
PLURALSIGHT

Data Visualization

Introduction to Tableau

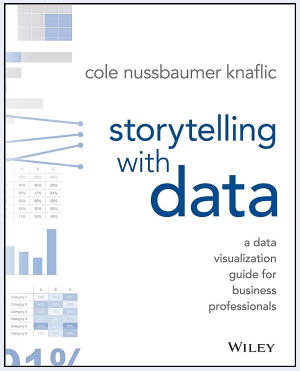
AGENDA

- **Stand Up** (Everyone to Participate “Yay”)
- **Introduction to Tableau**

DATA VISUALIZATION CHART CATEGORIES

Storytelling with Data

1.Understand the context: Before creating a data story, it is essential to understand the context of the data, including the audience, the purpose of the story, and the message that needs to be conveyed
2.Choose an effective visual display: Selecting the right visual display is crucial to ensure that the data is presented in a clear and understandable way. The choice of visual display should be based on the type of data and the message that needs to be conveyed
3.Eliminate clutter: Clutter can distract the audience from the message and make the data story difficult to understand. It is essential to eliminate unnecessary elements and simplify the visual display to ensure that the message is clear
4.Direct the audience's attention: Highlighting the most important parts of the data and directing the audience's attention to them is crucial to ensure that the message is understood. This can be achieved through the use of color, size, and other visual cues
5.Think like a designer: Design thinking involves considering the audience's needs and preferences when creating a data story. It is essential to create a story that is visually appealing, easy to understand, and engaging
6.Leverage the power of storytelling: Storytelling is a powerful tool that can help make data more relatable and memorable. By incorporating a narrative into the data story, it is possible to create a more engaging and impactful message



Data Puke

"**Data puke**" is a term used in the data visualization field to describe charts, graphs, or dashboards that present an overwhelming amount of data without clear organization, focus, or meaningful interpretation.

Essentially, it's when a visualization offers a lot of data but little to no insight or clarity.

Data Puke

Here are a few characteristics often associated with data puke:

- **Overwhelming Information:** Too many data points, metrics, or dimensions are presented all at once without clear categorization or prioritization.
- **Lack of Clarity:** The visualization may lack a clear message or key takeaway, making it difficult for the audience to understand the main point or action item.
- **Poor Design:** This might involve using too many colors, overly complex charts, or cluttered layouts, which can distract from the data and make it hard to discern any meaningful patterns or trends.
- **No Narrative or Context:** Data puke often lacks a storyline or context to guide the viewer through the data and to understand its relevance or importance.
- **Inaccessibility:** It might be difficult for a wide range of audiences to understand due to jargon, complex data representations, or lack of explanatory text.

Mockups

Mockups are visual guides that represent the skeletal framework of a dashboard or visualization, often used to plan layout and user interactions without detailed design or data integration

Components

- **Layout**: The arrangement of various elements like charts, graphs, and controls.
- **Content Placement**: Indicating where text, images, and data visualizations will be placed.
- **User Interaction**: Representing how users will interact with the dashboard, including click, scroll, and hover actions.

Mockups

Significance of Mockups

Avoiding Pitfalls:

- **Minimizing Revisions**: Mockups allow for early feedback, reducing the need for revisions after development has begun.
- **Clarifying Vision**: They ensure that all stakeholders have a clear and unified vision of the final product, minimizing miscommunications or misaligned expectations.

Enhancing Collaboration:

- **Stakeholder Involvement**: Engaging stakeholders in the mockup phase can ensure their needs and expectations are considered from the start.
- **Interdepartmental Communication**: Facilitates better understanding and communication between design, development, and business teams.

Mockups

User Experience (UX) Planning:

- User Journey: Mockups help plan and visualize the user's journey and interactions with the dashboard.
- Accessibility: Ensures that considerations for user accessibility and usability are planned from the outset.

Efficient Resource Utilization:

- Time and Cost: Identifying and addressing issues in the mockup phase is generally quicker and more cost-effective than during development.
- Prioritization: Helps in prioritizing features and elements, ensuring that key components are focused upon during development.

Mockups

Notes from In Class Disussion

POC

- Proof Of Concept
- Prove if the technology and outcome is what you need before you fully invest
- Can run on dummy data
- Generally, 1-2 weeks (sometimes can be less in days)

MVP

- Minimal Viable Product
- Here you really really need to define an Acceptance Criteria

Pilot vs Prototype

Visual Vocabulary

Visual Vocabulary

There are so many ways to visualise data - how do we know which one to pick? Click on a category below to decide which data relationship is most important in your story, then look at the different types of charts within the category to form some initial ideas about what might work best. This list is not meant to be exhaustive, nor a wizard, but is a useful starting point for making informative and meaningful data visualisations.

Click any section below to view the charts

Deviation

Emphasise variations (+/-) from a fixed reference point. Typically the reference point is zero but it can also be a target or a long-term average. Can also be used to show sentiment (positive/neutral/negative).

Correlation

Show the relationship between two or more variables. Be mindful that, unless you tell them otherwise, many readers will assume the relationships you show them to be causal (i.e., one causes the other).

Ranking

Use where an item's position in an ordered list is more important than its absolute or relative value. Don't be afraid to highlight the points of interest.

Distribution

Show values in a dataset and how often they occur. The shape (or 'skew') of a distribution can be a memorable way of highlighting the lack of uniformity or equality in the data.

Change over Time

Give emphasis to changing trends. These can be short (intra-day) movements or extended series traversing decades or centuries: Choosing the correct time period is important to provide suitable context for the reader.

Part-to-Whole

Show how a single entity can be broken down into its component elements. If the reader's interest is solely in the size of the components, consider a magnitude-type chart instead.

Magnitude

Show size comparisons. These can be relative (just being able to see larger/bigger) or absolute (need to see fine differences). Usually these show a 'counted' number (for example, barrels, dollars or people) rather than a calculated rate or per cent.

Spatial

Used only when precise locations or geographical patterns in data are more important to the reader than anything else.

Flow

Show the reader volumes or intensity of movement between two or more states or conditions. These might be logical sequences or geographical locations.

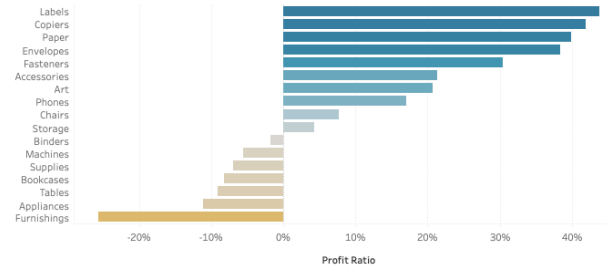
Deviation Chart Type

Deviation

Emphasise variations (+/-) from a fixed reference point. Typically the reference point is zero but it can also be a target or a long-term average. Can also be used to show sentiment (positive/neutral/negative).

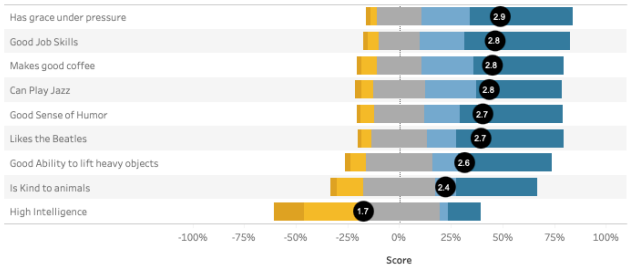
Diverging Bar

A simple standard bar chart that can handle both negative and positive magnitude values



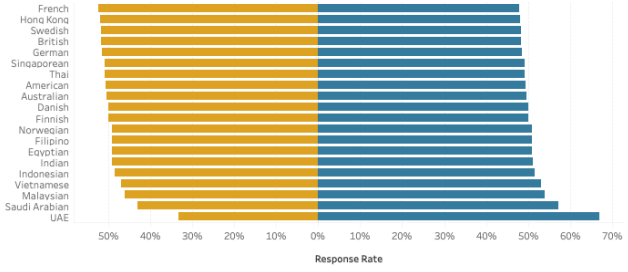
Diverging Stacked Bar

Perfect for presenting survey results which involve sentiment (e.g., disagree/neutral/agree)



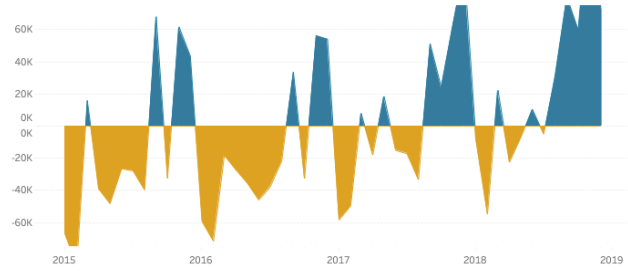
Spine Chart

Splits a single value into 2 contrasting components (e.g., Male/Female)



Surplus/Deficit Filled Line

The shaded area of these charts allows a balance to be shown – either against a baseline or between two series.



PLURALSIGHT

Deviation Chart Type

- They emphasize variations from a fixed reference point , typically the reference point is 0 but it can be a target or a long-term average for example
- They can be used to show sentiment
- Examples using Diverging Bar or a Diverging Stacked Bar

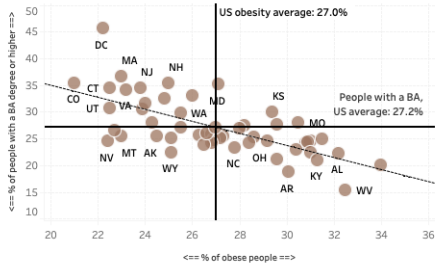
Correlation Chart Type

Correlation

Show the relationship between two or more variables. Be mindful that, unless you tell them otherwise, many readers will assume the relationships you show them to be causal (i.e., one causes the other).

