# Data Visualisation for Business

# ANL 201

*Advanced Data Visualisation Techniques*
*Study Unit 6*

January 2024

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# Recap

- What is a Business Performance Dashboard and its benefits?
- Types of Business Performance Dashboard- *Strategic, Tactical and Operational*
- Dashboard design principles
- Creating Business Performance Dashboard in Tableau
  - Adding advanced dashboard navigation- *Filter, Highlight, Go to URL*

# Visualisation of Spatial Data

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# Visualisation of Spatial Data

## Best practices for visualising spatial data

- Spatial data are related to the location of the subject matter, such as customer country, supplier address, etc.
- The most common way to visualise spatial data is with maps that place values within a geographic coordinate
- We can visualise the geographic coordinate of a location by mapping the latitude and longitude coordinates to two-dimensional space, and draw a point on the space
- If we want to explore relationships between entities, we can plot each entity on a map, and draw lines to connect each with the others they are associated with

# Visualisation of Spatial Data

Map- Refer to excel file <global superstore_2016.xls>

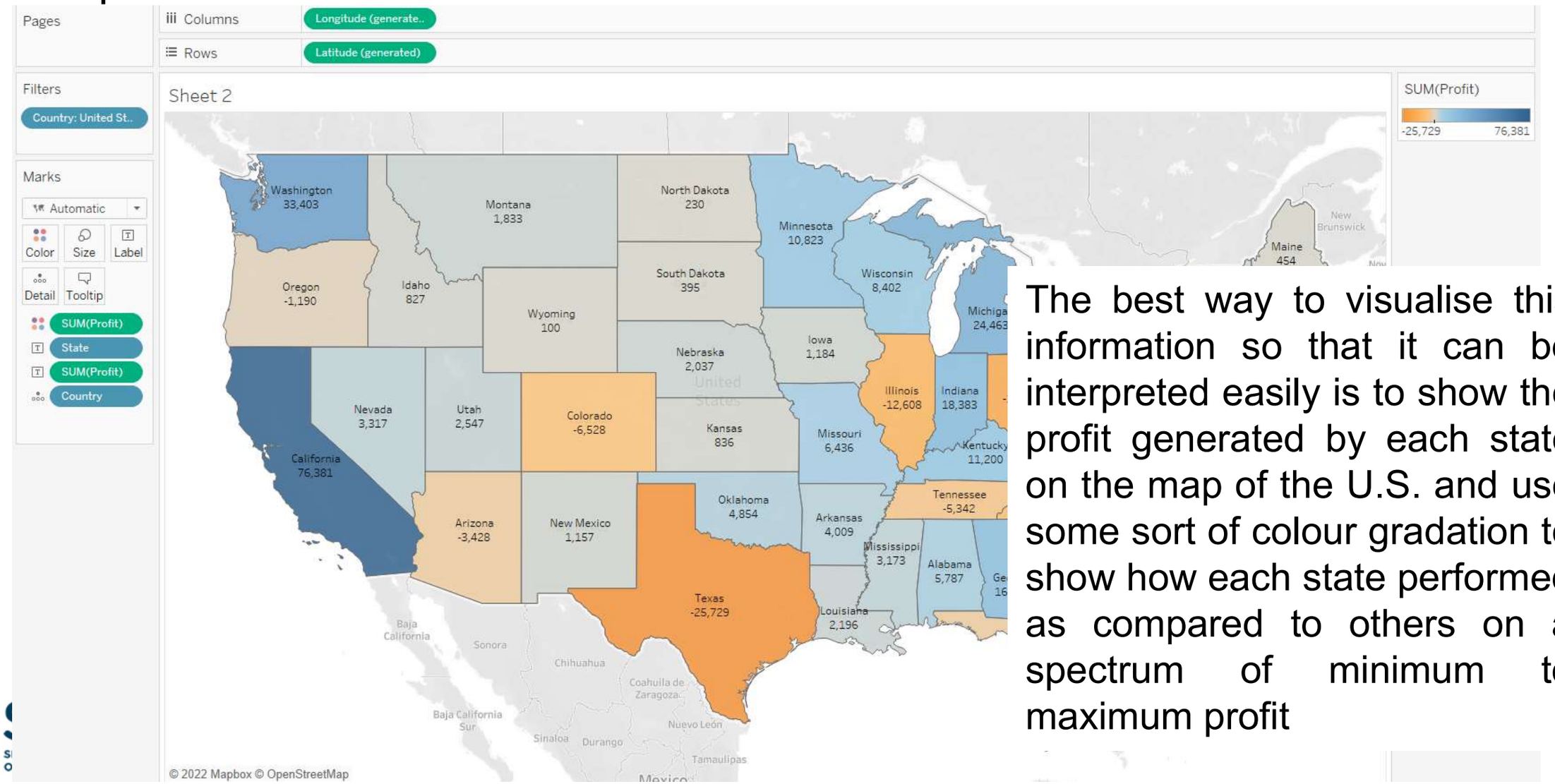
**Visualisation task:**

The sales vice president of global superstores would like to see how each state performed as compared to others in terms of profit generated in the U.S.

One way to visualise this is using a bar chart, but the categorical axis will get too long as there are almost 50 states in the U.S.. Another chart that could be used here is the pie-chart, but again, it will become too cluttered showing almost 50 slices in a single pie.

# Visualisation of Spatial Data

## Map




The best way to visualise this information so that it can be interpreted easily is to show the profit generated by each state on the map of the U.S. and use some sort of colour gradation to show how each state performed as compared to others on a spectrum of minimum to maximum profit

# Visualisation of Spatial Data

## Map

- Tableau supports following:
  - Worldwide airport codes, cities, countries, regions, territories, states, provinces
  - Some postcodes and second-level administrative districts (county-equivalents)
  - U.S. area codes, Core Based Statistical Areas (CBSA), Metropolitan Statistical Areas (MSA), Congressional districts, and Zip codes
  - Any latitude and longitude coordinates are supported, as long as they are in decimal degrees

# Visualisation of Spatial Data

## Map

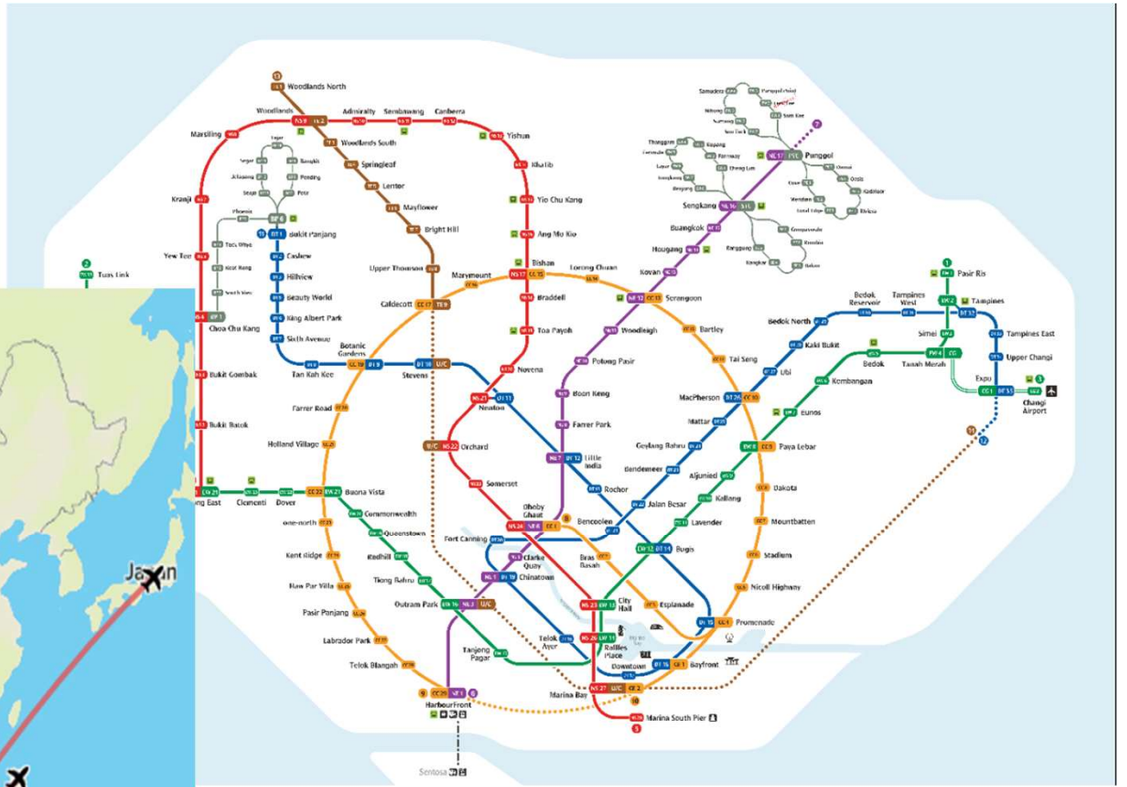
The steps to creating this visualisation in Tableau are illustrated below:

1. Create a new worksheet.
2. If necessary, assign the geographic role to fields that are not automatically recognised by Tableau as geographic data.
3. Drag and drop “Longitude” measure to columns.
4. Drag and drop “Latitude” measure to rows.
5. Drag and drop “Country” dimension on the “Detail”.
6. Add “Country” dimension to filters and filter “United States” from the countries list.
7. Drag and drop “State” dimension on the “label” marks card.
8. Drag and drop “Profit” measure on the “Color” marks card.
9. Drag and drop “Profit” measure on the “Label” marks card.

