Tableau Desktop Guide

Tableau Desktop is a powerful program to create visualizations, live dashboards, and more all in a user-friendly and modern package. While there is a learning curve, most of the base functionality can be easily learned without and prior experience with visualization softwares. Using Tableau Desktop is usually done under the assumption that data is properly cleaned and ready to be visualized. While there is a lite version of the manipulation tools Tableau Prep has, these are best used sparingly and entering clean prepped data. When you are visualizing the client’s data, make sure you have a clear understanding of what your end goal is, and what steps you are using to get there. Using the wrong type of average, or choosing the wrong graph can misrepresent the data, which is always a serious mistake. When in doubt, ask or write down your logic.

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Data Location:

This guide will use the output of the lemur data ran through the Tableau Prep Guide which we have kindly been given permission to use by Meredith Semel and the Global Change Center at VT.

If you have not done that guide, the data can be found here.

The key for each variable can be found here.

Data and Guide Overview:

This data was initially a consult that Data Services worked on for Meredith, and the guide will follow through that narrative. Meredith and her team visited 11 sites in Madagascar from August to October, collecting a wide range of data on the lemurs behavior, movements, eating habits, location, and much more. This data was initially cleaned, both by entering it through Tableau Prep and by some intense data cleaning by Meredith's team, enabling us to use the visuals. As with most data visualization projects, most of the work is spent cleaning the data to prep for visuals. Once the data was cleaned, Meredith was interested how the lemurs feeding habits changed between sites, as well as the difference in spread of each group. We will be doing the following:

- A map that allows us to see how the groups are distributed in Madagascar
- A map view that focuses on Binara Ana and Binara River (A location that has been divided due to deforestation. The lemurs in the Binara River group live in the deforested region, while those in Ana still live in the forest. These groups are separated by a river and steep river bed.)
- A scatterplot comparing group spread to nearest neighbor
- An advanced column chart comparing crown volume and height of each tree species, per group
- A bubble chart comparing crown volume and species per group
- An interactive dashboard that combines all visuals into one view

In the guide below each step will begin with an explanation. This will include the goal of the step, along with the logic behind why the steps are carried out. If you are confused as to why you are carrying out a certain step Google or ask for an explanation. The main take away when using any software is to understand the logic and thought process behind using it. This will allow you to confidently deviate from this guide and create your own visuals!

Connecting to Your Data:

Explanation

Tableau Desktop can connect to a wide number of data types and servers. Excel or CSV (called Text file in Tableau) are the most commonly used. Google Sheets is a great option for creating visuals that will update as more data is entered. Before anything else is done in Tableau Desktop we must connect our data. This step is basic, but fundamental.

We will then extract your data. This is done so that the data is stored within Tableau Desktop and is not being constantly read from the original data files. This will cut down on time to carry out functions within Tableau Desktop, and allow you to continue using Tableau Desktop if the data is moved or deleted. If the dataset changes you can refresh Tableau desktop to reflect those changes.

1. Using the blue bar on the lefthand side, click "More.." under "Connect" and navigate to your dataset (available to download above).
1. More..., navigate to data.

2. Extract your data by clicking the Extract button in the top right corner
   a. Extract

3. Go to your worksheet. Once the data has been connected, click the now orange "Sheet 1" button in the bottom left corner.
   a. Sheet 1

Tableau Worksheet Overview

Explanation
This is not a traditional step that will guide you through producing or changing anything on Tableau Desktop. This portion is focused on making sure that you have a firm understanding of each component of the Worksheet window and how they can be used. This is pivotal to using Tableau Desktop comfortably and efficiently. Spend time reading through this if you have not used Tableau Desktop before. Everything found here can be further augmented by looking up explanations from Tableau themselves. If a section is still unclear to you after this guide please research its function. Not every visualization will use every feature discussed below, but a broad overview will help you quickly pick up how to produce the desired results.
Dimensions in Tableau describe your data. They are typically not what you are trying to measure, but further define your dataset. This means most dimensions are not numerical (barring dates), and are descriptors. The dimension "Group" will tell you how many groups you have and their names, while the measure "Cvol" contains the crown volume (volume of a tree) found within each group and allows you to find which group of lemurs eats on the largest trees. Without the dimension "Group" Tableau would simply display the Cvol number of the entire dataset, the dimension is needed to separate the data.

