

Cartographic methods (and Cartographic License)

Sarah Battersby
Tableau Research

Goals

People are decent at making sense of spatial patterns

Good map design helps us find these spatial patterns faster

But...

Goals

People are decent at making sense of spatial patterns

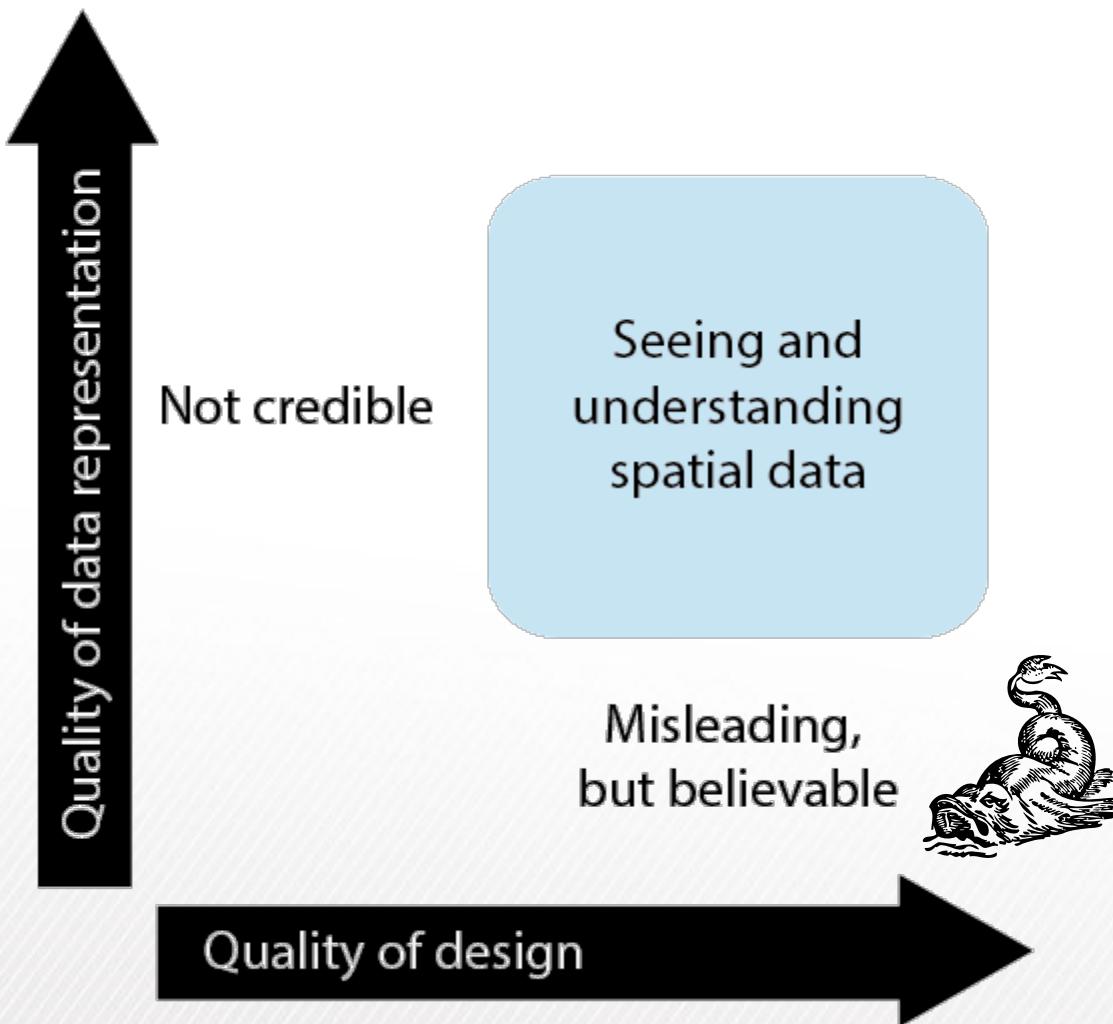
Good map design helps us find these spatial patterns faster

But



thar be dragons along the way

Where I'm coming from...



CARTOGRAPHIA

CARTOGRAPHIC LICENSE

C957822



This license is issued as a license to practice the art and science of cartography; it does not provide protection from any form of cartographic distortion or from the misuse of cartographic products.

DR. MAP
Cartographer

What does cartographic license get you?

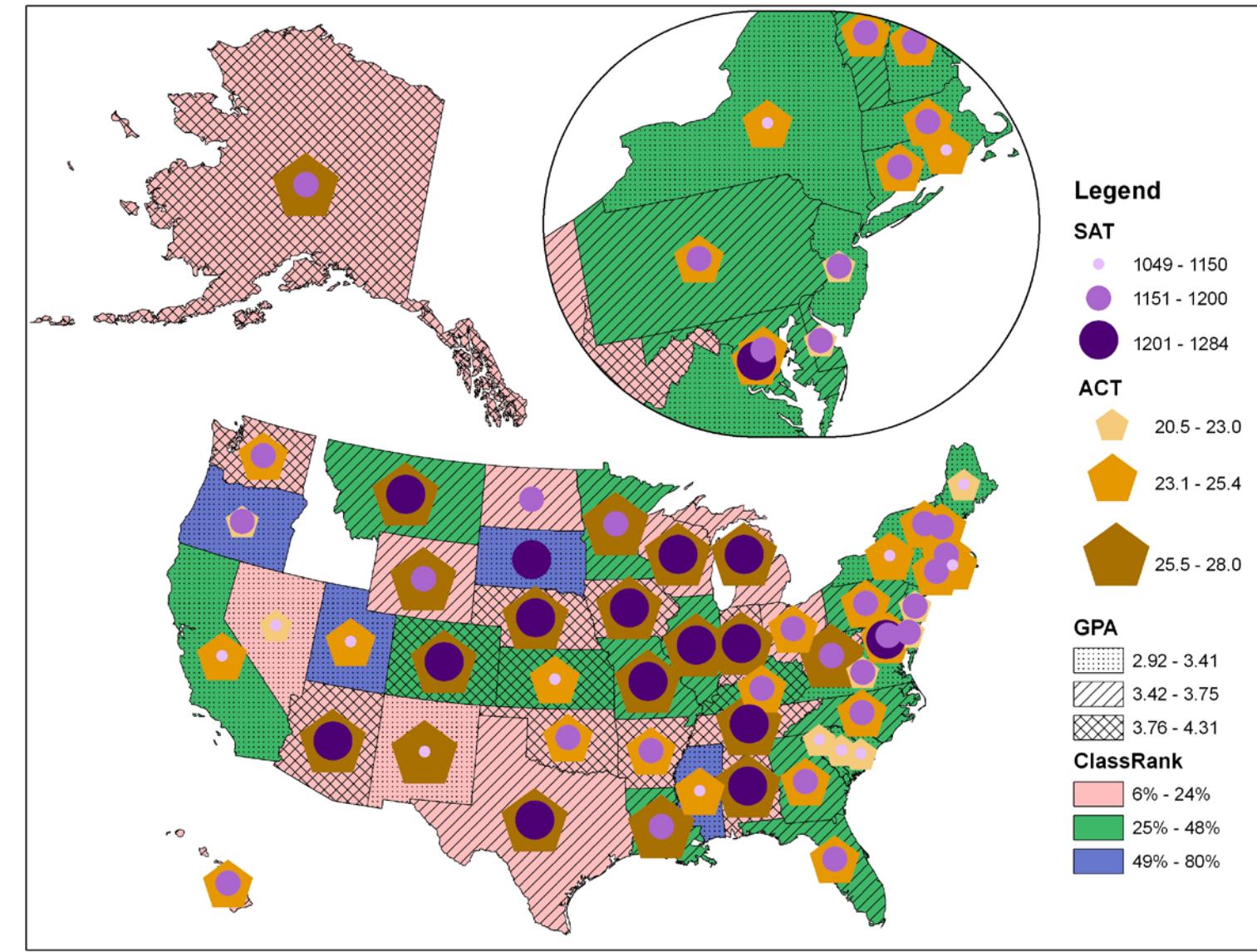
The individual to whom this license has been issued is hereby granted all rights of a cartographer, including, but not limited to:

- the freedom to adjust map content, layout, appearance, and level of distortion to shape, distance, area, and angle
- choose between bad data and no data
- create new cartographic truths, as needed.

Immediate loss of license



Immediate loss of license



Immediate loss of license



Took a while to find something even vaguely legit to explain this...



Use the right visualization

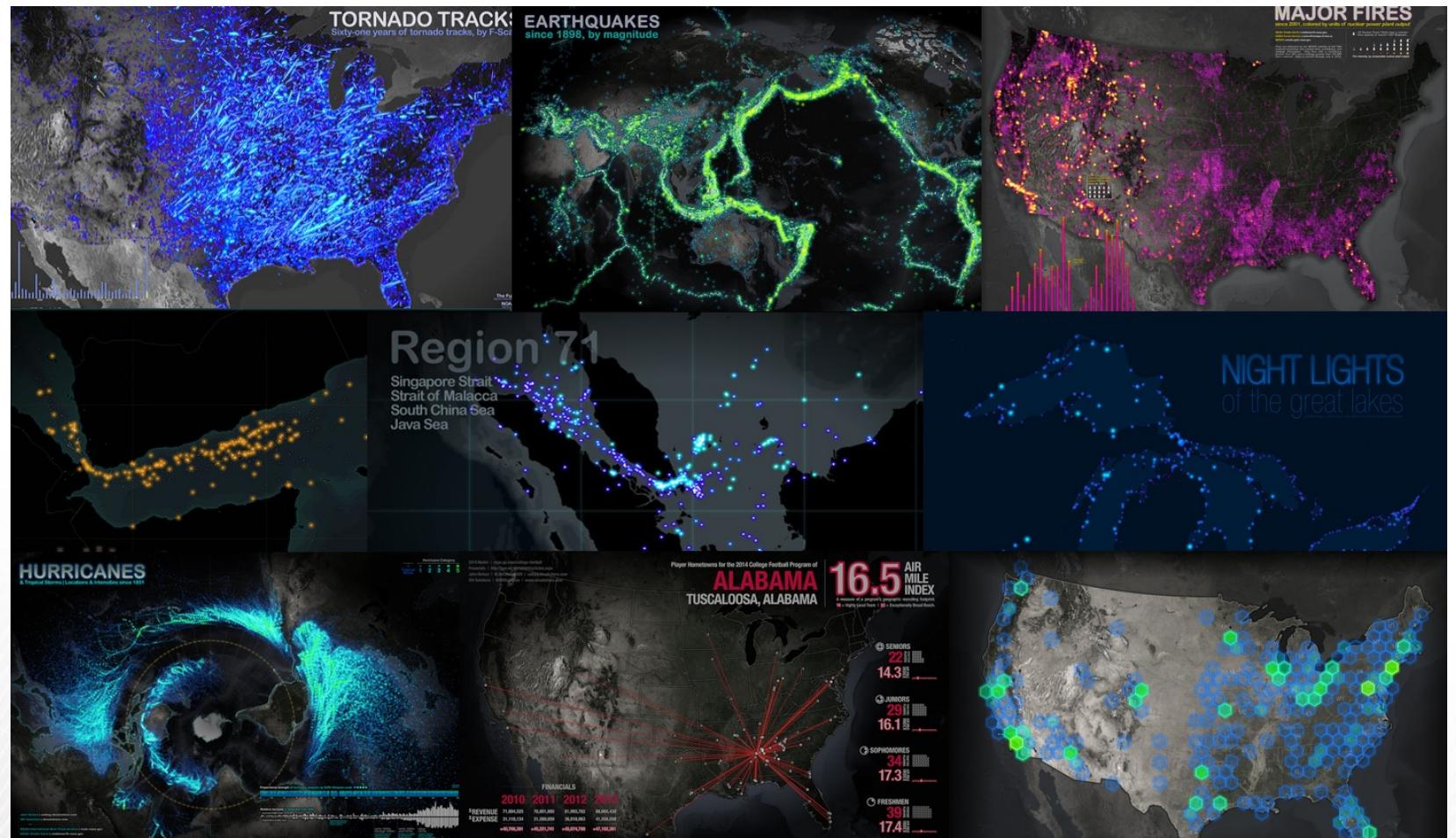
Why Make a Map?

Because...

maps are pretty.

you have spatial data.

you can.



