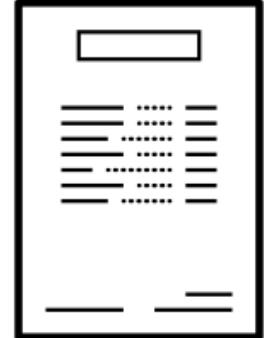


Tableau 2020





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1. Taking Off with Tableau



Taking Off with Tableau

We will cover the following topics in this lesson

- Connecting to data
- Foundations for building visualizations
- Creating bar charts
- Creating line charts
- Creating geographic visualizations
- Using Show Me
- Bringing everything together in a dashboard



Connecting to data

- Tableau connects to data stored in a wide variety of files and databases.
- This includes flat files, such as Excel documents, spatial files, and text files; relational databases, such as SQL Server and Oracle; cloud-based data sources, such as Snowflake and Amazon Redshift; and Online Analytical Processing (OLAP) data sources, such as Microsoft SQL Server Analysis Services.

Connecting to data

1. Open Tableau. You should see the home screen with a list of connection options on the left and, if applicable, thumbnail previews of recently edited workcourses in the center, along with sample workcourses at the bottom.
2. Under Connect and To a File, click on Text File.
3. In the Open dialog box, navigate to the \Learning Tableau\lesson 01 directory and select the Superstore.csv file.

Connections Add

Superstore
Text file

Files

Use Data Interpreter
Data Interpreter might be able to clean your Text file workbook.

Superstore.csv

New Union

Connection
 Live Extract

Filters
 0 | Add

Superstore

Need more data?
Drag tables here to relate them. [Learn more](#)

| | | Sort fields | Data source order | <input type="checkbox"/> Show aliases | <input type="checkbox"/> Show hidden fields | 1,000 | | row |
|---------------------------|---------------------|-----------------------|---------------------|---------------------------------------|---|---------------|--|-----|
| Abc Superstore.csv | @ Superstore.csv | Abc Superstore.csv | # Superstore.csv | Abc Superstore.csv | Customer ID | Customer Name | | |
| Category | City | Container | Customer ID | Customer Name | | | | |
| Scissors, Rulers and T... | Washington | Small Pack | 2867 | Dana Teague | | | | |
| Storage & Organization | Oxford | Medium Box | 1821 | Vanessa Boyer | | | | |
| Telephones and Com... | Irving | Small Box | 1402 | Wesley Tate | | | | |
| Paper | Irving | Small Box | 1402 | Wesley Tate | | | | |
| Bookcases | Oxford | Jumbo Box | 2747 | Brian Grady | | | | |

Tableau - Chapter 01 Starter

File Data Worksheet Dashboard Story Analysis Map Format Server Window Help

Standard Show Me

1 2 3 4 5 6 7

Data Analytics Superstore

Search

Tables

- Order Date
- Order ID
- Order Priority
- Postal Code
- Region
- Row ID
- Ship Date
- Ship Mode
- State
- Measure Names
- Discount
- Order Quantity
- Product Base Margin
- Profit
- Sales
- Shipping Cost
- Unit Price
- Latitude (generated)
- Longitude (generated)

Pages Columns Rows

Filters

Marks Automatic

- Color
- Size
- Text
- Detail
- Tooltip

Sheet 1

Drop field here

Drop field here

Select or drag data
Use the Shift or Ctrl key to select multiple fields

Data Source Workbook Introduction Sheet 1 Measures and Dimensions Sales by Department Bar Chart (two levels) Bar C

The screenshot shows the Tableau desktop application with the following interface elements:

- Top Bar:** File, Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, Help.
- Standard/Show Me Buttons:** Standard (selected), Show Me.
- Left Panel (Data Source):**
 - 1:** Data tab selected.
 - 2:** Analytics tab.
 - 3:** Superstore data source.
 - 4:** Search bar.
 - Tables:** Order Date, Order ID, Order Priority, Postal Code, Region, Row ID, Ship Date, Ship Mode, State, Measure Names, Discount, Order Quantity, Product Base Margin, Profit, Sales, Shipping Cost, Unit Price, Latitude (generated), Longitude (generated).
 - Filters:** None currently.
 - Marks:** Automatic, Color, Size, Text, Detail, Tooltip.
- Center Panel (Sheet 1):**
 - 5:** A large blue circle highlights the main workspace area.
 - Two "Drop field here" placeholder boxes.
- Right Panel (Shelf):**
 - 6:** A grid of visualization preview icons.
 - Select or drag data:** Use the Shift or Ctrl key to select multiple fields.
- Bottom Tab Bar:** Data Source, Workbook Introduction, Sheet 1 (selected), Measures and Dimensions, Sales by Department, Bar Chart (two levels), Bar C.

Connecting to data

To prepare for this, please do the following:

- From the menu, select File | Exit.
- When prompted to save changes, select No.
- From the \Learning Tableau\lesson 01 directory, open the file lesson 01 Starter.twbx. This file contains a connection to the Superstore data file and is designed to help you walk through the examples in this lesson.

Foundations for building visualizations

- When you first connect to a data source such as the Superstore file, Tableau will display the data connection and the fields in the Data pane.
- Fields can be dragged from the data pane onto the canvas area or onto various shelves such as Rows, Columns, Color, or Size.

Measures and dimensions

The screenshot shows the Power BI Data view interface. At the top, there are tabs for 'Data' (selected) and 'Analytics'. Below that is a search bar and a refresh button. On the left, under 'Tables', a list of dimensions is shown: Order ID, Order Priority, Postal Code, Region, Row ID, Ship Date, Ship Mode, State, and Measure Names. A blue arrow points from the 'Measure Names' entry to the text 'Dimensions are above the line'. To the right of this list is a vertical line. Below the line, under 'Measures', a list of measures is shown: Discount, Order Quantity, Product Base Margin, Profit, Sales, Shipping Cost, Unit Price, Latitude (generated), Longitude (generated), Number of Records, Superstore (Count), and Measure Values. The text 'Measures are below the line' is positioned to the left of this list.

Data Analytics

Superstore

Search

Tables

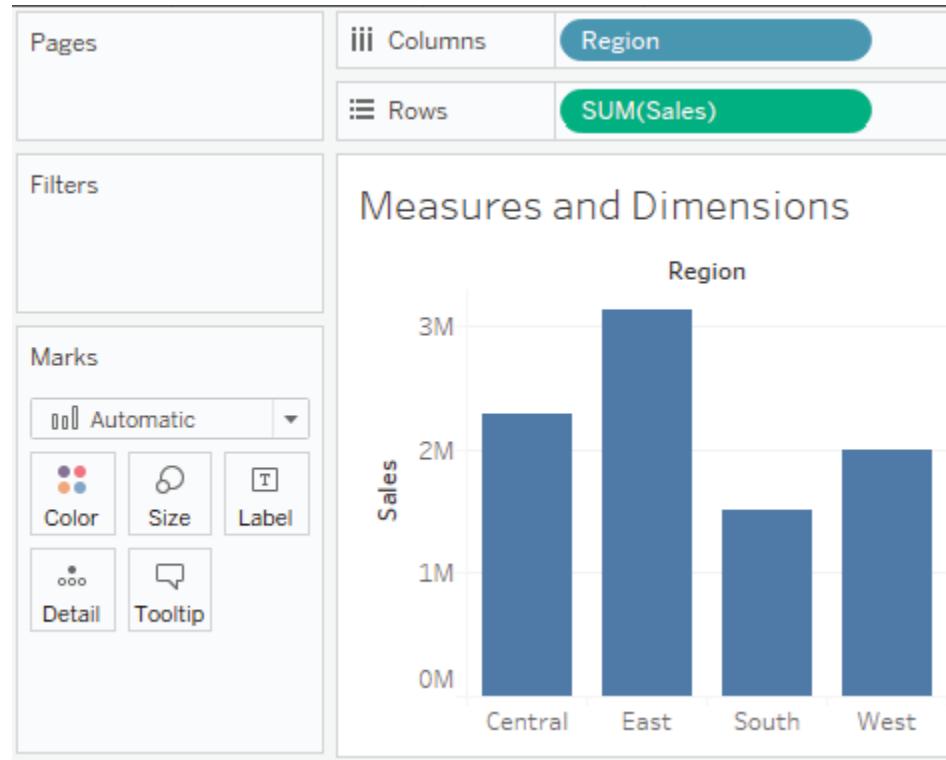
- # Order ID
- Abc Order Priority
- @ Postal Code
- Abc Region
- # Row ID
- Ship Date
- Abc Ship Mode
- ⊕ State
- Abc *Measure Names*

Dimensions are above the line

Measures are below the line

- # Discount
- # Order Quantity
- # Product Base Margin
- # Profit
- # Sales
- # Shipping Cost
- # Unit Price
- ⊕ *Latitude (generated)*
- ⊕ *Longitude (generated)*
- # Number of Records
- # *Superstore (Count)*
- # *Measure Values*

Measures and dimensions



Discrete and continuous fields

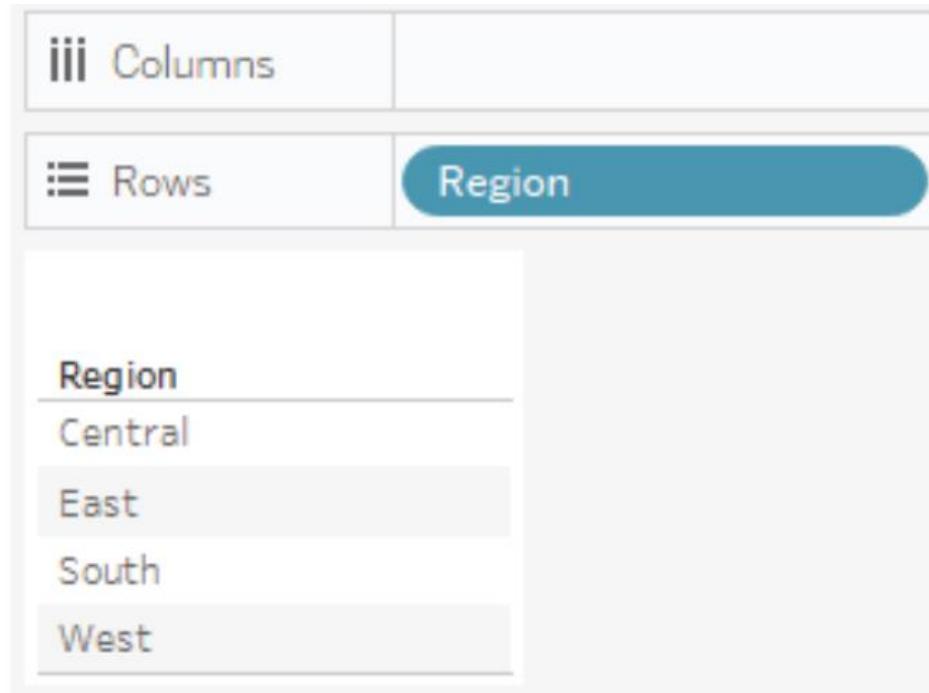
- Another important distinction to make with fields is whether a field is being used as discrete or continuous.
- Whether a field is discrete or continuous determines how Tableau visualizes it based on where it is used in the view.

Discrete fields

| | |
|--|---|
|  Columns |  Region |
|  Rows | |
|  Region | |
|  Central  East  South  West | |
| | |

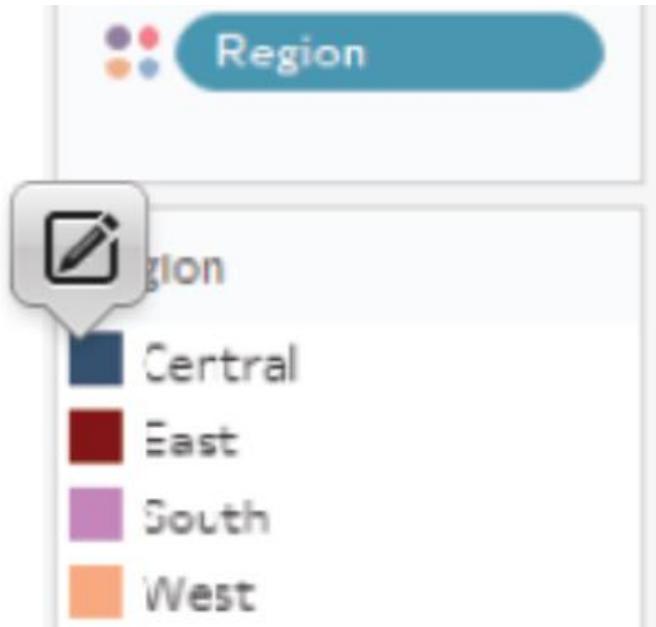
Discrete fields

- Here, it defines the row headers:



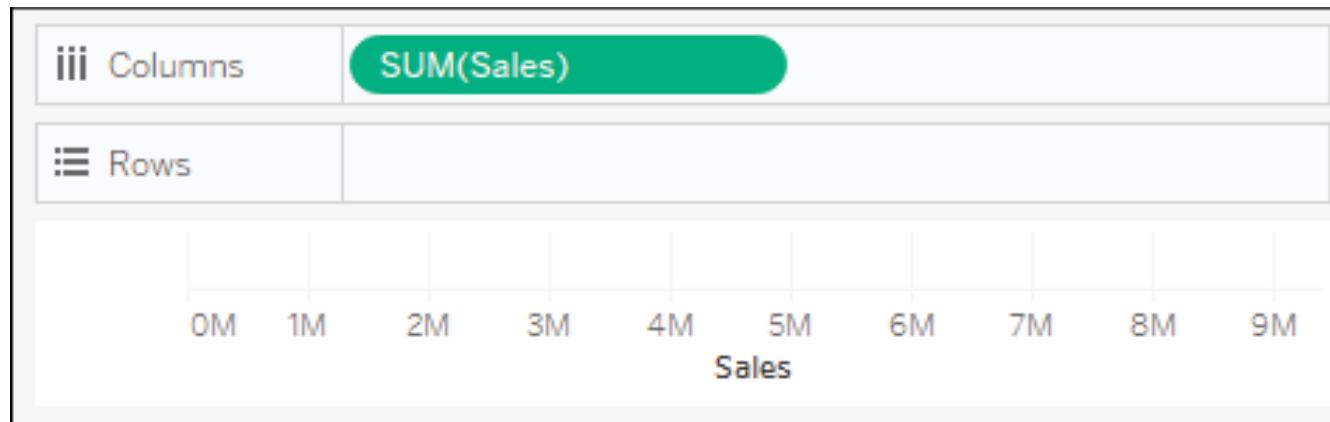
Discrete fields

- When used for Color, a discrete field defines a discrete color palette in which each color aligns with a distinct value of the field:



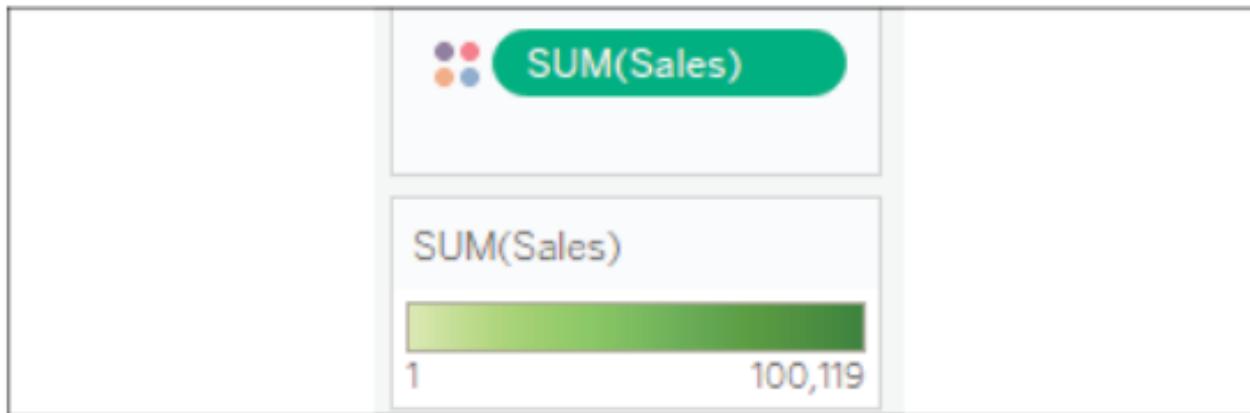
Continuous fields

- When used on Rows or Columns, a continuous field defines an axis



Continuous fields

- When used for color, a continuous field defines a gradient:



Continuous fields

While most dimensions are discrete by default, and most measures are continuous by default, it is possible to use any measure as a discrete field and some dimensions as continuous fields in the view, as shown here:

can be

| | Discrete | Continuous |
|-----------|----------|--------------------|
| Dimension | Yes | If Numeric or Date |
| Measure | Yes | Yes |

Continuous fields

In general, you can think of the differences between the types of fields as follows:

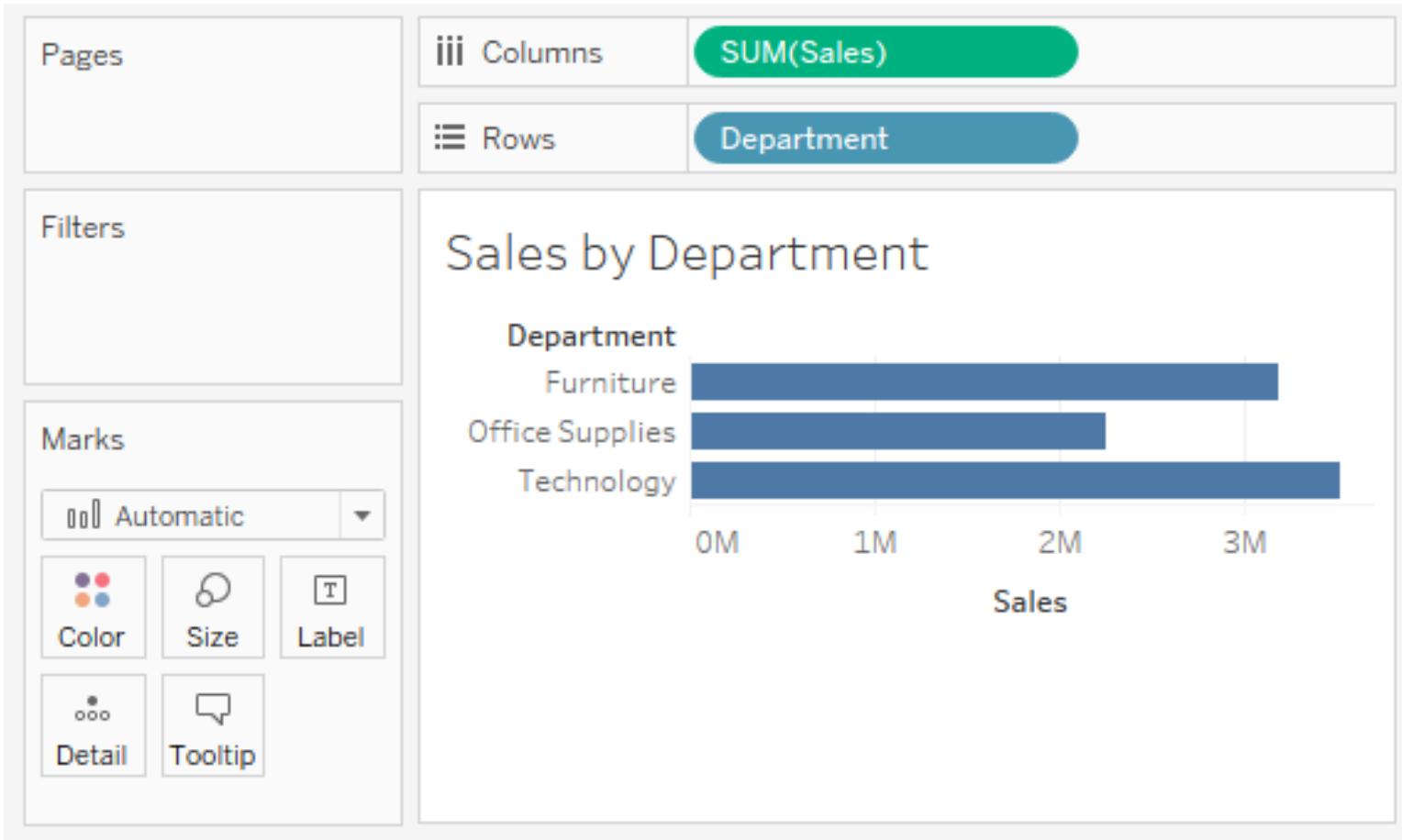
- Choosing between a dimension and measure tells Tableau how to slice or aggregate the data.
- Choosing between discrete and continuous tells Tableau how to display the data with a header or an axis and defines individual colors or a gradient.

Visualizing data

- A new connection to a data source is an invitation to explore and discover! At times, you may come to the data with very well-defined questions and a strong sense of what you expect to find.
- Other times, you will come to the data with general questions and very little idea of what you will find.

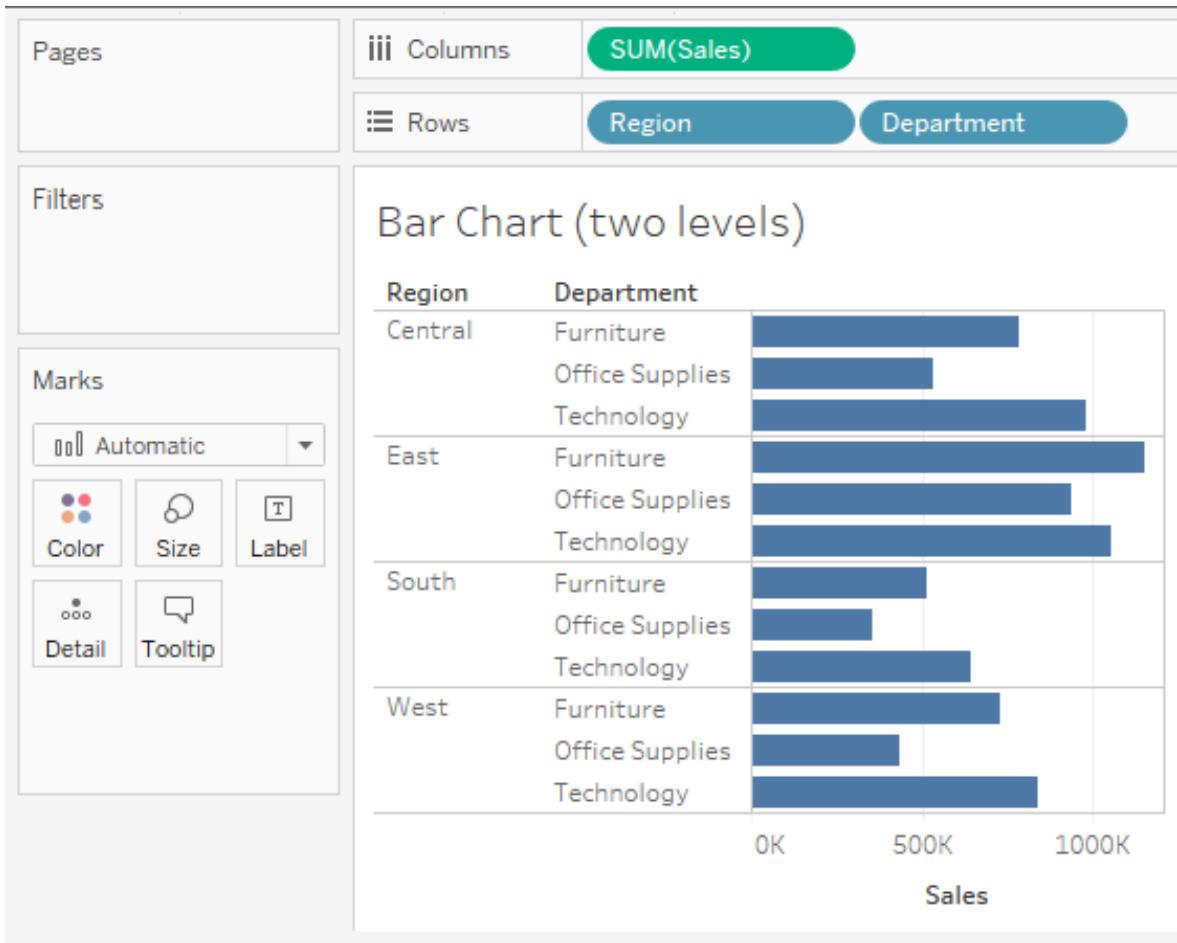
Bar charts

- Bar charts visually represent data in a way that makes the comparison of values across different categories easy.
- The length of the bar is the primary means by which you will visually understand the data.
- You may also incorporate color, size, stacking, and order to communicate additional attributes and values.

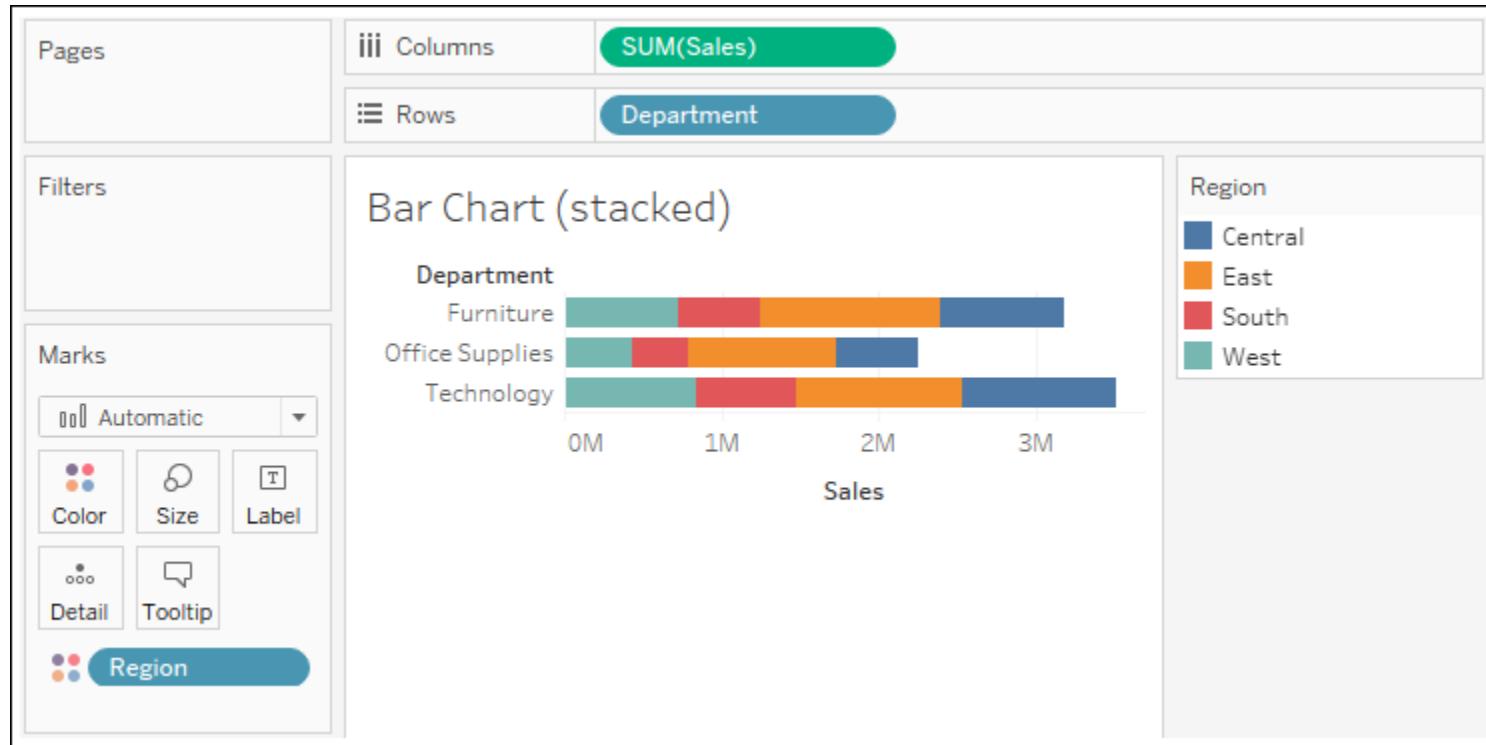


Iterations of bar charts for deeper analysis

1. Navigate to the Bar Chart (two levels) sheet, where you will find an initial view that is identical to the one you created earlier.
2. Drag the Region field from Dimensions in the Data pane to the Rows shelf and drop it to the left of the Department field already in view.

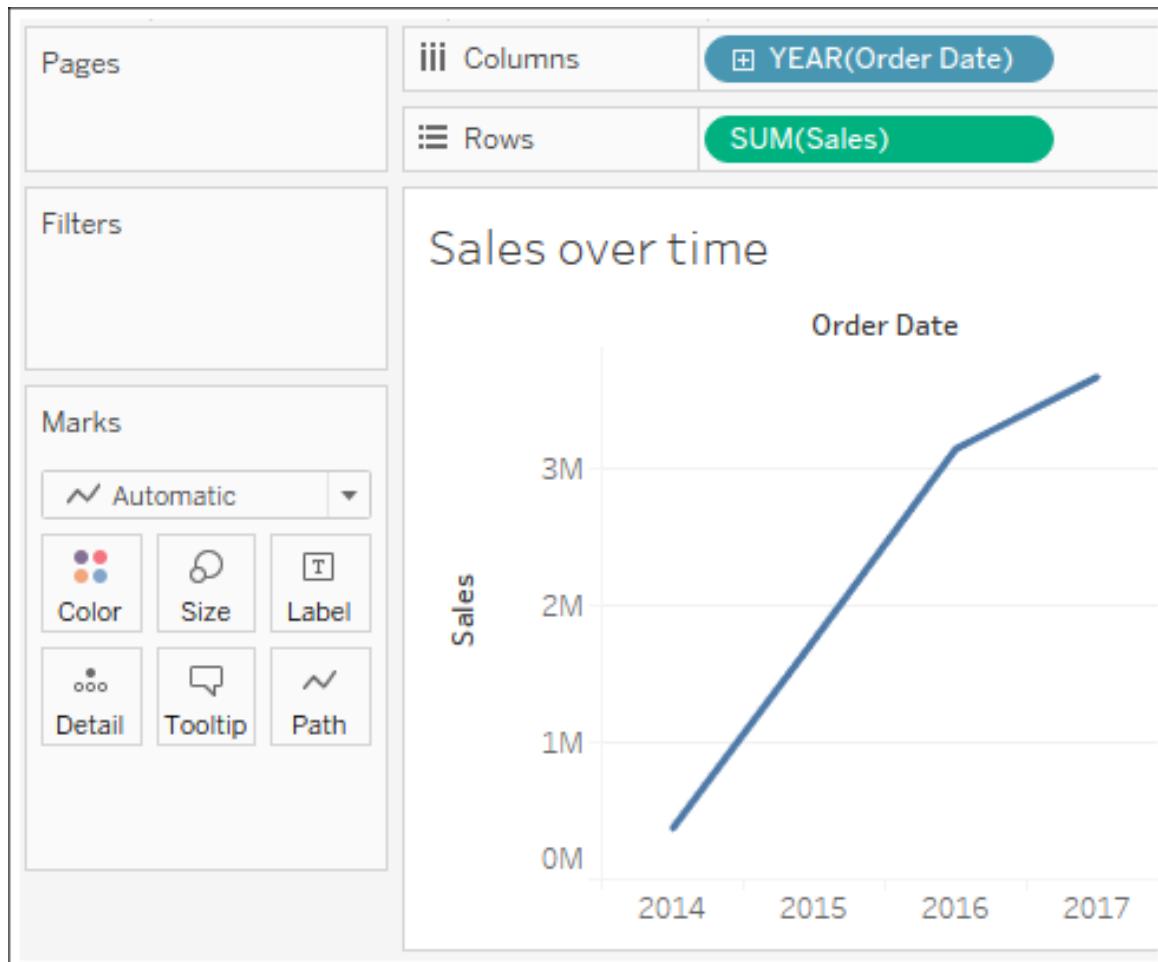


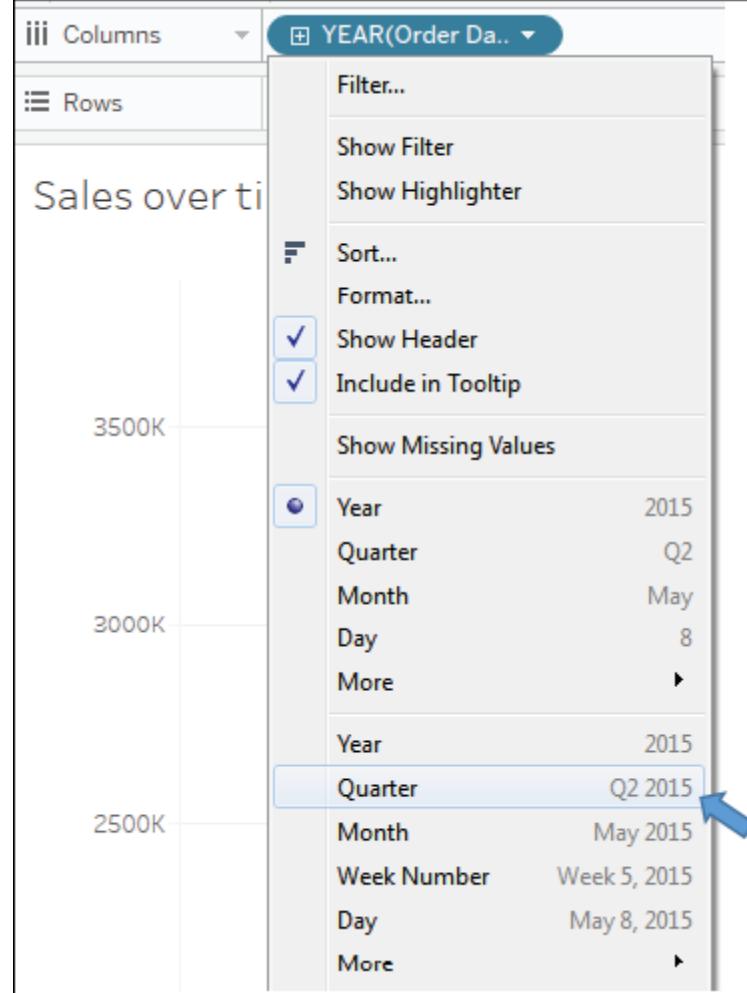
Iterations of bar charts for deeper analysis

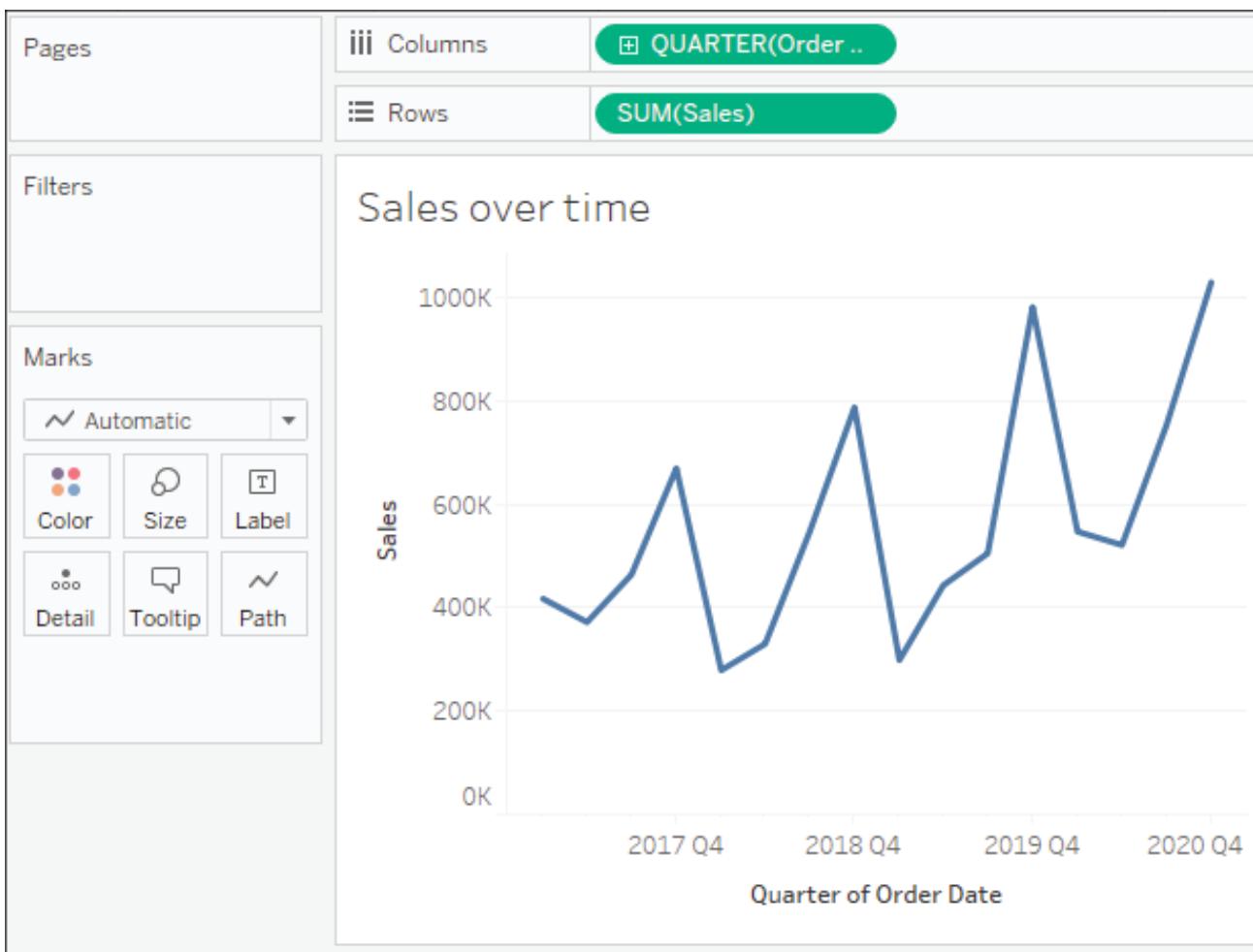


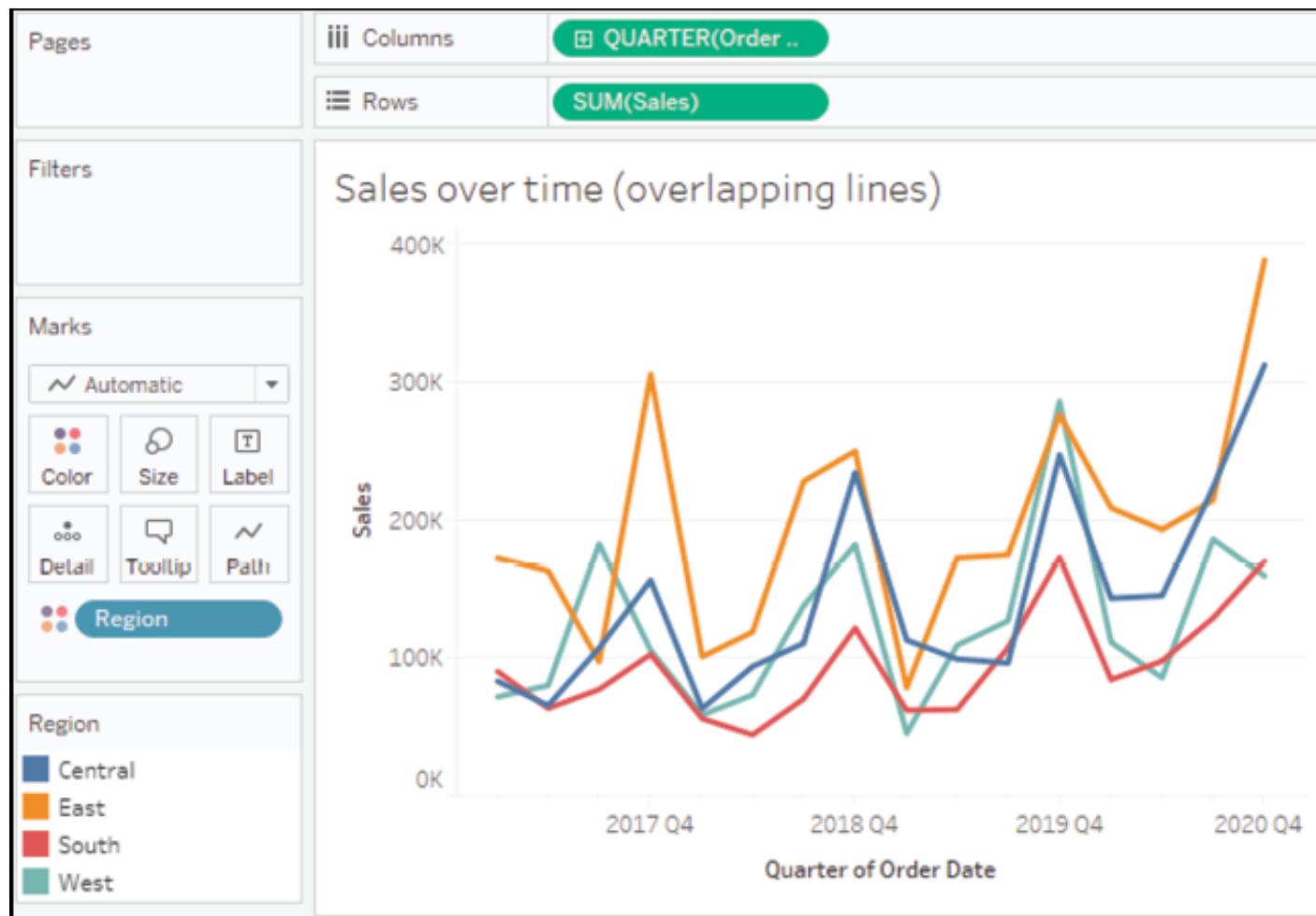
Line charts

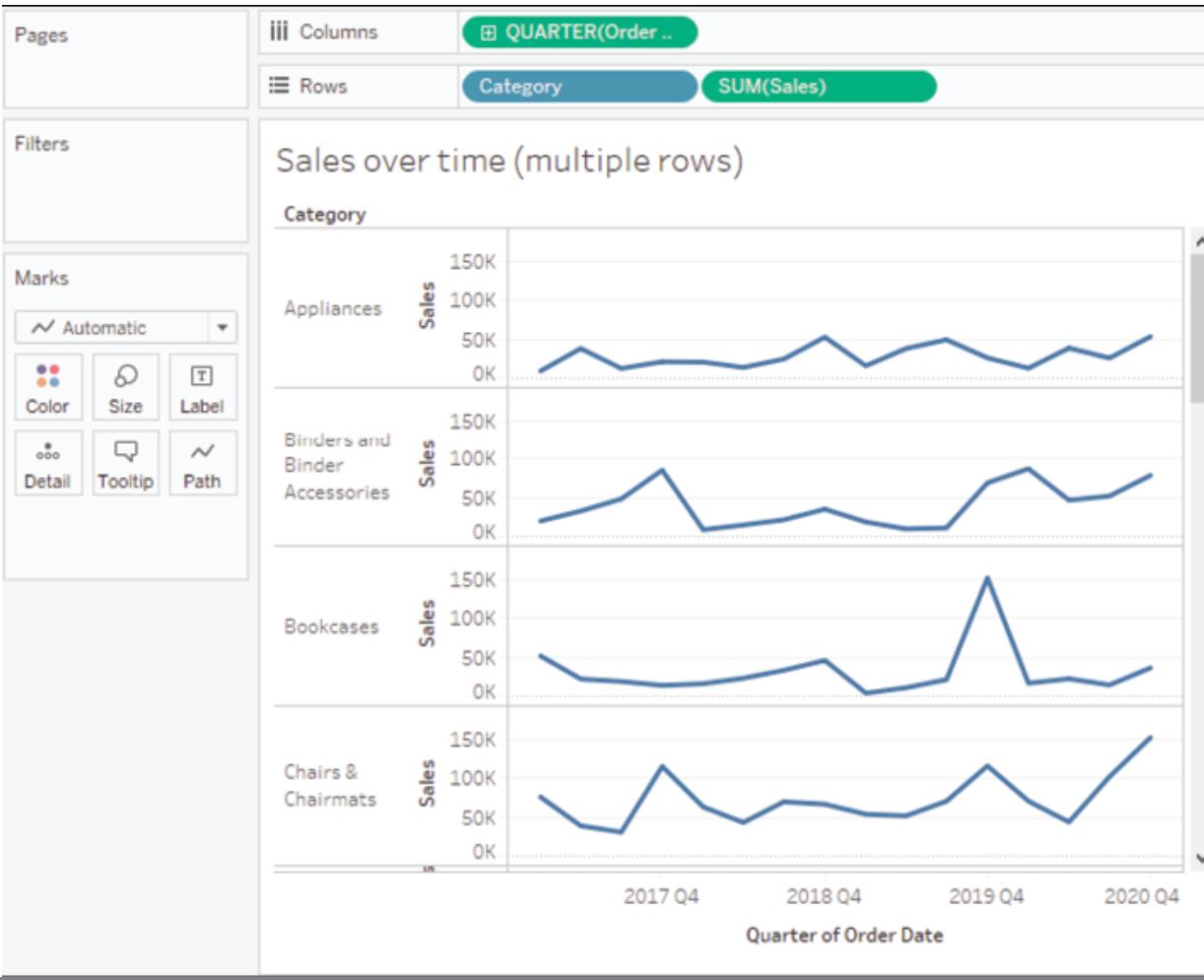
- Line charts connect related marks in a visualization to show movement or a relationship between those connected marks.
- The position of the marks and the lines that connect them are the primary means of communicating the data.
- Additionally, you can use size and color to communicate additional information.











Geographic visualizations

- In Tableau, the built-in geographic database recognizes geographic roles for fields such as Country, State, City, Airport, Congressional District, or Zip Code.
- Even if your data does not contain latitude and longitude values, you can simply use geographic fields to plot locations on a map.

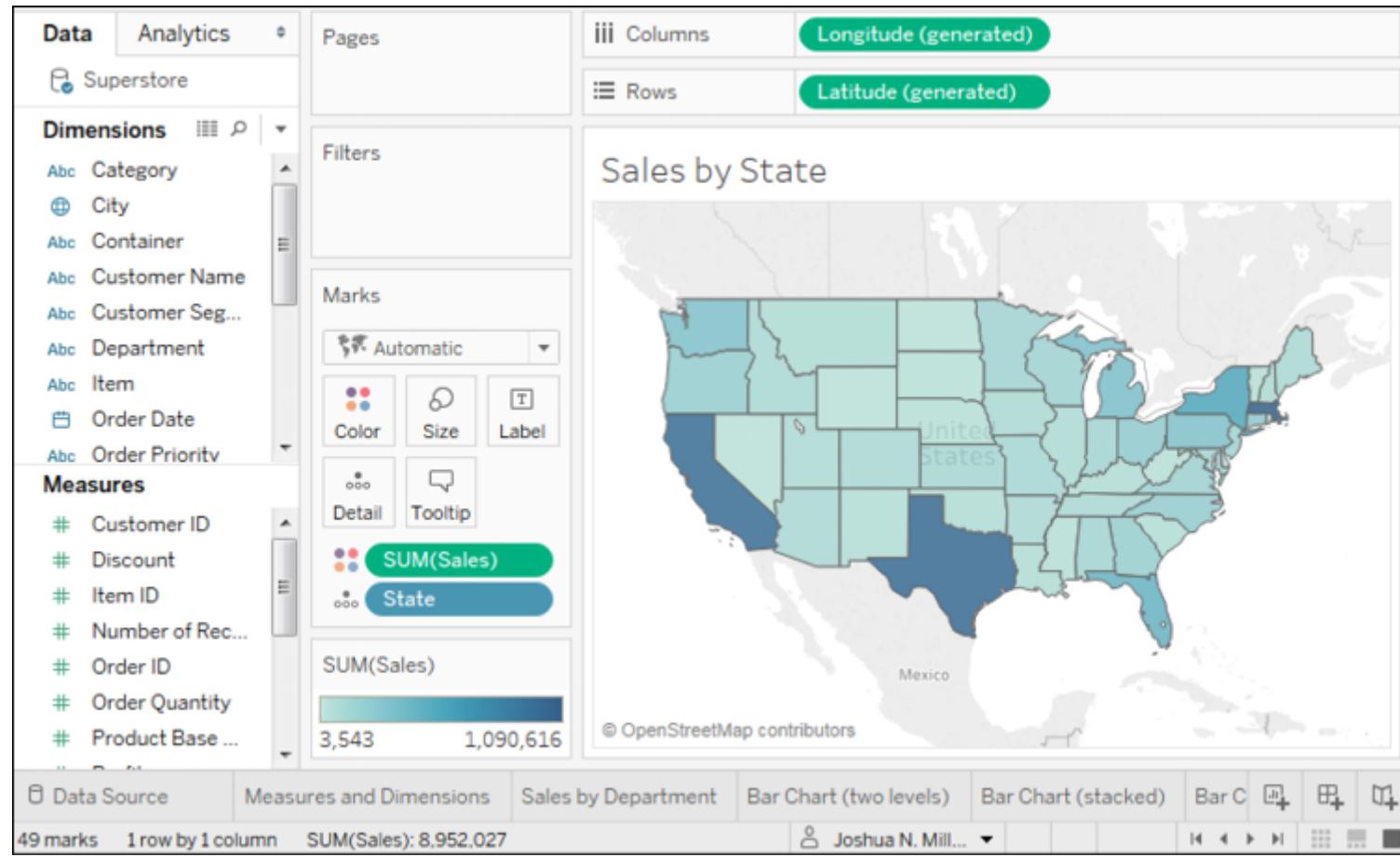
Geographic visualizations

Geographic visualization is incredibly valuable when you need to understand where things happen and whether there are any spatial relationships within the data. Tableau offers several types of geographic visualization:

- Filled maps
- Symbol maps
- Density maps

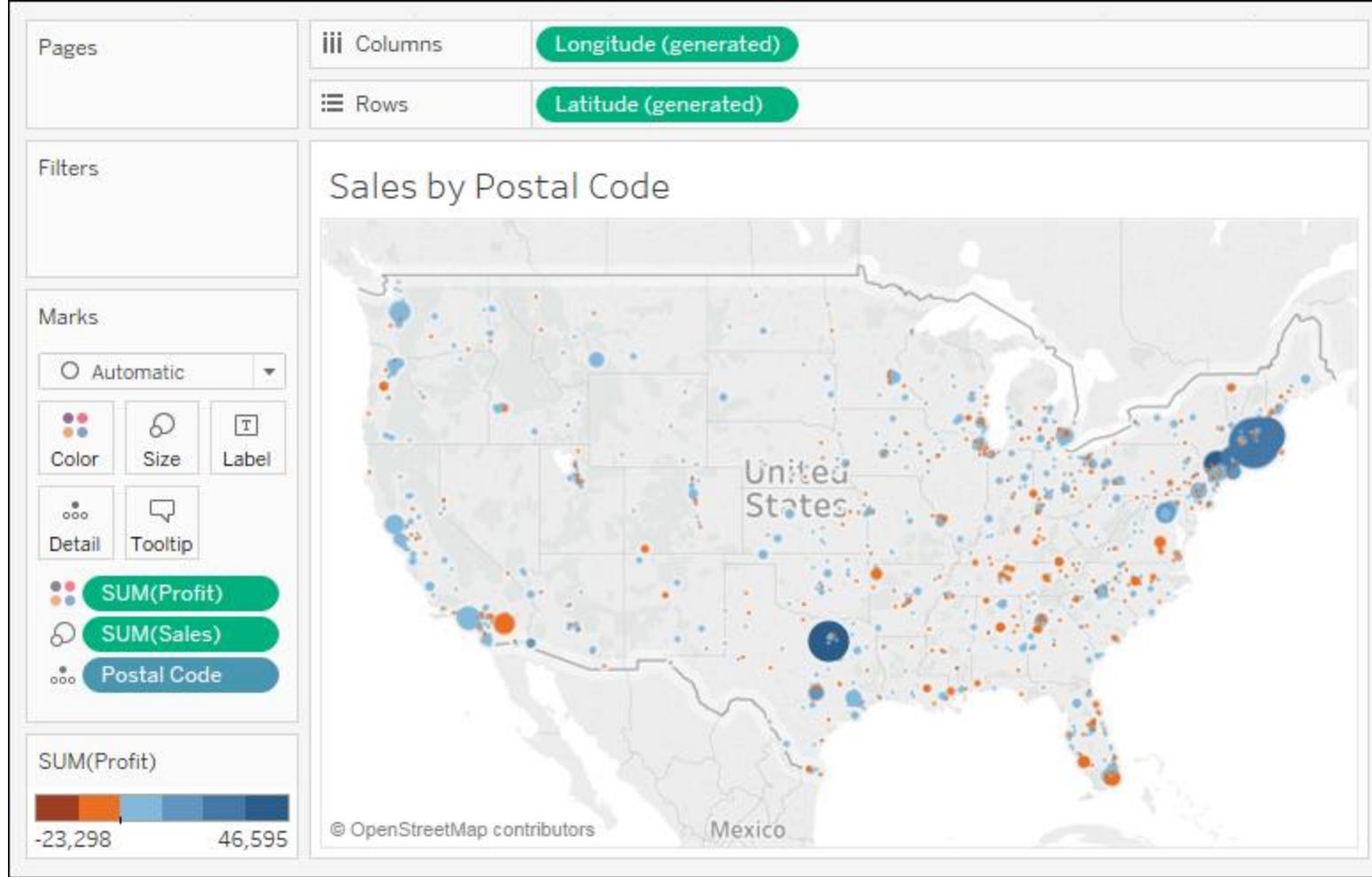
Filled maps

- Filled maps fill areas such as countries, states, or ZIP codes to show a location.
- The color that fills the area can be used to communicate measures such as average sales or population as well as dimensions such as region.
- These maps are also called choropleth maps.



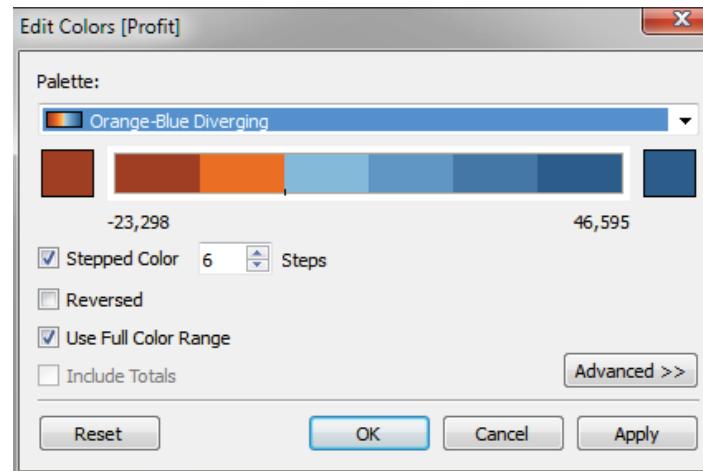
Symbol maps

- With symbol maps, marks on the map are not drawn as filled regions; rather, marks are shapes or symbols placed at specific geographic locations.
- The size, color, and shape may also be used to encode additional dimensions and measures.



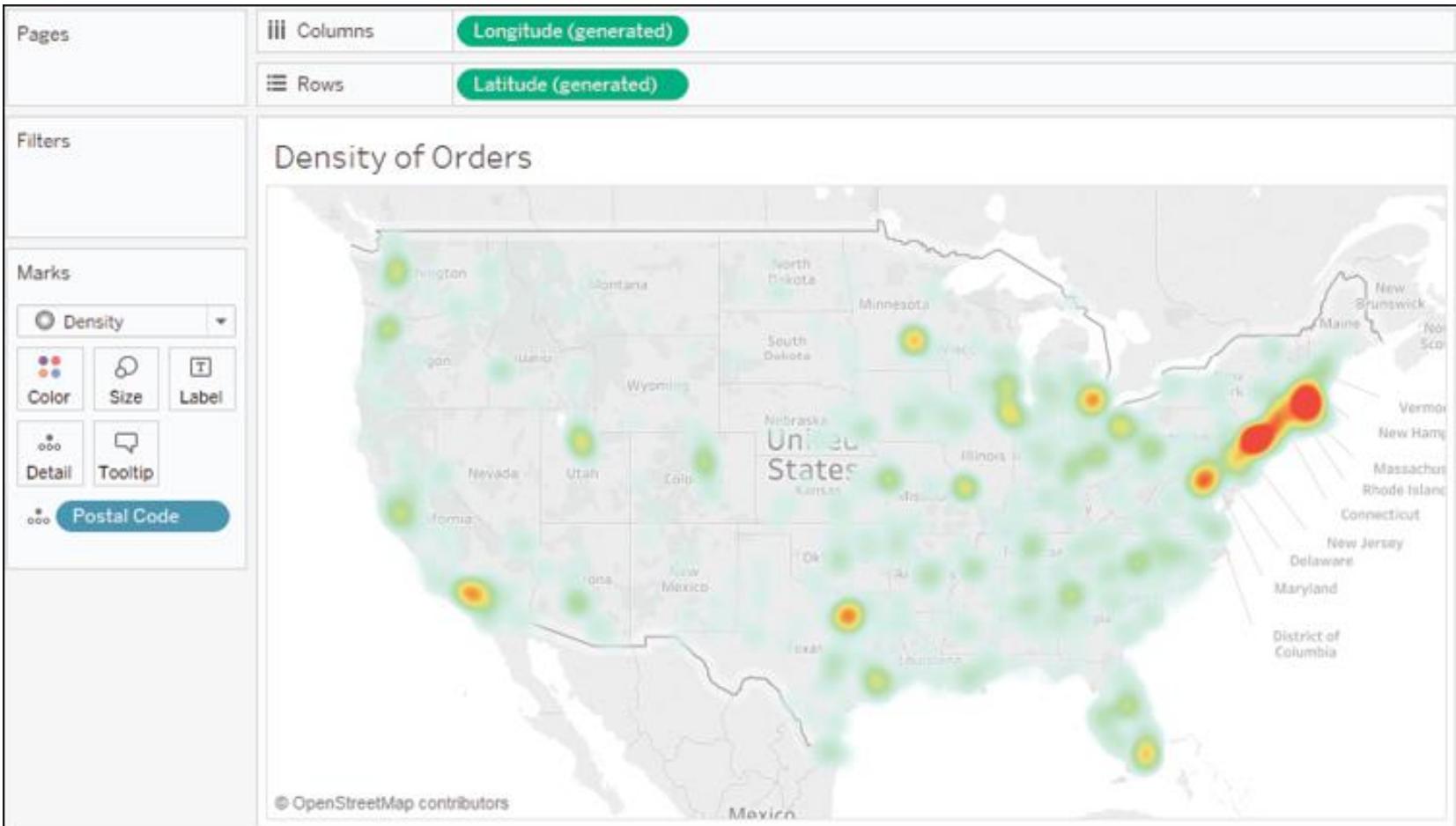
Symbol maps

- A combination of tweaking the size and using Stepped Color and Use Full Color Range, as shown here, produced the result for this example:



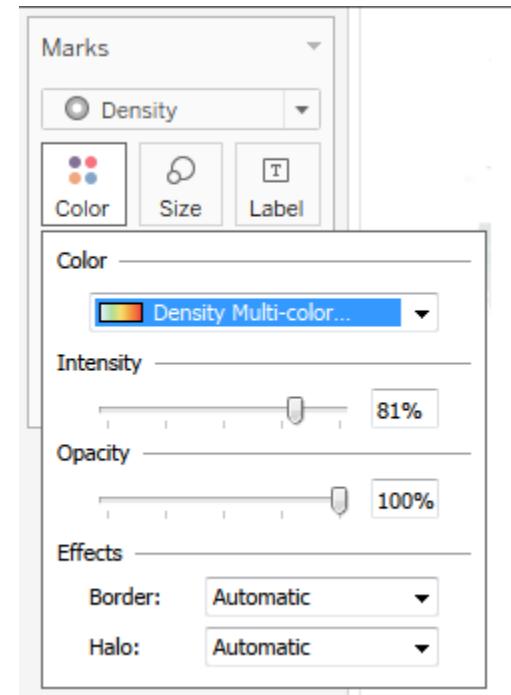
Density maps

- Density maps show the spread and concentration of values within a geographic area.
- Instead of individual points or symbols, the marks blend together, showing greater intensity in areas with a high concentration.
- You can control the Color, Size, and Intensity.



Density maps

- Try experimenting with the Color and Size options.
- Clicking on Color, for example, reveals some options specific to the Density mark type:



Using Show Me

- Show Me is a powerful component of Tableau that arranges selected and active fields into the places required for the selected visualization type.
- The Show Me toolbar displays small thumbnail images of different types of visualizations, allowing you to create visualizations with a single click.



For symbol maps try

1 geo \oplus Dimension

0 or more Dimensions

0 to 2 Measures

May use spatial measure in
place of geo dimension

Putting everything together in a dashboard

- Often, you'll need more than a single visualization to communicate the full story of the data.
- In these cases, Tableau makes it very easy for you to use multiple visualizations together on a dashboard.
- In Tableau, a dashboard is a collection of views, filters, parameters, images, and other objects that work together to communicate a data story.

Dashboard Layout

Default Phone

Device Preview

Size

Desktop Browser (1000 x 8... ▾)

Sheets

- Measures and Dime...
- Sales by Department
- Bar Chart (two level...)
- Bar Chart (stacked)
- Bar Chart (experim...
- Sales over time
- Sales over time (ov...
- Sales over time (m...
- Sales by State
- Sales by Postal Code
- Density of Orders
- Show Me

Objects

| | | | |
|--|------------|--|-----------|
| | Horizontal | | Web Page |
| | Vertical | | Blank |
| | Text | | Button |
| | Image | | Extension |

Tiled Floating

Show dashboard title

The dashboard interface

Grip

Sales by Department

Department

| Department | Sales |
|-----------------|-------|
| Furniture | ~3M |
| Office Supplies | ~2M |
| Technology | ~3M |

0M 1M 2M 3M

Sales

Remove from dashboard

Navigate to the sheet

Use the sheet as a filter on the dashboard

Open the dropdown menu

Go to Sheet

Duplicate Sheet

Fit

Title

Caption

Legends

- Color Legend (Sales)
- Shape Legend
- Size Legend (Sales)
- Map Legend

Filters

Highlighters

Show Page Control

View Toolbar

Use as Filter

Ignore Actions

Floating

Floating Order

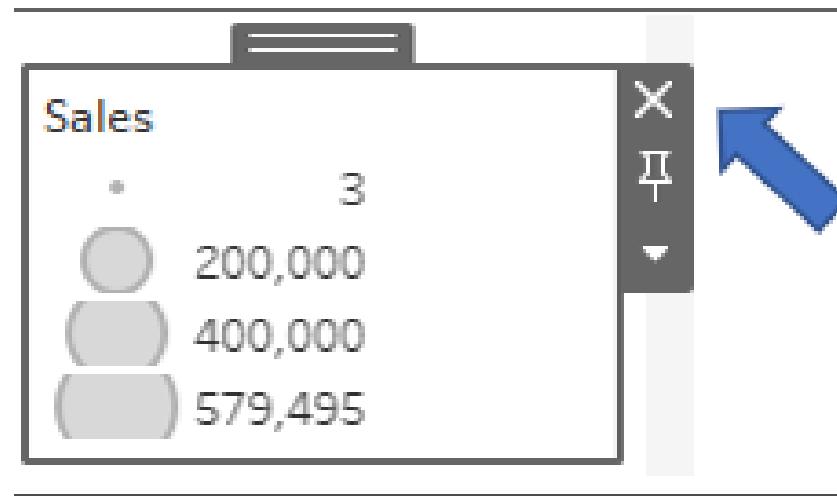
Deselect

Remove from Dashboard

Rename Dashboard Item...

Building your dashboard

- Select the Sales size legend by clicking on it. Use the X option to remove the legend from the dashboard:



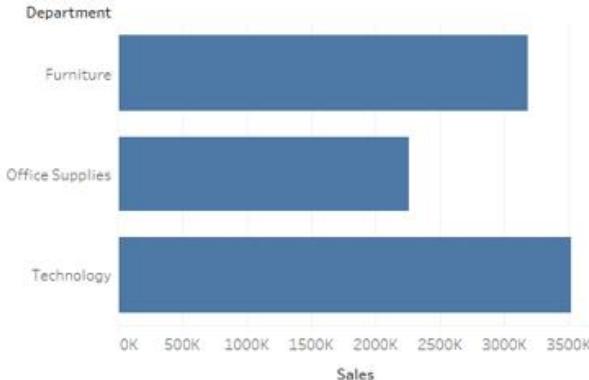
Building your dashboard

- For each view (Sales by Department, Sales by Postal Code, and Sales over time), select the view by clicking on an empty area in the view.
- Then, click on the Use as Filter option to make that view an interactive filter for the dashboard:

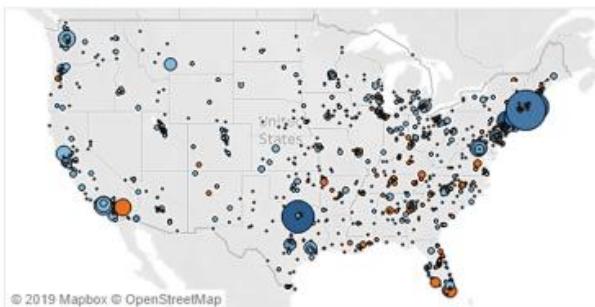


Superstore Sales

Sales by Department



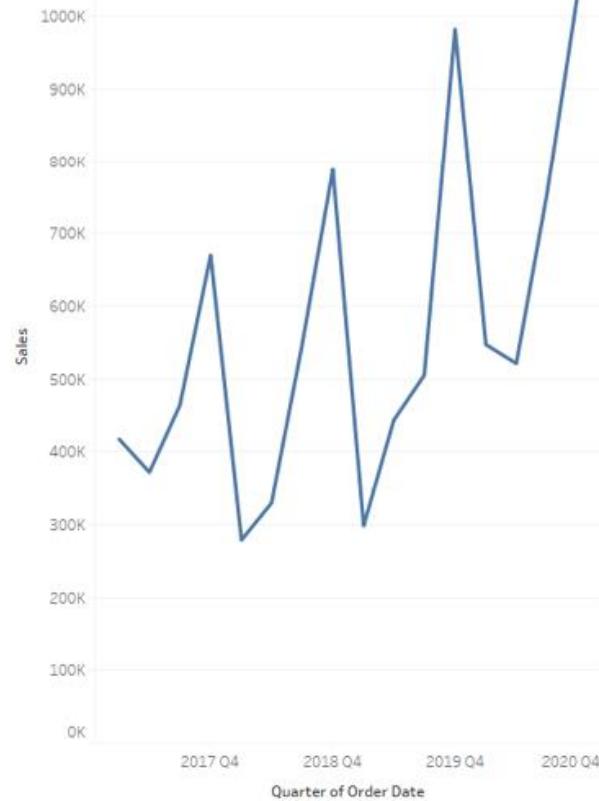
Sales by Postal Code



Profit



Sales over time



Summary

- Tableau's visual environment allows a rapid and iterative process of exploring and analyzing data visually.
- You've taken your first steps toward understanding how to use the platform.
- You connected to data and then explored and analyzed the data using some key visualization types such as bar charts, line charts, and geographic visualizations.

