

# Data Visualisation

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# What is Data Visualisation?

- **Data visualization** is visual representation or creation and study of the visually represented data
- Communicate information clearly and efficiently using Graphs, Plots, Statistical graphics etc.
- Numerical data may be encoded using dots, lines, or bars to visually communicate a quantitative message
- It makes complex data more accessible, understandable

# Why Visualizations came into Picture?

- Our visual system is extremely well built for visual analysis.
- There is a huge amount of data that arrives into your brain through eyes.
- Our brains are extremely good at tasks such as Pattern Matching, Edge Detection, Shape recognition.
- That last factor, pattern matching, is the key when it comes to discussing the benefits of presenting information visually.
- Typically, the important messages in data are represented in the patterns and pattern violations: trends, gaps, and outliers. This is the interesting stuff, this is what we go to the data hoping to find.

# Importance of Visualizing Data

- Visualizations casts data into a format that can be *easily grasped and understood* much more quickly and easily than the raw number alone.
- Visualization is that it allows us access to *huge amounts of data* in ways that would not be otherwise possible.
- Visualizations allows to access more *actionable insights*.
- Visualizations allows data to be presented both graphically and interactively.
- Visualizations are effective at conveying knowledge.

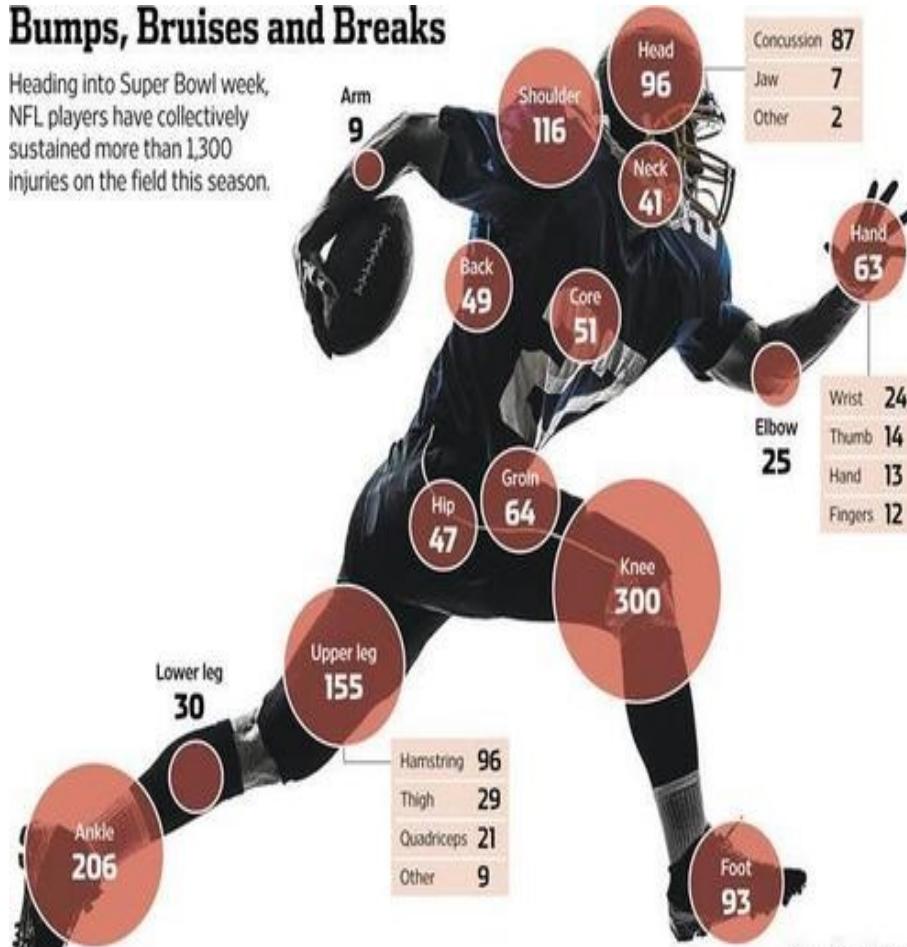
# Principles of Visualization

- We do not perceive absolutes, instead we perceive differences.
- We do not (and cannot) attend to everything we see.
- In order to filter the huge amount of data that we receive through our eyes, the eye is drawn to inconsistencies rather than common patterns.
- Differences drive attention – similarity leads a viewer to ignore things
- Our eyes are drawn towards familiar patterns.  
VIZ TIP – To build meaningful visualizations, we must ensure that we create the visualization to draw attention to the most important and interesting parts of the data.

# Principles of Visualization

## Bumps, Bruises and Breaks

Heading into Super Bowl week, NFL players have collectively sustained more than 1,300 injuries on the field this season.



Is it easy  
to draw  
insights  
from this  
Visualiza-  
tion?

# Tufte's Graphical Integrity Rules

- Put up by Edward Tufte
- Minimize the Lie Factor
- Use Consistent Scales
- Standardize (monetary) units
- Present data in context
- Show the data
  - Increase Data/Ink Ratio

# Visual Rhetoric

- Visual Rhetoric
  - The art of effective or persuasive use of charts, graphs, and other visual representations
  - This is really what we are focused on.

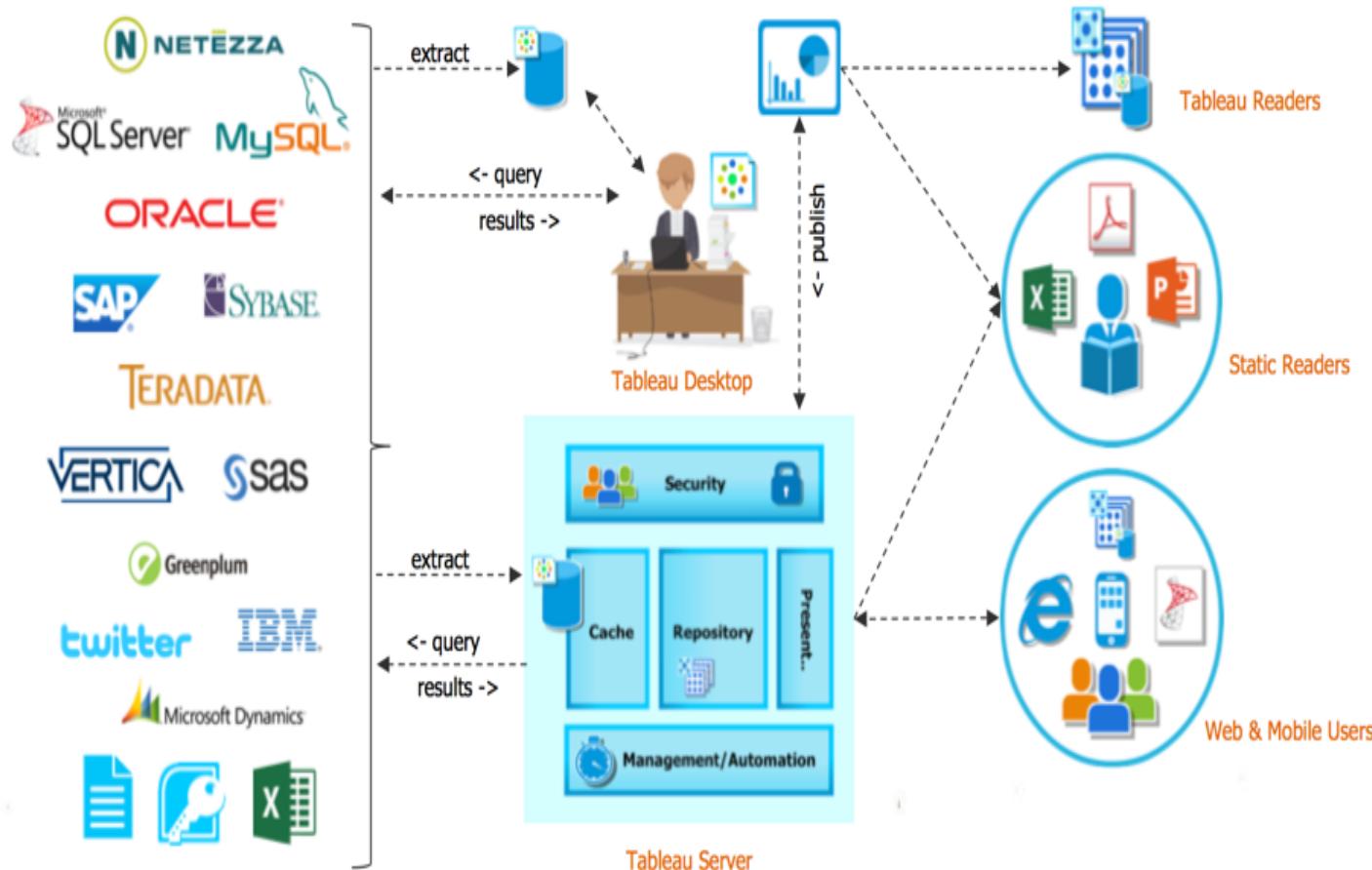
# Goal of Data Visualization

- The Goal of Data Visualization is to tell a story, without telling lies.
- Influences decisions.
- Encourages the eye to make comparisons.
- Visual encoding of information allows humans to process more information.
- Making invisible visible in Visualization.
- Present many attributes in a small space.

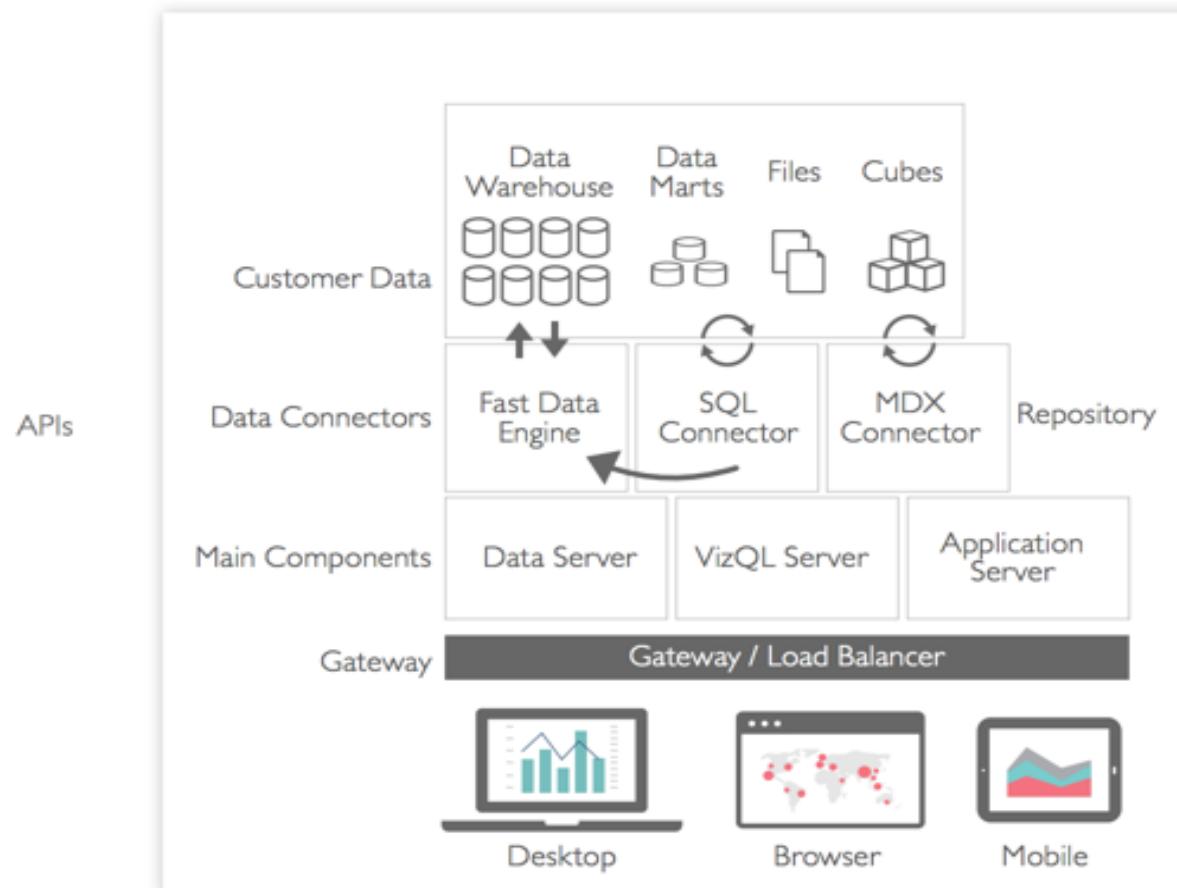
# Introduction to Tableau

- While social networking, cloud computing, and mobility are three of the biggest growth segments of Information Technology in the second decade of the 2000s, Business Intelligence is no slouch. Demand for new and innovative ways for organizations to view the ever-increasing amount of available data continues to grow. *Data Discovery* is a newer niche area of Business Intelligence that concentrates on visual and graphical analytics, as opposed to more traditional text-based reporting.

# Tableau Architecture



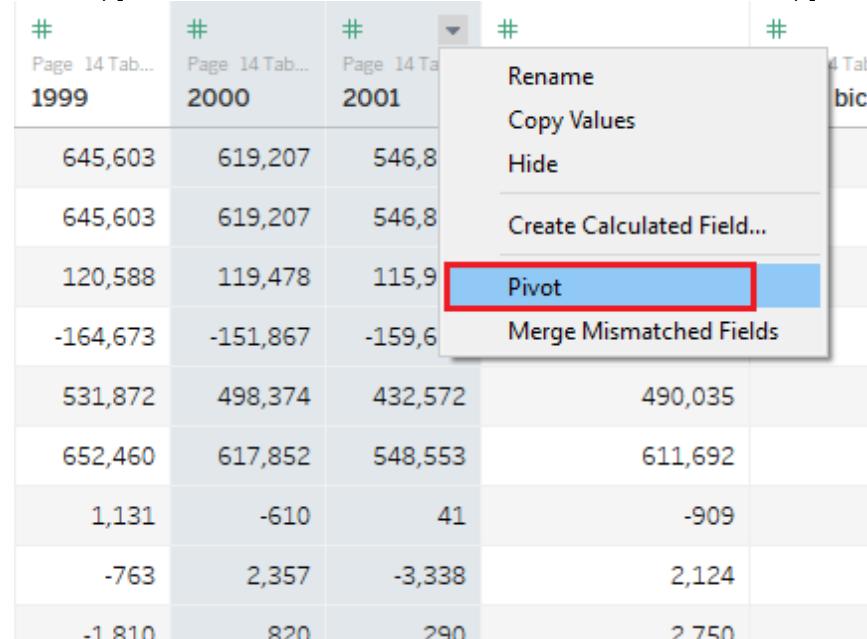
# Tableau Architecture



# Pivot Tables:

*Pivot Tables:* Is a tool which is used to summarize the Tables.

- Tableau is built in with Pivot Tables option. Let's check how to use this Option in Tableau.
- Click on the Selected filed which to be pivoted. Need to use Shift key for selecting more than one fields than right click> Click on Pivot.



A screenshot of a Tableau data view showing a context menu. The menu items are: Rename, Copy Values, Hide, Create Calculated Field..., Pivot (which is highlighted with a red box), and Merge Mismatched Fields. The background shows a data grid with columns labeled '#', 'Page 14 Tab...', '1999', '2000', '2001', and '#'. The data values range from -1,810 to 2,750.

#	Page 14 Tab...	1999	2000	2001	#
645,603	619,207	546,8			
645,603	619,207	546,8			
120,588	119,478	115,9			
-164,673	-151,867	-159,6			
531,872	498,374	432,572	490,035		
652,460	617,852	548,553	611,692		
1,131	-610	41	-909		
-763	2,357	-3,338	2,124		
-1,810	820	290	2,750		

# Pivot Tables:

Country (Luminescence)	Link to Country	Luminescence per capita	Population as on 2011	Luminescence/10 million..	Pivot Field name	Pivot Field value
					Name	Value
Argentina	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	3	41,445,246	0.7240	Notes (Final Data Set)N..	null
Argentina	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	3	41,445,246	0.7240	Notes (Final Data Set)N..	null
Argentina	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	3	41,445,246	0.7240	Notes (Final Data Set)N..	null
Argentina	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	3	41,445,246	0.7240	Notes (Final Data Set)N..	null
Argentina	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	3	41,445,246	0.7240	Notes (Final Data Set)N..	null
Australia	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	11	23,842,553	4.7120	Notes (Final Data Set)N..	born in the United States
Australia	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	11	23,842,553	4.7120	Notes (Final Data Set)N..	null
Australia	<a href="http://en.wikipedia.org...">http://en.wikipedia.org...</a>	11	23,842,553	4.7120	Notes (Final Data Set)N..	null

- After Pivoting two fields are formed which are Pivot field name and Pivot Field Values. We can change the Rename them by right clicking on it.

# Split Tables:

- What is this Split Option in Tableau?
- Let's check how it works. How to split a data in Tableau? Let's check how to split the data.
  - Splits the data present in columns
  - Works in two ways. A) Default Split and B) Custom Split

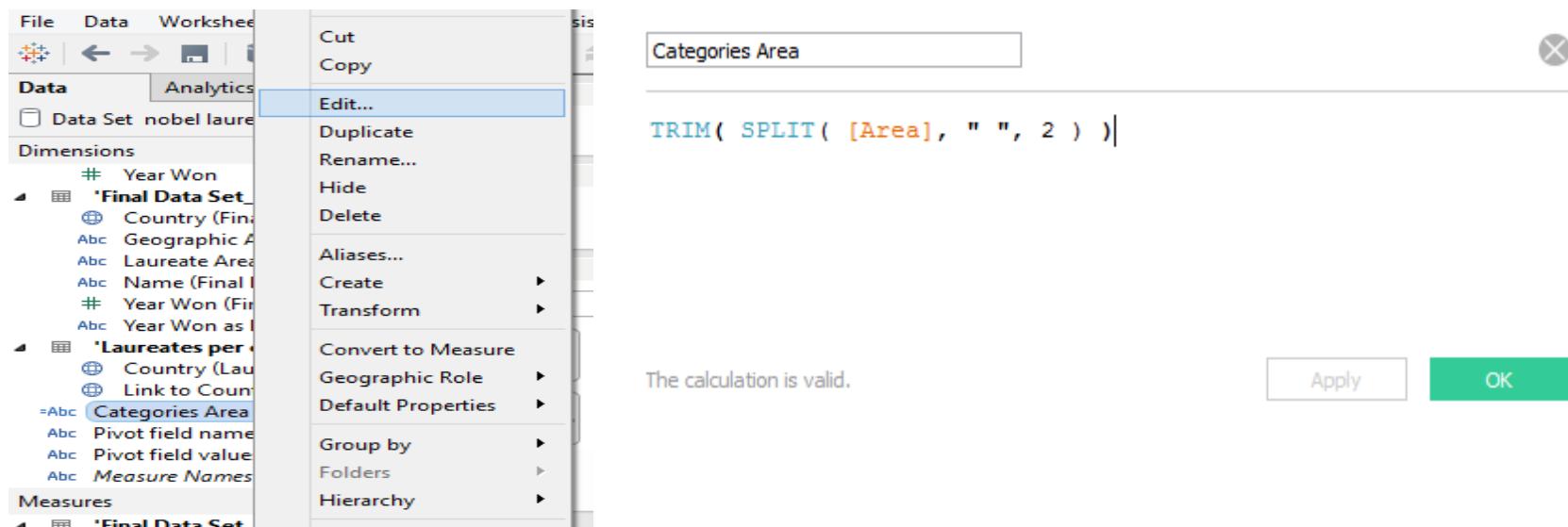
Name	Area	Area - Split 1	Year Won	Notes	F10	Country (Final Data ...	Name (Final Data Se...
	Abc Data Set nobel laur...	=Abc	# Data Set ...	Abc Data Set nobel laur...	Abc Data S...	@ Final Data Set!Nobe...	Abc Final Data Set!Nobe...
Alfred Kastler	Physics	Physics	1966	null	null	Canada	Charles B. Huggins
François Jacob	Physiology or Medicine	Physiology	1965	null	null	France	François Jacob
Jacques Monod	Physiology or Medicine	Physiology	1965	null	null	France	François Jacob
André Lwoff	Physiology or Medicine	Physiology	1965	null	null	France	François Jacob
Jean-Paul Sartre	Literature	Literature	1964	(declined the prize)	null	Australia	Aleksandr M. Prokhorov
Saint-John Perse	Literature	Literature	1960	null	null	Australia	Sir Frank Macfarlane B...
Albert Camus	Literature	Literature	1957	born in French Algeria	null	Canada	Lester B. Pearson
André Frédéric Cournand	Physiology or Medicine	Physiology	1956	null	null	France	André Frédéric Cournand



Activate Windows

# Split Tables:

- Just Right click on the field and select split. What is difference after splitting the Field 'Area'.
- In Area Field there are some Categories like Physiology or Medicine. No further clarification about that Categories. For further drilling in Categories we use 'Split' Option in Tableau.
- Let's check the Code behind this split option. For that just right click on the new field created after splitting.



# Hide Fields

- What is this Hide Option in Tableau?
- Let's check how it works. How to Hide field in Tableau? Let's check how Hide option works.
  - Hides the column

The screenshot shows the Tableau Data Source Editor interface. At the top, there are buttons for 'Sort fields' and 'Data source order' (with a dropdown arrow), and checkboxes for 'Show aliases' and 'Show hic'. Below this is a table with several columns and rows of data. A context menu is open over the third column header, which contains the text 'Abc'. The menu options are: Rename, Copy Values, Hide, Aliases..., Create Calculated Field..., Create Group..., Split, Custom Split..., Pivot (select multiple fields), and Describe... . The 'Hide' option is highlighted with a red box.

Orders Order Date	Orders Ship Date	Abc Orders Ship Mode	Abc	Abc	Orders Country	Orders City	Orders State
11/8/2017	11/11/2017	Second Class			United States	Henderson	Kentuc
11/8/2017	11/11/2017	Second Class			United States	Henderson	Kentuc
6/12/2017	6/16/2017	Second Class			United States	Los Angeles	Califor
10/11/2016	10/18/2016	Standard Class			United States	Fort Lauderdale	Florida
10/11/2016	10/18/2016	Standard Class			United States	Fort Lauderdale	Florida
6/9/2015	6/14/2015	Standard Class			United States	Los Angeles	Califor
6/9/2015	6/14/2015	Standard Class			United States	Los Angeles	Califor
6/9/2015	6/14/2015	Standard Class	Brosina Hoffman	Consumer	United States	Los Angeles	Califor

# Hide Fields

- Observe that the Column/ Field is now hiding

Abc Orders Order ID	Orders Order Date	Orders Ship Date	Abc Orders Customer Name	Abc Orders Segment	Orders Country	Orders City	Orders State
CA-2017-152156	11/8/2017	11/11/2017	Claire Gute	Consumer	United States	Henderson	Kentucky
CA-2017-152156	11/8/2017	11/11/2017	Claire Gute	Consumer	United States	Henderson	Kentucky
CA-2017-138688	6/12/2017	6/16/2017	Darrin Van Huff	Corporate	United States	Los Angeles	California
US-2016-108966	10/11/2016	10/18/2016	Sean O'Donnell	Consumer	United States	Fort Lauderdale	Florida
US-2016-108966	10/11/2016	10/18/2016	Sean O'Donnell	Consumer	United States	Fort Lauderdale	Florida
CA-2015-115812	6/9/2015	6/14/2015	Brosina Hoffman	Consumer	United States	Los Angeles	California
CA-2015-115812	6/9/2015	6/14/2015	Brosina Hoffman	Consumer	United States	Los Angeles	California
CA-2015-115812	6/9/2015	6/14/2015	Brosina Hoffman	Consumer	United States	Los Angeles	California

# Hide Fields

- How to retrieve the data that was hidden?

Check the box reading Show Hidden Fields

#		Abc Orders Row ID	Abc Orders Order ID	Abc Orders Order Date	Abc Orders Ship Date	Abc Orders Ship Mode	Abc Orders Customer ID	Abc Orders Customer Name	Abc Orders Segment
1	CA-2017-152156	11/8/2017	11/11/2017	Second Class	CG-12520	Claire Gute	Consumer		
2	CA-2017-152156	11/8/2017	11/11/2017	Second Class	CG-12520	Claire Gute	Consumer		
3	CA-2017-138688	6/12/2017	6/16/2017	Second Class	DV-13045	Darrin Van Huff	Corporate		
4	US-2016-108966	10/11/2016	10/18/2016	Standard Class	SO-20335	Sean O'Donnell	Consumer		
5	US-2016-108966	10/11/2016	10/18/2016	Standard Class	SO-20335	Sean O'Donnell	Consumer		
6	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman	Consumer		
7	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman	Consumer		
8	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman	Consumer		

Show aliases

Show hidden fields

# Hide Fields

- How to retrieve the data that was hidden?  
Click on the dropdown and select Unhide

#	Abc Orders Row ID	Abc Orders Order ID	Orders Order Date	Orders Ship Date	Abc Orders Ship Mode	Abc	Abc	Abc Orders Segment
1	CA-2017-152156	11/8/2017	11/11/2017	Second Class		Rename	Customer Name	Consumer
2	CA-2017-152156	11/8/2017	11/11/2017	Second Class		Copy Values	Customer	Consumer
3	CA-2017-138688	6/12/2017	6/16/2017	Second Class		Hide	Jean Huff	Corporate
4	US-2016-108966	10/11/2016	10/18/2016	Standard Class		Unhide	Sean O'Donnell	Consumer
5	US-2016-108966	10/11/2016	10/18/2016	Standard Class	SO-20335	Sean O'Donnell		Consumer
6	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman		Consumer
7	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman		Consumer
8	CA-2015-115812	6/9/2015	6/14/2015	Standard Class	BH-11710	Brosina Hoffman		Consumer

# Rename

- Why do we Rename?
  - To make it easy to understand the underlying data
- Other ways to Rename
  - Changes the Column Name or Field Name

The screenshot shows a data editor interface with a table of fields. At the top, there's a toolbar with a 'Sort fields' button (which has a red box around it) and a dropdown for 'Data source order'. The table has three columns: 'Field Name', 'Table', and 'Remote Field Name'. The rows show fields like Row ID, Order ID, Order Date, Ship Date, Ship Mode, Customer ID, Customer Name, Segment, and Country. In the middle-right of the table, the 'Ship Mode' row has a context menu open. The menu items are: Rename (which is highlighted with a red box), Copy Values, Hide, Aliases..., Create Calculated Field..., and Create Group... .

Field Name	Table	Remote Field Name
# Row ID	Orders	Row ID
Abc Order ID	Orders	Order ID
Order Date	Orders	Order Date
Ship Date	Orders	Ship Date
Abc Ship Mode		
Abc Customer ID		
Abc Customer Name		
Abc Segment		
Abc Country		

# Aliases

- What is this Aliases Option in Tableau?
  - Click on the dropdown and select Aliases
- What does Aliases do?
  - Changes the Field Members Name as it helps us in understanding the data under each Column

# Orders Row ID	Abc Orders Order ID	Orders Order Date	Orders Ship Date	Abc Orders Ship Mode	Abc	Abc	Abc Orders Segment
1	CA-2017-152156	11/8/2017	11/11/2017	Second Class	<ul style="list-style-type: none"><li>▼</li><li>Abc</li><li>Rename</li><li>Copy Values</li><li>Hide</li><li><b>Aliases...</b></li><li>Create Calculated Field...</li><li>Create Group...</li><li>Split</li><li>Custom Split...</li><li>Pivot (select multiple fields)</li><li>Describe...</li></ul>	Customer Name	Consumer
2	CA-2017-152156	11/8/2017	11/11/2017	Second Class			
3	CA-2017-138688	6/12/2017	6/16/2017	Second Class			
4	US-2016-108966	10/11/2016	10/18/2016	Standard Class			
5	US-2016-108966	10/11/2016	10/18/2016	Standard Class			
6	CA-2015-115812	6/9/2015	6/14/2015	Standard Class			
7	CA-2015-115812	6/9/2015	6/14/2015	Standard Class			
8	CA-2015-115812	6/9/2015	6/14/2015	Standard Class			

# Aliases

- Pop up window appears and edit the Value as per the requirement and click on OK

The screenshot shows a data grid interface with a modal dialog box overlaid. The dialog is titled "Edit Aliases [Ship Mode]" and contains a table with three columns: "Member", "Has Alias", and "Value (Alias)". A row for "First Class" has a red border around it, indicating it is selected or being edited. The table also lists "Same Day", "Second Class", and "Standard Class". To the right of the table are "OK" and "Cancel" buttons. Below the dialog, there are two checkboxes: "Show aliases" (checked) and "Show hidden fields" (unchecked). The main data grid below the dialog has columns for "# Orders", "Order ID", "Customer ID", "Customer Name", and "Segment". The data in the grid includes rows for various orders and their corresponding customer information.

# Orders	Order ID	Customer ID	Customer Name	Segment
1	CA-2017-152156	2520	Claire Gute	Consumer
2	CA-2017-152156	2520	Claire Gute	Consumer
3	CA-2017-138688	3045	Darrin Van Huff	Corporate
4	US-2016-108966	SO-20335	Sean O'Donnell	Consumer
5	US-2016-108966	SO-20335	Sean O'Donnell	Consumer
6	CA-2015-115812	BH-11710	Brosina Hoffman	Consumer
7	CA-2015-115812	BH-11710	Brosina Hoffman	Consumer
8	CA-2015-115812	BH-11710	Brosina Hoffman	Consumer

# Data Interpretation:

## *Data Interpretation:*

*Data Interpretation is the process of making sense of numerical **Data** that has been collected, analyzed and Presented.*

- Let's check how to use Data Interpretation in Tableau.

## Data Interpretation:

## Step-1: Open the Tableau Desktop

**Step-2: Import the file/data which need to be visualized**

The Data below is in unstructured format.

# Data Interpretation:

The Data after clicking on Data Interpreter will help you get the data in a default Structured format.

Tables

✓ Cleared with Data Interpreter  
Data interpretation removes auto data. [Review & results](#) (To undo changes, click the checkmark.)

Sort by fields Data source order

Show aliases | Show hidden fields

	Page 13 Table 2	Page 14 Table 1	Page 14 Table 2	Page 14 Table 3	Page 15 Table 1	Page 15 Table 2	Page 15 Table 3	Page 16 Table 1	Page 16 Table 2	Page 16 Table 3	Page 17 Table 1	Page 17 Table 2	Page 17 Table 3
Inflows	1995	1996	1997	1998	1999	Page 14 Table 12000	Page 14 Table 12000	2002 Million cu	2003 b/c metres	2004	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Precipitation	584,936	701,394	593,461	603,264	645,609	619,307	546,821	614,630	569,103	664,463	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Total inflows	584,936	701,394	593,461	603,264	645,609	619,307	546,821	614,630	569,103	664,463	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Evapotranspiration	120,254	125,098	122,180	121,157	120,538	119,478	115,580	121,667	118,545	122,628	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
generation	182,049	184,698	159,743	159,115	164,679	161,867	169,861	140,308	160,350	167,244	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Treatment and discharge	598,632	574,722	476,907	462,809	521,872	498,574	432,572	490,095	457,162	535,302	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Total outflows	573,895	589,810	599,087	604,060	662,460	617,662	543,653	611,692	673,707	658,991	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Sedimentation	620	1,638	1,301	2,085	1,131	610	41	909	345	1,593	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1
Lakes and reservoirs	289	264	1,676	1,714	769	2,357	3,598	2,124	761	1,967	Page 14 Table 1	Page 14 Table 1	Page 14 Table 1

# *Text Tables:*

*Shows the data in Tabular Column*

Pages

iii Columns  YEAR(Order Date)

Rows  Sub-Category

Filters

Marks

Automatic

Color  Size  Text

Detail  Tooltip

SUM(Sales)

Sheet 1

Sub-Catego...	Order Date			
	2015	2016	2017	2018
Accessories	\$25,014	\$40,524	\$41,896	\$59,946
Appliances	\$15,314	\$23,241	\$26,050	\$42,927
Art	\$6,058	\$6,237	\$5,961	\$8,863
Binders	\$43,488	\$37,453	\$49,683	\$72,788
Bookcases	\$20,037	\$38,544	\$26,275	\$30,024
Chairs	\$77,242	\$71,735	\$83,919	\$95,554
Copiers	\$10,850	\$26,179	\$49,599	\$62,899
Envelopes	\$3,856	\$4,512	\$4,730	\$3,379
Fasteners	\$661	\$545	\$960	\$858
Furnishings	\$13,826	\$21,090	\$27,874	\$28,915
Labels	\$2,841	\$2,956	\$2,827	\$3,861
Machines	\$62,023	\$27,764	\$55,907	\$43,545
Paper	\$14,835	\$15,288	\$20,662	\$27,695
Phones	\$77,391	\$68,314	\$78,962	\$105,341
Storage	\$50,329	\$45,048	\$58,789	\$69,678
Supplies	\$14,394	\$1,952	\$14,278	\$16,049
Tables	\$46,088	\$39,150	\$60,833	\$60,894



For **text tables** try

1 or more **Dimensions**

1 or more **Measures**

# Highlight Tables:

*Highlights the data as per the value*

Pages

iii Columns YEAR(Order Date)

Rows Sub-Category

Filters

Marks

Square

Color Size Label

Detail Tooltip

SUM(Sales) SUM(Sales)

Sheet 1

Order Date

Sub-Catego..	2015	2016	2017	2018
Accessories	\$25,014	\$40,524	\$41,896	\$59,946
Appliances	\$15,314	\$23,241	\$26,050	\$42,927
Art	\$6,058	\$6,237	\$5,961	\$8,863
Binders	\$43,488	\$37,453	\$49,683	\$72,788
Bookcases	\$20,037	\$38,544	\$26,275	\$30,024
Chairs	\$77,242	\$71,735	\$83,919	\$95,554
Copiers	\$10,850	\$26,179	\$49,599	\$62,899
Envelopes	\$3,856	\$4,512	\$4,730	\$3,379
Fasteners	\$661	\$545	\$960	\$858
Furnishings	\$13,826	\$21,090	\$27,874	\$28,915
Labels	\$2,841	\$2,956	\$2,827	\$3,861
Machines	\$62,023	\$27,764	\$55,907	\$43,545
Paper	\$14,835	\$15,288	\$20,662	\$27,695
Phones	\$77,391	\$68,314	\$78,962	\$105,341
Storage	\$50,329	\$45,048	\$58,789	\$69,678
Supplies	\$14,394	\$1,952	\$14,278	\$16,049
Tables	\$46,088	\$39,150	\$60,833	\$60,894

For highlight tables try

1 or more Dimensions

1 Measure

SUM(Sales)