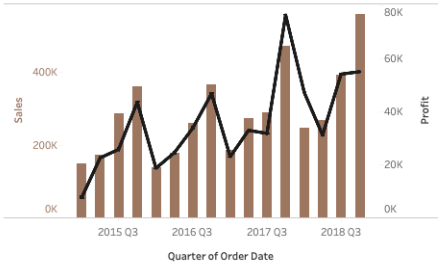
Scatterplot

The standard way to show the relationship between two continuous variables, each of which has its own axis.



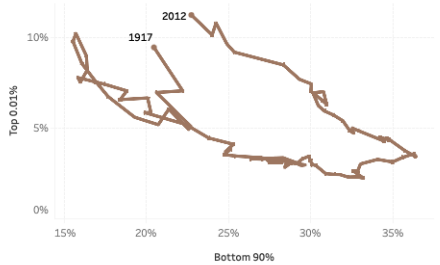
Line + Column

A good way of showing the relationship between an amount (columns) and a rate (line).



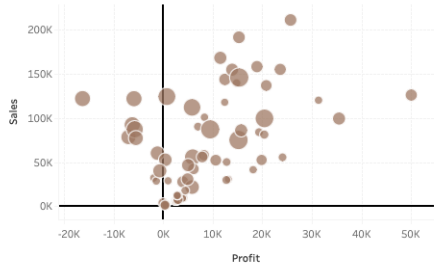
Connected Scatterplot

Usually used to show how the relationship between 2 variables has changed over time.



Bubble

Like a scatterplot, but adds additional detail by sizing the circles according to a third variable.



XY Heatmap

A good way of showing the patterns between 2 categories of data, less good at showing fine differences in amounts.

Age Range	I don't have a savings account	$0	Just the minimum balance requirement	Less than $1,000	$1,000-$4,999	$5,000-$9,999	$10,000 or more
Overall	21.0%	28.0%	9.0%	13.0%	10.0%	5.0%	14.0%
18-24	22.4%	21.8%	9.7%	19.1%	14.7%	4.7%	7.5%
25-34	18.0%	26.3%	10.6%	15.2%	12.5%	5.4%	12.1%
35-44	18.9%	31.6%	6.6%	11.6%	9.8%	5.6%	16.0%
45-54	21.6%	30.8%	7.7%	10.9%	7.5%	5.2%	16.2%
55-64	22.8%	28.4%	8.4%	10.7%	8.0%	4.8%	16.8%
65+	21.6%	27.6%	10.7%	8.2%	7.2%	4.7%	20.0%

Correlation Chart Type

- Show the relationship between two or more variables
- Relationship does not indicated causality (that one causes the other)
- Examples Scatterplot and XY Heatmap or highlight table

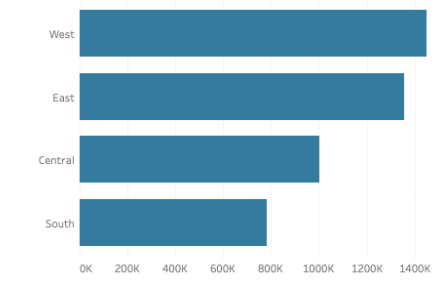
Rankin Chart Type

Ranking

Use where an item's position in an ordered list is more important than its absolute or relative value. Don't be afraid to highlight the points of interest.

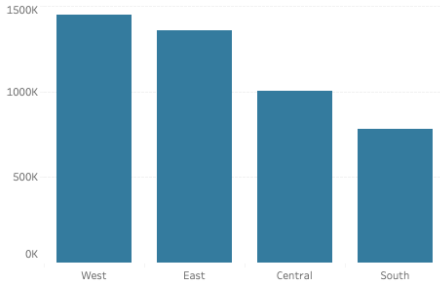
Ordered Bar

Standard bar charts display the ranks of values much more easily when sorted into order.



Ordered Column

Standard bar charts display the ranks of values much more easily when sorted into order.

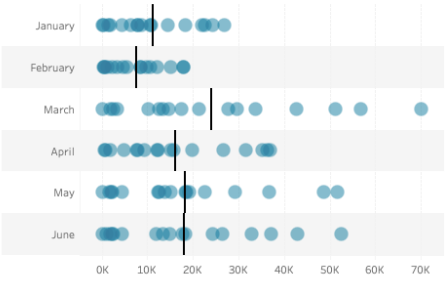


Ordered Proportional Symbol

Use when there are big variations between values and/or seeing fine differences between data is not so important.

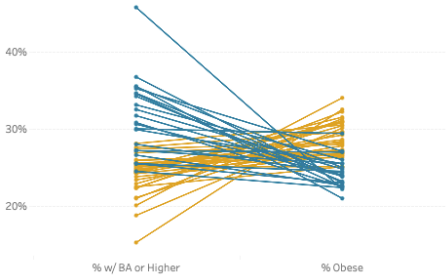
Dot Strip Plot

Dots placed in order on a strip are a space-efficient method of laying out ranks across multiple categories.



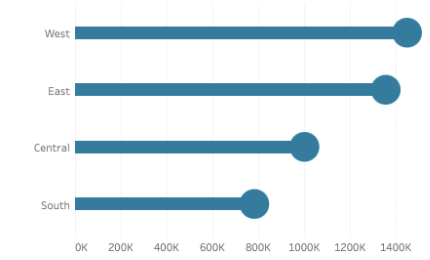
Slope

Perfect for showing how ranks have changed over time or vary between categories.



Lollipop Chart

Lollipops draw more attention to the data value than standard bar/column and can also show rank and value effectively.



Rankin Chart Type

- They show where an item's position is an ordered list and that is more important than its absolute or relative value (that is the ranking is more important)
- Examples like Ordered Bar or the Ordered Column

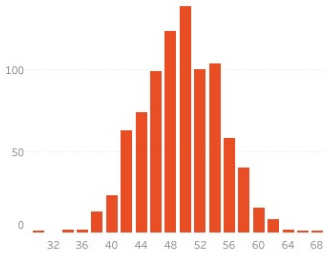
Distribution Chart Type

Distribution

Show values in a dataset and how often they occur. The shape (or 'skew') of a distribution can be a memorable way of highlighting the lack of uniformity or equality in the data.

Histogram

The standard way to show a statistical distribution - keep the gaps between columns small to highlight the 'shape' of the data.

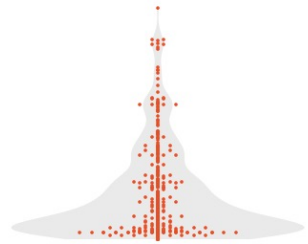


Boxplot

Summarise multiple distributions by showing the median (centre) and range of the data

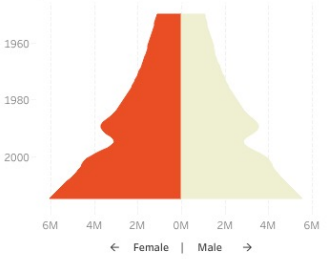
Violin Plot

Similar to a box plot but more effective with complex distributions (data that cannot be summarised with simple average).



Population Pyramid

A standard way for showing the age and sex breakdown of a population distribution; effectively, back to back histograms.



Dot Strip Plot

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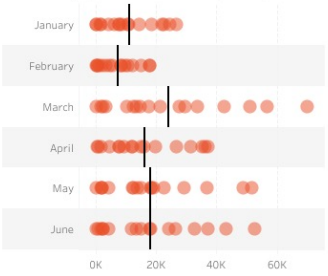
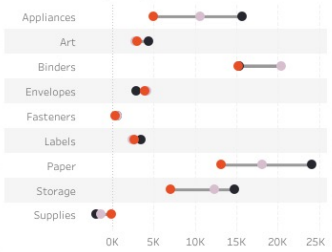


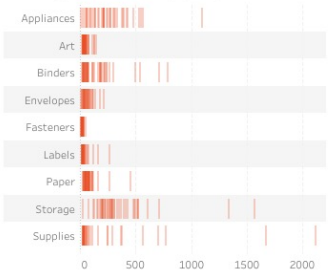
Dot Plot

A simple way of showing the change or range (min/max) of data across multiple categories.



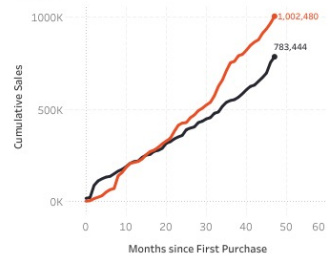
Barcode Plot

Like dot strip plots, good for displaying all the data in a table, they work best when highlighting individual values.



