

**Directions**

1. Open a new workbook, and create the connection to **Superstore Sales Training.xls** (found in the **Data** folder on the USB) with the following:
  - **Orders** table is the first table selected as the data source.
  - **Returns** table is selected as the second table.
  - An Inner join is created between the **Order** field in the **Orders** table and the **Order ID** field in the **Returns** table.
  - The connection is a Live connection.
2. Create the view:

Drag this	To
Number of Records	Columns
Category	Rows

3. Sort **Category** by **Number of Records** in descending order
4. Drag **Number of Records** to **Label** on the **Marks** card.
5. Name the worksheet **Count of Returns**, show the title, and save the workbook as a **.twbx** packaged workbook.

**Solution**

For the solution to this practice, see "Solution: Joining Tables" on page 217.



# 10. Using Multiple Data Sources

---

This module contains the following:

How Data Blending Works

Using Data Blending

Practice: Exploring Effect of Primary Data Source Selection

---

## How Data Blending Works

Data blending is an alternative to joining when you have multiple data sources that you want to analyze in a single view. The key difference is that a join requires the data tables to reside in the same data source, and they must have a common field. A data blend, in contrast, allows you to combine data from multiple unrelated sources. The data is blended on common dimensions.

To blend two or more data sources, you need to designate one of them as the primary data source, and any other sources to be secondary data sources. The data blend incorporates all of the data in the primary source, and uses a left join to bring in the data from the common field or fields in the secondary sources.

For example, consider two separate data sources called Actual Sales and Target Sales that have a Date field in common. The Date field can be used on the sheet from the primary Actual Sales source. When you switch to the secondary Target Sales data source in the Data pane, Tableau automatically links fields that have the same name. If the Date field does not need to be used in the view, it can still be the linking field by switching to the secondary source and finding the broken link next to the complementary dimension and clicking on it. This broken link appears automatically if fields are named the same.

## Using Data Blending

The data source from which a field is first added to the view is automatically selected as the primary data source; all others are secondary. Tableau creates relationships with fields from other data sources that have the same name and field type.

Here are two ways to blend data in Tableau.

### Blend two data sources with common fields

1. Add two data sources to a view.
2. Create a simple view using one data source.
3. Select the second data source, and look for a field with a broken paper clip. This indicates a common dimension field that can be used as a link between the data sources.
4. Click the paper clip icon to activate the link.

### Blend two data sources using a custom-defined relationship

1. Open the first data source in a worksheet.
2. Add the second data source.
3. On the **Data** menu, select **Edit Relationships**.
4. In the **Relationships** dialog box, under **Primary data source**, select the primary data source.

By default, Tableau selects the first data source to which you connected as the primary. If you choose to set the second data source as the primary, select it under **Primary data source**. The entry under **Secondary data source** updates automatically with the other data source.

5. Select **Custom** and then click **Add**.

6. On the Add/Edit Field Mapping dialog box, first click to select a field under **Primary data source field**, and then click the field you want to map to it under **Secondary data source field**, and then click **OK**.
7. Click **OK** to close the **Relationships** dialog box.
8. When you drag a field into your view on a worksheet, you will see the connected fields as an orange paperclip.

The blending is done on the member aliases of the common dimensions, so if the underlying values aren't an exact match they will need to be edited either in the data or using Tableau.

### Calculations in Data Blends

Some tips for working with calculations used in data blends:

- If you are creating table calculations across the data sources, you need to make sure the data is aggregated at the same level.
- The calculations you create are stored in the primary data source.

---

## Practice: Exploring Effect of Primary Data Source Selection

Locate the **Data** folder on the student USB and be ready to use **Superstore Sales Training.xls**, **SalesTargets.xlsx**, and **CategoryMaster.xlsx**. You will complete three different blends.

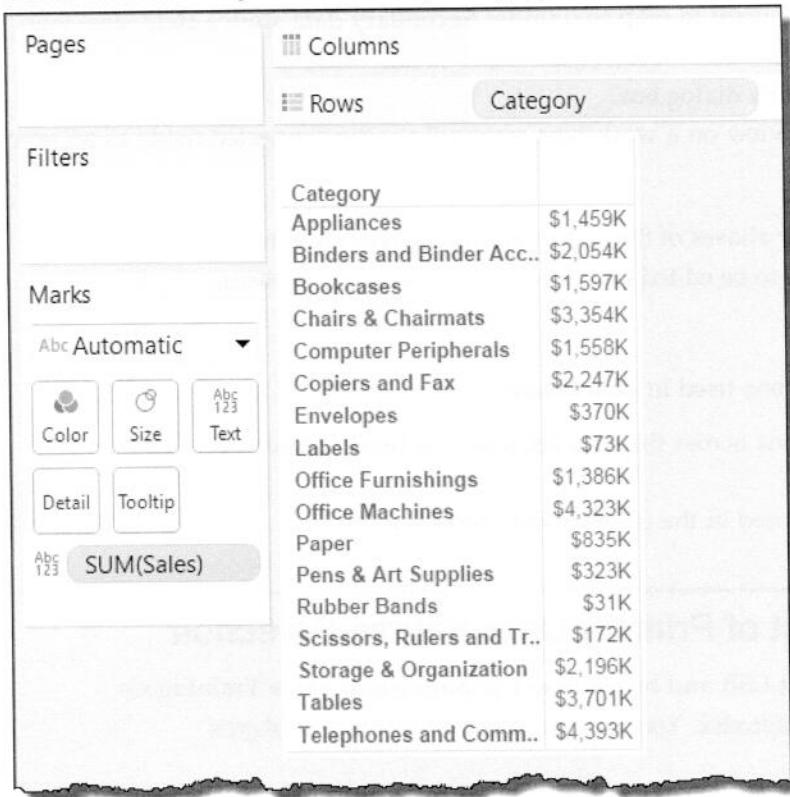
### Explore the Data

- In a new workbook, connect to the **Superstore Sales Training.xls** source in the **Data** folder of the student USB.
- Create a text table view that explores the actual sales by category in this data set.
- Connect to **SalesTargets.xlsx** and create a text table with category and sales targets

### Directions

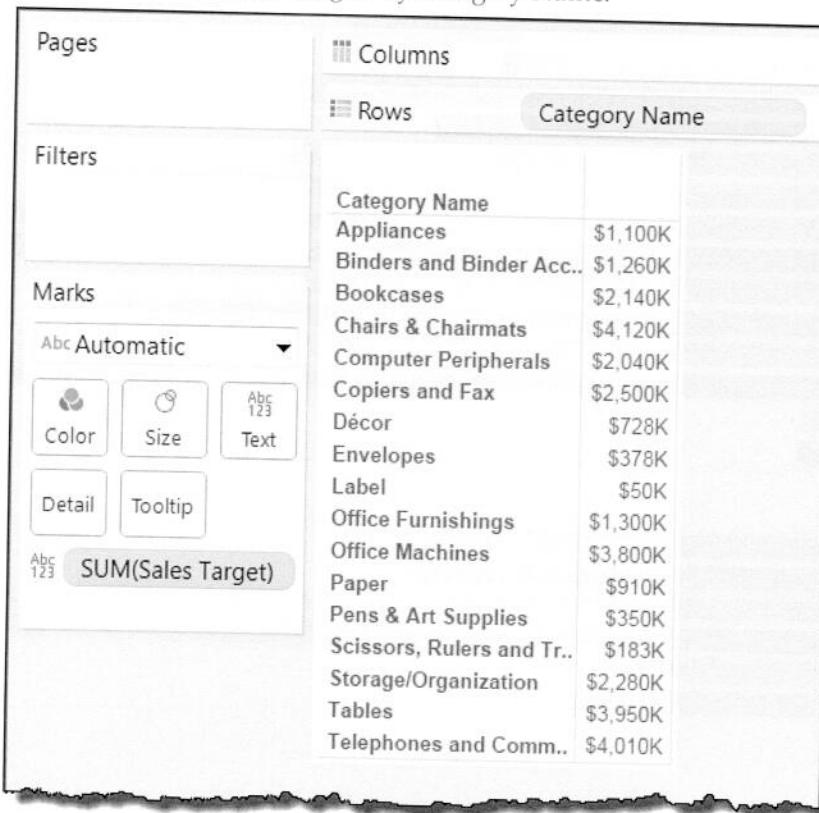
1. Open a new workbook, and connect to the **Superstore Sales Training.xls** source in the **Data** folder of the student USB.
2. Connect to the **Orders** table with a **Live** connection.
3. Explore the data by creating a text table with category and sales.
4. In the **Data** pane, change the default property of **Sales** so it displays as currency in thousands with no decimal point.

5. Name the view "Superstore Sales by Category."



6. Next, connect to the SalesTargets.xlsx file from the Data folder of the student USB and create a new sheet.
7. Explore the data by creating a text table with sales targets by category name.
8. In the Data pane, change the default property of Sales Target so it displays as currency in thousands with no decimal point.

9. Name the view "Sales Targets by Category Name."



### Blend One: Superstore First

- Blend the two data sources on Category, using Superstore Sales Training.xls as the primary source.
- Create a view using both data sources.

**Directions**

1. Create a new worksheet and name it "Superstore First."
2. Using options on the Data menu, define a custom relationship between the two sources based on the fields Category and Category Name.
3. Starting from Superstore Sales Training.xls, build the view:

Drag this	To
Sales	Columns
Category	Rows

4. Switch to the SalesTargets.xlsx source, and drag Sales Target to the Sales axis to create a combined axis view.
5. Use Measure Names to color the bars (only available in the primary source).
6. Change the bar colors to gray and blue.
7. Show the Nulls at Default Position.

## Blend Two: SalesTargets First

- Create a view that includes Category Names from SalesTargets.xlsx first:



- Correct for naming differences in the two data sources. Use **Edit Alias** to make the following changes to the **Category Name** display names as follows:
  - "Label" to "Labels"\*
  - "Storage/Organization" to "Storage & Organization"

### Directions

- In the same workbook, create a new worksheet and name it "SalesTargets First".
- From the SalesTargets data source, build the view:

Drag this	To
Sales Target	Columns
Category Name	Rows

- From the Superstore Sales Training source, drag Sales to the Sales Target axis to create a combined axis view.
- Use **Measure Names** to color the bars.
- Show the Nulls at Default Position.

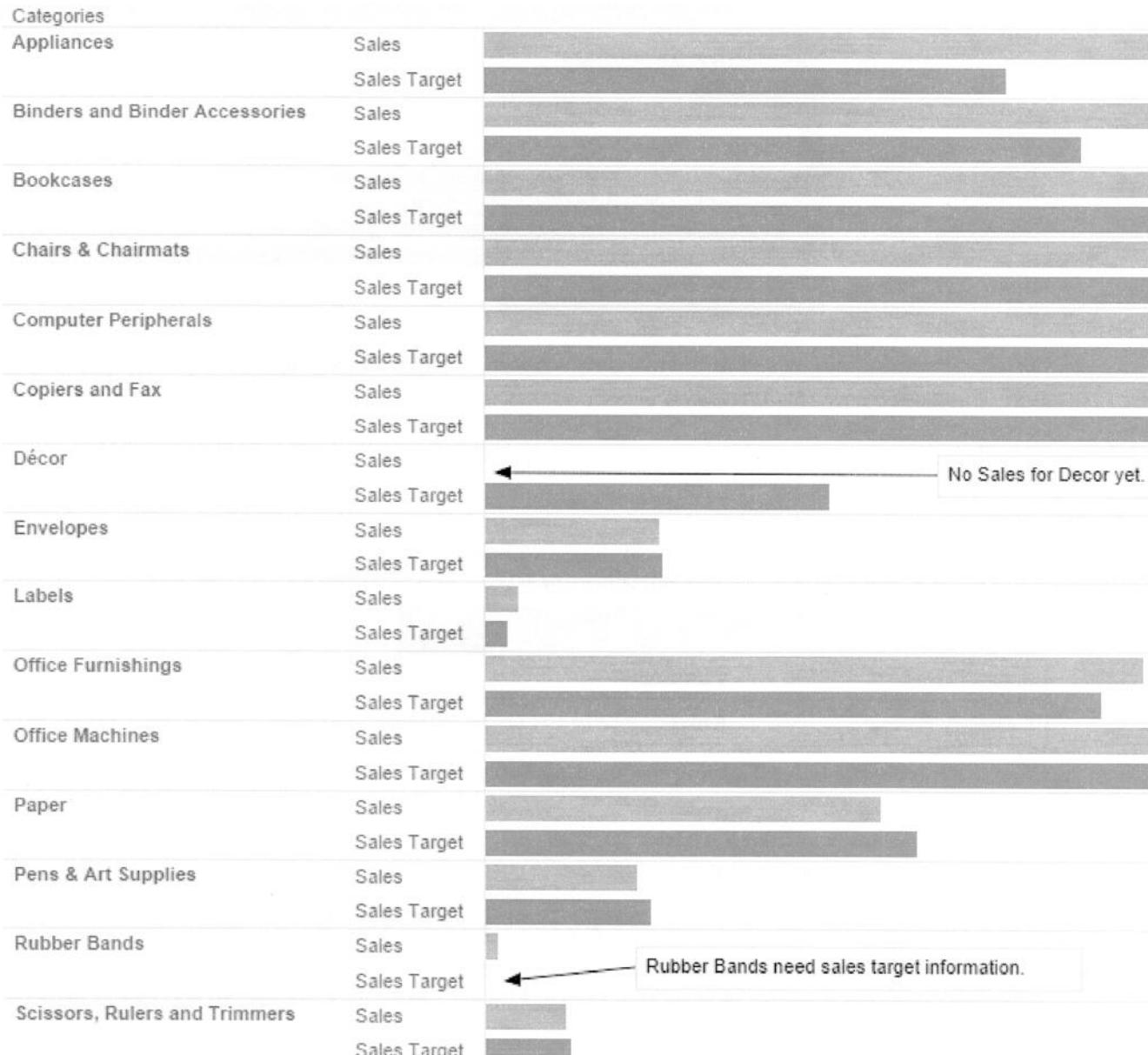
**NOTE** The null values are all in Sales Target, and are from Label, Storage/Organization, and Decor.

- Adjust colors to be consistent with the Superstore First view.
- In the "SalesTargets First" worksheet, edit the alias on the following Category Name display names:
  - Update "Label" to "Labels"
  - Update "Storage/Organization" to "Storage & Organization"

Observe how these changes affect the SalesTargets First view. Next, return to the worksheet for Superstore First and observe the rows. Note neither blend contains every value, even after these changes. Superstore First does not include Decor (which is only in SalesTargets), and SalesTargets First does not include Rubber Bands (which is only in Superstore).

### Blend Three: Return All Values

- To return every Category value, first create a connection to the CategoryMaster.xlsx source, and then blend both Superstore Sales Training and SalesTargets as secondary sources.
- Create the view which includes all categories, and then exclude any categories that do not have any values:



- Save the workbook as a .twbx packaged workbook.

#### Directions

1. In the same workbook, create a new worksheet named "All Categories".
2. Create a new data connection to a third data source, **CategoryMaster.xlsx**.
3. Edit the relationship for **Category Master** and **Superstore Sales Training** to blend the **Categories** and **Category** fields.
4. Edit the relationship for **Category Master** and **SalesTargets** to blend the **Categories** and **Category Name** fields.
5. Create the view:
  - Select **CategoryMaster.xlsx** as the source, and drag **Categories** to **Rows**.
  - Change the source to **Superstore Sales Training**, and drag **Sales** to **Columns**.
  - Change the source again to **SalesTargets.xlsx**, and drag **Sales Target** to the **Sales** axis to create a combined axis view.

**NOTE** There are two nulls: **Sales** for **Decor**, and **Sales Target** for **Rubber Bands**. These are null because while they exist in the master list of **Categories**, there is not corresponding data for those categories in the secondary data sources.

6. Complete the view:
  - Drag **Measure Names** from the **CategoryMaster.xlsx** connection to **Color** in the **Marks** card.
  - Show **Nulls** at their default position.
  - Add annotations for **Decor** and **Rubber Bands**.
7. Save the workbook as a .twbx packaged workbook.

#### Solution

For the solution to this practice, see "Solution: Exploring Effect of Primary Data Source Selection" on page 218.



# 11. Customizing Your Data

---

This module contains the following:

- Using Calculations in Desktop
  - Options for Creating Calculated Fields
  - String Functions
  - Date Calculations
  - Practice: Manipulating Strings and Data Type Conversions
  - Practice: Using Date Calculations
  - Calculations and Aggregations
  - Practice: Calculations and Aggregations in Profit Ratio
  - Practice: Calculated Fields and Joins
  - Practice: Using a Calculated Field in a Blended View
-

## Using Calculations in Desktop

A *calculated field* is a custom column derived from existing data in your data source.

### Why Use Calculated Fields?

Use calculated fields when your underlying data does not contain all of the values you need for your analysis. For example, you can use Sales and Profit in a calculated field to determine the ratio of sales to profit.

The calculated field editor supports many calculation types. A calculation can include some or all of the following components.

Component	Description
Fields	Includes both data source fields and calculated fields.
Functions	Functions you can use to create a formula, available from the drop-down menu. By default all functions are displayed.
Operators	Operators must be typed manually. All standard operators, such as addition (+), subtraction (-), multiplication (*), modulo (%) and division (/) as well as comparisons (==, =, >, <, >=, <=, !=, <>). and logical (AND, OR, NOT).
Parameters	Placeholder variables that can be inserted into calculations to replace constant values.
Comments	Insert custom comments for your calculations as a means of annotation for later review. To add a comment to a calculation, type two forward slash characters (//) into the formula box.

### Calculated Fields Versus Table Calculations

Tableau has both predefined calculations, and tools for developing your own calculations.

Calculation	Description
Calculated Fields	Custom calculations created using the Calculated Field editor and computed in the underlying data source.
Table Calculations, including Quick Table Calculations	Calculations computed locally using only the data in a view. Some predefined Table Calculations are available as Quick Table Calculations, but you can also specify the components of the formula for Table Calculations yourself.
Row and Column Totals	Predefined calculation available on the Analysis menu including subtotals and grand totals. These are a type of table calculation.

## Options for Creating Calculated Fields

You can write calculated fields in two ways:

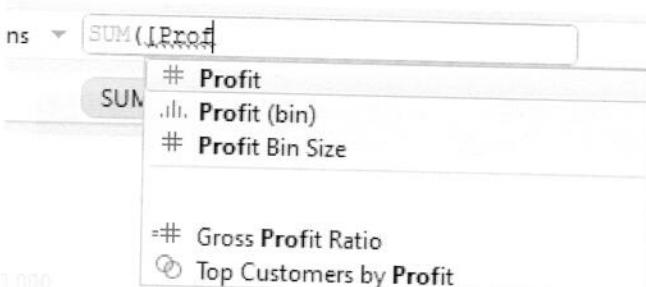
- Type them directly on **Columns**, **Rows**, or the **Marks** card. This method is referred to as *ad-hoc calculations*.
- Use the Calculated Field editor.

### **Ad-Hoc Calculations**

Use an ad-hoc calculation when you need a quick and simple formula for analysis, such as Profit Ratio, like this:



As you type the components of the calculation, Tableau suggests functions or fields to complete your formula:



Press **ENTER** to apply your calculation to the view.

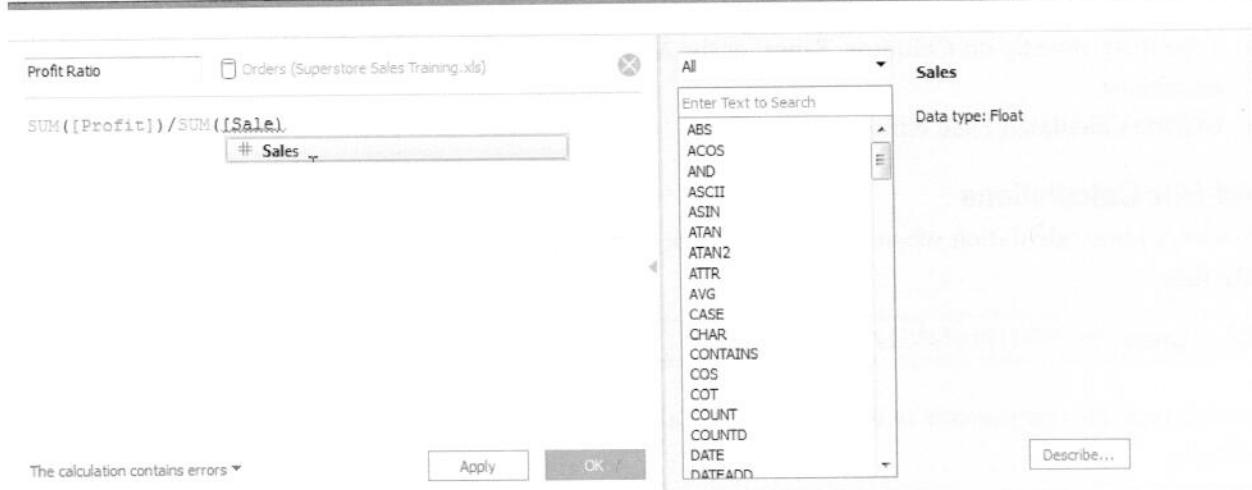
To save the calculation to your data source, drag the calculation to the data pane, and when prompted, name the calculation.

### **The Calculated Field Editor**

You can also create calculated fields in the Calculated Field editor.

- Click the **Analysis** menu and choose **Create Calculated Field** -OR-
- Right-click in the **Data** pane and choose **Create Calculated Field**.  
You can navigate to other screens in Desktop with the Calculated Field editor open and drag and drop fields from your **Data** pane into the editor.
- Type the formula in the **Formula** window, and click **Apply** to save the calculation and keep the editor open, or, click **OK** to save the calculation and close the dialog box.

The dialog box allows you to move between windows while it remains open.



### Formula Editor Conventions

Color or Symbol	Description
Red squiggly line	Syntax error. Hover over the error to see directions to fix it.
//Green text	Comments. These are ignored by the calculation but are useful for documenting the calculation logic.
[Orange Text]	Field names.
Blue Text( )	Functions.
[Purple Text]	Parameters.
<b>Bold Text</b>	Calculation is computed locally within Tableau on the aggregated results.
Plain Text (not bold)	Calculation computed at the database level.

Other items to note:

- UPPER/lowercase are ignored (except for field names).
- ENTER/RETURN/SPACE are ignored.
- Use " or ' for string fields.

### Types of Calculated Fields

You can use the formula editor to create many different types of calculated fields. It is not possible to list them all here, but some of the most commonly used types of calculated fields in Tableau include:

- Math operations across numbers, like addition or subtraction
- Logic statements, like If/Else or Case
- Aggregating data, for example average or maximum
- Manipulating strings, either putting strings together or breaking them down
- Date formulas, for example to pull out a date part or the difference between two dates

## Handling Null Values

When you join or blend to sources, you can have some records with no value (NULL) in the shared field. You can't do math with null values, because  $\text{null} + \text{any number} = \text{null}$ , but you can use the ZN function to replace NULL values with zero (0), which will then allow you to perform any required math functions.

## String Functions

Use string functions to change the way text appears in your view. When doing math, the plus sign (+) is the addition operator. When working with strings, the plus sign is the concatenation operator.

For example:

```
"First Name" + "Last Name" = First NameLast Name
```

Notice that no space is included between the first name and last name. You need to insert the space in the formula, like this:

```
"First Name" + " Last Name" = First Name Last Name
```

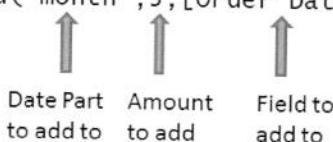
## Date Calculations

Use date calculations to calculate a difference between dates or to add some amount of time to an existing date field.

Many date functions use date parts in their calculations, and some are solely concerned with returning a particular date part. You can use the following date parts in date functions: year, month, day, hour, minute, or second.

Here is an example of a date calculation that adds 3 months to the Order Date field.

```
DateAdd('month',3,[Order Date])
```



DATEPARSE allows you to change a string into a recognized date field.

For example: DATEPARSE("MMM, dd, yy", "September, 4, 12") = 9/4/2012

---

**NOTE** DATEPARSE is sometimes not available depending on the type of data connection being used.

---

## Practice: Manipulating Strings and Data Type Conversions

Open *Manipulating Strings and Data Type Conversions\_Starter.twbx* and modify view according to the following specification:

- Shows the Customer ID and Customer Name in the first column.

Customer Number & Name	
Customer # 425 - Bruce Schroeder	\$17,544
Customer # 668 - Gloria Schwarz	\$20,617
Customer # 1137 - Ted Oliver	\$109,216
Customer # 1688 - David Chang	\$45,519
Customer # 1887 - Wendy Hobbs	\$42,747
Customer # 2726 - Christine Underwood	\$111,603
Customer # 3326 - Toni Faircloth	\$6,120

#### Directions

1. Notice that **Customer Name** and **SUM(Sales)** are in the view.
2. Create a calculated field named "Customer Number & Name". This calculated field should result in a concatenated string that displays **Customer # [Customer ID] - [Customer Name]**, as in the example image.

**NOTE** Remember that the string concatenation operator is the plus (+) sign and that the type conversion function for string is **STR()**.

3. Replace the **Customer Name** field on **Rows** with the new **Customer Number & Name** calculated field.

#### Solution

For the solution to this practice, see "Solution: Manipulating Strings and Data Type Conversions" on page 220.

---

## Practice: Using Date Calculations

Open **Using\_Date\_Calculations\_Starter.twbx** and create a view according to the following specification:

- Cross tab chart that shows the average days to ship for various levels of product categorization.
- Use a calculated field that includes the **DATEDIFF** function to calculate the days to ship.
- Use a calculated field that concatenates a string and rounds the calculation results.

Department	Category	
Furniture	Bookcases	Average Days to Ship: 2.14
	Tables	Average Days to Ship: 2.04
	Office Furnishings	Average Days to Ship: 2.00
	Chairs & Chairmats	Average Days to Ship: 1.98
Office Supplies	Envelopes	Average Days to Ship: 2.27
	Pens & Art Supplies	Average Days to Ship: 2.13
	Rubber Bands	Average Days to Ship: 2.07
	Appliances	Average Days to Ship: 2.06
	Storage & Organization	Average Days to Ship: 2.01
	Paper	Average Days to Ship: 2.00
	Labels	Average Days to Ship: 1.95
	Binders and Binder Accessori..	Average Days to Ship: 1.93
Technology	Scissors, Rulers and Trimmers	Average Days to Ship: 1.71
	Copiers and Fax	Average Days to Ship: 2.20
	Telephones and Communicati..	Average Days to Ship: 2.17
	Office Machines	Average Days to Ship: 2.01
	Computer Peripherals	Average Days to Ship: 2.00

Test the formula (with the default aggregation of SUM) using different levels of aggregation.

#### Directions

1. Create a calculated field named "Days to Ship" that calculates the number of days between the date an order was placed and the date the order was shipped. Use the DateDiff function to create this calculation.
2. Create a view to test the field:

Drag this field	To
Days to Ship	Text on the Marks card
Department	Rows

3. Change the SUM(Days to Ship) to Average (AVG).
4. Drag Category to Rows to the right of Department.
5. Create another calculated field that concatenates the text "Average Days to Ship:" to the results of the "Days to Ship" calculation you have created.

#### Solution

For the solution to this practice, see "Solution: Using Date Calculations" on page 221.

## Calculations and Aggregations

Aggregating in calculated fields can affect the formula's order of operations and therefore return different, and potentially incorrect, results.

For example, when you are computing weighted averages, you should apply an overall aggregate before computing ratios.

In some circumstances aggregation should not be applied (for example, when computing line-item calculations, which should be computed for each record, row by row).

## Practice: Calculations and Aggregations in Profit Ratio

Open Calculations and Aggregations Profit Ratio Starter.twbx and create a view according to the following specification:

- Create a view showing the profit by year and department.
- Create an ad-hoc calculation named "Profit Ratio" using the formula:  $[\text{Profit}]/[\text{Sales}]$
- Test the calculation: does the **Profit Ratio** field return the correct results?
- Edit the calculation to be  $\text{SUM}([\text{Profit}])/\text{SUM}([\text{Sales}])$  and re-test.
- Save the calculation in the Data pane as **Profit Ratio**.

Year of Order Date	Department		
	Furniture	Office Supplies	Technology
2010	58.74%	37.78%	43.72%
2011	56.50%	42.32%	44.90%
2012	59.12%	42.72%	46.19%
2013	59.06%	46.10%	47.25%

### Directions

1. Create a view using **Order Date**, **Department**, and **Profit**, showing **Profit** on Color with labels.
2. Use the **Profit** field on the **Marks** card to create an ad-hoc calculation for **Profit Ratio**, using the formula:  $[\text{Profit}]/[\text{Sales}]$ .
3. Format the calculation as a percentage with two decimal places.
4. Try dragging and dropping different dimensions in and out, and notice what happens to **Profit Ratio**.
5. Change the calculation to  $\text{SUM}([\text{Profit}])/\text{SUM}([\text{Sales}])$ .
6. Save the calculation in the **Data** pane as **Profit Ratio**, and set its default number format to percentage.

### Solution

For the solution to this practice, see "Solution: Calculation and Aggregation in Profit Ratio" on page 221.

## Practice: Calculated Fields and Joins

Open Calculated Fields and Joins Starter.twbx and create a view according to the following specification:

- Create a view showing the **Category** with the highest percentage of returned products.
- Review, and if necessary, modify the join type in the connection.

- Use a calculated field to find Percentage of Returns.
- Save the workbook.



### Directions

1. Click the **Data Source** tab to begin editing the data source.
2. Edit the connection between the **Orders** and **Returns** table to be a left join.
3. Create a new calculated field named "Percentage of Returns", defined as:  
`COUNT([Status])/COUNT([Number of Records])`
4. In the **Data** pane, change the default format of the **Percentage of Returns** calculated field to a percentage.
5. Build the view:

Drag this	To
Percentage of Returns	Columns
Category	Rows

6. Sort Category by Percentage of Returns in descending order.
7. Add Percentage of Returns as a Label in the view.
8. Use the **Worksheet** menu to show the title.
9. Save the workbook.

### Solution

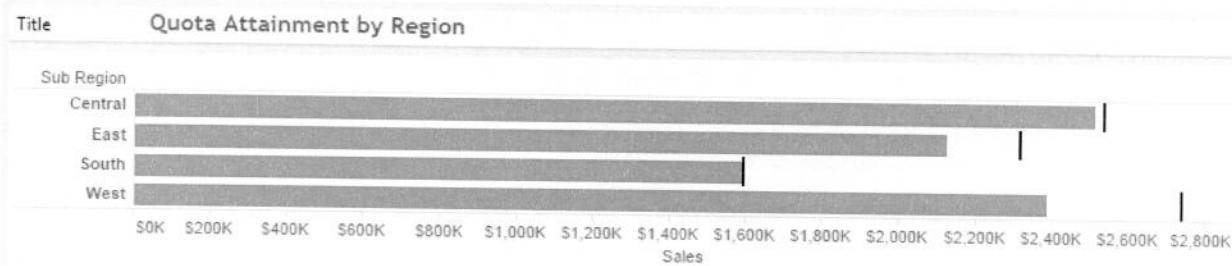
For the solution to this practice, see "Solution: Calculated Fields and Joins" on page 222.

---

## Practice: Using a Calculated Field in a Blended View

Locate the **Data** folder on the student USB and be ready to use **Superstore Sales Training.xls** and **US Superstore Quota.xls**.

- In a new workbook, connect to the Orders table in the Superstore Sales Training.xls source in the Data folder of the student USB, and then create another connection to the US Superstore Quota.xls source.
- Blend the two sources on State names.
- From Superstore Sales Training.xls, add Sales to Columns and Sub Region to Rows.
- Filter the data to the United States only.
- Bring Quota to Detail, and click on the link to US State to use it as a linking field.
- Add a Reference Line to represent the Quota for each Sub-Region.
- Format the Sales axis as currency in thousands with no decimal places, and show the worksheet title.
- Save the workbook as a .twbx packaged workbook.



### BONUS

- Create a calculated field named “At Quota?” in the Superstore Sales Training source:  
 $\text{SUM}([\text{Sales}]) \geq \text{SUM}([\text{US Superstore Quota (US Superstore Quota)}].[Quota])$
- Drag At Quota? to Color on the Marks card, and format the view to clearly show which Regions are not at quota



- Save changes to the workbook.

### Directions

1. In a new workbook, create a connection to the Orders table of the Superstore Sales Training.xls source in the Data folder of the student USB.
2. Use New Data Source to create a second connection to the US Superstore Quota.xls source in the Data folder of the student USB.
3. From the Data menu, edit the relationships to define a blend between Superstore Sales Training and US Superstore Quota.
  - Superstore Sales Training as Primary
  - US Superstore Quota as Secondary

- Select **Custom**, then **Add**
  - Primary field as **State**, Secondary field as **US State**
4. Create the initial view using **Superstore Sales Training**:
    - From **Measures**, drag **Sales** to **Columns**
    - From **Dimensions** drag, **Sub Region** to **Rows**
  5. Use **Country/Region** to filter to the United States only.
  6. Change the source to **US Superstore Quota**, and complete the view:
    - From **Measures**, drag **Quota** to **Detail** on the **Marks** card, and click on **OK** through the warning
    - Click on the link next to **US State** to use **US State** as linking field
  7. Create a reference line to show the quota:
    - Right-click on the axis for **Sales**, and choose to **Add Reference Line**
    - **Line** as type
    - **Per Cell**
    - **Value as Average of Sum(Quota)**
    - **No Label**
    - **Black line**
    - **No Fill**
  8. Right-click the **Sales** axis, and then click **Format**. Use the **Numbers** drop-down list to select **Currency (Custom)**, set **Decimal places** to 0, and set **Units** to **Thousands (K)**.
  9. Name the worksheet "Quota Attainment".
  10. Use the **Worksheet** menu to show the worksheet title.
  11. Save the workbook as a .twbx packaged workbook.

## BONUS

1. Create a calculated field named "At Quota?" in the **Superstore Sales Training** source using the following definition:  
`SUM([Sales]) >= SUM([US Superstore Quota (US Superstore Quota)].[Quota])`
2. Drag the new **At Quota?** field to **Color** on the **Marks** card.
3. Complete formatting by editing the color legend. False colored as Red, True colored as gray.
4. Save the workbook.

## Solution

For the solution to this practice, see "Solution: Using a Calculated Field in a Blended View" on page 222.



# 12. Using Calculations in Tableau

---

This module contains the following:

Understanding Where Calculations Occur

Split

Custom Split

Practice: Using Split

Calculations Performed on the Database

Practice: Calculation and Aggregation in Overall Profitability

Aggregating Dimensions in Calculations

Practice: Aggregating Dimensions in Calculations

Level of Detail (LOD) Calculations

Practice: Using LOD Calculations

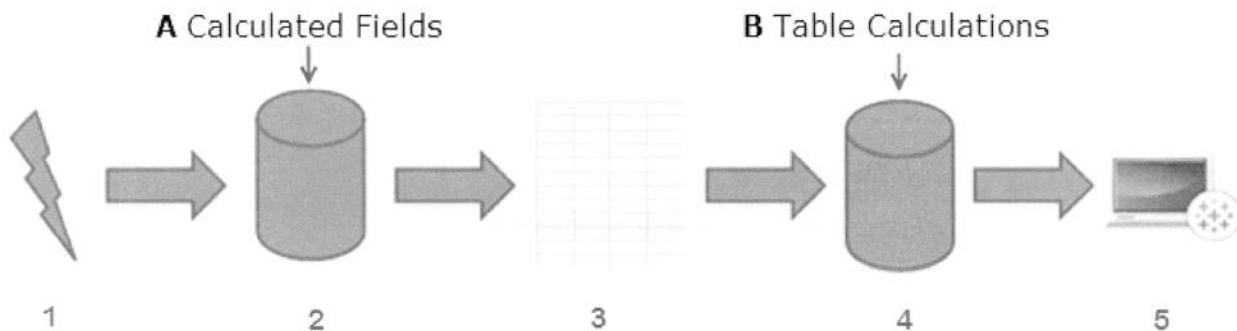
---

## Understanding Where Calculations Occur

Knowing how Tableau employs calculations can help you decide what kind of calculations to use for your analysis.

### How Calculations are Processed

- Calculated fields (A) are processed in the database.
- Table calculations (B) are processed locally.



When you generate and use a calculation:

- Tableau generates query and sends it to the database. All calculations (except table calculations) are passed to the database.
- The database processes the query.
- The database returns filtered, aggregated rows of data, included calculated columns.
- Tableau performs local processes, including table calculations.
- Tableau renders the visualization.

## Split

Using Split, you can autosplit regularly separated (delimited) strings in a column to create new columns. The separator can be a character or a space.

- Click the drop-down of the column you want to split, and select Split.

On the data source window, two columns display next to the split column.

Or

In the Data pane, the split dimension displays as two fields.

Split dimensions (using Split or Custom Split) are calculated fields. They have the same characteristics and limitations of calculated fields:

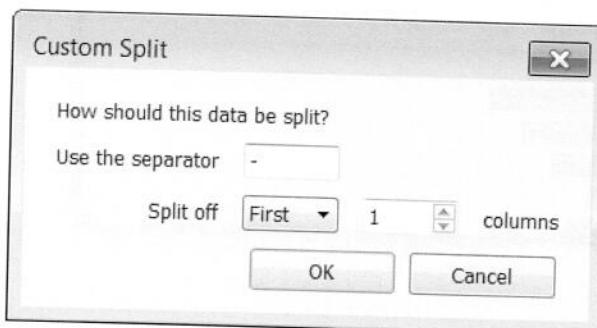
- They are materialized in extracts.
- They can be used for blends, but cannot be used for joins.
- They are not available for Pivot/Unpivot functionality.

## Custom Split

Use the Custom Split option when the column split you need is more complex, or when you want more control over how the column is separated. You can access Custom Split on the same menu as Split.

In some cases, Tableau displays the Custom Split dialog box even if you have selected **Split**. This occurs when the column you have selected is too complex for an automatic split.

Custom Split allows you to split a column into multiple columns, and to specify the separator used for the splits.



