Maps

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 6 out, due Friday.

Project 2 peer feedback due Friday.

Project 3 due next week Tuesday.

FAQs:

1. **Help, I don't understand D3??** Start by understanding basic examples: scatter plot, line plot, bar plot.
2. **How complicated does my Project 3 need to be?** Interaction doesn’t need to be complicated. More importantly: how does your interaction help user explore interesting pieces of data?

How much time did you spend on Lab 5?

tryclassbuzz.com
Code: **lab5**

Maps

When to use a map?

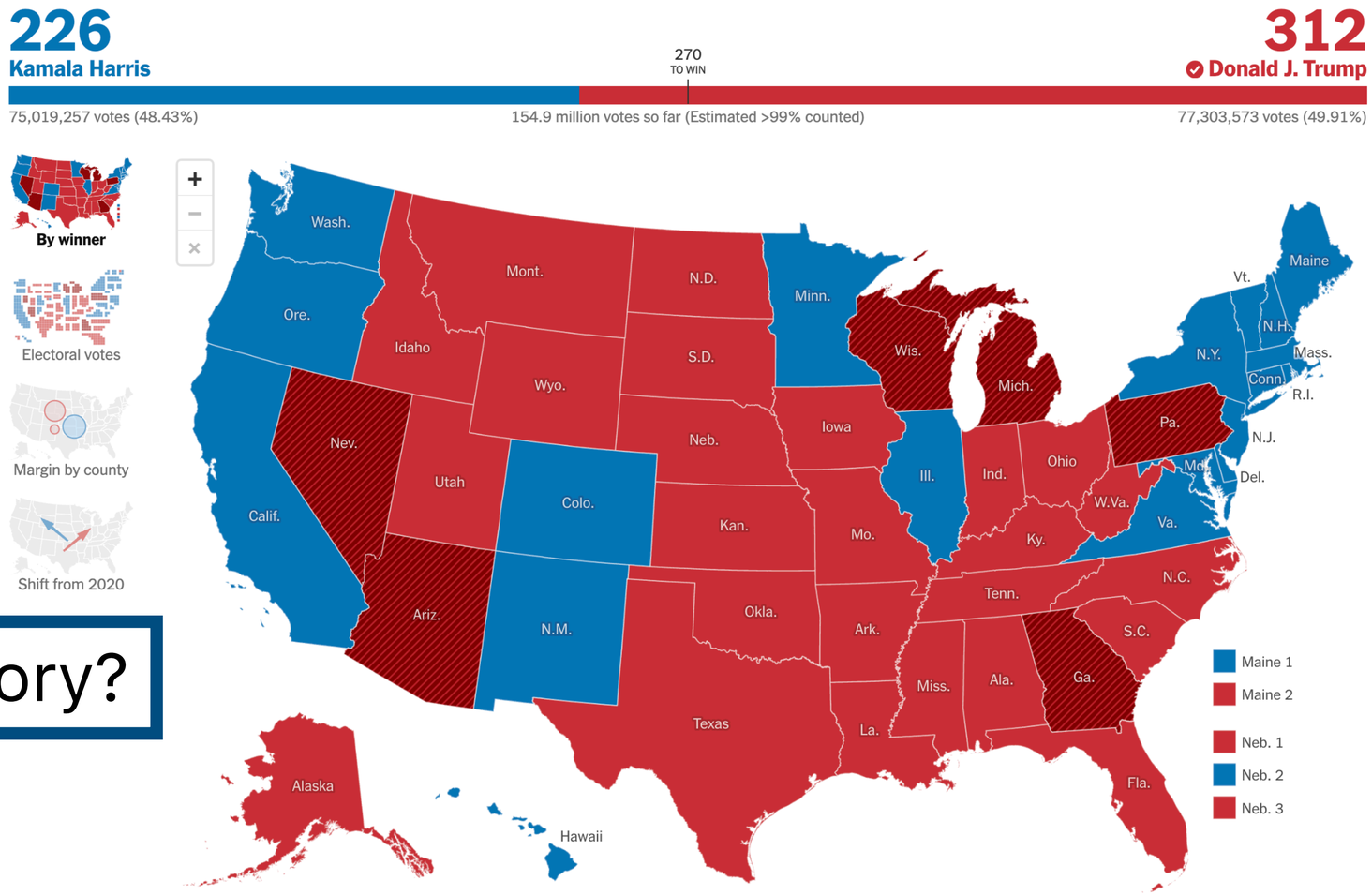
1. When data contains geographical attributes (e.g., latitude, longitude, city, state, country, etc.).
2. When you want to emphasize **geographic relationship**.

Geographic Relationships

✅ Who's winning my state?

❌ Is it a landslide?

❌ What are the paths to victory?



Geographic Relationships

✅ Who's winning my state?

✅ Is it a landslide?

❌ What are the paths to victory?

Results by state

Below are the latest results for each state, grouped according to pre-election ratings by the Cook Political Report.

Dem. Win Flip Rep. Win Flip

Harris expected to win easily

State	Margin	% In
Calif.	D+20 ✓	100%
Colo.	D+11 ✓	100%
Conn.	D+15 ✓	100%
Del.	D+15 ✓	100%
Hawaii	D+23 ✓	100%
Ill.	D+11 ✓	100%
Maine 1	D+22 ✓	100%
Md.	D+29 ✓	100%
Mass.	D+25 ✓	100%
N.J.	D+6 ✓	100%
N.Y.	D+13 ✓	100%
Ore.	D+14 ✓	100%
R.I.	D+14 ✓	100%
	D+32 ✓	100%
	D+18 ✓	100%
	D+86 ✓	100%

Harris expected to win narrowly

State	Margin	% In
Maine	D+7 ✓	100%
Minn.	D+4 ✓	100%
Neb. 2	D+5 ✓	100%
N.H.	D+3 ✓	100%
N.M.	D+6 ✓	100%
Va.	D+6 ✓	100%

Most competitive states

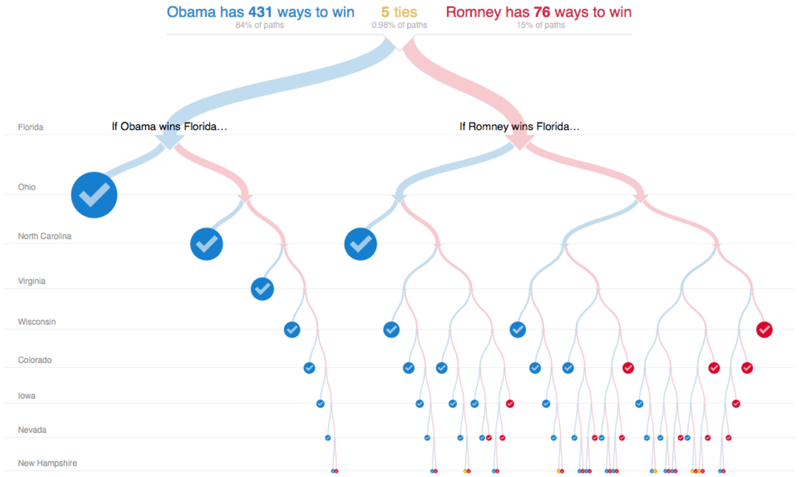
State	Margin	% In
Ariz.	R+6 ✓	100%
Ga.	R+2 ✓	100%
Mich.	R+1.4 ✓	100%
Nev.	R+3 ✓	100%
N.C.	R+3 ✓	100%
Pa.	R+1.7 ✓	100%
Wis.	R+0.86 ✓	100%

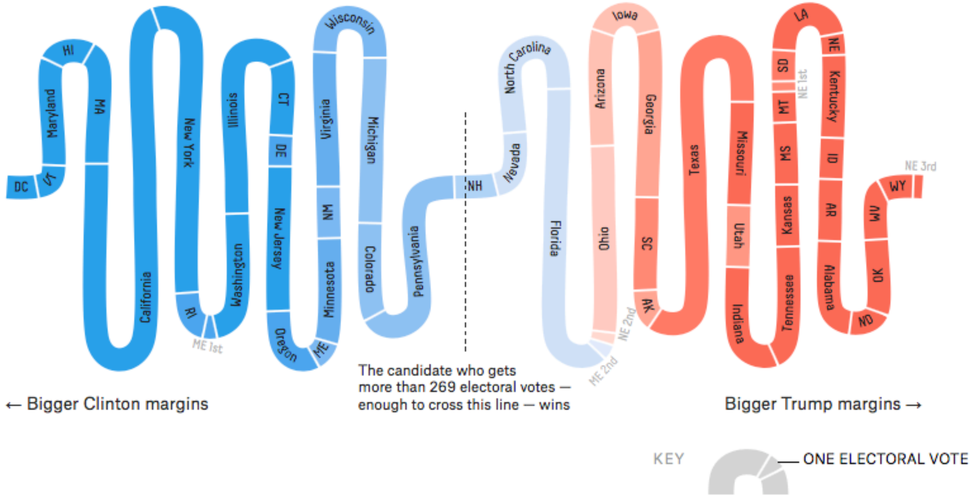
Trump expected to win narrowly

State	Margin	% In
Fla.	R+13 ✓	100%
Iowa	R+13 ✓	100%
Maine 2	R+10 ✓	100%
Texas	R+14 ✓	100%

Trump expected to win easily

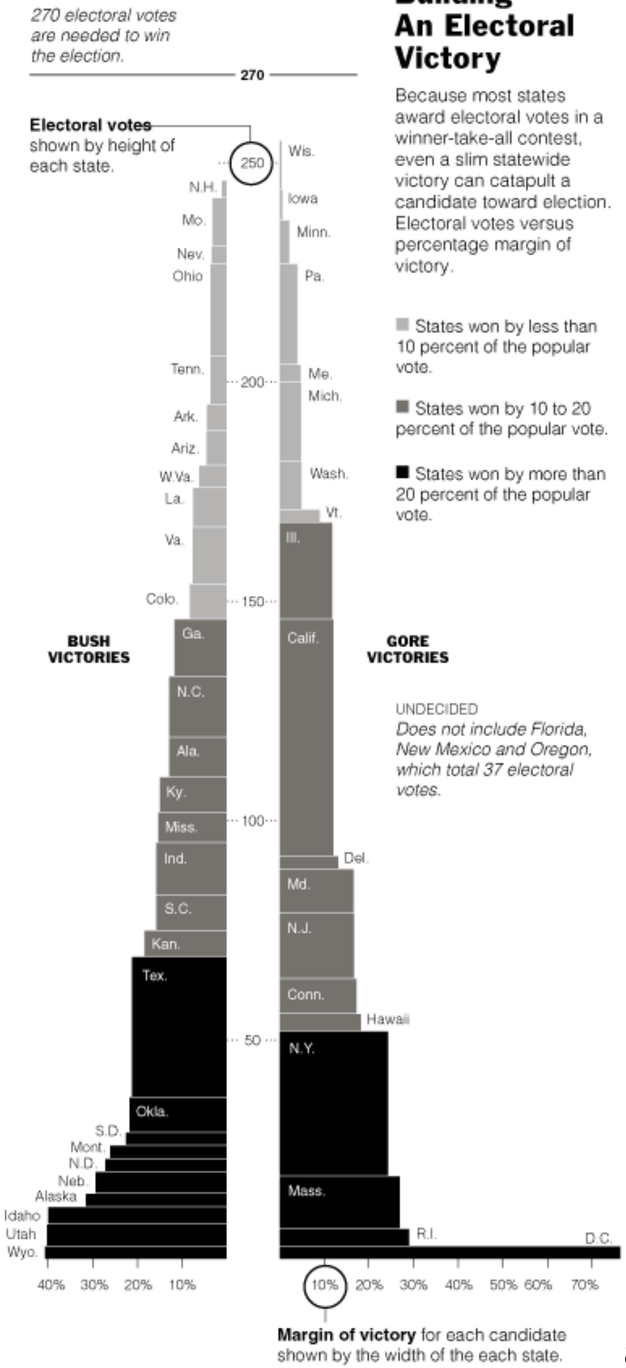
State	Margin	% In
Ala.	R+31 ✓	100%
Alaska	R+13 ✓	100%
Ark.	R+31 ✓	100%
Idaho	R+37 ✓	100%
Ind.	R+19 ✓	100%
Kan.	R+16 ✓	100%
Ky.	R+31 ✓	100%
La.	R+22 ✓	100%
Miss.	R+23 ✓	100%
Mo.	R+18 ✓	100%
Mont.	R+20 ✓	100%
Neb.	R+21 ✓	100%
Neb. 1	R+13 ✓	100%
Neb. 3	R+54 ✓	100%
N.D.	R+37 ✓	100%
Ohio	R+11 ✓	100%
Okla.	R+34 ✓	100%
S.C.	R+18 ✓	100%
S.D.	R+29 ✓	100%
Tenn.	R+30 ✓	100%
Utah	R+22 ✓	100%
W.Va.	R+42 ✓	100%
Wyo.	R+46 ✓	100%





KEY AVERAGE — 80% CHANCE OUTCOME FALLS IN THIS RANGE

	Expected margin of victory +75 +50 +25			+25 +50 +75	Chance of tipping election
Florida				D+0.7	17.6%
Pennsylvania				D+3.7	12.3%
Michigan				D+4.2	11.7%
North Carolina				D+0.7	11.2%
Virginia				D+5.6	6.0%
Colorado				D+4.0	6.0%
Ohio				R+1.9	5.2%
Wisconsin				D+5.3	4.8%
Minnesota				D+5.8	3.8%
Nevada				D+1.2	3.7%
Arizona				R+2.2	2.8%
New Mexico				D+5.8	2.8%
New Hampshire				D+3.6	2.3%
Georgia				R+4.0	2.3%



Building An Electoral Victory

Because most states award electoral votes in a winner-take-all contest, even a slim statewide victory can catapult a candidate toward election. Electoral votes versus percentage margin of victory.

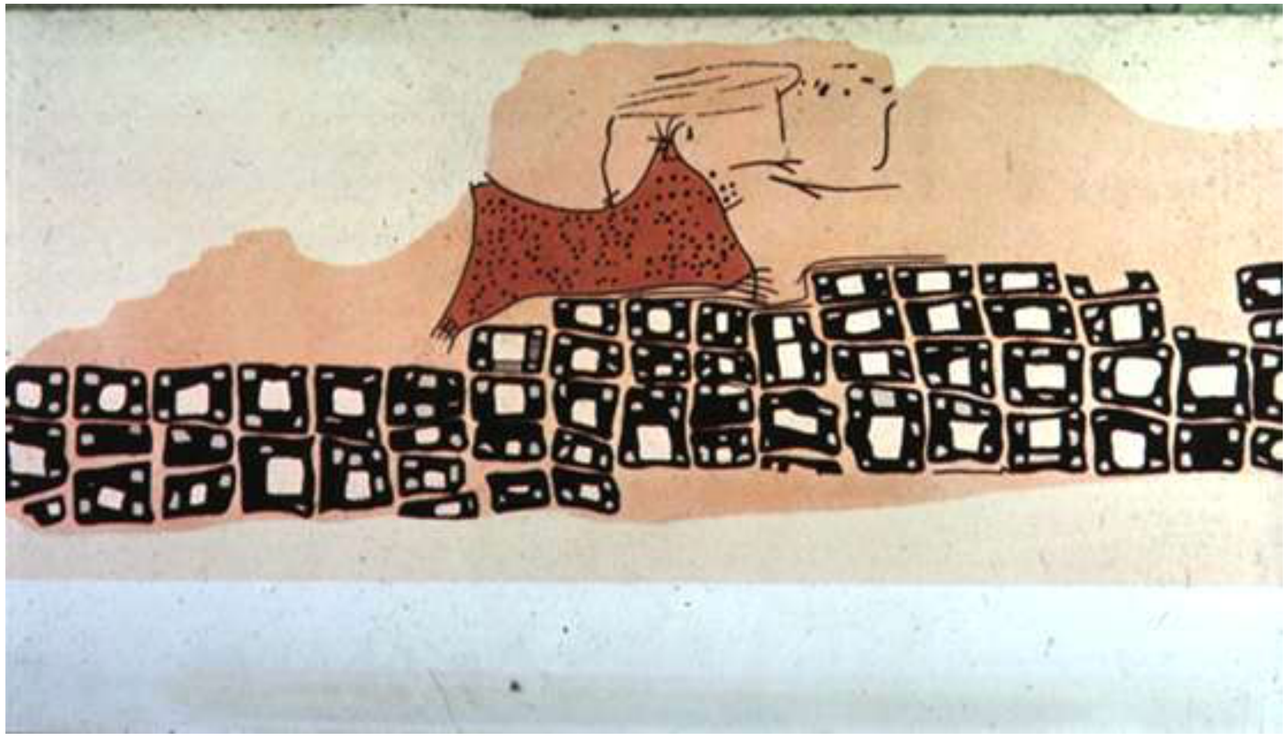
- States won by less than 10 percent of the popular vote.
- States won by 10 to 20 percent of the popular vote.
- States won by more than 20 percent of the popular vote.

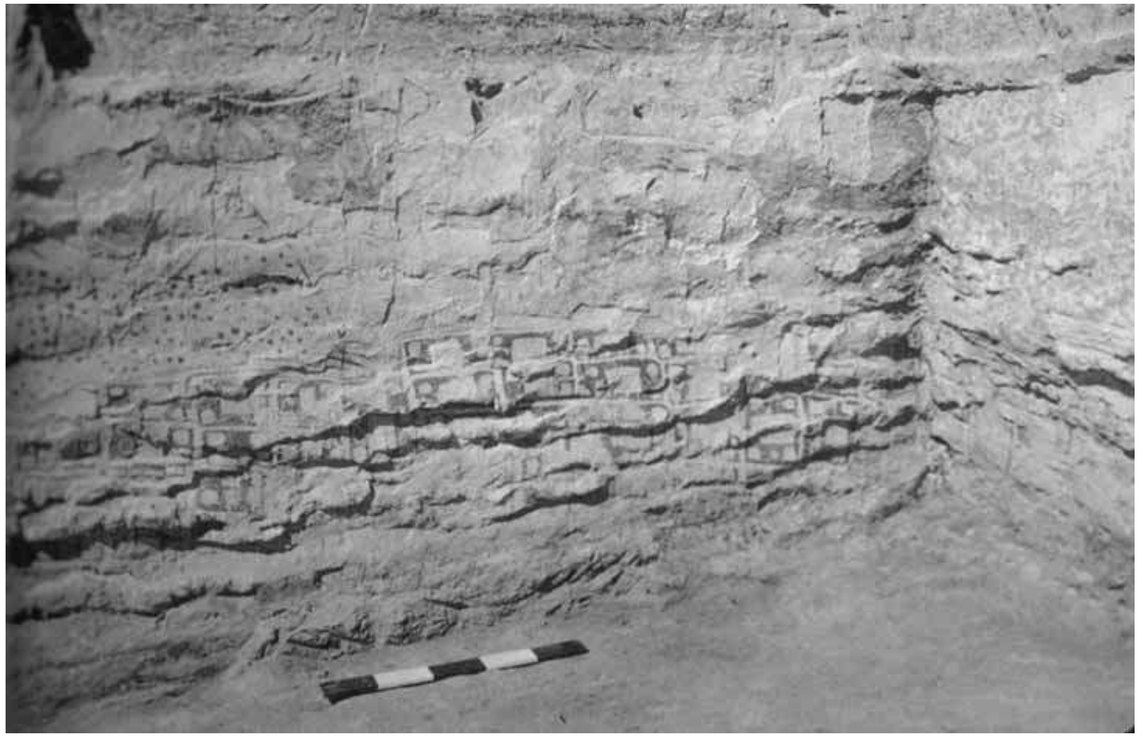
UNDECIDED
Does not include Florida, New Mexico and Oregon, which total 37 electoral votes.

Cartography

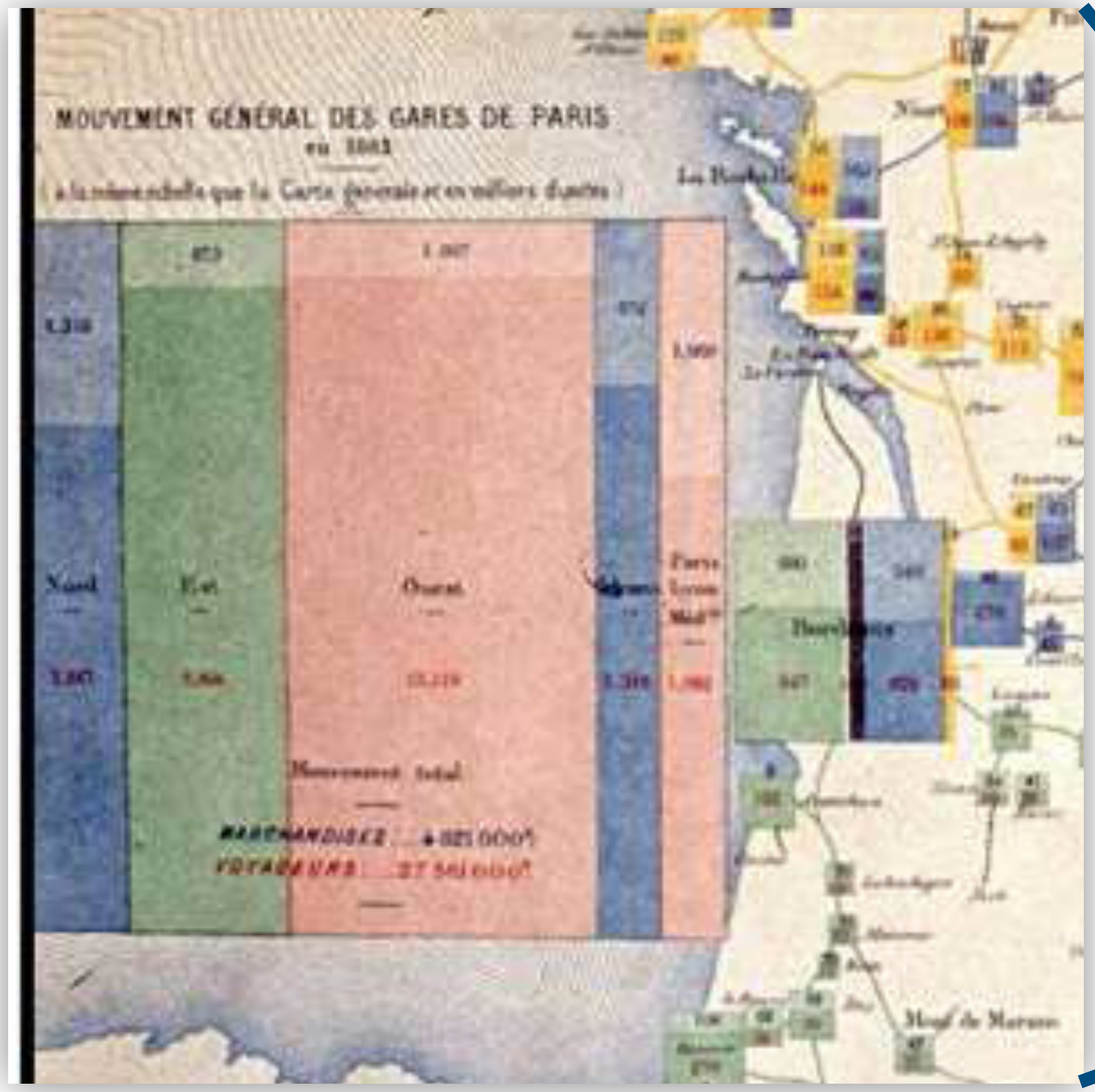
(Map Making)

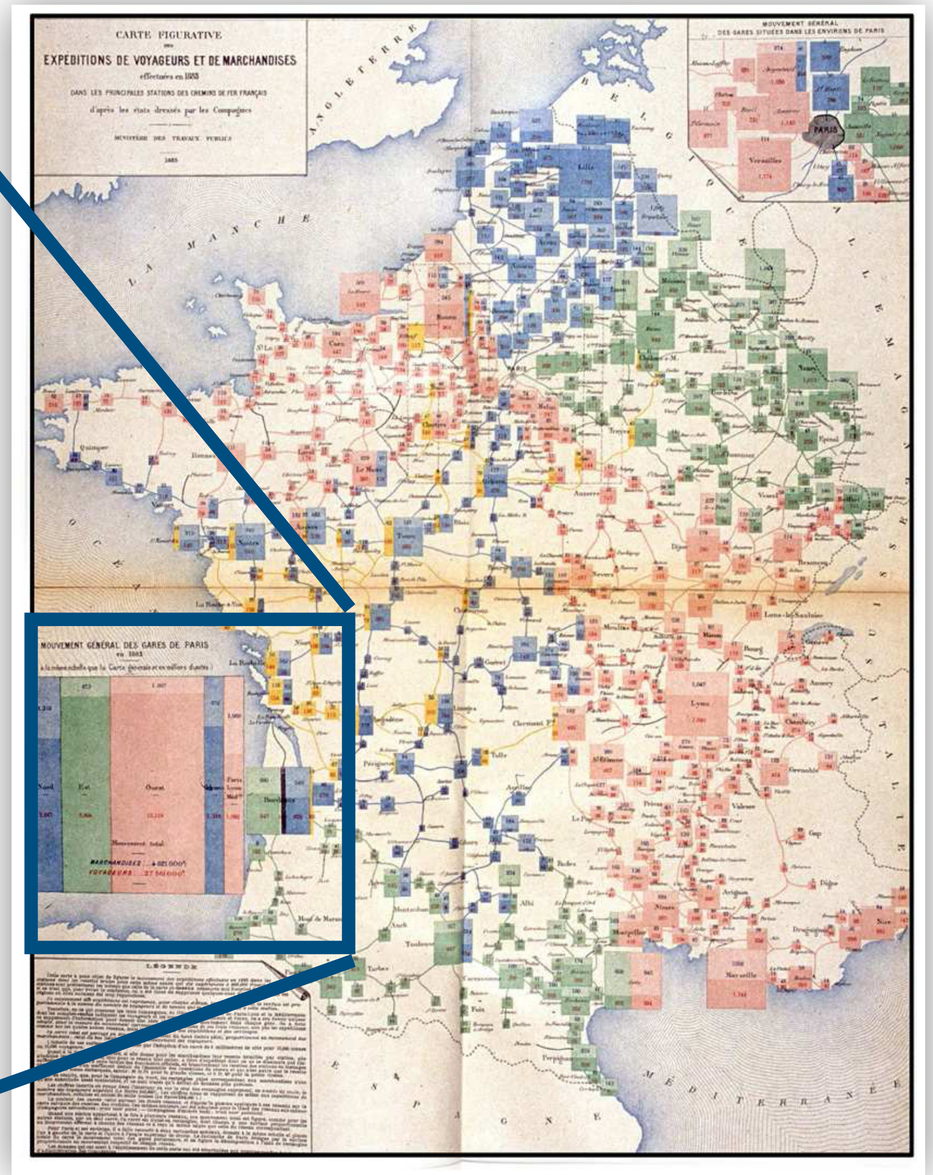
Oldest Known Map: Konya, Turkey (~6200 BC)