Cumulative Curve

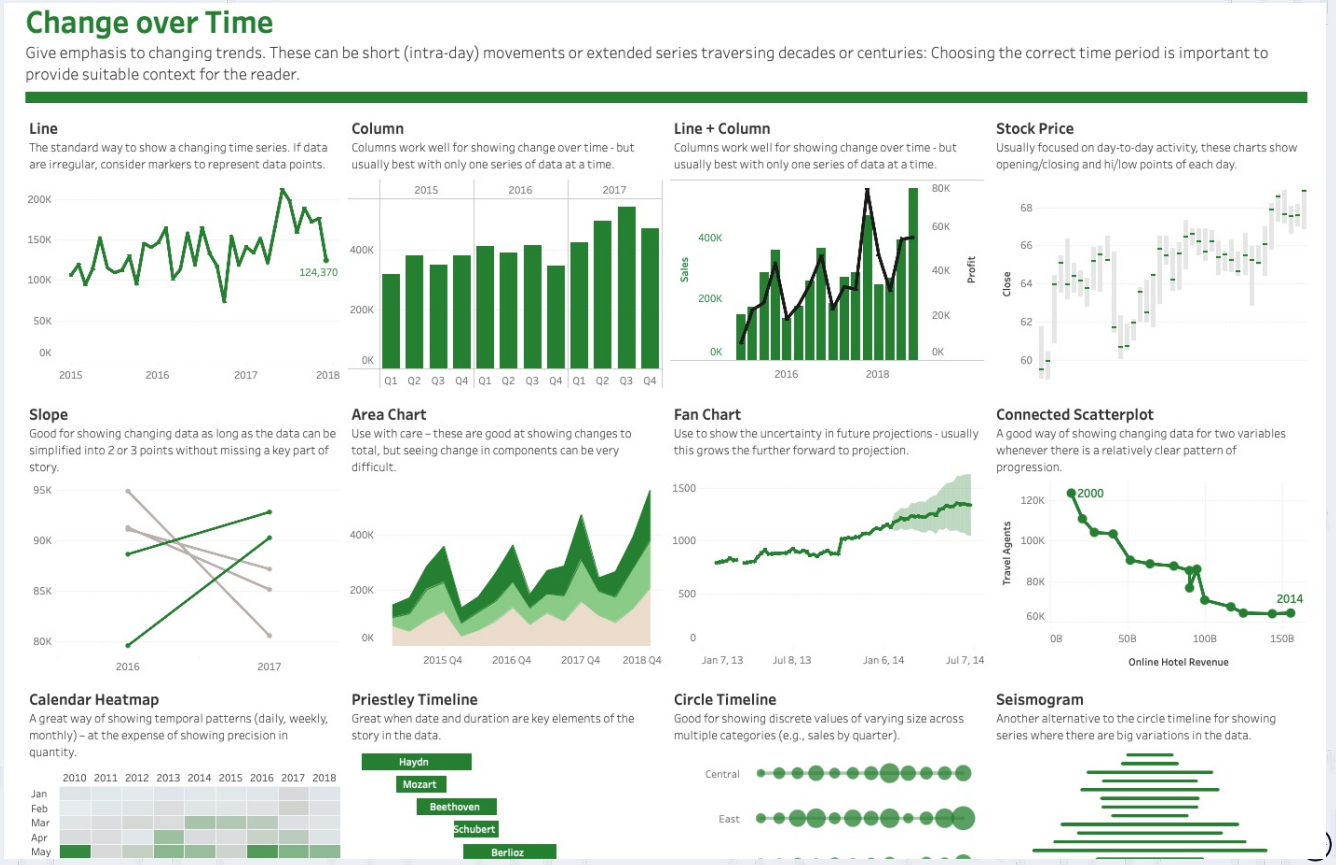
A good way of showing how unequal a distribution is: y axis is always cumulative frequency, x axis is always a measure.



Distribution Chart Type

- They show values in a dataset and how often they occur
- They show the shape or the skew of the distribution which be memorable way of highlighting the lack of uniformity or equality in the data
- Examples like Histogram or Box Plot

Change Over Time Chart Type



Change Over Time Chart Type

- They emphasize changing trends, they can be short intraday movements or extended series traversing decades
- Examples Line Short or the Slope Chart

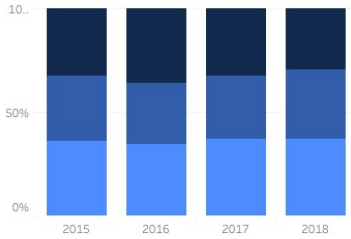
Part-to-Whole Chart Type

Part-to-Whole

Show how a single entity can be broken down into its component elements. If the reader's interest is solely in the size of the components, consider a magnitude-type chart instead.

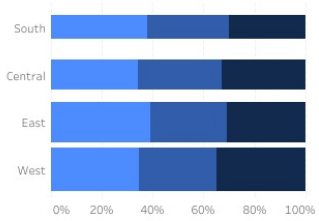
Stacked Column

A simple way of showing part-to-whole relationships but can be difficult to read with more than a few components.



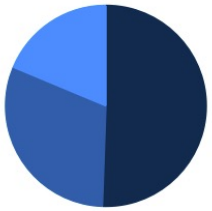
Proportional Stacked Bar

A good way of showing the size and proportion of data at the same time – as long as the data are not too complicated.



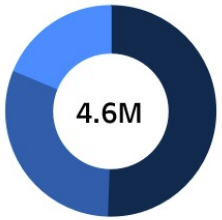
Pie Chart

A common way of showing part-to-whole data – but be aware that it's difficult to accurately compare the size of the segments.



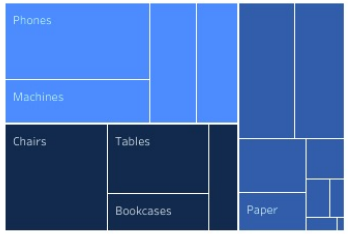
Donut Chart

Similar to a pie chart – but the centre can be a good way of making space to include more information about the data (e.g., total).



Treemap

Use for hierarchical part-to-whole relationships; can be difficult to read when there are many small segments.



Sunburst

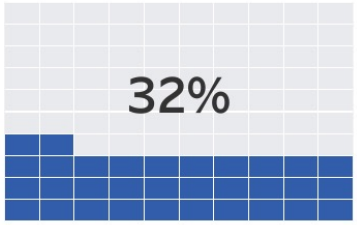
Another way of visualisaing hierarchical part-to-whole relationships. Use sparingly (if at all) for obvious reasons.

Arc

Another way of visualisaing hierarchical part-to-whole relationships. Use sparingly (if at all) for obvious reasons.

Gridplot

Good for showing % information, they work best when used on whole numbers and work well in multiple layout form.



Venn

Generally only used for schematic representation.

Waterfall

Can be useful for showing part-to-whole relationships where some of the components are negative

Part-to-Whole Chart Type

- They show how a single entity can be broken down into its component elements
- If the interest is in the size of the components you would consider using magnitude type charts instead
- Examples include Stacked column, Pie Charts, or Treetop

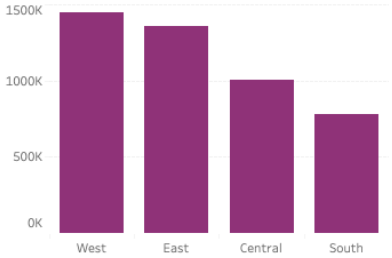
Magnitude Chart Type

Magnitude

Show size comparisons. These can be relative (just being able to see larger/bigger) or absolute (need to see fine differences). Usually these show a 'counted' number (for example, barrels, dollars or people) rather than a calculated rate or per cent.

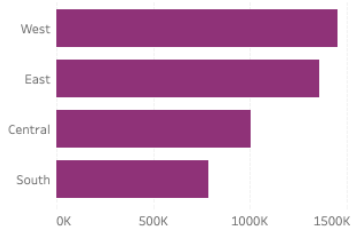
Column

The standard way to compare the size of things. Must always start at 0 on the axis.



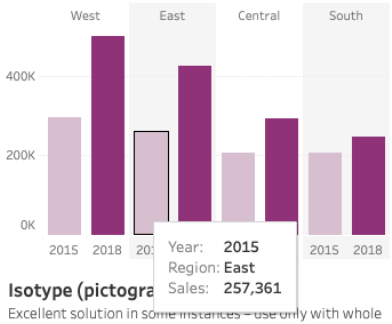
Bar

The standard way to compare the size of things. Must always start at 0 on the axis. Good when the data are not time series and labels have long category names.



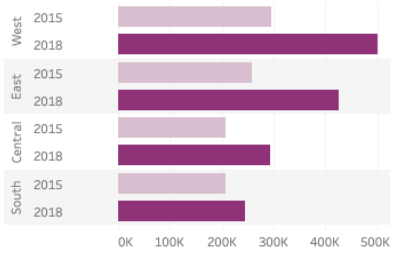
Paired Column

As per standard column, but allows for multiple series. Can become tricky to read with more than 2 series.



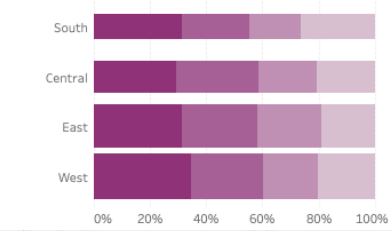
Paired Bar

As per standard bar, but allows for multiple series. Can become tricky to read with more than 2 series.



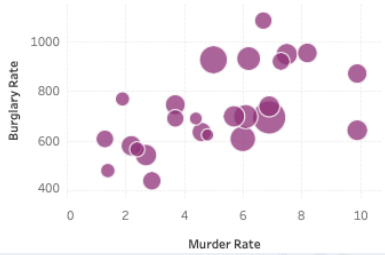
Proportional Stacked Bar

A good way of showing the size and proportion of data at the same time – as long as the data are not too complicated.



Proportional Symbol

Use when there are big variations between values and/or seeing fine differences between data is not so important.

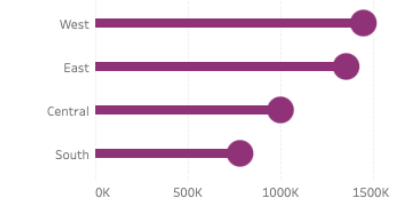


Isotype (pictogra

Excellent solution in some instances – use only with whole numbers (do not slice off an arm to represent a decimal).

Lollipop Chart

Lollipops draw more attention to the data value than standard bar/column - does not HAVE to start at zero (but preferable).



Magnitude Chart Type

- They show size comparisons
- They can be relative (just being able to see if they are larger) or absolute (need to see fine differences)
- They usually show a counted number something like barrels , dollars, or people, rather than a calculated rate or percent

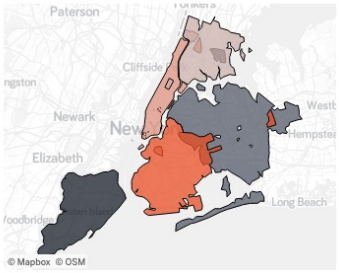
Spatial Chart Type

Spatial

Used only when precise locations or geographical patterns in data are more important to the reader than anything else.

