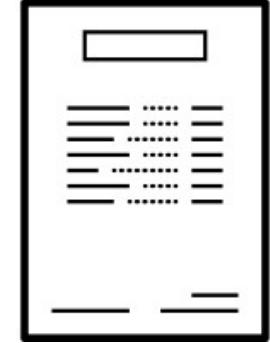


# Tableau 2020





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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

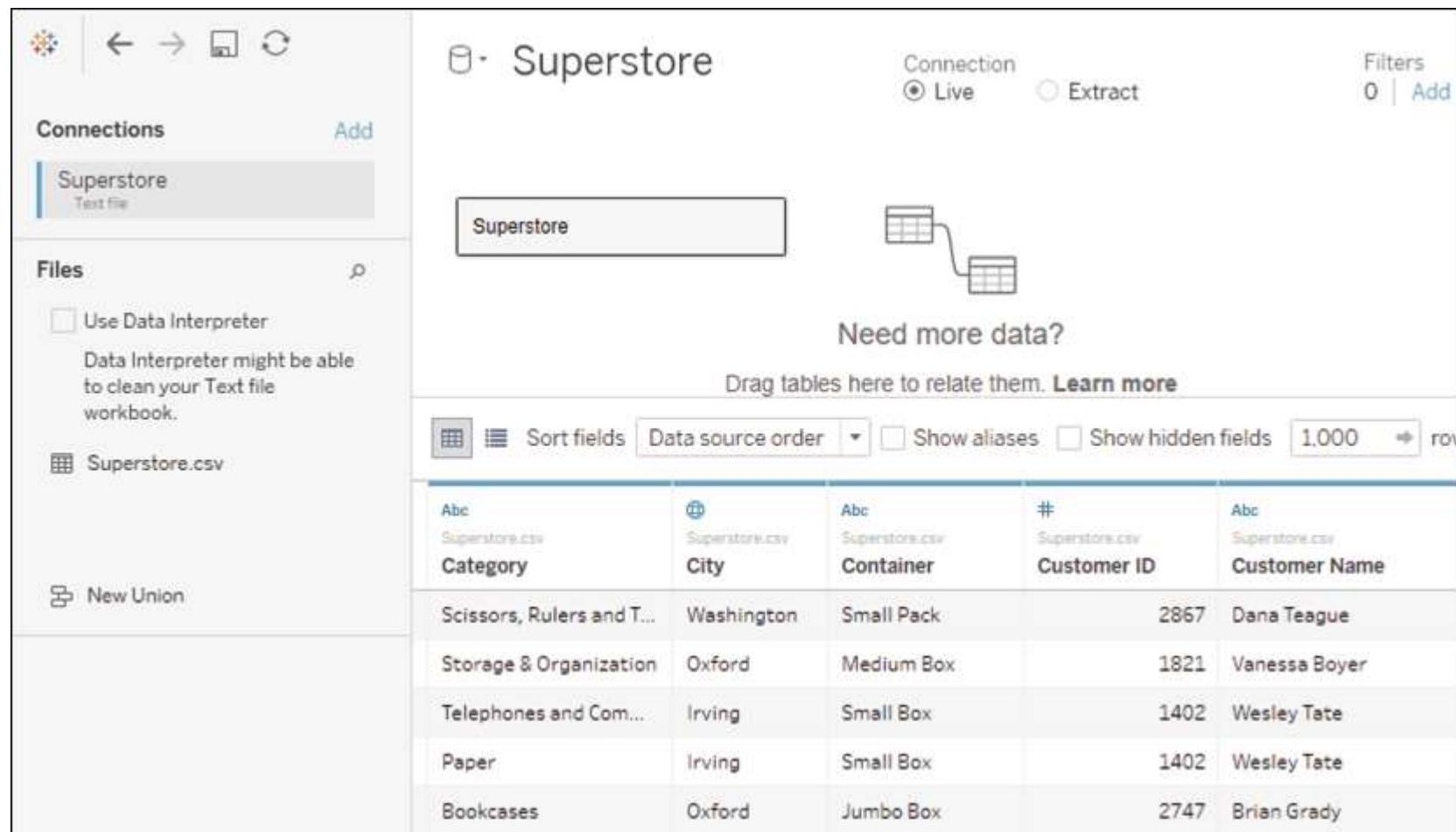


# Connecting to data

- 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.

The screenshot shows the Tableau desktop application interface. On the left, the sidebar displays 'Connections' (Superstore, Text file) and 'Files' (Superstore.csv). A note about using the Data Interpreter is present. On the right, the main workspace is titled 'Superstore'. It shows a single data source named 'Superstore' with a live connection. A message 'Need more data?' with a 'Drag tables here to relate them.' instruction and a 'Learn more' link is displayed. Below this, there are sorting and filtering options ('Sort fields', 'Data source order', checkboxes for 'Show aliases' and 'Show hidden fields', and a row limit of '1,000'). A preview of the data table is shown, containing the following data:

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

The screenshot shows the Tableau desktop application interface. The main window is titled "Tableau - Chapter 01 Starter".

- 1** File Data Worksheet Dashboard Story Analysis Map Format Server Window Help
- 2** Standard View Control Buttons
- 3** Data Source Selector: Superstore
- 4** Columns and Rows Fields
- 5** Sheet 1 Canvas
- 6** Show Me Dashboard
- 7** Navigation Bar: Data Source, Workbook Introduction, Sheet 1 (selected), Measures and Dimensions, Sales by Department, Bar Chart (two levels), Bar C

The left sidebar lists the "Superstore" data source with various dimensions and measures. The "Measures" section includes fields like Order Date, Order ID, Order Priority, Postal Code, Region, Row ID, Ship Date, Ship Mode, State, and several generated measures such as Measure Names, Discount, Order Quantity, Product Base Margin, Profit, Sales, Shipping Cost, Unit Price, Latitude (generated), and Longitude (generated).

The central workspace is labeled "Sheet 1" and contains three blank "Drop field here" placeholder areas.

The right side features a "Show Me" dashboard with a grid of visualization icons, and a tooltip at the bottom right says "Select or drag data Use the Shift or Ctrl key to select multiple fields".

# 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.

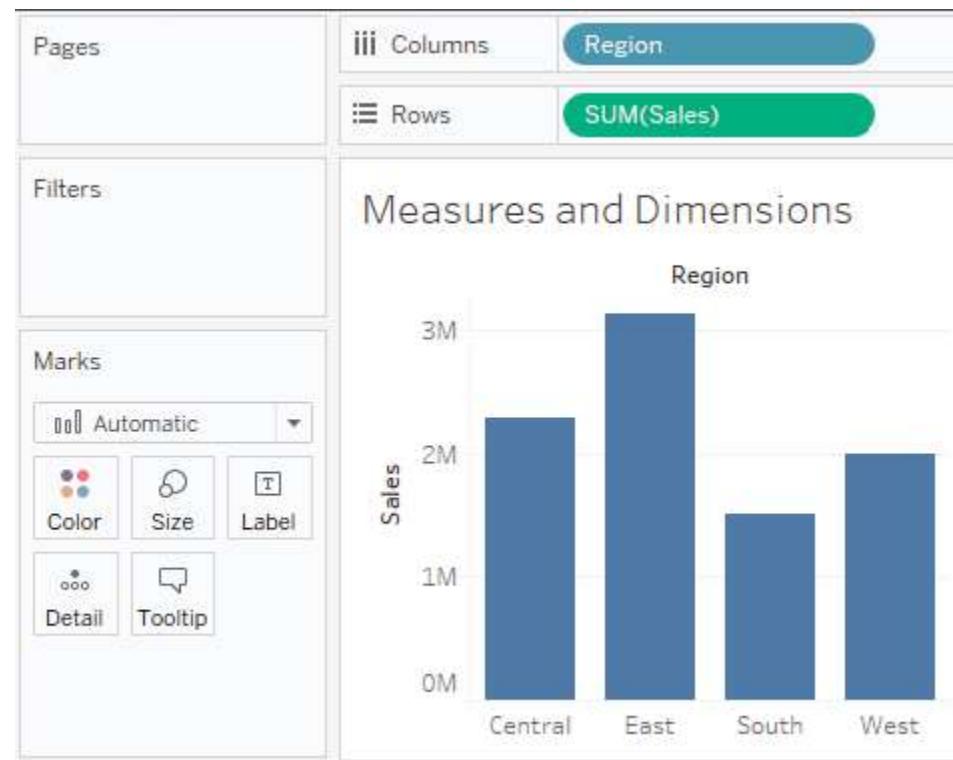
# Measures and dimensions

Dimensions  
are above the line

Measures  
are below the line

Data		Analytics
 Superstore		
Search		
<b>Tables</b>		
 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)		
 Number of Records		
 Superstore (Count)		
 Measure Values		

# Measures and dimensions



# Discrete and continuous fields

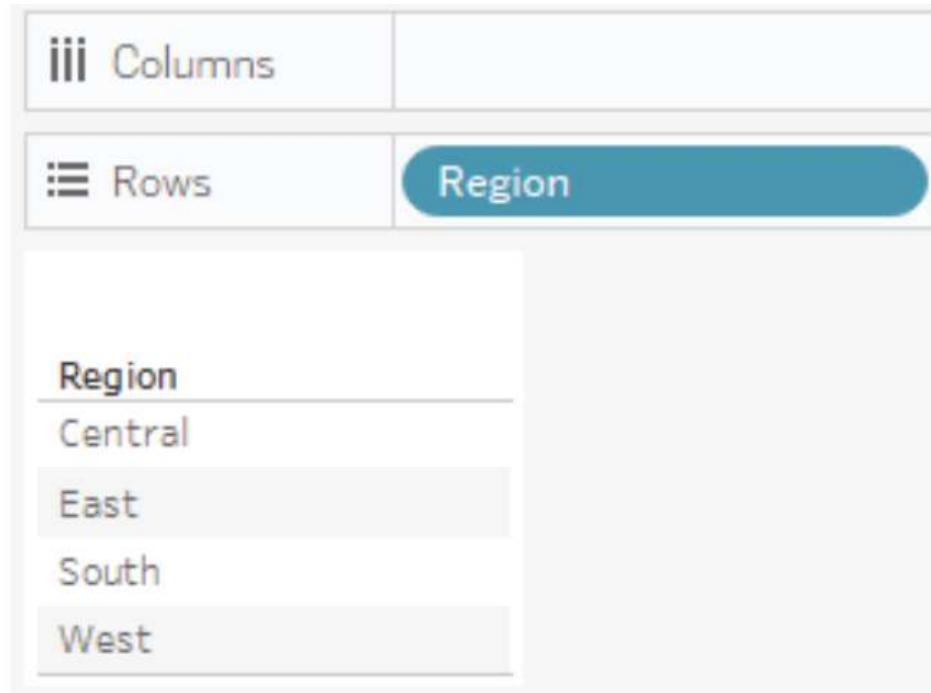
- Another important distinction to make with fields is whether a field is being used as discrete or continuous.
- Whether a field is discrete or continuous determines how Tableau visualizes it based on where it is used in the view.

# Discrete fields

Columns	Region
Rows	Region
Central	East
	South
	West

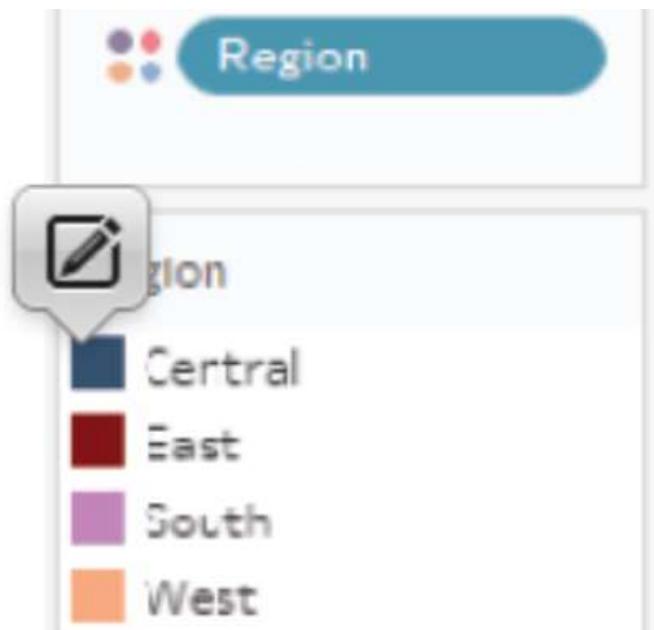
# Discrete fields

- 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:

		<i>can be</i>	
		Discrete	Continuous
A	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:

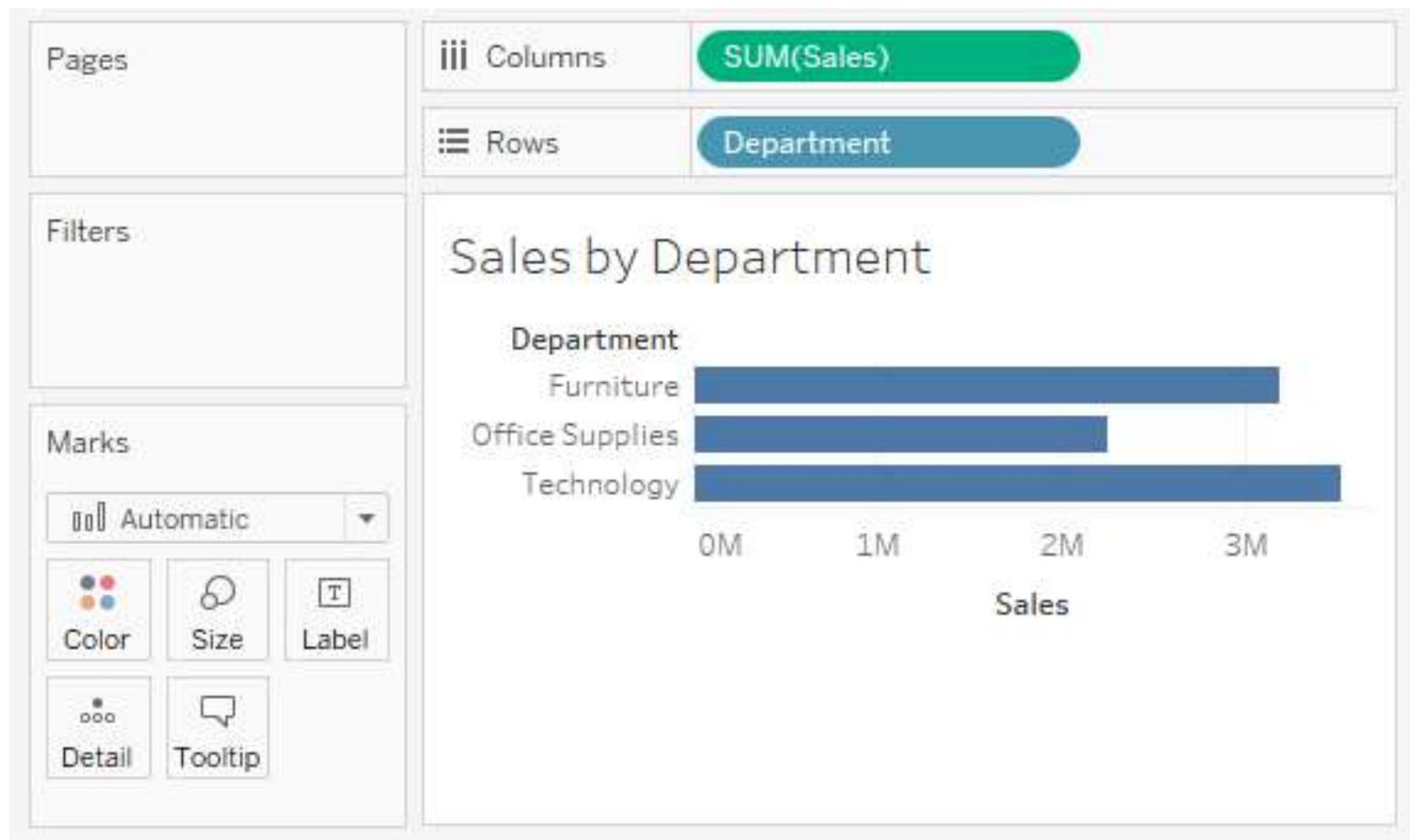
- Choosing between a dimension and measure tells Tableau how to slice or aggregate the data.
- Choosing between discrete and continuous tells Tableau how to display the data with a header or an axis and defines individual colors or a gradient.

# 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.

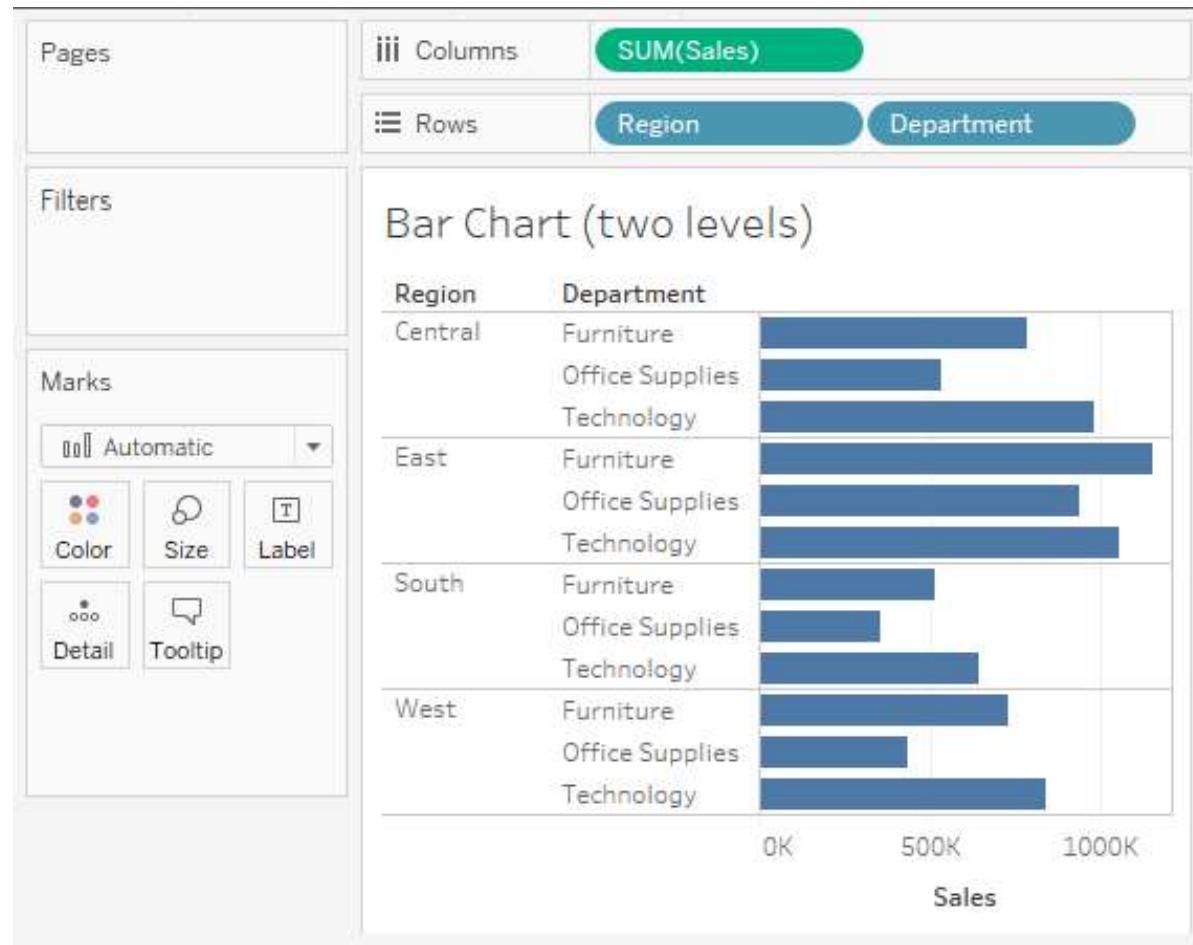
# Bar charts

- 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.

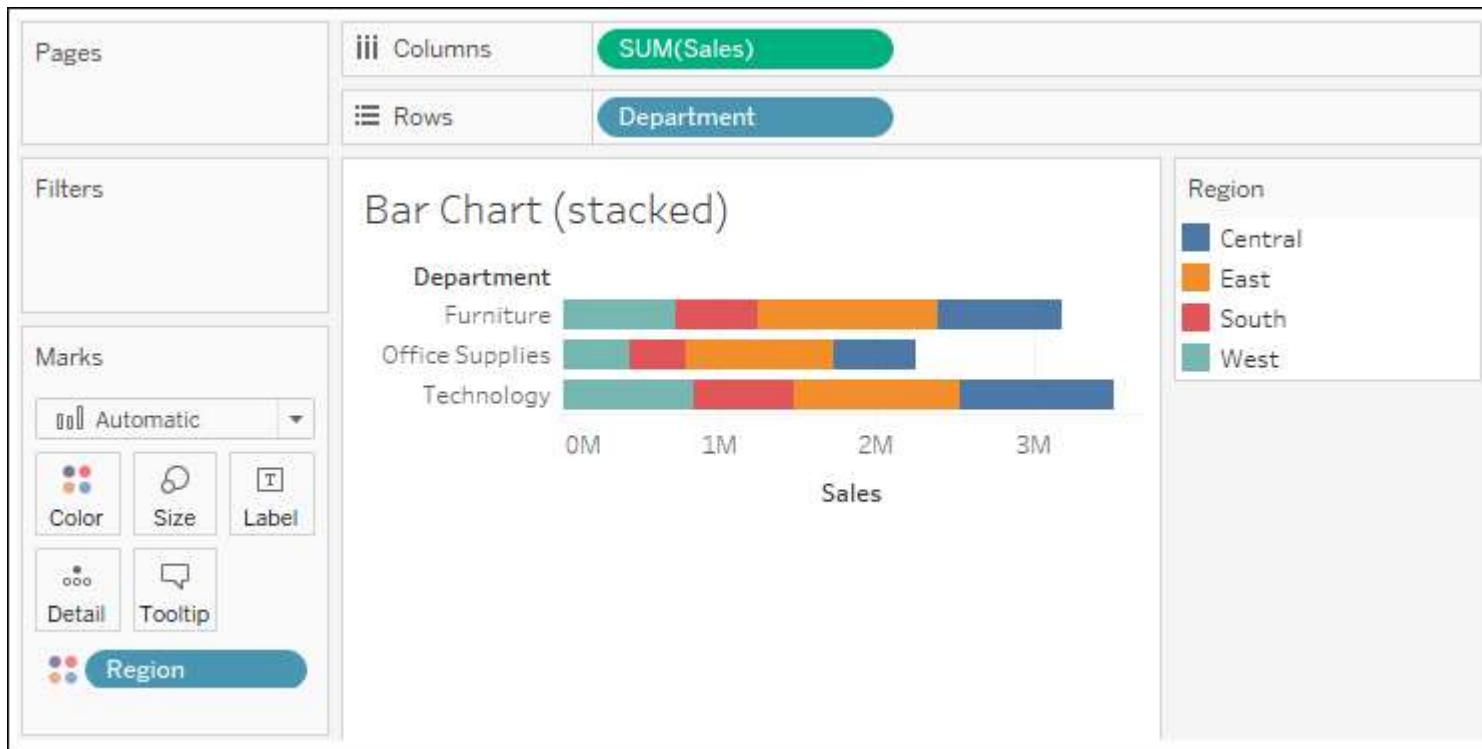


# Iterations of bar charts for deeper analysis

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.

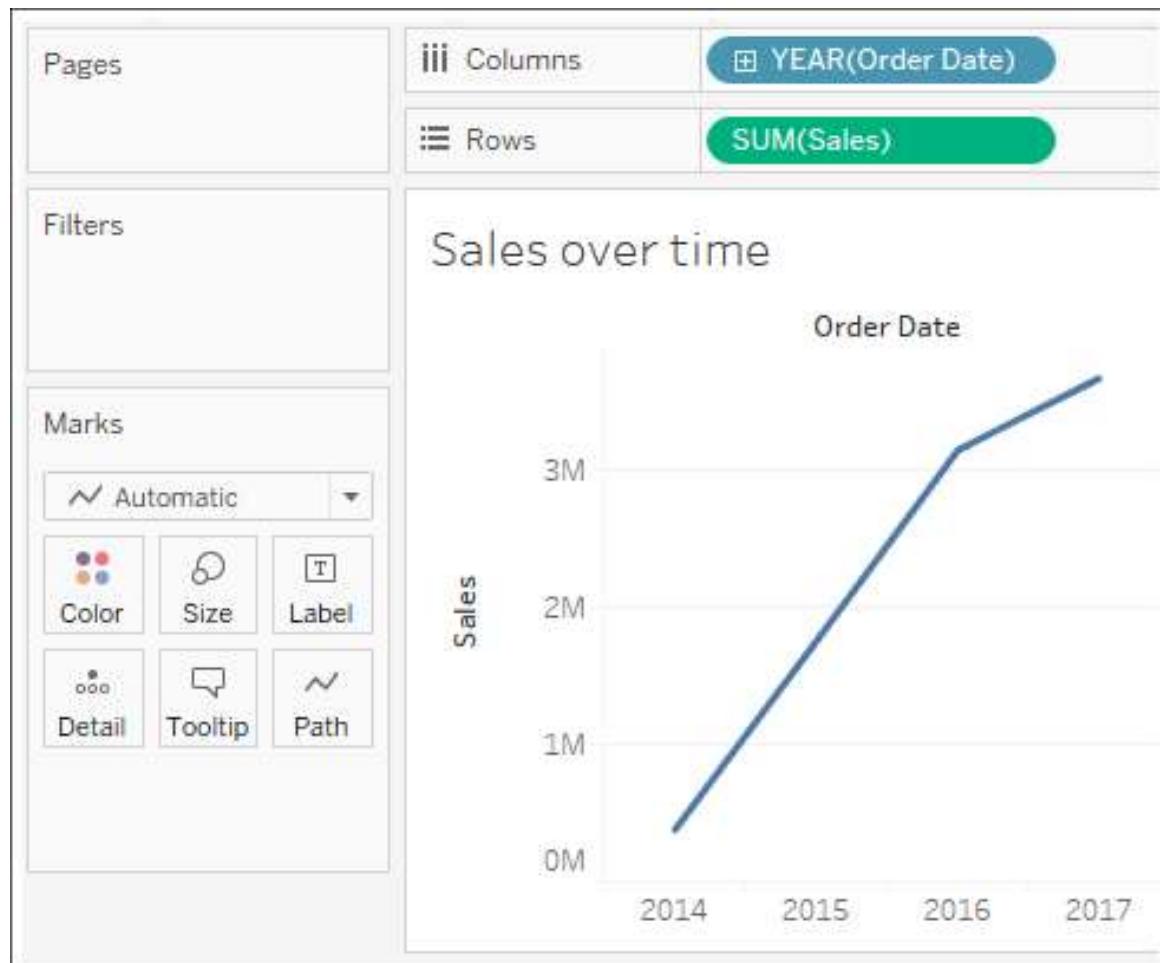


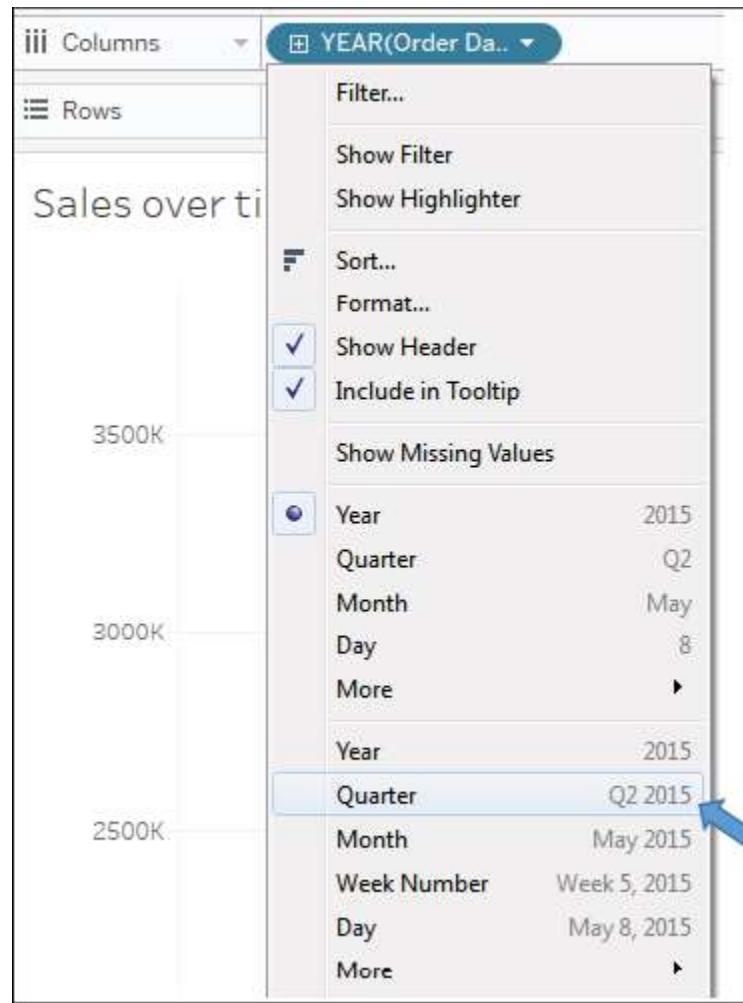
# Iterations of bar charts for deeper analysis

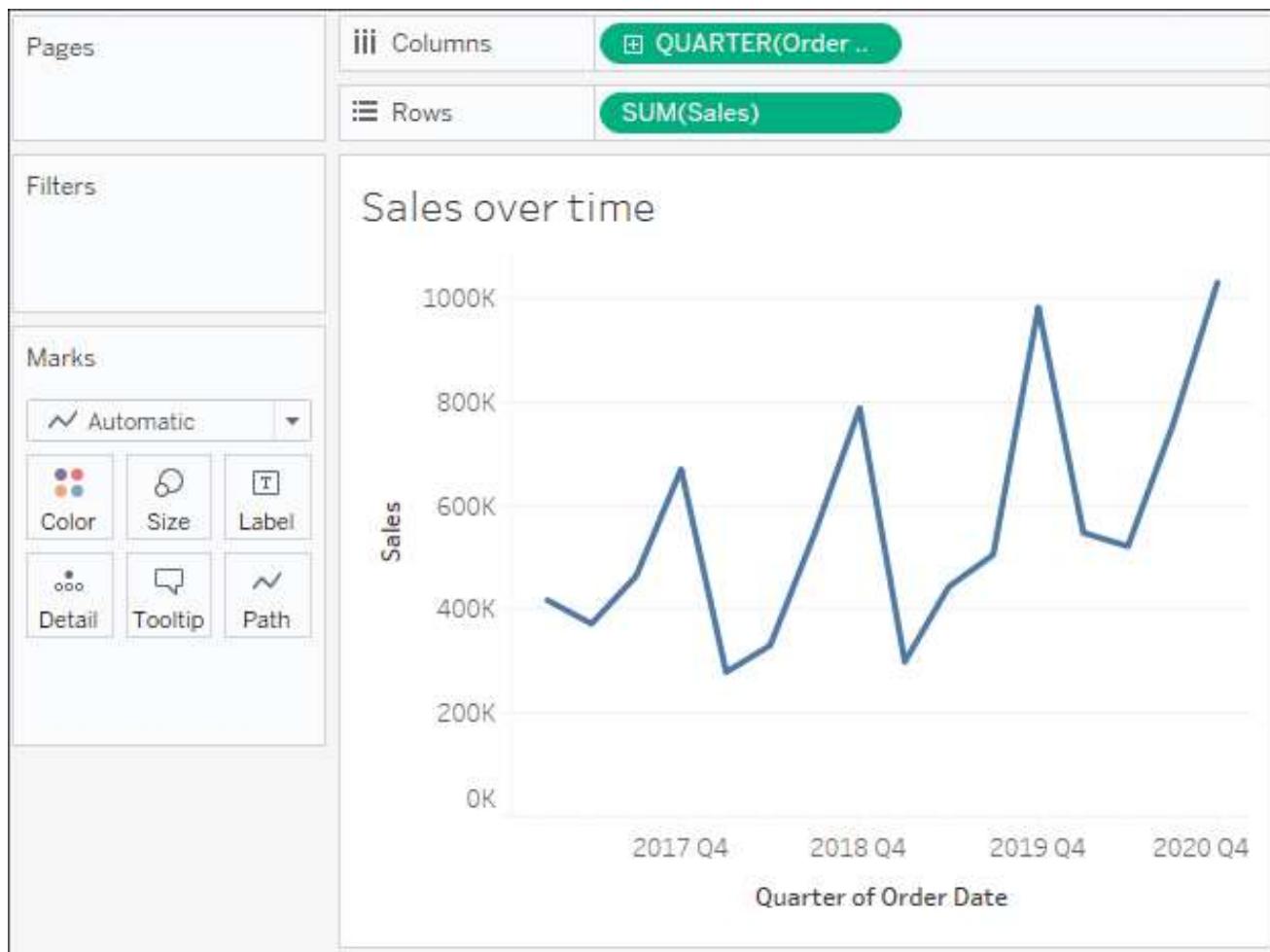


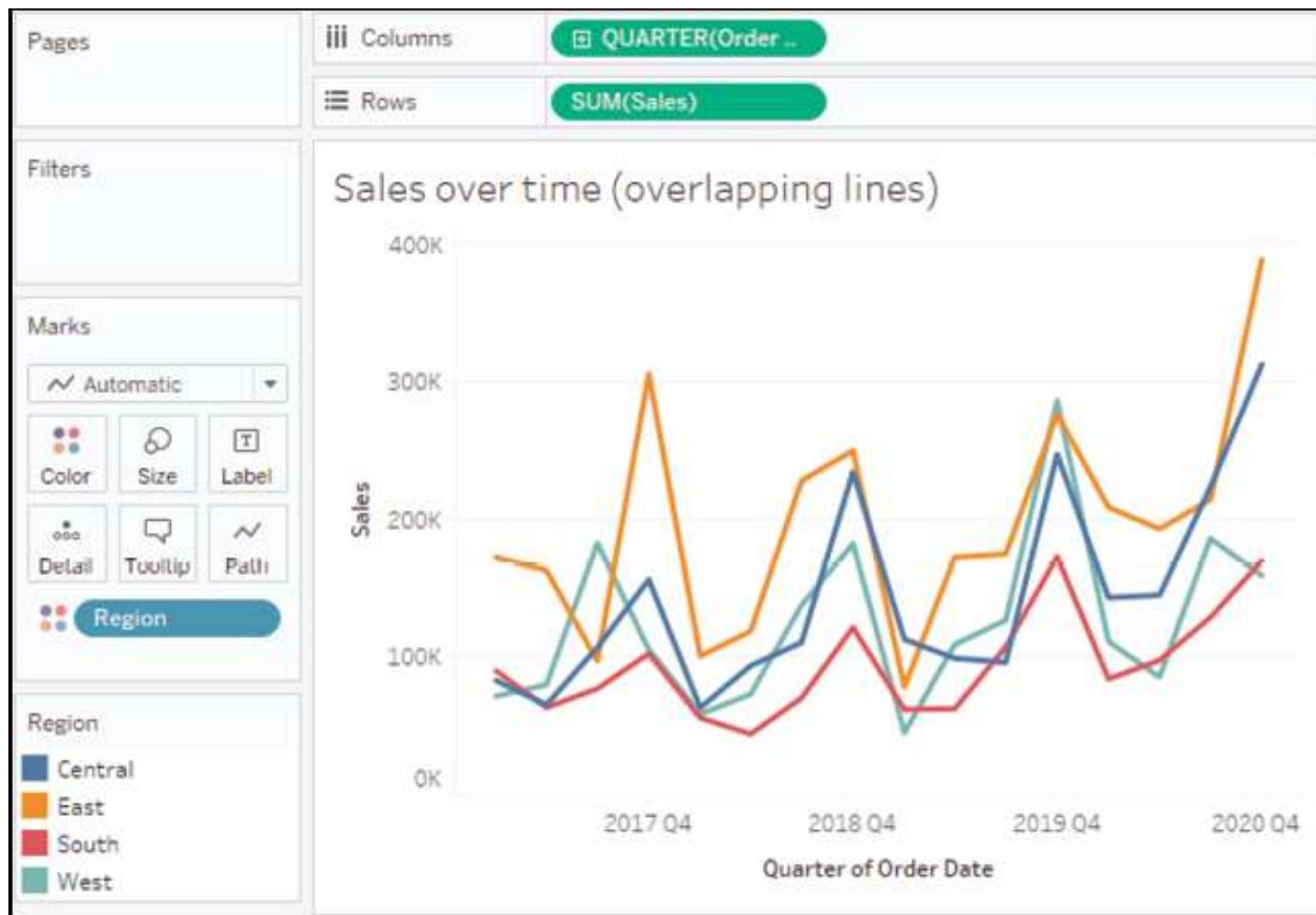
# Line charts

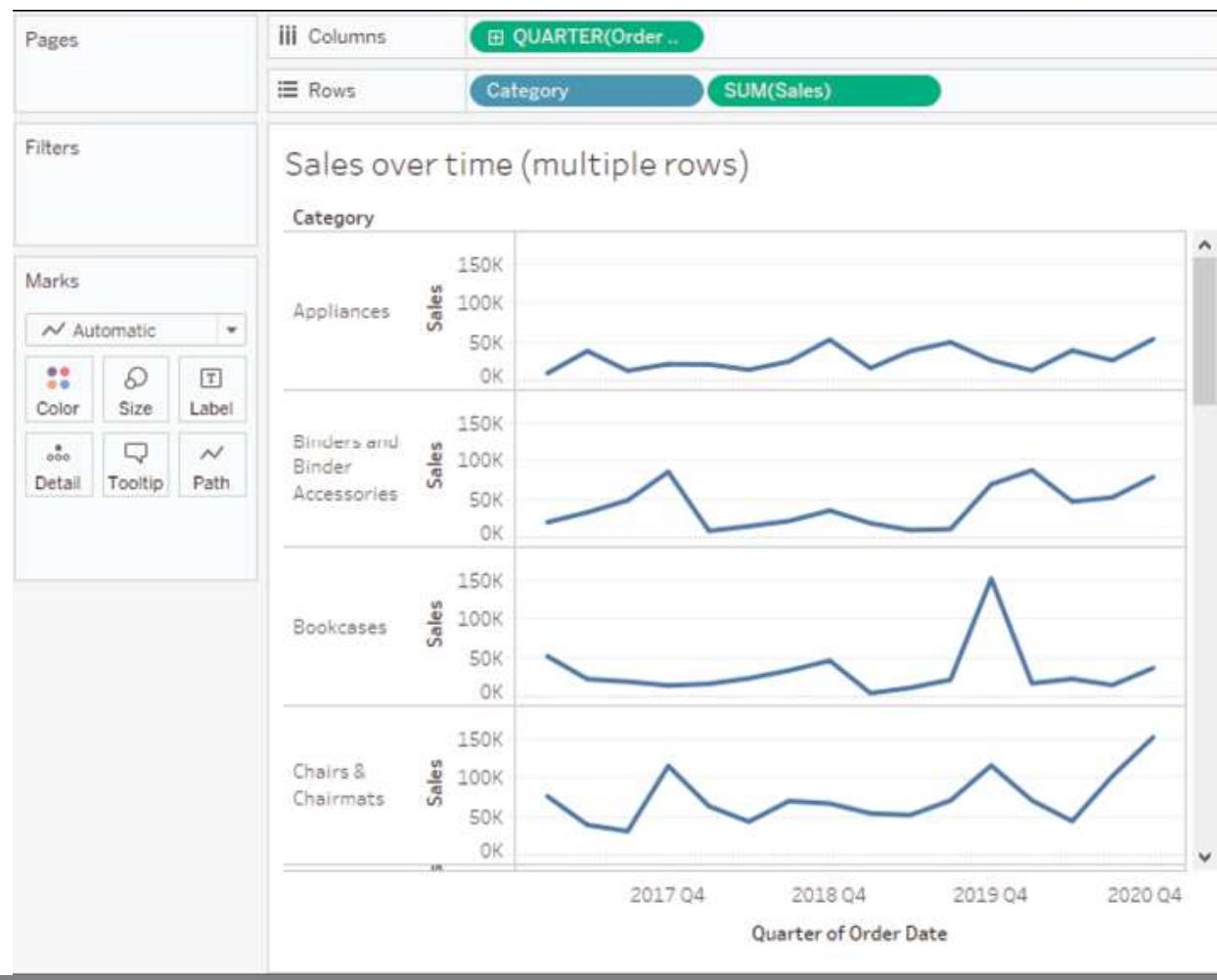
- Line charts connect related marks in a visualization to show movement or a relationship between those connected marks.
- The position of the marks and the lines that connect them are the primary means of communicating the data.
- Additionally, you can use size and color to communicate additional information.











