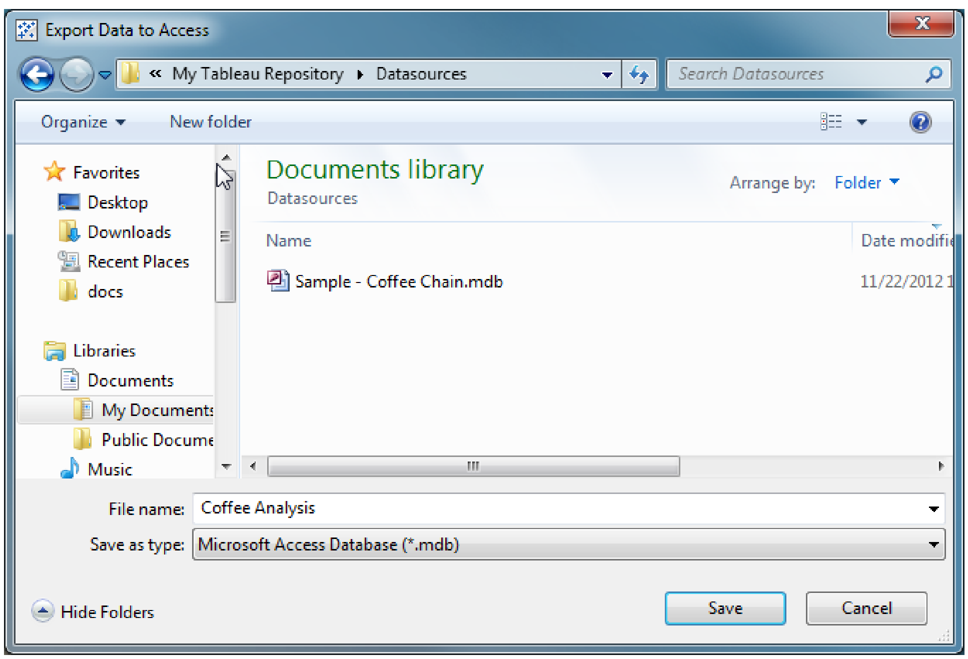
1. Select the desired data in Tableau. Right-click (Control-click on Mac) the view and then select **Select All**.



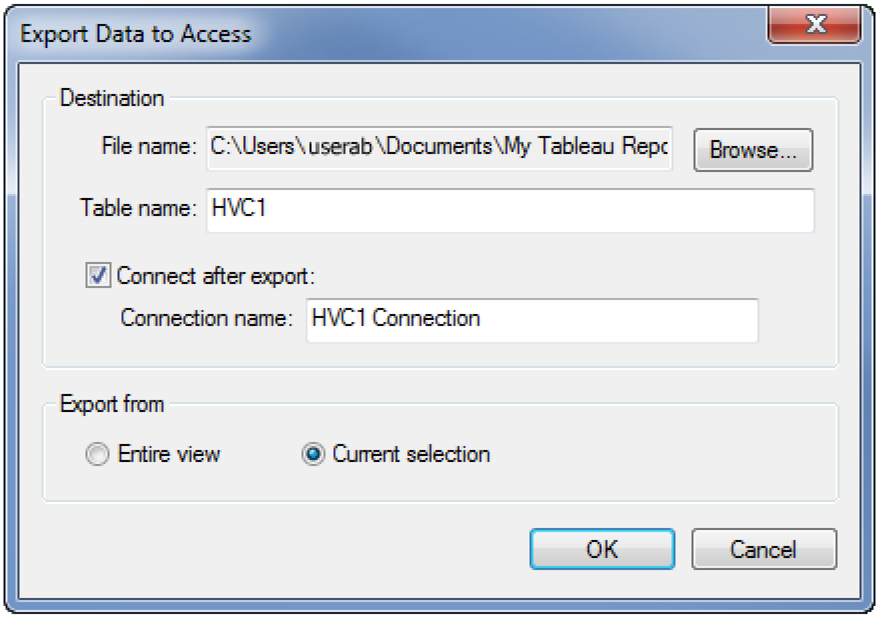
2. Select **Worksheet > Export > Data**.



3. Select a location and name for your Access database. Access databases end with a .mdb file extension.



4. Type a name for the database and click **Save**. The Export Data to Access dialog box is now displayed. The Connect after export option allows you to immediately connect to the new data source and continue working in Access without interrupting your work flow.



Copy Crosstab to Clipboard

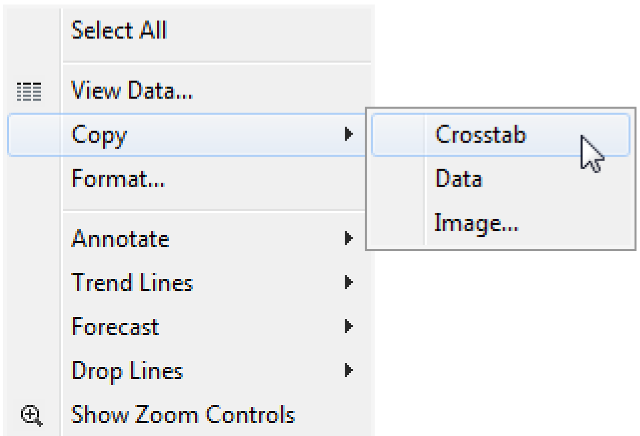
You can copy a crosstab (text table) version of a view to your local Clipboard and transfer it from the Clipboard to another application. For instance, you might want to transfer a crosstab in Tableau to a crosstab in Microsoft Excel. Or you might want to transfer the data behind a graphical view in Tableau to Excel in a crosstab format. Copying a crosstab to the Clipboard is restricted by the following general rules:

- You must copy all records in the view. You cannot copy a subset of records.
- This option is valid for aggregated views only. It cannot be used on disaggregated views of data, because a crosstab is by definition an aggregated view of data. In other words, the **Aggregate Measures** option on the Analysis menu must be selected in order for this option to work properly.

Other restrictions may apply depending on the data in your view. You cannot copy a crosstab if the view contains continuous dimensions such as continuous dates and times.

To copy a view as a crosstab to the clipboard:

1. Right-click (Control-click on Mac) any view in Tableau and select **Copy > Crosstab**.



2. Open an Excel worksheet and select Paste from Excel's Edit menu or press Ctrl-V.

	A	B	C	D	E	F	G	
1		Quarter of Date	Quarter of Date	Quarter of Date	Quarter of Date	Quarter of Date	Quarter of Date	Quai
2	Market	1-Jan-12	1-Apr-12	1-Jul-12	1-Oct-12	1-Jan-13	1-Apr-13	
3	Central	$9,109	$9,826	$10,112	$9,215	$13,737	$13,888	
4	East	$5,380	$6,499	$6,346	$5,936	$8,110	$9,185	
5	South	$3,077	$3,267	$3,515	$3,379	$4,637	$4,619	
6	West	$7,209	$7,596	$8,006	$7,354	$10,874	$10,737	

The pasted data always appears as a crosstab in Excel, even if the initial view of the data in Tableau was not in a crosstab format.

Export Crosstab to Excel

There is a more direct way to transfer a cross-tab view of data to Microsoft Excel on a Windows computer. Select **Worksheet > Export > Crosstab to Excel**.

Tableau automatically pastes a crosstab version of the current view into a new Excel workbook. This option automatically opens a new instance of the Excel application.

Although this is more direct, it can decrease performance because it is copying the formatting as well as the data. If the view you are exporting contains a lot of data, a dialog box opens asking whether you want to copy the formatting options. Disregarding the format can enhance performance.

On a Mac computer, **Export Crosstab to Excel** opens a dialog box where you can save the file. You must then manually open the file in Excel.

Extracting Data

Another way to export all data or a subset of your data to a new data source is to use Tableau Extracts. For details, see **Extract Your Data** on page 379.

Export as an Image

If you want to transfer your Tableau results into a presentation, report or web page, Tableau provides the following several options.

Copy to Another Application

To insert an image of your Tableau results into another application such as PowerPoint, Word, or Excel, follow these steps:

1. Select **Worksheet** > **Copy** > **Image**.
2. In the Copy Image dialog box, select the contents you want to include in the image and the legend layout (if the view contains a legend).
3. Click **Copy**. Tableau copies the current data view to the Clipboard.
4. Open the target application paste from the Clipboard.

   If the target application offers the option, paste the images as an Enhanced Meta File to get the best presentation quality.

Export to an Image File

The export image command saves the current view as an image file. You can export to an image file with the following three steps.

1. Select **Worksheet > Export > Image**.
2. In the Copy Image dialog box, select the contents you want to include in the image and the legend layout (if the view contains a legend).
3. Click **Save**.
4. In the Save Image dialog box, navigate to where you want to save the image file and type a file name into the text box. Select a file format from the Save as type drop-down menu.
5. Click **Save**.

Print to PDF

You can publish one or more views to PDF by selecting **File** > **Print to PDF**.

> When printing a sheet, filters in the view are not included. To show filters, create a dashboard containing the sheet and print the dashboard to PDF. Note, when printing a dashboard to PDF, the contents of web page objects are not included.

Exporting the Data Source

After connecting to data, you can save the data source to your repository. Saving the data source creates a shortcut to the data and lets you avoid having to create a new connection every time you want to use that data source. Exporting the data source is useful if you have added custom fields such as groups or sets to the Data pane. See **Export Data Sources** on page 417.

Copying Information Between Workbooks

You can combine resources from different workbooks into one, or pull information from a larger workbook into a standalone subset. To share or extract a subset of information, you can use any of the following actions on worksheets, dashboards, and stories:

- Copy and paste selected sheets to another workbook.
- Import a saved workbook into your current workbook.
- Export selected sheets to a new workbook.

What gets Copied or Saved with Selected Sheets

When you copy, save, or export selected sheets, other workbook items that the views in those sheets depend on are also included:

- Any associated visible or hidden sheets.
- Data sources for fields used in the selected sheets.
- Calculations, parameters, groups, sets, actions, custom shapes, and so on.

How Tableau Handles Duplicate Items

When you paste or import sheets from a different workbook, some items might already exist in the destination workbook, or some items might have the same name in both places. If Tableau encounters an exact duplicate item in the Data pane, such as a calculation, it does not paste or import that item into the destination workbook. However, if an item in the Data pane has the same name but is defined differently, Tableau imports and renames it.

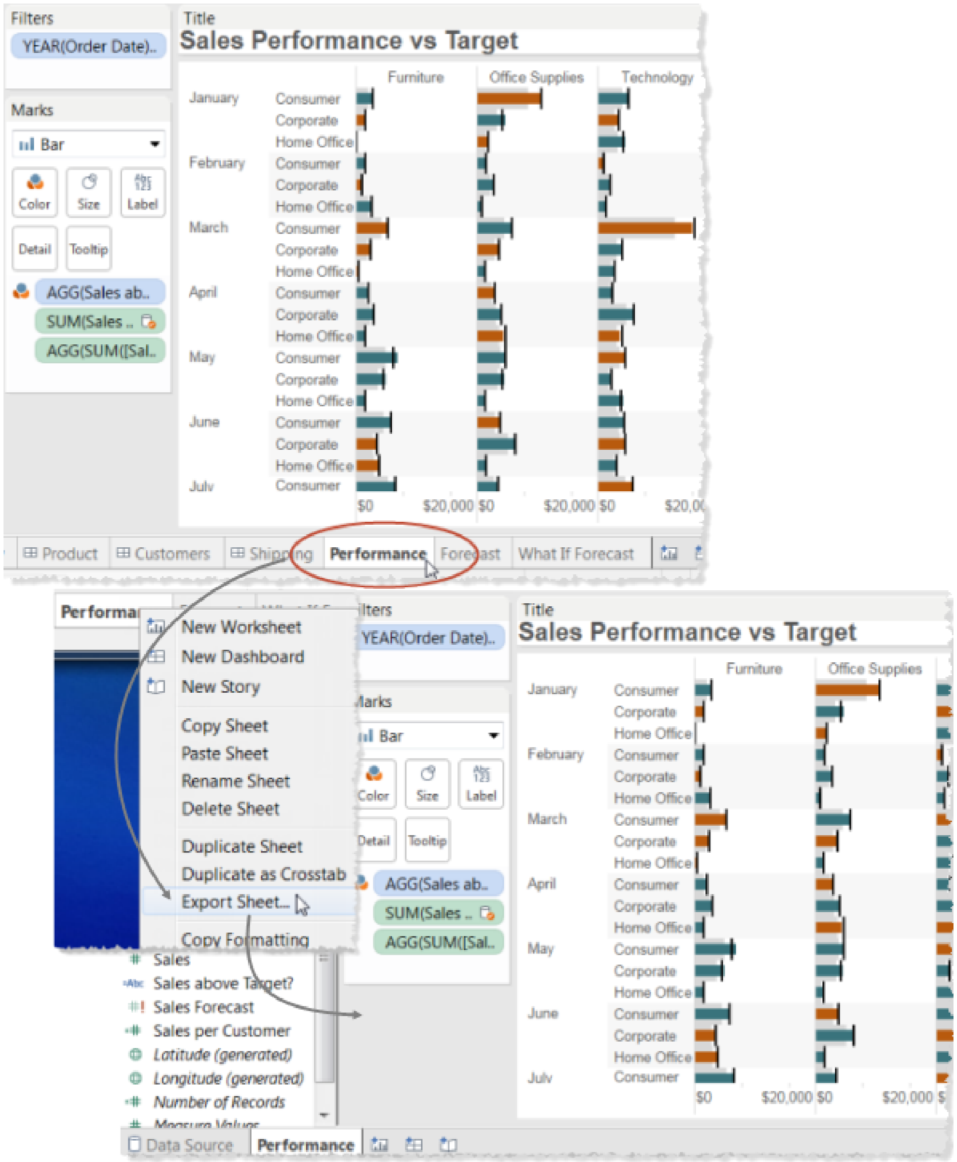
Tableau also pastes or imports sheets and data sources with duplicate names—whether only the name is identical, or their names and contents are identical—and it renames the newer copy.

Export and Import Sheets

If you want to extract a subset of information from a larger workbook to maintain as a standalone file, you can export or save selected sheets to a new workbook. You can then import that workbook into an existing one to incorporate its sheets and other objects into the existing workbook.

Note: These steps describe how to share your work among Tableau workbooks. You can also export views to use outside of Tableau. For information, see **Exporting Your Work** on page 1250.

1. Open the workbook that contains the sheets you want to export to a new file.
2. Using the tabbed worksheet or filmstrip view, right-click (control-click on Mac) the sheet tabs or thumbnail views, and then select **Export Sheet** to export a single sheet. Select **File** > **Save As** to save all sheets.
3. Specify the file format you want to save (.twb or .twbx), select the location for the new workbook file, give it a name, and click **Save**.

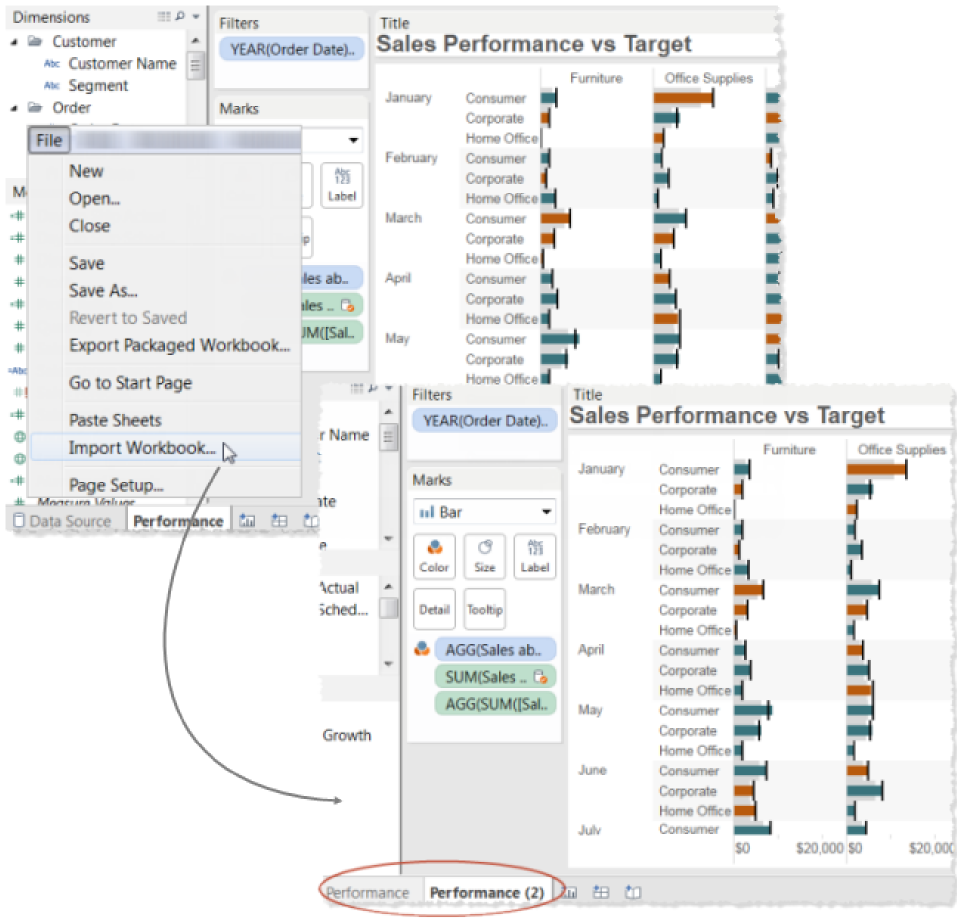


Import a Tableau Workbook

After you save or export selected sheets to a new workbook (.twb) file, you can import the information into another workbook.

1. With the existing workbook open, select **File** > **Import Workbook**.
2. Select the workbook that contains the sheets you saved from another workbook, and click **Open**.

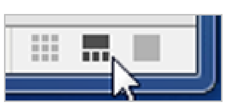
The following image shows an import result. As shown, when the imported workbook contains a duplicate sheet name, Tableau adds a number after the name of the imported sheet.



Copy and Paste Sheets

Copying and pasting sheets is a quick way to combine information from different workbooks or create a new workbook.

1. Open a workbook and display it in the filmstrip view.



2. Select the thumbnails of the sheets you want to copy, then right-click (control-click on Mac) and select **Copy Sheet**.

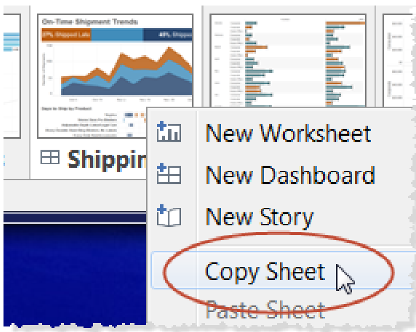


Tableau copies the information in the file format (.twb or .twbx) of the workbook.

3. Open the destination workbook, or create a new workbook. Right-click (Control-click on Mac) on the tab for any sheet, and select **Paste Sheet**.

   Pasted sheets are placed after existing worksheets, dashboards, and stories.

   > **Note:** The **Paste Sheet** option is not available when the active sheet is a story.

4. Save the changes.

> **Note:** You can also display the workbook in the tabbed sheet view and select the tabs you want to copy.

For information about what gets copied when you copy and paste sheets, see **Copying Information Between Workbooks** on page 1259

.

Print

After creating a view or several views in Tableau you can print them. The first thing you should do before printing is specify how you want the printed page to look using the Page Setup dialog box. Then you can print to a printer or publish to a PDF. You can also print the Tableau Help directly from your web browser or to a PDF.

Printing Results

Once you have a view or several views created in Tableau, you can print them or publish them as a PDF.

Page Setup

Before you print, there are several options you can set to specify how the worksheet will look when it is printed. For example, you can select which elements to include, set the printed page orientation, specify where you want to put the legend, margins, and more. You define These settings in the Page Setup dialog box. You can set different page setup options for each worksheet in the workbook. That way you can have different titles, captions, legend settings, etc., for each worksheet you want to print. To open the Page Setup dialog box, select **File > Page Setup**.

The Page Setup dialog box has the following tabs:

General

Use the General tab to select the elements you want to show when you print. You can show or hide the title, view, caption, color legend, shape legend, size legend, and map legend.

Specify how to handle headers and breaks. The headers refer to the headers in each of your views. When you select **Repeat headers and legends on each page**, the row and column headers will appear at the top of each printed page when a view breaks across several pages.

Select **Break pages on pane boundaries** to prevent page breaks in the middle of a cell in a table.

If you have used the Pages Shelf to build your view, you can select whether to print the current page only or all pages.

Layout

Use the Layout tab in the Page Setup dialog box to specify the layout legend, page margins, and centering options for printing.

Legend Layout

If you include one or more legends, you can select one of the options for how you want the legends to appear on the printed page.

Margins

Specify top, bottom, left, and right margins by typing values into the text boxes.

Centering

Optionally, select whether to center the view horizontally or vertically--or both--on the page.

Print Scaling

Use the Print Scaling tab to fit the view to a certain size or to change the page orientation. These options only affect printed documents. The scaling options you specify here will not affect exported images or PDFs. However, the orientation settings will be used as the default when you publish the workbook to Tableau Server or Tableau Public.

Print Scaling

You can scale your view to fit within a single page or scale it across multiple pages. Select from the following options:

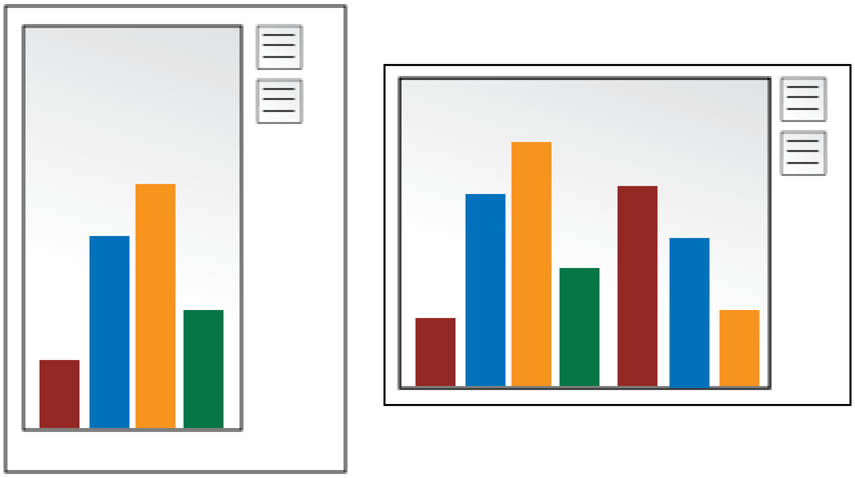
- Automatic – Scales the view automatically based on the paper size.
- Scale to – Scales the view to the specified percentage of its original size.
- Fit to – Scales the view to fit within the specified area. Select the number of printed pages across and down. For example, if you have a really wide view that is not very tall, you can specify three pages across by one page down.

Page Orientation

Use the page orientation settings to specify how you want the view oriented on the printed page. For example, if you have a view that is very wide but not very high, select **Landscape**. Select from the following page orientation options:

- Use Printer Setting – Use the page orientation that is already specified by the printer.
- Portrait – Presents the view so that it is oriented vertically on the printed page.
- Landscape – Presents the view so that it is oriented horizontally on the printed page.

The following diagram shows the difference between portrait and landscape page orientations.



These page orientation settings are used as the default settings when you publish the workbook to Tableau Server or Tableau Public.

Printing

After you have configured the **Page Setup** on page 1264 settings, you can print by selecting **File** > **Print**. In the Print dialog, select a printer, decide whether to show selections, specify a print range, and select the number of copies you want to print.

The following options in the Print dialog box are unique to Tableau.

Show Selections

When this option is selected any selections you've made in the views will be maintained while printing.

Changing the Print Range

When you print from a workbook with multiple worksheets, each worksheet represents one or more printed pages, depending on the page setup.

Select from the following print ranges:

- **Entire Workbook** - Prints all the worksheets in the workbook.
- **Active Sheet** - Prints only the sheet currently displayed in the workbook.
- **Selected Sheets** - Prints the selected sheets.

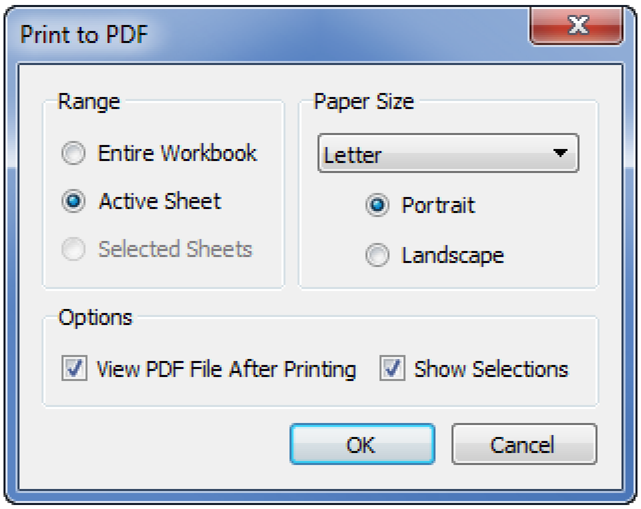
> You can select multiple worksheets in a workbook by holding down the CTRL or Shift keys while clicking the worksheet tabs that you want to select.

Print to PDF

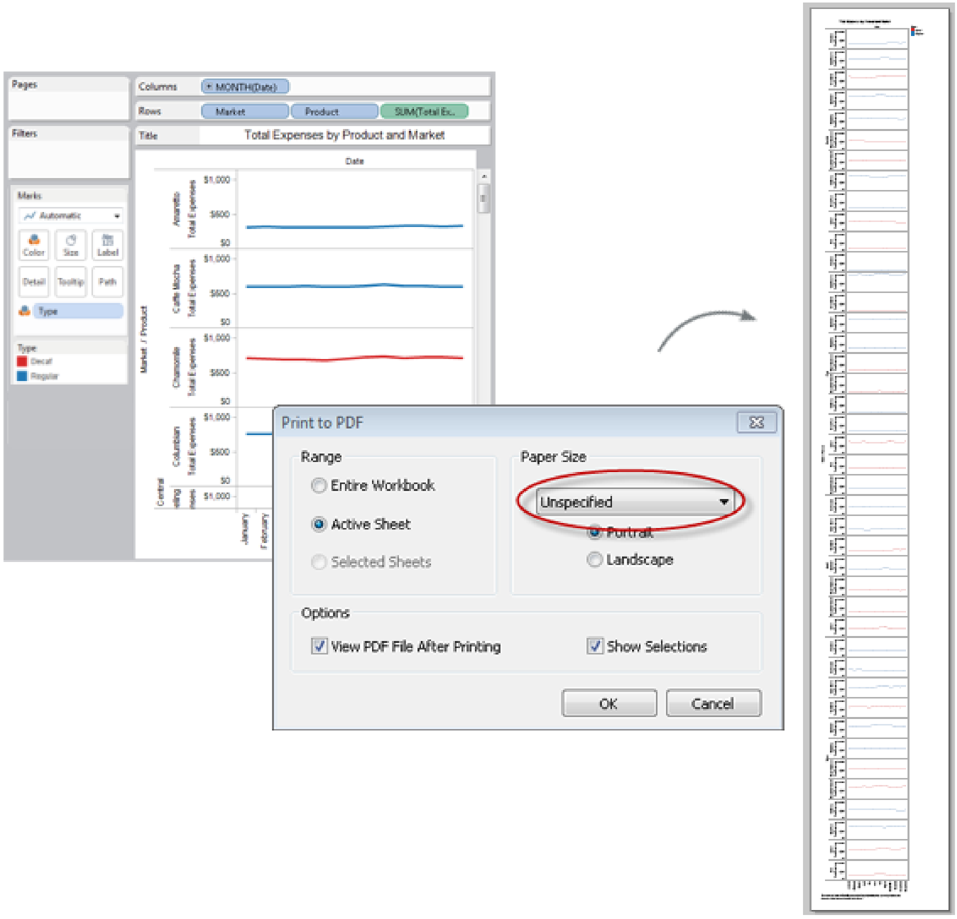
In Tableau, you can publish views as PDF files rather than printing them as hard copies. You do not need to have Adobe Acrobat installed on your computer.

To publish as a PDF:

1. Specify **Page Setup** on page 1264 options for each sheet in your workbook.
2. Select **File** > **Print to PDF**.



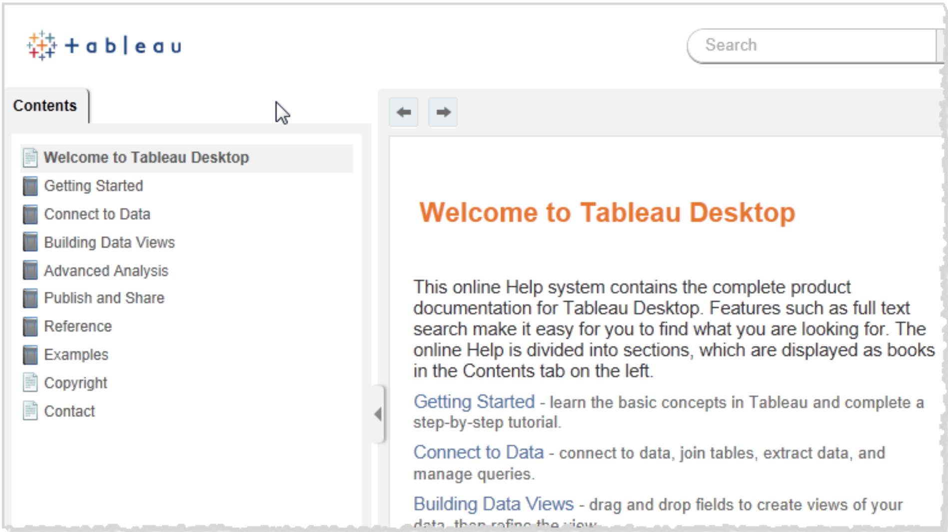
3. In the Print to PDF dialog box, select the print Range:
   - Entire Workbook - Publishes all the sheets in the workbook.
   - Active Sheet - Publishes only the sheet currently displayed in the workbook.
   - Selected Sheets - Publishes the selected sheets.
4. Select a **Paper Size**. If you select Unspecified, the paper size will expand to the necessary size to fit the entire view on a single page.



5. Select **View PDF File After Printing** if you want to automatically open the PDF after creating it. This option is only available if you have Adobe Acrobat Reader or Adobe Acrobat installed on your computer.
6. Select whether to **Show Selections**. When this option is selected the selections in the views are maintained in the PDF.
7. Click **OK** and specify where you want to save the PDF. Then click **Save**.

Printing the Help

You can print an individual Help topic using the print options in your Web browser.



In addition to printing individual help topics, you can also download an offline help system and a printable PDF.

Reference

This section contains reference information for using Tableau. Learn how to use functions and operators when writing calculation formulas. Also, see tips and tricks that can help you become more efficient with the product.

Connector Examples

Follow the link below for information on how to connect to your specific data source. Connectors are listed in the order that they appear on the **Connect** pane.

Excel

This topic describes how to connect Tableau to Microsoft Excel file data and set up the data source. Tableau can connect to .xls and xlsx files.

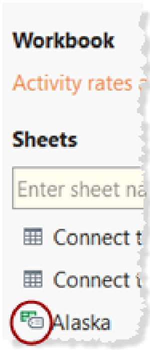
1. On the start page, under **Connect**, click **Excel**.
2. Select the Excel workbook you want to connect to, and then click **Open**.

   Alternatively, to connect to the Excel file using the Microsoft Jet-based connection, in the Open dialog box, click the **Open** drop-down menu, and then select **Open with Legacy Connection**. The data source page appears.
3. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. If your Excel file has one table, click the sheet to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

      You can also connect to a named range the same way you connect to a worksheet. The named range functions as a table in Tableau.

      You create named ranges in Excel by highlighting a range of cells and then selecting **Define Name** on the **Formulas** tab. When you connect to a named range in Tableau, an icon appears next to the sheet in the **Data Source** tab as shown below.



You can connect to multiple Excel worksheets at the same time as long as each data source has a unique name.

Optional Settings

You can set the following options before you build the view.

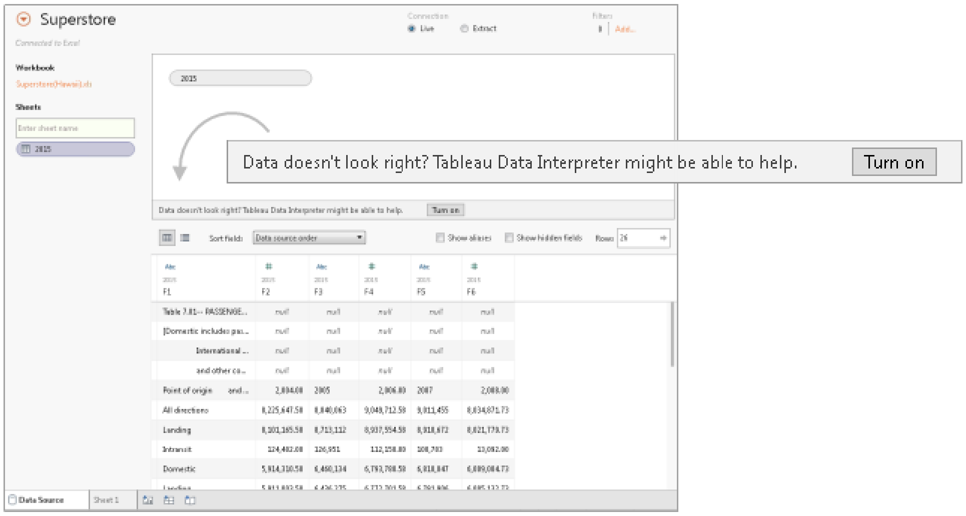
Set Excel table options

On the canvas, click the table drop-down arrow and then specify whether the data includes field names in the first row. If so, these names will become the field names in Tableau. If field names are not included, Tableau generates them automatically. You can rename the fields later.

Turn on Data Interpreter

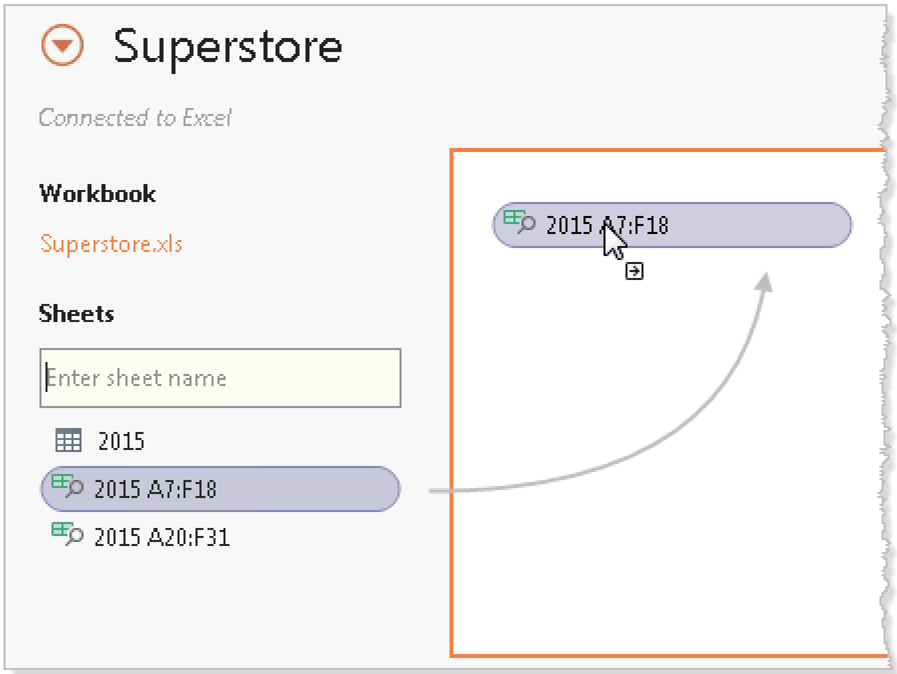
Sometimes, the format of the data in your Excel data makes it difficult to analyze in Tableau. For example, your Excel data might include additional tables, sub-tables, hierarchical headers, extraneous headers and footers, or empty rows and columns. Data Interpreter detects these sub-tables so that you can work with a subset of your data independently of the other data. It also removes the extraneous information to help prepare your data source for analysis.

After you set up the data source, if Tableau detects sub-tables, unique formatting, or that the data contains some extraneous information, it prompts you to use Data Interpreter.



To turn on Data Interpreter and review results

1. After you have connected to your Excel data and set up your data source, on the data source page, click **Turn on**.
2. Click **Review results**. A copy of your data source opens in Excel on the **Key for the Data Interpreter** tab.
3. Review the annotation key to find out how to read the results.
4. Click the subsequent tabs to review how Data Interpreter interpreted the data source. You can also review Data Interpreter results directly in the grid below Data Interpreter. If Data Interpreter does not provide the expected results, you can turn off the Data Interpreter to use the original data source.
5. If Data Interpreter detects additional tables in your data, replace the current table with the found table.



Note: If Data Interpreter has misidentified the range of the found table, click the table drop-down arrow on the canvas and then select **Customize found table** to adjust the corners of the found table.

Review the data, pivot, split, and create calculations

The first 1,000 rows of the data in the data source are automatically displayed in the grid. If you add or remove tables, or make changes to the join conditions, the grid updates. You can also do the following in the grid:

- Change the data type or geographical role of a column by clicking the data type icon.
- Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- Rename a field by double-clicking the column name.
- Reset a field name by clicking the column drop-down arrow and selecting **Reset Name**.
- Sort fields in the grid and metadata grid by selecting a sort option from the **Sort fields** drop-down list.
- Sort rows in the grid by clicking the sort button next to the column name.
- Pivot fields to transform data in a crosstab format into a columnar format. This is only available for non-legacy connection types. For more information, see **Pivot Data (from Columns to Rows)** on page 411.
- Split a string field into multiple fields. This is only available for non-legacy connection

types. For more information, see **Split a Field into Multiple Fields** on page 406.

- Create new calculations based on existing fields in the Tableau data source. Click the column drop-down arrow and select **Create Calculated Field**.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.

Examine the data source structure and perform management tasks

Use the metadata area to quickly examine the general structure of the Tableau data source and its fields. If you are working with a particularly large data source, use the metadata area to perform routine data management tasks such as sort fields, hide multiple fields at once, or quickly rename or reset fields.

Connect live or use an extract

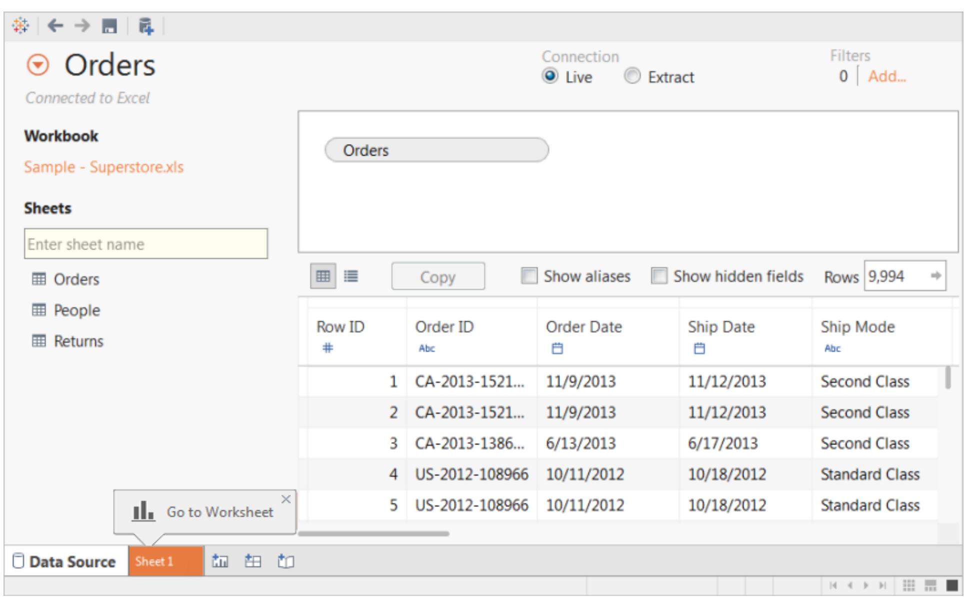
At the top of the Data Source page, select **Live** or **Extract** mode. If you choose to create an extract, the **Edit** link displays. Click **Edit** to set up filters that define a subset of the data that you want to include in the extract.

Add data source filters

At the top of the Data Source page, under **Filters**, click **Add** to add data source filters to restrict the visibility and use of the fields in the Tableau data source.

Microsoft Excel Data Source Example

An example of a Microsoft Excel data source is shown below.



Note: If the Excel file contains columns that are more than 254 characters wide, Tableau Desktop can't use these fields for workbooks that were created before Tableau Desktop 8.2. Also, you cannot use the legacy connection to connect to this data. Either remove the columns, modify them to fit within 254 characters prior to connecting in Tableau Desktop, or upgrade the Excel data source. For more information about upgrading data sources, see **Upgrade Data Sources** on page 420.

Text File

This topic describes how to connect Tableau to a text file data and set up the data source. Tableau connects to delimited text files (*.txt, *.csv, *.tab, *.tsv).

1. On the start page, under **Connect**, click **Text File**.
2. Select the file you want to connect to, and then click **Open**.

   Alternatively, to connect to the text file using the Microsoft Jet-based connection, in the Open dialog box, click the **Open** drop-down menu, and then select **Open with Legacy Connection**. The data source page appears.
3. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.The default name is automatically generated based on the file name.
   2. Click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can set the following options before building the view.

Set text file options

On the canvas, click the table drop-down arrow and then select whether the first row contains column names. This option is selected by default. Alternatively, you can have Tableau generate names when you connect. These names can be changed later. You can also select **Text file properties** to specify the following:

- Select the character that is used to separate the columns. Select from the list of characters or select **Other** to type in a custom character.
- Select the text qualifier that encloses values in the text file.

- Select a character set that describes the text file encoding. The available encodings are based on the operating system you are using. For example, on Windows, ANSI is listed as windows-1252 and OEM is listed as 437.

  Note: In workbooks created prior to Tableau Desktop 8.2 or that use the legacy connection, you can select ANSI, OEM, UTF-8, UTF-16, or Other. When you select Other, you must specify the character set in the provided text field. This value is verified when the connection is attempted.

- Select the locale by which the file should be parsed. This option tells Tableau which decimal and thousands separator to use.

Review the data, pivot, split, and create calculations

The first 1,000 rows of the data in the data source are automatically displayed below the grid. If you add tables, remove tables, or make changes to the join conditions, the grid updates. You can also do the following in the grid:

- Change the data type or geographical role of a column by clicking the data type icon.
- Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- Rename a field by double-clicking the column name to rename it.
- Reset a field name by clicking the column drop-down arrow and selecting **Reset Name**.
- Sort fields in both the grid and metadata grid by selecting a sort option from the **Sort fields** drop-down list.
- Sort rows in the grid by clicking the sort button next to the column name.
- Pivot fields to transform data in a crosstab format into a columnar format. This is only available for non-legacy connection types. For more information, see **Pivot Data (from Columns to Rows)** on page 411.
- Split a string field into multiple fields. This is only available for non-legacy connection types. For more information, see **Split a Field into Multiple Fields** on page 406.
- Create new calculations based on existing field in the Tableau data source. Click the column drop-down arrow and select **Create Calculated Field**.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.

Examine the data source structure and perform management tasks

Use the metadata area to quickly examine the general structure of the Tableau data source and its fields. If you are working with a particularly large data source, use the metadata area to perform routine data management tasks such as hide multiple fields at once or quickly rename or reset fields.

Connect live or use an extract

At the top of the Data Source page, select **Live** or **Extract** mode. If you choose to create an extract, the **Edit** link displays. Click **Edit** to set up filters that define a subset of the data that you want to include in the extract.

Add data source filters

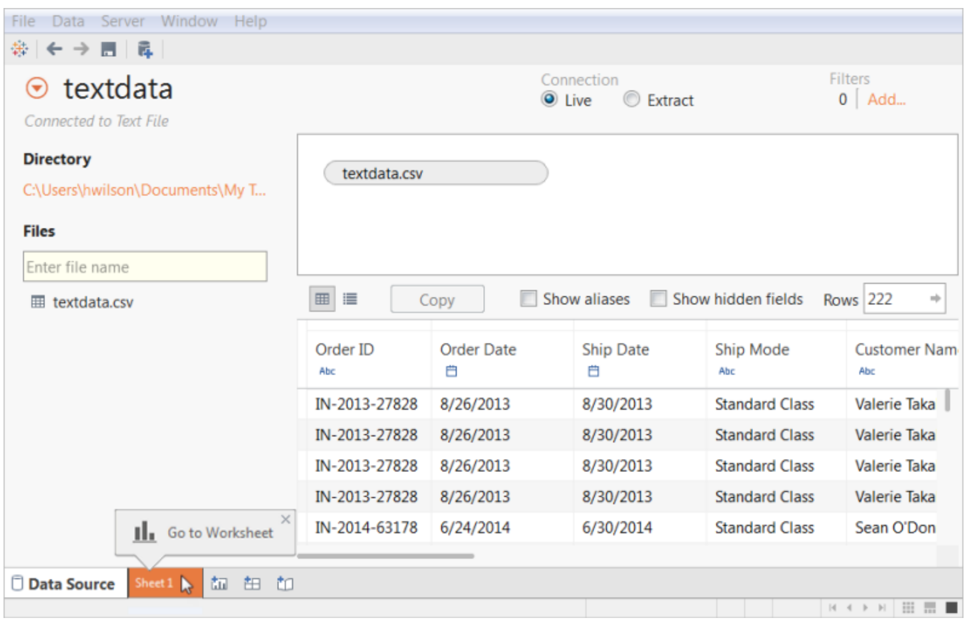
Add data source filters to restrict the visibility and use of the fields in the Tableau data source.

Best Practices

If all relevant text files for a multi-table connection are collected in a single directory, with nothing else in that directory, there is no possibility that users will inadvertently select a file that is not appropriate for the connection.

Text File Data Source Example

An example of a text file data source is shown below.



Note: If the text file contains columns that are more than 254 characters wide, Tableau is not able to use these fields for workbooks that were created before Tableau Desktop 8.2 or that use the legacy connection. Either remove the columns, modify them to fit within 254 characters prior to connecting in Tableau, or upgrade the text file data source. Large text files often perform poorly as a data source, because the queries can take a long time.

Access

This topic describes how to connect Tableau to a Microsoft Access file (*.mdb, *.accdb) and set up the data source. Tableau supports all Access data types except OLE Object and Hyperlink.

1. On the start page, under **Connect**, click **Access**, select the Access file that you want to connect to, and then click **OK**.

   If the Access file is password protected, select **Database Password**, and then enter the password.

   If the Access file is protected by workgroup security, select **Workgroup Security**, and then enter the Workgroup Information File name, User, and Password into the corresponding text fields.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau. The default name is automatically generated based on the file name.

   2. Drag a table to the canvas. You can drag a table or query.

   3. Click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can set the following options before building your view.

Review the data and change data types

The first 1,000 rows of the data in the data source is automatically displayed below the canvas. If you add tables, remove tables, or make changes to the join conditions, the grid updates. You can also do the following in the grid:

- Change the data type of a column by clicking the data type icon.
- Rename or hide the column by clicking the column header drop-down menu and selecting the respective option.

Manage metadata

Click the metadata area button to perform routine management tasks.

Rename or hide columns

Rename or hide a column by clicking the column header drop-down menu and selecting the respective option.

Connect live or use an extract

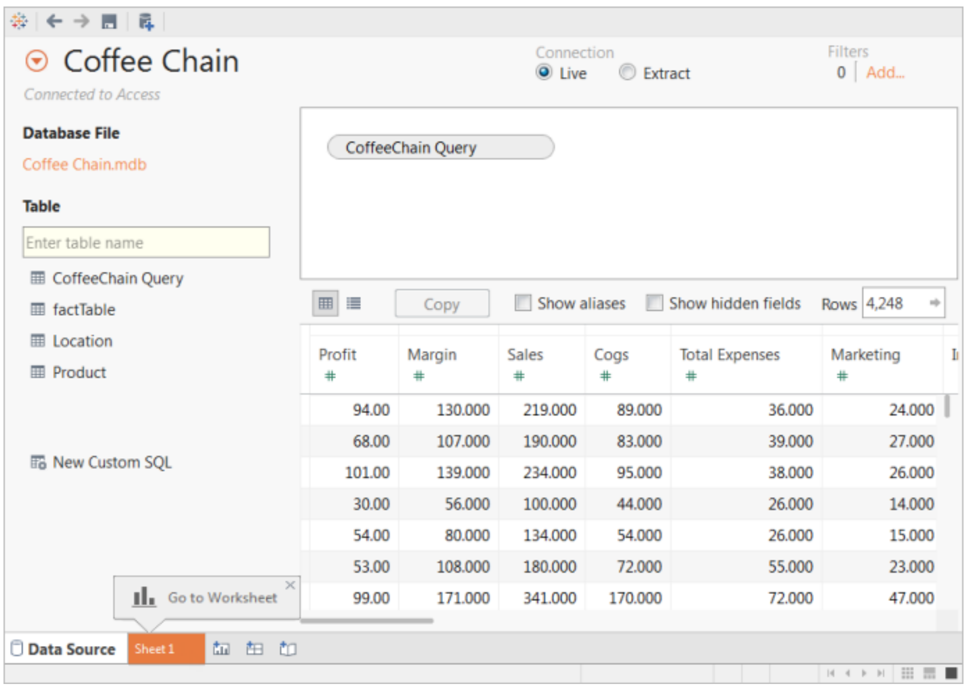
At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link will display allowing you to set up filters that define the subset of the data to include in the extract.

Add data source filters

Add data source filters to restrict the visibility and use of the fields in the data source.

Access Data Source Example

An example of an Access data source is shown below.



Profit	Margin	Sales	Cogs	Total Expenses	Marketing
94.00	130.000	219.000	89.000	36.000	24.000
68.00	107.000	190.000	83.000	39.000	27.000
101.00	139.000	234.000	95.000	38.000	26.000
30.00	56.000	100.000	44.000	26.000	14.000
54.00	80.000	134.000	54.000	26.000	15.000
53.00	108.000	180.000	72.000	55.000	23.000
99.00	171.000	341.000	170.000	72.000	47.000

Note: If the Access file contains columns that are more than 254 characters wide, Tableau will not be able to use these fields. Either remove the columns from the table or modify them to fit within 254 characters prior to connecting with Tableau.

Statistical File

This topic describes how to connect Tableau to a statistical file and set up the data source. Tableau connects to SAS (*.sas7bdat), SPSS (*.sav), and R (*.rdata, *.rda) data files.

1. On the start page, under **Connect**, click **Statistical File**, select the file that you want to connect to, and then click **Open**.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Click the sheet tab to start your analysis.

    For information about connecting to more than one table, see **Join Your Data** on page 349.

Note the following:

- The Statistical File connector does not support value labels.
- The Statistical File connector supports only one table per statistical file.

  If an error message appears, "An error occurred while communicating with the data source," make sure that your statistical file contains only one object, and that the object is a data frame or a matrix. R files may contain hidden objects in what appears to be a clean workspace. To check for hidden objects, run `ls(environment(), all.names=TRUE)` from RStudio.
- You can change the character encoding for a statistical file. For information, see Change the Character Encoding for Statistical Files in the Tableau Knowledge Base.

Optional Settings

You can make the following configurations before doing your analysis:

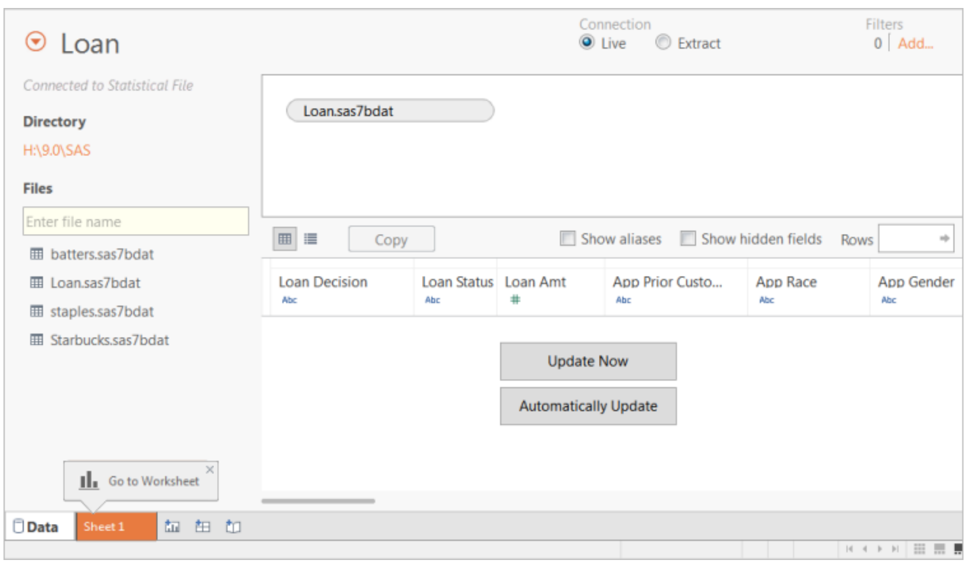
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data

source.

- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Statistical File Data Source Example

An example of a statistical file data source is shown below.



Other Files

This topic describes how to connect Tableau to supported file types, including Tableau Data Extract files and Tableau Workbooks.

1. On the start page, under **Connect**, click **Other Files**.
2. In the Open dialog box, navigate to and select a file.
3. Click **Open**.

4. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
5. Click the sheet tab to start your analysis.

Tableau Data Extract Data Source Example

An example of a Tableau Data Extract file data source is shown below.

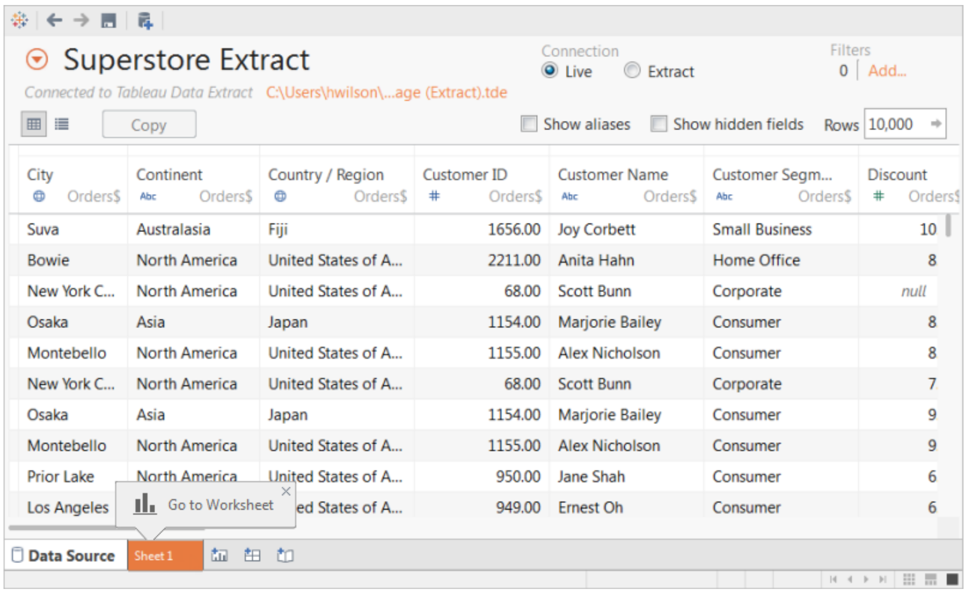


Tableau Server

This topic describes how to connect to a data source published to Tableau Server.

1. On the start page, under **Connect**, click **Tableau Server**.
2. Enter the name of the server and then click **Connect**.

Connected Desktop

You can stay connected to your Tableau Server and Tableau Online servers. Tableau Desktop saves each connection from session to session if you don't sign out. Next time you launch Tableau Desktop, you are signed in to your most recent server connection. In this case, you can skip step 3.

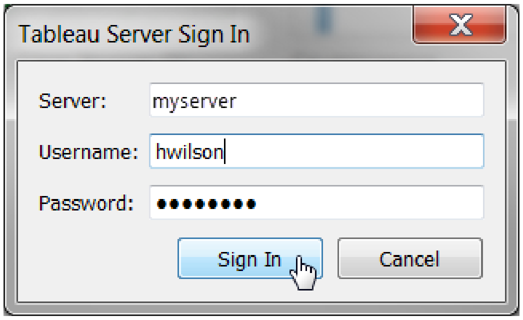
You can also sign in to another Tableau Server and quickly switch between servers and sites from the Tableau Desktop **Server** menu. For more information, see **Quick Start: Stay Connected with Automatic Sign-In** on page 177.

Kerberos environment

If Kerberos is enabled on Tableau Server and you are on a computer with valid Active

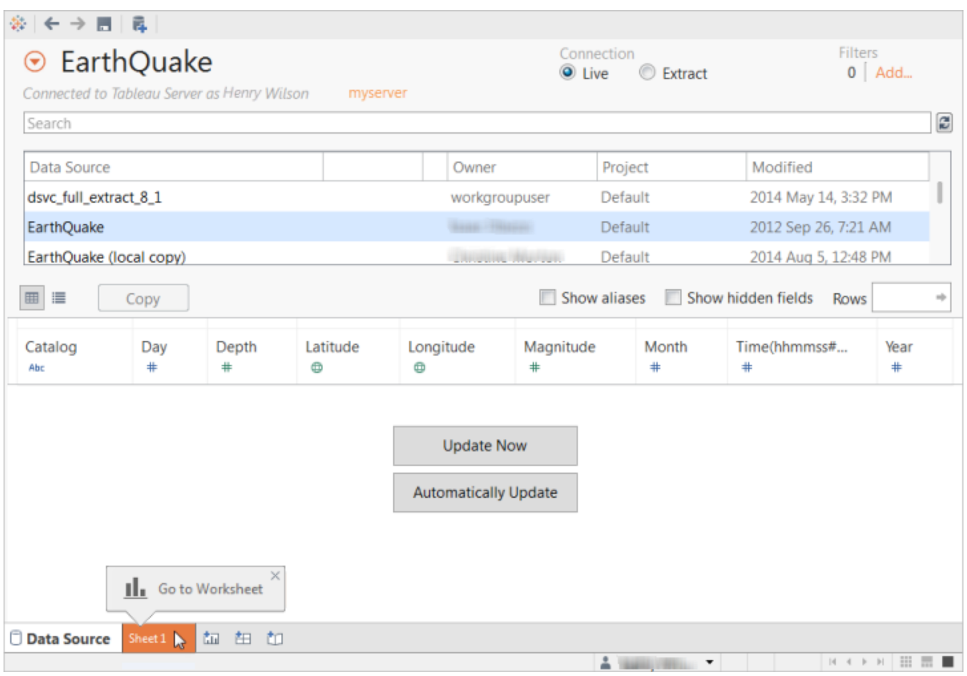
Directory credentials, you will connect automatically to the server. In this case, you can skip step 3. If Kerberos authentication fails, you will be prompted to provide a user name and password for authentication. If you need to change the user you're signed in as, see Switch Kerberos User.

3. Enter your user name and password, and then click **Sign In**.



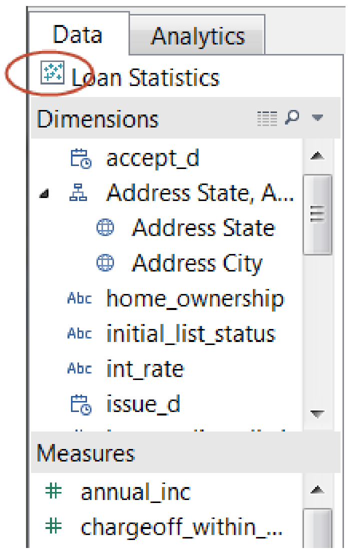
4. Select a data source from the list of published data sources.

   You can sort the list of data sources by clicking the column headers. Alternatively, search for a data source by using the search box. Click the refresh button to refresh the list and show any new data sources.



> **Note:** If you select a cube (multidimensional) data source, the Create Local Copy dialog box appears, and you must create a local copy of the data before you can start your analysis.

5. Click the sheet tab to start your analysis. Tableau Server data sources are shown in the Data pane with a Tableau icon.



You may want to download a local copy of the data source so that you can, for example, work offline or make changes to a data source without modifying the original. To download a local copy, on the **Data** menu, select the data source, and then select **Create Local Copy**. A duplicate of the data source is added to the Data pane.

Actian Matrix

This topic describes how to connect Tableau to an Actian Matrix (formerly ParAccel) database and set up the data source.

1. On the start page, under **Connect**, click **Actian Matrix**, and then do the following:
   1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
   2. Enter the user name and password, and then click **OK**.

      If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag a table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

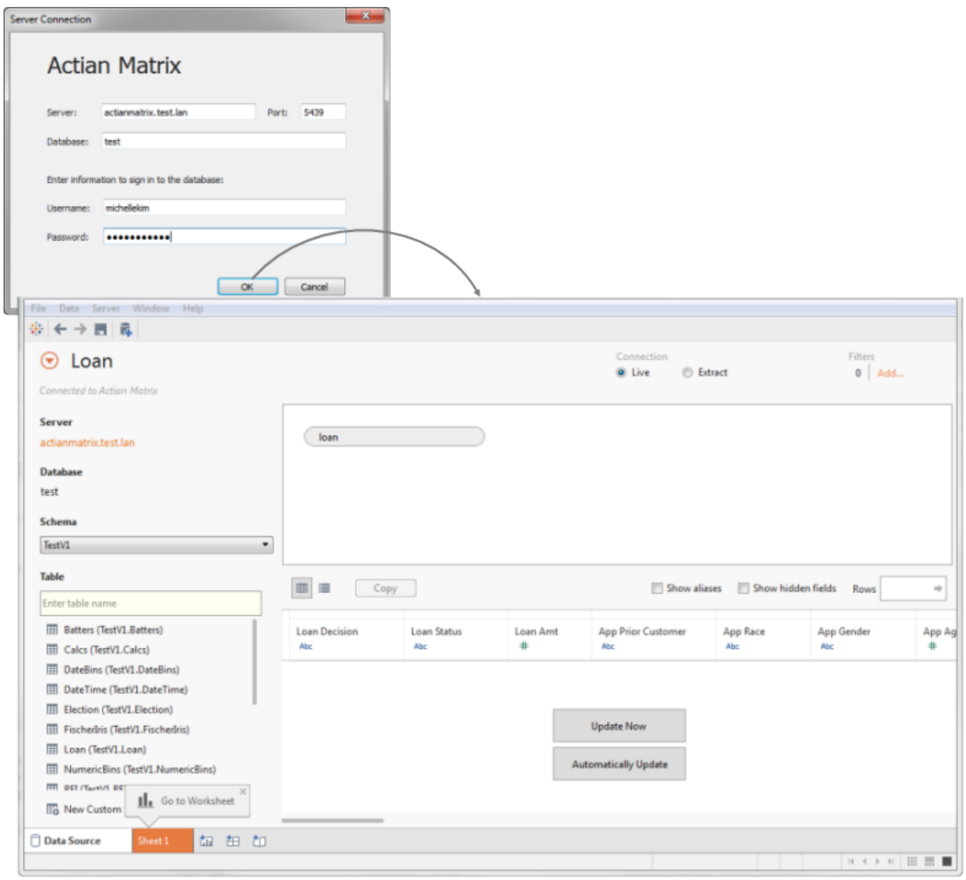
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link

displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Actian Matrix Data Source Example

An example of an Actian Matrix data source is shown below.



Actian Vectorwise

This topic describes how to connect Tableau to an Actian Vectorwise database and set up the data source.

1. On the start page, under **Connect**, click **Actian Vectorwise**, and then do the following:
    1. Enter the name of the virtual node for the database and the name of the database you want to connect to.
    2. Specify whether to use authentication defined in the virtual node, or a specific user name and password.
    3. Click **OK**.

        If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

        Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

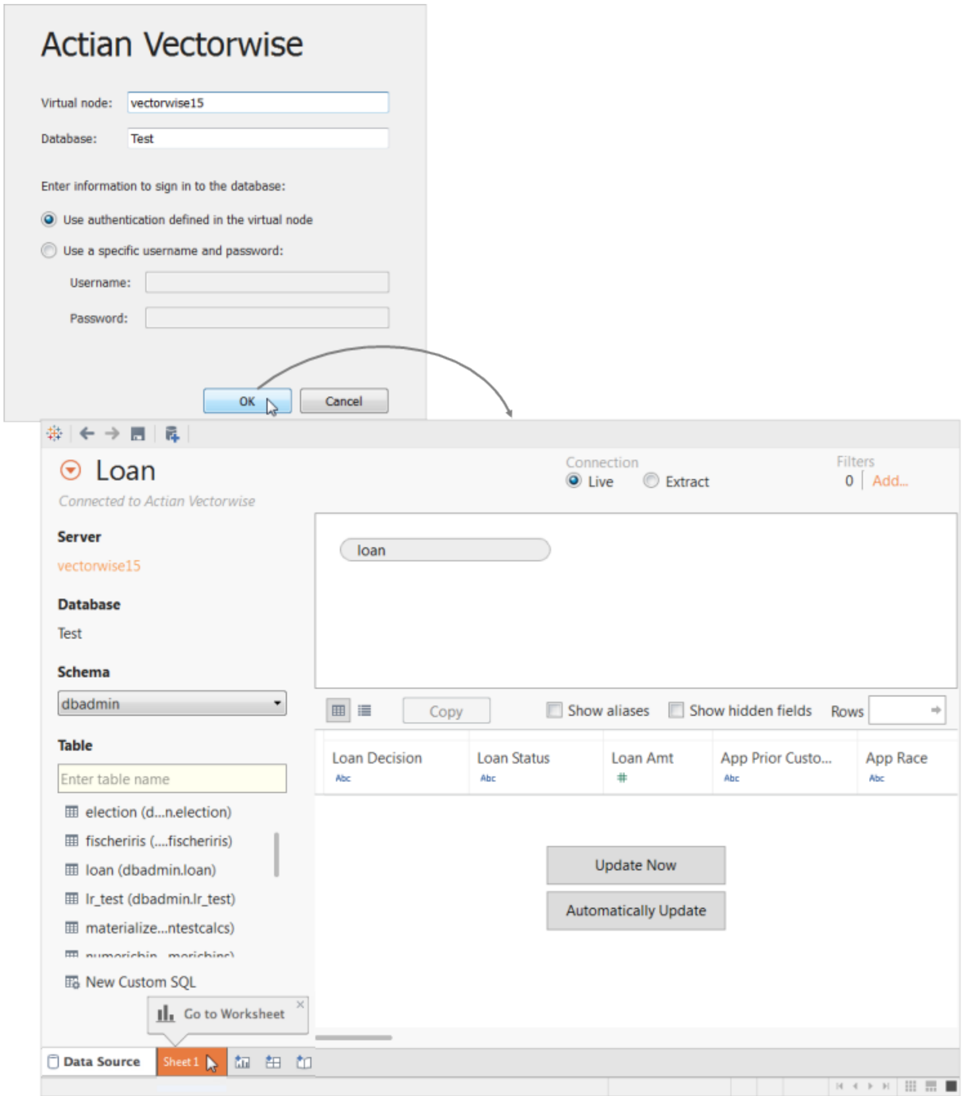
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Actian Vectorwise Data Source Example

An example of an Actian Vectorwise data source is shown below.



Amazon Aurora

This topic describes how to connect Tableau to an Amazon Aurora database and set up the data source.

1. On the start page, under **Connect**, click **Amazon Aurora**, and then do the following:
    1. Enter the name of the server that hosts the database.
    2. Enter the user name and password, and then click **OK**.

       Select the **Require SSL** check box when connecting to an SSL server.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

    Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

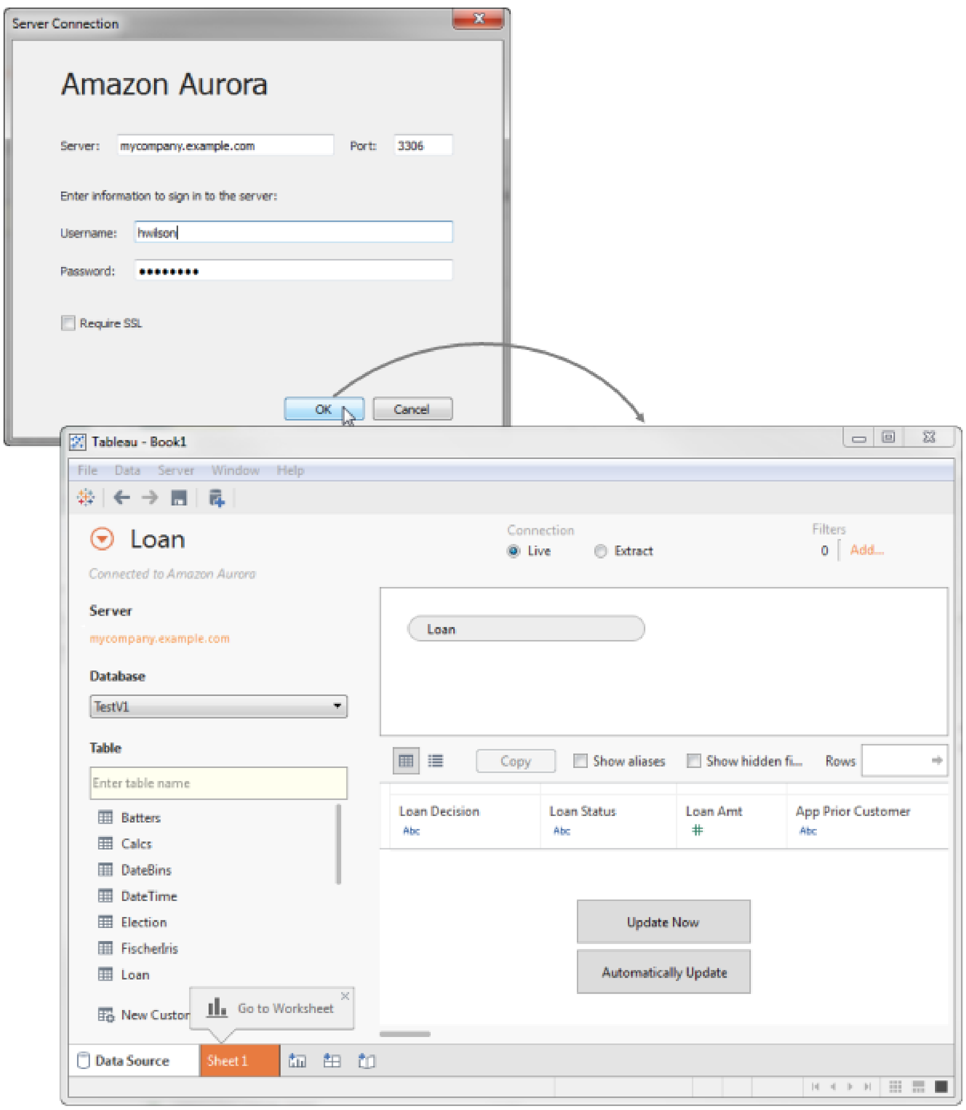
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or

extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Amazon Aurora Data Source Example

An example of an Amazon Aurora data source is shown below.



Amazon EMR

This topic describes how to connect Tableau to an Amazon EMR (Elastic MapReduce) database and set up the data source. For information about connecting to Hadoop data, see Connecting to Hadoop Hive in the Tableau Knowledge Base.

1. On the start page, under **Connect**, click **Amazon EMR**, and then do the following:
    1. Enter the name of the server that hosts the database and the port number to use.
    2. Select how to connect to the database. Depending on the version of Amazon EMR and the drivers you have installed, you can connect using one of the following:
        - Hive Server
        - Hive Server 2
        - Impala
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    4. Click **OK**.

        If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.
    3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

        Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

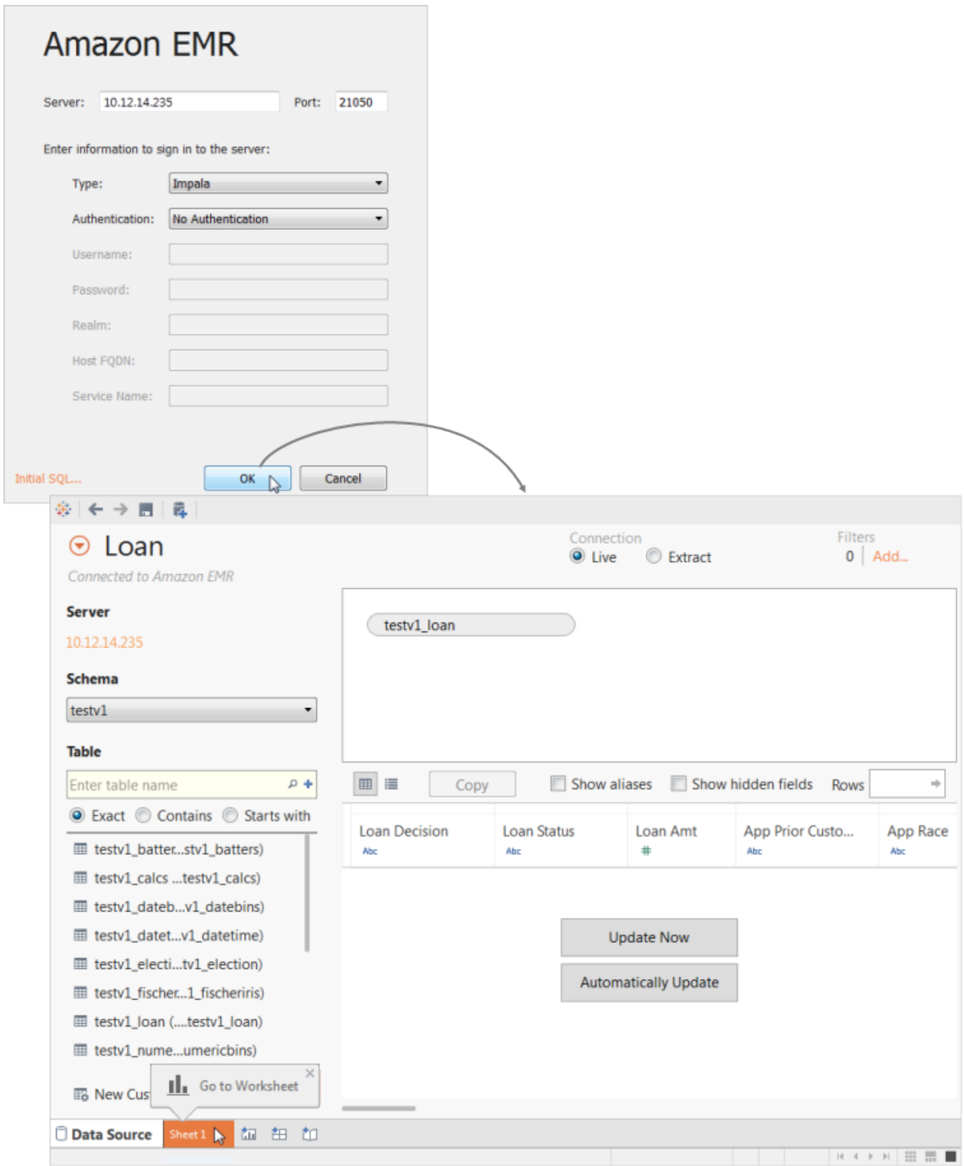
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Amazon EMR and Impala

When connecting to Amazon EMR using Impala, the queries are limited to 100,000 rows of data when the query includes an ORDER BY clause. This limit can be configured either by modifying the `"order-by-limit"` value in the workbook xml or using a TDC customization such as `<customization name="order-by-limit" value='10' />`.

Amazon EMR Data Source Example

An example of an Amazon EMR data source is shown below.



Amazon Redshift

This topic describes how to connect Tableau to an Amazon Redshift database and set up the data source.

1. On the start page, under **Connect**, click **Amazon Redshift**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database you want to connect to.
    2. Enter the user name and password, and then click **OK**.

       Select the **Require SSL** check box when connecting to an SSL server.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

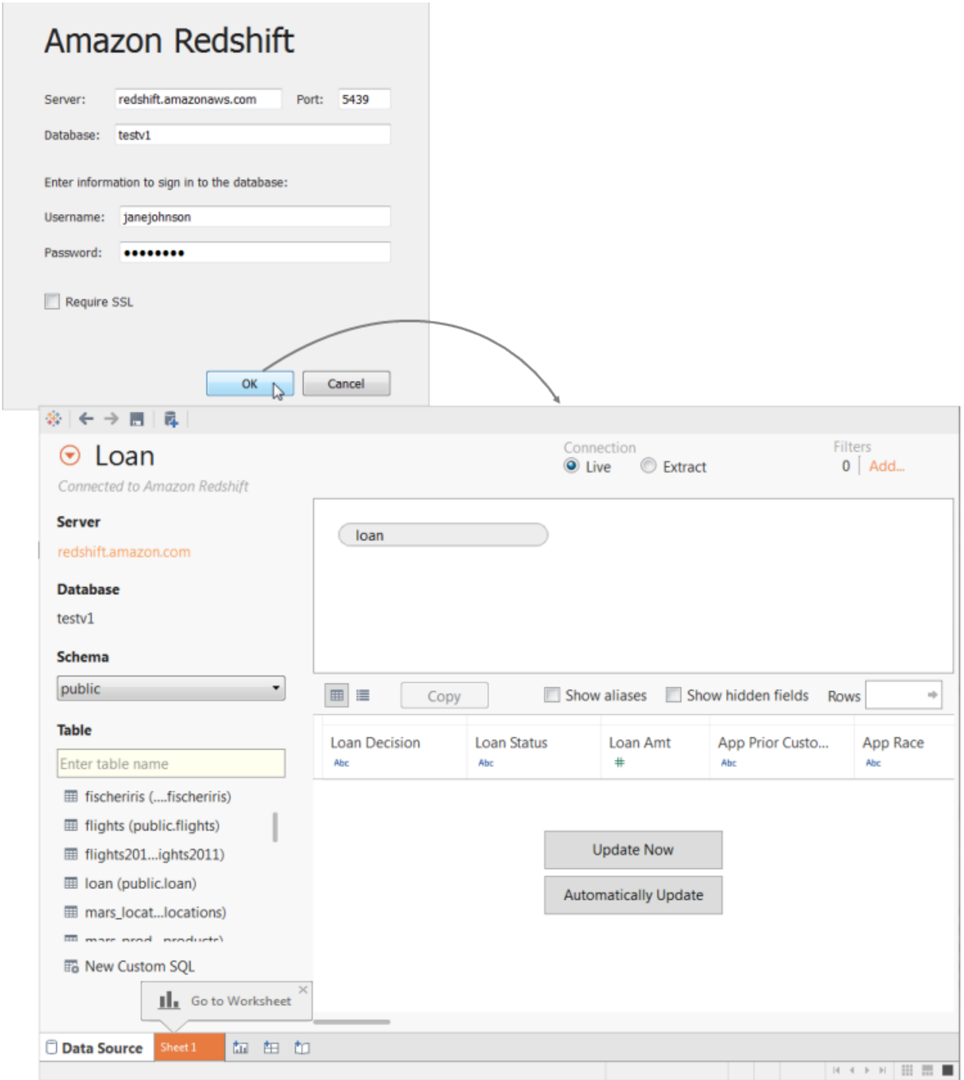
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Amazon Redshift Data Source Example

An example of an Amazon Redshift data source is shown below.



Aster Database

This topic describes how to connect Tableau to Aster Database data and set up the data source.

1. On the start page, under **Connect**, click **Aster Database**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
    2. Enter the user name and password.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run**

Initial SQL on page 344.

In Aster, initial SQL can be used to generate an output table, which can improve performance of subsequent database access. Initial SQL in Aster also supports SQL-MapReduce, a framework created by Teradata Aster to enable developers to write powerful and highly expressive SQL-MapReduce functions. For more information, see MapReduce, SQL-MapReduce Resources & Learning on the Teradata website.

4. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
   3. Under **Table**, select a table or use the text box to search for a table by name.
   4. Drag a table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

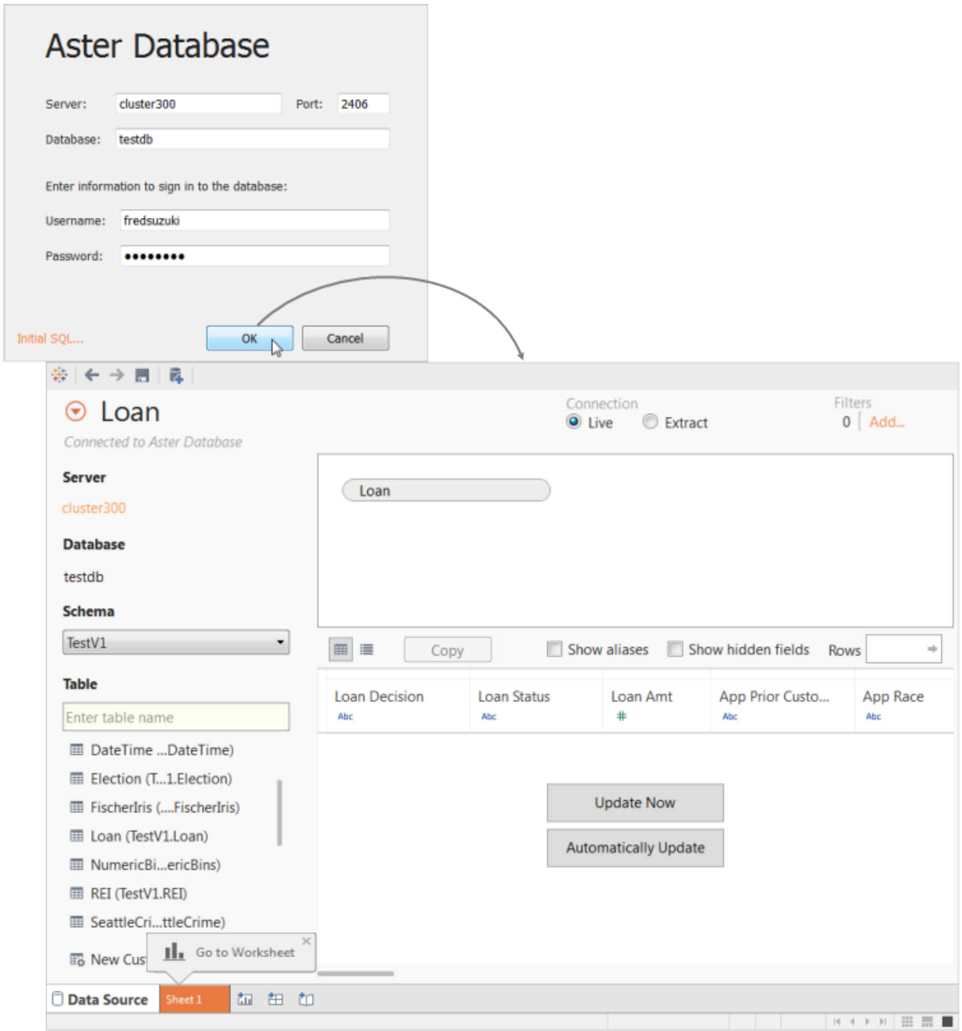
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the

field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Aster Database Data Source Example

An example of an Aster Database data source is shown below.



Cisco Information Server

This topic describes how to connect Tableau to a Cisco Information Server virtual database and set up the data source.

1. On the start page, under **Connect**, click **Cisco Information Server**, and then do the following:
    1. Enter the name of the server that hosts the data source you want to connect to.
    2. Enter the name of the **Datasource** you want to connect to.
    3. Select how you want to sign in to the server. Specify whether to use **LDAP** or a user name and password.
    4. Click **OK**.

If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Catalog** drop-down list, enter the catalog name in the text box, or select the catalog from the list.
    3. From the **Schema** drop-down list, enter the schema name in the text box, or select the schema from the list.
    4. Under **Table**, enter the table name in the text box, or select the table from the list.
    5. Drag the table to the canvas, and then click the sheet tab to start your analysis.

    Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

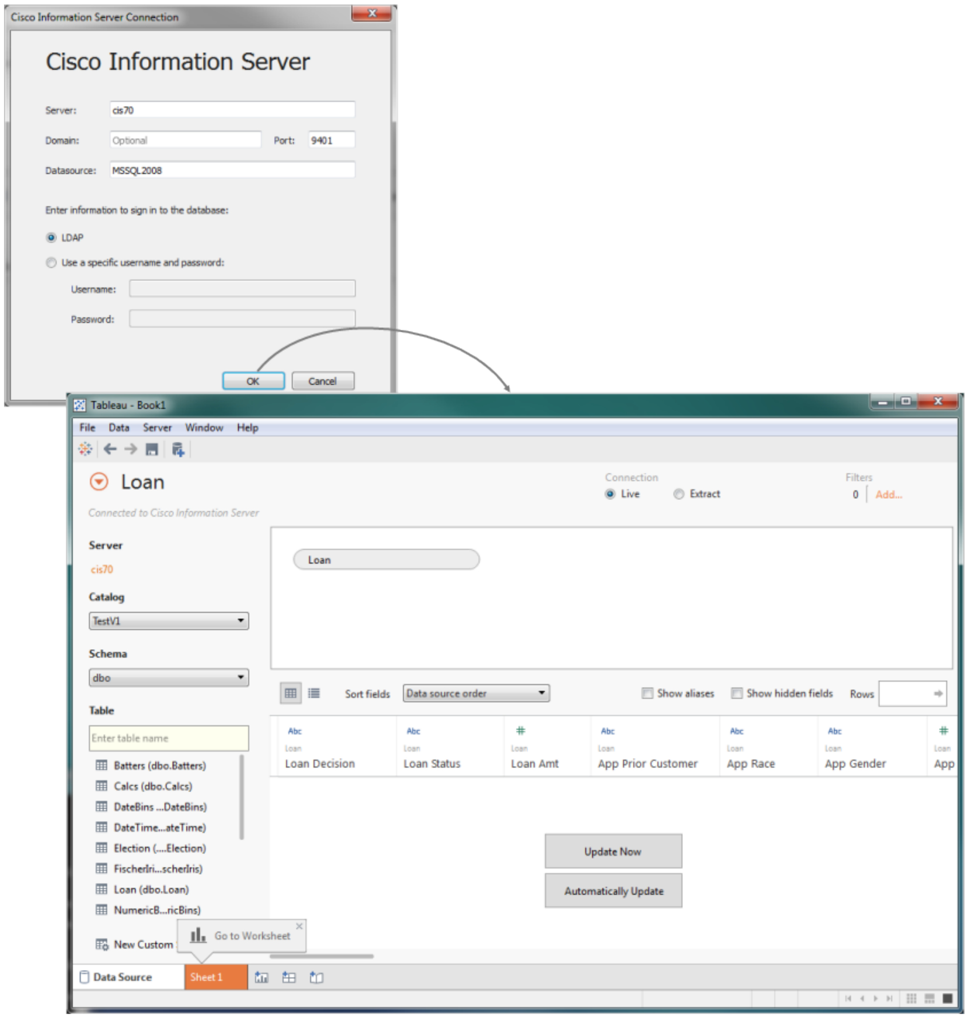
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data

source.

- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Cisco Information Server Data Source Example

Here is an example of a Cisco Information Server data source:



Cloudera Hadoop

This topic describes how to connect Tableau to a Cloudera Hadoop database and set up the data source. For more information about connecting to Hadoop data, see Connecting to Cloudera Hadoop in the Tableau Knowledge Base.

1. On the start page, under **Connect**, click **Cloudera Hadoop**, and then do the following:
    1. Enter the name of the server that hosts the database and the port number to use. If you are connecting using Cloudera Impala, you must use port 21050; this is the default port if you are using the 2.5.x driver (recommended).
    2. In the **Type** drop-down list, select the type of database to connect to. Depending on the version of Hadoop and the drivers you have installed, you can connect using one of the following:

- **Hive Server**
- **Hive Server 2**
- **Impala**

3. In the **Authentication** drop-down list, select the authentication method to use.
4. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
5. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.
   3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.
   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349. **Note:** This database type only supports equal (=) join operations.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

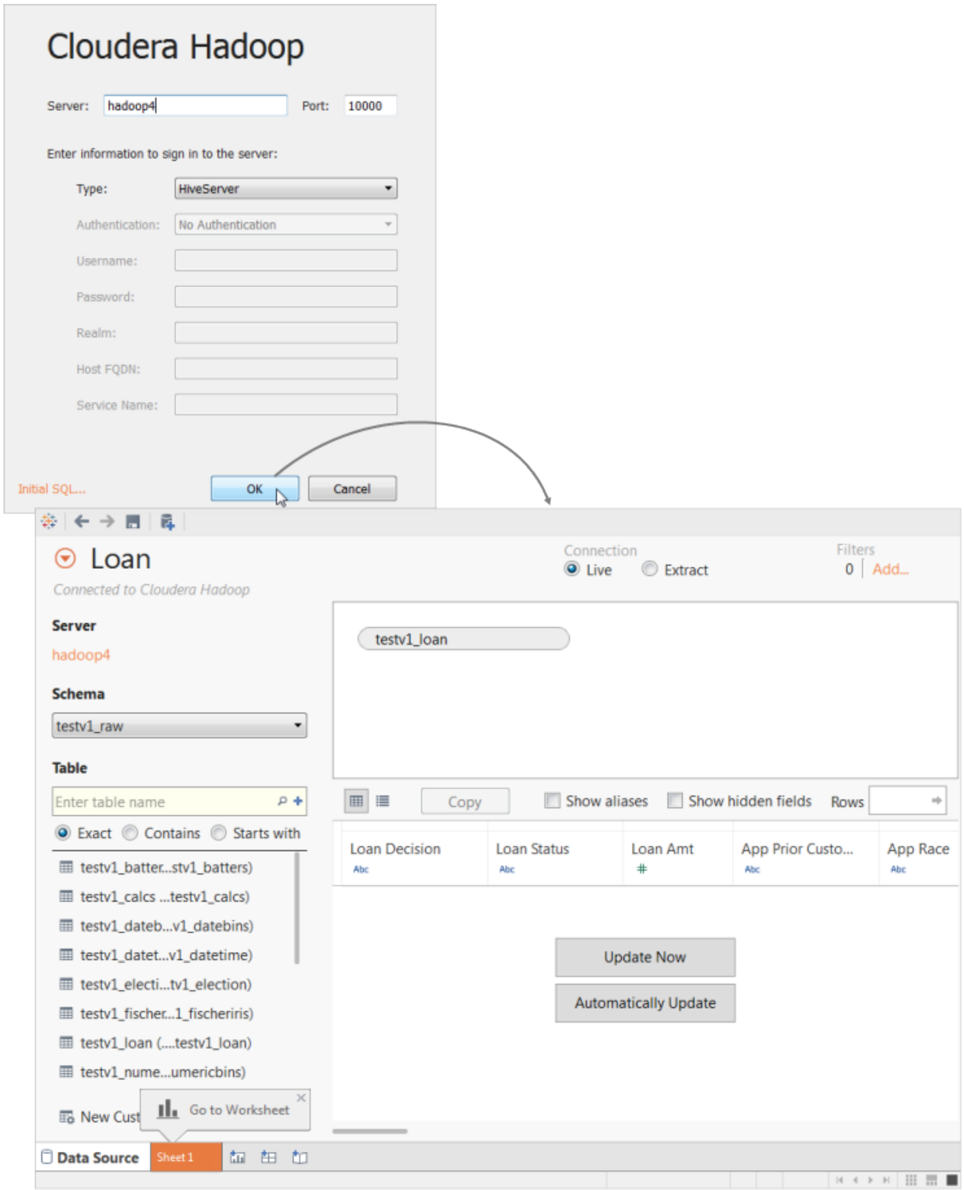
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Hadoop and Impala Query Limits

When connecting to Hadoop using Impala, the queries are limited to 100,000 rows of data when the query includes an ORDER BY clause. You can configure this limit by using a TDC customization such as `<customization name="order-by-limit" value='10' />`.

Cloudera Hadoop Data Source Example

Here is an example of a Cloudera Hadoop data source:



DataStax Enterprise

This topic describes discusses how to connect Tableau to DataStax Enterprise database and set up the data source.

1. On the start page, under **Connect**, click **DataStax Enterprise**, and then do the following:

    1. Enter the name of the server that hosts the database.

    2. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign

in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.

3. Click **OK**.

   If the connection is unsuccessful, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.

   3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.

   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.

- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.

- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

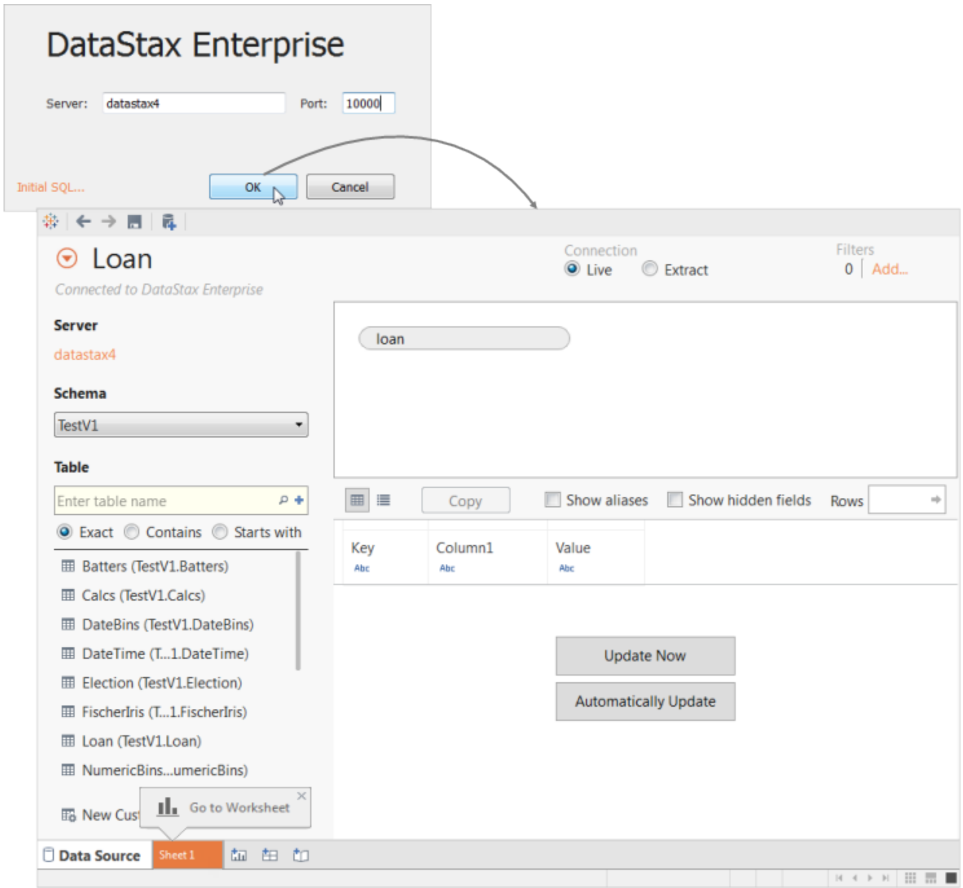
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.

- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

DataStax Enterprise Data Source Example

An example of a DataStax Enterprise data source is shown below.



EXASolution

This topic describes how to connect Tableau to data stored in the EXASolution platform and set up the data source. Tableau can connect to EXASolution version 4.2 and later.

1. On the start page, under **Connect**, click **EXASolution**, and then do the following:
    1. Enter the name of the server that you want to connect to.
    2. Enter the user name and password, and then click **OK**.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

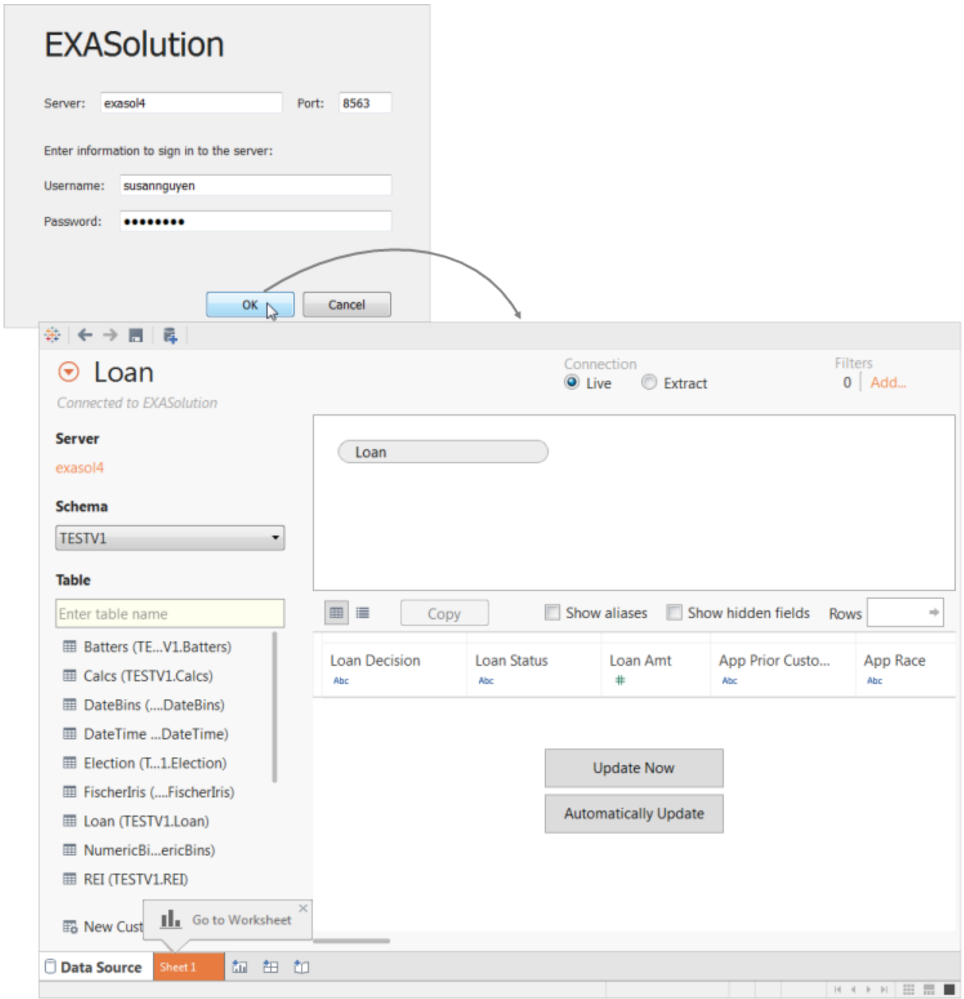
Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

EXASolution Data Source Example

An example of an EXASolution data source is shown below.



Firebird

This topic describes how to connect Tableau to a Firebird database and set up the data source.

1. On the start page, under **Connect**, click **Firebird**, and then do the following:
    1. Enter the name of the server that hosts the database, and specify the location of the database.
    2. Enter the user name and password, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select a table, drag it to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

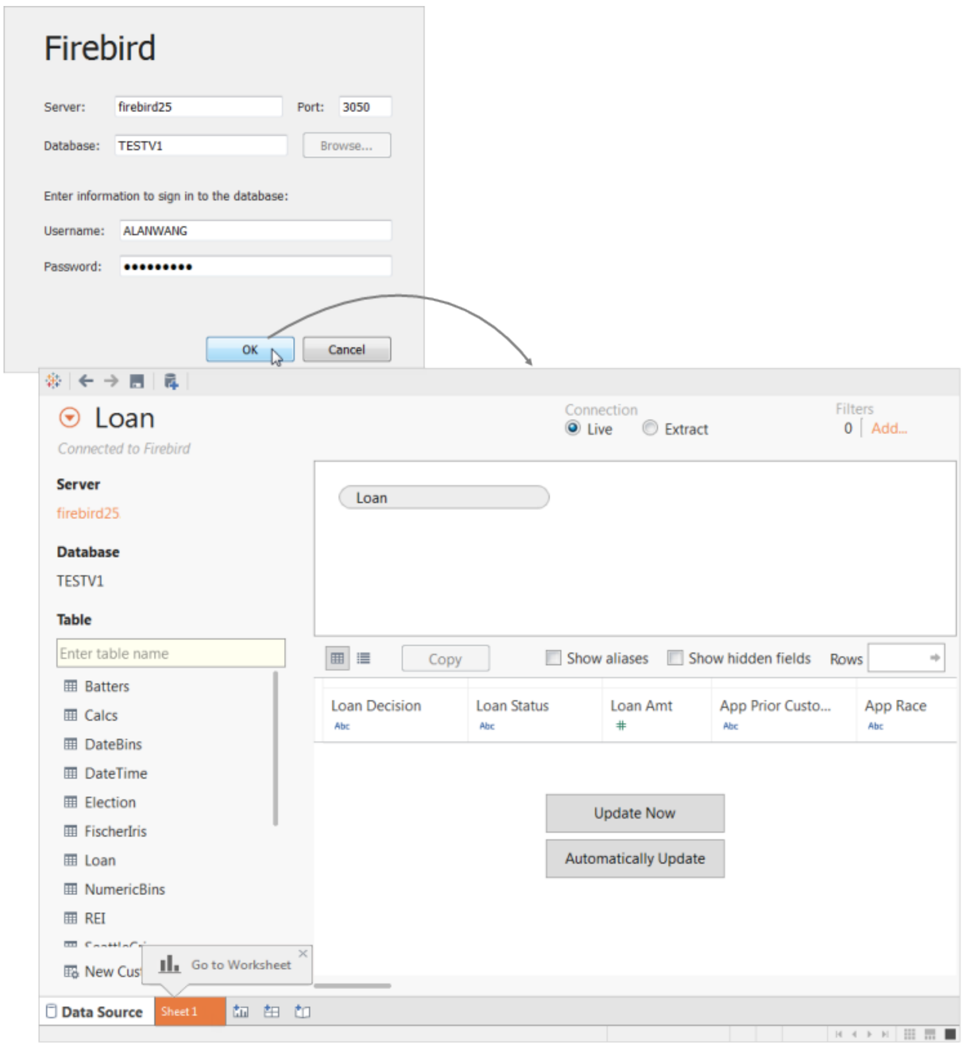
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Firebird Data Source Example

An example of a Firebird data source is shown below.

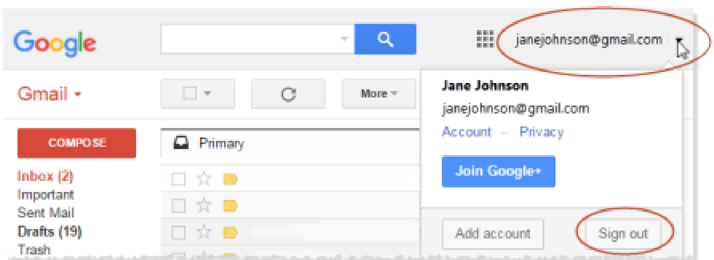


Google Analytics

This topic describes how to connect Tableau to Google Analytics (GA).

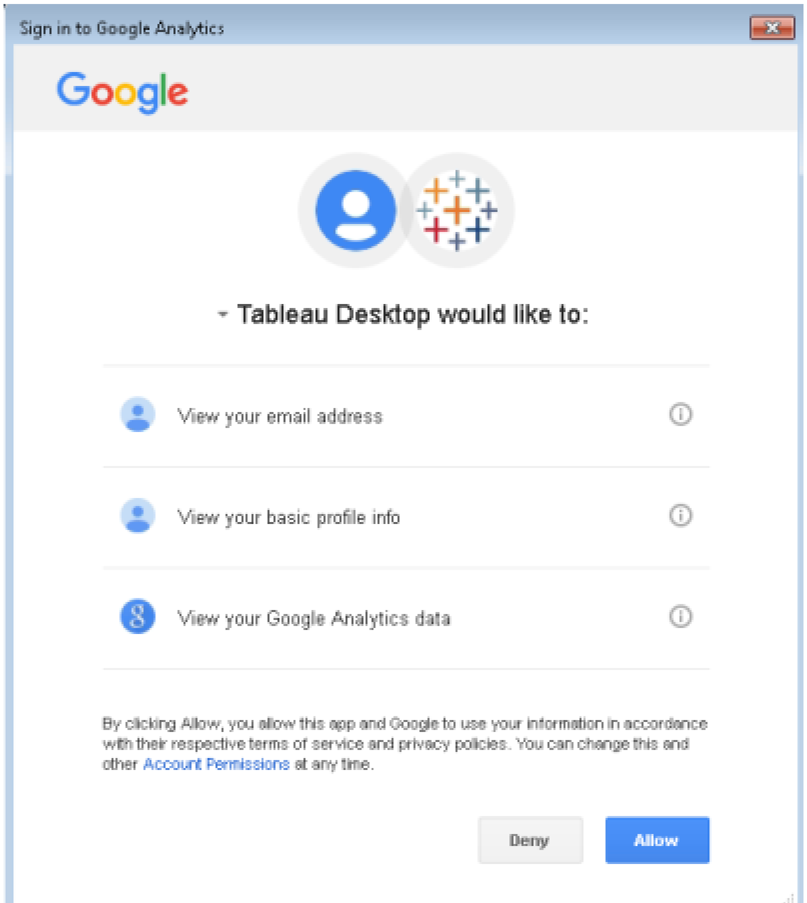
1. On the start page, under **Connect**, click **Google Analytics**.
2. Sign in to GA using your email address and password.

