

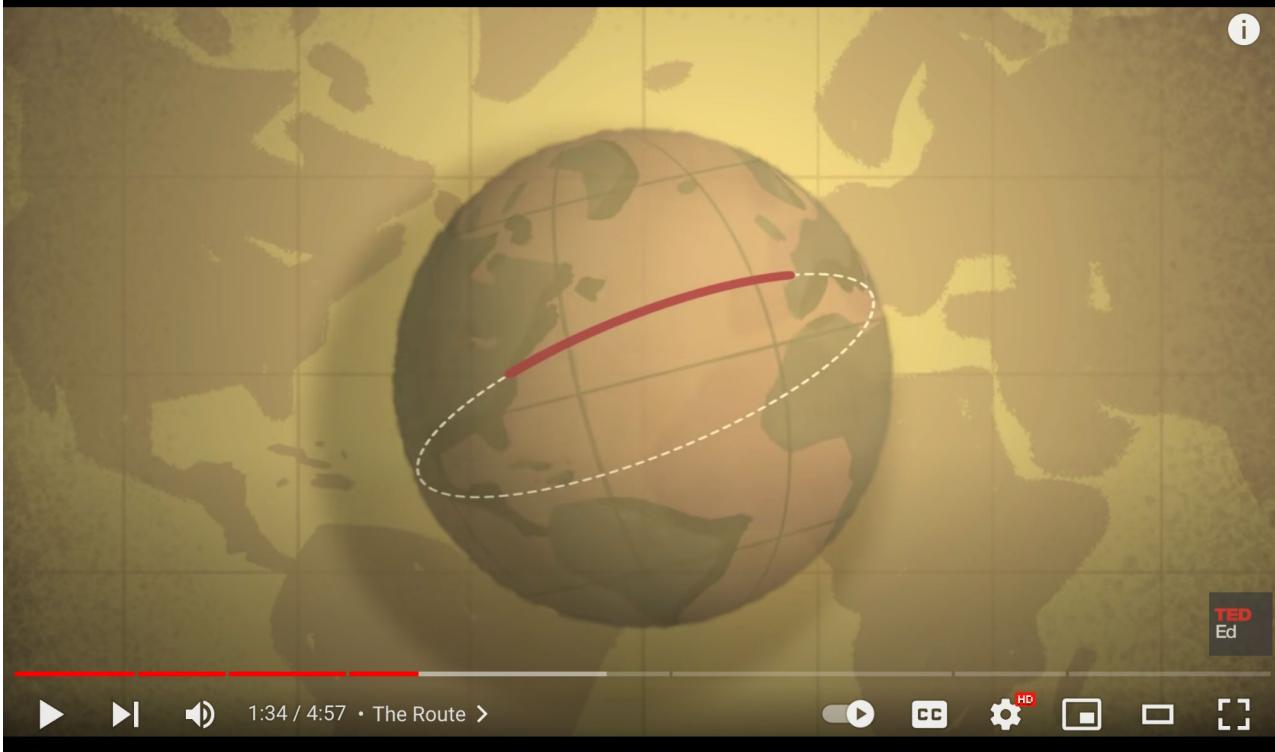
Data Visualization

W11-2

Quiz

- What do you find interesting in today's VotW?
- Why do we need a map projection? What factors should be considered when selecting a projection method?

No projection is perfect



Why every world map is wrong – Kayla Wolf



TED-Ed ✓
19.2M subscribers

Subscribe

Like 28K



Share

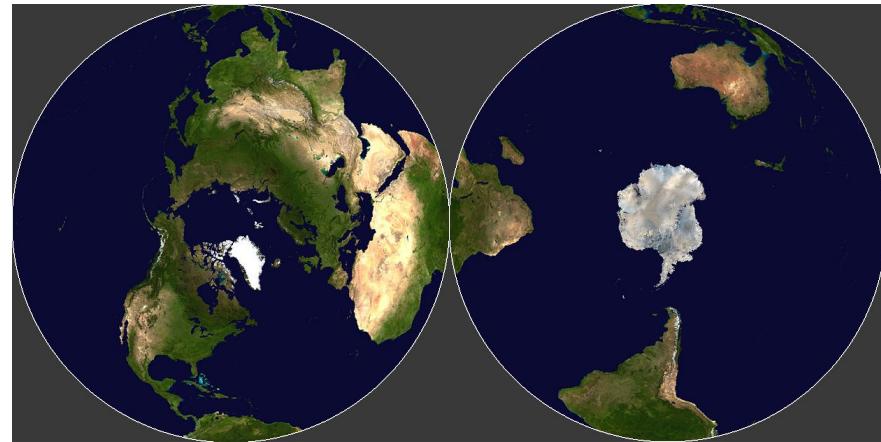
...

← THE BEST INVENTIONS OF 2021

PRESENTED BY

A More Accurate World Map

Gott-Goldberg-Vanderbei Projection



ISSUES

SCIENTIFIC
AMERICAN

Sign In | Newsletter

CULTURE | OPINION

The Most Accurate Flat Map of Earth Yet

A cosmologist and his colleagues tackle a centuries-old cartographic conundrum

By J. Richard Gott on February 17, 2021

<https://time.com/collection/best-inventions-2021/6112653/gott-goldberg-vanderbei-projection/>

<https://www.scientificamerican.com/article/the-most-accurate-flat-map-of-earth-yet/>

So, how to put data
on the map?

(What kinds of visual encodings can we use?)

1

Posted by u/JustBlue 9 years ago

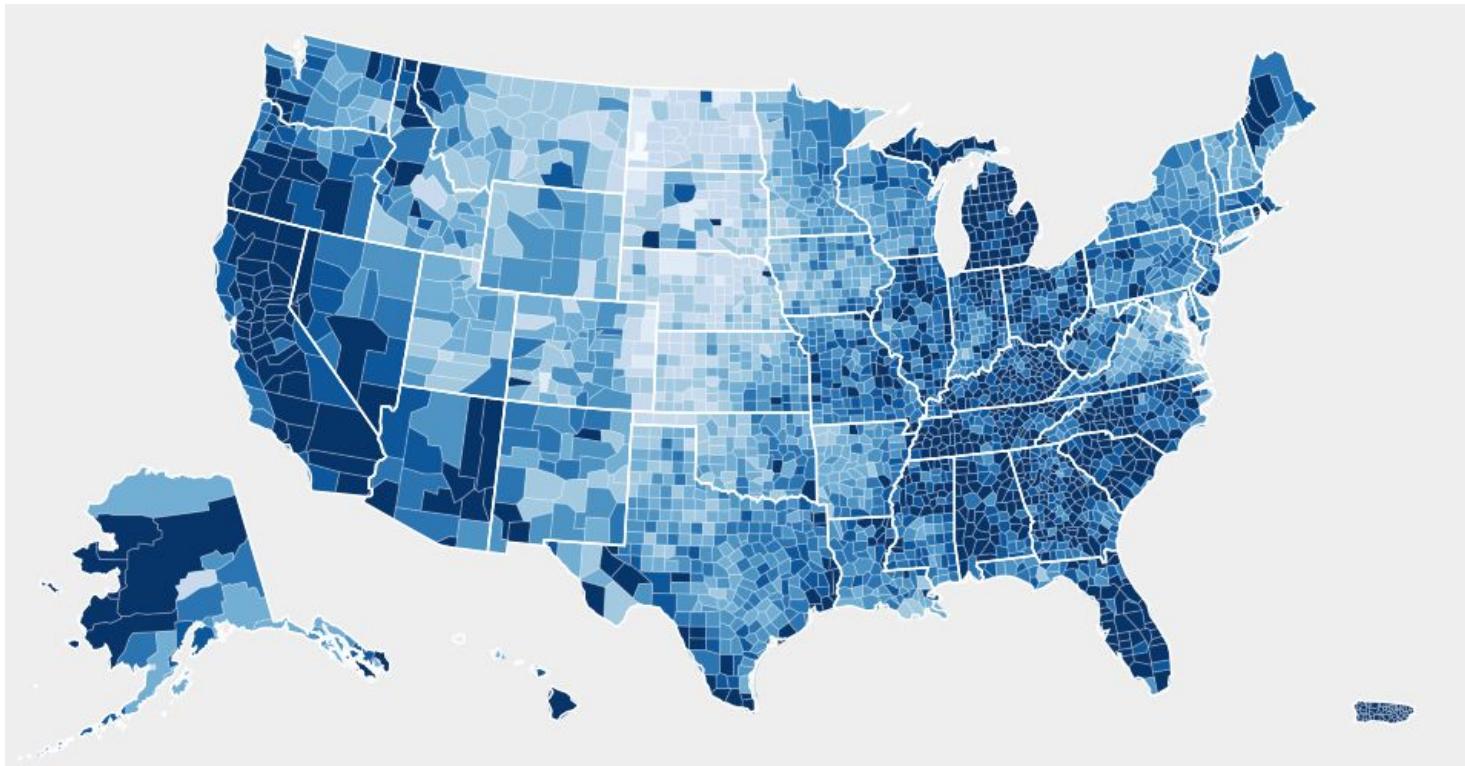
123 Definitive Stereotype Map Of Europe

↓

i.imgur.com/gpLOin... ↗



https://www.reddit.com/r/Infographics/comments/2g9is4/definitive_stereotype_map_of_europe/

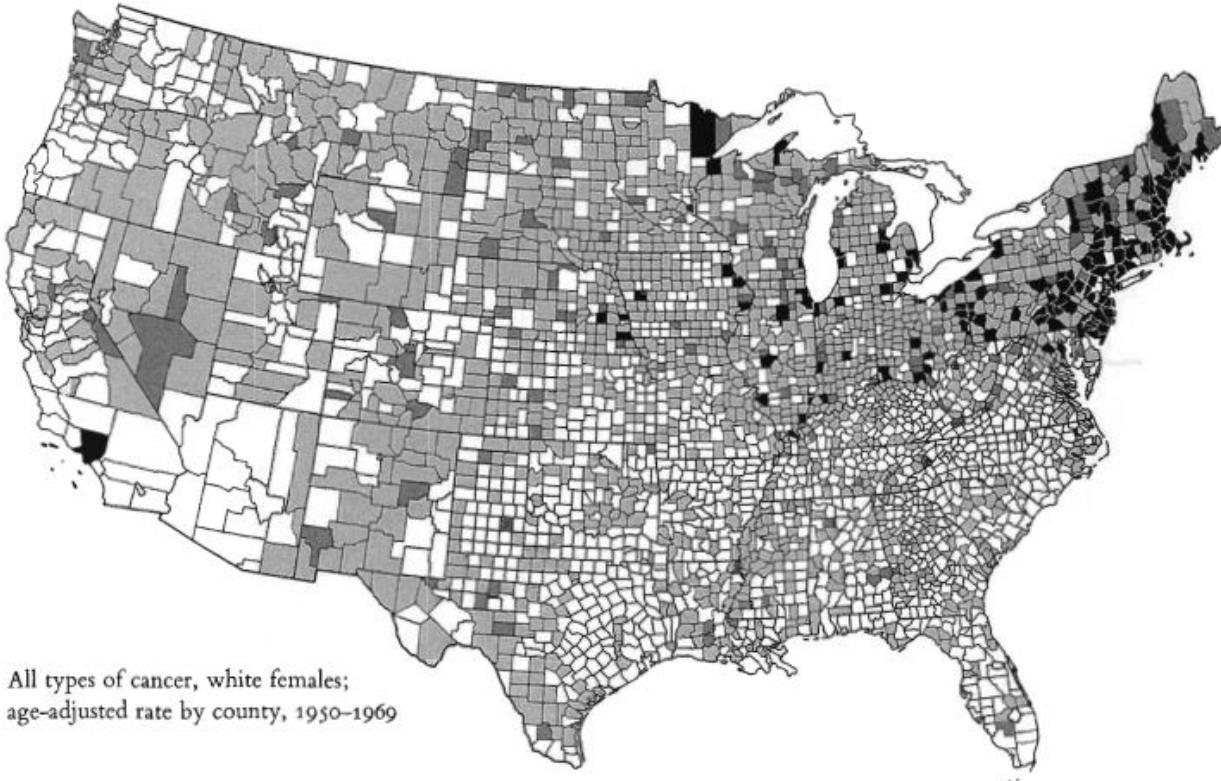


<https://observablehq.com/@d3/choropleth>

Choropleth Maps

χώρο– + πλήθ

“region” + “multitude”



