

**Data Literacy, Data Analysis, and Data Visualization Skills Matter a Great Deal for Today's Undergraduate and Graduate Students:** **Let's explore a hands-on data visualization practice!**

Given that data are being created and stored on an unprecedented scale, a strong data analytical skillset would be a notable plus for career-oriented students in the “Era of Data Ubiquity” (quotes Mitchell Stevens). Having strong skills in data literacy, data analysis, and data visualization can help both undergraduate and graduate students (who will be tomorrow's business practitioners and business leaders) make informed decisions using data. These skills can give them the ability to make “data-based decisions.”

Tableau is a data visualization software tool that allows users to create interactive charts, graphs, and dashboards from their data. It is meant to help people understand and analyze their data more effectively. Tableau is used by many types of organizations to make better decisions using their data. It can be connected to various data sources (e.g., Microsoft Excel, Microsoft Access, PDF files, Statistical files) and enables users to easily create visualizations by dragging and dropping elements. The insights generated by Tableau can be shared with others. Please **watch a 2:19 minute Tableau Introduction video** if you have little idea about the power of Tableau: [https://www.tableau.com/why-tableau/what-is-tableau?creative=&cq\\_cmp=1695532942&cq\\_net=g&cq\\_plac=#video](https://www.tableau.com/why-tableau/what-is-tableau?creative=&cq_cmp=1695532942&cq_net=g&cq_plac=#video)

Who can benefit from data literacy training? According to a Tableau blog, anyone can benefit from data literacy training, especially (1) business professionals, (2) organizations, (3) informed citizens, and (4) students. Feel free to check the details on a 2022 blog by Sue Kraemer (<https://tabsoft.co/3imKLY>).

The screenshot shows a web browser displaying a Tableau blog post. The URL in the address bar is [tableau.com/blog/build-your-data-skills-data-literacy-trail-trailhead?d=7013y00000vYh9&utm\\_campaign=TFT%20License%20...](https://tableau.com/blog/build-your-data-skills-data-literacy-trail-trailhead?d=7013y00000vYh9&utm_campaign=TFT%20License%20...). The page title is "Build Your Data Skills with the Data Literacy Trail on Trailhead". The main heading is "Build Your Data Skills with the Data Literacy Trail on Trailhead". Below it is a subtext: "Get the data skills you need to ask the right questions, make better decisions, and grow your career with this free training, available in 8 languages." A purple arrow points from the text "grow your career with this free training" down to the author's bio. The author's bio is for Sue Kraemer, Senior Data Skills Curriculum Strategy Manager at Tableau, posted on August 4, 2022. There are social sharing icons for LinkedIn, Twitter, and Facebook.

The future speaks data—do you? Despite data skills being the most in-demand skill in today's (and tomorrow's) job market, there's still a data literacy gap.

Get the training you need to ask the right questions, make better decisions, and grow your career. Start building your data skills—for free—with the [Build Your Data Literacy Trail on Trailhead](#). In support of our ongoing mission to help people everywhere see and understand data, the Trail is now available in [Japanese](#), [German](#), [French](#), [Spanish](#) (Mexico), [Portuguese](#) (Brazil), [Simplified Chinese](#), and [Korean](#).

In this hands-on data visualization practice, let's **use Tableau to visualize the moving relationship between income and life expectancy across over 150 nations in the past two hundred years** (from year 1800 up to year 2023).

1. We will download four relevant datasets from **data.world** (<https://data.world/missdataviz-wow2021-w11>). Pls click the underlined link to find the data sets online, and then save the files in your hard drive.

The screenshot shows the data.world website with the URL <https://data.world/missdataviz-wow2021-w11> highlighted in a yellow box. The page title is "WOW2021 W11". On the left, there's an "Overview" section with a "DESCRIPTION" field containing "Gap Minder Data" and a "SUMMARY" field stating "No summary added". In the center, there's a message box with the text: "If you do not have a [data.world](#) account, you need to complete a free online registration first. Otherwise, ask your instructor for his/her guidance." To the right, there's an "About this dataset" section with details like "SHARED WITH Everyone", "CREATED 2 years ago by @missdataviz", "SIZE 958.43 KB · Download", and "DICTIONARY 4 files, 859 columns, 0 tables · View". Below that is a "Recent updates" section showing two entries from "@missdataviz". At the bottom, there's a list of "4 files" with one item visible: "Data Geographies - v1 - by Gapminder.xlsx".

2. Please visit Tableau's official website and then download a 14-day free trial version of the **Tableau Desktop** (<https://www.tableau.com/products/desktop/download>).

The screenshot shows the Tableau website with the URL <https://www.tableau.com/products/desktop/download> highlighted in a yellow box. The page title is "Tableau Desktop: Start your free 14-day trial". It features a "TRY NOW" button and a form for entering personal information: First Name, Last Name, Business E-mail, Organization, and Company Size.

3. We will enable **Tableau Desktop** and then “connect” the datasets to the Tableau canvas [FYI, under **Connect**, select the relevant file types (e.g., a Microsoft Excel file, a .csv text file, or even a .sav SPSS data file). In the **Open** dialog box, navigate to and select a file. Select **Open...**]

The screenshot shows the Tableau Desktop interface. On the left, the 'Connect' menu is open, with 'Text file' highlighted by a red box and an arrow pointing to the 'Open' dialog box on the right. The 'Open' dialog box displays a list of files, with '2023-0105\_Tab...' selected. To the right of the 'Open' dialog is a text box containing a message about using a trial version of Tableau Desktop, a link to a LinkedIn profile, and a link to Google Scholar.

I am using a trial version of the **Tableau Desktop** in this demo. Notably, I also created a heat map demo using a FREE **Tableau Public**, and I will be happy to share that demo upon request via my LinkedIn profile.

LinkedIn (<https://www.linkedin.com/in/maxwell-hsu-47b3039/>)

Google Scholar  
<https://scholar.google.com/citations?user=fpEuLRkAAAAJ&hl=en>

Let's start with the income per person data set. As the "*income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted*" is a .csv file, we need to connect this file by clicking the "Text file" option. By default, the "Use Data Interpreter" option is not enabled. When we find that the 1<sup>st</sup> row data (e.g., **country, 1800**) correspond to the variable names, we will check the "Use Data Interpreter" box to address the issue (see Step #4).

The screenshot shows the Tableau Data Source editor. A blue box highlights the 'Undo' button in the top toolbar. The 'Files' section is expanded, showing a red box around the 'Use Data Interpreter' checkbox and its description. The preview pane shows a table with columns 'income\_per\_person\_gdpp...' and 'F1'. A red box highlights the first row, which contains 'country' and '1800'. A callout points from the text "country" in the preview to the 'country' field in the Fields table below. The Fields table shows two rows: 'F1' and 'F2'. The 'F1' row is linked to the 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted.csv' file, while the 'F2' row is linked to the 'income\_per\_person\_ordinner' file.

FYI: The **Undo** button is here!

income\_per\_person\_gdppercapita\_ppp\_inflation\_ad...

income\_per\_person\_gdpp...

Need more data?  
 Drag tables here to relate them. [Learn more](#)

“country” should be recognized as a variable name! See Step #4.

Name	Type	Field Name	Physical Table	Rem...
income_per_person_gdppercapita_ppp_inflation_adjusted.csv	Abc	F1	income_per_person_gdppercapita_ppp_inflation_adjusted.csv	F1
	#	F2	income_per_person_ordinner	F2

4. Let's check mark the "Cleaned with Data Interpreter" option (see the circled red rectangle box and the red circle). Subsequently, we will find that the first-row data (i.e., **country**, **1800**, **1801**, etc.) are recognized as variable names. FYI, **1800** represents "year 1800" while **1801** represents "year 1801."

The screenshot shows the Tableau Data Source interface. In the top-left corner, under 'Connections', there is a list of files: 'income\_per\_person\_gdpperc.csv', 'life\_expectancy\_years.csv', and 'population\_total.csv'. Below this, under 'Files', there is a section titled 'Cleaned with Data Interpreter' with a checked checkbox and a link 'Review the results'. A red box highlights this section. In the center, there is a preview of the data with the title 'income\_per\_person\_gdpperc...'. On the right, there are connection settings ('Connection Live') and filter options ('Filters 0 | Add'). Below the preview, a table shows data for several countries. The first row contains 'country', '1800', and '1801' as column headers. A red box highlights this first row. A purple box highlights the entire data preview area.

5. We will re-organize the data structure using the Pivot function (i.e., we will Pivot the income data).

The screenshot shows the Tableau Data Source interface, identical to the previous one but with a callout box overlaid. The callout box contains the following text: 'Hold both "Shift" and "Ctrl" keys to highlight all variables (all columns) but the **country** variable. In the highlighted area, click the drop-down arrow next to the column name to find this dropdown menu (see P. 5 for details.).' A red box highlights the 'Pivot' option in the dropdown menu, which is also circled. The rest of the interface is identical to the previous screenshot.

Hint: if you are not familiar with the power of the Pivot function, please check relevant information on this Tableau webpage: [https://help.tableau.com/current/prep/en-us/prep\\_pivot.htm](https://help.tableau.com/current/prep/en-us/prep_pivot.htm) or this Microsoft webpage: <https://bit.ly/3vMzVKd>

[help.tableau.com/current/pro/desktop/en-us/pivot.htm](https://help.tableau.com/current/pro/desktop/en-us/pivot.htm)

As the Tableau site reveals, once we select multiple columns (FYI, a variable would typically occupy one column), we will “click the drop-down arrow next to the column name, and then select **Pivot**. New columns called Pivot field names and Pivot field values are created and added to the data source.”

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What's New in Tableau

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› Connect to and Prepare Data

› Connect to Your Data

› Set Up Data Sources

› Plan the Data Source

› Relate Your Data

› Join Your Data

If you encounter any challenges when you attempt to select multiple columns/variables in Tableau, please consider resolving the issues with a Google search on your own or consulting your data analytics instructors.

After you have set up the data source, in the grid, select two or more columns. Click the drop-down arrow next to the column name, and then select **Pivot**. New columns called "Pivot field names" and "Pivot field values" are created and added to the data source. The new columns replace the original columns that you selected to create the pivot.

Abc	#	#	#	Abc	Rename
Quarter	Samsung	Nokia	Apple		Reset Name
Q4 '11	93.8300	111.7000	35.46		Copy Values
Q1 '12	89.2800	83.1600	33.12		Hide
Q2 '12	90.4300	83.4200	28.94		Create Calculated Field...
Q3 '12	97.9600	82.3000	24.62		Pivot

6. Double click "Pivot Field Name" and change it to **Year**. Change "Pivot Field Values" to **Income**. FYI, we should also click the data type icon and change variable **Year**'s data type from ABC (string) to Number (whole) here, but I failed to do so in Step #6 → Check Step #24 to see the consequence & how to fix it.

income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted.csv

income\_per\_person\_gdpp...

income\_per\_person\_gdpp...

