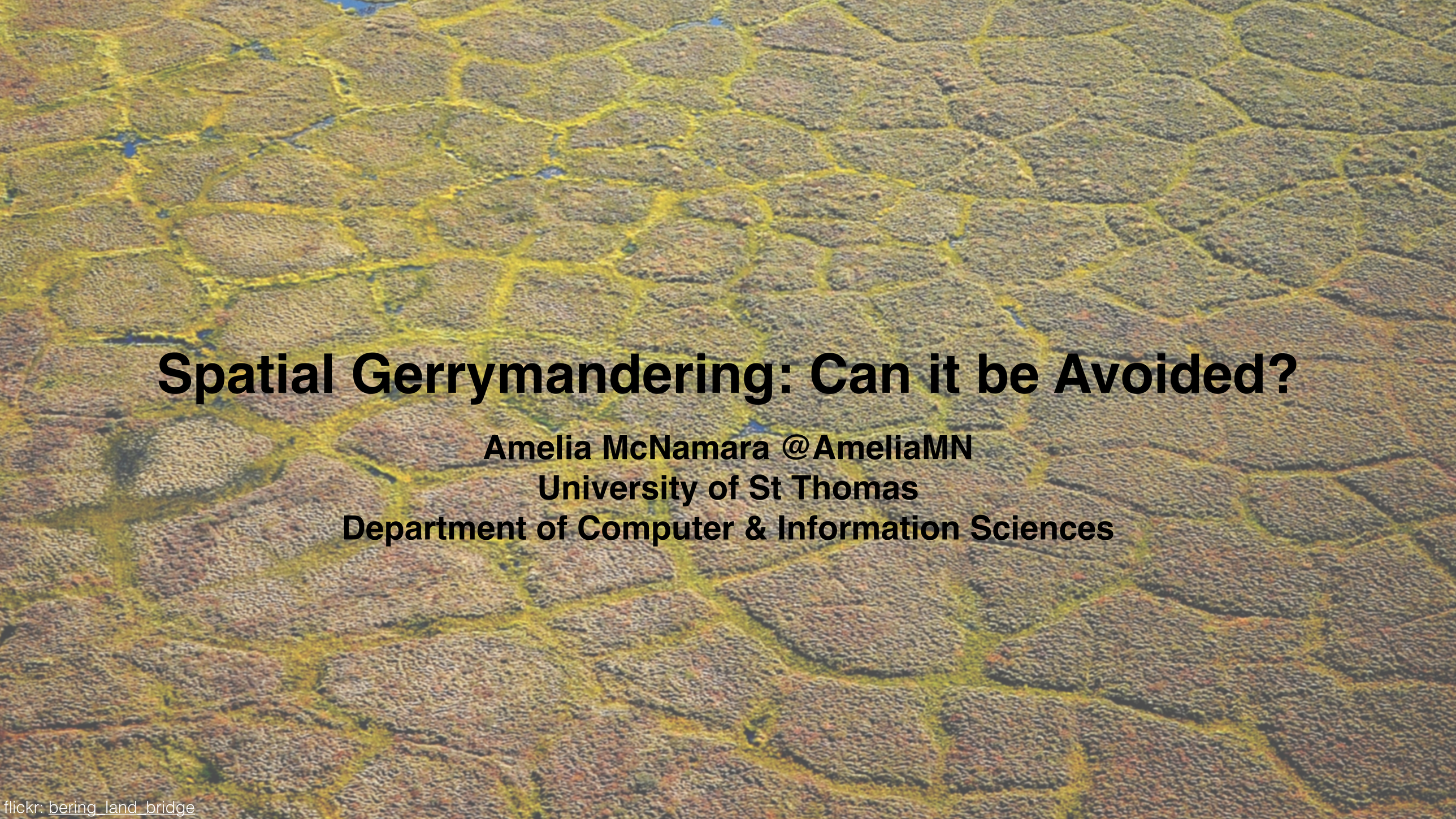


Spatial Gerrymandering: Can it be Avoided?

Amelia McNamara @AmeliaMN
University of St Thomas
Department of Computer & Information Sciences

