

DATA VISUALIZATION: INTRODUCTION TO TABLEAU

Contents

Unit 4: Introduction to Tableau

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What is Tableau?

- Tableau is an easy-to-use business intelligence software used for data analysis.
- Tableau natively connects to dozens of data sources, including Oracle and MS-SQL, as well as local sources like MS-Access and Excel.
- Once connected you use drag and drop tools to visualize and create interactive dashboards.
- Visualizations can be presented to your audience via PDF, Tableau Reader, Tableau Server/Online or Tableau Public.
- Tableau was founded in 2003 as a result of a computer science project at Stanford that aimed to improve the flow of analysis and make data more accessible to people through visualization.
- History. While at Stanford, founders Hanrahan and Stolte, as well as Diane Tang, created the predecessor to Tableau, named Polaris; Polaris was a data visualization software tool, built with the support of a United States Department of Energy defense program, the Accelerated Strategic Computing Initiative (ASCI).



What is Tableau?

Tableau is leading Business Intelligence (BI) and data visualization tool, designed to make data analysis accessible and intuitive for users across various skill levels. It empowers individuals and organizations to transform raw data into interactive and shareable dashboards, providing insights that drive informed decision-making.

Unlike traditional BI tools that require extensive technical knowledge, Tableau prioritizes user-friendliness, allowing both technical and non-technical users to create complex visualizations and analyses with ease. It supports a wide range of data sources, from spreadsheets and databases to cloud services, ensuring flexibility and connectivity.

With Tableau, users can delve into their data, exploring trends, patterns, and outliers through a variety of visualization options. The platform's drag-and-drop functionality simplifies the creation of charts, graphs, and dashboards, making data more comprehensible and actionable.

Available in both desktop and mobile versions, Tableau ensures that data is accessible anytime, anywhere, fostering a data-driven culture within organizations. Whether you are a data scientist, a business analyst, or someone just starting to explore the world of data, Tableau provides the tools and resources needed to turn data into insights and insights into impact.

What is Tableau

Tableau is a data visualization tool that lets us analyze virtually any type of structured data and produce highly interactive and attractive graphs, dashboards, and reports in minutes.

Using Tableau Effectively

Tableau makes it easier to create powerful, visual information that communicates what is important better than a spreadsheet or text table. Tableau has advanced capabilities for more technical users, but it dramatically lowers the bar for creating dashboards and performing analytical analysis for non-technical analysts and information consumers.” – Dan Murray, Interworks



Key Features and Capabilities:

Data Visualization: Tableau excels at transforming raw data into engaging and insightful visualizations, including charts, graphs, maps, and more.

Interactive Dashboards: Users can create interactive dashboards that allow for exploration and analysis of data, enabling users to drill down into specific areas of interest.

Data Connectivity: Tableau supports a wide range of data sources, including relational databases, online analytical processing cubes, cloud databases, and spreadsheets.

Self-Service Analytics: Tableau is designed to empower users to perform their own data analysis without relying on IT or specialized data experts.

Collaboration and Sharing: Tableau allows users to easily share their visualizations and dashboards with others, facilitating collaboration and data-driven decision-making.

AI and ML Capabilities: Tableau offers AI and machine learning capabilities to help users discover hidden trends and make predictions.

Data Governance: Tableau provides tools for data governance, security, and compliance, ensuring data integrity and trustworthiness.

Key Features and Capabilities:

Dashboard – A holistic and customizable visualization of an organization's data
Collaboration – Share data and visualizations in real-time for live collaboration.

Live and in-memory data – Use Tableau's live connection to extract data from the source or in-memory.

Advanced Visualization – Naturally, Tableau creates bar charts and pie charts. Still, its advanced visualizations also include boxplots, bullet charts, Gantt charts, histograms, motion charts, and treemaps, and that's just the tip of the iceberg.

Maps – Tableau's map feature lets users see where trends are happening.
Highly Robust Security – Tableau follows all industry best practices.

Mobile View – Create dashboards and reports from your phone or tablet.

Ask Data – Tableau understands dozens of natural languages. Users don't have to be data scientists to find answers within data.

Trend Lines and Predictive Analysis – Drag and drop technology creates trend lines for forecasting and predictions.

Key Features and Capabilities:

Cross-Database Join – Uncover insight through multiple datasets.

Nested Sorting – Sort data from headers, axes, or field labels.

Drag-and-Drop Integration – Tableau's drag-and-drop feature creates fast user-driven customization and formatting.

Data Connectors – Tableau supports dozens of data connectors.

Prep Conductor – Use Tableau Prep to clean and organize your data and connect to one of the dozens of data connectors.

Text Editor – Format your text in a way that makes sense to you.

Revision History – Revision history lets decision-makers and viewers see how the data has changed over time.

Licensing Views – All license holders will have viewing access to the dashboard and reports

ETL Refresh – Automatically or manually refresh as new data is added

Web Data Connector – Connect to the cloud and nearly every other online data source

Split Function – Split data to create new fields in all supporting data sources

Tableau Software

company Salesforce

Company type Subsidiary

Number of employees 4,181 (2018)

Parent Salesforce

Website tableau.com

Tableau Products:

Tableau Desktop: A desktop application for creating visualizations and dashboards.

Tableau Server: A platform for deploying and managing Tableau visualizations and dashboards within an organization.

Tableau Cloud: A cloud-based platform for deploying and managing Tableau visualizations and dashboards.

Tableau Public: A free platform for creating and sharing data visualizations online.

Tableau Prep: A tool for preparing and cleaning data for analysis.

Tableau Pulse: A reimagined data experience that empowers every employee with intelligent, personalized, and contextual insights.

Tableau Next: The agentic analytics platform that turns data into actionable insights.

Tableau Resources

- Free Trial

<https://www.tableau.com/en-gb/products/trial>

- Getting Started

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

- Free Training Videos

<https://www.tableau.com/learn/training>

- Tableau Add-In for Reshaping Data in Excel

<https://community.tableau.com/docs/DOC-10394>

- Higher Ed Analytics

<https://www.tableau.com/solutions/education-higher-ed-analytics>

- Viz of the Day

<https://public.tableau.com/en-us/gallery/?tab=viz-of-the-day&type=viz-of-the-day>

Tableau Desktop

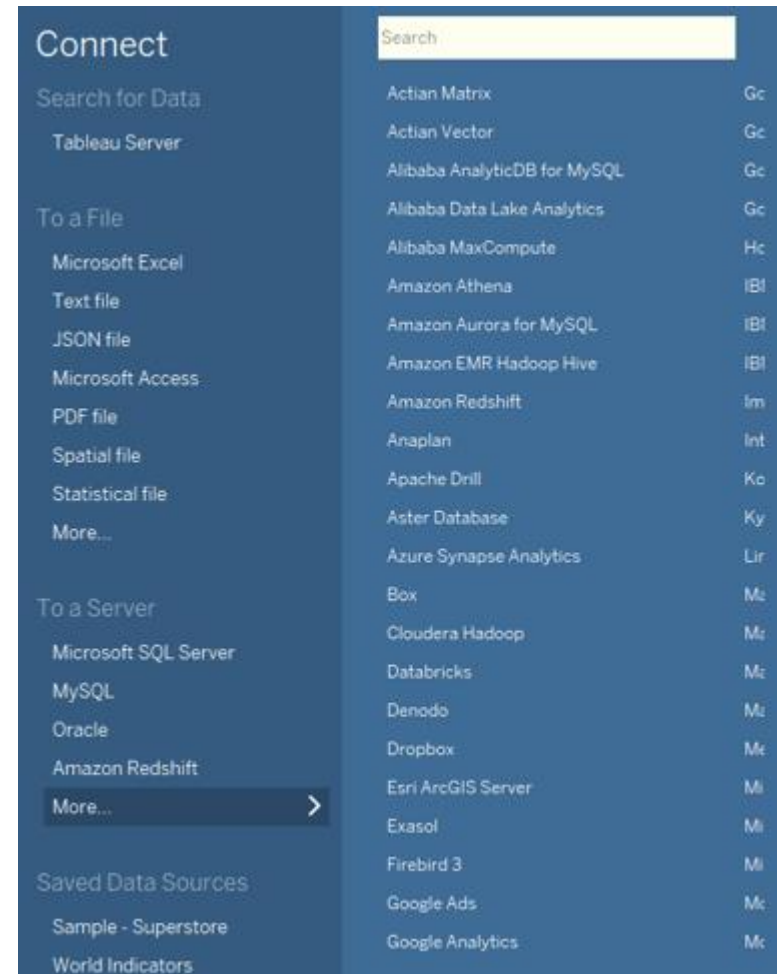
- Data visualization software that provides the ability to create interactive workbooks and dashboards to see and understand data in minutes.
- Tableau Desktop License
 - **FREE** for full time students, instructors and non-profit researchers:
 - <https://www.tableau.com/academic>
 - <https://www.tableau.com/academic/teaching/course-licenses>

Connect to and Prepare Data

Before you begin your analysis, you must connect to your data and then set up the data source. There are many optional configurations that you can make on the Data Source page that Tableau uses to interpret and interact with your data.