Auxiliary information:

- the symbol next to each field (Abc, a calendar, globe, #, etc) show the type of information Tableau automatically assigns to each field. Abc denotes string, # denotes a number, calendar denotes date, and a globe denotes a geographic role. By clicking on these symbols you can manually change the data type if Tableau has misidentified them.
- Fields can be moved between dimensions and measure by clicking and dragging. This is useful if Tableau misidentifies a field.

Measures are typically what you are actively trying to determine from your data. Hard numbers, coordinates, response counts, and much more will be housed here. A measure is typically the quantifier of the dimensions above. For example. The dimension "Group" will tell you how many groups you have and their names, while the measure "Cvol" contains the crown volume (volume of a tree) found within each group and allows you to find which group of lemurs eats on the largest trees. Without the measure "Cvol" Tableau would only display the different groups in the dataset, it would have no number to be compare the groups.

Auxiliary information:

- the symbol next to each field (Abc, a calendar, globe, #, etc) show the type of information Tableau automatically assigns to each field. Abc denotes string, # denotes a number, calendar denotes date, and a globe denotes a geographic role. By clicking on these symbols you can manually change the data type if Tableau has misidentified them.
- Fields can be moved between dimensions and measure by clicking and dragging. This is useful if Tableau misidentifies a field.

Pages are used to see how one field of your data modifies the resulting output. Imagine this function as overlaying a series of pages onto your worksheet that can be flipped through to see changes, similar to a flipbook. This can be used to see how the data changes over time (by putting a date field in the pages tab), by individual (by putting a unique identifier in the pages such as name), and much more. The image below shows an example Page tab that will appear on your worksheet, in this case modifying the data based on date. In this tab you can use the drop down to select a specific date, the arrows to move date forward or backwards (as well as using the square to stop), and the stacked blocks denote the speed the pages are "flipped." If you click "Show History" you can further select how past pages are shown. In the example below, I have all past dates staying on the worksheet, but have them faded to show that they're past.

![Example Page Tab]

As the name suggests, Filters allow you to filter your data to only show specific aspects. This is useful if you only wish to show data within a specific date range, from a specific group of people, only values within a specific numeric range, and more. Once a field is added to the filter tab a window will appear (shown below) allowing you to select which portions of your data you wish to show. The other options, such as "Condition" or "Top" allow for more advanced filtering with formulas. If you right click on the field within the filter tab (shown below) you can choose to show the filter, allowing yourself or other users to change what is filtered on the fly. Typically, this is shown if you want to give your end user more freedom, and hidden to restrict how much the visual can be changed.

![Filter Window]

As the name suggests, Filters allow you to filter your data to only show specific aspects. This is useful if you only wish to show data within a specific date range, from a specific group of people, only values within a specific numeric range, and more. Once a field is added to the filter tab a window will appear (shown below) allowing you to select which portions of your data you wish to show. The other options, such as "Condition" or "Top" allow for more advanced filtering with formulas. If you right click on the field within the filter tab (shown below) you can choose to show the filter, allowing yourself or other users to change what is filtered on the fly. Typically, this is shown if you want to give your end user more freedom, and hidden to restrict how much the visual can be changed.
The marks tab contains a lot of useful features to modify your visual and will likely be the tab you interact with most often. The drop down menu, which begins as “Automatic” is where you can select the type of visual you would like to produce. To use the other sub-tabs you drag a dimension or measure onto them. For example, to color the visual by “Group” you drag the “Group” dimension onto “Color”. Below is a brief explanation of each sub-tab:

- **Color**: used to modify how the visual is colored. If a dimension is used the colors will be distinct, a measure allows for a gradient.
- **Size**: usually used with a measure, allows you to change how each mark in the visual is sized. Typically, visuals keep a consistent size for each point added, but adding a size component allows for the points to automatically size based on the measure used.
- **Text**: Used to add text below marks on the visual. For example, putting "Group" on the text sub-tab will show the group name below each point on the visual.
- **Detail**: This is an important sub-tab used to tell Tableau Desktop how detailed to make your visuals. Adding details allows you to further define exactly what you are trying to show. For example, adding “Species” to a bar chart comparing crown volume to each group will cause each bar to further split to show how each species adds to the total average.
- **Tooltip**: Your tooltip is what you see when you hover your mouse over a datapoint. Clicking tooltip allows you to modify the text and what is shown
- **Shape** (only shown when shape is selected from the drop down): Allows you to select which shape each value within your field will receive.