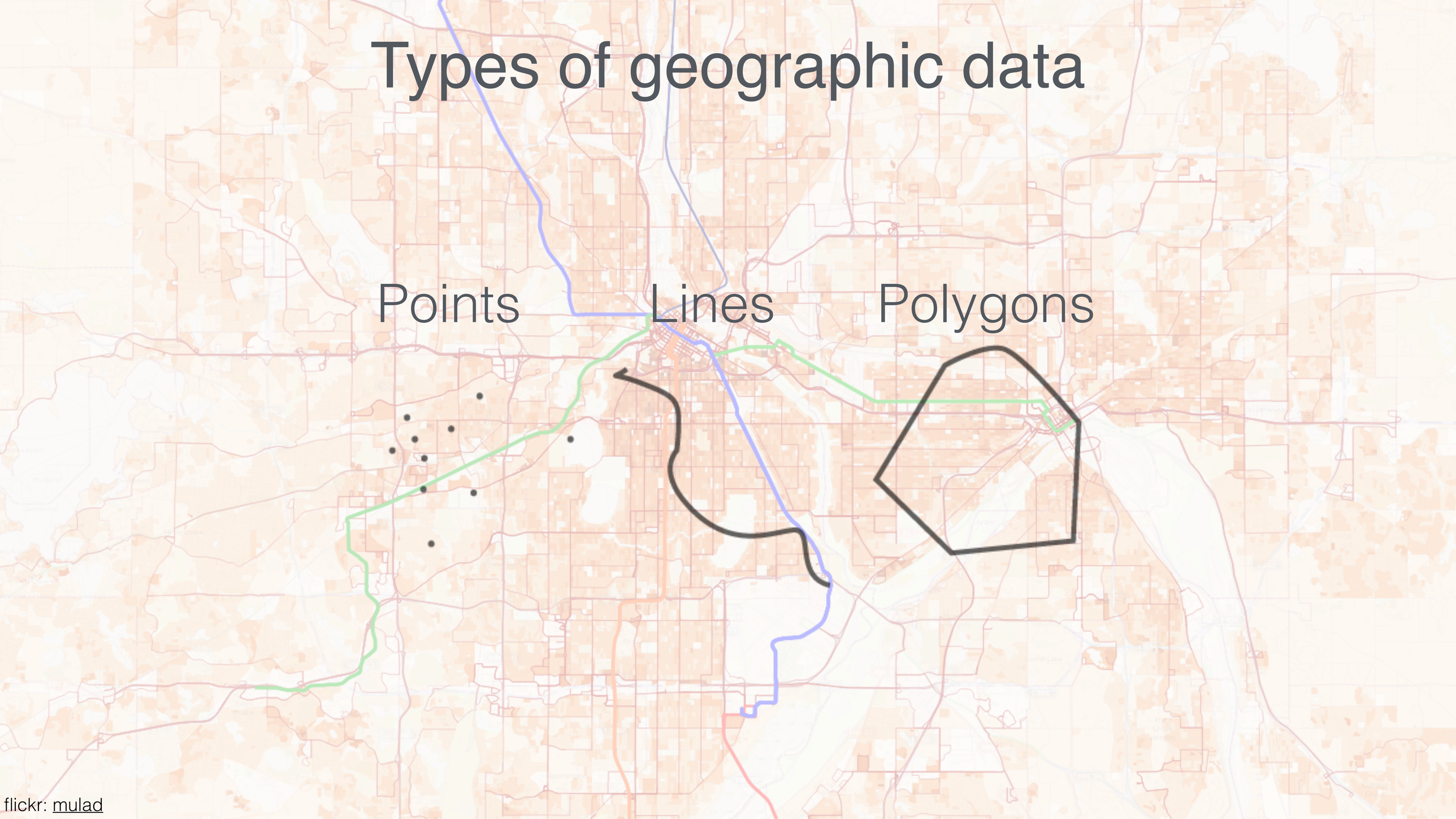
flickr: bering_land_bridge

Types of geographic data

Points

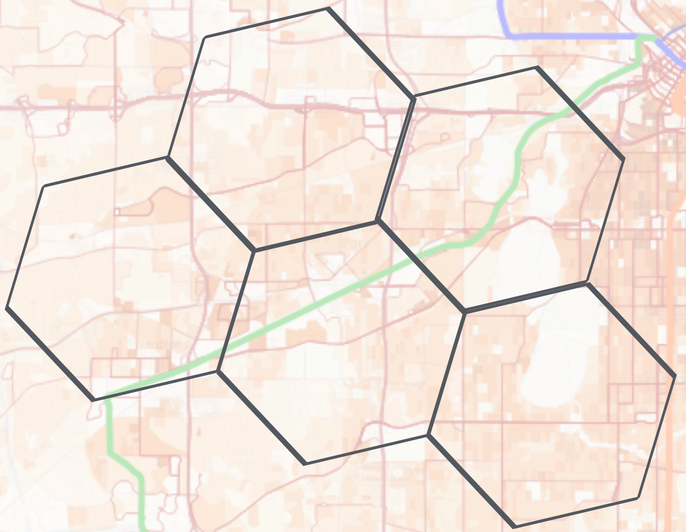
Lines

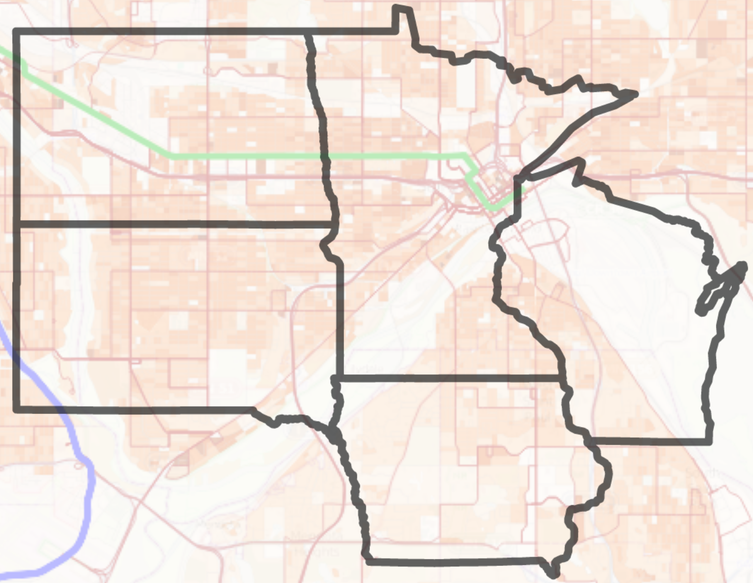
Polygons



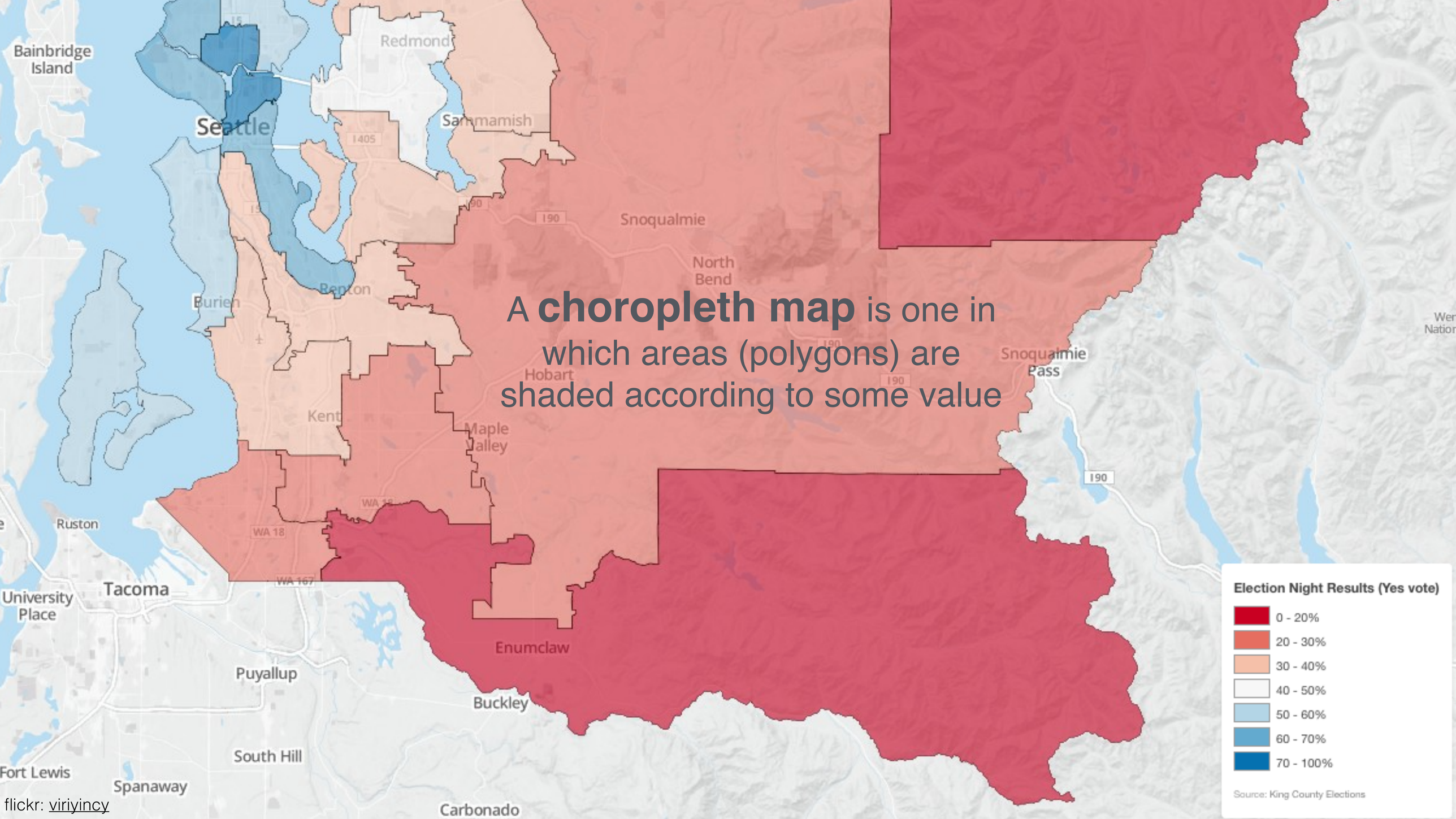
flickr: mulad

Polygons can be regular or irregular





flickr: mulad



A **choropleth map** is one in which areas (polygons) are shaded according to some value

flickr: viriyincy

Modifiable Areal Unit Problem

"The areal units (zonal objects) used in many geographical studies are arbitrary, modifiable, and subject to the whims and fancies of whoever is doing, or did, the aggregating"
- Stan Openshaw

http://gispopsci.org/maup/

flickr: mulad

What's so hard about histograms?

Histograms are a way to summarize a numeric variable. They use counts to aggregate similar values together and show you the overall distribution. However, they can be sensitive to parameter choices! We're going to take you step by step through the considerations with lots of data visualizations. If there's anything you do not understand after reading the essay, you can contact us; our contact information is at the very end. Comments and suggestions are welcomed!

Visualizing data

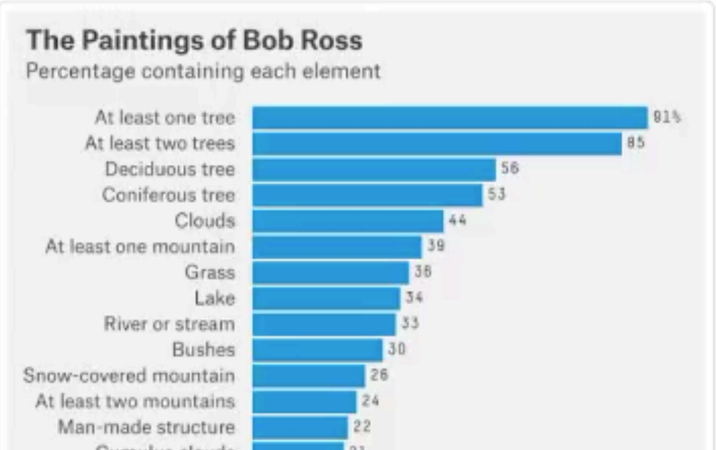
When thinking about data, it is often useful to produce visualizations to better understand distributions and relationships between variables. Since visualizations rely on humans to make and interpret them, they can be fraught with possibilities for misrepresentation, including perceptual issues and problems with axes.

In this essay, we are focusing on **distributions** of a single variable. The way you visualize a distribution depends on whether the variable of interest is categorical or numeric.

Categorical variables and their distributions

Categorical variables take on only a few specific values. For example, gender is a common categorical variable, perhaps with categories "male," "female," and "gender non-conforming."

To visualize the distribution of one categorical variable, we use what is called a bar chart (or bar graph). Bar charts show how many items are counted in each of a set of categories. For example, fivethirtyeight created the bar chart at right to show the features of Bob Ross paintings. The categories for painting elements are discrete choices, so Walt Hickey (the author of the chart) counted how many paintings contained each element and displayed the counts.



