

Presidential Election Data: Predominant Mapping



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Lesson Overview

The 2016 presidential election in the United States ended in surprise victory for Republican candidate Donald Trump. GIS can offer a geographic perspective of the election results and provide information to upcoming candidates concerning the "where" of the electoral contest.

Officials with both the Republican and the Democratic national committees have contracted you to provide them with a visual representation of the 2016 presidential election data. They want to geographically and mathematically display the election results in various ways. You have been contracted to visualize the data using predominant mapping and z-score.

Builds skills in

- Visualizing data using predominant mapping
- Calculating z-score
- Using Arcade expressions

Software Requirements

- An ArcGIS Online account (create a free [ArcGIS Public Account](#) or get a free [ArcGIS trial](#))

Estimated Time

- 1 hour

Exercise

Step 1: Save a copy of the data

First, you'll save a copy of a map with 2016 presidential election data.

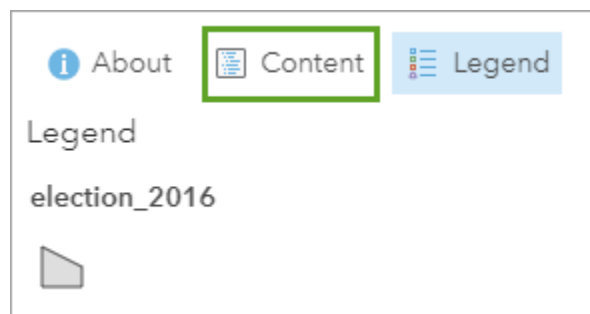
1. Open [Presidential Election 2016](#).
2. Click **Sign In**. Sign in to your ArcGIS account.
3. On the ribbon, click **Save** and choose **Save As**.
4. In the **Save Map** window, change the following metadata:
 - a. For **Title**, type Presidential Election 2016.
 - b. For **Tags**, remove the existing tag and add the tags Predominant Mapping and Z-score.
 - c. For **Summary**, type Presidential election results by county for 2016.
5. Click **Save Map**.

A copy of the map is saved.

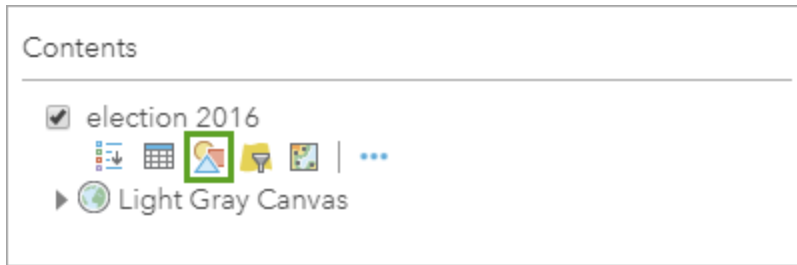
Step 2: Style the map by predominant category

The map includes data about the election results, but the map's style doesn't tell you anything about them. You'll style the counties by predominant category, which compares two or more attributes that share a common subject and unit of measurement and displays the one with the highest value. For your map, you'll use predominance to show which political party or candidate received the highest percentage of votes in each county.

1. Above the legend, click **Content**.



2. In the **Contents** pane, point to **election 2016** and click the **Change Style** button.

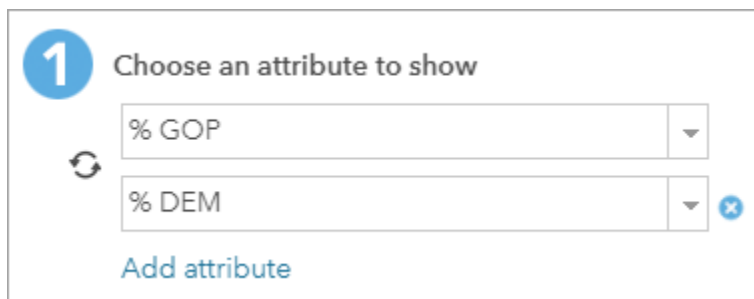


First, you'll choose what data you want to visualize.