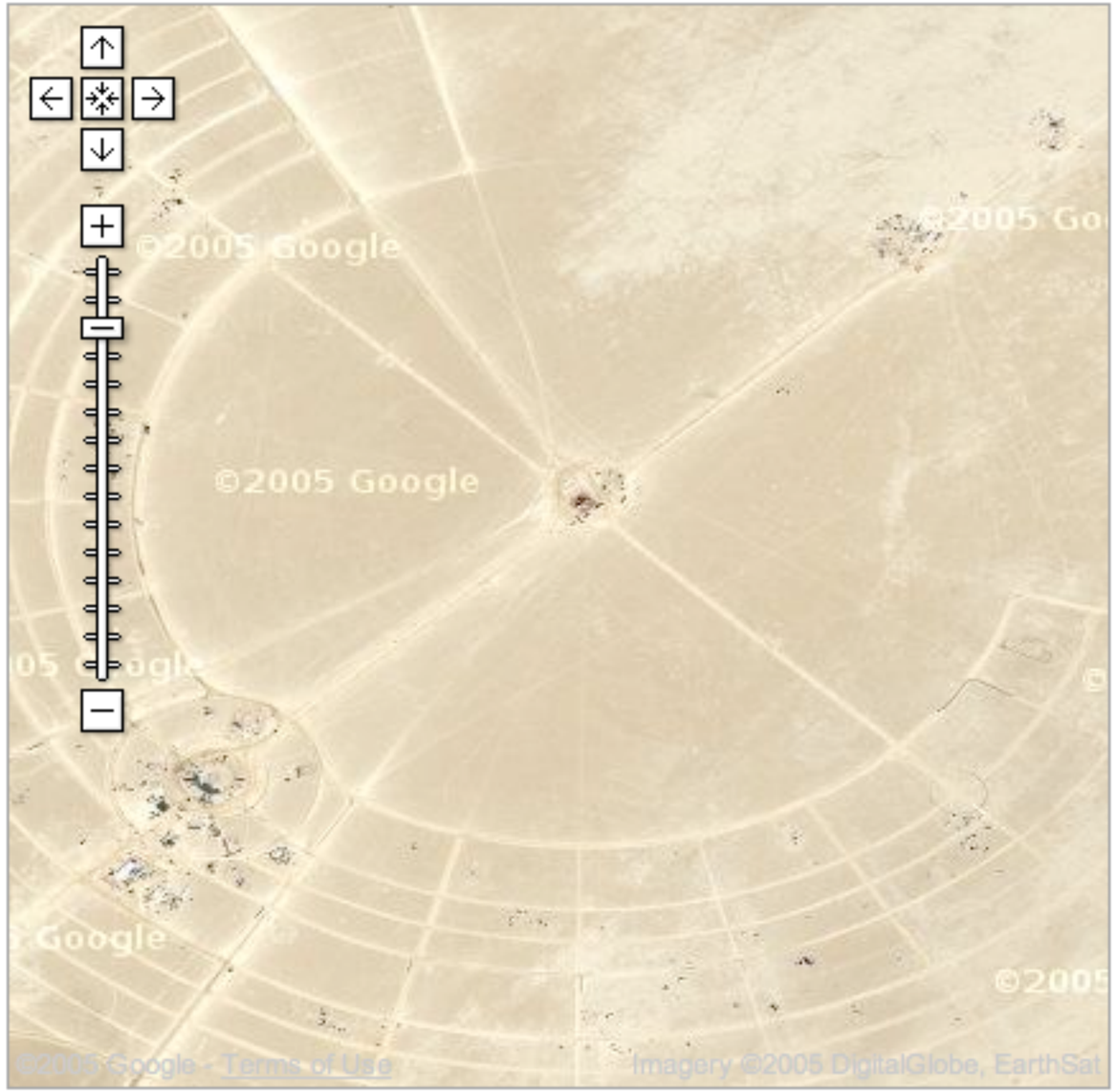


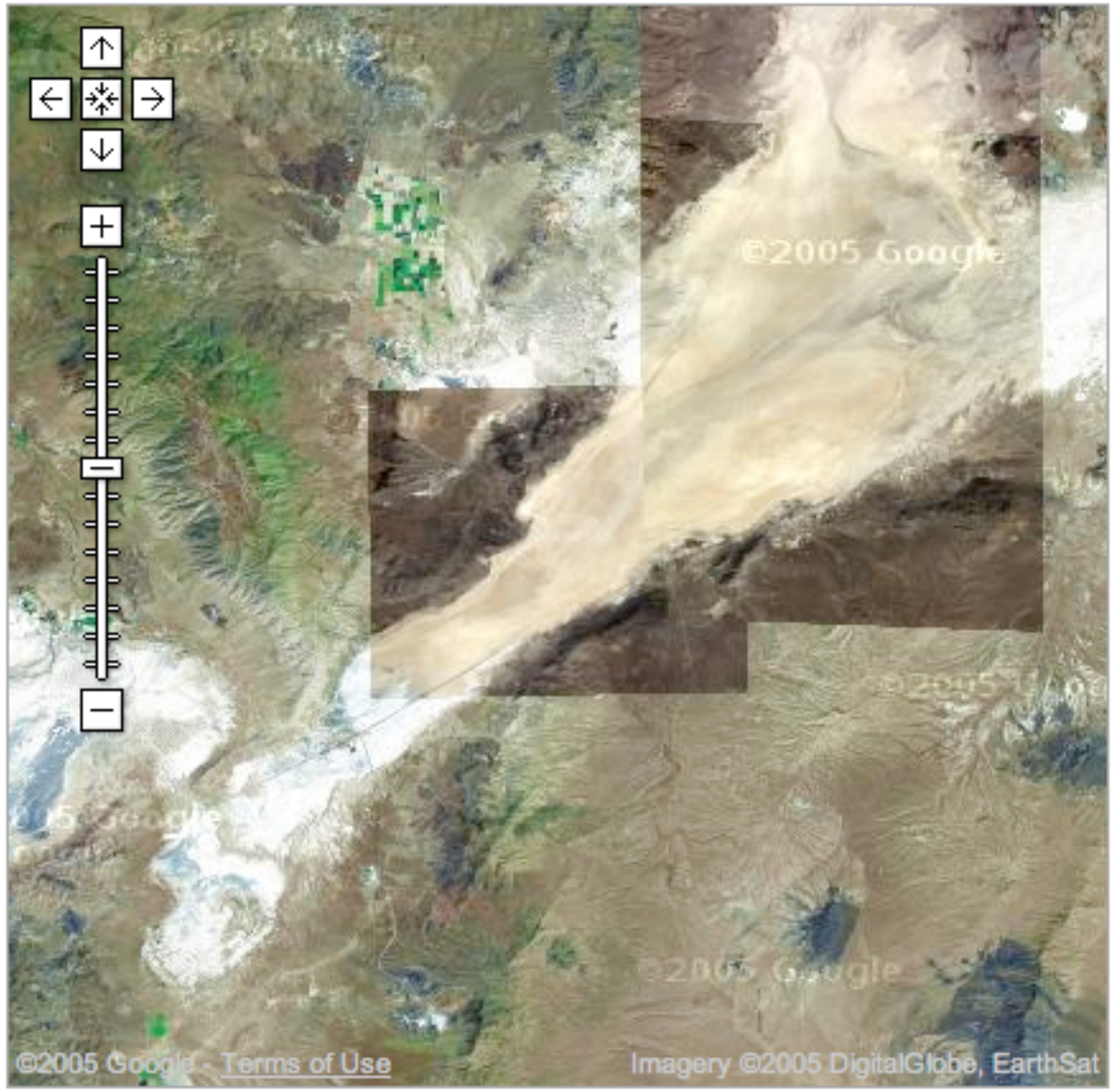
Rail Passengers and Freight from Paris 1884

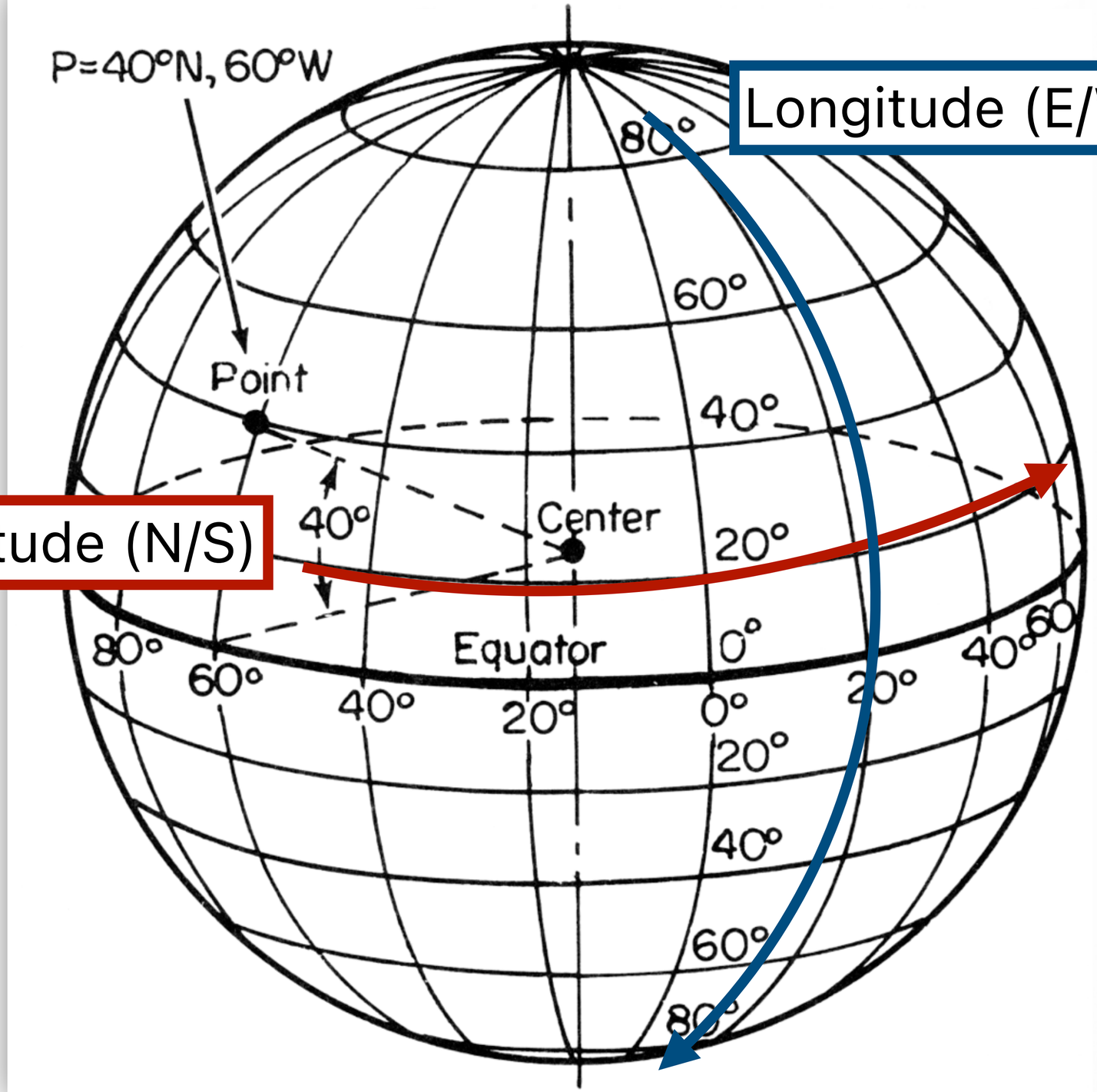




Google Maps, 2005







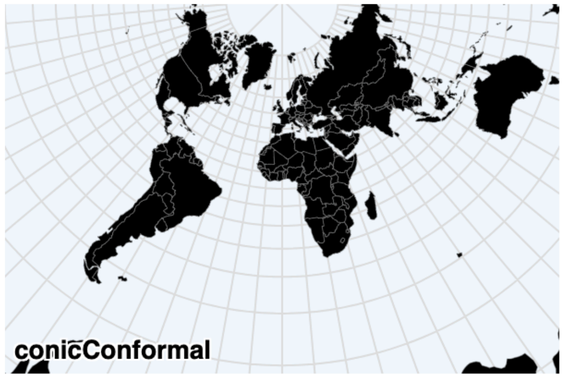
Longitude (E/W)

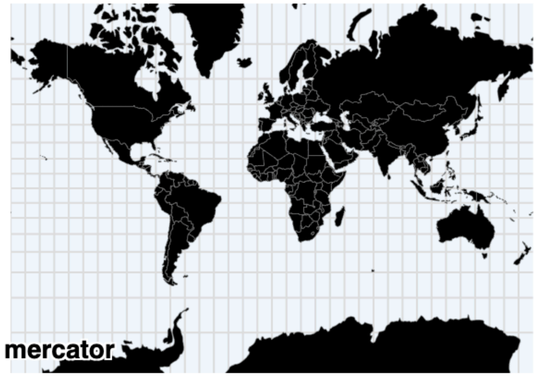
Latitude (N/S)

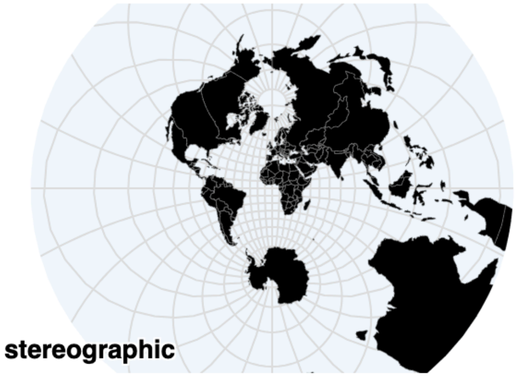
LONGitude lines are all long (some latitude lines are quite short!)

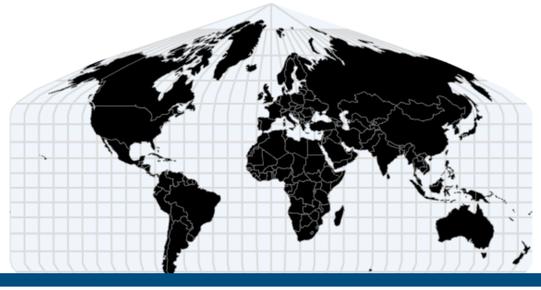
A sphere tears
when you flatten it

Exploring Projections





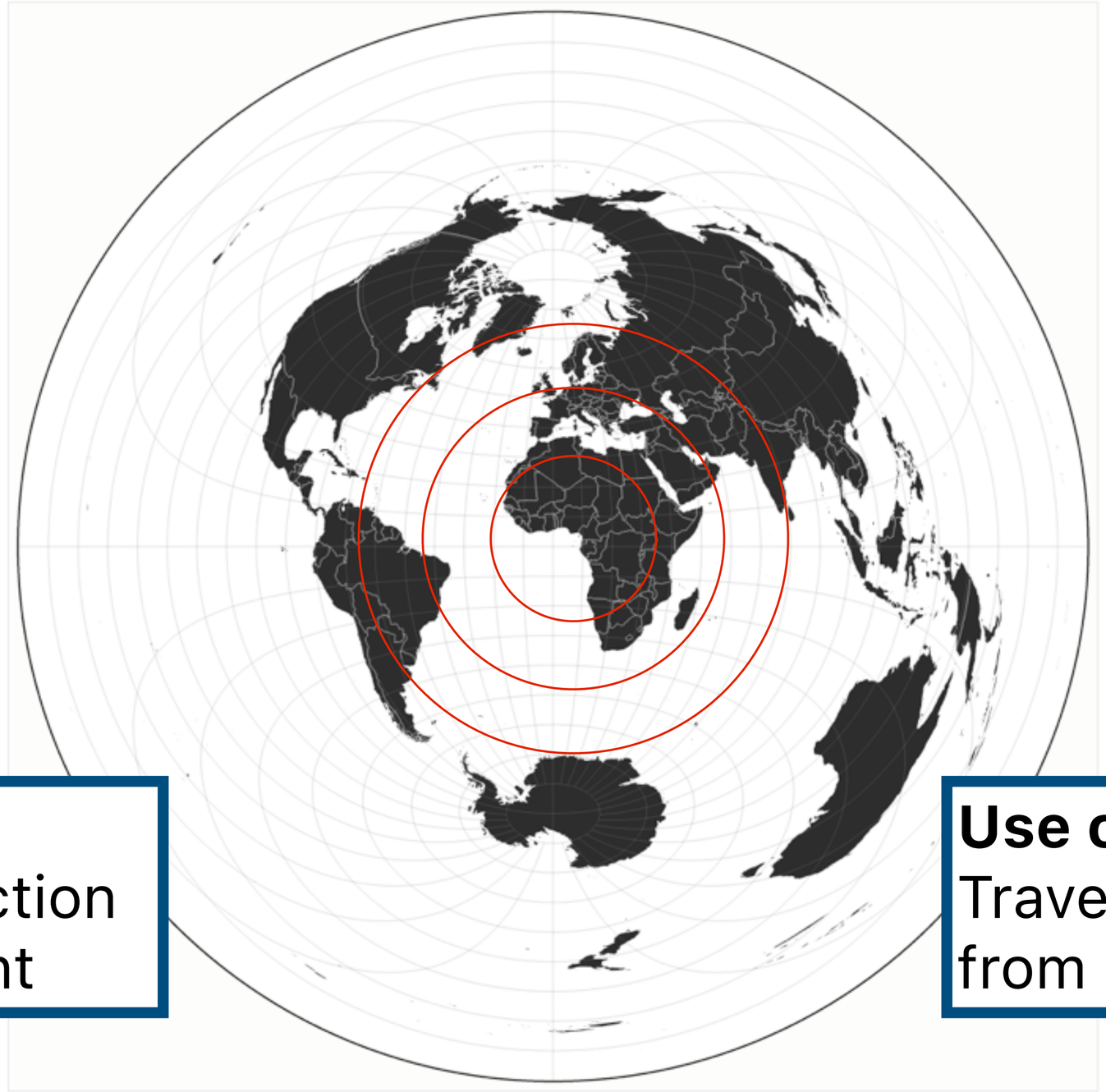




https://vega.github.io/vega/examples/projections/

Projections preserve some metrics, distort others

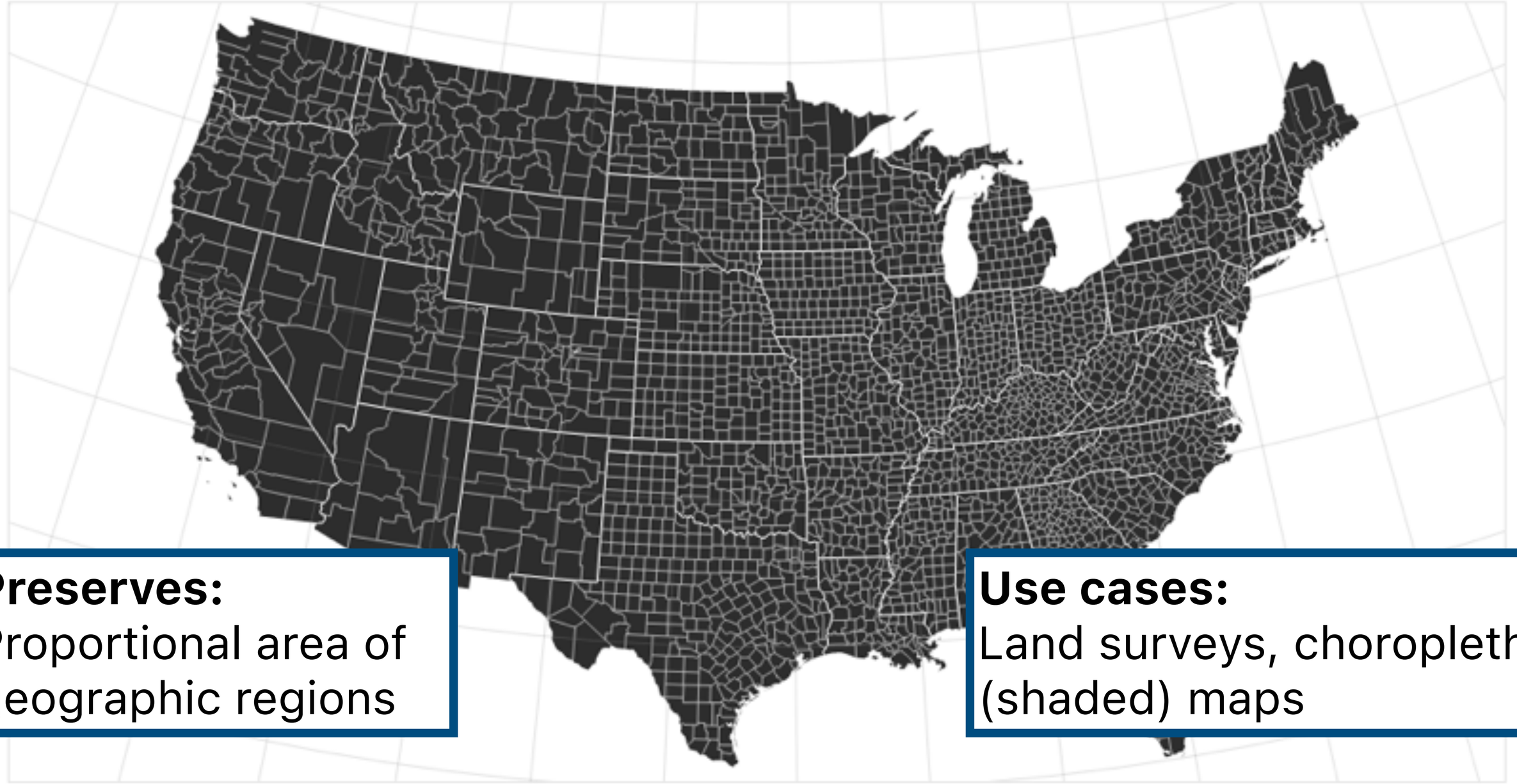
Azimuthal Equidistant



Preserves:
Distance & direction from center point

Use cases:
Travel / propagation from center point

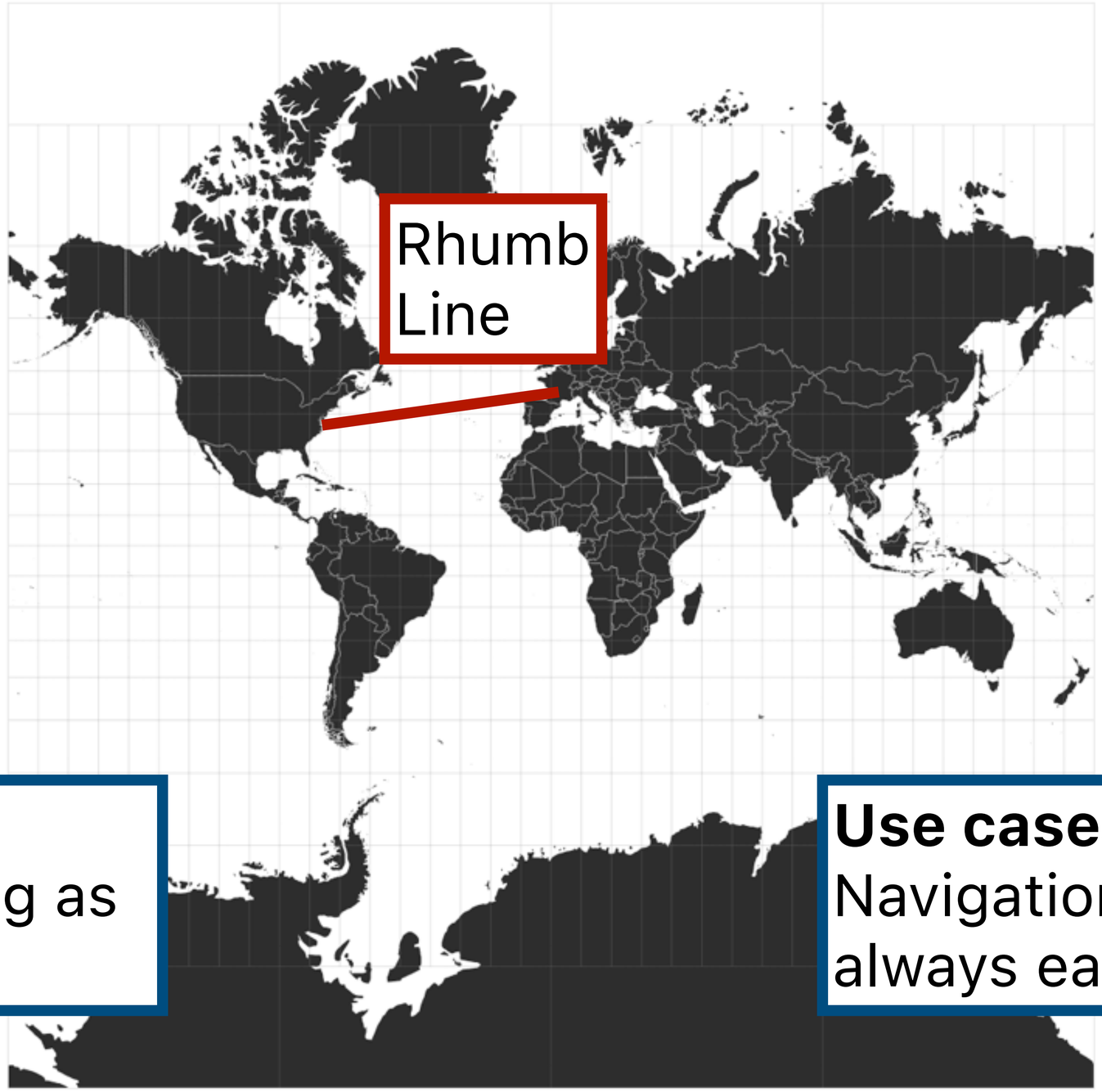
Albers Equal-Area Conic



Preserves:
Proportional area of geographic regions

Use cases:
Land surveys, choropleth (shaded) maps

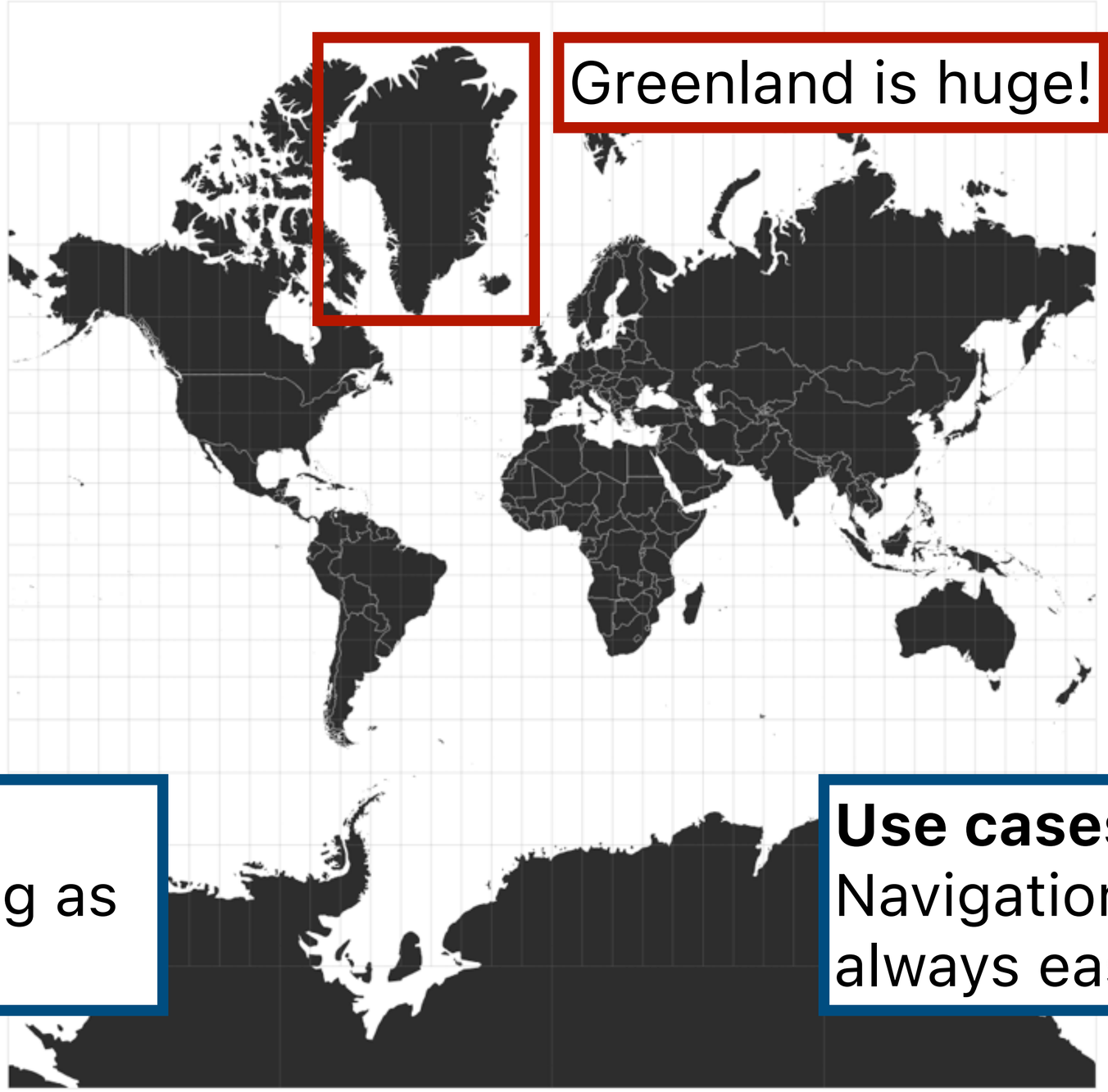
Spherical Mercator



Preserves:
Compass bearing as straight line

Use cases:
Navigation (left / right is always east / west)

Spherical Mercator

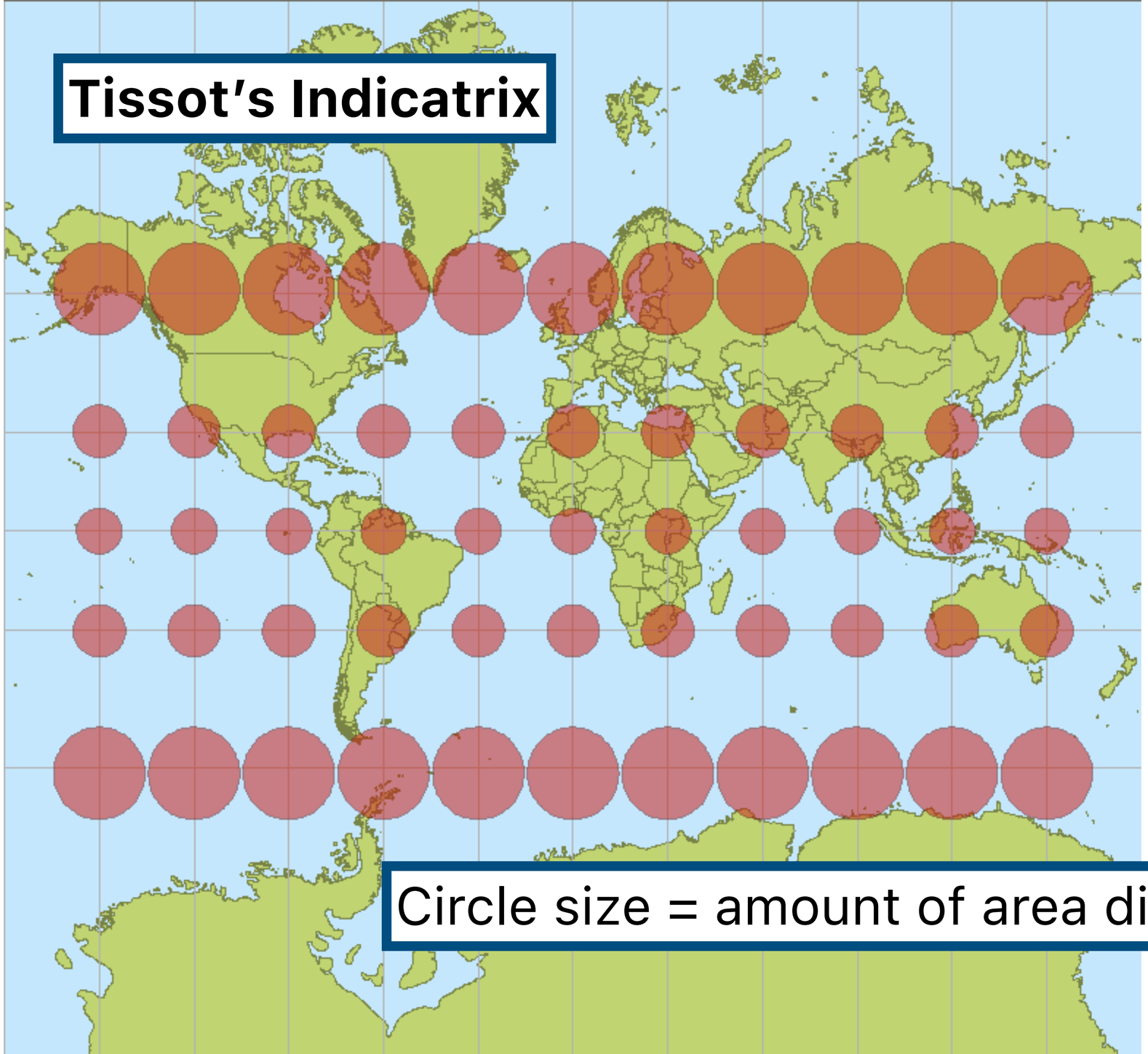


Greenland is huge!