COMPLETE LAB 1

2. Connecting to Data in Tableau



Connecting to Data in Tableau

We'll cover the following topics:

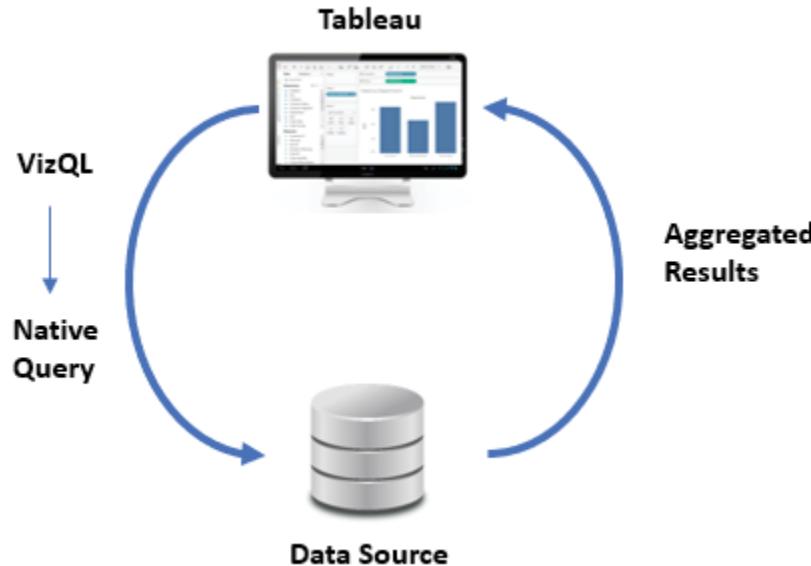
- The Tableau paradigm
- Connecting to data
- Managing data source metadata
- Working with extracts instead of live connections
- Filtering data

The Tableau paradigm

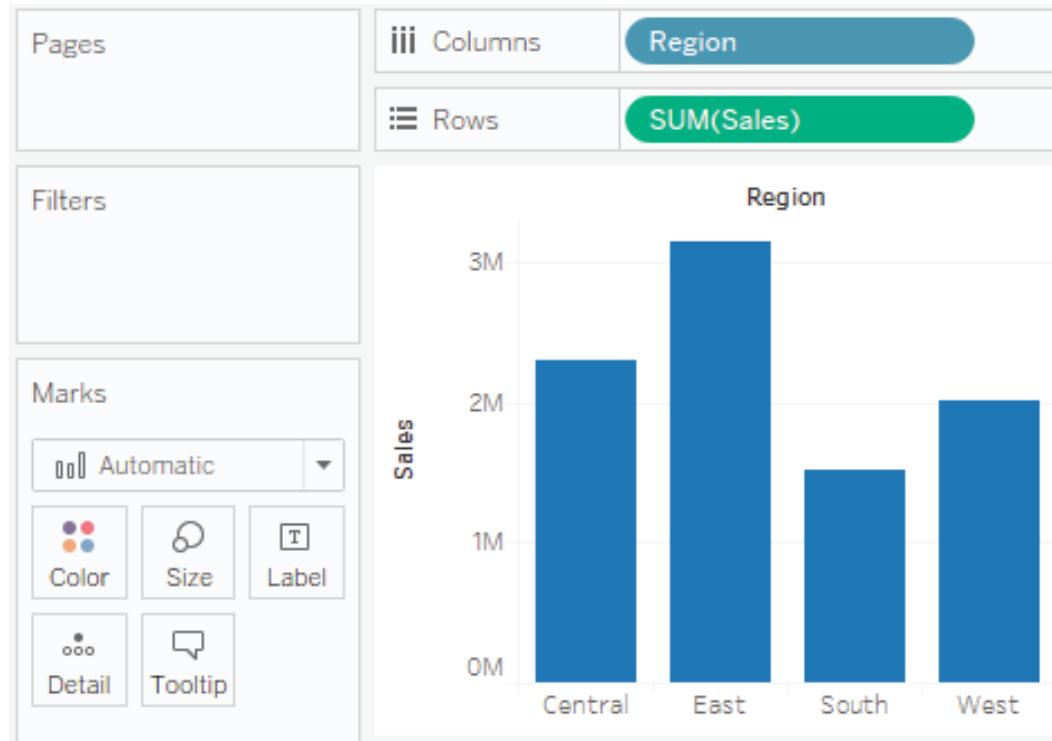
- The unique and exciting experience of working with data in Tableau is a result of VizQL (Visual Query Language).
- VizQL was developed as a Stanford University research project, focusing on the natural ways that humans visually perceive the world and how that could be applied to data visualization.
- We naturally perceive differences in size, shape, spatial location, and color.

The Tableau paradigm

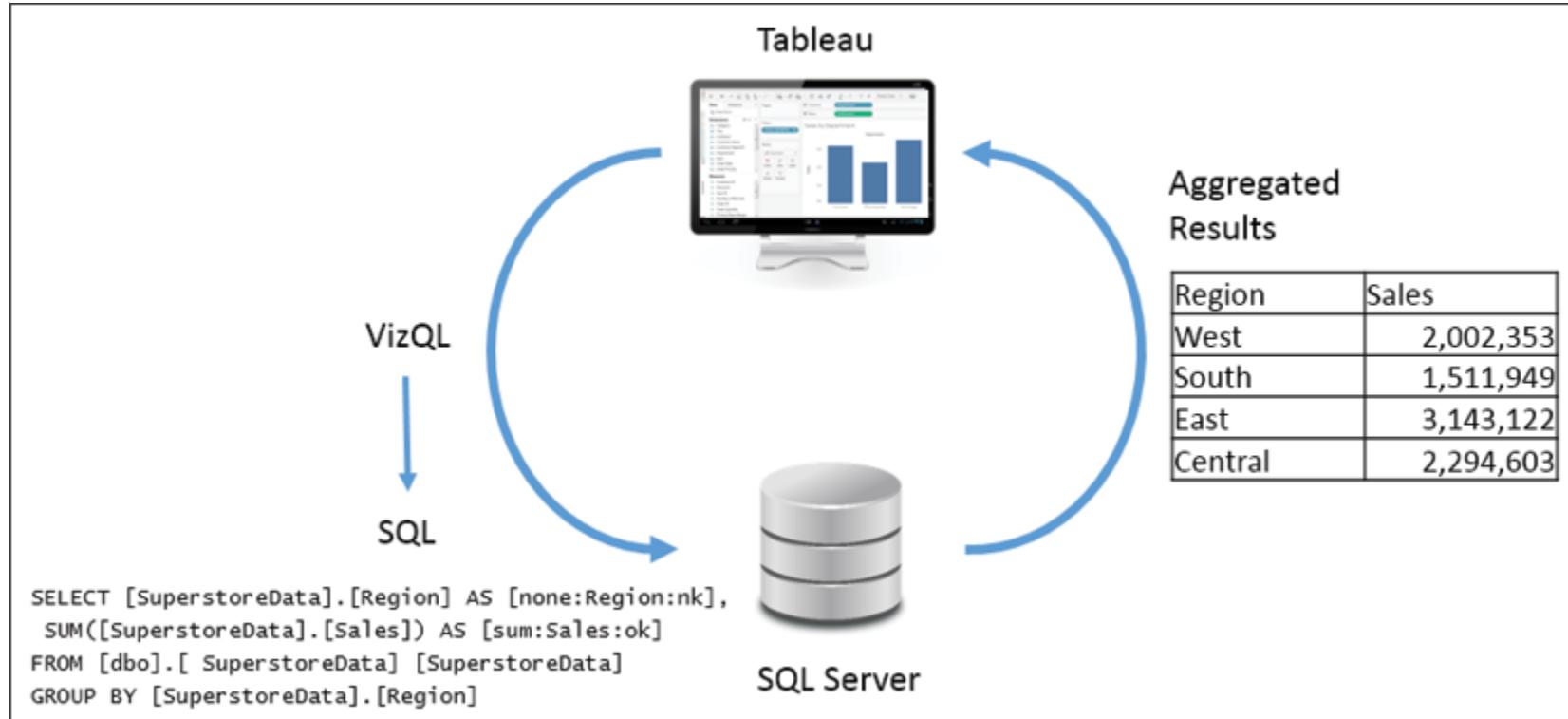
- In its simplest form, the Tableau paradigm of working with data looks like the following diagram:



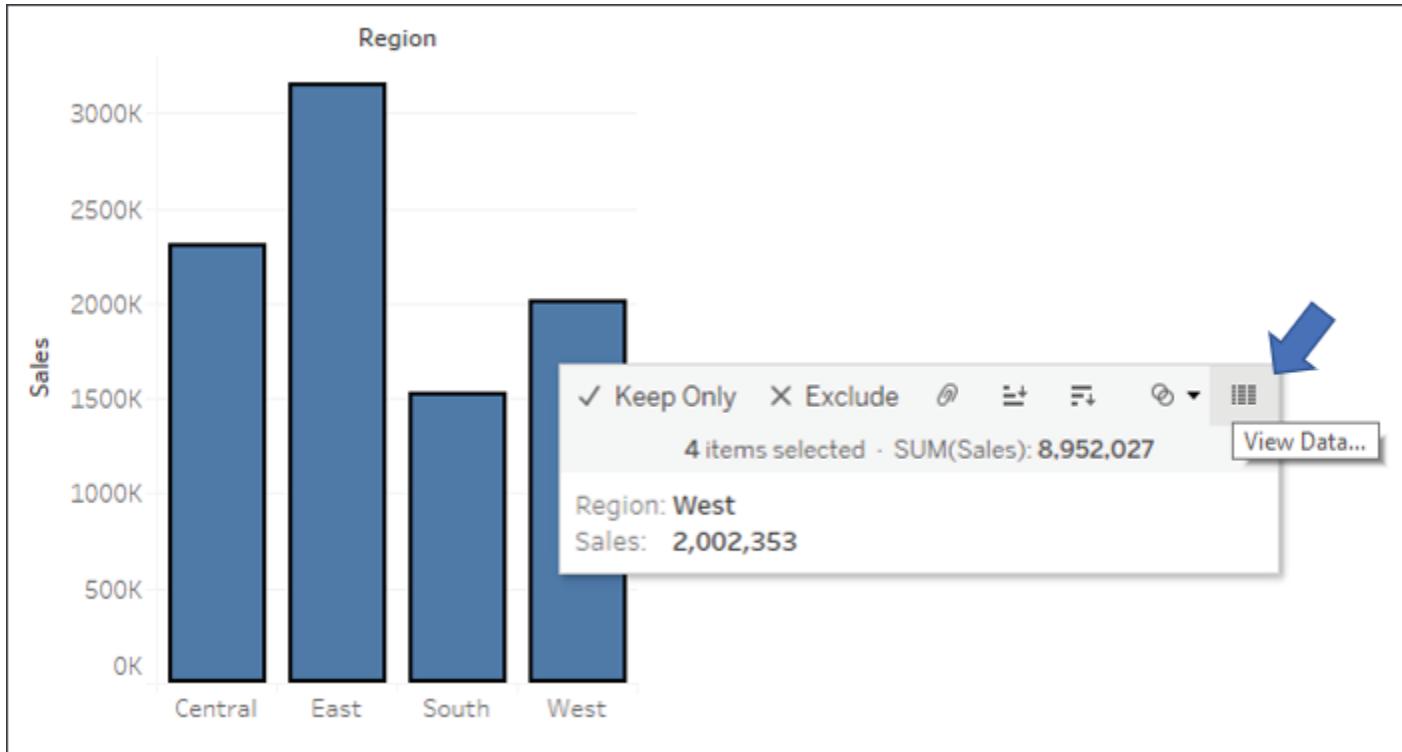
A simple example



A simple example



A simple example



A simple example

- This will reveal a View Data window:

| Region | Sales |
|---------|-----------|
| West | 2,002,353 |
| South | 1,511,949 |
| East | 3,143,122 |
| Central | 2,294,603 |

A simple example

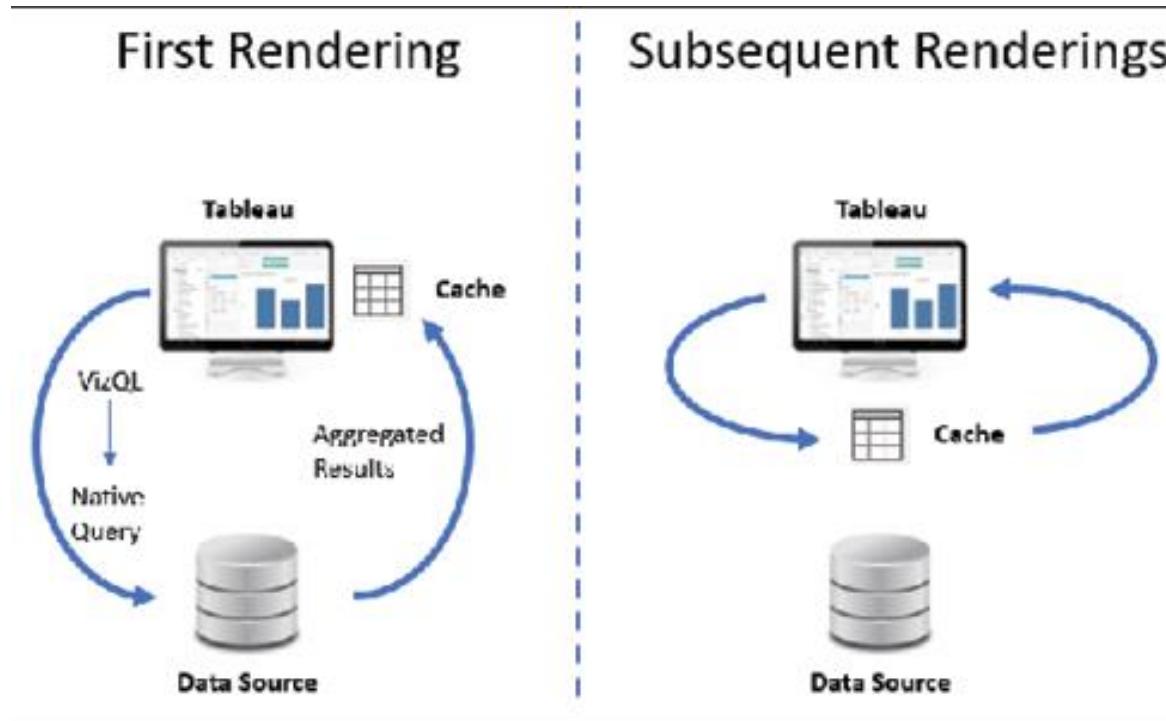
- In this case, there are 9,426 underlying records, as indicated on the status bar in the lower-right corner of the following screenshot:

The screenshot shows a software interface titled "View Data". At the top, it displays "9,426 rows" and has checkboxes for "Show aliases" and "Show all fields", along with "Copy" and "Export All" buttons. The main area is a table with the following data:

| Category | City | Container | Customer ID | Customer Name |
|------------|-----------|-----------|-------------|------------------|
| Appliances | Lancaster | Small Box | 1890 | Jonathan Drummey |
| Paper | Oxford | Small Box | 607 | Joe Mako |
| Paper | Boston | Small Box | 608 | Chuck Hooper |
| Paper | Conway | Small Box | 3073 | Shawn Wallwork |

At the bottom, there are navigation buttons for "Summary" and "Full Data", and the status bar shows "9,426 rows".

A simple example



Connecting to data

- There is virtually no limit to the data that Tableau can visualize! Almost every new version of Tableau adds new native connectors.
- Tableau continues to add native connectors for cloud-based data.
- The web data connector allows you to write a connector for any online data you wish to retrieve.
- The Tableau Hyper API allows you to programmatically read and write extracts of data, enabling you to access data from any source and write it to a native Tableau format.

Connecting to data in a file

File-based data includes all sources of data where the data is stored in a file. File-based data sources include the following:

- Extracts: A .hyper or .tde file containing data that was extracted from an original source.
- Microsoft Access: An .mdb or .accdb database file created in Access.
- Microsoft Excel: An .xls, .xlsx, or .xlsm spreadsheet created in Excel. Multiple Excel sheets or sub-tables may be joined or unioned together in a single connection.

1

2 Connections Add
Superstore Microsoft Excel

3 Sheets
Orders Returns
New Union

4 Orders and Returns

5 Orders ————— Returns

6 Connection
 Live Extract

7 Filters 0 | Add

8 Sort fields Data source order ▾ Show aliases Show hidden fields 1.000 ↗ rows

9

| Abc Orders Category | Orders City | Abc Orders Container | # Orders Customer ID | Abc Orders Customer Name | Abc Orders Customer Segment |
|---------------------------|----------------|----------------------------|----------------------------|--------------------------------|-----------------------------------|
| Paper | Ponca City | Small Box | 3035 | Larry Harris | Home Office |
| Paper | Ponca City | Wrap Bag | 3035 | Larry Harris | Home Office |
| Pens & Art Supplies | Stillwater | Wrap Bag | 3385 | J.B. Bond | Corporate |
| Binders and Binder Ac... | Desoto | Small Box | 3133 | Kurt Krohn | Corporate |
| Rubber Bands | Desoto | Wrap Bag | 3133 | Kurt Krohn | Corporate |
| Storage & Organization | Argyle | Small Box | 1697 | Mark Piland | Home Office |
| Tables | Grand Prairie | Jumbo Box | 1603 | Bill Eubanks | Small Business |

Pages

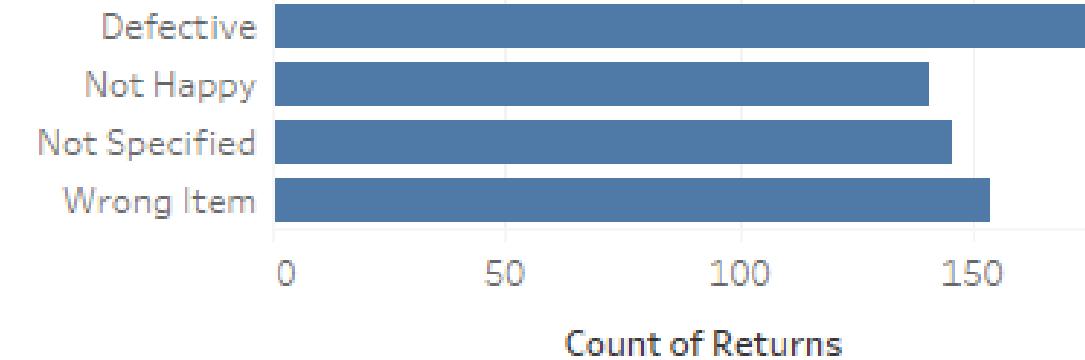
iii Columns

CNT>Returns)

Filters

Connect to Excel

Return Reason



Marks

Automatic



Color



Size



Label



Detail



Tooltip

Connecting to data on a server

- Database servers, such as SQL Server, Snowflake, Vertica, and Oracle, host data on one or more server machines and use powerful database engines to store, aggregate, sort, and serve data based on queries from client applications.
- Tableau can leverage the capabilities of these servers to retrieve data for visualization and analysis.

- As soon as the Microsoft SQL Server connection is selected, the interface displays options for some initial configuration as follows:

Microsoft SQL Server

Server: TDS-W541-JM\AGAPE

Database: Optional

Enter information to sign in to the database:

Use Windows Authentication (preferred)

Use a specific username and password:

Username:

Password:

Require SSL

Read uncommitted data

Initial SQL... Sign In

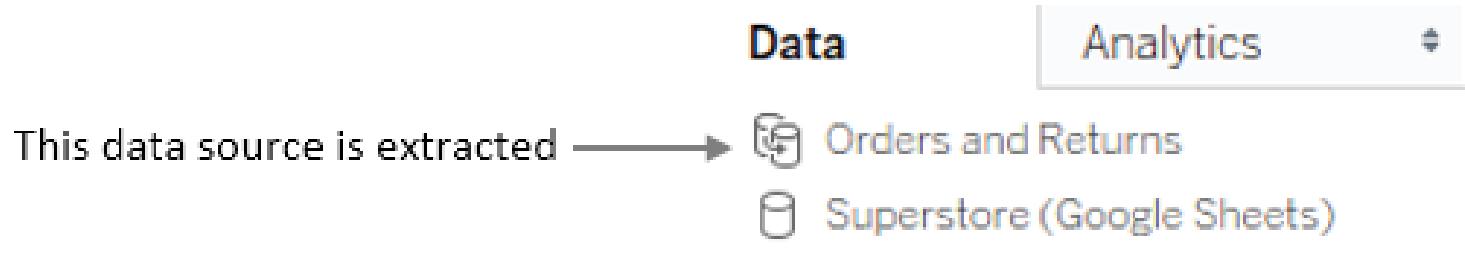
Connecting to data on a server

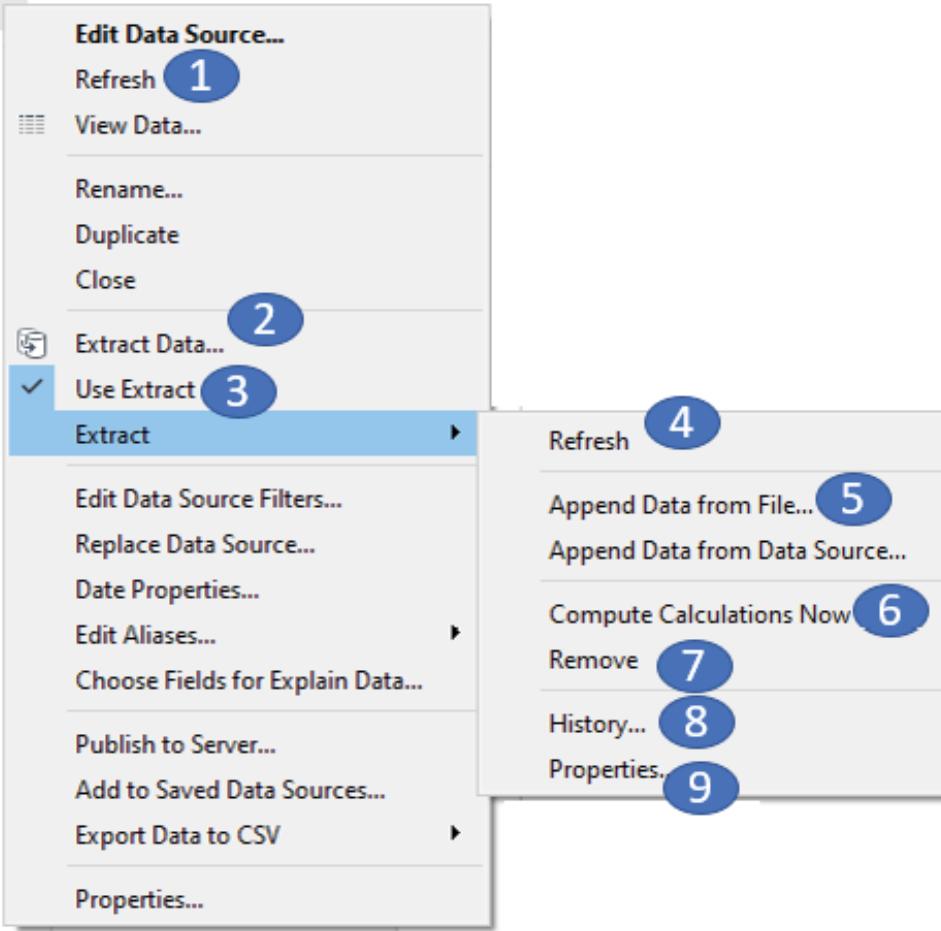
- Once you click the orange Sign In button, you will see a screen that is very similar to the connection screen you saw for Excel.
- The main difference is on the left, where you have an option for selecting a Database, as shown in the following screenshot:

The screenshot shows a user interface for connecting to a database. At the top, there's a 'Connections' section with a single entry: 'TDS-W541-JM\TDS Microsoft SQL Server'. Below it is a 'Database' dropdown set to 'Hospital'. The main area is titled 'Table' and lists several tables: Discharge Details, Hospital Visit, Hospital_Visits, Patient, Patient Visit, Primary Physician, v_Patients, and v_Visits. There are also options for 'New Custom SQL' and 'New Union'. At the bottom, under 'Stored Procedures', are three entries: Get_Active_Doctors, Get_Patient_Diagnoses, and Get_Patient_Treatments.

Using extracts

- Any data source that is using an extract will have a distinctive icon that indicates the data has been pulled from an original source into an extract, as shown in the following screenshot:





Connecting to data in the cloud

- Certain data connections are made to data that is hosted in the cloud.
- These include Amazon RDS, Google BigQuery, Microsoft SQL Azure, Snowflake, Salesforce, Google Sheets, and many others

Select Your Google Sheet

Signed in as milligan. [Sign Out](#)

| Name | Owned by | Last Opened By Me |
|--|-----------------|-------------------|
| Greek New Testament | Joshua Milligan | Mar 12, 2018 |
| Polygonic Hex Map.xlsx | Joshua Milligan | Dec 20, 2017 |
| SMS received | Joshua Milligan | Sep 25, 2017 |
| Teknion Sign Up Sheet August – December 2017 | | Aug 11, 2017 |
| Superstore | Joshua Milligan | Jul 10, 2017 |
| Company Profit | Joshua Milligan | Jun 27, 2017 |
| Test_1 | Joshua Milligan | Dec 5, 2017 |
| SMS received | Joshua Milligan | Sep 25, 2017 |
| Assimilations | Borg Queen | Aug 11, 2017 |
| Superstore | Joshua Milligan | Jul 10, 2017 |
| Company Profit | Joshua Milligan | Jun 27, 2017 |



Greek New Testament

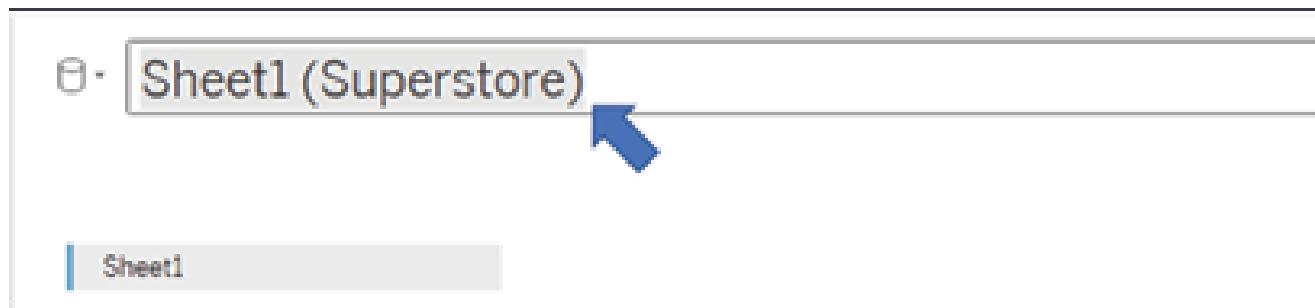
Last Modified On Dec 7, 2017

Last Modified By Joshua Milligan

[Open in Google Drive](#)

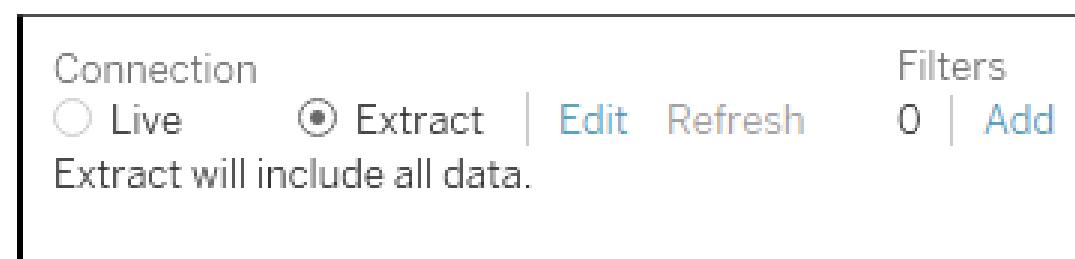
Connecting to data in the cloud

- Click the Data Source name to rename it to Superstore (Google Sheets):

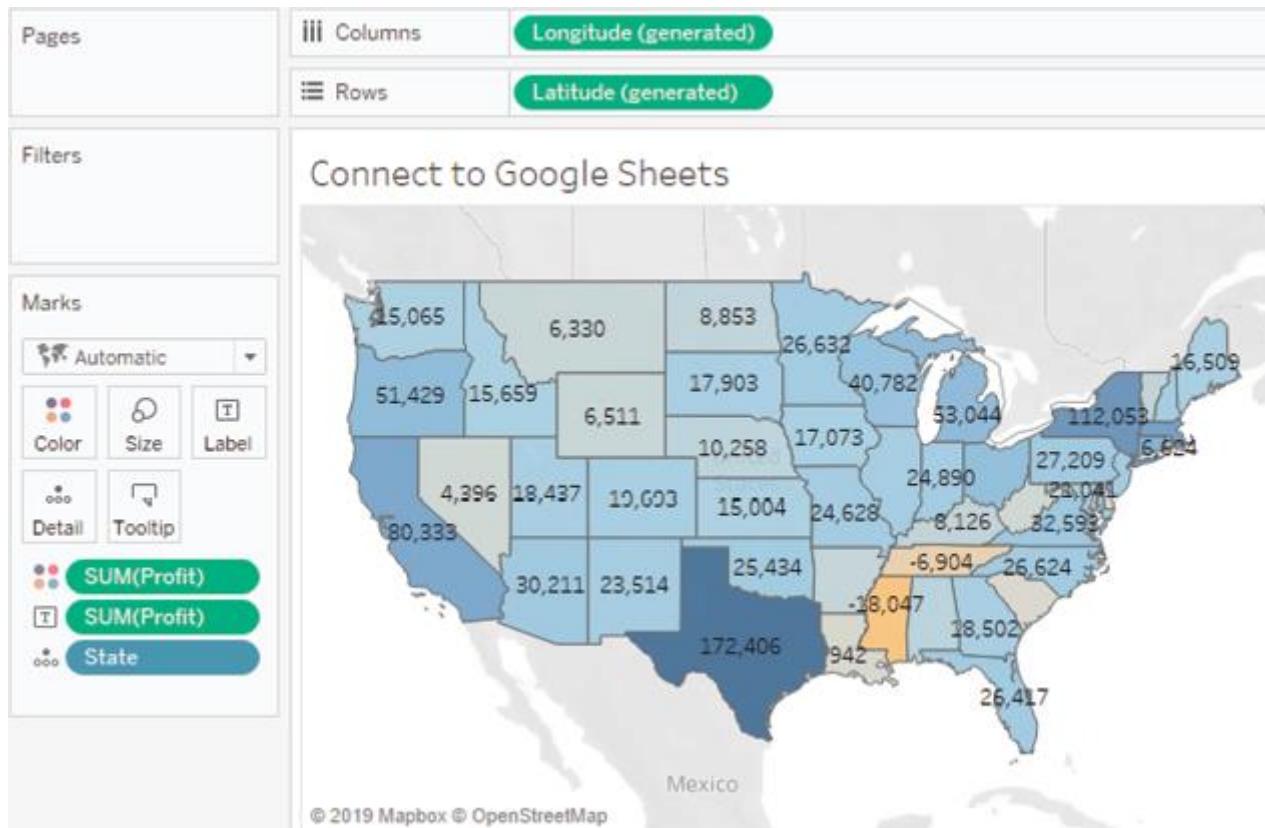


Connecting to data in the cloud

- For the purpose of this example, switch the connection option from Live to Extract.
- When connecting to your own Google Sheets data, you may choose either Live or Extract:



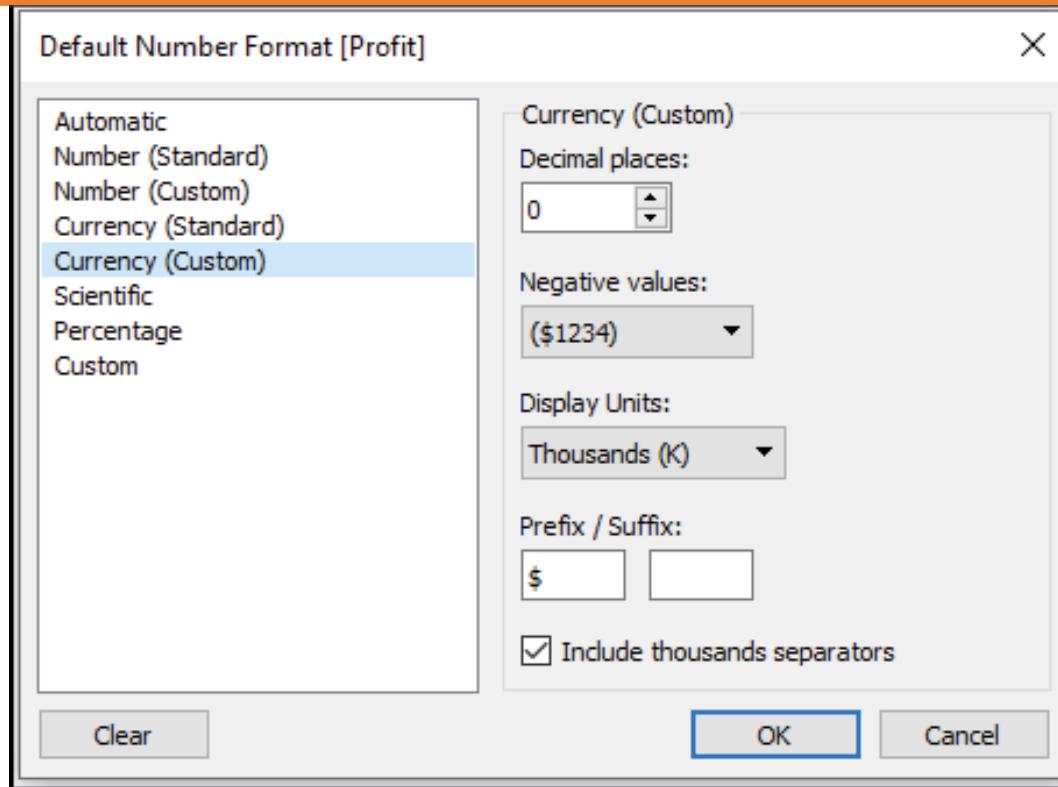
- Create a filled map of Profit by State, with Profit defining the Color and Label:



Managing data source metadata

- Data sources in Tableau store information about the connection(s).
- In addition to the connection itself (for example, database server name, database, and/or filenames), the data source also contains information about all the fields available (such as field name, data type, default format, comments, and aliases).
- Often, this data about the data is referred to as metadata.

Managing data source metadata



Pages

iii Columns

Longitude (generated)

Rows

Latitude (generated)

Filters

Marks

Automatic

Color
Size
LabelDetail
Tooltip

SUM(Profit)

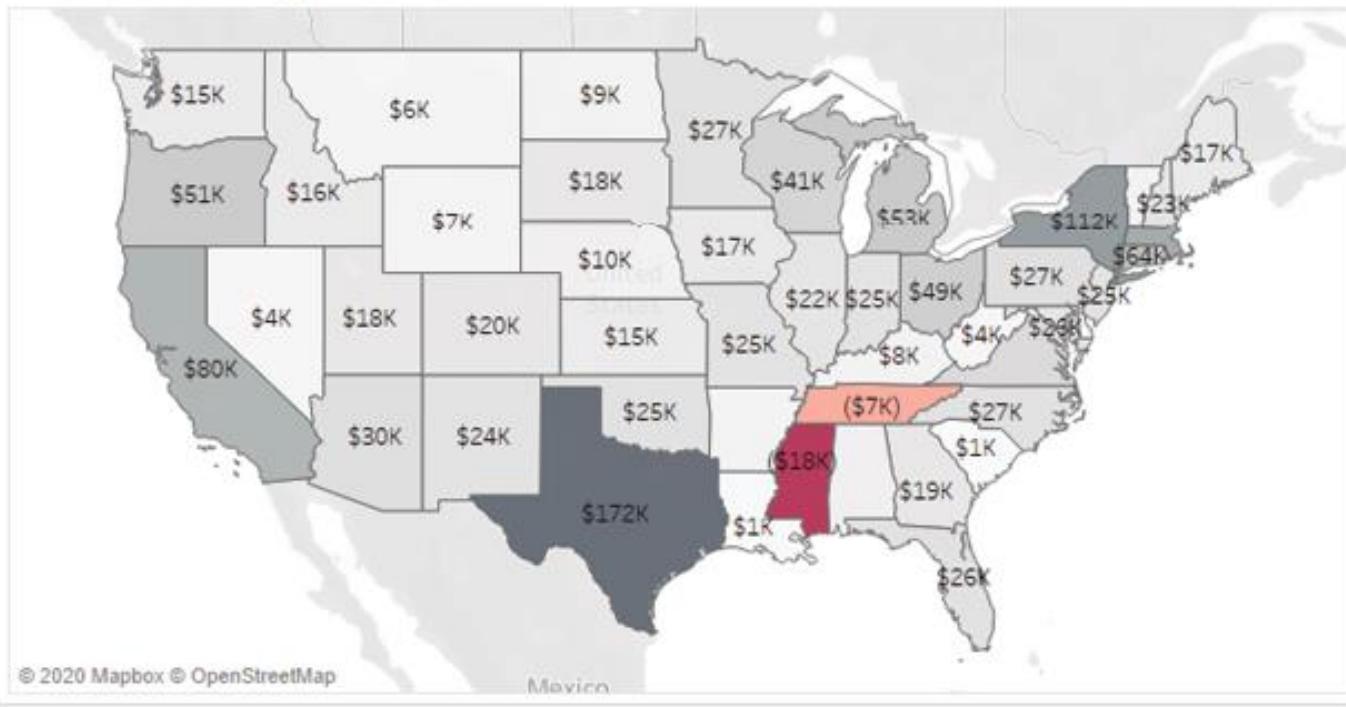
SUM(Profit)

State

SUM(Profit)

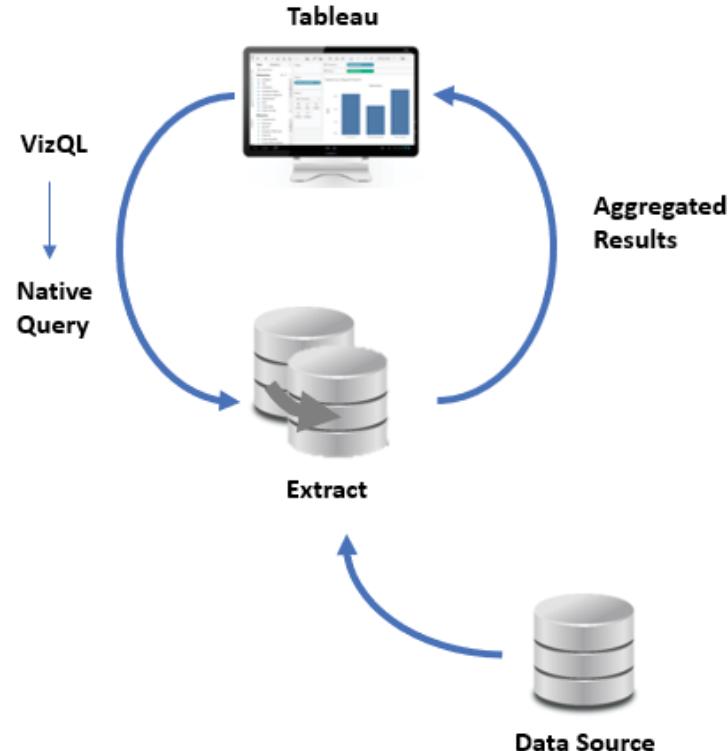


Connect to Google Sheets



Working with extracts instead of live connections

- Extracts extend the way in which Tableau works with data.
- Consider the following diagram:



Creating extracts

- Select Extract on the Data Source screen as follows.
The Edit... link will allow you to configure the extract:

Connection



Live



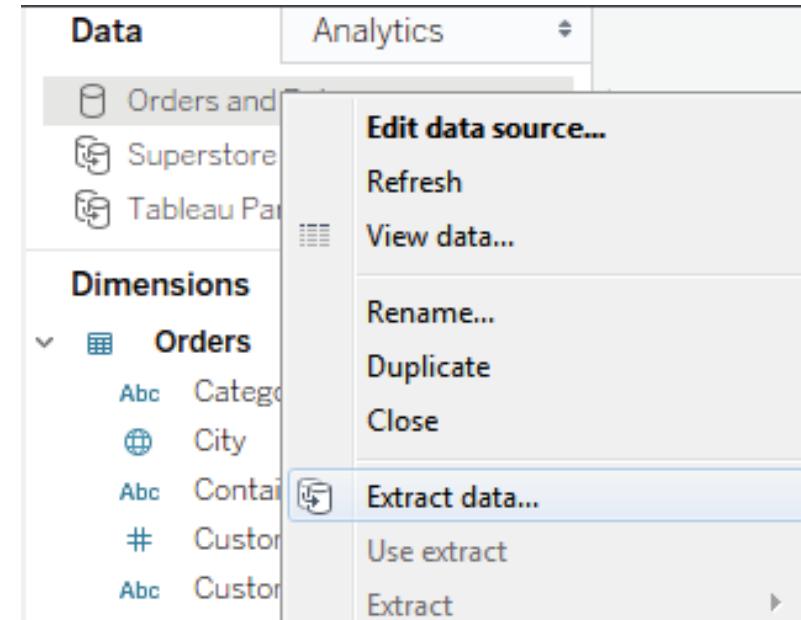
Extract

Edit...

Extract will include all data.

Creating extracts

- Select the data source from the Data menu, or right-click the data source on the data pane and select Extract data.
- You will be given a chance to set configuration options for the extract, as demonstrated in the following screenshot:



Extract Data X

Specify how to store data in the extract:

Data Storage

 Logical Tables Physical TablesStore data using one table for each logical table. [Learn more](#)

Use this option if you need to use extract filters, aggregation, or other extract settings.

Specify how much data to extract:

Filters (optional)

| Filter | Details |
|----------|-------------------------|
| Region | keeps Central and South |
| Category | keeps Office Machines |

[Add...](#)[Edit...](#)[Remove](#)

Aggregation

 Aggregate data for visible dimensions Roll up dates to Year

Number of Rows

 All rows Incremental refresh Top: Orders by rows Sample: Orders by rows[History...](#)[Hide All Unused Fields](#)[Extract](#)[Cancel](#)

Performance

There are two types of extracts in Tableau:

- Tableau Data Extracts (.tde files): prior to Tableau 10.5, these were the only type of extract available.
- Hyper (.hyper files) are available in Tableau 10.5 or later.

Portability and security

- Let's say that your data is hosted on a database server accessible only from inside your office network.
- Normally, you'd have to be onsite or using a VPN to work with the data.
- Even cloud-based data sources require an internet connection.
- With an extract, you can take the data with you and work offline.

When to use an extract

- You should consider various factors when determining whether to use an extract.
- In some cases, you won't have an option (for example, OLAP requires a live connection and some cloud-based data sources require an extract).
- In other cases, you'll want to evaluate your options.

Filtering data

- Data Source Filters are applied before all other filters and are useful when you want to limit your analysis to a subset of data. These filters are applied before any other filters.
- Extract Filters limit the data that is stored in an extract (.tde or .hyper). Data source filters are often converted into extract filters if they are present when you extract the data.

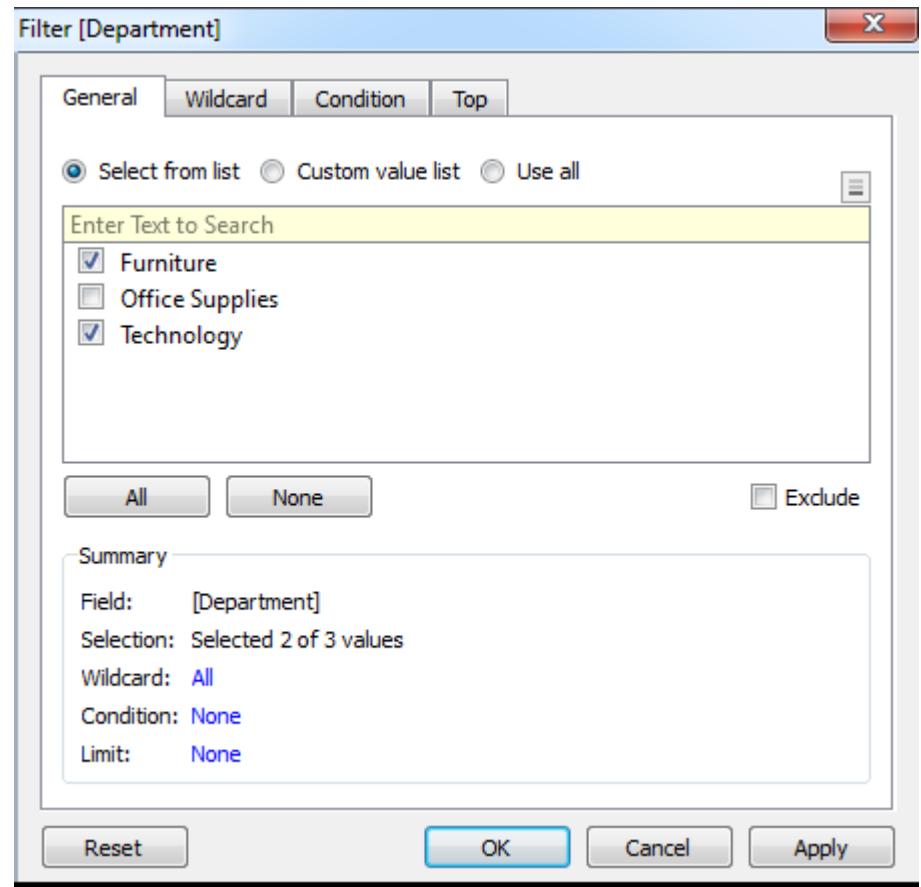
Filtering data

Additionally, you can apply filters to one or more views using one of the following techniques:

- Drag and drop fields from the data pane to the Filters shelf.
- Select one or more marks or headers in a view and then select Keep Only or Exclude, as shown here:

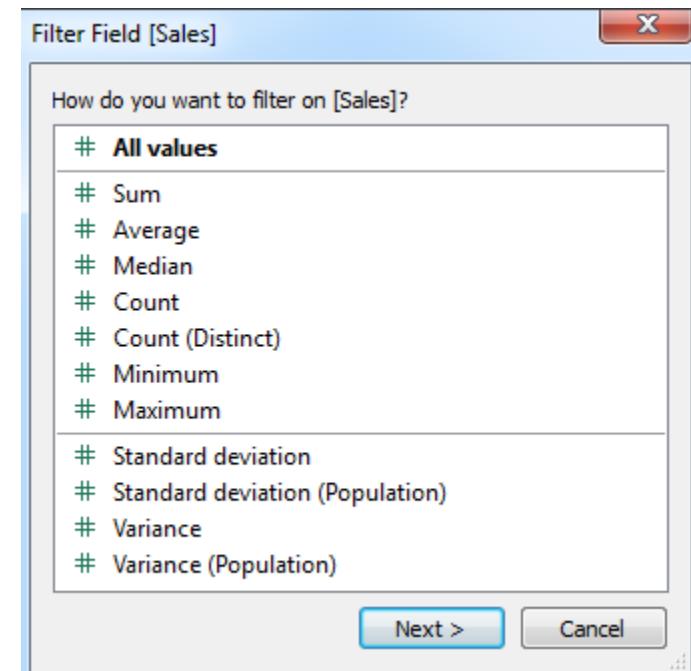


Filtering discrete (blue) fields



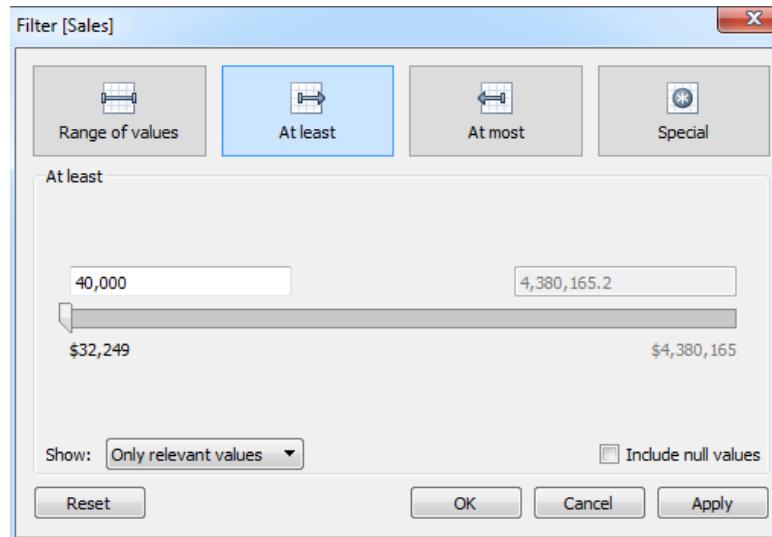
Filtering continuous (green) fields

- If you drop a continuous dimension onto the Filters shelf, you'll get a different set of options.
- Often, you will first be prompted as to how you want to filter the field, as follows:

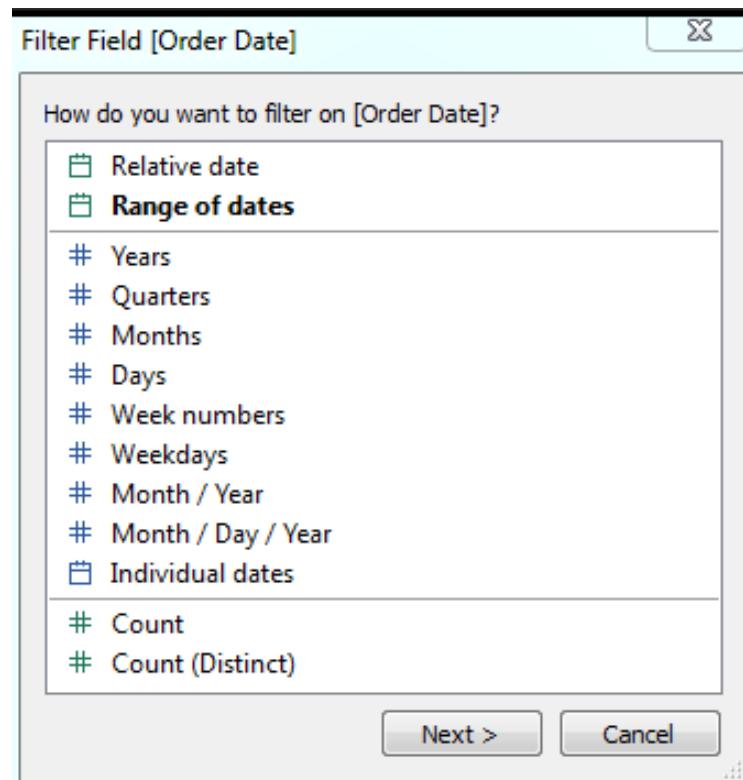


Filtering continuous (green) fields

- Once you've made a selection (or if the selection wasn't applicable for the field selected), you will be given another interface for setting the actual filter, as follows:



Filtering dates



Summary

- This lesson covered key concepts of how Tableau works with data.
- Although you will not usually be concerned with what queries Tableau generates to query underlying data engines, having a solid understanding of Tableau's paradigm will greatly aid you as you analyze data.

COMPLETE LAB 2

3. Moving Beyond Basic Visualizations



Moving Beyond Basic Visualizations

In this lesson, visualizations will fall under the following major categories:

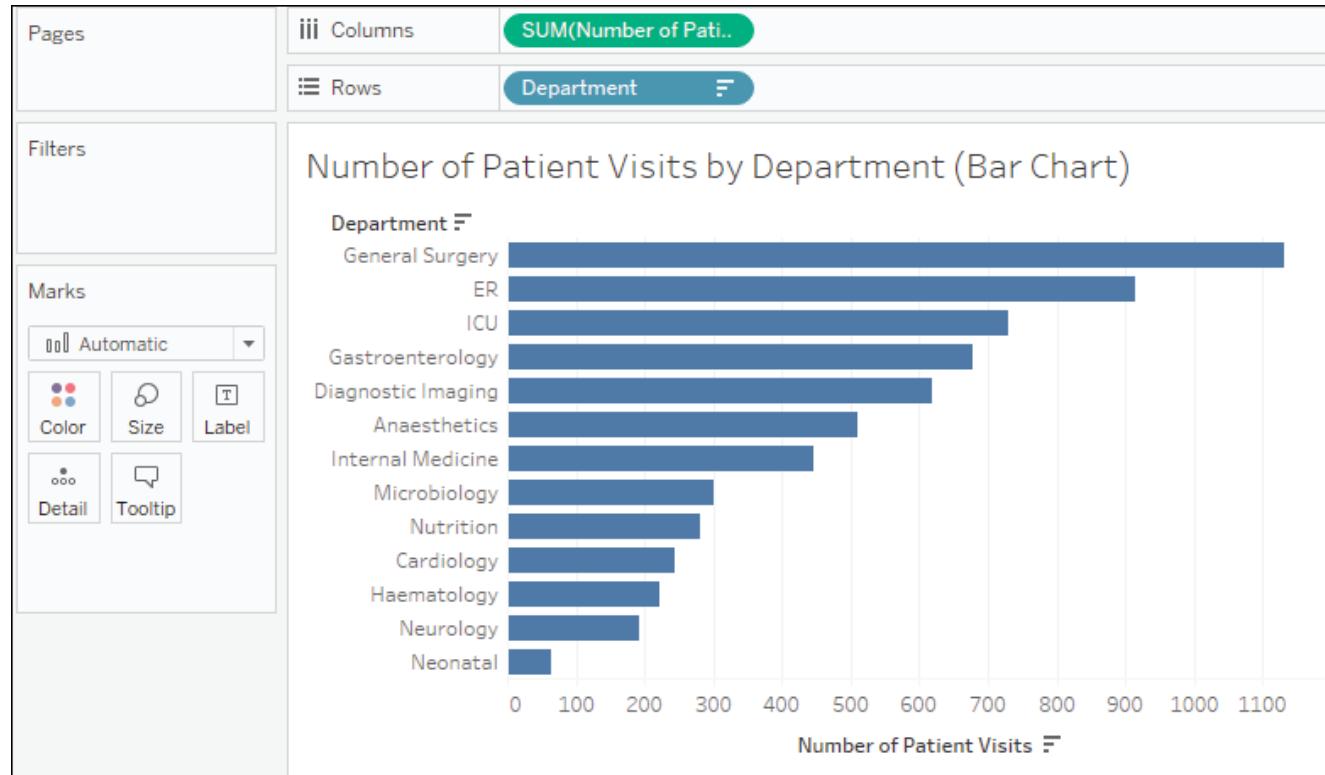
- Comparison
- Dates and times
- Relating parts of the data to the whole
- Distributions
- Multiple axes

Comparing values

Often, you will want to compare the differences between measured values across different categories. You might find yourself asking the following questions:

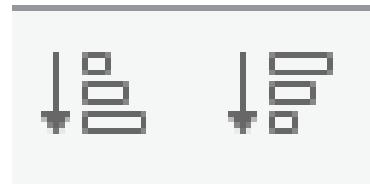
- How many customers did each store serve?
- How much energy did each wind farm produce?
- How many patients did each doctor see?

Bar charts



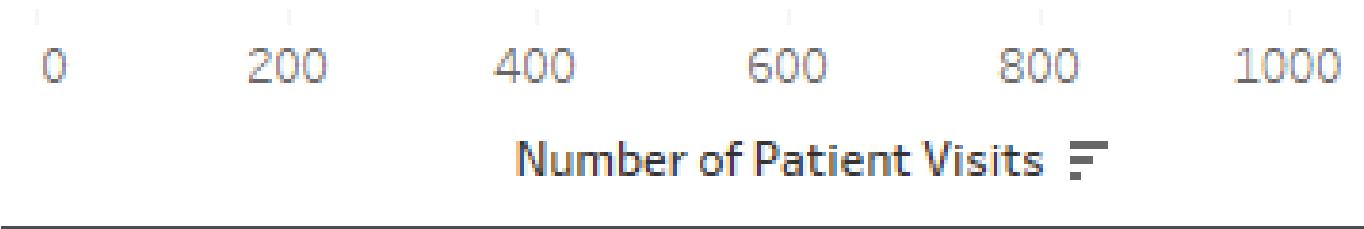
Bar charts

- Click one of the sort icons on the toolbar: This results in an automatic sort of the dimension based on the measure that defined the axis.
- Changes in data or filtering that result in a new order will be reflected in the view:



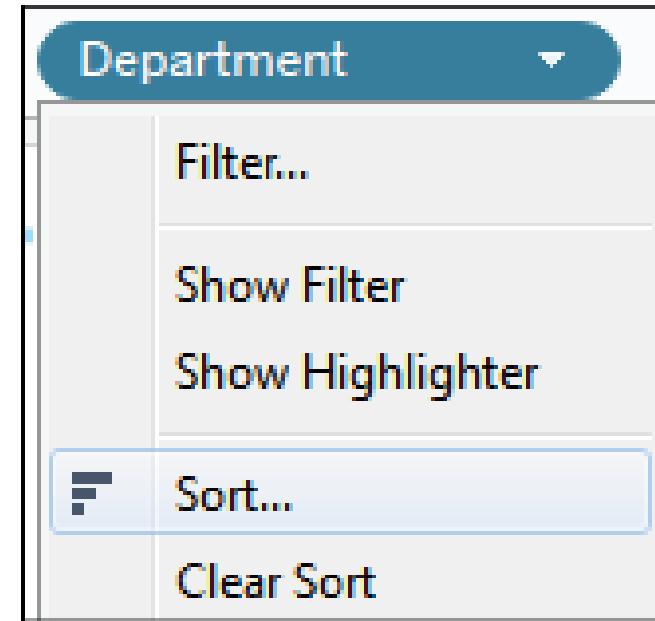
Bar charts

- Click the sort icon on the axis: The option icon will become visible when you hover over the axis and will then remain in place when you enable the sort.
- This will also result in automatic sorting:



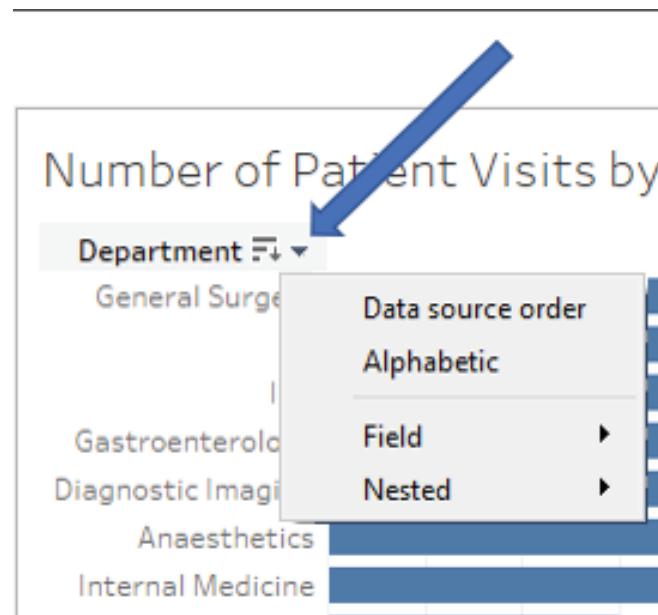
Bar charts

- Use the drop-down on the active dimension field and select Sort to view and edit the sorting options.
- You can also select Clear Sort to remove any sorting:



Bar charts

- Use the drop-down on the field label for rows and select the desired sorting option:

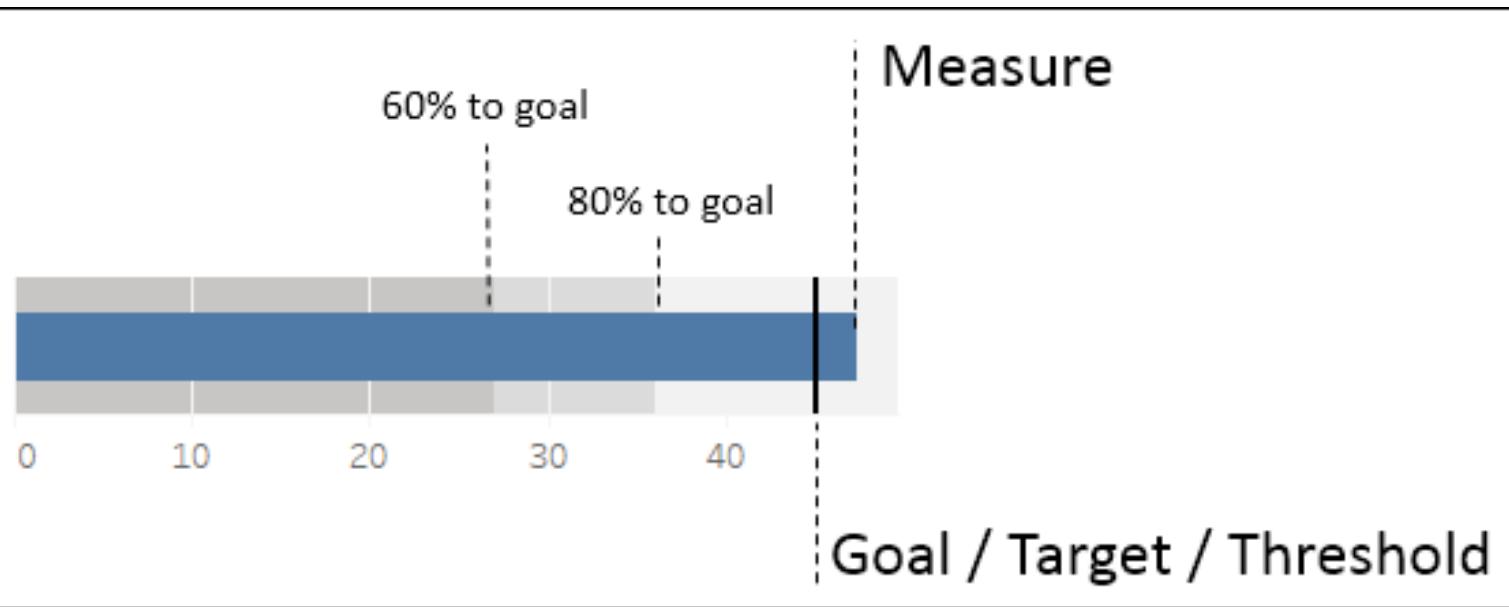


Bar chart variations

A basic bar chart can be extended in many ways to accomplish various objectives. Consider the following variations:

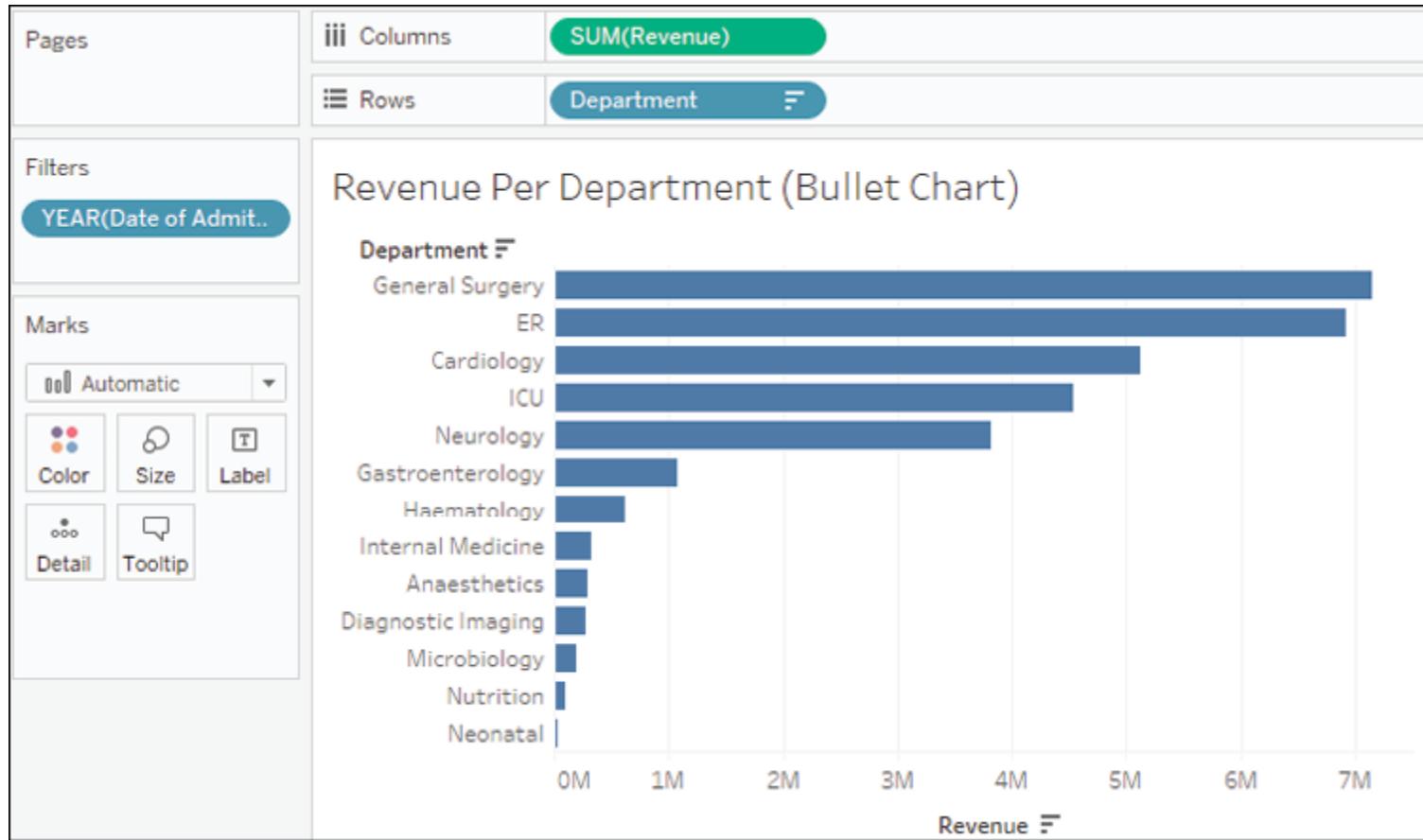
- Bullet chart to show progress towards a goal, target, or threshold
- Bar-in-bar chart to show progress toward a target or compare two specific values within a category
- Highlighting categories of interest

Bullet chart

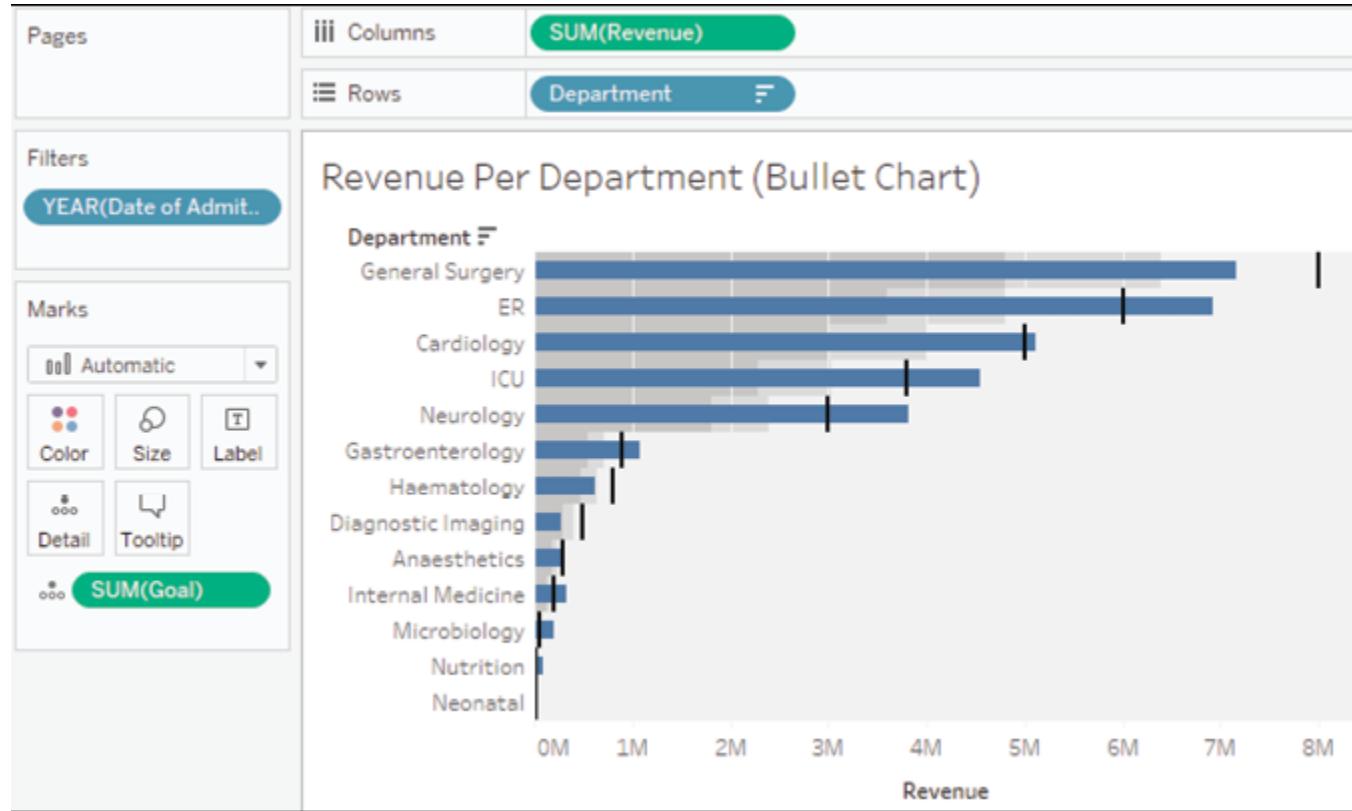


Bullet chart

| Department | Goal |
|--------------------|-------------|
| Anaesthetics | \$300,000 |
| Cardiology | \$5,000,000 |
| Diagnostic Imaging | \$500,000 |
| ER | \$6,000,000 |
| Gastroenterology | \$900,000 |
| General Surgery | \$8,000,000 |
| Haematology | \$800,000 |
| ICU | \$3,800,000 |
| Internal Medicine | \$200,000 |
| Microbiology | \$50,000 |
| Neonatal | \$10,000 |
| Neurology | \$3,000,000 |
| Nutrition | \$10,000 |

