

# PROGRAM

Tableau & Looker – Data Studio

07/03/2023



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school

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## PROGRAM

Tuesday 7 March

**Requirements: Tableau Desktop on your laptop**

- Introduction to Tableau
- Data for Group Evaluation

Wednesday 15 March

- Tableau Advanced
- Group sessions

Monday 20 March

**Requirements: have a Gmail account**

- Looker – DataStudio Introduction & Advanced
- Tableau Group Evaluation

	Tableau	Data Studio
Type	Group	Individual
Evaluation	Dashboard Presentation (Pitch 5 min)	Sharing a dashboard *
Deadline	March 20. 2023 (afternoon)	April 14. 2023 (18h)
Data	Sample EU Superstore or World Indicators Data Set	Choose your Data

\*Share your Dashboard with [csalomez@actinvision.com](mailto:csalomez@actinvision.com)

# Tableau Desktop

Introduction

07/03/2023



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# Summary

- 01 About Tableau
- 02 The community
- 03 First steps on Tableau Desktop
- 04 Data Connection
- 05 Data Types
- 06 Visualization Interface





# About Tableau

## Tableau Desktop Introduction



## Tableau Company

- American Publisher, created in 2003
- World headquarters in Seattle
- Revenue: \$950M and more than 50,000 customers (in 2018)
- Salesforce announces the acquisition of Tableau Software for \$15.3 billion in June 2019

# Tools



## Use and features:

- Connecting to a multitude of data sources;
- Preparing data;
- Developing data streams;

## Target audience:

- Analysts

## Licensing :

Local on-post installation, included in the Creator license



## Use and features:

- Connecting to a multitude of data sources;
- Data Exploration
- Visual and interactive analysis

## Target audience:

- Analyst

## Licensing :

Local on-post installation, included in the Creator license



## Use and features:

- Consumption of full workbooks in offline mode;
- Interactive navigation;
- No security management;

## Target audience:

- Small structures
- Meetings hosting

## Licensing :

included in the Explorer and Viewer license (Online)

# Licences

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## Creator

- Connecting to data
- Create data streams
- Create/publish data sources and/or workbooks
- All of Tableau's advanced features

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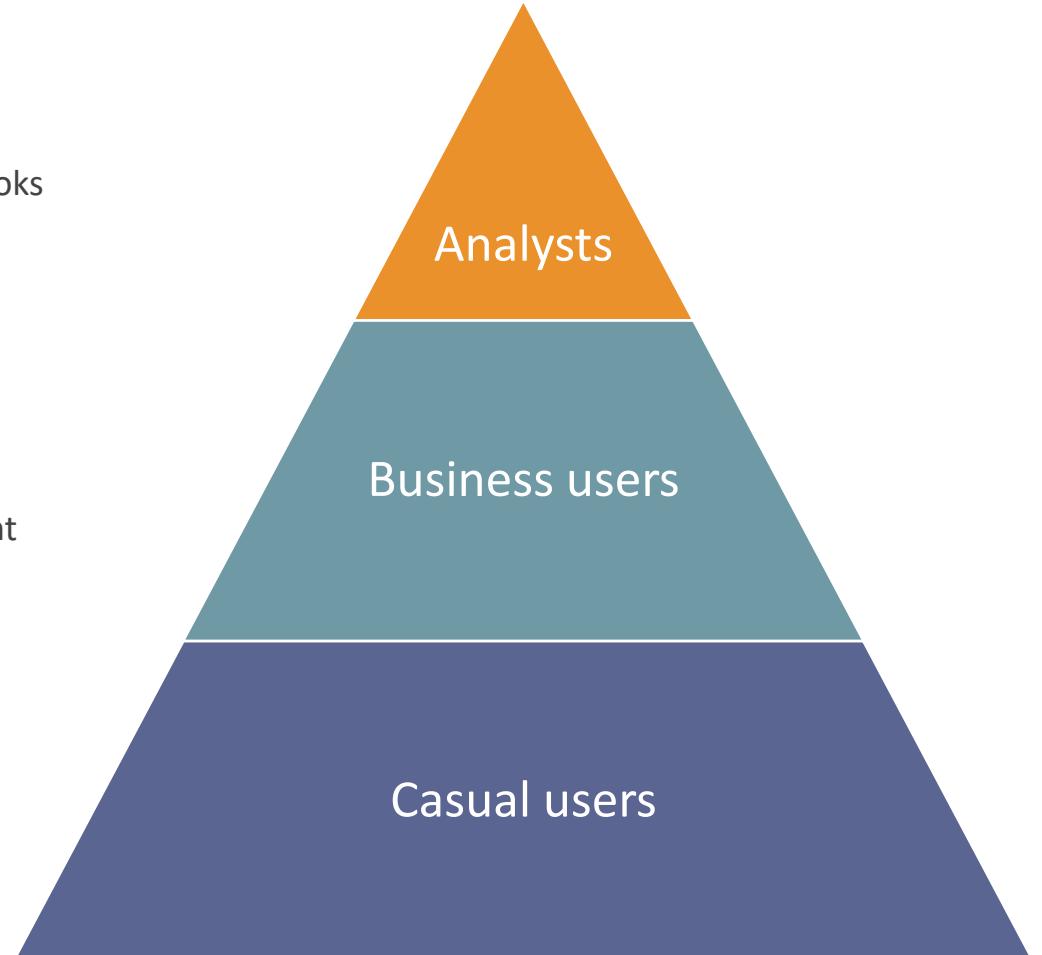
## Explorer

- Access to Tableau via a web interface
- Connect to published data sources
- Edit published content or create new content
- Creating and sharing personalized views

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## Viewer

- Access to Tableau via a web interface
- Interaction with published content
- Download a summary of the data
- Limited collaboration features



# The Community

An open publishing space: <http://www.tableau.com/public/community>

Regular events: <http://www.tableau.com/learn/events>

Training: <http://www.tableau.com/learn/training>

Support: <http://www.tableau.com/support>

Forums: <http://community.tableau.com/community/forums>

Blogs: <http://vizwiz.blogspot.fr>, <http://datavizblog.com/category/tableau/>



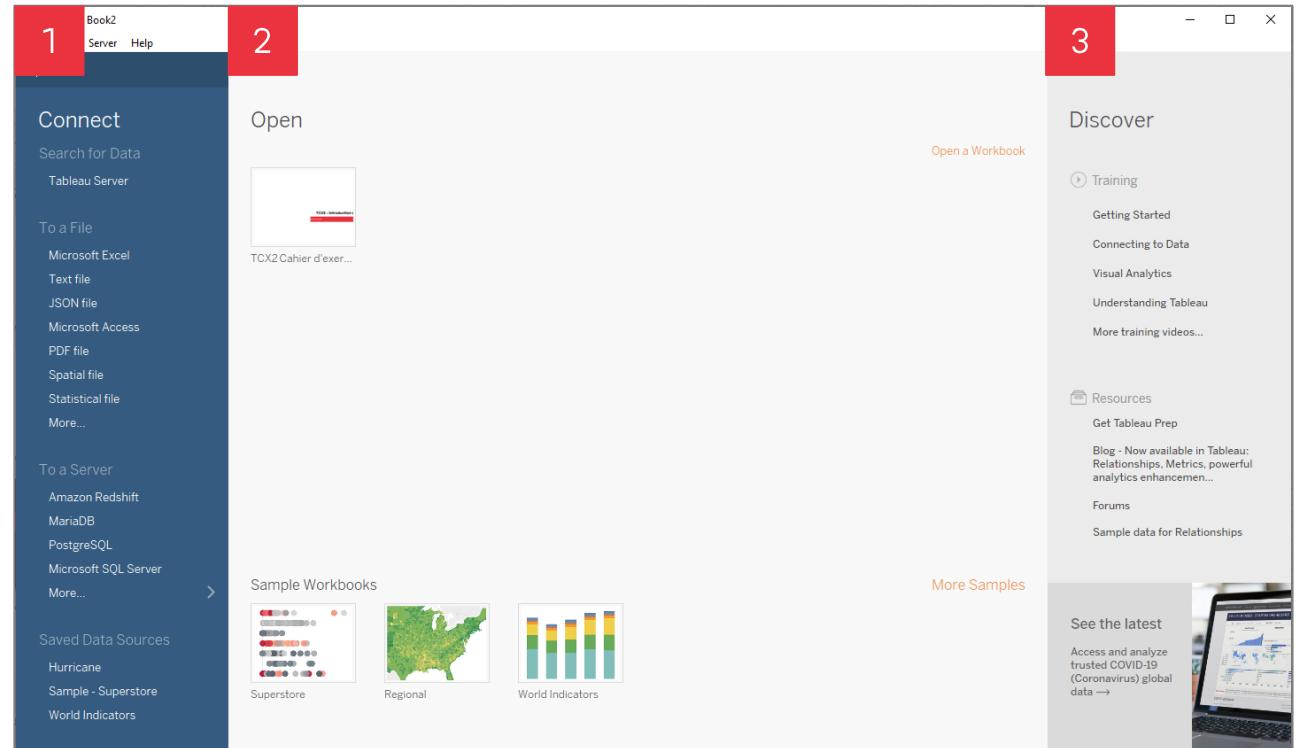
# First steps

# First steps on Tableau Desktop

The start page allows you to connect to the data, open the recently used workbooks, discover and explore the content produced by the community.

It consists of three panes:

1. Connect
2. Open
3. Discover



# 1. Connect

The Connection pane allows you to

## 1. Connect to data

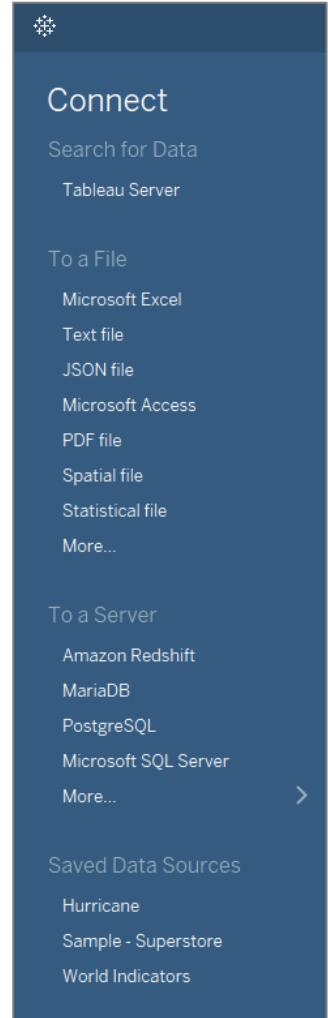
In a file: Excel-type flat file, text, Access... and Tableau files (extracts)

On a server: Oracle-type databases, MySQL

## 2. Open saved data sources

Data sources saved in the "My Tableau Repository" directory

Data provided by Tableau "Hurricane", "Sample - Superstore"



## 2. Open

The Open pane allows you to

### 1. Open recent workbooks

Empty space at the very first Tableau opening

By clicking on the thumbnail of a workbook, it opens  
"Open a Workbook" opens one of the workbooks

saved on the computer

### 2. Pin workbooks to the start page

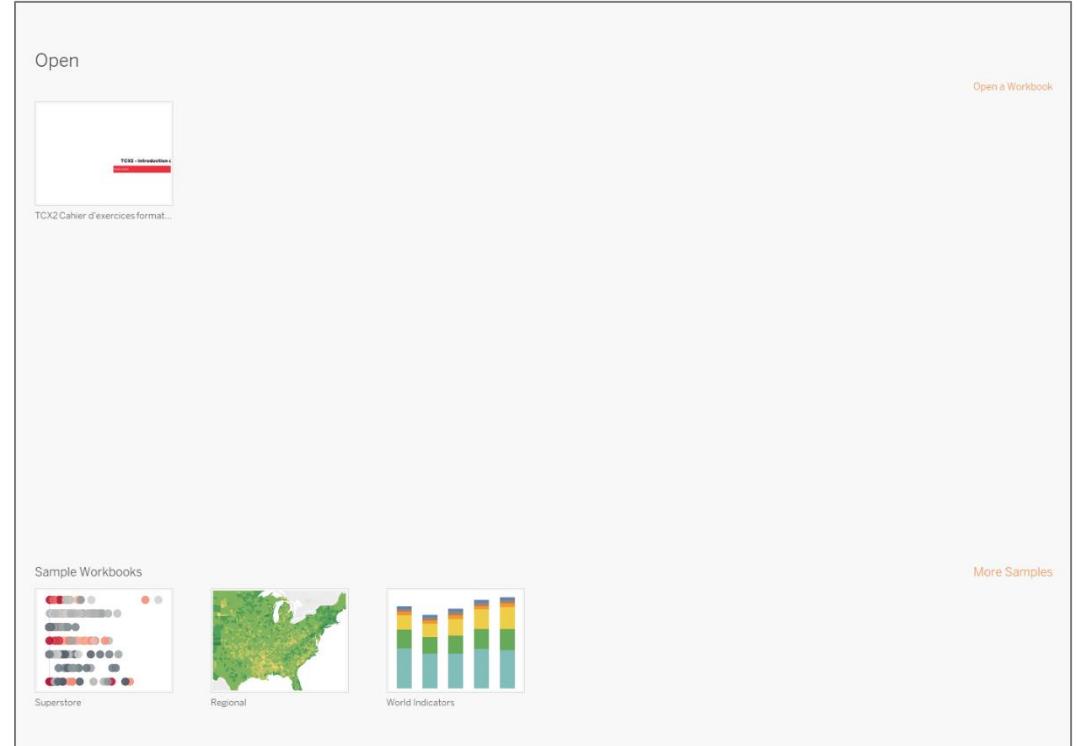
Click on the pin-shaped icon that appears on  
the corner of the miniature to pin a workbook



A pinned workbook is always displayed on the  
start page

### 3. Explore examples of workbooks

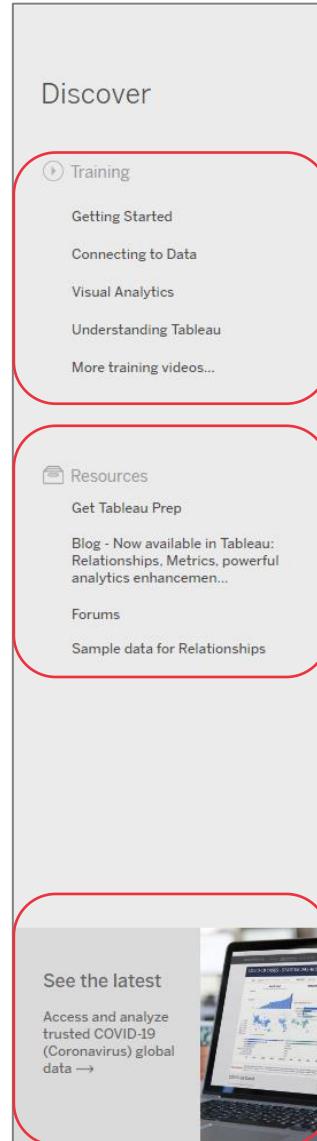
Explore and open workbook samples



### 3. Discover

The **Discover** pane allows you to

1. Access training videos
2. Read blogs and news about Tableau
3. Consult popular views in Tableau Public
4. Update Tableau



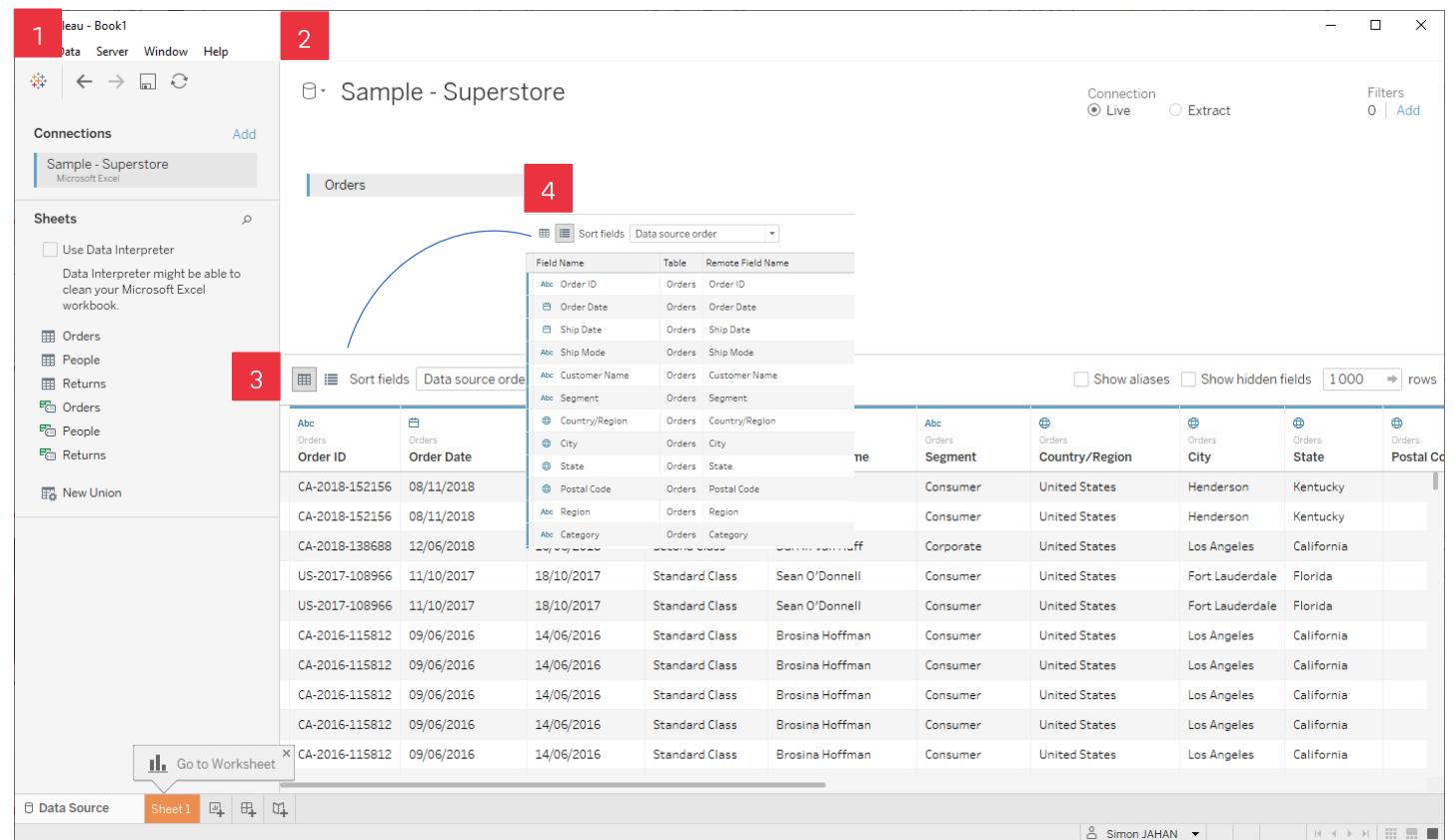


# Data Source Interface

# Overview

The "Data Source" pane generally contains four main areas

1. Left pane
2. Workspace
3. Data grid
4. Metadata Grid



# Connected Data source

The left pane shows the connected data source and data details. It varies depending on the type of data source.

**From a file** : Shows the name of the file and the worksheets it contains if it is an Excel file

**Relational data** : Shows server, database or schematic and tables in database

**Multidimensional data (cubes)**: it doesn't show

This includes adding more connections and creating links between databases.

# Workspace

The workspace displays information about the configuration of the source data as well as data combination options

1. Data source design space: Dragging one or more tables to the design area defines the source that will be used
2. Connection Type: Live/ Extract

**Live** : Tableau directly queries the database.

**Extract** : represents a subset of data, a snapshot, saved (.hyper).

3. Filter options on the data source: allows to directly filter the data source

# Grids

## Data grid

Shows the field names and the first 1000 lines of data contained in the source

Allows for general changes to the data source

- ❖ Sort or hide fields
- ❖ Rename fields or reset names
- ❖ Add aliases
- ❖ Create calculations
- ❖ Split fields
- ❖ Change the data type

## Metadata Grid

Shows the fields of the source as a list

Quickly examine the source structure

Identify the source of the fields

Lets you make the following changes

- ❖ Rename fields
- ❖ Hide fields
- ❖ Change data type

# Data Type

- The type of information stored in the field
- Each type is represented by an icon

Icon	Data type
Abc	Text (string) values
□	Date values
🕒	Date & Time values
#	Numerical values
T F	Boolean values (relational only)
⊕	Geographic values (used with maps)

- Tableau can sometimes misinterpret the type of a field.
  - **Solution:** Change the type of data on either the data source interface or the design interface

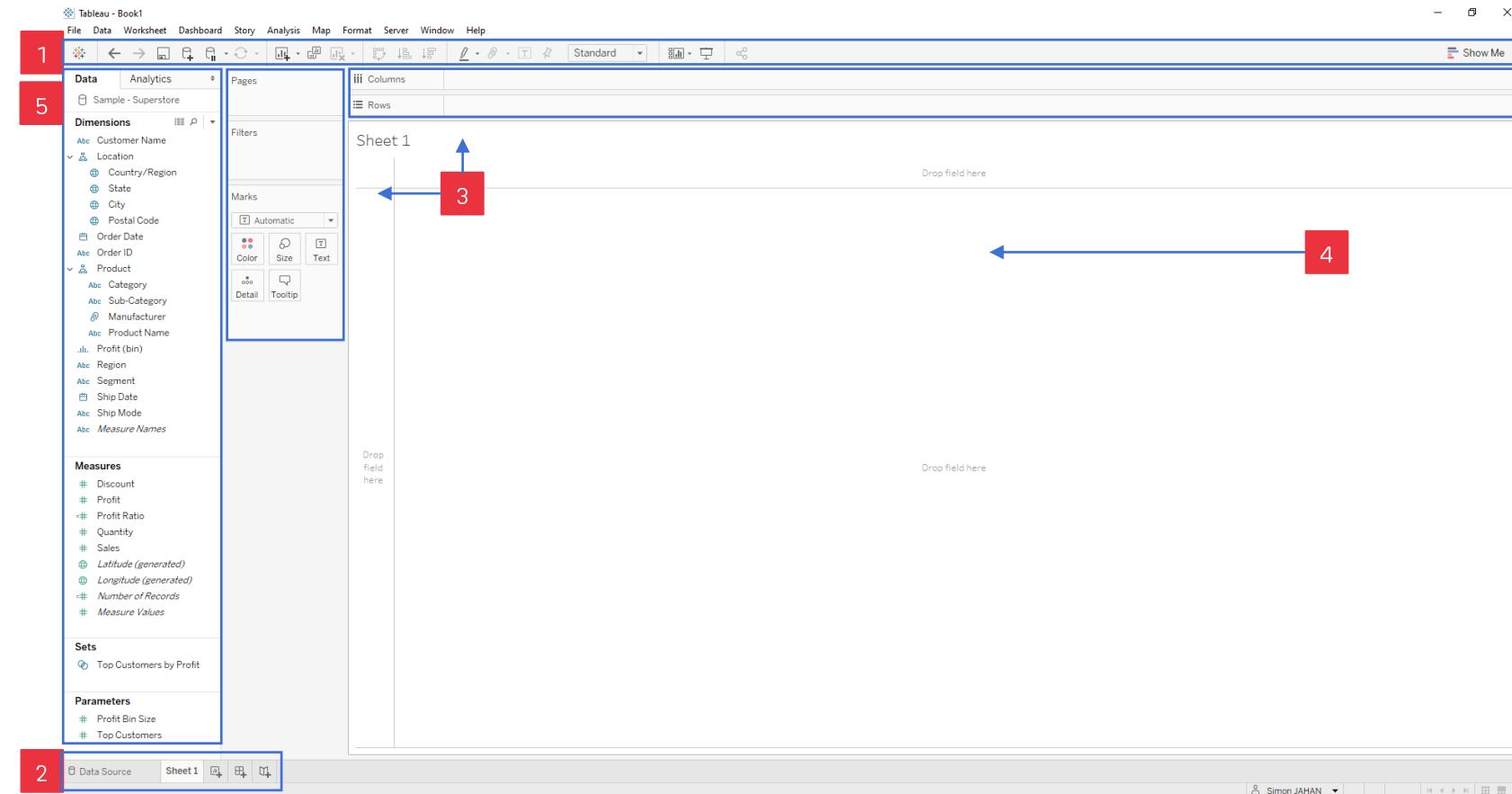


# Visualization Interface

# Visualization Interface

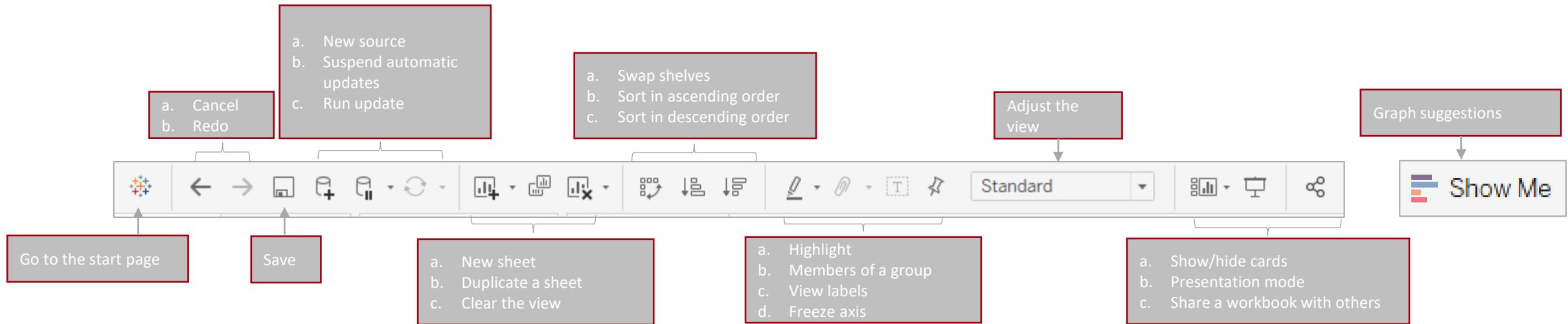
The workspace contains different elements that allow you to build a visualization

