CSCI E-79: The Art and Design of Information
Spring 2019

LAB 3

Creating visualizations with tools

Part 2: Tableau

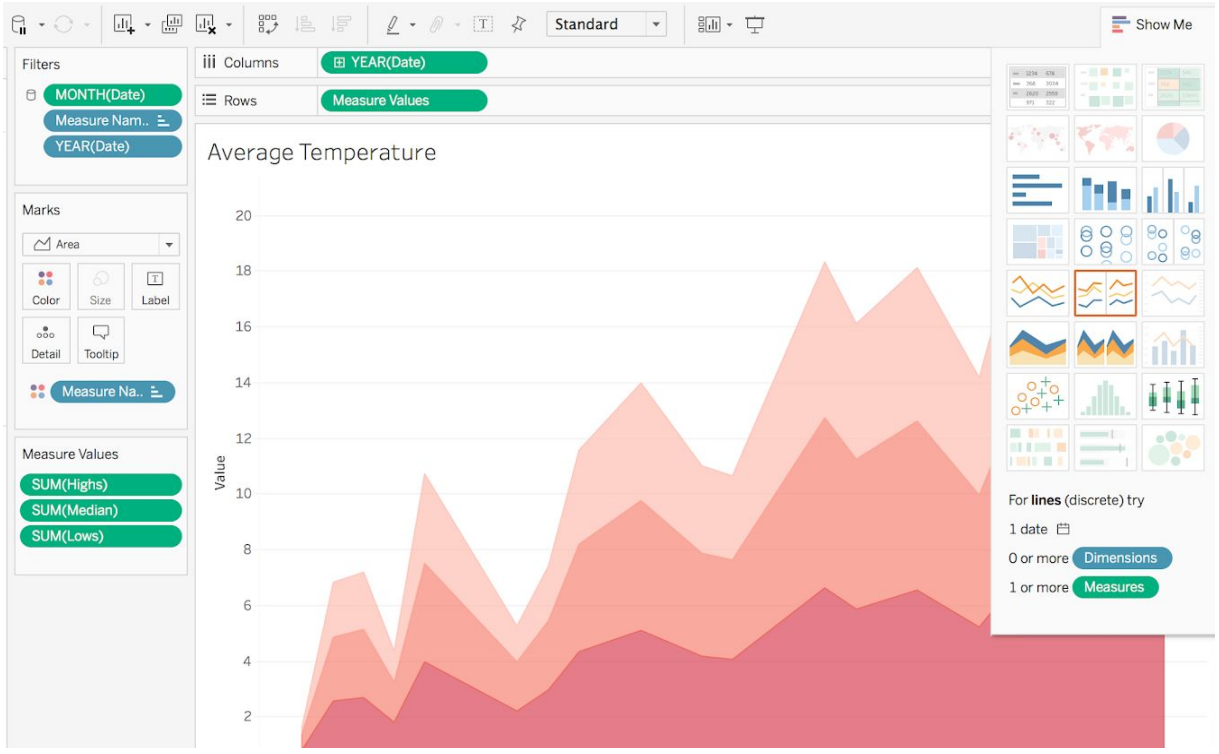

Figure 1: Tableau Interface

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Introduction

Welcome to E-79 Lab 3!

This lab will guide you through the creation of visualizations with Tableau. Tableau is a powerful data visualization tool that helps transforming raw data into more understandable format. Tableau makes data analysis very fast and allows the creation of visualizations in the form of both, worksheets and dashboards. The tool offers very intuitive interface, allowing a non-technical user to create a customized fully-functional visual representations.

Topics and Learning Objectives

- Working with Tableau, creating worksheets and dashboards
- Data exploration and data visualization
- Creating multiple visualizations, changing data and models
- Spotting trends, patterns, and insights
- Combine different visualizations in a final dashboard

What is Tableau?

Tableau is a powerful and intuitive business intelligence and data visualization tool. It helps understanding trends in data, offering an intuitive interface and easy-to-learn functionalities. It allows the user to conduct a deep data exploration and supports generating effective visualization. Tableau aims to transform the way people use data - in fact it is very easy for analyzing big datasets using different visual formats.

The biggest strength of Tableau is interactivity. It provides interactive visualizations and dashboards, easy on the spot linking, sorting, and filtering. Moreover, Tableau is one step closer to the democratization of data - you don't need technical skills to understand the trend. It is fast, reliable, and easy to use, providing a great environment for intuitive play with all visual elements and features.

WHY USING TABLEAU?

Tableau is a perfect tool for "fast prototyping". It allows performance of the Excel-like operations and the creation of visualizations without previous data processing. It can be used to explore data and models until you find the final "shape", with a set of functionalities that will create polished and custom visualizations. It is famous for creating dashboards, but limited for integrating functionalities with other frameworks.

ADVANTAGES IN USING TABLEAU

Fast Visualizations and insights

This is one of the biggest strengths in Tableau. You can work with a lot of unstructured data and create a range of visualizations thanks to built-in features. Users have the option to switch between different visualizations in order to bring a greater context, ways of drilling down and exploring the data in more detail. It also helps exploring the visualizations and look at the same data from different angles.

User-friendly interface

The interface is nicely organized for people who do not have coding experience. Everything can be done without a prior domain expertise. Since most of the features are drag-and-drop, each visualization is easy to generate.

Working with various data sources

Tableau is included by various organizations that use data-driven applications. This is where Tableau has an edge over all other business intelligence and analytics tools. Tableau lets you work by connecting to various data sources, data warehouses, cloud data, big data, and many other types of data storages into a single application.

Getting started

1/ Download and install Tableau

Tableau Desktop is free for students and allows you to export a series of different formats and save your work locally.

Tableau Public is free for everyone. It allows you to perform any kind of data exploration and visualization, but you can't save or export your files. You can only upload your work on a public Tableau server.

2/ Convert ".csv" in ".xlsx" with Excel

1. Start Excel
2. Select 'Data', and then click 'From Text'.
3. Browse for the file you want to open, and click 'Import'.
4. In the Text import wizard, make sure the 'Delimited' option is selected. Click 'Next'.
5. In the delimiters section, tick 'Comma'. The text qualifier box should show the double-quote symbol. Click 'Next'.
6. Mark each column as 'Text'. The first column will initially be highlighted. Move the horizontal cursor as far as it will go to the right; then, holding the shift key down, click the very last column heading. You should now have every column highlighted. Click the 'Text' data format. It will now say 'Text' in the header of every column. Click Finish.
7. It may ask you 'Where do you want to put the data?'. It will allow you to click into any cell on the blank worksheet to determine where the data should go. Click 'OK' to proceed.
8. The data should appear in the spreadsheet. Where column headings are included these will appear in the top row.

Once you have your ".csv" converted you can save the Excel file and open Tableau.

Visualizing data with Tableau

1/ add your data

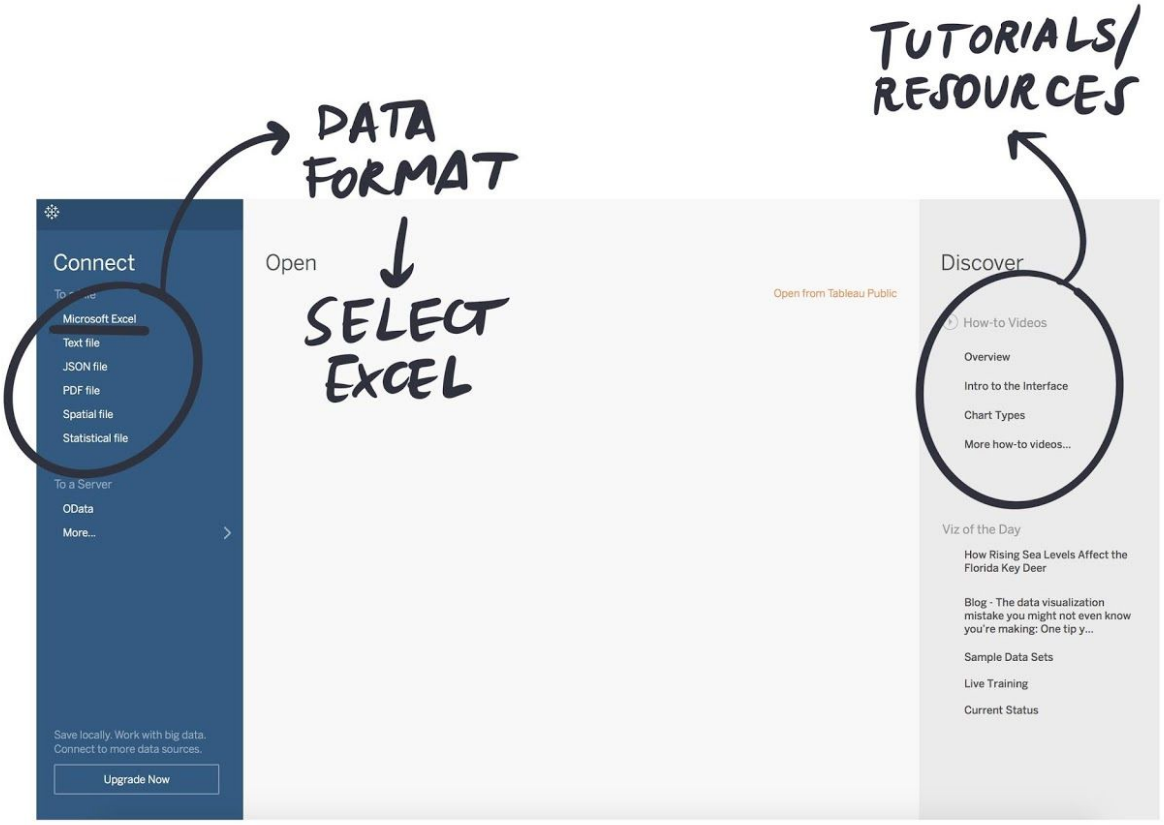


Figure 2: Import data to Tableau

Uploading data in Tableau is very simple. In the first window that appears, click on the file format, in this case select Microsoft Excel.

Select the file .xlsx from the computer folder.