# 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.

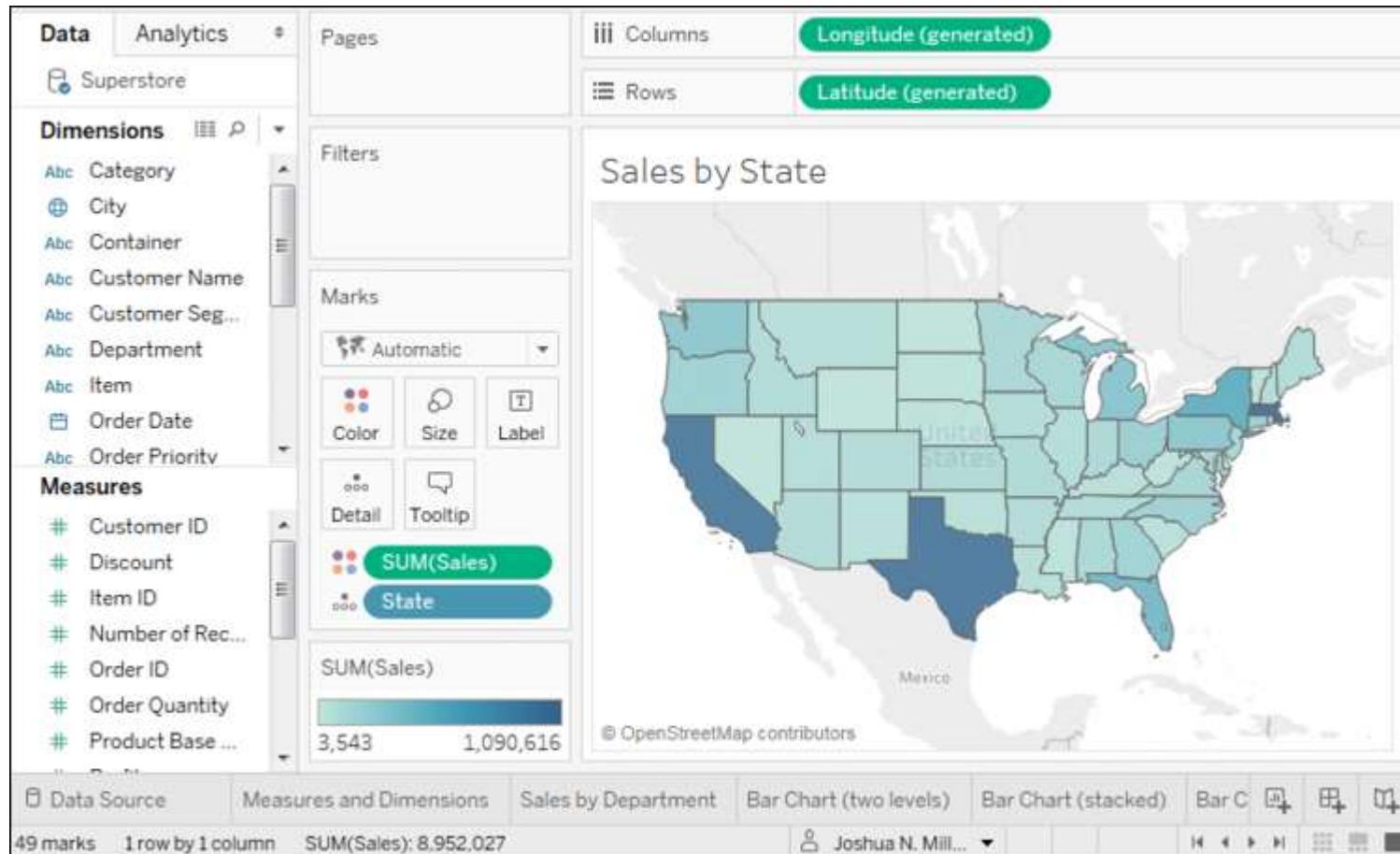
# Geographic visualizations

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

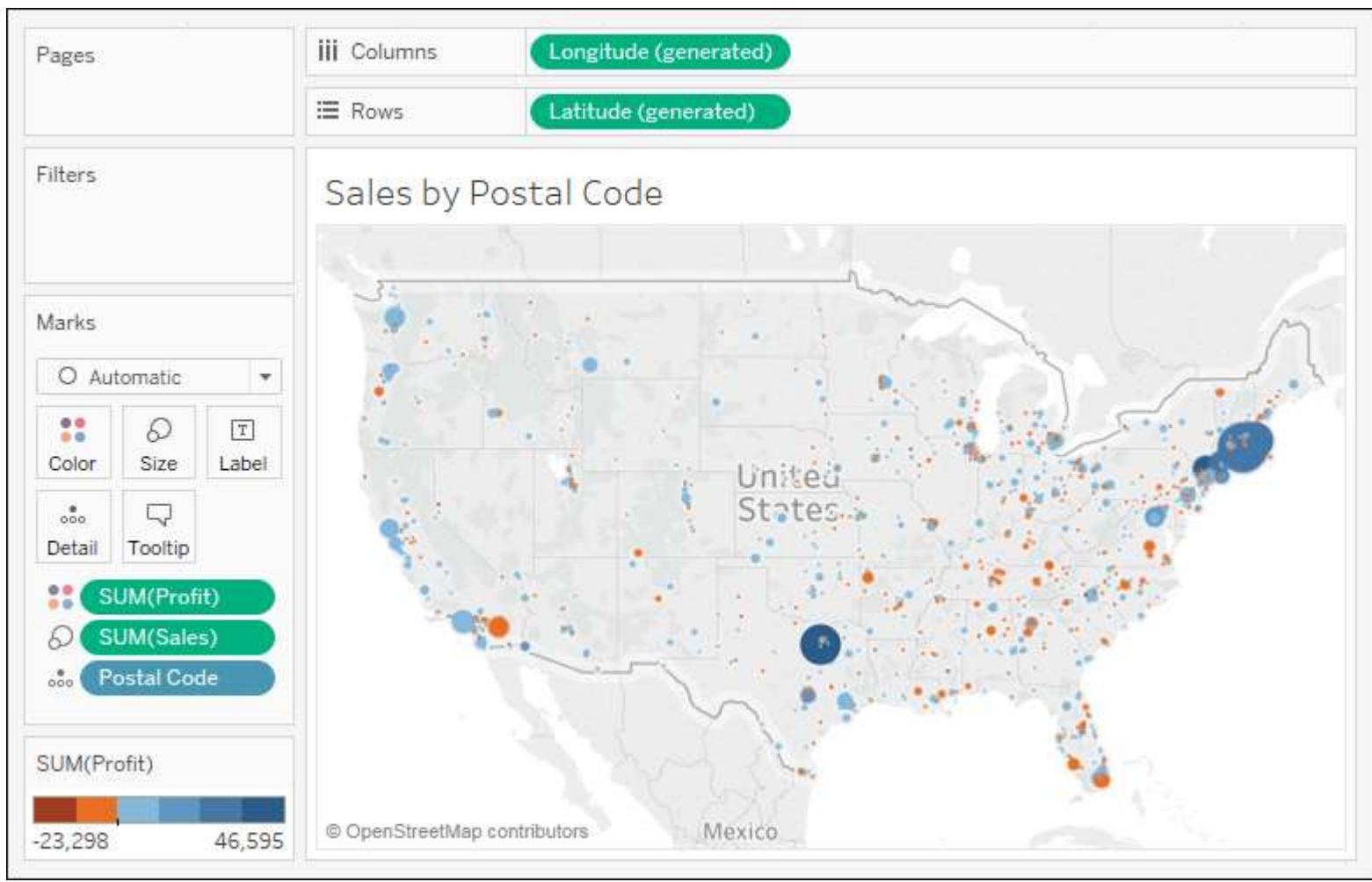
# Filled maps

- 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.



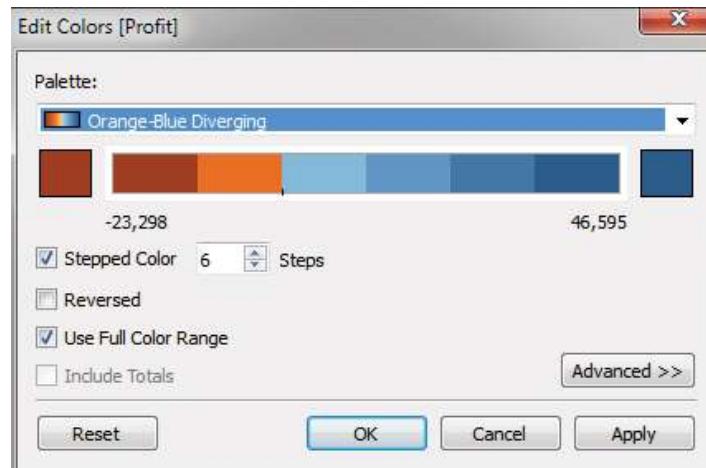
# Symbol maps

- 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.



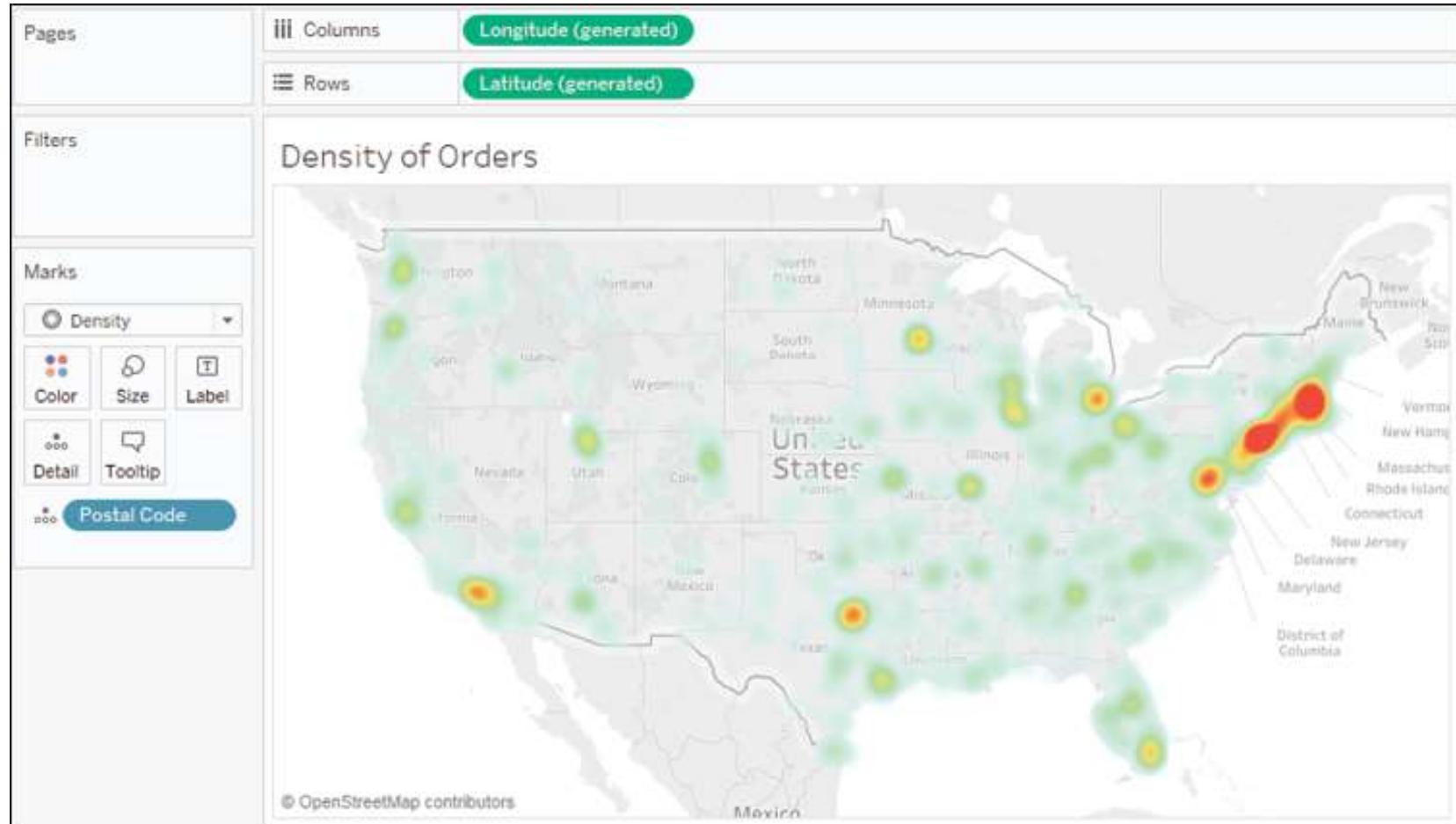
# Symbol maps

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



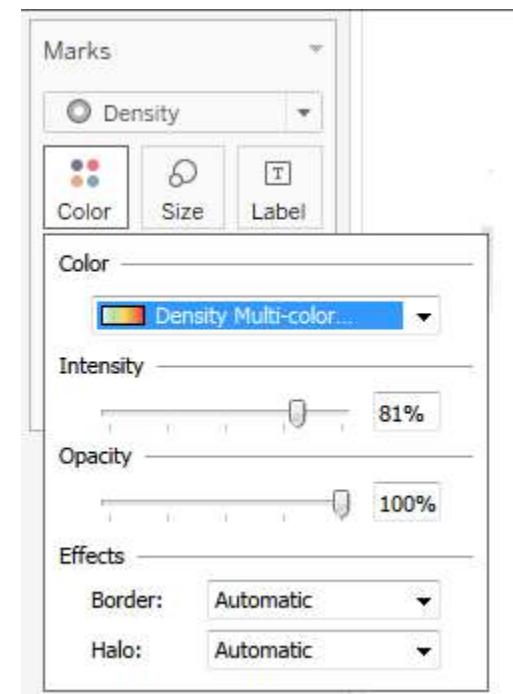
# Density maps

- 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.

Show Me

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.

# The dashboard interface

The screenshot shows a dashboard configuration interface. At the top right, there's a "Layout" dropdown menu with "Default" and "Phone" options, and a "Device Preview" button. Below it, a "Size" section is set to "Desktop Browser (1000 x 8...)" with a dropdown arrow. A horizontal line separates this from the "Sheets" section, which lists various data visualizations like "Measures and Dime...", "Sales by Department", etc. Another horizontal line separates the sheets from the "Objects" section, which includes icons for "Horizontal", "Vertical", "Text", "Image", "Web Page", "Blank", "Button", and "Extension". A "Tiled" button is highlighted in dark grey, while "Floating" is in light grey. At the bottom, there's a checkbox for "Show dashboard title".

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

Grip

Sales by Department

Department

Department	Sales
Furniture	~2.8M
Office Supplies	~1.5M
Technology	~3.2M

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  
 Filters  
 Highlighters  
Show Page Control  
View Toolbar

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

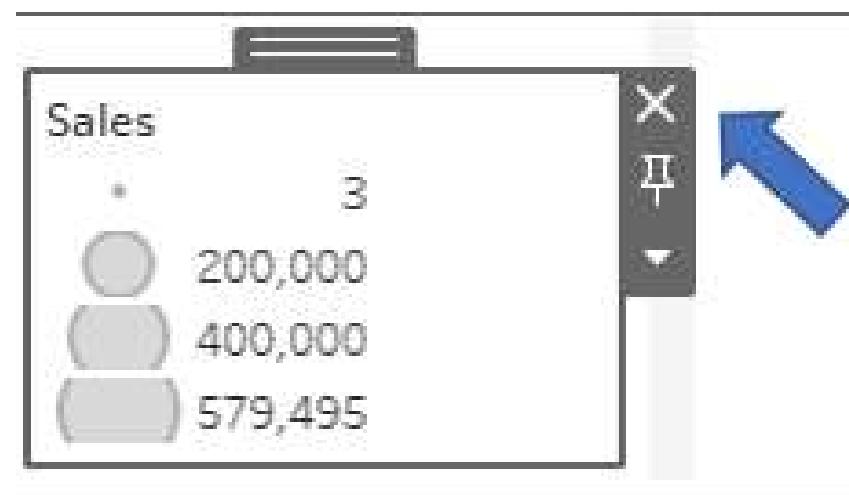
Use as Filter  
Ignore Actions

Floating  
Floating Order

Deselect  
Remove from Dashboard  
Rename Dashboard Item...

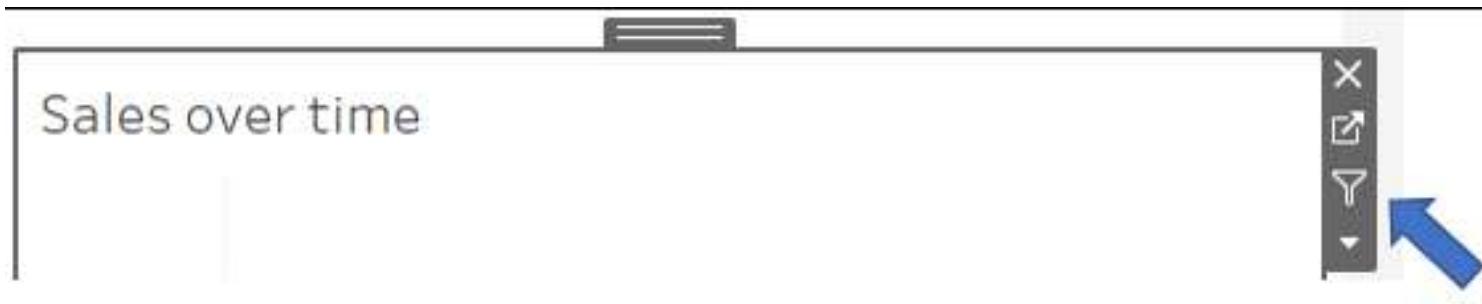
# Building your dashboard

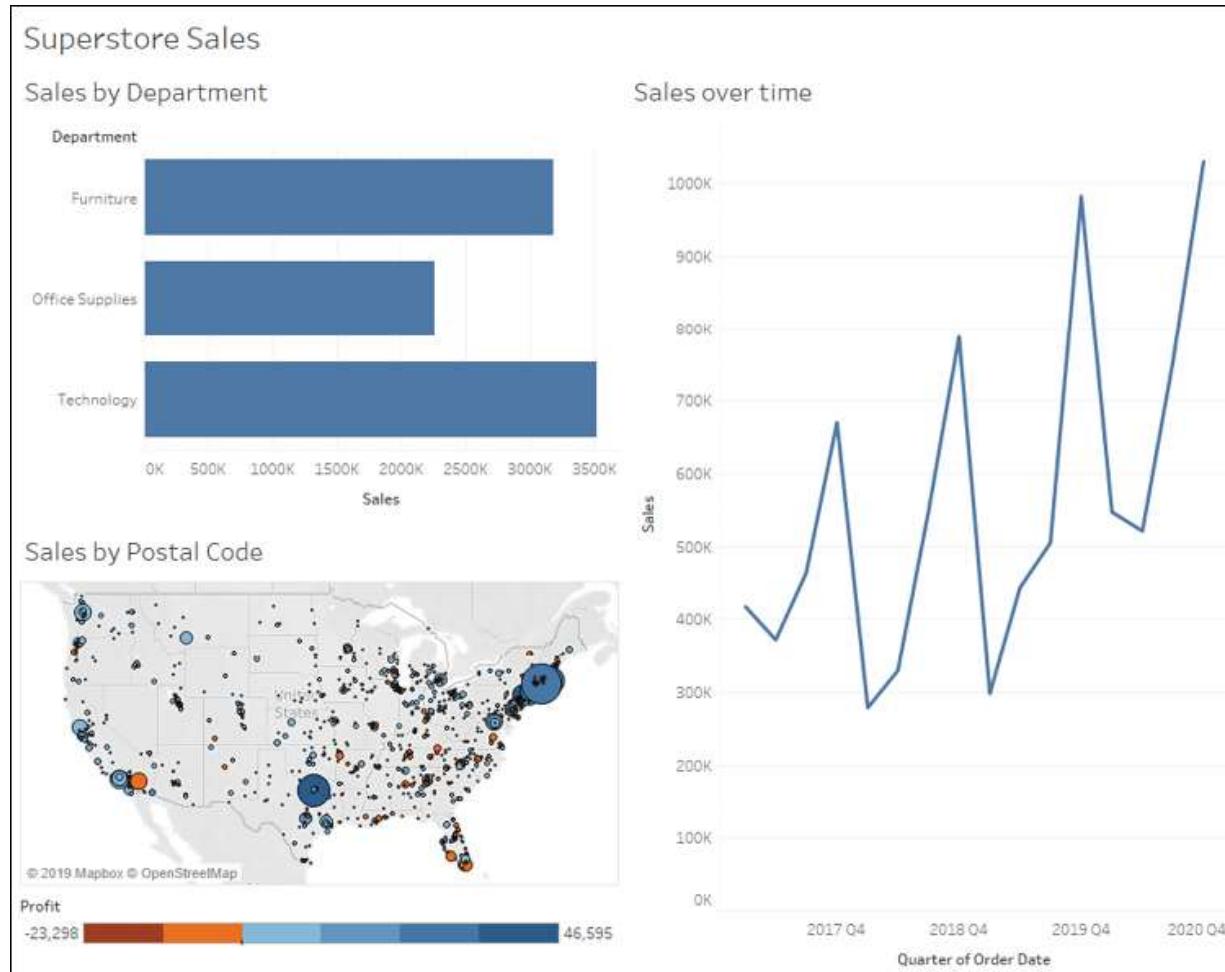
- Select the Sales size legend by clicking on it. Use the X option to remove the legend from the dashboard:



# 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:





# 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:

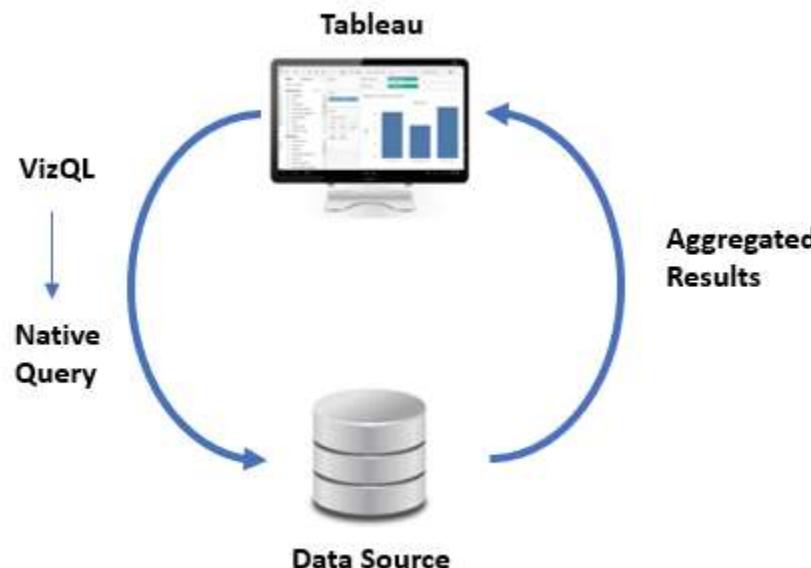
- The Tableau paradigm
- Connecting to data
- Managing data source metadata
- Working with extracts instead of live connections
- Filtering data

# The Tableau paradigm

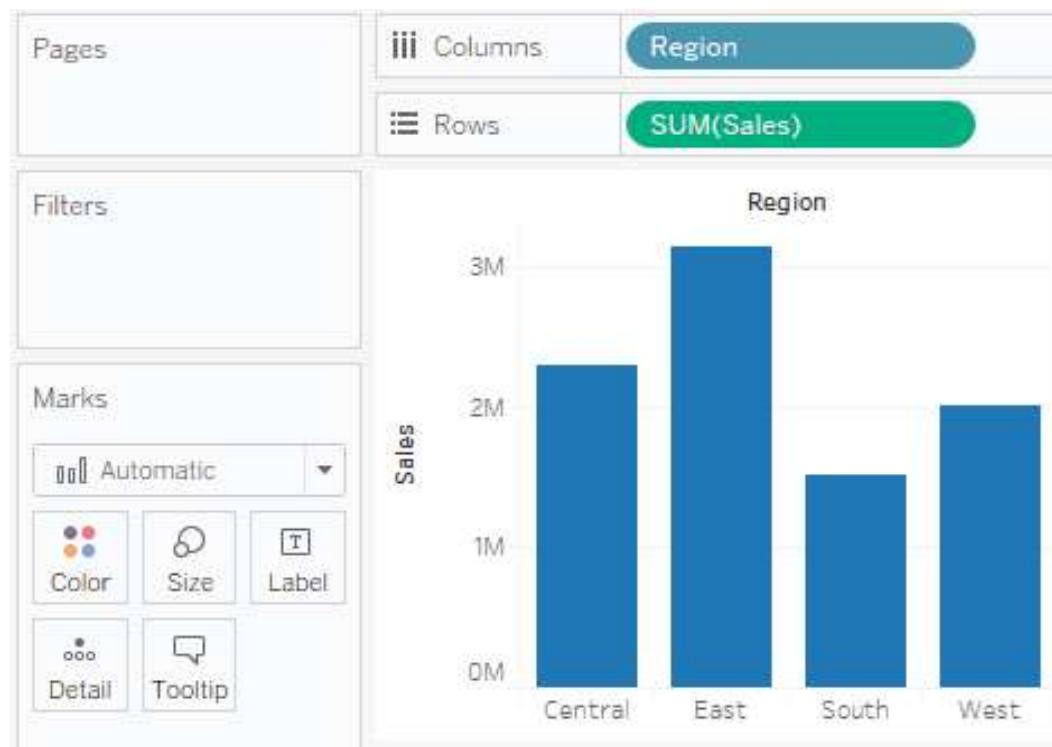
- The unique and exciting experience of working with data in Tableau is a result of VizQL (Visual Query Language).
- VizQL was developed as a Stanford University research project, focusing on the natural ways that humans visually perceive the world and how that could be applied to data visualization.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

# The Tableau paradigm

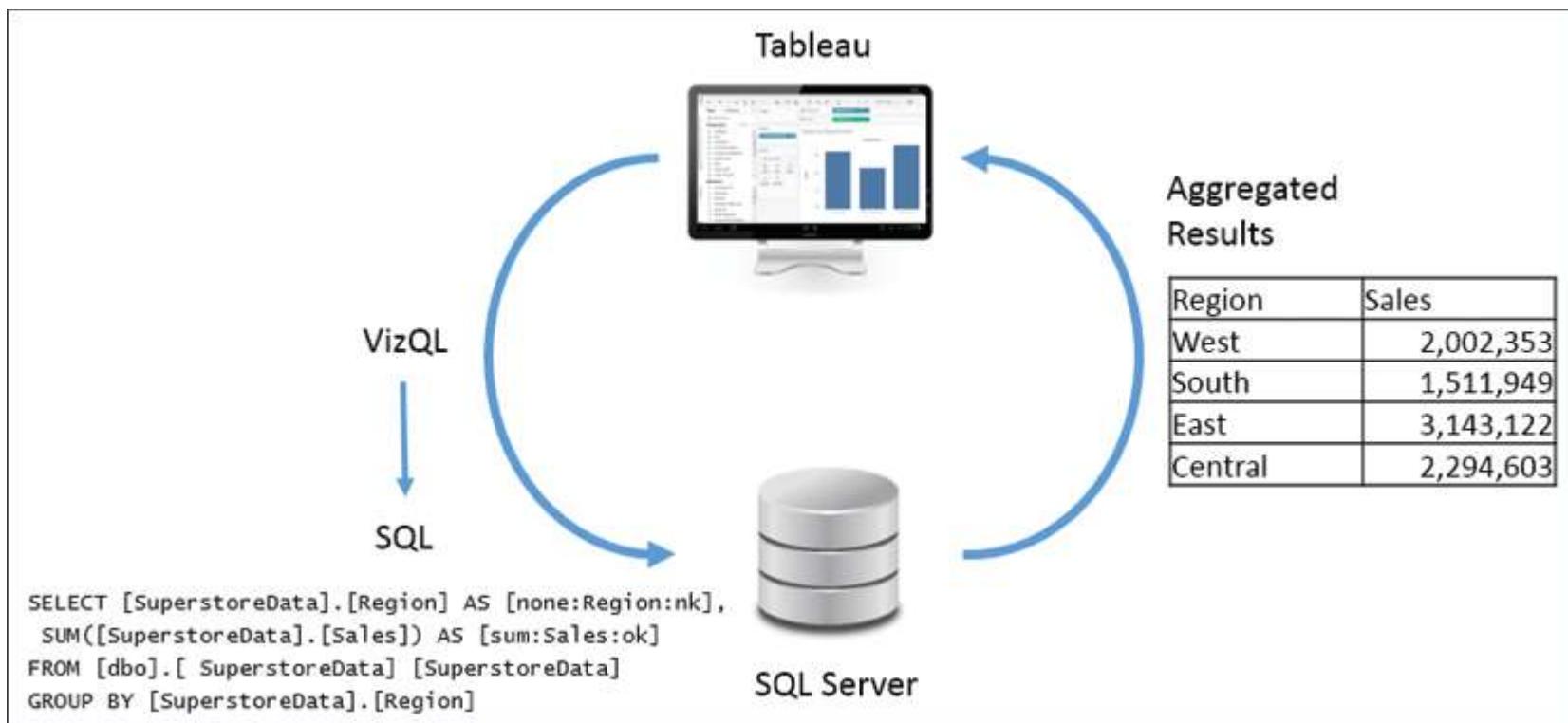
- In its simplest form, the Tableau paradigm of working with data looks like the following diagram:



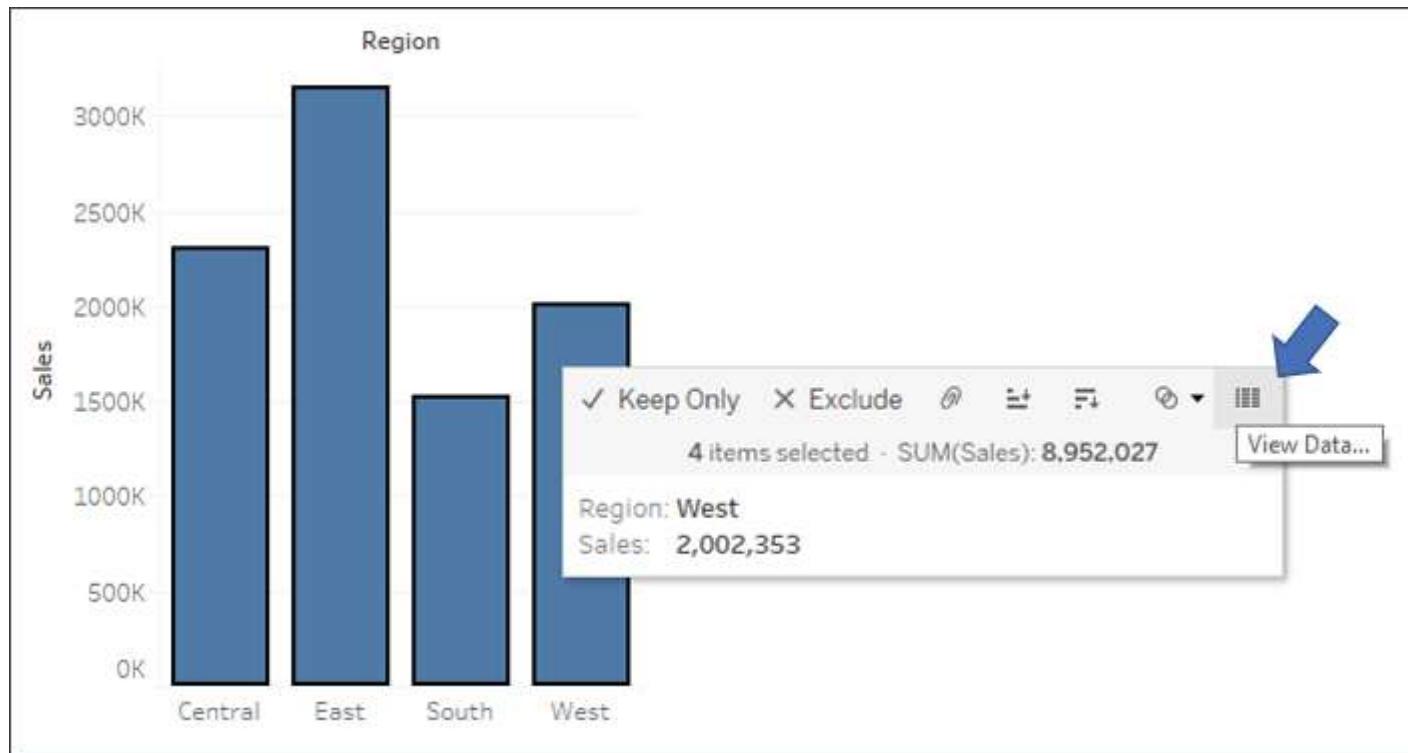
# A simple example



# A simple example



# A simple example



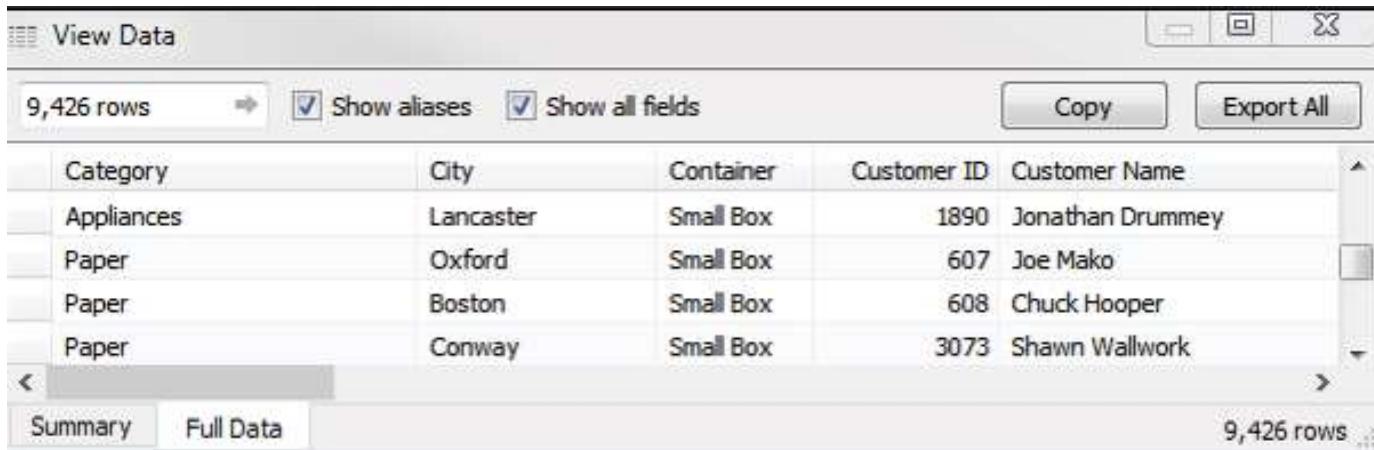
# A simple example

- 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:

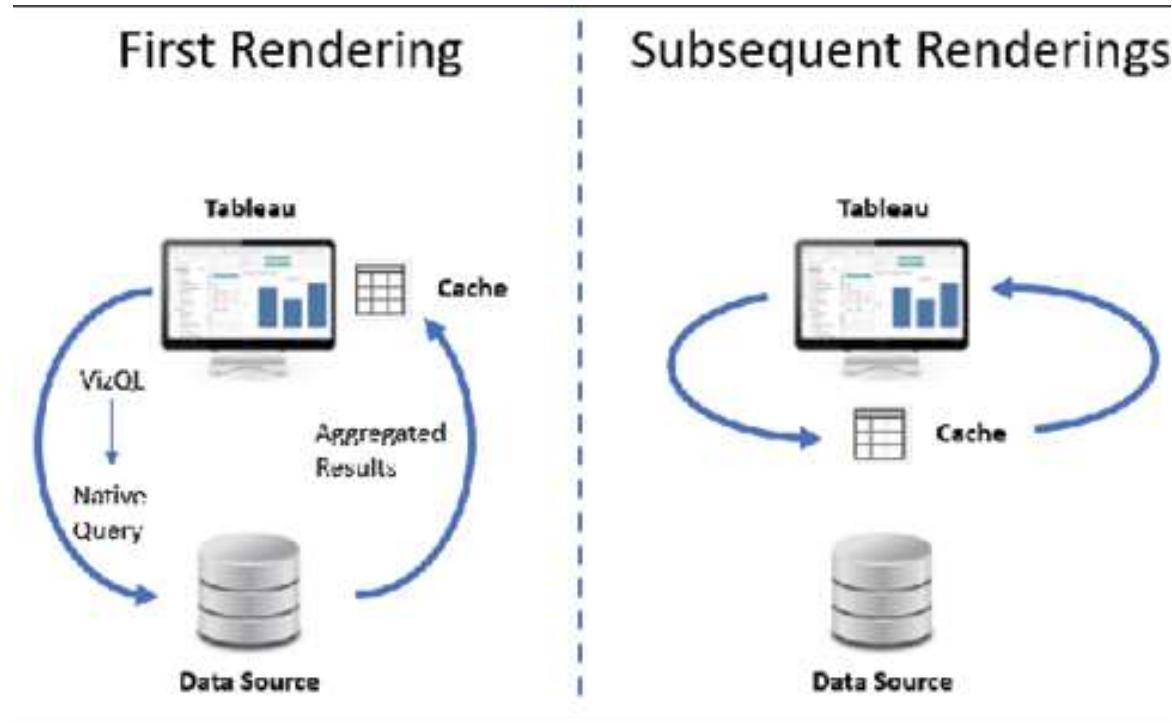


The screenshot shows a software interface titled "View Data". At the top, it displays "9,426 rows" with a dropdown arrow, and two checked checkboxes: "Show aliases" and "Show all fields". To the right are "Copy" and "Export All" buttons. The main area is a table with the following data:

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

At the bottom left are "Summary" and "Full Data" buttons. The bottom right corner of the table area 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

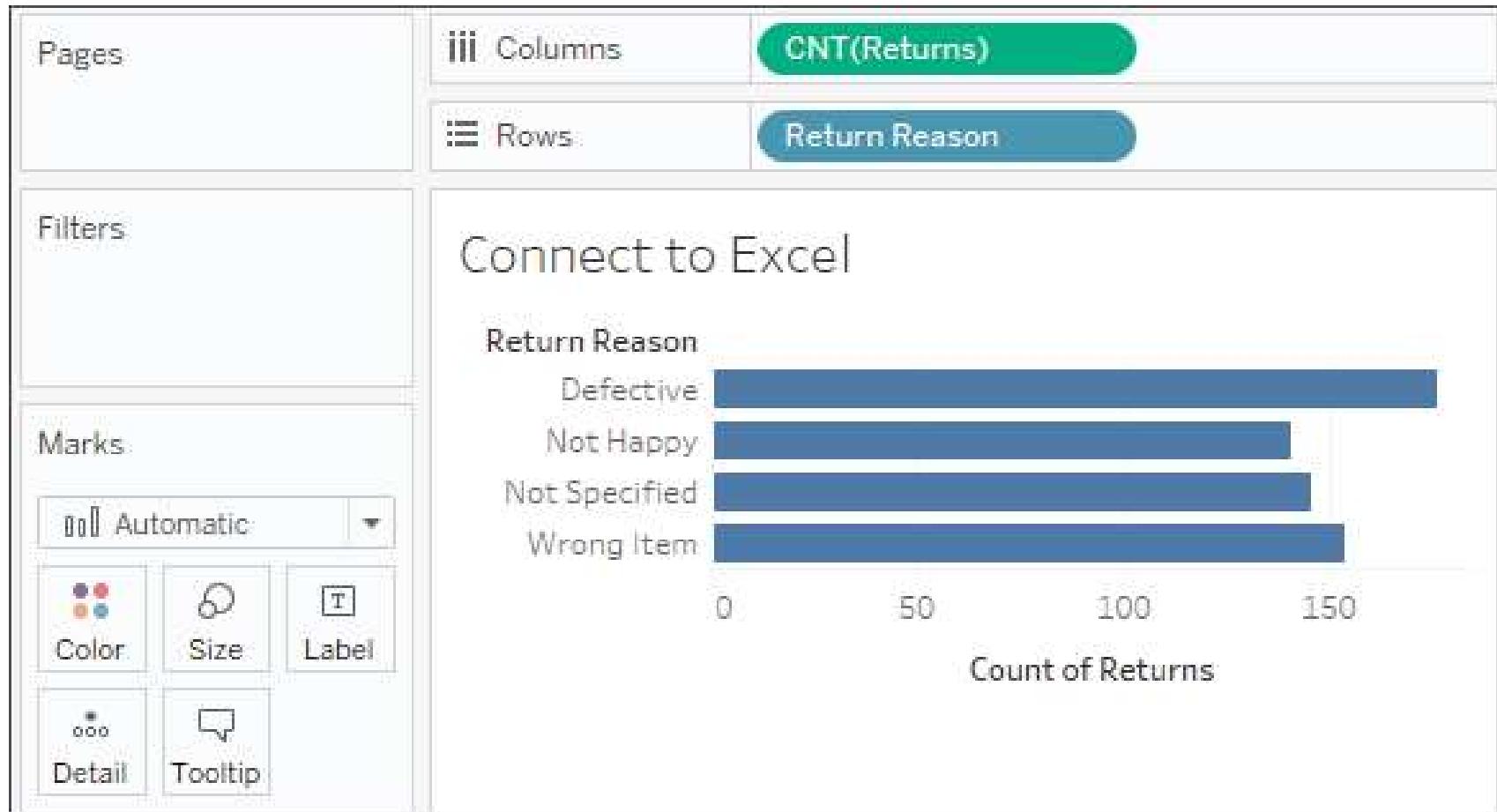
File-based data includes all sources of data where the data is stored in a file. File-based data sources include the following:

- 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.

The screenshot shows the Power BI desktop interface with the following numbered elements:

1. Home icon
2. Connections pane: Superstore (Microsoft Excel) selected.
3. Sheets pane: Orders and Returns listed.
4. Report title: Orders and Returns.
5. Data flow diagram showing a relationship between Orders and Returns.
6. Connection settings: Live (selected) and Extract.
7. Filters pane: 0 filters added.
8. Sort fields: Data source order dropdown and checkboxes for Show aliases and Show hidden fields.
9. Preview pane: A table with columns: Category, City, Container, Customer ID, Customer Name, and Customer Segment. The data is as follows:

Category	City	Container	Customer ID	Customer Name	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



# 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:

X

### Microsoft SQL Server

---

Server:

Database:

Enter information to sign in to the database:

Use Windows Authentication (preferred)

Use a specific username and password:

Username:

Password:

Require SSL

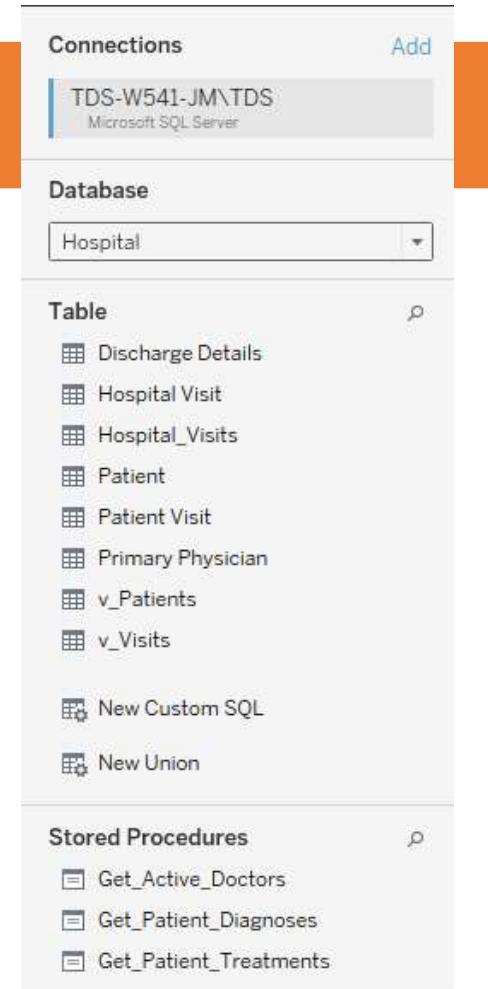
Read uncommitted data

---

Initial SQL... Sign In

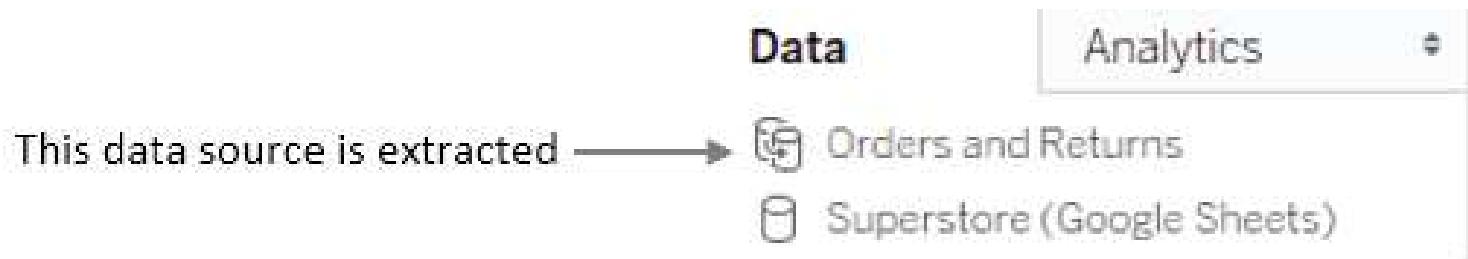
# Connecting to data on a server

- 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:

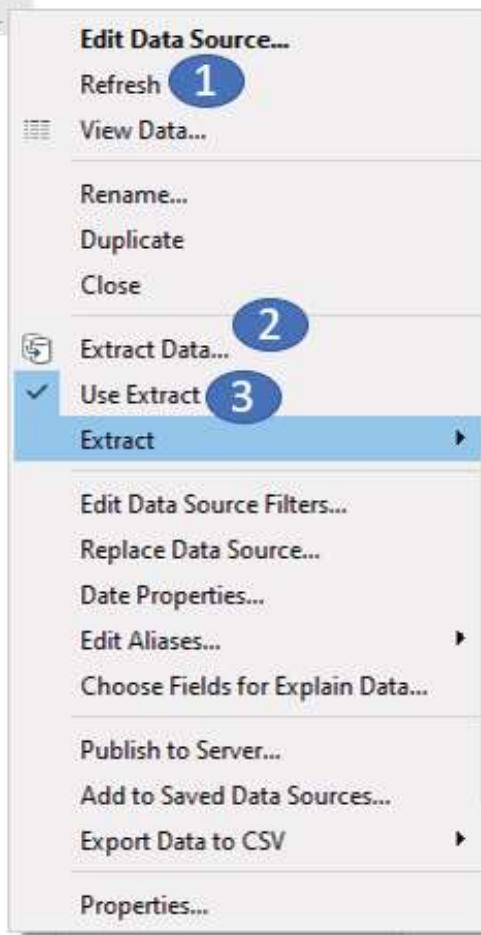


# Using extracts

- 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:



 Superstore (Google She...