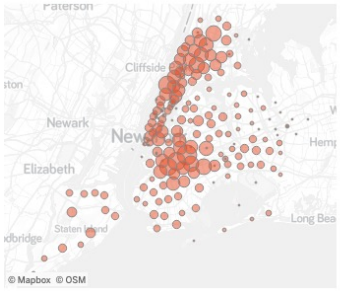
Basic Choropleth (rate/ratio)

The standard approach for putting data on a map – should always be rates rather than totals and use a sensible base geography.



Proportional Symbol (count/magnitude)

Use for totals rather than rates – be wary that small differences in data will be hard to see.

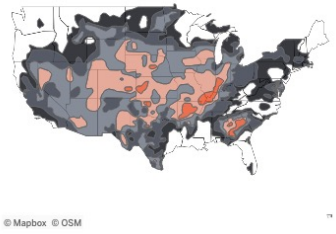


Flow Map

For showing unambiguous movement across a map.

Contour Map

For showing areas of equal value on a map. Can use deviation colour schemes for showing +/- values

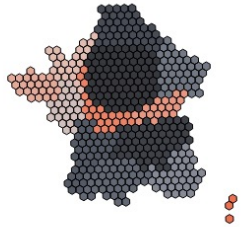


Equalized Cartogram

Converting each unit on a map to a regular and equally-sized shape – good for representing voting regions with equal value.

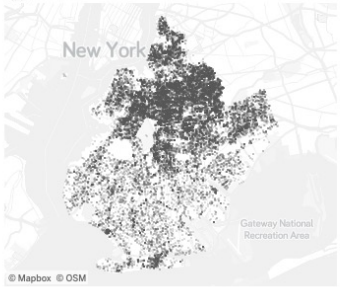
Scaled Cartogram

Stretching and shrinking a map so that each area is sized according to a particular value.



Dot Density

Used to show the location of individual events/locations – make sure to annotate any patterns the reader should



Heat Map

Grid-based data values mapped with an intensity colour scale. As choropleth map – but not snapped to an admin/political unit.

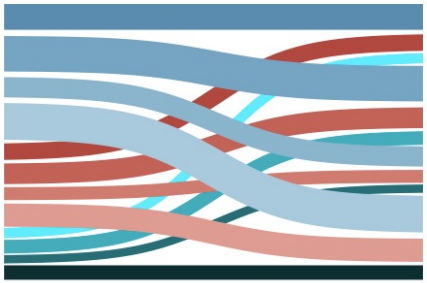
Flow Chart Type

Flow

Show the reader volumes or intensity of movement between two or more states or conditions. These might be logical sequences or geographical locations.

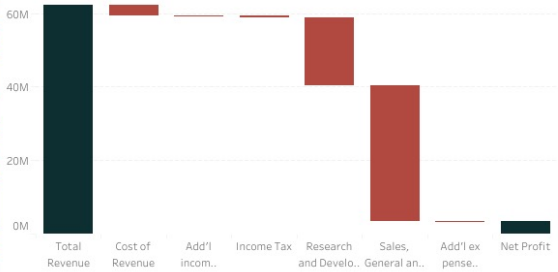
Sankey

Shows changes in flows from one condition to at least one other; good for tracing the eventual outcome of a complex process.



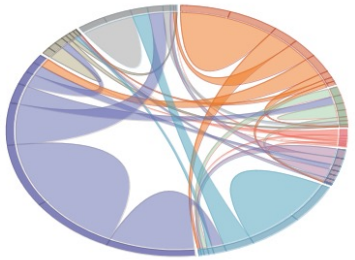
Waterfall

Designed to show the sequencing of data through a flow process, typically budgets. Can include +/- components.



Chord

A complex but powerful diagram which can illustrate 2-way flows (and net winner) in a matrix.



Network

Used for showing the strength and inter-connectedness of relationships of varying types.

Flow Chart Type

- They show volumes or intensity of movement between two or more states or conditions
- They can be logical sequences or geographical locations
- Examples include Sandy, Waterfall, or Network

On Selecting a Chart Type

- Choosing the right chart type is essential for the success of your chart
- The chart type should support the story you are trying to tell
- And you should consider your audience data literacy as part of the selection
- Don’t choose a complex chart if your audience is not very data literate

DATA SOURCES

DATA SOURCE

Simple Definition

A **Data Source** in Tableau is a connection to a database or location where the data is stored

Detailed Definition

A **Data Source** in Tableau refers to the file, database, feed, or other platforms from which data is imported or connected to Tableau. It can be a database, a spreadsheet, a web data connector, or any other structured data that Tableau can connect to. Data sources are pivotal in Tableau as they serve as the foundational layer upon which visualizations and analyses are built.

DATA CONNECTION

Live Connection

- **Real-time updates**: Any changes made in the data source are directly available in Tableau Desktop (enables real-time or near real-time analysis)
- **Load on the Database**: Depending on the complexity of your visualizations and the size of your data, live connections might put a significant load on your database, especially with multiple users querying simultaneously.
- **Dependency**: Your reports and dashboards depend on the availability of the data source. If the database is down or the connection is lost, you cannot access your data.
- **Performance Issues**: Live connections can be slower than extracts because databases are not always optimized for fast performance

DATA CONNECTION

Extract Connection

- **Snapshot of Data**: An extract is a static snapshot of the data, pulled into a Tableau data extract (.tde or .hyper) file, which is saved and can be refreshed on a scheduled basis or manually. **Need to be Refreshed**.
- **Data Freshness**: The data might not be as fresh or up-to-date as with a live connection, depending on when the extract was last refreshed.
- **Faster Performance**: Extracts are often faster because the data is pre-aggregated and indexed in a highly optimized format, reducing the load on the original data source and often resulting in quicker visualization rendering.
- **Offline Access**: Since the data is saved in an extract file, you can work with your data without being connected to the original data source.
- Data Size: Extracts might be limited by the volume of data they can practically handle, depending on system resources and performance considerations.

DATA CONNECTION

Use a Live Connection when:

- You need real-time or near real-time data insights.
- Working with extremely large datasets that are not practical to store as an extract.
- Your data is sensitive and should not be stored outside the original database.

Use an Extract when:

- You need to improve performance and reduce the load on your database.
- Working offline or without a stable connection to your data source.
- Your data does not need to be analyzed in real-time and periodic updates are sufficient.
- Great for complex visualizations with large data sets or many filters

DATA MODEL

Simple Definition

A **Data Model** is a diagram that tells Tableau how it should query data in the connected database tables.

Detailed Definition

A **Data Model** in Tableau refers to the structured organization and configuration of data from your data source, which is used to build visualizations. It involves defining the relationships between different tables or entities, creating calculated fields, and organizing measures and dimensions, ensuring that the data is structured and related in a way that accurately supports your analyses and visualizations.

DATA MODEL

As of Tableau 2020.2 and later, the data model has the logical (semantic) layer and a physical layer, which gives you more options for combining data using schemas to fit your analysis.

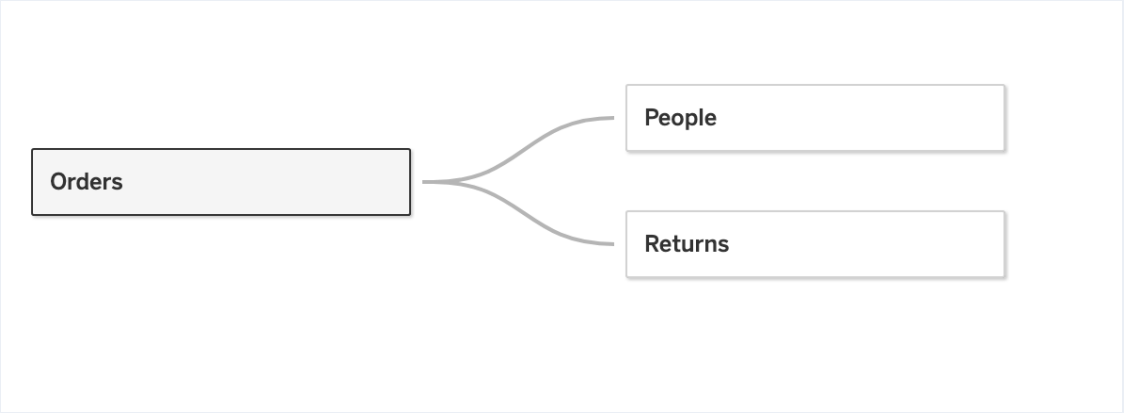
Physical Model

- The physical layer is where you can combine data using joins and unions
- Each physical table corresponds to a table in the connected database, and you can see all the tables from the database on the left side of the data source view

Logical Model

- A logical table can contain one or more physical tables
- By default, when you drop tables into the data source canvas in Tableau Desktop, you are working in the logical layer and can define relationships between logical tables