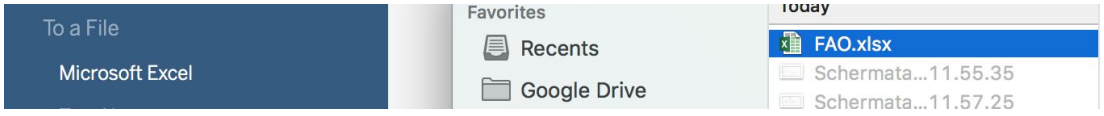


Figure 3: Selecting .xlsx form to upload

At this point you will see the name of your dataset appearing on the left-hand side and a list of the fields it contains.

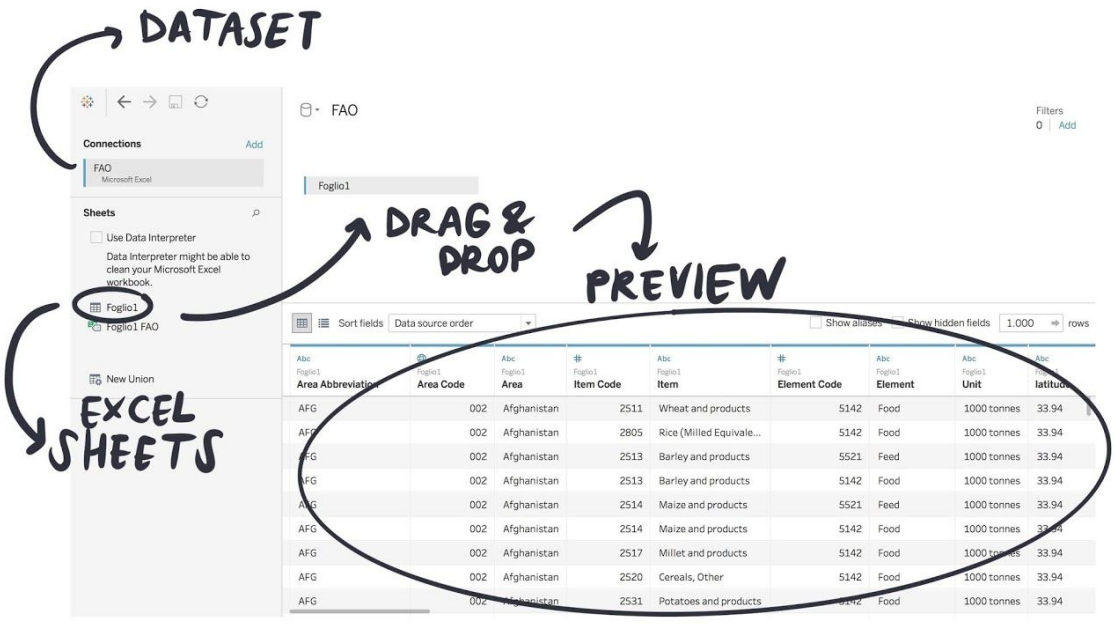


Figure 4: Imported in Tableau - final view

At this point, your dataset is uploaded and you can see it on the left side of the screen, divided by spreadsheets.

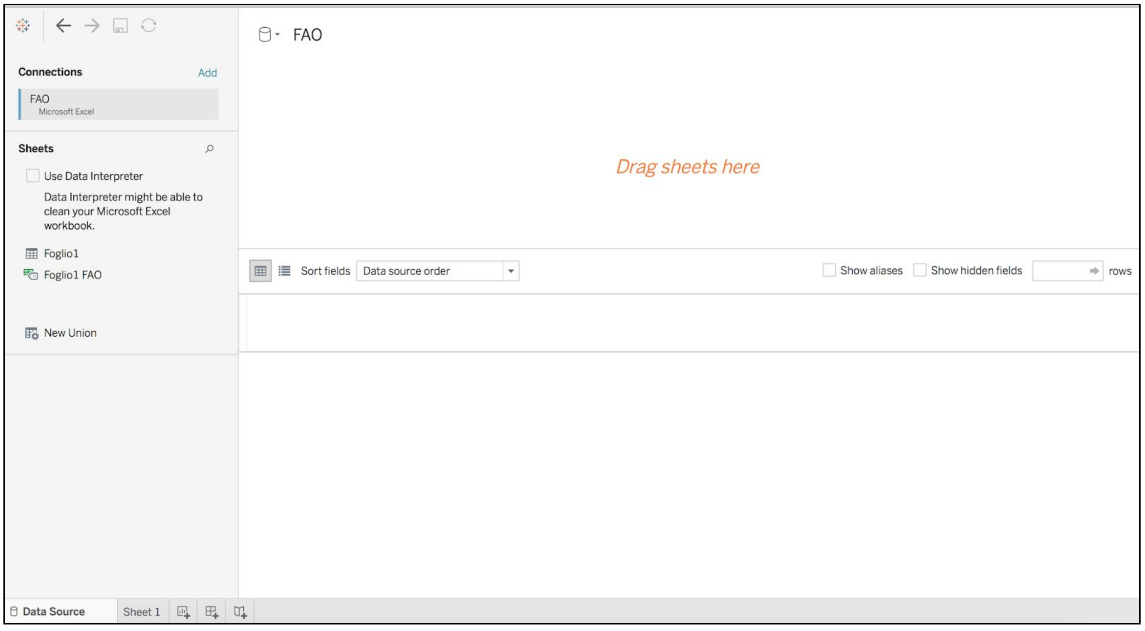


Figure 5: Imported dataset on the left-hand side

Drag and drop the spreadsheets that you want to use on the top right area of the screen and wait until the data are loaded.

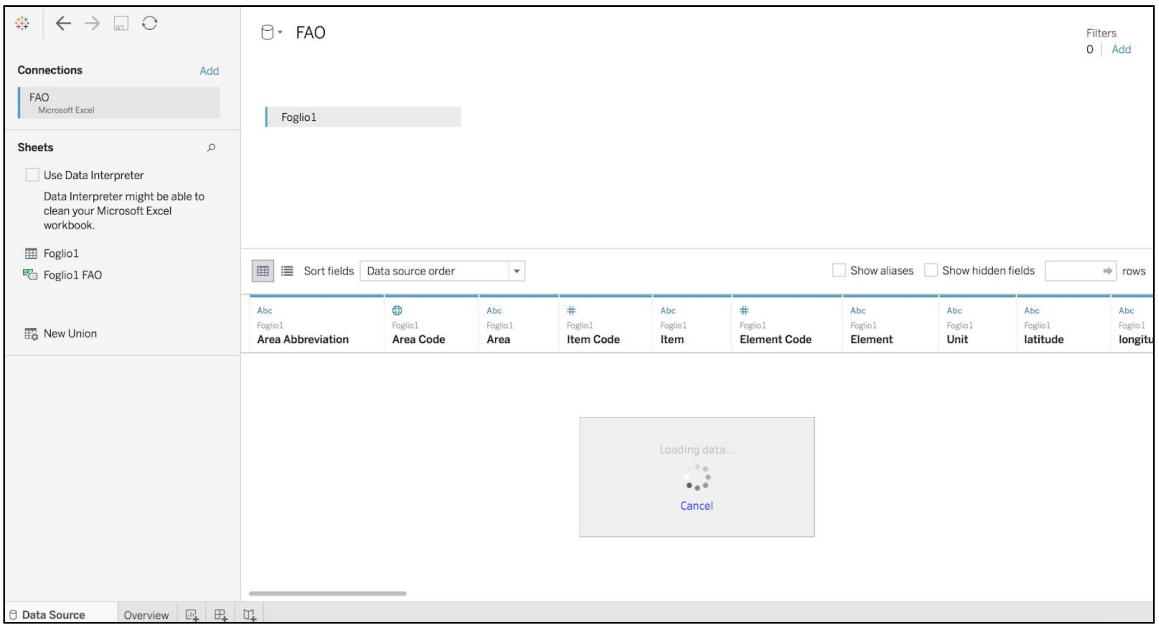
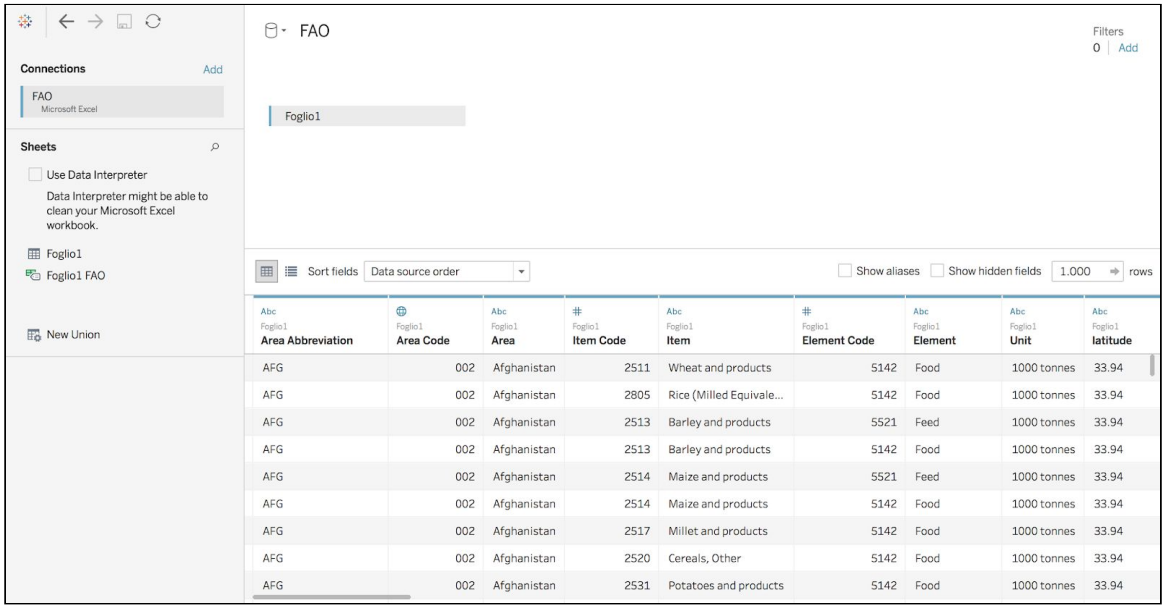


Figure 6: Loading dataset

Once the data is loaded you will see a preview of your dataset, with columns and rows.