Tableau Desktop – Data Connections

- Connections to a wide variety of data sources
 - **File Systems** such as CSV, Excel
 - **Relational Systems** such as Oracle, SQL Server, DB2
 - **Cloud Systems** such as Windows Azure, Google BigQuery
 - **Other Sources** such as ODBC
- List of Supported Connectors:
https://help.tableau.com/current/pro/desktop/en-us/exampleconnections_overview.htm



Download Tableau Desktop

- The Free Personal Edition of Tableau Desktop can be downloaded from Tableau Desktop. You need to register with your details to be able to download. After downloading, the installation is a very straightforward process in which you need to accept the license agreement and provide the target folder for installation. The following steps and screenshots describe the entire setup process.

Tableau Public

- Making your reports and potentially YOUR DATA available
 - De-identify everything
 - Strip out non relevant data
 - Do not allow download
- FREE with restrictions
 - Support for data sets of up to 10 million rows
 - Storage limit of 10 GB
 - Data source limitations – i.e., Excel, Text-based, Google Drive
 - Edit viz in browser (beta)



Start the Installation Wizard

Double-click the **TableauDesktop-64bit-9-2-2.exe**. It will present a screen to allow the installation program to run. Click "Run".



Tableau Features

- Tableau provides solutions for all kinds of industries, departments, and data environments.
- Following are some unique features which enable Tableau to handle diverse scenarios.
- [?] Speed of Analysis: As it does not require high level of programming expertise, any user with access to data can start using it to derive value from the data.
- [?] Self-Reliant: Tableau does not need a complex software setup. The desktop version which is used by most users is easily installed and contains all the features needed to start and complete data analysis.
- [?] Visual Discovery: The user explores and analyzes the data by using visual tools like colors, trend lines, charts, and graphs. There is very little script to be written as nearly everything is done by drag and drop.

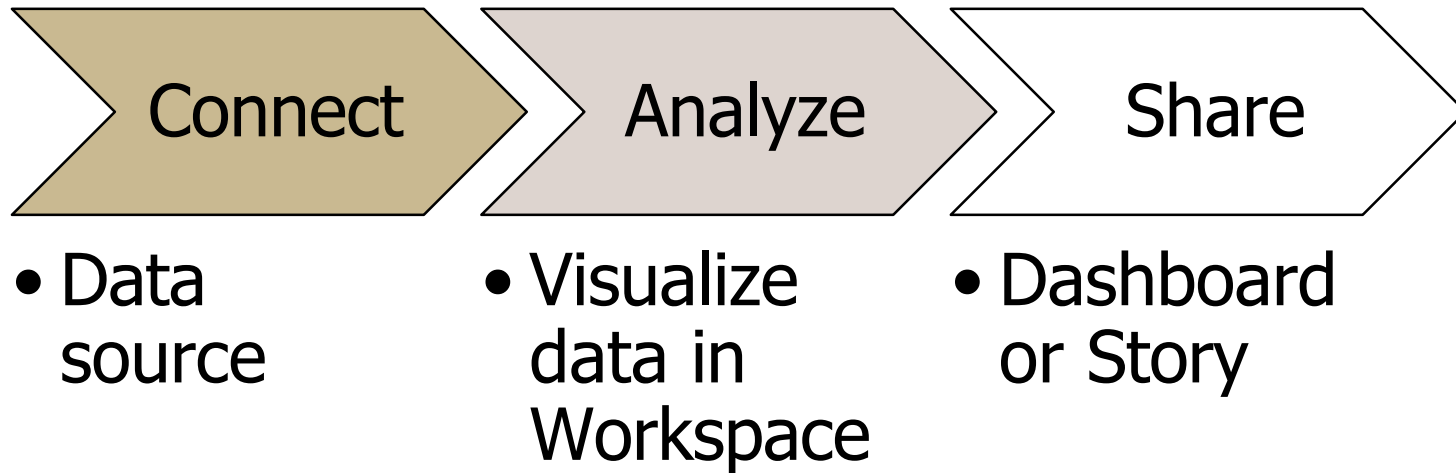
Tableau Features

- . [?] Blend Diverse Data Sets: Tableau allows you to blend different relational, semistructured and raw data sources in real time, without expensive up-front integration costs. The users don't need to know the details of how data is stored.
- [?] Real-Time Collaboration: Tableau can filter, sort, and discuss data on the fly and embed a live dashboard in portals like SharePoint site or Salesforce. You can save your view of data and allow colleagues to subscribe to your interactive dashboards so they see the very latest data just by refreshing their web browser.
- [?] Centralized Data: Tableau server provides a centralized location to manage all of the organization's published data sources. You can delete, change permissions, add tags, and manage schedules in one convenient location. It's easy to schedule extract refreshes and manage them in the data server. Administrators can centrally define a schedule for extracts on the server for both incremental and full refresher

Tableau Desktop – Graphic Types

- Area Chart
- Bar Chart
- Box Plot
- Bubble Chart
- Bullet Graph
- Density Marks (Heatmap)
- Gantt Chart
- Dot Plot
- Highlight Table
- Histogram
- Line Chart
- Maps (Geographical and Heat)
- Pie Chart
- Scatter Plot
- Text Table
- Treemap
- Word Cloud

Tableau Workflow



Connect

Connect

Search for Data

Tableau Server

To a File

- Microsoft Excel
- Text file
- JSON file
- PDF file
- Spatial file
- Statistical file
- More...

To a Server

- Microsoft SQL Server
- MySQL
- Oracle
- Amazon Redshift
- More...

Saved Data Sources

- Sample - Superstore
- World Indicators

Open

Superstore

overview_v1

overview_v1_test

Book1

edu_data_analysis

Highest Score

test1

Sample Workbooks

Superstore

Regional

World Indicators

Open a Workbook

More Samples

Connect



Connect

Search for Data

Tableau Server

To a File

Microsoft Excel

Text file

JSON file

PDF file

Spatial file

Statistical file

More...

To a Server

Microsoft SQL Server

MySQL

Oracle

Amazon Redshift

More...