All types of cancer, white females;
age-adjusted rate by county, 1950-1969

Life expectancy, 2021

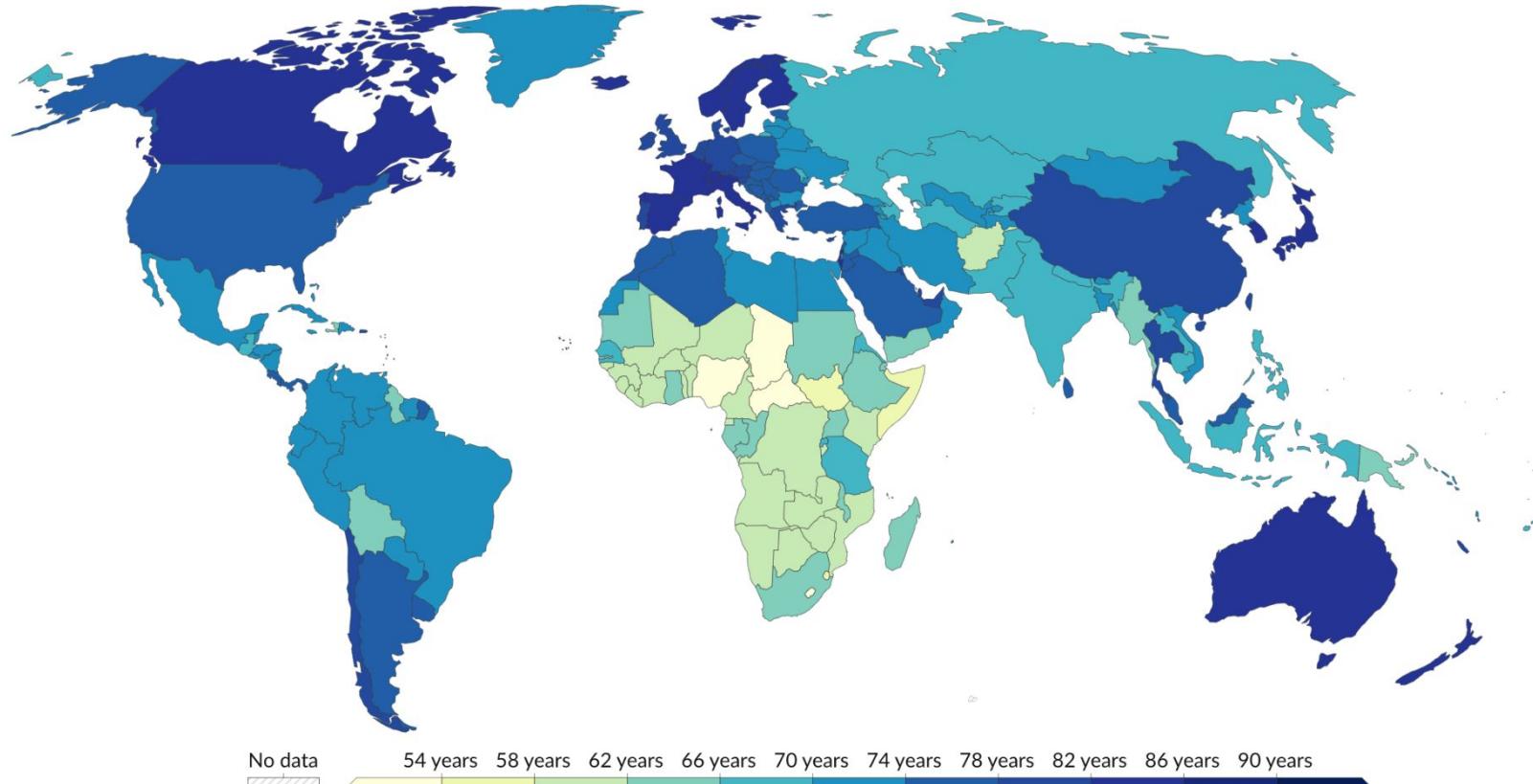
The total number of years a newborn is expected to live.

Table

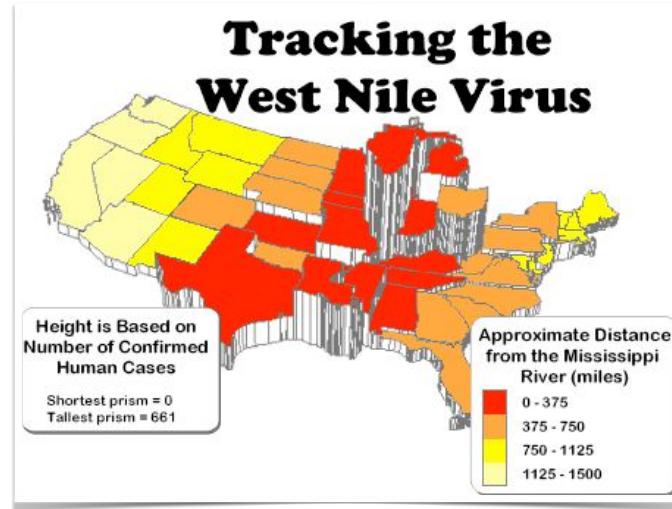
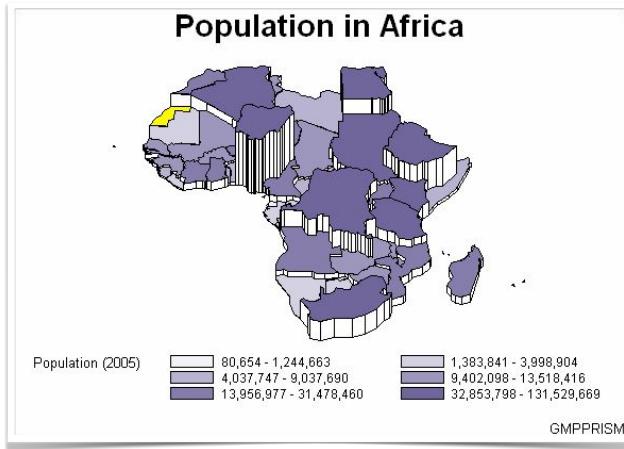
Map

Chart

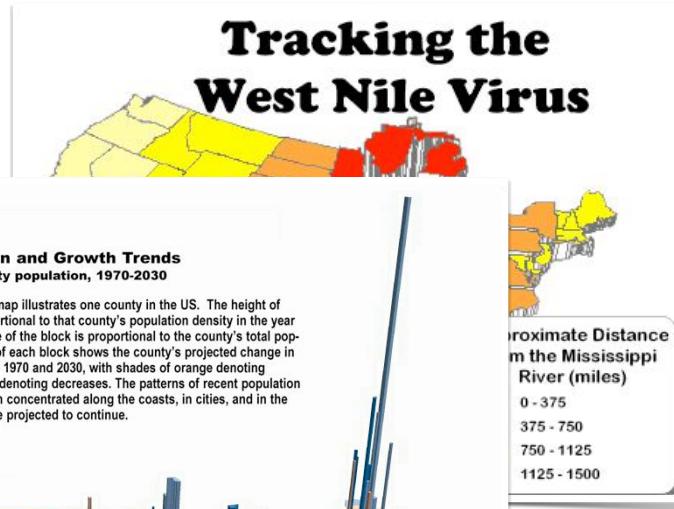
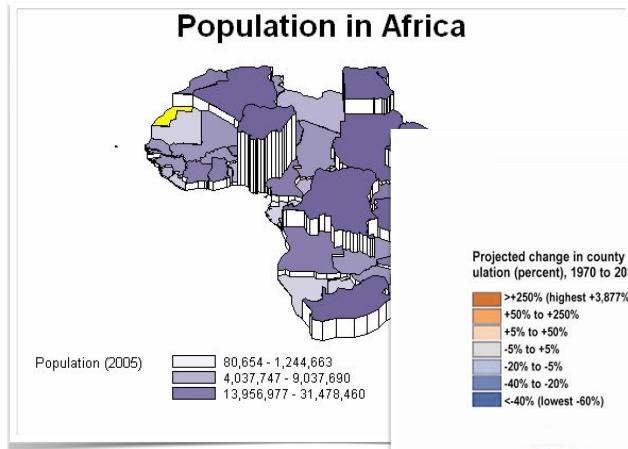
World



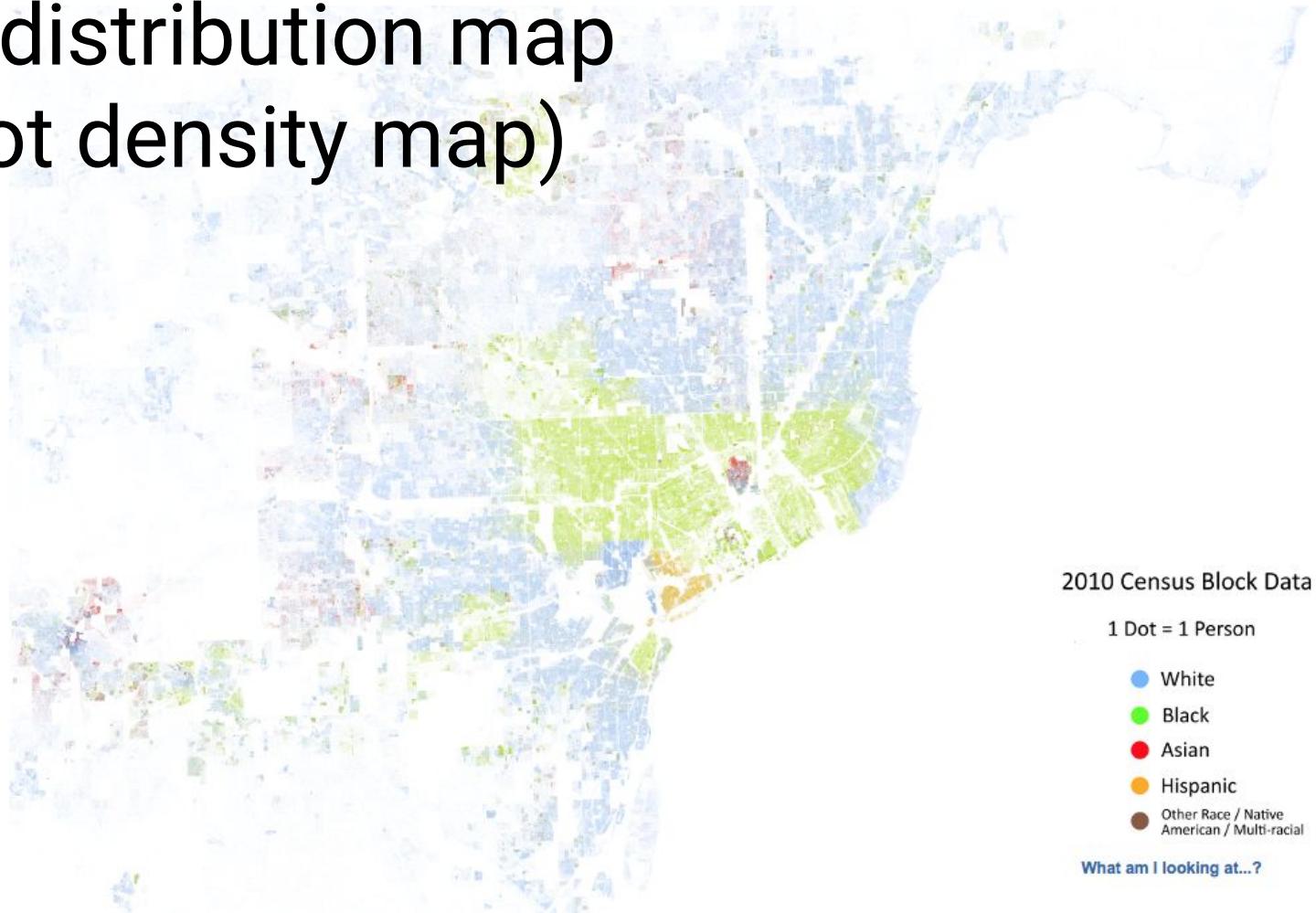
Prism map



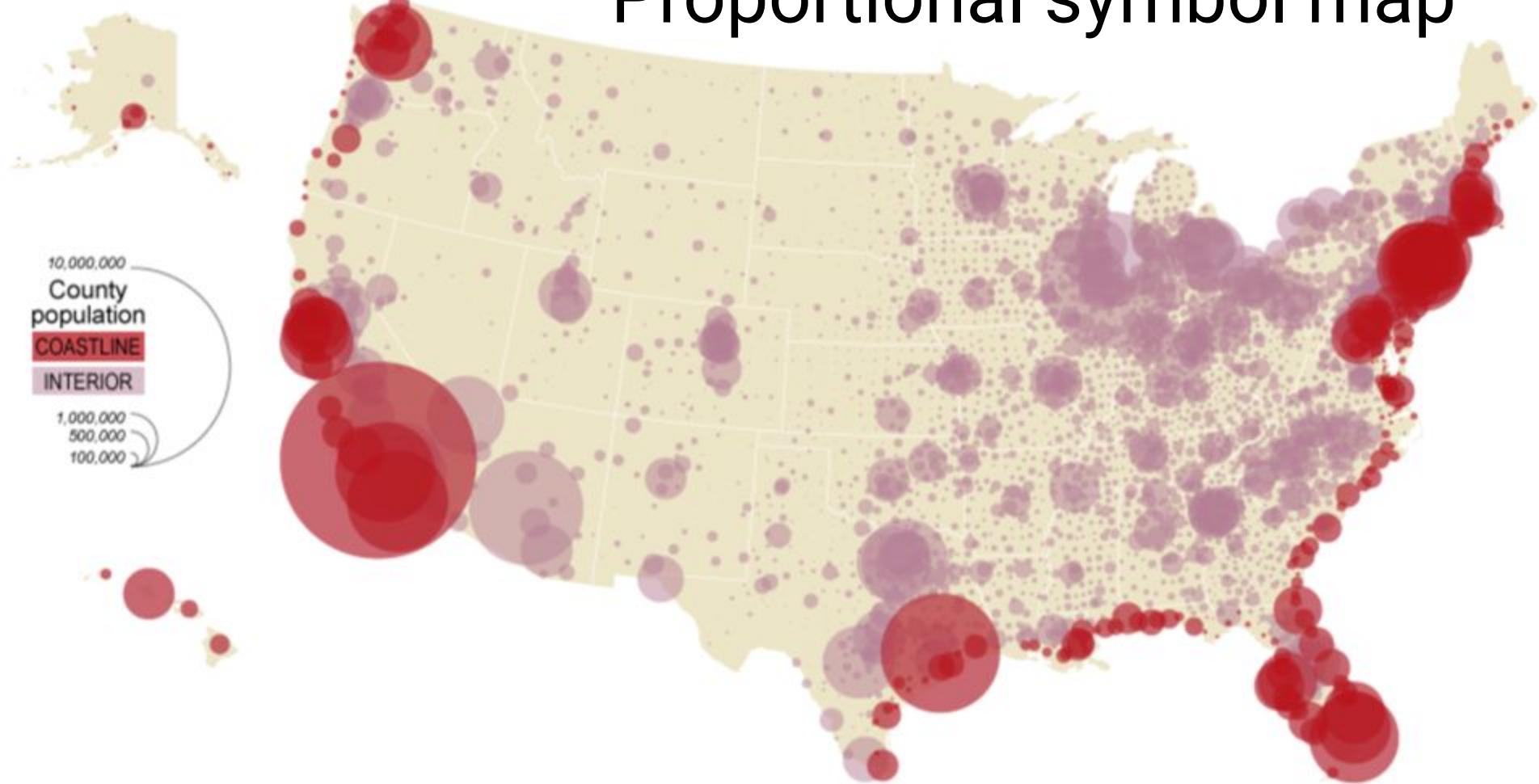
Prism map



Dot distribution map (Dot density map)