3. In the **Change Style** pane, for **Choose an attribute to show**, choose **% GOP**.

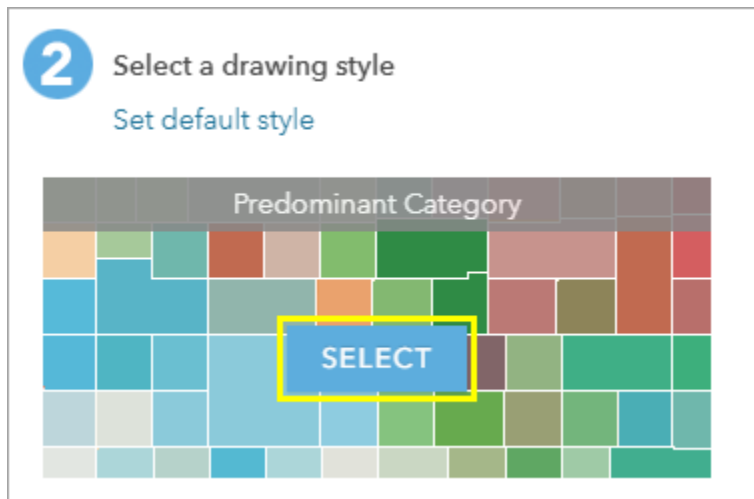
4. Click **Add attribute**.

5. For the second attribute, choose **% DEM**.



Next, you'll choose the style you want to use to display the data.

6. Under **Select a drawing style**, for **Predominant Category**, click **Select**.



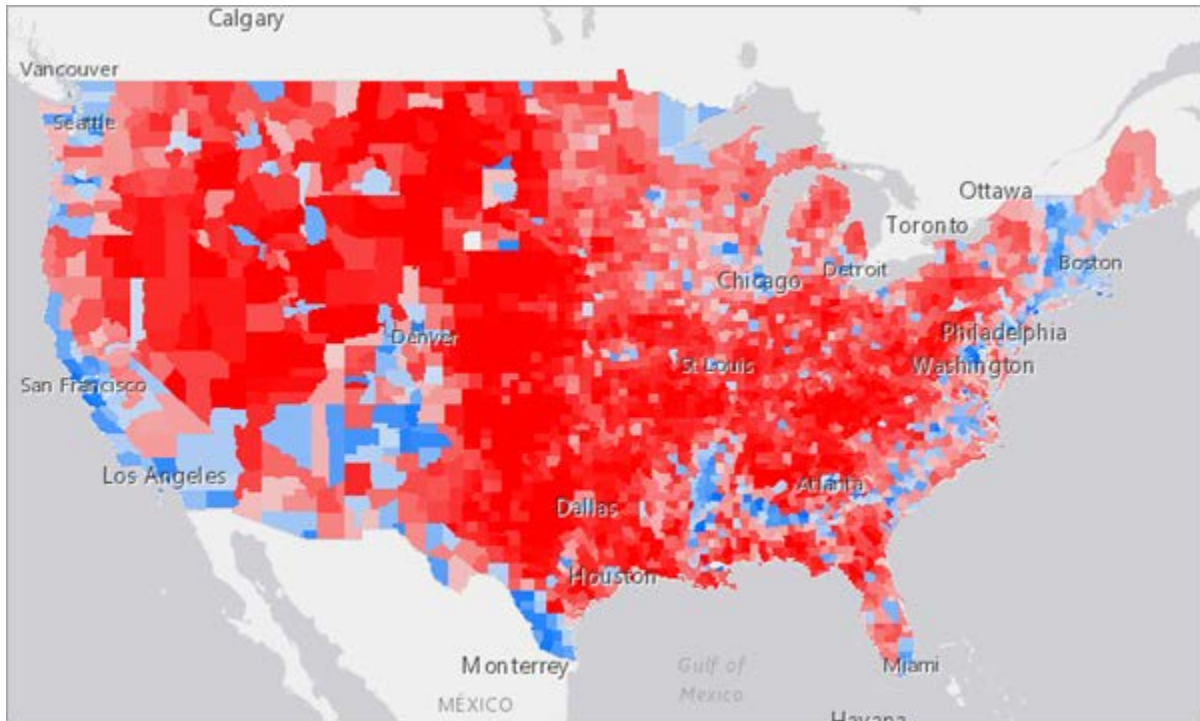
The style on the map changes, but the colors for counties with predominantly Democratic or Republican voters are random. You'll change the colors to match the colors for each political party.