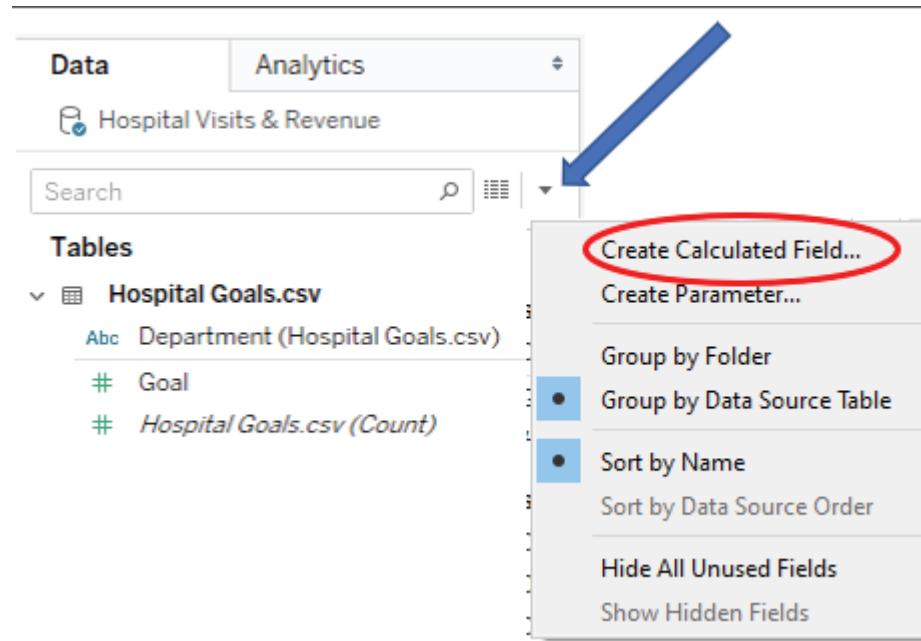


- The completed bullet chart should look like the following:



Calling out thresholds

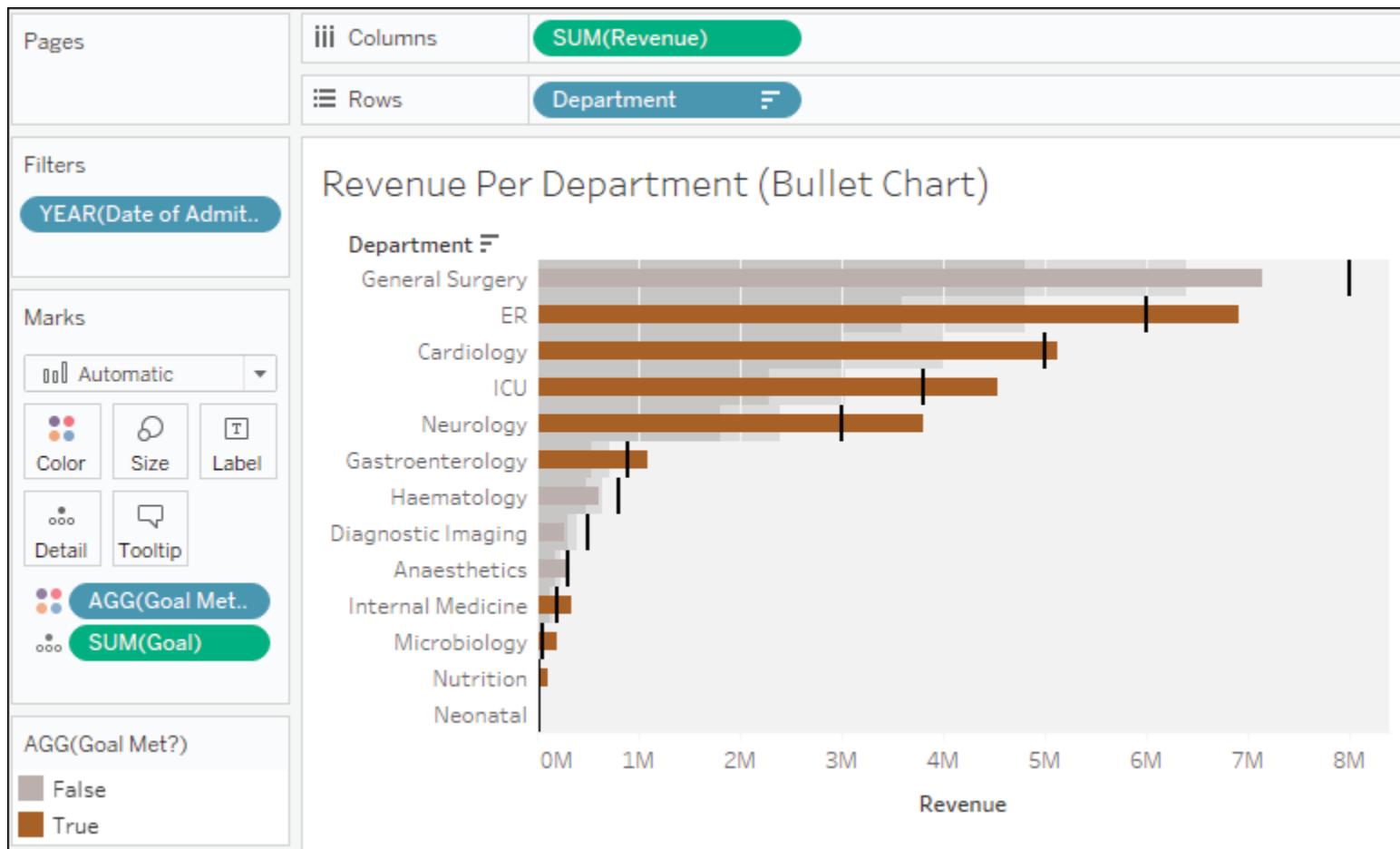
- Use the drop-down arrow in the Data pane and select Create Calculated Field...:

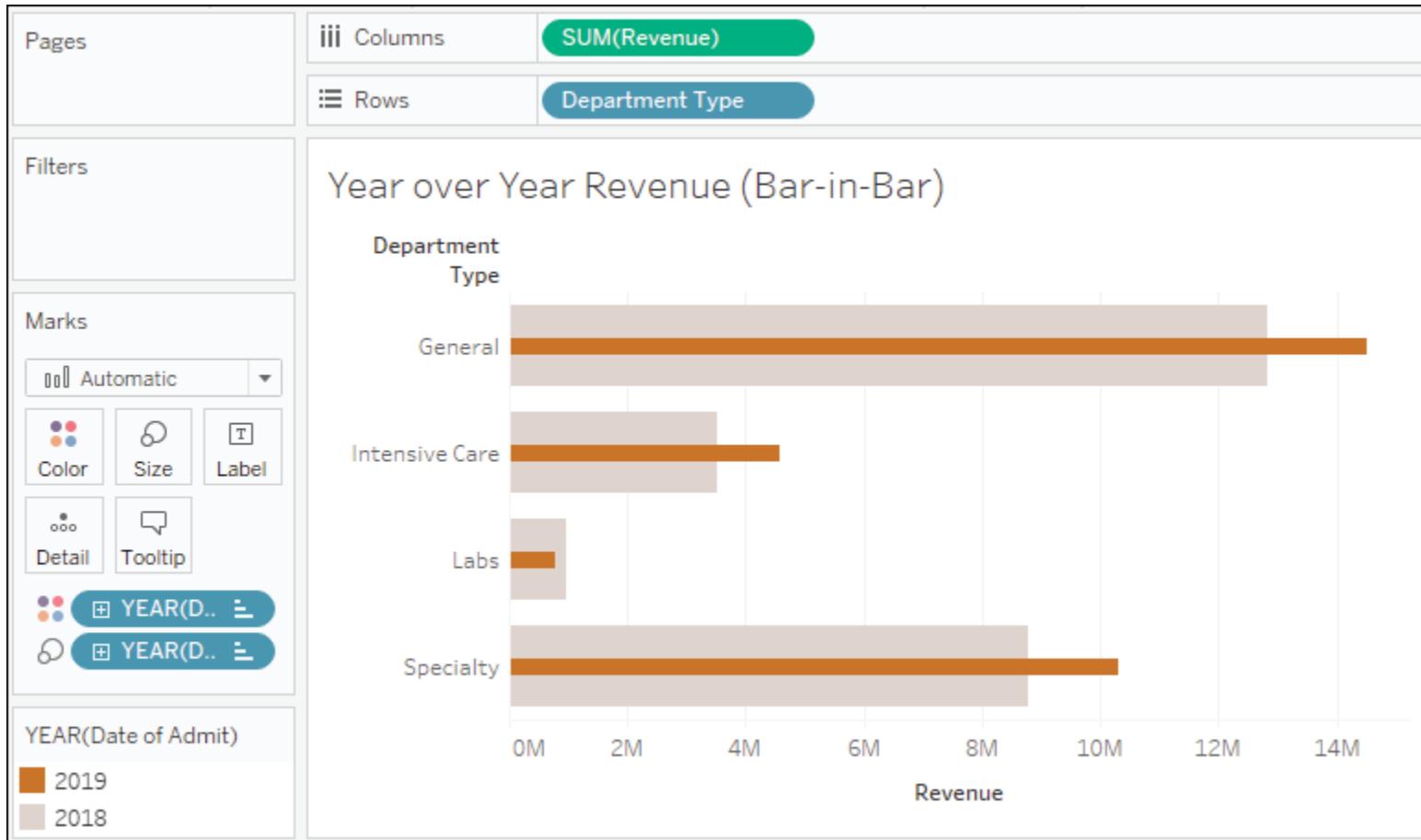


Calling out thresholds

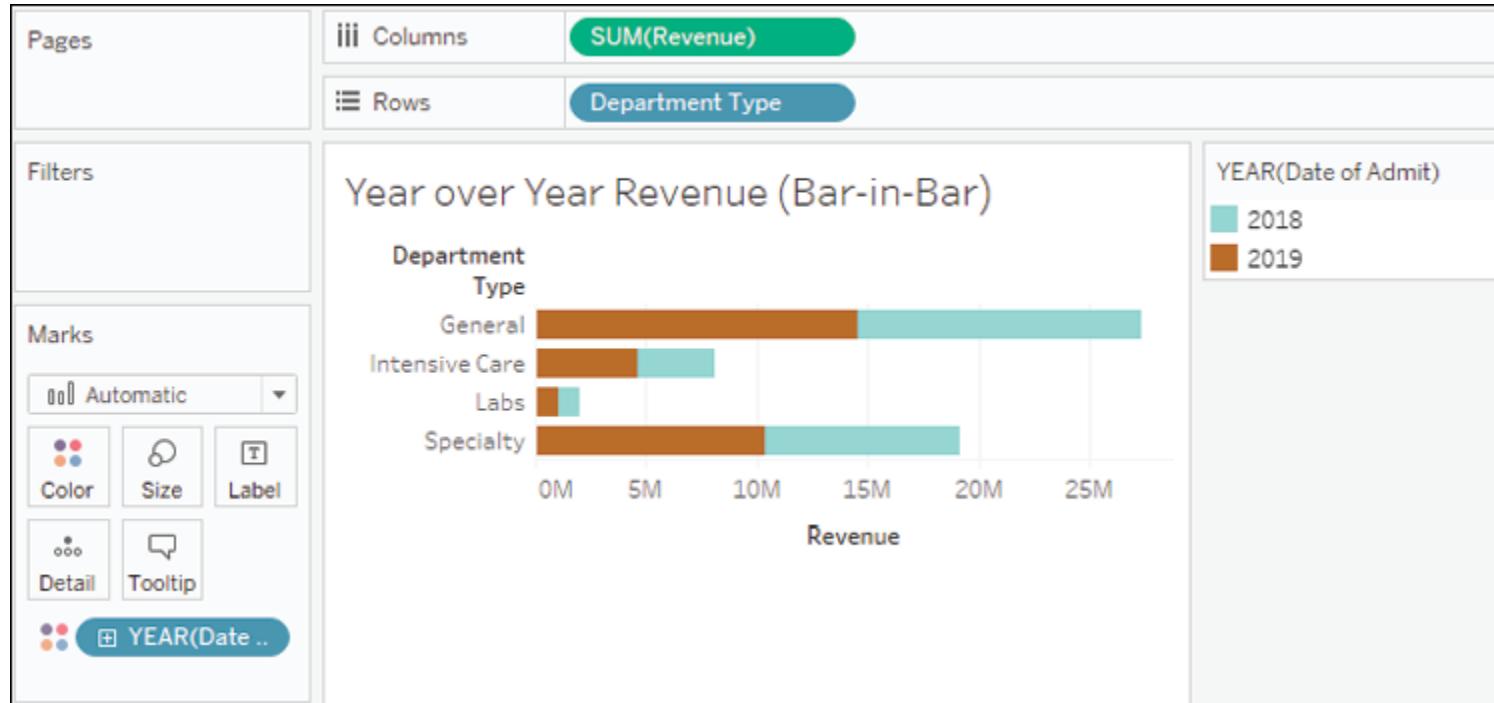
- Name the calculated field named Goal Met? with the following code:

$\text{SUM}([\text{Revenue}]) \geq \text{SUM}([\text{Goal}])$



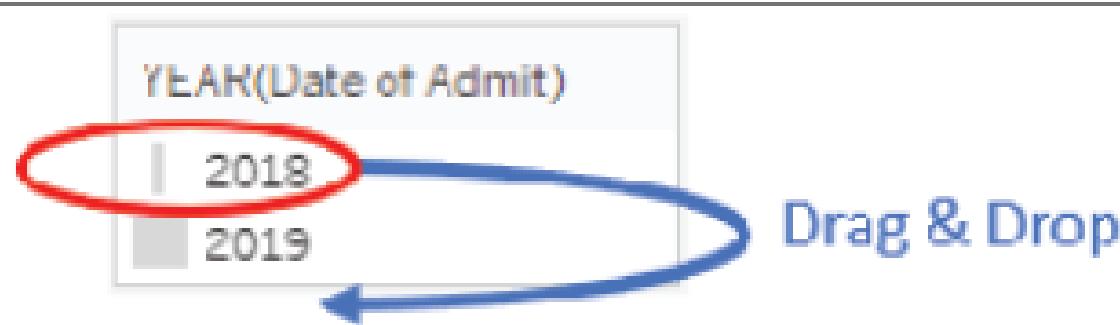


Bar-in-bar chart



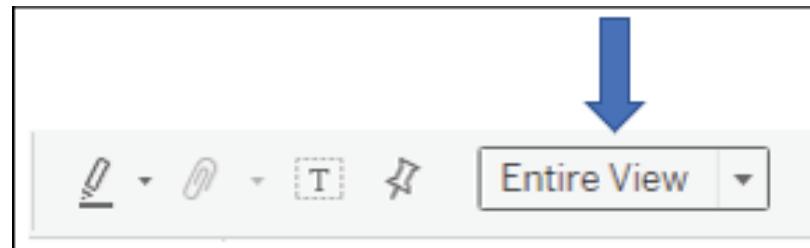
Bar-in-bar chart

- We want 2019 to be in front and 2018 to be in the background, so drag and drop 2019 within the Size legend to reorder the values so that 2018 comes after 2019:

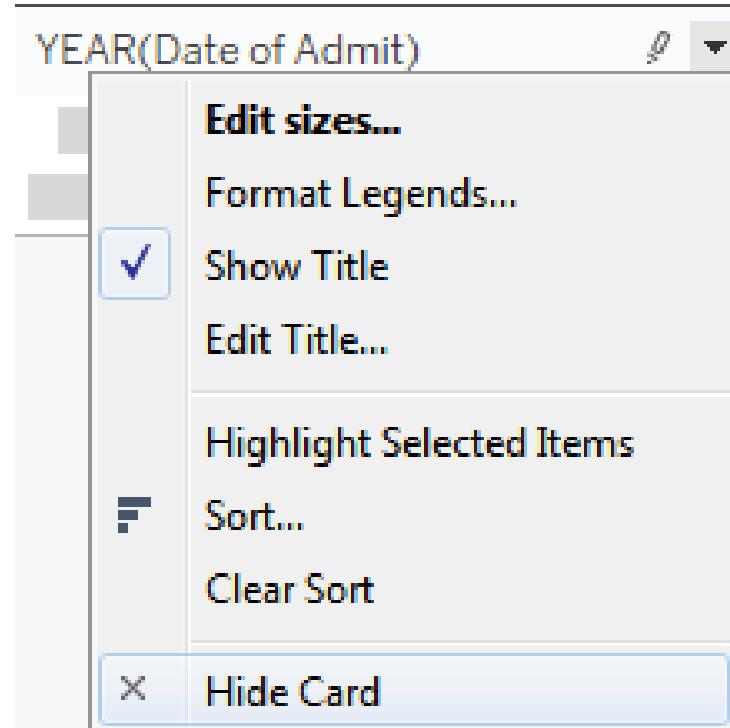


Bar-in-bar chart

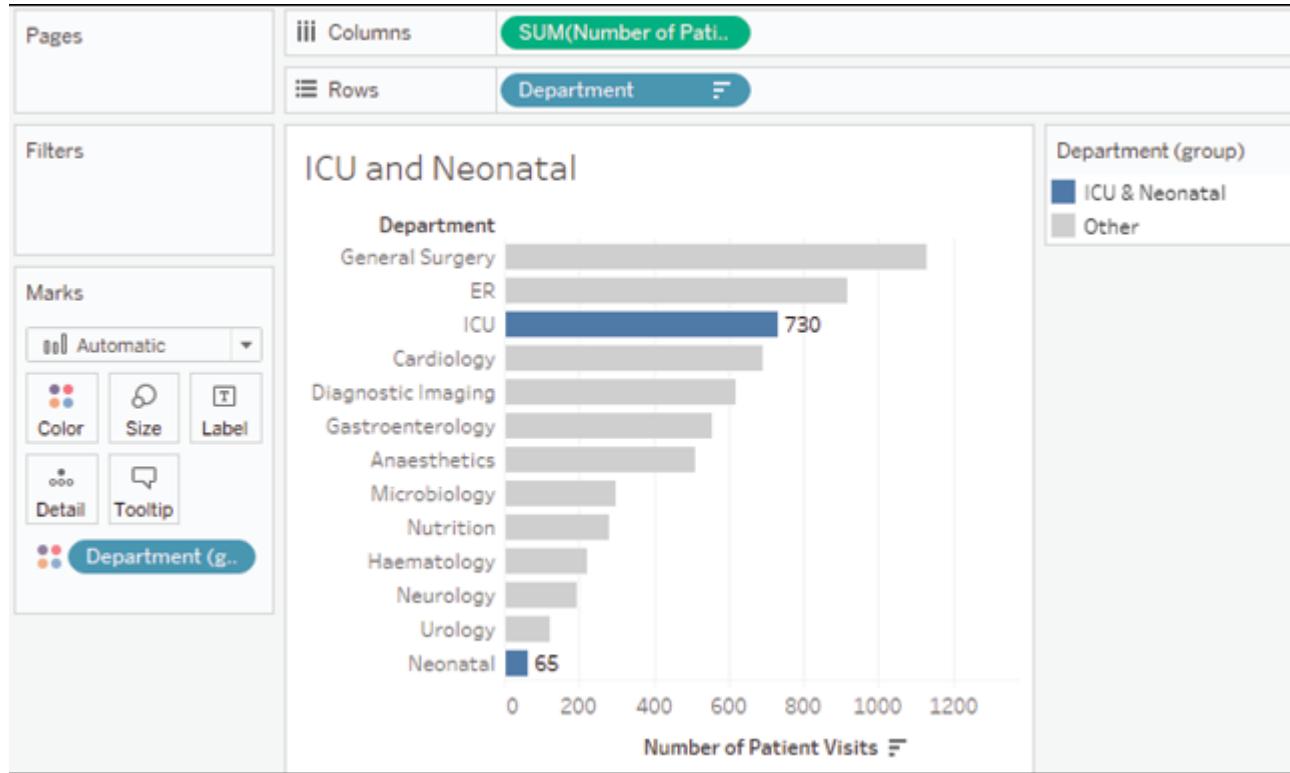
- Adjusting the sizing of the view. Accomplish this by hovering over the canvas, just over the bottom border, until the mouse cursor changes to a sizing cursor, and then click and drag to resize the view.
- You may also want to adjust how the view fills the space.
- Use the drop-down on the toolbar and experiment with the options:



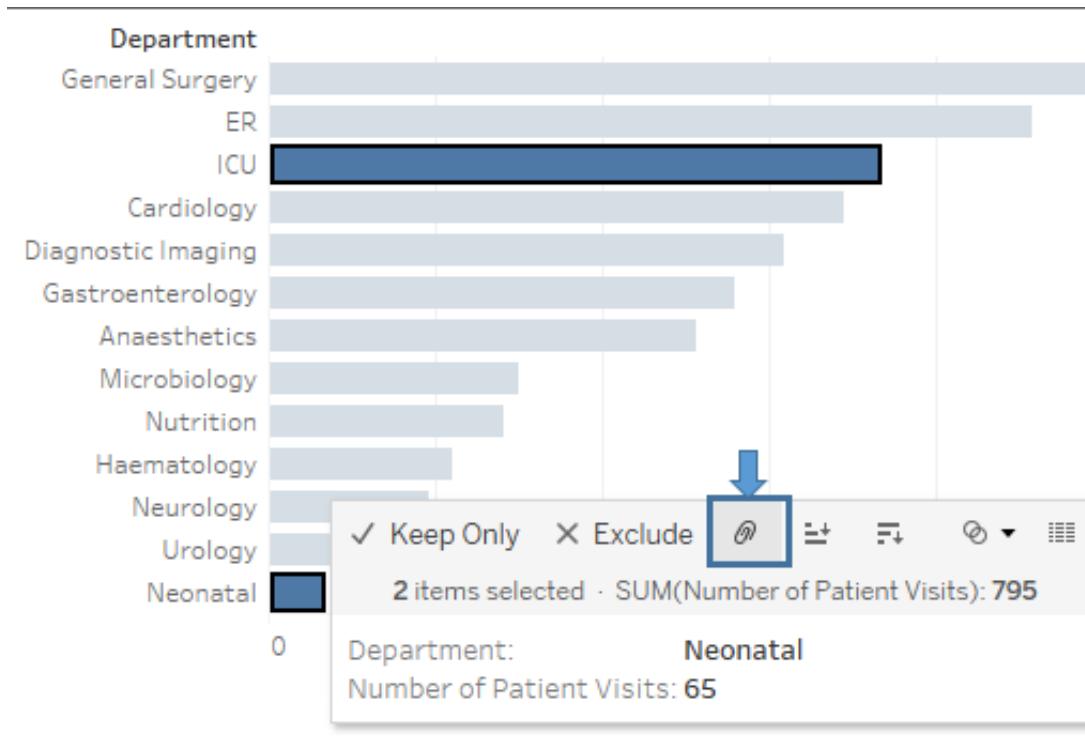
Bar-in-bar chart



Highlighting categories of interest



Highlighting categories of interest



Visualizing dates and times

In your analysis, you will often want to understand when something happened. You'll ask questions like the following:

- When did we gain the most new customers?
- Is profit trending up or down?
- What times of day have the highest call volume?
- What kinds of seasonal trends do we see in sales?

Date parts, date values, and exact dates

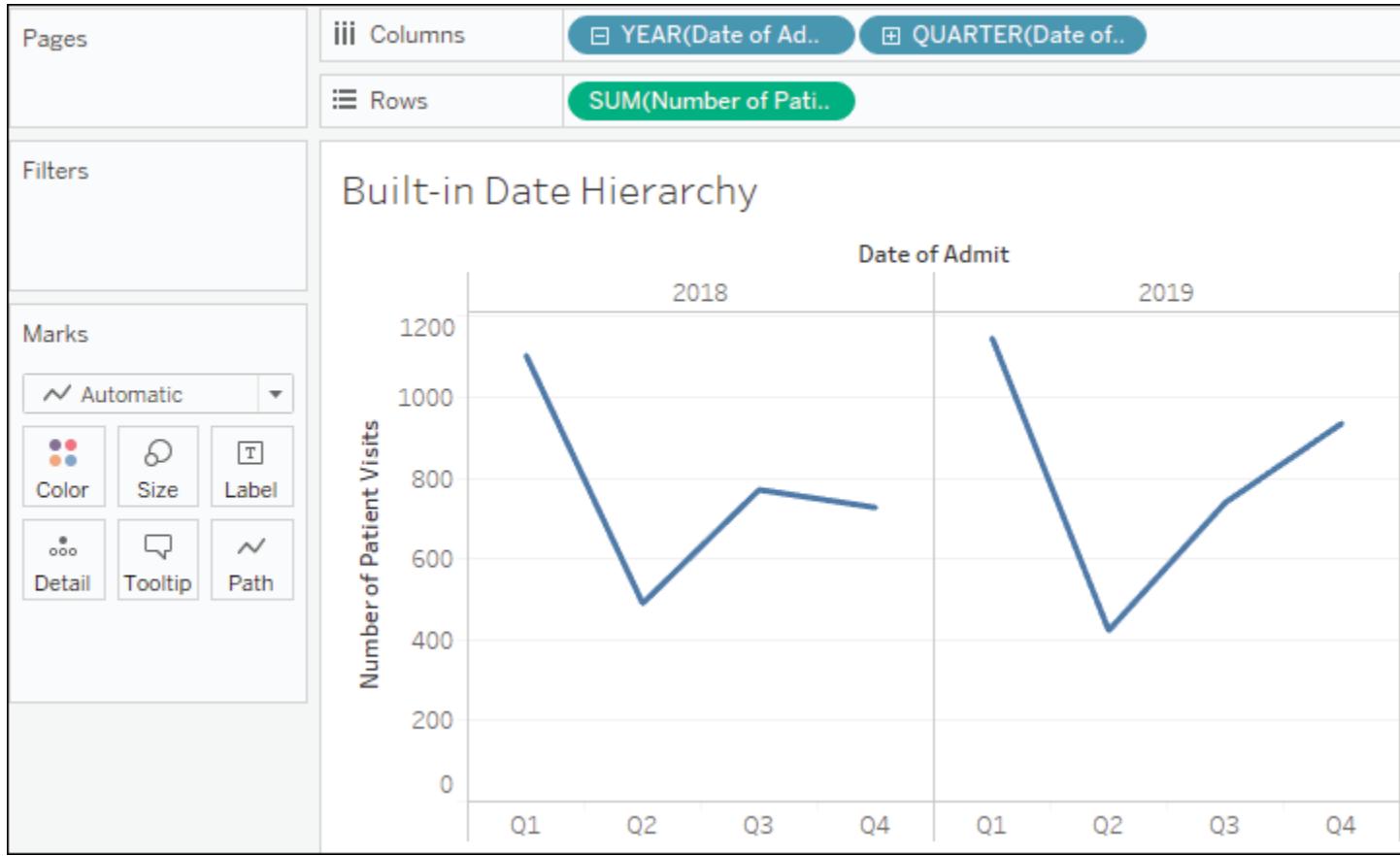
- To see this in action, continue with the lesson 3 workcourse, navigate to the Built-in Date Hierarchy sheet, and create a view similar to the one that was shown by dragging and dropping Number of Patient Visits to Rows and Date of Admit to Columns.
- The YEAR(Date of Admit) field on Columns will have a plus sign indicator, like this:

⊕ YEAR(Date of Ad..)

Date parts, date values, and exact dates

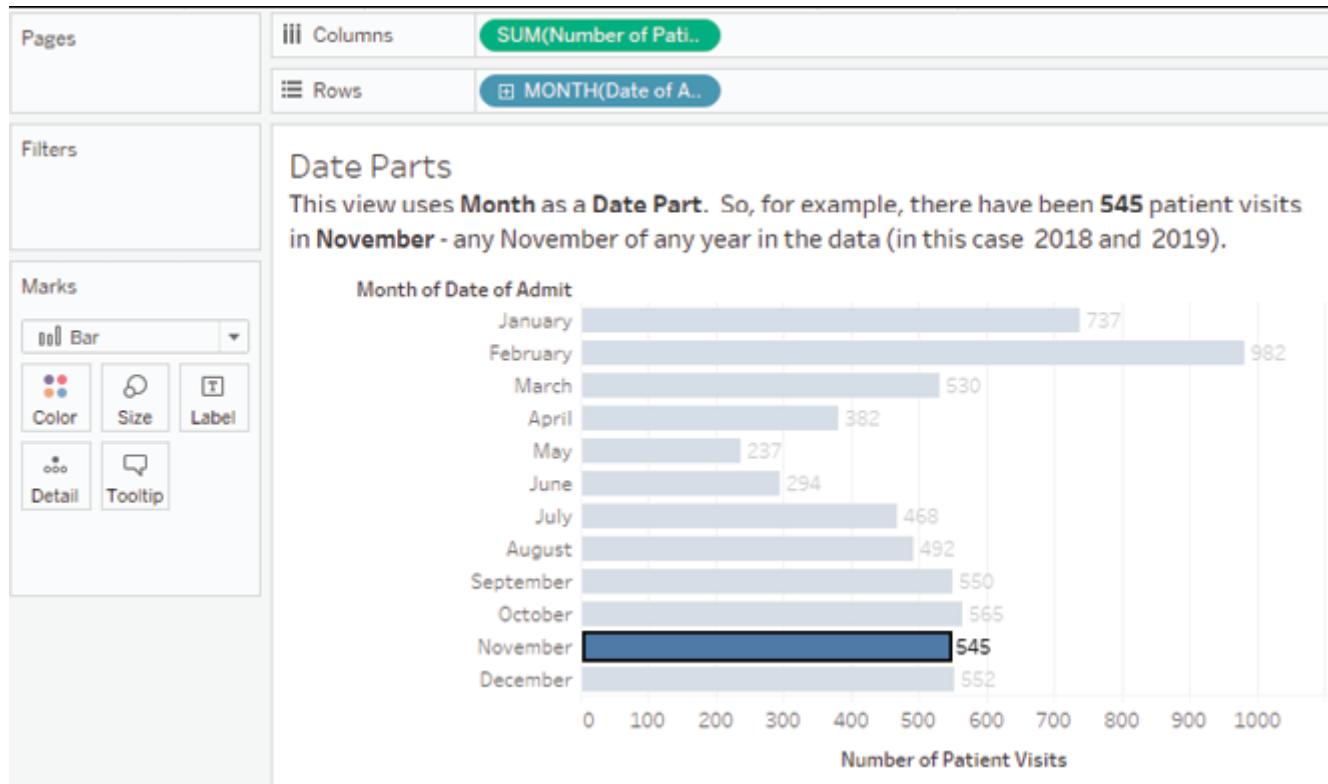
- You'll also find a plus or minus indicator as you hover over headers, like this:

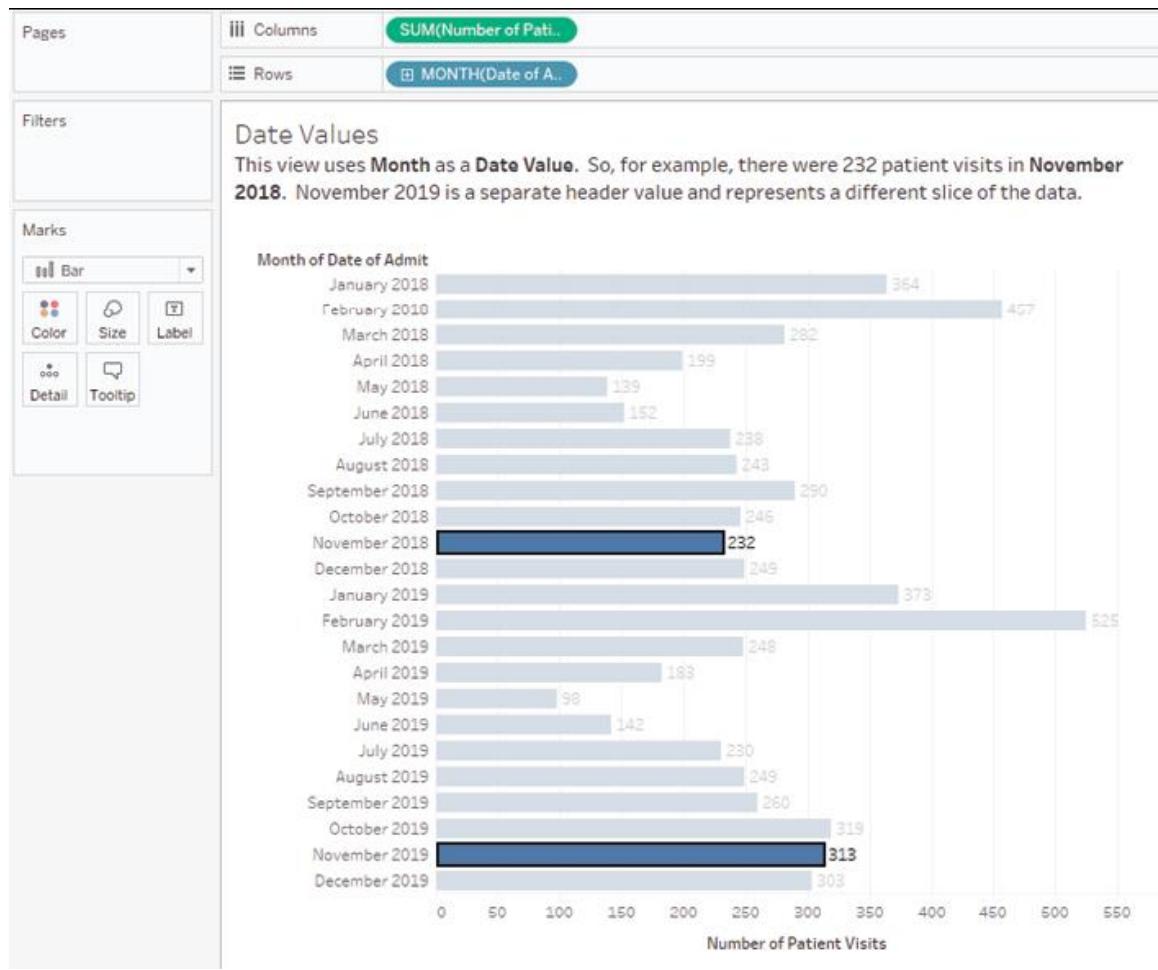




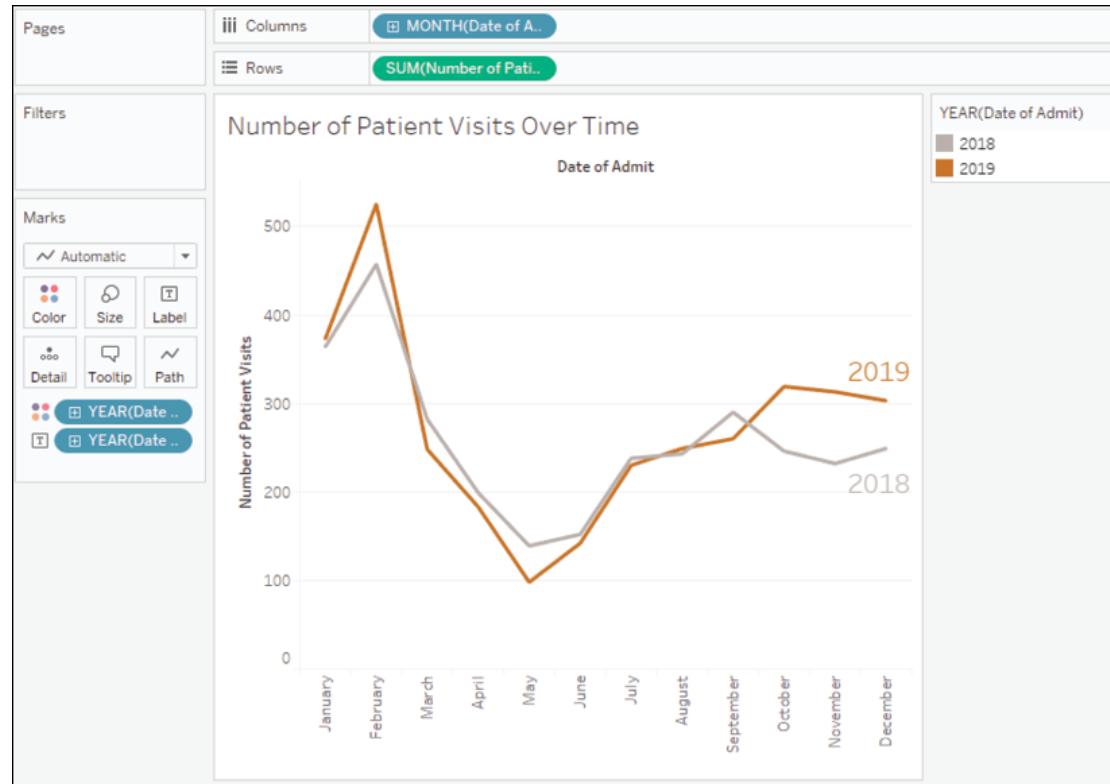
| | | |
|---|--------------|---|
| Show Missing Values | | Show dates that are "skipped" in the data |
| <input checked="" type="radio"/> Year | 2011 | |
| Quarter | Q2 | |
| Month | May | |
| Day | 8 | |
| More | ▶ | Date Part |
| Year | 2011 | |
| Quarter | Q2 2011 | |
| Month | May 2011 | |
| Week Number | Week 5, 2011 | |
| Day | May 8, 2011 | |
| More | ▶ | Date Value (Truncated) |
| Exact Date | | Exact Value of Field |
| Attribute | | |
| Measure | ▶ | |
| <input checked="" type="radio"/> Discrete | | |
| Continuous | | Switch between Discrete and Continuous |

Date parts, date values, and exact dates

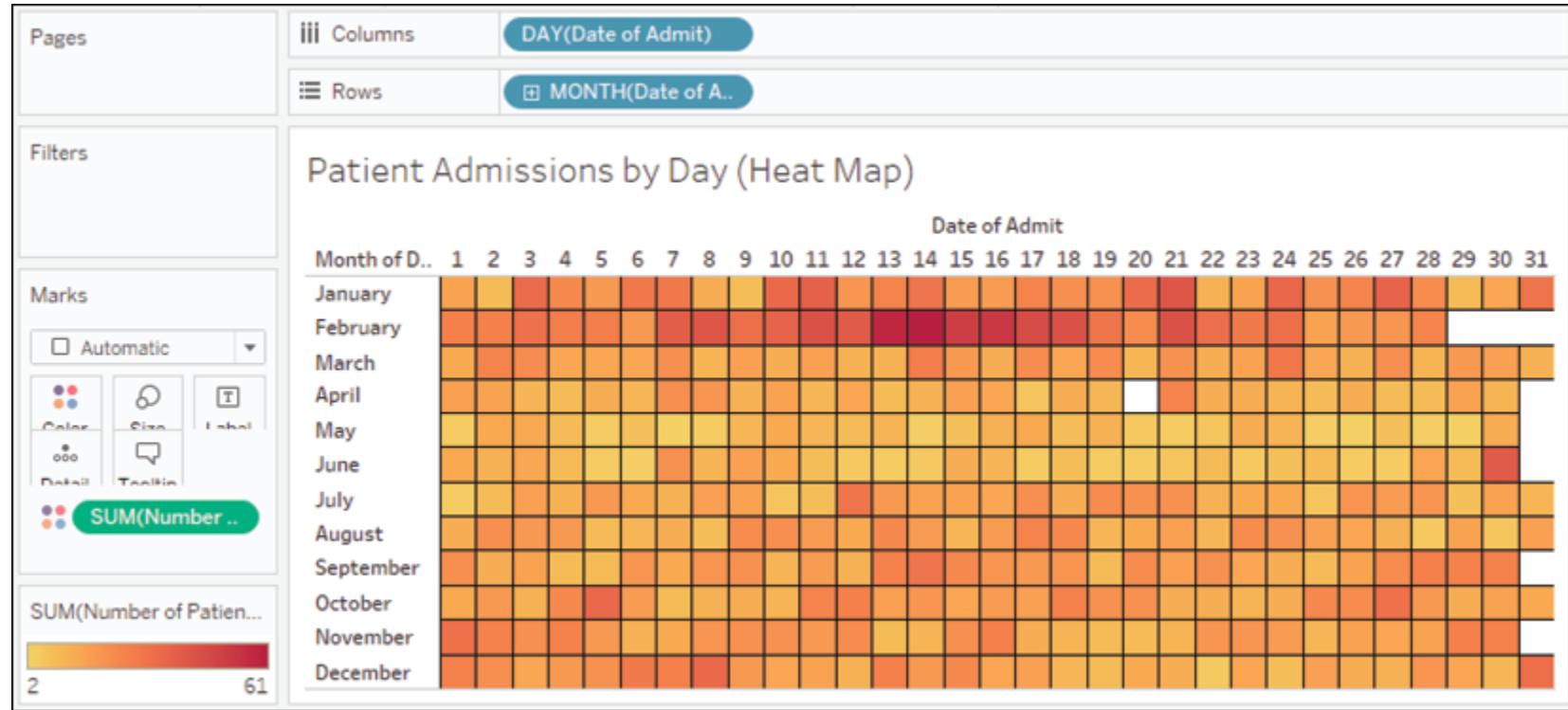




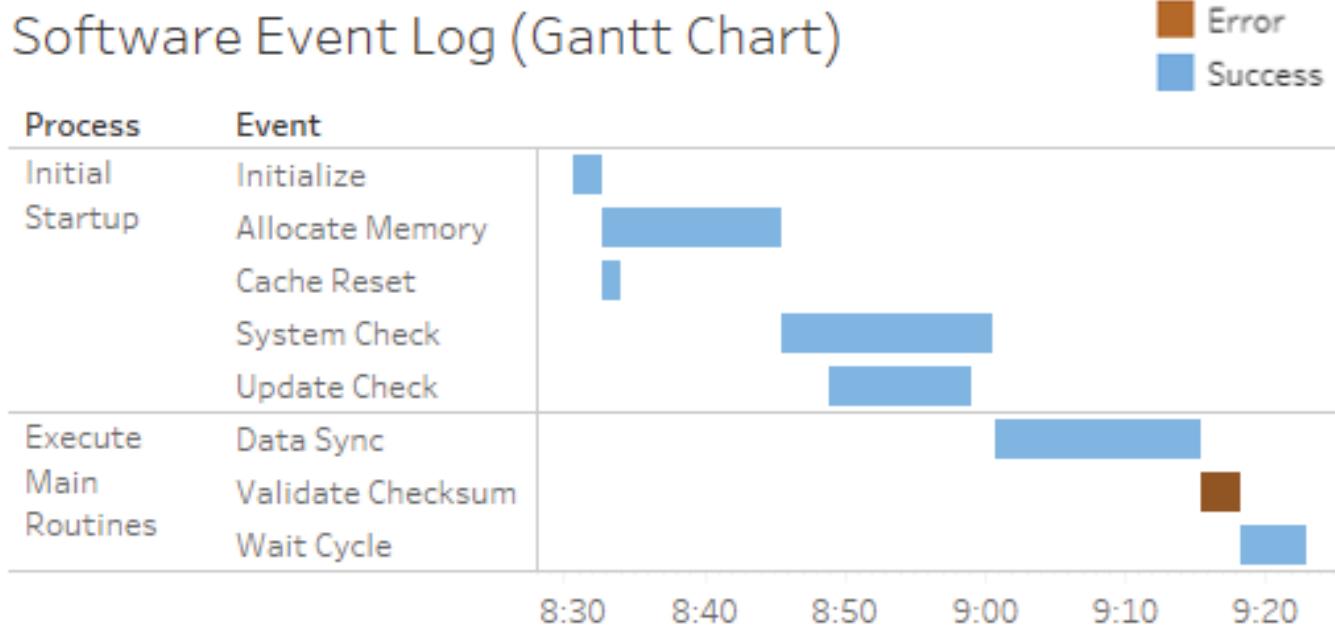
Variations of date and time visualizations



Date parts, date values, and exact dates

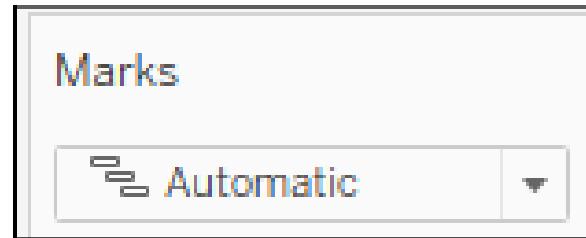


Gantt charts



Gantt charts

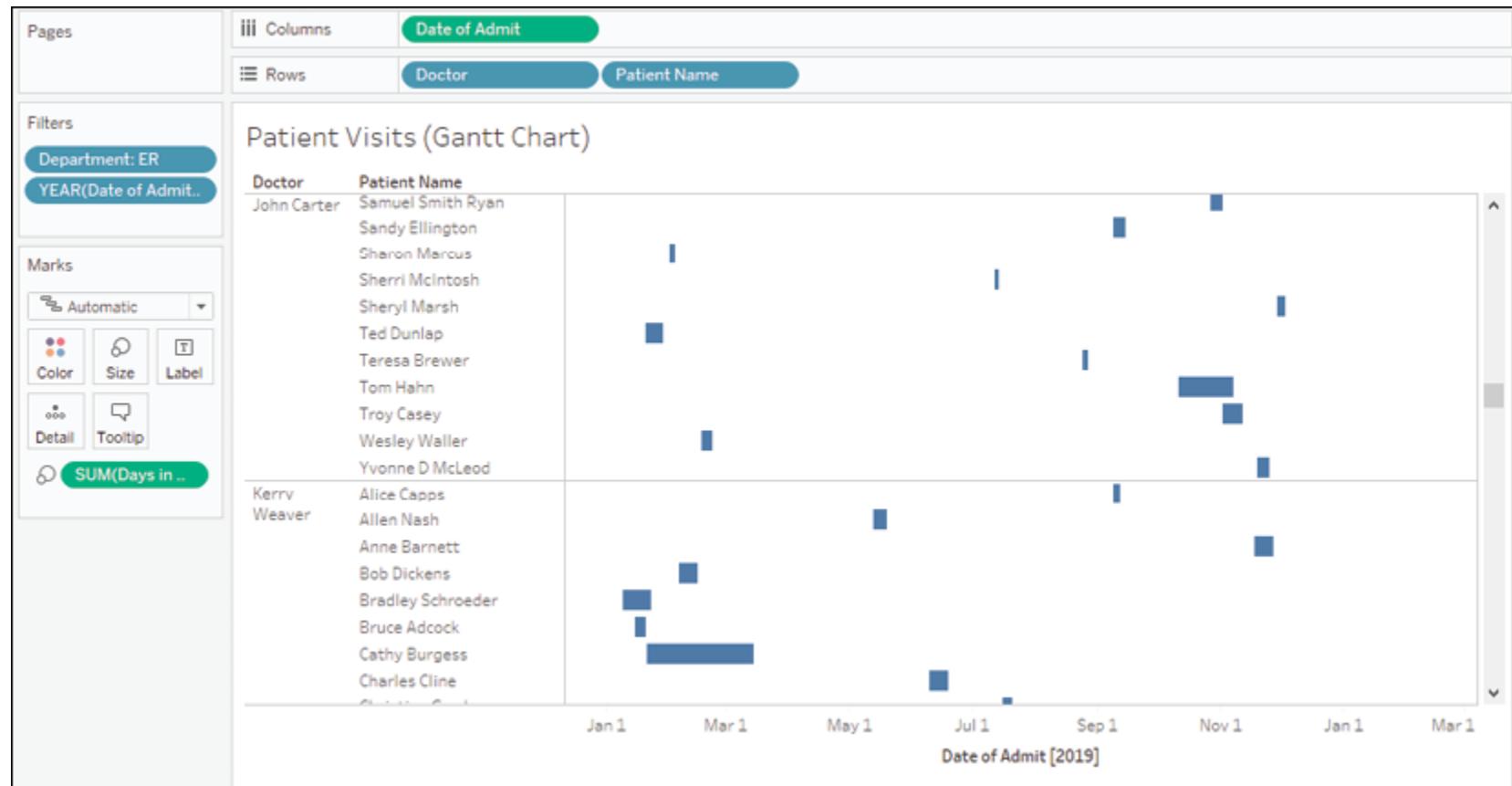
- Place Department on Filters and keep only ER.
- Place Date of Admit on Filters, select Years as the option for filtering, and keep only 2019.
- Place Date of Admit on Columns as a continuous Exact Date or as a Day value (not Day part) & Notice that Tableau's automatic default for the mark type is Gantt bars:



Gantt charts

- The length of the Gantt bar is set by placing a field with a value of duration on the Size shelf. There is no such field in this dataset.
- However, we have the Date of Discharge, and we can create a calculated field for the duration. We'll cover calculations in more detail in the next lesson.
- For now, select Analysis from the menu and click Create Calculated Field.... Name the field Days in the Hospital and enter the following code:

DATEDIFF('day', [Date of Admit], [Date of Discharge])

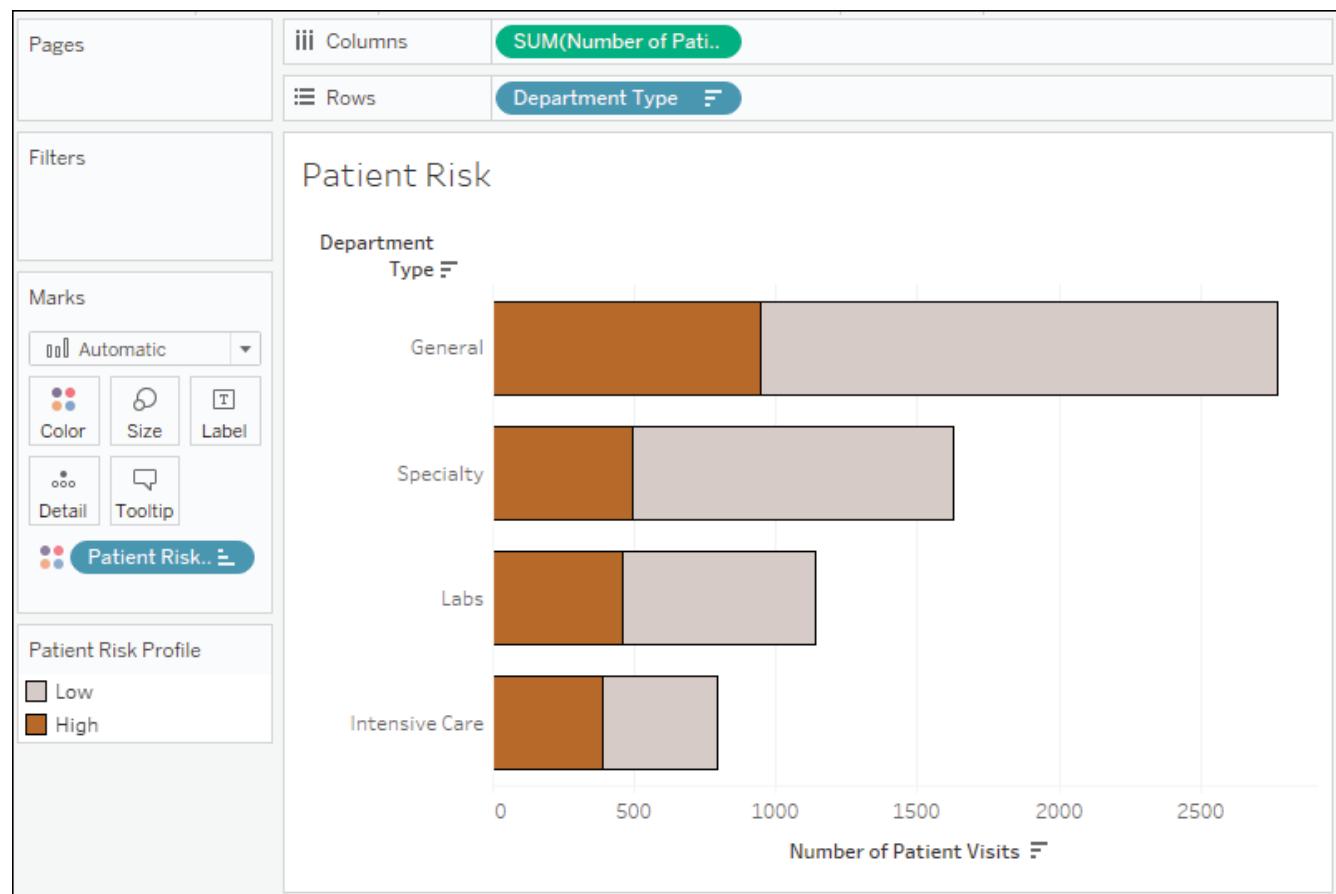


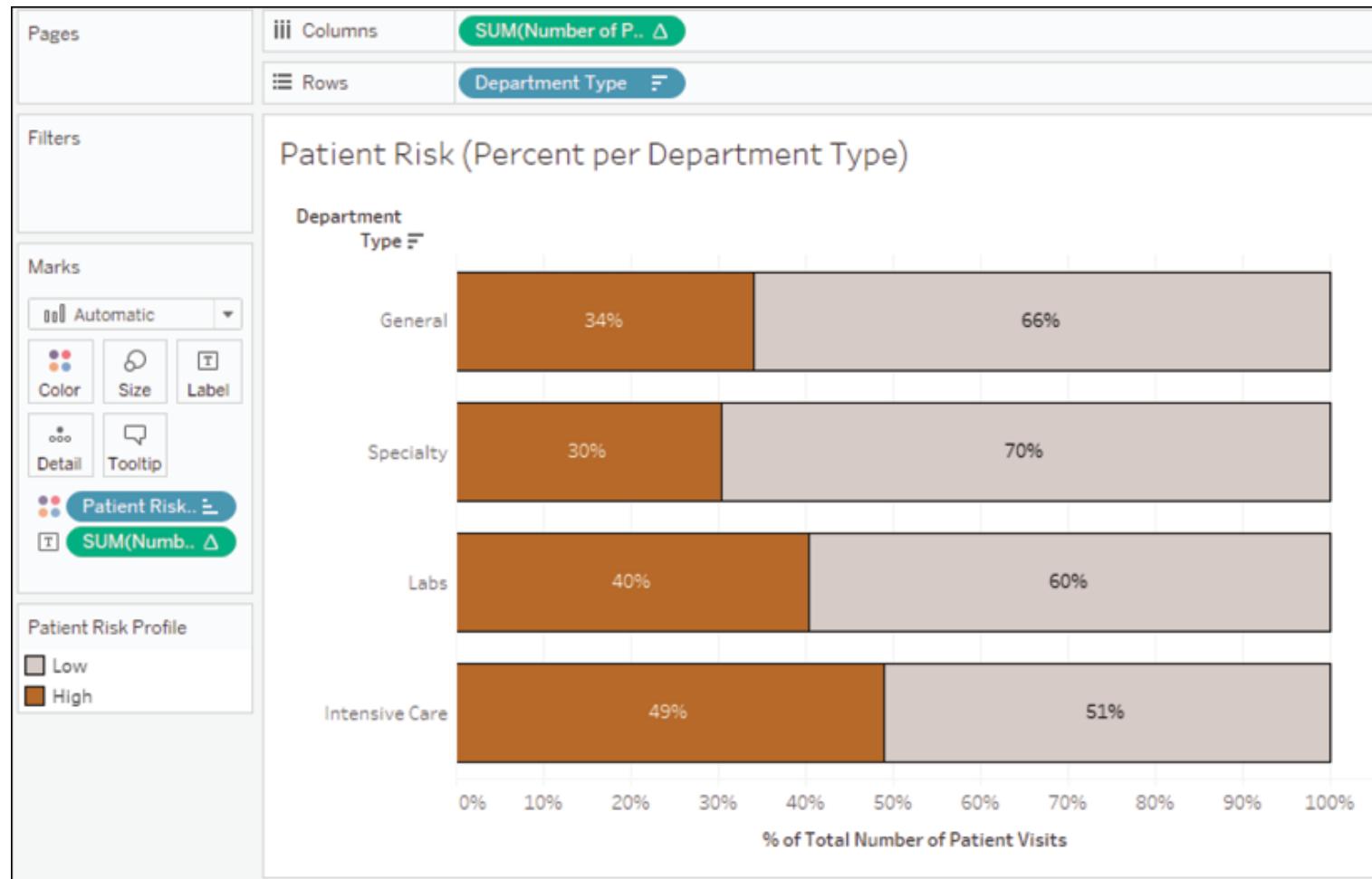
Relating parts of the data to the whole

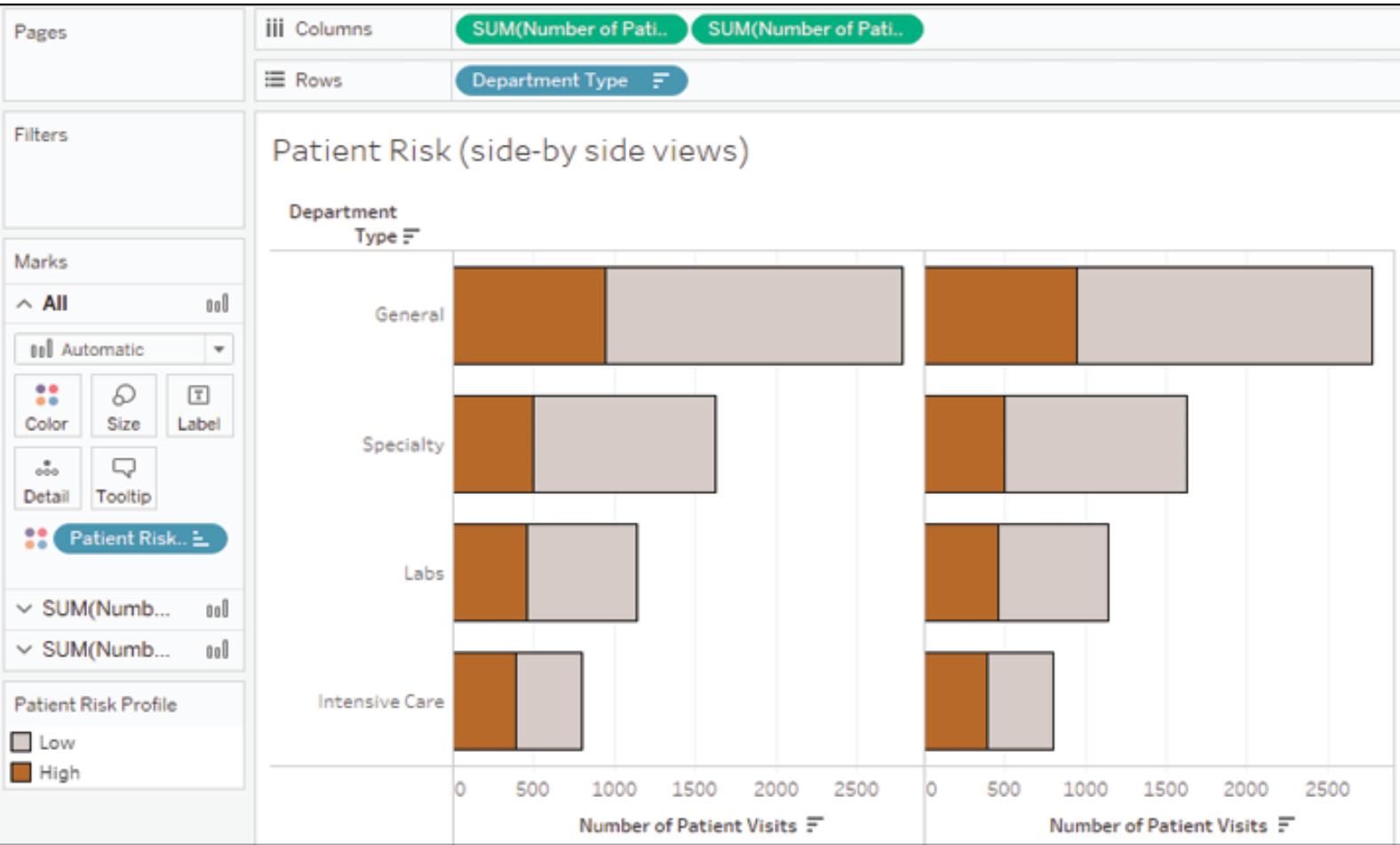
As you explore and analyze data, you'll often want to understand how various parts add up to a whole. For example, you'll ask questions such as the following:

- How much does each electric generation method (wind, solar, coal, and nuclear) contribute to the total amount of energy produced?
- What percentage of total profit is made in each state?
- How much space does each file, subdirectory, and directory occupy on my hard disk?