Data Model



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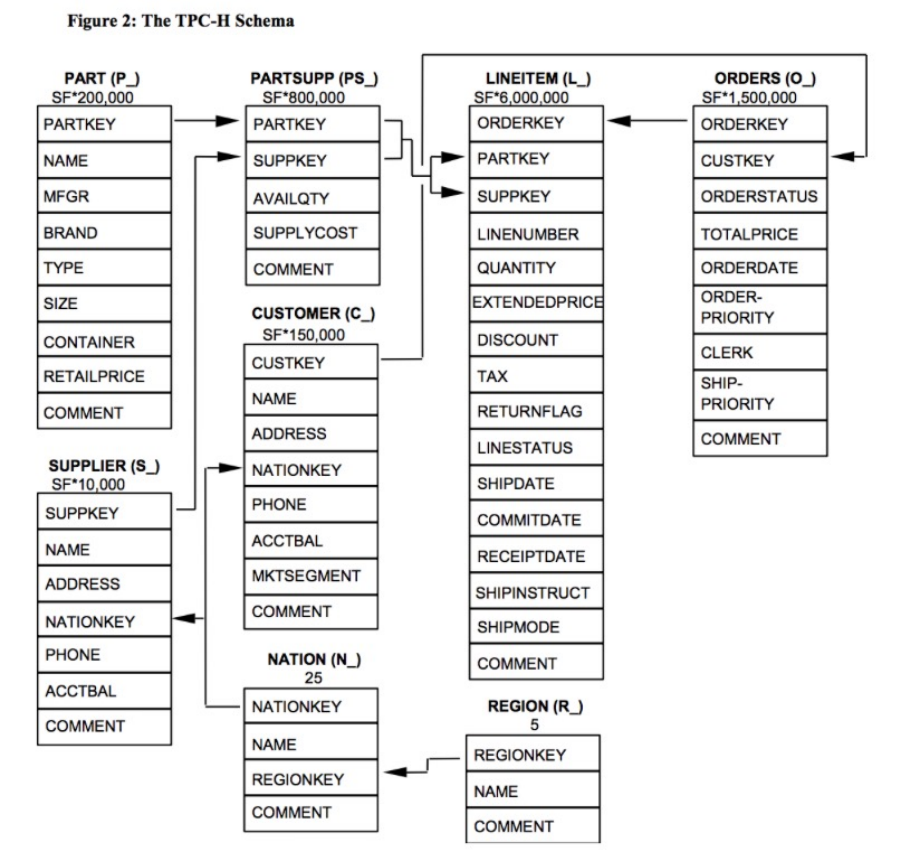

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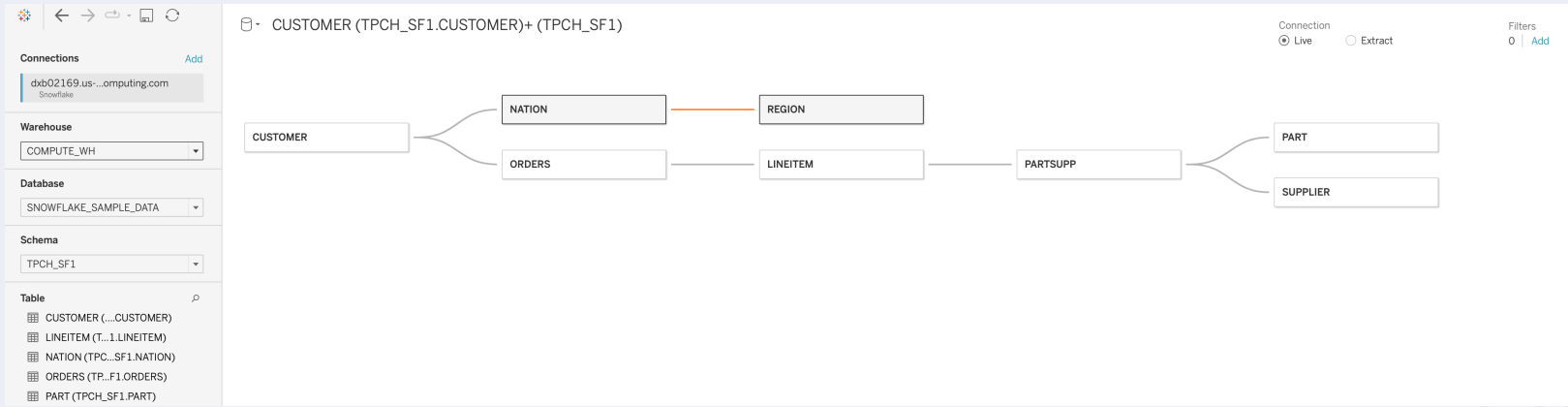
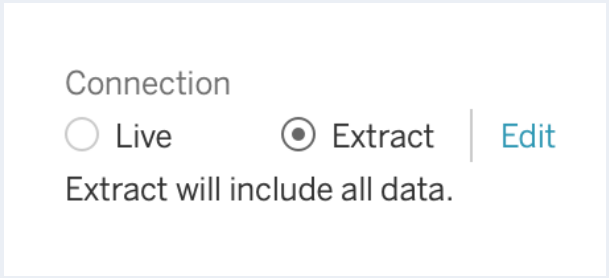


DATA SOURCES



DATA CONNECTION

Extracts:

- Extract files are a **local copy** of a subset or entire data set that can be used to share data with others, work offline, and improve performance
- A **.hyper** or **.tde** file containing data that was extracted from an original source.
- The **.hyper** file format is designed to be faster and more efficient than the previous **.tde** file format

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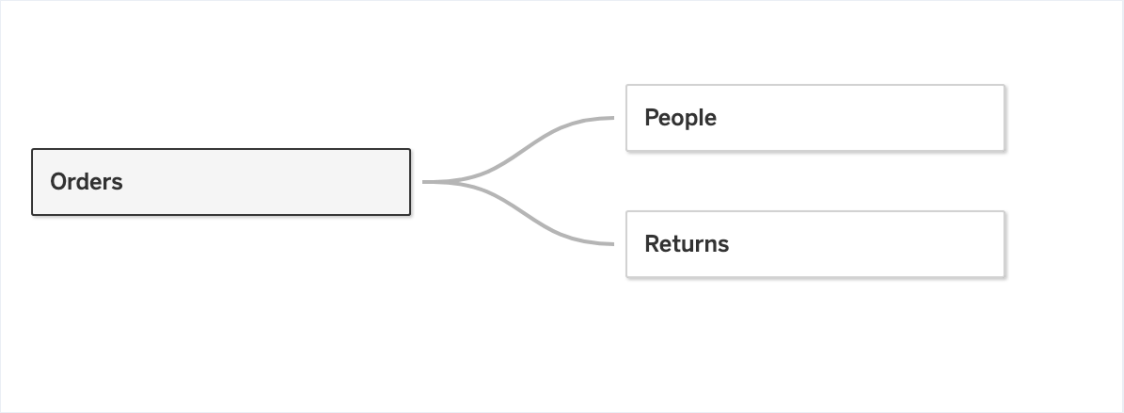


Tableau VizQL

- VizQL is a visual query language
- It is essentially a translator of SQL queries that supports the query and analytics capabilities of standard database query languages, SQL and MDX
- VizQL is the engine under the hood that makes Tableau go, and it is the language that enables the user to drag-and-drop actions which are then converted into queries that fetch results in image

Tableau VizQL

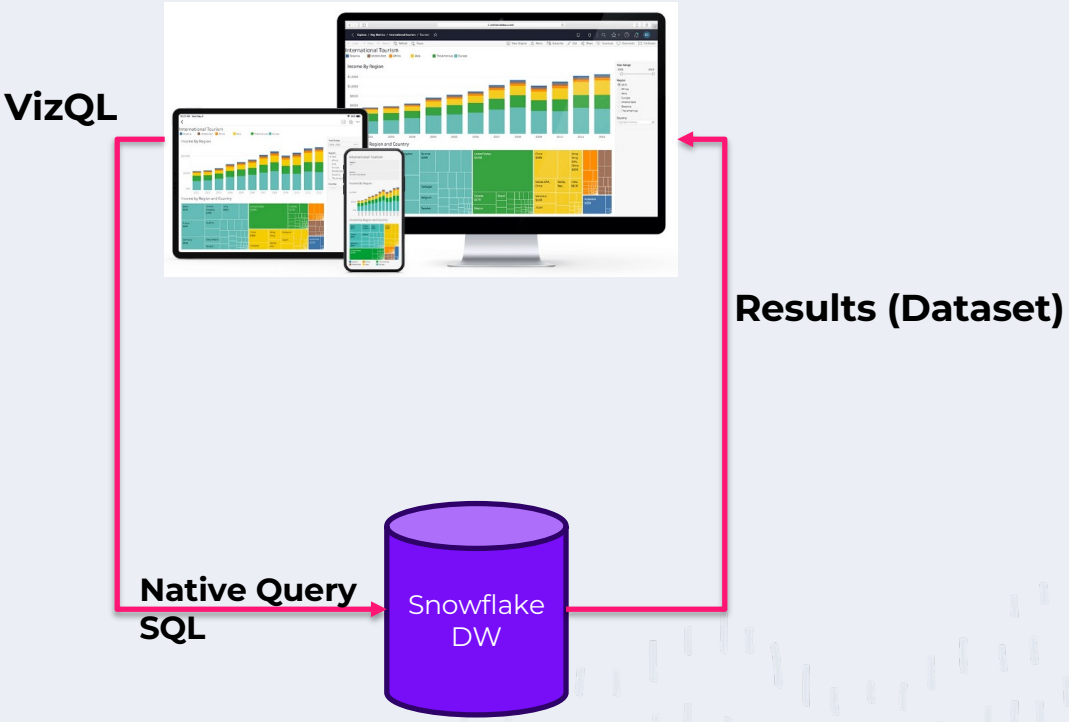


TABLEAU FILTERS

Tableau Filters

- **Extract** filters
- **Data source** filters
- **Context** filters
- **Dimension** filters
- **Measures** filters
- **Calculated** filters