Assorted awesome maps by John Nelson

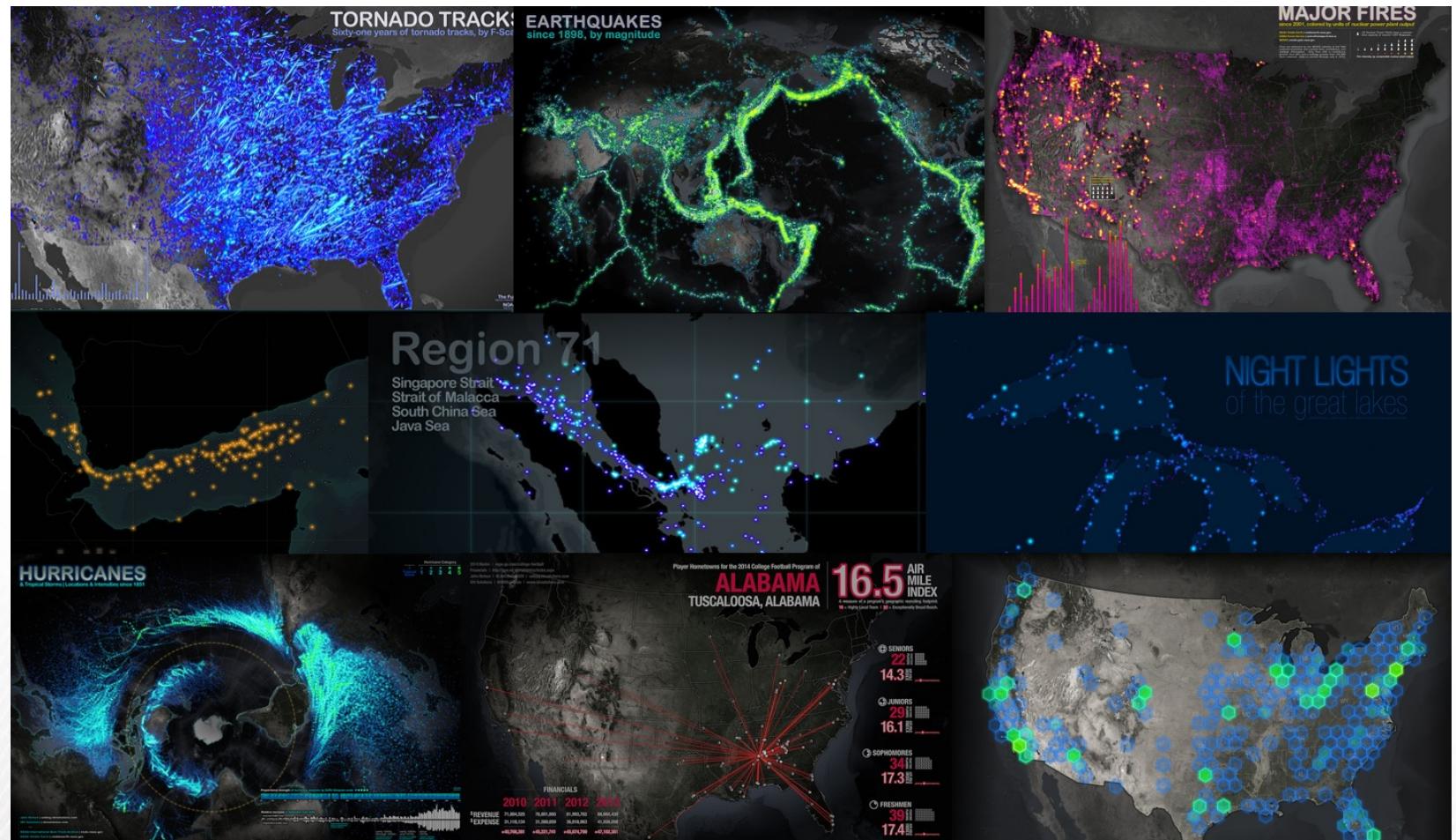
Why Make a Map?

Because...

maps are pretty.

WRONG!
you have spatial data.

you can.



Assorted awesome maps by John Nelson

Why Make a Map?

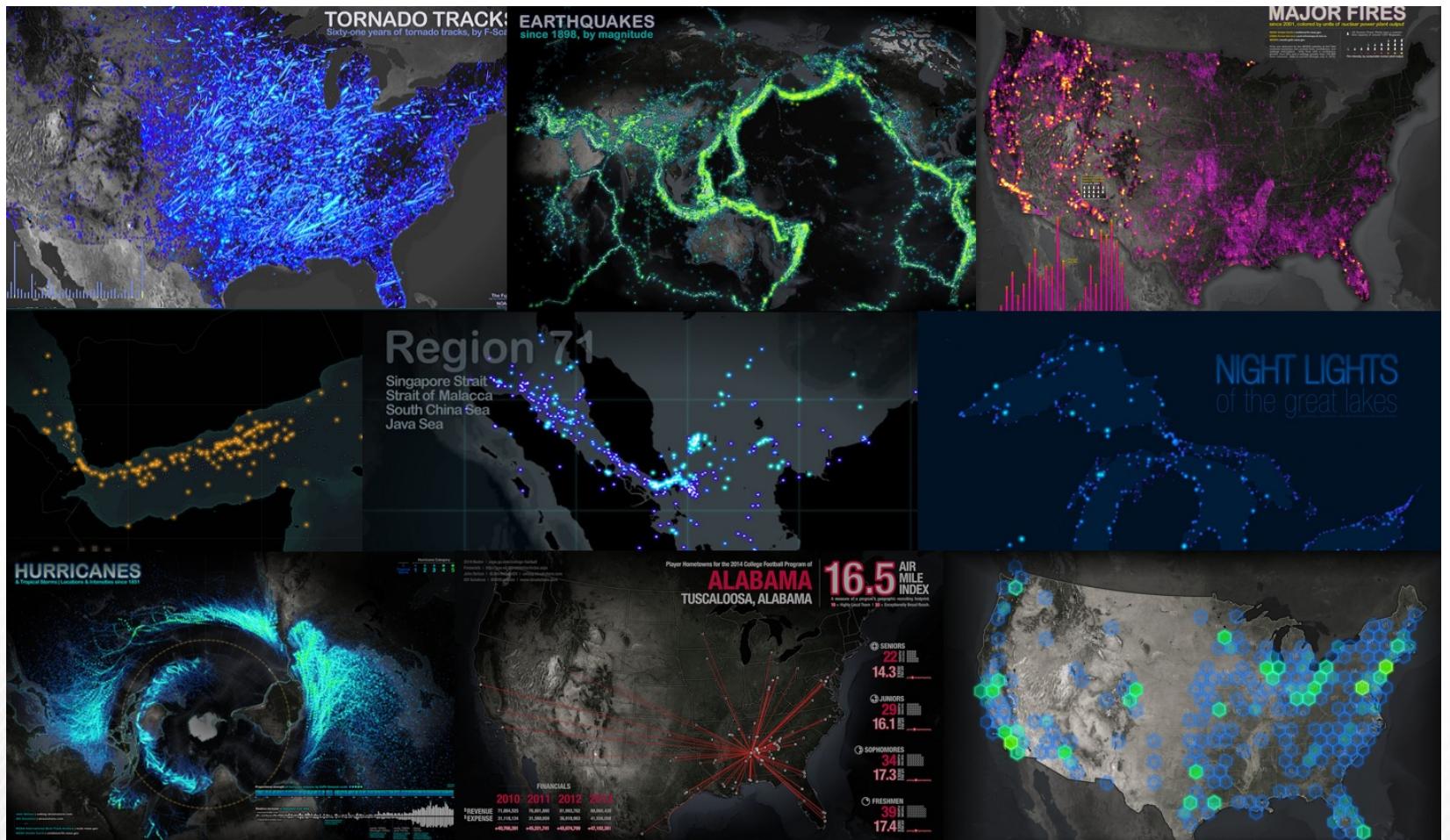
Because...

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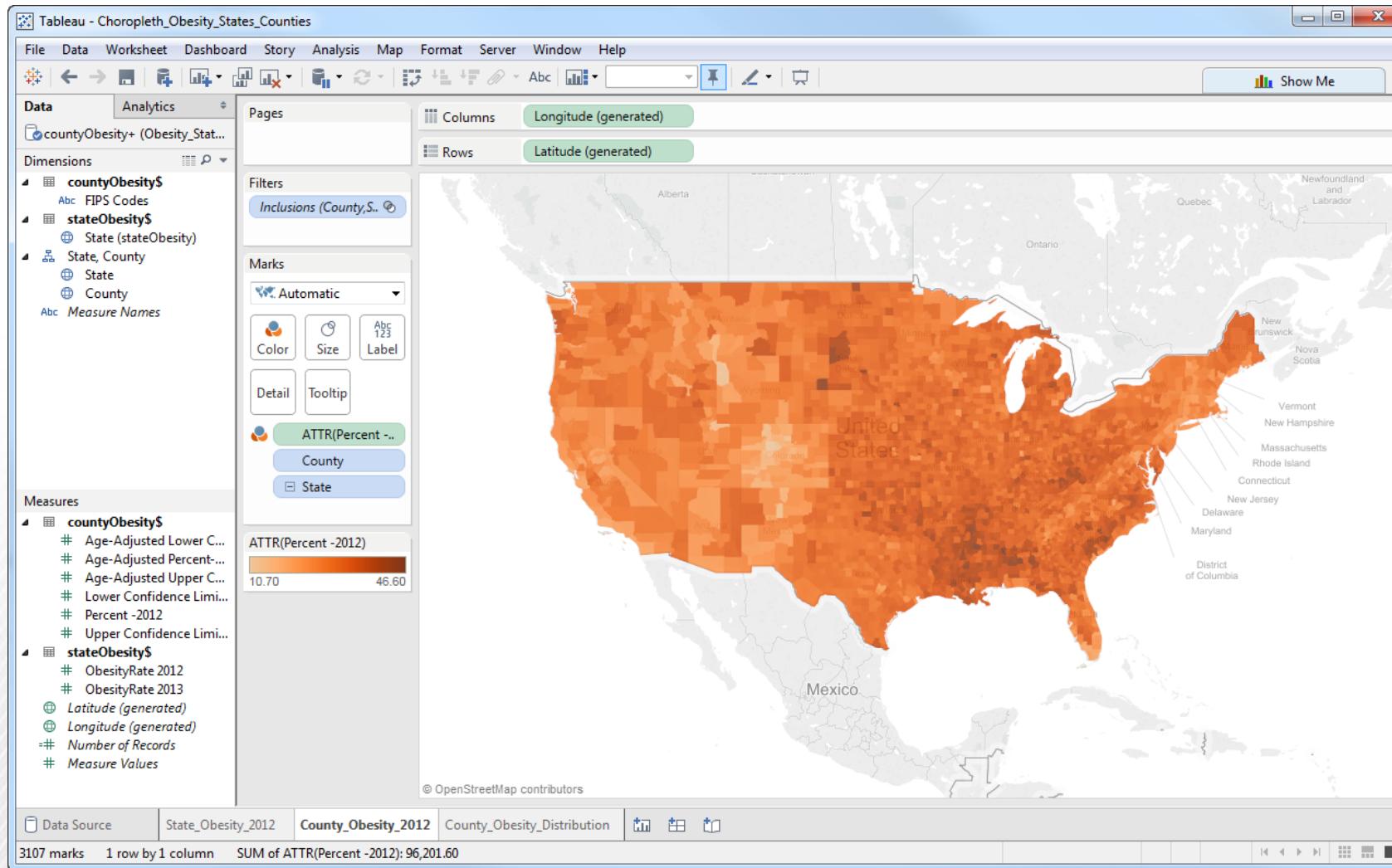
Because it helps you answer
a spatial question!



Assorted awesome maps by John Nelson

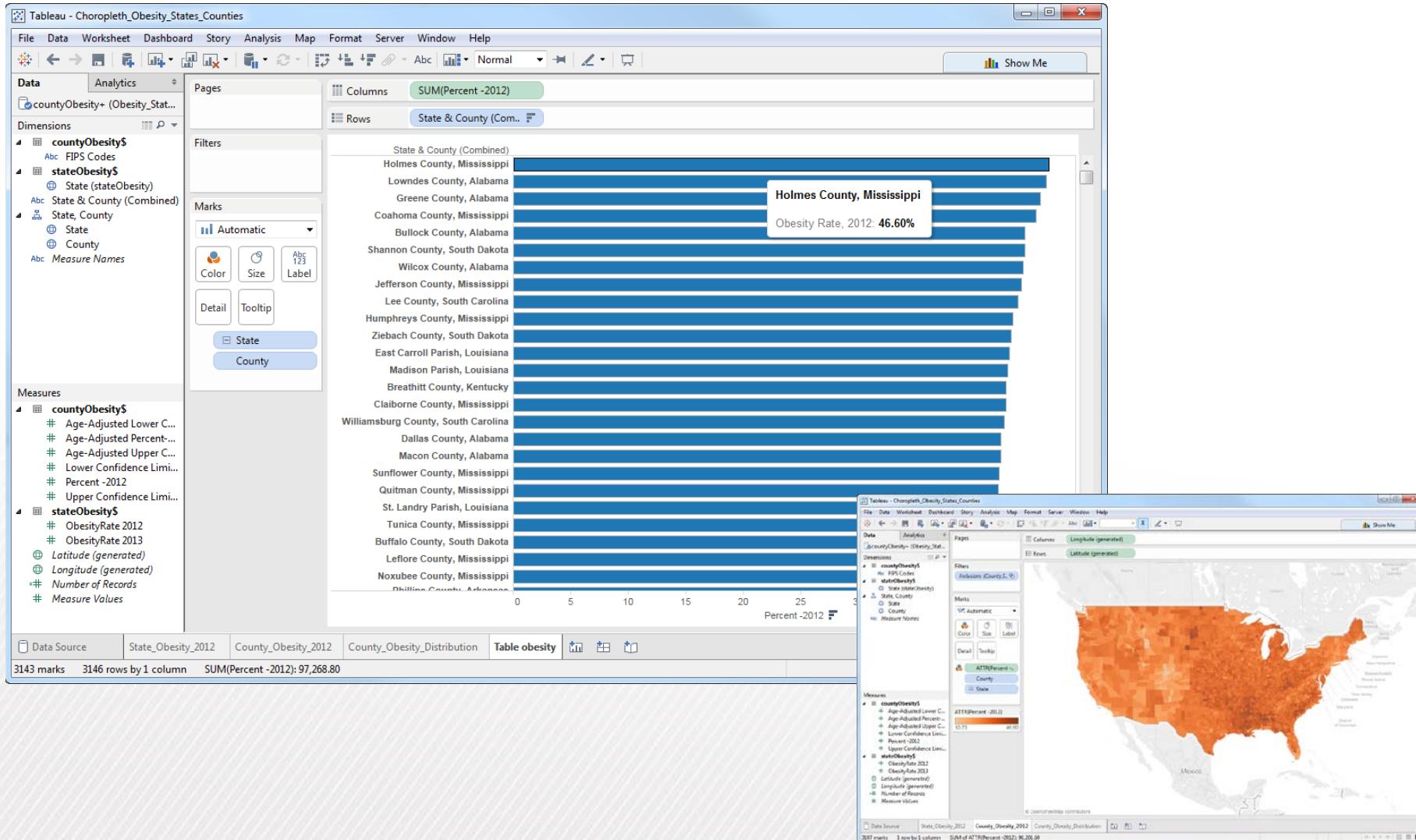
Bad Map Questions

What county has the highest adult obesity rate?