Saved Data Sources

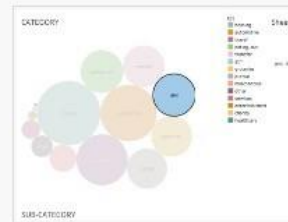
Sample - Superstore

World Indicators

Open



Superstore



overview_v1



1	A	False
	B	True
	C	False
2	A	False
	B	True
	C	True

Highest Score



test1

Data Sources Types

Spreadsheets

- Excel or csv file

Relational Databases

- MySQL or Oracle

Cloud Data

- AWS or Microsoft Azure

Other Sources

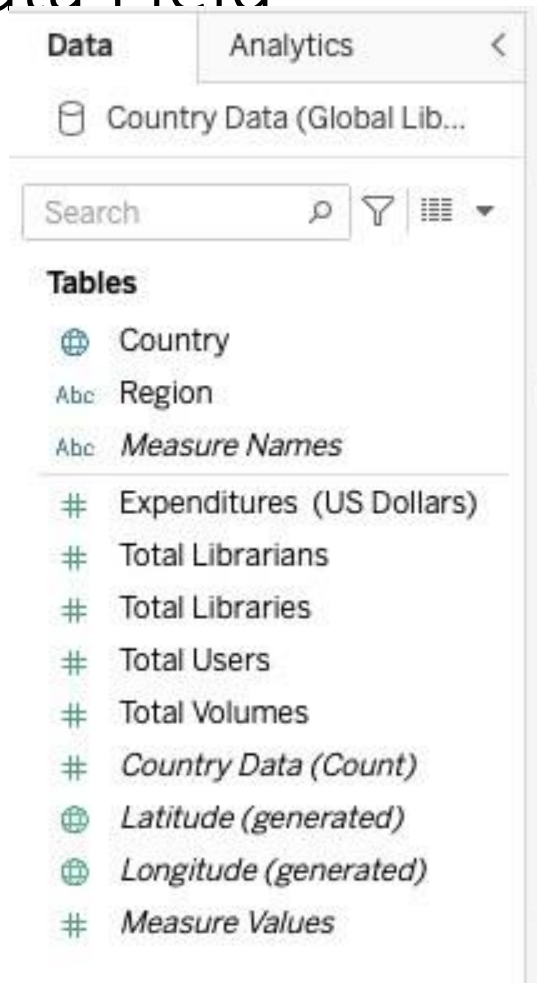
- Spatial Files or R

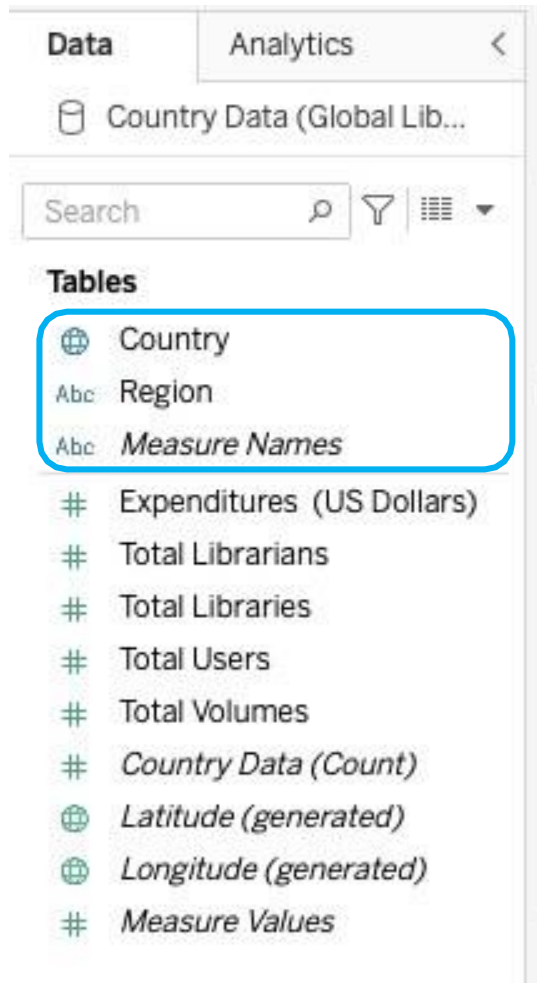
Data Field

A field, also known as a column, is a single piece of information from a record in a data set.

- Qualitative Field (Dimensions)
 - Describes or Categorizes Data
 - What, when or who
 - Slices the quantitative data
- Quantitative Field (Measures)
 - Numerical Data
 - Provides measurement for qualitative category
 - Can be used in calculations

Data Field

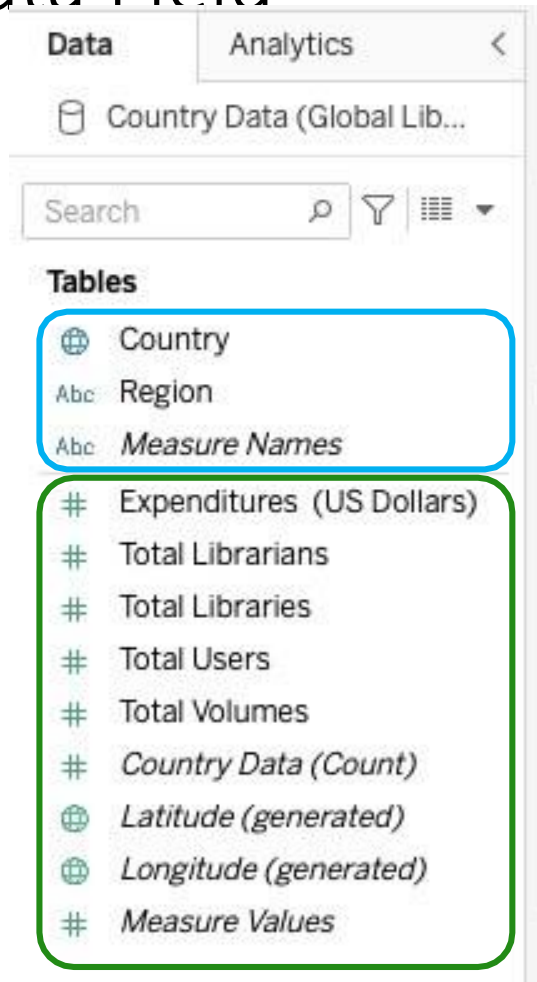




Dimensions

Data Field

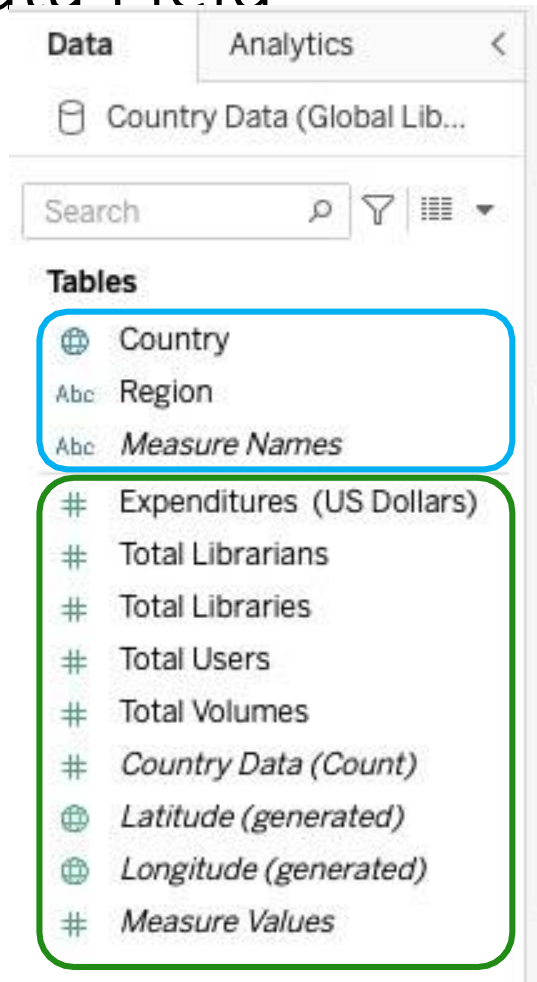
Data Field



Dimensions

Measures

Data Field



Dimensions

Measures

- By default, aggregated by SUM
- Can be aggregated as average, median, count, or count distinct.

Data Field

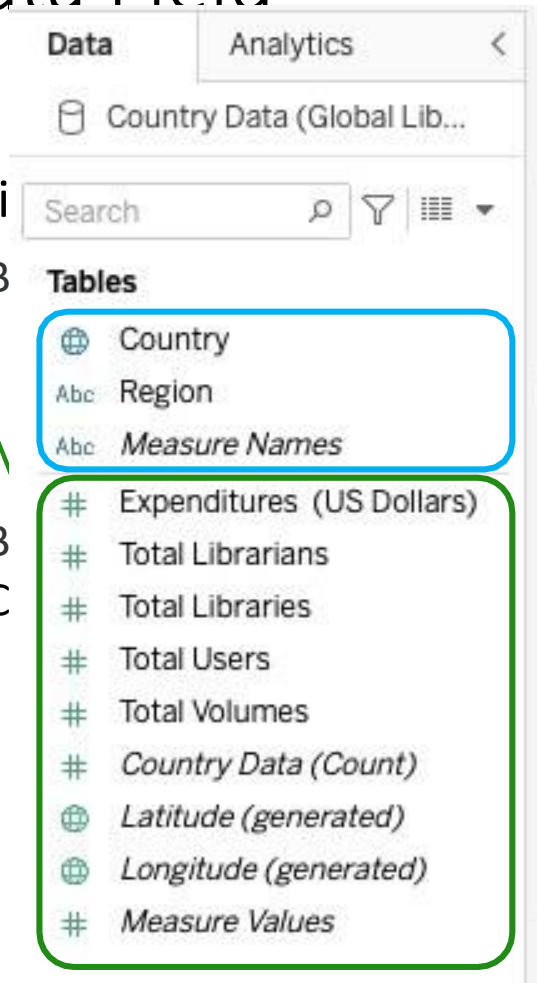
- Di

- B

- N

- B

- C



total into smaller totals by category.

M

e, median, count, or count distinct.

Data Types

Abc

Text or String Values



Discrete Date/Time



Discrete Date



Geographic field -
State or Zip Code









Continuous
Numeric Value



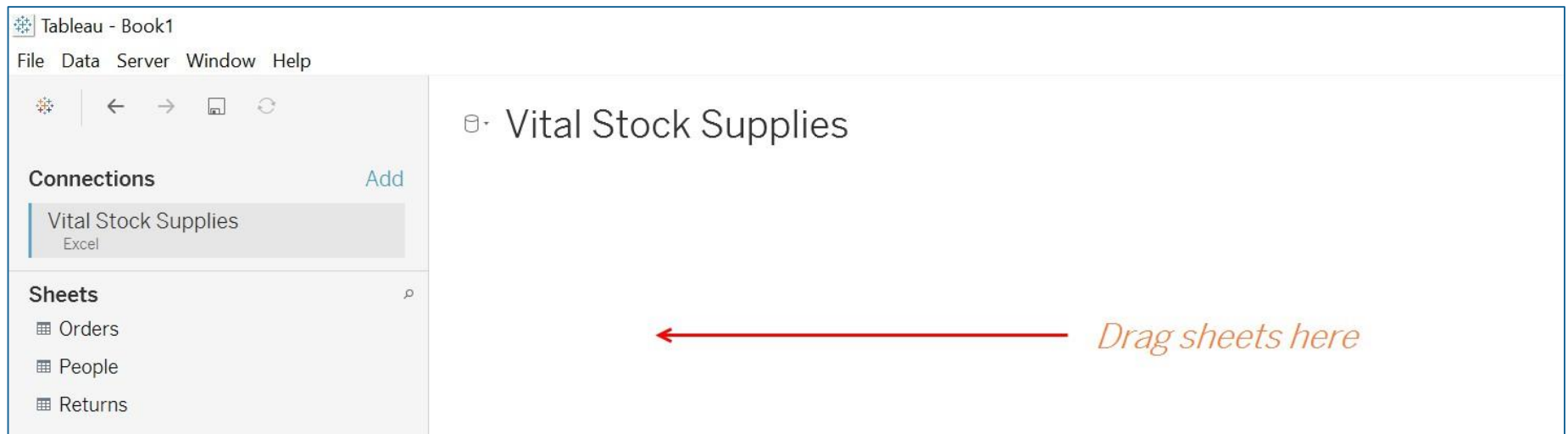
Calculated Field

Data type icons in Tableau

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)
	Image role (used with image link URLs)
	Cluster Group (used with Find Clusters in Data )

Navigation Pane

Once you choose your data source, you (and it) are brought to the Data Source Page where you can format your metadata.