Because of their discrete nature, there's not much to decide when drawing a bar chart. An

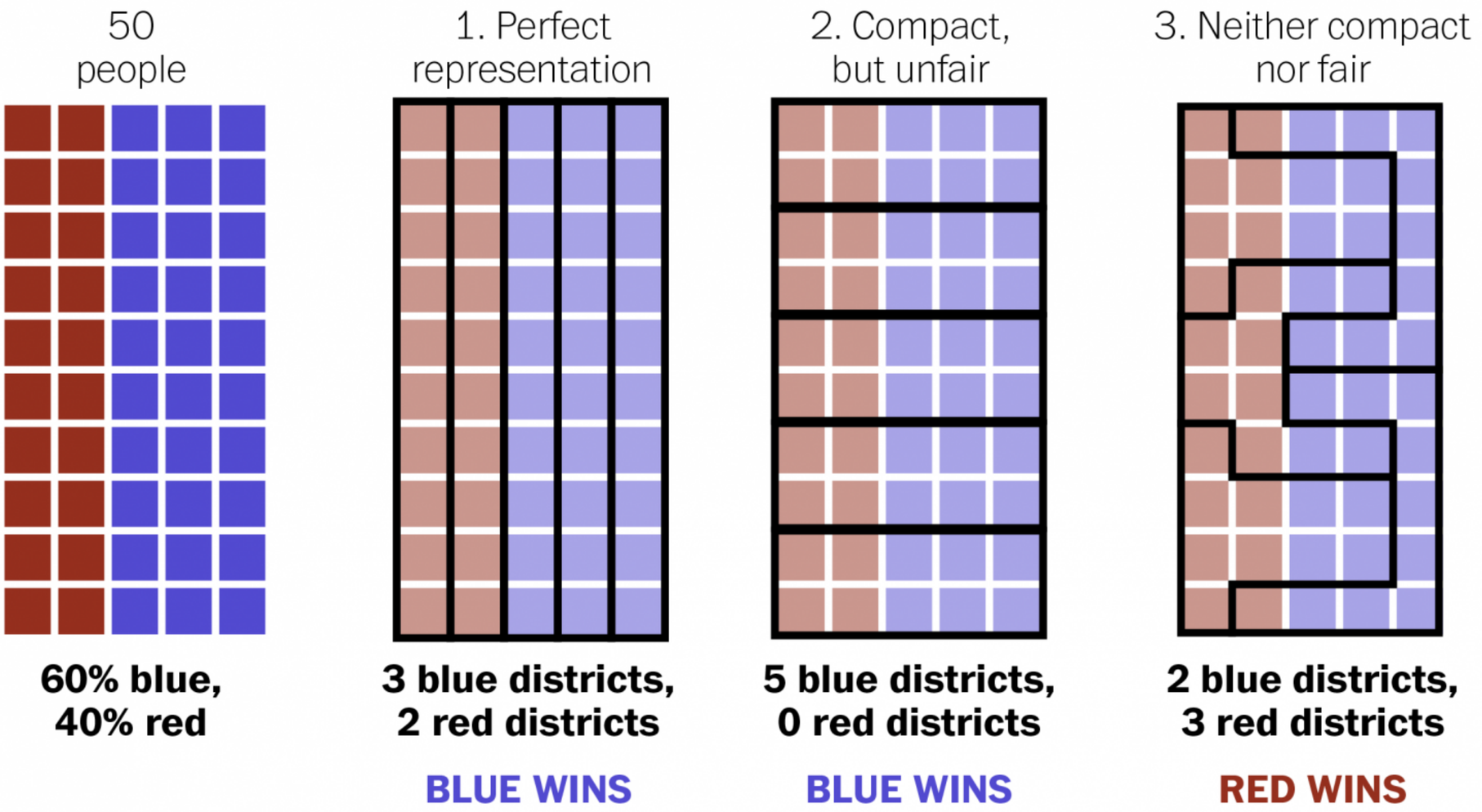
Gerrymandering

wikipedia: Elkanah Tisdale (1771-1835) (often falsely attributed to Gilbert Stuart)[1] - Originally published in the Boston Centinel, 1812.