Need more data?  
Drag tables here to relate them. [Learn more](#)

income\_per\_person\_gdpp... 3 fields 46513 rows

Name: income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted.csv

Fields

Type	Field Name	Physical Table
country	income_per_person_gdppercapita_ppp_inflation_adjusted.csv	income_per_person_gdppercapita_ppp_inflation_adjusted.csv
Year	Pivot.	Pivot Field Names
Income	Pivot.	Pivot Field Values

Change the newly created Pivot Field Names to **Year** and **Income**.

7. We will connect the second data set (i.e., population total) to the Tableau canvas with the Drag and Drop trick.

Tableau - Book1

File Data Server Window Help

Connections Add

income\_per\_person... Text file

Files

- Cleaned with Data Interpreter
- [Review the results](#). (To undo changes, clear the check box.)
- income\_per\_person\_gdppercv.csv
- life\_expectancy\_years.csv
- population\_total.csv**

New Union New Table Extension

income\_p... — populatio... ▾

How do relationships differ from joins? Learn more

income\_per\_person... Operator population\_total.csv

Abc country = Abc Country (Popula ▾

+ Add more fields

> Performance Options

population_total.csv	# population_total.csv	# population_total.csv	# population_total.csv
Country (Population Tot...	1800	1801	1802
Afghanistan	3,280,000	3,280,000	3,280,000
Albania	400,000	402,000	404,000
Algeria	2,500,000	2,510,000	2,520,000
Andorra	2,650	2,650	2,650
Angola	1,570,000	1,570,000	1,570,000
Antigua and Barbuda	37,000	37,000	37,000

8. Please highlight all variables but the **country** variable. Likewise, we will re-organize the data structure using the Pivot table function. Change the variables names to "**Year 1**" and "**Population**" (like Step #6). Also, please change **Year 1**'s data type from ABC (a string) to Number(Whole). Revisit Step #6 again.

Tableau - Book1

File Data Server Window Help

Connections Add

income\_per\_person... Text file

Files

- Cleaned with Data Interpreter
- [Review the results](#). (To undo changes, clear the check box.)
- income\_per\_person\_gdppercv.csv
- life\_expectancy\_years.csv
- population\_total.csv

New Union New Table Extension

income\_p... — populatio... ▾

How do relationships differ from joins? Learn more

income\_per\_person... Operator population\_total.csv

Abc country = Abc Country (Popula ▾

+ Add more fields

> Performance Options

In the highlighted area, click the arrow to find this dropdown menu.

population\_total.csv # population\_total.csv # population\_total.csv # population\_total.csv

2097 2098

75,800,000	75,600,000	75,400,000
1,190,000	1,170,000	1,140,000
70,700,000	70,700,000	70,700,000
62,700	62,600	62,500
179,000,000	103,000	57,200,000

Pivot

Hint: Do NOT highlight the **country** variable when we attempt to generate a Pivot variable ... Also, please change the newly created variable name to **Year 1** (or any variable name but "**Year**" because this variable name has been used and the **Year** variable could be found in the income per person data file).

9. We will recognize the relationship between variable **Year** (in the income per person data set) and variable **Year 1** (in the population total data set). Remember to edit variable **Year 1**'s data type (to Number).

The screenshot shows the Tableau interface with two data sources connected by a relationship. The top data source is 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted' and the bottom is 'population\_total.csv'. A blue arrow highlights the relationship between the 'Year' field in the top source and the 'Year 1' field in the bottom source. The 'Year 1' field in the bottom source is circled in yellow and has a red border. A context menu is open over this field, with the 'Number (decimal)' and 'Number (whole)' options circled in purple.

10. We will hide all variables but the **Population** variable (Hint: it's okay if you skip the hiding step, as not hiding other variables won't cause any issues when we create a bubble chart).

The screenshot shows the Tableau interface with the same two data sources and relationship as the previous screenshot. A context menu is open over the 'Year 1' field in the 'population\_total.csv' data source, with the 'Hide' option circled in red.

Note: the **Year** variable in the income per person data set corresponds to the **Year 1** variable in the population total data set.

11. Now, we will connect the third data set (i.e., life expectancy) to this Tableau project.

The screenshot shows the Tableau Data Source interface. On the left, under 'Connections', there is one entry: 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted' (Text file). Under 'Files', there are three entries: 'Cleaned with Data Interpreter' (checkbox checked), 'income\_per\_person\_gdpperc.csv', and 'life\_expectancy\_years.csv'. A red arrow points from the 'life\_expectancy\_years.csv' entry to a callout box. The callout box contains the text: 'Let's connect the Life Expectancy data file to this Tableau canvas (let's mimic what we did in Step #7 to Step #10).' Below the callout box, a processing request window is visible with the message 'Executing query.' and 'Elapsed time 00:07'. The main data preview area shows a single column named 'Population' with all values being 3,280,000. The bottom right corner of the data preview has a small red circle.

12. Similarly, we will Pivot the life expectancy data (FYI, you may want to revisit Step #8).

The screenshot shows the Tableau Data Source interface. On the left, under 'Connections', there is one entry: 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted' (Text file). Under 'Files', there are four entries: 'Cleaned with Data Interpreter' (checkbox checked), 'income\_per\_person\_gdpperc.csv', 'life\_expectancy\_years.csv', and 'population\_total.csv'. A red arrow points from the 'income\_per\_person\_gdpperc.csv' entry to a callout box. The callout box contains the text: 'Note that the income data set is now connected to both the population data set and the life expectancy data set.' Below the callout box, a context menu is open over the 'life\_expectancy\_years.csv' column in the data preview. The menu options include 'Rename', 'Copy Values', 'Hide', 'Create Calculated Field...', 'Pivot' (which is highlighted with a red box), and 'Merge Mismatched Fields'. A red circle highlights the 'Pivot' option in the menu. The data preview shows columns for 'Year' (097, 2098, 2099) and 'Life Expectancy' (77.3000, 77.4000, 77.5000, etc.).

Hint: Leave the **country** variable intact (i.e., the **country** variable should not be included in the Pivoting task). As a reminder, hold both the **Ctrl** and **Shift** keys when you attempt to highlight multiple columns.

### 13. Change/update the Pivot variable names: name them as *Year* and *Life Expectancy*.

The screenshot shows the Tableau Data Source interface. On the left, there are connections to three CSV files: 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted', 'life\_expectancy\_years.csv', and 'population\_total.csv'. In the center, a relationship is being defined between 'income\_per\_person\_gdpp...' and 'life\_expectancy\_years.csv'. The relationship type is 'Operator' and the fields are 'Abc country' and 'Abc Country (Life Ex...'. On the right, a preview of the data is shown in a grid format. The first two columns are labeled 'Country (Life Expecta...' and 'Year 2'. The third column is labeled 'Pivot2' and contains the value 'Life Expectancy'. A red arrow points from the 'Pivot2' column header to the 'Year 2' field in the relationship editor.

### 14. It's about time to instruct Tableau to recognize the additional relationships between the data sets.

The screenshot shows the Tableau Data Source interface with a red box highlighting the 'Create Relationship Calculation...' button in the relationship editor. The relationship editor shows 'Year 2' and 'Year' fields. The preview pane on the right shows a grid of data with columns for 'Country (Life Expectancy Years.Csv)', 'Year 2', 'Pivot2', and 'Life Expectancy'. A red box also highlights the 'Year 2' field in the preview pane.

15. After we hide variables **country** and **Year 2**, the only “visible” variable in the life expectancy data set will be “Life Expectancy”. Check the red box between Step #14 and Step #15 (a relationship between **Year** in the income data set and **Year 2** in the life expectancy data set has been established).

The screenshot shows the Tableau Data Source interface. On the left, there's a list of files: 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted' (selected), 'life\_expectancy\_years.csv', and 'population\_total.csv'. In the center, a 'Relationships' section shows a connection between 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted' and 'life\_expectancy\_years.csv'. A red box highlights the 'Year' field in the first file and the '# Year 2' field in the second file. On the right, a preview of the 'Pivot2' worksheet shows a single column of data labeled 'Life Expectancy'.

We will hide two variables (see Step #10): **country** & **Year 2**.

16. We will connect the last data set (i.e., the Geographies) to the current Tableau project. Since this data file is an Excel type, click "Microsoft Excel" and Open "Data Geographies-v1-by Gapminder." Notably, I use Microsoft Windows 11's File Explorer function to reveal all four data sets' filenames.

The screenshot shows the Tableau Data Source interface with an 'Add a Connection' dialog open. The 'Add' button is highlighted with a red box. A red arrow points from the 'To a File' section to a Windows File Explorer window displaying four CSV files: 'Data Geographies - v1 - by Gapminder', 'income\_per\_person\_gdppercapita\_ppp\_inflation\_adjusted', 'life\_expectancy\_years', and 'population\_total'. A red box highlights the 'Data Geographies - v1 - by Gapminder' file. A callout box at the bottom says 'Adding the Geographies data to the Tableau database'.