7. For **Predominant Category**, click **Options**.

8. Next to **% GOP**, click the color icon. Choose a bright red color and click **OK**.

9. Change **% DEM** to a bright blue color.

The colors on the map change. Counties in red received a higher percentage of Republican (GOP) votes, while counties in blue received a higher percentage of Democratic (DEM) votes. Counties with lighter colors are those where the both parties received close to 50 percent of the vote, while counties with darker colors are those where one party received a much higher percentage than the other. The magnitude of the difference between the two candidates is called the strength of predominance.



10. At the bottom of the **Change Style** pane, click **OK**.

Q1. Which areas of the United States predominantly voted for the Republican candidate? Which areas predominantly voted for the Democratic candidate?

A1. _____

Step 3: Style the map by predominant category and size

Your map shows the strength of predominance using color. Next, you'll change the style to show the strength of predominance using size.

1. In the **Change Style** pane, for **Predominant Category and Size**, click **Select**. Then, click **Options**.
2. For **Counts and Amounts (Size)**, click **Options**.
3. Under **Size**, click **Specify size range**.
4. For **Min**, type 4 px. For **Max**, type 15 px.

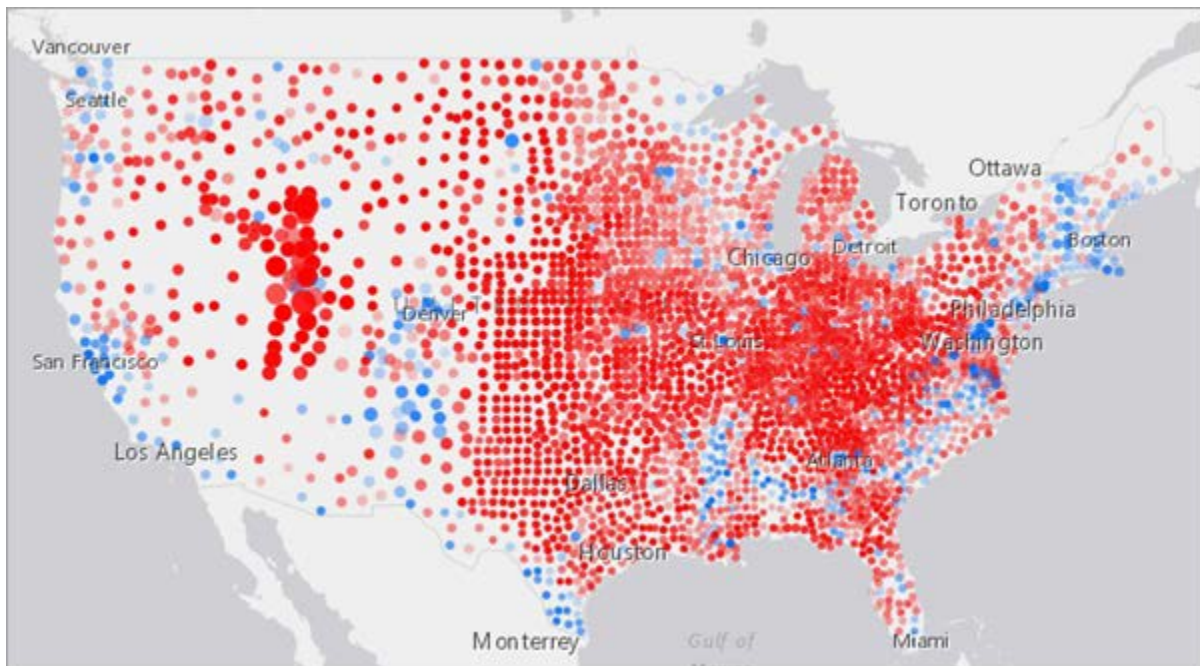
Size

Adjust size range automatically

Specify size range

Min px Max px

The map style changes. Each county is styled with a circle. The color of the circle still indicates which candidate received a higher percentage of votes, while the size of the circle indicates the strength of predominance.



5. Click **OK**. Then, click **Done**. Click **Done** a second time to return to the **Contents** pane.

6. On the ribbon, click **Save** and choose **Save**.