http://bit.ly/LWT_gerrymandering

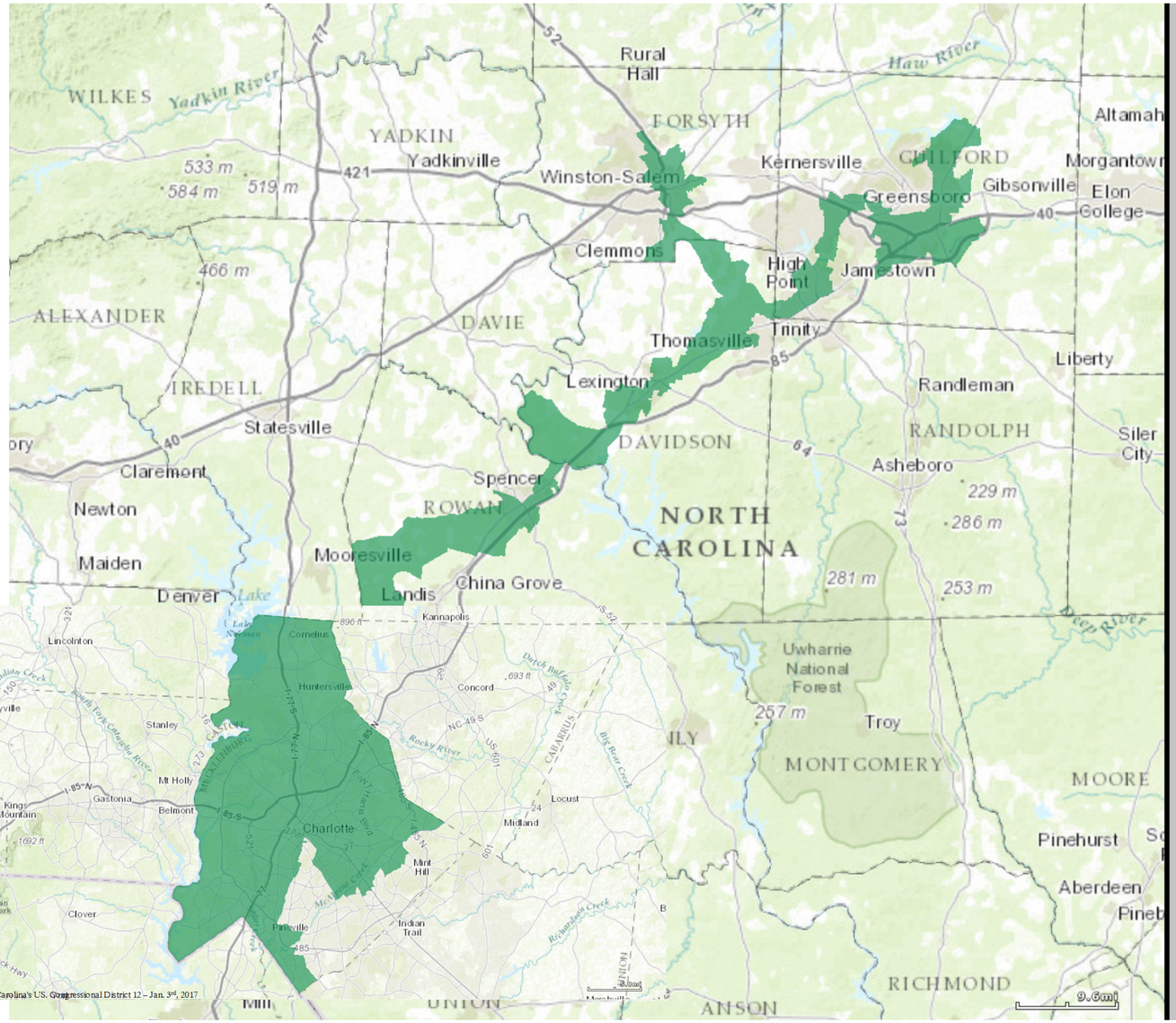
Gerrymandering, explained

Three different ways to divide 50 people into five districts

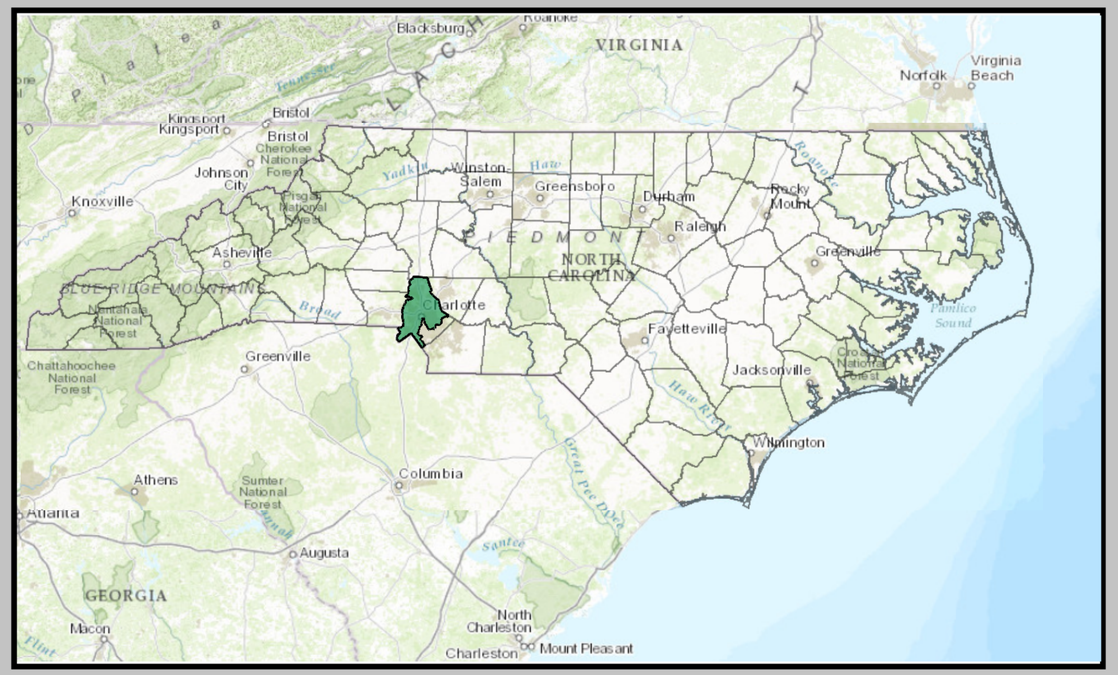


https://www.washingtonpost.com/news/wonk/wp/2015/03/01/this-is-the-best-explanation-of-gerrymandering-you-will-ever-see

North Carolina’s 12th district



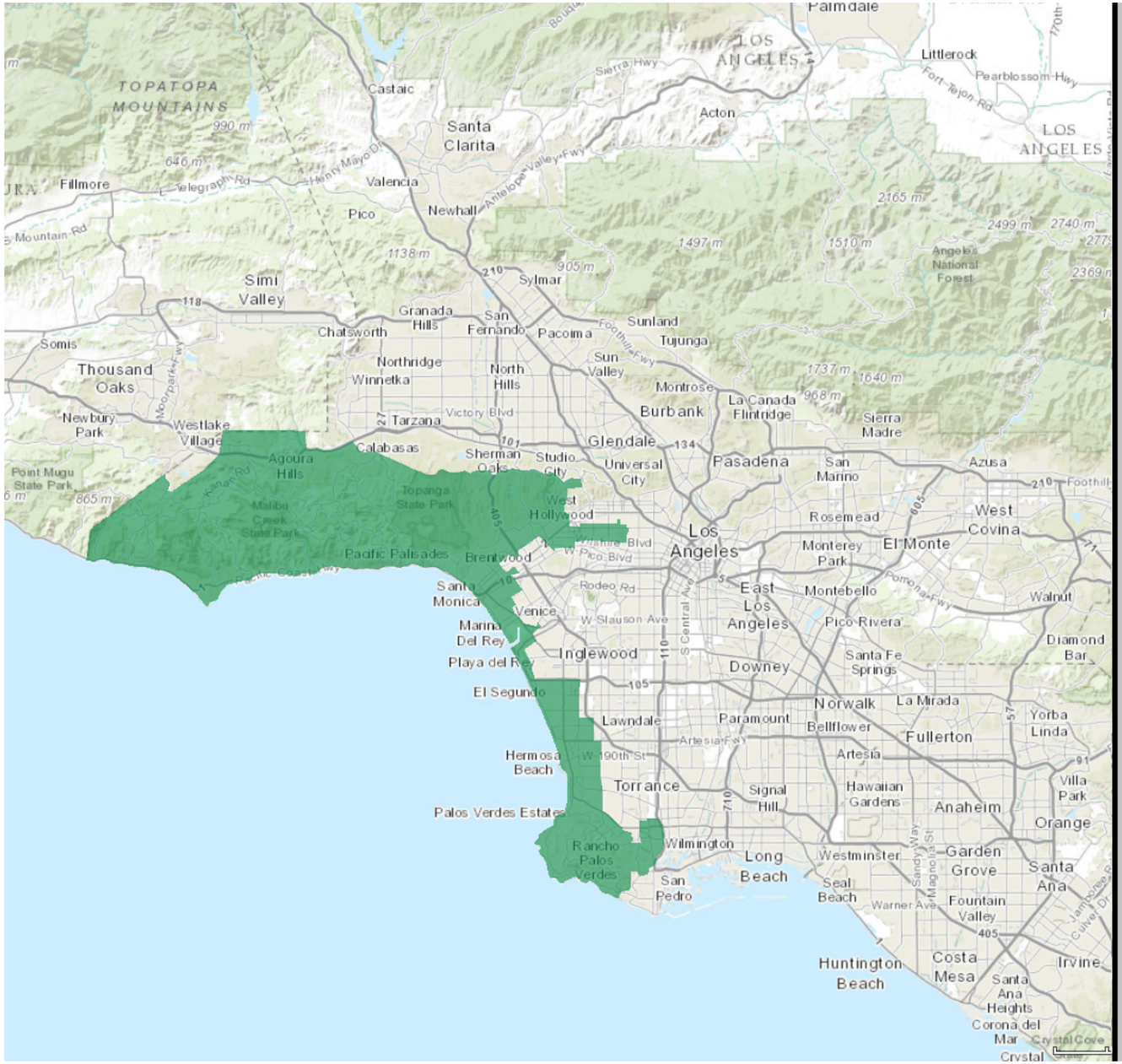
North Carolina US District 12



US Congressional districts since 2013
Source: http://nationalatlas.gov, 1 Million Scale project.

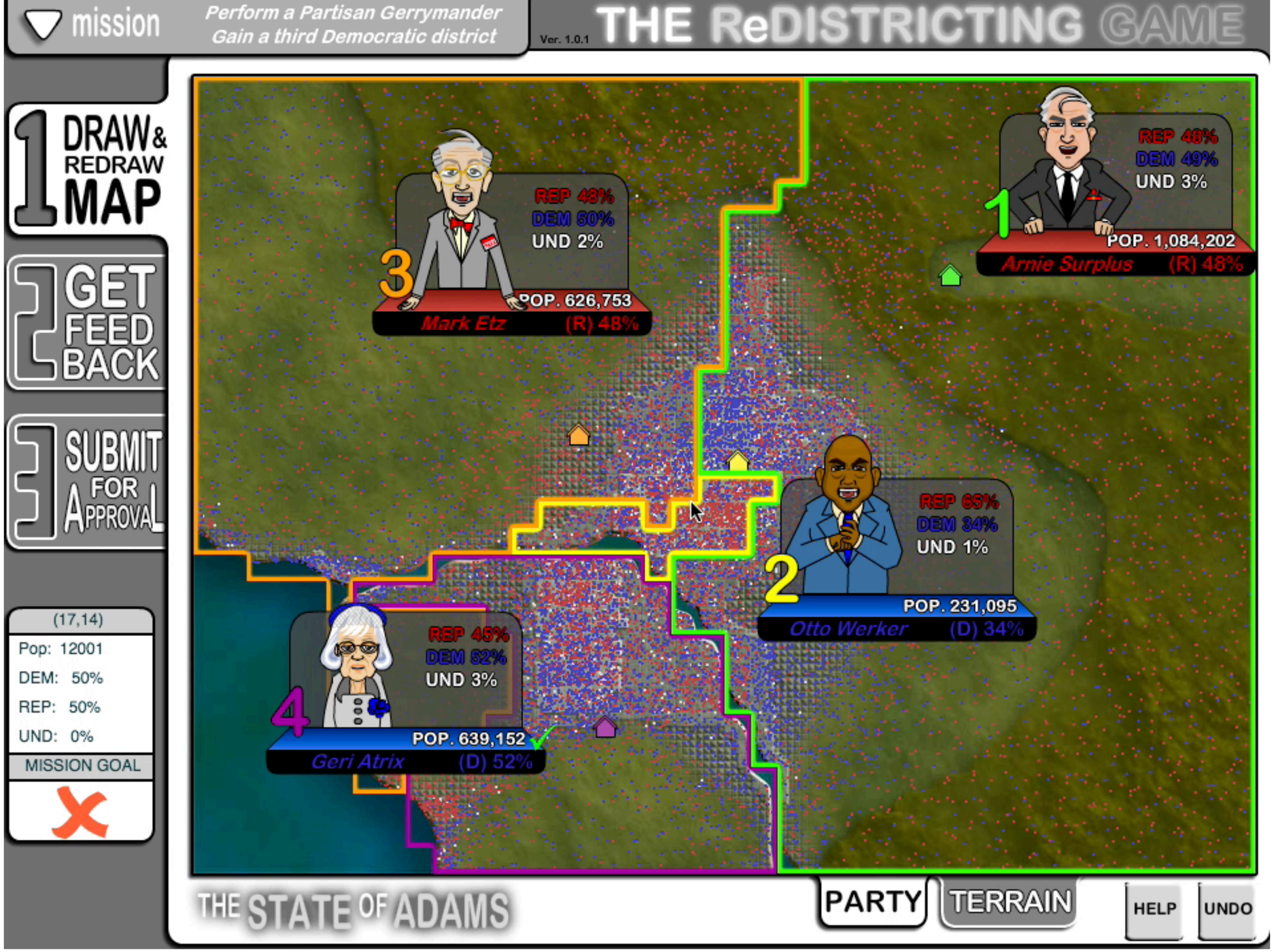
https://en.wikipedia.org/wiki/North_Carolina%27s_12th_congressional_district