# Visualisation of Spatial Data

## Path maps (flow maps) & Spider maps (Origin-destination maps)

- Maps that show point-to-point detail or path between two locations

- Spider maps show path between an origin and one or more destination locations

# Visualisation of Spatial Data

Mapping point-to-point detail (<point to point map dataset.xls>)

A path ID for every unique path

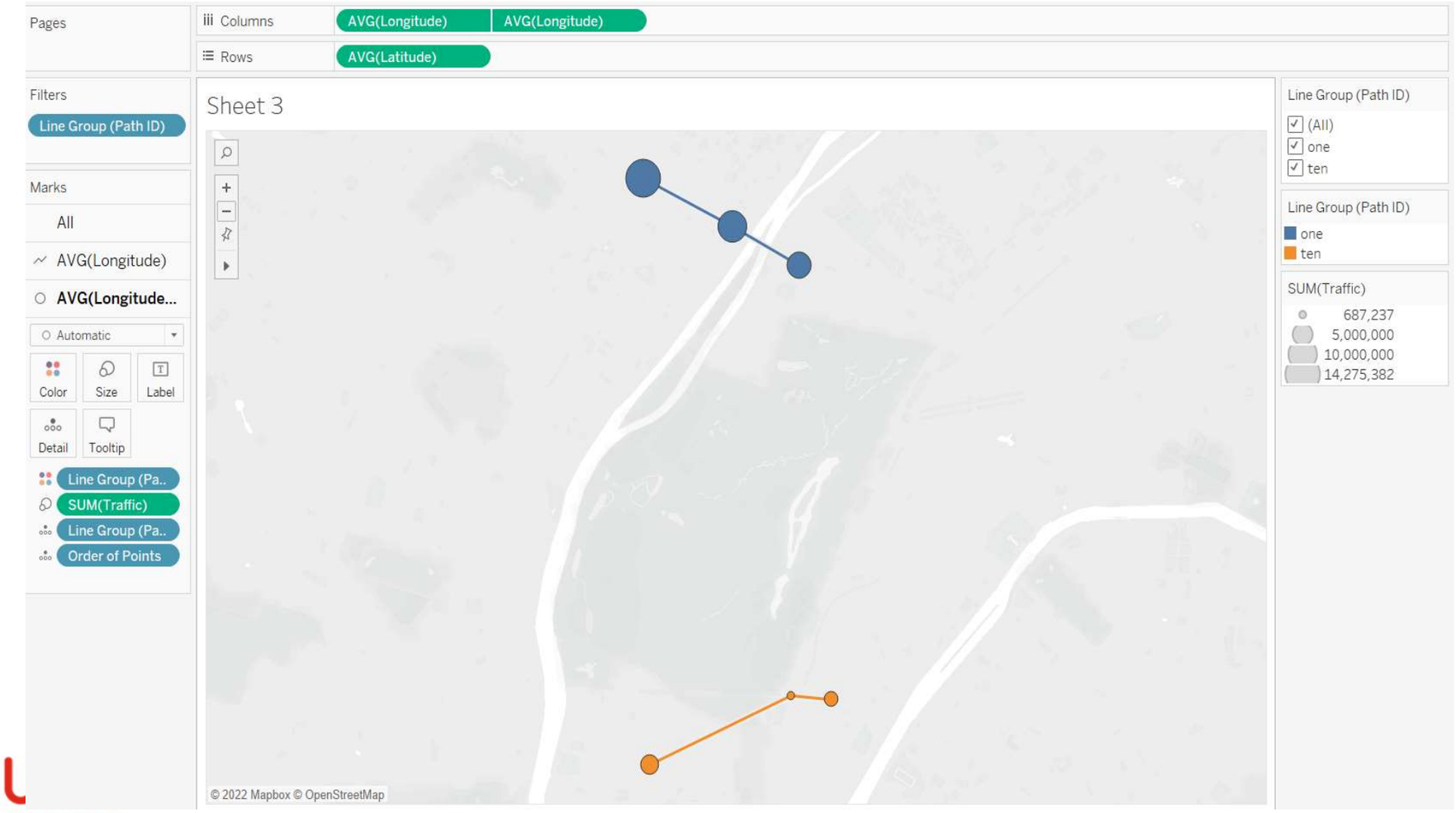
Numbers to define the drawing order of each data point

Latitude and longitude coordinates for every location

| Line (suburban metro line number) | Line Group (Path ID) | Order of Points | Station (Paris, France) | Latitude | Longitude | Traffic |
|---|---|---|---|---|---|---|
| 1 | 1 | 1 | La Défense (Grande Arche) | 48.891934 | 2.237883 | 14,275,382 |
| 1 | 1 | 2 | Esplanade de la Défense | 48.887843 | 2.250442 | 9,843,051 |
| 1 | 1 | 3 | Pont de Neuilly | 48.884509 | 2.259892 | 6,902,931 |
| 10 BOUCLE | 10 | 1 | Boulogne-Jean-Jaurès | 48.842222 | 2.238836 | 3,847,782 |
| 10 BOUCLE | 10 | 2 | Porte d'Auteuil | 48.848074 | 2.258648 | 687,237 |
| 10 BOUCLE | 10 | 3 | Michel-Ange-Auteuil | 48.847740 | 2.264297 | 2,222,709 |

# Visualisation of Spatial Data

## Point to point map (Dataset- <point to point map dataset.xls>)



# Visualisation of Spatial Data

## Point to point map (Dataset- <point to point map dataset.xls>)

Below are the steps to creating a point-to-point map in Tableau using the dataset <point to point map dataset.xls>:

1. Create a new worksheet.
2. In the new worksheet, from Measures, drag Longitude to the Columns shelf, and Latitude to the Rows shelf.
3. From Dimensions, drag Line Group (Path ID) to Detail on the Marks card.
4. On the Marks card, click the Mark Type drop-down and select Line.
5. From Measures, drag Point Order to Path on the Marks card.
6. Point Order is aggregated as a sum.
7. On the Marks card, right-click the SUM(Point Order) field and select Dimension.
8. From Dimensions, drag Line Group (Path ID) to Color on the Marks card.
9. Each line now has its own colour associated with it, and a colour legend is added to the view.

(*Contd….)*

# Visualisation of Spatial Data

## Point to point map (Continued from previous slide)

10. From Measures, drag Longitude to the Columns shelf and place it to the right of the first longitude field.
11. On the Marks card, under the bottom AVG (longitude) tab, click the Mark type drop-down and select Automatic.
12. On the Columns shelf, right-click the second AVG (Longitude) field (on the right), and select Dual Axis. Your map views are now layered on top of one another.
13. From Measures, drag Traffic to Size, on the bottom AVG (longitude) Marks card. The size of the data points update to show the amount of traffic per station.
14. On the Marks card, click Size and move the slider to the right.
15. On the Marks card, click Color, and then, under Effects, click the Border drop-down and select a colour.
16. The view is now complete. You can quickly find the stations on each metro line with the most traffic.

# Discussion

What type of chart will you recommend for the scenarios listed?

(a) The Customer Service Director of a network service provider is interested to know where majority of their customers are residing so that he is able to plan the location of the new service centre.

(b) The Sales Director of a mobile phone manufacturer is interested to compare the sales performance of a new mobile model that had just been launched across regions.

(c) The Sales Director of a mobile phone manufacturer is interested to compare the sales performance of a new mobile model that had just been launched with other mobile models of the company in the various regions.

# Discussion

What type of chart will you recommend for the scenarios listed?

| | |
|---|---|
| (a) The Customer Service Director of a network service provider is interested to know where majority of their customers are residing so that he is able to plan the location of the new service centre. | Map |
| (b) The Sales Director of a mobile phone manufacturer is interested to compare the sales performance of a new mobile model that had just been launched across regions. | Bar Chart |
| (c) The Sales Director of a mobile phone manufacturer is interested to compare the sales performance of a new mobile model that had just been launched with other mobile models of the company in the various regions. | Side-by-side Bar Chart/ circle view |

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# Visualisation of Multi Variable Data

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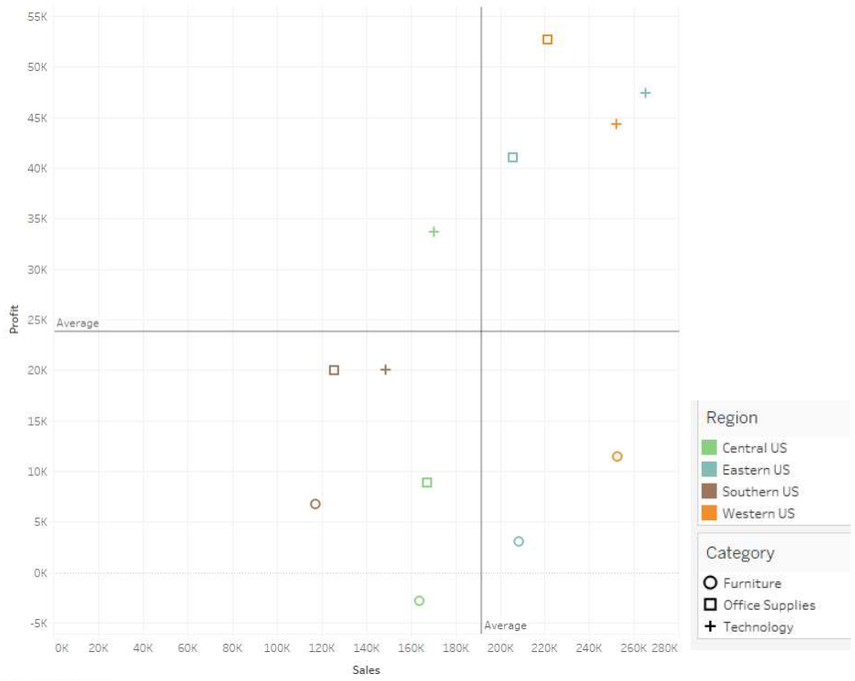
# Visualisation of Multi Variable Data

Scatterplot- Refer to excel file <global superstore_2016.xls>

**Visualisation task:**

When the sales vice president would like to compare the profit and sales across categories and regions for the U.S., he can use a scatter plot in Tableau




Scatter plots' shows relationships between two numeric variables

Identification of correlational relationships are common with scatter plots

Scatter plots also use colour, shape and size to express more aspects of the variables