\$545 \$105,341

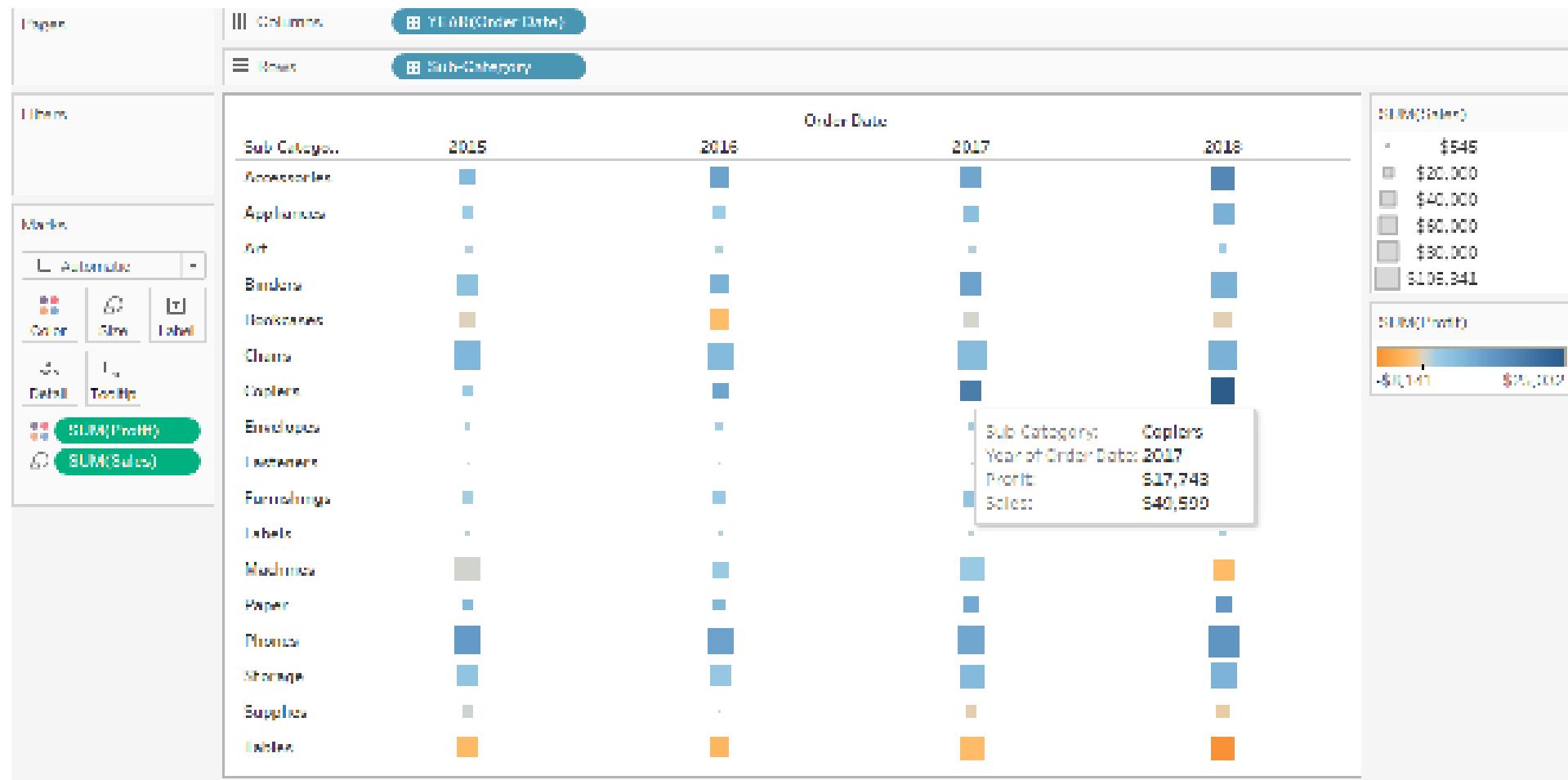
# Heat Tables:

*Heat table with one measure added on the view*



# Heat Tables:

*Heat table with two measures added on the view*

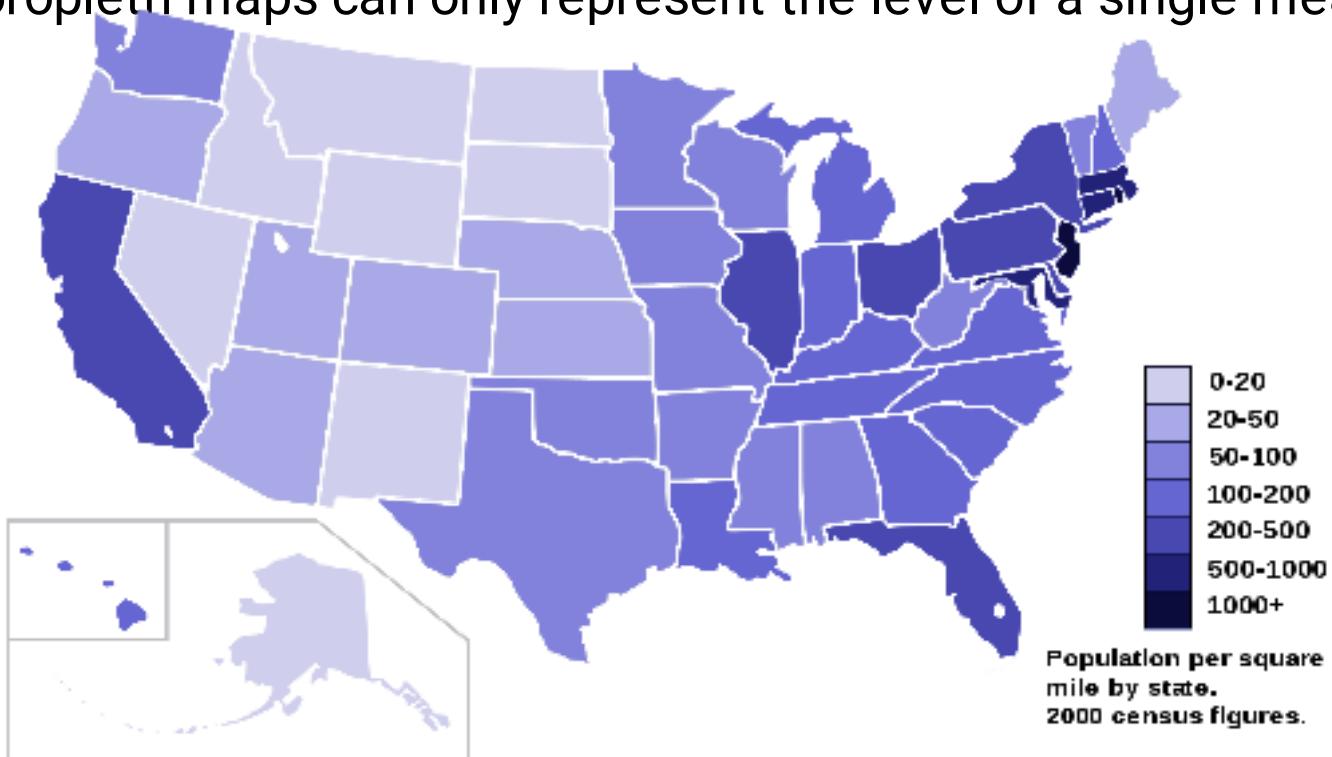


## *Maps in Tableau:*

- For Geographical Maps, Tableau has built in support for Chloropleth and (Proportional) Symbol maps.
- Tableau also supports the use of custom maps, which can be anything (floor plan, campus map, etc.).
- Tableau can recognize Geographical roles like Airports, CBSA/MSA (US), City, State/ Province, Country, County, Area Codes (US), Congressional Districts (US), NUTS (Europe), Zipcode/ Postcode

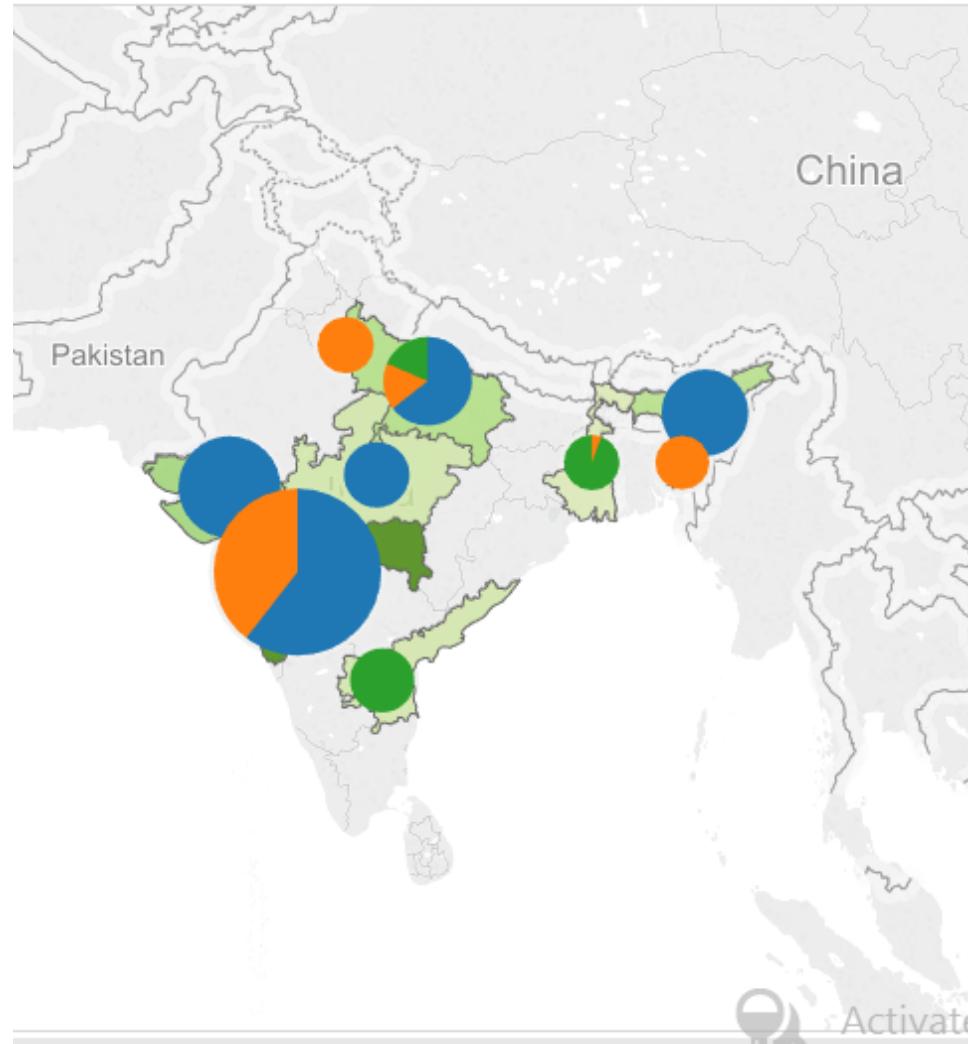
# *Filled Maps:*

- Choropleth, or filled maps, are the most common.
  - Use a color gradient to denote the quantitative element of interest
  - Choropleth maps can only represent the level of a single measure.



# *Symbol Maps:*

- Common emerging “standard” for map presentations.
- In this example, we have two variables represented on map, sales (shading), and category (pie chart)
- Size can be proportional or not.



# *Connecting with WMS Server:*

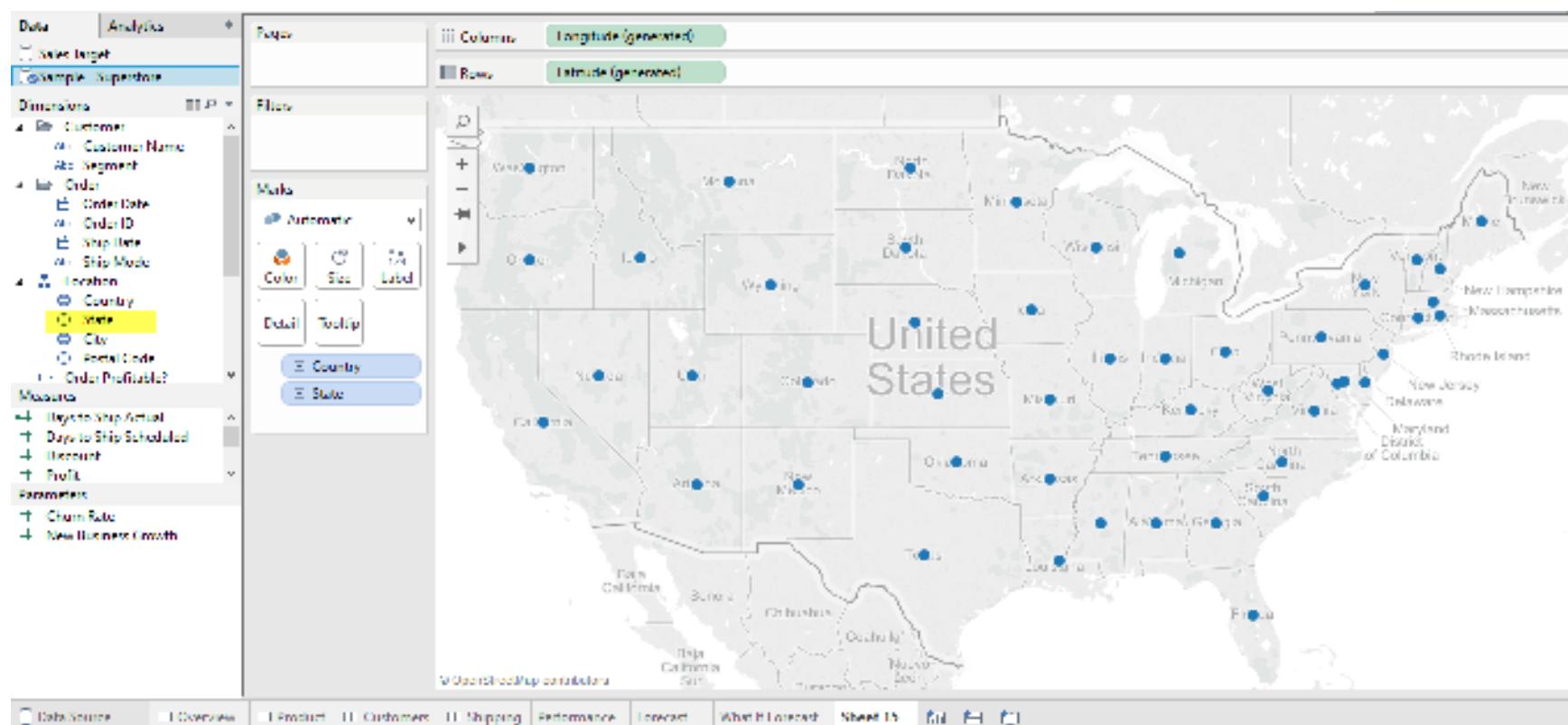
- Web Map Service is the abbreviation of WMS
- Tableau makes it easy to replace the standard maps with custom maps provided by map services.
- The easiest way to replace Tableau's standard maps is with a web map service.

## *Pre-Requisites for Using WMS Server:*

- ✓ Java SE 6 update 22(or any latest version) need to installed.
- ✓ <http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html> you can download java se6 from this link
- ✓ Download “Geoserver”
- ✓ <http://geoserver.org/release/stable/> you can download geoserver from this link

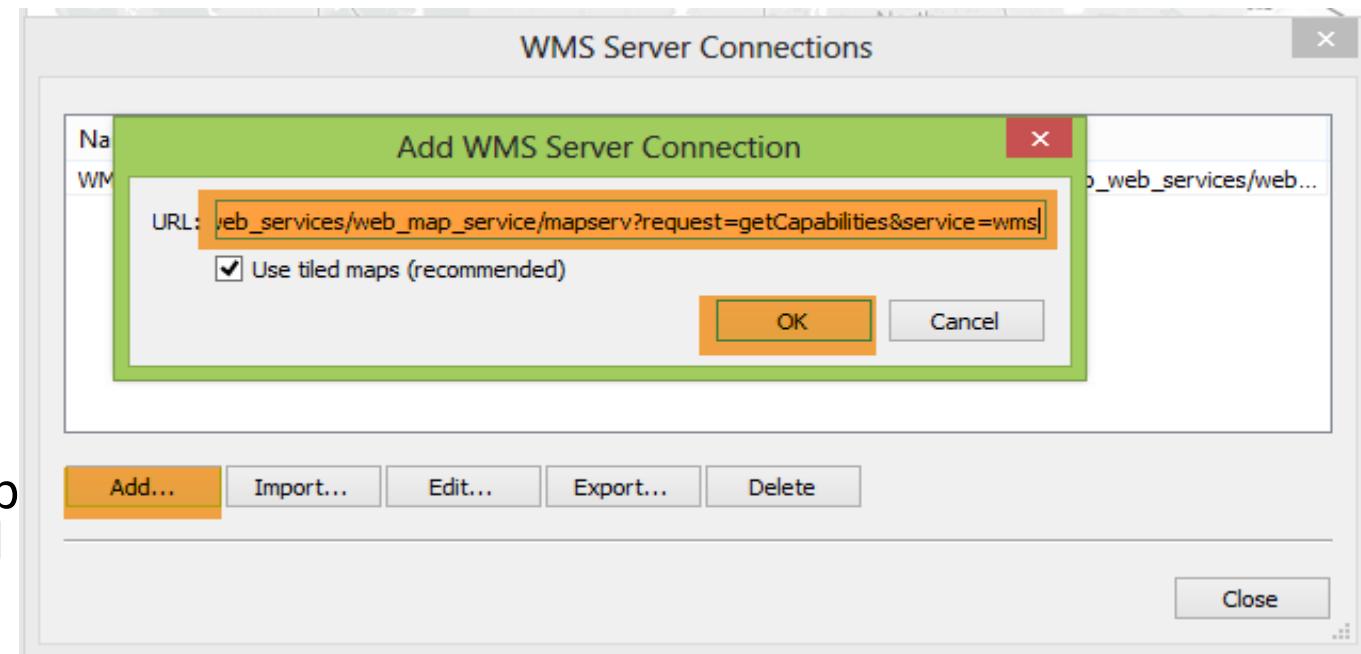
# Connecting with WMS Server:

- Step-1: Connect data to the Sample Superstore.
- Step-2: Double click on the state present in Dimensions pane.



# Connecting with WMS Server:

- Step-3: Now, click on the Maps < Backgrounds Maps< WMS Server

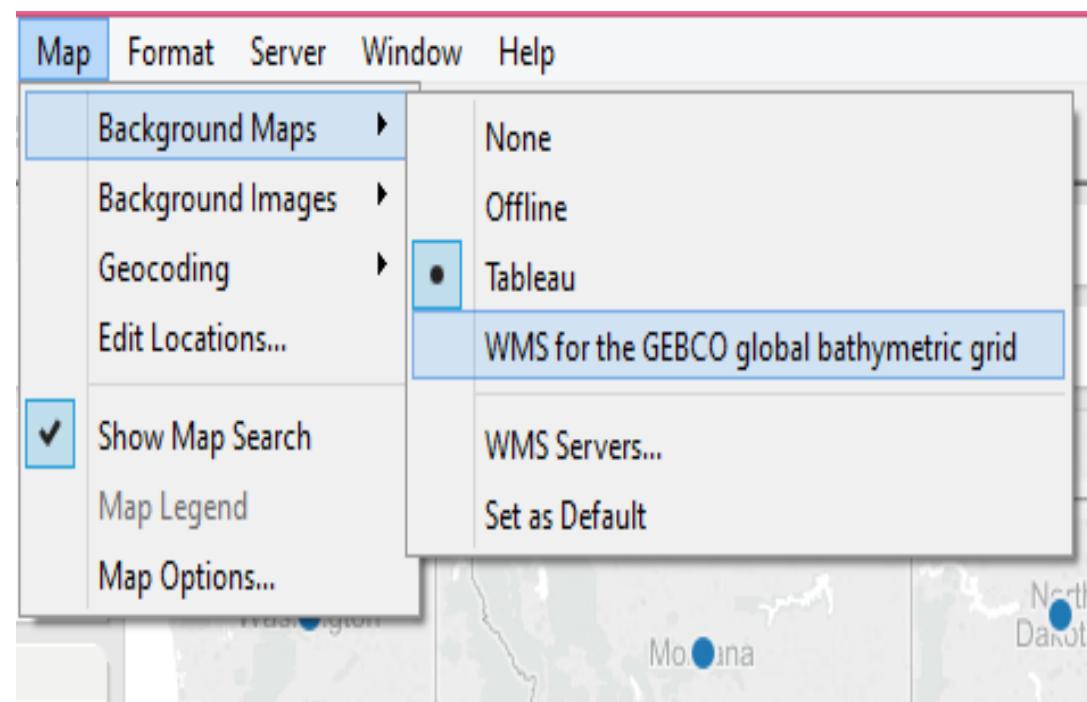


- Step  
and

Server

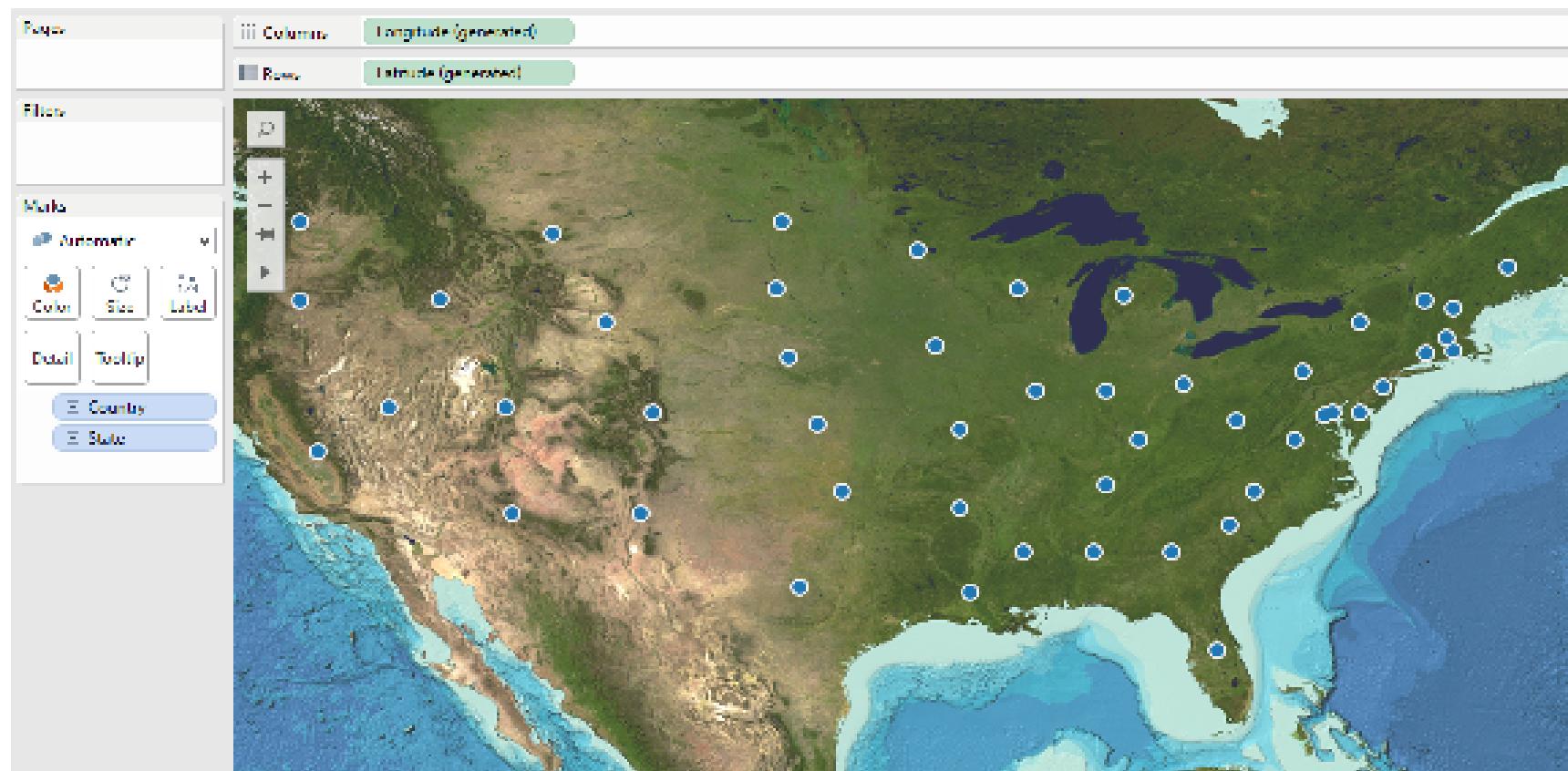
# Connecting with WMS Server:

- Step-6: Now click on Maps < Background Maps and select the server you recently added into tableau.



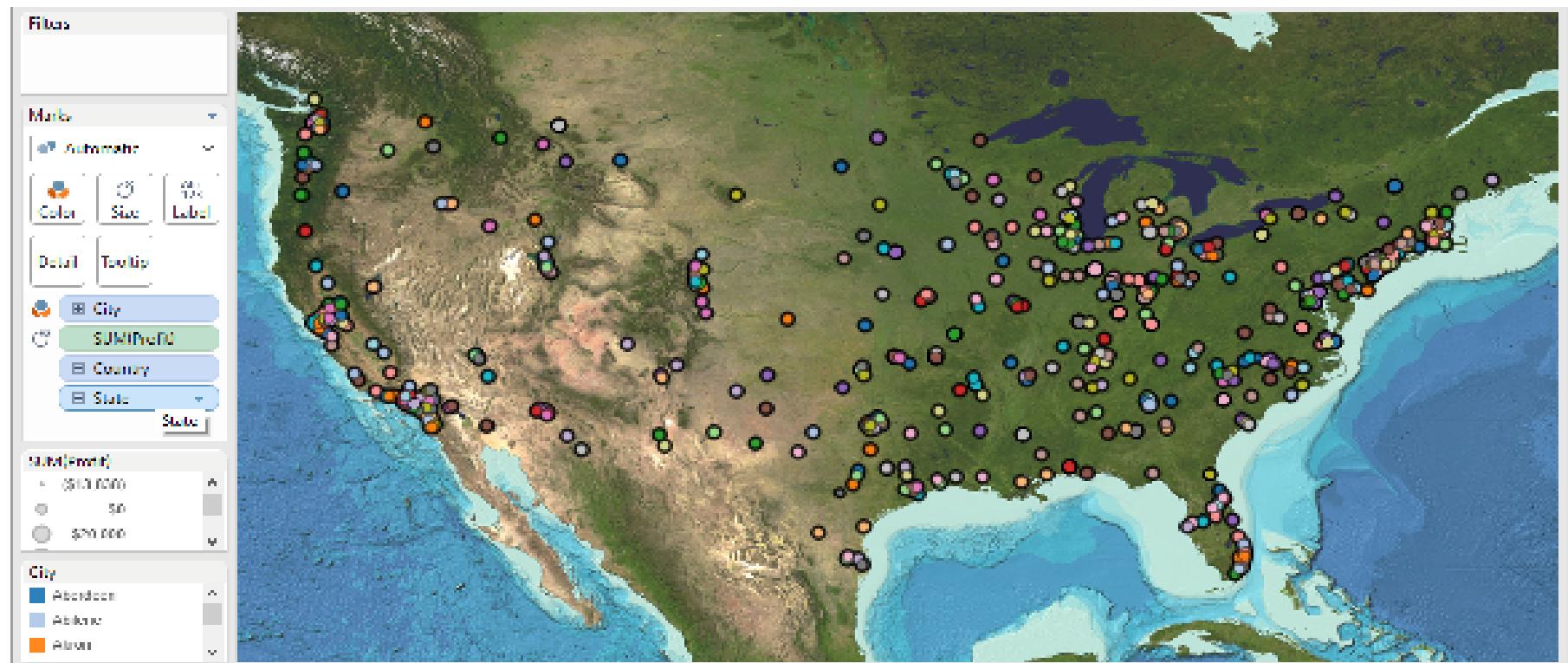
# Connecting with WMS Server:

- Step-7: Select the Server you added from Background maps



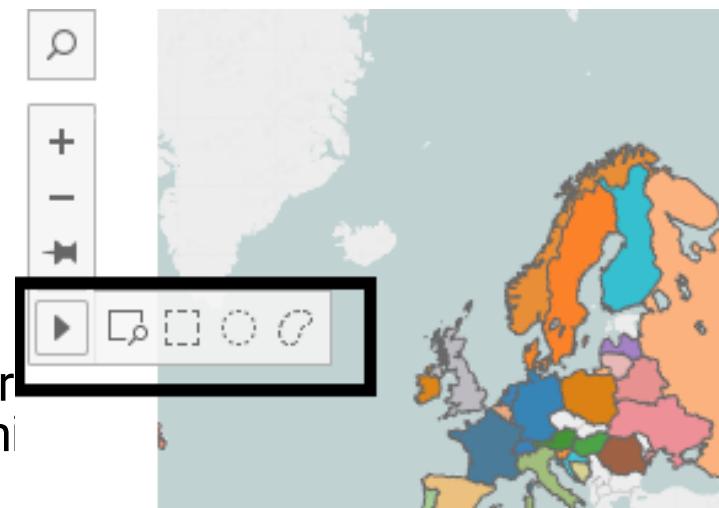
# Connecting with WMS Server:

- Step-8: Let's add some details to this visualization.
- Step-9: Place Profit in Size and City in Color.



# *Radial, Rectangular & Lasso Selection:*

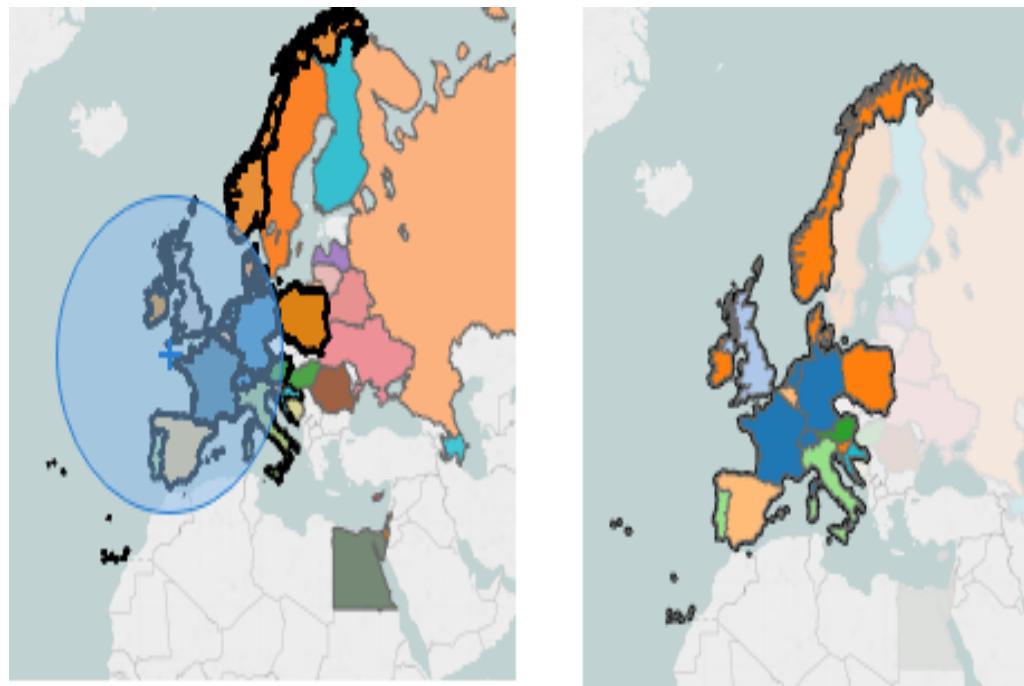
- Radial and Lasso Selection are the new features in the Tableau



- While we hover over the map, we can find this icons. Last two icons are used for filtering selected area.
- Last two icons in the Filtering icon are called as Radial and Lasso Selection icons.
- These two are newly added in the Tableau 9.0

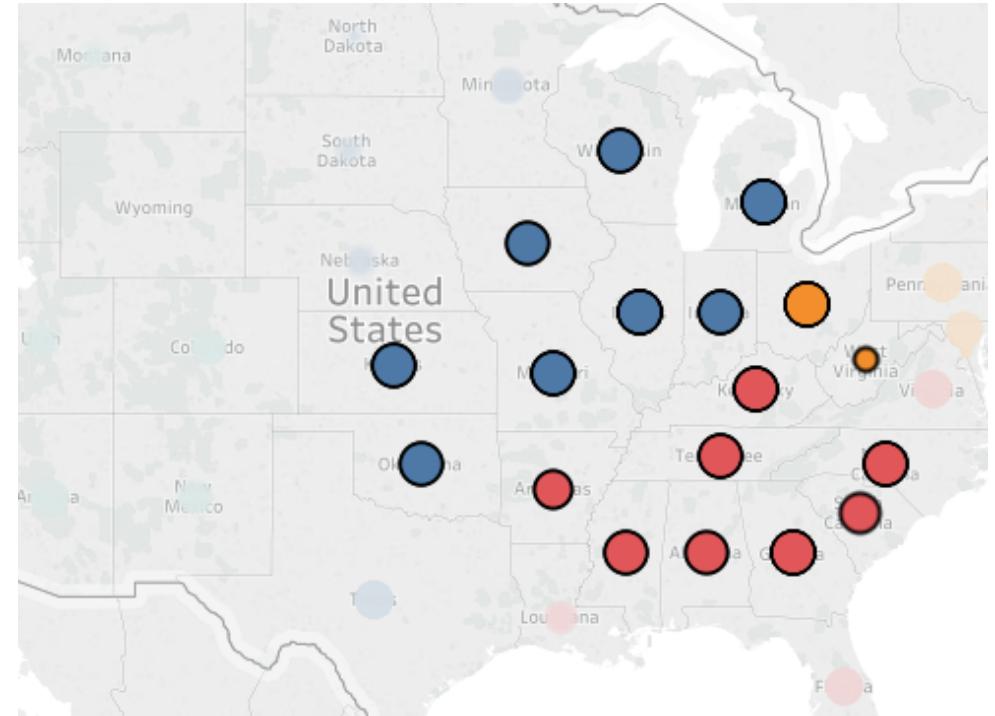
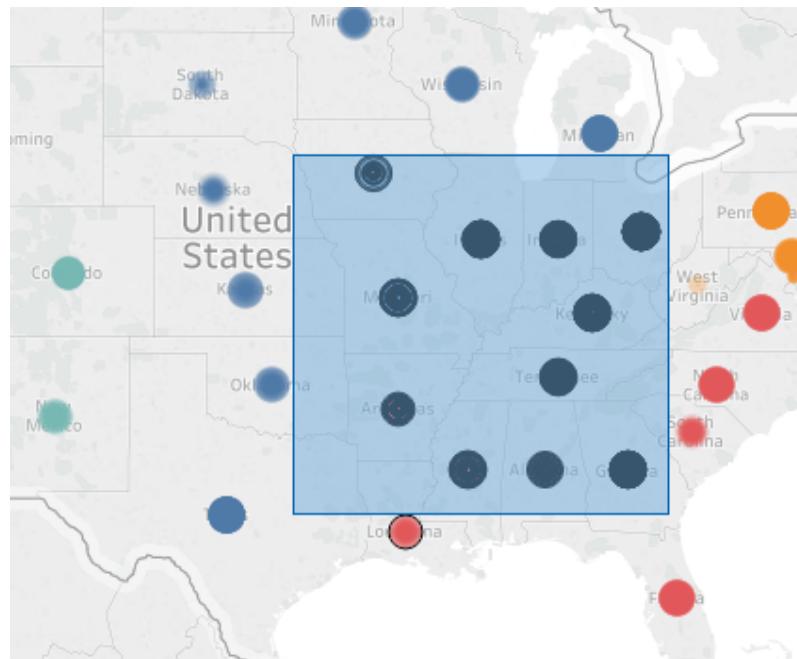
# *Radial, Rectangular & Lasso Selection:*

- Radial Selection:



