

CS 571 - Data Visualization & Exploration

Maps

Instructor: Hamza Elhamdadi

UMassAmherst

Upcoming Dates

Tomorrow May 9**:

- Homework 5 Due
- Project Screencast Submission Due

May 12: Final Project Submission Due

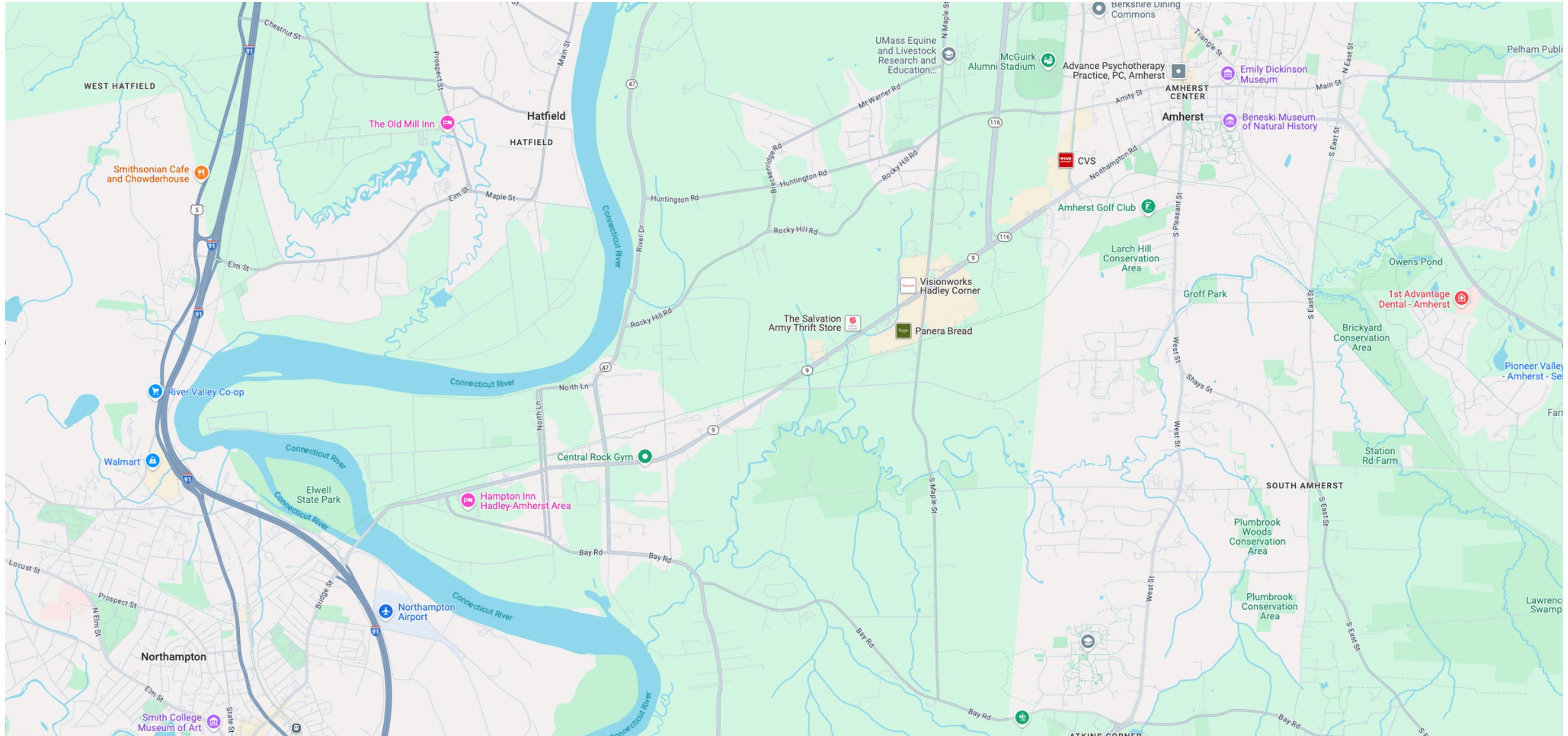
**Only if you requested an extension by May 2

Maps!

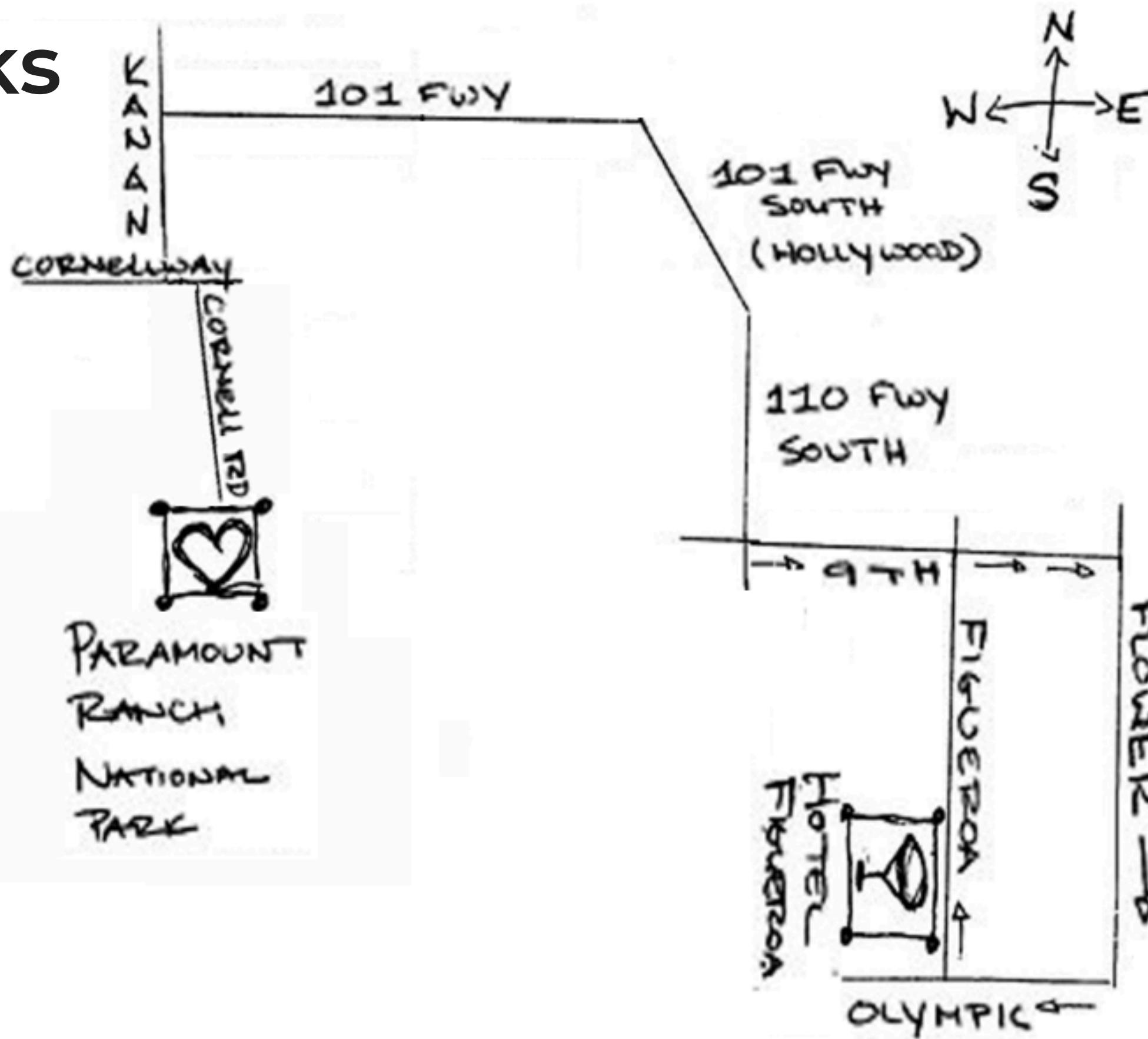
- Landmarks
- Discrete Data
- Continuous Data
- Choropleths
- Cartograms
- Projections

Landmarks

Landmarks



Landmarks



Landmarks

Rendering Effective Route Maps: Improving Usability Through Generalization

Category: Research Paper ID: 0267

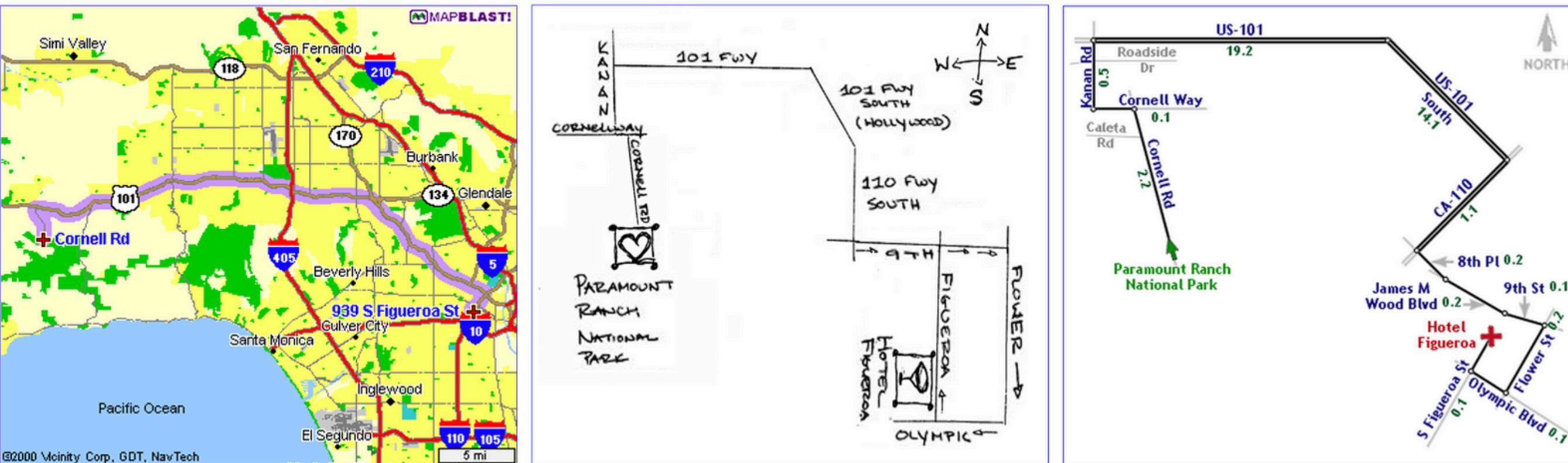


Figure 1: Three route maps for the same route rendered by (left) a standard computer-mapping system, (middle) a person, and (right) BeeLine, our route map rendering system. The standard computer-generated map is difficult to use because its large, constant scale factor causes the short roads to vanish and it is cluttered with extraneous details such as city names, parks and roads that are far away from the route. Both the handdrawn map and the BeeLine map exaggerate the lengths of the short roads to ensure they are visible and maintain a simple, clean design that emphasizes the most essential information for following the route.

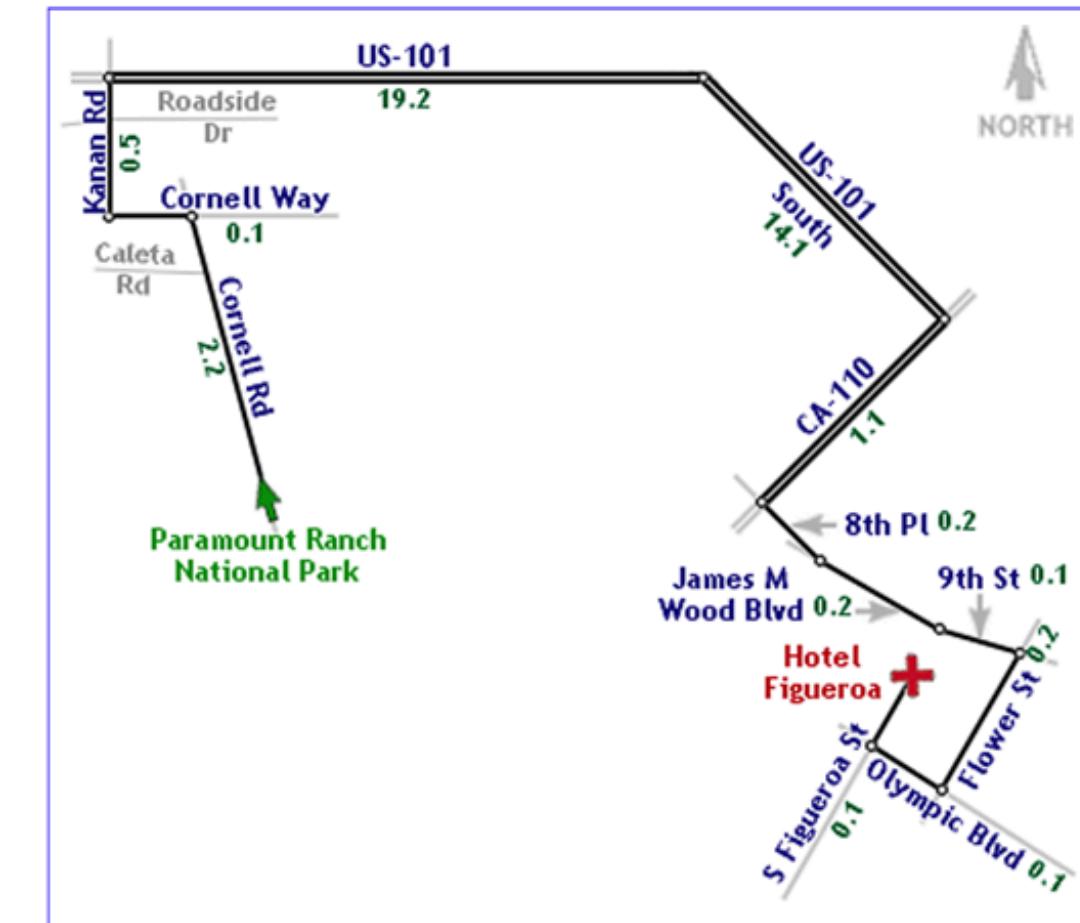
Abstract

Route maps, which depict a path from one location to another, have emerged as one of the most popular applications on the Web. Current computer-generated route maps, however, are often very difficult to use. In this paper we present a set of cartographic general-

clarity of the map and to emphasize the most important information [15, 20]. This type of generalization, performed either consciously or sub-consciously, is prevalent both in quickly sketched maps and in professionally designed route maps that appear in print advertisements, invitations, and subway schedules [25, 12].

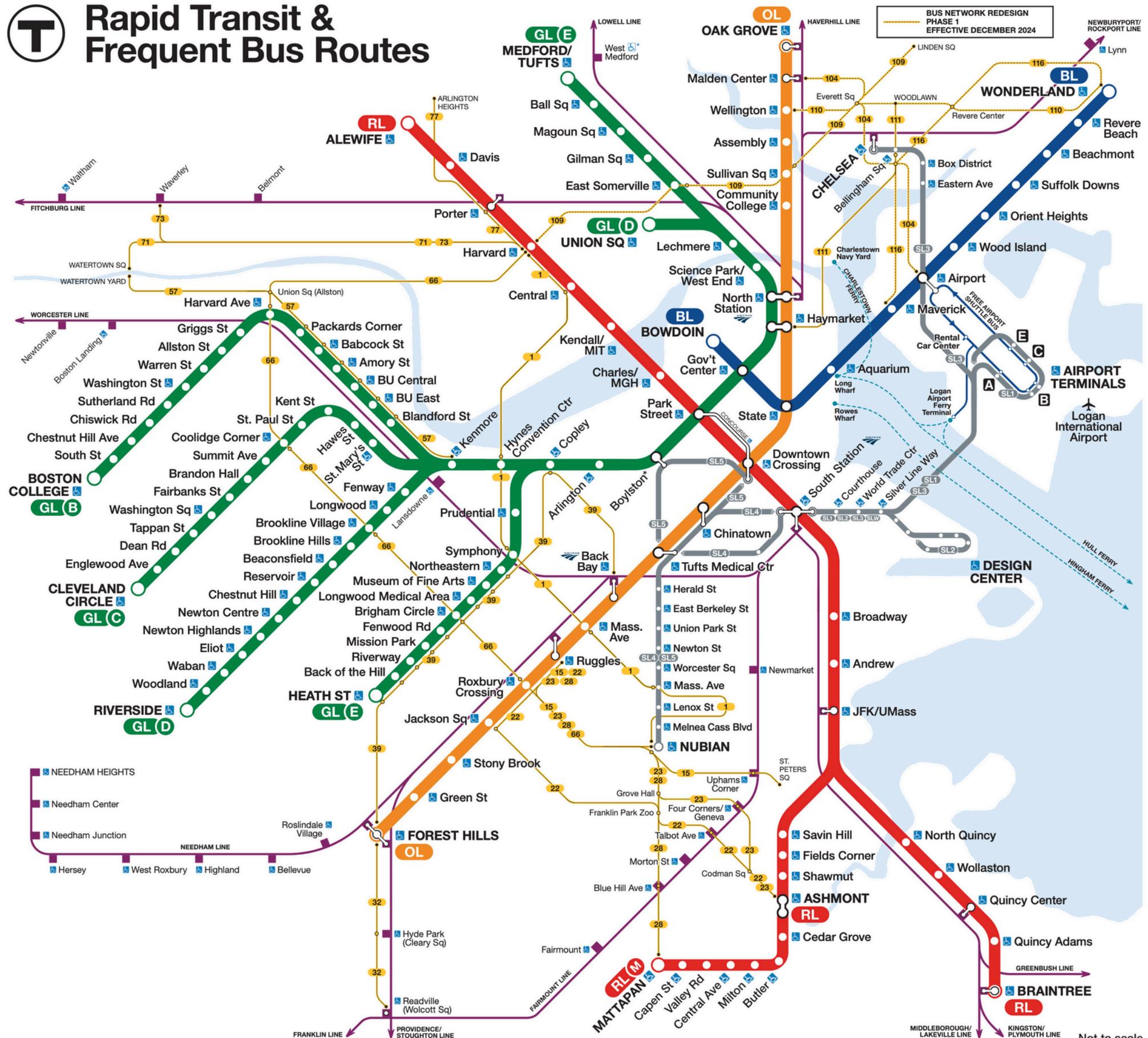
Route Map Recommendations

- straighten lines
- snap turns to hard angles
- expand the regions that have turns
- contract long straight roads
- label carefully
- maintain the overall orientation