Sheets on the left navigation pane behave like tables in a database.

Navigational features

- you will get acquainted with various navigational features available in Tableau interface. On running Tableau desktop, you get the menu at the top which shows all the commands we can navigate. Lets open a blank workbook and go through the various important features under each menu.
- **Menu Commands**
- On closing the getting started window, you get the main interface with all the available Menu commands. They represent the entire set of features available in Tableau. Various sections of the menu are shown in the following diagram. Next, you can see some details of each menu.
-

Navigational features

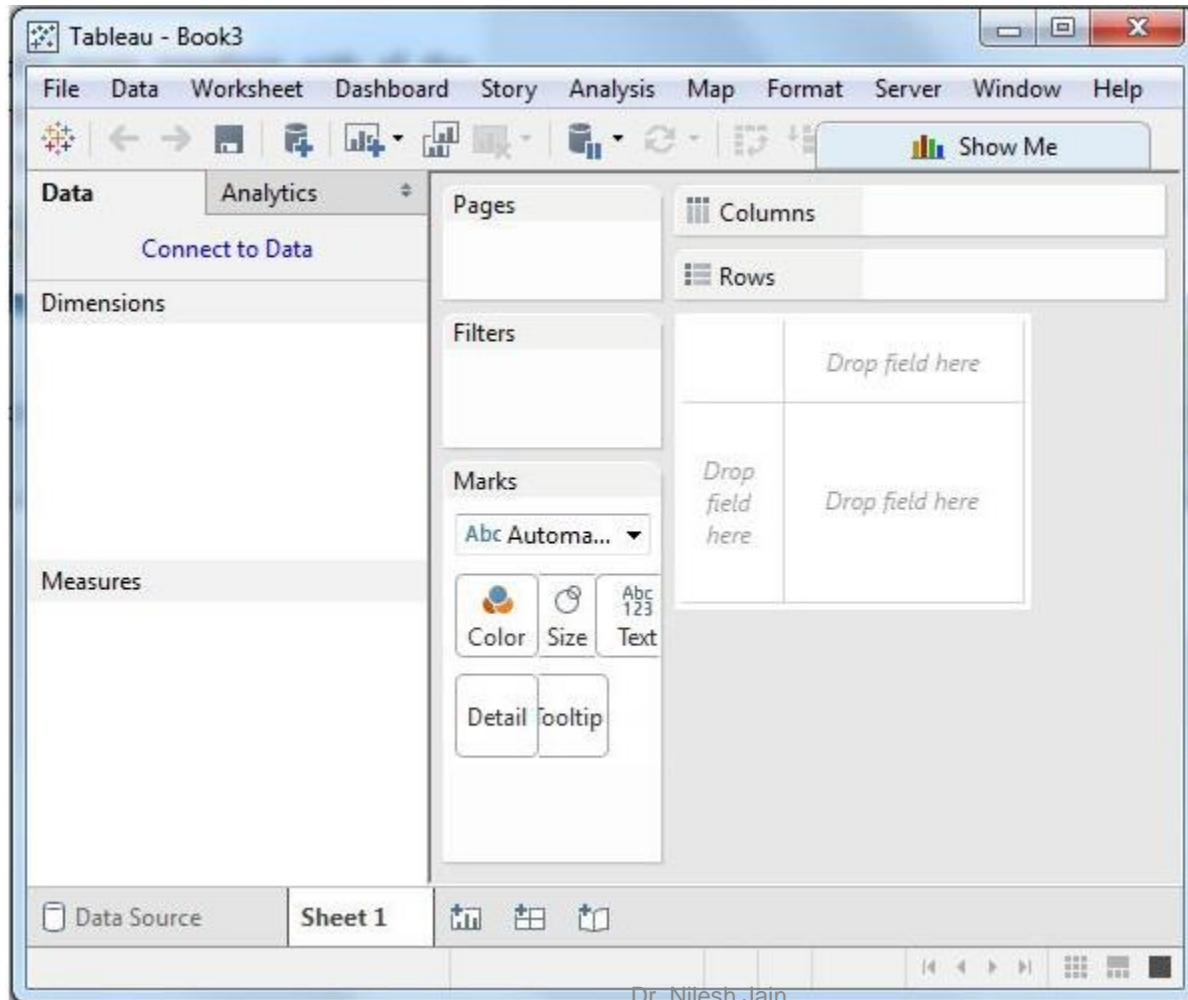


Tableau - Custom Data View

A custom data view is used to extend the normal data views with some additional features so that the view can give different types of charts for the same underlying data. For example, you can drill down a dimension field which is part of a pre-defined hierarchy so that additional values of the measures are obtained at a different granularity. Following are some of the frequently used and important custom data views Tableau offers.

Drill Down View

For dimension fields which are part of a hierarchy, you usually need to know the result of analysis for the next or previous level of aggregation. For example, when you know the result for a quarter, you get interested to know the results for each month in that quarter, and you may even need the result for each week. This is a case of drilling down the existing dimensions to get a finer level of granularity.

To drill down and drill up for individual dimension members in a hierarchy, right-click a table header and select Drill Down from the context menu. Consider a bar chart created with the dimension category in the columns shelf and the measure Sales in the Rows shelf. Right-click on the bar representing Furniture and select Drill Down.

Tableau File Types

You can save your work using several different Tableau specific file types: workbooks, bookmarks, packaged data files, data extracts, and data connection files. Each of these file types are described below. For related details,

- **Workbooks (.twb)** – Tableau workbook files have the .twb file extension. Workbooks hold one or more worksheets, plus zero or more dashboards and stories.

- **Bookmarks (.tbm)** – Tableau bookmark files have the .tbm file extension. Bookmarks contain a single worksheet and are an easy way to quickly share your work. For more information,

- **Packaged Workbooks (.twbx)** – Tableau packaged workbooks have the .twbx file extension. A packaged workbook is a single zip file that contains a workbook along with any supporting local file data and background images. This format is the best way to package your work for sharing with others who don't have access to the original data.

Tableau File Types and Folders

- **Extract (.hyper)** – Tableau extract files have the .hyper extension. Extract files are a local copy of a subset or entire data set that you can use to share data with others, when you need to work offline, and improve performance. For more information,

- **Data Source (.tds)** – Tableau data source files have the .tds file extension. Data source files are shortcuts for quickly connecting to the original data that you use often. Data source files do not contain the actual data but rather the information necessary to connect to the actual data as well as any modifications you've made on top of the actual data such as changing default properties, creating calculated fields, adding groups, and so on. For more information,

- **Packaged Data Source (.tdsx)** – Tableau packaged data source files have the .tdsx file extension. A packaged data source is a zip file that contains the data source file (.tds) described above as well as any local file data such as extract files (.hyper), text files, Excel files, Access files, and local cube files. Use this format to create a single file that you can then share with others who may not have access to the original data stored locally on your computer. For more information

Extract Your Data

-
- A data extract is a subset of information that is saved separately from the original dataset. It serves two purposes: to enhance performance and to utilize Tableau features that may not be available or supported in the original data. By creating a data extract, you can effectively reduce the overall data volume by applying filters and setting other limitations.
- After a data extract is created, it can be refreshed with the latest data from the original source. During the refresh process, you have the flexibility to choose between a full refresh, which replaces all existing content in the extract, or an incremental refresh, which only includes new rows since the previous refresh.
-

Benefits of Extracts

- Handling large datasets: Extracts can handle massive amounts of data, even reaching billions of rows. This allows users to work with extensive datasets efficiently.
- Improved performance: Interacting with views that utilize extract data sources results in better performance compared to views connected directly to the original data. Extracts optimize query performance, resulting in faster data analysis and visualization.
- Enhanced functionality: Extracts provide access to additional Tableau functionality that may not be available or supported by the original data source, such as specific functions.
- Offline data access (Tableau Desktop): Extracts allow for offline access to data. This means that even when the original data source isn't available, users can still save, manipulate, and work with the data locally.

Create an extract

There are multiple ways to create an extract, but the main approach is explained below.