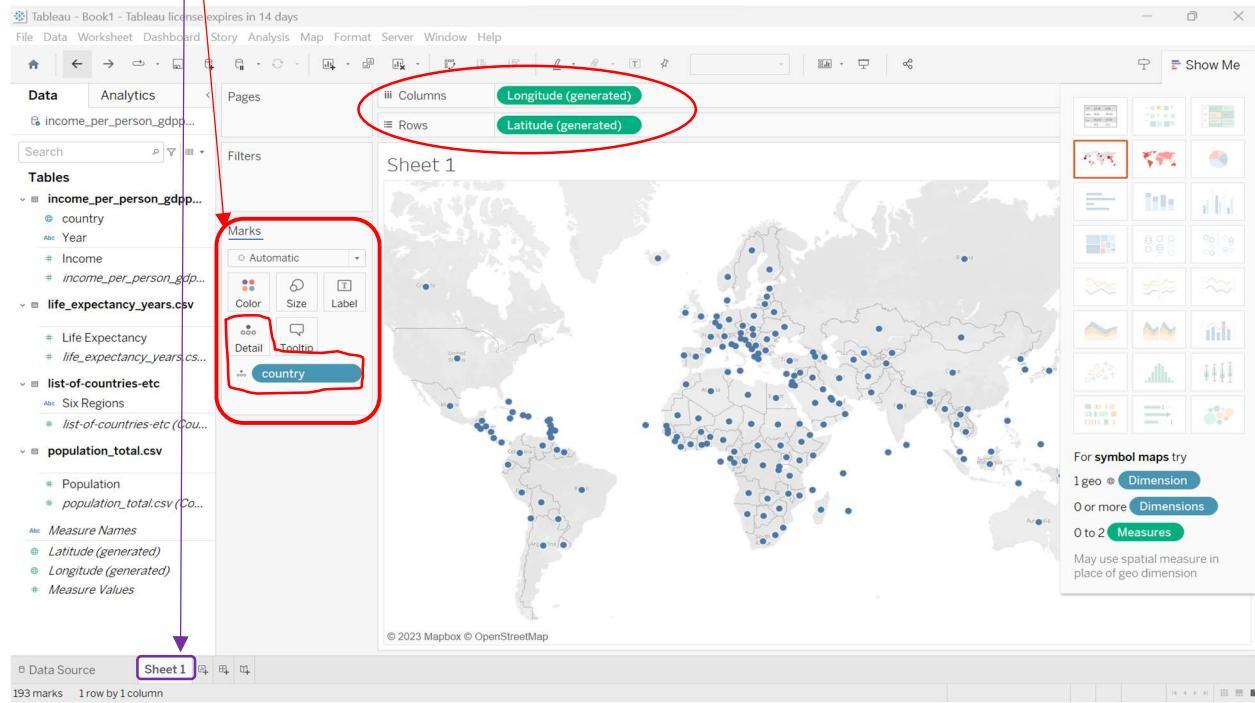
17. Now, let's connect the "list-of-countries-etc" sheet to the income per person data set shown on the Tableau canvas. Establish the relationship between two data sets (i.e., income & list of countries), and the exclamation mark (see the purple circle) will disappear. Note that we need to connect Income data set's **country** variable with list-of-countries-etc data set's **Name** variable.

The screenshot shows the Tableau Data Source interface. On the left, under 'Connections', there is a connection to 'income\_per\_person\_gdpperc.csv'. Under 'Sheets', the 'list-of-countries-etc' sheet is selected. In the center, a 'Drag and Drop' area shows a relationship being established between 'income\_per\_person\_gdpperc.csv' and 'list-of-countries-etc'. A purple circle highlights the path from the first sheet to the second. A red box highlights the 'Name' field in a dropdown menu for selecting a field to relate to 'income\_per\_person\_gdpperc.csv'. Below this, a tooltip says 'Select matching fields to create this relationship.' At the bottom, a red box highlights the 'Name' field in the 'Select a field' dropdown.

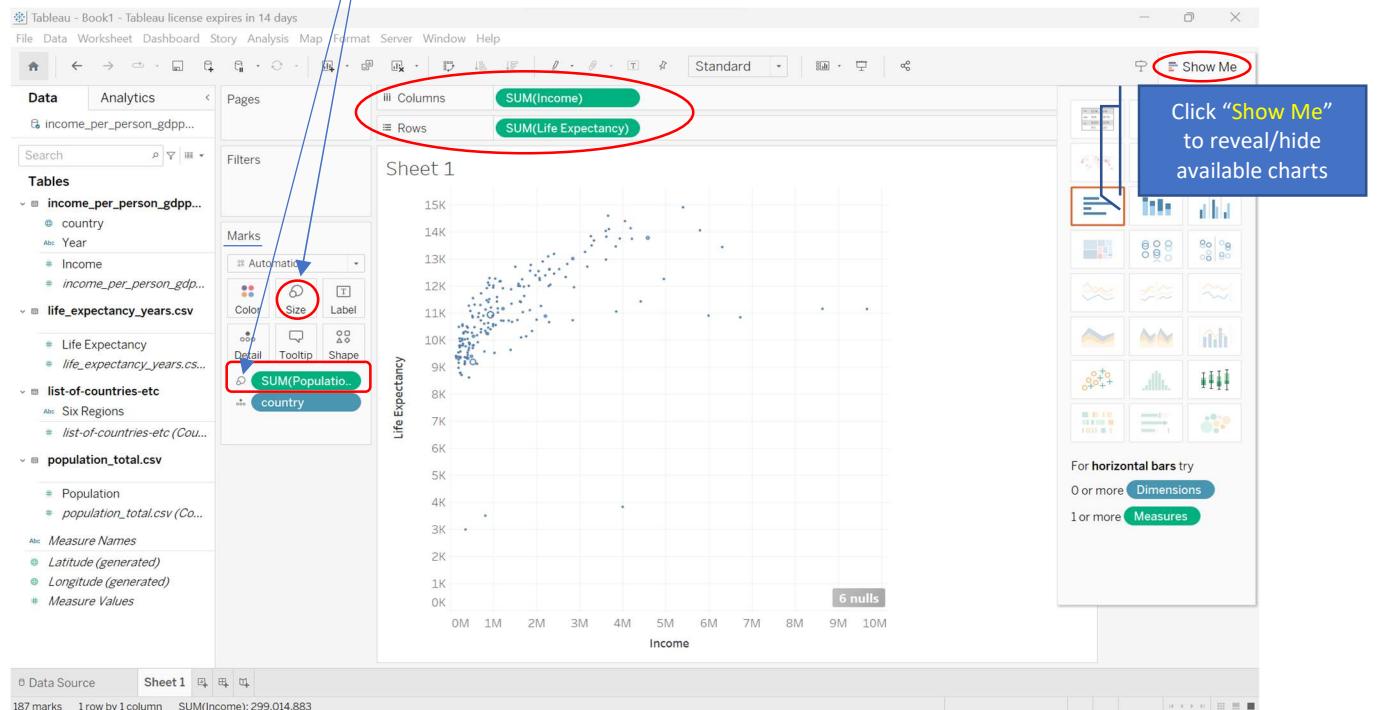
18. Again, we will hide all variables but the "**Six Regions**" variable in the list of countries data set.

The screenshot shows the Tableau Data Source interface. On the left, under 'Connections', there is a connection to 'income\_per\_person\_gdpperc.csv'. Under 'Sheets', the 'list-of-countries-etc' sheet is selected. A checkbox labeled 'Cleaned with Data Interpreter' is checked. In the 'Fields' section, a table shows one row: 'Type' (Abc), 'Field Name' (Six Regions), 'Phys...' (list-of...), and 'Rem...' (six\_re...). The 'Six Regions' field is highlighted with a red box. The 'Fields' section also includes a 'Name' dropdown and a 'Fields' table with other variables like 'south\_asia', 'europe\_central\_asia', etc.

19. We are now ready to build a “static” bubble chart. Specifically, please click “Sheet1” at the bottom. After clicking “**Sheet 1**” (on the bottom of the Tableau window), we will need to drag the **country** variable to the **Marks** card (i.e., the Detail).



20. Let's remove the Longitude and Latitude information from the chart. Next, let's associate the **income** variable with the X-axis (i.e., columns) and associate the **life expectancy** variable with the Y-axis (i.e., rows). Notably, the darkness of the dot's color corresponds to each country's population.



21. We will drag the **Year** variable to the “Pages” box (as a dimension). In addition, we will drag the same **Year** variable to the “Filter” box and then exclude the missing data (i.e., Null) from the data visualization task. More details about Tableau’s filtering function could be found online.

The screenshot shows the Tableau desktop interface. On the left, the data source pane lists several CSV files: 'income\_per\_person\_gdpp...', 'life\_expectancy\_years.csv', 'list-of-countries-etc', and 'population\_total.csv'. The 'Year' field is selected and placed on both the 'Pages' shelf (top) and the 'Filters' shelf (middle). The main canvas displays a chart titled 'Sheet 1 - Null' with 'Life Expectancy' on the Y-axis (ranging from 0 to 90) and 'Year' on the X-axis (ranging from 1800 to 1809). A purple arrow points from the 'Year' field on the Pages shelf to the 'Filters' shelf. Another purple arrow points from the 'Filters' shelf to the 'Filter [Year]' dialog box. A red box highlights the 'Filters' shelf, and another red box highlights the 'Null' option in the 'Enter search text' dropdown of the filter dialog. A callout box on the right contains the text: "A ‘null’ value is a field that is blank, and signifies missing or unknown values. We will instruct Tableau to ‘exclude’ the Null values from the chart." A red arrow points from this callout box to the 'Exclude' checkbox in the filter dialog, which is also highlighted with a red box.

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## Filter Data from Your Views

Applies to: Tableau Cloud, Tableau Desktop, Tableau Server

Filtering is an essential part of analyzing data. This article describes the many ways you can filter data from your view. It also describes how you can display interactive filters in the view, and format filters in the view.

**Watch a Video:** To see related concepts demonstrated in Tableau, watch these free training videos: [Ways to Filter](#) (2 minutes), [Where Tableau Filters](#) (4 minutes), [Using the Filter Shelf](#) (7 minutes), [Interactive Filters](#) (4 minutes), and [Additional filtering topics](#) (7 minutes). Use your [tableau.com](#) account to sign in.

22. We will modify the scale. The way to show the "Edit Axis [income]" is to double click **income** at the bottom of the chart. Once we are in the Edit Axis [Income] pop-up window, check mark "Logarithmic" and uncheck "Include zero."

The screenshot shows the Tableau interface with the 'Edit Axis [Income]' dialog box open. The 'Scale' section is highlighted with a red box, showing 'Logarithmic' checked and 'Include zero' unchecked. A callout box on the right says 'Do NOT include zero in this data visualization practice.' Another callout box on the right says 'Don't be confused by the various chart types. In this project, we will focus on creating a bubble chart.'

Hint: The variable "**year**" could be an issue (as it appears the data type is still a string, with an ABC icon)... and we will deal with this issue in Step #24.

23. The data sets include income and life expectancy information all the way to year 2040.

The screenshot shows a bubble chart in Tableau with 'SUM(Life Expectancy)' on the Y-axis and 'Income' on the X-axis. The time dimension is controlled by a slider at the bottom right labeled 'Year'. A callout box says 'We can click the right arrow to move the time forward (e.g., from 2003 to 2023), and turn the static bubble chart to a dynamic moving bubble chart.'