As you can see in the image below, I have used a number of the sub-tabs to create a completely different visual than the starting bar chart given by putting “Group” and “Cvol” in the columns and rows, respectfully. I initially added “Species” as a detail, telling Tableau I wanted to also know how the species of tree compared within each group. I then colored by “Species” to quickly denote between them, modified the tool tip, and used “Cvol” as size to quickly show which trees had the largest crown volume. The marks is a very powerful tab, and can dramatically change your visuals.
Columns and rows are where you drag your dimensions or measures to produce the visuals. Multiple fields can be added to both, resulting in stacked visuals. In the image below, I wanted to know information on each group, further broken by the species of trees. By placing "Group" first Tableau creates columns for every group. By adding "Species" tableau further creates columns for each species of tree found within that group. I was then curious of the crown volume and the NNDist (how spread the lemur group is), so I added both to rows. This creates two separate graphs showing both. By right clicking on one of the measures you can select “Dual Axis.” This shows both measures in one graph, with the first measure axis on the left and the second on the right.

NOTE: I changed the graph type of NNDist in the marks tab to be a line instead of dots.

These three buttons, from left to right, add new worksheets, dashboards, and stories.

- Worksheet: typically a single visual or graph made by comparing dimensions and measures. Likely where you will spend the majority of your time
- Dashboards: a place to layout and display multiple (potentially) connected visuals. This allows you to show the end user multiple data points in one view and can be made interactive. Filters and pages can be applied to entire dashboards, and pictures, links, text, and more can be added as well.
- Stories: Tableau's version of a presentation. Stories allows for one worksheet or dashboard per slide, all of which can be interactive. Used to tell a longer narrative with the visuals in a cohesive package.

The analytics tab allows for basic analytics to be applied to your visuals automatically. These can be further formatted to a degree, but do not allow for deep statistically summaries to be formed. In short, these analytic tools are more exploratory and surface level than a deep-dive you can achieve with JMP, SAS, R, or another statistical program. To use, drag whatever analytic you are interested in onto the worksheet, and apply it to the table, plane, or cell.

- Table: Applies to the entire visual, takes all data in the visual into account
- Pane: Will apply to sections of your data. A pane is an overarching column or row that contains additional fields within it. In the example below, each group would be a pane, and each species would be the additional data points within each pane (called a cell)
- Cells are the most detailed fields within your visual. These have no additional fields below them, and typically are found within panes.

The Show Me button is a great way to see what visuals are possible within Tableau. The list given is by no means exhaustive, but gives you a strong foundation to start building your visuals. This window will also show you what combination of dimensions and measures are needed to produce specific visuals.
Building the Maps

**Explanation**

Now that you have a familiarity with the components of the Tableau Worksheet we can begin building your first visual.

We will begin with the map to check that each group properly appears (a good sign that the data was cleaned in Prep properly) and to use as a reference point for how the groups are distributed. In Tableau Desktop a map will automatically be generated if geo-coded (simply meaning Tableau recognizes the data is meant to be mapped) data is placed on the worksheet. Once a rough map is made we will use aliases to give the groups cleaner names.

Latitude and Longitude will be moved from Measures to Dimensions. This is because we want each point to be treated as a discrete entity, and not summed together as a whole. Placing them in the Dimensions category ensures that each value is treated as an individual. If this is not done all Latitude and Longitude values will be summed, and only that sum will be plotted (which will not be where the lemurs are)! From there we will create a second map that focuses on Binara Ana and River, and add additional information about the crown volume and tree species for each point. This will allow us to quantitatively check if there is any difference in the trees that the lemurs are feeding on in both groups (remember, Binara River lives in a deforested riverbed).