   Note: If Google bypasses the sign-in screen and goes directly to the approval screen shown in the next step, it means you are already signed in to a Google account. If you are signed in, make sure you are using the account that provides access to your Google Analytics information. To sign out of an account, click the drop-down arrow next to the account name, and then click **Sign out**. You can then sign in using the correct credentials.

3. Click **Allow** to let Tableau Desktop access your GA data.

   If your data source is OAuth enabled, you create an OAuth connection.



4. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
5. Follow the steps at the top of the data source page to complete the connection.

   Step 1 – Select an Account, Property, and Profile using the drop-down menus.

   Step 2 – Select filters for a date range and a segment.

   - For **Date Range**, you can select one of the predefined date ranges or select specific dates. When selecting a date range, GA can provide complete data only up to the previous full day. For example, if you choose Last 30 days, data will be retrieved for the last 30-day period ending yesterday.
   - For **Segment**, select a segment to filter your data. Segments are preset filters that you can set for a GA connection. Default Segments are defined by Google, and Custom Segments are defined by the user on the GA website. Segments also help prevent sampling to occur by filtering the data as defined by the segment. For example, with a segment, you can get

results for a specific platform, such as tablets, or for a particular search engine, such as Google.

> **Note:** GA restricts the amount of data that it returns in a query. When you attempt to retrieve more data than GA allows in a single query, GA returns sampled data instead. If Tableau detects that your GA query might return sampled data, Tableau attempts to bypass the query restriction to return all data instead. For more information, see **All Data vs. Sampled Data** below below. For more information about data sampling and the associated risks, see Sampled Data from Google Analytics in the Tableau Knowledge Base.

Step 3 – Add dimensions and measures by using the **Add Dimension** and **Add Measure** drop-down menus, or select a predefined set of measures from the **Choose a Measure Group** drop-down menu. Some dimensions and measures cannot be used together. For more information, see Dimensions & Metrics Reference Guide on the Google developer website.

6. Click the sheet tab to start your analysis. After you click the sheet tab, Tableau imports the data by creating an extract. Note that Tableau Desktop supports only extracts for Google Analytics. You can update the data by refreshing the extract. For more information, see **Extract Your Data** on page 379.

All Data vs. Sampled Data

GA restricts the amount of data that it returns from a query and provides sampled data instead. Sampled data is a random subset of your data. When performing analysis on sampled data, you can miss interesting outliers, and aggregations can be inaccurate. If Tableau detects that your query might return sampled data, by default, Tableau creates multiple queries from your query, and then combines the results from the queries to return all data.

You see the following message when Tableau returns all data.

> **Note:** If the query stays within the boundaries of the query restrictions, GA doesn't return sampled data and you do not see the above message.

Troubleshoot issues with returning all data

If your query continues to return sampled data, consider the following:

- **Missing date dimension** – You must use the date dimension in your query to return all data.
- **Too much data** – Your query might contain too much data. Reduce the date range.

Note: The minimum date range is one day.

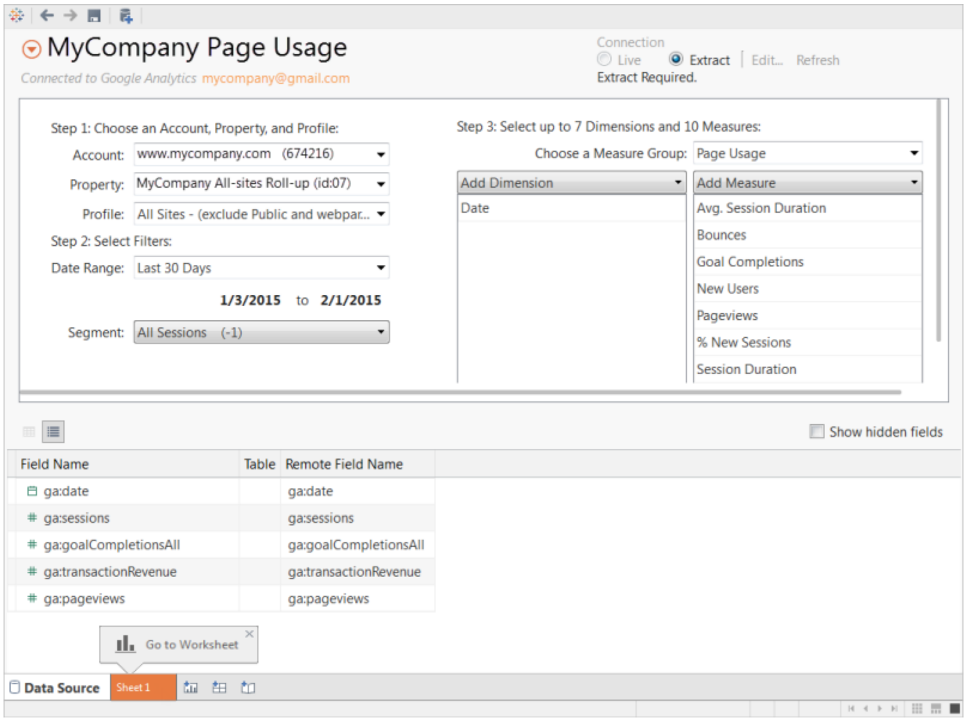
- **Non-aggregatable dimensions and measures** – Some dimensions and measures cannot be separated into multiple queries. If you suspect a problematic dimension or measure in your query, hover over the **All data** button to see the tooltip that shows which dimensions or measures to remove from your query. For more information about these types of dimensions and measures, see Sampled Data from Google Analytics in the Tableau Knowledge Base.
- **Legacy workbooks** – Workbooks created in Tableau Desktop 9.1 and earlier cannot return all data. Open the legacy workbook in Tableau Desktop 9.2 and save the workbook.

Return sampled data

In cases when workbook performance is critical or there are specific dimensions and measures you want to use in your query that are not supported by Tableau's default query process, use sampled data instead. To return sampled data, click the **Sample data** button.

Google Analytics Data Source Example

An example of a Google Analytics data source connection is shown below.

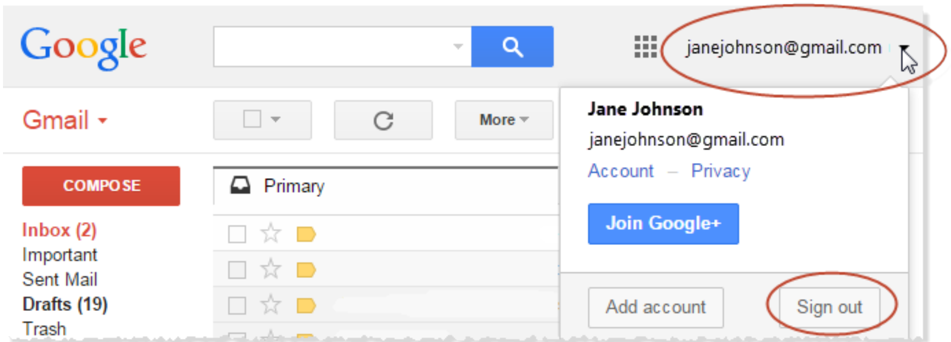


Google BigQuery

This topic describes how to connect Tableau to Google BigQuery and set up the data source.

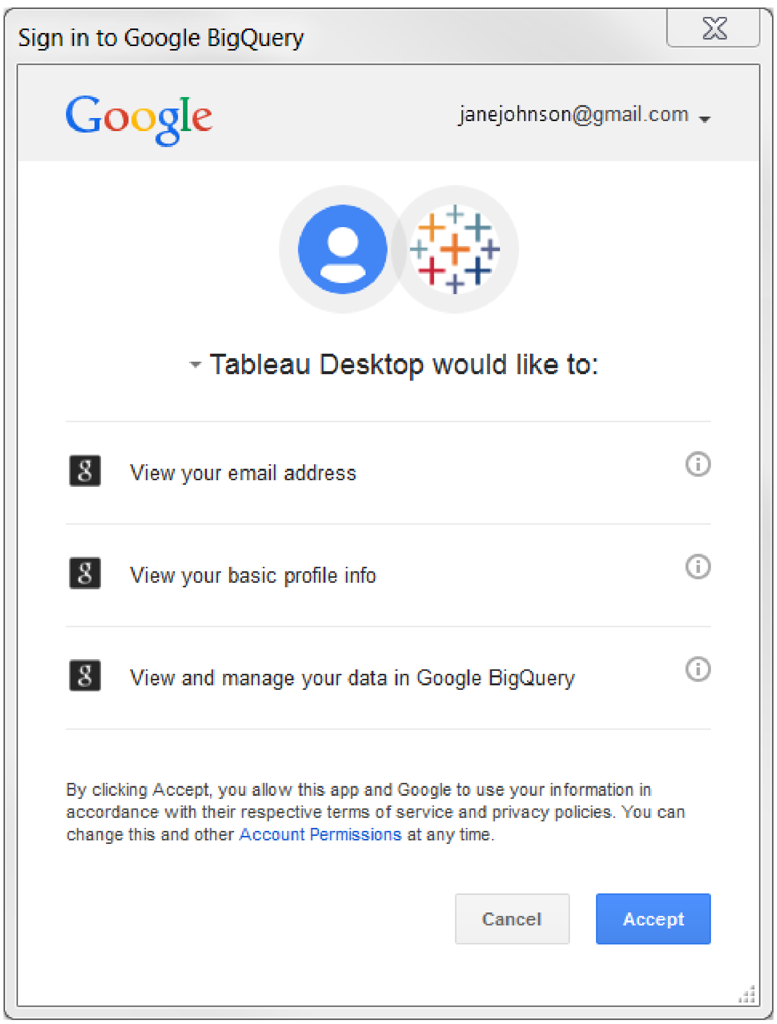
1. On the start page, under **Connect**, click **Google BigQuery**.
2. Sign in to Google BigQuery using your email address and password.

   Note: If Google bypasses the sign-in screen and goes directly to the approval screen shown in the next step, it means that you are already signed in to a Google account. If you are signed in, make sure that you are using the account that provides access to your Google BigQuery data. To sign out of an account, click the drop-down arrow next to the account name, and then click **Sign out**. You can then sign in using the correct credentials.



3. Click **Accept** to let Tableau Desktop access your Google BigQuery data.

   If your data source is OAuth enabled, you create an OAuth connection.



4. On the data source page, do the following:

1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
2. From the **Project** drop-down list, select a project. Alternatively, select **publicdata** to connect to sample data in BigQuery.
3. From the **Dataset** drop-down list, select a data set.
4. Under **Table**, select a table.

   Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the

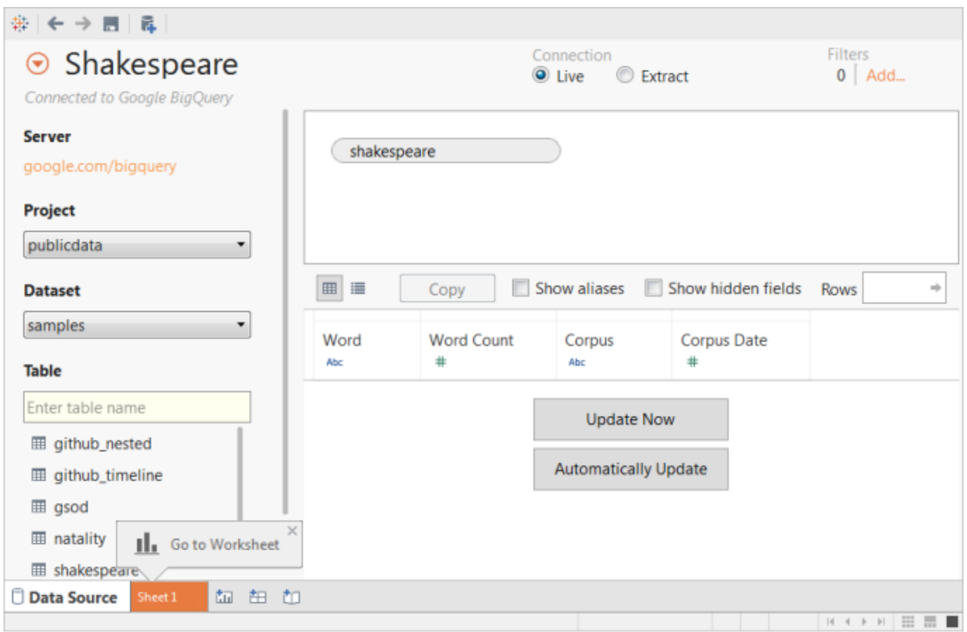
extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Note: Because of the large volume of data in BigQuery, Tableau recommends that you connect live.

Google BigQuery Data Source Example

An example of a Google BigQuery data source is shown below.



Google Cloud SQL

This topic describes how to connect Tableau to a Google Cloud SQL database instance and set up the data source.

1. On the start page, under **Connect**, click **Google Cloud SQL**, and then do the following:
    1. Enter the IP address of the server that hosts the database.
    2. Enter the user name and password, and then click **OK**.

       Select the **Require SSL** check box when connecting to an SSL server.

If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

    2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.

    3. Under **Table**, select a table or use the text box to search for a table by name.

    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

        Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

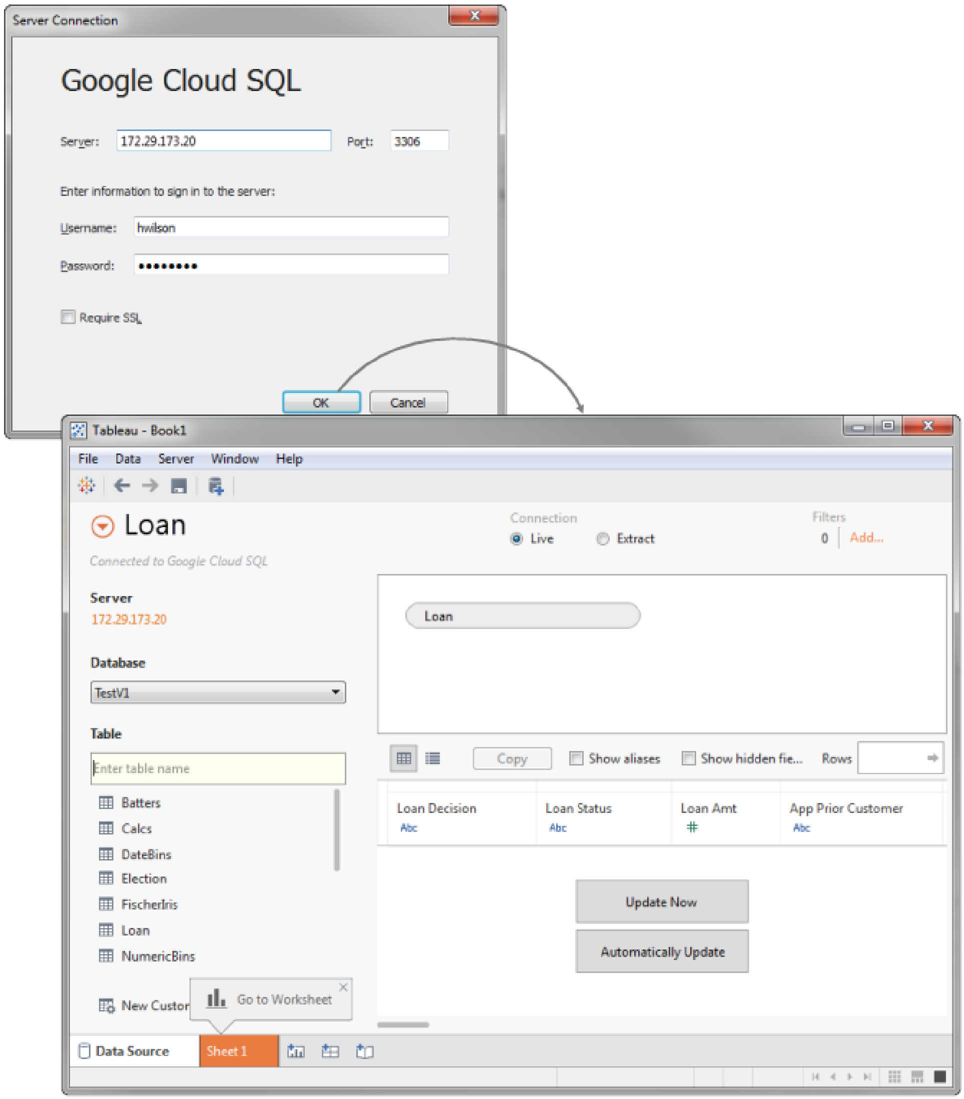
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C.

Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.

- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Google Cloud SQL Data Source Example

An example of a Google Cloud SQL data source is shown below.



Hortonworks Hadoop Hive

This topic describes how to connect Tableau to a Hortonworks Hadoop Hive database and set up the data source. For more information about connecting to Hadoop data, see Connecting to Hadoop Hive in the Tableau Knowledge Base.

1. On the start page, under **Connect**, click **Hortonworks Hadoop Hive**, and then do the following:

    1. Enter the name of server that hosts the data base.

    2. In the **Type** drop-down list, select the type of database to connect to:

        - **HiveServer**

        - **HiveServer2**

3. In the **Authentication** drop-down list, select the authentication method to use.
4. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
5. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.
   3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.
   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

      Note: This database type only support equal (=) join operations.

Optional Settings

You can make the following configurations before doing your analysis:

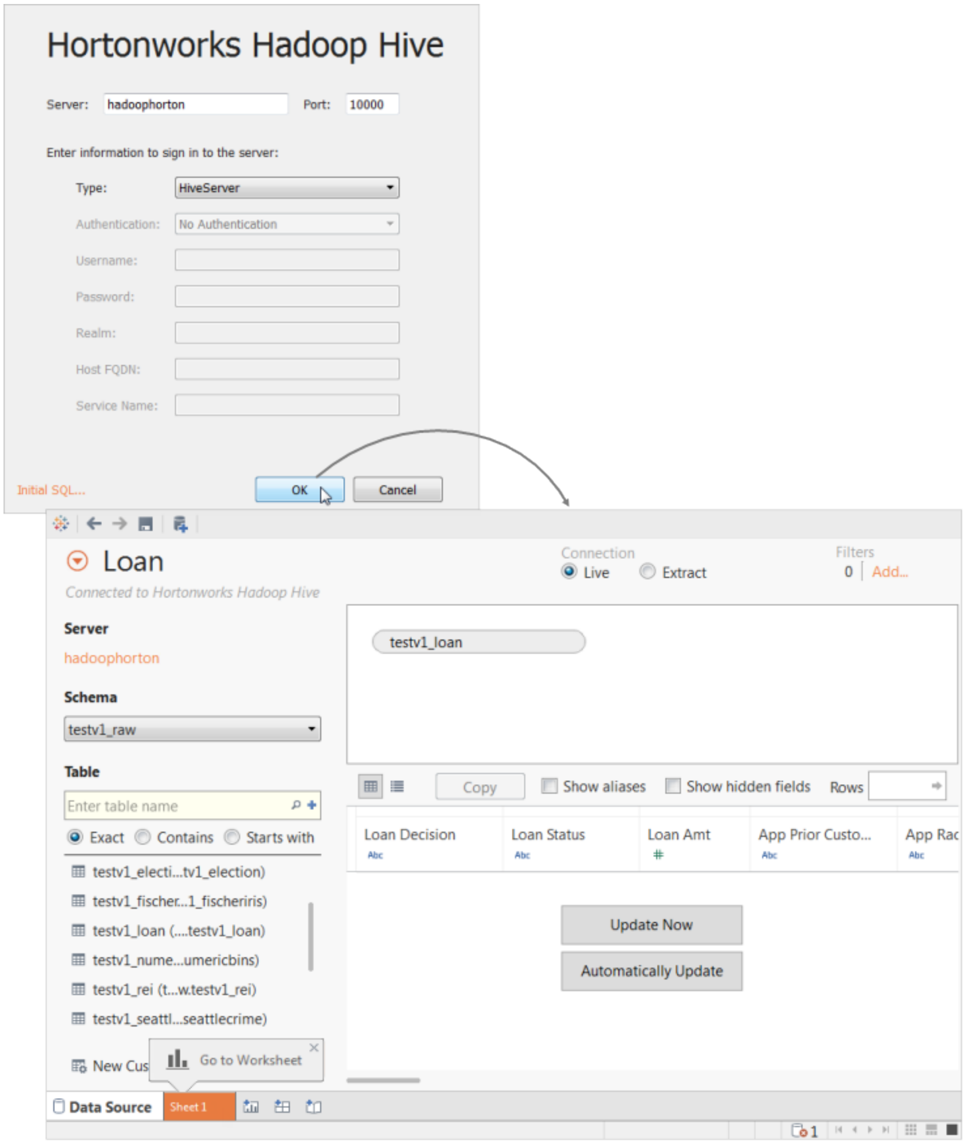
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the

field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Hortonworks Hadoop Hive Data Source Example

An example of a Hortonworks Hadoop Hive data source is shown below.



HP Vertica

This topic describes how to connect Tableau to an HP Vertica database and set up the data source.

1. On the start page, under **Connect**, click **HP Vertica**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
    2. Enter the user name and password.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign

in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.

4. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

   2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.

   3. Under **Table**, select a table or use the text box to search for a table by name.

   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.

- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.

- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

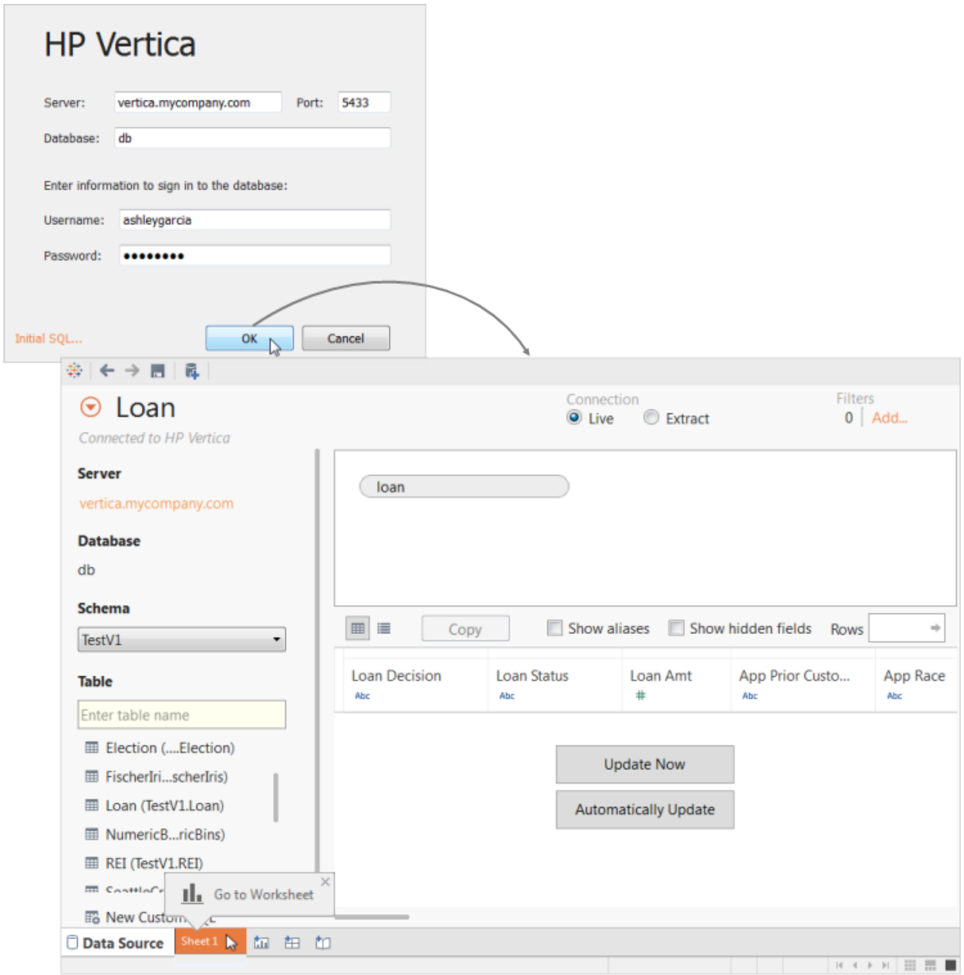
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.

- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

HP Vertica Data Source Example

An example of an HP Vertica data source is shown below.



IBM BigInsights

This topic describes how to connect Tableau to an IBM BigInsights database.

1. On the start page, under **Connect**, click **IBM BigInsights**, and then do the following:
    1. Enter the name of the server that hosts the database.
    2. Enter the port number.
    3. Enter the name of the database you want to connect to.
    4. Enter your user name and password.
    5. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    6. Click **OK**.

If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

    Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

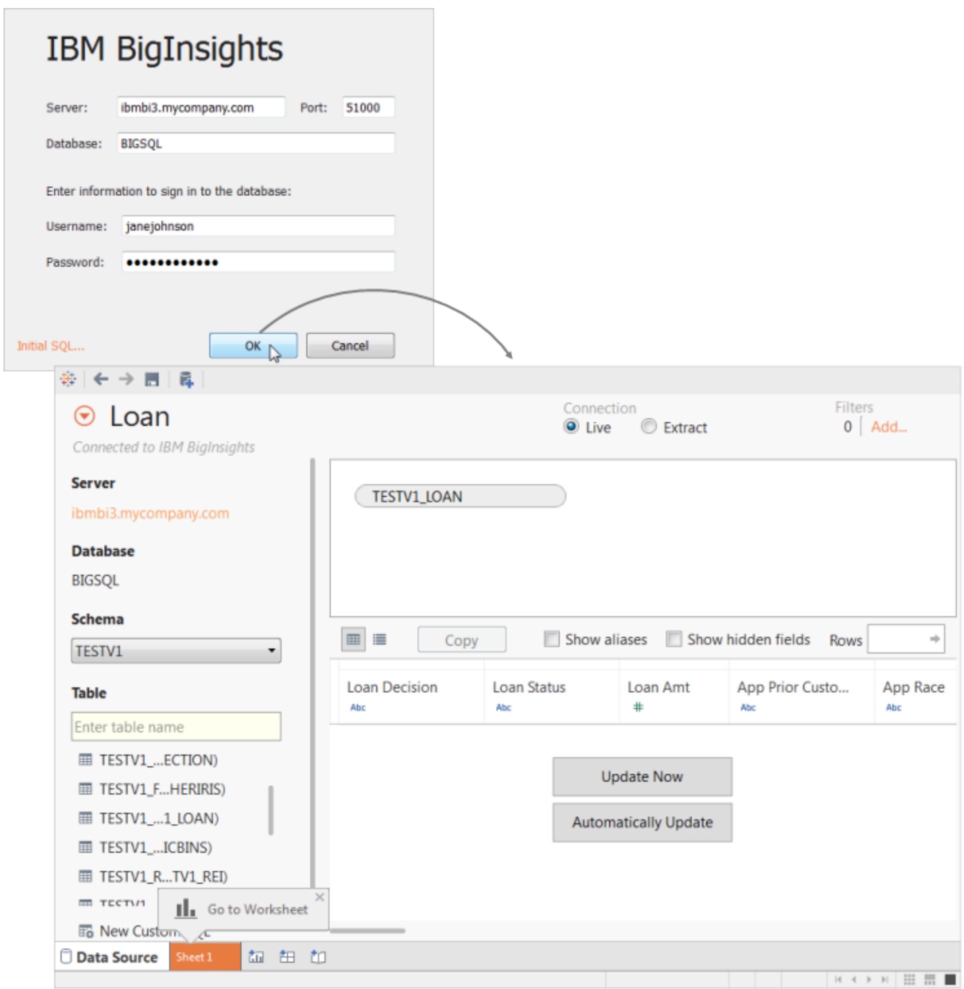
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C.

Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.

- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

IBM BigInsights Data Source Example

An example of an IBM BigInsights data source is shown below.



IBM DB2

This topic describes how to connect Tableau to an IBM DB2 database and set up the data source. You can also use this connector to connect to an IBM DB2 for z/OS database. Refer to the Technical Specifications to confirm which DB2 databases are supported.

1. On the start page, under **Connect**, click **IBM DB2**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.

       The port is dependent on the type of server you are connecting to and whether you are connecting to an encrypted port. Generally, use 50000 for a non-encrypted port and 60000 for an encrypted port. It is possible that your server is configured to use a non-standard port. Contact your administrator if you don't know which port to connect to.
    2. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    3. Enter your user name and password, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag a table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

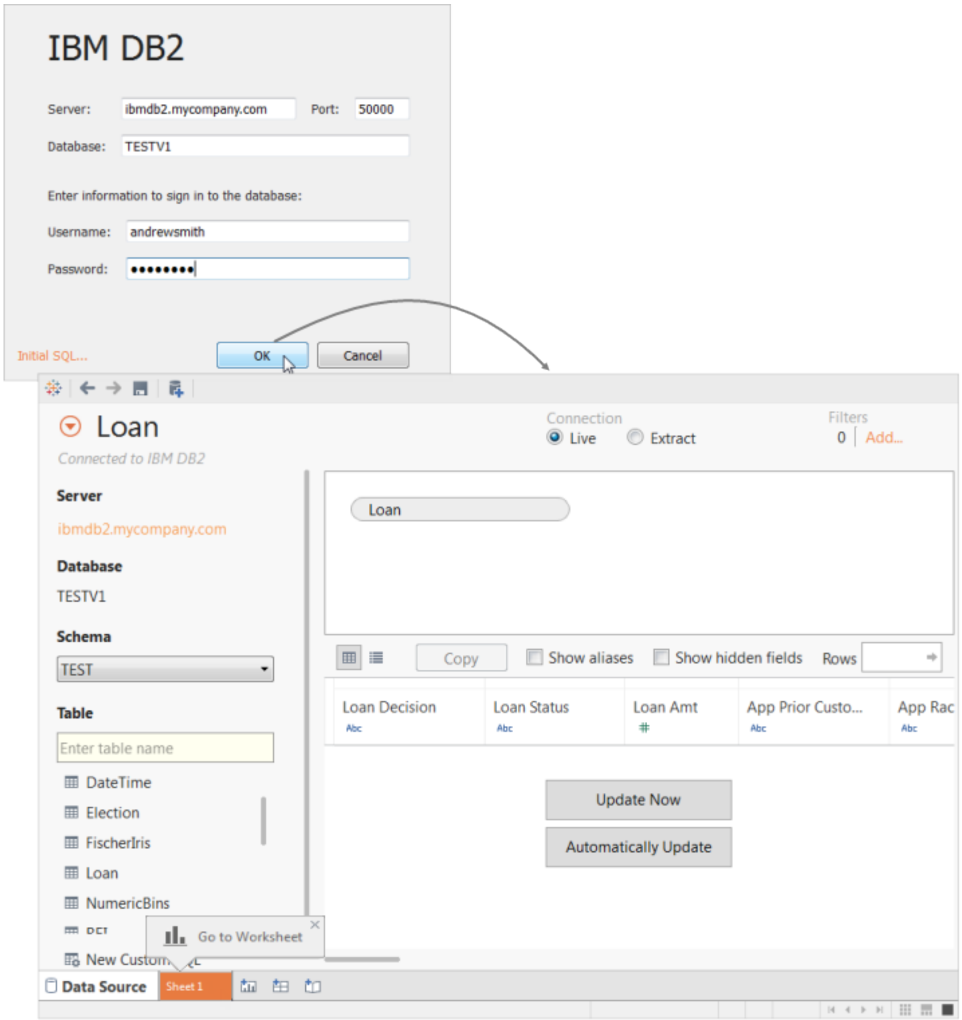
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.

- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

IBM DB2 Data Source Example

An example of an IBM DB2 data source is shown below.



IBM PDA (Netezza)

This topic describes how to connect Tableau to an IBM PDA (PureData System for Analytics) database and set up the data source.

1. On the start page, under **Connect**, click **IBM PDA (Netezza)**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
    2. Enter the user name and password, and then click **OK**.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Under **Table**, select a table or use the text box to search for a table by name.

3. Drag a table to the canvas, and then click the sheet tab to start your analysis.

   Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

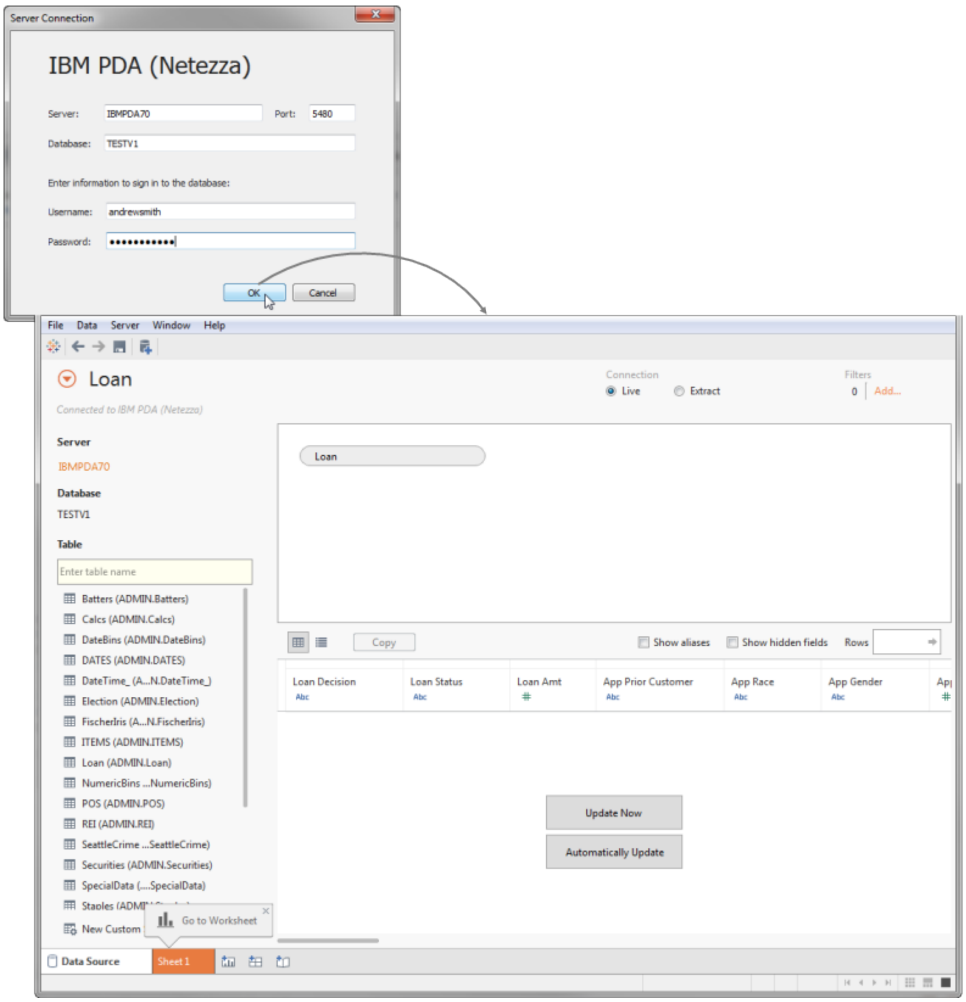
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the

data source name to connect to and add new data sources or edit other data sources in the workbook.

IBM PDA (Netezza) Data Source Example

An example of an IBM PDA (Netezza) data source is shown below.



Kognitio

This topic describes how to connect Tableau to a Kognitio database and set up the data source.

1. On the start page, under **Connect**, click **Kognitio**, and then do the following:
    1. Enter the name of the server that hosts the database you want to connect to.

        Note: When using Tableau Desktop on a Mac, use a fully qualified domain name, such as mydb.test.ourdomain.lan, instead of a relative domain name, such as mydb or mydb.test. Alternatively, add the domain to the list of Search Domains for the Mac computer. To update the list of Search Domains, go to **System Preferences** > **Network** > **Advanced**; then open the **DNS** tab. If you do this then you need only provide the server name when connecting.

    2. Enter the user name and password, and then click **OK**.

        Select the **Require SSL** check box when connecting to an SSL server.

        If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

        Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

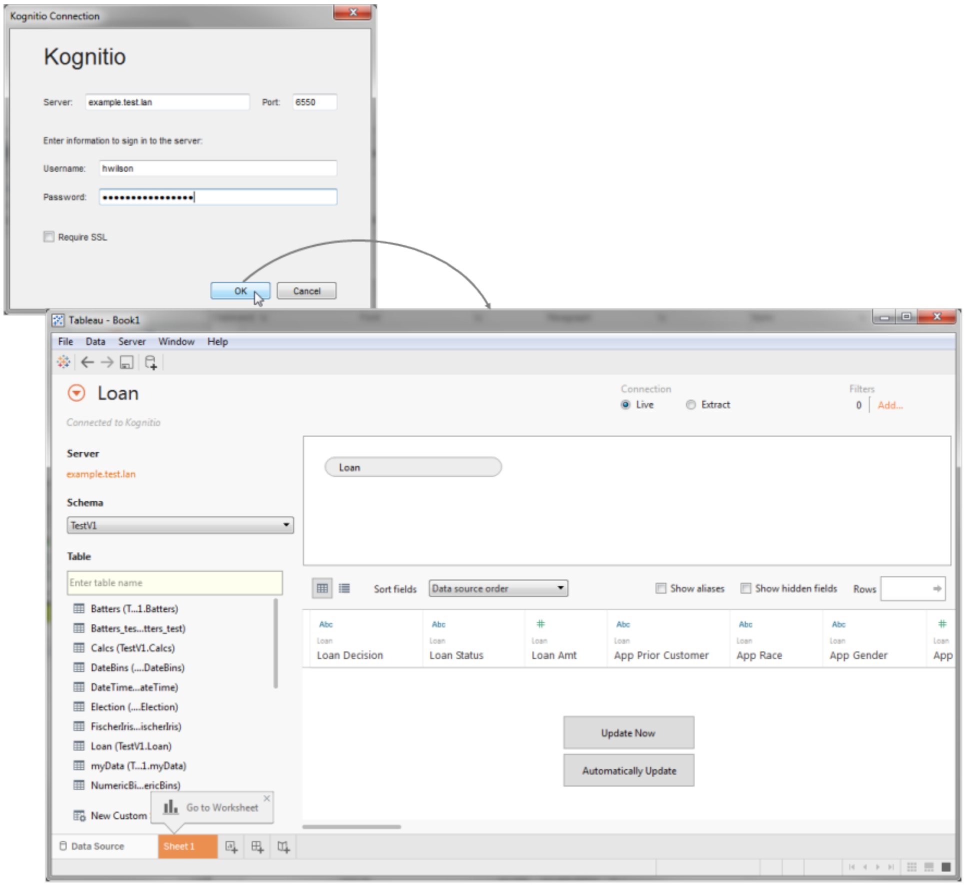
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Kognitio Data Source Example

Here is an example of a Kognitio data source:



MapR Hadoop Hive

This topic describes how to connect Tableau to a MapR Hadoop Hive database and set up the data source. For more information about connecting to Hadoop data, see Connecting to Hadoop Hive in the Tableau Knowledge Base.

1. On the start page, under **Connect**, click **MapR Hadoop Hive**, and then do the following:

    1. Enter the name of the server that hosts the database.

    2. In the **Type** drop-down list, select the type of database to connect to. You can select one of the following:

        - **HiveServer**
        - **HiveServer2**

    3. In the **Authentication** drop-down list, select the authentication method to use.

    4. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign

in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.

5. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.

   3. In the **Table** text box, click the search icon or enter the table name and click the search icon,

   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

      Note: This database type supports only equal (=) join operations.

Optional Settings

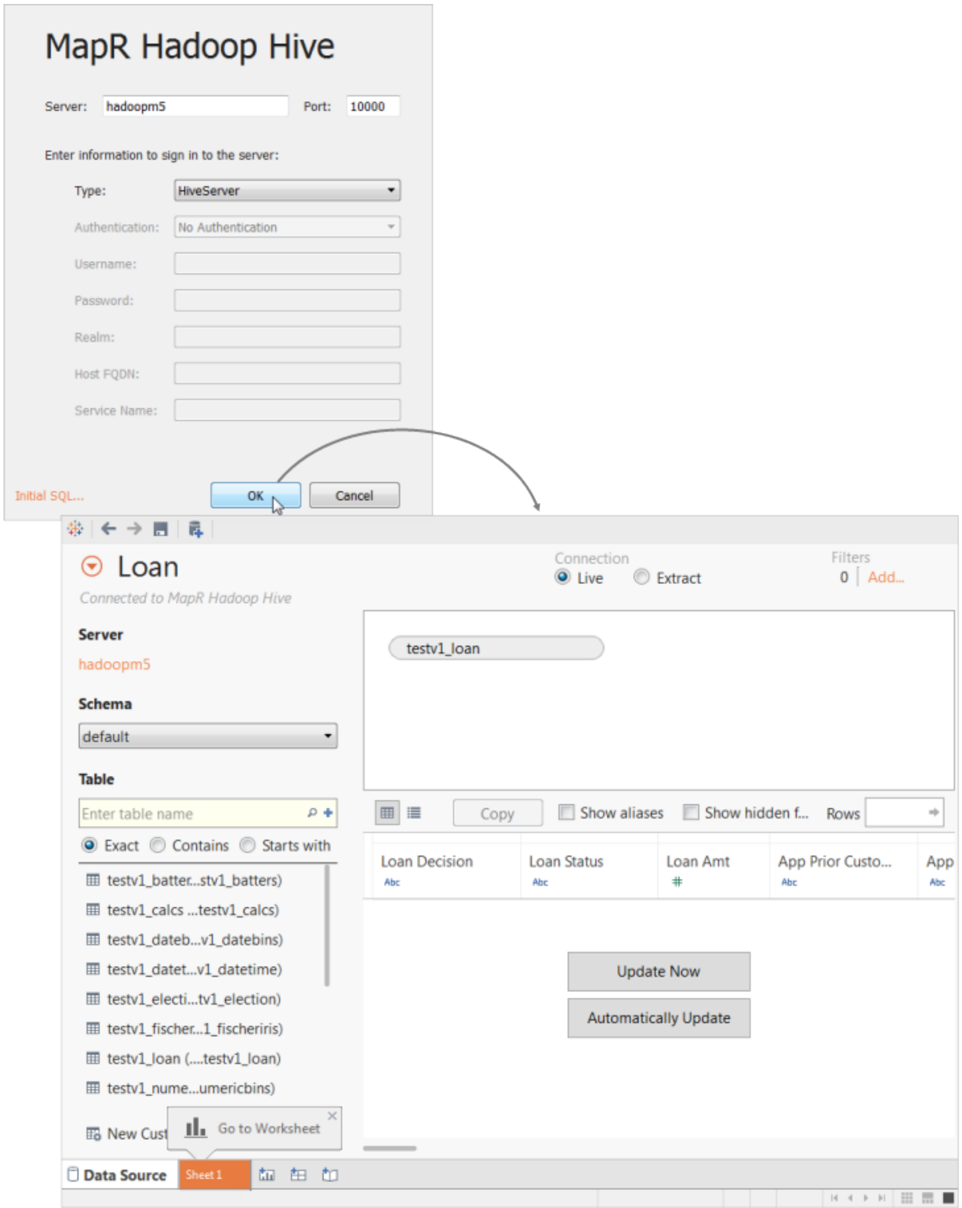
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

MadR Hadoop Data Source Example

An example of a MapR Hadoop Hive data source is shown below.



MarkLogic

This topic describes how to connect Tableau to a MarkLogic database.

1. On the start page, under **Connect**, click **MarkLogic**, and then do the following:
    1. Enter the name of the server that hosts the database you want to connect to.
    2. Enter the port number for the ODBC server process of the database you want to connect to.
    3. Enter your user name and password, and then click **OK**.

If the connection is unsuccessful, verify that your user name and password are correct and that the port number correctly identifies the MarkLogic database configured by your database administrator. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

    2. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.

    3. Under **Table**, select a table or use the text box to search for a table by name.

    4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

    Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

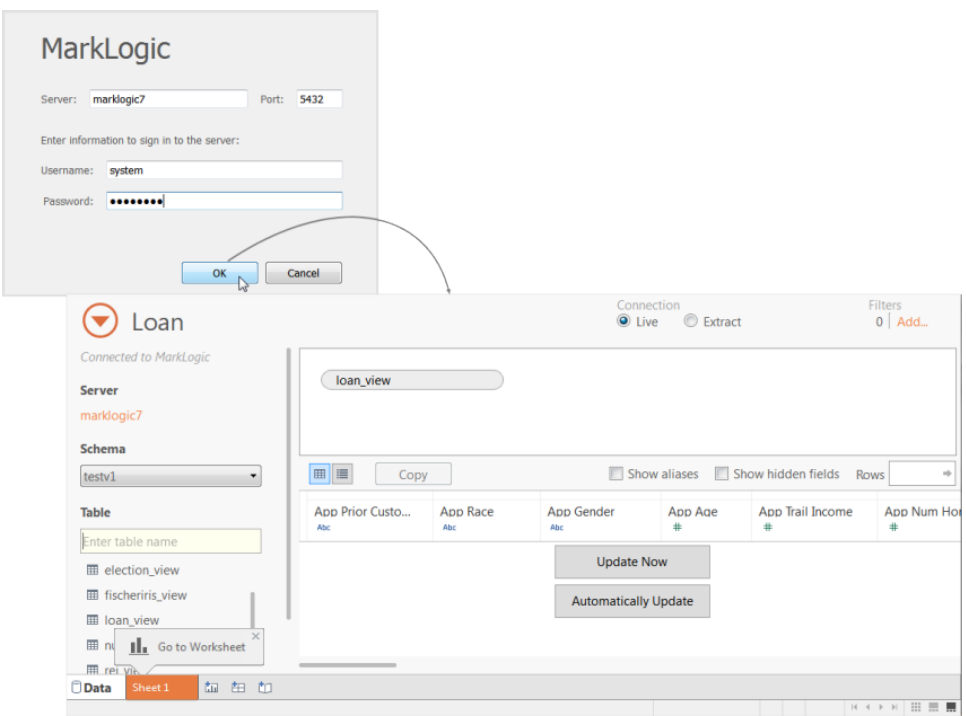
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.

- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

MarkLogic Data Source Example

An example of a MarkLogic data source is shown below.



Microsoft Analysis Services

This topic describes how to connect Tableau to a Microsoft Analysis Services database.

1. On the start page, under **Connect**, click **Microsoft Analysis Services**, and then do the following:
    1. Select whether to connect to a remote cube file on a server or to a local cube file.

       To connect to a remote cube file, select **Server** and enter the name of the server in the text box. If you are connecting to the server using HTTP, you can enter the URL as the server name.

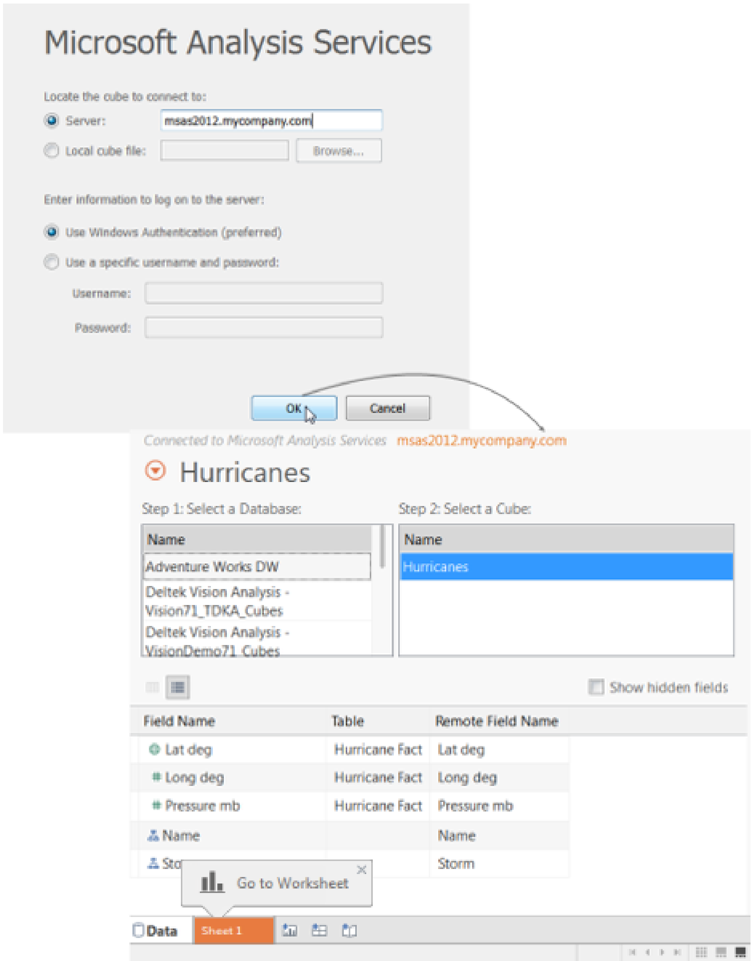
       To connect to a local cube file, select **Local cube file** and click **Browse** to navigate to the cube file on your computer.
    2. Enter your user name and password to sign in to the server, if required, and then click **OK**.

       Specify whether to use Windows Authentication or a specific user name and password. If the cube is password protected, and you are not in a Kerberos environment, you must enter your user name and password.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select a database.
    3. Select a cube from the database.
    4. Click the sheet tab to start your analysis.

Microsoft Analysis Services Data Source Example

An example of a Microsoft Analysis Services data source is shown below.



Microsoft PowerPivot

This topic describes how to connect Tableau to a Microsoft PowerPivot database.

1. On the start page, under **Connect**, click **Microsoft PowerPivot**, and then do the following:
    1. Select whether to connect to a PowerPivot file using a SharePoint URL, a SharePoint UNC (file path), or a local Excel file.

       If you plan to publish the workbook to Tableau Server, make sure to connect to a PowerPivot file on SharePoint. Tableau Server does not support connections to local PowerPivot files.
    2. Click **OK**.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

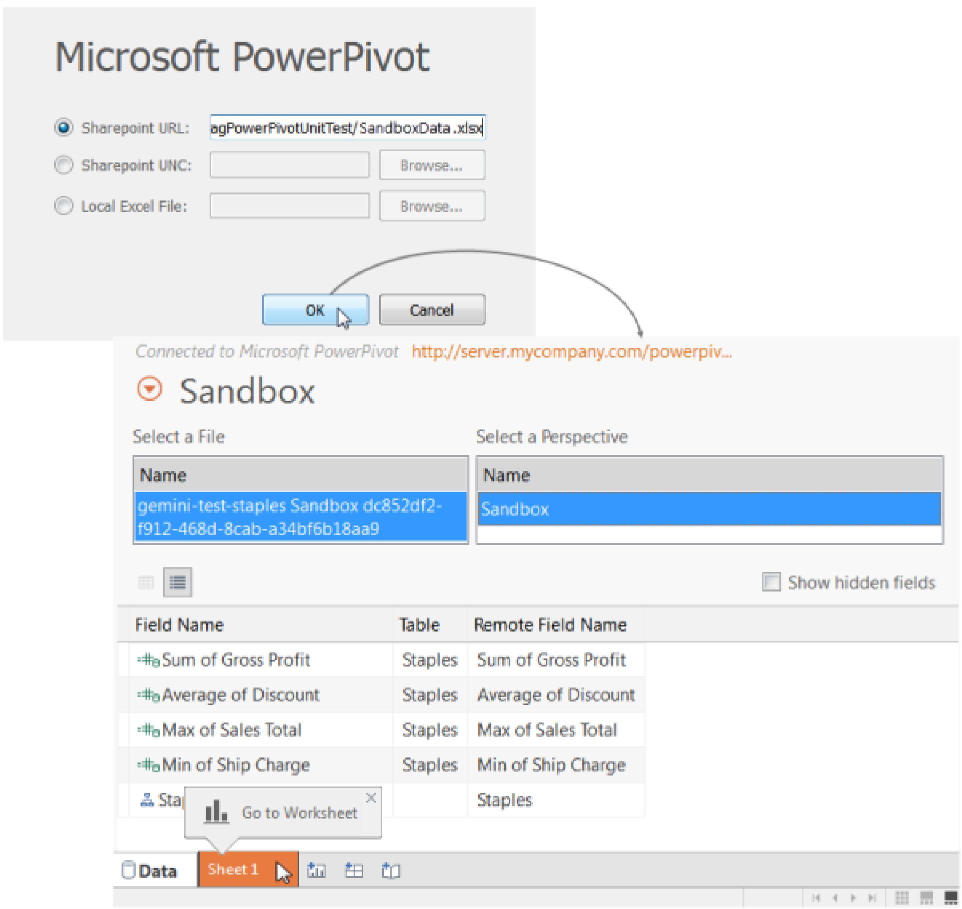
2. The file name appears under **Select a File**. Note that there is one file per connection. Select a perspective available in that file.

   PowerPivot data sources may contain one or more perspectives. Perspectives are subsets of objects from the model that define sets of data. Typically perspectives are defined for a particular group of users or business scenario. Using perspectives can make it easier to navigate large data sources.