# 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](#)

Search by sheet name or enter URL

[Search](#)

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](#)

[Cancel](#)

[Connect](#)

# Connecting to data in the cloud

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

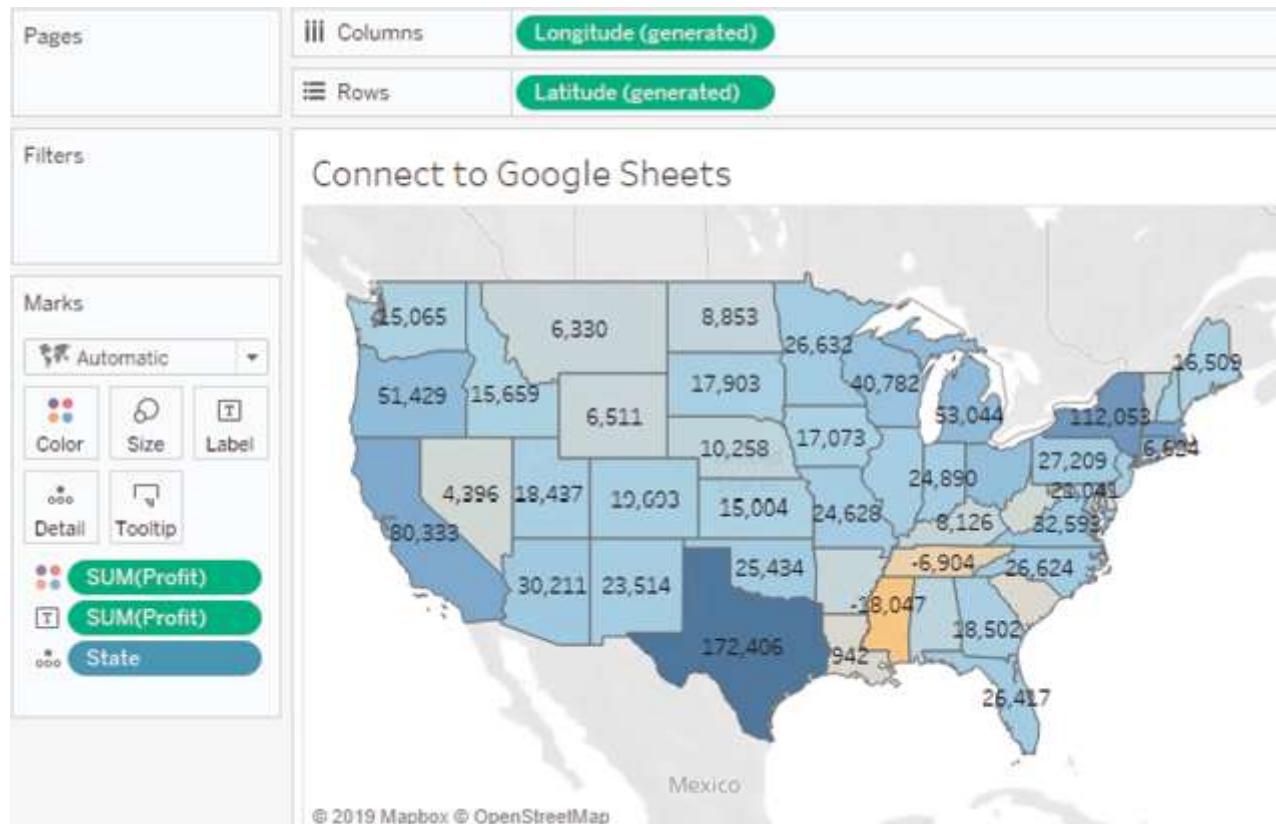


# Connecting to data in the cloud

- 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:



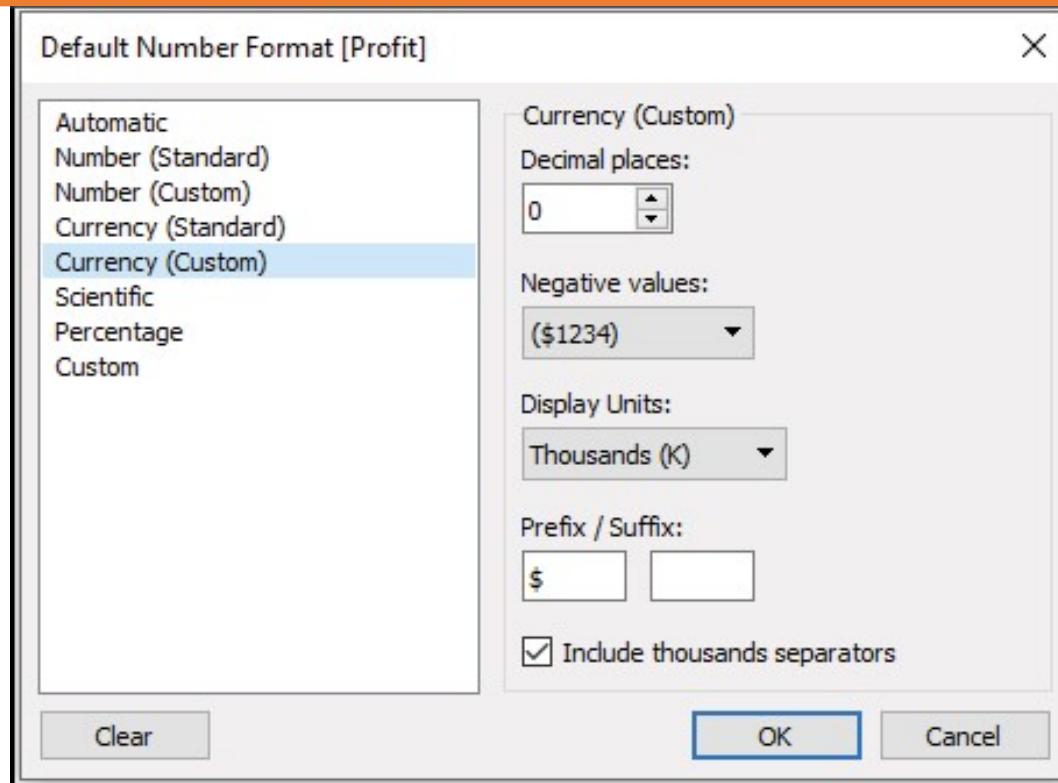
- Create a filled map of Profit by State, with Profit defining the Color and Label:

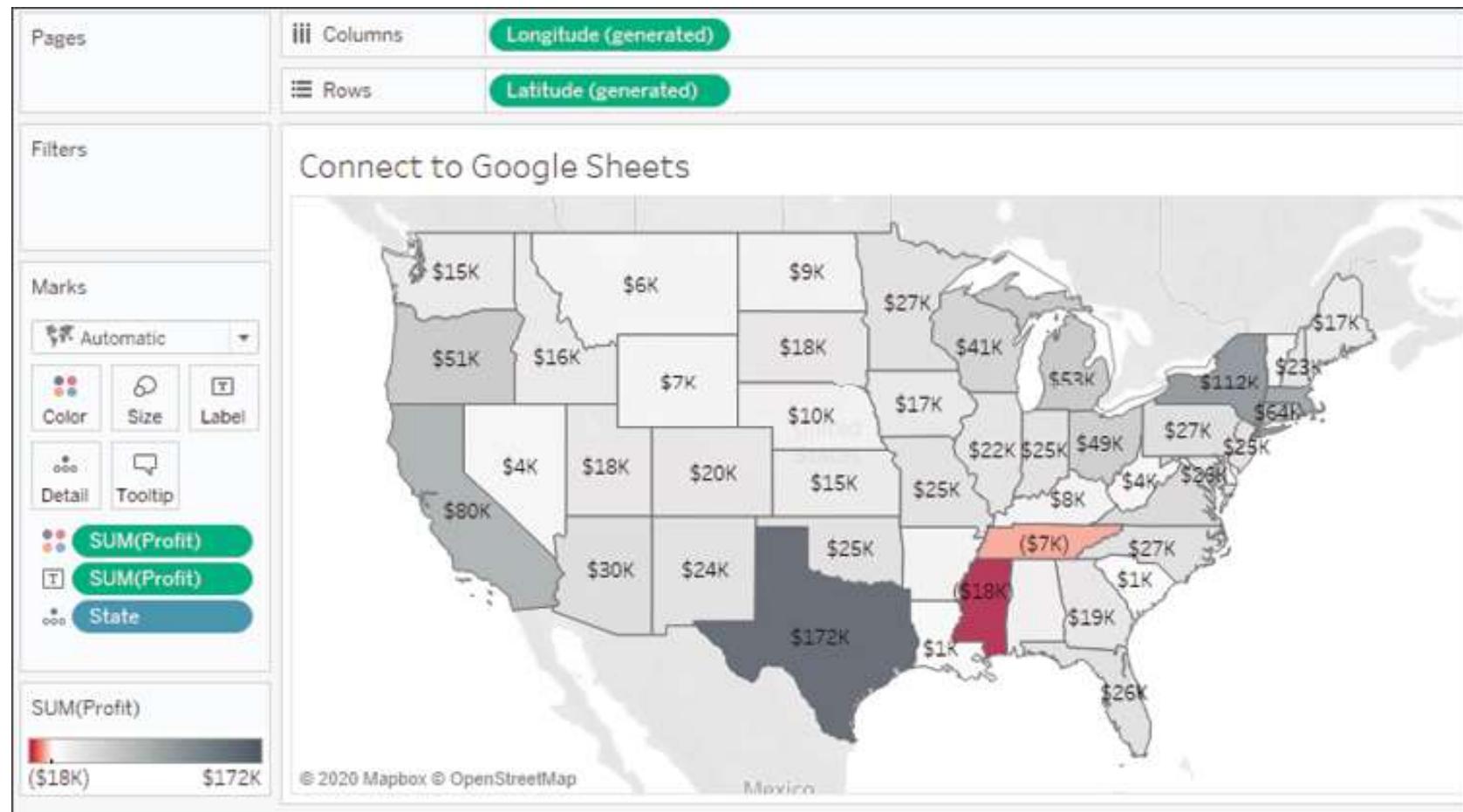


# Managing data source metadata

- 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.

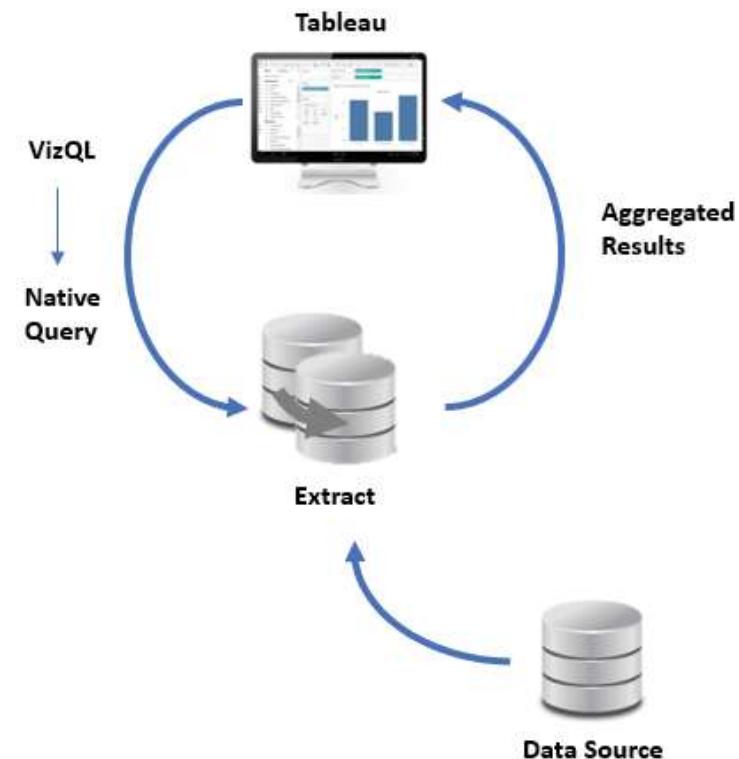
# Managing data source metadata





# Working with extracts instead of live connections

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



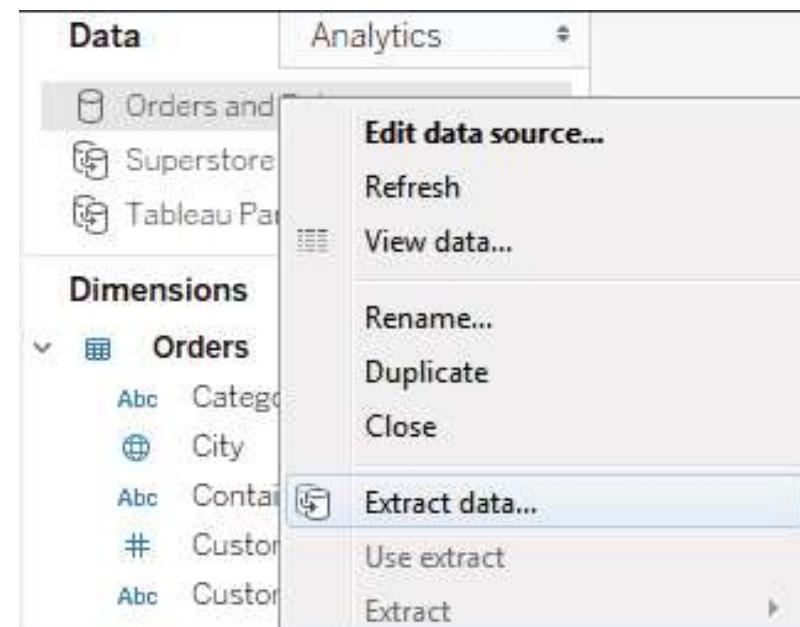
# Creating extracts

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



# 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**

Specify how to store data in the extract:

Data Storage

Logical Tables       Physical Tables

Store 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.

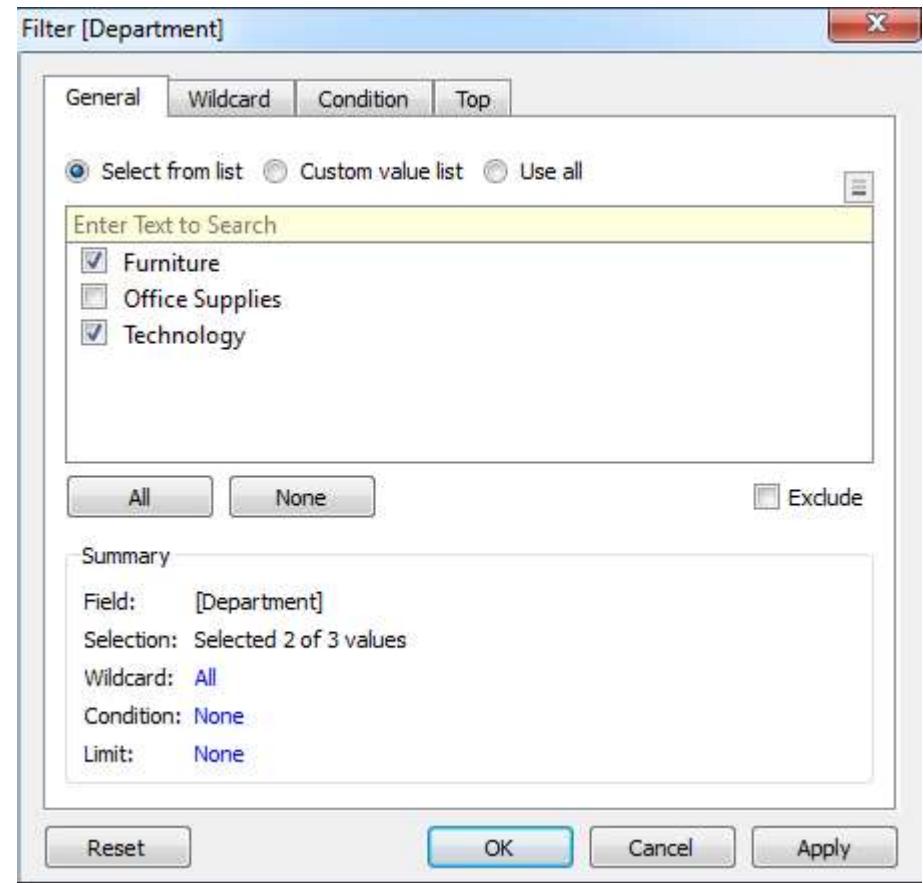
# Filtering data

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:

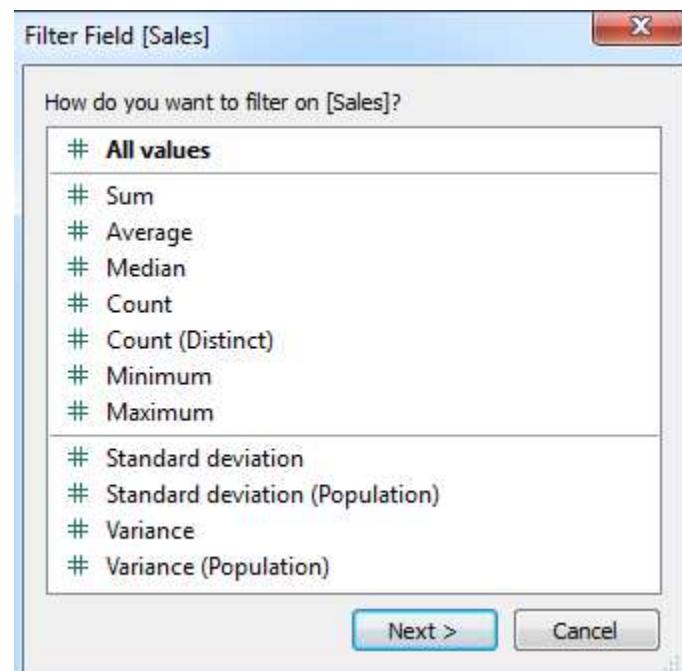


# Filtering discrete (blue) fields



# 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:

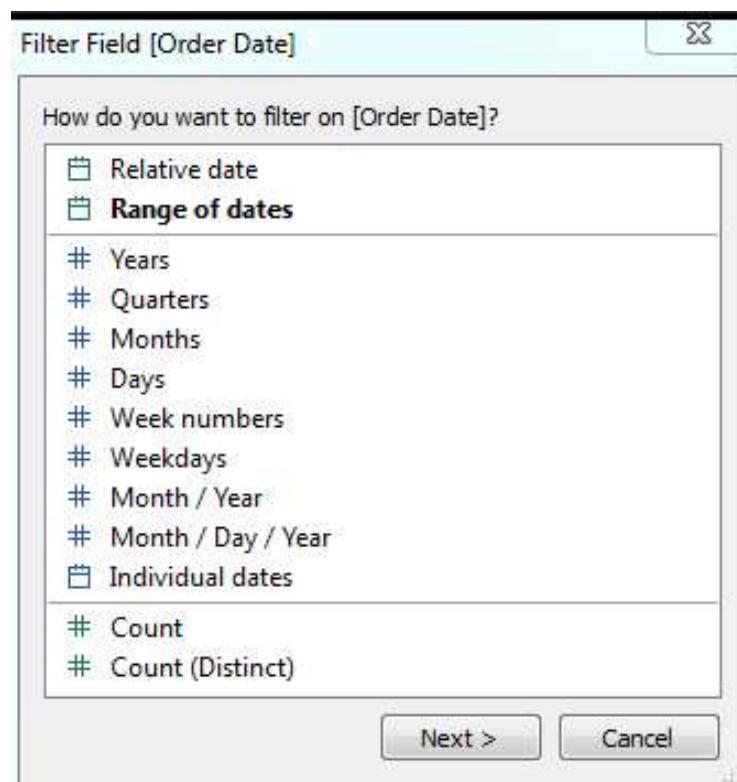


# Filtering continuous (green) fields

- 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:

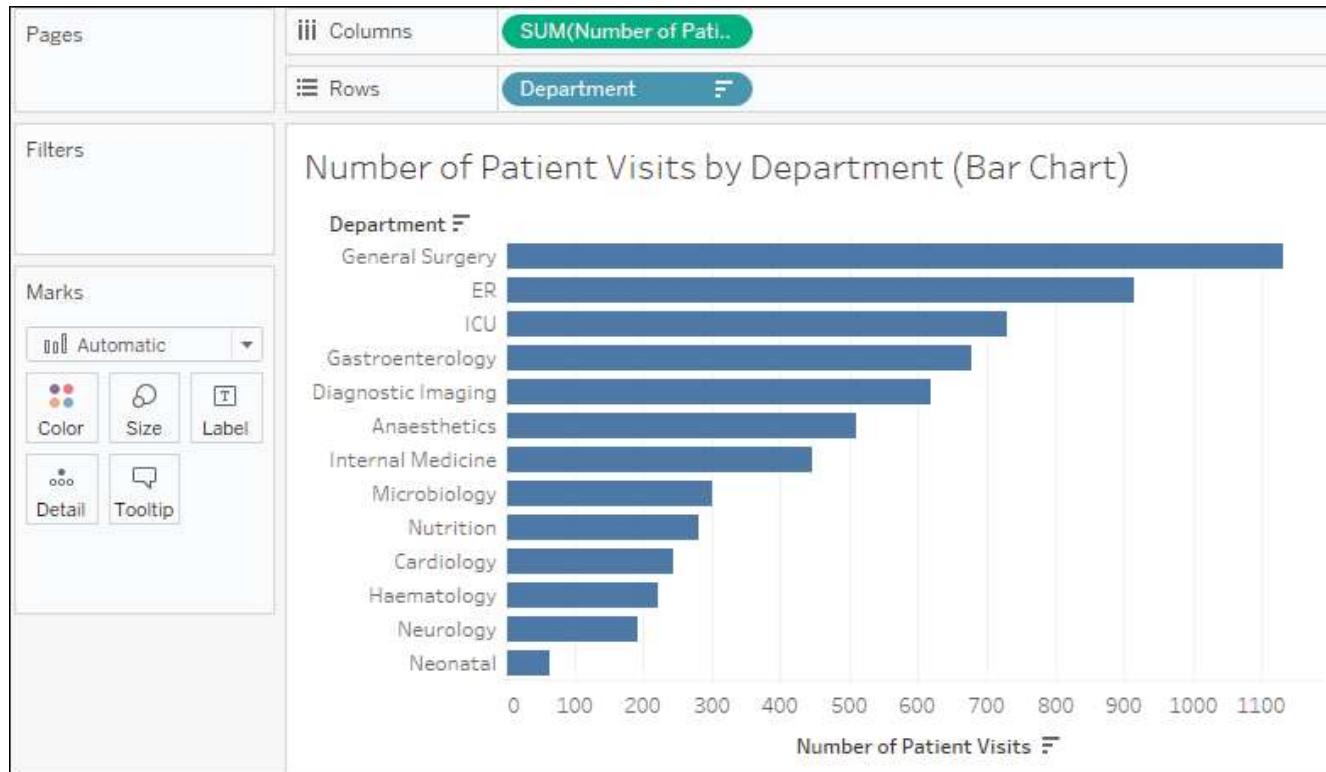
- Comparison
- Dates and times
- Relating parts of the data to the whole
- Distributions
- Multiple axes

# Comparing values

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

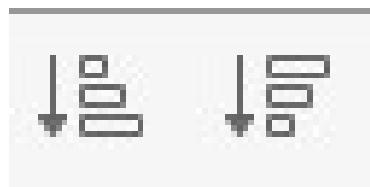
- How many customers did each store serve?
- How much energy did each wind farm produce?
- How many patients did each doctor see?

# 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:



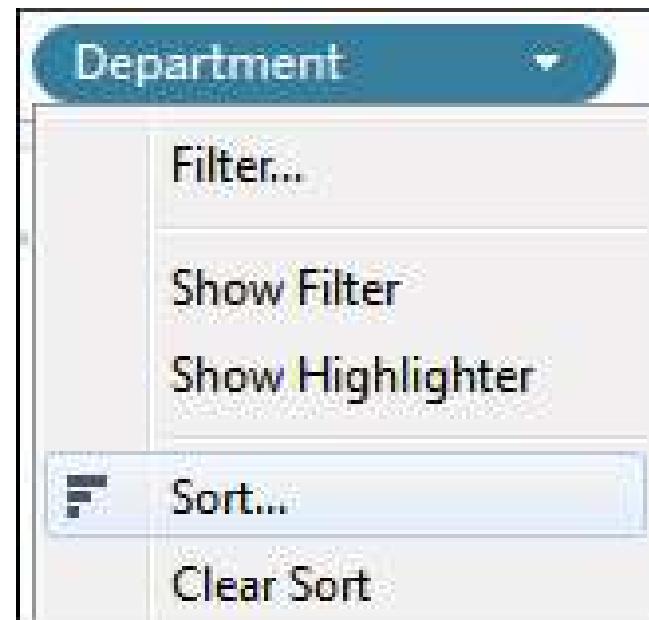
# Bar charts

- 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:

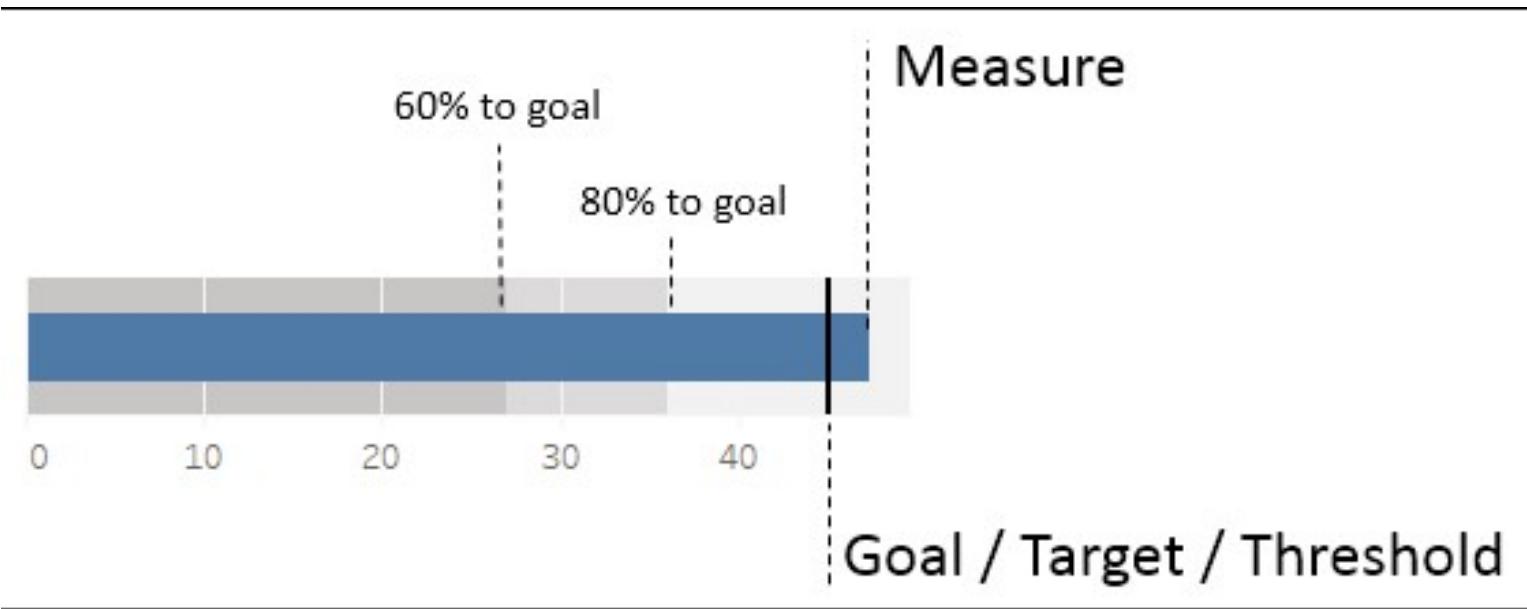


# Bar chart variations

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

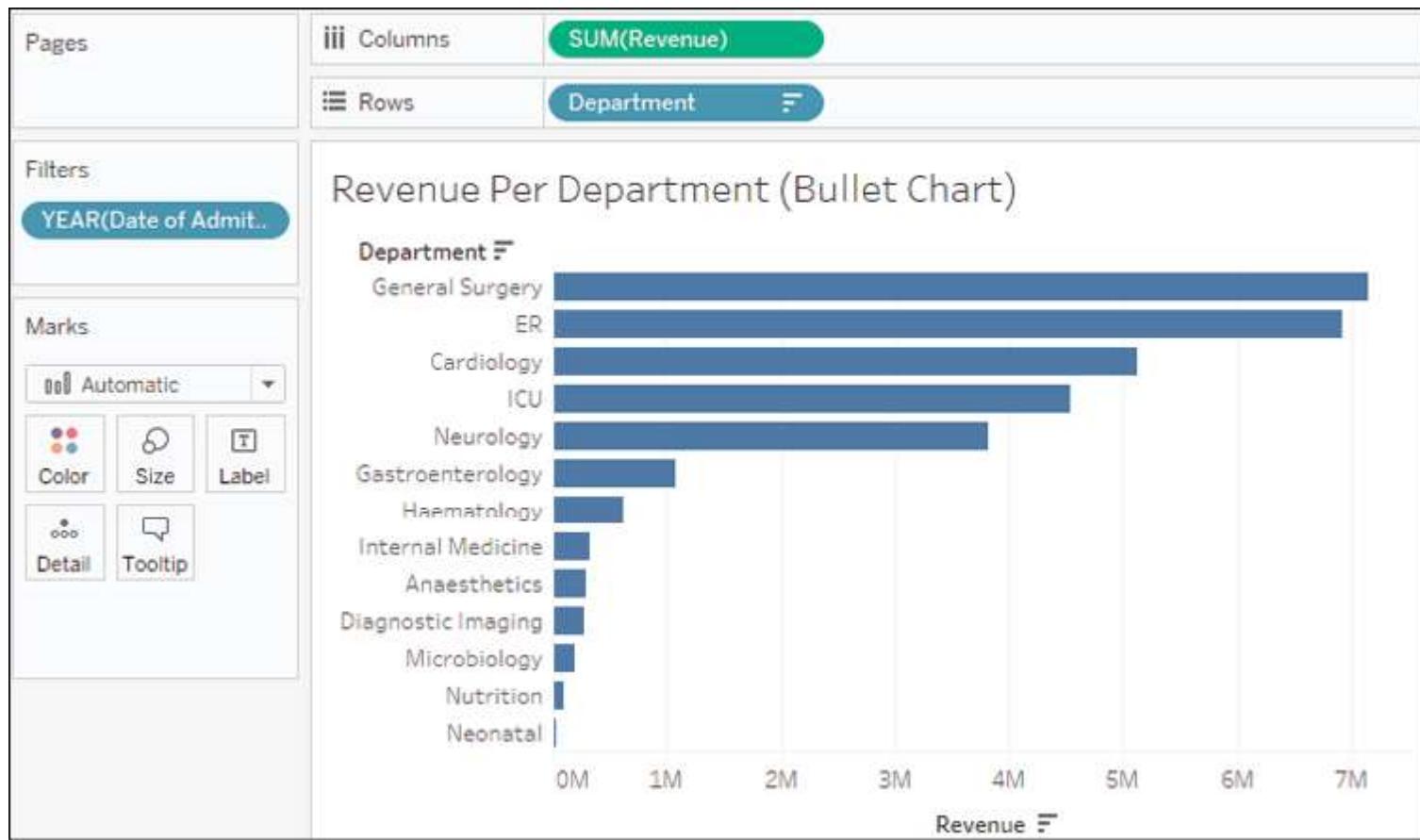
- Bullet chart to show progress towards a goal, target, or threshold
- Bar-in-bar chart to show progress toward a target or compare two specific values within a category
- Highlighting categories of interest

# Bullet chart

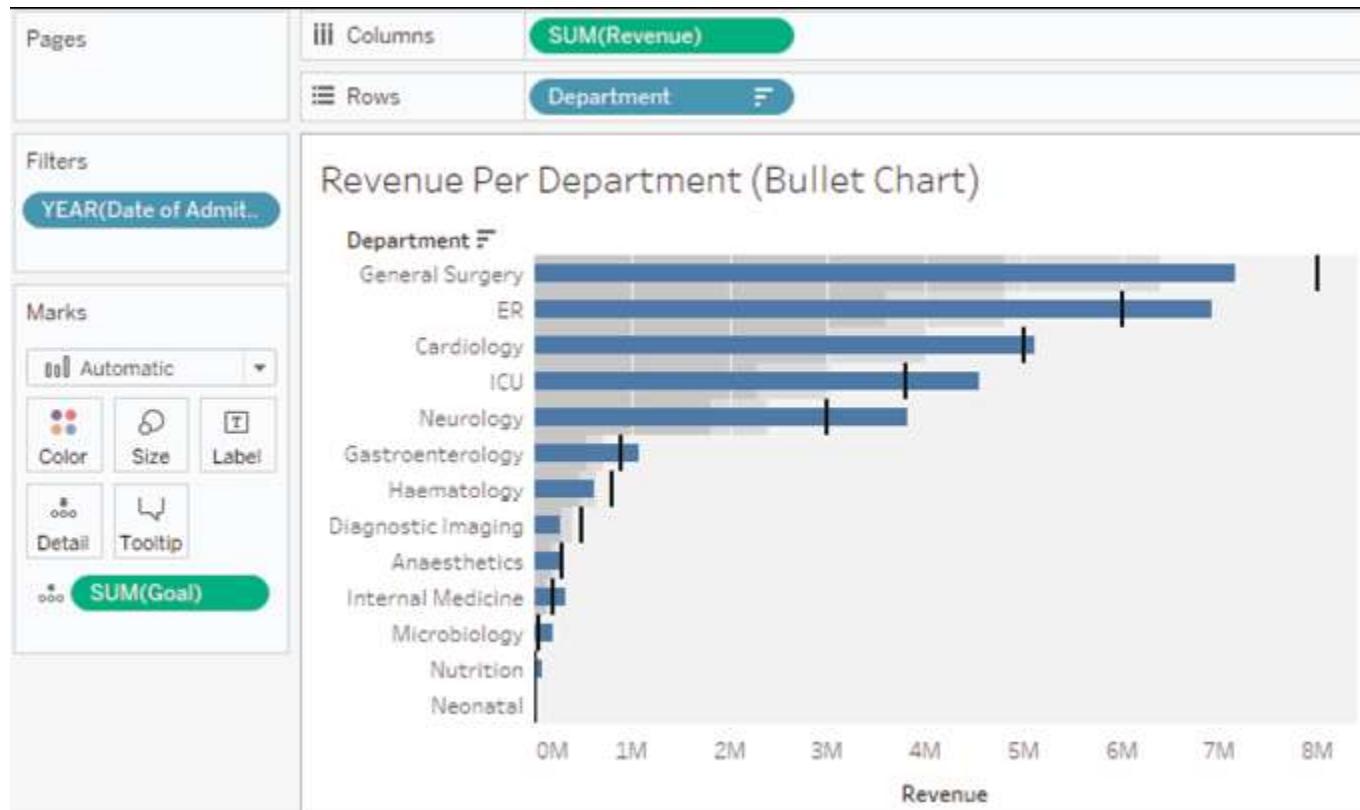


# Bullet chart

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

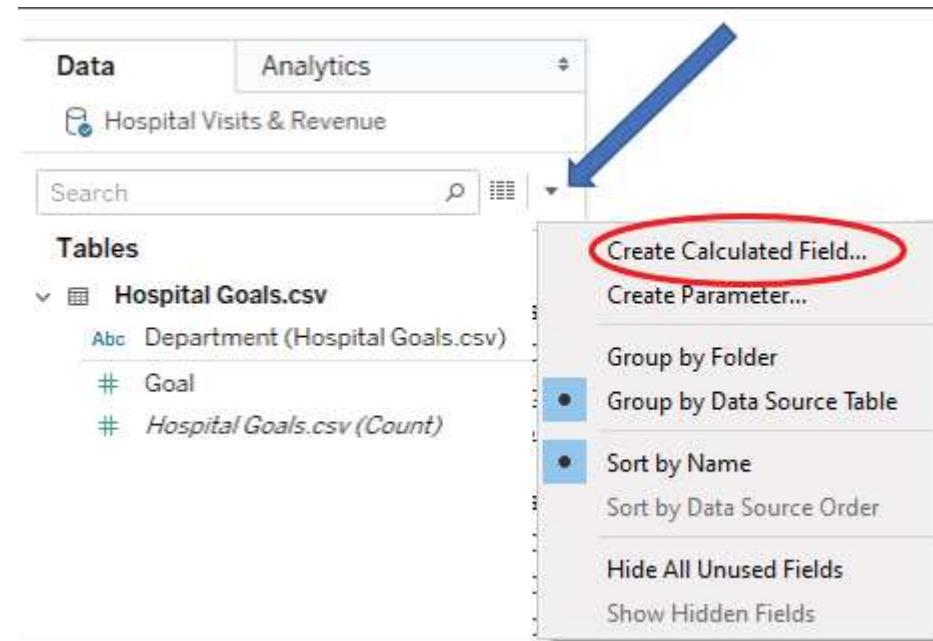


- The completed bullet chart should look like the following:



# Calling out thresholds

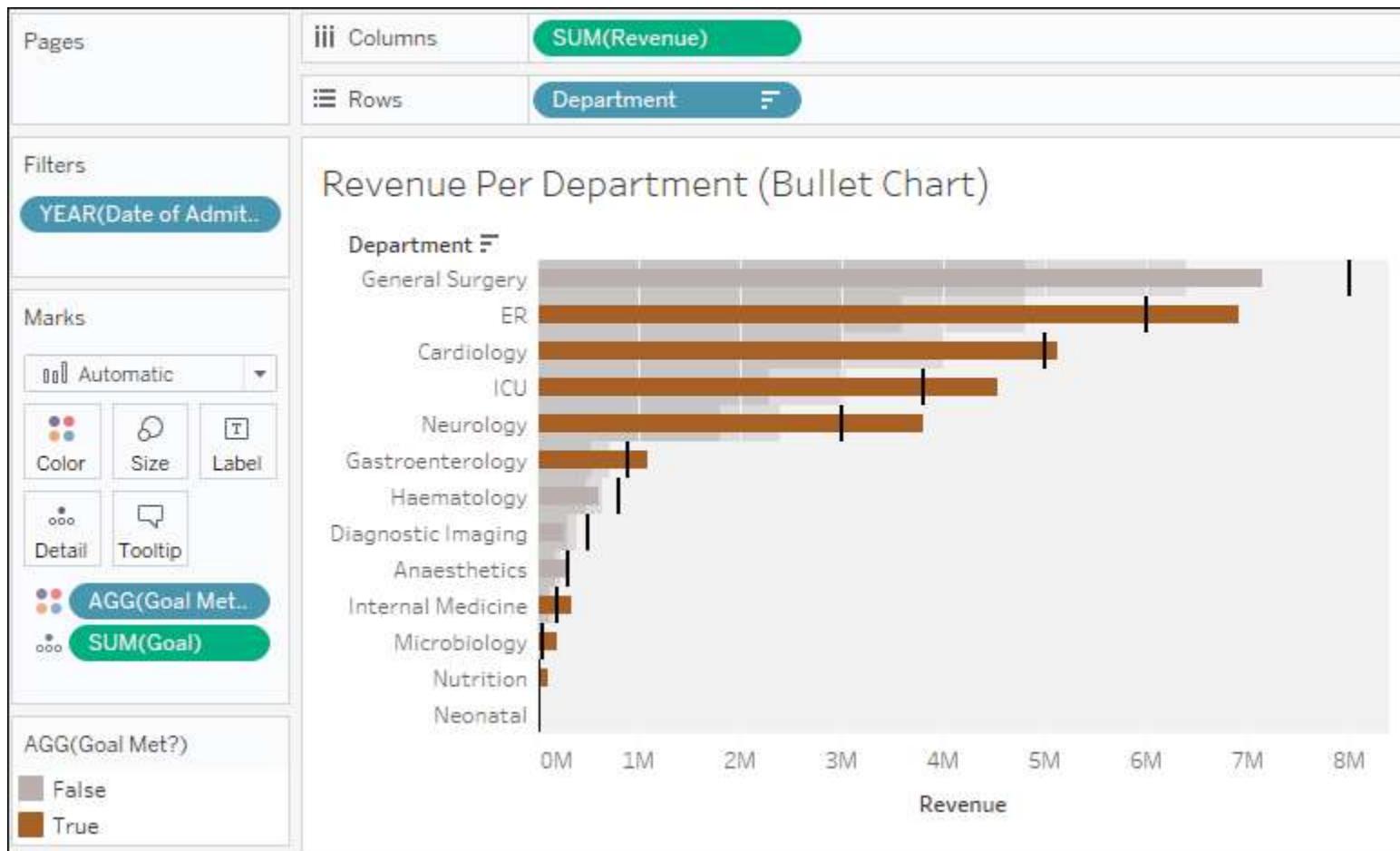
- Use the drop-down arrow in the Data pane and select Create Calculated Field...:

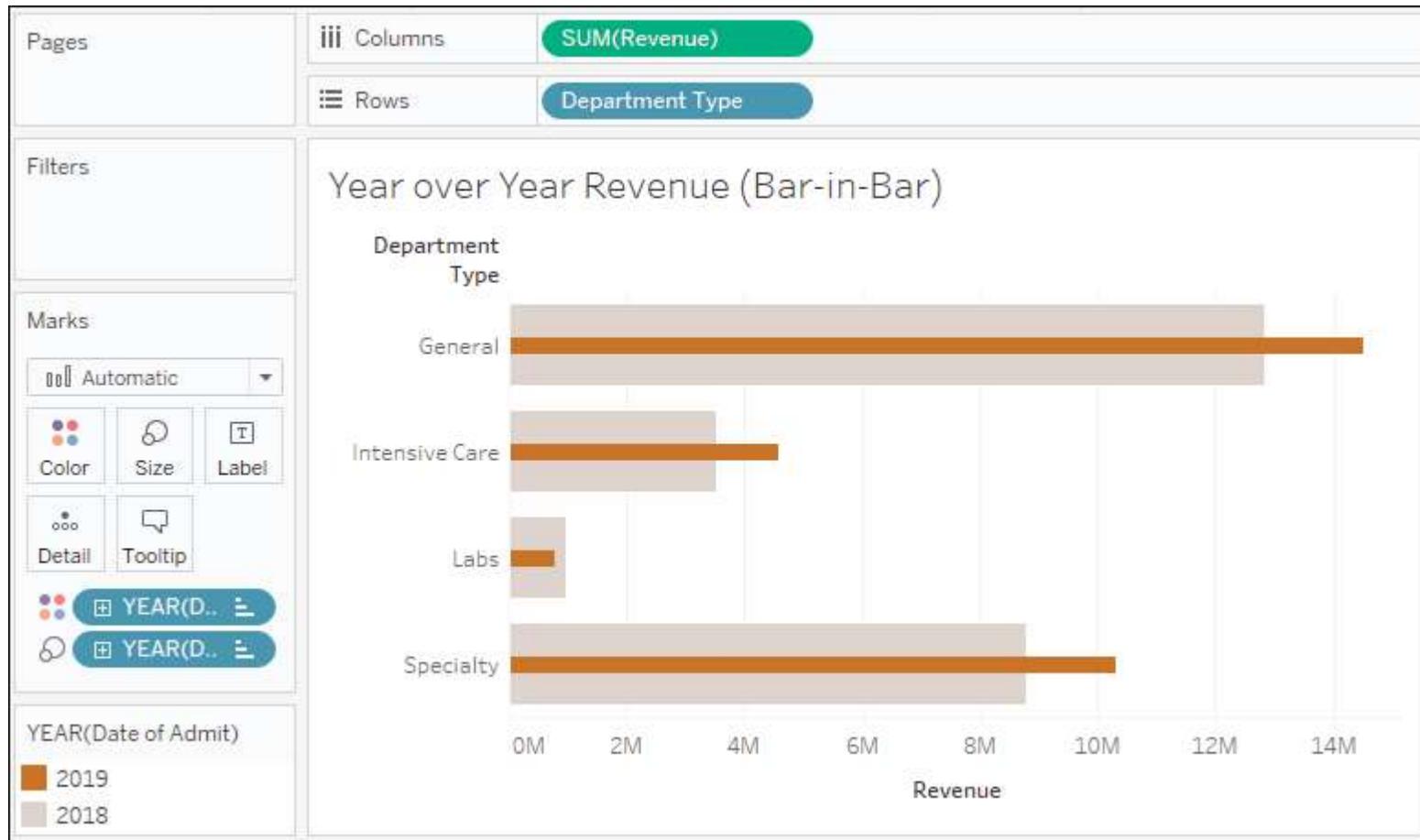


## Calling out thresholds

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

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





# Bar-in-bar chart



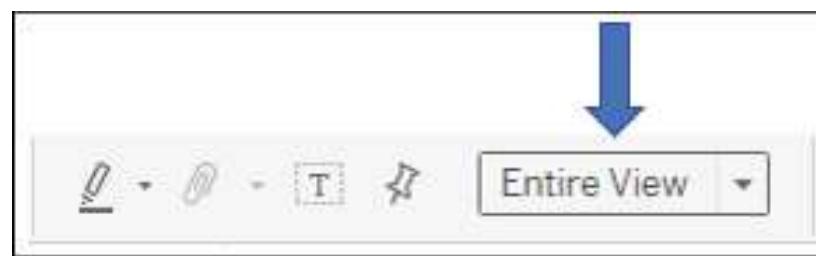
## Bar-in-bar chart

- 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:

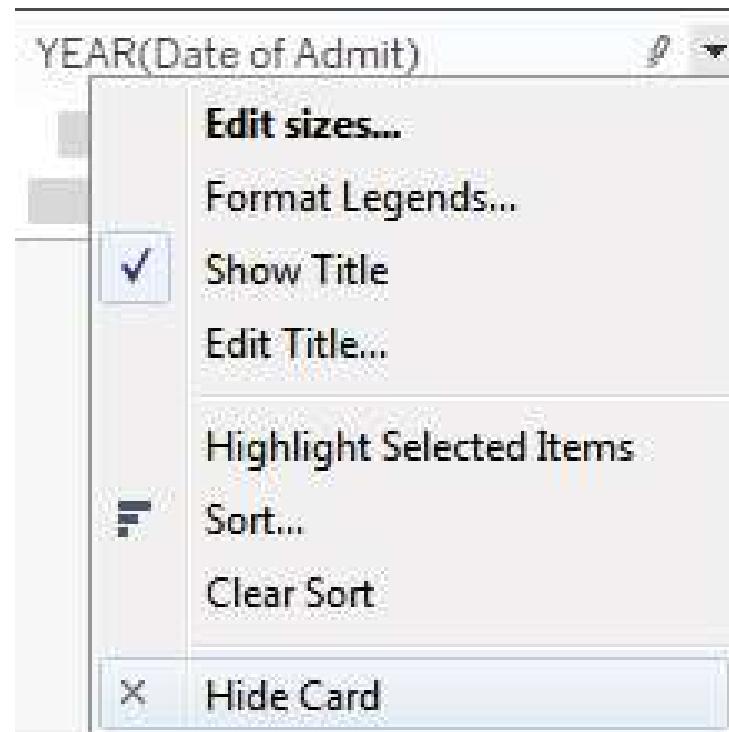


## Bar-in-bar chart

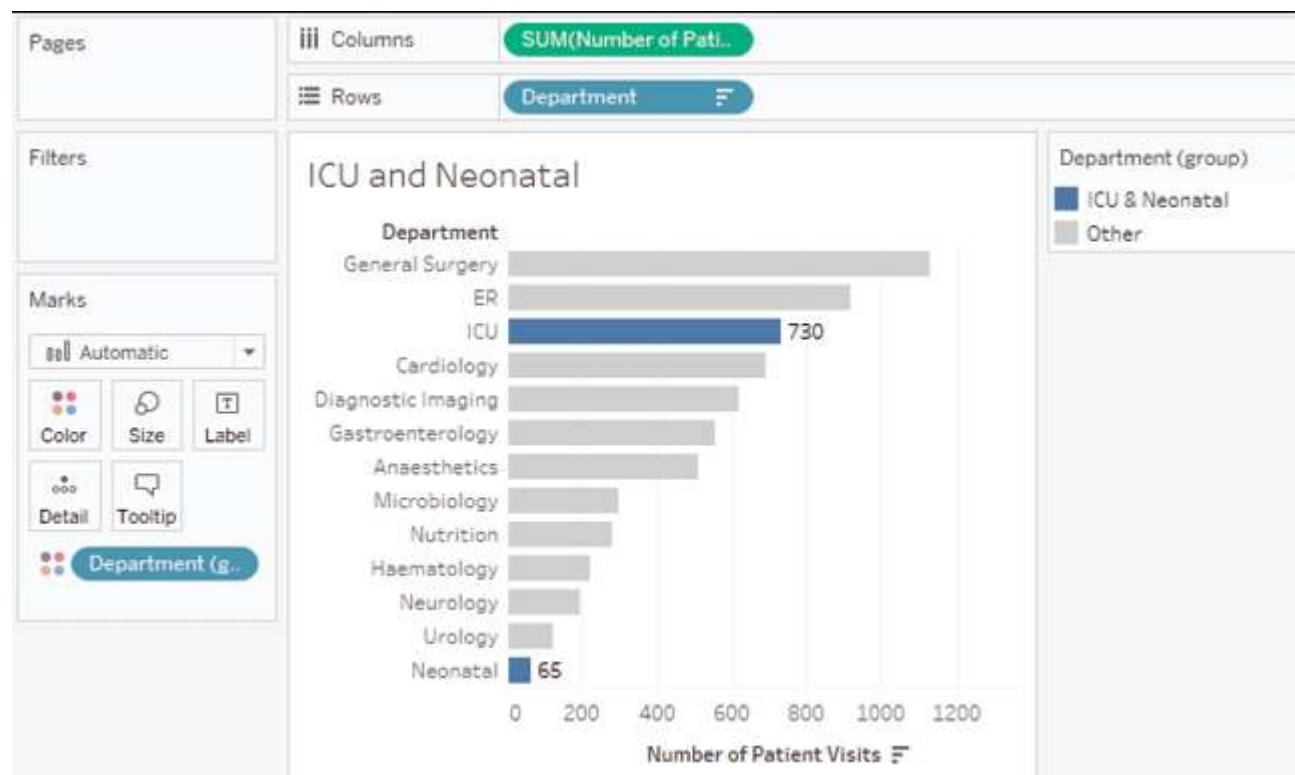
- Adjusting the sizing of the view. Accomplish this by hovering over the canvas, just over the bottom border, until the mouse cursor changes to a sizing cursor, and then click and drag to resize the view.
- You may also want to adjust how the view fills the space.
- Use the drop-down on the toolbar and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



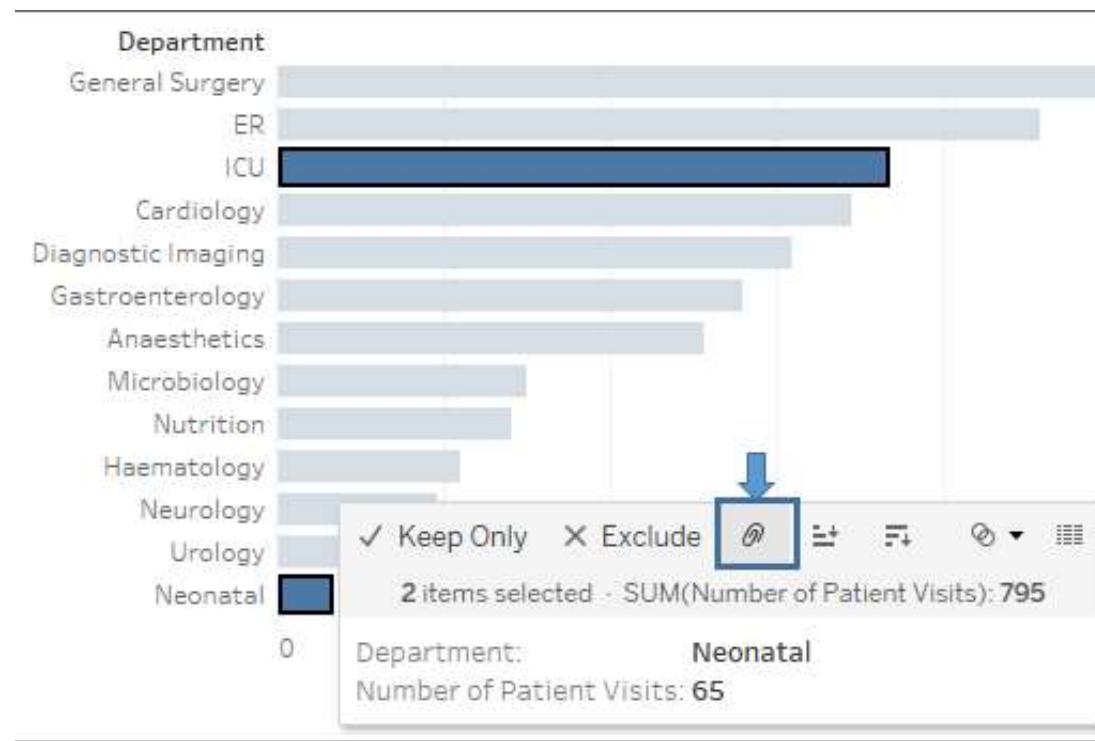
# Bar-in-bar chart



# 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

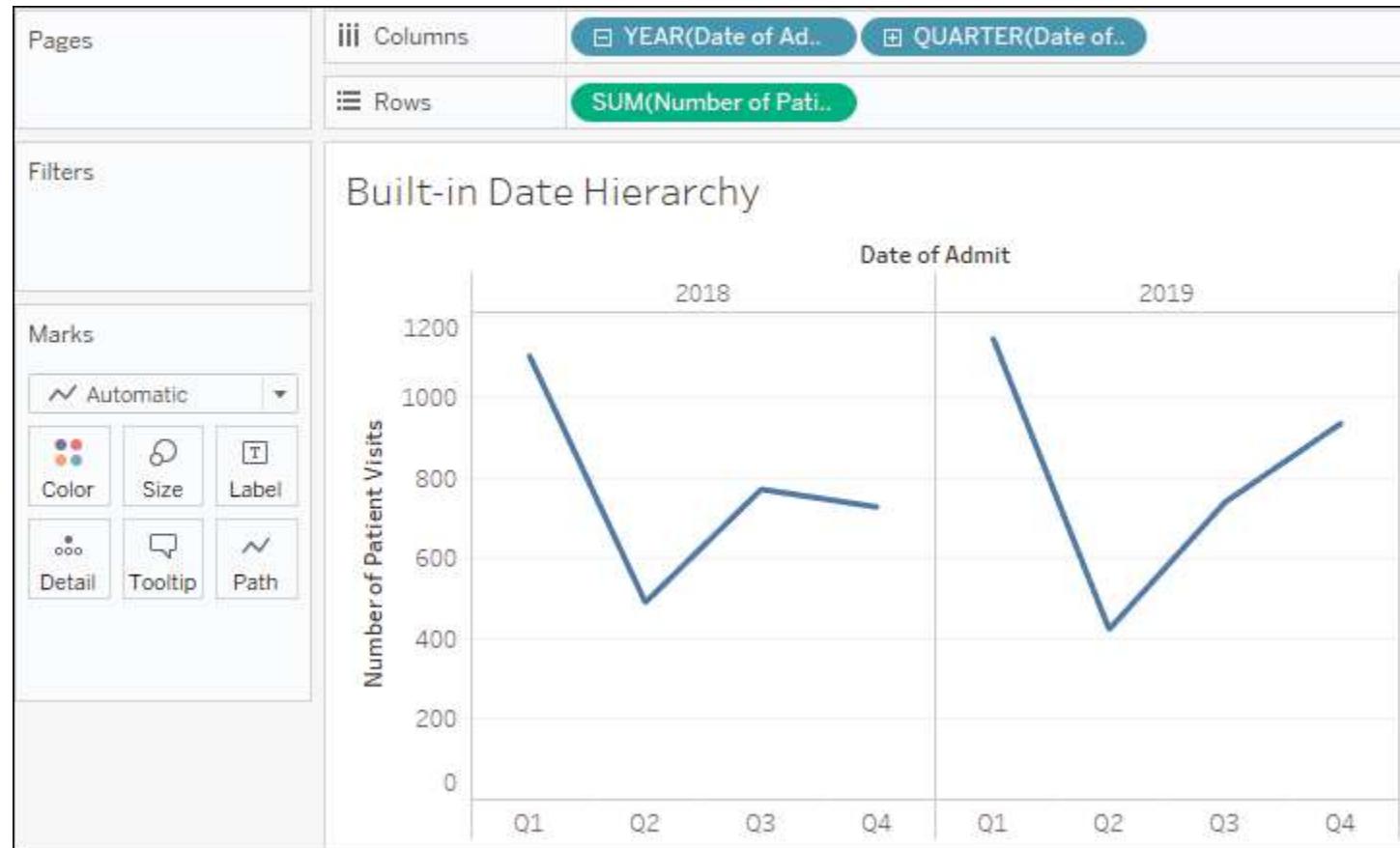
- To see this in action, continue with the lesson 3 workcourse, navigate to the Built-in Date Hierarchy sheet, and create a view similar to the one that was shown by dragging and dropping Number of Patient Visits to Rows and Date of Admit to Columns.
- The YEAR(Date of Admit) field on Columns will have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



# 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	
<input checked="" type="radio"/> Year	2011
Quarter	Q2
Month	May
Day	8
More	▶
Year	2011
Quarter	Q2 2011
Month	May 2011
Week Number	Week 5, 2011
Day	May 8, 2011
More	▶
Exact Date	
Attribute	
Measure	▶
<input checked="" type="radio"/> Discrete	
Continuous	

Show dates that are “skipped” in the data

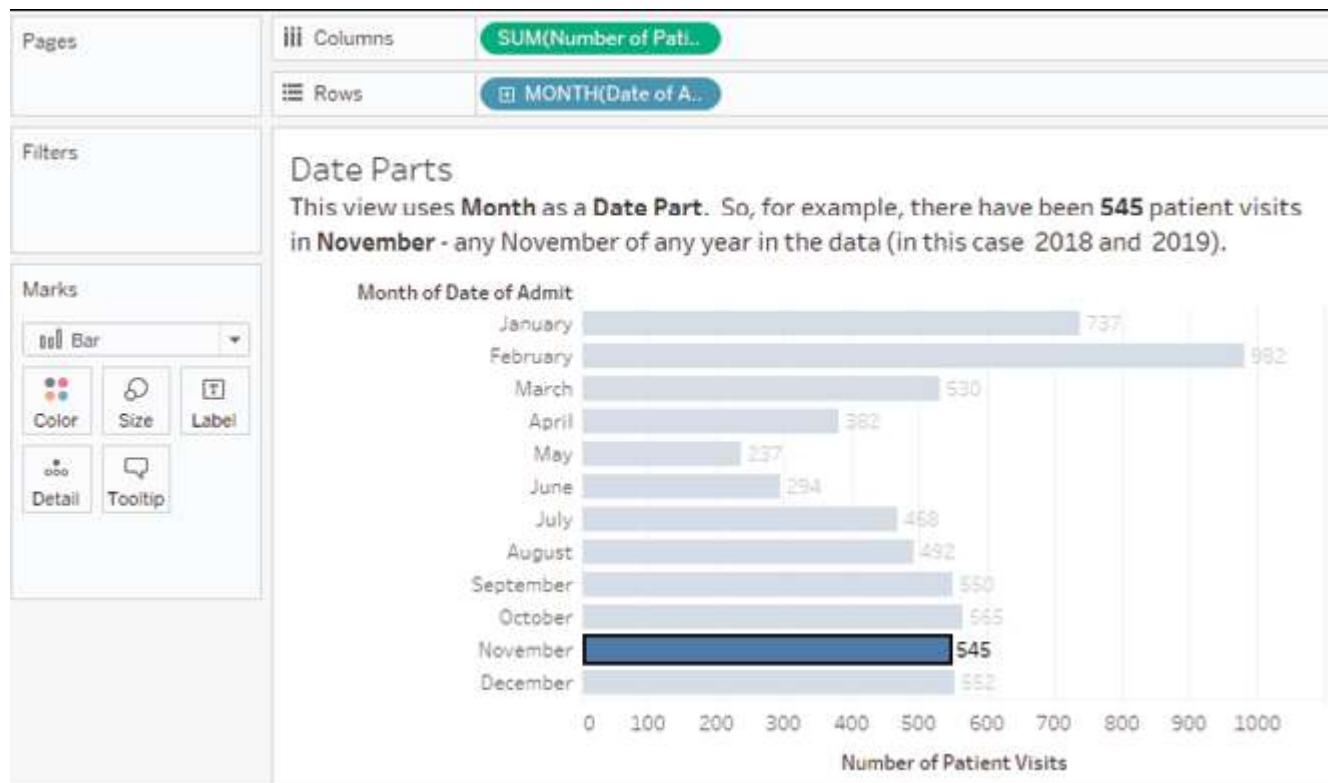
**Date Part**

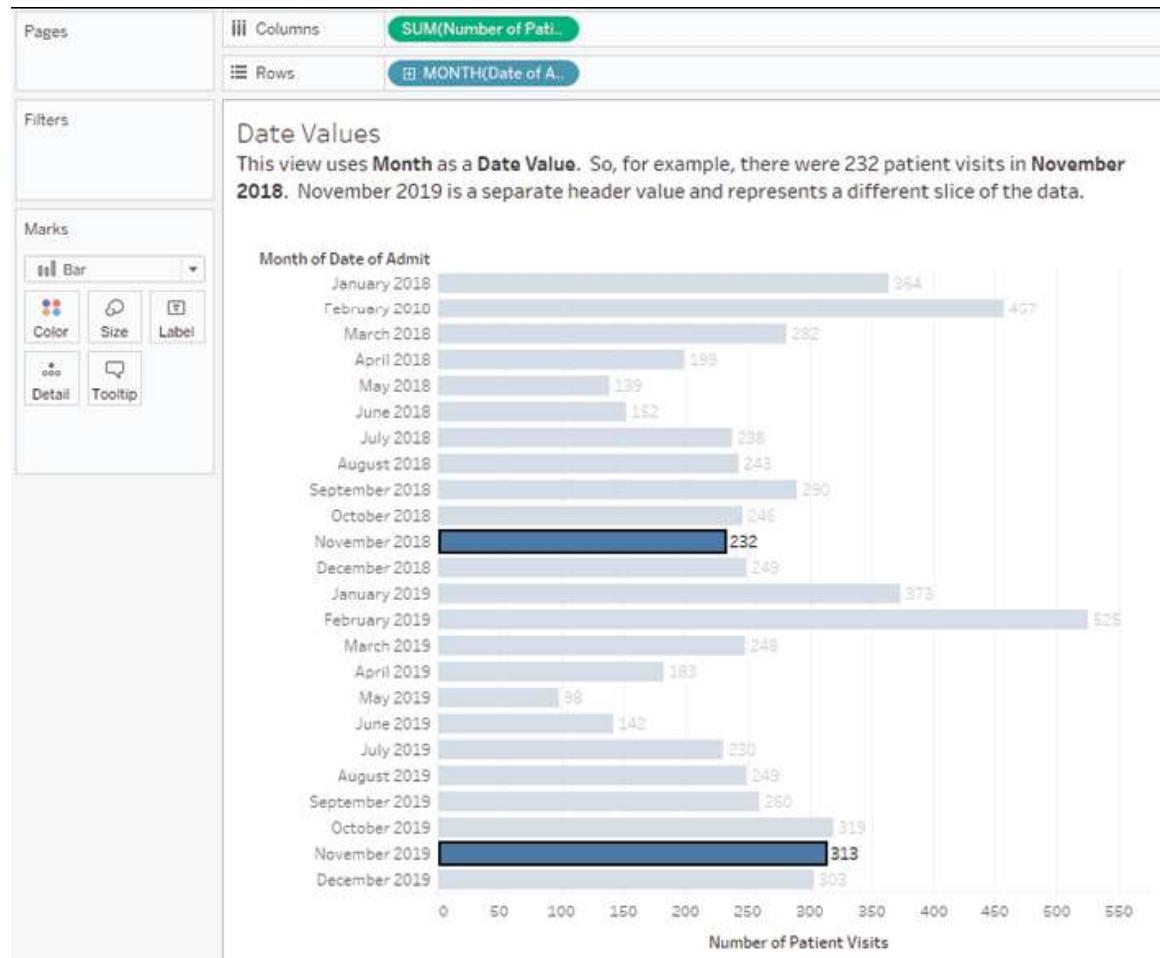
**Date Value (Truncated)**

**Exact Value of Field**

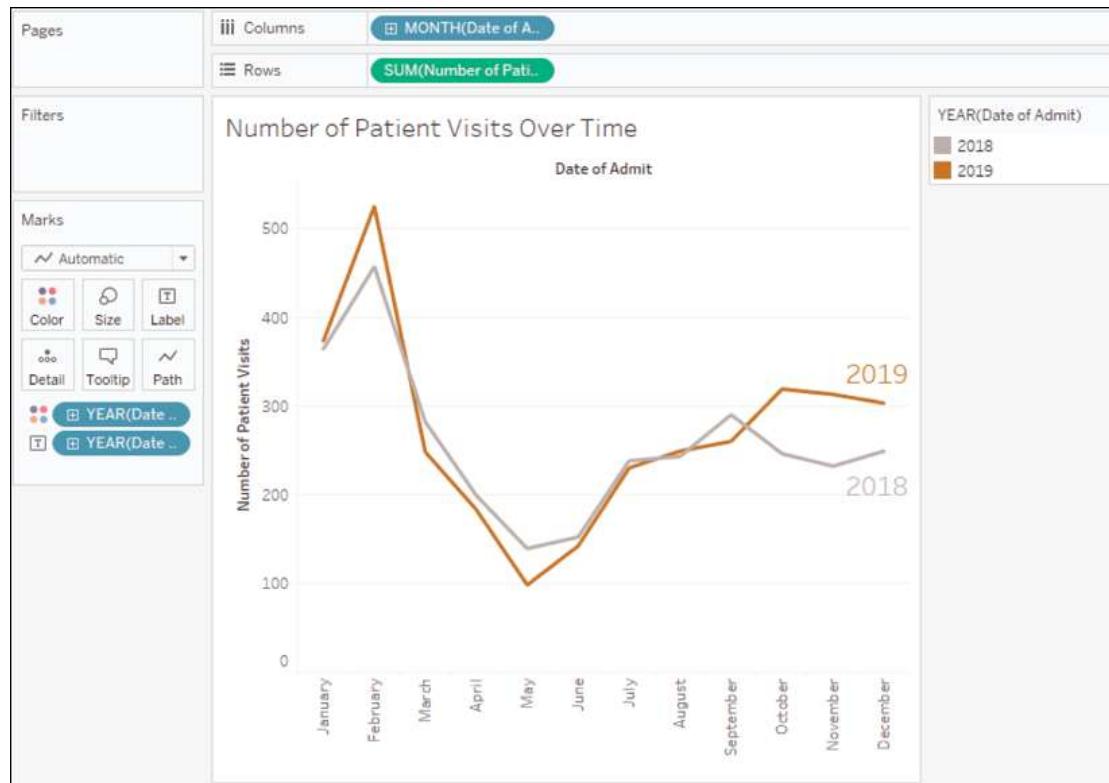
Switch between Discrete and Continuous

# Date parts, date values, and exact dates

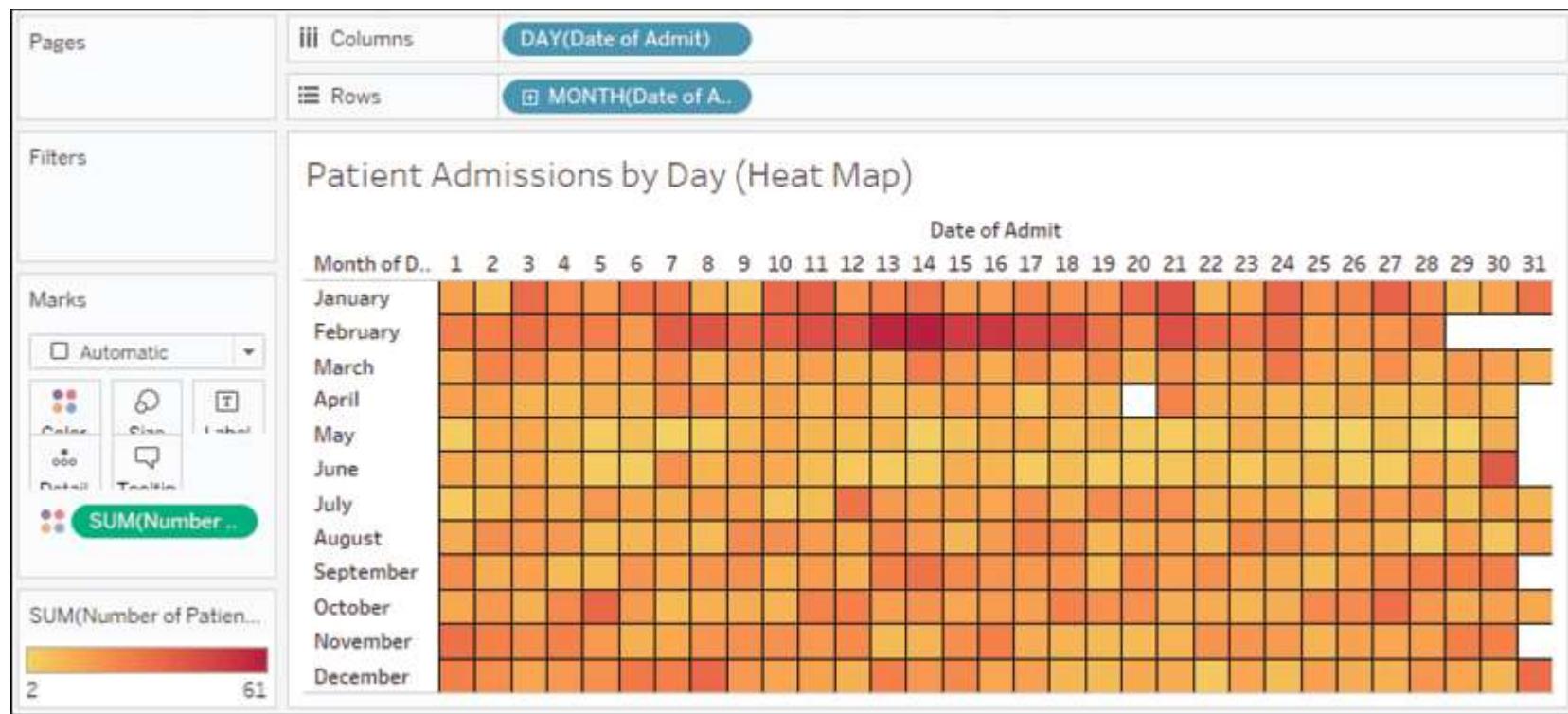




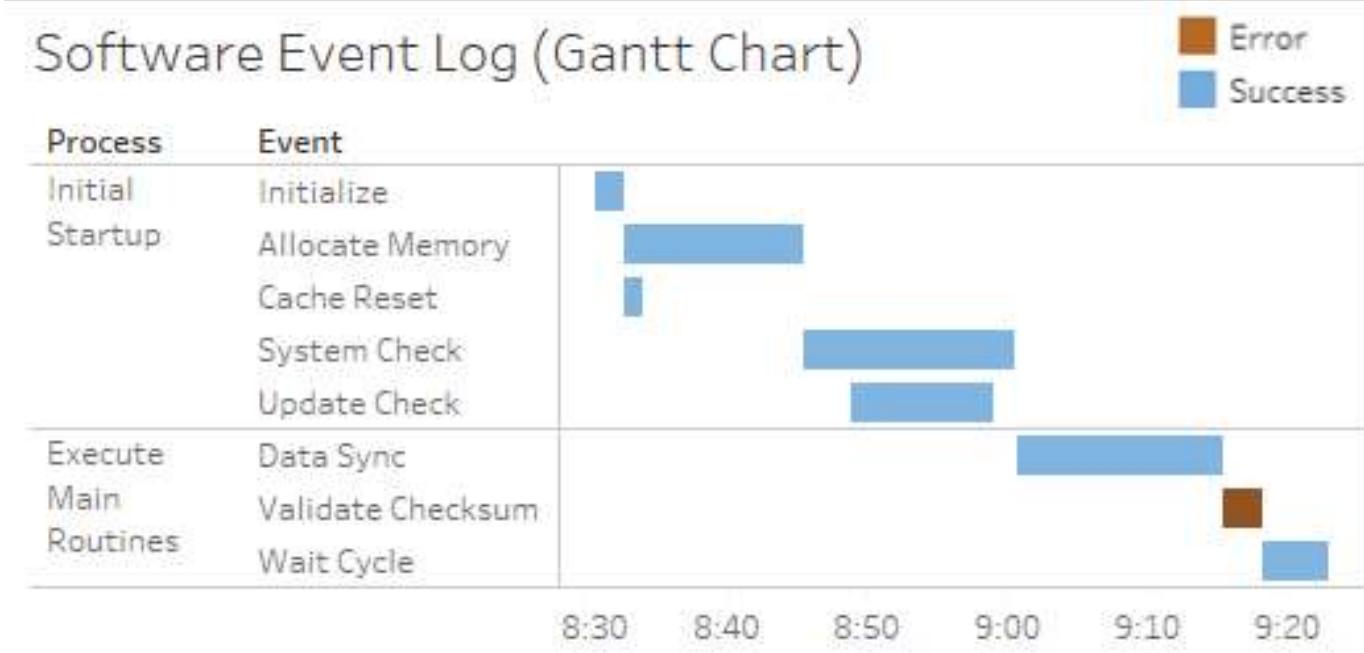
# Variations of date and time visualizations



# Date parts, date values, and exact dates



# Gantt charts



# Gantt charts

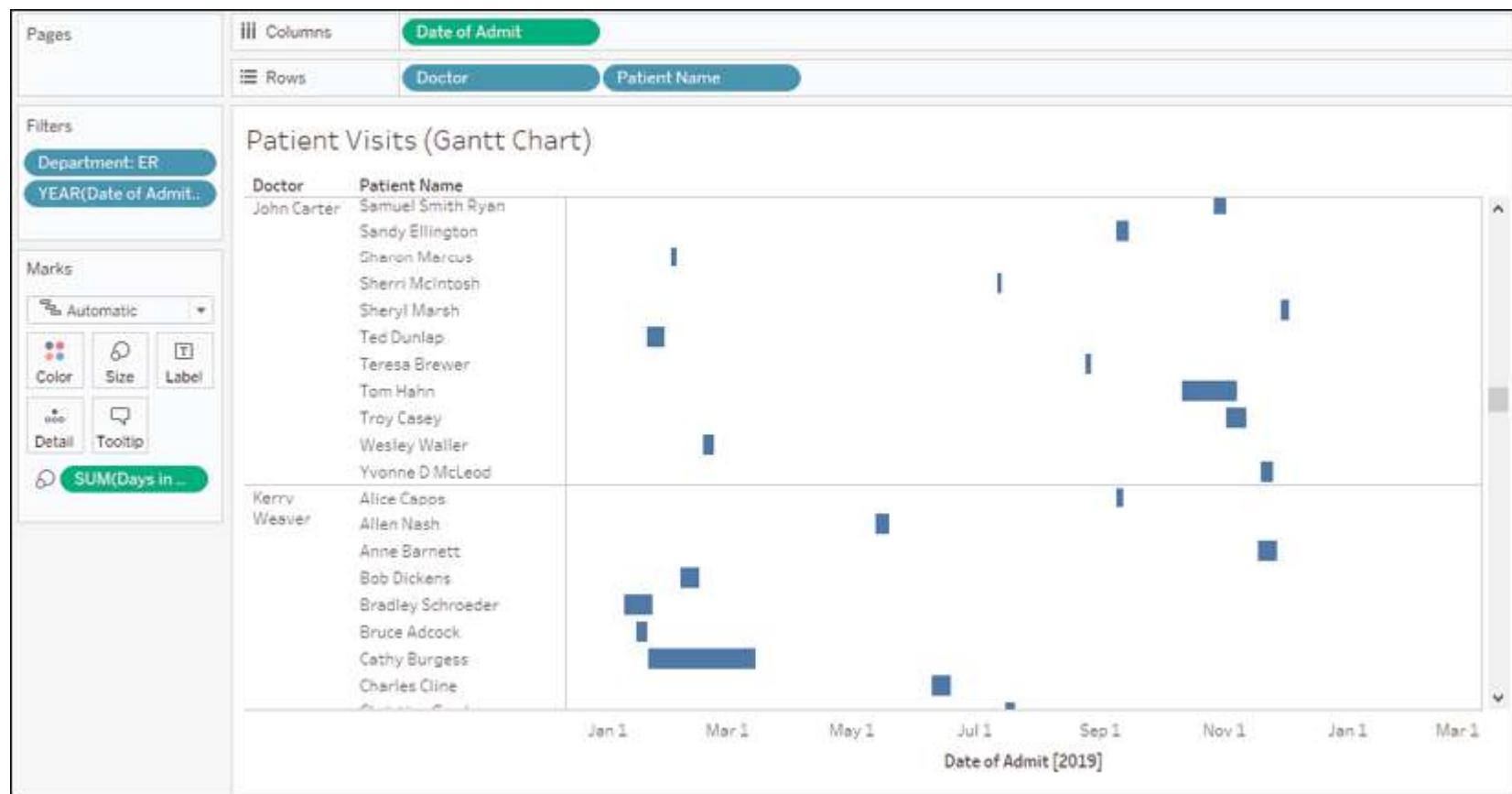
- Place Department on Filters and keep only ER.
- Place Date of Admit on Filters, select Years as the option for filtering, and keep only 2019.
- Place Date of Admit on Columns as a continuous Exact Date or as a Day value (not Day part) & Notice that Tableau's automatic default for the mark type is Gantt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

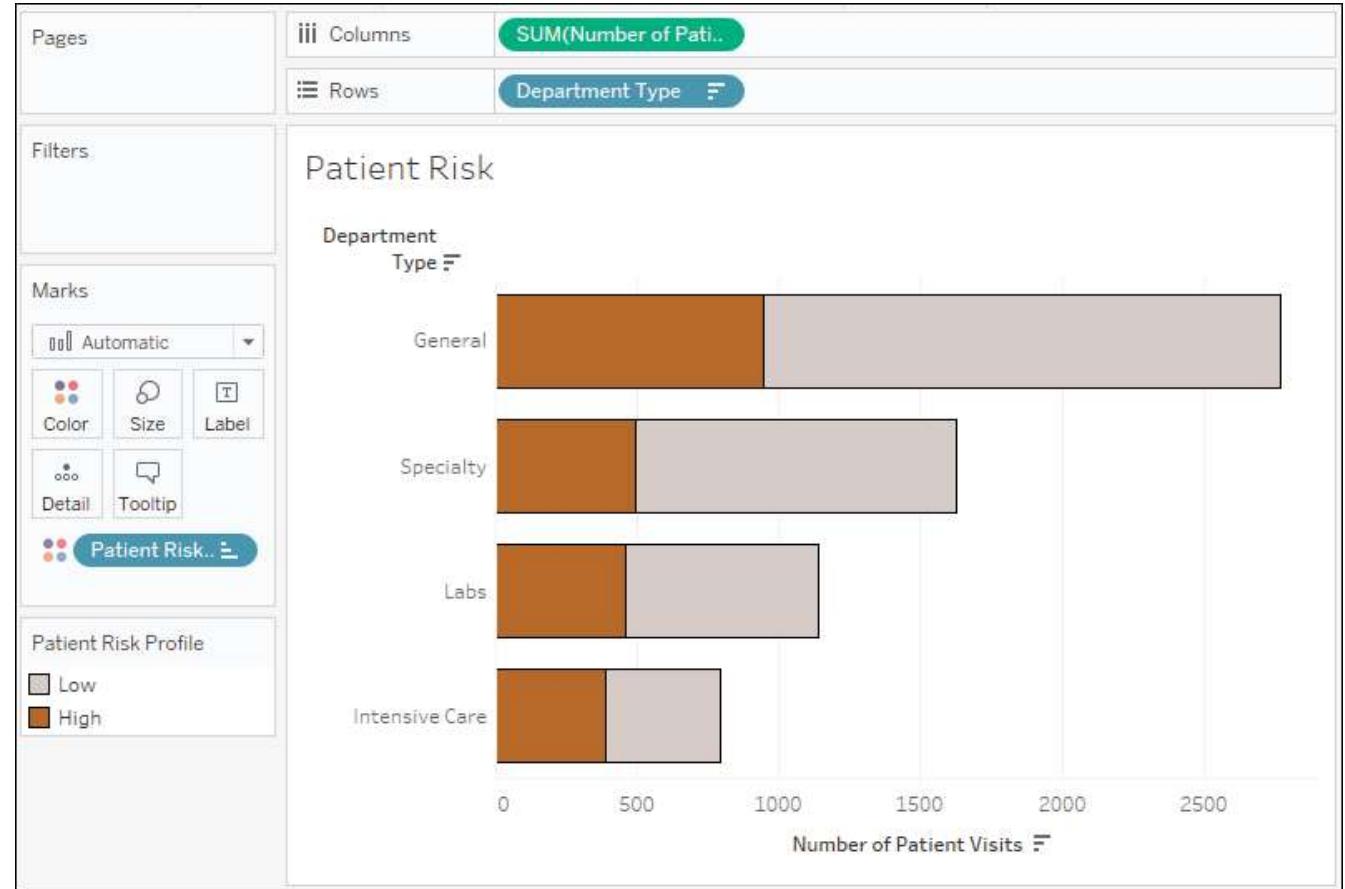


# Relating parts of the data to the whole

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

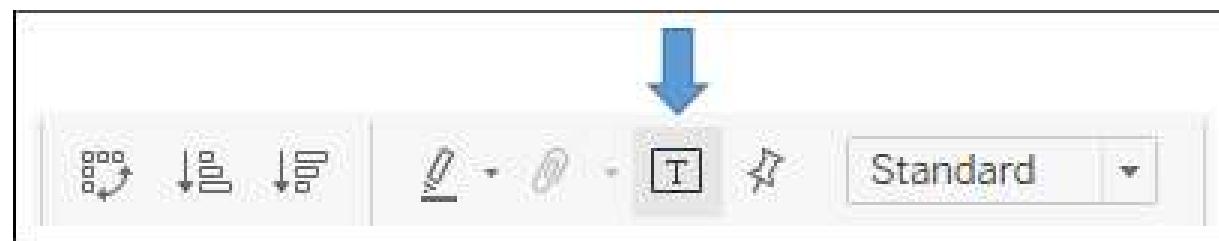






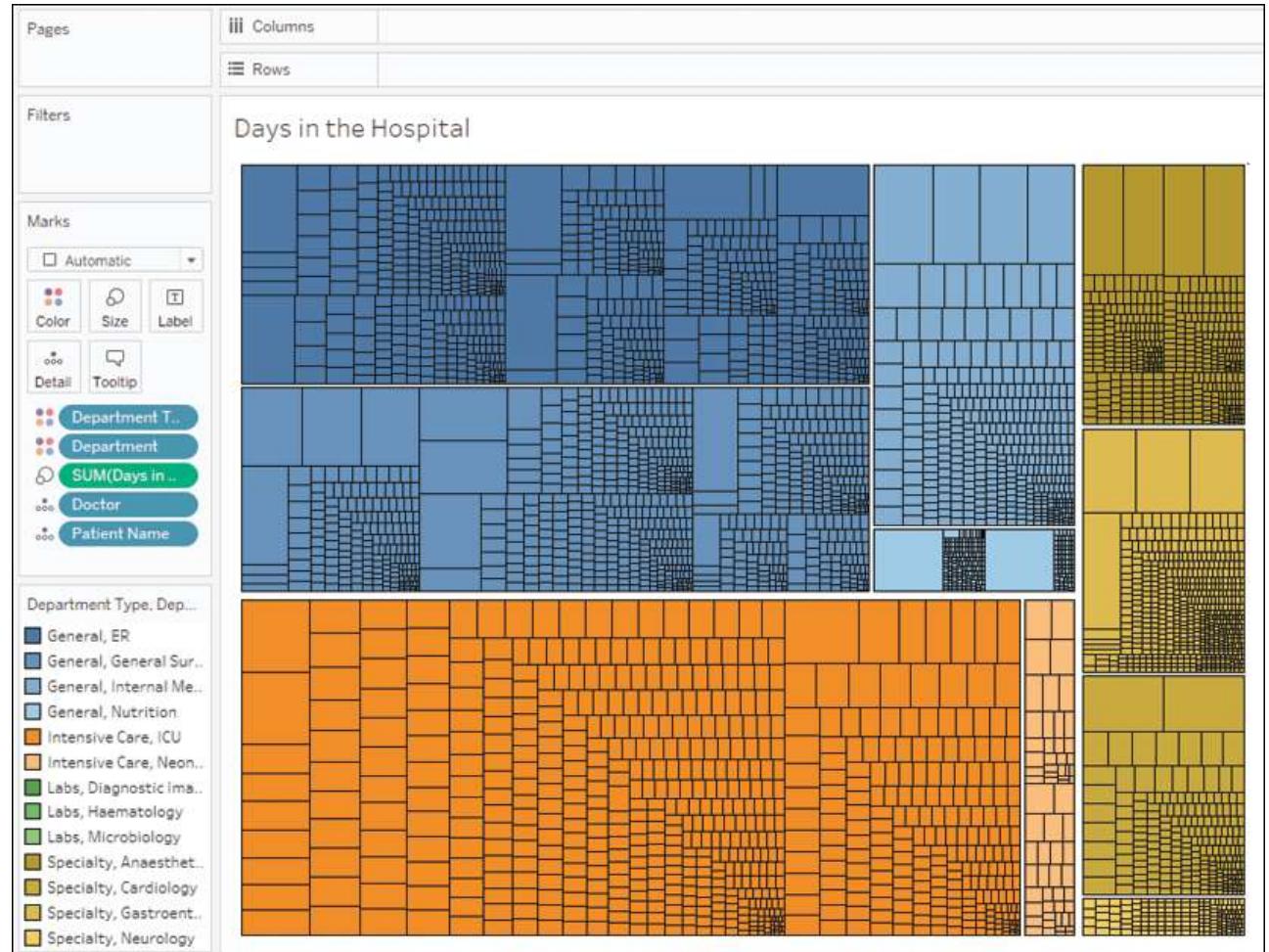
# Stacked bars

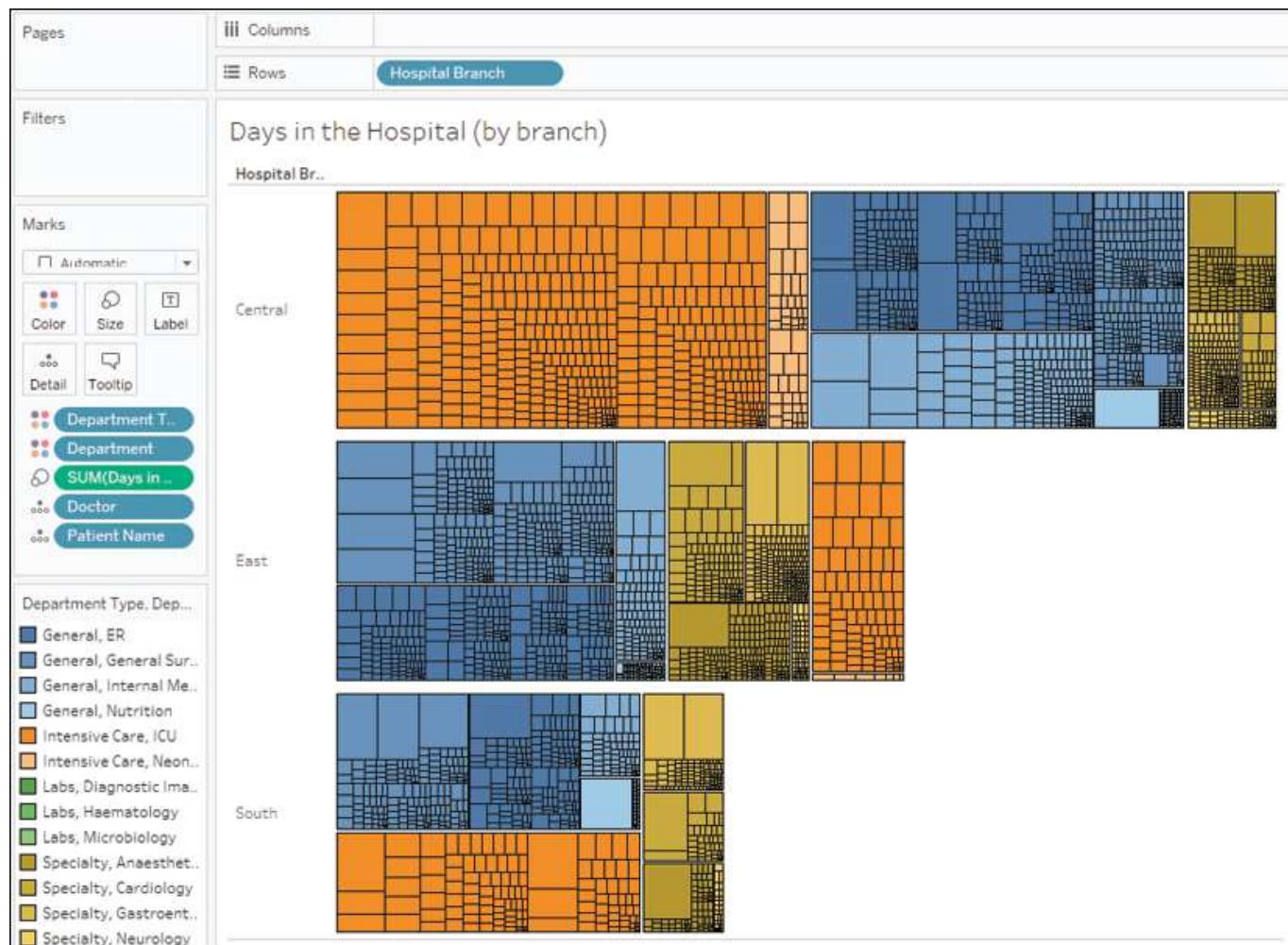
- Turn on labels by clicking the T button on the top toolbar.
- This turns on default labels for each mark:





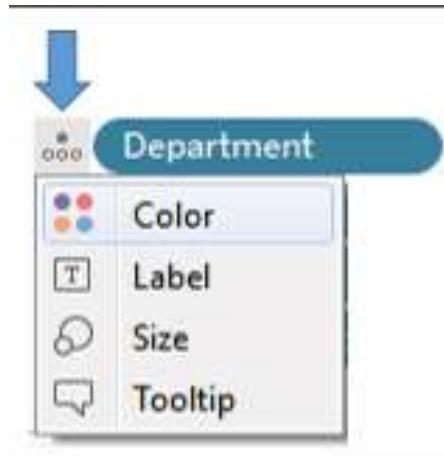
# Treemaps



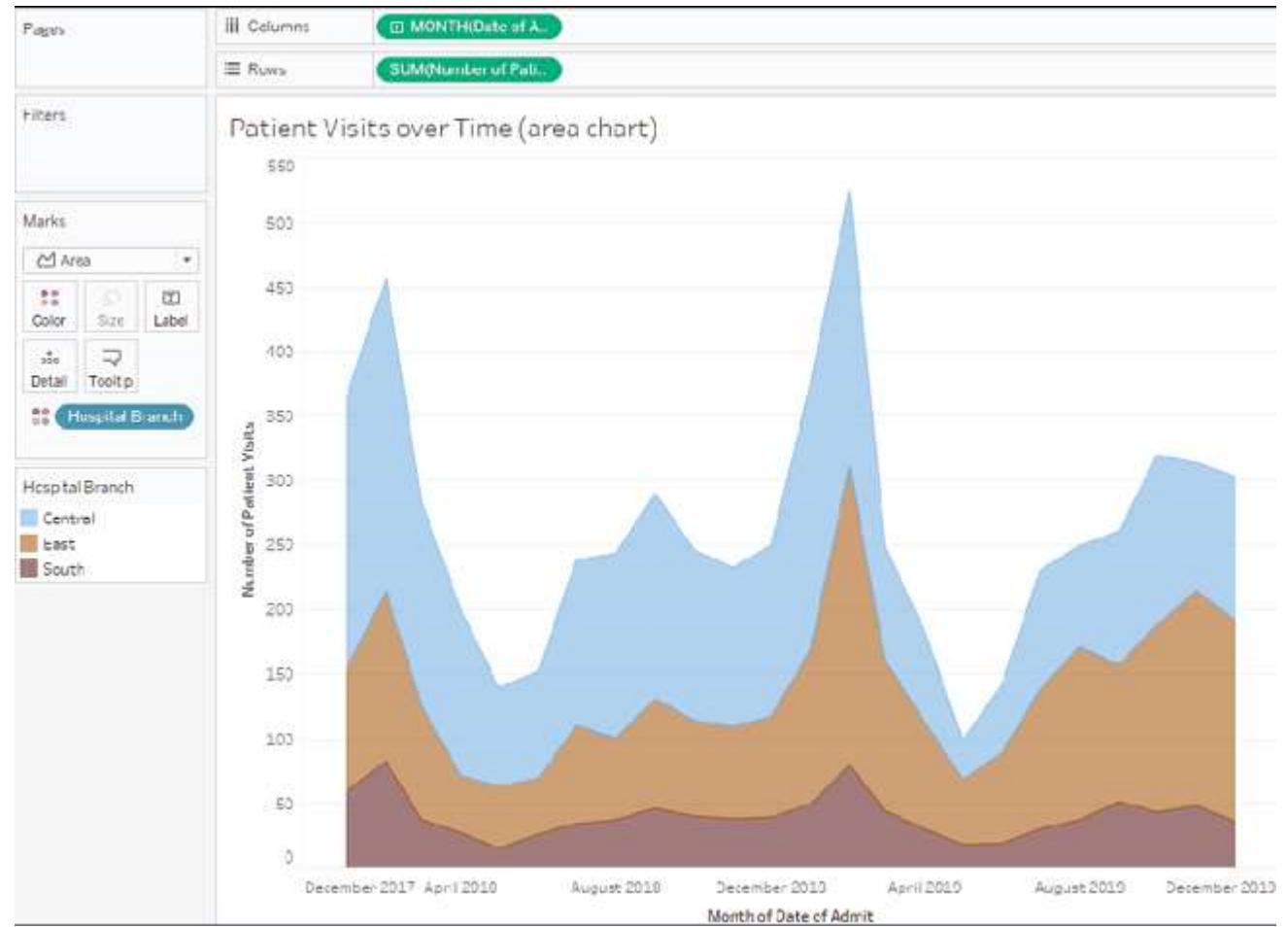


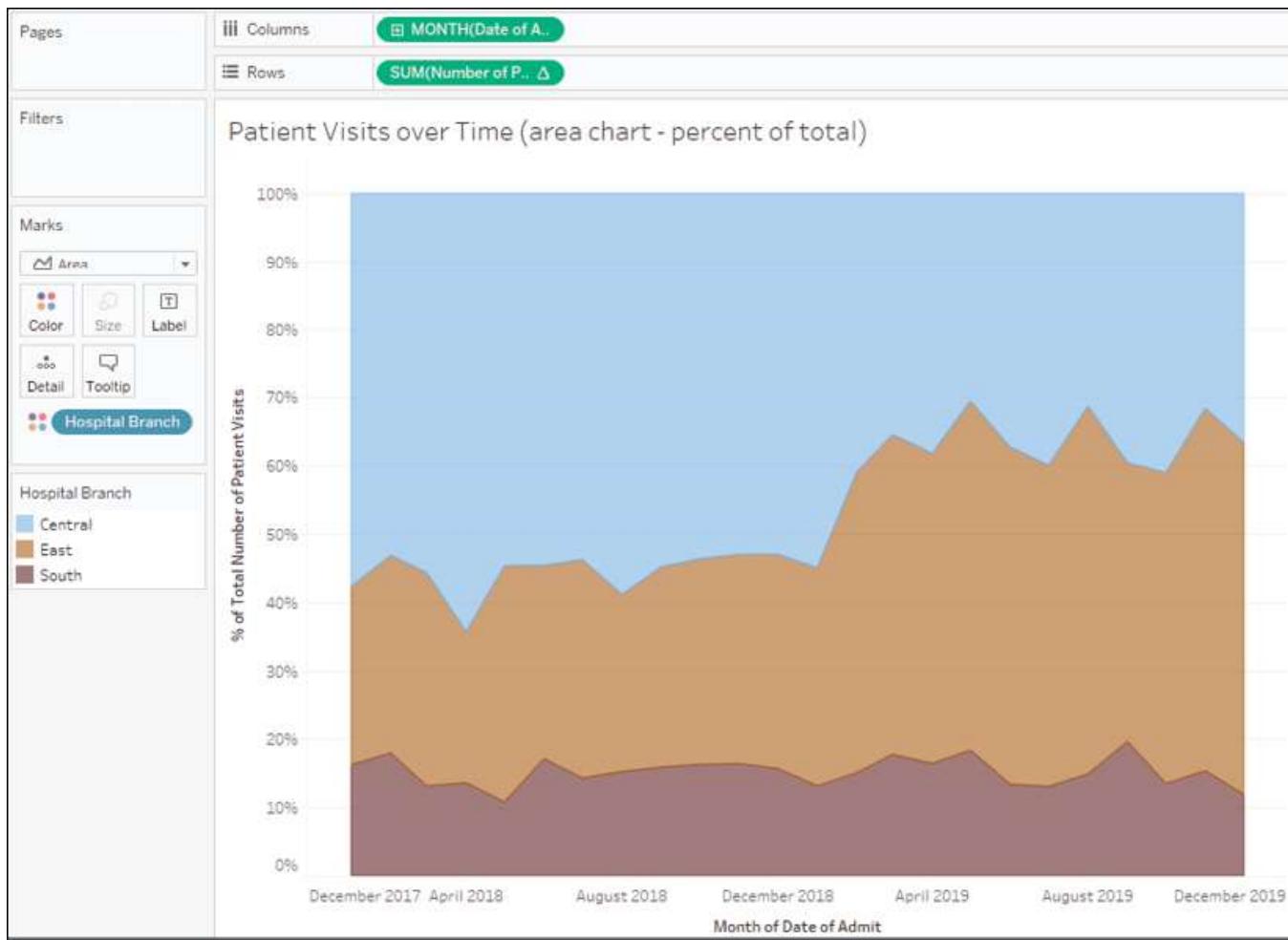
# Treemaps

- 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:

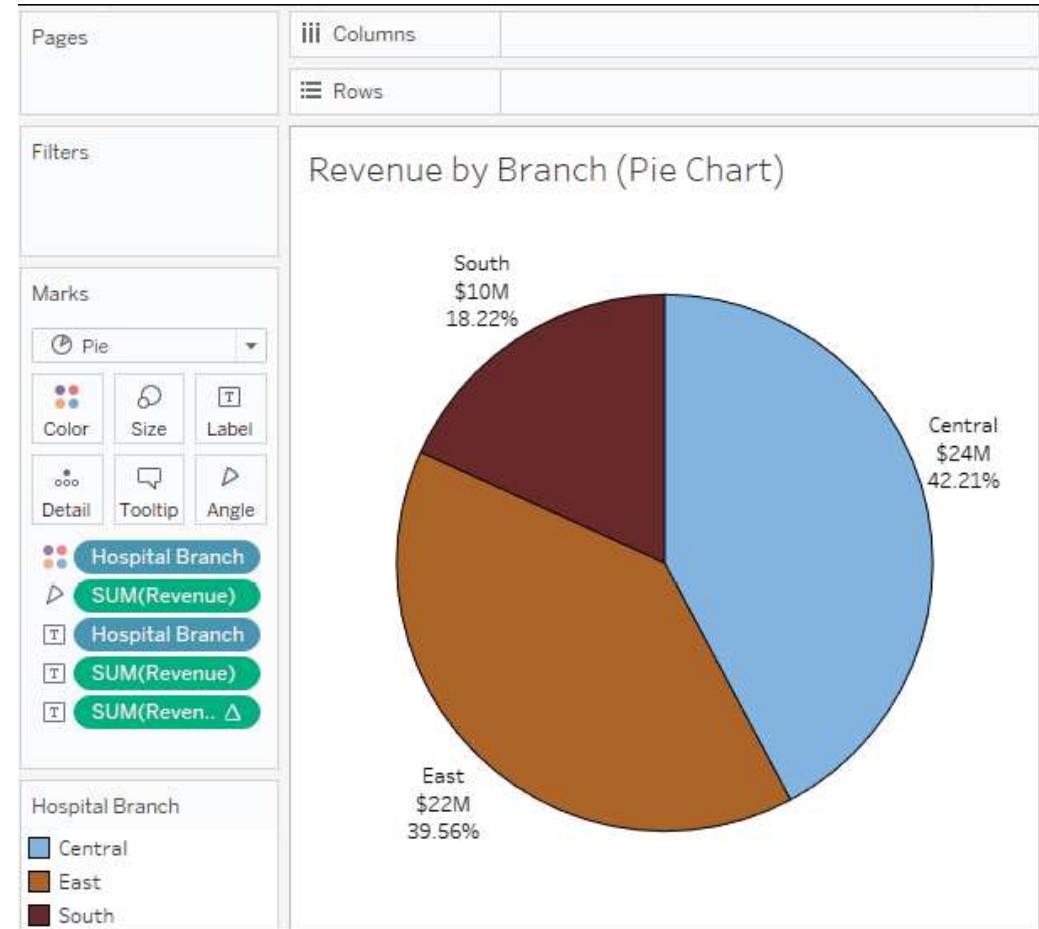


# Area charts





# Pie charts



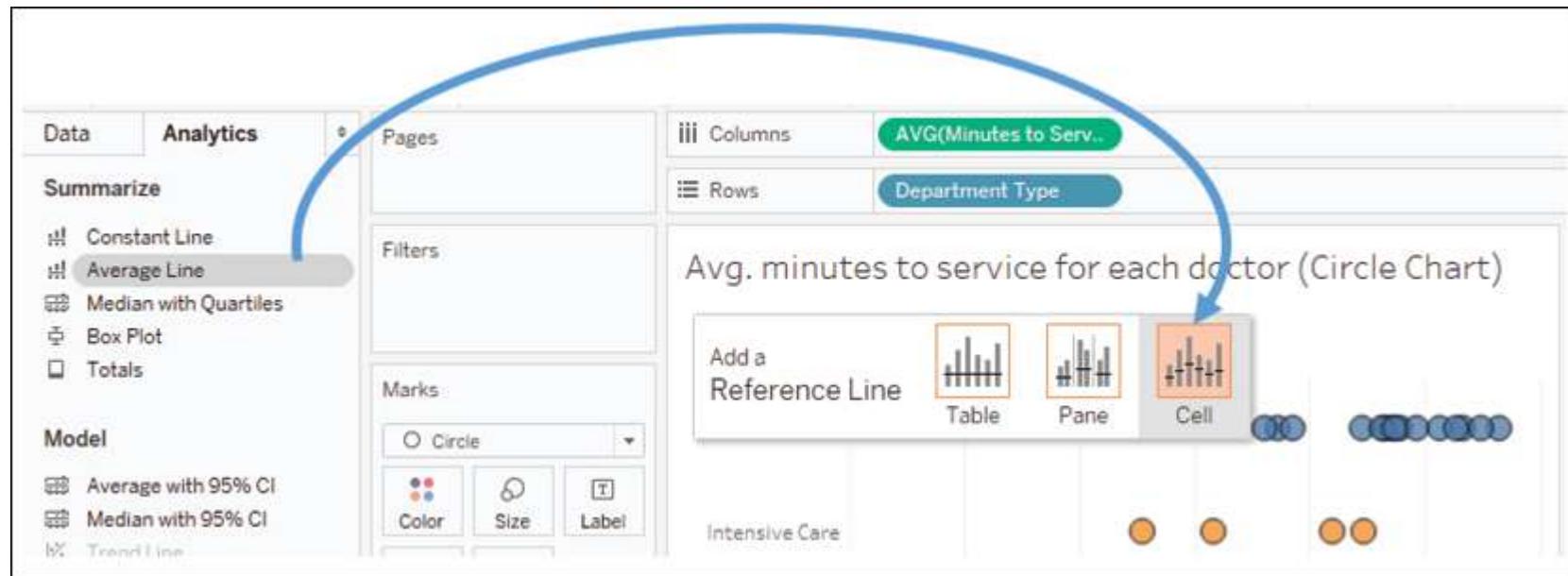
# Visualizing distributions

- 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



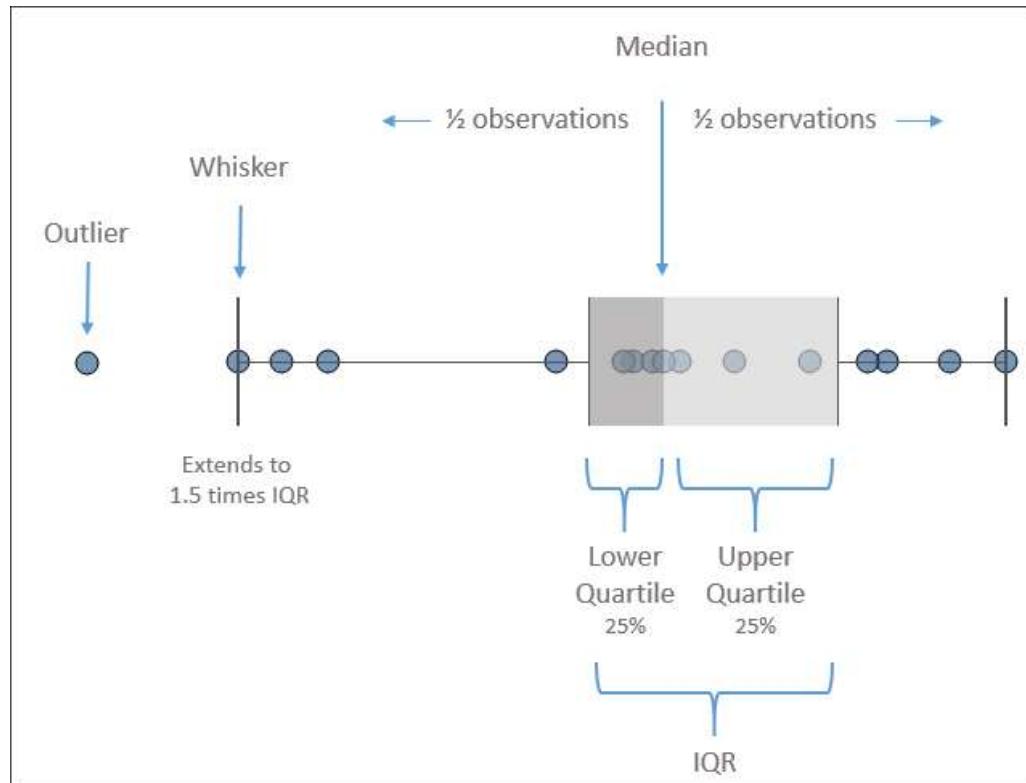
You may also click one of the resulting average lines and select Edit to find fine-tuning options, such as labeling.

# 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?

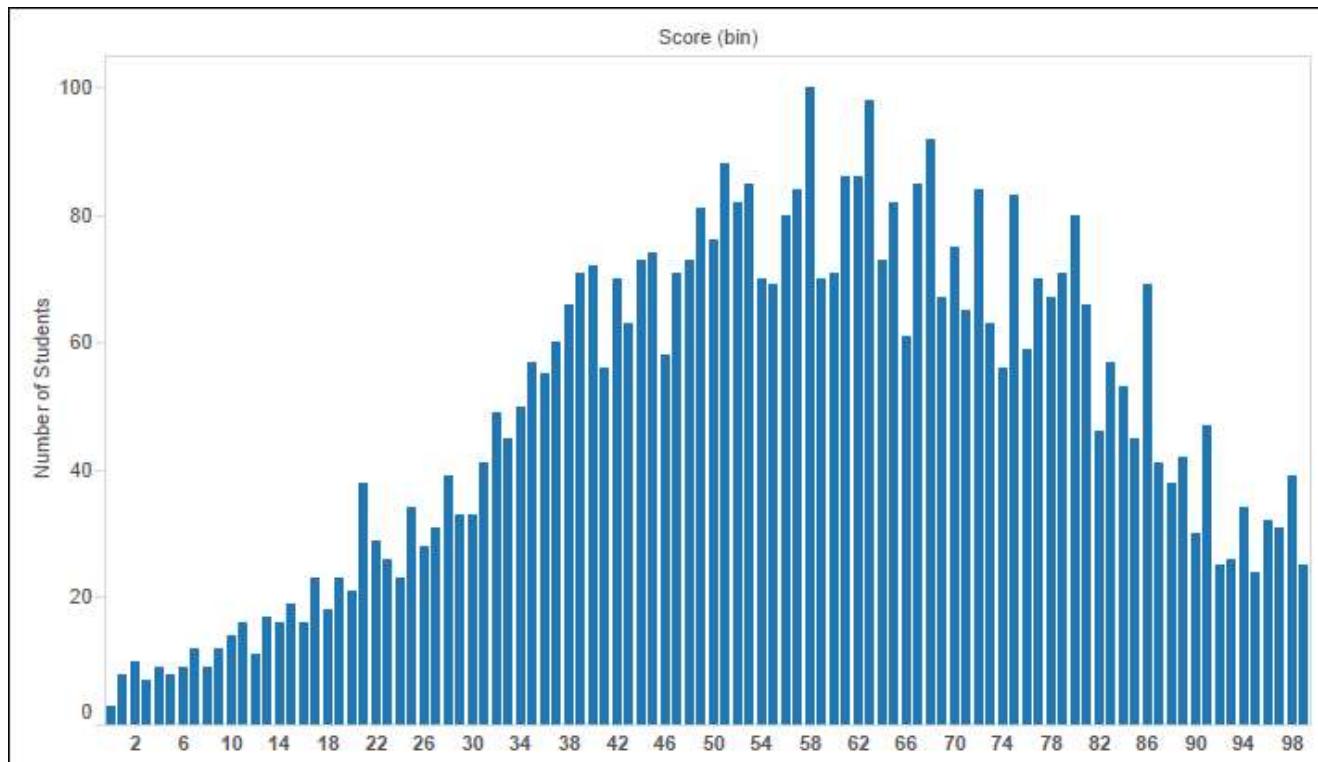


# Box and whisker plots



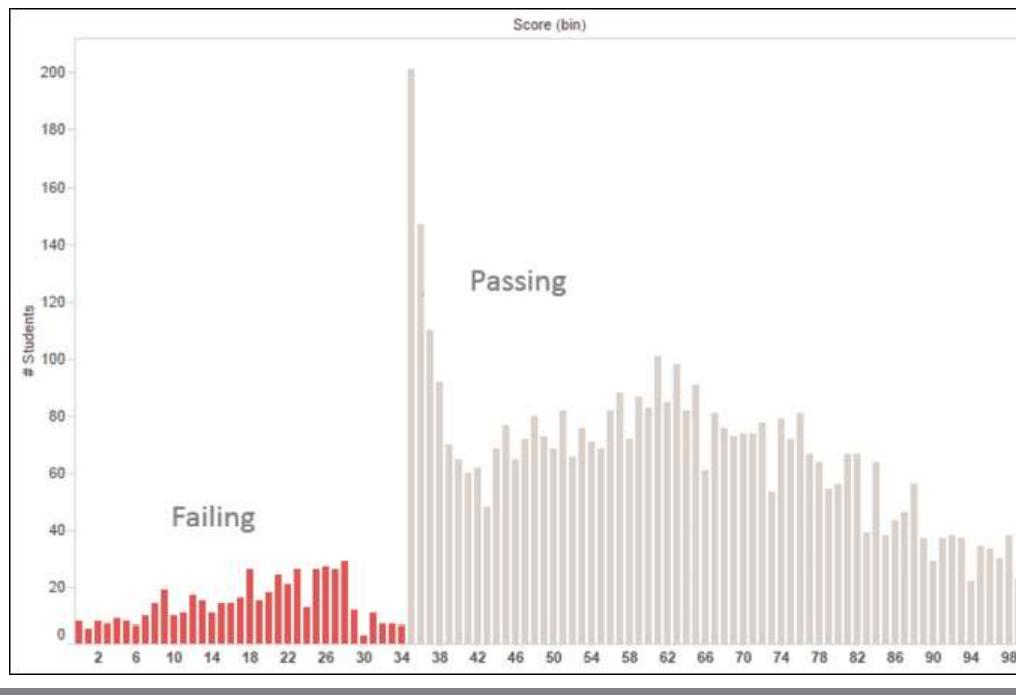


# Histograms



# Histograms

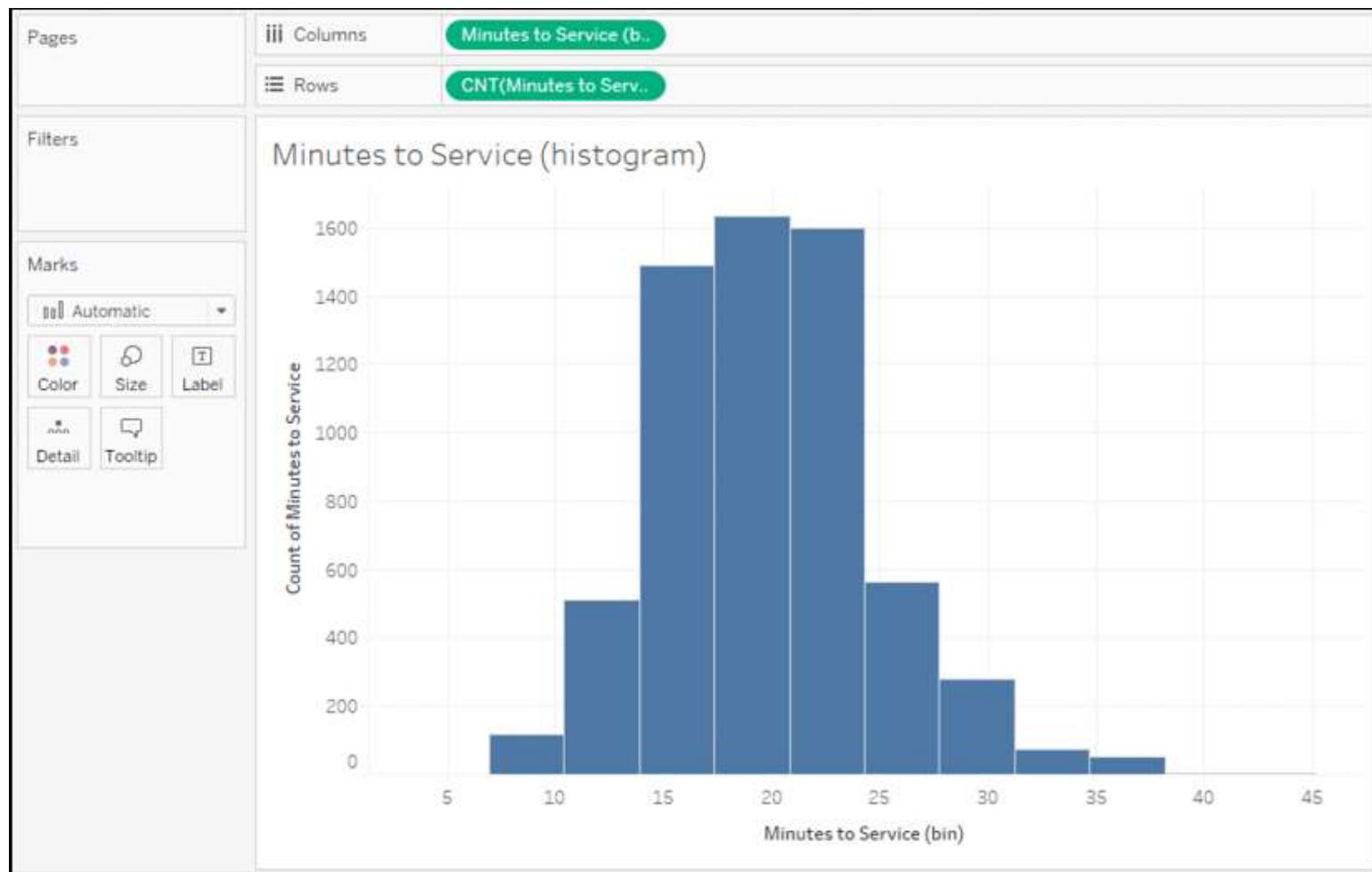
What if auditors saw something like this?



# 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: Minutes to Service (bin)

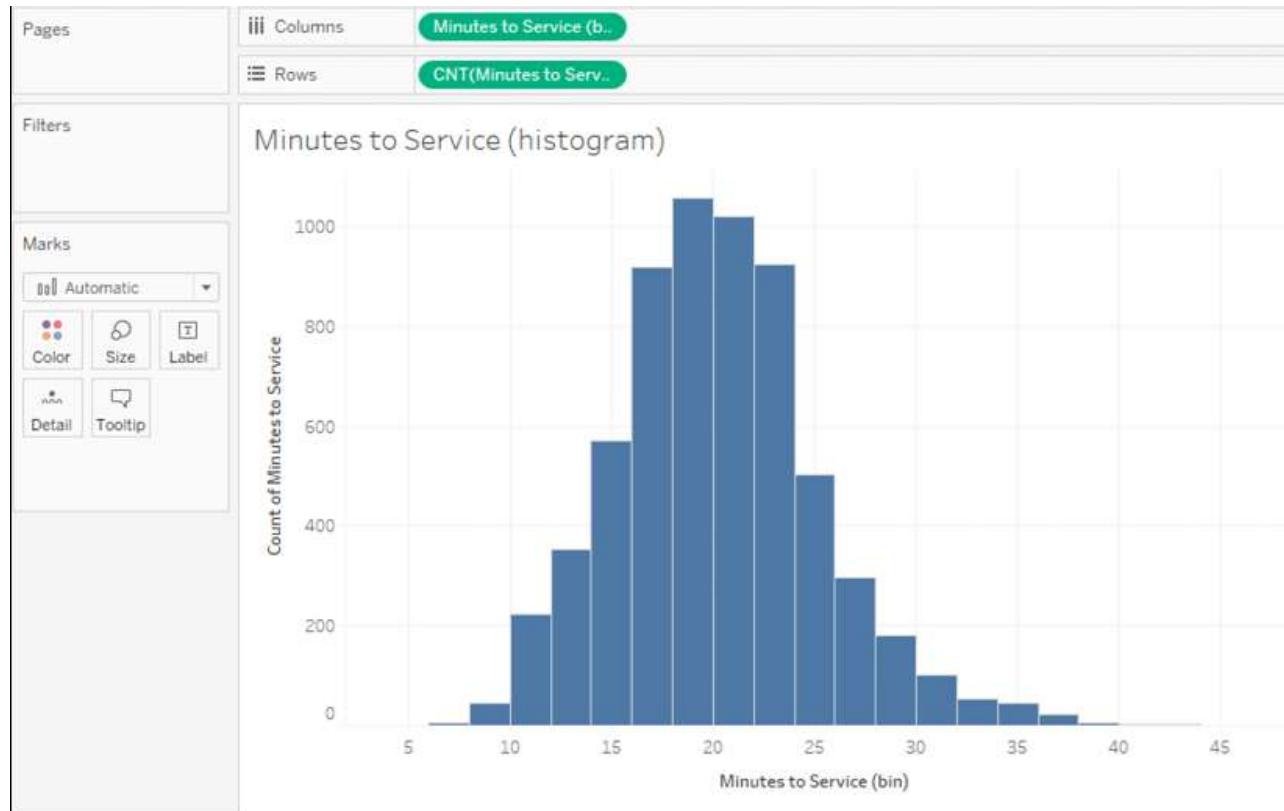
Size of bins: 3.47 Suggest Bin Size

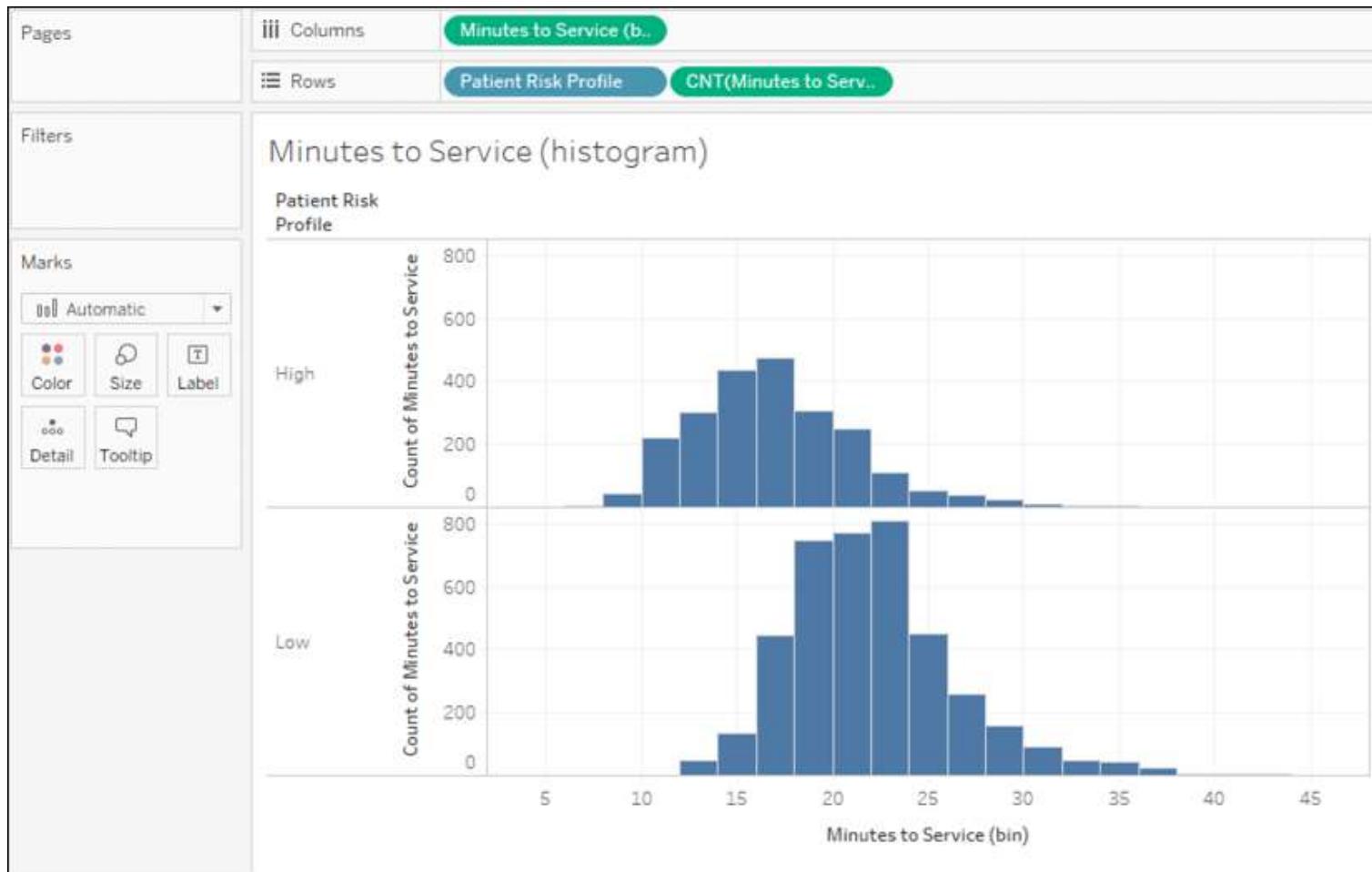
Range of Values:

Min:	4	Diff:	40
Max:	44	CntD:	40

OK Cancel

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

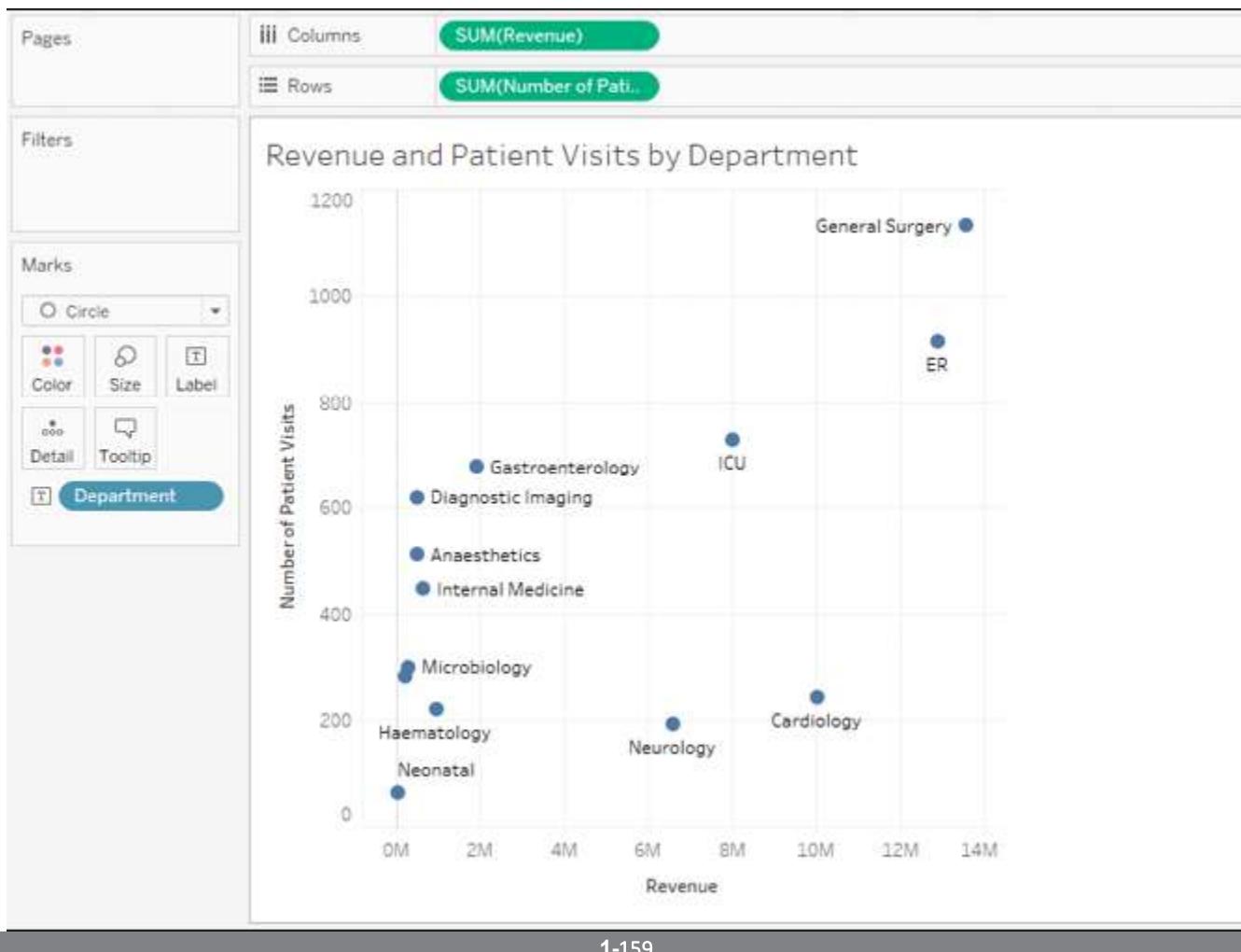




# Scatterplot

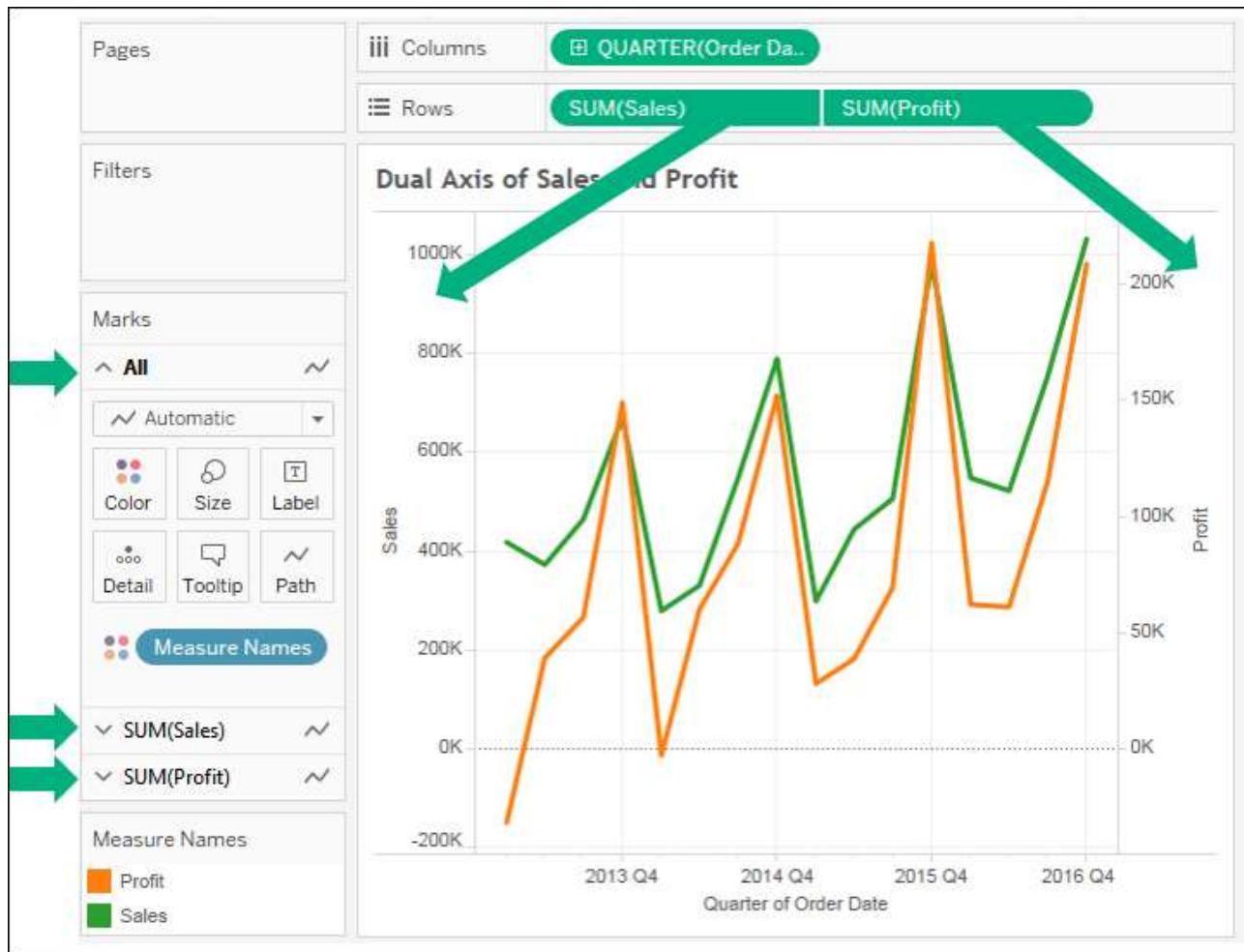
A scatterplot is an essential visualization type for understanding the relationship between two measures. Consider a scatterplot when you find yourself asking questions like the following:

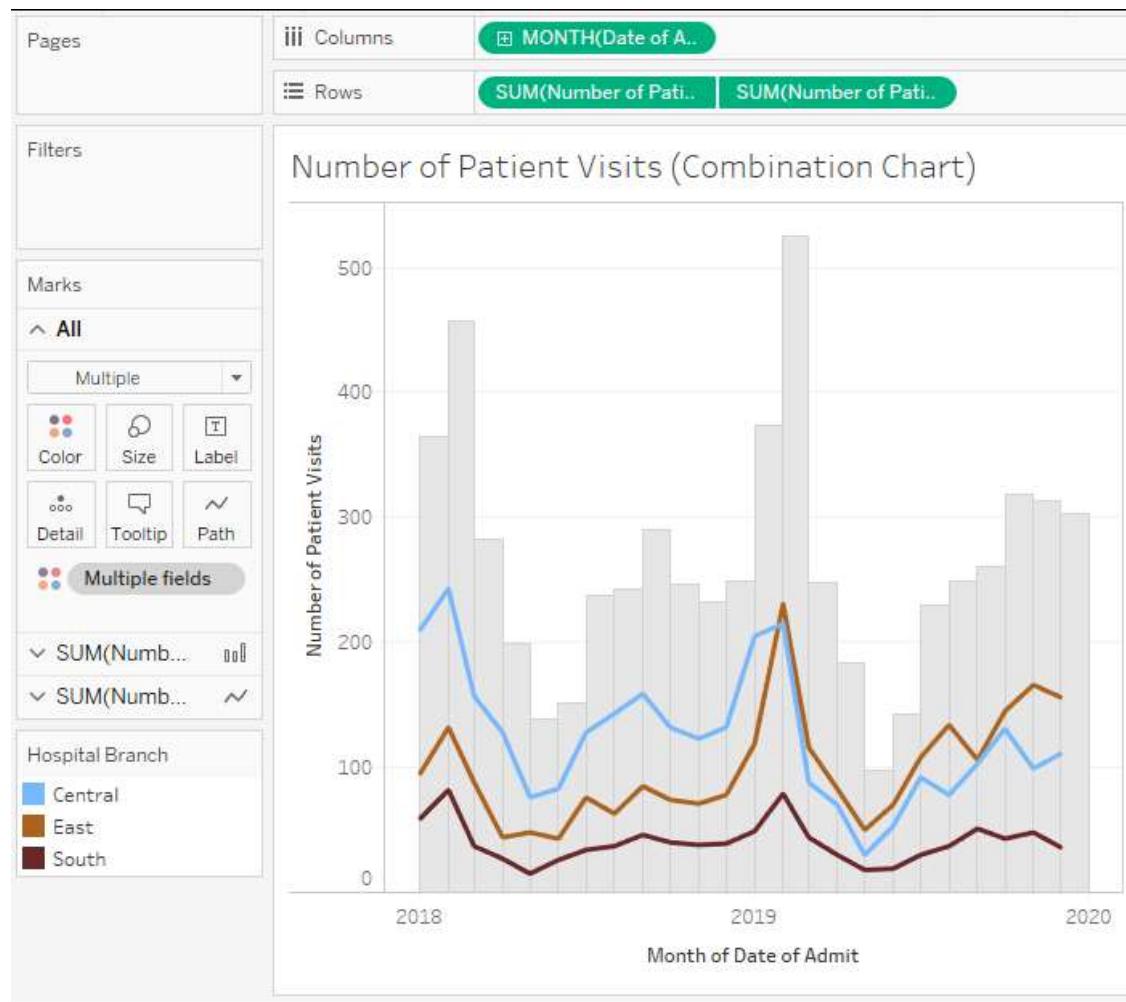
- Does how much I spend on marketing really make a difference on sales?
- How much does power consumption go up with each degree of heating/cooling?
- Is there any correlation between hours of study and test performance?