Q2. Based on the map, is it possible to tell which candidate received a higher number of votes overall? Why or why not?

A2. _____

Step 4: Calculate z-score for % DEM

A z-score is a numerical measurement of a single value's relationship to the average of all values. If a value's z-score is 0, it means the value is identical to the average value. Z-scores may also be positive or negative numbers, with a positive z-score indicating the value is above the average and a negative z-score indicating it is below the average.

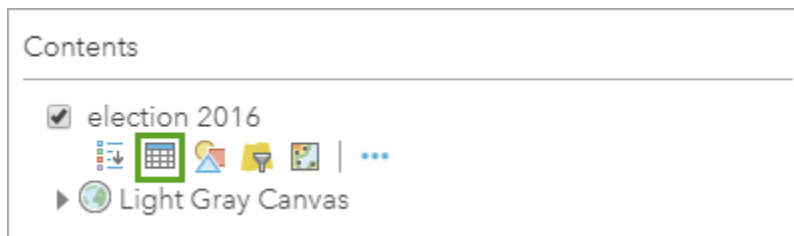
Positive and negative z-scores also reveal the number of standard deviations the score is above or below the average. In this dataset, one standard deviation accounts for about 68 percent of the people, in this case representing 68 percent of the people either voted Democratic or Republican.

To calculate the z-score for a value, subtract the average from the value. Then, divide the result by the standard deviation, as in the following expression:

$$(Value - Average Value) / Standard Deviation$$




You'll create an Arcade expression to calculate the z-score for every value in the layer.

1. In the **Contents** pane, point to **election 2016** and click the **Show Table** button.



The table appears. It contains all of the layer's attributes.

2. In the table, scroll right until you see the **% DEM** field.
3. Click the **% DEM** heading and choose **Statistics**.

Shape__Length	% DEM	% GOP
24.266646374095142	 Sort Ascending	3
18.7316206047123	 Sort Descending	3
4.166791734069814	 Statistics	3

The **Statistics** window appears. This window displays several statistics regarding this attribute's data. To calculate the z-score, you'll need the average value and the standard deviation.

4. Write down the **Average** and **Standard Deviation** values.

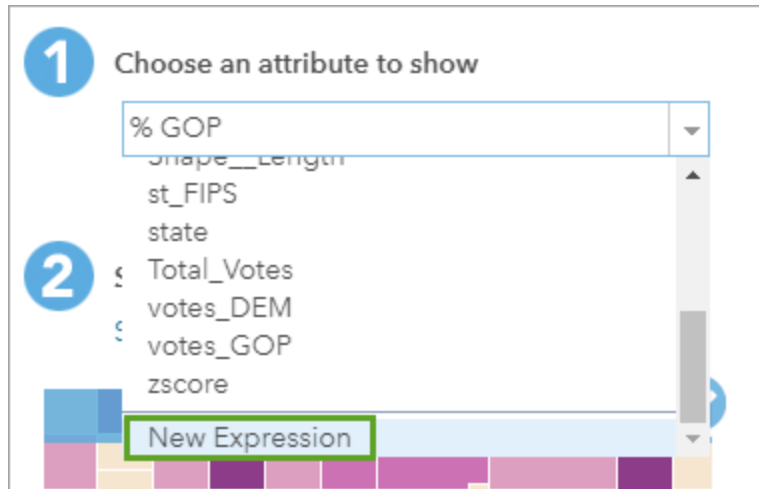
The average is 0.3174 and the standard deviation is 0.1527.