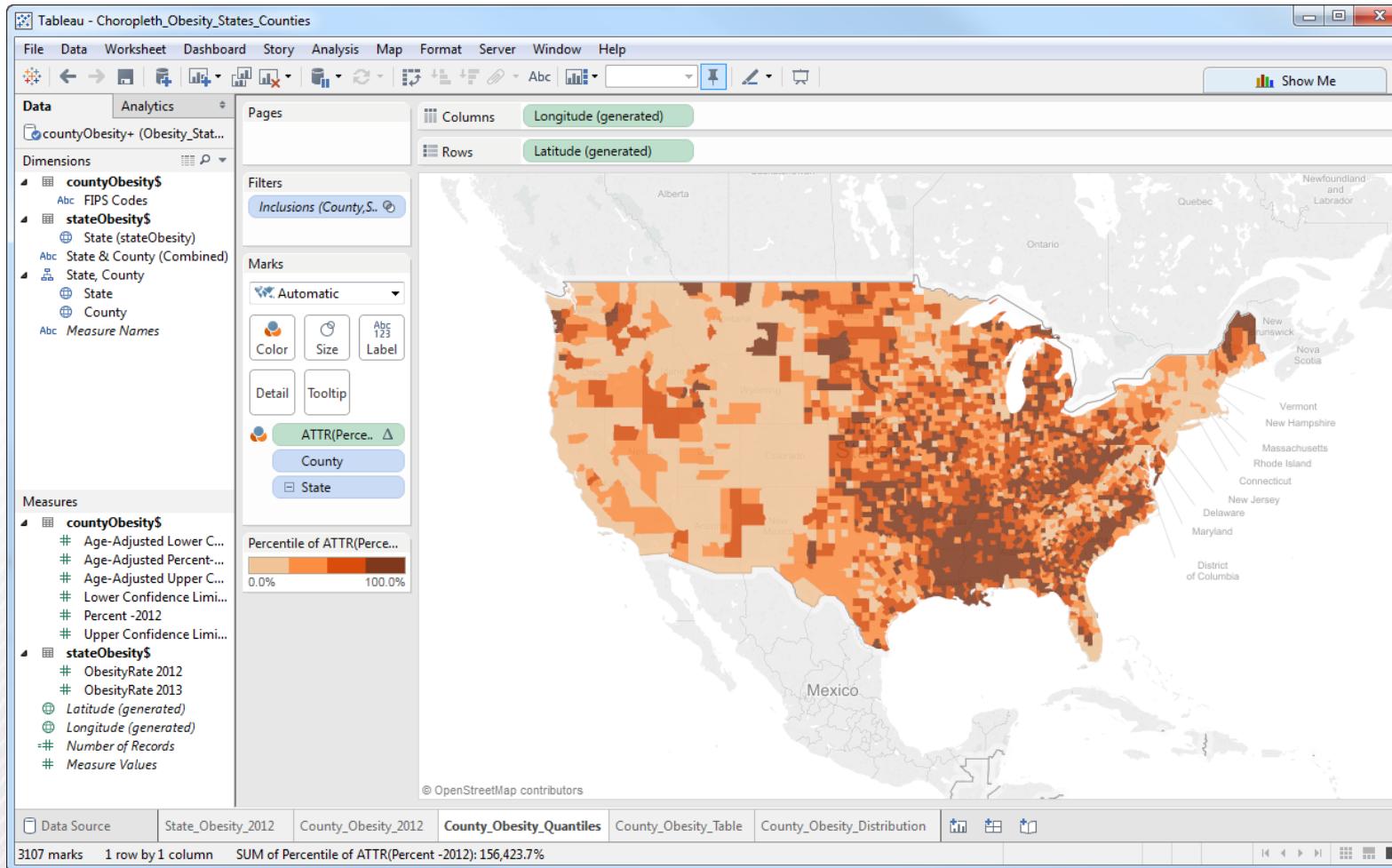
Bad Map Questions

What county has the highest adult obesity rate?



Good Map Questions

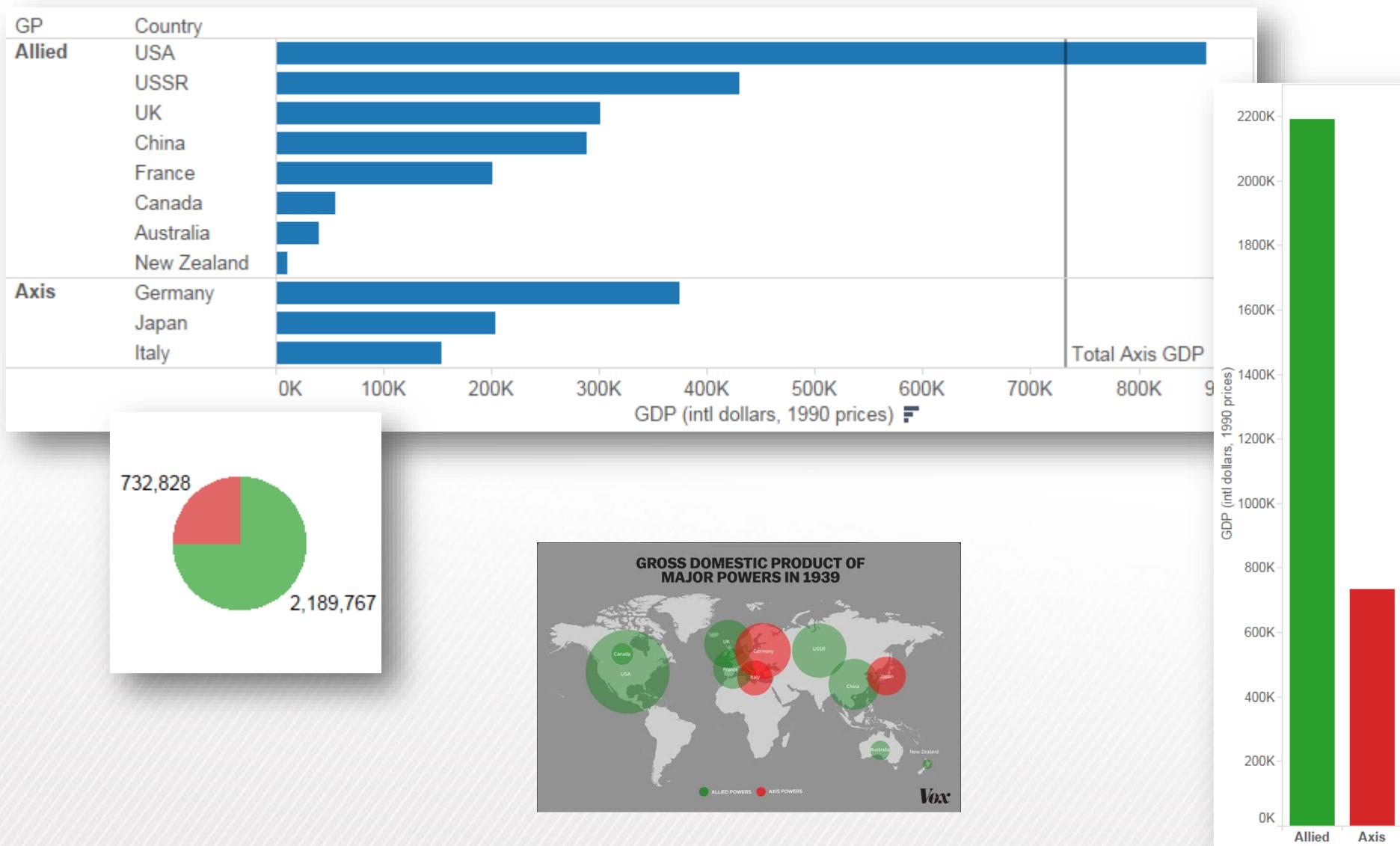
Where are the regions with highest obesity rates? Are there clusters?



Maps can explain anything, right?

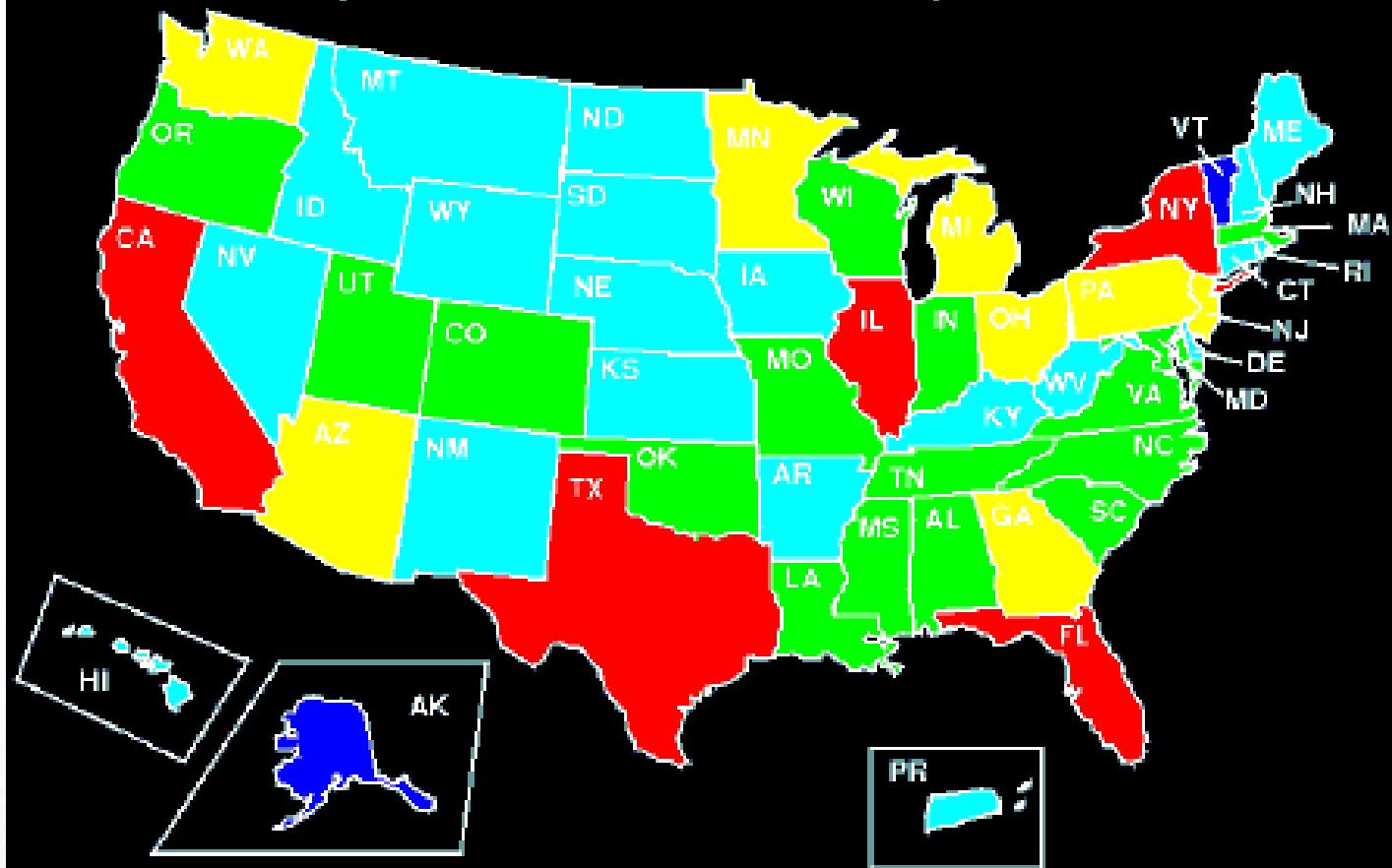


Is it the *spatial* that is important here?