Proportional symbol map

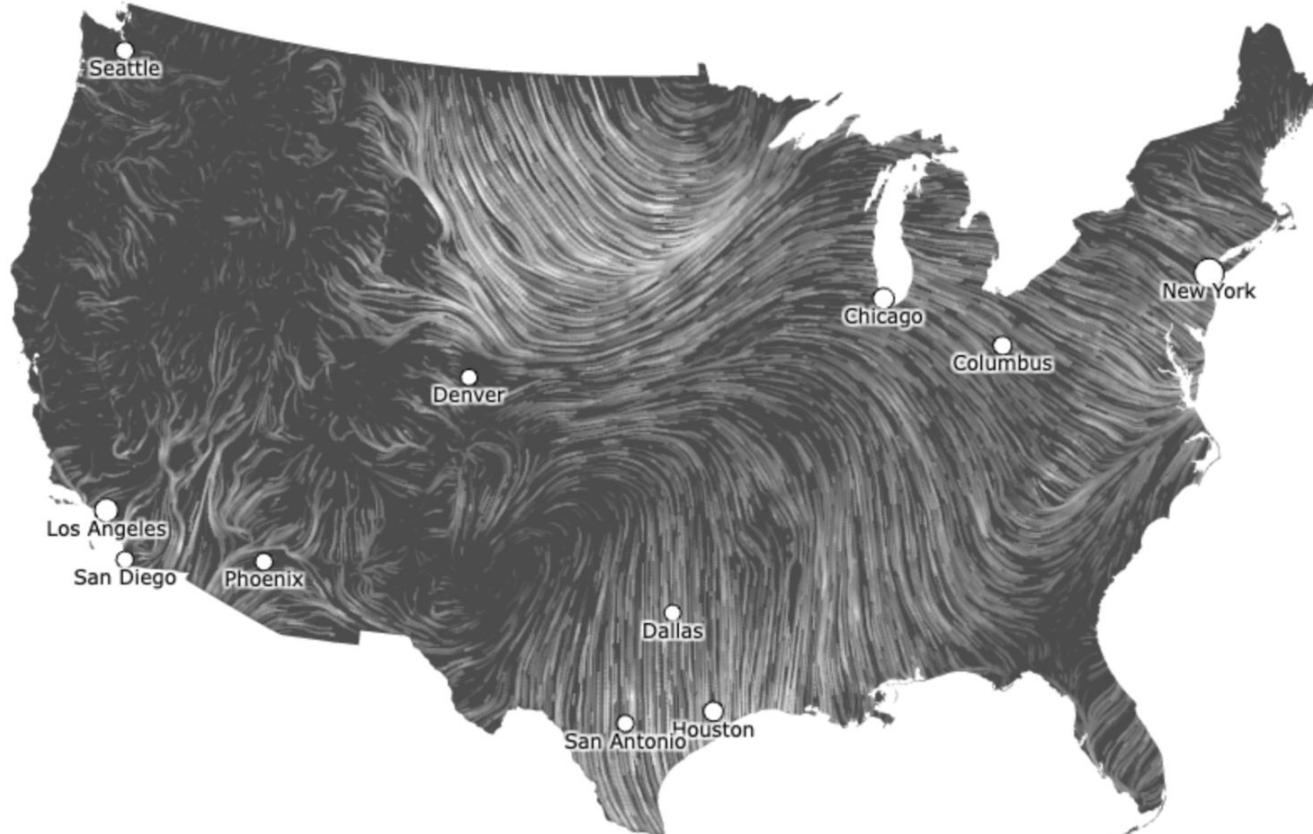
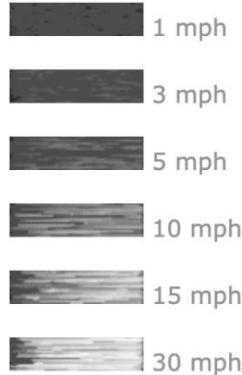


October 30, 2023

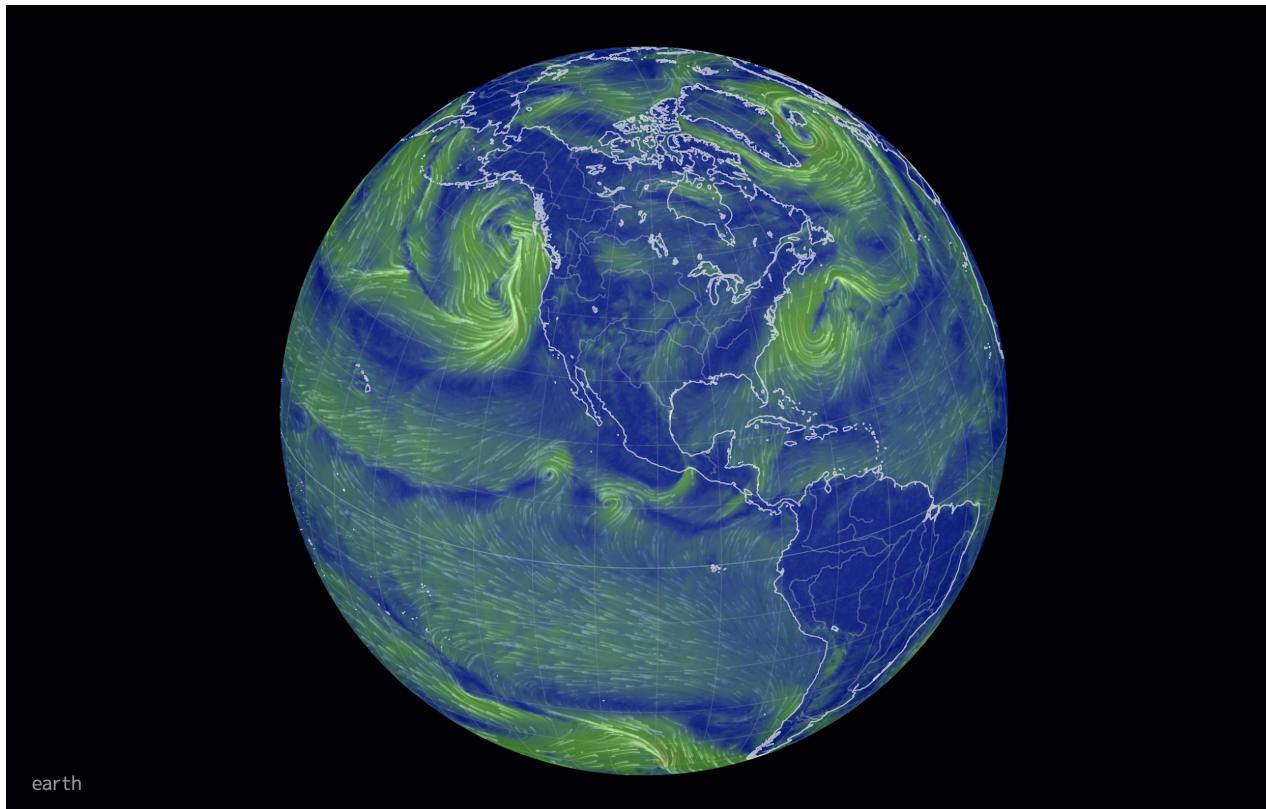
5:00 pm EST

(time of forecast download)

top speed: **32.1 mph**
average: **9.0 mph**



<https://earth.nullschool.net>

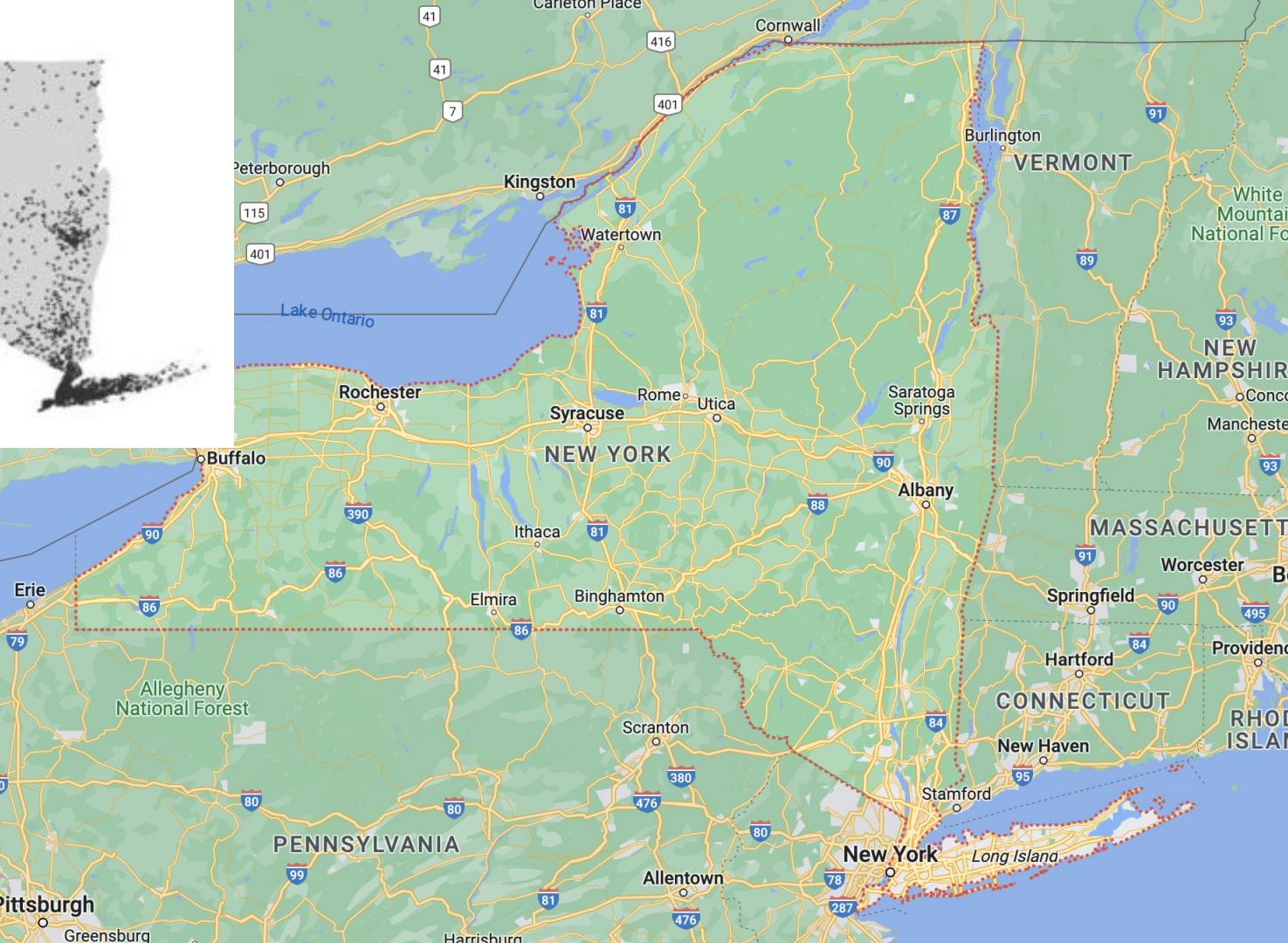


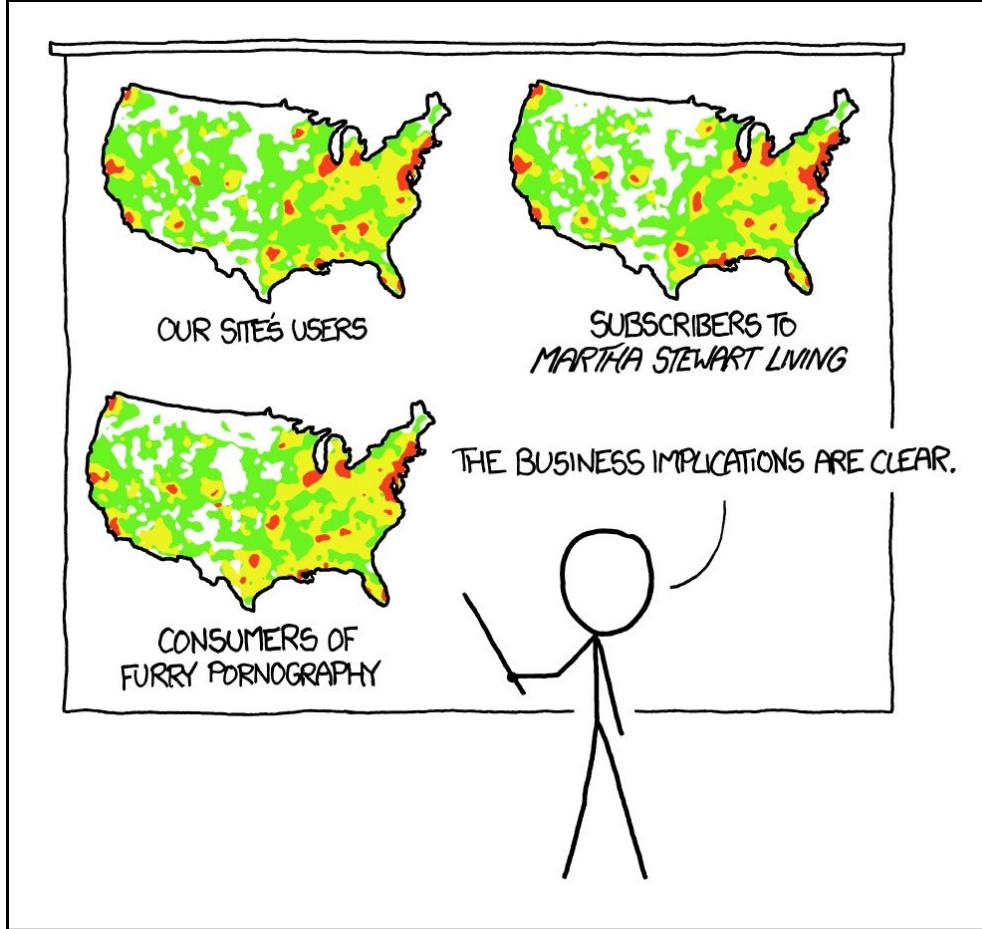
Some considerations



Lung cancer cases among males in the
state of New York, 1993-1997
(each dot represents 10 cases)