Stacked bars

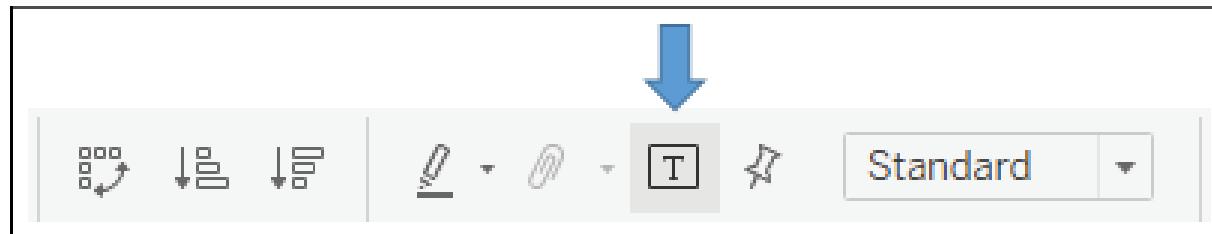






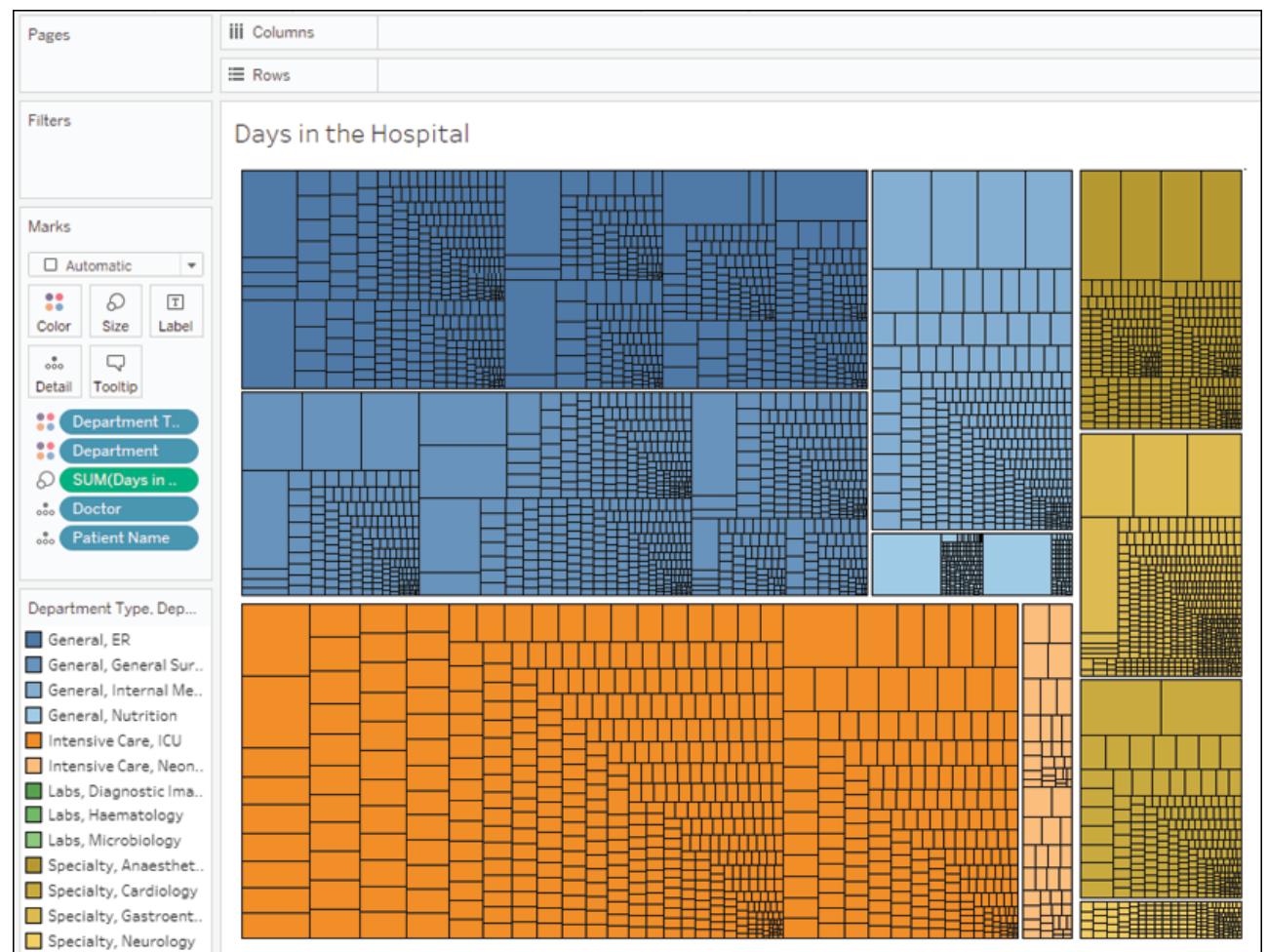
Stacked bars

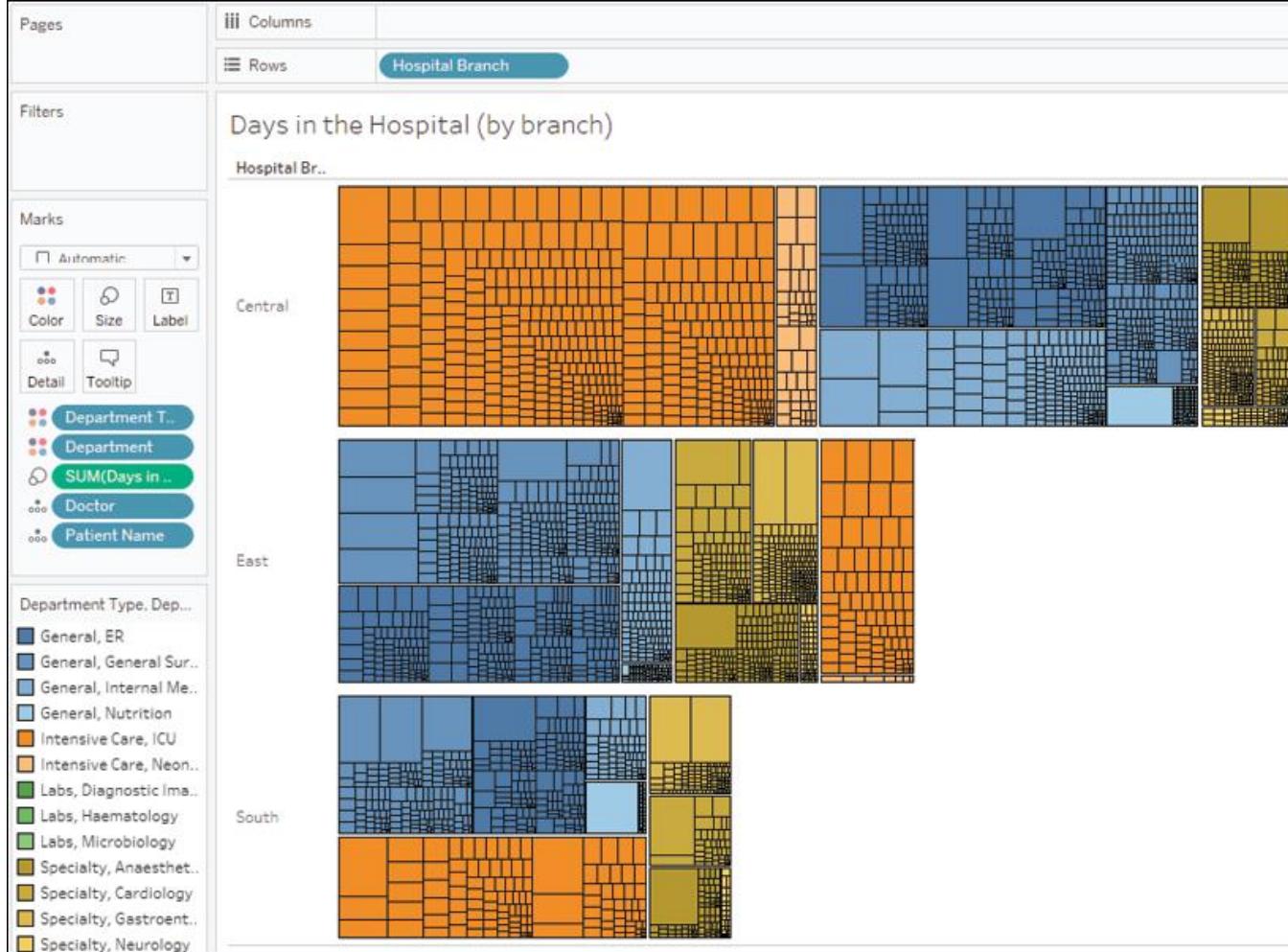
- Turn on labels by clicking the T button on the top toolbar.
- This turns on default labels for each mark:





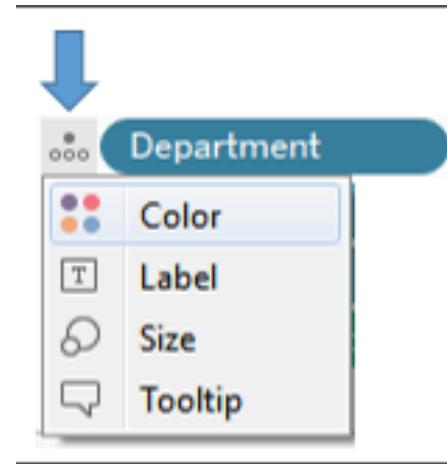
Treemaps



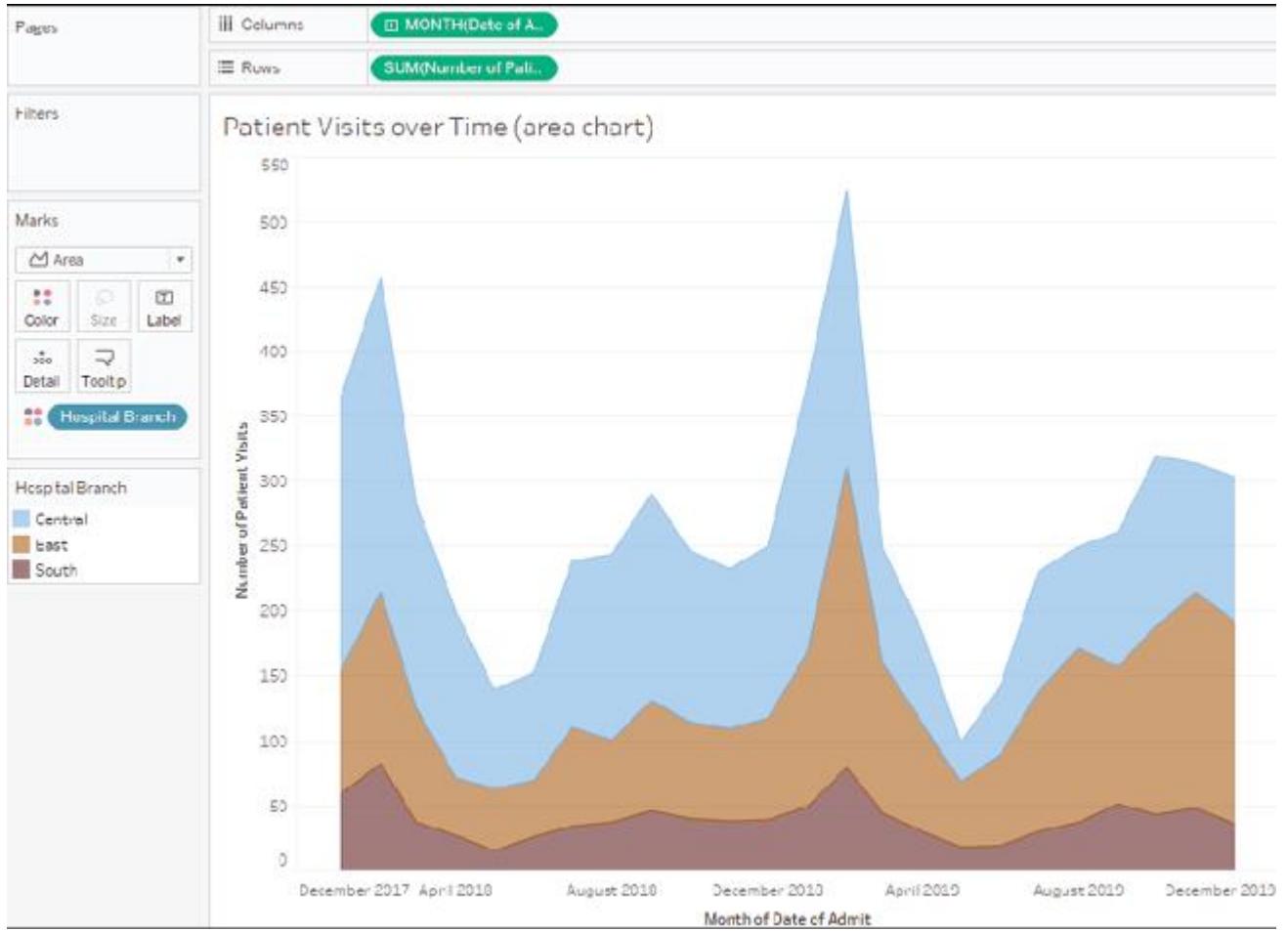


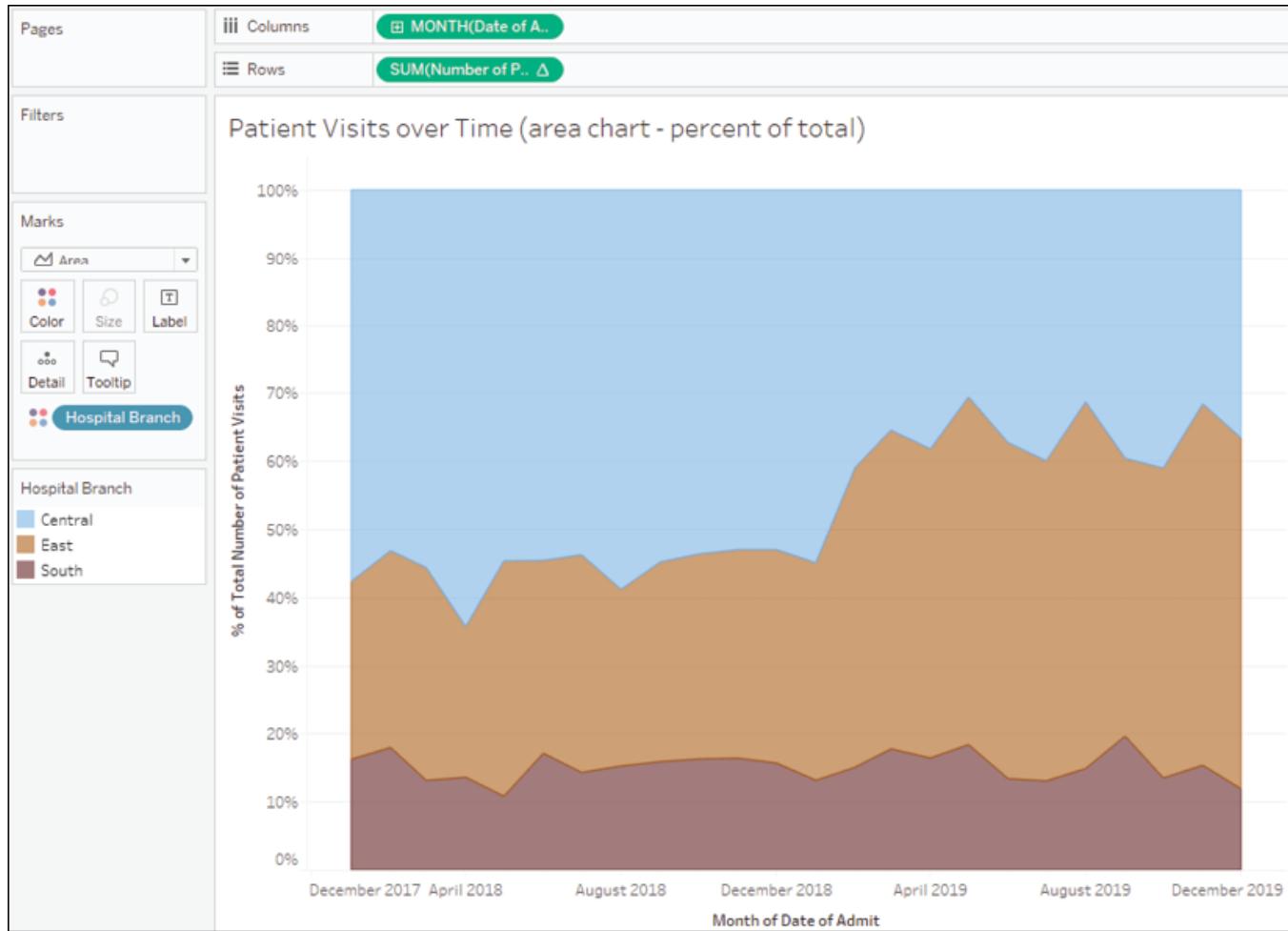
Treemaps

- Alternatively, the icon or space to the left of each field on the Marks card can be clicked to change which shelf is used for the field:

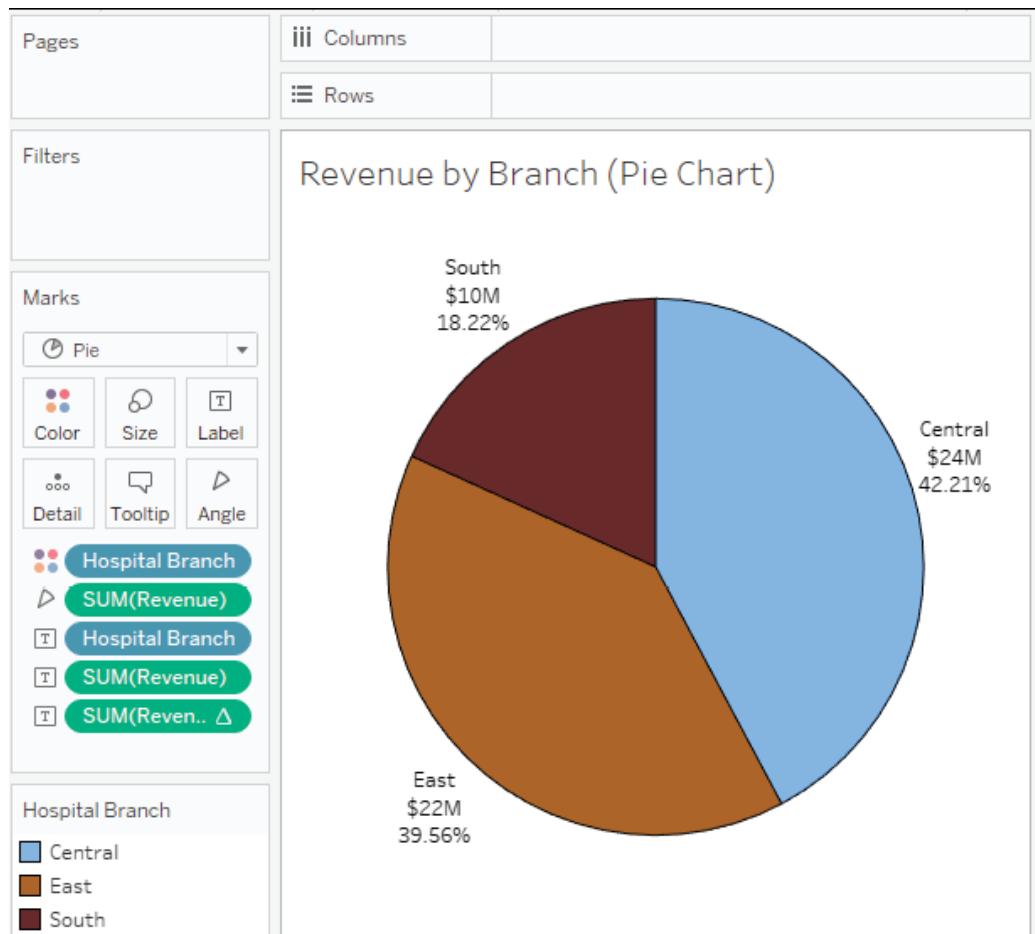


Area charts





Pie charts



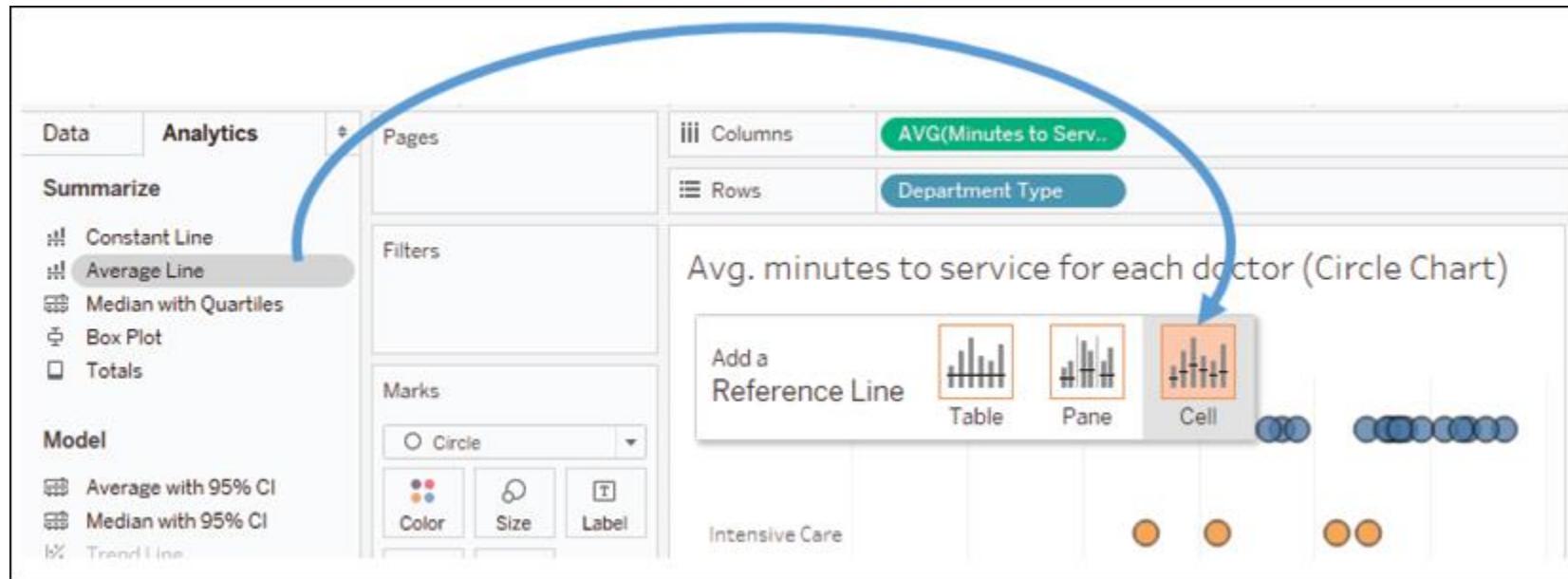
Visualizing distributions

- Often, simply understanding totals, sums, and even the breakdown of part-to-whole only gives a piece of the overall picture.
- Most of the time, you'll want to understand where individual items fall within a distribution of all similar items.

Circle charts



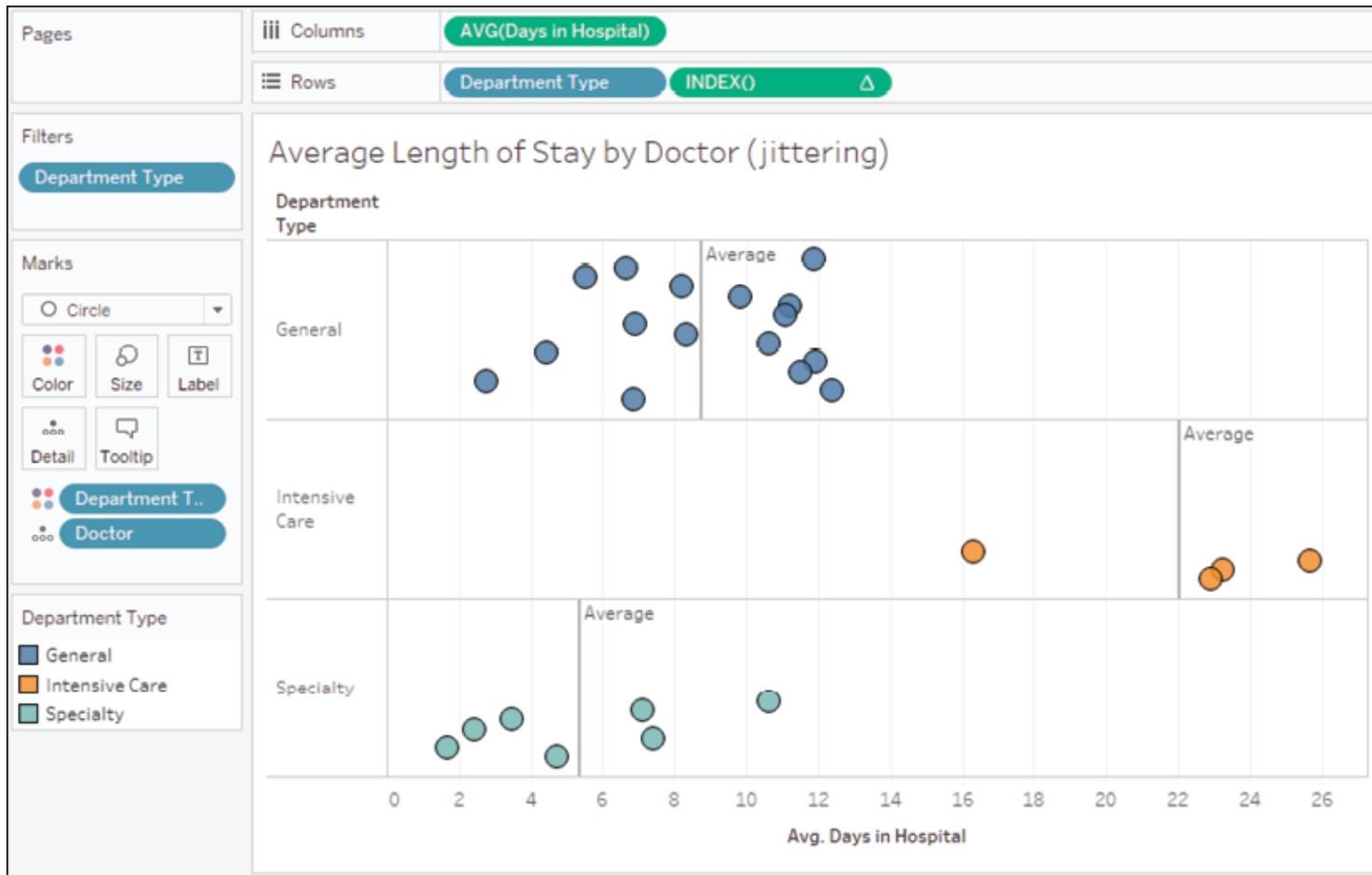
Circle charts



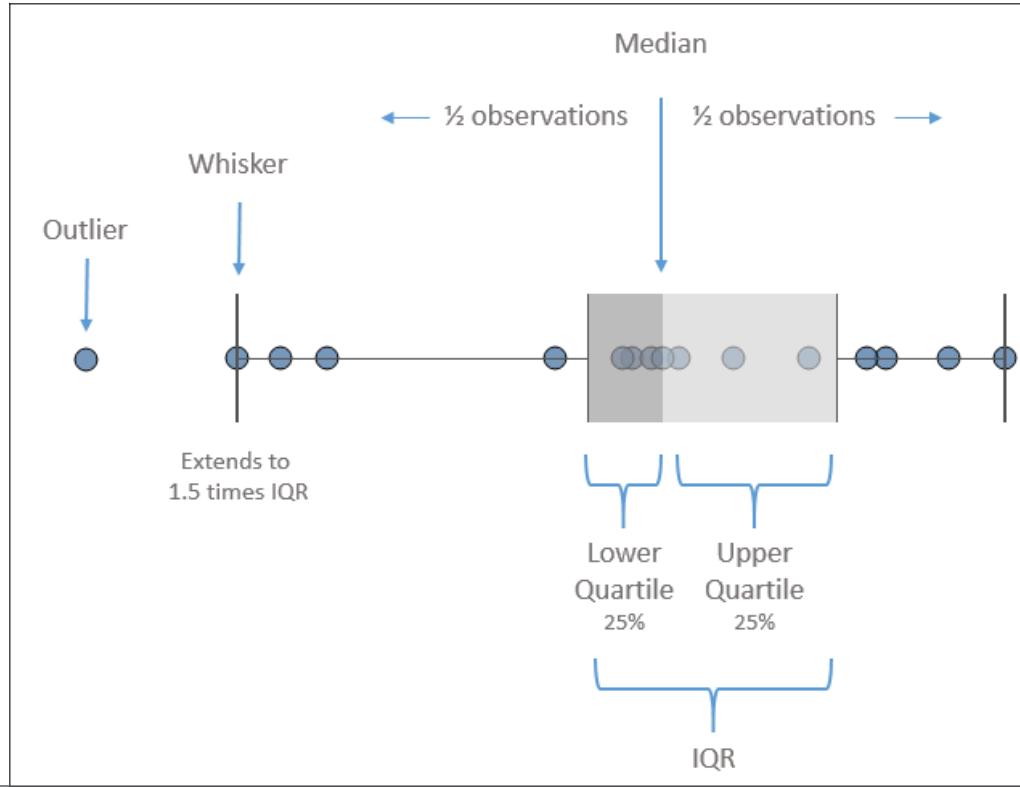
You may also click one of the resulting average lines and select Edit to find fine-tuning options, such as labeling.

Jittering

- When using views like circle plots or other similar visualization types, you'll often see that marks overlap, which can lead to obscuring part of the true story.
- Do you know for certain, just by looking, how many doctors there are in Intensive Care who are above average? How many are below?

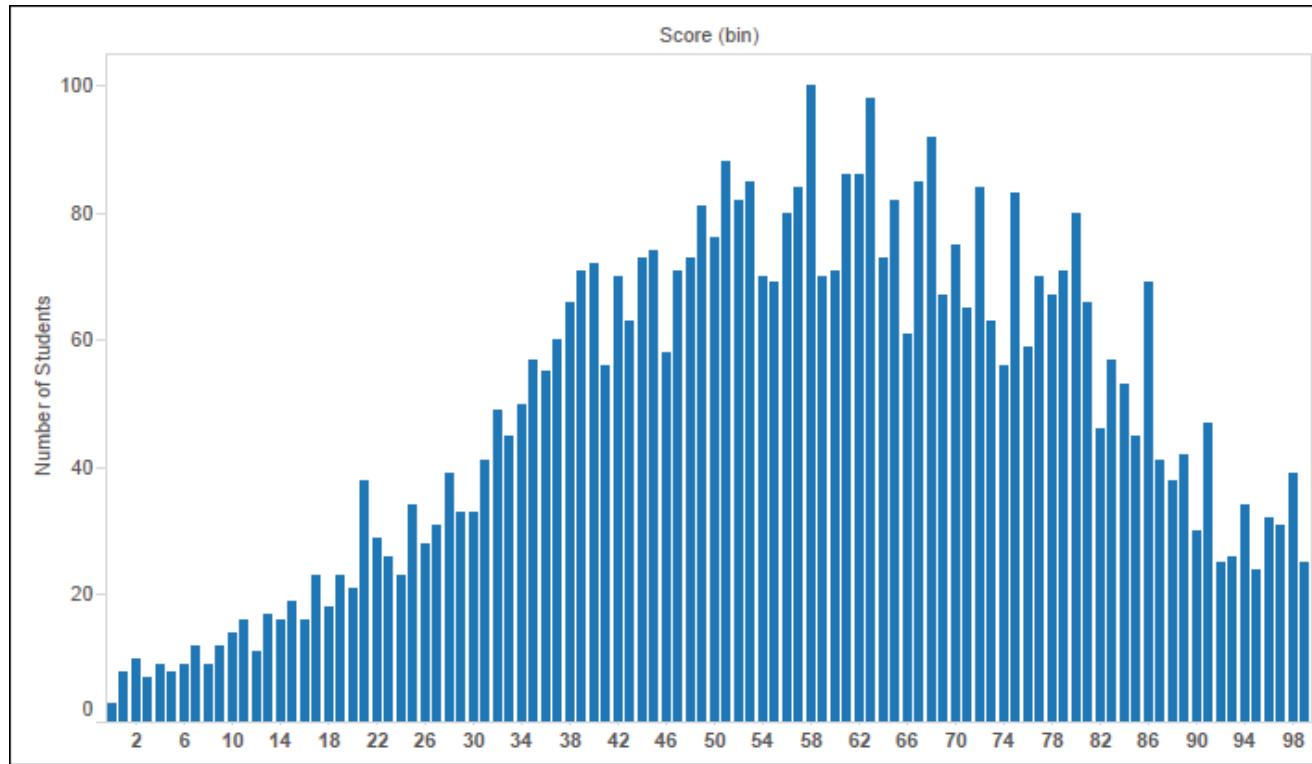


Box and whisker plots



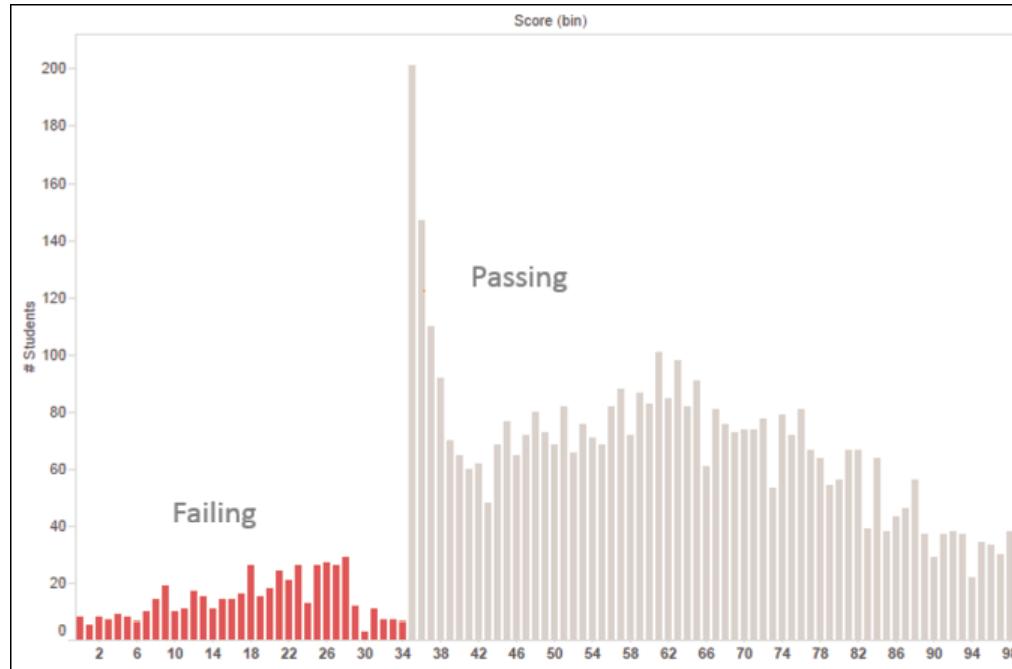


Histograms



Histograms

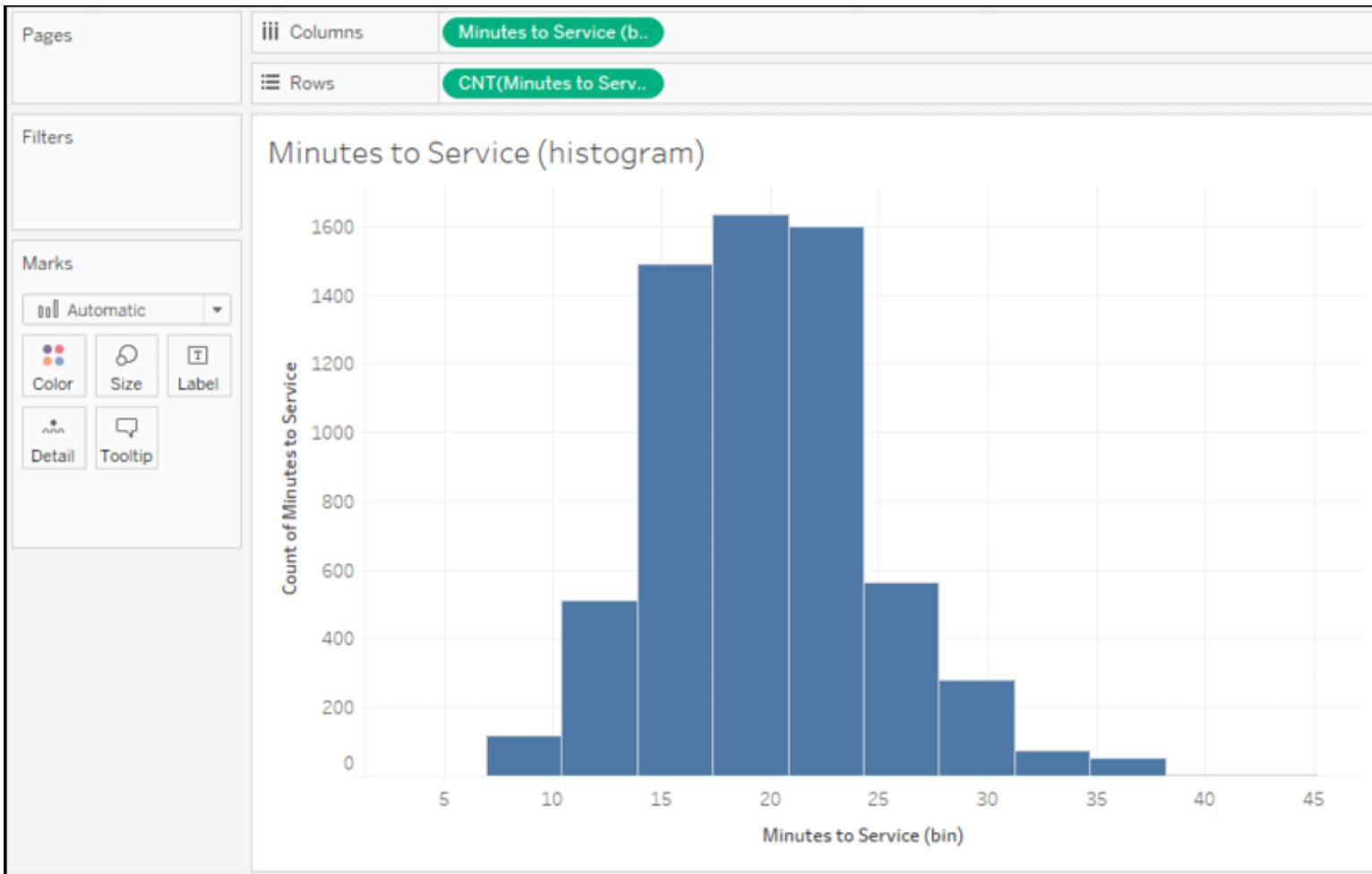
What if auditors saw something like this?



Histograms

You might start with a blank view follow steps like these:

1. Click to select the Minutes to Service field under Measures in the data pane.
2. Expand Show Me if necessary and select the histogram.



Histograms

Edit Bins [Minutes to Service] X

New field name:

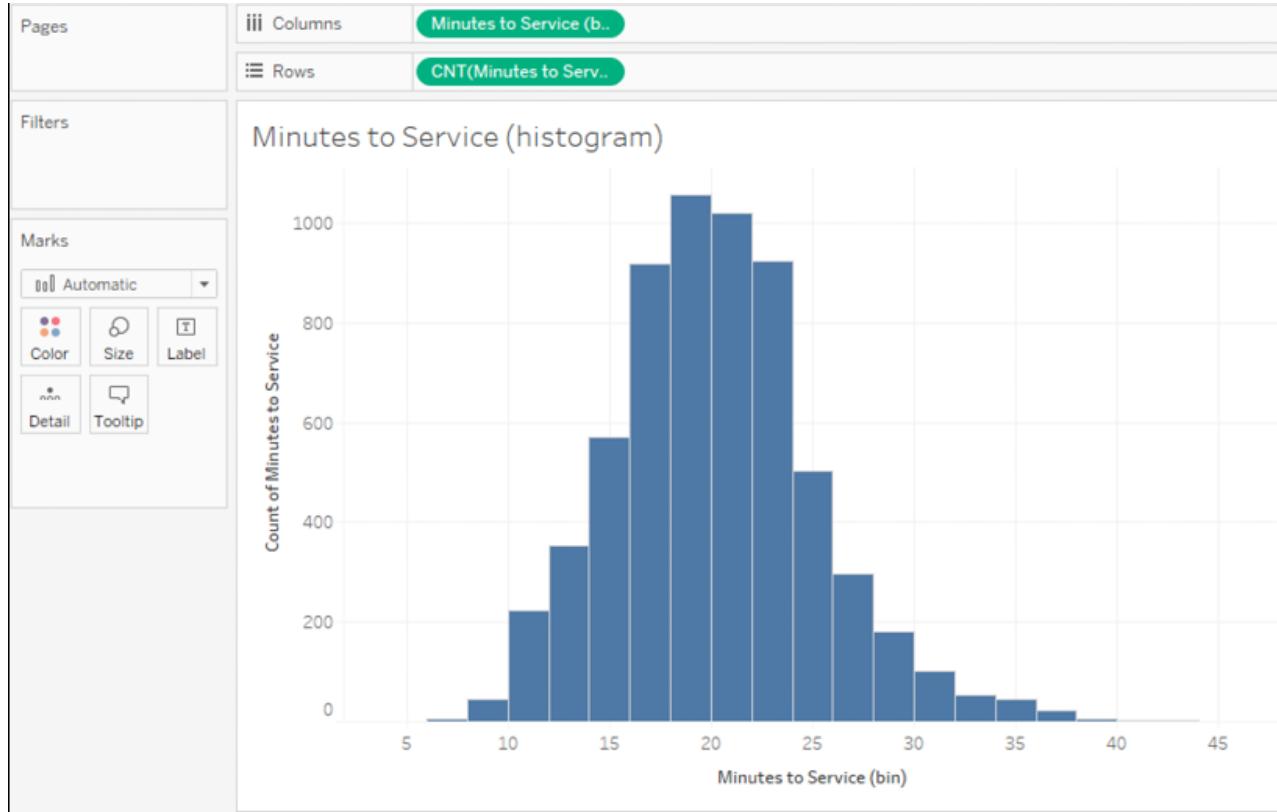
Size of bins: [Suggest Bin Size](#)

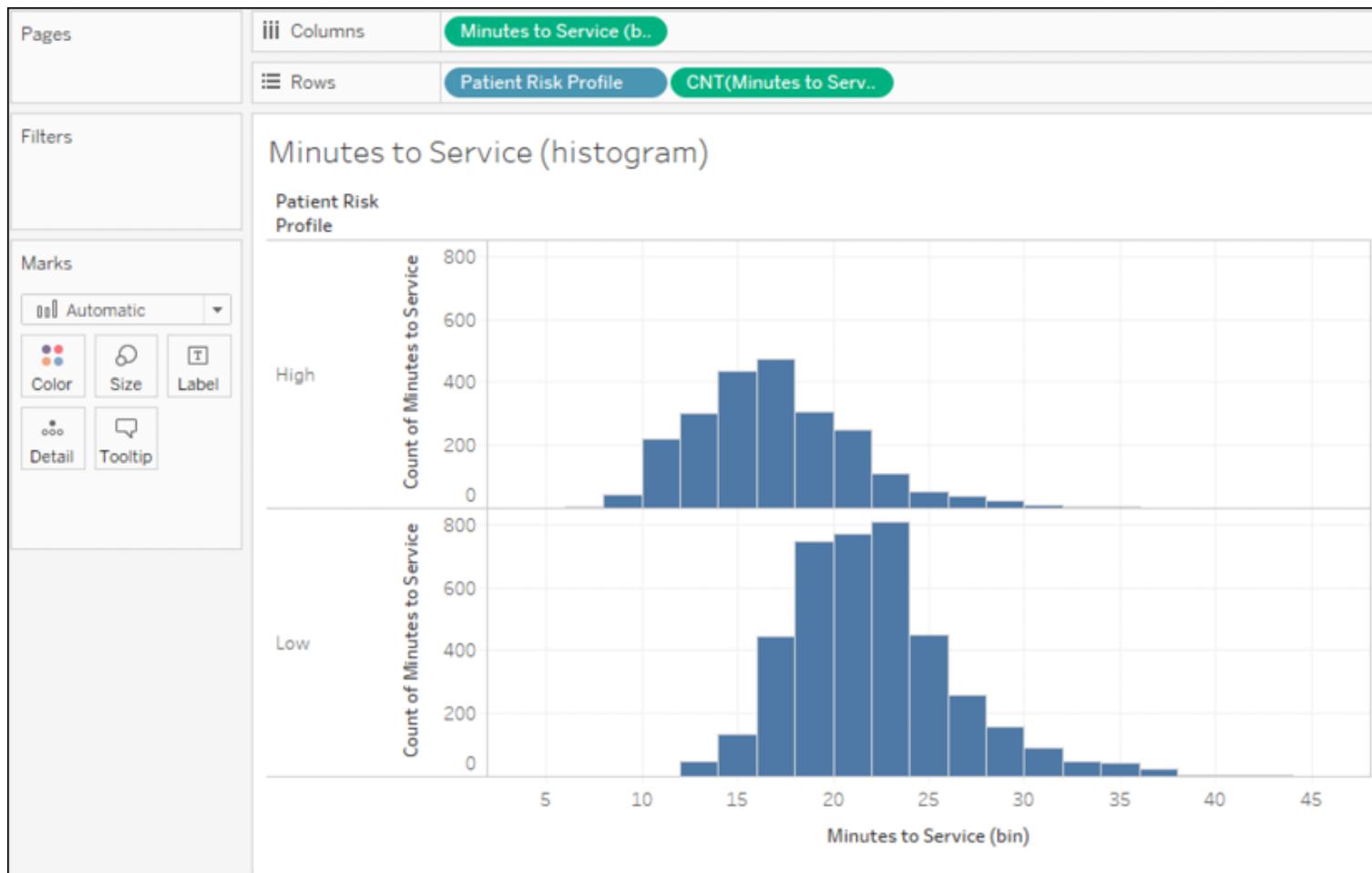
Range of Values:

| | | | |
|------|---------------------------------|-------|---------------------------------|
| Min: | <input type="text" value="4"/> | Diff: | <input type="text" value="40"/> |
| Max: | <input type="text" value="44"/> | CntD: | <input type="text" value="40"/> |

[OK](#) [Cancel](#)

- Here, for example, is the same histogram with each bin sized to 2 minutes:

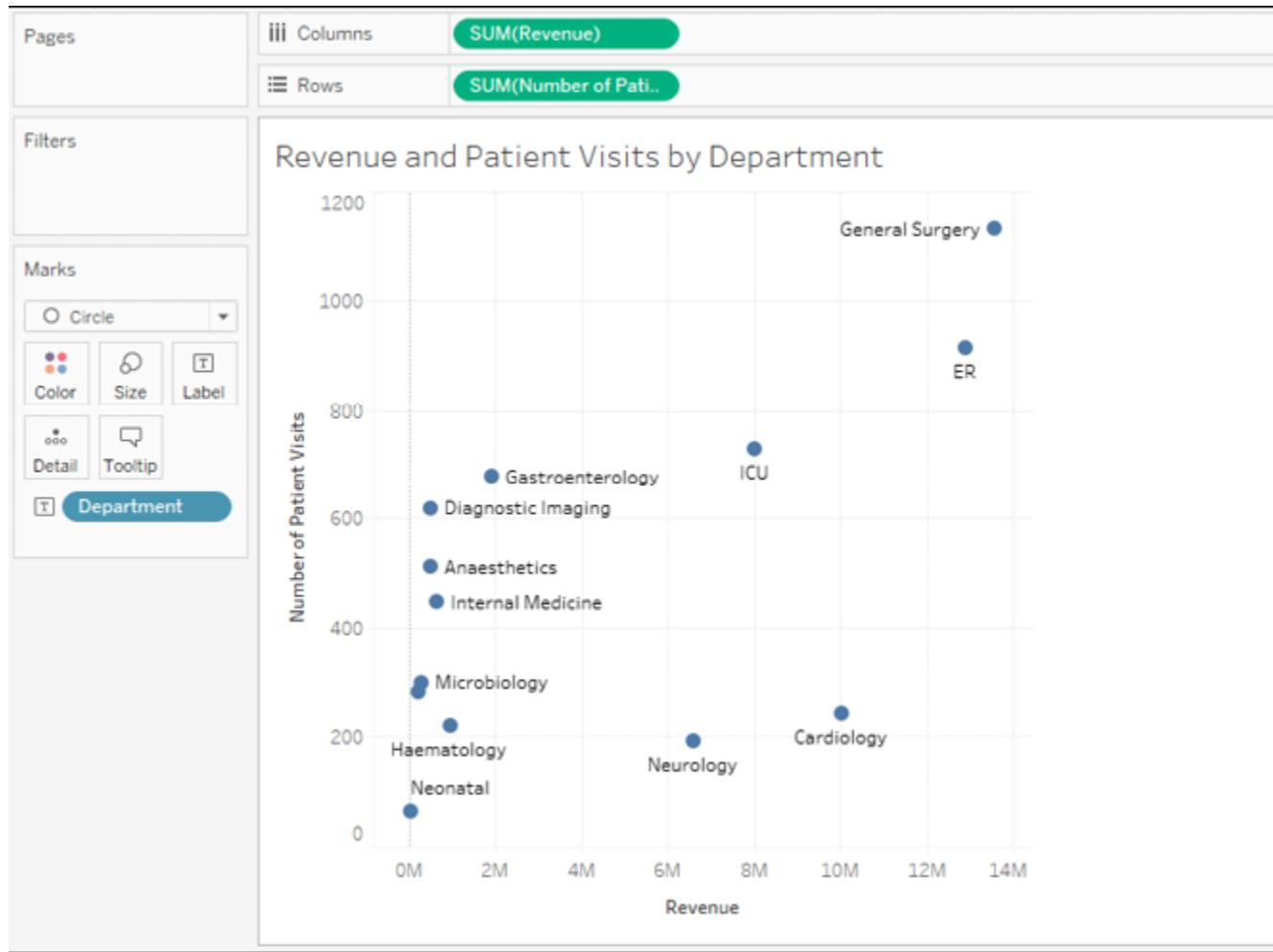




Scatterplot

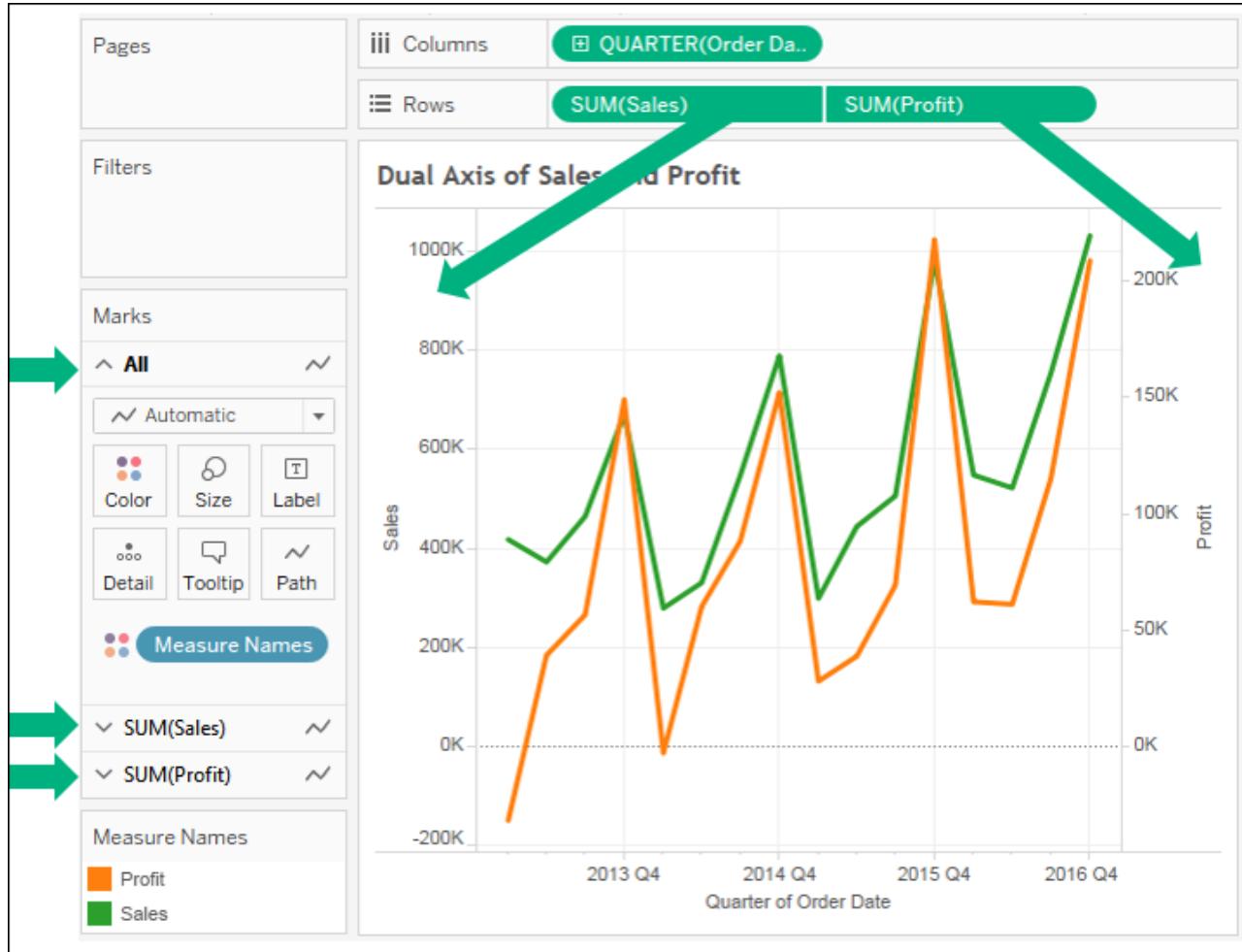
A scatterplot is an essential visualization type for understanding the relationship between two measures. Consider a scatterplot when you find yourself asking questions like the following:

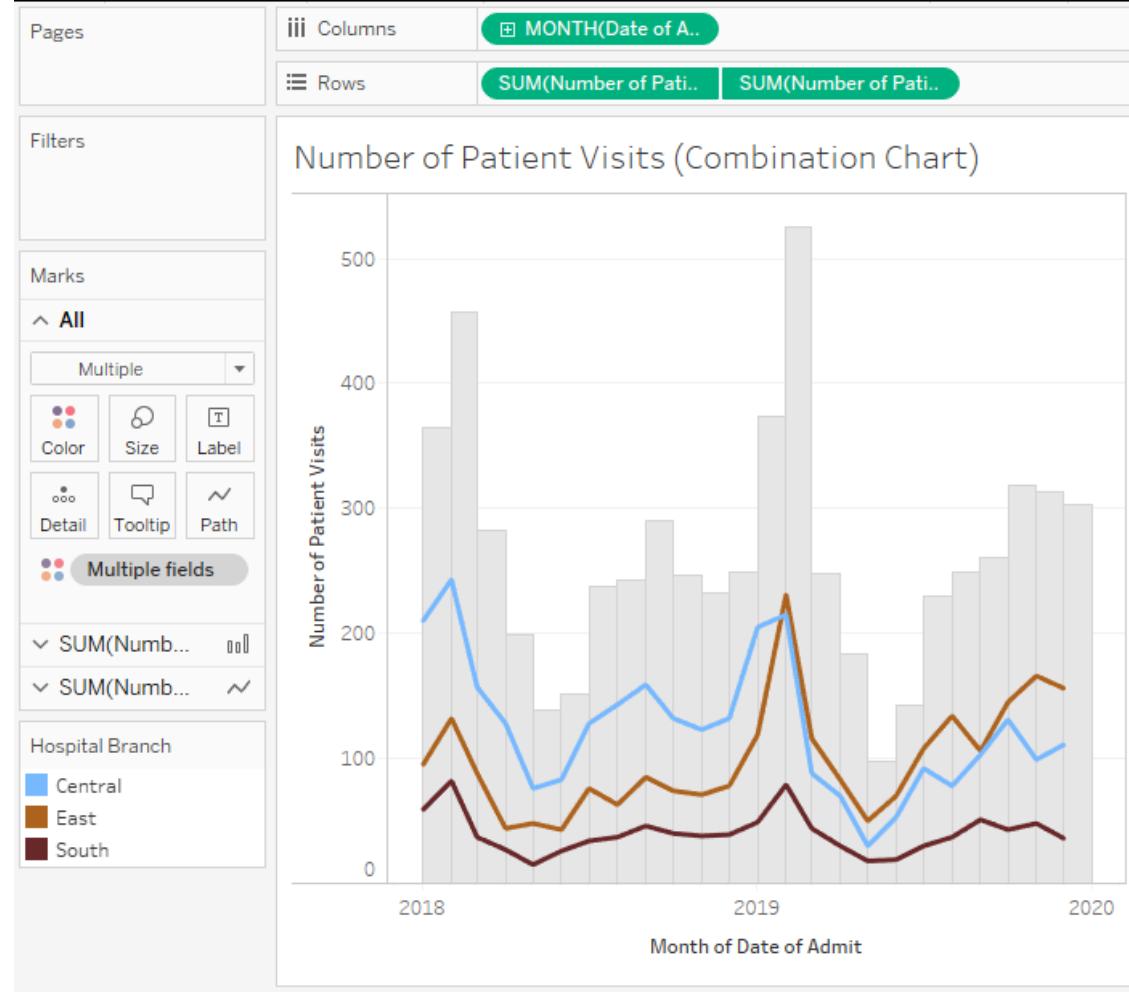
- Does how much I spend on marketing really make a difference on sales?
- How much does power consumption go up with each degree of heating/cooling?
- Is there any correlation between hours of study and test performance?



Dual-axis and combination charts

- One very important feature in Tableau is the ability to use a dual axis.
- Scatterplots use two axes, but they are X and Y.
- You also observed in the stacked bar example that placing multiple continuous (green) fields next to each other on Rows or Columns results in multiple side-by-side axes.





Summary

- We've covered quite a bit of ground in this lesson! You should now have a good grasp of when to use certain types of visualizations.
- The types of questions you ask about data will often lead you to a certain type of view.
- You've explored how to create these various types and how to extend basic visualizations using a variety of advanced techniques, such as calculated fields, jittering, multiple mark types, and dual axis.

COMPLETE LAB 3

4. Starting an Adventure with Calculations and Parameters



Starting an Adventure with Calculations & Parameters

The topics we will study here are as follows:

- Overview of the four main types of calculations
- Creating and editing calculations
- Row-level calculation examples
- Aggregate calculation examples
- Parameters
- Practical examples
- Performance considerations

Introduction to calculations

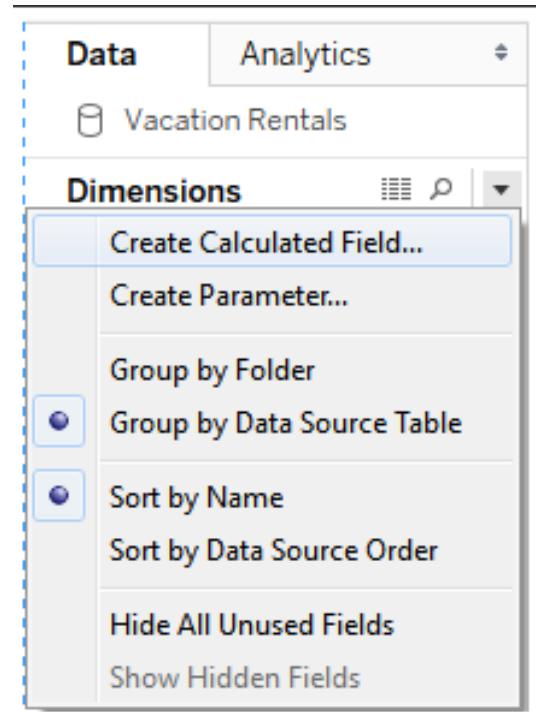
- A calculation is often referred to as a Calculated Field in Tableau because, in most cases, when you create a calculation, it will show up as either a new measure or dimension in the data pane.
- Calculations consist of code that's made up of functions, operations, and references to other fields, parameters, constants, groups, or sets.

The four main types of calculations

- **Row-level calculations:** These calculations are performed for every row of underlying data.
- **Aggregate calculations:** These calculations are performed at an aggregate level, which is usually defined by the dimensions used in the view.
- **Level of detail calculations:** These special calculations are aggregations that are performed at a specified level of detail, with the results available at the row level.
- **Table calculations:** These calculations are performed on the table of aggregate data that has been returned by the data source to Tableau.

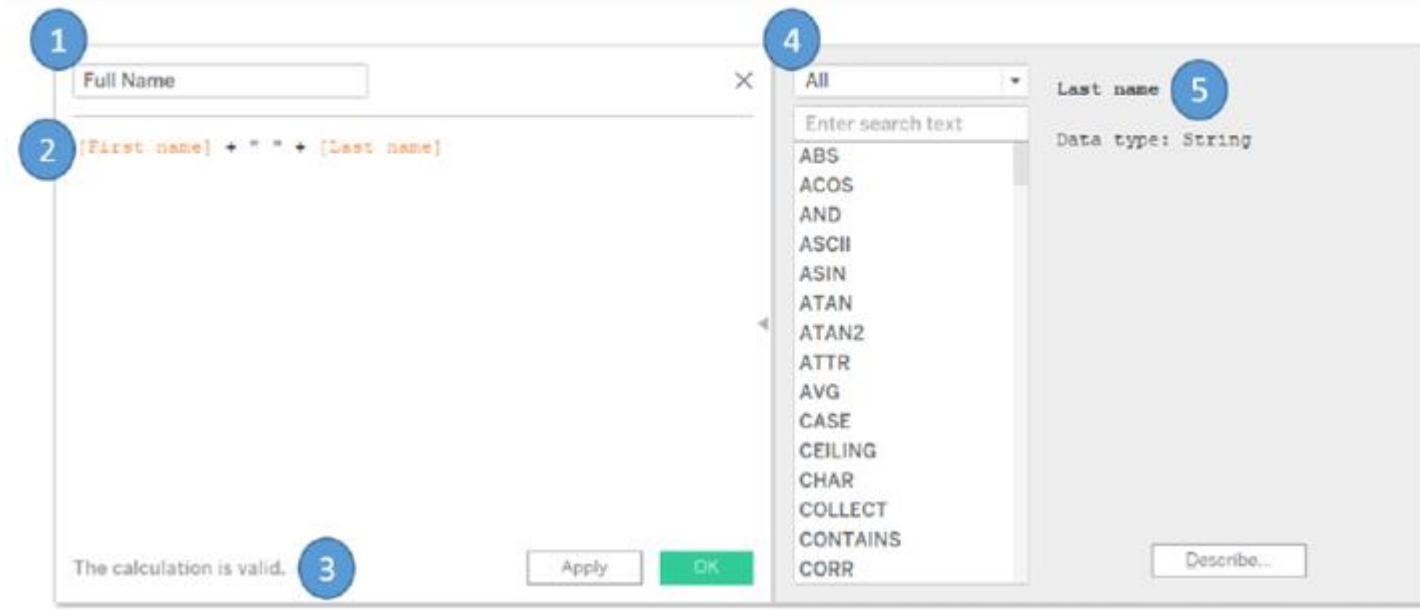
Creating and editing calculations

- Select Analysis | Create Calculated Field... from the menu.
- Use the drop-down menu next to Dimensions in the Data pane:



Creating and editing calculations

- The interface for creating and editing calculations looks like this:



Data types

- Fundamental to the concept of calculations are data types, which describe the kind of information stored by a field, parameter, or returned by a function.
- Tableau distinguishes six types of data:
- Number (decimal), Number (whole), Date and Time, Date, String, Boolean & Spatial etc.

Additional functions and operators

| Operator / Keyword | Description |
|--------------------|---|
| AND | Logical <i>and</i> between two Boolean (true/false) values or statements |
| OR | Logical <i>or</i> between two Boolean values or statements |
| NOT | Logical <i>not</i> to negate a Boolean value or statement |
| = or == | Logical <i>equals to</i> to work course test the equality of two statements or values (single or double equal signs are equivalent in Tableau's syntax) |
| + | Addition of numeric or date values or the concatenation of strings |
| - | Subtraction of numeric or date values |
| * | Multiplication of numeric values |
| / | Division of numeric values |
| ^ | Raise to a power with numeric values |
| () | Parentheses to define the order of operations or enclose function arguments |
| [] | Square brackets to enclose field names |
| { } | Curly braces to enclose the level of detail calculations |
| // | Double slash to start a comment |

Example data

| Rental Property | First | Last | Start | End | Discount | Rent | Tax per Night |
|------------------|---------|------------|--------|--------|----------|-------|---------------|
| 112-Asbury Atoll | Mary | Slessor | Dec 2 | Dec 9 | 150 | 1,500 | 15 |
| 112-Asbury Atoll | Amy | Carmichael | Dec 9 | Dec 15 | 0 | 1,500 | 15 |
| 155-Beach Breeze | Charles | Ryrie | Dec 2 | Dec 9 | 260 | 1,300 | 10 |
| 155-Beach Breeze | Dwight | Pentecost | Dec 16 | Dec 23 | 280 | 1,400 | 10 |
| 207-Beach Breeze | Lewis | Chafer | Dec 9 | Dec 23 | 280 | 2,800 | 10 |
| 207-Beach Breeze | John | Walvoord | Dec 2 | Dec 9 | 60 | 1,500 | 10 |

Row-level calculations

- We'll walk through several examples of row-level calculations in this section.
- You'll find the completed calculations in the Complete workcourse, but you might prefer to start from scratch in the Starter workcourse.

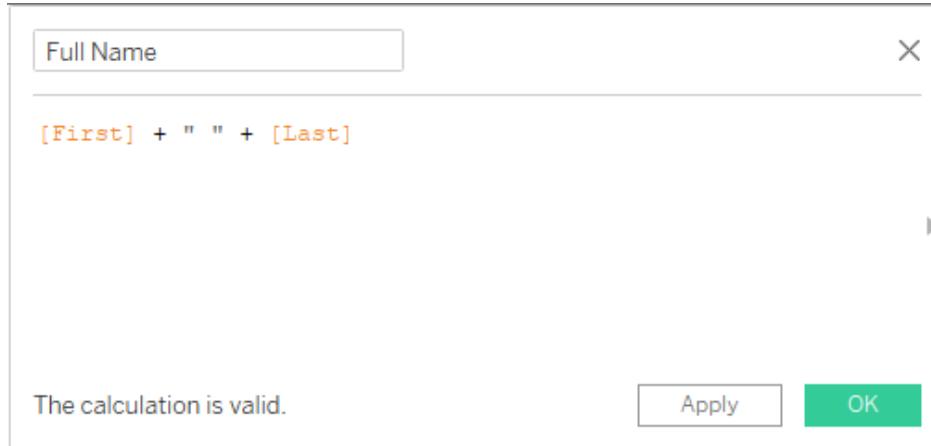
Simple example

- We'll start with a very simple example and then build up in complexity.
- In the lesson 04 workcourse, create a new calculated field called Full Name with the following code:

[First] + " " + [Last]

Simple example

- Previous code concatenates the strings of First and Last with a space in-between them.
- Your calculation editor should look something like the following:

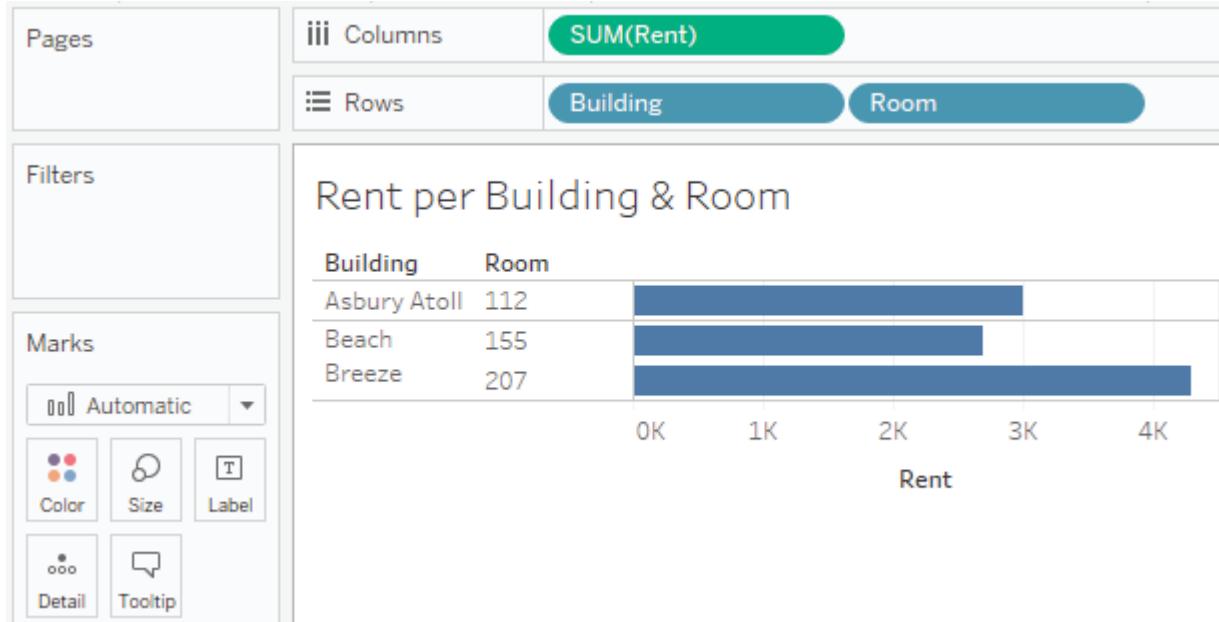


More complex examples

- Name the first Room with the following code:
SPLIT([Rental Property], "-", 1)
- Then, create another calculated field named Building with the following code:
SPLIT([Rental Property], "-", 2)

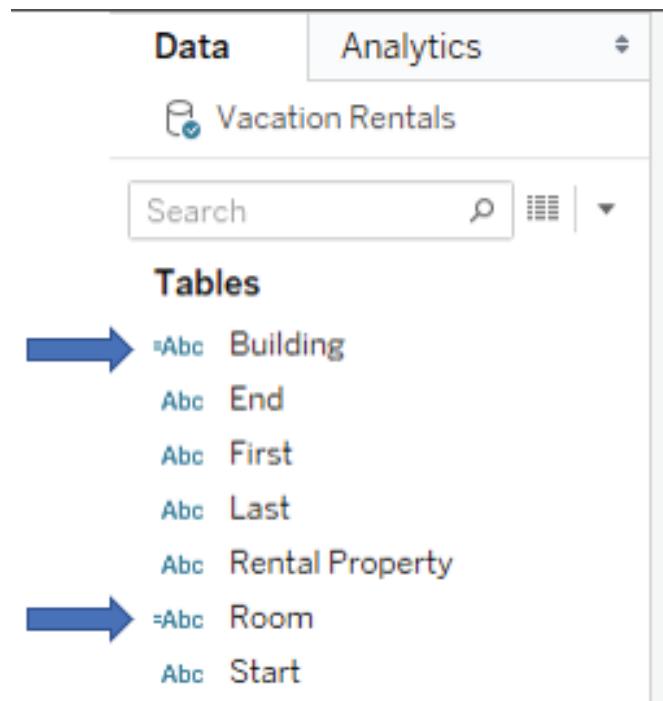
More complex examples

- Using the two calculated fields, create a bar chart of Rent per Building & Room, like this:



More complex examples

- Note that Tableau adds a small equals sign to the icon of the fields in the data pane to indicate that they are calculated fields:



The screenshot shows the Tableau Data pane. At the top, there are tabs for "Data" and "Analytics", and a section for "Vacation Rentals". Below this is a search bar and a filter icon. The main area is titled "Tables" and lists several fields:

- =Abc Building
- Abc End
- Abc First
- Abc Last
- Abc Rental Property
- =Abc Room
- Abc Start

Two blue arrows point from the text in the list to the icons for "Building" and "Room", highlighting them.

More complex examples

- Here, the new fields of Building and Unit, along with the row-level values, can be clearly seen:

View Data: Vacation Rentals

6 rows Show aliases Copy Export All

| Building | End | First | Last | Rental Property | Room | Start | Discount | Rent | Tax per Night |
|--------------|--------|---------|------------|------------------|------|--------|----------|----------|---------------|
| Asbury Atoll | 9-Dec | Mary | Slessor | 112-Asbury Atoll | 112 | 2-Dec | 150 | 1,500.00 | 15 |
| Asbury Atoll | 15-Dec | Amy | Carmichael | 112-Asbury Atoll | 112 | 9-Dec | 0 | 1,500.00 | 15 |
| Beach Breeze | 9-Dec | Charles | Ryrie | 155-Beach Breeze | 155 | 2-Dec | 130 | 1,300.00 | 10 |
| Beach Breeze | 23-Dec | Dwight | Pentecost | 155-Beach Breeze | 155 | 16-Dec | 280 | 1,400.00 | 10 |
| Beach Breeze | 23-Dec | Lewis | Chafer | 207-Beach Breeze | 207 | 9-Dec | 280 | 2,800.00 | 10 |
| Beach Breeze | 9-Dec | John | Walvoord | 207-Beach Breeze | 207 | 2-Dec | 60 | 1,500.00 | 10 |

Extending the example

- We'll extend the example a bit more and assume you know that the floor of a room is indicated by its number.
- Rooms 100 through 199 are on the first floor, and 200 through 299 are on the second.
- You'd like to have that information available for analysis.

More complex examples

- Instead, you can create a row-level calculation in Tableau to extend the data.
- To do so, create a calculated field named Floor with the following code:

```
IF LEFT([Room], 1) = "1"  
THEN "First Floor"  
ELSEIF LEFT([Room], 1) = "2"  
THEN "Second Floor"  
END
```

Planning for data variations

- To account for additional cases, we might simplify our calculation to the following:

`LEFT([Room], 1)`

- This code simply returns the leftmost character of the room number.

Planning for data variations

- We'll get 3 for 306 and 8 for 822. But what if we have room numbers such as 1056 on the tenth floor, and 1617 on the sixteenth?
- We'd have to consider other options, such as the following:

`MID([Room], 0, LEN([Room]) - 2)`

Aggregate calculations

- We've already considered aggregations such as sum, min, and max in Tableau.
- Often, you'll use fields as simple aggregations in the view.
- But sometimes, you'll want to use aggregations in more complex calculations.
- For example, you might be curious to explore the percentage of the rent that was discounted, There is no such field in the data.