3. Click the sheet tab to start your analysis.

Microsoft PowerPivot Data Source Example

An example of a Microsoft PowerPivot data source is shown below.



Microsoft SQL Server

This topic describes how to connect Tableau to a Microsoft SQL Server database and set up the data source.

Note: Use the Microsoft SQL Server connector to connect to Microsoft SQL Server Parallel Data Warehouse (PDW), Microsoft Azure SQL Data Warehouse, or Microsoft Azure SQL Database.

1. On the start page, under **Connect**, click **Microsoft SQL Server**, and then do the following:
    1. Enter the name of the server you want to connect to.
    2. Select how you want to sign in to the server. Specify whether to use Windows Authentication or a specific user name and password. If the server is password protected, and you are not in a Kerberos environment, you must enter the user name and password.

       Select the **Require SSL** check box when connecting to an SSL server.
    3. Specify whether to **Read uncommitted data**. This option sets the database isolation level to Read Uncommitted. Long queries from Tableau, including extract refreshes, can lock the database and delay transactions. Select this option to allow queries to read rows that have been modified by other transactions even when they have not been committed yet. When this option is cleared, Tableau uses the default isolation level specified by the database.
    4. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    5. Click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.

       You can also specify a stored procedure in the database. For more information about stored procedures, including a list of constraints specific to SQL Server databases, see **Use a Stored Procedure** on page 402.
    4. Drag the table or stored procedure to the canvas, and then click the sheet tab to

start your analysis.

Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

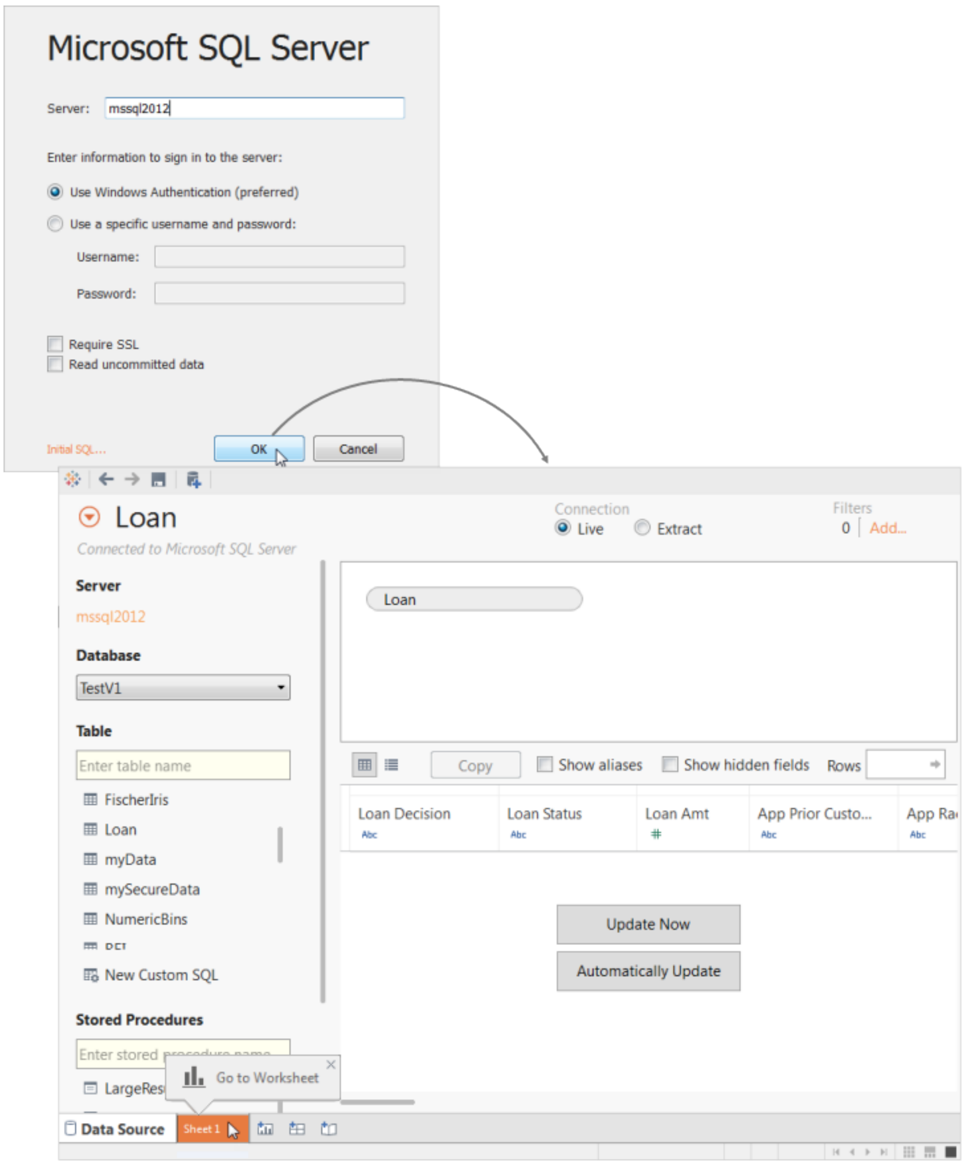
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the

data source name to connect to and add new data sources or edit other data sources in the workbook.

Microsoft SQL Server Data Source Example

An example of a Microsoft SQL Server data source is shown below.



Note: Tableau Desktop does not support the Microsoft SQL Server TIME data type. Fields of this data type are not imported and do not appear in Tableau Desktop. If included in stored procedures, TIME data type fields will not appear in Tableau Desktop. For more information, see **Use a Stored Procedure** on page 402.

MonetDB

This topic describes how to connect Tableau to a MonetDB database and set up the data source.

1. On the start page, under **Connect**, click **MonetDB**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
    2. Enter the user name and password, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, select a schema.
    3. Under **Table**, select a table or use the text box to search for a table by name.
    4. Drag a table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

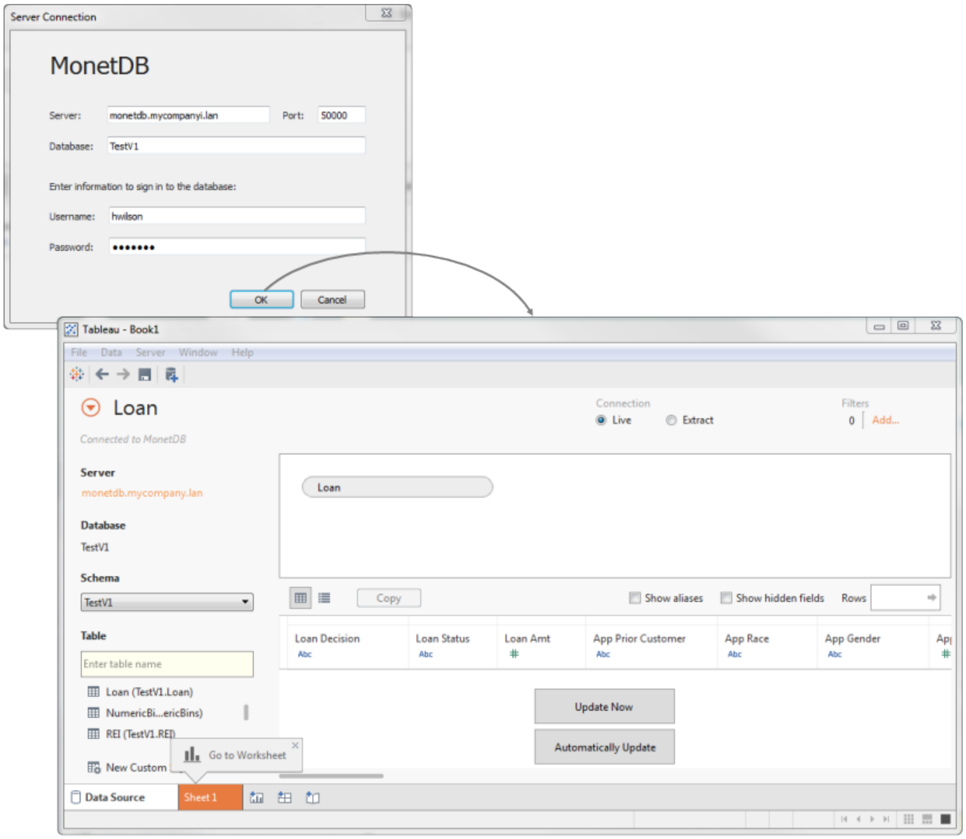
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the

field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

MonetDB Data Source Example

An example of a MonetDB data source is shown below.



MySQL

This topic describes how to connect Tableau to a MySQL database and set up the data source.

1. On the start page, under **Connect**, click **MySQL**, and then do the following:
    1. Enter the name of the server that hosts the database.
    2. Enter the user name and password, and then click **OK**.

       Select the **Require SSL** check box when connecting to an SSL server.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.
    3. Under **Table**, select a table or use the text box to search for a table by name.

4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

   Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

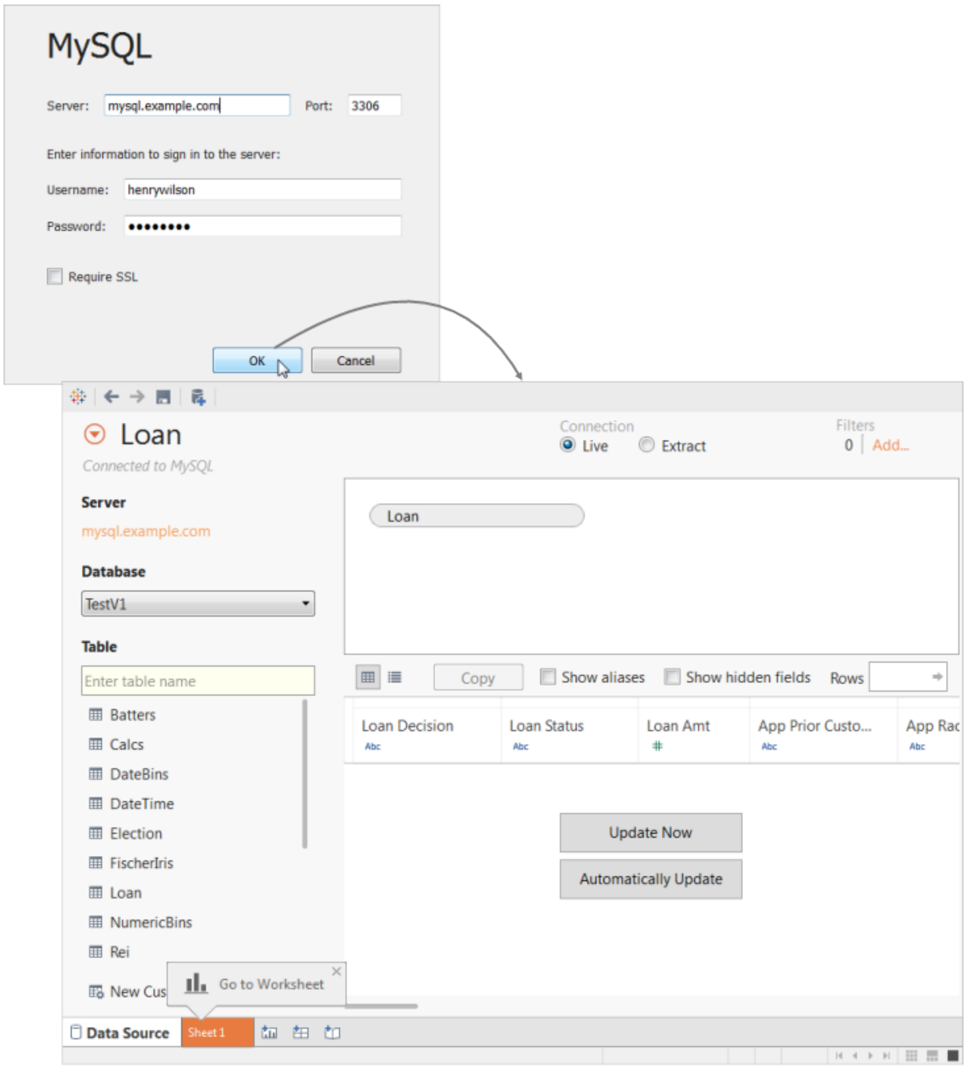
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the

data source name to connect to and add new data sources or edit other data sources in the workbook.

MySQL Data Source Example

An example of a MySQL data source is shown below.



OData

This topic describes how to connect Tableau to an OData data source. Tableau connects to OData V2, and does not support browsing OData service documents.

Note: Use the OData connector to connect to your Windows Azure Marketplace data. Workbooks created in earlier versions of Tableau that use the Windows Azure Marketplace DataMarket connector will work as expected.

1. On the start page, under **Connect**, click **OData**, and then do the following:
    1. Enter the server URL for the data you are connecting to.
    2. If necessary, enter authentication information.

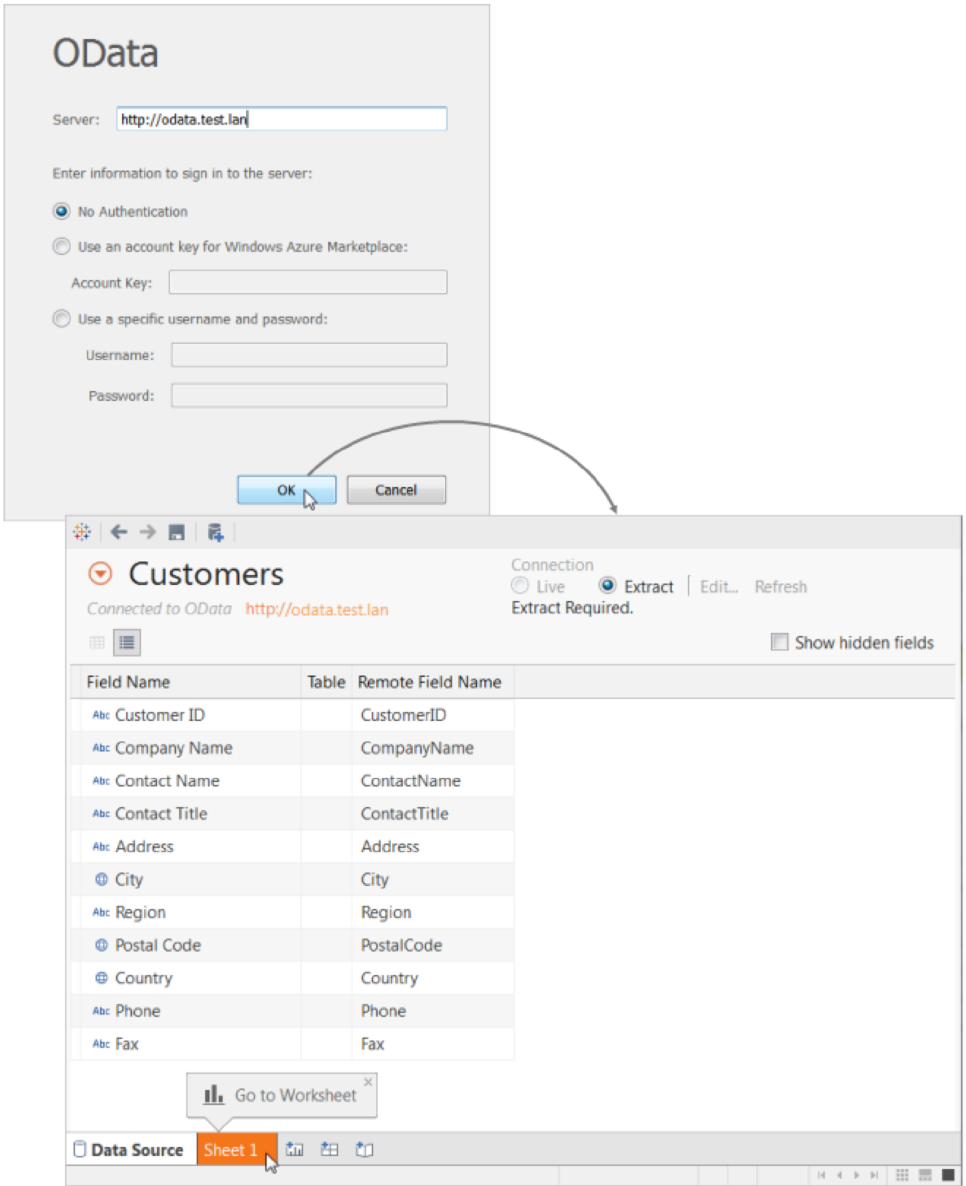
       You can authenticate using your Windows Azure Marketplace (DataMarket) account key, or a user name and password.
    3. Click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Click the sheet tab to start your analysis.

       After you click the sheet tab, Tableau imports the data by creating an extract. For more information about extracts, see **Extract Your Data** on page 379. Note that Tableau Desktop supports only extracts for OData. Unlike many extract connections, extracts from OData data sources cannot be refreshed. To get the updated data, you must reconnect to the data source.

OData Data Source Example

An example of an OData data source is shown below.



Oracle

This topic describes how to connect Tableau to an Oracle database and set up the data source.

1. On the start page, under **Connect**, click **Oracle**, and then do the following:
    1. Enter the server name. Optionally, specify the Oracle service name and port.
    2. Select how you want to sign in to the server. Specify whether to use Windows Authentication or a specific user name and password. If the server is password protected, you must enter the user name and password.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of

every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.

4. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema. **Note:** Search is case-sensitive.

   3. Under **Table**, click the search icon or enter the table name and click the search icon, and then select the table. **Note:** Search is case-sensitive.

   4. Drag a table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.

- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.

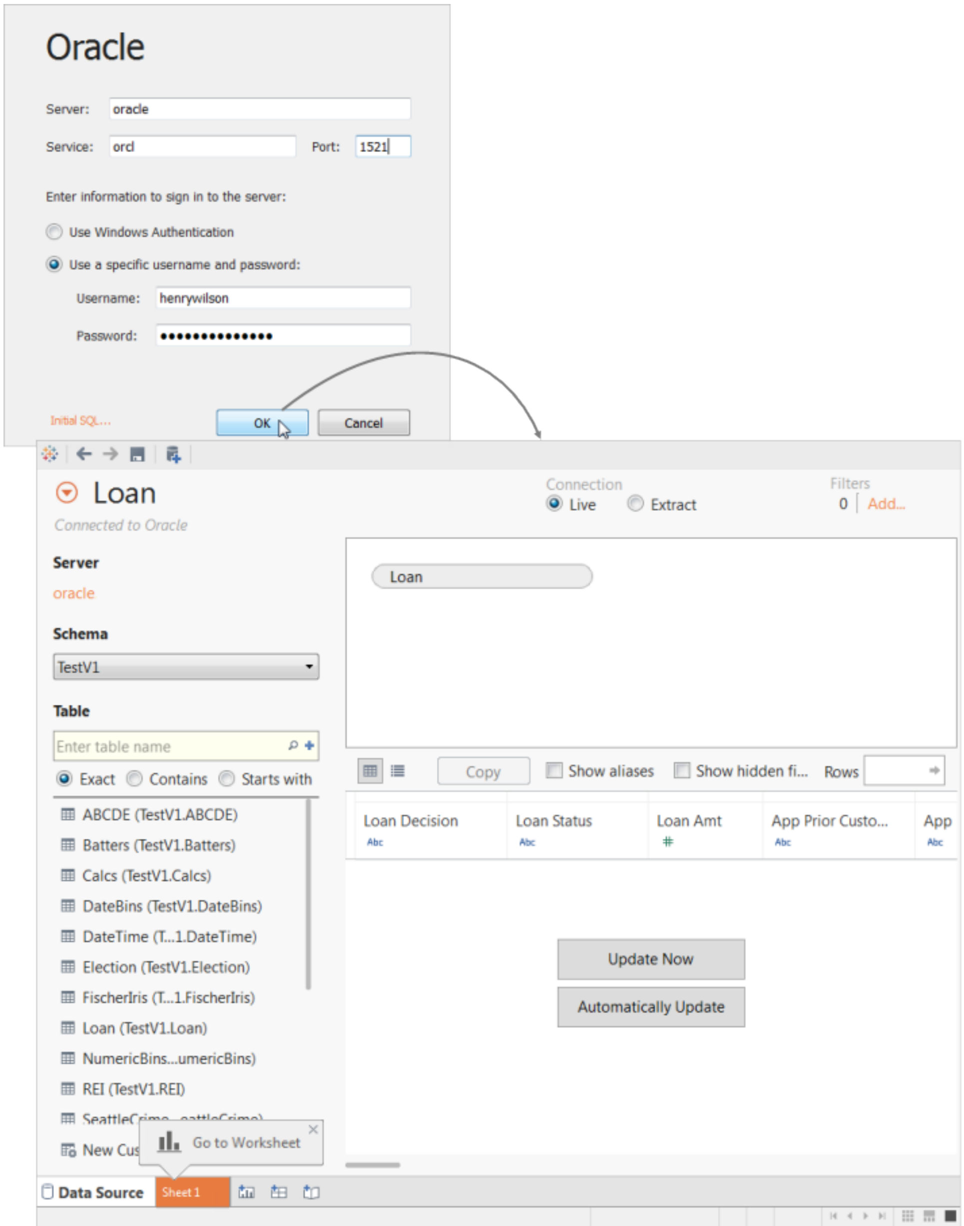
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.

- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Oracle Data Source Example

An example of an Oracle data source is shown below.



In order to use your net services definitions in Tableau, you must set either TNS_ADMIN or ORACLE_HOME as an environment variable. To set TNS_ADMIN as the environment variable use the full path of the directory that contains the tnsnames.ora file. To set ORACLE_HOME as an environment variable use the path to the main Oracle directory.

Oracle Essbase

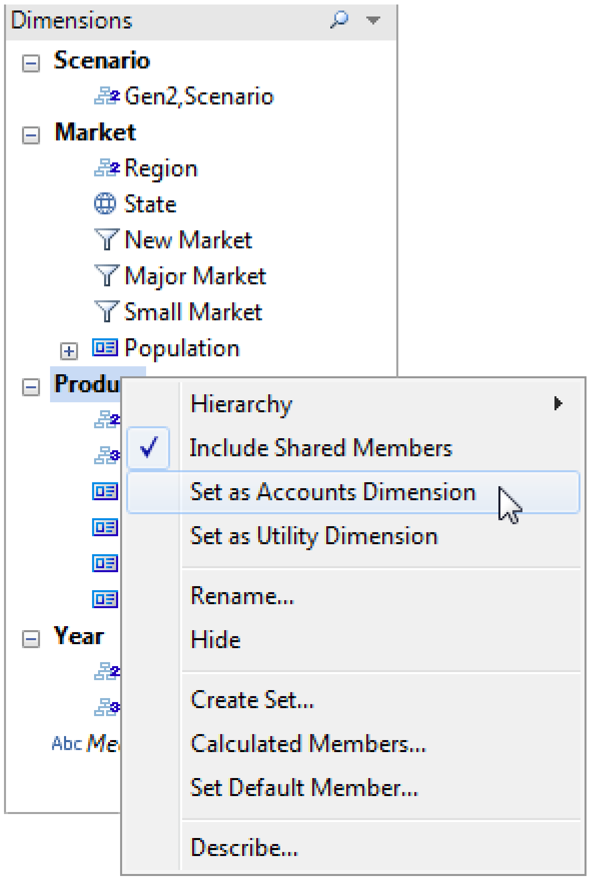
This topic describes how to connect Tableau to an Oracle Essbase database.

1. On the start page, under **Connect**, click **Oracle Essbase**, and then do the following:
    1. Enter the name of the server that hosts the database.
    2. Enter your user name and password to sign in to the server, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select an application.
    3. Select a database from your application.
    4. Click the sheet tab to start your analysis.

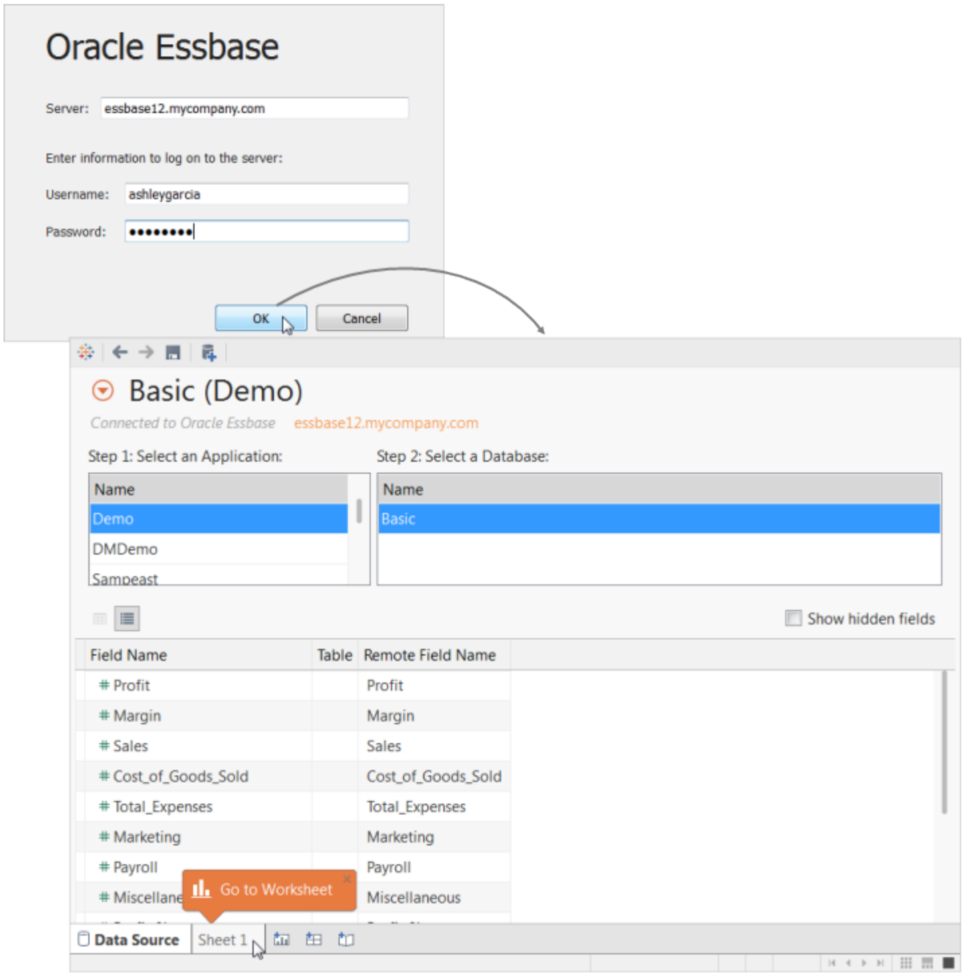
Set an Accounts Dimension

In some case, the accounts dimension for your data source can appear in the Dimensions area of the Data pane. This might occur if there is an error in the cube and another field is identified as the accounts dimension or there is no accounts dimension set at all. The accounts dimension defines the fields that are included as measures. To correct this error, right-click the field and then select **Set as Accounts Dimension** from the context menu.



Oracle Essbase Data Source Example

An example Oracle Essbase data source is shown below.



Pivotal Greenplum Database

This topic describes how to connect Tableau to a Pivotal Greenplum Database and set up the data source.

1. On the start page, under **Connect**, click **Pivotal Greenplum Database**, and then do the following:
    1. Enter the name of the server that hosts the database and the name of the database you want to connect to.
    2. Enter the user name and password.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    4. Click **OK**.

If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. Select and drag a table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

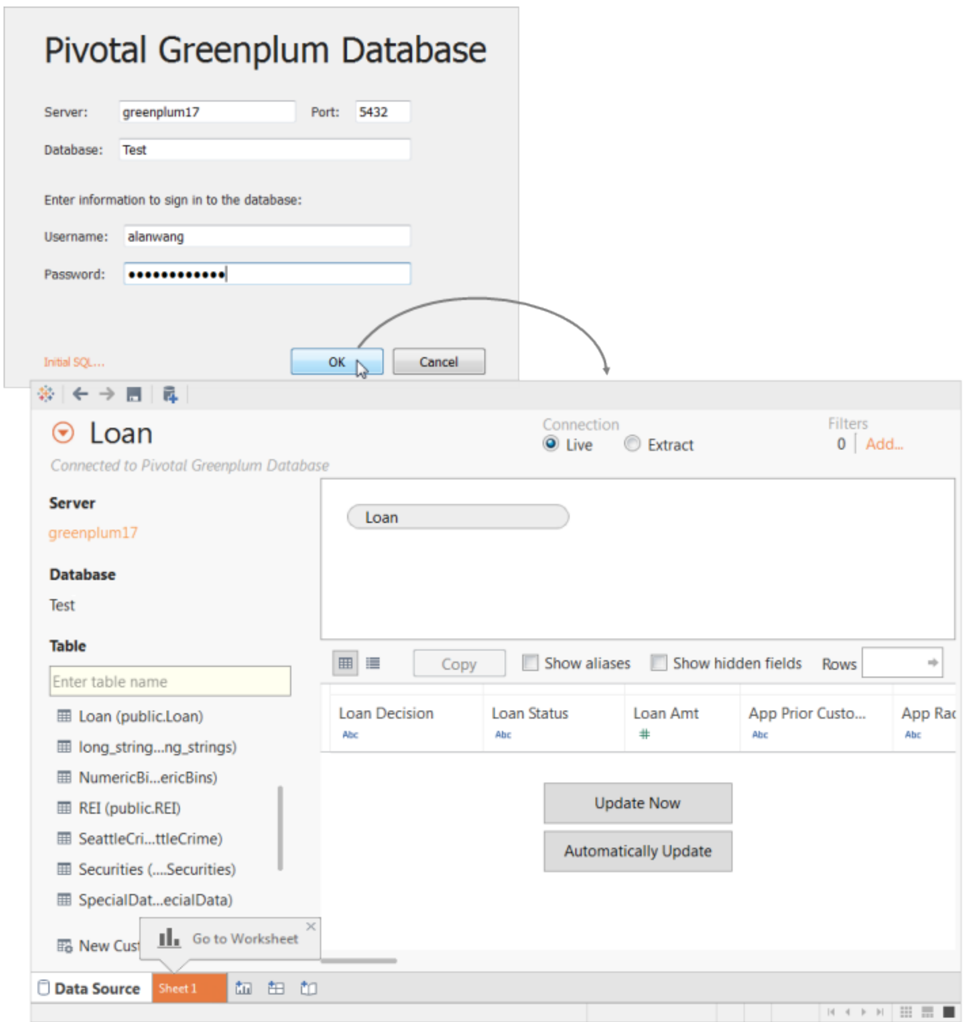
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or

extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Pivotal Greenplum Database Data Source Example

An example of a Pivotal Greenplum Database data source is shown below.



PostgreSQL

This topic describes how to connect Tableau to a PostgreSQL database and set up the data source.

1. On the start page, under **Connect**, click **PostgreSQL**, and then do the following:
   1. Enter the name of the server that hosts the database and the name of the database that you want to connect to.
   2. Select how you want to sign in to the server. Specify whether to use **Integrated Authentication** or **User Name and Password**. If the server is password protected, and you are not in a Kerberos environment, you must enter the user name and password.

      Select the **Require SSL** check box when connecting to an SSL server.

      If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. Under **Table**, select a table or use the text box to search for a table by name.
   3. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

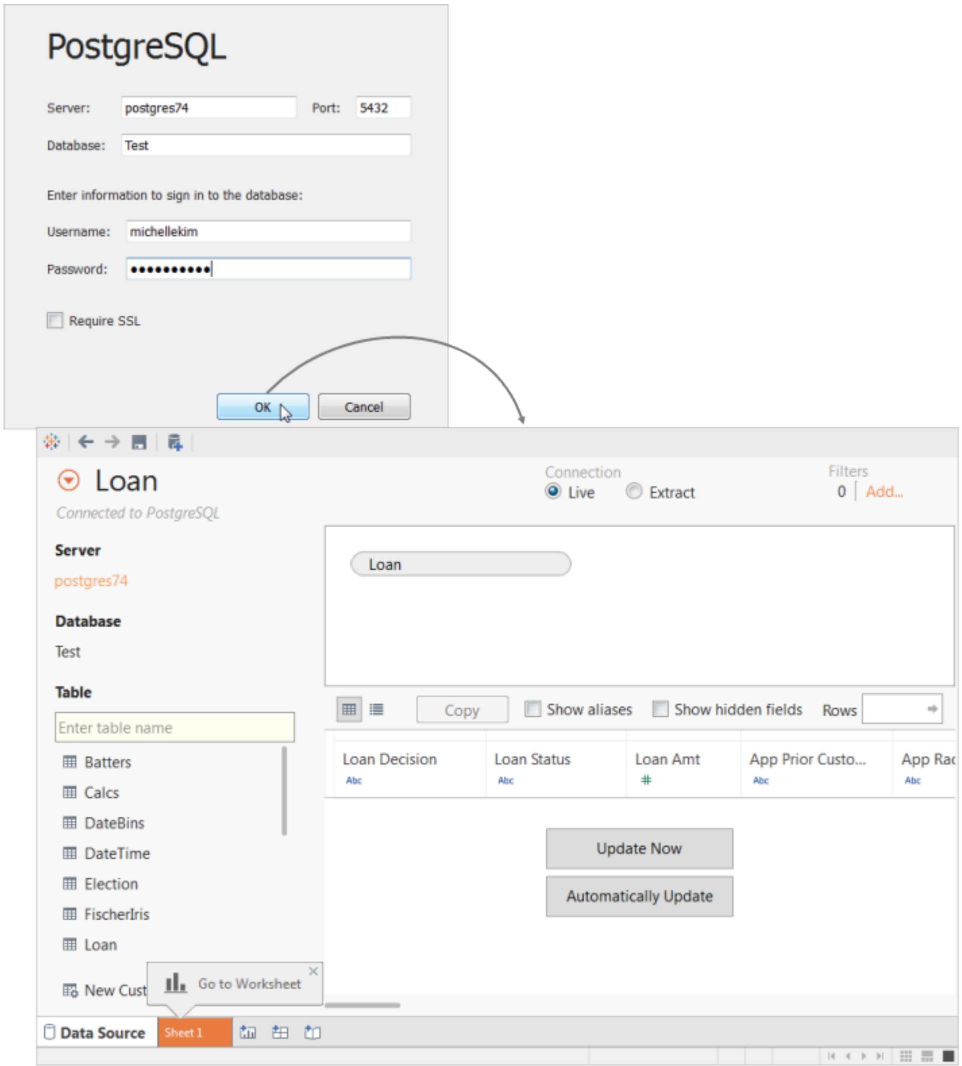
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

PostgreSQL Data Source Example

An example of a PostgreSQL data source is shown below.



Progress OpenEdge

This topic describes how to connect Tableau to a Progress OpenEdge database and set up the data source.

1. On the start page, under **Connect**, click **Progress OpenEdge**, and then do the following:

    1. Enter the name of the server that hosts the database and the name of the database you want to connect to.

    2. Enter the user name and password, and then click **OK**.

        If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. Under **Table**, select a table or use the text box to search for a table by name.
   3. Drag the table to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

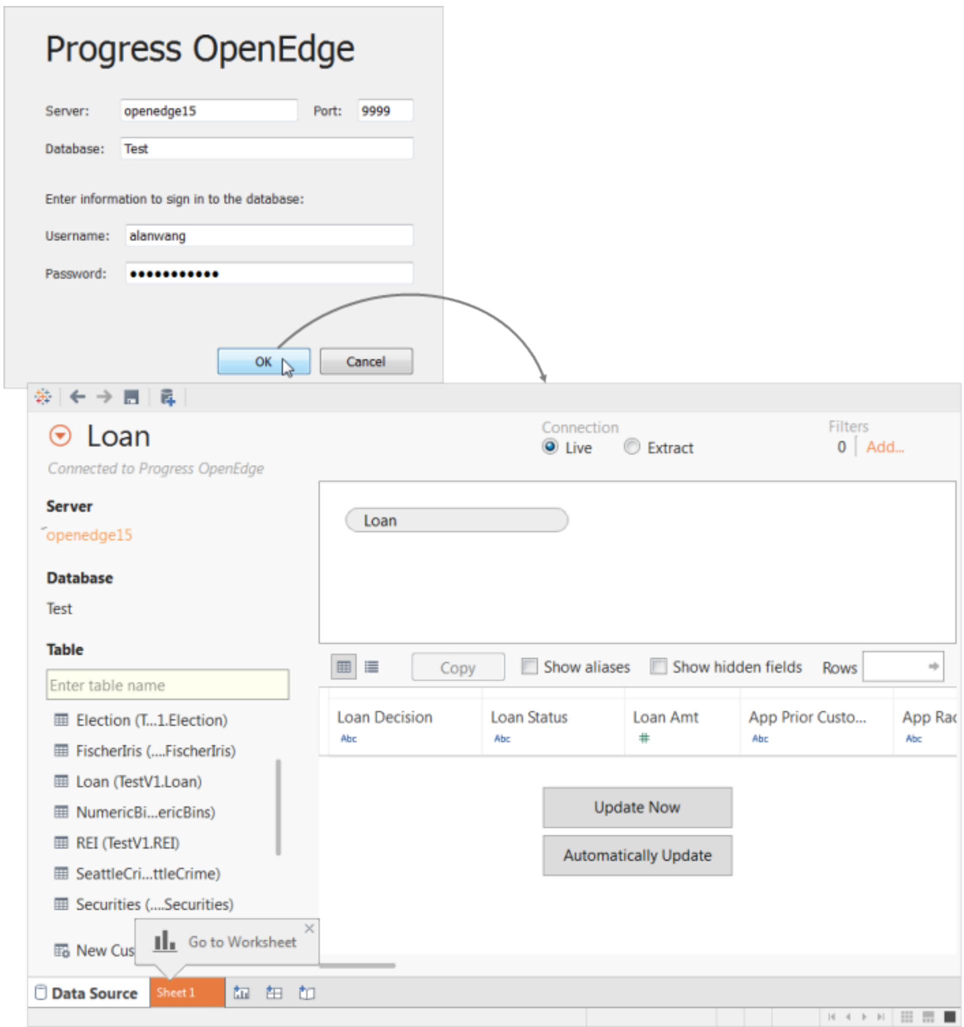
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Progress OpenEdge Data Source Example

An example of a Progress OpenEdge data source is shown below.



Salesforce

This topic describes how to connect Tableau to Salesforce.com data.

1. On the start page, under Connect, click **Salesforce**, and then do the following:
    1. Enter your user name and password for Salesforce.com.
    2. Click **Log In**.
    3. In the Allow Access dialog box, click **Allow**.

       If the connection is unsuccessful, verify that the authentication information is correct. If the connection continues to fail, your computer is having trouble locating the server or you may not have permission to access the data. Contact your network administrator or Salesforce administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select a standard connection or create your own custom connection.

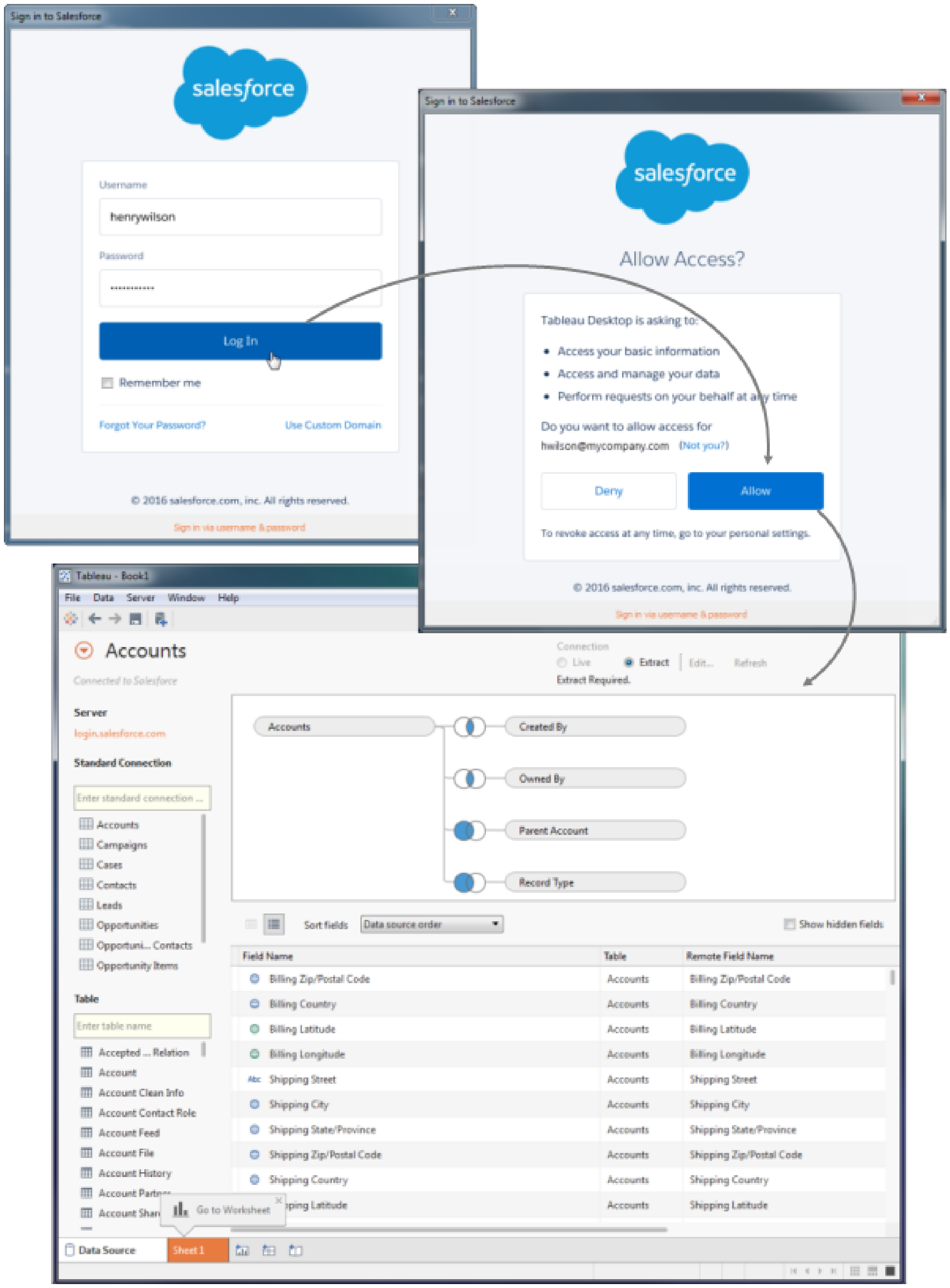
       Under **Standard Connection**, you can select from a list of predefined queries, which represent commonly used objects, and drag it to the canvas. Or, under **Table**, you can select a single table, which includes any custom objects your company has created, and drag it to the canvas. When you drag a table to the canvas, the list of tables you can select from to join is filtered. You can create joins on any string fields and on fields that are constrained references between tables. (Only left and inner joins are supported.) You can also add joins later. For more information, see **Join Your Data** on page 349.
    3. Click the sheet tab to start your analysis.

       After you click the sheet tab, Tableau imports the data by creating an extract. Note that Tableau Desktop supports only extracts for Salesforce. You can update the data by refreshing the extract. For more information, see **Extract Your Data** on page 379.

       The initial extract may take some time depending on the amount of data that is included. After the initial extract, you can incrementally update objects by refreshing the extract.

Salesforce Data Source Example

An example of a Salesforce data source is shown below.



After you log in and click **Allow**, Tableau imports the data by creating an extract. You can update the data by refreshing the extract. For more information, see **Extract Your Data** on page 379.

> The initial extract may take some time depending on the amount of data that is included. After the initial extract, you can incrementally update objects by refreshing the extract.

Updated Salesforce API

Beginning in Tableau 9.0, Salesforce extracts are created with a newer Salesforce API, version 30.0. When you attempt to do a full or incremental refresh on an extract created prior to Tableau 9.0 (which was created with an older version of the API), Tableau prompts you to either upgrade the extract to use the newer Salesforce API, or continue to use the older Salesforce API. For more information on the benefits and considerations of upgrading, see Upgrade to Salesforce API 30.0 in the Tableau Knowledge Base.

Troubleshooting Salesforce Connections

Tableau leverages the various force.com APIs to connect to Salesforce.com, Force.com, and Database.com data. These services have some restrictions on the type of data and the amount of data that you can access at a given time. If you are having trouble connecting, the following list of common restrictions may help you find a solution.

Company Account and User Profile Configuration

In order for Tableau to connect to Salesforce data, all of the following must be enabled on both your company's account and your user profile:

- SOAP API for signing in
- REST API for getting meta data
- BULK API for downloading objects
- REST API for downloading objects that the BULK API does not support
- Replication SOAP APIs for retrieving changes in the data

In order to optimize for performance and ensure the APIs are available for all of their customers, Salesforce.com balances the load by limiting the number of concurrent API requests as well as limiting the total number of API requests overall. An error occurs if these limits are reached while connected using Tableau. See the Salesforce.com developer documentation to learn more about these limits.

> Some editions of Salesforce may not allow API access at all. Contact your Salesforce administrator to verify that your account has access to the above list of APIs.

Errors During Extract

When you connect to Salesforce using Tableau, the data is automatically extracted into a Tableau Data Extract file. In some cases, certain fields cannot be extracted because of character limits. Specifically, text fields that are greater than 4096 characters and calculated fields will not be included in the extract. If you have calculated fields in your data, you will need to recreate them in Tableau after creating the extract.

In addition, the Force.com API restricts queries to 10,000 total characters.

SAP HANA

This topic describes how to connect Tableau to an SAP HANA database.

1. On the start page, under **Connect**, click **SAP HANA**, and then do the following:
   1. Enter the name of the server that hosts the database you want to connect to.
   2. Specify how you want to sign in to the server:

      Select **Use Windows Authentication** if your environment supports single sign-on (SSO). For more information, see **Quick Start: SAP HANA Single Sign-On** on page 60. **Note:** Tableau Desktop requires SAP HANA driver version 1.00.85 and later to support SSO for SAP HANA.

      Or, select **Use a specific user name and password**.

      If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
   2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.
   3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.
   4. Drag the table to the canvas, and then click the sheet tab to start your analysis.

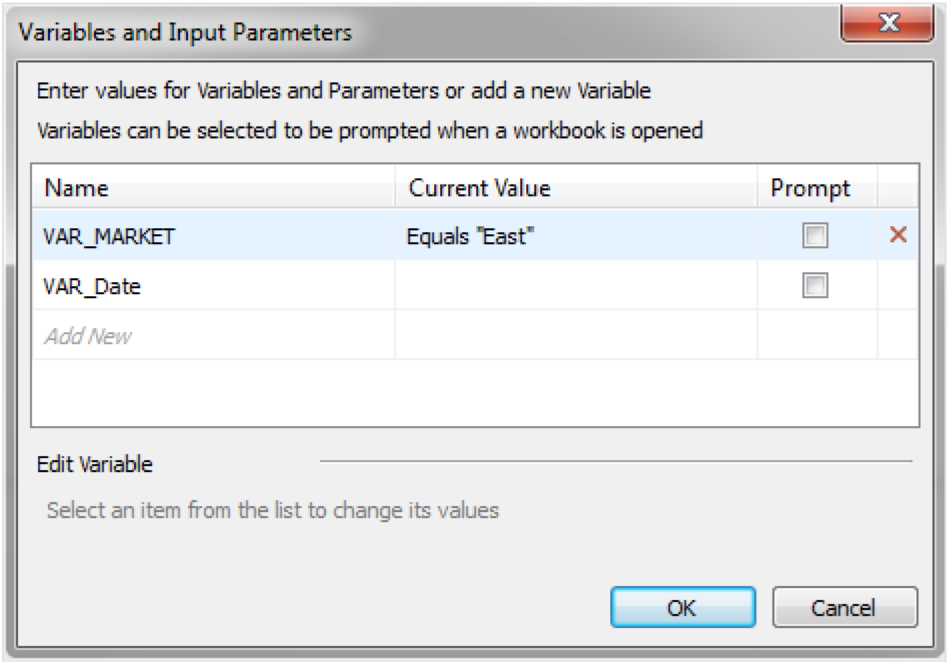
      By default, column labels are displayed instead of column names.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

      > **Note:** When you create a self-join with an analytic view, if one of the tables contains variables, make sure that the table with variables is on the left. Otherwise, the join may not return the expected results.

Select Variables and Input Parameters

If the table you use includes required or optional variables or parameters, the Variables and Input Parameters dialog box opens.



- Required variables and parameters display their current value or ***Required**.
- Optional variables and parameters display their current value or are blank.
- Prompt for the variable when the workbook is opened by selecting the check box under **Prompt**.

Select a variable or parameter and type or select a value for it. Repeat for all required values and any optional values that you want to include, and then click **OK**.

For more information, see Work with SAP BW Variables and SAP HANA Variables and Input Parameters in the Tableau Knowledge Base.

Optional Settings

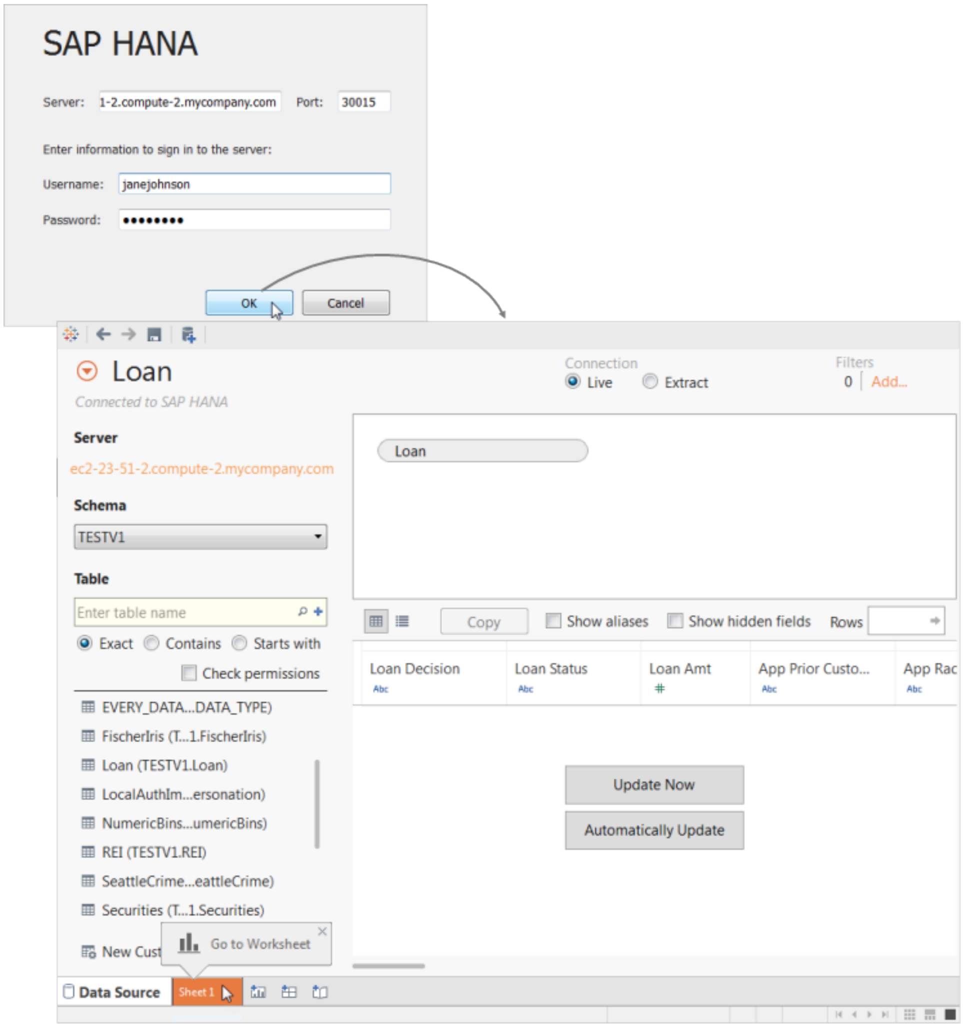
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

SAP HANA Data Source Example

An example of an SAP HANA data source is shown below.



SAP NetWeaver Business Warehouse

This topic describes how to connect Tableau to an SAP NetWeaver Business Warehouse (BW) data source.

1. On the start page, under **Connect**, click **SAP NetWeaver Business Warehouse**, and then do the following:

    1. Select a connection from the drop-down list.

        A connection appears in the drop-down list if a system entry exists for it. You can create a new system entry using the SAP Logon utility, or contact your database administrator.

    2. Enter the user name and password to sign in to the server. Optionally, enter the **Client ID** for the BW system and the **Language**.