Use the right symbols / encoding

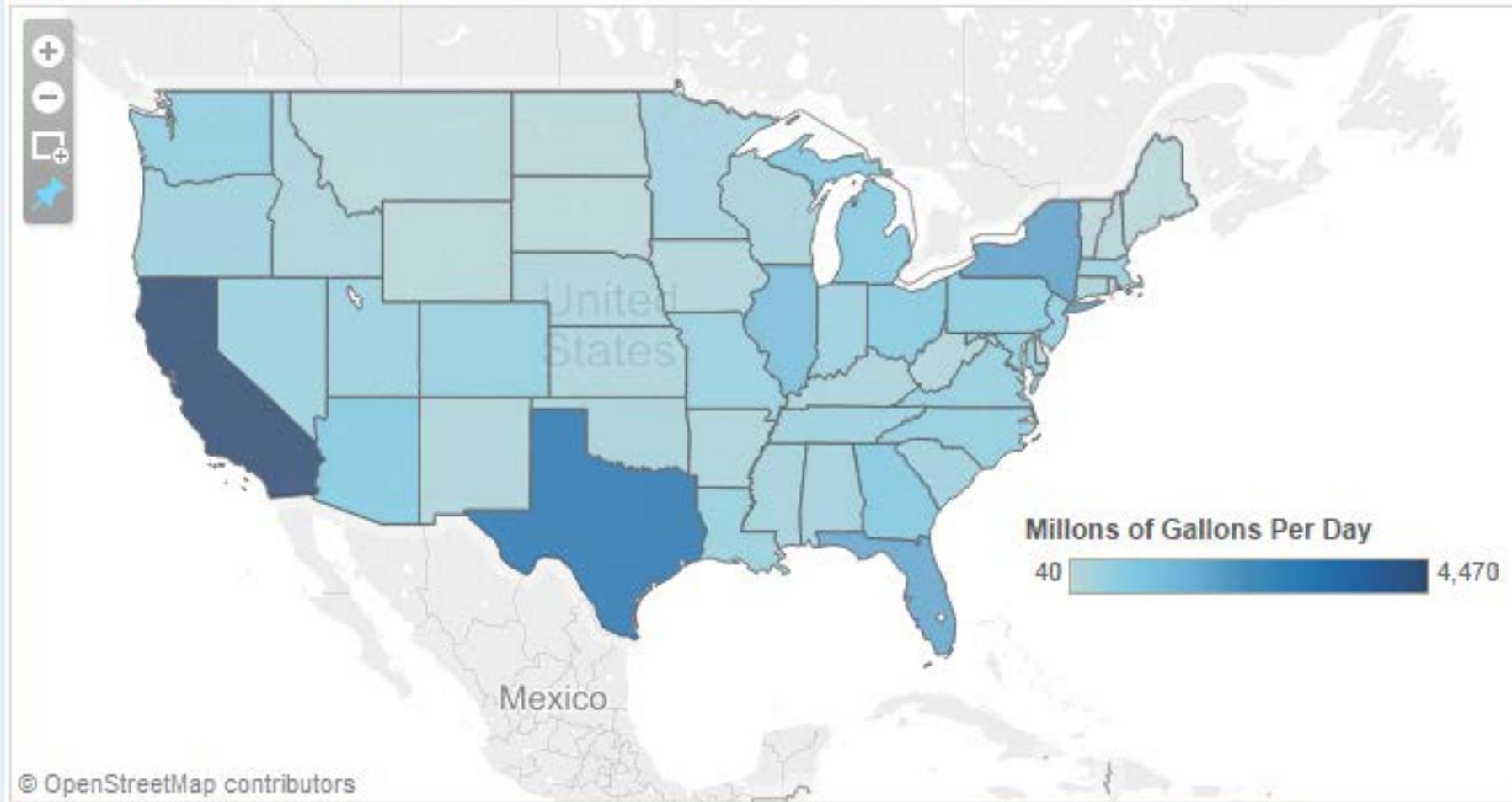
Domestic freshwater use (withdrawals and deliveries) for 1990



There is a legend under here...
and I am hiding it from you for now

Domestic Fresh Water Use, 2005

Millions of Gallons Per Day



Symbolization should be intuitive

Don't know what to use?

1. What level of measurement? (nominal, ordinal, interval, ratio)
2. What type of data? (points, lines, polygons)
3. Anything special? (continuous, discrete, diverging, symbols, etc.)

GTS

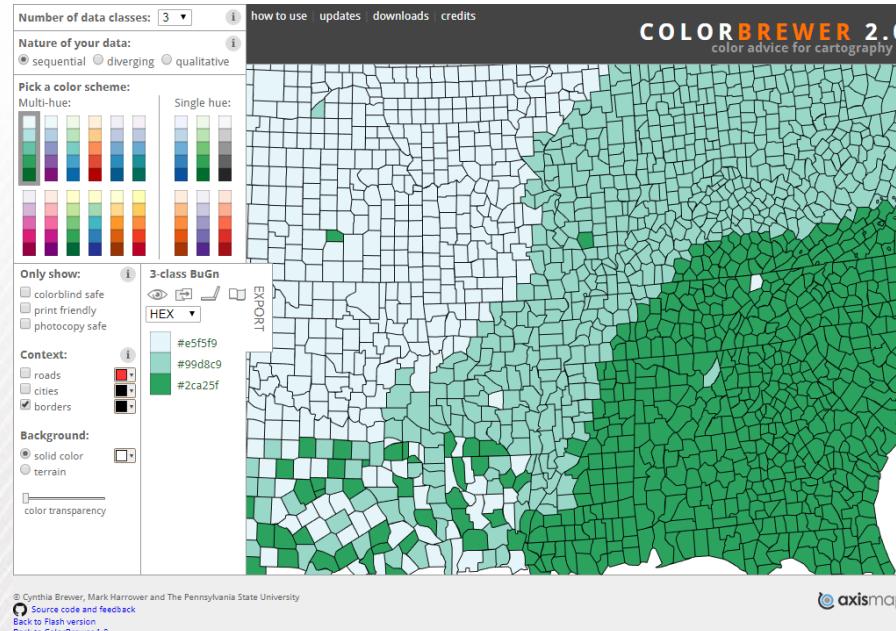
More boring words...but good references

Considering visual variables as a basis for information visualization – Sheelagh Carpendale

Principles of Symbolization – chapter from Slocum, et al. *Cartography and Geovisualization*

Cartography: An introduction – British Cartographic Society (£12.99)

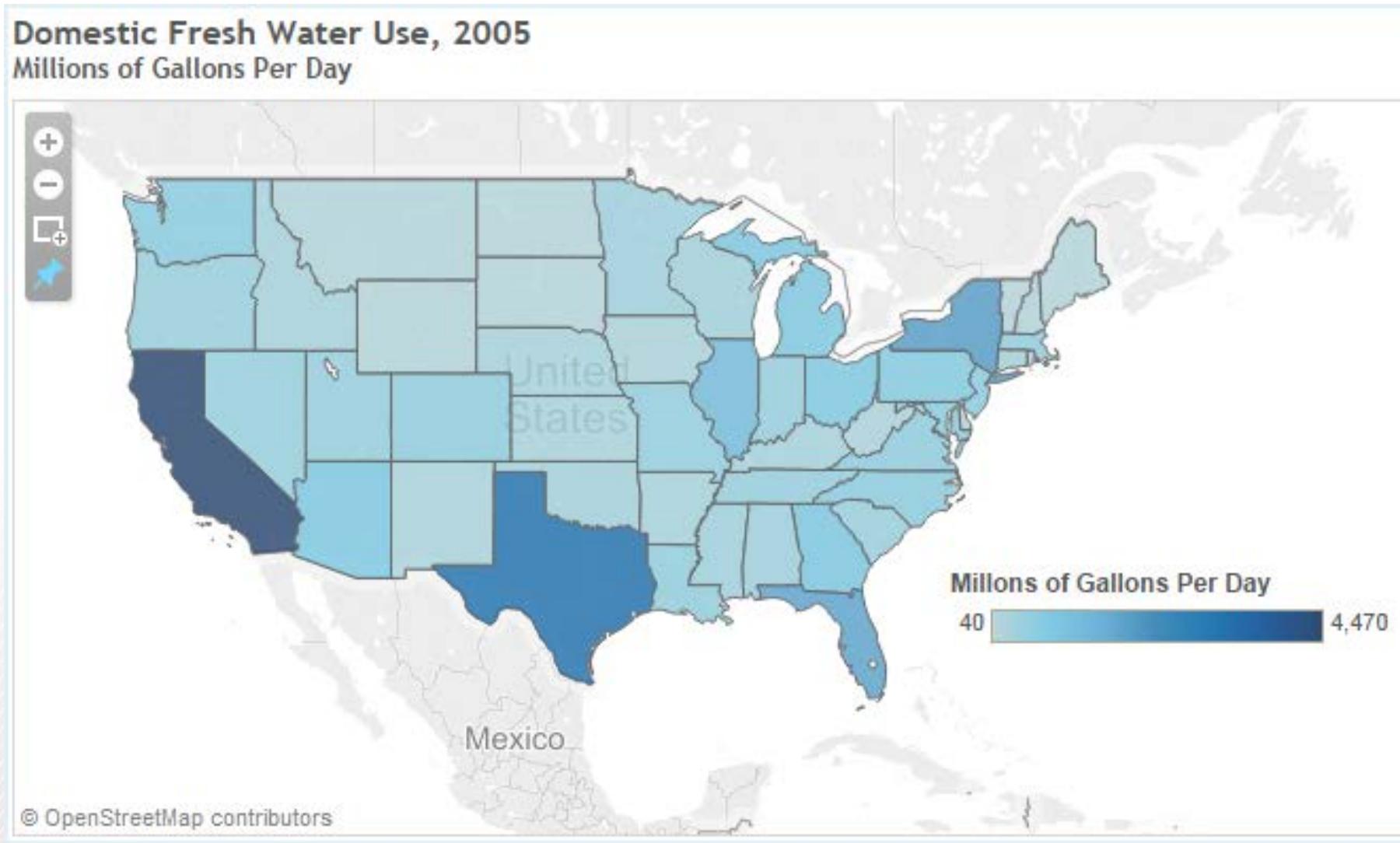
ColorBrewer

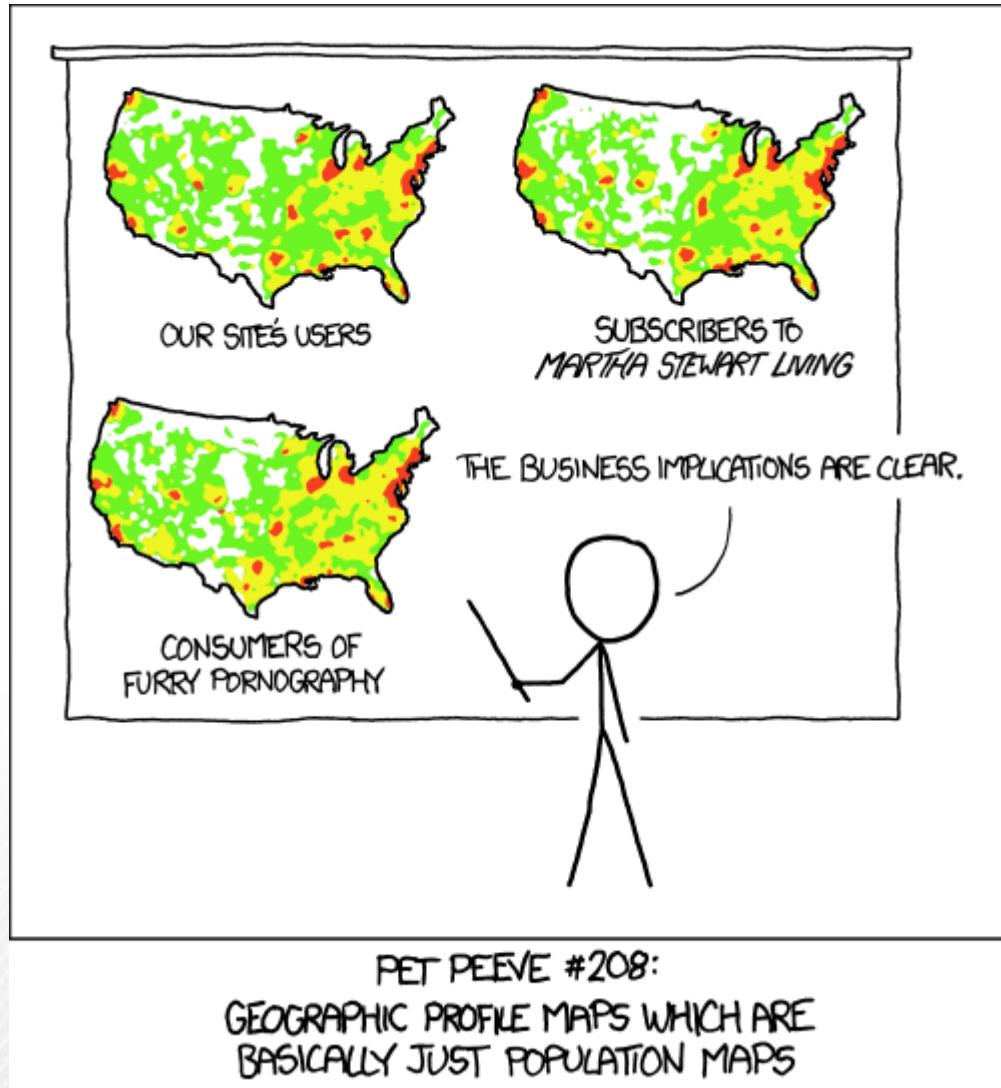


Always think about the underlying data

What does your map really show?

