

Begin to use Tableau Public

As you've been learning, Tableau is a powerful data visualization tool used by data professionals around the world. Tableau offers a free browser version of its software, Tableau Public, which enables learners like you to try out its capabilities. Tableau Public is the software you will use throughout this course on data visualization. In this reading, you will sign up (if you haven't already done so) and log in to Tableau Public. Then, you'll be guided through the Tableau Public platform and account features.

Sign in to Tableau Public

Sign in with an existing account

If you already have a Tableau.com account, use your existing login credentials to sign in to Tableau Public. Click [here](#) to learn more. If this is your first time signing in to Tableau Public with your Tableau.com account, set an account password by resetting your password. To do so, select [reset password](#).

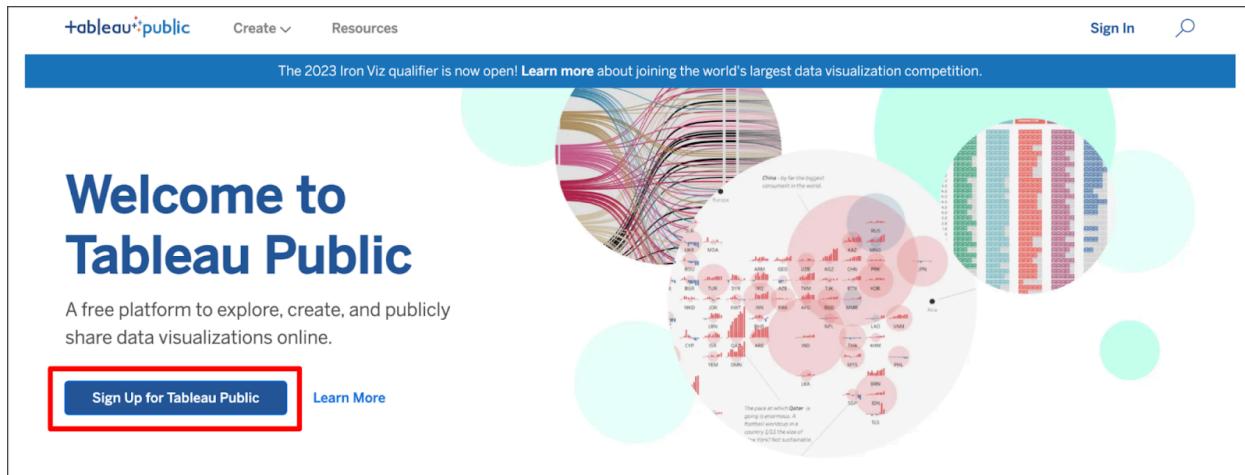
Sign in for the first time

If you do not yet have a pre-existing Tableau.com or Tableau Public account, use these instructions to create one. If you have a Tableau Public account, skip ahead to the "Navigate Tableau Public" section

First, go to the [Tableau Public home page](#). If this link does not open to the Tableau Public homepage, enter public.tableau.com in your browser's address bar.

Note: Tableau Public works best on Chrome (Windows, Mac, Android), Edge (Windows), Firefox (Windows and Mac), Safari (Mac and IOS).

Next, click **Sign Up for Tableau Public**.



This is a free platform to explore, create, and publicly share data visualizations online. There is a hyperlink option to learn more.

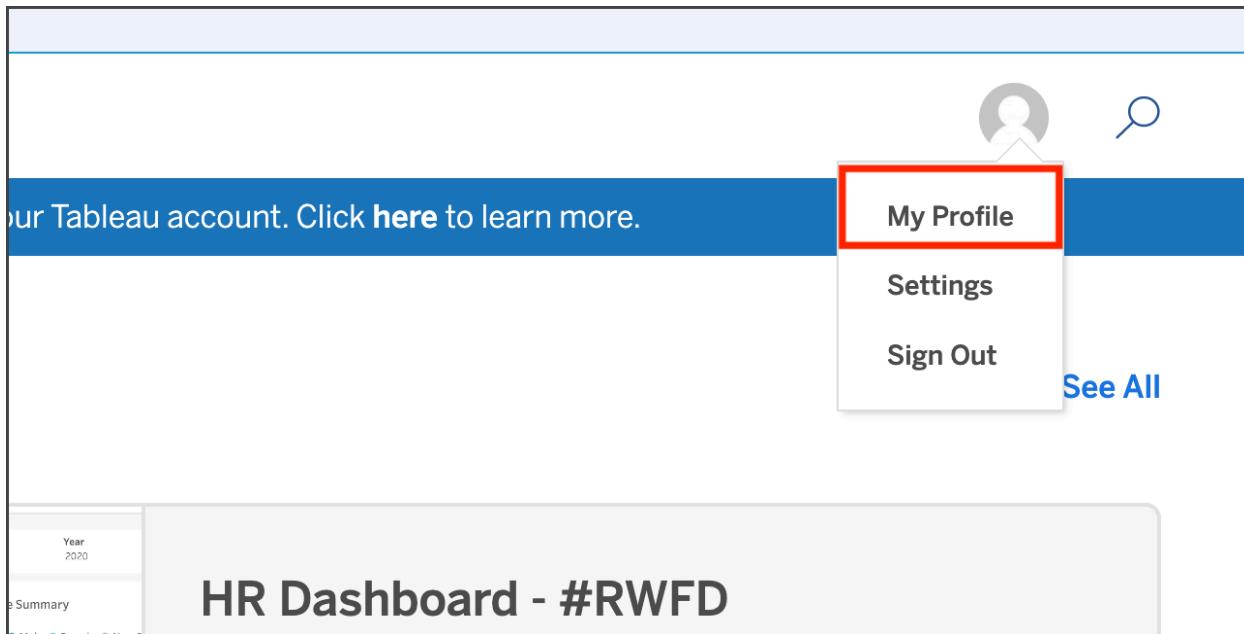
Fill in all the required fields and click **Create My Account**.

Navigate Tableau Public

The Tableau Public home page contains resources and guides to help data professionals learn more about and get inspired by data visualizations. You can explore any and all of the links on this landing page to help enhance your knowledge of Tableau. If you're new to Tableau Public, the most helpful place to start is the Learn page, which has how-to videos, (free to use) sample data, and user forums.

Access My Profile

During this course, the instructor will give you the opportunity to log in to Tableau Public and follow along in the creation of a data visualization. Select the user symbol icon on the Tableau Public homepage then **My Profile** from the dropdown menu to get started.



Create a Viz

Within your Tableau Public profile, you'll find tabs for **Vizzes**, **Favorites**, **Following**, and **Followers**. If you haven't created a public viz yet, there are two buttons in the **Vizzes** tab: **Create a Viz** and **Explore Sample Data**. Selecting the Explore Sample Data button is a great way to try out the tool on your own and test how the software works in a sandbox-like environment. There is also a **Create a Viz** button at the upper right of the page. At the instructor's prompt, select either of the two **Create a Viz** buttons.

Vizzes 0

Favorites 0

Following 0

Followers 0

Create a Viz

Get Started

Connect to your data to create a visualization and save it to your profile. Need some data? Explore our sample data sets for inspiration.

[Create a Viz](#)

[Explore Sample Data](#)

Want to use Tableau Public offline?

[Download the free Desktop app](#)

The text on this page reads: Connect to your data to create a visualization and save it to your profile. Need some data? Explore our sample data sets for inspiration. Want to use Tableau Public offline? There is a hyperlink to Download the free Desktop app.

After you select **Create a Viz**, you will be directed to a screen that asks you to connect to data.

Tableau Public needs data to work with, such as a spreadsheet, .json, or .csv file, for example.

When prompted by the instructor, upload the data provided using the **Connect to Data** screen. You can also use any of the sample data that you find in the [Learn](#) area.

Connect to Data

Connect to the data you need to visualize. [Learn more](#)

Files

Connectors

Drag and drop a file

or

[Upload from computer](#)

The Connect to Data screen. Connect to the data you need to visualize. There is a hyperlink to Learn more. The Files tab is open, where you can drag and drop a file or upload from computer. After you upload data, you are ready to start designing data visualizations. Happy designing, future Viz Whiz!

Key takeaways

Now that you've completed this reading, you should be able to access Tableau Public with your own account, navigate the Tableau Public resources, and connect to data. These are your first steps to learning how to design data visualizations with Tableau!

Resources for more information

To help you troubleshoot or to learn more, explore the following links:

- Tableau Public not working? Check out these [Technical specifications and storage requirements](#).
- [The Tableau Public Discover page](#) includes 'Viz of the Day' and other beautiful vizzes designed on the platform.
- [Google Career Certificates](#) page on Tableau Public: This gallery contains all the visualizations created in the video lessons so you can explore these examples more in-depth.
- [Tableau Public resources page](#): This links to the resources page, including some how-to videos and sample data.
- [Tableau Accessibility FAQ](#): Access resources about accessibility in Tableau visualizations using the FAQ, which includes links to blog posts, community forums, and tips for new users.
- [Tableau community forum](#): Search for answers and connect with other users in the community on the forum page.
- [Build Your Data Literacy course](#): Build your data literacy skills in order to interpret, explore, and communicate effectively with data.

Visualizations in spreadsheets and Tableau

This reading summarizes the seven primary chart types: column, line, pie, horizontal bar, area, scatter, and combo. Then, it describes how visualizations in spreadsheets compare to those in Tableau.

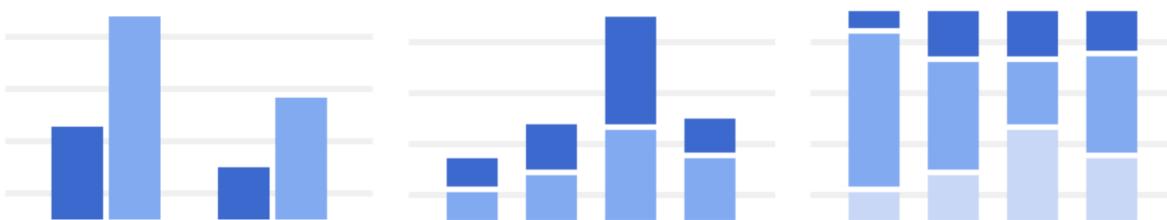
Primary chart types in spreadsheets

In spreadsheets, **charts** are graphical representations of data from one or more sheets. Although there are many variations to choose from, we will focus on the most broadly applicable charts to give you a sense of what is possible in a spreadsheet. As you review these examples, keep in mind that these are meant to give you an overview of visualizations rather than a detailed tutorial. Another reading in this program will describe the applicable steps and process to create a chart more specifically. When you are in an application, you can always select **Help** from the menu bar for more information.

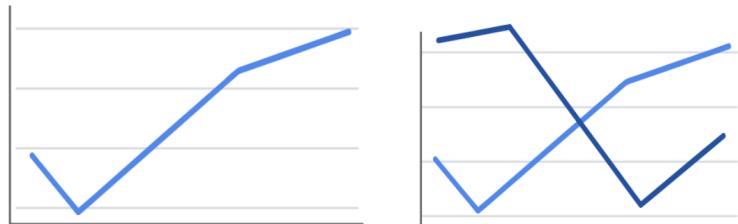
- To create a chart In Google Sheets, select the data cells, click **Insert** from the main menu, and then select **Chart**. You can set up and customize the chart in the dialog box on the right.
- To create a chart in Microsoft Excel, select the data cells, click **Insert** from the main menu, and then select the chart type. Tip: You can optionally click **Recommended Charts** to view Excel's recommendations for the data you selected and then select the chart you like from those shown.

These are the primary chart types available:

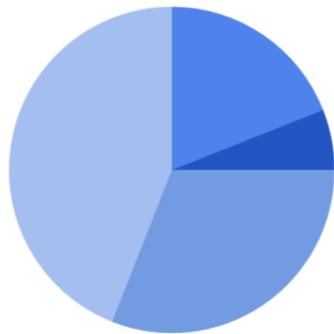
- **Column (vertical bar)**: a column chart allows you to display and compare multiple categories of data by their values.



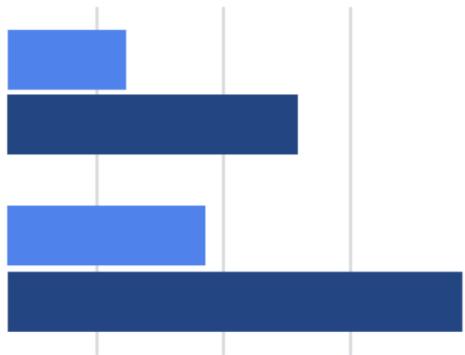
- **Line**: a line chart showcases trends in your data over a period of time. The last line chart example is a combo chart which can include a line chart. Refer to the description for the combo chart type.



- **Pie:** a pie chart is an easy way to visualize what proportion of the whole each data point represents.



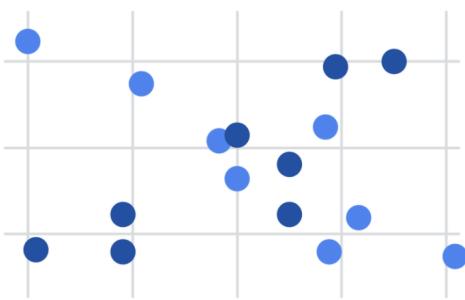
- **Horizontal bar:** a bar chart functions similarly to a column chart, but is flipped horizontally.



- **Area:** area charts allow you to track changes in value across multiple categories of data.



- **Scatter:** scatterplots are typically used to display trends in numeric data.



- **Combo:** combo charts use multiple visual markers like columns and lines to showcase different aspects of the data in one visualization. The example below is a combo chart that has a column and line chart together.



You can find more information about other charts here:

- [Types of charts and graphs in Google Sheets](#): a Google Help Center page with a list of chart examples you can download.
- [Excel Charts](#): a tutorial outlining all of the different chart types in Excel, including some subcategories.

How visualizations differ in Tableau

As you have also learned, Tableau is an analytics platform that helps data analysts display and understand data. Most if not all of the charts that you can create in spreadsheets are available in Tableau. But, Tableau offers some distinct charts that aren't available in spreadsheets. These are handy guides to help you select chart types in Tableau:

- [Which chart or graph is right for you?](#) This presentation covers 13 of the most popular charts in Tableau.
- [The Ultimate Cheat Sheet on Tableau Charts](#). This blog describes 24 chart variations in Tableau and guidelines for use.

Types of visualizations in Tableau

In addition to more traditional charts, Tableau also offers some more specific visualizations that you can use in your dashboard design:

- **Highlight tables** appear like tables with conditional formatting. Review the [steps to build a highlight table](#).
- **Heat maps** show intensity or concentrations in the data. Review the [steps to build a heat map](#).
- **Density maps** illustrate concentrations (such as a population density map). Refer to [instructions to create a heat map for density](#).
- **Gantt charts** demonstrate the duration of events or activities on a timeline. Review the [steps to build a Gantt chart](#).
- **Symbol maps** display a mark over a given longitude and latitude. Learn more from this [example of a symbol map](#).