Area Abbreviation	Area Code	Area	Item Code	Item	Element Code	Element	Unit	latitude
AFG	002	Afghanistan	2511	Wheat and products	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2805	Rice (Milled Equivale...	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2513	Barley and products	5521	Feed	1000 tonnes	33.94
AFG	002	Afghanistan	2513	Barley and products	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2514	Maize and products	5521	Feed	1000 tonnes	33.94
AFG	002	Afghanistan	2514	Maize and products	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2517	Millet and products	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2520	Cereals, Other	5142	Food	1000 tonnes	33.94
AFG	002	Afghanistan	2531	Potatoes and products	5142	Food	1000 tonnes	33.94

Figure 7: Loaded dataset

At this point you can explore columns and rows of the dataset. Tableau automatically recognizes datatypes in the columns, noted with a little icon on the top of the column name. As you can see in this example, it can detect strings, lon/lat, and/or numbers. If the datatype is wrong you can change it by clicking on the small icon and selecting the correct one.

2/ Interface and layout

In the left hand side of the interface you can find the **fields** that Tableau automatically divides into **dimensions** and **measures.** Dimensions are discrete values, while measures are continuous values. You can drag and drop all the fields in the central part of the interface.

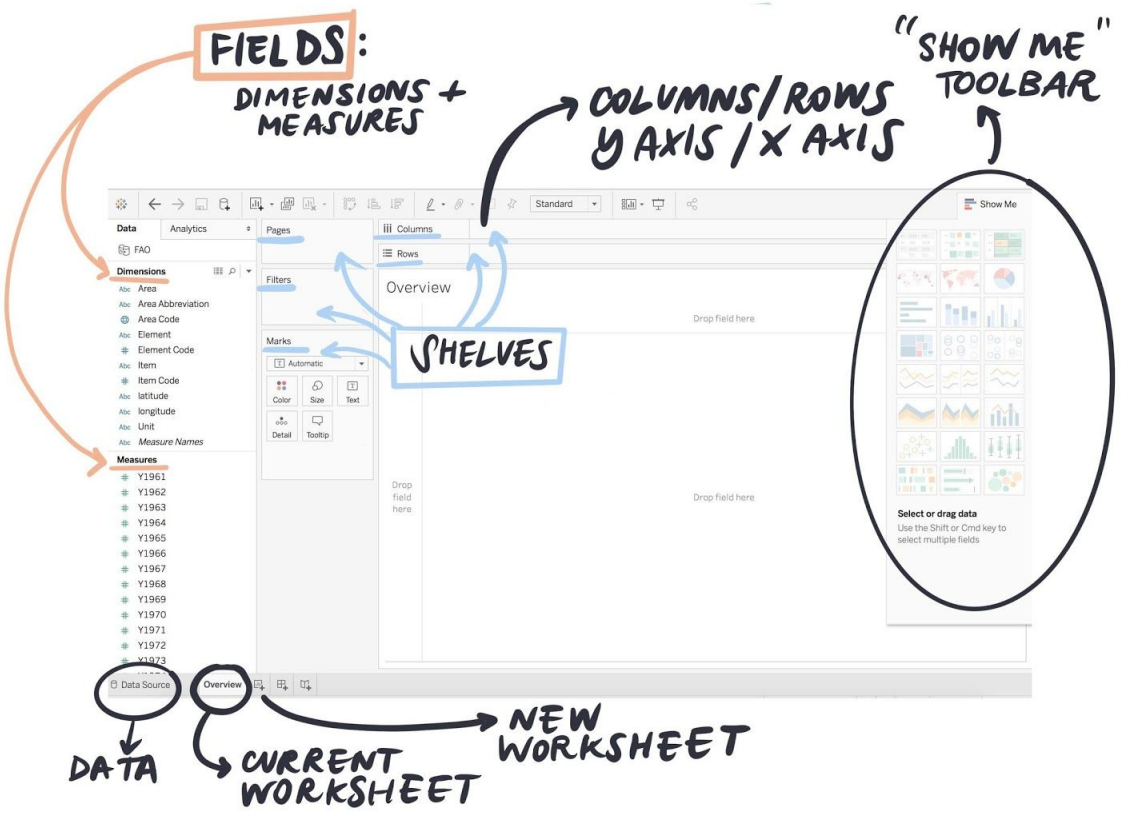


Figure 8: Tableau Worksheet Interface

The second “section” of the interface, right after the fields, contains three **shelves**: **pages**, **filters,** and **marks**. Next to this section there are other two shelves: **columns** and **rows**. The central part is where the visualization is displayed.

FILTERS SHELF

The Filters shelf allows you to specify which data to include and exclude. You just have to drag and drop a field into the the shelf and by clicking on it or clicking on the little arrow on the right, you can select what values to show. If you click on the little arrow, you can also select “show filters” and another shelf will appear on the right side of the screen, where you can select the values.

For example, you might want to analyze the profit for each customer’s segment, but only for certain shipping containers and delivery times. By placing fields on the Filters shelf, you can create such view.

PAGES SHELF

The Pages shelf lets you break a view into a series of pages. When you place a dimension on the Pages shelf, Tableau adds a new row for each member. When you place a measure on the Pages shelf, Tableau automatically converts the measure into a discrete value.

Each view on the Page shelf is based on a member of the placed field. You can easily switch through the views and compare them on a common axis, using the controls that get added to the view by moving a field to the Pages shelf. When you add a field to the Pages shelf, a page control is automatically added to the right hand side of your main view.

There are three ways to navigate through the pages in a view:

- Jump to a specific page
- Manually advance through the pages
- Automatically advance

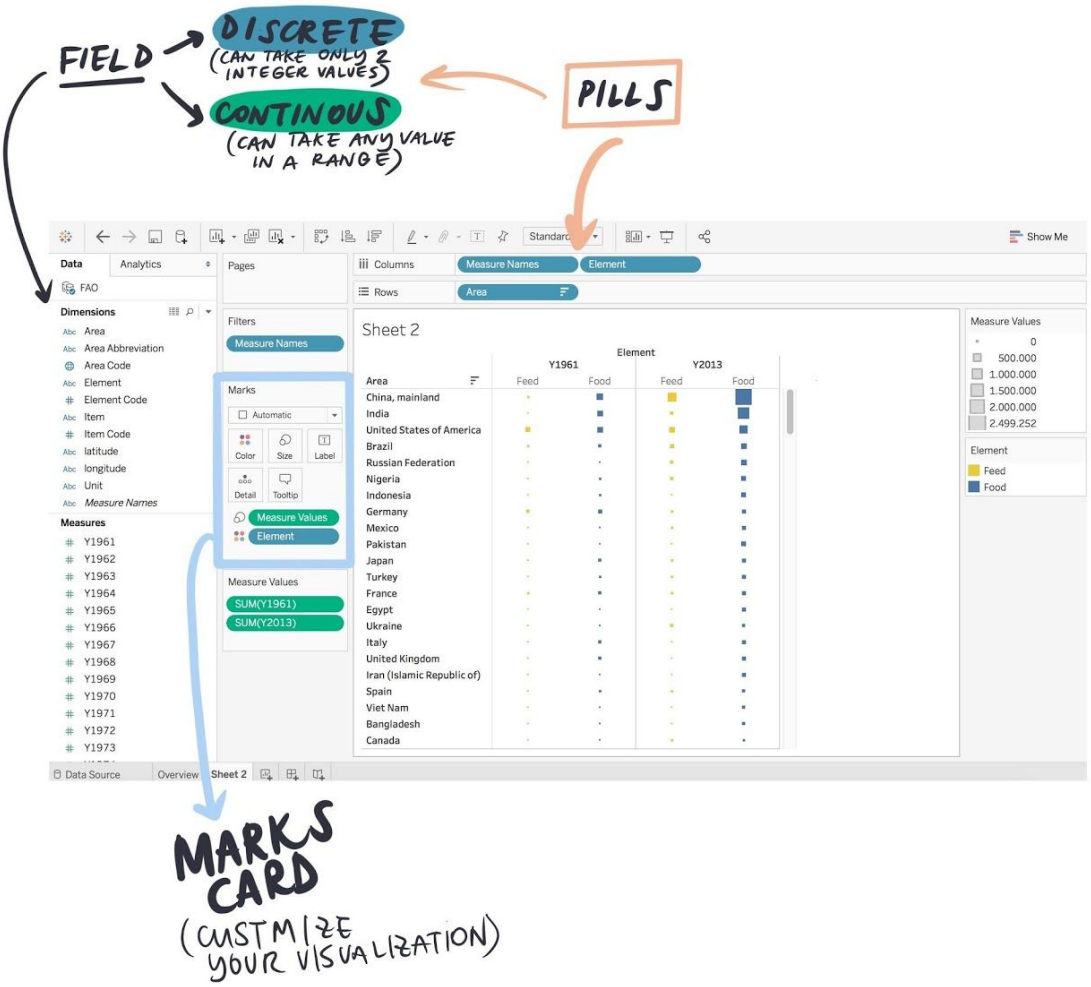


Figure 8: Tableau Worksheet options

MARKS CARD

The Marks card is a key element for visual analysis in Tableau. As you drag fields to different properties in the Marks, you add context to the visual marks in the view. You can use the Marks card to set the mark type, and to encode your data with color, size, shape, text, and detail.

The mark shelf allows you to map variables. By dragging the fields you can link them to different visual channels. By clicking on the single button, you have access to a lot of different options for each one.

ROWS AND COLUMNS

Drag fields from the data panel to create the structure for your visualization. The **Columns** shelf creates the columns of a table, while the **Rows** shelf creates the rows of a table. You can place any number on these shelves. When you place a dimension on the Rows or Columns shelves, you can create headers for the members of that dimension. When you place a measure on the Rows or Columns shelf, quantitative axes for that measure are created. As you add more fields to the view, additional headers and axes are included.

Generally, you will add dimensions and measures to create rows and columns, either by including all the data or subsetting the data using filters. However, when you filter data it is also excluded from calculations and other computations performed on the summarized data in the table. Instead of filtering the data, you can hide a row or a column, so it doesn't display the view, but it is still included in calculations.

To hide a row or a column right-click (ctrl-click on Mac) the row or column you want to hide, and then select Hide.

To show hidden data open the field menu for a hidden column or row and select Show Hidden Data.