Let's revisit the uselessness of this map





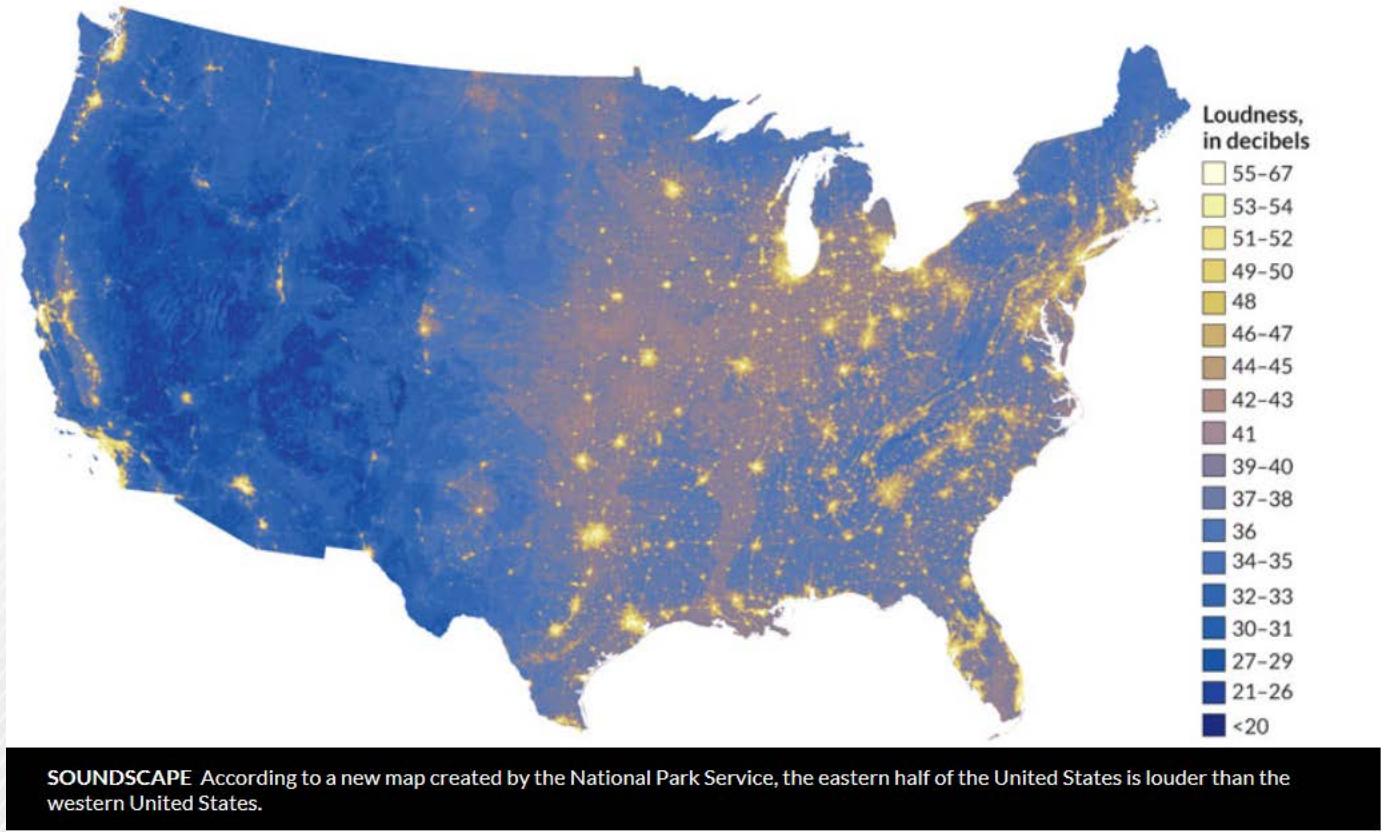
An ambitious National Park Service project exploits computer algorithms to predict the loudness of a typical summer day from coast to coast.

SCIENCE VISUALIZED SUSTAINABILITY, CONSERVATION

A coast-to-coast picture of America's cacophony of sounds

New National Park Service map draws the United States' summer soundscape

BY SUSAN MILIUS 12:12PM, FEBRUARY 16, 2015

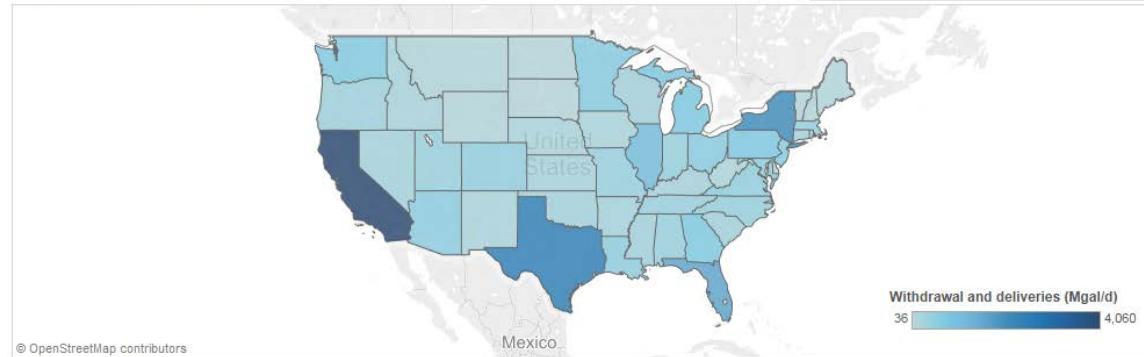


What Might Be Influencing Your Data

Be especially careful
with counts

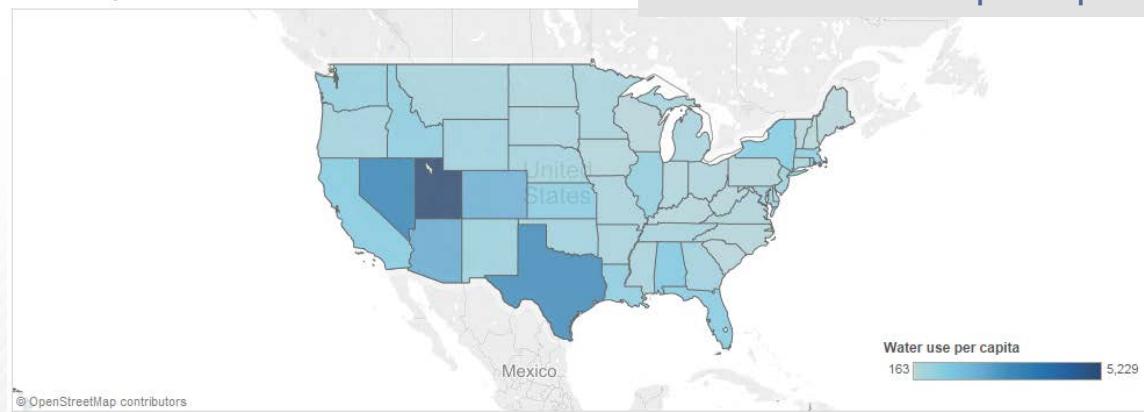
“Normalize” your data with a calculated field

Domestic Freshwater Use, 1990
Millions of Gallons Per Day



Water withdrawals

Domestic Freshwater Use Per Capita, 1990
Gallons Per Day



Water withdrawals per capita

Water use per capita

```
([Withdrawal and deliveries in Mgald] * 1000000) / ([Population (in 1000s)]*1000)
```

Know what the symbols mean

...and what your readers might interpret

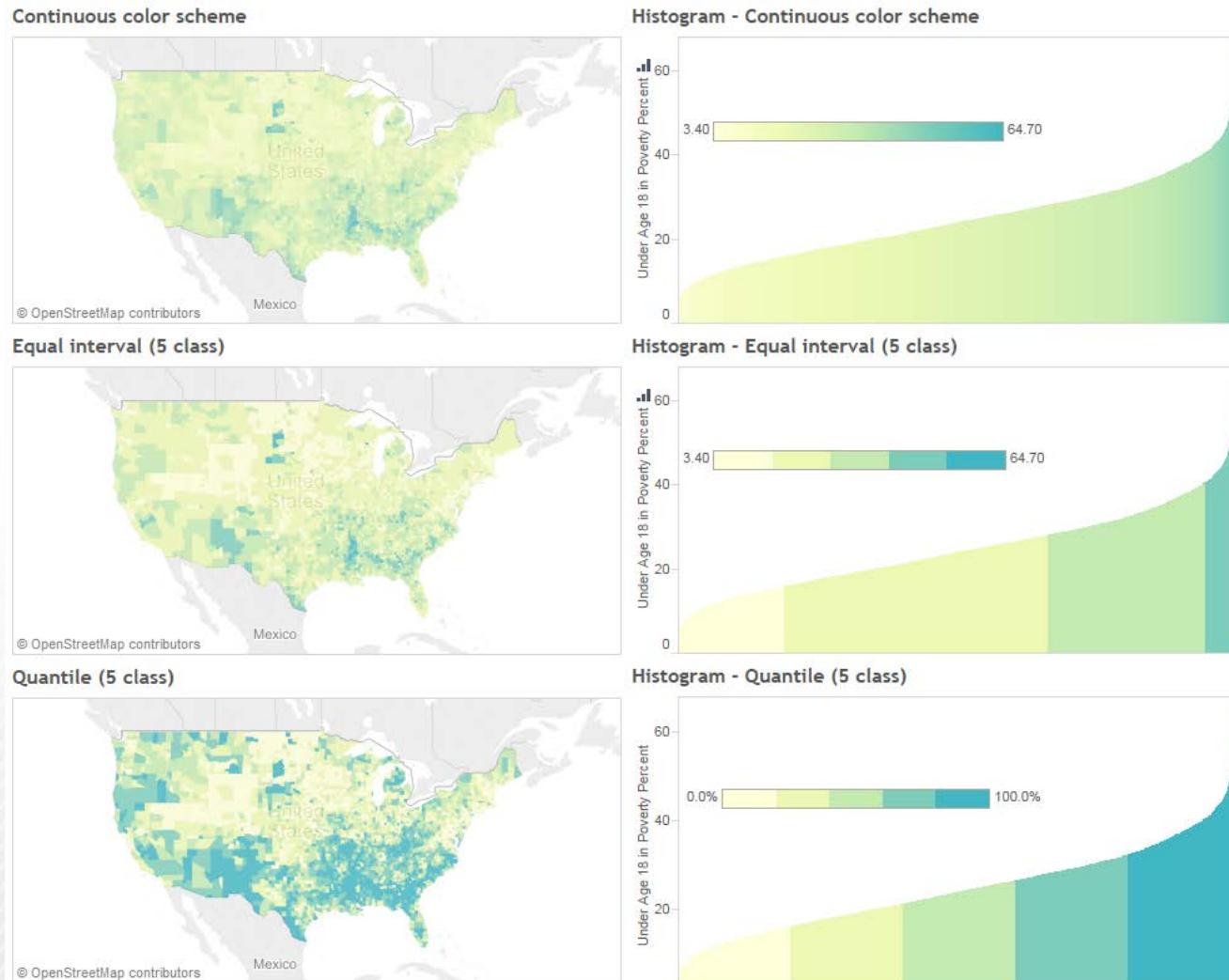
Data classification

Data classification

What do those colors mean?

Percent of children under the age of 18 living in poverty

By county

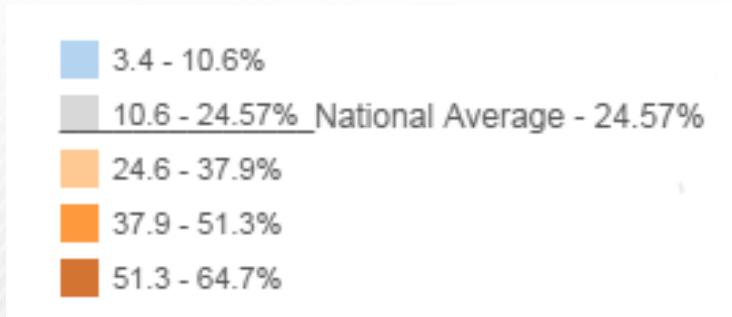


If you know your data...