1. **Making the Large Map:**
   a. To begin, we need to select and drag both "Latitude" and "Longitude" from Measures into Dimensions (this can be done individually, or CTRL-Clicking (CMD-Click on Mac) both)
   i. **Change Latitude and Longitude to Measures**
b. With "Latitude" and "Longitude" still selected drag them both onto the detail sub-tab in the Marks tab.
   i. You should see Tableau Desktop automatically generate "Latitude (generated)" and "Longitude (generated)" in the columns and rows, along with a oval-shaped cluster of groups appear.
   ii. This is done so that Tableau Desktop understands how detailed you want the map to be. In this case, you want each Lat and Long point plotted, so we add both as necessary detail on our map.
   iii. Drag "Latitude" and "Longitude" to Detail

c. To better identify each group we will drag the "Group" dimension into the color sub-tab in the Marks tab.
   i. This is done to help the user quickly see where each group is and how they are located in relation to one another.
   ii. Drag "Group" to Color

d. We should now see a map similar to the one above, along with a color legend to the right of the map. We will now edit the aliases of each group. To do so, right click on the "Group" field in the dimensions window, and click "Aliases." From there, edit each alias to the names listed below
ii. This is done to produce more legible and professional visuals. While the original values were readable, leaving them would produce a visual that feels unpolished.

iii. Right click “Group,” Aliases

iv. These steps are done to help identify your sheet in the future, and to save work in repeating previous steps. Anytime you have a visual and wish to change a component I recommend duplicating the worksheet first, so the original copy remains intact.
ii. Right click sheet, Rename. Right click sheet, Duplicate.

Move to your new sheet by clicking its name. I recommend renaming this sheet as well (I chose “Binara Comparison”). Now, click the drop-down menu in the Marks tab and select “Shape.” Then, within the Mark tab, drag “Group” that is currently assigned to color onto the Shape sub-tab. You can use the mouse wheel or the zoom buttons in the map tools (top left of the map) to zoom into your points. If the points move outside the window of the map use the arrow in the zoom tools and select the arrows to move the map. Zoom until the groups fill the map.

This is done to highlight the different ways points can be differentiated within Tableau. We will use the color later to show the different tree species.

ii. Change Marks type to Shape, drag “Group” onto Shape, Zoom in on Binara
We will now drag our last two components onto our map. First, drag the measure "Cvol" onto the Size sub-tab in Marks, and drag the dimension "Species" onto the Color sub-tab. You may see a warning when dropping "Species" onto Color, if you do select "Add all members."

1. This is done so we can compare different components of the two groups together in one map. This enables us to see the difference in crown volume and the types of trees feed on in both.

2. Drag "Cvol" onto Size, "Species" onto Color

Finally, we need to change how "Cvol" is measured. Tableau Desktop defaults to sum, but we are interested in the average. To do this, right click on the "SUM(Cvol)" field within the Marks tab, hover over "Measure(sum)," and select "Average" in the submenu.

1. This is done because we are interested in the average crown volume per tree, not the sum. If we selected sum we would get much larger crown volumes than are actually represented in the field. It is very important that you understand how you are measuring your data, and if that is the proper function to use.

2. Right click "SUM(Cvol)". hover over "Measure(sum)", select "Average"
III. We should now have created two maps and are now ready to do some quantitative analysis on the measures related to group 
behavior and feeding habits. The finished two maps are shown below.
1. Create a new sheet and name it something distinct (I chose "Scatterplot").
2. Drag the measure "NNdist" into the Columns tab, and "Group Spread" into the Rows tab. Change both from sum to average.

3. We will now have a single point on our plot, which is the average of all nearest neighbor and group spread data, which hardly makes more a scatterplot. To fix this, drag the dimension "Behavioral Date Time" onto the Detail sub-tab. Then, right click the "Behavioral Date Time" field within the Marks tab, hover over the second "More" and select "Hour" in the submenu.
   a. This is done because Tableau Desktop defaults to using year from date dimensions. As this data was all collected in one year we see very little change. By changing Tableau Desktop to read each date down to the hour we see much more points represented. We use the second set of date options because the first is considered "discrete dates" meaning that they only delimit based on the option selected. Meaning, if you select Hour from this group Tableau will show all points that occur in each hour, but not break these points by year, month, week, or day. The second set is considered "continuous dates" and delimit down to the smallest measure you select. So, by selecting hour as a continuous date Tableau organizes each date by year, month, day, and hour to build each point.
   b. Drag "Behavioral Date Time" onto Detail, right click and select Hour from second group of date choices.

Explanation

We will now begin to quantitatively analyze our data, first by seeing if there is a relationship between Nearest Neighbor (how close the nearest two lemurs are in a group) and Group Spread (how far the entire group is spread). This step assumes you have at least read the previous steps and are familiar with some base functionality within Tableau Desktop at this point.