- **Filled maps** are maps with areas colored based on a measurement or dimension. Explore an [example of a filled map](#).
- **Circle views** show comparative strength in data. Learn more from this [example of a circle view](#).
- **Box plots**, also known as **box and whisker charts**, illustrate the distribution of values along a chart axis. Refer to the [steps to build a box plot](#).
- **Bullet graphs** compare a primary measure with another and can be used instead of dial gauge charts. Review the [steps to build a bullet graph](#).
- **Packed bubble charts** display data in clustered circles. Review the [steps to build a packed bubble chart](#)

Activity Overview

Now that you know how to create a visualization in Tableau, you'll use the dataset and instructions in this activity to create your own visualization. If you have questions along the way, refer to the previous video, [Create a data visualization in Tableau](#).

In this activity, you'll practice the following skills:

- Connect data to Tableau.
- Create a chart.
- Customize your chart.
- Delete a chart or sheet.

By the time you complete this activity, you'll be able to create and customize visualizations in Tableau. This will enable you to share your valuable data insights with others.



Step-By-Step Instructions

Follow the instructions to complete each step of the activity. Then answer the question at the end of the activity before going to the next course item.

Step 1: Access the dataset

Click the following link and select Use Template to create a copy of the dataset. Download this dataset to your computer by selecting File > Download > Microsoft Excel (.xlsx). If you don't have a Google account, download the dataset directly from the attachment below.

Link to dataset: [CO2](#)

OR

Download dataset:

[CO2 Dataset](#)

[XLSX File](#)

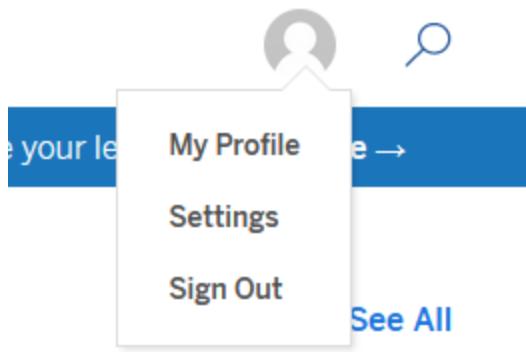


Step 2: Connect data to Tableau

1. Log in to Tableau Public. If you have not yet created an account, refer to the reading [Begin to use Tableau Public](#).

Note: Tableau frequently updates its user interface. The latest changes may not be reflected in the screenshots presented in this activity, but the principles remain the same. Adapting to changes in software updates is an essential skill for data analysts, and it's helpful for you to practice troubleshooting. You can also reach out to your community of learners on the discussion forum for help.

2. Select the user profile icon and choose My Profile to display your Tableau profile and any vizzes you've created.



3. Select the Create a Viz button.

A screenshot of the Tableau Public dashboard. At the top, there are tabs for 'Vizzes' (underlined in orange), 'Favorites', 'Following', and 'Followers'. To the right of these tabs is a blue 'Create a Viz' button. Below the tabs, the main area is titled 'Get Started' with the sub-instruction: 'Connect to your data to create a visualization and save it to your profile. Need some data? Explore our sample data sets for inspiration.' There are two buttons at the bottom: 'Create a Viz' (which has a red box drawn around it) and 'Explore Sample Data'. Below these buttons, there is a note about using Tableau Public offline and a link to download the free Desktop app.

4. When you select Create a Viz, Tableau may open the Connect to Data dialog box. If so, select the Files tab and upload the CO2 dataset you downloaded earlier.
If selecting Create a Viz does not open the Connect to Data dialog box, in the Tableau Public interface, select the Data tab and then New Data Source. Upload the CO2 dataset.
5. After you upload the data, notice the list of data connections and sheets beside the main Data-Source Interface. The data connection is the CO2 dataset you've connected. It contains eight sheets, including one labeled CO2 Data Cleaned.

The screenshot shows the Tableau Public interface. On the left, a sidebar titled 'Connections' displays a single entry: 'World_Bank_CO2' (Microsoft Excel). Below this, the 'Sheets' section lists several data tables: 'About', 'CO2 (kt) for Split', 'CO2 (kt) Pivoted', 'CO2 (kt) RAW DATA', 'CO2 Data Cleaned', 'CO2 Per Capita (Pivoted)', 'CO2 Per Capita RAW DATA', 'Metadata - Countries', and 'New Union'. A green box highlights the 'Data Source' tab at the bottom of the sidebar. On the right, the main canvas is titled 'World_Bank_CO2' and features a placeholder area with a grid icon and the text 'Drag tables here'. At the bottom of the canvas, there are sorting and filtering options: 'Sort fields' and 'Data source order'.

6. Double-click on the sheet CO2 Data Cleaned to load that sheet's data into the main part (canvas) of the Tableau Public page. Alternatively, drag and drop the sheet onto the canvas where it says Drag tables here.

Note: Loading a sheet twice may cause you to inadvertently create a table relationship between the loaded sheets (similar to joining tables in SQL). You'll explore this later in the course. For now, if you do this accidentally, don't worry! Just right-click on the second box to remove it from the table listings.

CO2 Data Cleaned+ (2_UYJGngRI21G)

Create Extract
Extract will contain all data. ⓘ

A screenshot of the Tableau interface. At the top, there's a header with the title "CO2 Data Cleaned+ (2_UYJGngRI21G)". Below the header, there are two dropdown menus: "CO2 Data Cleaned" and "CO2 Data Cleaned1". A red warning icon is positioned between them. A context menu is open over the "CO2 Data Cleaned1" field, listing options: Open..., Rename, Reset Table Name, Swap with root (CO2 Data Cleaned), Remove, Field names are in first row, Generate field names automatically, and Convert to Union... The "Remove" option is highlighted with a red rectangle.

A dotted line with a warning symbol connects the two. The down arrow in the right of CO2 data cleaned 1 field has been selected, which opens a menu with the following choices: Open, Rename, Reset Table Name, Swap with root (CO2 Data Cleaned), Remove, Field names are in first row, Generate field names automatically. The Remove option is highlighted.

7. When the sheet is loaded, Tableau displays the table schema with the field names, data types, etc. Select the Update Now button to bring up the first 100 rows in the table; you can increase the number of rows in the settings above the data view. In the following image, the number of rows displayed has been increased to 1,000.

A screenshot of the Tableau data view. The title bar says "Tableau Public - Book1". On the left, the sidebar shows connections ("World_Bank_CO2 Microsoft Excel") and sheets ("CO2 Data Cleaned (World_Bank_CO2) (2)", "CO2 Data Cleaned"). The main area shows a table with the following columns: Country Code, Country Name, Region, Year, CO2 (kt), and CO2 Per Capita (m...). The table has 6 rows. At the bottom right of the table, there's a "1.000" button with a red rectangle around it, indicating the number of rows displayed. The entire screenshot is framed by a red border.

Country Code	Country Name	Region	Year	CO2 (kt)	CO2 Per Capita (m...)
ABW	Aruba	Latin America & Cari...	1960	null	null
ABW	Aruba	Latin America & Cari...	1961	null	null
ABW	Aruba	Latin America & Cari...	1962	null	null
ABW	Aruba	Latin America & Cari...	1963	null	null
ABW	Aruba	Latin America & Cari...	1964	null	null
ABW	Aruba	Latin America & Cari...	1965	null	null
ABW	Aruba	Latin America & Cari...	1966	null	null

Each row corresponds to a single data point, and each column represents a different feature. Tableau automatically interprets the type of data in each column and displays the following icons above the column names, to indicate how Tableau has interpreted the data in the column:

- #: Numeric data
- Abc: String data
- Globe: Geographic data
- Calendar: Date data
- Calendar: Date and time data

In the previous image, Tableau has interpreted the first two columns as geographic data, the third column as string data, and the last three columns as numeric data.

Step 3: Access your data in Tableau

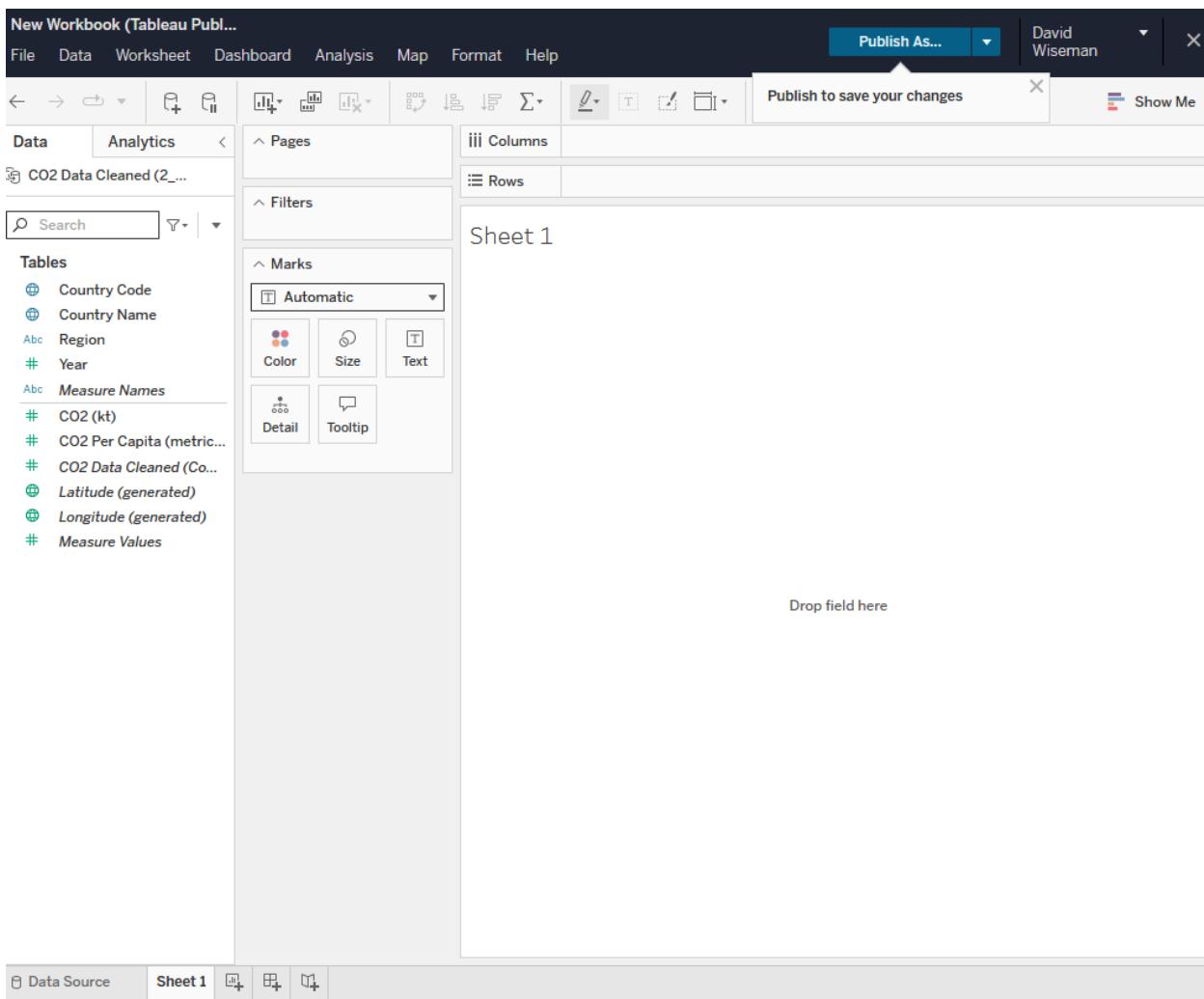
Now that you have all of your data loaded into Tableau, you can use it to create a visualization in which the CO2 emissions are displayed per country.

Select the Sheet 1 tab to open the New workbook pane in the display.

The screenshot shows the Tableau Data Source pane with the following details:

- Connections:** CO2 Data Cleaned (2_UYJGngRI21GC) is selected.
- Sheets:** The 'Sheet 1' tab is highlighted with a red box.
- Fields:**

Type	Field Name	Physical Type	Role
Globe	Country Code	CO2 Dat...	Count...
Abc	Country Name	CO2 Dat...	Count...
#	Region	CO2 Dat...	Region
#	Year	CO2 Dat...	Year
#	CO2 (kt)	CO2 Dat...	CO2 (...)
#	CO2 Per Capita (metric tons)	CO2 Dat...	CO2 P...
- Actions:** Buttons for 'Update Now' and 'Update Automatically' are visible.



Step 4: Understand dimensions and measures

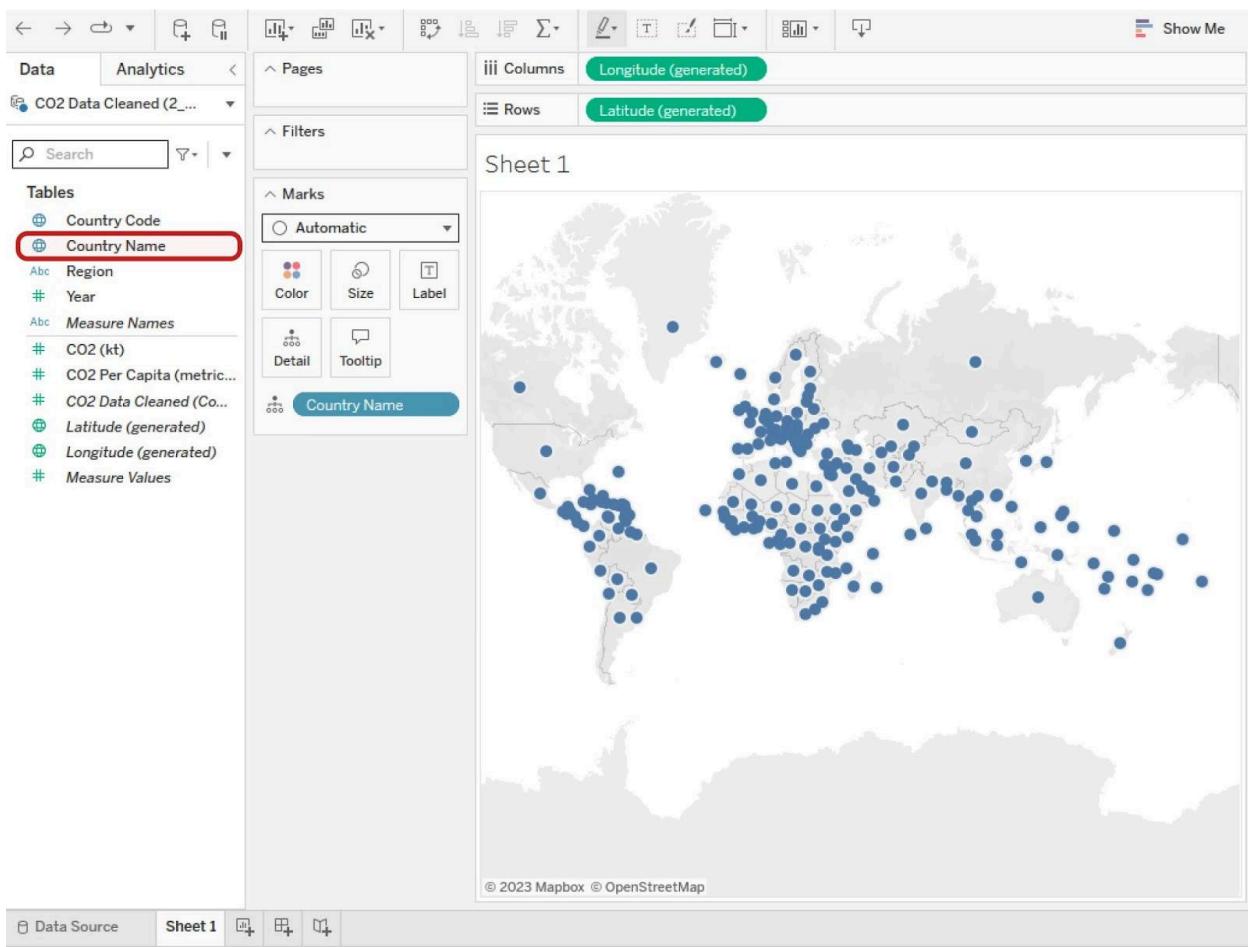
The Data pane in the side bar displays column names in a list. In Tableau and most business intelligence software, you will find two types of data elements: dimensions and measures. According to the [Tableau documentation](#):

- Dimensions contain qualitative values (such as names, dates, or geographical data). You can use dimensions to categorize, segment, and reveal the details in your data. Dimensions affect the level of detail in the view.
- Measures contain numeric, quantitative values that you can measure. Measures can be aggregated. When you drag a measure into the view, Tableau applies an aggregation to that measure (by default).