California's 33rd district

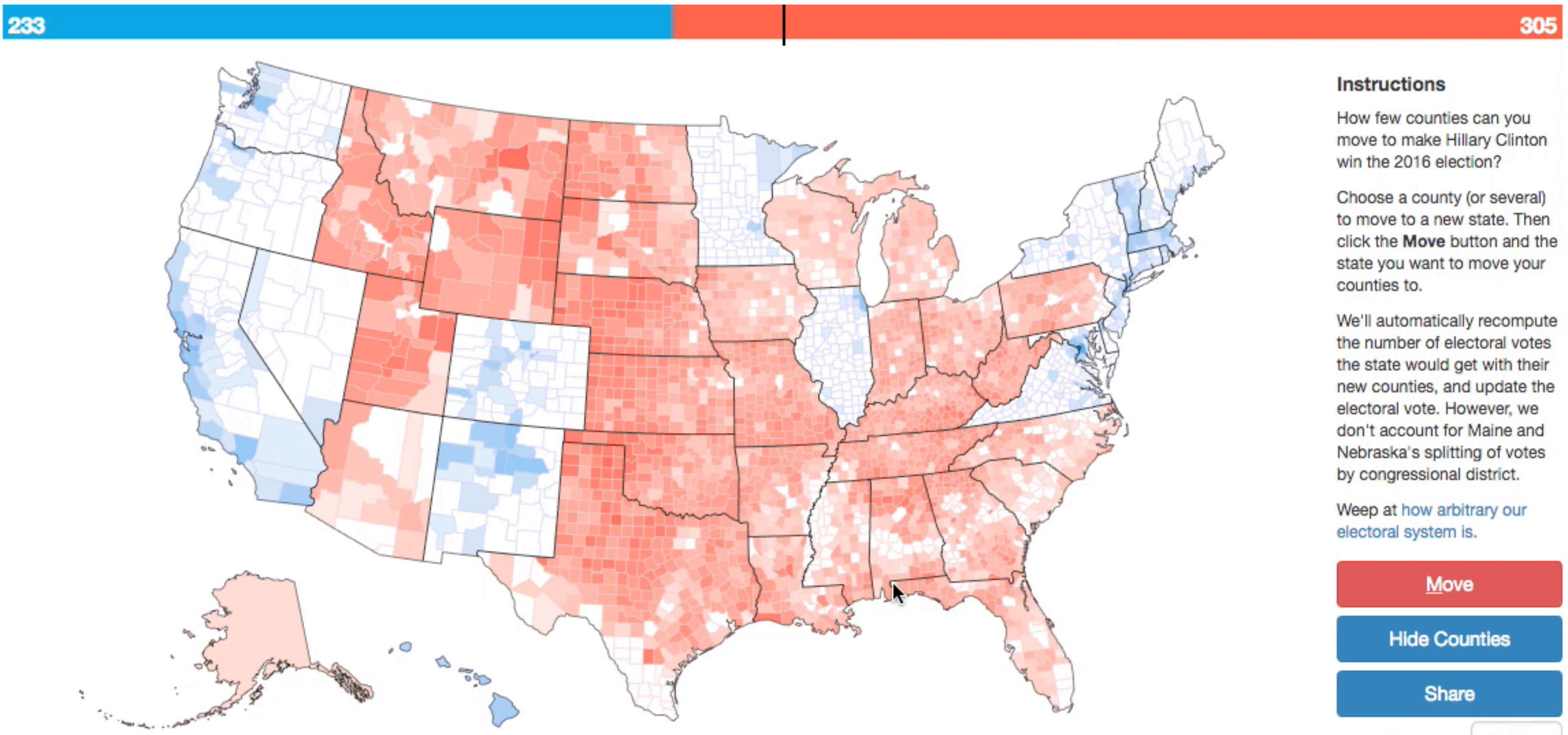


California US District 33

US Congressional districts since 2013
Source: http://nationalatlas.gov, 1 Million Scale project.