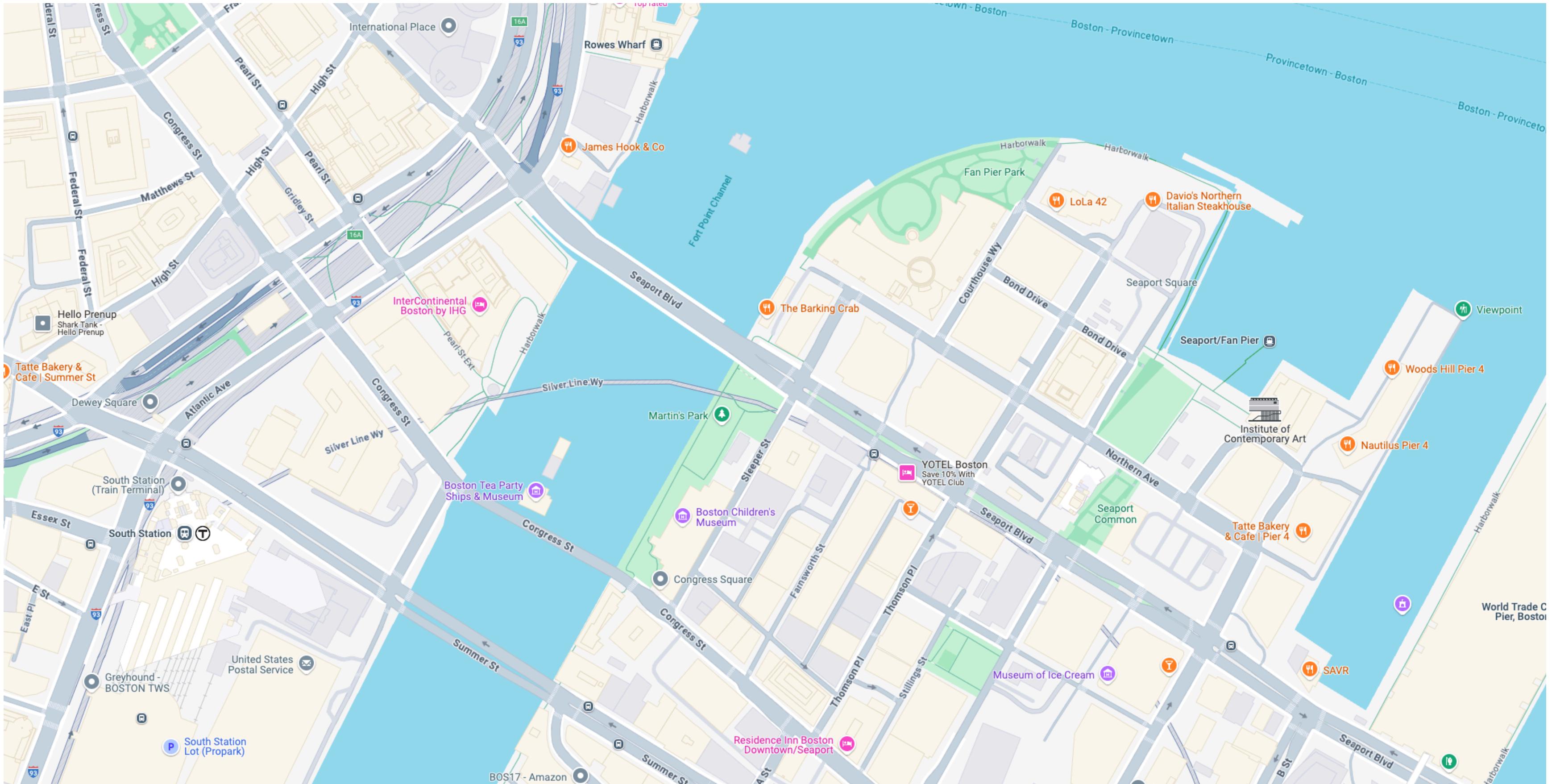


Rapid Transit & Frequent Bus Routes



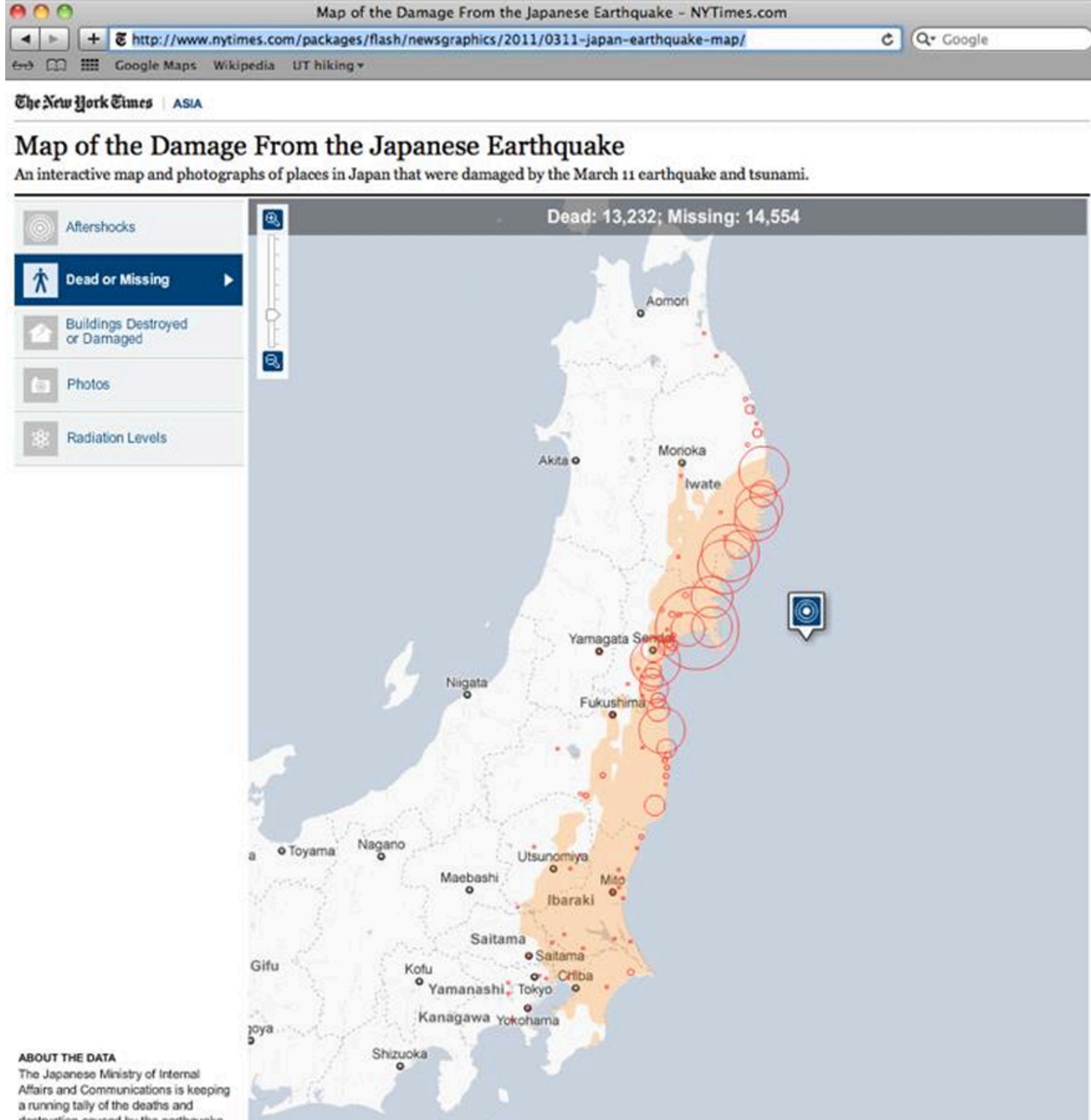
Discrete Data

Data as Icons/Glyphs

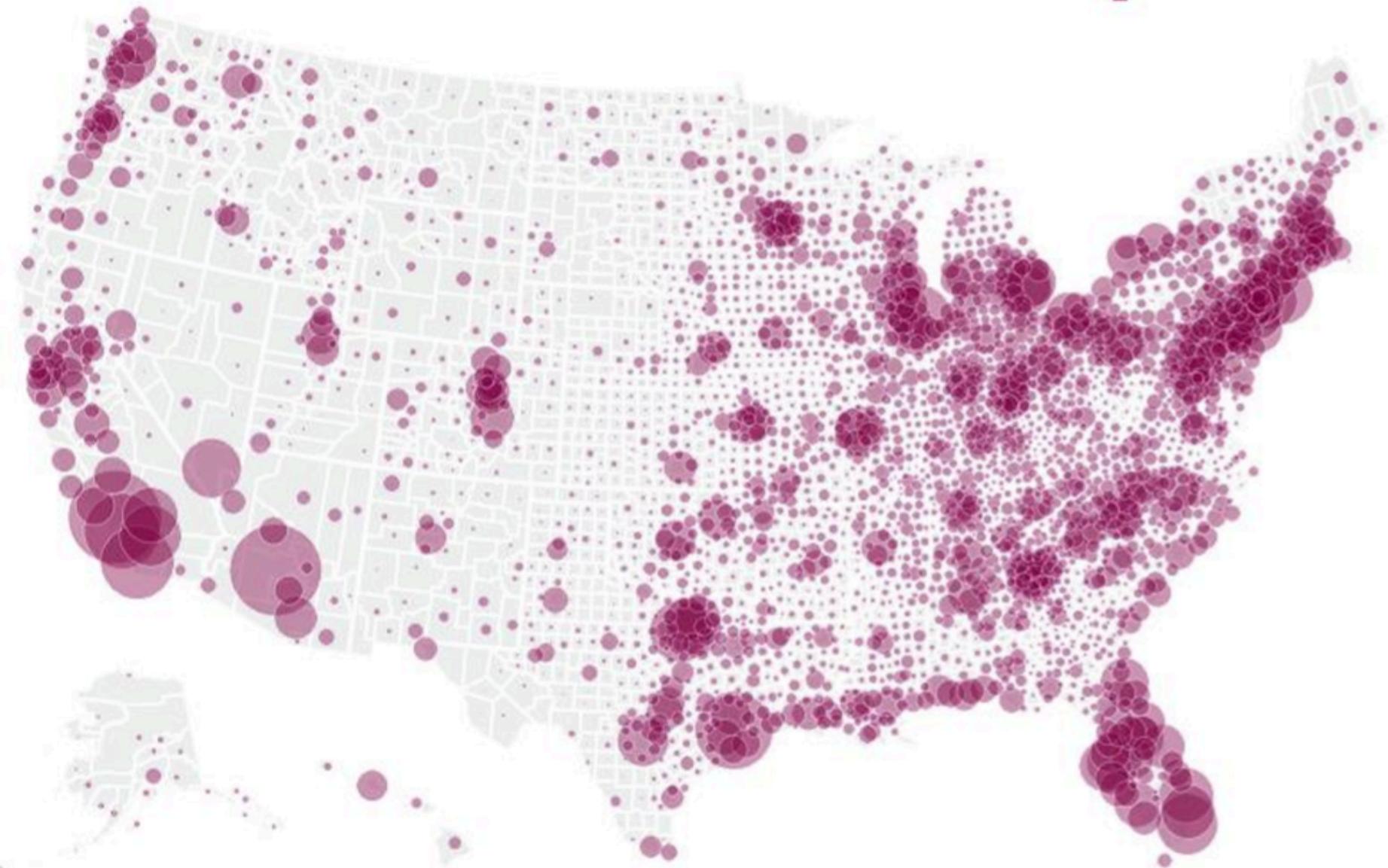


Data as Points

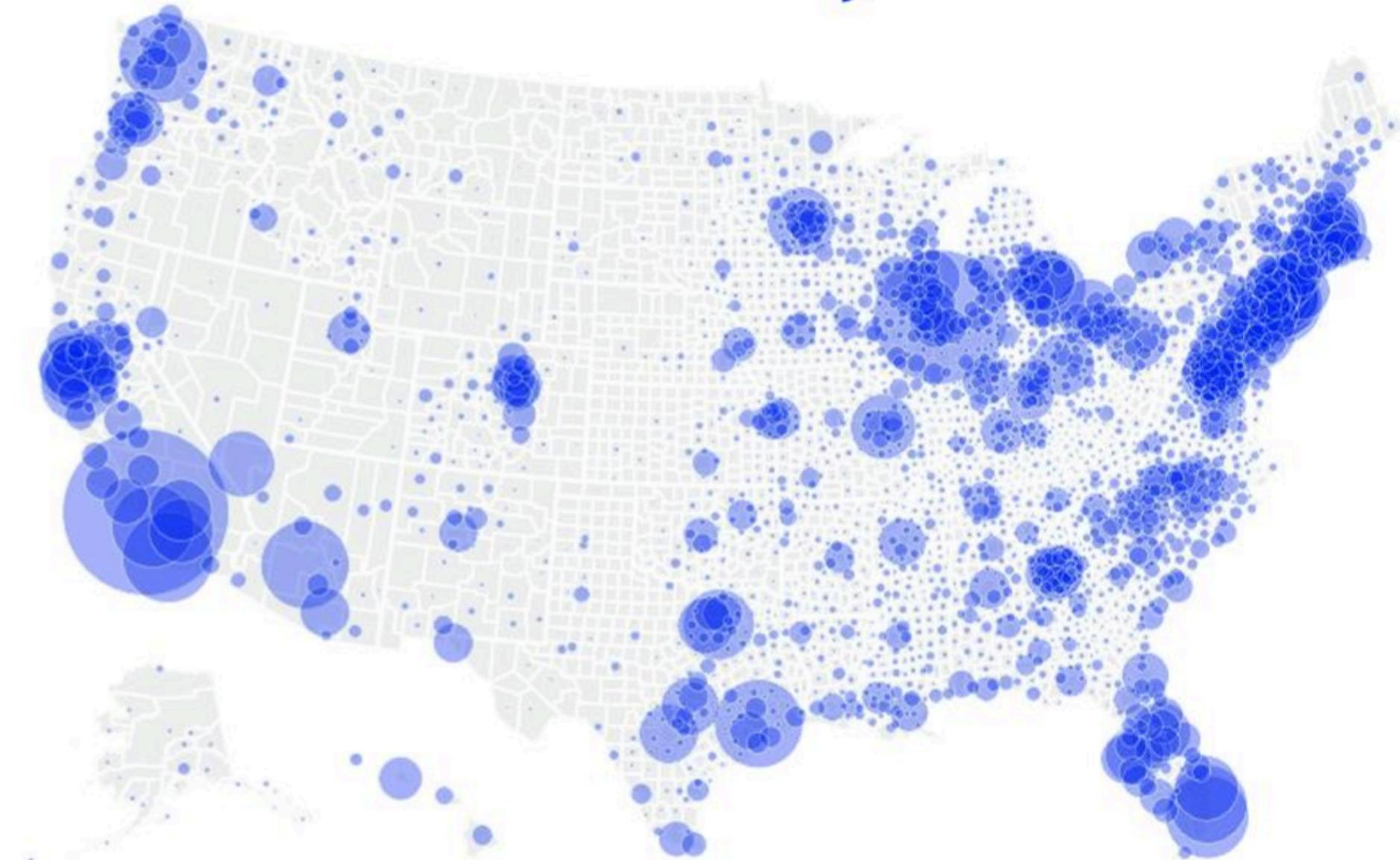
Data: Ordered/Quantitative
Encoding: Size



Votes for Donald Trump



Votes for Hillary Clinton



Mapping America: Every City, Every Block

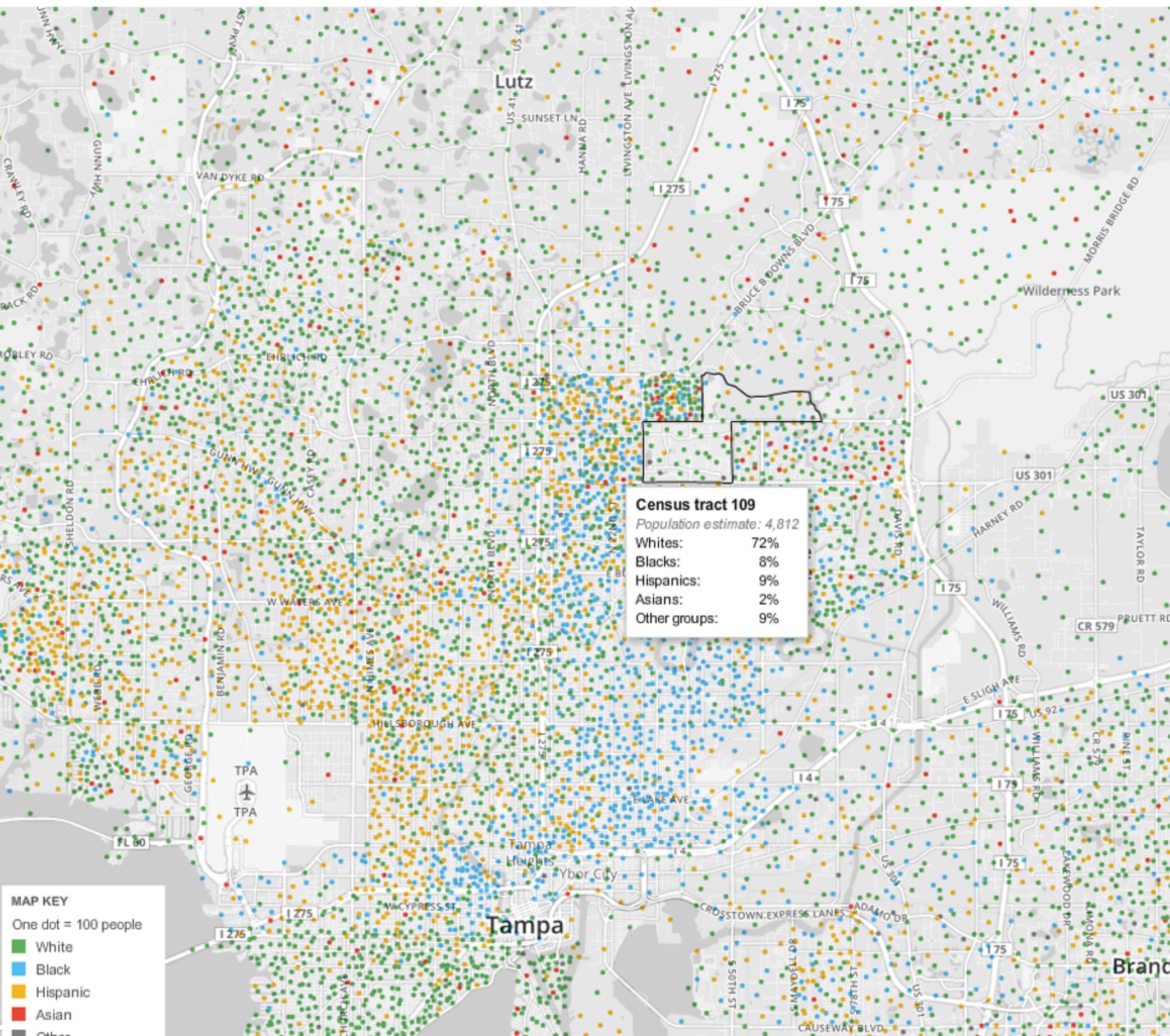
Find something interesting? Share this view on [Twitter](#) or [Facebook](#)

Browse local data from the Census Bureau's American Community Survey, based on samples from 2005 to 2009. Because these figures are estimates, they are subject to a margin of error, particularly in places with a low population, and are best regarded as estimates.