In the Data pane of the Tableau side bar, you'll see dimensions listed above the gray line and measures below the gray line (under Measure Names). These allow you to build and customize charts.

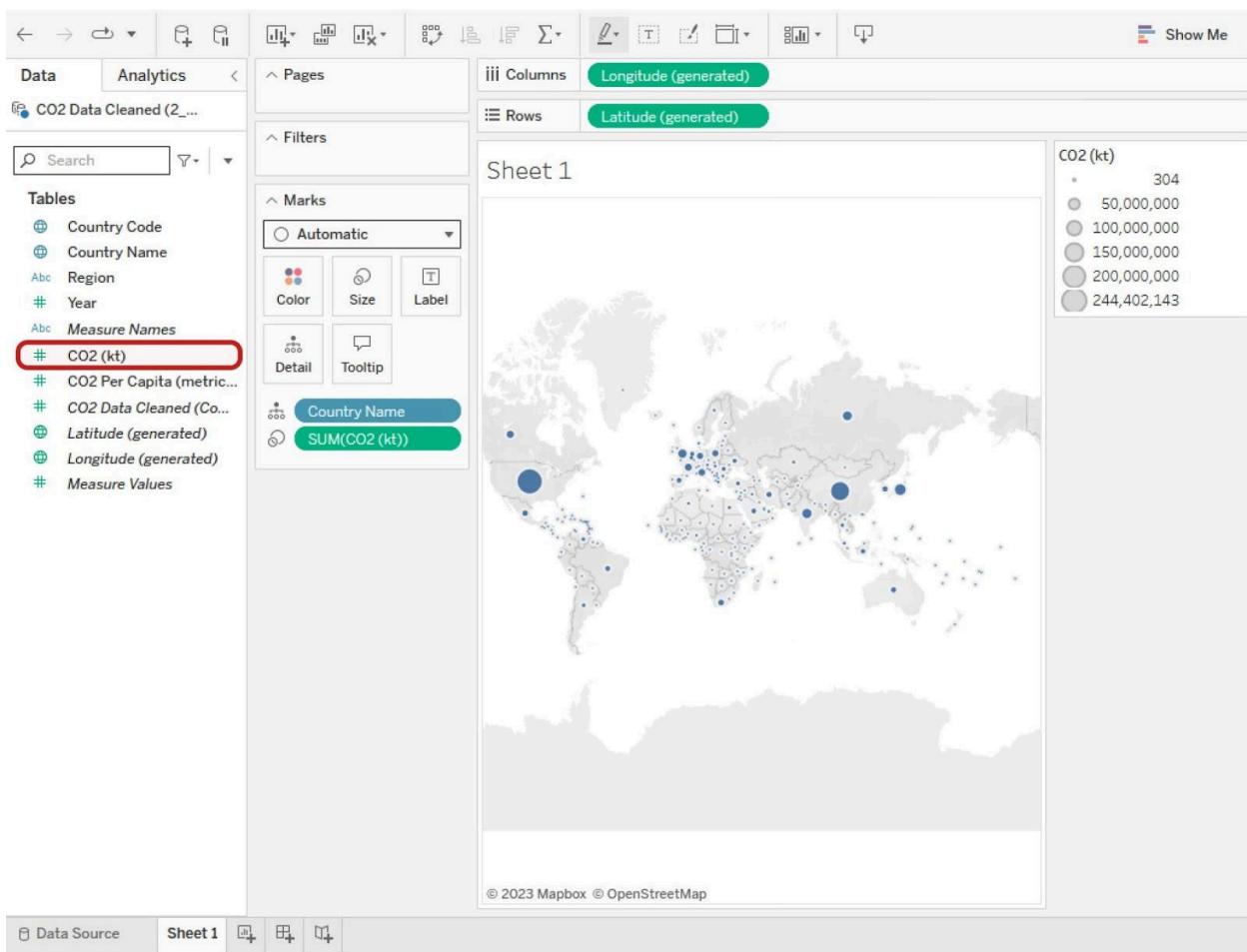
Step 5: Create a visualization chart of CO2 emissions

Now, create a chart that displays the CO2 emissions per country. In the Data pane of the sidebar, double-click the Country Name dimension. The canvas displays a map of the countries with points indicating which countries are represented in the data.



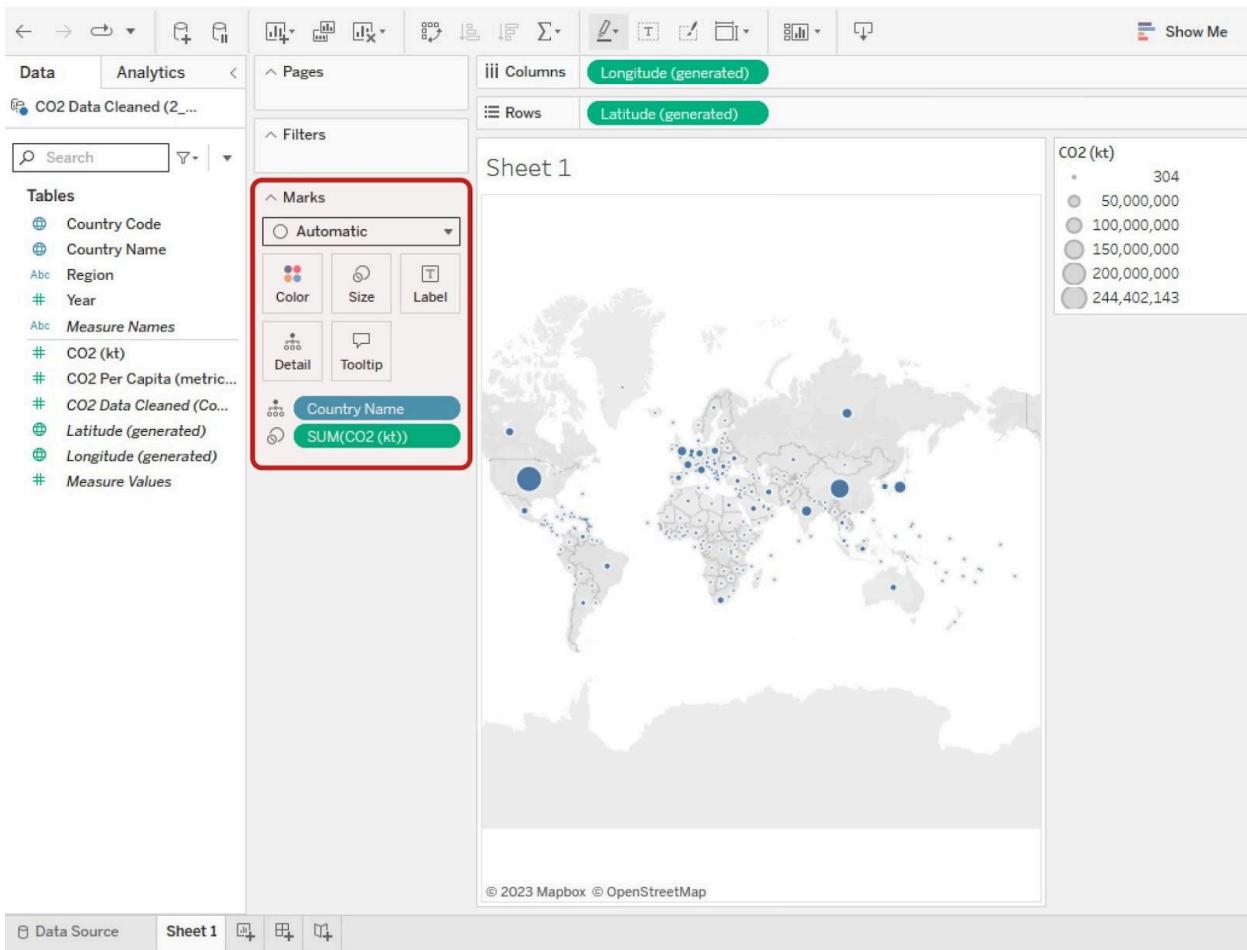
The points are all the same size because, if there is no measure selected, Tableau defaults to scale each country equally. If you want to scale point size by kilotons (kt) of CO2 emissions, you need to include a specific measure.

To do this, double-click (or drag and drop onto the sheet) the measure CO2 (kt) in the Data pane. This changes the size of the dots to be proportional to the amount of CO2 emitted, as in the example below.



There is a callout box around CO2 (kt). The world map now displays a dot marker on each country, but the point vary in size based on each country's CO2 emissions.

Tableau has a wide selection of options for depicting the measure of a given dimension. Most of these options are contained in the Marks card, Filter shelf, and Page shelf.

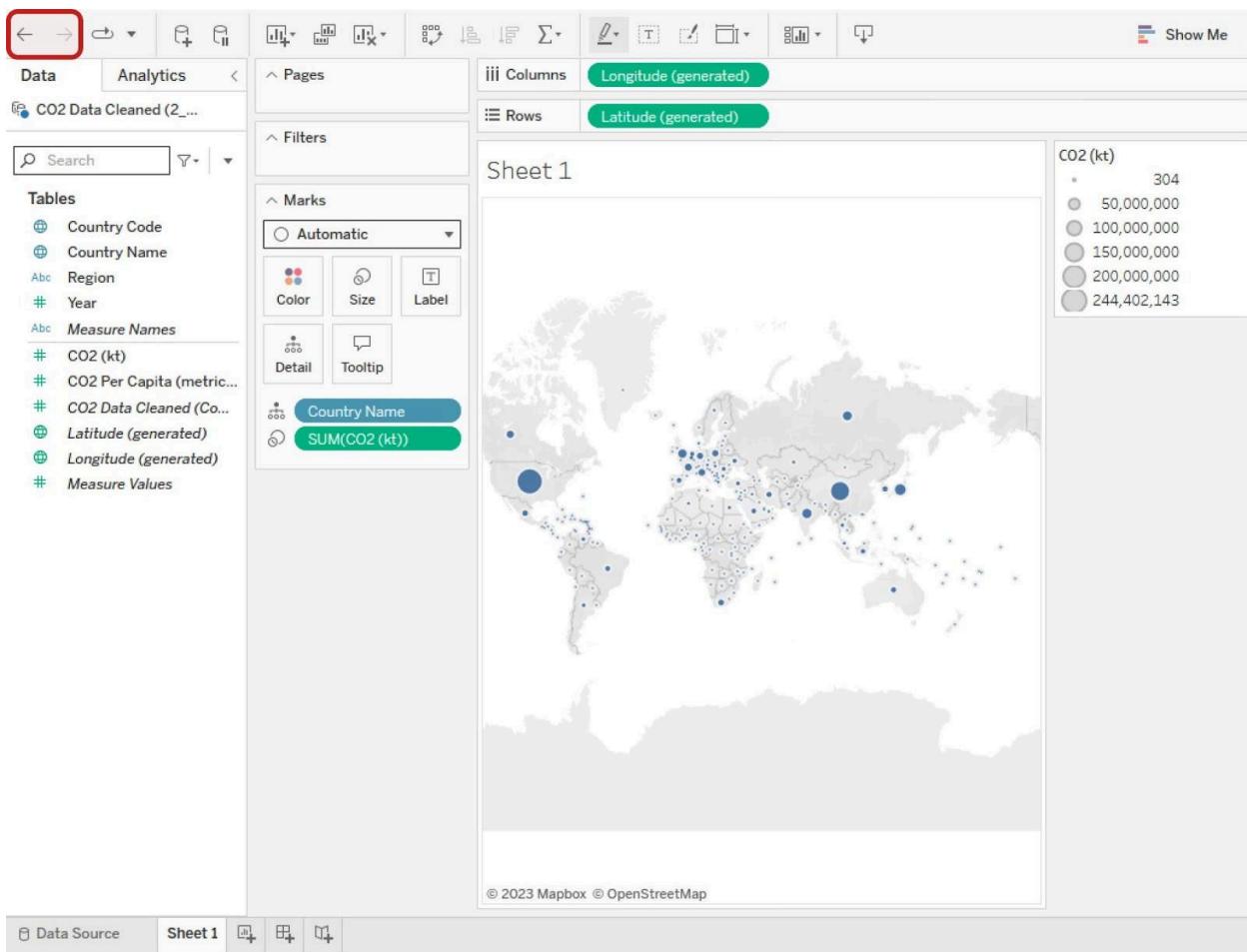


Step 6: Customize your chart's dimensions and measures

If you drag and drop a measure on one of the option classes, such as Color, Size, or Label, you can change that aspect of the measure's visualization on the chart.