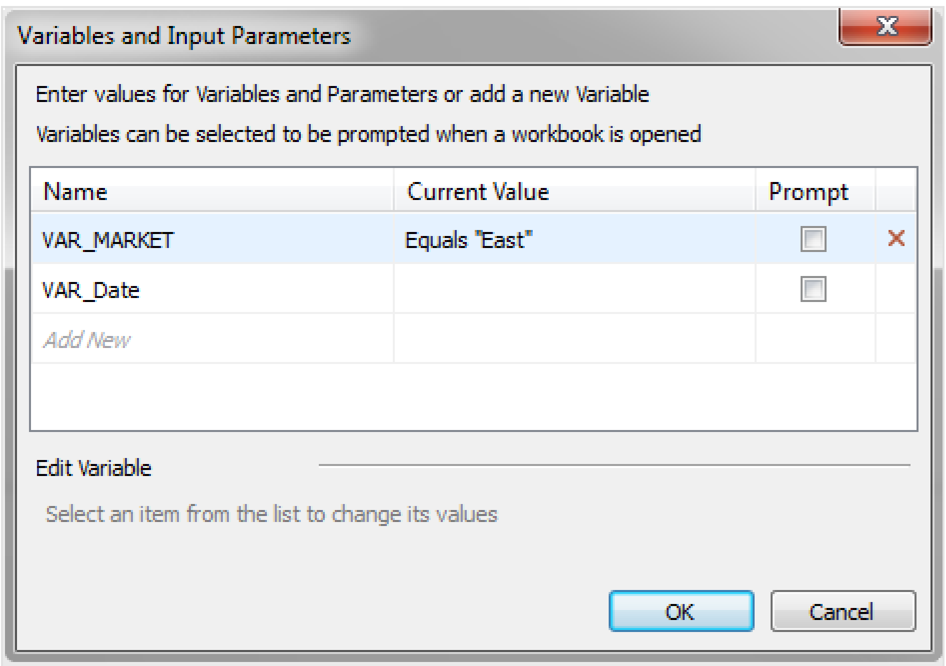
    3. Click **OK**.

If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select a catalog or InfoProvider.
    3. Select a cube or query.
    4. Click the sheet tab to start your analysis.

Select Variables and Input Parameters

If the table you use includes required or optional variables or parameters, the Variables and Input Parameters dialog box opens.



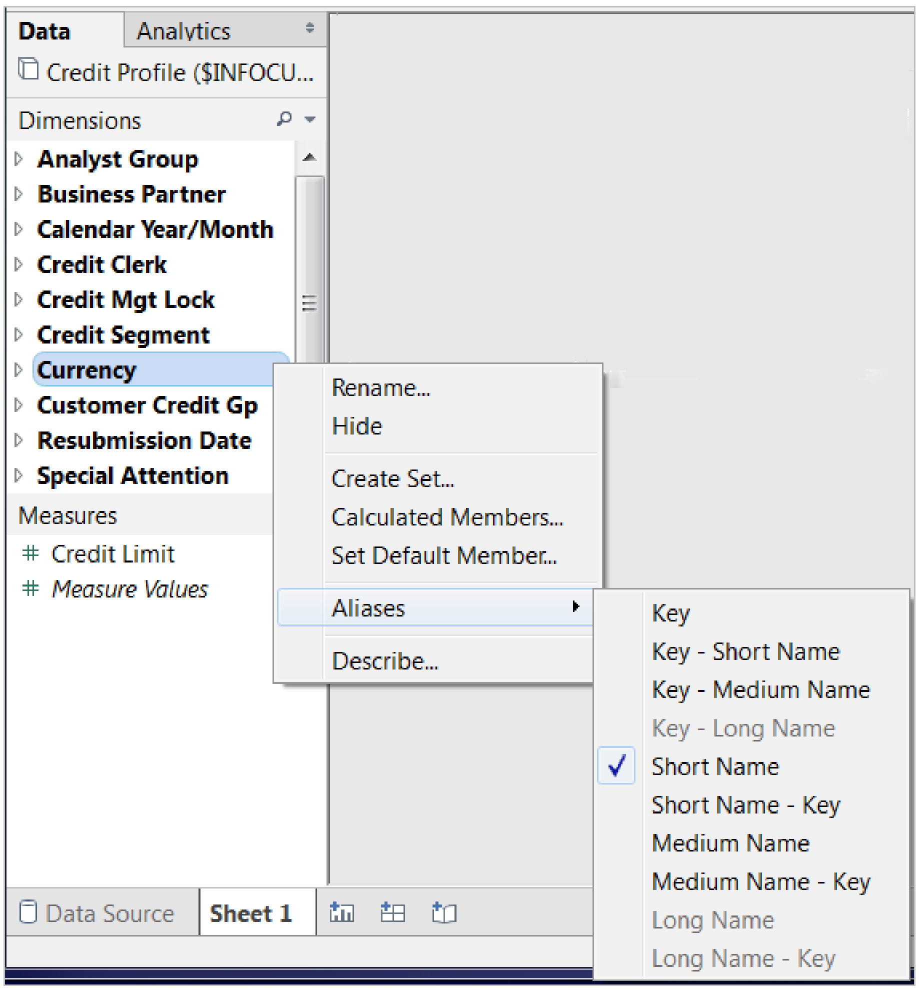
- Required variables and parameters display their current value or ***Required**.
- Optional variables and parameters display their current value or are blank.
- Prompt for the variable when the workbook is opened by selecting the check box under **Prompt**.

Select a variable or parameter and type or select a value for it. Repeat for all required values and any optional values that you want to include, and then click **OK**.

For more information, see Work with SAP BW Variables and SAP HANA Variables and Input Parameters in the Tableau Knowledge Base.

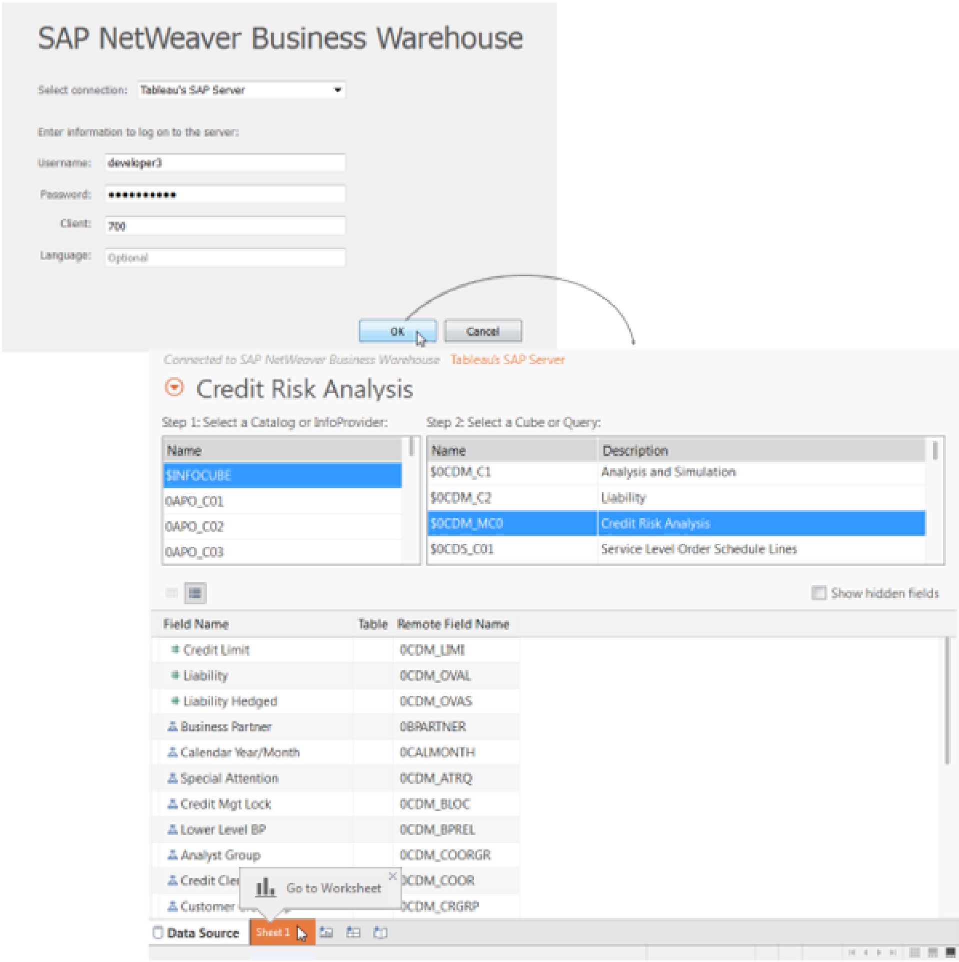
Select the Alias for a Dimension

When you connect to SAP NetWeaver Business Warehouse (SAP BW) databases, you have the option to select which alias to use for dimensions. SAP BW offers a number of different options including long name, short name, medium name, and key. Sometimes the alias used by default is not very useful. You can right-click the dimension and change it to another option such as Short Name, which changes the labels to something more meaningful.



SAP BW Data Source Example

An example of an SAP BW data source is shown below.



For more information about connecting to SAP NetWeaver Business Warehouse databases, see Connecting to SAP BW in the Tableau Knowledge Base.

For information about using SAP BW extracts and their limitations, see SAP BW Extract Limitations in the Tableau Knowledge Base.

SAP Sybase ASE

This topic describes how to connect Tableau to an SAP Sybase ASE database and set up the data source. Tableau connects to Sybase ASE version 15.2 and later.

1. On the start page, under **Connect**, click **SAP Sybase ASE**, and then do the following:
    1. Enter the name of the server you want to connect to, and specify the port to use.
    2. Enter the user name and password.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run**

Initial SQL on page 344.

4. Click **OK**.

   If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.

2. On the data source page, do the following:

   1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

   2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.

   3. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.

   4. Under **Table**, select a table or use the text box to search for a table by name.

      You can also specify a stored procedure in the database. To access stored procedures, the database must be appropriately configured with a linked server, which could be a remote server or a pointer to the database itself (known as *loopback*). For more information, see **Use a Stored Procedure** on page 402.

   5. Drag a table or stored procedure to the canvas, and then click the sheet tab to start your analysis.

      Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.

- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

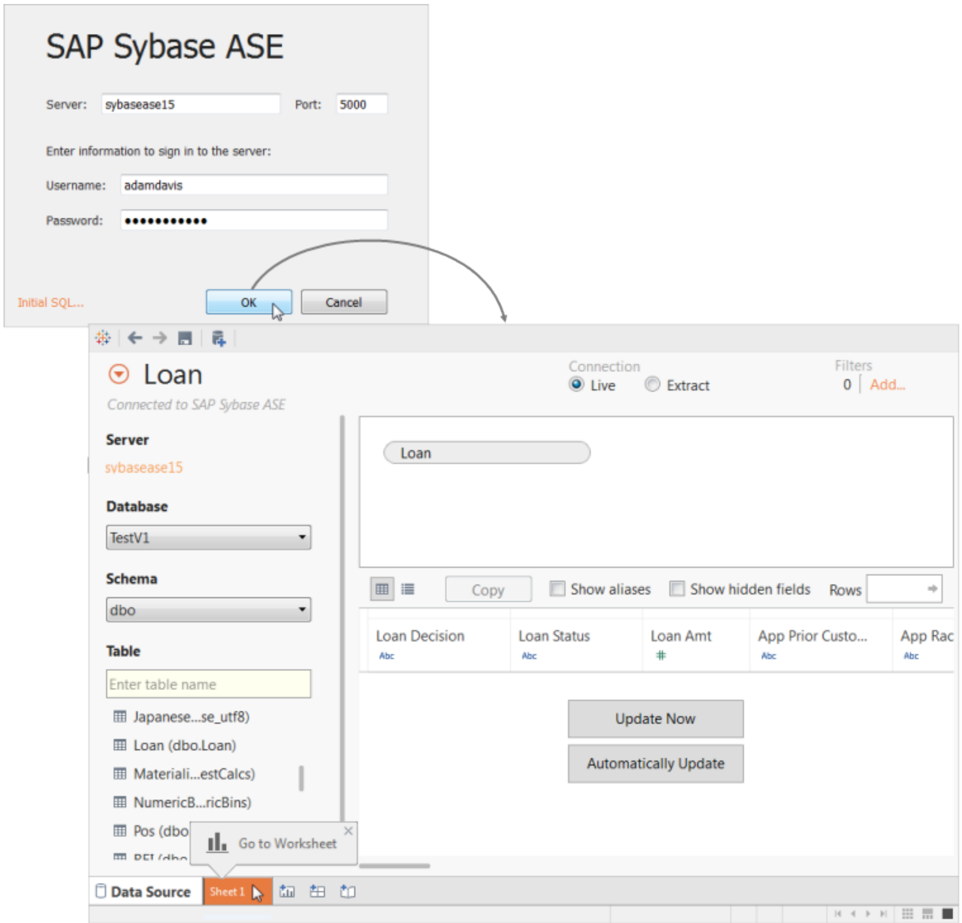
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.

- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.

- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

SAP Sybase ASE Data Source Example

An example of an SAP Sybase ASE data source is shown below.



SAP Sybase IQ

This topic describes how to connect Tableau to a SAP Sybase IQ database and set up the data source.

1. On the start page, under **Connect**, click **SAP Sybase IQ**, and then do the following:
   1. Enter the host name that hosts the database and the name of the server that you want to connect to.
   2. Select how you want to sign in to the server. Specify whether to use Windows Authentication or a specific user name and password. If the server is password protected, you must enter the user name and password.
   3. Click **OK**.

      If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:

1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
2. From the **Database** drop-down list, select a database or use the text box to search for a database by name.
3. Under **Table**, select a table or use the text box to search for a table by name.
4. Drag a table to the top area of the data source page, and then click the **Sheet 1** tab to start your analysis.

   Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

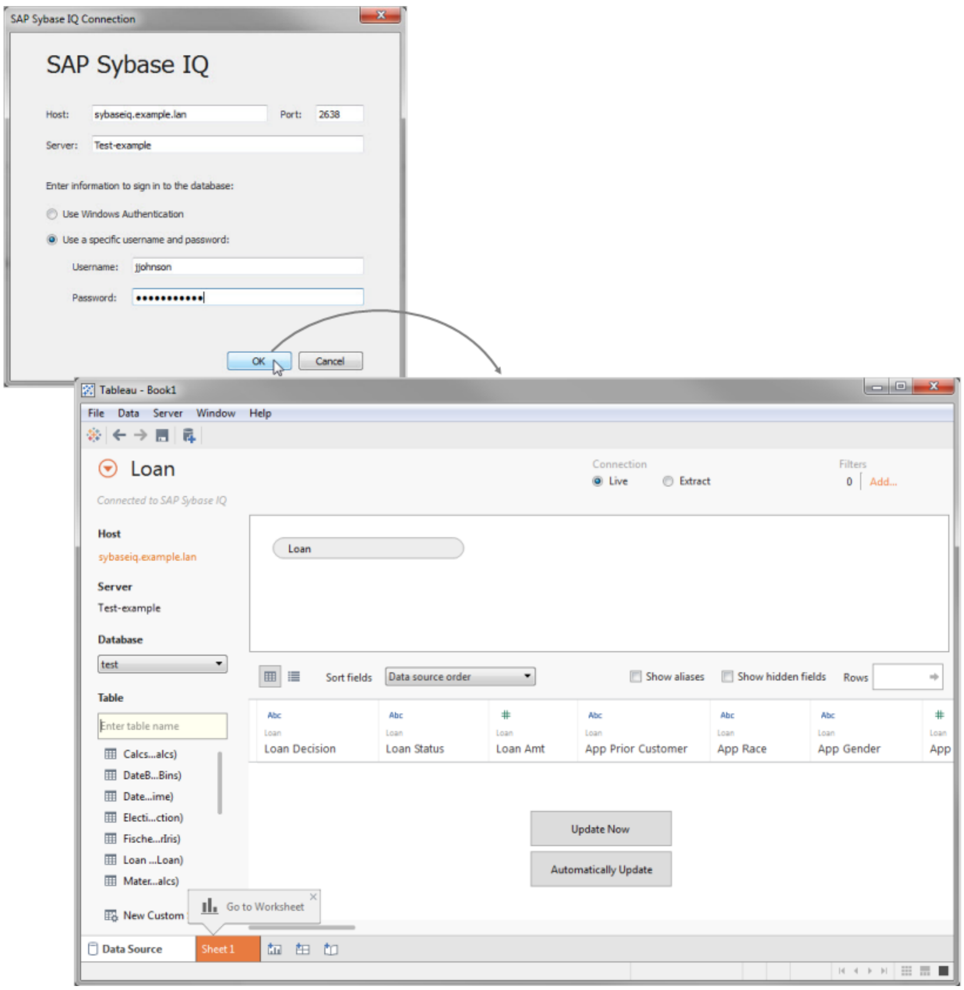
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link

displays allowing you to set up filters that define a subset of the data to include in the extract.

- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

SAP Sybase IQ Data Source Example

An example of an SAP Sybase IQ data source is shown below.



Snowflake

This topic describes how to connect Tableau to a Snowflake data warehouse and set up the data source.

1. On the start page, under **Connect**, click **Snowflake**, and then do the following:
    1. Enter the name of the server that you want to connect to.
    2. Enter your user name and password, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Warehouse** drop-down list, select the warehouse or use the text box to search for a warehouse by name.
    3. From the **Database** drop-down list, select a database or use the text box to search for a database by name.
    4. From the **Schema** drop-down list, select a schema or use the text box to search for a schema by name.
    5. Under **Table**, select a table or use the text box to search for a table by name.
    6. Drag a table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

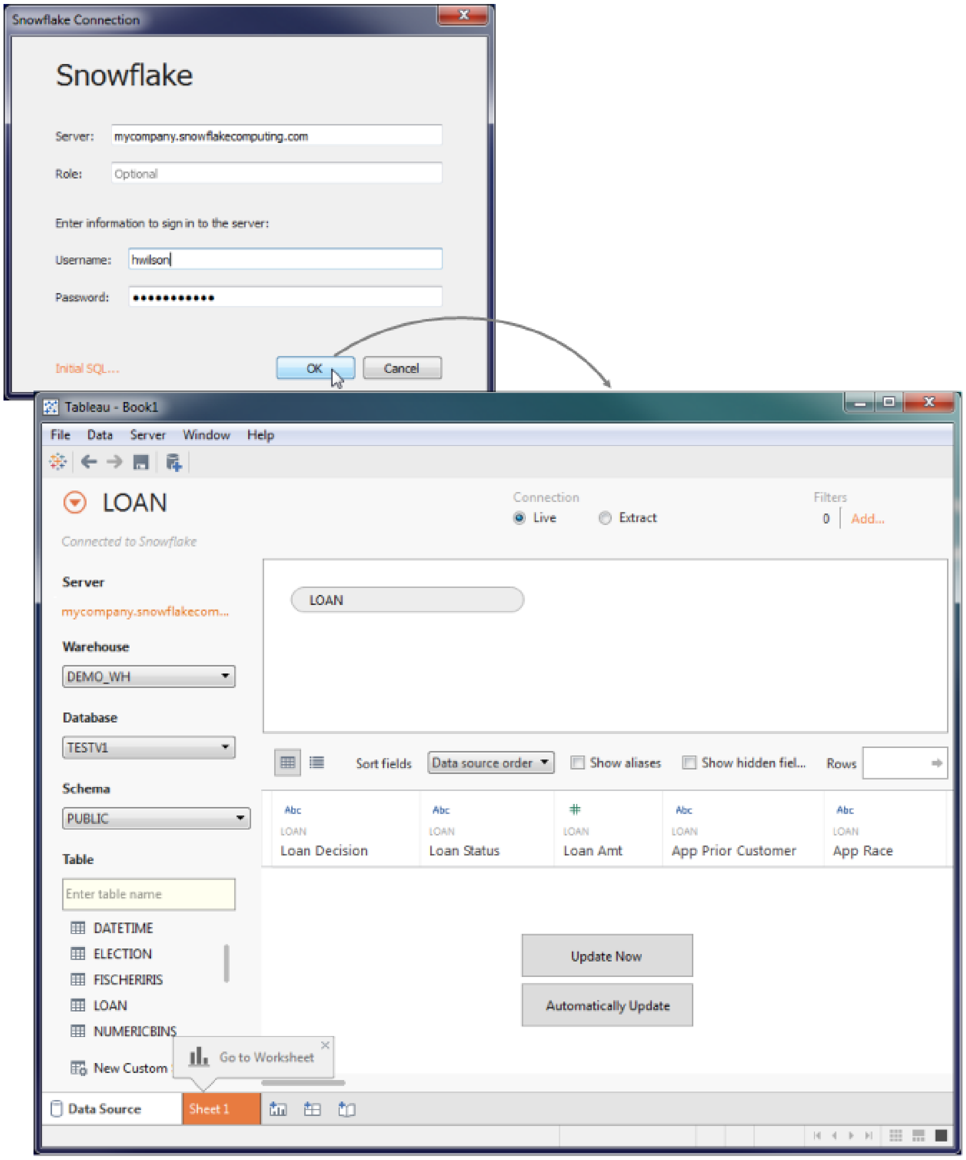
You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.

- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Snowflake Data Source Example

An example of a Snowflake data source shows below.



Spark SQL

This topic describes how to connect Tableau to a Spark SQL database and set up the data source. Tableau can connect to Spark version 1.2.1 and later.

> **Note:** On Windows, you can use the Spark SQL connector to connect to a Spark cluster on Azure HDInsight. To do this, install the Spark on Azure HDInsight drivers.

1. On the start page, under **Connect**, click **Spark SQL**, and then do the following:
    1. Enter the name of the server that hosts the database and the port number to use.
    2. Connect to the database using SparkThriftServer. Note that the legacy SharkServer and SharkServer2 connections are provided for your use, but are not supported by Tableau.
    3. (Optional) Click **Initial SQL** to specify a SQL command to run at the beginning of every connection, such as when you open the workbook, refresh an extract, sign in to Tableau Server, or publish to Tableau Server. For more information, see **Run Initial SQL** on page 344.
    4. Click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Schema** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the schema.
    3. In the **Table** text box, click the search icon or enter the table name and click the search icon, drag the table to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

Optional Settings

You can make the following configurations before doing your analysis:

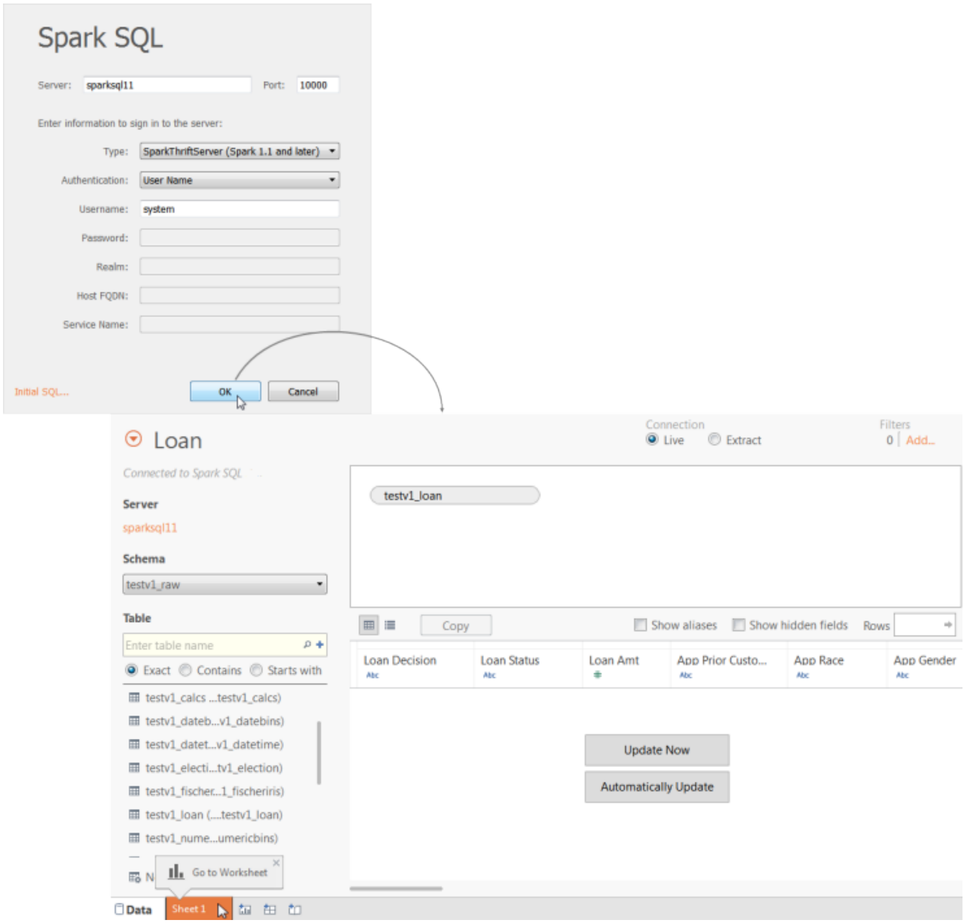
- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or

table order. Sort the row values by clicking the sort button next to the column name.

- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Spark SQL Data Source Example

An example of a Spark SQL data source is shown below.



Splunk

This topic describes how to connect Tableau to Splunk data.

1. On the start page, under **Connect**, click **Splunk**, and then do the following:
    1. Enter the server URL. You should use HTTPS to connect to Splunk data.

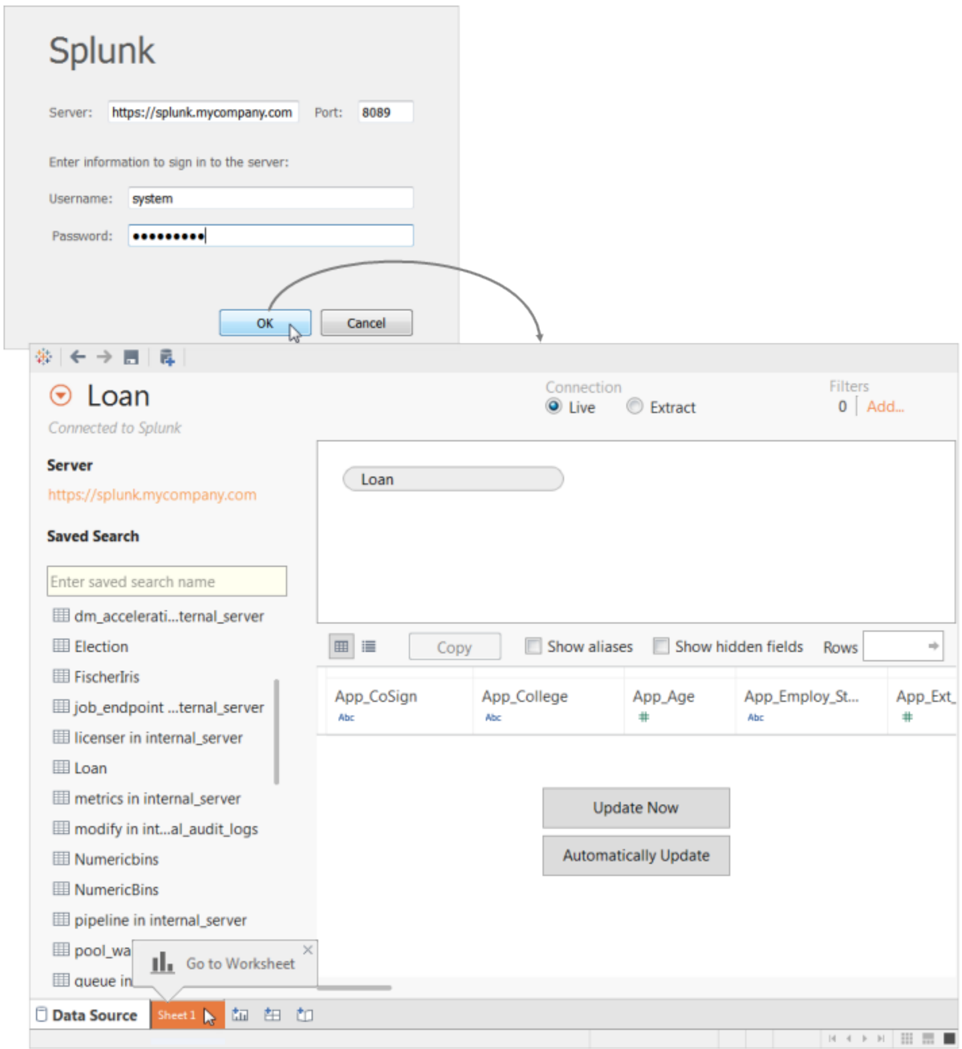
       Servers often contain multiple databases. Enter the name of a specific database on the server. Database names are case sensitive.
    2. Enter your user name and password, and then click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.

2. Under **Saved Search**, enter a saved search name in the text box or select a saved search from the list, and drag it to the box at the top of the data source page.
3. Click the sheet tab to start your analysis.

Splunk Data Source Example

An example of a Splunk data source is shown below.



Teradata

This topic describes how to connect Tableau to a Teradata database or a Teradata Unity server and set up the data source.

1. On the start page, under **Connect**, click **Teradata**, and then do the following:
    1. Enter the name of the server that hosts the database you want to connect to.

       Note: You can connect to a Teradata Unity server by entering the appropriate URL in the **Server** text box.
    2. Select how you want to sign in to the server. Specify whether to use the built-in **Teradata Database** authentication, **LDAP**, or **Integrated Authentication**. If the server is password protected, and you are not in a Kerberos environment, you must select **Teradata Database** or **LDAP** and enter the user name and password.
    3. (Optional) Click **Query Banding and Initial SQL**.

       Query banding enables you to pass parameters into the Teradata environment. For more information, see **Advanced Teradata Options** on page 1396. Additionally, you can specify a SQL command that will be run once upon connection. For more information, see **Run Initial SQL** on page 344.
    4. Click **OK**.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. From the **Database** drop-down list, click the search icon or enter the schema name in the text box and click the search icon, and then select the database.
    3. In the **Table** text box, click the search icon or enter the table name and click the search icon, and then select the table.

       You can also specify a stored procedure in the database. For more information and for a list of constraints specific to Teradata databases, see **Use a Stored Procedure** on page 402.
    4. Drag the table or stored procedure to the canvas, and then click the sheet tab to start your analysis.

       Use custom SQL to connect to a specific query rather than the entire data source. For more information, see **Connect to a Custom SQL Query** on page 397. For information on connecting to more than one table, see **Join Your Data** on page 349.

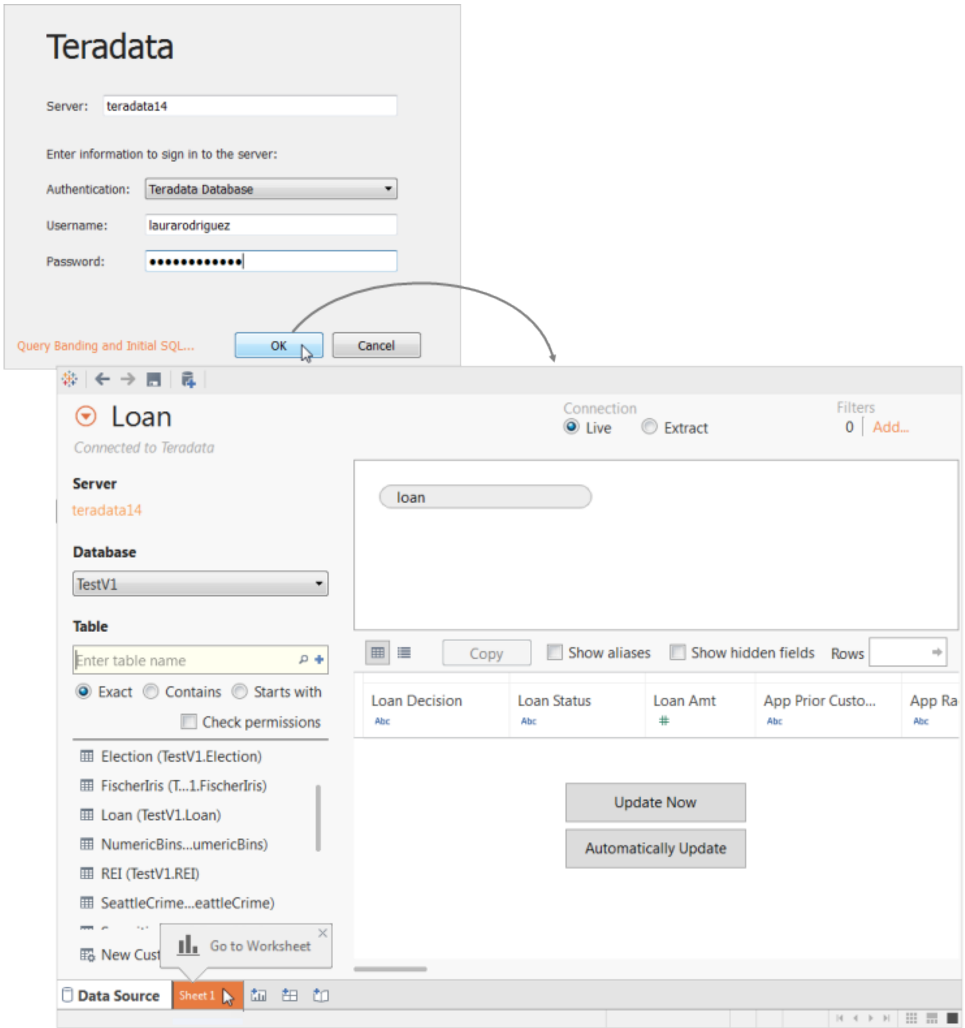
Optional Settings

You can make the following configurations before doing your analysis:

- **View the data in the Tableau data source** – In the grid, click **Update Now** to preview the first 1,000 rows of your live or extract data source. If you add tables, remove tables, or make changes to the join conditions, click **Update Now** again to see your changes. If you want changes to automatically reflect in the grid, click **Automatically Update**.
- **Manage metadata** – Click the metadata grid button to perform routine management tasks.
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. You can sort the columns by data source or table order. Sort the row values by clicking the sort button next to the column name.
- **Hide fields** – Hide a field by clicking the column drop-down arrow and selecting **Hide**.
- **Rename fields and reset field names** – Double-click the field name to rename the field. You can also select a column or multiple columns, click the column drop-down, and then select **Reset Name** to revert back to the original name of the field.
- **Split columns** – Depending on the data source, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Connect live or use an extract** – At the top of the data source page, select a live or extract connection to the data source. If you choose to take an extract, an Edit link displays allowing you to set up filters that define a subset of the data to include in the extract.
- **Add data source filters** – At the top of the data source page, add data source filters to restrict the visibility and use of the fields in the data source.
- **Add new or edit other data sources** – Click the orange drop-down arrow next to the data source name to connect to and add new data sources or edit other data sources in the workbook.

Teradata Data Source Example

An example of a Teradata data source is shown below.



Advanced Teradata Options

When connecting to Teradata databases you can optionally set up query bands and initial sql. These advanced options are used to increase performance and take advantage of the built in security rules of the database.

Query Bands

When connecting to a Teradata database, you can optionally define query band statements that run during connection. Query banding allows you to pass parameters into the Teradata environment. Use these to set up a workbook to filter the data based on security rules that exist in the database. For example, you can pass in the Tableau Server user name for the current user so when the view is loaded it only shows the data specific to that user. Query bands can also be used to improve performance. When connecting to Teradata, you can define a map between the name of the attributes passed into the query band and the corresponding values from Tableau.

To set up query banding:

1. On the data source page, select **Data** > **Query Banding and Initial SQL**.
2. In the subsequent dialog box, specify name/value pairs in the top text box labeled Query Banding. You can use the **Insert** drop-down menu to add Tableau values. The Tableau values are described in the table below.

Value	Description	Example
`<TableauMode>`	The mode Tableau is operating in when generating queries. This value will either be “Connect” when retrieving metadata or “Analytical” when retrieving actual data.	Connect or Analytical
`<LoginUser>`	The user name of the person signed in to the database.	jsmith
`<ServerUser>`	The signed-in Server user. Does not include domain name. **Note:** `ProxyUser` returns the same value as `ServerUser`. However, `ProxyUser` sets up impersonation and stores the Tableau Server user in the query	jsmith

Value	Description	Example
	band parameter. If you are using query banding for security purposes, you should use `ProxyUser` instead. This will ensure that query results are not shared between different users. `ServerUser` should only be used for auditing purposes.	
`<ServerUserFull>`	The signed-in server user including the domain name (if the server is using Active Directory). **Note:** `ProxyUserFull` returns the same value as	domain.lan\jsmith

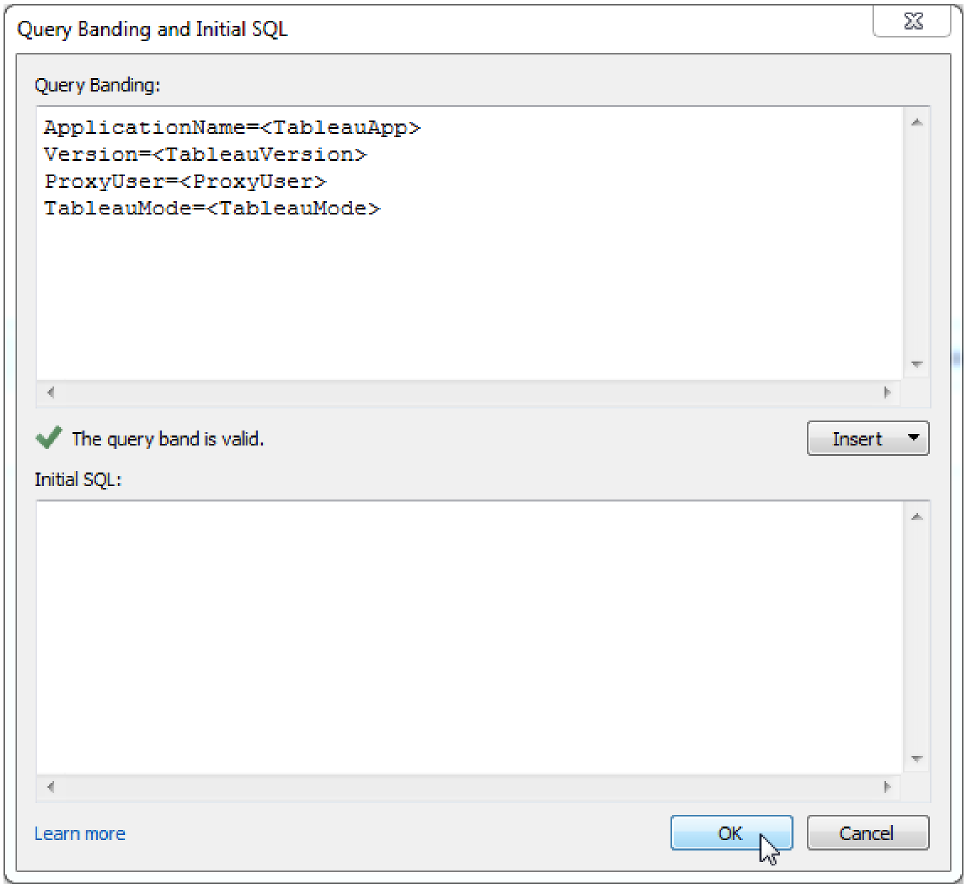
Value	Description	Example
	`ServerUserFull`. However, `ProxyUserFull` sets up impersonation and stores the Tableau Server user in the query band parameter. If you are using query banding for security purposes, you should use `ProxyUserFull` instead. This will ensure that query results are not shared between different users. `ServerUserFull` should only be used for auditing purposes.	
`<ProxyUser>`	Used when setting up impersonation on the server.	jsmith

Value	Description	Example
	Provides the username of the current server user.	
<ProxyUserFull>	Used when setting up impersonation on the server. Provides the username and domain name of the current server user.	domain.lan\jsmith
<TableauApp>	The name of the Tableau applic- ation.	Tableau Desktop Professional or Tableau Server
<TableauVersion>	The version of the Tableau application	6100.11.0428.0300
<WorkbookName>	The name of the workbook.	Financial-Analysis

An example query band statement is shown below. This example passes the user name for the current server user.

```
Applic-
ationName-
=<TableauApp>Version=<TableauVersion>ProxyUser=<ProxyUser>TableauMode=<Tableau
```

Tableau checks the statement for errors as you type. When it is valid a green check mark displays at the bottom of the text box.



Initial SQL

When connecting to Teradata databases, you can optionally specify a SQL command that will be run once upon connection. See **Run Initial SQL** on page 344 to learn more about adding these commands to your connection.

> **Note:** If Tableau detects that the Initial SQL payload cannot be delivered in one query, it attempts to split the query into separate statements, where each statement must end with a semicolon followed by a newline character, with no additional characters (such as an extra space) in between. This requirement is important because if a semicolon exists within the interior of a statement, for example within a string literal, it may not be safe to split the statement at that point. If the Initial SQL code that you specify in Tableau returns an error, and the same Initial SQL is deemed valid by the Teradata databases, it may be that Tableau has split the query incorrectly. If this happens, try reformatting the SQL code in Tableau manually.

Teradata OLAP Connector

This topic describes how to establish a Teradata OLAP connection.

1. On the start page, under **Connect**, click **Teradata OLAP Connector**, and then do the following:
    1. Select a connection from the drop-down list.

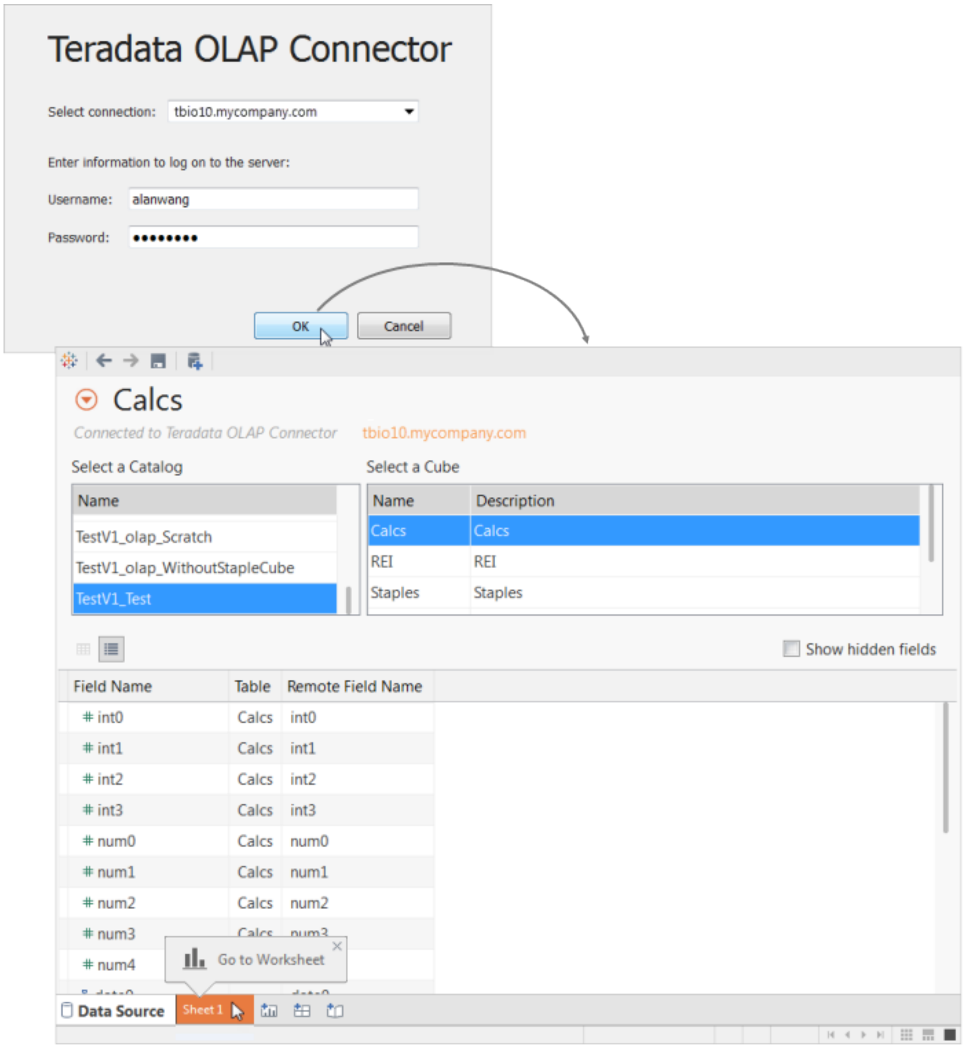
       A connection appears in the drop-down list if a system DSN exists for that connection. Use the Windows ODBC Data Source Administrator utility to create a system DSN, or contact your database administrator.
    2. Enter your user name and password to log in to the server.

       If the connection is unsuccessful, verify that your user name and password are correct. If the connection continues to fail, your computer is having trouble locating the server. Contact your network administrator or database administrator.
    3. Click **OK**.
2. On the data source page, do the following:
    1. (Optional) Click the default data source name at the top of the page, and then enter a unique data source name for use in Tableau.
    2. Select a catalog.
    3. Select a cube from the catalog.
    4. Click the sheet tab to start your analysis.

Named sets from a Teradata OLAP data source are displayed in the **Sets** area of the **Data** pane in Tableau. You can interact with these named sets in the same way you interact with other custom sets in Tableau. For more information, see **Sets** on page 750. You can view underlying data for Teradata OLAP data sources, provided the database administrator has enabled this functionality. For more information, see **View Data** on page 852.

Teradata OLAP Data Source Example

An example of a Teradata OLAP connection is shown below.



Web Data Connector

This topic describes web data connectors, what to do before you use a connector, and how to connect Tableau to a web data connector.

You can use a web data connector to connect to data that is accessible over HTTP and that doesn't already have a connector. A web data connector is an HTML file that includes JavaScript code. You can create your own web data connector or use one that has been created by someone else. The web data connector must be hosted on a web server running locally on your computer, on a third-party web server, or on Tableau Server.

Test and vet the web data connector

You should use a web data connector that you trust. If you are unfamiliar with the web data connector, you or your Tableau Server administrator should test and vet the web data connector before you use it. For more information, see Testing and Vetting Web Data Connectors in the Tableau Server documentation.

When to use an imported web data connector

When you use a web data connector, Tableau creates an extract of the data that the connector accesses. You can refresh the extract in Tableau Desktop.

When you publish the data source or workbook to Tableau Server, you cannot refresh the extract on Tableau Server unless the web data connector was imported to Tableau Server before you used it. For more information, see Web Data Connectors in Tableau Server in the Tableau Server Help.

The import process results in a URL where the web data connector is available on Tableau Server. The server administrator should give this URL to you and to anyone else who wants to use the connector in a workbook.

If you open a workbook on Tableau Server that was created using a web data connector, but the connector has not been imported to Tableau Server, and you want to be able to refresh the extract on Tableau Server, follow the process for testing, vetting, and importing the connector. Then, in your workbook, edit the connection and change the URL of the connector to the URL provided by Tableau Server. You can then refresh your data on Tableau Server.

When you publish to Tableau Online, as a security measure, Tableau Online can't connect to or refresh an extract created by a web data connector. To refresh a web data connector extract, you use the sync client. For more information, see Schedule Refreshes Using the Sync Client in the Tableau Online Help.

Connect to the data source

1. On the start page, under **Connect**, click **Web Data Connector**.
2. Enter the URL of the web data connector that you want to connect to, and then press Enter.

   Note: If you enter a URL to a website, rather than to a web data connector, an error message will appear.

3. If the connector displays a webpage, enter any information that you're prompted for, and

then submit the page.

4. Wait while the connector retrieves your data and imports it into Tableau as an extract.
5. Click the sheet tab to start your analysis.

Optional settings

After you connect, you can make the following configuration changes to the data source before you start your analysis.

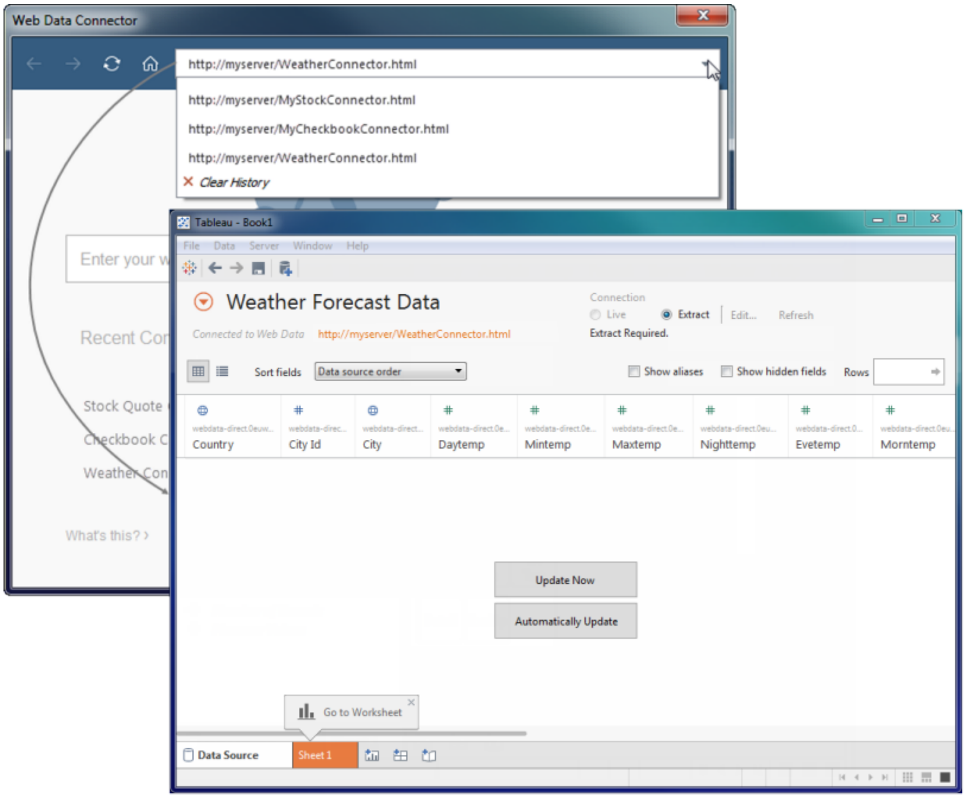
- **Sort fields and rows** – From the **Sort fields** drop-down list, select how you want to sort the columns in the grid or metadata grid. Sort the row values by clicking the sort button next to the column name.
- **Rename or hide columns** – Click the column header drop-down arrow and select the option you want.
- **Split columns** – Depending on how the data is structured, you can split the columns in your data into new fields. For more information, see **Split a Field into Multiple Fields** on page 406.
- **Create calculations** – Create a new calculation based on an existing field in the data source.
- **Copy values** – Copy values in the grid by selecting the values and then pressing Ctrl+C. Alternatively, to copy values in the metadata grid, select the values, right-click, and then select **Copy**.
- **Add new or edit other data sources** – Click the drop-down arrow next to the data source.

Web data connector data source example

An example of a web data connector data source is shown below. The first time you connect to a web data connector, the connection page outlines how to connect to the web data connector.

After you connect to a web data connector, on the connection page, you can do the following:

- View a history of all the web data connectors that you've connected to, or clear the history, in the drop-down list in the address bar.
- View your five most recently used connectors under Recent Connectors.
- Click links at the bottom on the window to learn more about web data connectors:
  - **What's this?** links to an overview of this feature.
  - **Use a connector** links to this topic.
  - **Build a connector** links to the Web Data Connector SDK, which provides tools and documentation for building a web data connector.



Other Databases (ODBC)

You can see the file and database types that are supported by Tableau Desktop listed on the start page, under **Connect**. For the various files and database types you see listed, Tableau has implemented customized techniques and capabilities so that you can get the most from your data.

If your file or database type is not listed, you may be able to use the general ODBC standard for connecting Tableau Desktop to your data. To connect to your data using the ODBC driver, do the following:

1. On the start page, under **Connect**, click **Other Databases (ODBC)**.
2. Enter the information required to make the connection.

   Note: If table or schema names are not listed, click the search icon or enter the name in the text box and click the search icon, and then select the name.

For more information, see Tableau and ODBC in the Tableau Knowledge Base.

> **Important:** When you use an ODBC driver to connect to an unsupported database, the outcome may vary and compatibility with Tableau Desktop features is not guaranteed.

Functions, Operators, & Data Types

This section explains how to use and combine the various data types supported by Tableau. In addition, this section discusses how to format and use the building blocks of formulas in Tableau. These parts include literal expressions, functions, and operators.

All of these features are important to understand when you create custom fields such as calculations.

Data Types

Tableau supports string, date/datetime, number, and boolean data types. These data types are automatically handled in the proper fashion. However, if you create calculated fields of your own, you need to be aware of how to use and combine the different data types in formulas. For example, you cannot add a string to a number. Also, many functions that are available to you when you define a calculation only work when they are applied to specific data types. For example, the `DATEPART()` function can accept only a date/datetime data type as an argument. So, you can write `DATEPART('year',#April 15,2004#)` and expect a valid result: 2004. You cannot write `DATEPART('year',"Tom Sawyer")` and expect a valid result. In fact, this example returns an error because "`Tom Sawyer`" is a string, not a date/datetime.