Additional Shelves, Legends, Cards, and Controls

Some additional options are displayed as a result of a certain views. For example, the Color legend is displayed when there is a field with an option for a color change. Tableau provides controls for moving or customizing these elements of the view.
The following list provides more details:

- **Measure Values Shelf**– Measure Values is a special field that always appears at the bottom of the Measures area of the Data pane and contains all the measures of your data collected into one field. Tableau automatically adds Measure Values to the view when multiple measures are sharing the same axis. When Measure Values is in the view, Tableau displays a Measure Values shelf showing all the included measures. You can add measures to or remove measures from this card. See Measure Values and Measure Names.

- **Color Legend** – Shows how colors are allocated when there is a field on the Color. For more information, see Assign colors to marks.
- **Shape Legend** – Shows how shapes are allocated when there is a field on Shape. For more information, see Change the shape of marks.
- **Size Legend** – Shows how size is allocated when there is a field on Size. For more information, see Change the size of marks .
- **Map Legend** – Shows the legend for the symbols and patterns on a map. The map legend is not available for all map providers.
- **Parameter Controls** – A separate parameter control is available for every parameter in the workbook. For more information, see Create Parameters.
- **Title** – A title is displayed by default for every view. The default title is the sheet name. Double-click a title (Control-click on a Mac) to edit it.
- **Caption** – Choose **Show caption** from the Worksheet menu to display a caption for the view. For more information, see Captions.
- **Summary Card** – Choose **Show summary** from the Worksheet menu to display a summary card for the view. For more information, see Summary Card.
- **Page Control** – Provides options for navigating through pages when there is a field on the Pages shelf. For more information, see Pages shelf.

3/ Create a visualization

In this example we are going to create the first graph by double-clicking the fields you want to visualize.

Example 1

Let us compare the total number of food and feed produced every 10 years, from 1961 to 2011.

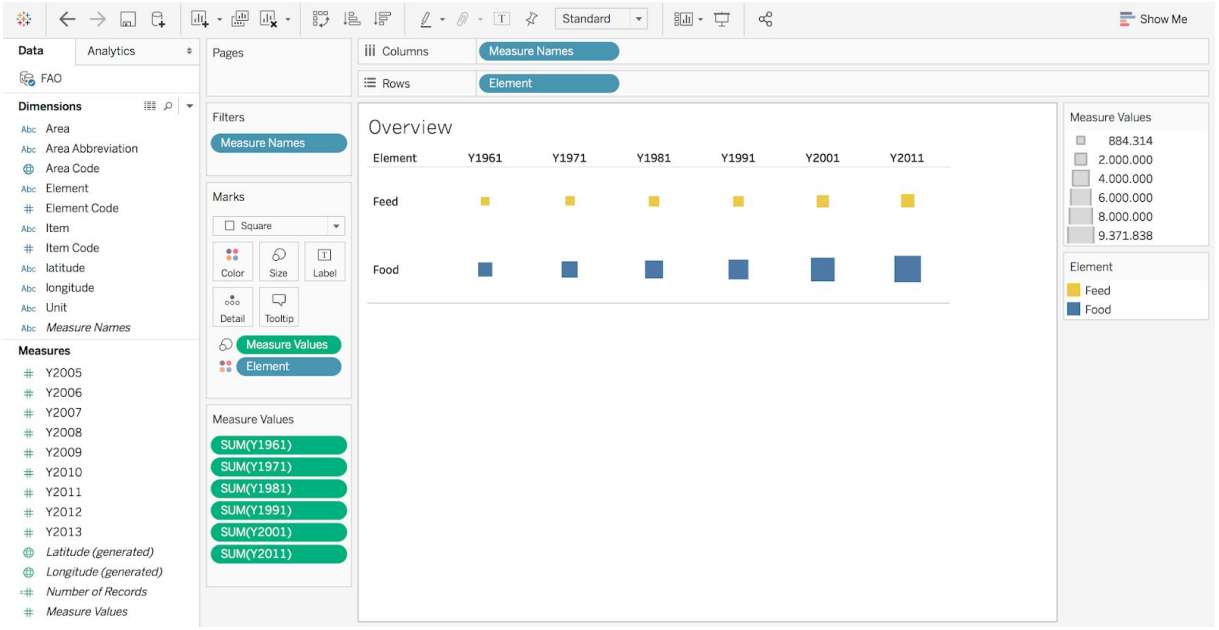


Figure 9: Tableau Worksheet - working with fields

Double click on the dimension **measure names.**

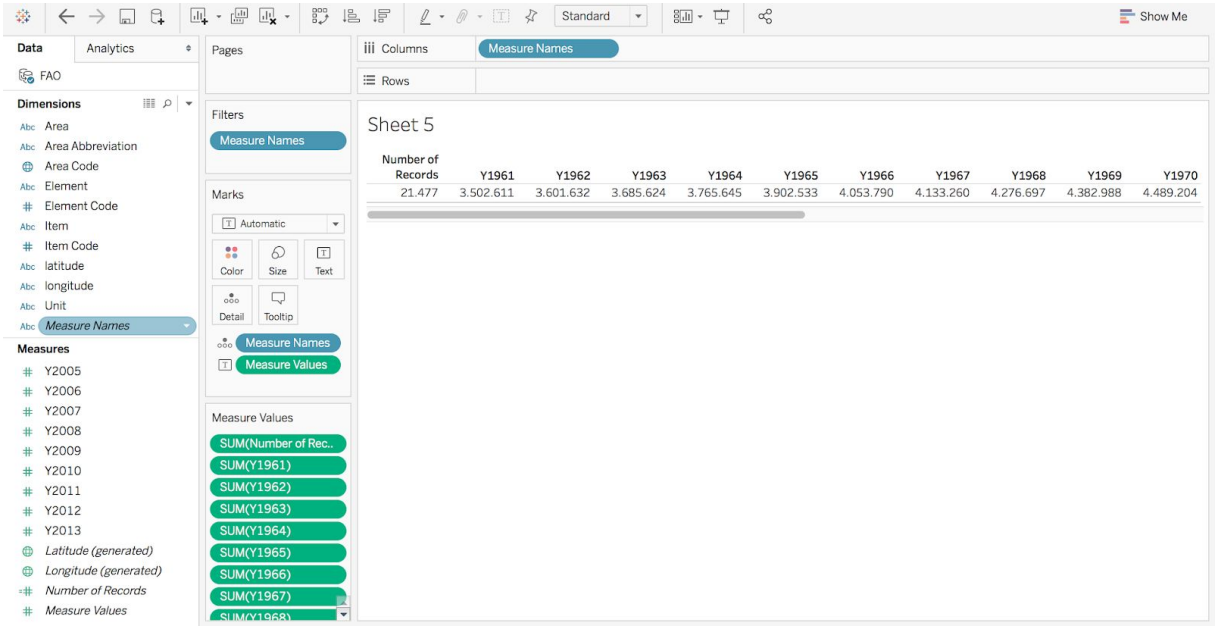


Figure 10: Tableau Worksheet measure names

If you double-click on the field **elements,** it will be automatically added in the rows shelf.

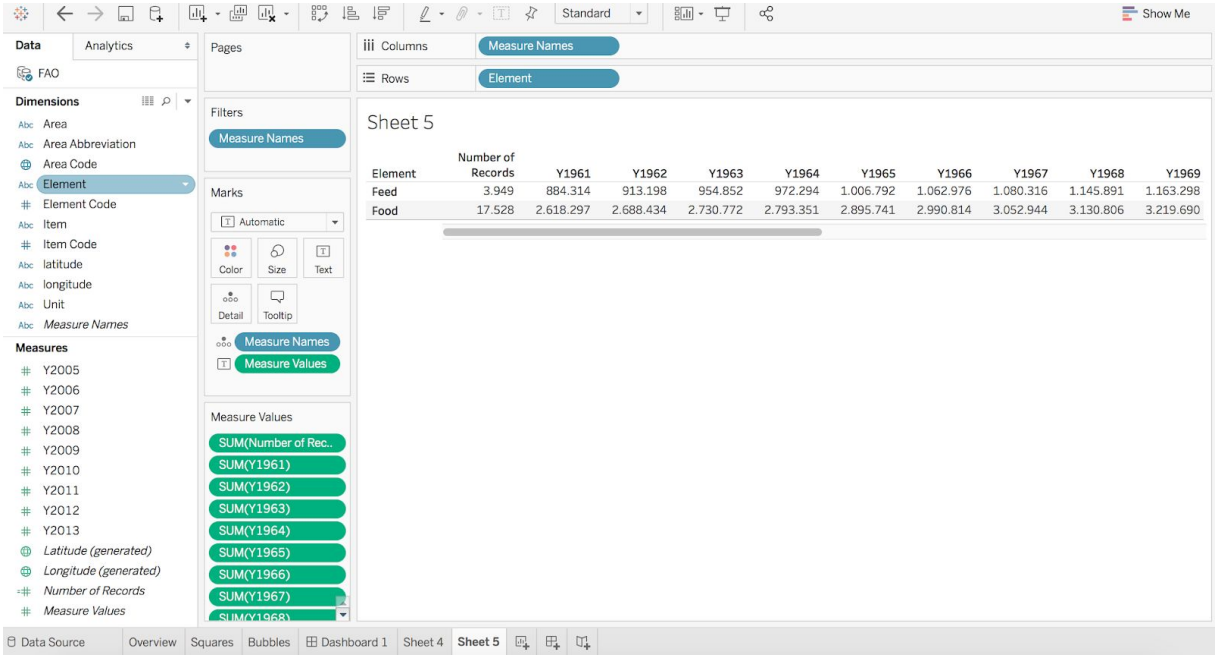


Figure 11: Tableau Worksheet - working with shelves

Click on the icon next to the “Measure Values” and change it to **size**, in order to make the size of the squares change according to the values.