After you connect to your data and set up the data source on the Data Source page, in the upper-right corner, select Extract, and then select the Edit link to open the Extract Data dialog box.

The Extract option selected to show the Edit link

Expand each section to see its options, or select Expand All. More information on each section is presented further on in this topic.

Data Storage: change between Logical Tables or Physical Tables.

Filters: set up filters to limit how much data gets extracted based on fields and their values.

Create an extract

Aggregation: select Aggregate data for visible dimensions to aggregate the measures using their default aggregation. You can also select Roll up dates to a specified date level such as Year, Month, etc.

Number of Rows: set the number of rows you want to extract. You can extract All rows, Sample, or the Top N rows.

Incremental refresh: set up an incremental refresh based on a specific column and date range. You can also choose whether or not last rows are replaced or appended.

- When finished, choose Save Settings.
- Select the sheet tab. This initiates the creation of the extract.
- Next, select a location to save the extract.
- Enter an extract file name.
- Select Save. If the Save dialog box doesn't display,
- Extract settings descriptions

Adding, Renaming, and Deleting Worksheets:

In Tableau, you can manage worksheets by adding new ones, renaming, saving, deleting, and reordering them. You can also create a paged workbook for printing or sharing, which is a different format than a standard Tableau workbook.

Adding, Renaming, and Deleting Worksheets:

Add a Worksheet:

Click the "+" icon at the bottom of the Tableau window to add a new worksheet.

Rename a Worksheet:

Double-click the sheet name on the Sheet tab or right-click and select "Rename" to change the name.

Save a Worksheet:

Tableau automatically saves your work as you make changes, but you can also save the workbook with a new name using "Save As".

Delete a Worksheet:

Right-click the worksheet tab and select "Delete".
in paged workbooks.

Note:

If a worksheet is used in a dashboard, you must first remove it from the dashboard before you can delete it.

Reordering Worksheets:

Drag and Drop: Simply click and drag the worksheet tab to a new position within the workbook.

Paged Workbook:

Create a Paged Workbook:

Use the "File" menu to select "Save As" and choose "Paged Workbook" as the file type.

Paged Workbook Features:

Paged workbooks are designed for printing or sharing in a specific layout, allowing for better control over the appearance of the visualizations.

Note:

Paged workbooks have a different format than standard Tableau workbooks, and not all Tableau features are available in paged workbooks.

Blend Your Data

Data blending is a method for combining data from multiple sources. Data blending brings in additional information from a secondary data source and displays it with data from the primary data source directly in the view.

Data blending is particularly useful when the blend relationship—the linking fields—need to vary on a sheet-by-sheet basis, or when combining published data sources.

Options to combine data

There are several ways to combine data, each with their own strengths and weaknesses.

Relationships are the default method and can be used in most instances, including across tables with different levels of detail. Relationships are flexible and adapt to the structure of the analysis on a sheet by sheet basis. However, you can't create relationships between tables from published data sources.

Joins combine tables by adding more columns of data across similar row structures. This can cause data loss or duplication if tables are at different levels of detail, and joins must be established before analysis can begin. You can't use a published data source in a join.

Blends, unlike relationships or joins, never combine the data directly. Instead, blends query each data source independently, aggregate the results to the appropriate level, then present the results together visually in the view. Because of this, blends can handle different levels of detail and also work with published data sources. Blends don't create a new, blended data source (and therefore can't be published as a "blended data source"). Instead, they are simply blended results visualized per sheet.

Types of Tableau Operators

There are 3 basic operators in tableau:

- Arithmetic Operators
- Relational Operators
- Logical Operators

a. Arithmetic Operators in Tableau

The Arithmetic administrators can be utilized to make articulations on numbers and date information compose segments.

- Addition – +
- Subtraction – –
- Multiply – *
- Divide – /
- Modulation – %
- Power – ^

Tableau Logical Operators

Logical operators contain only three commands.

- a. Logical conjunction operator “AND”
- b. Logical disjunction operator “OR”
- c. Logical negation operator “NOT”

Relational Operators in Tableau

A comparison operator is a binary operator that takes two operands whose values are being compared.

Comparison operators are used in conditional statements, especially in loops, where the result of the comparison decides whether execution should proceed. They form the key to program flow control, known as conditional processing.

- Equality Operator – =
- Not Equality Operator – < >, !=, ^=
- Greater Than Operator – >
- Less Than Operator – <
- Greater Than Equal to Operator – >=
- Less Than Equal to Operator – <=

Tableau Functions

The Tableau functions in this reference are organized by category. Click a category to browse its functions. Or press Ctrl+F (Command-F on a Mac) to open a search box that you can use to search the page for a specific function.

- Number functions
- String functions
- Date functions
- Logical functions
- Aggregate functions
- User functions
- Table calculations
- Pass-Through functions (RAWSQL)
- Spatial functions
- Additional functions

Number functions

Syntax	ABS(number)
Output	Number (positive)
Definition	Returns the absolute value of the given <number>.
Example	ABS(-7) = 7 ABS([Budget Variance]) The second example returns the absolute value for all the numbers contained in the Budget Variance field.

CEILING	
Output	integer
Definition	Rounds a <number> to the nearest integer of equal or greater value.
Example	CEILING(2.1) = 3

DIV

Syntax	DIV(integer1, integer2)
Output	Integer
Definition	Returns the integer part of a division operation, in which <integer1> is divided by <integer2>.
Example	DIV(11,2) = 5

floor

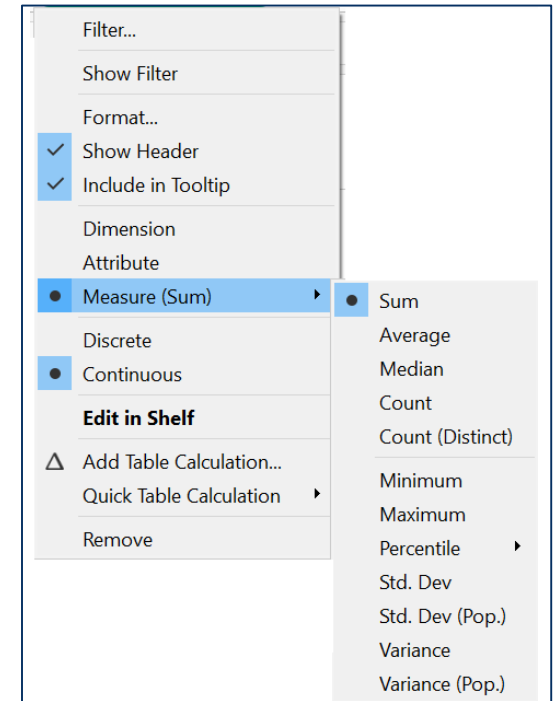
syntax	FLOOR(number)
Output	Integer
Definition	Rounds a number to the nearest <number> of equal or lesser value.
Example	FLOOR(7.9) = 7

Basic Calculations

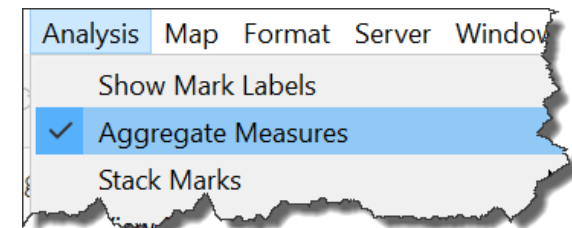
- ▶ Calculations are created to enhance the dashboard.
- ▶ Tableau takes granular data and aggregates them in the View.
- ▶ Calculations help in extending the usage of aggregations.
- ▶ If we're looking for a particular dimension or measure that does not seem to exist in our data source, we can form them from calculations.

Aggregating Data

- ▶ When a **Measure** is placed on a Shelf, Tableau automatically aggregates the data.
 - ▶ Tableau defaults to Sum.
- ▶ You can change the aggregation to other types (Average, Max, Min) by clicking on the Pill, navigating to **Measure (Sum)** and selecting from the list of other choices.

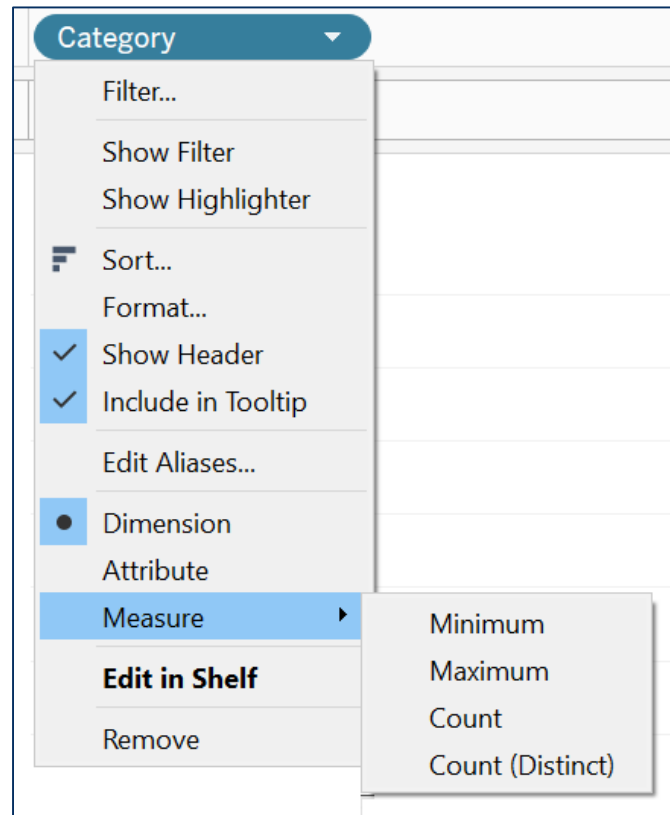


✍ **Note:** You can disaggregate data by navigating to the **Analysis Menu** and deselecting **Aggregate Measures**.