5. Click **Close**. Close the table.

6. In the **Contents** pane, point to **election 2016** and click the **Change Style** button.

To style the layer by z-score, you'll need to create a new expression to use as the attribute to show.

7. For **Choose an attribute to show**, next to **% DEM**, click the x to remove the attribute.
8. Click **% GOP**, scroll down, and choose **New Expression**.



A window appears with options for creating mathematical expressions using the attributes in the data. You'll create an expression that calculates z-score using the average and standard deviation values you recorded previously.

9. Next to **Custom**, click **Edit**. Change the name of the expression to Z-score % DEM.

10. Click **Save**.

11. Create the following expression: $((\$feature.DEM_per)-0.3174)/0.1527$

```

Expression
1 // Write a script that returns a value that will be used to
2 // For example, find the percentage of males:
3 // Round(($feature.MalePop / $feature.TotalPop) * 100, 2)
4
5 ((\$feature.DEM_per)-0.3174)/0.1527

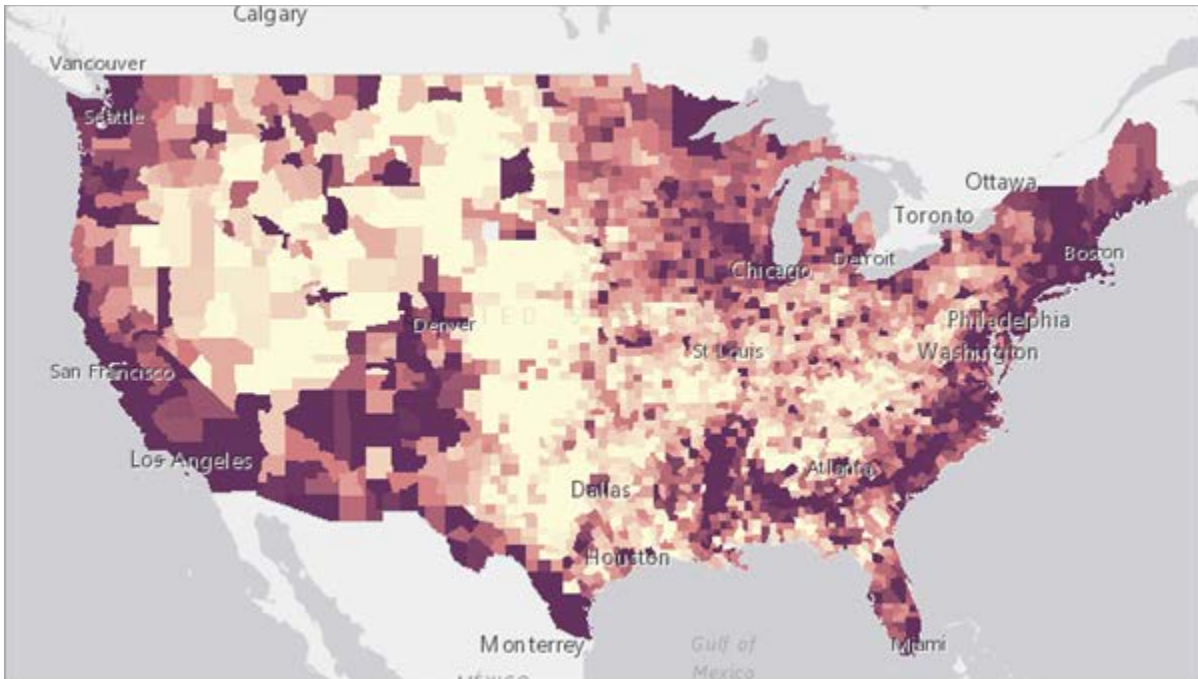
```

12. Click **OK**.

The expression you created is added as a new attribute that you can use to style the layer.