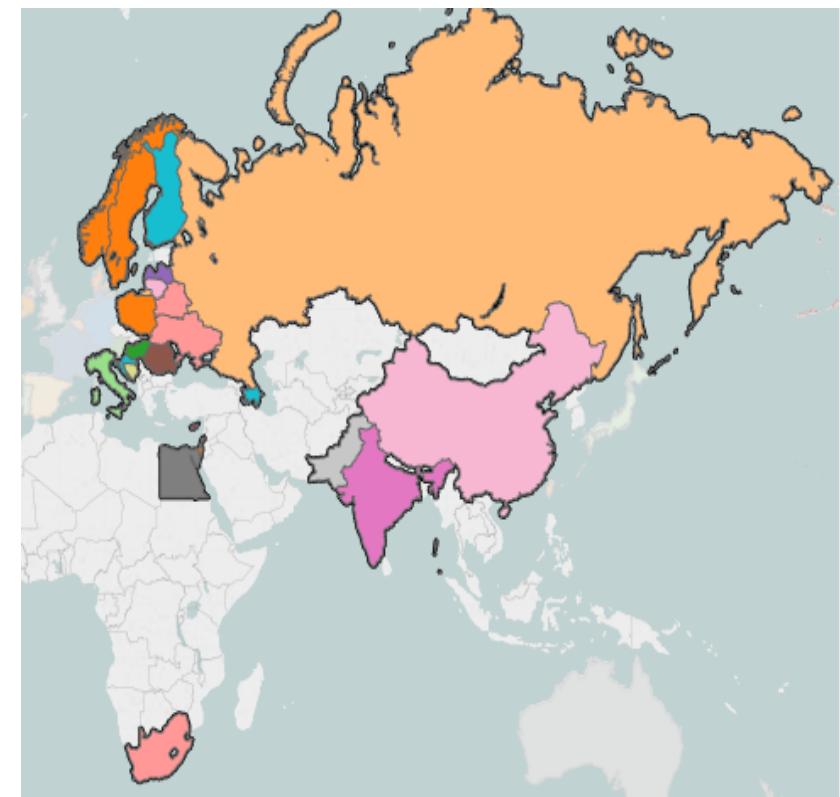
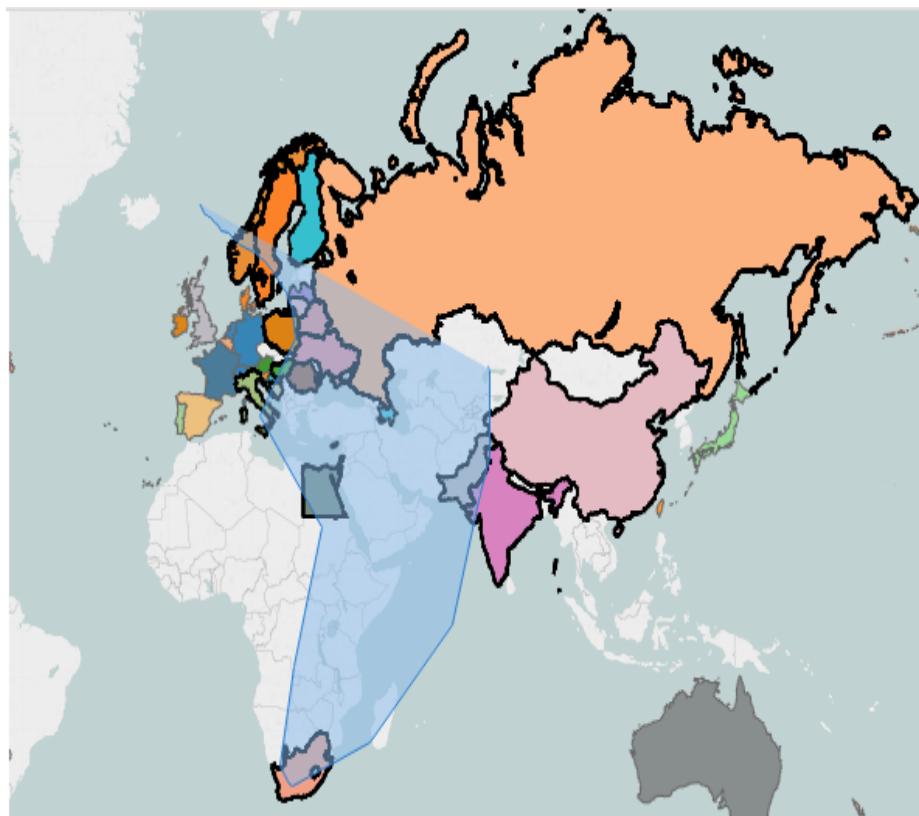
# *Radial, Rectangular & Lasso Selection:*

- Rectangular Selection:



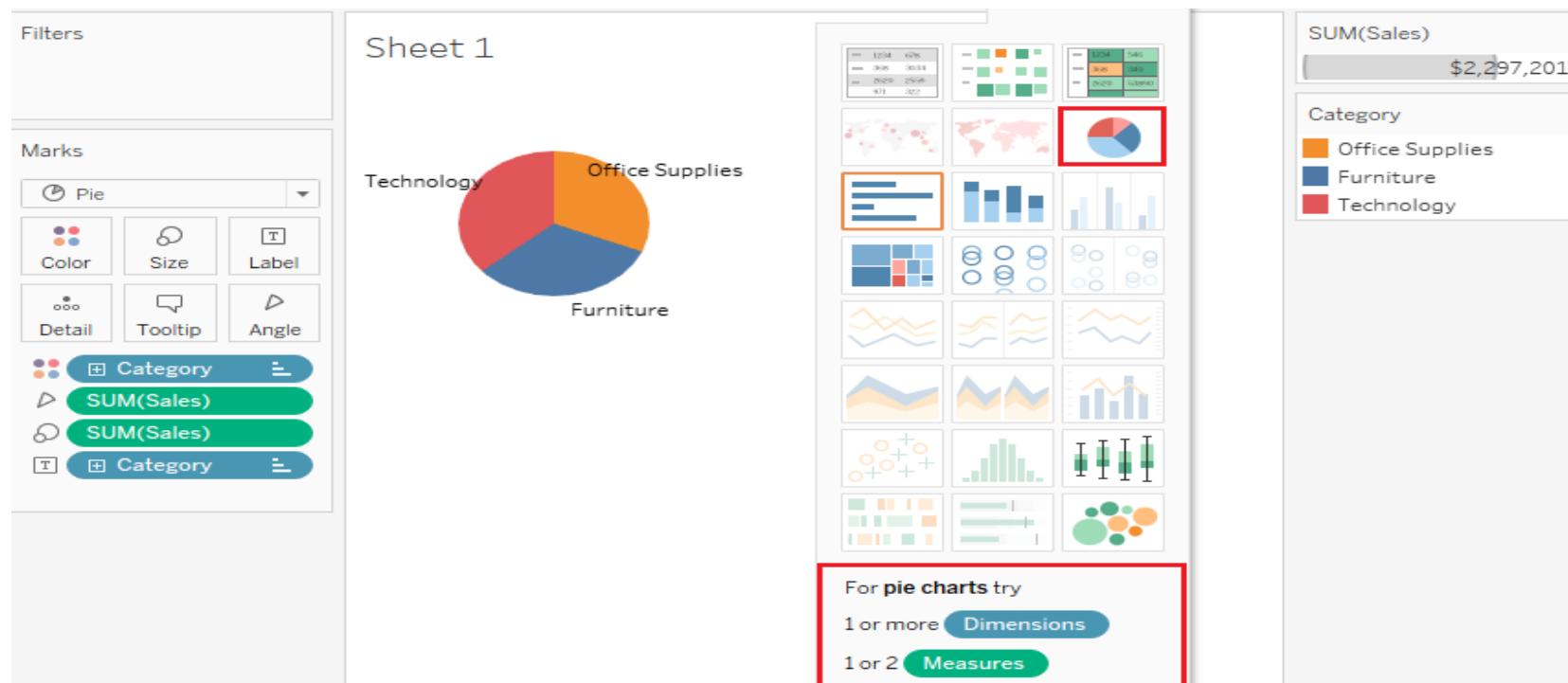
# *Radial, Rectangular & Lasso Selection:*

- Lasso Selection:



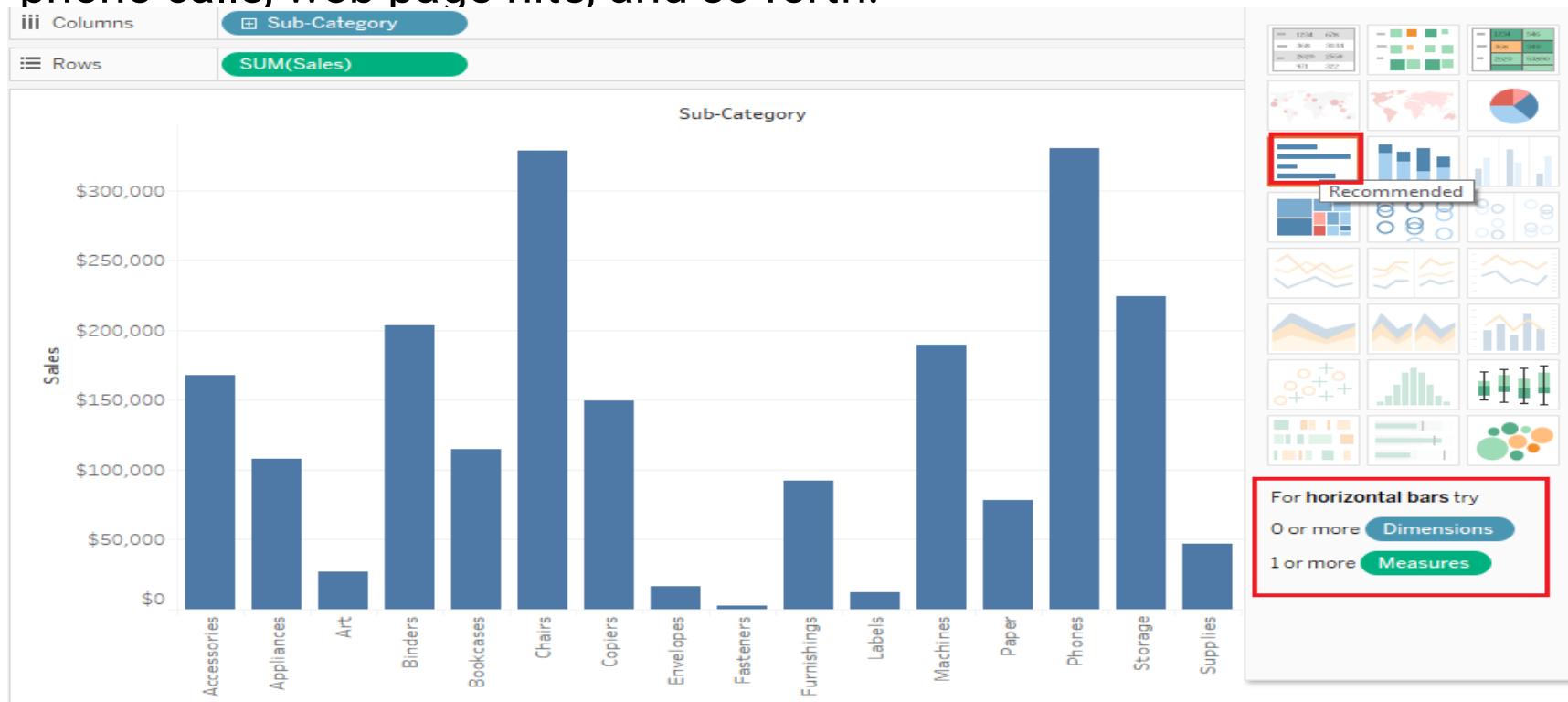
# Pie Chart

Although some authorities in visual design decry them (preferring, for example, stacked bar charts), *pie charts* remain a fixture of the visualization world. They are used to show a single measure for a smaller number of dimension members (not more than six or eight), illustrating what “piece of the pie”. Tableau provides the ability to populate a worksheet with a single pie chart, and even as a chosen mark type for other types of visualizations, such as maps.



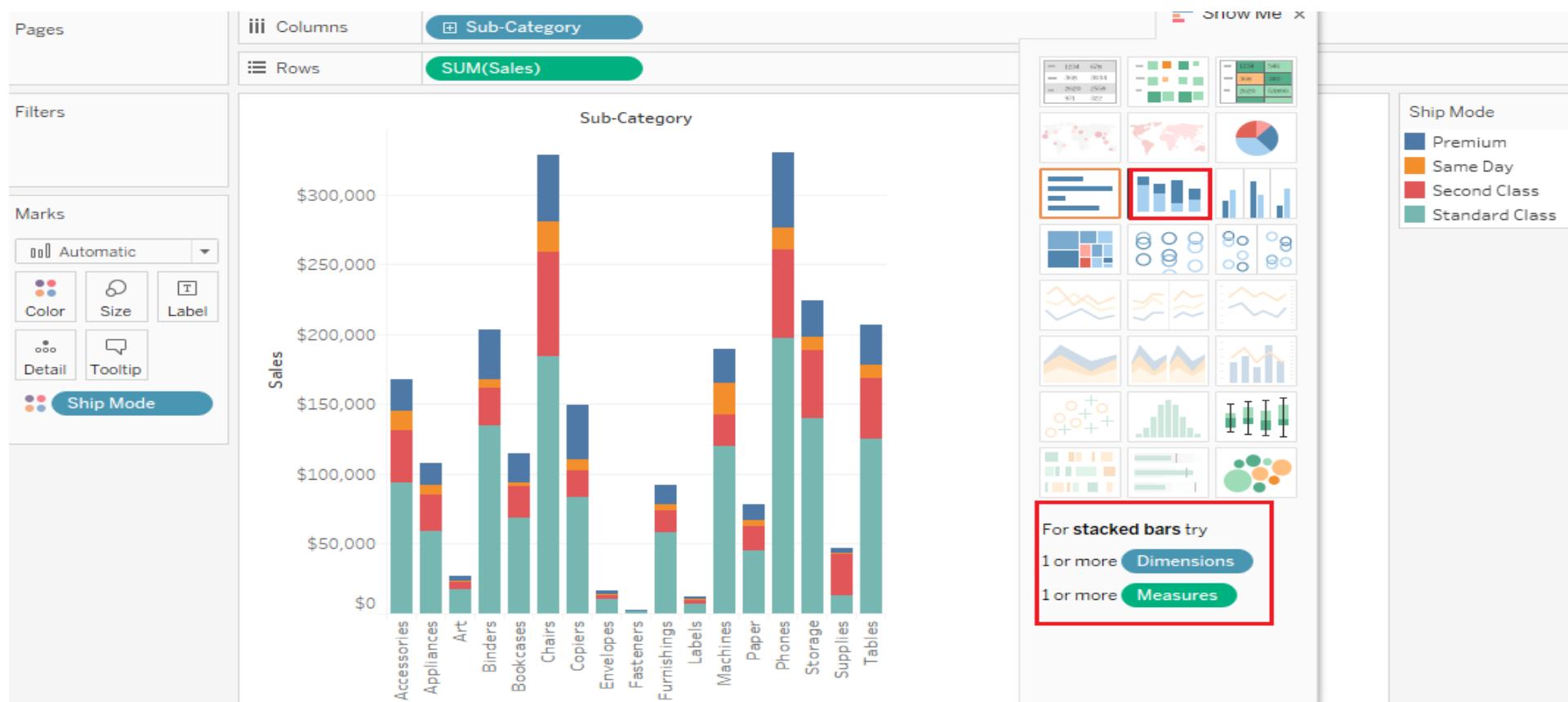
# Bar Chart

Despite all the visualization possibilities, and the plethora of tools to create charts and graphs, the basic *bar chart* is still probably used more than any other type. This is very useful for comparing many different types of measures, including dollars, quantities, number of phone calls, web page hits, and so forth.



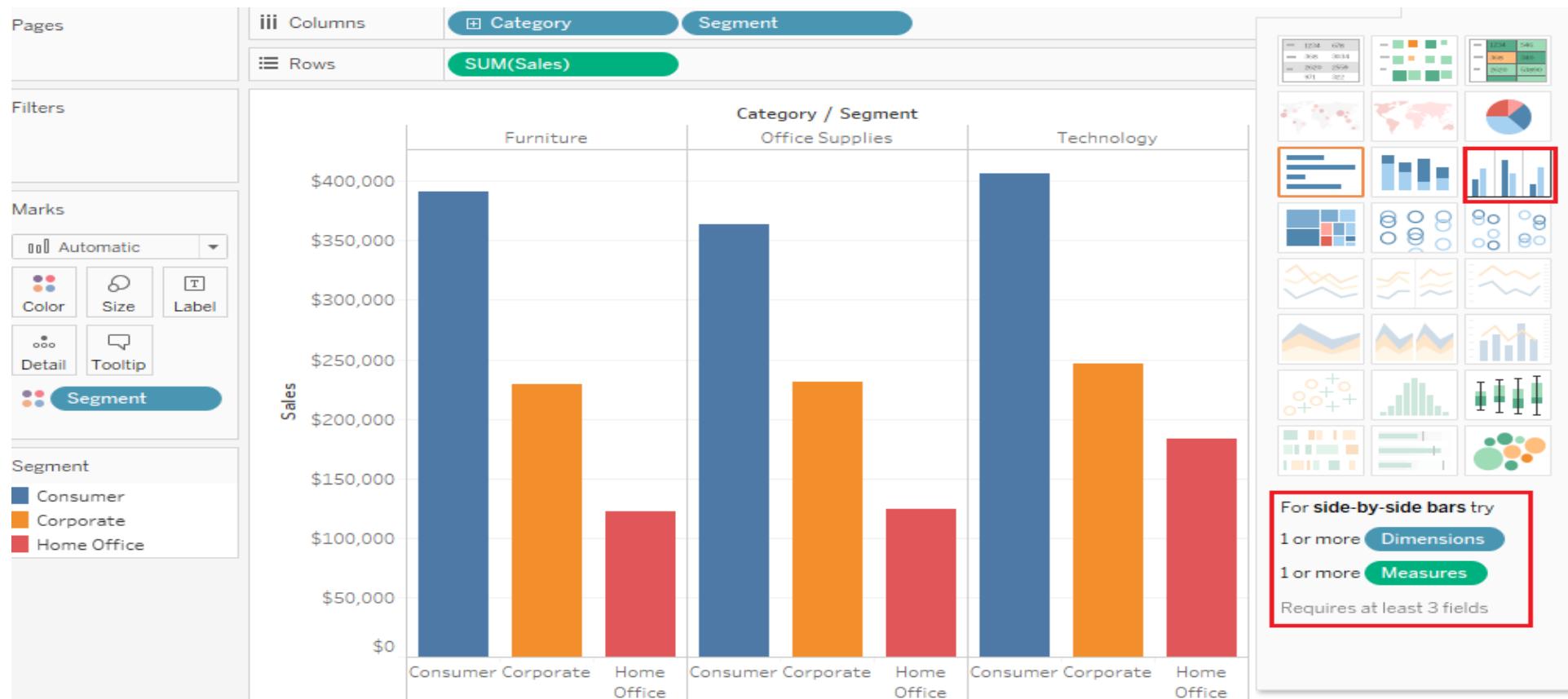
# Stacked Bar Chart

Here each bar is stacked based on the Dimension on the Color Shelf



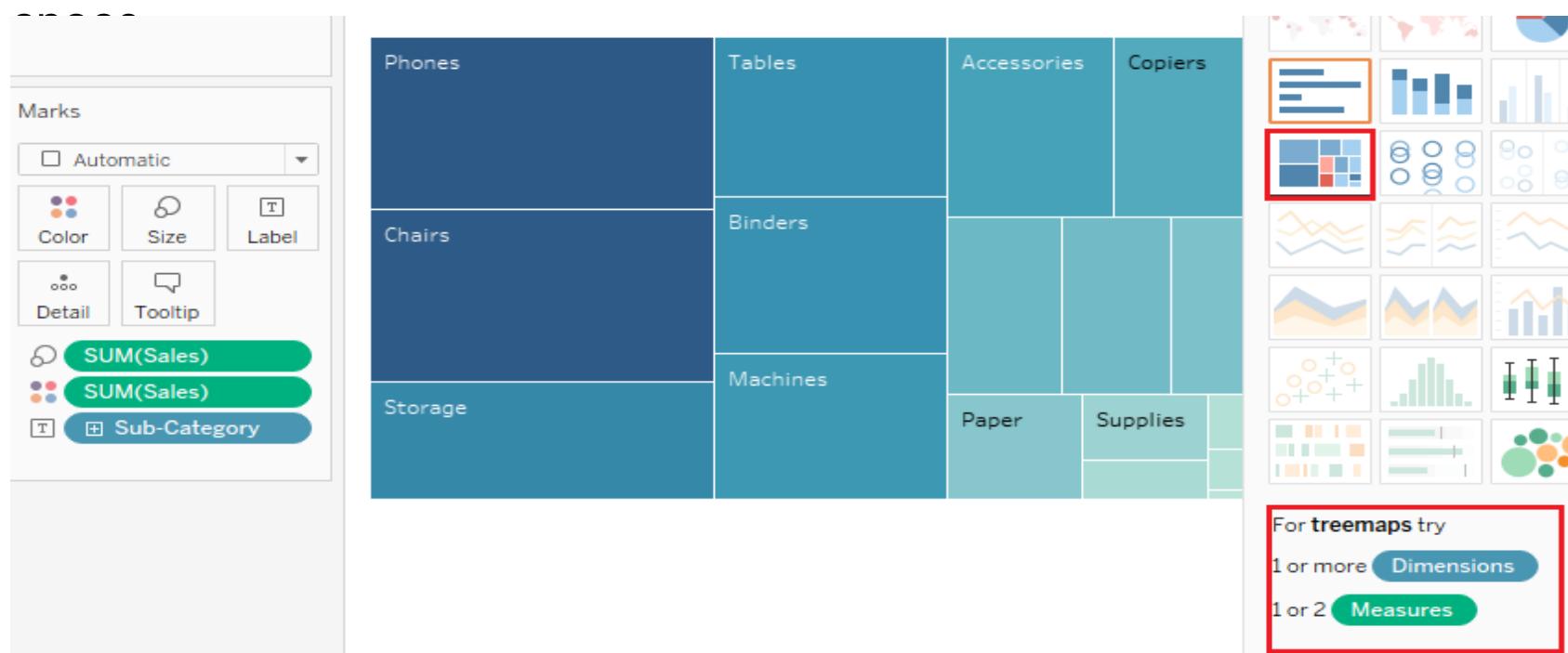
# Side by Side Bar Chart

Comparison between Dimensions based on Measure

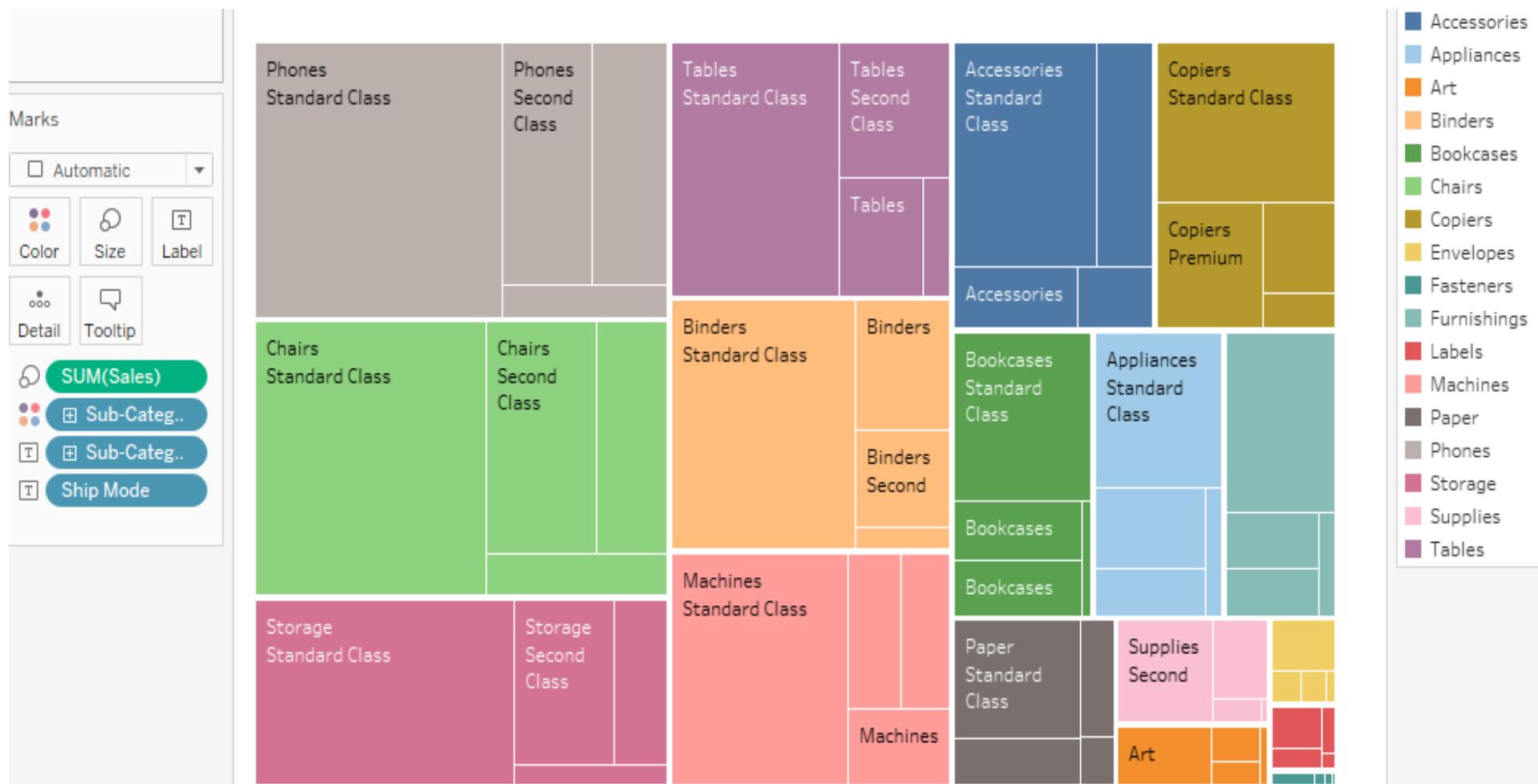


# Treemap

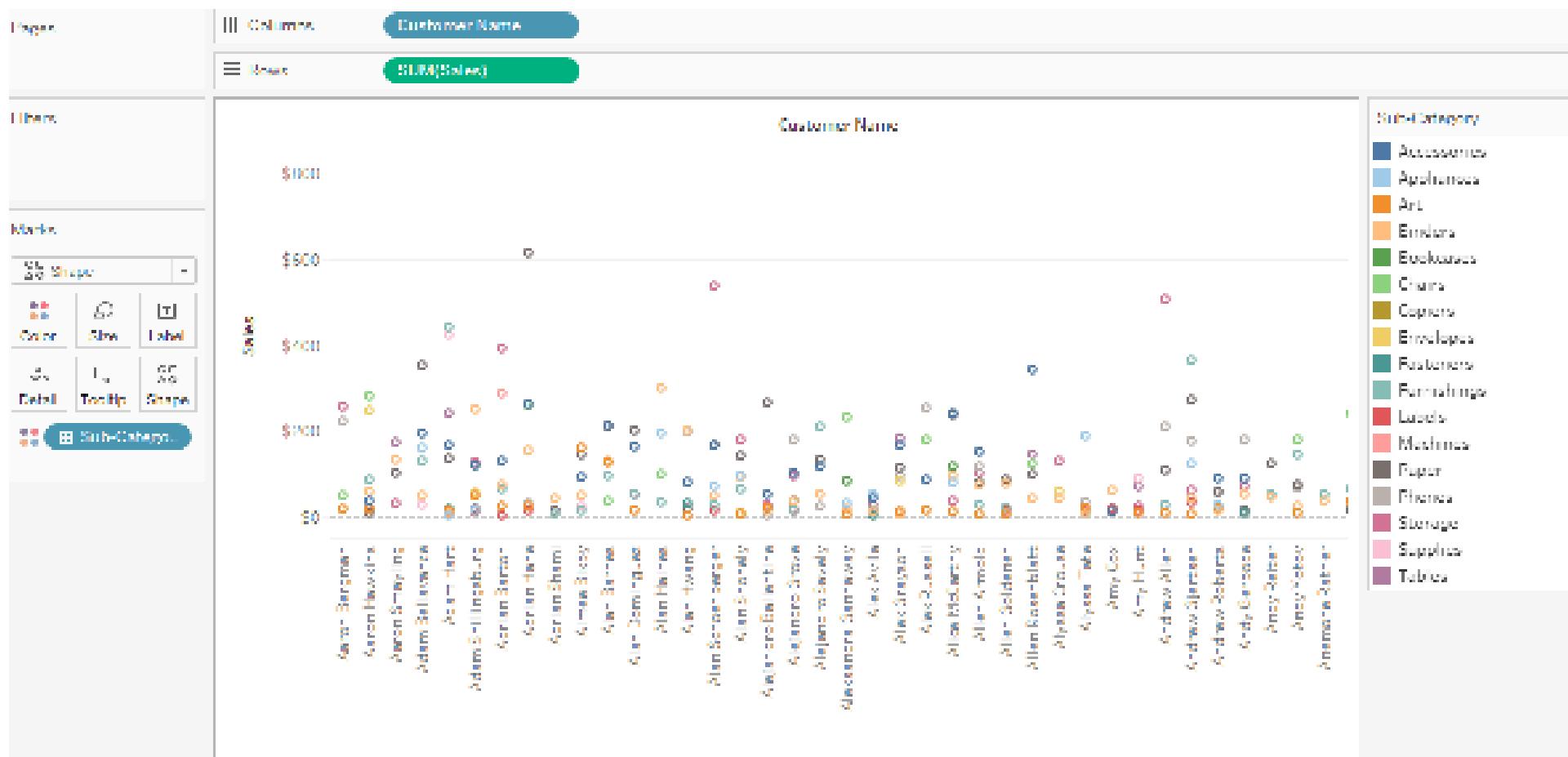
A tree map is designed to display hierarchical data as rectangles within rectangles. For each rectangle, two measures can be coded—one will affect the size of a rectangle, and the other will affect color. Tree map can display a large number of dimension members in a relatively small



# *Tree Maps:*



# *Circles Chart:*

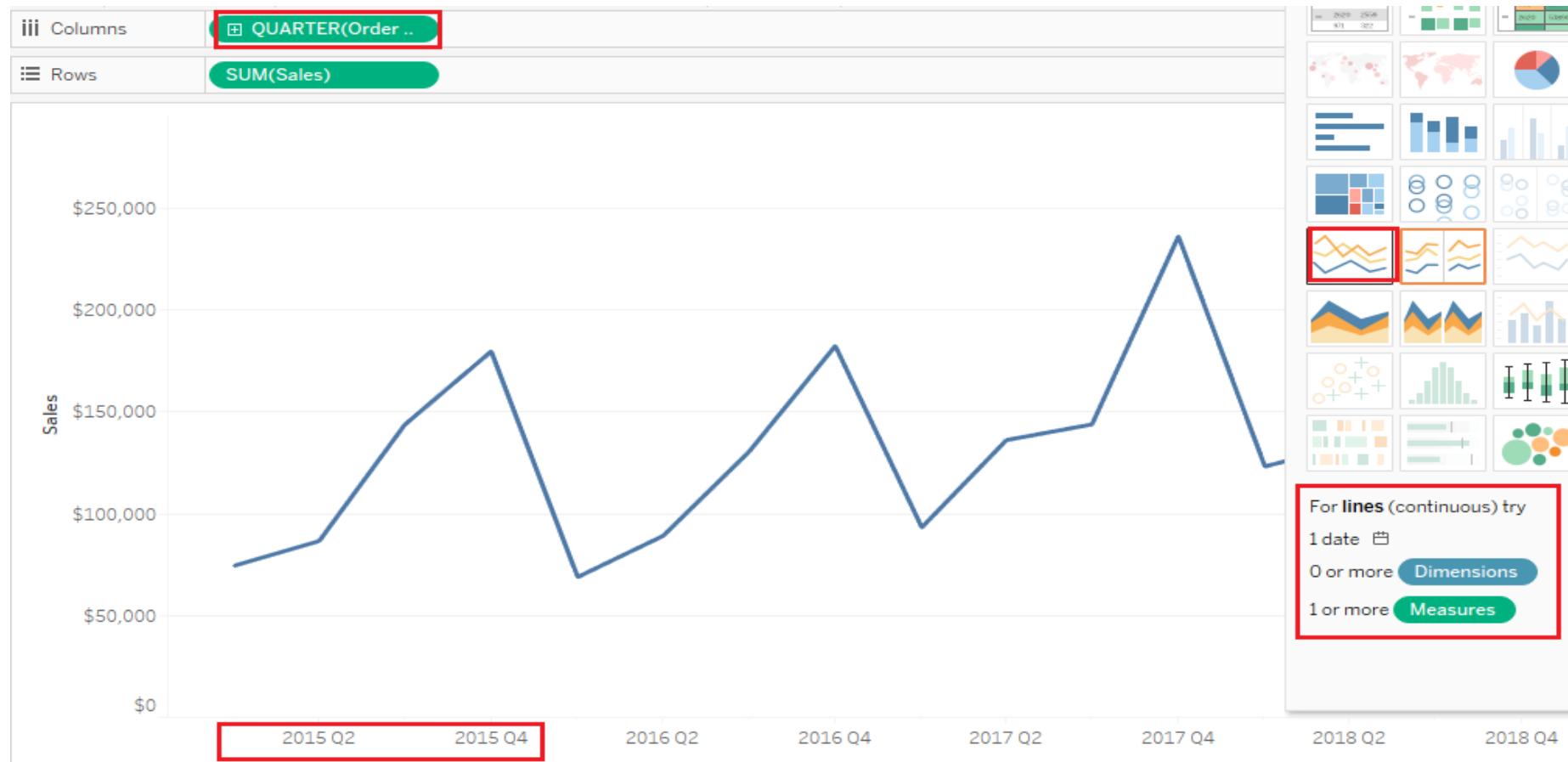


# *Side by Side Circles:*



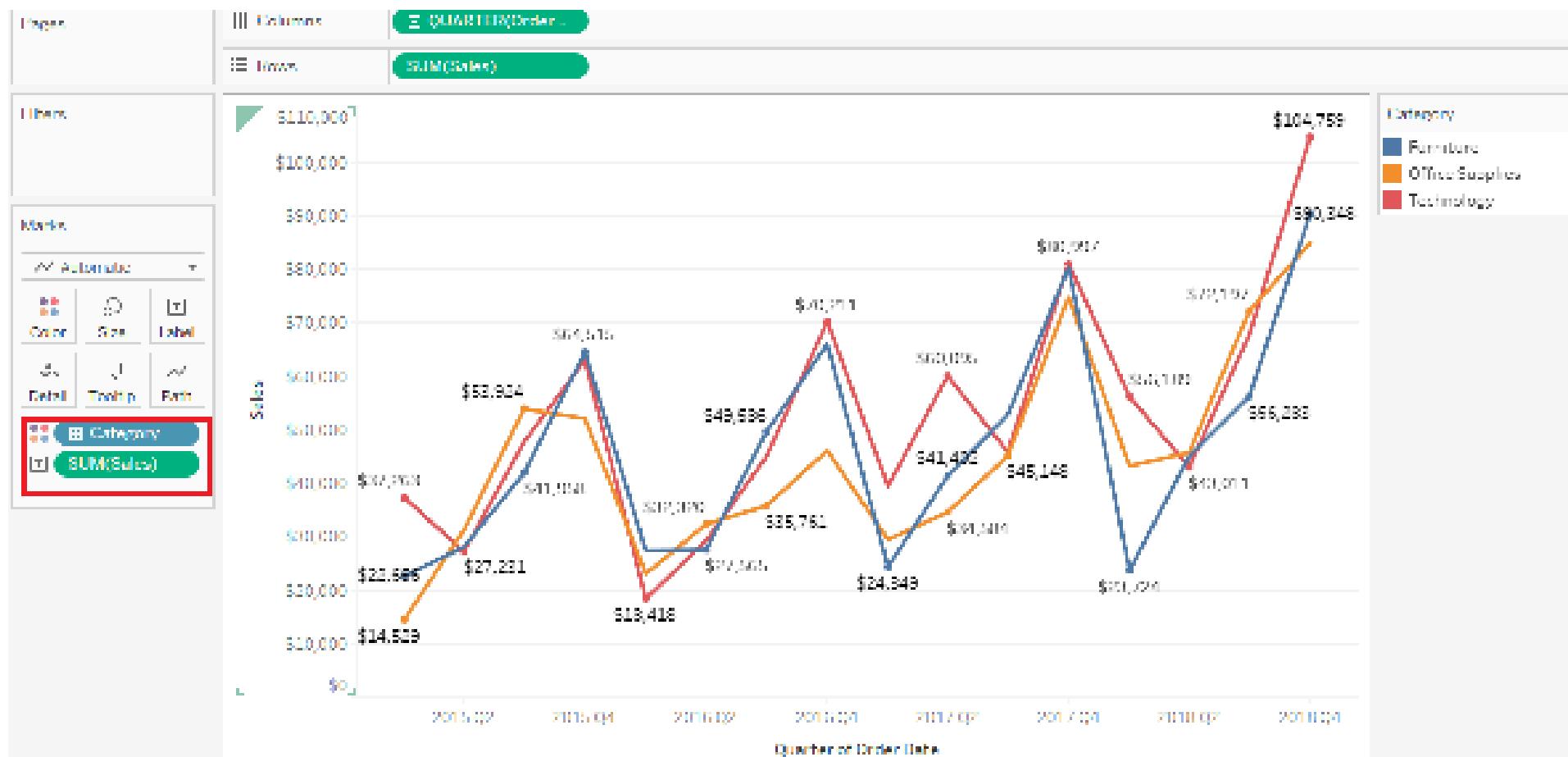
# Line Chart Continuous

- Line Chart gives the understanding of how the datapoints are connected to form a Line chart.