24. We will create a functional filter to reveal the moving bubble charts to the current year (i.e., 2023). Specifically, we will create a calculated field to set the time ceiling to be the current year (e.g., 2023). FYI, the to-be-typed formula in the calculated field box is [Year] <= YEAR(TODAY())

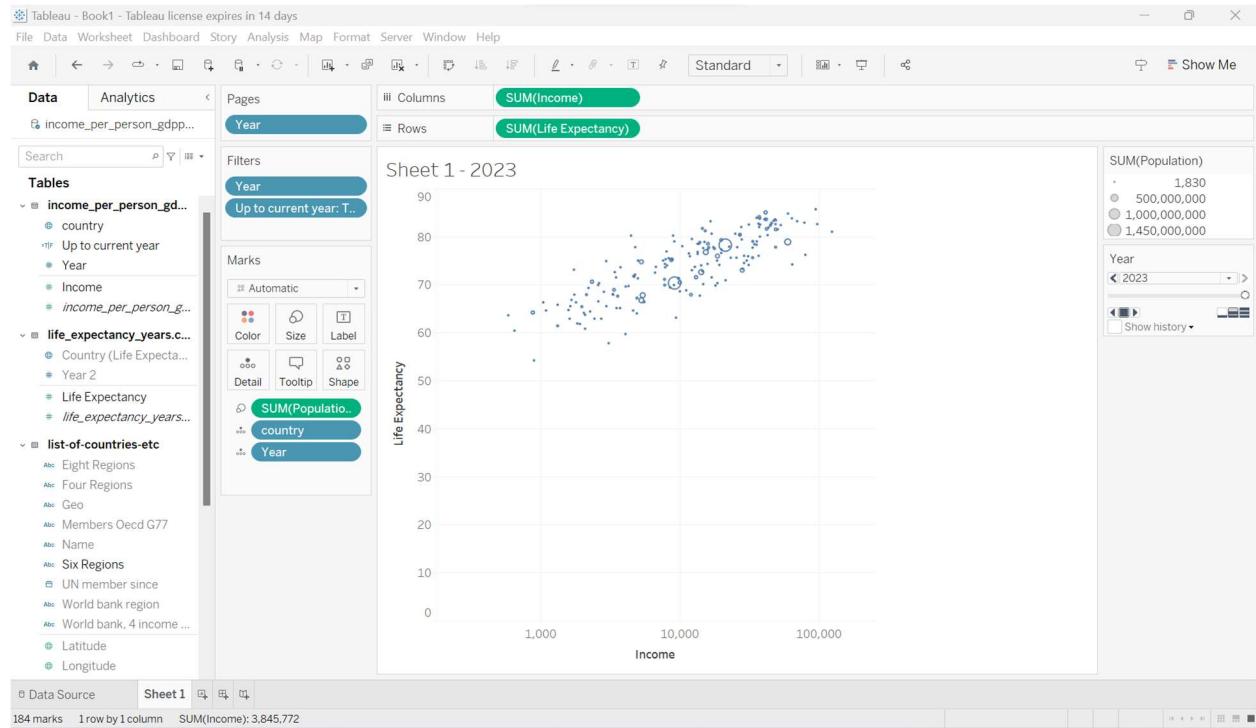
Click the triangle to create a calculated field.

The screenshot shows the Tableau interface with a calculated field dialog open. The dialog title is "Up to current year" and contains the formula "[Year] <= YEAR(TODAY())". The message "The calculation is valid." is displayed below the formula. The background shows a scatter plot of Income vs. Population for various countries, with a color scale for population size.

Hint: Check the variable **Year**'s data type. If we do not update variable **Year**'s data type (from ABC to Whole #), we won't be able to adequately create a "calculated field." Thus, we should double click the **Year** variable and then change its data type from ABC (string) to Number (whole).

The screenshot shows the Tableau interface with the 'Filter' dialog open for the 'Up to current year' condition. The 'General' tab is selected. Under 'Select from list', the 'True' checkbox is checked and highlighted with a red circle. The 'Summary' section at the bottom shows the field is '[Up to current year]' and the selection is 'Selected 1 of 3 values'. The background shows a scatter plot of Income vs. Population for various countries, with a color scale for population size.

25. The current year shown on this revised bubble chart is year 2023.



26. We will bring the “region” information to the chart. FYI, check the Appendix (p. 20) for Tableau’s Replacement function; the **to-be-typed** formula is **UPPER(REPLACE([Six Regions], ‘\_’, ‘’))** → It’s not recommended to copy and paste the formula onto the following box... or you might encounter errors.

Click the triangle to call out a calculated field again.

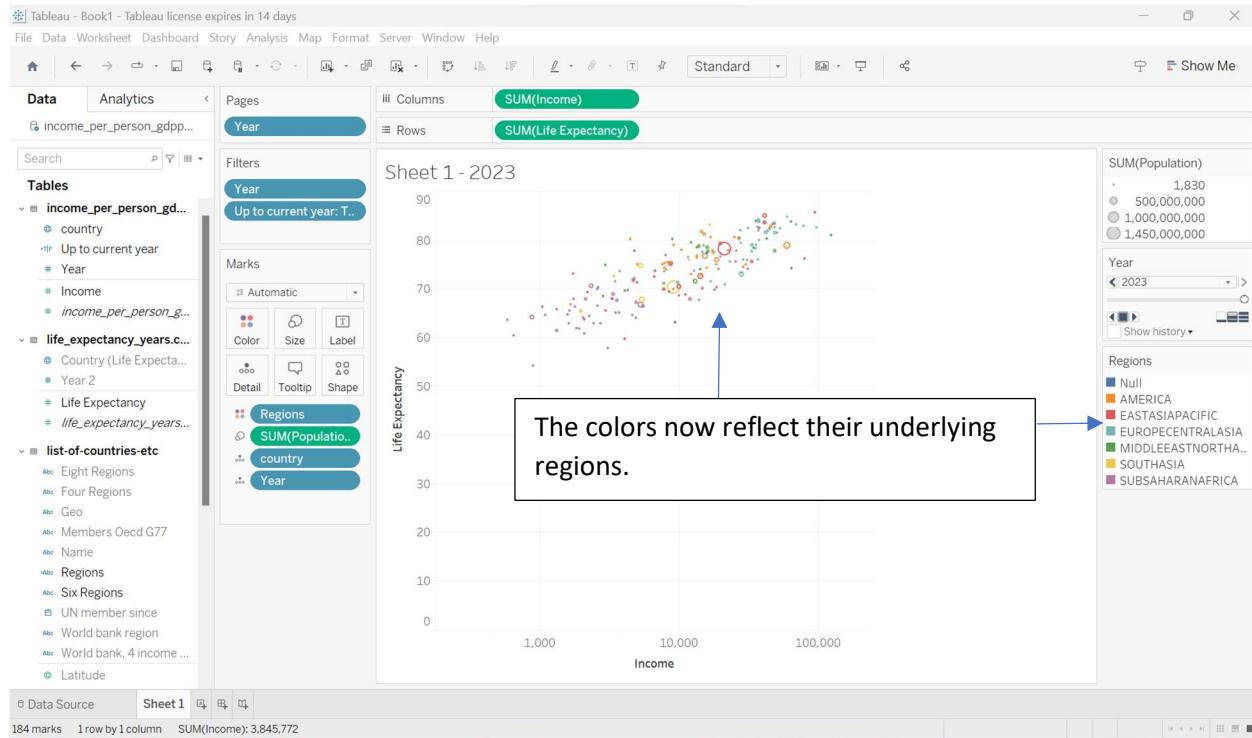
upper(Replace(([Six Regions], '\_', ''))

The calculation is valid.

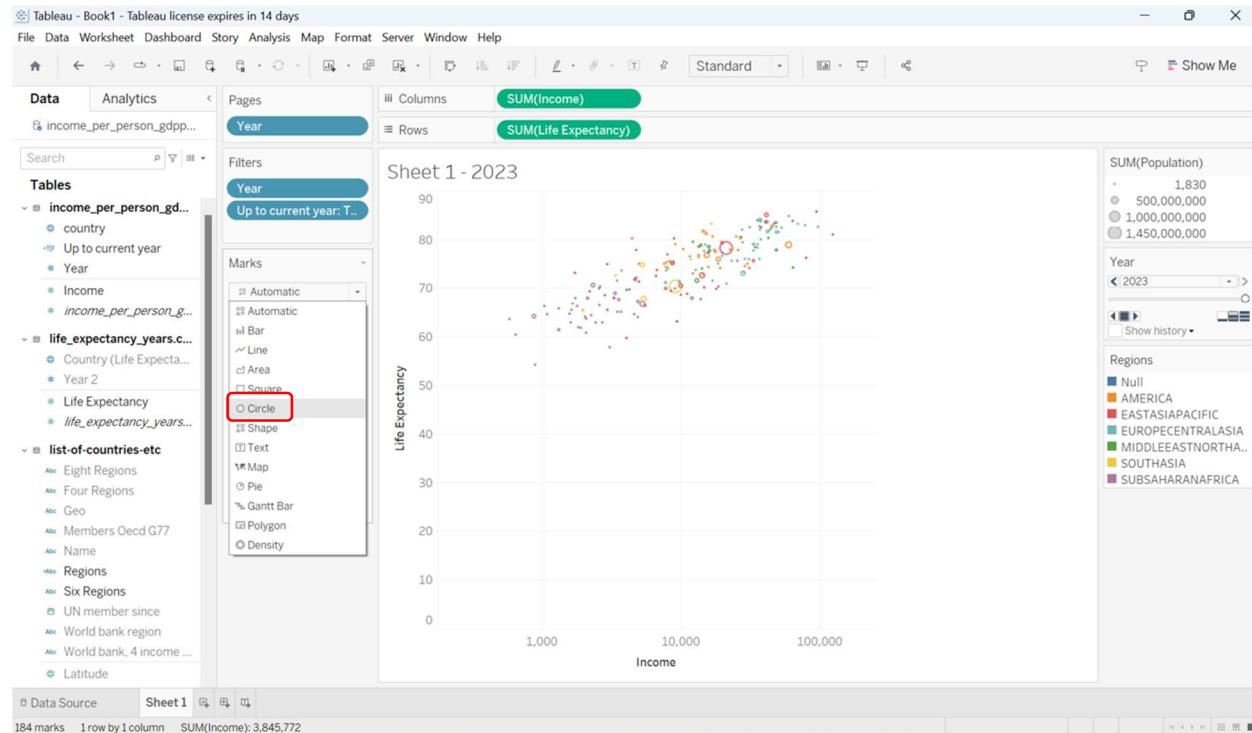
Asiyah Fox (Customer) asked a question.  
January 12, 2022 at 7:53 PM

Trouble with basic copy/pasting on Tableau Desktop for Mac.