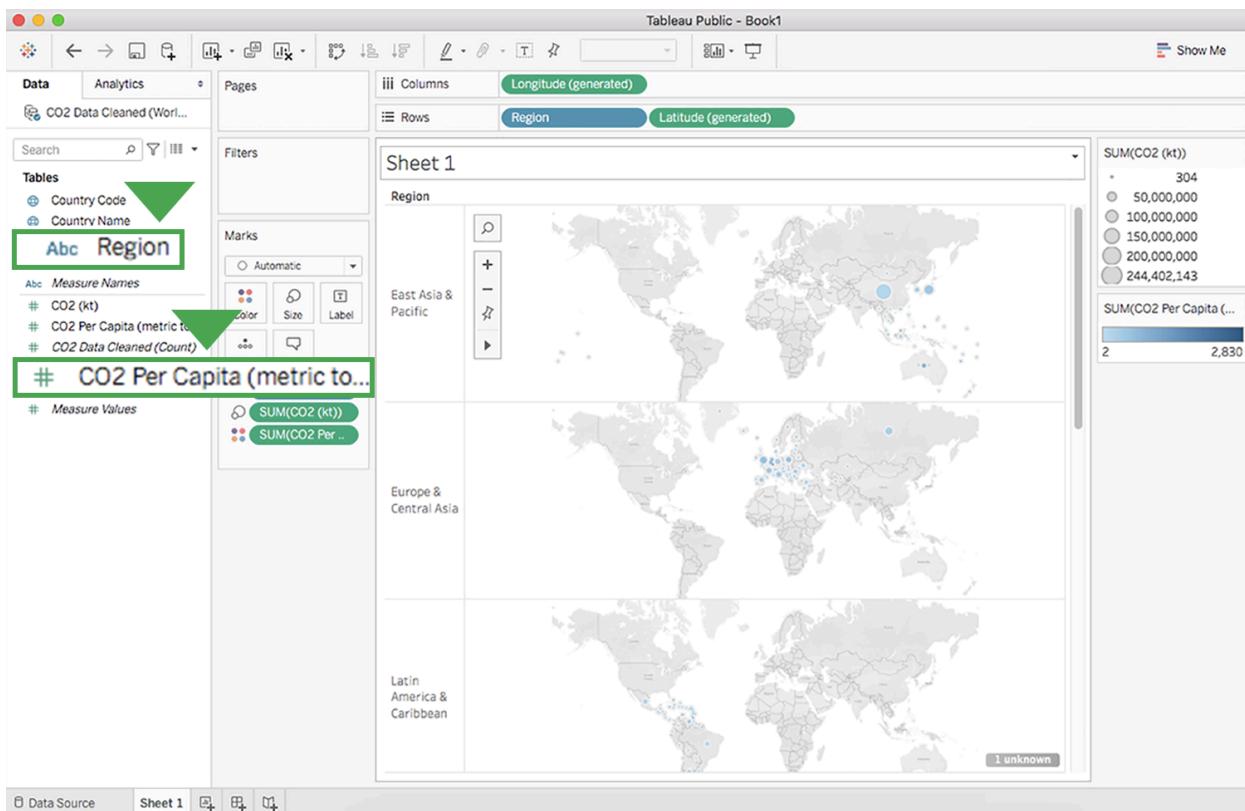
For example, if you want to change the color of the CO2 measure, drag the measure CO2 (kt) from the sidebar to the Marks card and drop it on the Color box. This will change the measure's configuration to a color breakdown. Then, select the Color box in the Marks card to pull up a menu for changing the color and its options. To change the color, select the Edit Colors button.

Try out the different options available. You can always reverse a change by selecting the Back arrow button in the toolbar or using your computer's default undo keyboard shortcut. Similarly, you can redo changes you make by selecting the Forward arrow button.



Change dimensions and measures

Changing either the dimension or the measure on a chart is simple. Suppose that, instead of visualizing the CO2 per country, you want to chart the CO2 per capita per region. To do this, in the sidebar, double-click on the dimension Region. Then double-click on the measure CO2 Per Capita. This will result in seven world charts: East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, North America, South Asia, and Sub-Saharan Africa.

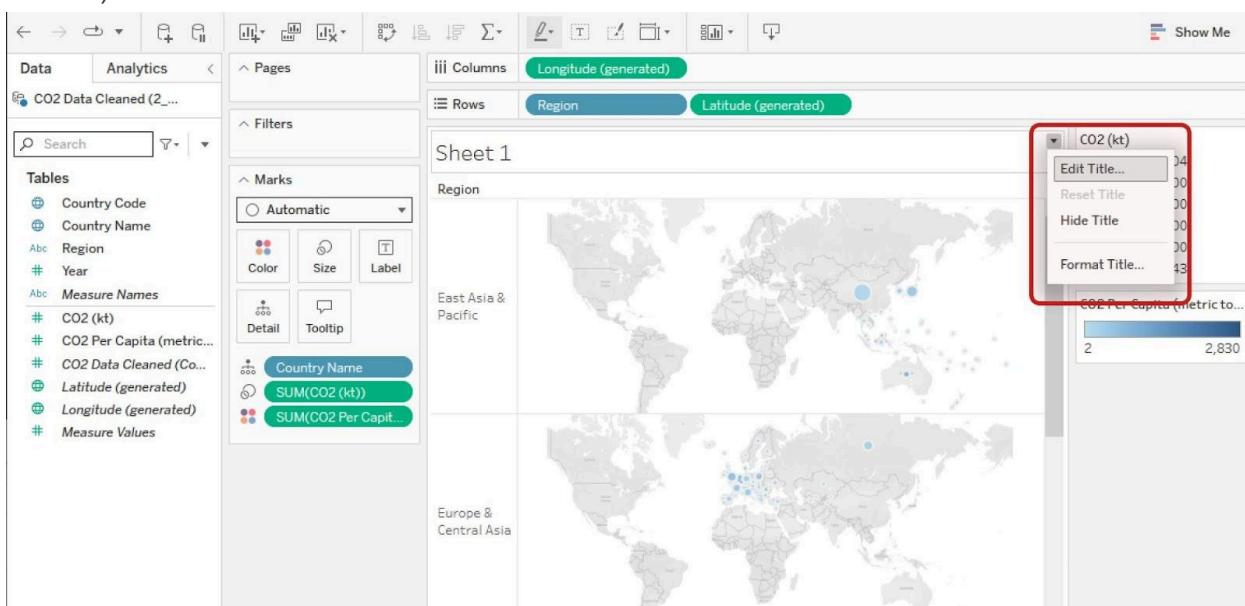


Just below this, under measure names, there is a callout box around CO2 per capita in metric tons.

Step 7: Customize your chart's title

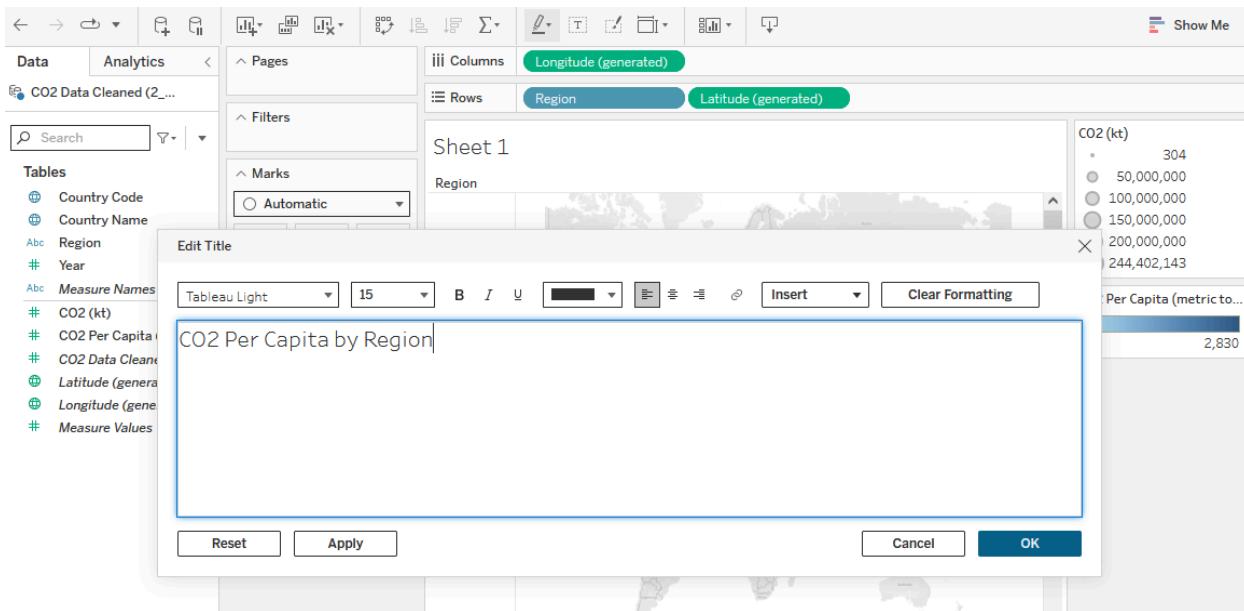
Currently, the title of this chart is Sheet 1. To give the chart a more descriptive title:

1. Point to the title box, select the dropdown list menu, and then select Edit Title to open the Edit Title dialog box. (You can also double-click Sheet 1 to open the Edit Title dialog box where you can change the title.)



The menu includes options to Edit Title, Reset Title, Hide Title, and Format Title. Edit Title is highlighted.

2. Enter any title you wish and select OK. A descriptive title helps people understand what the chart visual seeks to convey. For example, you could title this chart “CO2 Per Capita by Region.”

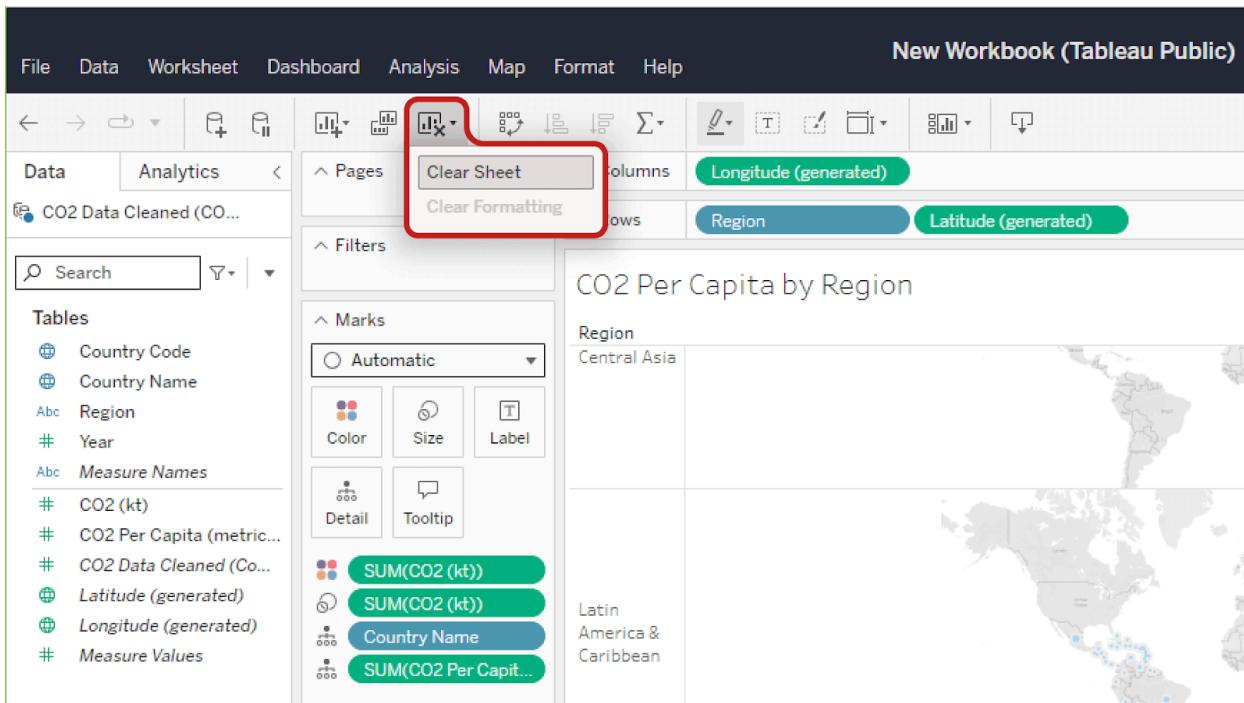


You can also choose to insert an object, or clear formatting. CO2 Per Capita by Region has been typed into the title field. Below four buttons allow you to Reset, Apply, Cancel, or OK

Step 8: Delete a chart or sheet

Delete a chart

To delete a chart from the sheet, select the Clear Sheet button in the toolbar.



On this same dropdown menu, the clear formatting option is greyed out.]
This will completely delete the chart and bring you back to an empty sheet.

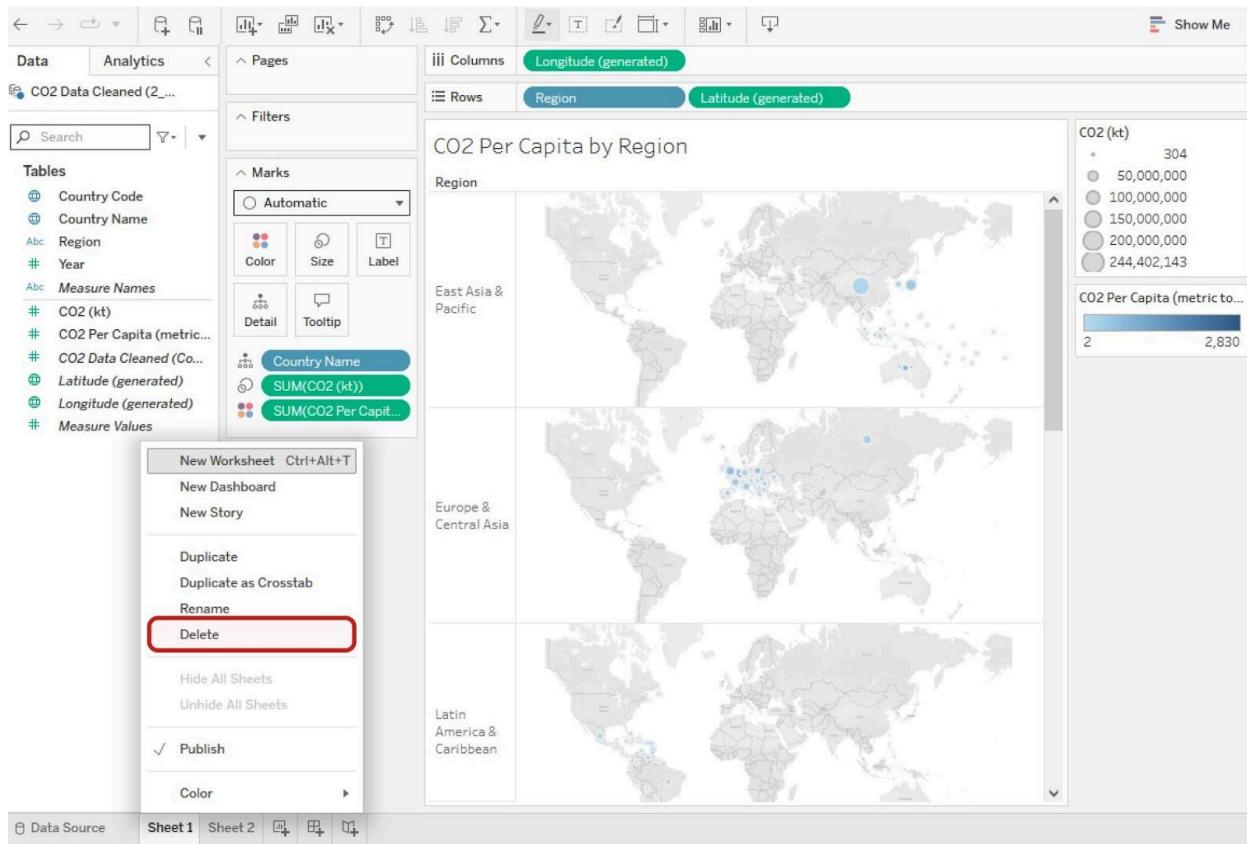
Note: This will not remove the sheet title.