Tableau Filters

Extract filters

- Extract filters remove data from the extracted data source

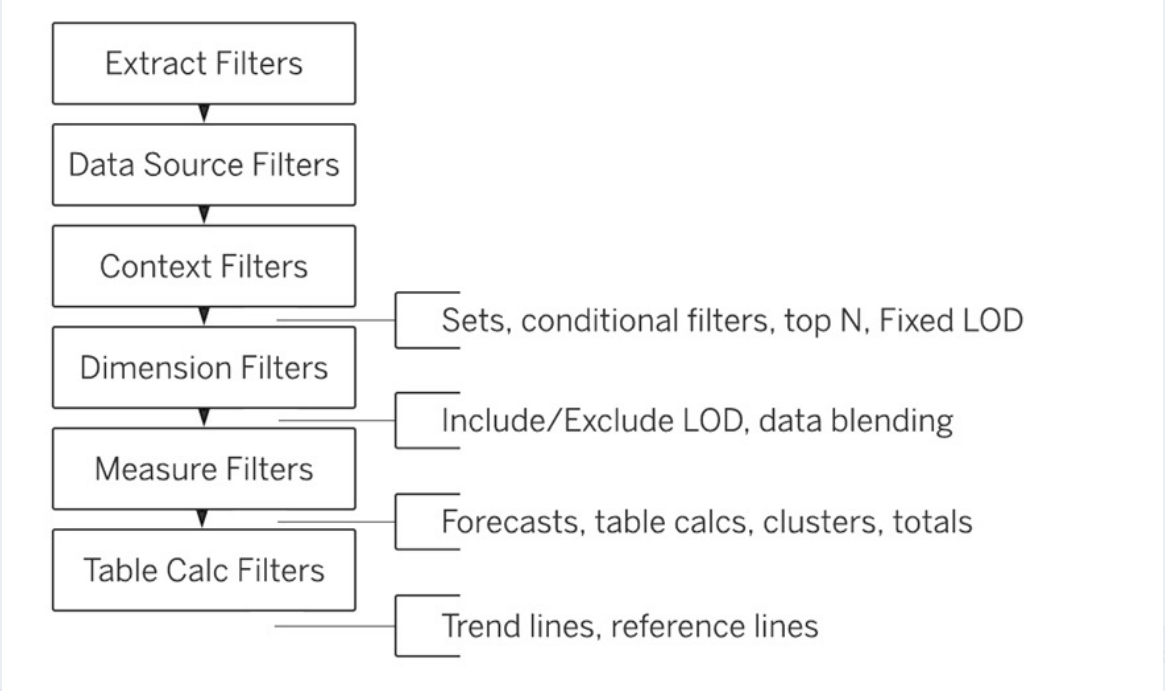
Data source filters

- Data source filters are applied throughout the workbook
- **Context** filters
- **Dimension** filters
- **Measures** filters
- **Calculated** filters

Order of Operations (Query Pipeline)

- **Extract and Data Source Filters**: These filters are applied first and can be set in the data source page. They filter your data before it enters Tableau, which can be useful for excluding unnecessary fields from your analysis
- **Context Filters**
- **Top N/ Conditional Filters**: These filters limit the data to a specified subset, such as the top 10 items based on a measure.
- **Dimension Filters**: Dimension filters are applied after context filters and affect the view by excluding specific dimensions or members from the data
- **Measure Filters**: Measure filters are applied after dimension filters and affect the view by excluding specific measures or values from the data
- **Table Calculations**: Table calculations are performed after all filters have been applied and can be used to perform calculations on the displayed data, such as running totals or percent of total

Order of Operations (Query Pipeline)



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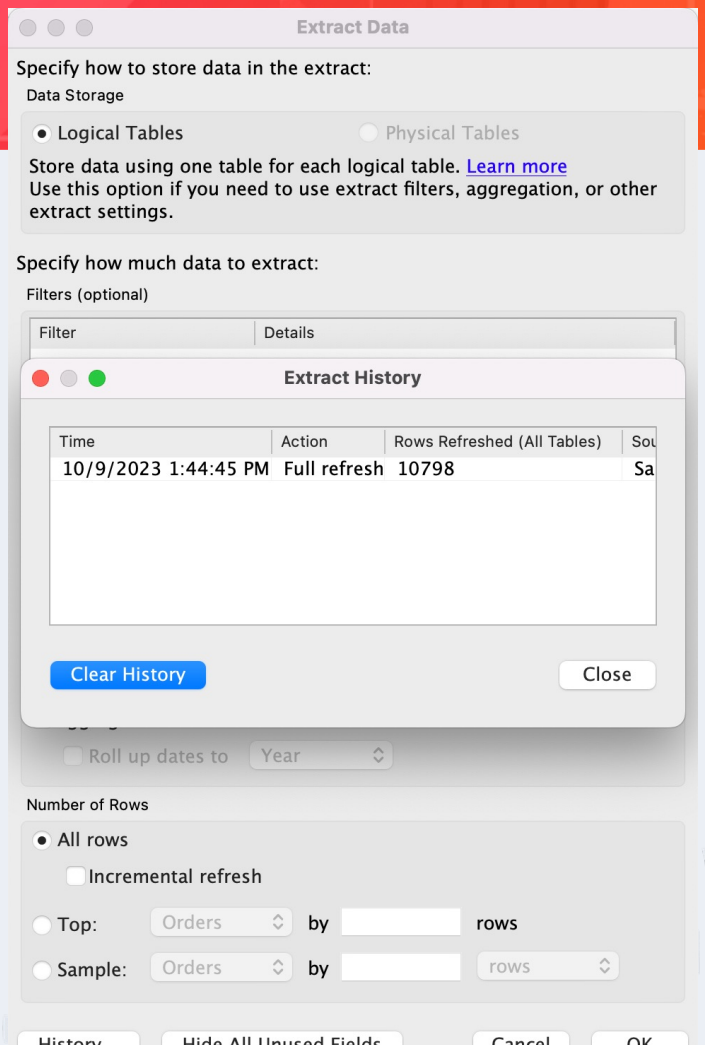
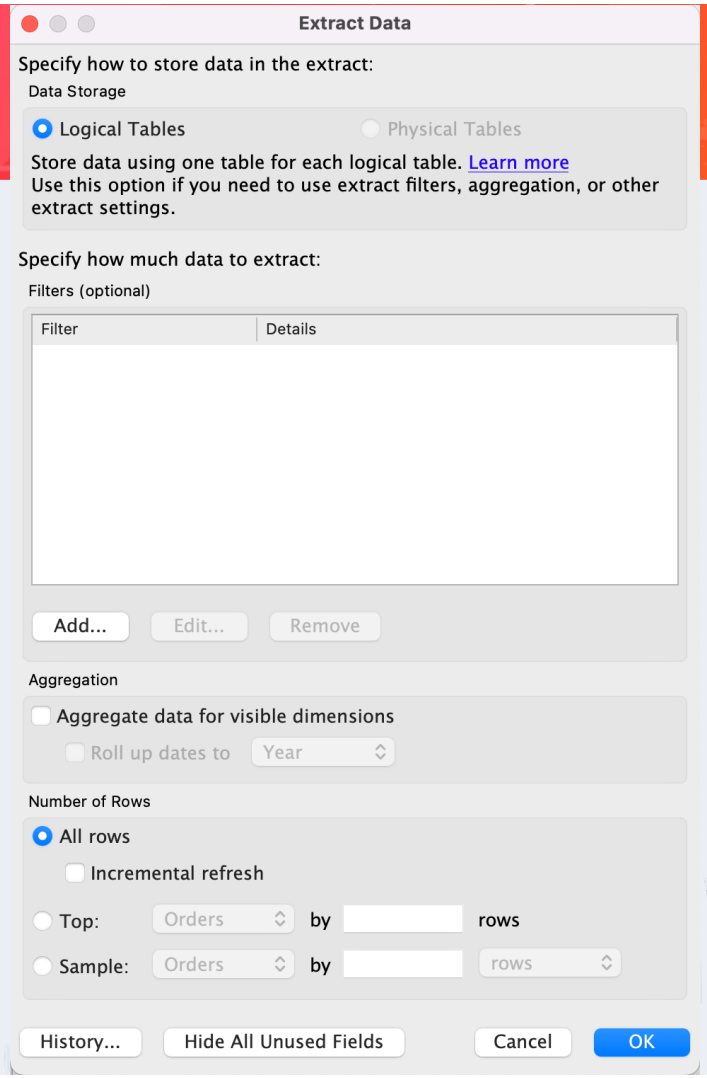
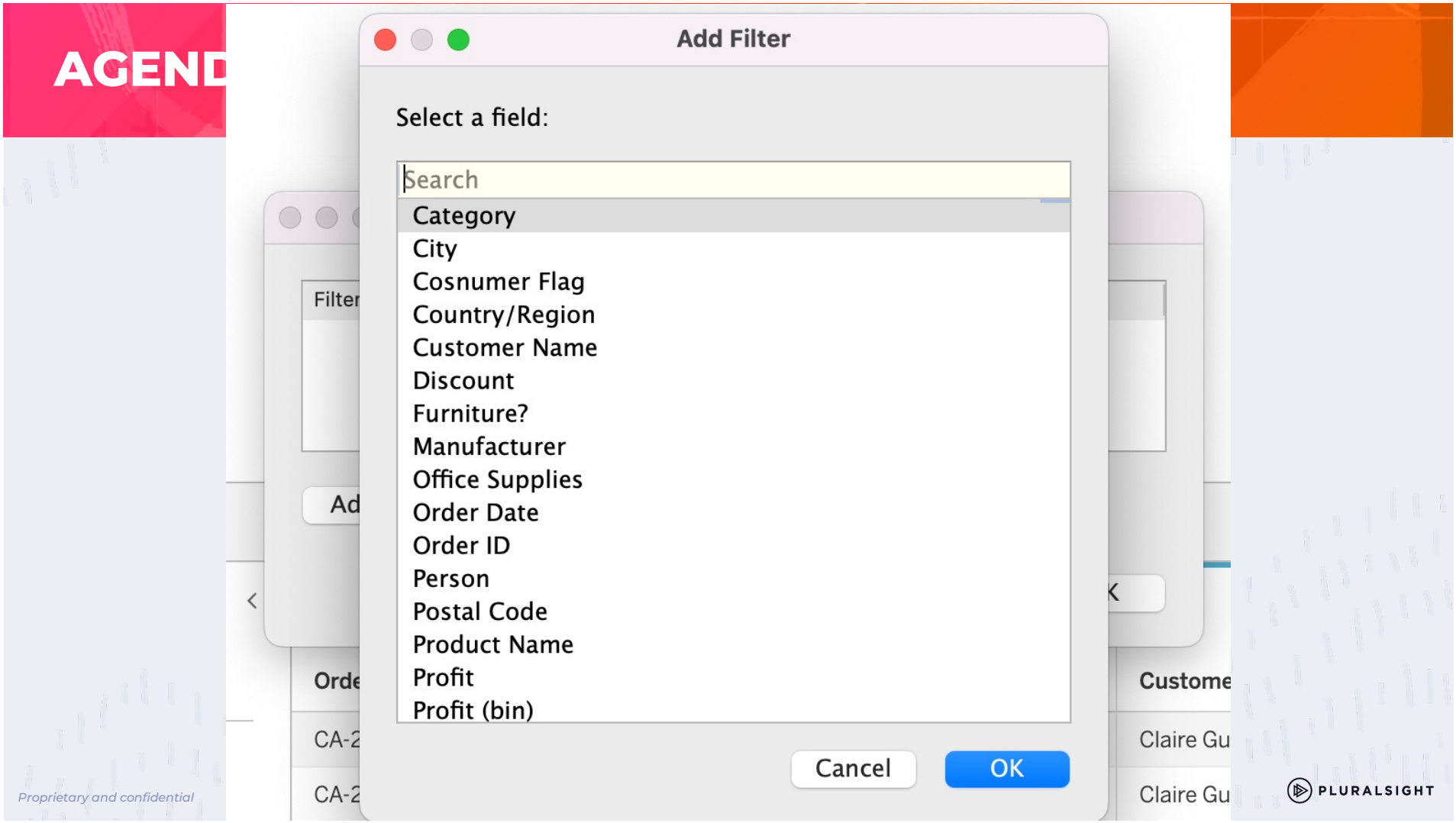