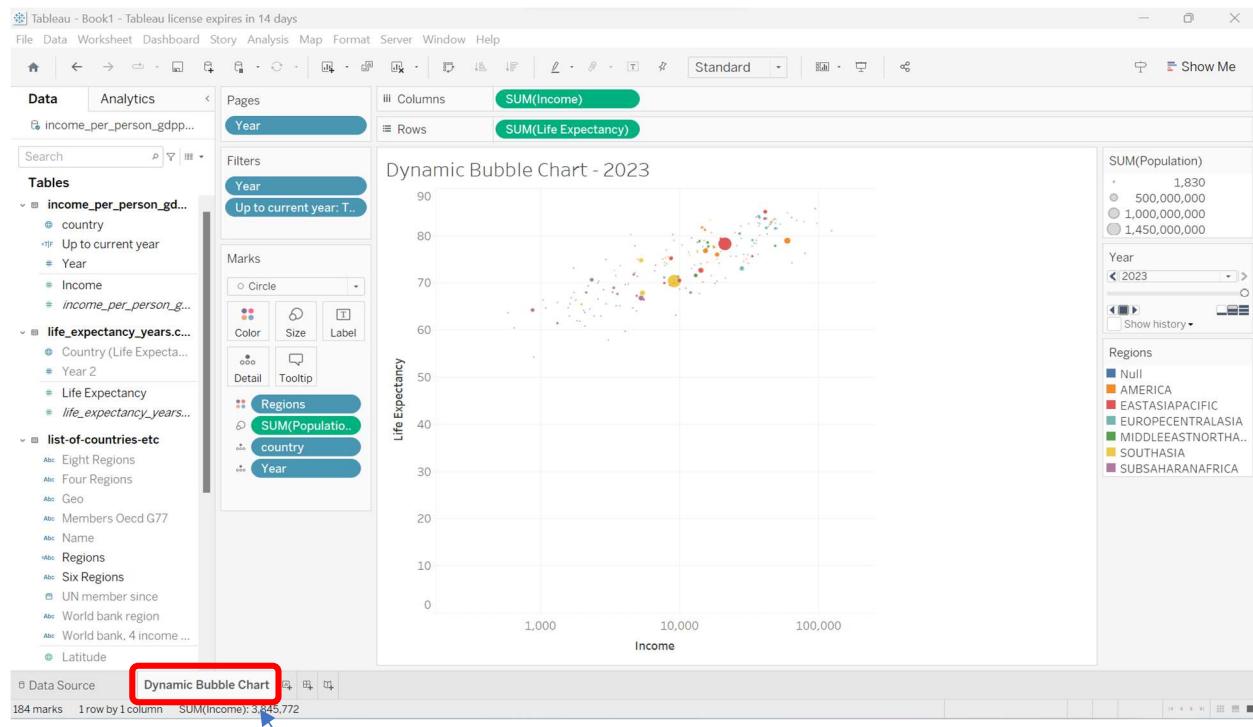
I've worked with Tableau for years at other companies, and I've never experienced this issue previously. However, over the last few years at my current company where we use Macs, several coworkers and I experience an issue when copy/pasting on Tableau Desktop.



## 27. We will replace the dots with circles.

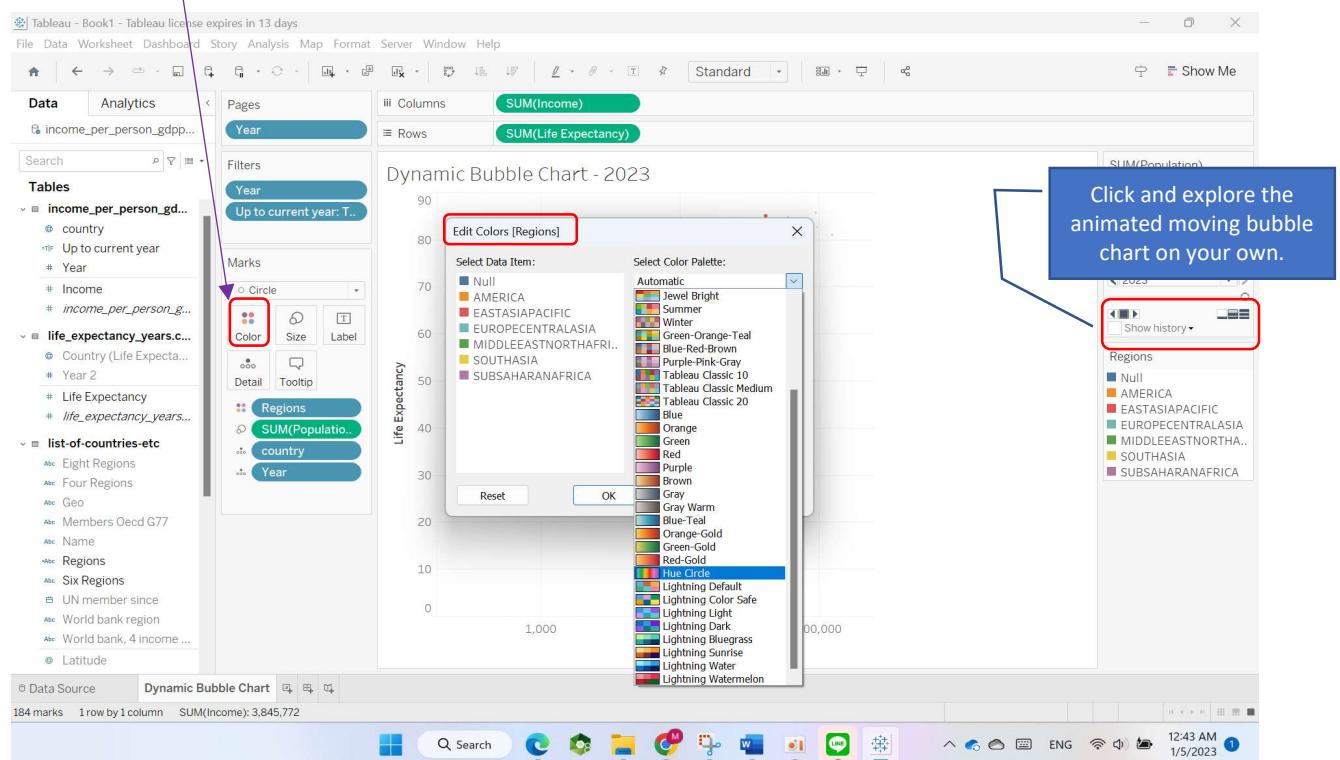


## 28. We will update the chart name (from “Sheet 1” to “Dynamic Bubble Chart”).

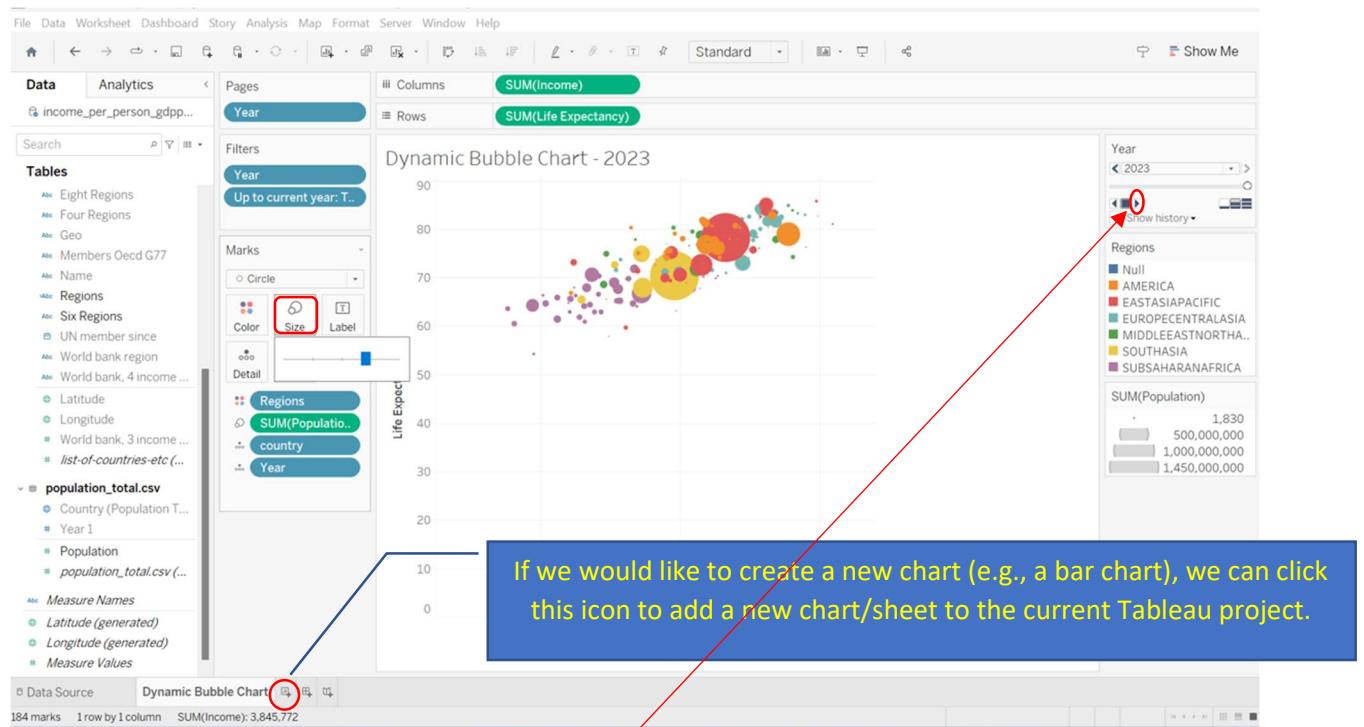


Hint: just click the name of the sheet and we can change its name.