As mentioned before, we will use the Detail sub-tab in the Marks tab to add detail to the plot. In this case, we want to plot each point individually, meaning that we will need to use a dimension that is unique to each piece of data. With the Lemur data, every time a behavioral data point is entered the date and time is reported, down to the minute. This is specific enough to use as our detail tab to keep each data point separate.
3. 

4. Now that we have our points, we will add a trend line to our scatterplot. Click on the "Analytics" tab in the top left, and drag "Trend Line" over your scatterplot. You will see options for the different types of trend line, hover over "Power" and release the mouse. A trend line should now appear on your plot.

   a. Trend lines allow us to see how much the variance of one variable is explained by the other. In our case, the $R^2$ is 0.27, which means that the nearest neighbor does not explain the variance in group spread well.

   b. Analytics, Drag "Trend Line" onto "Power" over the scatterplot

5. As you may have noticed, there is unused white space to the right of the visual. We can use this space by changing the view. At the top of the Tableau Desktop window, to the right of the columns and rows fields, is a drop down menu that says "Standard." Click the drop down arrow and select "Entire View."

   a. This is done to maximize the size of the visual. The different view types are useful depending on the size of your visual. If you have a large number of columns you wish to see in one view select "Fit Width," for example.

   b. Change from "Standard" to "Entire View"

   c.
6. You have now created a scatterplot that should look like the one below. We will use this process to create a packed bubble a more intricate graph in the steps below.

![Scatterplot Image]

Making a Packed Bubble Chart

**Explanation**

One of the benefits of using Tableau is that you can create graphs that are visually distinct from the traditional scatterplots (above) and bar charts (below). As these graphs are constantly used we become desensitized to them and stop analyzing them as closely. Adding in a less common graph will break the monotony somewhat and keep a users attention. A balance has to be struck, however, between creating something new and exciting and making something overly complex that can't be deciphered. This step also shows that entire visualizations can be built without ever dragging a field onto Columns or Rows.

We will be making a packed bubble because they are traditionally colorful and round, which are atypical in quantitative visualizations. Be cautious using a packed bubble with too many data points, it will quickly become hard to compare the bubbles. I would argue that the packed bubble we will be making is not a useful graph (besides looking visually appealing), but it is useful to know how to make one. When I make these for clients I traditionally include a bar or column chart below it so that the viewers attention is grabbed by the bubbles, and they can analyze the data using the bar charts.

We will begin with a Tree Map and change it to a Packed Bubble. Between the two, Tree Maps typically are better at comparing percentages and to a whole than Packed Bubble.

1. Create and name a new worksheet (I choose "Packed Bubble")
2. Drag "Species" onto the Detail sub-tab in Marks
3. Drag "Species" onto the Color sub-tab in Marks
4. Change the view from "Standard" to "Entire View" using the drop down above Columns and Rows
5. Drag "Cvol" onto the Size sub-tab in Marks. Change the measure from SUM to AVG.
6. You will have created a tree map. Tree maps show how much percent each component takes of the total. In this case, it is showing how each tree species crown volume adds to the overall crown volume.

![Tree Map Image]

7. Click the drop down menu in the Marks tab and select "Circle"
8. We've now created a colorful, albeit not entirely useful, packed bubble chart with. Now back to more useful graphs that allow for some deep analytics.

Creating a Complex Chart

Explanation

Now that we have a decent grasp on how to build graphs in Tableau we will combine our previous skills to create a much richer graph than before. We will use multiple dimensions and measures, dual axes, filters, analytics, and more. Our goal is to build a graph that compares the Crown Volume to the height of each species of tree found within each group.

1. Create and name a new worksheet (I choose "Cvol Comparison").
2. Drag "Group" and "Species" to the Columns.
3. Drag "Cvol" and "Height" to the Rows. Change both to Avg.
   a. You will now have a modified Marks tab. It will contain different Marks tabs for each graph that you have in the worksheet, and you can move between them by selecting on the drop down menu. The sub-tabs can be change independently on each graph, or applied to all using the "All" drop down.