1. Toolbar
2. Data source and sheets tabs
3. Sheets and shelves
4. Design area - View
5. Sidebar : Data and Analytics panes



# Toolbar

Allows you to perform common actions when creating/modifying a view



# Visualization Interface

## 2. Data source and sheet tabs

Access to the "Data Source" interface

Allows to create and access different sheets, dashboards and stories

## 4. Design area

Lets you visualize the charts

## 3. Shelves

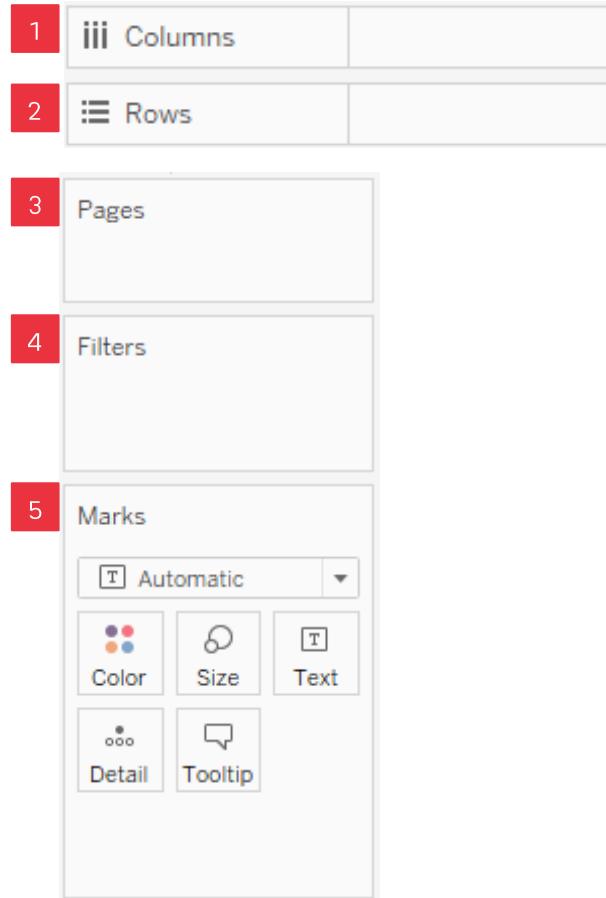
It is located at the bottom of the workbook. It displays descriptions of menu items as well as information about the current view

## 5. Sidebar

Contains data and analytics panes

- Data: list of data source fields
- Analytics: provides drag-and-drop access for different options (reference lines, Totals, Averages...)

# Shelves and Card



1. The columns shelf allows you to create the columns of a table
2. The rows shelf allows you to create the rows of a table
3. The "Pages" shelf divides a view into a series of pages. By placing a field on the pages shelf, a page set is created and each page presents a different view.
4. The "Filters" shelf shows which data to include and exclude in the view
5. The "Marks" card is a key element for your analysis. This card allows you to customize the visualization accurately.



# Questions

# Tableau Desktop

Data Visualization

07/03/2023



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# Data Visualization

- 01 **Building charts** (double-click, drag & drop, show me)
- 02 **Tables**
- 03 **Marks (definition, usage, mark types)**
- 04 **Formatting and customization**
- 05 **Exercises**

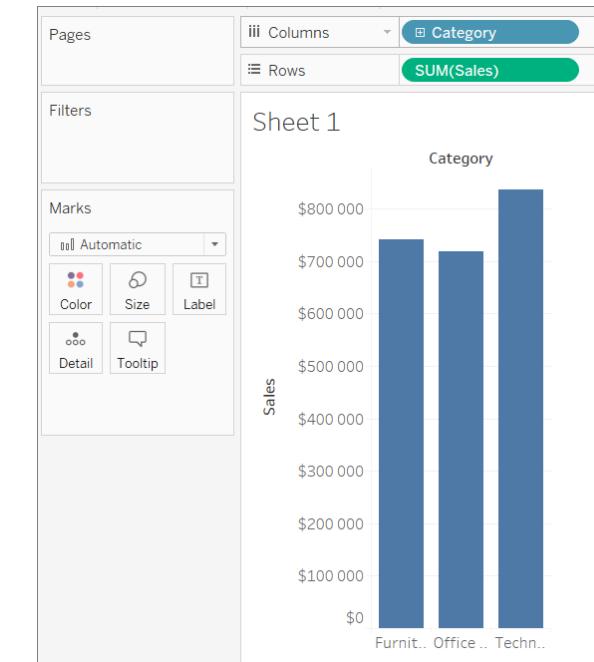
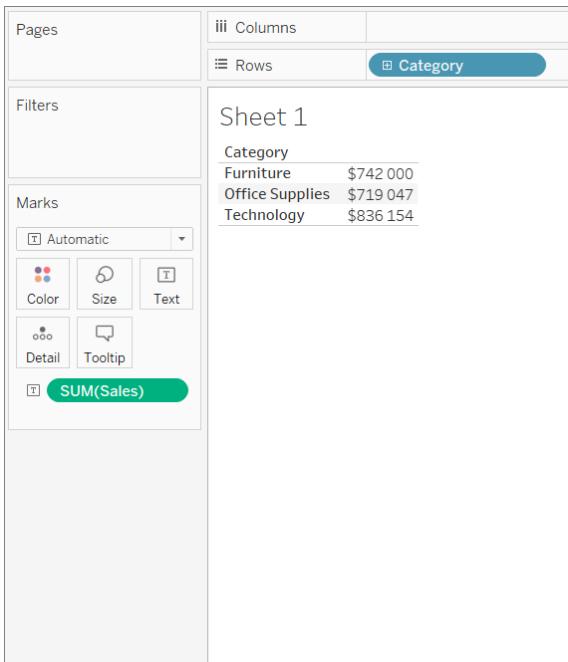


# Build a chart – Double Click

You can build a chart in Tableau using one of three methods: Double Click, Drag & Drop and Show Me.

By **double-clicking** on objects from the list under the data pane, the chart will automatically be generated.

- Double click on a dimension then a measure  
→ a data table
- Double click on a measure then a dimension  
→ a chart



# Build a chart – Drag & Drop

Drag and drop into the workspace the fields you want to see.

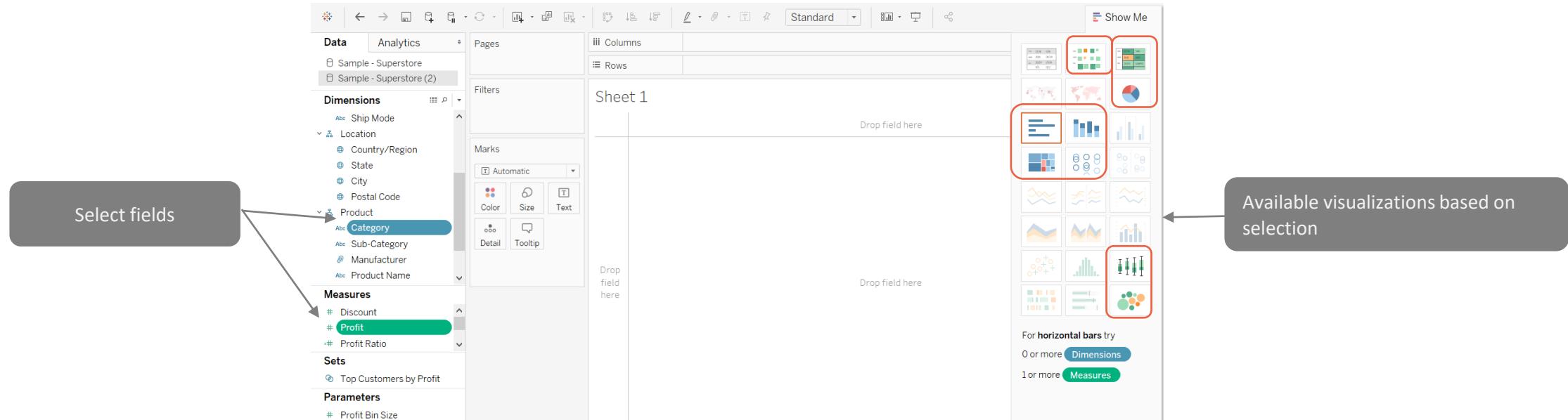
This screenshot shows the Tableau Data View interface. On the left, the 'Dimensions' pane is expanded, listing 'Ship Mode', 'Location' (with 'Country/Region', 'State', 'City', 'Postal Code'), 'Product' (with 'Category', 'Sub-Category', 'Manufacturer', 'Product Name'), and 'Measures'. The 'Rows' shelf at the top has two items: 'Pages' and 'iii Columns'. The 'Marks' shelf contains 'Automatic' (selected), 'Color', 'Size', and 'Text' options, with 'Detail' and 'Tooltip' buttons below. A large central workspace is labeled 'Sheet 1' and features a 'Show Me' button. A red box labeled '1' is positioned in the top right corner of the workspace area.

This screenshot shows the Tableau Data View interface after a field has been dragged. The 'Dimensions' pane remains the same. In the 'Rows' shelf, the 'Category' item is now highlighted with a blue selection bar. The 'Marks' shelf is identical to the first screenshot. The 'Sheet 1' workspace now displays a list of categories: Furniture, Office Supplies, Technology, and a 'Show Me' button. A red box labeled '2' is positioned in the top right corner of the workspace area.

# Build a chart – Show Me

In the upper right corner of the interface, the Show Me tab gives you access to a range of predefined charts.

Select all the fields\* you wish to see (measures and dimensions), click on Show Me and select the desired chart type.



\* [Ctrl+right click](#) to select multiple fields at a time

# Tables – 3 ways

## Double Click

You can build a table when double-clicking in the following order:

- Double click on a dimension
- Double click on a measure

## Show me

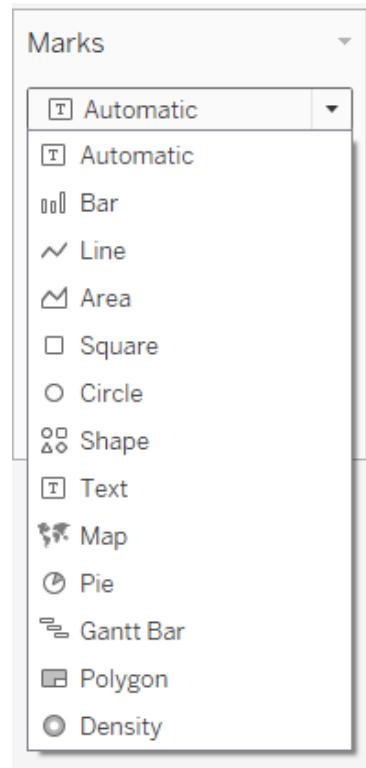
- Select the dimension and measure fields you wish to see.
- Click on Show Me
- Select Table

## Drag & Drop

- Drag the desired dimensions to the Rows shelf (or Columns)
- Select Text as the Mark Type
- Drag the desired measure(s) to Text on the Marks card

# Marks - Definition

A mark is the intersection of all dimensions in a given visualization. By dragging and dropping fields into the view, data is represented using Marks.



# Mark Types

## Bar

Useful to compare values

- Dimensions: displays field members for the comparison
- Measures: displays the associated values for each dimension member

Bar charts can be

- horizontal
- vertical
- stacked

## Line

Depicts trends.

Useful to see data over time (Months, Years, etc.)

## Area

A line chart where the area between the line and the axes is filled: lines are stacked and do not overlap. Useful when displaying running sums over time with multiple dimension members.

Example:

- Funnel

# Mark Types

## Circle

Displays data using filled circles (discs), allowing comparisons between different values.

### Examples

- Scatterplot
- Bubble plot
- Bump Chart

## Square

Allows a distinctive representation of each data point.

- Dimensions: rows & columns.
- Measures: color & size.

### Examples

- Heat Map
- Tree Map

## Shape

When Tableau automatically determines the Mark Type as Shape, data is displayed as empty circles.

- Allows the attribution of a specific shape for each value of a category
- Marks are distinguished by field values

# Mark Types

## Text

Displays values associated with one or many dimension members. This type of view is often called text table, cross-tab, or pivot table.

## Map

Used for the creation of polygon or line based maps. This mark type uses built in or custom geocoding to fill a polygon or draw lines.

Additional features:

- Map layers
- Map options

## Pie

Shows proportions

→ Effective in some instances (comparing one value to 100%), even though stacked bars are often more relevant.

## Example

- Donuts



# DEMO – SHOW ME BUTTON

# Customization – Marks Card

The Marks card is a key element for visual analysis in Tableau. It allows you to encode your data with Color, Size, Shape, Text and Details.

These icons allow you to identify which mark property is being used by which field

Category

SUM(Sales)

SUM(Quantity)

You can change a mark property simply by clicking on the icon

Category

Label

Size

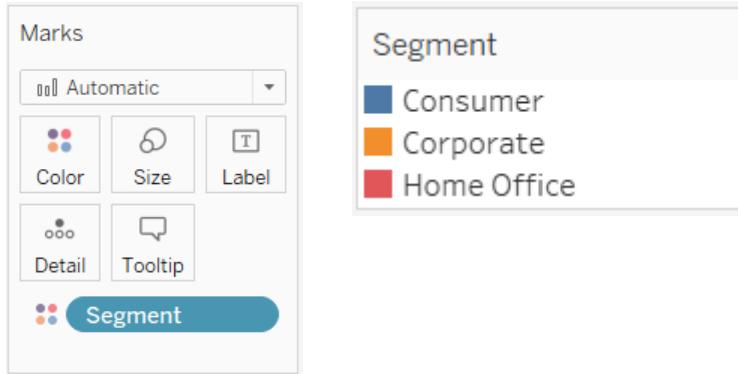
Detail

Tooltip

# Customization – Color property

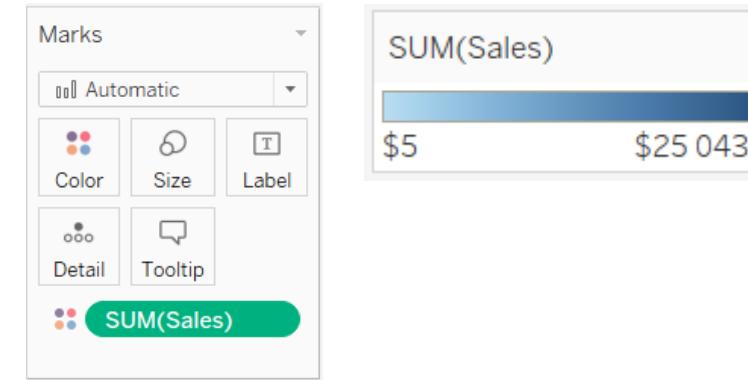
## Qualitative Data (Dimension and Discrete Metric)

The marks in the view are broken out by category, and each category is assigned a color.



## Quantitative Data (Continuous Metric)

Each mark in the view is colored based on its value, on a sequential/diverging scale or gradient.



To change colors:

- In the Marks card, click on Color > Change Colors
- Double click on the legend / key

# Customization – Size property

## Qualitative Data (Dimension and Discret Metric)

The marks in the view are broken out by category, and each category is assigned a size.

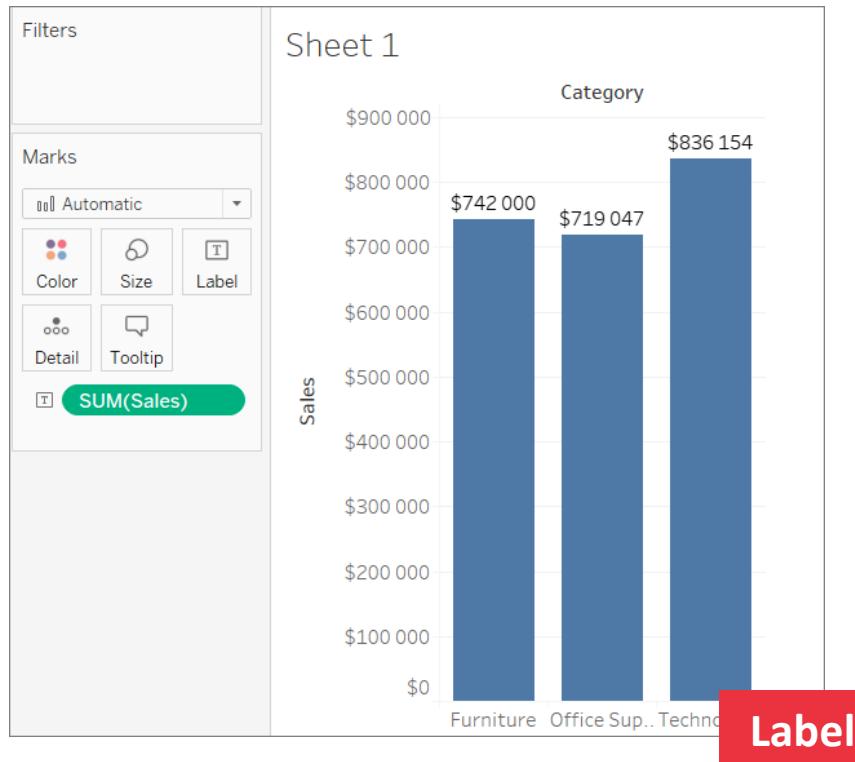
## Quantitative Data (Continue Metric)

Each mark in the view is colored based on its size.

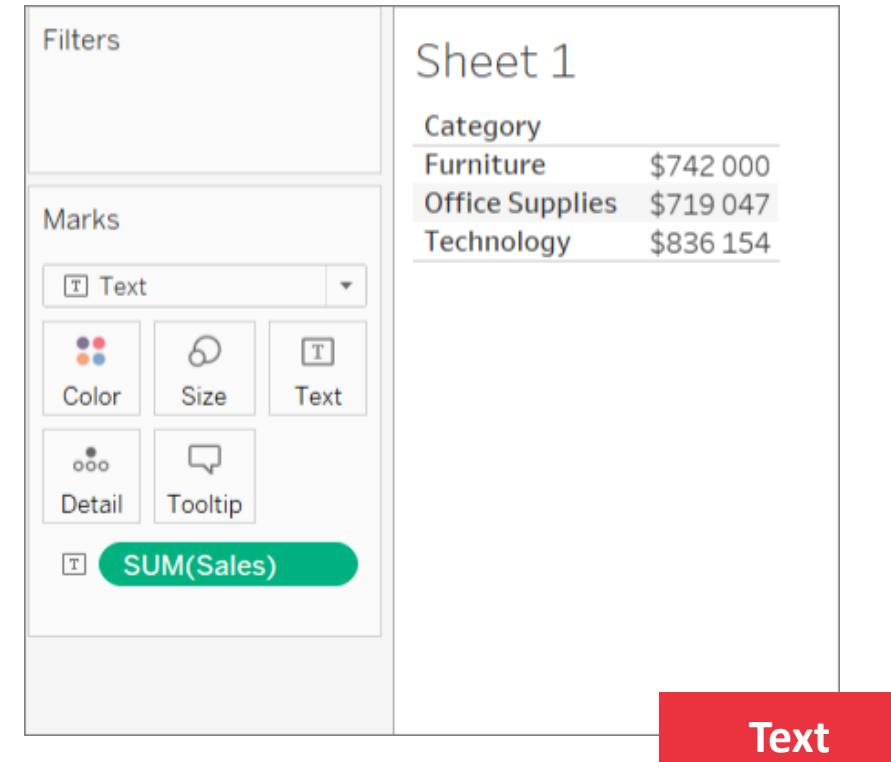
# Customization – Label/Text Property

Displays information from the fields you want.

By dragging & dropping a field to Label in the Marks card, the data value will appear in the view. If you use a table, the Label shelf is replaced with Text



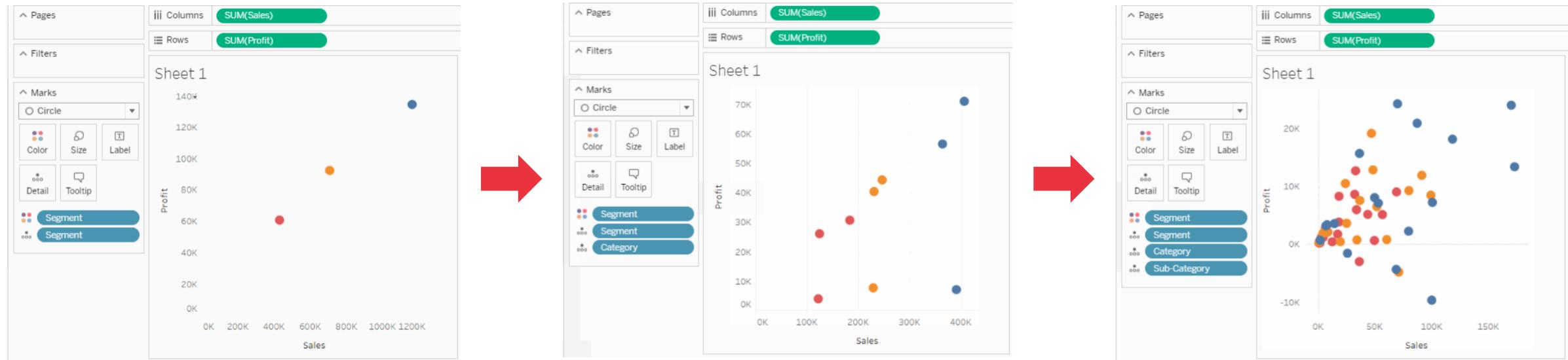
Label



Text

# Customization – Detail Property

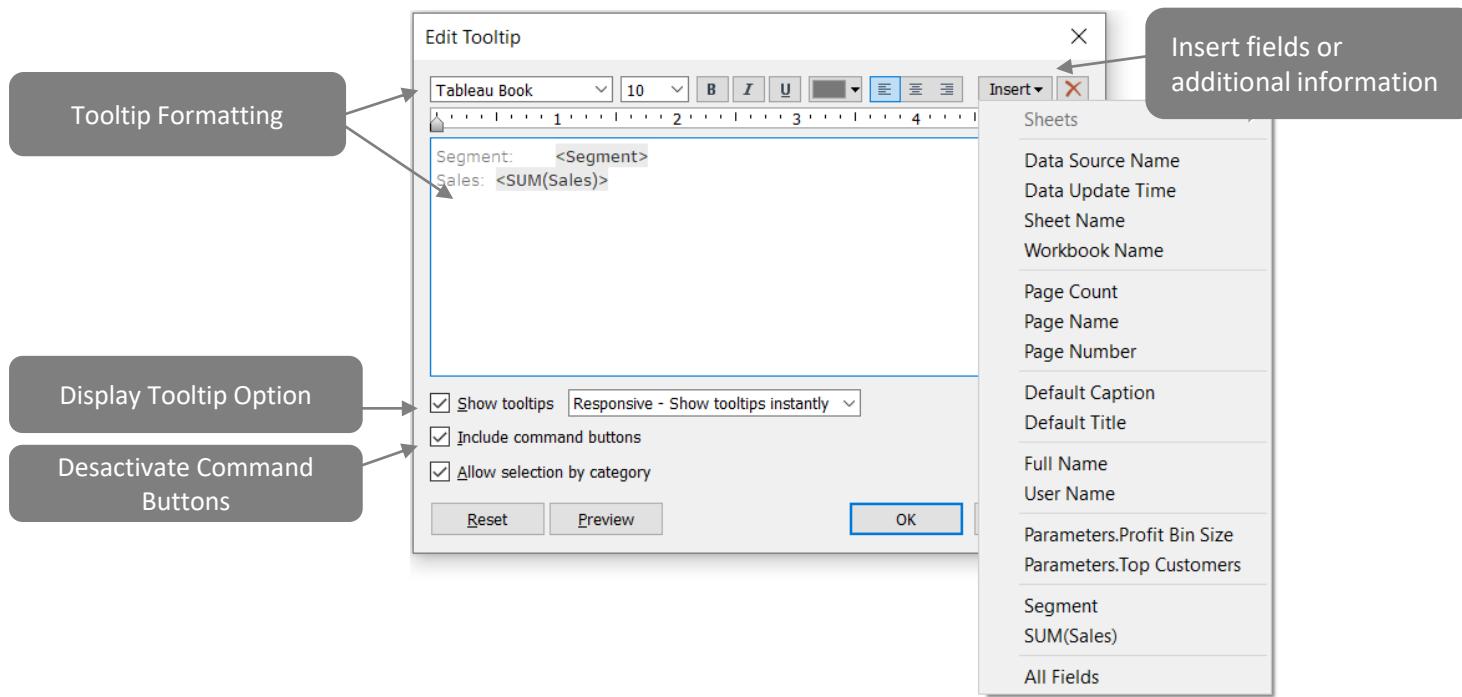
When you drop a dimension on Detail on the Marks card, the marks in a data view are separated according to the members of that dimension. -> adds an additional level of detail / granularity to the view.