If you delete a chart by accident or change your mind, select the Back button to undo the deletion.

Delete a sheet

If you want to delete a sheet in its entirety, right-click on the sheet's tab at the bottom of the screen and select Delete. You won't be able to delete a sheet if it is the only sheet in your file.

Note: Unlike clearing a sheet, deleting a sheet altogether cannot be reversed!



Menu choices include New Worksheet, New Dashboard, New Story, Duplicate, Duplicate as Crosstab, Rename, Delete, Hide All Sheets, Unhide All Sheets, Publish, and Color.

The skills you've practiced in this hands-on activity will help you get started visualizing your data. This is far from the end of the story, though. As you progress through this course, you'll continue refining your Tableau skills.

Pro Tip: Save the activity dataset

Be sure to save a copy of the dataset you used to complete this activity. You can use it for further practice or to help you work through your thought processes for similar tasks in a future data analyst role.

You have started exploring Tableau as a data visualization tool in business intelligence dashboards to convey insights with stakeholders. Throughout this program, you will continue to use and access Tableau—eventually using it to create your own dashboards. This reading will enable you to familiarize yourself with Tableau's interface and functionality.

Create a profile on Tableau Public

With Tableau Public, you can create and share visualizations. If you don't already have an account, make one on the [Tableau Public](#) site. Note that trying to make an account from the main page will sign you up for a Tableau Free Trial rather than a Tableau Public account.

The screenshot shows the Tableau Public homepage. At the top, there is a navigation bar with the Tableau Public logo, a 'Create' dropdown menu, and a 'Resources' link. To the right of the navigation is a 'Sign In' button and a user icon. A blue banner at the top of the main content area says, 'You can now log in to Tableau Public using your Tableau account. Click [here](#) to learn more.' Below this, the main heading 'Welcome to Tableau Public' is displayed in large, bold, dark blue text. Underneath the heading, a subtext reads, 'A free platform to explore, create, and publicly share data visualizations online.' At the bottom of the main content area are two buttons: 'Sign Up for Tableau Public' (in white text on a dark blue background) and 'Learn More' (in light blue text on a white background). The central part of the page features a large, circular data visualization composed of various smaller charts and graphs, illustrating global consumption patterns.

The difference between these two options is that a Free Trial lasts for 14 days, whereas Tableau Public gives you long-term access through the web version of the program. It has some limitations compared to the other versions of Tableau, but it is free to use and will enable you to complete the upcoming activities. You can also use your Tableau credentials to access Tableau Public if you already have an account! You are welcome to try the free trial or purchase Tableau, but it is not required for this program.

Complete the information in the signup form. When you click the **Create My Profile** button, you'll be transferred to your profile page. This is where your Tableau Public visualizations can be made public to share with your peers. In the tabs on this page, you can access lists of visualizations you've made, visualizations you've favorited, authors you are following, and authors who are following you. By clicking **Edit Profile**, you can add additional information like your bio, title, organization, and links to social media accounts. This is also where you can enable Tableau Public's **Hire Me** button. The **Hire Me** button will indicate to potential hiring managers that your Tableau skills are available for hire.

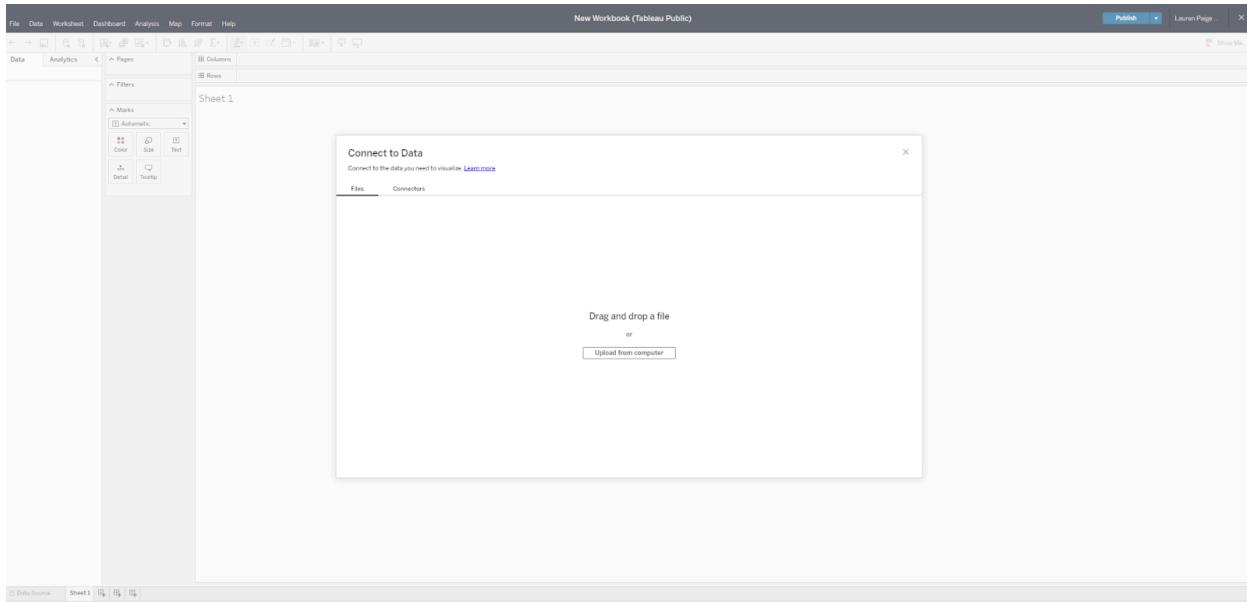
Optional: Download the desktop version

With the desktop application, you can use features from Tableau Public without connecting to the internet. It is free to use, just like Tableau Public's online version. Keep in mind that this application cannot be used on the Chromebook operating system and is not required for this course. If you are using Windows or Mac OS, this desktop application will enable you to complete upcoming activities that use Tableau Public. To download [Tableau Public Desktop](#)

[Edition](#) (this is optional), log into your account and review the [system requirements](#) for your operating system.

Loading and linking data

Tableau enables you to load in your own data and link it to other datasets directly in the platform. When you log in, choose to **Create a Viz**. This will open a new worksheet where you can upload data or connect to online sources, such as your Google Drive.



Once you upload data to your worksheet, it will populate the Connections pane.

The screenshot shows the Tableau Public interface. On the left, there's a sidebar with 'Connections' (containing 'Copy of CO2 Dataset (Microsoft Excel)') and 'Sheets' (listing various CO2-related datasets like 'CO2 (kt) for Split', 'CO2 (kt) Pivoted', etc.). The main workspace is titled 'Copy of CO2 Dataset' and contains a grid placeholder with the instruction 'Drag tables here'. At the bottom, there are tabs for 'Data Source' and 'Sheet 1', along with other standard spreadsheet-like tools.

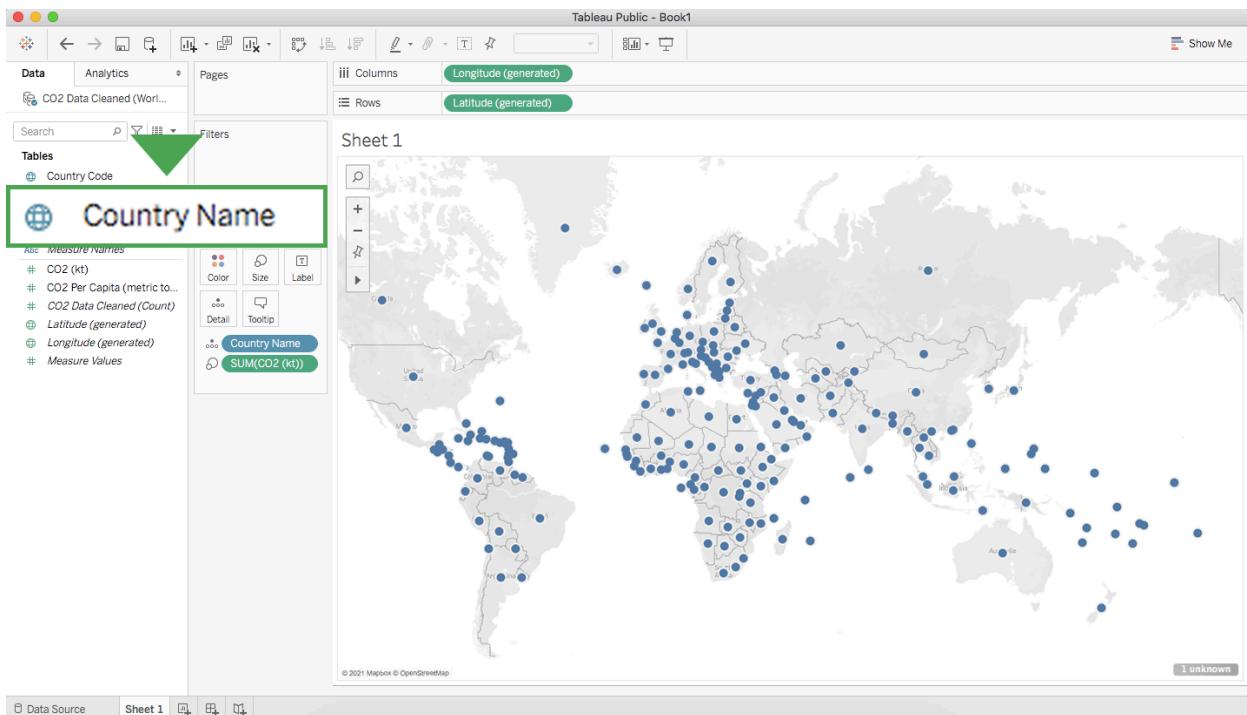
You can add more connections to other data sources in order to build visualizations that compare different datasets. Simply drag and drop tables from the Sheets section in order to join tables and generate those connections:

This screenshot shows a more complex setup in Tableau. A 'Join' dialog is open, connecting 'CO2 Data Cleaned' (Year) to 'Energy' (Year). Below the dialog, the joined table structure is displayed, showing columns from both datasets: Country Code, Country Name, Region, Year, CO2 (kt), CO2 Per Capita (metric tons), Country, Year1, and Energy use (kg of oil eq.). The interface includes a 'Connections' sidebar with multiple datasets and a main workspace for building the visualization.

Dimensions and measures

Tableau uses dimensions and measures to generate customized charts. For example, check out this chart focusing on CO2 emissions per country. The Country Name dimension can be used to

show a map of the countries on the planet with dots indicating which countries are represented in the data.



The dots are all the same size because—with no measure selected—Tableau defaults to scale each country equally. If you want to scale by CO₂ emissions, you need to include a specific measure. Here is the same chart with a measure for CO₂ kiloton (kt). This changes the size of the dots to be proportional to the amount of CO₂ emitted:

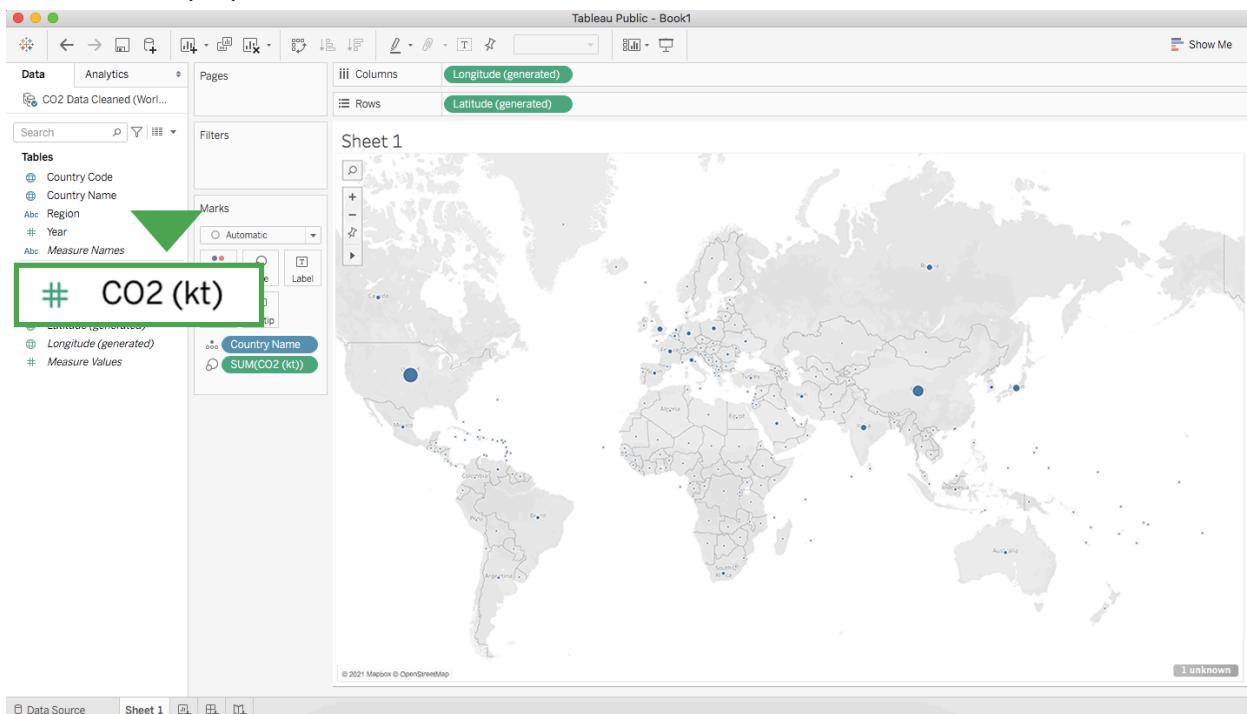
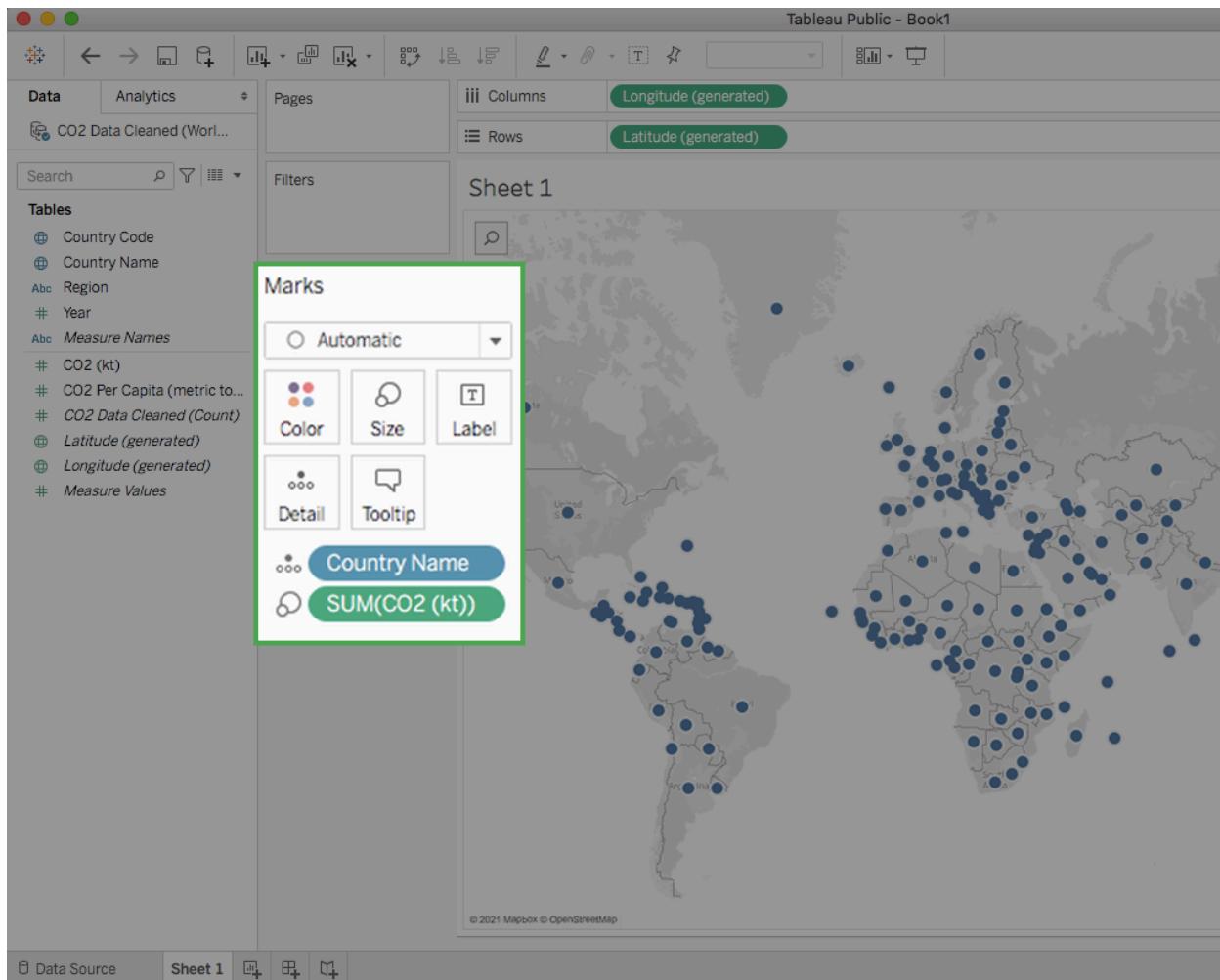