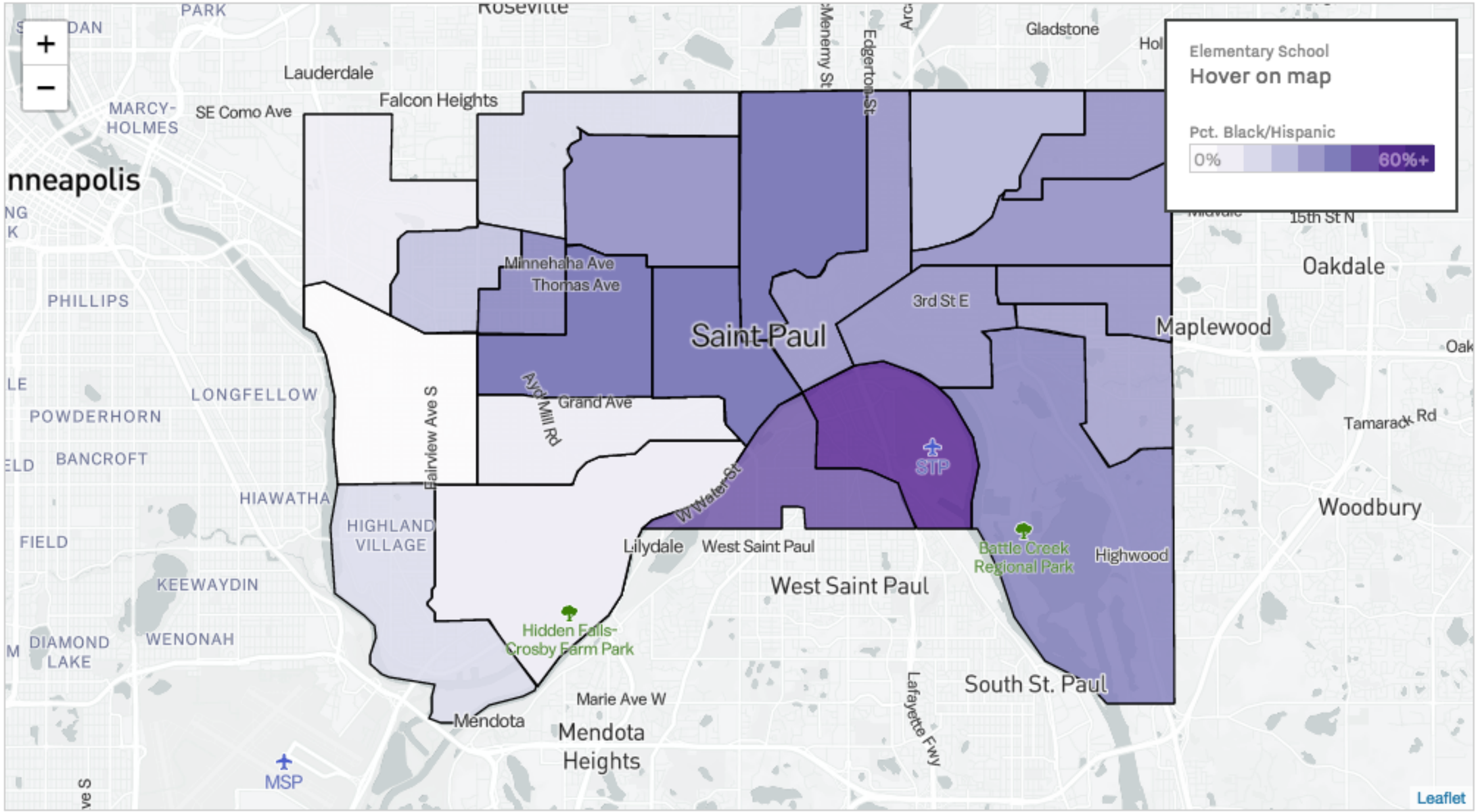


http://redistrictinggame.org/



http://kevinhayeswilson.com/redraw/

Gerrymandering school districts

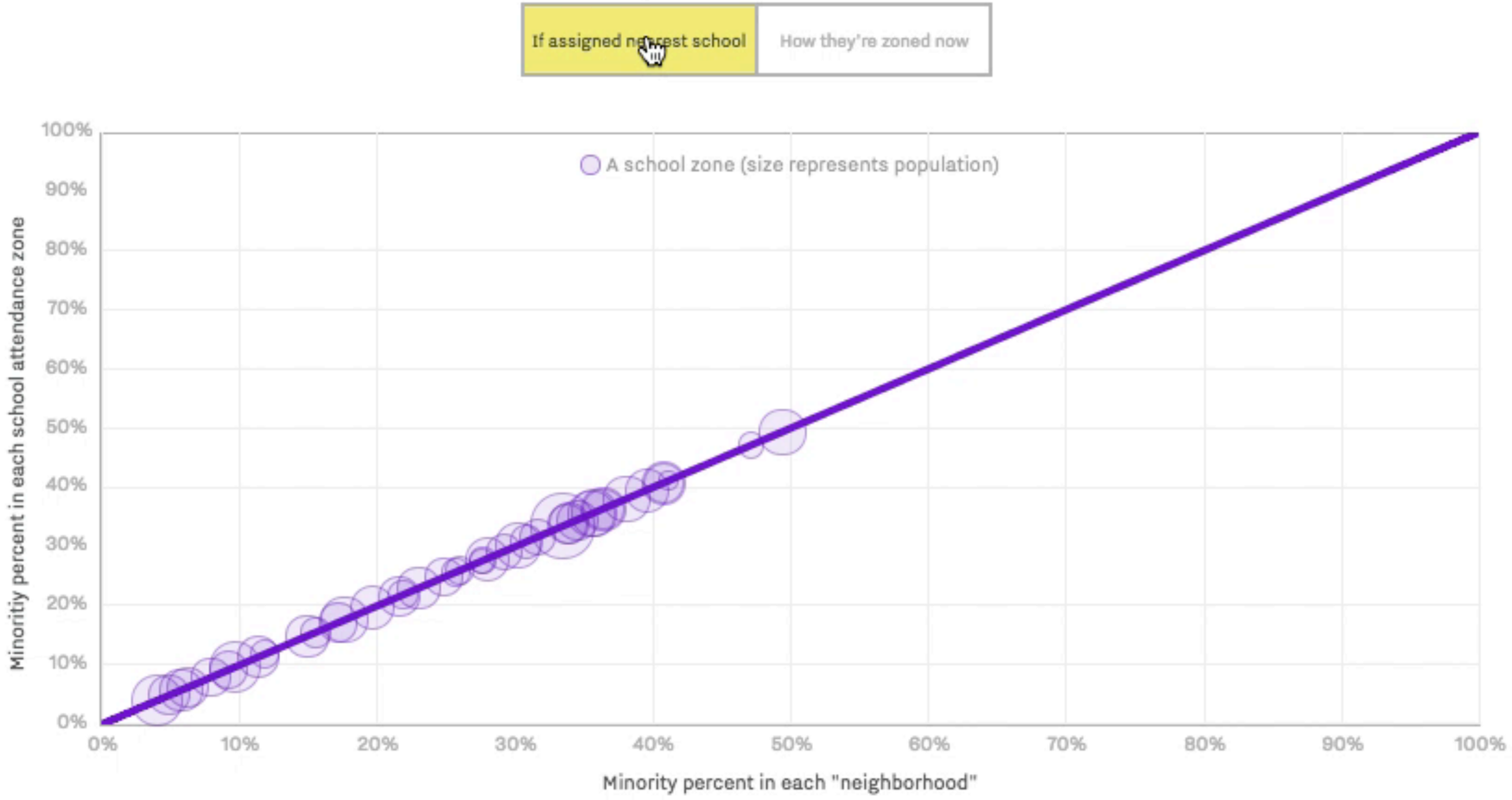


Data from research by Tomas E. Monarrez, an economics PhD candidate at the University of California, Berkeley

https://www.vox.com/2018/1/8/16822374/school-segregation-gerrymander-map

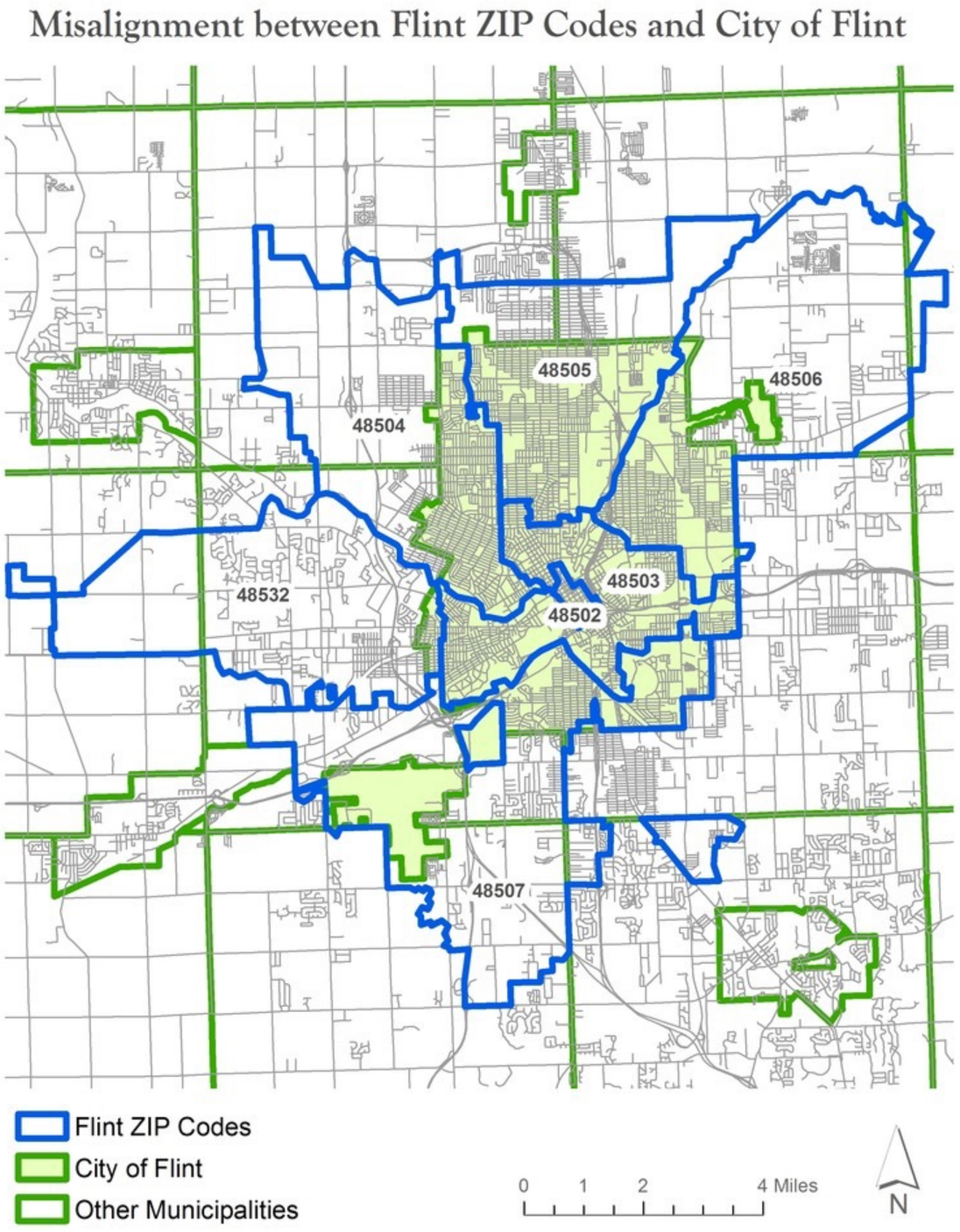
Do the border for St. Paul Public School District make schools more integrated than the underlying neighborhoods?

If everyone goes to the nearest school, the neighborhood segregation is just recreated.