Unlike dropping a dimension on the Rows or Columns shelf, dropping it on Detail on the Marks card is a way to show more data without changing the table structure.

# Customization – Tooltip Property

- Tooltips are details that appear when you hover over one or more marks in the view.  
→ the data displayed is specific and relevant to the selected data point
- Formatting and customization: click on Tooltip in the Marks card and then select Modify Tooltip.



Command buttons allow you to:

- Filter Marks
- Create groups
- Create sets
- Display underlying data

By default, these are activated.

# Customization - Mark Property

## Shape



- Available when the Shape Mark is selected.
- Allows you to encode data by assinging shapes to different marks.

## Path



- Available when **Line** Marks are selected.
- Allows you to specify the order and direction in which lines are drawn.

## Angle



- Available when the **Pie** Mark is selected
- Determines the Angle value for each slice of the Pie.



# DEMO – Marks Card

# Formatting

Tableau lets you define formatting parameters for the entire worksheet, for all rows and columns, as well as specific parts of the view.

You can customize the formatting settings for:

- Font
- Paragraph Alignment
- Background
- Borders
- Line Separators
- Tooltips

To access worksheet customization features:

- Access a worksheet or dashboard in the workbook.
- In the Format menu, choose which part of the view you wish to format.



# Exercises

# Exercise 1

1. Connect to the "Sample - Superstore" file
2. Recreate this visualization showing the orders by quantity, sales, profit and average discount.

Exercice 1

Order ID	Customer Name	Product Name	Quantity	Sales	Profit	Avg. Discount
CA-2019-100867	Eugene Hildebrand	RCA Visys Integrated PBX..	3	33	9	0,0
CA-2019-107153	George Zrebassa	Decoflex Hanging Persona..	2	11	4	0,2
CA-2019-115238	Jane Waco	iKross Bluetooth Portable..	10	210	59	0,0
		Eldon 200 Class Desk Acce..	5	31	13	0,0
		DAX Two-Tone Rosewood/..	1	9	4	0,0
		Weyerhaeuser First Choic..	1	6	3	0,0
		Eldon Image Series Desk ..	5	24	10	0,0
CA-2019-115777	Doug O'Connell	Xerox 200	1	388	182	0,0
CA-2019-117964	Michael Knudson	12-1/2 Diameter Round W..	5	40	-21	0,6
		Newell 343	7	16	2	0,2
CA-2019-119508	Tracy Zic	Eldon Image Series Desk ..	6	25	9	0,0
		Avery Hi-Liter Fluorescent..	5	17	6	0,0
CA-2019-123625	Bruce Galang	Hand-Finished Solid Wood..	10	170	58	0,0
		Acco Glide Clips	7	88	30	0,0
CA-2019-123664	Neil Cohen	Deflect-o SuperTray Unbr..	5	58	-25	0,6
CA-2019-125388	Michael Paige	Crate-A-Files	4	57	15	0,0
		Westinghouse Mesh Shad..	3	118	12	0,2
CA-2019-126438	Alex Russell	Eberhard Faber 3 1/2" Gol..	2	15	4	0,0
CA-2019-126634	Alan Barnes	Flat Face Poster Frame	5	94	40	0,0
CA-2019-129322	Denny Rilanto	GRC Document DFO Person..	7	448	210	0,0



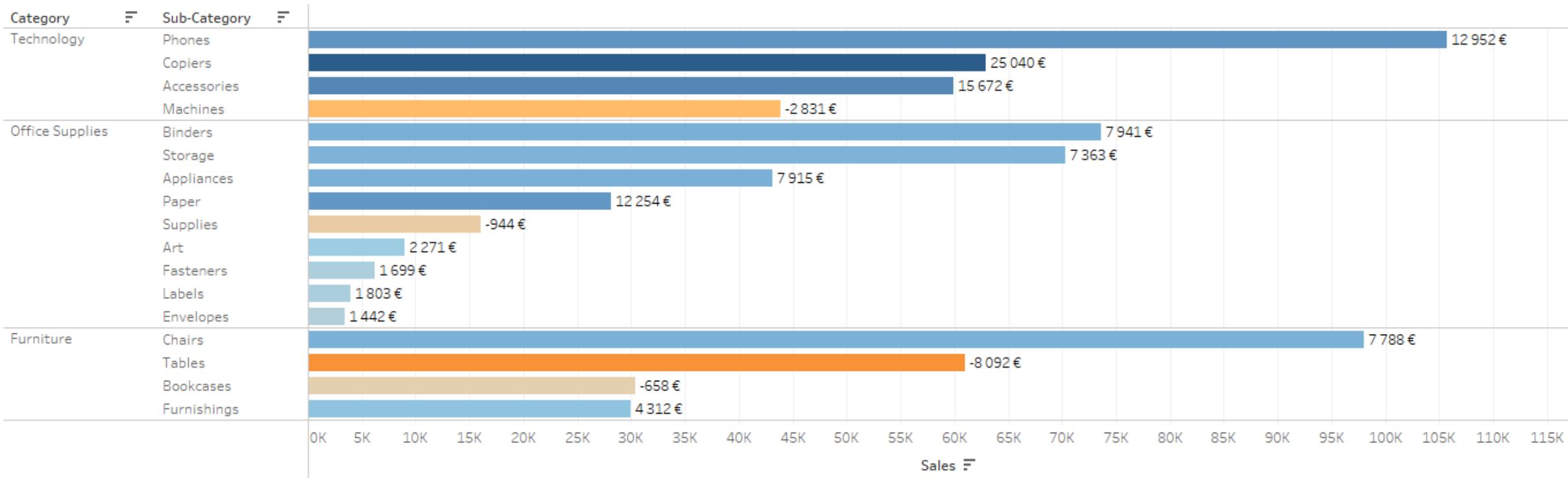
Select 1-2 Dimensions and 2 Metrics then use the show me button. And finish the visualization

Time: 5 min

# Exercise 2

Recreate this visualization showing the categories and sub-categories by sales (bar) and profit (color). Filter the data on year 2022.

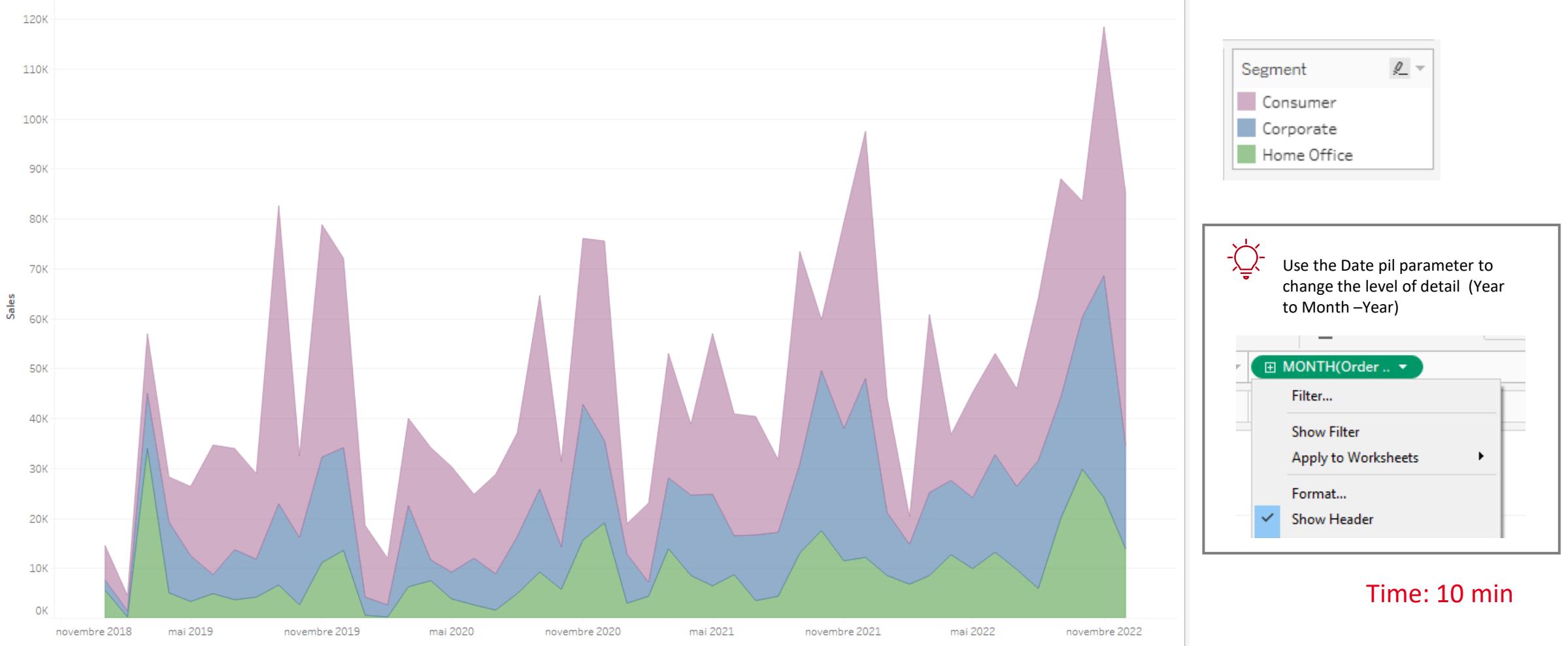
Bonus: add the profit values in label



Time: 10 min

# Exercise 3

Recreate this visualization showing sales evolution by month-year for each segment.





# Questions

# Tableau Desktop

Dashboarding Fundamentals

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# DASHBOARDING FUNDAMENTALS

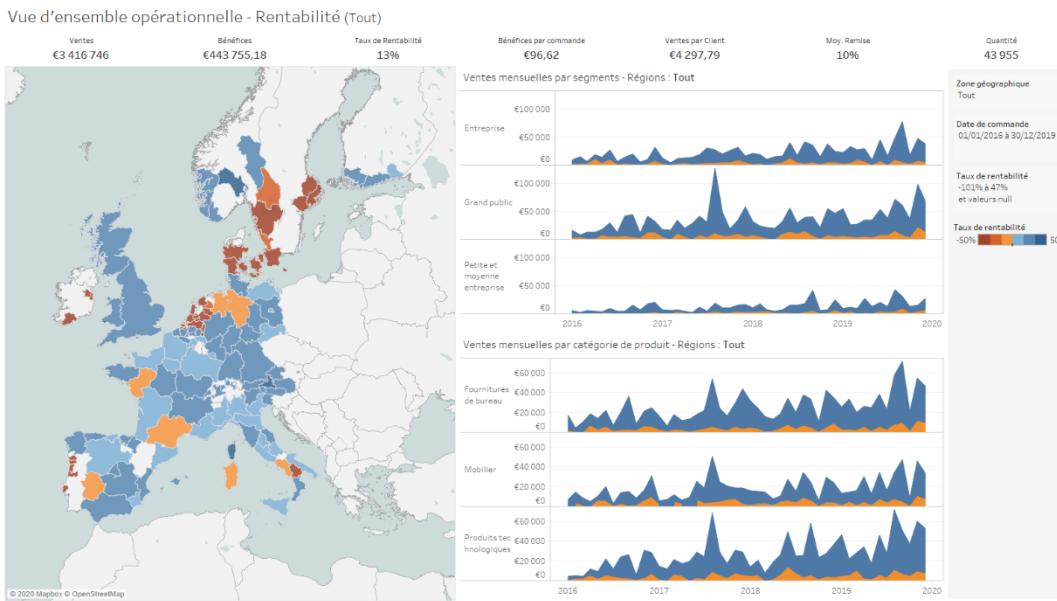
- 01 User Interface
- 02 Layout
- 03 Dashboard objects
- 04 Generated filter actions
- 05 Exercises



# INTRODUCTION

Dashboards are used to present a **set of indicators** on the same screen in order to grasp a better understanding of a company's activity, in general or in a particular business area.

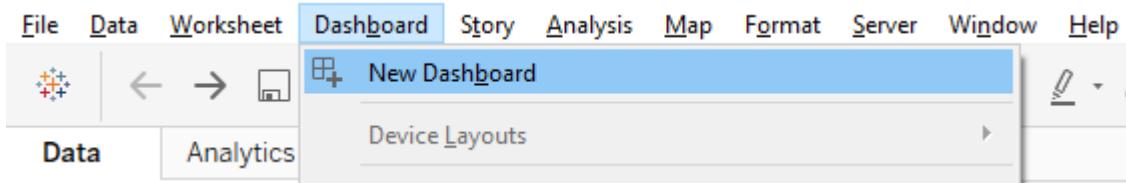
In Tableau, a dashboard can gather **several sheets** and all associated information at the same place, allowing you to compare and control different data simultaneously.



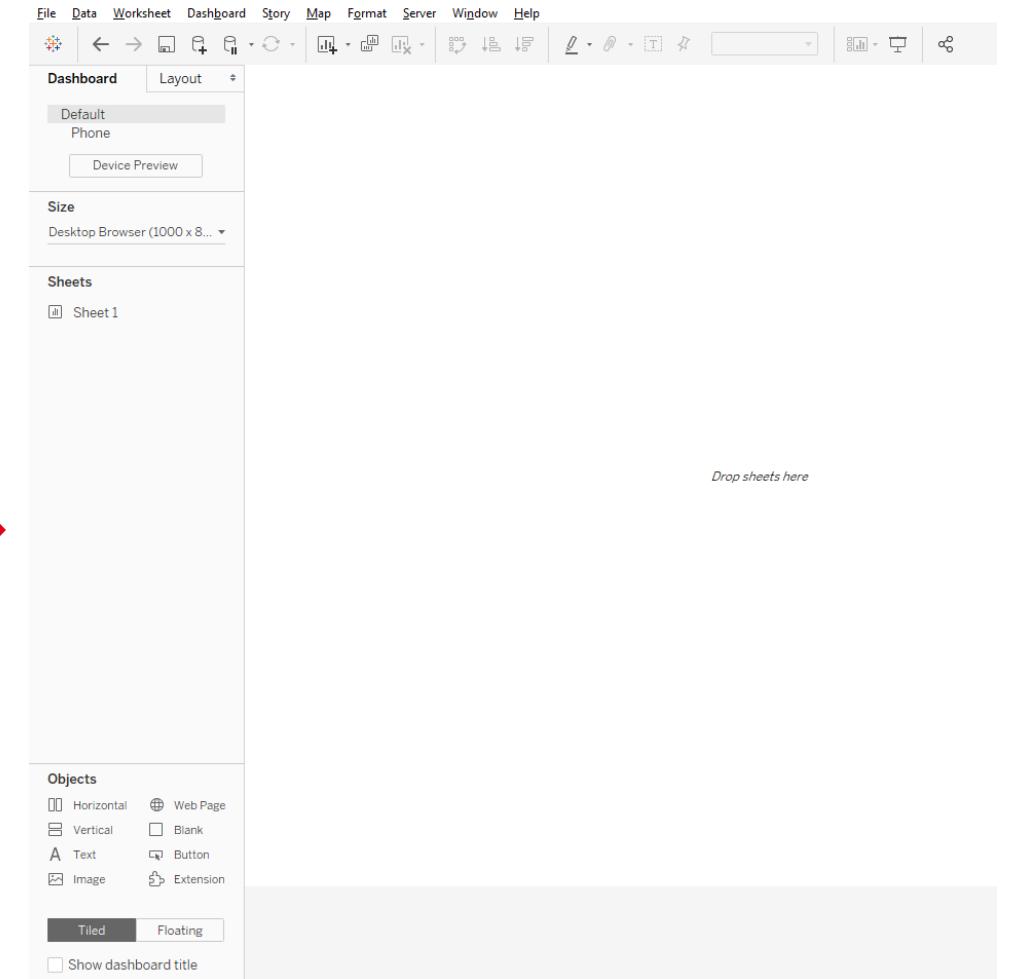
# INTERFACE 1/3

To create a new dashboard:

- From the taskbar:

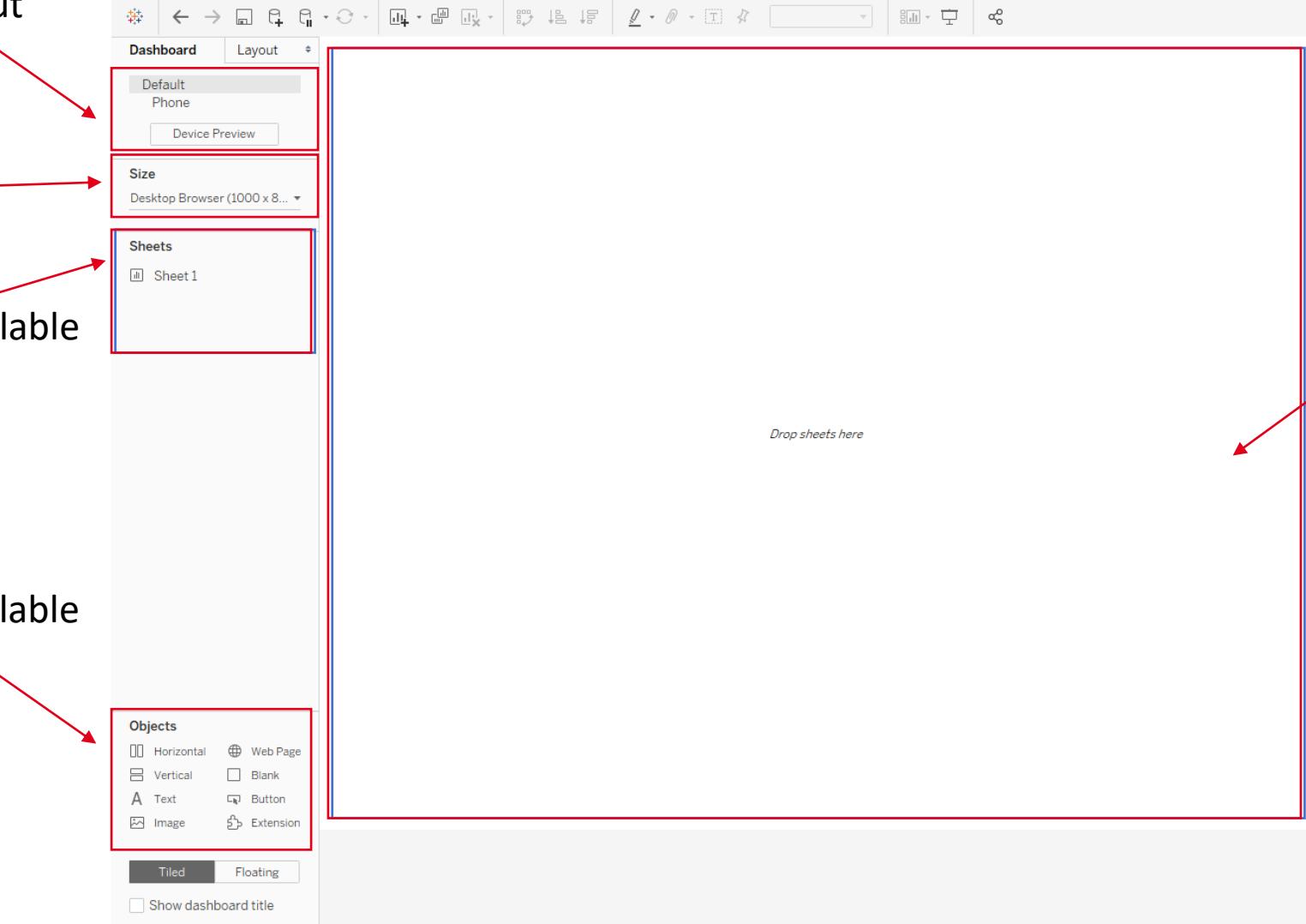


- From the "New dashboard" tab at the bottom of the workbook:



# INTERFACE 2/3

Mobile Layout



Dashboard Size

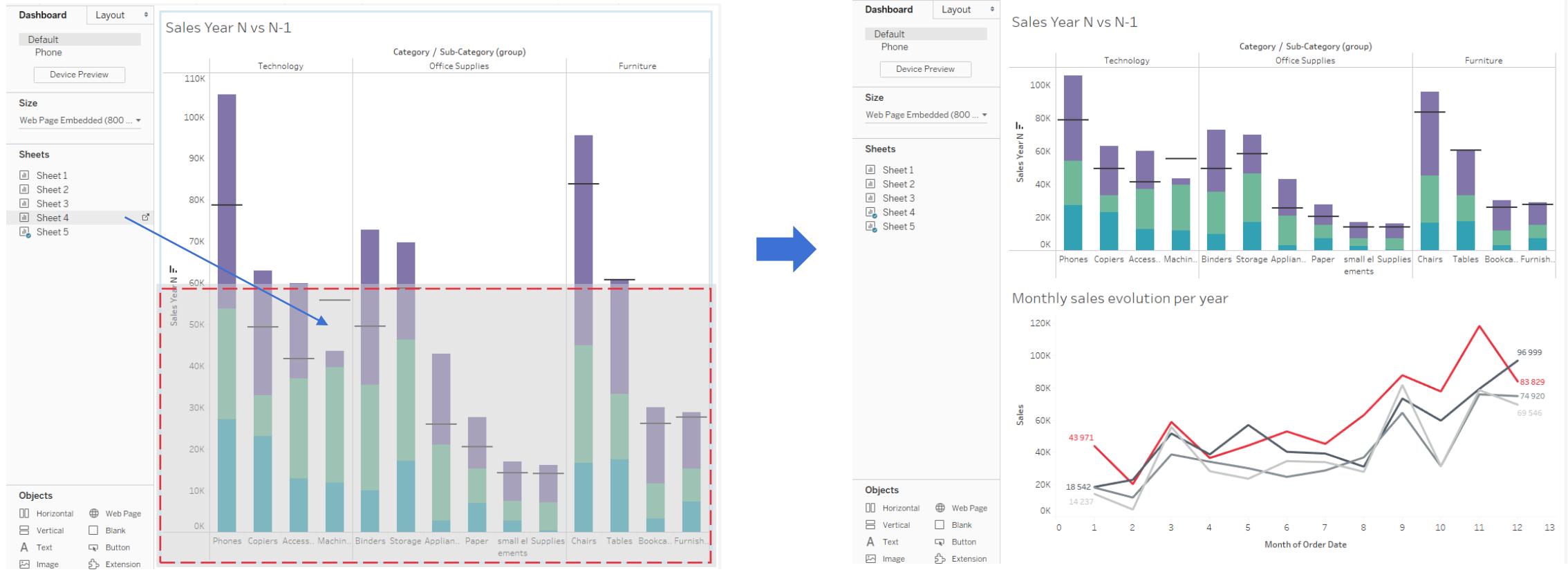
List of available sheets

List of available objects

Dashboard display area

# INTERFACE 3/3

To place the sheets (or objects) on the dashboard, simply drag and drop the items in the display area:

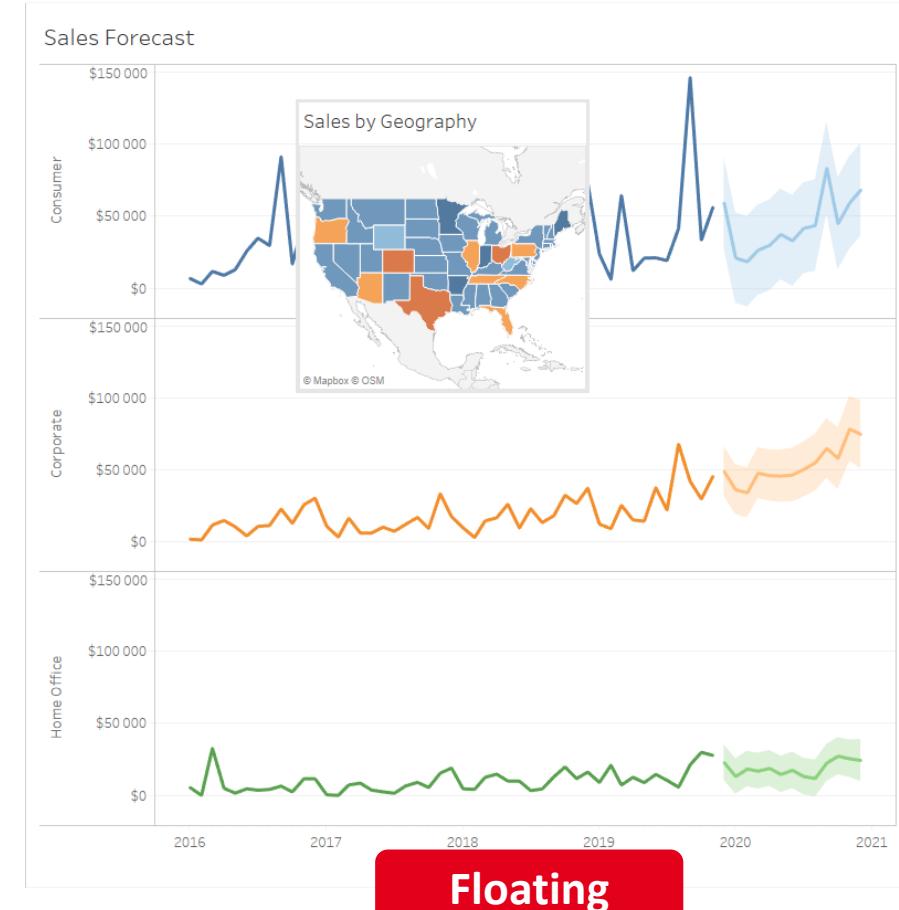
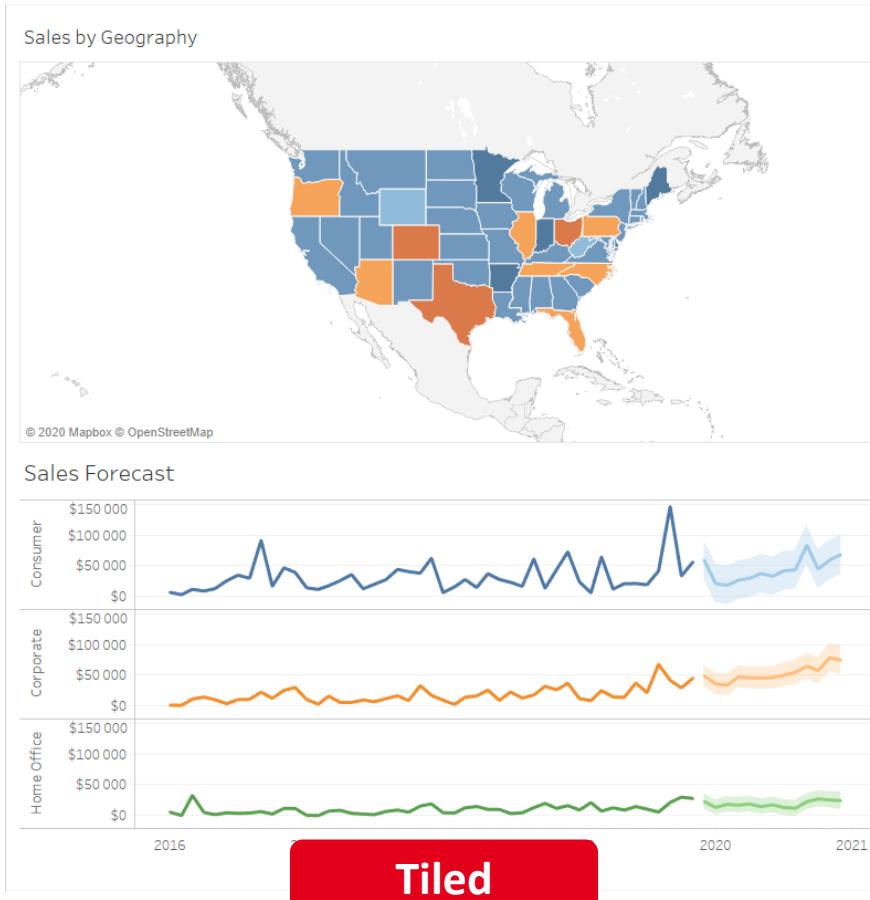




# DEMO – INTERFACE

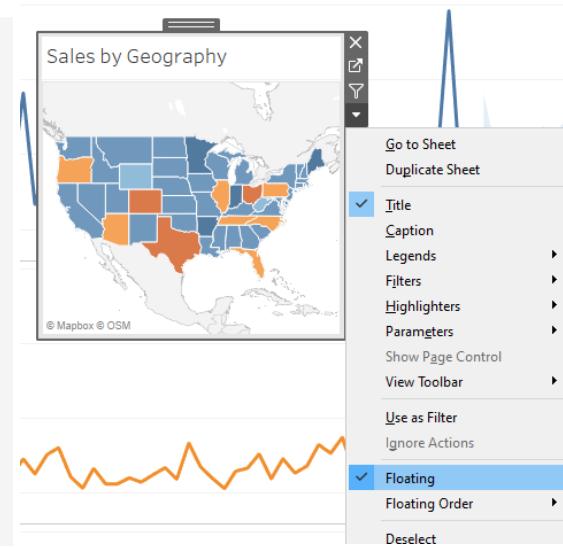
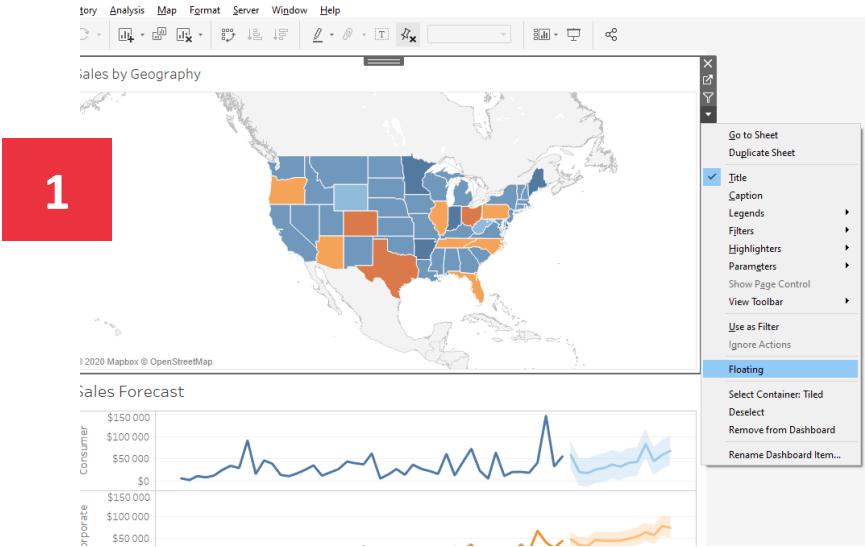
# DASHBOARD LAYOUT: TILES 1/2

Each sheet and object can either be tiled or floating.



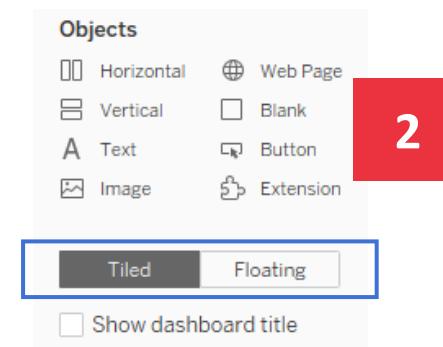
# DASHBOARD LAYOUT: TILES 2/2

There are 2 ways to bring tiled or floating elements to your dashboard:



By changing the object settings in the dashboard directly

Or by selecting the desired layout *before* dragging the item into the dashboard



# DASHBOARD LAYOUT: CONTAINERS 1/2

Layout containers let you group related objects together and fine-tune how your dashboard resizes when users interact with them.

## Horizontal container

Adds a **Horizontal** layout container.

The widths of sheets and objects placed in a horizontal container automatically adjust to perfectly fit the width of the container.

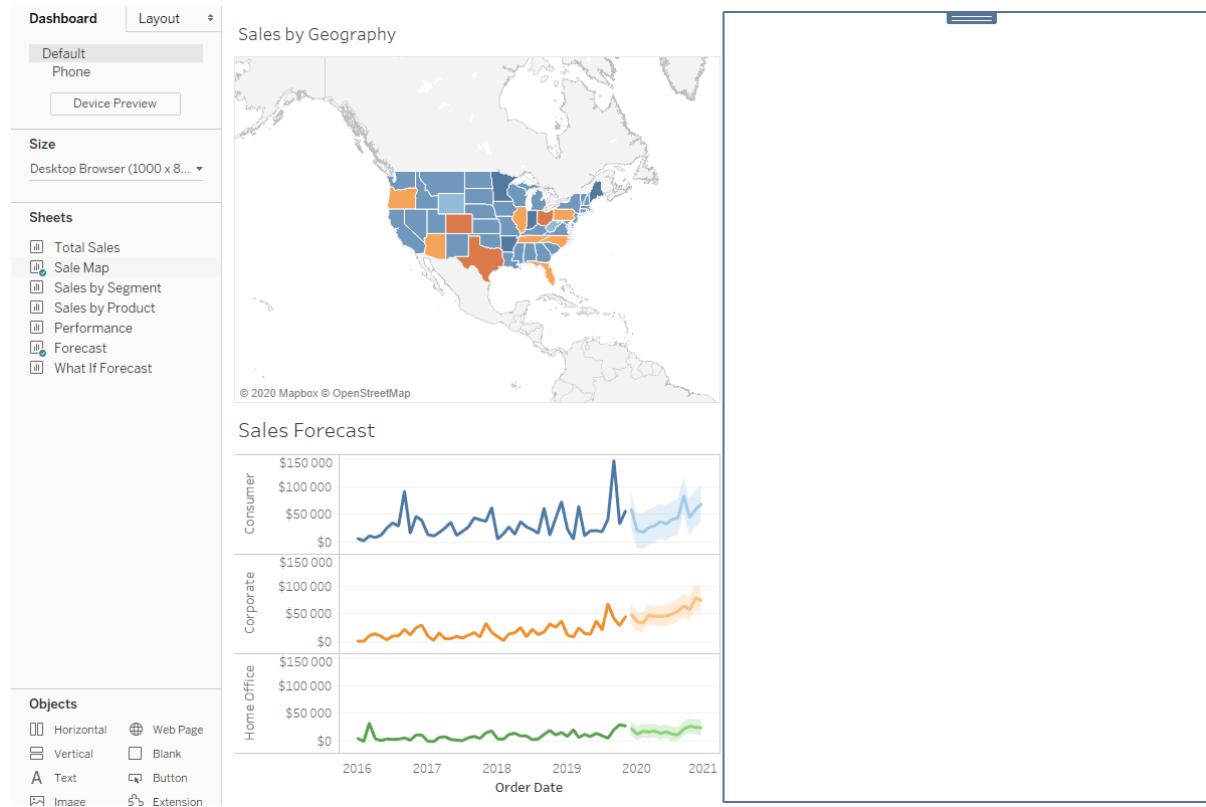
## Vertical container

Adds a **Vertical** layout container.

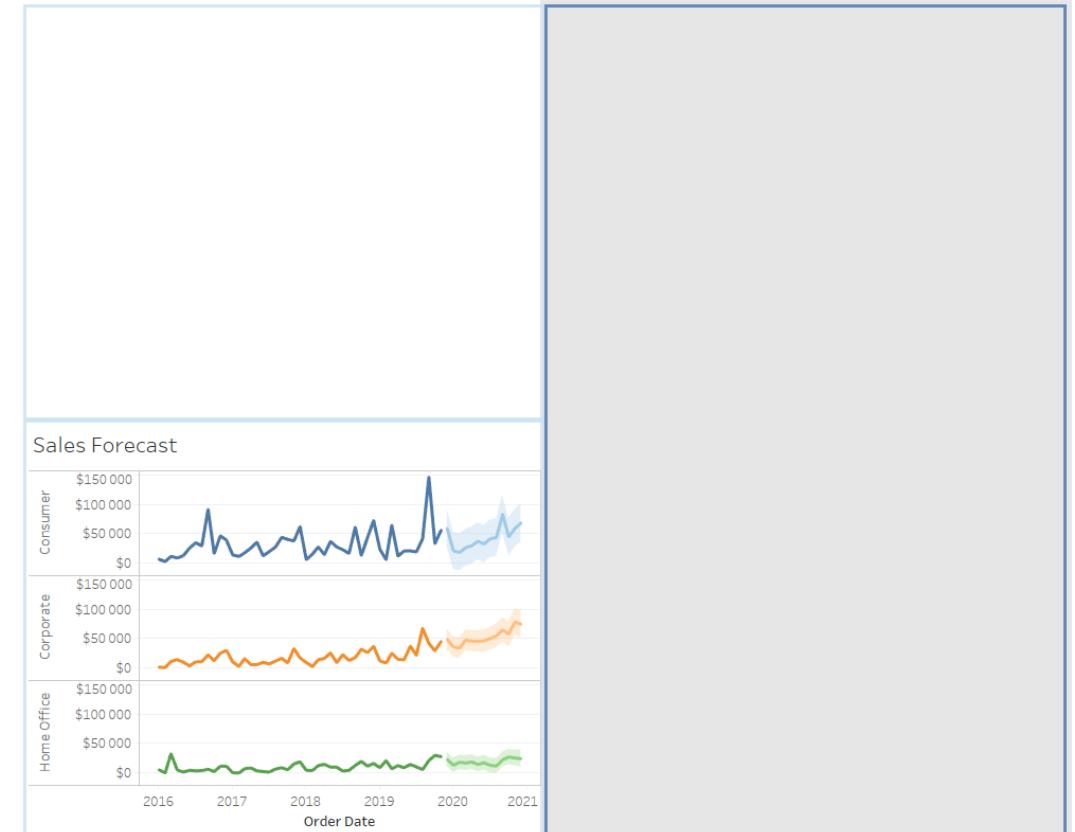
The heights of sheets and objects placed in a vertical container automatically adjust to perfectly fit the height of the container.

# DASHBOARD LAYOUT: CONTAINERS 2/2

To add a container, simply drag and drop the selected container into the dashboard display area:



To move a view or object in a container, drag and drop the sheet (or object) into the container area:



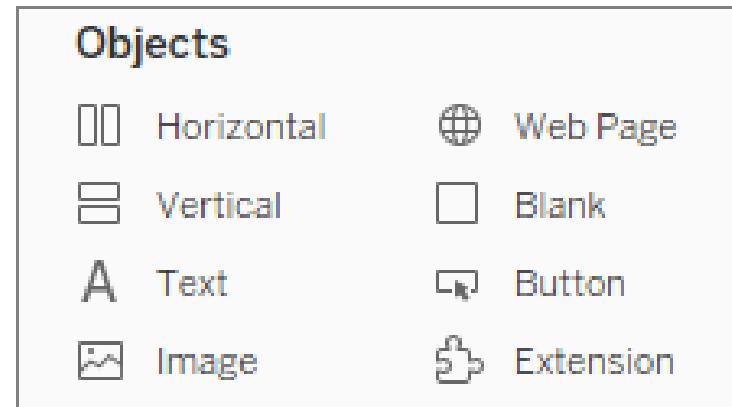


# DEMO – TILE & CONTAINERS

# AVAILABLE OBJECTS

In addition to spreadsheets, Tableau offers the possibility of adding other objects to enhance the dashboard :

- Containers
- Texts
- Images
- URL links
- Blank spaces
- Buttons
- Extensions



# BLANK & TEXT

## Blank objects

Add blank spaces to your dashboard in the following cases, for example:

- Adapt spacing between objects
- Create dividing lines in the dashboard

## Text

Add text to the dashboard, but it cannot contain fields or be interactive. Text is generally used for:

- Titles, headers
- Annotations, comments

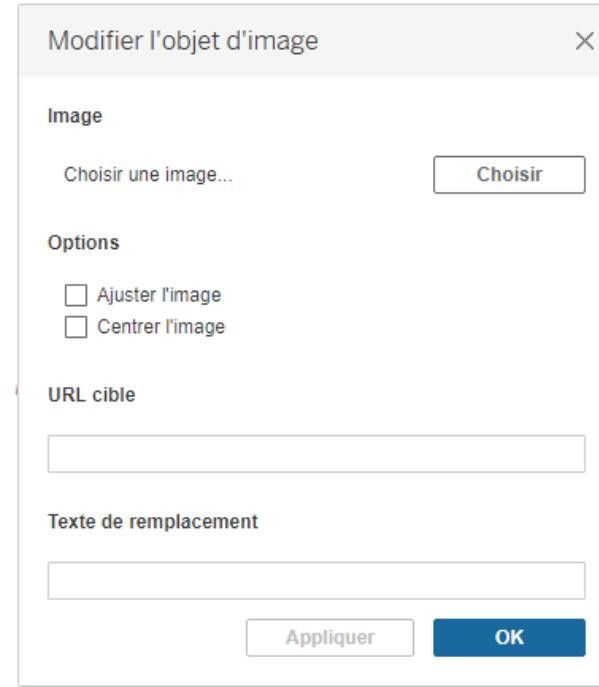
To add these items, simply drag them into the dashboard display area.

# IMAGE & WEB PAGE

## IMAGE

Tableau offers to add Images to the dashboards. They may be:

- Logos
- Icons
- A background image



To add an image, just drag Image from the objects on  
the dashboard and edit settings:

## WEB PAGE

You can also embed **URL links** in the dashboard.

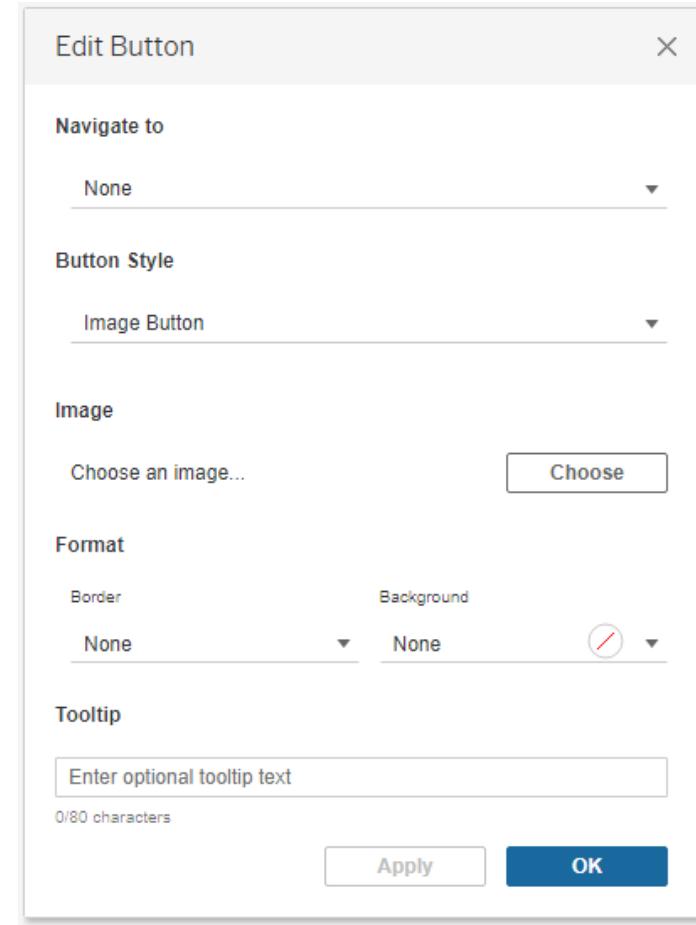
Simply drag the Web Page object in the dashboard and write down the URL:

# BUTTON

You can finally add a Button with a navigation action to your dashboard.

The user can set the button with several options:

- The navigation link
- Image customization
- The format and type of the button
- The tooltip



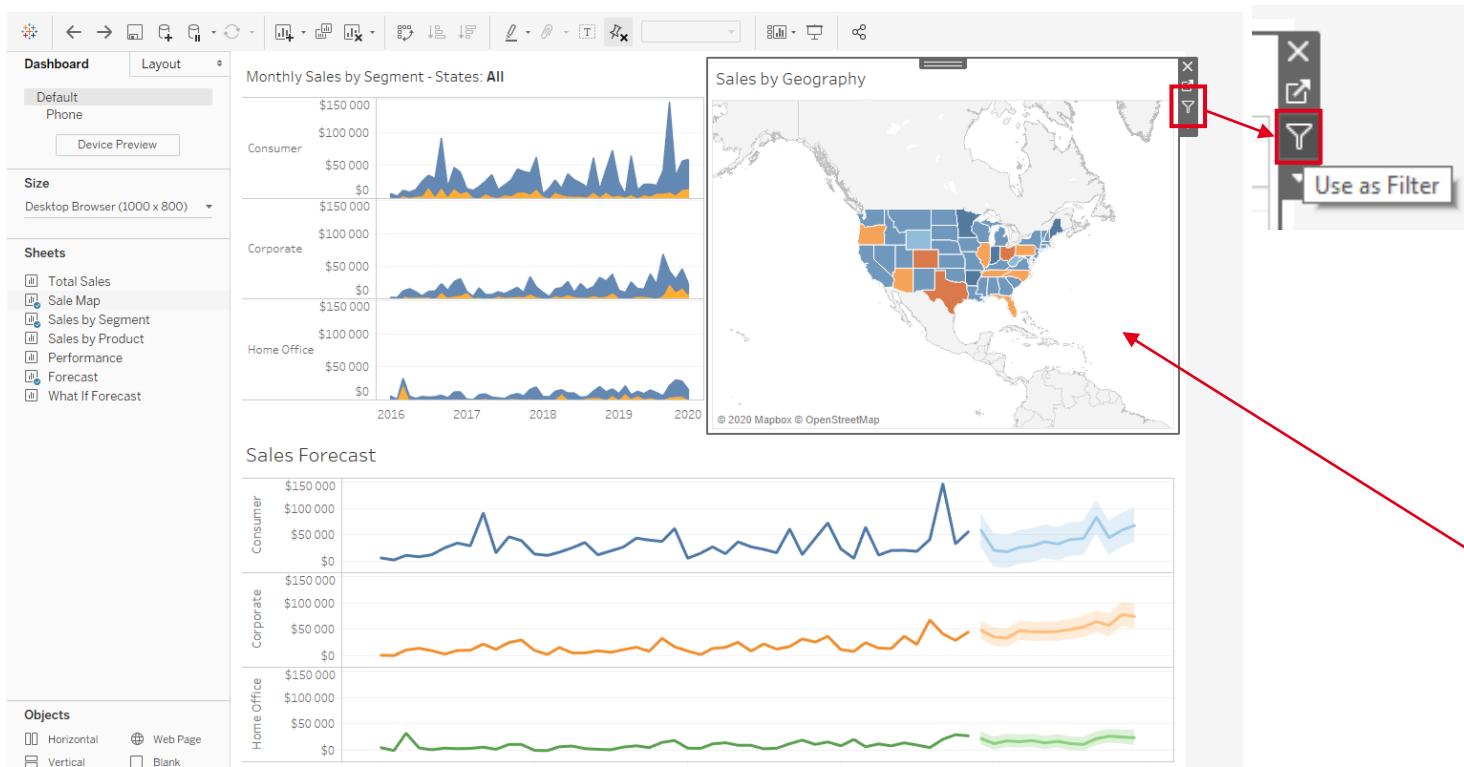


# DEMO – OBJECTS

# FILTER ACTIONS

You can quickly make your dashboard interactive by adding a filter action to a sheet. This makes it dynamic and will affect and filter the other sheets.