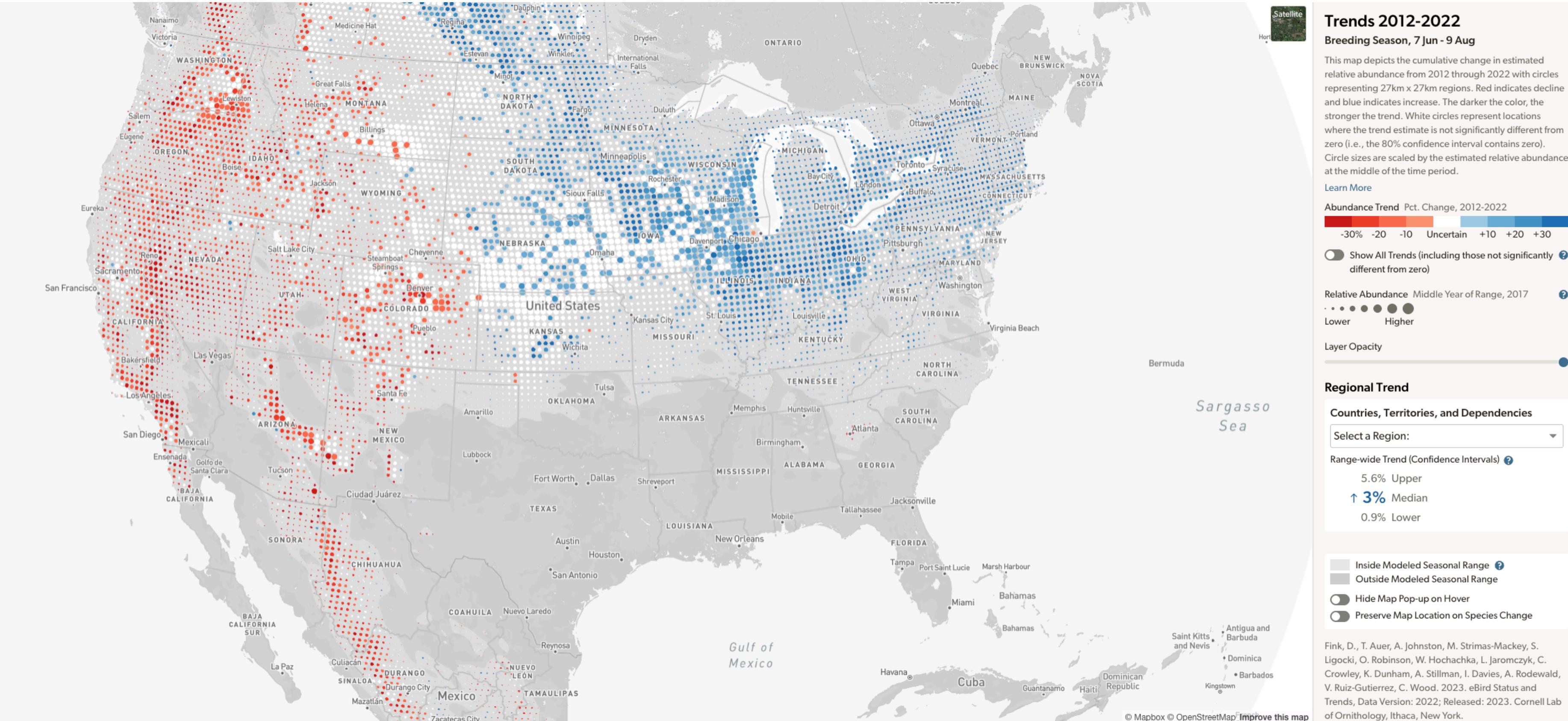
Data as Points

Data: Categorical
Encoding: Hue

Distribution of racial and ethnic groups

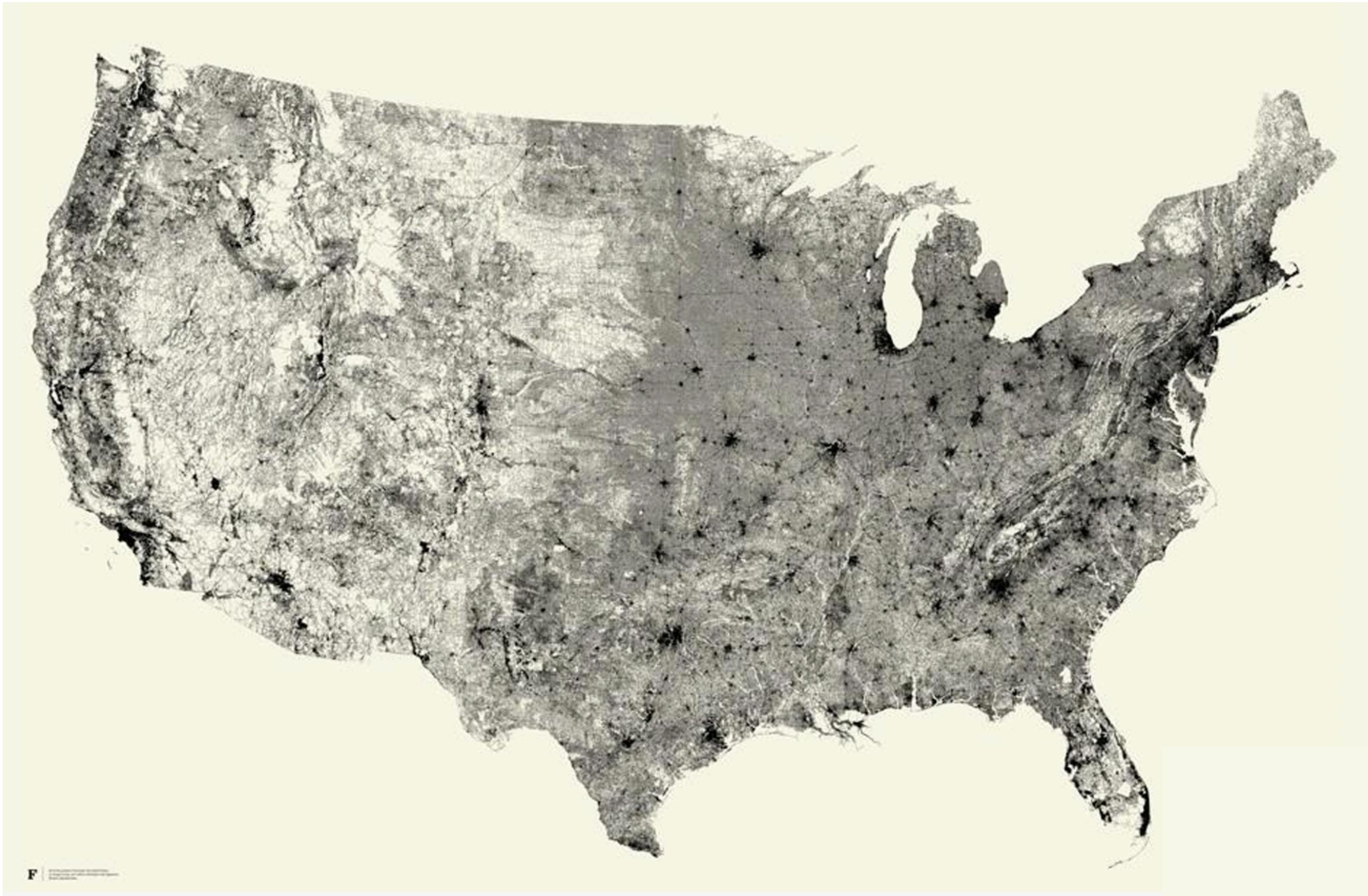


Data as Points

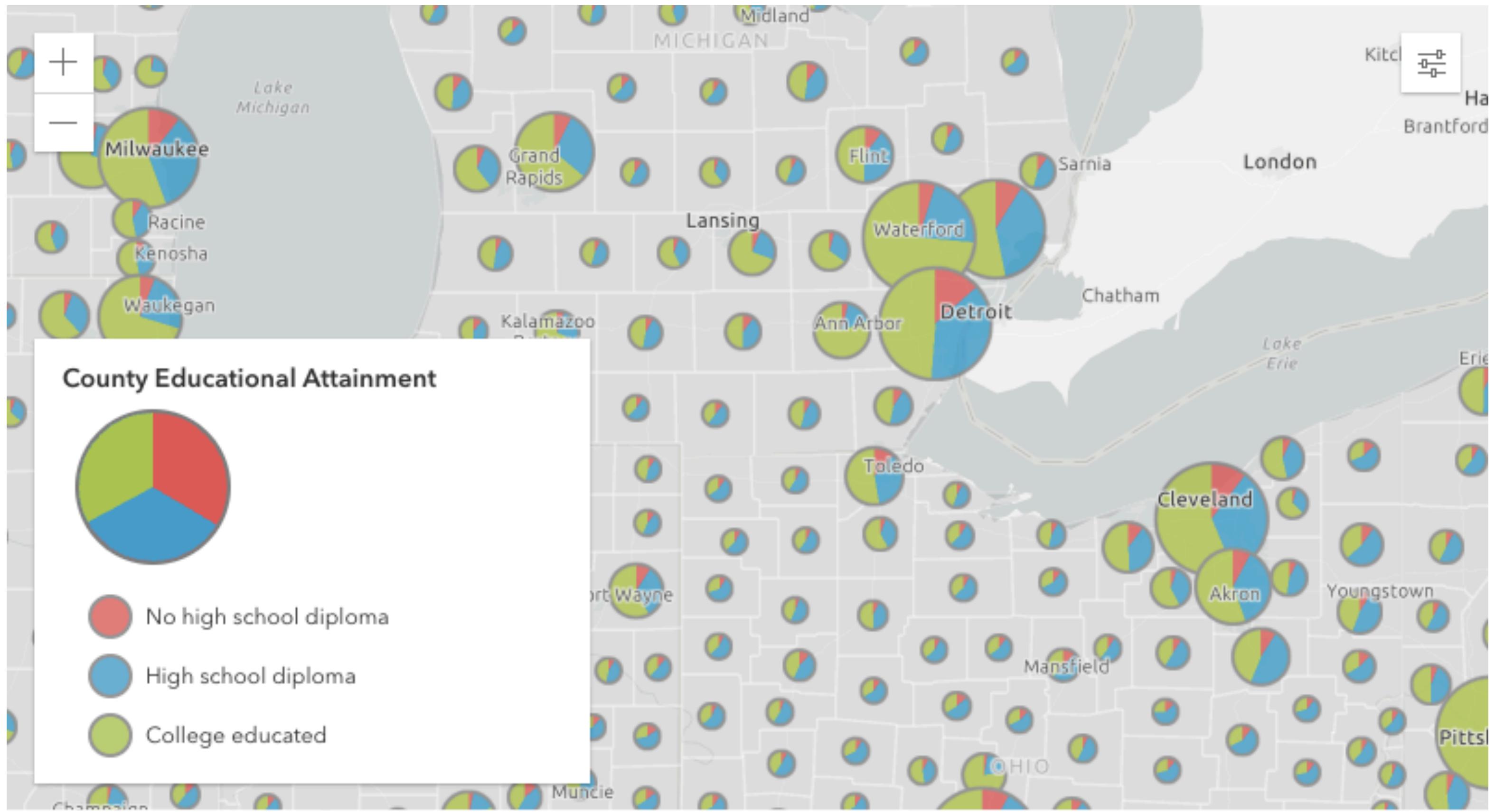


Data as Lines

<https://fathom.info/allstreets>



Data as Charts

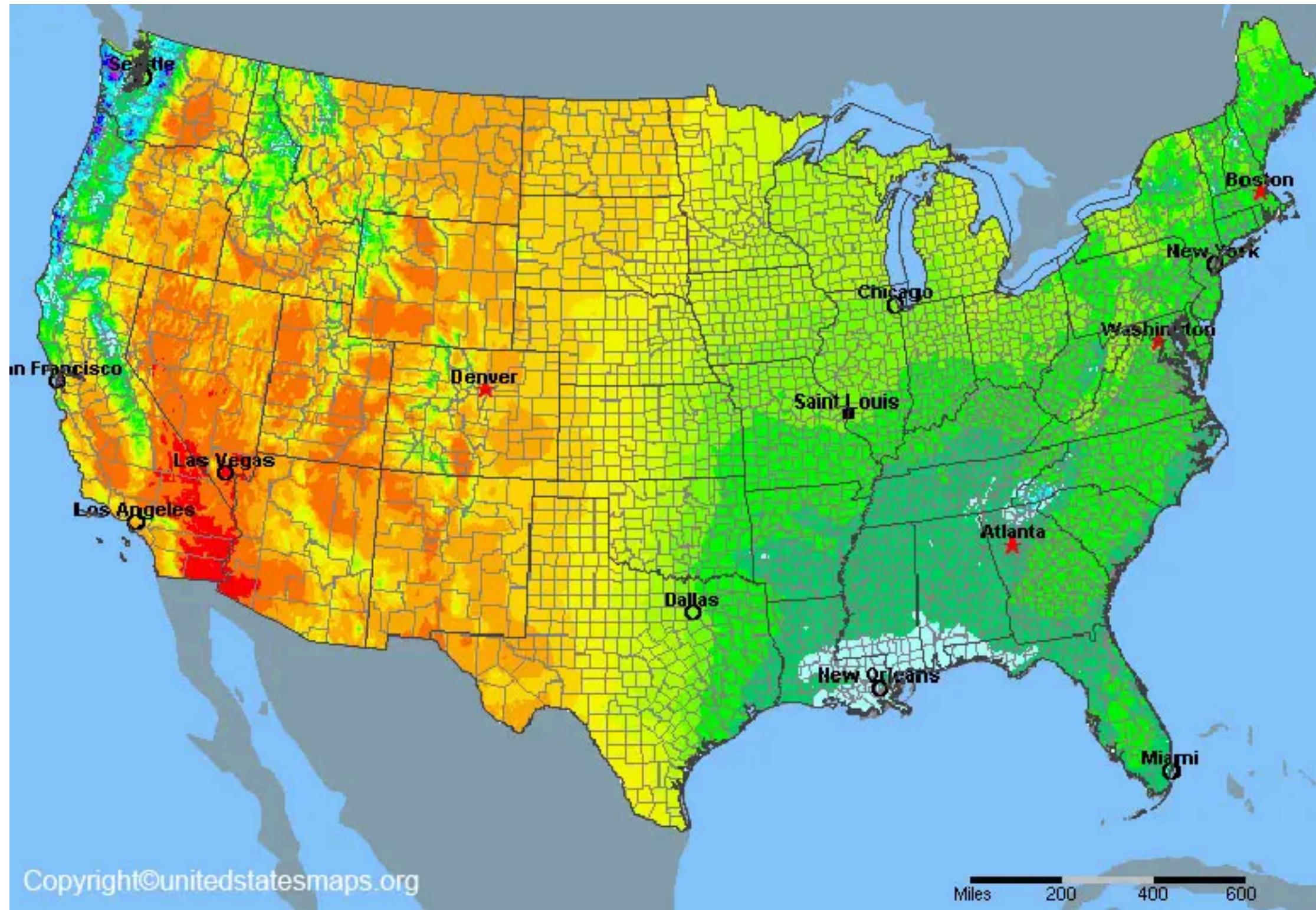


Continuous Data

Isopleths

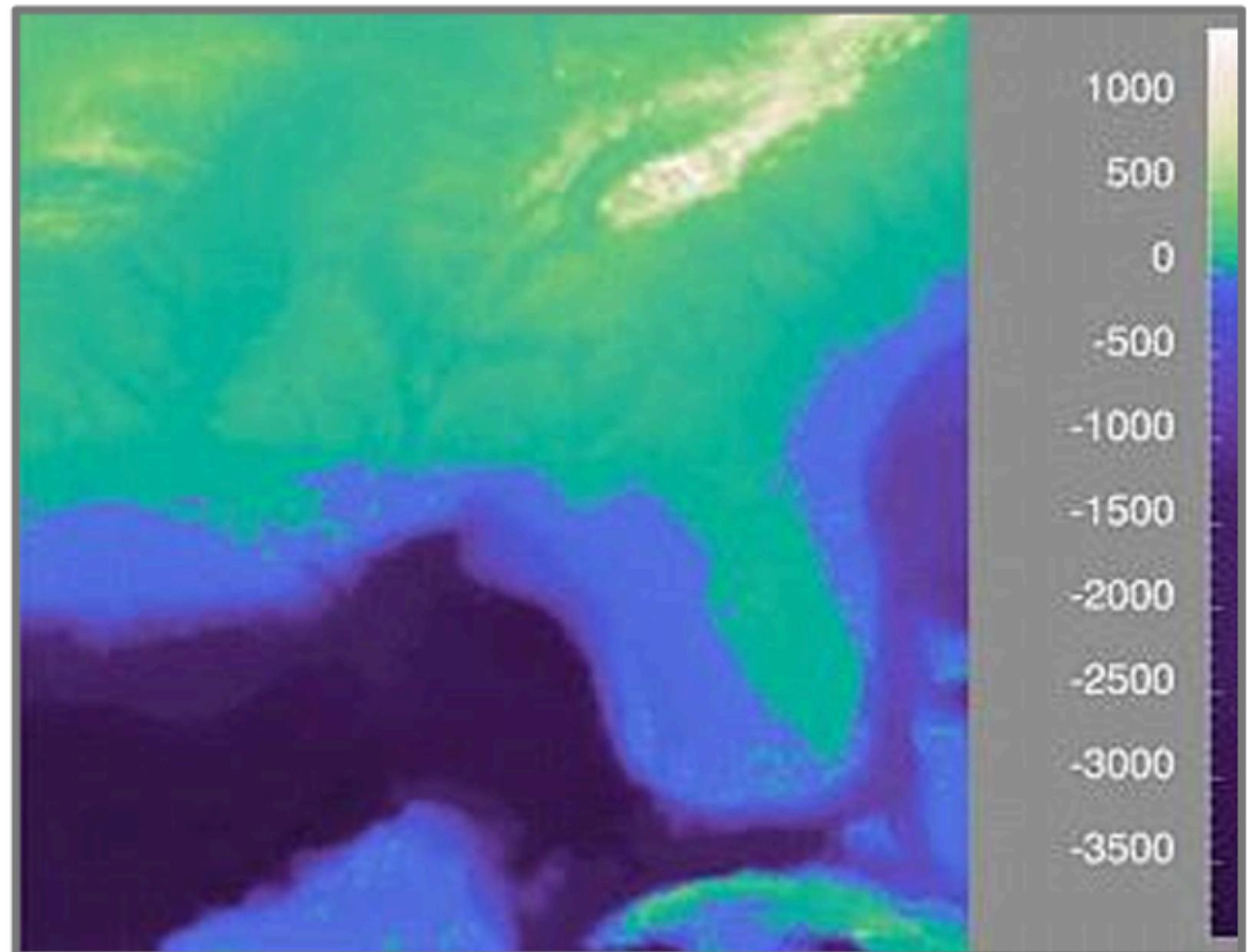
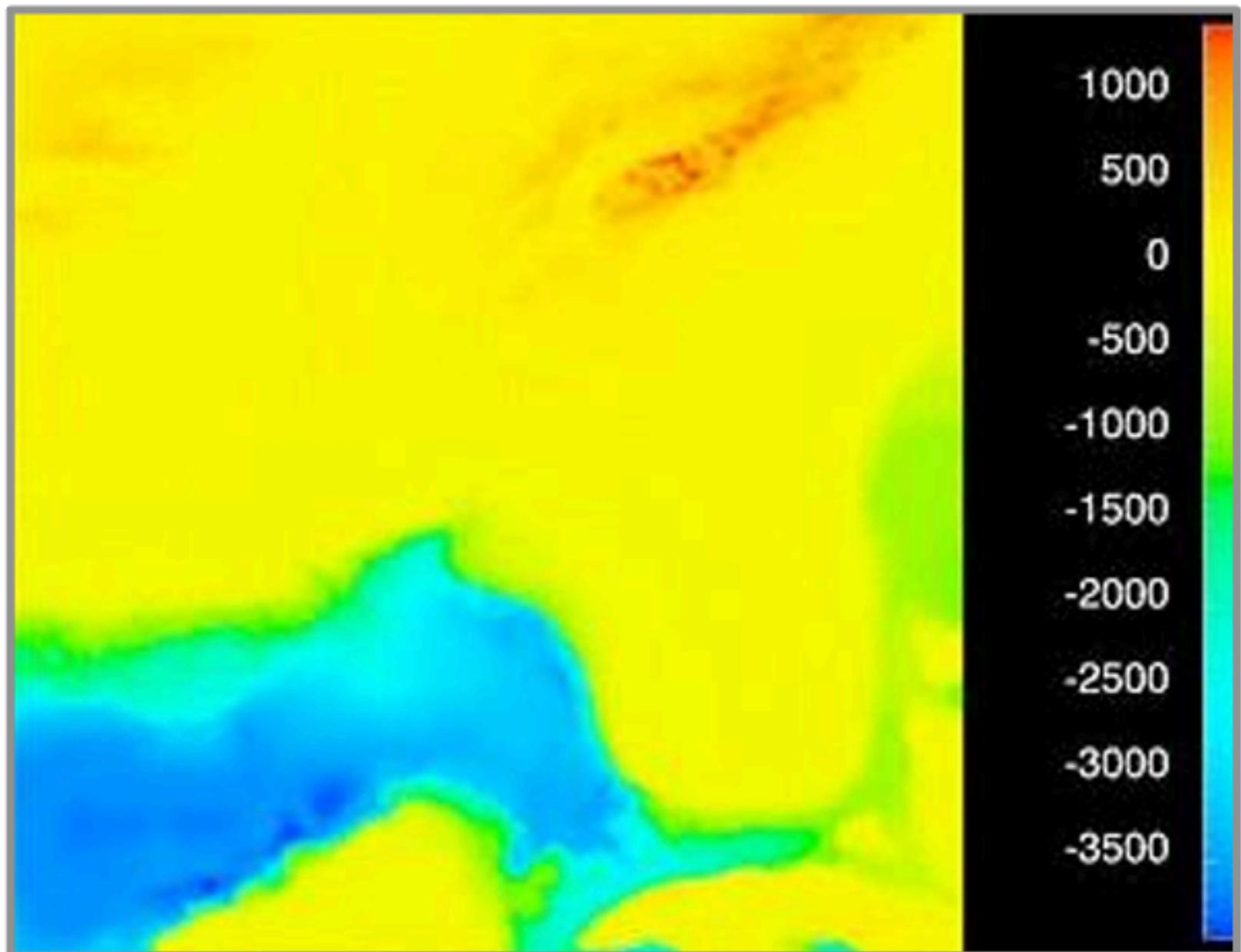
Map which **overlays continuous data** with a third encoding channel