a

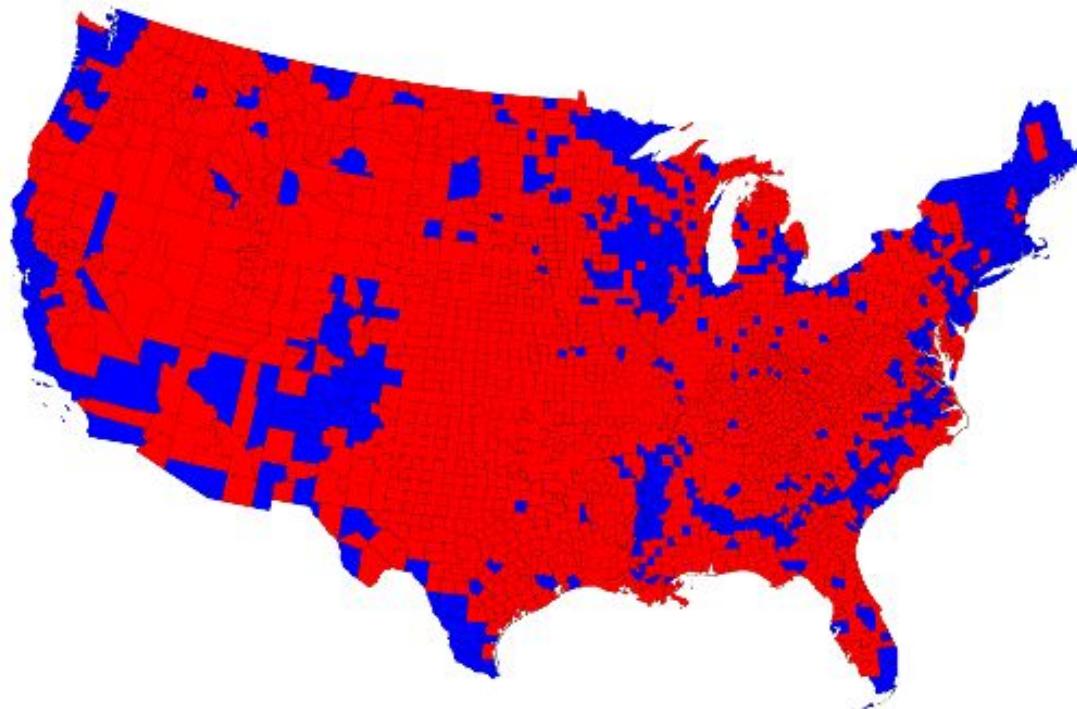




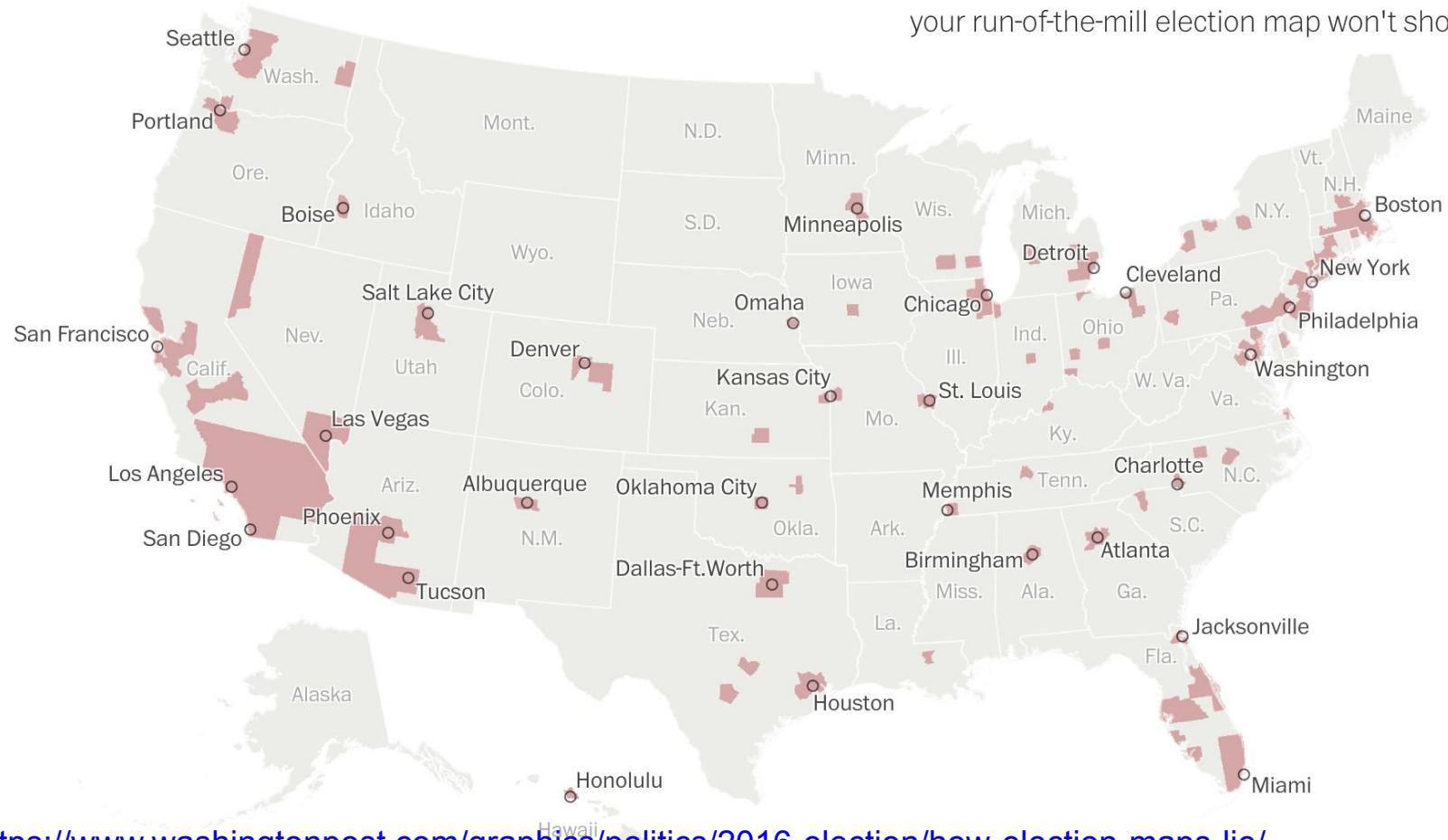
PET PEEVE #208:
GEOGRAPHIC PROFILE MAPS WHICH ARE
BASICALLY JUST POPULATION MAPS

<http://www-personal.umich.edu/~mejn/election/2012/>

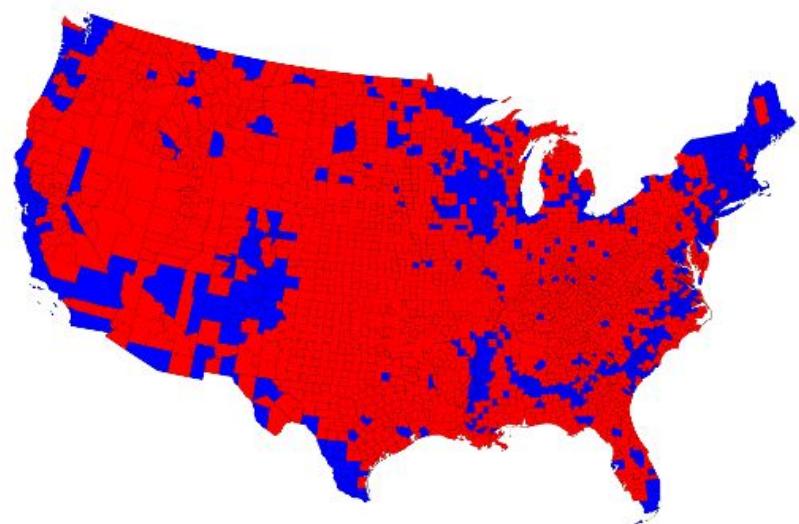
2012 Election result by counties



In 2012, about the same number of votes were cast in  **these 160 counties** as were cast in the  **rest of the country**. But, your run-of-the-mill election map won't show you that.



How can we mitigate these issues?



Many solutions!

Cartogram

“A **cartogram** is a map in which some thematic mapping variable – such as travel time, population, or Gross National Product – is substituted for land area or *distance*”

GRUNDY'S MAP OF THE UNITED STATES

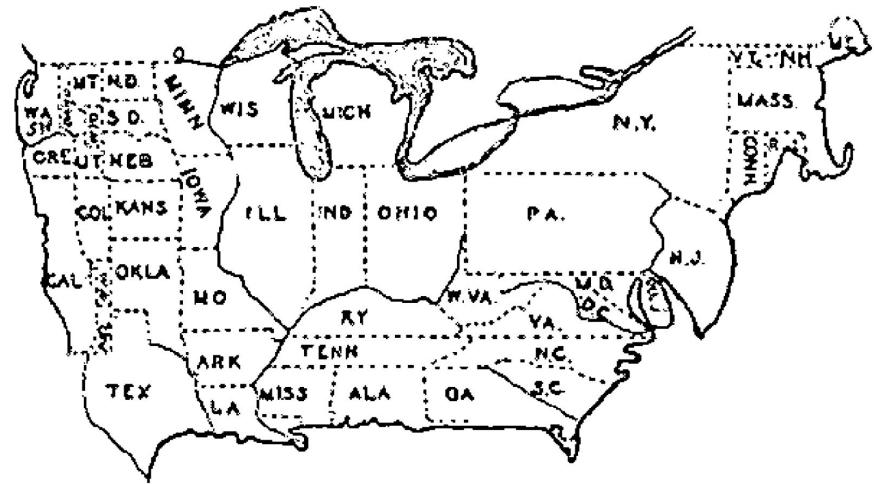
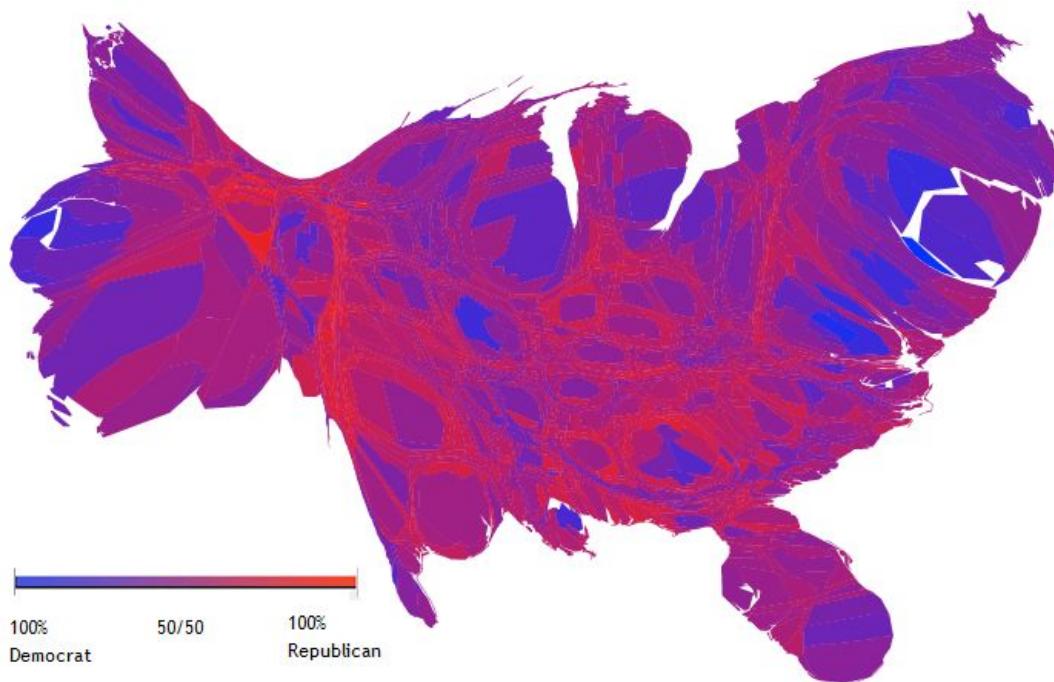


Figure 1. "Joseph R. Grundy, Pennsylvania manufacturer, suggested in the Senate lobby committee that the present equal power of States in voting on tariff bills is unfair because of differences in voting strength. Here's a map of the United States showing the size of each State on the basis of population and Federal Taxes." From the Washington Post November 3, 1929.