# 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.

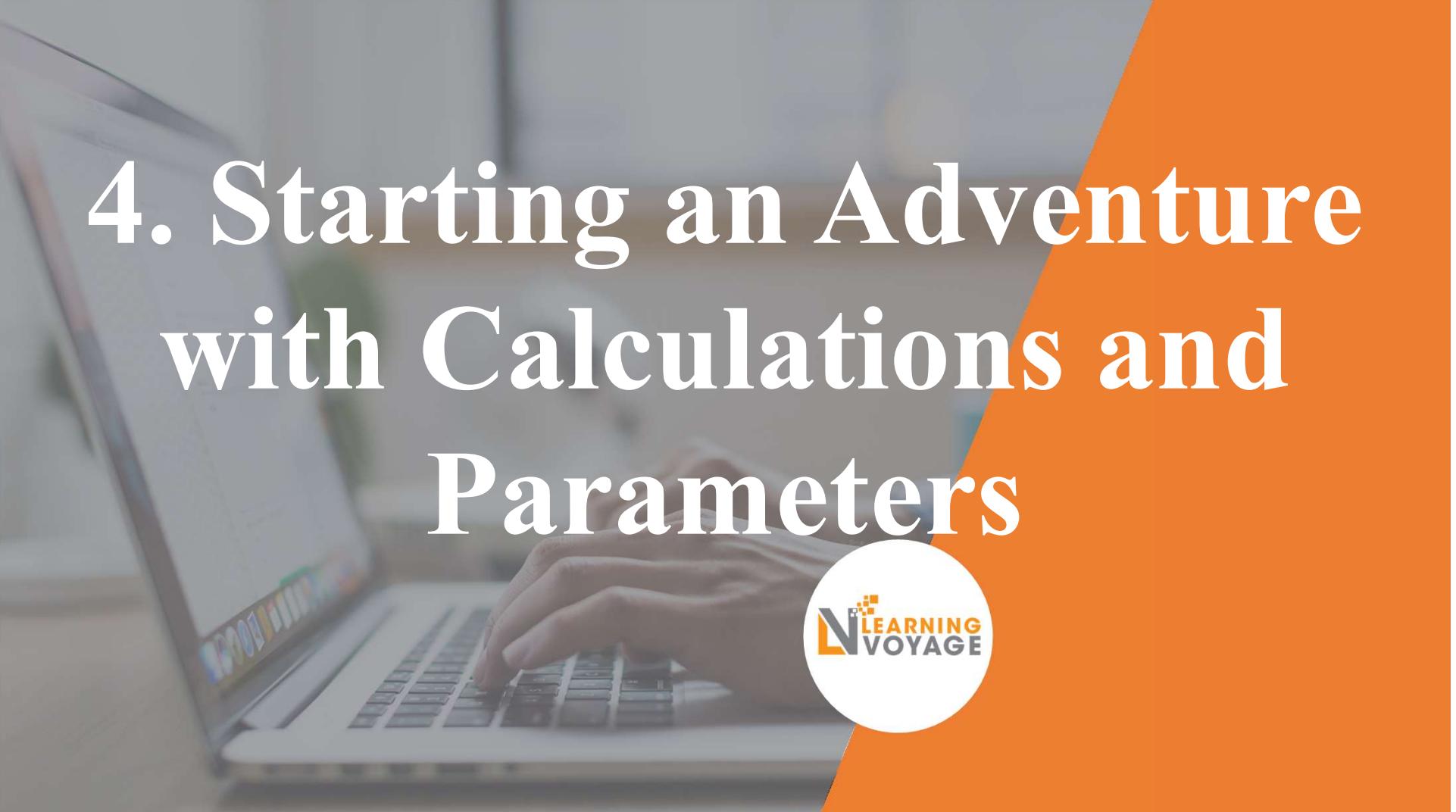




# Summary

- 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

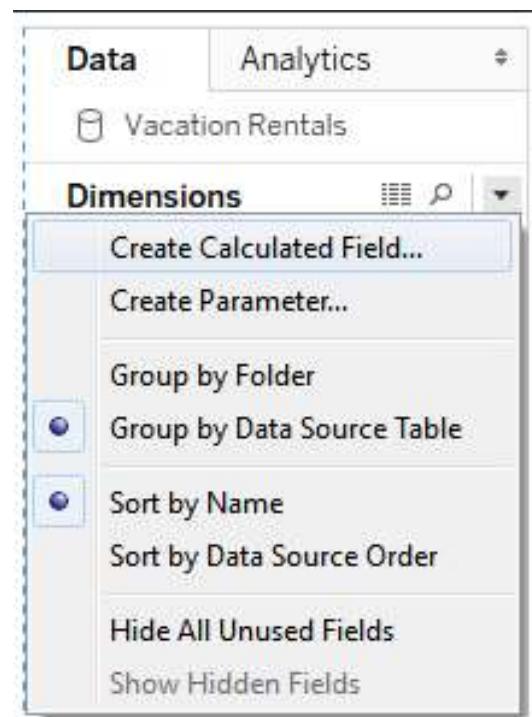
- A calculation is often referred to as a Calculated Field in Tableau because, in most cases, when you create a calculation, it will show up as either a new measure or dimension in the data pane.
- Calculations consist of code that's made up of functions, operations, and references to other fields, parameters,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

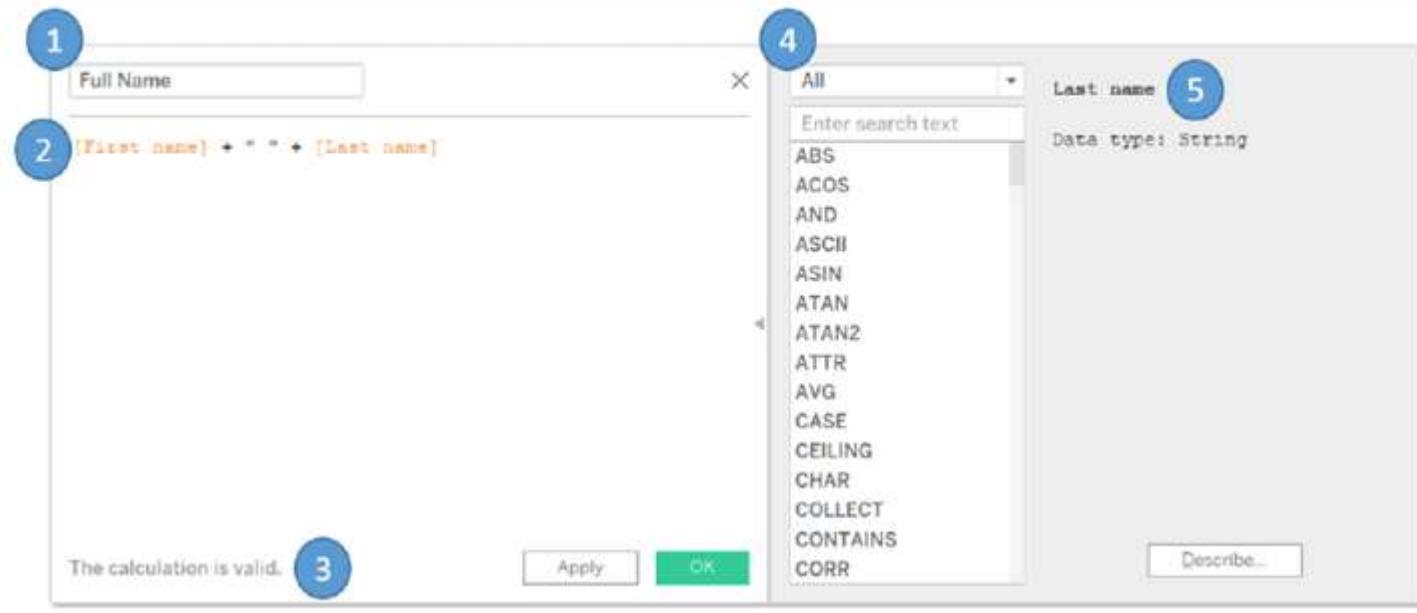
# Creating and editing calculations

- 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</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:

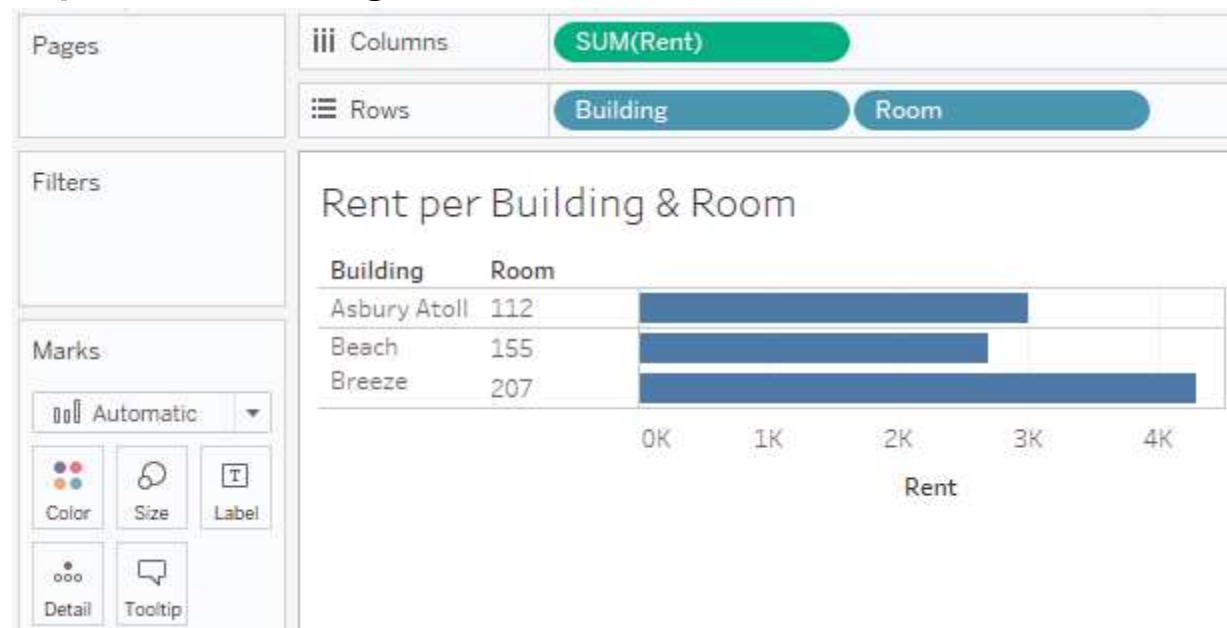


## More complex examples

- 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'. Below the tabs, the title 'Vacation Rentals' is displayed with a folder icon. A search bar and a filter icon are also present. 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 left towards the '=Abc' icons for 'Building', 'Room', and 'Start', highlighting them as calculated fields.

# 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

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:

$\text{MID}([\text{Room}], 0, \text{LEN}([\text{Room}]) - 2)$

# 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)

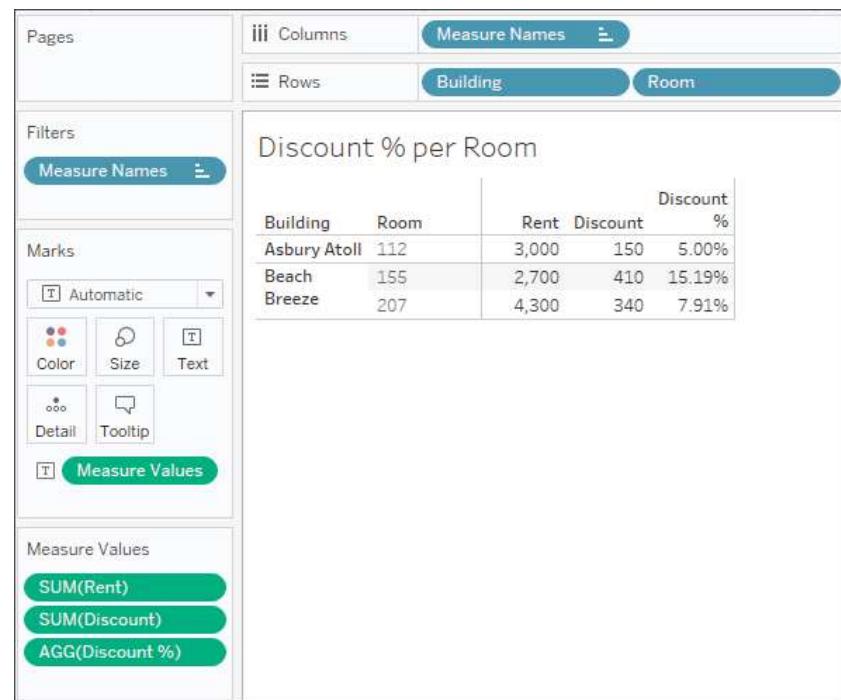
AGG(Discount %)

### Discount % per Rental

Building	Room	Full Name	Start	End	Rent	Discount	%
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
Lewis Chafer	9-Dec		23-Dec	2,800	280	10.00%	

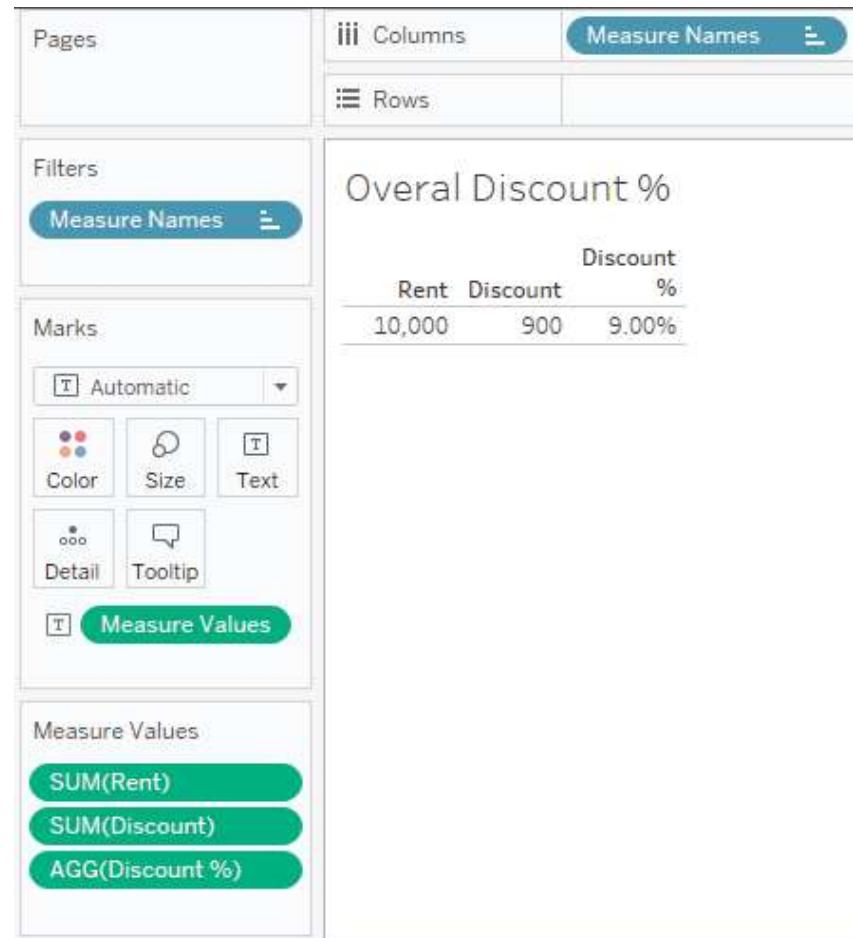
# Aggregate calculations

- 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:



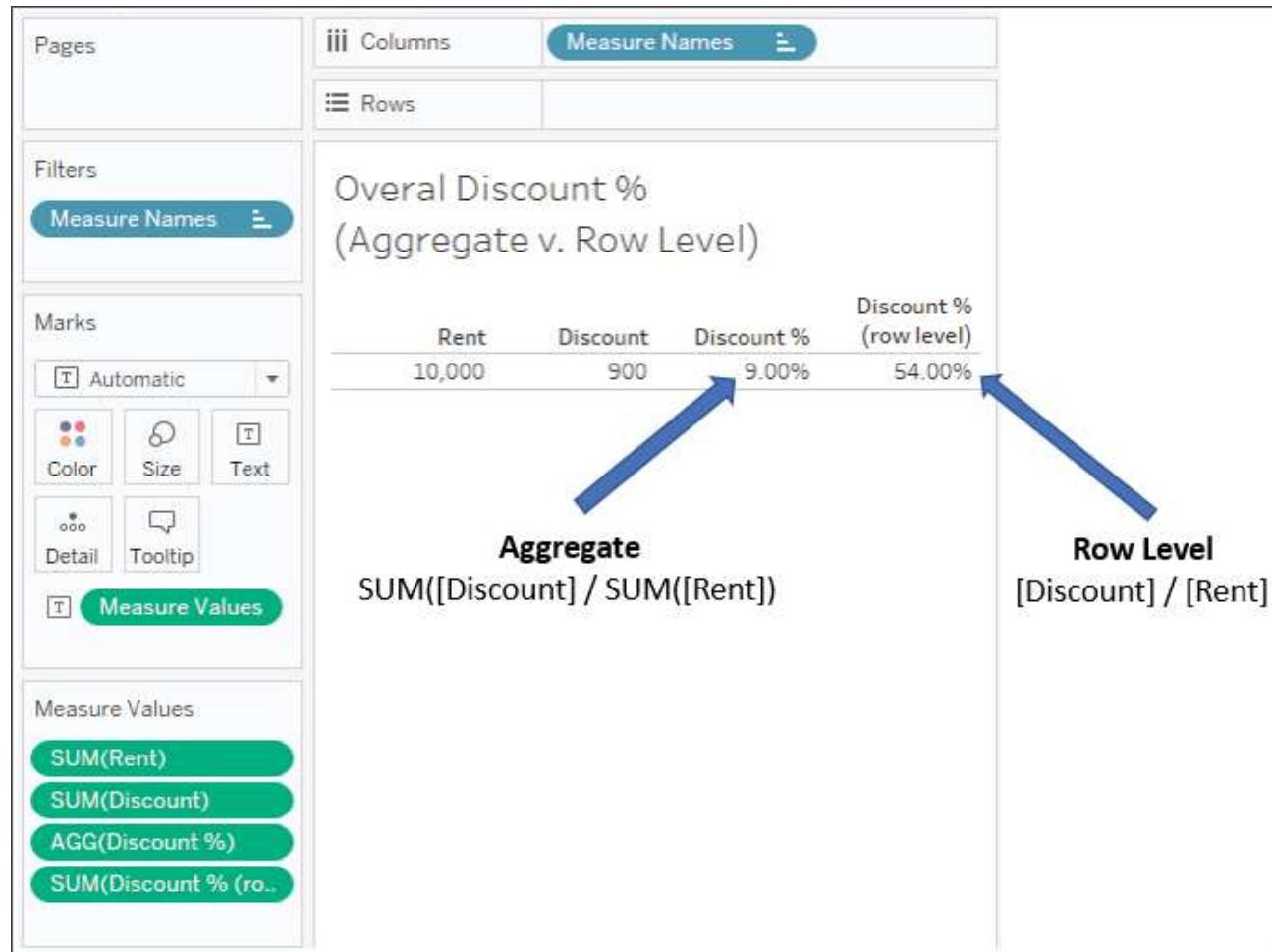
# Aggregate calculations

- 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])**



# Why the row level versus aggregate difference matters

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

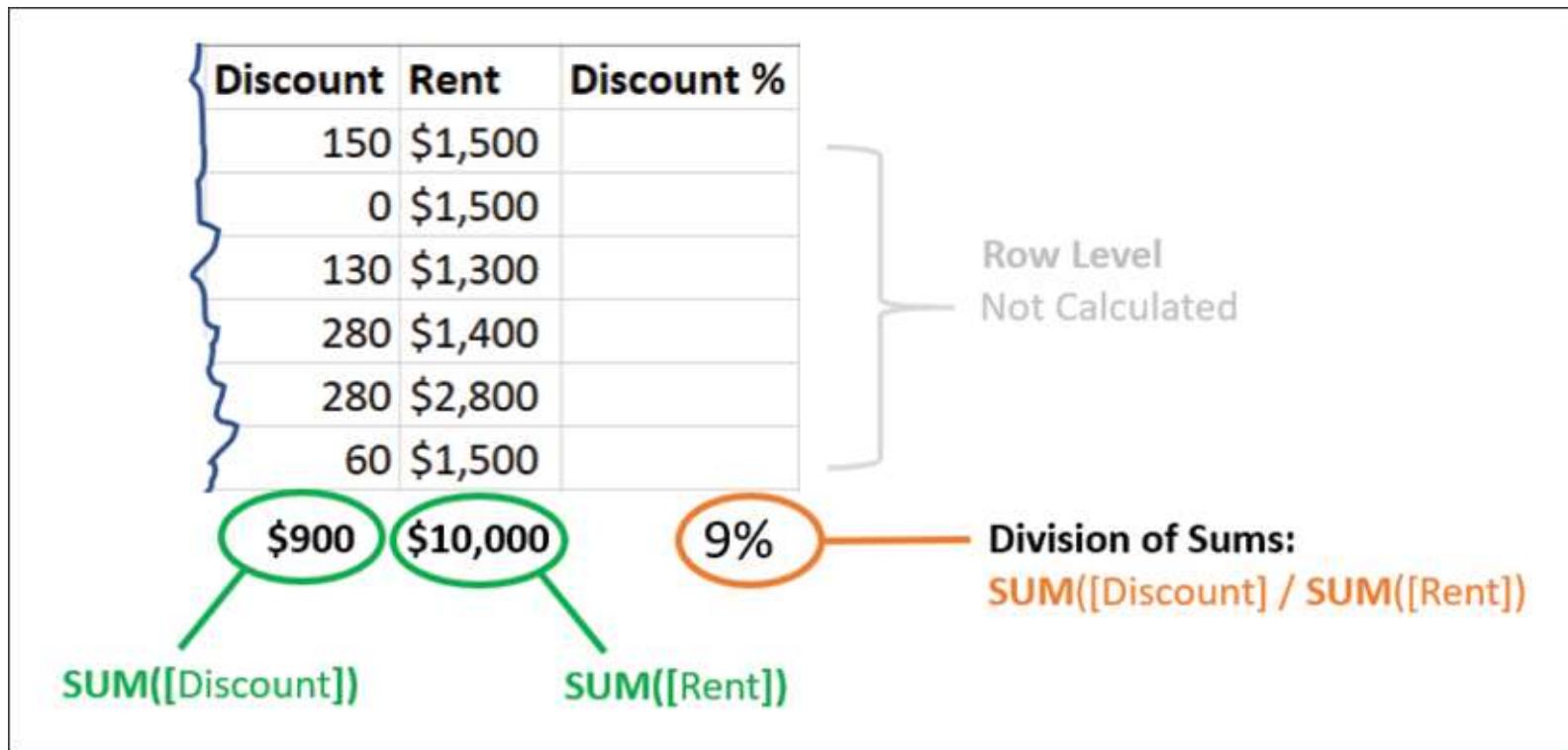
Rental Property	First	Discount	Rent	Discount %
112-Asbury Atoll	Mary	150	\$1,500	10%
112-Asbury Atoll	Amy	0	\$1,500	0%
155-Beach Breeze	Charles	130	\$1,300	10%
155-Beach Breeze	Dwight	280	\$1,400	20%
207-Beach Breeze	Lewis	280	\$2,800	10%
207-Beach Breeze	John	60	\$1,500	4%

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

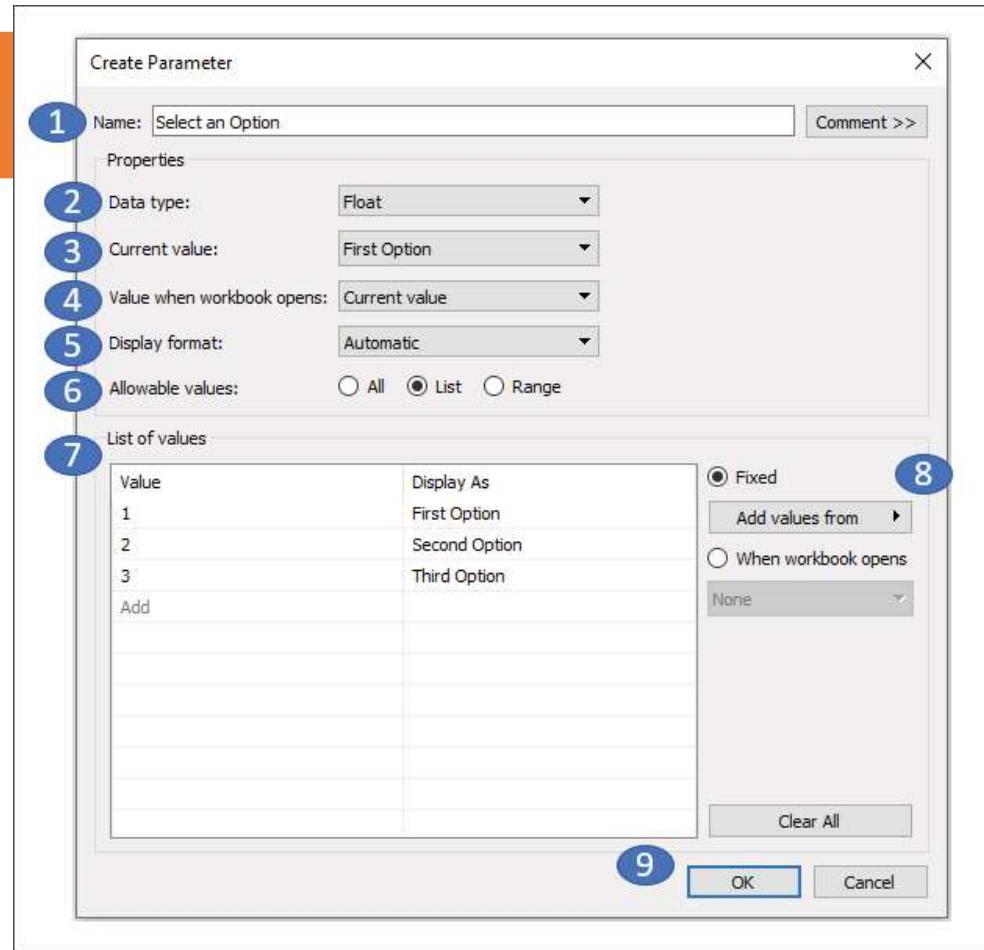
# Creating parameters

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....

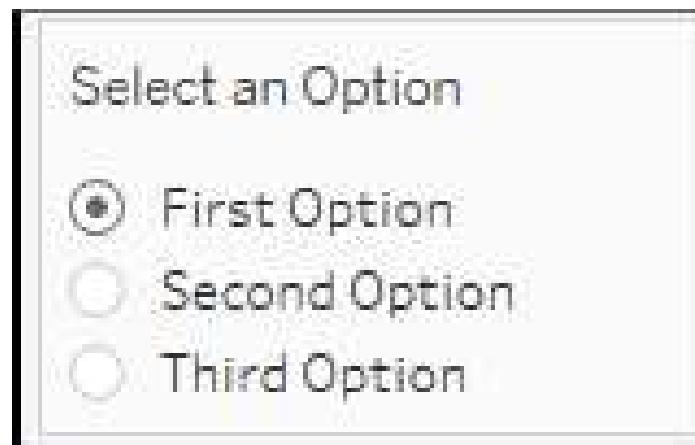
# Creating parameters

- 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 a data view titled "Corrected Date Values". The view includes a header row with columns: Rental Prop., Room, Start, End, Start Date, and End Date. Below the header, there are six data rows corresponding to different rental properties and rooms. The data is as follows:

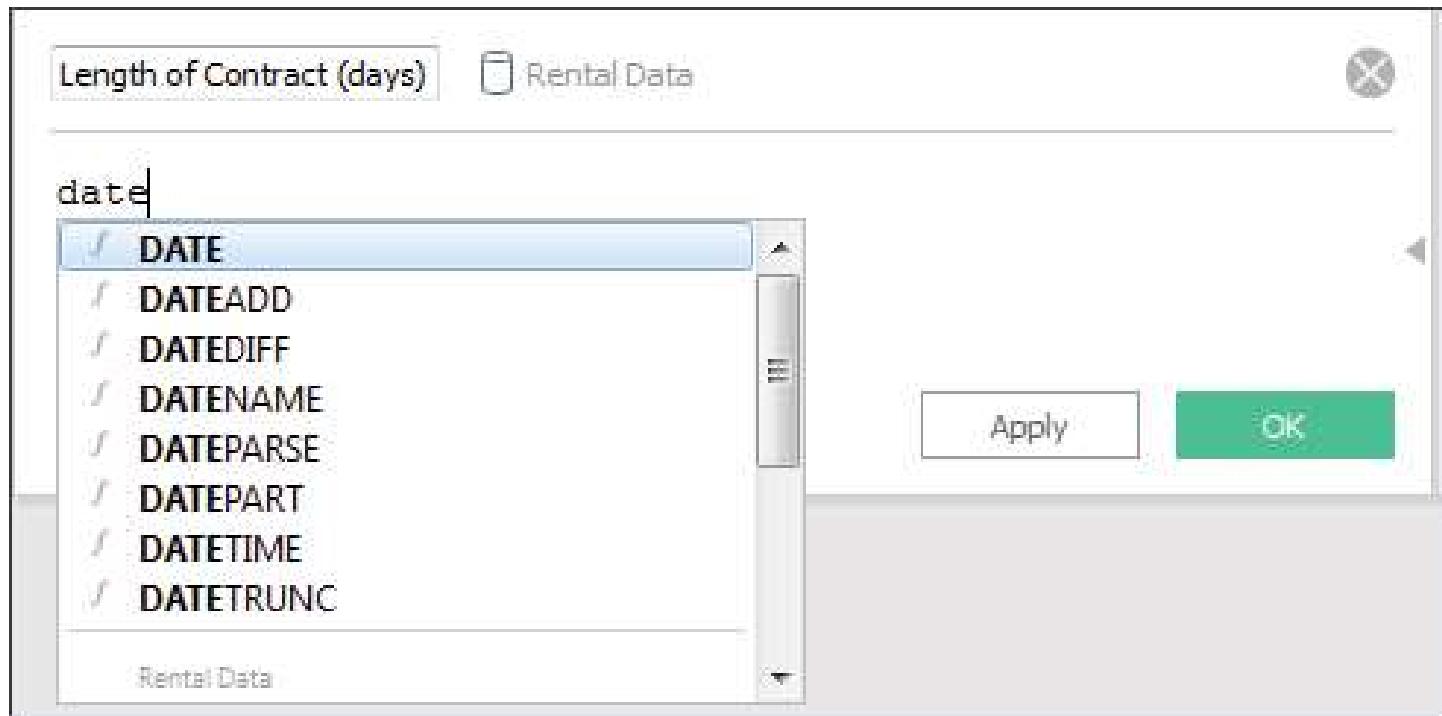
Rental Prop.	Room	Start	End	Start Date	End Date
112-Asbury	112	2-Dec	9-Dec	12/2/2020	12/9/2020
Atoll		9-Dec	15-Dec	12/9/2020	12/15/2020
155-Beach	155	2-Dec	9-Dec	12/2/2020	12/9/2020
Breeze		16-Dec	23-Dec	12/16/2020	12/23/2020
207-Beach	207	2-Dec	9-Dec	12/2/2020	12/9/2020
Breeze		9-Dec	23-Dec	12/9/2020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

## Extending the data

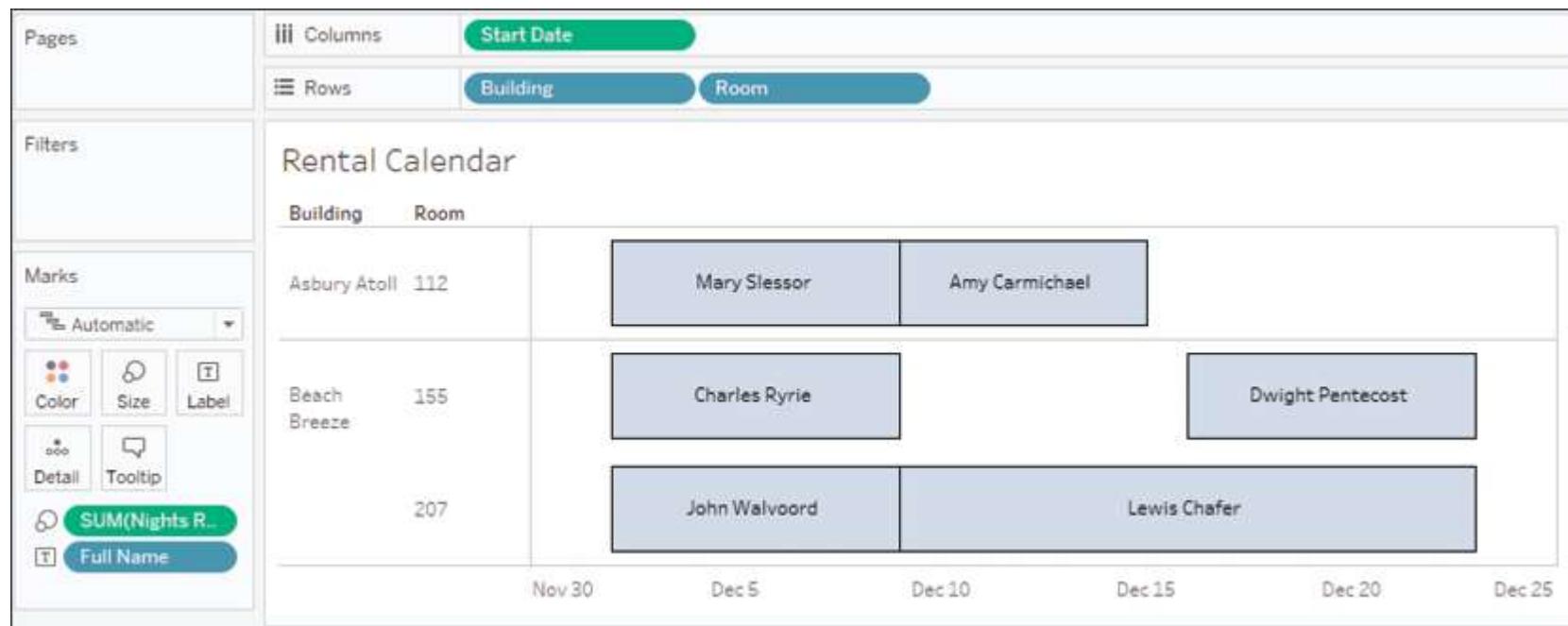
- Create a calculated field named Nights Rented with the following code:

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

iii Columns    Start Date

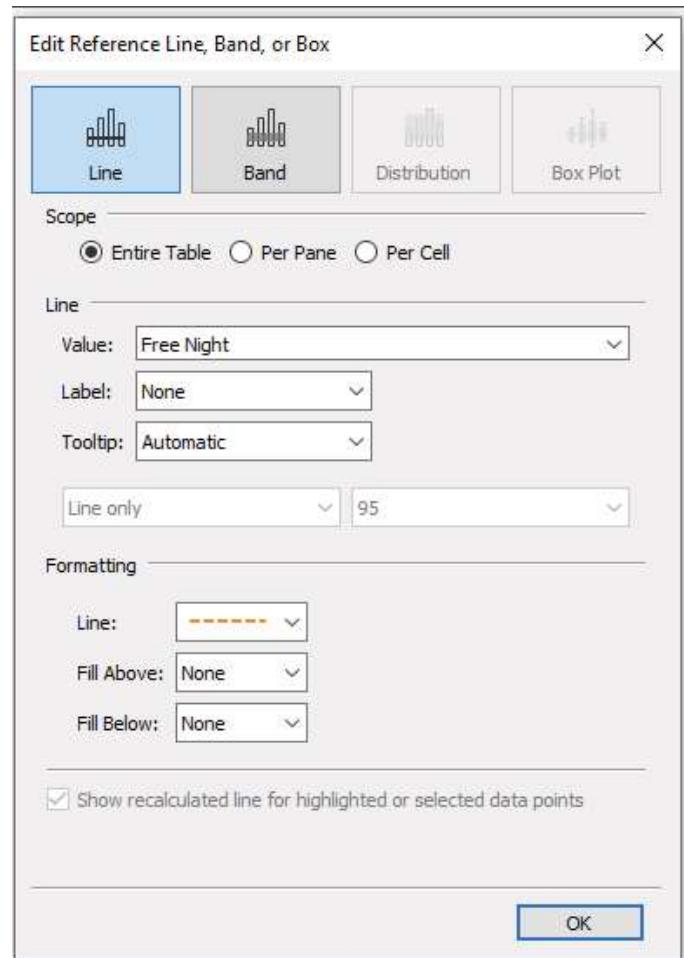
Rows    Building    Room

### Free Night Analysis

Add a Reference Line

Table	Bar Chart	Scatter Plot
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:



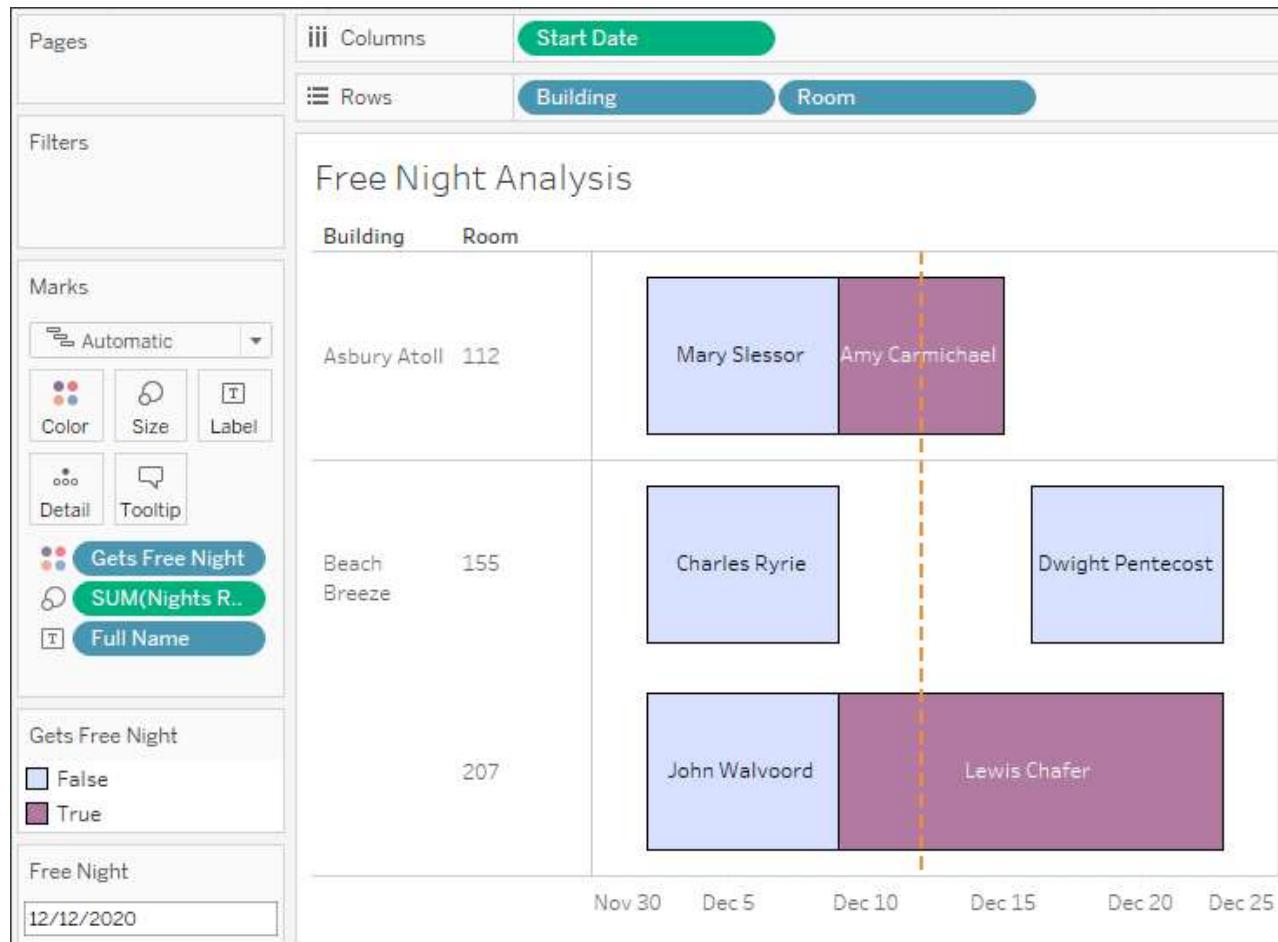
## Enhancing user experience, analysis, and visualizations

- 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.