Isopleths: Heatmaps



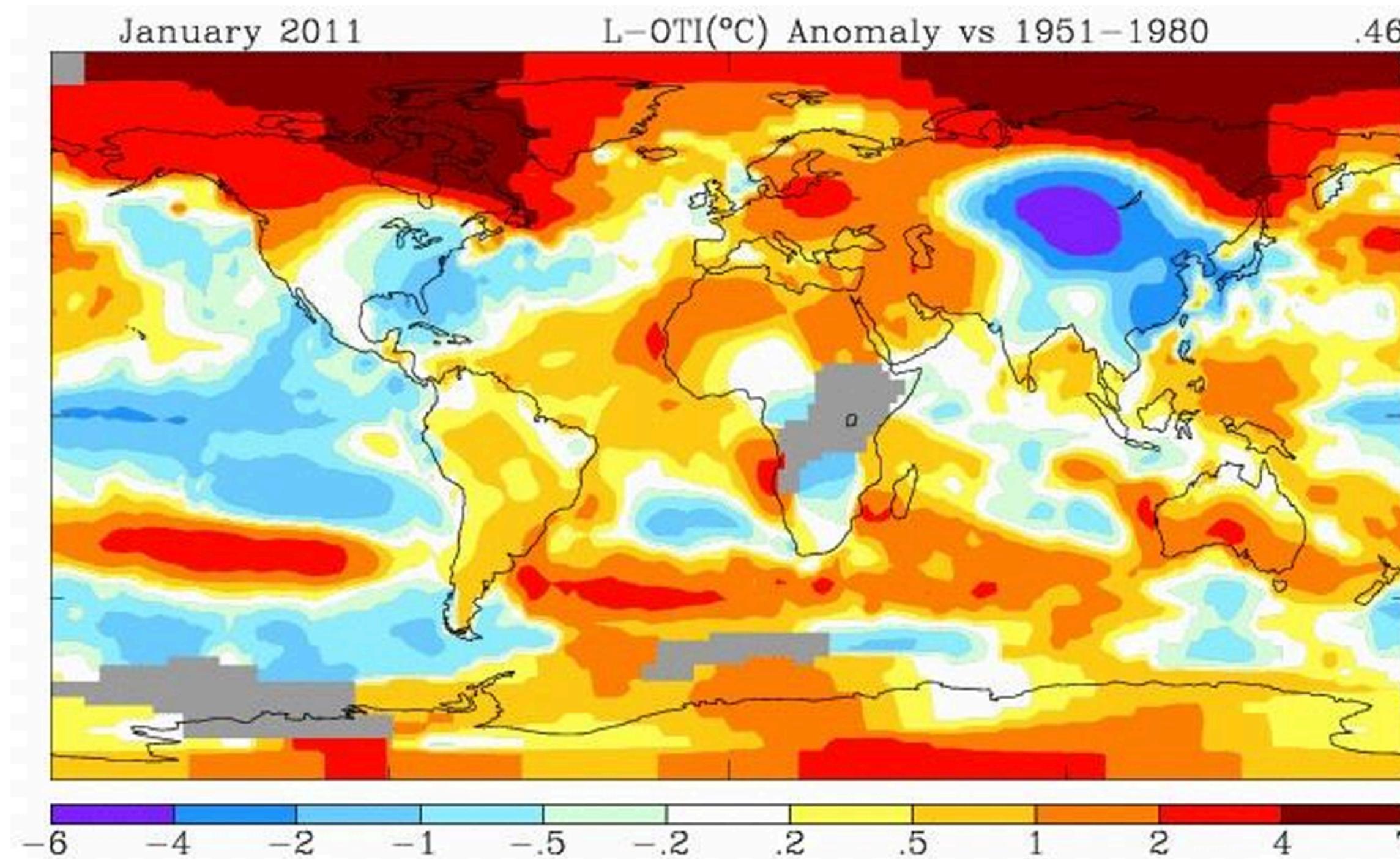
Isopleths: Heatmaps

Choose an appropriate colormap



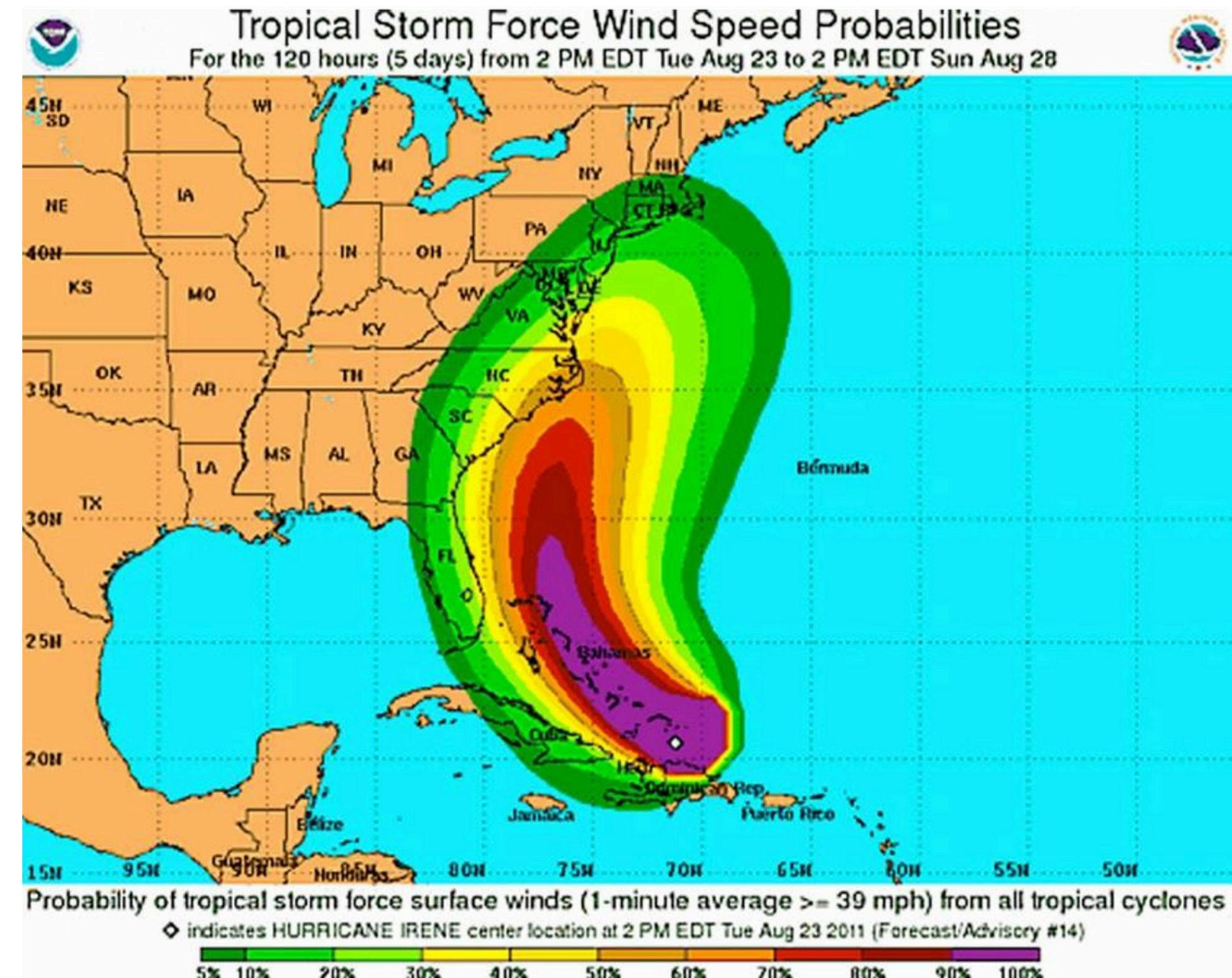
Isopleths: Heatmaps

Bin the data



Isopleths: Heatmaps

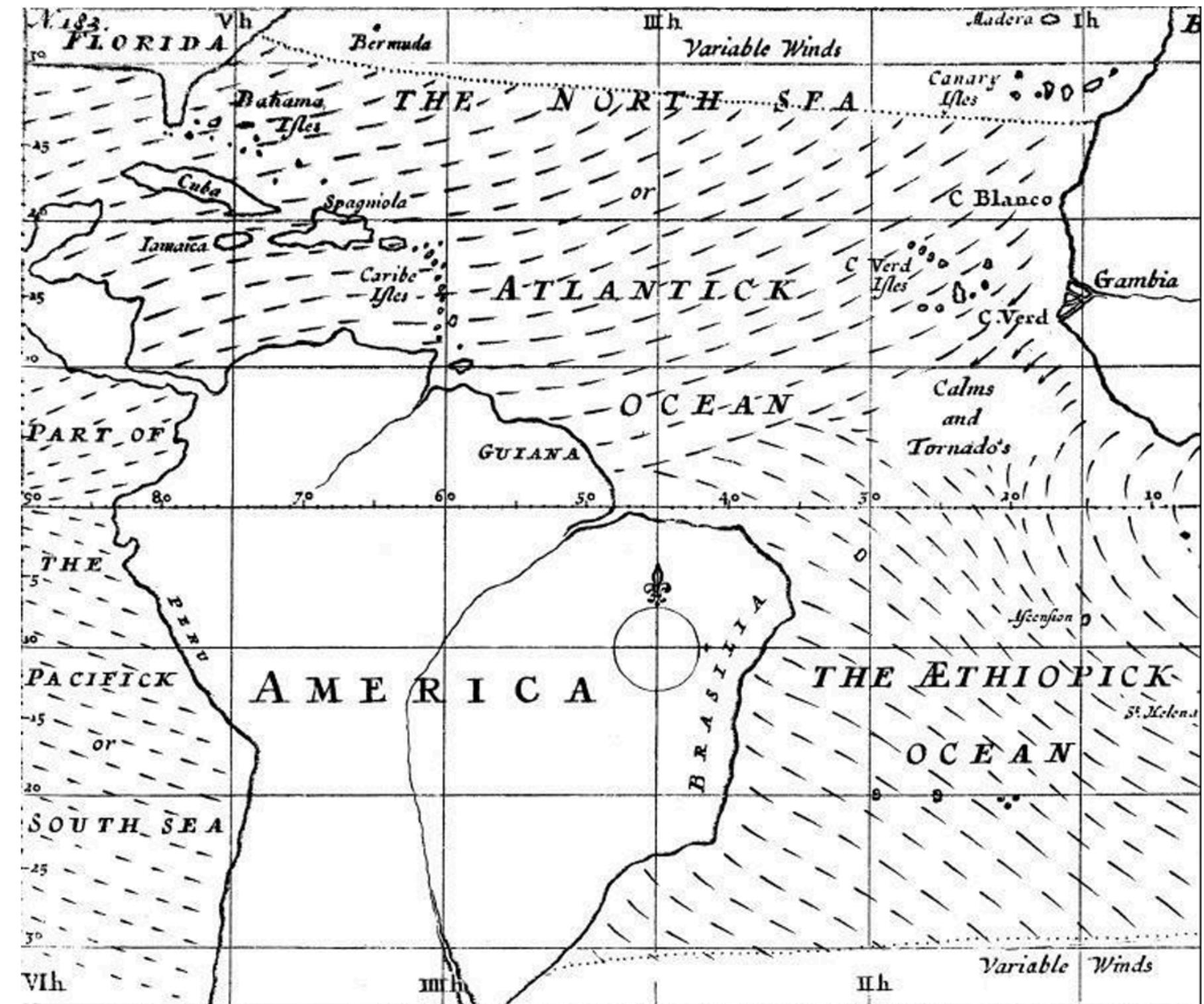
Bin the data



Isopleths: Isocurves

Earliest documented weather map

Show movement or direction of data patterns



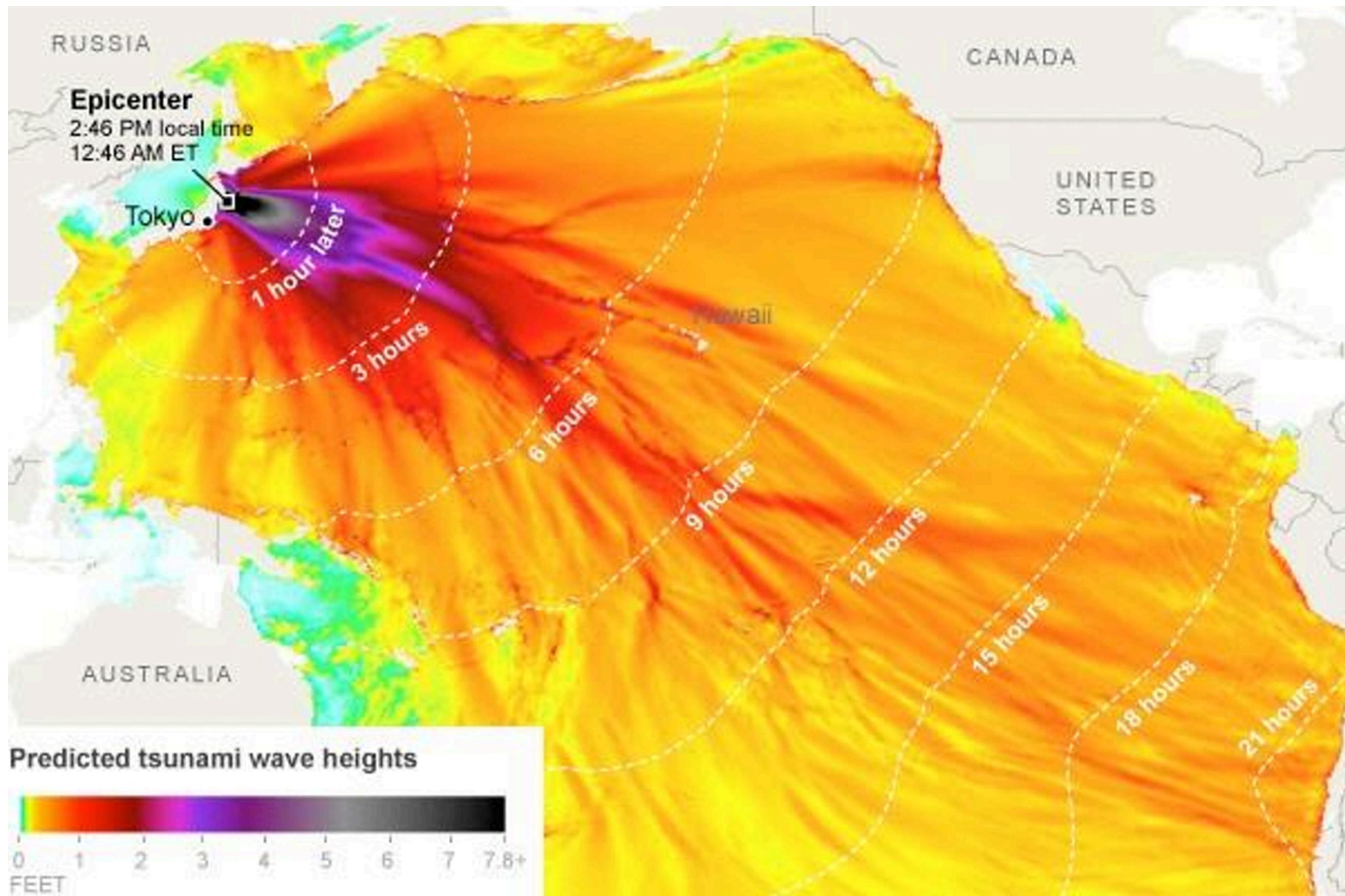
Isopleths: Isocurves

Show Topology



Isopleths: Isocurves

Show Time

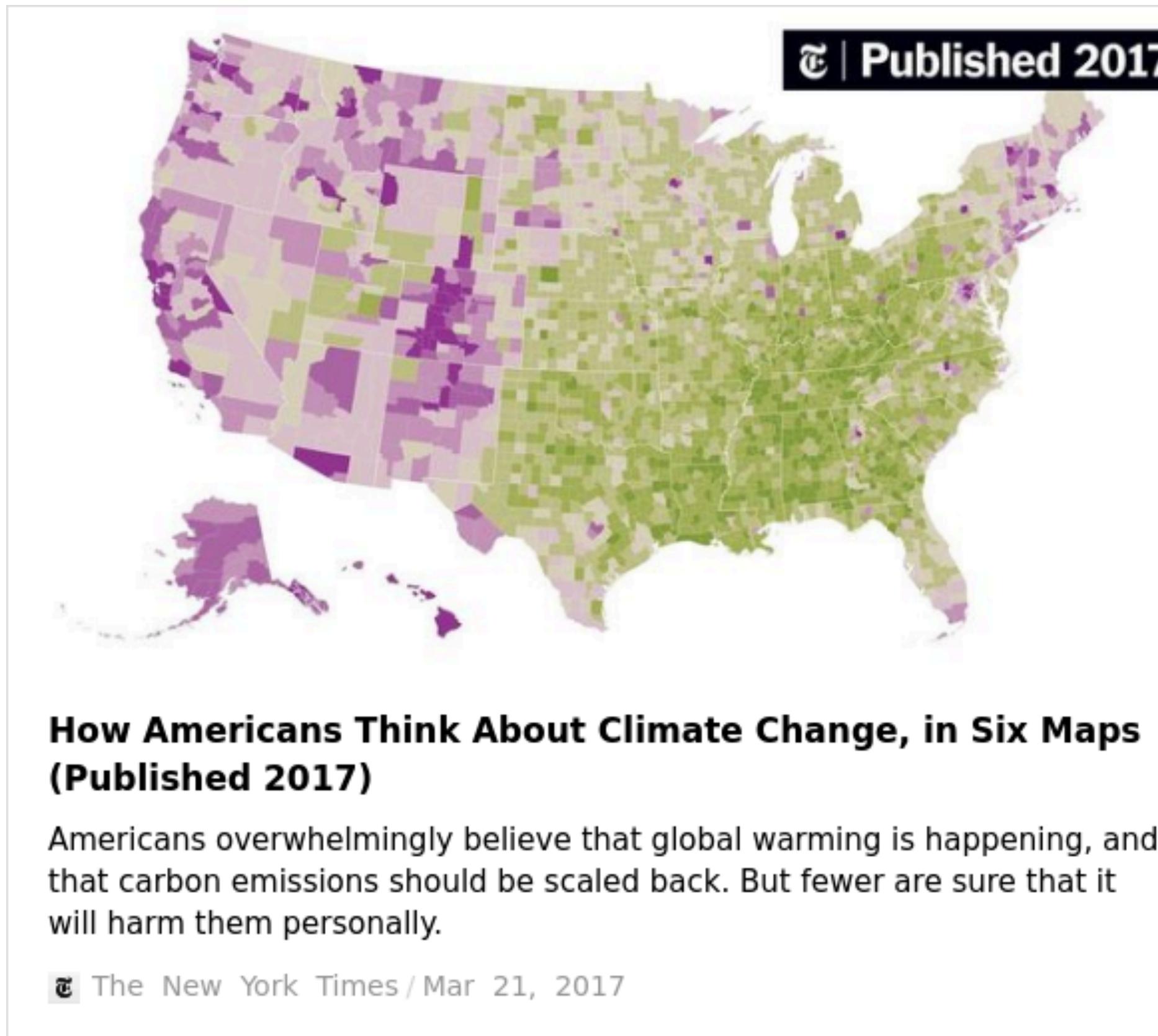


Choropleths

Choropleths

Map in which areas are **shaded, colored, or patterned** relative to a data attribute value