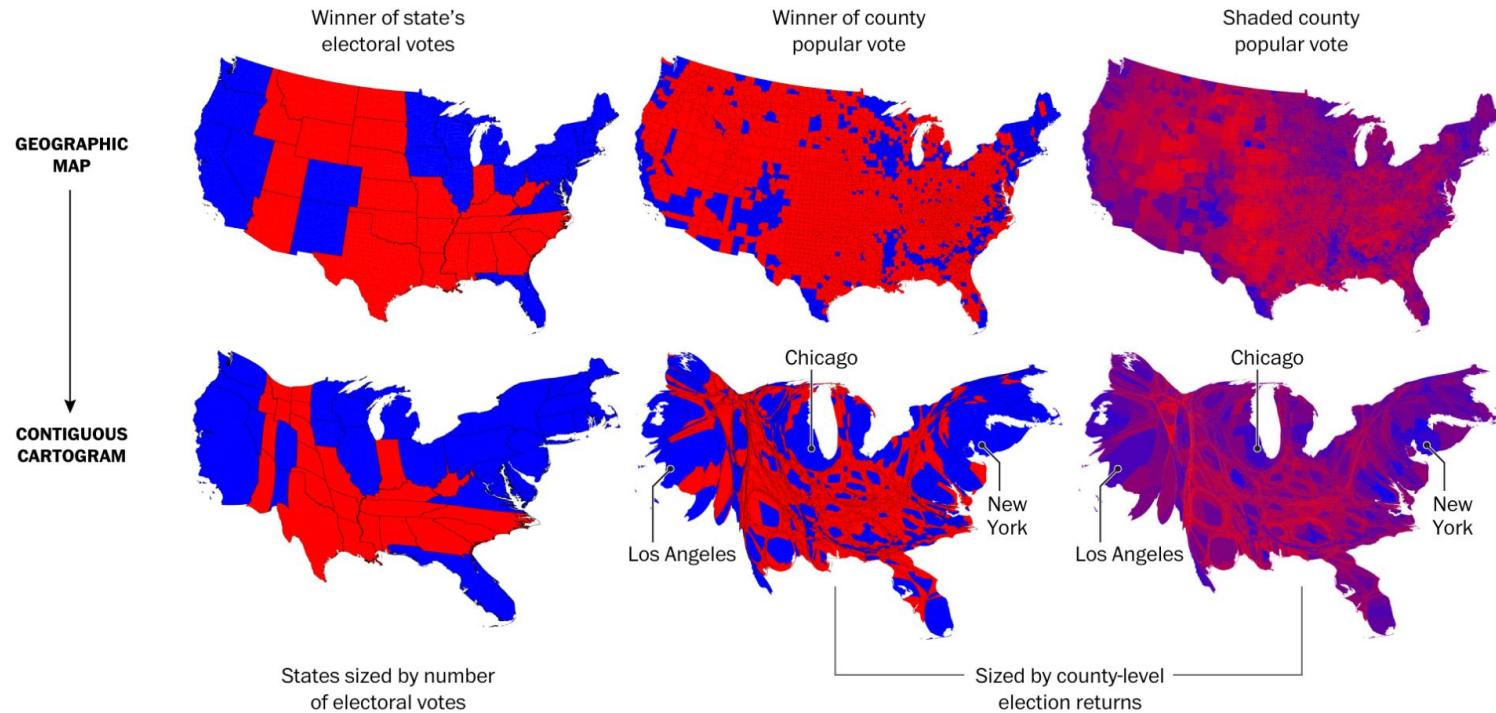
Literary Digest, April 23, 1921.

Relative Size of Each of the United States If Based on Electrical Energy Sold for Light and Power in 1921.

Contiguous cartogram

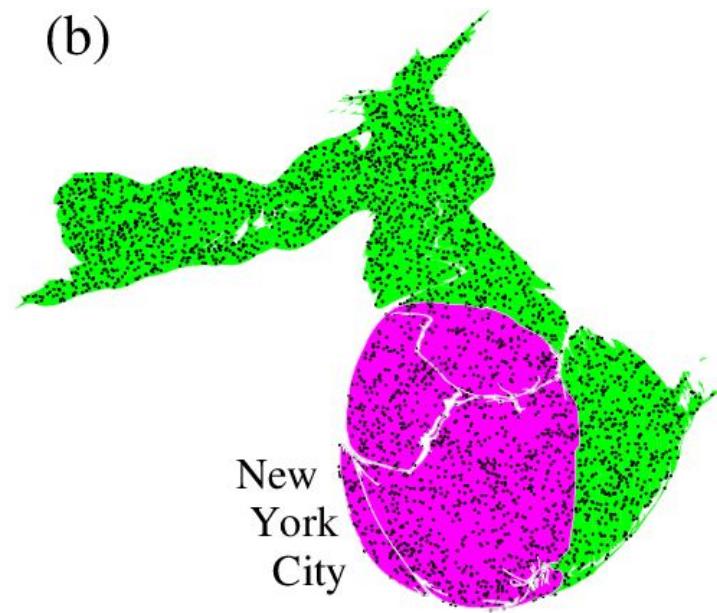
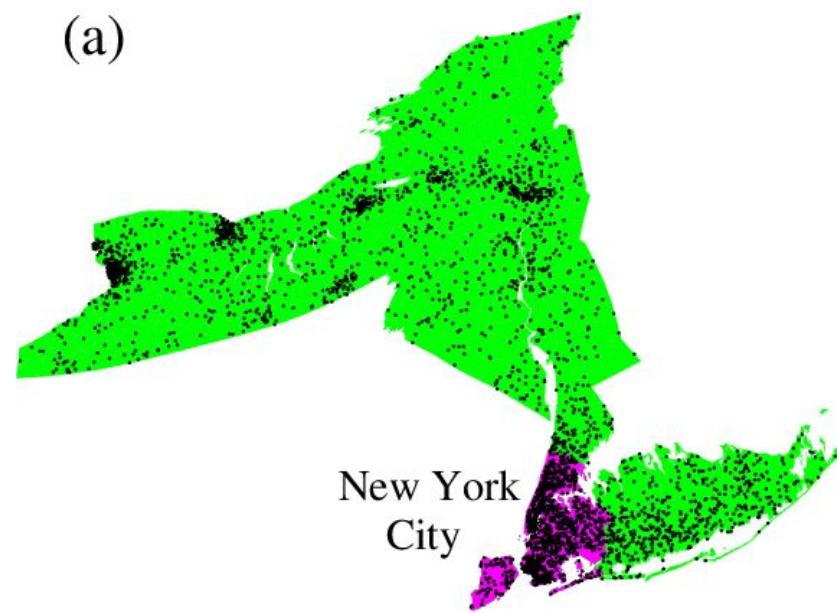


Density-equalizing cartogram



Maps courtesy of Mark Newman

Michael T. Gastner and M. E. J. Newman, Diffusion-based method for producing density-equalizing maps
<http://www.pnas.org/content/101/20/7499.abstract>



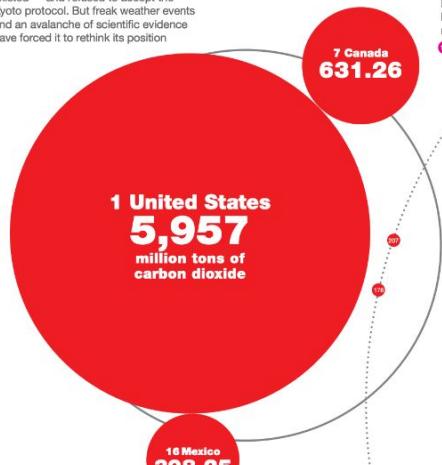
Hot spots – the carbon atlas

North America

6.99bn tons of CO₂

14% growth in carbon emissions, 1995–2005

The US as a major producer of greenhouse gases has been reluctant to accept that man-made climate change even existed — and refused to accept the Kyoto protocol. But freak weather events and an avalanche of scientific evidence have forced it to rethink its position



Central & South America

1.10bn tons of CO₂

29% growth in carbon emissions, 1995–2005

Increased freak weather events mean the IPCC is concerned South America will be hard-hit by climate change. Agriculture, water supplies and the unique natural habitat could be affected by a temperature increase of up to 4°C by the end of the century

CO₂ emission growth of the highest 20 emitters, 1995 to 2005

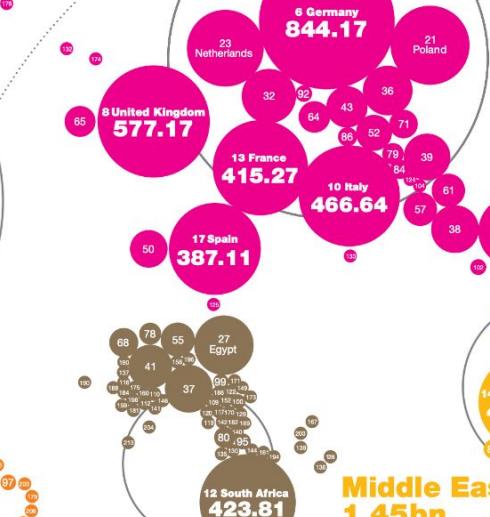
87%

Europe

4.67bn tons of CO₂

9% growth in carbon emissions, 1995–2005

For the first time, there is hard scientific evidence of climate change affecting Europe, said the Intergovernmental Panel on Climate Change recently. Freak weather events, such as the heatwaves of 2003, will become ever more common



Africa

1.04bn tons of CO₂

28% growth in carbon emissions, 1995–2005

It carbon emissions may be small but this is the continent most vulnerable to the effects of climate change, hitting food and water supplies, causing coastal flooding and an increase in tropical diseases such as malaria — as well as destroying parts of the ecosystem



Middle East

1.45bn tons of CO₂

62% growth in carbon emissions, 1995–2005

The region is a major contributor to global greenhouse gas emissions, through an oil and gas industry which produces over 30 percent of world oil supply and over 10 percent of its gas

Highest per person CO₂ emissions, Top twenty, 2005, tons

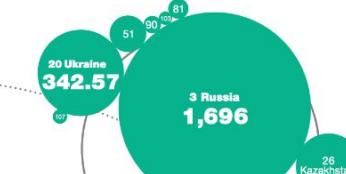
61.94

Eurasia

2.58bn tons of CO₂

4% growth in carbon emissions, 1995–2005

Russia's carbon emissions dropped from 583 million metric tons of carbon in 1992 to 405 million metric tons in 1998, due to its then-deteriorating economic situation. Now, the energy giant may make clean up trading carbon credits



World total

28.19bn tons of CO₂

28% growth in carbon emissions, 1995–2005

World carbon emissions are up from 18.3bn tons in 1980 — and with rapid industrialization in the developing world, those numbers will climb higher. The effect is delayed, which means even if we stopped emitting carbon now, it would go on increasing in the atmosphere



Asia & Oceania

10.36bn tons of CO₂

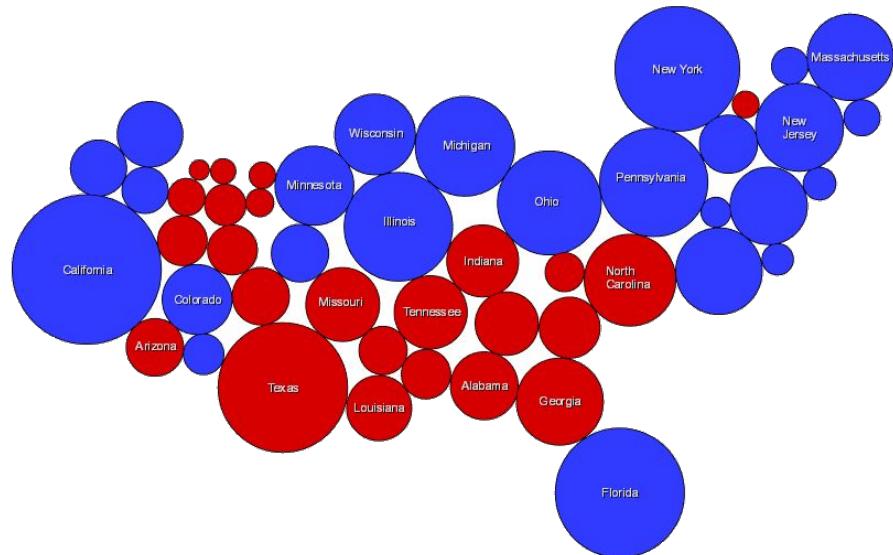
58% growth in carbon emissions, 1995–2005

Rapid industrialization combined with greater numbers of people moving to cities has provoked a huge rise in carbon emissions — with China rapidly moving to become the world's greatest carbon emitter in the next two years — some scientists say this has happened already