4. As you've probably noticed, one point towers over the others, greatly skewing the results to the point where all other trees appear to be at zero. As this is clearly an outlier we will exclude it from our data. To do so, click on the point and in the pop-up window that appears select "Exclude."
   a. This is done because the point right-skews the graph so heavily that the other points are not visible. As the point lists the average height at 43,203 meters (roughly 26 miles, which would be much farther than most of the Earth's atmosphere) we can safely assume there was an error in data entry and safety exclude this point.
   b. Right click outlier, select Exclude.
5. To overlay this information, we will create a dual-axis. To do so, right-click the second measure in the Rows and select "Dual Axis."
   a. This is done to further strengthen the comparison between Crown Volume and height in one compact visual.
   b. Right click Height, click "Dual Axis"

6. Click on the drop-down option "Avg(Cvol)" in the marks tab, and change the mark type from "Automatic" to "Bar".
7. Change the view from "Standard" to "Entire View" using the drop-down menu at the top of the Tableau Desktop window, above columns and rows.
8. Add an average line per pane to both "Cvol" and "Height"
   a. To do this, click on the Analytics tab in the top left of the Tableau Desktop window, and drag the "Average Line" option over your graph. Hover over to the "Pane" option and release your mouse. This should create an average line for both measures in every pane. The difference between tables, panes, and cells is explained above in the "Tableau Worksheet Overview" step. A worksheet with this step completed is shown below.
      i. This is done for two reasons. For one, we can see the average height and crown volume of each group visited. Secondly, we will use these average lines to apply some conditional formatting.
      ii. Analytics, Drag "Average Line" over pane
III. 9. We will now edit our Average Lines:
   a. For Height Average Lines:
      i. Right click any of the average lines for the heights (the red dots) and select "Edit"
      
   1. Click the drop down menu next to "Label:" (currently showing "Computation") and select "Value"
      1. This is done because having a collection of lines that each say "Average" doesn't convey a lot of useful information. By changing this to the average value we can see what the actual average value is.
      2. Change Label to "Value"

   b. For Cvol Average Lines:
      i. Right click any of the average lines for Cvol (the blue bars) and select "Edit"
ii. Click the drop down menu next to "Label:" and select "Value".

iii. Click the drop down menu next to "Fill Above:" and select a color (I choose green). Do the same for "Fill Below:" (I choose yellow).

1. This is done to show which tree species lie above the average for crown volume, and which fall below. This further helps the end user quickly differentiate above and below average crown volume for each tree species.

2. Select a color for "Fill Above:" and "Fill Below:".

With so much detail shown on one graph, we will give our end user the ability to filter it to their specifications.

a. Drag the "Group" dimension onto the Filters tab. In the window that appears click "OK".

b. Right click on the "Group" field within the Filters tab and select "Show Filter."

   i. This is done to give the user the ability to filter the graph how they would like to view it. Do this when you want to give the user more control of the visuals.
   
   ii. Right click "Group," "Show Filter."

10. b.

11. Finally, we will hide the species names.
   a. Right click any of the tree species names and select "Show Header"
   i. This is done because the tree names are so tightly packed that they don't all appear, and those that do appear in small text. As the tree name is kept in the tool tip, removing this frees up room on the graph and reduces clutter.
   ii. Right click species, "Show Header"

12. We have now created a fairly complex chart in Tableau. Your graph should look similar to the one shown below. Now, onto making one dashboard to bring all these pieces together.
Dashboard Overview

Explanation

Now that we've made our visuals we can begin building our dashboard. Dashboards allow for a lot of information to be conveyed at once, and allow you to connect visuals together to create one unified story. Before we dive into building a dashboard it is useful to understand what each tab in this window can do.

The Size tab is a small but important one. Here you will choose how large the dashboard is going to be, sized in comparison to the traditional ways the dashboards will be viewed (on a desktop, laptop, paper, etc.). When in doubt use “Automatic,” but be aware that someone on a smaller screen may see the worksheets stretched or shrunk to fit their screen. If you are creating a visual meant to be viewed by a diverse set of people on different devices use the “Fixed Range” option to set exactly how the dashboard will look at its smallest and largest.

This will show the worksheets you have built that can be used on the dashboard. Each worksheet can only be used once, so if you want to show the visual twice on one dashboard you will need to duplicate it. This is partially why we made two maps earlier.

The Objects tab is the most versatile and is how you can add a lot of customization to your dashboard.

- **Horizontal and Vertical Objects:**
  - Allow you to manually split how the dashboard will be set up. Using a horizontal object helps layout the next two worksheets so that they appear on the same horizontal level. These objects can take time to get used to, and I recommend sketching out how you wish to layout your dashboard before using these if you aren't familiar with them.