# Line Chart Continuous

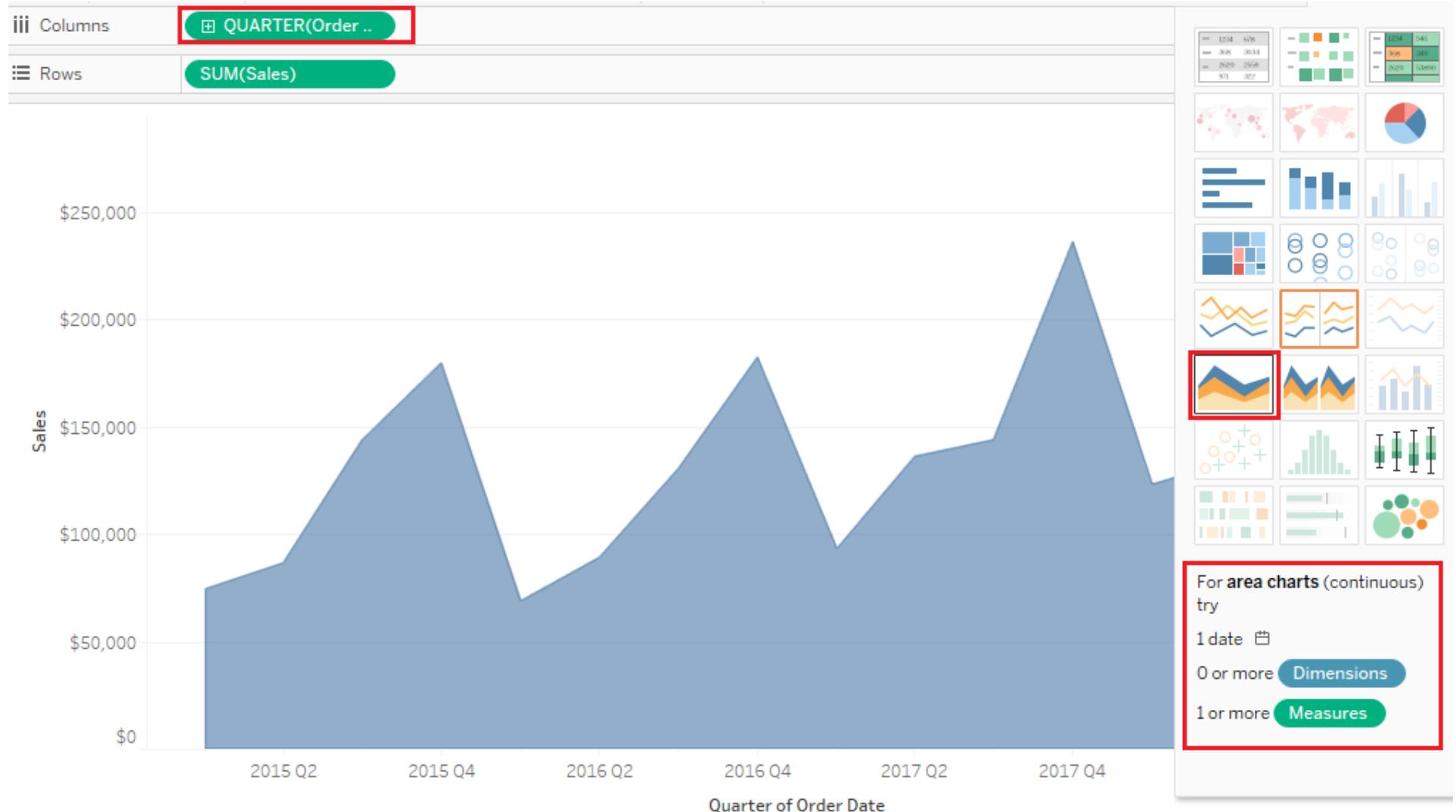
- Line Chart with added color lines which are obtained by adding Dimensions to the Color shelf



# Line Chart Discrete

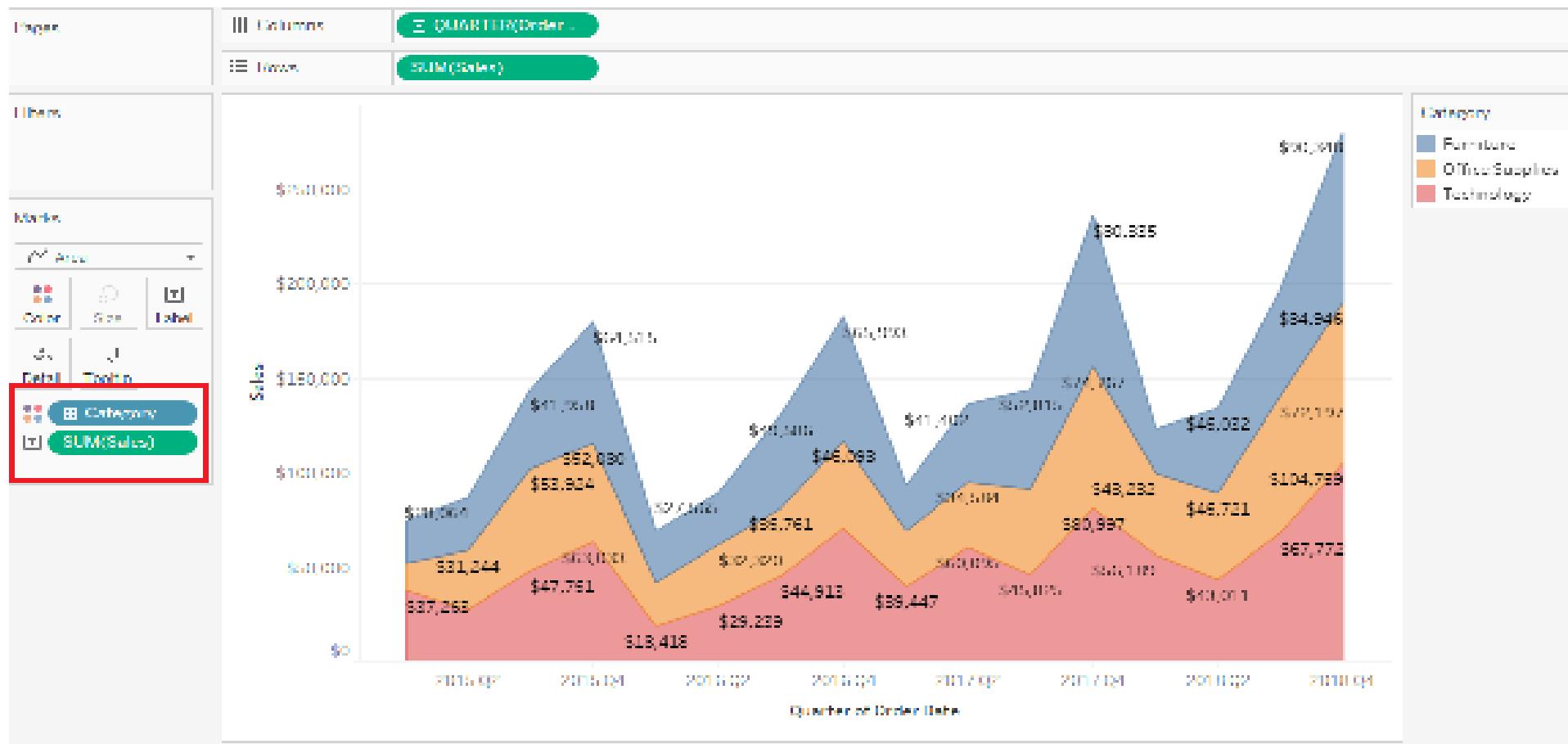


# Area Chart Continuous



# Area Chart Continuous

- Area Chart when Dimension is added on the Color Shelf give the feel of a Stacked Bar Chart



# Area Chart Discrete

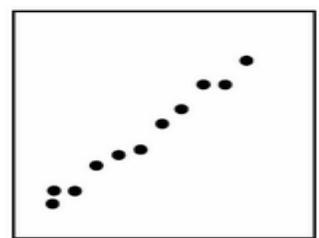


# What is Scatter Diagram

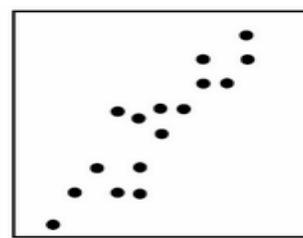
- Judge strength of relationship by width or tightness of scatter.
- Determine direction of the relationship, e.g. If X increases, and Y decreases, it is negative correlation, similarly if X increases, and Y increases, it is positive correlation

# What is Scatter Diagram

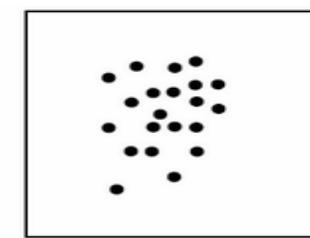
- Scatter diagrams or plots provides a graphical representation of the relationship of two continuous variables
- **Be Careful** - Correlation does not guarantee causation. Correlation by itself **does not imply a cause and effect relationship!**



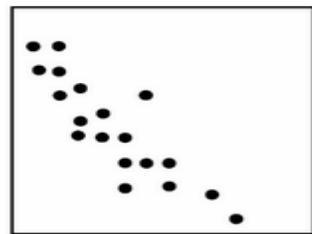
Strong positive correlation



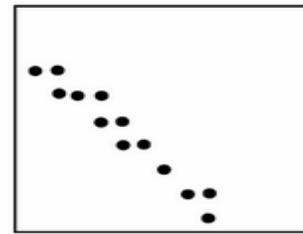
Moderate positive correlation



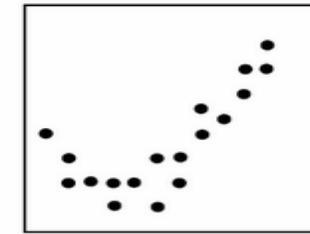
No correlation



Moderate negative correlation



Strong negative correlation



Curvilinear relationship

# Scatter plot in Tableau:

**8. Scatter Plot:** Although more esoteric than many of the standard chart types discussed in this chapter so far, the *scatter plot* can provide very meaningful visualization of two related numeric measures. There are, generally speaking, two different analyses that scatter plots help consider: comparison/correlation of the two measures, and existence of outliers. In most cases, one or more related dimensions are also used in a scatter plot.



# Correlation Analysis:

- Correlation Analysis measures the degree of linear relationship between two variables
  1. Range of correlation coefficient -1 to +1
  2. Perfect positive relationship +1
  3. No Linear relationship Perfect negative relationship -1
- If the absolute value of the correlation coefficient is greater than 0.85, then we say there is a good relationship
  - Example:  $r = 0.87$ ,  $r = -0.9$ ,  $r = 0.9$ ,  $r = -0.87$  describe good relationship
    - Example:  $r = 0.5$ ,  $r = -0.5$ ,  $r = 0.28$  describe poor relationship
  - Correlation values of -1 or 1 imply an exact linear relationship. However, the real value of correlation is in quantifying less than perfect relationships
  - We can perform regression analysis, which attempts to further describe this type of relationship, if the correlation is good between<sup>69</sup> the 2 variables

# Regression Analysis:

Regression Analysis + Correlation + Scatter Plots = Predict future performance using past results

- While Correlation explains the degree of linear relationship that exists between two variables, Regression defines the relationship more precisely and we use it when there is existing data over a period of time
- Regression analysis is a tool that uses data on relevant variables to develop a prediction equation, or model
- It generates an equation to describe the statistical relationship between one or more predictors and the response variable and to predict new observations
- In Simple Linear Regression, a single variable "X" is used to define/predict Y

E.g. Used car cost =  $B_1 + (B_2) \times (\text{Miles driven}) + E$  (error)

1. Simple Regression Equation :  $Y = B_1 + (B_2) * (X) + E$  (error)
2.  $Y = mx + c + e$
3.  $m$  = slope,  $c$  = constant/intercept,  $e$  = error

# Regression Analysis:

- **R-squared**-also known as Coefficient of determination, represents the % variation in output (dependent variable) explained by input variables/s or Percentage of response variable variation that is explained by its relationship with one or more predictor variables
- Higher the R<sup>2</sup>, the better the model fits your data
- R<sup>2</sup> is always between 0 and 100%
- R squared is between 0.65 and 0.8 => Moderate correlation
- R squared in greater than 0.8 => Strong correlation

# Regression Analysis:

- **Prediction and Confidence Interval** are types of confidence intervals used for predictions in regression and other linear models
- Prediction Interval: Represents a range that a single new observation is likely to fall given specified settings of the predictors
- Confidence interval of the prediction: Represents a range that the mean response is likely to fall given specified settings of the predictors
- The prediction interval is always wider than the corresponding confidence interval because of the added uncertainty involved in predicting a single response versus the mean response

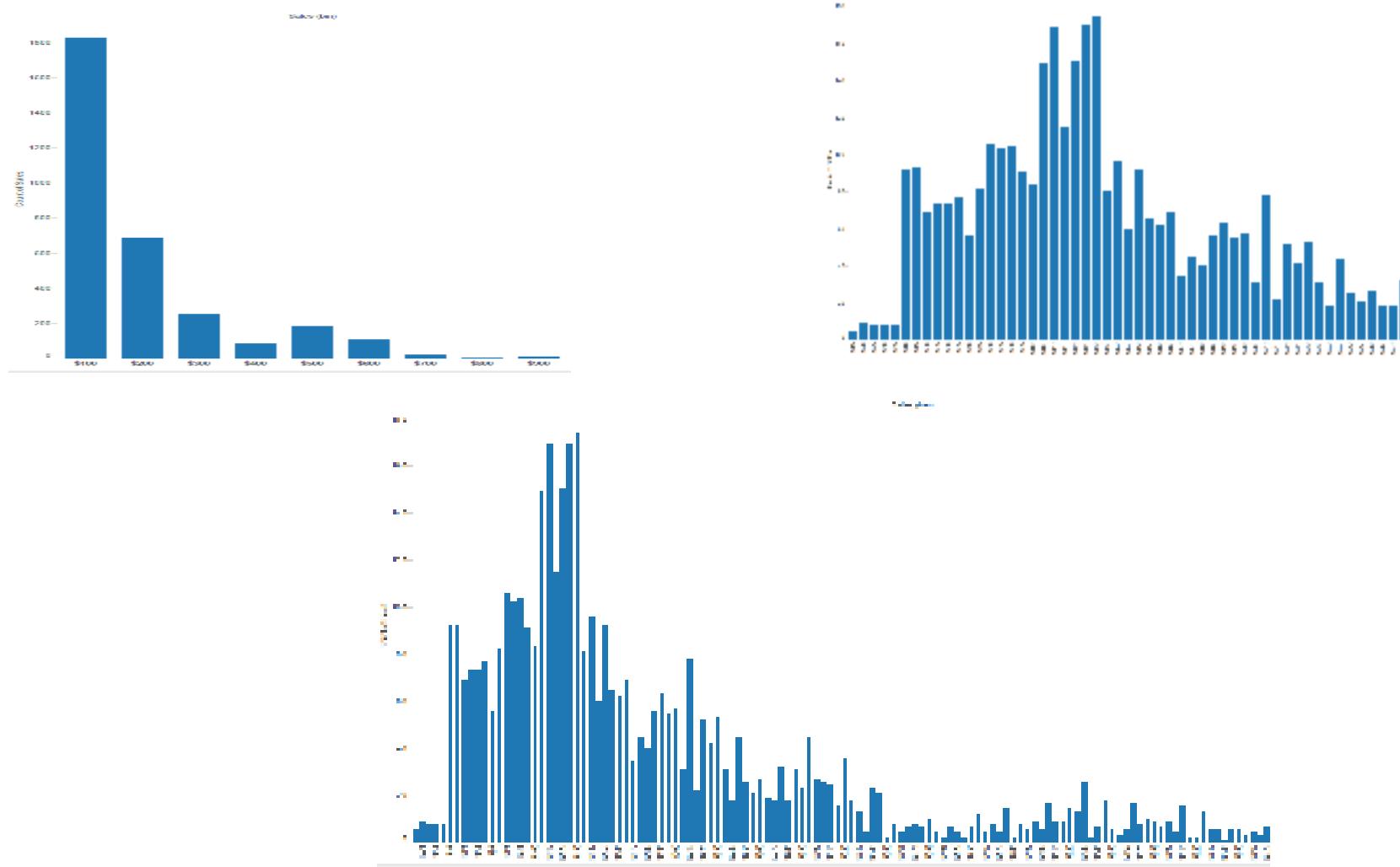
# What are Histograms?

- The classic display for the distribution is the histogram
- Tableau will quickly create a histogram for you in about 5 seconds.
- BUT – you will need to do some experimenting with it to get the histogram not wrong
  - Most importantly with “bin size”

# Bin Sizes in Tableau:

- By default, Tableau creates bins based upon the overall range.
- However, these bins are only sometimes the right size.
- You should experiment with bin size until the bins help you tell your story (without lying).
  - Changing bin size
  - Creating custom bins

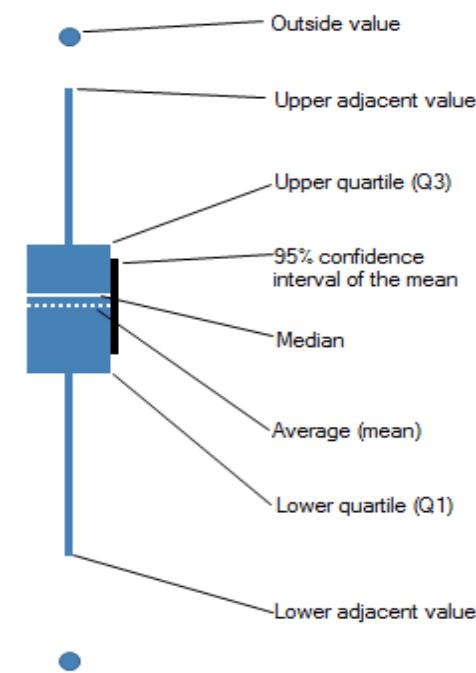
# Bin Sizes in Tableau:



# What is Box Plot?

A simple way of representing statistical data on a plot in which a rectangle is drawn to represent the second and third quartiles, usually with a vertical line inside to indicate the median value. The lower and upper quartiles are shown as horizontal lines either side

- Minimum value – the smallest value in the data set
- Second quartile – the value below which the lower 25% of the data are contained
- Median value – the middle number in a range of numbers
- Third quartile – the value above which the upper 25% of the data are contained
- Maximum value – the largest value in the data set

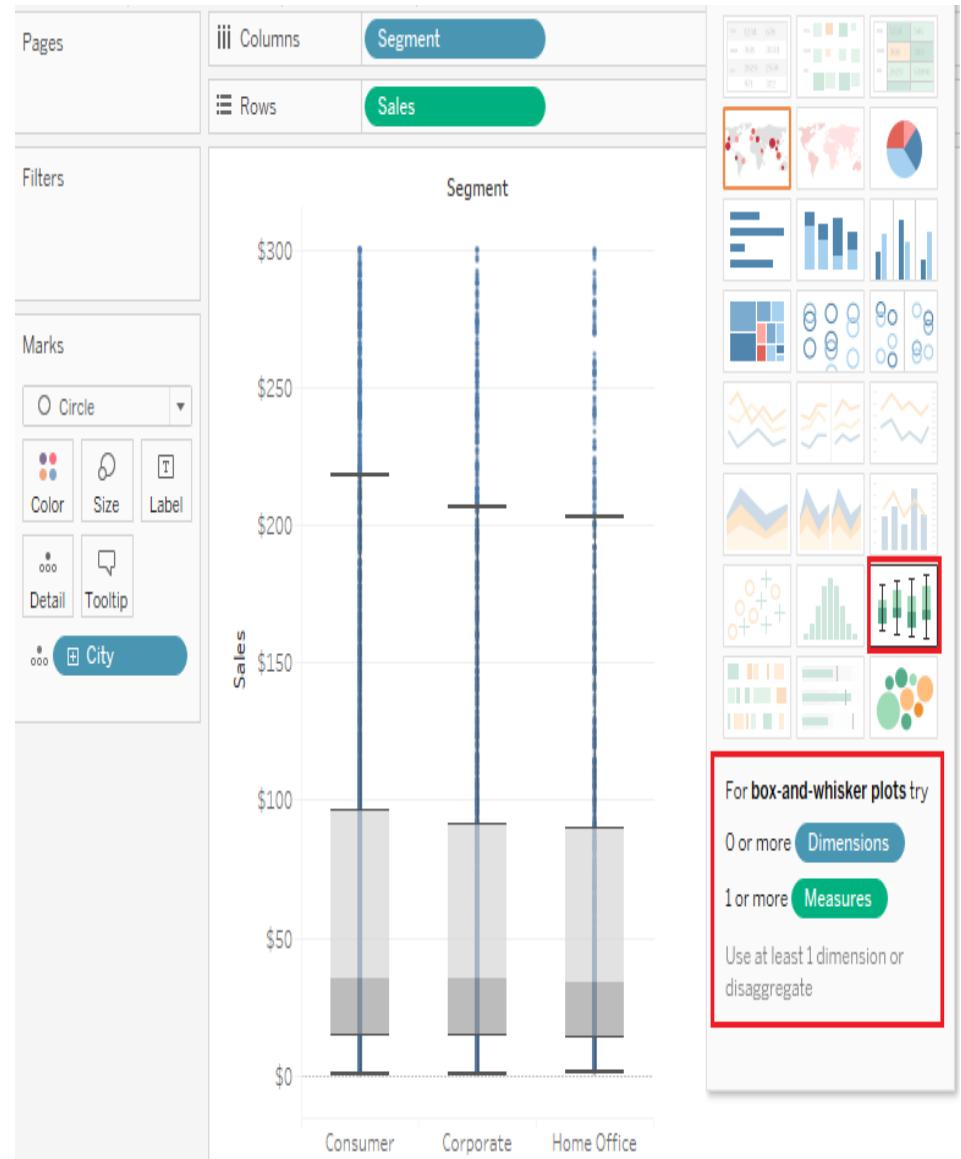


# Why to use Box Plots?

- Box and whisker plots are very effective and easy to read. They summarize data from multiple sources and display the results in a single graph. Box and whisker plots allow for comparison of data from different categories for easier, more effective decision-making.

# Box Chart in Tableau:

Although it may not be found as frequently as bar, line, and pie charts, the *box plot* is a very useful visualization when circumstances demand it. Introduced in the mid-1970s by the statistician John Tukey, the box plot excels at displaying the distribution of data over a range. You can easily determine where the heaviest concentration of data elements is in the range, and optionally, you can easily identify outliers.



# Pareto Chart:

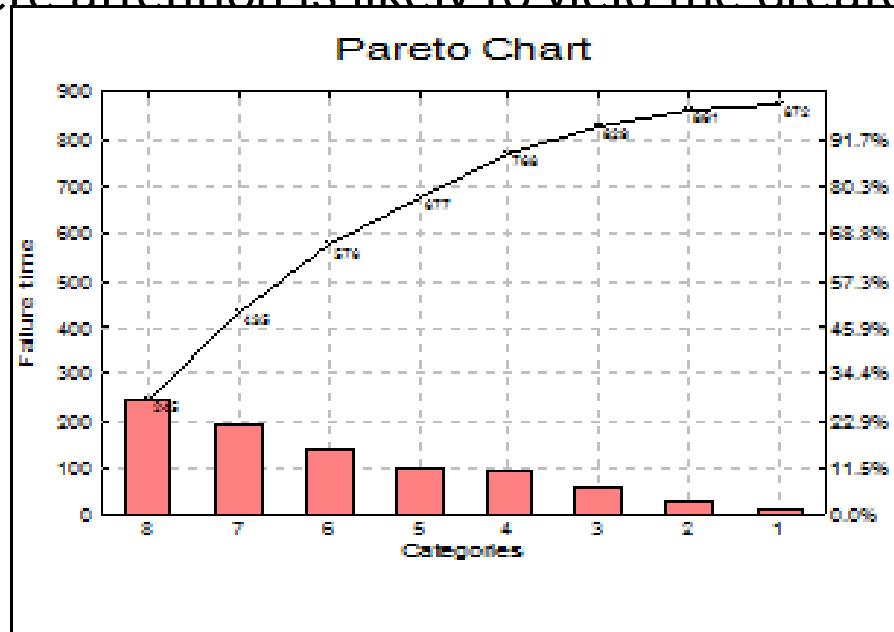
## *What is a Pareto Chart?*

A Pareto chart, also called a Pareto distribution diagram, is a vertical bar graphs in which values are plotted in decreasing order of relative frequency from left to right. Pareto charts are extremely useful for analyzing what problems need attention first because the taller bars on the chart, which represent frequency, clearly illustrate which variables have the greatest cumulative effect on a given system.

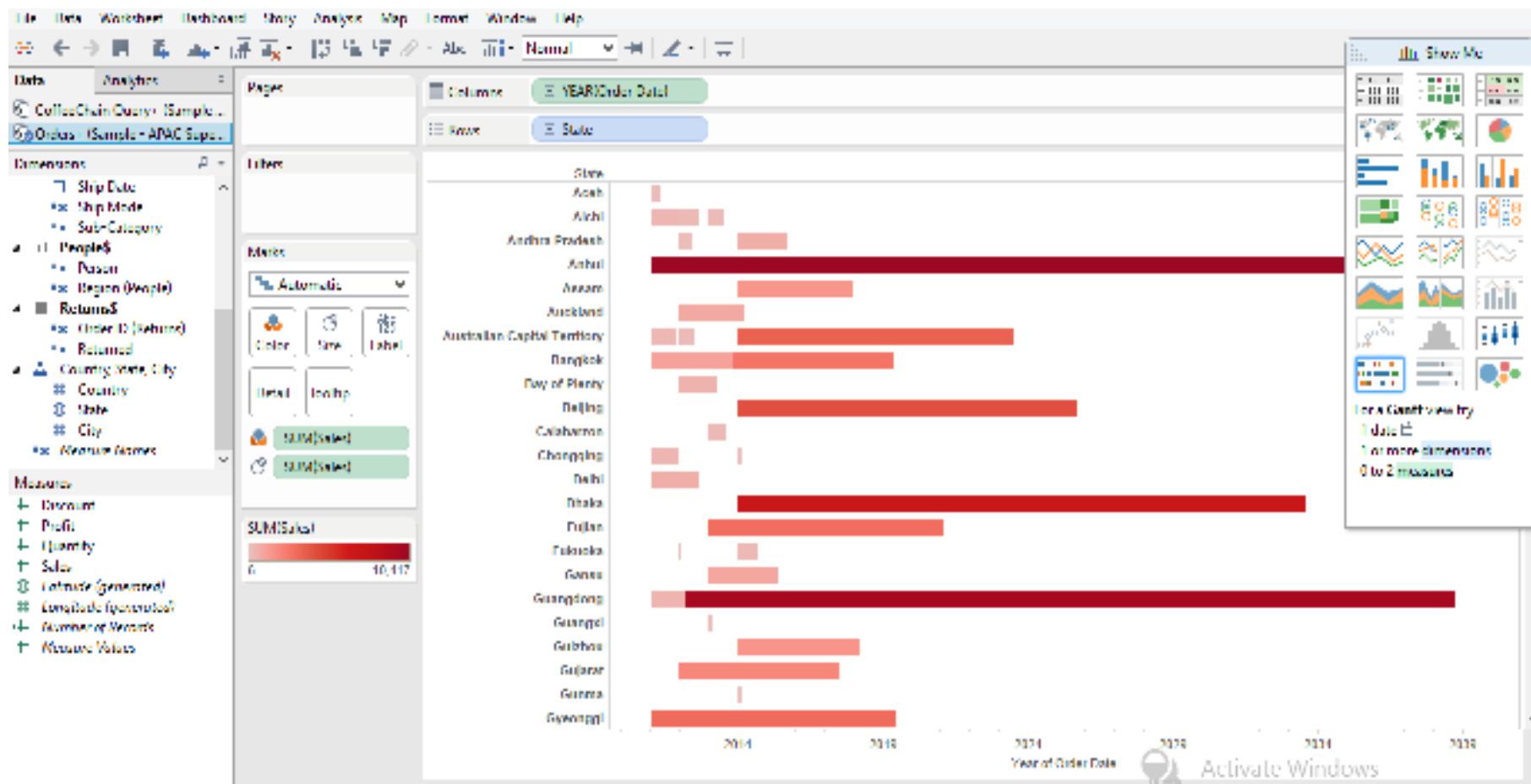
The Pareto chart provides a graphic depiction of Pareto Principle a theory maintaining that 80% of the output in a given situation or system is produced by 20% of the input.

# Pareto Chart:

Pareto Chart is a point-to-point graph, which shows the cumulative relative frequency, may be superimposed on the bar graph. Because the values of the statistical variables are placed in order of relative frequency, the graph clearly reveals which factors have the greatest impact and where attention is likely to yield the greatest benefit.

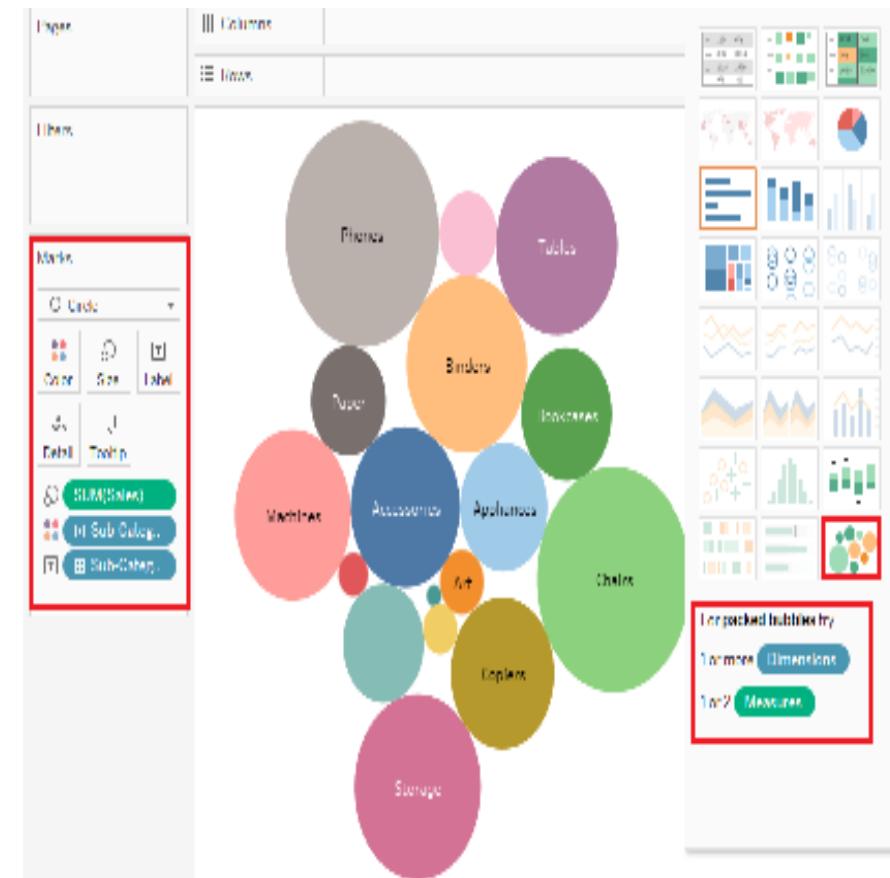


# Gantt View:



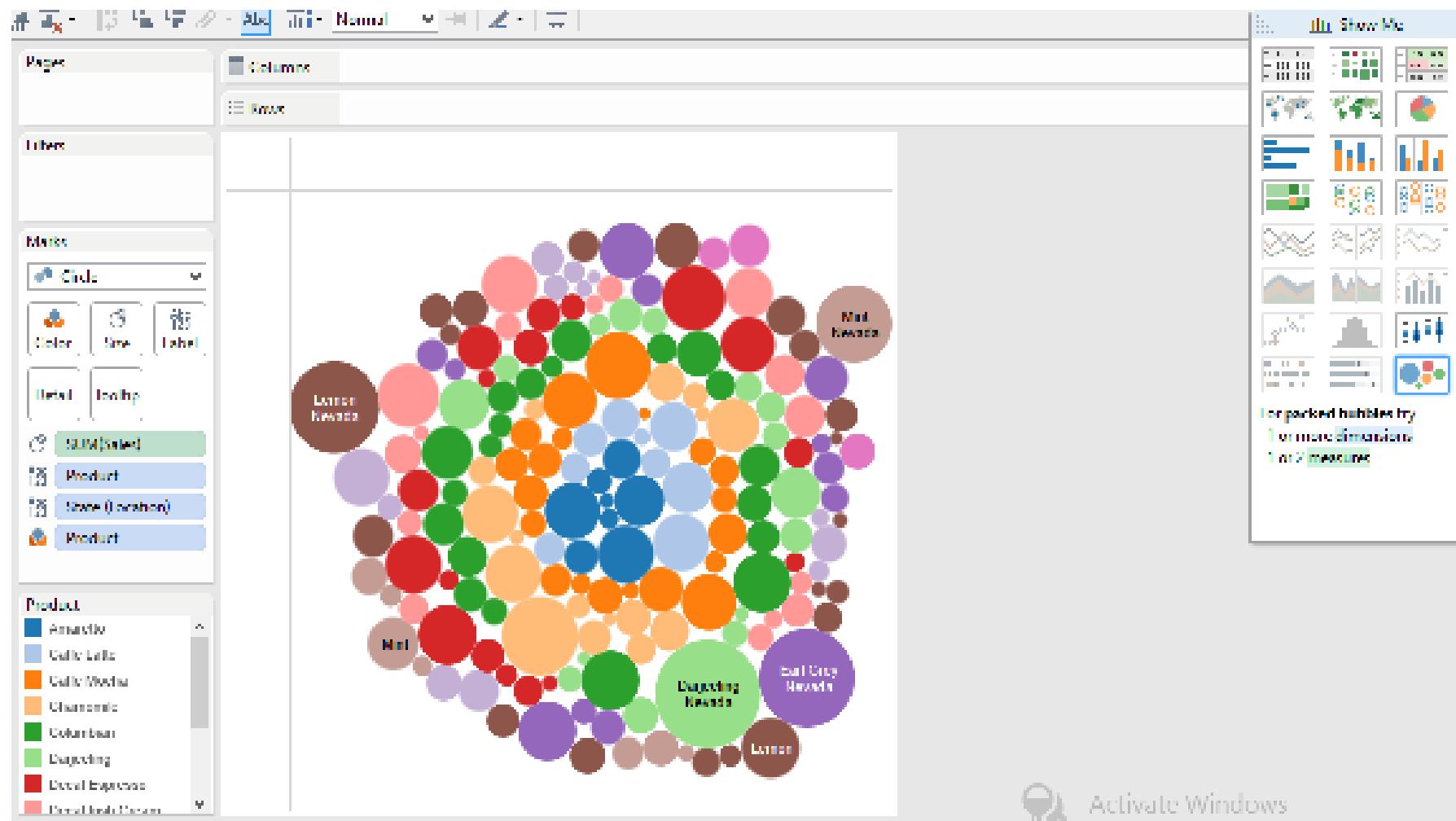
# Bubble Chart in Tableau:

*Tableau* can create two variations of a chart designed to visualize a comparison of size and color of a numeric measure. By displaying varying sizes and colors in filled circles, the *bubble chart* leads to quick comparison and correlation of the chosen metric. One Tableau bubble chart is a variation on the scatter plot (discussed previously). While this bubble chart variation still plots marks on two numeric axes to exhibit a height/width correlation between values.