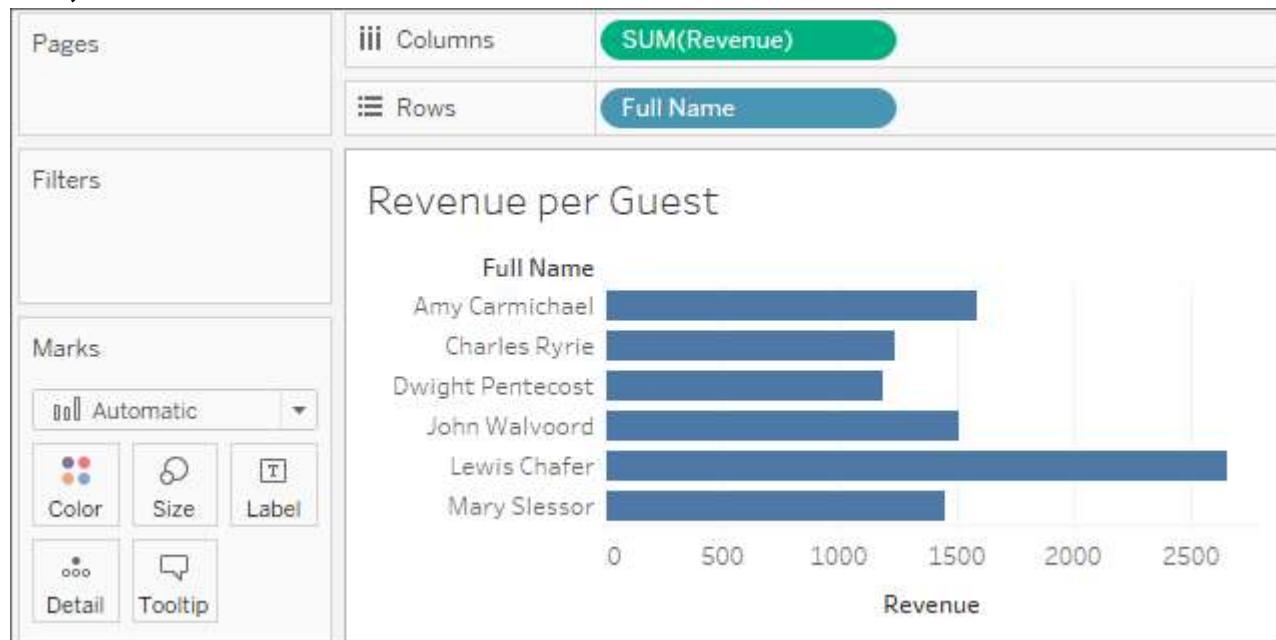
# Meeting business requirements

- 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])

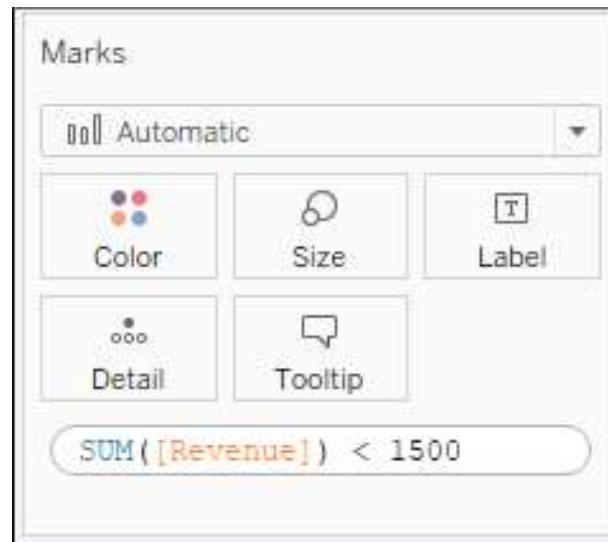
# Ad hoc calculations

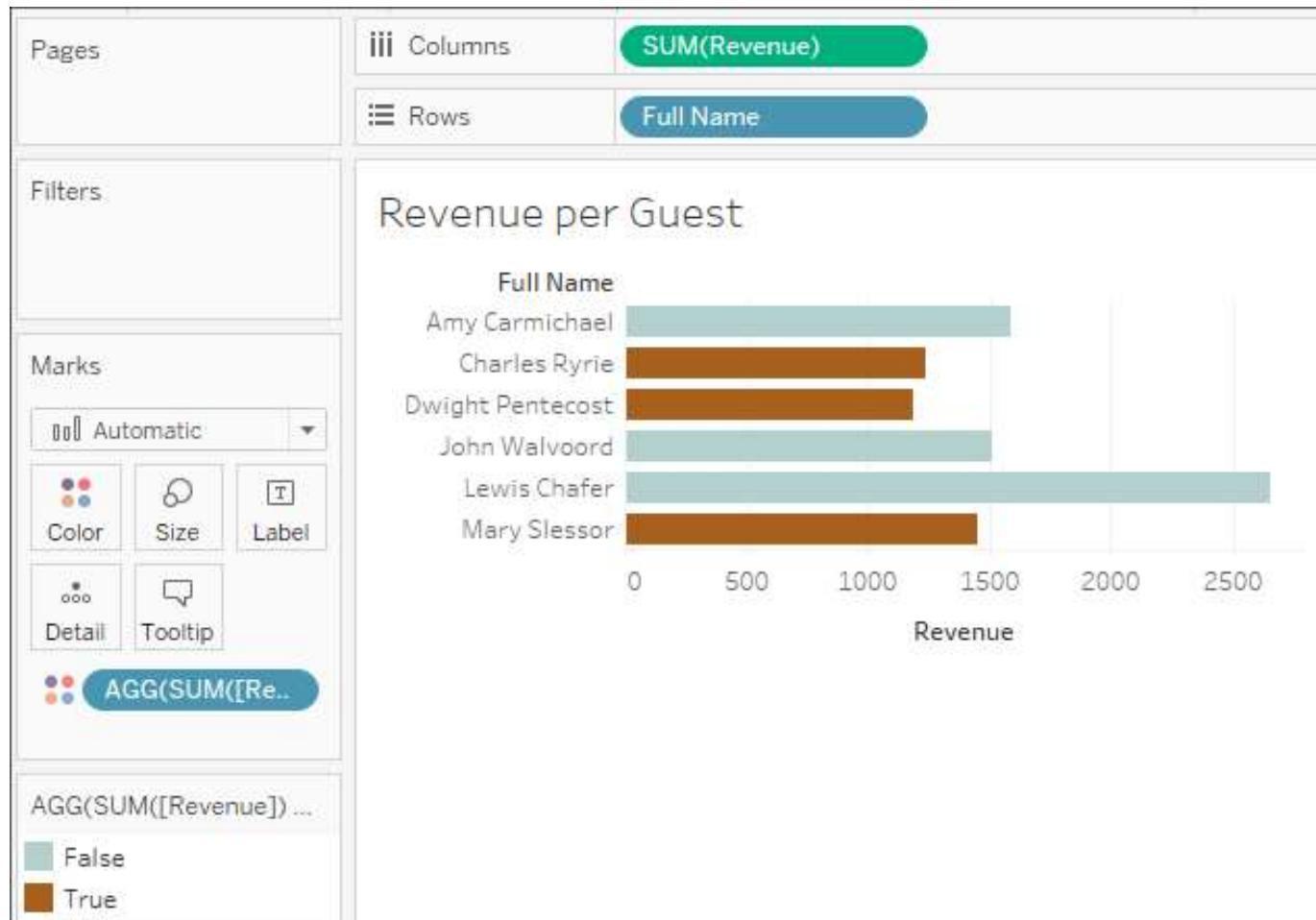
- Let's say you have a simple view that shows the Revenue per Guest, like this:



# 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:

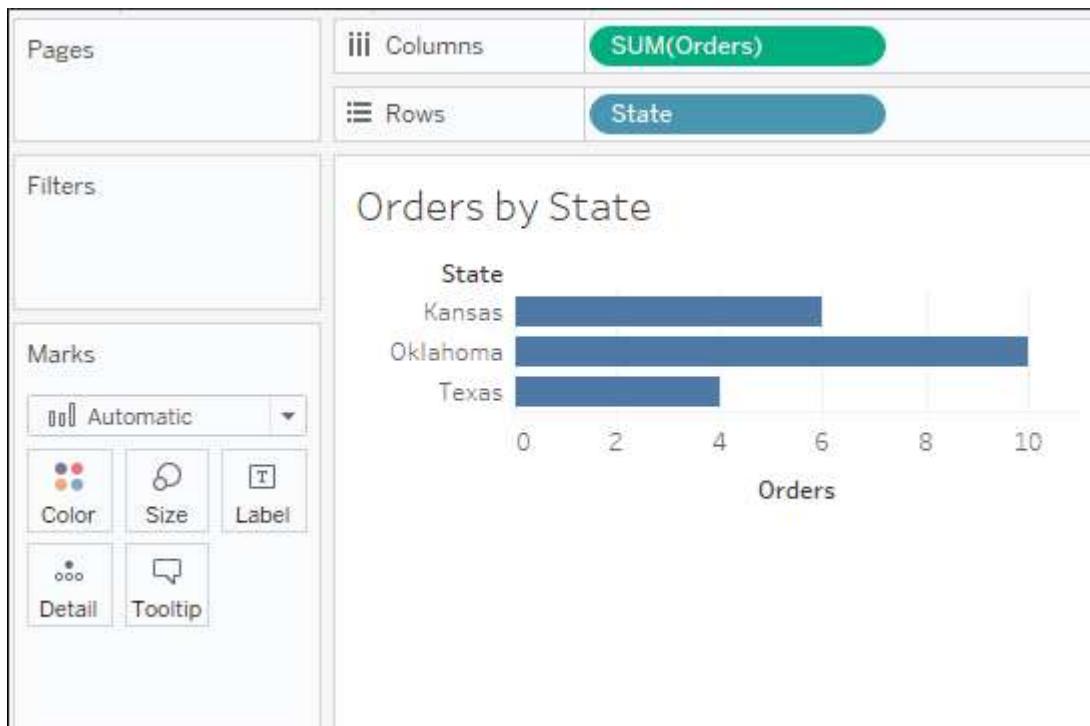
- Data level of detail
- View level of detail
- Calculated level of detail

# Overview of level of detail

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

<b>Customer</b>	<b>State</b>	<b>Membership Date</b>	<b>Membership Level</b>	<b>Orders</b>
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:

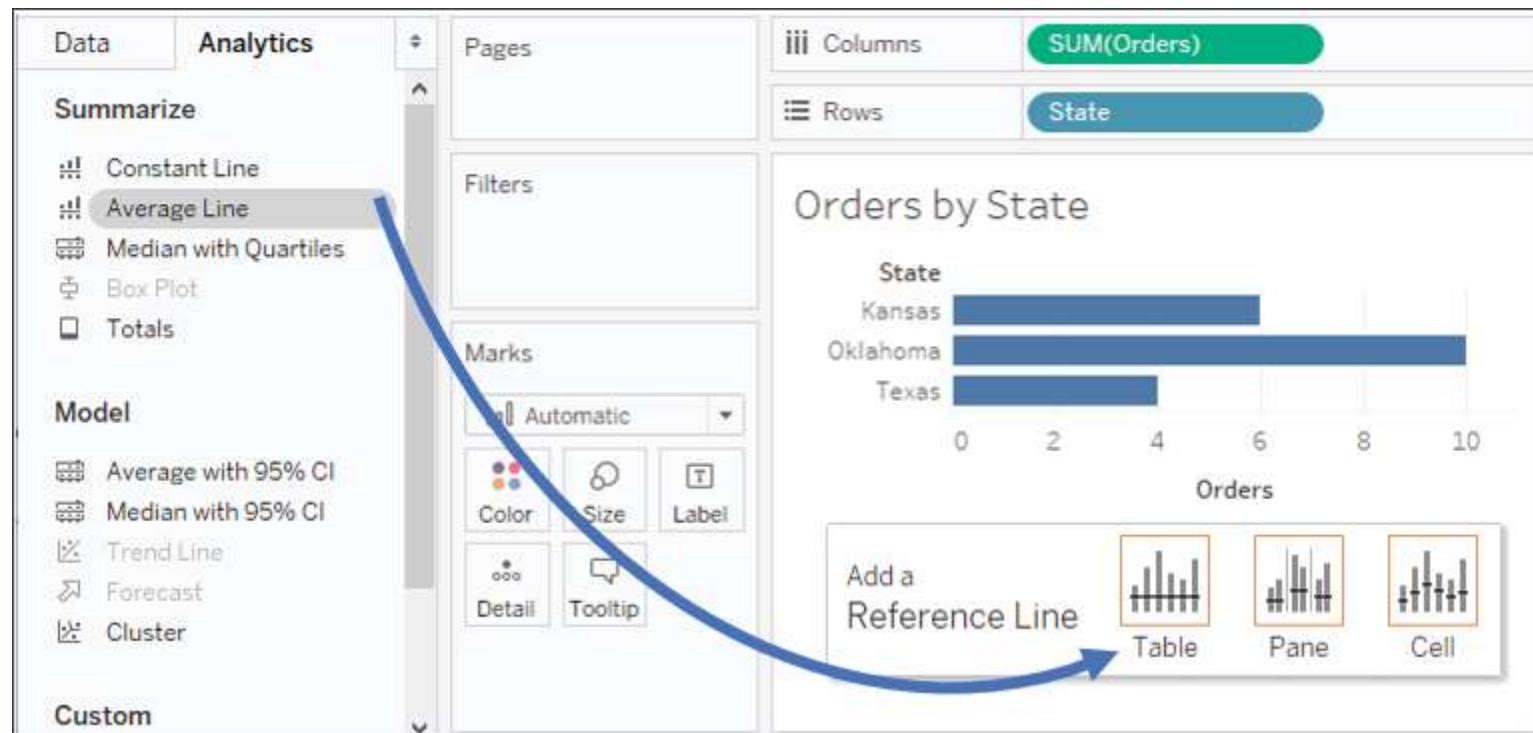
```
{INCLUDE [Membership Level] : AVG([Orders])}
```

# 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:

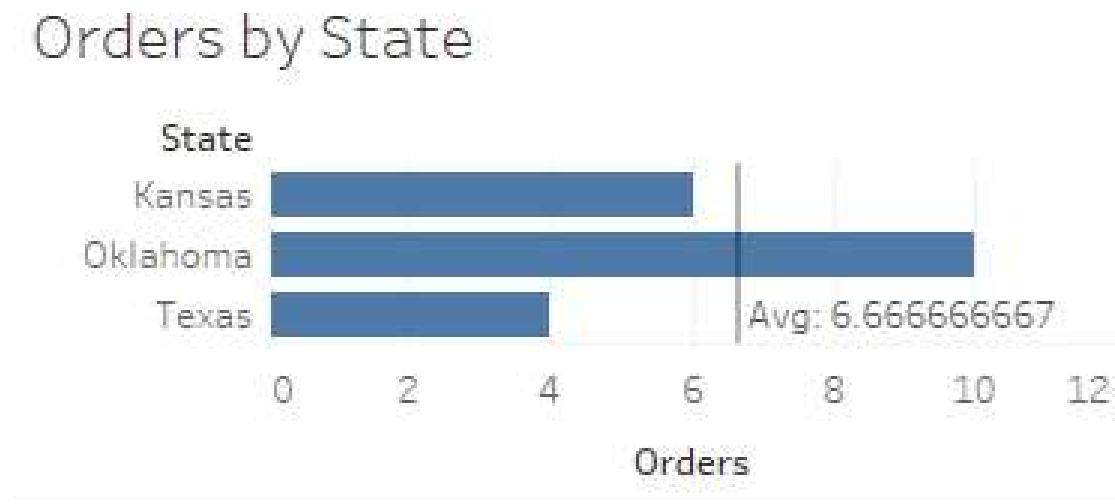
{EXCLUDE [Customer] : AVG([Orders])}

# An illustration of the difference level of detail can make



An illustration of the difference level of detail can make

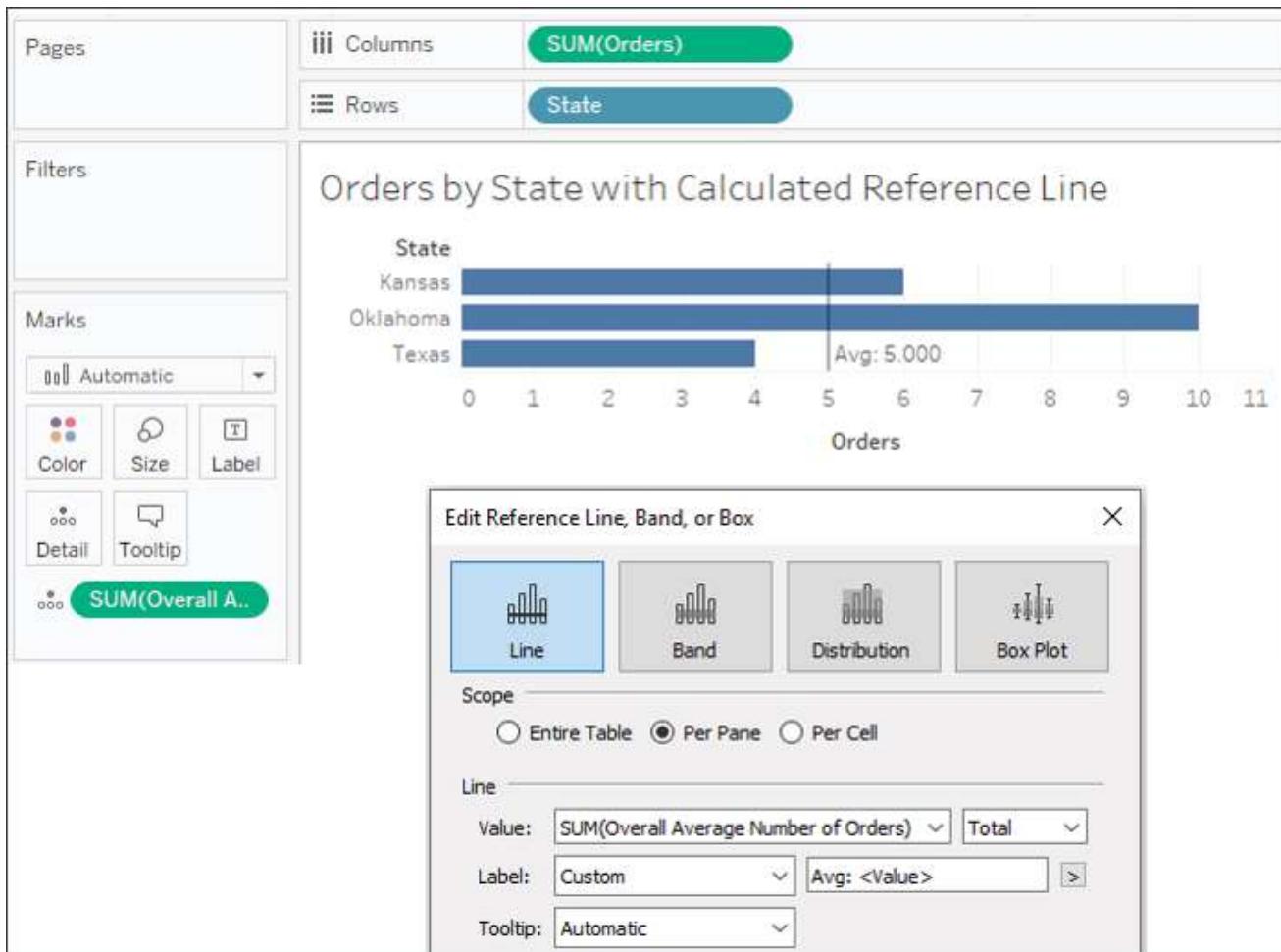
- You'll end up with an average line that looks like this:



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?

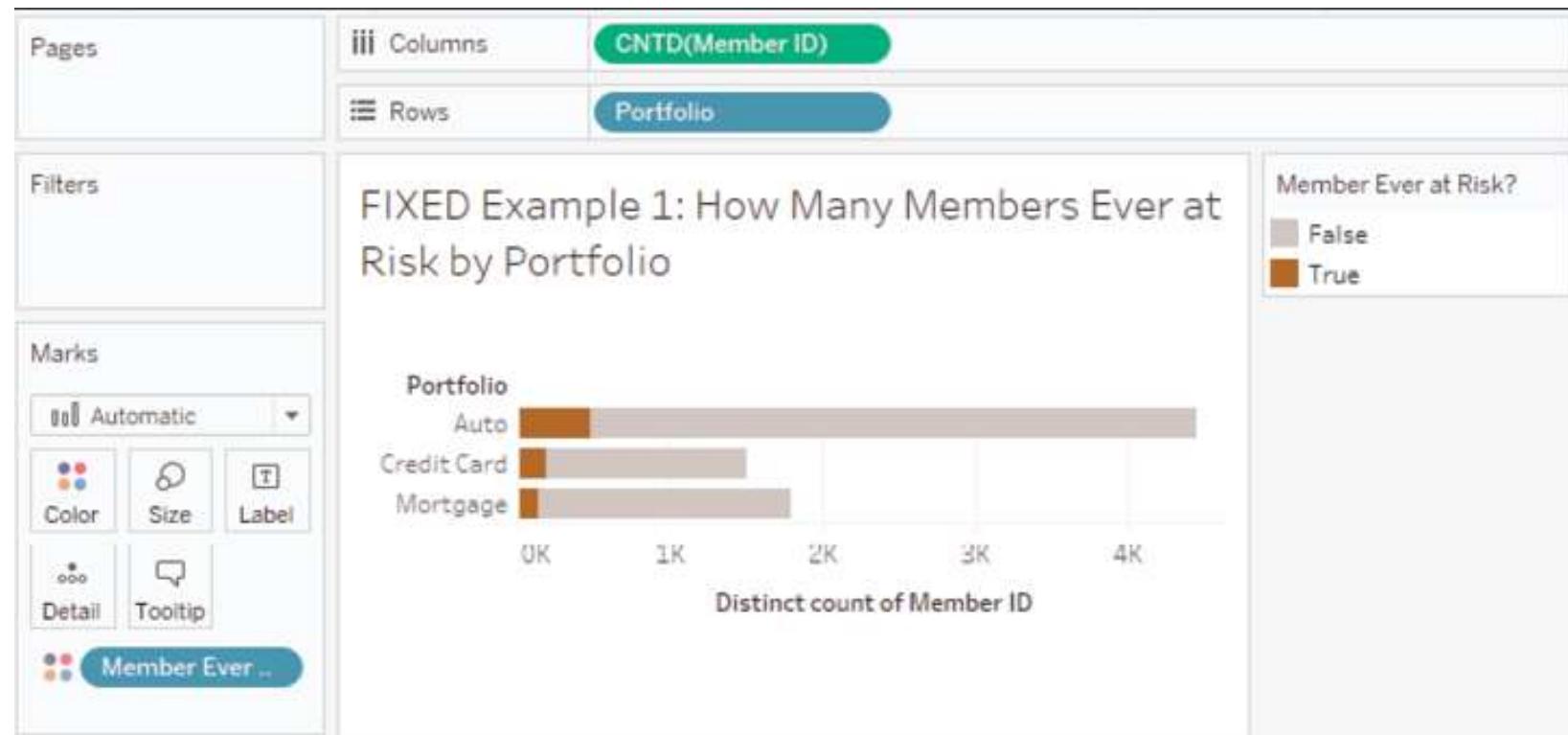
- We want every record for a given member to be TRUE if any of the records for that member are below the threshold and FALSE if none of the records are below the threshold.
- One solution is to use a level of detail calculation, which we'll name Member Ever at Risk?, with the code:

{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?

Member ID	Member Name	Loan 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

## 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]

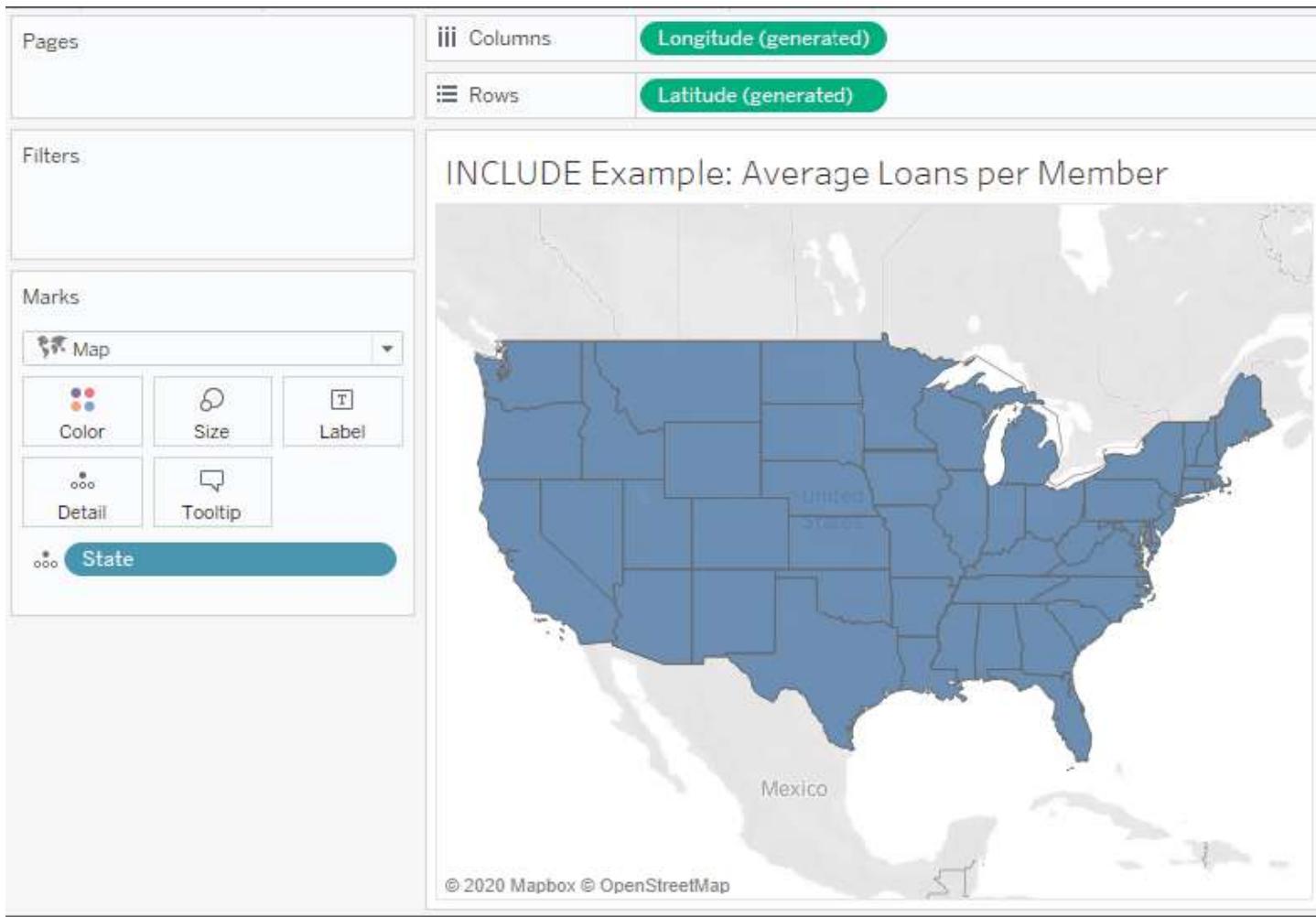
- You can see the results of the calculation here:

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

## Example of include level of detail expressions

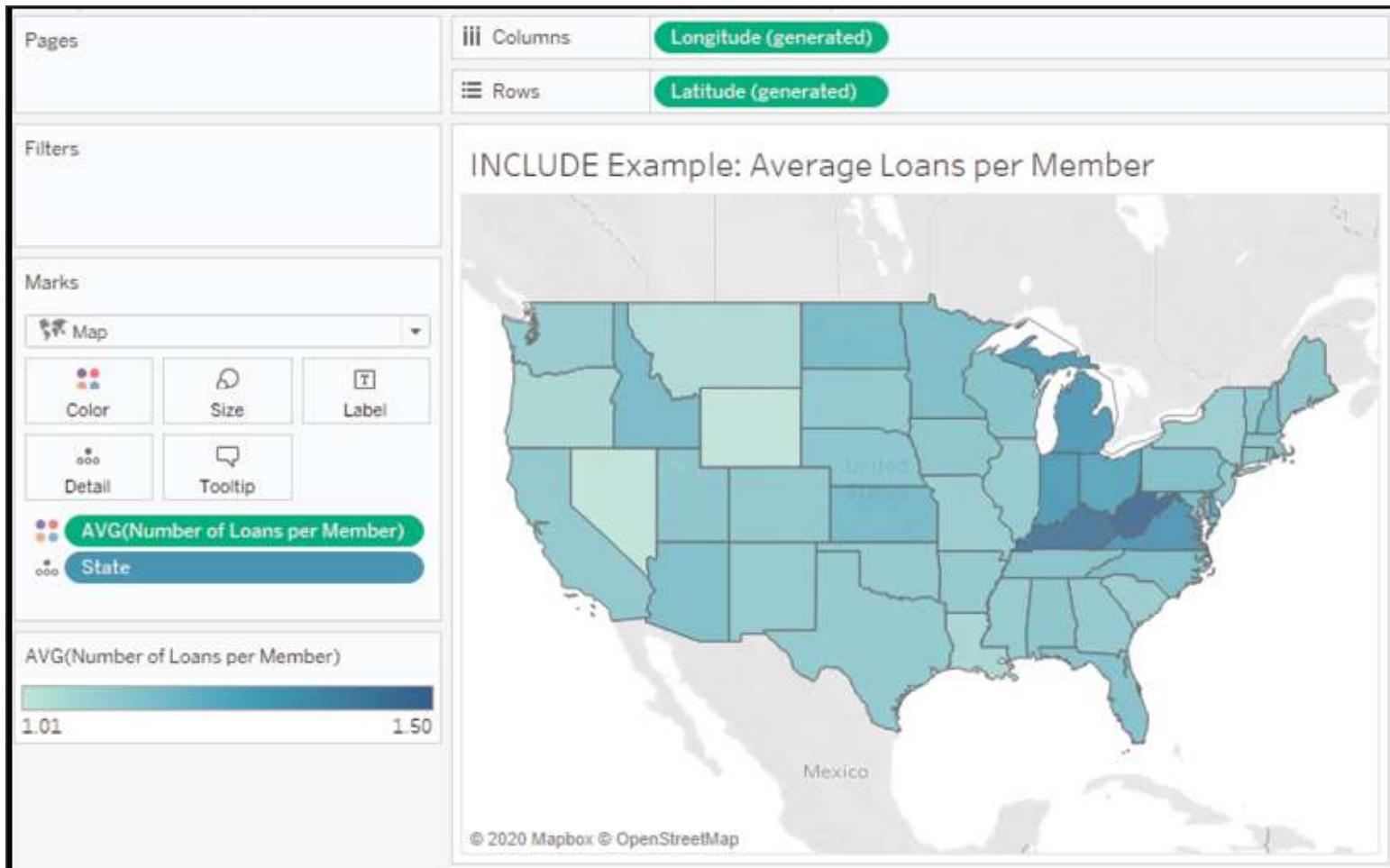
- Include level of detail calculations can be very useful when you need to perform certain calculations at levels of detail that are lower (more detailed) than the view level of detail.
- Let's take a look at an example.



# 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

Filters

State: North Dakota

Marks

Automatic

Color	Size	Text
Detail	Tooltip	

CNTD(Loan Number)

iii Columns

Rows State Member ID

### Crosstab to illustrate

State	Member ID	
North	1576	1
Dakota	2557	1
	2660	2
	3548	1
	4491	2
	4656	2
	5365	1
	6460	1
	6517	1
	9601	1
	10147	1
	11258	1
	11895	1
	19140	1
	28925	1

# 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

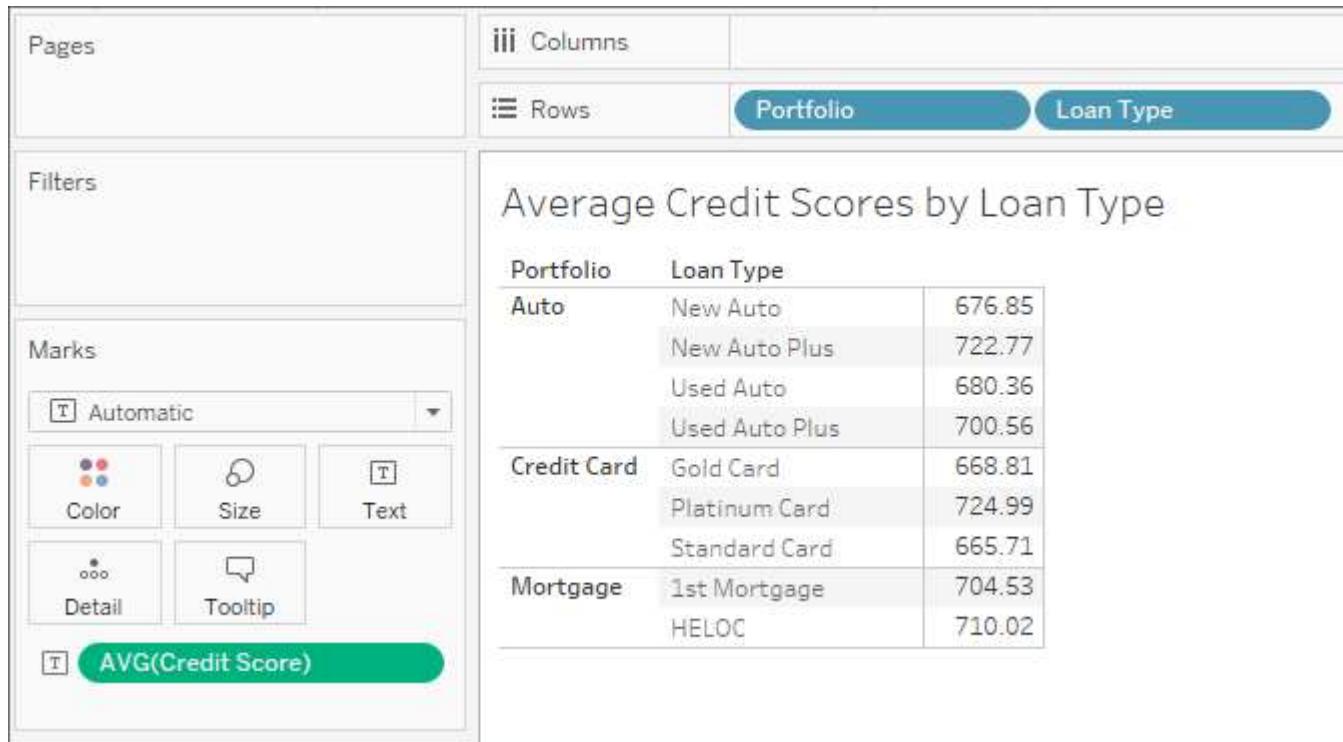
- Another approach would be to use a fixed level of detail expression, such as:

{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)

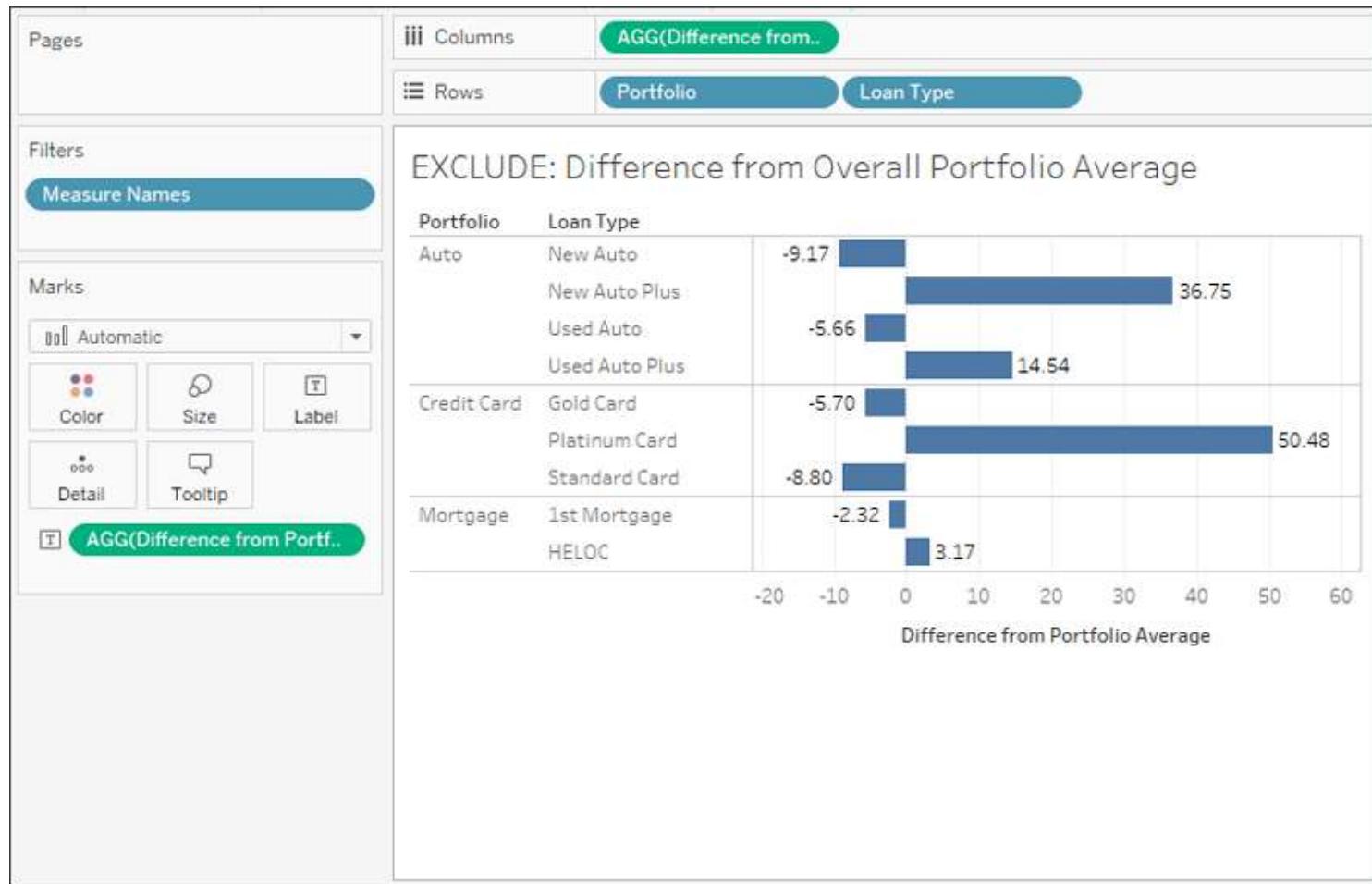
EXCLUDE: Avg Credit Scores

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:

$\text{AVG}([\text{Credit Score}]) - \text{AVG}([\text{Average Credit Score Excluding Loan Type}])$



# 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.

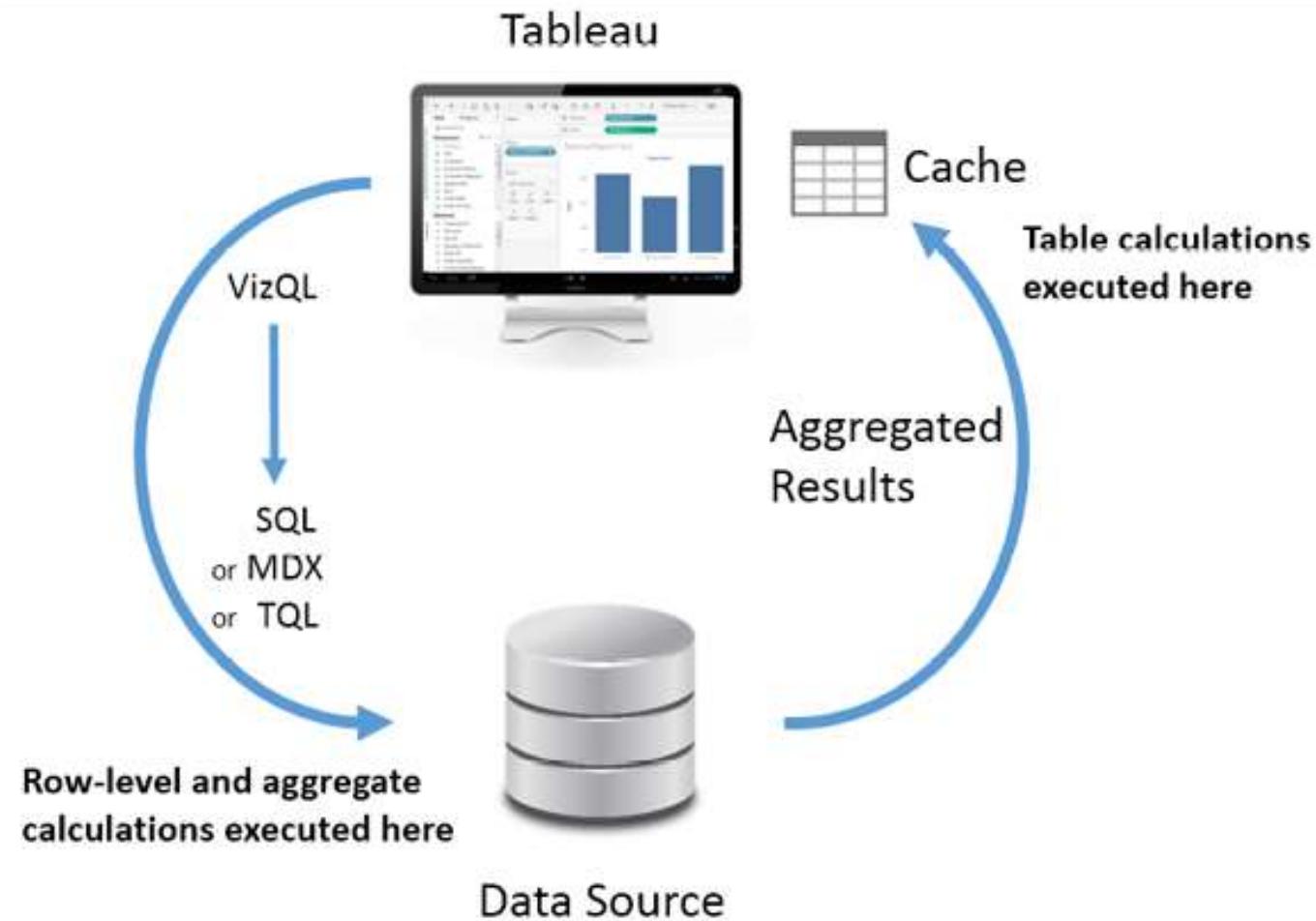
# Diving Deep with Table Calculations

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.