- **Text and Image Objects:**
  - As the names suggest, use these to add text boxes or images to your dashboard. These can be used to explain the flow of your data, or to add a picture to sit alongside it, such as a logo or lemur.

- **Web Page Objects:**
  - These allow you to have a live window in your dashboard that links and displays an external site. Useful if you want to add a Wikipedia entry about lemurs, or if another agency has already created a visual you are interested in.

- **Blank Objects:**
  - Used as placeholders or white space to your dashboard.
Building a Dashboard

Explanation
We are now finally ready to build our dashboard. This step is much more individual and creative than the past, as you can layout your dashboard in the way you feel best tells your story. I will go over how I felt the data was best laid out, and which additional windows I hid or re-arranged on my dashboard.

1. Using the Size tab, click on "Desktop Browser" then "Fixed Size" and select "Automatic"

2. Drag "Map Overview" onto the space marked "Drop Sheets Here." It will fill up the entire dashboard, this is okay.
3. Drag "Binara Comparison" to the right half of the "Map Overview" so that a grey rectangle covers the right half of the "Map Overview" sheet. Once in place, drop the worksheet in place
   a. This grey rectangle will show you where the visual is going to be placed on the dashboard. By moving the visual to different spots on the dashboard you can customize where these sheets appear.
4. Drag "Scatterplot" to the right half of "Binara Comparison" so that the grey rectangle covers the right half. Once in place, drop the worksheet.
   a. You should now have three worksheets in a horizontal row like the image below.
5. Drag "Packed Bubble" to the very bottom of the dashboard. A grey rectangle should cover the bottom half of the three visuals placed above. You have now created a second row of visuals.
6. Drag "Cvol Comparison" to the right half of the second row you just created until the grey rectangle is in the proper place and release. The dashboard should now look like the image below.

7. We will now focus on cleaning up the dashboard by removing unnecessary legends and editing titles.
   a. Right click on the "Group" legend in the top right corner and select "Floating." Then, drag the legend using the grey tab on the top over the map.
      i. This is done so that we can have the legend float on top of the Madagascar map. By allowing this legend to float it can still be shown while covering the unneeded portion of the map.
      ii. Right click Group legend, Floating
   b. Click on the Group shape legend, then click on the X that appears in the top left corner of the legend to hide it. Do the same for "Avg. Cvol" and "Measure Names."
c. Select the "Species" legend and use the grey tab on the top to move it to the left of the packed bubble.

d. Right click on the Group filter, hover over "Apply to Worksheets" and select "Selected Worksheets." In the window that appears select "All on Dashboard."
   i. This is done so that the filter can affect all visualizations we have created. By doing this, our end user can compare the specific groups they are interested in.
   ii. Right click "Group" filter, "Apply to Worksheets," "Selected Worksheets," "All on Dashboard"

iii. To edit titles, right click on a title and select "Edit Title." Do this so that every title is descriptive and has a caption if necessary.
   i. Title names should tell the viewer what they are looking at and why it is important. Your title can tell the viewer what you want them to take away. A graph titled "Weak Positive Correlation Between Nearest Neighbor and Group Spread" is much more informative than "Nearest Neighbor vs Group Spread"
   f. To edit axis, right click on an axis and select "Edit Axis." Make sure you include units!
   g. To resize worksheets, click on the worksheet you wish to scale and put your mouse over one of the edges. The cursor should change and you can click and drag the edge to size as needed.
   i. Do this for each of your worksheets until you are satisfied with your sizing.

You should now have successfully created a dashboard housing all of your visualizations! My version is shown below.
Wrap Up

You should have created a dashboard filled with 5 distinct visuals made within Tableau Desktop. This still only scratches the surface of what is possible within Tableau Desktop, but with this foundational knowledge you should be able to begin learning the advanced features. The Tableau community is large and vocal, meaning that if you have a specific question it is likely that someone else has asked and answered it. A copy of my completed Tableau packaged workbook is linked below, along with a link to a Tableau Public page that lets you see the interactive features if you do not have Tableau Desktop installed. I strongly recommend scrolling through Tableau Gallery if you want to see some advanced dashboards and great inspiration. I hope this guide is the beginning to some fantastic visualizations!

- Packaged Workbook
- Tableau Public
- Tableau Gallery

Last updated 8/7/2018


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