Tableau has a wide variety of options for depicting the measure for a given dimension. Most of these options are contained near the main display and the column with dimensions and measures.



Key takeaways

Tableau allows you to customize measures with options such as Color, Size, and Label, which change those aspects of the measure's visualization on the chart. As you customize measures in Tableau, you will want to consider accessibility for your audience. As a refresher, you can check out [this video on accessible visualizations from the Google Data Analytics Certificate program.](#)

Essential design principles

You recently learned about pre-attentive attributes of data visualization—the building blocks of data visualizations: marks and channels. In this reading, you'll take this understanding a step further with essential design principles.

As an analyst, your audiences will have a variety of roles, backgrounds, and perspectives. You might present information to other data analysts, to clients, or to executives in your company's C-suite. You're responsible for developing data visualizations that convey the information your audience needs in a manner that makes sense to everyone.

Design principles

These design principles are important to your work as a data analyst because they help ensure that you're creating visualizations that communicate your data effectively to your audience. By keeping these rules in mind, you can plan and evaluate your data visualizations to decide if they're working. And, if they aren't, you can adjust them!

<u>Principle</u>	<u>Description</u>
<u>Choose the right visual</u>	<u>One of the first things you have to decide is which visual will be the most effective for your audience. Sometimes, a simple table is the best visualization. Other times, you need a more complex visualization to illustrate your point.</u>
<u>Optimize the data-ink ratio</u>	<u>The data-ink entails focusing on the part of the visual that is essential to understanding the point of the chart. Try to minimize non-data ink like boxes around legends or shadows to optimize the data-ink ratio.</u>
<u>Use orientation effectively</u>	<u>Make sure the written components of the visual, like the labels on a bar chart, are easy to read. You can change the orientation of your visual to make it easier to read and understand.</u>
<u>Color</u>	<u>There are a lot of important considerations when thinking about using color in your visuals. These include using color consciously and meaningfully, staying consistent throughout your visuals, being considerate of what colors mean to different people, and using inclusive color scales that make sense for everyone viewing them.</u>
<u>Numbers of elements</u>	<u>Think about how many elements you include in any visual. If your visualization uses lines, try to plot five or fewer. If that isn't possible, use color or hue to emphasize important lines. Also, when using visuals like pie charts, try to keep the number of segments to less than seven since too many elements can be distracting.</u>

Avoiding misleading or deceptive charts

As you are considering what kind of visualization to create and how to design it, you will also want to be sure that you are not creating misleading or deceptive charts. Data analysis provides insights and knowledge that people use to make decisions. So, it's important that the visualizations you create are communicating data insights accurately and truthfully.

Here are some common errors to avoid so that your visualizations aren't accidentally misleading:

<u>What to avoid</u>	<u>Why</u>
<u>Cutting off the y-axis</u>	<u>Changing the scale on the y-axis can make the differences between different groups in your data seem more dramatic, even if the difference is actually quite small.</u>
<u>Misleading use of a dual y-axis</u>	<u>Using a dual y-axis without clearly labeling it in your data visualization can create extremely misleading charts.</u>
<u>Artificially limiting the scope of the data</u>	<u>If you only consider the part of the data that confirms your analysis, your visualizations will be misleading because they don't take all of the data into account.</u>
<u>Problematic choices in how data is binned or grouped</u>	<u>It is important to make sure that the way you are grouping data isn't misleading or misrepresenting your data and disguising important trends and insights.</u>
<u>Using part-to-whole visuals when the totals do not sum up appropriately</u>	<u>If you are using a part-to-whole visual like a pie chart to explain your data, the individual parts should add up to equal 100%. If they don't, your data visualization will be misleading.</u>
<u>Hiding trends in cumulative charts</u>	<u>Creating a cumulative chart can disguise more insightful trends by making the scale of the visualization too large to track any changes over time.</u>
<u>Artificially smoothing trends</u>	<u>Adding smooth trend lines between points in a scatter plot can make it easier to read that plot, but replacing the points with just the line can actually make it appear that the point is more connected over time than it actually was.</u>

Key takeaways

Design principles are important for creating effective data visualizations. When creating visualizations, consider the audience, choose the right visual for the job, and be sure to avoid misleading or deceptive visuals. By following these principles, you'll be able to design visualizations that are effective, informative, and easy to understand, which will help you communicate findings to a wider audience and make a greater impact on your organization!

The key to effective presentations is data visualizations that are clear and convincing. In turn, the key to effective visualizations is selecting the best way to depict your data.

You have learned about a few types of visualizations (e.g., bar graphs, pie charts) and what each type is best at emphasizing. Determining which type of visualization to use is essential to giving your presentation the impact it needs.

So far, you have considered a few rules about what makes a helpful data visualization:

- Five-second rule: A data visualization should be clear, effective, and convincing enough to be absorbed in five seconds or less.
- Color contrast: Graphs and charts should use a diverging color palette to show contrast between elements.
- Conventions and expectations: Visuals and their organization should align with audience expectations and cultural conventions. For example, if the majority of your audience associates green with a positive concept and red with a negative one, your visualization should reflect this.
- Minimal labels: Titles, axes, and annotations should use as few labels as it takes to make sense. Having too many labels makes your graph or chart too busy. It takes up too much space and prevents the labels from being shown clearly.

4. If stakeholders prefer to view data in a spreadsheet-type format, what can be added to a Tableau visualization?

- Companion table
 Headers and footers
 Key
 Legend

 **Correct**

If stakeholders prefer to view data in a spreadsheet-type format, a companion table can be added to a Tableau visualization. Companion tables show the same data in a different way.

Link to data: <https://public.tableau.com/profile/grow.with.google#!/>

Activity Overview

The video you just watched showed you how to make and visualize **JOINS** in Tableau. Now, you can use the datasets and instructions in this activity to perform the **JOINS** yourself. Feel free to refer back to the previous video if you get stuck.

In earlier activities, you worked in Tableau to create a data visualization. In this activity, you will review a scenario, link different data sources in Tableau, and create visualizations using multiple datasets.

By the time you complete this activity, you will be able to make visualizations out of data from multiple sources. This will enable you to visualize comparisons and combinations of data, which will allow you to share more complex projects in your career as a data analyst.



Scenario

Review the following scenario. Then complete the step-by-step instructions.

Imagine you are working as a data analyst at a policy research institute. For your current project, you need to create a visualization that shows the CO2 emissions per capita for each country from 2000-2011. You need to provide a visual presentation that not only allows someone to visually compare CO2 emissions between countries from year to year, but also provides information about each country's population, GDP, and energy use.

You already have a dataset that includes emissions for each country between the years 1960 - 2011. But, the information that you need on energy use, total population, and GDP you had to collect from a government website. Each dataset is in a separate file. Moreover, some of the information is missing for some countries.

Often you will work with datasets that are missing information. Whether or not you need to find this missing information will depend on your project. In this case, you will notice that the missing information is from the 1960s, 1970s, and 1980s.

Luckily, your project is only concerned with the data from 2000-2011. You need an efficient way to utilize some data from one source, and some data from other sources. Taking just the information that you need from each source and creating a new data source takes a lot of time.

Tableau allows you to link data from different sources, as well as import data from different formats.

While you won't be working with one in this assignment, Tableau allows you to use a Web Data Connector. This tool allows you to import the data you need directly from another site. Your visualizations will update when the data sources for your visualization are updated.

Step-By-Step Instructions

Follow the instructions to complete each step of the activity. Then answer the questions at the end of the activity before going to the next course item.

Step 1: Access the datasets

Click the link to create a copy of the datasets and download them. Note that upon opening the CO2 dataset below, you will immediately see the About page load with a single URL code at top. Navigate to the bottom of the document, and you can access all the raw and cleaned CO2 data by clicking on the different sheets. All of these sheets will be accessed by the Tableau platform once loaded. If you don't have a Google account, download the datasets directly from the attachments below.

Link to datasets: [CO2](#), [energy](#), [total population](#), and [gdp total](#)

OR

Download datasets:

[CO2](#)

[XLSX File](#)

[Energy data](#)

[XLSX File](#)

[totalpopulation](#)

[XLSX File](#)

[gdptotal](#)

[XLSX File](#)

Step 2: Load the data

1. Log in to [Tableau Public](#).

- Note: Tableau frequently updates its user interface. The latest changes may not be reflected in the screenshots, but the principles in this activity remain the same. Adapting to changes in software updates is an essential skill for data analysts, and we encourage you to practice troubleshooting. You can also reach out to your community of learners on the discussion forum for help.

2. Go to your profile and click Create a Viz.

3. From the Connect to Data window, go to the Files tab and open the CO2 dataset you downloaded earlier.

4. From the Data Source tab on the bottom of the interface, go to the Connections header at the top of the left-side column.

The screenshot shows the Tableau interface. The top navigation bar has 'File', 'View', 'Data', 'Analysis', 'Dashboard', 'Help' tabs, and a 'Sign In' button. Below the navigation is the 'Connections' panel, which lists a single connection named 'CO2 Dataset' (Microsoft Excel). A '+' icon is at the top right of this panel. Below the connections is the 'Sheets' panel, which lists various data sources: 'About', 'CO2 (kt) for Split', 'CO2 (kt) Pivoted', 'CO2 (kt) RAW DATA', 'CO2 Data Cleaned', 'CO2 Per Capita (Pivoted)', 'CO2 Per Capita RAW DATA', 'Metadata - Countries', and 'New Union'. A magnifying glass icon is at the top right of the sheets panel.

Connections

CO2 Dataset
Microsoft Excel

Sheets

Use Data Interpreter

Data Interpreter may be able to clean your Microsoft Excel workbook.

- grid About
- grid CO2 (kt) for Split
- grid CO2 (kt) Pivoted
- grid CO2 (kt) RAW DATA
- grid CO2 Data Cleaned
- grid CO2 Per Capita (Pivoted)
- grid CO2 Per Capita RAW DATA
- grid Metadata - Countries

grid New Union

5. Click the + icon to add another data source. Start with the energy dataset.
 6. Repeat step 5 for the other datasets, gdptotal and totalpopulation.
- Now, you should have all four datasets loaded into Tableau. The datasets will be on the left-hand side of your screen under Connections.

Note: As you progress through the activity, make sure to save your progress by clicking File, then Publish or the Publish button in the top right corner of the screen. If you are asked to "Create an Extract," do so. It may take some time to create an extract of the data you are using in this activity, but it is essentially the same as saving your progress.