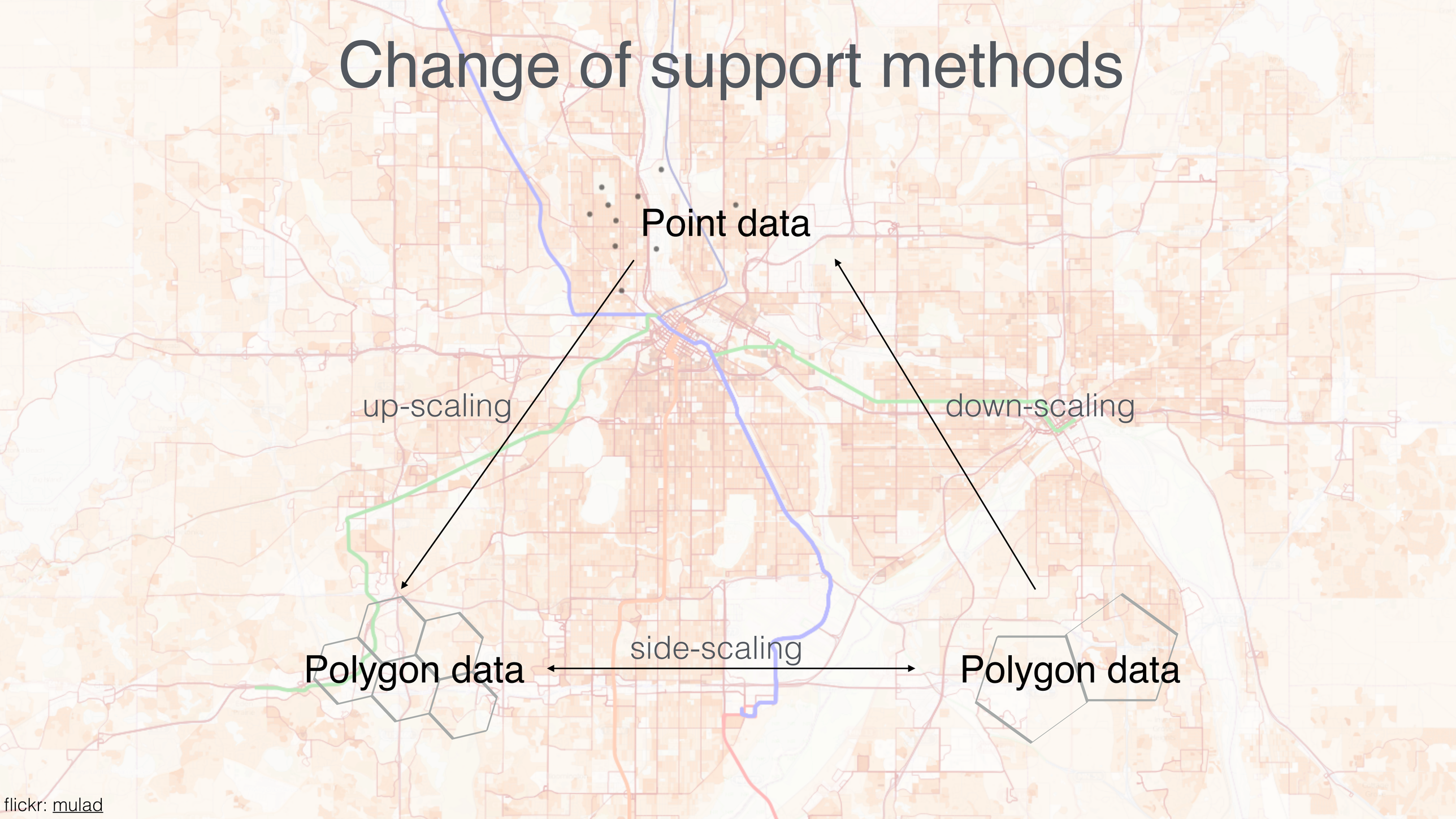
Data from research by Tomas E. Monarrez, an economics PhD candidate at the University of California, Berkeley

https://www.vox.com/2018/1/8/16822374/school-segregation-gerrymander-map



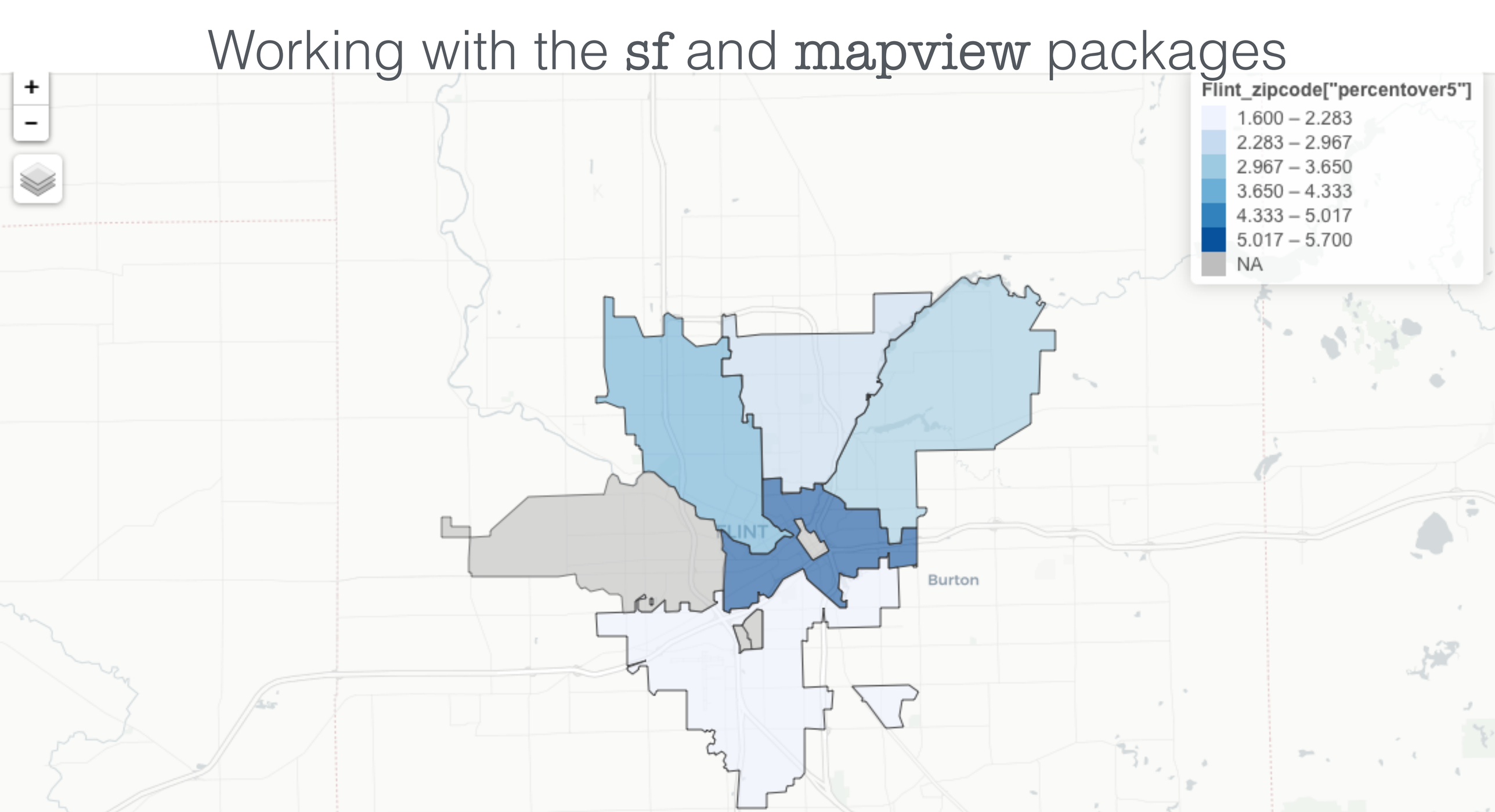
http://theconversation.com/how-zip-codes-nearly-masked-the-lead-problem-in-flint-65626

Change of support methods



flickr: mulad

Working with the `sf` and `mapview` packages



Joint work with students Eva Gjekmarkaj, Junzhou Liu, Yvonne Niyonzima, Carolyn Stephen, Zixian Li. Exploring MAUP using Flint water data

Flint's Water Crisis Started 5 Years Ago. It's Not Over.

Pipes are now being replaced and officials say the water is safe, but residents still worry, drink bottled water and doubt their elected leaders.

Rick Hayood loaded bottles of water into a resident's car in Flint, Mich., in October. Five years after the city's water crisis, suspicions remain high. Brittany Greeson for The New York Times

By Mitch Smith, Julie Bosman and Monica Davey

April 25, 2019

On April 25, 2014, a group of smiling officials in Flint, Mich., stood in front of television cameras, held their glasses aloft and toasted the switch to the city's new water source, the Flint River.