Just select the option "Use as a filter" on one of the sheets:



Selection on this sheet will filter all other sheets on the dashboard



# DEMO – FILTER ACTIONS

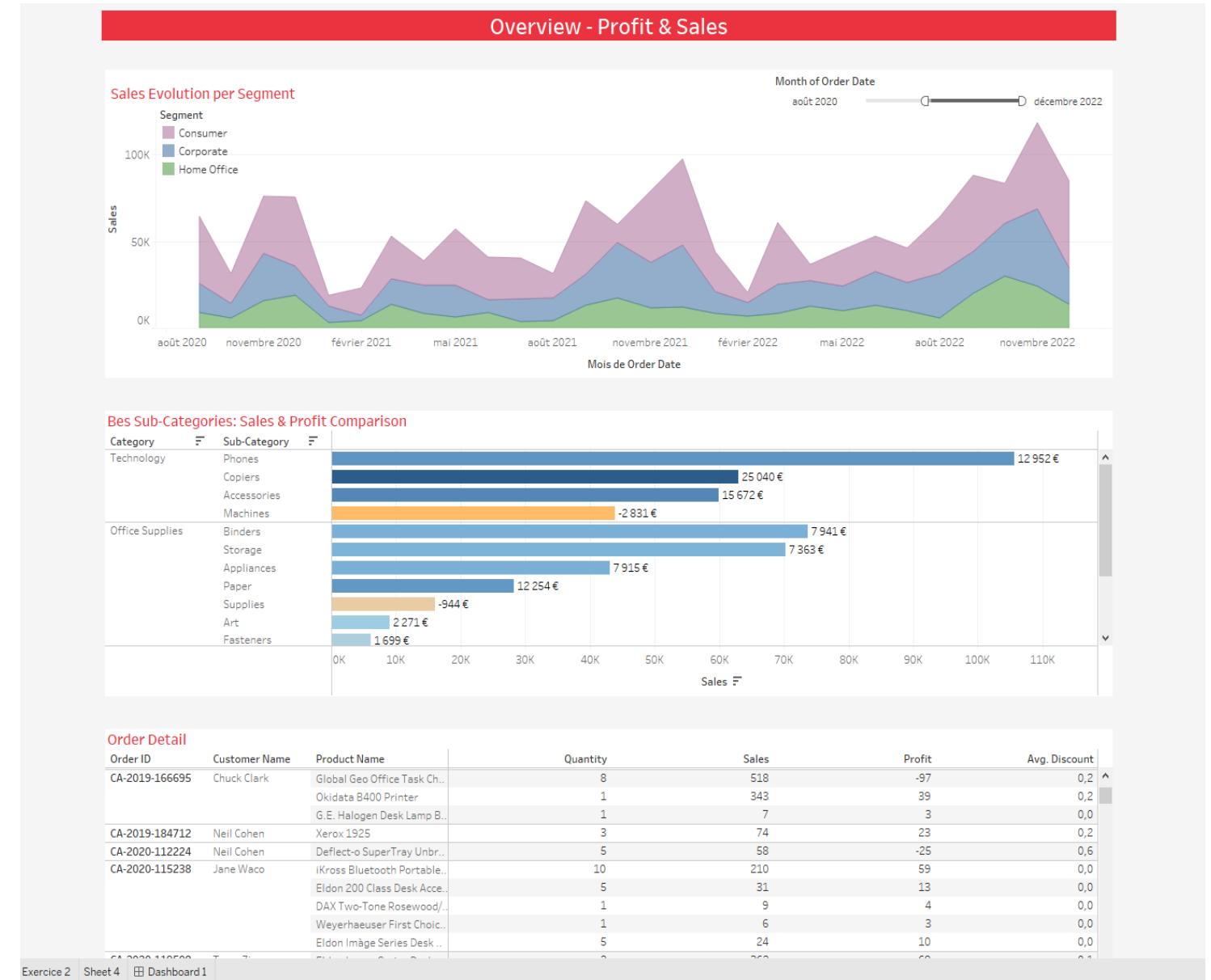


# Exercises

# Exercise 1

Recreate this dashboarding using the graphs you built in the first part.

/!\ We would like to be able to filter the whole dashboard by Category or Subcategory by clicking on a graph.



Time: 15 min



# GROUP EVALUATION

# Group Evaluation

I'm the Sales Director and I want to have an overview of my business.

You are a 3-consultants group and you have to give me this vision by creating a dashboard with several KPI and graphs.

Use the Sample Superstore and don't use the graphs you already created in an exercise.

During a 5-10 min Pitch you have to:

- Explain the big insight of your analyse using the dashboard
- Explain why do you use these graphs to visualize data
- Tell me which technical elements you use for each graph (group, create calculated fields, dual axis)

# Tableau Desktop

Data Visualization 2

07/03/2023



em  
lyon  
business  
school



early makers  
since 1872

# Data Visualization

- 01 Discrete vs Continuous
- 02 Dates Manipulation
- 03 Groups and Sorting
- 04 Aggregation Calcul
- 05 Axes
- 06 Exercises



# DISCRETE VS CONTINUOUS

Tableau represents data differently in the view depending on whether the field is discrete (Blue) or continuous (Green).

Continuous and Discrete are mathematical terms:

- Continuous means "forming a continuous, uninterrupted whole" 
- Discrete means "individually separated and distinct" 

Placed in the shelf of rows or columns, a continuous field will add an axis to the view.

Placed in the shelf of rows or columns, a discrete field will add a header to the view.

# DISCRETE VS CONTINUOUS

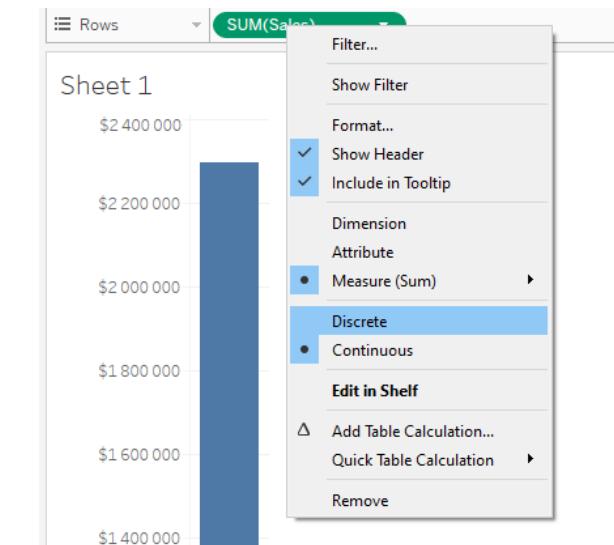
While most dimensions are discrete and most measures continuous, it is important not to confuse these notions.

The **Discrete** or **Continuous** nature of a field is defined by its type:

- Strings and Boolean fields are necessarily **Discrete**
- All other fields can be used as **Discrete** or **Continuous**

	<b>Discrete</b>	<b>Continuous</b>
<b>Dimension</b>	Product Name	YEAR(Order Date)
<b>Measure</b>	SUM(Profit)	SUM(Profit)

At any time, the discrete or continuous nature of a field can be changed, via the drop-down menu



# DISCRETE VS CONTINUOUS

The use of a **Continuous** or **Discrete** field will produce different behaviors in Tableau

	<b>Discrete</b>	<b>Continuous</b>
<b>Rows or columns shelves</b>	Generates headers list of members of the dimension	Generates axis
<b>Color (Marks)</b>	Category-colored palette	Sequential or divergent color scale
<b>Size (Marks)</b>	Sizes set according to the order of sorting set on the field	Sizes based on the value taken by the field in relation to the possible range of values for the field
<b>Filters</b>	List of members of the dimension	Use of the values range, Min/Max



# DEMO – DISCRETE VS CONTINUOUS

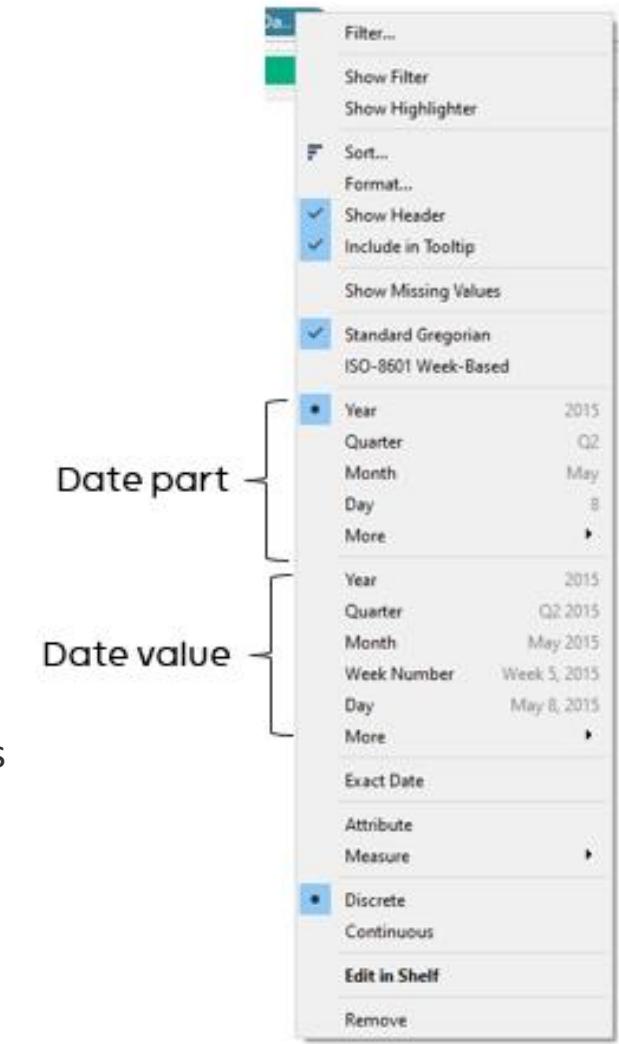
# DATES MANIPULATION

Tableau generates, for each date present in the data source, **two distinct hierarchies**.

- **Date part**-> Whole number corresponding to the Year number/Month/Week Etc...  
**Discrete** by default, extracts a whole number corresponding to the year number/Month/Week... from a date  
This hierarchy is the results of the DATEPART function
- **Date value**-> The date of the start of the chosen period (Year/Month/Week Etc... )  
**Continuous** by default, takes the first day of the chosen period.  
This hierarchy is the results of the DATETRUNC function

Notice :

- Whatever the chosen format and hierarchy, it is possible to work with discrete or continuous values. The change from one to the other is done through the contextual menu.



# DATES MANIPULATION

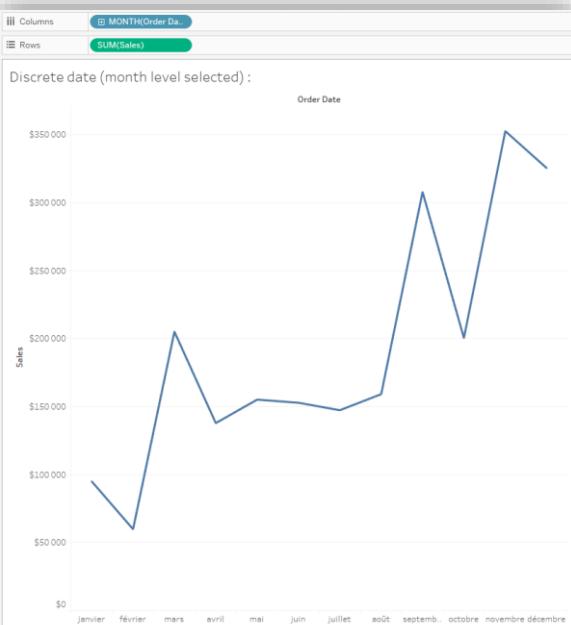
By default, date dimensions are discrete fields for which Tableau automatically selects a date level when placed on a shelf.

Once the field is placed on a shelf, you can use a date as **continuous quantity**. To do this, use the **contextual menu** and select one of the continuous date options.

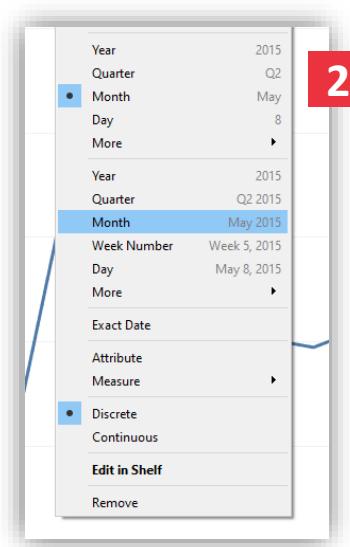
→ Choosing continuous dates generates a quantitative axis for date values.

For example, the view below shows sales as a function of a discrete order date (1). The color of the "Order Date" field goes from blue to green (3) once it is converted to a continuous value (2).

Discrete date (month level selected):

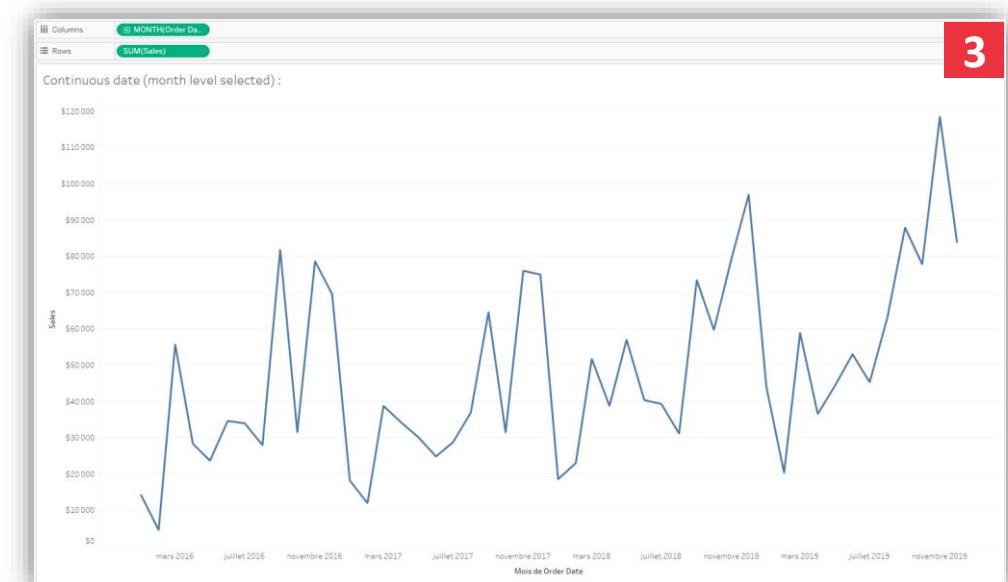


1



2

Continuous date (month level selected):



3



# DEMO – DATES MANIPULATION

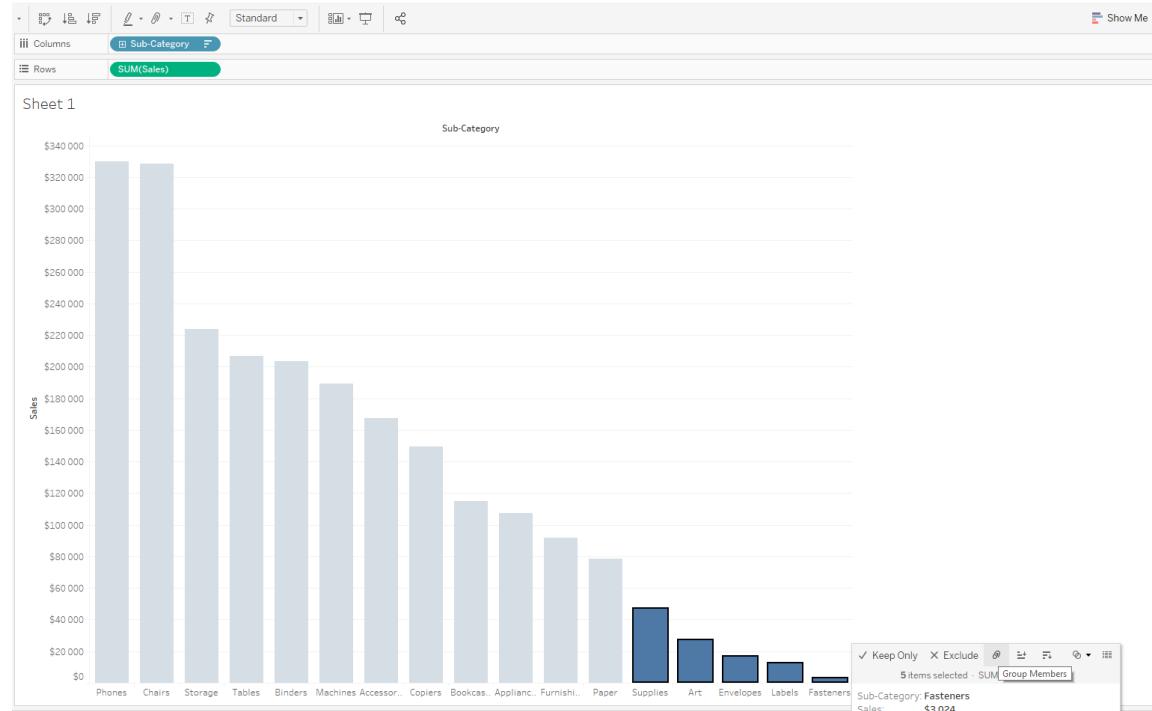
# GOUPS – CREATION METHOD 1

Groups allow to associate members to be grouped in a field.

Examples of use:

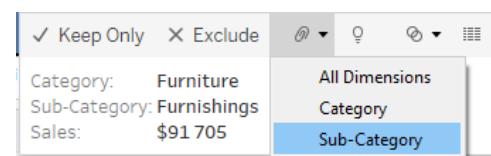
- Grouping data by category
- Correcting anomalies

To create a group, select one or more marks  
and click on the "Group" icon 



Note:

If the view contains multiple levels of detail, select a level to group the members together.



# GOUPS – CREATION METHOD 2

It is also possible to create a group from a field in the Data pane

1. Make a right-click on the field from the Data pane, **Create > Group**
2. Select the values to be grouped together, then **Group**
3. Name the group

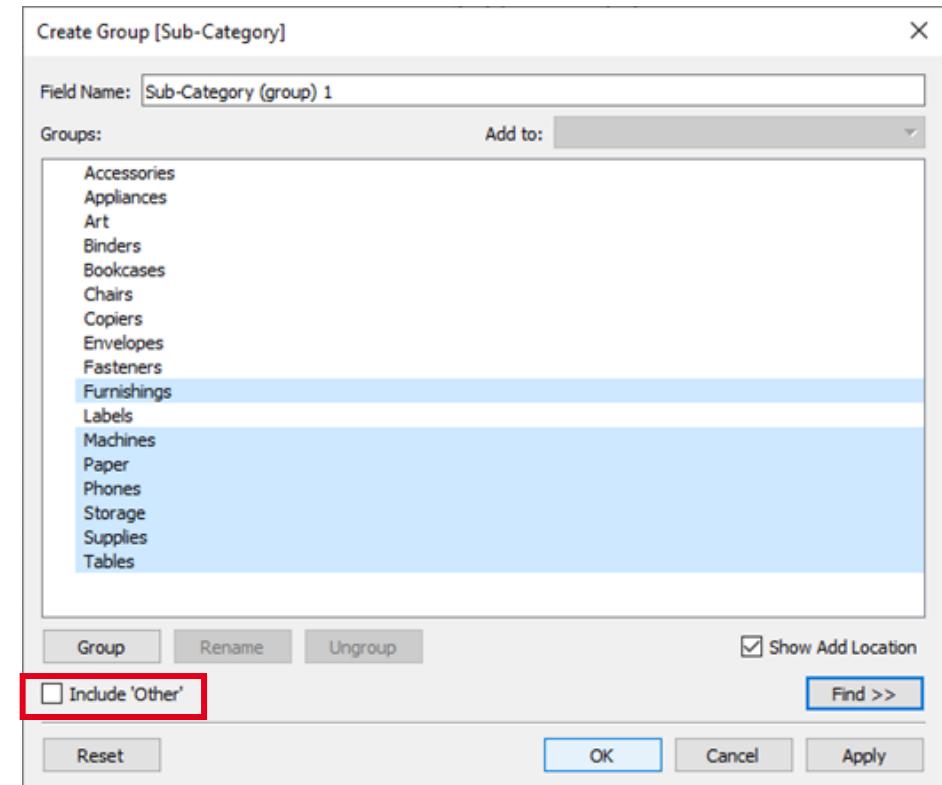
The screenshot shows the Power BI Data pane with a list of fields on the left and a chart preview on the right. A context menu is open over the 'Sub-Category' field, which is highlighted with a red box labeled '1'. The menu options include 'Add to Sheet', 'Show Filter', 'Duplicate', 'Rename', 'Hide', 'Aliases...', 'Create' (with sub-options 'Calculated Field...', 'Group...', 'Set...', 'Parameter...'), 'Transform' (with sub-options 'Convert to Measure', 'Change Data Type', 'Geographic Role', 'Default Properties'), 'Group by', 'Folders', 'Hierarchy', 'Replace References...', and 'Describe...'. The 'Group...' option is highlighted with a blue selection bar. To the right of the menu, a chart shows Sales values ranging from \$20 to \$240. On the far right, a 'Create Group [Sub-Category]' dialog box is open, labeled '2'. It has a 'Field Name:' input field containing 'Sub-Category (group) 1'. Below it is a 'Groups:' list box containing a scrollable list of category names: Accessories, Appliances, Art, Binders, Bookcases, Chairs, Copiers, Envelopes, Fasteners, Furnishings, Labels, Machines, Paper, Phones, Storage, Supplies, and Tables. At the bottom of the dialog are buttons for 'Group', 'Rename', 'Ungroup', 'Find >>', 'Include 'Other'' (unchecked), and 'OK', 'Cancel', 'Apply'.

# GOUPS – INCLUDE OTHERS

It is possible to bring all remaining or non-reunited members together in an 'Other' group.

**Use cases:** The option is useful for highlighting certain groups or comparing specific groups with each other. If you have a view that shows the Sales product category versus the Profit category, you may want to highlight the high-performance, low-performance categories in the view, and bring all the other categories together in an "Other" group.