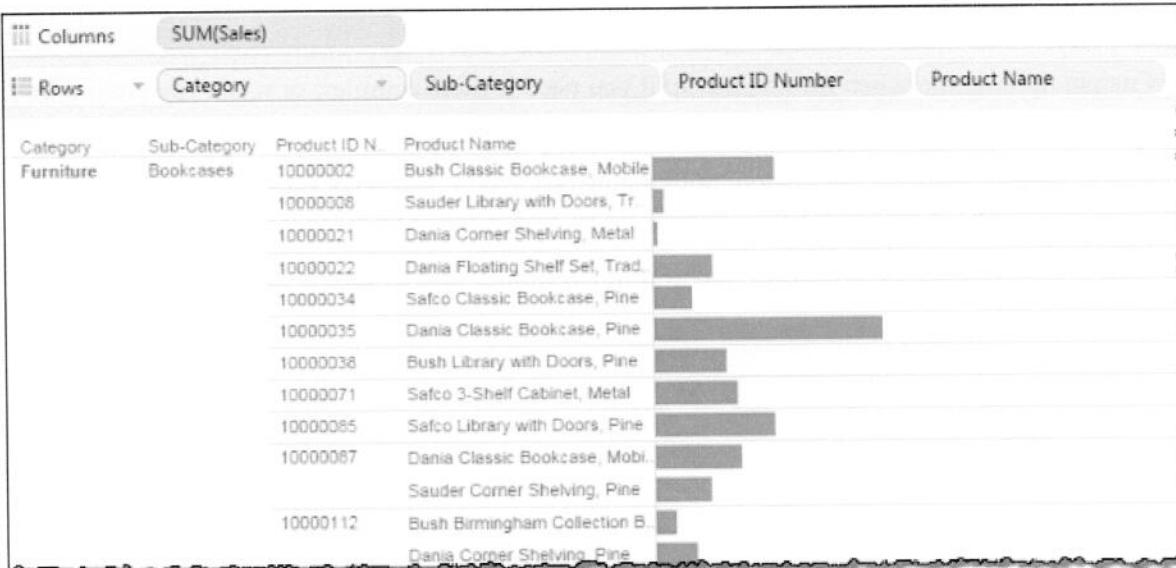
1. On the Data Source tab, click the drop-down arrow of the column to be split, and select **Custom Split**.
2. Enter a separator, and set the options for splitting off the columns.
  - If you choose **First** or **Last**, specify the number of columns to split. (For example, Split off First 2 columns, Split off Last 4 columns). You can split up to 10 columns.
  - If you choose **All**, the column will split into as many columns as needed (up to 10).
3. Click **OK**.

---

## Practice: Using Split

Open `Using_Split_Starter.twbx`, and use split to create three fields and a related view according to the following specification:

- The **City, State** field has been split into two fields: **City** and **State**.
- The **Product ID** field's last 8 digits are used in a new field called **Product ID Number**, created by a custom split.
- The new **City** field has a geographical role of **City**.
- A visualization has been created like the one shown, or you may create your own. This example could be used to identify product names that share the same ID number.



### Directions

1. Use **Split** to separate the **City, State** field into two fields named **City** and **State**.
2. Use **Custom Split** to create a field for only the **Product ID Number** at the end of the **Product ID** field.  
**TIP** For example, if the **Product ID** was TEC-MA-10000851, the **Product ID Number** for that row would be 10000851.
3. Use the **Metadata grid** to change the **City** field's geographical role to **City**.
4. Create the visualization shown above, or create your own.

### Solution

For the solution to this practice, see "Solution: Using Split" on page 224.

## Calculations Performed on the Database

Calculated fields are built directly into the query and processed by the database. Conceptually, they add a new column to your data set. If you have millions or billions of records, you should consider adding these calculated fields to the data table itself so they don't need to be calculated as needed.

In general, the calculations executed on a database through Tableau are either row by row, or aggregate.

### Row by Row

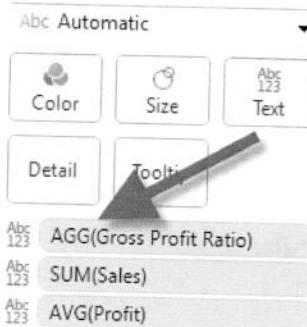
Also known as record-level calculations, row by row refers to calculations where Tableau is not pre-defining an aggregation for the data source to apply. The query is sent to the database directly, and the database calculates results for every record, row by row. The results are aggregated after the calculations have run and can then be customized locally in Tableau by right-clicking on the calculation once it is used in a view.

### Aggregate Calculations

If you want to analyze the overall gross margin for every product in your data source, or compute a weighted average, use an *aggregate* calculation. Aggregate calculations are written to compute within

entire columns of data in the data source, as opposed to individual records. Any fields that have an aggregation pre-defined in the calculation display as AGG([Field Name]) when dragged into a view.

#### Marks

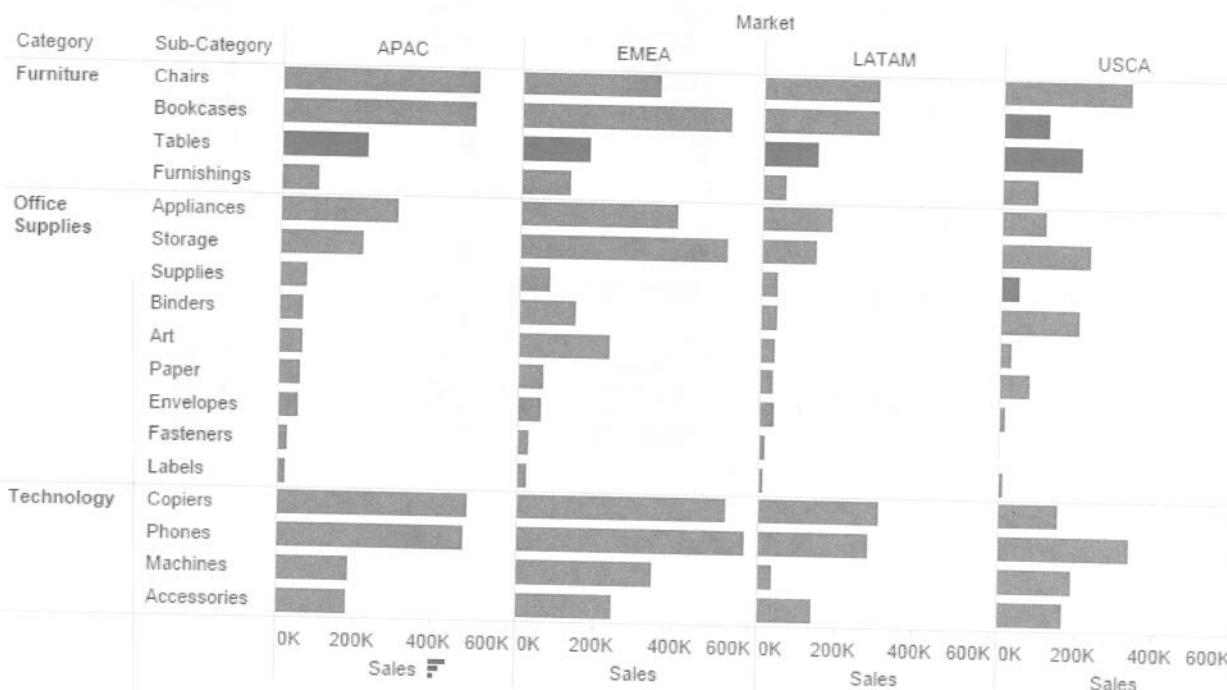


## Practice: Calculation and Aggregation in Overall Profitability

Open Calculations and Aggregations Profitability Starter.twbx and create two views according to the following specification:

### Overall Profitability View

- View shows Sales by Market, Category, and Sub-Category.
- Sales axis formatted to show currency by thousands (K) with no decimals.
- Uses a calculated field (Sum(Profit) is greater than 0), to define Color of marks (red = not profitable, gray = profitable).
- Values sorted by descending order in APAC Market.



**Directions**

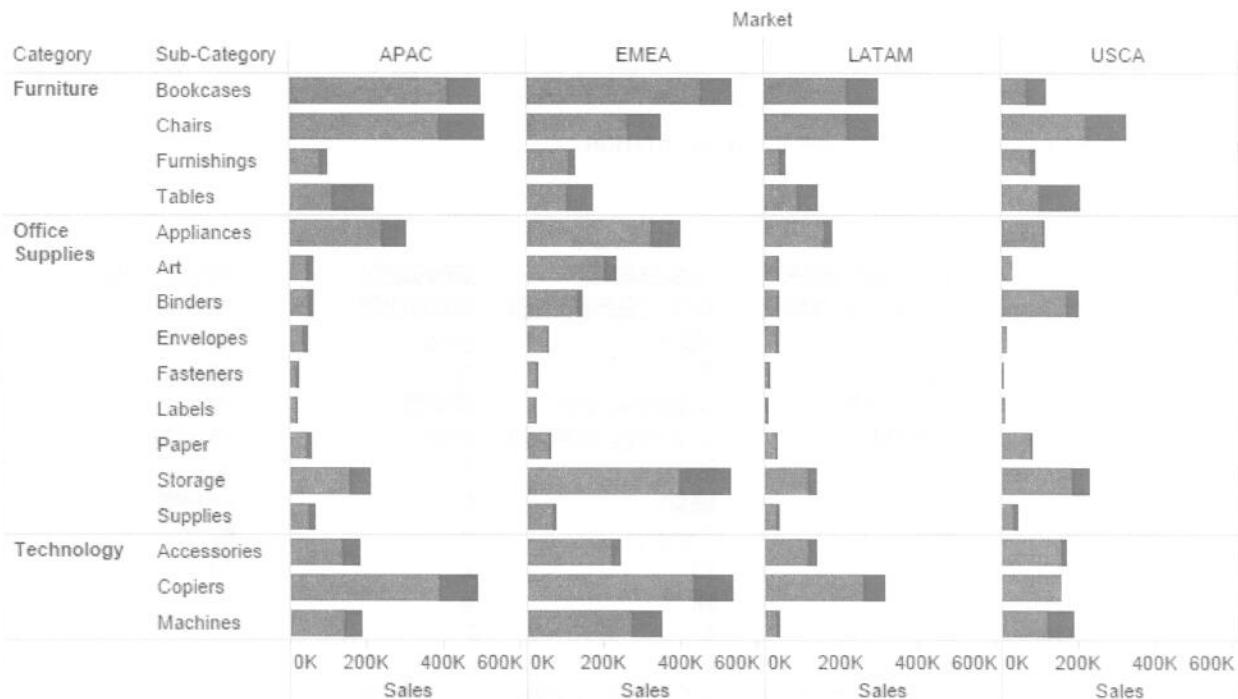
1. In the worksheet named Overall Profitability, build the view:

Drag this field	To
Sales	Columns
Market	Columns (LEFT of Sales)
Category	Rows
Sub-Category	Rows (RIGHT of Category)

2. Create a calculated field named "Profitable Overall?" with the following formula:  
 $\text{SUM}([\text{Profit}]) > 0$
3. From Measures, drag Profitable Overall? to Color on the Marks card.
4. In the color legend, define False as red, True as gray.
5. Sort by the APAC Sales axis in descending order.
6. Save the workbook.

**Profitability by Transaction**

- Uses view from previous steps.
- Uses a calculated field to show profitability by transaction and define Color of marks (red = not profitable, gray = profitable).



**Directions**

1. Duplicate the sheet Overall Profitability and name it Profitability by Transaction.
2. Create a calculated field:
  - Name: Profitable Transaction?
  - Define the Formula: `[Profit] > 0`
3. From Dimensions, drag Profitable Transaction? to Color on the Marks card.
4. In the color legend, define False as red, True as gray.
5. Save changes to the workbook.

**Solution**

For the solution to this practice, see "Solution: Calculation and Aggregation in Overall Profitability" on page 225.

## Aggregating Dimensions in Calculations

When writing Tableau Desktop calculations, you might see an error related to aggregated and non-aggregated data. You can avoid this error by applying the same level of aggregation to all components of the calculation. This is true for both measures and dimensions.

You need an aggregate dimension when:

- Blending multiple sources in which the dimensions do not have a consistent level of detail.
- Requesting that a dimension member be returned when you are aggregating elsewhere in the calculation.

### Functions for Aggregating Dimensions

Here are a few options for aggregating dimensions.

Function	Description
MIN	Returns the minimum of 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.
MAX	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.
ATTR	Returns the value of the expression if it has a single value for all rows. Otherwise returns an asterisk. Null values are ignored.

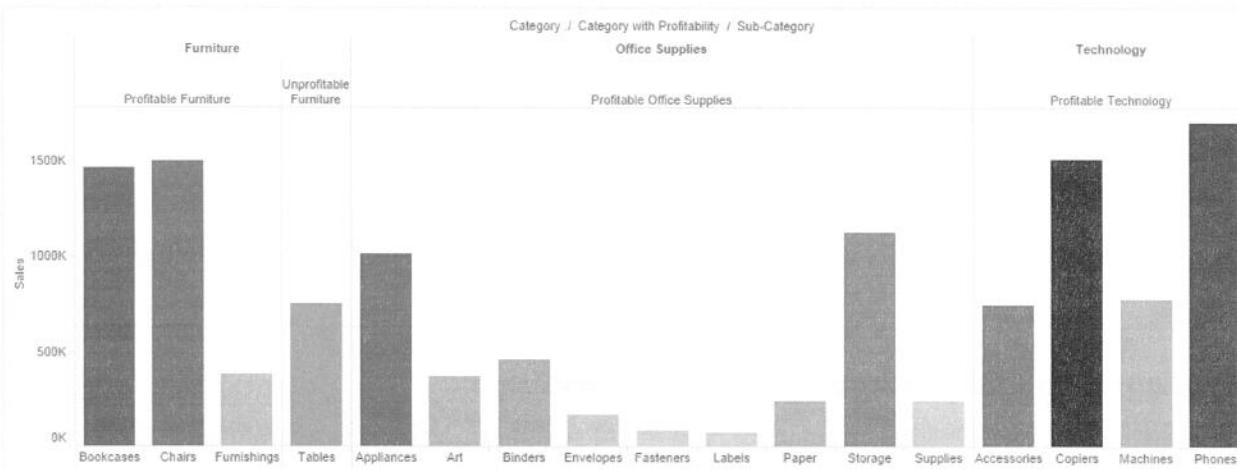
In general, using MIN and MAX yields better performance; however, ATTR is useful for working with multiple data sources.

---

## Practice: Aggregating Dimensions in Calculations

Open Aggregating Dimensions in Calculations Starter.twbx and create a view according to the following specification:

- View shows Sales on Rows, Category and Sub-Category on Columns, and Profit in color.
- Uses calculated field named "Category with Profitability" that tests for profitability, then concatenates "Profitable" or "Unprofitable" with the Category, depending on the status.



### Directions

- Create the view:

Drag this field	To
Sales	Rows
Category	Columns
Sub-Category	Columns (to RIGHT of Category)
Profit	Color on the Marks card

- Create a calculated field called "Category with Profitability" that uses this calculation:

```
IF SUM([Profit]) > 0 THEN "Profitable " + MIN([Category])
ELSE "Unprofitable " + MIN([Category])
END
```

This calculation tests for profitability, and then concatenates either "Profitable" or "Unprofitable" with the Category, depending on the result.

- Move the new calculation to Columns, between Category and Sub-Category.
- Save the workbook.

### Solution

For the solution to this practice, see "Solution: Aggregating Dimensions in Calculations" on page 226.

## Level of Detail (LOD) Calculations

*Level of detail* refers to the granularity or aggregation of the data in your view. LOD (level of detail) calculations give you more precise control over the granularity or aggregation levels shown in your view.

LOD calculations are useful for looking at data that might otherwise be misleading when aggregated. Use LOD calculations for:

- Cohort analysis
- Totals and averages across segments
- Aggregates of aggregates
- Binning aggregates

LOD calculations, unlike table calculations, are calculated using data source level queries, which is important to keep in mind when considering performance.

FIXED LOD calculations always aggregate to the level of detail specified in the expression.

EXCLUDE and INCLUDE LOD calculations behave **relative to** the view's current level of detail.

## Syntax and Calculation Types

Syntax structure:

{Keyword [Column1], [Column2], [ColumnN]: Aggregate Expression}

For example:

{**FIXED** [State]:**SUM**([Sales])}

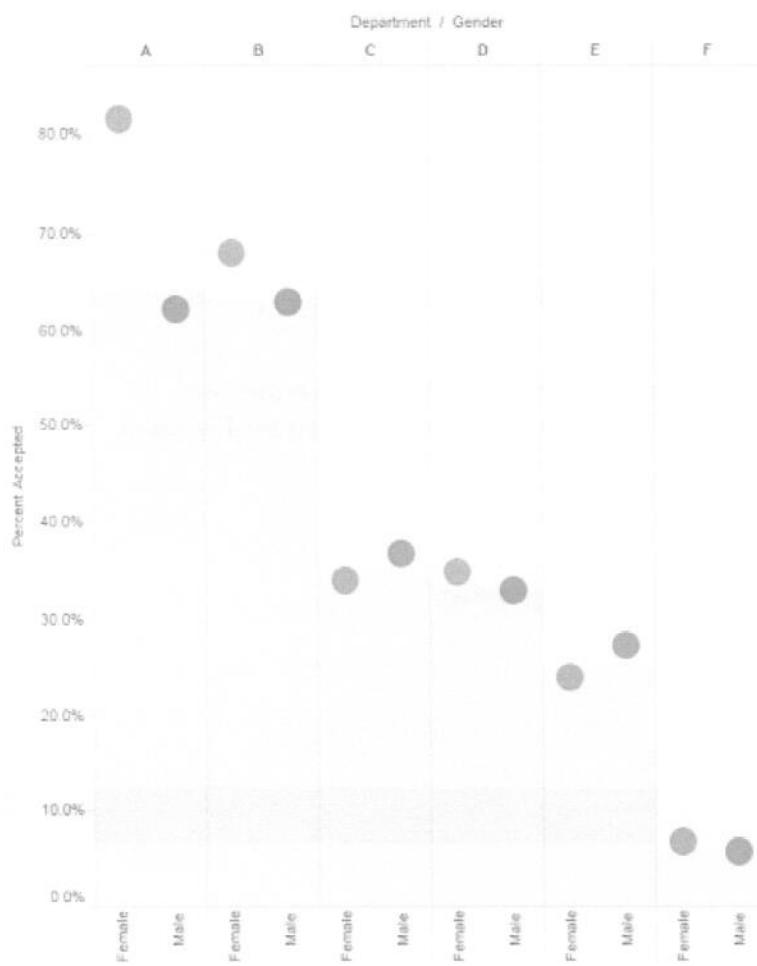
There are three different LOD calculation keywords.

Keyword	Description	Example
Fixed	Allows you to specify the aggregation or granularity independent of the fields used in the level of detail of the visualization.	AVG({ <b>FIXED</b> [State]: <b>SUM</b> ([Sales])}) Total sales for each state, averaged across all states.
Include	Calculates results at a level less aggregated than the visualization's level of detail.	{ <b>INCLUDE</b> [City]: <b>SUM</b> ([Sales])} Sum of Sales, including the City level of detail.
Exclude	Calculates results at a level more aggregated than the visualization's level of detail.	{ <b>EXCLUDE</b> [City]: <b>SUM</b> ([Sales])} Sum of Sales, excluding the City level of detail.

## Practice: Using LOD Calculations

Open **Using LOD Calculations Starter.twbx** and investigate a case of potential gender bias by creating a view according to the following specification:

- Shows Female and Male acceptance rates by Department.
- Includes a reference line with a light gray Fill Below color that shows the overall acceptance rate for each department (excluding Gender).



#### Directions

1. Duplicate the first sheet in the workbook and name the duplicate sheet "Admissions by Department and Gender". Note that males are accepted into this school at a higher rate than females.
2. Add **Department** to the visualization to get a comparison of acceptance rates per department.
3. Create a level of detail calculation called "Percent Accepted Excluding Gender", using the following formula:  
 $\{EXCLUDE [Gender]:[Percent Accepted]\}$
4. Change the **Default Number Format** of the level of detail calculation to a percentage with 1 decimal place.
5. From **Measures**, drag **Percent Accepted Excluding Gender** to **Detail** on the **Marks** card. NOTE This adds the calculation to the view so it can be used in a reference line.
6. Add a reference line that uses the **Percent Accepted Excluding Gender** calculation per pane, with no **Label**, no **Line**, no **Fill Above** value, and a light gray **Fill Below** color.
7. Change the mark type to **Circle**.

NOTE When broken down by department, the prominent bias toward male acceptance is no longer there. Departments A and B actually accepted a high percentage of females. However, only a small

number of females applied to those departments, so the overall percentage of females accepted across all departments was much smaller than that of males.

### Solution

For the solution to this practice, see "Solution: Using LOD Calculations" on page 226.

---



# 13. Analyzing Data with Quick Table Calculations

---

This module contains the following:

Using Quick Table Calculations

Practice: Running Total of Sales

Practice: Year over Year Change

---



## Using Quick Table Calculations

Quick table calculations are predefined computations that can be run against the data in your view. Select the drop-down menu on the measure you want to use for the calculation and then select the type of quick table calculation to use.

Quick table calculations use a default direction for operations, such as "Table (across)". They also use a default comparison type, such as the measure compared to the "previous" cell. You can change the direction with the **Compute Using** context menu, and change the comparison using the **Relative To** context menu.

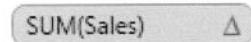
Descriptions are based on default behavior.

Quick Table Calculation	Description
Running total	Adds totals across the table.
Difference	Calculates the difference from previous column, across a table.
Percent difference	Calculates the percent difference from previous column, across a table.
Percent of total	Calculates the values percent of the total sum in a table.
Rank	Calculates the integer rank of the value across the table.
Percentile	Calculates the statistical percentile of the value across the table.
Moving average	Calculates the average value based on a range around the current value. Used to smooth short term fluctuations.
YTD Total	Calculates the running total from the beginning of the year across the table.
Compound growth rate	Calculates the current value as a percentage from the first value.
Year over year growth	Calculates a percentage for the current value compared to the same period in the previous year.
YTD Growth	Calculates a percentage change from the same time period in the previous year and then calculates a running total over a year.

### Add a Quick Table Calculation

- On a measure field in a view, click the drop-down menu, select **Quick Table Calculation**, and choose the calculation type.

A field used in a table calculation displays with an icon:



### Edit a Quick Table Calculation

Click the drop-down menu on the field with the table calculation icon, and do one of the following:

- Change the **Compute Using** option: Allows you to change the computation from the default to another option, for example, Table (Down) or Pane (Down). Options are contextual.

- **Edit Table Calculation:** Opens the Edit Table Calculation dialog box, which has more editing options.

## Practice: Running Total of Sales

Open `Running_Total_of_Sales_Starter.twbx` and use the `Quarterly Sales by Department` sheet to create a view according to the following specification:

- Use a crosstab to show **Sales** and **Running Total** by **Department** and then **Quarter**.

Department	Quarter of O..	Sales				Running Sum of Sales along Pane (Down)			
		2010	2011	2012	2013	2010	2011	2012	2013
Furniture	Q1	\$466,226	\$360,948	\$408,633	\$521,013	\$466,226	\$360,948	\$408,633	\$521,013
	Q2	\$449,053	\$399,147	\$476,654	\$499,022	\$915,278	\$760,096	\$885,287	\$1,020,035
	Q3	\$432,342	\$516,708	\$619,161	\$1,068,368	\$1,347,620	\$1,276,804	\$1,504,448	\$2,088,404
	Q4	\$738,936	\$791,899	\$1,201,270	\$1,088,434	\$2,086,557	\$2,068,703	\$2,705,718	\$3,176,838
Office Supplies	Q1	\$195,715	\$274,363	\$300,340	\$408,272	\$195,715	\$274,363	\$300,340	\$408,272
	Q2	\$356,473	\$331,250	\$319,913	\$589,558	\$552,188	\$605,613	\$620,253	\$997,830
	Q3	\$407,397	\$359,484	\$425,434	\$607,058	\$959,585	\$965,098	\$1,045,687	\$1,604,888
	Q4	\$586,254	\$634,563	\$639,617	\$1,076,129	\$1,545,839	\$1,599,661	\$1,685,304	\$2,681,016
Technology	Q1	\$598,936	\$311,402	\$471,326	\$681,141	\$598,936	\$311,402	\$471,326	\$681,141
	Q2	\$298,971	\$577,070	\$536,662	\$801,433	\$897,907	\$888,472	\$1,007,988	\$1,482,574
	Q3	\$728,095	\$698,549	\$748,776	\$1,086,193	\$1,626,002	\$1,587,021	\$1,756,764	\$2,568,767
	Q4	\$877,384	\$1,144,912	\$1,250,775	\$1,708,320	\$2,503,386	\$2,731,933	\$3,007,539	\$4,277,087

### Directions

1. Edit **Sales** so that it shows the **Running Sum of Sales**.

**NOTE** If you use Quick Table Calculation, the **Running Total** defaults to run across the rows instead of down the columns. If it can't run across the rows, then it will default to run down the columns.

2. Ensure that **Running Total** is computed with the total calculated down each column, restarting for each new **Department**.
3. Add **Sales** to the view so that it is before **Running Total**.
4. Move the **Measure Names** field to the left of **Order Date**.
5. Save the workbook.

### Solution

For the solution to this practice, see "Solution: Running Total of Sales" on page 227.

## Practice: Year over Year Change

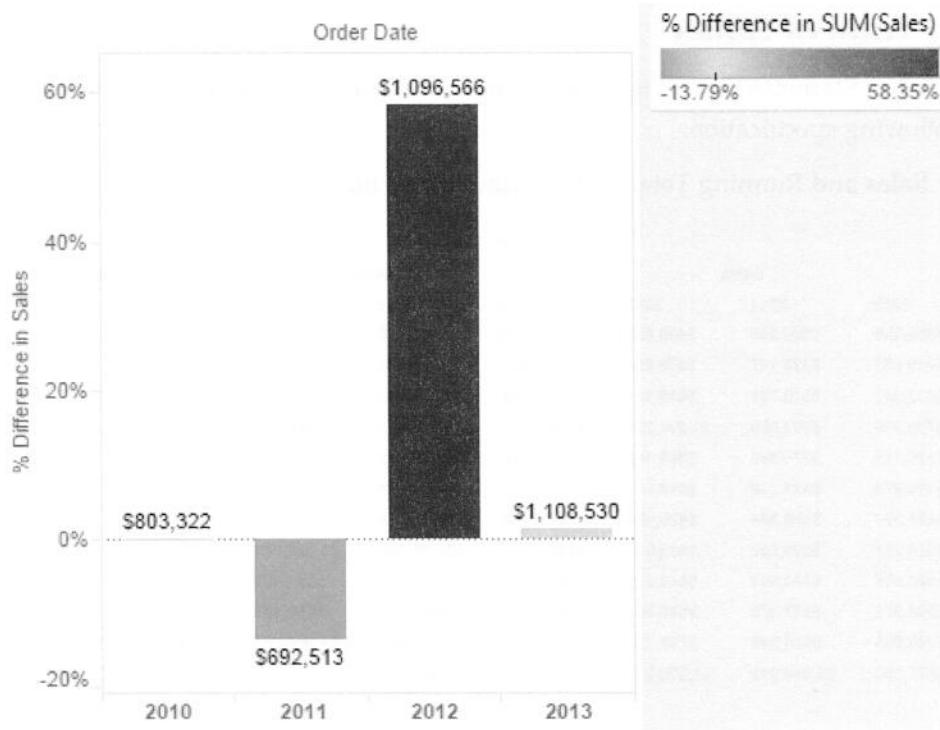
Open `Year_over_Year_Change_Starter.twbx` and create a view according to the following specification:

- Shows **Sales** by **Year of Order Date** as a label
- Shows **Year over Year Growth of Sales** as a bar chart.
- Filters the view to show only the results for **Tables**.

## Using Tableau Desktop

---

- Uses Color encoded bars with the % Difference.
- Shows nulls at the default position.



### Directions

1. Create the initial view:

Drag this field	To
Order Date	Columns

2. Add Sales to Rows, and show it as Year over Year growth.
3. On the Marks card, change the mark type for Year over Year Sales to Bar.
4. Show the amount of change year over year using color.
5. Filter the view to show only the Tables Category.
6. Drag another instance of Sales to Label.
7. Set the Null values to show at the default position.

### Solution

For the solution to this practice, see "Solution: Year over Year Change" on page 228.

---

# 14. Advanced Table Calculations

---

This module contains the following:

- Table Calculation Scope and Direction
  - Null Values in Table Calculations
  - Practice: Profitability as a Percent of Total
  - Table Calculations for Statistical Analysis
  - Practice: Moving Average
-

## Table Calculation Scope and Direction

You can control the order of calculation when you assign a specific direction as well as defining the area where the calculation is performed (scope). The following example shows the default behavior, which uses SUM(Sales) with the Quick Table Calculation “Percent of Total” applied:

Category	Sub-Category	Order Date				Grand Total
		2011	2012	2013	2014	
Furniture	Bookcases	17.69%	21.68%	25.64%	34.99%	100.00%
	Chairs	19.03%	19.65%	28.47%	32.86%	100.00%
	Furnishings	16.58%	21.12%	29.00%	33.20%	100.00%
	Tables	19.44%	21.67%	26.73%	32.16%	100.00%
	<b>Total</b>	18.39%	20.89%	27.19%	33.52%	100.00%
Office Supplies	Appliances	17.15%	22.05%	25.22%	35.58%	100.00%
	Art	17.24%	22.13%	26.34%	34.29%	100.00%
	Binders	18.63%	20.22%	26.21%	34.73%	100.00%
	Envelopes	16.58%	22.24%	29.73%	31.65%	100.00%
	Fasteners	16.35%	23.40%	25.94%	34.31%	100.00%
	Labels	18.53%	21.14%	25.04%	35.37%	100.00%
	Paper	17.47%	21.09%	28.88%	32.58%	100.00%
	Storage	19.24%	20.28%	27.48%	34.02%	100.00%
	Supplies	19.57%	27.81%	27.12%	35.50%	100.00%
	<b>Total</b>	17.84%	20.99%	26.66%	34.46%	100.00%
Technology	Accessories	15.14%	23.81%	28.01%	33.83%	100.00%
	Copiers	14.59%	21.67%	27.55%	36.46%	100.00%
	Machines	20.61%	20.52%	25.46%	33.41%	100.00%
	Phones	19.78%	21.33%	26.57%	32.34%	100.00%
	<b>Total</b>	17.44%	21.57%	26.82%	34.06%	100.00%
<b>Grand Total</b>		17.87%	21.18%	26.94%	34.01%	100.00%

The default direction of table calculations is Across the rows, giving each row a Grand Total of 100%.

If you select the measure field in the view and choose “Edit Table Calculation”, you can keep the scope as Table, but change the direction to “Down”, which provides different results for the percent totals:

Category	Sub-Category	Order Date				<b>Grand Total</b>
		2011	2012	2013	2014	
Furniture	Bookcases	11.48%	11.68%	11.04%	11.94%	11.60%
	Chairs	12.65%	11.92%	12.55%	11.47%	11.88%
	Furnishings	2.83%	3.06%	3.28%	2.98%	3.05%
	Tables	6.51%	6.12%	5.94%	5.86%	5.99%
	<b>Total</b>	33.47%	32.08%	32.82%	32.05%	32.52%
Office Supplies	Appliances	7.67%	8.33%	7.49%	8.37%	8.00%
	Art	2.64%	3.08%	2.88%	2.97%	2.94%
	Binders	3.85%	3.49%	3.56%	3.73%	3.65%
	Envelopes	1.24%	1.42%	1.49%	1.26%	1.35%
	Fasteners	0.60%	0.73%	0.63%	0.66%	0.66%
	Labels	0.60%	0.58%	0.54%	0.60%	0.58%
	Paper	1.89%	1.92%	2.07%	1.83%	1.93%
	Storage	9.10%	8.54%	9.09%	8.92%	8.92%
	Supplies	2.11%	1.62%	1.94%	2.01%	1.92%
	<b>Total</b>	29.90%	29.70%	29.68%	30.36%	29.96%
Technology	Accessories	5.02%	6.44%	6.16%	5.90%	5.93%
	Copiers	9.58%	12.22%	12.20%	12.20%	11.94%
	Machines	7.11%	5.97%	5.82%	6.06%	6.16%
	Phones	14.88%	13.60%	13.32%	12.84%	13.50%
	<b>Total</b>	38.63%	38.22%	37.50%	37.59%	37.53%
<b>Grand Total</b>		100.00%	100.00%	100.00%	100.00%	100.00%

If you change the table calculation to assign the scope to Pane, the percent totals are calculated for each pane separately:

Category	Sub-Category	Order Date				Grand Total
		2011	2012	2013	2014	
Furniture	Bookcases	34.30%	37.02%	33.64%	37.24%	35.68%
	Chairs	37.70%	34.35%	38.25%	35.80%	36.53%
	Furnishings	8.45%	9.52%	10.00%	9.29%	9.38%
	Tables	19.46%	19.10%	18.10%	17.67%	18.42%
<b>Total</b>		<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>
Technology	Accessories	13.71%	16.84%	16.43%	15.68%	15.79%
	Copiers	26.14%	31.87%	32.63%	34.06%	31.81%
	Machines	19.40%	15.62%	15.53%	16.10%	16.42%
	Phones	40.75%	35.57%	35.51%	34.16%	35.87%
<b>Total</b>		<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>
Office Supplies	Appliances	25.00%	28.04%	25.22%	27.50%	29.70%

If necessary, you can save the calculation to edit it even further:

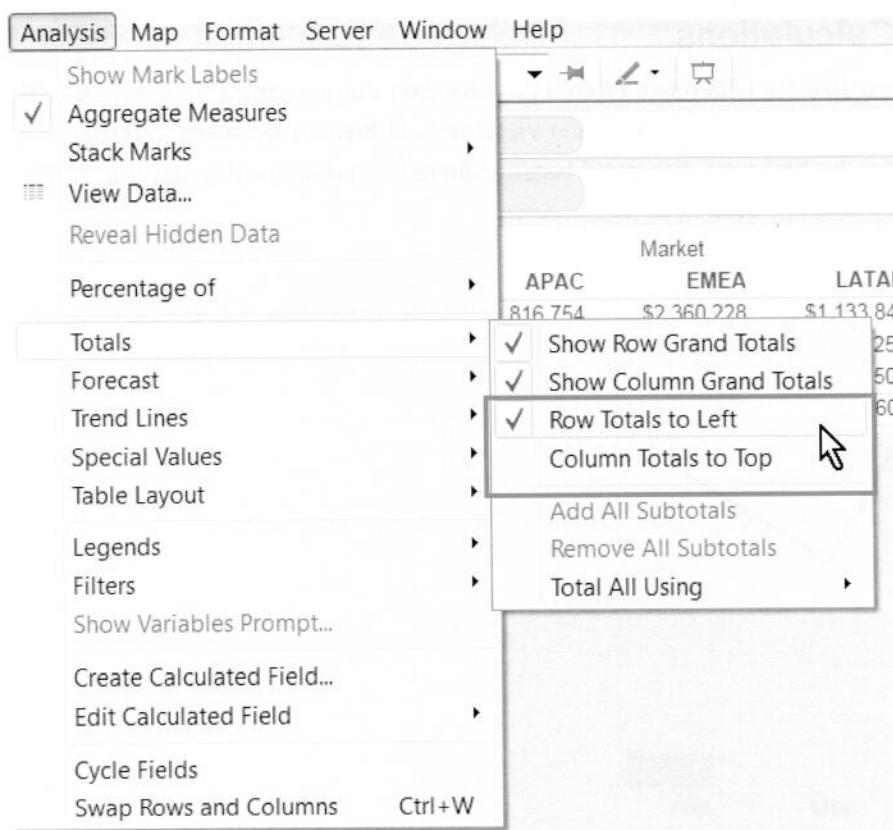
1. CTRL + drag the measure with the table calculation applied from the worksheet to the Data pane.
2. In the **Rename Field** dialog box, name the calculation.
3. Right-click the calculated field you just created, and click **Edit**.

Locally-computed calculations give you more flexibility in controlling the logic, which is not always available when calculations are performed at the data source.

## Total and Subtotal Position

Segment	APAC	EMEA	LATAM	USCA	Market	<b>Grand Total</b>
Consumer	\$1,816,754	\$2,360,228	\$1,133,847	\$1,197,120		\$6,507,949
Corporate	\$1,078,466	\$1,375,519	\$645,252	\$725,460		\$3,824,698
Home Office	\$690,524	\$792,277	\$385,506	\$441,548		\$2,309,855
<b>Grand Total</b>	<b>\$3,585,744</b>	<b>\$4,528,024</b>	<b>\$2,164,605</b>	<b>\$2,364,129</b>		<b>\$12,642,502</b>

By default, Tableau places totals and subtotals to the right or the bottom of the view. You can change the position so that totals appear to the left or the top of the view.



On the **Analysis** menu, click **Totals**, and then check or clear **Row Totals to Left** or **Column Totals to Top** to change the position of your totals.

Segment	Grand Total	APAC	EMEA	LATAM	Market
Consumer	\$6,507,949	\$1,816,754	\$2,360,228	\$1,133,847	\$1,197,120
Corporate	\$3,824,698	\$1,078,466	\$1,375,519	\$645,252	\$725,460
Home Office	\$2,309,855	\$690,524	\$792,277	\$385,506	\$441,548
Grand Total	\$12,642,502	\$3,585,744	\$4,528,024	\$2,164,605	\$2,364,129

*Row grand totals on left side of view.*

## Addressing and Partitioning

To create a table calculation, you need to define both what you want to compute and what to compute along. For example, to define a running sum calculation for several years, you compute a running sum along the Date field. Both what to compute and how to compute it are defined in the calculated field dialog box using the **Calculation Type** and **Calculate Along** drop-down menus.