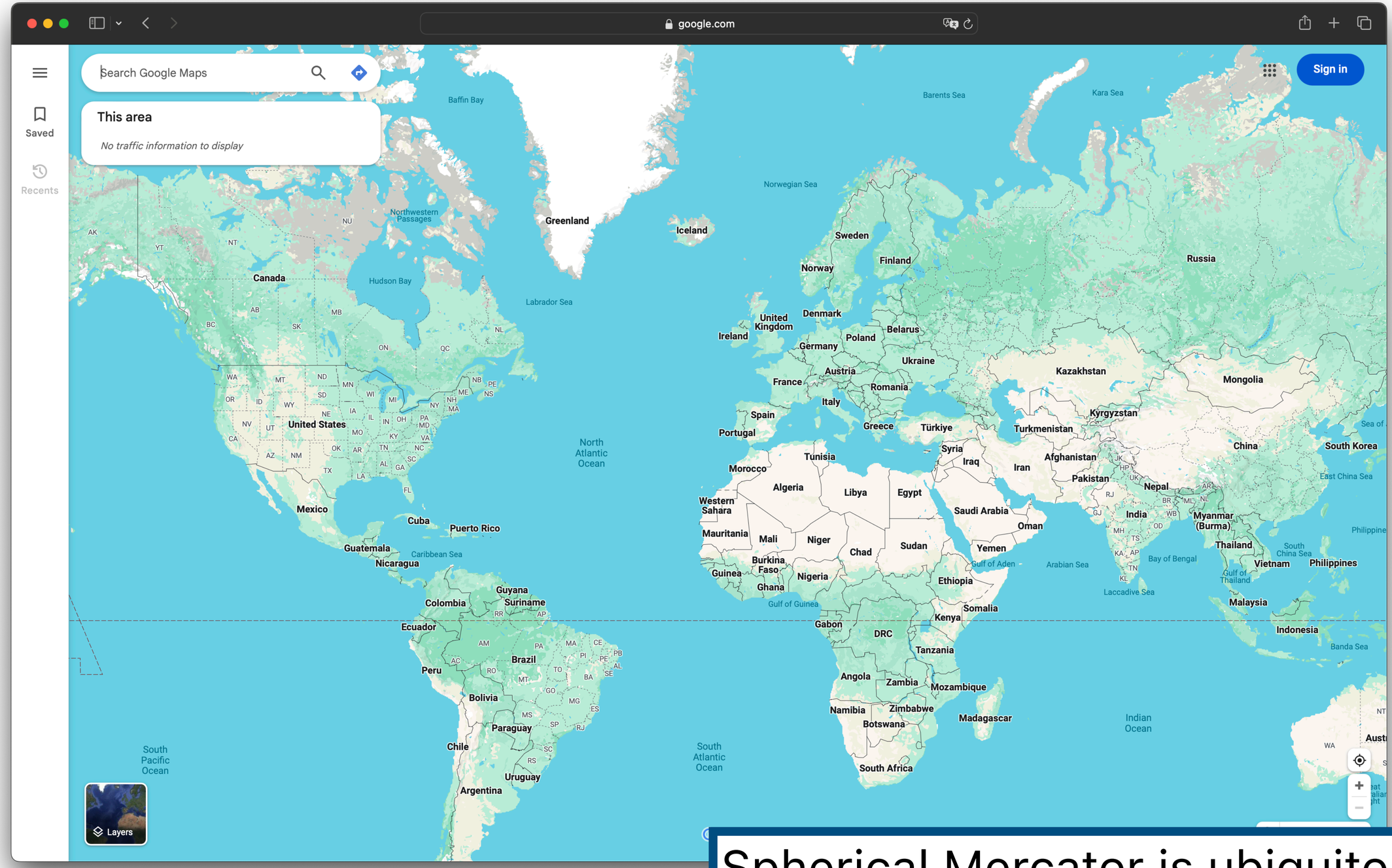
Preserves:
Compass bearing as straight line

Use cases:
Navigation (left / right is always east / west)

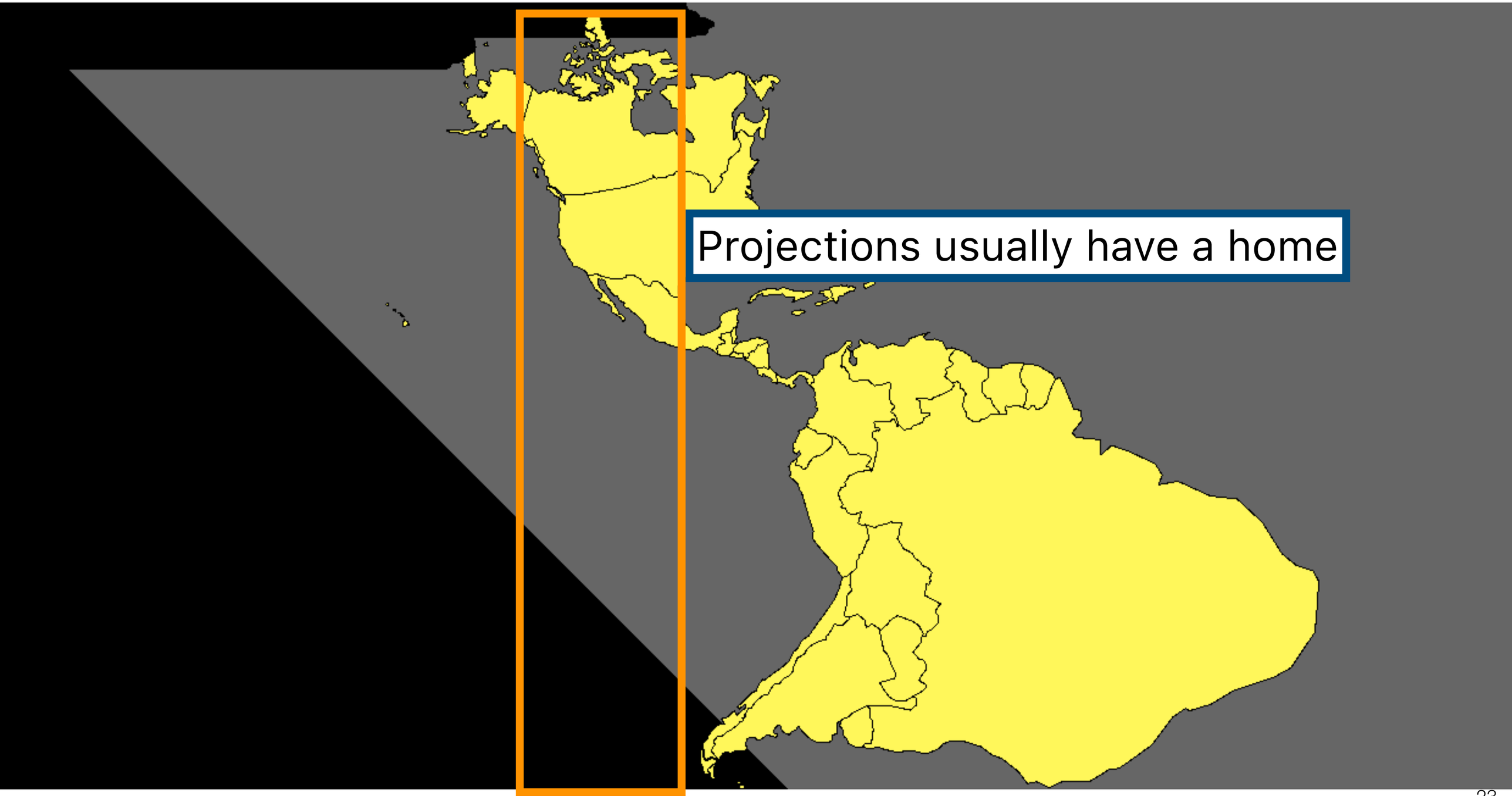
Tissot’s Indicatrix



Circle size = amount of area distortion



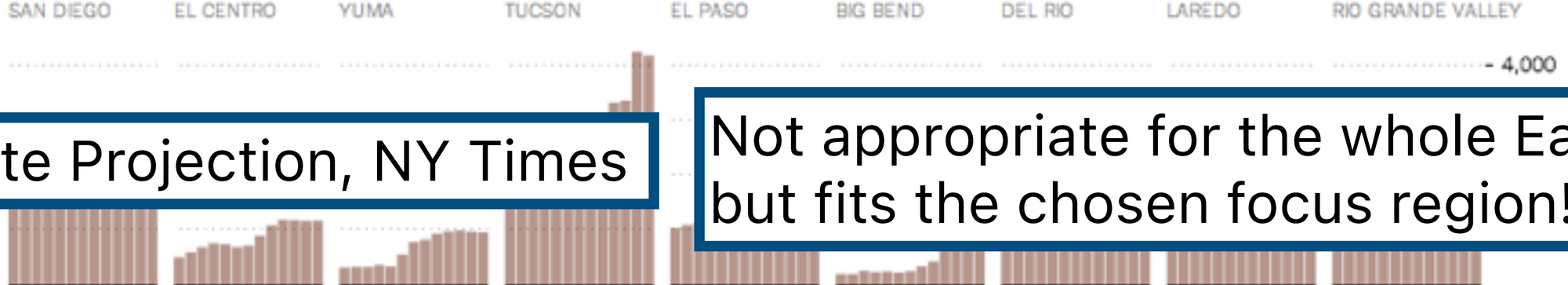
Spherical Mercator is ubiquitous on web


Projections usually have a home

Increased Border Enforcement, With Varying Results

There are now more agents along the 1,954 mile-long border than ever before...

Border agents per sector.



Satellite Projection, NY Times

Not appropriate for the whole Earth, but fits the chosen focus region!

WHAT YOUR FAVORITE

MAP PROJECTION

SAYS ABOUT YOU

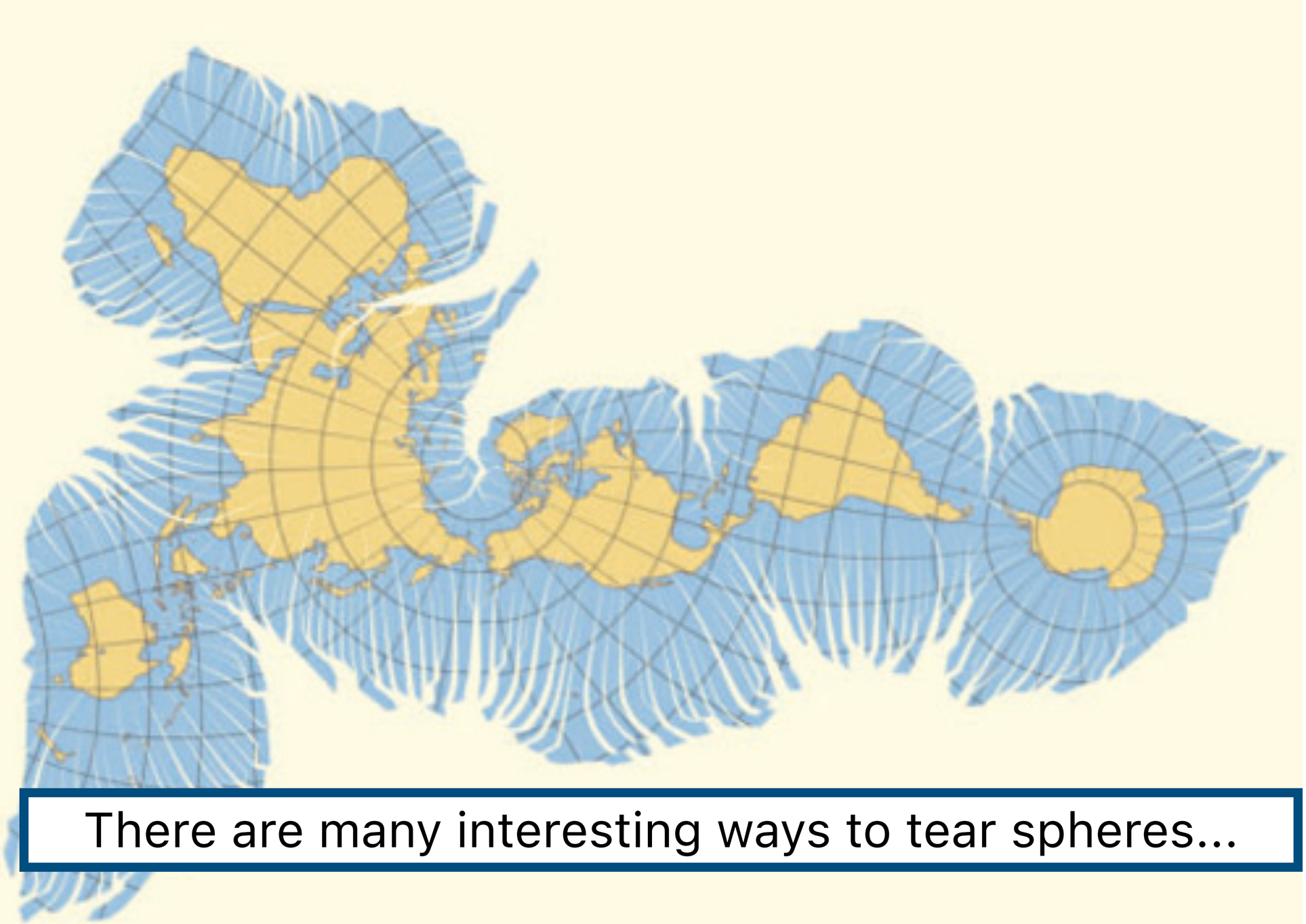
http://xkcd.com/977

MERCATOR

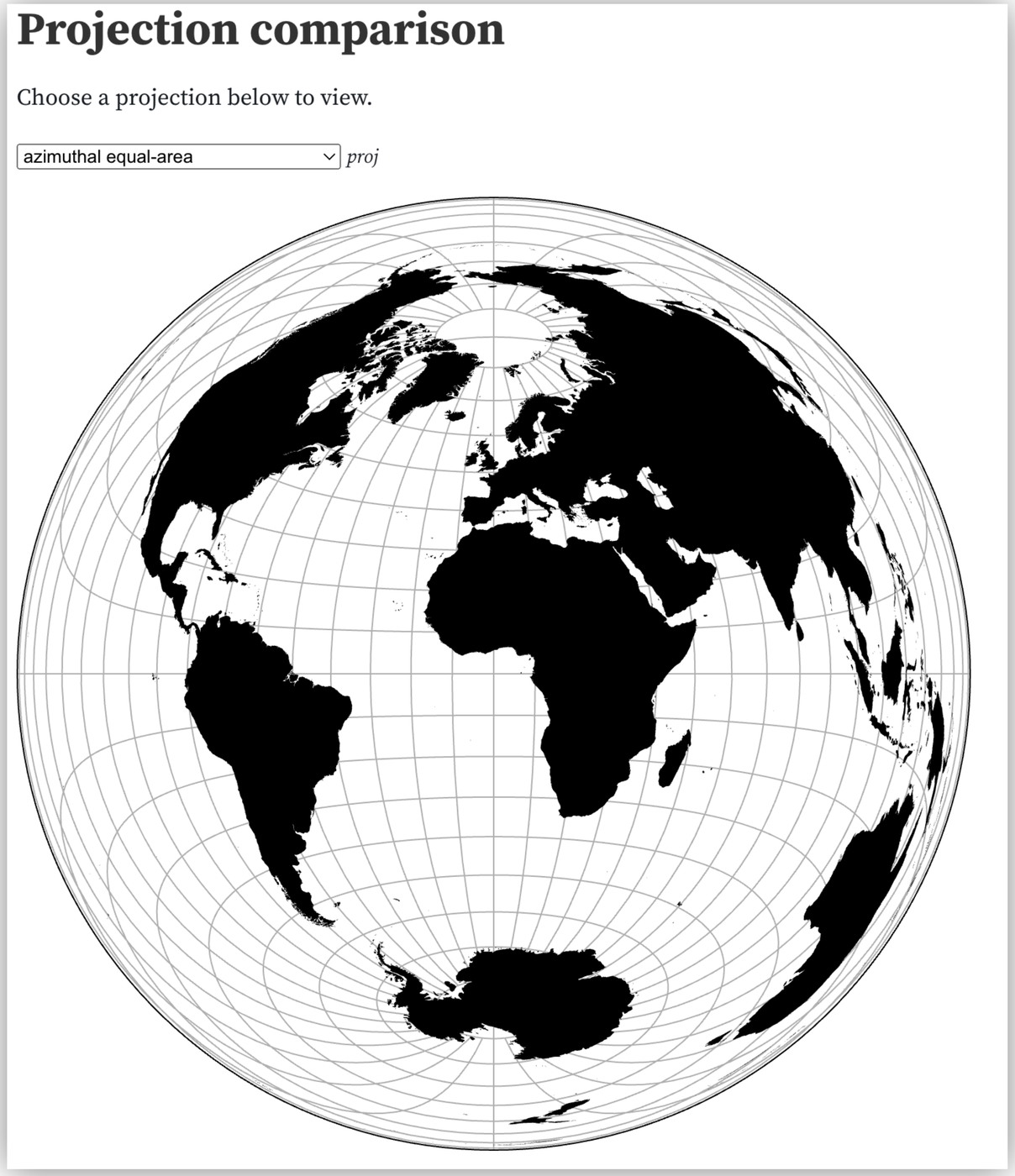
YOU'RE NOT REALLY INTO MAPS.

VAN DER GRINTEN

YOU'RE NOT A COMPLICATED PERSON. YOU LOVE THE MERCATOR PROJECTION; YOU JUST WISH IT WEREN'T SQUARE. THE EARTH'S NOT A SQUARE, IT'S A CIRCLE. YOU LIKE CIRCLES. TODAY IS GONNA BE A GOOD DAY!



There are many interesting ways to tear spheres...



https://bit.ly/d3-proj

Respond with this format:

projection:
pros:
cons:

tryclassbuzz.com
Code: **proj**

Mapping

(Visualizing Geospatial Data)

How does the data change?

Where does the data occur?

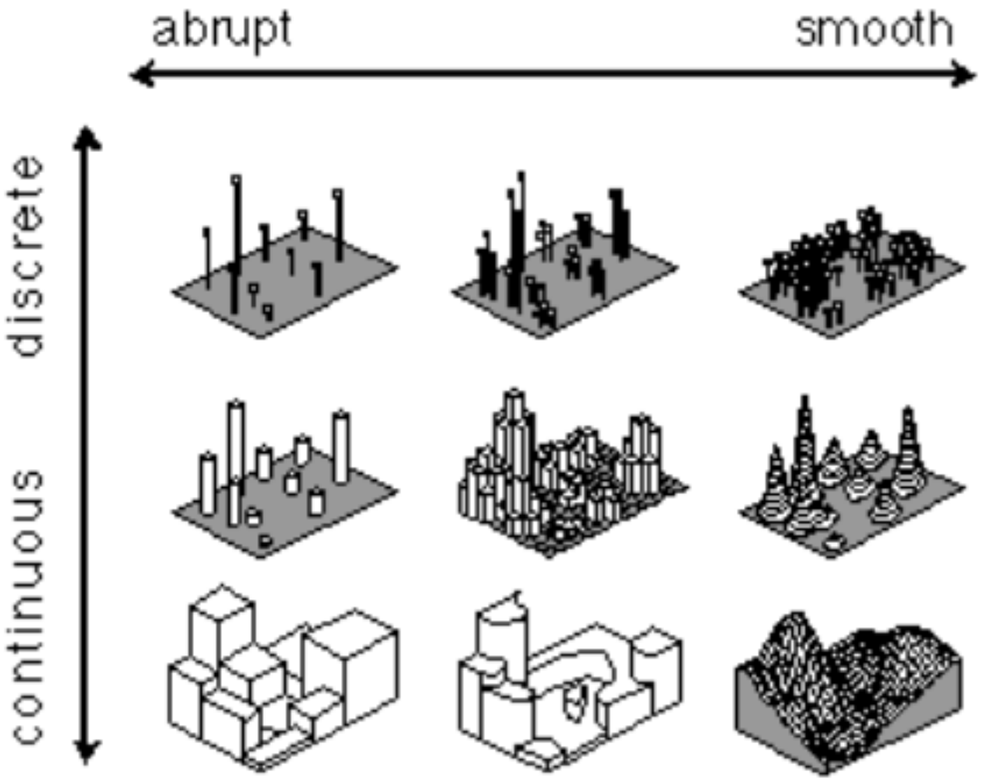


Fig. 8. Data models representing points in the continuity-abruptness phenomena space.

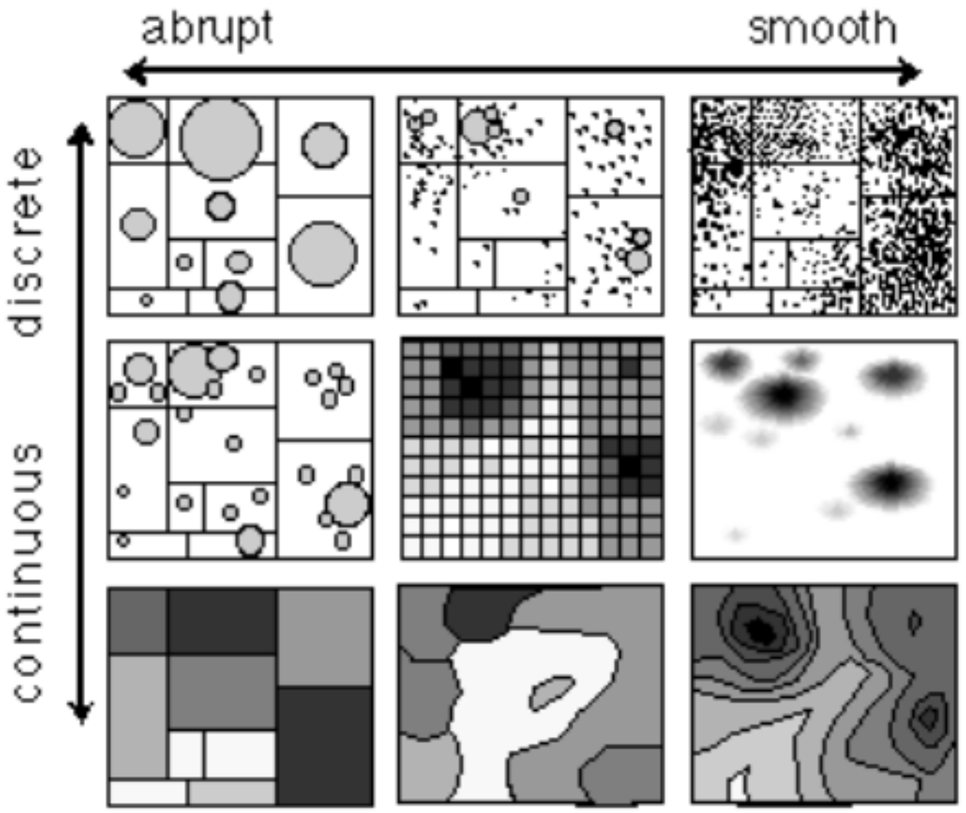


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.