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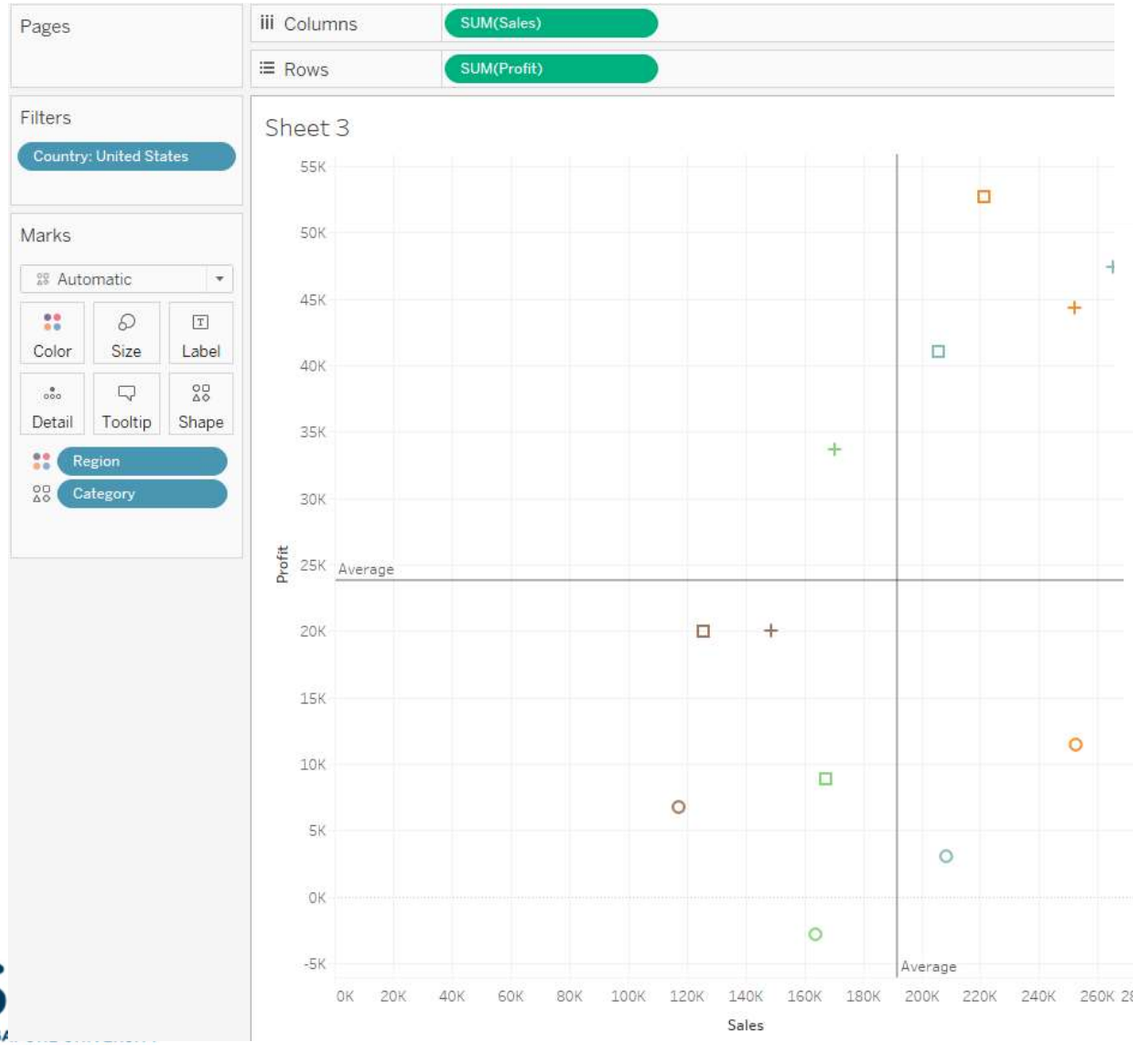
# Visualisation of Multi Variable Data

## Scatterplot




Both office supplies and technology categories generated above average sales and profit in the east and west


They can be loosely called the star performers in these two regions

On the other hand, all three categories performed below average in terms of both sales and profit in the South. This could be a reason for concern and also indicates some problem that needs further investigation

# Visualisation of Multi Variable Data

Scatterplot- Refer to excel file <global superstore_2016.xls>

Below are the steps to creating a scatter plot in Tableau:

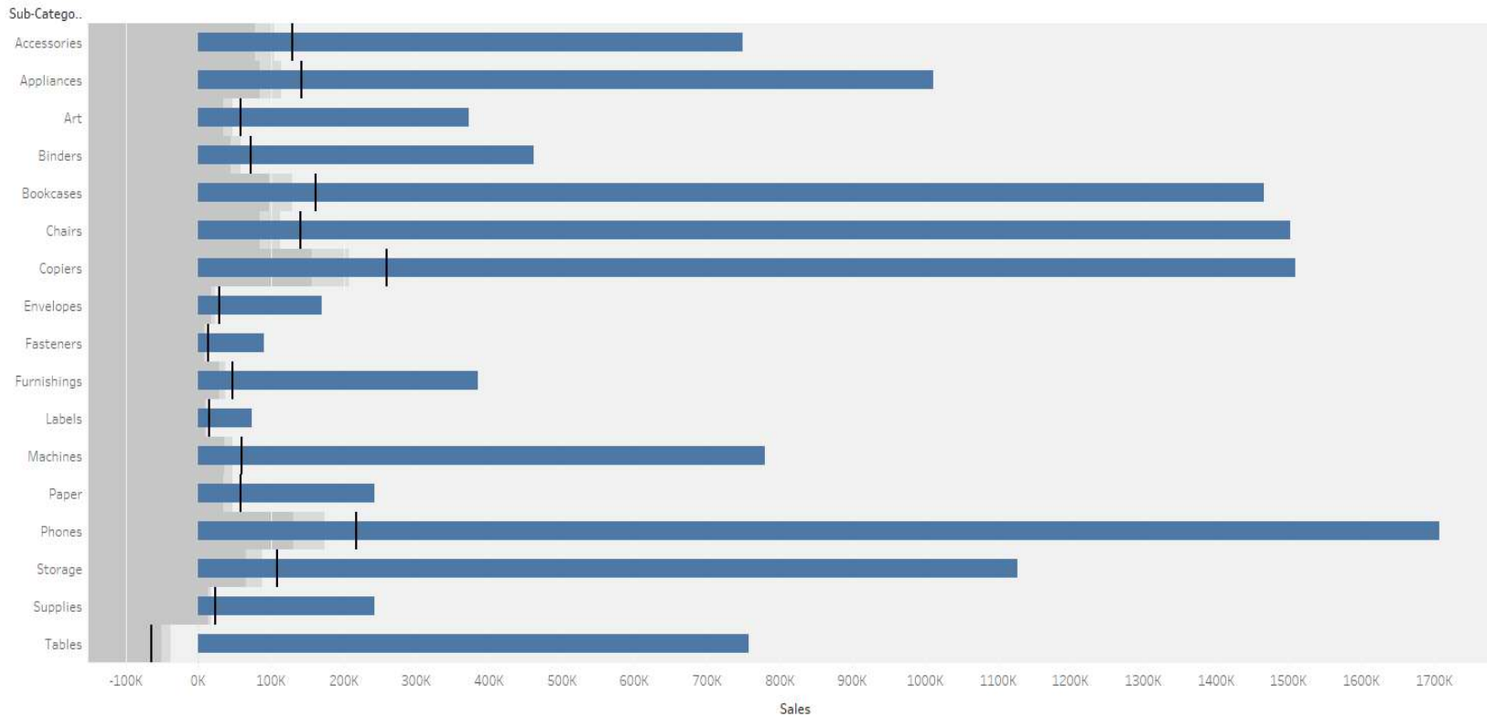
1. Create a new worksheet.
2. Drag “Sales” measure into the worksheet’s columns. The measure is automatically aggregated as a summation.
3. Drag “Profit” measure into the worksheet’s rows. The measure is automatically aggregated as a summation.
4. Drag and drop “Region” dimension on the “Color” marks card.
5. Drag and drop “Category” dimension on the “Shape” marks card.
6. Drag and drop “Country” dimension in “Filters” and select “United States” in the country name drop down list.
7. Click the “Analytics” tab next to “Data” pane. From the drop down menu, double click on “Reference Line” under “Custom”.

# Visualisation of Multi Variable Data

## Bullet chart

**Visualisation task:**

When the sales manager of the company would like to visualise the sales in the years 2012 and 2013 in each region together with target sales, he can use a bullet chart in Tableau.




A bullet chart is a bar chart that includes reference lines and reference distributions for each cell in the chart (1 dimension and 2 measures). . The bullet chart is usually created to compare actual value with target value of the measure.

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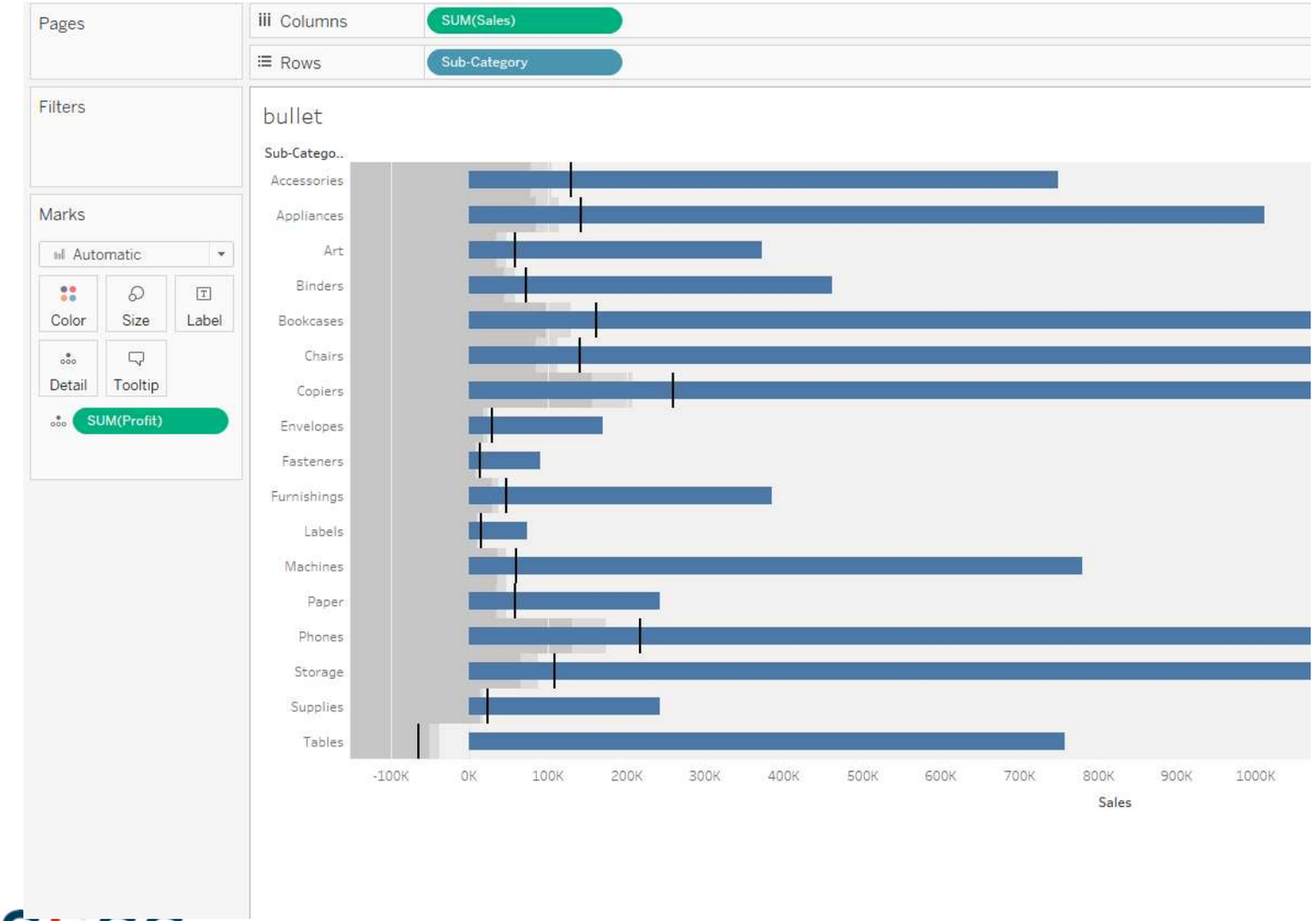
# Visualisation of Multi Variable Data