→ Includes "Other" category / Does not include the "Other" category





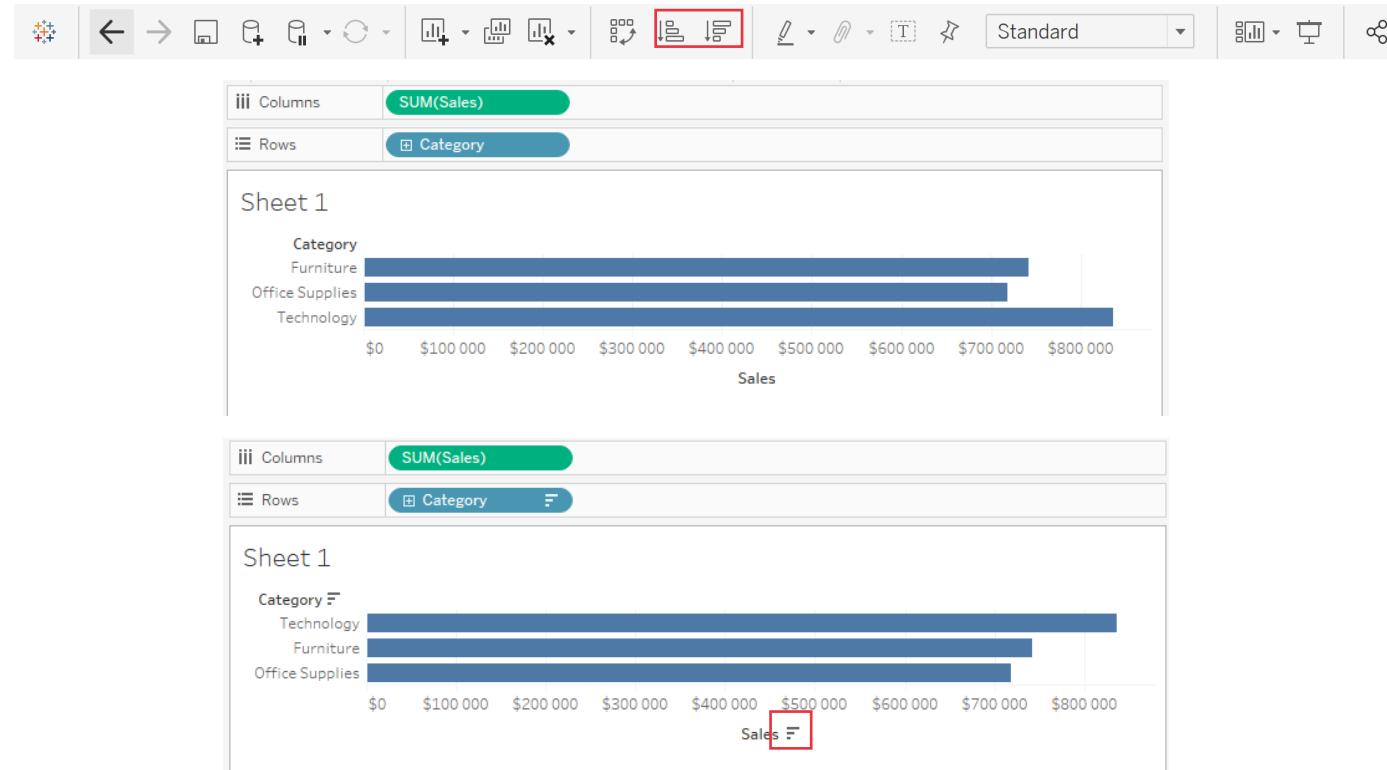
# DEMO – GROUPS



# DEMO – GROUPS

# SORTING

It is easy and quick to sort a graph with sorting icons in the toolbar

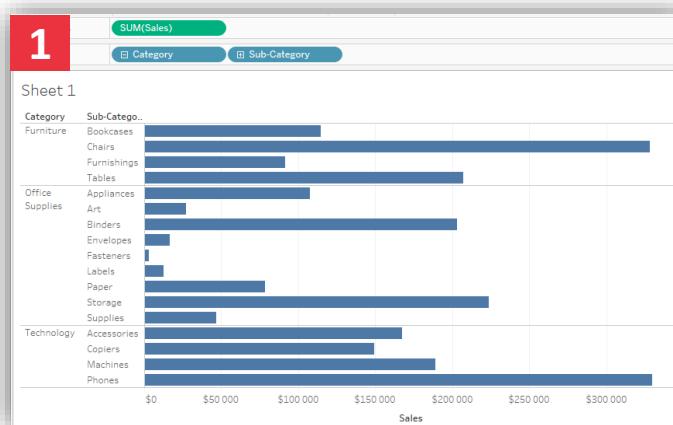


# SORTING

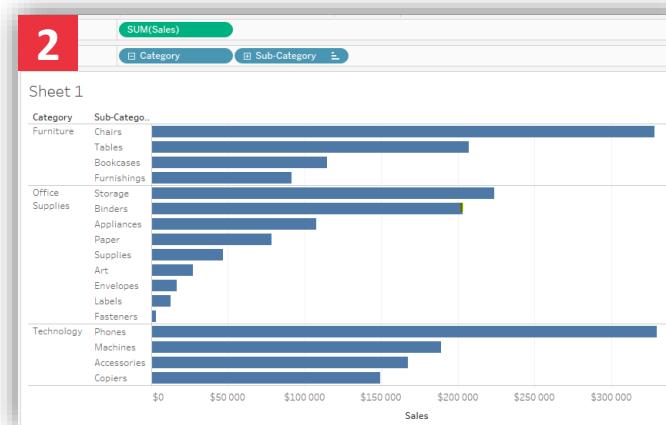
If several discrete fields are within the view, it is possible to sort each of these fields by selecting it and clicking the sort button.

Be careful, sorting is done in a nested way. A sorting on the second field will reorder the values within each of the members of the first field.

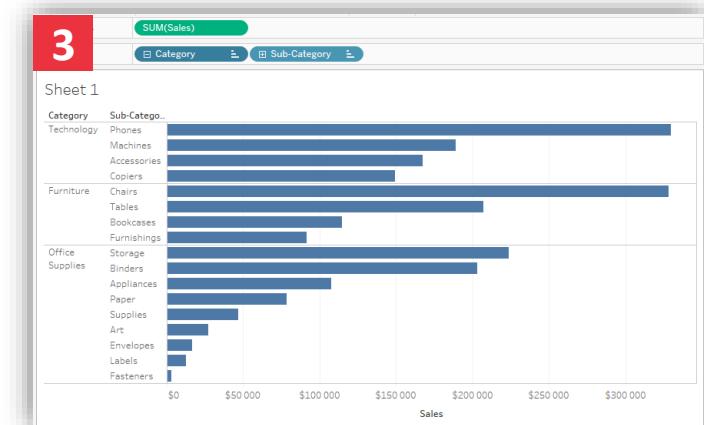
No sorting



Sorting out subcategory



Sorting on categories





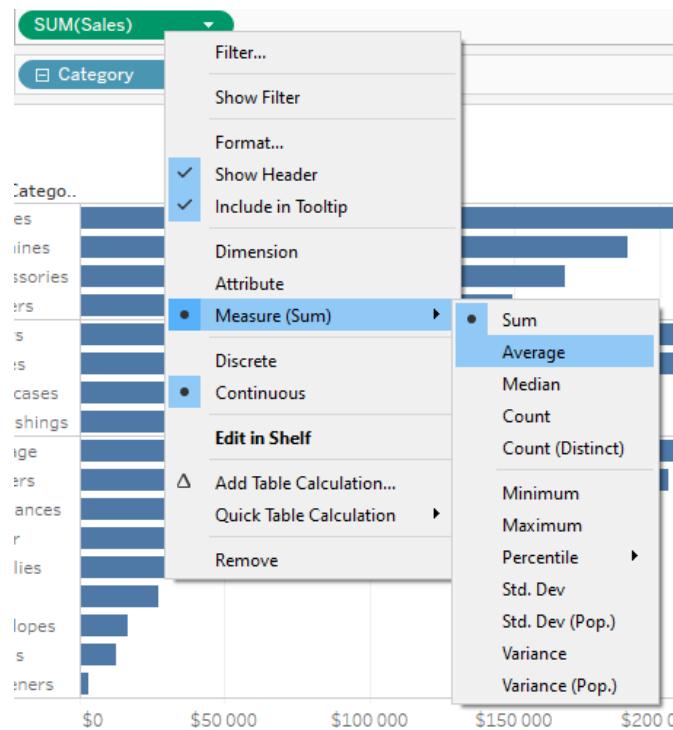
# DEMO – SORTING

# AGGREGATE A MEASURE

As soon as a measure is added to the view, an aggregation is applied to this measure by default. The type of aggregation applied varies depending on the context of the view.

In the following example, the function applied is SUM: **SUM(Sales)**

It is possible to change the function applied with a right-click on the measure and then Measure (Sum) - Select a function



# AGGREGATION FUNCTION

The aggregation functions preset by Tableau are:

**Attribute**: ATTR (expression)

Returns the value of the expression if this value is unique for all lines. Otherwise, the returned value is Null. Zero values are ignored.

**Sum** : SUM (expression)

Returns the sum of all the values of the expression. The SUM function can only be used with numeric fields. Zero values are ignored.

**Average** : AVG (expression)

Returns the average of all the values of the expression. The AVG function can only be used with numeric fields. Zero values are ignored.

**Minimum** : MIN (expression)

Returns the minimum value of an expression in all records. If the expression corresponds to a string, this function returns the first value in alphabetical order.

**Maximum** : MAX (expression)

Returns the maximum value of an expression in all records. If the expression corresponds to a string, this function returns the last value in alphabetical order.

# AGGREGATION FUNCTION

**Median** In: MEDIAN (expression)

Returns the median value of an expression in all records. The median value can only be used with numeric fields.

**Variance** : VAR (expression)

Returns the statistical variance of all values in the expression given based on a population sample.

**Variance (Pop.)** : VARP (expression)

Returns the statistical variance of all values in the given expression of the entire population.

**Collection** : COLLECT (spatial)

An aggregate calculation combining values in the argument field. Zero values are ignored.

Note : Collect can only be used with spacial data fields.

**Correlation** : CORR (expression 1, expression2)

Returns the Pearson correlation coefficient of two expressions.

# AGGREGATION FUNCTION

**Count** : COUNT (expression)

Returns the number of items in a group. Zero values are ignored.

**Count (Distinct)** : COUNTD (expression)

Returns the number of separate elements of a group. Zero values are ignored.

**Covariance** : COVAR (expression 1, expression2)

Returns sample covariance of two expressions.

**Covariance (pop.)** : COVARP (expression 1, expression2)

Returns population covariance of two expressions.

**Percentile** : PERCENTILE (expression, number)

Returns the value of the percentile for the given expression corresponding to the number indicated. The value must be between 0 and 1 (included), for example 0.66, and must be a numerical constant.

**Standard deviation** : STDEV (expression)

Returns the statistical standard deviation of all values in the given expression based on a population sample.

**Standard deviation (pop.)** : STDEVP (expression)

Returns the statistical standard deviation of all values in the expression given according to a biased population.



# DEMO – AGGREGATION FUNCTION

# USE OF AXES

It is possible to compare several measures in a single view in several ways:

- Create individual axes for each measure
- Blend two measures to share an axis
- Use a dual axis where two independent axes are overlayed in the same pane

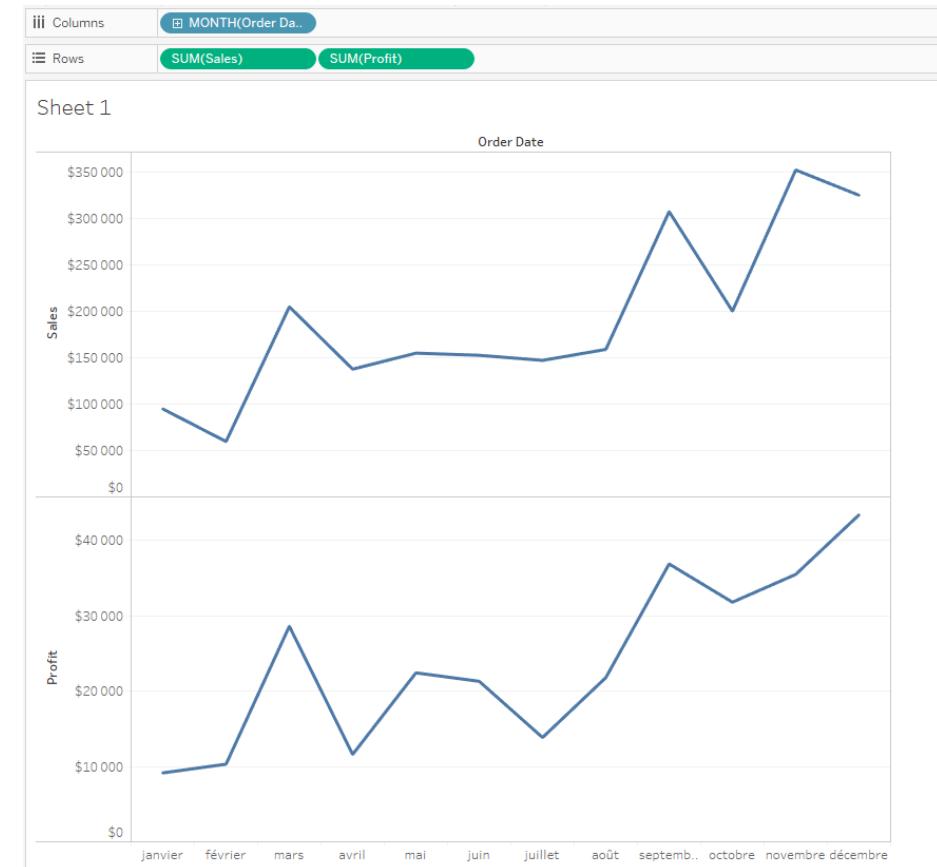
# INDIVIDUAL AXES

To add individual axes for each measure, you need to slide the measures to the Rows or Columns shelves:

- Add a continuous field to the Rows shelf to add an extra axis to the table rows
- Add a continuous field to the Columns shelf to add an extra axis to the table columns

The example on the right shows monthly sales and profits.

The Sales and Profit axis are individual rows of the table  
and have independent scales.

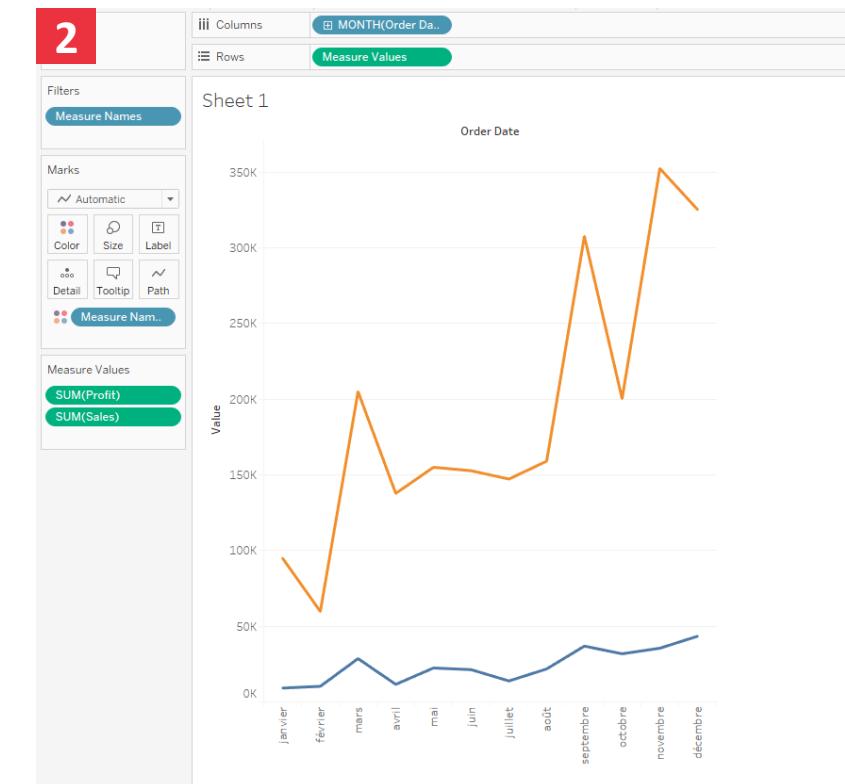
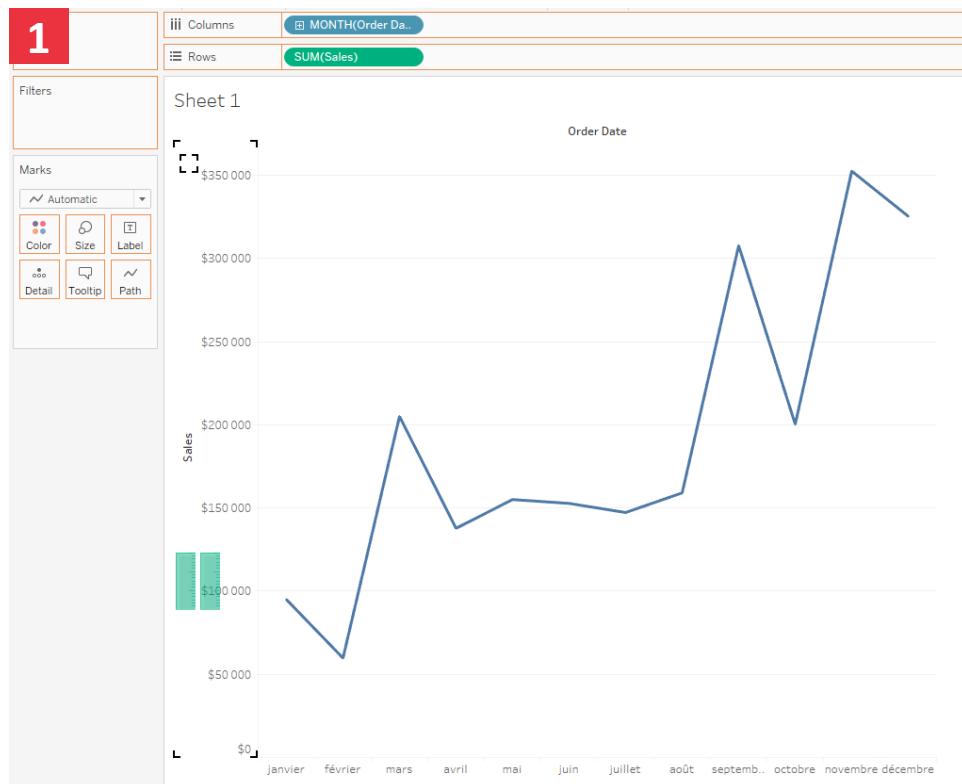


# BLEND AXES

The measures can share a single axis so that all the marks are displayed in a single pane.

To merge several measures, simply drag a measure or axis and place that measure or axis on an existing axis.

Instead of adding rows and columns to the view, when you combine measures, there is only one row or column and all the values of each measure are displayed along a continuous axis. For example, the view (2) presents monthly sales and profits on a shared axis.



# BLEND AXES – MEASURE NAMES AND VALUES

This fusion of axes is based on the use of the generated fields : measure names and values.

Tableau automatically creates these fields so you can create certain types of views involving multiple measures.

- The **Measure Values** field is always at the bottom of the Measures area of the **Data** pane and aggregates all the measures of your data, grouped into a single field with continuous values.
- The **Measure Names** field is always at the bottom of the Dimensions area of the **Data** pane and groups the names of all measures of your data, grouped into a single field with discrete values.

When the view includes the **Measure Values** field, Tableau creates a **Measure Values shelf**, framed in red on the right, which lists the measures of the data source with their default aggregations

The screenshot shows the Tableau interface with the Data pane open. The 'Measure Names' field is selected in the Data pane. On the right, a view titled 'Sheet 1' is displayed with data for various measures. A red box highlights the 'Measure Values' shelf at the bottom of the Data pane, which lists the measures and their default aggregations.

Measure	Value
Discount	16%
Number of Records	9 994
Profit	\$286 397
Profit Ratio	12%
Quantity	37 873
Sales	\$2 297 201

Measure Values

- AVG(Discount)
- SUM(Number of Rec...)
- SUM(Profit)
- AGG(Profit Ratio)
- SUM(Quantity)
- SUM(Sales)

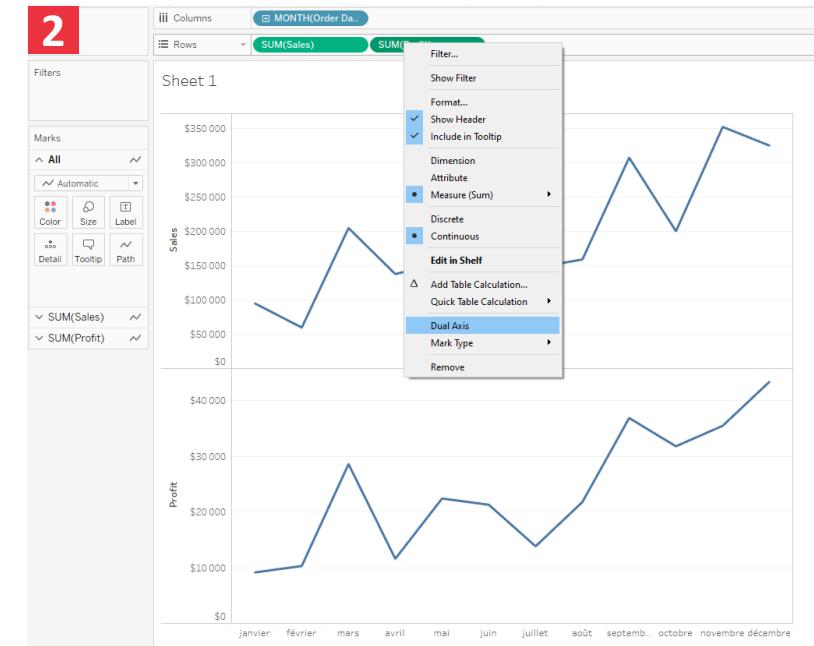
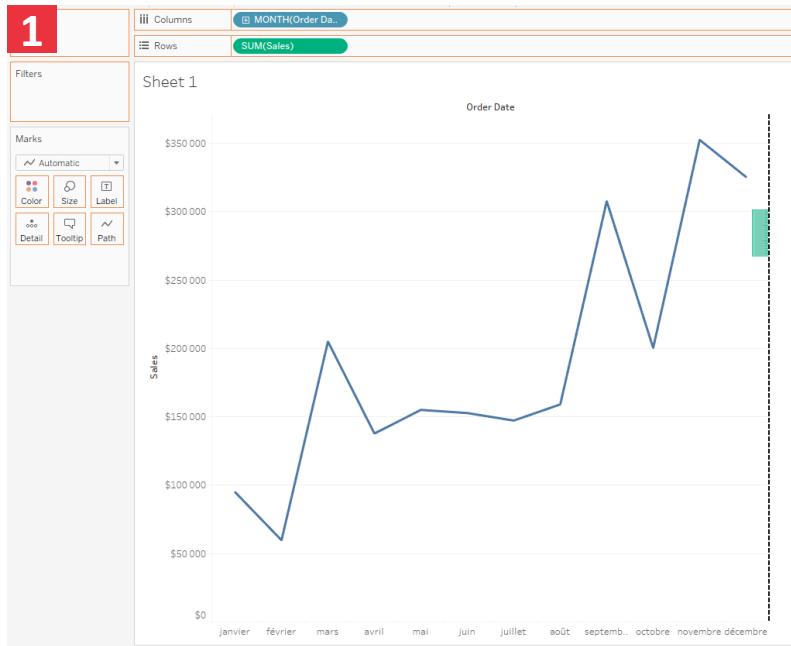
# DUAL AXIS

It is possible to compare two measures using a dual axis, i.e. overlapping independent axes. In particular, dual axes are useful for analyzing two measures with non-comparable scales.

The generation of these dual axis is done either

- By sliding the second measure opposite to the first axis (1)
- Via the second field's menu in the rows or columns shelf (2)

To align the two axes on a dual axis graph to have the same scale, right click on the secondary axis and select **Synchronize axis**. In this way, the scale of the secondary axis is aligned with the scale of the primary axis.