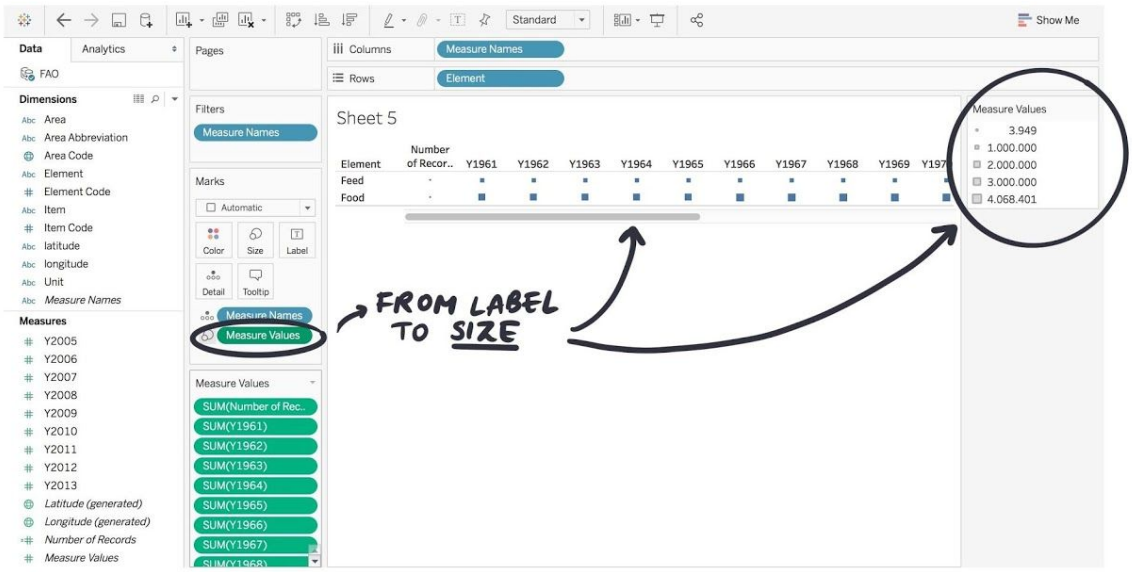


Figure 12: Tableau Worksheet - from Label to Size

Drag and drop the field “element” into the marks card and change the mark to a color. At this point you will see a legend with two colors reflecting the categories contained in the selected field (the food and the feed).

By clicking on the color icon next to the field you can change and customize the colors. You can also select a gradient if you have multiple values.

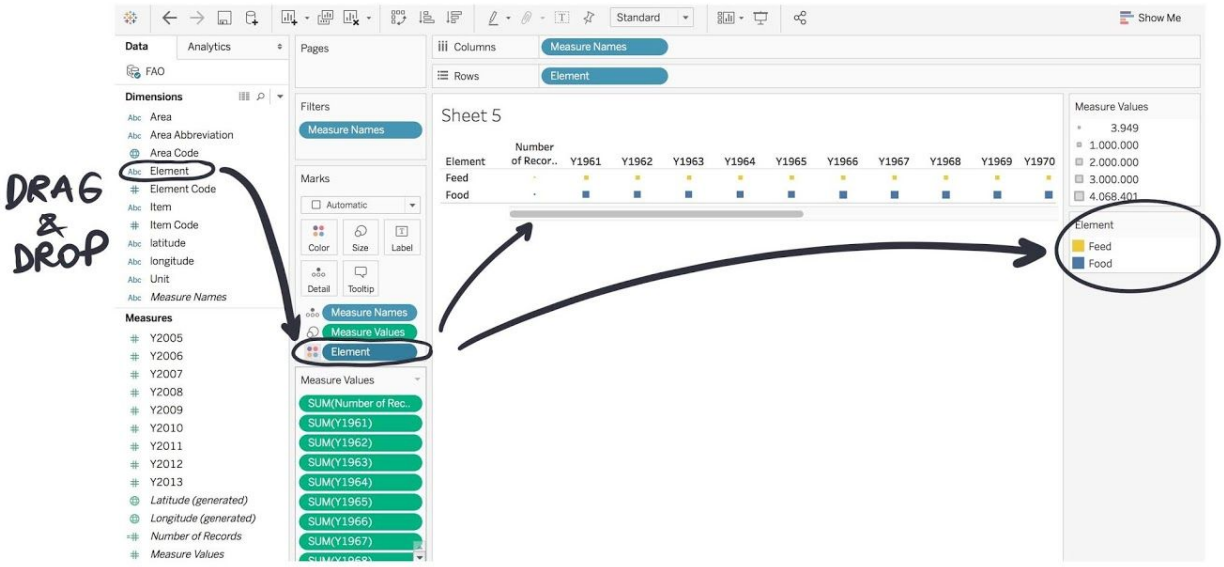


Figure 13: Tableau Worksheet working with shelves

At this point we have visualized food and feed production for all the years in the dataset. Now we want to select and explore only specific years. First, select the field “measure names” in the filters shelf. Than, check the all the years of interest in displaying.

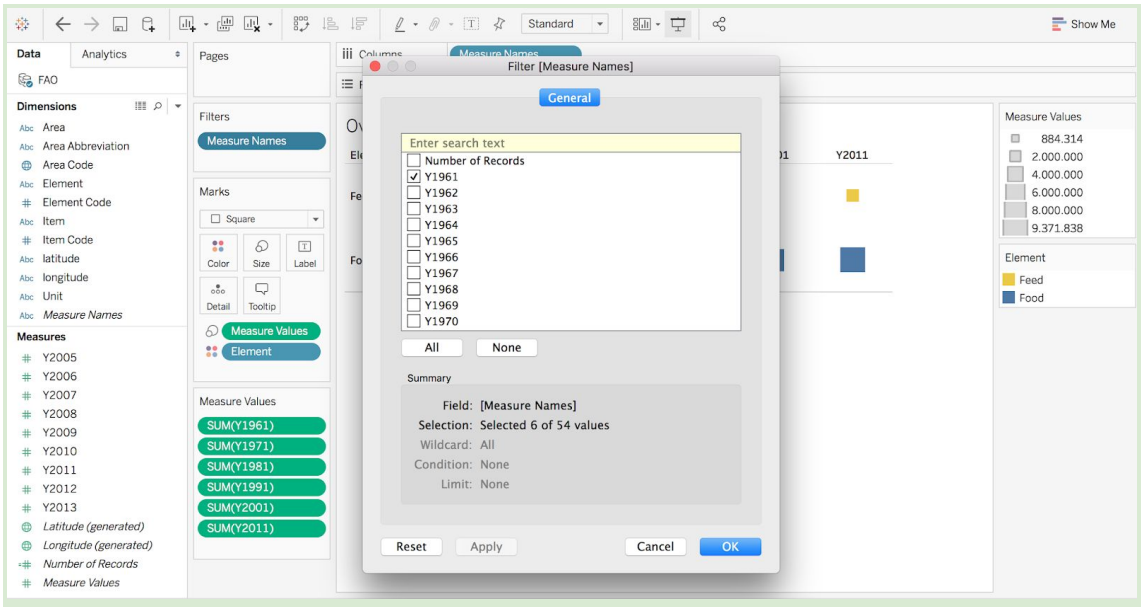


Figure 14: Pick the Years

Example 2

In this case we want to compare the amounts of food and feed produced in two years (1961 and 2013) by different countries.

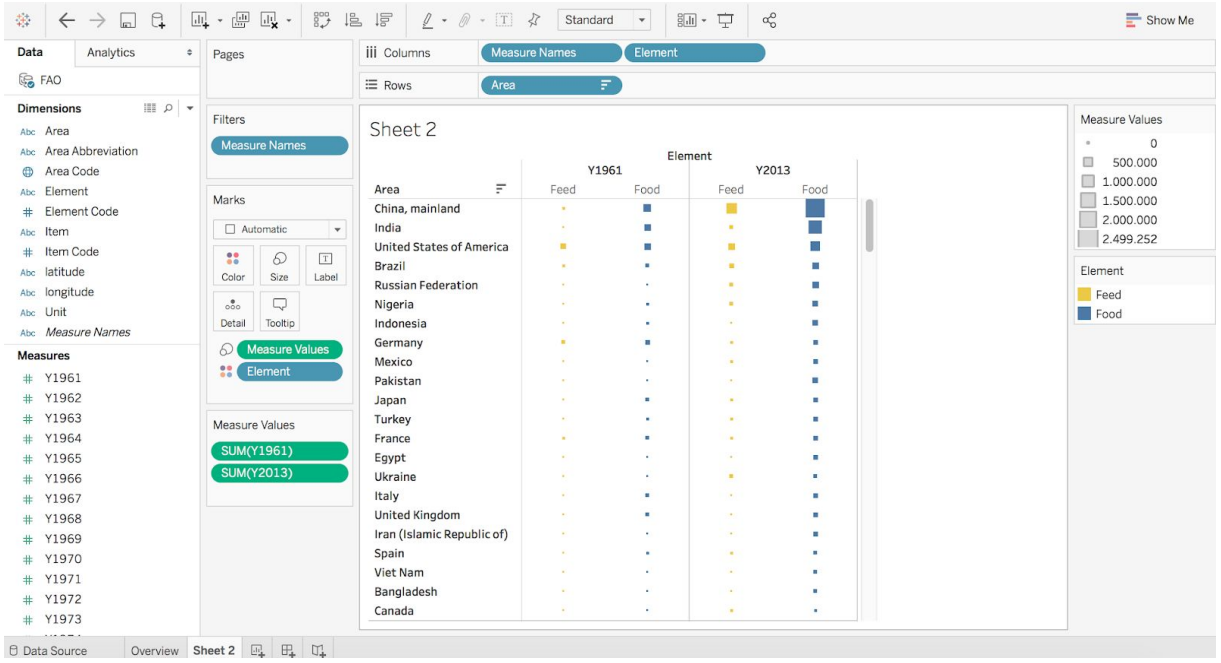


Figure 15: Dragging fields “Measure Names”, “Element”, and “Area”

We are going to drag the fields “measures names” and “elements” into the columns shelf, and the field “area” into the rows shelf. The pills in the shelves are resembling the order of the dragged fields. Also, the order corresponds to the hierarchy in which the data is filtered in the visualization.

Next, let us filter the years through the field “measure names” in the filters shelf and associate the mark colors to “elements” and size to “values”.

As last step, we want to filter the first 10 countries by values. Add Area in the filters shelf, click on, and select the top: by field > top > 10 > year > sum.