## Bullet chart




For this dataset, we will compare sales with profit

Actual sales compared to estimated sales (profit, in this case).

The centre blue bar represents actual value

The black vertical line represents a target value (profit, in this case).

The grey coloured bands represent ranges, such as poor, average, and good.

# Visualisation of Multi Variable Data

## Bullet chart

Below are the steps to creating a bullet chart in Tableau:

1. Create a new worksheet.
2. Drag “Sub-Category” dimension into the worksheet’s rows.
3. Drag “Sales” and “Profit” measures into the worksheet’s columns.
4. From the drop down menu on the right hand side, choose “Bullet Chart” as the chart type.
5. Right click on x-axis and select “Swap Reference Line Fields” option from the drop down menu to change the “Sales” and “Profit” positions in the graph.

# Visualisation of Multi Variable Data

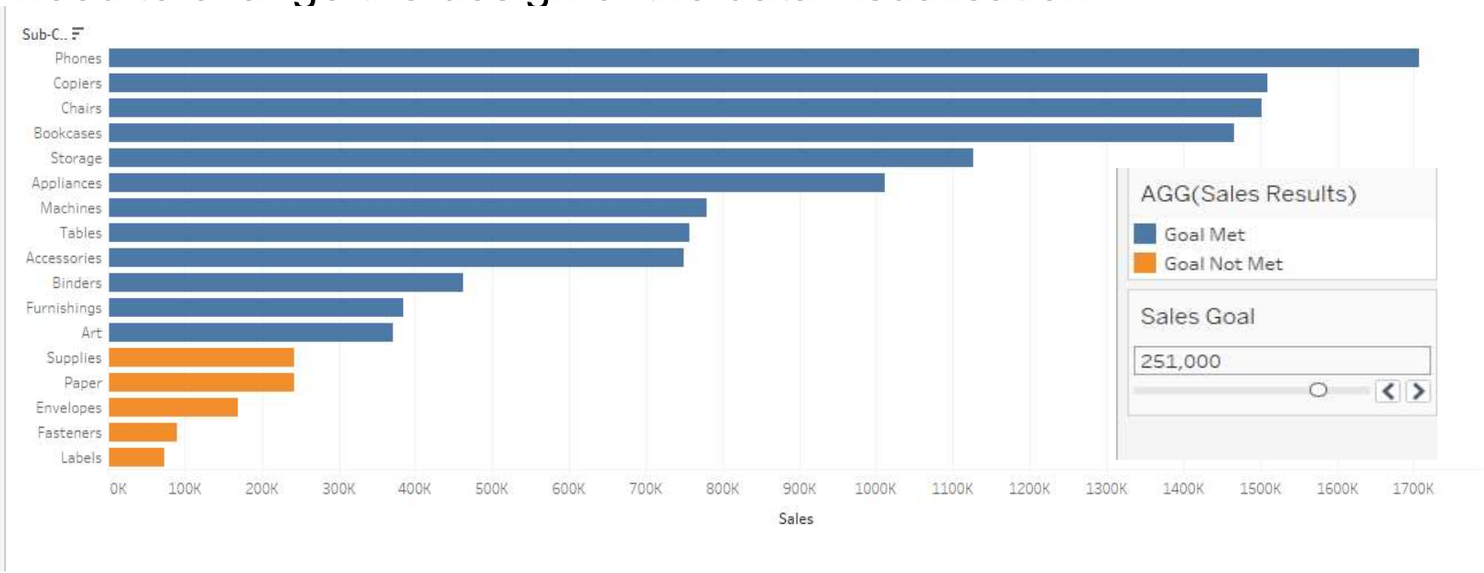
## Building Parameters

Parameters can change normally static values into dynamic entities.

Facilitate ad-hoc analysis without the need to change the design of the data visualisation.

A parameter is a workbook variable- number, date, or string that can replace a constant value

For example, create a calculated field that returns “True” if sales > $100,000 else “False”




You can replace the constant value of “100000” in the formula with a parameter.

Then, using the parameter control, you can dynamically change the threshold in your calculation.

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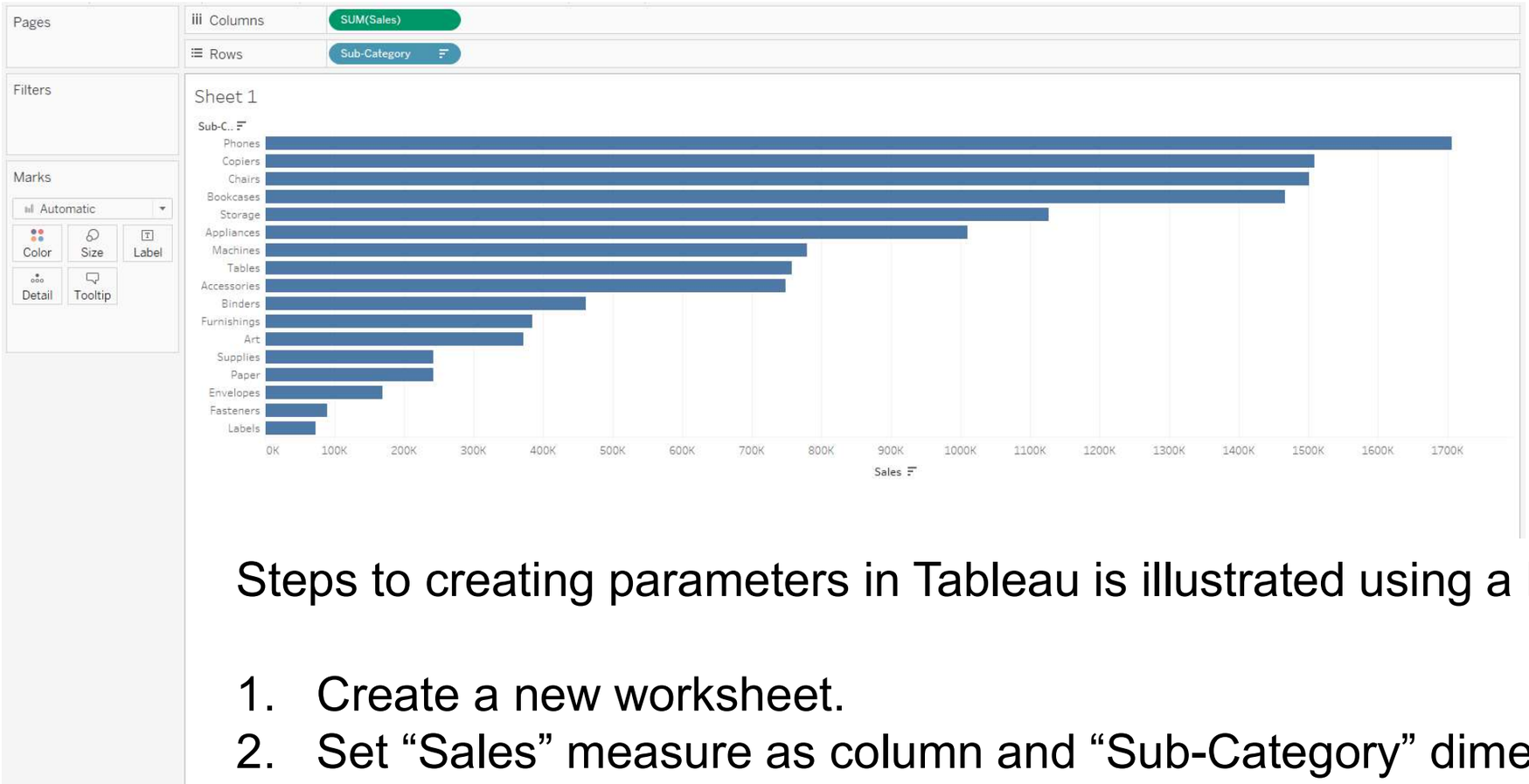
# Visualisation of Multi Variable Data

## Building Parameters




Steps to creating parameters in Tableau is illustrated using a horizontal bar graph

1. Create a new worksheet.
2. Set “Sales” measure as column and “Sub-Category” dimension as rows.
3. Sort the bars from highest to lowest sales.