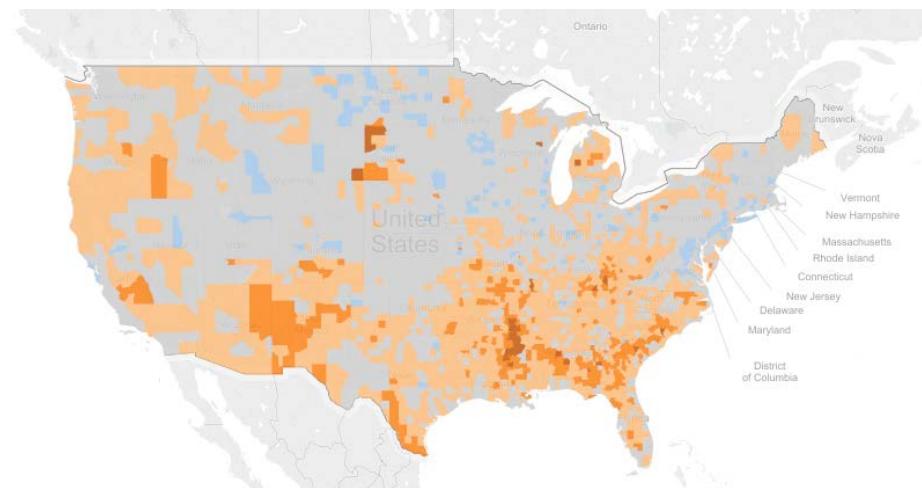
Custom classification... knock yourself out with smart classes!

Example: Emphasize counties above and below the US Average (24.57)

Annotate legend



Percent of children under the age of 18 living in poverty



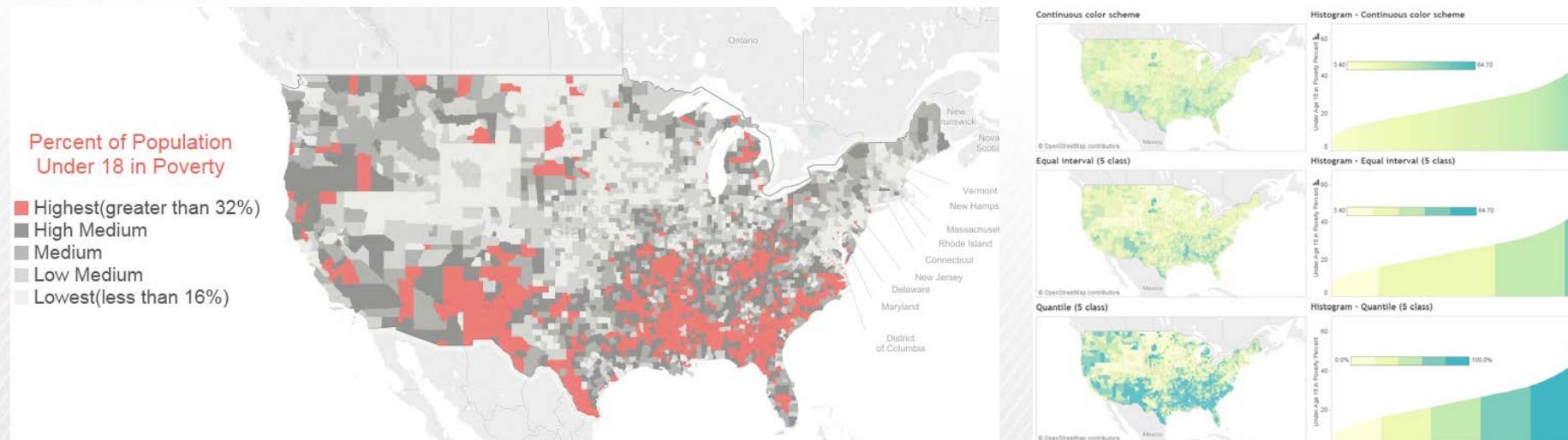
What Breaks Should You Use?

It depends on your data, your audience, and your purpose

What do you need to show?

What do the class breaks mean?

How can you use class breaks to create visual hierarchies to help
“tell your story”



Know your out-of-the-box options

The screenshot shows the 'Layer Properties - cow | Style' dialog box in ArcGIS. The 'Graduated' style tab is selected. In the 'Mode' dropdown, 'Equal Interval' is highlighted. The 'Classes' input field contains the value '5'. A tooltip or callout box is overlaid on the screen, pointing to the 'Mode' dropdown, containing the following text:

I could spend an hour on these, but I'm probably already over the half hour allocated for the whole presentation...

Classes 5

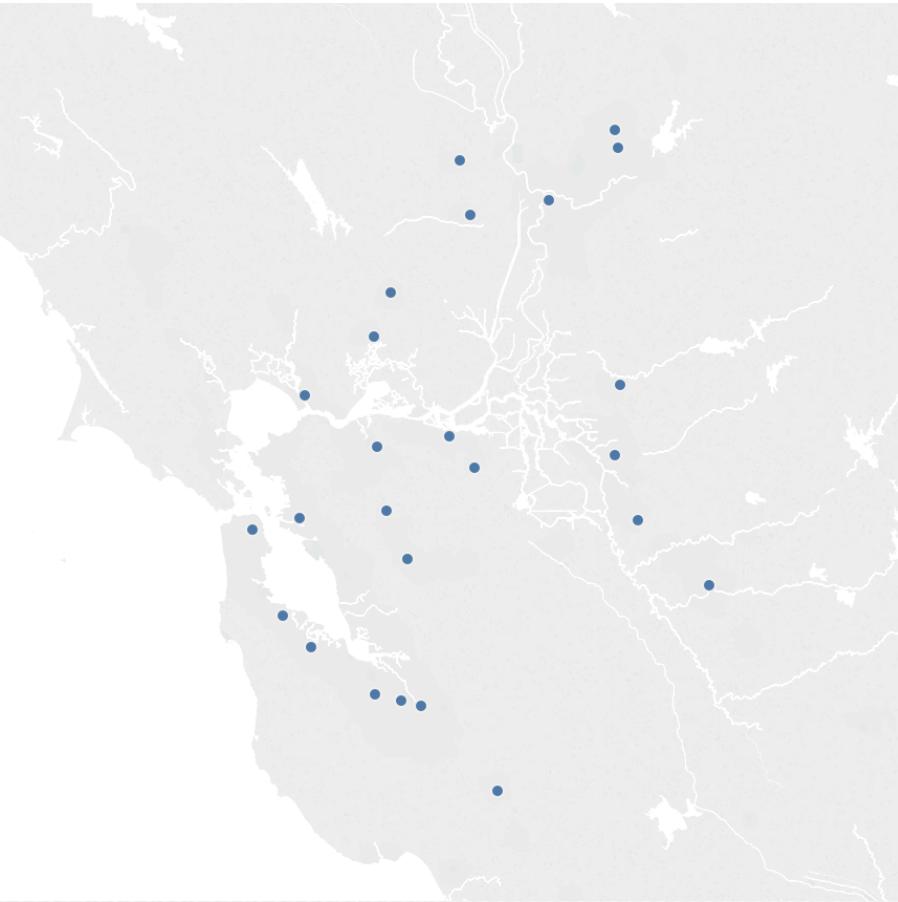
Mode Equal Interval

Precision

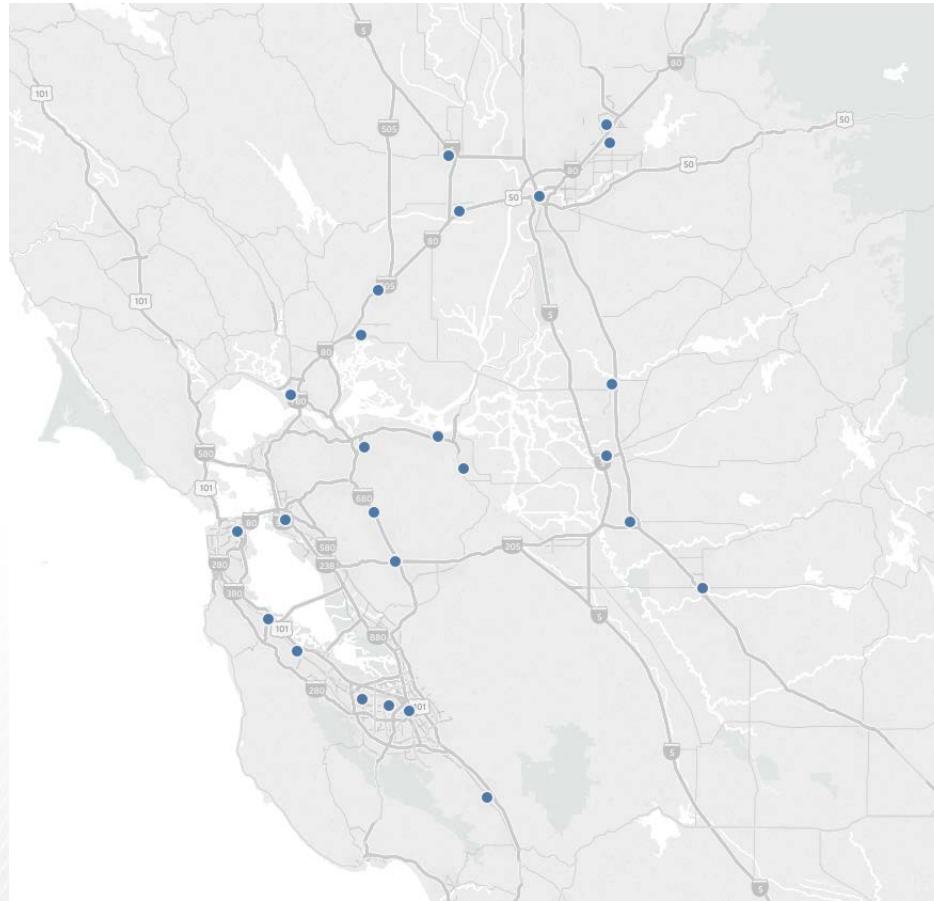
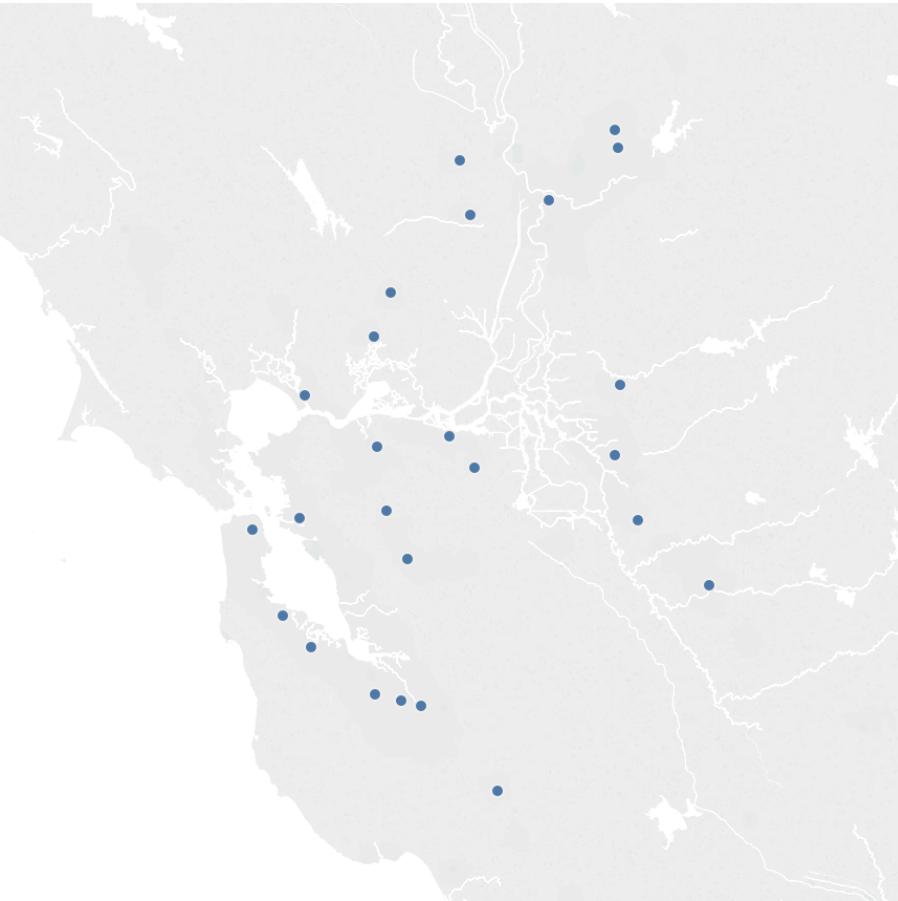
Equal Interval
Quantile (Equal Count)
Natural Breaks (Jenks)
Standard Deviation
Pretty Breaks

Just enough context...