[MacEachren. Visualizing Uncertain Information. 1992]

Dot Distribution Map

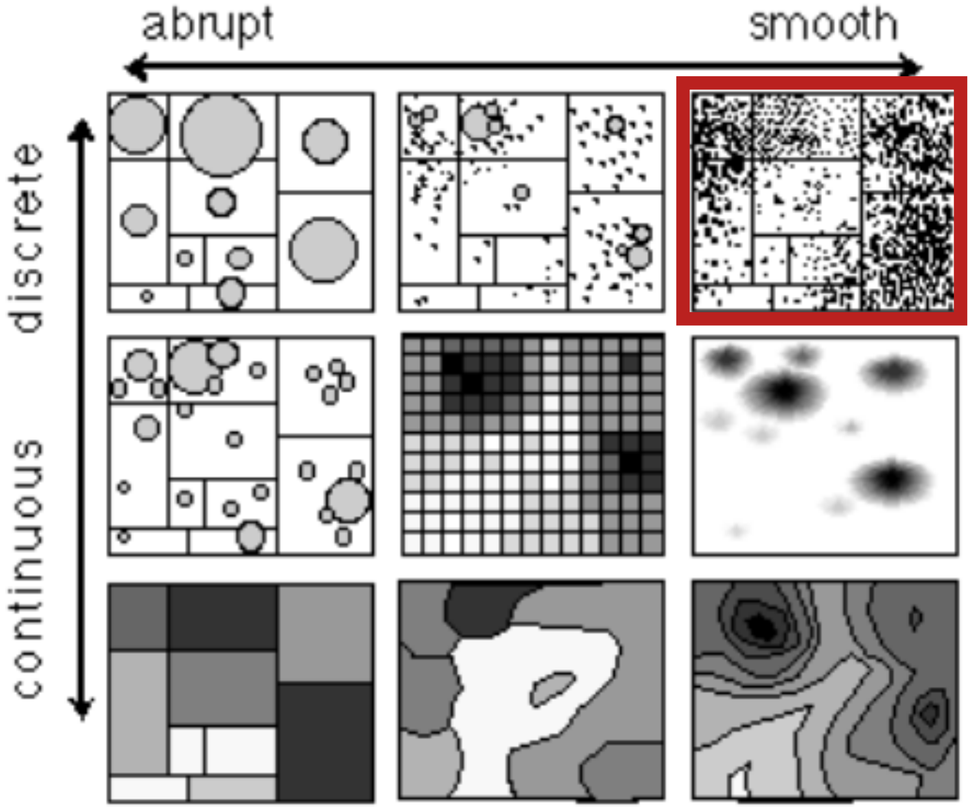
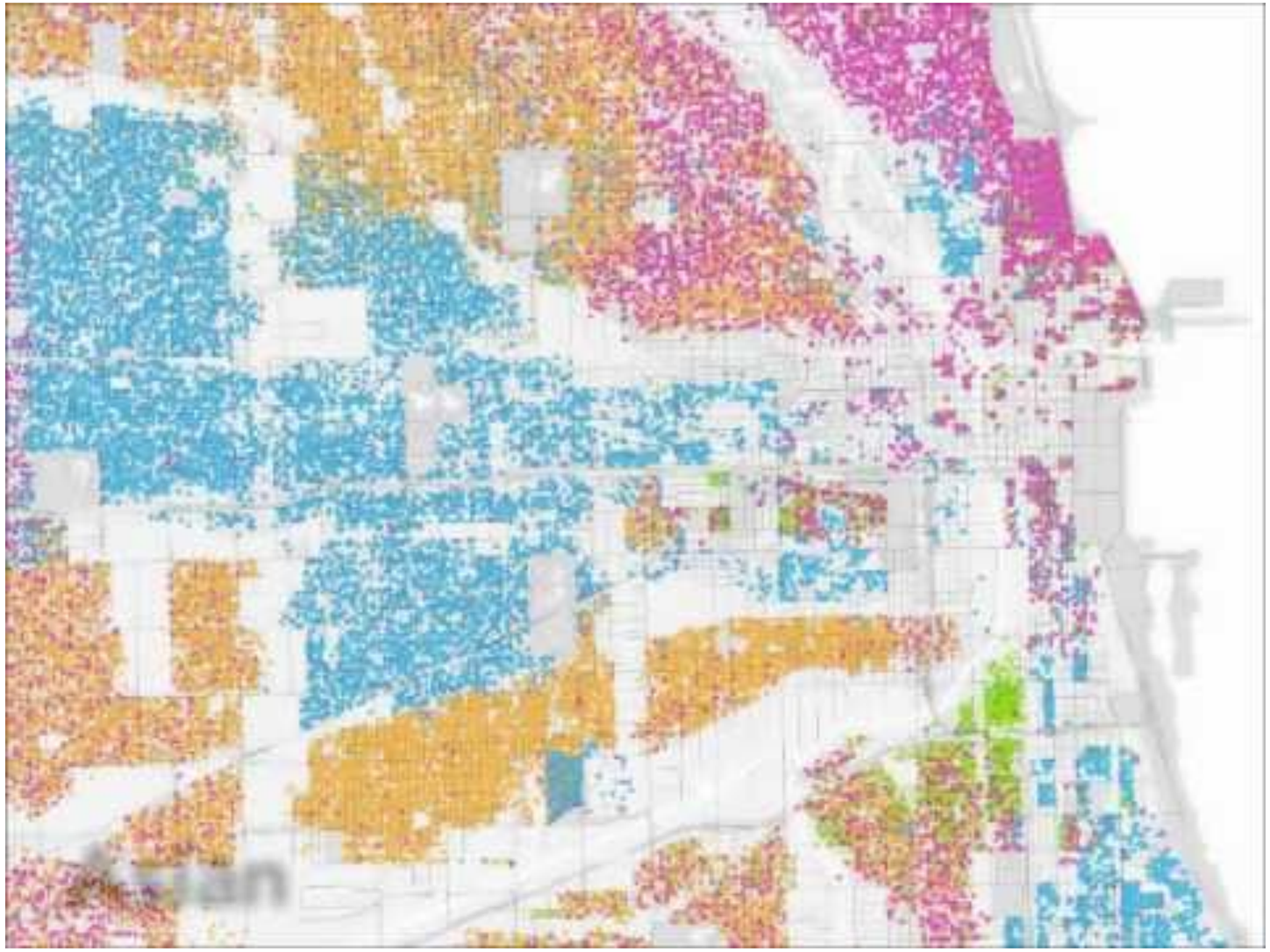


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



https://www.youtube.com/watch?v=8pRcdMVkA3k

Dot Distribution Map

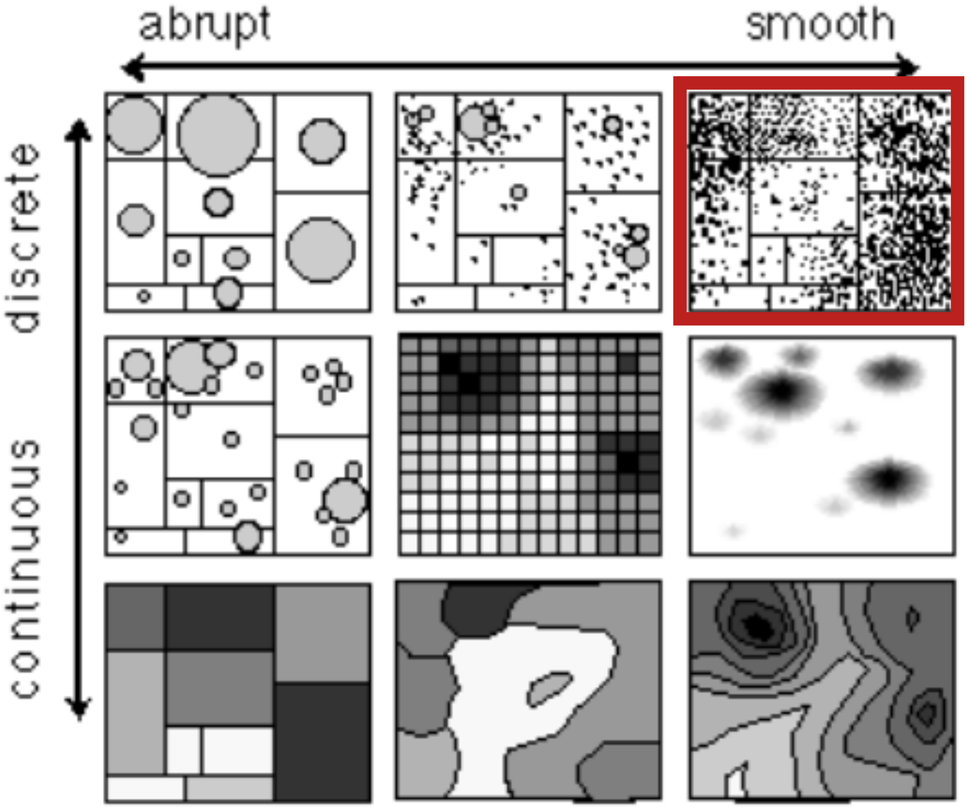
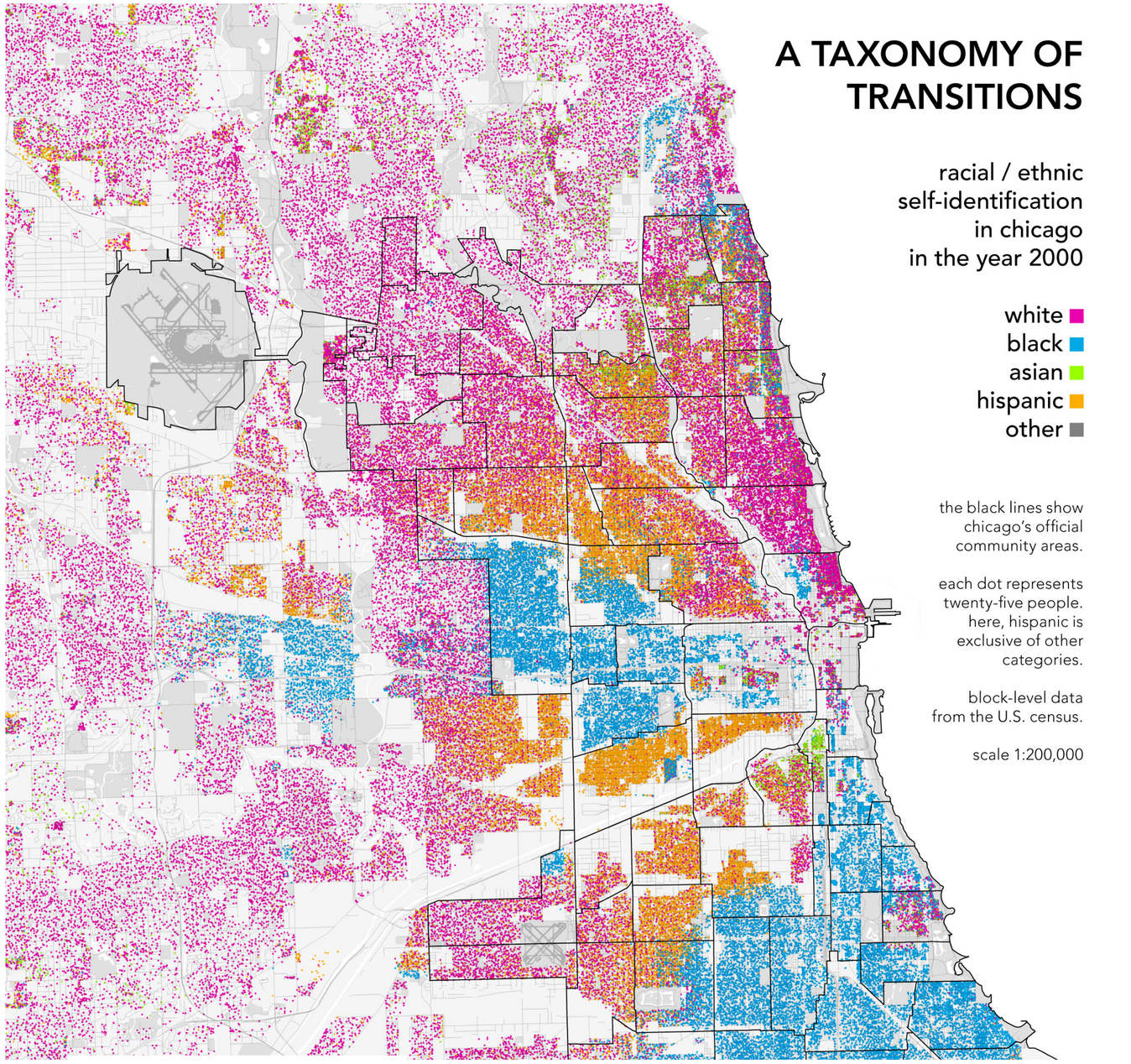


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



Dot Distribution Map

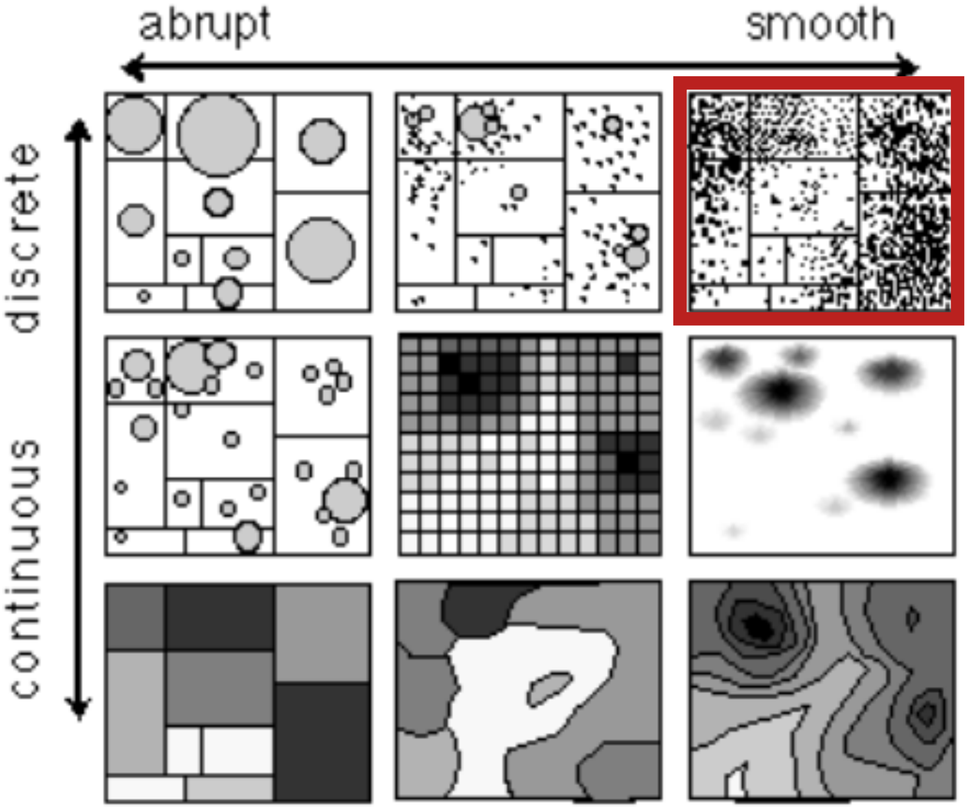
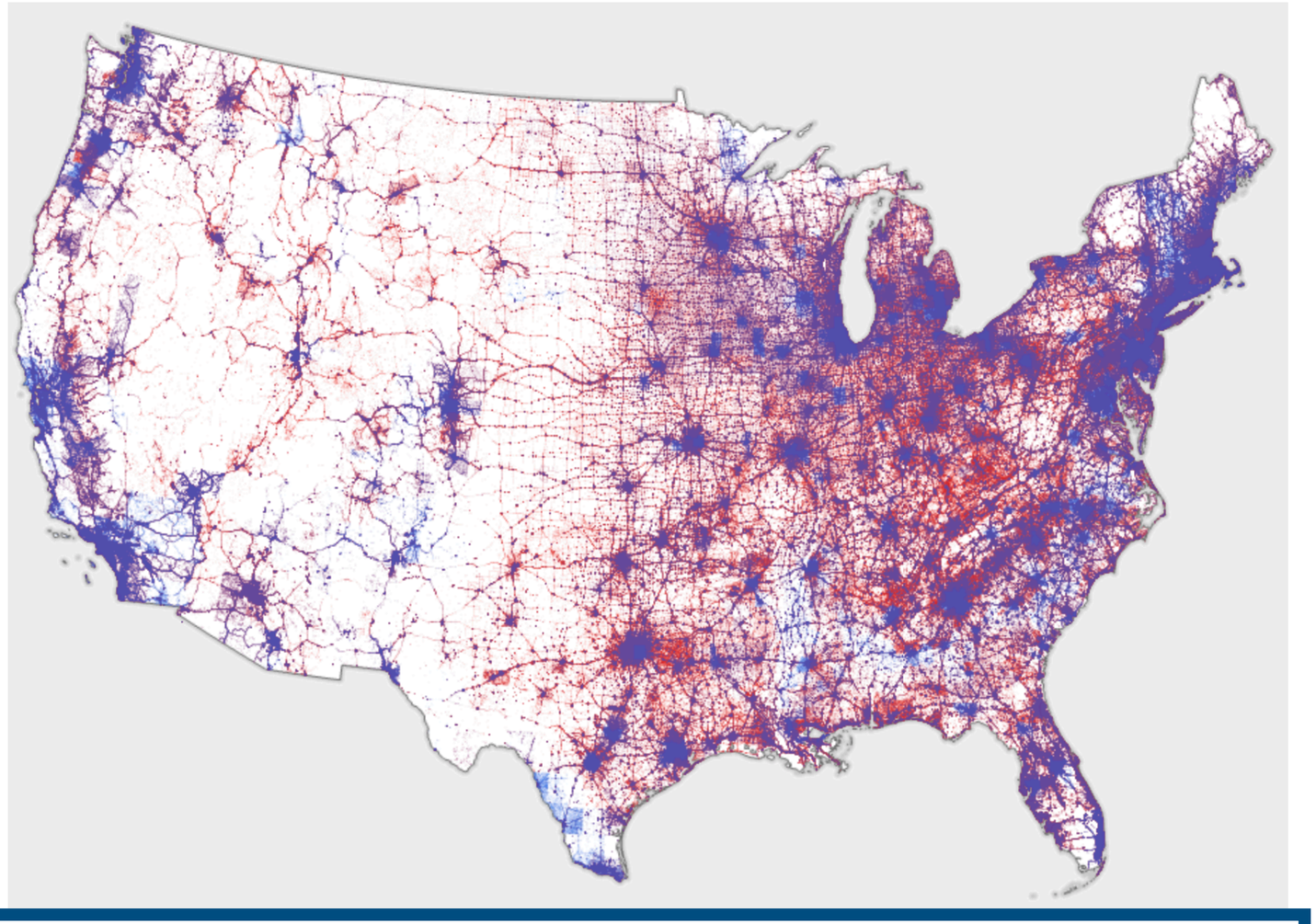


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



Votes cast in the 2016 Presidential Election

Dot Distribution Map

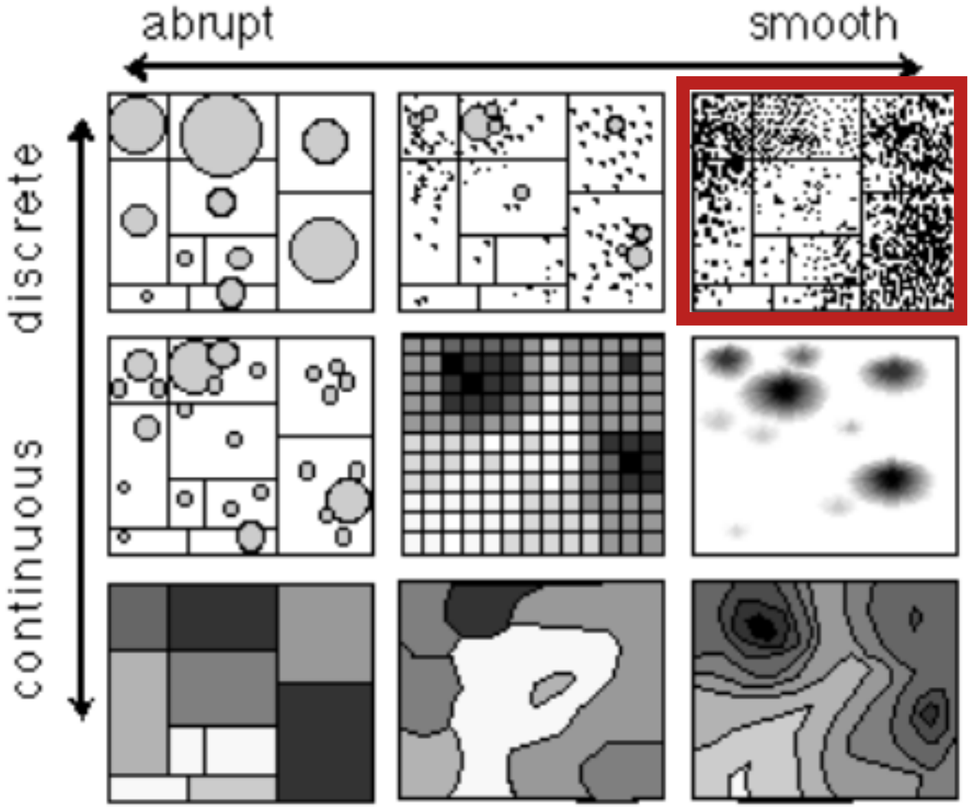
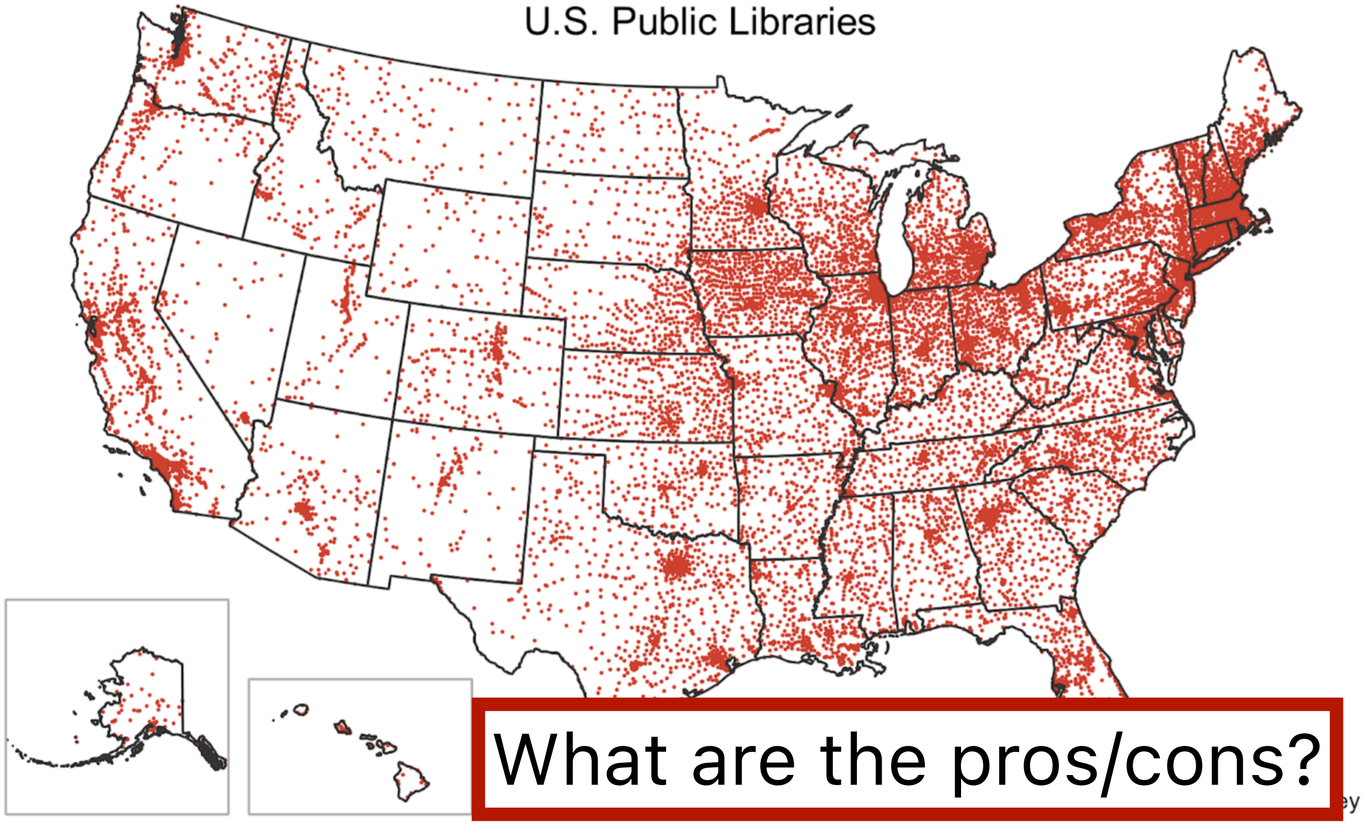


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



What are the pros/cons?

tryclassbuzz.com
Code: **dots**

Dot Distribution Map

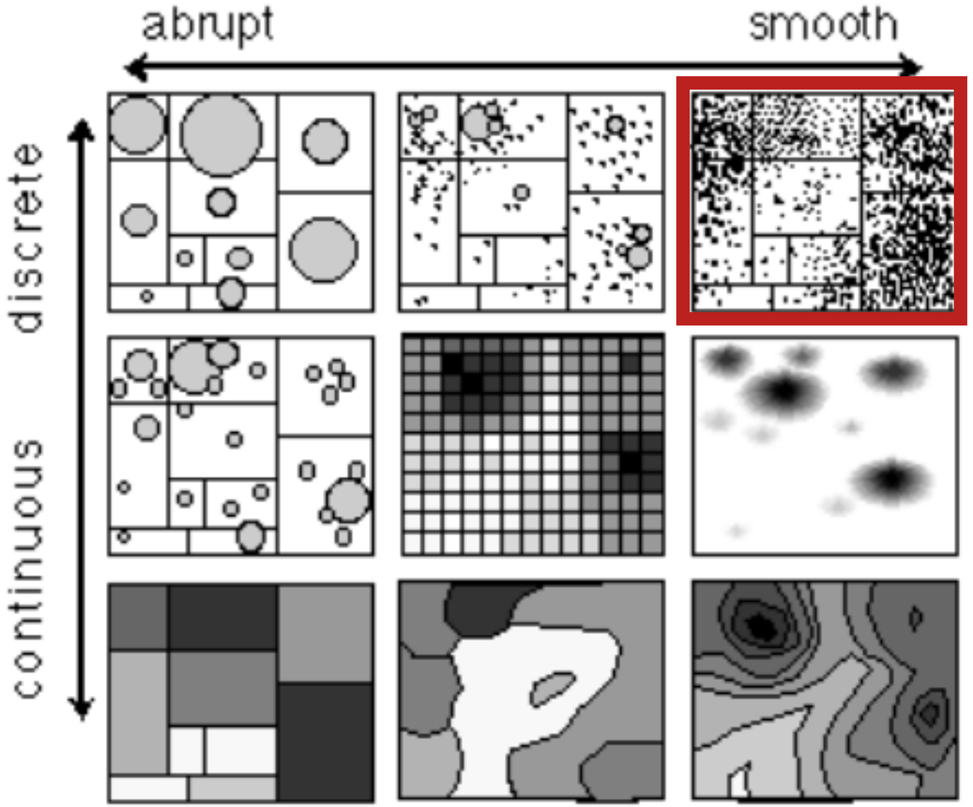
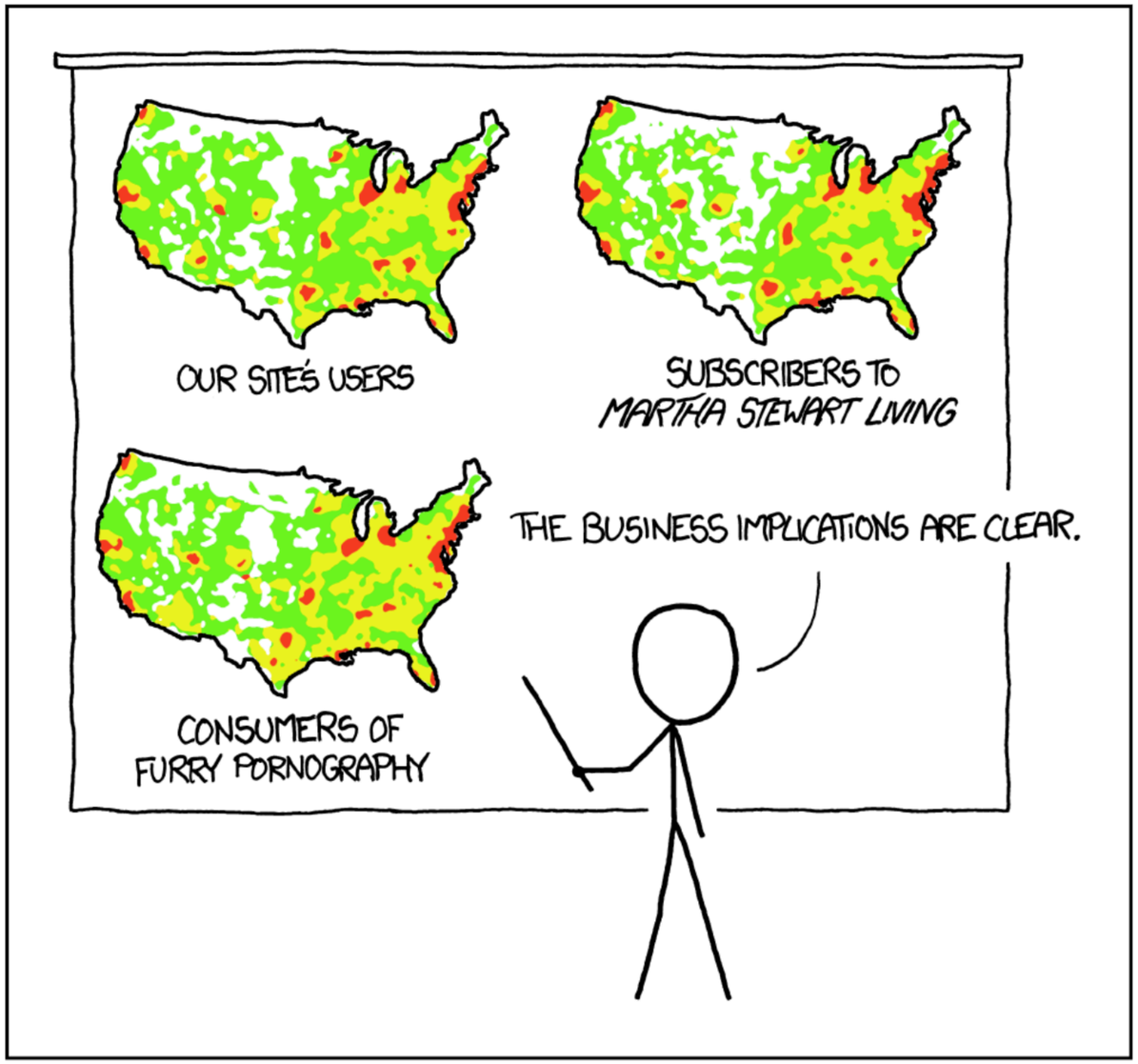