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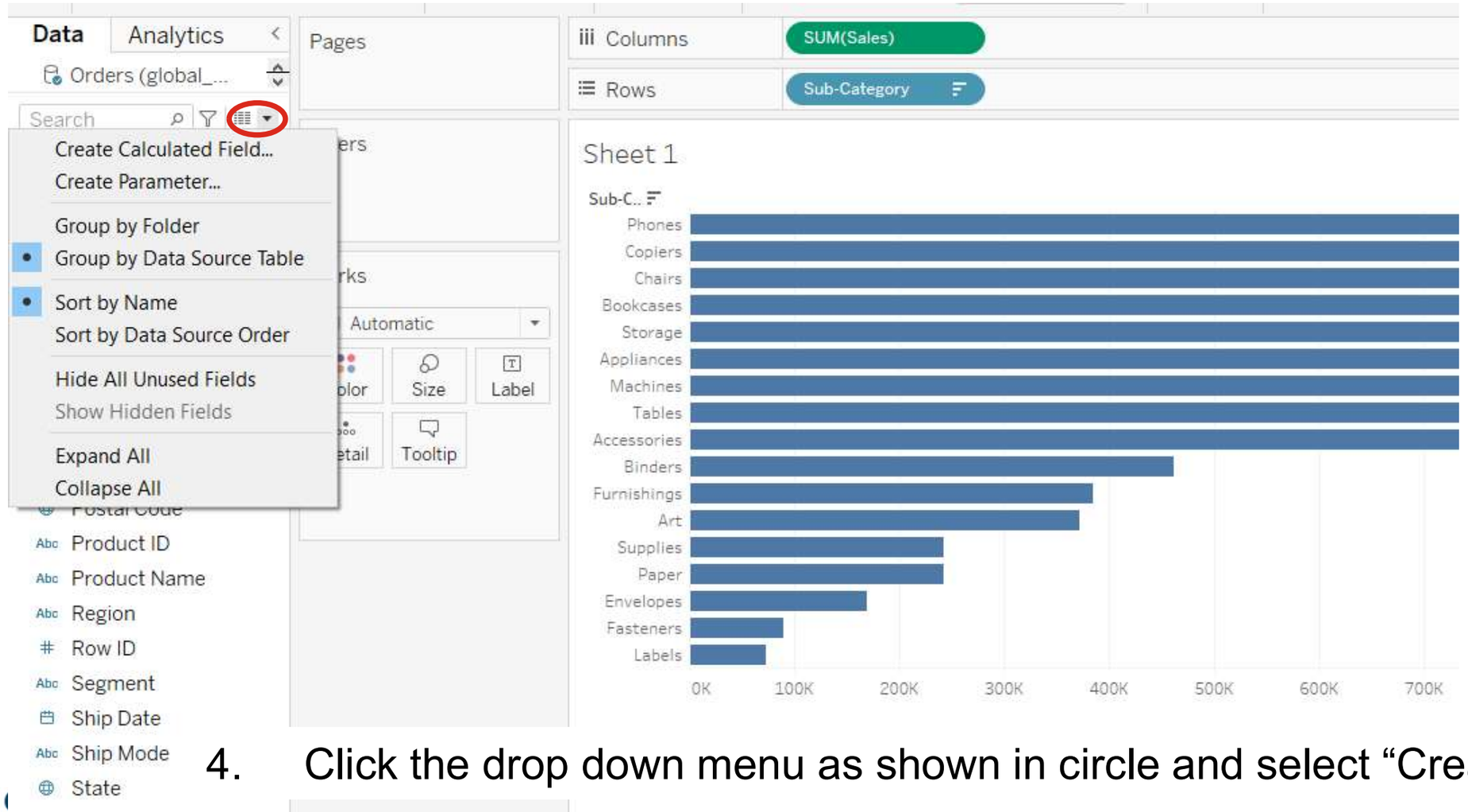
# Visualisation of Multi Variable Data

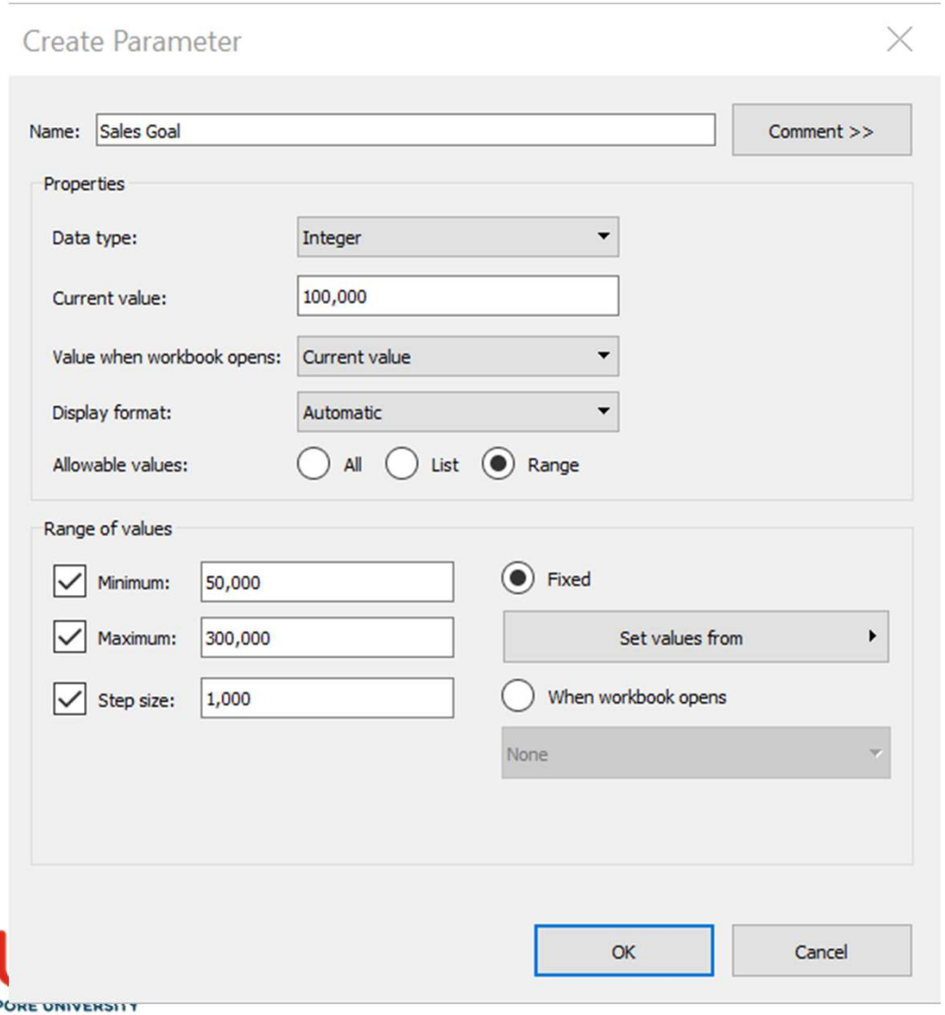
## Building Parameters




4. Click the drop down menu as shown in circle and select “Create Parameter”

# Visualisation of Multi Variable Data

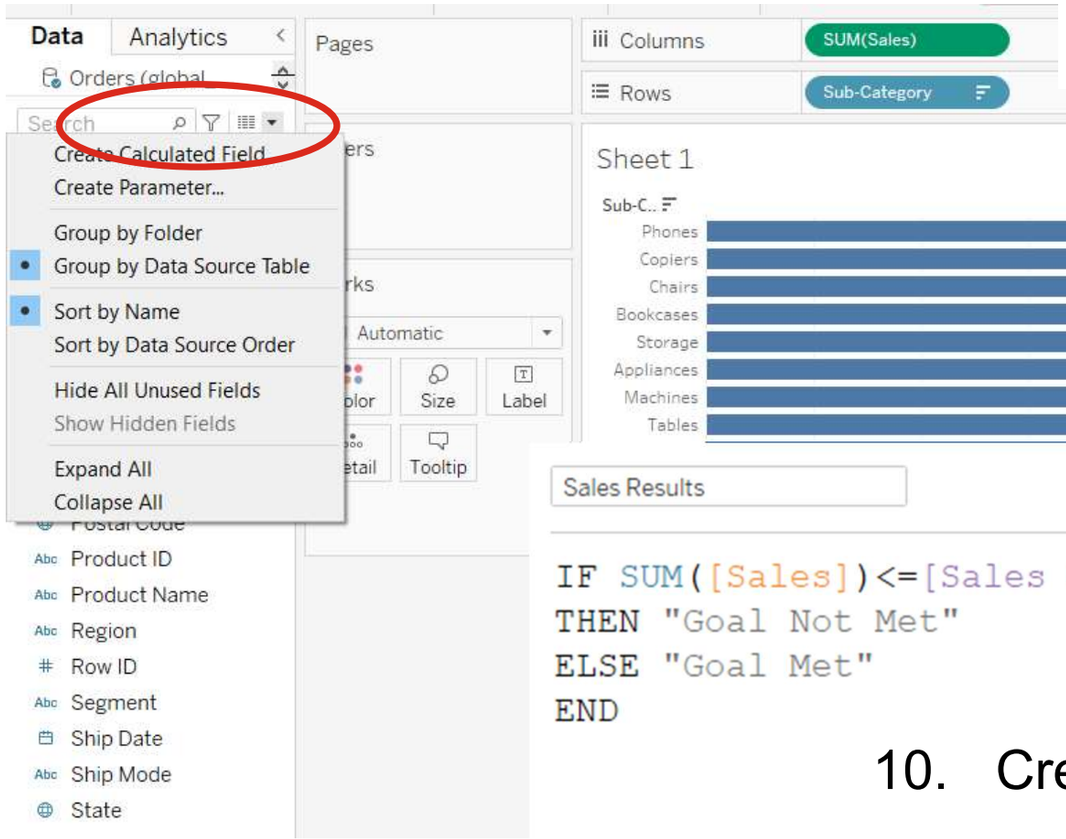
## Building Parameters




5. Set the data type to be “Integer” and format to “Currency (standard)”.
6. Specify current value as 100,000.
7. Select Range option in Allowable values option.
8. Specify the minimum as 50,000, maximum as 300,000 and step size as 1000.