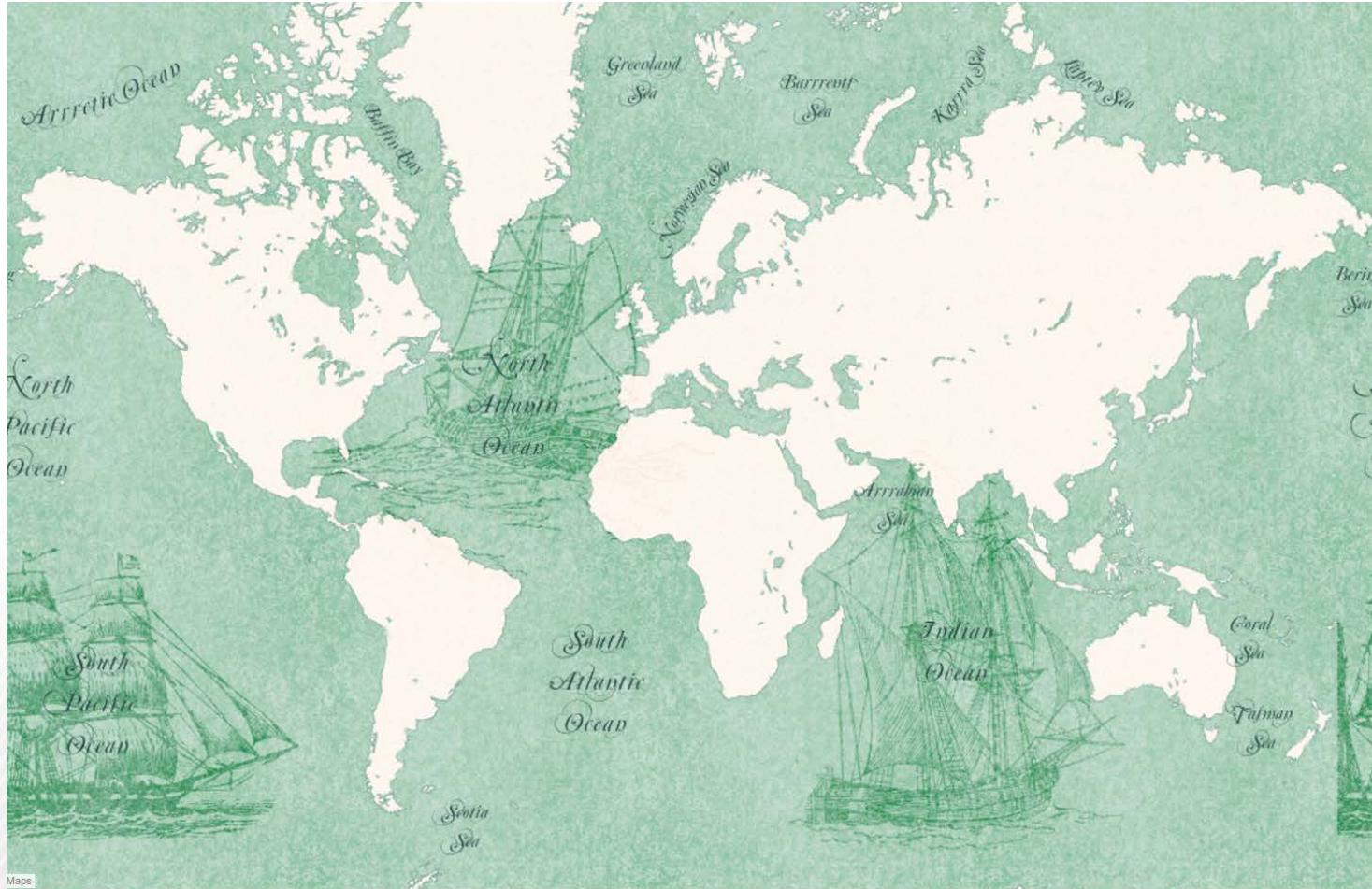
The importance of base map context



The importance of base map context

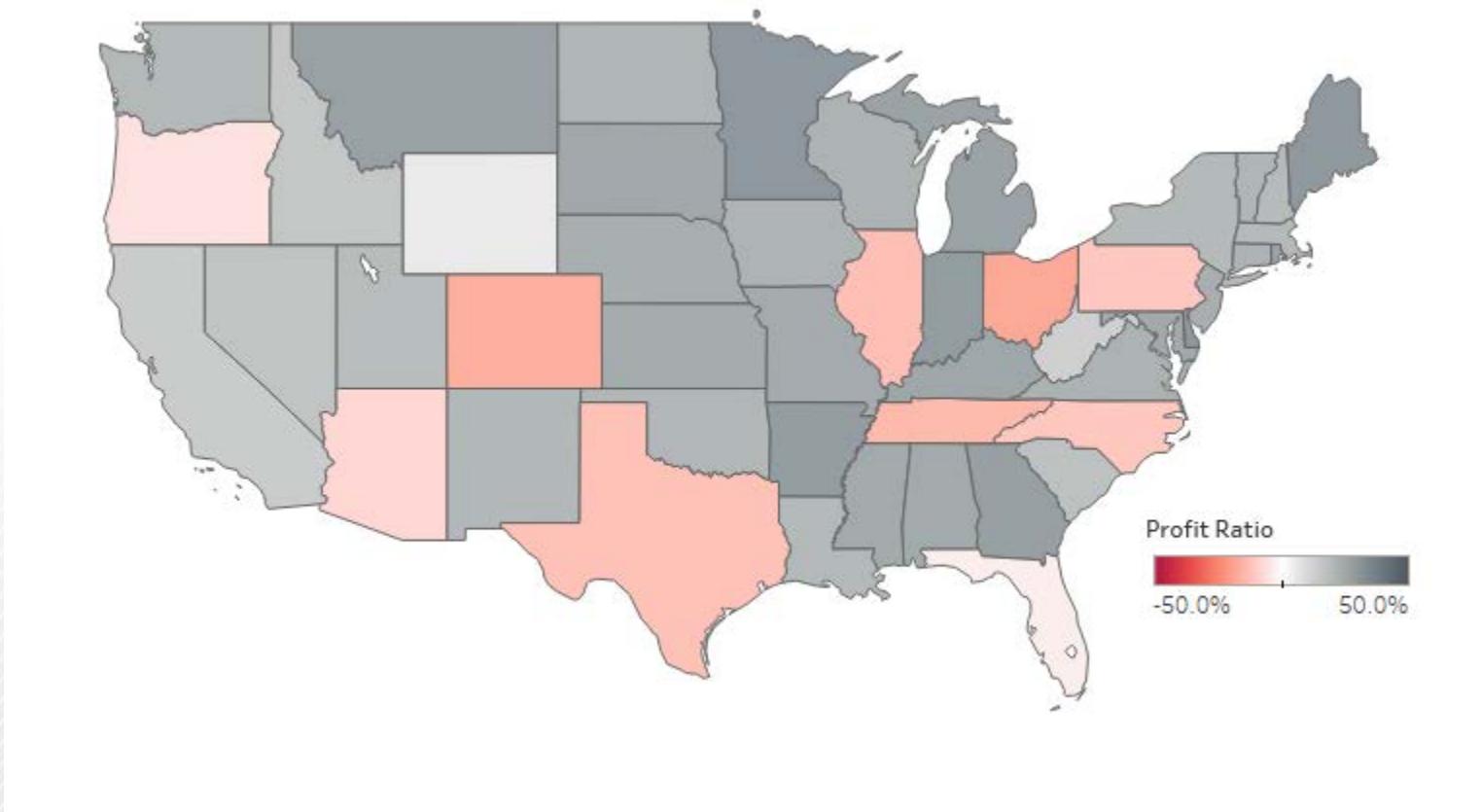


Or even fancier – I'm a Mapbox fan



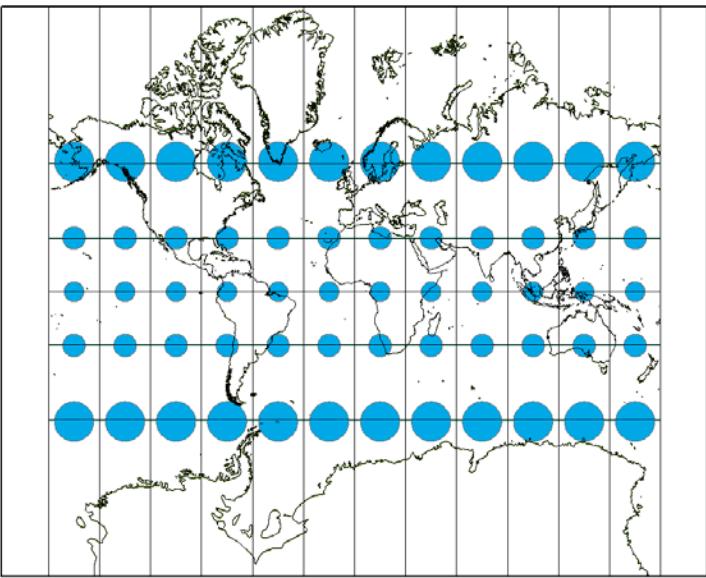
Sometimes data itself is sufficient context

Don't be afraid to just delete the basemap



Know the limitations of the map

Map projections in 30 seconds (or so)



- Conformal --- preserves local angles
- Equal area --- preserves area
- Equidistant --- preserves distance
- Compromise --- preserves nothing, but generally looks nice

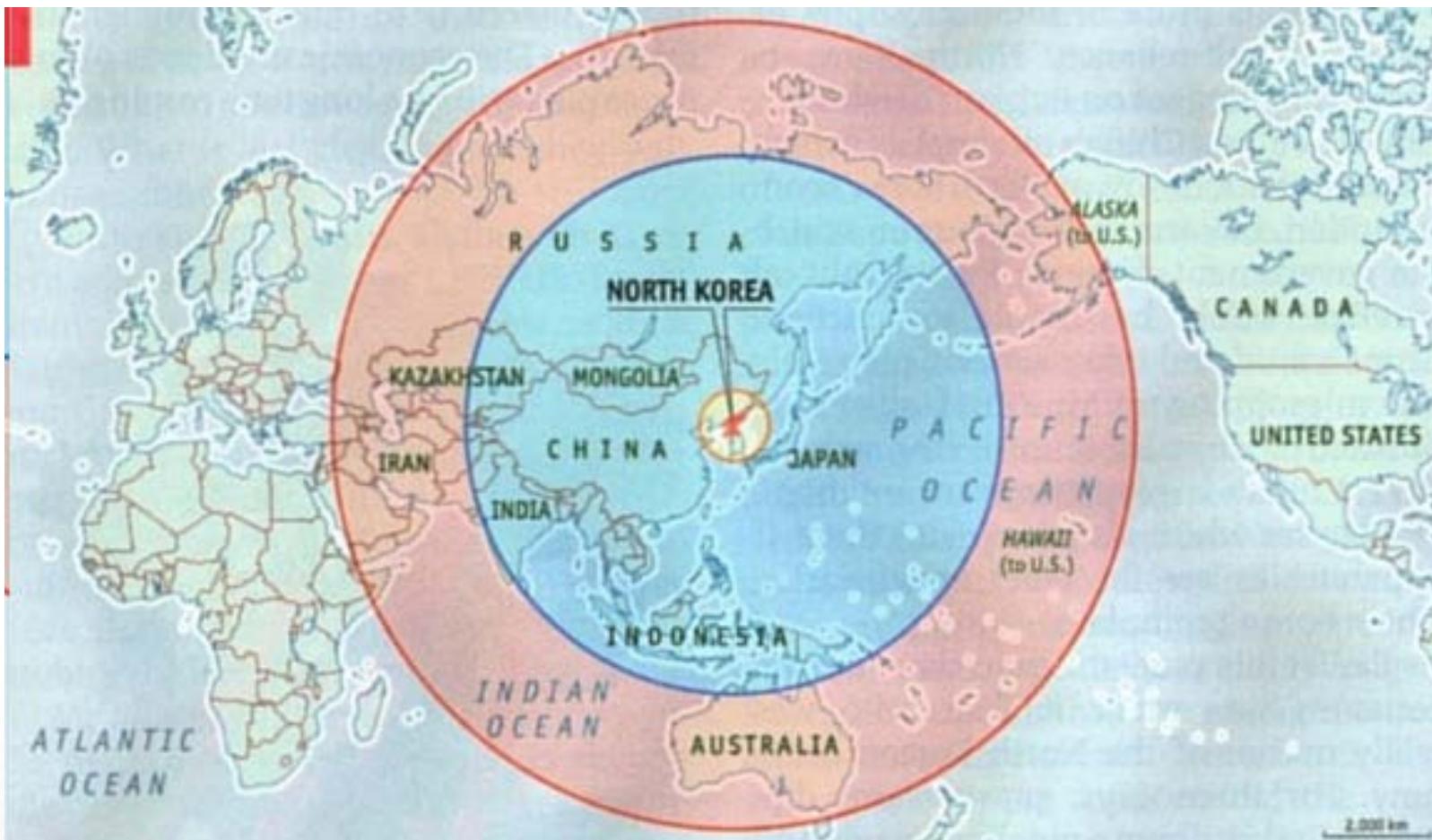
Misc projection resources

<http://gistbok.ucgis.org/bok-topics/map-projections>

<https://www.mapthematics.com/Essentials.php>

https://en.wikipedia.org/wiki/Map_projection

<https://community.tableau.com/people/sarah.battersby.0/blog/2017/05/12/working-with-projected-data-in-tableau-part-i-map-projection-basics>