# Hands-On:

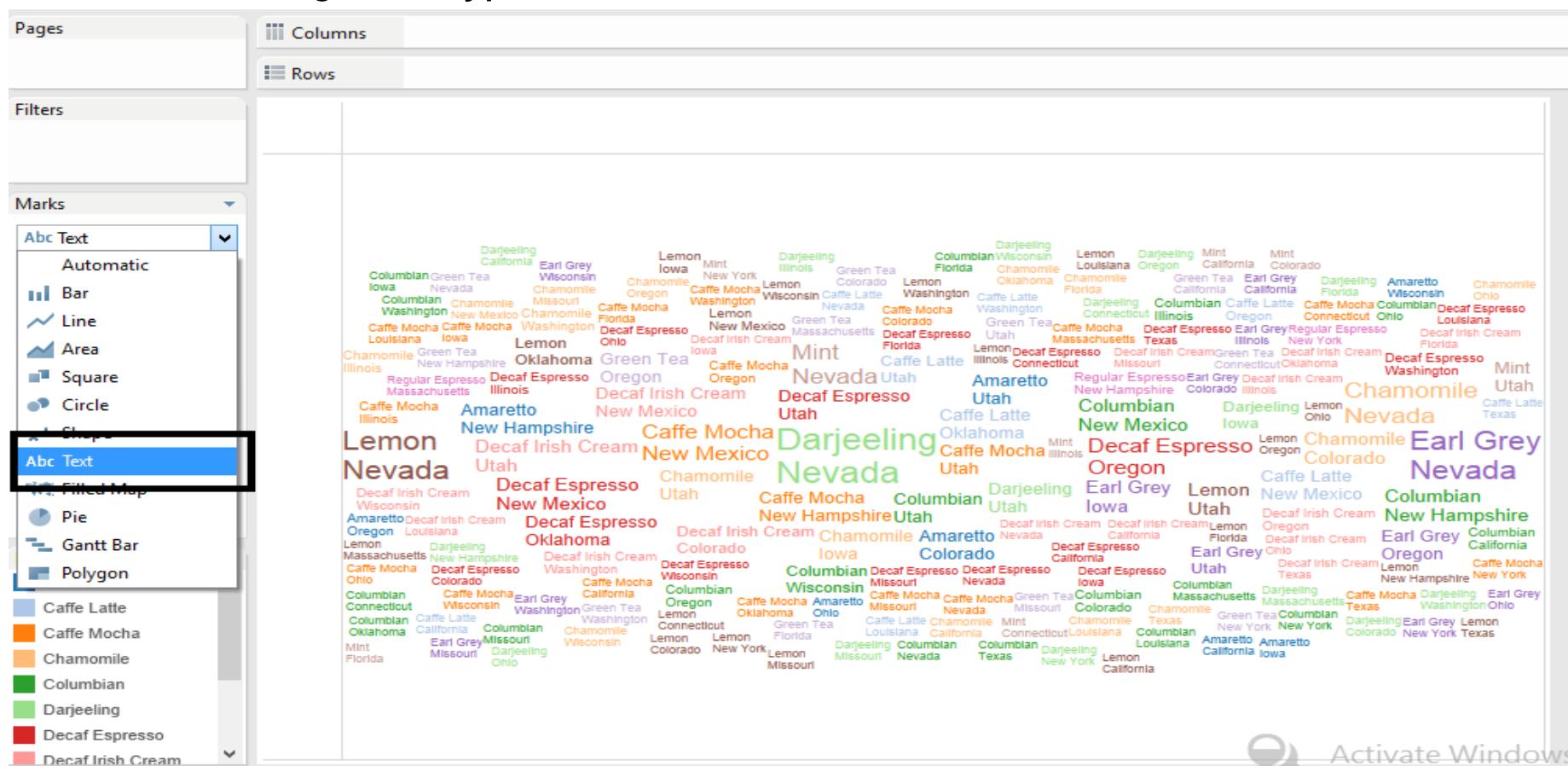
## *Packed Bubbles:*



# Hands-On:

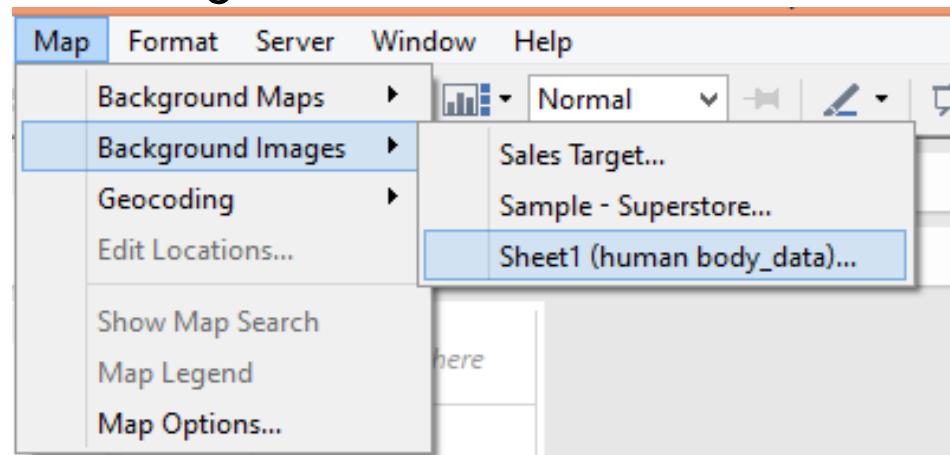
## Word Cloud:

We can change the type of visualization format from bubbles to Text.



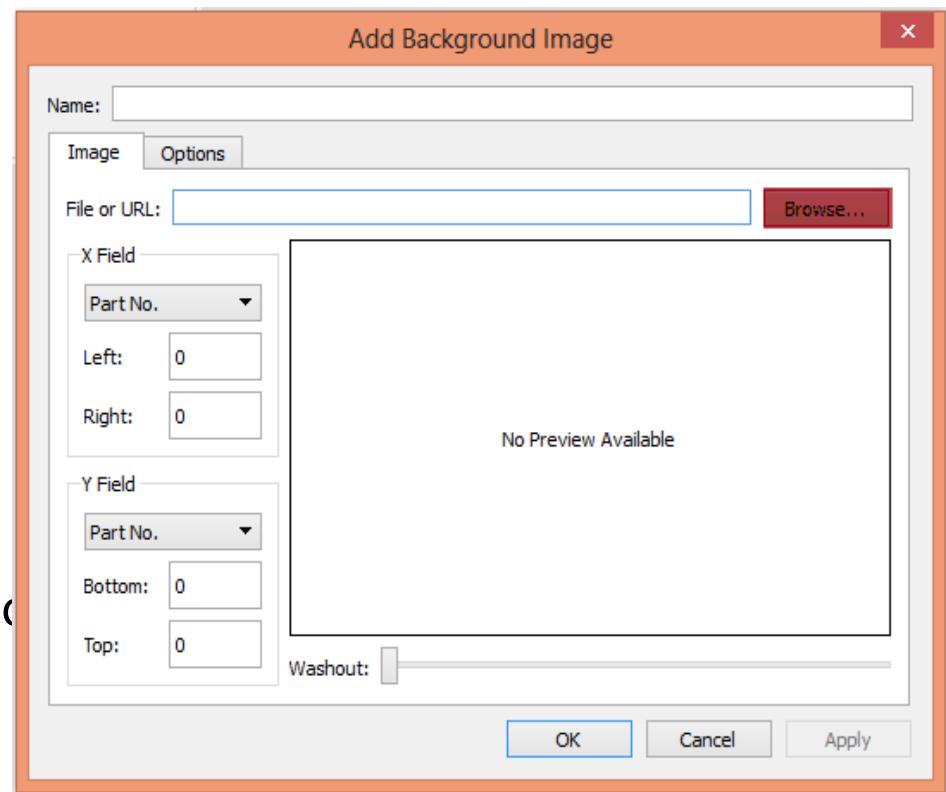
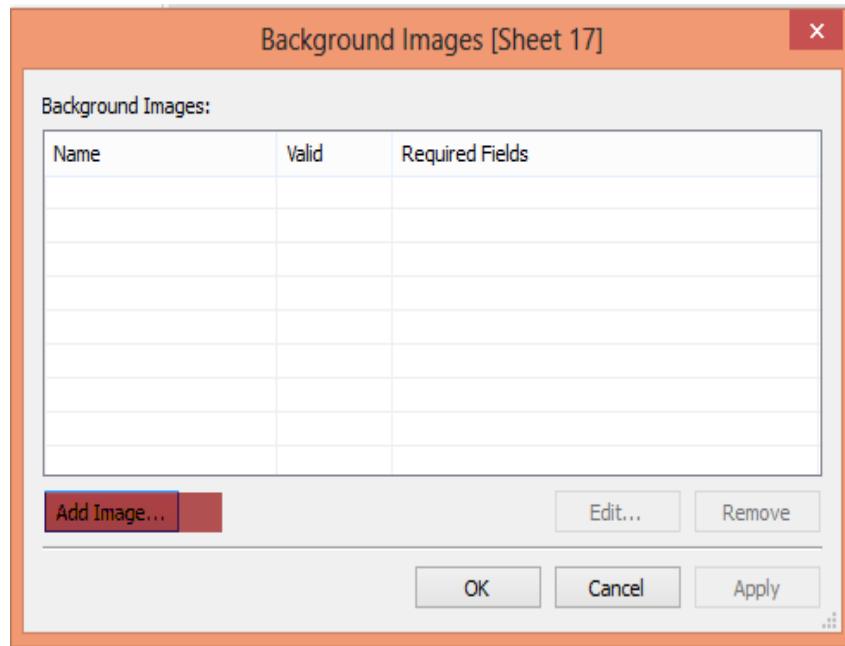
# Adding Background Image:

- Step-1: We can add background images in Tableau.
- Step-2: Let's check how to add background images.
- Step-3: We need to add width and height of the image in the dataset.
- Step-4: Open the Tableau desktop.
- Step-5: Connect to the dataset
- Step-6: Click on Maps < Background images < Select the dataset which required image.



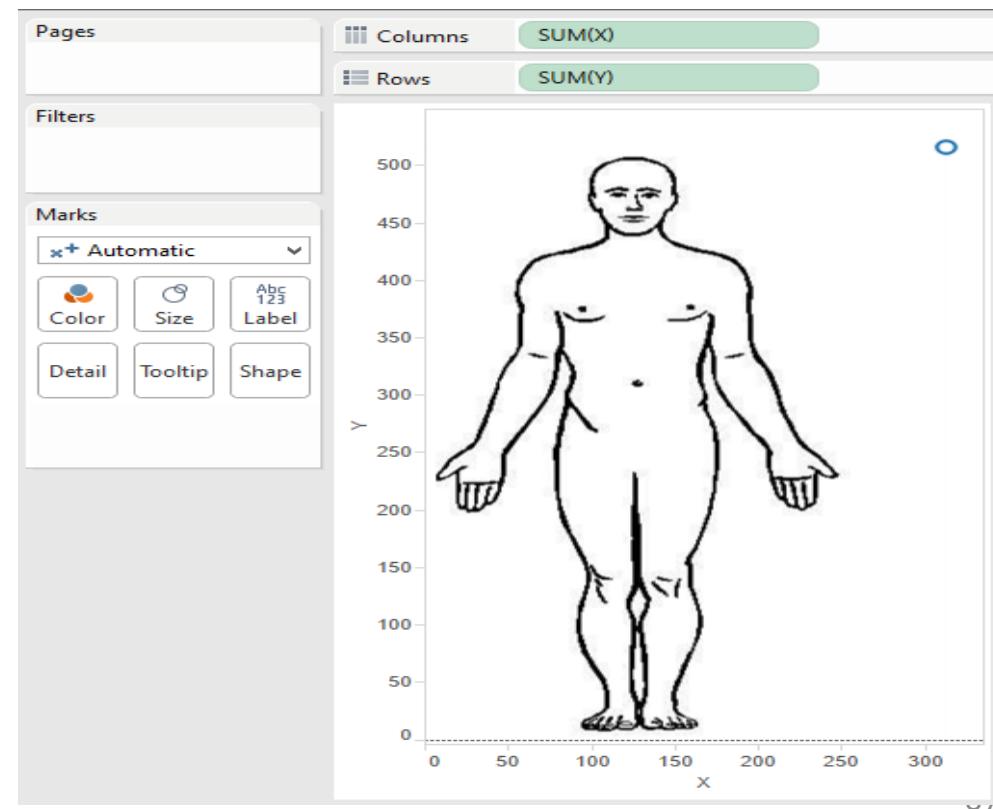
# Adding Background Image:

- Step-7: Click on Add image.



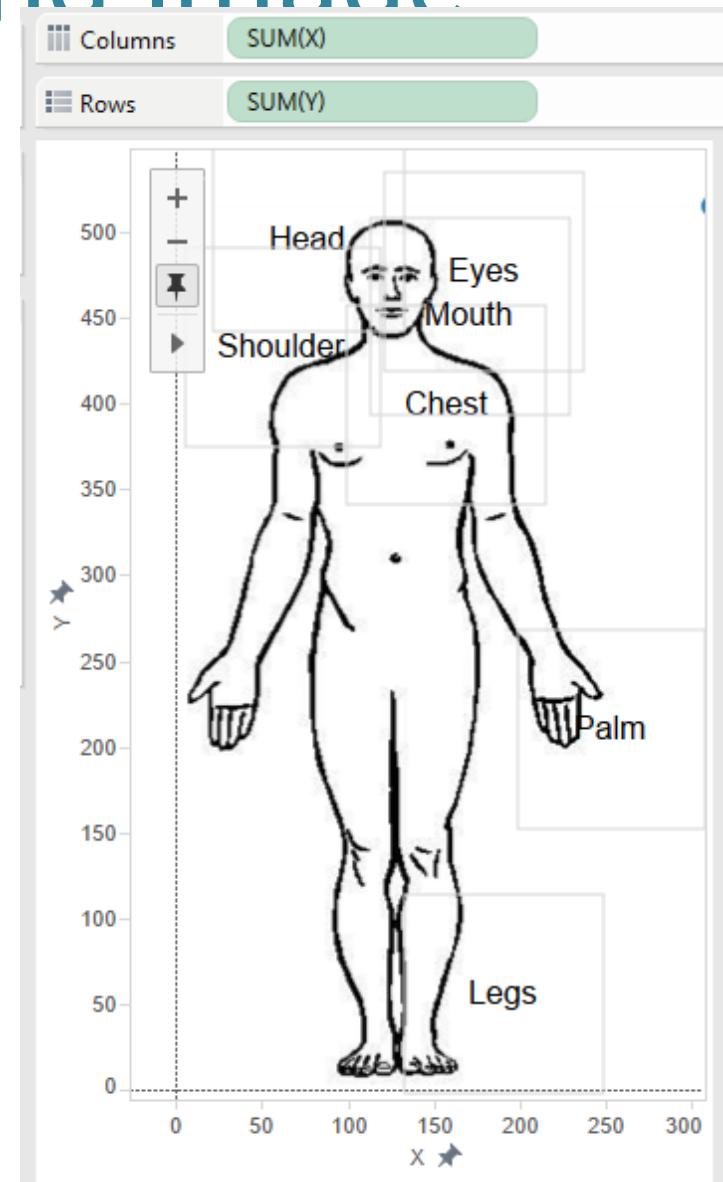
# Adding Background Image:

- Step-7: Click on Add image.
- Step-8: We can't view the background image.
- Step-9: Now place X in columns and Y in Rows.



# Adding Background Image:

- Step-11: Now, add different names to the parts by Annotations.
- Step-12: This is how we add background images in Tableau.

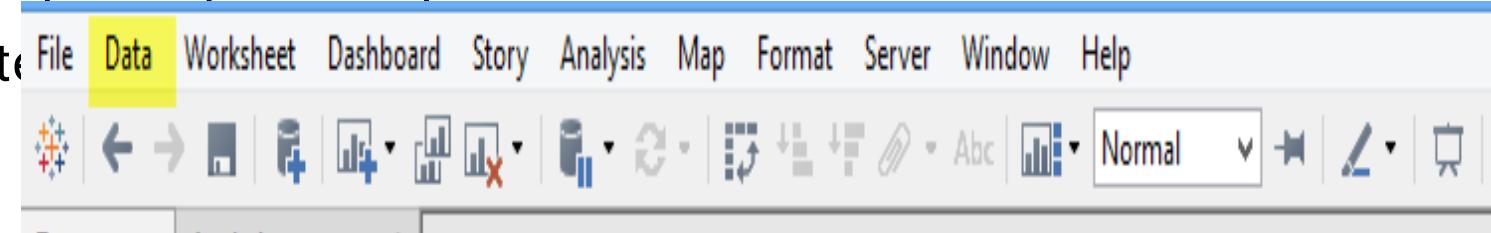


# Creating Workbook Data Extract:

- ✓ *If your data is coming from some connected data sources, extracting such data from a workbook will let you work on that data even if you are disconnected. The extracts are also useful when dealing with large data files as you can apply filters to select only a few rows (based on conditions).*

- ✓ *Hands-On:*

- Step-1: Import Sample- Coffee Chain dataset.



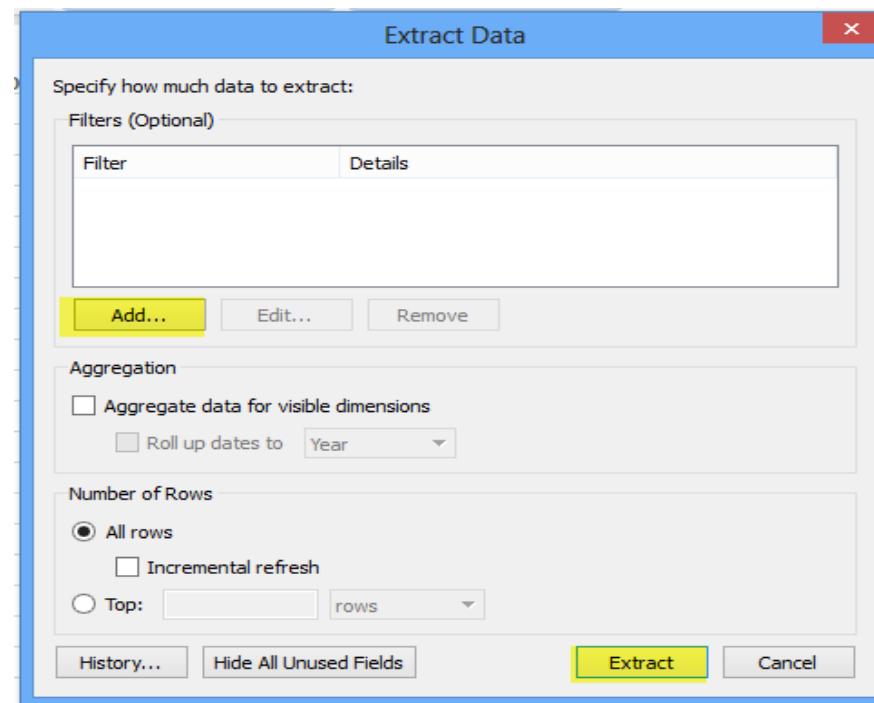
- Step-3: Goto coffechain and select Extract data.

# Creating Workbook Data Extract:

The screenshot shows the Tableau desktop application interface. The menu bar at the top includes: Data, Worksheet, Dashboard, Story, Analysis, Map, Format, Server, Window, and Help. The 'Data' menu is open, displaying options such as New Data Source (Ctrl+D), Paste Data (Ctrl+V), Refresh All Extracts..., Tableau Data Server, Edit Relationships..., Replace Data Source..., Upgrade Data Sources..., and a list of connected data sources. The 'Returns\$' source is currently selected, indicated by a checked checkbox icon. The 'Edit Data Source...' option is highlighted in blue. To the right of the menu, there is a data preview pane showing a table with columns 'Customer ID' and 'id number'. Below the preview is a context menu with options like Extract Data..., Use Extract, Extract, Edit Data Source Filters..., Replace Data Source..., Assume Referential Integrity, Date Properties..., Edit Aliases..., Publish to Server..., Add to Saved Data Sources..., and Properties... The bottom right corner of the interface shows the number 90.

# Creating Workbook Data Extract:

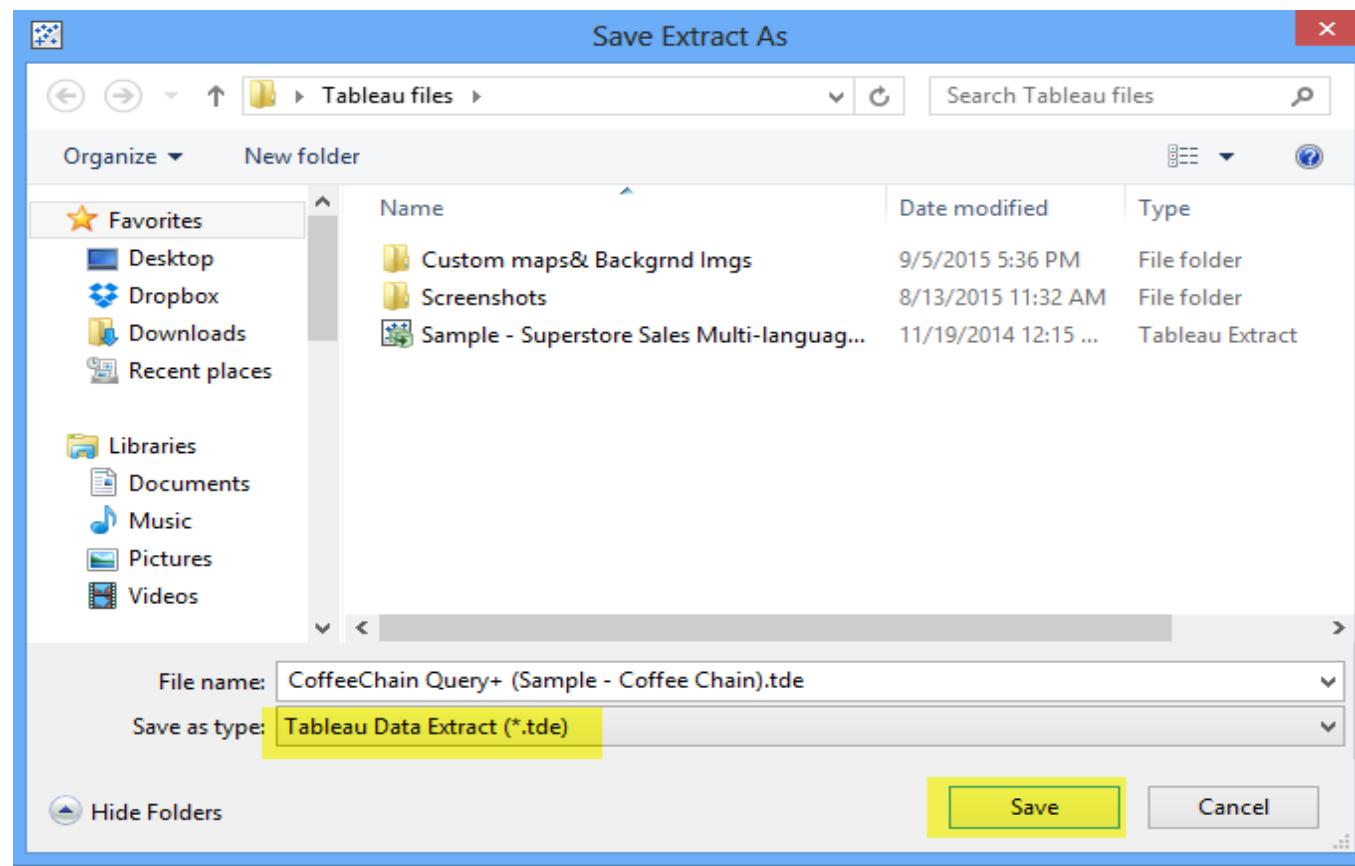
- Step-4: Now Hit on Extract data.



- Step-5: If we want we can filter the data and we can extract the data what we need rather than extracting entire data.

# Creating Workbook Data Extract:

- Step-6: Extracted data will be saved in .tde format which means Tableau Data Extract.

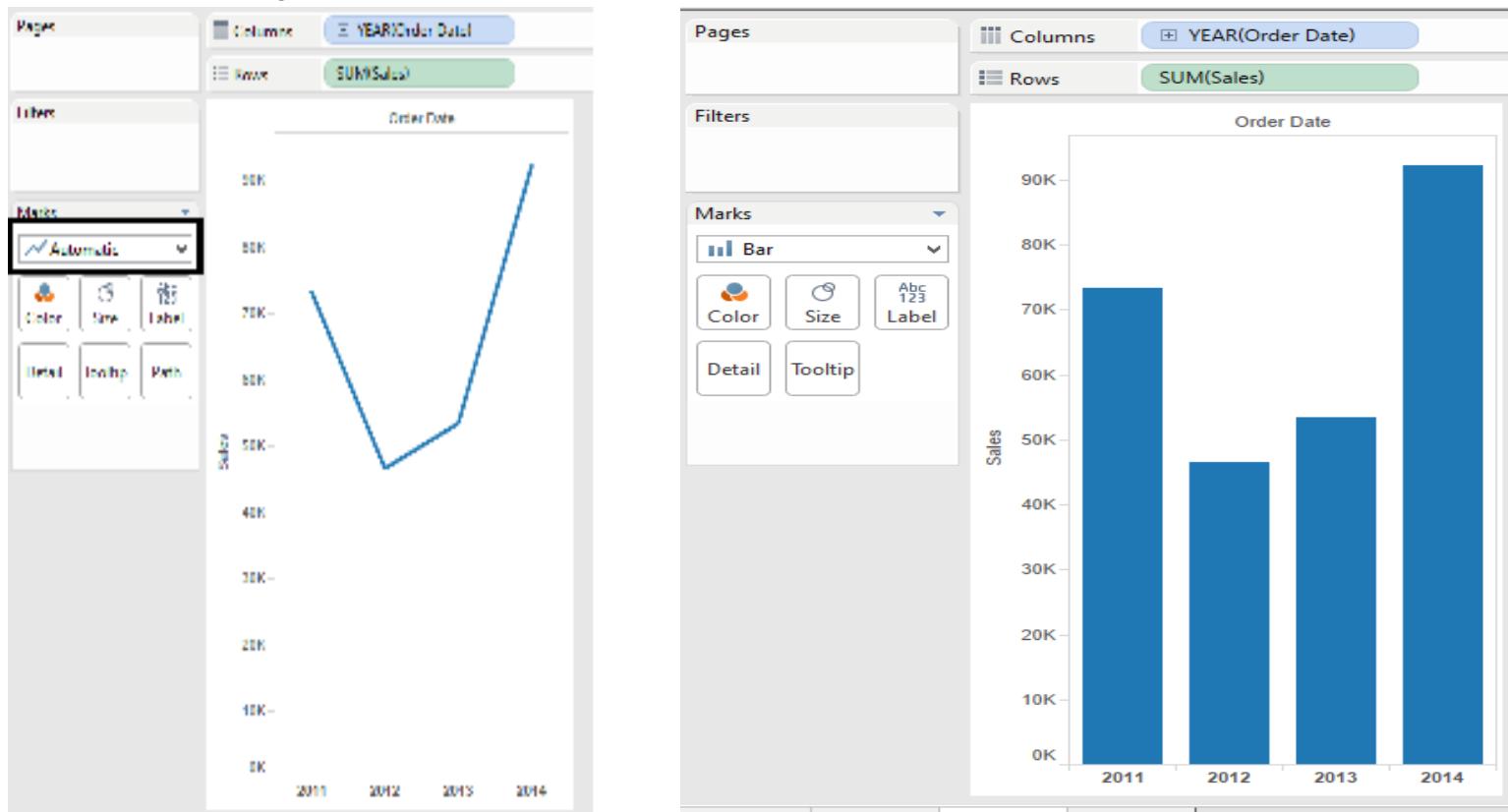


# Filters and their working at different level

# Steps Involved:

## Creating Calculated Fields

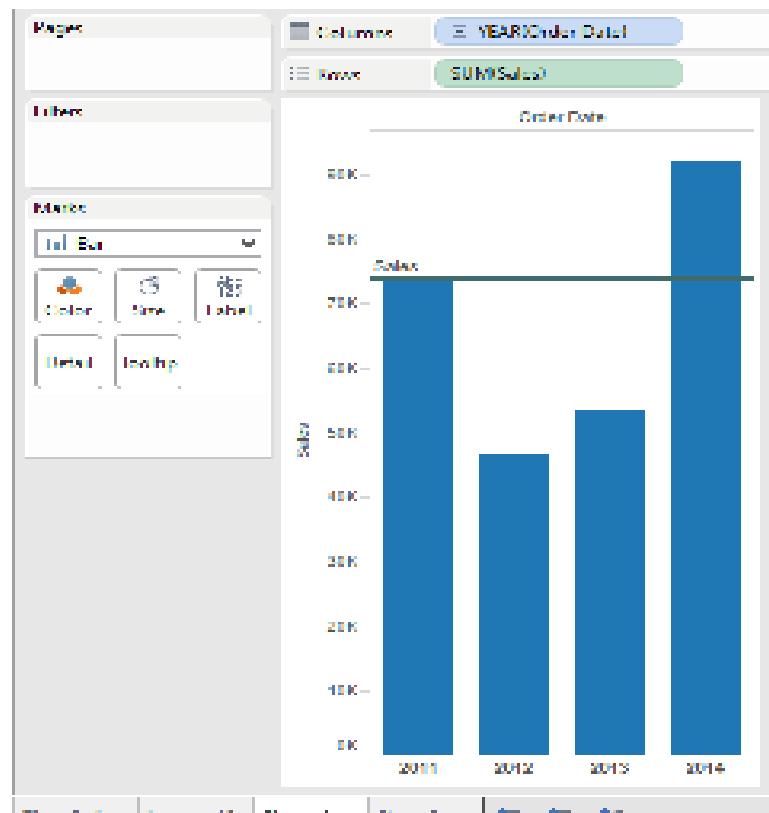
- Now let's drag Order date to Columns and Sales to Rows.
- And change the visualization from Automatic to Bars.



# Steps Involved:

## Creating Calculated Fields

- Now, Let's add manual reference line to the pane.
- I'll name the reference line as Sales and I'll give constant value as 74k.



# Steps Involved:

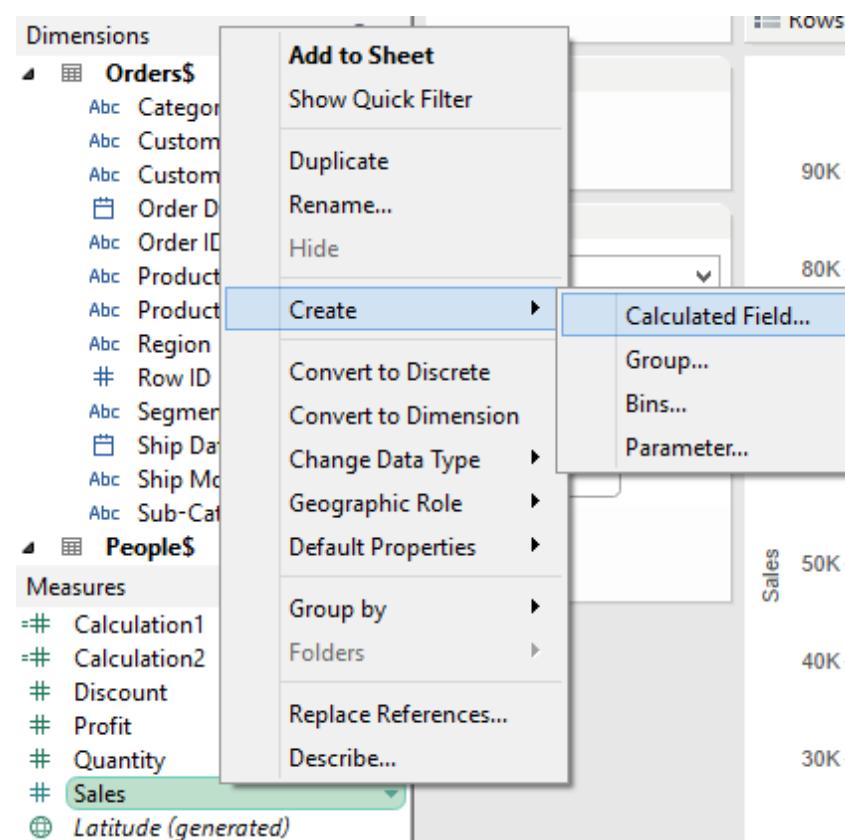
## Logical Functions:

- ✓ Case and if functions are similar in that they both allow testing of an expression and returning values on various conditions.
- ✓ The Case function is usually easier to read and is usually the preferred way of testing expressions.
- ✓ The If function allows us to test on numeric conditions whereas the CASE function doesn't allow that.
- ✓ ZN function is useful when we want to return '0' when expression is 'null'.

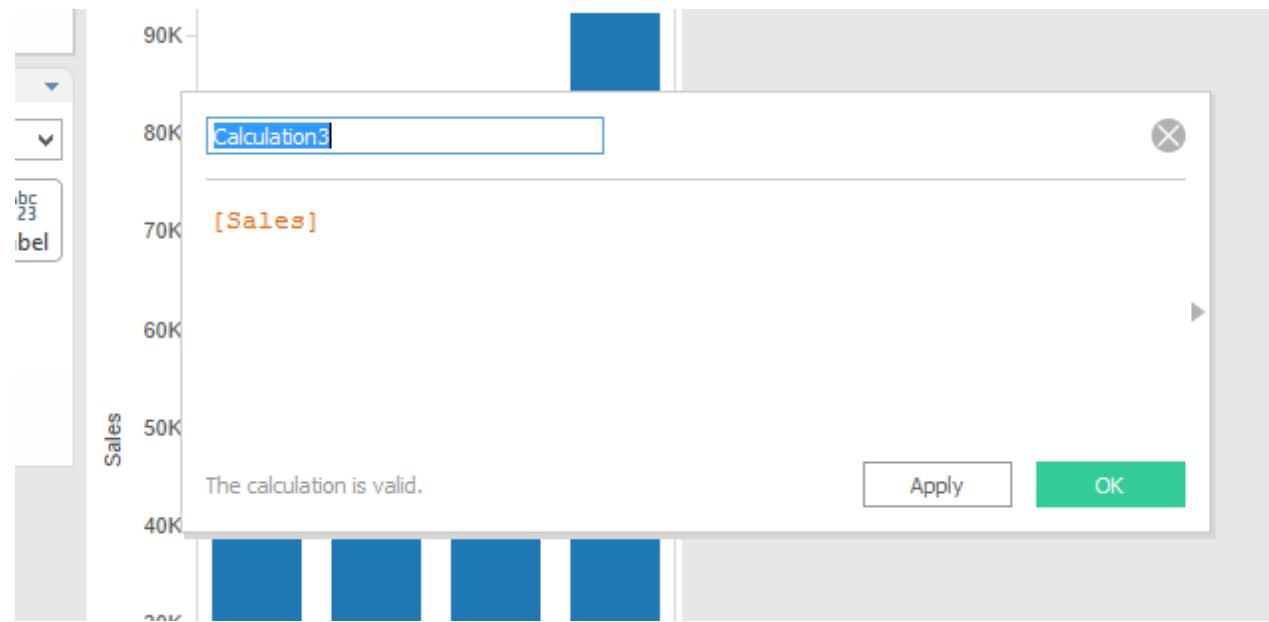
# Steps Involved:

## Creating Calculated Fields

- Let's add Calculated field to the Sales.
- How to add the Calculated Field? Let's see.