TABLEAU DEMO

AGENDA

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Add Filter
Select a field:
Search
Category
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Discount
Furniture?
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Office Supplies
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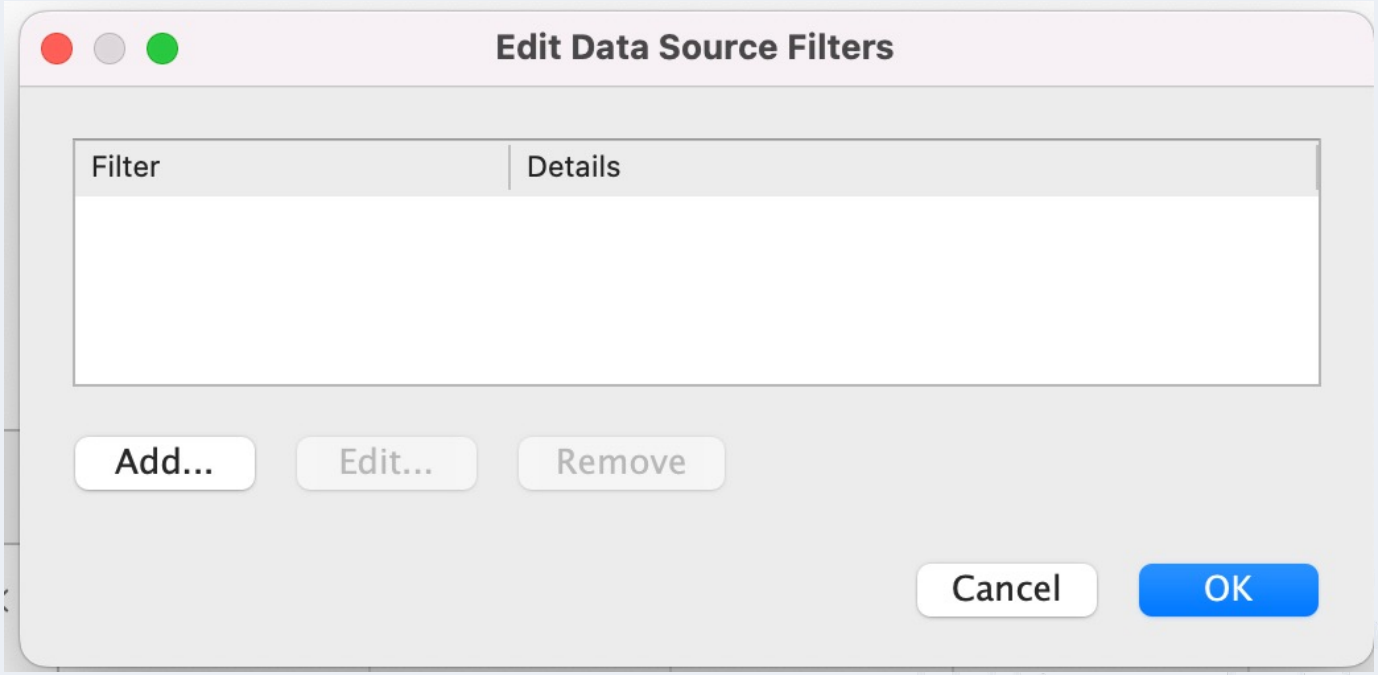

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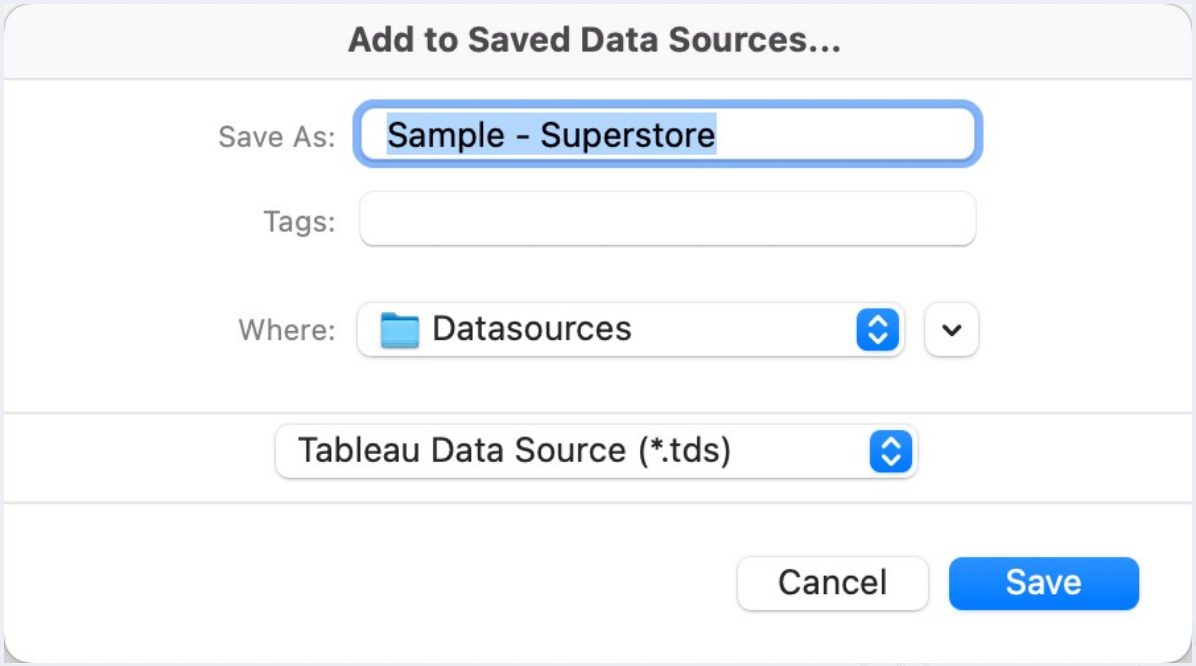

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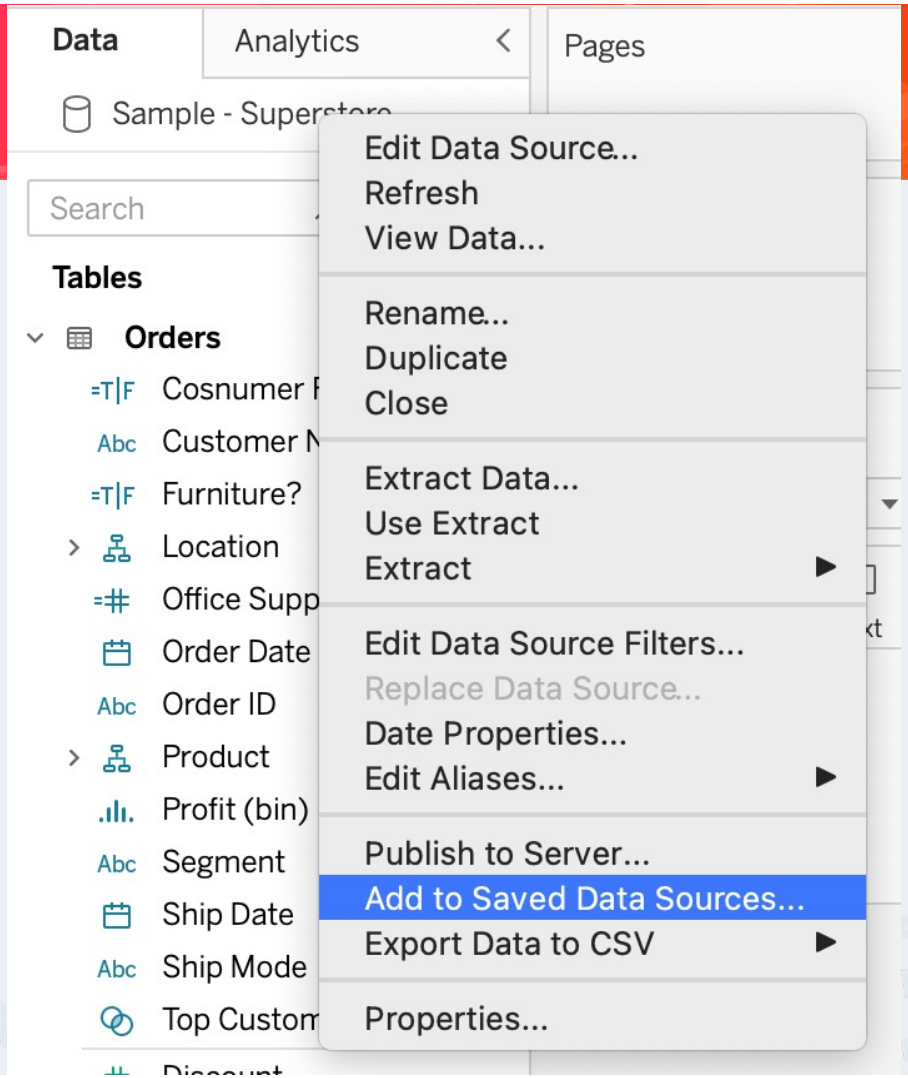