Aggregating Data

- Dimensions can also be aggregated by right-clicking the Pill, selecting Measure, and choosing from the list of options available:



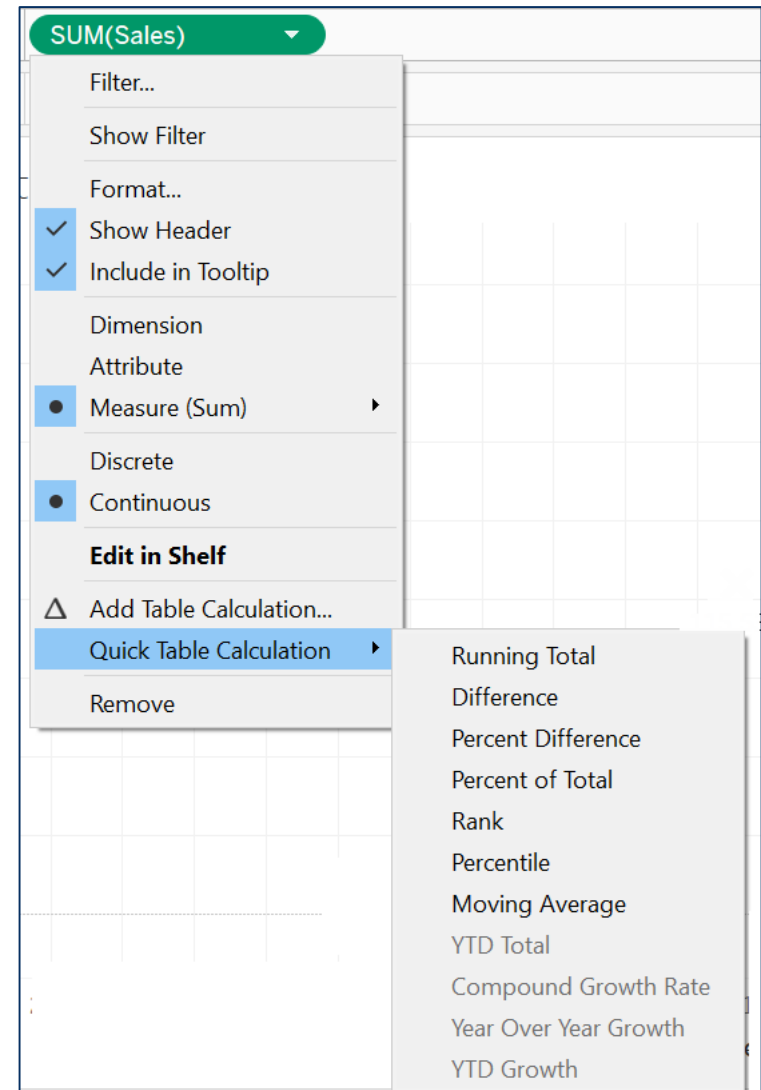
Granularity of Data

- ▶ Data granularity refers to the level of detail or depth of data in a View
- ▶ Defined by the Dimension fields
- ▶ If a Dimension is dragged to Detail, it will change the granularity of the visualization
- ▶ Dragging a Measure to Detail will have no effect

Quick Table Calculations

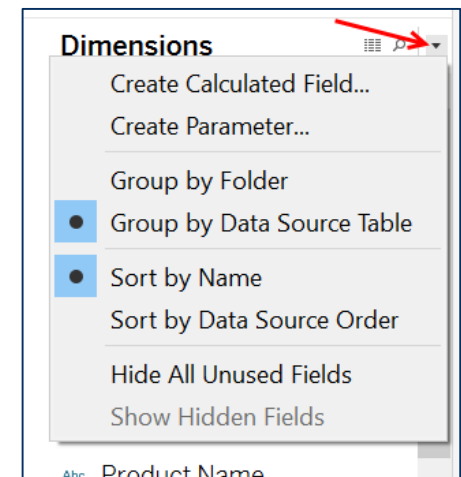
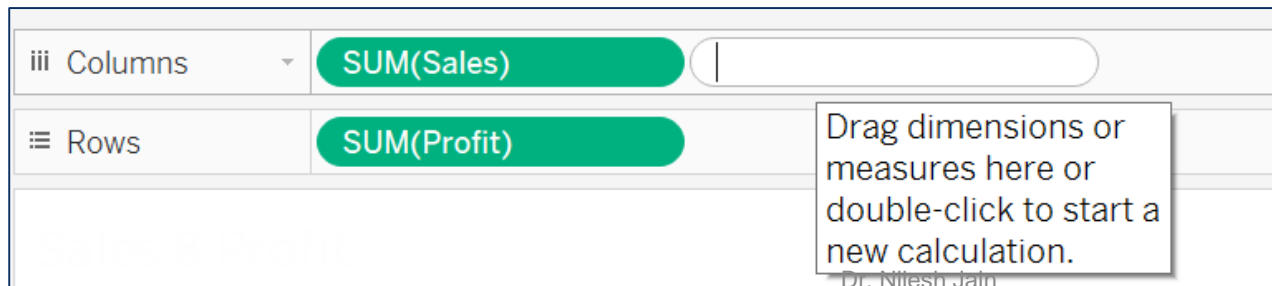
- ▶ A quick table calculation is a one-step process where you choose a common, pre-defined calculation type from a list.
- ▶ Tableau automatically applies the most typical settings for that calculation type.

To apply a quick table calculation, simply right-click a measure from a Shelf or Mark and choose **Quick Table Calculation** from the context menu.



Calculated Fields

- ▶ When your data source doesn't contain all the fields you need, you can add new ones as calculated fields
- ▶ The calculated fields are saved as part of the data source and can be used as often as necessary
- ▶ There's several ways to create calculated fields. You can do this easily by using the calculation editor from the drop-down, by double-clicking a Shelf or a Field on a Shelf, or by right-clicking “white space” on the Data pane under Dimensions or Measures
- ▶ Calculated fields can be created from existing calculations
- ▶ Calculations are based on Formulas and Fields



Formulas Make Up Calculated Fields

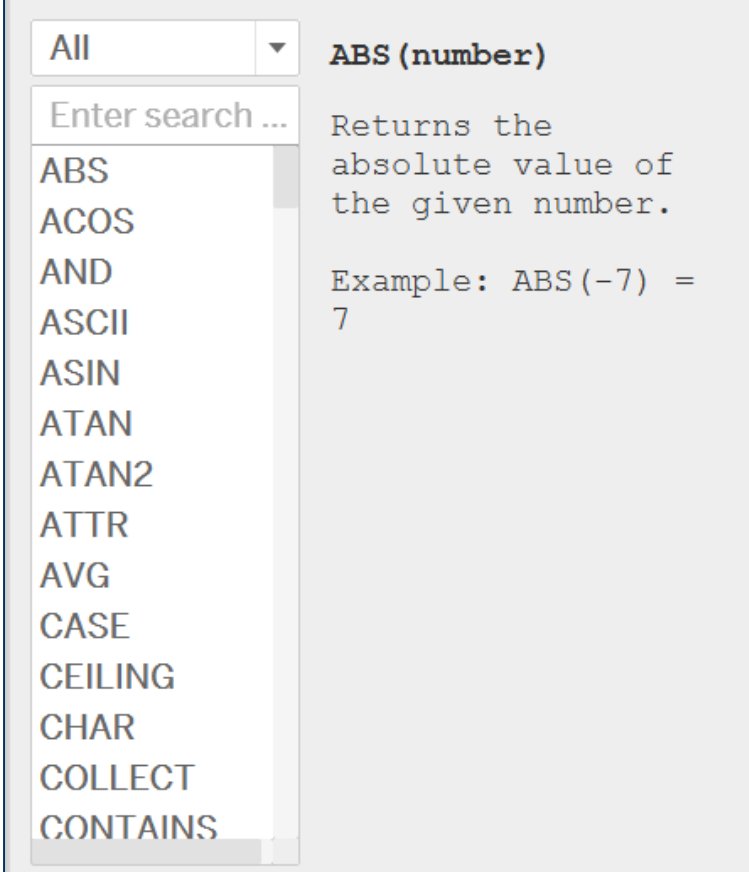
- ▶ Formulas can contain functions, fields, operators, parameters, or comments
- ▶ The Calculation Editor provides **color coding** based on the Field added
 - ▶ Functions: **Light Blue**
 - ▶ Fields: **Orange**
 - ▶ Operators: **Black**
 - ▶ Parameters: **Purple**
 - ▶ Comments: **Grey**

✍ **Note:** Tableau makes attempts to guess what you're trying to do and provides you with the tools you need for brackets and parenthesis. You should not have to do much typing or guessing.