## 29. We can modify the colors for the aesthetic purposes. Just click Color to Edit colors.

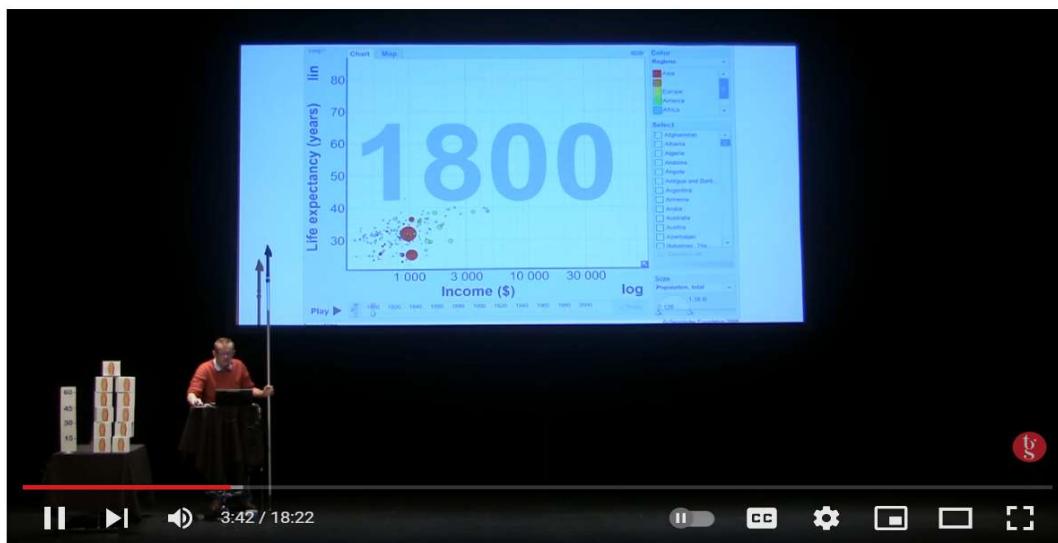


30. We can also click the Size icon to further modify the size of the circles in this bubble chart.



Finally, we are ready to demonstrate an animated moving bubble chart and tell our story by clicking a forward triangle button (see a red circle shown on the above). If you wonder how to give an impressive live presentation using the dynamic charts, you might find **Prof. Hans Rosling's** presentation of relevance. Please click the underlined link for a MUST SEE presentation: Please do watch the first four-minute video, and then feel free to briefly scan through the rest of this YouTube video.

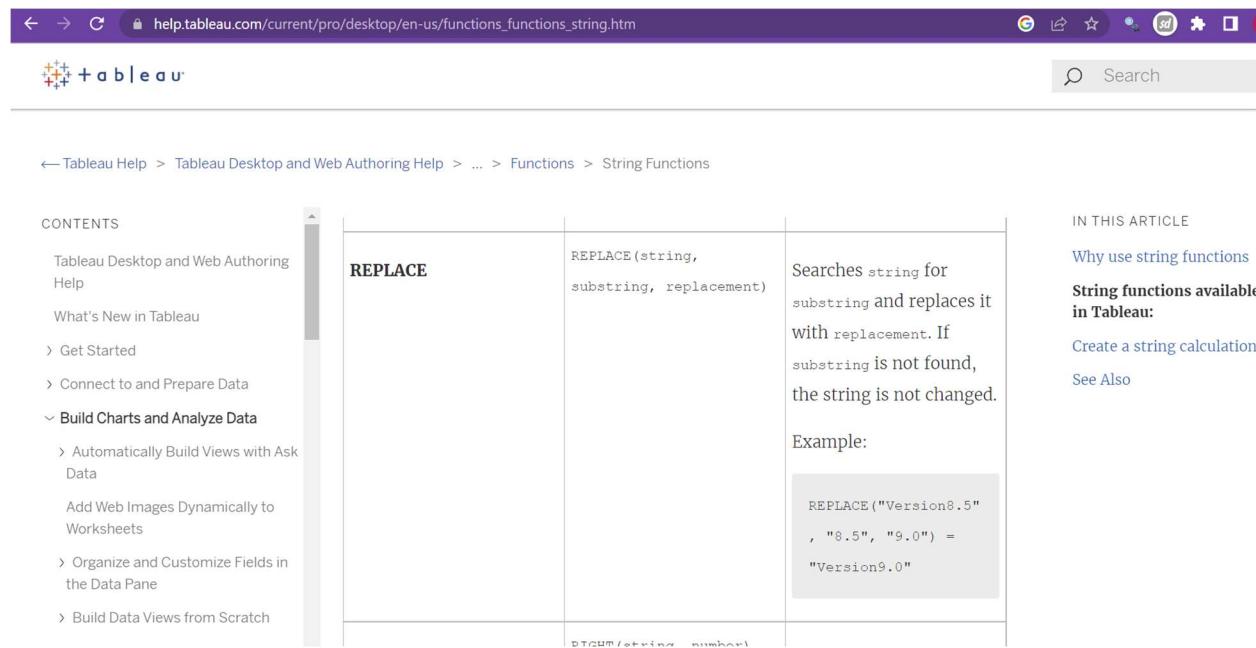
[https://www.ted.com/talks/hans\\_rosling\\_new\\_insights\\_on\\_poverty?referrer=playlist-the\\_best\\_hans\\_rosling\\_talks\\_yo&autoplay=true](https://www.ted.com/talks/hans_rosling_new_insights_on_poverty?referrer=playlist-the_best_hans_rosling_talks_yo&autoplay=true)



Correlating income and life expectancy throughout history | Hans Rosling | TGS.ORG

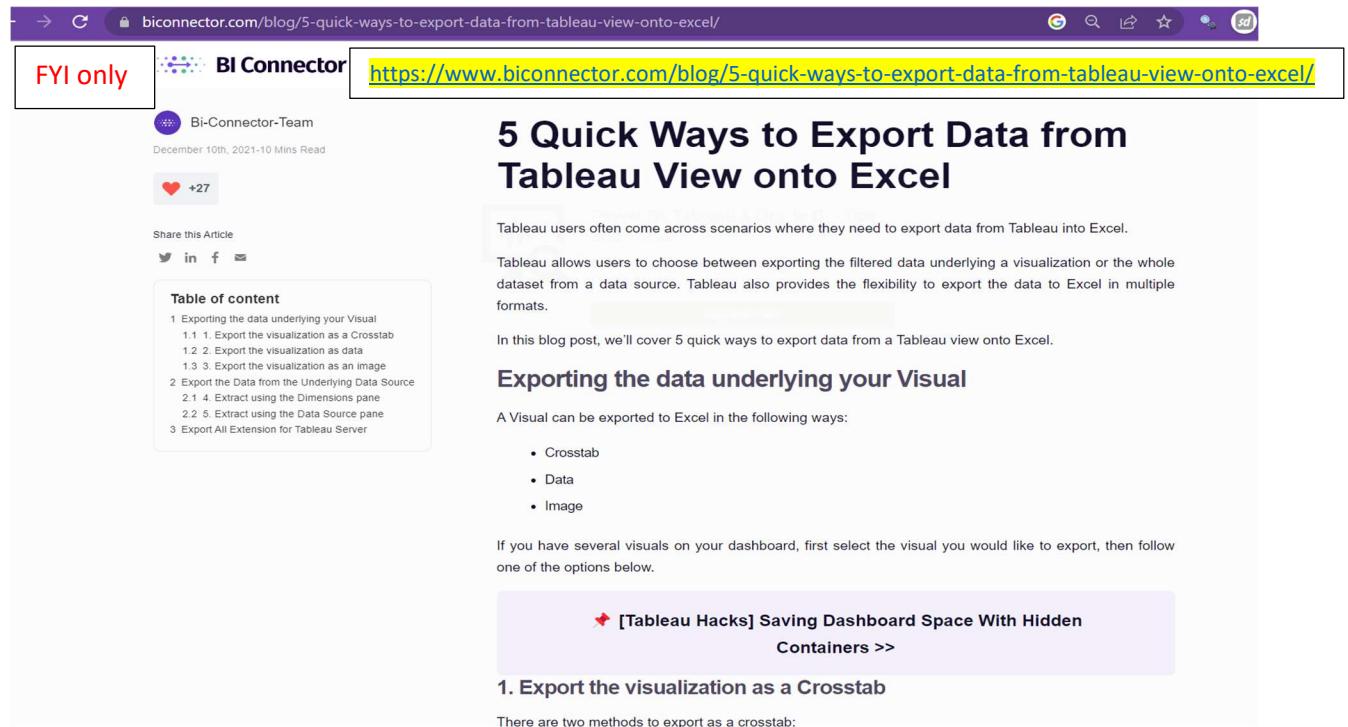
## Appendix:

1. Tableau's main functions (e.g., Replacement) could be found online:  
<https://help.tableau.com/current/pro/desktop/en-us/functions.htm>