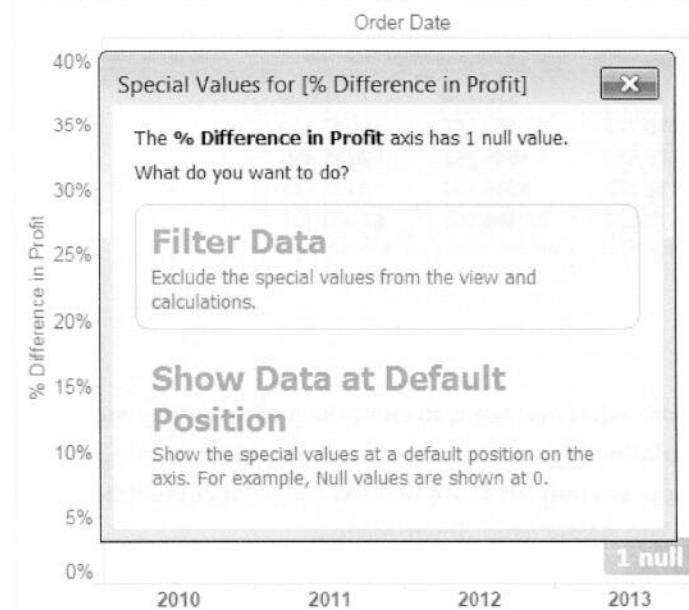
The definition of what to compute along has two parts: addressing fields and partitioning fields. The addressing fields define what part of the table you are computing along. The partitioning fields define how to group the calculation. You can specify the addressing in the **Table Calculation** dialog box. The addressing can be relative to the table structure or a specific field.

## Null Values in Table Calculations

When viewing Table Calculations like "% Difference From", the first data value in the visualization will often be null, which may be misleading. For example, when viewing % Difference by years, Tableau cannot calculate the difference for the first year displayed because there is no data for the first year to be compared.



**NOTE** Excluding the first year will not work, as it creates a filter at the database level, which means the null value still exists but is pushed down to the following year.



Based on the scenario described above, you could do the following for null values:

Option	Description
Hide the first year (Right-click on the first year header, and choose <b>Hide</b> )	This does not filter the result from the database, but the first value is returned in the result set and available for table calculations. After it is used for calculations, it is hidden from the visual result. However, when showing actuals as well as % of change in the same visualization, the actual value for the first year would be hidden as well.
Click on the Null Indicator to <b>Filter Data</b> (see graphic)	<b>Filter Data</b> removes the null values from the view, which also removes the year header. This is a filter based on the values within the Table Calculation field. You can also right-click on the field in the view, select <b>Filter</b> , then <b>Special</b> , and choose <b>Non-null Values</b> .
Click on the Null Indicator to <b>Show Data at Default Position</b> (see graphic)	<b>Show Data at Default Position</b> will format nulls to be mapped to 0. Careful when using this option as it could potentially misrepresent the data, implying that there is a 0 value as opposed to missing values. This option can also be found by right-clicking on the Table Calculation field in the view and choosing <b>Format &gt; Pane &gt; Special Values &gt; Show at Default Value</b> .
Hide Nulls (Right-click the Null Indicator, and choose <b>Hide Indicators</b> )	Hiding the nulls in the view means not only are the values hidden but also the indicator for null values goes away. This can be done from the <b>Format</b> menu of the Table Calculation field by choosing <b>Format &gt; Pane &gt; Special Values &gt; Hide (Break Lines) OR Hide (Connect Lines)</b> . Right-clicking the Null Indicator in the view and choosing <b>Hide Indicator</b> defaults to <b>Hide (Break Lines)</b> .

## Practice: Profitability as a Percent of Total

Open **Profitability as Percent of Total Starter.twbx** and create a view according to the following specification:

- View shows **Order Date** as discrete Year, and **Sales** on Columns, **Category** and **Sub-Category** on Rows.
- Uses a calculated field to evaluate profit or loss for each record.
- Uses a table calculation to edit **Sales** to calculate a percent of total, and defines the scope to show each combination of **Sub-Category** and **Year** as 100%.

Category	Sub-Category	Order Date							
		2011		2012		2013		2014	
Furniture	Bookcases	78.39%	21.61%	78.01%	21.99%	79.17%	20.83%	80.72%	
	Chairs	73.94%	26.06%	73.87%	26.13%	73.34%	26.66%	72.18%	27.82%
	Furnishings	79.79%	20.21%	81.87%		81.33%		80.71%	
	Tables	55.18%	44.82%	57.80%	42.20%	54.83%	45.17%	50.25%	49.75%
Office Supplies	Appliances	83.36%		81.40%		85.90%		82.47%	
	Art	85.89%		85.22%		85.92%		85.48%	
	Binders	83.39%		85.25%		84.84%		85.13%	
	Envelopes	83.67%		85.03%		85.56%		82.57%	
	Fasteners	82.64%		83.75%		81.14%		80.67%	
	Labels	88.78%		86.50%		86.67%		84.77%	
	Paper	91.25%		87.23%		88.98%		90.49%	
	Storage	75.03%	24.97%	74.86%	25.14%	78.80%	21.20%	77.95%	22.05%
Technology	Supplies	86.10%		80.34%	19.66%	78.15%	21.85%	75.99%	24.01%
	Accessories	82.05%		88.42%		85.63%		85.29%	
	Copiers	81.63%		79.14%	20.86%	82.76%		85.30%	
	Machines	58.08%	41.92%	78.24%	21.76%	79.12%	20.88%	77.50%	22.50%
	Phones	87.66%		86.03%		81.67%		83.81%	
		0%	50%	100%	0%	50%	0%	50%	100%
		% of Total Sales		% of Total Sales		% of Total Sales		% of Total Sales	

## Directions

- In the Profitability as % of Total worksheet, create the view:

Drag this field	To
Sales	Columns
Order Date	Columns (place LEFT of Sales)
Category	Rows
Sub-Category	Rows (place RIGHT of Category)

- Create a calculated field named "Profit or Loss":

```
IF [Profit] > 0 THEN "Profit"
ELSE "Loss"
END
```

- Right-click on the Sales field and select Add Table Calculation.

- Calculation Type: Percent of Total
- Summarize the values from: Cell

- Drag the "Profit or Loss" calculation to Color on the Marks card.

- Control-drag to move a copy of **SUM(Sales △)** from Columns to Label on the Marks card.

- Save the changes to the workbook.

## Solution

For the solution to this practice, see "Solution: Profitability as a Percent of Total" on page 228.

## Table Calculations for Statistical Analysis

You can create and use table calculations for statistical analysis.

Table calculation	Used for
Moving Average	Smoothing short-term fluctuations in data to display clearer long-term trends.
Percentile	Computing percentiles for a set of values.

### Add a Table Calculation

1. On the drop-down menu of the field you want to use for the calculation, choose **Add Table Calculation**.
2. In the **Table Calculation** dialog box, select the **Calculation Type**.
3. Set the applicable options as described below.

**NOTE** The options that display in the **Table Calculation** dialog box vary according to the selected calculation type.

#### Moving Average

Field	Setting
Calculation Type	Moving Calculation
Summarize values using	Average
Moving along	Options are based on the visualization. For a typical crosstab, you can start with Table (Across).
Previous values	Indicate how many values to use before the current value when running the calculation.
Next values	Indicate how many values to use after the current value when running the calculation.
Include current value	Check to include the current value in the calculation.
Null if there are not enough values	Some points in the final view will be null when there are not enough values to create the moving calculation.
Perform secondary calculation on the result	Select to run an addition calculation on the result, like converting a value to percent of total. Window expands for you to add second calculation.

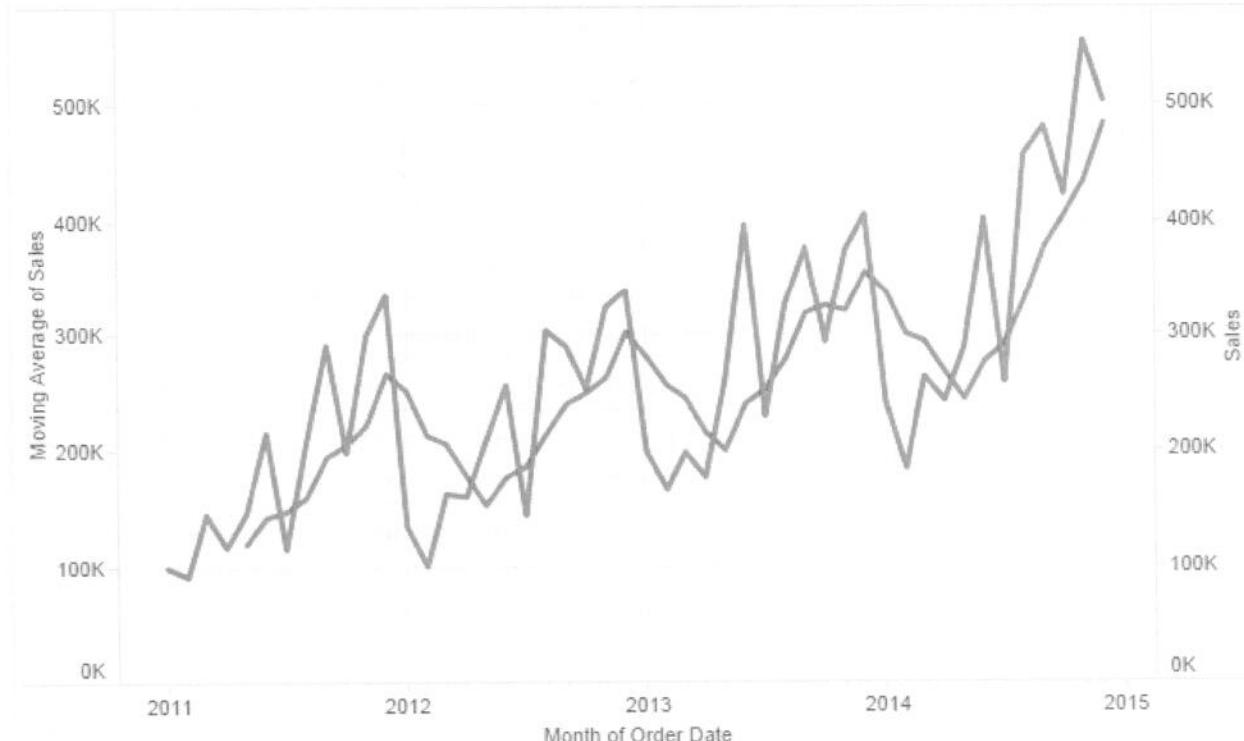
**Percentile**

Field	Setting
Calculation Type	Percentile
Running along	Table (Across). This is the default setting, but you can change this.
Sort by	Measure used for calculation.
Sort order	Choose Descending or Ascending.

**Practice: Moving Average**

Open **Moving Average Starter.twbx** and create a view according to the following specification:

- Create the initial view with Sales and Order Date as a continuous month.
- Perform a table calculation on **Sales** so it returns a moving average.
- Drag another iteration of **Sales** to **Rows**, and then change the view to a dual axis so the two lines are in the same pane.
- Synchronize the axes.
- Format the pane for the moving average of **Sales** to hide nulls.



---

**Directions**

1. Create the initial view:
  - From **Measures**, drag **Sales** to **Rows**
  - From **Dimensions**, drag **Order Date** to **Columns**
  - Right-click on the **Order Date** field on the **Columns** shelf and change it to a continuous Month Moving Average, using the following options:
    - Calculation Type: **Moving Calculation**
    - Summarize values using: **Average**
    - Moving along: **Table (Across)**
    - Previous values: 4
    - Next values: 0
    - Null if there are not enough values: checked on
2. On **Rows**, right-click on the field for **Sales**, and use **Add Table Calculation** to present **Sales** as a Moving Average, using the following options:
  - Calculation Type: **Moving Calculation**
  - Summarize values using: **Average**
  - Moving along: **Table (Across)**
  - Previous values: 4
  - Next values: 0
  - Null if there are not enough values: checked on
3. From **Measures**, drag another copy of **Sales** to **Rows** after the Moving Average. This will create two separate panes for the view.
4. On **Rows**, right-click on the second **Sales** field and choose **Dual Axis** to combine the lines to a single view, colored by **Measure Names**.
5. Right-click on the **Sales** axis, and then click **Synchronize Axis**.
6. On **Rows**, right-click on the field for **Moving Average of Sales** and choose **Format**.
7. In the **Format** window on the left, on the **Pane** tab, under **Special Values**, on the **Marks** list, choose **Hide (Break Lines)**, which will remove the null indicator, but not show the nulls at the default value of 0. Tip: You may instead right-click the null indicator and choose **Hide Indicator**.
8. Save the workbook.

**Solution**

For the solution to this practice, see "Solution: Moving Average" on page 229.

---



# 15. Highlighting Data with Reference Lines

---

This module contains the following:

Using Reference Lines

Reference Bands

Practice: Reference Lines

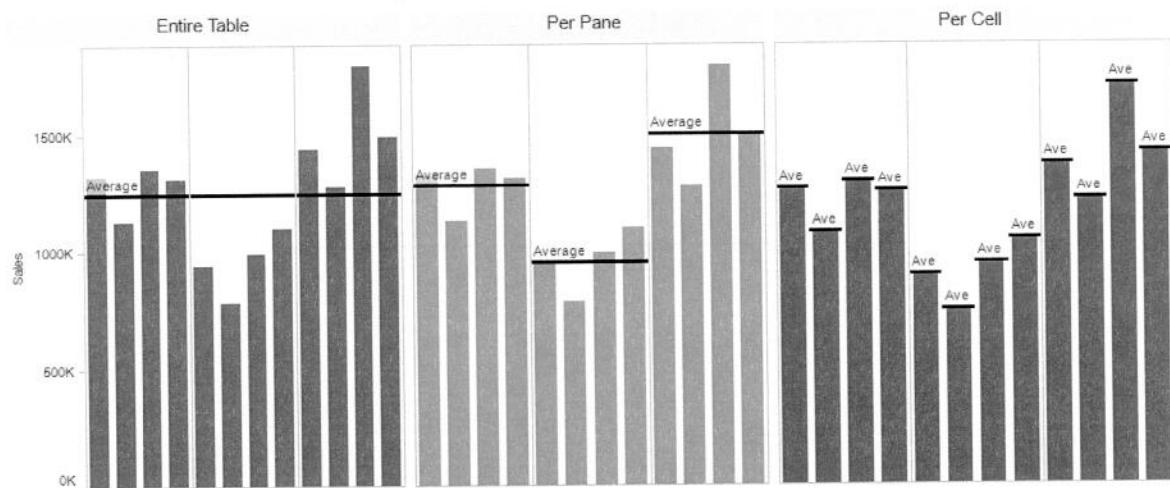
---

## Using Reference Lines

Reference lines mark specific values or regions on an axis based on constant or computed values. For example, if you are analyzing the monthly sales for several products, a reference line added to the average sales mark shows how each product performed against the average. Computed values can be based on a specified measure field, as long as the field is used somewhere in the worksheet.

Most of the functions are calculated locally on the data that is already in the view.

You can set the reference line scope to Entire Table, Per Pane, or Per Cell (see below):



### Add a Reference Line

1. Right-click on the axis to be used for the reference line, and choose **Add Reference Line**.
2. On the Add Reference Line dialog box, choose **Line**.
3. Under **Scope**, specify **Entire Table**, **Per Pane**, or **Per Cell** (see graphic above for example).
4. Under **Line**, set the **Value** computation to mark on the axis. You can select from the following options:

Option	Description
Average	Places a line at the average value along the axis
Constant	Places a line at the specified value on the axis
Maximum	Places a line at the maximum value
Median	Places a line at the median value
Minimum	Places a line at the minimum value
Sum	Places a line at the SUM of all the values in either the cell, pane, or entire view
Total	Places a line at the aggregate of all the values in either the cell, pane, or the entire view

5. Select how you want to label the line:

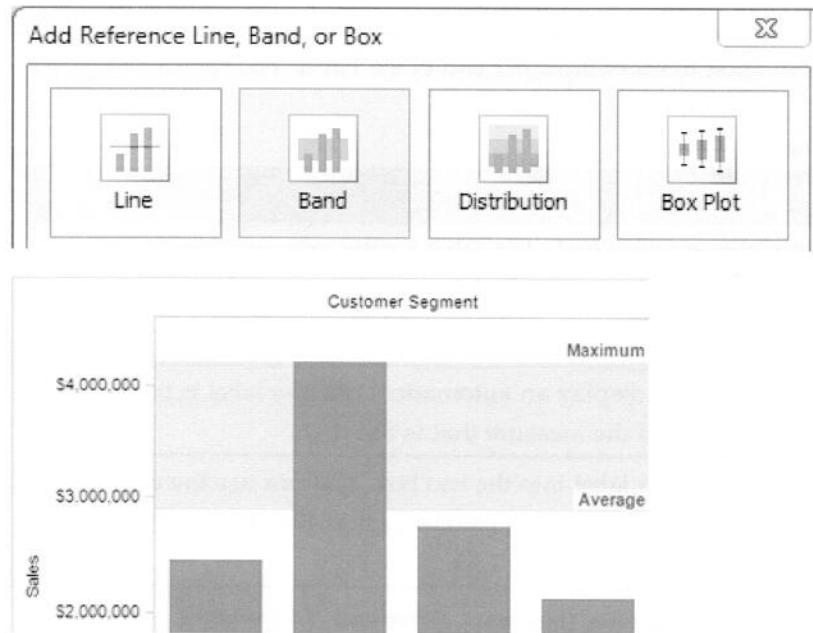
Option	Description
None	Does not include a label for the reference line
Value	Includes a label that corresponds to value on the axis
Computation	Displays an automatic label based on the computation and the measure selected
Custom	Adds a custom label to the text box (Use the menu to the right of the text box to insert values such as the computation or the value.)

6. Format the line using the options shown on the dialog box, and click OK.

## Reference Bands

Reference bands show data that falls within a certain window value, and display as shaded areas between two constant or computed values. You can use the same computed values used for reference lines.

Most of the functions are calculated after data is returned.



### Add a Reference Band

1. Right-click on the axis to be used for the reference line, and choose Add Reference Line.
2. On the Add Reference Line dialog box, choose Band.
3. Under Scope, specify Entire Table, Per Pane, or Per Cell.
4. Under Band From, set the Value computation to mark on the axis. You can select from the following options:

Option	Description
Average	Places a band at the average value along the axis
Constant	Places a band at the specified value on the axis
Maximum	Places a band at the maximum value
Median	Places a band at the median value
Minimum	Places a band at the minimum value
Sum	Places a band at the sum of all the values in either the cell, pane, or entire view
Total	Places a band 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 that uses a custom aggregation. The total is computed using the underlying data and behaves the same as selecting one of the totals options on the Analysis menu. If "Total All Using" has been assigned, the function applied matches the one that has been selected.

- Under **Band To**, set the **Value** computation to mark the other end of the band. You can use the same options as described in step 4.
- Select how you want to label the line:

Option	Description
None	Select this option to not include a label for the reference line.
Value	Select this option to include a label that is the corresponding value on the axis.
Computation	Select this option to display an automatic label. The label is based on the computation and the measure that is selected.
Custom	Use to type a custom label into 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.

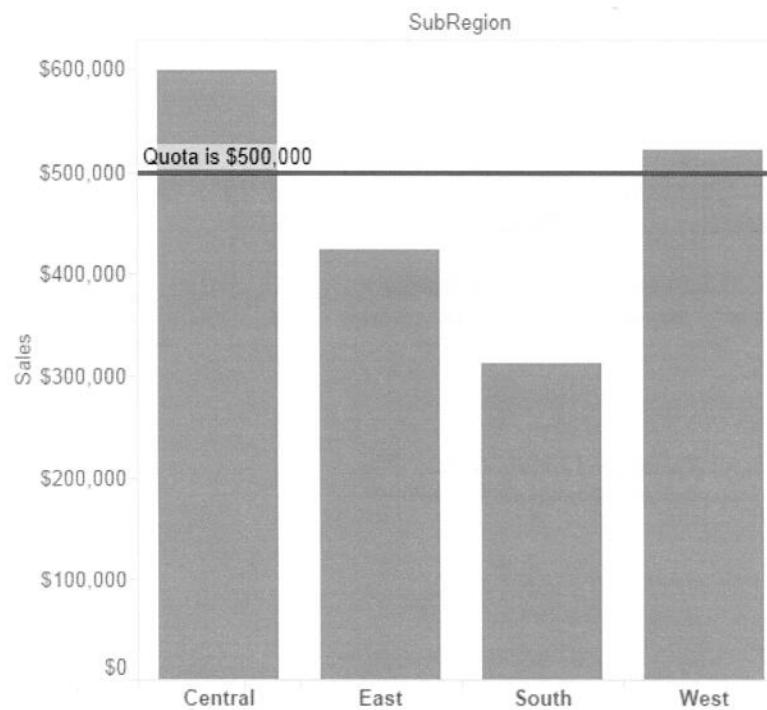
- Formatting is available for the band, and for the lines that mark either ends of the band.

## Practice: Reference Lines

Open **Reference\_Line\_Starter.twbx** and create two views according to the following specification:

### View One

- Includes a red line displayed with a value of \$500,000 across the view.
- Has a label indicating that the line shows the quota.
- Includes the value of the quota in the label.



#### Directions

- Add a dark red and bold reference line for the entire table, with a constant value type of \$500,000 and a custom label that reads "Quota is \$500,000".

#### View Two

- Duplicate of View One.
- Show Sales for each Customer Segment by SubRegion.
- Quota reference line is removed.
- Includes Average Sales by Segment as a reference line.



#### Directions

- Duplicate the **View One** worksheet and name the new worksheet **View Two**.
- Remove the Quota reference line.
- Drag **Customer Segment** to **Columns**.
- Drag **SubRegion** to **Rows**.
- Move **SUM (Sales)** to **Columns** after **Customer Segment**.
- Use the **Analytics** pane to add an **Average Reference Line by Pane** to the view.

7. Edit the Reference Line to be black and display the value of the Average as a label.
8. To view comparative average lines, select **SubRegion** labels.



### Solution

For the solution to this practice, see "Solution: Reference Lines" on page 229.

---

# 16. Creating and Using Parameters

---

This module contains the following:

Using Parameters

Using Parameters with Reference Lines

Parameters and Filters

Practice: Dynamic Measure Selection and Reference Line

Practice: Using a Parameter to Filter across Sources

---

## Using Parameters

A parameter is a value users can change when interacting with a view. It allows your user to have input control over the visualization. Parameters are not specific to a data source or worksheet, so the defined value can be used across the entire workbook and across disparate sources.

Users change parameter values with parameter controls that you can add to the view. To display a parameter control, right-click the parameter in the Data pane and selecting **Show Parameter Control**.

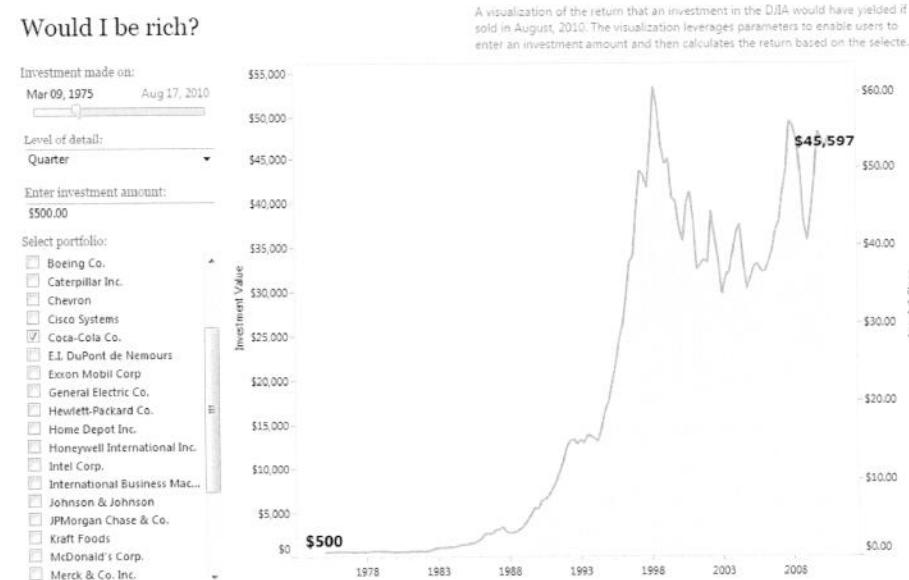
You can place parameter controls on worksheets and dashboards so they are included when you save to the web or publish to Tableau Server.

Some of the many uses of parameters include:

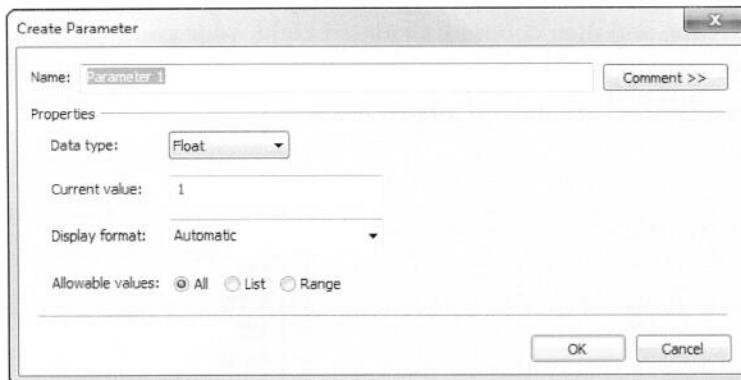
- Capturing values for filters
- User-controlled thresholds
- What-if analysis
- Dynamic fields, axes, titles, and so forth
- Filtering across disparate sources
- Top N

Tableau automatically builds in parameters in specific places, such as in bins, reference lines, and top N filters.

Parameters are user-defined values that can be implemented throughout your workbooks. The values are not tied to a particular field or data source, which means the list selections within the parameter are static.



Since parameter selections are not driven by data values, it is recommended that you reference the parameter in a calculation, unless you use the parameter in filters (Top N), binned measures, or reference lines.



### To Add a Parameter

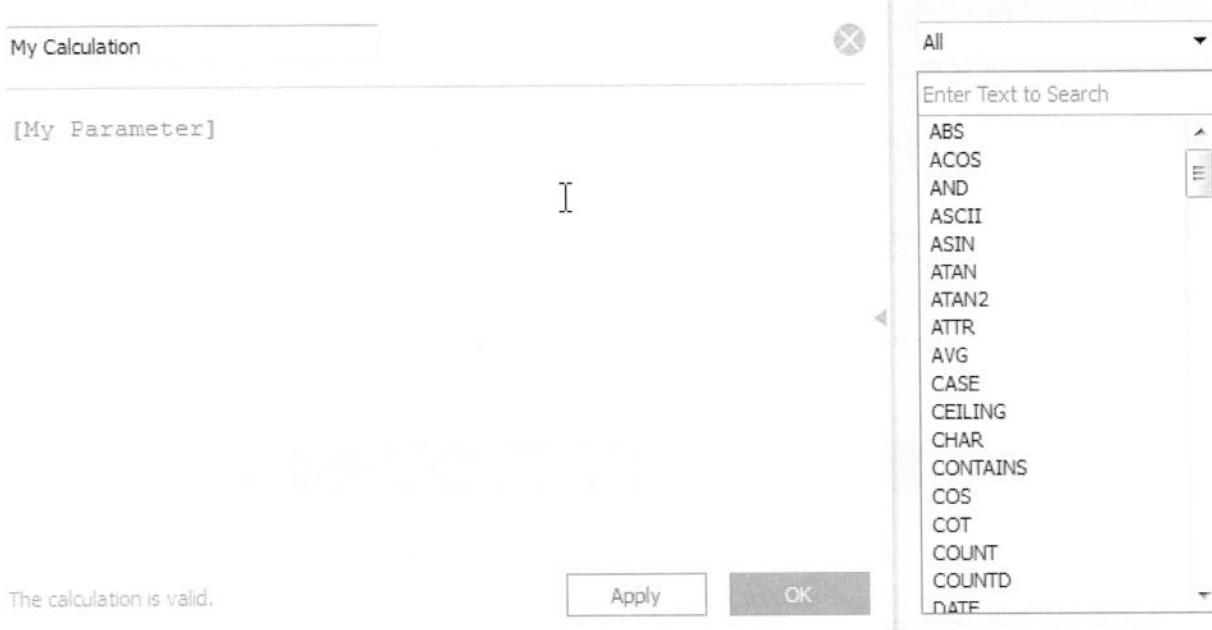
1. In the Data pane, right-click and select **Create Parameter**.
2. Name the parameter.
3. Specify the data type and then follow the corresponding steps for defining the parameter:

Specify the data type ...and then define the parameter	
Float	<ul style="list-style-type: none"> <li>■ Set the display format.</li> <li>■ Set allowable values. If you select <b>List</b>, enter the values in the list of values table. For <b>Range</b>, define the step size.</li> </ul>
Integer	<ul style="list-style-type: none"> <li>■ Use the same steps as <b>Float</b>.</li> </ul>
String	<ul style="list-style-type: none"> <li>■ Set allowable values, <b>All</b> or <b>List</b>.</li> <li>■ If you select <b>List</b>, enter the values in the list of values table.</li> </ul>
Boolean	<ul style="list-style-type: none"> <li>■ Set <b>Current value</b> to <b>True</b> or <b>False</b>.</li> <li>■ Set <b>Aliases</b> values for <b>True</b> and <b>False</b> (optional).</li> </ul>
Date	<ul style="list-style-type: none"> <li>■ Select the <b>Display format</b> from the drop-down list.</li> <li>■ Set allowable values. If you select <b>List</b>, enter the values in the list of values table.</li> <li>■ For <b>Range</b>, define the minimum and maximum date for the range, and define the step size.</li> </ul>
Date & time	<ul style="list-style-type: none"> <li>■ Use the same steps as <b>Date</b>, but include the timestamp.</li> </ul>

### Steps in Creating a Parameter for Use in a Calculated Field

1. Create the parameter – provide a name, data type, and define a default value or restrictions on acceptable values.
2. Create a calculated field that references the parameter. **NOTE** The calculated field receives the input and updates the view.

When you right-click the parameter, select **Create**, and then choose **Calculated Field**, your parameter displays in the formula editor. The parameter also appears on an autocomplete list in the formula editor when you type the parameter's name, and can be used in other calculated fields.



3. Use the calculated field in the view.
4. Show the parameter control.

## Using Parameters with Reference Lines

You can use a parameter with a reference line to allow users to change the value shown by the reference line. This can be useful if you want your users to be able to move the reference line relative to the value shown by the parameter.

### Add a Reference Line with a Parameter

1. Create and save the parameter you want to use.
2. Right-click in your worksheet to add the reference line.
3. In the **Reference Line, Band, or Box** dialog box, choose the type and scope of the reference you want to use.
4. Under **Line**, select the parameter you created from the **Value** drop-down list.
5. Edit the other options as desired, and click **OK**.
6. Right-click the parameter to show the control in your worksheet, and test the reference line.

## Parameters and Filters

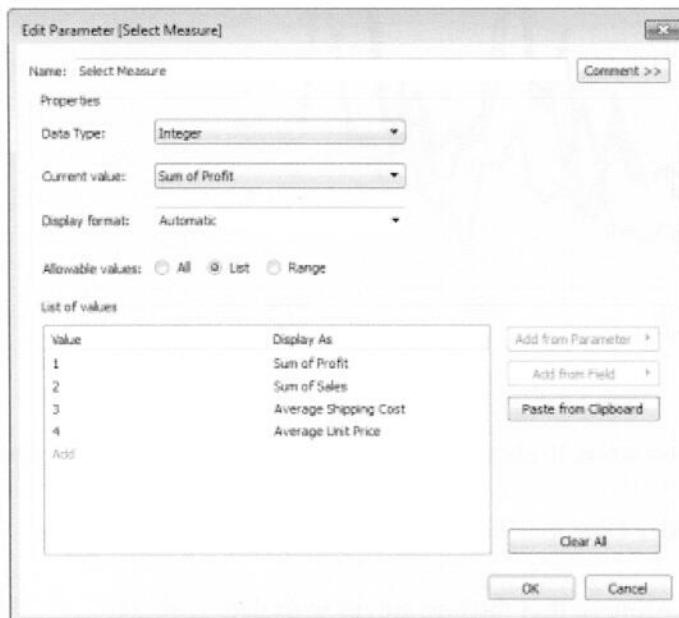
Parameters can be used as filters on a dashboard to customize selectable options, and to allow you to filter across disparate data sources. Since parameters are not tied to a particular data source, a single parameter control can be used to filter multiple views on a dashboard, as long as each of those views includes a calculation that references the parameter itself.

## Practice: Dynamic Measure Selection and Reference Line

Open Dynamic Measure Selection and Reference Line Starter.twbx and create a view according to the following specification::

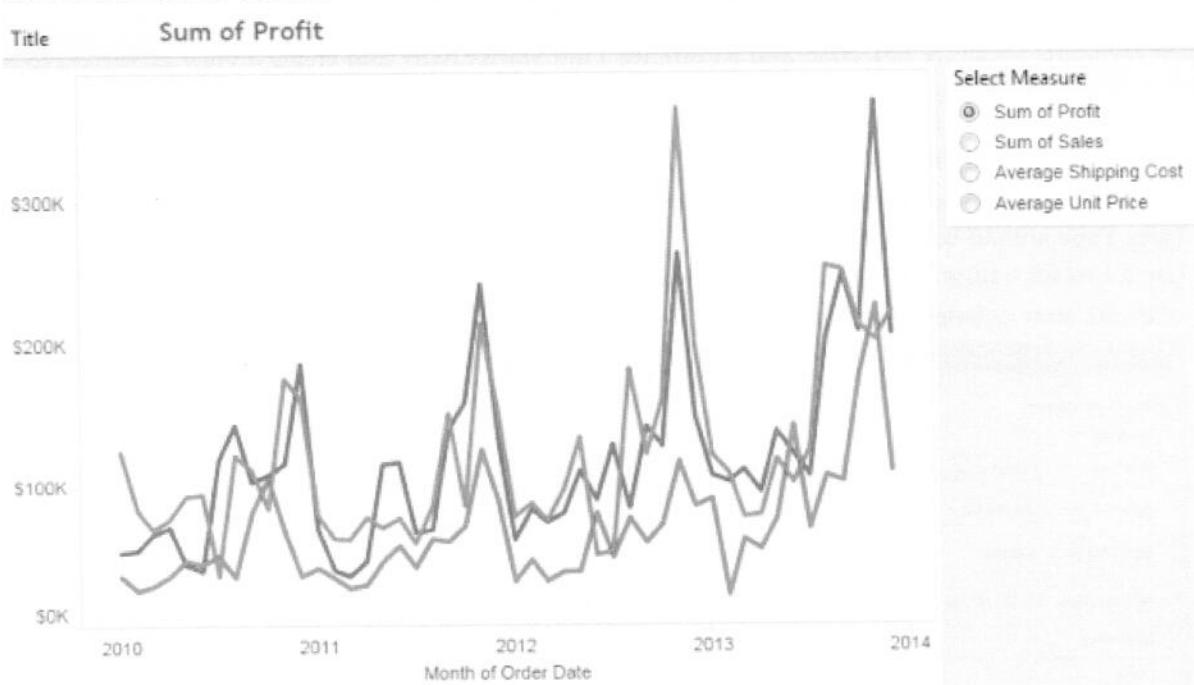
### Part 1: Use Dynamic Measure Selection

- Create a Parameter to drive the measure selection:
- Data Type should be Integer.
- Use a List for values. The value can be anything you like, but the Display names should relate to sum of Profit, sum of Sales, average Shipping Cost, and average Unit Price.



- Create a calculated field which selects the measure to include based on the parameter selection. A CASE statement on the **Select Measure** parameter is recommended. For example, when the case is 1, then the result could be SUM(Profit).
- Build the view to show the chosen Measure on Rows and continuous Month of Order Date on Columns. **Department** should be represented by Color.
- Show the Parameter Control as a single value list.
- Show the worksheet title, and then have it update based on the Measure selection.

- Format the view as shown.



#### Part 2: Create a Dynamic Reference Line

- Add a date selection parameter, which allows users to choose a day from available values in **Order Date**.
- Include a reference line on the month of **Order Date** axis based on the value of the reference date parameter.
- Display a parameter control for the reference line so that the line moves with date selection.

- Uses a calculated field to indicate if an order date is before or after the selected reference line, like the example below:



**Directions, Part 1: Use Dynamic Measure Selection**

1. Create a parameter defined as follows:

- Name = Select Measure
- Data Type = Integer
- Current Value = 1
- Display Format = Automatic
- Allowable Values = List
- List of Values:

Value	Display As
1	Sum of Profit
2	Sum of Sales
3	Average Shipping Cost
4	Average Unit Price

2. Create a new Calculated Field:

- Name = Measure
  - In the **Formula** field, type:
- ```
CASE [Select Measure]
WHEN 1 THEN SUM([Profit])
WHEN 2 THEN SUM([Sales])
WHEN 3 THEN AVG([Shipping Cost])
WHEN 4 THEN AVG([Unit Price])
END
```

3. Create the view:

| Drag this                        | To                        |
|----------------------------------|---------------------------|
| Measure (calculated field)       | Rows                      |
| Order Date (as Continuous Month) | Columns                   |
| Department                       | Color (on the Marks card) |

4. Use the **Select Measure** Parameter to create a single value list control.

5. Format the view:

- Right-click the axis for **Measure** and choose **Edit Axis**. Clear the title.
- Right-click the left vertical axis, choose **Format**, display the scale as currency to Thousands, and then close the **Format** pane.
- Show the worksheet title, and then double-click on the title to edit it.
- Clear the title, and use the **Insert** menu to insert <Parameters.Select Measure>.

**Directions, Part 2: Create a Dynamic Reference Line**

1. Create a new parameter :

- Name = Reference Date
- Data Type = Date & time

- Display Format = mm/dd/yyyy
  - Allowable Values = Range
  - Use Set From Field>Order Date to define the Minimum and Maximum dates
  - Step Size = 1 Month
2. Use the Analytics pane to add a Reference Line with these settings:
    - Type = Line
    - Scope = Entire Table
    - Value = Reference Date, Minimum
    - Label = Value
    - Line as a black dashed line
    - No Fills
  3. Show the parameter control for the Reference Date parameter.
  4. Create a Calculated Field that determines whether the Order Date is before or after the Reference Date:
    - Name = Before or After
    - In the Formula field, type:  
`ATTR(IF [Order Date] >= [Reference Date]  
THEN "After" ELSE "Before" END)`
  5. From Measures, drag Before or After to Detail on the Marks card.
  6. On the Marks card, click the drop-down arrow to the left of AGG(Before or After), and click Color.  
**TIP** You won't see the drop-down arrow until the mouse pointer is over the field.
  7. Move the Reference Date slider to put the reference line in the middle of the view.
  8. On the Marks card, use a manual sort on the AGG(Before or After) field to make it so that Before is sorted at the top of the list. **NOTE** This moves the darker colors in the line chart to the left of the reference line.
  9. Test the view.