13. In the **Change Style** pane, for **Counts and Amounts (Color)**, click **Select**.

The style changes.



14. Click **Done**.

15. In the **Contents** pane, for the **election 2016** layer, click the **More Options** button and choose **Rename**.

16. Change the layer name to Z-score % Dem and click **OK**.

Q3. Look at the map legend. What do the darker and lighter colors on the map represent? What is the highest z-score value? What is the lowest?

A3. _____

Step 5: Calculate z-score for % GOP

You'll repeat the process to calculate the z-score for the % GOP attribute. First, you'll create a copy of the **Z-score % Dem** layer.

1. In the **Contents** pane, for **Z-score % Dem**, click **More Options** and choose **Copy**.

2. Rename the **Z-score % Dem – copy** layer to Z-score % GOP.

Next, you'll find the necessary statistics.

3. Open the table for the **Z-score % GOP** layer. Display the statistics of the **% GOP** attribute.

4. Record the average (0.6354) and standard deviation (0.1559). Close the **Statistics** window and the table.

Lastly, you'll create the expression and change the style.

5. In the **Contents** pane, for **Z-score % GOP**, click **Change Style**.

6. For **Choose an attribute to show**, click **Edit Expression**.



7. Rename the expression Z-score % GOP.

8. Change the expression to the following expression: $((\$feature.GOP_per)-0.6354)/0.1559$

9. Click **OK**.

10. In the **Change Style** pane, for **Counts and Amounts (Color)**, click **Select**.

11. Click **Done**.

You can compare the z-score for the percentages of Democratic votes and the percentage of Republican votes by turning the layers on and off.

12. Save the map.

Q4. How is the Z-score % GOP layer different from the Z-score % Dem layer? Is there a relationship between the spatial distribution of high and low z-scores in each layer?

A4. _____

In this exercise, you visualized 2016 presidential election data by predominant mapping and by z-score. You made observations about the spatial distribution of the political parties' voting preferences. You also learned about some statistical methods for deriving insight from data. Political parties, pollsters, or other officials involved in future elections can use this map to target campaigns or make predictions about future election results.

Exercise Answers

Q1. Which areas of the United States predominantly voted for the Republican candidate? Which areas predominantly voted for the Democratic candidate?

A1. Most of the central United States voted for the Republican candidate, as well as most of Florida and Gulf coast. The areas that predominantly voted for the Democratic candidate are located along the East and West coasts, with other areas being the Southwest, much of central Colorado, and parts of the Great Lakes regions.

Q2. Based on the map, is it possible to tell which candidate received a higher number of votes overall? Why or why not?

A2. It is not possible to tell which candidate received a higher number of votes from the map alone. The map shows the percentage of votes cast in each county, but does not indicate the total number of votes. Some counties may have had more votes cast in them than other counties.

Q3. Look at the map legend. What do the darker and lighter colors on the map represent? What is the highest z-score value? What is the lowest?

A3. The darker colors on the map represent areas with a positive z-score, while the lighter colors represent areas with a negative z-score. The highest z-score value is 1, indicating that the highest values were one standard deviation away from the mean. The lowest z-score value is -1, indicating that the lowest values were also one standard deviation away from the mean.

Q4. How is the Z-score % GOP layer different from the Z-score % Dem layer? Is there a relationship between the spatial distribution of high and low z-scores in each layer?

A4. The spatial distribution of z-scores in each layer is inverted. Areas on one layer with a high z-score have a low z-score on the other layer, while areas with a low z-score on one layer have a high z-score on the other.

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Kathryn Keranen is an award-winning teacher and author. She serves as an instructor in Geographic Science at James Madison University and is the co-founder of the award-winning Geospatial Semester. With Bob Kolvoord, she is the co-author of the Making Spatial Decisions series from ESRI Press.

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