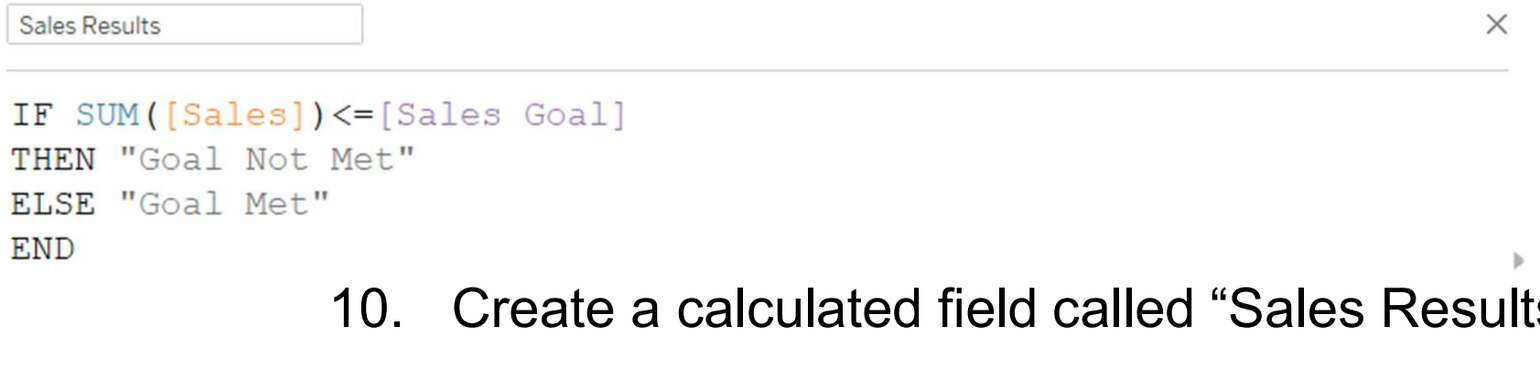
# Visualisation of Multi Variable Data

## Building Parameters




9. Open the “Create Calculated Field” window

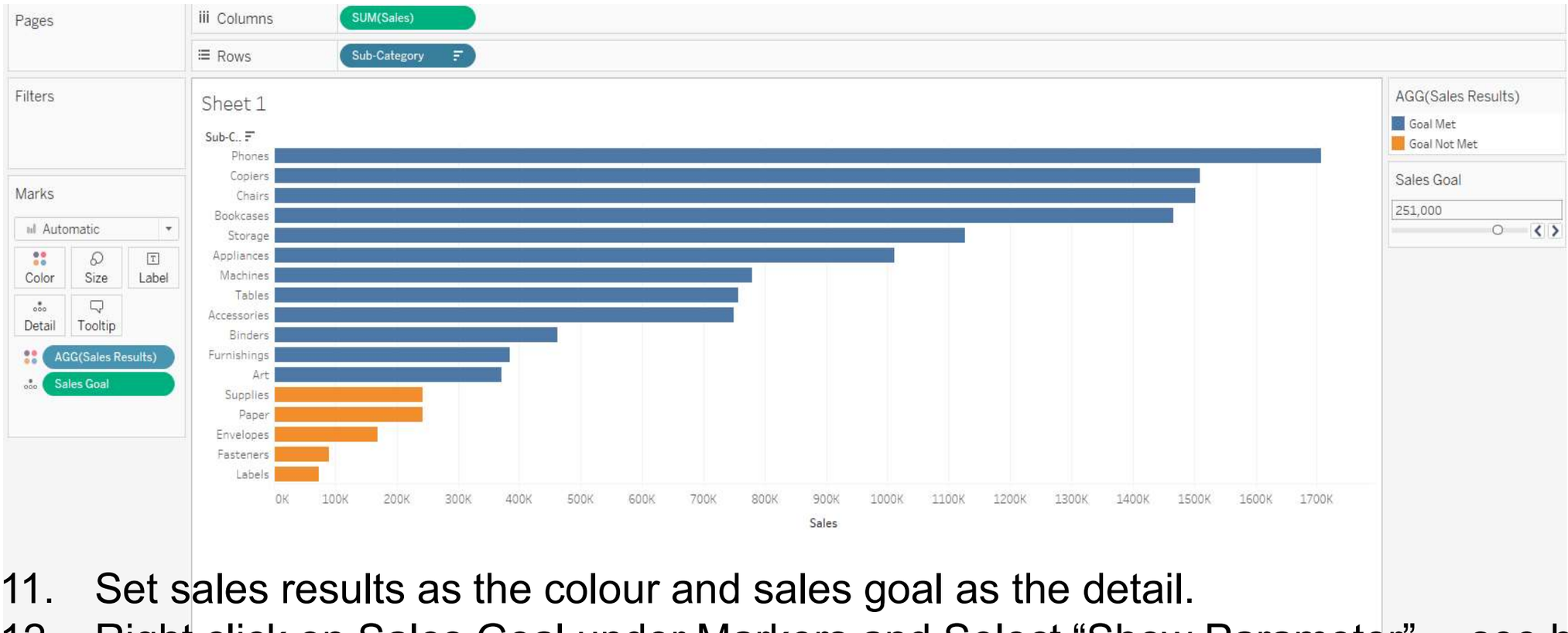



10. Create a calculated field called “Sales Results”

# Visualisation of Multi Variable Data

## Building Parameters




11. Set sales results as the colour and sales goal as the detail.
12. Right click on Sales Goal under Markers and Select “Show Parameter”— see how the colour changes accordingly when you move the sales goal slider

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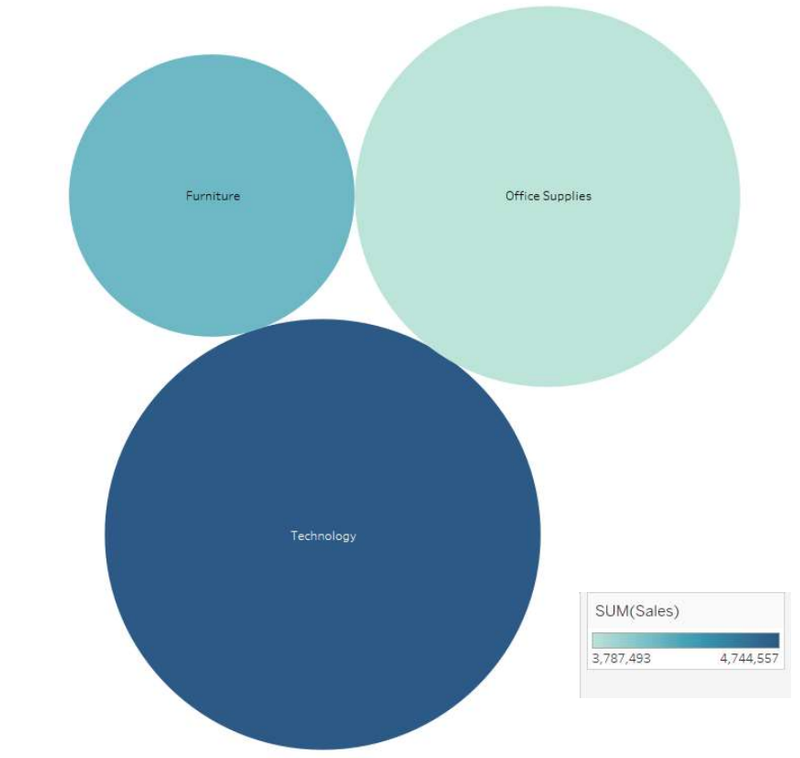
# Visualisation of Multi Variable Data

## Bubble chart

**Visualisation task:**

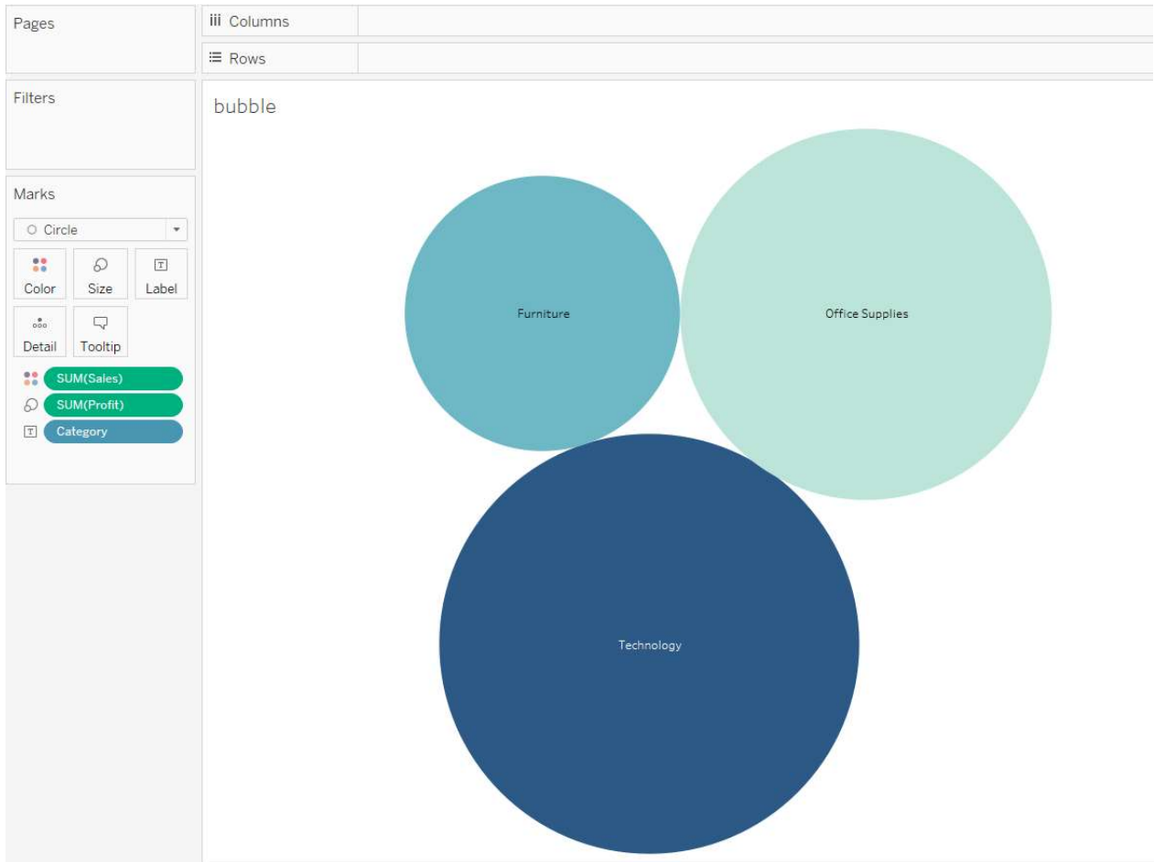
When the sales manager of the company would like to do a rough comparison of the profit and the sales across product categories/sub-categories/regions, he/she can use a bubble chart in Tableau.