#### Solution

For the solution to this practice, see "Solution: Dynamic Measure Selection and Reference Line" on page 230.

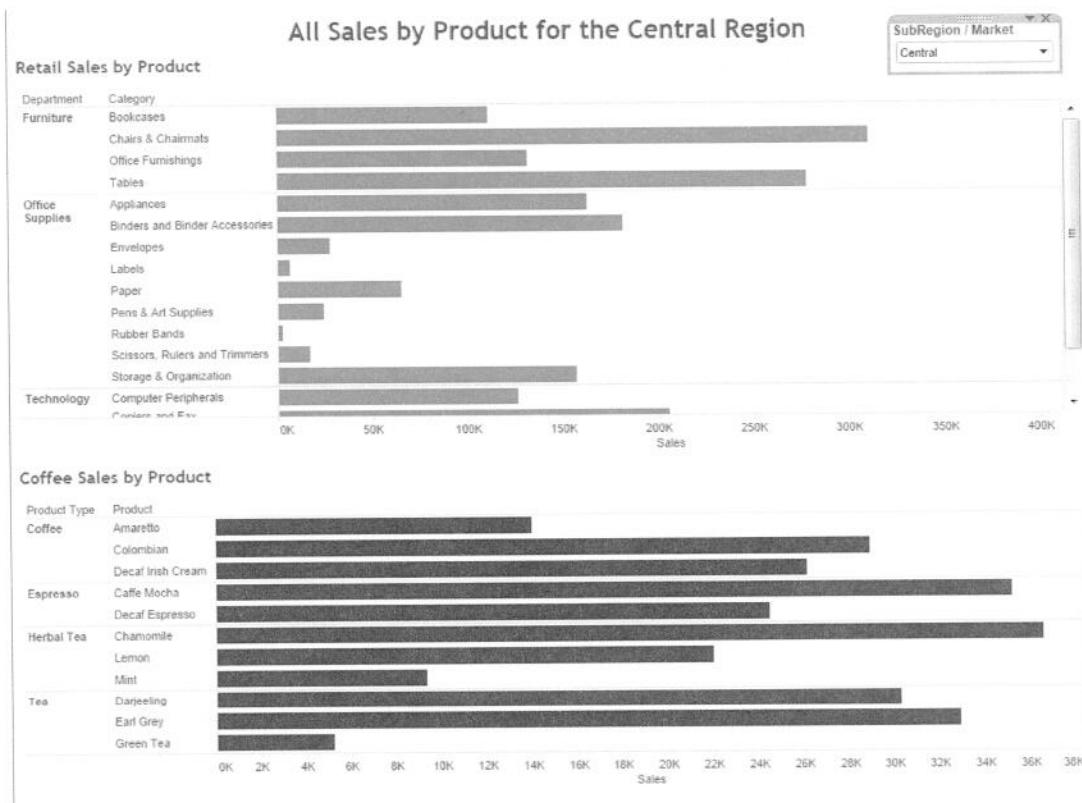
---

## Practice: Using a Parameter to Filter across Sources

Open **Using a Parameter to Filter across Sources Starter.twbx** and create a view according to the following specification:

- Select the **Retail Sales by Product** worksheet and the **Orders (Superstore Sales Training.xls)** data source, and build a view with Sales on Columns, and Department and Category on Rows.
- Create a parameter named "**SubRegion / Market**" and define it as a list of all possible SubRegions.
- Create a calculated field named "**Select Filter**" that uses a Boolean to test if **SubRegion** is equal to the parameter selection for **SubRegion / Market**.
- Set the **Select Filter** to True. Show the parameter control for **SubRegion / Market**, and test that it filters the view.

- Select the Coffee Sales by Product worksheet and the CoffeeChain Query (Sample - CoffeeChain.mdb) data source, and build a view with Sales on Columns, and Product Type and Product on Rows. Make the marks brown.
- Create a “Select Filter” calculated field that uses a Boolean to test if Market is equal to the Parameter selection for SubRegion / Market.
- Filter the field to only show True. Show the parameter control, and test that it filters the view.
- Select the All Sales by Product dashboard, drag Retail Sales by Product and Coffee Sales by Product onto the dashboard, and make the parameter control a floating object in the top right.
- Show the title, and edit it to: <Sheet Name> for the <Parameters.SubRegion / Market> Region



### Directions

- Select the Orders (Superstore Sales Training.xls) data source.
- On the Retail Sales by Product worksheet, build the view:
  - Sales to Columns
  - Department then Category to Rows
- Create a new parameter:
  - Name: SubRegion / Market
  - Data Type: String
  - Allowable Values: List
  - Add From Field > Orders (Superstore Sales Training.xls) > SubRegion

4. Create a new Calculated Field:
  - Name: Select Filter
  - Formula: [SubRegion] = [SubRegion / Market]
5. Filter the field "Select Filter" to only show True values.
6. Right-click on the parameter for SubRegion / Market, and Show Parameter Control.
7. Test that changing the parameter control filters the view.
8. Select the Coffee Sales by Product worksheet.
9. Select the CoffeeChain Query (Sample - Coffee Chain.mdb) data source.
10. Build the view:
  - Sales to Columns
  - Product Type, then Product to Rows
  - Change mark color to brown
11. Create a new Calculated Field in the Coffee Chain source:
  - Name: Select Filter
  - Formula: [Market] = [SubRegion / Market]
12. Filter the field "Select Filter" to only show True values.
13. Right-click on the parameter for SubRegion / Market, and show the parameter control.
14. Test that changing the parameter control filters the view.
15. Select the "All Sales by Product" dashboard and drag the views for Retail Sales by Product and Coffee Sales by Product onto the dashboard. Note that the parameter control only appears once.
16. Complete dashboard formatting:
  - Use Dashboard > Show Title to add a Title to the Dashboard, then double click to edit it.
  - Make the Title name display the selected region: <Sheet Name> for the <Parameters.SubRegion / Market> Region
  - In the menu for the SubRegion / Market parameter control, change it to a Floating object, and place it immediately to the right of the title.
17. Save the workbook.

### Solution

For the solution to this practice, see "Solution: Using a Parameter to Filter Across Sources" on page 233.



# 17. Mapping Data Geographically

---

This module contains the following:

- Mapping in Tableau
  - Navigation and Selection in Maps
  - Practice: Geographic Mapping
  - Background Maps and Layers
  - Modifying Geocode Locations within Tableau
  - Practice: Modifying Locations
  - Using Background Images for Spatial Analysis
  - Practice: Background Images
-

## Mapping in Tableau

You can create views using maps to show data distributions by geographic locations. Fields in your data with geographic information display in the Tableau Data pane with a globe icon:

### State

Tableau automatically generates Latitude and Longitude fields for many geographic areas. You can use these fields to overlay your data onto live maps for spatial analysis.

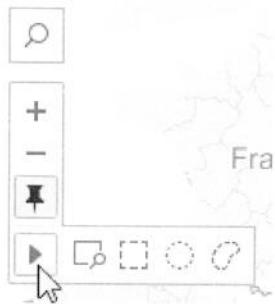
The fields for Latitude and Longitude display under Measures. Tableau can encode latitude and longitude for many different geographic information types, such as zip codes, area codes, congressional districts, and so forth, with zoom levels that range from the entire world to street-level views.

### Create a Simple Map

1. In the **Data** pane, under **Dimensions**, select a field with a globe icon, and drag it to **Detail** on the **Marks** card.
2. In the **Data** pane, under **Measures**, select the value you want to show on the map and drag it to the generated map.
3. Use the **Marks** card to change the marks on the map. For example, if you want a filled map, select **Filled Map** from the mark type drop-down. You can also add labels and edit tooltips for your map, and use the **Marks** card to encode colors and size variation in data points.

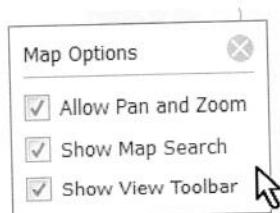
## Navigation and Selection in Maps

Maps created in Desktop include navigation, search, and selection options in a view toolbar.



| Feature               | How to use                                                                                                                                                                                       |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Map Search            | Click the Map Search icon, type a geographic search term into the text box, and then press <b>ENTER</b> to initiate a search.                                                                    |
| Zoom and Pan          | To zoom in or out, use the + and - icons on the map toolbar. To pan across the map, click and drag the mouse pointer across the map.                                                             |
| Reset Axes            | To reset the map to the original view, click the pushpin icon.                                                                                                                                   |
| Zoom Area             | Selects an area in a rectangular shape, and then zooms the map in to the selected area.                                                                                                          |
| Rectangular Selection | Selects an area in a rectangular shape. All marks in the area display as selected.                                                                                                               |
| Radial Selection      | Selects an area in a circular range (radial). Click the circular dotted line icon, and then click+drag the cursor around the area you want to select. All marks in the area display as selected. |
| Lasso Selection       | Selects an area of an irregular shape. Click the kidney shaped dotted line icon, and then click+drag the cursor around the area you want to select. All marks in the area display as selected.   |

## Map Options

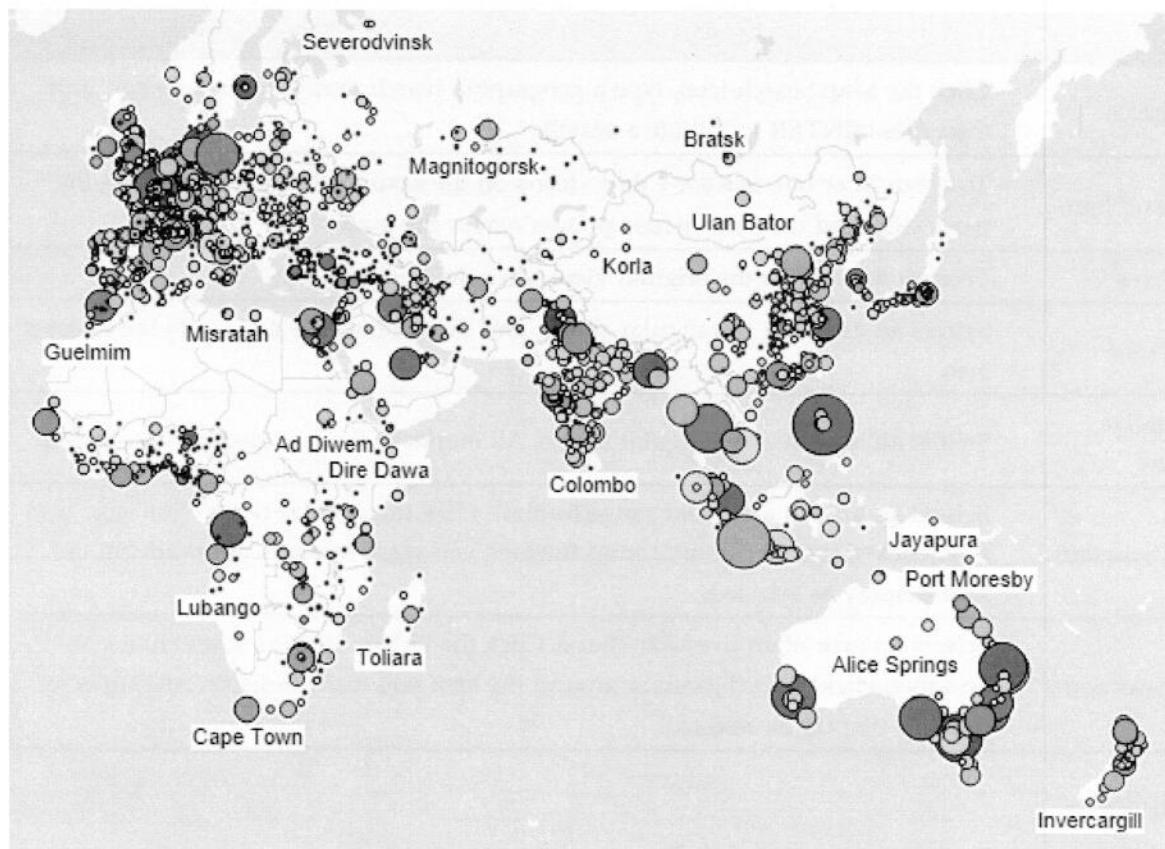


You can choose to show or hide various navigation and search options in a worksheet. On the **Map** menu, click **Map Options** and then check or clear the options you want to include or exclude.

## Practice: Geographic Mapping

Open **Geographic\_Mapping\_Starter.twbx** and create a view according to the following specification:

- Shows **Sales** by size and **Profit** by color on a map of cities.
- Uses a **Market** filter that shows only the **APAC** and **EMEA** markets.
- Uses the following **Map Options** settings: Normal style of map, not showing Country/Region Names.
- Has **City** names labeled, and marks that have a black border with no halo.



### Directions

1. In the Data pane, expand the Country, State, City hierarchy.
2. Create the view using the following table:

| Drag this                                | Here                     |
|------------------------------------------|--------------------------|
| City (under expanded Location hierarchy) | Detail on the Marks card |
| Sales                                    | Size on the Marks card   |
| Profit                                   | Color on the Marks card  |

3. On the Marks card, use the Size slider to increase the size of the marks.
4. Create a Market filter that shows only APAC and EMEA.
5. Use Map Layers to select the Normal map style and remove the labels for Region/Country names.
6. Add a label for City names.
7. Use the Marks card to add a black border color and set the Halo to None.
8. Click the "1 unknown" notification on the map and edit the location from "Londonnn" (which is not spelled correctly) to "London".
9. Add a filter to the view with a slider for profit.
10. Test the levels of zoom, and map selection options on your map.

### Solution

For the solution to this practice, see "Solution: Geographic Mapping" on page 234.

## Background Maps and Layers

The following features can add insight and visual appeal to your map-based visualizations.

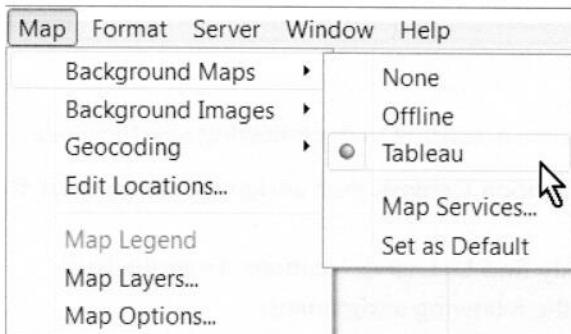
| Feature         | Description                                                                                                                                                                       |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Background Maps | Maps automatically generated by Tableau when you use geographic data, or connections to maps generated by other map service providers.                                            |
| Map Layers      | Additional geographic details that can be layered onto your map from the <b>Map Layers</b> window, such as area code boundaries, streets and highways, and prominent place names. |
| Data Layers     | Layers that show U.S. census information for the regions on your map, such as per capita income, median age, and average household size.                                          |

By default, Desktop uses the Tableau background map, which is generated using an Internet connection. If you're working offline, you can use the Offline background map. Tableau stores copies of maps you're using, but turning layers on and off, zooming in or out, and panning may require online updates to the map.

You can also connect to other background map services, such as a Web Map Service (WMS) server that you have access to, or background maps available through Mapbox.

### Change the Background Map

- On the **Map** menu, select **Background Maps**, and then choose a background map.



To connect to a different map service, click **Map Services** and then add connection information to Mapbox or a WMS server. For more information, see "Background Maps" in Tableau Online Help.

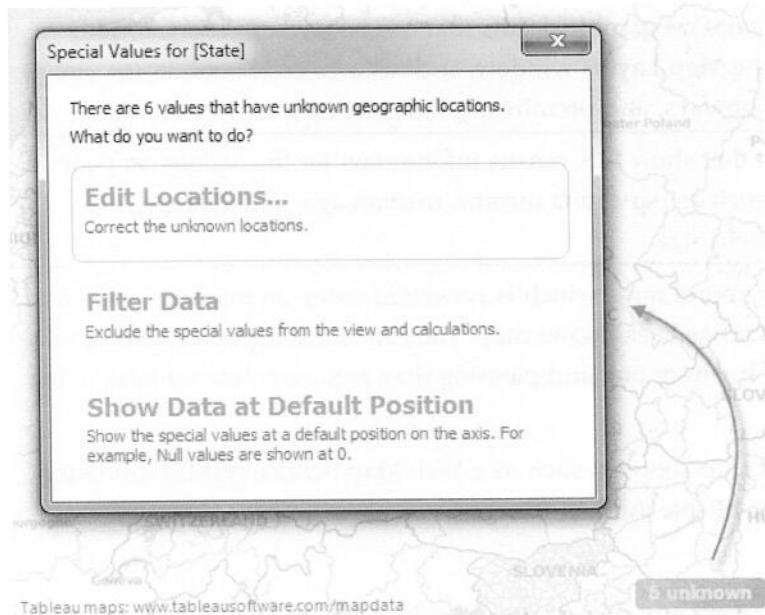
### Add a Map Layer and Data Layer

- On the **Map** menu, click **Map Layers** to open the **Map Layers** window on the left.
- In the **Map Layers** window, under **Map Layers**, click the check box next to the map layers you want.
- In order to use a data layer, make sure the background map is set to **Tableau** and that you are online. On the **Map** menu, click **Background Maps**, and then click **Tableau** if it is not already selected.

4. In the Map Layers window, under Data Layer, click the Layer drop-down menu, and then choose a data layer.
5. In the Map Layers window, click the X in the top right corner to close the window.

## Modifying Geocode Locations within Tableau

You can correct geographic data that does not match or is incorrect. This allows you to use geocoding capabilities with Tableau regardless of data source errors.



## Practice: Modifying Locations

Open **Modifying Locations Starter.twbx** and create a view according to the following specifications:

- Create a copy of the Region field and name it **Distribution Centers**, then assign the Geographic Role for Country/Region.
- Create a map of Distribution Centers, which will only find Unknown locations. From the Null indicator, click and choose **Edit Locations** to make the following assignments:
  - AsiaPac as Singapore
  - EMEA as United Kingdom
  - Latam as Brazil
  - North America as United States
- Label the marks by **Distribution Centers**.
- Change the mark type to **Shape**, and use the custom shape **Truck.png** from the Data folder of the student USB (copy and paste it to a new folder named **My Images** in the Tableau Shapes folder).
- Size the marks by the **Number of Records** for each center, and increase the mark size.



### Directions

1. In the Dimensions area, right-click on the **Region** field and select **Duplicate**.
2. Click **Region (copy)** and hold the mouse button down until the field name appears in an edit box, and then rename the copy "Distribution Centers."
3. Click the icon to the left of **Distribution Centers** and choose **Geographic Role>Country/Region**.
4. From **Dimensions**, drag **Distribution Centers** to **Detail** on the **Marks** card to create a point map. Notice that only null values exist.
5. At the bottom-right of the map, click on the null indicator and choose **Edit Locations**. Assign the following countries to represent the locations of the **Distribution Centers**:
  - AsiaPac as Singapore.
  - EMEA as United Kingdom.
  - Latam as Brazil.
  - North America as United States.
6. On the **Marks** card, drag **Distribution Centers** to **Label**.
7. Create a new folder in the **Shapes** directory (found in **My Documents\My Tableau Repository\Shapes**) called **My Images**. Copy the image **Truck.png** from the **Data** folder of the student USB into the new **My Images** folder:



8. On the **Marks** card, change the mark type to **Shape**.
9. Click on **Shape**, and then click **More Shapes**.

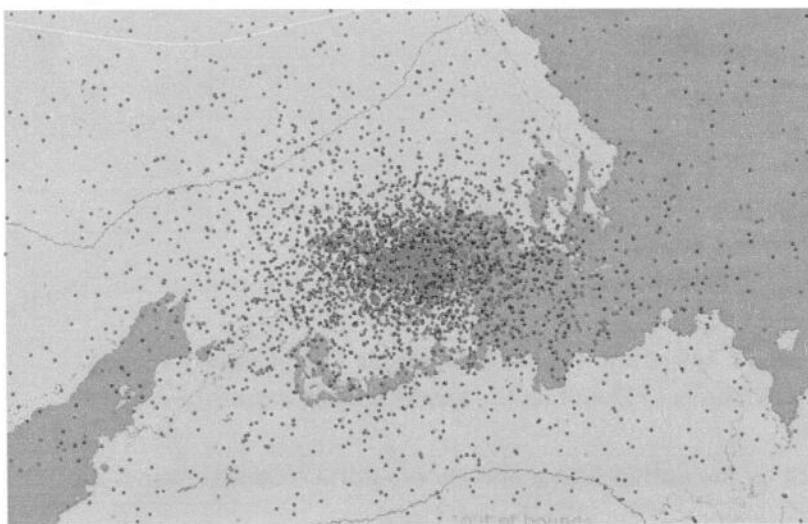
10. Click Reload Shapes, click Apply, navigate to the Shape Palette for My Images, click Assign Palette, and click OK.
11. From Measures, drag Number of Records to Size on the Marks card. Click on Size again, and increase the size of the marks.
12. Save the workbook.

#### Solution

For the solution to this practice, see "Solution: Modifying Locations" on page 235.

---

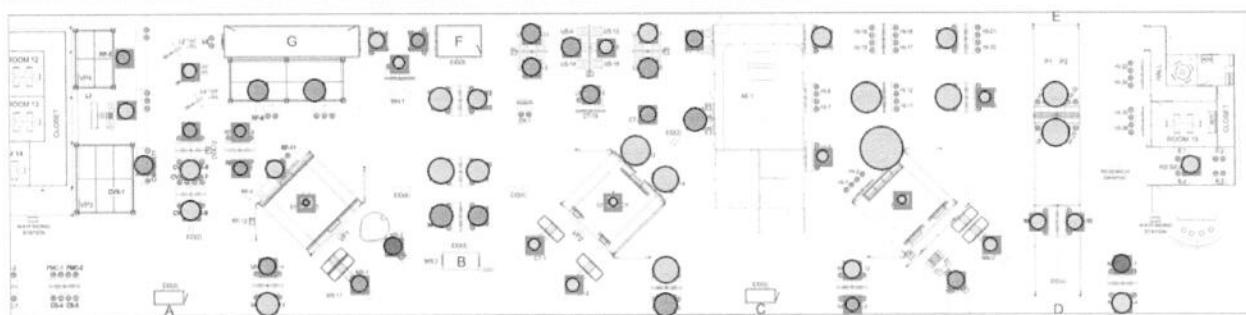
## Using Background Images for Spatial Analysis



Background images display underneath your data to add more context to the marks in the view. A common use of background images is adding custom maps 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.

**NOTE** Since the picture is static, you will only be able to zoom as your picture quality allows.

---



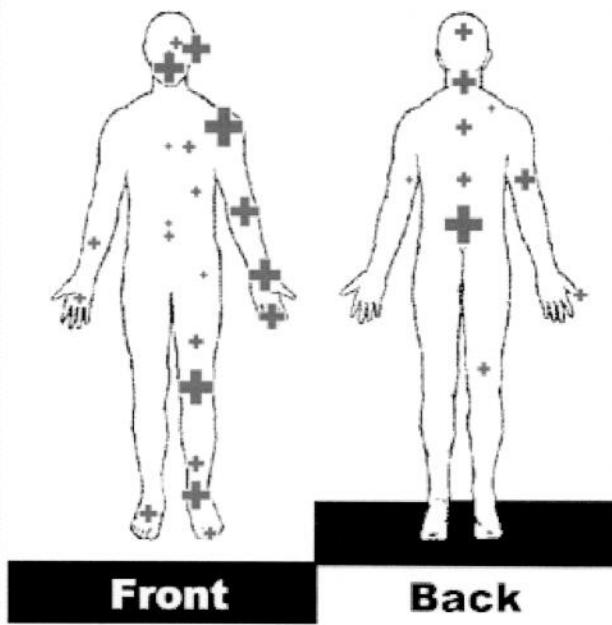
Your data may already be structured with x and y coordinates OR there might be no logical coordinate data at all. You can use Tableau's mapping capabilities to track the position of data that is not geographical.

**BEST PRACTICE TIP** When mapping coordinates, use a table for position values (x,y) and join or blend to data based on a position ID dimension field.

## Practice: Background Images

Open **Background Images Starter.twbx** and create a view according to the following specification:

- Use the **Map** menu to define a background image tied to the **Work Injury** data source.
- Use the image called **Body Map.gif** in the **Data** folder of the student USB.
- Define the **X** field with the range for **Location X** of 0 to 99, and the **Y** field with the range for **Location Y** of 0 to 100.
- **Location X to Columns, Location Y to Rows.** Change aggregation for both to **Average**.
- **Details by Location of Injury.** **Size by Number of Records.**
- Format the marks as in the example below.
- Edit the tooltip to remove references to **Location X** and **Location Y**, and to change the "Number of Records" header to "Number of Injuries".



### Directions

1. Note that the workbook already has a connection to two joined tables (**Injuries** and **Injury Location**) in the **Work Injury Data.xls** data source. Also note that the worksheet has the title and caption set to show.
2. From the **Map** menu, select **Background Images**, and then click **Injury location+ (Work Injury Data.xls)**. This will relate the image to the correct data set.

3. From the **Background Images** dialog box, click **Add Image** to add the background image.

**NOTE** The following settings define the background image to use, the data it is tied to, and the scale to be used when placing marks on the image. This scale is arbitrary, and is defined by the user to match the data.

- **Name** = Injury Image
- **File** = Student USB\Data\Body Map.gif
- **X Field** = Location X
- **Left** = 0
- **Right** = 99
- **Y Field** = Location Y
- **Bottom** = 0
- **Top** = 100

4. Build the view:

- **Location X** to **Columns**, then right-click and change the aggregate function to **Average**.
- **Location Y** to **Rows**, then right-click and change the aggregate function to **Average**.
- **Location of Injury** to **Detail**.
- **Number of Records** to **Size**.

5. Format the view:

- Click on the null indicator at the bottom right of the view and choose **Filter Data**.
- Right-click on **AVG(Location X)** on **Columns**, and click off **Show Header**.
- Right-click on **AVG(Location Y)** on **Rows**, and click off **Show Header**.
- Change the mark shape to a bold filled-in cross.
- Change the mark color to red.
- Make the mark size larger.
- Edit the mark tooltip to remove the references to **Location X** and **Y** and to change the gray header that says "Number of Records" to "Number of Injuries."

6. Save the workbook.

#### Solution

For the solution to this practice, see "Solution: Background Images" on page 236.

---

# 18. Showing Breakdowns of the Whole

---

This module contains the following:

Pie Charts and Parts of the Whole

Practice: Percent of Total Sales

Creating Tree Maps

Practice: Tree Map

---

## Pie Charts and Parts of the Whole

Under the right circumstances, pie charts are great for showing part to whole relationships; however, our perceptual system is bad at comparing areas or angles accurately.

If you use a pie chart, stick to dimensions with few members, and add labels to help your audience make more accurate judgments.

### Uses for Pie Charts

Pie charts are useful for:

- Filtering or highlighting actions on a dashboard
- Showing a high level breakdown of a measure by dimension with a small number of members

In Tableau, the pie is one of the Mark types you can choose on the Marks card.

### Create a Pie Chart

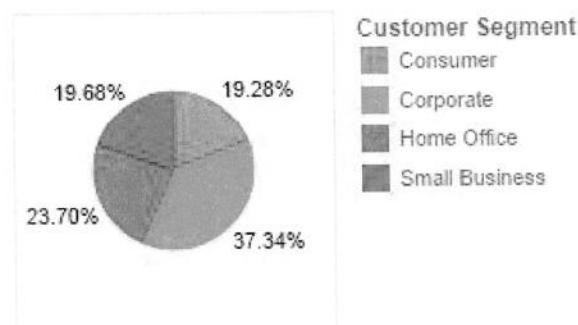
1. On the **Marks** card, select **Pie** from the drop-down list of mark types.
2. Drag the dimension field you want to slice to **Color** on the **Marks** card.
3. Drag the measure that determines the size of each slice to **Angle** on the **Marks** card.

---

## Practice: Percent of Total Sales

Open **Percent\_of\_Total\_Starter.twbx** and create a view according to the following specification:

- Show how **Sales** breaks down by **Customer Segment**.
- Show **Sales** as a percent of total in a label.



### Directions

1. Change the mark type to **Pie**.
2. Create the initial view:

| Drag this field  | To                      |
|------------------|-------------------------|
| Customer Segment | Color on the Marks card |
| Sales            | Angle on the Marks card |
| Sales            | Label on the Marks card |

3. Calculate Sales as a percent of total. (Hint: use the Sales field on the label).

### Solution

For the solution to this practice, see "Solution: Percent of Total of Sales" on page 237.

## Creating Tree Maps

The tree map is another good option for showing part to whole relationships, especially data sets with long tails, because tree maps show all of the data at once. You can further encode tree maps with color to differentiate categories, and add other labels that show number values (percent of total, for example.)

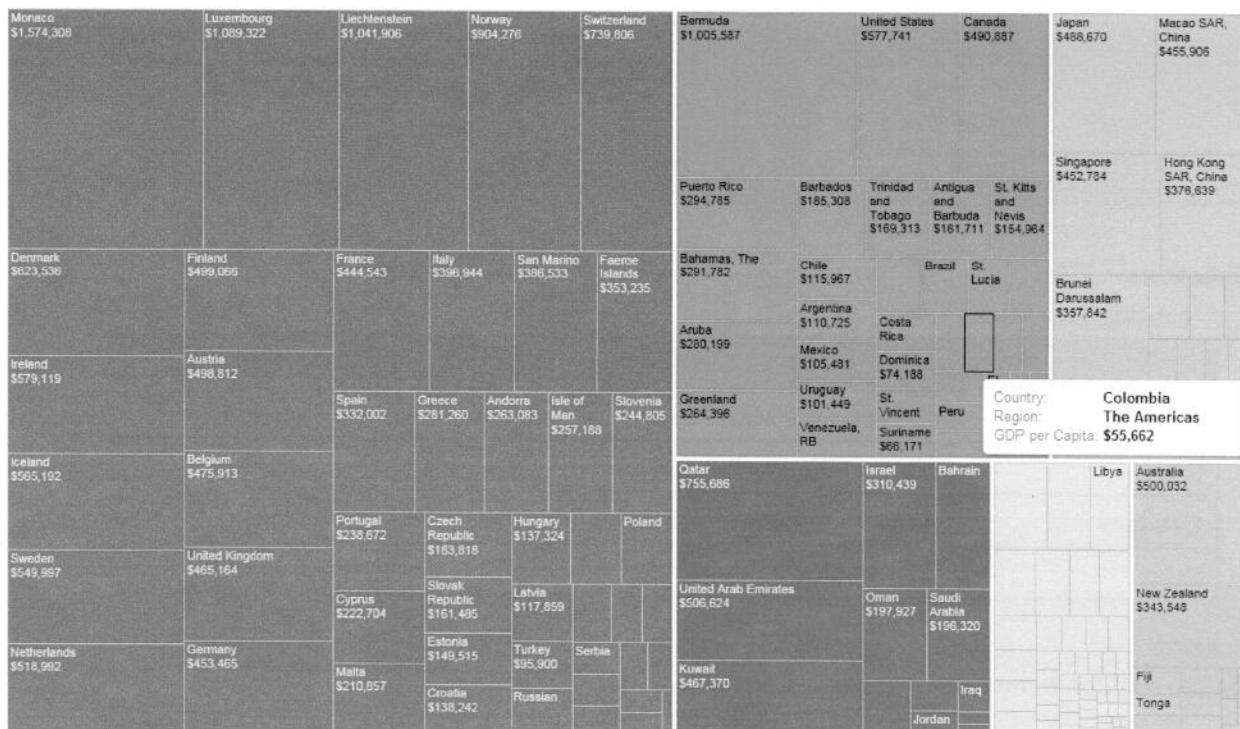
Tree maps are especially good for hierarchical categorical data (many levels of dimensions).

### Create a Tree Map

1. Drag a measure to Size on the Marks card.
2. Drag a dimension to Color on the Marks card.

These steps give you a basic tree map. You can also label the tree map by dragging the same dimensions you added above to Label on the Marks card.

This example shows the GDP per capita by region and then country. Notice that although some of the shapes are too small to include labels, you can hover over the area to see a tooltip with information about the data point. This gives a user visibility into every data point in the view.



## Practice: Tree Map

Open Tree\_Map\_Starter.twbx and create a view according to the following specification:

- Show Region by Color
- Show SUM(Sales) by Size
- Category and Sales are displayed as labels

|                                             |                                     |                                             |                    |                              |                                           |                                 |           |
|---------------------------------------------|-------------------------------------|---------------------------------------------|--------------------|------------------------------|-------------------------------------------|---------------------------------|-----------|
| Office Machines<br>\$1,677,165              | Tables<br>\$1,367,835               | Copiers and Fax<br>\$722,735                | Binders and Binder |                              | Tables<br>\$997,353                       | Chairs & Chairmats<br>\$593,617 | Storage & |
| Telephones and Communication<br>\$1,639,454 | Chairs & Chairmats<br>\$1,186,950   | Bookcases<br>\$576,166                      | Office             | Office Machines<br>\$783,829 | Telephones and Communication<br>\$725,871 |                                 | Office    |
|                                             | Storage & Organization<br>\$772,193 | Appliances<br>\$573,057                     |                    |                              | Telephones and                            | Copiers and Fax                 | Chairs &  |
| Telephones and Communication<br>\$1,325,585 | Chairs & Chairmats<br>\$1,137,075   | Binders and Binder Accessories<br>\$624,117 |                    | Office Machines<br>\$587,975 | Storage &                                 |                                 | Office    |
| Office Machines<br>\$1,273,556              | Tables<br>\$784,506                 | Storage & Organization<br>\$616,594         | Office             | Tables<br>\$551,236          |                                           |                                 | Paper     |
|                                             | Copiers and Fax<br>\$663,450        | Bookcases<br>\$486,842                      | Paper<br>\$242,289 |                              |                                           |                                 |           |

### Directions

- Create the Tree Map:

| Drag this field | To                       |
|-----------------|--------------------------|
| Region          | Color on the Marks card  |
| Sales           | Size on the Marks card   |
| Category        | Labels on the Marks card |
| Sales           | Labels on the Marks card |

### Solution

For the solution to this practice, see "Solution: Tree Map" on page 237.

# 19. Comparing Measures Against a Goal

---

This module contains the following:

Showing Total Progress Toward a Goal (Bar in Bar Graph)

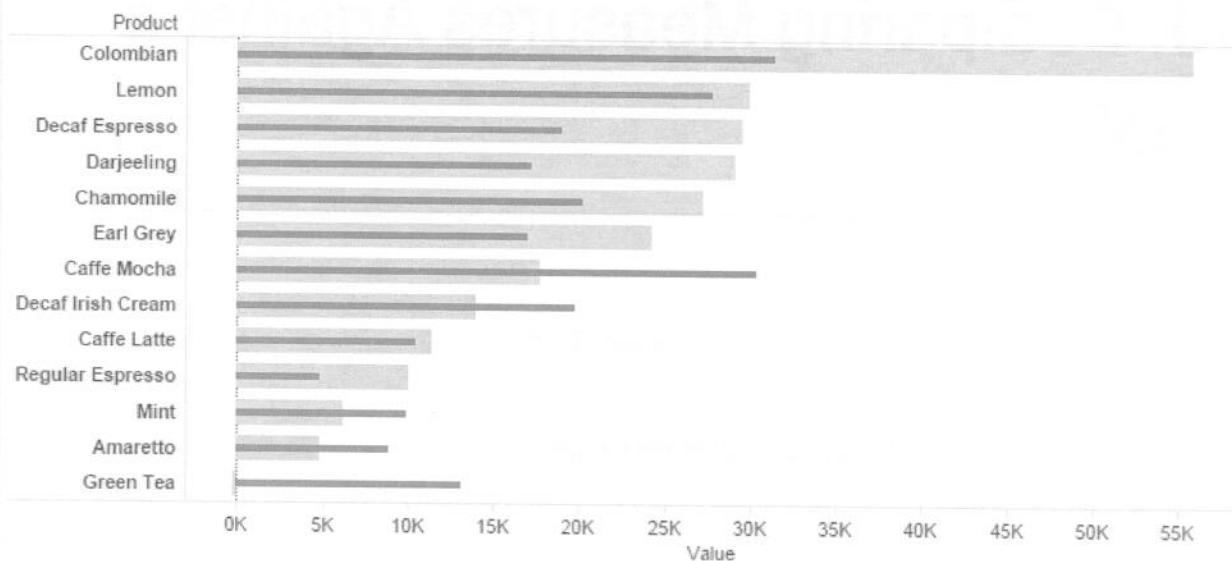
Practice: Bar in Bar Chart

Showing Staged Progress Toward a Goal (Bullet Graph)

Practice: Bullet Graph

---

## Showing Total Progress Toward a Goal (Bar in Bar Graph)

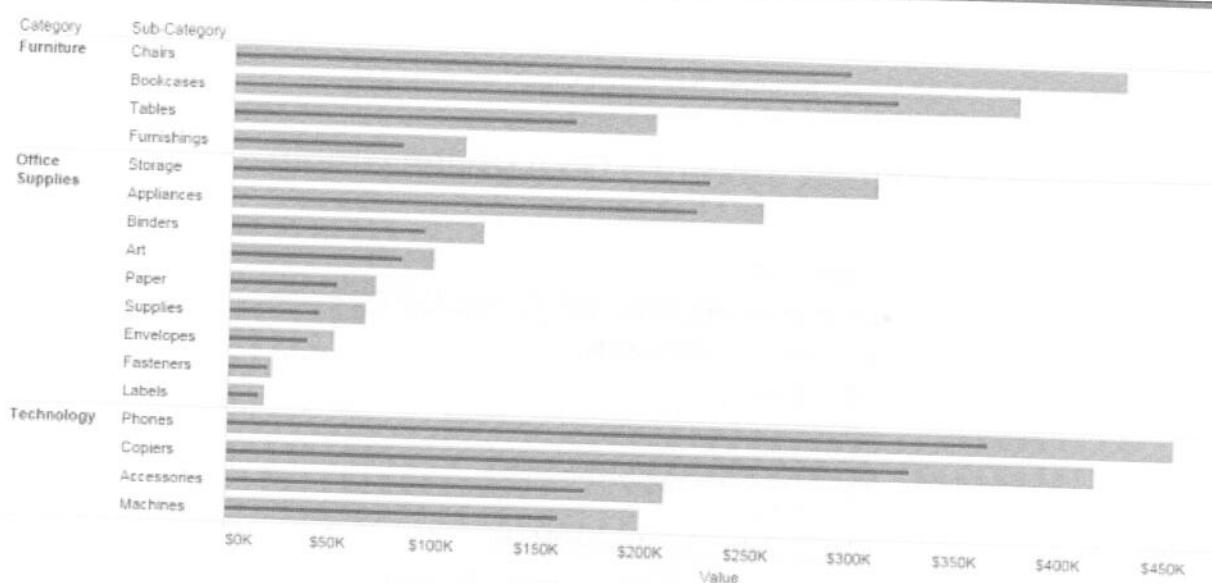


The Bar in Bar chart is useful when you want to evaluate a dimension using another dimension without stacking marks or expanding the axis. For example, you might use a Bar in Bar chart if you needed to see the Sum of Sales by both Category and Region, wanted to retain the Dimensions axis on the Category level, and wanted each mark to start at zero and end at the appropriate dollar amount. Using a Bar in Bar chart provides a quick visual comparison of which categories had the highest and lowest sales within your regions.