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



PET PEEVE #208:
GEOGRAPHIC PROFILE MAPS WHICH ARE BASICALLY JUST POPULATION MAPS

Proportional Symbol Map

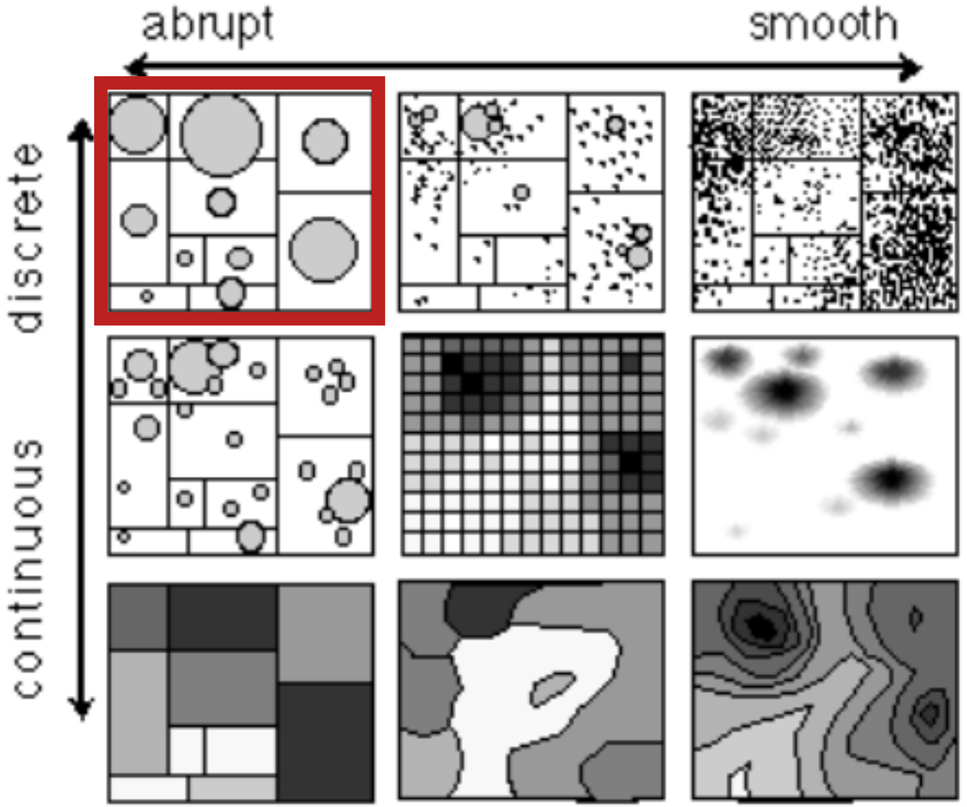
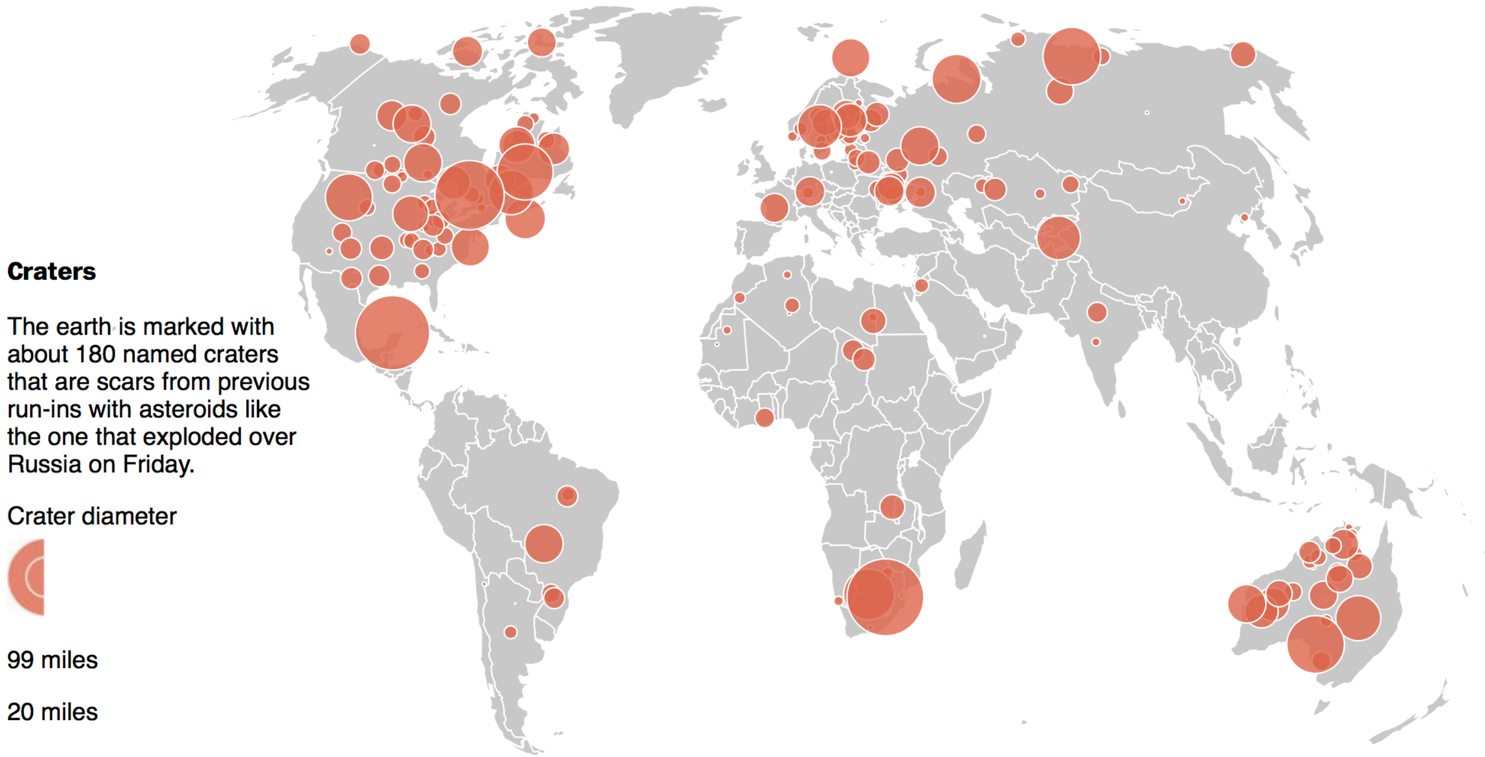


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



http://www.washingtonpost.com/wp-srv/special/world/russia-meteor/index.html

Proportional Symbol Map

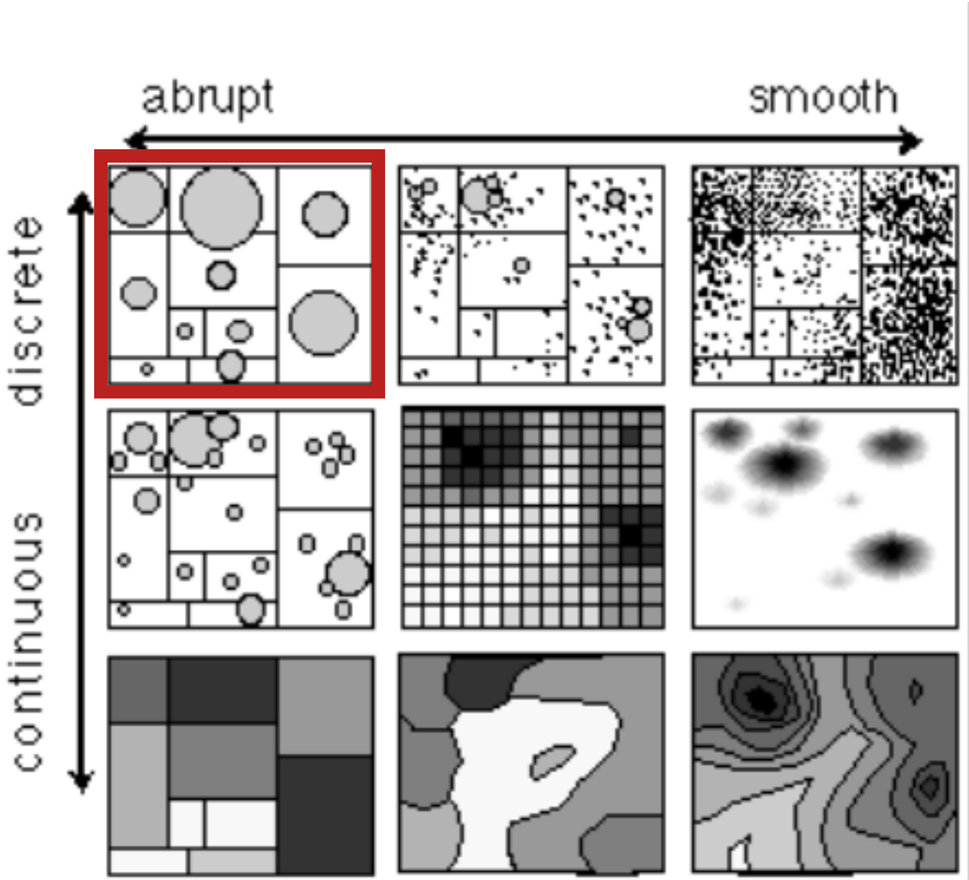
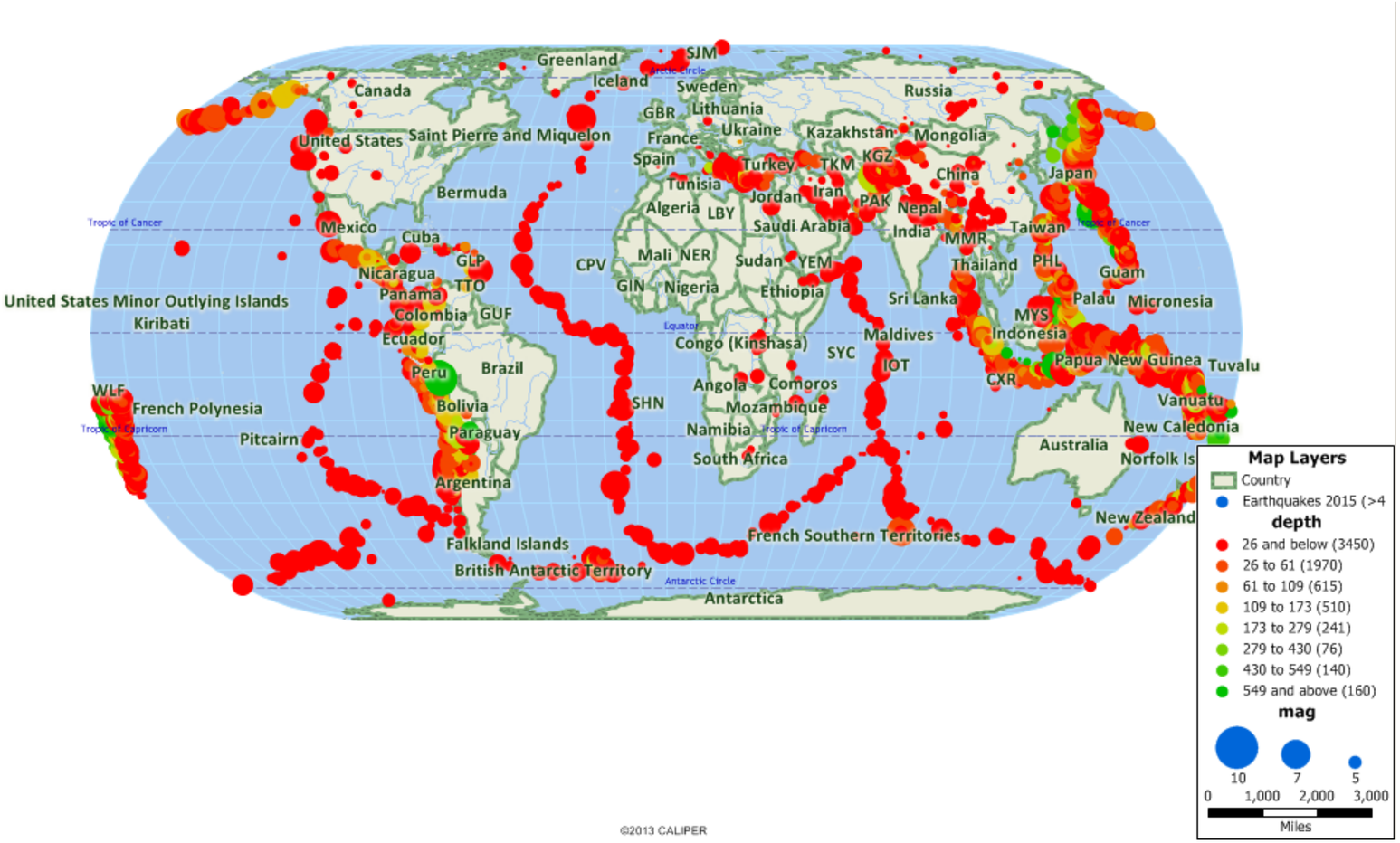


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



Graduated Symbol Map

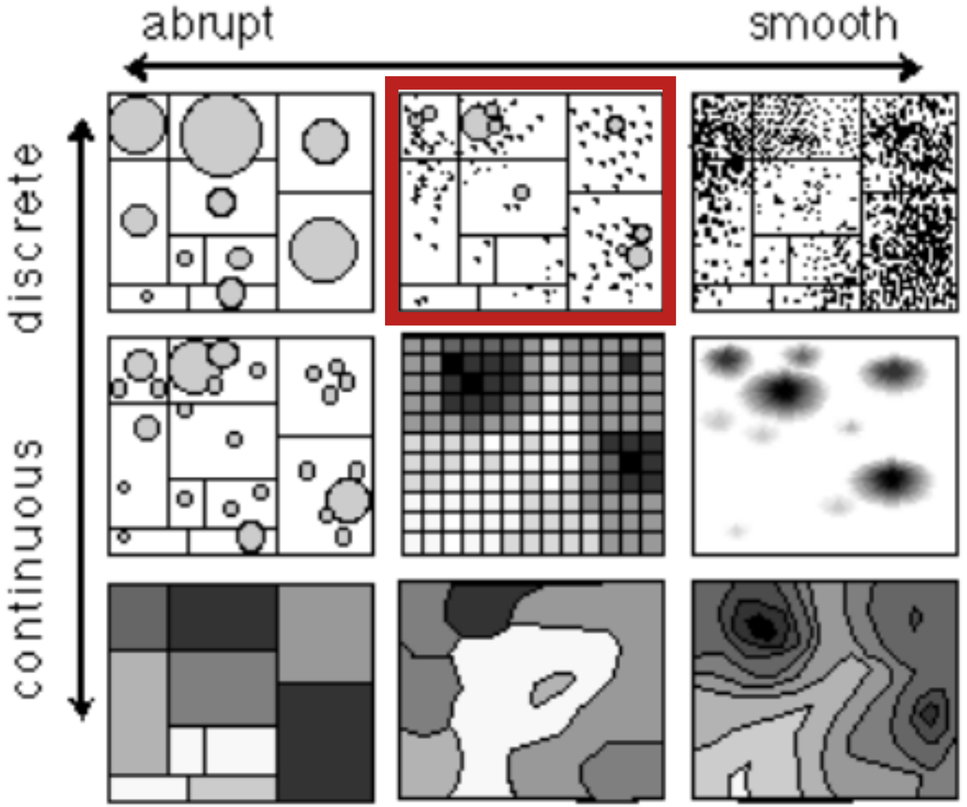
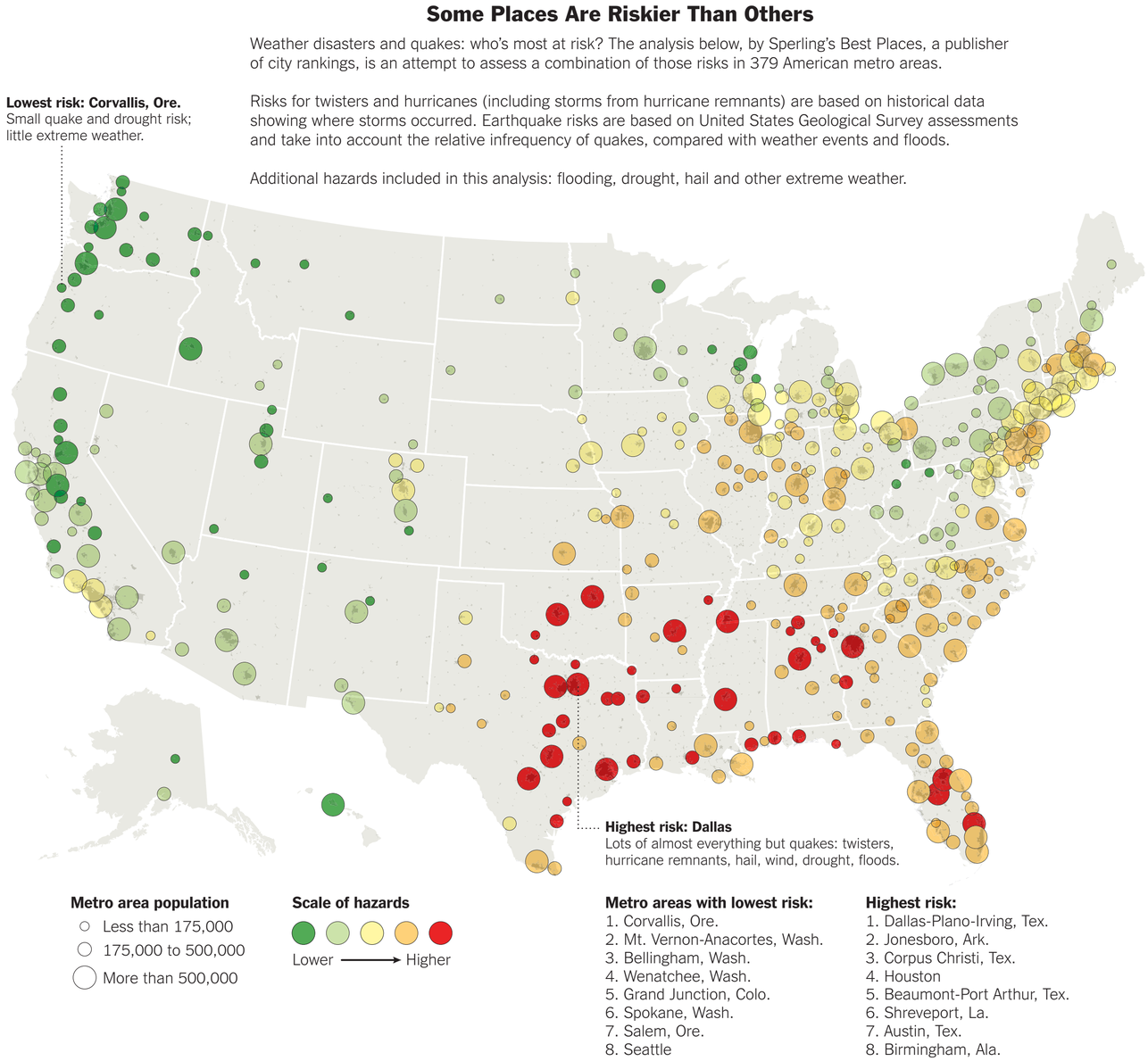


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



https://archive.nytimes.com/www.nytimes.com/interactive/2011/05/01/weekinreview/01safe.html?_r=0

Graduated Symbol Map

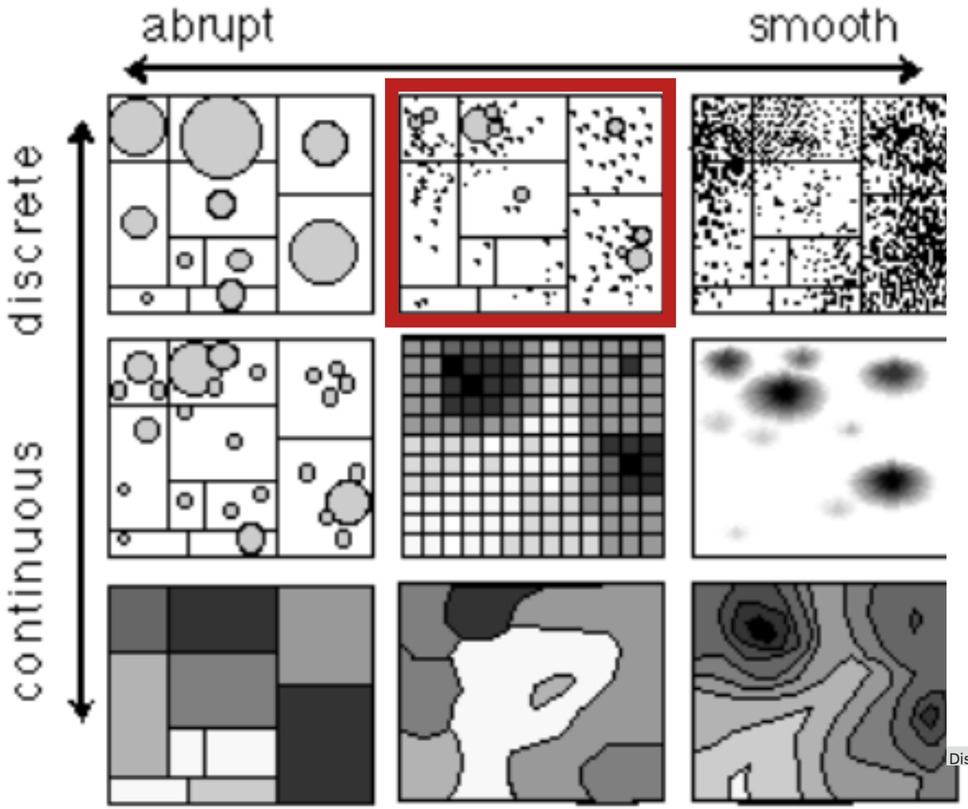
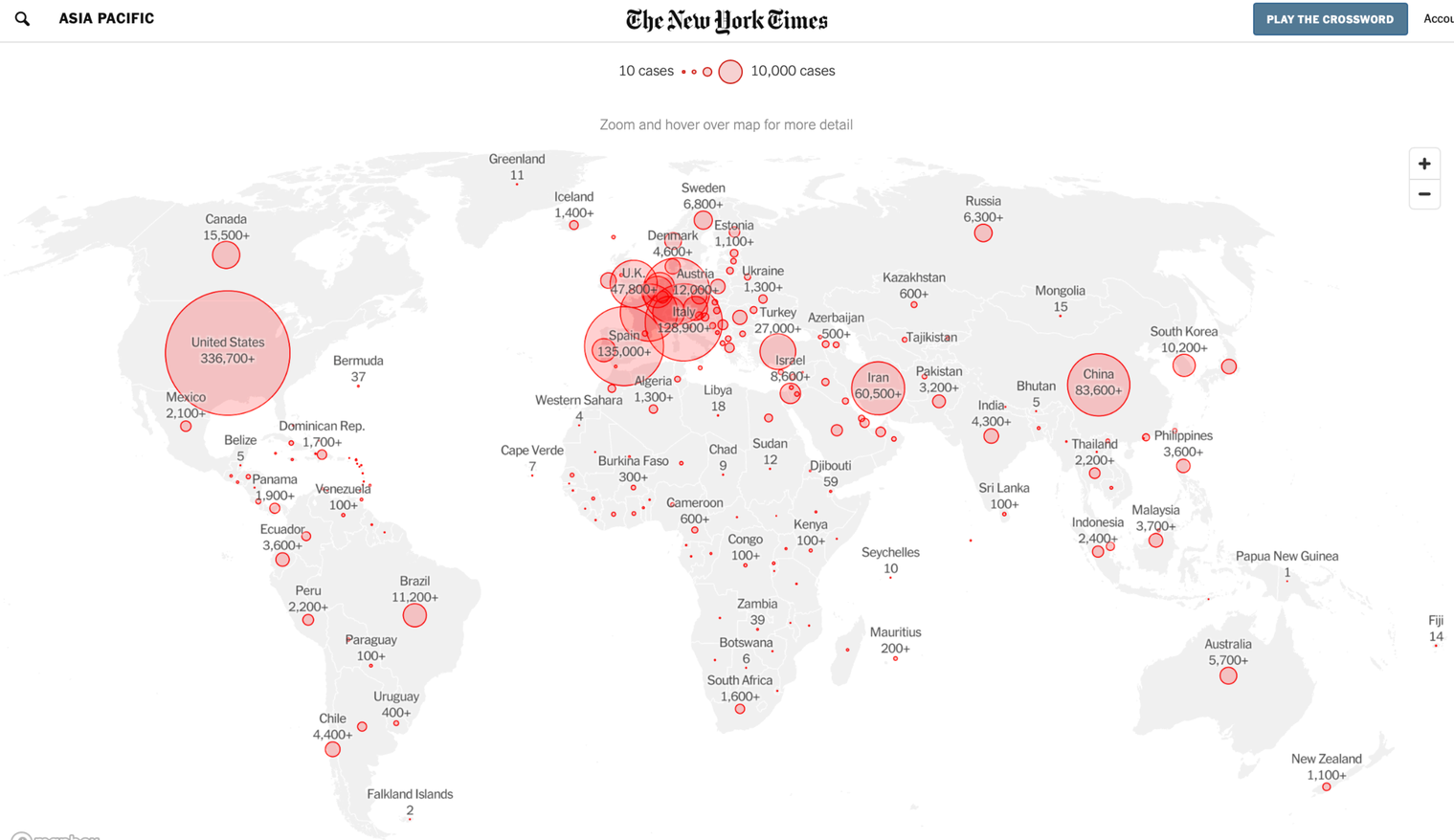


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



https://www.nytimes.com/interactive/2021/world/covid-cases.html

Graduated Symbol Map?