A bubble chart displays one-to-many comparisons by using size and colour. However, it does not allow precise comparison between different bubbles. Therefore, we should use a bubble chart only when we do not require precise visual ranking of the bubble. Use packed bubble charts to display data in a cluster of circles. Dimensions define the individual bubbles, and measures define the size and colour of the individual circles.

# Visualisation of Multi Variable Data

## Bubble chart




From the bubble chart above, we can roughly conclude that the technology category has both the highest sales and profit whereas the furniture category has the lowest profit despite medium sales. On the other hand, office supplies makes good profit despite having the lowest sales among the three categories, which could also indicate that the category has higher profit margins and with increased sales with the right marketing stimuli, it can drive the bottom-line of the company.

# Visualisation of Multi Variable Data

## Bubble chart

Below are the steps to creating a bubble chart in Tableau:

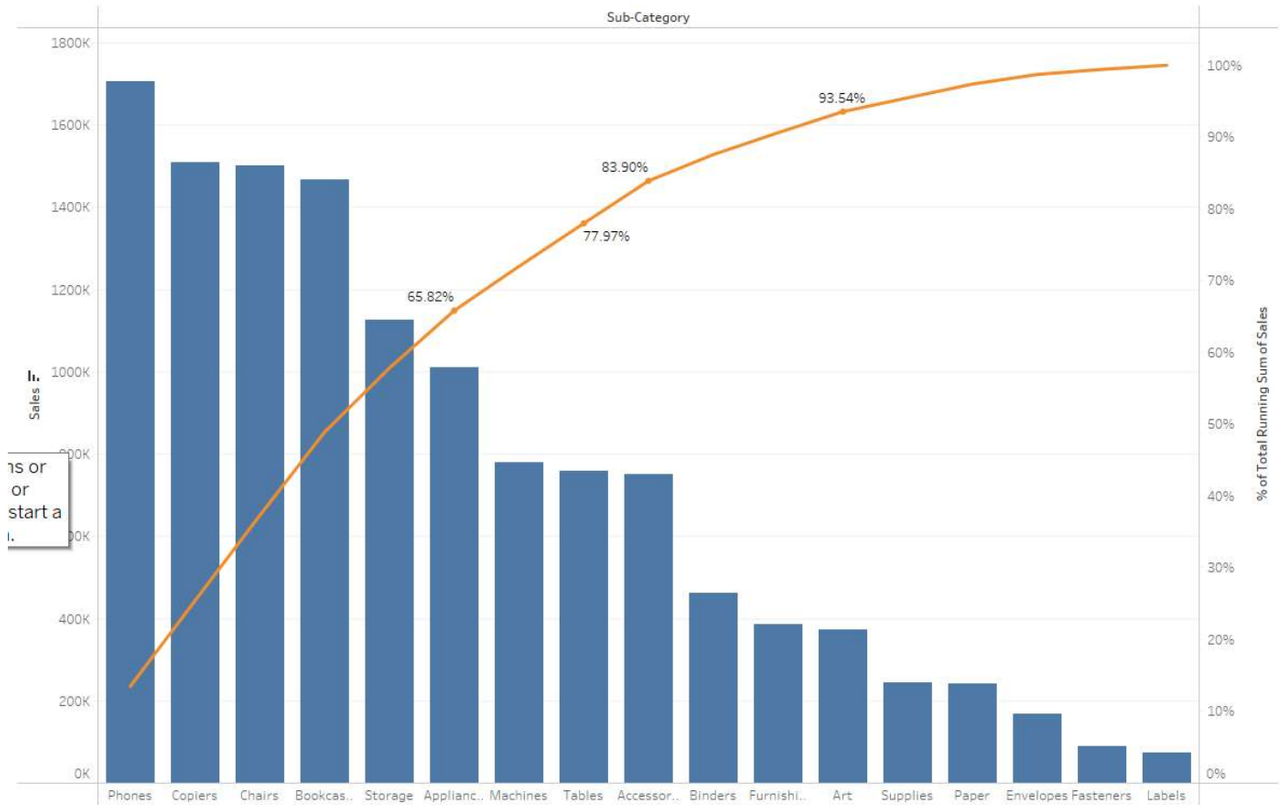
1. Create a new worksheet.
2. Drag the ”Category” dimension into the worksheet’s columns.
3. Drag the ”Profit” measures into the worksheet’s rows.
4. Choose “Packed Bubbles” as the chart type.
5. Drag the “Sales” measure into “Colour” on the Marks Card to colour code the bubbles based on the “Sales” value.

# Visualisation of Multi Variable Data

## Pareto chart

**Visualisation task:**

A Pareto chart is a type of chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the ascending cumulative total is represented by the line. It shows the percentage of total sales that come from the top products, and thus helps the business manager identify the key segments of the customer base that are most important for the business's success.



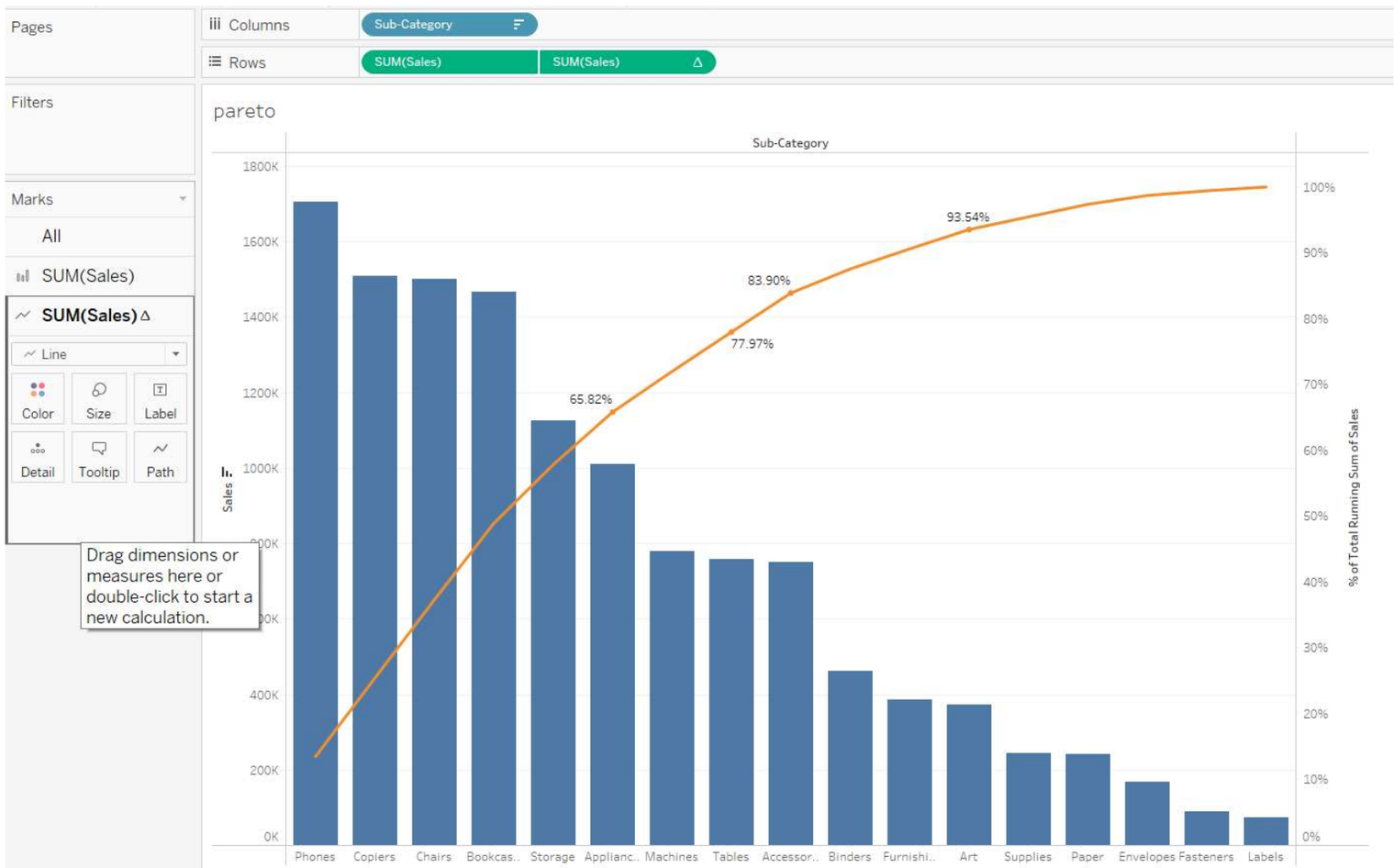
# Visualisation of Multi Variable Data

## Pareto chart

- The Pareto chart visualises the 80-20 rule, as developed by Vilfredo Pareto in 1960
- Originally developed to describe the unequal distribution of wealth. Pareto made the observation that 80% of land was typically owned by 20% of the population
- The principle was further expanded by others to propose that for many events, roughly 80% of the effects come from 20% of the causes.
- In general, the 80-20 rule states that 20% of the inputs account for 80% of the outputs
- In business, for example, 80% of profits not infrequently derive from 20% of the available products

# Visualisation of Multi Variable Data

## Pareto chart

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The line in the Pareto chart corresponds to the cumulative sales value as a percentage of total sales for the categories up to that point.

In the above chart, the label values on the line graph indicate that the top nine sub-categories (from “Phones” to “Accessories” on the x-axis) account for ~84% of sales.

Thus, out of the 17 sub-categories, 84% of the sales comes from 9 or ~53% of the products.

This can be useful in determining the allocation of resources to respective products.

# Visualisation of Multi Variable Data

## Pareto chart

Below are the steps to creating a Pareto chart in Tableau:

1. Create a new worksheet.
2. Drag and drop “Sub-Category” dimension under columns in worksheet.
3. Drag and drop “Sales” measure under rows in worksheet and arrange the bars in descending order of sales.
4. Drag and drop “Sales” measure next to the first “Sales” and select chart type as “Line”. Two separate charts are created.
5. Now click on the second “Sales” in the rows and select dual axis option from the drop down menu. The line chart is superimposed on the bar graph.
6. For the “Sales” corresponding to the line chart, click add table calculation and select “running total” under primary calculation type and select add secondary calculation option.
7. Select “Percent of total” under secondary calculation type and click ok.