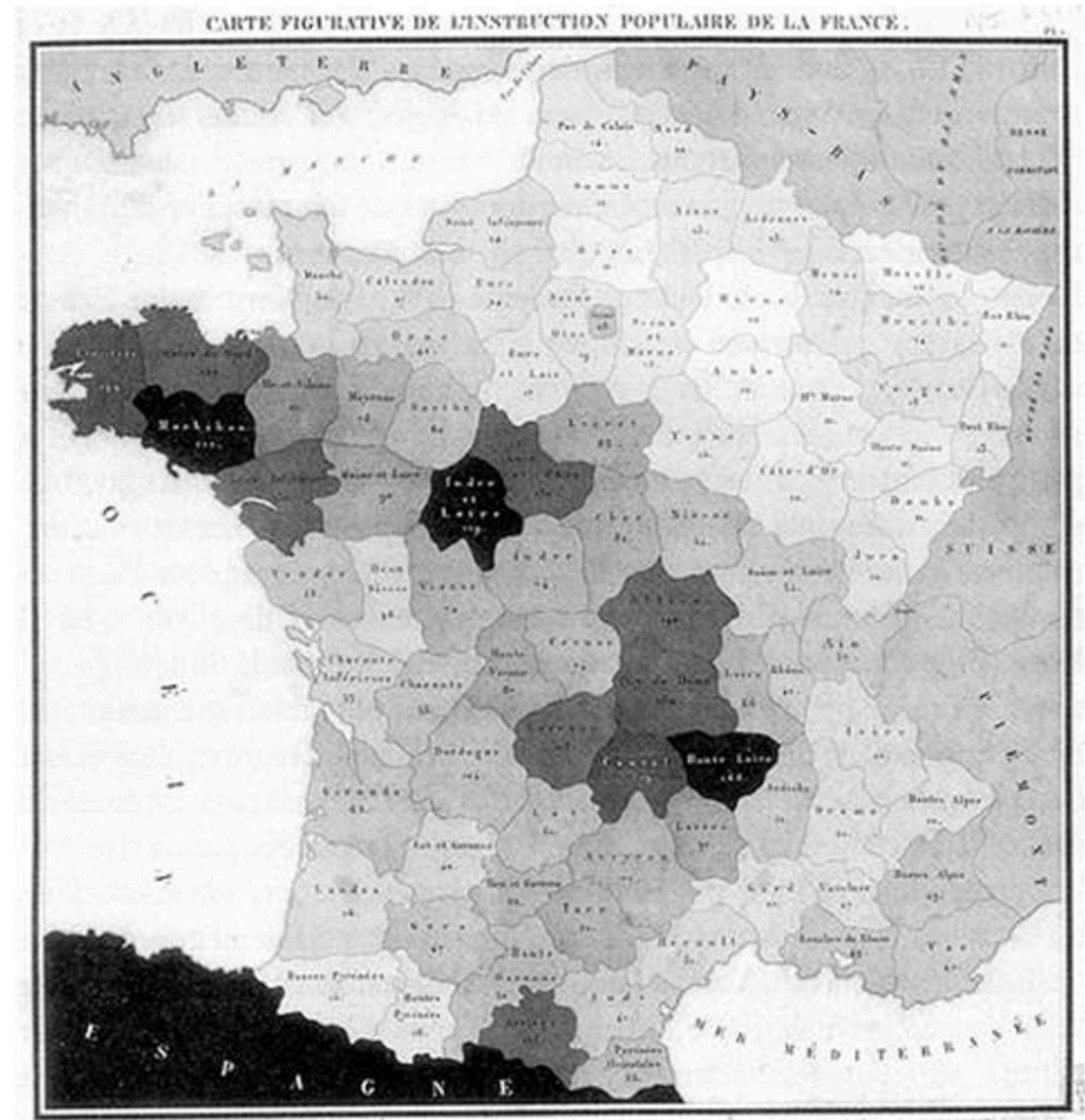
Choropleths



<https://www.nytimes.com/interactive/2017/03/21/climate/how-americans-think-about-climate-change-in-six-maps.html>