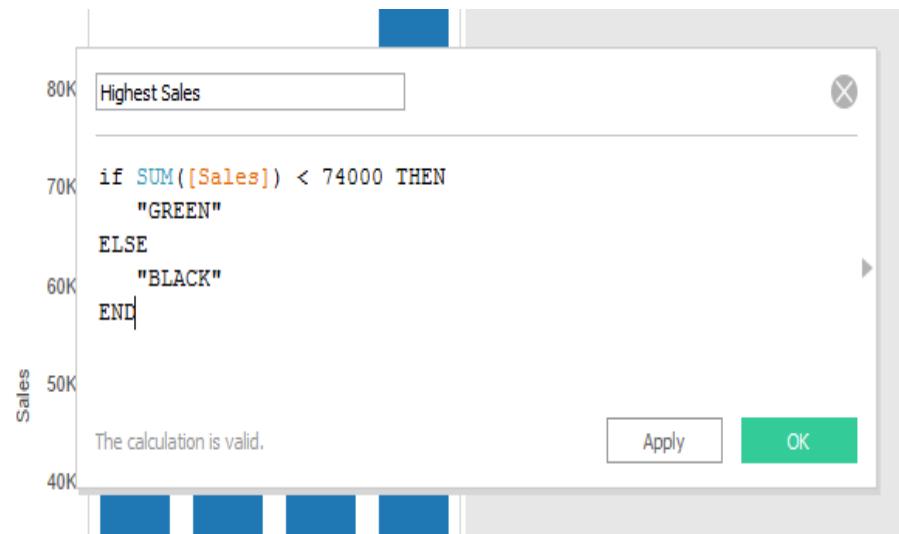


# Steps Involved:



- In place of Calculation3 we can give name as we like.
- And lets us basic IF ELSE statement

# Steps Involved:



The screenshot shows a dialog box for defining a calculated field. The field name is "Highest Sales". The formula is:

```
if SUM([Sales]) < 74000 THEN  
    "GREEN"  
ELSE  
    "BLACK"  
END
```

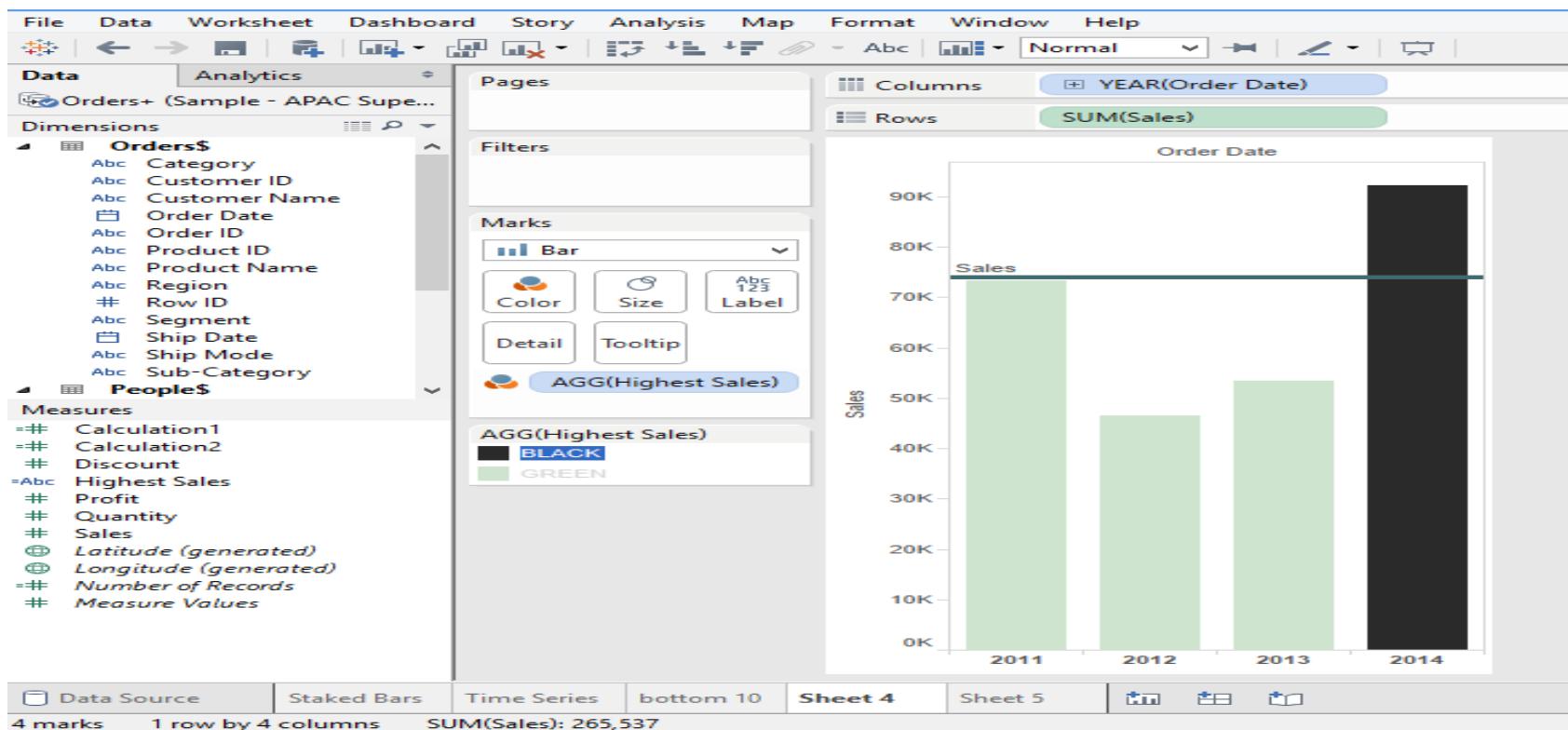
A message at the bottom of the dialog box says "The calculation is valid." There are "Apply" and "OK" buttons at the bottom right.

**Measures**

- =# Calculation1
- =# Calculation2
- # Discount
- :Abc Highest Sales
- # Profit
- # Quantity
- # Sales
- 🌐 Latitude (generated)
- 🌐 Longitude (generated)
- =# Number of Records
- # Measure Values

- Press 'APPLY'
- Now we can view Highest Sales as an Field in Measure pane.
- Now drag and drop the Highest Sales in 'Color'.

# Steps Involved:

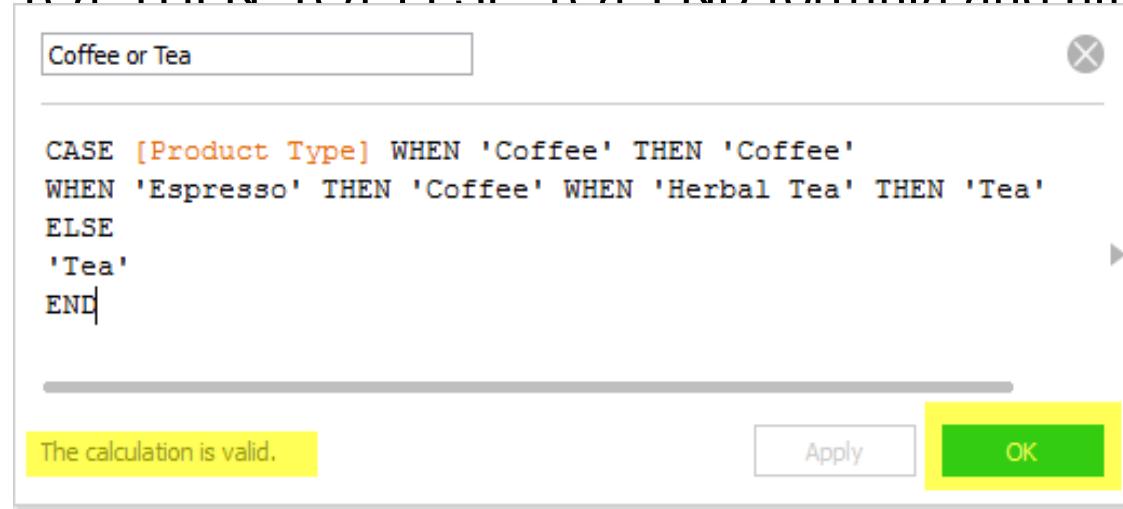


- All the Sales which are less than 74000 are colored as 'Green' and Sales which are greater than 74000 are colored as 'Black'.
- This is how we use Calculated Fields in Tableau.

# Steps Involved:

## *Using “CASE IF” Calculations:*

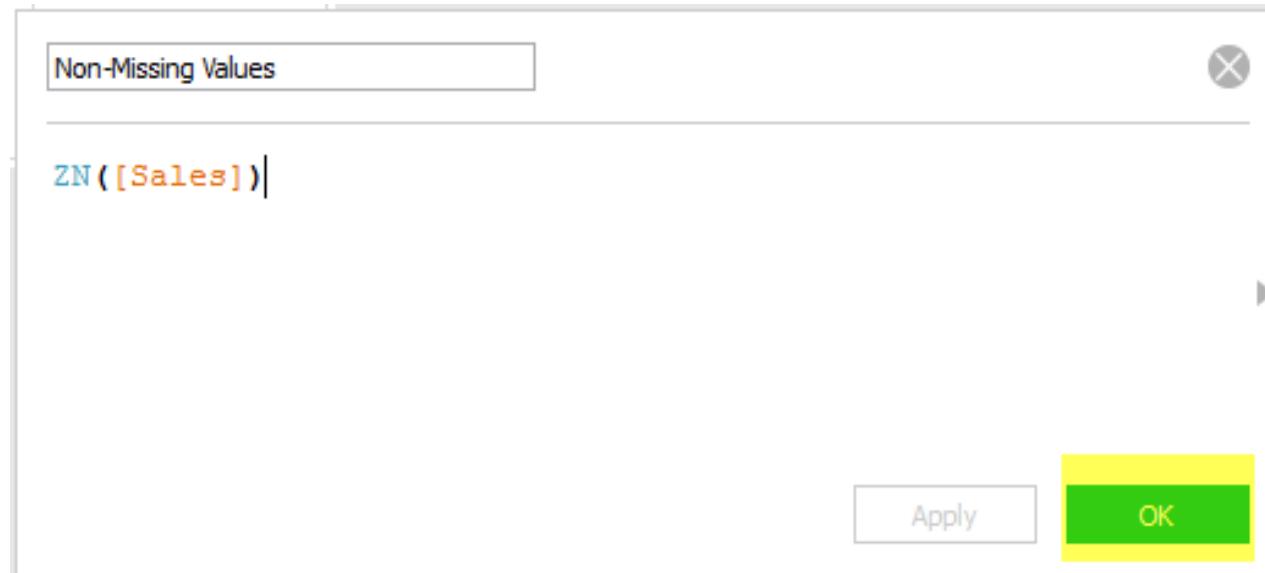
- Step-1: Right-click on Product Type from Dimensions and click on Create Calculated Field.
- Step-2: In the Name box, enter Coffee or Tea.
- Step-3: In the Formula box, enter the CASE [Product Type] WHEN 'Coffee' THEN 'Coffee' WHEN 'Espresso' THEN 'Coffee' WHEN 'Herbal Tea' THEN 'Tea' ELSE 'Tea' END formula and hit OK.



# Steps Involved:

## *Using '0' instead of Missing Values:*

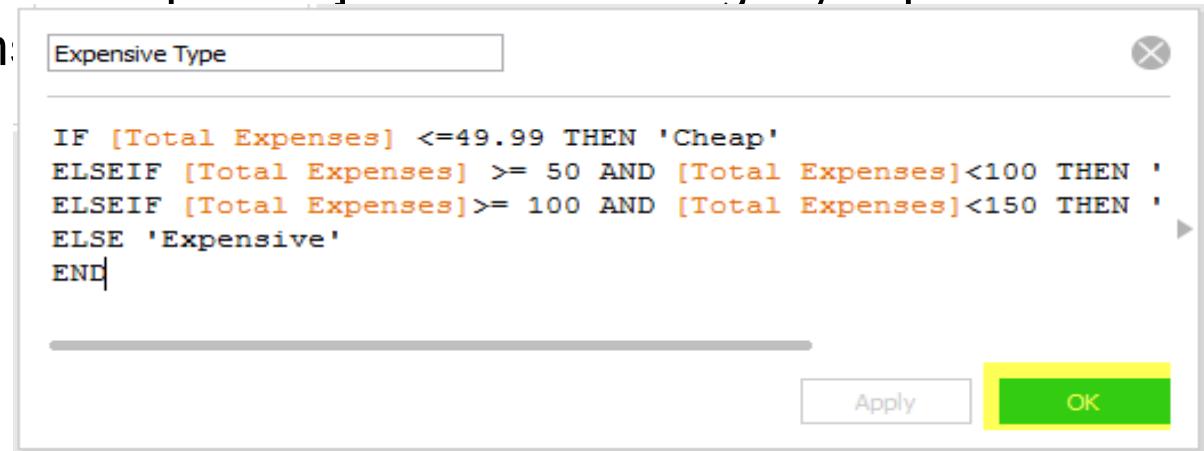
- Step-1: To use 0 instead of missing values of Sales, right-click on Sales from Measures and click on Create Calculated Field.
- Step-2: In the Name box, enter Non-missing Sales.
- Step-3: In the Formula box, enter ZN([Sales]) and hit OK.



# Steps Involved:

## *Using 'Else-if' Function Calculations:*

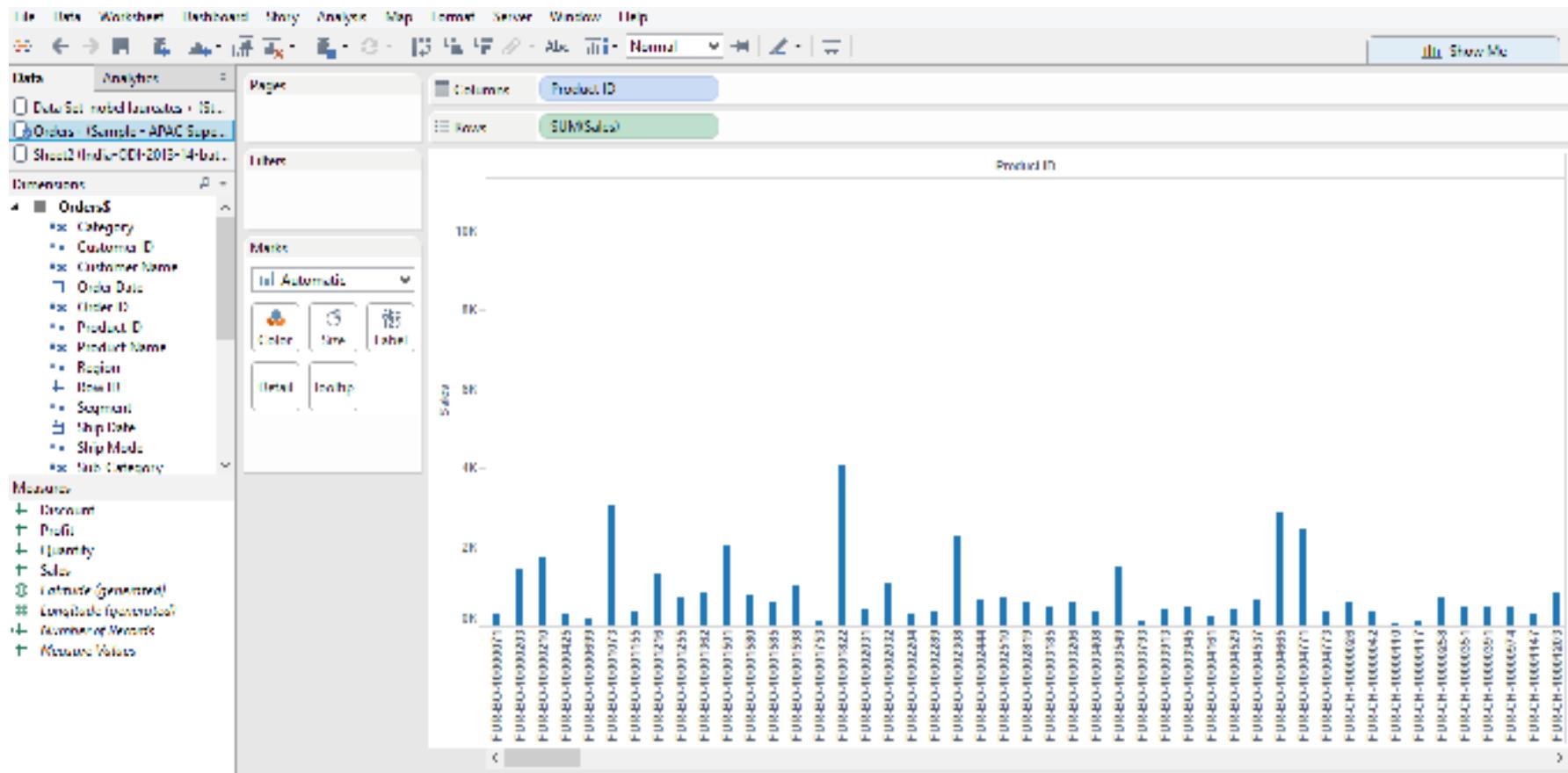
- Step-1: To see Total Expenses in some categories, right-click on Total Expenses from Measures and click on Create Calculated Field.
- Step-2: In the Name box, enter Expensive Type.
- Step-3: In the Formula box, enter the IF [Total Expenses] <= 49.99 THEN 'Cheap' ELSEIF [Total Expenses] >= 50 and [Total Expenses] < 100 THEN 'Somewhat Expensive' ELSEIF [Total Expenses] >= 100 and [Total Expenses] < 150 THEN 'Slightly Expensive' ELSE 'Very Expensive'



# Ad-Hoc Calculations:

## Step-1: Import the file Sample APAC Superstore

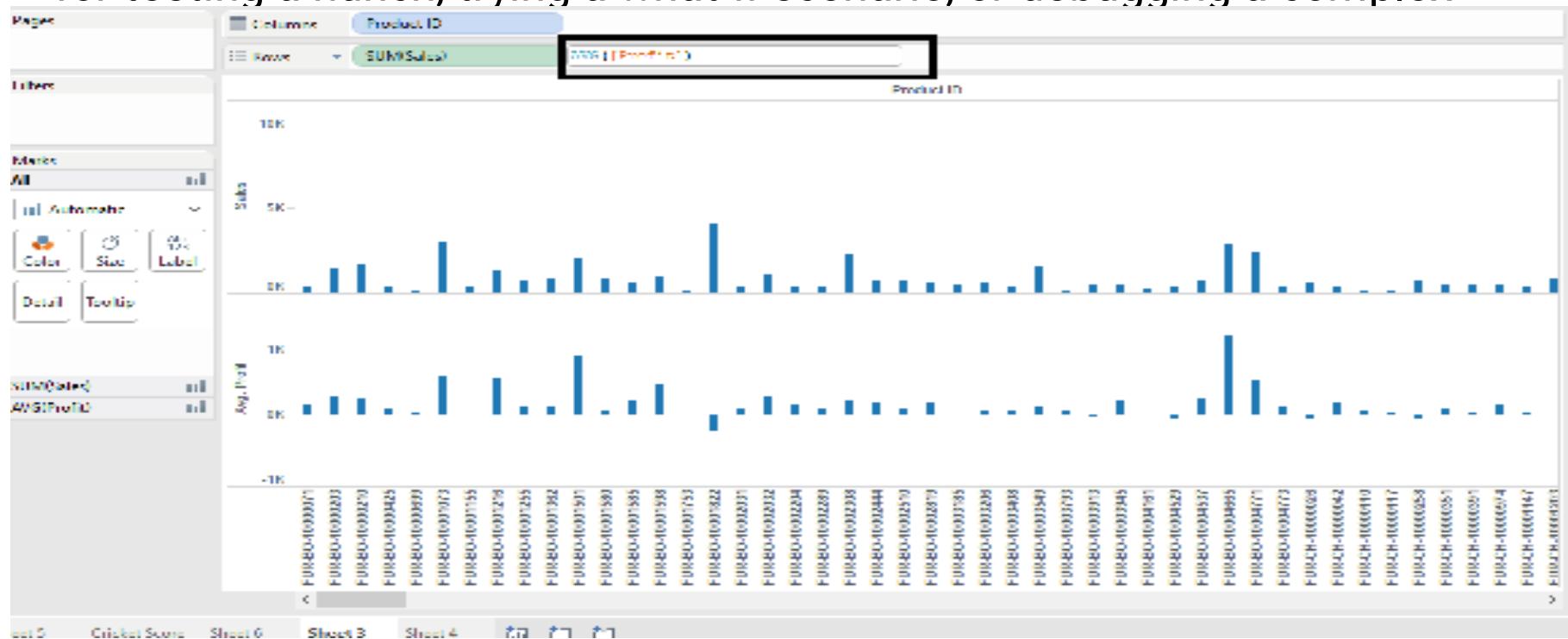
**Step-2: Drag Product ID into columns and Drag Sales into rows**



# Ad-Hoc Calculations:

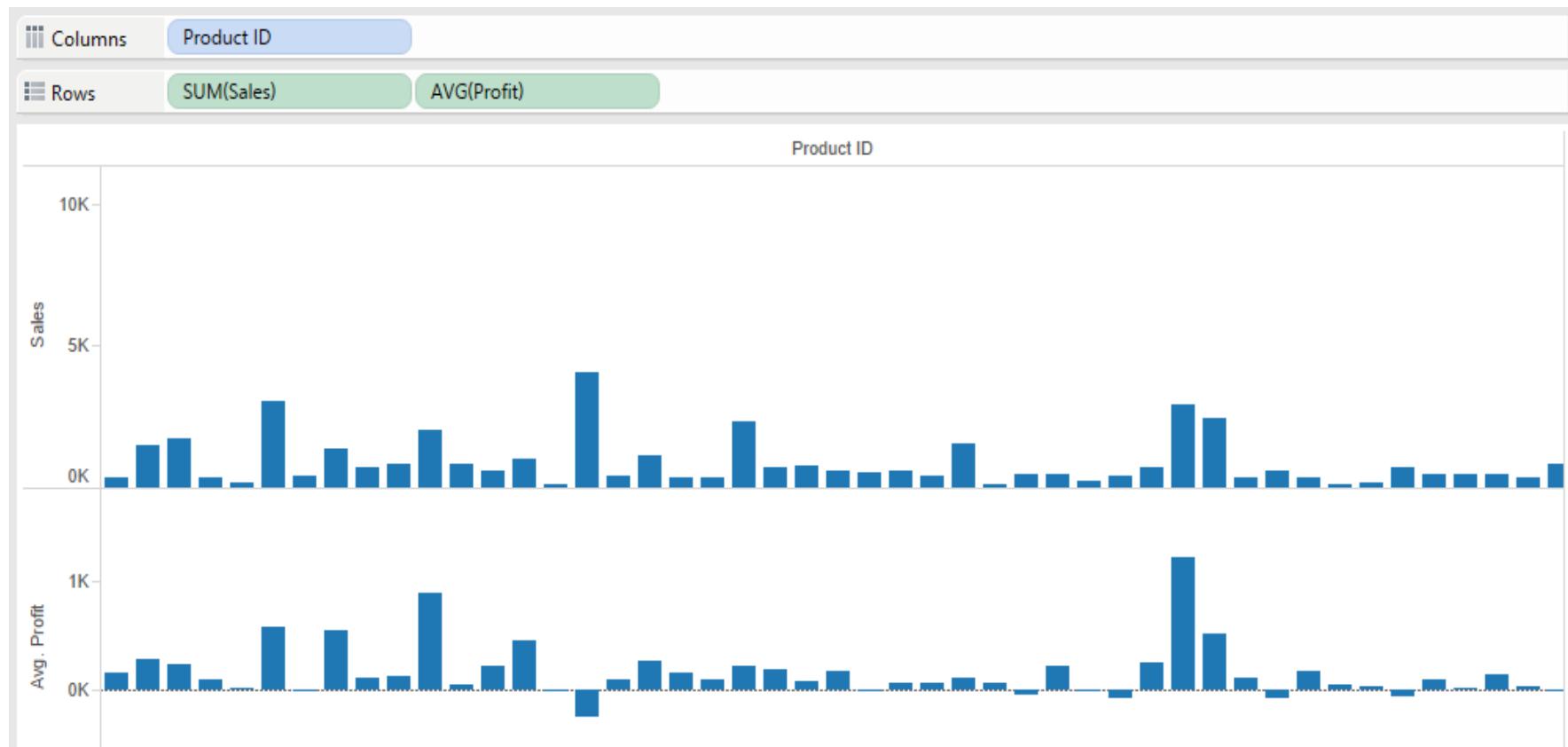
## *What is Ad-Hoc Calculations?*

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



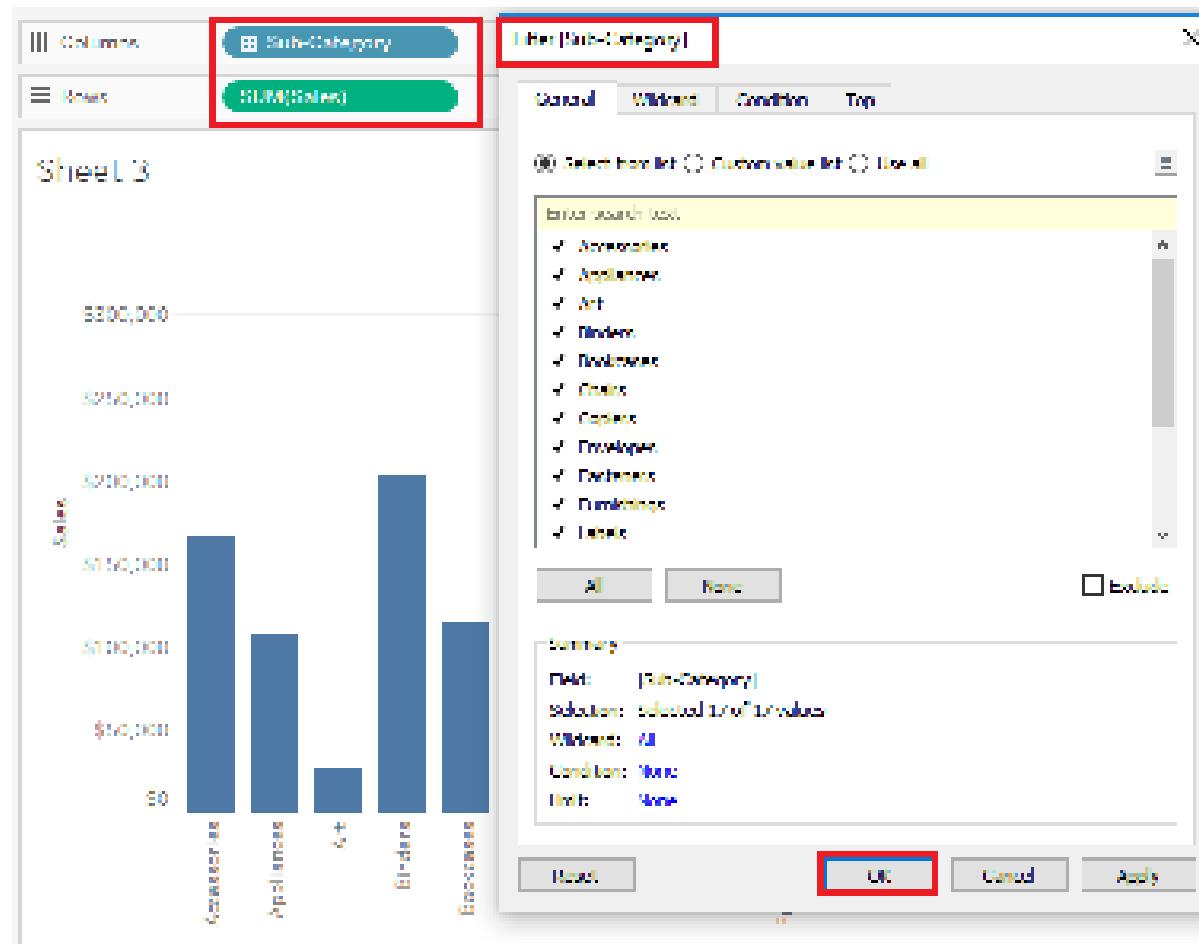
# Ad-Hoc Calculations:

Step-3: Directly given the Calculation in the rows and apply control+Enter to execute the code.



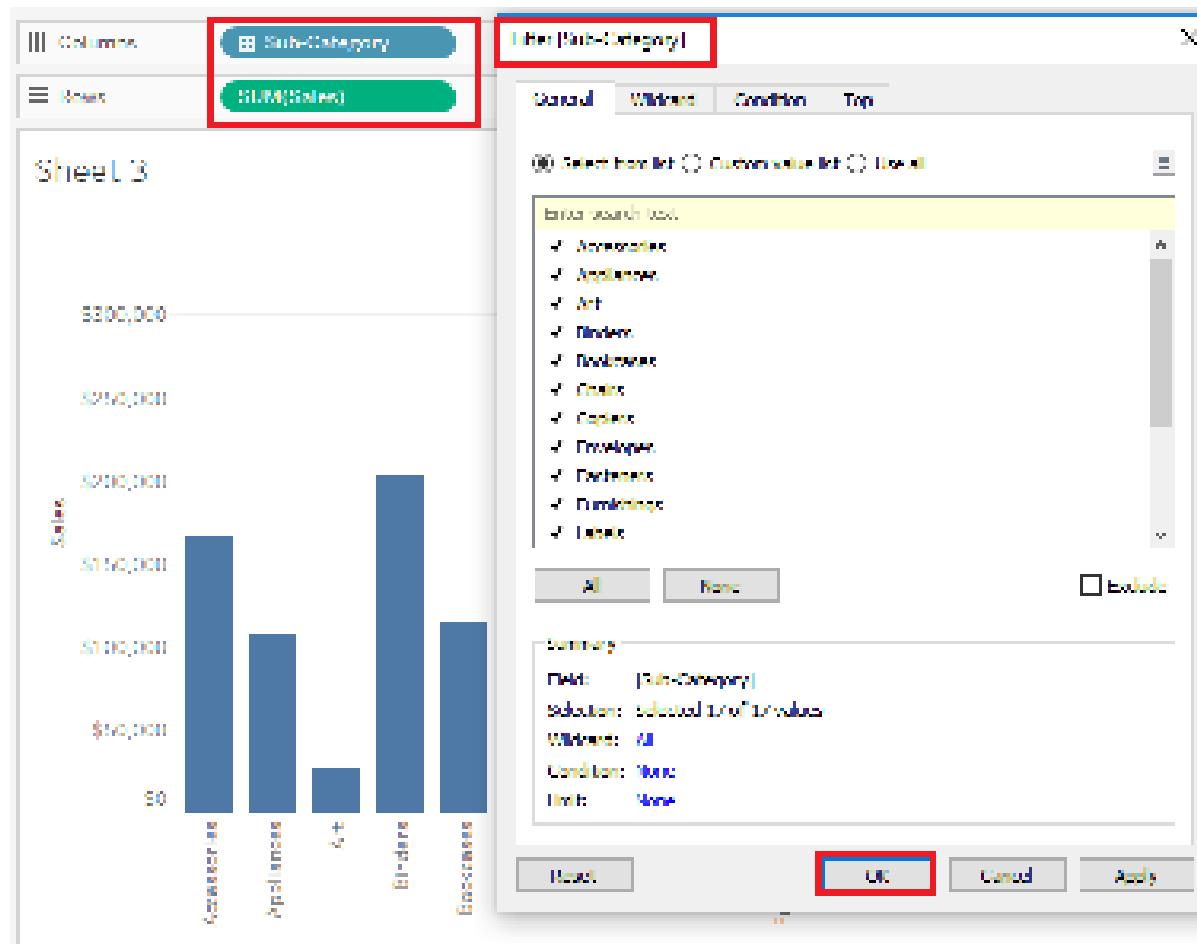
# Dimension Filters

- Here, the Filter used is a Dimension



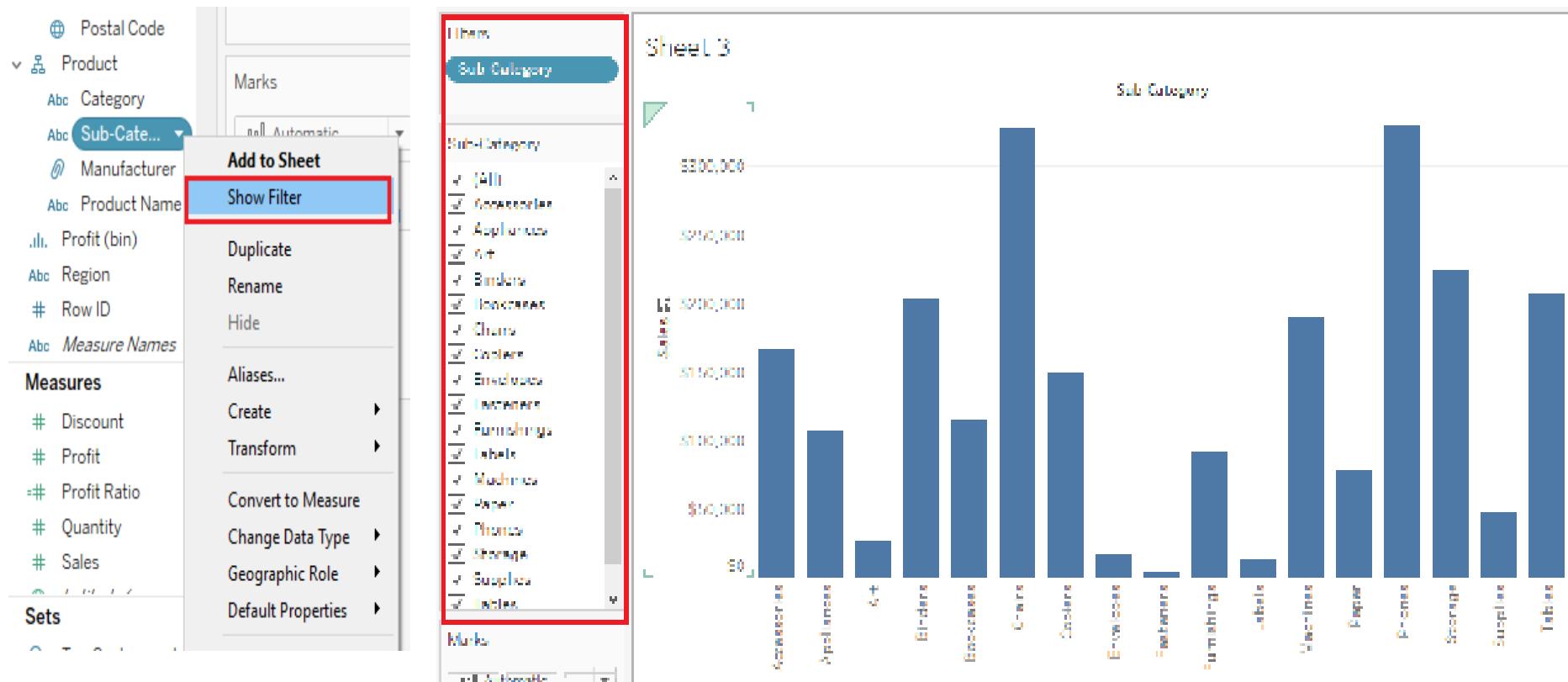
# Dimension Filters

- Here, the Filter used is a Dimension



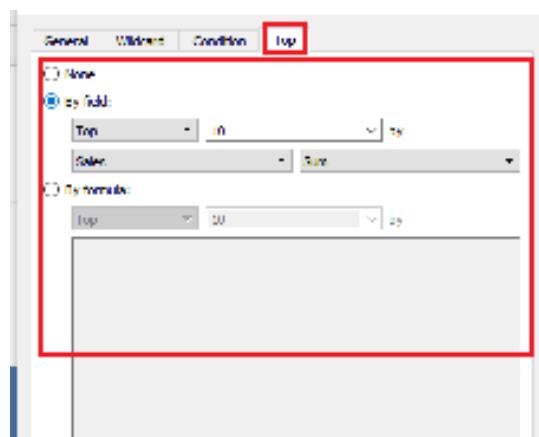
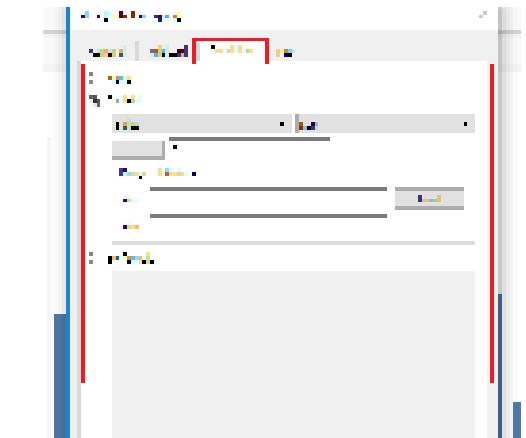
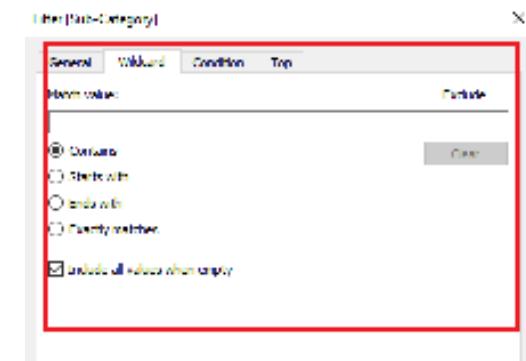
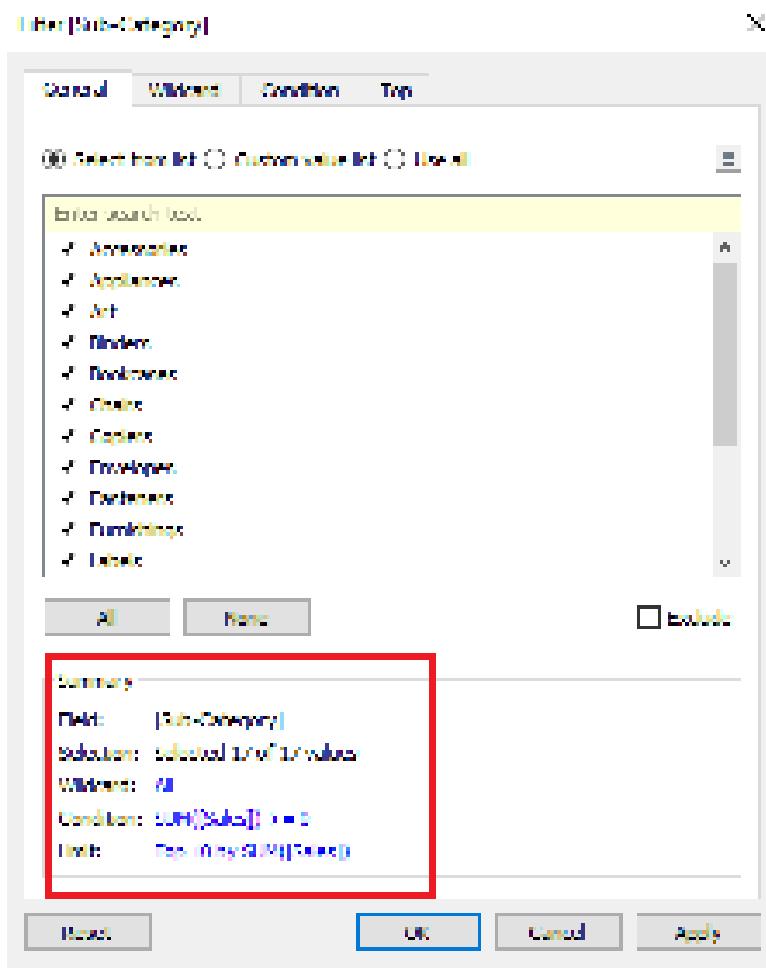
# Dimension Filters