> Although Tableau will attempt to fully validate all calculations, some data type errors cannot be found until the query is run against the database. These issues appear as error dialogs at the time of the query rather than in the calculation dialog box.

The data types supported by Tableau are described below. Refer to **Type Conversion** on page 1427 to learn about converting from one data type to another.

STRING

A sequence of zero or more characters. For example, "`Wisconsin`", "`ID-44400`", and "`Tom Sawyer`" are all strings. Strings are recognized by single or double quotes. The quote character itself can be included in a string by repeating it. For example, ‘O''Hanrahan’.

DATE/DATETIME

A date or a datetime. For example "`January 23, 1972`" or "`January 23, 1972 12:32:00 AM`". If you would like a date written in long-hand style to be interpreted as a a date/datetime, place the # sign on either side of it. For instance, “`January 23, 1972`” is treated as a string data type but `#January 23, 1972#` is treated as a date/datetime data type.

NUMBER

Numerical values in Tableau can be either integers or floating-point numbers.

With floating-point numbers, results of some aggregations may not always be exactly as expected. For example, you may find that the SUM function returns a value such as -1.42e-14 for a column of numbers that you know should sum to exactly 0. This happens because the Institute of Electrical and Electronics Engineers (IEEE) 754 floating-point standard requires that numbers be stored in binary format, which means that numbers are sometimes rounded at extremely fine levels of precision. You can eliminate this potential distraction by using the ROUND function (see **Number Functions** on the next page or by formatting the number to show fewer decimal places.

Operations that test floating point values for equality can behave unpredictably for the same reason. Such comparisons can occur when using level of detail expressions as dimensions, in categorical filtering, creating ad-hoc groups, creating IN/OUT sets, and with data blending.

> **Note**: The largest signed 64-bit integer is 9,223,372,036,854,775,807. When connecting to a new data source, any column with data type set to **Number (Whole)**, can accommodate values up to this limit; for larger values, Tableau will use floating point.

BOOLEAN

A field that contains the values `TRUE` or `FALSE`. An unknown value arises when the result of a comparison is unknown. For example, the expression `7 > Null` yields unknown. Unknown booleans are automatically converted to Null.

Formatting Literals

When you are using functions you will sometimes want to use literal expressions to represent numbers, strings, dates, and more. A literal expression signifies a constant value that is represented “as is.” For example, you may have a function where your input is a date. Rather than just type “May 1, 2005”, which would be interpreted a a string, you would type #May 1, 2005#, which is equivalent to using a date function to convert the argument from a string to a date (refer to **Date Functions** on page 1422). You can use numeric, string, date, boolean, and Null literals. The way to format each of these literals is described below.

Numeric Literals

A numeric literal is written exactly like you usually write numbers. If you want to input the number one as a numeric literal you would type 1. Subsequently, if you want to input the number 3.1415 as a numeric literal you would type 3.1415.

String Literals

A string literal can be written either using single quotations or double quotations. If your string has a single or double quotation within it, simply type the symbol twice. For example, if you wanted to input the string “cat” as a string literal you could type ‘cat’ or “cat”. Additionally, if you want to type the string “She’s my friend.” as a string literal you could type ‘She’’s my friend.’ or “She’s my friend.”

Date Literals

Date literals are signified by the pound symbol (#). If you wanted to input the date “August 22, 2005” as a literal date you would type #August 22, 2005#.

Boolean Literals

Boolean literals are written as either true or false. If you wanted to input “true” as a boolean literal you would type true.

Null Literals

Null literals are written simply as Null. If you wanted to input “Null” as a Null literal you would type Null.

Functions

The calculation functions are grouped into categories. These are the same categories used in the calculation editor. The aggregate functions such as sum, average, and so on are described in **Aggregations** on page 245.

For information on calculations, see **Calculations** on page 1005.

Number Functions

ABS(number)

Returns the absolute value of the given number.

Examples

`ABS(-7) = 7`

`ABS([Budget Variance])`

The second example returns the absolute value for all the numbers contained in the `Budget Variance` field.

ACOS(number)

Returns the arc cosine of the given number. The result is in radians.

Example

`ACOS(-1) = 3.14159265358979`

ASIN(number)

Returns the arc sine of a given number. The result is in radians.

Example

```
ASIN(1) = 1.5707963267949
```

ATAN(number)

Returns the arc tangent of a given number. The result is in radians.

Example

```
ATAN(180) = 1.5652408283942
```

ATAN2(y number, x number)

Returns the arc tangent of two given numbers (x and y). The result is in radians.

Example

```
ATAN2(2, 1) = 1.10714871779409
```

CEILING(number)

Rounds a number to the nearest integer of equal or greater value.

Example

```
CEILING(3.1415) = 4
```

Availability by data source

Data Source	Support
Microsoft Access	Not supported
Microsoft Excel	Supported
Text File	Supported
Statistical File	Supported
Tableau Server	Supported
Actian Vectorwise	Not supported
Amazon Aurora	Not supported
Amazon EMR	Supported
Amazon Redshift	Not supported

Aster Database	Not supported
Cloudera Hadoop	Supported
DataStax Enterprise	Supported
EXASolution	Not supported
Firebird	Not supported
Google Analytics	Supported
Google BigQuery	Supported
Google Cloud SQL	Not supported
Hortonworks Hadoop Hive	Supported
HP Vertica	Not supported
IBM BigInsights	Not supported
IBM DB2	Not supported
IBM Netezza	Not supported
MapR Hadoop Hive	Supported
MarkLogic	Not supported
Microsoft Analysis Services	Not supported
Microsoft PowerPivot	Not supported
Microsoft SQL Server	Not supported
MySQL	Not supported
Oracle	Not supported
Oracle Essbase	Not supported
ParAccel	Not supported
Pivotal Greenplum	Not supported

PostgreSQL	Not supported
Progress OpenEdge	Not supported
Salesforce	Supported
SAP HANA	Not supported
SAP Sybase ASE	Not supported
SAP Sybase IQ	Not supported
Spark SQL	Supported
Splunk	Not supported
Teradata	Not supported
Teradata OLAP Connector	Not supported

COS(number)

Returns the cosine of an angle. Specify the angle in radians.

Example

```
COS(PI( ) /4) = 0.707106781186548
```

COT(number)

Returns the cotangent of an angle. Specify the angle in radians.

Example

```
COT(PI( ) /4) = 1
```

DEGREES(number)

Converts a given number in radians to degrees.

Example

```
DEGREES(PI( )/4) = 45.0
```

DIV(integer1, integer2)

Returns the integer part of a division operation, in which integer1 is divided by integer2.

Example

```
DIV(11,2) = 5
```

EXP(number)

Returns e raised to the power of the given number.

Examples

```
EXP(2) = 7.389
```

```
EXP(-[Growth Rate]*[Time])
```

FLOOR(number)

Rounds a number to the nearest integer of equal or lesser value.

Example

```
FLOOR(3.1415) = 3
```

Availability by data source

Data Source	Support
Microsoft Access	Not supported
Microsoft Excel	Supported
Text File	Supported
Statistical File	Supported
Tableau Server	Supported
Actian Vectorwise	Not supported
Amazon Aurora	Not supported
Amazon EMR	Supported
Amazon Redshift	Not supported
Aster Database	Not supported
Cloudera Hadoop	Supported
DataStax Enterprise	Supported
EXASolution	Not supported
Firebird	Not supported

Google Analytics	Supported
Google BigQuery	Supported
Google Cloud SQL	Not supported
Hortonworks Hadoop Hive	Supported
HP Vertica	Not supported
IBM BigInsights	Not supported
IBM DB2	Not supported
IBM Netezza	Not supported
MapR Hadoop Hive	Supported
MarkLogic	Not supported
Microsoft Analysis Services	Not supported
Microsoft PowerPivot	Not supported
Microsoft SQL Server	Not supported
MySQL	Not supported
Oracle	Not supported
Oracle Essbase	Not supported
ParAccel	Not supported
Pivotal Greenplum	Not supported
PostgreSQL	Not supported
Progress OpenEdge	Not supported
Salesforce	Supported
SAP HANA	Not supported
SAP Sybase ASE	Not supported

SAP Sybase IQ	Not supported
Spark SQL	Supported
Splunk	Not supported
Teradata	Not supported
Teradata OLAP Connector	Not supported

HEXBINX(number, number)

Maps an x, y coordinate to the x-coordinate of the nearest hexagonal bin. The bins have side length 1, so the inputs may need to be scaled appropriately.

HEXBINX and HEXBINY are binning and plotting functions for hexagonal bins. Hexagonal bins are an efficient and elegant option for visualizing data in an x/y plane such as a map. Because the bins are hexagonal, each bin closely approximates a circle and minimizes variation in the distance from the data point to the center of the bin. This makes the clustering both more accurate and informative.

Example

```
HEXBINX([Longitude], [Latitude])
```

HEXBINY(number, number)

Maps an x, y coordinate to the y-coordinate of the nearest hexagonal bin. The bins have side length 1, so the inputs may need to be scaled appropriately.

Example

```
HEXBINY([Longitude], [Latitude])
```

LN(number)

Returns the natural logarithm of a number. Returns `Null` if number is less than or equal to 0.

LOG(number [, base])

Returns the logarithm of a number for the given base. If the base value is omitted, base 10 is used.

MAX(number, number)

Returns the maximum of the two arguments, which must be of the same type. Returns `Null` if either argument is `Null`. `MAX` can also be applied to a single field in an aggregate calculation.

Examples

```
MAX(4,7)
```

`MAX(Sales,Profit)`

`MAX([First Name],[Last Name])`

MIN(number, number)

Returns the minimum of the two arguments, which must be of the same type. Returns `Null` if either argument is `Null`. `MIN` can also be applied to a single field in an aggregate calculation.

Examples

`MIN(4,7)`

`MIN(Sales,Profit)`

`MIN([First Name],[Last Name])`

PI( )

Returns the numeric constant pi: 3.14159.

POWER(number, power)

Raises the number to the specified power.

Examples

`POWER(5,2) = 52 = 25`

`POWER(Temperature, 2)`

You can also use the ^ symbol:

`5^2 = POWER(5,2) = 25`

Radians (number)

Converts the given number from degrees to radians.

Example

`RADIANS(180) = 3.14159`

ROUND(number, [decimals])

Rounds numbers to a specified number of digits. The `decimals` argument specifies how many decimal points of precision to include in the final result. If `decimals` is omitted, `number` is rounded to the nearest integer.

Example

This example rounds every `Sales` value to an integer:

`ROUND(Sales)`

Some databases, such as SQL Server, allow specification of a negative `length`, where -1 rounds `number` to 10's, -2 rounds to 100's, and so on. This is not true of all databases. For example, it is not true of Excel or Access.

SIGN(number)

Returns the sign of a number: The possible return values are -1 if the number is negative, 0 if the number is zero, or 1 if the number is positive.

Example

If the average of the profit field is negative, then

`SIGN(AVG(Profit)) = -1`

SIN(number)

Returns the sine of an angle. Specify the angle in radians.

Example

`SIN(0) = 1.0`

`SIN(PI( )/4) = 0.707106781186548`

SQRT(number)

Returns the square root of a number.

Example

`SQRT(25) = 5`

SQUARE(number)

Returns the square of a number.

Example

`SQUARE(5) = 25`

TAN(number)

Returns the tangent of an angle. Specify the angle in radians..

Example

`TAN(PI ( )/4) = 1.0`

ZN(expression)

Returns the expression if it is not null, otherwise returns zero. Use this function to use zero values instead of null values.

Example

`ZN([Profit]) = [Profit]`

String Functions

ASCII(string)

Return the ASCII code for the first character of `string`.

Example

```
ASCII('A') = 65
```

CHAR(number)

Returns the character encoded by the ASCII code `number`.

Example

```
CHAR(65) = 'A'
```

CONTAINS(string, substring)

Returns true if the given string contains the specified substring.

Example

```
CONTAINS(“Calculation”, “alcu”) = true
```

ENDSWITH(string, substring)

Returns true if the given string ends with the specified substring. Trailing white spaces are ignored.

Example

```
ENDSWITH(“Tableau”, “leau”) = true
```

FIND(string, substring, [start])

Returns the index position of `substring` in `string`, or 0 if the `substring` isn't found. If the optional argument `start` is added, the function ignores any instances of `substring` that appear before the index position `start`. The first character in the string is position 1.

Examples

```
FIND("Calculation", "alcu") = 2

FIND("Calculation", "Computer") = 0

FIND("Calculation", "a", 3) = 7

FIND("Calculation", "a", 2) = 2

FIND("Calculation", "a", 8) = 0
```

FINDNTH(string, substring, occurrence)

Returns the position of the nth occurrence of substring within the specified string, where n is defined by the occurrence argument.

Example

```
FINDNTH("Calculation", "a", 2) = 7
```

LEFT(string, number)

Returns the left-most number of characters in the string.

Example

```
LEFT("Matador", 4) = "Mata"
```

LEN(string)

Returns the length of the string.

Example

```
LEN("Matador") = 7
```

LOWER(string)

Returns `string`, with all characters lowercase.

Example

```
LOWER("ProductVersion") = "productversion"
```

LTRIM(string)

Returns the string with any leading spaces removed.

Example

```
LTRIM(" Matador ") = "Matador "
```

MAX(a, b)

Returns the maximum of `a` and `b` (which must be of the same type). This function is usually used to compare numbers, but also works on strings. With strings, `MAX` finds the value that is highest in the sort sequence defined by the database for that column. It returns `Null` if either argument is `Null`.

Example

```
MAX ("Apple","Banana") = "Banana"
```

MID(string, start, [length])

Returns the string starting at index position `start`. The first character in the string is position 1. If the optional argument `length` is added, the returned string includes only that number of characters.

Examples

```
MID("Calculation", 2) = "alculation"
```

`MID("Calculation", 2, 5) ="alcul"`

MIN(a, b)

Returns the minimum of `a` and `b` (which must be of the same type). This function is usually used to compare numbers, but also works on strings. With strings, `MIN` finds the value that is lowest in the sort sequence. It returns `Null` if either argument is `Null`.

Example

`MIN ("Apple","Banana") = "Apple"`

REPLACE(string, substring, replacement)

Searches `string` for `substring` and replaces it with `replacement`. If `substring` is not found, the string is not changed.

Example

`REPLACE("Version8.5", "8.5", "9.0") = "Version9.0"`

RIGHT(string, number)

Returns the right-most number of characters in `string`.

Example

`RIGHT("Calculation", 4) = "tion"`

RTRIM(string)

Returns `string` with any trailing spaces removed.

Example

`RTRIM(" Calculation ") = " Calculation"`

SPACE(number)

Returns a string that is composed of the specified `number` of repeated spaces.

Example

`SPACE(1) = " "`

SPLIT(string, delimiter, token number)

Returns a substring from a string, using a delimiter character to divide the string into a sequence of tokens.

The string is interpreted as an alternating sequence of delimiters and tokens. So for the string `abc-defgh-i-jkl`, where the delimiter character is '-', the tokens are abc, defgh, i, and jlk. Think of these as tokens 1 through 4. SPLIT returns the token corresponding to the token number. When the token number is positive, tokens are counted starting from the left end of the string; when the token number is negative, tokens are counted starting from the right.

Examples

```
SPLIT ('a-b-c-d', '-', 2) = 'b'
SPLIT ('a|b|c|d', '|', -2) = 'c'
```

Some data sources impose limits on splitting string. The following table shows which data sources support negative token numbers (splitting from the right) and whether there is a limit on the number of splits allow per data source. A SPLIT function that specifies a negative token number and would be legal with other data sources will return this error with these data sources: “Splitting from right is not support by the data source.”

Data Source	Left/Right Constraints	Maximum Number of Splits	Version Limitations
Tableau Data Extract	Both	Infinite	
Microsoft Excel	Both	Infinite	
Text file	Both	Infinite	
Salesforce	Both	Infinite	
OData	Both	Infinite	
Google Analytics	Both	Infinite	
Tableau Data Server	Both	Infinite	Supported in version 9.0.
HP Vertica	Left only	10	
Oracle	Left only	10	
MySQL	Both	10	
PostgreSQL	Left only prior to version 9.0; both for version 9.0 and above	10	

Teradata	Left only	10	Version 14 and later
Amazon Red-shift	Left only	10	
Aster Data-base	Left only	10	
Google BigQuery	Left only	10	
Hortonworks Hadoop Hive	Left only	10	
Cloudera Hadoop	Left only	10	Impala supported starting in version 2.3.0.
Microsoft SQL Server	Both	10	2008 and later

STARTSWITH(string, substring)

Returns true if `string` starts with `substring`. Leading white spaces are ignored.

Example

```
STARTSWITH("Joker", "Jo") = true
```

TRIM(string)

Returns the string with leading and trailing spaces removed. For example, `TRIM(" Calculation ") = "Calculation"`

UPPER(string)

Returns string, with all characters uppercase.

Example

```
UPPER("Calculation") = "CALCULATION"
```

Date Functions

Tableau provides a variety of date functions. Many of the examples use the `#` symbol with date expressions. See **Formatting Literals** on page 1408 for an explanation of this symbol. Additionally, many date functions use `date_part`, which is a constant string argument. The valid `date_part` values that you can use are:

date_part	Values
'year'	Four-digit year
'quarter'	1-4
'month'	1-12 or "January", "February", and so on
'dayofyear'	Day of the year; Jan 1 is 1, Feb 1 is 32, and so on
'day'	1-31
'weekday'	1-7 or "Sunday", "Monday", and so on
'week'	1-52
'hour'	0-23
'minute'	0-59
'second'	0-60

Note: Date functions do not take account of the configured fiscal year start. See .**Fiscal Dates** on page 800.

DATEADD(date_part, increment, date)

Returns an `increment` added to `date`. The type of increment is specified in `date_part`.

Example

```
DATEADD('month', 3, #2004-04-15#) = 2004-07-15 12:00:00 AM
```

This expression adds three months to the date `#2004-04-15#`.

DATEDIFF(date_part, date1, date2, [start_of_week])

Returns the difference between `date1` and `date2` expressed in units of `date_part`.

The `start_of_week` parameter is optional. If it is omitted, the start of week is determined by the data source. See **Date Properties for a Data Source** on page 791.

Example

```
DATEDIFF('week', #2013-09-22#, #2013-09-24#, 'monday')= 1
```

```
DATEDIFF('week', #2013-09-22#, #2013-09-24#, 'sunday')= 0
```

The first expression returns 1 because when `start_of_week` is 'monday', then 22 September (a Sunday) and 24 September (a Tuesday) are in different weeks. The second expression returns 0 because when `start_of_week` is 'sunday' then 22 September (a Sunday) and 24 September (a Tuesday) are in the same week.

DATENAME(date_part, date, [start_of_week])

Returns `date_part` of `date` as a string. The `start_of_week` parameter is optional.

If it is omitted, the start of week is determined by the data source. See **Date Properties for a Data Source** on page 791.

Examples

`DATENAME('year', #2004-04-15#) = "2004"`

`DATENAME('month', #2004-04-15#) = "April"`

DATEPARSE(format, string)

Converts a string to a datetime in the specified format. Support for some locale-specific formats is determined by the computer's system settings. Letters that appear in the data and do not need to be parsed should be surrounded by single quotes (' '). For formats that do not have delimiters between values (e.g., MMddyy), verify that they are parsed as expected. The format must be a constant string, not a field value. This function returns `Null` if the data does not match the format.

This function is available for non-legacy Microsoft Excel and text file connections, MySQL, Oracle, PostgreSQL, and Tableau data extract data sources. Some formats may not be available for all data sources.

Examples

`DATEPARSE ("dd.MMMM.yyyy", "15.April.2004") = #April 15, 2004#`

`DATEPARSE ("h'h' m'm' s's'", "10h 5m 3s") = #10:05:03#`

For more examples, see Understanding the DATEPARSE Function in the Tableau Knowledge Base.

DATEPART(date_part, date, [start_of_week])

Returns `date_part` of `date` as an integer.

The `start_of_week` parameter is optional. If it is omitted, the start of week is determined by the data source. See **Date Properties for a Data Source** on page 791.

> **Note:** When the `date_part` is weekday, the `start_of_week` parameter is ignored. This is because Tableau relies on a fixed weekday ordering to apply offsets.

Examples

`DATEPART('year', #2004-04-15#) = 2004`

`DATEPART('month', #2004-04-15#) = 4`

DATETRUNC(date_part, date, [start_of_week])

Truncates the specified date to the accuracy specified by the date_part. This function returns a new date. For example, when you truncate a date that is in the middle of the month at the month level, this function returns the first day of the month. The `start_of_week` parameter is optional. If it is omitted, the start of week is determined by the data source. See **Date Properties for a Data Source** on page 791.

Examples

```
DATETRUNC('quarter', #2004-08-15#) = 2004-07-01 12:00:00 AM
```

```
DATETRUNC('month', #2004-04-15#) = 2004-04-01 12:00:00 AM
```

DAY(date)

Returns the day of the given date as an integer.

Example

```
DAY(#2004-04-12#) = 12
```

ISDATE(string)

Returns true if a given string is a valid date.

Example

```
ISDATE("April 15, 2004") = true
```

MAKEDATE(year, month, day)

Returns a date value constructed from the specified year, month, and date.

Available for Tableau Data Extracts. Check for availability in other data sources.

Example

```
MAKEDATE(2004, 4, 15) = #April 15, 2004#
```

MAKEDATETIME(date, time)

Returns a datetime that combines a date and a time. The date can be a date, datetime, or a string type. The time must be a datetime. This function is available only for MySQL connections.

Examples

```
MAKEDATETIME("1899-12-30", #07:59:00#) = #12/30/1899 7:59:00 AM#
```

```
MAKEDATETIME([Date], [Time]) = #1/1/2001 6:00:00 AM#
```

MAKETIME(hour, minute, second)

Returns a date value constructed from the specified hour, minute, and second.

Available for Tableau Data Extracts. Check for availability in other data sources.

Example

```
MAKETIME(14, 52, 40) = #14:52:40#
```

MAX(expression) or MAX(expr1, expr2)

Usually applied to numbers but also works on dates. Returns the maximum of `a` and `b` (`a` and `b` must be of the same type). Returns `Null` if either argument is `Null`.

Examples

```
MAX(#2004-01-01# ,#2004-03-01#) = 2004-03-01 12:00:00 AM
```

```
MAX([ShipDate1], [ShipDate2])
```

MIN(expression) or MIN(expr1, expr2)

Usually applied to numbers but also works on dates. Returns the minimum of `a` and `b` (`a` and `b` must be of the same type). Returns `Null` if either argument is `Null`.

Examples

```
MIN(#2004-01-01# ,#2004-03-01#) = 2004-01-01 12:00:00 AM
```

```
MIN([ShipDate1], [ShipDate2])
```

MONTH(date)

Returns the month of the given date as an integer.

Example

```
MONTH(#2004-04-15#) = 4
```

NOW( )

Returns the current date and time.

The return varies depending on the nature of the connection:

- For a live, unpublished connection, NOW returns the data source server time.
- For a live, published connection, NOW returns the data source server time.
- For an unpublished extract, NOW returns the local system time.
- For a published extract, NOW returns the local time of the Tableau Server Data Engine. When there are multiple worker machines indifferent time zones, this can produce inconsistent results.

Example

```
NOW( ) = 2004-04-15 1:08:21 PM
```

TODAY( )

Returns the current date.

Example

`TODAY( ) = 2004-04-15`

YEAR (date)

Returns the year of the given date as an integer.

Example

`YEAR(#2004-15#) = 2004`

Type Conversion

The result of any expression in a calculation can be converted to a specific data type. The conversion functions are `STR()`, `DATE()`, `DATETIME()`, `INT()`, and `FLOAT()`. For example, if you want to cast a floating point number like 3.14 as an integer, you could write `INT(3.14)`. The result would be `3`, which is an integer. The casting functions are described below.

> A boolean can be cast to an integer, float, or string, It cannot be cast to a date. `True` is 1, 1.0, or “1”, while False is 0, 0.0 or “0”. `Unknown` maps to `Null`.

DATE(expression)

Returns a date given a number, string, or date expression.

Examples

`DATE([Employee Start Date])`

`DATE("April 15, 2004") = #April 15, 2004#`

`DATE("4/15/2004")`

`DATE(#2006-06-15 14:52#) = #2006-06-15#`

Quotation marks are required in the second and third examples.

DATETIME(expression)

Returns a datetime given a number, string, or date expression.

Example

`DATETIME(“April 15, 2005 07:59:00”) = April 15, 2005 07:59:00`

FLOAT(expression)

Casts its argument as a floating point number.

Examples

`FLOAT(3) = 3.000`

`FLOAT([Age])` converts every value in the `Age` field to a floating point number.

INT(expression)

Casts its argument as an integer. For expressions, this function truncates results to the closest integer toward zero.

Examples

`INT(8.0/3.0) = 2`

`INT(4.0/1.5) = 2`

`INT(0.50/1.0) = 0`

`INT(-9.7) = -9`

When a string is converted to an integer it is first converted to a float and then rounded.

STR(expression)

Casts its argument as a string.

Example

`STR([Age])` takes all of the values in the measure called `Age` and converts them to strings.

Logical Functions

CASE expression WHEN value1 THEN return1 WHEN value2 THEN return2...ELSE default return END

Use the CASE function to perform logical tests and return appropriate values. CASE is often easier to use than IIF or IF THEN ELSE. The CASE function evaluates `expression`, compares it to a sequence of values, `value1`, `value2`, etc., and returns a result. When a value that matches `expression` is encountered, CASE returns the corresponding return value. If no match is found, the default return expression is used. If there is no default return and no values match, then Null is returned.

Typically, you use an IF function to perform a sequence of arbitrary tests, and you use a CASE function to search for a match to an expression. But a CASE function can always be rewritten as an IF function , although the CASE function will generally be more concise.

Many times you can use a group to get the same results as a complicated case function.

Examples

```
CASE [Region] WHEN "West" THEN 1 WHEN "East" THEN 2 ELSE 3 END
```

```
CASE LEFT(DATENAME('weekday',[Order Date]),3) WHEN "Sun" THEN 0
WHEN "Mon" THEN 1 WHEN "Tue" THEN 2 WHEN "Wed" THEN 3 WHEN "Thu"
THEN 4 WHEN "Fri" THEN 5 WHEN "Sat" THEN 6 END
```

IIF(test, then, else, [unknown])

Use the IIF function to perform logical tests and return appropriate values. The first argument, `test`, must be a boolean: either a boolean field in the data source, or the result of a logical expression using operators (or a logical comparison of AND, OR, or NOT). If `test` evaluates to TRUE, then IIF returns the `then` value. If `test` evaluates to FALSE, then IIF returns the `else` value.

A boolean comparison may also yield the value UNKNOWN (neither TRUE nor FALSE), usually due to the presence of Null values in test. The final argument to IIF is returned in the event of an UNKNOWN result for the comparison. If this argument is left out, Null is returned.

Examples

```
IIF(7>5, "Seven is greater than five", "Seven is less than five")
```

```
IIF([Cost]>[Budget Cost], "Over Budget", "Under Budget")
```

```
IIF([Budget Sales]!=0,[Sales]/[Budget Sales],0)
```

```
IIF(Sales>=[Budget Sales], "Over Cost Budget and Over Sales
Budget", "Over Cost Budget and Under Sales Budget","Under Cost
Budget")
```

IF test THEN value END / IF test THEN value ELSE else END

Use the IF THEN ELSE function to perform logical tests and return appropriate values. The IF THEN ELSE function evaluates a sequence of test conditions and returns the value for the first condition that is true. If no condition is true, the ELSE value is returned. Each test must be a boolean: either be a boolean field in the data source or the result of a logical expression. The final ELSE is optional, but if it is not provided and there is no true test expression, then the function returns Null. All of the value expressions must be of the same type.

Examples

```
IF [Cost]>[Budget Cost] THEN "Over Budget" ELSE "Under Budget"
END
```

```
IF [Budget Sales]!=0 THEN [Sales]/[Budget Sales] END
```

IF test1 THEN value1 ELSEIF test2 THEN value2 ELSE else END

Use this version of the IF function to perform logical tests recursively. There is no built-in limit to the number of ELSEIFvalues you can use with an IF function, though individual databases may impose a limit on IF function complexity. While an IF function can be rewritten as a series of nested IIF statements, there are differences in how the expressions will be evaluated. In particular, an IIF statement distinguishes TRUE, FALSE and UNKNOWN, whereas an IF statement only worries about TRUE and not true (which includes both FALSE and UNKNOWN).

Example

```
IF [Region]="West" THEN 1 ELSEIF [Region]="East" THEN 2 ELSE 3
END
```

IFNULL(expression1, expression2)

The IFNULL function returns the first expression if the result is not null, and returns the second expression if it is null.

Example

```
IFNULL([Proft], 0) = [Profit]
```

ISDATE(string)

The ISDATE function returns `TRUE` if the string argument can be converted to a date and `FALSE` if it cannot.

Examples

```
ISDATE("January 1, 2003") = TRUE
```

```
ISDATE("Jan 1 2003") = TRUE
```

```
ISDATE("1/1/03") = TRUE
```

```
ISDATE("Janxx 1 2003") = FALSE
```

ISNULL(expression)

The ISNULL function returns `TRUE` if the expression is `Null` and `FALSE` if it is not.

MIN(expression) or MIN(expression1,expression2)

The MIN function returns the minimum of an expression across all records or the minimum of two expressions for each record.

Use cases

Use logical functions to create specific views from a data source without changing the source itself. For example, combine different members of a dimension, or filter a segment out of a view. Below are a few basic examples, using the IF statement with different types of logical operator. For more information about logical operators, see **Operators** on page 1462.

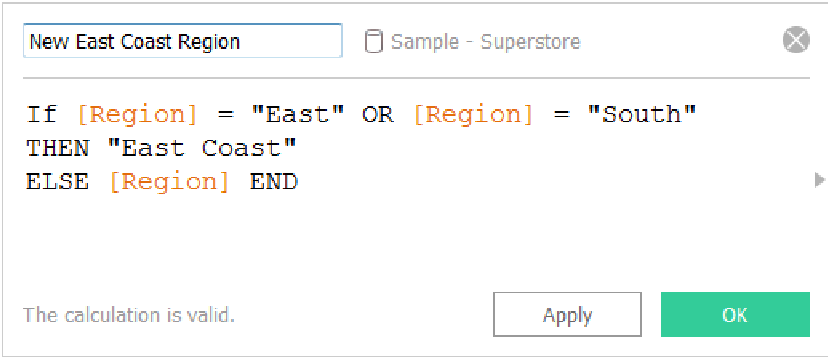
Learn how to use logical functions to group members of a field, compare values, exclude values, and create virtual bins:

Group members of a field

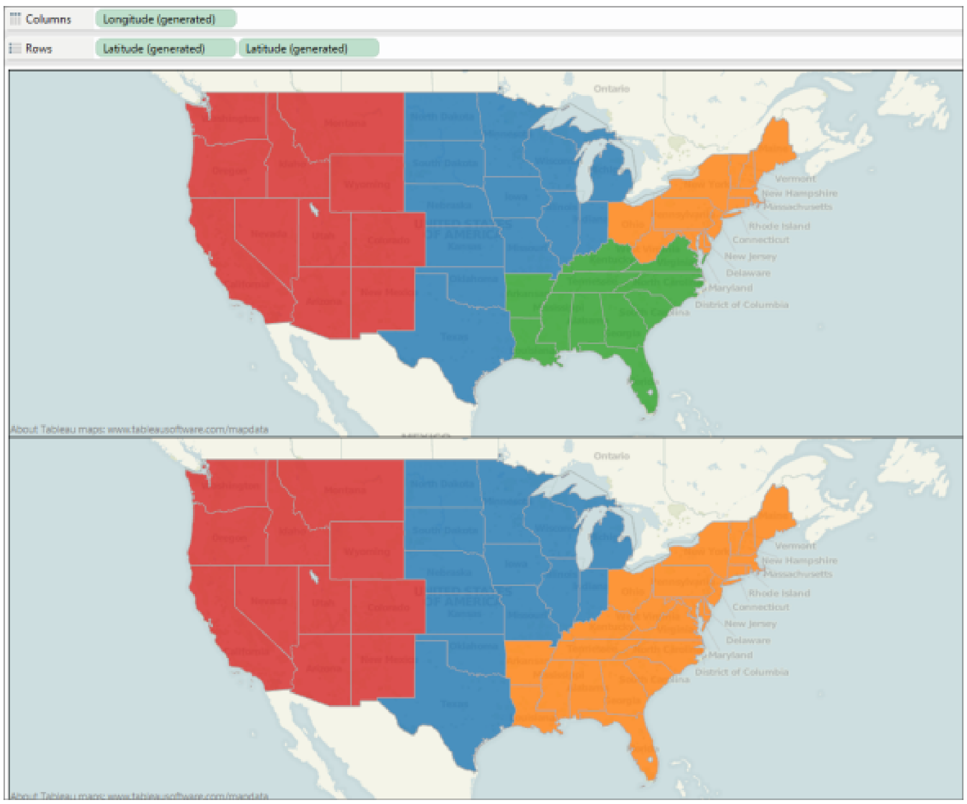
In an OR statement, only one of the conditions in the statement needs to be true for the entire calculation to evaluate to true.

In this example, an **OR** operator is used to create a new region called East Coast, made up of members of the East and South regions:

```
IF [Region] = “East” OR [Region] = “South” THEN “East Coast” ELSE
[Region] END
```



Using this calculation, your view will update to look like this:

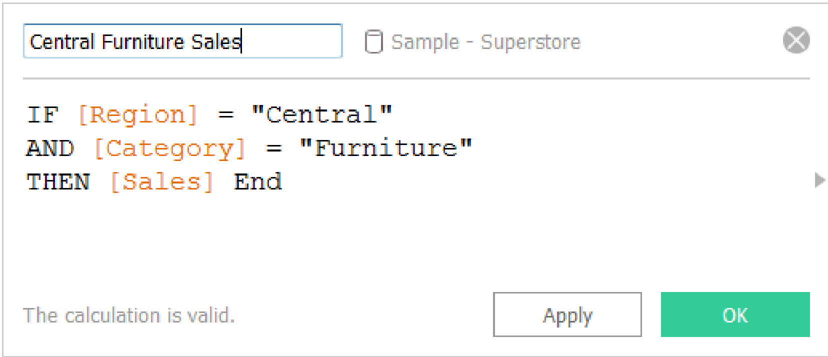


Compare values

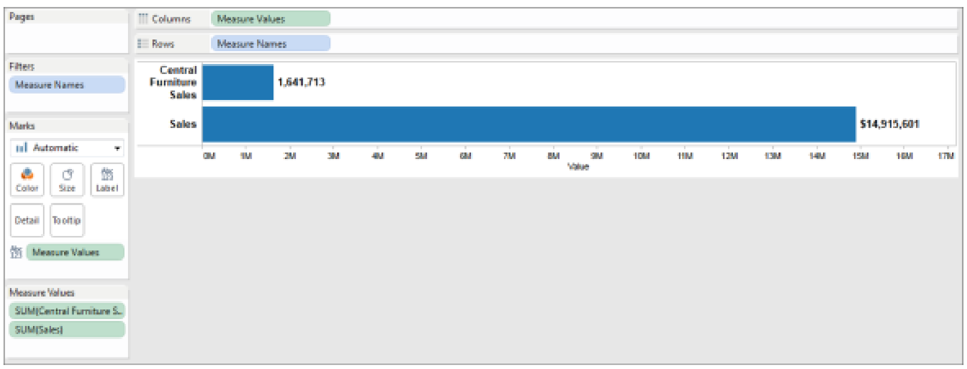
Logical statements that use the **AND** operator are useful when more than one field needs to be involved. In an AND statement, all conditions must evaluate to true for the overall calculation to be true.

The following calculation finds furniture sales for the Central region:

```
IF [Region] = “Central” AND [Product Category] = “Furniture” THEN
[Sales] END
```



Use this calculation in a view to easily show how furniture sales in the Central region compare to total sales.

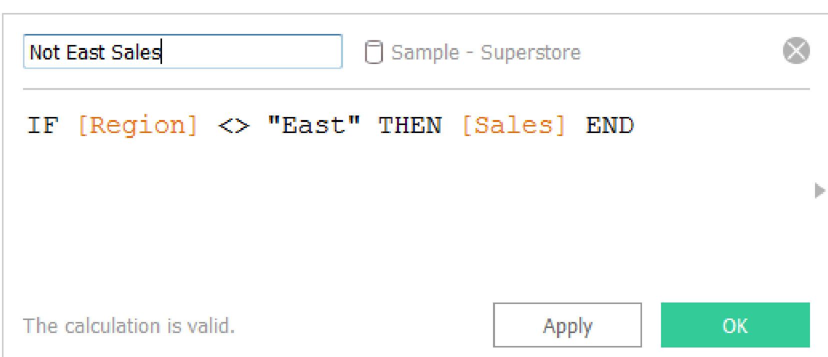


Exclude values

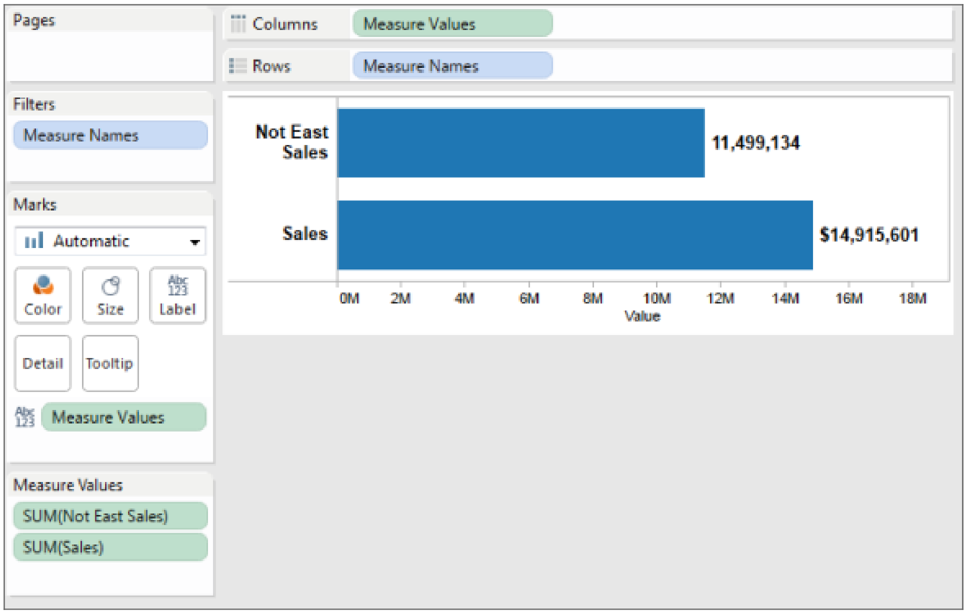
The calculation in this example uses the **not equal to** operator (<>). This operator is often used to exclude values or filter a member of a dimension out of a view.

The following formula calculates the total sales for all regions except East:

```
IF Region <> “East” THEN [Sales] END
```



Using this calculation, your view will update to look like this:



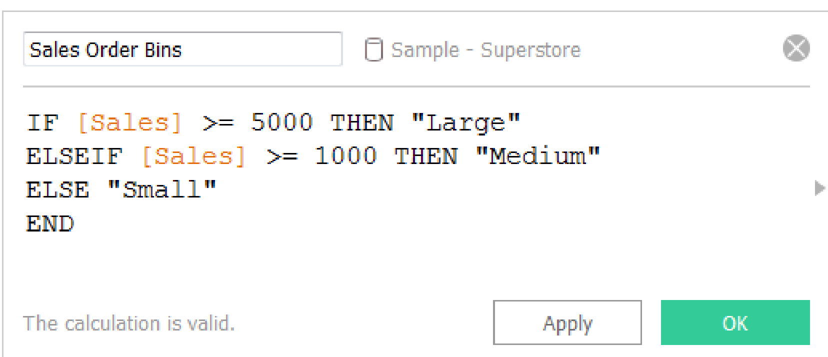
Create virtual bins

The **greater than or equal to** operator (>=) can be used to create virtual bins to categorize data in different ways. This type of calculation is very useful and is similar to how KPIs (Key Performance Indicators) are evaluated. In this calculation, the **>=** operator is used to group sales into large, medium, and small orders based on the dollar amount.

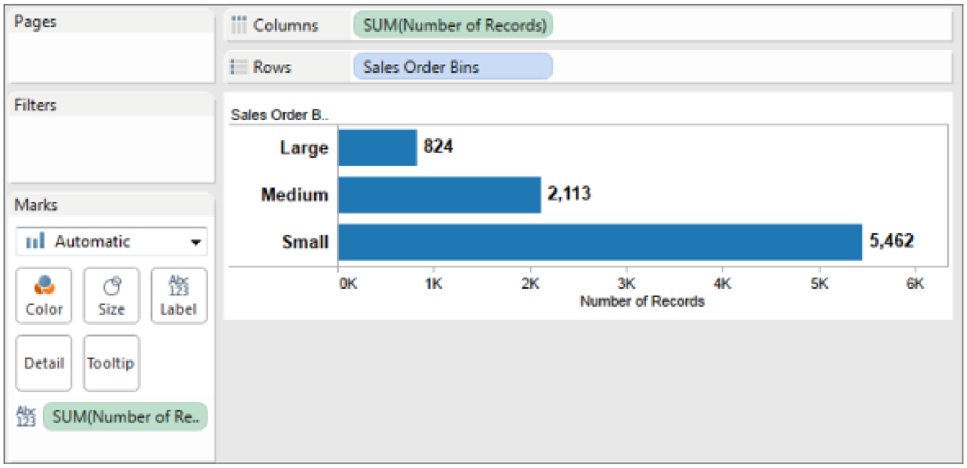
```
IF [Sales] >= 5000 THEN "Large Order"

ELSEIF [Sales] >= 1000 THEN "Medium Order"

ELSE "Small Order" END
```



Using this calculation, your view will update to look like this:



Aggregate Functions

Aggregations and floating-point arithmetic: The results of some aggregations may not always be exactly as expected. For example, you may find that the Sum function returns a value such as -1.42e-14 for a column of numbers that you know should sum to exactly 0. This happens because the Institute of Electrical and Electronics Engineers (IEEE) 754 floating-point standard requires that numbers be stored in binary format, which means that numbers are sometimes rounded at extremely fine levels of precision. You can eliminate this potential distraction by using the ROUND function (see **Number Functions** on page 1409) or by formatting the number to show fewer decimal places.

ATTR(expression)

Returns the value of the expression if it has a single value for all rows. Otherwise returns an asterisk. Null values are ignored.

AVG(expression)

Returns the average of all the values in the expression. AVG can be used with numeric fields only. Null values are ignored.

COUNT(expression)

Returns the number of items in a group. Null values are not counted.

COUNTD(expression)

Returns the number of distinct items in a group. Null values are not counted. This function is not available in the following cases: workbooks created before Tableau Desktop 8.2 that use Microsoft Excel or text file data sources, workbooks that use the legacy connection, and workbooks that use Microsoft Access data sources. Extract your data into an extract file to use this function. See **Extract Your Data** on page 379.

MAX(expression)

Returns the maximum of an expression across all records. If the expression is a string value, this function returns the last value where last is defined by alphabetical order.

MEDIAN(expression)

Returns the median of an expression across all records. Median can only be used with numeric fields. Null values are ignored. This function is not available for workbooks created before Tableau Desktop 8.2 or that use legacy connections. It is also not available for connections using any of the following data sources:

- Access
- Amazon Redshift
- Cloudera Hadoop
- HP Vertica
- IBM DB2
- IBM Netezza
- Microsoft Excel
- Microsoft SQL Server
- MySQL
- Teradata
- Text files

For other data source types, you can extract your data into an extract file to use this function. See **Extract Your Data** on page 379.

MIN(expression)

Returns the minimum of an expression across all records. If the expression is a string value, this function returns the first value where first is defined by alphabetical order.

PERCENTILE(expression, number)

Returns the percentile value from the given expression corresponding to the specified number. The number must be between 0 and 1 (inclusive)—for example, 0.66, and must be a numeric constant.

This function is available for the following data sources.

- Non-legacy Microsoft Excel and Text File connections.
- Extracts and extract-only data source types (for example, Google Analytics, OData, or Salesforce).
- Sybase IQ 15.1 and later data sources.
- Oracle 10 and later data sources.
- Cloudera Hive and Hortonworks Hadoop Hive data sources.
- EXASolution 4.2 and later data sources.

For other data source types, you can extract your data into an extract file to use this function. See **Extract Your Data** on page 379.

STDEV(expression)

Returns the statistical standard deviation of all values in the given expression based on a sample of the population.

STDEVP(expression)

Returns the statistical standard deviation of all values in the given expression based on a biased population.

SUM(expression)

Returns the sum of all values in the expression. SUM can be used with numeric fields only. Null values are ignored.

VAR(expression)

Returns the statistical variance of all values in the given expression based on a sample of the population.

VARP(expression)

Returns the statistical variance of all values in the given expression on the entire population.

Pass-Through Functions (RAWSQL)

These RAWSQL pass-through functions can be used to send SQL expressions directly to the database, without first being interpreted by Tableau. If you have custom database functions that Tableau doesn't know about, you can use these pass-through functions to call these custom functions.

Your database usually will not understand the field names that are shown in Tableau. Because Tableau does not interpret the SQL expressions you include in the pass-through functions, using the Tableau field names in your expression may cause errors. You can use a substitution syntax to insert the correct field name or expression for a Tableau calculation into pass-through SQL. For example, if you had a function that computed the median of a set of values, you could call that function on the Tableau column [Sales] like this:

```
RAWSQLAGG_REAL(“MEDIAN(%1)”, [Sales])
```

Because Tableau does not interpret the expression, you must define the aggregation. You can use the RAWSQLAGG functions described below when you are using aggregated expressions.

> RAWSQL pass-through functions will not work with published data sources.

> These functions may return different results starting in Tableau Desktop 8.2 than they did in earlier versions of Tableau Desktop. This is because Tableau now uses ODBC for pass-through functions instead of OLE DB. ODBC truncates when returning real values as integer; OLE DB rounds when returning real values as integer.

RAWSQL Functions

The following RAWSQL functions are available in Tableau.

RAWSQL_BOOL(“sql_expr”, [arg1], …[argN])

Returns a Boolean result from a given SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values.

In the example, %1 is equal to [Sales] and %2 is equal to [Profit].

RAWSQL_BOOL(“IIF(%1 > %2, True, False)”, [Sales], [Profit])

RAWSQL_DATE(“sql_expr”, [arg1], …[argN])

Returns a Date result from a given SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Order Date].

Example

```
RAWSQL_DATE("%1", [Order Date])
```

RAWSQL_DATETIME(“sql_expr”, [arg1], …[argN])

Returns a Date and Time result from a given SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Delivery Date].

Example: RAWSQL_DATETIME(“MIN(%1)”, [Delivery Date])

RAWSQL_INT(“sql_expr”, [arg1], …[argN])

Returns an integer result from a given SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Sales].

Example

```
RAWSQL_INT("500 + %1", [Sales])
```

RAWSQL_REAL(“sql_expr”, [arg1], …[argN])

Returns a numeric result from a given SQL expression that is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Sales]

Example

```
RAWSQL_REAL("-123.98 * %1", [Sales])
```

RAWSQL_STR("sql_expr", [arg1], …[argN])

Returns a string from a given SQL expression that is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Customer Name].

Example

```
RAWSQL_STR("%1", [Customer Name])
```

RAWSQLAGG_BOOL("sql_expr", [arg1], …[argN])

Returns a Boolean result from a given aggregate SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values.

In the example, %1 is equal to [Sales] and %2 is equal to [Profit].

Example: RAWSQLAGG_BOOL("SUM(%1) >SUM(%2)", [Sales], [Profit])

RAWSQLAGG_DATE("sql_expr", [arg1], …[argN])

Returns a Date result from a given aggregate SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Order Date].

Example

```
RAWSQLAGG_DATE("MAX(%1)", [Order Date])
```

RAWSQLAGG_DATETIME("sql_expr", [arg1], …[argN])

Returns a Date and Time result from a given aggregate SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Delivery Date].

Example

```
RAWSQLAGG_DATETIME("MIN(%1)", [Delivery Date])
```

RAWSQLAGG_INT("sql_expr", [arg1,] …[argN])

Returns an integer result from a given aggregate SQL expression. The SQL expression is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Sales].

Example

```
RAWSQLAGG_INT("500 + SUM(%1)", [Sales])
```

RAWSQLAGG_REAL(“sql_expr”, [arg1,] …[argN])

Returns a numeric result from a given aggregate SQL expression that is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Sales]

Example

```
RAWSQLAGG_REAL(“SUM( %1)”, [Sales])
```

RAWSQLAGG_STR(“sql_expr”, [arg1,] …[argN])

Returns a string from a given aggregate SQL expression that is passed directly to the underlying database. Use %n in the SQL expression as a substitution syntax for database values. In this example, %1 is equal to [Discount].

Example

```
RAWSQLAGG_STR(“AVG(%1)”, [Discount])
```

User Functions

Use these user functions to create user filters based on user lists in your data source. For example, assume you have a view that shows the sales performance for each employee. When you publish that view, you may want to only allow employees to see their own sales numbers. You can use the function CURRENTUSER to create a field that returns True if the username of the person signed in to the server is the same as the employee name in the view. Then when you filter the view using this calculated field, only the data for the user who is currently signed in is shown.

FULLNAME( )

Returns the full name for the current user. This is the Tableau Server or Tableau Online full name when the user is signed in; otherwise the local or network full name for the Tableau Desktop user.

Example

```
[Manager]=FULLNAME( )
```

If manager Dave Hallsten is signed in, this example returns True only if the Manager field in the view contained Dave Hallsten. When used as a filter, this calculated field can be used to create a user filter that only shows data that is relevant to the person signed in to the server.

ISFULLNAME(string)

Returns true if the current user's full name matches the specified full name, or false if it does not match. This function uses the Tableau Server or Online full name when the user is signed in; otherwise it uses the local or network full name for the Tableau Desktop user.

Example

```
ISFULLNAME("Dave Hallsten")
```

This example returns true if Dave Hallsten is the current user, otherwise it returns false.

ISMEMBEROF(string)

Returns true if the person currently using Tableau is a member of a group that matches the given string. If the person currently using Tableau is signed in, the group membership is determined by groups on Tableau Server or Tableau Online. If the person is not signed in, this function returns false.

Example

```
IF ISMEMBEROF("Sales") THEN "Sales" ELSE "Other" END
```

ISUSERNAME(string)

Returns true if the current user's username matches the specified username, or false if it does not match. This function uses the Tableau Server or Online username when the user is signed in; otherwise it uses the local or network username for the Tableau Desktop user.

Example

```
ISUSERNAME("dhallsten")
```

This example returns true if dhallsten is the current user; otherwise it returns false.

USERDOMAIN()

Returns the domain for the current user when the user is signed on to Tableau Server. Returns the Windows domain if the Tableau Desktop user is on a domain. Otherwise this function returns a null string.

Example

```
[Manager]=USERNAME() AND [Domain]=USERDOMAIN()
```

USERNAME( )

Returns the username for the current user. This is the Tableau Server or Tableau Online username when the user is signed in; otherwise it is the local or network username for the Tableau Desktop user.

Example

```
[Manager]=USERNAME( )
```

If the manager dhallsten was signed in, this function would only return True when the Manager field in the view is dhallsten. When used as a filter this calculated field can be used to create a user filter that only shows data that is relevant to the person signed in to the server.

Table Calculation Functions

Use table calculation functions to customize table calculations. Table Calculations are computations that are applied to the values in the entire table and are often dependent on the table structure itself. See **Customizing Table Calculations** on page 1062 for information about creating and customizing table calculations.

FIRST( )

Returns the number of rows from the current row to the first row in the partition. For example, the view below shows quarterly sales. When FIRST() is computed within the Date partition, the offset of the first row from the second row is -1.

		Region			
Year of Order Date	Quarter of Order Date	Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

First()

$160,877	0
$197,213	-1
$302,678	-2
$297,208	-3
$180,609	-4
$195,785	-5
$116,613	-6

Example

When the current row index is 3, `FIRST() = -2`.

INDEX( )

Returns the index of the current row in the partition, without any sorting with regard to value. The first row index starts at 1. For example, the table below shows quarterly sales. When INDEX() is computed within the Date partition, the index of each row is 1, 2, 3, 4..., etc.