### Practice: Bar in Bar Chart

Open **Bar in Bar Starter.twbx** and create a view according to the following specification:

- Create two calculated fields for 2012 and 2013 sales.
- Build the view with 2012 Sales and 2013 Sales by **Category** and **Sub-Category**. Initially create a combination axis view.
- Move **Measure Names** from Columns to Color, and then another copy of **Measure Names** to Size.
- Turn off **Stack Marks**.



### Directions

1. Open **Bar in Bar Starter.twbx** and note that the workbook contains a worksheet with a title and caption set to show in the view.
2. Create a calculated field for **2012 sales**:
  - **Name:** 2012 Sales
  - **Formula:** IF YEAR([Order Date]) = 2012 THEN [Sales] END
3. Right-click the new **2012 Sales** field, duplicate it, and use the copy to create a **2013 Sales** calculated field:
  - **Name:** 2013 Sales
  - **Formula:** IF YEAR([Order Date]) = 2013 THEN [Sales] END
4. Create the view:

| Drag this field | To                                |
|-----------------|-----------------------------------|
| 2012 Sales      | Columns                           |
| Category        | Rows                              |
| Sub-Category    | Rows (place to RIGHT of Category) |

5. Drag **2013 Sales** to the axis for **2012 Sales** to create a combined axis view.

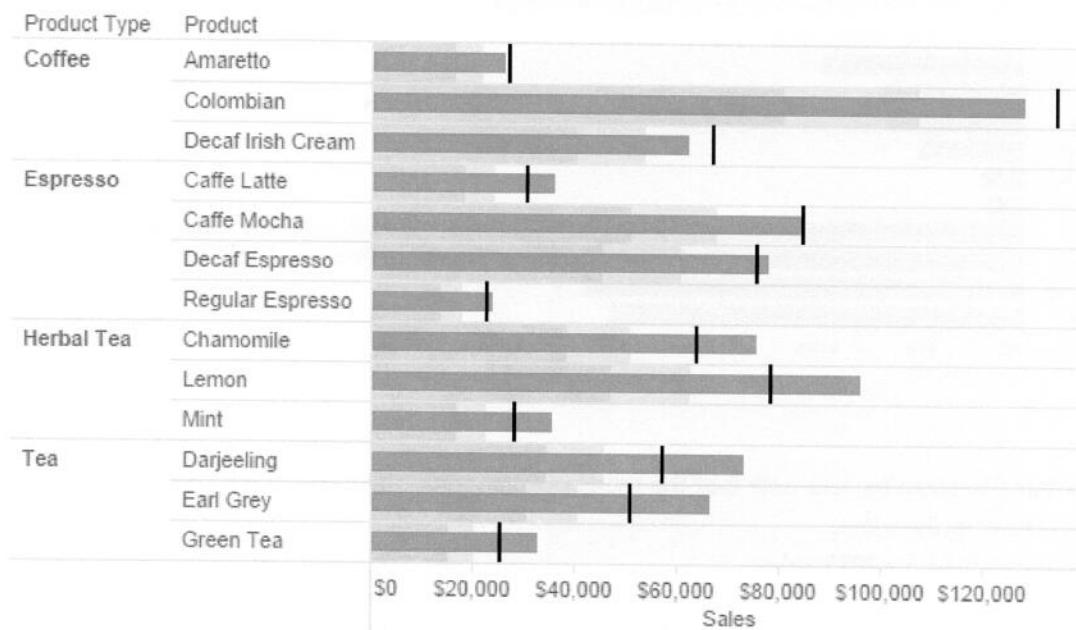
**NOTE** This will engage the **Measure Names** and **Measure Values** fields.

6. From **Rows**, drag **Measure Names** to **Color** on the **Marks** card, which will stack the marks.
7. On the **Marks** card, CTRL+click **Measure Names** and drag a copy of it to **Size** on the **Marks** card.
8. From the **Analysis** menu, click **Stack Marks**, and click **Off** to start both bars at the **0** position.
9. Format the view:
  - Edit the **Color Legend** (Hint: use the Gray palette)
  - Sort the bars in descending order
  - Format the axis for currency to thousands
10. Save the workbook.

**Solution**

For the solution to this practice, see "Solution: Bar in Bar Chart" on page 237.

## Showing Staged Progress Toward a Goal (Bullet Graph)



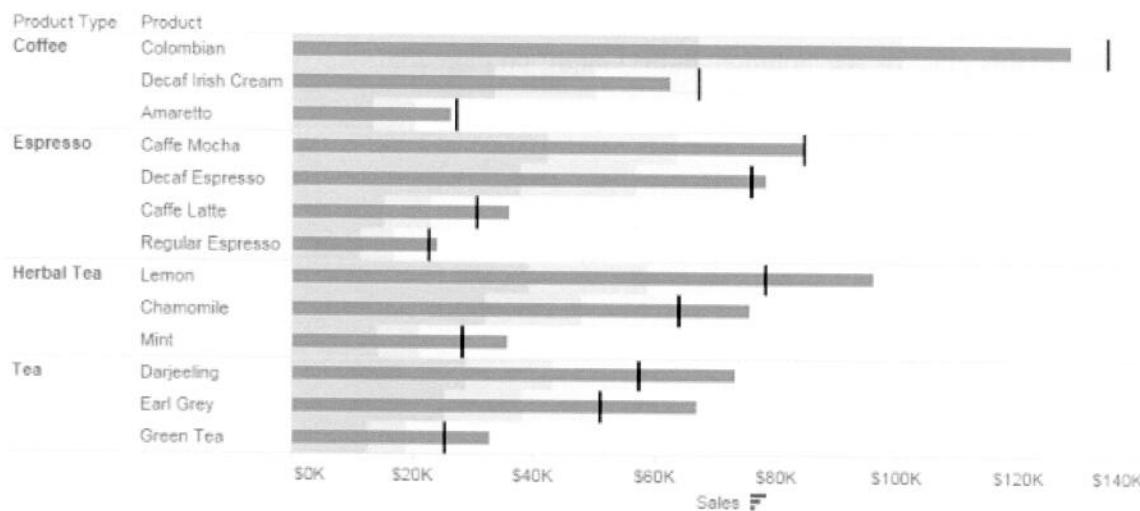
A bullet graph is a variation of a bar graph and was developed by Stephen Few to replace dashboard gauges and meters. The bullet graph is generally used to compare a primary measure to one or more other measures in the context of qualitative ranges of performance. Occasionally, bullet graphs are used to compare the same measure across multiple categories, such as using the data from one region as the threshold for other regions.

## Practice: Bullet Graph

Open **Bullet Graph Starter.twbx** and create a view according to the following specification:

**NOTE** Do not use the Show Me option for this activity.

- Build a view of Sales by Product Type and Product.
- Add a Reference Line to each Product for Budget Sales. (Hint: Budget Sales to Details first.)
- Add a Reference Line to show Distribution of Budget Sales to 50, 75, and 100%.
- Create a calculated field named “Sales Exceeds Quota?” to determine if Sales are below budget, and color the bars to quickly determine which Products have not met their goal.
- Format the view.

**Directions**

1. Create the view:
  - Sales to Columns
  - Product Type and then Product to Rows
  - Sort bars in descending order by Sales
2. Drag Budget Sales to Detail on the Marks card.
3. Right-click on the Sales axis and choose Add Reference Line and select these options:
  - Line as Type
  - Scope = Per Cell
  - Value = Sum(Budget Sales) with an Average aggregation
  - Label = None
  - Bold line, colored black
4. Right-click on the Sales axis a second time and choose Add Reference Line and select these options:
  - Distribution as Type
  - Scope = Per Cell
  - Computation = Percentages: 50, 75, 100% of SUM(Budget Sales) with an Average aggregation
  - Label = None
  - Select Fill Below
  - Fill = Blue Light
5. Create the following calculated field to determine if Sales is below budget:
  - Name: Sales Exceeds Quota?
  - Formula: `SUM([Sales]) >= SUM([Budget Sales])`
6. Drag Sales Exceeds Quota? to Color on the Marks card, and adjust the color so False is orange and True is dark blue.
7. Format the view:
  - Click on Size in the Marks card and reduce the size of the bars to make it easier to see the distribution behind them.
  - Format the axis for currency.
8. Save the workbook.

**Solution**

For the solution to this practice, see "Solution: Bullet Graph" on page 238.

---

# 20. Defining Subsets of Your Data

---

This module contains the following:

Using Sets

Practice: Creating and Using Sets

Showing the Biggest and the Smallest

Practice: Nested Top N with Context

Practice: Nested Top N with Rank - Complex Example

---

## Using Sets

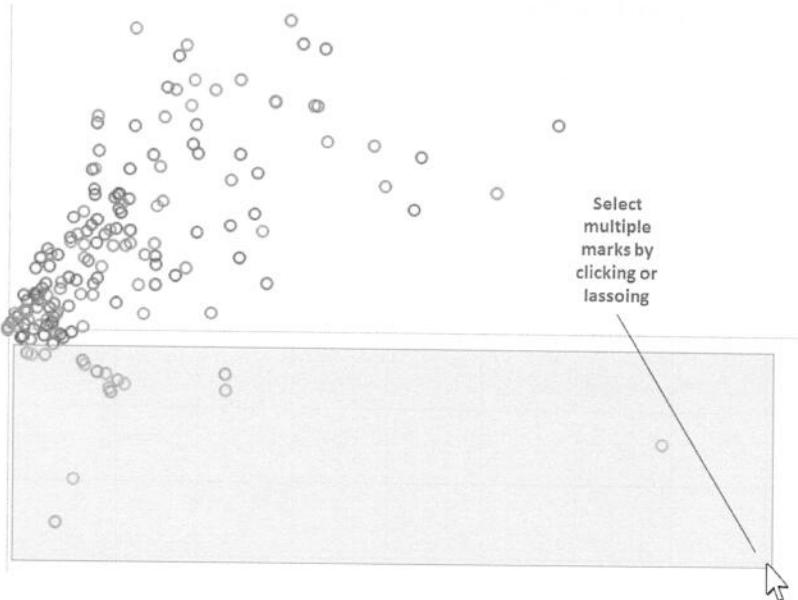
Sets are custom fields you create based on existing dimensions. They represent subsets of your data that meet certain conditions. Tableau Desktop displays sets in the Sets area of the Data pane and labels them with the sets ( icon).

Use sets to:

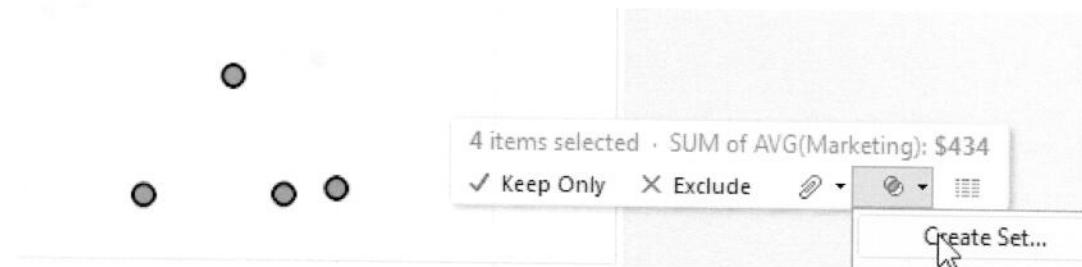
- View or highlight data meeting a specific computed condition, for example, a set that contains only customers with sales over a certain threshold.
- Monitor key data points, for example, high- or low-performing sales regions.
- Combined fields. Create sets containing multiple, specific fields you want to view together.

### Create a Subset of the Data

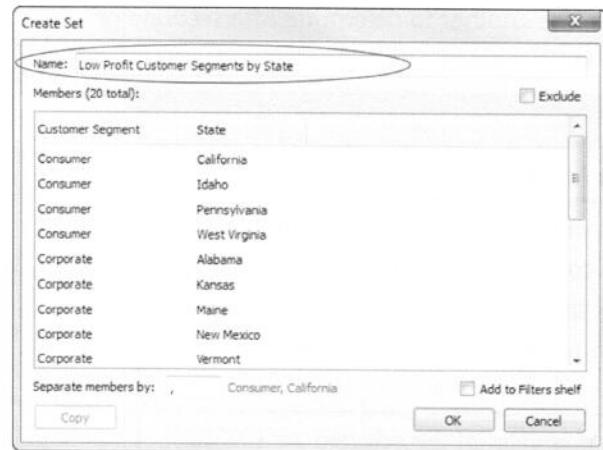
1. Select one or more dimension members to include in a set.



2. Click the Set icon on the Tooltip and select **Create Set**.



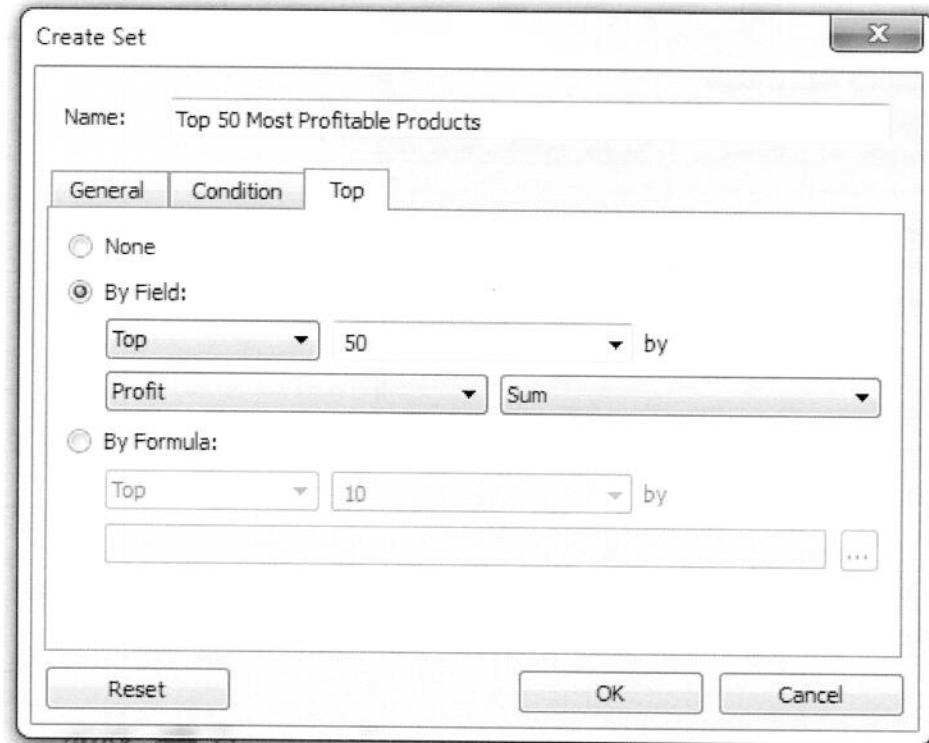
3. In the Create Set dialog box, name the set and then click OK.



### Create a Set to Use as a Filter

You can save any filters you create as a set and use them in all worksheets in a workbook.

1. Right-click the dimension you want to filter on, then click **Create** and select **Set**.
2. In the Create Set dialog box, select checkboxes of members to keep, and then click **OK**. (Alternatively, you can also select members conditionally, for example, Top 50 Products by Profit.)



*Create Set dialog box*

---

**NOTE** You can also create sets by multi-selecting marks in a view and choosing the set icon in the tooltip.

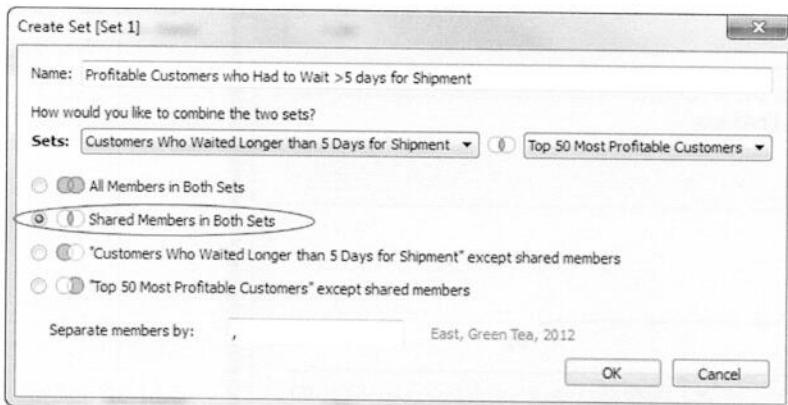
---

## Combined Sets

Combined sets allow you to compare multiple sets to one another to determine intersections or differences across the sets. There are several options for combined sets:

| Combined set option              | Description                                                                                                                                                                       |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All Members in Both Sets         | Combines all members of both sets.                                                                                                                                                |
| Shared Members in Both Sets      | Combines only the members from both sets that have common data points. For example, customers that are the top 50 most profitable AND who waited longer than 5 days for shipment. |
| <Set Name> except shared members | Keeps all members of the selected set EXCEPT those shared with the unselected set.                                                                                                |

1. In the **Sets** section of the **Data** pane, multi-select 2 sets, and right-click to select **Create Combined Set**.  
**NOTE** This option will not be available if the sets were created off of different dimensions.
2. Select how you want to combine the sets, for example, Shared Members in Both Sets, and then click **OK**.



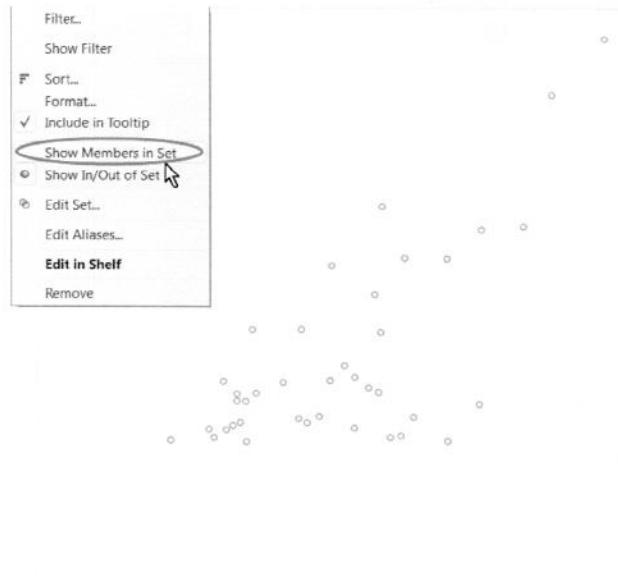
3. Use the new set in the view to highlight or filter the members of your new set (for example, you can drag the set to **Color** on the **Marks** card).

## In and Out Sets

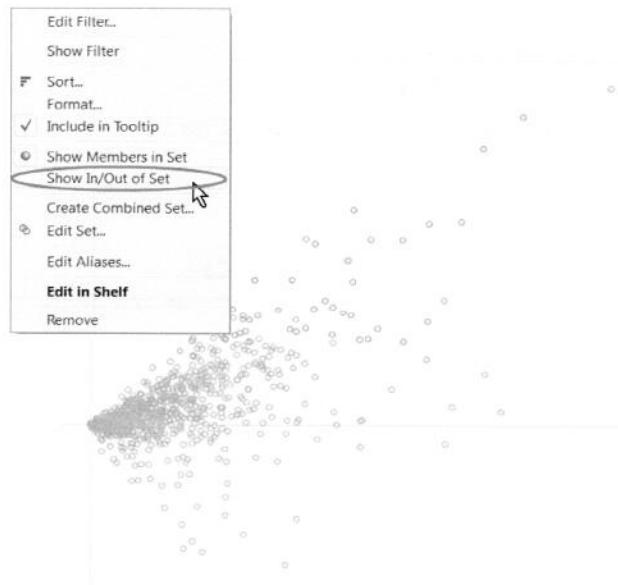
Instead of looking at individual members of a set, you can compare members in a set to members not in the set. Select **Show In/Out of Set** on the field menu to use this option.

1. Right-click a field in the view and select one of the following:

- Show Members in Set to show only the set members.



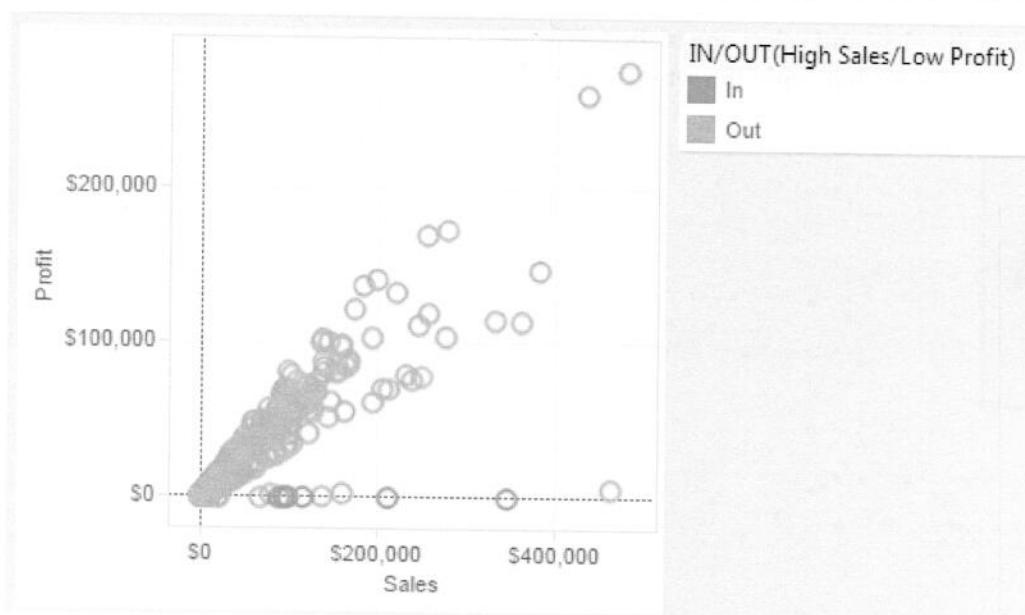
- Show In/Out of Set to show data both in and out of the set. Data in and out are shown in different colors.



## Practice: Creating and Using Sets

Open `Creating_and_Using_Sets_Starter.twbx` and create a view according to the following specification:

- Includes a set for the top 100 items by sales.
- Includes a set for the bottom 100 items by profit.
- Uses combined sets to highlight the items that are among the highest sold and the lowest in profits.



#### Directions

1. Create a scatter plot with **SUM(Sales)** on the X (horizontal) axis and **SUM(Profit)** on the Y (vertical) axis.
2. Drag **Item** to the view.
3. Right-click **Item** to create a set for Top 100 selling products.
4. Right-click **Item** to create a set for Bottom 100 products by **Profit**.
5. Create a combined set that shows the intersection of the sets created in steps 1 and 2.
6. Use the combined set to show the products that are in the set by color.

#### Solution

For the solution to this practice, see "Solution: Creating and Using Sets" on page 239.

## Showing the Biggest and the Smallest

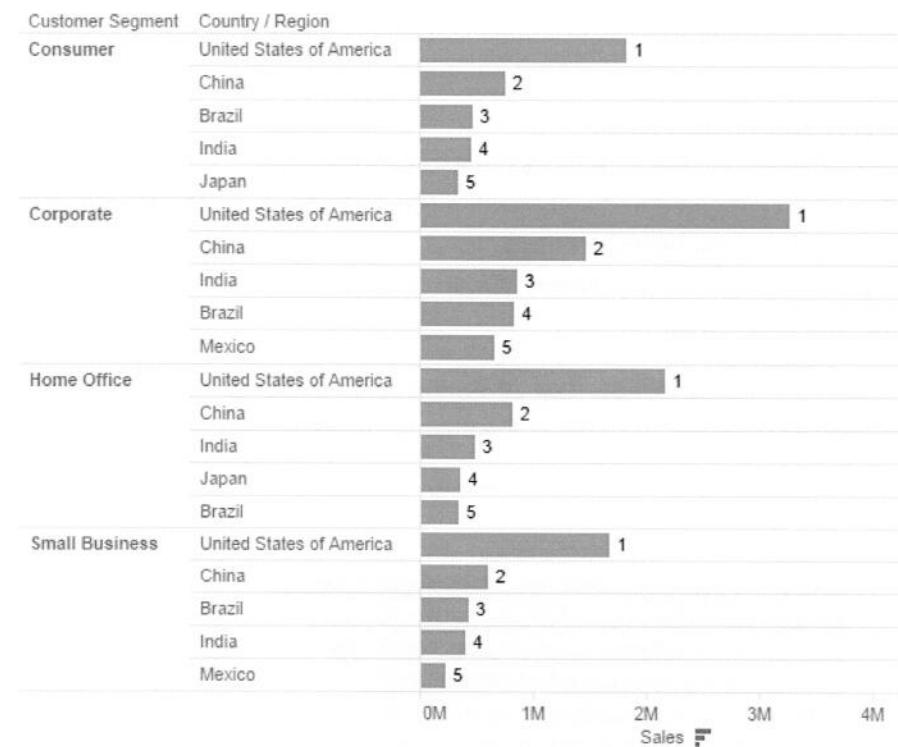
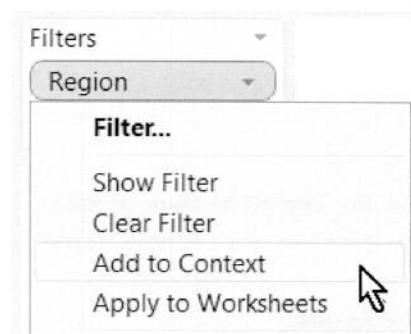


Tableau has several built-in features that can determine the Top N within a category, but because of how nested sorting works, the visual display may vary. Context Filters are an effective tool for analyzing Top N data for subsets of the data set.

If you are applying filters to a large data source, you can improve performance by setting up context filters. First, use a context filter on the data source, and then apply other filters to just the resulting records. This sequence avoids applying each filter to each record in the data source.



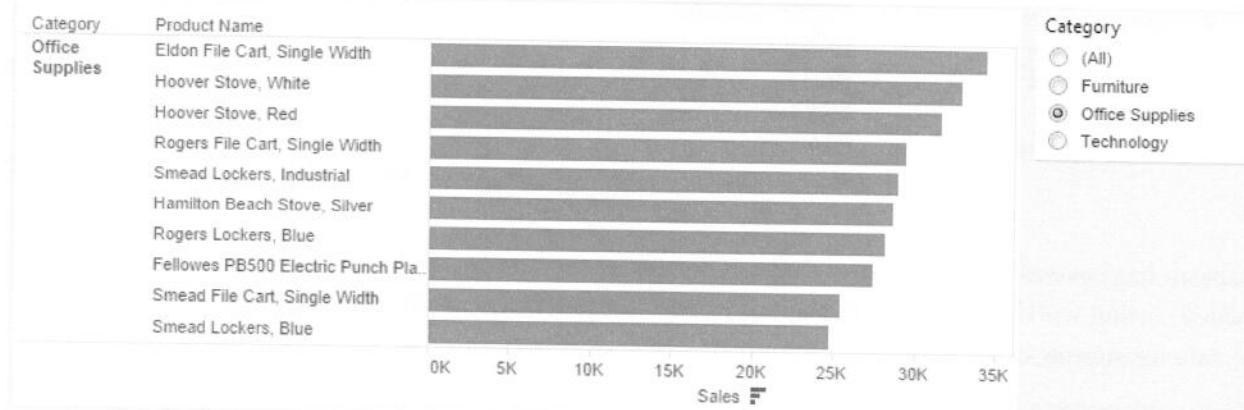
Adding a filter to Context creates a temporary table that limits what Tableau queries before all other queries for your view are run. You can add multiple filters to the context to limit the size of the temporary table. Add to Context can be effective for performance considerations or advanced filtering when a) the filter doesn't change often AND b) the resulting data reduces to 1/10th or less of the number of records.

## Practice: Nested Top N with Context

Open **Nested Top N with Context Starter.twbx** and create a view according to the following specification:

- Build a view of Sales by Category and Product Name.
- Filter **Product Name** and choose to show the top 10 by **Sales** in descending order.
- Add a filter for **Category** to the view, configured to display with a **Single Value List**. (On the filter in the view, click through each **Category** to observe the results.)
- On **Filters**, right click **Category** and choose **Add to Context**. (On the filter in the view, click through each **Category** again and notice the difference.)

**NOTE** Creating the Context for **Category** means that the **Top 10 Product Name** filter is only run against the chosen **Category**, rather than the top 10 overall. Whatever the filter selection, it will always return 10 values.



### Directions

1. Build the view:
  - Sales to Columns
  - Category, then Product Name to Rows (If a Warning dialog box appears, choose Add All Members)
  - Sort by Sales in descending order
2. Drag another instance of **Product Name** to **Filters** and choose to show the **Top 10 by Sum of Sales**.
3. Right-click on **Category**, click **Show Filter**, and then make the filter in the view use a **Single Value List**.
4. On the filter in the view, click through each **Category** and observe the results.

**NOTE** The **Product Names** are the same Top 10 overall, but filtered by **Category**.

5. On **Filters**, right-click **Category** and choose **Add to Context**.
6. On the filter in the view, click through each **Category** again and notice the difference.
7. Save the workbook.

**Solution**

For the solution to this practice, see "Solution: Nested Top N with Context" on page 240.

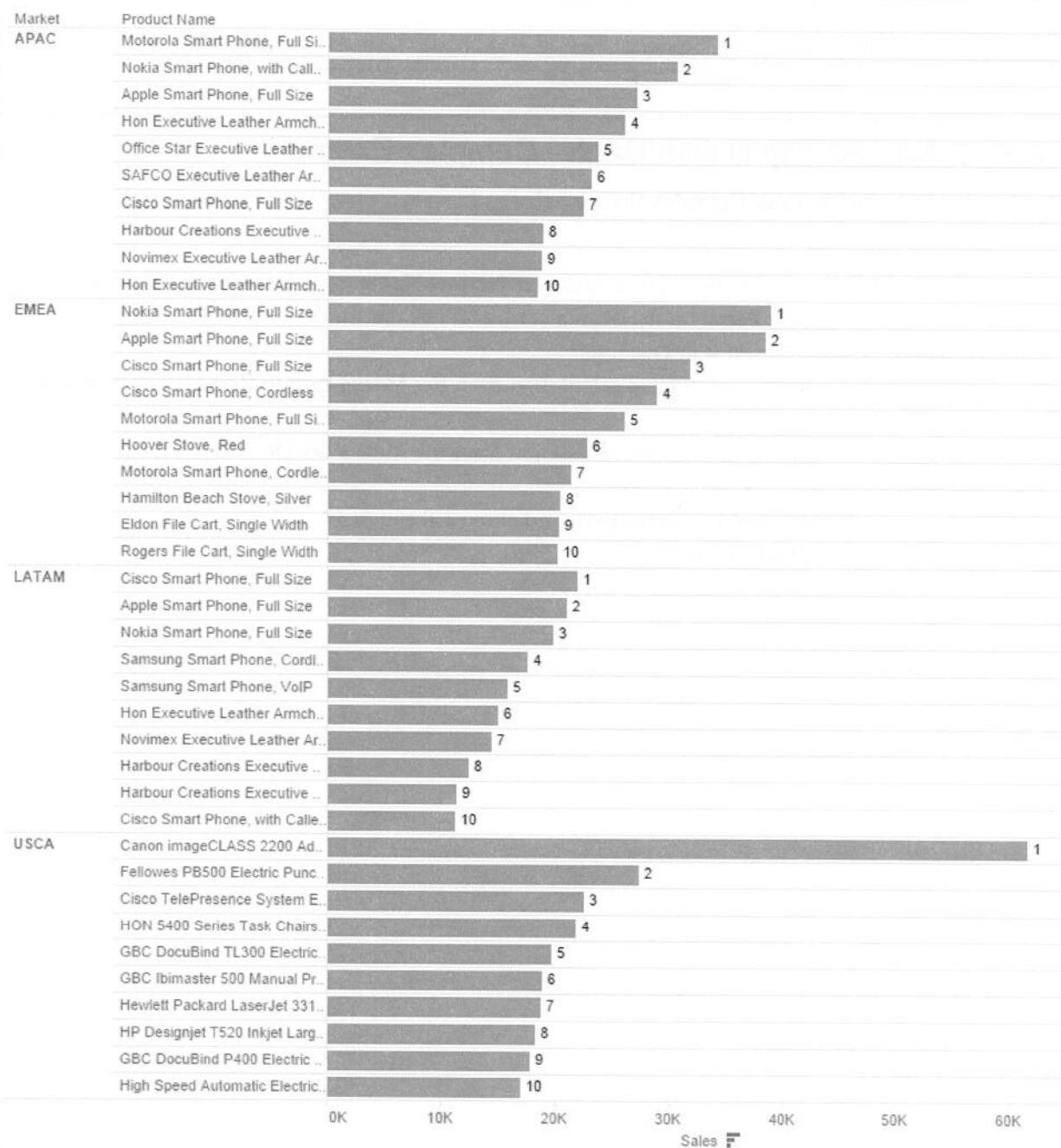
---

---

## Practice: Nested Top N with Rank - Complex Example

Open **Nested Top N with Rank Complex Starter.twbx** and create a view according to the following specification:

- Show Sales by Market and Product Name, and sort **Product Name** by Sales in descending order.
- Add an instance of **Sales** to **Label** on the **Marks** card, and use the **Rank** quick table calculation with **Pane (Down)** on it, and convert it to **Discrete**.
- Drag a copy of **Sales** with the quick table calculation from the **Marks** card to **Rows** between **Market** and **Product Name**.
- Drag a copy of **Sales** with the quick table calculation from the **Marks** card to **Filters**, and click **OK** in the dialog box.
- On **Filters**, convert **SUM(Sales)** to **Continuous**, and show 1 through 10.
- On **Rows**, hide the **SUM(Sales)** header.



### Directions

1. Create the view:
  - Sales to Columns.
  - Market and Product Name to Rows.
  - Sort Product Name by Sales in descending order.

Products are sorted by their overall sales, not the sales within the Market. This example can't be solved with Rank and a filter like the preceding activity.

3. Drag a new instance of **Sales** to the **Label** on the **Marks** card, and then right-click to add the **Rank Quick Table Calculation**, using **Pane (Down)**.
4. Change the **Sales** field on the **Marks** card to **Discrete**.
5. CTRL+click-drag a copy of **SUM(Sales)** with the **Rank** calculation from the **Marks** card to **Rows** and drop between **Market** and **Product Name**.
6. CTRL+click-drag a copy of **SUM(Sales)** with the **Rank** calculation from the **Marks** card to **Filters**, and click **OK** in the **Filter** dialog box.
7. On **Filters**, change **SUM(Sales)** to **Continuous**, and in the **Filter** dialog box, choose a **Range of Values** from 1 through 10 to only view the top 10.
8. On **Rows**, right-click on **SUM(Sales)**, and deselect **Show Header**.
9. Save the workbook.

#### Solution

For the solution to this practice, see "Solution: Nested Top N with Rank - Complex Example" on page 241.

---



# 21. Viewing Distributions

---

This module contains the following:

Bins and Histograms

Practice: Histogram with Binned Measures

Box and Whisker Plots

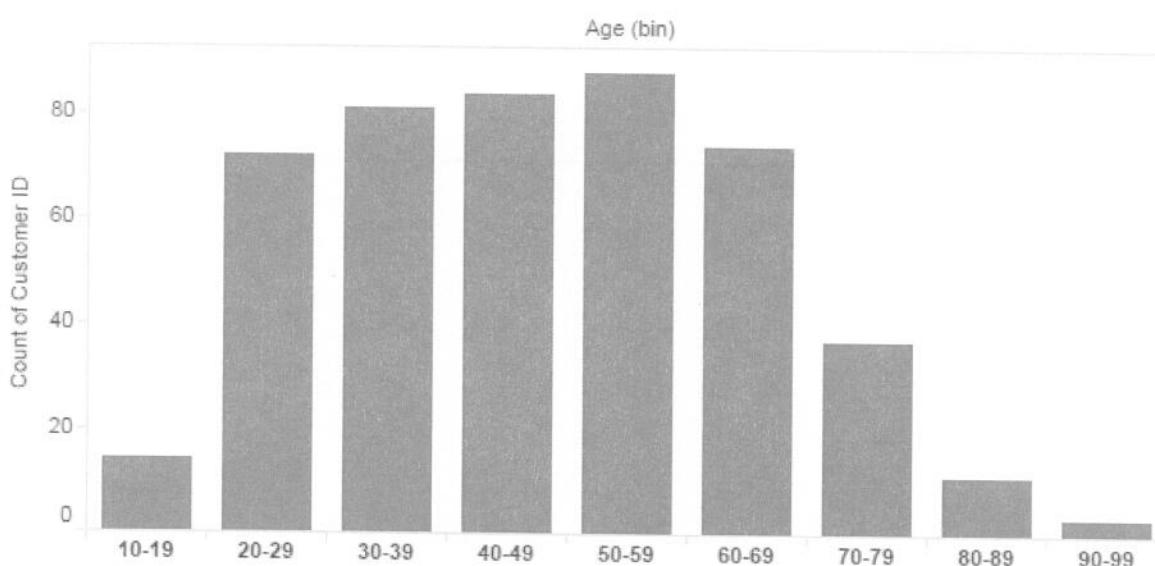
Practice: Box and Whisker Plot

---

## Bins and Histograms

Bins group values for use in histograms, which show the distribution of your data. For example, if you have a measure containing customer ages ranging from 18 to 90, and you wanted to analyze how your customers break down into different age groups, you would create a bin for the age measure, and use the Histogram view to see how the data is organized.