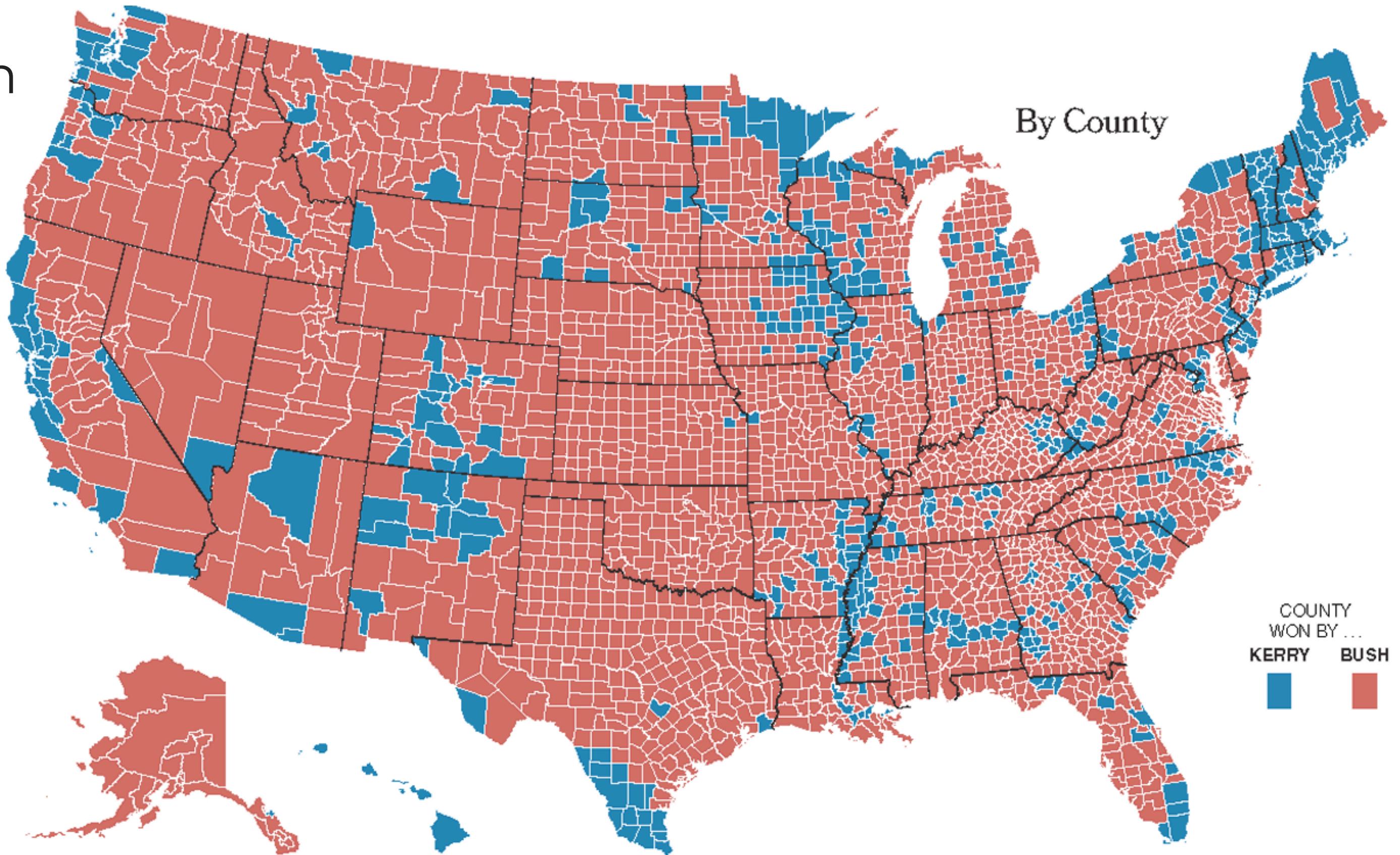
Choropleths

Charles Dupin, 1826



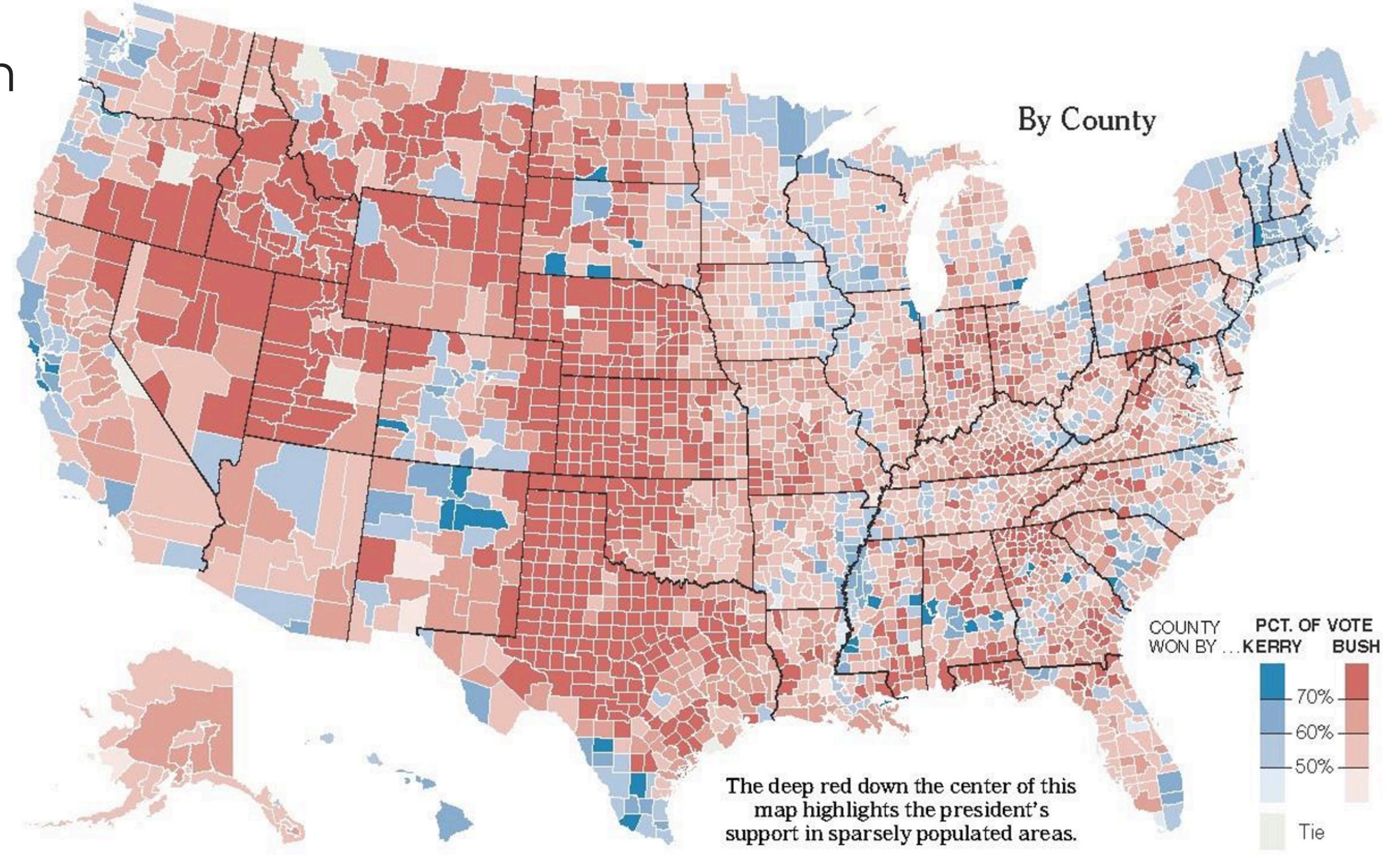
Choropleths

2004 Election



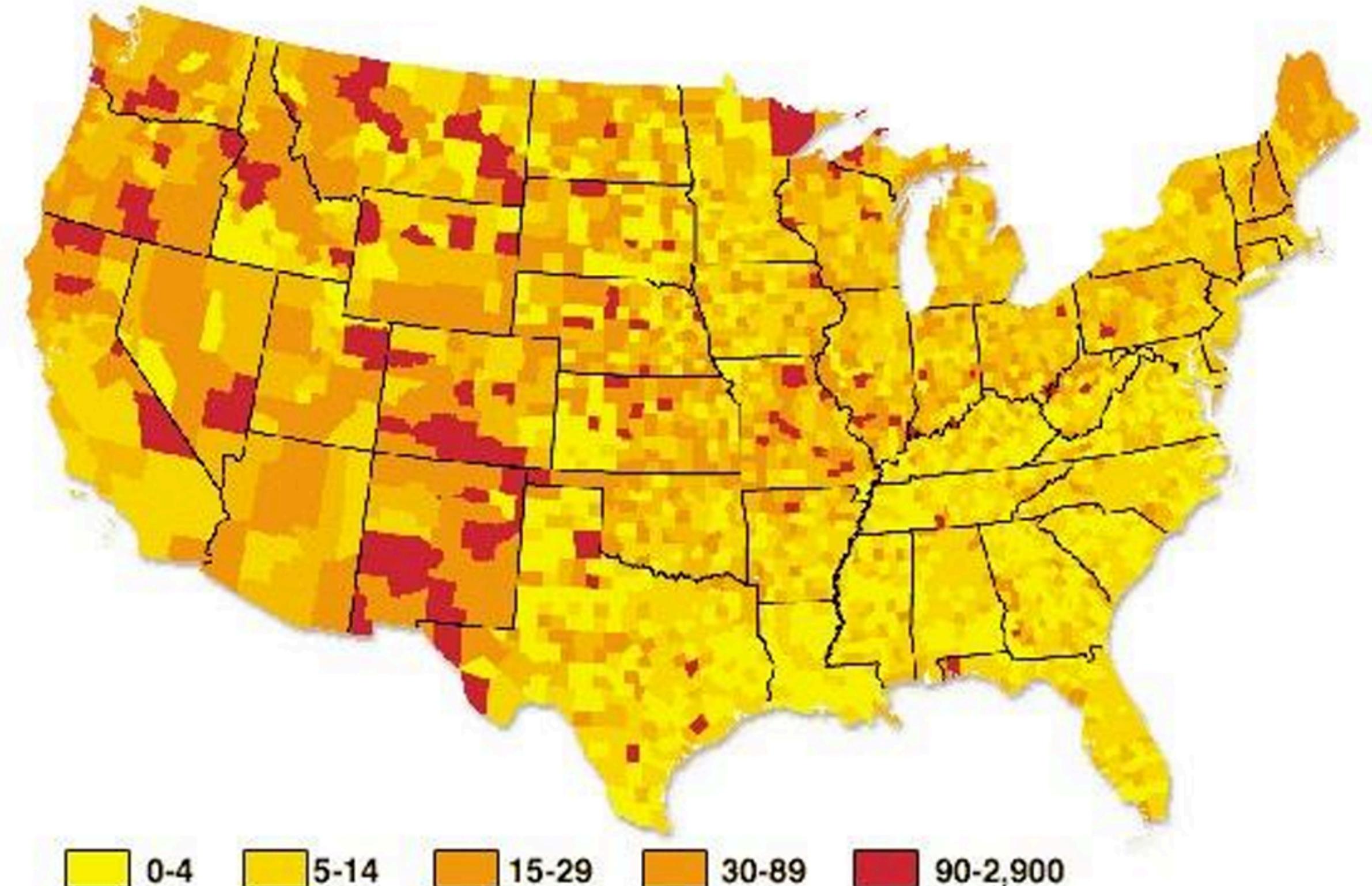
Choropleths

2004 Election



Choropleths

UFO Hotspots

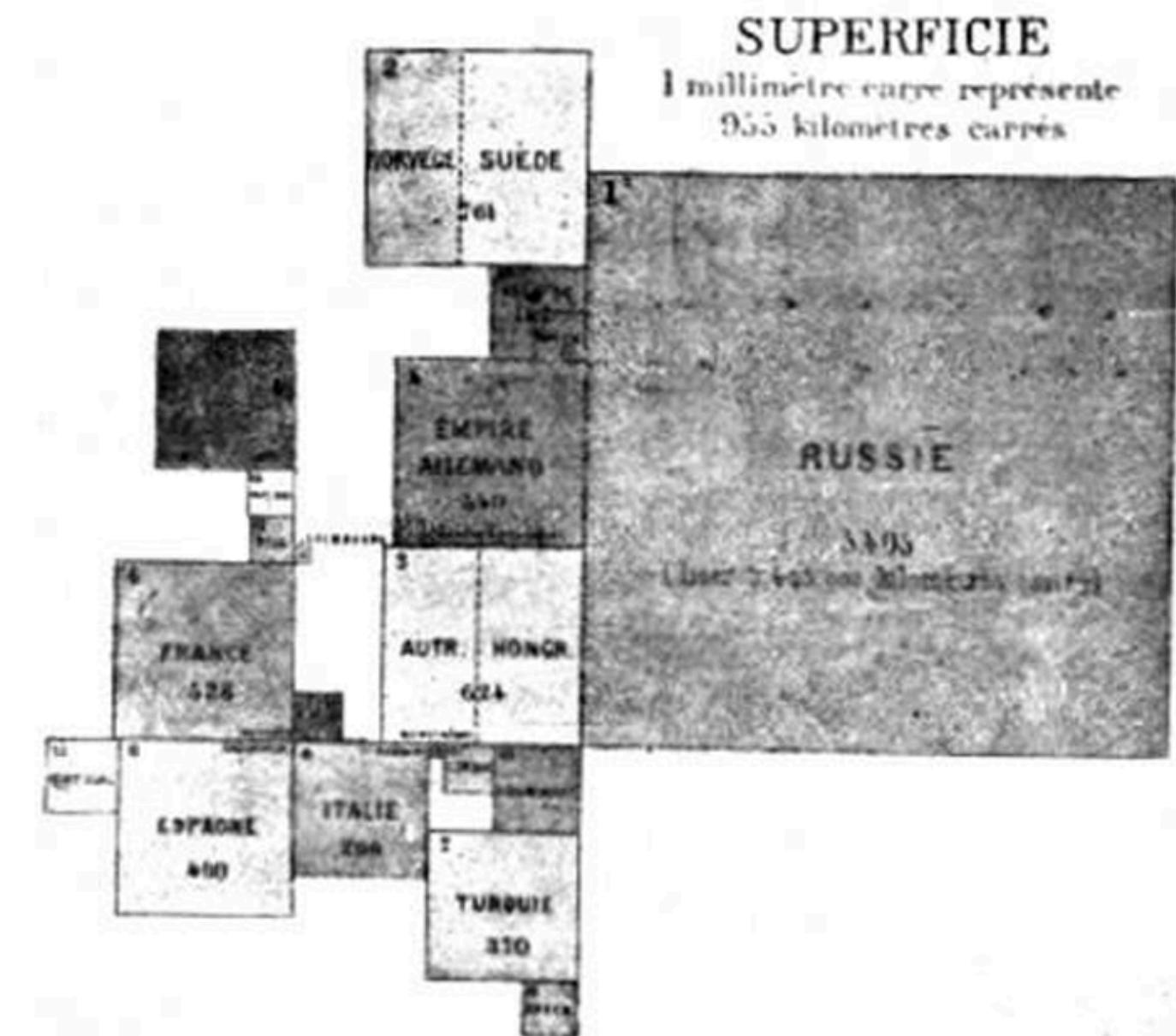


Cartograms

Cartograms

Map in which areas are **scaled** and **distorted** relative to a data attribute value

STATISTIQUE FIGURATIVE



Emile Levassieur, 1868

Cartograms

2006 ELECTION GUIDE

SENATE RACES

HOUSE RACES

GOVERNORS' RACES

RACE PROFILES

New York Times
ratings

198

Safe Dem.

16

Leaning Dem.

17

Toss up

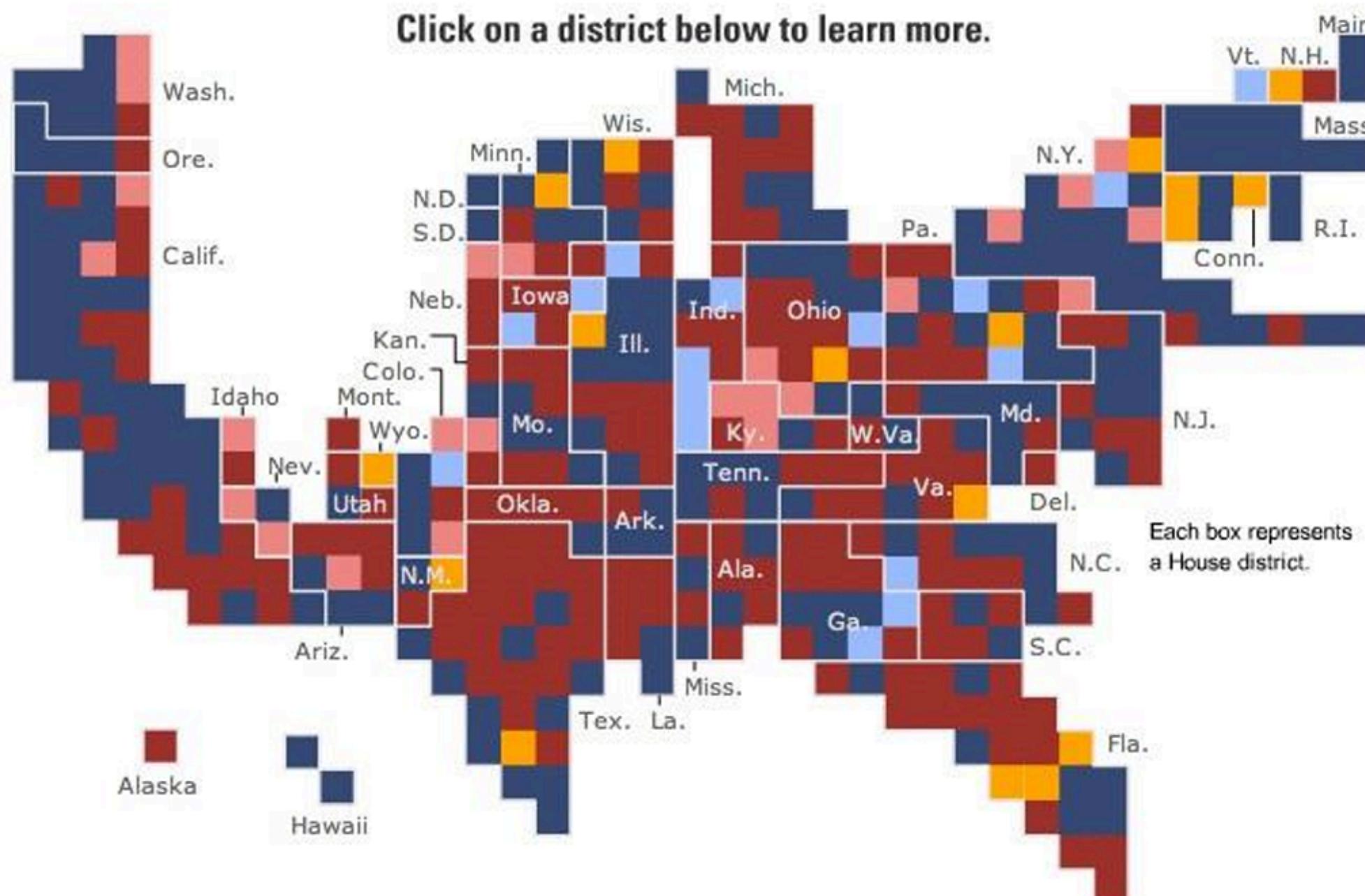
24

Leaning Rep.

180

Safe Rep.

Click on a district below to learn more.



ANALYZE RACES

CREATE OUTCOMES

Shade the map using the pulldown...

New York Times ratings

...then show only certain states

New York Times ratings ?

Democrat: Safe Leaning Toss Up

Republican: Safe Leaning

Current Rep. Dem. Rep.

Margin in 2004 House race

Democrat: >50% 25-50% <25%

Republican: >50% 25-50% <25%

Votes for president
 Kerry Gore
 Bush Bush

Appearances by big fundraisers ?

George W. Bush Bill Clinton

Races to watch ?

Open races

Switch districts ?

Urbanization

Urban Suburban Rural Mixed

Race/Ethnicity

White Black Hispanic

Median income

<\$30K \$30-50K >\$50K

RESET

Cartograms

Search Business

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World Business

Markets

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DealBook

Media & Advertising

Small Business

Your Money

SPARK
BUSINESS

THE MOST REWARDS IN BUSINESS



LEARN MORE »

MORE INFO

September 4, 2008

E-MAIL | FEEDBACK

What Your Global Neighbors Are Buying

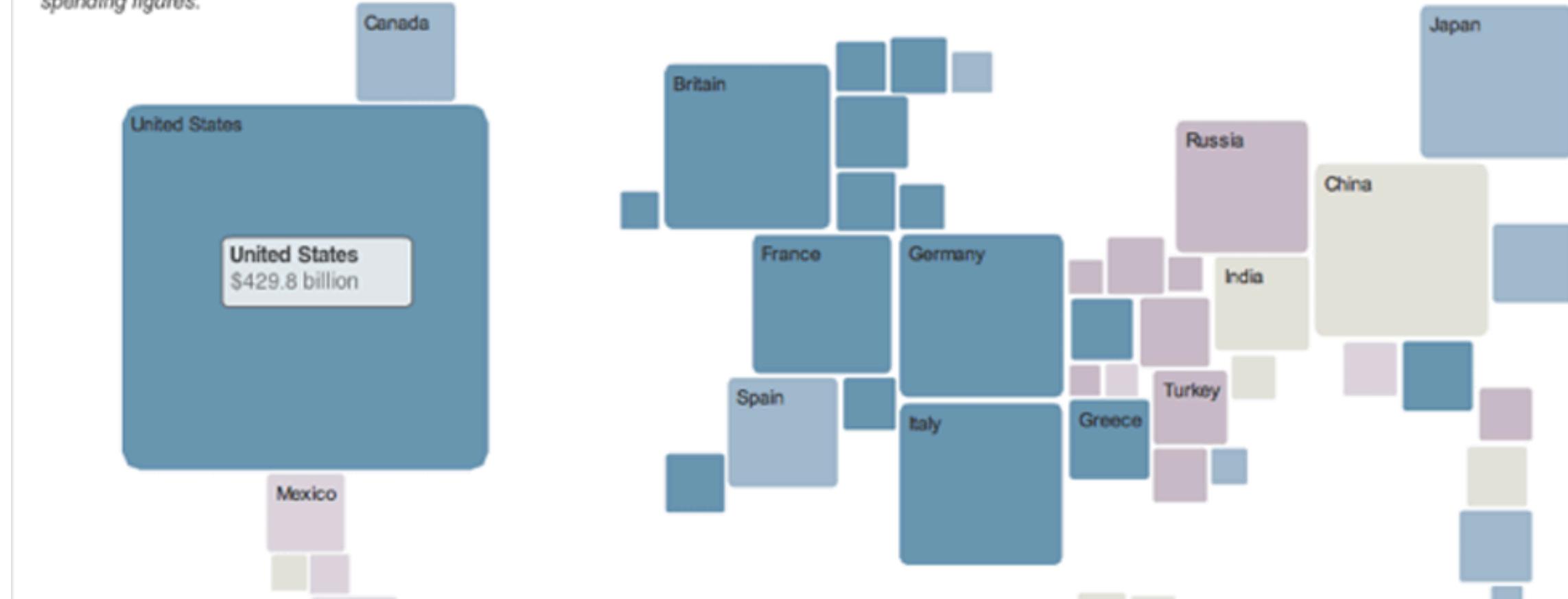
How people spend their discretionary income – the cash that goes to clothing, electronics, recreation, household goods, alcohol – depends a lot on where they live. People in Greece spend almost 13 times more money on clothing as they do on electronics. People living in Japan spend more on recreation than they do on clothing, electronics and household goods combined. Americans spend a lot of money on everything.

[Related Article](#)
[CLOTHING & FOOTWEAR](#) [ELECTRONICS](#) [ALCOHOL & TOBACCO](#) [HOUSEHOLD GOODS](#) [RECREATION](#)

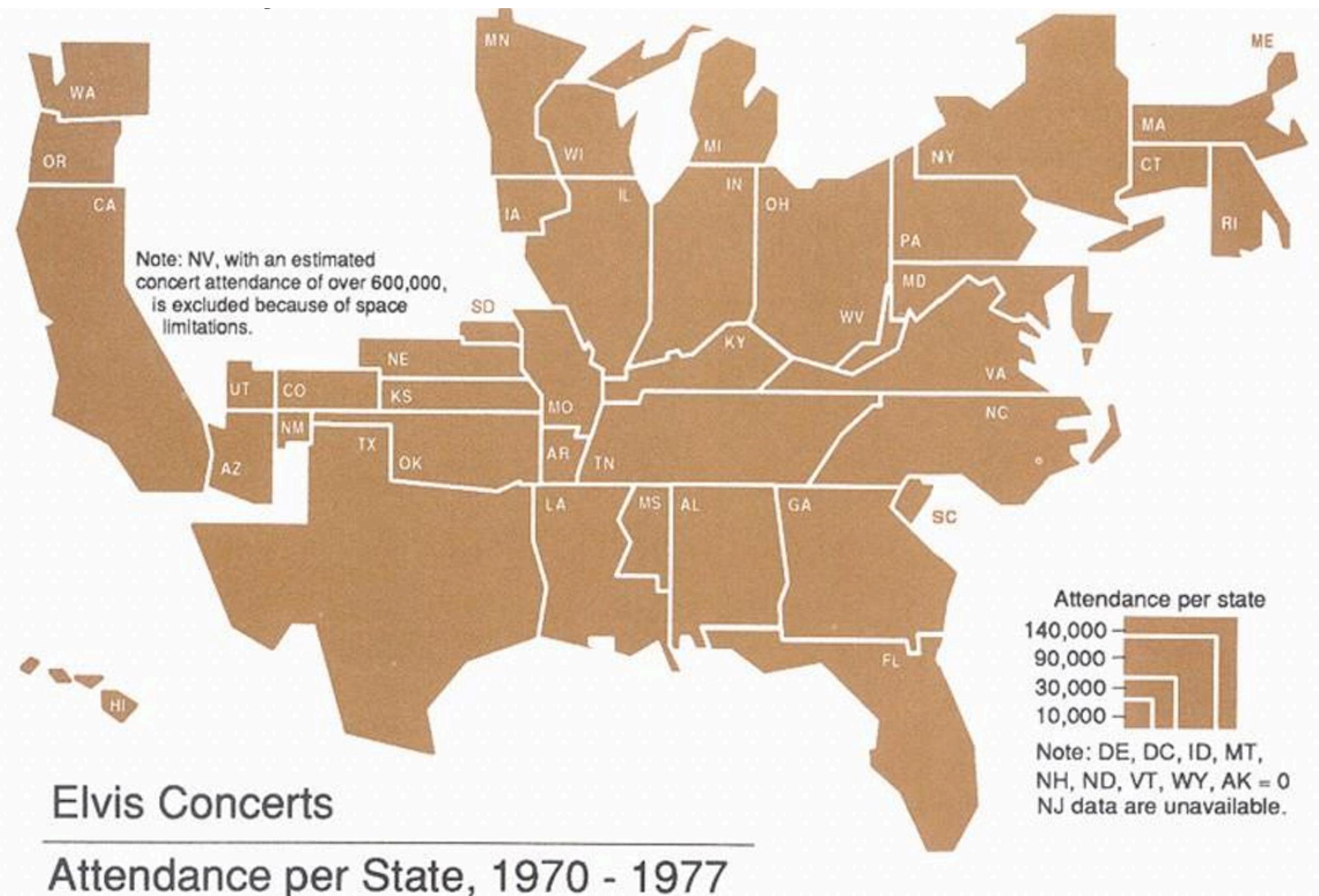
Boxes represent selected countries and are scaled according to total spending in 2007.



Roll over countries to see spending figures.



Cartograms



Source: Stanley, David E., with Frank Coffey. *The Elvis Encyclopedia*.
Santa Monica, CA.: General Publishing Group, Inc., 1994.

© 1995 Andrew Dent and Linda Turnbull

Cartograms

Global internet use (2013)