# Forecasting

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# Forecasting

- Forecasting is the act of predicting future values based on historical values
  - Trend and season
  - Trend only: 5 data points
  - Season only: two seasons or one season plus five periods
  - No trend or season

*Read these two webpages to understand how to perform forecasting in Tableau…*

https://help.tableau.com/current/pro/desktop/en-us/forecast_options.htm

https://help.tableau.com/current/pro/desktop/en-us/forecast_how_it_works.htm

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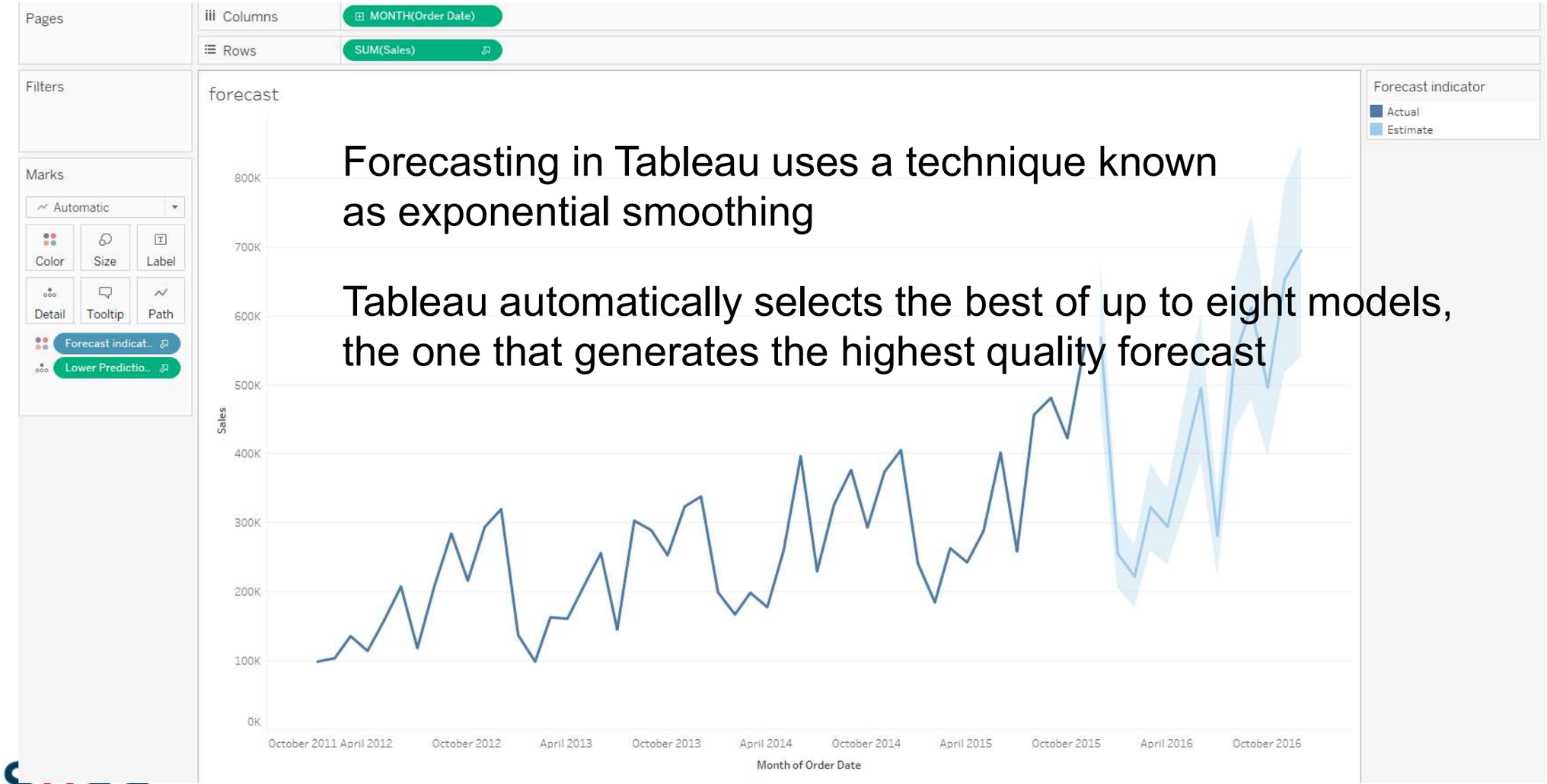
# Forecasting




Forecasting in Tableau uses a technique known as exponential smoothing

Tableau automatically selects the best of up to eight models, the one that generates the highest quality forecast

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# Forecasting

The steps to create a forecast chart in Tableau are as below:

1. Set “month (order date)” to be column and “sum (sales)” as rows.

2. Click on “Analysis” tab and select “Forecast” from the drop down menu. By default, the forecast period is set at 13 and the interval is months.

3. You may modify this by selecting “Forecast” -> “Forecast Options” from the drop down menu.

4. For each measure that is forecasted, a summary table can be displayed by clicking on the “Analysis” tab and selecting “Forecast” -> “Describe Forecast” from the drop down menu.

# Forecasting

## Summary Table

Describe Forecast

Summary | Models

**Options Used to Create Forecasts**

Time series: Month of Order Date

Foreca
Forecas

Seaso

Sum of

The difference between the first and the last forecast estimate points. The interval for those two points is shown in the column header. When values are shown as percentages, this field shows the percentage change from the first forecast period

| Initial | Change From Initial | Seasonal Effect | | | | Contribution | | |
|---|---|---|---|---|---|---|---|---|
| December 2017 | December 2017 – December 2018 | High | | Low | | Trend | Season | Quality |
| 103,260 ± 18,670 | 0 | November 2018 | 37,518 | February 2018 | -31,547 | 0.0% | 100.0% | Ok |

The value and prediction interval of the first forecast period.

These fields are displayed for models identified as having seasonality—that is, a repeating pattern of variation over time. They show the high and low value of the seasonal component of the last full seasonal cycle in the combined time series of actual and forecast values. The seasonal component expresses the deviation from the trend and so varies around zero and sums to zero over the course of a season.

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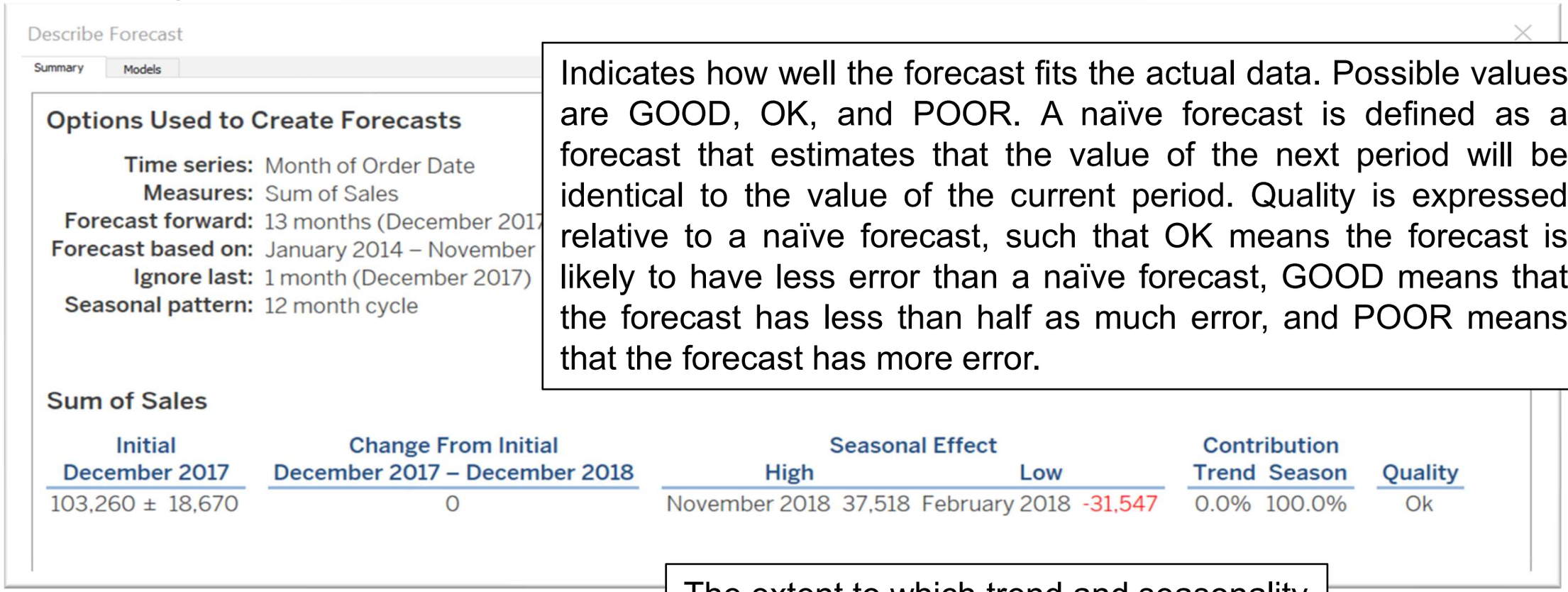
# Forecasting

## Summary Table


Describe Forecast

Summary | Models

**Options Used to Create Forecasts**

| | |
|---|---|
| **Time series:** | Month of Order Date |
| **Measures:** | Sum of Sales |
| **Forecast forward:** | 13 months (December 201 |
| **Forecast based on:** | January 2014 – November |
| **Ignore last:** | 1 month (December 2017) |
| **Seasonal pattern:** | 12 month cycle |

**Sum of Sales**

| Initial | Change From Initial | Seasonal Effect | | | | Contribution | | |
|---|---|---|---|---|---|---|---|---|
| December 2017 | December 2017 – December 2018 | High | | Low | | Trend | Season | Quality |
| 103,260 ± 18,670 | 0 | November 2018 | 37,518 | February 2018 | -31,547 | 0.0% | 100.0% | Ok |

Indicates how well the forecast fits the actual data. Possible values are GOOD, OK, and POOR. A naïve forecast is defined as a forecast that estimates that the value of the next period will be identical to the value of the current period. Quality is expressed relative to a naïve forecast, such that OK means the forecast is likely to have less error than a naïve forecast, GOOD means that the forecast has less than half as much error, and POOR means that the forecast has more error.

The extent to which trend and seasonality contribute to the forecast. These values are always expressed as percentages and add up to 100%.

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