"Here's to Flint!" Dayne Walling, the mayor, said, taking a gulp of river water.

https://www.nytimes.com/2019/04/25/us/flint-water-crisis.html

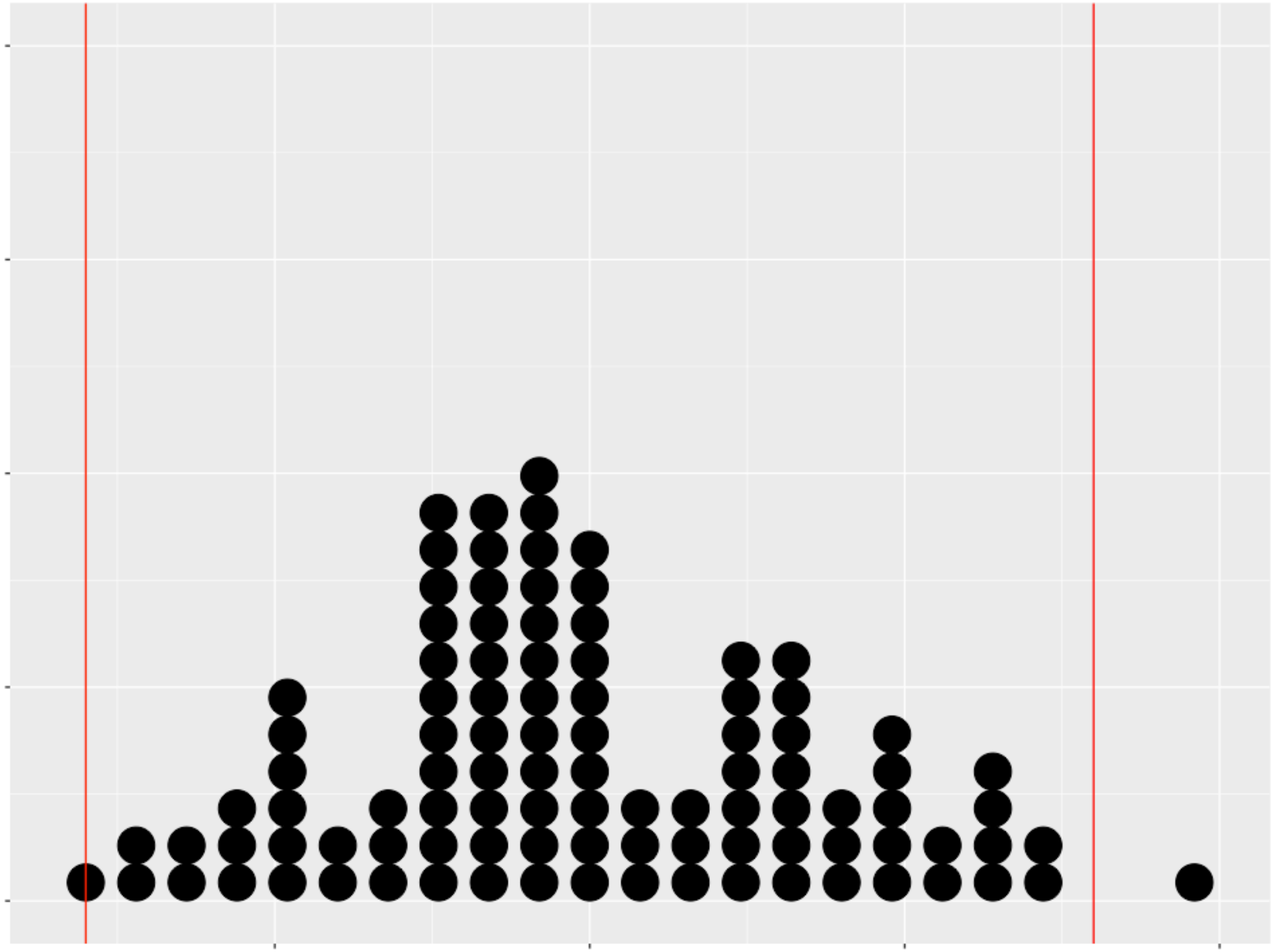
Sampling distributions

Statisticians often talk about p-values, which are how likely a particular outcome would be, if the null hypothesis were true.

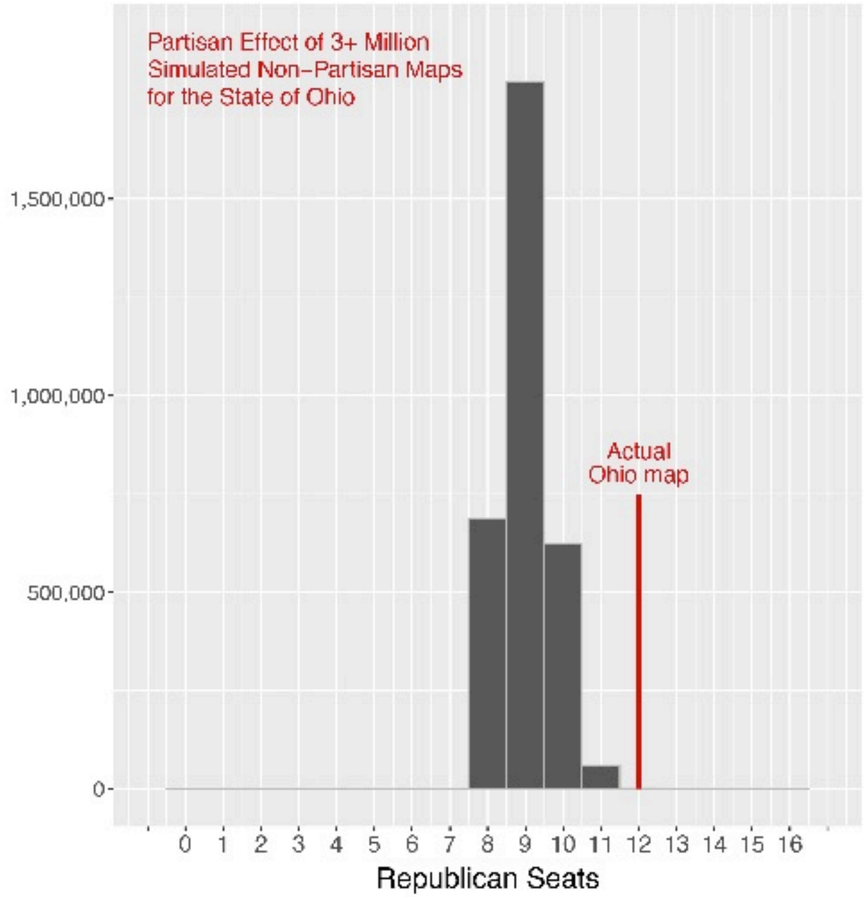
- If this drug really had no effect on cancer, how likely would it be to see this much improvement just by chance?

- If there was no correlation between income and test scores, how likely would it be to see this strong of a relationship just by chance?

- If we flipped a coin 100 times, how likely would it be to get more than 60 heads?



Wendy K Tam Cho



From Technology-enabled coin flips for judging partisan gerrymandering.

- Algorithms can foster a more democratic society http://bit.ly/AlgorithmsCho Nature, June 2018.

- Toward a talismanic redistricting tool: A computational method for identifying extreme redistricting plans. Cho and Yan Liu http://bit.ly/TalismanicMaps Election Law Journal 15(4), 2016.

- Technology-enabled coin flips for judging partisan gerrymandering. http://bit.ly/TechFlips Southern California Law Review Postscript 93, 2019.

Syllabus

NOTE: Where it is feasible, a syllabus (headnote) will be released, as is being done in connection with this case, at the time the opinion is issued. The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader. See *United States* v. *Detroit Timber & Lumber Co.,* 200 U. S. 321, 337.

SUPREME COURT OF THE UNITED STATES

Syllabus

RUCHO ET AL. *v.* COMMON CAUSE ET AL.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE MIDDLE DISTRICT OF NORTH CAROLINA

No. 18–422. Argued March 26, 2019—Decided June 27, 2019*

Voters and other plaintiffs in North Carolina and Maryland filed suits challenging their States' congressional districting maps as unconstitutional partisan gerrymanders. The North Carolina plaintiffs claimed that the State's districting plan discriminated against Democrats, while the Maryland plaintiffs claimed that their State's plan discriminated against Republicans. The plaintiffs alleged violations of the First Amendment, the Equal Protection Clause of the Fourteenth Amendment, the Elections Clause, and Article I, §2. The District Courts in both cases ruled in favor of the plaintiffs, and the defendants appealed directly to this Court.

Held: Partisan gerrymandering claims present political questions beyond the reach of the federal courts. Pp. 6–34.

(a) In these cases, the Court is asked to decide an important question of constitutional law. Before it does so, the Court "must find that

flickr: bering_land_bridge