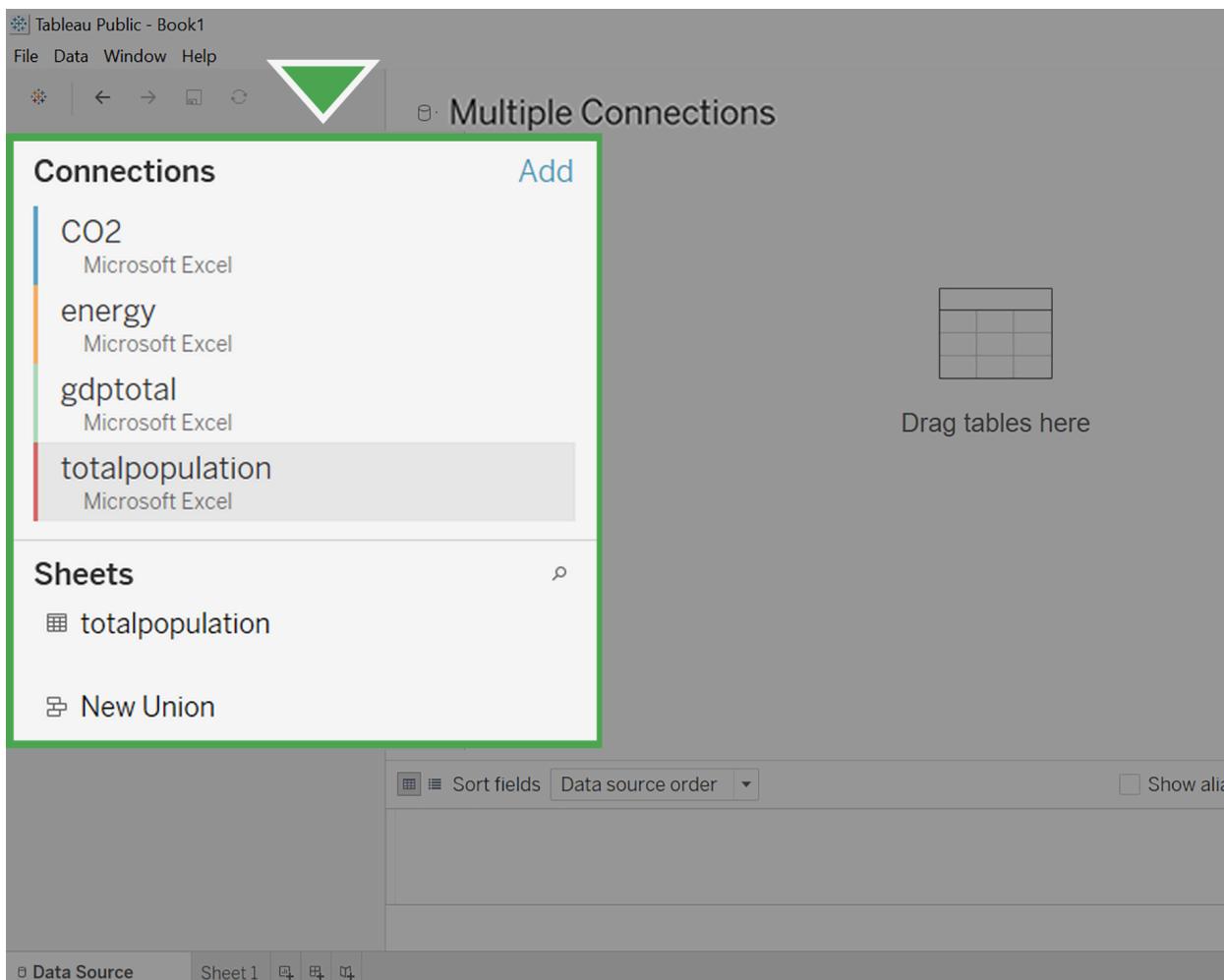
You'll notice that Tableau has already added one of the data sources into the area Multiple Connections. In the screenshot below, Energy is already loaded.

The screenshot shows the Tableau Public interface with the following details:

- File** | **Data** | **Window** | **Help**
- Connections**: CO2, energy, totalpopulation, gdptotal.
- Sheets**: gdptotal, New Union.
- Central Area**: energy (Multiple Connections)**: A green-bordered box labeled "energy".
- Data Preview****: A table with columns: Country, Year, Energy use (kg of oil equivalent). Data rows: Afghanistan (2000, 2001, 2002, 2003) all show NA.

If one of the datasets has already been loaded in, you can remove it by dragging the box to the left-hand side (the grey area) of the screen. Click on the box labeled Energy in the center-top of the screen and drag it off to the left to delete it.

Once you remove the data from Multiple Connections, it should appear similar to the image below.



Step 3: Make connections with JOINS

Now, you'll set up the connections between the different datasets by creating **JOINS** between them. You learned about **JOINS** in the previous course.

As a refresher: **INNER JOINS** and **OUTER JOINS** are types of relationships that can be used to combine data based on common columns of information.

In Tableau, you'll notice that the former **JOINS** window has now become a multi-purpose Relationships window. By double-clicking your data tables, you can edit the **JOINS** instead of the relationships.

Follow these instructions to create **JOINS** in Tableau:

1. Click on CO2 under Connections.
2. Under Sheets, you will notice all the different sheets in the CO2 dataset. Find CO2 Data Cleaned and double-click on it to load it.
3. Hover your cursor over the right side of the CO2 Data Cleaned box and click on the arrow.
4. Select Open to open the CO2 Data Cleaned dataset. *Make sure you complete this step.* This allows you to change the physical table, which will allow you to create **JOINS**. Otherwise, you will only be able to edit Relationships. Usually, you could use either option to accomplish the same goal. But for the purposes of this activity, we specifically want to use **JOINS**.

Your screen should appear similar to the screenshot below.

□ CO2 Data Cleaned (Multiple Connections)

Create Extract
Extract will include all data. Filters

The screenshot shows the Power BI interface with the 'CO2 Data Cleaned' dataset selected. At the top, there's a message stating 'CO2 Data Cleaned is made of 1 table.' Below this is a table preview with one row labeled 'CO2 Data Cleaned'. On the right side of the interface, there are buttons for 'Create Extract' and 'Filters'.

5. Click on the energy dataset under Connections.
6. Drag the energy sheet across to the CO2 Data Cleaned box under Multiple Connections. A Join pop-up window will appear.
7. The popup window may automatically populate with Year from CO2 Data Cleaned and Year1 from Energy. If not, put Year on the left side of the chart and Year1 on the right side.
8. Click on Add new join clause under Year. A dropdown menu will appear.
9. Select Country Name on the left side and Country on the right side.
10. Click the X to close the dropdown menu.

□ CO2 Data Cleaned+ (Multiple Connections)

The screenshot shows the Power BI interface with the 'CO2 Data Cleaned' dataset selected. It displays a join configuration between 'CO2 Data Cleaned' and 'Energy' datasets. The 'Join' section shows four options: Inner, Left, Right, and Full Outer. The 'Data Source' section maps 'Year' to 'Year1'. The 'Sort fields' section is visible. The 'Add new join clause' section shows a mapping from 'Country Name' in 'CO2 Data Cleaned' to 'Country' in 'Energy'. The bottom part of the interface shows the columns of the joined dataset, including 'Country Code', 'Country Name', 'Region', 'Year', and 'CO2 (kt)'.

11. Click Update now to examine the dataset. You will notice that Year and Year1 have a number sign above them. Change the data type to date for each of these columns.
12. In the column, Year click on the # (not the arrow next to it) and select Date from the available options.

After completing the first field, you will notice a red exclamation mark between CO2 Data Cleaned and Energy. This indicates that the columns you have joined are no longer of the same data type. One is formatted as date, and the other numeric.

You will also notice that after changing Year (CO2 Data Cleaned) to a Date type, the data preview pane will no longer display properly.

13. To fix this, go to the column list in the lower left of the screen.

The screenshot shows the Power BI Data Flow interface. At the top, it says "CO2 Data Cleaned+ (Multiple Connections)". Below that, a diagram shows "CO2 Data Cleaned" connected to "Energy". A note says "CO2 Data Cleaned is made of 2 tables." On the right, there are buttons for "Create Extract", "Extract will include all data.", "Filters", and "Add".

The main area shows the "CO2 Data Cleaned" connection details. It has a dropdown menu set to "CO2 Data Cleaned". Below that, a table lists the fields:

Type	Field Name	Physical Type	Remarks
⊕	Country Code	CO2 Dat...	Count...
⊕	Country Name	CO2 Dat...	Count...
Abc	Region	CO2 Dat...	Region
☰	Year	CO2 Dat...	Year
#	CO2 (kt)	CO2 Dat...	CO2 (...)
#	CO2 Per Capita (metric tons)	CO2 Dat...	CO2 P...
⊕	Country	Energy	Country
#	Year1	Energy	year
Abc	Energy use (kg of oil equiva...	Energy	Energ...

A note "Data preview unavailable" is visible next to the Year field.

14. Select the # icon next to the Year1 (Energy) column. Then, change the data type to Date.

Name

CO2 Data Cleaned

Fields

Type	Field Name	Physical...	Rem...
🌐	Country Code	CO2 Dat...	Count...
🌐	Country Name	CO2 Dat...	Count...
📅	Number (decimal)	CO2 Dat...	Region
📅	Number (whole)	CO2 Dat...	Year
#	Date && Time	CO2 Dat...	CO2 (...)
#	✓ Date	CO2 Dat...	CO2 P...
#	String	CO2 Dat...	CO2 P...
#	Boolean	Energy	Country
📅	Default	Energy	year
Abc	Energy use (kg of oil equiva...	Energy	Energ...

You may need to click Update Now in the preview pane to display the data properly. Make sure to repeat this step when you change more data types later on in this exercise.

The red exclamation mark will disappear. You might notice that all the years have been put into a month/day/year form with the default month and day as January 1st. This will not create any problems when creating a visualization, as you will filter the data by year.

Step 4: Connect additional datasets

Before adding any additional joins, the data type for Year(Gdptotal) needs to change.

A pop-up window will appear for the join. It might already be populated with Year1 under Datasource and Year(Gdptotal) under gdptotal.

1. Click on gdptotal under Connections.
2. Under Sheets, drag the gdptotal sheet into the white space underneath the energy box.
3. Go to the column list in the lower left of the screen, scroll until you find the column Year(Gdptotal). Click on # above it. A drop-down menu will appear.
4. Select Date from the drop-down menu.

If the data preview does not display properly, fix the date type in the lower left pane.

5. Click on the Venn diagram between energy and gdptotal. Click on Add new join clause under year. A drop-down menu will appear.

6. Under CO2 Data Cleaned click on Country Name.

7. Click on the empty field under gdptotal across from Country Name. A dropdown menu will appear.

8. Set the right side of the join statement to Country1.

9. Close the Join pop-up by clicking on its exit button.

Now you are going to join totalpopulation, the last of the four datasets that you downloaded.

10. Click on totalpopulation under Connections.

11. Under Sheets, drag the totalpopulation sheet into the white space to the right of the energy and gdptotal boxes.

A pop-up window will appear for the join. It should already be populated with Year under Datasource and Year(totalpopulation) under totalpopulation.

12. Go to the column list in the lower left of the screen, scroll until you find the Year(totalpopulation) column. Click on # above it. A drop-down menu will appear.

13. Select Date from the drop-down menu.

If the data preview does not display properly, fix the date type in the lower left pane.

14. Click on the Venn diagram to the left of totalpopulation. Click on Add new join clause under Year. A drop-down menu will appear.

15. Under CO2 Data Cleaned click Country Name.

16. Click on the empty field under totalpopulation across from Country Name. A dropdown menu will appear.

17. Click Country (totalpopulation).

18. Close the Join pop-up by clicking on its exit button.

19. Click the Update button to view your data columns.

Congratulations! You have successfully joined four different sources of data.

You should take some time to study your dataset. The only years you should notice in your dataset are between 2000-2011. While your dataset CO2 went from 1960-2011, and your other datasets went from 2000-2015, the intersection (the years they have in common) only includes 2000-2011. This is just the time span that you need.

If the dataset had gone beyond those dates, you would have filtered out the unneeded years in your visualization.

Reviewing the dataset, you may have noticed that some of your measurement values need to be changed. The data type for the column Energy use is listed as string data. You can tell this because of the Abc icon above the name. The column currentGDP is also formatted as type string.

20. Find the Abc icon above the Energy use column. Change it to Number (decimal).

21. Find the Abc icon above the currentGDP column. Change it to Number (whole).

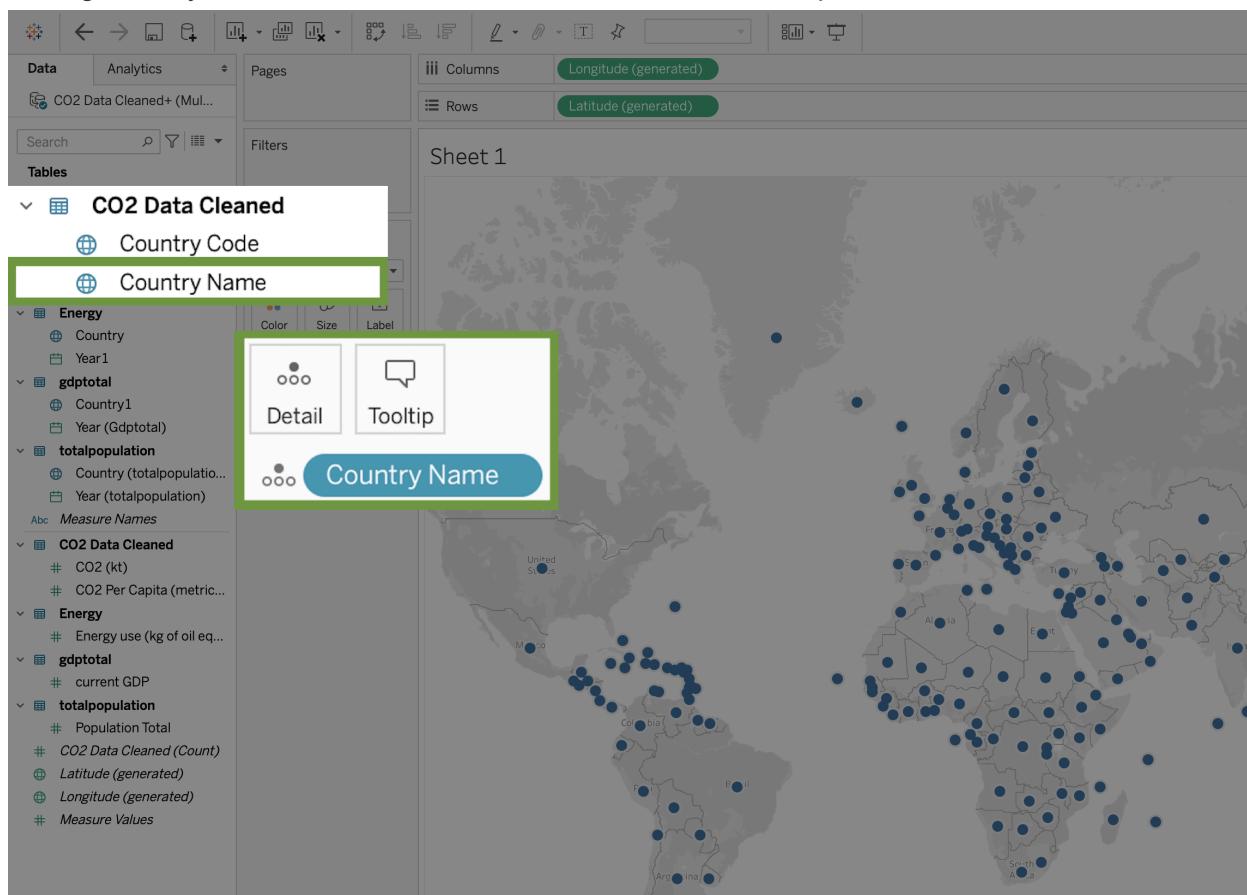
If the data preview does not display properly, fix the date type in the lower left pane.

Step 5: Create a visualization

At the bottom of your screen, you will notice a tab labeled Sheet 1.

1. Click on the tab Sheet1.

2. Drag Country Name under CO2 Data Cleaned into the Detail square.



3. Drag CO2 Per Capita to Color.

4. Click on Color, then Edit Colors.

5. Click on the Palette dropdown and change it from Automatic to Red-Green diverging.

6. Check the boxes for Stepped Color and Reversed. (Because green is generally viewed as positive for CO2 emissions, you want the colors to move towards red as emissions go up.)