- Here, the Filter used is a Dimension



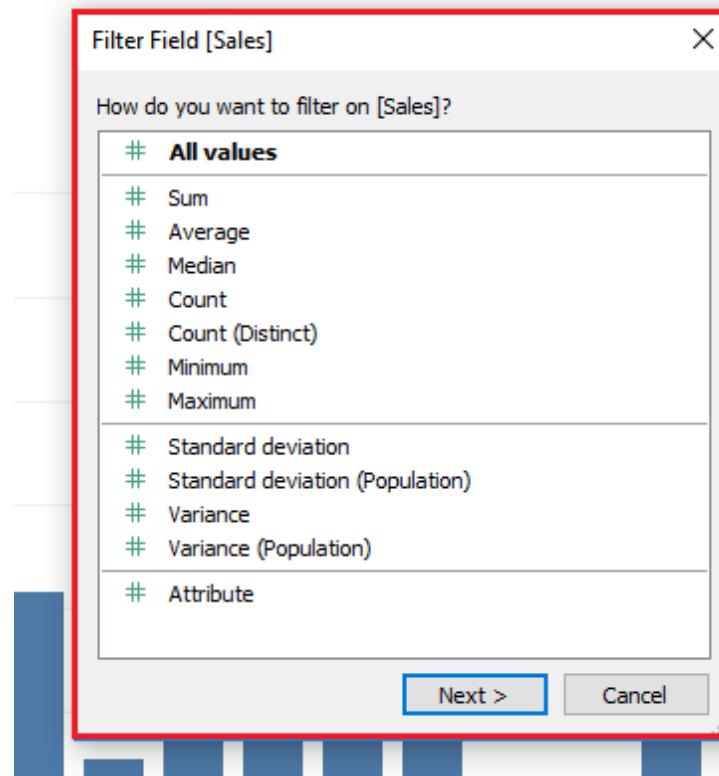
# *Dimension Filters*

- Here, the Filter used is a Dimension



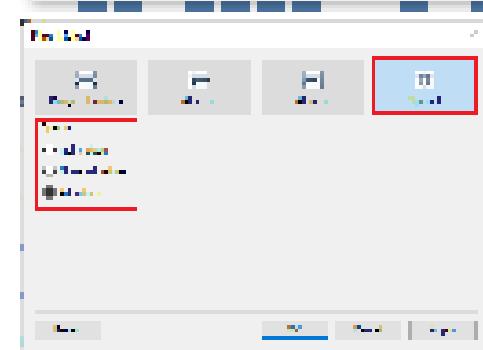
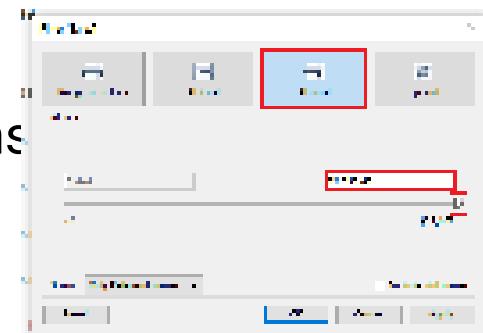
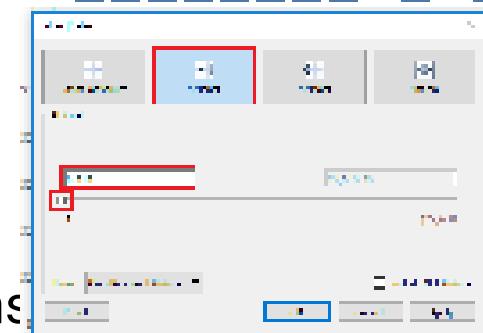
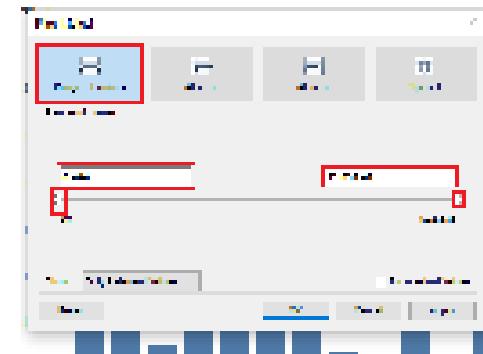
# *Measures Filters*

- Here, the Filter used is a Measures
  - You can see



# *Measures Filters*

- Range of Values
  - Change the least and highest values
- At least
  - Change only least value, highest value is constant
- At most
  - Change only highest value, least value is constant
- Special
  - Select between, null, non-null and all values

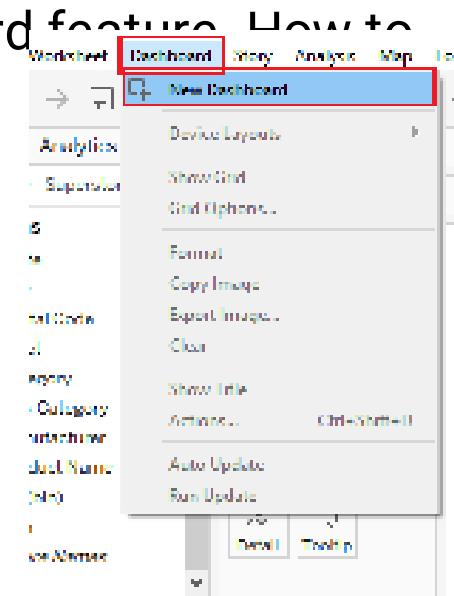


# Dashboards

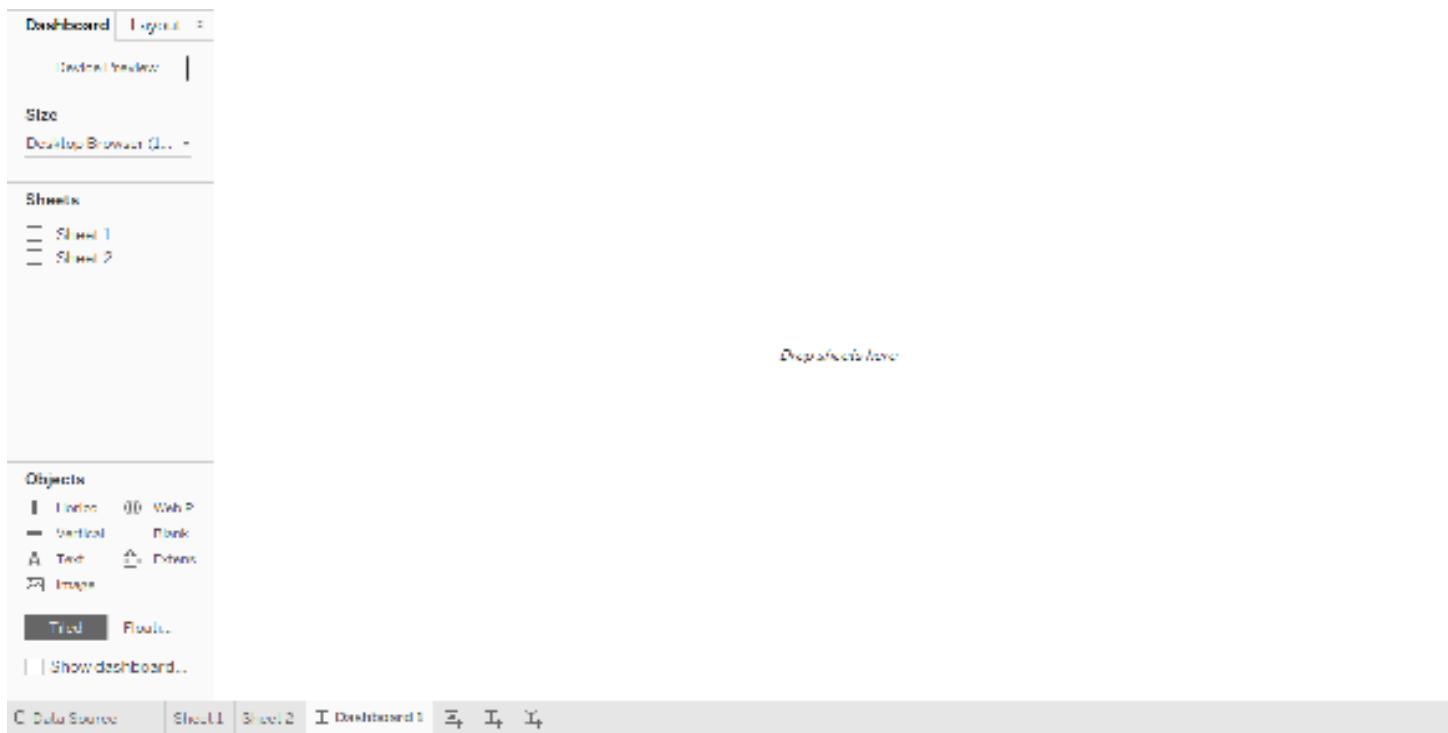
- Now I want to compare different sales with profits at different regions at a glance in single sheet. I hope Dashboards will help us to look at different visualizations in a single sheet. Is Tableau built with Dashboards?
- Answer is YES, Tableau is inbuilt with Dashboard feature.



- Click on the New Dashboard either on Menu bar or at the bottom of the page.



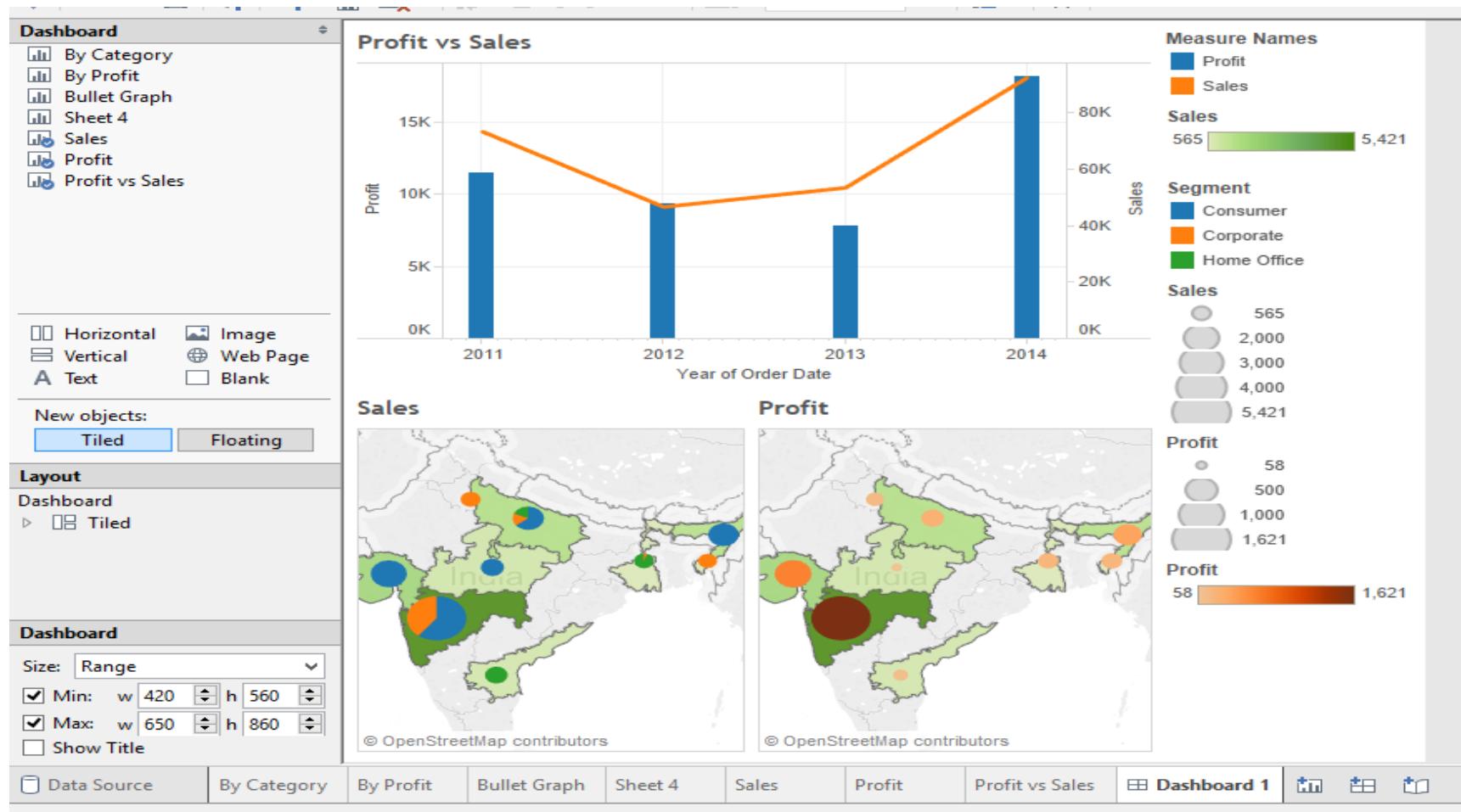
# Steps Involved:



- Above image shows Dashboard interface. On left side we can view a Dashboard pane and the Dashboard pane contain all the sheets we are moving around.
- We just need to drag the sheets we needed to compare.

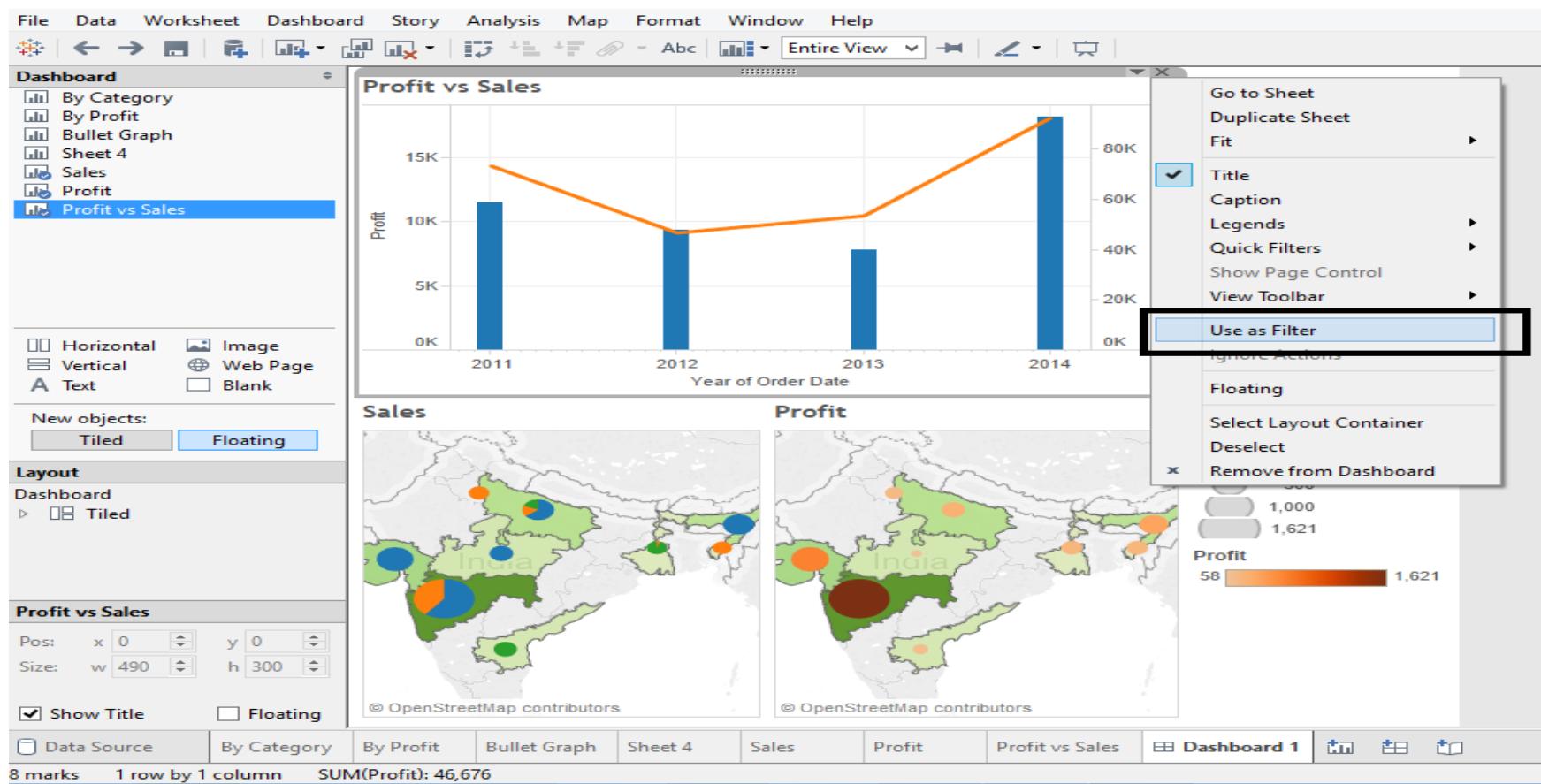
# Steps Involved:

- Now I'm going to drag Sales, Profit and Profit vs Sales sheets to the Dashboard.



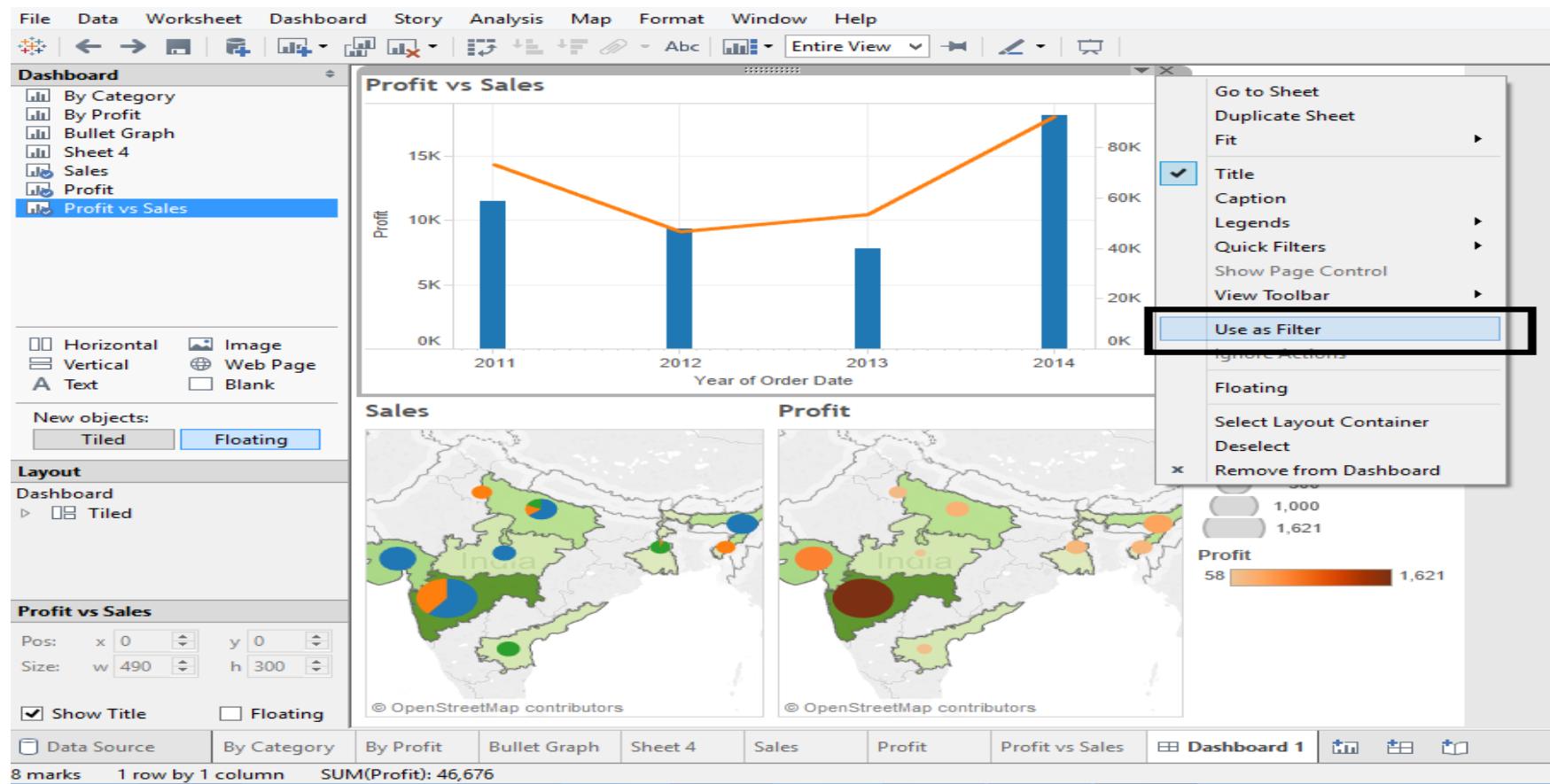
# Steps Involved:

- We can create Filters in Dashboards.
- By taking one sheet as reference we can Filter other sheets.



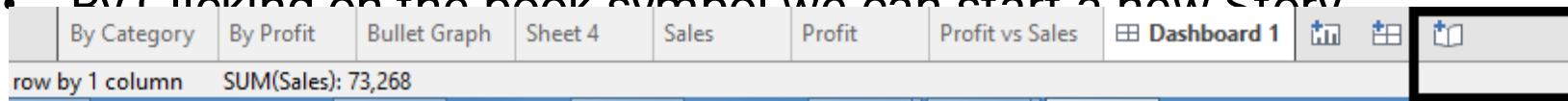
# Steps Involved:

- By clicking on Use as Filter, we can use that particular slide as Filter.
- Let's check how it works.

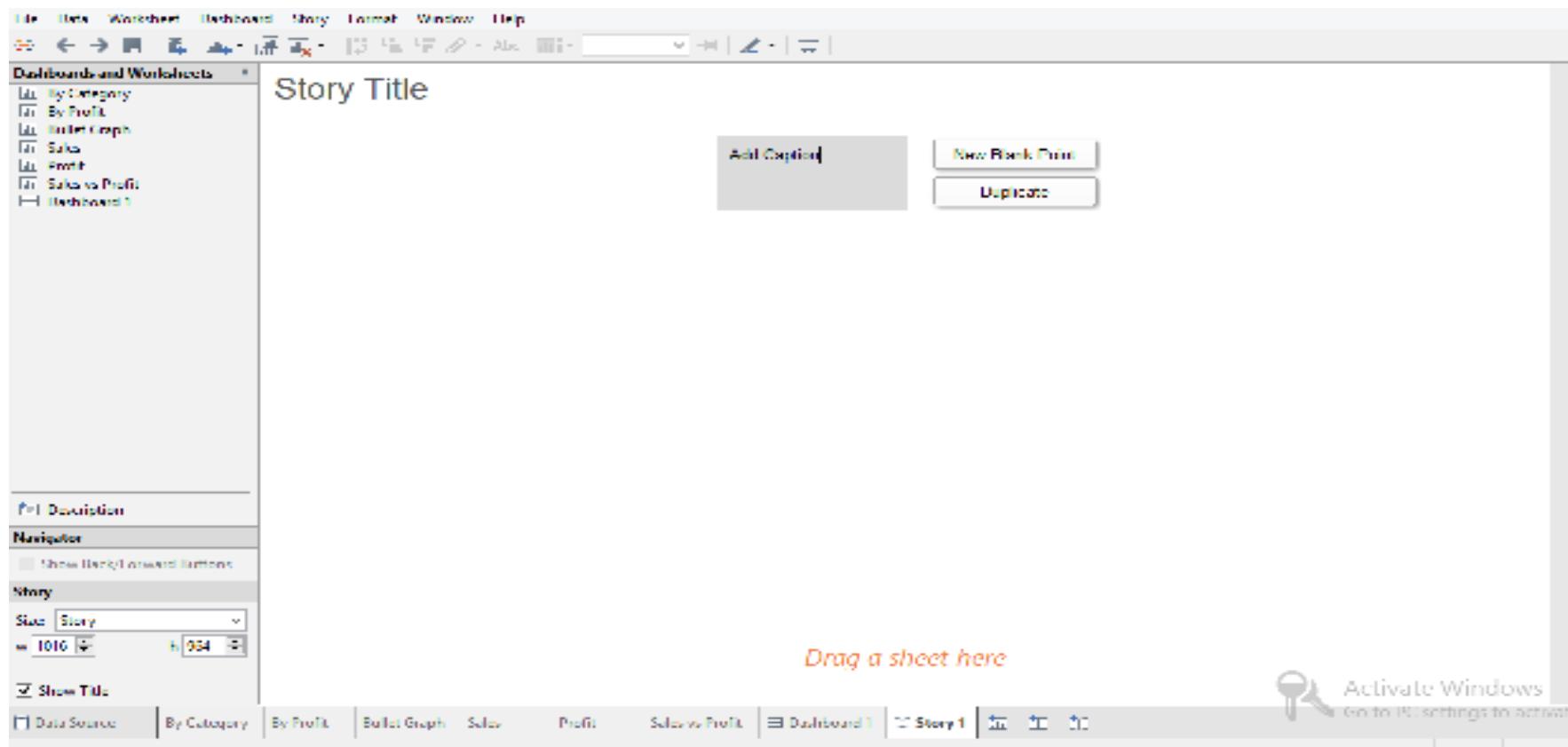


# Steps Involved:

- Dashboards are fine but I want to deliver complete picture of a company in a story format.
- Is there any chance to create some stories with worksheets in Tableau?
- Answer is YES.
- Yes, we can create or we can narrate some stories with worksheets so that the information in the Visualizations can be understood very easily and can be remembered very easily.
- Let's check how to create simple stories using Tableau.
- By Clicking on the book symbol we can start a new Story

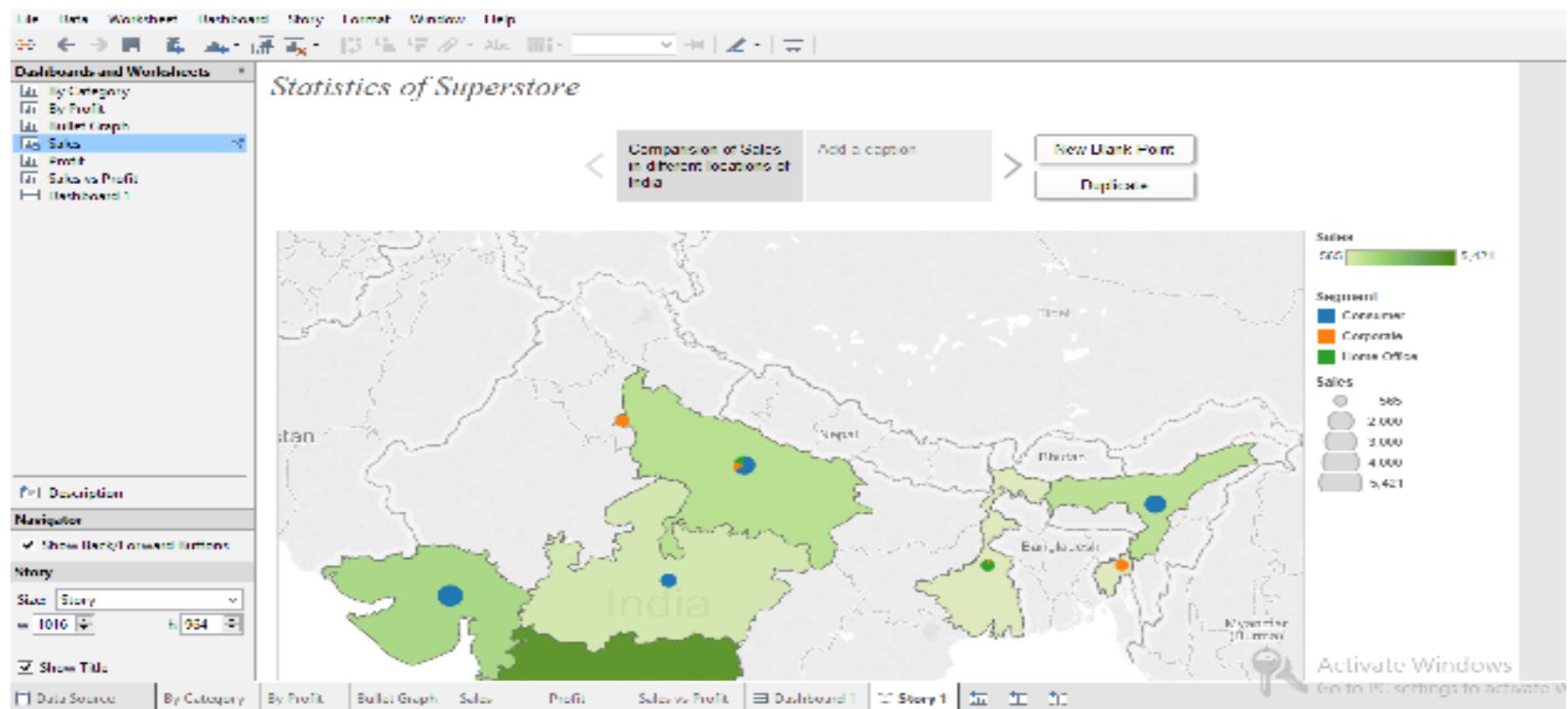


# Story



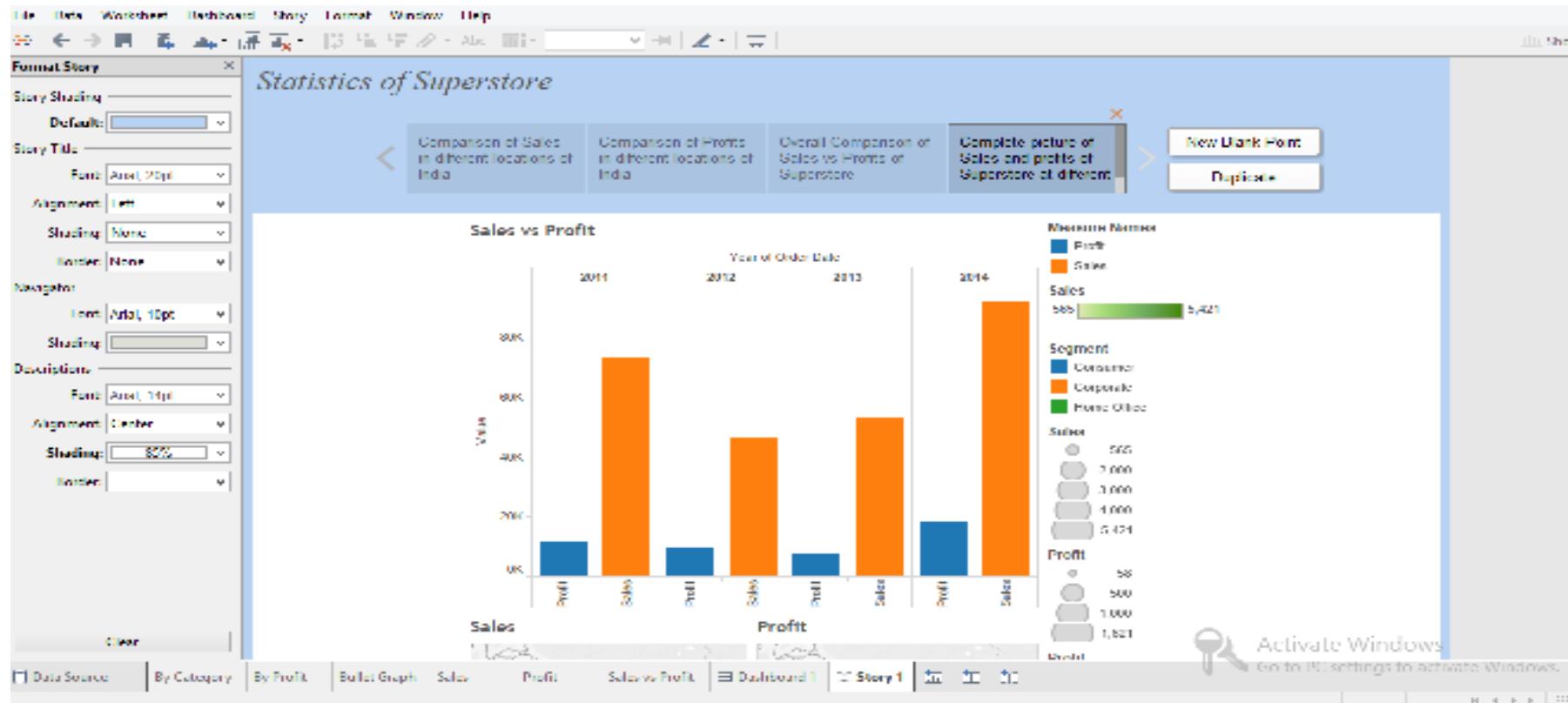
- Interface of Story Board. We can add Story Title, and we can create different slides in the Story.