# 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:

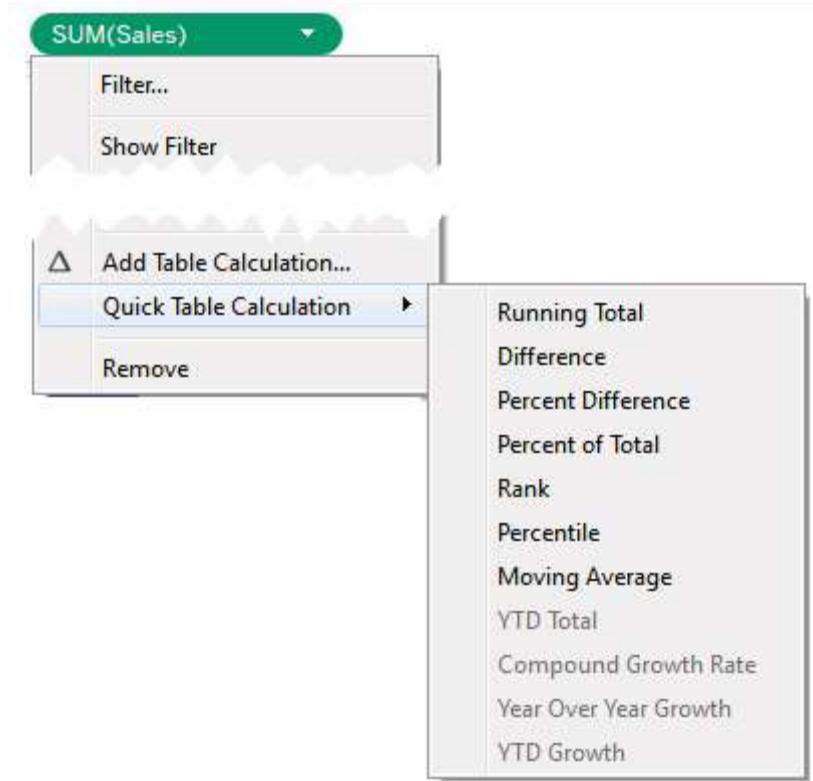


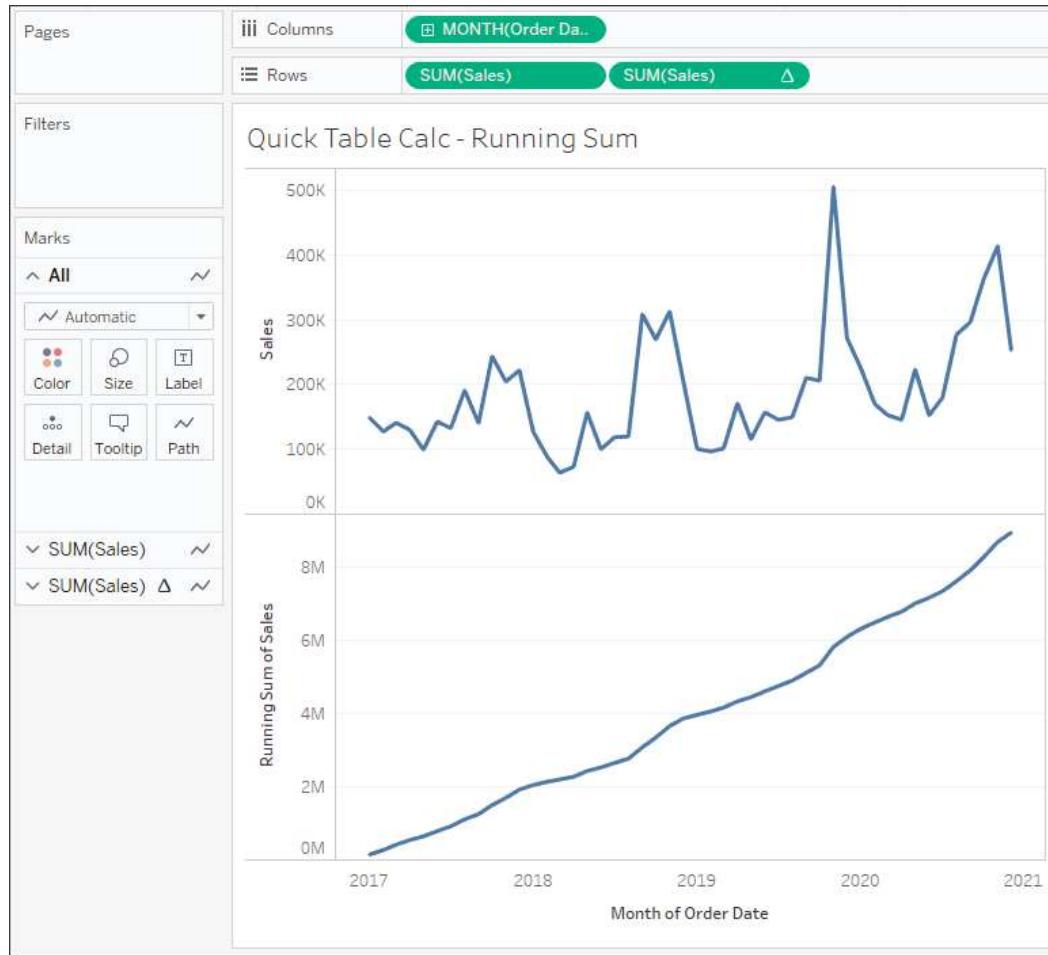
An active field without a table calculation applied

Following is the active field with a table calculation:



# Quick table calculations





Some examples of Quick Table Calcs

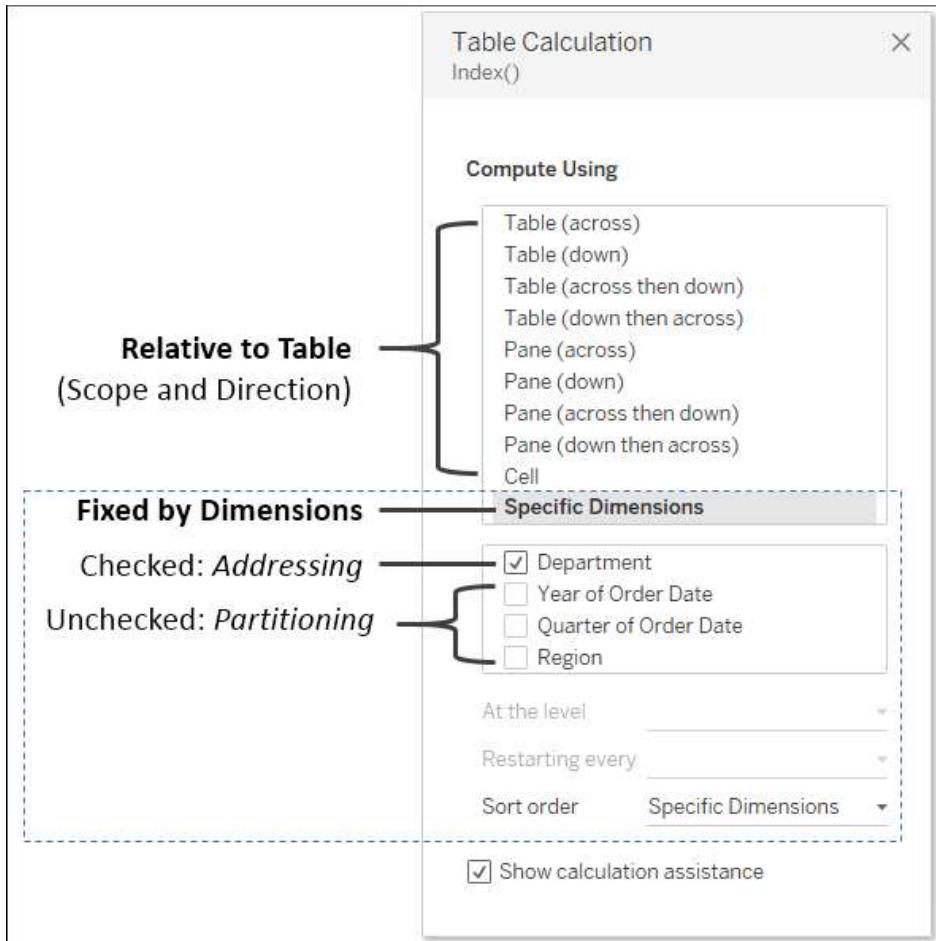
Year of Order Date	Quarter of Order Date	Sales	Running Sum of Sales along Table (Down)	Difference in Sales from the Previous along Table (Down)	Rank of Sales along Table (Down)
2017	Q1	417,555	417,555		12
	Q2	372,289	789,844	-45,266	13
	Q3	464,319	1,254,163	92,030	10
	Q4	670,182	1,924,345	205,863	5
2018	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.

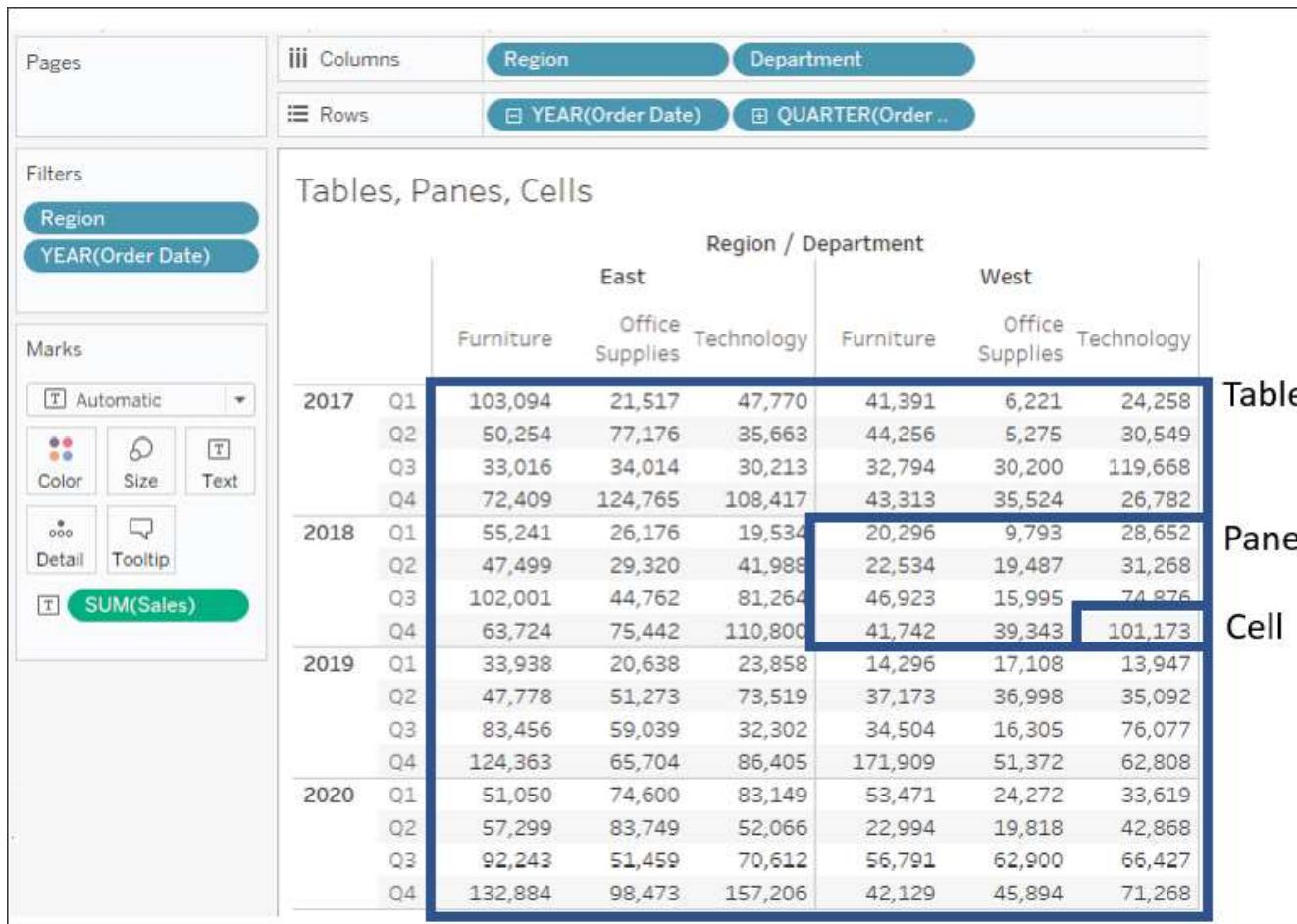
Specifically, scope and direction refer to the following:

- **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



# 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.

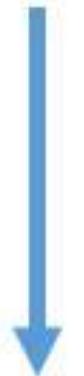
## Table (across):



		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		
		Furniture	Office Supplies	Technolo..	Furniture	Office 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):

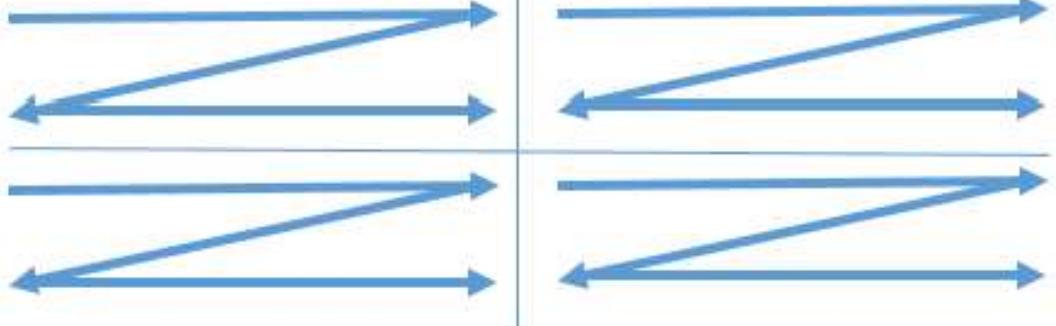


		East			West		
		Furniture	Office Supplies	Technolo..	Furniture	Office Supplies	Technolo..
2015	Q1	1	2	3	1	2	3
	Q2	1	2	3	1	2	3
	Q3	1	2	3	1	2	3
	Q4	1	2	3	1	2	3
2016	Q1	1	2	3	1	2	3
	Q2	1	2	3	1	2	3
	Q3	1	2	3	1	2	3
	Q4	1	2	3	1	2	3

## Pane (down):

		East			West		
		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	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



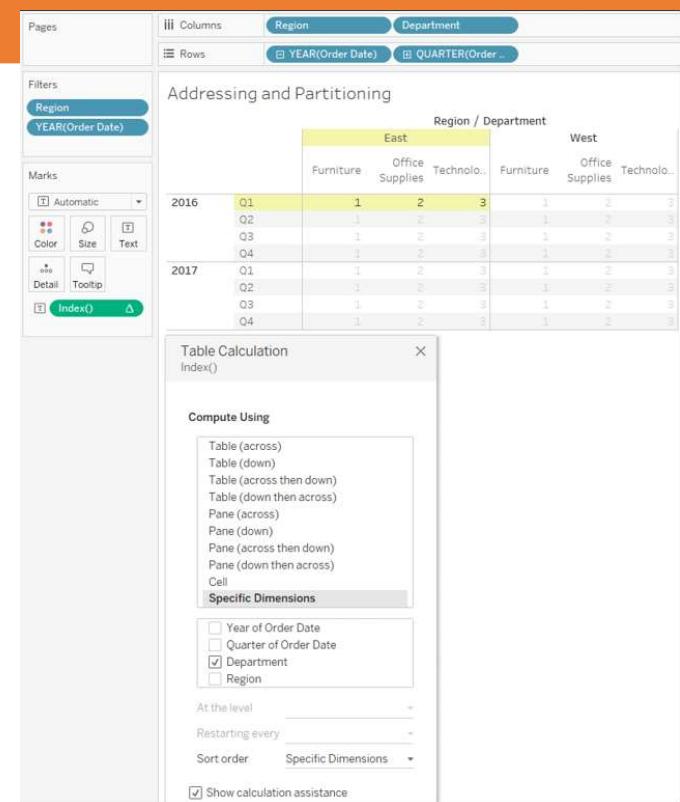


		East			West		
		Furniture	Office Supplies	Technolo..	Furniture	Office Supplies	Technolo..
2015	Q1	1	2	3	1	2	3
	Q2	4	5	6	4	5	6
	Q3	7	8	9	7	8	9
	Q4	10	11	12	10	11	12
2016	Q1	1	2	3	1	2	3
	Q2	4	5	6	4	5	6
	Q3	7	8	9	7	8	9
	Q4	10	11	12	10	11	12

# 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 Columns  YEAR(Order Date)  QUARTER(Order Date)

Rows Region Department

**Filters**

**Region** YEAR(Order Date)

**Marks**

Automatic Color Size Text

Detail Tooltip Index()

**Addressing and Partitioning**

		2016				Order Date			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>East</b>	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
<b>West</b>	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** Index()

Year of Order Date  
 Quarter of Order Date  
 Department  
 Region

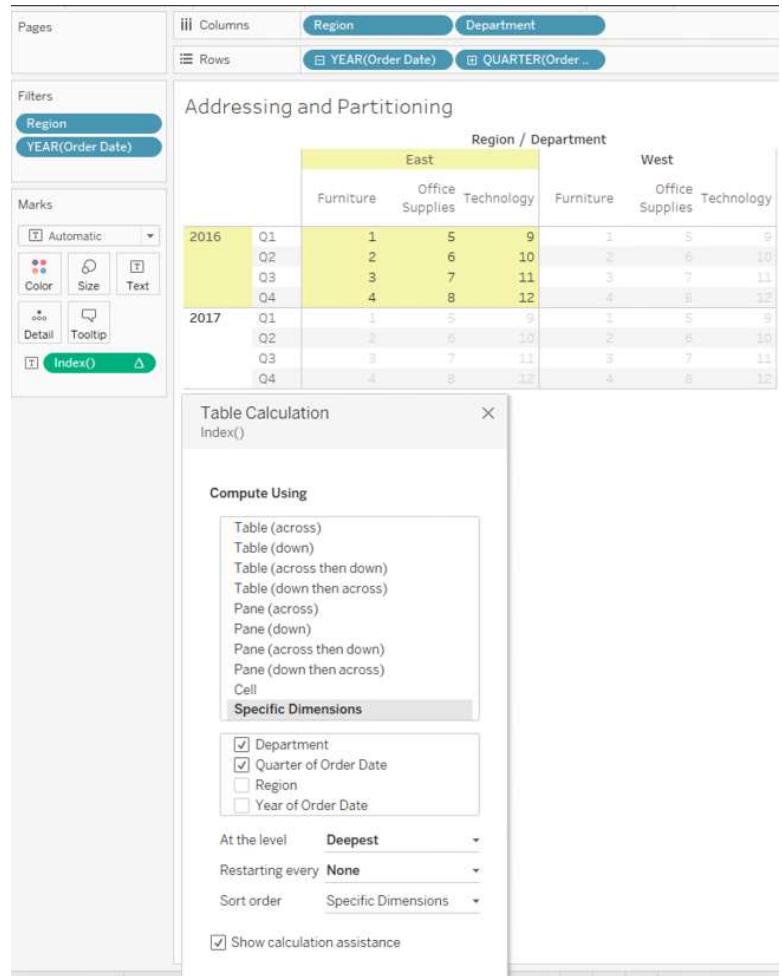
At the level \_\_\_\_\_

Restarting every \_\_\_\_\_

Sort order Specific Dimensions

Show calculation assistance

# Working with addressing and partitioning



Pages

Columns: Region, Department

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

Filters: Region, YEAR(Order Date)

Marks: Automatic, Color, Size, Text, Detail, Tooltip, Index()

### Addressing and Partitioning

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

Table Calculation: 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**

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

Department	Category	Index along Category	First along Category	Last along Category	Size along 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

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 Accessories	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
	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,
	Storage & Organization	Scissors, Rulers and ...	,Appliances,Binders and Binder Accessories,Envelopes,Labels,Paper,Pens & Art Supplies,Rubber Bands,Scissors,
Technology	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
	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
Technology	Storage & Organizat..	585,717	2,258,384	8,670
	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
Technology	Storage & Organizat..	585,717	2
	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.

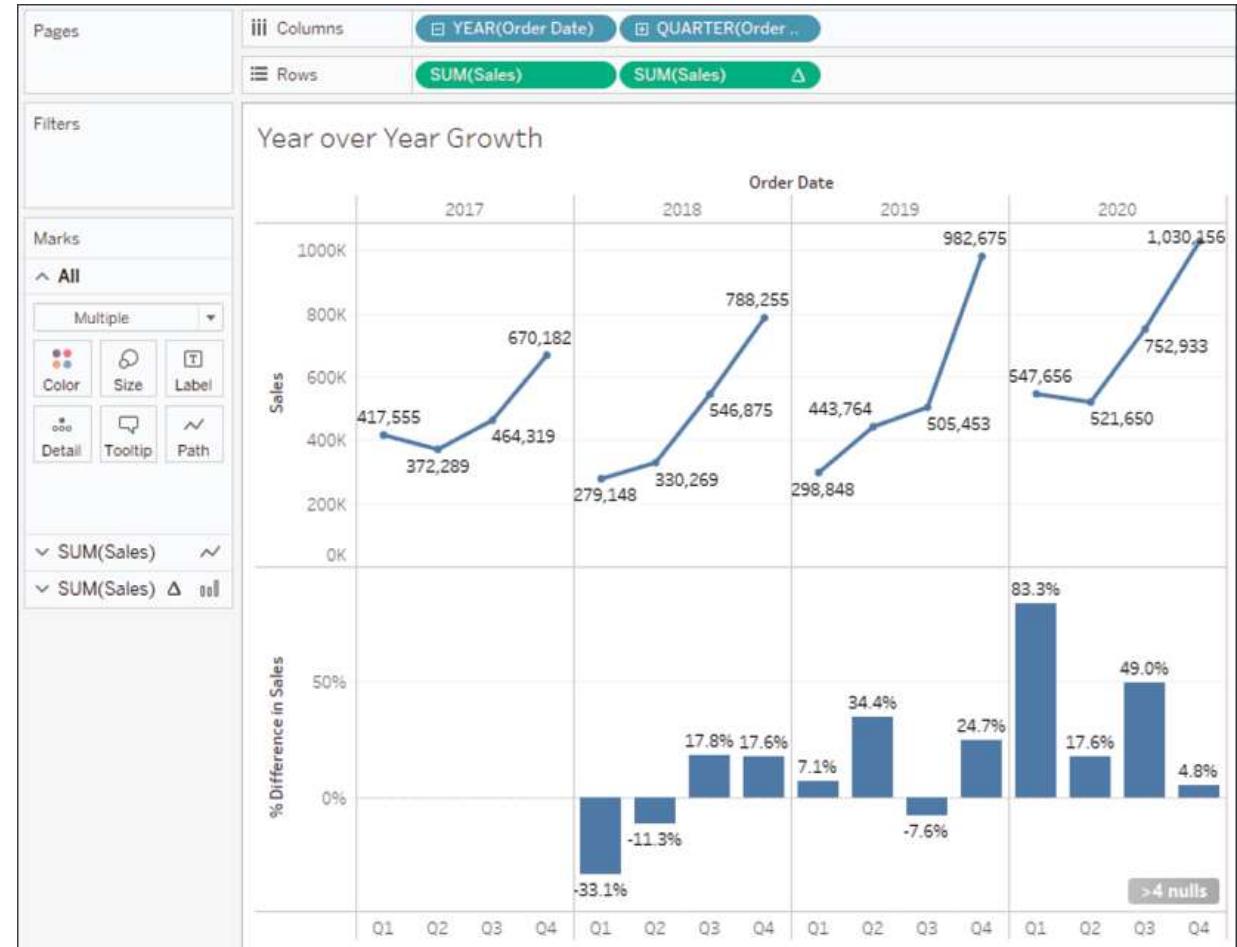
# The Total function

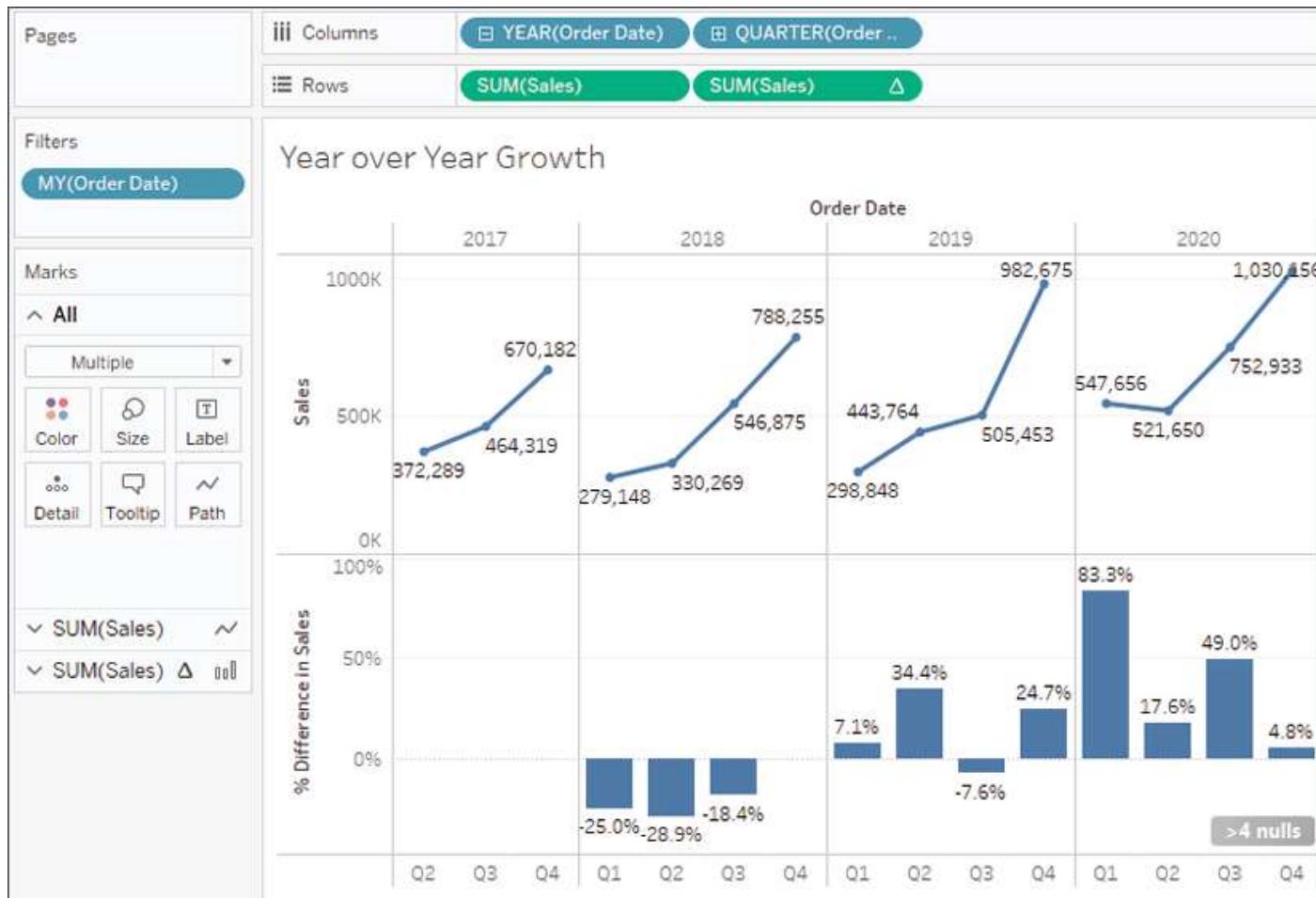
- The Total function deserves its own category because it functions a little differently from the others.
- Unlike the other functions that work on the aggregate table in the cache, Total will re-query the underlying source for all the source data rows that make up a given partition.
- In most cases,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

# Practical examples

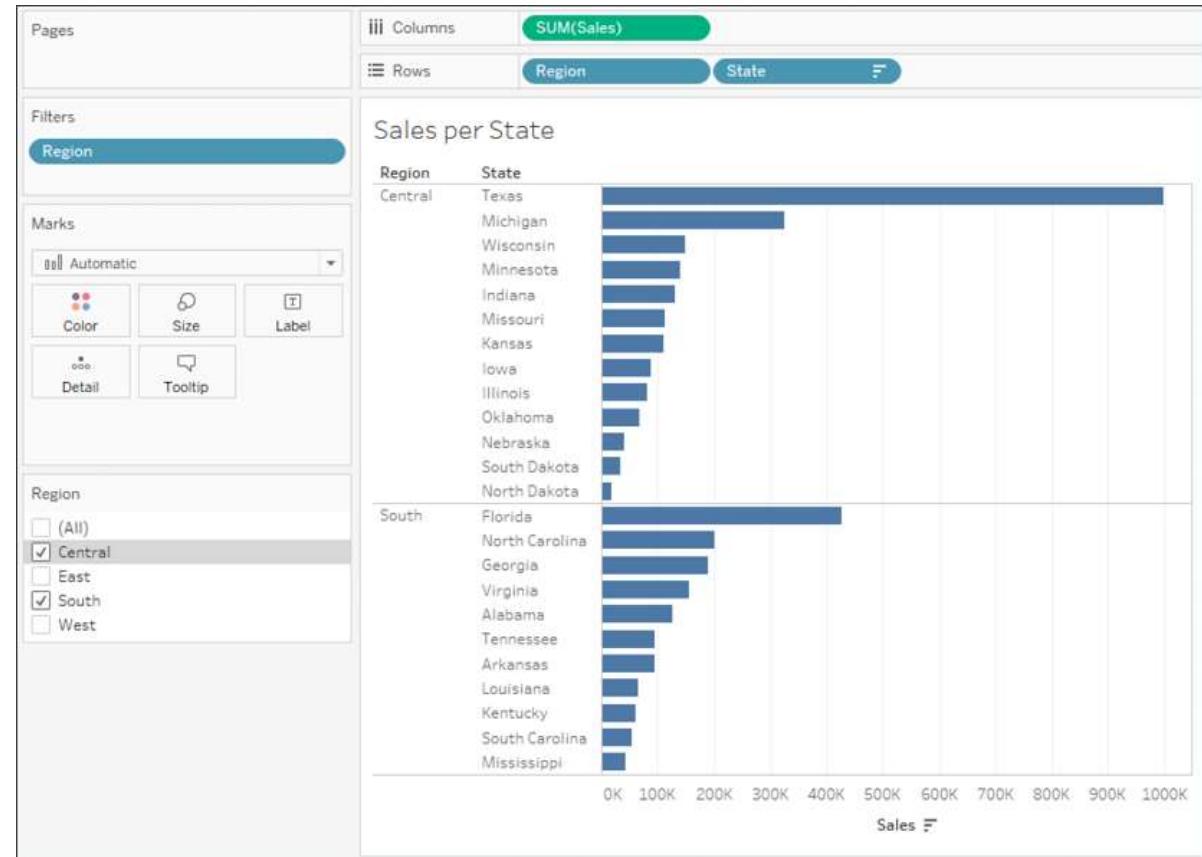
- Having looked at some of the essential concepts of table calculations, let's consider some practical examples.
- We'll look at several examples, although the practical use of table calculations is nearly endless.

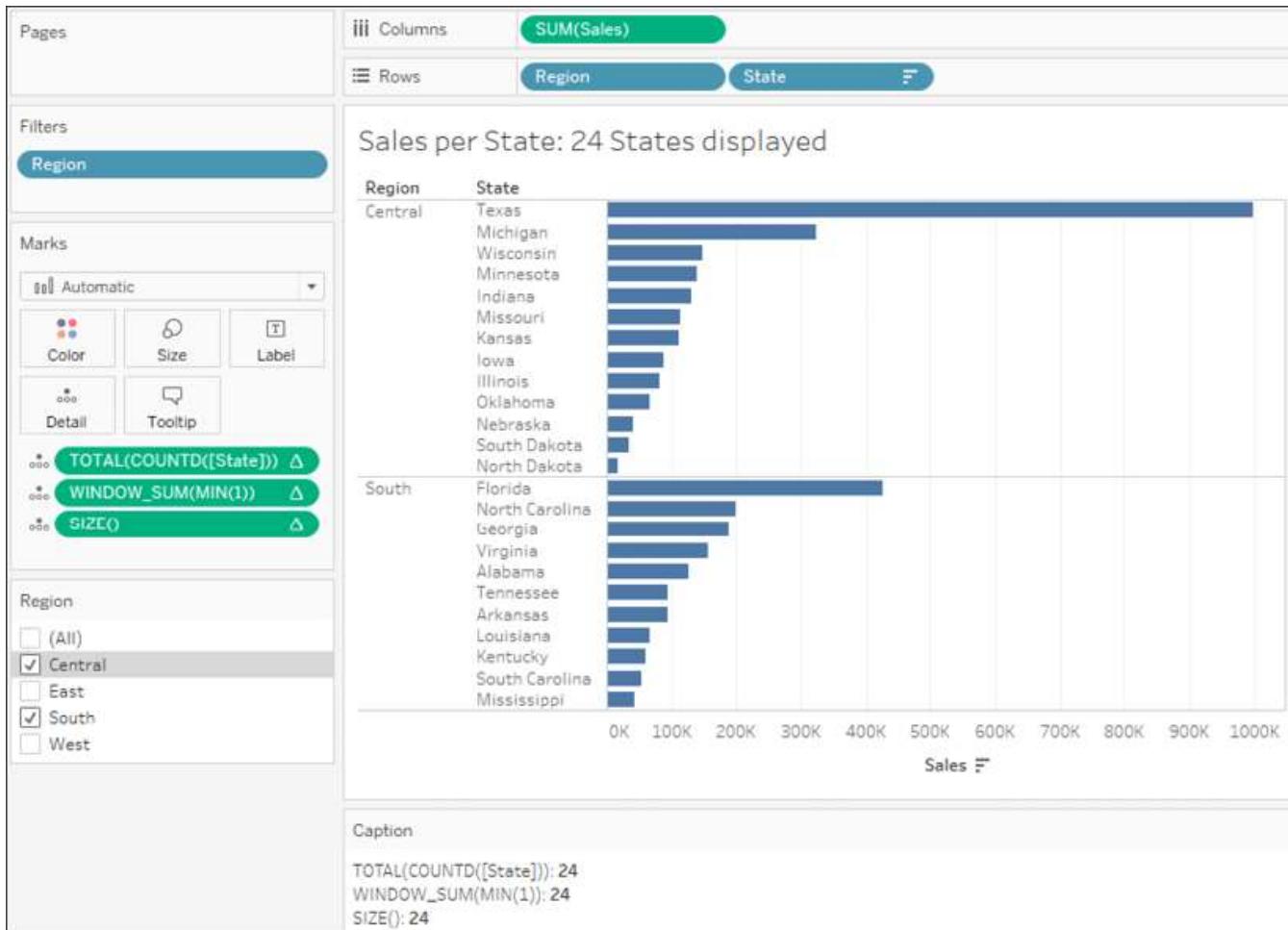
# Year over year growth



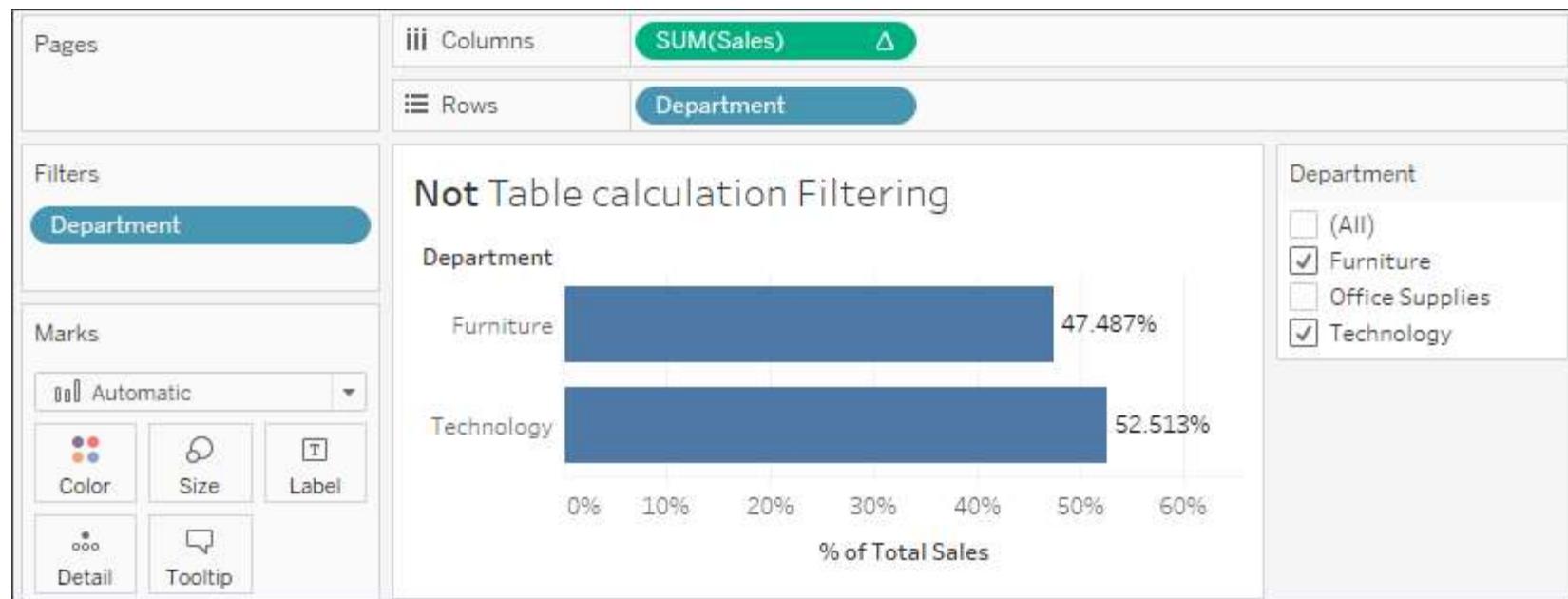


# Dynamic titles with totals

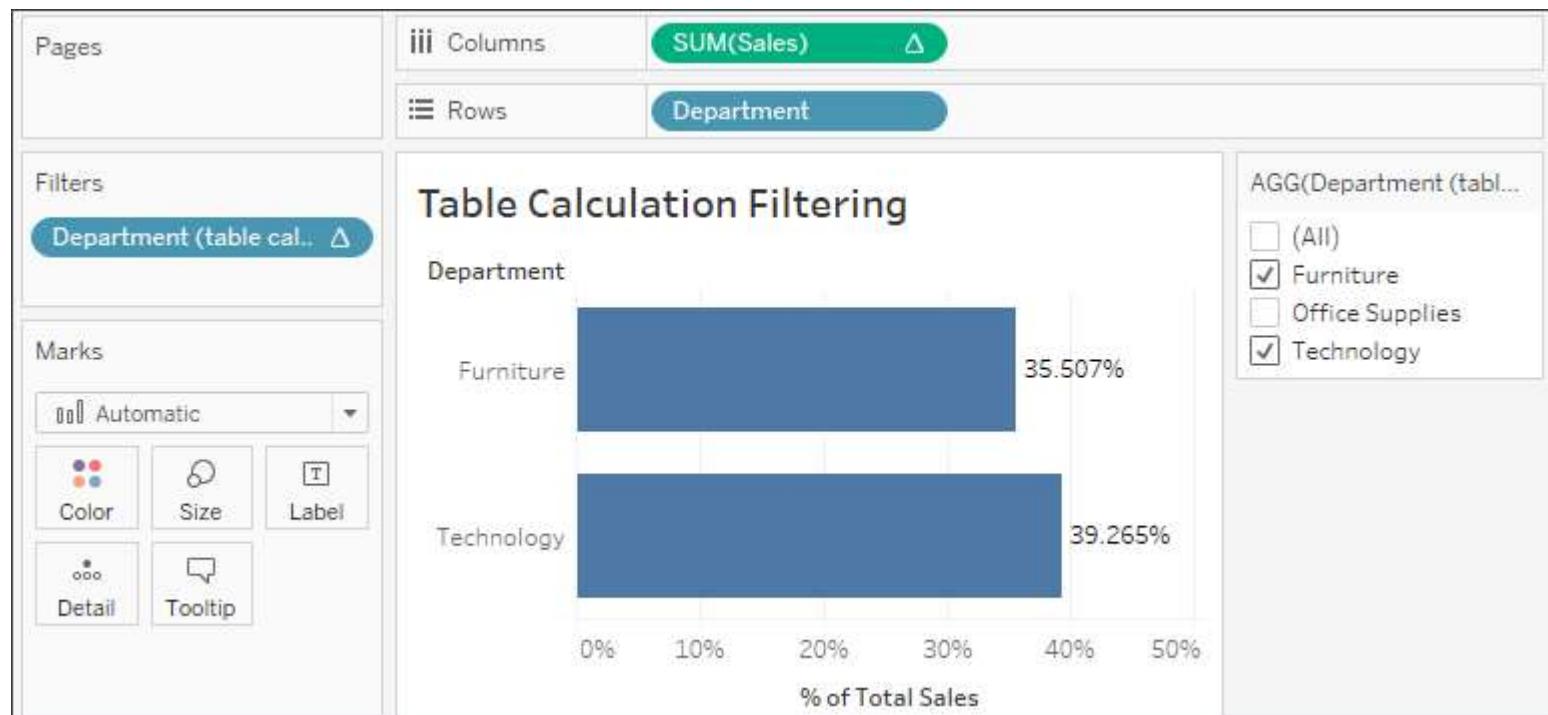




# Table calculation filtering (late filtering)



# 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