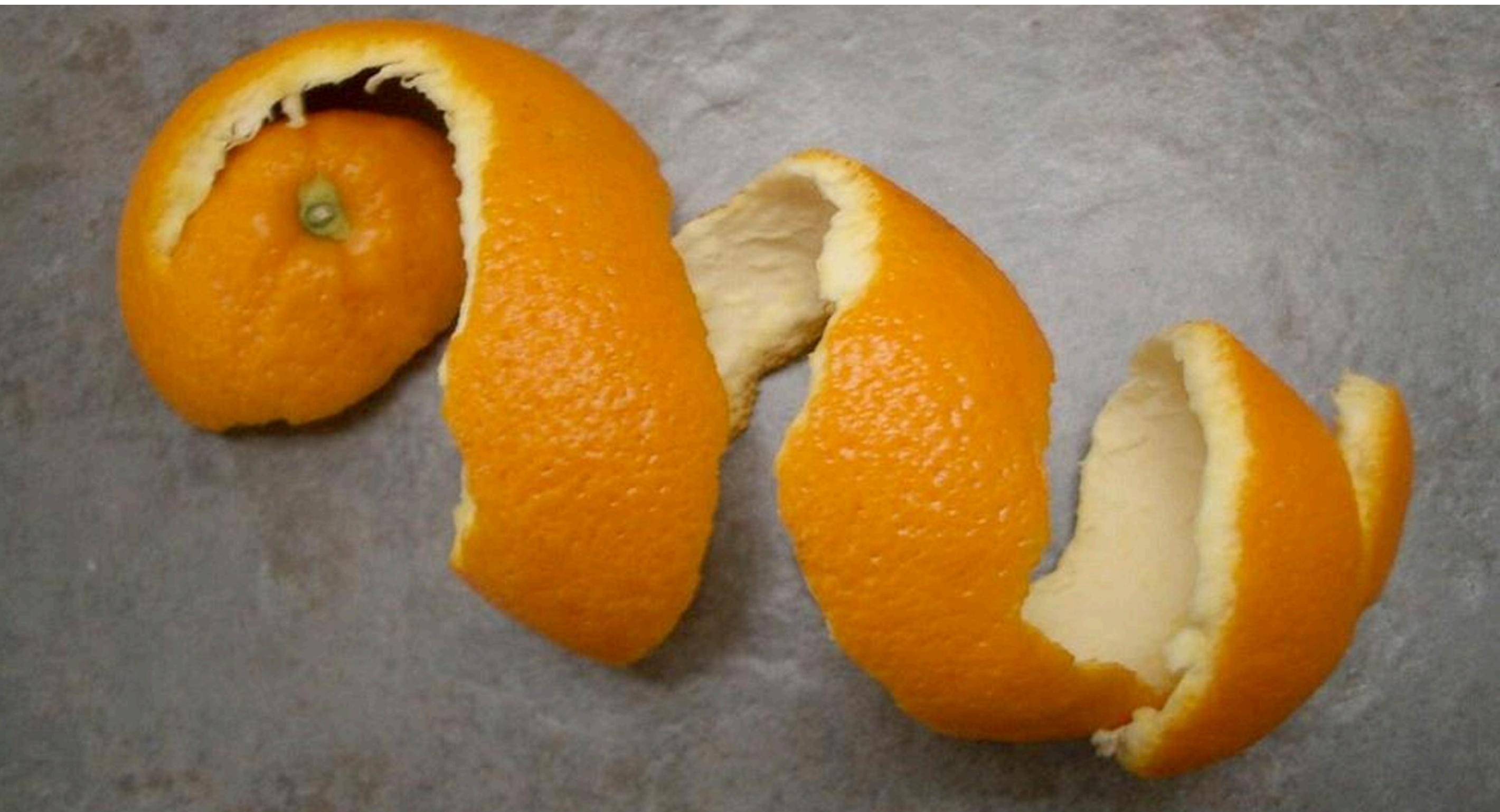
Cartograms

Harry Beck's Tube Map



Projections **Flattening the Globe**

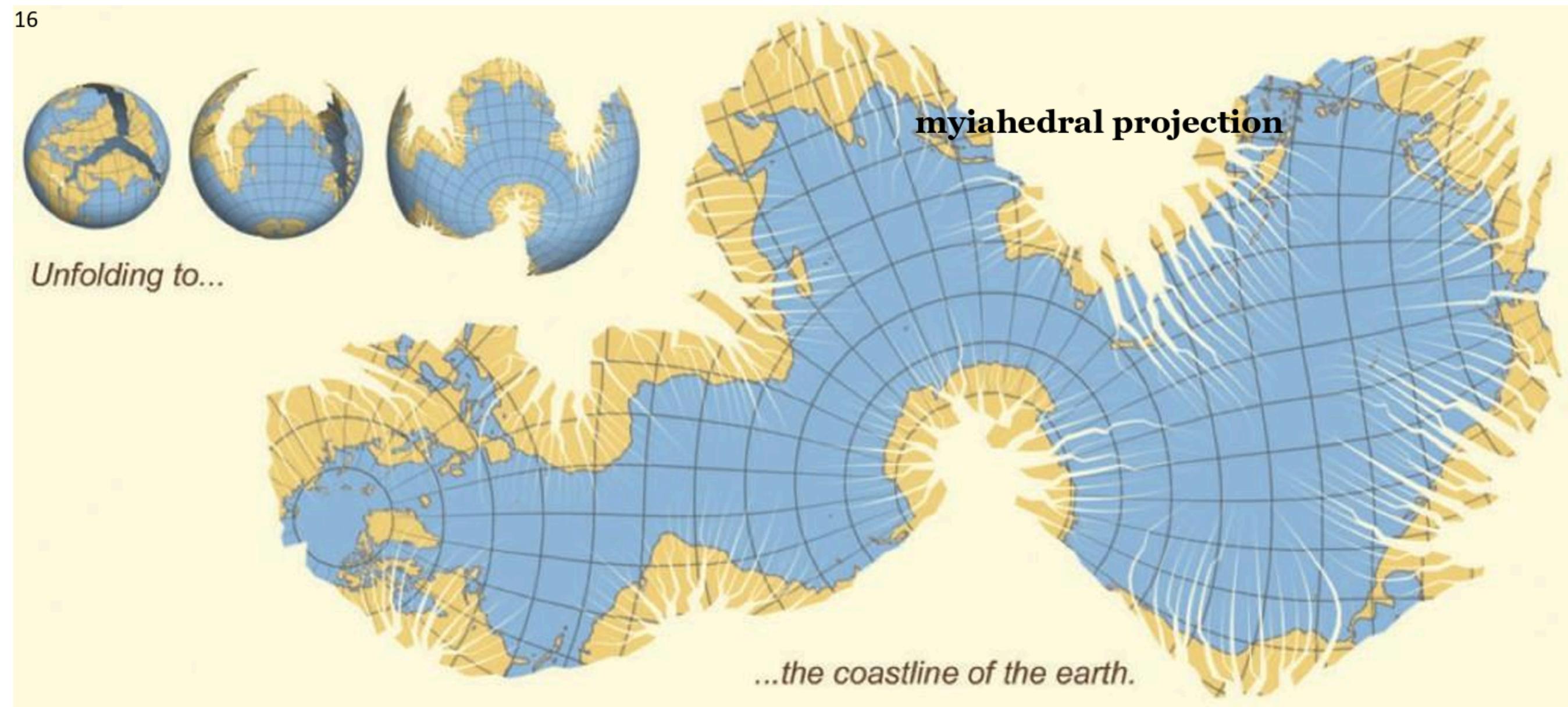
A sphere tears when you try to flatten it



Map Projection

Requires tearing and/or distortion

So many ways to distort and/or tear



Map Projection

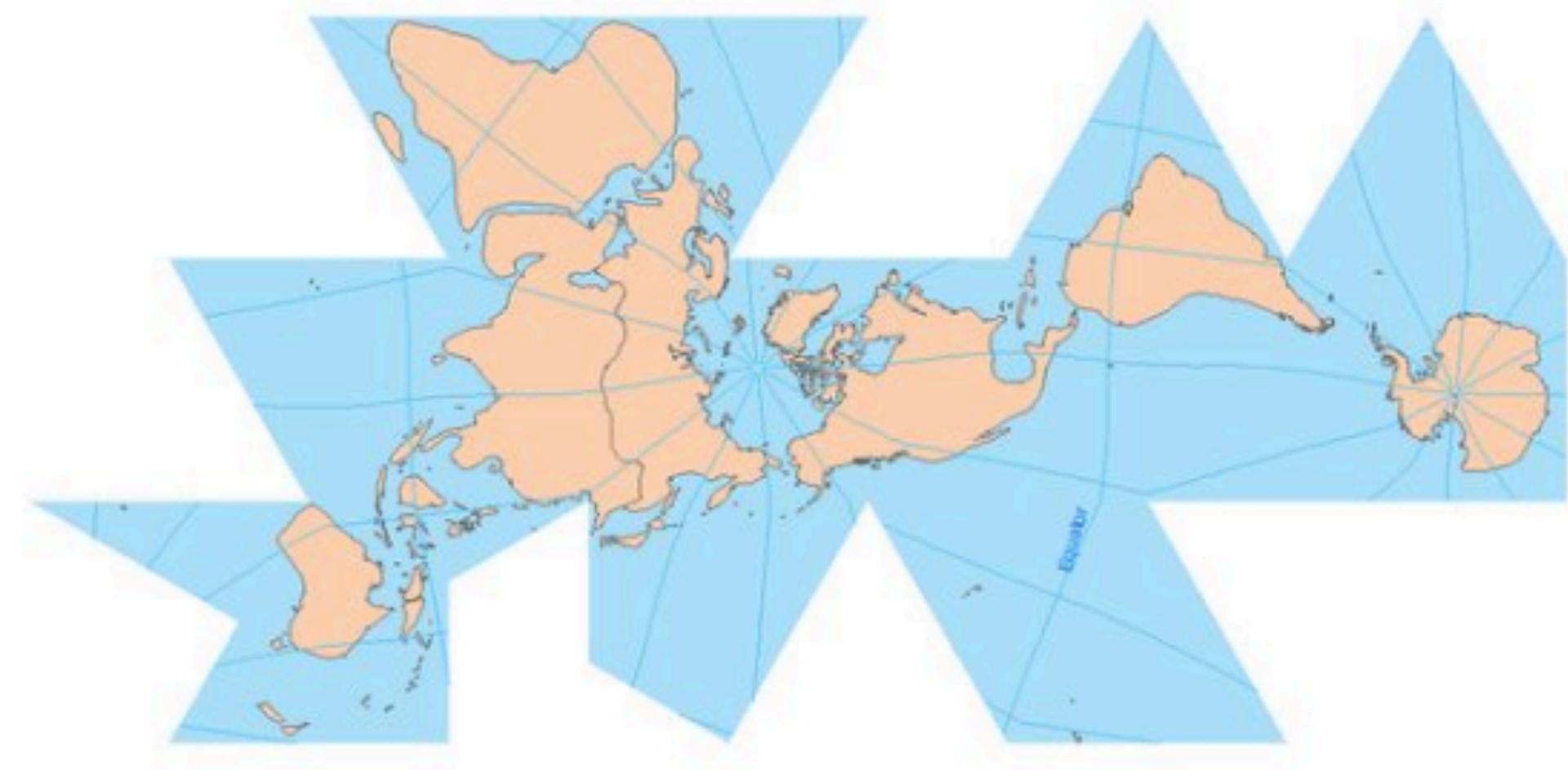
Requires tearing and/or distortion

So many ways to distort and/or tear



Map Projection

[https://gisgeography.com/
map-projection-types/](https://gisgeography.com/map-projection-types/)



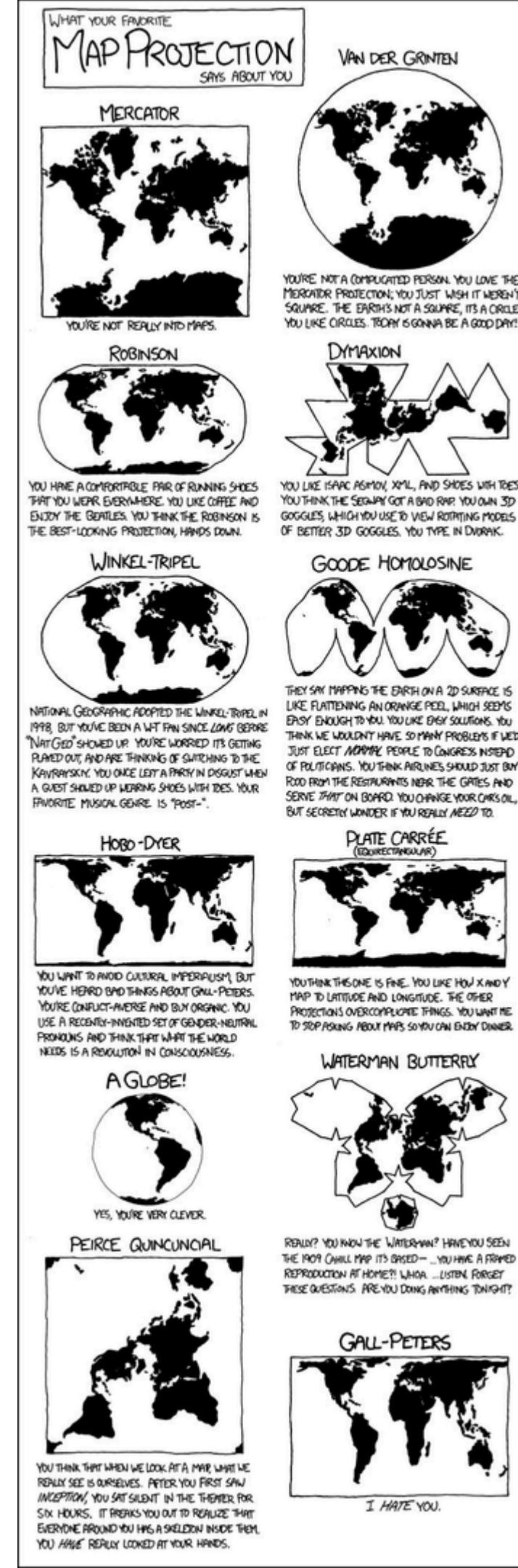
50 Map Projections Types: A Visual Guide

If you're in need of a visual reference guide to map projection types, this goldmine of the top 50 global map projections used by cartographers will help.