		Region			
Year of Order Date	Quarter of Order Date	Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

INDEX()

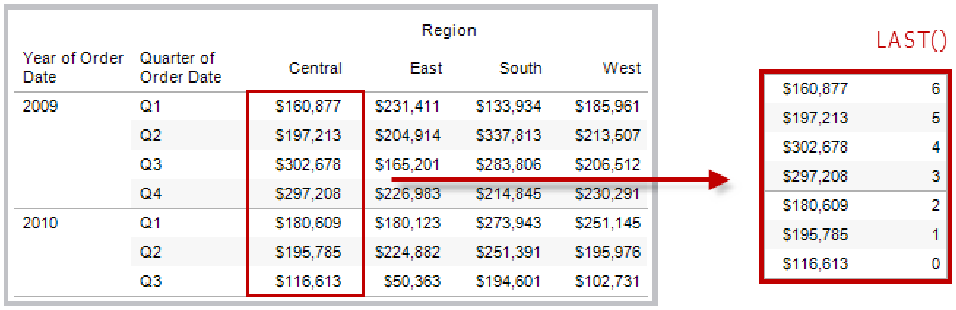
$160,877	1
$197,213	2
$302,678	3
$297,208	4
$180,609	5
$195,785	6
$116,613	7

Example

For the third row in the partition, `INDEX() = 3`.

LAST( )

Returns the number of rows from the current row to the last row in the partition. For example, the table below shows quarterly sales. When LAST() is computed within the Date partition, the offset of the last row from the second row is 5.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

LAST()

$160,877	6
$197,213	5
$302,678	4
$297,208	3
$180,609	2
$195,785	1
$116,613	0

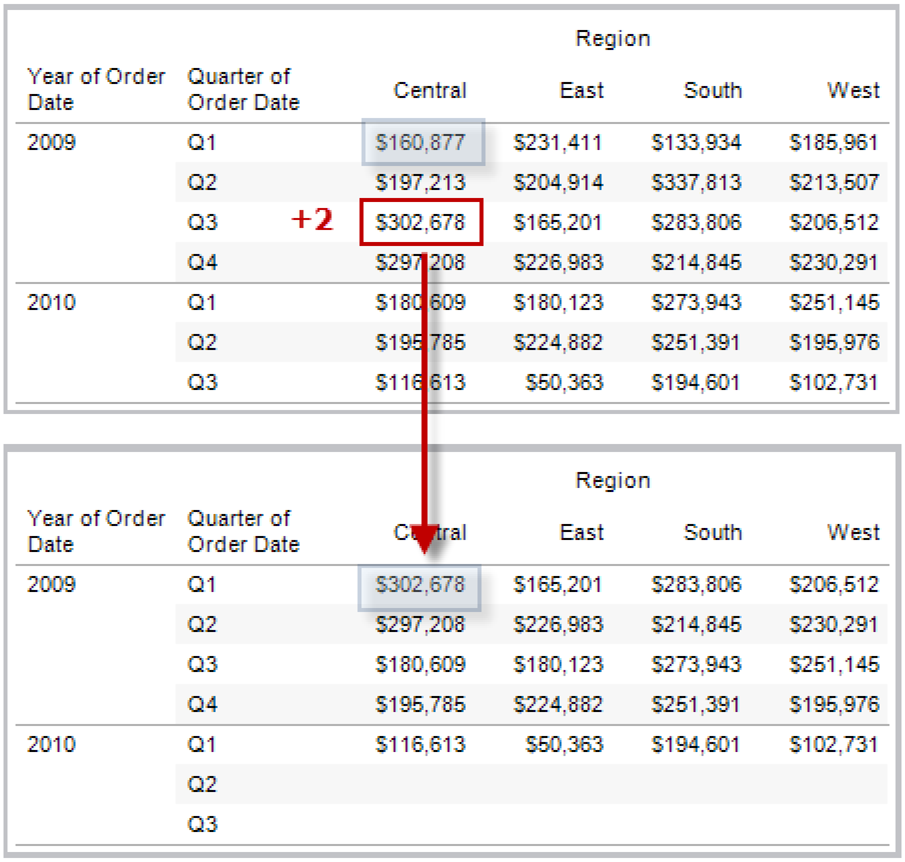
Example

When the current row index is 3 of 7, `LAST() = 4`.

LOOKUP(expression, [offset])

Returns the value of the expression in a target row, specified as a relative offset from the current row. Use FIRST() + n and LAST() - n as part of your offset definition for a target relative to the first/last rows in the partition. If `offset` is omitted, the row to compare to can be set on the field menu. This function returns NULL if the target row cannot be determined.

The view below shows quarterly sales. When `LOOKUP (SUM(Sales), 2)` is computed within the Date partition, each row shows the sales value from 2 quarters into the future.



Year of Order Date	Quarter of Order Date	Central	East	South	West
		Region			
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

Year of Order Date	Quarter of Order Date	Central	East	South	West
		Region			
2009	Q1	$302,678	$165,201	$283,806	$206,512
	Q2	$297,208	$226,983	$214,845	$230,291
	Q3	$180,609	$180,123	$273,943	$251,145
	Q4	$195,785	$224,882	$251,391	$195,976
2010	Q1	$116,613	$50,363	$194,601	$102,731
	Q2				
	Q3				

Example

`LOOKUP(SUM([Profit]), FIRST()+2)` computes the SUM(Profit) in the third row of the partition.

PREVIOUS_VALUE(expression)

Returns the value of this calculation in the previous row. Returns the given expression if the current row is the first row of the partition.

Example

`SUM([Profit]) * PREVIOUS_VALUE(1)` computes the running product of SUM(Profit).

RANK(expression, ['asc' | 'desc'])

Returns the standard competition rank for the current row in the partition. Identical values are assigned an identical rank. Use the optional `'asc' | 'desc'` argument to specify ascending or descending order. The default is descending.

With this function, the set of values (6, 9, 9, 14) would be ranked (4, 2, 2, 1).

Nulls are ignored in ranking functions. They are not numbered and they do not count against the total number of records in percentile rank calculations.

For information on different ranking options, see **Rank Calculation** on page 1052.

Example

The following image shows the effect of the various ranking functions (RANK, RANK_DENSE, RANK_MODIFIED, RANK_PERCENTILE, and RANK_UNIQUE) on a set of values. The data set contains information on 14 students (StudentA through StudentN); the **Age** column shows the current age of each student (all students are between 17 and 20 years of age). The remaining columns show the effect of each rank function on the set of age values, always assuming the default order (ascending or descending) for the function.

Student	Age	RANKofAge	RANK_DENSEofAge	RANK_MODIFIEDofAge	RANK_PERCENTILEofAge	RANK_UNIQUEofAge
StudentA	19	4	2	7	79%	4
StudentB	18	8	3	12	50%	8
StudentC	19	4	2	7	79%	5
StudentD	18	8	3	12	50%	9
StudentE	17	13	4	14	14%	13
StudentF	18	8	3	12	50%	10
StudentG	19	4	2	7	79%	6
StudentH	20	1	1	3	100%	1
StudentI	19	4	2	7	79%	7
StudentJ	20	1	1	3	100%	2
StudentK	20	1	1	3	100%	3
StudentL	17	13	4	14	14%	14
StudentM	18	8	3	12	50%	11
StudentN	18	8	3	12	50%	12

RANK_DENSE(expression, ['asc' | 'desc'])

Returns the dense rank for the current row in the partition. Identical values are assigned an identical rank, but no gaps are inserted into the number sequence. Use the optional `'asc' | 'desc'` argument to specify ascending or descending order. The default is descending.

With this function, the set of values (6, 9, 9, 14) would be ranked (3, 2, 2, 1).

Nulls are ignored in ranking functions. They are not numbered and they do not count against the total number of records in percentile rank calculations.

For information on different ranking options, see **Rank Calculation** on page 1052.

RANK_MODIFIED(expression, ['asc' | 'desc'])

Returns the modified competition rank for the current row in the partition. Identical values are assigned an identical rank. Use the optional `'asc' | 'desc'` argument to specify ascending or descending order. The default is descending.

With this function, the set of values (6, 9, 9, 14) would be ranked (4, 3, 3, 1).

Nulls are ignored in ranking functions. They are not numbered and they do not count against the total number of records in percentile rank calculations.

For information on different ranking options, see **Rank Calculation** on page 1052.

RANK_PERCENTILE(expression, ['asc' | 'desc'])

Returns the percentile rank for the current row in the partition. Use the optional `'asc' | 'desc'` argument to specify ascending or descending order. The default is ascending.

With this function, the set of values (6, 9, 9, 14) would be ranked (0.25, 0.75, 0.75, 1.00).

Nulls are ignored in ranking functions. They are not numbered and they do not count against the total number of records in percentile rank calculations.

For information on different ranking options, see **Rank Calculation** on page 1052.

RANK_UNIQUE(expression, ['asc' | 'desc'])

Returns the unique rank for the current row in the partition. Identical values are assigned different ranks. Use the optional `'asc' | 'desc'` argument to specify ascending or descending order. The default is descending.

With this function, the set of values (6, 9, 9, 14) would be ranked (4, 2, 3, 1).

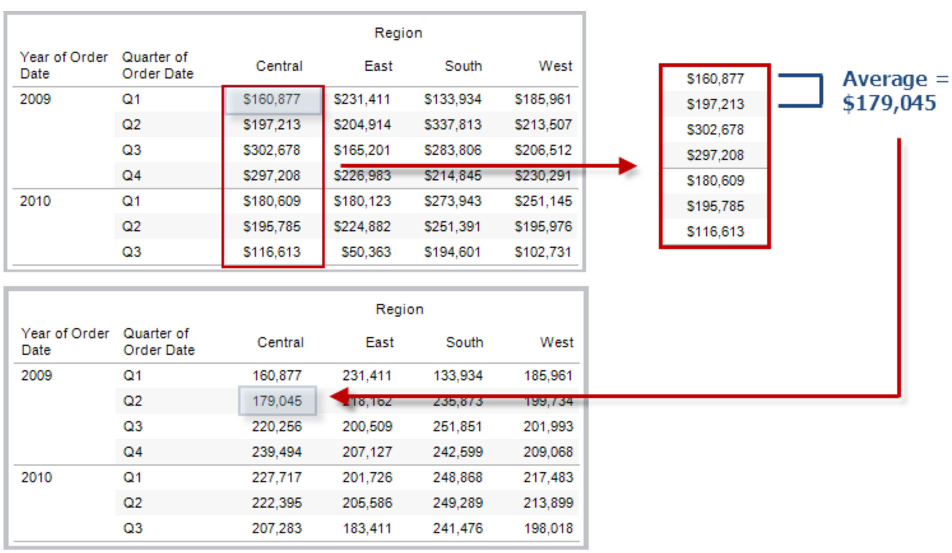
Nulls are ignored in ranking functions. They are not numbered and they do not count against the total number of records in percentile rank calculations.

For information on different ranking options, see **Rank Calculation** on page 1052.

RUNNING_AVG(expression)

Returns the running average of the given expression, from the first row in the partition to the current row.

The view below shows quarterly sales. When `RUNNING_AVG(SUM([Sales])` is computed within the Date partition, the result is a running average of the sales values for each quarter.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	160,877	231,411	133,934	185,961
	Q2	179,045	218,162	235,873	199,734
	Q3	220,256	200,509	251,851	201,993
	Q4	239,494	207,127	242,599	209,068
2010	Q1	227,717	201,726	248,868	217,483
	Q2	222,395	205,586	249,289	213,899
	Q3	207,283	183,411	241,476	198,018

Example

`RUNNING_AVG(SUM([Profit]))` computes the running average of SUM(Profit).

RUNNING_COUNT(expression)

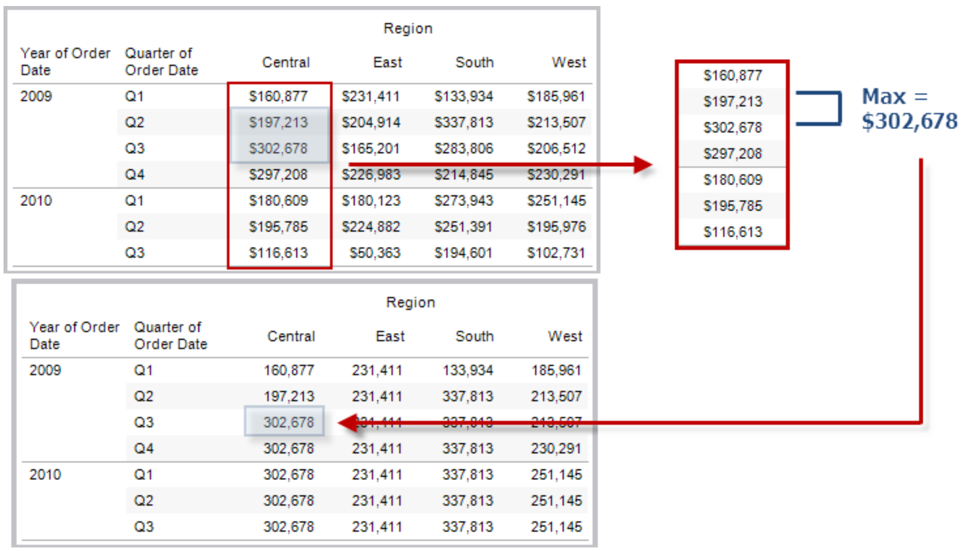
Returns the running count of the given expression, from the first row in the partition to the current row.

Example

`RUNNING_COUNT(SUM([Profit]))` computes the running count of SUM(Profit).

RUNNING_MAX(expression)

Returns the running maximum of the given expression, from the first row in the partition to the current row.

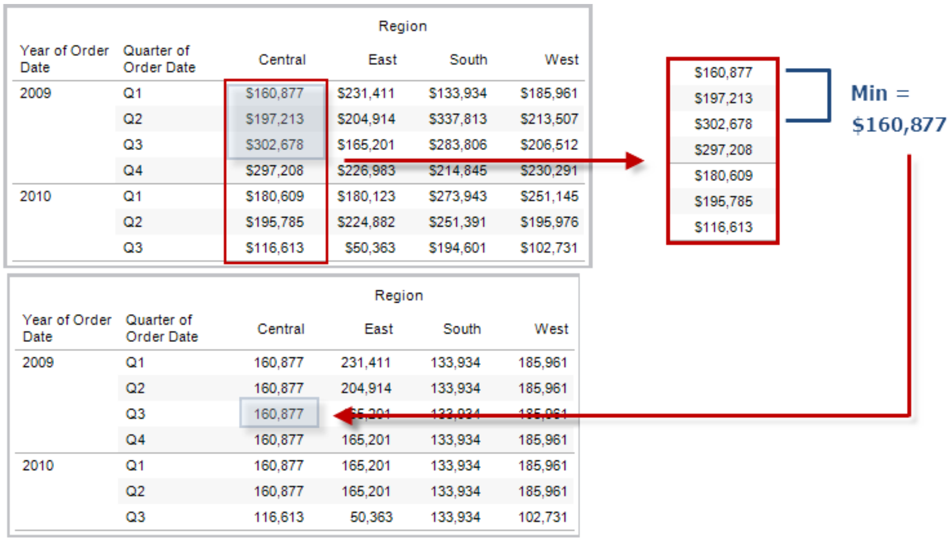


Example

`RUNNING_MAX(SUM([Profit]))` computes the running maximum of SUM(Profit).

RUNNING_MIN(expression)

Returns the running minimum of the given expression, from the first row in the partition to the current row.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

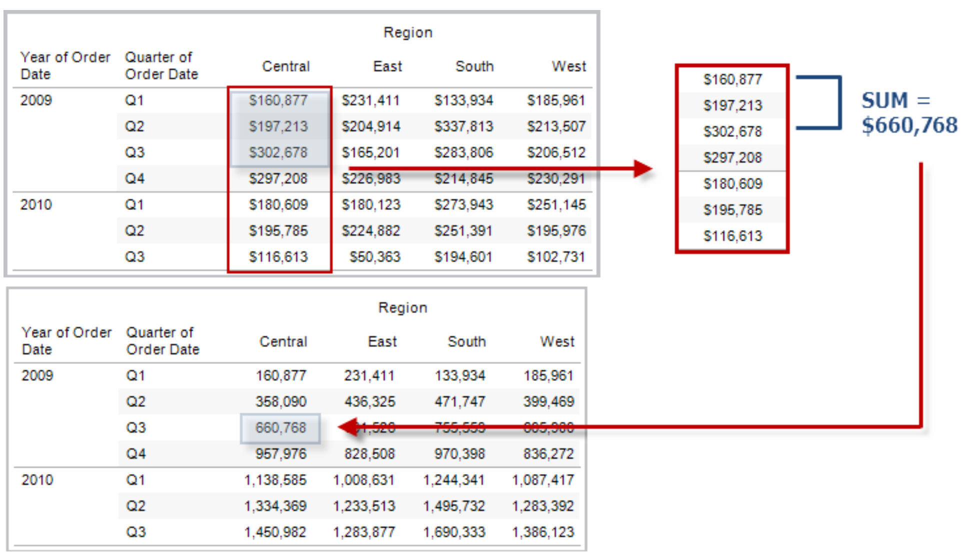
Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	160,877	231,411	133,934	185,961
	Q2	160,877	204,914	133,934	185,961
	Q3	160,877	[illegible]	133,934	185,961
	Q4	160,877	165,201	133,934	185,961
2010	Q1	160,877	165,201	133,934	185,961
	Q2	160,877	165,201	133,934	185,961
	Q3	116,613	50,363	133,934	102,731

Example

`RUNNING_MIN(SUM([Profit]))` computes the running minimum of SUM(Profit).

RUNNING_SUM(expression)

Returns the running sum of the given expression, from the first row in the partition to the current row.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

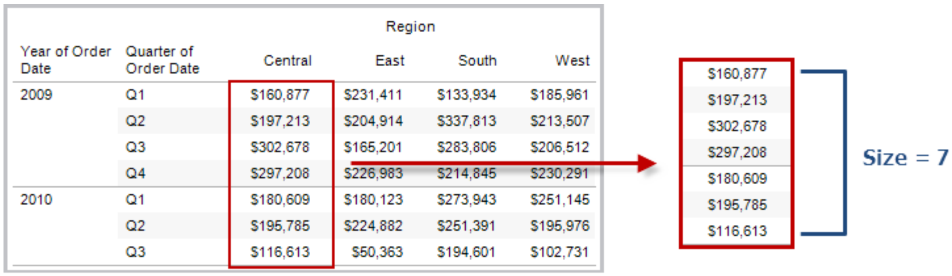
Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	160,877	231,411	133,934	185,961
	Q2	358,090	436,325	471,747	399,469
	Q3	660,768	[illegible]	755,559	[illegible]
	Q4	957,976	828,508	970,398	836,272
2010	Q1	1,138,585	1,008,631	1,244,341	1,087,417
	Q2	1,334,369	1,233,513	1,495,732	1,283,392
	Q3	1,450,982	1,283,877	1,690,333	1,386,123

Example

`RUNNING_SUM(SUM([Profit]))` computes the running sum of SUM(Profit)

SIZE()

Returns the number of rows in the partition. For example, the view below shows quarterly sales. Within the Date partition, there are seven rows so the Size() of the Date partition is 7.



Example

`SIZE() = 5` when the current partition contains five rows.

SCRIPT_BOOL

Returns a Boolean result from the specified R expression. The R expression is passed directly to a running Rserve instance. Use .arg*n* in the R expression to reference parameters (.arg1, .arg2, etc.).

Examples

In the following example, .arg1 is equal to SUM([Profit]):

```
SCRIPT_BOOL("is.finite(.arg1)", SUM([Profit]))
```

The next example returns True for store IDs in Washington state, and False otherwise. This example could be the definition for a calculated field titled IsStoreInWA.

```
SCRIPT_BOOL('grepl(".*_WA", .arg1, perl=TRUE)',ATTR([Store ID]))
```

SCRIPT_INT

Returns an integer result from the specified R expression. The R expression is passed directly to a running Rserve instance. Use .arg*n* in the R expression to reference parameters (.arg1, .arg2, etc.).

Examples

In the following example, .arg1 is equal to SUM([Profit]):

```
SCRIPT_INT("is.finite(.arg1)", SUM([Profit]))
```

In the next example, k-means clustering is used to create three clusters:

```
SCRIPT_INT('result <- kmeans(data.frame(.arg1,.arg2,.arg3,.arg4),
3);result$cluster;', SUM([Petal length]), SUM([Petal width]),SUM
([Sepal length]),SUM([Sepal width]))
```

SCRIPT_REAL

Returns a real result from the specified R expression. The R expression is passed directly to a running Rserve instance. Use .arg*n* in the R expression to reference parameters (.arg1, .arg2, etc.).

Examples

In the following example, .arg1 is equal to SUM([Profit]):

```
SCRIPT_REAL("is.finite(.arg1)", SUM([Profit]))
```

The next example converts temperature values from Celsius to Fahrenheit.

```
SCRIPT_REAL('library(udunits2);ud.convert(.arg1, "celsius",
"degree_fahrenheit")',AVG([Temperature]))
```

SCRIPT_STR

Returns a string result from the specified R expression. The R expression is passed directly to a running Rserve instance. Use .arg*n* in the R expression to reference parameters (.arg1, .arg2, etc.).

Examples

In the following example, .arg1 is equal to SUM([Profit]):

```
SCRIPT_STR("is.finite(.arg1)", SUM([Profit]))
```

The next example extracts a state abbreviation from a more complicated string (in the original form 13XSL_CA, A13_WA):

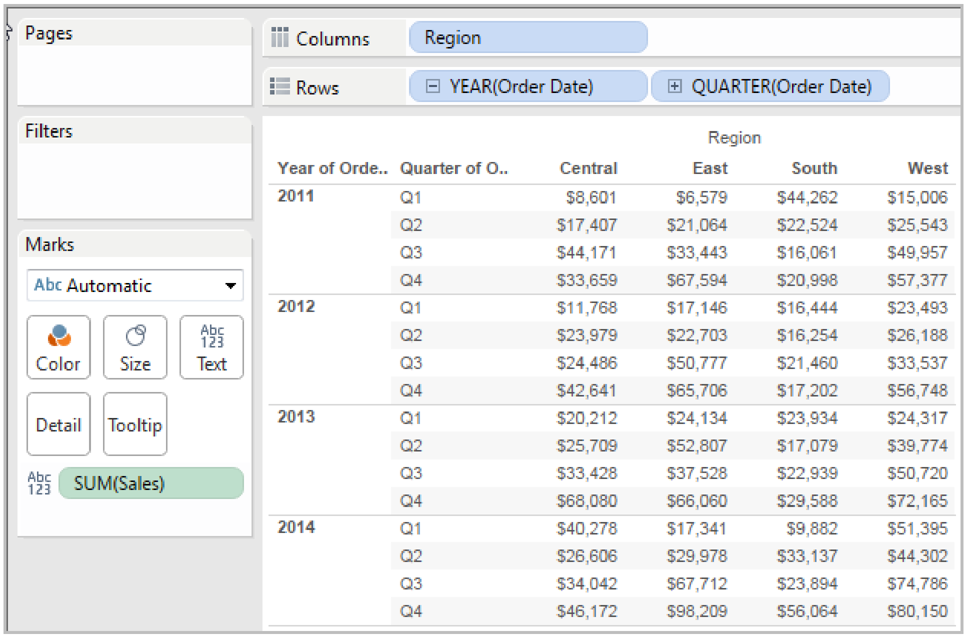
```
SCRIPT_STR('gsub(".*_", "", .arg1)',ATTR([Store ID]))
```

TOTAL(expression)

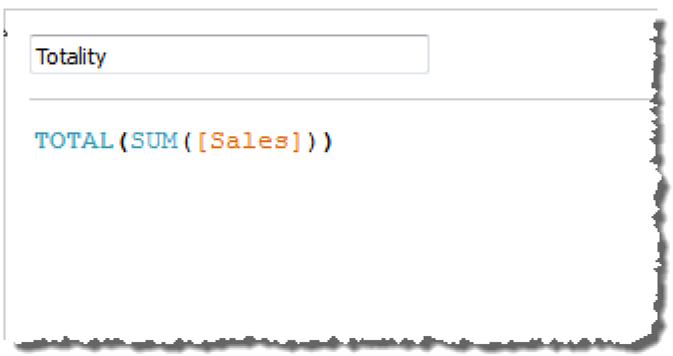
Returns the total for the given expression in a table calculation partition.

Example

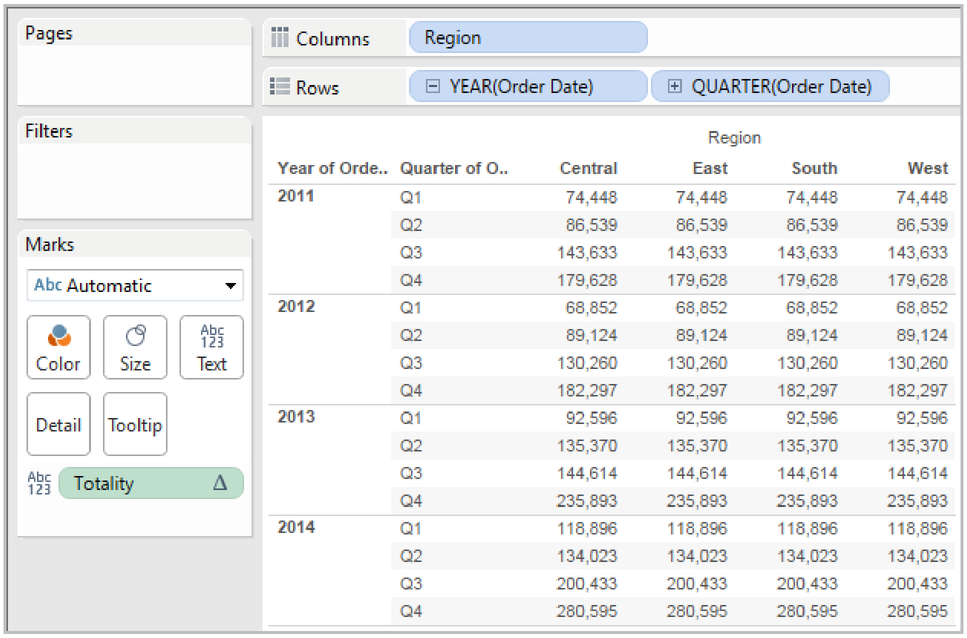
Assume you are starting with this view:



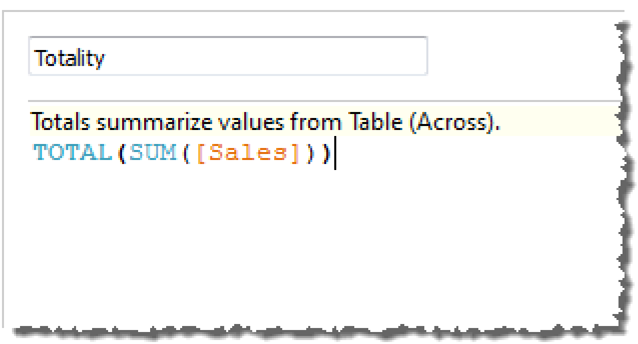
You open the calculation editor and create a new field which you name **Totality**:



You then drop **Totality** on Text, to replace **SUM(Sales)**. Your view changes such that it sums values based on the default **Compute Using** value:



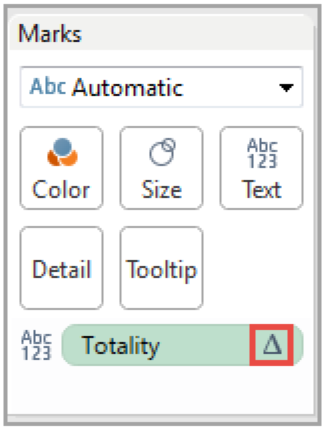
This raises the question, What is the default **Compute Using** value? If you right-click (Control-click on a Mac) **Totality** in the Data pane and choose **Edit**, there is now an additional bit of information available:



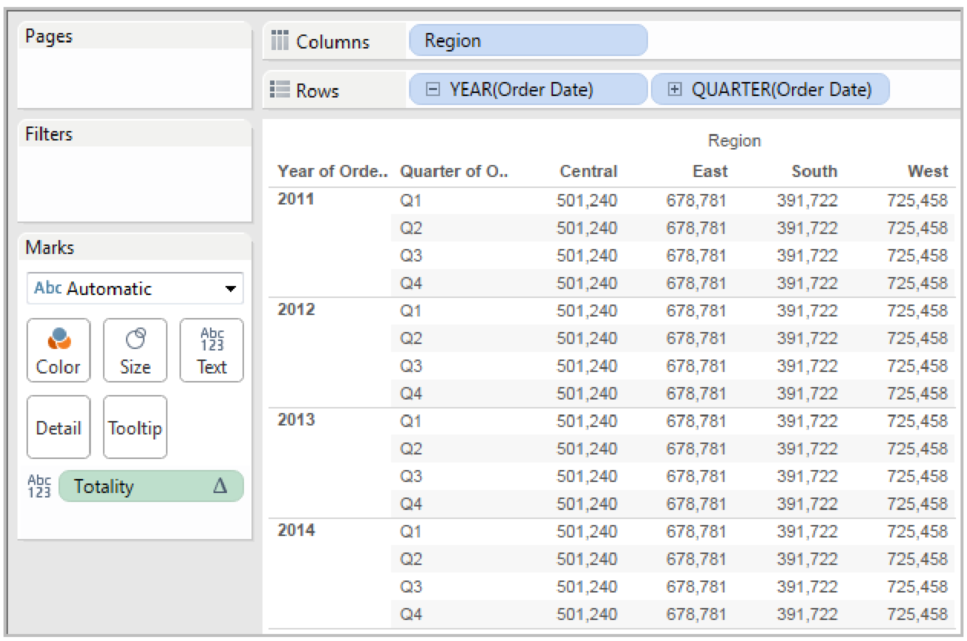
The default **Compute Using** value is **Table (Across)**. The result is that **Totality** is summing the values across each row of your table. Thus, the value that you see across each row is the sum of the values from the original version of the table.

The values in the 2011/Q1 row in the original table were $8601, $6579, $44262, and $15006. The values in the table after **Totality** replaces **SUM(Sales)** are all $74,448, which is the sum of the four original values.

Notice the triangle next to Totality after you drop it on Text:



This indicates that this field is using a table calculation. You can right-click the field and choose **Edit Table Calculation** to redirect your function to a different **Compute Using** value. For example, you could set it to **Table (Down)**. In that case, your table would look like this:

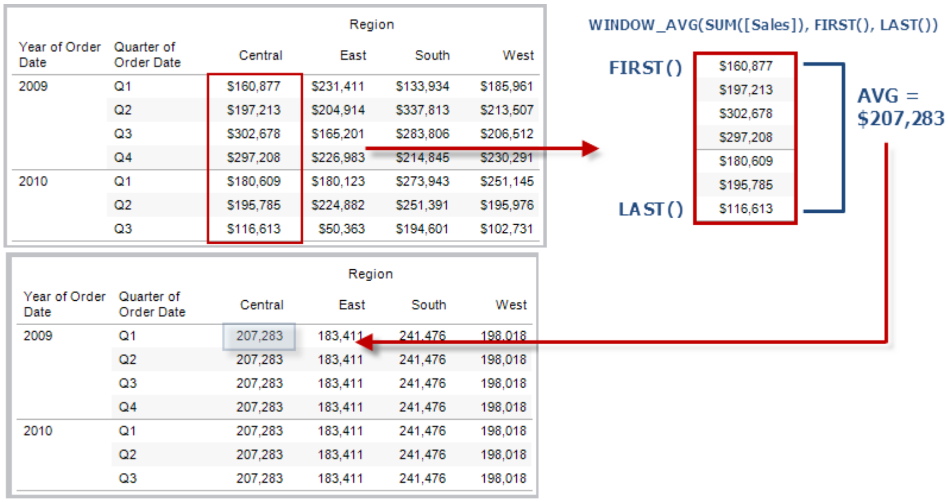


		Region			
Year of Orde..	Quarter of O..	Central	East	South	West
2011	Q1	501,240	678,781	391,722	725,458
	Q2	501,240	678,781	391,722	725,458
	Q3	501,240	678,781	391,722	725,458
	Q4	501,240	678,781	391,722	725,458
2012	Q1	501,240	678,781	391,722	725,458
	Q2	501,240	678,781	391,722	725,458
	Q3	501,240	678,781	391,722	725,458
	Q4	501,240	678,781	391,722	725,458
2013	Q1	501,240	678,781	391,722	725,458
	Q2	501,240	678,781	391,722	725,458
	Q3	501,240	678,781	391,722	725,458
	Q4	501,240	678,781	391,722	725,458
2014	Q1	501,240	678,781	391,722	725,458
	Q2	501,240	678,781	391,722	725,458
	Q3	501,240	678,781	391,722	725,458
	Q4	501,240	678,781	391,722	725,458

WINDOW_AVG(expression, [start, end])

Returns the average of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

For example, the view below shows quarterly sales. A window average within the Date partition returns the average sales across all dates.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	207,283	183,411	241,476	198,018
	Q2	207,283	183,411	241,476	198,018
	Q3	207,283	183,411	241,476	198,018
	Q4	207,283	183,411	241,476	198,018
2010	Q1	207,283	183,411	241,476	198,018
	Q2	207,283	183,411	241,476	198,018
	Q3	207,283	183,411	241,476	198,018

Example

`WINDOW_AVG(SUM([Profit]), FIRST()+1, 0)` computes the average of SUM(Profit) from the second row to the current row.

WINDOW_COUNT(expression, [start, end])

Returns the count of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

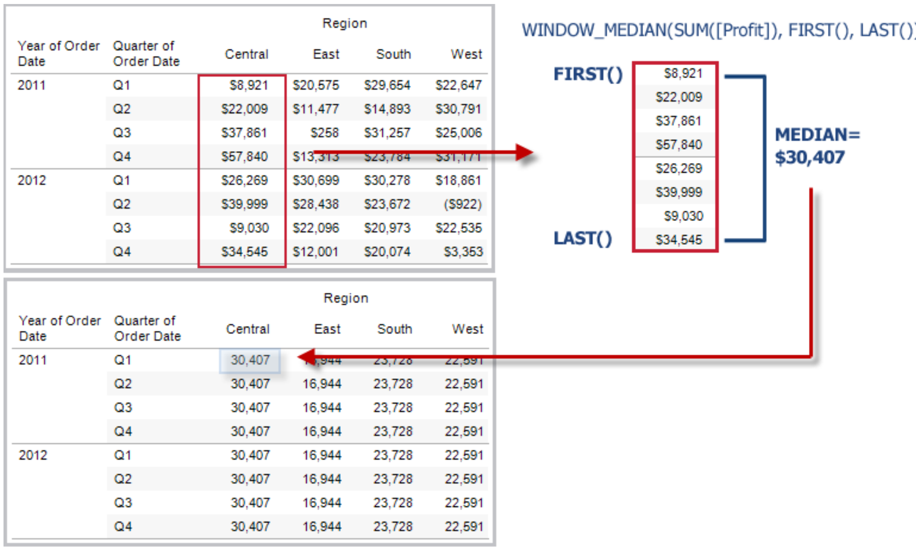
Example

`WINDOW_COUNT(SUM([Profit]), FIRST()+1, 0)` computes the count of SUM(Profit) from the second row to the current row

WINDOW_MEDIAN(expression, [start, end])

Returns the median of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

For example, the view below shows quarterly profit. A window median within the Date partition returns the median profit across all dates.



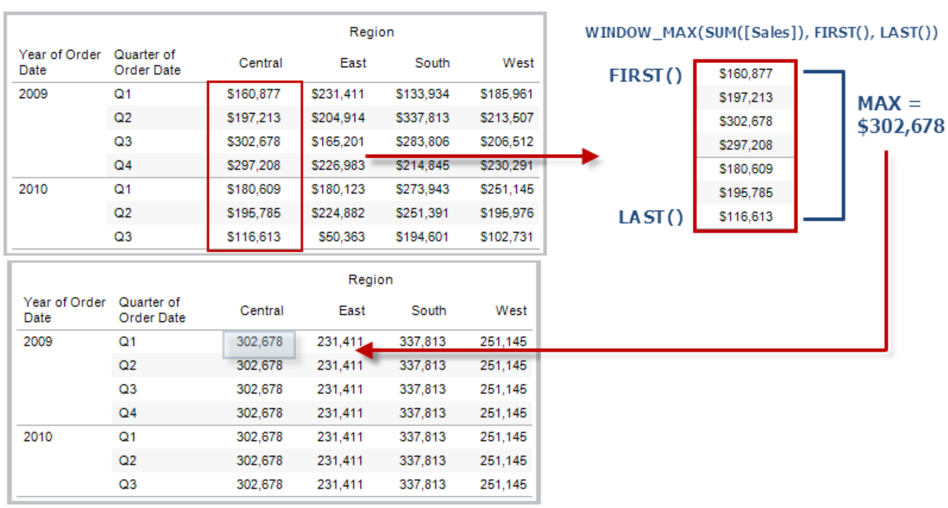
Example

`WINDOW_MEDIAN(SUM([Profit]), FIRST()+1, 0)` computes the median of SUM (Profit) from the second row to the current row.

WINDOW_MAX(expression, [start, end])

Returns the maximum of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

For example, the view below shows quarterly sales. A window maximum within the Date partition returns the maximum sales across all dates.



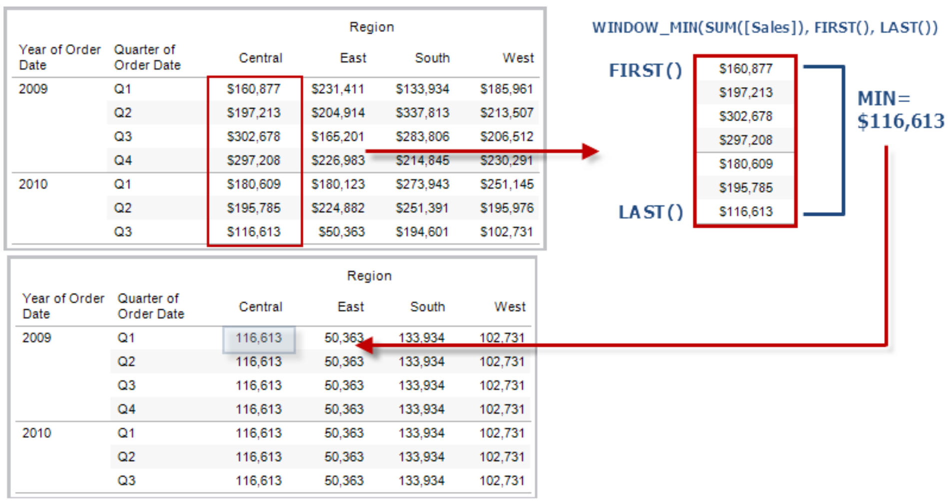
Example

`WINDOW_MAX(SUM([Profit]), FIRST()+1, 0)` computes the maximum of SUM (Profit) from the second row to the current row.

WINDOW_MIN(expression, [start, end])

Returns the minimum of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

For example, the view below shows quarterly sales. A window minimum within the Date partition returns the minimum sales across all dates.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	116,613	50,363	133,934	102,731
	Q2	116,613	50,363	133,934	102,731
	Q3	116,613	50,363	133,934	102,731
	Q4	116,613	50,363	133,934	102,731
2010	Q1	116,613	50,363	133,934	102,731
	Q2	116,613	50,363	133,934	102,731
	Q3	116,613	50,363	133,934	102,731

Example

`WINDOW_MIN(SUM([Profit]), FIRST()+1, 0)` computes the minimum of SUM (Profit) from the second row to the current row.

WINDOW_PERCENTILE(expression, number, [start, end])

Returns the value corresponding to the specified percentile within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

Example

`WINDOW_PERCENTILE(SUM([Profit]), 0.75, -2, 0)` returns the 75th percentile for SUM(Profit) from the two previous rows to the current row.

WINDOW_STDEV(expression, [start, end])

Returns the sample standard deviation of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

Example

`WINDOW_STDEV(SUM([Profit]), FIRST()+1, 0)` computes the standard deviation of SUM(Profit) from the second row to the current row.

WINDOW_STDEVP(expression, [start, end])

Returns the biased standard deviation of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

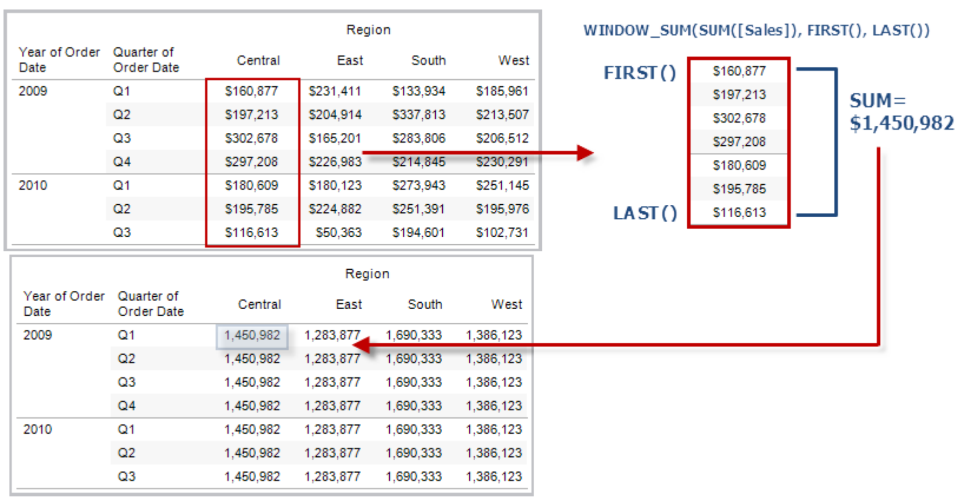
Example

`WINDOW_STDEVP(SUM([Profit]), FIRST()+1, 0)` computes the standard deviation of SUM(Profit) from the second row to the current row.

WINDOW_SUM(expression, [start, end])

Returns the sum of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

For example, the view below shows quarterly sales. A window sum computed within the Date partition returns the summation of sales across all quarters.



Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	$160,877	$231,411	$133,934	$185,961
	Q2	$197,213	$204,914	$337,813	$213,507
	Q3	$302,678	$165,201	$283,806	$206,512
	Q4	$297,208	$226,983	$214,845	$230,291
2010	Q1	$180,609	$180,123	$273,943	$251,145
	Q2	$195,785	$224,882	$251,391	$195,976
	Q3	$116,613	$50,363	$194,601	$102,731

Year of Order Date	Quarter of Order Date	Region: Central	East	South	West
2009	Q1	1,450,982	1,283,877	1,690,333	1,386,123
	Q2	1,450,982	1,283,877	1,690,333	1,386,123
	Q3	1,450,982	1,283,877	1,690,333	1,386,123
	Q4	1,450,982	1,283,877	1,690,333	1,386,123
2010	Q1	1,450,982	1,283,877	1,690,333	1,386,123
	Q2	1,450,982	1,283,877	1,690,333	1,386,123
	Q3	1,450,982	1,283,877	1,690,333	1,386,123

Example

`WINDOW_SUM(SUM([Profit]), FIRST()+1, 0)` computes the sum of SUM(Profit) from the second row to the current row.

WINDOW_VAR(expression, [start, end])

Returns the sample variance of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

Example

`WINDOW_VAR((SUM([Profit])), FIRST()+1, 0)` computes the variance of SUM (Profit) from the second row to the current row.

WINDOW_VARP(expression, [start, end])

Returns the biased variance of the expression within the window. The window is defined by means of offsets from the current row. Use FIRST()+n and LAST()-n for offsets from the first or last row in the partition. If the start and end are omitted, the entire partition is used.

Example

`WINDOW_VARP(SUM([Profit]), FIRST()+1, 0)` computes the variance of SUM (Profit) from the second row to the current row.

Additional Functions

REGEXP_REPLACE(string, pattern, replacement)

Returns a copy of the given string where the regular expression pattern is replaced by the replacement string. This function is available for Text File, Hadoop Hive, Google BigQuery, PostgreSQL, Tableau Data Extract, Microsoft Excel, Salesforce, HP Vertica, Pivotal Greenplum, Teradata (version 14.1 and above), and Oracle data sources.

For Tableau data extracts, the pattern must be a constant.

For information on regular expression syntax, see your data source's documentation. For Tableau extracts, regular expression syntax conforms to the standards of the ICU (International Components for Unicode), an open source project of mature C/C++ and Java libraries for Unicode support, software internationalization, and software globalization. See the Regular Expressions page in the online ICU User Guide.

Example

REGEXP_REPLACE('abc 123', '\s', '-') = 'abc-123'

REGEXP_MATCH(string, pattern)

Returns true if a substring of the specified string matches the regular expression pattern. This function is available for Text File, Google BigQuery, PostgreSQL, Tableau Data Extract, Microsoft Excel, Salesforce, HP Vertica, Pivotal Greenplum, Teradata (version 14.1 and above), Impala 2.3.0 (through Cloudera Hadoop data sources), and Oracle data sources.

For Tableau data extracts, the pattern must be a constant.

For information on regular expression syntax, see your data source's documentation. For Tableau extracts, regular expression syntax conforms to the standards of the ICU (International Components for Unicode), an open source project of mature C/C++ and Java libraries for Unicode support, software internationalization, and software globalization. See the Regular Expressions page in the online ICU User Guide.

Example

REGEXP_MATCH('-([1234].[The.Market])-','\[\s*(\w*\.)(\w*\s*\])')=true

REGEXP_EXTRACT(string, pattern)

Returns the portion of the string that matches the regular expression pattern. This function is available for Text File, Hadoop Hive, Google BigQuery, PostgreSQL, Tableau Data Extract, Microsoft Excel, Salesforce, HP Vertica, Pivotal Greenplum, Teradata (version 14.1 and above), and Oracle data sources.

For Tableau data extracts, the pattern must be a constant.

For information on regular expression syntax, see your data source's documentation. For Tableau extracts, regular expression syntax conforms to the standards of the ICU (International Components for Unicode), an open source project of mature C/C++ and Java libraries for Unicode support, software internationalization, and software globalization. See the Regular Expressions page in the online ICU User Guide.

Example

REGEXP_EXTRACT('abc 123', '[a-z]+\s+(\d+)') = '123'

REGEXP_EXTRACT_NTH(string, pattern, index)

Returns the portion of the string that matches the regular expression pattern. The substring is matched to the nth capturing group, where n is the given index. If index is 0, the entire string is returned. This function is available for Text File, PostgreSQL, Tableau Data Extract, Microsoft Excel, Salesforce, HP Vertica, Pivotal Greenplum, Teradata (version 14.1 and above), and Oracle data sources.

For Tableau data extracts, the pattern must be a constant.

For information on regular expression syntax, see your data source's documentation. For Tableau extracts, regular expression syntax conforms to the standards of the ICU (International Components for Unicode), an open source project of mature C/C++ and Java libraries for Unicode support, software internationalization, and software globalization. See the Regular Expressions page in the online ICU User Guide.

Example

REGEXP_EXTRACT_NTH('abc 123', '([a-z]+)\s+(\d+)', 2) = '123'

Hadoop Hive Specific Functions

GET_JSON_OBJECT(JSON string, JSON path)

Returns the JSON object within the JSON string based on the JSON path.

PARSE_URL(string, url_part)

Returns a component of the given URL string where the component is defined by url_part. Valid url_part values include: 'HOST', 'PATH', 'QUERY', 'REF', 'PROTOCOL', 'AUTHORITY', 'FILE' and 'USERINFO'.

Example

PARSE_URL('http://www.tableau.com', 'HOST') = 'www.tableau.com'

PARSE_URL_QUERY(string, key)

Returns the value of the specified query parameter in the given URL string. The query parameter is defined by the key.

Example

PARSE_URL_QUERY('http://www.tableau.com?page=1&cat=4', 'page') = '1'

XPATH_BOOLEAN(XML string, XPath expression string)

Returns true if the XPath expression matches a node or evaluates to true.

Example

XPATH_BOOLEAN('<values> <value id="0">1</value><value id="1">5</value>', 'values/value [@id="1"] = 5') = true

XPATH_DOUBLE(XML string, XPath expression string)

Returns the floating-point value of the XPath expression.

Example

XPATH_DOUBLE('<values><value>1.0</value><value>5.5</value> </values>', 'sum(value/*)') = 6.5

XPATH_FLOAT(XML string, XPath expression string)

Returns the floating-point value of the XPath expression.

Example

XPATH_FLOAT('<values><value>1.0</value><value>5.5</value> </values>','sum(value/*)') = 6.5

XPATH_INT(XML string, XPath expression string)

Returns the numerical value of the XPath expression, or zero if the XPath expression cannot evaluate to a number.

Example

XPATH_INT('<values><value>1</value><value>5</value> </values>','sum(value/*)') = 6

XPATH_LONG(XML string, XPath expression string)

Returns the numerical value of the XPath expression, or zero if the XPath expression cannot evaluate to a number.

Example

XPATH_LONG('<values><value>1</value><value>5</value> </values>','sum(value/*)') = 6

XPATH_SHORT(XML string, XPath expression string)

Returns the numerical value of the XPath expression, or zero if the XPath expression cannot evaluate to a number.

Example

XPATH_SHORT('<values><value>1</value><value>5</value> </values>','sum(value/*)') = 6

XPATH_STRING(XML string, XPath expression string)

Returns the text of the first matching node.

Example

XPATH_STRING('<sites ><url domain="org">http://www.w3.org</url> <url domain="com">http://www.tableau.com</url></sites>', 'sites/url[@domain="com"]') = 'http://www.tableau.com'

Google BigQuery Specific Functions

DOMAIN(string_url)

Given a URL string, returns the domain as a string.

Example

DOMAIN('http://www.google.com:80/index.html') = 'google.com'

GROUP_CONCAT(expression)

Concatenates values from each record into a single comma-delimited string. This function acts like a SUM() for strings.

Example

GROUP_CONCAT(Region) = "Central,East,West"

HOST(string_url)

Given a URL string, returns the host name as a string.

Example

HOST('http://www.google.com:80/index.html') = 'www.google.com:80'

LOG2(number)

Returns the logarithm base 2 of a number.

Example

LOG2(16) = '4.00'

LTRIM_THIS(string, string)

Returns the first string with any leading occurrence of the second string removed.

Example

LTRIM_THIS('[-Sales-]','[-') = 'Sales-]'

RTRIM_THIS(string, string)

Returns the first string with any trailing occurrence of the second string removed.

Example

RTRIM_THIS('[-Market-]','-]') = '[-Market'

TIMESTAMP_TO_USEC(expression)

Converts a TIMESTAMP data type to a UNIX timestamp in microseconds.

Example

TIMESTAMP_TO_USEC(#2012-10-01 01:02:03#)=1349053323000000

USEC_TO_TIMESTAMP(expression)

Converts a UNIX timestamp in microsseconds to a TIMESTAMP data type.

Example

USEC_TO_TIMESTAMP(1349053323000000) = #2012-10-01 01:02:03#

TLD(string_url)

Given a URL string, returns the top level domain plus any country domain in the URL.

Example

TLD('http://www.google.com:80/index.html') = '.com'

TLD('http://www.google.co.uk:80/index.html') = '.co.uk'

Operators

To create calculated fields and formulas, you need to understand the operators supported by Tableau. This section discusses the basic operators that are available and the order (precedence) of operations.

+ (addition)

This means addition when applied to numbers and concatenation when applied to strings. When applied to dates, it can be used to add a number of days to a date. For example,

```
7 + 3

Profit + Sales

'abc' + 'def' = 'abcdef'

#April 15, 2004# + 15 = #April 30, 2004#
```

– (subtraction)

This means subtraction when applied to numbers and negation if applied to an expression. When applied to dates, it can be used to subtract a number of days from a date. Hence it can also be used to calculate the difference in days between two dates. For example,

```
7 - 3
```

```
Profit - Sales
```

```
-(7+3) = -10
```

```
#April 16, 2004# - 15 = #April 1, 2004#
```

```
#April 15, 2004# - #April 8, 2004# = 7
```

* (multiplication)

This means numeric multiplication. For example, `5 * 4 = 20`.

/ (division)

This means numeric division. For example, `20 / 4 = 5`.

% (modulo)

This calculates a numeric remainder. For example, `5% 4 = 1`.

= =, =, >, <, >=, <=, !=, <>(comparisons)

These are the basic comparison operators that can be used in expressions. Their meanings are as follows: = = or =(equal to), > (greater than), < (less than), >= (greater than or equal to), <= (less than or equal to), != and <> (not equal to).

Each operator compares two numbers, dates, or strings and returns a boolean (`TRUE` or `FALSE`). Booleans themselves, however, cannot be compared using these operators. For example, `TRUE=TRUE` is not a valid expression. To compare booleans in this way, use the logical operators `AND` and `OR`. For example, `TRUE AND TRUE` is a valid expression.

^ (power)

This symbol is equivalent to the POWER function. It raises a number to the specified power.