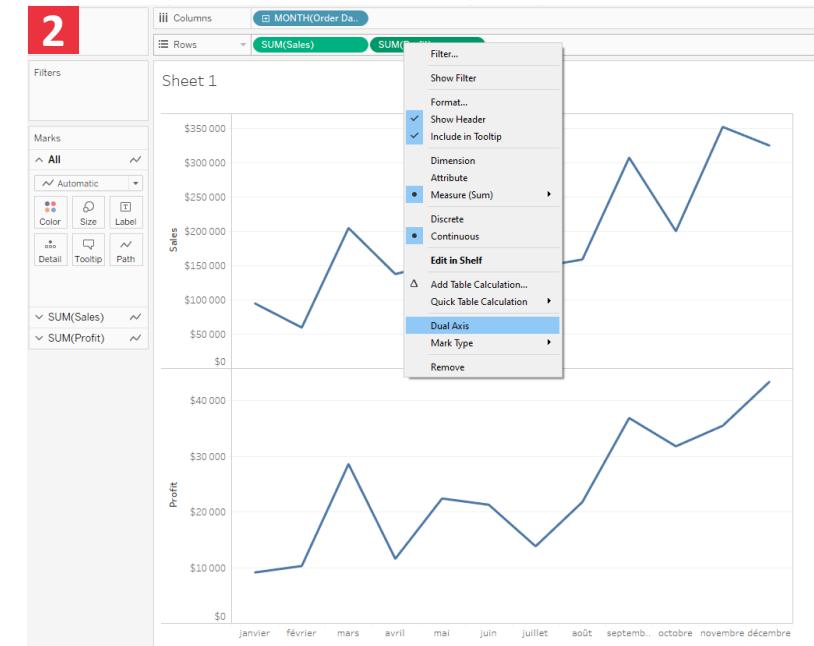
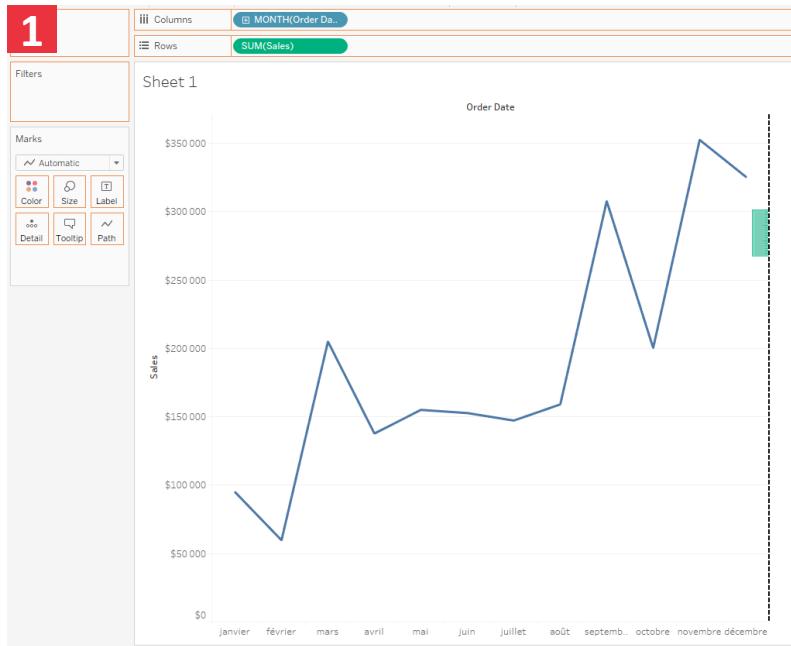
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# DUAL AXIS

	Blended Axis	Dual axis
Number of measures	Not limited	2 measures only
Axis	1 shared single axis	2 independent axis
Marks	1 unique and shared mark	2 independent mark shelves



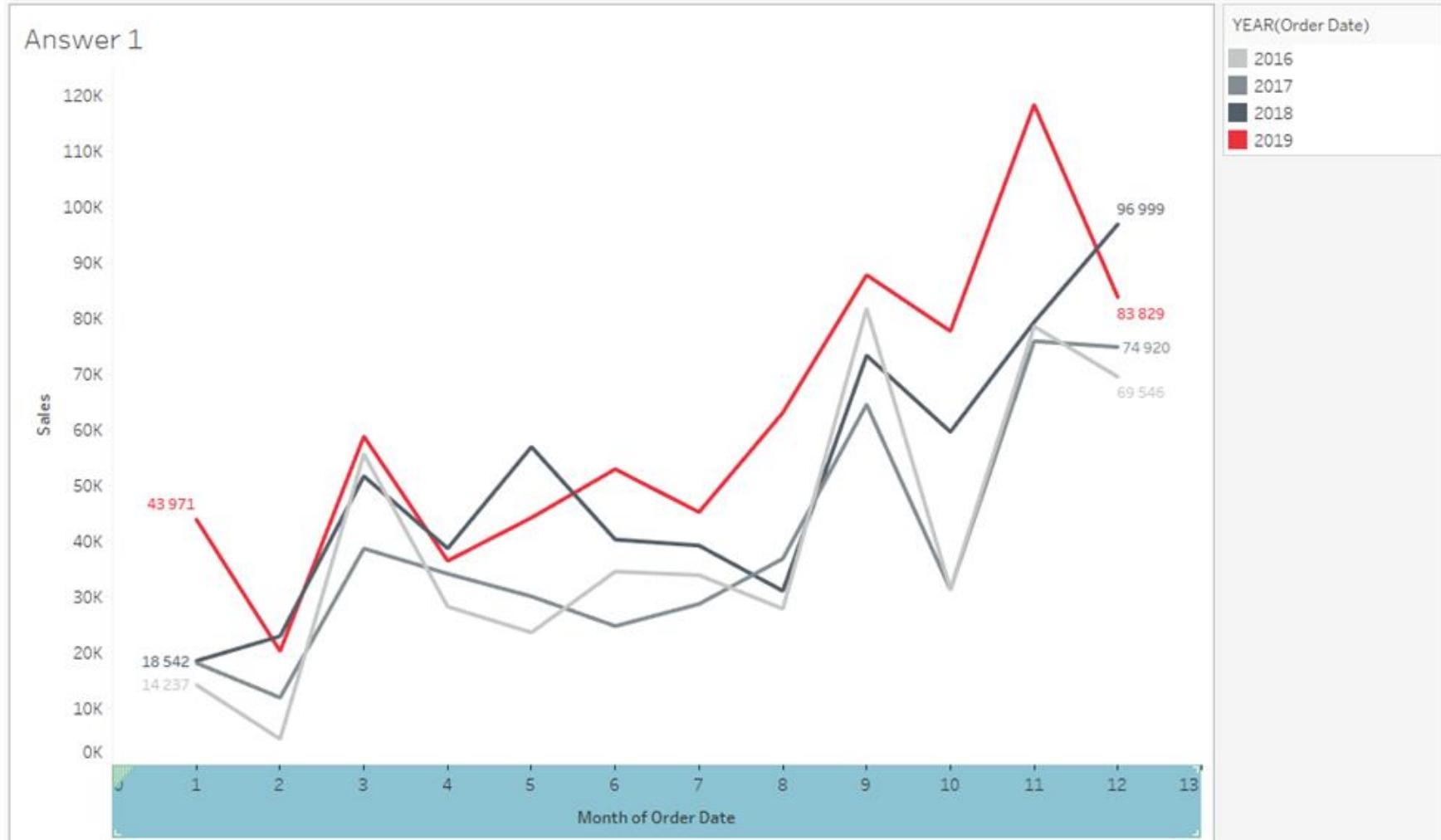
# DEMO – AXIS



# Exercise

# Exercise 1

Recreate the following view showing the monthly sales evolution as well as the evolution according to previous years



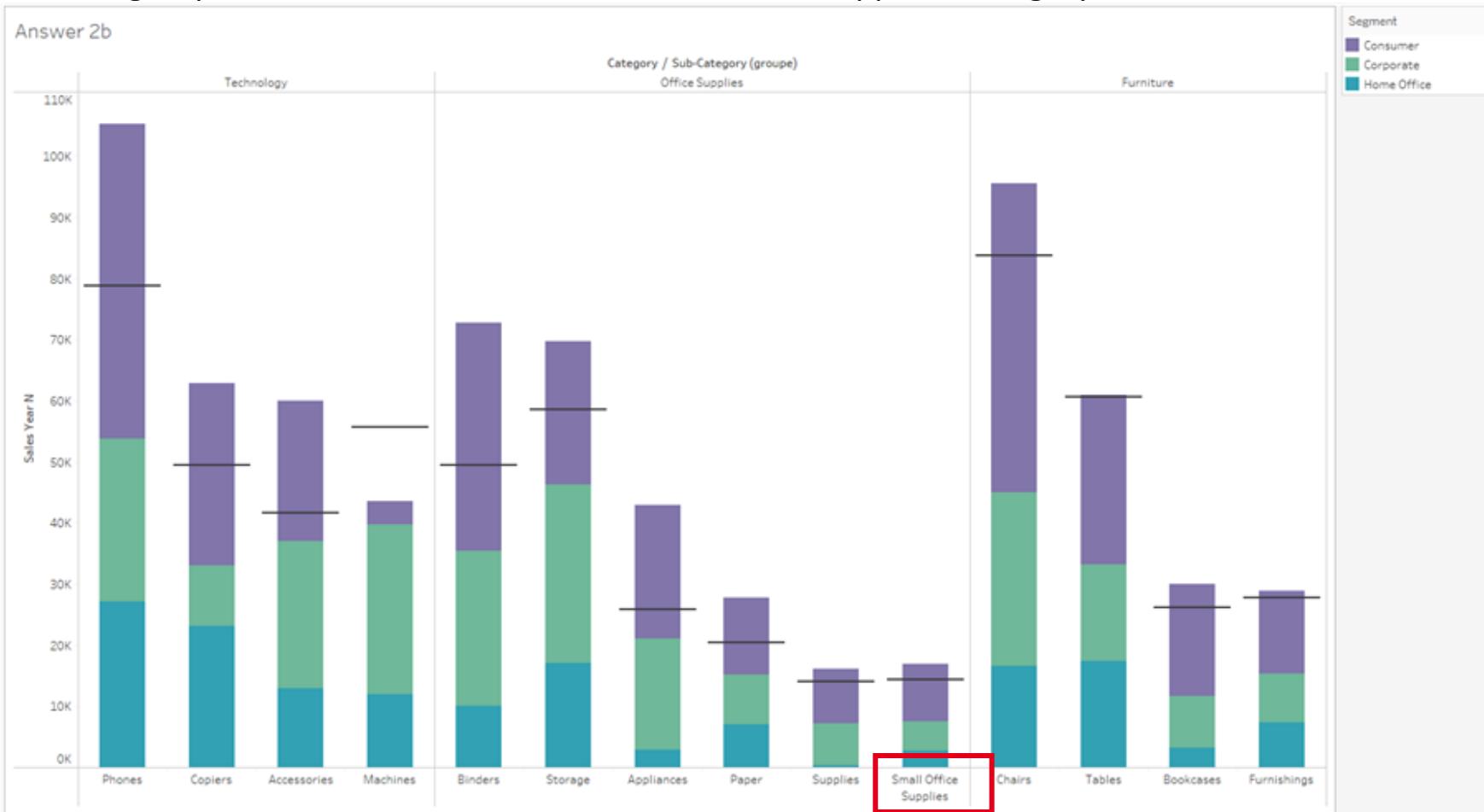
# Exercise 2

Reproduce the view below that represents the sales for Year N distributed along the category hierarchy and client segment

- Use the Sales Year N field : *IF YEAR([Order Date])={MAX(YEAR([Order Date]))} THEN [Sales] ELSE 0 END*

- Sort the categories and sub-categories

- Add A group of the 4 smallest elements of the "Office Supplies" category -> rename this set "Small Office Supplies"



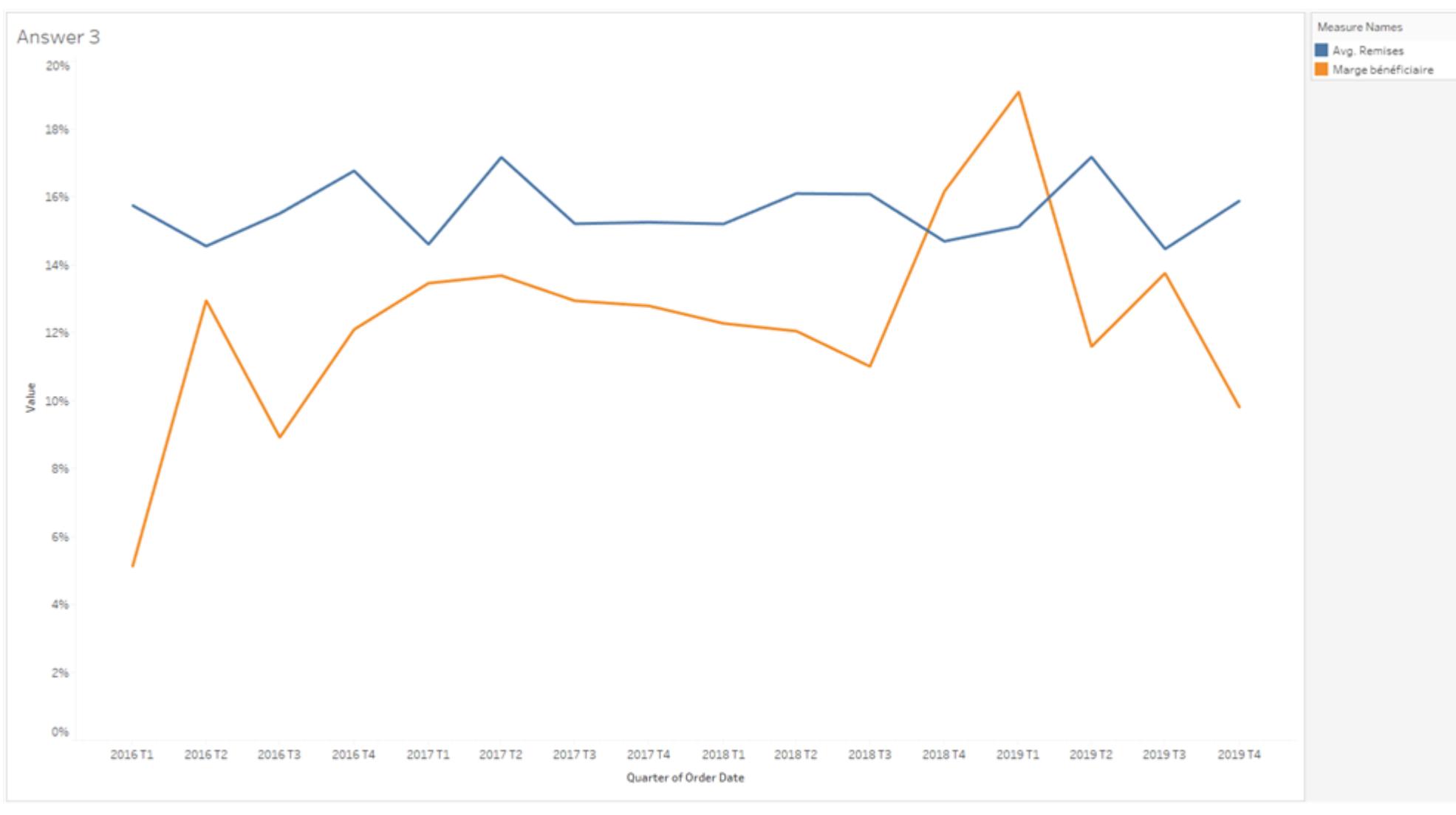
**Bonus:** Add the dark horizontal bar which represent the sales for Year N-1:

Create the field Sales Year N-1:  
*IF YEAR([Order Date])={MAX(YEAR([Order Date]))}-1 THEN [Sales] ELSE 0 END*

Time: 20 min

# Exercise 3

Recreate the following view showing the quarterly evolution of the Profit margin and average Discount on a same axis



Time: 10 min

# Tableau Desktop

Calculated Fields

07/03/2023



em  
lyon  
business  
school



early makers  
since 1872

# Calculated Fields

- 01 Create Calculation Fields
- 02 Aggregations Functions
- 03 Logical Functions
- 04 Conversion Functions
- 05 Aggregate a Calculated Field
- 06 Exercises



# INTRODUCTION

## What for?

It is possible in Tableau to create additional fields to complete the data source and complete its analysis:

New field stored in data source

Doesn't change other data

## What uses?

- Segmenting data
- Converting the data type in a field
- Aggregating data
- Filtering results
- Conditional formatting
- Calculating reports

# CREATE A CALCULATED FIELD

1

A screenshot of the Tableau Data Source Order view. A context menu is open over a data item, listing options like Rename, Copy Values, Hide, Create Calculated Field..., Create Group..., Pivot (select multiple fields), and Describe... The 'Create Calculated Field...' option is highlighted with a blue selection bar.

2

A screenshot of the Tableau interface showing the Analysis tab selected. In the top navigation bar, the 'Analysis' tab is highlighted. A red box highlights the 'Create Calculated Field...' option in the dropdown menu under the Analysis tab, which is identical to the one shown in the Data Source Order view.

# CREATE A CALCULATED FIELD

Calculation1

X

Formula Editor

Apply OK

List of available functions

ABS (number)

Returns the absolute value of the given number.

Example: ABS (-7) = 7

Description and example of use of the function

The screenshot shows a 'Formula Editor' dialog box with a title bar 'Calculation1'. Below the title bar is a dropdown menu labeled 'List of available functions' with an arrow pointing to it. The menu lists various function categories: All, Number, String, Date, Type Conversion, Logical, Aggregate, User, Table Calculation, Spatial, ATTR, AVG, CASE, CEILING, CHAR, COLLECT, CONTAINS, CORR, and COS. The 'Logical' category is currently selected. To the right of the menu, a specific function is detailed: 'ABS (number)' which 'Returns the absolute value of the given number.' An example is provided: 'Example: ABS (-7) = 7'. At the bottom of the dialog box, there are 'Apply' and 'OK' buttons.

# AGGREGATION FUNCTIONS

The screenshot shows the Power BI Data Editor interface. On the left, the 'Fields' pane displays various columns and measures. A red box highlights the measure '# Number of customers'. An arrow points from this highlighted measure to the text 'Created field available in data source' located in the center of the screen.

**Number of customers**

COUNTD([Customer Name])

The calculation is valid.

Apply OK

**Created field available in data source**

Postal Code  
Product  
Category  
Sub-Category  
Manufacturer  
Product Name  
Profit (bin)  
Region  
Measure Names

**Measures**

- =# Number of customers
- # Profit
- # Profit Ratio
- # Quantity
- # Sales
- Latitude (generated)
- Longitude (generated)
- # Number of Records

All

Enter search text

COUNTD (expression)

Returns the number of distinct items in a group. NULL values are not counted. Each unique value is counted only once.

Example: COUNTD([Region])

ASIN  
ATAN  
ATAN2  
ATTR  
AVG  
CASE  
CEILING  
CHAR  
COLLECT  
CONTAINS  
CORR  
COS  
COT  
COUNT  
COUNTD  
COVAR

# AGGREGATION FUNCTIONS

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Returns the value of the expression if this value is unique for all lines. Otherwise, the returned value is Null. Zero values are ignored.

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Returns the minimum value of an expression in all records. If the expression corresponds to a string, this function returns the first value in alphabetical order.

**Maximum** : MAX (expression)

Returns the maximum value of an expression in all records. If the expression corresponds to a string, this function returns the last value in alphabetical order.

# AGGREGATION FUNCTIONS

**Median** : MEDIAN (expression)

Returns the median value of an expression in all records. The median value can only be used with numeric fields.

**Counting** : COUNT (expression)

Returns the number of items in a group. Zero values are ignored.

**Counting (Distinct)** : COUNTD (expression)

Returns the number of distinct elements of a group. Zero values are ignored.

# LOGICAL FUNCTIONS

Treshold  Sales Commission X

```
IF SUM([Sales]) > 1000000
THEN "Above" ELSE "Under"
END
```

The calculation is valid.

Apply OK

List of available logical functions

Logical

Enter search text

- AND
- CASE
- ELSE
- ELSEIF
- END
- IF
- IFNULL
- IIF
- ISDATE
- ISNULL
- MAX
- MIN

IF <expr> THEN <then> [ELSEIF <expr2> THEN <then2> ...] [ELSE <else>] END

Tests a series of expressions returning the <then> value for the first true <expr>.

Example: IF [Profit] > 0 THEN 'Profitable' ELSEIF [Profit] = 0 THEN 'Breakeven' ELSE 'Loss' END

# LOGICAL FUNCTIONS

The most commonly used logical functions in calculated fields:

**CASE** : CASE <expression> WHEN <value1> THEN <return1> ... [ELSE <else>]END

Finds the first value that corresponds to the expression and returns the corresponding value.

**IF** : IF <expression> THEN <then> [ELSEIF <expression2>THEN <then2>] ELSE <else> END

Tests a series of expressions referring to the value <THEN> for the first <TRUE> expression

**IFNULL** : IFNULL (expression1, expression2)

Returns expression 1 if it is not zero, otherwise returns expression 2.

**IIF** : IIF (test, Then, Else, [unknown])

Checks to see if a condition is met. Returns a value if it is true, another value if it is false and a third optional value or NULL if it is unknown.

**ISDATE** : ISDATE (chain)

Returns True if a given string is a valid date.

**ISNULL** : ISNULL (expression)

Returns True if the expression does not contain valid values (Null).

# CONVERSION FUNCTIONS

The most commonly used conversion functions in calculated fields:

**Date** : DATE (expression)

Returns a date based on a number, string or date expression.

**Int** : INT (expression)

Returns an whole number based on an expression. This feature truncates results on the whole number closest to 0.

**MAKEDATE** : MAKEDATE(Year, month, day)

Returns a date value in the form of year, month and day.

**Str** : STR (expression)

Returns a string based on an expression

# DATE FUNCTIONS

The most commonly used date functions in calculated fields:

**DATEADD** : DATEADD (date\_part, interval, date)

Adds an increment to the specified date and returns the new date. The increment is defined by the interval and the date\_part.

**DATEDIFF** : DATEDIFF(expression)

Returns the difference between two dates in where start\_date is subtracted from end\_date. The difference is expressed in units of date\_part. If start\_of\_week is omitted, the week start day is determined by the start day configured for the data source.

**DATENAME** : DATENAME(date\_part, date, [start\_of\_week])

Returns a part of the given date as a string, where the part is defined by date\_part. If start\_of\_week is omitted, the week start is determined by the start day configured for the data source.

**DAY, MONTH, YEAR** : DAY(date), MONTH (date), YEAR (date)

Returns the day, month or year of a given date in the form of an integer.

**TODAY** : TODAY()

Returns the current date.

# STRING FUNCTIONS

The most commonly used string functions in calculated fields:

**CONTAINS** : CONTAINS(string, substring)

Returns true if the given string contains the specified substring.

**LEFT** : LEFT(string, number)

Returns the left-most number of characters in the string.

**RIGHT** : RIGHT (string, number)

Returns the right-most number of characters in the string.

**REPLACE** : REPLACE(string, substring, replacement)

Searches string for substring and replaces it with replacement. If substring is not found, the string is not changed.

**FIND** : FIND(string, substring, [start])

Returns the index position of substring in string, or 0 if the substring isn't found. If the optional argument start is added, the function ignores any instances of substring that appear before the index position start. The first character in the string is position 1.

**Len** : LEN (string)

Returns the length of the string.

# ERROR HANDLING

The most commonly used string functions in calculated fields:

**CONTAINS** : CONTAINS(string, substring)

Returns true if the given string contains the specified substring.

**LEFT** : LEFT(string, number)

Returns the left-most number of characters in the string.

**RIGHT** : RIGHT (string, number)

Returns the right-most number of characters in the string.

**REPLACE** : REPLACE(string, substring, replacement)

Searches string for substring and replaces it with replacement. If substring is not found, the string is not changed.

**FIND** : FIND(string, substring, [start])

Returns the index position of substring in string, or 0 if the substring isn't found. If the optional argument start is added, the function ignores any instances of substring that appear before the index position start. The first character in the string is position 1.

**Len** : LEN (string)

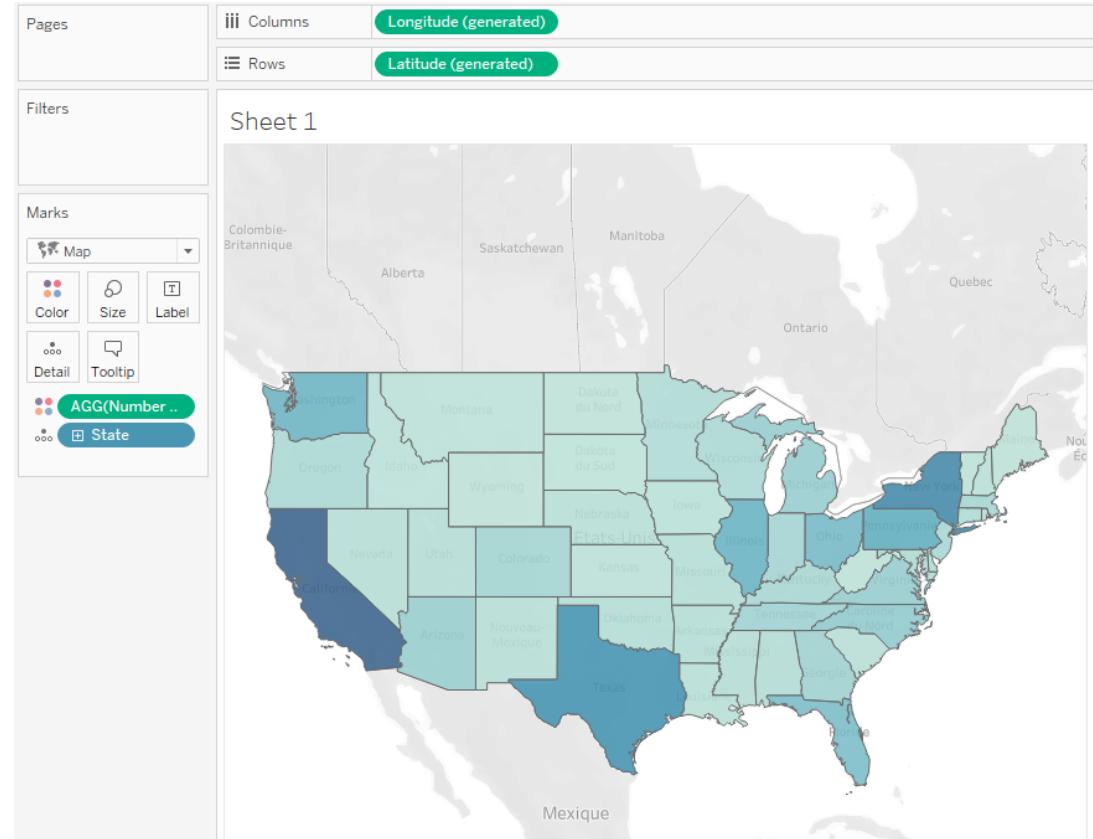
Returns the length of the string.