 GIS Geography / Feb 3, 2019

Map Projection

<http://xkcd.com/977/>



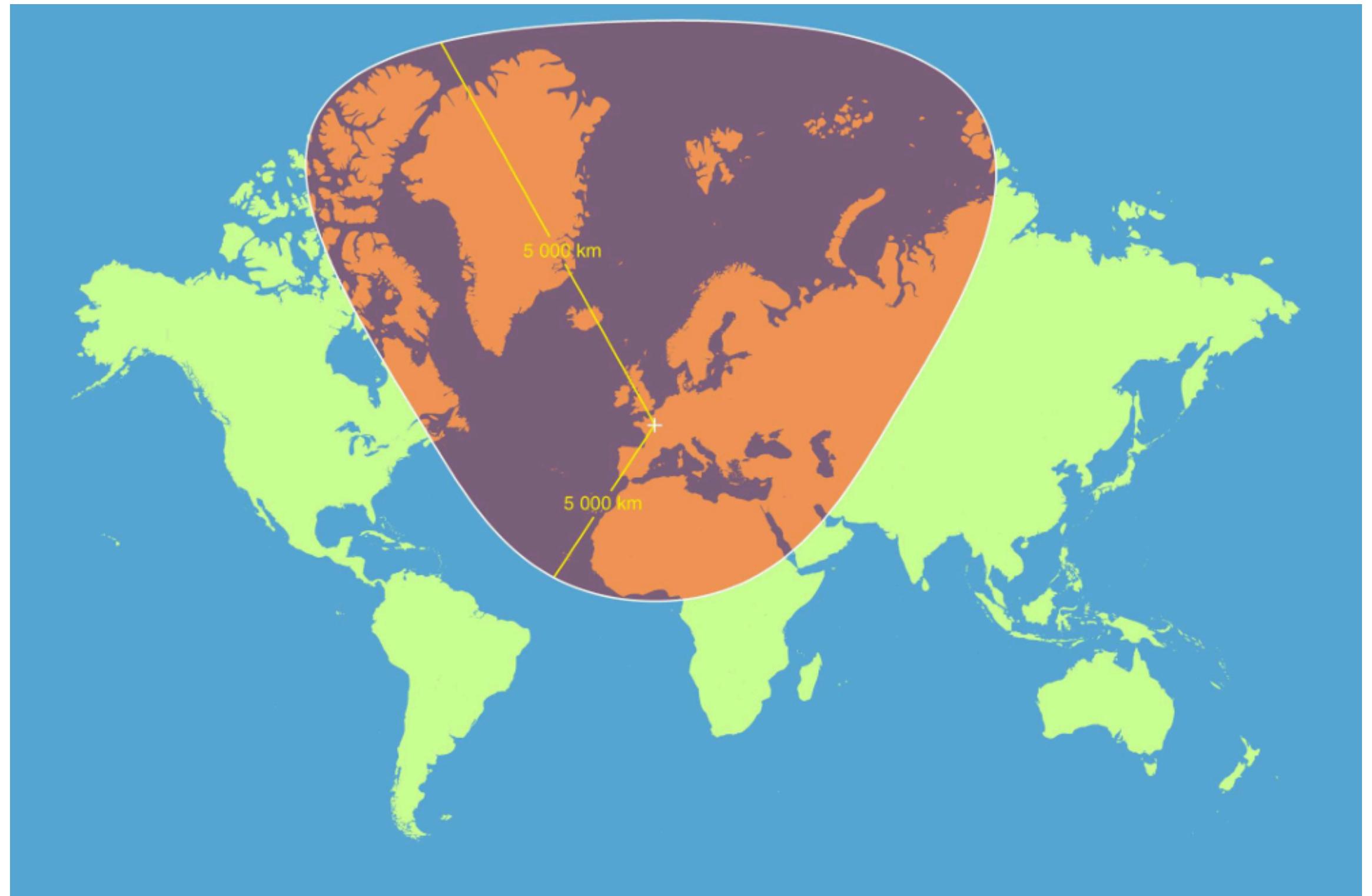
Map Projection: Mercator

Most Common Map
Projection



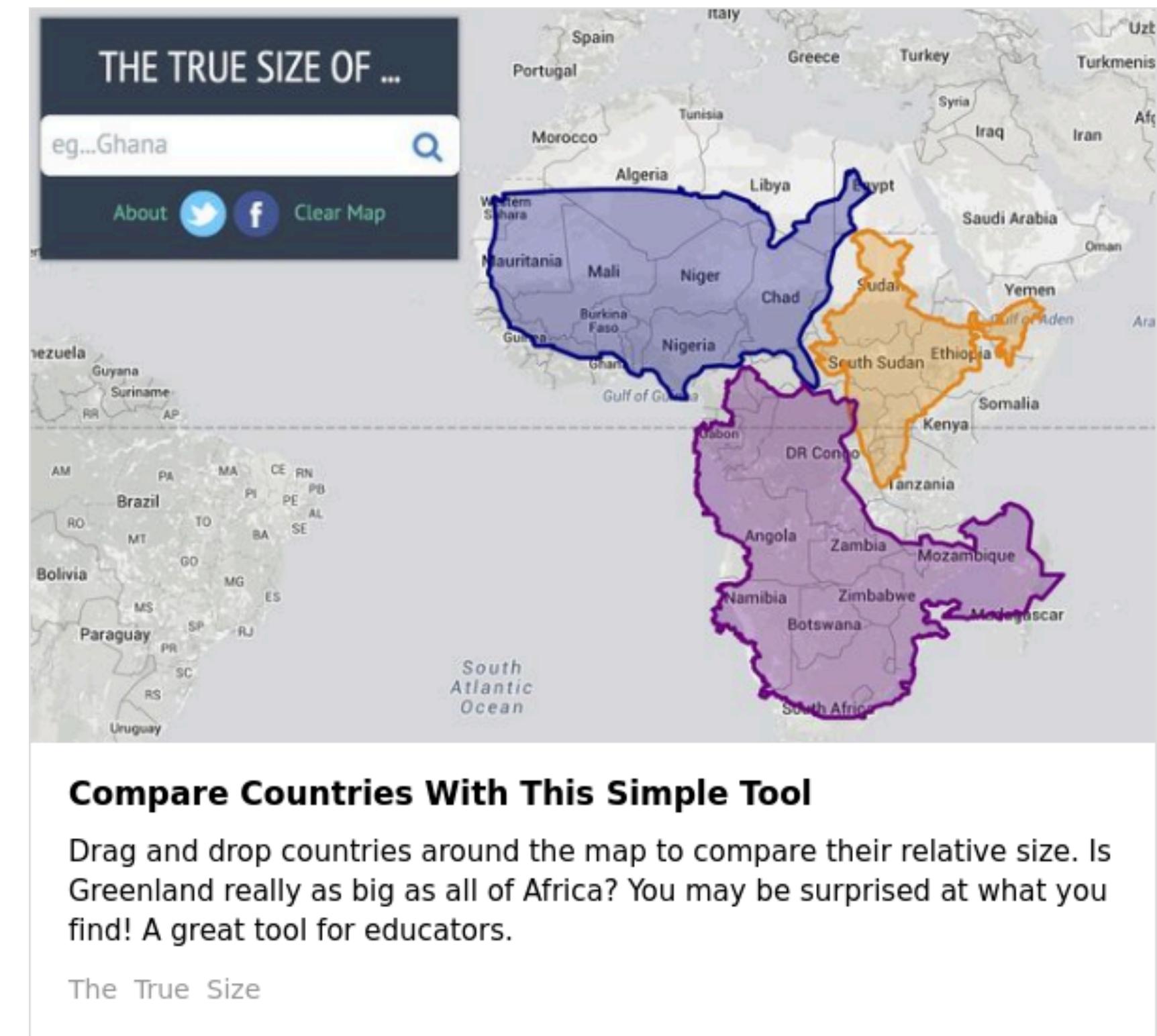
Map Projection: Mercator

A circle with radius
5000km centered at
Paris, France



Map Projection: Mercator

<https://thetruesize.com/#>

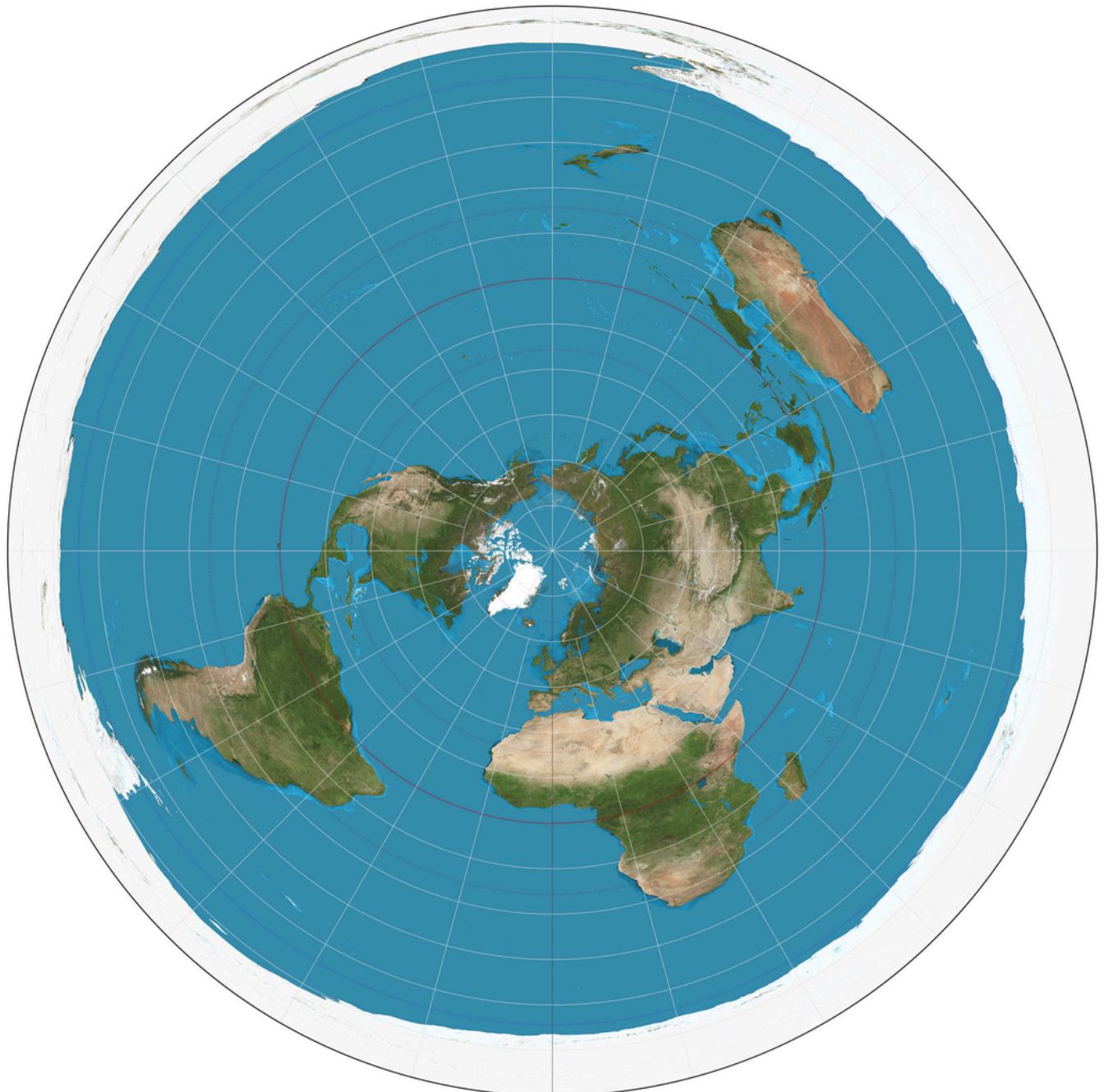


Map Projection: Classes

What features of the map would you like to maintain?

Preserve Direction?

- Azimuthal is a good choice

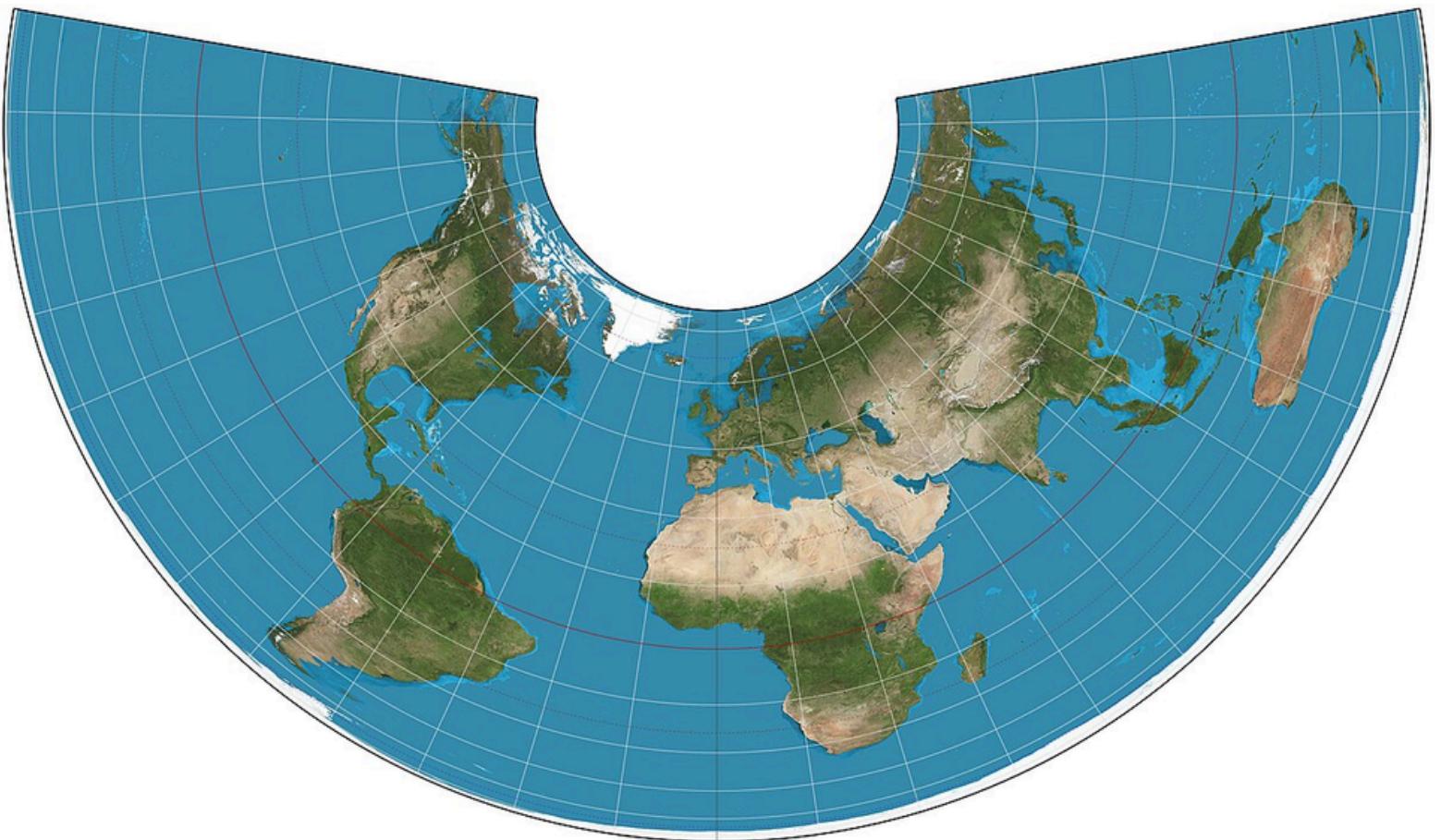
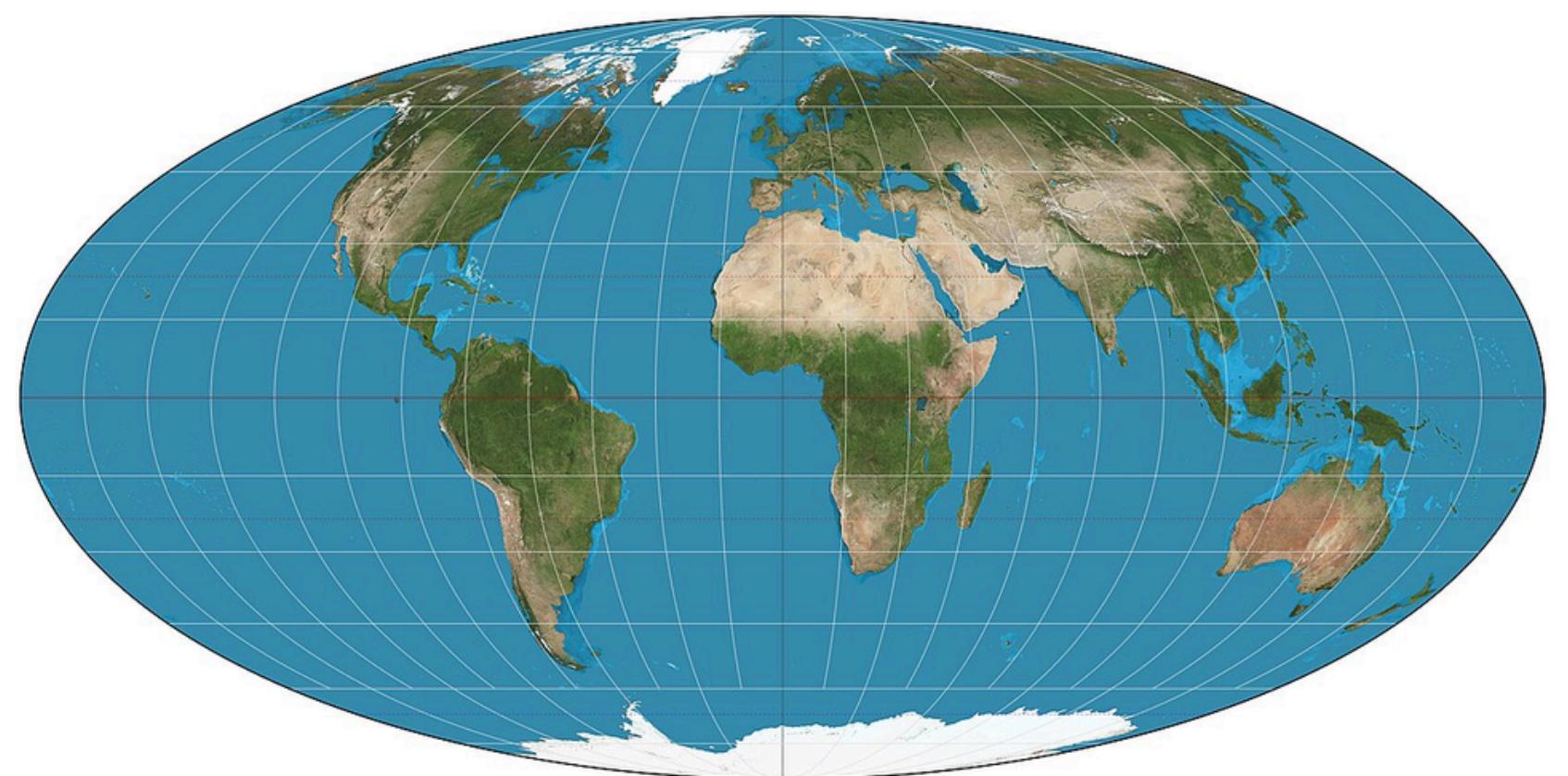


Map Projection: Classes

What features of the map would you like to maintain?

Preserve Area?

- maybe Mollweide or Albers

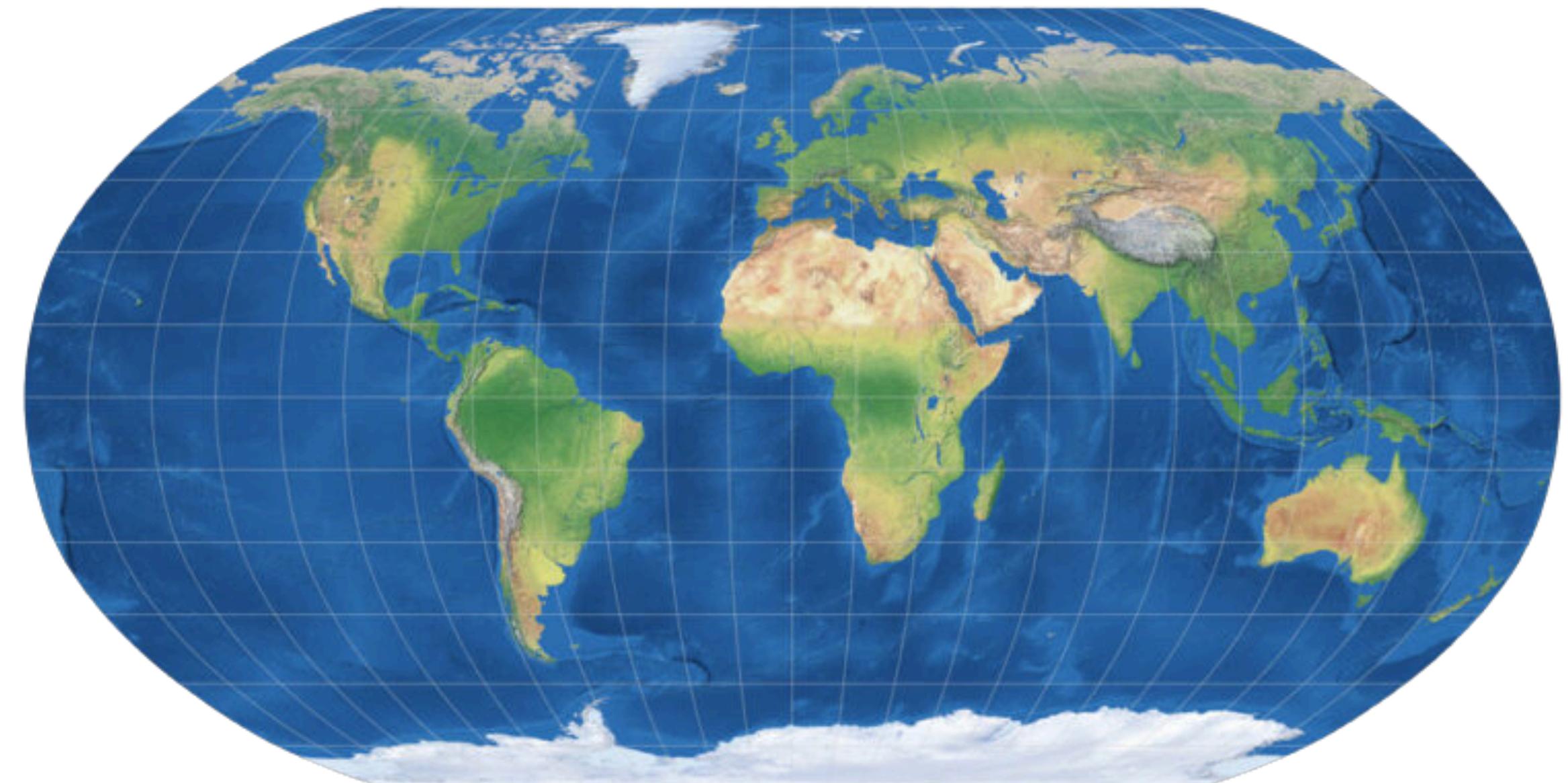


Map Projection: Classes

What features of the map would you like to maintain?

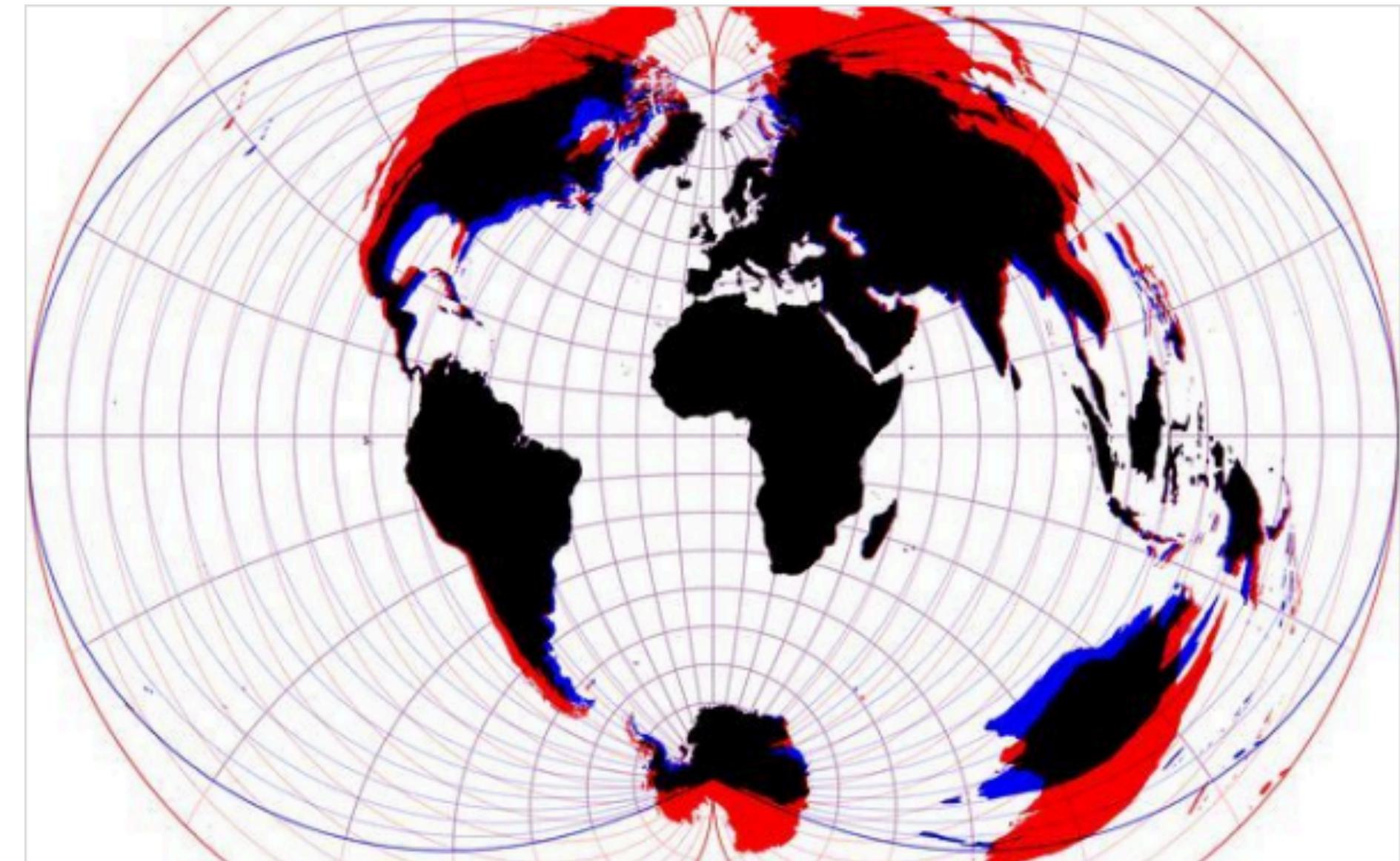
Balance Area, Shape, and Direction?

- Robinson



Map Projection: Comparing Projections

[https://observablehq.com/@d3/
projection-comparison](https://observablehq.com/@d3/projection-comparison)



Projection comparison

Choose two projections below to compare. Appendix Edit the projections array below, or red and blue above, to define a new projection.

Observable / Jul 17, 2023

FIN

Upcoming Dates

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- Homework 5 Due
- Project Screencast Submission Due

Monday May 12: Final Project Submission Due

**Only if you requested an extension by May 2