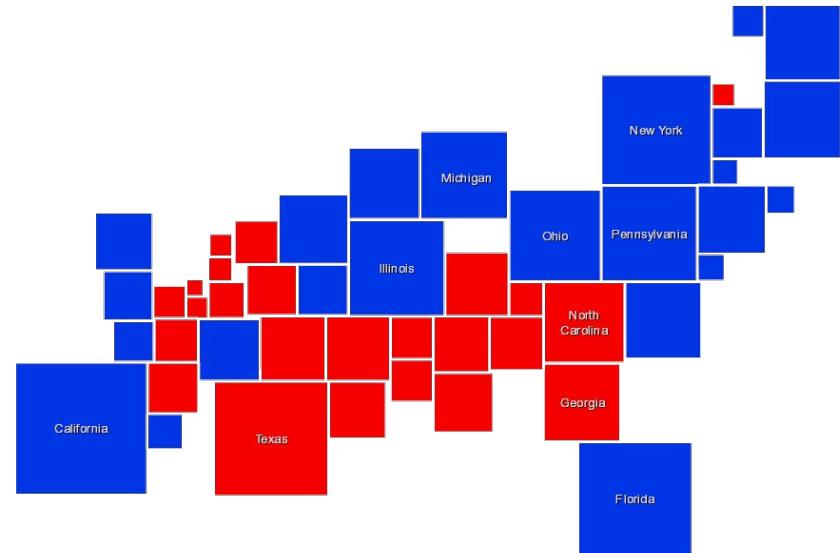


These are the latest UN figures for climate change emissions. Reliable, but provisional estimates for 2006 by Dutch government researchers suggest China's CO₂ emissions increased by 8% in 2006 and have now

Graphical cartogram (Diagrammatic cartogram)

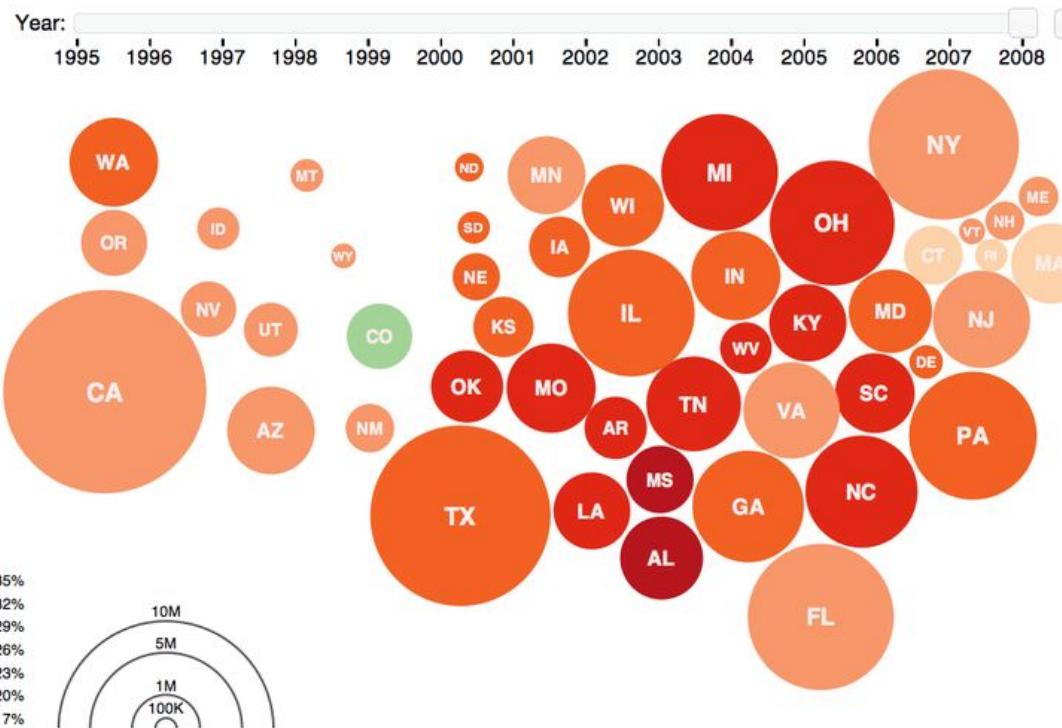


Dorling diagram (using circles)

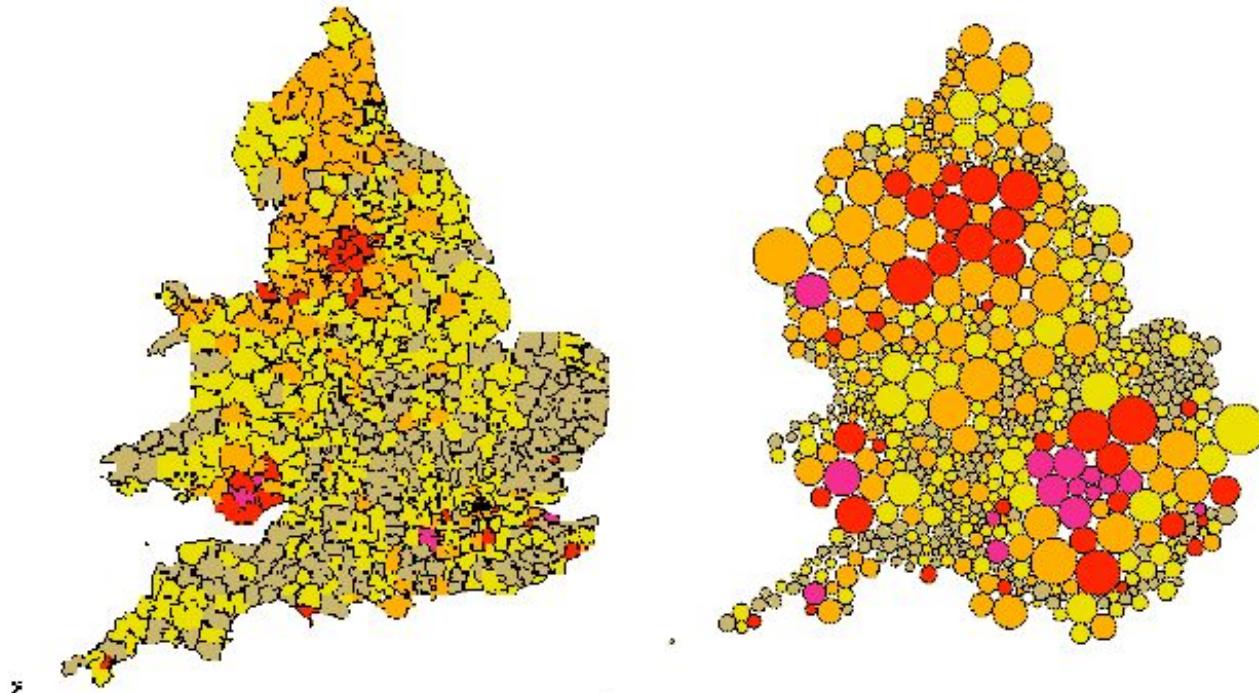


Demers cartogram (using squares)

Dorling Cartogram of Obesity in the U.S., 2008

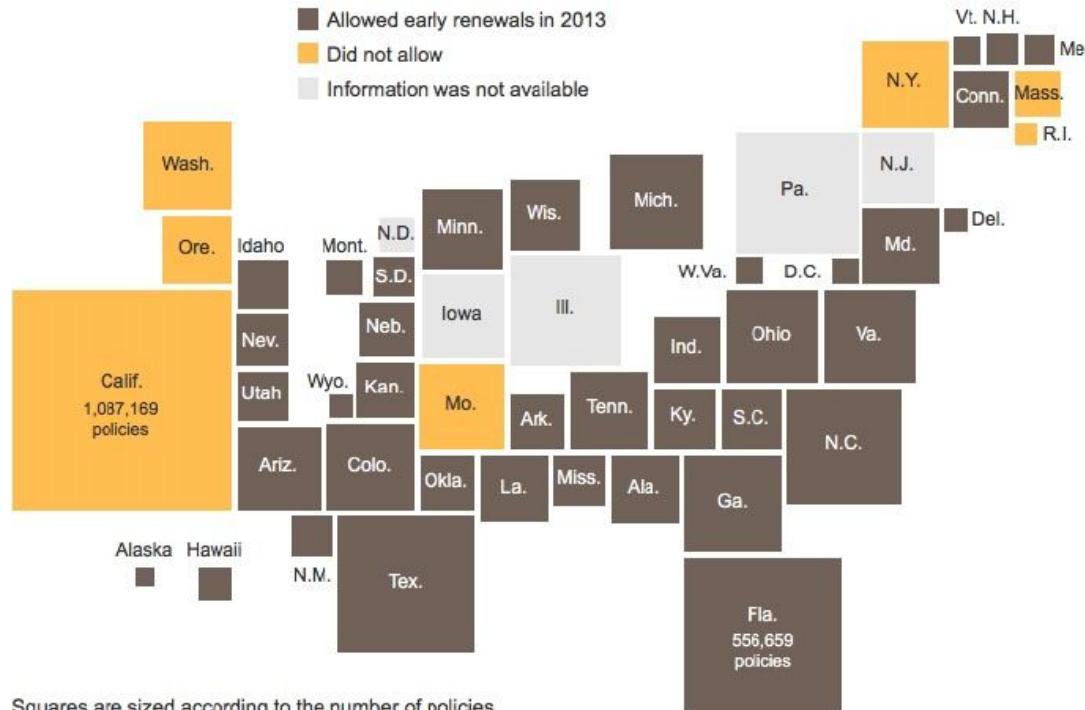


COMPARISON OF A TRADITIONAL MAP AND CARTOGRAM REPRESENTATIONS OF
THE PERCENTAGE OF THE MALE POPULATION OF WORKING AGE IN 1891



Demers cartogram

States Where Insured Could Renew Plans Before Change by Obama



Any drawback of the contiguous
and graphical cartograms?

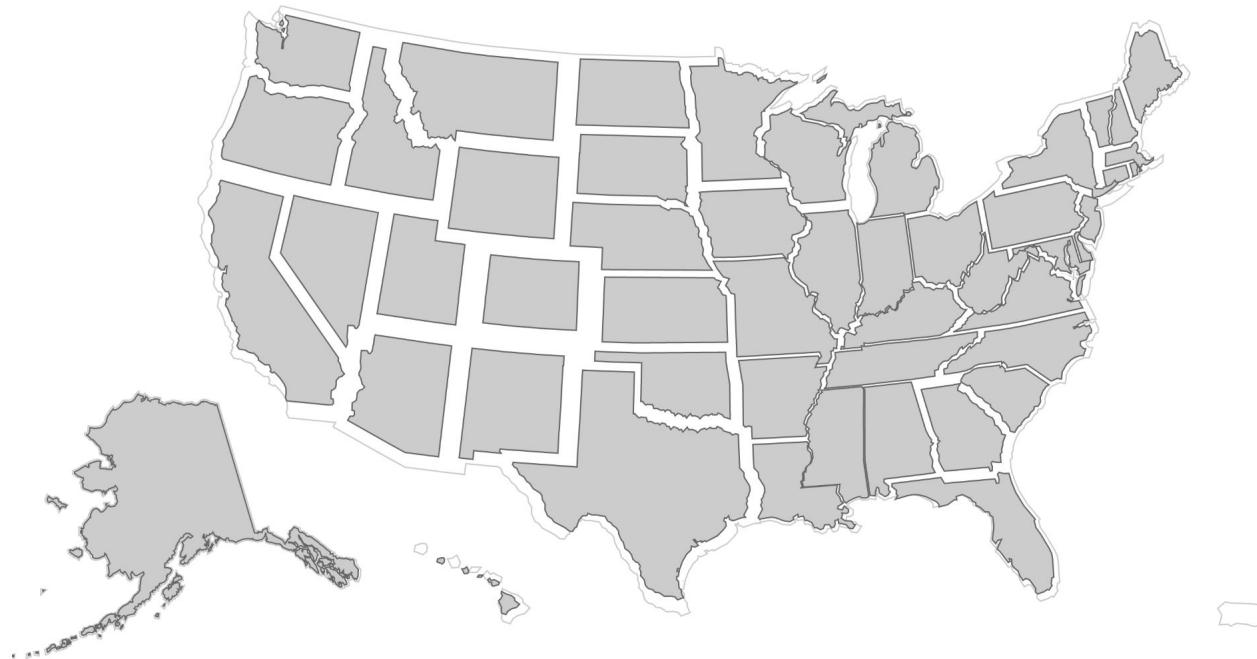
They dramatically **distort**
the shape of regions