Aggregate calculations

- Let's create a calculation named Discount % with the following code:

$\text{SUM}([\text{Discount}]) / \text{SUM}([\text{Rent}])$

Pages

Columns Measure Names

Rows Building Room Full Name Start End

Filters

Measure Names

Marks

Automatic

Color Size Text

Detail Tooltip

Measure Values

SUM(Rent)

SUM(Discount)

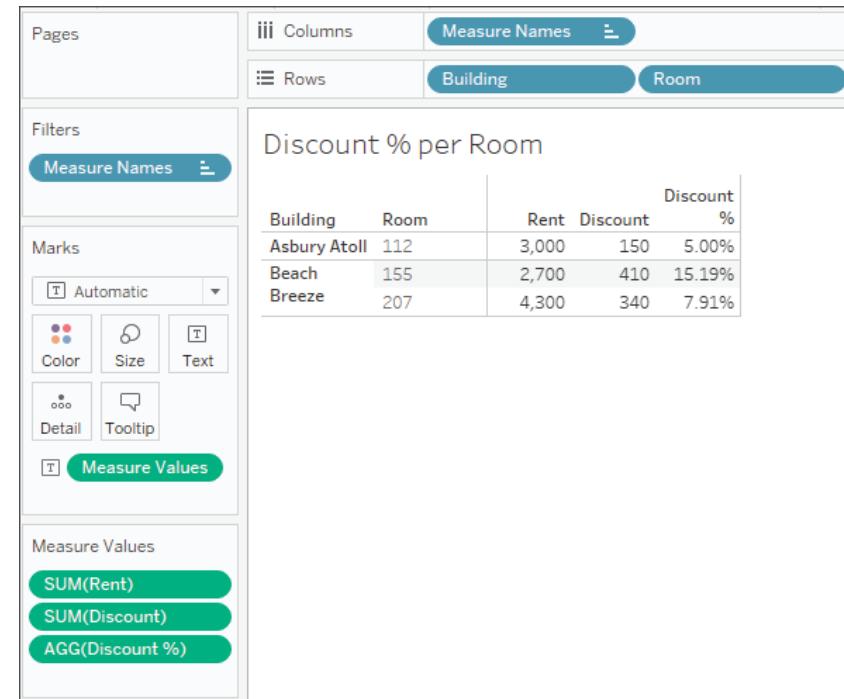
AGG(Discount %)

Discount % per Rental

| Building | Room | Full Name | Start | End | Rent | Discount | Discount % |
|--------------|------|-----------------|--------|--------|-------|----------|------------|
| Asbury Atoll | 112 | Amy Carmichael | 9-Dec | 15-Dec | 1,500 | 0 | 0.00% |
| | | Mary Slessor | 2-Dec | 9-Dec | 1,500 | 150 | 10.00% |
| Beach Breeze | 155 | Charles Ryrie | 2-Dec | 9-Dec | 1,300 | 130 | 10.00% |
| | | Dwight Pentec.. | 16-Dec | 23-Dec | 1,400 | 280 | 20.00% |
| | 207 | John Walvoord | 2-Dec | 9-Dec | 1,500 | 60 | 4.00% |
| Lewis Chafer | | 9-Dec | 23-Dec | 2,800 | 280 | 10.00% | |

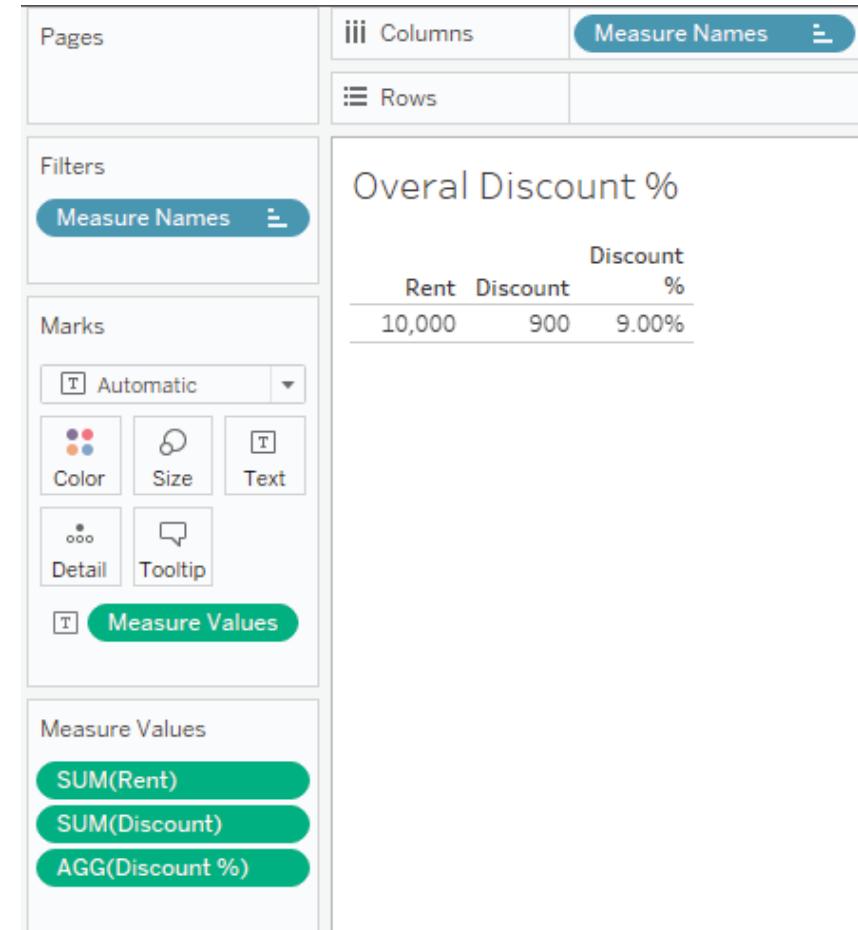
Aggregate calculations

- You can see the percentage given by way of discount for each rental period.
- However, notice how the values change when you remove all fields except Building and Room:



Aggregate calculations

- Notice that the values change again, as expected, if you look at the overall dataset without slicing by any dimensions:



Why the row level versus aggregate difference matters

- Let's say you created a Discount % (row level) calculation with the following code:
[Discount]/[Rent]
- The code differs from the aggregate calculation you created previously, which had the following code:
SUM([Discount])/SUM([Rent])

Pages

Columns Measure Names

Rows

Filters

Measure Names

Marks

Automatic

Color

Size

Text

Detail

Tooltip

Measure Values

SUM(Rent)

SUM(Discount)

AGG(Discount %)

SUM(Discount % (ro..

Overall Discount % (Aggregate v. Row Level)

| Rent | Discount | Discount % | Discount % (row level) |
|--------|----------|------------|------------------------|
| 10,000 | 900 | 9.00% | 54.00% |

Aggregate
 $\text{SUM}([\text{Discount}] / \text{SUM}([\text{Rent}]))$

Row Level
 $[\text{Discount}] / [\text{Rent}]$

Why the row level versus aggregate difference matters

- In fact, the row-level calculation and the final aggregation is performed like this:

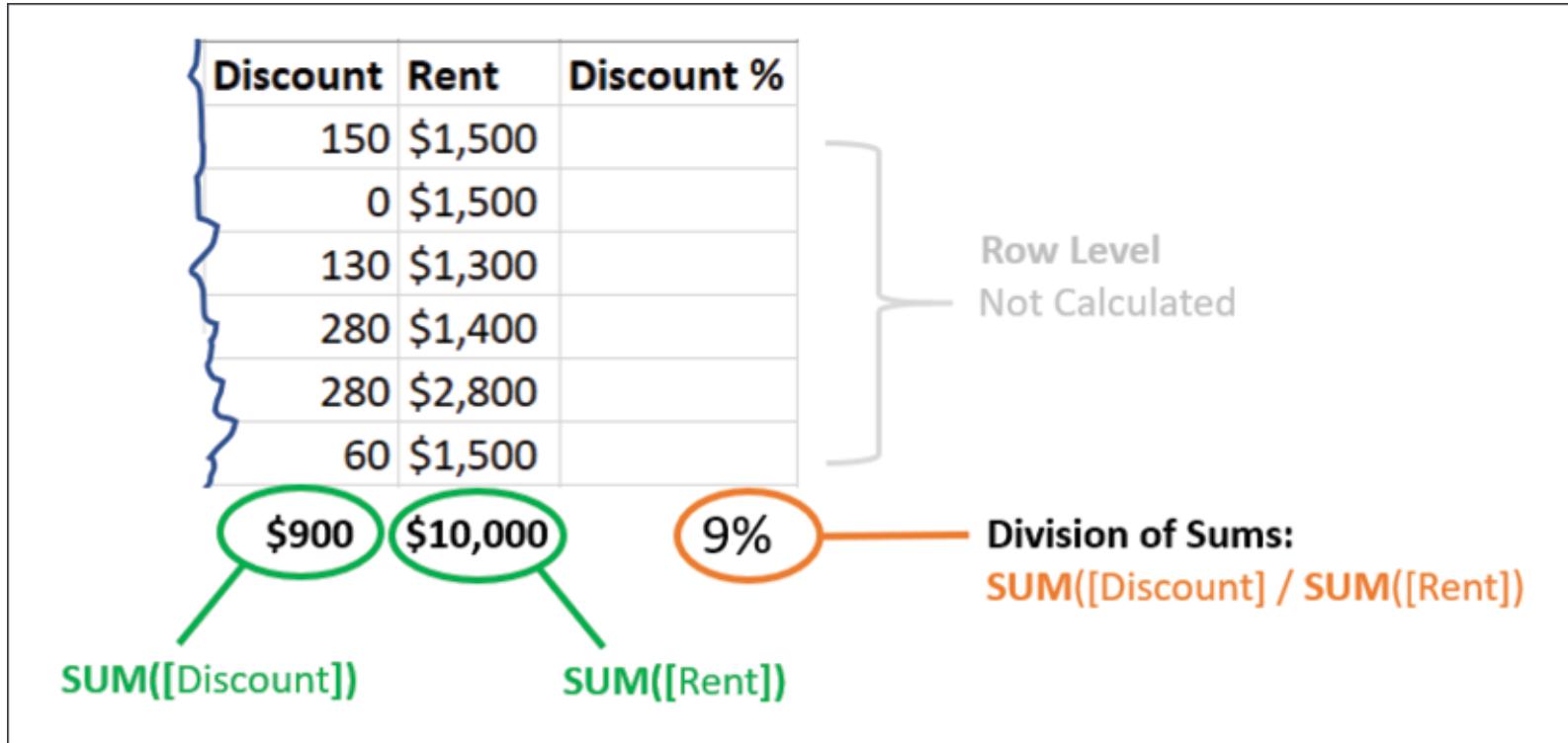
| Rental Property | First | Discount | Rent | Discount % |
|------------------|---------|----------|---------|------------|
| 112-Asbury Atoll | Mary | 150 | \$1,500 | 10% |
| 112-Asbury Atoll | Amy | 0 | \$1,500 | 0% |
| 155-Beach Breeze | Charles | 130 | \$1,300 | 10% |
| 155-Beach Breeze | Dwight | 280 | \$1,400 | 20% |
| 207-Beach Breeze | Lewis | 280 | \$2,800 | 10% |
| 207-Beach Breeze | John | 60 | \$1,500 | 4% |

Row Level
 $[Discount] / [Rent]$
Results calculated for each row

Final Aggregation
Sum of row level results

54%

Why the row level versus aggregate difference matters



Parameters

- Before moving to some additional examples of row-level and aggregate calculations, let's take a little side trip to examine parameters, given that they can be used in incredible ways in calculations.
- A parameter in Tableau is a placeholder for a single, global value such as a number, date, or string.
- Parameters may be shown as controls (such as sliders, drop-down lists, or type-in text boxes) to end users of dashboards or views, giving them the ability to change the current value of the parameter.

Parameters

- Alter the results of a calculation
- Change the size of bins
- Change the number of top or bottom items in a top n filter or top n set
- Set the value of a reference line or band
- Change the size of bins
- Pass values to a custom SQL statement that's used in a data source

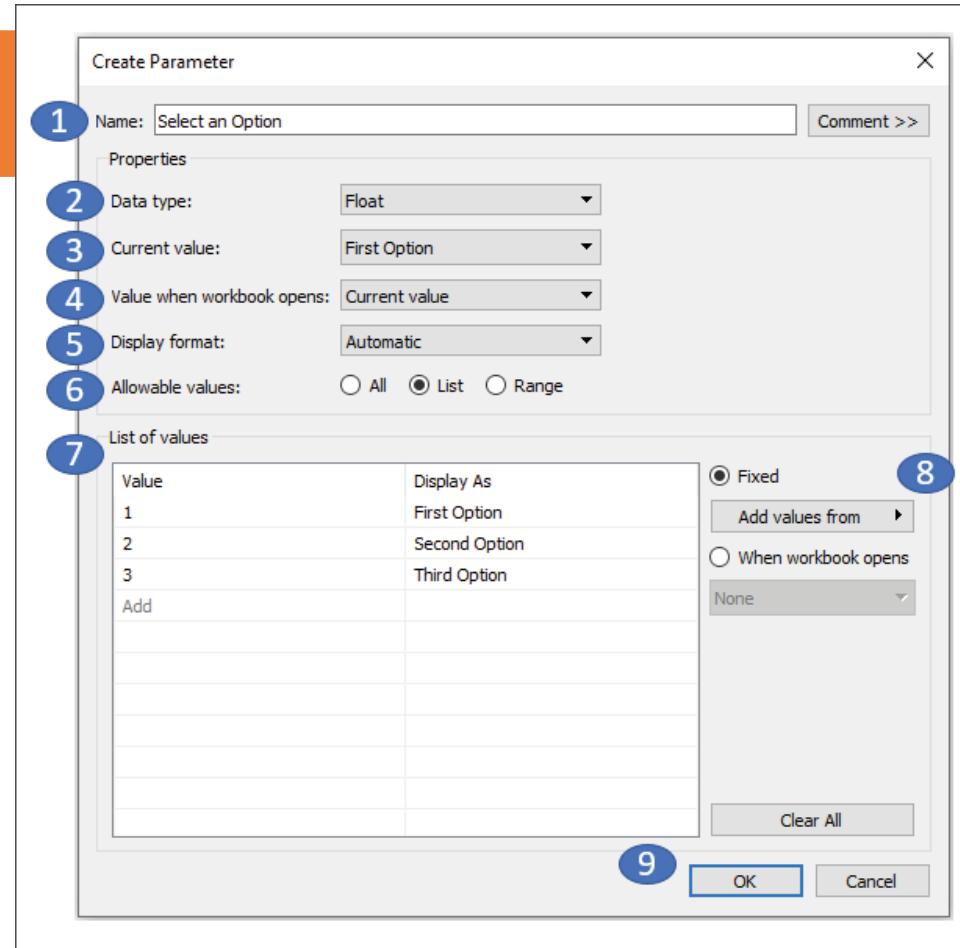
Creating parameters

Creating a parameter is similar to creating a calculated field & there are multiple ways to create a parameter in Tableau:

- Use the drop-down menu next to Dimensions in the data pane and select Create Parameter.
- Right-click an empty area in the data pane and select Create Parameter.
- Use the drop-down menu on a field, set, or parameter already in the data pane and select Create | Parameter...

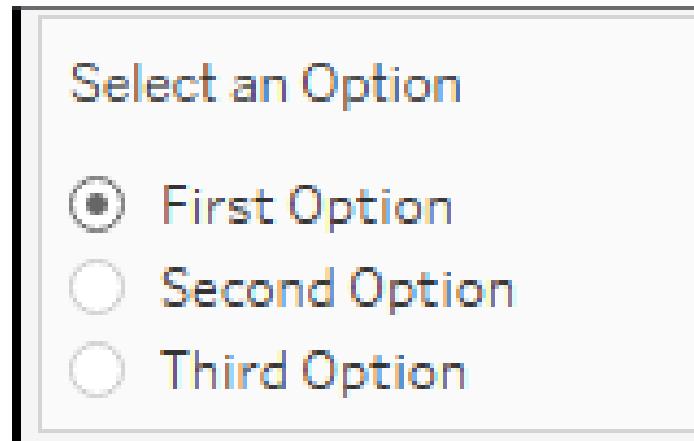
Creating parameters

- When you first create a parameter (or subsequently edit an existing parameter), Tableau will present an interface like this:



Creating parameters

- The parameter control, shown as a single value list, for the parameter we created earlier:



Practical examples of calculations and parameters

- Let's turn our attention to some practical examples of row-level and aggregate calculations.
- The goal is to learn and understand some of what is possible with calculations.
- You will be able to build on these examples as you embark on your analysis and visualization journey.

Fixing data issues

- Often, data is not entirely clean. That is, it has problems that need to be corrected before meaningful analysis can be accomplished.
- For example, dates may be incorrectly formatted, or fields may contain a mix of numeric values and character codes that need to be separated into multiple fields.
- Calculated fields can often be used to fix these kinds of issues.

Fixing data issues

- We'll continue working with the Vacation Rentals data.
- You'll recall that the start and end dates looked something like this:

| Start | End |
|--------|--------|
| Dec 2 | Dec 9 |
| Dec 9 | Dec 15 |
| Dec 16 | Dec 23 |

Fixing data issues

- Here is the code for getting the start date:
DATE([Start] + ", 2020")
- And here is the code for getting the end date:
DATE([End] + ", 2020")

Fixing data issues

- A quick check in Tableau reveals the expected results:

The screenshot shows a Tableau interface with the following components:

- Pages:** Shows "Corrected Date Values".
- Columns:** Shows "Rental Prop..", "Room", "Start", "End", "Start Date", and "End Date".
- Rows:** Shows data for four rental properties: "112-Asbury", "Atoll", "155-Beach", and "Breeze".
- Marks:** Shows settings for "Automatic" marks, "Color", "Size", "Text", "Detail", and "Tooltip".
- Filters:** Not visible in the screenshot.

The data table displays the following information:

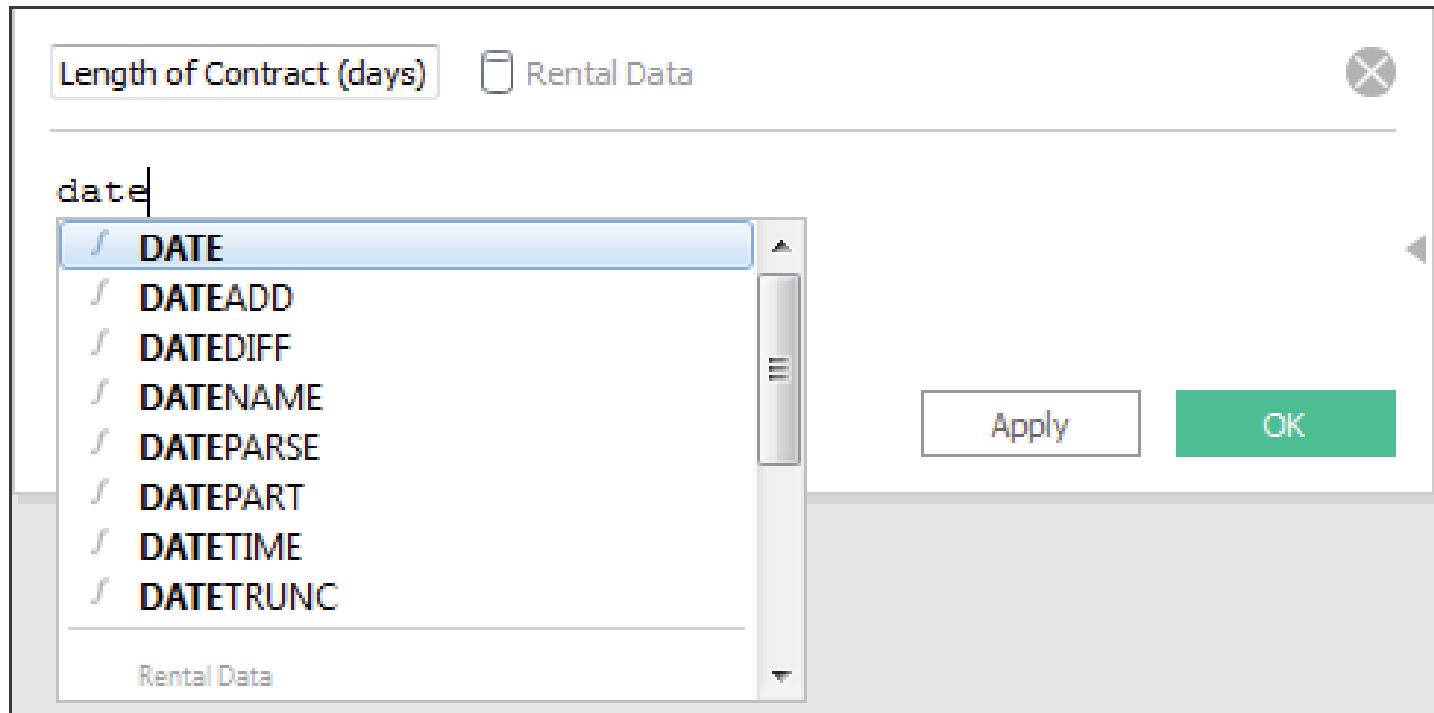
| Rental Prop.. | Room | Start | End | Start Date | End Date | |
|---------------|------|--------|--------|------------|------------|-----|
| 112-Asbury | 112 | 2-Dec | 9-Dec | 12/2/2020 | 12/9/2020 | Abc |
| Atoll | | 9-Dec | 15-Dec | 12/9/2020 | 12/15/2020 | Abc |
| 155-Beach | 155 | 2-Dec | 9-Dec | 12/2/2020 | 12/9/2020 | Abc |
| Breeze | | 16-Dec | 23-Dec | 12/16/2020 | 12/23/2020 | Abc |
| 207-Beach | 207 | 2-Dec | 9-Dec | 12/2/2020 | 12/9/2020 | Abc |
| Breeze | | 9-Dec | 23-Dec | 12/9/2020 | 12/23/2020 | Abc |

Extending the data

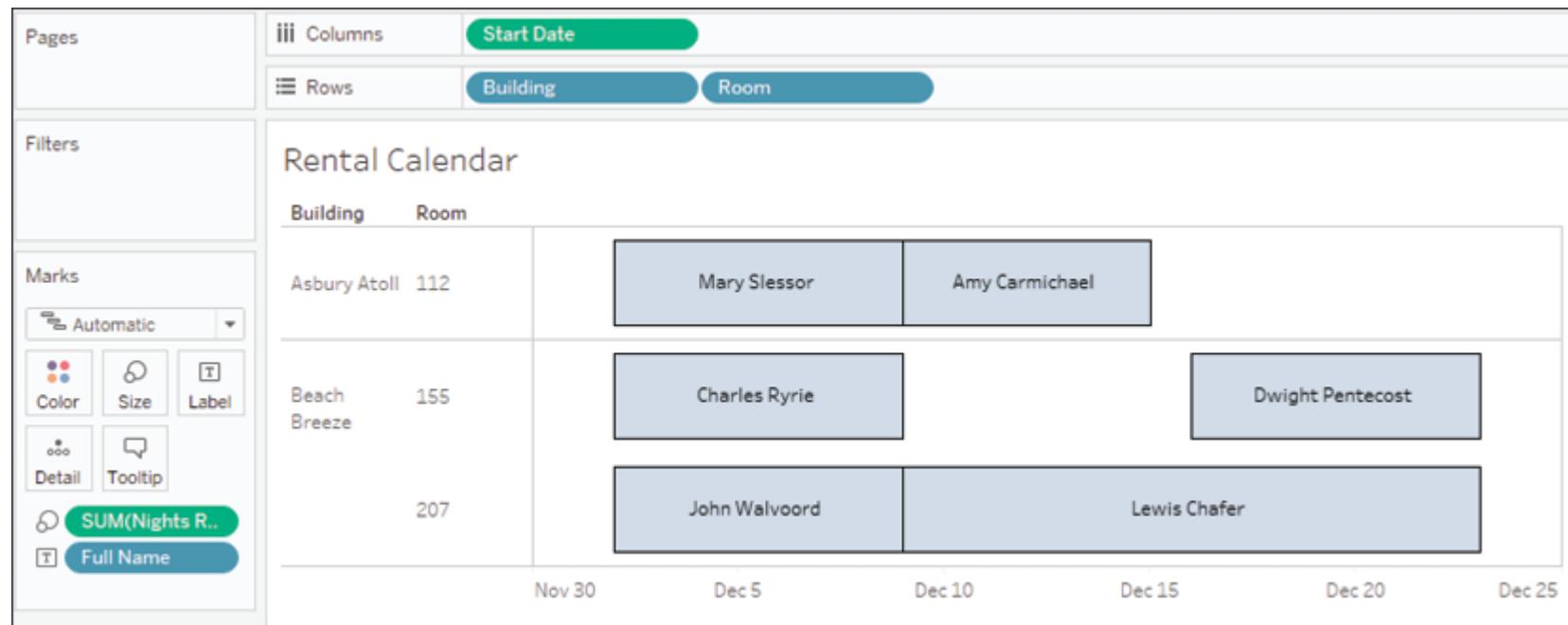
- Create a calculated field named Nights Rented with the following code:

DATEDIFF('day', [Start Date], [End Date])

Extending the data



Extending the data



Enhancing user experience, analysis, and visualizations

- Calculations and parameters can greatly enhance the user experience, the analysis, and the visualizations.
- Let's say we want to give the vacation condo manager the ability to do some what-if analysis.
- Every year, she offers a free night during the month of December.

Data **Analytics**

Summarize

- Constant Line
- Average Line
- Median with Quartiles
- Box Plot
- Totals

Model

- Average with 95% CI
- Median with 95% CI
- Trend Line
- Forecast
- Cluster

Custom

- Reference Line
- Reference Band
- Distribution Band
- Box Plot

Pages

Columns Start Date

Rows Building Room

Filters

Marks

Automatic

Color Size Label

Detail Tooltip

Gets Free Night
SUM(Days Re...
Full Name

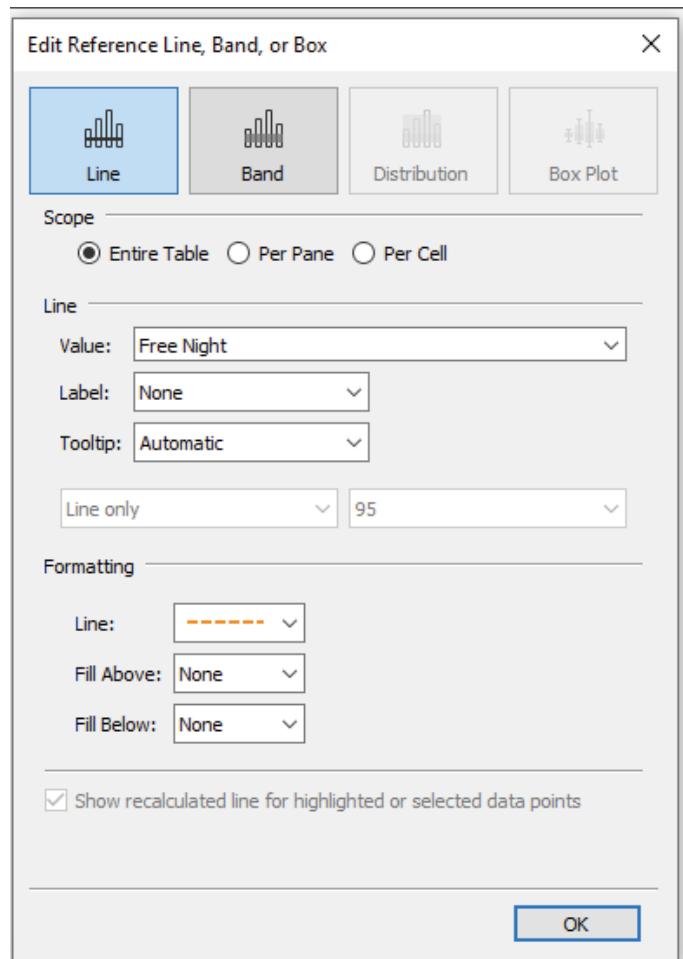
Free Night Analysis

Add a Reference Line

Table Pane Cell

| | | |
|--------------|--------|---------------|
| Beach Breeze | 155 | Charles Ryrie |
| | 207 | John Walvoord |
| | Nov 30 | Dec 5 |

- In the resulting dialog box, set Line Value to Free Night.
- You may wish to set the Label to None, or Custom with the text Free Night.
- You may also wish to adjust the formatting of the line:



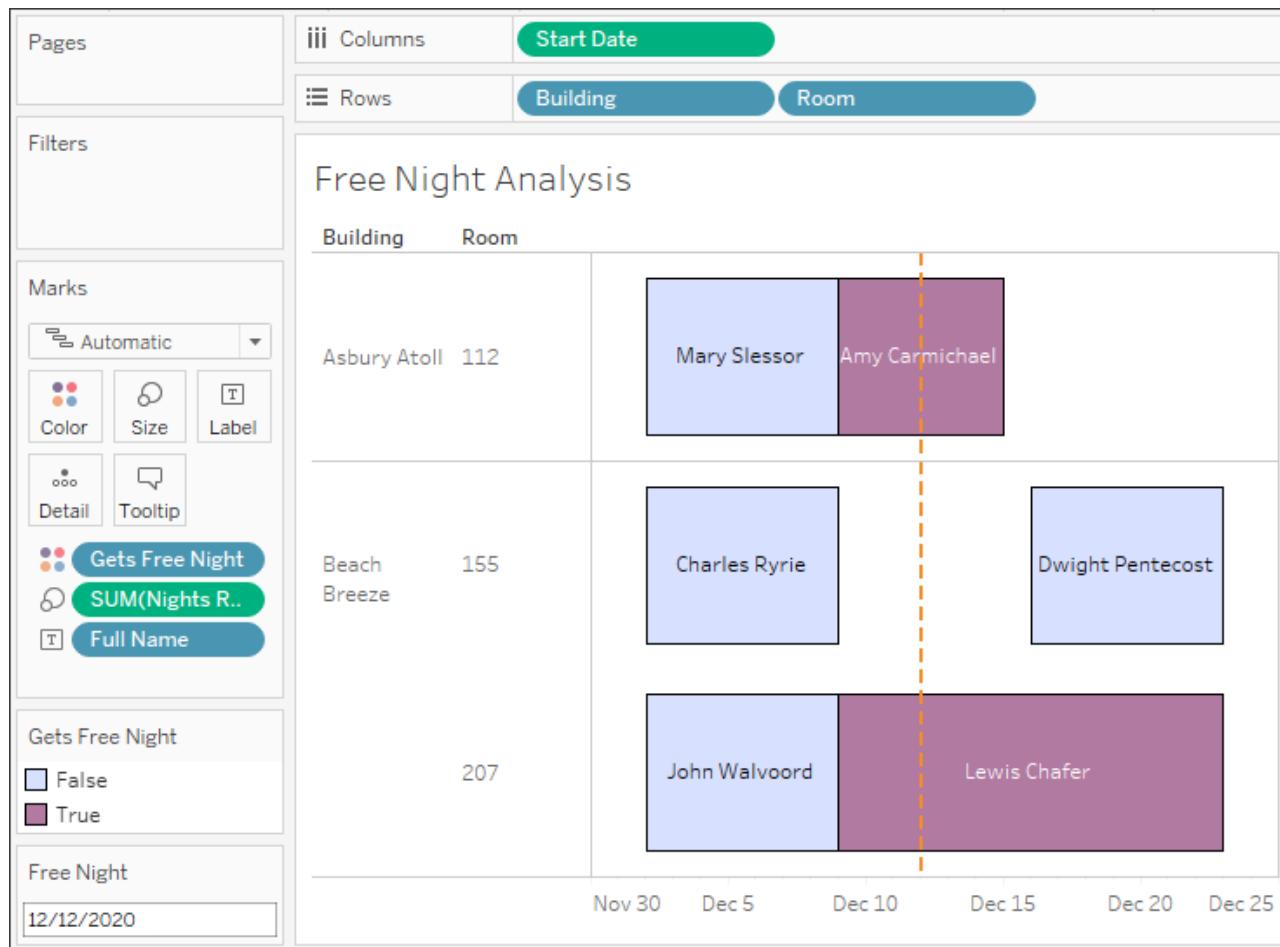
Enhancing user experience, analysis, and visualizations

- Create a calculated field called Gets Free Night that returns a true or false value, depending on whether the free night falls within the rental period:

[Free Night] >= [Start Date]

AND

[Free Night] <= [End Date]



Meeting business requirements

- Sometimes, data doesn't exactly match what your organization wants.
- For example, the measures in the data may not be the exact metrics required to make key business decisions.
- Or dimension values may need to be grouped according to a certain set of rules.

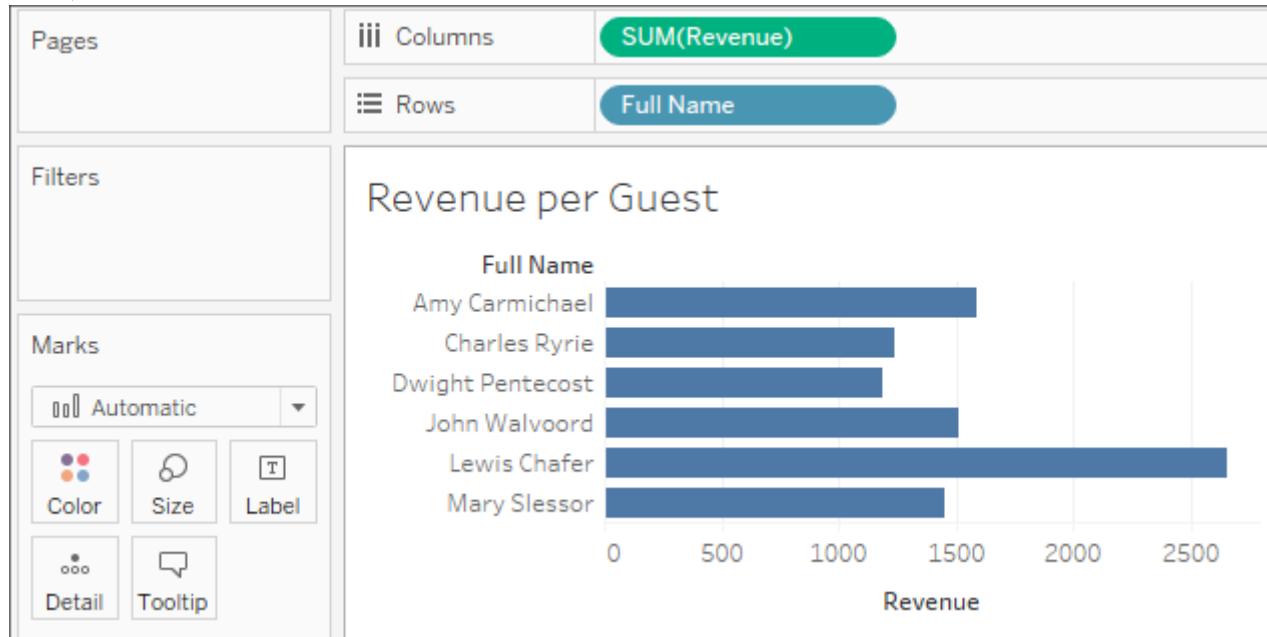
Meeting business requirements

- In this example, consider that the measure Rent is simply the base rent and does not include the discount or taxes.
- Those are separate fields in the data.
- If you needed to analyze the total Revenue, you'd need to calculate it. That calculation might look something like this:

[Rent] - [Discount] + ([Tax per Night] * [Nights Rented])

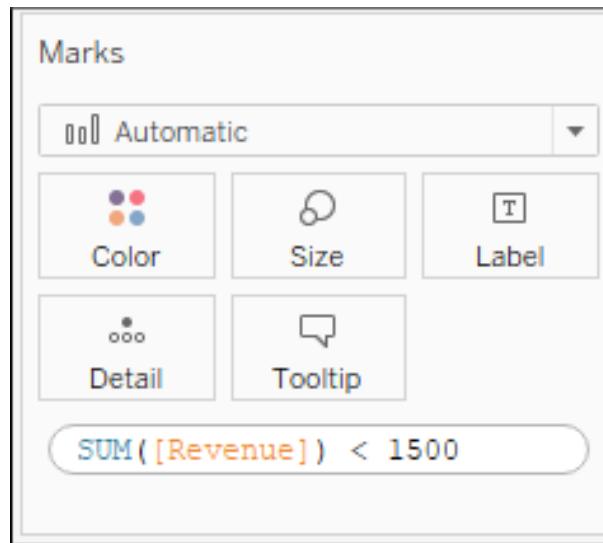
Ad hoc calculations

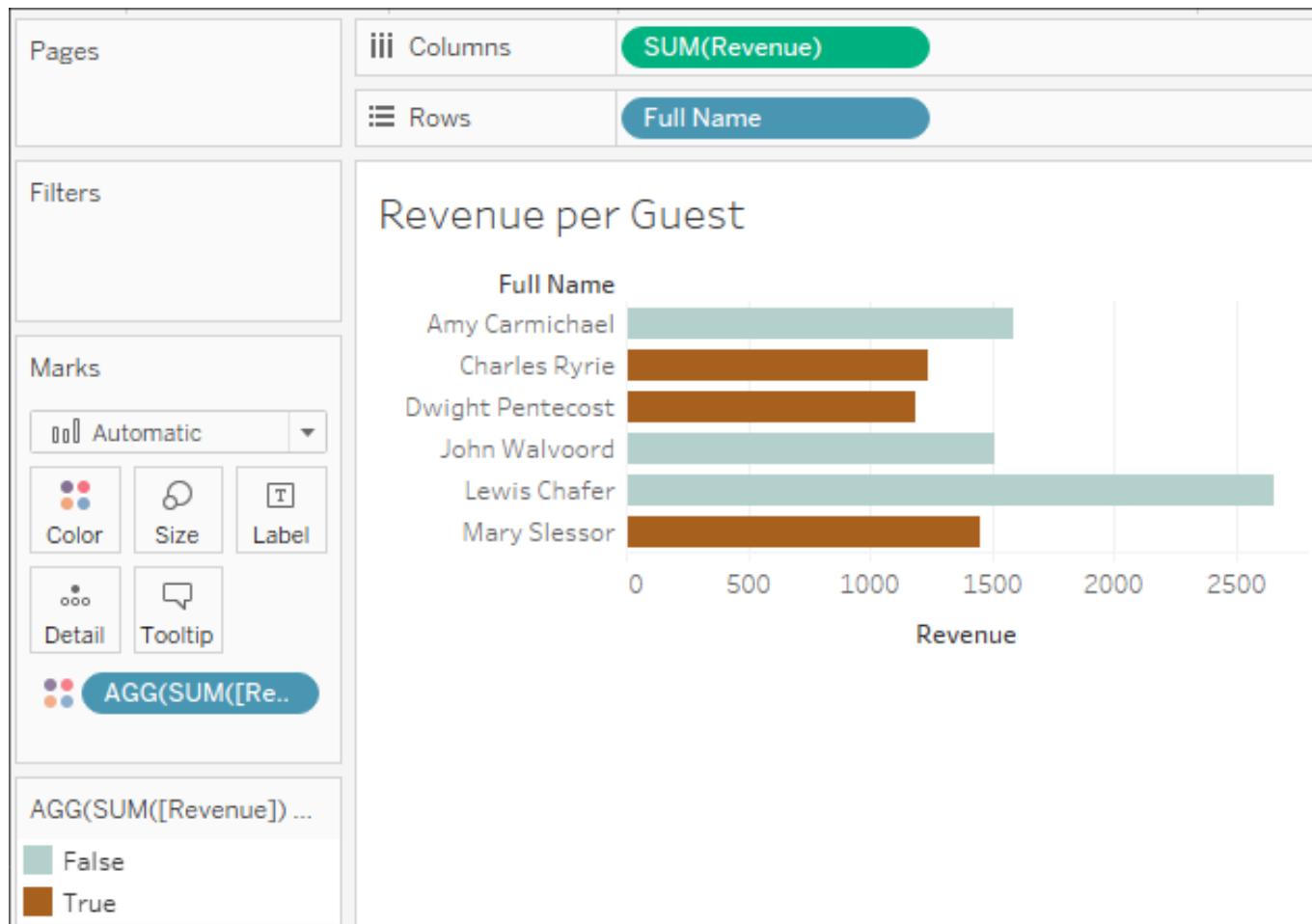
- Let's say you have a simple view that shows the Revenue per Guest, like this:



Ad hoc calculations

- In this example, we've double-clicked the empty space on the Marks shelf:





Performance considerations

- When working with a small dataset and an efficient database, you often won't notice inefficient calculations.
- With larger datasets, the efficiency of your calculations can start to make a difference to the speed at which a view is rendered.

Performance considerations

//This is potentially less efficient...

IF [Type] = "Dog" AND [Age] < 1 THEN "Puppy"

ELSEIF [Type] = "Cat" AND [Age] < 1 THEN "Kitten"

END

//...than this code:

IF [Age] < 1 THEN

 IF [Type] = "Dog" THEN "Puppy"

 ELSEIF [Type] = "Cat" THEN "Kitten"

END

END

Summary

- Calculations open amazing possibilities in Tableau.
- You are no longer confined to the fields in the source data.
- With calculations, you can extend the data by adding new dimensions and measures, fix bad or poorly formatted data, and enhance the user experience with parameters for user input and calculations that enhance the visualizations.

COMPLETE LAB 4

5. Leveraging Level of Detail Calculations



Leveraging Level of Detail Calculations

In this lesson, we'll cover the following:

- Overview of level of detail
- Level of detail calculation syntax and variations
- Examples of FIXED level of detail calculations
- Examples of INCLUDE level of detail calculations
- Examples of EXCLUDE level of detail calculations

Overview of level of detail

What does the term level of detail mean? A lot depends on the context in which the term is used. Within Tableau, we'll distinguish several levels of detail, each of which is vitally important to understand in order to properly analyze data:

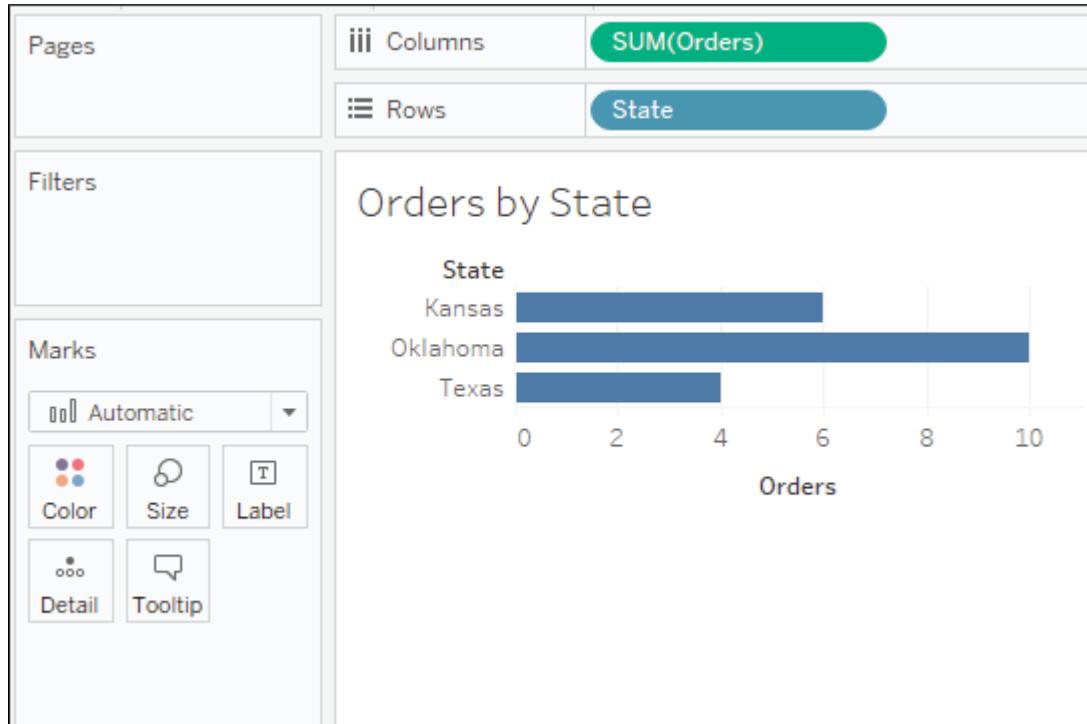
- Data level of detail
- View level of detail
- Calculated level of detail

Overview of level of detail

- Consider the following data set, with a data level of detail of one record per customer:

| Customer | State | Membership Date | Membership Level | Orders |
|----------|----------|-----------------|------------------|--------|
| Neil | Kansas | 2009-05-05 | Silver | 1 |
| Jeane | Kansas | 2012-03-17 | Gold | 5 |
| George | Oklahoma | 2016-02-01 | Gold | 10 |
| Wilma | Texas | 2018-09-17 | Silver | 4 |

- Now consider a view created from the data with a view level of detail of state:



Overview of level of detail

Based on that view, we might want to enhance our understanding by asking additional questions, such as the following:

- Which customer was the first member of each state in the view?
- How does the number of orders per state compare to the average number of orders for all states?
- Which membership level had the highest or lowest number of orders per state?

Level of detail calculations

Level of detail syntax

- Level of detail calculations follow this basic pattern of syntax:

{FIXED|INCLUDE|EXCLUDE [Dim 1],[Dim 2] :
AGG([Field])}

Level of detail types

- Three types of level of detail calculations are used in Tableau: **FIXED**, **INCLUDE**, and **EXCLUDE**.

FIXED

- Fixed level of detail expressions work at the level of detail that's specified by the list of dimensions in the code, regardless of what dimensions are in the view.
- For example, the following code returns the average orders per state, regardless of what other dimensions are in the view:

```
{FIXED [State] : AVG([Orders])}
```

FIXED

- You may include as many dimensions as needed or none.
- The following code represents a fixed calculation of the average orders for the entire set of data from the data source:

{**FIXED** : AVG([Orders])}

- Alternately, you might write the calculation in the following way with identical results:

{AVG([Orders])}

INCLUDE

- For example, the following code calculates the average orders at the level of detail that's defined by dimensions in the view, but includes the dimension Membership Level, even if Membership Level is not in the view:

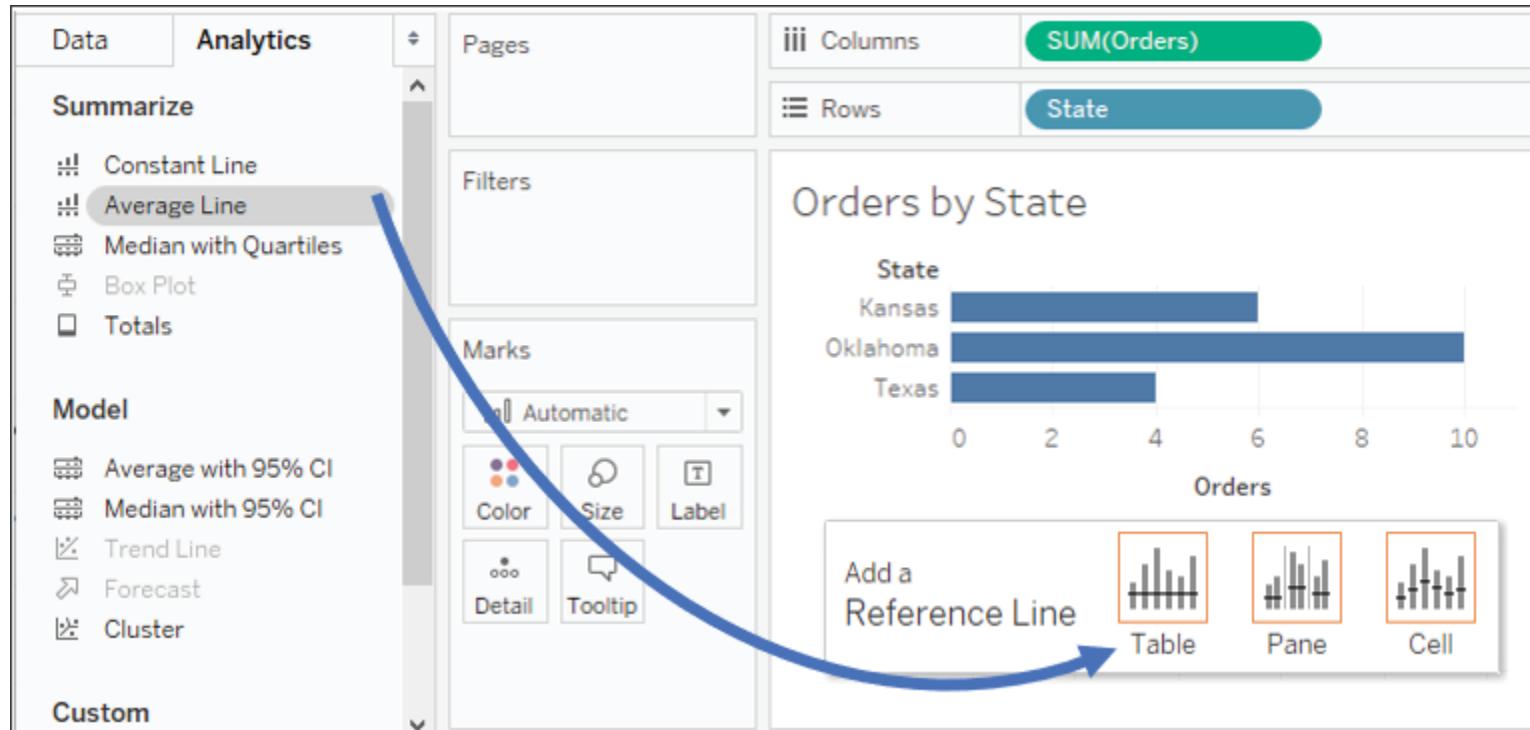
```
{INCLUDE [Membership Level] : AVG([Orders])}
```

EXCLUDE

- For example, the following code calculates the average number of orders at the level of detail defined in the view, but does not include the Customer dimension as part of the level of detail, even if Customer is in the view:

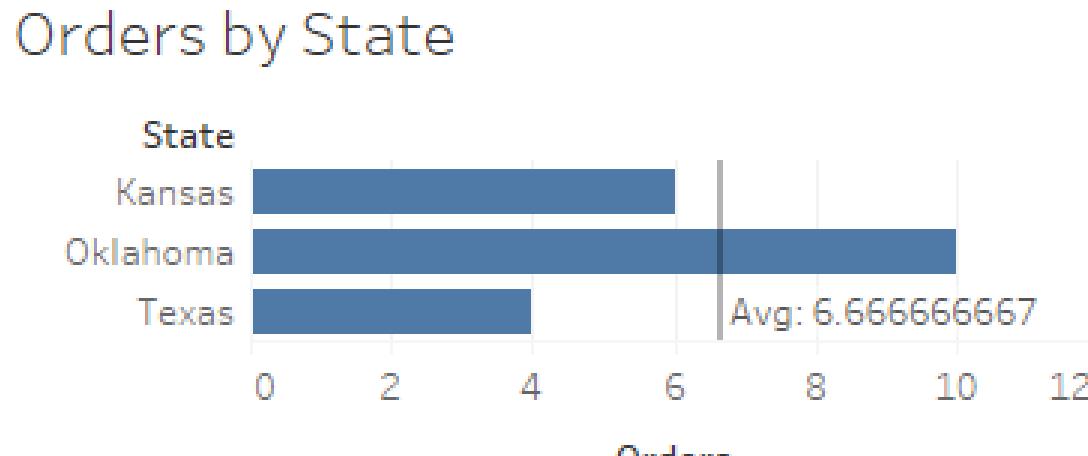
```
{EXCLUDE [Customer] : AVG([Orders])}
```

An illustration of the difference level of detail can make



An illustration of the difference level of detail can make

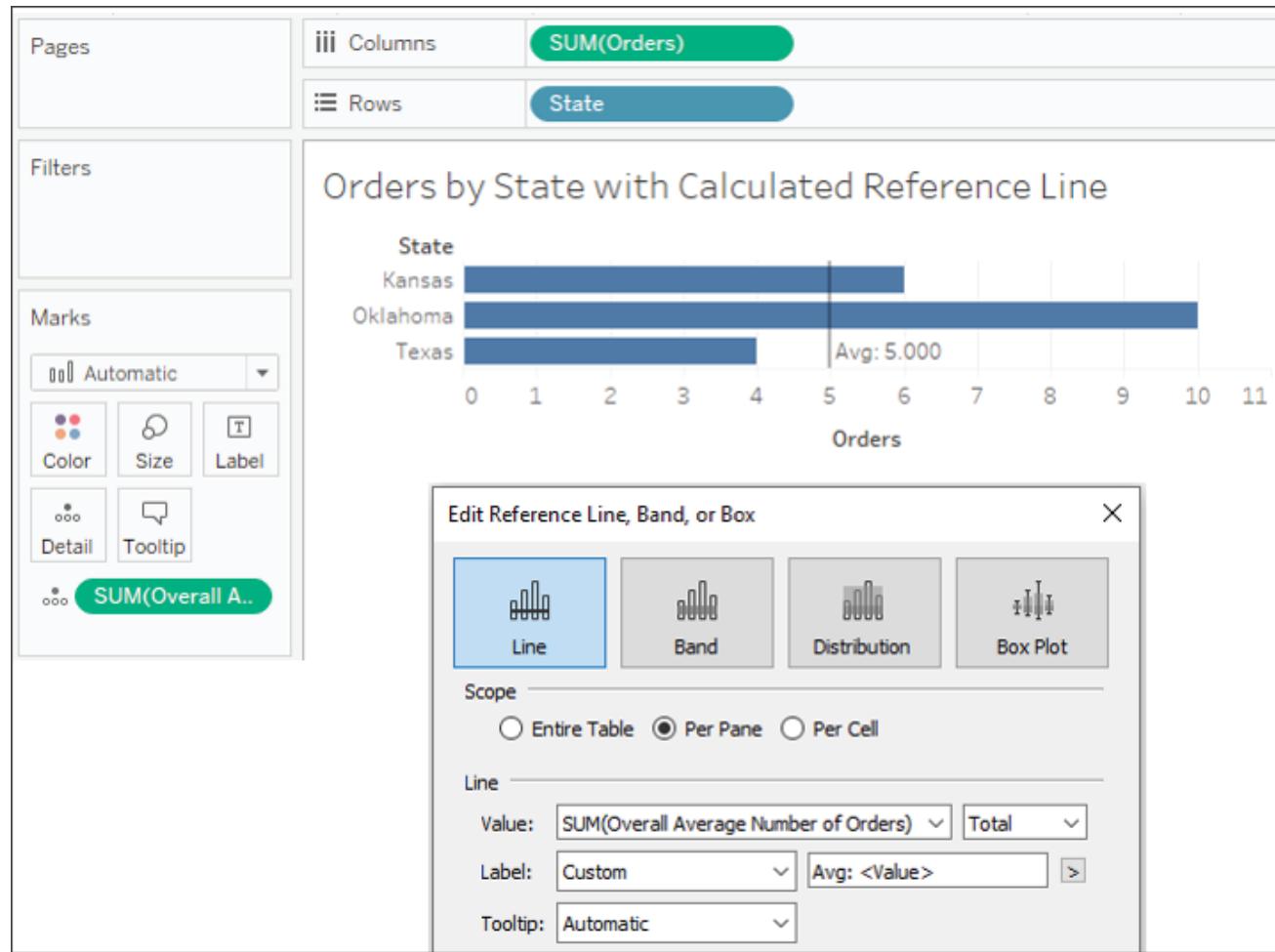
- You'll end up with an average line that looks like this:



An illustration of the difference level of detail can make

- To get the average number of orders present in the entire data set, we might consider creating a calculation named Overall Average Number of Orders and using a fixed level of detail calculation like this:

```
{FIXED : AVG([Orders])}
```



An illustration of the difference level of detail can make

- You'll recall that the original data set had four records, and a quick check validates the result:

$$(1 + 5 + 10 + 4) / 4 = 5$$

Examples of fixed level of detail calculations

| Date | Portfolio | Loan Type | Balance | Open Date | Member Name | Credit Score | Age | State |
|----------|-----------|--------------|---------|------------|-------------|--------------|-----|--------------|
| 3/1/2020 | Auto | New Auto | 15987 | 9/29/2018 | Samuel | 678 | 37 | California |
| 7/1/2020 | Mortgage | 1st Mortgage | 96364 | 8/7/2013 | Lloyd | 768 | 62 | Ohio |
| 3/1/2020 | Mortgage | HELOC | 15123 | 4/2/2013 | Inez | 751 | 66 | Illinois |
| 3/1/2020 | Mortgage | 1st Mortgage | 418635 | 9/30/2015 | Patrick | 766 | 60 | Ohio |
| 5/1/2020 | Auto | Used Auto | 1151 | 10/22/2018 | Eric | 660 | 44 | Pennsylvania |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... |

Was a member ever at risk?

| Member ID | Member Name | Loan Type | Date | Balance | Credit Score |
|-----------|-------------------|-----------|----------|---------|--------------|
| 158 | Vicki Modzelewski | Used Auto | 1/1/2020 | 10,615 | 712 |
| | | | 2/1/2020 | 10,441 | 712 |
| | | | 3/1/2020 | 10,285 | 699 |
| | | | 4/1/2020 | 10,108 | 699 |
| | | | 5/1/2020 | 9,891 | 699 |
| | | | 6/1/2020 | 9,736 | 717 |
| | | | 7/1/2020 | 9,556 | 717 |
| 479 | Thomas Villareal | Used Auto | 2/1/2020 | 7,407 | 526 |
| | | | 3/1/2020 | 7,191 | 526 |
| | | | 4/1/2020 | 6,984 | 563 |
| | | | 5/1/2020 | 6,771 | 563 |
| | | | 6/1/2020 | 6,551 | 563 |
| | | | 7/1/2020 | 6,334 | 591 |
| | | | 8/1/2020 | 6,115 | 591 |
| | | | | | |
| 576 | Charles Reeves | Used Auto | 1/1/2020 | 28,145 | 610 |
| | | | 2/1/2020 | 27,187 | 610 |
| | | | 3/1/2020 | 26,226 | 535 |
| | | | 4/1/2020 | 25,267 | 535 |
| | | | 5/1/2020 | 24,302 | 535 |
| | | | 6/1/2020 | 23,337 | 530 |
| | | | 7/1/2020 | 22,366 | 530 |
| | | | | | |

Was a member ever at risk?

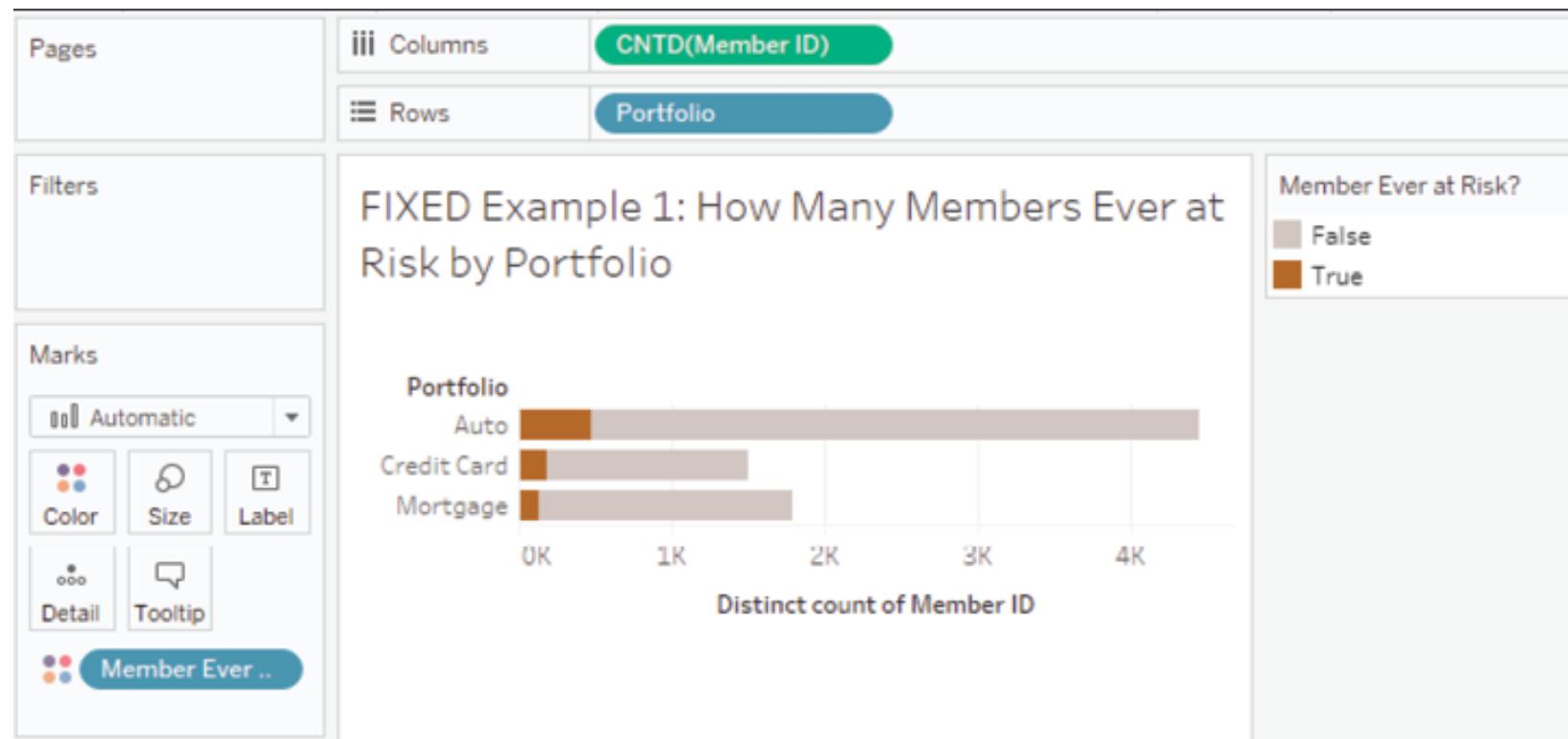
- We want every record for a given member to be TRUE if any of the records for that member are below the threshold and FALSE if none of the records are below the threshold.
- One solution is to use a level of detail calculation, which we'll name Member Ever at Risk?, with the code:

{FIXED [Member ID] : MIN([Credit Score])} < 550

FIXED Example 1: Member Ever at Risk?

| Member ID | Member Name | Loan Type | Date | Member Ever at Risk? | Balance | Credit Score |
|-----------|-------------------|-----------|----------|----------------------|---------|--------------|
| 158 | Vicki Modzelewski | Used Auto | 1/1/2020 | False | 10,615 | 712 |
| | | | 2/1/2020 | False | 10,441 | 712 |
| | | | 3/1/2020 | False | 10,285 | 699 |
| | | | 4/1/2020 | False | 10,108 | 699 |
| | | | 5/1/2020 | False | 9,891 | 699 |
| | | | 6/1/2020 | False | 9,736 | 717 |
| | | | 7/1/2020 | False | 9,556 | 717 |
| 479 | Thomas Villareal | Used Auto | 2/1/2020 | True | 7,407 | 526 |
| | | | 3/1/2020 | True | 7,191 | 526 |
| | | | 4/1/2020 | True | 6,984 | 563 |
| | | | 5/1/2020 | True | 6,771 | 563 |
| | | | 6/1/2020 | True | 6,551 | 563 |
| | | | 7/1/2020 | True | 6,334 | 591 |
| | | | 8/1/2020 | True | 6,115 | 591 |
| 576 | Charles Reeves | Used Auto | 1/1/2020 | True | 28,145 | 610 |
| | | | 2/1/2020 | True | 27,187 | 610 |
| | | | 3/1/2020 | True | 26,226 | 535 |
| | | | 4/1/2020 | True | 25,267 | 535 |
| | | | 5/1/2020 | True | 24,302 | 535 |
| | | | 6/1/2020 | True | 23,337 | 530 |
| | | | 7/1/2020 | True | 22,366 | 530 |

Was a member ever at risk?



Latest balance for a member

Many data sets contain a series of events or a history of transactions. You may find yourself asking questions such as:

- What diagnoses are common for a patient's first visit to the hospital?
- What was the last reported status of each computer on the network?
- How much did each customer spend on their last order?
- How much did the first trade of the week make compared to the last?

| Loan | | | | | |
|-----------|------------------|--------|---------------|----------|---------|
| Member ID | Member Name | Number | Loan Type | Date | |
| 14827 | Kelly Wooldridge | 1 | New Auto Plus | 1/1/2020 | 21,684 |
| | | | | 2/1/2020 | 21,348 |
| | | | | 3/1/2020 | 21,001 |
| | | | | 4/1/2020 | 21,001 |
| | | | | 5/1/2020 | 20,327 |
| | | | | 6/1/2020 | 19,987 |
| | | | | 7/1/2020 | 19,646 |
| 16024 | Joseph Clark | 1 | Used Auto | 2/1/2020 | 19,043 |
| | | | | 3/1/2020 | 18,656 |
| | | | | 4/1/2020 | 18,263 |
| | | | | 5/1/2020 | 17,873 |
| | | | | 6/1/2020 | 17,479 |
| | | | | 7/1/2020 | 17,087 |
| | | | | 8/1/2020 | 16,691 |
| | | | | | |
| 16070 | Gerald Quinney | 1 | 1st Mortgage | 3/1/2020 | 144,138 |
| | | | | 4/1/2020 | 140,943 |
| | | | | 5/1/2020 | 137,737 |
| | | | | 6/1/2020 | 134,520 |
| | | | | 7/1/2020 | 131,293 |
| | | | | | |
| | | 2 | Used Auto | 3/1/2020 | 6,809 |
| | | | | 4/1/2020 | 6,636 |
| | | | | 5/1/2020 | 6,460 |
| | | | | 6/1/2020 | 6,285 |
| | | | | 7/1/2020 | 6,107 |
| | | | | 8/1/2020 | 5,929 |
| | | | | 9/1/2020 | 5,749 |

Latest balance for a member

- What if you want to identify only the records that represent the latest known balance for a member?
- You might consider using a fixed level of detail calculation called Latest Date per Member/Loan with code such as this:

{FIXED [Member ID],[Loan Number] : MAX([Date])} = [Date]

FIXED Example 2: Most Recent Balance

| Member ID | Member Name | Loan Number | Loan Type | Date | Latest Date per Member/Loan |
|-----------|------------------|-------------|---------------|----------|-----------------------------|
| 14827 | Kelly Wooldridge | 1 | New Auto Plus | 1/1/2020 | False 21,684 |
| | | | | 2/1/2020 | False 21,348 |
| | | | | 3/1/2020 | False 21,001 |
| | | | | 4/1/2020 | False 21,001 |
| | | | | 5/1/2020 | False 20,327 |
| | | | | 6/1/2020 | False 19,987 |
| | | | | 7/1/2020 | True 19,646 |
| 16024 | Joseph Clark | 1 | Used Auto | 2/1/2020 | False 19,043 |
| | | | | 3/1/2020 | False 18,656 |
| | | | | 4/1/2020 | False 18,263 |
| | | | | 5/1/2020 | False 17,873 |
| | | | | 6/1/2020 | False 17,479 |
| | | | | 7/1/2020 | False 17,087 |
| | | | | 8/1/2020 | True 16,691 |
| 16070 | Gerald Quinney | 1 | 1st Mortgage | 3/1/2020 | False 144,138 |
| | | | | 4/1/2020 | False 140,943 |
| | | | | 5/1/2020 | False 137,737 |
| | | | | 6/1/2020 | False 134,520 |
| | | | | 7/1/2020 | True 131,293 |
| | | 2 | Used Auto | 3/1/2020 | False 6,809 |
| | | | | 4/1/2020 | False 6,636 |
| | | | | 5/1/2020 | False 6,460 |
| | | | | 6/1/2020 | False 6,285 |
| | | | | 7/1/2020 | False 6,107 |
| | | | | 8/1/2020 | False 5,929 |
| | | | | 9/1/2020 | True 5,749 |

- You can see the results of the calculation here:

Example of include level of detail expressions

- Include level of detail calculations can be very useful when you need to perform certain calculations at levels of detail that are lower (more detailed) than the view level of detail.
- Let's take a look at an example.