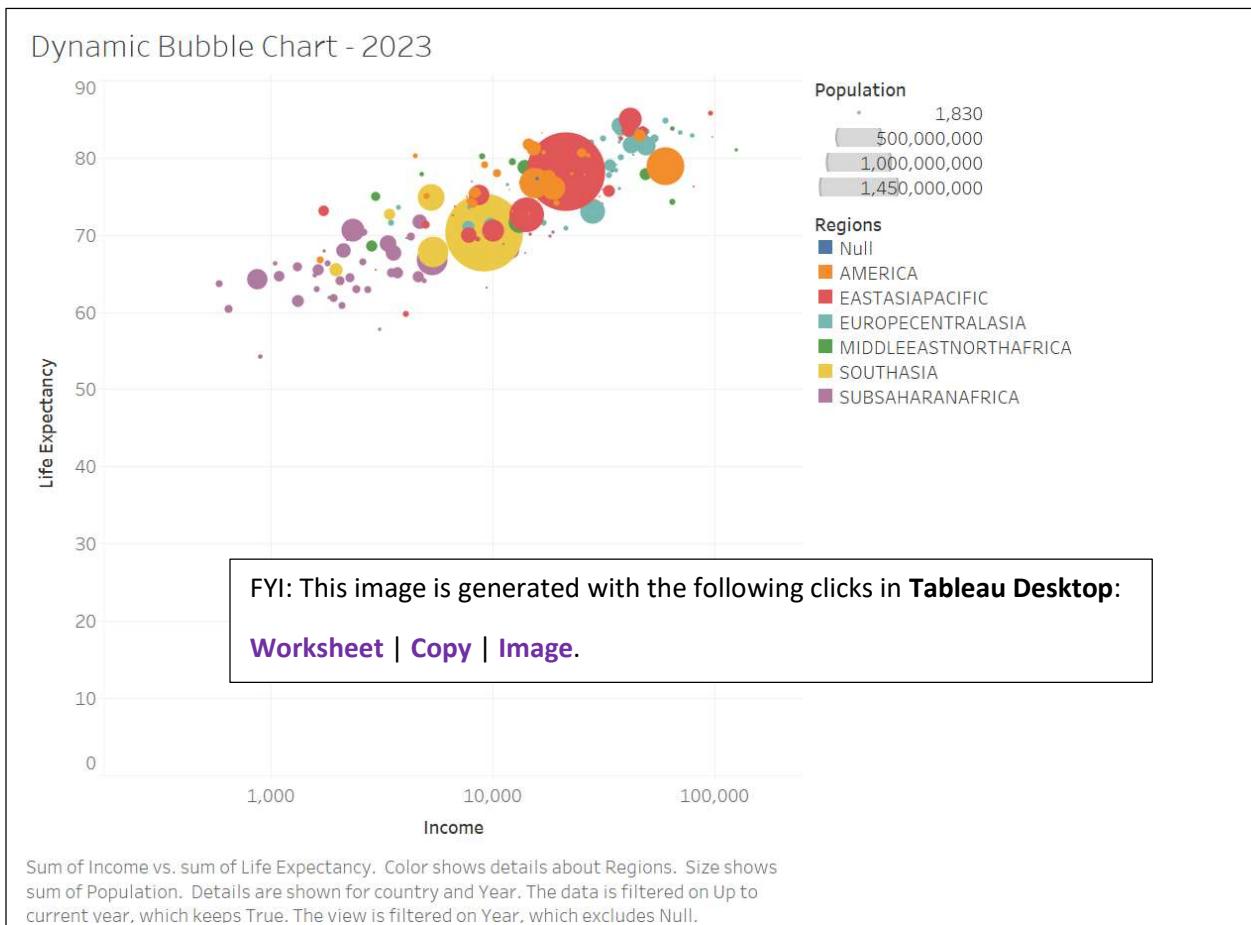
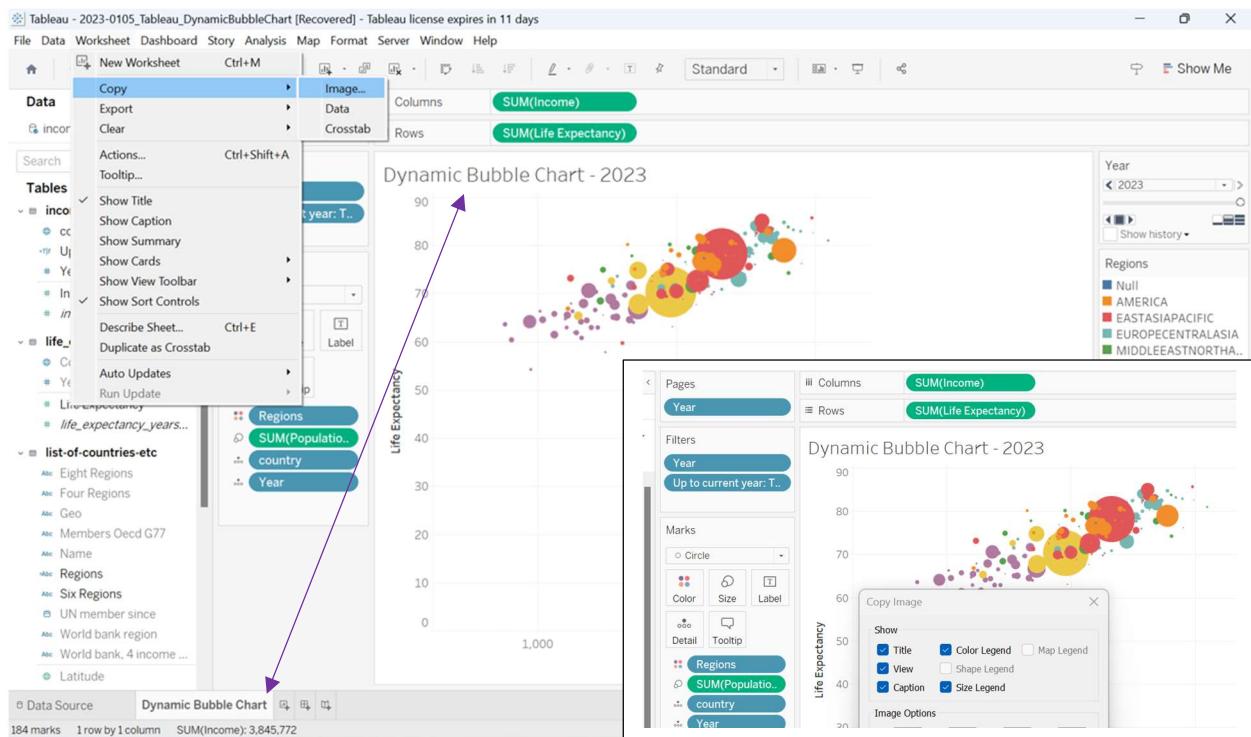


The screenshot shows the Tableau Help website with the URL [https://help.tableau.com/current/pro/desktop/en-us/functions\\_string.htm](https://help.tableau.com/current/pro/desktop/en-us/functions_string.htm) in the address bar. The page title is "String Functions". On the left, there is a navigation sidebar with "CONTENTS" and a list of topics under "Tableau Desktop and Web Authoring Help". The main content area displays a table for the "REPLACE" function, which includes the syntax `REPLACE(string, substring, replacement)`, a description of how it searches for a substring and replaces it with a replacement, and an example code block showing `REPLACE("Version8.5", "8.5", "9.0") = "Version9.0"`. To the right, there is a "IN THIS ARTICLE" sidebar with links to "Why use string functions", "String functions available in Tableau:", "Create a string calculation", and "See Also".

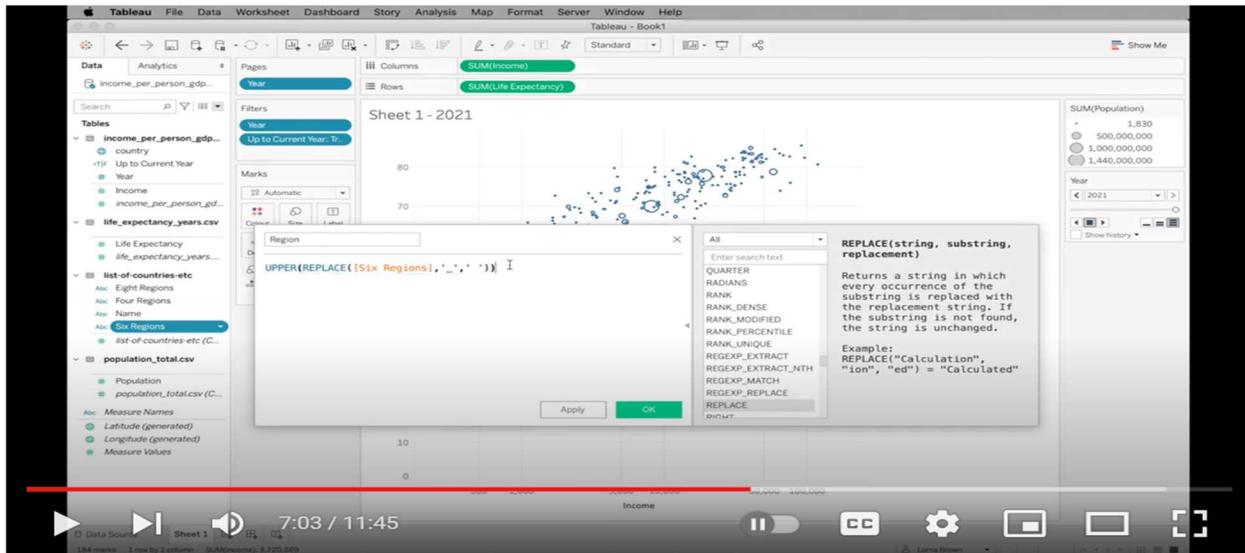
2. Feel free to Google search for additional Tableau tips (e.g., how to export data from Tableau View onto Excel or a relational database).



The screenshot shows a blog post titled "5 Quick Ways to Export Data from Tableau View onto Excel" by Bi-Connector Team. The post has a red "FYI only" box at the top left. It includes a table of contents with five methods for exporting data. The first method is "Exporting the data underlying your Visual". Below this, there is a section titled "Exporting the data underlying your Visual" with a bulleted list of three options: Crosstab, Data, and Image. A note says if you have several visuals on your dashboard, you should select the one you want to export. At the bottom, there is a callout box for "[Tableau Hacks] Saving Dashboard Space With Hidden Containers >>" and a section titled "1. Export the visualization as a Crosstab".



3. If you (the audience) prefer to watch a Tableau bubble chart creation video, you may find the following two YouTube videos of help.



#WOW2021 Week 11 | Tableau : Can you recreate the work of Hans Rosling?

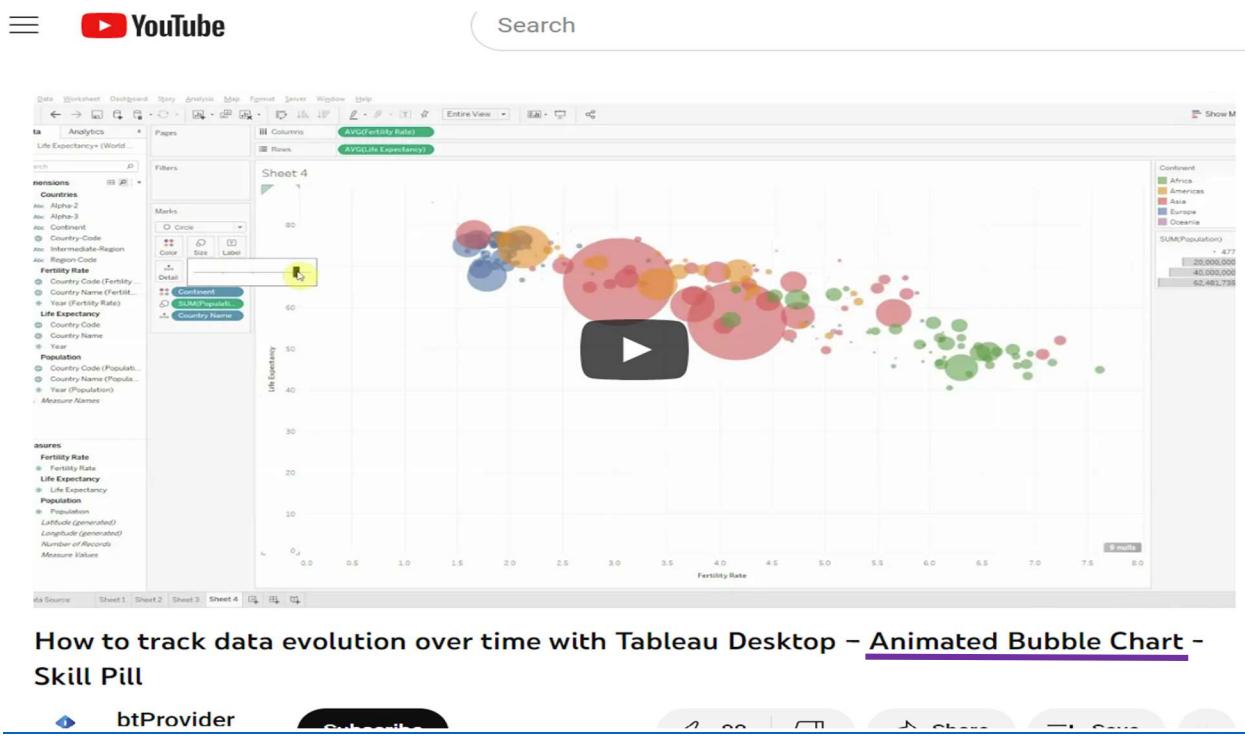

Workout Wednesday
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 11

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...