For example:

```
6^3 = 216
```

AND

This is a logical operator. An expression or a boolean must appear on either side of it. For example,

```
IIF(Profit =100 AND Sales =1000, "High", "Low")
```

If both expressions are TRUE (i.e., not FALSE and not UNKNOWN), then the result is TRUE. If either expression is UNKNOWN, then the result is UNKNOWN. In all other cases, the result is FALSE.

If you create a calculation in which the result of an AND comparison is displayed on a worksheet, Tableau displays TRUE and FALSE. If you would like to change this, use the Format area in the format dialog.

OR

This is a logical operator. An expression or a boolean must appear on either side of it. For example,

```
IIF(Profit =100 OR Sales =1000, "High", "Low")
```

If either expression is TRUE, then the result is TRUE. If both expressions are FALSE, then the result is FALSE. If both expressions are UNKNOWN, then the result is UNKNOWN.

If you create a calculation in which the result of an OR comparison is displayed on a worksheet, Tableau displays TRUE and FALSE. If you would like to change this, use the Format area in the format dialog. The OR operator employs "short circuit evaluation." This means that if the first expression is evaluated to be TRUE, then the second expression is not evaluated at all. This can be helpful if the second expression results in an error when the first expression is TRUE, because the second expression in this case is never evaluated.

NOT

This is a logical operator. It can be used to negate another boolean or an expression. For example,

```
IIF(NOT(Sales = Profit),"Not Equal","Equal")
```

Precedence

All operators are evaluated in a specific order. For example, 2*1+2 is equal to 4 and not equal to 6. The reason is that the * operator is always evaluated before the + operator.

The following table shows the order in which operators are evaluated. The first line has the highest precedence. Operators on the same line have the same precedence. If two operators have the same precedence they are evaluated from left to right in the formula.

Precedence	Operator
1	– (negate)
2	^ (power)
3	*, /, %
4	+, –

Precedence	Operator
5	==, >, <, >=, <=, !=
6	NOT
7	AND
8	OR

Parentheses can be used as needed. Operators that appear within parentheses are evaluated before those outside of parentheses, starting from the innermost parentheses and moving outward. For example, (1+ (2*2+1)*(3*6/3)) = 31.

Performance

This section includes information on creating performance recordings, and suggestions for improving Tableau's performance. One of the important things to understand is that Tableau is only as fast as your data source. So if your data source responds slowly to queries, then Tableau must wait for the data source before displaying results. As a best practice, use Tableau with databases that are suitable for real-time querying and analysis.

Create a Performance Recording

With the Performance Recording feature in Tableau, you can record performance information about key events as you interact with workbooks. You then view performance metrics in a performance workbook that Tableau creates automatically. The steps you follow to create and view performance recording vary somewhat between Tableau Desktop and Tableau Server. However, the resulting performance workbooks have the same format in both Tableau Desktop and Tableau Server.

Use performance workbooks to analyze and troubleshoot performance issues pertaining to different events that are known to affect performance, including:

- Query execution
- Geocoding
- Connections to data sources
- Layout computations
- Extract generation
- Blending data
- Server blending (Tableau Server only)

Tableau support may request that you create performance workbooks as they assist you with diagnosing performance issues.

To create a performance recording in Tableau Desktop

To start recording performance, follow this step in Tableau Desktop:

Help > Settings and Performance > Start Performance Recording

To stop recording, and then view a temporary workbook containing results from the recording session, follow this step:

Help > Settings and Performance > Stop Performance Recording

You can then save this workbook as a packaged workbook (.twbx) file, and send it to Tableau support.

Interpret a Performance Recording Workbook

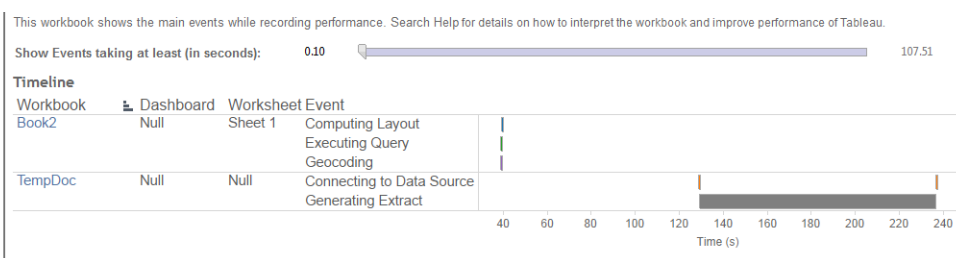
A performance recording workbook is a Tableau dashboard that contains three views: **Timeline**, **Events**, and **Query**.

For information on how to create a performance recording in Tableau Desktop, see **Create a Performance Recording** on the previous page.

Timeline

The uppermost view in a performance recording dashboard shows the events that occurred during recording, arranged chronologically from left to right. The bottom axis shows elapsed time since Tableau started, in seconds.

In the Timeline view, the **Workbook**, **Dashboard**, and **Worksheet** columns identify the context for events. The **Event** column identifies the nature of the event, and the final column shows each event's duration and how it compares chronologically to other recorded events:



Events

The middle view in a performance recording workbook shows the events, sorted by duration (greatest to least). Events with longer durations can help you identify where to look first if you want to speed up your workbook.

Different colors indicate different types of events. The range of events that can be recorded is:

- Computing layouts.

  If layouts are taking too long, consider simplifying your workbook.

- Connecting to data source.

  Slow connections could be due to network issues or issues with the database server.

- Executing query.

  - For live connections, if queries are taking too long, it could be because the underlying data structure isn't optimized for Tableau. Consult your database server's documentation. As an alternative, consider using an extract to speed performance.

  - For extracts, if queries are taking too long, review your use of filters. If you have a lot of filters, would a context filter make more sense? If you have a dashboard that uses filters, consider using action filters, which can help with performance.

- Generating extract.

  To speed up extract generation, consider only importing some data from the original data source. For example, you can filter on specific data fields, or create a sample based on a specified number of rows or percentage of the data.

- Geocoding.

  To speed up geocoding performance, try using less data or filtering out data.

- Blending data.

  To speed up data blending, try using less data or filtering out data.

- Server rendering.

  You can speed up server rendering by running additional VizQL Server processes on additional machines.

Query

If you click on an **Executing Query** event in either the **Timeline** or **Events** section of a performance recording dashboard , the text for that query is displayed in the Query section. For example:

Query

```
SELECT "State"."ID" AS "ID",
  "StateSynonyms"."Name" AS "State_Name",
  "State"."ParentID" AS "State_ParentID"
FROM "StateSynonyms"
  INNER JOIN "State" ON (("State"."ID" = "StateSynonyms"."ParentID") AND ("State"."MapCode" = "StateSynonyms"."MapCode
```

Sometimes the query is truncated and you'll need to look in the Tableau log to find the full query. Most database servers can give you advice about how to optimize a query by adding indexes or other techniques. See your database server documentation for details.

Sometimes for efficiency, Tableau intelligently combines multiple queries into a single query against the data. In this case, you may see an **Executing Query** event for the Null worksheet and zero queries being executed for your named worksheets.

General Performance Tips

Use the following tips to create performant and responsive workbooks.

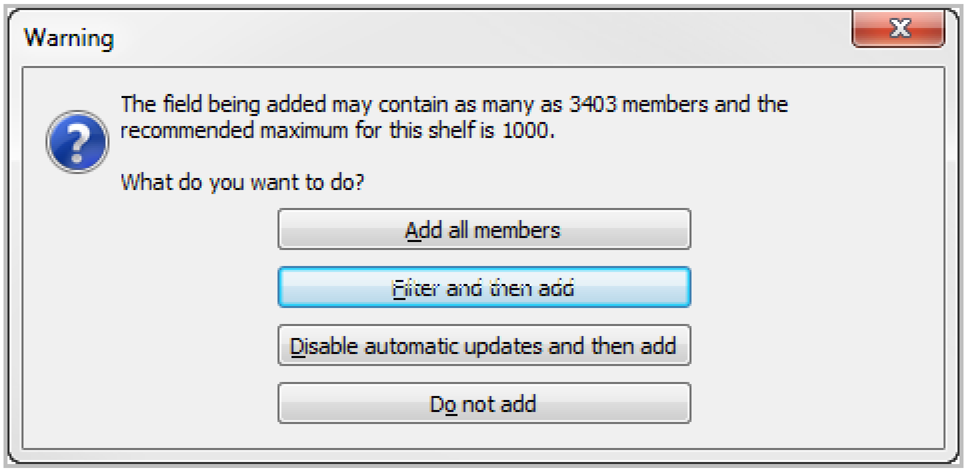
- Keep workbooks small. The fewer worksheets and data sources in a workbook, the faster that it will perform.
- Test your workbooks. Use performance recordings to evaluate the performance of a workbook, especially if you plan on sharing or publishing the workbook. For more information on performance recordings, see **Create a Performance Recording** on page 1465.
- Use extracts. When you use extracts, you can interact with data faster than if you were connected to a database or even a flat file. For more information, see **Extract Your Data** on page 379.
  - Reduce the amount of data. When you create an extract, use filters to exclude data that you don't need. Also, ask yourself if you need all of the records in a data source, or if you can limit the extract to a representative sample. For more information, see **Extract Your Data** on page 379.
  - Hide unused fields. For extracts, the Hide Unused Fields option also removes the unused fields from the extract itself to decrease its size. For more information, see **Hide or Unhide Fields** on page 228.
  - Optimize extracts. Optimize an extract to speed up future queries. For example, the extract may store calculations in advance to improve performance. For more information, see **Optimize Extracts** on page 388.
- Use filters carefully. Filters provide enormous flexibility and expressiveness, but they can also be computationally expensive.
  - Reduce the number of filters.
  - Use Keep Only filters instead of Exclude filters. Because Exclude filters need to load all of the data for a dimension, they run slower than Keep Only filters. For more information, see **Select Data to Filter** on page 608.
  - Only use context filters when they limit the size of the data set significantly. For more information, see **Speeding up Context Filters** on page 1475.

- Use blending and joins carefully.
  - Restrict joins to the fewest number of tables possible. In cases where you need access to many tables in a workbook, you may want to create separate data connections with joins that are tailored to a particular worksheet.
  - Avoid data blending on dimensions with many unique values because the data is blended in-memory.
- Take advantage of database features. One of the most common performance bottlenecks is the data source itself.
  - Use native database drivers. If you connect to a data source with native database drivers, you will often experience significantly faster performance than if you connect to the same data source with ODBC. For a list of drivers, see Drivers and Activation on the main Tableau website.
  - Avoid custom SQL. In most cases, custom SQL runs slower than queries created by Tableau because Tableau cannot perform query optimizations on custom SQL. In cases where it is necessary to use custom SQL, use an extract so that the query only needs to run once.
  - Assume referential integrity. If the database supports soft referential integrity, you can use the Assume Referential Integrity option to improve the performance of inner joins. For more information, see **Assuming Referential Integrity** on page 352.
  - Partition large database tables. You can often improve performance if you break up a large database table into multiple smaller tables.

Performance Tips: All Data Sources

The following performance tips apply to all data sources supported by Tableau.

- **Turn off Automatic Updates**. When you place a field on a shelf, Tableau generates the view by automatically querying the data source. If you are creating a dense data view, the queries might be time consuming and significantly degrade system performance. In this case, you can instruct Tableau to turn off queries while you build the view. You can then turn queries back on when you are ready to see the result. Refer to **Managing Queries** on page 1472 for more information.
- **Look for Warnings**. Tableau displays a performance warning dialog box when you attempt to place a large dimension (with many members) on any shelf. The dialog box provides four choices as shown in the figure below. If you choose to add all members, then you might experience a significant degradation in performance.



- **Avoid Generating Too Many Panes**. If you attempt to create many panes in a table, Tableau will warn you that the requested table "contains more than the recommended maximum number of panes." In most cases, you should not display more than the recommended number of panes because such a view is not very useful.

Performance Tips: Relational Data Sources

The following performance tips apply to relational data sources.

- Context filters – If you are setting filters that significantly reduce the data set size, and that will be used for more than several data views, you should set those filters as context filters. Refer to **Filtering** on page 608 for how to create context filters. For more information about performance improvement with context filters refer to **Speeding up Context Filters** on page 1475.
- Aggregate measures – If the views you create are slow, make sure you are working with aggregated measures rather than disaggregated measures. When views are slow it usually means you are trying to view many rows of data at once. You can reduce the number of rows by aggregating the data. In other words, make sure the **Aggregate Measures** option on the **Analysis** menu is selected.
- Sets – If you want to filter a dimension to remove members based on a range of measure values, you should create a set rather than using a quantitative filter. For instance, you can create a set that only returns the Top 50 items in a dimension, rather than all of the items in a dimension.

  When creating a group from a selection as described in **Creating Groups** on page 736, make sure you've included only the columns of interest. Each additional column included in the set will result in decreased performance.
- Extract Large Text and Excel Files – If your data source is large text or Excel file, you

should create a Tableau Extract to improve performance and gain new functionality. Note that if you connect Tableau to a large text file, you will be prompted to extract the data if the file is considered to be too large to perform well.

- Use a database server – You should consider storing your data in a database server like Microsoft SQL Server. The Professional Edition of Tableau can connect to these larger database servers.
- Create indexes for tables – Index the tables in your relational database. To successfully index your data set, you should identify the fields that you frequently filter on and add them to the index. If you have a field that you use as a context filter often, consider setting it as your primary index. If you are working with Access tables that have more than 200,000 rows of data, consider setting indexes on the tables. You can learn how to do this by searching for “index” in the Access online help. Access allows you to store 2 GB of data (approximately 1-2 million rows) in a database, but it performs poorly well below this limit.
- Break up your data – If you have a lot of data, consider breaking it into smaller pieces. For example, you can create a cluster of Access tables that address specific subsets of your data.
- **Add filters first** - If you are working with a large data source and have automatic updates turned off, it is possible to create a really slow query when adding filters to the view. Rather than build the view and then specify filters, you should first specify the filters and then drag fields to the view. That way, when you run the update or turn on automatic updates, the filters will be evaluated first.

Performance Tips: Multidimensional Data Sources

In Tableau, multidimensional data sources are supported only in Windows.

The following performance tips apply to multidimensional data sources.

- Filtering – If your cube has a single large dimension, you should set a filter directly on that dimension rather than setting a filter on another dimension or measure. For example, suppose you want to reduce the numbers of products being displayed in a data view. It is much more efficient to set the filter directly on **Products** or to create a computed set based on **Products** (such as Top 10) rather than filtering other fields such as **Location** or **Profit**.

  Also, you should avoid selecting large numbers of members from a large dimension. When a dimension is large, it is best to keep the size of the filter to less than a thousand members.
- Sets – When creating a set from a selection as described in **Creating a Set** on page 751, make sure you've included only the columns of interest in the Create Set from

Selection dialog box. Each additional column included in the group will result in decreased performance. For instance, if you create a set that contains all regions with sales between 8000 and 15000 but you include a column that does not affect the members of the set, you may notice a performance decrease. To remove extra columns, right-click the column and select **Remove This Column** from the context menu.

- Sorting – Avoid applying sorts to levels within a very large hierarchy.
- Large Root Levels – If you are working with a dimension whose root level is greater than 1000 but it is not too large (greater than 100,000) you should avoid using the filter dialog to filter the data. Instead, drag the dimension to a shelf and use the Exclude command in the headers context menus to limit the data that is displayed in the view. In this particular case, dragging a dimension with this size root level to the filter shelf may cause a long query.

Managing Queries

Queries are automatically generated every time you add a field to a shelf and interact with the view. Tableau offers several ways you can manage these queries once they are sent to the underlying data.

Automatic Updates

When you place a field on a shelf, Tableau generates the view by querying the data source. If you are creating a dense data view that involves many fields, the queries might be time consuming and significantly degrade system performance. In this case, you can instruct Tableau to turn off automatic updates.

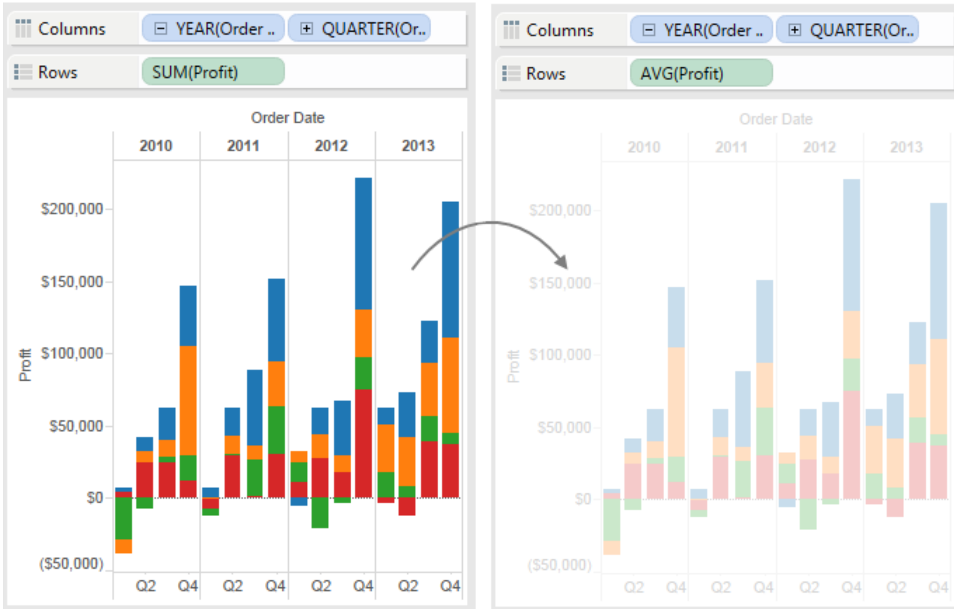
By default, automatic updates are turned on and the toolbar button is highlighted . However, it is sometimes more efficient for Tableau to execute the queries you need for your final view, rather than for every intermediate step required to compose that view. You can turn off updates by pressing the **Automatic Updates** toolbar button.

You can also turn automatic updates on and off by pressing F10 on your keyboard.

While automatic updates are turned off, you can still update the view at any time by pressing F9

or clicking the **Run Update**  button on the toolbar. This way, you can update your data view at an intermediate step. It is possible to enter an invalid state when automatic updates are turned off. When this happens, the view is desaturated and invalid commands are disabled. The view and commands become available again when you click **Run Update** on the toolbar.

For example, the view below has automatic updates turned off. When the aggregation for Profit is changed from a summation to an average, the view is desaturated to let you know that you have made a change to the view that has made the current view invalid.



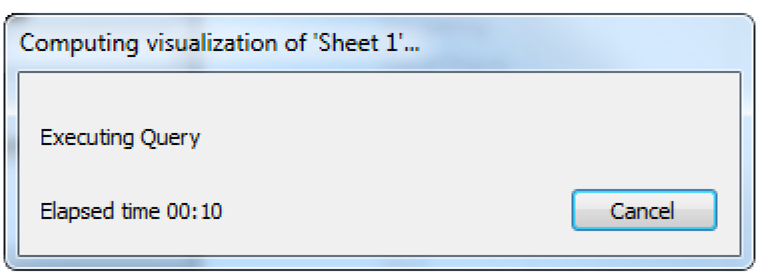
How Automatic Updates Affect Dashboards and Stories

You configure automatic updates on a per-view basis. This means that you can have a dashboard where some views are updating automatically, and others are not. Similarly, you can have a story where some story points are updating automatically, and others are not. But when dashboards or stories are published to Tableau Server, automatic updates affect either none of the contributing views in a story or dashboard, or all of the views.

Cancel Query

This command is used any time you want to stop a query that is in process. You may want to cancel a query that is taking a long time to complete due to the size of the data source. When a query is taking a long time to complete, a progress dialog box opens.

Click **Cancel** in the Processing Request dialog box.



After canceling a query the view becomes invalid because it is in an in-between state. The result is a blank view although all your fields are still on the shelves. To resume working with Tableau, alter the view in anyway and allow the query to complete.

Canceling a large number of queries can result in performance degradation in the underlying database. Although the query has been abandoned by Tableau, it is still executing on the database.

Abandoned Queries

When you cancel a query in Tableau, the database is told to stop processing the query. However, some databases do not support cancel (MS Excel, MS Access, Essbase, Microsoft Analysis Services 2000). If you cancel a query using one of these types of data sources, the query is abandoned by Tableau but is still running in the background and using resources. When you have abandoned queries, an indicator appears in the bottom right corner of the workbook showing the number of queries still running . As queries in the background complete, the number will go down. It is important to monitor the number of queries running and not let the number get too high, otherwise you will see performance degradation of both Tableau and the underlying database.

Note: Text, Microsoft Excel, and Microsoft Access data sources may be temporarily unavailable after canceling a query because of a lock performed internally. You may have to wait until the abandoned query has completed before re-connecting.

Precision Warnings

When you add a field to a view that contains values with more precision than Tableau can model, a warning icon is displayed in the bottom right corner of the status bar. For example, a value in the database may have 22 decimal places but Tableau only supports up to 15. When you add that field to the view, you get a precision warning. If you click on the warning, you can read more details including the number of decimal places that have been truncated in the view.

Remember that the precision of the data displayed in Tableau will always first be dependent on the data in your database. If the values in your database exceed 15 decimal places, when you add them to the view, the value is truncated and a precision warning appears.

Reducing Upload Times

It isn't always possible to reduce upload times, but here are some considerations to keep in mind.

Avoid Publishing Packaged Workbooks

It is a best practice to publish workbooks (.twb files) and data sources separately, rather than publishing them together as packaged workbook (.twbx files). This may not make your initial uploads of workbooks and data sources any faster than publishing them together, but it makes republishing workbooks faster (if you don't have to also republish data sources), and it makes data sources available online for new workbooks. For data sources that are extracts, it also allows you to schedule automated refreshes.

Make Extracts Smaller

For Tableau extracts, you can help speed uploads by making your extract smaller. As you create extracts, consider:

- Removing unused fields from extracts.
- Making extracts smaller with sampling and filtering.
- Aggregating data for visible dimensions.

See Also

Extract Your Data on page 379

Issues with Large Text and Excel Files on the next page

Publish a Data Source on page 1208

Speeding up Context Filters

To improve performance of context filters, especially on large data sources, follow these general rules.

- Using a single context filter that significantly reduces the size of the data set is much better than applying many context filters. In fact, if a filter does not reduce the size of the data set by one-tenth or more, it is actually worse to add it to the context because of the performance cost of computing the context.
- Complete all of your data modeling before creating a context. Changes in the data model, such as converting dimensions to measures, require recomputing the context.
- Set the necessary filters for the context and create the context before adding fields to other shelves. Doing this work first makes the queries that are run when you drop fields on other shelves much faster.
- If you want to set a context filter on a date you can use a continuous date. However, using date bins like YEAR(date) or context filters on discrete dates are very effective.

If your data set is heavily indexed, context filters may not provide performance improvement and may actually cause slower query performance.

Context filters can adversely affect any query performance improvements when using the **Include joined tables only when referenced** option in the Tables dialog box. See the note at the bottom of **Join Your Data** on page 349.

Issues with Large Text and Excel Files

You may encounter the following issues while working with large text and Microsoft Excel data sources:

- Performance issues
- Excel file errors

Performance Issues

If you have a workbook that was created before Tableau Desktop 8.2 and that uses large text or Excel data sources or the legacy connection, you may experience poor performance. This is due to queries running slowly. If your file has more than 20,000 rows, you should extract the data using the extract feature in Tableau Desktop.

Note: This issue applies only to workbooks created on Windows.

To create an extract of a text or Excel file

1. Connect to a new text or Excel file. For information about connecting to a text or Excel file, see **Connect to Your Data** on page 342.
2. At the top of the data source page, select **Extract**. Alternatively, on the **Data** menu in the worksheet, select a data source, and then select **Extract Data**.
3. Specify filters and options to define a subset of data or just click **Extract** to include all the data. For more information, see **Extract Your Data** on page 379.

   The data from the text or Excel file is converted and stored with the name you specify.

Excel File Errors

While simultaneously working with an Excel file and a Tableau workbook that uses the Excel file as its underlying data source, you may see an error in the Excel file indicating that changes to the Excel file could not be saved because of a sharing violation. You might see this error message when your Tableau workbook uses a large Excel file as its data source. In cases like this, the Excel file cannot be simultaneously edited or saved while the Tableau workbook is open. Alternatively, you can contact Customer Support for a potential solution to avoid future errors like this when working with large Excel files.

Keyboard Shortcuts

General Keyboard Shortcuts

Tableau keyboard shortcuts are listed below.

Description	Keyboard Shortcut	
	Windows	Mac
Select all data	**Ctrl+A**	**Command-A**
Use Rectangular Selection tool	**A**	**A**
Smaller cell size	**Ctrl+B**	**Command-B**
Bigger cell size	**Ctrl+Shift+B**	**Command-Shift-B**
Copy selected data	**Ctrl+C**	**Command-C**
Place selected field on Columns shelf	**Alt+Shift+C**	**Option-Shift-C**
Connect to data source	**Ctrl+D**	**Command-D**
Use Lasso Selection Tool	**D**	**D**
Describe sheet	**Ctrl+E**	**Command-E**
Makes the find command in the Data pane active	**Ctrl+F**	**Command-F**
Place selected field on Filters shelf	**Alt+Shift+F**	**Option-Shift-F**
Enter/Exit Full Screen		**Control-Command-F**
Switch in and out of Presentation Mode	**F7** , **Ctrl+H**	**Option-Return**
Place selected field on Size	**Alt+Shift+I**	**Option-Shift-I**
Flip orientation of column labels at bottom of view	**Ctrl+L**	
Place selected field on Detail	**Alt+Shift+L**	**Option-Shift-L**
New worksheet	**Ctrl+M**	**Command-T**
New workbook	**Ctrl+N**	**Command-N**
Open file	**Ctrl+O**	**Command-O**

Place selected field on Color	**Alt+Shift+O**	**Option-Shift-O**
Print	**Ctrl+P**	**Command-P**
Place selected field on Pages shelf	**Alt+Shift+P**	**Option-Shift-P**
Place selected field on Rows shelf	**Alt+Shift+R**	**Option-Shift-R**
Save file	**Ctrl+S**	**Command-S**
Use Radial Selection Tool	**S**	**S**
Place selected field on Shape	**Alt+Shift+S**	**Option-Shift-S**
Place selected field on Text/Label	**Alt+Shift+T**	**Option-Shift-T**
Paste clipboard	**Ctrl+V**	**Command-V**
Swap rows and columns	**Ctrl+W**	**Control-Command-W**
Cut text selection (e.g., in captions, titles, formulas, etc.)	**Ctrl+X**	**Command-X**
Place selected field on Rows shelf	**Alt+Shift+X**	**Option-Shift-X**
Redo	**Ctrl+Y**	**Command-Shift-Z**
Place selected field on Columns shelf	**Alt+Shift+Y**	**Option-Shift-Y**
Undo	**Ctrl+Z**	**Command-Z**
Clear the current worksheet	**Alt+Shift+Backspace**	**Option-Shift-Delete**
Make rows narrower	**Ctrl+Left Arrow**	**Control-Command-Left Arrow**
Make rows wider	**Ctrl+Right Arrow**	**Control-Command-Right Arrow**
Make columns shorter	**Ctrl+Down Arrow**	**Control-Command-Down Arrow**
Make columns taller	**Ctrl+Up Arrow**	**Control-Command-Up Arrow**
Show Me!	**Ctrl+1** , **Ctrl+Shift+1**	**Command-1**
Add the selected field to the sheet.	**Enter**	**Return**

Only works with a single field		
Opens the Help	**F1**	**Shift-Command-Question Mark**
Deletes the selected sheet (on a dashboard)	**Ctrl+F4**	
Closes the current workbook	**Alt+F4**	**Command-W**
Starts and stops forward playback on the pages shelf	**F4**	
Starts and stops backward play-back on the pages shelf	**Shift+F4**	
Refreshes the data source	**F5**	**Command-R**
Skip forward one page	**Ctrl+Period**	**Command-Period**
Skip backward one page	**Ctrl+Comma**	**Command-Comma**
Cycle forward through open work-sheets	**Ctrl+Tab** , **Ctrl+F6**	**Shift-Command-Close Brace**
Cycle backward through open work-sheets	**Ctrl+Shift+Tab** , **Ctrl+Shift+F6**	**Shift-Command-Open Brace**
Run update	**F9**	**Shift-Command-0**
Toggles Automatic Updates on and off	**F10**	**Option-Command-0**
Reverts workbook to last saved state	**F12**	**Option-Command-E**
Clears the selection (Desktop and Reader only)	**Esc**	**Esc**

Navigation and Selection Shortcuts

In addition to the standard keyboard shortcuts there are several key combinations that can make navigating and selecting marks fast and easy.

Description	**Keyboard/Mouse Action**	
	Windows	**Mac**

Selects the mark	**Click**	**Click**
Selects a group of marks	**Drag**	**Drag**
Adds individual marks to the selection	**Ctrl+Click**	**Command-Click**
Adds a group of marks to the selection	**Ctrl+Drag**	**Command-Drag**
Pans around the view	**Shift+Drag**	**Shift-Drag**
Zooms in to a point in the view (requires zoom mode if not map)	**Double-click** , **Ctrl+Shift+Click**	**Double-click** , **Shift-Command-Click**
Zooms out from a point on a map (requires zoom mode if not map)	**Ctrl+Shift+Alt+Click**	**Shift-Option-Command-Click**
Zooms out	**Shift+Double-click**	**Shift–Double-click**
Zooms in to an area in the view (requires zoom mode if not map)	**Ctrl+Shift+Drag**	**Shift-Command-Drag**
Zooms in and out on a map	**Scroll**	**Scroll**
Drags a row and scrolls through a long list simultaneously	**Click+Drag to bottom of pane+Hold**	**Click-Scroll**, **Command-Hold**

Field Selection Shortcuts

There are several key and mouse combinations that can make creating a view and selecting fields fast and easy.

Description	**Keyboard/Mouse Action**	
	Windows	**Mac**
Opens the Drop Field menu	**Right-click+Drag to shelf**	**Option-Drag to shelf**
Copies a field in the view to be placed on another shelf or card	**Ctrl+Drag**	**Command-Drag**

Adds a field to the view	**Double-click**	**Double-click**

Upgrade Tableau Desktop

This section includes information on upgrading from a previous or a beta version, and on how to turn the product update feature off or on.

Upgrade from a Previous or Beta Version

When you upgrade to Tableau 9.3 from previous versions, your repository is upgraded. Any bookmarks, workbooks, and data sources that you had in your old repository will still be accessible by the application. In addition, the new sample data sources and workbooks will replace the old samples unless you have modified them and saved them as your own.

If you have participated in the Tableau Software Beta program, you also have a beta repository. While this folder will still exist after you install Tableau 9.3, the application will no longer access it. To make your beta workbooks accessible in Tableau 9.3, copy the workbooks from the beta repository to your new 9.3 repository.

Turn Product Updates Off or On

To ensure that you always have the most up-to-date features, security resolutions, and corrected issues, Tableau Desktop includes a product update feature. When you start Tableau Desktop, product updates prompts you to download an updated maintenance version of Tableau Desktop, if one exists. The update downloads immediately and then installs when you exit Tableau. You can also choose to postpone or skip the update.

Note the following:

- Updates are not downloaded and installed on your computer if your Product Maintenance has expired. For more information, see the Product Maintenance FAQ.
- You may not be prompted for product updates. For more information see Why Am I Not Prompted for Product Updates in the Tableau Knowledge Base.

Turn off product updates

Product updates is on by default. You can turn off product updates from the Help menu, or on Windows, by running the installer.

Use the Help menu

Select **Help** > **Settings and Performance** > **Disable Product Updates for Me**.

Run the installer

To turn off product updates on Windows, run the Tableau Desktop installer, and then click **Customize**. In the Custom setup dialog box,

1. Clear the **Check for Tableau product updates** check box.
2. Click **Install**.

To turn product updates on again, run the installer, click **Customize**, and select the check box.

Administrators control product updates

As an administrator, you can turn product updates off or on for your users. You can also determine the Tableau Desktop version that your users will update to. Rather than having users update to the version of their choice (or choose not to update), you can make sure that your users update to the version you choose. For more information, see Control Product Updates for Your Users in the Tableau Knowledge Base.

Accessing the Help

Tableau offers multiple ways to access the help topics. First, you can always view the online help by selecting **Help** > **Open Help** in the application. You must have an internet connection to view these pages. However, you can download a copy of the help files to your hard drive so that you can open them even when you are not connected to the internet. Finally, you can choose to download a printable PDF version of the help. This section explains each of the three ways to view the help.

Viewing the Online Help

The online help is the best way to access the most current documentation. You can open the help by selecting **Help** > **Open Help** in the application or by pressing **F1** on your keyboard. You must have an internet connection to access this help.

Download the Offline Help

Although it is more efficient to view the help online, there may be times when you do not have access to the internet. In these cases, you may want a copy of the help stored on your computer. Download the offline help from the Product Help page on the Tableau website.

You must have an internet connection to initially download the help, but any subsequent times you want to access the help you are not required to be online.

If you choose to download the help and use the offline version, please remember to update your local files periodically in order to ensure you are viewing the most recent information. Anytime you want to update your offline help files, repeat the download and overwrite the existing files.

> If you download the offline help, Tableau will always open the local files when you select **Help** > **Open Help** in the application. You can view the online help by visiting the Product Help page on the Tableau website

Download a PDF

You must have Adobe Reader to view this file. Adobe Reader is a free software that can be found on Adobe's Web site: www.adobe.com. You can download the PDF from the Product Help page on the Tableau website.

R Connection

R is an open source software programming language and a software environment for statistical computing and graphics. In Tableau Desktop, you can use a set of four functions to pass R expressions to an Rserve server and obtain a result. The functions are

`SCRIPT_BOOL`

`SCRIPT_INT`

`SCRIPT_REAL`

`SCRIPT_STR`

See **Table Calculation Functions** on page 1441 for details and examples.

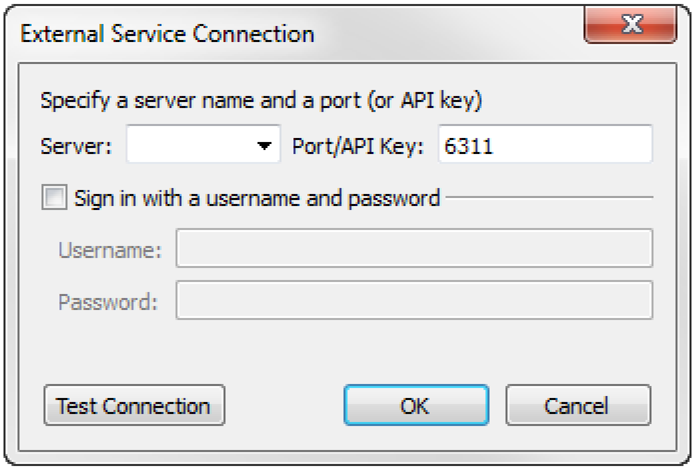
Before you can use any of the SCRIPT functions, you must establish a connection to an Rserve server, which is a server that allows applications to access R functionality. See Rserve for details. And for more information about using R with Tableau, see the blog post Tableau 8.1 and R.

> Tableau has been tested with R versions 3.1 and 3.2, and with Rserver version 0.6-8.

Configure an Rserve Connection

To configure an Rserve connection, follow these steps:

1. On the Help menu in Tableau Desktop choose **Settings and Performance > Manage Exernal Service connection** to open the External Service Connection dialog box:



2. Enter or select a server name using a domain or an IP address. The drop-down list includes **localhost** and the server you most recently connected to.
3. Specify a port. Port 6311 is the default port for Rserve servers.
4. If the server requires credentials, specify a Username and Password.
5. Click **Test Connection**.
6. Click **OK**.

If no connection can be established, an error message is displayed. Click **Show Details** in the message to see any diagnostic information returned by the server.

Share a Workbook That Requires an Rserve Connection

You may need to send a workbook that contains R functionality to other users, who may be using different copies of Tableau Desktop on other computers. Or, users may download a workbook from Tableau Server that contains R functionality. Before users will be able to use the R functionality in workbooks they have received or downloaded to Tableau Desktop, they must configure Rserve connections on their computers.

Publish a Workbook That Requires an Rserve Connection

Before you publish a workbook that relies on an Rserve connection to Tableau Server, you should configure Tableau Server to have its own Rserve connection. You do this by configuring settings with `tabadmin set`. The settings are equivalent to the values you set in the Rserve Connection dialog box. They are:

- `vizqlserver.rserve.host`
- `vizqlserver.rserve.port`
- `vizqlserver.rserve.username`
- `vizqlserver.rserve.password`

Note: The settings vizqlserver.rserve.username and vizqlserver.rserve.password should be omitted if Tableau Desktop connects to RServe without a username and password.

For information on how to use the above `tabadmin set` options to configure Tableau Server, see Change Tableau Server's Configuration from the Command Line.

Tableau cannot verify that workbooks that use R will render properly on Tableau Server. There might be scenarios where a required statistical library is available on a user's machine but not on the Rserve instance that Tableau Server is using.

For views that cannot be rendered in Tableau Server because of an R script error, you see a warning error when you publish the workbook:

This worksheet contains R scripts, which cannot be viewed on the target platform until the administrator configures an Rserve connection.

You cannot publish a workbook that contains R scripting to Tableau Online.

Because Tableau Server provides an authentication mechanism, it can be more secure to expose Rserve functionality to users through Tableau Server than in Tableau Desktop.

Troubleshooting R Connections

This topic describes errors you can receive when Tableau is connected to an Rserve server—or attempting to connect to an Rserve server. It also lists issues that you may encounter as you use R with Tableau.

Note: Tableau technical support cannot assist with writing, troubleshooting, or debugging R scripts.

Error Messages on the next page

Other Issues on page 1489

Error Messages

Error Message	Comments
Unsupported type passed as an argument to SCRIPT function.	Tableau can only export the following Tableau data types to R: • Number (Decimal) • Number (Whole) • Boolean • String • Date • Date/Time
Unexpected number of results returned by SCRIPT function. Function expected %2 values; %1 values were returned.	The R script result must be either a scalar or vector of length one that is replicated for all rows, or a vector of length equal to the number of rows in the Tableau result table.
The result returned by the SCRIPT function is of an unexpected type.	Occurs when an invalid data type is received. Tableau can only import the following data types from R: • RDouble • RInteger • RLogical • RCharacter This error is also reported if the result is null or if there was a script execution error for which Tableau could not collect an explanation from R.
This worksheet contains R scripts, which are not supported on the target platform.	This error is reported when you attempt to publish a worksheet containing an R script to a server that does not allow R scripts because `vizqlserver.script.disabled` is set to true.
This worksheet contains R scripts, which	This error is reported when the server is configured to prevent Desktop from publishing worksheets with R scripts because `vizqlserver.script.disabled` is set to false. (The setting

cannot be viewed on the target platform until the administrator configures an Rserve connection.	is named contrary to its meaning: true means Desktop can publish worksheets with R scripts, false means Desktop cannot publish worksheets with R scripts.) Setting `vizqlserver.script.disabled` to false will not prevent Tableau Online users from using tabcmd to publish workbooks with R scripts; however, the resulting views will generate this error when opened in a browser.
An error occurred while communicating with the Rserve service.	Tableau runs all R scripts inside of the "try" R function. This error is displayed along with an R generated error message when the “try” function traps an R evaluation error.
This Rserve connection does not support authentication. Try connecting without specifying a password.	
Authentication failed. Please provide a valid Rserve username and password.	
An unsupported authentication type is enabled in Rserve.	Either disable Rserve authentication or change to plaintext password authentication.
No Rserve connection configured. Specify a server name and try again.	See **R Connection** on page 1483.
The calculation '%1' contains a disabled R script. Configure an Rserve connection to enable	See **R Connection** on page 1483.

custom R scripts.	
The workbook you are attempting to publish contains custom R scripts. Custom R scripts are not allowed in public workbooks.	You cannot publish workbooks containing R scripts to Tableau Public.
Tableau Public does not support running R scripts. To take advantage of R integration, upgrade to Tableau Professional.	The "Tableau Public" in this error refers to Tableau Desktop Public.
Tableau Reader cannot load custom R scripts. To take advantage of R integration, upgrade to Tableau Professional.	You cannot view workbooks containing R scripts in Tableau Reader.
Rserve is busy or not responding. Failed to create socket to Rserve.	Tableau has timed out a read pending on connection to Rserve – the timeout is 250ms. An IPC connection Read of the Rserve protocol header has thrown an exception.
Unrecognized Rserve signature.	The Rserve header signature must be "Rsrv".
Unrecognized Rserve version.	The Rserve header version must be "0103".
Unrecognized Rserve protocol.	The Rserve header protocol must be "QAP1".
Authentication fail-	Tableau attempted and failed to authenticate with Rserve. Verify

ure when connecting to R.	that you entered a valid password.
Incorrect number of bytes in parameter/body.	
The length of data which Tableau read does not equal the length promised by the header.	
Unrecognized response type.	The transport protocol type when reading a result was not SEXP as expected.
Excessively long <type>vector.	Unreasonably large number measuring the length of data sent to or from Rserve possibly indicating a corrupt protocol header.
Invalid Rserve command.	Tableau may have improperly implemented the Rserve protocol.
Response from server was Error " << (uint32_t)status << ". See Rsrv.h for details.	Various error conditions are documented in the comments in Rsrv.h.
Excessively long header offset.	This may be due to a garbled header with an unreasonable offset to response data.
Rserve socket failed.	A login, script evaluation, read pending check, result read, or Tableau field to R script argument assignment threw a non-standard exception.

Other Issues

SCRIPT Functions Run Even in Logical Statements That Evaluate as False

A function that sends an expression to a running Rserve instance will be executed even when it is within a logical statement that would otherwise prevent it from being executed. This is true for logical functions such as IF, IIF, and CASE. For example:

```
IF 1==0 THEN
```

```
[[R script code]]

ELSE

"1 does not equal 0"

END
```

Glossary

A

action

An interaction that you can add to your views. There are three types of action: Filter, Highlight, and URL.

ad-hoc calculation

A calculation that you can create and update as you work with a field on a shelf in the view. Also known as type-in calculation or in-line calculation.

aggregation

A result of a mathematical operation applied to a measure. Predefined aggregations include summation and average. You can convert dimensions to measures by aggregating them as a count. For relational data sources, all measures must be either aggregated or disaggregated (unless they appear on the Filters shelf). Tableau aggregates measures, usually as a summation, when you place them on a shelf. For multidimensional (OLAP) data sources, aggregations are defined when the cube is created and cannot be modified in Tableau.

alias

An alternative name that you can assign to a field or to a dimension member.

Analytics pane

A pane on the left side of your workbook that provides quick and easy access to common analytic features in Tableau. From the Analytics pane, you can drag reference lines, box plots, trend lines forecasts, and other items into your view. Toggle between the Data pane and the Analytics pane by clicking one of the tabs at the top of the side bar.

B

bin

A user-defined grouping of measures in the data source.

blending data

The process of combining data from different data source types in a view. The first data source that you use in the view becomes the primary data source. The remaining data sources become the secondary.

bookmark

A .tbm file in the Bookmarks folder in the Tableau repository that contains a single worksheet. Much like web browser bookmarks, .tbm files are a convenient way to quickly display different analyses.

C

calculated field

A new field that you create by using a formula to modify the existing fields in your data source.

caption

A description of the current view on the active worksheet. For example, “Sum of Sales for each Market”. You can automatically generate captions or create your own custom captions. Show and hide the caption by selecting Worksheet > Show Caption.

cell

A basic element of any table that you create in Tableau. You can control cells to enhance your data view, which is useful for text tables and heat maps.

color legend

An area of the view that displays the colors associated with a measure or dimension member. The default legend is modified when you place a dimension or a measure on the Color property.

Color property

A property on the Marks card that enables you to encode data by assigning different colors to the marks in a view. The property accepts measures and dimensions. When you place a dimension on the Color property, Tableau separates the marks according to the members in the dimension, and assigns a unique color to each member. When you place a measure on the Color property, Tableau draws each mark with a different color using a continuous range. In both cases, a legend describes the color encoding.

Columns shelf

A shelf at the top of the workbook that you use to create the columns of a data table. The shelf accepts any number of dimensions and measures. When you place a dimension on the Columns shelf, Tableau creates headers for the members of that dimension. When you place a measure on the Columns shelf, Tableau creates quantitative axes for that measure. See also Rows shelf.

crosstab

A text table view. Use text tables to display the numbers associated with dimension members.

cube

A data source that is connected to a multidimensional database. Also known as multidimensional data source. For example, data sources that connect to Microsoft Analysis Services or Oracle Essbase are called cubes.

custom geocoding

A process of adding your own location data to extend the built-in geocoding.

dashboard

A combination of several views arranged on a single page. Use dashboards to compare and monitor a variety of data simultaneously.

Data Interpreter

A tool that parses your Excel data source to help prepare your data for analysis.

Data pane

A pane on the left side of the workbook that displays the fields of the data sources to which Tableau is connected. The fields are divided into dimensions and measures. The Data pane also displays custom fields such as calculations, binned fields, and groups. You build views of your data by dragging fields from the Data pane onto the various shelves that are a part of every worksheet.

data source

The source of data outside or inside Tableau.

Data Source page

A page where you can set up your data source. The Data Source page generally consists of four main areas: left pane, join area, preview area, and metadata area.

data view

see: view

Detail property

A property on the Marks card that you can use to separate the marks in a view according to the level of detail (that is, members) of a dimension. The Detail property works only on aggregated data.

dimension

A field of categorical data. Dimensions typically hold discrete data such as hierarchies and members that cannot be aggregated. Examples of dimensions include dates, customer names, and customer segments. See also: measure.

E

encoding

A visual representation of your data. You can encode your data by color, shape, size, and path using the associated worksheet shelves.

extract

A saved subset of a data source that you can use to improve performance and analyze offline. You can create an extract by defining filters and limits that include the data you want in the extract.

F

field

A dimension or a measure in a database. For relational data sources, fields are the columns of a table. For cube (multidimensional) data sources, fields are the dimensions of a cube. Each dimension or column contains a unique attribute of the data, such as customer name, sales, or product type.

field label

A row or column heading that indicates the data field used to create the view. For example, a view that has rows for East, Central, and West might have a Region field label at the top of the column indicating that each row is a member of the Region field.

Filters shelf

A shelf on the left of the workbook that you can use to exclude data from a view by filtering it using measures and dimensions.

forecast

A calculation that predicts future trends based on current trends and data.

Format pane

A pane that contains formatting settings that control the entire worksheet, as well as individual fields in the view. When open, the Format pane appears on the left side of the workbook.

G

group

A field you can use to combine dimension members into higher level categories. For example, you could group a dimension that contains states into regions. Groups are marked with a paper clip icon in the Data pane.

H

header

A label for member names for each field that you place on Rows or Columns.

hexagonal binning

A technique for clustering data in a two-dimensional plane.

I

in-line calculation

see: ad-hoc calculation

J

join area

An area at the top of the Data Source page where you can drag tables or select queries or cubes to set up your data source. See also: Data Source page.

join condition

A relationship between fields in a join. You can define the relationship in the join area of the data source. See also: joining.

joining

A process of combining data from multiple tables in same-type data sources.

L

level of detail (LOD) expression

A syntax that supports aggregation at dimensionalities other than the view level. With level of detail expressions, you can attach one or more dimensions to any aggregate expression.

LOD

see: level of detail (LOD) expression

M

marks

A part of the view that visually represents one or more rows in a data source. A mark can be, for example, a bar, line, or square. You can control the type, color, and size of marks.

Marks card

A card to the left of the view where you can drag fields to control mark properties such as type, color, size, shape, label, tooltip, and detail.

measure

A field of quantitative data. Measures are fields that are dependent variables. They are typically quantitative fields or calculated fields like sales, temperature, or frequency. You can also create discrete measures in Tableau. See also: dimension.

metadata area

An area that can be accessed from the Data Source page by clicking the metadata button and that displays the fields in your data source as rows so that you can quickly examine the structure of your data source and perform routine management tasks, such as renaming fields or hiding multiple fields at once. When connected to cube data, the metadata displays by default. See also: Data Source page.

multidimensional data source

see: cube

P

packaged workbook

A single zip file with a .twbx extension that contains a workbook along with any supporting local file data sources and background images. Use this format to package your work for sharing with others who don’t have access to the data.

Pages shelf

A shelf to the left of the view that you can use to split a view into a sequence of pages based on the members and values in a discrete or continuous field. Adding a field to the Pages shelf is like adding a field to the Rows shelf, except that a new page is created for each new row.

pane

An area in the table that is created by the intersection of rows and columns. Tables consist of one or more panes. The number of panes in a view depends on the number and type of fields placed on the Rows and Columns shelves.

parameter

A dynamic value that can replace a constant value in calculations, filters, and reference lines.

pass-through function

A function that sends SQL expressions directly to the database to access custom database functions.

Path property

A property on the Marks card that you can use to encode data by connecting marks using a particular drawing order. The property accepts measures and dimensions. Dimensions connect the marks according to the members in the dimension. If the dimension is a date, the drawing order is given by the date order. If the dimension contains words, the line is drawn based on the order of the words in the data source. Measures connect the marks according to the values of the measure. The measure can be aggregated or dis-aggregated. See also: path.

pill

A field in the view.

preview area

An area at the bottom of the Data Source page where you can review the fields and the first 10,000 rows of the data in the data source. You can also use preview area to make general modifications to your data source, such as hiding or renaming a field, or changing its data type. See also: Data Source page.

primary data source

The first data source that you use in a blended view. See also: blending data, secondary data source.

Q

query

A set of formalized instructions that Tableau uses to communicate with data-bases. Common query languages include SQL and MDX. Every time you build a view of your data, Tableau translates your actions into queries and retrieves the requested information from the data source. If you are building a dense data view, you can turn queries off until all the fields you want are placed on shelves.

R

relational data source

A data source that is connected to a relational database.

relational database

A database that presents information in tables with rows and columns. Examples of relational databases that Tableau supports are Excel workbooks, Access databases, comma-delimited text files, MySQL database, and Tableau Data Extract files.

Repository

A collection of workbooks, bookmarks, data sources, and logs. By default, the Tableau Repository is located on the drive where Tableau is installed, in the My Documents\My Tableau Repository folder.

Rows shelf

A shelf at the top of the workbook that you can use to create the rows of a data table. The shelf accepts any number of dimensions and measures. When you place a dimension on the Rows shelf, Tableaus creates headers for the members of that dimension. When you place a measure on the Rows shelf, Tableau creates quantitative axes for that measure.

S

secondary data source

A second or subsequent data source that you use in a blended view. See also: blending data, primary data source.

set

A custom field that defines a subset of data based on some conditions. A set can be based on a computed condition or on a specific data point in the view. Sets appear at the bottom of the Data pane in the Sets area.

Shape legend

A legend that displays the shapes associated with dimension members. The legend appears on worksheets that have a dimension placed on the Shape shelf.

Shape shelf

A shelf to the left of the view that you can use to encode data by assigning different shapes to the marks in the view. The Shape shelf accepts dimensions only. When you place a dimension on the shelf, Tableau separates the marks according to the members of the dimension, and a legend describes the encoding. You cannot place a measure on the shelf because measures do not contain members.

sheet

A view (also known as worksheet), dashboard, or story. Sheets appear as tabs at the bottom of the workbook.

shelves

Named areas to the left and top of the view. You build views by placing fields onto the shelves. Some shelves are available only when you select certain mark types. For example, the Shape shelf is available only when you select the Shape mark type.

Size shelf

A shelf to the left of the view that allows you can use to encode data by assigning different sizes to the marks in the view. The Size shelf accepts measures and dimensions. When you place a dimension on the shelf, Tableau separates the marks according to the members in the dimension, and assigns a unique size to each member. When you place a measure on the shelf, Tableau assigns a different size to each mark using a continuous range.

small multiples

A view that contains small multiple charts of the same type.

story

A sheet that contains a sequence of views or dashboards that work together to convey information.

story point

An individual view in a story.

T

table

A visual presentation of a data view. Tables consist of panes, headers, and cells.

table calculation

A computation that uses data from multiple rows in the database and that is applied to the values in the table.

Text shelf

A shelf to the left of the view that you can use to view the numbers associated with a view, and to encode data by assigning text labels to the marks. The shelf accepts measures and dimensions. The most common view using the Text shelf is a text table.

tooltip

Data details that appear when you hover over one or more marks in the view.

type-in calculation

see: ad-hoc calculation

V

view

A representation of your data in a Tableau worksheet or dashboard. You can create data views by placing fields on shelves.

W

workbook

A file with a .twb extension that contains one or more worksheets (and possibly also dashboards and stories).

worksheet

A sheet where you build views of your data by dragging fields onto shelves.

Copyright

Contact Us

Directory of worldwide offices

Sales

Contact

Support

1. Search our support resources.
2. Review the search results to see if your question is answered.
3. If you can't find what you need, scroll to the bottom of the search results, and click **Continue and Create Case**.