In this example, each bin is defined by an age range, such as 10-19, 20-29, 30-39, and so forth. Each data point is placed in the relevant bin, and the bin is represented by a column on a bar chart. Each bar represents the count of items that meet the criteria of the bin.



*Histogram*

### Creating Histograms and Bins

There are two ways to create histograms in Tableau:

- Use Show Me
- Use the Measure Context menu

#### Create a Histogram using Show Me

1. Put a measure on Rows.
2. On Show Me, click the Histogram icon.



A histogram is created and a new bin is created and placed on the Columns shelf.

3. Right-click the newly created bin in the Dimensions area and click Edit.
4. In the **Edit Bins** dialog box, adjust the size of the bins.
5. Use the Load button to view the minimum and maximum values as well as the difference between the two.

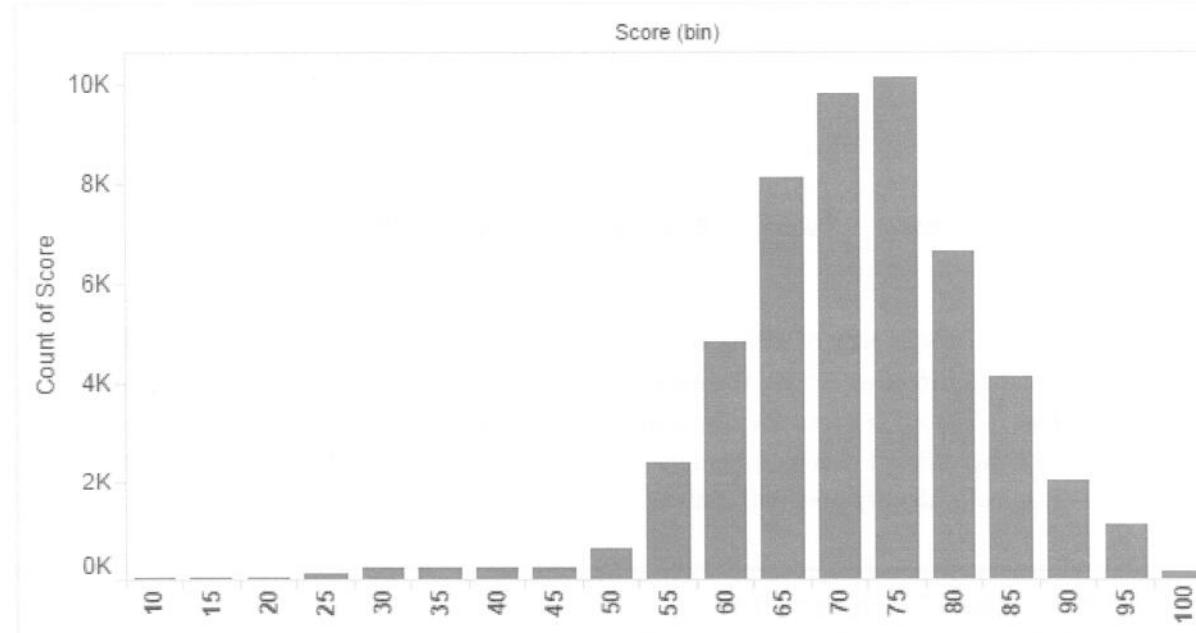
### Create a Histogram using the Context Menu

1. In the **Measures** area, right-click the measure that you want to use and click **Create Bins**.
2. In the **Create Bins** dialog box, enter a name for the field and the size to use for the bins. You can use the **Load** button to see the minimum and maximum values for the measure.
3. Drag the measure from step 1 to **Rows** and the newly created bin field from the **Dimensions** area to **Columns**.
4. Right click the measure on **Rows**, select **Measure**, and click **Count**.

### Practice: Histogram with Binned Measures

Open *Creating\_a\_Histogram\_with\_Binned\_Measures\_Starter.twbx* and create a view according to the following specification:

- Shows count of **Score** with a bin size of 2.
- Modify **Score(bin)** size to be 5.



#### Directions

1. Create bins of **Score**, keeping the default name of **Score(bin)**, and change the size of bins to 2.
2. Create the view:

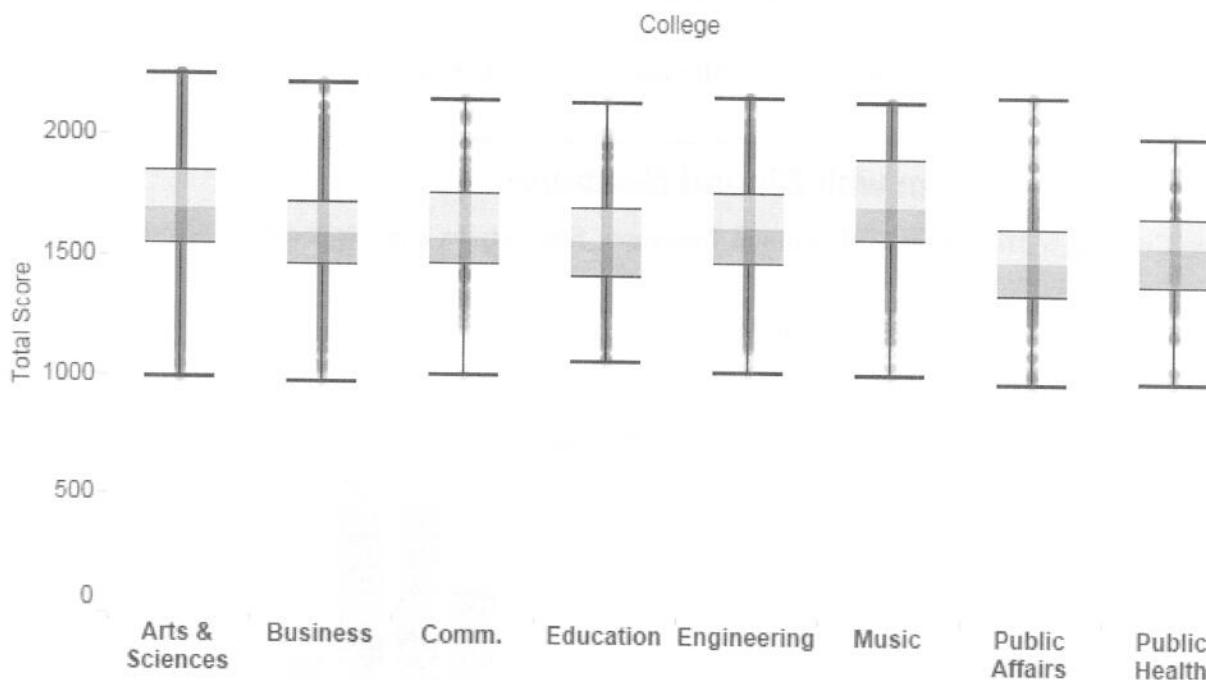
| Drag this field | To      |
|-----------------|---------|
| Score           | Rows    |
| Score(bin)      | Columns |

3. Change the **Score** measure to **Count** aggregation.
4. Change the size of the **Score bin** to 5.

## Solution

For the solution to this practice, see "Solution: Histogram with Binned Measures" on page 242.

## Box and Whisker Plots

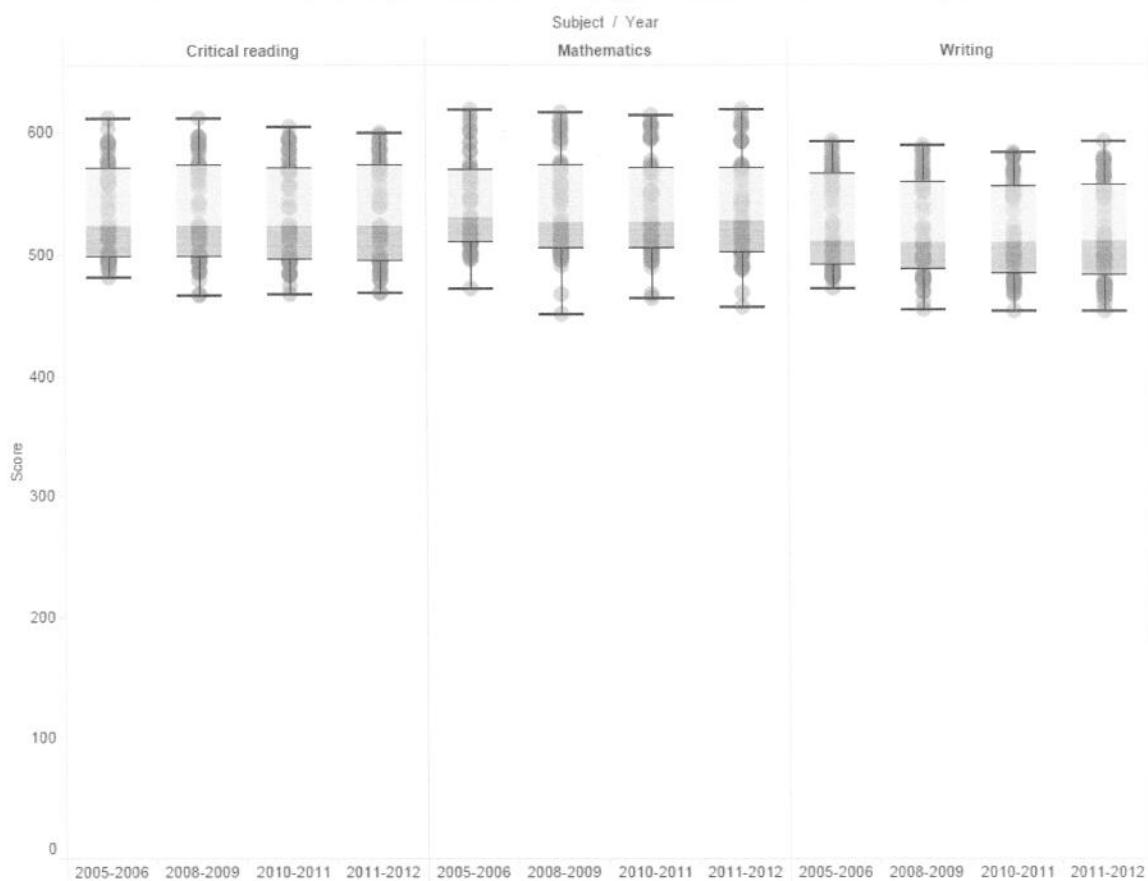


Box plots are a visually concise way of seeing and contrasting distributions of data. The boxes show the middle 50% of the data (or in other words, the middle two quartiles of data). Whiskers are added to box plots to show further information about the distribution of the data. In Desktop, whiskers can be configured to show either the full extent of the data or 1.5 times the interquartile range (the length of the box). Use the latter to help identify potential outliers.

## Practice: Box and Whisker Plot

Open **Box and Whisker Plot Starter.twbx** and create the view:

- View shows **Subject** and **Year** of Average SAT scores at the detail of **State**.
- Mark type is a circle.
- Color is adjusted to 50% transparency.



#### Directions

1. Use **Show Me** to create the view: select **Score** and **Subject**, and choose **box-and-whisker plot**.
2. Drag **Subject** from the **Marks** card to **Columns**.
3. Change **Score** from **SUM** to **AVG**.
4. Drag **Year** to **Columns** after **Subject**.
5. Add **State** to **Detail**.
6. Set **Color transparency** to **50%**.

#### Solution

For the solution to this practice, see "Solution: Box and Whisker Plot" on page 242.



## 22. Statistics and Forecasting

---

This module contains the following:

Trend Lines

Using the Analytics Pane

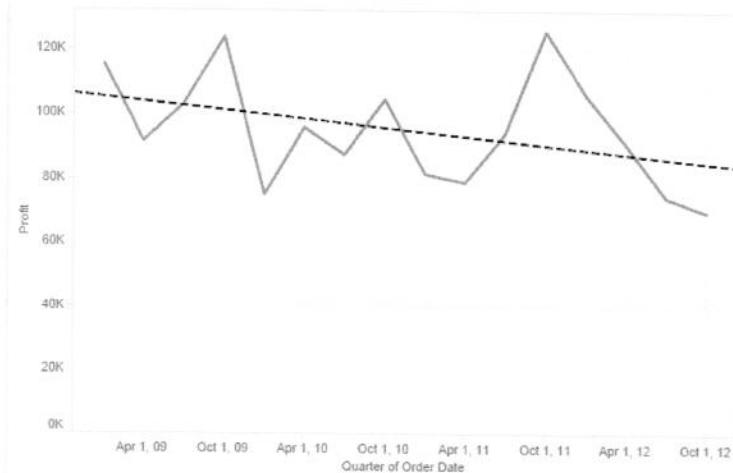
Forecasting

Practice: Trend Lines with Small Multiples

---

## Trend Lines

You can use Tableau's trend line feature to incrementally construct interactive models of behavior that you can use to make predictions about your data. For example, you can answer questions like whether profit is predicted by time, or whether average delays at an airport are significantly correlated with the month of the year.



To add trend lines to a view, both axes must contain a field that can be interpreted as a number. This can also be a date / time field, because Tableau can interpret time as numeric values. The only exception to this is with the M/D/YY and MM/YYYY date formats.

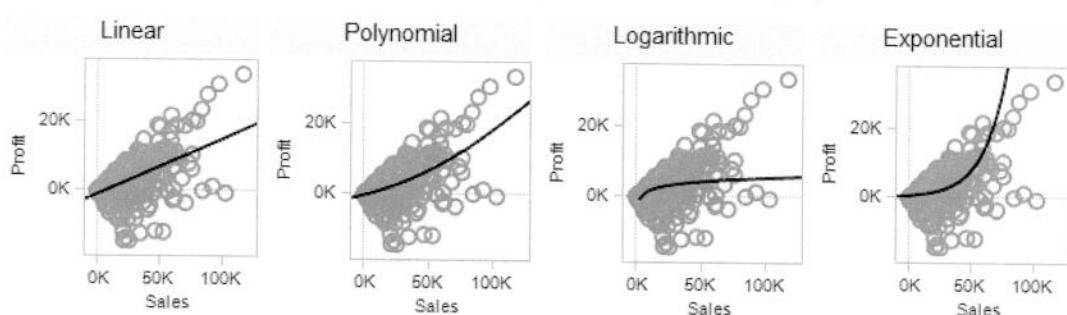
### Add a Trend Line

1. Right-click in the view and choose **Trend Lines**.

**NOTE** This command adds a linear trend line and adds a trend line for each color if there is a discrete field on the **Color** shelf.

2. Right-click in the view again, and select **Edit Trend Lines**.

3. In the Edit Trend Lines dialog box, specify one of the following options:



You can also use the Analytics Pane to add a trend line:

- From the Analytics pane, under **Model**, drag **Trend Line** to the view and drop it on a trend line option (**Linear**, **Polynomial**, and so forth).

## Trend Model

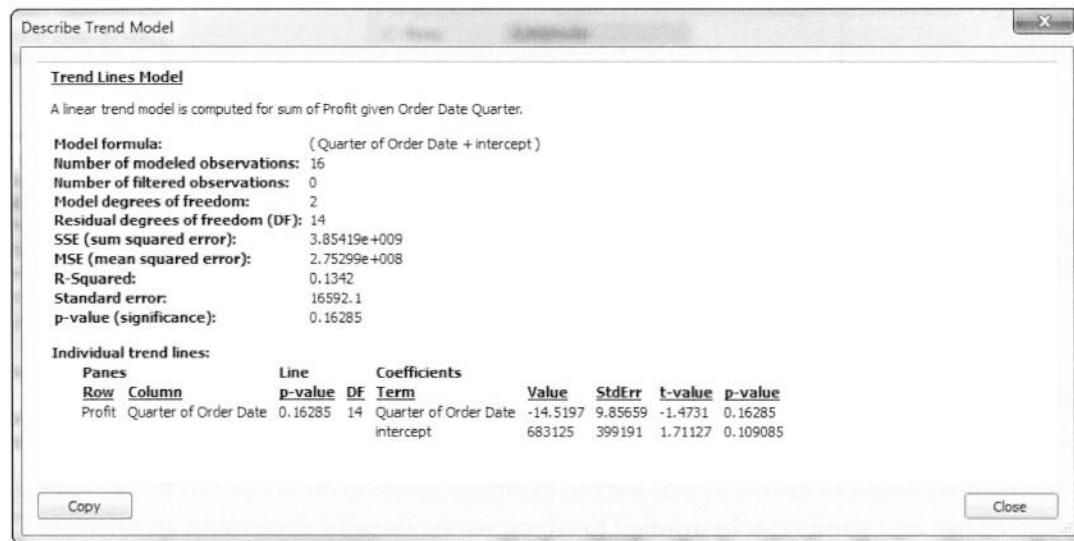
When you add a trend line to your view, you are building a statistical model and answering the question of whether the factors in your view predict a specific value (measure).

### View P-Value and Formula for a Trend Model

You can view the p-value and formula for individual trend lines in two ways:

- Right-click a specific trend line in the view and choose **Describe Trend Model**.
- or-
- On the **Analysis** menu, select **Trend Lines**, and choose **Describe Trend Model** to see the Trend Line table.

The table in the **Describe Trend Model** dialog box lists all the trend lines in your view along with their p-value and formula. This is a quick way to gain insight into which (if any) trend lines are statistically significant.



### Add the Statistical Summary Card to Your Worksheet

- On the **Worksheet** menu, choose **Show Summary**.

**NOTE** You can also right-click on any gray portion of the view workspace to access **Show Summary**.

### Export the Trend Data

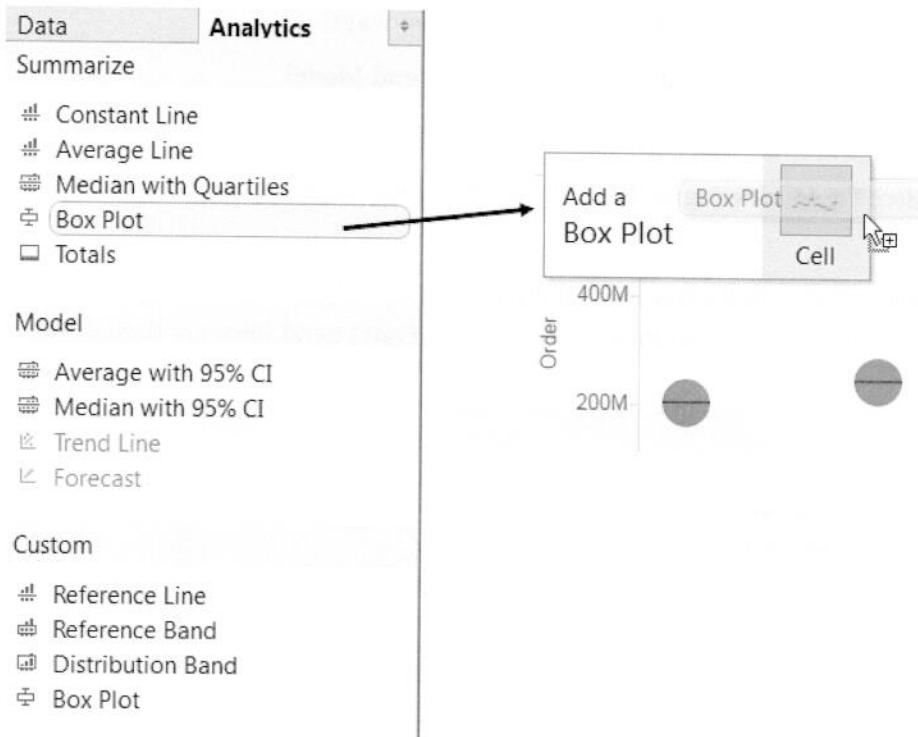
Exporting trend data when Trend Lines are used also exports the Predictions as well as Residuals. This allows for a cross check to ensure that the chosen model (linear, logarithmic, exponential, polynomial) represents the data accurately.

- On the **Worksheet** menu, select **Export** and choose **Data**.

An Access Database file is created that can then be instantly connected to Tableau Desktop after export.

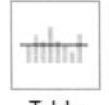
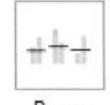
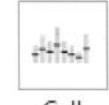
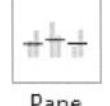
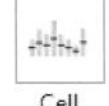
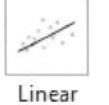
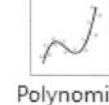
## Using the Analytics Pane

You can access common data analysis tools from the Analytics Pane. The Analytics pane allows you to add any of these options quickly with a simple drag and drop action, with no further formatting required.



To add data analysis to your view, drag the object you want to add to the worksheet and drop it on a scope or calculation option.

When you drag the analysis object to the view, you see the available scope or other options for the type. For example, reference lines and bands can be applied to tables, panes, or cells, depending on the type. A constant reference line can only be applied to a whole table, and box plots are only applied to cells.

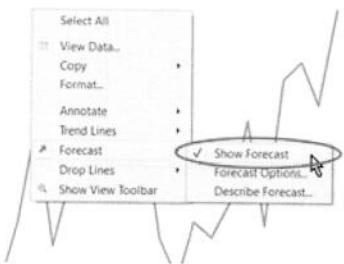
| Analysis type               | Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Constant Reference Line     | You can only add a constant value to an entire table.<br><br>Add a Reference Line<br><br>Table                                                                                                                                                                                                                                                                                                                                                       |
| Average Line Reference Line | You can add these types of lines to Tables, Panes, or Cells.<br><br>Add a Reference Line<br><br>Table <br>Pane <br>Cell                                                                                                                                                         |
| Bands                       | You can add bands to Tables, Panes, or Cells.<br><br>Add a Distribution Band<br><br>Table <br>Pane <br>Cell                                                                                                                                                                     |
| Trend Lines                 | You can select Linear, Logarithmic, Exponential, or Polynomial calculations for the trend line.<br><br>Add a Trend Line<br><br>Linear <br>Logarithmic <br>Exponential <br>Polynomial |
| Forecast                    | There is only one option for adding a Forecast.<br><br>Add a Forecast<br><br>Forecast                                                                                                                                                                                                                                                                                                                                                              |

## Forecasting

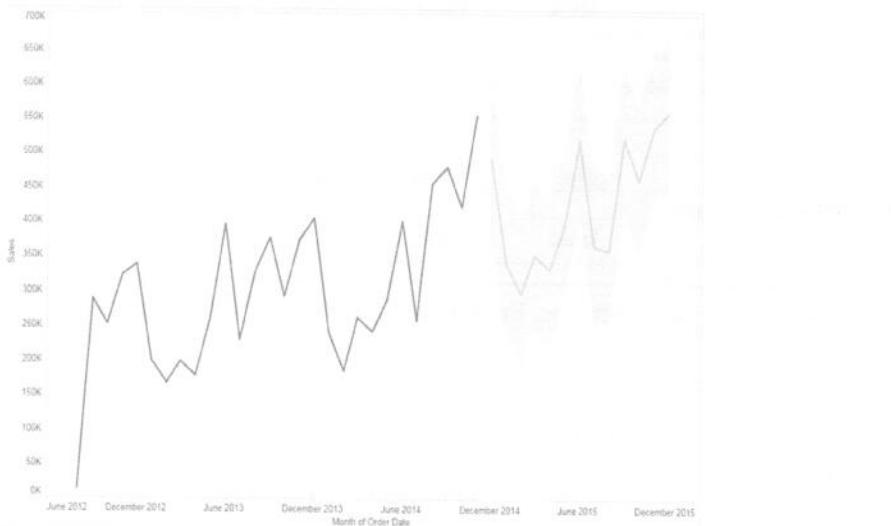
Forecasting is a way to estimate future values based on continuous historical data. Tableau provides built-in statistical models to forecast your data including models that account for seasonality and trends. In Tableau, you can turn on forecasting when viewing data over time.

### Turn on Forecasting

- Right-click in the view, select **Forecast**, and choose **Show Forecast**.



The forecast is shown as a lighter line projecting into the future and a shaded prediction interval.



You can also use the Analytics Pane to add a forecast to your view.

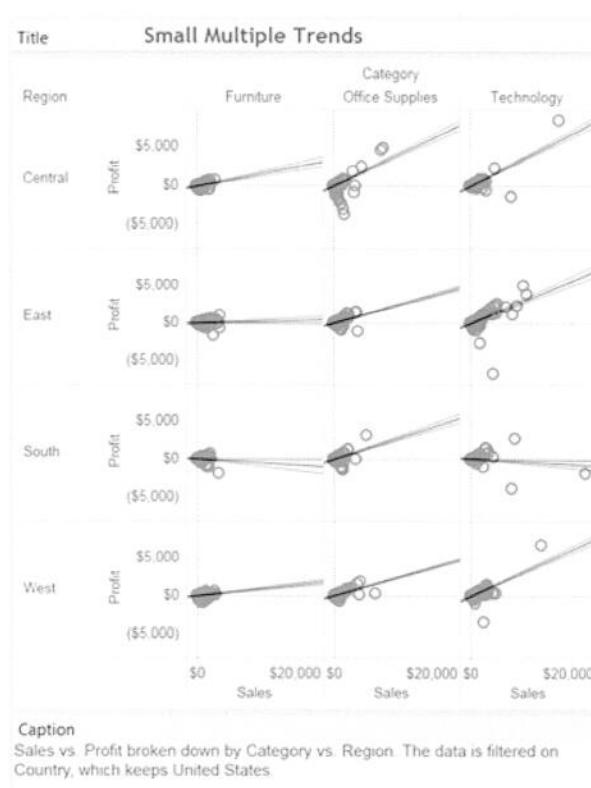
- From the Analytics pane, under **Model**, drag and drop **Forecast** into the view.

---

### Practice: Trend Lines with Small Multiples

Open **Trend Lines with Small Multiples Starter.twbx** and create a view according to the following specification:

- Shows a scatter plot with **Sales** and **Profit**.
- Data is filtered for United States only.
- Data is disaggregated to show all transactions.
- Small multiples created by adding **Category** to Columns and **Region** to Rows.
- Each small multiple has a trend line.



### Directions

1. Note that the worksheet is set to show title and caption.
2. Create the initial view:
  - From Dimensions, drag **Country** to **Filters** and set it to **United States** only.
  - From Measures, drag **Sales** to **Columns**.
  - From Measures, drag **Profit** to **Rows**.
3. Disaggregate the measures to show individual transactions in each individual plot.
4. Add to the view:
  - From Dimensions, drag **Category** to **Columns** and place it to the **LEFT** of **Sales**.
  - From Dimensions, drag **Region** to **Rows** and place it to the **LEFT** of **Profit**.

**NOTE** The addition of the dimensions to the **Column** and **Row** shelves turns the single scatter plot into small multiples.
5. Add the Trend Lines.
6. Try selecting portions of the data to view comparative trend lines. **TIP** On the **Worksheet** menu, click **Show View Toolbar** and then select **Show on Hover** to enable **Radial** and **Lasso** selection.

### Solution

For the solution to this practice, see "Solution: Trend Lines with Small Multiples" on page 242.



# 23. Making Your Views Available

---

This module contains the following:

Dashboards

Dashboard Actions

Practice: Building a Dashboard

Practice: Creating an Interactive Dashboard

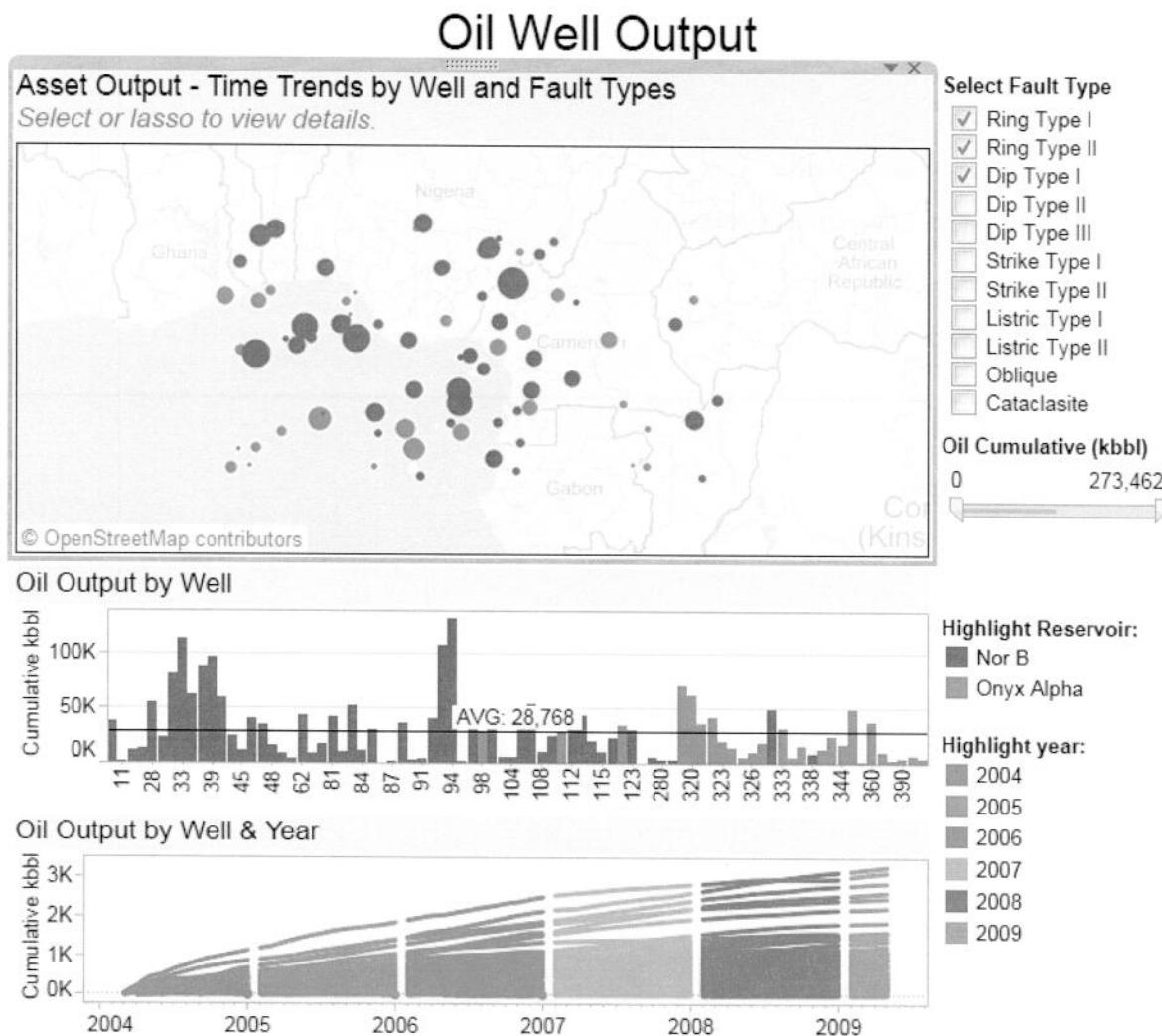
Telling Stories with Data

Practice: Creating a Story

---

## Dashboards

A dashboard is a collection of worksheets and supporting information shown in a single view 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.

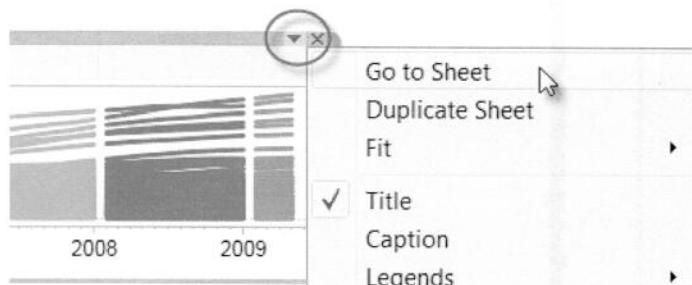
### Understanding the Connections between Dashboards and Worksheets

The views in a dashboard are connected to the worksheets they represent. When you make changes to a view, either on the worksheet directly or on its dashboard representation, both locations will show your changes. This interaction is important to remember when configuring the views in your dashboard.

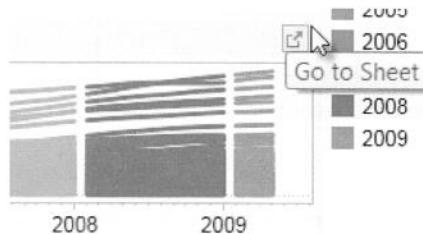
### Edit the Original Worksheet

From the dashboard, you can easily return to a worksheet by clicking on its tab at the bottom of the workbook, or by using either of these convenient methods:

- Click the view on the dashboard to select it. In the upper right corner of the view's border, click the small gray drop-down arrow, and then click **Go to Sheet** on the menu.



- Click the **Go to Sheet** button that appears in the upper right corner of any view, selected or not, when you hover over it.



### Duplicate a Worksheet

- Click the view on the dashboard to select it. In the upper right corner of the view's border, click the small gray drop-down arrow, and then click **Duplicate Sheet** on the menu.



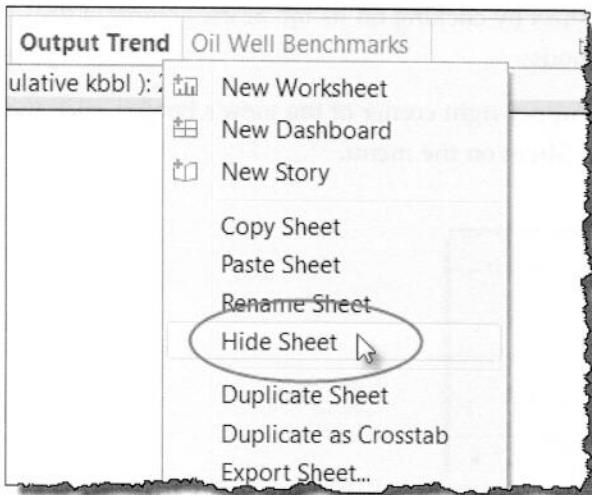
### Hide a Worksheet

You can hide worksheets so that they are not shown in the filmstrip, sheet sorter, or in the tabs along the bottom of the workbook.

**NOTE** A worksheet must be used in a dashboard before it can be hidden.

- Click the view on the dashboard to select it. In the upper right corner of the view's border, click the small gray drop-down arrow, and then click **Go to Sheet** on the menu.

2. Right-click on the worksheet tab, and then select **Hide Sheet**.

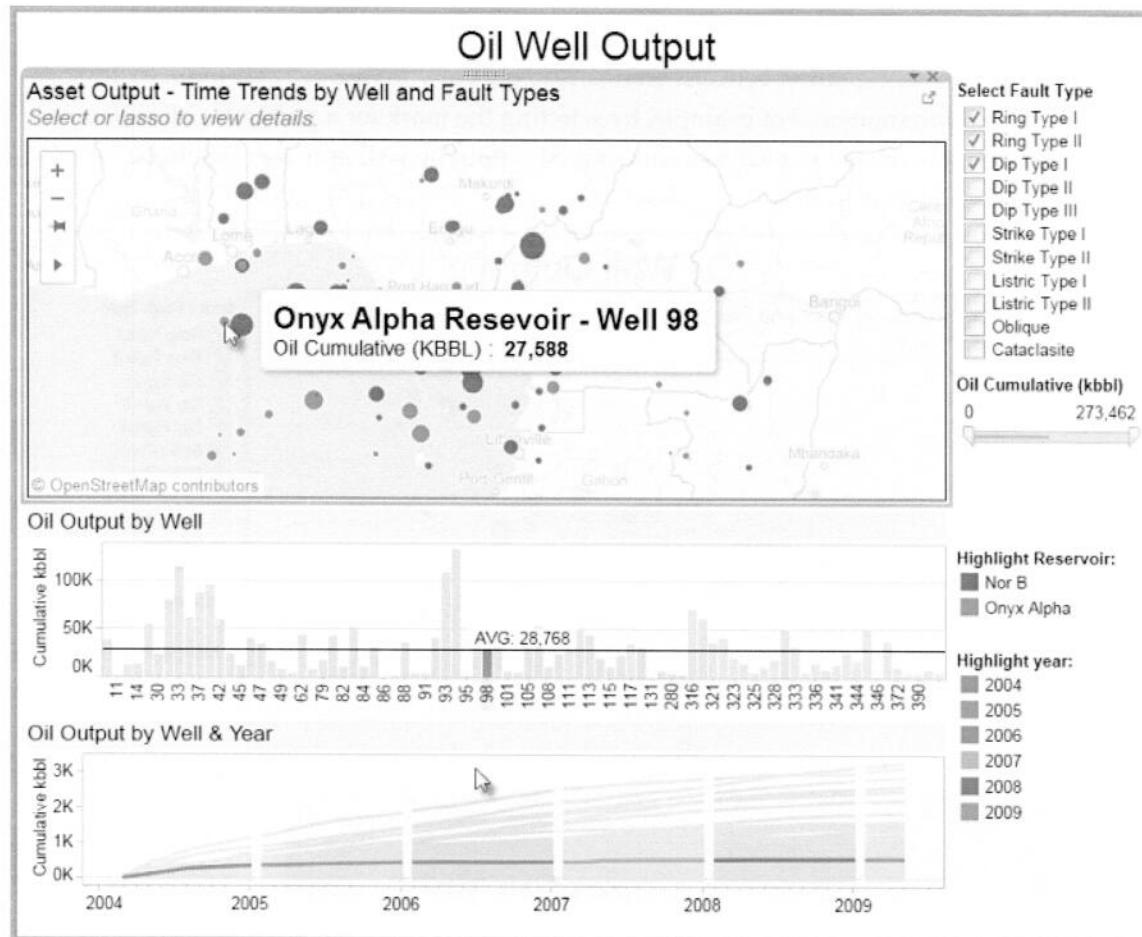


## Dashboard Actions

Tableau enables you to connect dashboard worksheets to other worksheets in the same workbook using **Highlight** and **Filter** actions, and to external web resources using **URL** actions.