Pages

Columns

Longitude (generated)

Filters

Rows

Latitude (generated)

Marks

Map

Color

Size

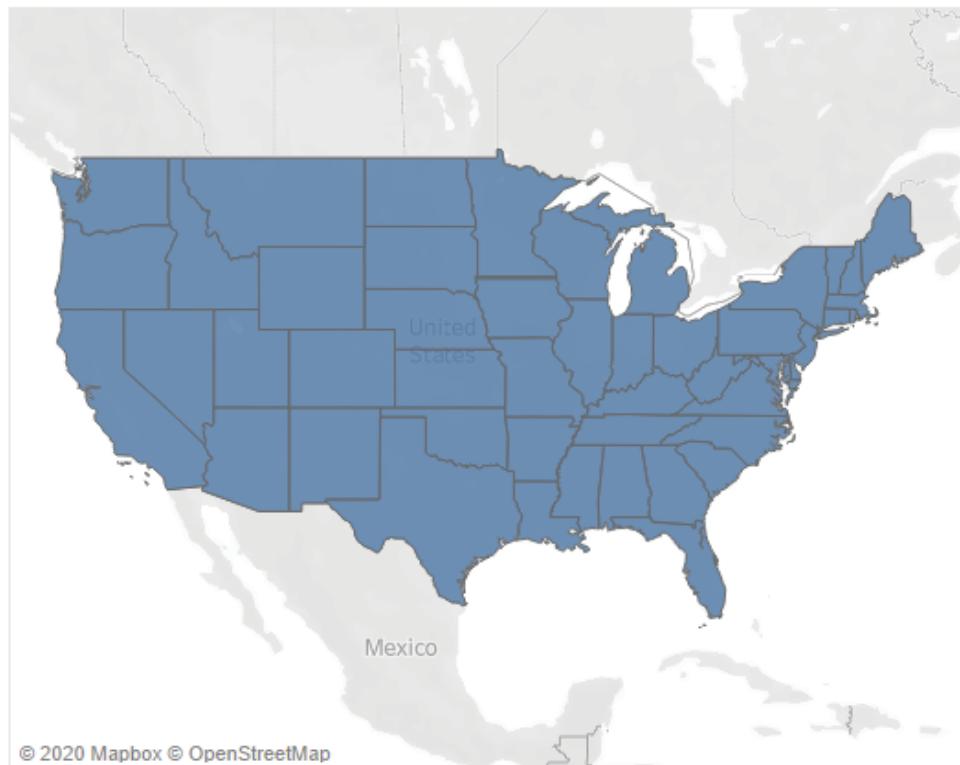
Label

Detail

Tooltip

State

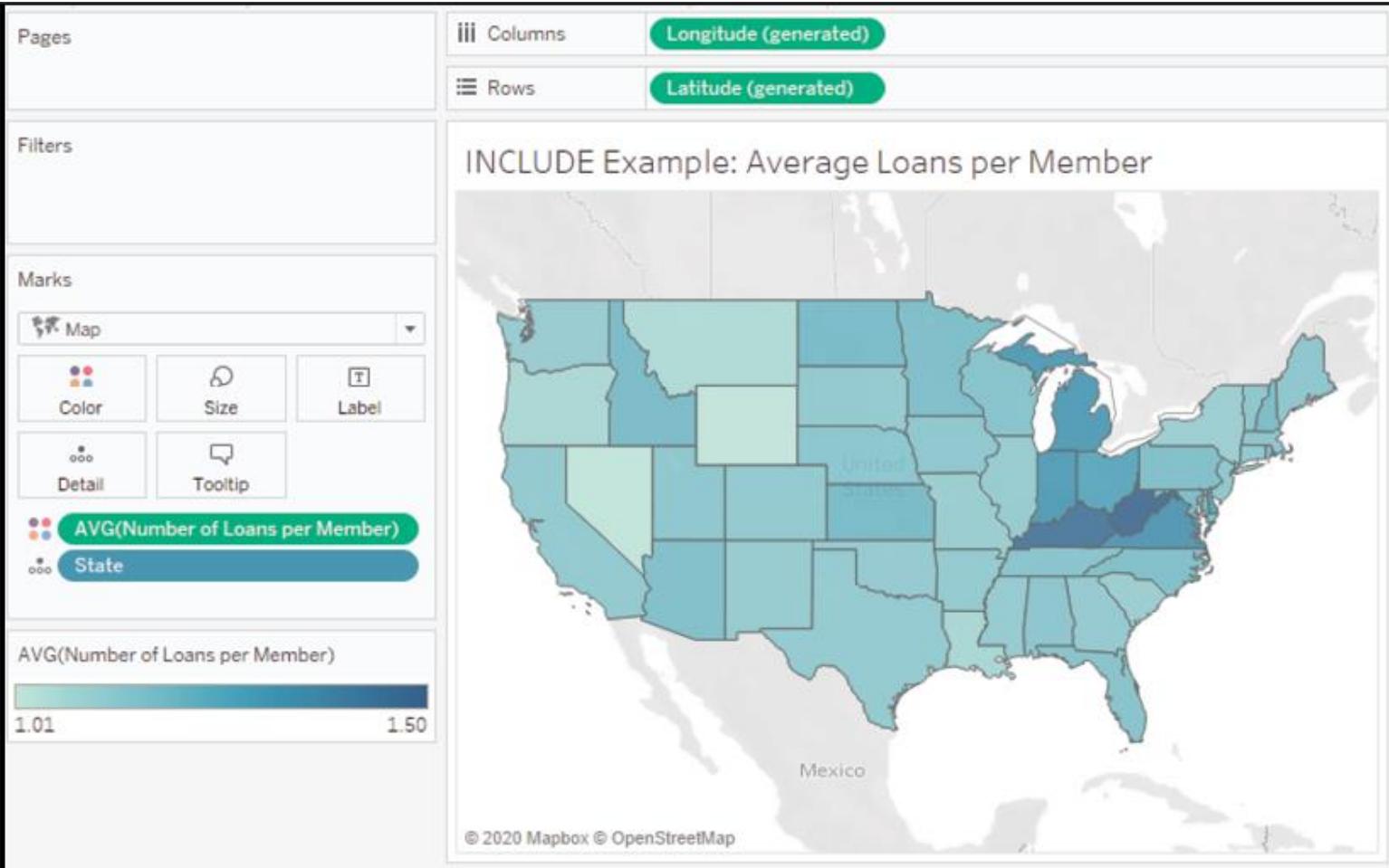
INCLUDE Example: Average Loans per Member



Average loans per member

- While there are several possible approaches to solving this kind of problem, here we'll consider using the following level of detail expression named Number of Loans per Member:

```
{INCLUDE [Member ID] : COUNTD([Loan Number])}
```



Pages

iii Columns

Rows State Member ID

Filters

State: North Dakota

Marks

Automatic

Color

Size

Text

Detail

Tooltip

CNTD(Loan Number)

Crosstab to illustrate

| State | Member ID |
|--------|-----------|
| North | 1576 |
| Dakota | 2557 |
| | 2660 |
| | 3548 |
| | 4491 |
| | 4656 |
| | 5365 |
| | 6460 |
| | 6517 |
| | 9601 |
| | 10147 |
| | 11258 |
| | 11895 |
| | 19140 |
| | 28925 |

Alternative approaches

- It's worth noting that the above dataset actually allows you to use MAX([Loan Number]) instead of COUNTD([Loan Number]) as the number simply increments for each member based on how many loans they have.
- The highest number is identical to the number of loans for that member.

Alternative approaches

- There are also a few other approaches to solving this problem, such as the calculation.
- For example, you could write the following code:

```
COUNTD(STR([Member ID]) + "_" + STR([Loan  
Number]))  
/  
COUNTD([Member ID])
```

Alternative approaches

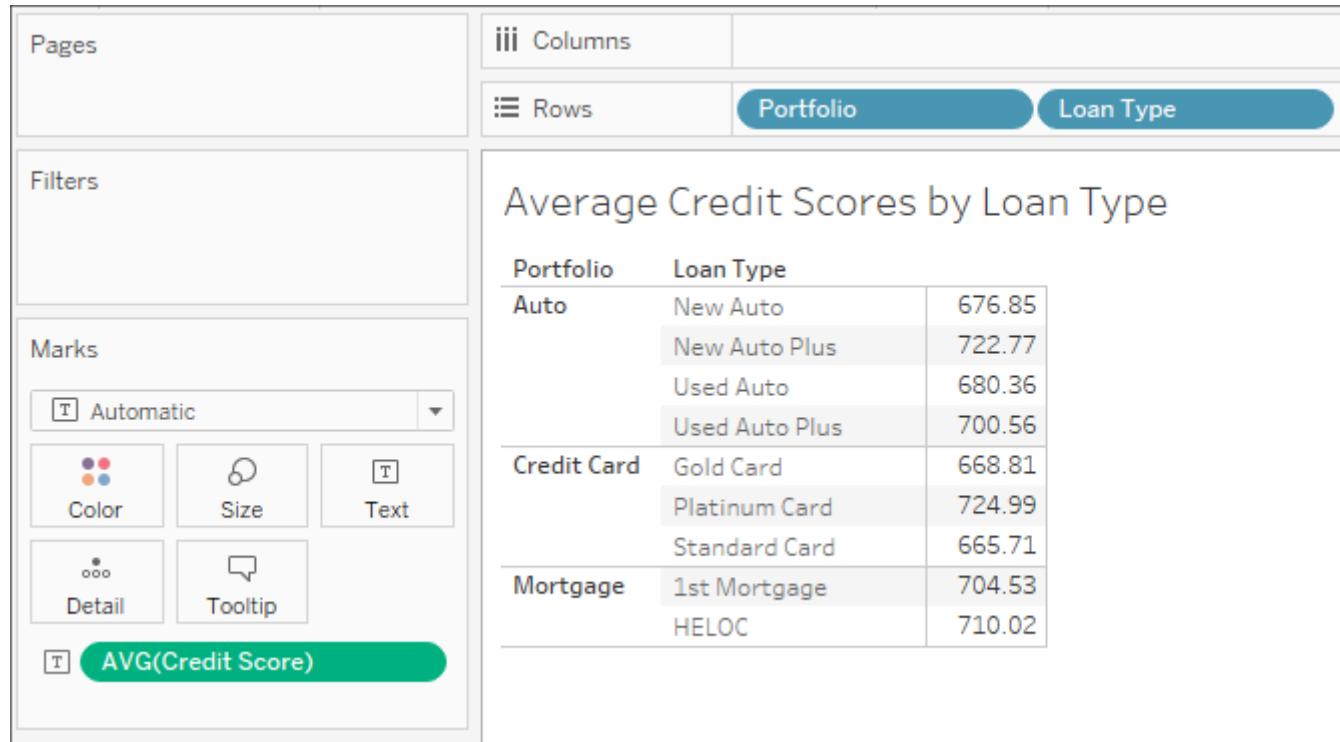
- Another approach would be to use a fixed level of detail expression, such as:

```
{FIXED [State],[Member ID] : COUNTD([Loan Number])}
```

Example of exclude level of detail calculations

- Exclude level of detail calculations are useful when you want to perform certain calculations at higher (less detailed) levels than the view level of detail.
- The following example will demonstrate how we can leverage this functionality.

Average credit score per loan type



Average credit score per loan type

- What if we wanted to compare the average credit score of each loan type with the overall average credit score for the entire portfolio?
- We could accomplish this with an exclude level of detail calculation that looks like this:

{EXCLUDE [Loan Type] : AVG([Credit Score])}

Pages

iii Columns Measure Names

Rows Portfolio Loan Type

Filters

Measure Names

Marks

Automatic

Color Size Text

Detail Tooltip

Measure Values

ATTR(Average Credit Score Excl.)

AVG(Credit Score)

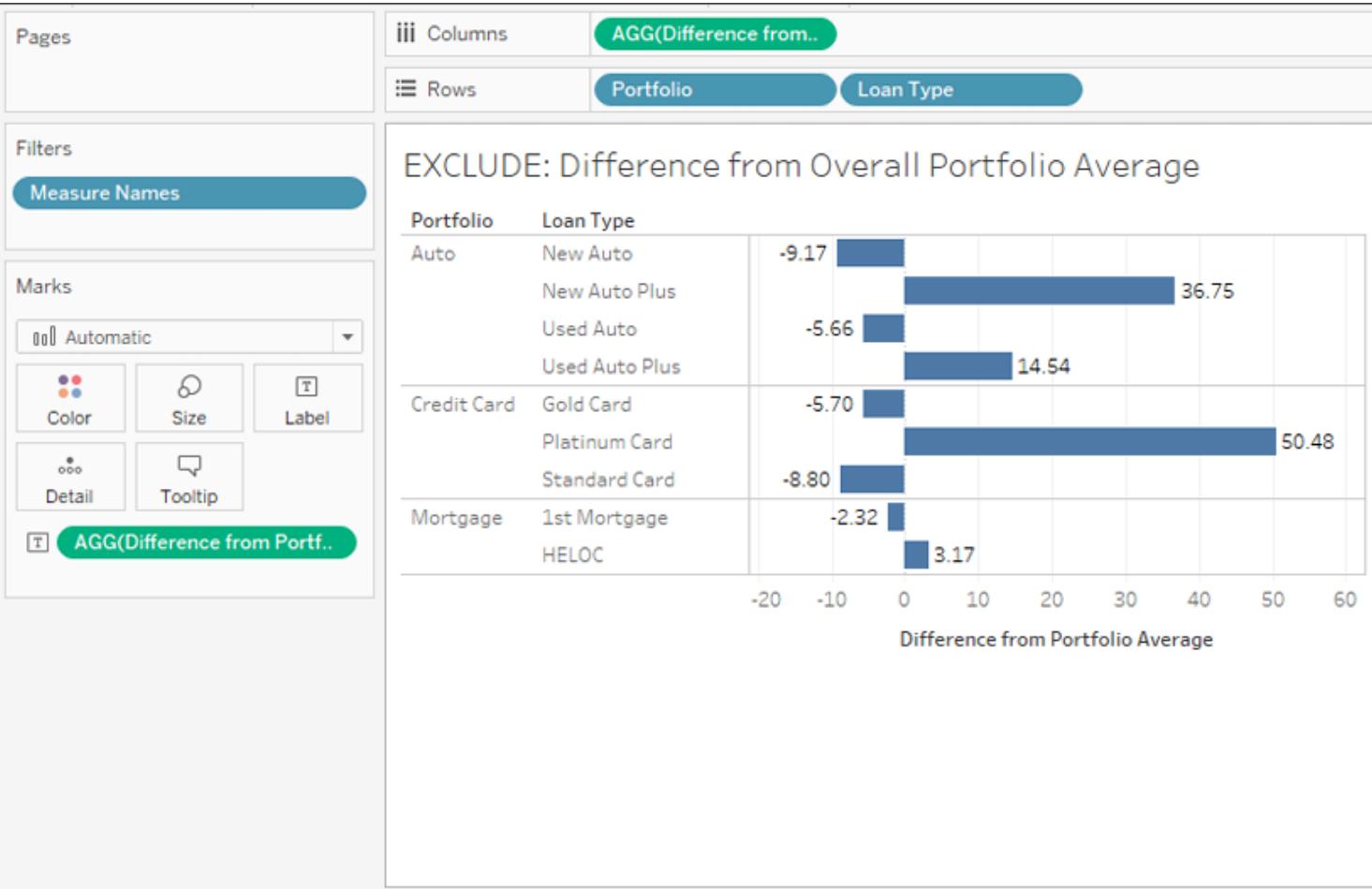
EXCLUDE: Avg Credit Scores

| Portfolio | Loan Type | Average Credit Score Excluding Loan Type | Avg. Credit Score |
|-------------|----------------|---|-------------------|
| Auto | New Auto | 686.02 | 676.85 |
| | New Auto Plus | 686.02 | 722.77 |
| | Used Auto | 686.02 | 680.36 |
| | Used Auto Plus | 686.02 | 700.56 |
| Credit Card | Gold Card | 674.51 | 668.81 |
| | Platinum Card | 674.51 | 724.99 |
| | Standard Card | 674.51 | 665.71 |
| Mortgage | 1st Mortgage | 706.85 | 704.53 |
| | HELOC | 706.85 | 710.02 |

Average credit score per loan type

- We can extend the calculation a bit to give us the difference between the overall portfolio average and the average of each loan type.
- The code would look like this:

AVG([Credit Score]) - AVG([Average Credit Score Excluding Loan Type])



Summary

- Level of detail expressions greatly extend what you can accomplish with calculations.
- You now have a toolset for working with data at different levels of detail.
- With fixed level of detail calculations, you can identify the first or last event in a series or whether a condition is ever true across entire subsets of data.

COMPLETE LAB 5

6. Diving Deep with Table Calculations



Diving Deep with Table Calculations

- They make it possible to use data that isn't structured well and still get quick results without waiting for someone to fix the data at the source.
- They make it possible to compare and perform calculations on aggregate values across rows of the resulting table.
- They open incredible possibilities for analysis and creative approaches to solving problems, highlighting insights, or improving the user experience.

Diving Deep with Table Calculations

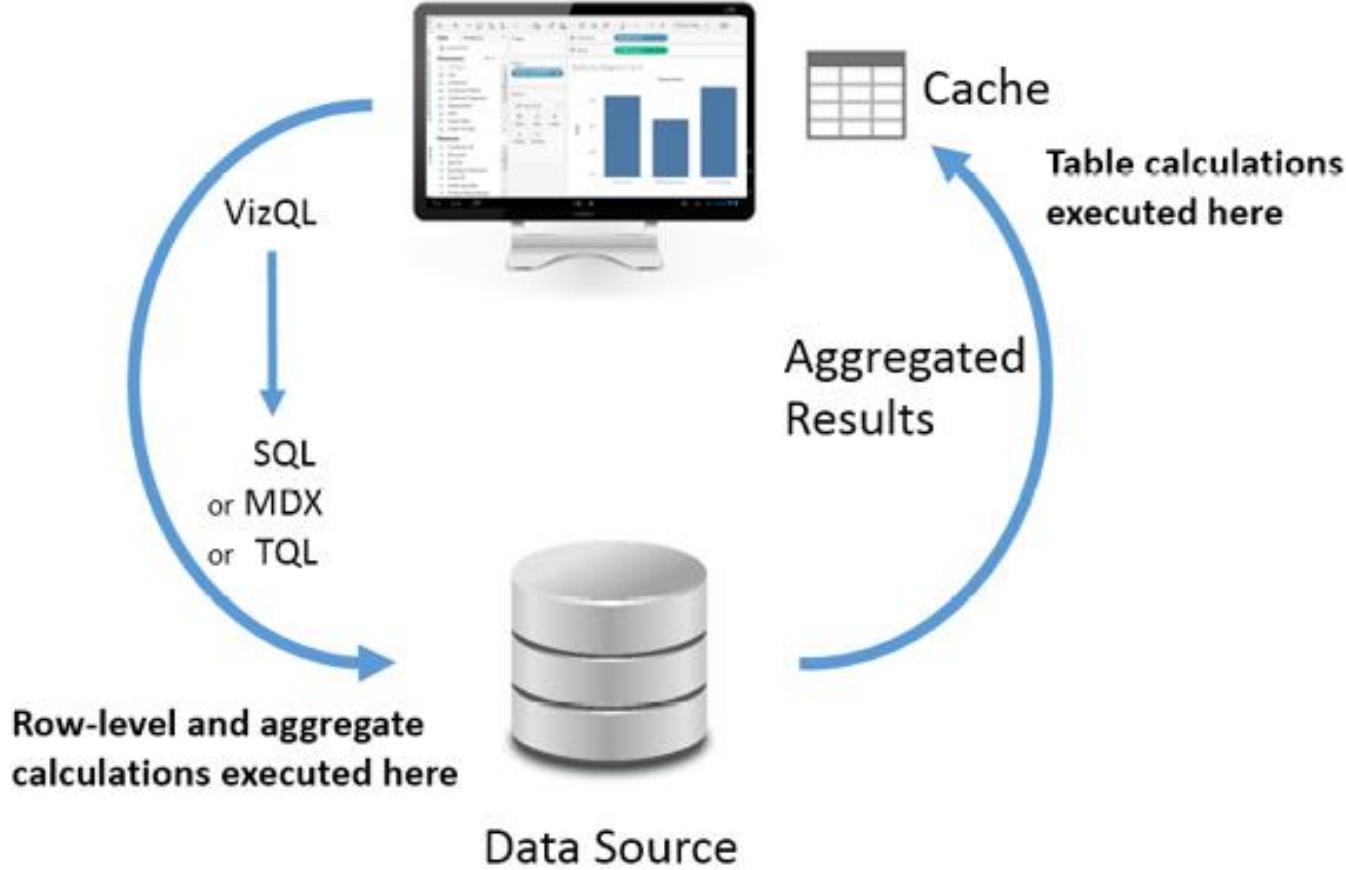
We'll consider these topics:

- An overview of table calculations
- Quick table calculations
- Scope and direction
- Addressing and partitioning
- Custom table calculations
- Practical examples

An overview of table calculations

- Table calculations are different from all other calculations in Tableau. Row-level, aggregate calculations, and LOD expressions, which we explored in the previous lessons, are performed as part of the query to the data source.
- If you were to examine the queries sent to the data source by Tableau, you'd find the code for your calculations translated into whatever implementation of SQL the data source used.

Tableau



Creating and editing table calculations

There are several ways to create table calculations in Tableau, including:

- Using the drop-down menu for any active field used as a numeric aggregate in the view, select Quick Table Calculation and then the desired calculation type.
- Using the drop-down menu for any active field that is used as a numeric aggregate in the view, select Add Table Calculation, then select the calculation type, and adjust any desired settings.
- Creating a calculated field and using one or more table calculation functions to write your own custom table calculations.

An overview of table calculations

Following is a snippet of an active field without a table calculation:



SUM(Sales)

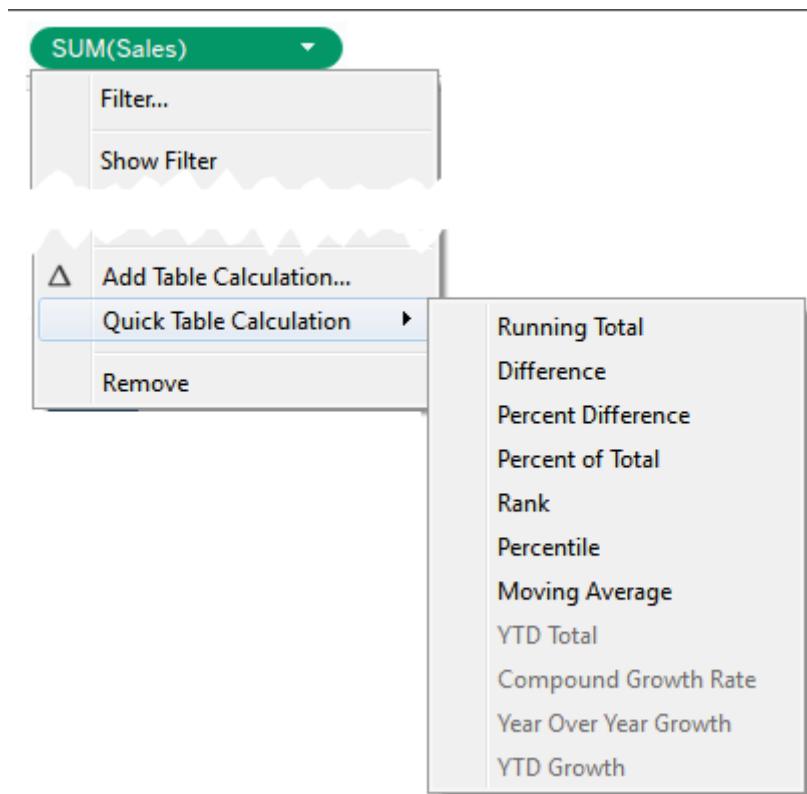
An active field without a table calculation applied

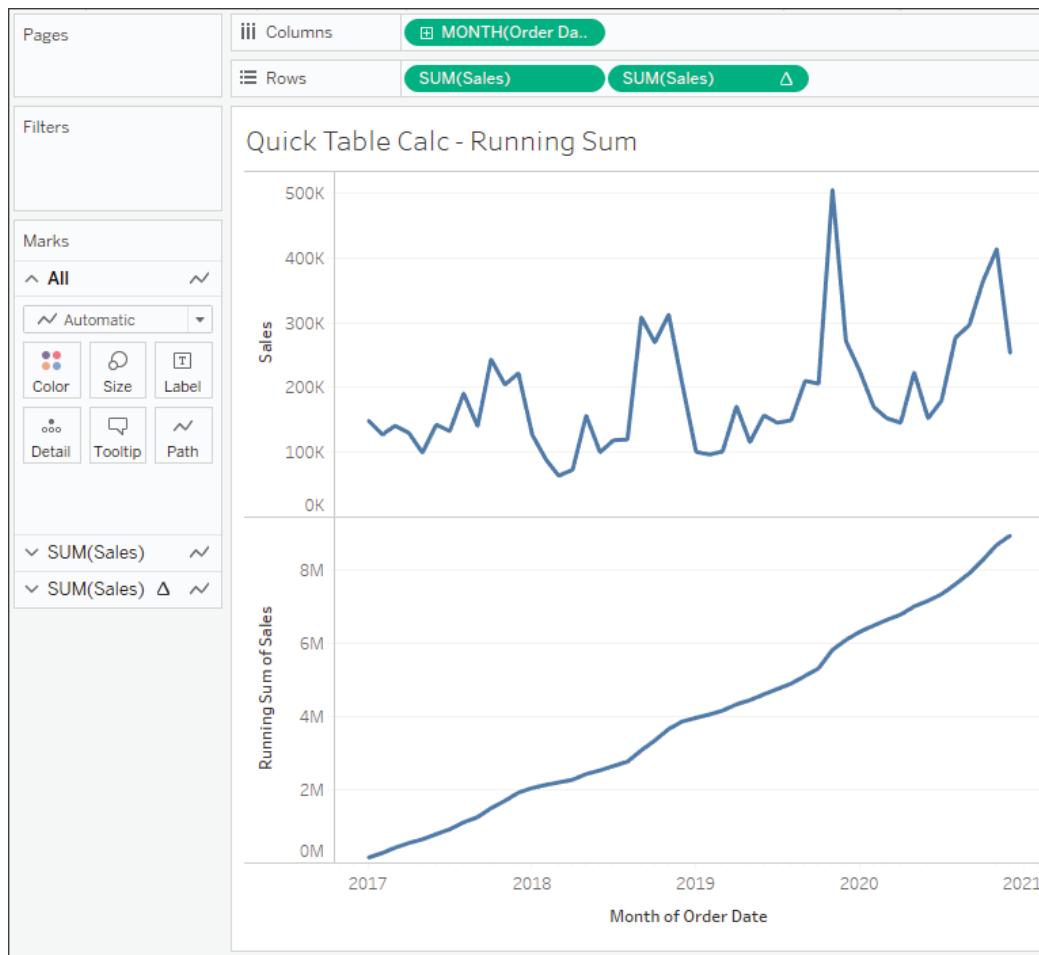
Following is the active field with a table calculation:



SUM(Sales) Δ

Quick table calculations





Some examples of Quick Table Calcs

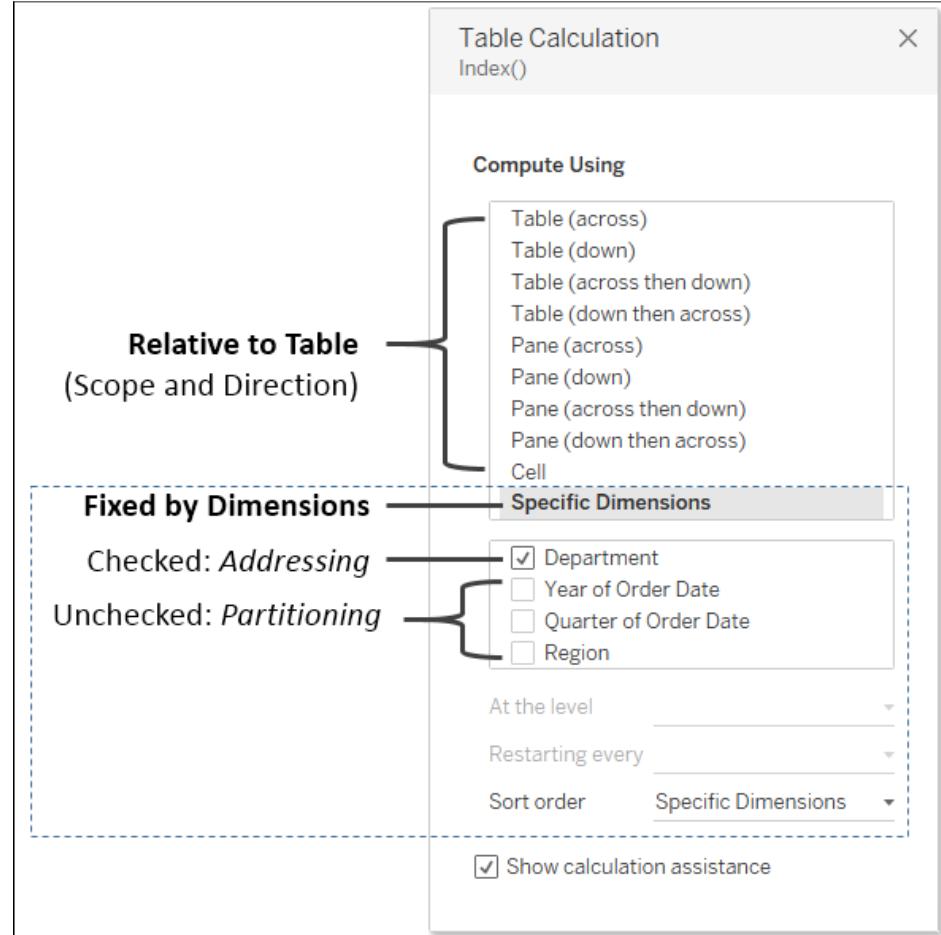
| Year of Order Date | Quarter of Order Date | Sales | Running Sum of Sales along Table (Down) | Difference in Sales from the Previous along Table (Down) | Rank of Sales along Table (Down) |
|--------------------|-----------------------|-----------|---|--|----------------------------------|
| 2017 | Q1 | 417,555 | 417,555 | | 12 |
| | Q2 | 372,289 | 789,844 | -45,266 | 13 |
| | Q3 | 464,319 | 1,254,163 | 92,030 | 10 |
| | Q4 | 670,182 | 1,924,345 | 205,863 | 5 |
| 2018 | Q1 | 279,148 | 2,203,493 | -391,034 | 16 |
| | Q2 | 330,269 | 2,533,762 | 51,121 | 14 |
| | Q3 | 546,875 | 3,080,637 | 216,606 | 7 |
| | Q4 | 788,255 | 3,868,892 | 241,380 | 3 |
| 2019 | Q1 | 298,848 | 4,167,740 | -489,407 | 15 |
| | Q2 | 443,764 | 4,611,504 | 144,916 | 11 |
| | Q3 | 505,453 | 5,116,957 | 61,689 | 9 |
| | Q4 | 982,675 | 6,099,632 | 477,222 | 2 |
| 2020 | Q1 | 547,656 | 6,647,288 | -435,019 | 6 |
| | Q2 | 521,650 | 7,168,938 | -26,006 | 8 |
| | Q3 | 752,933 | 7,921,871 | 231,283 | 4 |
| | Q4 | 1,030,156 | 8,952,027 | 277,223 | 1 |

Relative versus fixed

We'll look at the details shortly, but first it is important to understand that table calculations may be computed in one of the two following ways:

- Relative
- Fixed

- You can see these concepts in the user interface.
- The following is the Table Calculation editor that appears when you select Edit Table Calculation from the menu of a table calculation field:



Scope and direction

Scope and direction are terms that describe how a table calculation is computed relative to the table. Specifically, scope and direction refer to the following:

- **Scope:** The scope defines the boundaries within which a given table calculation can reference other values.
- **Direction:** The direction defines how the table calculation moves within the scope.

Scope and direction

The options for scope and direction relative to the table are as follows:

- Scope options: Table, pane, and cells
- Direction options: Down, across, down then across, across then down

Pages

iii Columns Region Department

Rows YEAR(Order Date) QUARTER(Order ...)

Filters

Region

YEAR(Order Date)

Marks

Automatic

Color Size Text

Detail Tooltip

SUM(Sales)

Tables, Panes, Cells

| | | Region / Department | | | | | |
|------|----|---------------------|-----------------|------------|-----------|-----------------|------------|
| | | East | | | West | | |
| | | Furniture | Office Supplies | Technology | Furniture | Office Supplies | Technology |
| 2017 | Q1 | 103,094 | 21,517 | 47,770 | 41,391 | 6,221 | 24,258 |
| | Q2 | 50,254 | 77,176 | 35,663 | 44,256 | 5,275 | 30,549 |
| | Q3 | 33,016 | 34,014 | 30,213 | 32,794 | 30,200 | 119,668 |
| | Q4 | 72,409 | 124,765 | 108,417 | 43,313 | 35,524 | 26,782 |
| 2018 | Q1 | 55,241 | 26,176 | 19,534 | 20,296 | 9,793 | 28,652 |
| | Q2 | 47,499 | 29,320 | 41,988 | 22,534 | 19,487 | 31,268 |
| | Q3 | 102,001 | 44,762 | 81,264 | 46,923 | 15,995 | 74,876 |
| | Q4 | 63,724 | 75,442 | 110,800 | 41,742 | 39,343 | 101,173 |
| 2019 | Q1 | 33,938 | 20,638 | 23,858 | 14,296 | 17,108 | 13,947 |
| | Q2 | 47,778 | 51,273 | 73,519 | 37,173 | 36,998 | 35,092 |
| | Q3 | 83,456 | 59,039 | 32,302 | 34,504 | 16,305 | 76,077 |
| | Q4 | 124,363 | 65,704 | 86,405 | 171,909 | 51,372 | 62,808 |
| 2020 | Q1 | 51,050 | 74,600 | 83,149 | 53,471 | 24,272 | 33,619 |
| | Q2 | 57,299 | 83,749 | 52,066 | 22,994 | 19,818 | 42,868 |
| | Q3 | 92,243 | 51,459 | 70,612 | 56,791 | 62,900 | 66,427 |
| | Q4 | 132,884 | 98,473 | 157,206 | 42,129 | 45,894 | 71,268 |

Table

Pane

Cell

Working with scope and direction

- In order to see how scope and direction work together, let's work through a few examples.
- We'll start by creating our own custom table calculations. Create a new calculated field named Index with the code `Index()`.
- `Index()` is a table calculation function that starts with a value of 1 and increments by one as it moves in each direction and within a given scope.

Table (across):



| | | East | | | West | | |
|------|----|-----------|-----------------|------------|-----------|-----------------|------------|
| | | Furniture | Office Supplies | Technolo.. | Furniture | Office Supplies | Technolo.. |
| 2015 | Q1 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q2 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q3 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q4 | 1 | 2 | 3 | 4 | 5 | 6 |
| 2016 | Q1 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q2 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q3 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q4 | 1 | 2 | 3 | 4 | 5 | 6 |

Table (down):

| | | East | | | West | | |
|------|----|-----------|----------|------------|-----------|----------|------------|
| | | Office | | | Office | | |
| | | Furniture | Supplies | Technolo.. | Furniture | Supplies | Technolo.. |
| 2015 | Q1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Q2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Q3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Q4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 2016 | Q1 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Q2 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Q3 | 7 | 7 | 7 | 7 | 7 | 7 |
| | Q4 | 8 | 8 | 8 | 8 | 8 | 8 |



Table (across then down):



| | | East | | | West | | |
|------|----|-----------|-----------------|------------|-----------|-----------------|------------|
| | | Furniture | Office Supplies | Technolo.. | Furniture | Office Supplies | Technolo.. |
| 2015 | Q1 | 1 | 2 | 3 | 4 | 5 | 6 |
| | Q2 | 7 | 8 | 9 | 10 | 11 | 12 |
| | Q3 | 13 | 14 | 15 | 16 | 17 | 18 |
| | Q4 | 19 | 20 | 21 | 22 | 23 | 24 |
| 2016 | Q1 | 25 | 26 | 27 | 28 | 29 | 30 |
| | Q2 | 31 | 32 | 33 | 34 | 35 | 36 |
| | Q3 | 37 | 38 | 39 | 40 | 41 | 42 |
| | Q4 | 43 | 44 | 45 | 46 | 47 | 48 |

Pane (across):

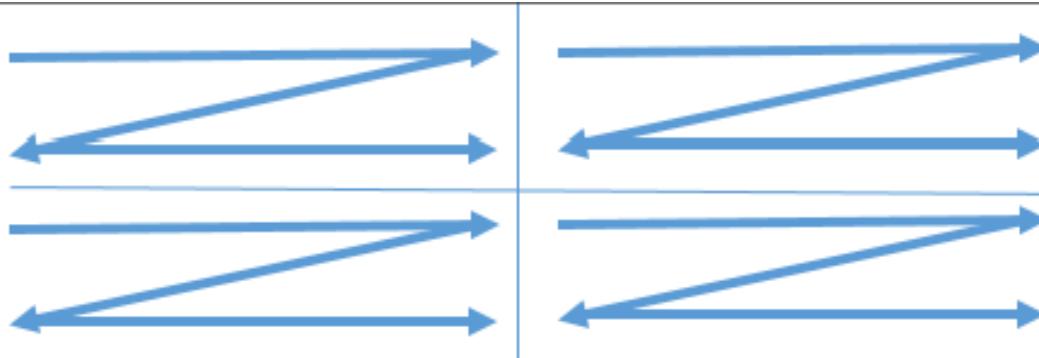


| | | East | | | West | | |
|------|----|-----------|-----------------|------------|-----------|-----------------|------------|
| | | Furniture | Office Supplies | Technolo.. | Furniture | Office Supplies | Technolo.. |
| 2015 | Q1 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q2 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q4 | 1 | 2 | 3 | 1 | 2 | 3 |
| 2016 | Q1 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q2 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q4 | 1 | 2 | 3 | 1 | 2 | 3 |

Pane (down):

| | | East | | | West | | | |
|------|----|-----------|-----------------|------------|-----------|-----------------|------------|---|
| | | Furniture | Office Supplies | Technolo.. | Furniture | Office Supplies | Technolo.. | |
| 2015 | Q1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Q2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Q3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Q4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 2016 | Q1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Q2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Q3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Q4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |





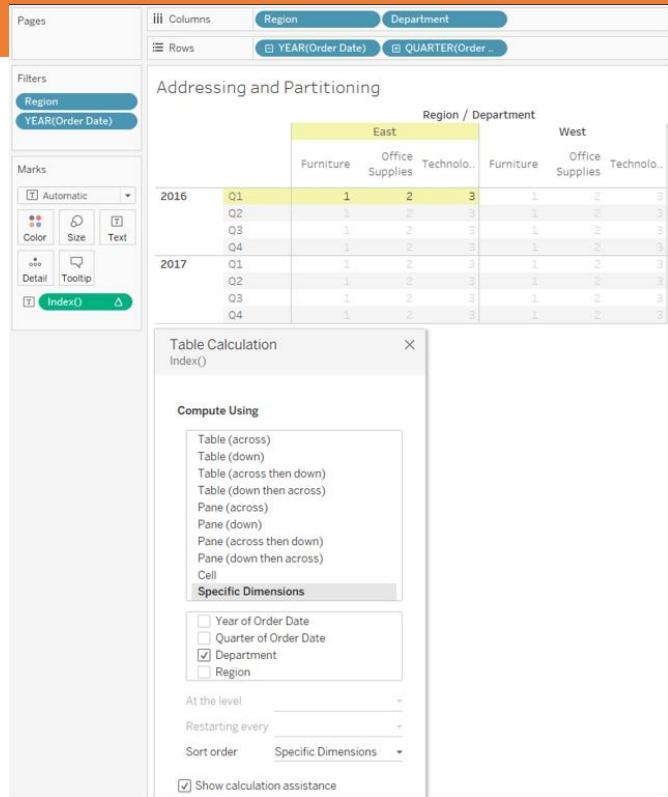
| | | East | | | West | | |
|------|----|-----------|-----------------|------------|-----------|-----------------|------------|
| | | Furniture | Office Supplies | Technolo.. | Furniture | Office Supplies | Technolo.. |
| 2015 | Q1 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q2 | 4 | 5 | 6 | 4 | 5 | 6 |
| | Q3 | 7 | 8 | 9 | 7 | 8 | 9 |
| | Q4 | 10 | 11 | 12 | 10 | 11 | 12 |
| 2016 | Q1 | 1 | 2 | 3 | 1 | 2 | 3 |
| | Q2 | 4 | 5 | 6 | 4 | 5 | 6 |
| | Q3 | 7 | 8 | 9 | 7 | 8 | 9 |
| | Q4 | 10 | 11 | 12 | 10 | 11 | 12 |

Addressing and partitioning

- Addressing and partitioning are very similar to scope and direction but are most often used to describe how table calculations are computed with absolute reference to certain fields in the view.
- With addressing and partitioning, you define which dimensions in the view define the addressing (direction) and all others define the partitioning (scope).

Addressing and partitioning

- The result of selecting Department is as follows:



Pages YEAR(Order Date) QUARTER(Order ...)

Rows Region Department

Filters
 Region
 YEAR(Order Date)

Marks
 Automatic
Color Size Text
Detail Tooltip
 Index() △

Addressing and Partitioning

| | | Order Date | | | | Order Date | | | |
|------|-----------------|------------|----|----|----|------------|----|----|----|
| | | 2016 | | | | 2017 | | | |
| | | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| East | Furniture | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Office Supplies | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Technology | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| West | Furniture | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Office Supplies | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Technology | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Table Calculation X

Compute Using

- Table (across)
- Table (down)
- Table (across then down)
- Table (down then across)
- Pane (across)
- Pane (down)
- Pane (across then down)
- Pane (down then across)
- Cell
- Specific Dimensions**

Year of Order Date
 Quarter of Order Date
 Department
 Region

At the level _____

Restarting every _____

Sort order Specific Dimensions

Show calculation assistance

Working with addressing and partitioning

The screenshot shows the Tableau interface with the following components:

- Top Bar:** Shows "Pages", "Region" (selected), "Department", "Rows", "YEAR(Order Date)", and "QUARTER(Order ..)".
- Left Panel:** Includes "Filters" (Region, YEAR(Order Date)), "Marks" (Automatic, Color, Size, Text, Detail, Tooltip, Index()), and a "Table Calculation" window.
- Addressing and Partitioning Window:** A grid titled "Region / Department" with columns for East (Furniture, Office Supplies, Technology) and West (Furniture, Office Supplies, Technology). The data is partitioned by Year (2016, 2017) and Quarter (Q1-Q4).
- Table Calculation Window:** Details the "Index()" calculation, including "Compute Using" (specific dimensions: Department, Quarter of Order Date), "At the level" (Deepest), "Restarting every" (None), "Sort order" (Specific Dimensions), and "Show calculation assistance".

| | | Region / Department | | | | | |
|------|----|---------------------|-----------------|------------|-----------|-----------------|------------|
| | | East | | | West | | |
| | | Furniture | Office Supplies | Technology | Furniture | Office Supplies | Technology |
| 2016 | Q1 | 1 | 5 | 9 | 1 | 5 | 9 |
| | Q2 | 2 | 6 | 10 | 2 | 6 | 10 |
| | Q3 | 3 | 7 | 11 | 3 | 7 | 11 |
| | Q4 | 4 | 8 | 12 | 4 | 8 | 12 |
| 2017 | Q1 | 1 | 5 | 9 | 1 | 5 | 9 |
| | Q2 | 2 | 6 | 10 | 2 | 6 | 10 |
| | Q3 | 3 | 7 | 11 | 3 | 7 | 11 |
| | Q4 | 4 | 8 | 12 | 4 | 8 | 12 |

Pages Region Department

Rows YEAR(Order Date) QUARTER(Order ..)

Addressing and Partitioning

| | | Region / Department | | | West | | |
|------|----|---------------------|-----------------|------------|-----------|-----------------|------------|
| | | East | Office Supplies | Technology | Furniture | Office Supplies | Technology |
| 2016 | Q1 | 1 | 3 | 5 | 1 | 3 | 5 |
| | Q2 | 1 | 3 | 5 | 1 | 3 | 5 |
| | Q3 | 1 | 3 | 5 | 1 | 3 | 5 |
| | Q4 | 1 | 3 | 5 | 1 | 3 | 5 |
| 2017 | Q1 | 2 | 4 | 6 | 2 | 4 | 6 |
| | Q2 | 2 | 4 | 6 | 2 | 4 | 6 |
| | Q3 | 2 | 4 | 6 | 2 | 4 | 6 |
| | Q4 | 2 | 4 | 6 | 2 | 4 | 6 |

Table Calculation X

Index()

Compute Using

- Table (across)
- Table (down)
- Table (across then down)
- Table (down then across)
- Pane (across)
- Pane (down)
- Pane (across then down)
- Pane (down then across)
- Cell
- Specific Dimensions**

Department
 Quarter of Order Date
 Region
 Year of Order Date

At the level **Deepest** ▼

Restarting every **None** ▼

Sort order **Specific Dimensions** ▼

Show calculation assistance

Custom table calculations

- Before we move on to some practical examples, let's briefly discuss how to write your own table calculations, instead of using quick table calculations.
- You can see a list of available table calculation functions by creating a new calculation and selecting Table Calculation from the drop-down list under Functions.

Meta table functions

- These are the functions that give you information about the partitioning and addressing.
- These functions also include Index, First, Last, and Size:

Meta table functions

| Meta Table Calculations | | Index along Category | First along Category | Last along Category | Size along Category |
|-------------------------|--------------------------------|----------------------|----------------------|---------------------|---------------------|
| Department | Category | | | | |
| Furniture | Bookcases | 1 | 0 | 3 | 4 |
| | Chairs & Chairmats | 2 | -1 | 2 | 4 |
| | Office Furnishings | 3 | -2 | 1 | 4 |
| | Tables | 4 | -3 | 0 | 4 |
| Office Supplies | Appliances | 1 | 0 | 8 | 9 |
| | Binders and Binder Accessories | 2 | -1 | 7 | 9 |
| | Envelopes | 3 | -2 | 6 | 9 |
| | Labels | 4 | -3 | 5 | 9 |
| | Paper | 5 | -4 | 4 | 9 |
| | Pens & Art Supplies | 6 | -5 | 3 | 9 |
| | Rubber Bands | 7 | -6 | 2 | 9 |
| | Scissors, Rulers and Trimmers | 8 | -7 | 1 | 9 |
| | Storage & Organization | 9 | -8 | 0 | 9 |
| Technology | Computer Peripherals | 1 | 0 | 3 | 4 |
| | Copiers and Fax | 2 | -1 | 2 | 4 |
| | Office Machines | 3 | -2 | 1 | 4 |
| | Telephones and Communication | 4 | -3 | 0 | 4 |

Lookup and previous value

| Department | Category | Lookup | Previous Value |
|-----------------|-------------------------------|--------------------------|--|
| Furniture | Bookcases | Null | ,Bookcases |
| | Chairs & Chairmats | Bookcases | ,Bookcases,Chairs & Chairmats |
| | Office Furnishings | Chairs & Chairmats | ,Bookcases,Chairs & Chairmats,Office Furnishings |
| | Tables | Office Furnishings | ,Bookcases,Chairs & Chairmats,Office Furnishings,Tables |
| Office Supplies | Appliances | Null | ,Appliances |
| | Binders and Binder Accessor.. | Appliances | ,Appliances,Binders and Binder Accessories |
| | Envelopes | Binders and Binder Acc.. | ,Appliances,Binders and Binder Accessories,Envelopes |
| | Labels | Envelopes | ,Appliances,Binders and Binder Accessories,Envelopes,Labels |
| Technology | Paper | Labels | ,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper |
| | Pens & Art Supplies | Paper | ,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper,Pens & Art Supplies |
| | Rubber Bands | Pens & Art Supplies | ,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper,Pens & Art Supplies,Rubber Bands |
| | Scissors, Rulers and Trimmers | Rubber Bands | ,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper,Pens & Art Supplies,Rubber Bands,Scissors, |
| Technology | Storage & Organization | Scissors, Rulers and .. | ,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper,Pens & Art Supplies,Rubber Bands,Scissors, |
| | Computer Peripherals | Null | ,Computer Peripherals |
| | Copiers and Fax | Computer Peripherals | ,Computer Peripherals,Copiers and Fax |
| | Office Machines | Copiers and Fax | ,Computer Peripherals,Copiers and Fax,Office Machines |
| Technology | Telephones and Communication | Office Machines | ,Computer Peripherals,Copiers and Fax,Office Machines,Telephones and Communication |

Lookup and previous value

- The first row in each partition gets a NULL result from the lookup (because there isn't a row before it).
- For Previous_Value, we used this code:

Previous_Value("") + "," + ATTR([Category])

Running Functions

| Department | Category | Sales | Running Sum of Sales along Category | Running Min of Sales along Category |
|-----------------|-------------------------|-----------|---|---|
| Furniture | Bookcases | 507,496 | 507,496 | 507,496 |
| | Chairs & Chairmats | 1,164,586 | 1,672,082 | 507,496 |
| | Office Furnishings | 444,634 | 2,116,716 | 444,634 |
| | Tables | 1,061,922 | 3,178,638 | 444,634 |
| Office Supplies | Appliances | 456,736 | 456,736 | 456,736 |
| | Binders and Binder .. | 638,583 | 1,095,319 | 456,736 |
| | Envelopes | 147,915 | 1,243,234 | 147,915 |
| | Labels | 23,446 | 1,266,680 | 23,446 |
| | Paper | 253,620 | 1,520,300 | 23,446 |
| | Pens & Art Supplies | 103,265 | 1,623,565 | 23,446 |
| | Rubber Bands | 8,670 | 1,632,235 | 8,670 |
| | Scissors, Rulers and .. | 40,432 | 1,672,667 | 8,670 |
| | Storage & Organizat.. | 585,717 | 2,258,384 | 8,670 |
| Technology | Computer Periphera.. | 490,851 | 490,851 | 490,851 |
| | Copiers and Fax | 661,215 | 1,152,066 | 490,851 |
| | Office Machines | 1,218,655 | 2,370,721 | 490,851 |
| | Telephones and Com.. | 1,144,284 | 3,515,005 | 490,851 |

Window functions

Window Functions

| Department | Category | Sales | Window Sum along Category | Window Max along Category |
|-----------------|-------------------------|-----------|------------------------------|------------------------------|
| Furniture | Bookcases | 507,496 | 3,178,638 | 1,164,586 |
| | Chairs & Chairmats | 1,164,586 | 3,178,638 | 1,164,586 |
| | Office Furnishings | 444,634 | 3,178,638 | 1,164,586 |
| | Tables | 1,061,922 | 3,178,638 | 1,164,586 |
| Office Supplies | Appliances | 456,736 | 2,258,384 | 638,583 |
| | Binders and Binder .. | 638,583 | 2,258,384 | 638,583 |
| | Envelopes | 147,915 | 2,258,384 | 638,583 |
| | Labels | 23,446 | 2,258,384 | 638,583 |
| | Paper | 253,620 | 2,258,384 | 638,583 |
| | Pens & Art Supplies | 103,265 | 2,258,384 | 638,583 |
| | Rubber Bands | 8,670 | 2,258,384 | 638,583 |
| | Scissors, Rulers and .. | 40,432 | 2,258,384 | 638,583 |
| | Storage & Organizat.. | 585,717 | 2,258,384 | 638,583 |
| Technology | Computer Periphera.. | 490,851 | 3,515,005 | 1,218,655 |
| | Copiers and Fax | 661,215 | 3,515,005 | 1,218,655 |
| | Office Machines | 1,218,655 | 3,515,005 | 1,218,655 |
| | Telephones and Com.. | 1,144,284 | 3,515,005 | 1,218,655 |

Rank functions

Rank Functions

| Department | Category | Sales | Rank along Category |
|-----------------|-------------------------|-----------|---------------------|
| Furniture | Bookcases | 507,496 | 3 |
| | Chairs & Chairmats | 1,164,586 | 1 |
| | Office Furnishings | 444,634 | 4 |
| | Tables | 1,061,922 | 2 |
| Office Supplies | Appliances | 456,736 | 3 |
| | Binders and Binder .. | 638,583 | 1 |
| | Envelopes | 147,915 | 5 |
| | Labels | 23,446 | 8 |
| | Paper | 253,620 | 4 |
| | Pens & Art Supplies | 103,265 | 6 |
| | Rubber Bands | 8,670 | 9 |
| | Scissors, Rulers and .. | 40,432 | 7 |
| | Storage & Organizat.. | 585,717 | 2 |
| Technology | Computer Periphera.. | 490,851 | 4 |
| | Copiers and Fax | 661,215 | 3 |
| | Office Machines | 1,218,655 | 1 |
| | Telephones and Com.. | 1,144,284 | 2 |

Script functions

- These functions allow integration with the R analytics platform or Python, either of which can incorporate simple or complex scripts for everything from advanced statistics to predictive modeling.
- It's beyond the scope of this course to dive into all that is possible, but documentation and examples are readily available on Tableau's website and from various members of the Tableau community.

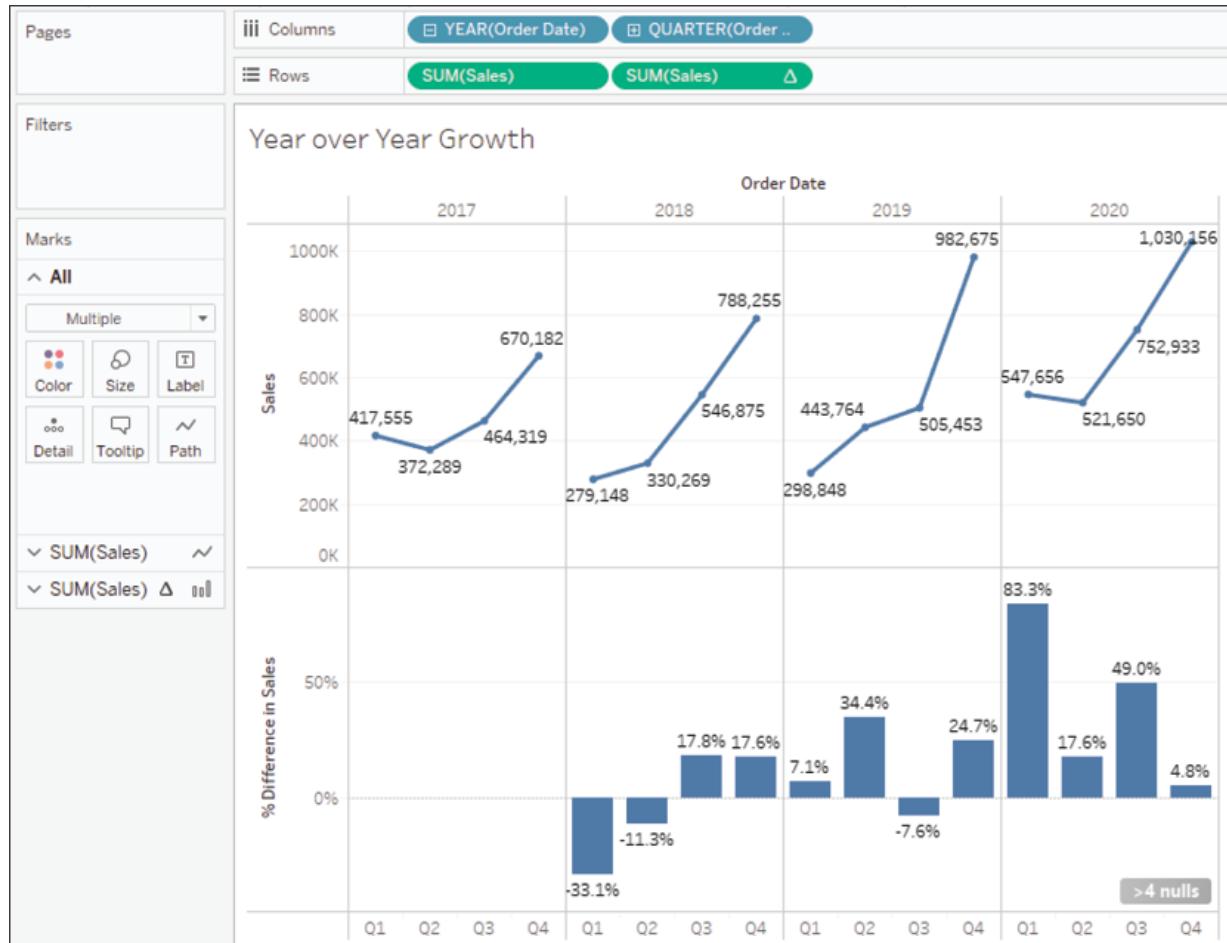
The Total function

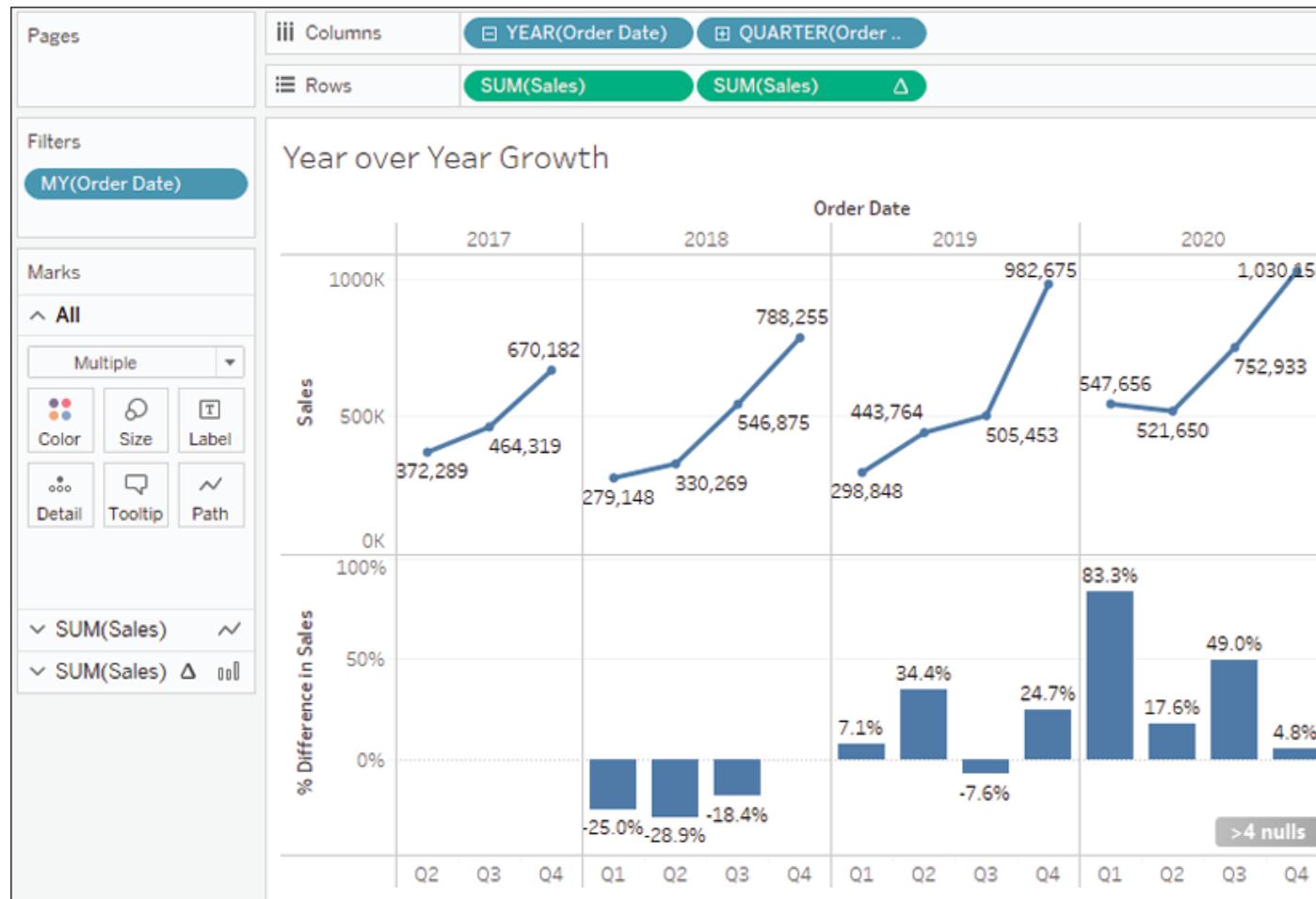
- The Total function deserves its own category because it functions a little differently from the others.
- Unlike the other functions that work on the aggregate table in the cache, Total will re-query the underlying source for all the source data rows that make up a given partition.
- In most cases, this will yield the same result as a window function.

Practical examples

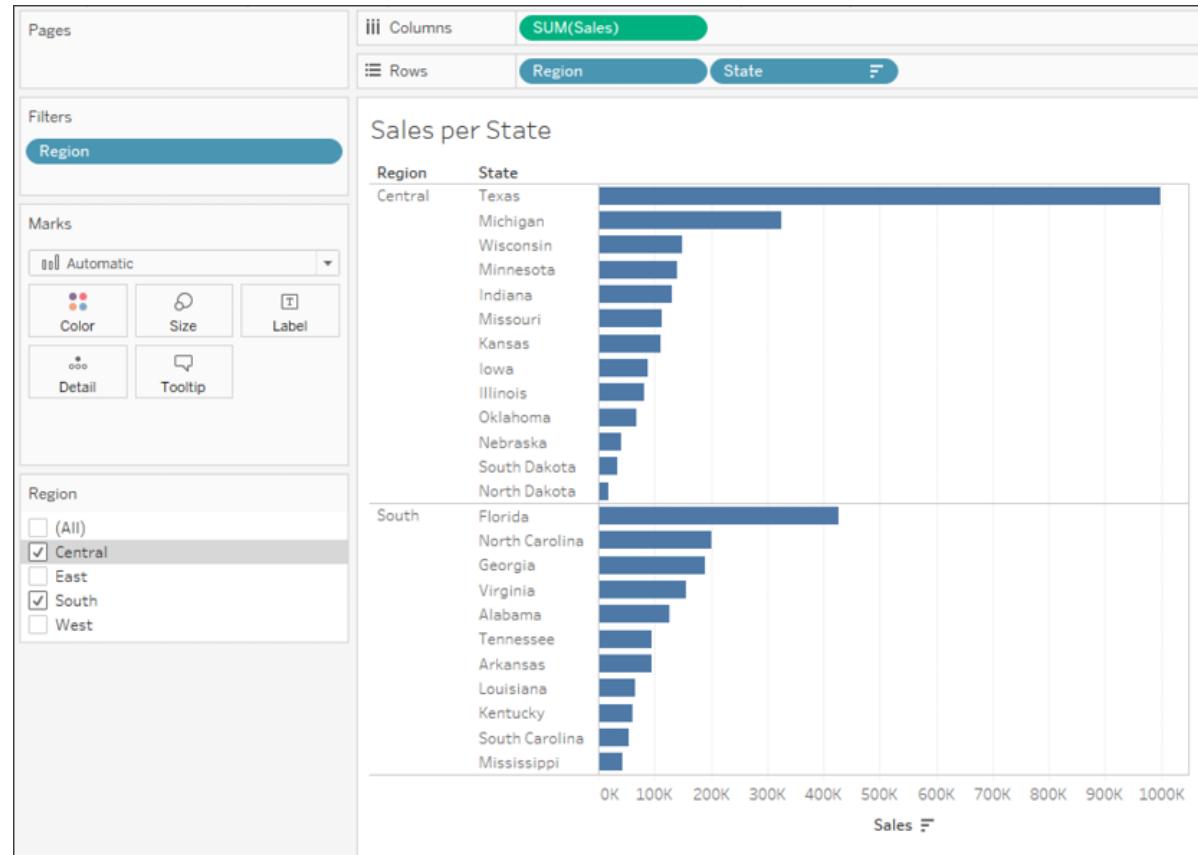
- Having looked at some of the essential concepts of table calculations, let's consider some practical examples.
- We'll look at several examples, although the practical use of table calculations is nearly endless.