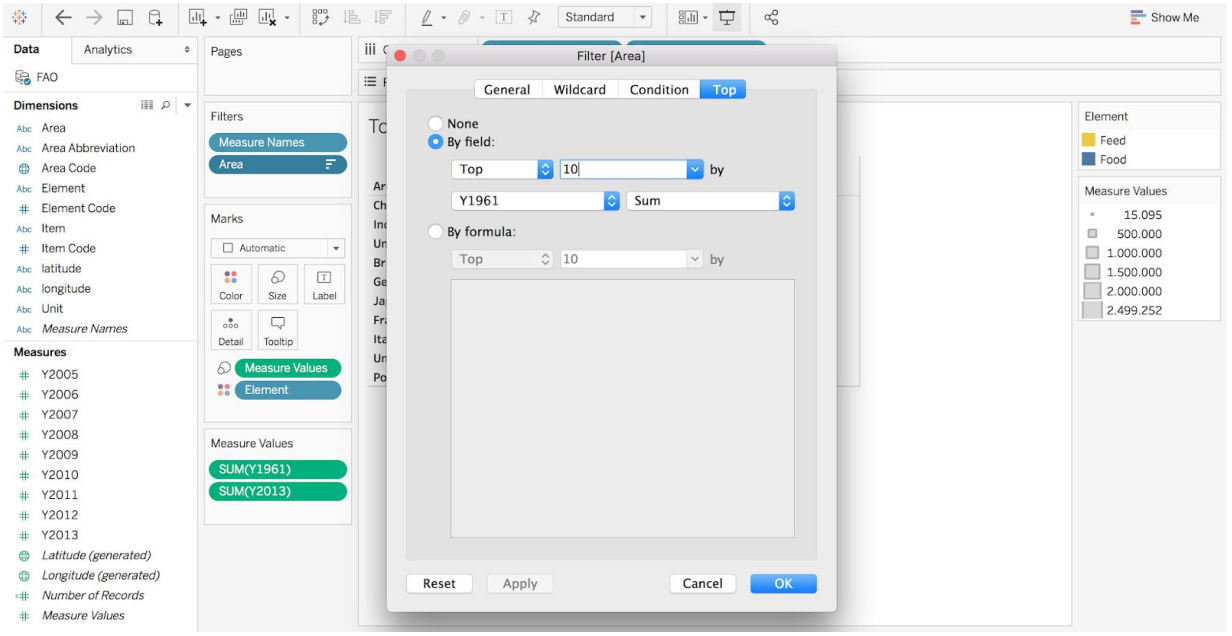


Figure 16: Sort By Field

The final result is presented with Figure 17.

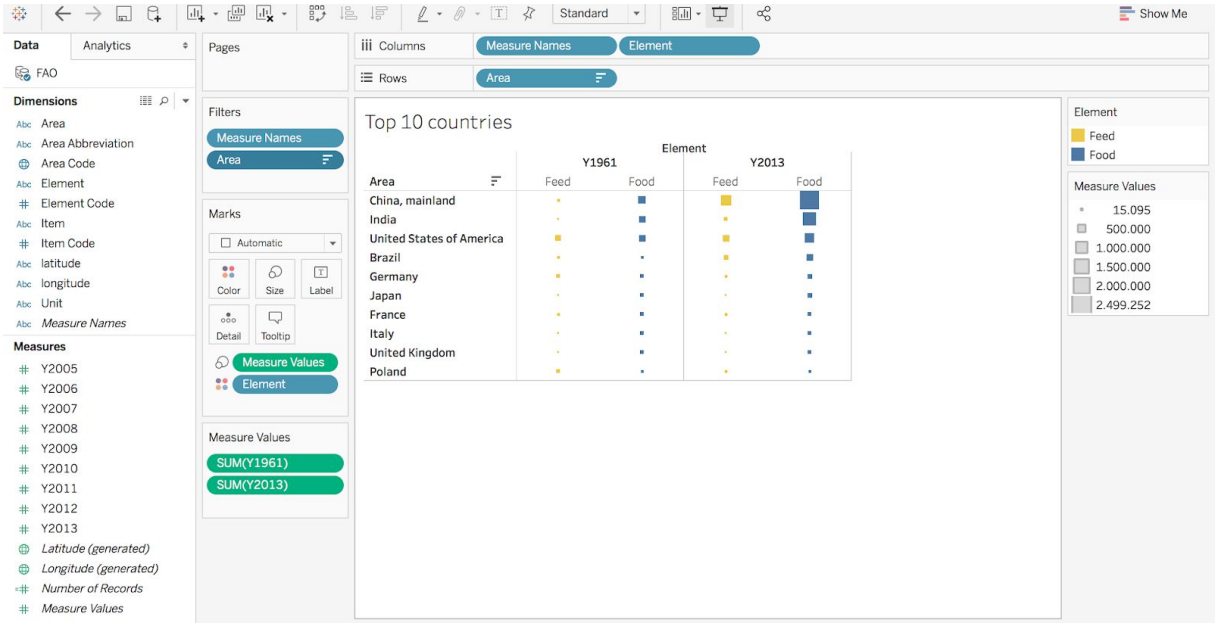


Figure 17: Final Result

4/ The ‘show me’ toolbar

Another option to create visualizations is using the SHOW ME toolbar. Next example compares the amount of each item, and see which ones are the most produced/exported.

The SHOW ME toolbar is helpful when:

A. you have a specific visualization in mind
B. you know which fields you want to analyze, but don’t know which chart would work best for your data

Example 1
Press CMD or CTRL and click on the fields that you want to use.
You will see the charts available on the right-hand side. Outlined with red is the suggested chart.

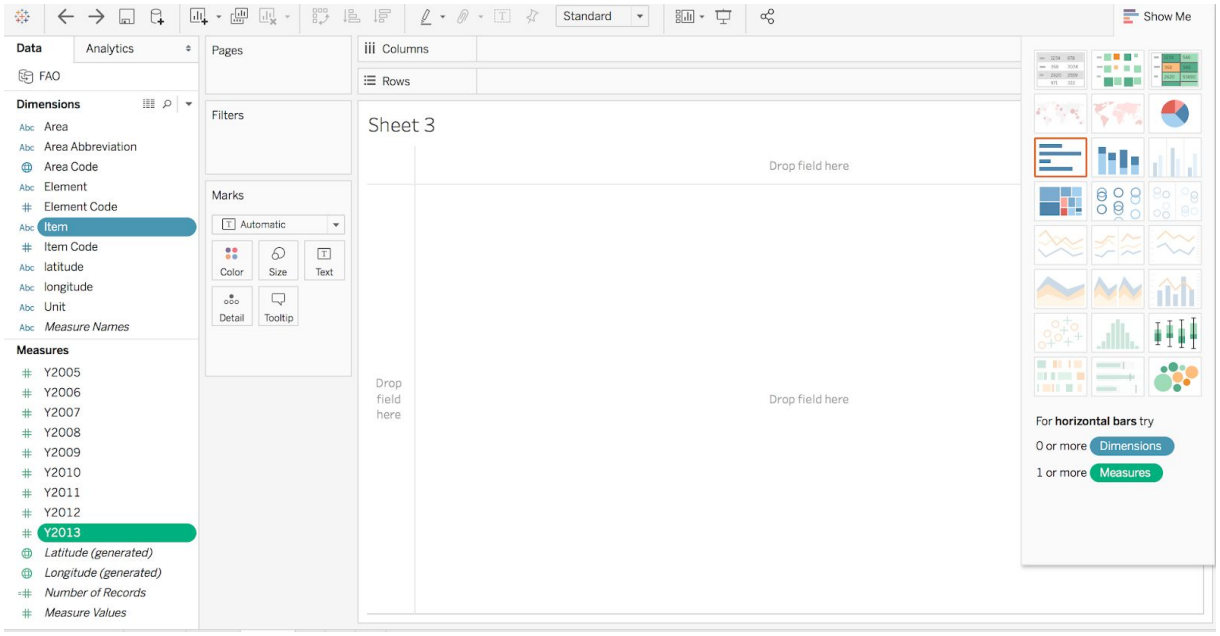


Figure 18: Show Me Toolbar

Once you have selected the model that you want to use, start editing the pills in the marks card. The figure below shows the item dragged to add labels to the circles. “Sum of 2013” changes the size of the bubbles.

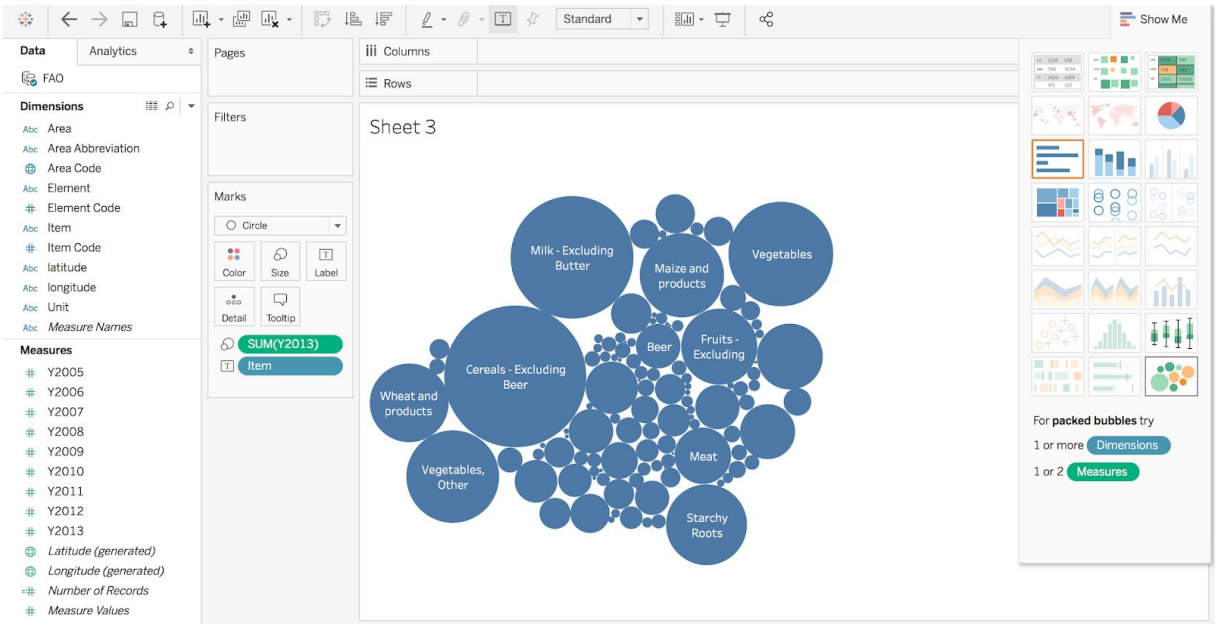


Figure 19: Bubble Chart - Show Me Toolbar

If you would like to add another visual variable (e.g. a color) or want bubbles in different shades of the same color (from the smallest to the biggest circle), you have to add another pill to the marks card and associate it to the variable color. Then, click on edit colors and select a gradient.