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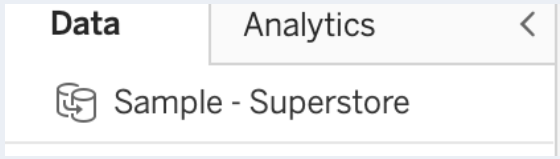

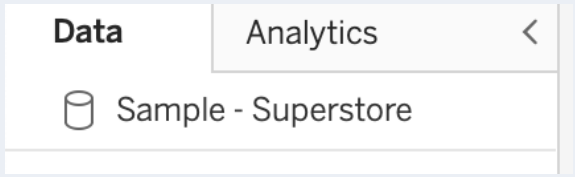

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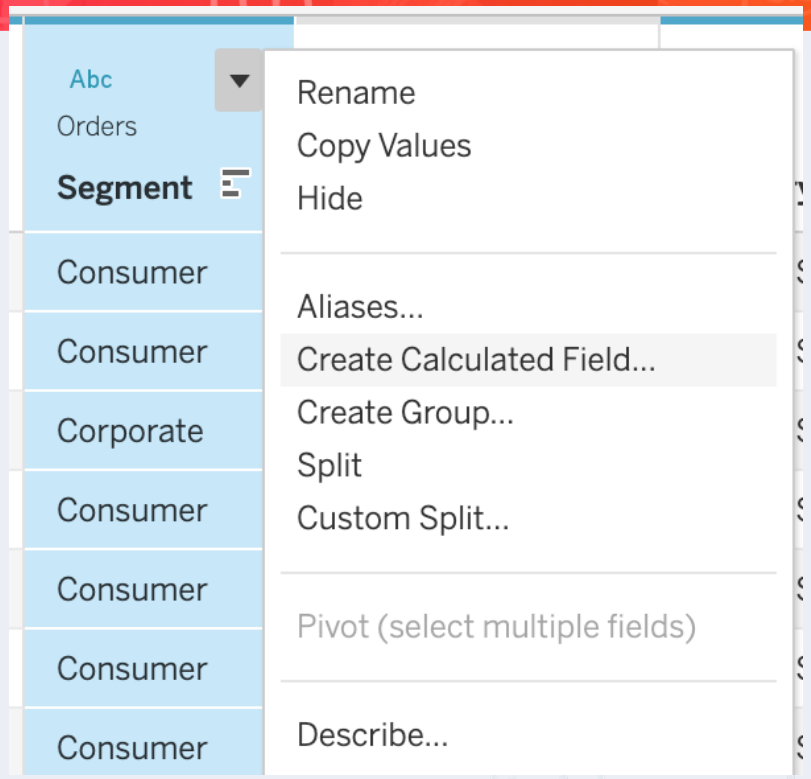

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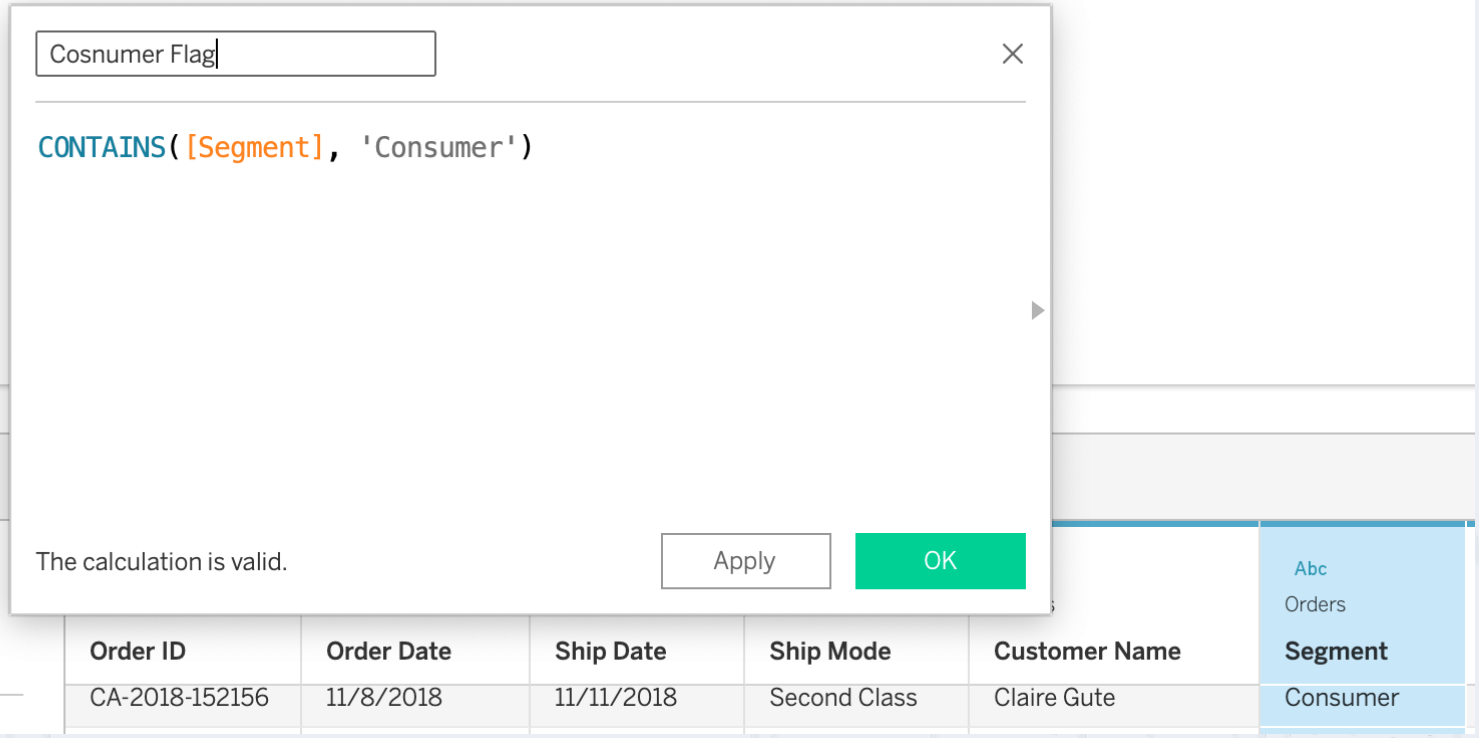


AGENDA

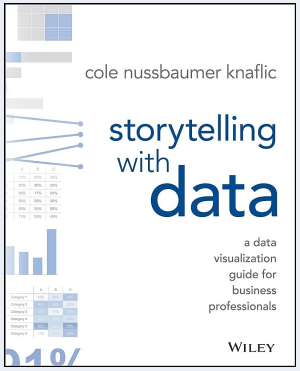
INTRODUCTION TO DATA VISUALIZATION AND STORYTELLING

Data storytelling is the art of presenting complex data and analytics in a compelling narrative that helps tell a story and influence and inform a particular audience

Microsoft

Storytelling with Data

1.Understand the context: Before creating a data story, it is essential to understand the context of the data, including the audience, the purpose of the story, and the message that needs to be conveyed
2.Choose an effective visual display: Selecting the right visual display is crucial to ensure that the data is presented in a clear and understandable way. The choice of visual display should be based on the type of data and the message that needs to be conveyed
3.Eliminate clutter: Clutter can distract the audience from the message and make the data story difficult to understand. It is essential to eliminate unnecessary elements and simplify the visual display to ensure that the message is clear
4.Direct the audience's attention: Highlighting the most important parts of the data and directing the audience's attention to them is crucial to ensure that the message is understood. This can be achieved through the use of color, size, and other visual cues
5.Think like a designer: Design thinking involves considering the audience's needs and preferences when creating a data story. It is essential to create a story that is visually appealing, easy to understand, and engaging
6.Leverage the power of storytelling: Storytelling is a powerful tool that can help make data more relatable and memorable. By incorporating a narrative into the data story, it is possible to create a more engaging and impactful message



FOUNDATIONS OF DATA VISUALIZATION

Introduction to Data Visualization

Data Visualization refers to the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data.

Key Components

1. **Elements of Visualization:**
   - **Charts and Graphs**: Bar, line, pie, scatter plots, etc.
   - **Maps**: Geographical data representation.
   - **Tables**: Grids of text or numbers.
   - **Infographics**: Visual representations of information.
   - **Dashboards**: Consolidated visualizations for data monitoring and analysis

2. **Data:**
   - **Quantitative**: Numerical data.
   - **Categorical**: Descriptive data.
   - **Temporal**: Time-related data.
   - **Spatial**: Location-related data.

Key Components

3. **Design Principles:**
- **Clarity**: Clear and unambiguous visuals.
- **Accuracy**: Precise representation of data.
- **Efficiency**: Quick and easy comprehension of data.
- **Aesthetics**: Visually pleasing and engaging.

4. **Tools and Technologies:**
- **Software**: Tableau, Power BI, Excel, etc.
- **Programming Languages**: Python (with libraries like Matplotlib, Seaborn), R, etc.

The importance of data visualization is evident in the "age of Big Data," where it helps make sense of the trillions of rows of data generated every day

Someone Said So