Year over year growth





Dynamic titles with totals



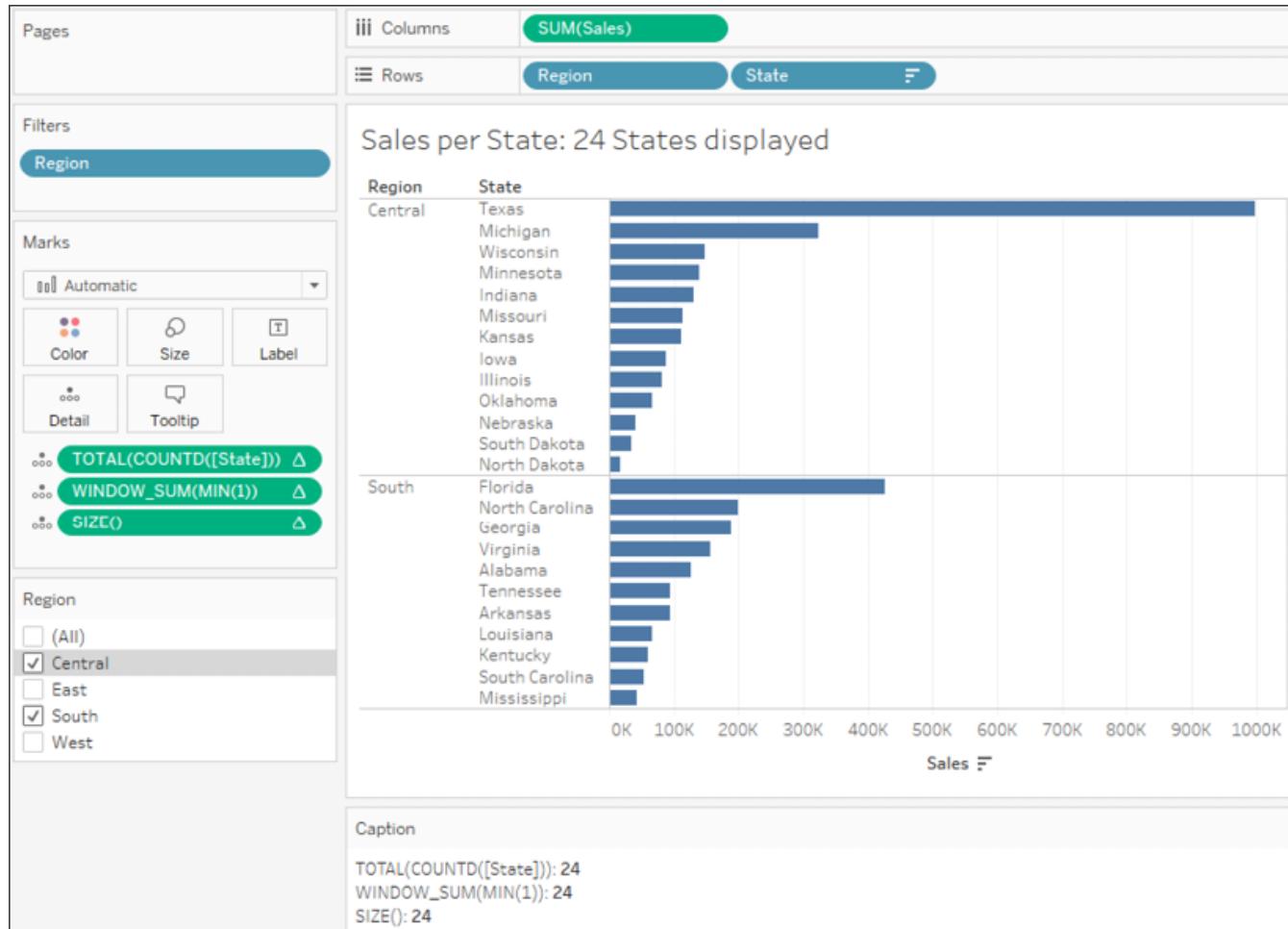
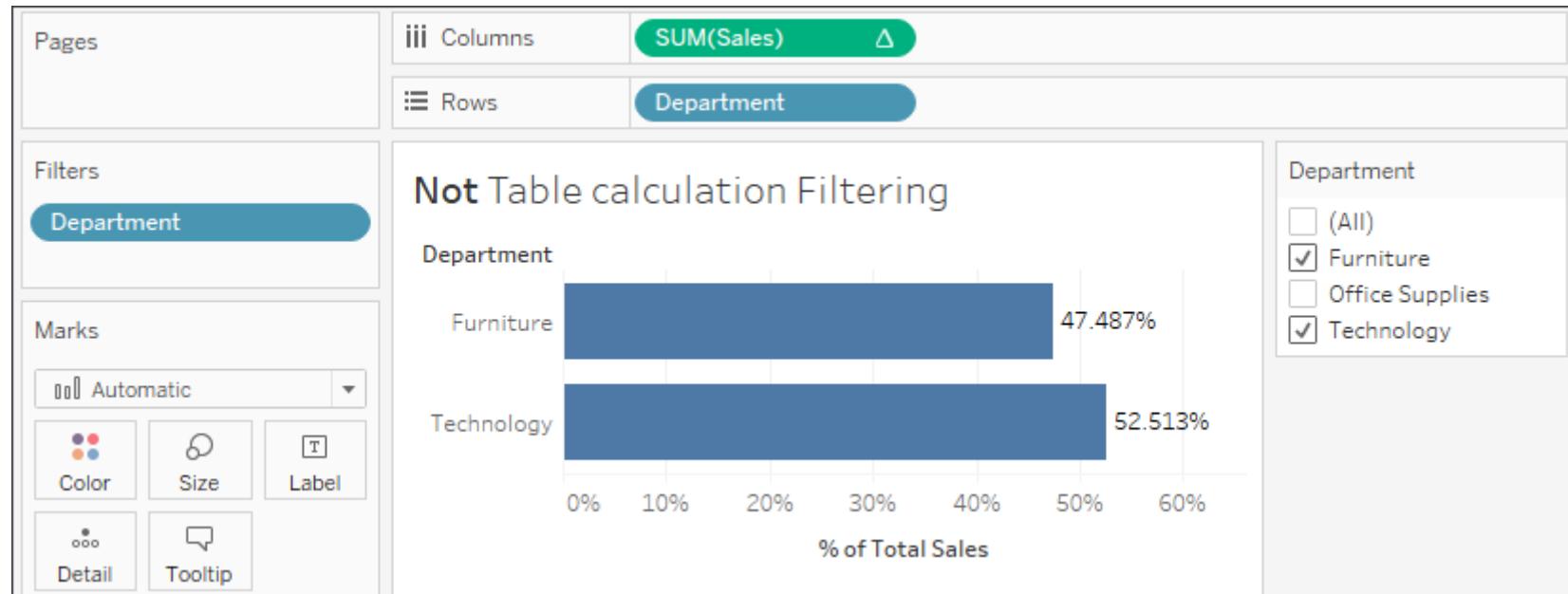
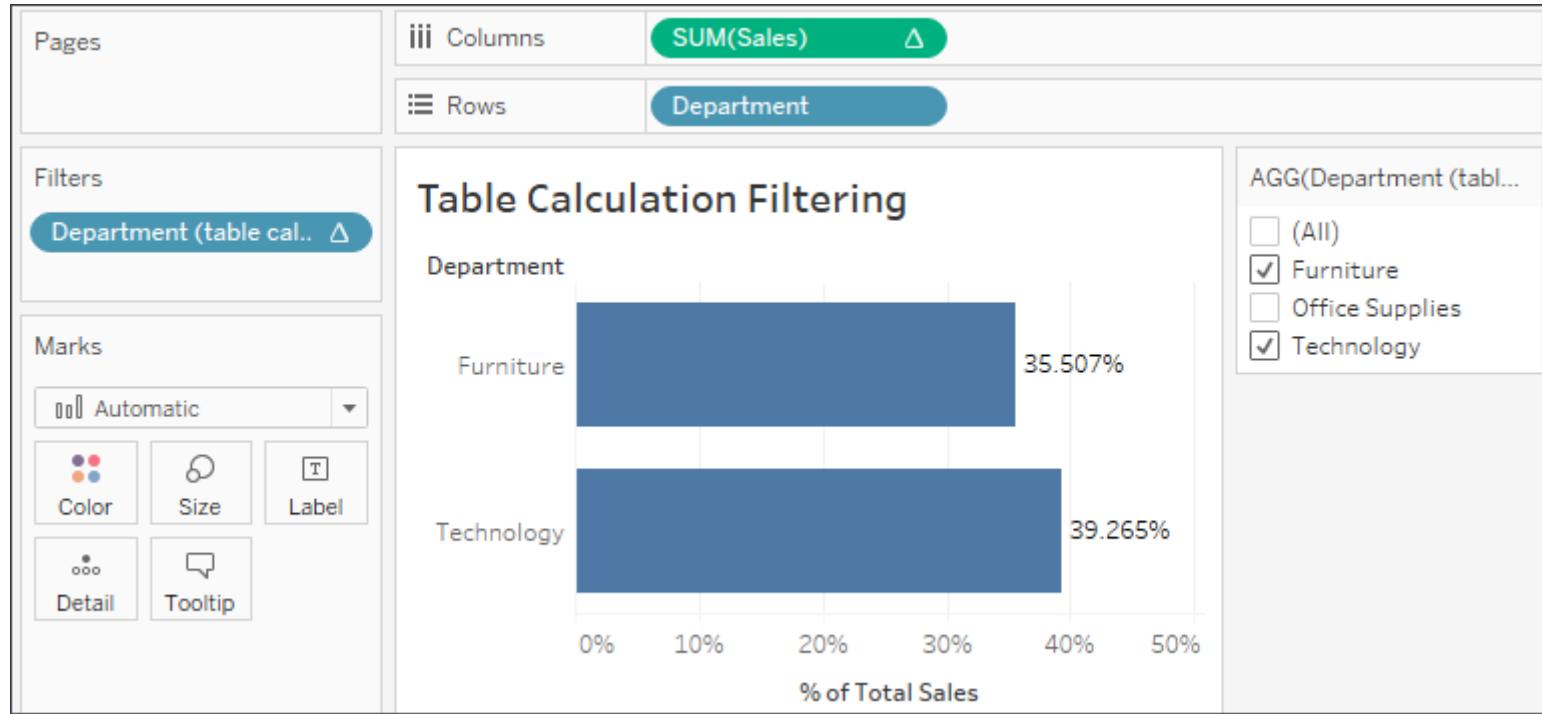


Table calculation filtering (late filtering)



Year over year growth



Summary

- We've covered a lot of concepts surrounding table calculations in this lesson.
- You now have a foundation for using the simplicity of quick table calculations and leveraging the power of advanced table calculations.
- We've looked at the concepts of scope and direction as they apply to table calculations that operate relative to the row and column layout of the view.

COMPLETE LAB 6

7. Making Visualizations That Look Great and Work Well



Making Visualizations

This lesson will cover the following topics:

- Visualization considerations
- Leveraging formatting in Tableau
- Adding value to visualizations

Visualization considerations

- Tableau employs good practices for formatting and visualization from the time you start dropping fields on shelves.
- You'll find that the discrete palettes use colors that are easy to distinguish, the fonts are pleasant, the grid lines are faint where appropriate, and numbers and dates follow the default format settings defined in the metadata.
- The default formatting is more than adequate for discovery and analysis.

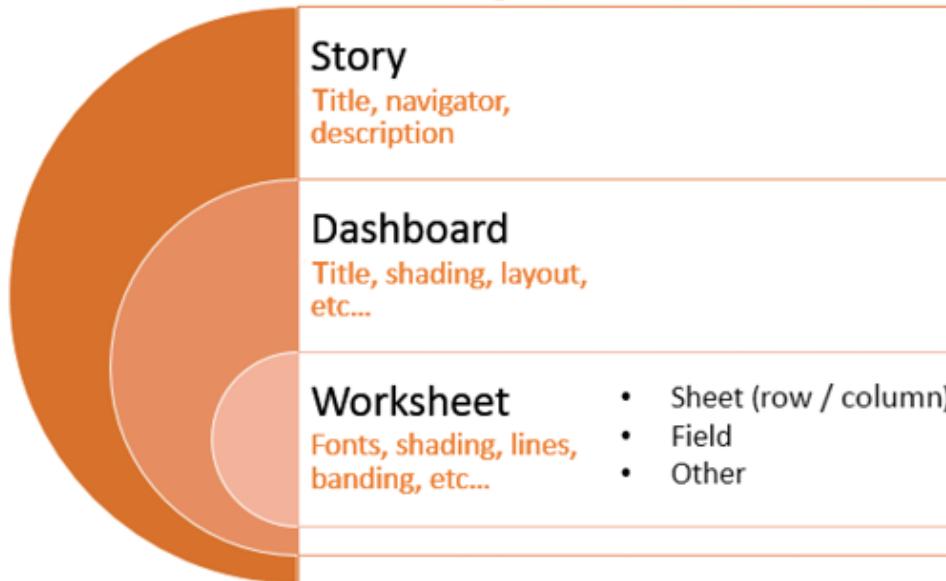
Data Source

Default metadata field
formats, colors, shapes



Workbook

Global Formatting



Workcourse-level formatting

Format Workbook X

Fonts

All
Tableau Book

Worksheets
Tableau Book 9 ▾

Tooltips
Tableau Book 10 ▾

Worksheet Titles
Tableau Light 15 ▾

Dashboard Titles
Tableau Book 18 ▾

Story Titles
Tableau Regular 18 ▾

Less ▾

Lines

Grid Lines

Zero Lines

Trend Lines

Reference Lines

Drop Lines

Axis Rulers

Axis Ticks

Reset to Defaults

Worksheet-level formatting

Formatting: Parts of the View

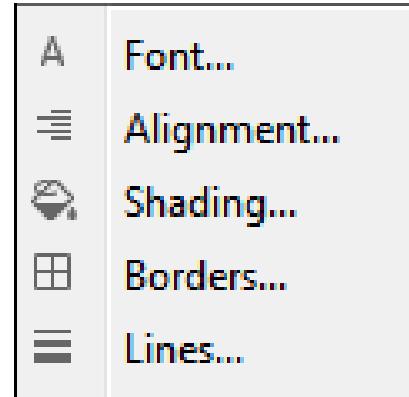
Customer Segment

| Department | Category | Consumer | Corporate | Home Office | Small Business | Grand Total |
|-----------------|-------------------------------|-----------|-----------|-------------|----------------|-------------|
| Furniture | Bookcases | 32,626 | 262,085 | 79,404 | 73,381 | 507,496 |
| | Chairs & Chairmats | 305,381 | 407,724 | 212,830 | 238,651 | 1,164,586 |
| | Office Furnishings | 69,528 | 115,506 | 197,188 | 62,412 | 444,634 |
| | Tables | 228,934 | 363,979 | 287,507 | 181,502 | 1,061,922 |
| | (a) Total | 696,469 | 1,149,294 | 776,929 | 555,946 | 3,178,638 |
| Office Supplies | Appliances | 63,813 | 167,941 | 124,757 | 100,225 | 456,736 |
| | Binders and Binder Accessor.. | 103,625 | 225,160 | 148,472 | 161,326 | 638,583 |
| | Envelopes | 37,643 | 44,462 | 22,577 | 43,233 | 147,915 |
| | Labels | 3,713 | 7,929 | 5,411 | 6,393 | 23,446 |
| | Paper | 53,004 | 89,312 | 61,123 | 50,181 | 253,620 |
| | Pens & Art Supplies | 24,027 | 36,004 | 21,765 | 21,469 | 103,265 |
| | Rubber Bands | 1,710 | 2,197 | 2,294 | 2,469 | 8,670 |
| | Scissors, Rulers and Trimme.. | 14,628 | 9,625 | 12,947 | 3,232 | 40,432 |
| | Storage & Organization | 121,719 | 154,918 | 179,151 | 129,929 | 585,717 |
| Technology | Total | 423,882 | 737,548 | 578,497 | 518,457 | 2,258,384 |
| | Computer Peripherals | 80,805 | 224,142 | 110,840 | 75,064 | 490,851 |
| | Copiers and Fax | 148,504 | 205,639 | 174,718 | 132,354 | 661,215 |
| | Office Machines | 260,011 | 516,513 | 245,019 | 197,112 | 1,218,655 |
| | Telephones and Communicat.. | 225,571 | 436,295 | 282,962 | 199,456 | 1,144,284 |
| (b) Grand Total | | 714,891 | 1,382,589 | 813,539 | 603,986 | 3,515,005 |
| | | 1,835,242 | 3,269,431 | 2,168,965 | 1,678,389 | 8,952,027 |

7

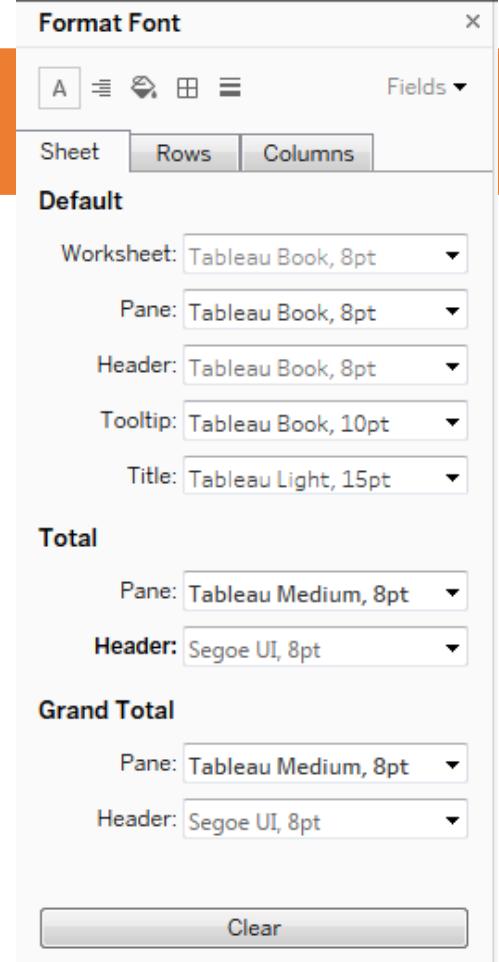
Worksheet-level formatting

- To view the format window, select Format from the menu and then Font..., Alignment..., Shading..., Borders..., or Lines....:



Worksheet-level formatting

- You should now see the format window on the left, in this case, Format Font. It will look like this:



Field-level formatting

- For example, is the window as it appears for the SUM(Sales) field:

Format SUM(Sales)

A ⌂ ⌂ Fields ▾

Axis Pane

Default

Font: Tableau Book, 8pt

Alignment: Automatic

Numbers: 123,456

Totals

Font: Tableau Medium, 8pt

Alignment: Automatic

Numbers: 123,456

Grand Totals

Font: Tableau Medium, 8pt

Alignment: Automatic

Numbers: 123,456

Special Values (eg. NULL)

Text: (Blank)

Marks: Show at Indicator

Custom number formatting

- When you alter the format of a number, you can select from several standard formats, as well as a custom format.
- The custom format allows you to enter a format string that Tableau will use to format the number.

Custom number formatting

- Some examples, assuming the positive number is 34,331.336 and the negative number is -8,156.7777:

| Format String | Resulting Value |
|--------------------------------|---|
| #;-# | 34331 and -8157 |
| #,###.##; (#,###.##) | 34,331.34 and (8,156.78) |
| #,###.00000;-#,###.00000 | 34,331.33600 and -8,156.77770 |
| "up "#,###;"down "#,###;"same" | up 34,331 and down 8,157 |
| #,###"▲"; #,###"▼" | 34,331▲ and 8,157▼ |

Custom number formatting

- You can replicate these examples and experiment with other format strings using the Custom Number Formatting view in the Starter or Complete workcourses:

The screenshot shows the 'Format' dialog box for a value of -8156.7777. The 'Numbers' dropdown is open, displaying various format categories: Automatic, Number (Standard), Number (Custom), Currency (Standard), Currency (Custom), Scientific, Percentage, and Custom. The 'Custom' option is selected, and its format string '#,###" ▲";#,###" ▼" is shown in the 'Format' input field. A blue arrow points from this input field down to a 'Custom Number Formatting' view in the bottom right corner of the interface. This view displays the same format string and shows two numerical values: 34331.336 and 8,157.

Format -8156.7777

A Axis Fields

Font: Tableau Book, 9pt

Alignment: Automatic

Numbers: 123.456 ▲

Totals

Font:

Alignment:

Numbers:

Automatic
Number (Standard)
Number (Custom)
Currency (Standard)
Currency (Custom)
Scientific
Percentage
Custom

Custom
Format:
#,###" ▲";#,###" ▼"

Pages Columns

Rows 34331.336

Custom Number Formatting

34331.336 8,157 ▼

Marks

Automatic

Color Size Text

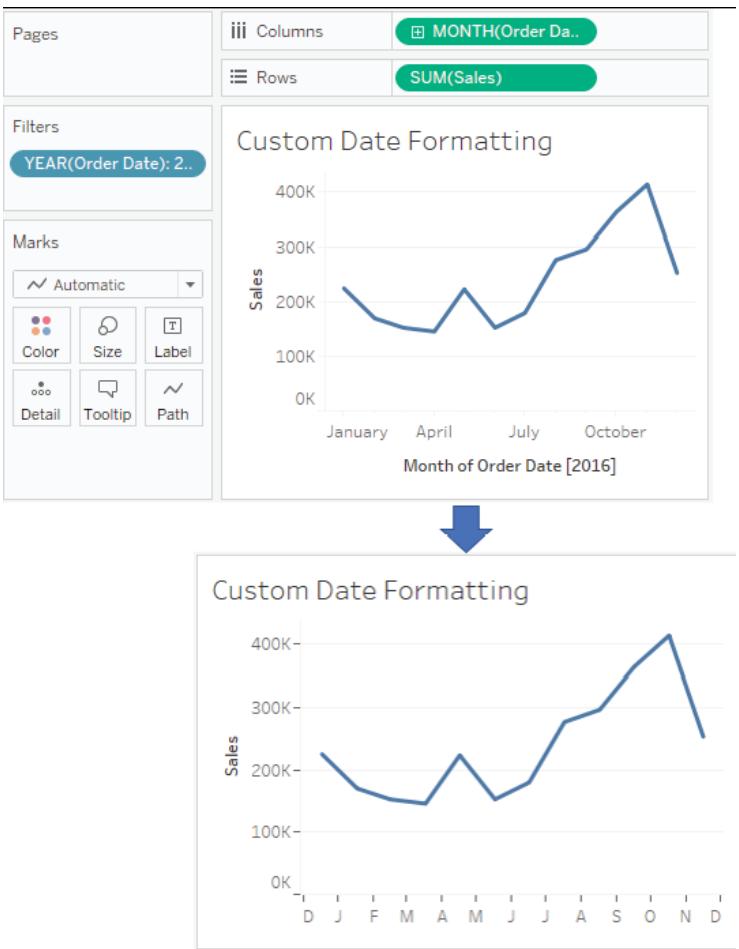
Detail Tooltip

-8156.7777

Custom date formatting

| Format String | Resulting Value |
|------------------------|--------------------------------|
| m/d/yyyy | 11/8/2018 |
| dd/mm/yyyy | 08/11/2018 |
| "The date is" m/d/yyyy | The date is 11/8/2018 |
| mmm d, yyyy | Nov 8, 2018 |
| mmmm dd yyyy | November 08 2018 |
| mm/dd/yyyy h:mm AM/PM | 11/08/2018 1:30PM |
| tttt | 1:30:28 PM |
| dddd, mmmm d, HH:MM:ss | Thursday, November 8, 13:30:28 |
| ddd | Thu |

- Notice how applying some custom date formatting improves the readability of the axis for a small timeline in this example:



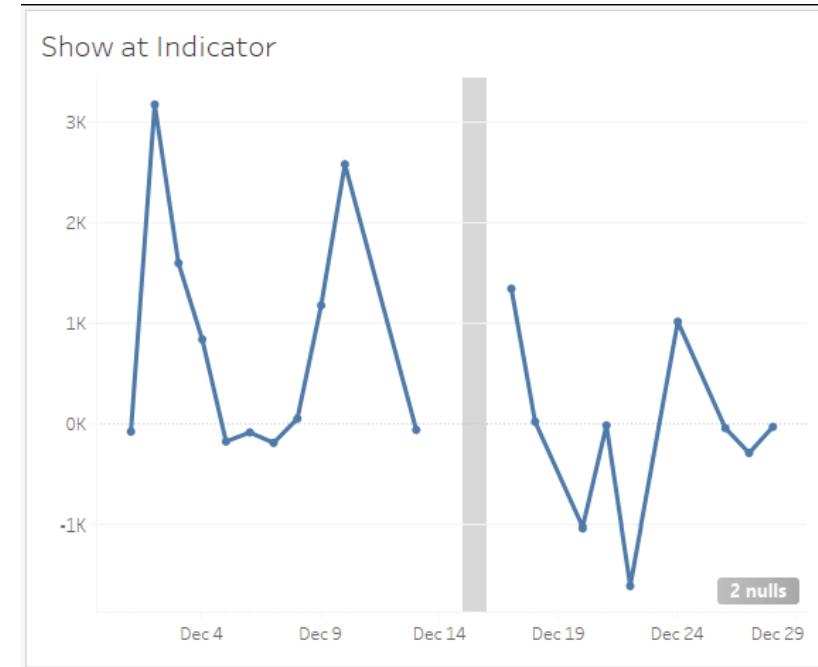
Null formatting

- An additional aspect of formatting a field is specially formatting Null values.
- When formatting a field, select the Pane tab and locate the Special Values section, as shown in the following screenshot:



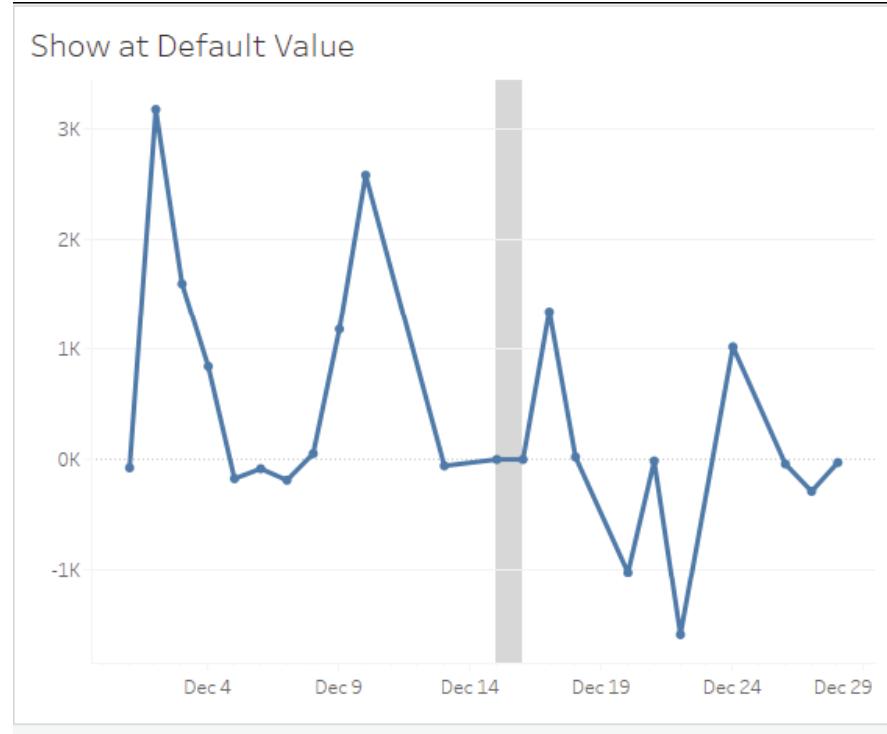
Null formatting

- Show at Indicator reveals no marks in the gray band with the number of null values indicated in the lower-right corner:



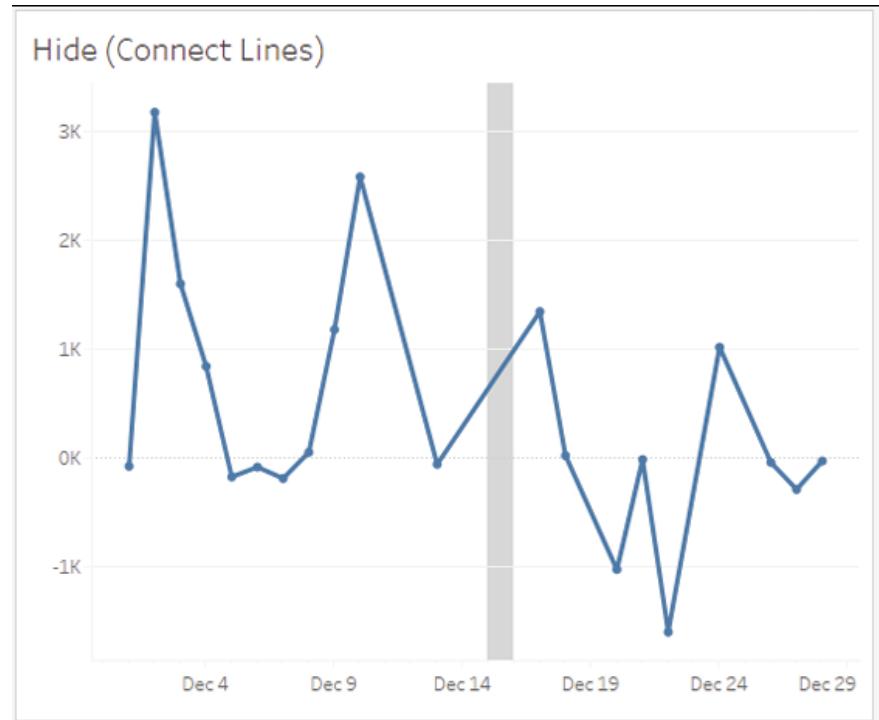
Null formatting

- Show at Default Value places marks at 0 and connects the lines:



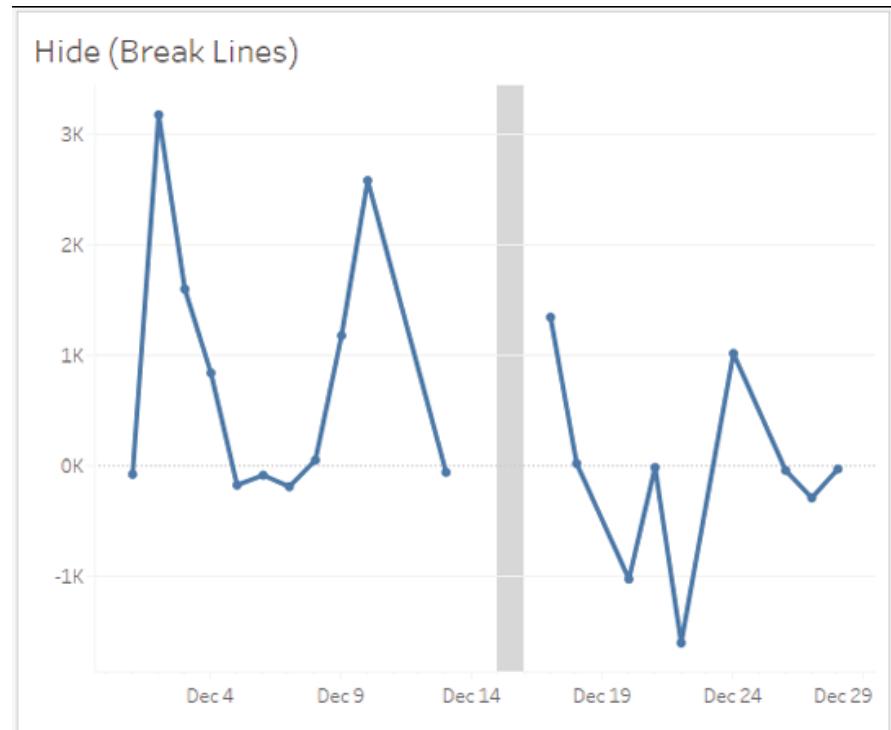
Null formatting

- Hide (Connect Lines) removes marks for the missing values, but does connect the existing marks:



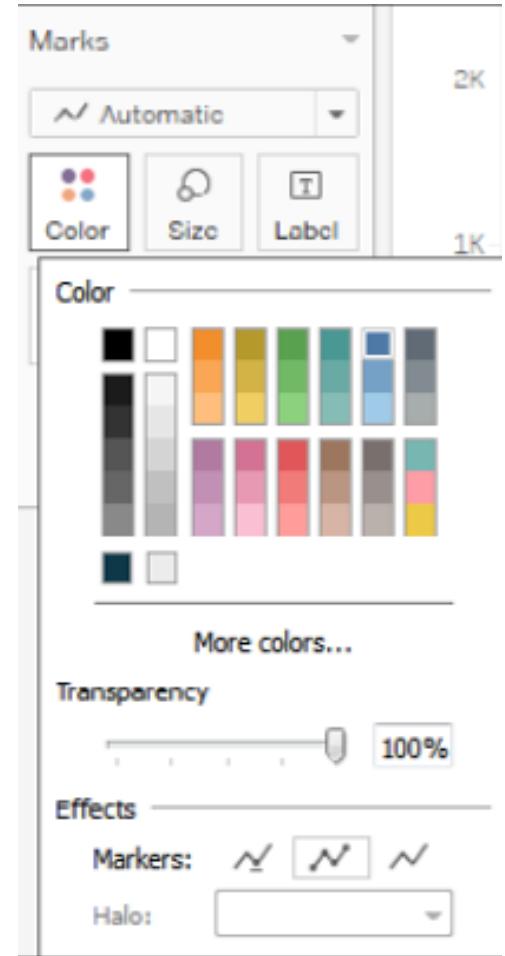
Null formatting

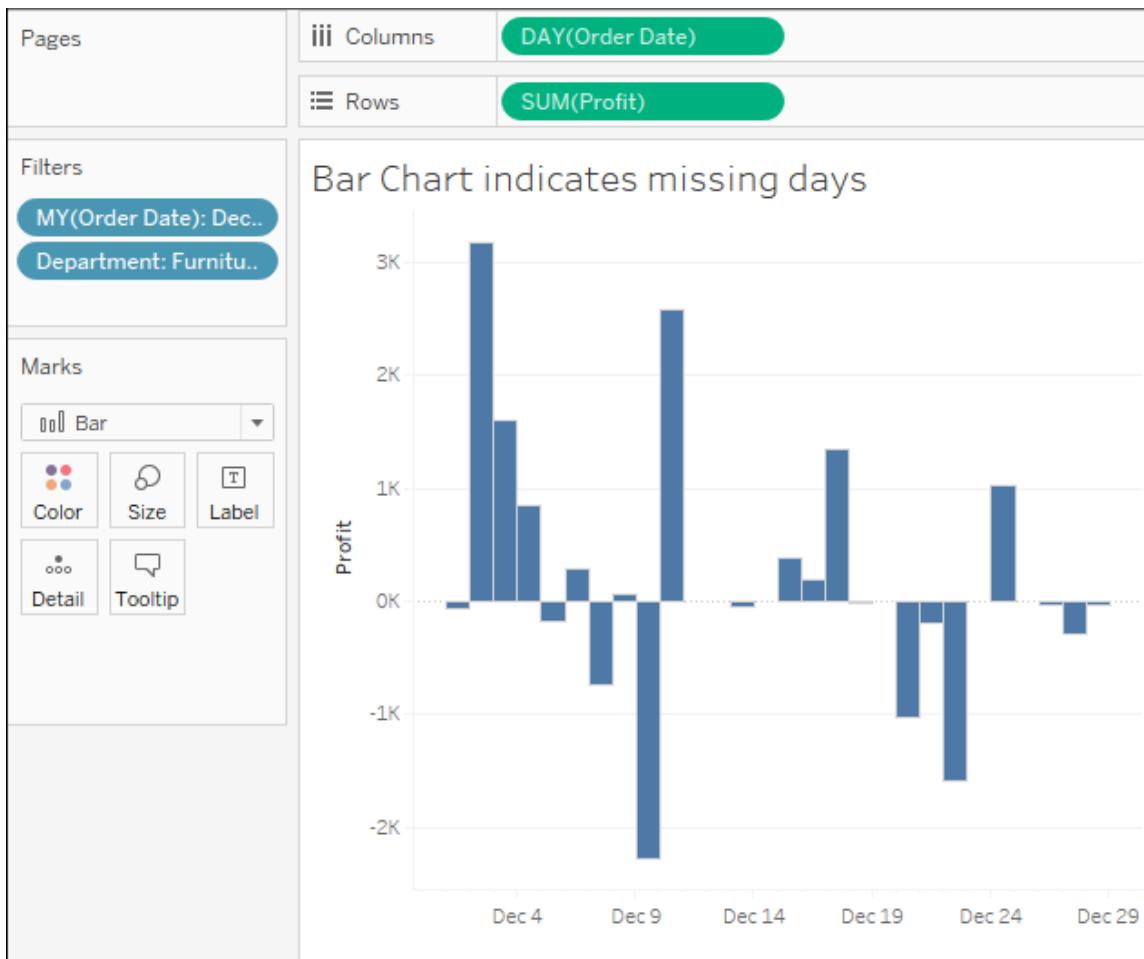
- Hide (Break Lines) removes the marks for the missing values and does not connect the existing marks:



Null formatting

- Some mark types support additional options such as border and/or halo, as shown here:



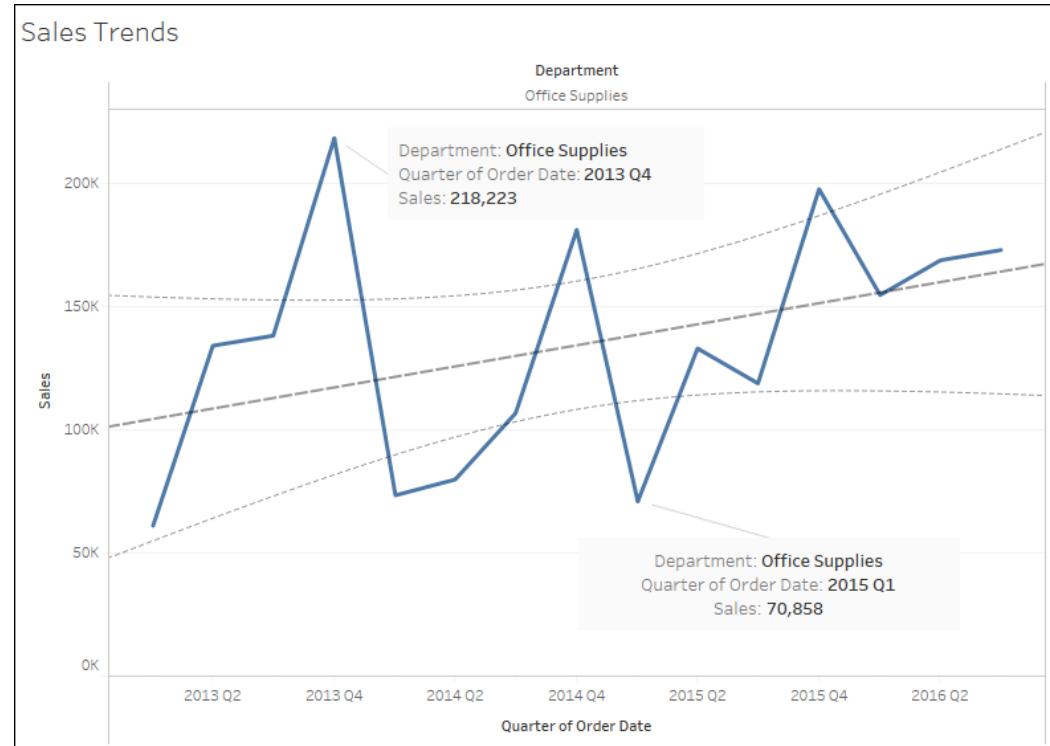


Adding value to visualizations

- Now that we've considered how formatting works in Tableau, let's look at some ways in which formatting can add value to a visualization.
- When you apply custom formatting, always ask yourself what the formatting adds to the understanding of the data.

Adding value to visualizations

- Consider the following visualization, all using default formatting:



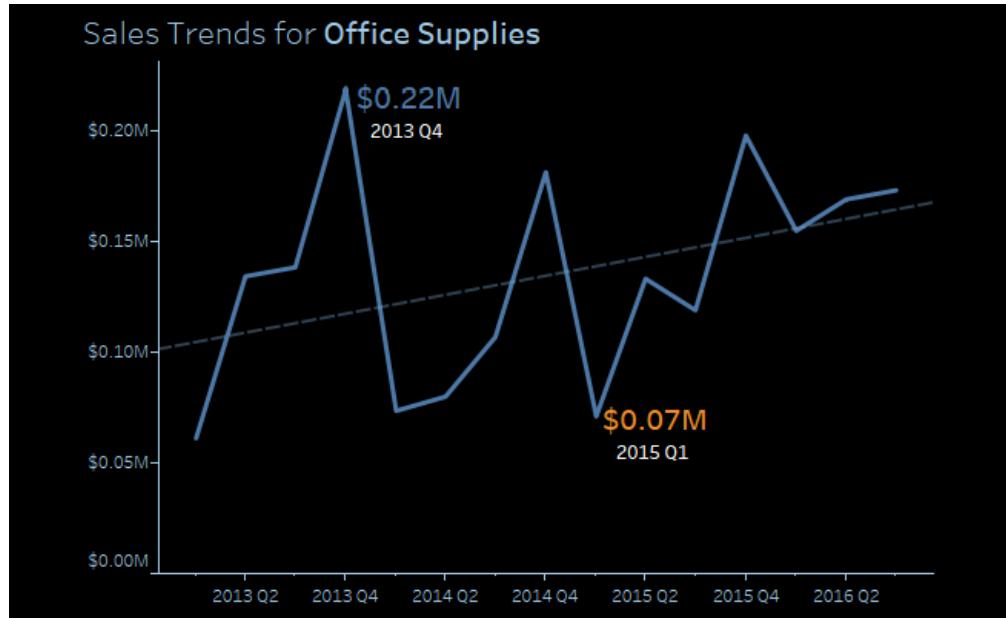
Adding value to visualizations

- The default format works fairly well, but compare that to this visualization:



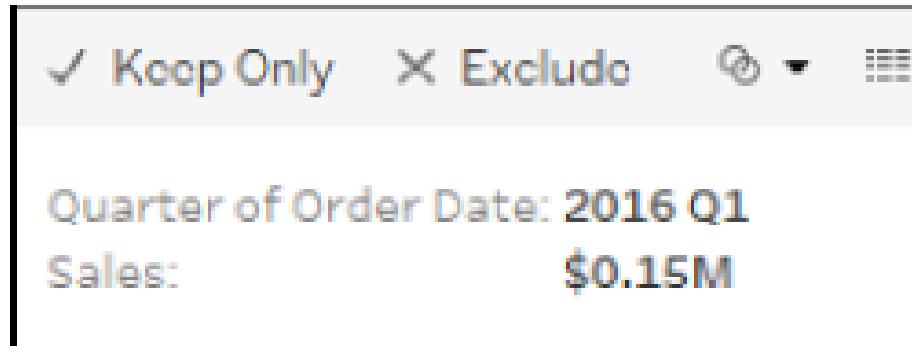
Adding value to visualizations

- Formatting can also be used to dramatically alter the appearance of a visualization.
- Consider the following chart:



Tooltips

- Consider the following default tooltip that displays when the end user hovers over one of the marks shown in the preceding screenshot:

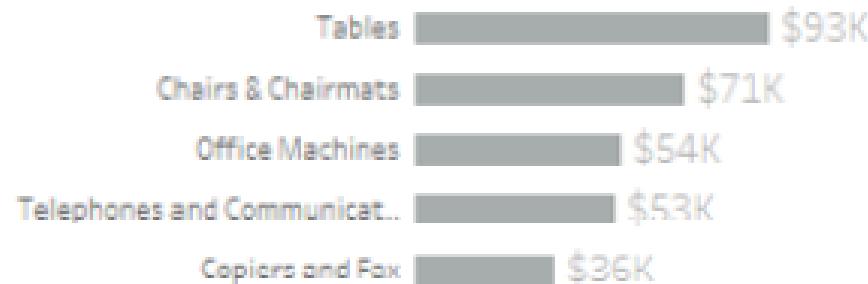


Tooltips

- Compare it to this tooltip:
-

Office Supplies

Sales of \$0.12M in 2015 Q3



Edit Tooltip

Tableau Book 10 B I U Insert X

<ATTR(Department)>
Sales of <SUM(Sales)> in <QUARTER(Order Date)>

<Sheet name="Categories" maxwidth="300" maxheight="300"
filter="

Show tooltips Responsive - Show tooltips instantly ▾
Include command buttons
Allow selection by category

OK Cancel

Sheets Data Source Name Data Update Time Sheet Name Workbook Name Page Count Page Name Page Number Default Caption Default Title Full Name User Name ATTR(Department) Department QUARTER(Order Date) SUM(Sales) All Fields

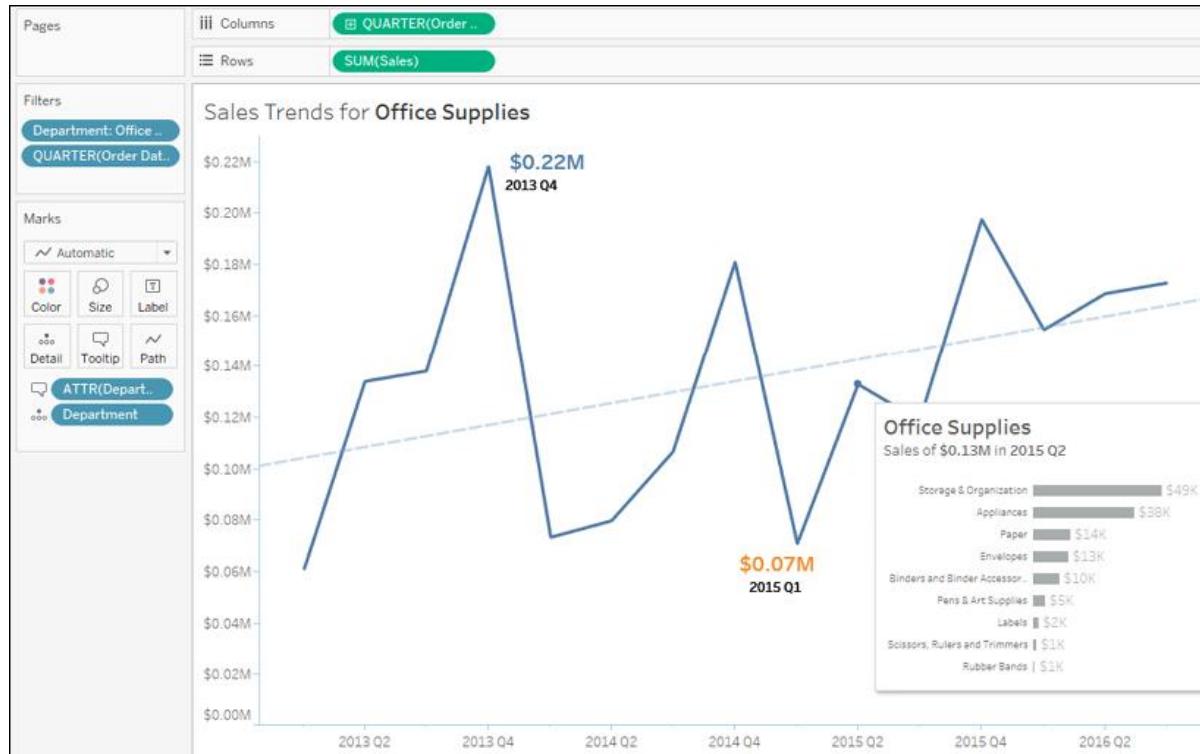
Bar Chart indicates missing days Categories Data Densification Dramatic Formatting Formatting: Parts of the View Hide (Break Lines) Hide (Connect Lines) Sales Trends Show at Default Value Show at Indicator Some formatting

Viz in Tooltip

- In the preceding screenshot, the following tag was added to the tooltip by selecting Insert | Sheets | Categories:

```
<Sheet name="Categories" maxwidth="300"  
maxheight="300" filter="<All Fields>">
```

Notice the final view with the tooltip:



Summary

- The goal of formatting is to increase effective communication of the data at hand.
- Always consider the audience, setting, mode, mood, and consistency as you work through the iterative process of formatting.
- Look for formatting that adds value to your visualization and avoid useless clutter.

COMPLETE LAB 7

8. Telling a Data Story with Dashboards



Telling a Data Story with Dashboards

This lesson will cover the following topics:

- Introduction to dashboards
- Designing dashboards in Tableau
- Designing for different displays and devices
- Interactivity with actions
- Stories

Introduction to dashboards

Dashboard definition

- From a Tableau perspective, a dashboard is an arrangement of individual visualizations, along with other components, such as legends, filters, parameters, text, containers, images, extensions, buttons, and web objects, that are arranged on a single canvas. Ideally, the visualizations and components should work together to tell a complete and compelling data story.
- Dashboards are usually (but not always) interactive.

Dashboard objectives

- The primary objective of a dashboard is to communicate data to a certain audience with an intended result.
- Often, we'll talk about telling the data story, That is, there is a narrative (or multiple narratives) contained within the data that can be communicated to others.
- While you can tell a data story with a single visualization or even a series of complex dashboards, a single Tableau dashboard is the most common way to communicate a single story.

Dashboard objectives

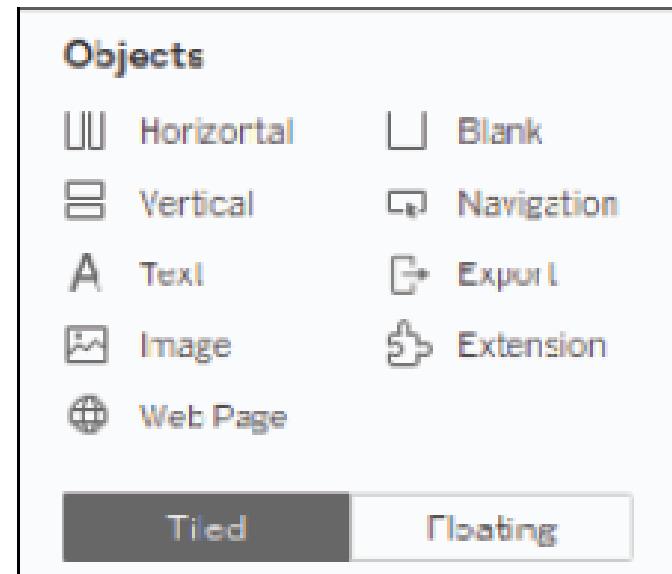
There are numerous possible approaches to building dashboards based on your objectives. The following is by no means a comprehensive list:

- Guided analysis
- Exploratory
- Scorecard/Status snapshot
- Narrative

Designing dashboards in Tableau

Objects

- Dashboards are made up of objects that are arranged on a canvas.
- You'll see a list of objects that can be added to a dashboard in the left-hand pane of a dashboard:

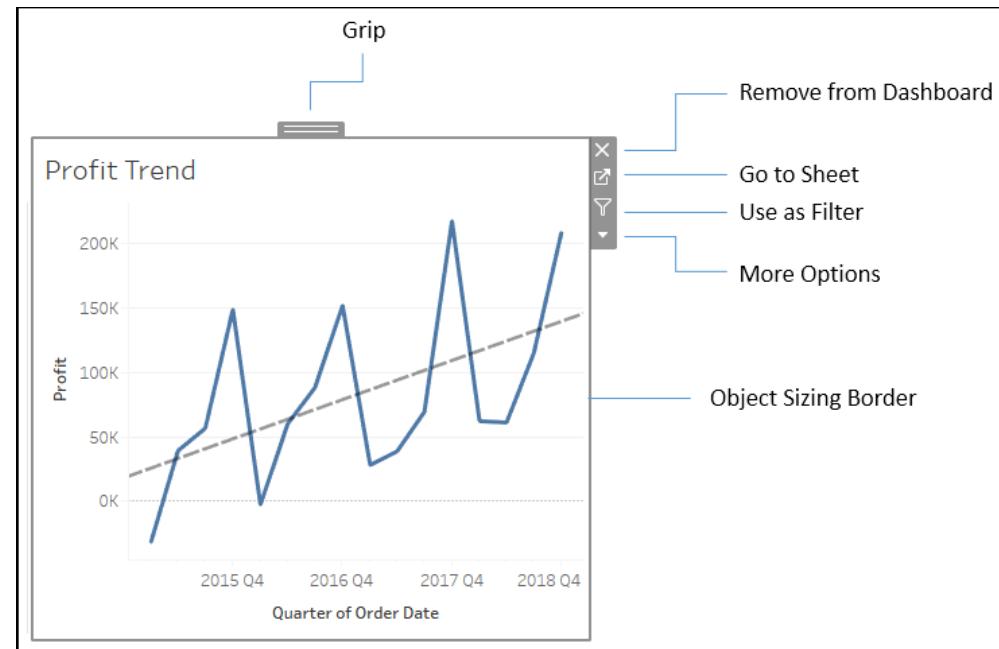


Tiled versus floating

- An object is either tiled or floating. If it is a tiled object, it will snap into the dashboard or layout container where you drop it.
- If it is a floating object, it will float over the dashboard in layers.
- You can change the order of the layers for a floating object.
- You'll notice the Tiled or Floating buttons directly beneath the Objects pallet in the preceding image.

Manipulating objects on the dashboard

- You may wish to manipulate an object once it is part of a dashboard.
- Every object has certain controls that become visible when you select it:



A dashboard to understand profitability

Having covered some conceptual topics as well as practical matters related to dashboard design, we'll dive into an example.

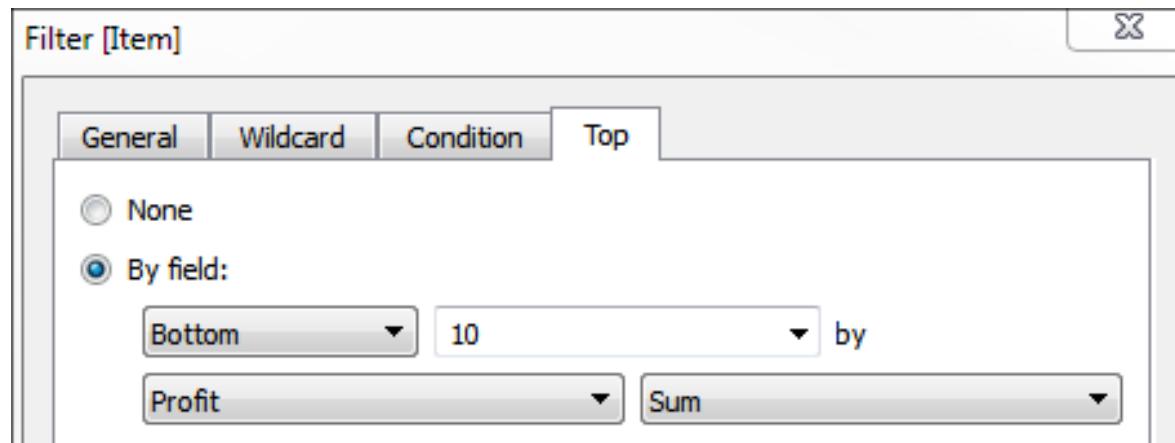
- Let's say you've been tasked with helping management find which items are the least profitable.
- Management feels that most of the least profitable items should be eliminated from their inventory.

Building the views



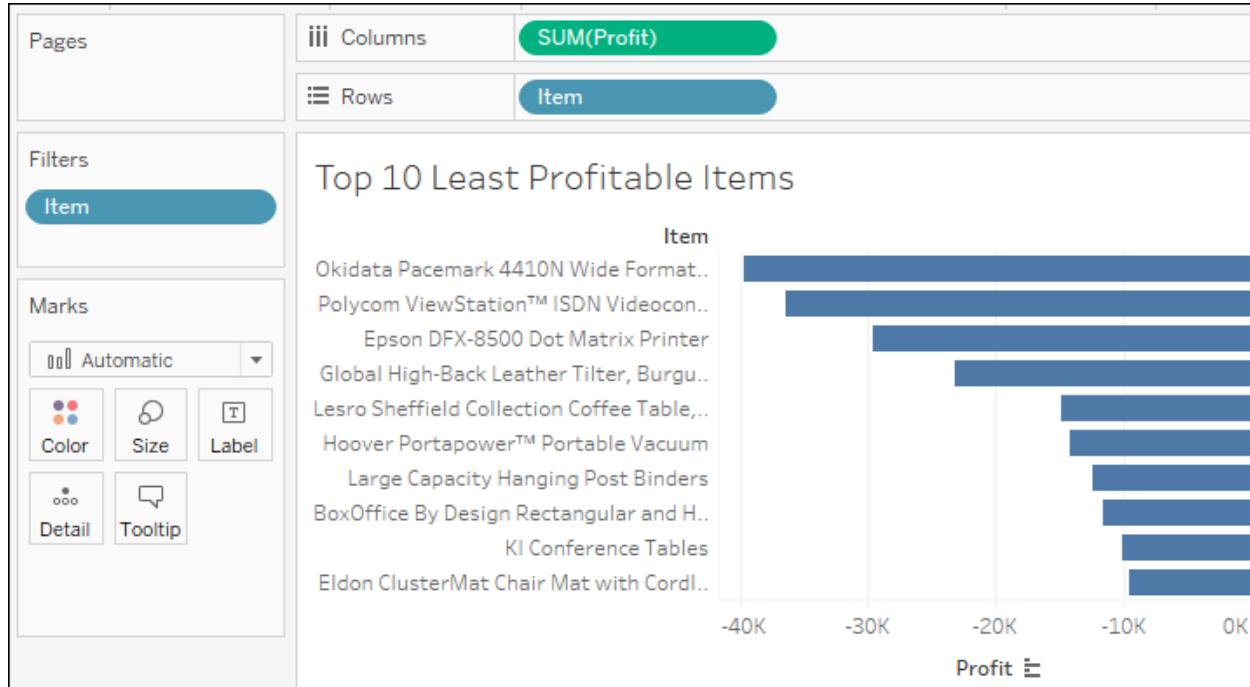
Building the views

- Select the Top tab, and adjust the settings to filter by field.
- Specify Bottom 10 by Sum(Profit):



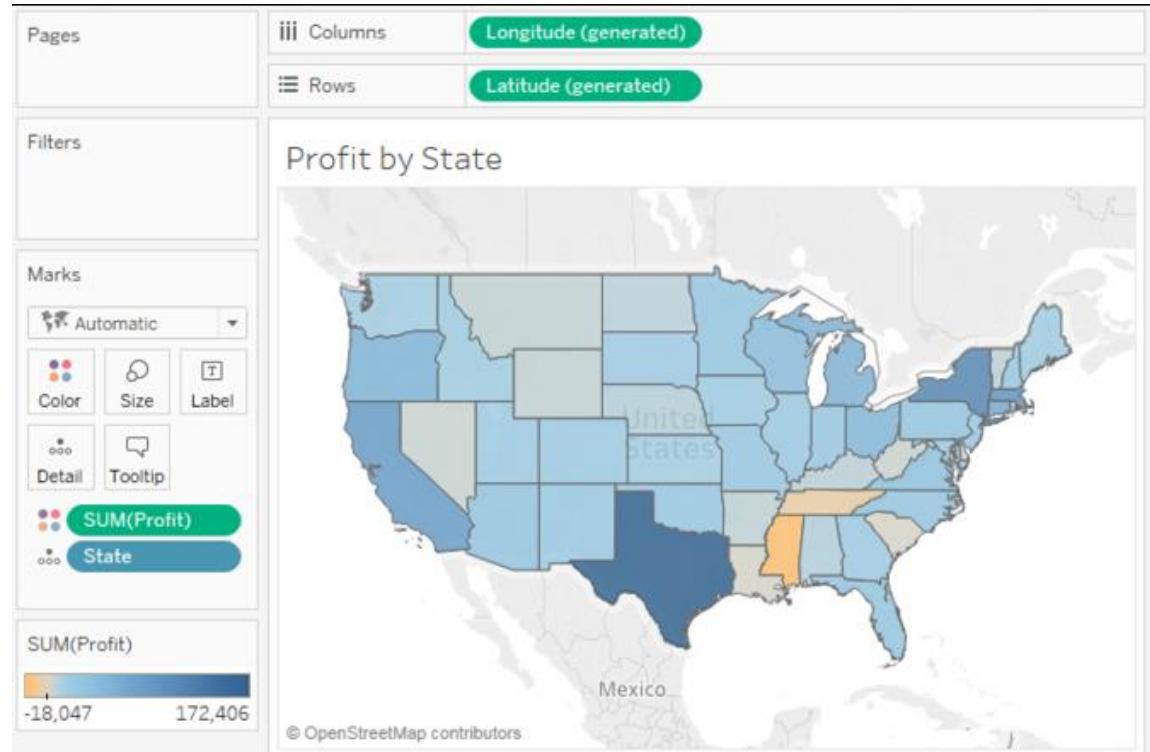
Building the views

- Rename the sheet Top 10 Least Profitable Items:



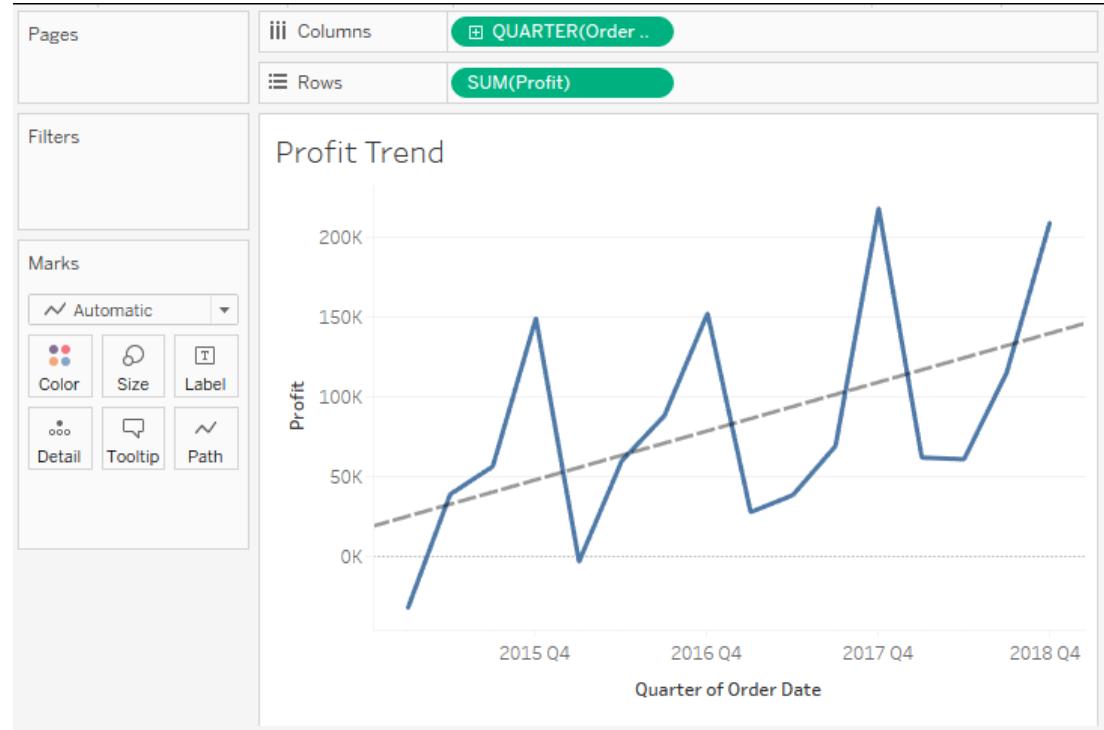
Building the views

- Rename the sheet to Profit by State



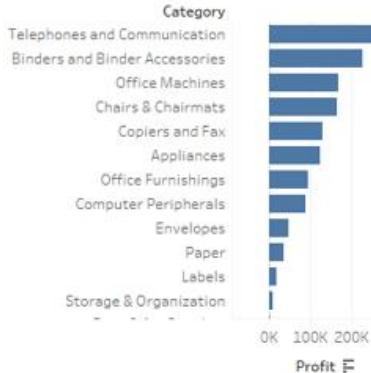
Building the views

- Rename the sheet to Profit Trend:



Is Least Profitable Always Unprofitable?

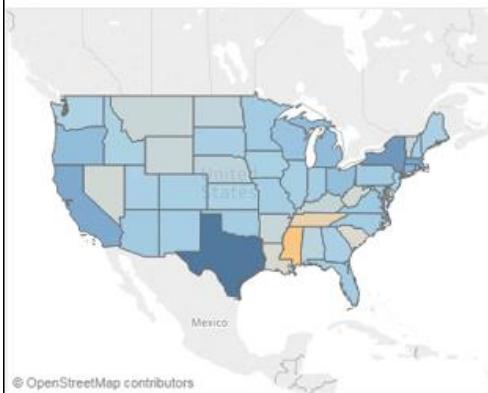
Overall Profit by Category



Top 10 Least Profitable Items



Profit by State



Profit Trend



Is Least Profitable Always Unprofitable?