### Highlight Actions

Use highlight actions 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, using the color legend to select related marks, or creating an advanced highlight action.



### Add a Highlight Action

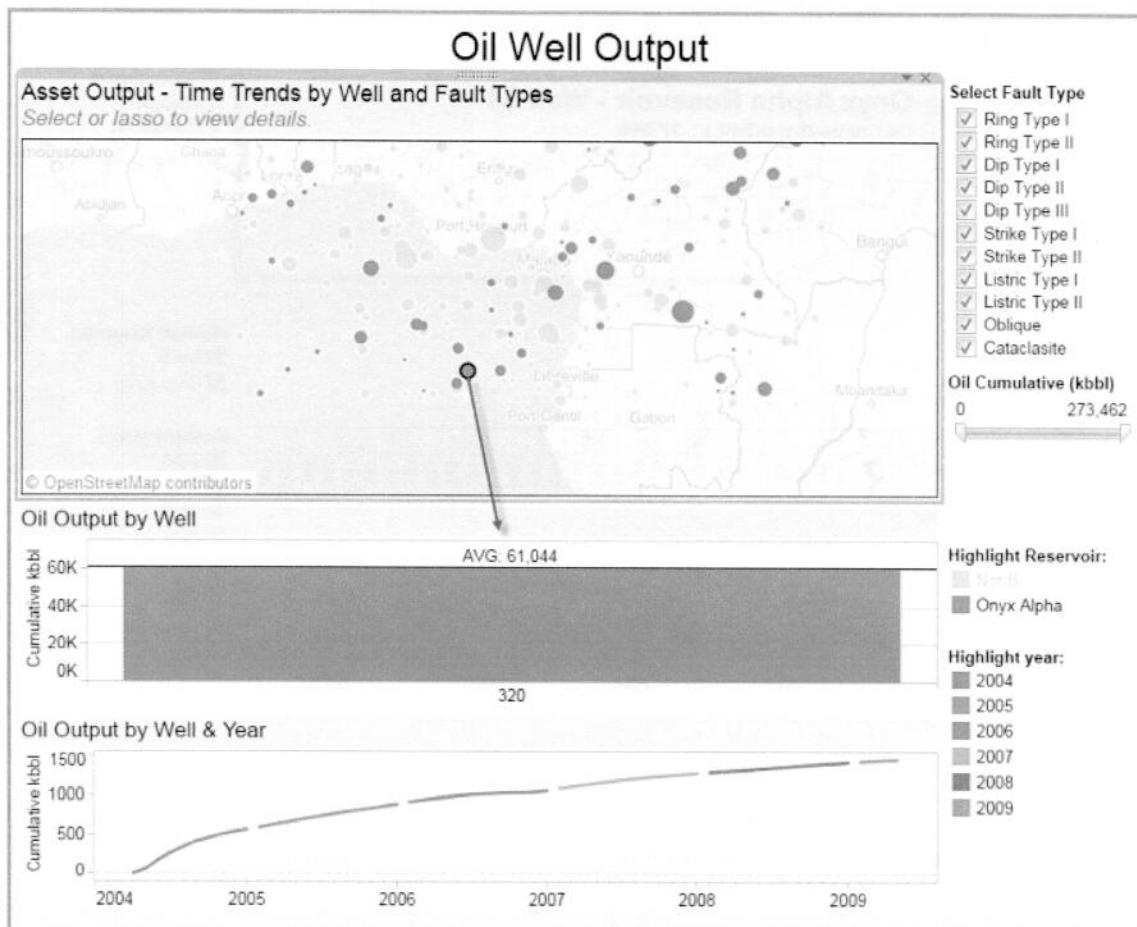
1. On the Dashboard menu, click Actions.
2. In the Actions dialog, click the Add Action button, and then select Highlight.
3. Use the following settings for the highlight:

| For this field      | Enter                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------|
| Name                | Give the <b>Highlight</b> action a meaningful name.                                       |
| Source Sheets       | Sheet(s) containing the marks you are using to initiate your highlighting.                |
| Run action on       | Choose Hover, Select, or Menu. (see Options for Running Actions below for a description.) |
| Target Sheets       | Sheet(s) to be highlighted by the Source sheet(s).                                        |
| Target Highlighting | Select the items that will be highlighted by the source sheet action.                     |

4. Click OK.

## Filter Actions

Use filter actions to send information between worksheets, typically from a selected mark to another sheet showing related information. For example, by selecting the mark for a particular oil well on a dashboard map view, the related worksheets showing oil output by well and year would be filtered to show only data related to that well.



### Add a Filter Action

1. On the Dashboard menu, click Actions.
2. In the Actions dialog, click the Add Action button, and then select Filter.

3. Use the following settings for the filter:

| For this field              | Enter                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name                        | Give the <b>Filter</b> action a meaningful name.                                                                                                                                                                                                                                                                                                       |
| Source Sheets               | Sheet(s) containing the marks you are using to initiate your filtering.                                                                                                                                                                                                                                                                                |
| Run action on               | Choose <b>Hover</b> , <b>Select</b> , or <b>Menu</b> . (see Options for Running Actions below for a description.)                                                                                                                                                                                                                                      |
| Target Sheets               | Sheet(s) to be filtered by the Source sheet(s).                                                                                                                                                                                                                                                                                                        |
| Clearing the selection will | <p>How the values display after the filter is cleared:</p> <ul style="list-style-type: none"> <li>■ <b>Leave the filter</b> continues filtering based on last selection.</li> <li>■ <b>Show all values</b> removes the filter.</li> <li>■ <b>Exclude all values</b> removes the filter and hides the view until the next selection is made.</li> </ul> |

4. Click **OK**.

## URL Actions

A URL action is a hyperlink that points to a webpage, file, or other web-based resource outside of Tableau. Use URL actions to link to more information about your data. To make the link relevant to your data, you can substitute field values of a selection into the link text and URL as parameters.



### Add a URL Action

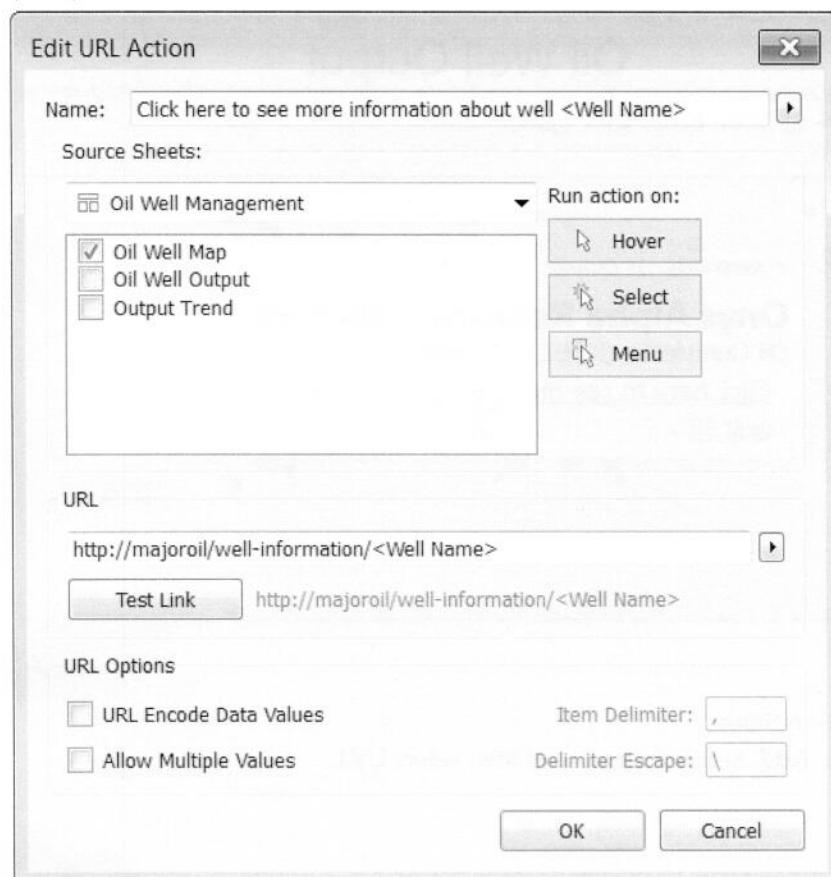
1. On the Dashboard menu, click **Actions**.
2. In the Actions dialog, click the **Add Action** button, and then select **URL**.

3. Use the following settings to create the URL action:

| For this field | Enter                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name           | Name of the URL action--will be used as the link text.                                                                                                                                                                                                                                                                                                                                    |
| Source Sheets  | Sheet(s) to use as the source.                                                                                                                                                                                                                                                                                                                                                            |
| Run action on  | Choose Hover, Select, or Menu. (see Options for Running Actions below for a description.)                                                                                                                                                                                                                                                                                                 |
| URL            | URL link of the outside data source you want to use.                                                                                                                                                                                                                                                                                                                                      |
| URL Options    | <p><b>URL Encode Data Values:</b> If you have values in your data that are not allowable in a URL, select this option so those values are translated to URL encoded characters.</p> <p><b>Allow Multiple Values:</b> Select if you are linking to a website that can take lists of values as parameters in the link. You must also indicate the item delimiter, and delimiter escape.</p> |

4. Click OK.

For the URL action shown in the image above, the following options were selected. Note the use of <Well Name>, one of the Dimensions from the source worksheet, in the URL text (Name) and link (URL).



## Options for Running Actions

You can set all types of dashboard actions to run in one of three ways: **Hover**, **Select**, and **Menu**.

| For this field | Action                                                                                                                                                |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hover          | Rest the pointer over a mark in the view to run the action. This option works well for <b>Highlight</b> and <b>Filter</b> 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           | Click a mark in the view, and then select an option on the tooltip context menu. This option works well for <b>Filter</b> and <b>URL</b> actions.     |

## Practice: Building a Dashboard

Open `Building_a_Dashboard_Starter.twbx` and create a view according to the following specification:

- The worksheets in the starter workbook are displayed together in a single dashboard.
- **Region** is used as a global filter.
- Pie chart used as a filter.

### Directions

1. Add a **Dashboard** (grid) sheet and name it “Sales Dashboard.”
2. Change the settings for size to **Laptop**, and select **Show Title**.
3. Drag the three worksheets onto the dashboard space in a way that is visually appealing.

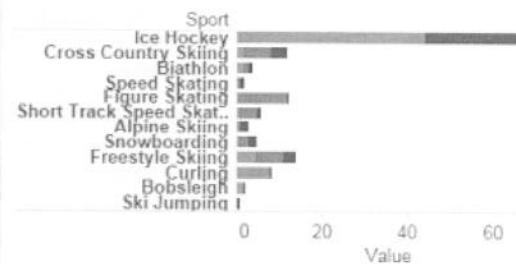
- Vertical layout container holds the views on the right, with the **Total Medals by Sport** view set to fit the space, and the **Medals by Athlete** view set to fit the width.
- The map selection controls the bar chart and the text table, and the sheets display as empty if nothing on map is selected.
- The bar chart for **Total Medal by Sport** controls the **Medals by Athlete** view, and filters the **Medals by Athlete** view to hide items not selected.
- View titles for the two views on the right include variables to display the country and sport. Add instructive text to titles to support user interaction.
- Add URL actions to the dashboard.

## 2014 Sochi Olympics Results

**Medals by Country**  
Click a country:



**Total Medals by Sport for Canada, Finland, France**  
Next, click a sport to see athletes:



**Medals by Athlete None**

### Directions

1. Add a new dashboard tab named "2014 Sochi Olympics Results."
2. Change the dashboard size to **Exactly**, with a width = 900, height = 600.
3. Add **Medals by Country** to the view.
4. Drag a vertical layout container to the right edge of the dashboard.
5. Add **Total Medals by Sport** to the new layout container.
6. Add **Medals by Athlete** to the layout container and place it below **Total Medals by Sport**.
7. Resize the map so it takes up a little more than half the frame, while still fitting the views in the layout container on the right.
8. Add the following filter actions:

| Setting                     | Value                                                        |
|-----------------------------|--------------------------------------------------------------|
| Name                        | Map Filter                                                   |
| Source Sheets               | 2014 Sochi Olympics Results<br>dashboard / Medals by Country |
| Run action on               | Select                                                       |
| Target Sheets               | Ensure all available sheets are selected                     |
| Clearing the selection will | Exclude All Values                                           |

| Setting                     | Value                 |
|-----------------------------|-----------------------|
| Name                        | Filter for Athletes   |
| Source Sheets               | Total Medals by Sport |
| Run action on               | Select                |
| Target Sheets               | Medals by Athlete     |
| Clearing the selection will | Exclude all values    |

9. Test the actions you just added.
  - Click the map to filter the other views.
  - Click a sport in the bar chart to build a list of athletes.
  - Click a blank area in the bar chart to clear the player list.
10. Set **Total Medals by Sport** to fit entire view.
11. Set **Medals by Athlete** to fit width.
12. Edit the title for **Total Medals by Sport**. Leave the reference for the sheet name, and add a reference for the country name. The final title formula looks like this: <Sheet Name> for <Country>
13. Edit the title for **Medals by Athlete** to include the reference for Sport. The final title formula is: <Sheet Name> <Sport>.
14. Show the dashboard title.
15. Create an action using a URL to look up a sport on Wikipedia, and tie it to the view for **Total Medals by Sport** and **Medals by Athlete**:

| Setting       | Value                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------|
| Name          | Look up information about <Sport>                                                                   |
| Source Sheets | Medals by Athlete and Total Medals by Sport                                                         |
| Run Action On | Menu                                                                                                |
| URL           | <a href="http://en.wikipedia.org/wiki/&lt;Sport&gt;">http://en.wikipedia.org/wiki/&lt;Sport&gt;</a> |

16. Test the URL action by returning to the dashboard, and hovering over a bar in the Total Medals by Sport view.
17. Add another URL to look up a specific player:

| Setting       | Value                                                                                                                     |
|---------------|---------------------------------------------------------------------------------------------------------------------------|
| Name          | Look up information about <Athlete>                                                                                       |
| Source Sheets | Medals by Athlete                                                                                                         |
| Run Action On | Menu                                                                                                                      |
| URL           | <a href="http://www.bing.com/search?q=&lt;Athlete&gt;+Olympics">http://www.bing.com/search?q=&lt;Athlete&gt;+Olympics</a> |
| URL Options   | URL Encode Data Values                                                                                                    |

18. Test the URL actions.

19. Save the workbook.

#### Solution

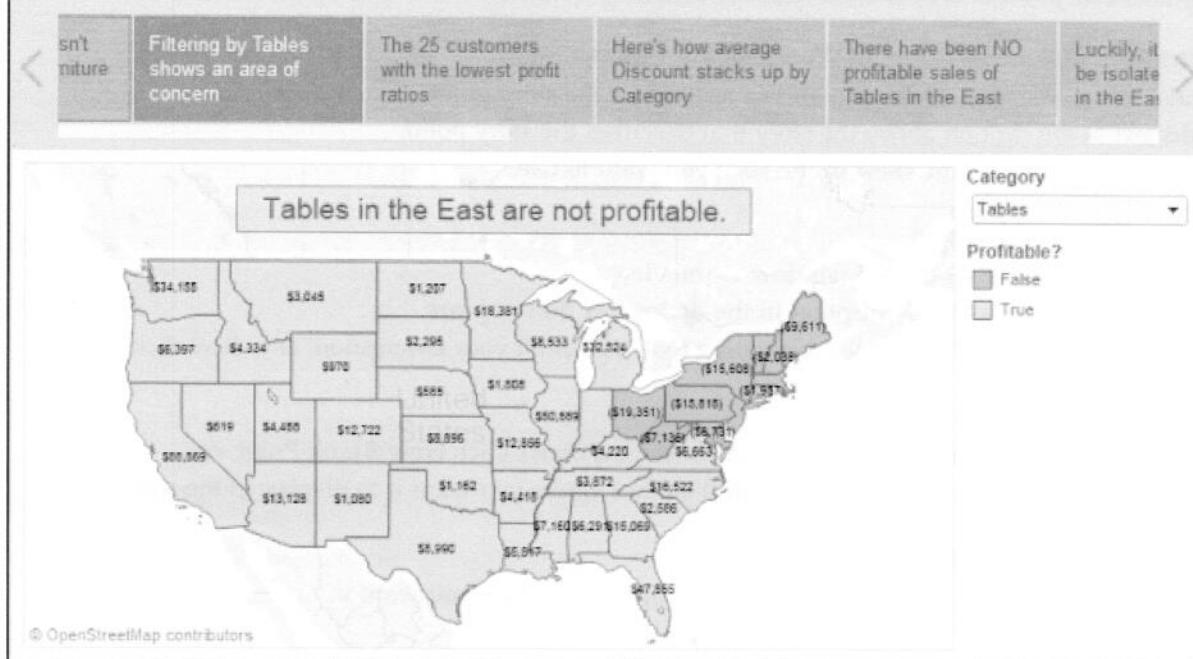
For the solution to this practice, see "Solution: Creating an Interactive Dashboard" on page 244.

## Telling Stories with Data

A story is a connected series of worksheets and dashboards. Stories allow an author to capture insights and share them as a sequential presentation. A story is made of a set of story points: worksheets or dashboards that highlight specific insights. Using a story, an author can share a "state" of a visualization and explain the insight with annotations, captions, and descriptions.

When you are connected to data, and have your worksheets and dashboards ready to share, you can save "states" of your work to display in a presentation experience.

## What Is Happening with Tables in the East?



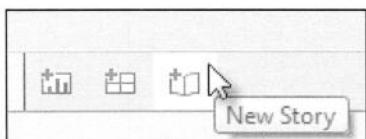
## How to Build a Story

Each story point captures a dashboard or worksheet as you have set it. This could be a filter setting or selected mark. Users can still interact with your story, but when they refresh the view, it reverts to the original setting as you built it.

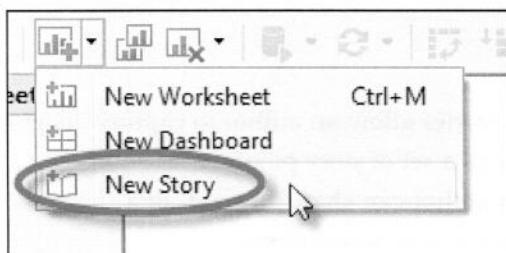
### Start a Story

There are several common ways to start a story:

- On the bottom toolbar, click the New Story button.



- On the toolbar, click the new worksheet icon's drop-down arrow, and select New Story.



- On the Story menu, select New Story.

### Add a Sheet or Dashboard to a Story Point:

1. From the Dashboards and Worksheets pane, drag a worksheet or dashboard to the story.
2. Set the story point to the state you want to share.

### Capture your Insight or "State" of Worksheet or Dashboard:

1. Make selections, filter, highlight, and so forth to set the story point.
2. Add text to the caption above the story that describes the story point.
3. Click **Update** to save the sheet in the state you want to use.

### Add Descriptions to a Story:

1. Drag **Description** from the left window to the view.
2. Type and customize the description in the dialog box that appears.
3. Use the **Description** dialog box's formatting tools to format your description, and then click **OK**.

### Add a New Blank Point:

- Next to the last navigator box (which contain the captions), click **New Blank Point** -or-
- Drag and drop a sheet to the navigator in the place where you want it to display in the story.

### Rearrange the Order of the Story Points

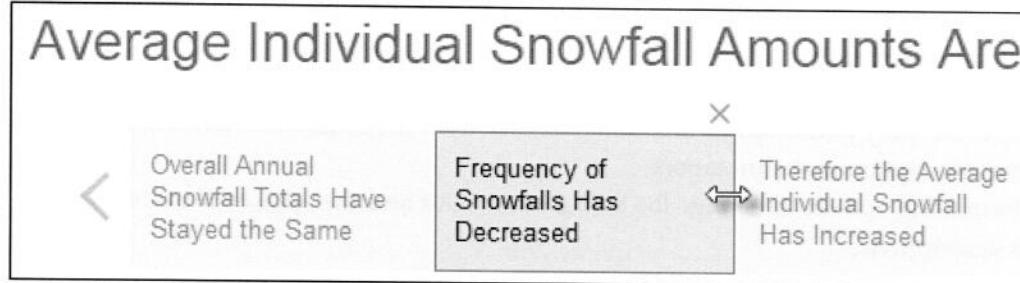
- In the navigator, drag and drop a story point caption to where you want it.

### Delete a Story Point

- In the navigator, hover over a story point, and then click the orange X just above the box.

### Format a Story

1. On the **Story** menu, select **Format**.
2. Use the **Format Story** pane to format the story. You can alter the color, font, and background color of the title area, overall heading area, navigator, and descriptions. **NOTE** To reset formatting to its default state, on the **Format Story** pane, click the **Clear** button at the bottom.
3. Change the size of the navigator boxes by clicking and dragging an edge of a box.



### Dashboards versus Story Points

The window you use for story points looks somewhat similar to the dashboard window, but these two features serve different purposes. In general, dashboards support data exploration and questions. Story points are better for sharing specific data insights to tell a data story.

When you are building stories, you need to do the majority of your worksheet or dashboard editing BEFORE you add it to the story. The story points window has limited editing capabilities.

Here are some of the key similarities and differences between dashboards and story points:

| Feature                                                                        | Dashboards | Story points                             |
|--------------------------------------------------------------------------------|------------|------------------------------------------|
| Has a tab on the bottom of the screen to create a new one                      | Yes        | Yes                                      |
| Allows editing of sheet items such as titles, filters, and other view elements | Yes        | No                                       |
| Changes you make are saved as you go                                           | Yes        | Yes                                      |
| Worksheet titles appear                                                        | Yes        | No (stripped when added to story points) |
| "Look and feel" edits                                                          | Yes        | Somewhat limited                         |
| User interactivity with items in the view such as filters, highlight, etc.     | Yes        | Yes                                      |
| Publish to Server                                                              | Yes        | Yes                                      |
| Publish to Reader                                                              | Yes        | Yes                                      |
| Edits to worksheets show after they have been added to a Dashboard or Story    | Yes        | Yes                                      |

## Practice: Creating a Story

Using the worksheets provided, or using worksheets and dashboards of your own creation, build a story of your own. You may use external sources of data.

Open **Creating a Story Starter.twbx** and create a view according to the following specification:

- Uses three or more worksheets or dashboards (use the worksheets provided or create your own worksheets and dashboards).
- Introduces a problem and presents a potential insight or solution.
- Contains one or more story points saved at a different state than the original visualization.
- Uses at least one description and annotation.
- Makes use of formatting options to change the background color and the appearance of the title, navigator, and descriptions.
- Has a navigator that is sized to fit the captions.

The following shows just one example of the type of story you might come up with.



#### Directions: Create and Size the Story

1. Open **Creating a Story Starter.twbx**.
2. Set the size of the story.
3. Give your story a title.

#### Directions: Add Worksheets and Dashboards, and Put the Story in Order

1. Add worksheets and dashboards until you have enough to tell your story.
2. Arrange the order of the story points so that they tell the best story possible.



3. From **Dimensions**, drag **Sub-Category** to **Rows**, placing it to the right of the **Category** field.
4. From **Measures**, drag **Profit** to **Color** on the **Marks** card.
5. On the **SUM(Profit)** legend, click the drop-down arrow, click **Edit Colors**, and on the **Edit Colors** dialog box, choose **Orange-Blue Diverging** from the **Palette** drop-down.

#### Share as an Image

1. From the **Worksheet** menu point to **Export** and then click **Image**.
2. In the **Export Image** dialog box, verify that **Color Legend** and **View** are selected under **Show** and select one of the layout options under **Image Options**.
3. Click **Save**.
4. Save the file as a jpeg to the root directory of the USB and name it "Bar Chart Image."
5. Open PowerPoint and insert the new image.

#### Share as a Packaged Workbook

1. On the **File** menu, choose **Save As**.
2. In the **Save As** dialog box, name the file "Bar Chart", and on the **Save as Type** menu, select **Tableau Packaged Workbook (\*.twbx)**, and then click **Save**.

**NOTE** For an example of a complete solution to this practice, see [Creating\\_a\\_Local\\_Data\\_Connection\\_Solution.twbx](#).

---

## Solution: Filtering

The following is a solution to "Practice: Filtering" on page 19.

1. Open **Filtering\_Starter.twbx**.
2. On the **Data** pane, right-click **Market**, and click **Show Filter**.
3. On the **Market** filter in the view, click the drop-down arrow, and choose **Single Value (List)**.
4. Click the drop-down arrow again for the **Market** filter in the view, select **Customize**, and clear the check mark next to **Show "All" Value**.
5. Click the drop-down arrow again for the **Market** filter in the view and choose **Edit Title**.
6. Name the filter "Select a Market" and then click **OK** to close the dialog box.
7. Right-click **Sales**, select **Default Properties**, and click **Number Format**. On the **Default Number Format** screen, select **Currency (Custom)**, set **Decimal place** to 0 (zero), and click **OK**.
8. From **Measures**, drag **Sales** to **Filters**.
9. In the **Filter Field** dialog box, click **Sum**, click **Next**, and then click **OK**.
10. Right-click the **SUM(Sales)** filter, and choose **Show Filter**.
11. Click the drop-down arrow for the **SUM(Sales)** filter in the view, and choose **Edit Title**.
12. Name the filter "Adjust View by Sales" and click **OK**.
13. Experiment with the sliders and notice the "AND" logic being used. The results shown are those that match the criteria of both filters.

**NOTE** For an example of a complete solution to this practice, see [Filtering\\_Solution.twbx](#).

## Solution: Creating Visual Groupings

The following is a solution to "Practice: Creating Visual Groupings" on page 30.

1. Open [Creating\\_Visual\\_Groupings\\_Starter.twbx](#).
2. CTRL + click each of the following bars: Envelopes, Fasteners, and Labels.

**TIP** Make sure to select the bars, not the text.

3. With these items selected, right-click and choose **Group**.
4. CTRL + click to select the bars that represent each of the following: Machines, Copiers, and Appliances.
5. With these items selected, right-click and choose **Group**.
6. In **Dimensions** in the **Data** pane, right-click **Sub-Category** (group), and choose **Edit Group**.
7. In the **Edit Group** dialog box select Envelopes, Fasteners, Labels, and click **Rename**.
8. In activated text box for the group, type "Desk Supplies".
9. In the **Edit Group** dialog box select Appliances, Copiers, and Machines and click **Rename**.
10. In the activated text box for the group, type "Office Machines" and click **OK**.

**NOTE** All of the items not included in another group are automatically included in a group named **Other**. You cannot rename a group alias to "Other", because this alias is already used by Desktop.

**NOTE** For an example of a complete solution to this practice, see [Creating\\_Visual\\_Groupings\\_Solution.twbx](#).

---

## Solution: Discrete and Continuous Dates

The following is a solution to "Practice: Discrete and Continuous Dates" on page 37.

### Discrete Months View

1. Open [Using\\_Discrete\\_and\\_Continuous\\_Dates\\_Starter.twbx](#).
2. Verify that **Sheet 1** is selected.
3. From **Measures**, drag Sales to **Rows**.
4. From **Dimensions**, drag Order Date to **Columns**.
5. On the **Marks** card, click the mark type drop-down list and change it from Automatic to Bar.

### Continuous Custom Dates

1. Open **Custom\_Dates\_Starter.twbx** and select the sheet named **Continuous Quarters**.
2. In **Dimensions**, right-click **Order Date**, click **Create**, and then click **Custom Date**.
3. In the **Create Custom Date** dialog box, name the custom date "Order Date (Continuous Quarters)", select **Quarters** from the **Detail** drop-down list, verify that **Date Value** is selected, and click **OK**.
4. Drag the newly created **Order Date (Continuous Quarters)** to **Columns** on top of the **Month** field to replace it.

### Discrete Custom Dates

1. Switch to the sheet named **Discrete Quarters**.
2. In the **Data** pane, right-click on **Order Date**, click **Create**, and then click **Custom Date**.
3. In the **Create Custom Date** dialog box, name the custom date "Order Date (Discrete Quarters)", select **Quarters** from the **Detail** drop down list, select **Date Part**, and then click **OK**.
4. Drag the newly created **Order Date (Discrete Quarters)** to **Columns**, and remove the other instance of **Order Date** from **Columns**.
5. On the **Marks** card, change the mark type to **Bar**.

### Discrete Custom Date Hierarchy (Years to Quarters)

1. Switch to the sheet named **Year to Quarter Custom Date Hierarchy**.
2. In the **Data** pane, right-click **Order Date**, click **Create**, and then click **Custom Date**.
3. In the **Create Custom Date** dialog box, name the custom date "Order Date (Discrete Years)", select **Years** from the **Detail** drop down list, select **Date Part**, and then click **OK**.
4. In the **Data** pane, drag **Order Date (Discrete Quarters)** on top of **Order Date (Discrete Years)** to create a hierarchical group.
5. Double-click the hierarchical group name and type "Order Date (Discrete Years to Quarters)".
6. On **Columns**, replace **MONTH (Order Date)** with the newly created hierarchy **Order Date (Discrete Years to Discrete Quarters)**, and expand to show both years and quarters.
7. On the **Marks** card, change the mark type to **Bar**.

NOTE For an example of a complete solution to this practice, see **Custom\_Dates\_Solution.twbx**.

---

## Solution: Combined Axis Chart

The following is a solution to "Practice: Combined Axis Chart" on page 46.

1. Open **Combined Axis Chart\_Starter.twbx**.
2. From **Measures**, drag **Sales** to **Rows**.
3. From **Dimensions**, drag **Department** to **Rows**.
4. From **Dimensions**, drag **Customer Segment** to **Columns**.
5. From **Measures**, drag **Profit** to the vertical **Sales** axis. Drop the field when the mouse icon changes into a double ruler.
6. From **Dimensions**, drag **Measure Names** to **Color** on the **Marks** card.
7. On the axis marked **Value**, right-click, select **Edit Axis**, in the **Title** box, type "Dollars" and then click

## Solution: Highlight Table

The following is a solution to "Practice: Highlight Table" on page 61.

1. Open **Highlight\_Table\_Starter.twbx**.
2. From **Measures**, drag **Profit** to **Text** on the **Marks** card.
3. From **Measures**, drag **Profit** to **Color** on the **Marks** card.
4. On the **Marks** card, change the mark type to **Square**.
5. From **Dimensions**, drag **Department** and **Category** to **Rows**, placing **Category** on the right.
6. From **Dimensions**, drag **Region** and **SubRegion** to **Columns**, placing **SubRegion** on the right.
7. On the **Marks** card, click **Color** and click **Edit Colors**. In the **Palette** drop-down, choose **Orange-Blue Diverging** and then click **OK**.

**BONUS:** To remove the "Null" subheader, right-click on the label, and choose **Edit Alias**. In the **Edit Alias** dialog box, replace "Null" with a blank space, and click **OK**.

**NOTE** For an example of a complete solution to this practice, see **Highlight\_Table\_Solution.twbx**.

---

## Solution: Totals and Aggregation

The following is a solution to "Practice: Totals and Aggregation" on page 63.

### **View One**

1. Open **Totals\_and\_Aggregations\_Starter.twbx**.
2. Use the worksheet named **Total Sales**.
3. On the **Analysis** menu, choose **Totals**, and click **Show Row Grand Totals**.
4. On the **Analysis** menu, choose **Totals**, and click **Show Column Grand Totals**.
5. On the **Analysis** menu, choose **Totals**, and click **Add All Subtotals**.

### **View Two**

1. Use the worksheet named **Average Sales (Weighted)**.
2. On the **Marks** card, click the **SUM(Sales)** drop-down arrow, select **Measure (Sum)**, and click **Average**.

### **View Three**

1. Use the worksheet named **Average Sales (Visible)**.
2. On the **Analysis** menu, select **Totals**, point to **Total All Using**, and click **Average**.

**NOTE** For an example of a complete solution to this practice, see **Totals\_and\_Aggregations\_Solution.twbx**.

---

## Solution: Creating a Data Extract

The following is a solution to "Practice: Creating a Data Extract" on page 70.

14. On the **Worksheet** menu, click **Show Title**.
15. Save the file as a packaged workbook (.twbx).

**NOTE** For an example of a complete solution to this practice, see **Joining Tables Solution.twbx**.

---

## Solution: Exploring Effect of Primary Data Source Selection

The following is a solution to "Practice: Exploring Effect of Primary Data Source Selection" on page 79.

### Explore the Data

1. Open a new workbook.
2. Under **To a file**, click **Excel**.
3. Browse to select the **Superstore Sales Training.xls** source in the **Data** folder of the student USB, select it, and click **Open**.
4. On the **Data Source** page, under **Sheets**, double-click the **Orders** table.
5. Click **Sheet 1**.
6. From **Dimensions**, drag **Category** to **Rows**.
7. From **Measures**, drag **Sales** to **Text** on the **Marks** card.
8. In the **Data** pane, right-click **Sales**, click **Default Properties**, and then click **Number Format**. Click **Currency (Custom)**, set **Decimal places** to 0, set **Units** to **Thousands (K)** and then click **OK**.
9. Double-click the worksheet tab, type "Superstore Sales by Category" and press the **ENTER** key.
10. On the **Data** menu, click **New Data Source**.
11. Under **To a file**, click **Excel**.
12. Browse to the **SalesTargets.xlsx** data source in the **Data** folder of the student USB, select it, and click **Open**.
13. On the **Data Source** page, make sure the **SalesTargets** table is selected, and click the icon  to open a new worksheet.
14. In the **Data** pane, make sure the **SalesTargets** data source is selected, and then, from **Dimensions**, drag **Category Name** to **Rows**.
15. From **Measures**, drag **Sales Target** to **Text** on the **Marks** card.
16. In the **Data** pane, right-click **Sales Target**, click **Default Properties**, and then click **Number Format**. Click **Currency (Custom)**, set **Decimal places** to 0, set **Units** to **Thousands (K)** and then click **OK**.
17. Double-click the new worksheet tab that says **Sheet 2**, type "Sales Targets by Category Name" and press the **ENTER** key.

### Blend One: Superstore First

1. Create a new worksheet and name it **Superstore First**.
2. From the **Data** menu, choose **Edit Relationships**.
3. In the **Relationships** dialog box, click the **Primary data source** drop-down list, select **Orders (Superstore Sales Training)** as the primary data source, and make sure **SalesTargets** is listed under **Secondary data source**.
4. In the **Relationships** dialog box, select **Custom**, and click **Add**.
5. In the **Add/Edit Field Mapping** dialog box, select **Category** under **Primary data source field**, select **Category Name** under **Secondary data source field**, and then click **OK**.

9. In the Relationships dialog box, leave **Categories (CategoryMaster)** as the primary source, and select **SalesTargets (SalesTargets)** as the secondary source.
10. In the Relationships dialog box, select **Custom**, and then click **Add**.
11. In the Add/Edit Field Mapping dialog box choose to blend between **Categories** and **Category Name** fields, and click **OK**.
12. In the Relationships dialog box, click **OK**.
13. On the **Data** pane, with the source **Categories (CategoryMaster)** selected, drag **Categories** from **Dimensions** to **Rows**.
14. From the **Orders (Superstore Sales Training)** source, drag **Sales** from **Measures** to **Columns**.
15. From the **SalesTargets (SalesTargets)** source, drag **Sales Target** from **Measures** to the **Sales** axis to create a combined axis view.
16. From the **Categories (CategoryMaster)** source, drag **Measure Names** from **Dimensions** to **Color** on the **Marks** card.
17. Click the null indicator in the bottom right corner of the view, and choose **Show Data at Default Position**.
18. In the view, right-click the empty area next to **Sales** for **Decor**, click **Annotate**, and then click **Point**.
19. In the **Edit Annotation** dialog box, type "No Sales for Decor yet." and click **OK**.
20. Annotate **Rubber Bands** in the same way, except type "Rubber bands needs sales target information."
21. Save the workbook as a .twbx packaged workbook.

NOTE For an example of a complete solution to this practice, see **Exploring Effect of Primary Data Source Selection Solution.twbx**.

---

## Solution: Manipulating Strings and Data Type Conversions

The following is a solution to "Practice: Manipulating Strings and Data Type Conversions" on page 91.

1. Open **Manipulating Strings And Data Type Conversions\_Starter.twbx**, and notice that **Customer Name** and **SUM(Sales)** are currently in the view.
2. Right-click in the **Data** pane, and choose **Create Calculated Field**.
3. In the top left text box, type "Customer Number & Name" as the calculated field name.
4. Click in the blank white space on the left, and type the following formula:  

```
"Customer # " + STR([Customer_ID]) + " - " + [Customer Name]
```
5. Click **OK**.
6. From **Dimensions**, drag **Customer Number & Name** to **Rows** on top of the existing **Customer Name** field in **Rows** to replace it.
7. On the **Warning** dialog box, click **Add All Members**.
8. If necessary, drag the border of the first column to the right so all of the text shows.

NOTE For an example of a complete solution to this practice, see **Manipulating Strings And Data Type Conversions\_Solution.twbx**.

- 
6. On the **Marks** card, double-click **SUM([Profit] / [Sales])** to edit the calculation.
  7. Revise the calculation to **SUM([Profit])/SUM([Sales])** and then press **ENTER**.

#### Save the Calculation

1. Drag the calculation you just edited from the **Marks** card to the **Data** pane.
2. In the **Rename Field** dialog box, type "Profit Ratio" and then click **OK**.
3. In the **Measures** window, click the **Profit Ratio** drop-down arrow, point to **Default Properties**, and then select **Number Format**. In the **Default Number Format** dialog, select **Percentage**, and then click **OK**.

**NOTE** The view now shows the expected percentages for **Profit Ratio**.

**NOTE** For an example of a complete solution to this practice, see **Calculations and Aggregations Profit Ratio Solution.twbx**.

---

## Solution: Calculated Fields and Joins

The following is a solution to "Practice: Calculated Fields and Joins" on page 94.