***Don't "fight" the tool!**

Functions

- ▶ Functions can be filtered by category
- ▶ Use the **Enter search ...** box to find specific functions
- ▶ Clicking on a function provides tips and examples to guide you



The screenshot shows a user interface for searching functions. At the top, there is a dropdown menu set to 'All'. Below it is a search bar labeled 'Enter search ...'. A list of functions is displayed below the search bar, including ABS, ACOS, AND, ASCII, ASIN, ATAN, ATAN2, ATTR, AVG, CASE, CEILING, CHAR, COLLECT, and CONTAINS. To the right of the list, the details for the 'ABS (number)' function are shown. The description states: 'Returns the absolute value of the given number.' An example is provided: 'Example: ABS(-7) = 7'.

Function	Description
ABS (number)	Returns the absolute value of the given number. Example: <code>ABS(-7)</code> = 7

Comments

- ▶ Comments can provide context or detail on calculations
- ▶ Define comments using two forward slashes

Example

```
SUM([Profit])/SUM([Sales])//Added by Amy Such
```

Auto-Completion for Formulas

- ▶ Tableau will automatically attempt to fill in a formula
- ▶ First attempts to find based on *starts with* then *contains*
- ▶ Clicking **Enter** will enter your formula or function into your forming calculation
- ▶ If you first type a `[` auto-complete will show fields, parameters, or sets instead of functions
- ▶ If you're using multiple data sources, auto-complete will add the fully-qualified name of the Field so you can see exactly where things are being pulled from

What Are LOD Expressions

In Tableau, LOD (Level of Detail) expressions are used to compute values at different levels in a visualization. These expressions allow for more granular control over how data is aggregated and displayed in a visualization.

To put this simply, LOD expressions provide a way to isolate specific levels of data in a visualization, regardless of the other filters or dimensions present. This allows for more precise and flexible analysis of data.

Here's a sample syntax:

```
{FIXED [Dimension]: AGG([Measure])}
```

LOD Expressions

For example, suppose we have a dataset that contains sales information for different regions and product categories. We want to create a bar chart that shows the total sales for each region, but we also want to see the combined average sales for all regions.

This is where LOD expressions come in handy.

With an LOD expression, we can create a calculated field that determines the average sales for all regions, regardless of what is selected in the visualization. We can then add that to our bar chart and compare it to the total sales for each region.

Types of LOD Expressions

There are three types of LOD expressions in Tableau: FIXED, INCLUDE, and EXCLUDE. Each type allows for a different level of control over how data is aggregated.

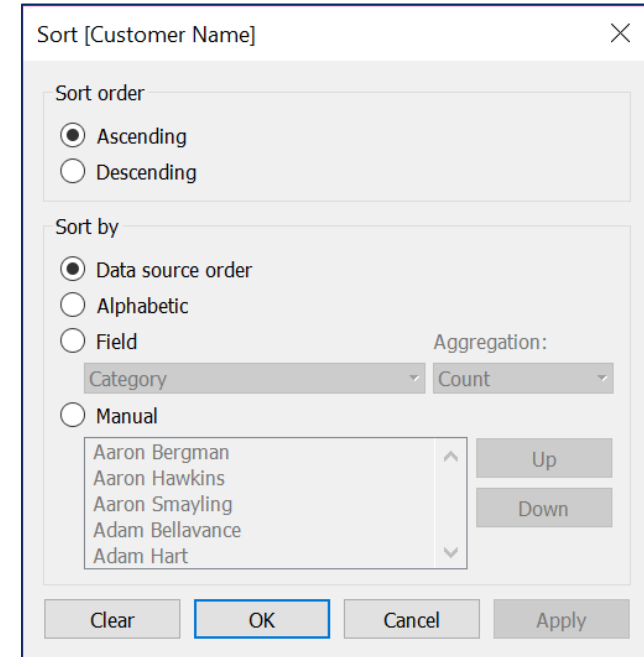
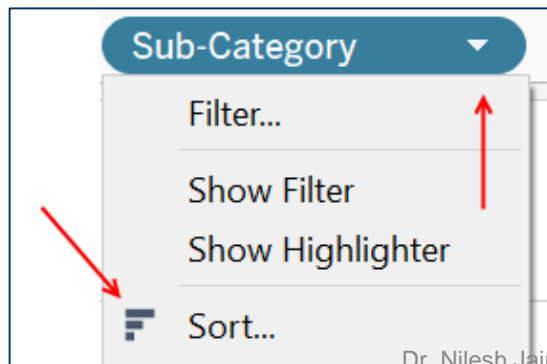
Feature	Fixed LOD	Include LOD	Exclude LOD
Definition	Fixed LOD expressions compute a value using the specified dimensions, without regard to the dimensions present in the view.	Include LOD expressions allow you to compute aggregations that are more granular than the view level, including additional dimensions.	Exclude LOD expressions enable the computation of aggregations that are less granular than the view, excluding certain dimensions.
Syntax Example	{FIXED [Dimension]: AGG([Measure])}	{INCLUDE [Dimension]: AGG([Measure])}	{EXCLUDE [Dimension]: AGG([Measure])}
Use Case	Use Fixed LOD for calculations that need to be constant across the entire dataset or within specific groupings defined by the fixed dimensions	Use Include LOD when you need to include additional dimensions in your calculation that are not in the view <small>Dr. Nilesh Jain</small>	Use Exclude LOD when you want to remove certain dimensions from your calculation, making it less detailed than the current view

SORTING & FILTERING

- ▶ Analysis can be enhanced by sorting results
- ▶ Sorting can be done using buttons for simple sorting

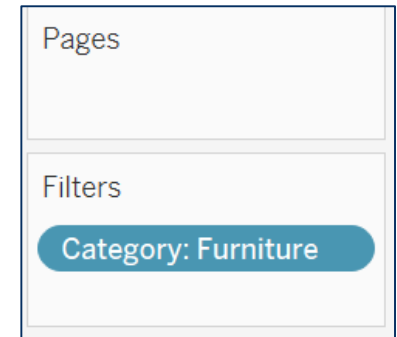


- ▶ Or ... manually through the advanced sorting dialog which is achieved by right-clicking on a Pill from the Shelf and clicking **Sort**.

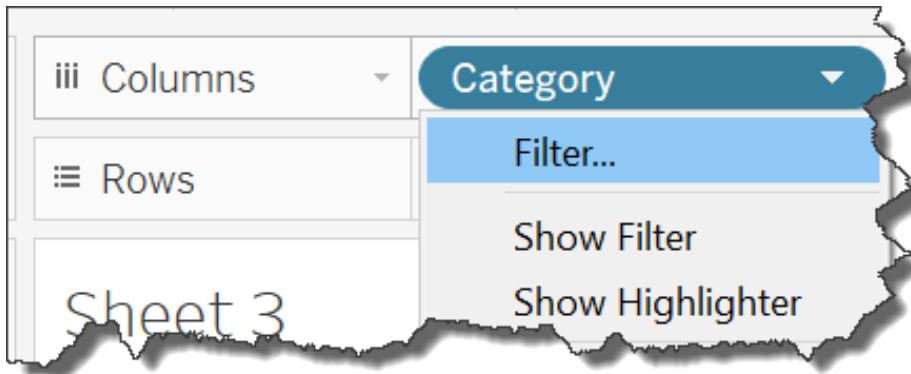


SORTING & FILTERING

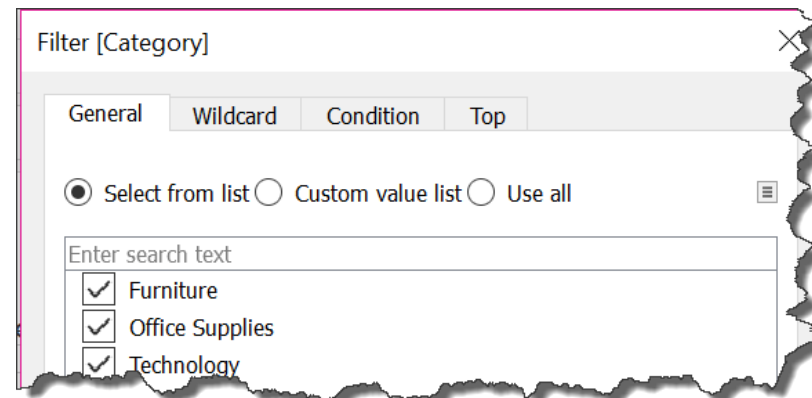
- ▶ Filtering results allows you to focus on particular aspects of your data
- ▶ Filter by dragging data fields from the Data pane to the Filters card