# Steps Involved:



- I have added the Title and First slide to my story. And I named my first slide as “Comparison of Sales in different locations of India”.
- In same lines try to create different slides for our story.

# Steps Involved:



- By clicking on New blank point we get a slide.
- There are different slides in the “Statistics of Superstore”. By moving around the slides we can convey our information in form Story.

# Connecting Tableau with R:

Before connecting Tableau with R, Let's have a brief look on *What is R?*

## *What is R?*

R is a popular statistical language used to perform sophisticated statistical analysis and predictive analytics, such as linear and nonlinear modeling, statistical tests, time-series analysis, classification, clustering, etc.

The R-console primarily utilizes a command-line interface, but there are many GUI tools available for download to make it easier to write R programs (most of them are free). With R, users can create variables, formulas, functions, and graphs to visualize their analysis and predictions.

# Connecting Tableau with R:

*How is Tableau integrating with R?*

R functions and models can now be used in Tableau by creating new calculated fields that dynamically invoke the R engine and pass values to R. The results are then returned back to Tableau for use by the Tableau visualization engine.

*How to Integrate Tableau with R?*

*Step-1:* If you don't have a R then download the R from this below link

<http://ftp.iitm.ac.in/cran/>

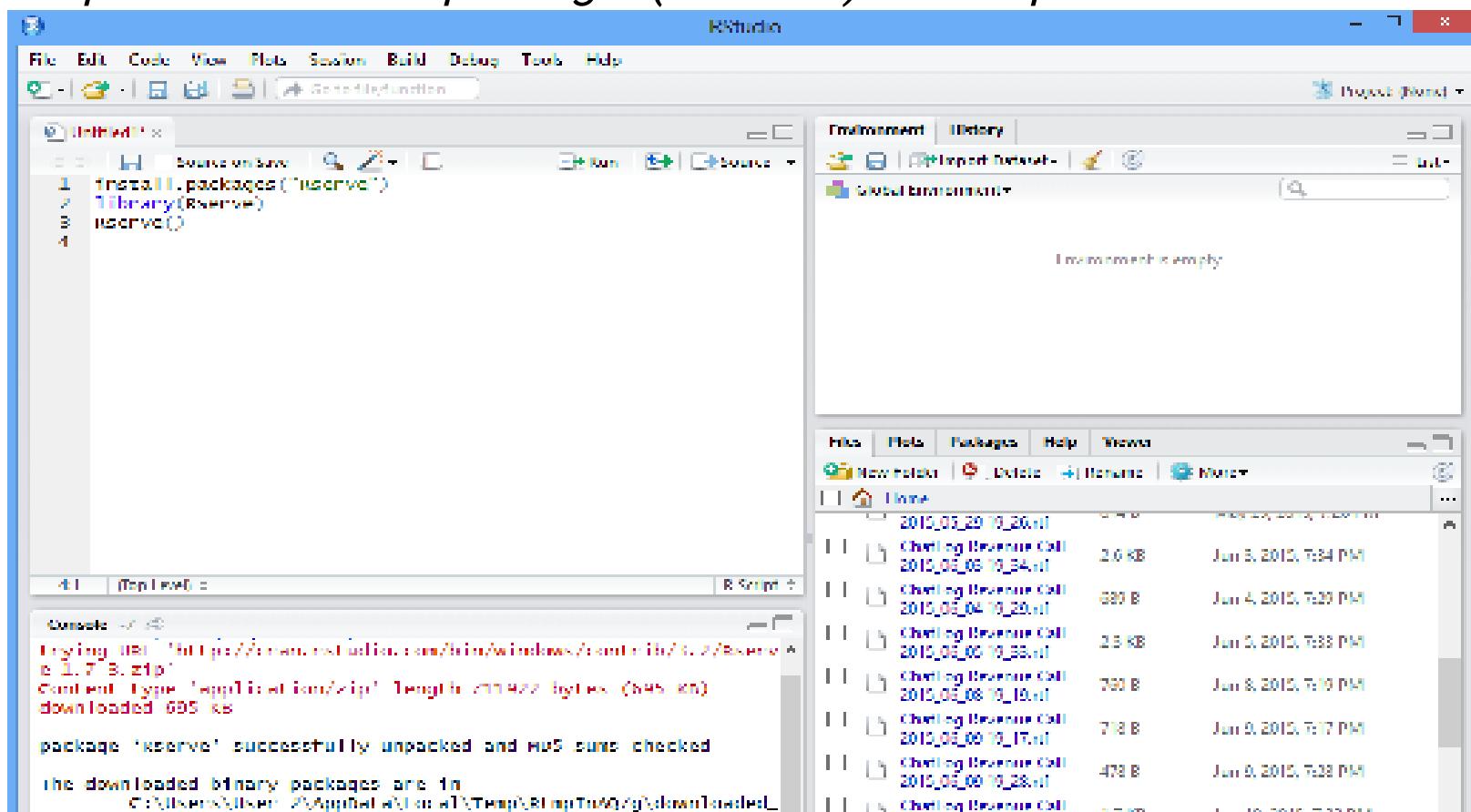
*Step-2:* Install R studio after installing R

*Step-3:* Now install the Rserve in R Studio.

# Connecting Tableau with R:

*How to Integrate Tableau with R?*

*Step-4: Enter `install.packages("Rserve")` in Rscript*



The screenshot shows the RStudio interface with the following details:

- Code Editor:** The 'Untitled.R' script contains the following R code:

```
install.packages("Rserve")
library(Rserve)
Rserve()
```
- Console Output:** The 'Console' tab shows the output of the R command to download the 'Rserve' package:

```
trying URL 'http://cran.rstudio.com/bin/windows/contrib/3.1/Rserve_1.7-3.zip'
Content type: application/x-zip' Length: 271422 bytes (265 KB)
downloaded 265 KB

package 'Rserve' successfully unpacked and MD5 sums checked
```

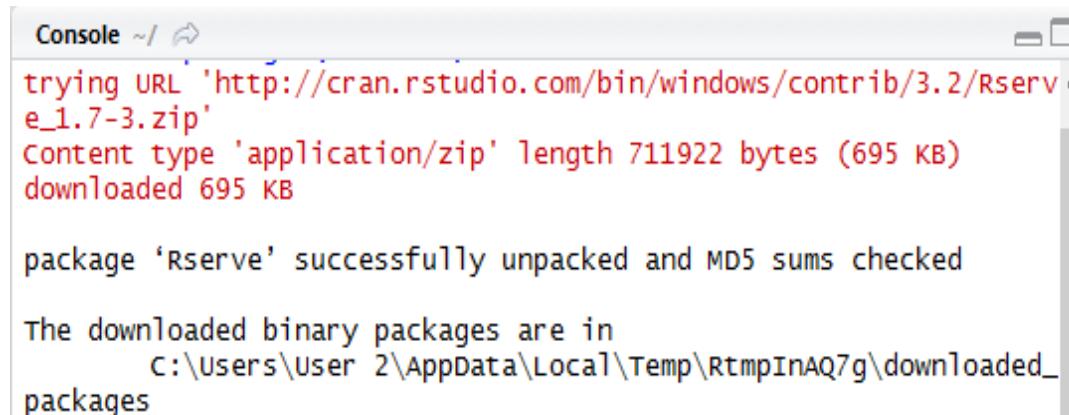
The downloaded binary packages are located at `C:\Users\Aman\AppData\Local\Temp\RtmpfBqg\downloaded_`.
- Environment:** The 'Environment' tab shows the global environment is empty.
- Files:** The 'Files' tab shows a list of files in the current directory, all named 'Checking Revenue Call' with various dates and file sizes.

# Connecting Tableau with R:

*How to Integrate Tableau with R?*

*Step-5: `install.packages("Rserve")` < Click enter*

*Step-6: We can view the R is automatically connecting to the data and automatically getting installed to the R packages.*



```
Console ~ / 
trying URL 'http://cran.rstudio.com/bin/windows/contrib/3.2/Rserve_1.7-3.zip'
Content type 'application/zip' length 711922 bytes (695 KB)
downloaded 695 KB

package 'Rserve' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
  C:\users\user 2\AppData\Local\Temp\RtmpInAQ7g\downloaded_
  packages
```

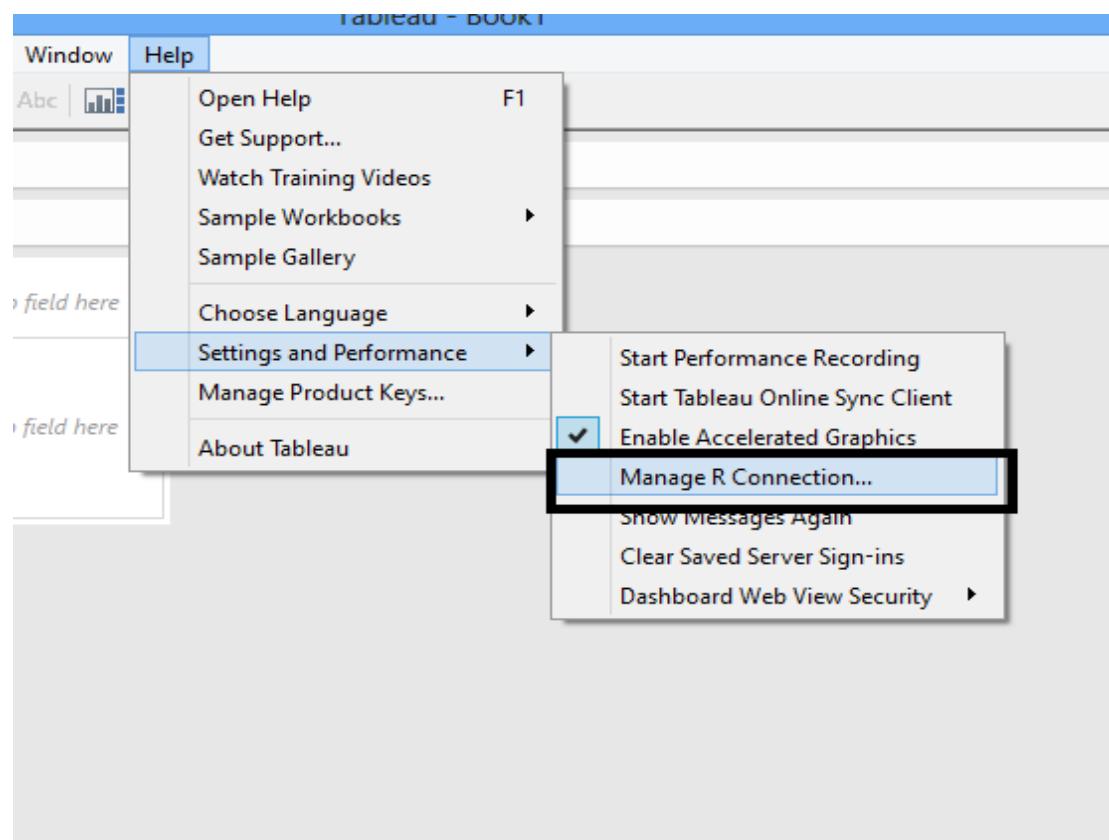
*Step-7: Now in R script enter `library(Rserve)`*

`Rserve()`

# Connecting Tableau with R:

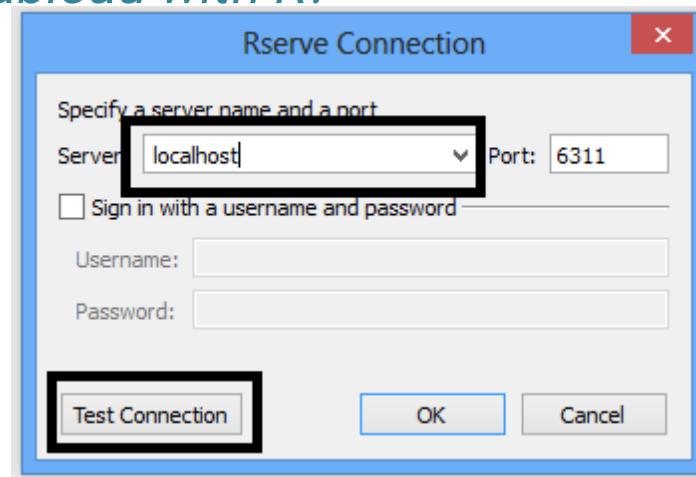
*How to Integrate Tableau with R?*

**Step-8:** Now open Tableau and goto help< Setting and Performance< Manage R connection.

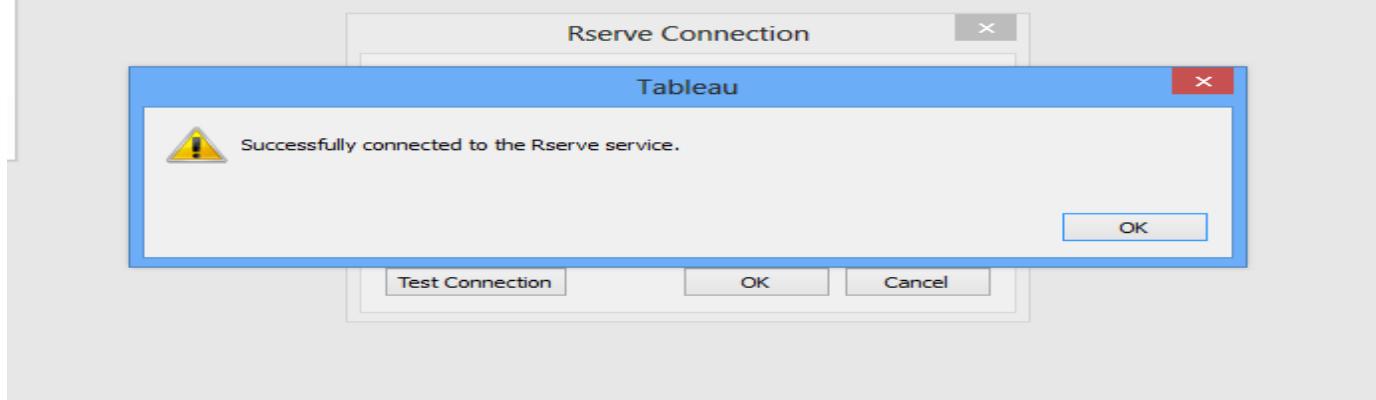


# Connecting Tableau with R:

*How to Integrate Tableau with R?*



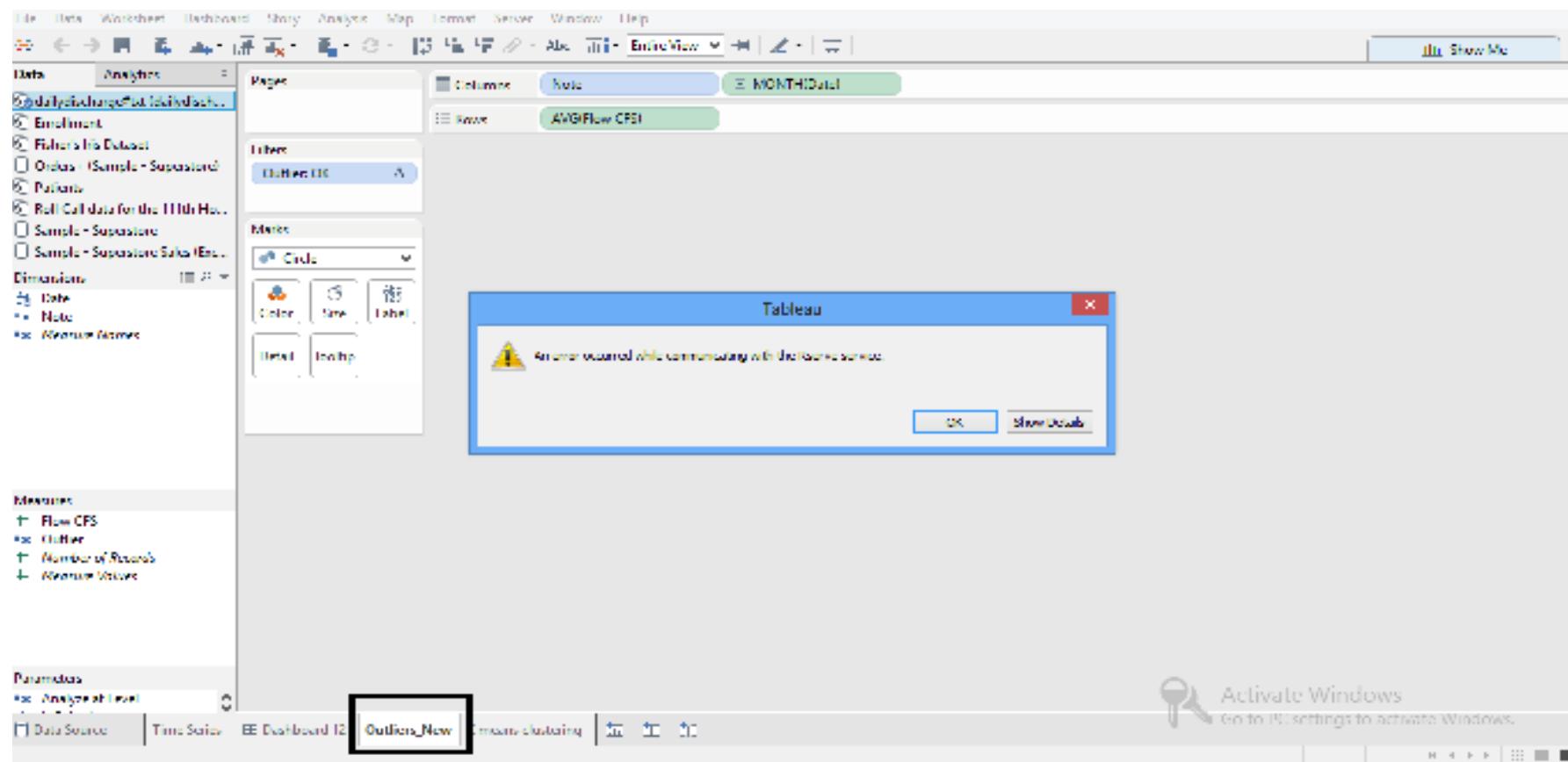
Step-9: Enter Server name as **localhost** and port as **6311** and click on Test Connection button. If you get a message like 'Successfully connected to the Rserve service.' then your Tableau or R connection is successful.



# Connecting Tableau with R:

*Hands-On:*

*Step-1:* Now open the file [r and tableau integration](#) file using Tableau.  
And click on the [outliers](#) sheet.

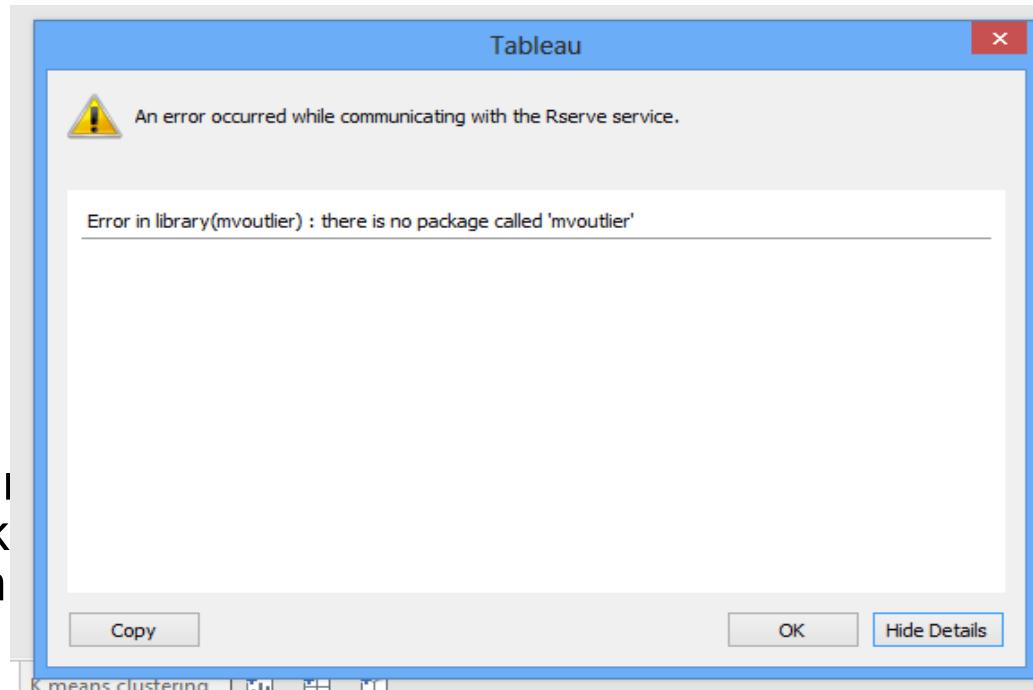


# Connecting Tableau with R:

## *Hands-On:*

**Step-2:** Let's check why it is showing error in opening the Outliers Sheet. SO click on the Show details.

**Step-3:** Error in Tableau Studio Pack missing in the R to download  
mvoutlier in

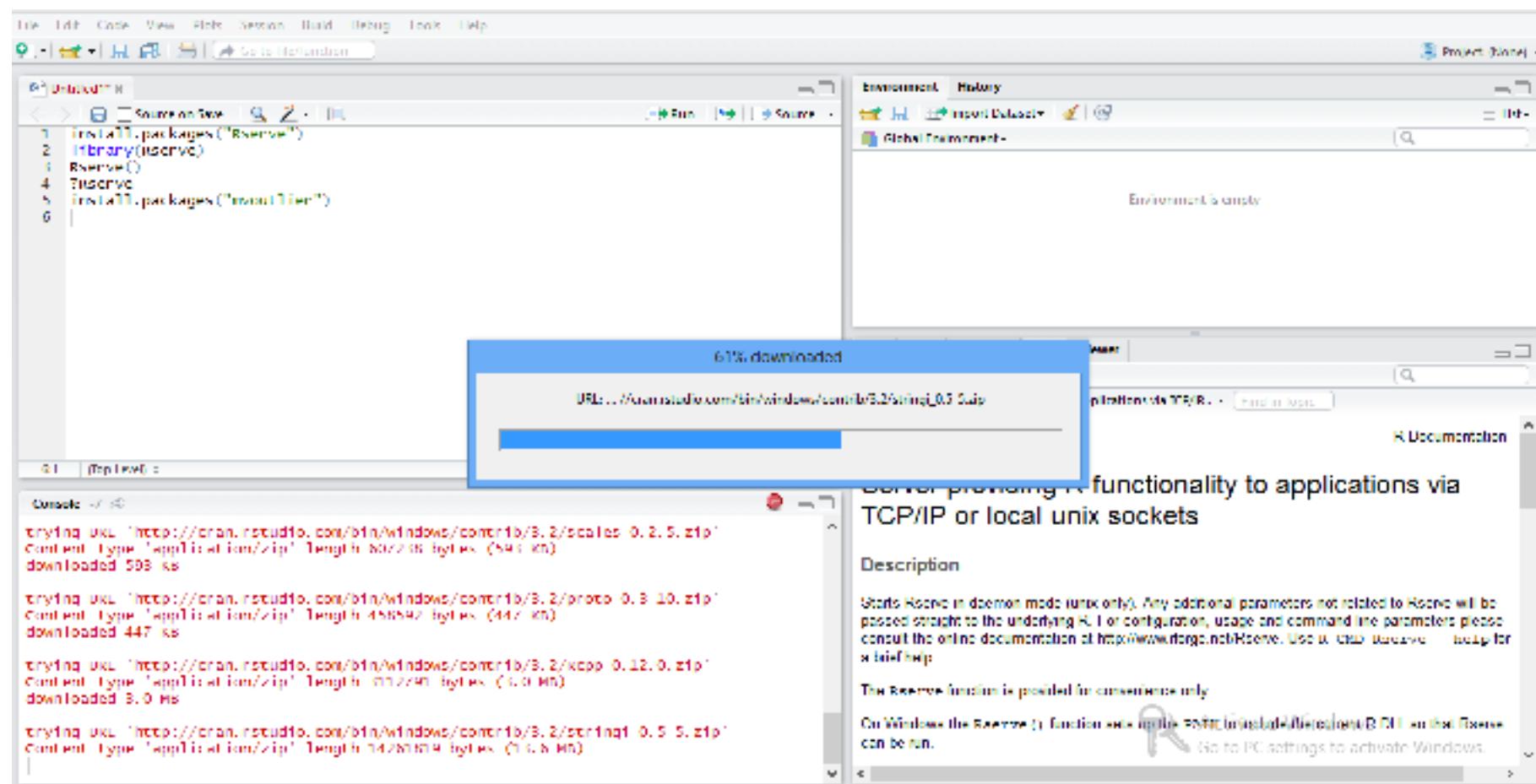


missing in the R  
to download

# Connecting Tableau with R:

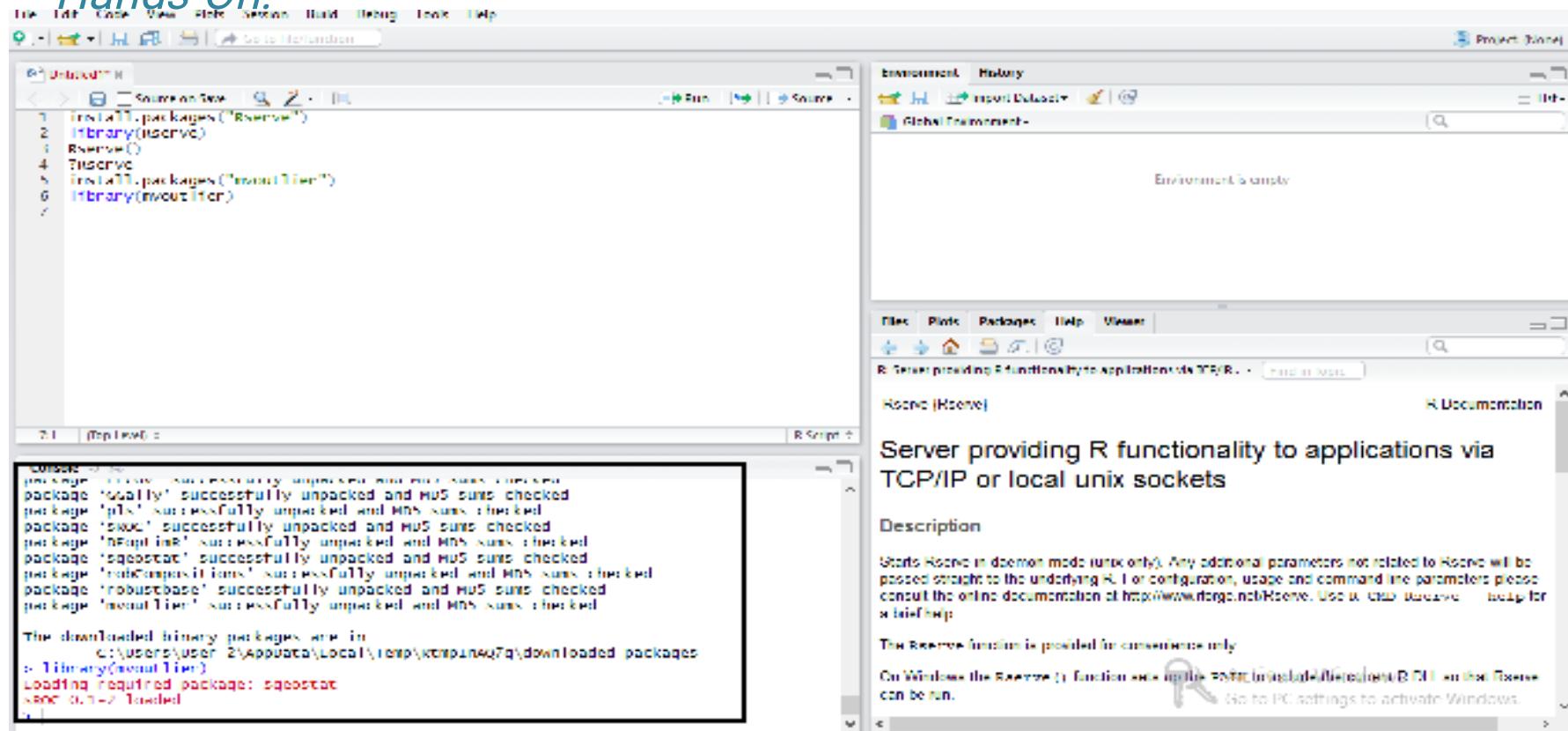
*Hands-On:*

**Step-4:** Let's install the [mvoutlier](#) package in R



# Connecting Tableau with R:

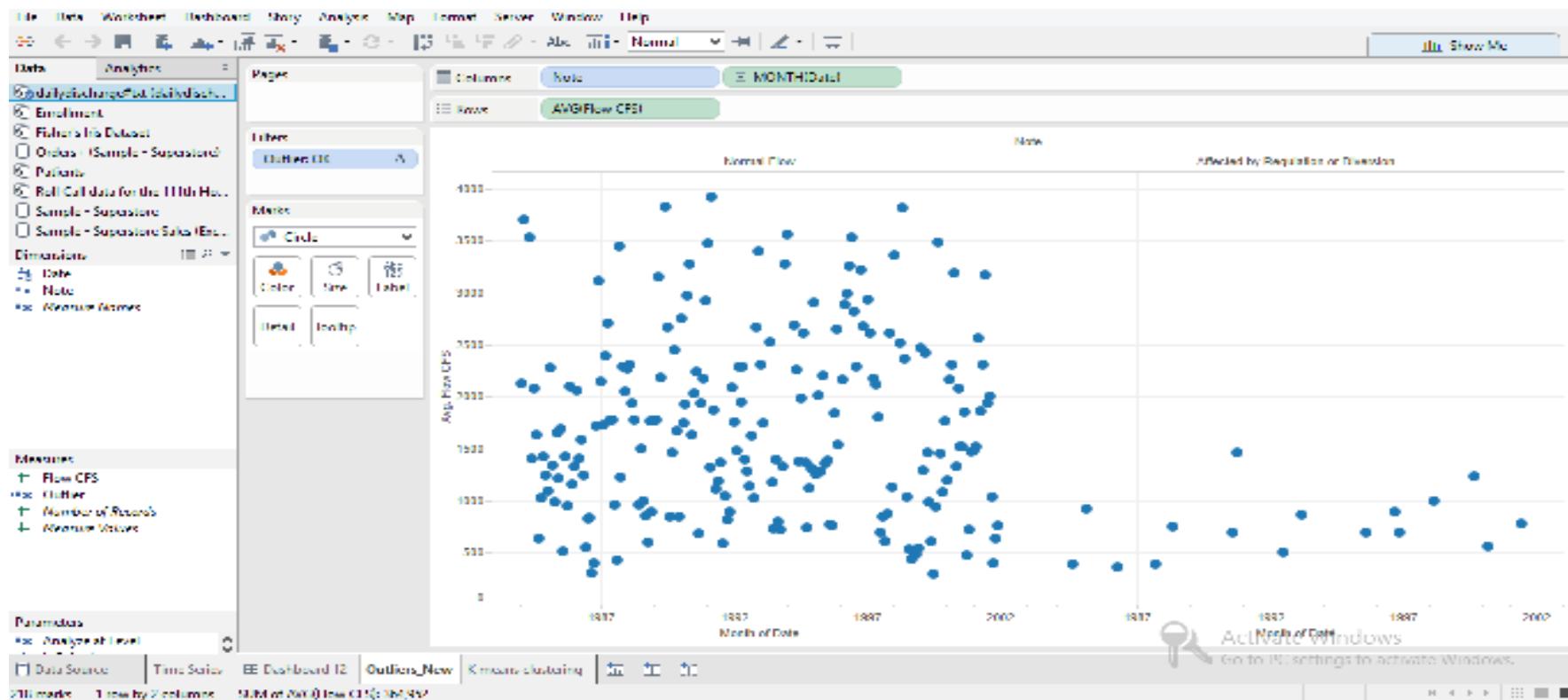
## *Hands-On:*



*Step-5: Now let's open the outliers worksheet. Let's check whether its showing error message or opening data.*

# Connecting Tableau with R:

*Hands-On:*

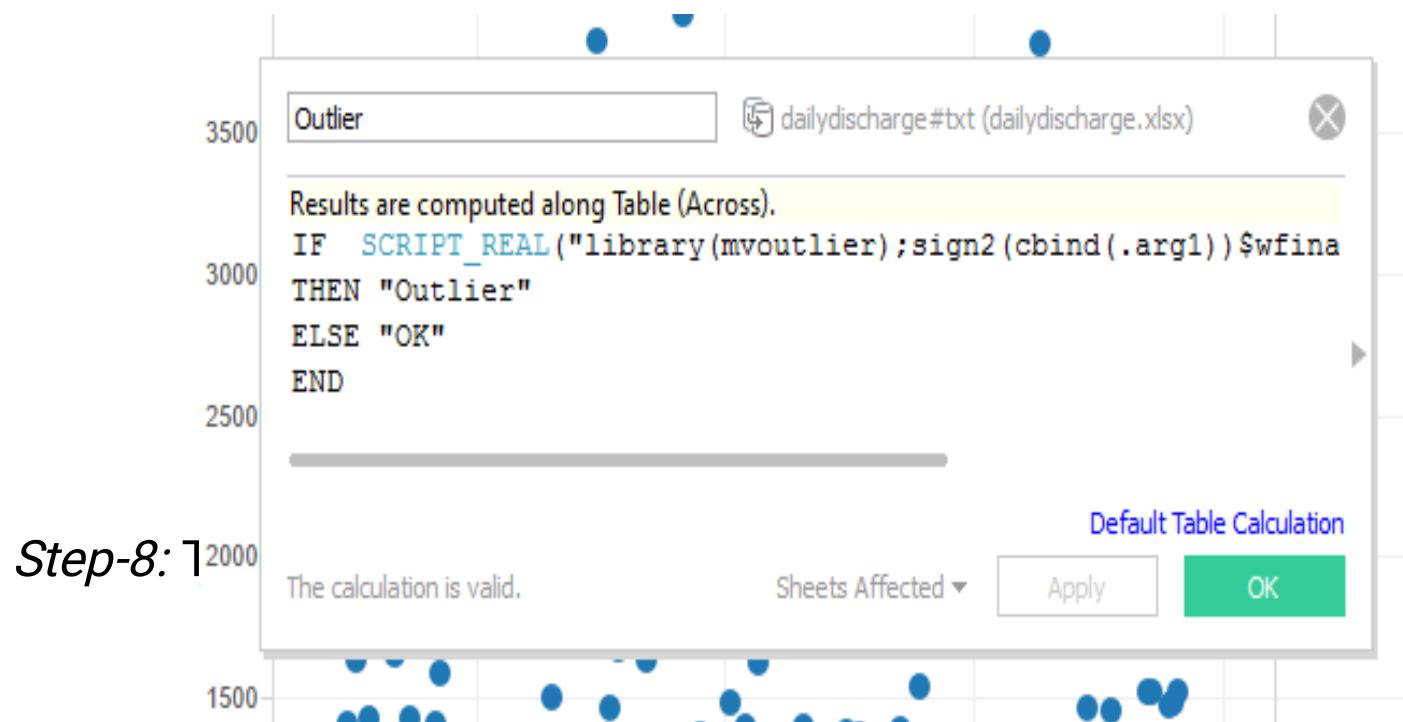


*Step-6: Yeah Visualization is displayed. Let's check the R Script behind Outliers Field.*

# Connecting Tableau with R:

*Hands-On:*

Step-7: Click on Outliers Field in Measure pane < Click on Edit < Enter



Step-8: 1