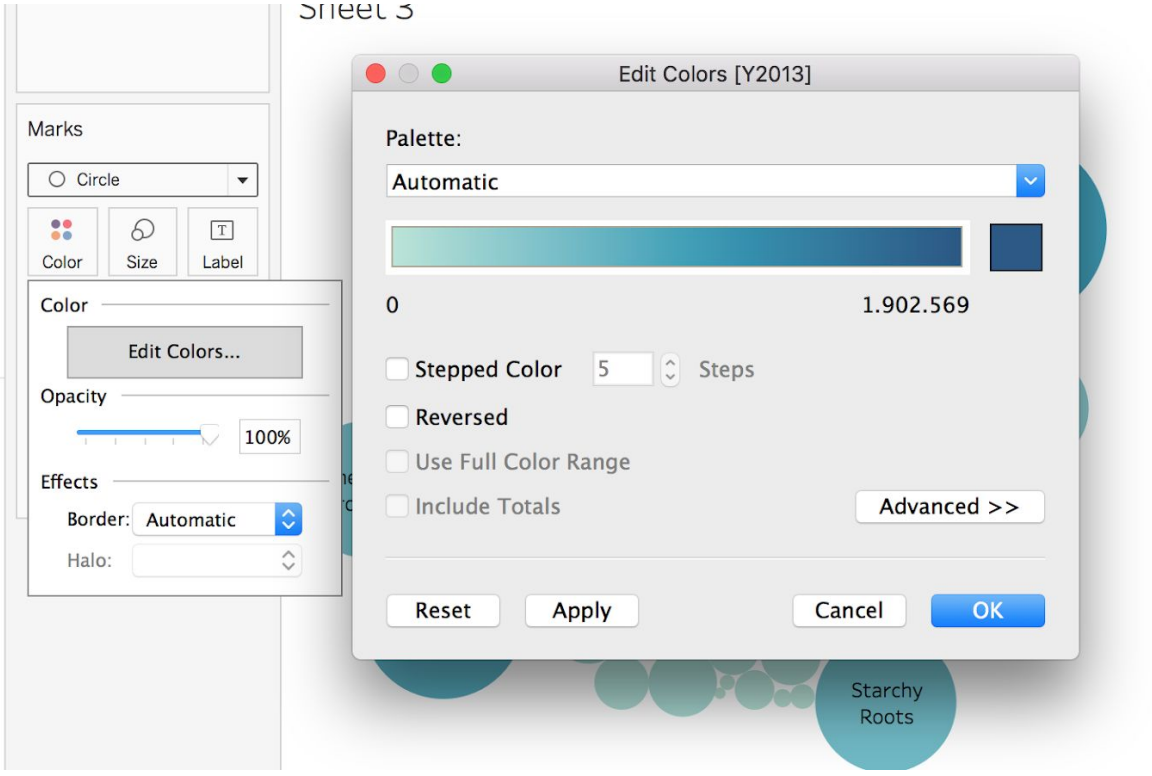


Figure 20: Edit Colors

Figure 21 shows final result.

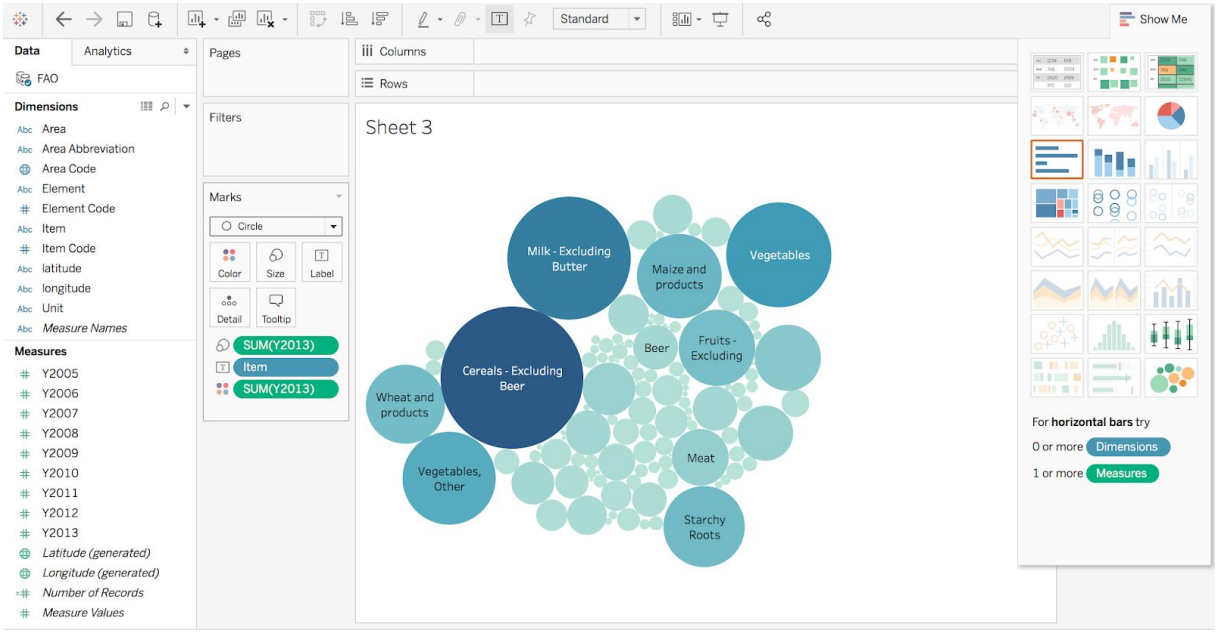


Figure 21: Final Result after adding Colors

If you click on the little arrow on the right of the pills, you can change what type of operation you want to perform on the selected data. The following figure shows the use of the SUM.

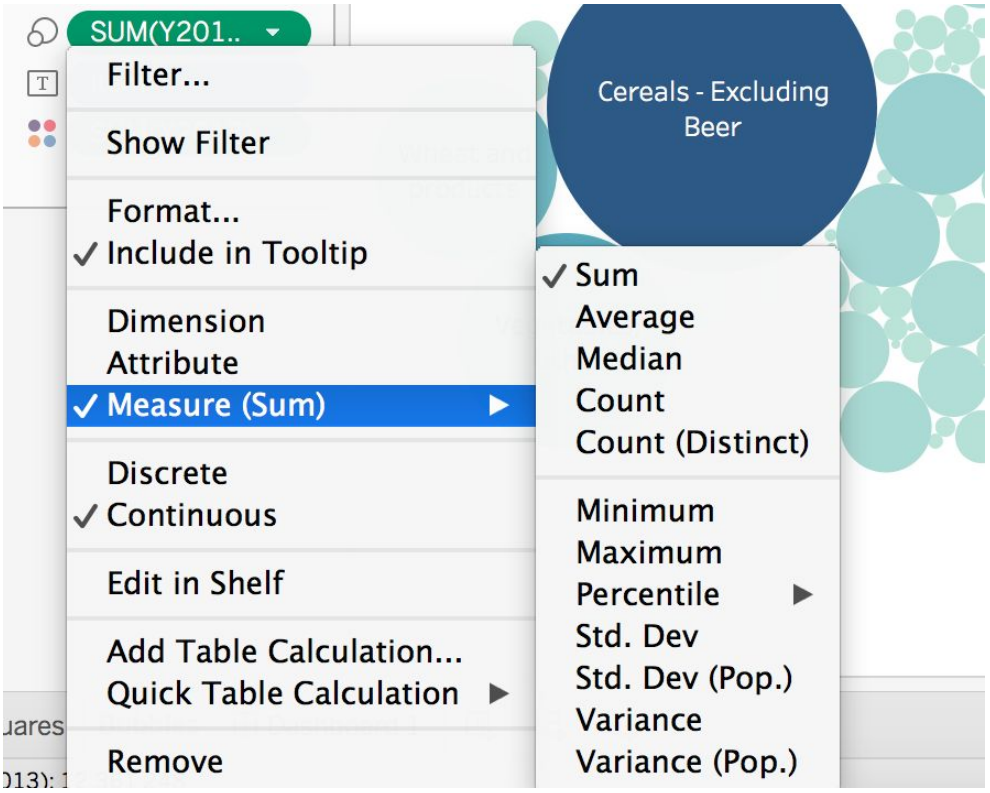


Figure 22: Using Measure (Sum)

Now let us try with a different shape to show the measures. Click on the first selection menu in the marks card to select the type of the shape. The following picture shows the result by clicking a treemap.