7. Click the Show Advanced dropdown.

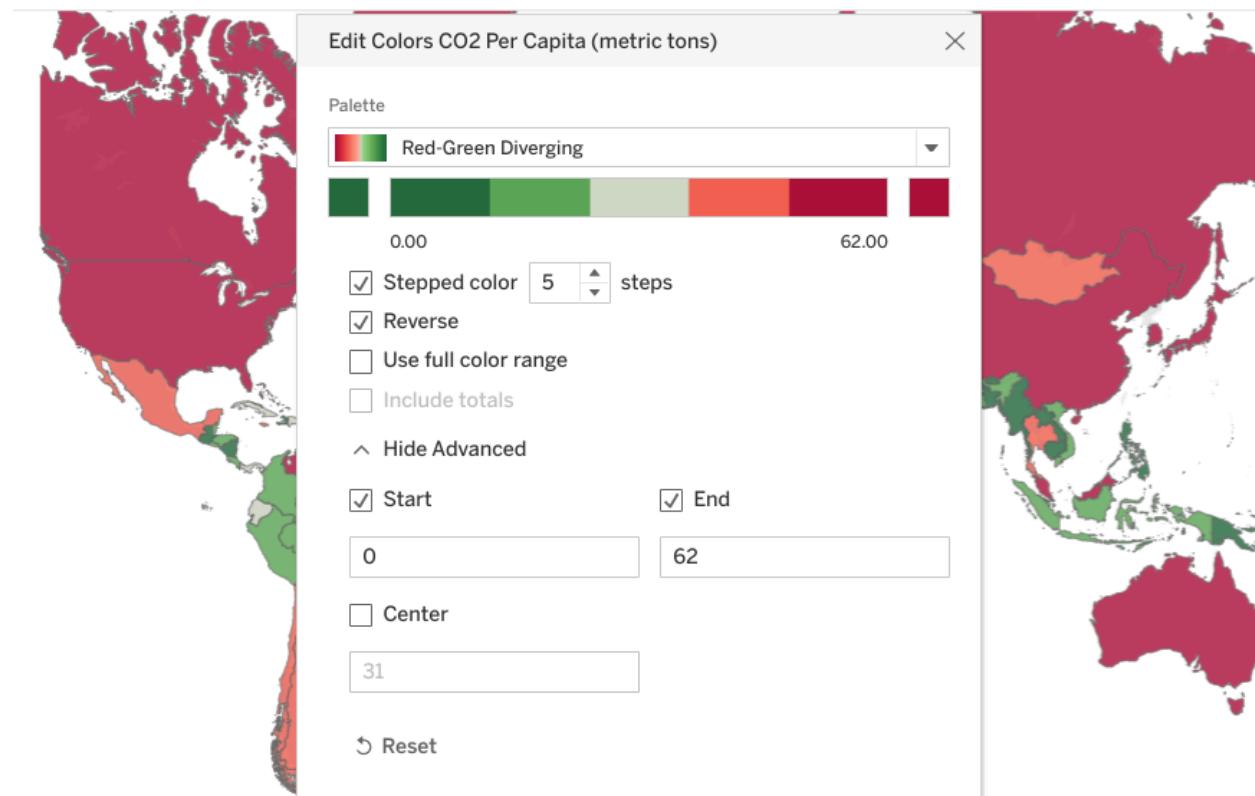
8. Check the Start and End boxes.

You might have noticed that the legend on the right-hand side of the screen shows Sum(CO2 per capita). You need to change the start and end values in order to notice color contrasts showing red shades.

The lowest CO2 Per Capita emission for any year is 0.0396 and the largest is 61.9898.

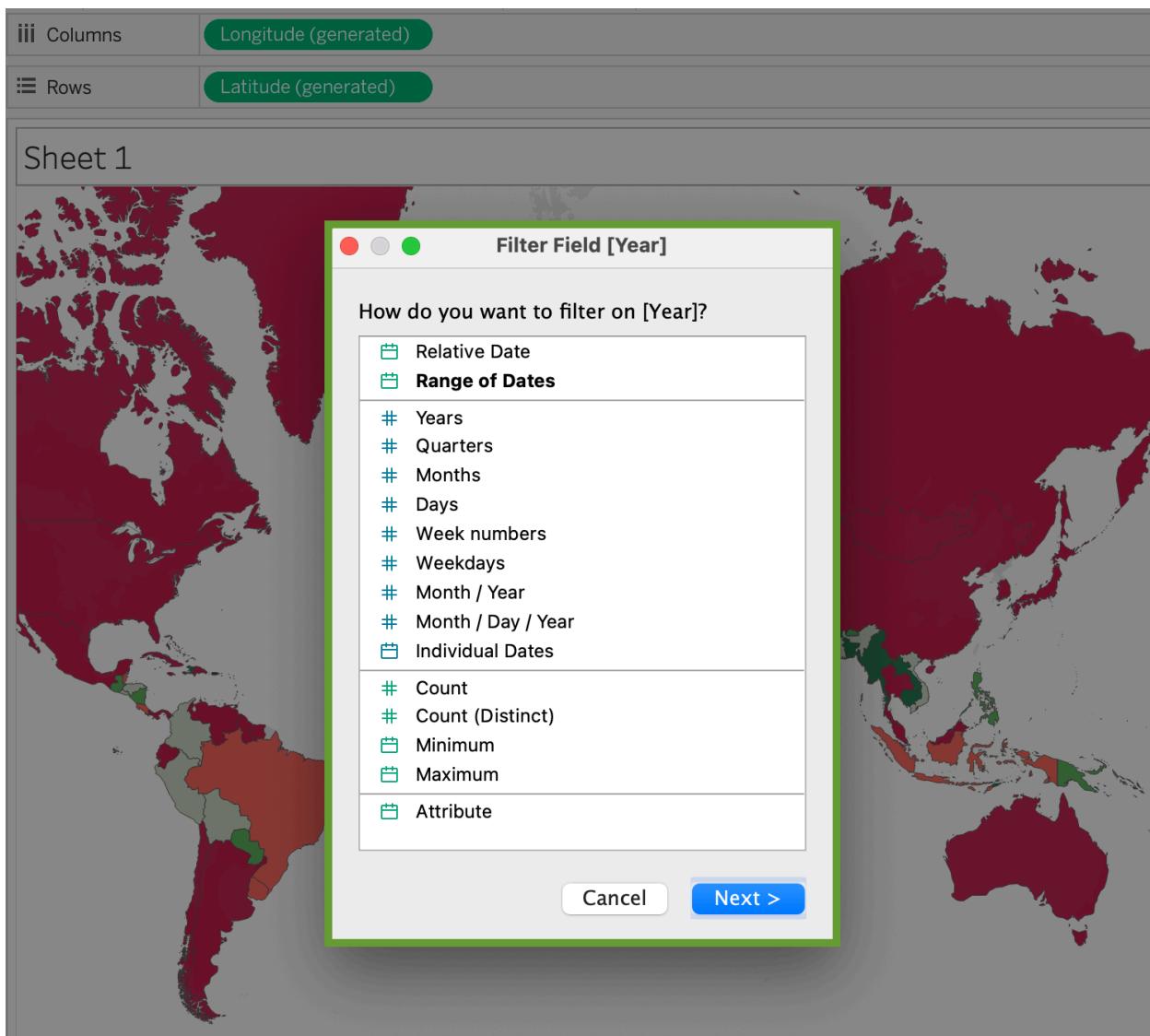
9. Enter 0 into the Start field, and 62 into the End field. Click OK. Click the X button.

Note: These values are the highest and lowest emissions between 2000-2011. Your screen should now look like this:

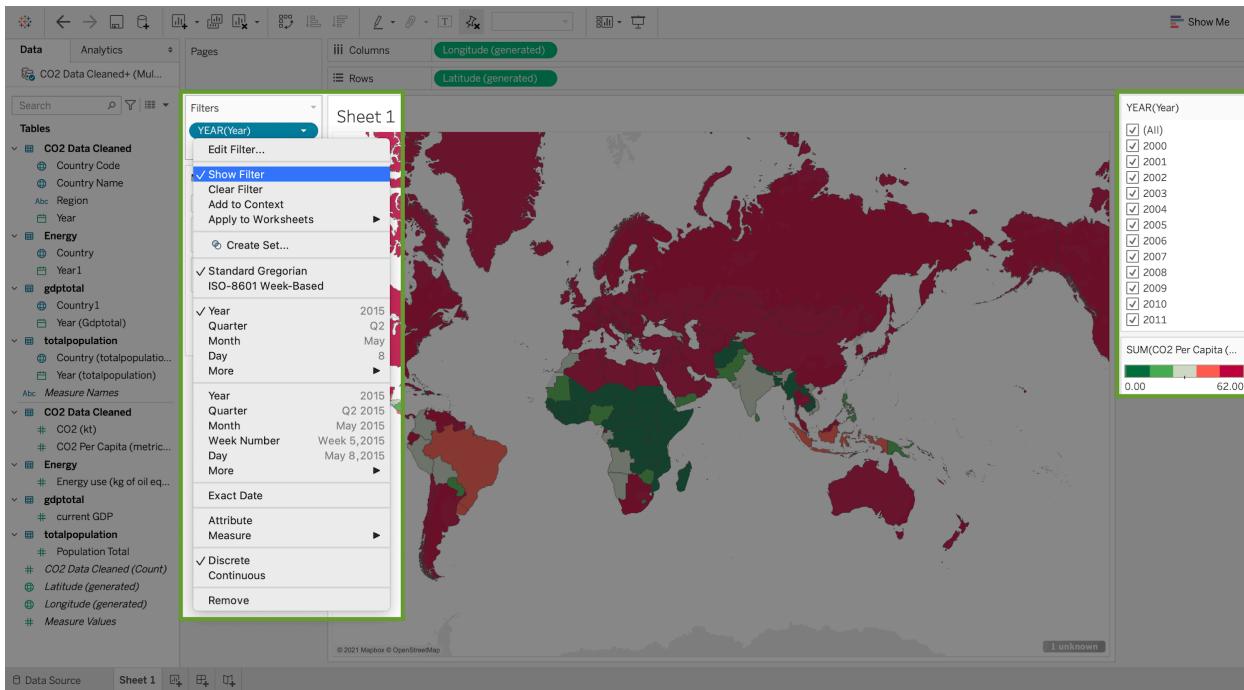


10. Drag Year from under CO2 Data Cleaned into the Filters area.

11. Click on Years, Next, All, OK.



12. In the Filters box, right-click on YEAR(Year)
13. Select Show Filter. The filter will appear on the right side of the screen.



14. Click on the arrow to the right of YEAR(Year) on the far-right side of the screen.
 15. Select Single Value (dropdown). Now the areas are colored only for the values of each year. Use the checkboxes in the list to choose which years you want to include in the visualization. You can select only the years between 2000-2011 to view the emissions relevant to the scenario.
- Congratulations! You've linked your data and made a comprehensive data visualization in Tableau.
- Final Note: It is important to understand that you are not required to submit any exported dashboards or visualizations from the Tableau Public interface to move forward in this course. Your reflection answer is here for personal guidance and growth. Moreover, it is highly suggested that you export any visualizations from your gallery as a PDF or embedding the interactive dashboard for your portfolio. For more information on exporting and embedding visualizations, please refer to the section titled, [Tableau Public: Export](#).

Pro Tip: Save the activity datasets

Be sure to save a copy of the datasets you used to complete this activity. You can use it for further practice or to help you work through your thought processes for similar tasks in a future data analyst role.

Tableau resources for combining multiple data sources

Now that you have some experience working with data in Tableau, you are ready to start doing more, including combining multiple data sources. This reading will provide you with some how-to guides for that, and other helpful resources you can use as you practice using Tableau on your own.

Resource	Description
<u>Set up data sources</u>	This page links to other resources explaining how to set up your data sources and prepare them for analysis once you have connected them to your Tableau account. It specifically includes articles explaining how to join or blend data, and what a union is and how they work. This is a great starting point as you get ready to begin using and combining data sources.
<u>Join your data</u>	Joining refers to the process of combining data sources based on common fields. This article gives a more detailed explanation of the different joins, how to use them in Tableau, and an example join with a step-by-step guide.
<u>Don't be scared of relationships</u>	Relationships allow you to combine multiple data sources in Tableau. This is a more flexible alternative to joins, and doesn't force you to create one single table with your multiple data sources. This article will give you more insight into how relationships work.
<u>How relationships differ from joins</u>	This article goes into more detail about the differences between using relationships and joins , and guides you through the process of using relationships to combine data.
<u>Blend your data</u>	Data blending is another method you can use to combine multiple data sources. Instead of truly combining the data, blends allow you to query and aggregate data from multiple sources. This resource goes into more detail about blending and includes a tutorial.
<u>Combining multiple date fields</u>	This resource provides examples that explain how to combine date fields when using four different methods of data combination in Tableau.

1. A data analyst uses Tableau Public to create a data visualization. They are still refining the visualization and want to prevent misinterpretation by others until it is finished. How can they make sure their Viz is private for the time being??

 - Lock the Viz
 - Select **File** and **Save** and then select **Private**
 - Toggle **Show Viz on Profile** to off
 - Select **Source** and the **Private**

2. A data team uses Tableau to create a scatter plot of sales data, with the ability to filter by region, product, or time period. This enables sales managers to view how sales are trending in different regions, for different products, and over time. What type of visualization are they using?

 - Static
 - Interactive
 - Public
 - Infographic

3. Fill in the blank: In Tableau, a _____ palette is a color theme that displays two ranges of data values using two different hues, with color intensity representing the magnitude of the values.

 - inverted
 - contrasting
 - diverging
 - overlayed

4. While designing a city map in Tableau, you use a color scheme with high contrast among the different districts to ensure they are easy to distinguish for people with color vision deficiencies. What does it mean to have contrast?

- The color scheme is monotone
- The color scheme is aesthetically pleasing
- The color scheme uses a range of different colors
- The color scheme is uniform

5. An analyst works with Tableau to analyze highway traffic data. They select specific time routes in the southeastern United States, then analyze the traffic patterns in those states. What tool do they use to select this region?

- Rectangular
- Radial
- Pan
- Lasso

6. You use Tableau for a project about spacecraft trajectories. You drag the Spacecraft field onto a shelf, selecting a specific craft. This enables you to monitor the trajectories that will be most meaningful to your project. What menu are you using in this scenario?

- Filters
- Attributes
- Formats
- Dimensions

7. Fill in the blank: A data professional uses Tableau's _____ tool to horizontally and vertically shift their perspective of a scatter plot in order to compare customers who have made a high number of purchases.

- rectangular
- pan
- lasso
- radial

8. Which of the following statements accurately describe key design principles for creating data visualizations? Select all that apply.

- A key color principle is using color consciously and meaningfully.
- Optimizing the number of elements might include choosing to plot fewer lines.
- Choosing the right visual involves considering which graphic will be most effective for your audience.
- Using orientation effectively requires being considerate of what colors mean to different people.

9. Which type of data is best suited for visualization using a line chart?

- Data points without a specific order
- Continuous data over time
- Proportional data representing parts of a whole
- Categorical data

10. Data from which of the following scenarios is best suited for visualization using a bar chart?

- New vs. returning customers
- Company budget breakdown by category
- Website traffic over months
- Income levels across age groups