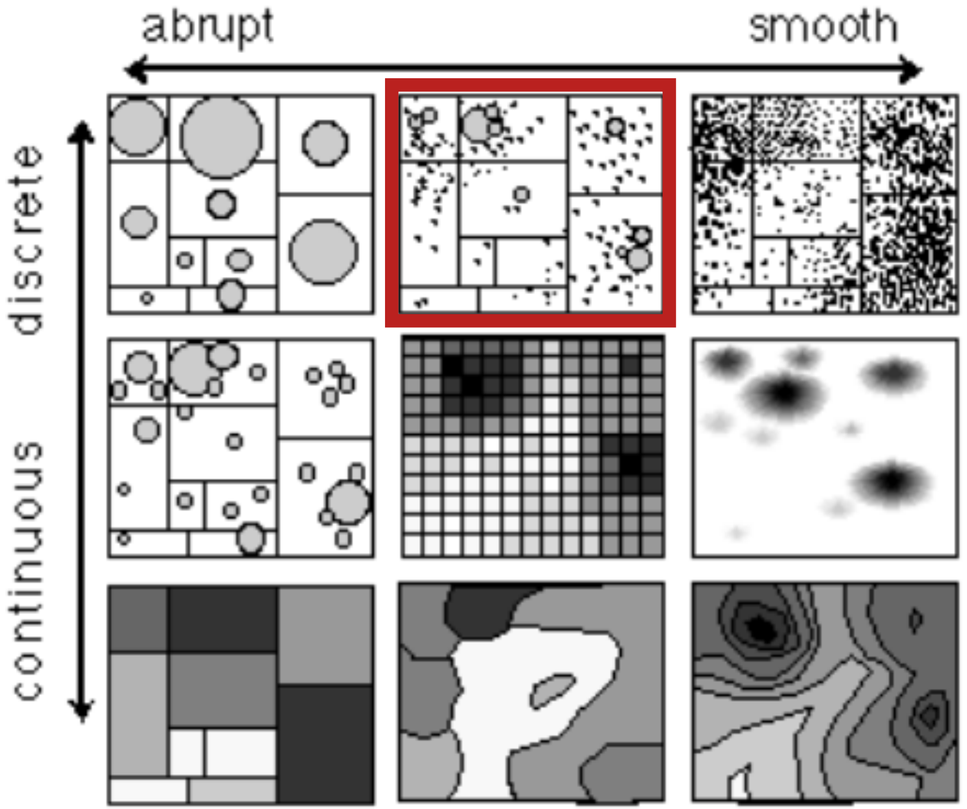
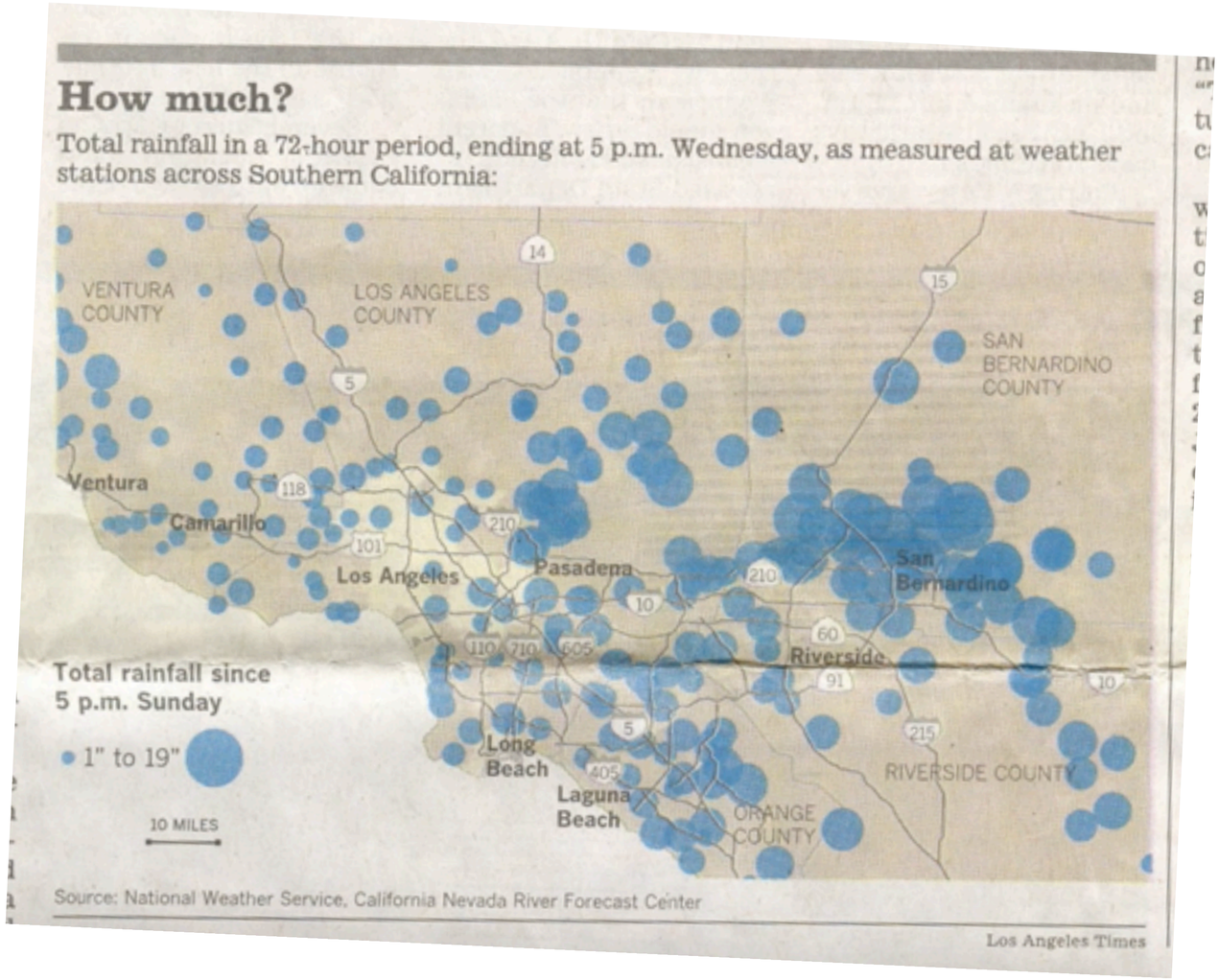


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



Isopleth / Heat Map

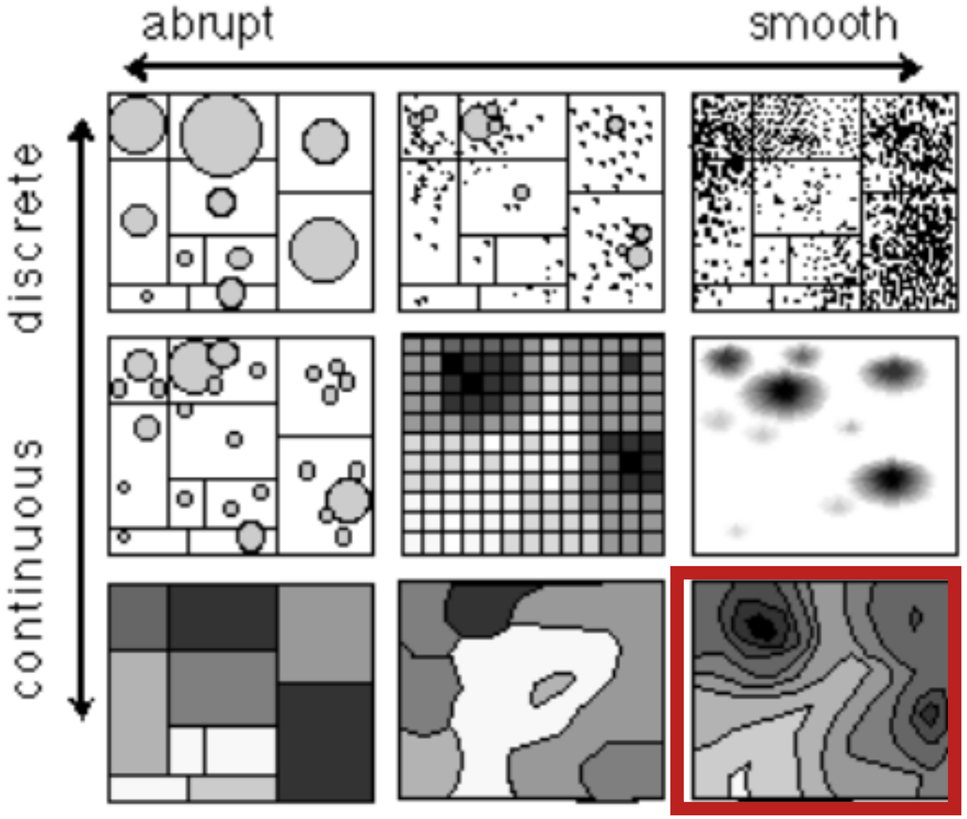
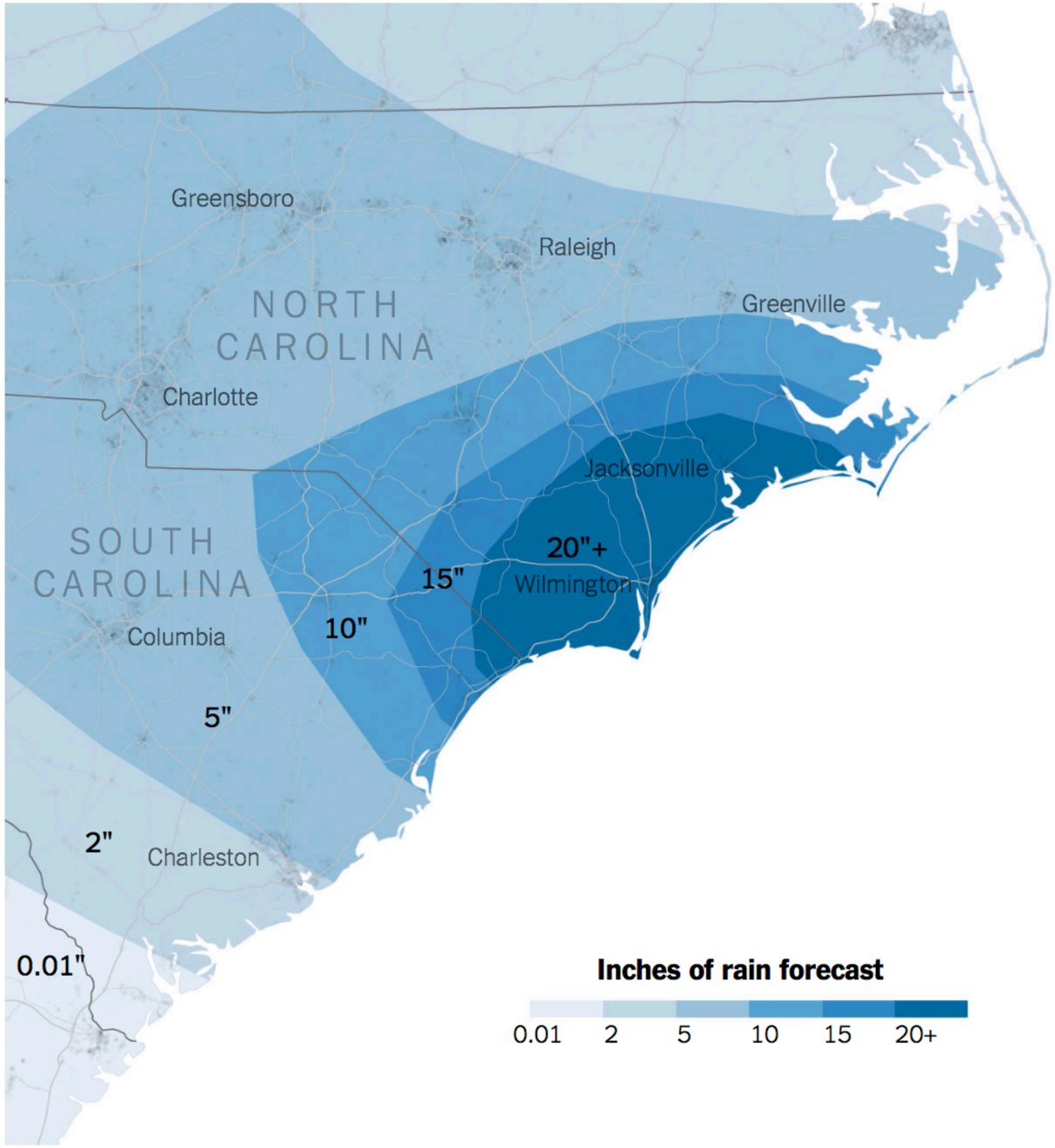


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



Source: National Weather Service

Choropleth

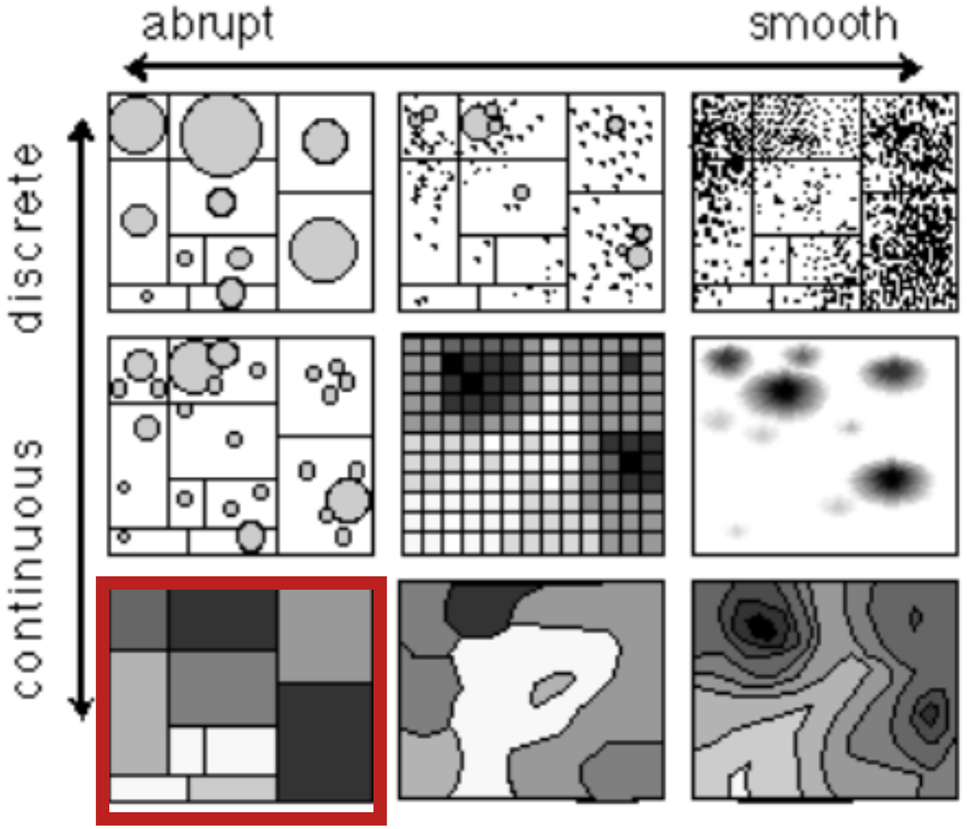
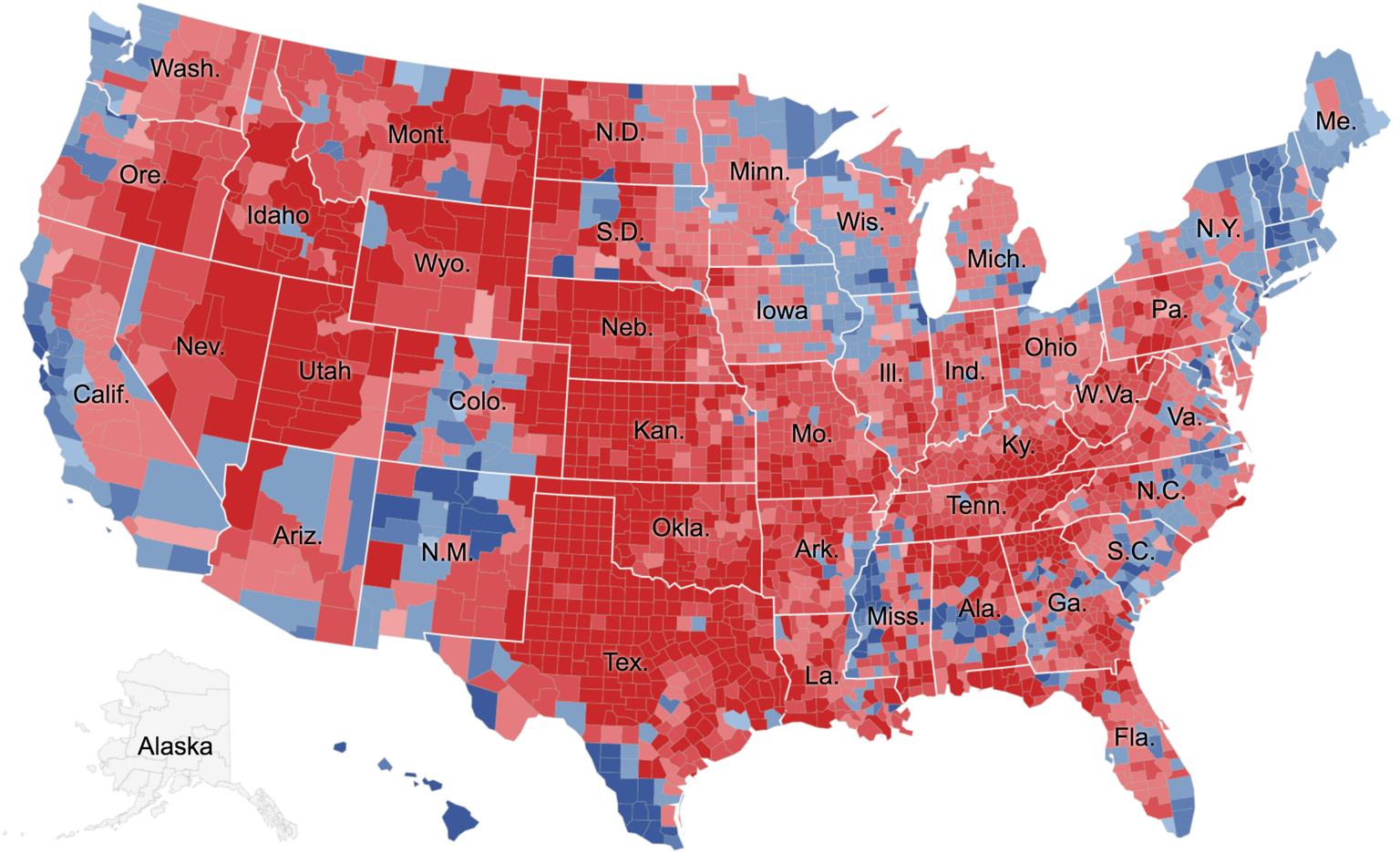


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.



https://www.nytimes.com/interactive/2016/11/01/upshot/many-ways-to-map-election-results.html

Choropleth

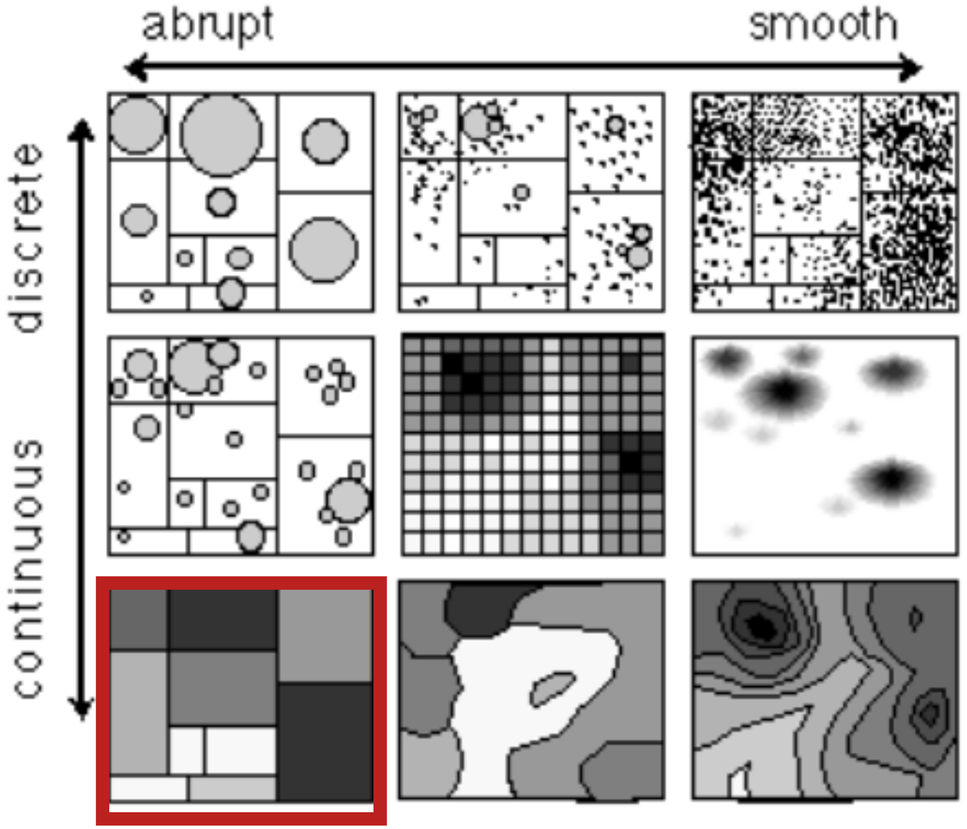
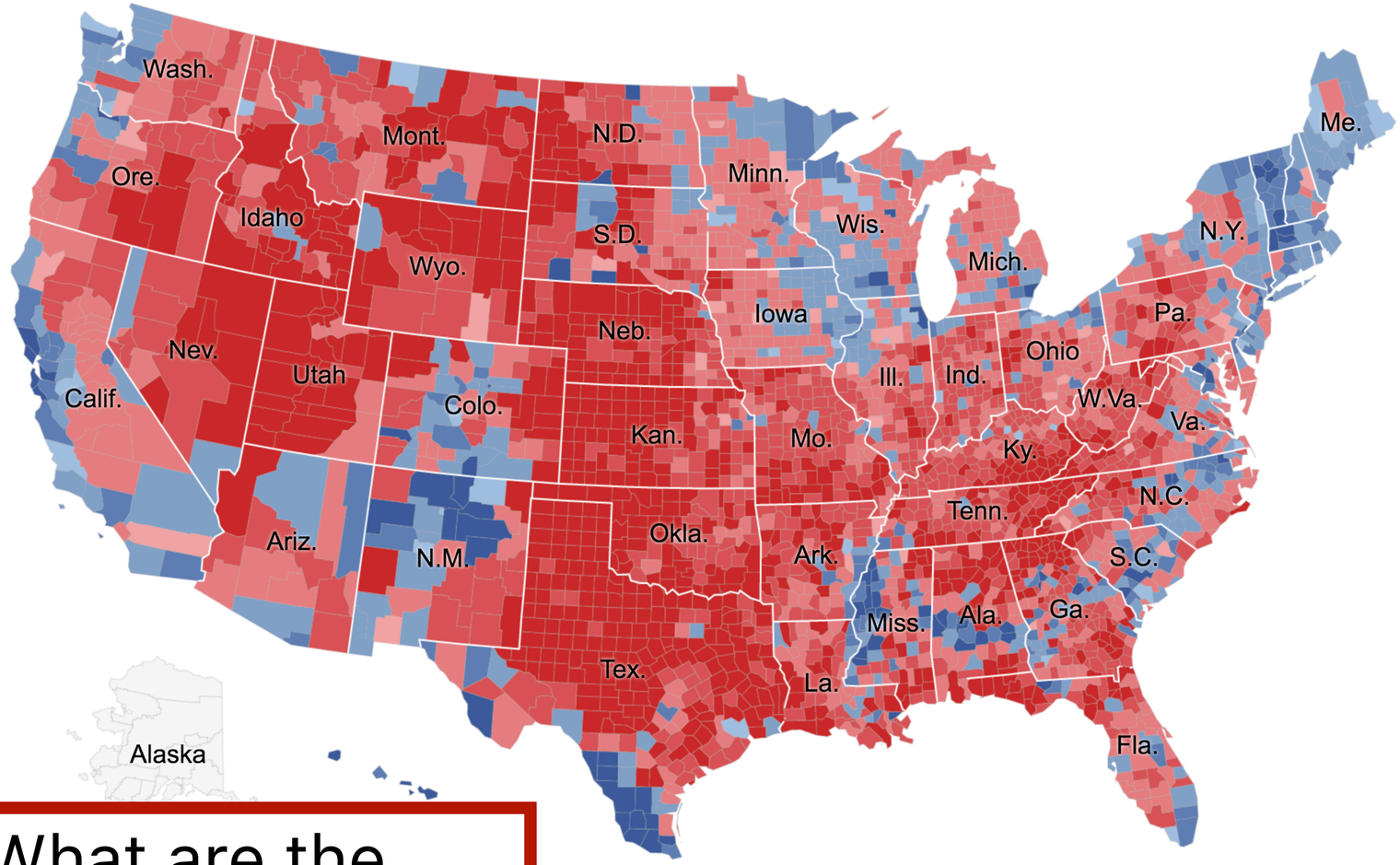


Fig. 9. Possible 2D translations of the 3D data models shown in figure 8.

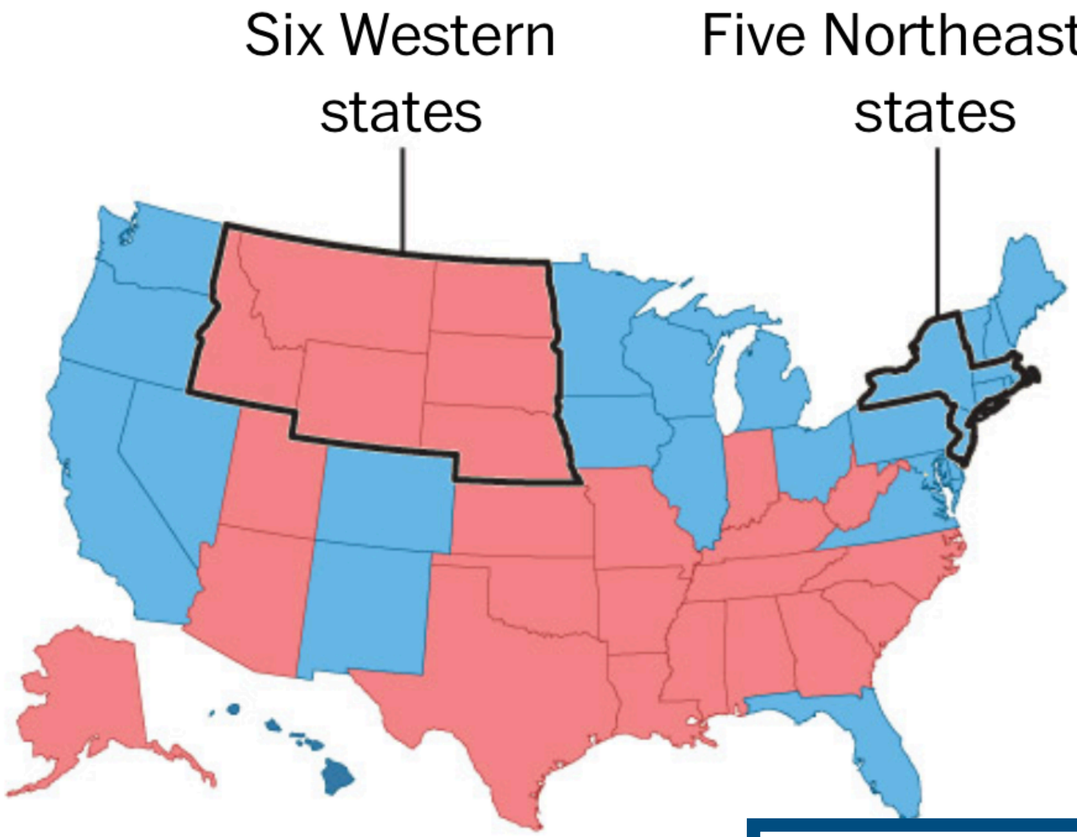


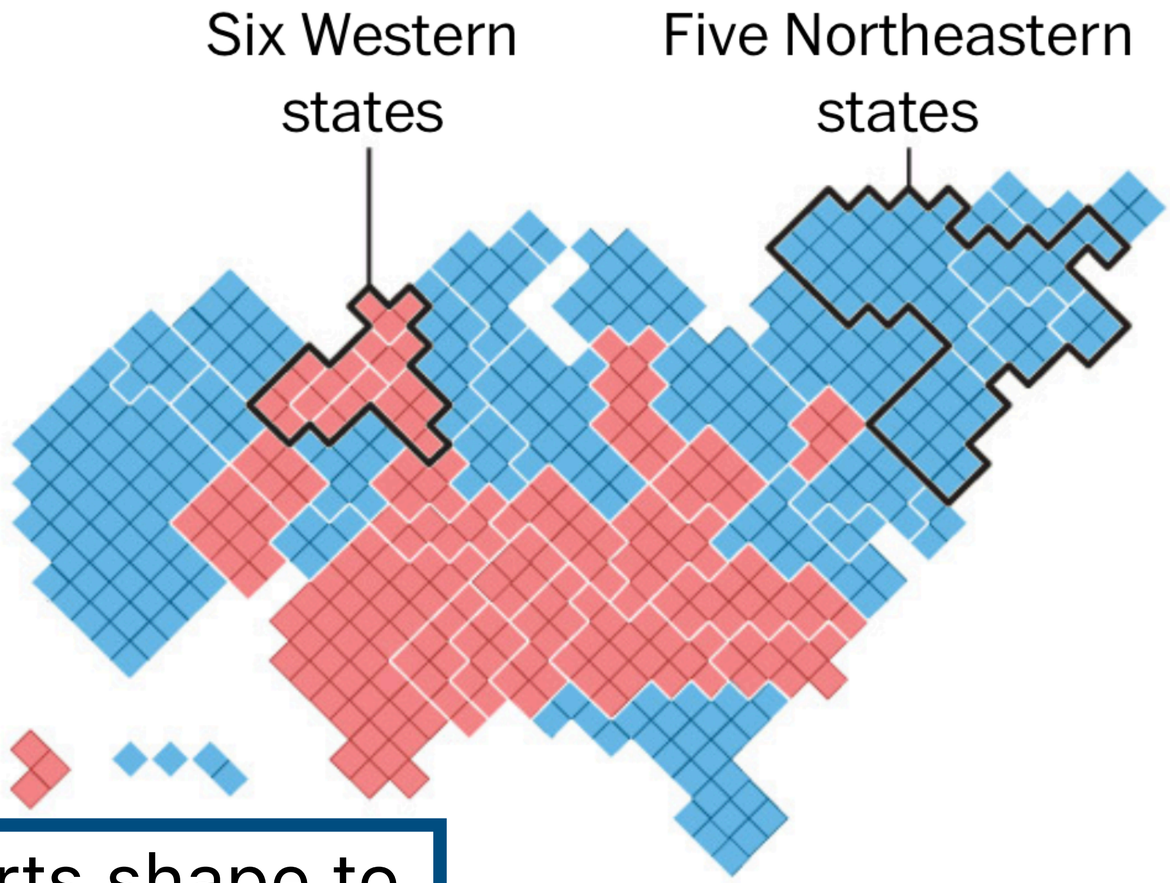
What are the pros/cons of this display?