1. Open **Calculated Fields and Joins Starter.twbx**.
2. Click the **Data Source** tab to start editing the data source.
3. Click the two overlapping circles between the **Orders** and **Returns** tables to begin editing the join type.
4. Click **Left** as the join type.
5. Click the **Percentage of Returns** worksheet tab.
6. In the **Data** pane, right-click in a blank area and then click **Create Calculated Field**.
7. In the **Calculated Field** dialog box, name the calculation "Percentage of Returns", and use the following formula: `COUNT([Status])/COUNT([Number of Records])`
8. Click **OK**.
9. In the **Measures** area, right-click on **Percentage of Returns**, select **Default Properties**, and choose **Number Format**.
10. In the **Default Number Format** dialog box, choose **Percentage**, accepting the default decimal places, and click **OK**.
11. From **Measures**, drag **Percentage of Returns** to **Columns**.
12. From **Dimensions**, drag **Category** to **Rows**.
13. On the **Percentage of Returns** axis, click the Sort icon  to sort **Category** by **Percentage of Returns** in descending order.
14. From **Measures**, drag another instance of **Percentage of Returns** to **Label** on the **Marks** card.
15. On the **Worksheet** menu, and then click **Show Title**.

**NOTE** For an example of a complete solution to this practice, see **Calculated Fields and Joins Solution.twbx**.

---

## Solution: Using a Calculated Field in a Blended View

The following is a solution to "Practice: Using a Calculated Field in a Blended View" on page 95.

---

- 
3. Click **OK** in the Calculated Field dialog box.
  4. From **Measures**, drag **At Quota?** to **Color** on the **Marks** card.
  5. Click the drop-down arrow on the **AGG(At Quota?)** color legend, and choose **Edit Colors**.
  6. Edit the colors so **False** is red and **True** is gray, and click **OK**.

**NOTE** For an example of a complete solution to this practice, see [Using a Calculated Field in a Blended View Solution.twbx](#).

---

## Solution: Using Split

The following is a solution to "Practice: Using Split" on page 101.

### Split the Columns

1. Click the **Data Source** tab.
2. At the top of the **City, State** column, click the drop-down arrow and select **Split**. **TIP** The correct drop-down arrow is to the right of **City, State**.
3. At the top of the **Product ID** column, click the drop-down arrow and select **Custom Split**.
4. In the Custom Split dialog box, complete the following:
  - Make sure **Use the separator** is set to a hyphen -.
  - On the **Split off** drop-down menu, select **Last**.
  - Set the number of columns to **1**.
  - Click **OK**.

### Manage the Metadata

1. Click the **Manage metadata** icon. **TIP** It's just above the data preview table.
2. In the **Field Name** column, click the **City, State - Split 1** field to activate editing, rename the field "City", and then press **Enter**.
3. Repeat step 2 to rename **City, State - Split 2** to "State", and to rename **Product ID - Split 1** to "Product ID Number".
4. To the left of the **City** field, click the icon, click **Geographic Role**, and then select **City**. **TIP** The **State** field already has a geographic role of **State/Province**.

### Build a Visualization

1. Click the **Sheet 1** tab.
2. In the **Data pane**, from **Measures**, drag **Sales** to **Columns**.
3. From **Dimensions**, drag **Category** to **Rows**.
4. From **Dimensions**, drag **Sub-Category** to **Rows** and place it to the right of **Category**.
5. From **Dimensions**, drag **Product ID Number** to **Rows** and place it to the right of **Sub-Category**.
6. From **Dimensions**, drag **Product Name** to **Rows** and place it to the right of **Product ID Number**.

**NOTE** For an example of a complete solution to this practice, see [Using\\_Split\\_Solution.twbx](#).

---

## Solution: Aggregating Dimensions in Calculations

The following is a solution to "Practice: Aggregating Dimensions in Calculations" on page 105.

1. Open Aggregating Dimensions in Calculations Starter.twbx.
2. From Measures, drag Sales to Rows.
3. From Dimensions, drag Category to Columns.
4. On Columns, click the plus sign next to Category to show Sub-Category.
5. From Measures, drag Profit to Color on the Marks card.
6. On the Analysis menu, choose Create Calculated Field.
7. In the Calculation Editor dialog box, name the calculated field "Category with Profitability".
8. In the white space on the left, enter the following formula:

```
IF SUM([Profit])>0 THEN "Profitable " + MIN([Category])
ELSE "Unprofitable " + MIN([Category])
END
```

This calculation tests for profitability, and then concatenates either "Profitable" or "Unprofitable" with the Category, depending on the result. Click OK.

9. From Measures, drag the new Category with Profitability calculated field to Columns, and place between Category and Sub-Category.

NOTE For an example of a complete solution to this practice, see Aggregating Dimensions in Calculations Solution.twbx.

---

## Solution: Using LOD Calculations

The following is a solution to "Practice: Using LOD Calculations" on page 107.

### Disaggregate the Data by Department

1. Open Using\_LOD\_Calculations Starter.twbx.
2. Right-click the Admissions by Gender tab, and then select Duplicate Sheet.
3. Right-click the Sheet 2 worksheet tab, click Rename Sheet, type "Admissions by Department and Gender", and press the ENTER key.
4. From Dimensions, drag Department to Columns and place it to the left of Gender.

### Create the LOD Calculation

1. On the Analysis menu, click Create Calculated Field.
2. In the Calculated Field dialog box, name the calculation "Percent Accepted Excluding Gender".
3. Enter the following text in the calculation editor:  
  {EXCLUDE [Gender]:[Percent Accepted]}
4. Click OK.
5. In Measures, right-click Percent Accepted Excluding Gender, point to Default Properties, and then select Number Format.

---

## Solution: Year over Year Change

The following is a solution to "Practice: Year over Year Change" on page 113.

1. Open **Year\_over\_Year\_Change\_Starter.twbx**. Notice the data is already filtered to "Tables."
2. From **Measures**, drag **Sales** to **Rows**.
3. From **Dimensions**, drag **Order Date** to **Columns**.
4. Click the drop-down arrow on **SUM(Sales)**, select **Quick Table Calculation**, and choose **Year over Year Growth**.
5. On the **Marks** card, in the drop-down, change the mark type to **Bar**.
6. Press and hold **CTRL** while you drag the **Sales** field from **Rows** to **Color** on the **Marks** card.
7. From **Measures**, drag **Sales** to **Label** on the **Marks** card.
8. From **Dimensions**, drag **Category** to **Filters**.
9. In the **Filters [Category]** dialog box, under **Select from list**, click the check box for **Tables** to select it, and then click **OK**.
10. Click the **null** indicator (appears on the lower right corner of the view).
11. In the **Special Values** for dialog box, select **Show Data at Default Position**.

**NOTE** For an example of a complete solution to this practice, see **Year\_Over\_Year\_Change\_Solution.twbx**.

---

## Solution: Profitability as a Percent of Total

The following is a solution to "Practice: Profitability as a Percent of Total" on page 121.

1. Open **Profitability as Percent of Total Starter.twbx**.
2. From **Measures**, drag **Sales** to **Columns**.
3. From **Dimensions**, drag **Order Date** to **Columns** and drop it to the **LEFT** of **Sales**.
4. From **Dimensions**, drag **Category** to **Rows**.
5. From **Dimensions**, drag **Sub-Category** to **Rows** and drop it to the **RIGHT** of **Category**.
6. Right-click **Profit** in the **Measures** area, point to **Create**, and then click **Calculated Field**.
7. Use the steps below to complete the **Calculated Field** dialog box.
  - In the **Name** field, type "Profit or Loss".
  - In the **Formula** field, type:  
IF [Profit] > 0 THEN "Profit"  
ELSE "Loss"  
END
  - Click **OK**.
8. On **Columns**, right-click **SUM (Sales)**, and then click **Add Table Calculation**.
9. Use the steps below to complete the **Table Calculation** dialog box.
  - Click the **Calculation Type** drop-down list, and then click **Percent of Total**.
  - Click the **Summarize the values from:** drop-down list, and then click **Cell**.
  - Click **OK**.
10. From **Dimensions**, drag **Profit or Loss** to **Color** on the **Marks** card.
11. Control-drag to move a copy of **SUM (Sales) △** from **Columns** to **Label** on the **Marks** card.



- **Line Value:** 500,000 Constant. To type a value in the Value text box, first select **Constant** in the drop down list to the right of the text box
  - **Line Label:** Custom "Quota is <Value>". For the Label, type "Quota is" in the text box and then select <Value> in the list that is exposed by the right facing arrow next to the text box
  - **Formatting:** Thick Red Line, no fill above or below.
4. Click **OK**.

### View Two

1. On the **View One** worksheet tab, right-click and choose **Duplicate Sheet**.
2. On the new worksheet tab, double-click to activate editing and type "View Two".
3. Right-click the Quota reference line and choose **Remove**.
4. From **Dimensions**, drag **Customer Segment** to **Columns** and drop it to the left of **SubRegion**.
5. From **Columns**, drag **SubRegion** to **Rows**.
6. From **Rows**, drag **SUM(Sales)** to **Columns**, to the right of **Customer Segment**.
7. From the **Analytics** pane, drag **Average Line** to the view, and drop it on **Pane**.
8. Right-click on the Average Reference line (any of them will work) and click **Edit**.
9. In the **Edit Reference Line, Band or Box** dialog box, edit the following:
  - Under **Line**, click the **Label** drop-down and select **Value**.
  - Under **Formatting**, click the **Line** drop-down, and choose the black color for the line.
10. Click **OK**.

**NOTE** For an example of a complete solution to this practice, see **Reference\_Line\_Solution.twbx**.

---

## Solution: Dynamic Measure Selection and Reference Line

The following is a solution to "Practice: Dynamic Measure Selection and Reference Line" on page 137.

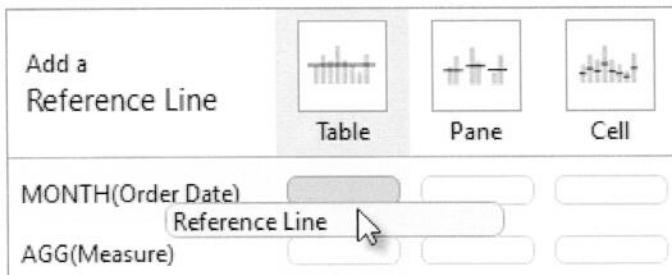
### Part 1: Create the Dynamic Measure Selection Parameter

1. Open **Dynamic Measure Selection and Reference Line Starter.twbx**.
2. Right-click anywhere in the **Dimensions or Measures** area, and click **Create Parameter**.
3. Use the steps below to complete the **Create Parameter** dialog box.
  - Name the parameter "Select Measure".
  - Set the **Data Type** drop-down list to **Integer**.
  - Set the **Current Value** field to **1**.
  - Set the **Display Format** drop-down list to **Automatic**.
  - Next to **Allowable Values**, select **List**.
  - Set the below values under **List of Values**, and then click **OK**.

| Value | Display as            |
|-------|-----------------------|
| 1     | Sum of Profit         |
| 2     | Sum of Sales          |
| 3     | Average Shipping Cost |
| 4     | Average Unit Price    |

**Part 2 (Continued): Add the Reference Line**

1. Click the **Analytics** tab to open the **Analytics** pane.
2. From the **Analytics** pane, drag **Reference Line** into the view and drop it on the symbol at the intersection of **Table** and **Month(Order Date)**.



3. Use the steps below to complete the **Add Reference Line, Band, or Box** dialog box.
  - Make sure the **Type** is set to **Line**.
  - Under **Scope**, make sure **Entire Table** is selected.
  - Set the **Value** drop-down lists to **Reference Date** and **Minimum**.
  - Set the **Label** drop-down list to **Value**.
  - Set the **Line** drop-down list as a gray dashed line.
  - Set the **Fill** drop-down lists to **None**.
  - Click **OK**.
4. Click the **Data** tab to open the **Data** pane.
5. In the **Parameters** area, right-click **Reference Date** and select **Show Parameter Control**. **NOTE** Test the **Reference Date** slider to make sure it moves the reference line.

**Part 2 (Continued): Add a Calculation**

1. On the **Analysis** menu, select **Create Calculated Field**.
2. Use the steps below to complete the **Calculated Field** dialog box, and then click **OK**.
  - In the top left box, type "Before or After" as the name of the calculated field.
  - In the **Formula** field, type the text below, and then click **OK**:
 

```
ATTR(IF [Order Date] >= [Reference Date]
      THEN "After" ELSE "Before" END)
```
3. From **Measures**, drag **Before or After** to **Detail** on the **Marks** card.
4. On the **Marks** card, hover the mouse to the left of **AGG(Before or After)**, click the drop-down arrow, and then click **Color**. **TIP** You won't see the drop-down arrow until the mouse pointer is over the field.
5. Move the **Reference Date** slider to test the view. **NOTE** Leave the reference line somewhere in the middle of the view before moving on to the next step.
6. On the **Marks** card, right-click **AGG(Before or After)** and select **Sort**.
7. In the **Sort** dialog box, select **Manual**, click and drag **Before** to move it to the top of the list, and then click **OK**. **NOTE** This moves the darker colors in the line chart to the left of the reference line.

**NOTE** For an example of a complete solution to this practice, see **Dynamic Measure Selection and Reference Line Solution.twbx**.

26. In the top right corner, click the **SubRegion / Market** drop-down list, and click some of the options to make sure the parameter control is working.
27. Click the **All Sales by Product** tab to select the empty dashboard.
28. From the **Dashboard** window, drag **Retail Sales by Product** to the blank area in the view.
29. From the **Dashboard** window, drag **Coffee Sales by Product** to the bottom half of the view. Note that the **SubRegion / Market** parameter control is shown only once.
30. On the **Dashboard** menu, click **Show Title**.
31. Double-click the title to open the **Edit Title** dialog box.
32. Use the steps below to complete the **Edit Title** dialog box.
  - After <Sheet Name>, type: "for the"
  - Make sure there are spaces before and after the text "for the", and then put the cursor at the end, after the last space.
  - Click the **Insert** drop-down list, and then click **Parameters.SubRegion / Market**.
  - After <Parameters.SubRegion / Market>, type a space, and then type: "Region"
  - Click **OK**.
33. Click the object containing the parameter control to show its borders and menus, and then click the drop-down arrow in the top right, and click **Floating**.
34. Click and drag the parameter control object as needed to position it in the top right corner of the dashboard.

**NOTE** For an example of a complete solution to this practice, see [Using a Parameter to Filter across Sources Solution.twbx](#).

---

## Solution: Geographic Mapping

The following is a solution to "Practice: Geographic Mapping" on page 147.

1. Open **Geographic\_Mapping\_Starter.twbx**.
2. From **Dimensions**, from the **Country, State, City** hierarchy, drag **City** to **Detail** on the **Marks** card.
3. From **Measures**, drag **Sales** to **Size** on the **Marks** card.
4. From **Measures**, drag **Profit** to **Color** on the **Marks** card.
5. On the **Marks** card, click **Size**, and move the slider to increase the size of the marks.
6. From **Dimensions**, drag **Market** to **Filters**.
7. Select the check boxes next to **APAC** and **EMEA**, and then click **OK**.
8. On the **Map** menu, click **Map Layers** and in the **Map Layers** window, set the following options:

| Section    | Option                                                |
|------------|-------------------------------------------------------|
| Background | In the <b>Style</b> drop down, select <b>Normal</b> . |
| Map Layers | <b>Clear Country/Region Names</b> .                   |

9. Click **X** to close the **Map Layers** window.
10. On the **Marks** card, drag **City** to **Label**.
11. On the **Marks** card, click **Color**, and then on the **Border** drop-down list, select the black box, and then on the **Halo** drop-down list, select **None**.

---

NOTE For an example of a complete solution to this practice, see [Modifying Locations Solution.twbx](#).

---

## Solution: Background Images

The following is a solution to "Practice: Background Images" on page 153.

1. Open **Background Images Starter.twbx**.
2. Note that the workbook already has a connection to two joined tables (**Injuries** and **Injury Location**) in the **Work Injury Data.xls** data source. Also note that the worksheet has the title and caption set to show.
3. On the **Map** menu, select **Background Images** and choose **Injury location+ (Work Injury Data.xls)**. This relates the image to the correct data set.
4. On the **Background Images** dialog box, click **Add Image**.
5. Use the steps below to complete the **Add Background Image** dialog box.
  - In the **Name** field, type "Injury Image".
  - Next to **File or URL**, click **Browse**.
  - In the **Browse Image** dialog box, navigate to the **Data** folder on the USB, select **Body Map.gif**, and click **Open**.
6. In the **X Field** section, use the following settings:
  - Click the drop-down list, and then click **Location X**.
  - In the **Left** field, type **0**.
  - In the **Right** field, type **99**.
7. In the **Y Field** section, use the following settings:
  - Click the drop-down list, and then click **Location Y**.
  - In the **Bottom** field, type **0**.
  - In the **Top** field, type **100**.
  - Click **OK**.
8. Click **OK** again in the **Background Images** dialog box.
9. From **Measures**, drag **Location X** to **Columns**.
10. On the **Columns** shelf, right-click **SUM(Location X)**, select **Measure (Sum)**, and click **Average**.
11. From **Measures**, drag **Location Y** to **Rows**.
12. On **Rows**, right-click **SUM (Location Y)**, select **Measure (Sum)**, and click **Average**.
13. From **Dimensions**, drag **Location of Injury** to **Detail** on the **Marks** card.
14. From **Measures**, drag **Number of Records** to **Size** on the **Marks** card.
15. In the bottom right corner of the view, click the nulls indicator.
16. In the **Special Values** dialog box, click **Filter Data**.
17. On **Columns**, right-click **AVG (Location X)**, and click **Show Header** to deselect it.
18. On **Rows**, right-click **AVG (Location Y)**, and click **Show Header** to deselect it.
19. On the **Marks** card, click **Shape**, and click the bold, filled-in plus sign (+) as the mark.
20. On the **Marks** card, click **Color**, and click red.
21. On the **Marks** card, click **Size**, and click to the right of the indicator on the slider to increase the size of the marks.
22. On the **Marks** card, click **Tooltip**, and use the steps below to complete the **Edit Tooltip** dialog box.

6. Use the steps below to complete the **Calculated Field** dialog box.
  - Change the text in the top left box to "2013 Sales".
  - Change the formula to:  

$$\text{IF YEAR([Order Date]) = 2013 THEN [Sales] END}$$
  - Click OK.
7. From **Measures**, drag **2012 Sales** to **Columns**.
8. From **Dimensions**, drag **Category** to **Rows**.
9. From **Dimensions**, drag **Sub-Category** to **Rows** and place it to the right of **Category**.
10. From **Measures**, drag **2013 Sales** to the **2012 Sales** axis, dropping it when two green bars appear, to create a combined axis view.

**NOTE:** This engages the **Measure Names** and **Measure Values** fields.

11. From **Rows**, drag **Measure Names** to **Color** on the **Marks** card, which stacks the marks.
12. On the **Marks** card, press and hold the **Control** key while dragging **Measure Names** to **Size**. This adds a copy of **Measure Names** to size.
13. On the **Analysis** menu, select **Stack Marks**, and choose **Off** to start both bars at the 0 position.
14. On the **Measure Names Color** legend, click the drop-down arrow, and choose **Edit Colors**.
15. In the **Edit Colors** dialog box, select the **Gray 5** palette, click **Assign Palette**, and click **OK**.
16. On **Columns**, click **Measure Values** to select it.
17. On the toolbar, click the **Sort Descending** icon to sort the bars in descending order.
18. Right-click the **Value** axis, and select **Format**.
19. In the **Format** window on the left, click the **Numbers** drop-down, choose **Currency (Custom)**, set **Decimal places** to 0, and set **Units** to **Thousands (K)**.
20. Save the workbook.

**NOTE** For an example of a complete solution to this practice, see **Bar in Bar Solution.twbx**.

---

## Solution: Bullet Graph

The following is a solution to "Practice: Bullet Graph" on page 162.

1. Open **Bullet Graph Starter.twbx**.
2. From **Measures**, drag **Sales** to the **Columns** shelf.
3. From **Dimensions**, drag **Product Type** to the **Rows** shelf.
4. From **Dimensions**, drag **Product** to the **Rows** shelf, placing it to the right of **Product Type**.
5. Hover the mouse pointer over the **Sales** axis until the **Sort** icon  appears, and then click the **Sort** icon to sort the products in descending order.
6. From **Measures**, drag **Budget Sales** to **Detail** on the **Marks** card.
7. Right-click on the **Sales** axis, and then select **Add Reference Line**.
8. Complete the **Add Reference Line**, **Band**, or **Box** dialog box:
  - In the top left, make sure **Line** is selected as the type.
  - Under **Scope**, select **Per Cell**.
  - Under **Line**, set the **Value** drop-down lists to **SUM (Budget Sales)** and **Average**.
  - Under **Line**, set the **Label** drop-down list to **None**.



| Drag this | To                         |
|-----------|----------------------------|
| Sales     | Columns                    |
| Profit    | Rows                       |
| Item      | Middle of grid in the view |

### To create a set for Top Selling Products

1. Under Dimensions in the Data pane, right-click Item, select Create, and click Set.
2. In the Create Set dialog box, under Name, type "Top Selling Products".
3. In the Top tab of the Create Set dialog box, select By field. Ensure that Top is selected in the first drop-down list, and enter 100 in the drop-down list next to it.
4. In the Category drop-down list, select Sales and verify that Sum is selected for the drop-down list next to it.
5. Click OK.

### To create a set for the Least Profitable Products

1. Under Dimensions in the Data pane, right-click Item select Create and click Set.
2. In the Create Set dialog box, under Name, type "Least Profitable Products" in the Name text box.
3. In the Top tab of the Create Set dialog box, select By field. Select Bottom in the Top drop-down list and enter 100 in the drop-down list next to it.
4. In the Category drop-down list select Profit and verify that Sum is select for the drop-down list next to it.
5. Click OK.

### To create a Combined Set and highlight the members

1. Under Sets in the Data pane, CTRL+click to multi-select Top Selling Products and Least Profitable Products, and then right-click one of the selected sets and choose Create Combined Set.
2. In the Create Set dialog box:
  - Type "High Sales/Low Profit" in the Name text box.
  - Select Least Profitable Products in the left drop-down list.
  - Select Top Selling Products in the right drop-down list.
  - Select Shared Members in Both Sets.
  - Click OK.
3. From Sets in the Data pane, drag High Sales/Low Profit to Color on the Marks card.

NOTE For an example of a complete solution to this practice, see [Creating\\_and\\_Using\\_Sets\\_Solution.twbx](#).

---

## Solution: Nested Top N with Context

The following is a solution to "Practice: Nested Top N with Context" on page 172.

1. Open Nested Top N with Context Starter.twbx.
2. From Measures, drag Sales to Columns.

NOTE For an example of a complete solution to this practice, see [Nested Top N with Rank Complex Solution.twbx](#).

---

## Solution: Histogram with Binned Measures

The following is a solution to "Practice: Histogram with Binned Measures" on page 179.

1. Open [Creating\\_A\\_Histogram\\_With\\_Binned\\_Measures\\_Starter.twbx](#).
2. In the **Measures** area of the **Data** pane, right-click on **Score**, point to **Create**, and click **Bins**.
3. In the **Create Bins** dialog box, type "2" in the **Size of bins** field, and then click **OK**.
4. From **Measures**, drag **Score** to **Rows**.
5. From **Dimensions**, drag **Score (bin)** to **Columns**.
6. On the **Rows** shelf, right-click **SUM(Score)**, point to **Measure (Sum)** and click **Count**.
7. In the **Dimensions** area of the **Data** pane, right-click **Score (bin)** and click **Edit**.
8. On the **Edit Bins** dialog box, type "5" in the **Size of bins** field, and click **OK**.

NOTE For an example of a complete solution to this practice, see [Creating\\_A\\_Histogram\\_With\\_Binned\\_Measures\\_Solution.twbx](#).

---

## Solution: Box and Whisker Plot

The following is a solution to "Practice: Box and Whisker Plot" on page 180.

1. Open [Box and Whisker Plot Starter.twbx](#).
2. From the **Data** pane, use **CTRL+click** to multi-select **Score**, **Subject** and then the **box-and-whisker plot**  option on **Show Me**. Click the **Show Me** tab again to close the **Show Me** dialog box.
3. On **Rows**, click the drop-down arrow on the **SUM(Score)** field, point to **Measure (Sum)**, and then click **Average**.
4. From the **Marks** card, drag **Subject** to **Columns**.
5. From **Dimensions**, drag **Year** to **Columns**, to the right of **Subject**.
6. From **Dimensions**, drag **State** to **Detail** on the **Marks** card to show distribution by state.
7. On the **Marks** card, click **Color**, and under **Transparency**, click the center of the slider to set it at 50%.

NOTE For an example of a complete solution to this practice, see [Box and Whisker Plot Solution.twbx](#).

---

## Solution: Trend Lines with Small Multiples

The following is a solution to "Practice: Trend Lines with Small Multiples" on page 188.

1. Open [Trend Lines with Small Multiples Starter.twbx](#).
2. Note that the worksheet is set to show title and caption.
3. From **Dimensions**, drag **Country** to **Filters**.
4. In the **Filter** dialog box, on the **General** tab, select **United States**, and click **OK**.
5. From **Measures**, drag **Sales** to **Columns**.

7. Repeat Step 6 for Plot of Sales.
8. Remove the Customer Segment and Sales legends: click to select, and then click X.
9. Add a blank tile to the top right corner, and adjust the height so the Region filter aligns with the top two worksheets.

#### Create the filters for the dashboard

1. On the Region filter in the view, click the drop-down arrow, select Apply to Worksheets, and click All Using this Data Source.
2. On the Sales by Segment view, click the drop-down arrow and choose Use as Filter.
3. On the toolbar, click the Presentation Mode icon, and test the filters in the dashboard.

**NOTE** For an example of a complete solution to this practice, see [Building\\_a\\_Dashboard\\_Solution.twbx](#).

---

## Solution: Creating an Interactive Dashboard

The following is a solution to "Practice: Creating an Interactive Dashboard" on page 200.

1. Open [Creating\\_an\\_Interactive\\_Dashboard\\_Starter.twbx](#).
2. Click the New Dashboard tab .
3. Double-click the new dashboard tab and name it "2014 Sochi Olympics Results".
4. From the Size drop-down list, select Exactly, and set Width to 900 and Height to 600.
5. Drag the Medals by Country worksheet onto the dashboard.
6. Right-click the title for the worksheet, click **Edit Title**, and add on the next line below the title: type "Click a country:" and format the font to size 10. Click OK.
7. In the Dashboard window, click **Vertical** and drag a vertical layout container to the far right of the dashboard, and drop it when you see a vertical gray area from top to bottom on the far right.
8. Drag the Total Medals by Sport worksheet into the layout container.
9. Drag the Medals by Athlete worksheet into the layout container beneath Total Medals by Sport.
10. Click the Medals by Country map, and resize it to occupy just over half the dashboard space.
11. On the Dashboard menu at the top of the screen, click **Actions**, then click **Add Action**, and choose **Filter**.
12. Use the following settings for the filter:

| Setting                     | Value                                                        |
|-----------------------------|--------------------------------------------------------------|
| Name                        | "Map Filter"                                                 |
| Source Sheets               | 2014 Sochi Olympics Results<br>dashboard / Medals by Country |
| Run action on               | Select                                                       |
| Target Sheets               | Ensure that all available sheets are selected.               |
| Clearing the selection will | Exclude all values                                           |

13. Click OK.

NOTE For an example of a complete solution to this practice, see [Creating\\_an\\_Interactive\\_Dashboard\\_Solution.twbx](#).

---

## Solution: Creating a Story

The following is a solution to "Practice: Creating a Story" on page 206.

### Directions: Create and Size the Story

1. Open [Creating a Story Starter.twbx](#).
2. Click the **New Story** tab  to start a new story.
3. In the bottom left corner, under **Story**, set the **Size** drop-down list to the size of your choice.
4. Double-click **Story Title** to open the **Edit Title** dialog box and give your story a title.

### Directions: Add Worksheets and Dashboards to the Story

1. Click the tab of a dashboard or worksheet you would like to add to the story. **TIP** You may want to create your own worksheet or dashboard to use.
2. Review the dashboard or worksheet and make any changes you would like before adding it to the story.
3. If you are adding a dashboard, in the bottom left corner, under **Dashboard**, click the **Size** drop-down list, and then click **Fit to Story 1**. **NOTE** This will make your dashboard the same size as your story.
4. Click the **Story 1** tab to go back to your story.
5. From **Dashboards and Worksheets**, drag a dashboard or worksheet into the story.
6. Click **Add a Caption** in the navigator box to edit the caption for this dashboard or worksheet.
7. Click **New Blank Point** to add another story point to your story.
8. Repeat steps 1-7 as needed until you have enough story points to tell your story. **TIP** Three or four story points should be enough for this activity.

### Directions: Put the Story in Order

1. Click and drag the navigator boxes to put your story points in order. **TIP** If you need to, you can remove a story point by dragging it out of the view.
2. Confirm the sequence of your story points by considering questions like the following:
  - Does the first story point introduce the problem you are trying to explore?
  - Does the last story point present an interesting insight or conclusion?
  - Are the story points ordered logically to lead your audience from the initial problem to the final insight?

### Directions: Customize Your Story Points

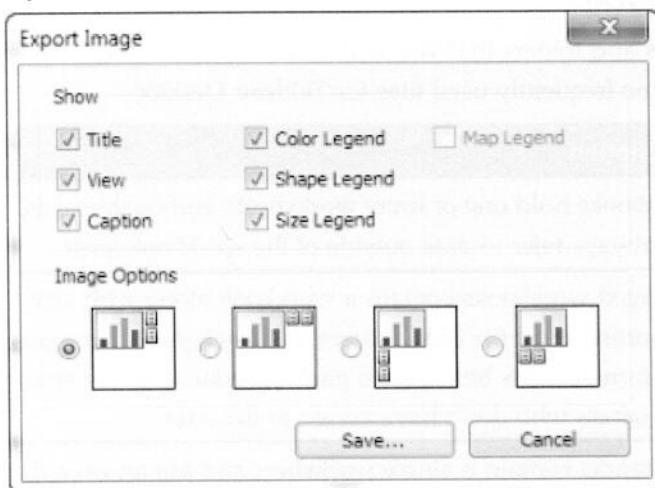
1. Choose a story point to customize using the following steps.
  - Make sure filters are set to show the specific categories or ranges of data that you want.
  - Select the data points, regions, or other information that you want to be highlighted.
  - If the story point is a map, pan and zoom to the area you want to focus on.
  - If the story point is a chart, change the way columns or rows are sorted if you need to.
  - Set the value of any parameters to the value you want.
  - Click **Update** to save the state of the story point.



## Export to an Image File

The export image command saves the current view as an image file.

1. On the **Worksheet** menu, select **Export**, and then choose **Image**.
2. In the **Export Image** dialog box, select the content you want to include in the image and the legend layout (if the view contains a legend).



3. Click **Save**.
4. Choose the image format, name the file, and save it to the desired location.

### Exporting from a Dashboard

- On the **Dashboard** menu, do one of the following:

| To              | Do this                                                                                                                                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Copy an image   | <ol style="list-style-type: none"> <li>1. Select <b>Copy Image</b>.</li> <li>2. Paste image into the destination tool (such as PowerPoint).</li> </ol>                                                                                              |
| Export an image | <ol style="list-style-type: none"> <li>1. Select <b>Export Image</b>.</li> <li>2. In the <b>Save Image</b> dialog box, name the file, and select the desired format (*.jpeg, *.png, *.bmp, and so forth).</li> <li>3. Click <b>Save</b>.</li> </ol> |

## Exporting the Data Only

There are a few options to export data from Tableau to another application, or to create a new data source that contains a portion of the records in your original data source.

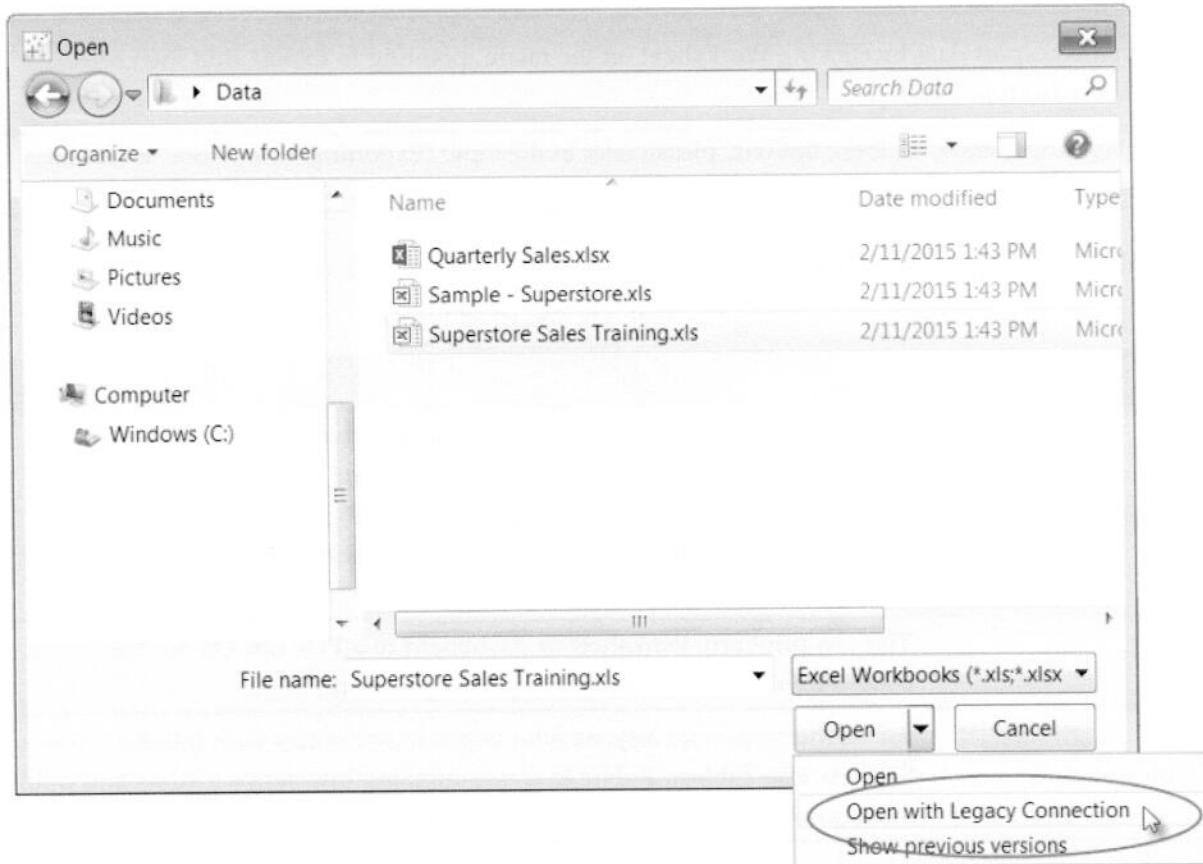
You can:

- Copy records to the clipboard and paste them to a destination.
- Export data to Access, or a crosstab to Excel.

You can select any portion of a data view to export. To export all data in a view, right-click in the view and choose **Select All**. After selecting the data in your view to export, right-click a selected portion, point to **Copy**, and then select **Crosstab** or **Data**.

- Non-equi joins
- Fixed-width file formats in schema.ini

To use a legacy connection, after browsing to select the file, click the **Open** drop-down list and select **Open with Legacy Connection**.



The legacy option is available only when creating the initial data connection. A legacy connection can be upgraded later, but a standard connection can't be changed to a legacy connection later.

The legacy connection is relevant only for connections to data from a file; capabilities such as custom SQL, right joins, full joins, and non-equi joins are available for other data connections with their native Tableau connection.

## How Tableau Performs Automatic Geocoding of Data

During the data connection process, Tableau reads the first few rows of data and the field names to identify potential geographic data, such as Country, State, Zip Code, and so forth. Tableau compares these fields to its own geocode files and uses any matches to generate appropriate latitude and longitude fields within the connection.

## Custom Geocoding

Tableau can replicate its geocoding capabilities with user-defined definitions, which can be used to tailor any mapping analysis to fit your needs.

Unlike the geocoding done automatically, you need to store custom geocoding files under:

My Documents\My Tableau Repository\Local Data Import

(as opposed to Program Files\Tableau\Local\Data).

When coordinates are not listed in a single data source, you can use data blending to relate two sources based on a common field. You can keep geocoding in a separate file and blend this data to represent it spatially without having to import into the Tableau Desktop repository. For more information, see "Custom Geocoding" in Tableau Online Help.

## Further Assistance

The following options are available for you if you need assistance, or want to further your knowledge of Tableau products and data visualization best practices.

Most of these options are available on [www.tableau.com](http://www.tableau.com).

### Further Training

Visual Analytics: Recommended for experienced users who want to improve and deepen their understanding of analytics and visual best practices.

Server Administration: For users administering a Tableau Server installation, including managing content, users, and permissions.

Server Architecture: For those architecting and administering a large deployment of Tableau Server, or a consultant who will be involved in many deployments of Tableau Server.

For more information, go to [www.tableau.com/learn/training](http://www.tableau.com/learn/training).

### Consulting Services

Certified Tableau Consultants deliver services ranging from remote coaching sessions, to onsite rapid deployments, to ongoing consulting to drive Tableau adoption.

For more information and a complete description of consulting services, go to [www.tableau.com/consulting](http://www.tableau.com/consulting).

### Manuals and Online Help

To access the online help, in Tableau Desktop, click **Help** on the menu bar and choose **Open Help**.

To access a help PDF file, go to [www.tableau.com/support/help](http://www.tableau.com/support/help), and click a **PDF Help** link.

### Knowledge Base

To access the knowledge base, use [www.tableau.com/support/product](http://www.tableau.com/support/product), and click **Knowledge Base**.

## Server Certifications



**LEVEL I:** A Tableau Server Qualified Associate has the knowledge to administer Tableau Server in a single-machine environment.

**LEVEL II:** A Tableau Server Certified Professional has comprehensive knowledge and skills to design and implement Tableau Server in single-machine and enterprise environments. You must first become a Tableau Server Qualified Associate before taking this exam.

### Interested?

For more information or to register for an exam, go to [www.tableau.com/certification](http://www.tableau.com/certification).