# USE A CALCULATED FIELD IN A VIEW

The calculated field is used in a graph like any other field depending on whether it is a dimension or a measure.

Here in our example, we have dragged the number of customers (calculated field we created previously) that is used as a measure.

So we get the number of customers per state.



# AGGREGATE A MEASURE

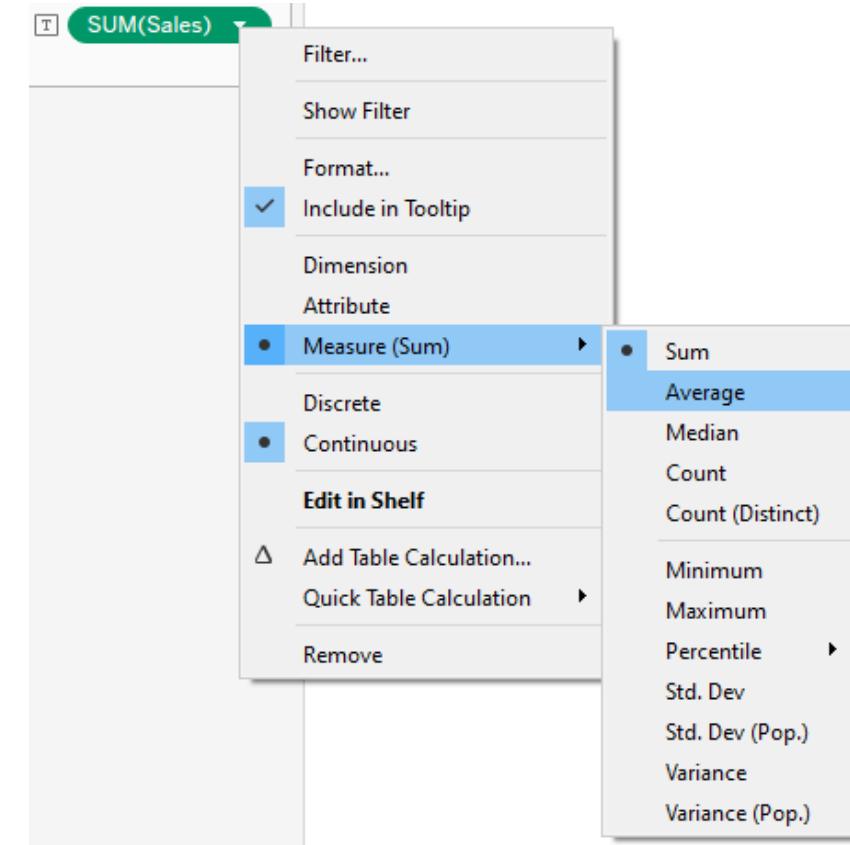
Reminder

As soon as a measure is added to the view, an aggregation is applied to this measure by default. The type of aggregation applied varies depending on the context of the view.

In the following example, the function applied is SUM:

SUM(Sales)

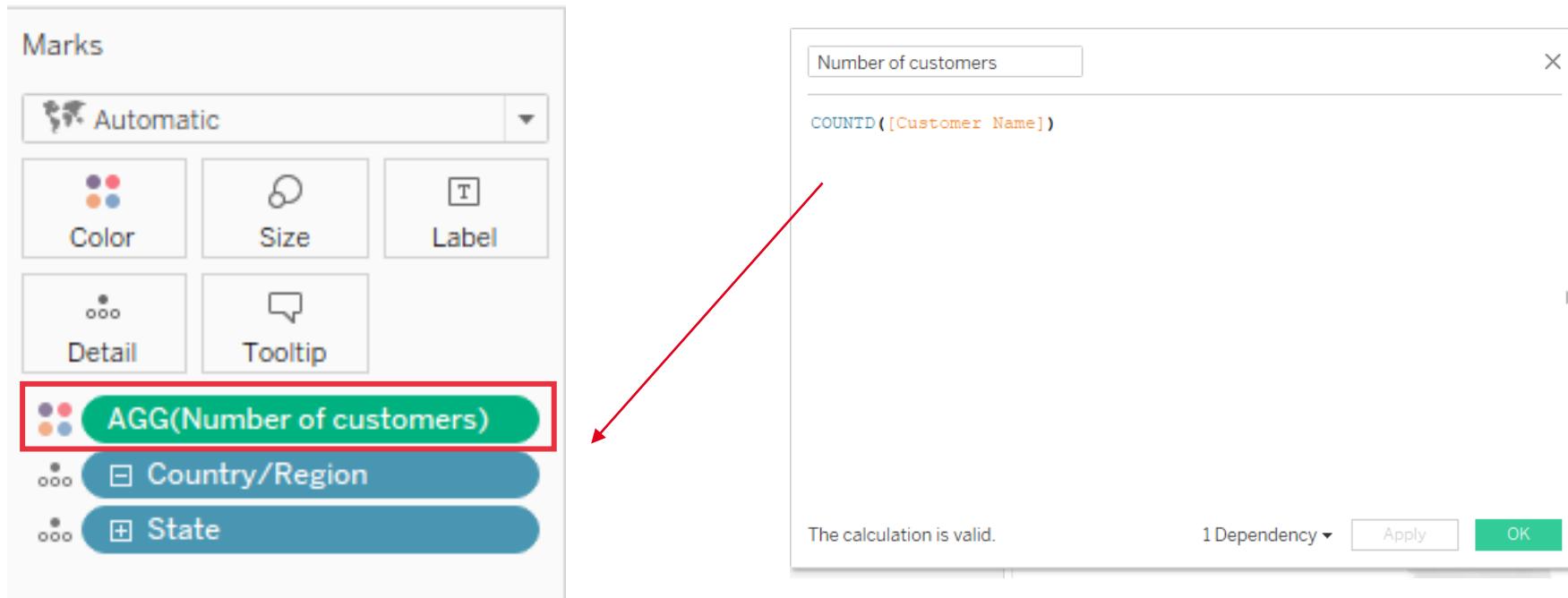
It is possible to change the function applied with a right-click on the measurement and then **Measure (Sum) - Select function**



# AGGREGATE A CALCULATED FIELD

There are two ways to aggregate a calculated field:

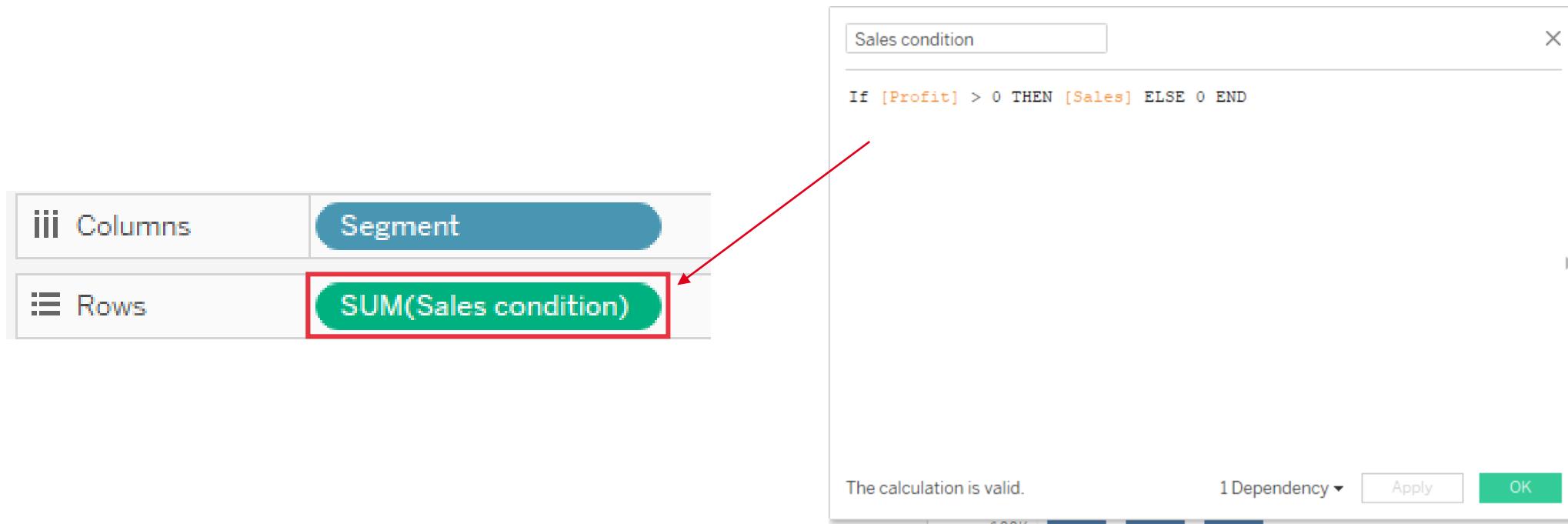
The calculated field uses an aggregation function in the calculation, so it is prefixed by AGG when used in the view. In our example, the aggregation function used is COUNTD.



# AGGREGATE A CALCULATED FIELD

There are two ways to aggregate a calculated field:

The calculated field does not use an aggregation function in the calculation, so it is prefixed by an aggregation function when used in the view. In our example, the aggregation function used is Sum.



# A FEW RULES

- **Rule 1 :** For any aggregated calculation, it is impossible to combine an aggregate value with a disaggregated value. For example,  $\text{SUM}(\text{Price}) * [\text{Items}]$  is not a valid expression because  $\text{SUM}(\text{Price})$  is aggregated, but not  $\text{Items}$ . On the other hand, the terms  $\text{SUM}(\text{Price} * \text{Items})$  and  $\text{SUM}(\text{Price}) * \text{sum}(\text{Items})$  are both valid.
- **Rule 2 :** Constants in an expression act as aggregated or disaggregated values, depending on the case. For example:  $\text{SUM}(\text{Price} * 7)$  and  $\text{SUM}(\text{Price}) * 7$  are both valid expressions.
- **Rule 3 :** All functions can be evaluated on aggregate values. However, the arguments of a given function must all be aggregated or disaggregated. For example,  $\text{MAX}(\text{SUM}(\text{Sales}), \text{Profit})$  is not a valid expression because  $\text{Sales}$  is aggregated, but not  $\text{Profit}$ . On the other hand,  $\text{MAX}(\text{SUM}(\text{Sales}), \text{SUM}(\text{Profit}))$  is a valid expression.
- **Rule 4 :** The result of an aggregation calculation is always a measure.
- **Rule 5 :** Like predefined aggregations, aggregation calculations are calculated correctly for general totals. For more information, see General Totals.

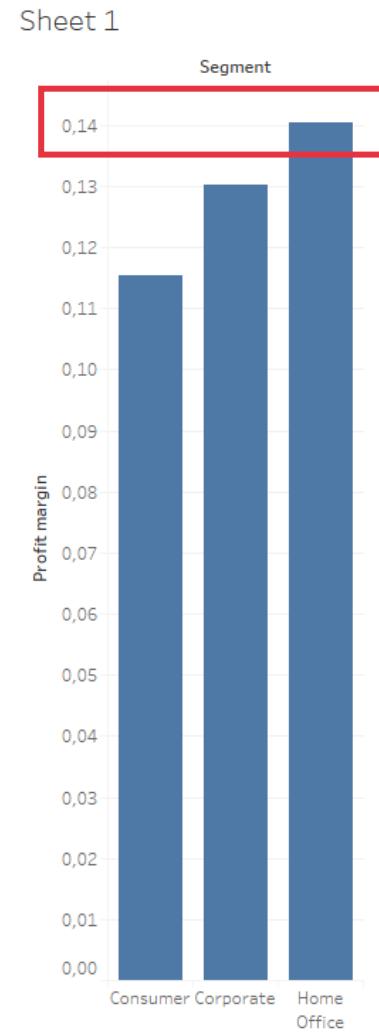
# Aggregate calculations VS detailed calculations 1/2

Example: Calculation of a profit margin

*Aggregate calculation: the sum of all profits in relation to the sum of all sales.*

The field is then aggregated into the view.

Profit margin  
 $\text{SUM}([\text{Profit}]) / \text{SUM}([\text{Sales}])$

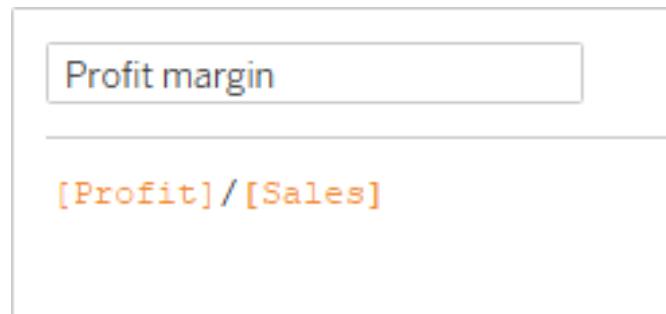


# Aggregate calculations VS detailed calculations 1/2

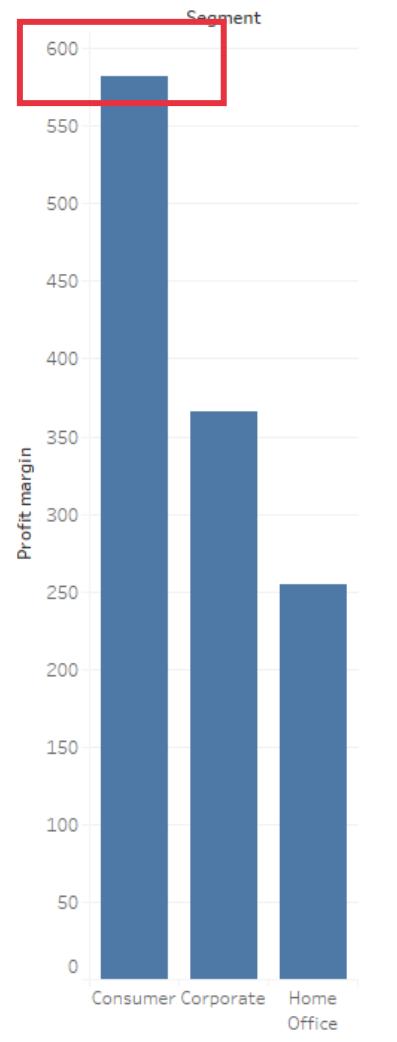
## Example: Calculating a profit margin

*Data line-level calculation: the benefits for a data line versus sales for a data line.*

*The field is then aggregated into the view.*



Sheet 1

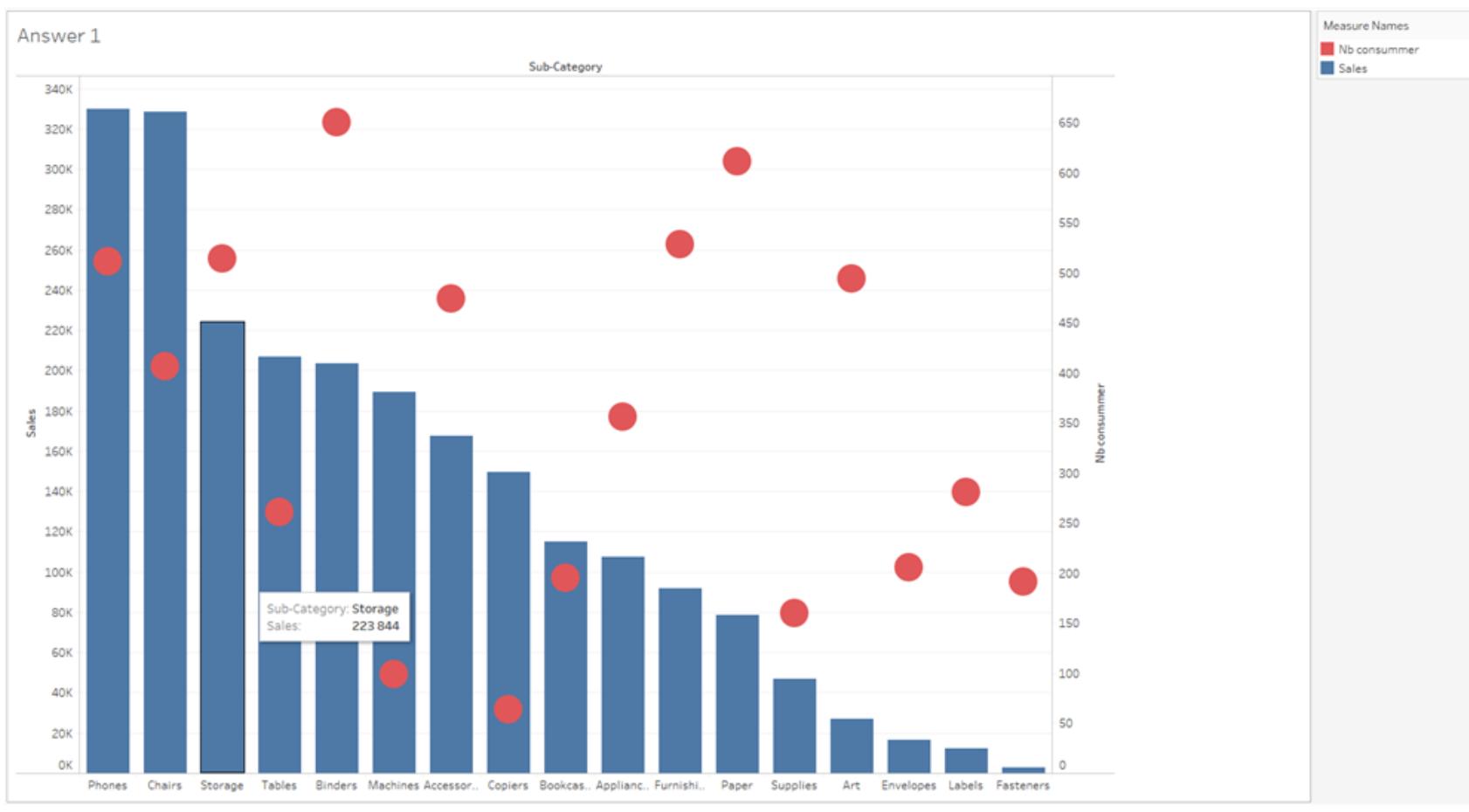




# Exercise

# Exercise 1

Reproduce the view below showing the analysis of the relation between sales per product sub-category and the number of clients that purchased products in these sub-categories.



Time: 10 min

# Exercise 2

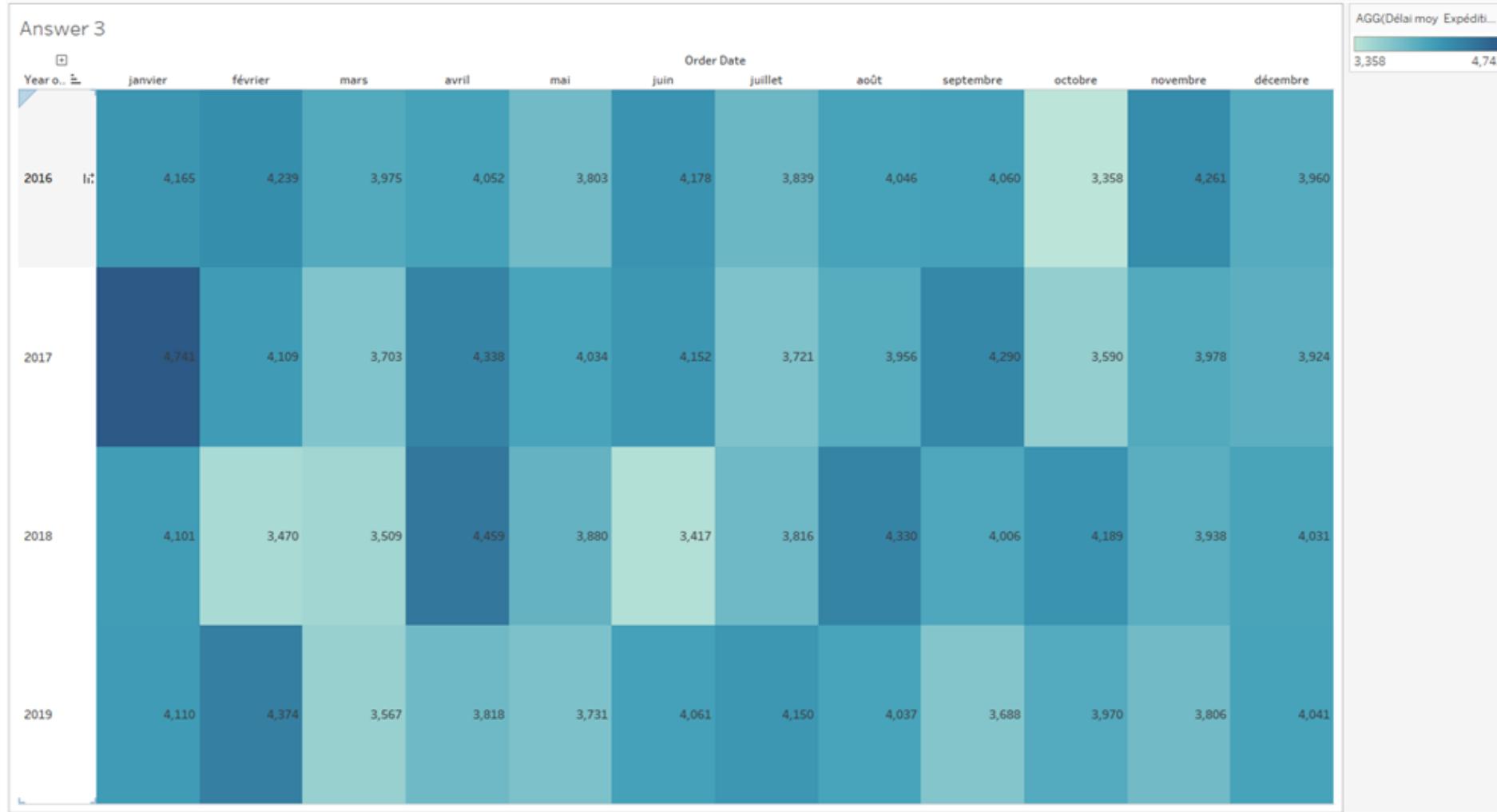
Reproduce the view below showing the sales per sub-category and per segment. The sales below 50 000\$ are highlighted.

Answer 2					AGG(Mise en lumière)
Category	Sub-Category	Segment			
		Consumer	Corporate	Home Office	
Furniture	Bookcases	68 633	34 006	12 241	KO
	Chairs	172 863	99 141	56 445	OK
	Furnishings	49 620	25 001	17 084	KO
	Tables	99 934	70 872	36 160	OK
Office Supplies	Appliances	52 820	36 589	18 124	KO
	Art	14 252	8 590	4 276	OK
	Binders	118 161	51 560	33 691	KO
	Envelopes	7 771	5 943	2 763	OK
	Fasteners	1 681	783	560	OK
	Labels	6 709	4 102	1 675	OK
	Paper	36 324	23 883	18 272	OK
	Storage	100 492	79 791	43 560	KO
	Supplies	25 741	19 435	1 497	OK
Technology	Accessories	87 105	48 191	32 085	KO
	Copiers	69 819	46 829	32 880	OK
	Machines	79 543	60 277	49 419	KO
	Phones	169 933	91 153	68 921	OK

Time: 10 min

# Exercise 3

Reproduce the view below showing the average shipping delay of orders in days per year and month.



Time: 10 min

# Exercise 3

AJOUTER LES FILTRES DANS TDV2? + parameters