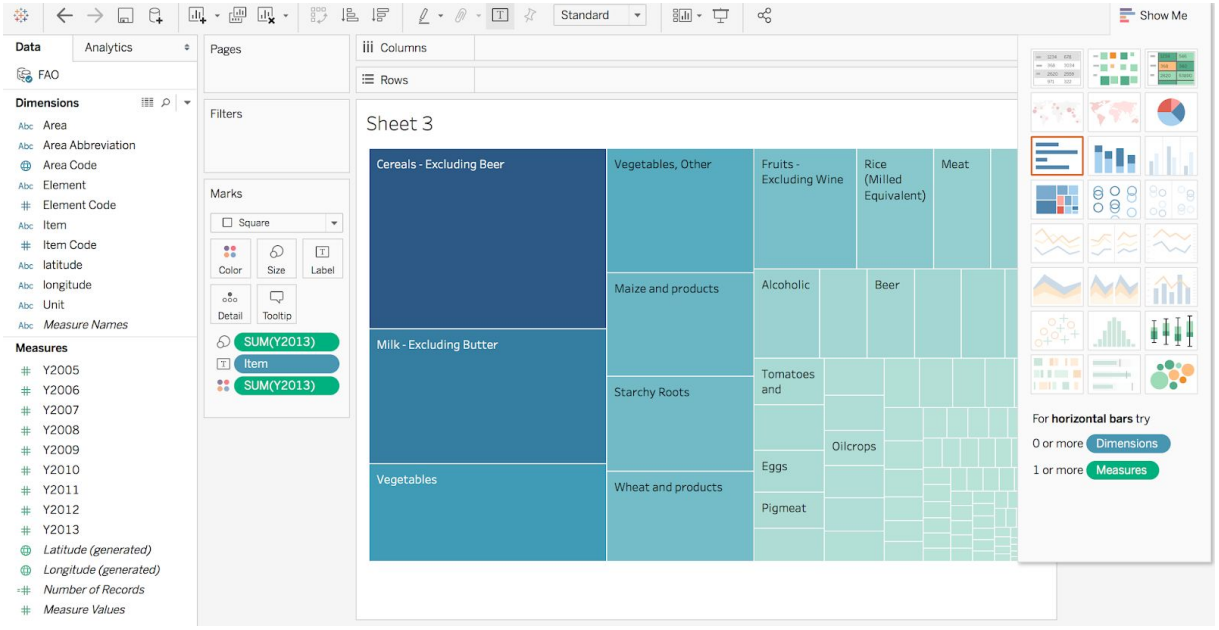


Figure 23: Treemap

Example 2

Drag and drop the fields you want to visualize in the columns and rows shelves. Then, open the SHOW ME toolbar and select the models available. In this worksheets, we want to compare food and feed production in 2013 for all the countries, and we want to use a treemap again. Drag and drop the dimensions area and elements to the column shelf and the measure values to the rows shelf. Filter the values leaving only the year 2013. Open the SHOW ME toolbar and select the treemap. Adjust the variables in the marks shelf by linking color to elements and size to SUM (2013).

Figure 24: Treemap of food vs. feed

To show the quantities as percentages, drag and drop the value in the mark shelf, then click on the little arrow on the right-hand side, select ‘quick table calculation’ and than select ‘percent of total’.

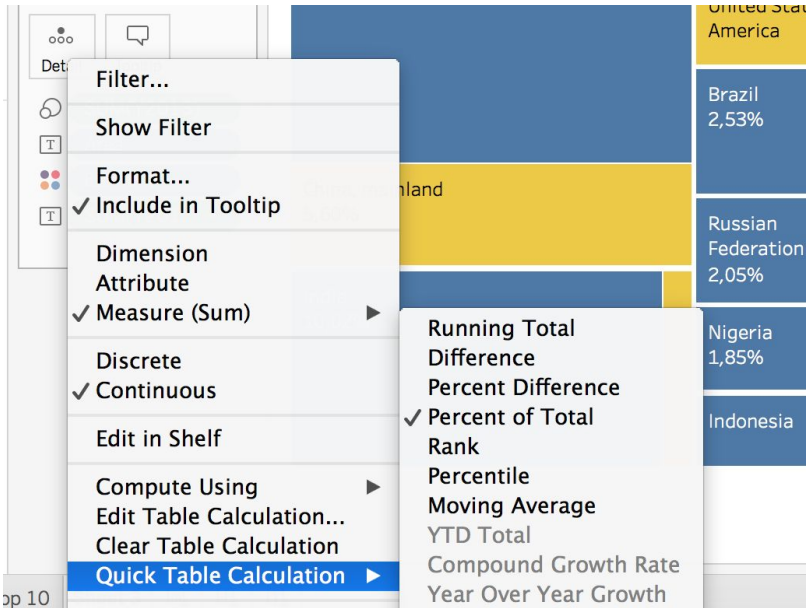


Figure 25: Quick Table Calculation

5/ Create a dashboard

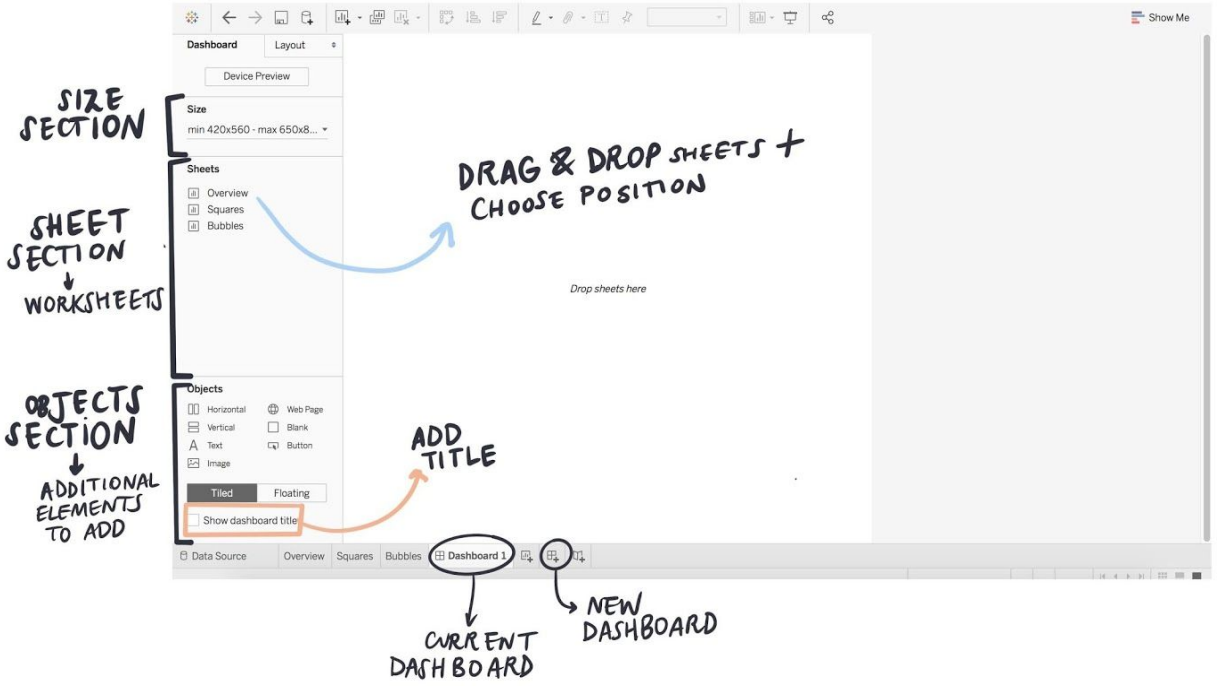


Figure 26: Dashboard Options in Tableau

The following steps show how to create the Dashboard in Tableau:

1. Choose the size of the dashboard from the “size section”.
2. Drag and drop the worksheets listed on the left. Before dropping, choose the position on the dashboard.
3. You can add a title by clicking on the checkbox at the bottom of the objects section.
4. You can also interact with the elements in the dashboard to change position, to add ot to remove them.

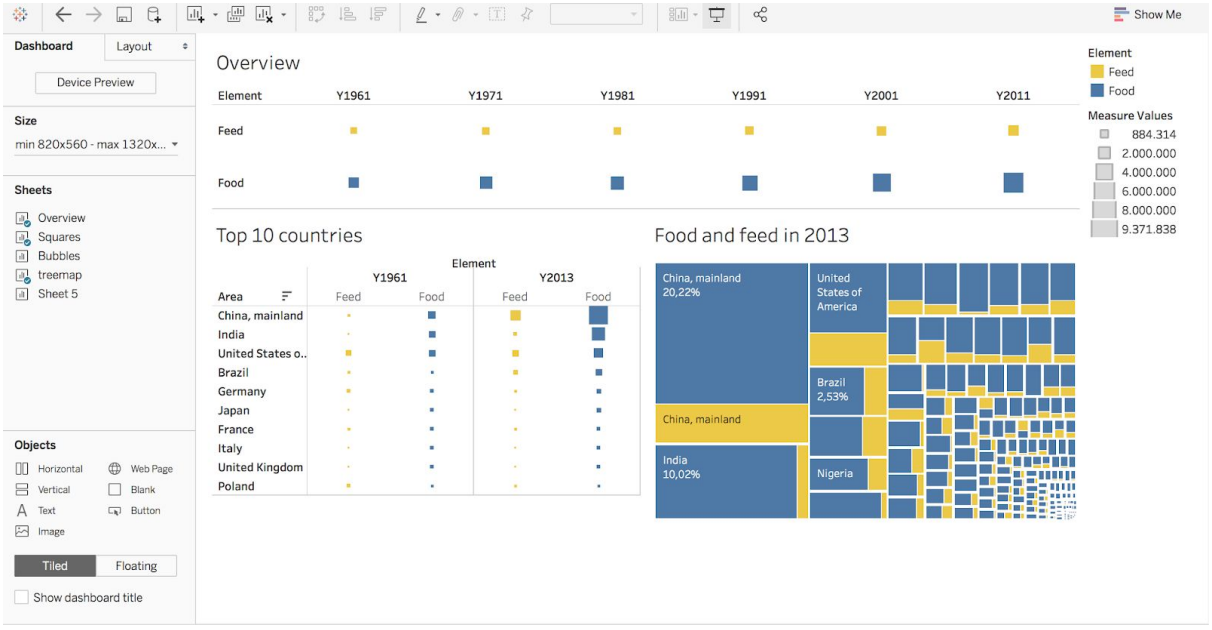


Figure 27: Drag & Drop visualizations in the Dashboard

6/ Export Images

To export worksheets, go to worksheet > export > image, select the format PNG, choose the destination folder and export. To export the dashboard go to dashboard > export image, select format and destination to export. You can additionally specify what elements to include in the final PNG image.

There are many other options that Tableau provides in term of exporting your work and embedding it into outside applications. For example, you can upload Tableau dashboard to a public server and obtain URL link for further integration in another environment. However, not every single application will enable fully interactive Tableau visualization. We will work more on incorporating your interactive dashboards into external applications later in the semester.

Credits and additional resources

01.
Tableau Public Resources
Additional Resources
Url: here

02.
Tableau Public
Workbooks
Url: here

03.
Tableau Support
Support
Url: here

04.
HESA
Importing ".csv" formatted data into Excel
Url: here

05.
IntelliPat
What is Tableau
Url: here