tryclassbuzz.com
Code: **choro**

ion-results.html

GEOGRAPHIC MAP → **CARTOGRAM OF ELECTORAL VOTES**

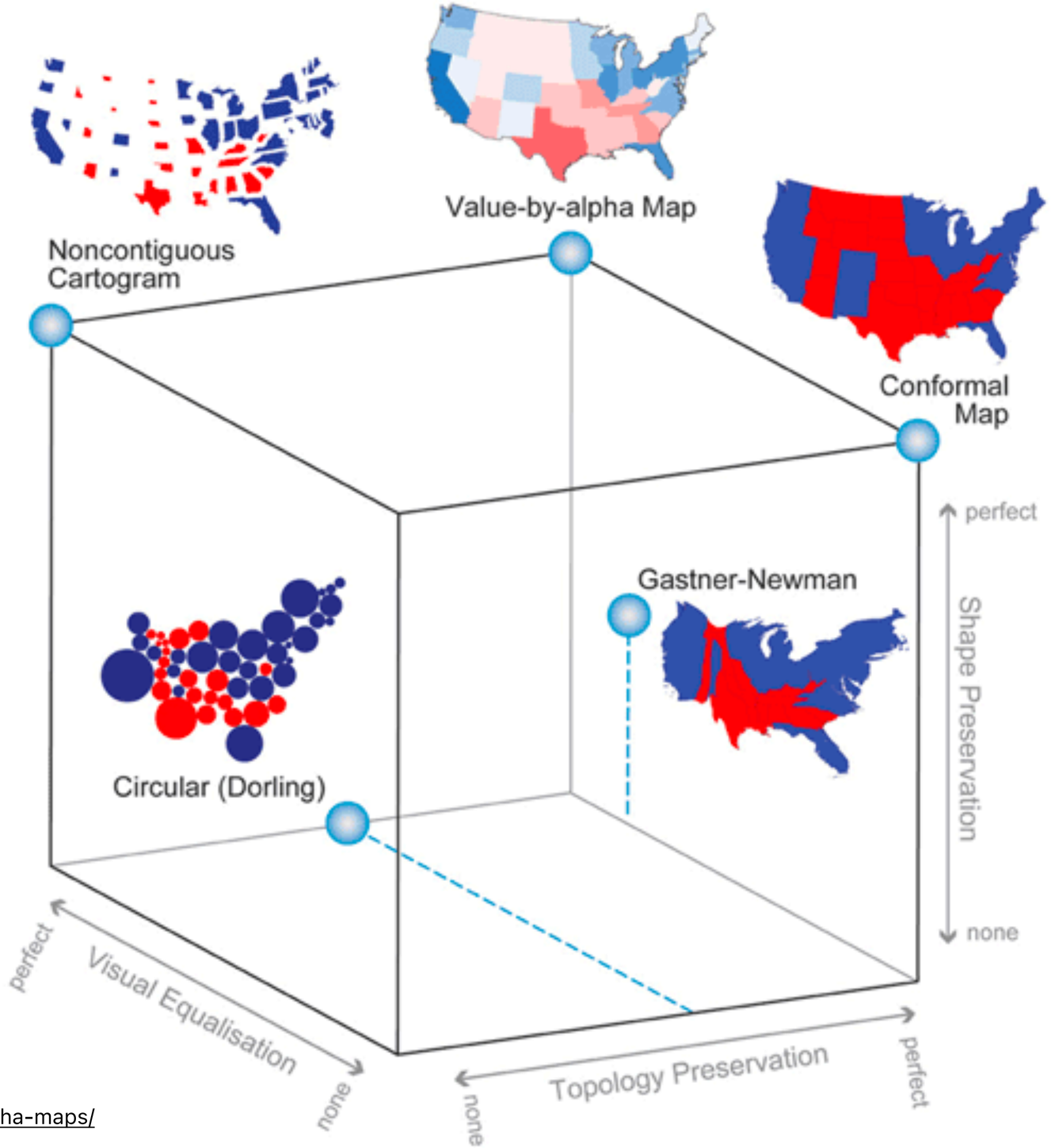




Cartogram: Distorts shape to convey quantity

What are the pros/ cons of this display?

tryclassbuzz.com
Code: **carto**

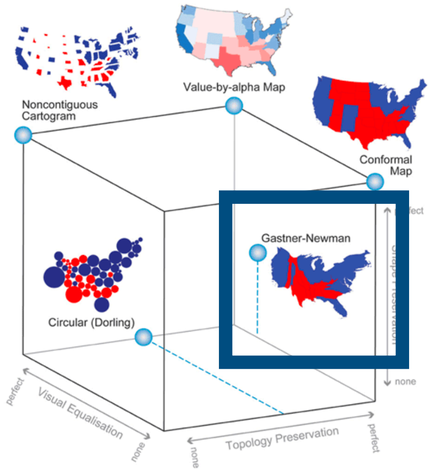


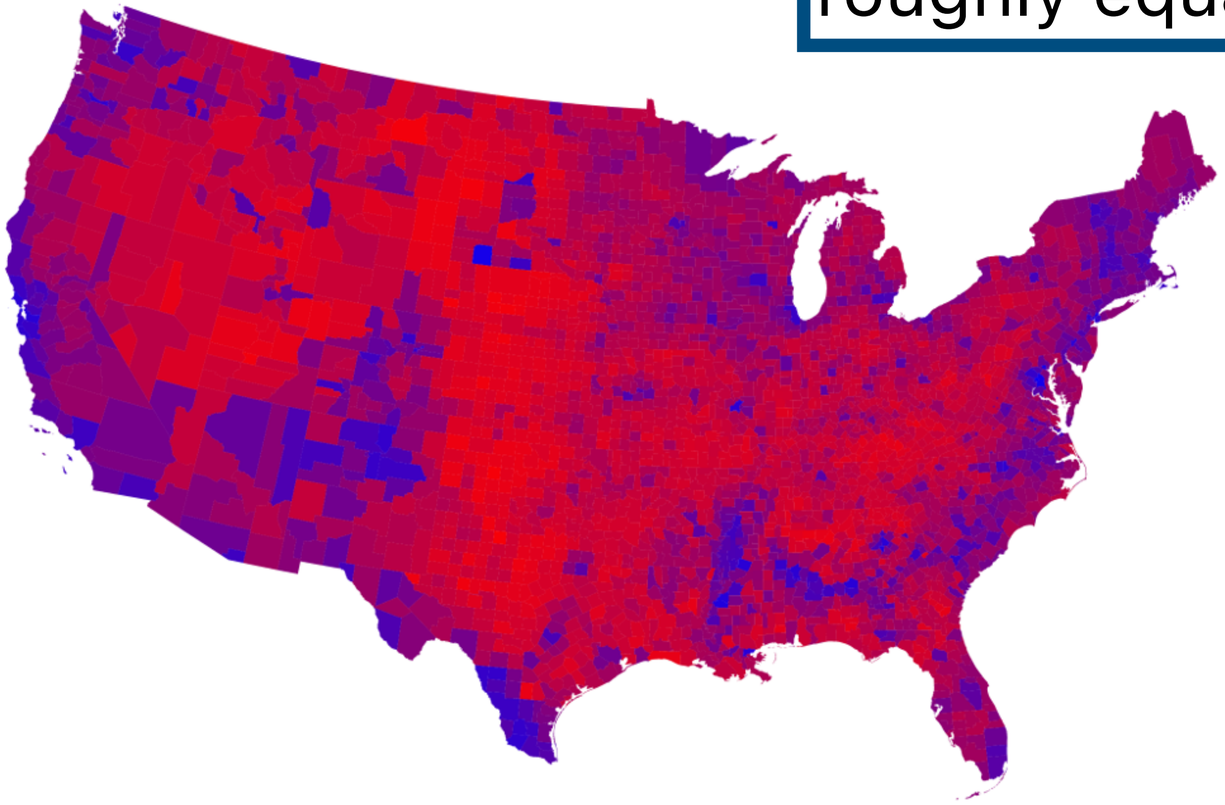
https://andywoodruff.com/blog/value-by-alpha-maps/

Gaster-Newman

Physical diffusion model.

Population "flows" from high-density areas to low-density areas until density is roughly equal everywhere.





China Still Dominates, but Some Manufacturers Look Elsewhere

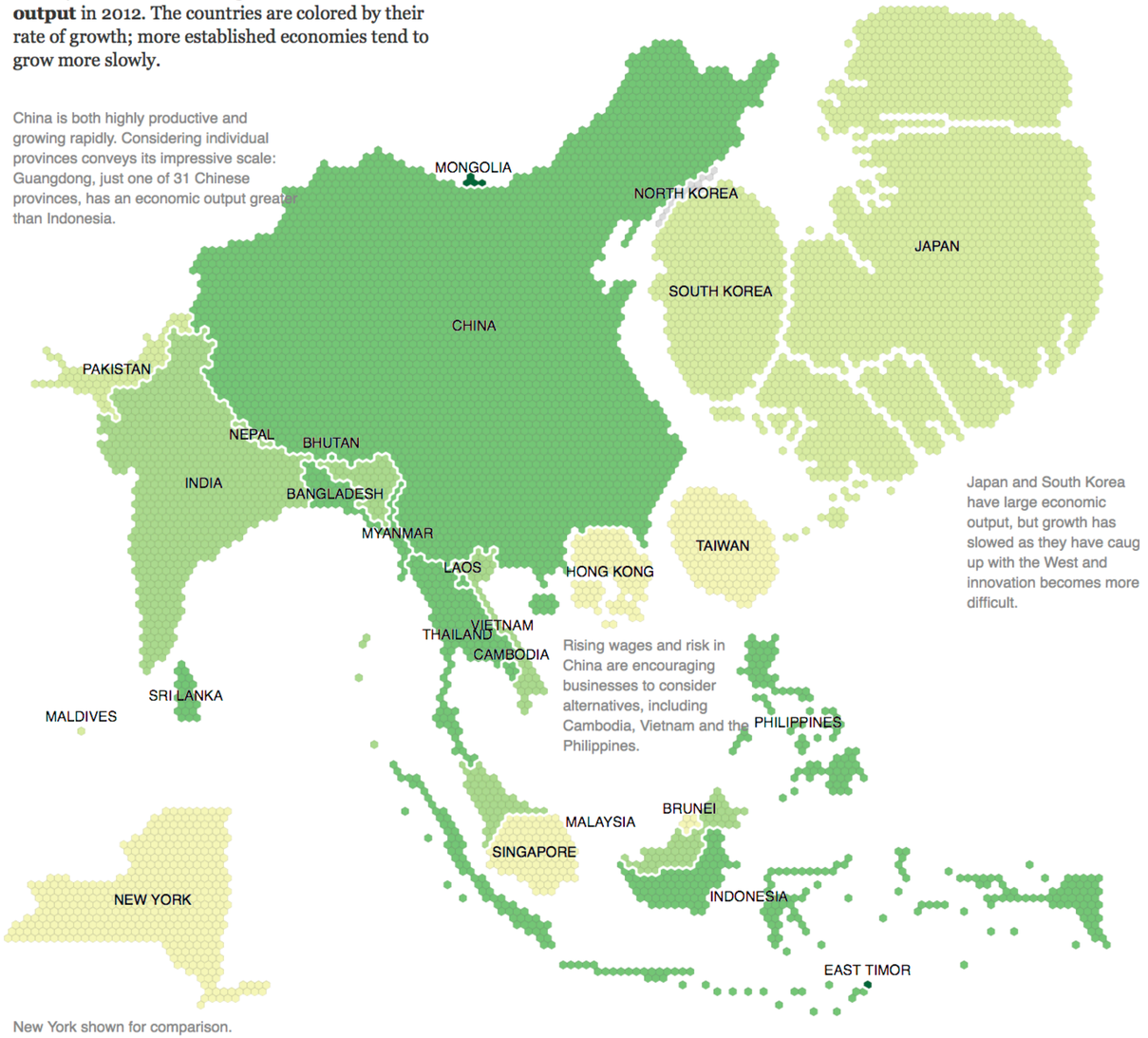
While China maintains its overwhelming dominance in manufacturing, multinational companies are looking for ways to limit their reliance on factories there. Related Article »

Economic Output

In this map, geography is distorted so that each country is **sized according to its economic output** in 2012. The countries are colored by their rate of growth; more established economies tend to grow more slowly.

Each hexagon represents $2.7 billion in G.D.P.

G.D.P. growth, 2011 to 2012: 2 4 6 8 +10%



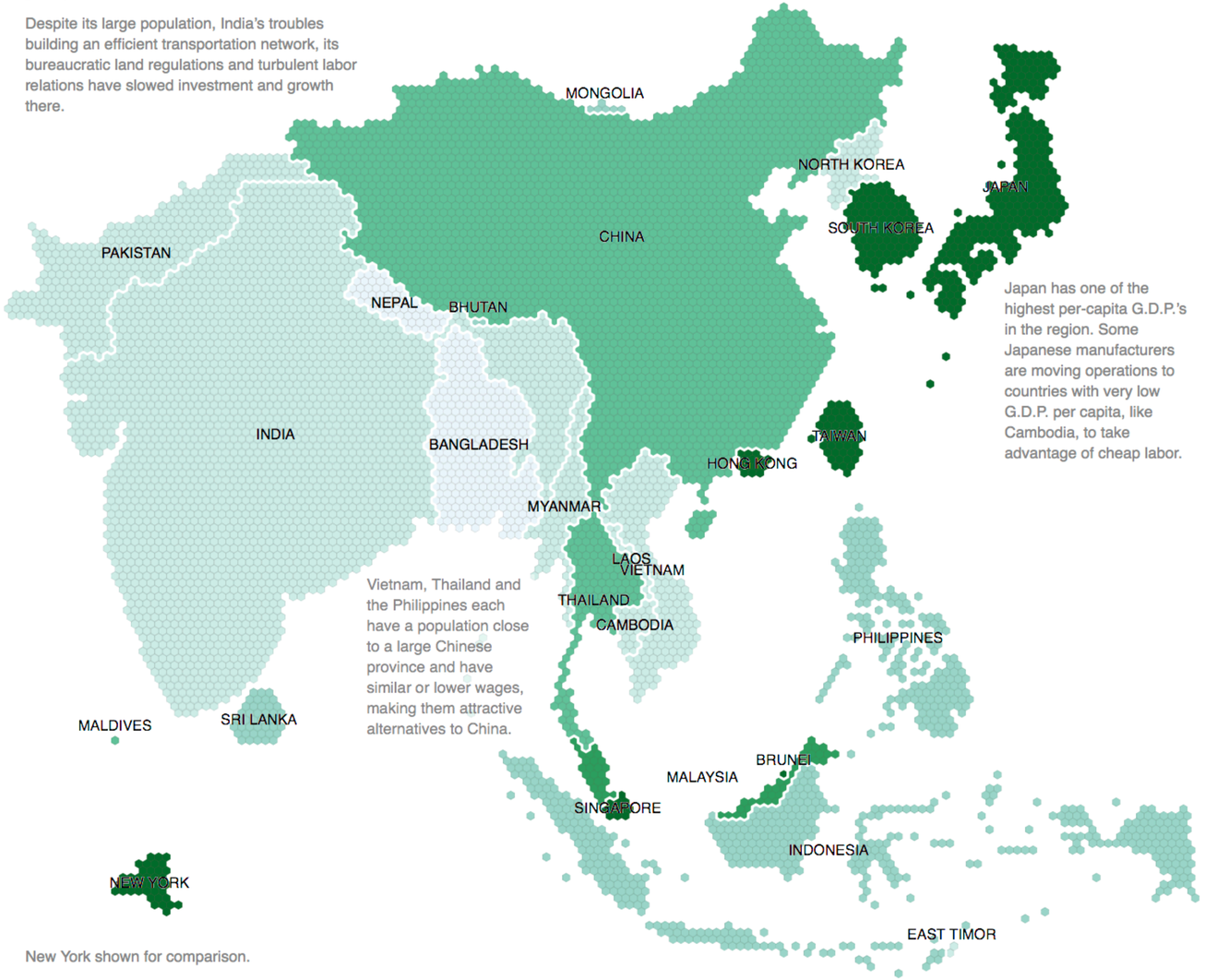
New York shown for comparison.

Population

Sizing by population instead gives an estimate of a country's economic potential, at least for labor-based manufacturing. The color here shows the economic output per capita: a measure of how effectively that potential has been realized, and a proxy for labor cost.

Each hexagon represents 500,000 people

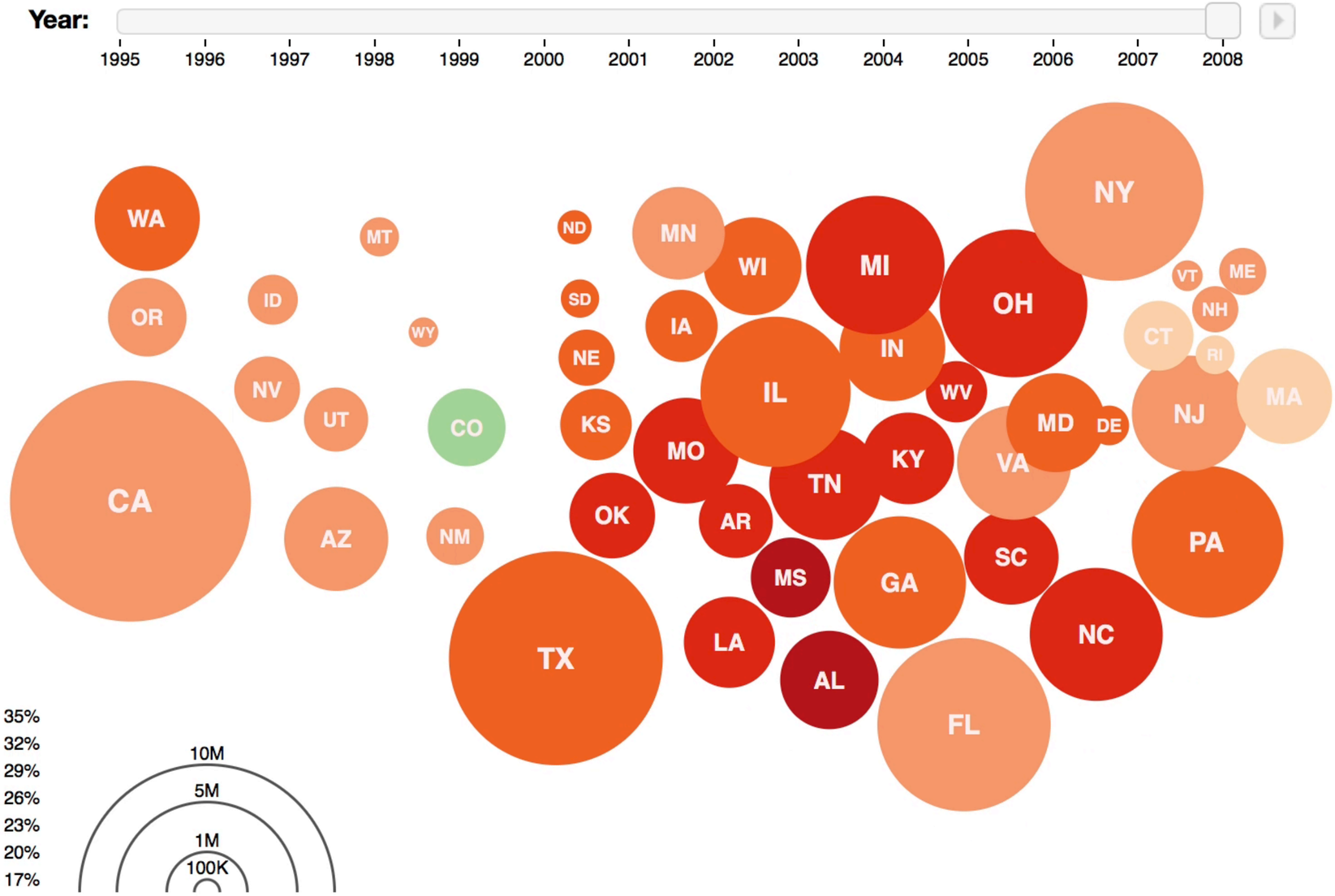
G.D.P. per capita, 2012: 1 2 5 10 $20K

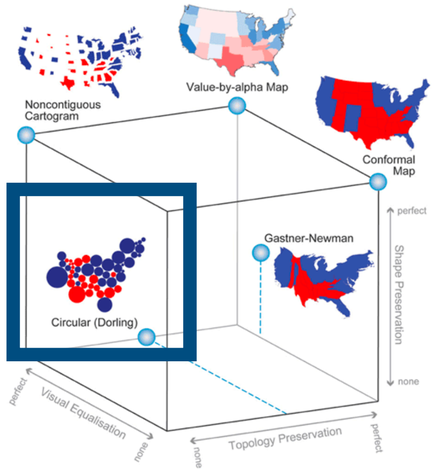


New York shown for comparison.

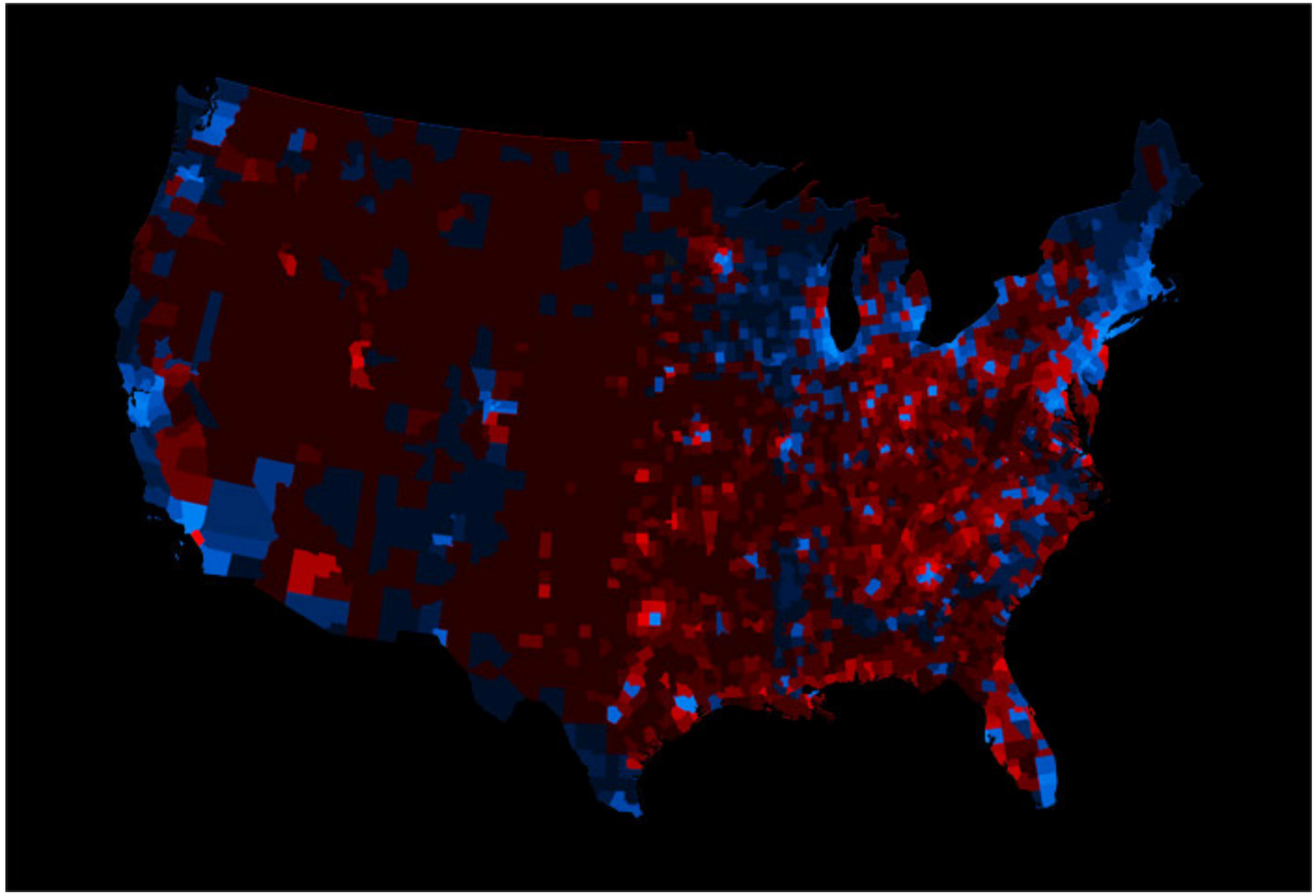
By MIKE BOSTOCK; Additional reporting by KEITH BRADSHER

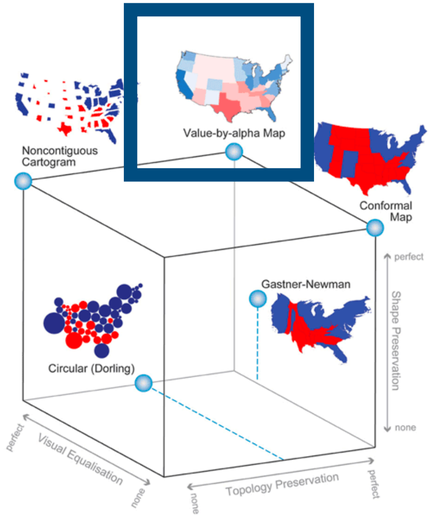
Dorling Cartograms





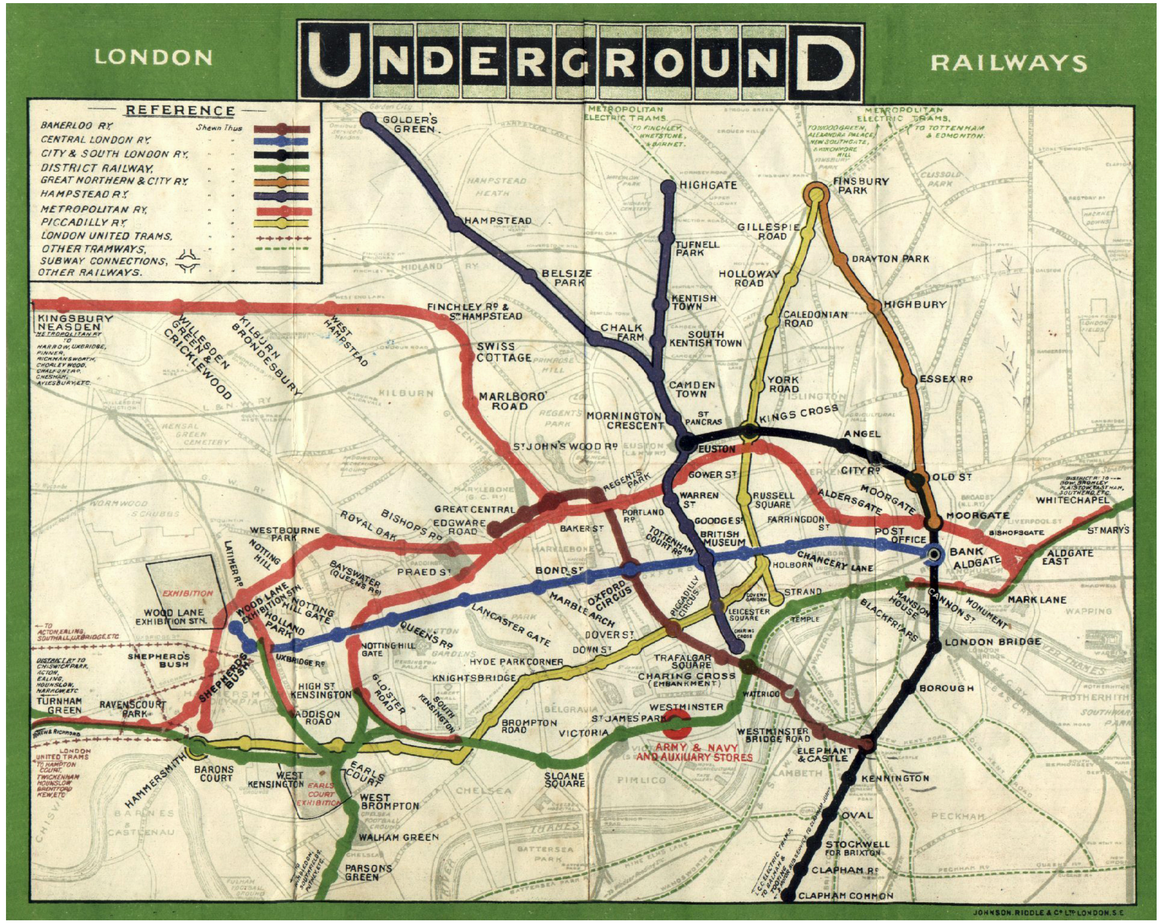
Value-By-Alpha





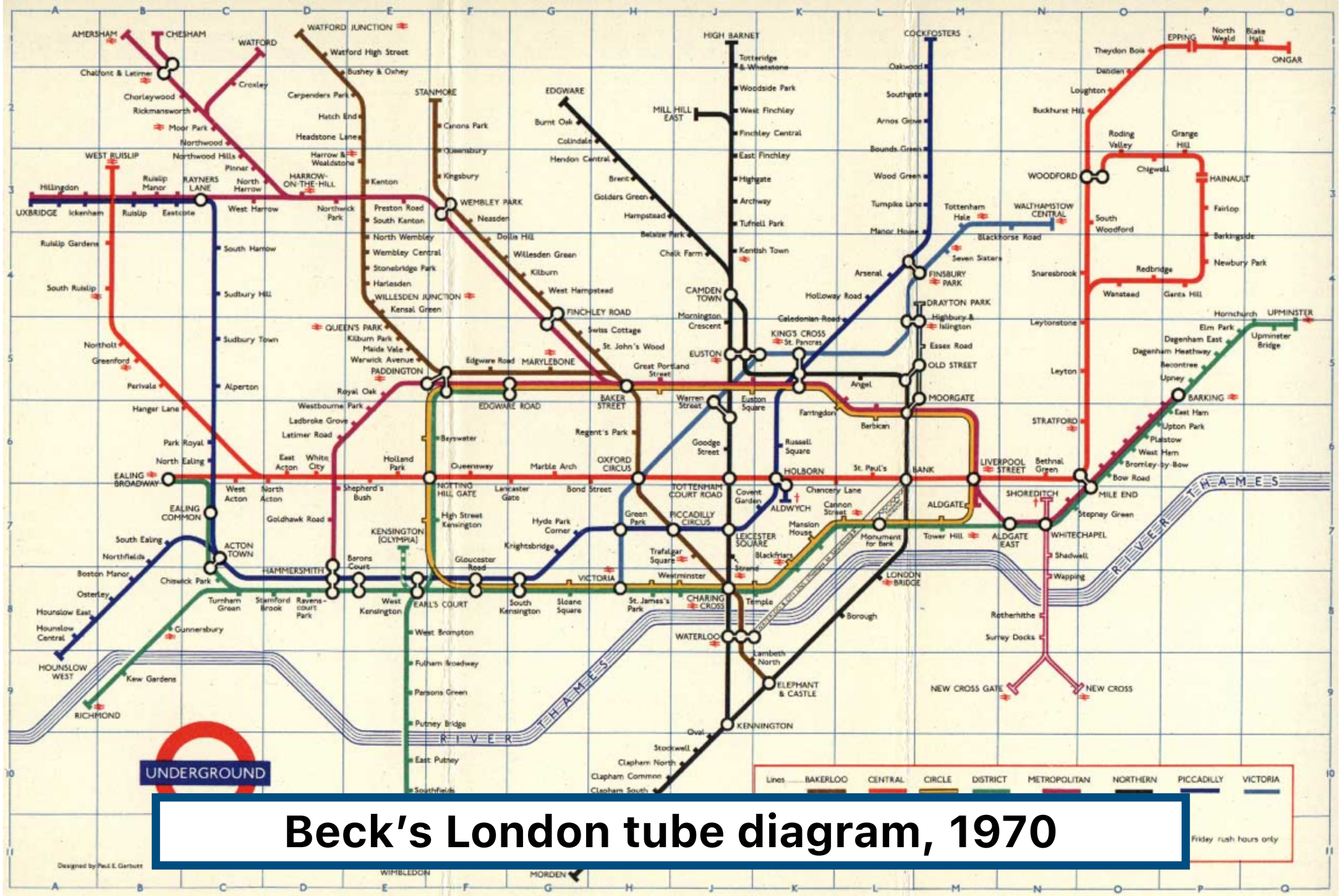
https://andywoodruff.com/blog/value-by-alpha-maps/