Non-contiguous cartogram



d3.js

Non-Contiguous Cartogram

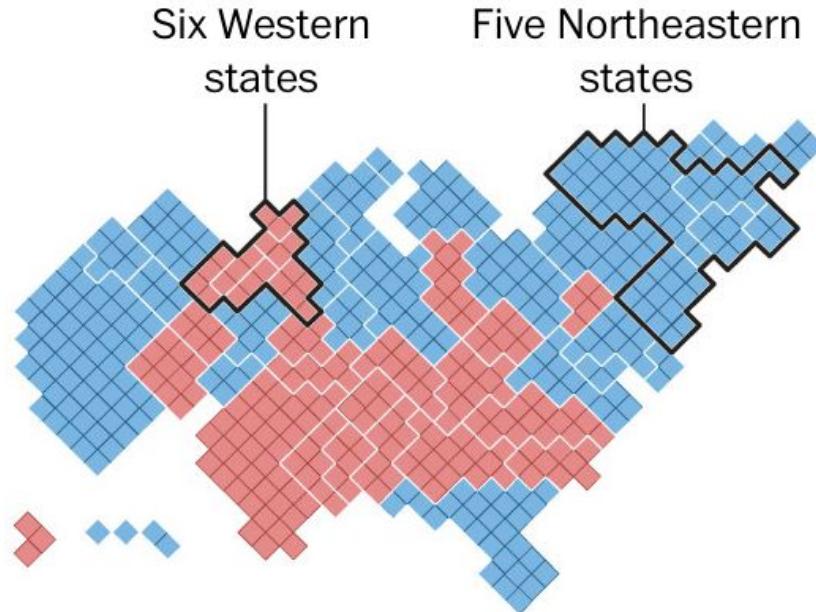
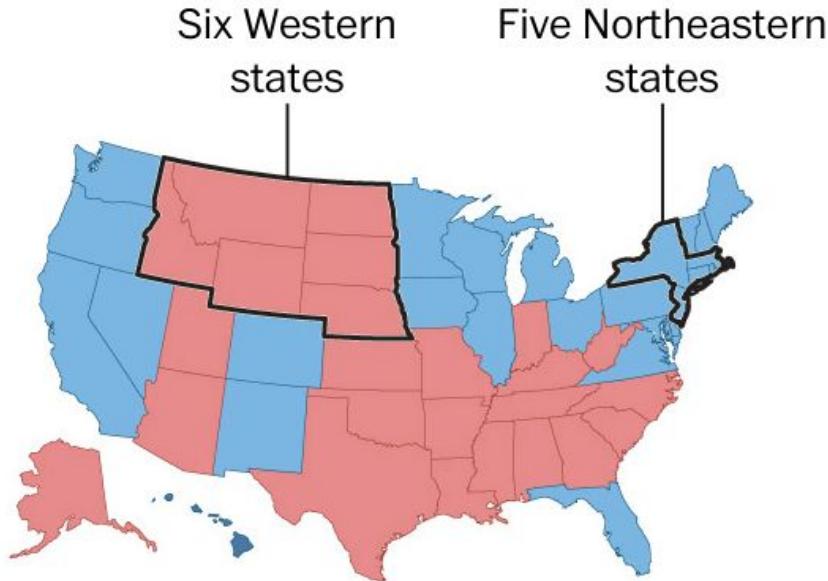


Inspired by [Zachary Johnson](#). Non-contiguous cartogram design invented by [Judy Olsen](#). Albers projection derived from work by [Tom Carden](#). U.S. state and county boundaries from the [U.S. Census Bureau](#), simplified using [GDAL](#) and [MapShaper](#).

<https://strongriley.github.io/d3/ex/cartogram.html>

Gridded cartogram (Mosaic cartogram)

GEOGRAPHIC MAP → CARTOGRAM OF ELECTORAL VOTES

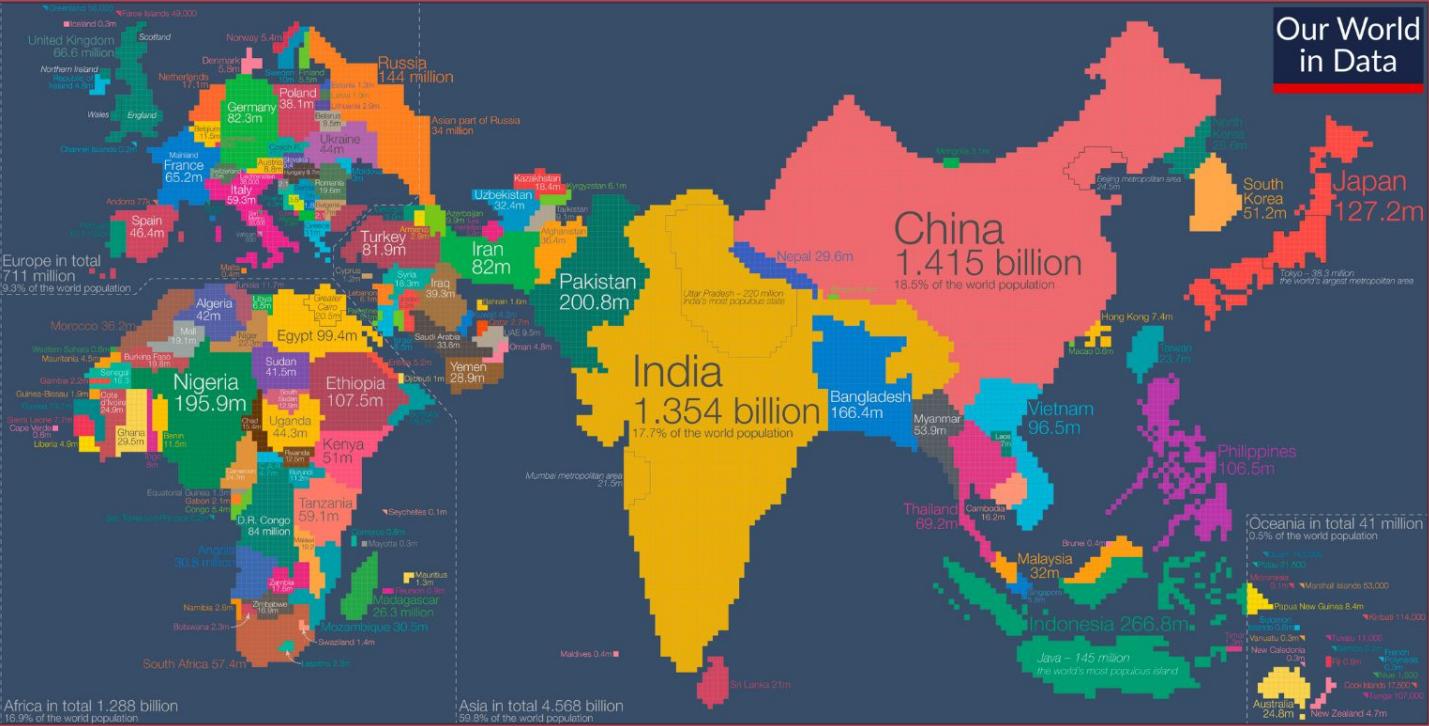


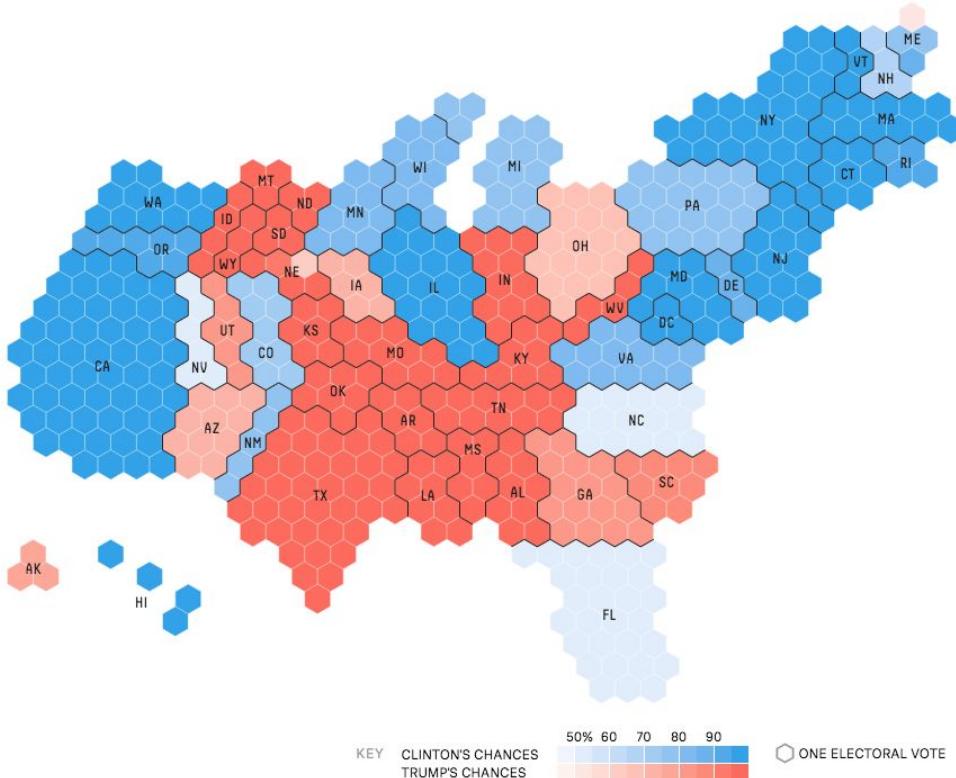
World Population in 2018

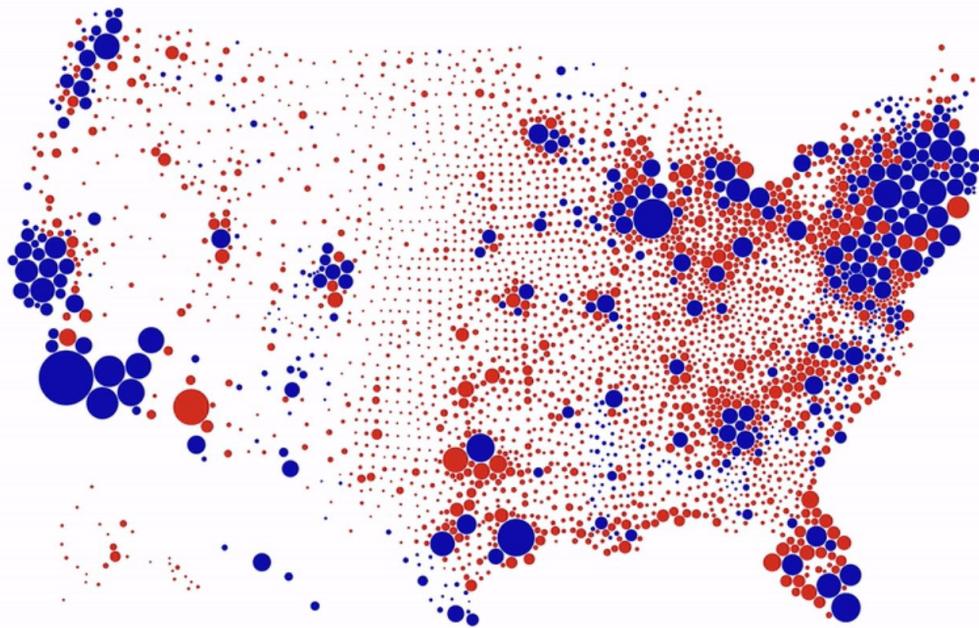
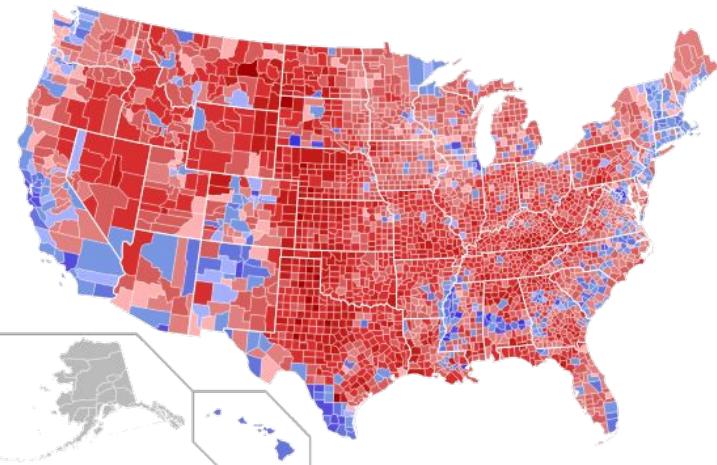
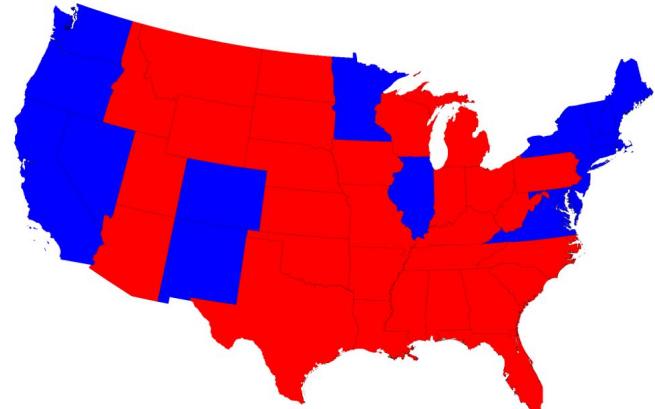
The country's size in this map represents the size of the population. Each square [■] represents 500,000 people. All 15,266 squares show where the world's 7.633 billion people live.

by Max Roser for [Our World in Data.org](#) – the free online publication that presents the research and data to make progress against the world's largest problems.

