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Visualizing Geographic and Spatial Data

Many data sets include geographic or spatial information. You might have ZIP codes, country codes, or city names. You might have latitudes and longitudes. Or, you might have data that can be plotted using x and y coordinates. For example, the coordinates might map to positions within parts or objects.

When you have geographic data, the most effective graphical tool is a geographic map. Plotting your data on a map can often reveal geographic patterns that would otherwise be difficult to identify or understand.

Let's return to the Mobile Cellular subscription scenario. Remember that these are data on mobile cell phone subscriptions per 100 people, from 1990 to 2017. The data set includes information on 217 countries grouped into seven regions and four income groups.

Because we have the names of the countries (and ISO codes), a geographic map can be created using shape files.

Shape files map the names of countries to latitudes and longitudes, enabling you to easily create geographic maps.

In this video, you see examples of maps created using shape files, but you won't learn what's going on behind the scenes to create these maps.

For more information on using and creating shape files, see the Read About It for this module.

This is a map of mobile subscriptions per 100 people for 2017. The scale goes from blue (very low) to gray (medium) to red (high), where the range of average values is from 0 to 250. This is called a diverging color scale.

Changing the color in the geographic map to a sequential scale makes the map much less dependent on the key.

Here is the same map with a white-to-orange sequential scale.

Data are missing for many countries in 2017. These show as gray shapes. The fact that these data are missing was obscured with the diverging scale.

Note that you learn more about the use of color for effective visualizations in the next lesson.

By creating a trellis plot and using data filtering, you can see how mobile phone subscriptions have changed geographically since 2000.

For example, look at the differences between 2000 and 2005. You can see the countries that are starting to have a lot of cell phones in 2005.

And from 2005 to 2010, you can see that some countries really stand out as having a lot of cell phones.

In these examples, we use shape files to create geographic maps. Shape files can also be used to create custom maps.

For example, let's say that you're studying temperature fluctuations in your building. You can create shape files and then use these shape files to create a map of the building or of a particular floor of your building.

In this example, a floor of a building is colored by the temperature in Fahrenheit.

You can see that there is variability across the different offices on the floor and that the afternoon temperatures are, in general, cooler in the offices.

However, the multi-use shared room is quite a bit hotter in the afternoon.

Rather than using shape files, you can also create geographic maps if your data set has latitudes and longitudes. Here's a popular example, called Napoleon's March.

This is a geographic map based on data used by Charles Minard to map Napoleon's Russian campaign. The width of the lines denotes the size of the army. The color indicates whether the army was charging or retreating.

With latitudes and longitudes, you can also put a background map on the graph, which shows national or regional boundaries, or other features like rivers. This can help you interpret data in the proper context.

What if your data set has x and y coordinates, rather than latitudes and longitudes?

For example, consider measurements for wafers and dies in the semiconductor industry. Wafers are produced in lots, and within each wafer there are many die locations. The data are in the file Wafer Stacked Small.jmp, in the course data folder.

In this example, there are five lots of wafers, with six wafers per lot. There are 1423 die locations per wafer.

The locations within each die have x and y coordinates. The number of defects at each die location is given.

Let's say that you want to visualize defects across the lots and across the wafers within a lot.

Here, you see a trellis plot of heat maps for the average number of defects per lot.

The Y axis is the y-location within the wafer, and the X axis is the x-location.

This map shows that there are lot to lot differences.

Lots 4 and 5 have many more defects, and you can see that the defects tend to occur in certain regions of the wafers.

Let's take a closer look at Lot 4. There are six wafers in this lot. You can see that most of the defects occurred within one of the wafers, Wafer 4.

These defects are largely at the top and bottom of the wafer.

But there are also defects along the perimeter of the first wafer.

Could this be a different failure mode?

In Lot 5, you can see that two of the wafers show the same top and bottom defect pattern.

Wafer 4 seems to have a different pattern, with defects spread across the surface.

These wafer heat maps enable you to learn about the nature of die defects. Some lots don't have a lot of defects.

Within lots, there are at least three different defect patterns. These patterns might be from different failure modes. Imagine how useful this information is for a team addressing wafer defects!

In this video, you've learned about using maps to visualize geographic and spatial data.

In the next JMP demonstration videos, you see how to graph your data using shape files that are included with JMP. You also see how to create geographic maps when you have x and y coordinates.

For information about creating your own shape files, search for Custom Map Files in the JMP Help at jmp.com/help.

For additional details on graphing spatial and geographic data, see the Read About It for this module.

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