Route Maps

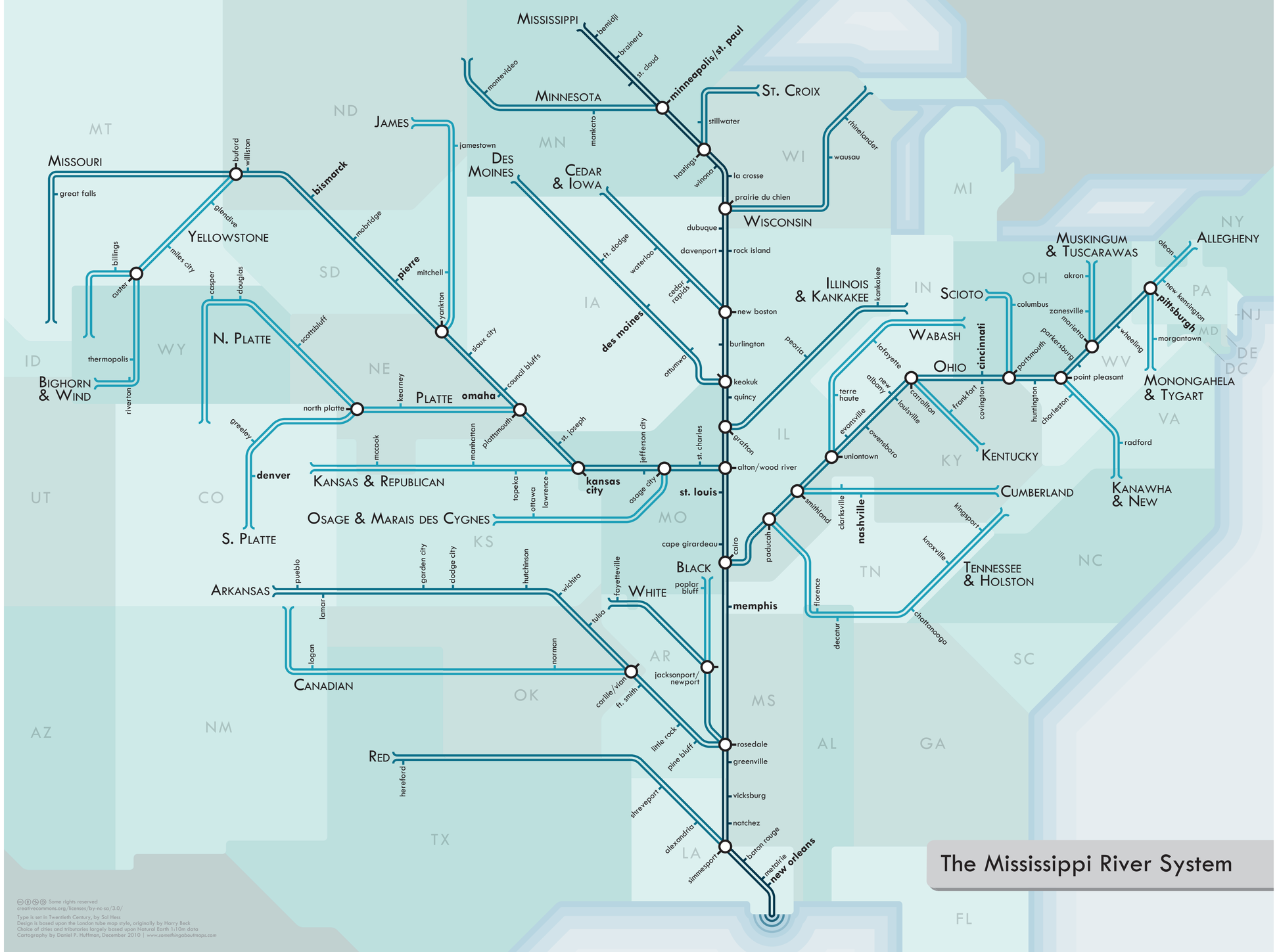


Geographic version of

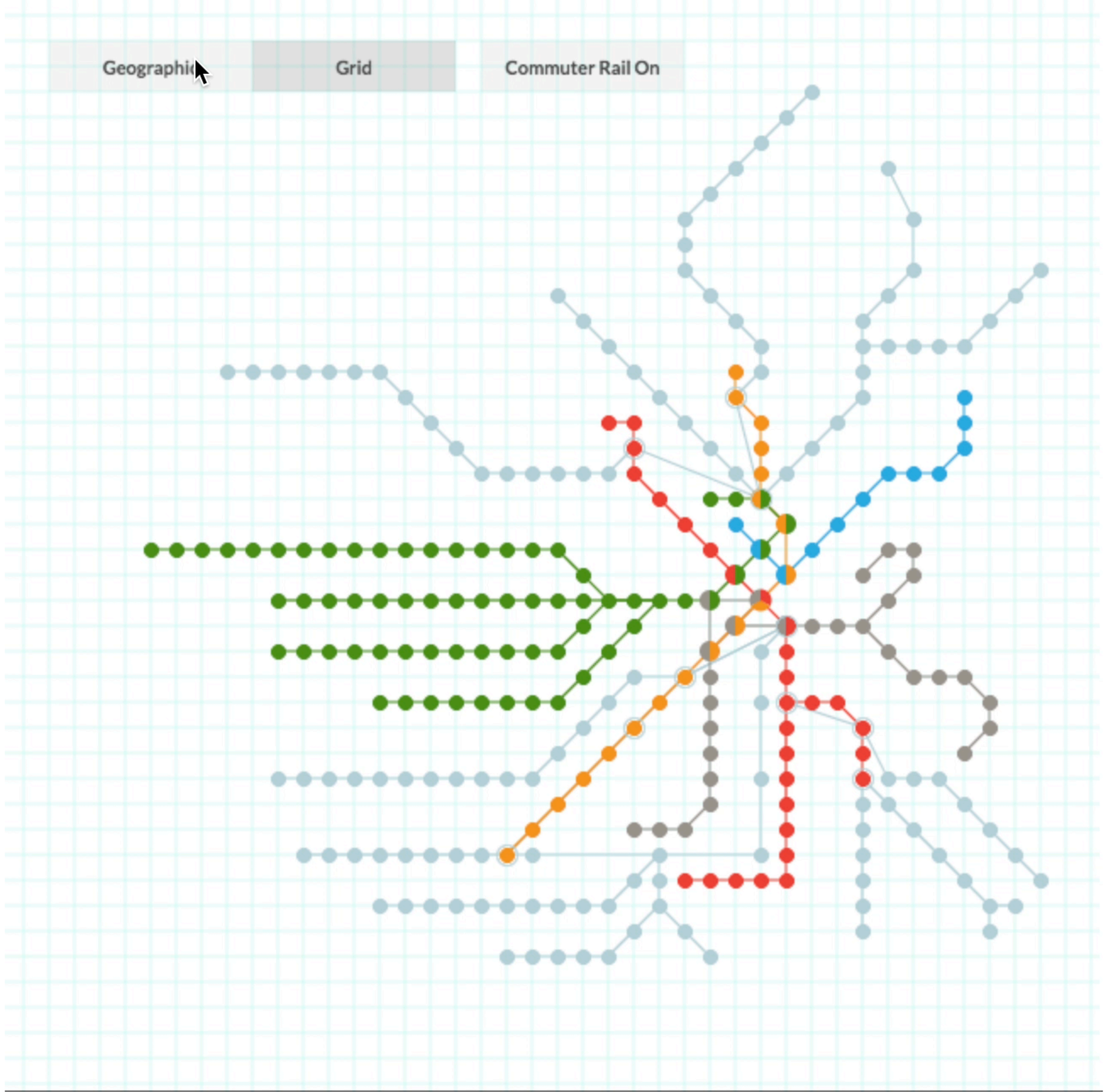
London Underground



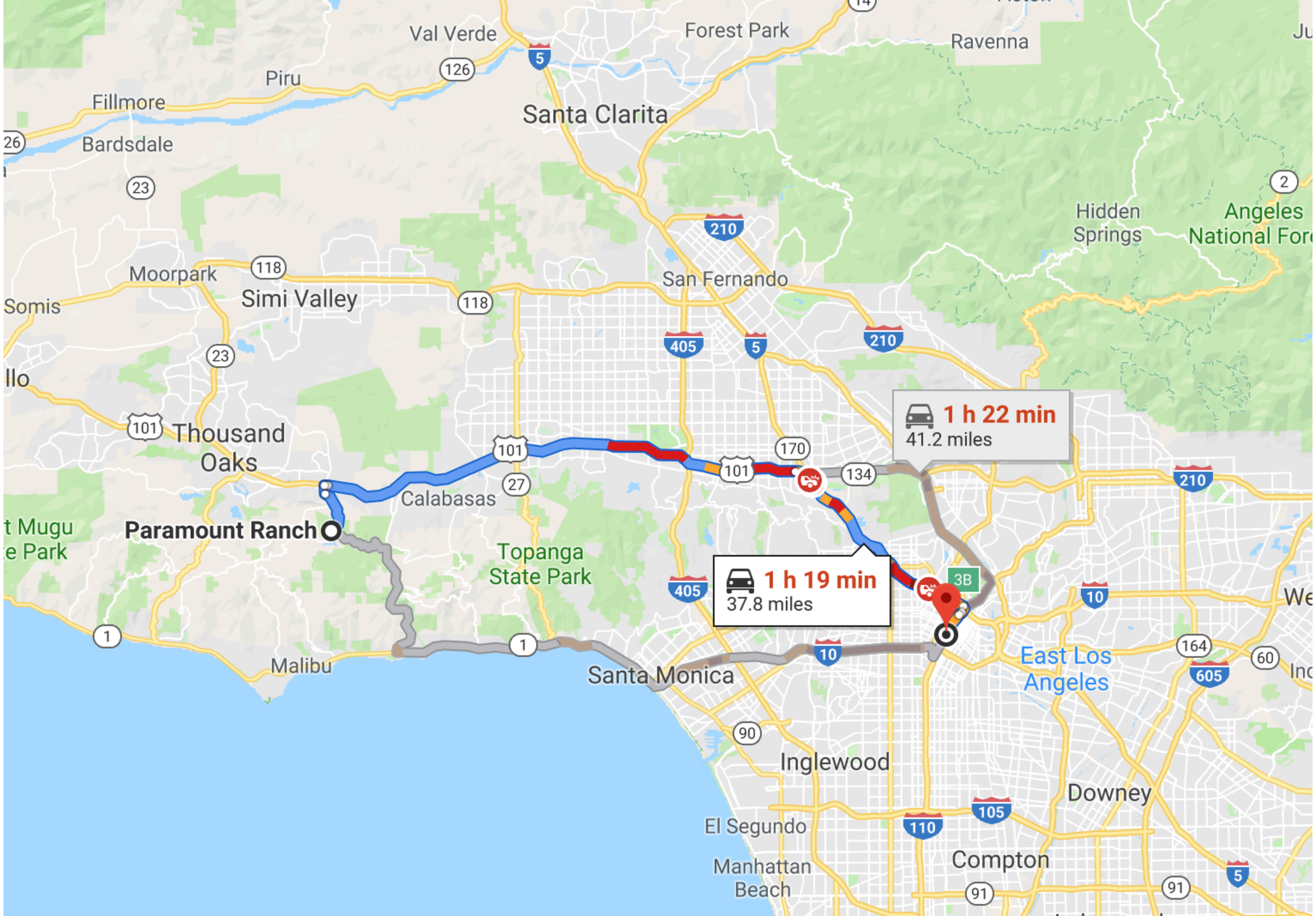
Beck's London tube diagram, 1970

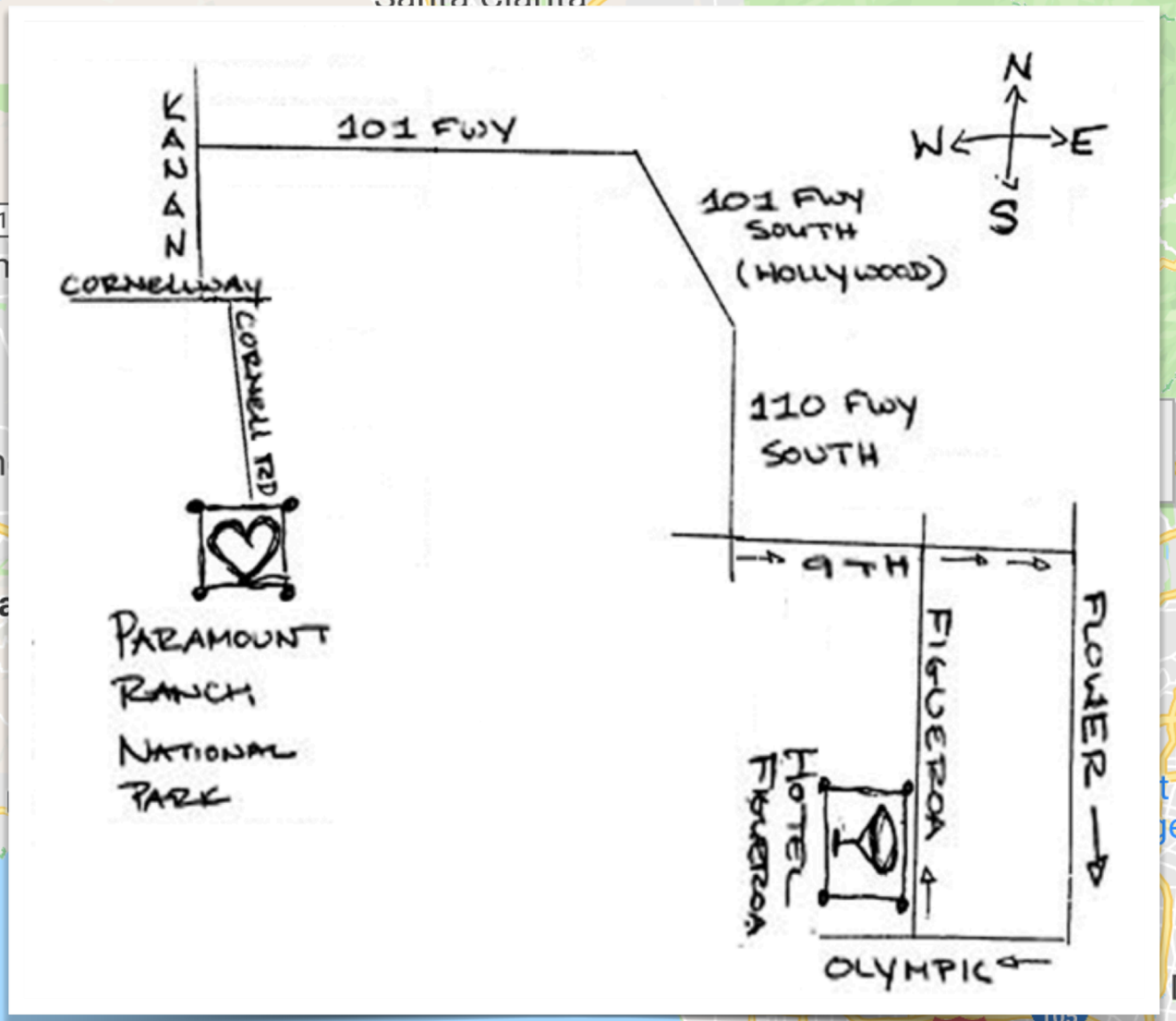


Some rights reserved
creativecommons.org/licenses/by-nc-sa/3.0/
Type is set in Twentieth Century, by Sol Hess
Design is based upon the London tube map style, originally by Harry Beck
Choice of cities and tributaries largely based upon Natural Earth 1:10m data
Cartography by Daniel P. Huffman, December 2010 | www.somethingaboutmaps.com

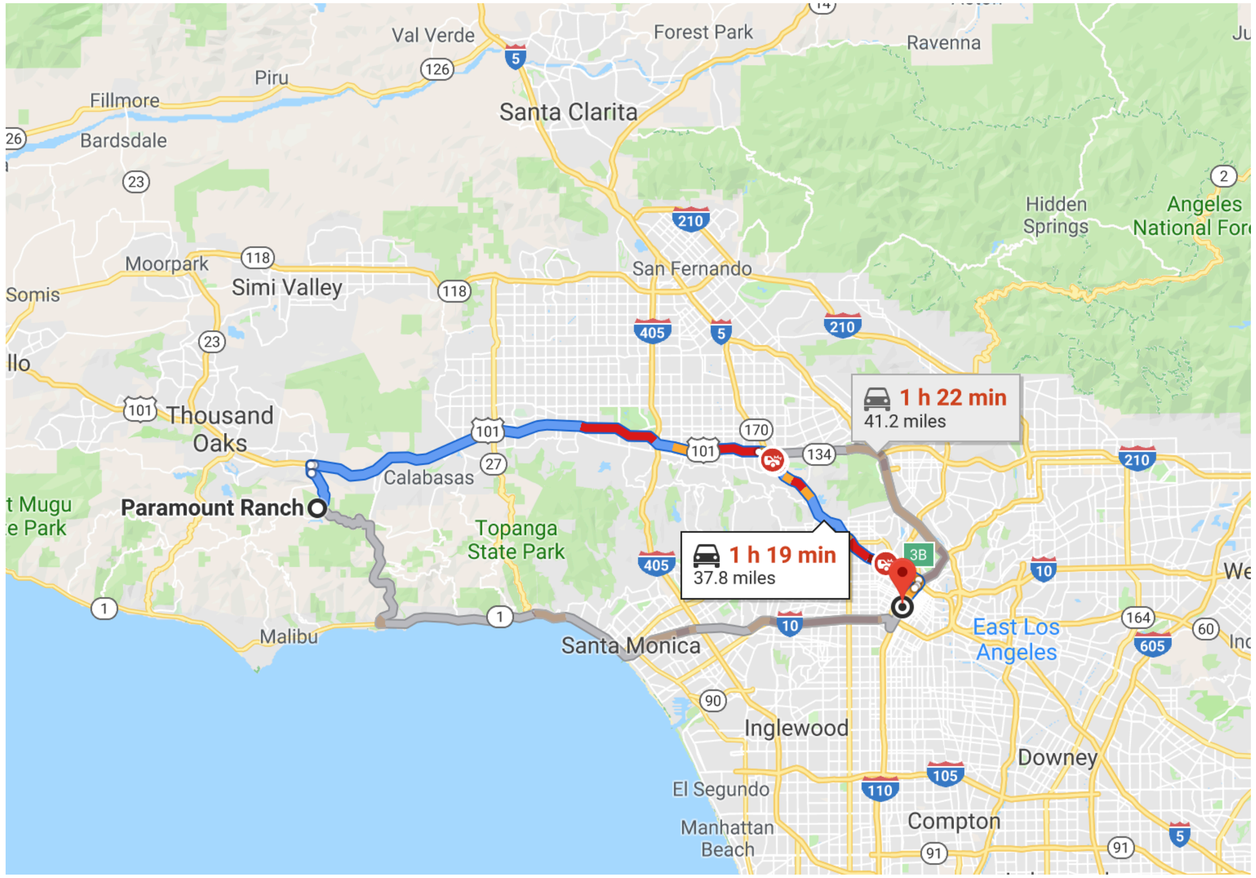


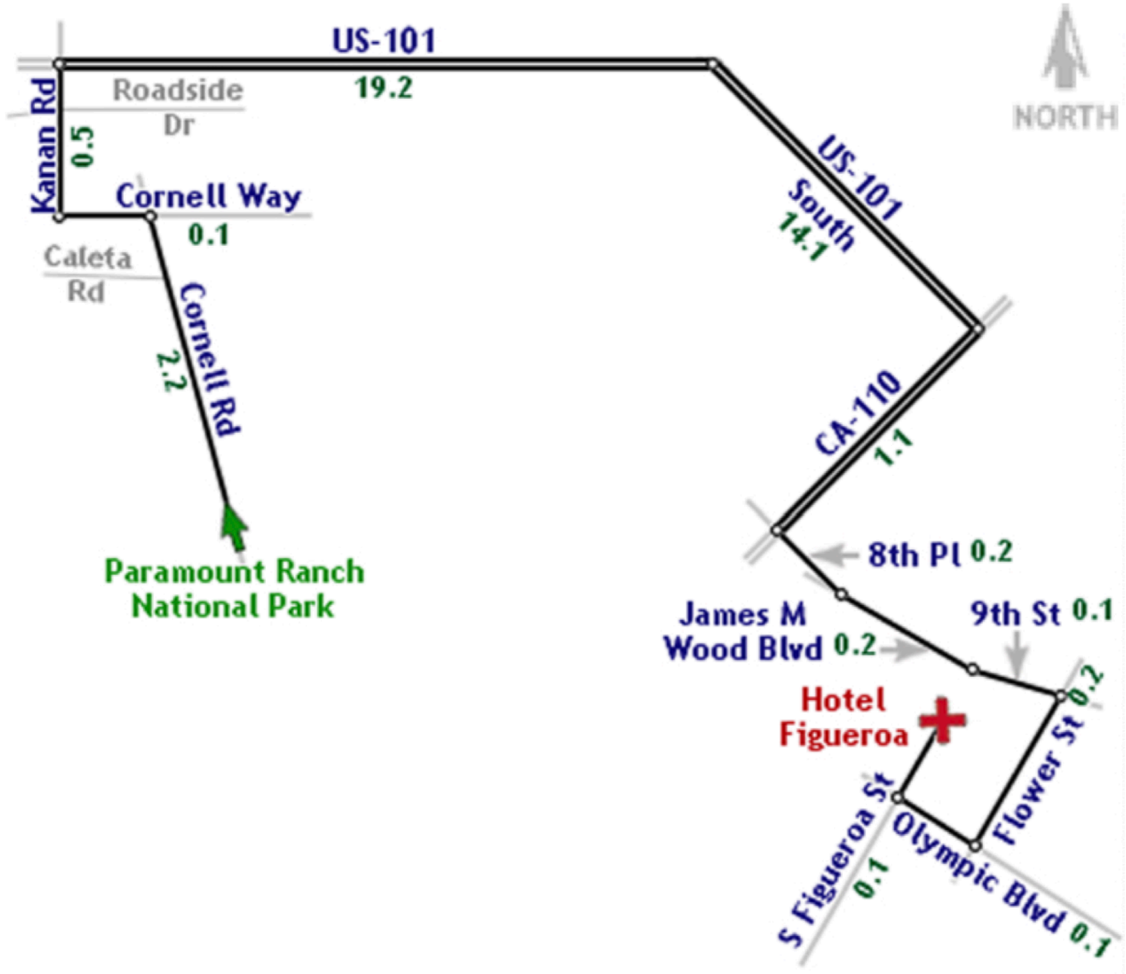
https://fathom.info/notebook/4756/


Val Verde
Forest Park
Ravenna
Piru
Fillmore
Bardsdale
Santa Clarita
Hidden Springs
Angeles National For
Moorpark
Simi Valley
San Fernando
Somis
Thousand Oaks
Calabasas
Paramount Ranch
Topanga State Park
1 h 22 min
41.2 miles
1 h 19 min
37.8 miles
Malibu
Santa Monica
East Los Angeles
Inglewood
Downey
El Segundo
Manhattan Beach
Compton


KANAN
101 FWY
CORNELL WAY
CORNELL RD
PARAMOUNT RANCH, NATIONAL PARK
101 FWY SOUTH (HOLLYWOOD)
110 FWY SOUTH
9TH
FIGUEROA
HOTEL FIGUEROA
FLOWER
OLYMPIC
N
W
E
S

Line Drive





Agrawala, Maneesh, and Chris Stolte. "Rendering effective route maps: Improving usability through generalization." SIGGRAPH 2001

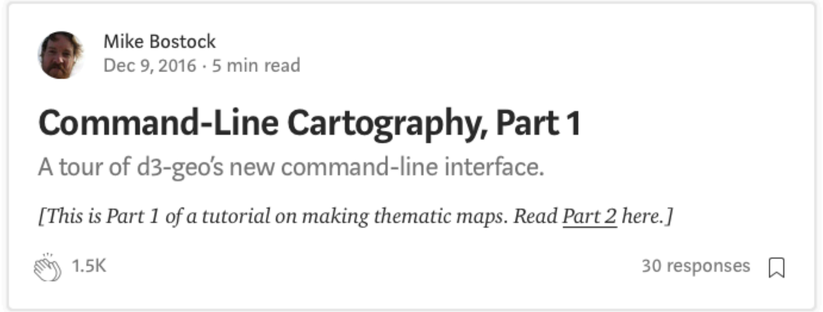
Tooling for Maps

Web Tools

D3: Projections, paths, graticules
GeoJSON: JSON format for geo data.
TopoJSON: Topology → compressed GeoJSON.
Leaflet: open-source, customizable map tile system.
Mapbox: commercial map tile system

Data Resources

Natural Earth Data: naturalearthdata.com
OpenStreetMap: openstreetmap.org
U.S. Government: nationalatlas.gov, usgs.gov

Tutorials

Command Line Cartography, by Mike Bostock
https://medium.com/@mbostock/command-line-cartography-part-1-897aa8f8ca2c