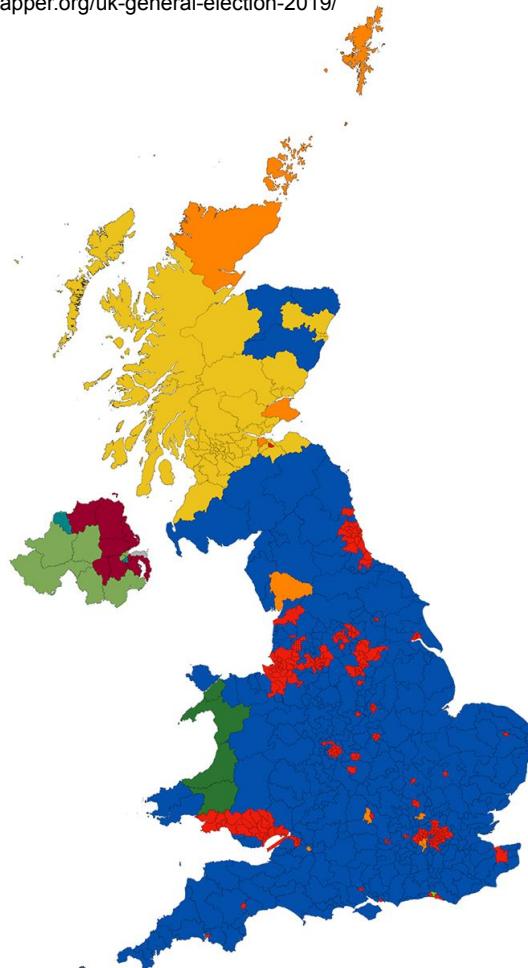
Population data from the *United Nations Population Division*
Version 3 (October 2018)



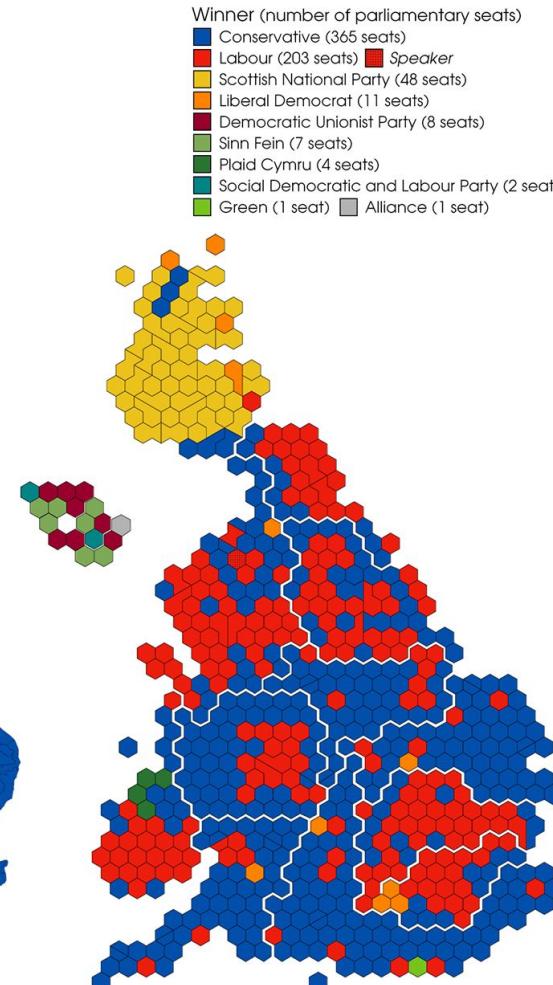




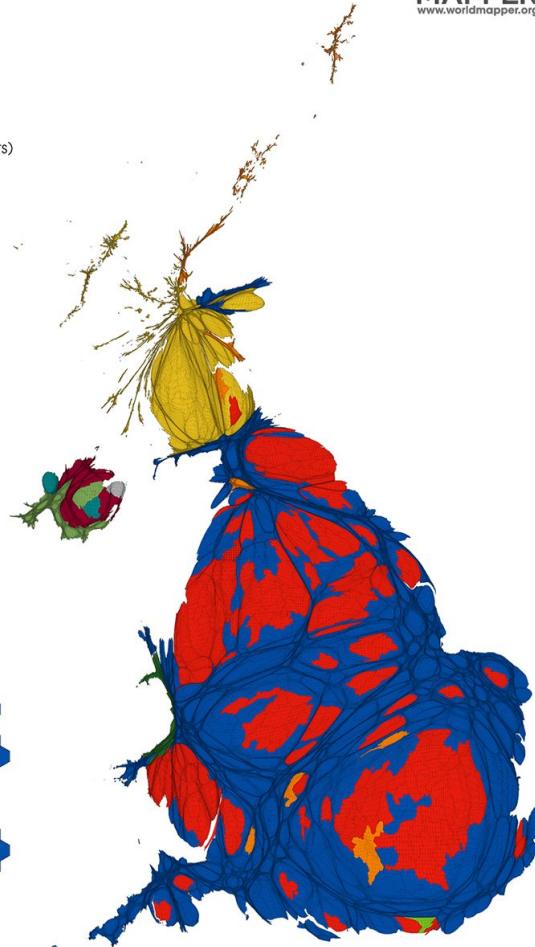
<https://demcastusa.com/2019/11/11/land-doesnt-vote-people-do-this-electoral-map-tells-the-real-story/>



Geographic view
Map showing land area

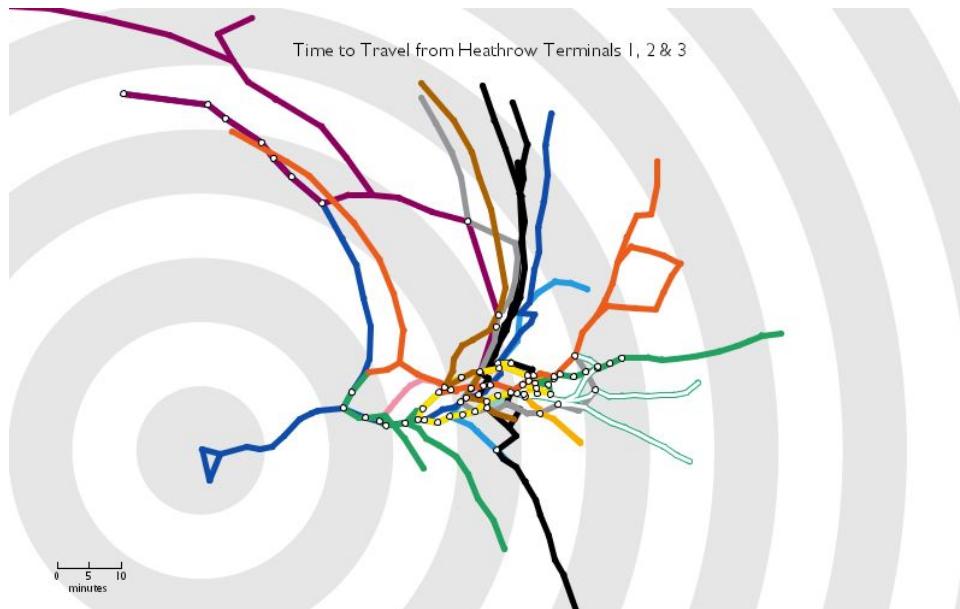


Constituency view
Map showing seats in parliament



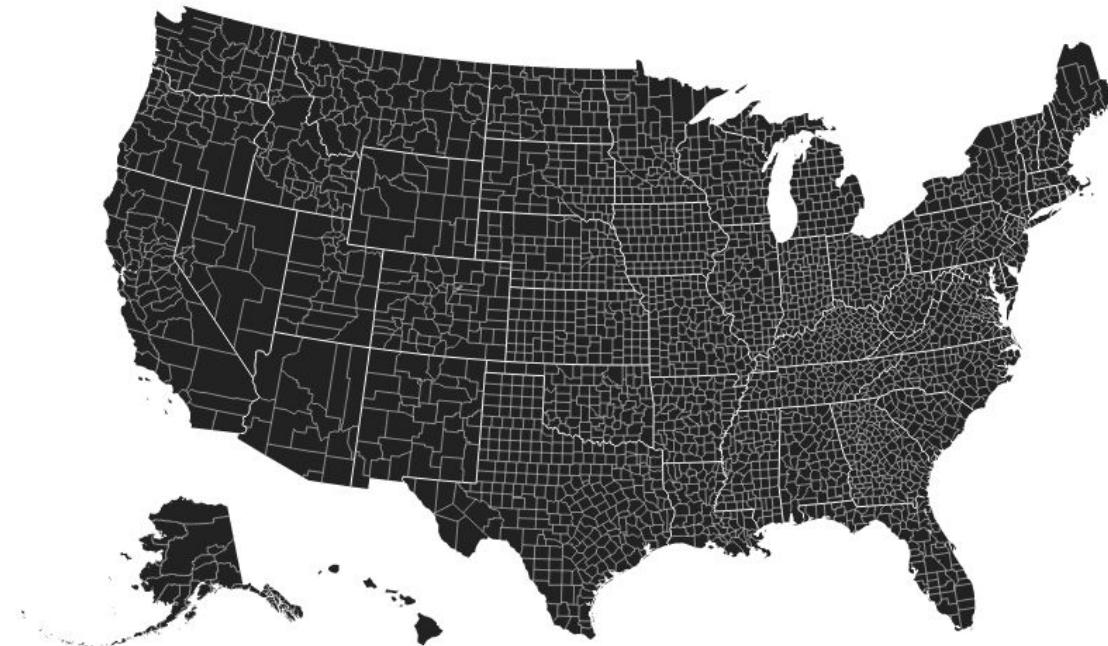
Population view
Map showing population distribution

Distance cartogram



Time to travel from Heathrow terminal
-> distance from the center

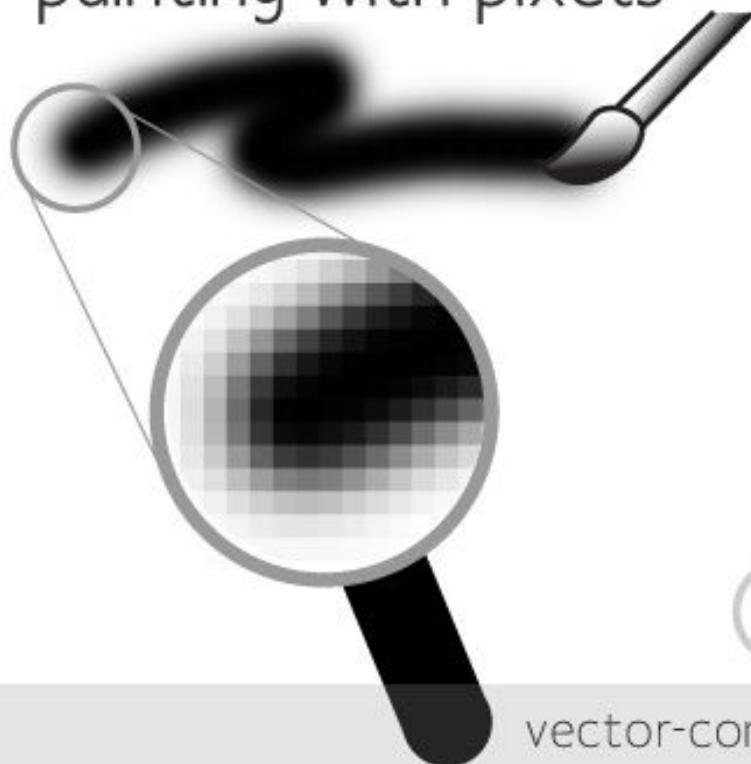
How do you store & draw a
map like this?



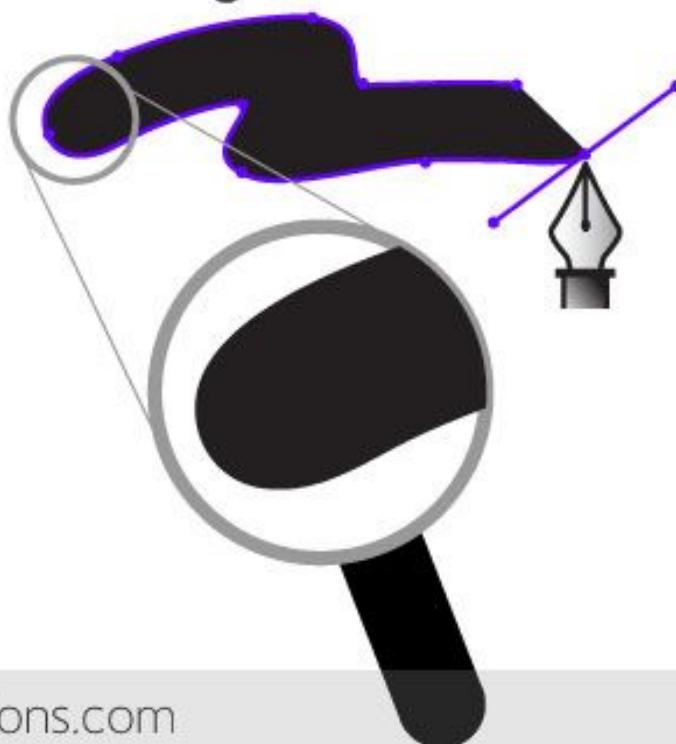
Raster vs. Vector

Image vs. Drawing Instruction

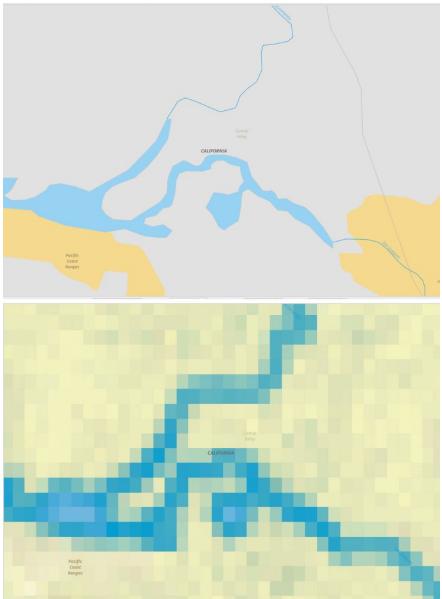
painting with pixels



drawing with vectors



Aerial and satellite map images?



Rendering cost?



Zoom levels, aesthetics, and storage cost?

Style customization?



Your data?