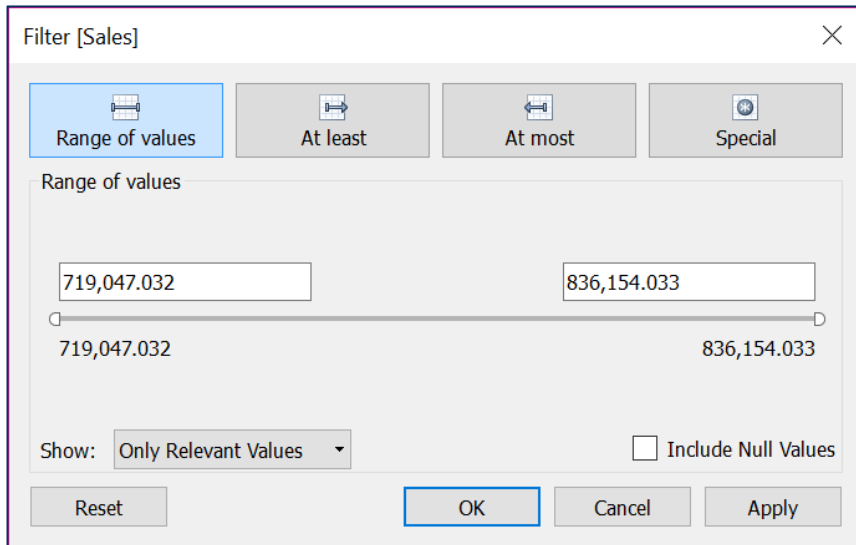
- ▶ Filtering can also be created by right-clicking a Pill on a Shelf



- ▶ In either case, a Filter dialog box will reflect the data type chosen and prompt you for additional criteria



Numeric Filter Dialog Box



Filter [Sales]

Range of values | At least | At most | Special

Range of values

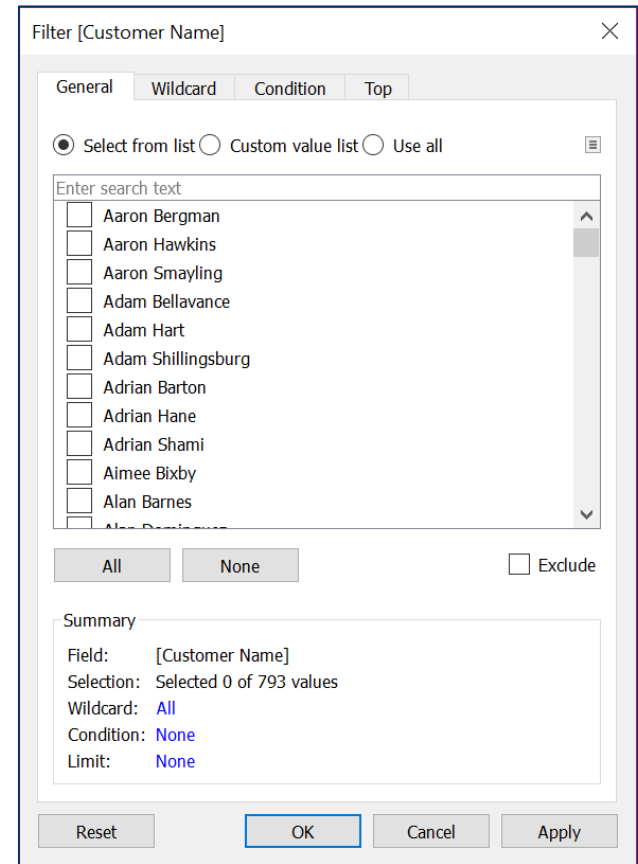
719,047.032 | 836,154.033

719,047.032 | 836,154.033

Show: Only Relevant Values | ☐ Include Null Values

Reset | OK | Cancel | Apply

Text Filter Dialog Box



Filter [Customer Name]

General | Wildcard | Condition | Top

☒ Select from list ☐ Custom value list ☐ Use all

Enter search text

- ☐ Aaron Bergman
- ☐ Aaron Hawkins
- ☐ Aaron Smayling
- ☐ Adam Bellavance
- ☐ Adam Hart
- ☐ Adam Shillingsburg
- ☐ Adrian Barton
- ☐ Adrian Hane
- ☐ Adrian Shami
- ☐ Aimee Bixby
- ☐ Alan Barnes
- ☐ Alex Deminor

All | None | ☐ Exclude

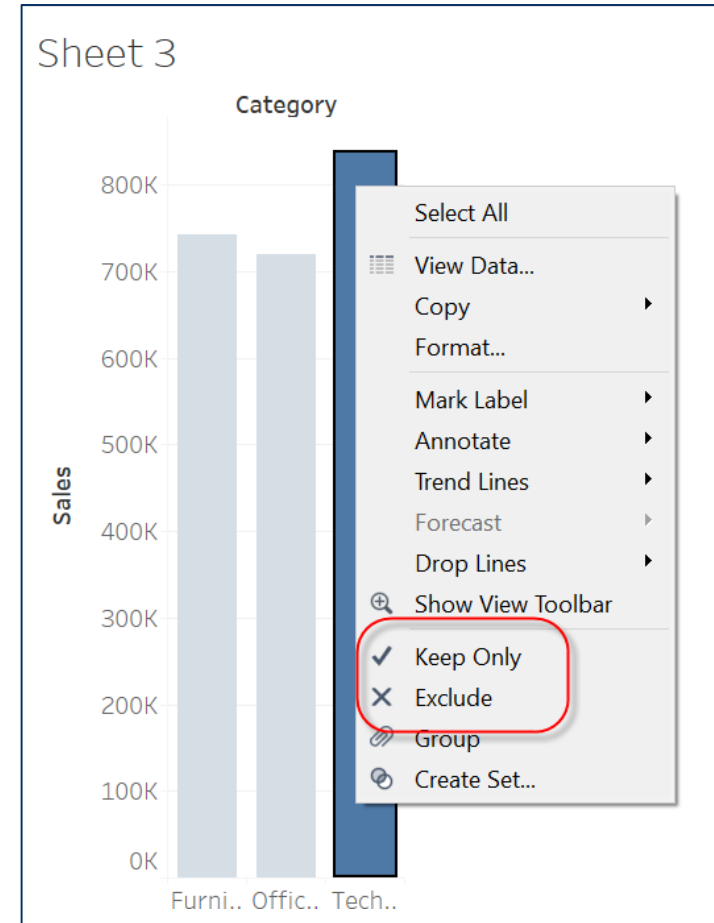
Summary

Field: [Customer Name]
 Selection: Selected 0 of 793 values
 Wildcard: All
 Condition: None
 Limit: None

Reset | OK | Cancel | Apply

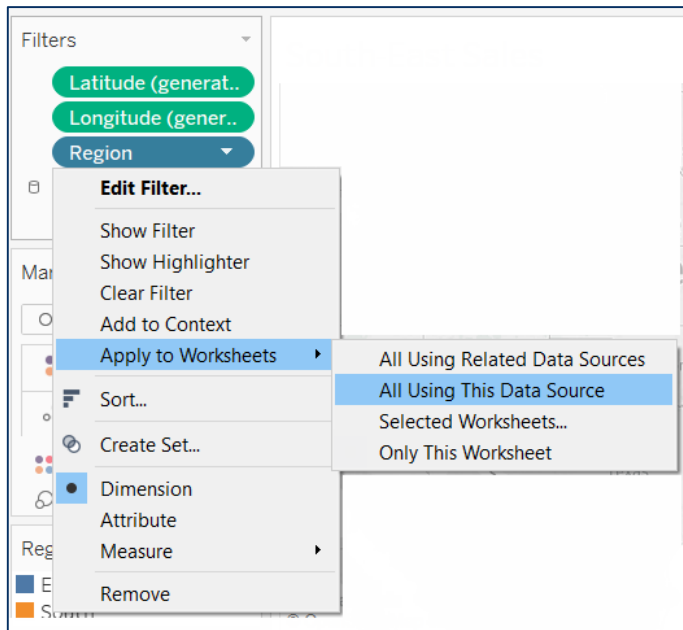
Filtering Data

- ▶ Simple filtering can be done by selecting the headers or marks in a View and choosing the **Keep Only** or **Exclude** options
- ▶ The Dimension members are removed from the View and the filtered fields are added to the Filters shelf
- ▶ When selecting headers that are part of a hierarchy all of the next level members are selected automatically
- ▶ Individual marks can be selected on a View, making it easy to focus on or remove outliers



Apply Filters to Multiple Worksheets

- ▶ When you had a filter to a worksheet, by default it applies to the current worksheet.
- ▶ Sometimes, however, you might want to apply the filter to other worksheets in the workbook.
- ▶ You can select specific worksheets to apply the filter to or apply it globally to all worksheets that use the same data source or related data sources.



On the Filters shelf, right-click the field and select: **Apply to Worksheets > All Using Related Data Sources**

- ▶ Filters that use this option are global across the workbook.