<https://www.youtube.com/watch?v=LaCprFuwmHk>

\*\*\*\*\*



How to track data evolution over time with Tableau Desktop – Animated Bubble Chart – Skill Pill

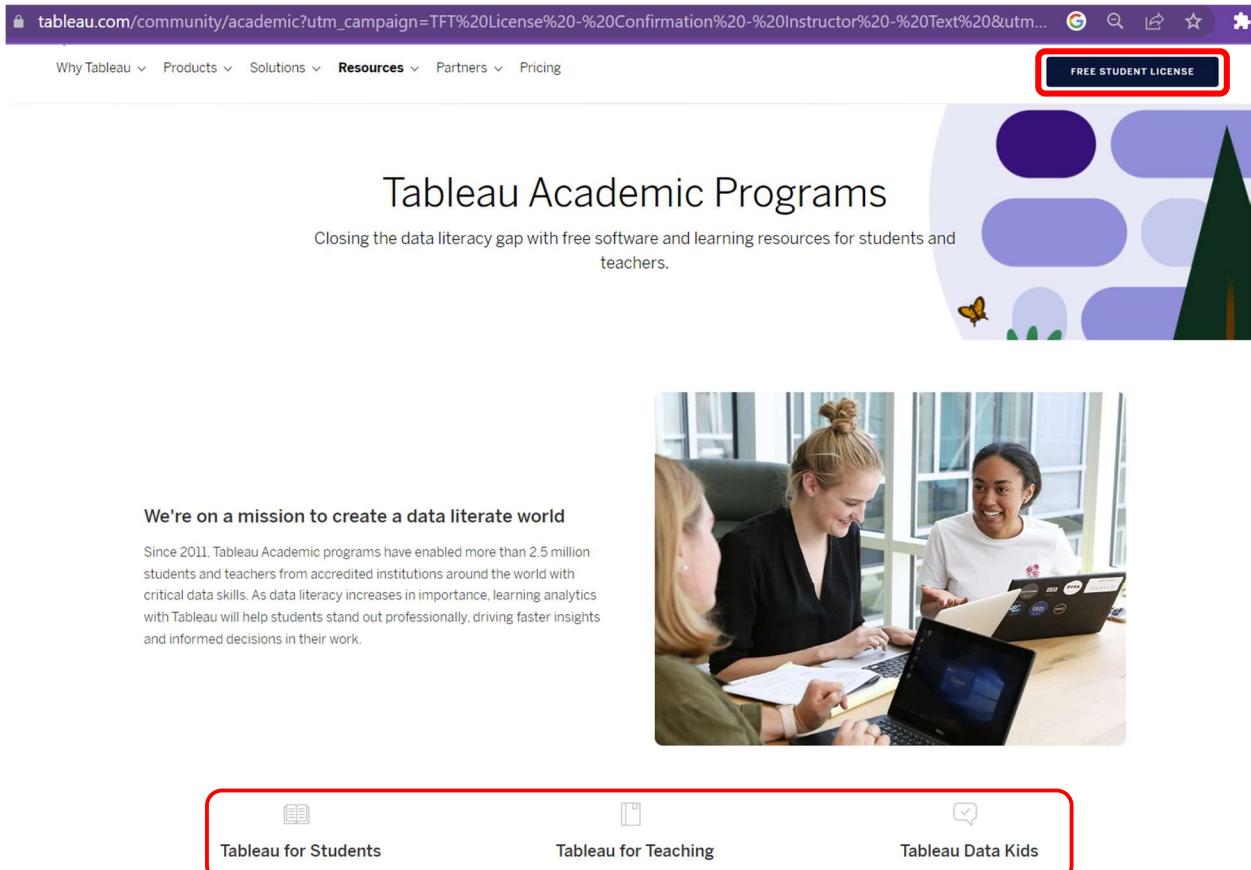
<https://www.youtube.com/watch?v=lK6AE3u6LGs>

4. Tableau also offers quite a few training videos (<https://tabsoft.co/3QuMLGp>). Happy learning!

The screenshot shows the Tableau Learning page for 2022.2. At the top, there's a navigation bar with links for Why Tableau, Products, Solutions, Resources, Partners, and Pricing. On the right, there are buttons for SIGN IN, BUY NOW, and TRY NOW. Below the navigation, a search bar is present. The main content area is titled "Free Training Videos" and "2022.2". A section titled "Creator" describes responsibilities for deep data prep and analysis. It lists three video categories: "Getting Started" (9 videos, 20 min), "Tableau Prep" (2 videos, 10 min), and "1 VIDEO". To the right, a sidebar titled "More ways to learn and connect" includes a link to "What's New in Tableau 2022.4" which features short demos of new functionalities.

The screenshot shows a specific video titled "Getting Started: Web Authoring in Tableau Online" by James Pollard, a Learning Experience Designer. The video player interface shows a play button, volume control, and a progress bar at 0.01 / 0.22. To the right of the video, a sidebar titled "CURRENT TOPIC: Getting Started" lists several related topics with their durations: "Getting Started" (1 MIN), "Tableau Cloud" (1 MIN), "Connecting to Data" (2 MIN), "The Workspace Area" (2 MIN), "Map: Profit Ratio by Geography" (2 MIN), "Area Charts: Sales by Category; Sales by Segment" (5 MIN), and "Text Table: Key Performance Indicators" (2 MIN).

5. To learn more about available Tableau programs, check out its Academic Community page:  
<https://tabsoft.co/3vOkq4m>



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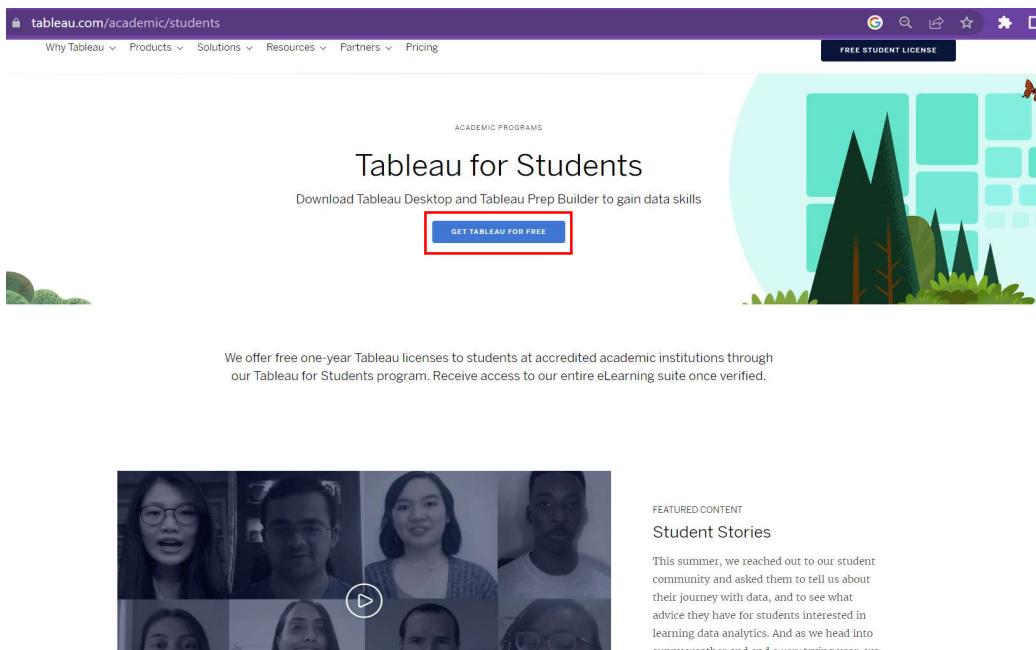


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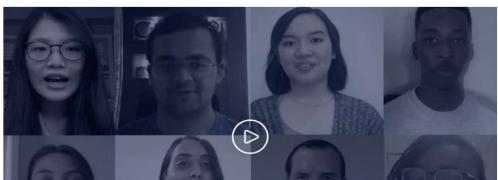
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**FEATURED CONTENT**  
**Student Stories**

This summer, we reached out to our student community and asked them to tell us about their journey with data, and to see what advice they have for students interested in learning data analytics. And as we head into

7. Explore the Tableau Community (<https://community.tableau.com/s/>). For example, click the Forums and then check the **Tableau Public!**

The screenshot shows the Tableau Community website at <https://community.tableau.com/s/>. The top navigation bar includes links for Why Tableau, Products, Solutions, Resources, and Partners. On the right, there are buttons for PRICING, TRY NOW, LOGIN, and a search icon. The main header says "Community". Below it, a navigation bar has links for Home, My Activity, **Forums** (which is highlighted with a yellow box), Ideas, Groups, Resources, Get Started, and Blogs. A "FORUMS" button is also present. The main content area features a "Welcome to the Community!" message, a search bar, and a button to "ASK A QUESTION". A promotional banner at the bottom encourages users to "Take the Tableau Blueprint Assessment to Start your Year!" with a "TAKE THE ASSESSMENT!" button.

The screenshot shows the "Explore Forums" page at <https://community.tableau.com/s/explore-forums>. The top navigation bar is identical to the previous screenshot. The main content area has a heading "Have a Question? Click on a Topic below" and a sub-instruction "Choose a topic relevant to your question and select "Ask a Question" within the chosen topic." A red box highlights a note: "New to the Forums? Check out our [First Time Here](#) page for help on how to search for answers and how to best ask questions." Below this, a section titled "Have a Question about a Tableau Product? Choose below" lists several categories: Tableau Desktop, Tableau Server, Tableau Prep (which is circled in red), Tableau Cloud, Tableau Public (which is circled in red), Actions & Filters, Server Admin, Licensing, Calculations, Data Connectivity, Dates & Times, Developers & APIs, Installations & Upgrades, Exports & Subscriptions, Maps & Geocoding, and a "View all Topics" link. A blue box with yellow text "See a text box on page 3." points to the Tableau Public category, and another blue box with yellow text "I recommend this one too." points to the Tableau Prep category. A red arrow points from the "See a text box on page 3." box to the "I recommend this one too." box. At the bottom, there is a "Browse All Topics" link.

**Acknowledgement:** Special thanks to Prof. Gary H.T. Chao for his constructive comments toward a draft version of this 30-step Tableau Bubble chart learning tutorial.

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