1. Select a Department from the dropdown
2. Select a category below
3. Select an item below

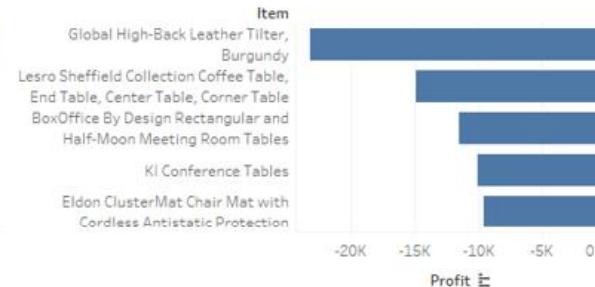
Department

Furniture

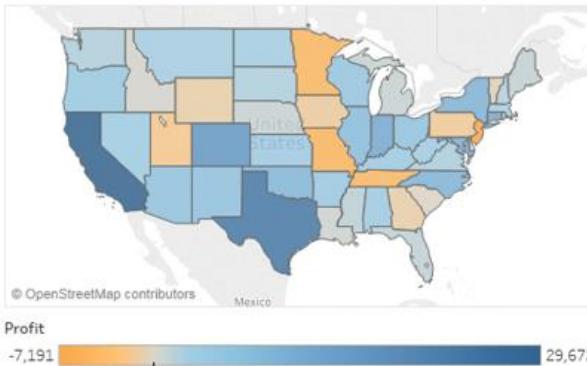
Overall Profit by Category



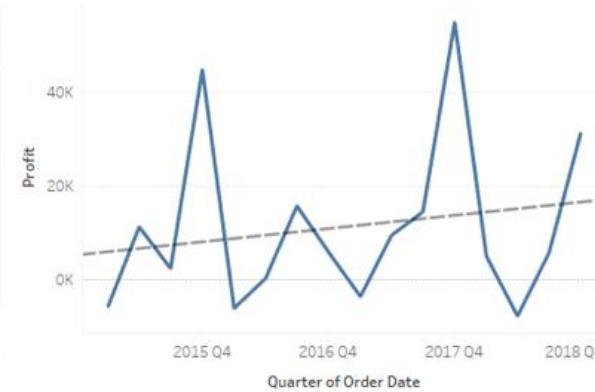
Top 10 Least Profitable Items



Profit by State

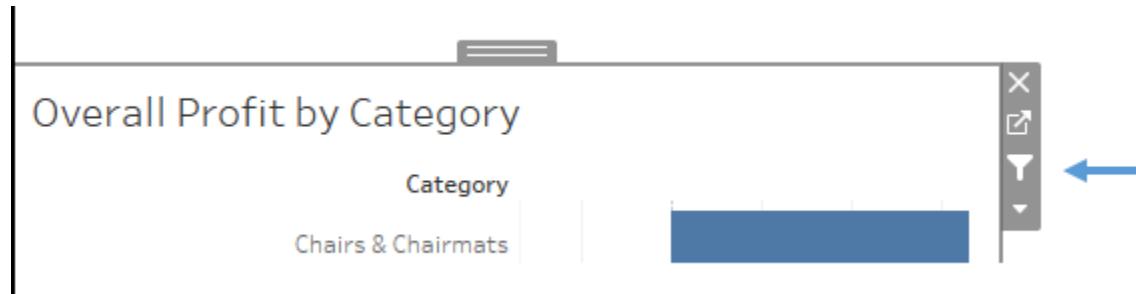


Profit Trend

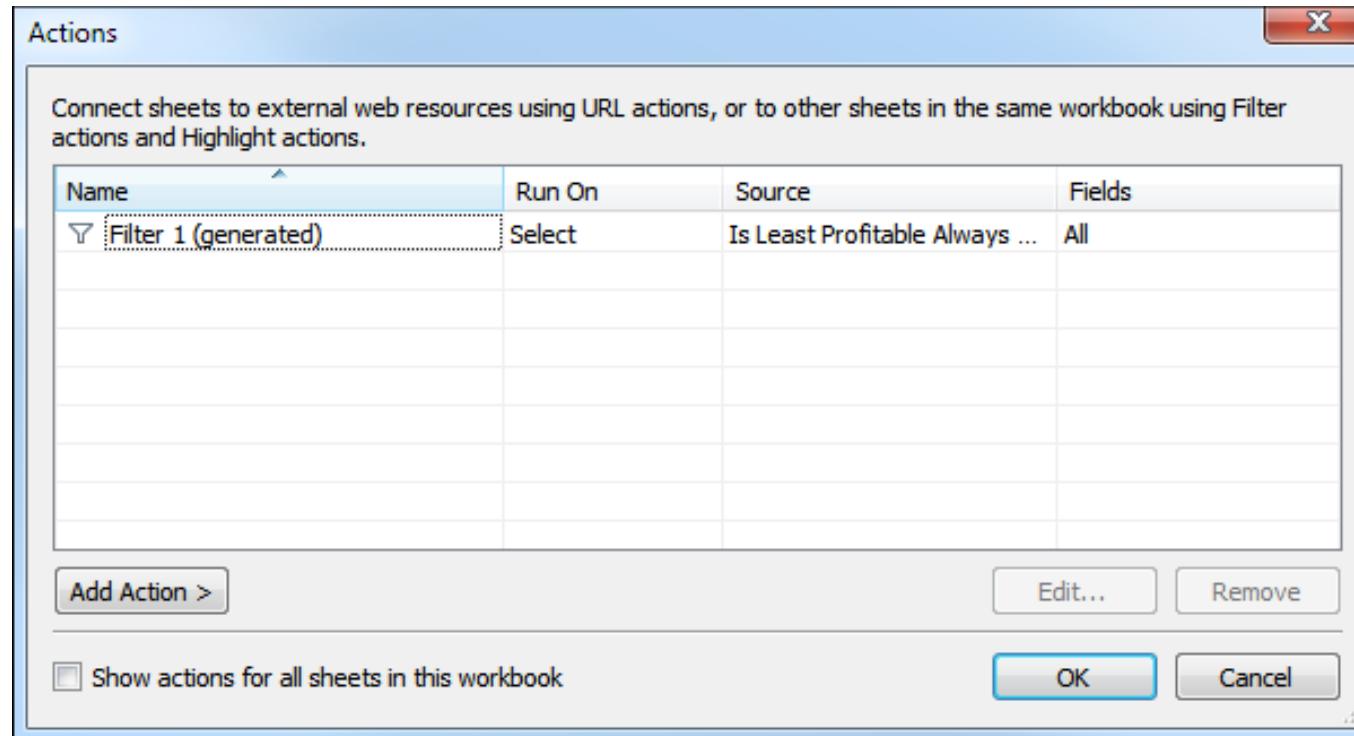


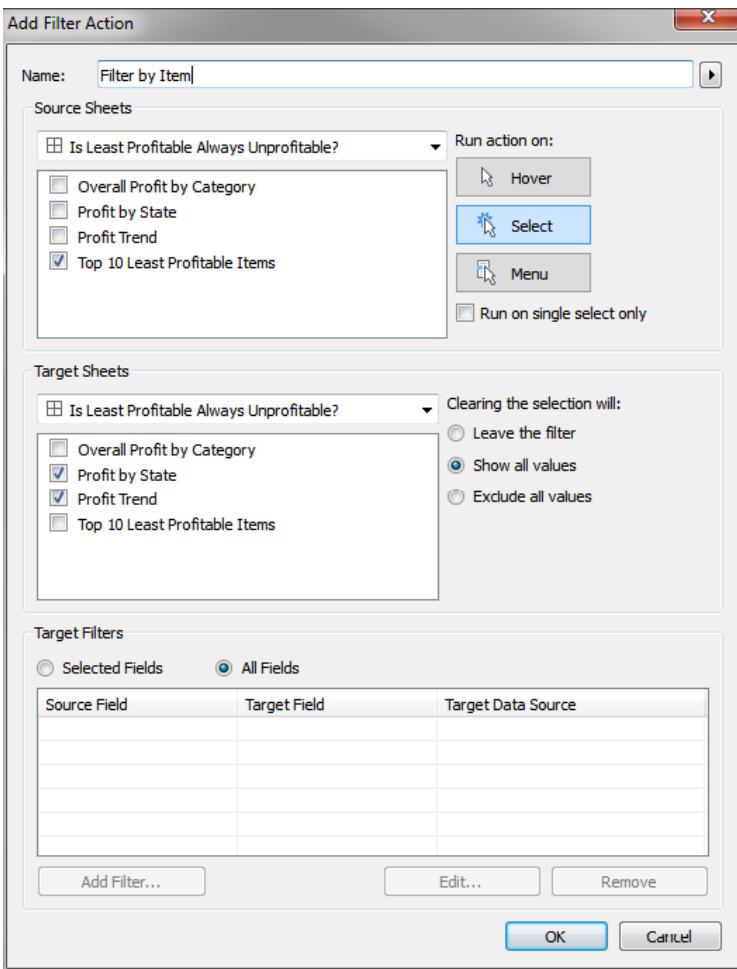
Implementing actions to guide the story

- Click the Use as Filter button on the Overall Profit by Category view.
- This will cause the view to be used as an interactive filter for the entire dashboard.
- That is, when the user selects a bar, all other views will be filtered based on the selection:



Implementing actions to guide the story





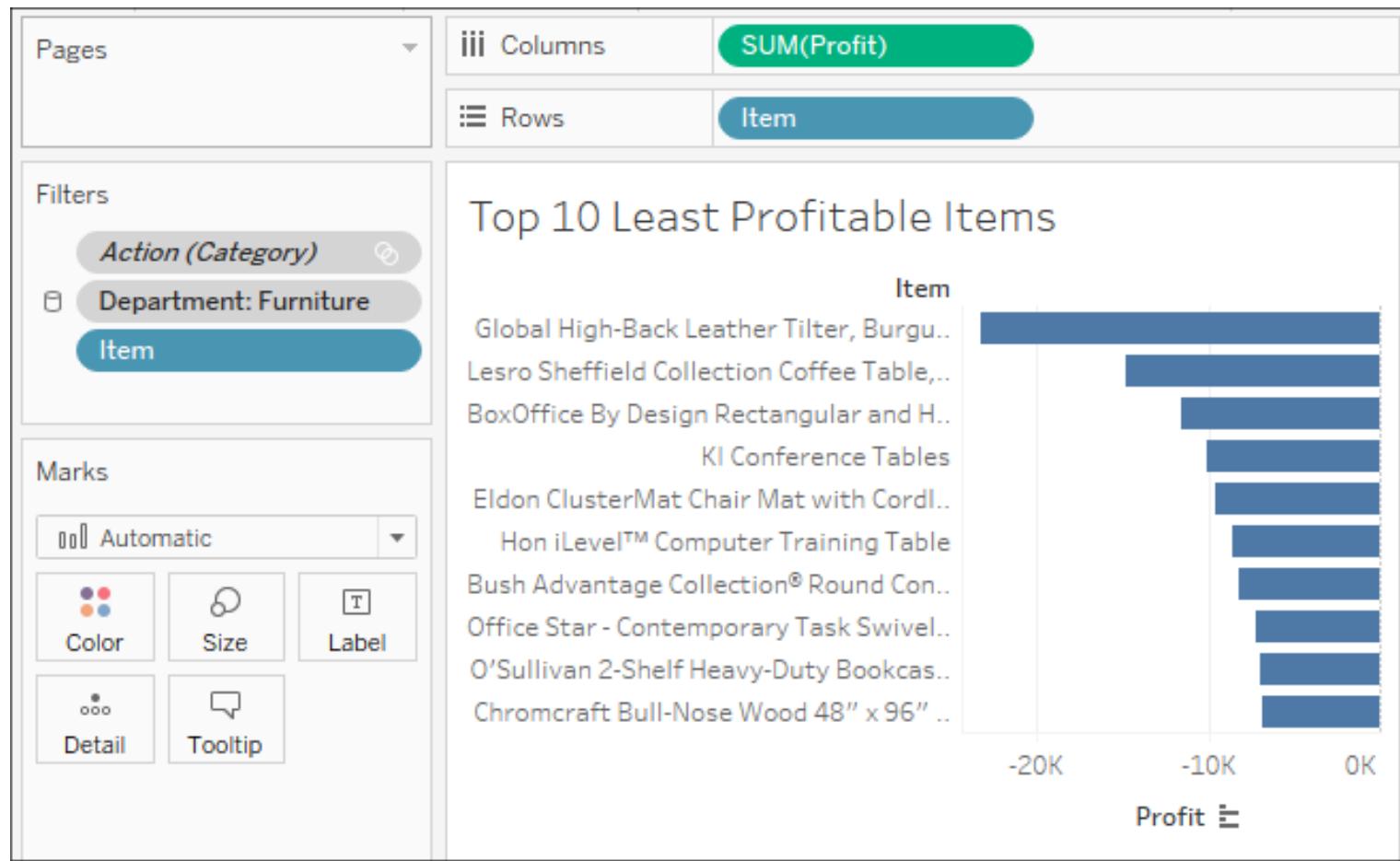
Implementing actions to guide the story

You now have three filters (two are actions) that drive the dashboard:

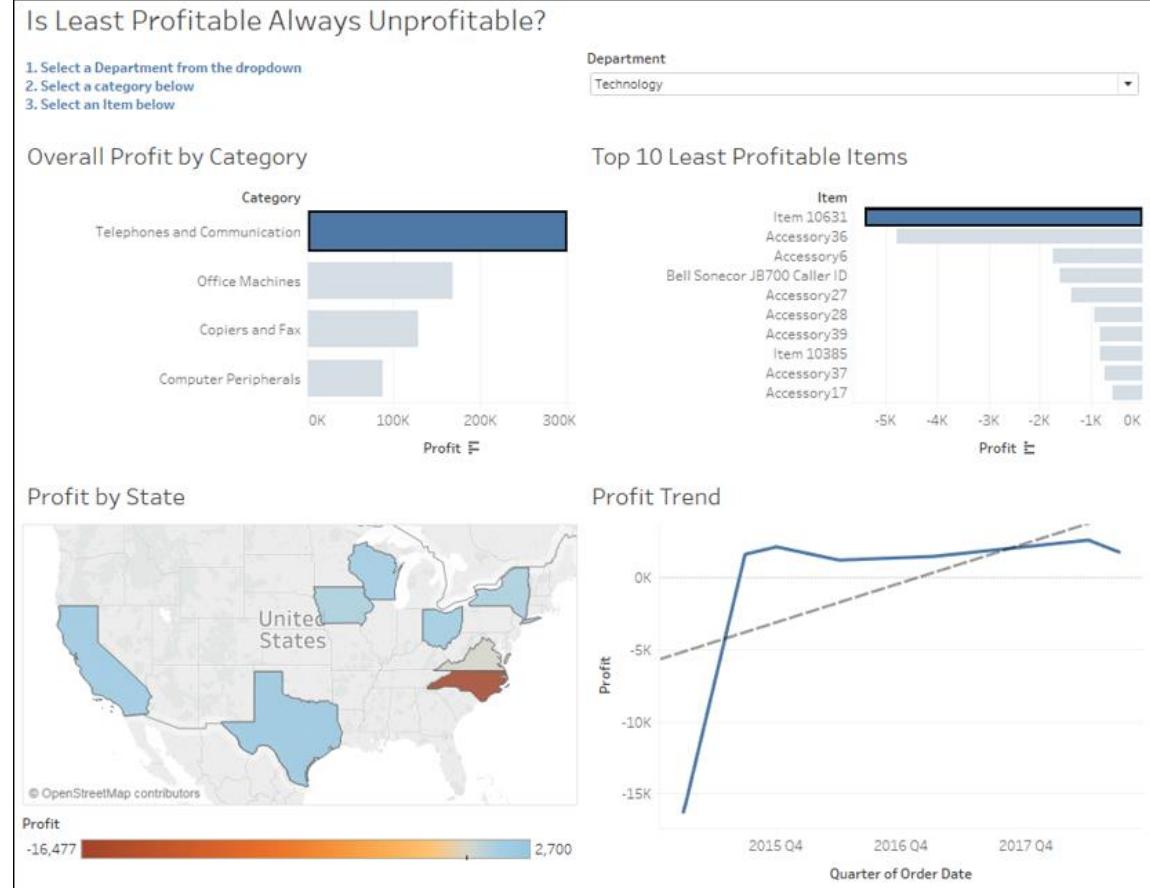
- Selecting a department from the drop-down will filter the entire dashboard (and all views in the workcourse as you set it to filter every view using the data source)
- Selecting a category (clicking a bar or header) will filter the entire dashboard to that selection
- Selecting an item (clicking a bar or header) will filter the Profit by State and Profit Trend dashboards

Context filtering

- You may have noticed that when you use the drop-down filter to select a single department or select a single category, you have fewer than 10 items in the Top 10 view.
- For example, selecting Furniture from the Department filter and clicking on the bar for Tables results in only three items being shown.

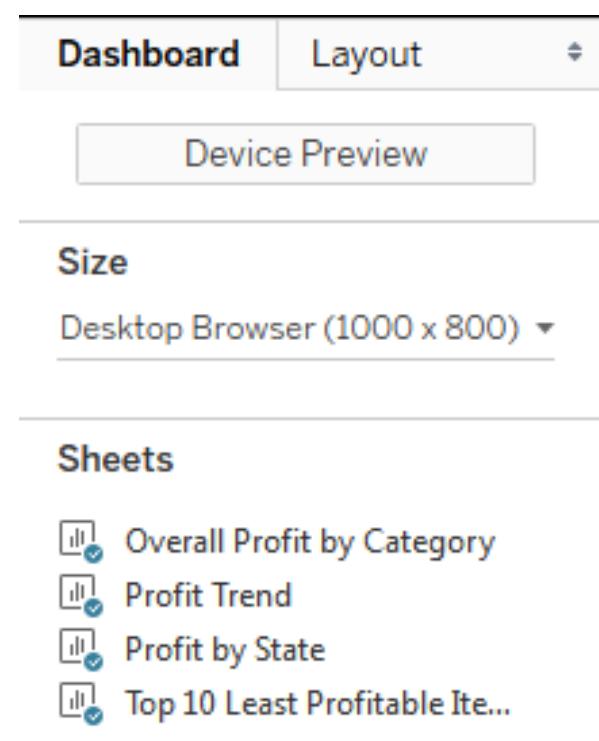


Implementing actions to guide the story



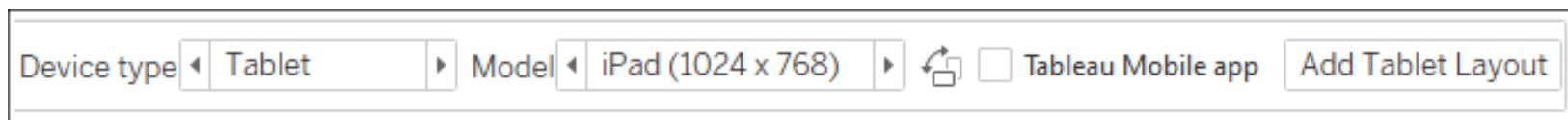
Designing for different displays and devices

- The top of the Dashboard tab on the left sidebar reveals a button to preview the dashboard on various devices, as well as a drop-down for Size options:



Designing for different displays and devices

- Clicking the Device Preview button not only allows you to see how your dashboard will look with various device types (and even specific models) but also allows you to add a layout for each device type, which you can customize:



Designing for different displays and devices

- Clicking the Add Layout button (that is, the Add Tablet Layout button in the preceding screenshot) will add a layout under the Dashboard tab on the left sidebar:

The screenshot shows a user interface for managing dashboard layouts across different devices. At the top, there's a navigation bar with tabs for 'Dashboard' and 'Layout'. Below this, a dropdown menu shows 'Default' selected, followed by 'Tablet' and 'Phone'. A large button labeled 'Device Preview' is visible. The main area is divided into sections for 'Size - Tablet' and 'Layout - Tablet'. Under 'Size - Tablet', three radio buttons are shown: 'Default' (unchecked), 'Fit all' (checked), and 'Fit width' (unchecked). A 'Height' input field with up and down arrows is also present. Under 'Layout - Tablet', two buttons are shown: 'Default' (selected) and 'Custom' (unchecked). A note below states: 'The content and layout of the dashboard on all devices will match the Default dashboard.' Another note below says: 'Click "Custom" to change how the dashboard will look for the devices.'

Dashboard **Layout**

Default **Phone**

Device Preview

Size - Phone

- Default
- Fit all
- Fit width

Height

Layout - Phone

- Default **Custom**

- Overall Profit by Category
- Department
- Profit Trend
- Profit by State
- Profit
- Top 10 Least Profitable Items
- 1. Select a Department from the dropdown
- Is Least Profitable Always Unprofitable?

Clear all

Objects

- Horizontal Web Page
- Vertical Blank
- Text Extension
- Image

Tiled **Floating**

Show dashboard title

Device Preview **Device type**

Is Least Profitable Always Unprofitable?

1. Select a Department from the dropdown
2. Select a category below
3. Select an item below

Department: Technology

Overall Profit by Category

| Category | Profit |
|-------------------------|--------|
| Telephones and Commu... | ~280K |
| Office Machines | ~180K |
| Copiers and Fax | ~150K |
| Computer Peripherals | ~100K |

Top 10 Least Profitable Items

| Item | Profit |
|-----------------------------|--------|
| Item 10631 | ~-3K |
| Accessory36 | ~-2K |
| Accessory6 | ~-1.5K |
| Bell Sonoco JB700 Caller ID | ~-1.5K |
| Accessory27 | ~-1.2K |
| Accessory28 | ~-1.2K |
| Accessory39 | ~-1.2K |
| Item 10385 | ~-1.2K |
| Accessory37 | ~-1.2K |
| Accessory17 | ~-1.2K |

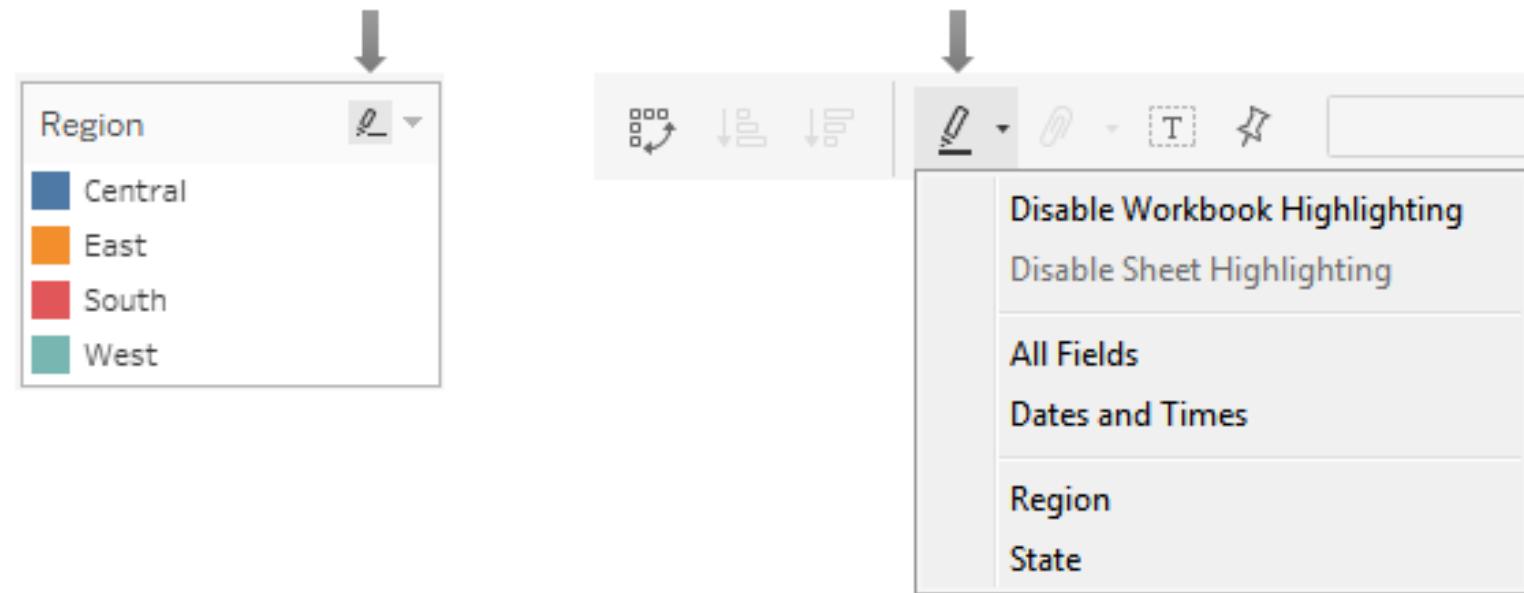
Profit by State

Interactivity with actions

Tableau supports six kinds of actions:

- Filter actions
- Highlight actions
- URL actions
- Go to Sheet
- Parameter actions
- Set actions

Interactivity with actions

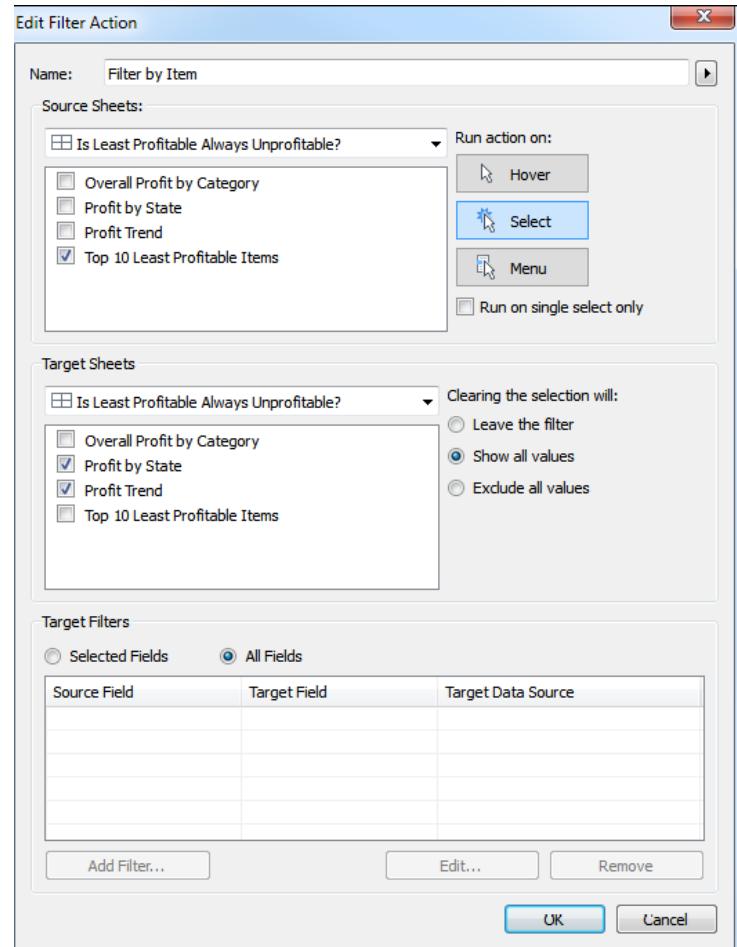


Filter actions

- Filter actions are defined by one or more source sheets that pass one or more dimensional values as filters to target sheets upon an action.
- Remember that every mark on a sheet is defined by a unique intersection of dimensional values.

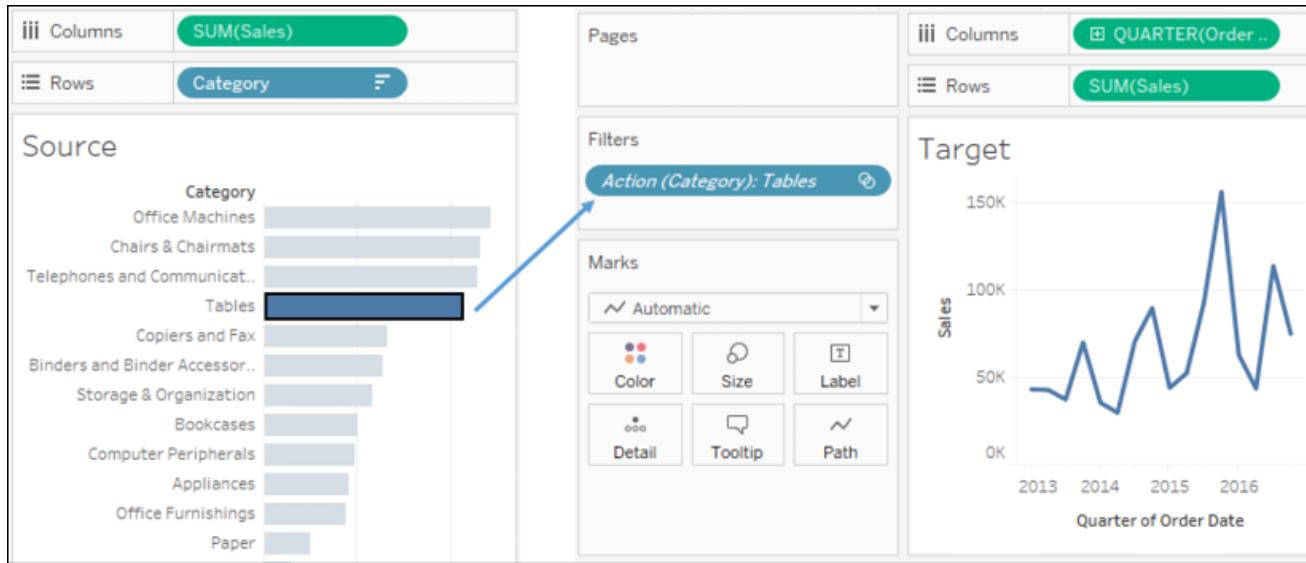
Filter actions

- When you create or edit a filter action, you will see options like these:



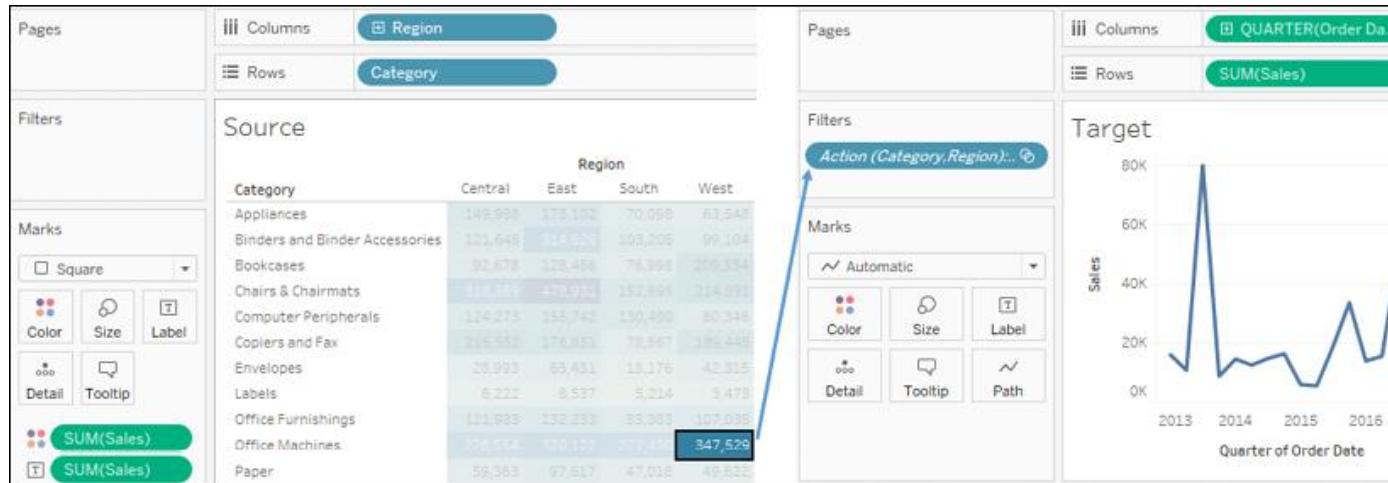
Filter actions

- Consider the following example of a filter action that's triggered when a bar is selected in the source:



Filter actions

- In this example, the filter contains Office Machines and West, matching the dimensions that define the selected square:



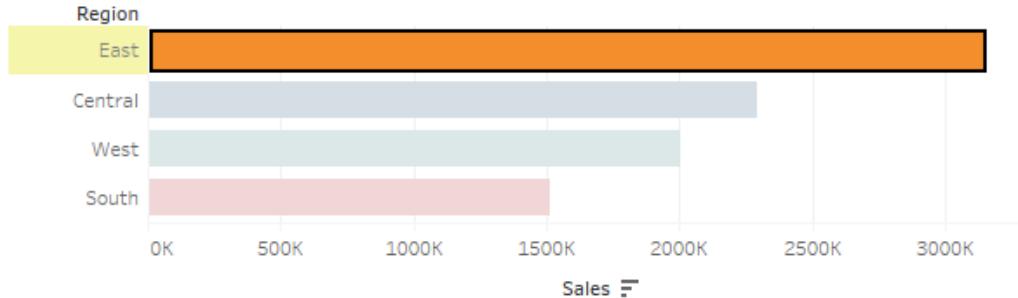
Highlight actions

- This type of action does not filter target sheets. Instead, highlight actions cause marks that are defined, at least in part, by the selected dimensional value(s) to be highlighted in the target sheets.
- The options for highlight actions are very similar to filter actions, with the same configuration options for source and target sheets, and which events are able to trigger the action.

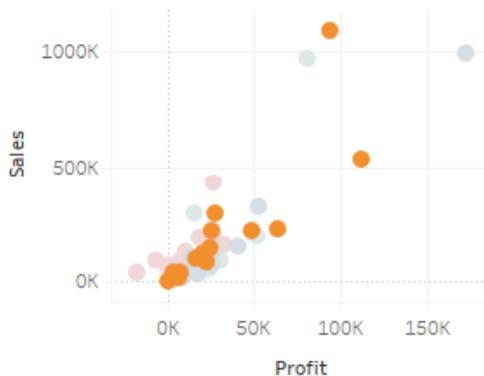
Highlight actions

- Both the map and scatter plot have Region on the Detail part of the Marks card:

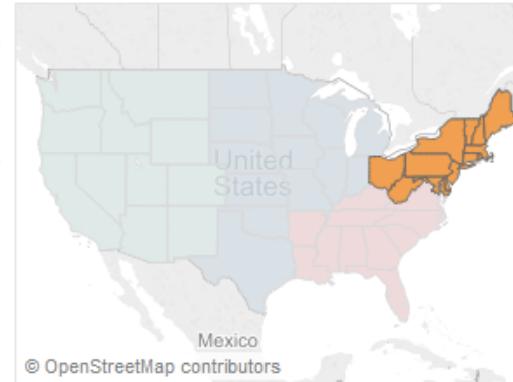
Sales by Region



Sales and Profit by State



Regions

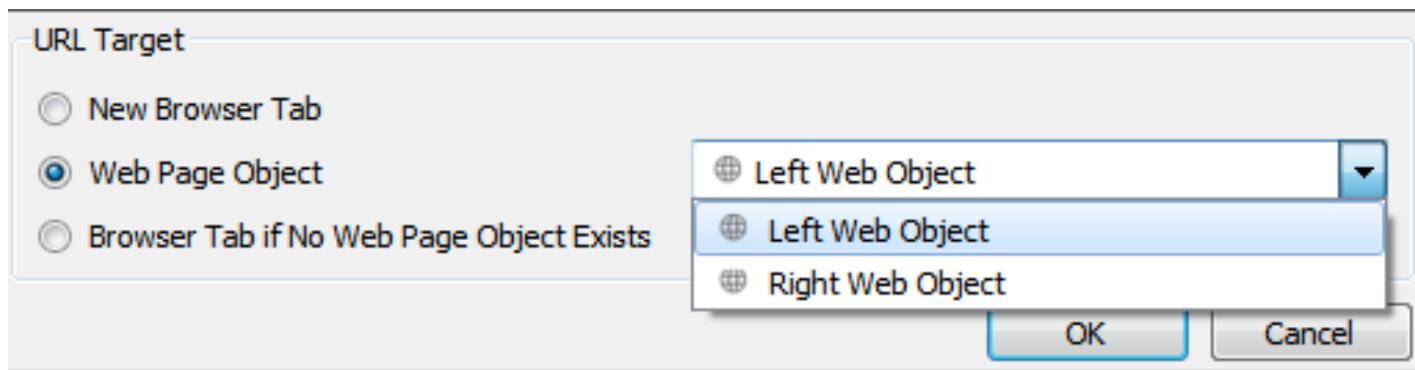


URL actions

- URL actions allow you to dynamically generate a URL based on an action and open it within a web object in the dashboard or in a new browser window or tab.
- URL actions can be triggered by the same hover, menu, and select events as other actions.
- The name of the URL action differentiates it and will appear as the link when used as a menu.

URL actions

- You may specify a target for the URL action when you create or edit the URL action:



URL actions

Item hierarchy

Dashboard

▼ Tiled

▼ Horizontal

Right Web Object

Left Web Object

Edit URL...

Floating

Fix Width

Edit Width...

Select Layout Container

Deselect

Remove from Dashboard

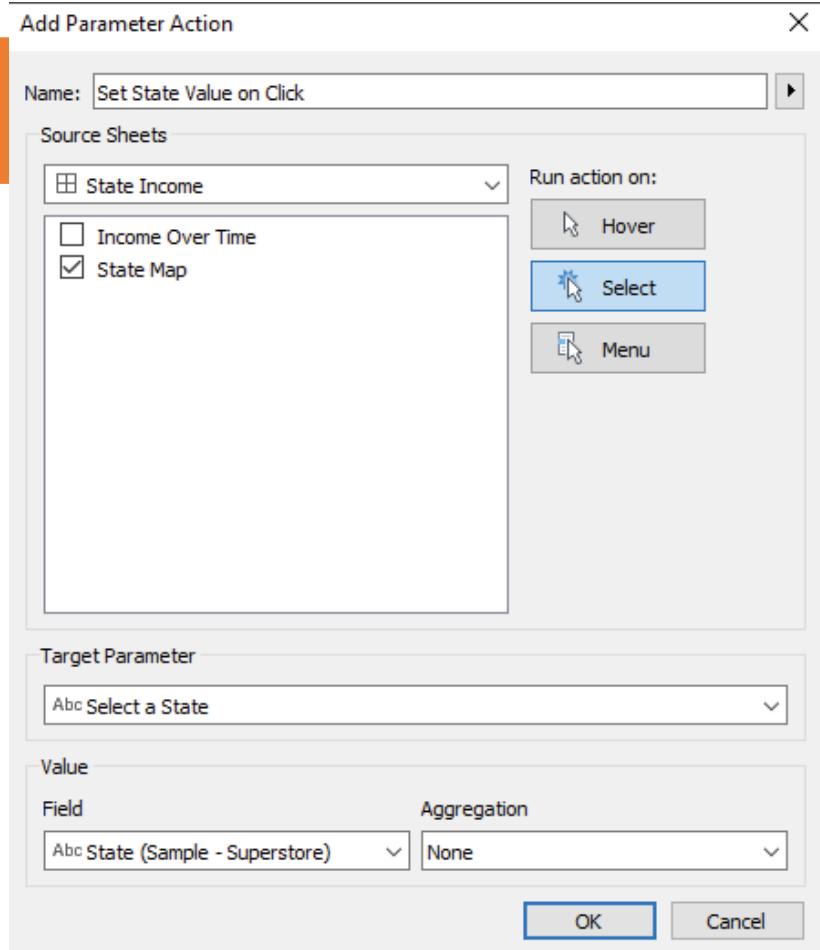
Rename Dashboard Item...

Go to Sheet actions

- Go to Sheet actions (also called navigation actions) allow you to specify navigation to another dashboard or sheet in the workcourse based on user interaction with one or more views.
- For example, clicking a bar in a bar chart might navigate to another dashboard.
- These are similar to filter actions that define another sheet as a target but Go to Sheet actions do not set any filters.

Parameter actions

- Parameter actions allow you to set the value of a parameter based on a user action.
- When you create a parameter action, you'll set options using a screen like this:



Set actions

- Set actions allow you to populate a set with one or more values for one or more dimensions.
- This is very powerful because sets can be used on any shelf to encode any visual element, can be leveraged in calculations, and can be used as filters.
- They can be used in all of these ways—and in different ways—in different views.
- This gives you incredible flexibility in what can be accomplished with set actions.

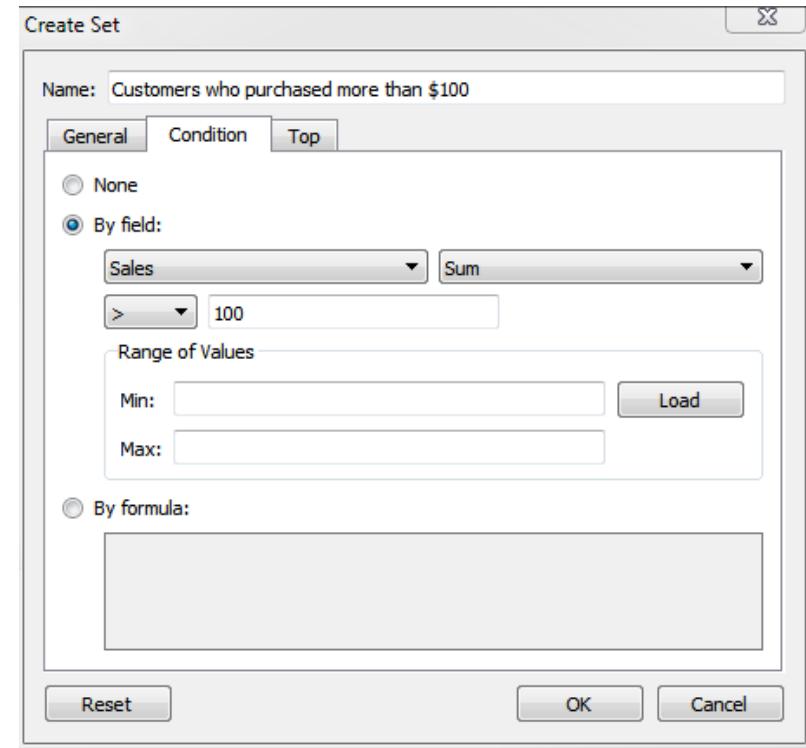
Sets

A set in Tableau defines a collection of records from the data source. At a row-level, each record is either in or out of the set. There are two types of sets:

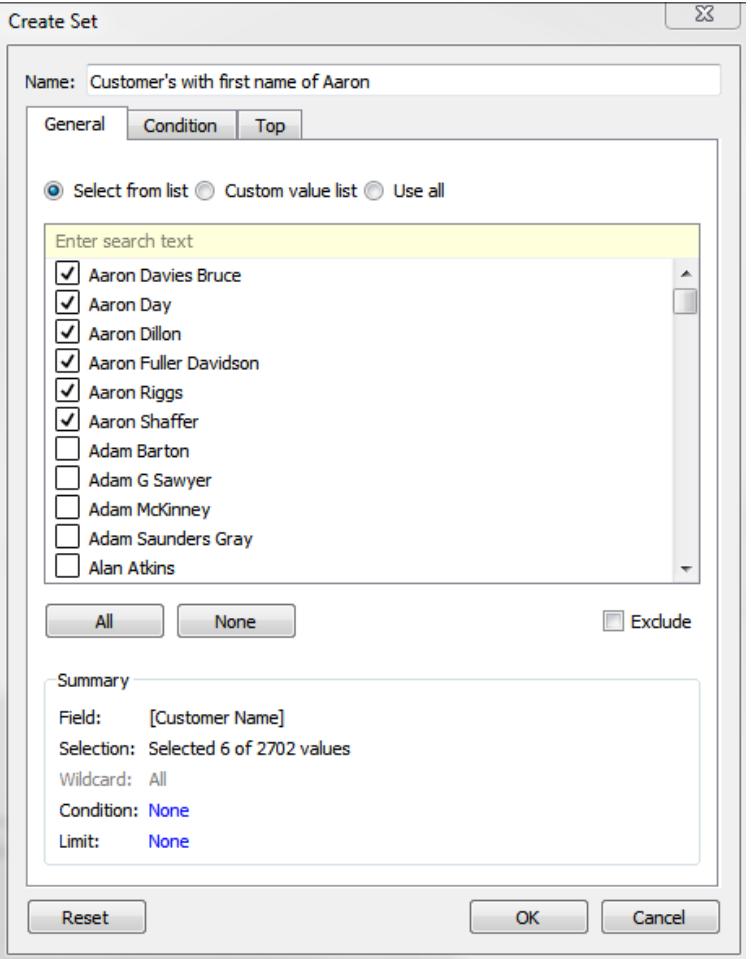
- Dynamic sets (sometimes called computed or calculated sets)
- Fixed sets

Sets

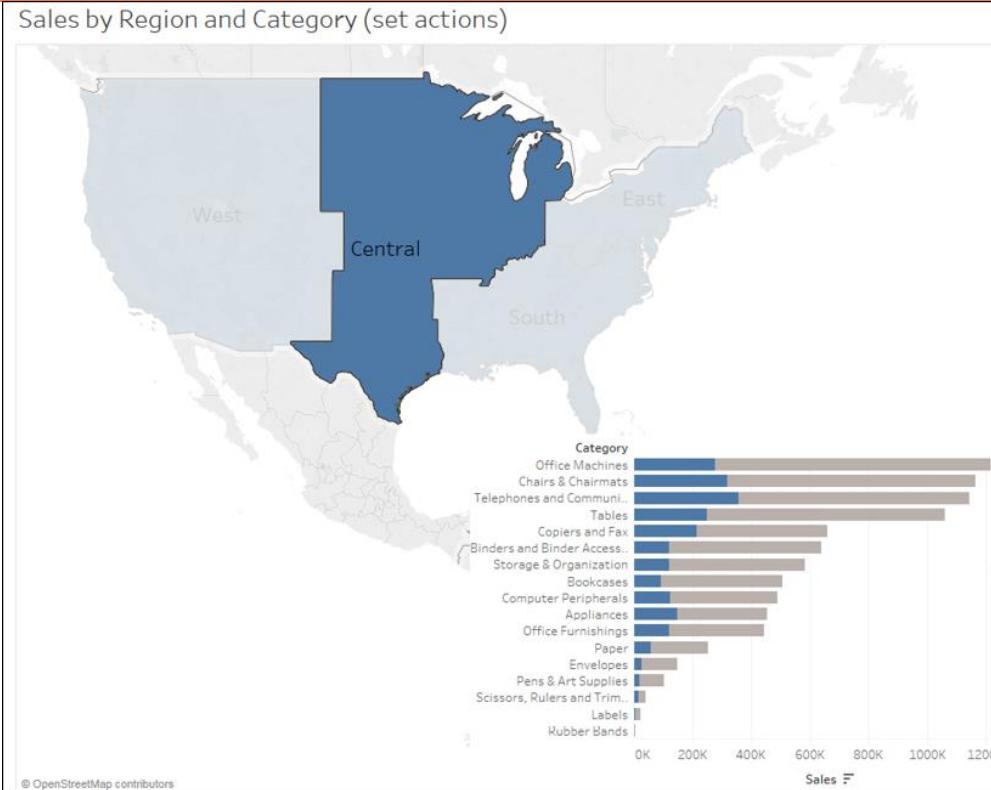
- For example, if you were to use the drop-down menu on Customer Name in the data pane and select Create | Set, then you could stipulate a condition that defines which records belong to the set:



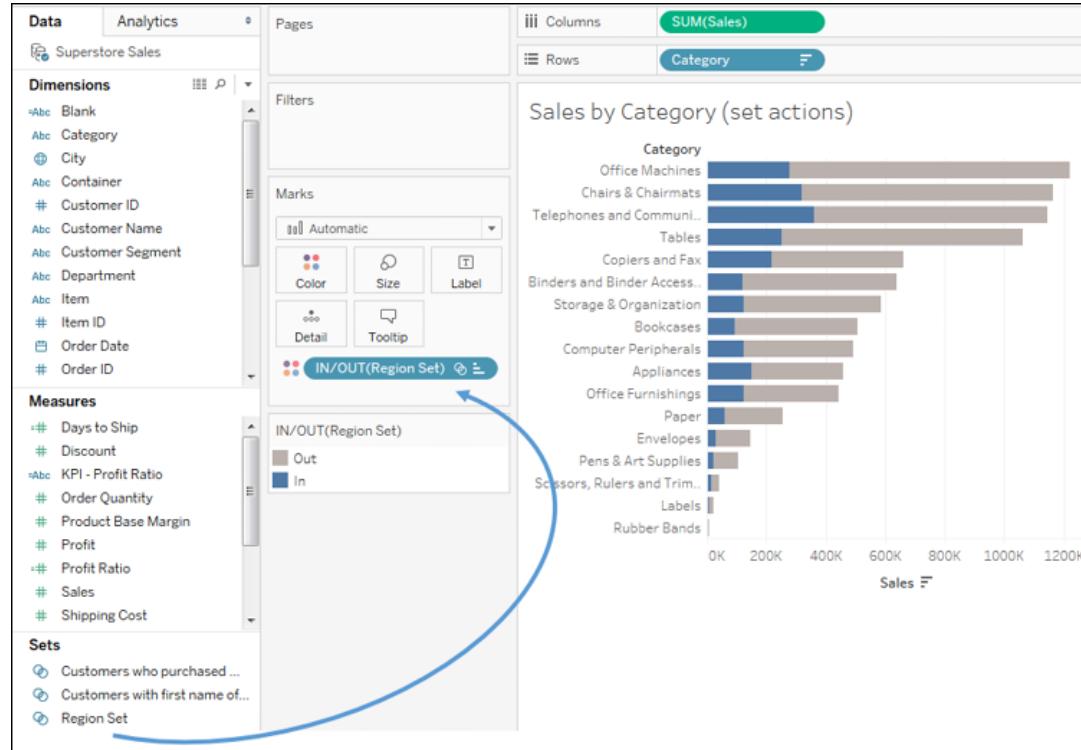
Sets



A set action example

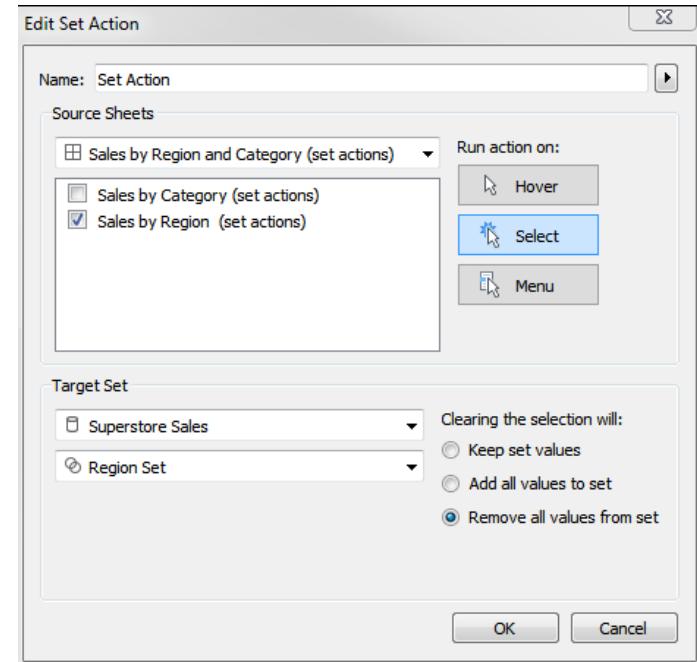


A set action example



A set action example

- Add a set action by selecting Dashboard | Actions from the menu and then Add Action | Change Set Values... in the resulting dialog.
- The resulting dialog has many similar features to other action types:



A regional scorecard dashboard

- Now, we'll consider another example dashboard that demonstrates slightly different objectives. Let's say everyone in the organization has agreed upon a KPI of profit ratio.
- Furthermore, there is consensus that the cut-off point between an acceptable and poor profit ratio is 15%, but management would like to have the option of adjusting the value dynamically to see whether other targets might be better.

A regional scorecard dashboard

- Consider the following dashboard:



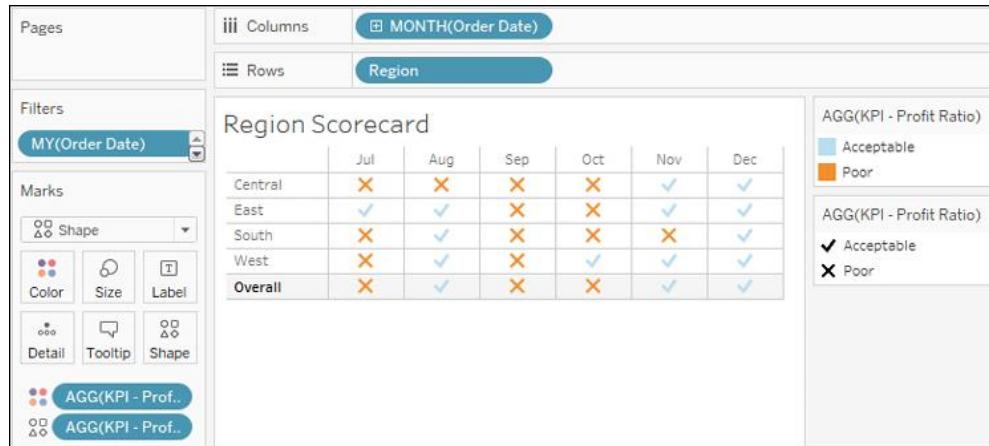
A regional scorecard dashboard

- Create a second calculation named KPI - Profit Ratio with the following code:

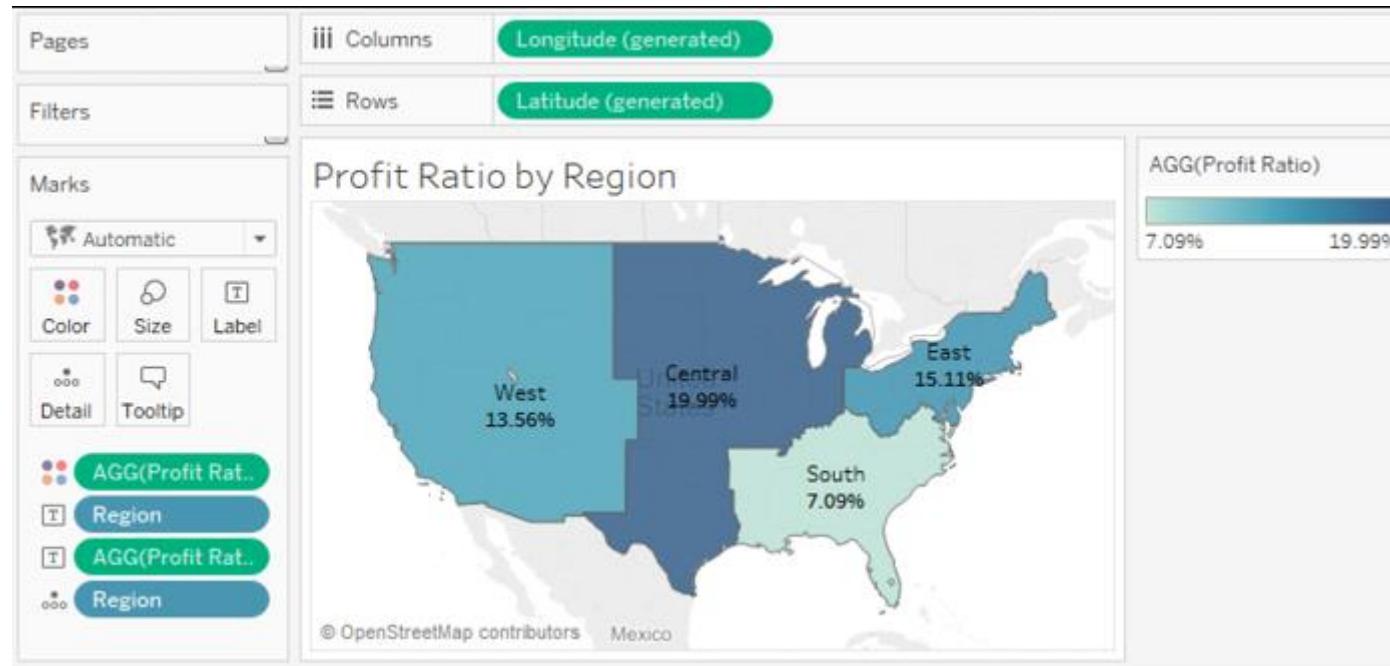
```
IF [Profit Ratio] >= [Profit Ratio KPI Target]  
THEN "Acceptable"  
ELSE "Poor"  
END
```

A regional scorecard dashboard

- Add Order Date as a filter and set it to the top 6 by field (Order Date as Min).
- This will dynamically filter the view to the last six months:

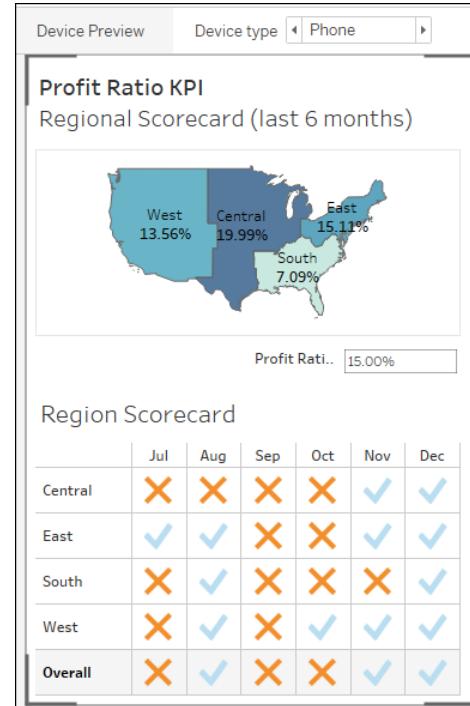


A regional scorecard dashboard



A regional scorecard dashboard

- Once both views have been created, you can arrange the views as a dashboard.
- The example in the lesson 08 Complete workcourse has a phone layout applied to it as seen here:

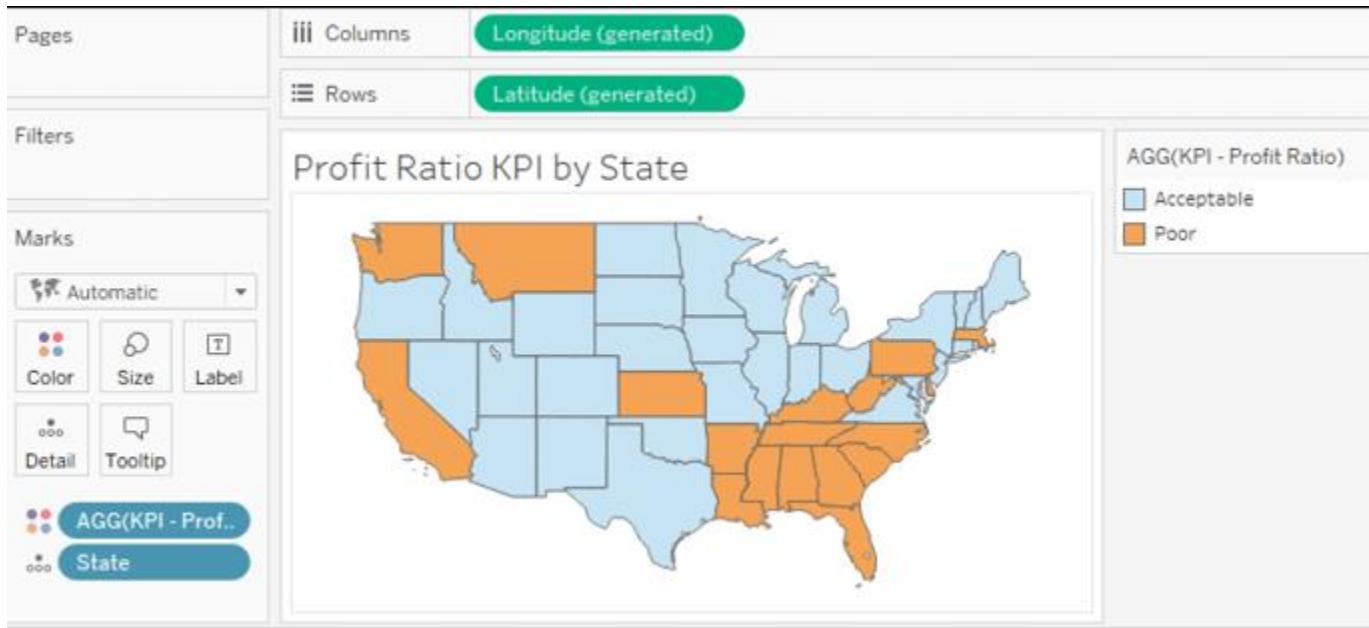


Stories

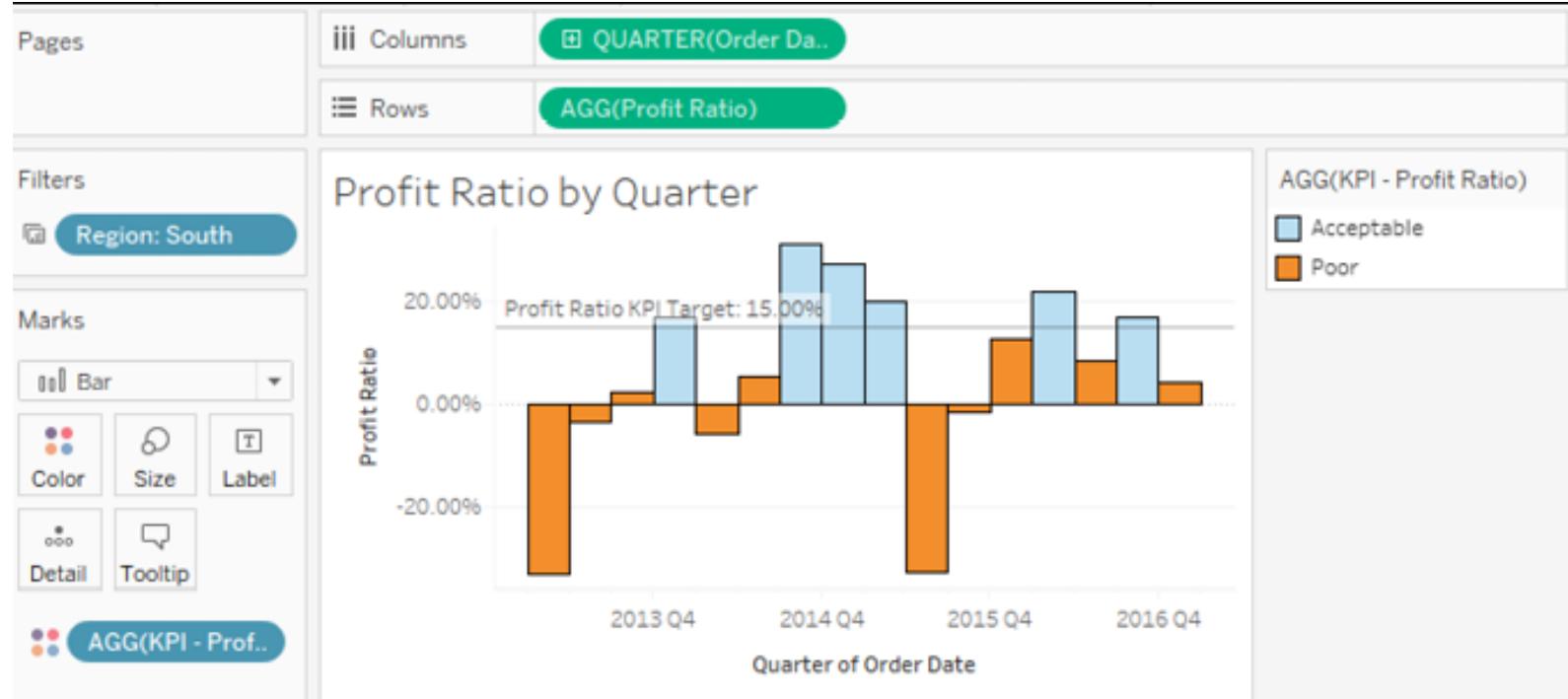
- The stories feature allows you to tell a story using interactive snapshots of dashboards and views, The snapshots become points in a story.
- This allows you to construct a guided narrative or even an entire presentation.
- Let's consider an example in which story points might be useful.

Stories

- Add Profit Ratio to the Detail part of the Marks card so that it is available for later use:



Stories

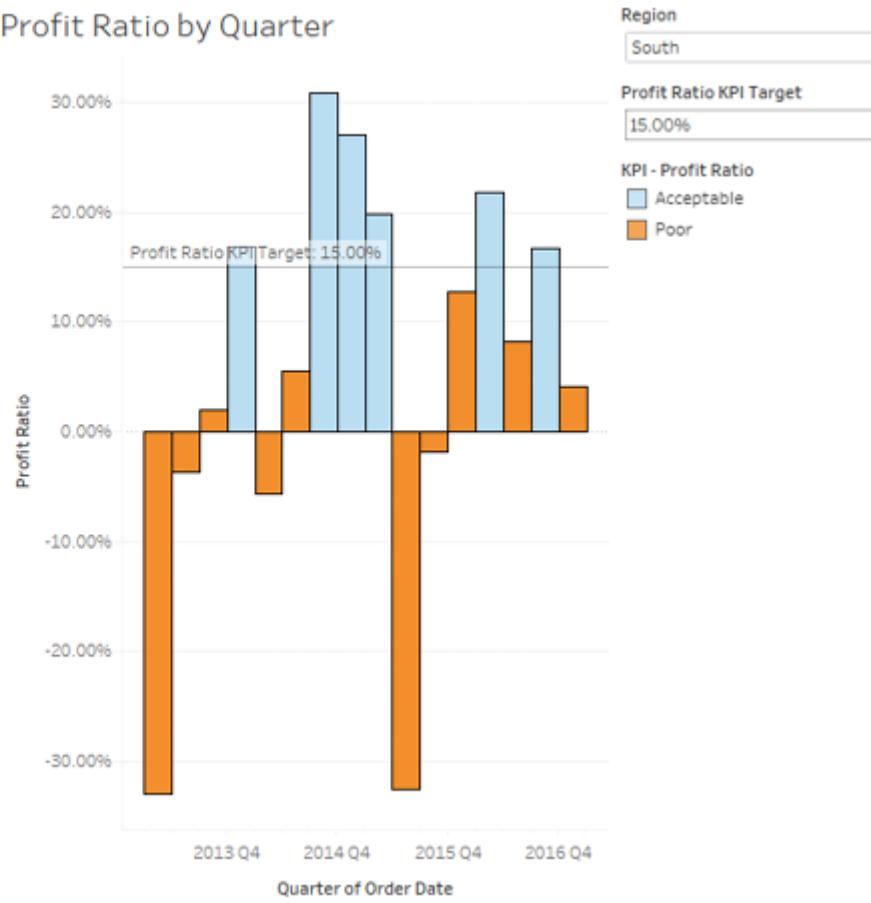


Stories

Profit Ratio KPI by State



Profit Ratio by Quarter



| Region | South |
|-------------------------|--------------------|
| Profit Ratio KPI Target | 15.00% |
| KPI - Profit Ratio | Acceptable Poor |

Stories

Story Title

Update X

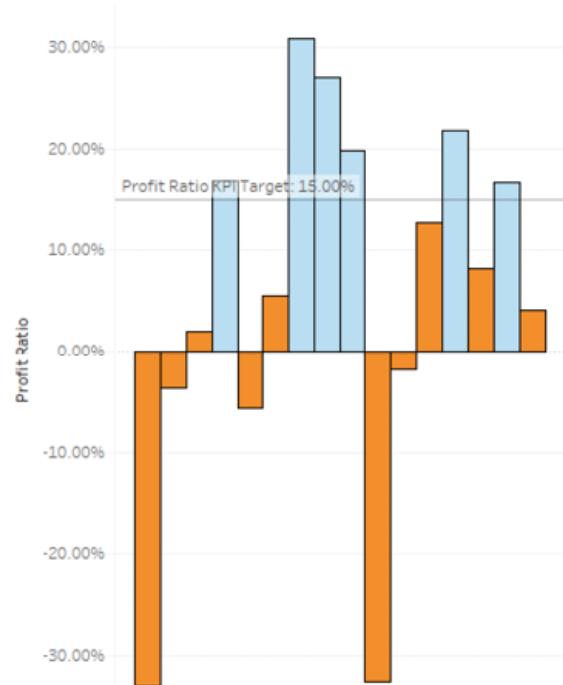
< Story Point 1 Story Point 2 >

New Blank Point
Save as a New Point

Profit Ratio KPI by State



Profit Ratio by Quarter



Stories

- Add the Regional Scorecard dashboard as the first story point. Select the South region in the map.
- Give the story point the following text: The South Region has not performed well the last 6 months:

South Region Analysis

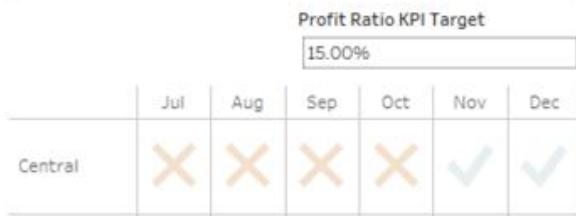
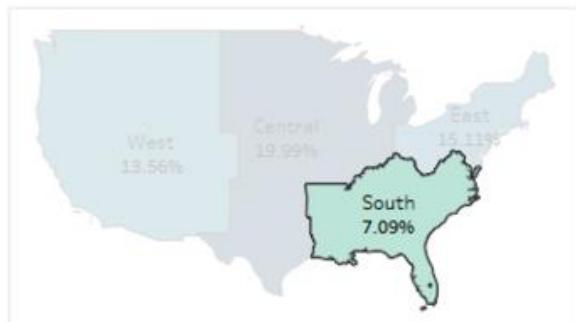
The South Region has not performed well the last 6 months.

New Blank Point

Duplicate

Profit Ratio KPI

Regional Scorecard (last 6 months)



South Region Analysis



The South Region has not performed well the last 6 months.

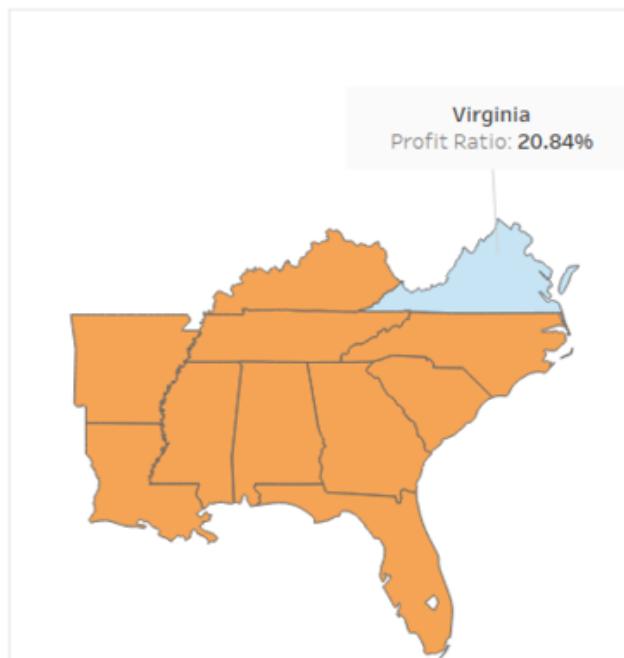


Only one state has met the 15% target overall

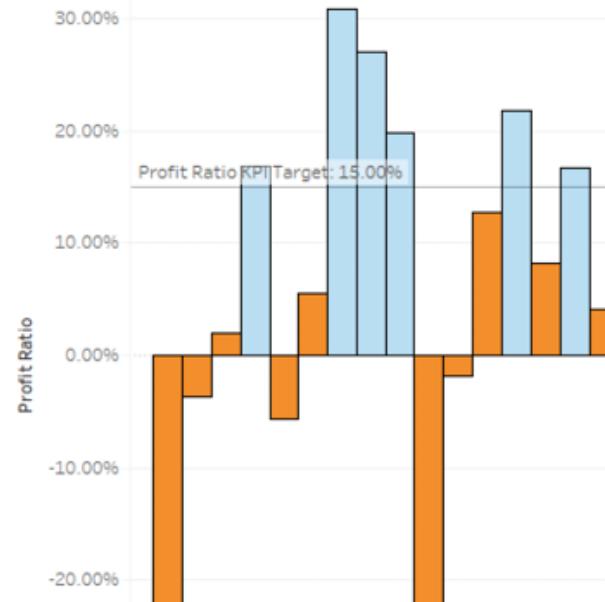
New Blank Point

Duplicate

Profit Ratio KPI by State



Profit Ratio by Quarter



South Region Analysis

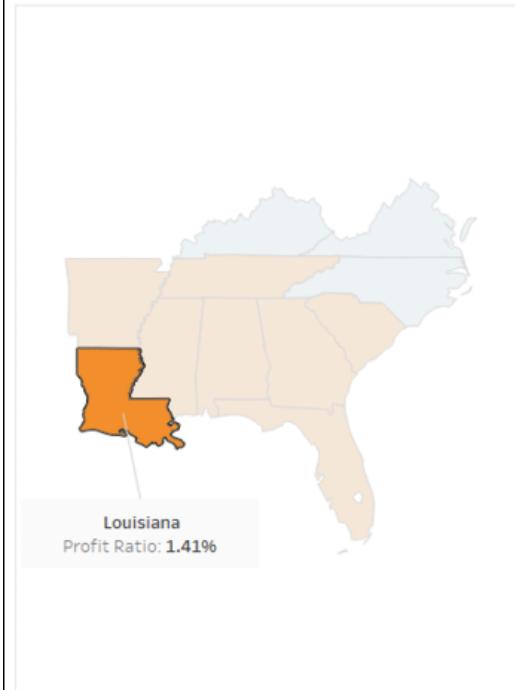
The South Region has not performed well the last 6 months.

Only one state has met the 15% target overall

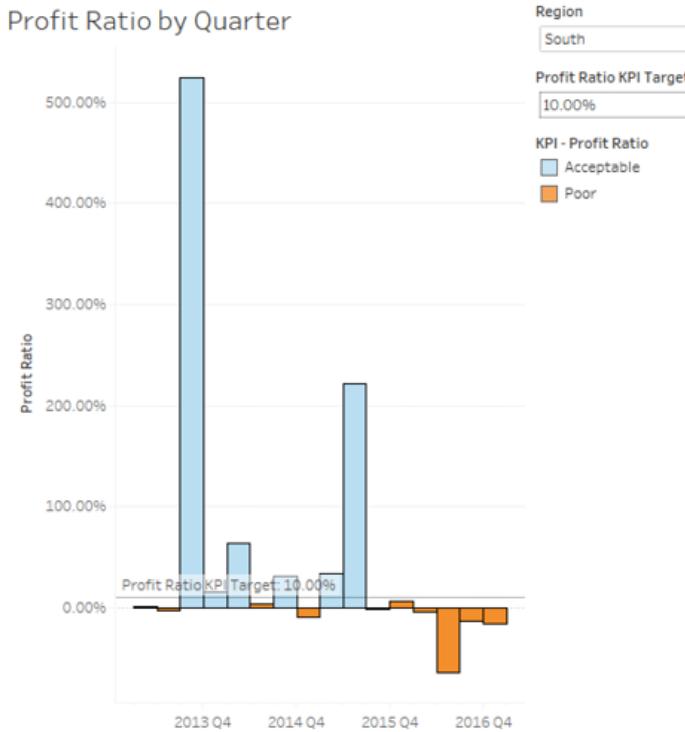
3 states would meet a goal of 10%

Certain states have performed well historically

Profit Ratio KPI by State



Profit Ratio by Quarter



Summary

- When you are ready to share your discovery and analysis, you will likely use dashboards to relate the story to your audience.
- The way in which you tell the story will depend on your objectives, as well as your audience and the mode of delivery.
- Using a combination of views, objects, parameters, filters, and legends, you can create an incredible framework for telling a data story.

COMPLETE LAB 8

9. Visual Analytics – Trends, Clustering, Distributions, and Forecasting



Visual Analytics – Trends, Clustering, Distributions, and Forecasting

This lesson will cover the built-in statistical models and analysis, including the following topics:

- Trends
- Clustering
- Distributions
- Forecasting