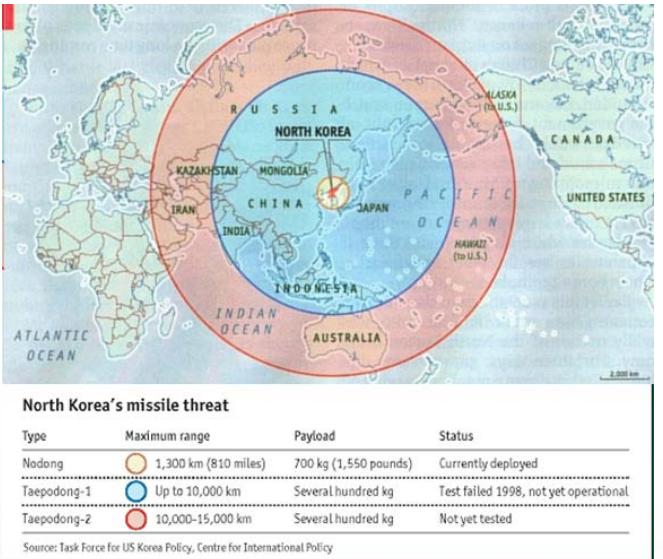


North Korea's missile threat

Type	Maximum range	Payload	Status
Nodong	1,300 km (810 miles)	700 kg (1,550 pounds)	Currently deployed
Taepodong-1	Up to 10,000 km	Several hundred kg	Test failed 1998, not yet operational
Taepodong-2	10,000-15,000 km	Several hundred kg	Not yet tested

Source: Task Force for US Korea Policy, Centre for International Policy

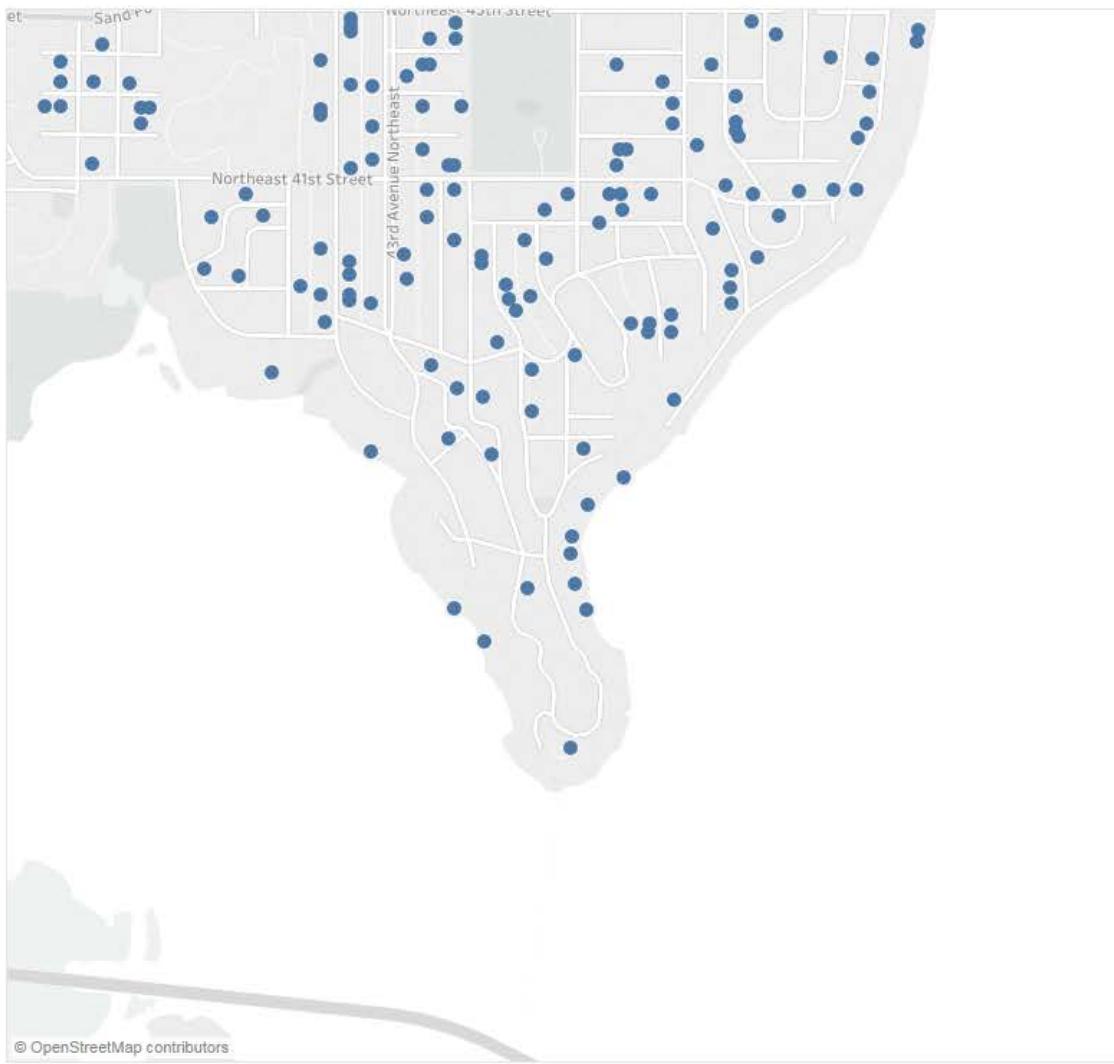
Source: The Economist



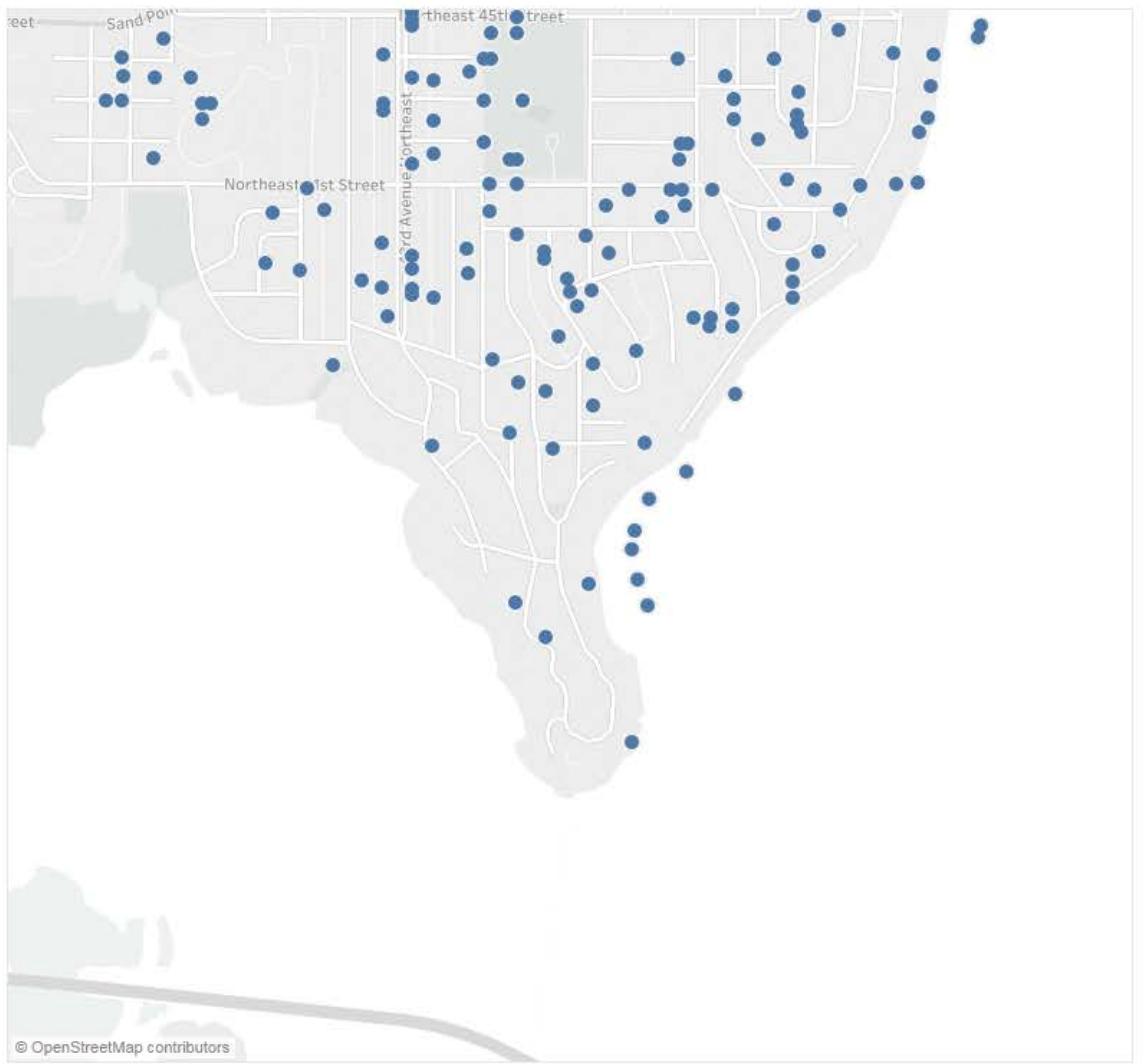
Source: The Economist

The houseboat market of Seattle – Redfin sales dataset.

Original data



Datum shift



Analytic results



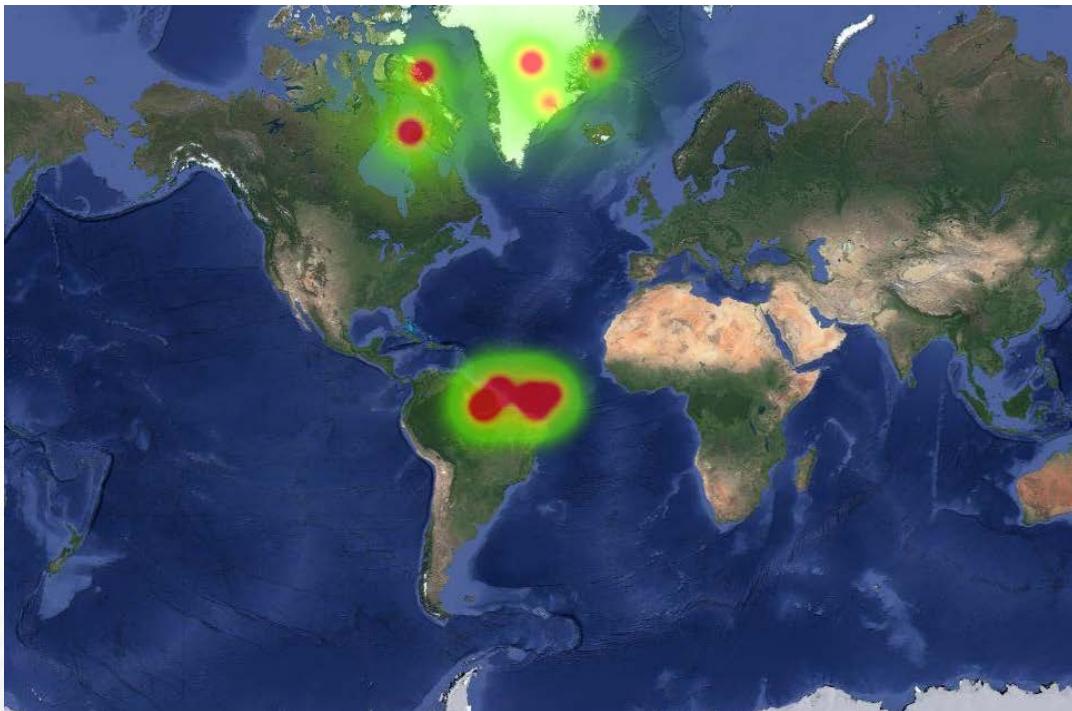
Source: daan Strebe and me having fun with Google Heatmap API

Analytic results



Source: daan Strebe and me having fun with Google Heatmap API

Analytic results



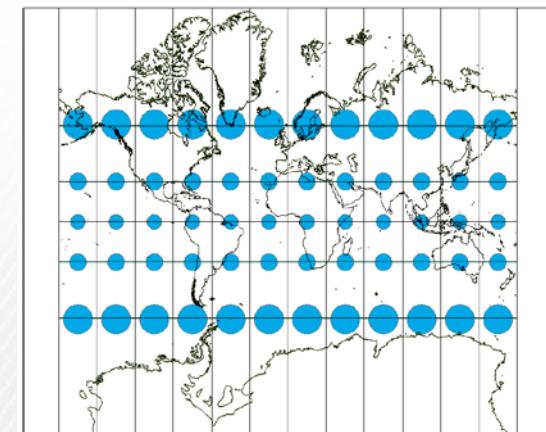
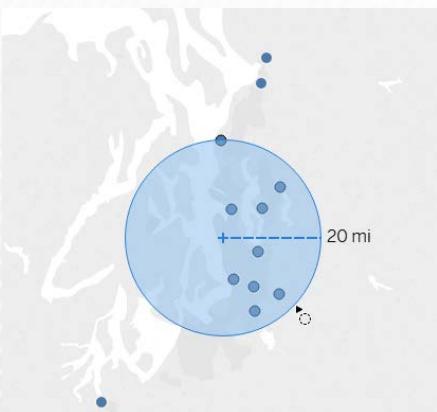
Source: daan Strebe and me having fun with Google Heatmap API

What do we need to think about with Web Mercator?

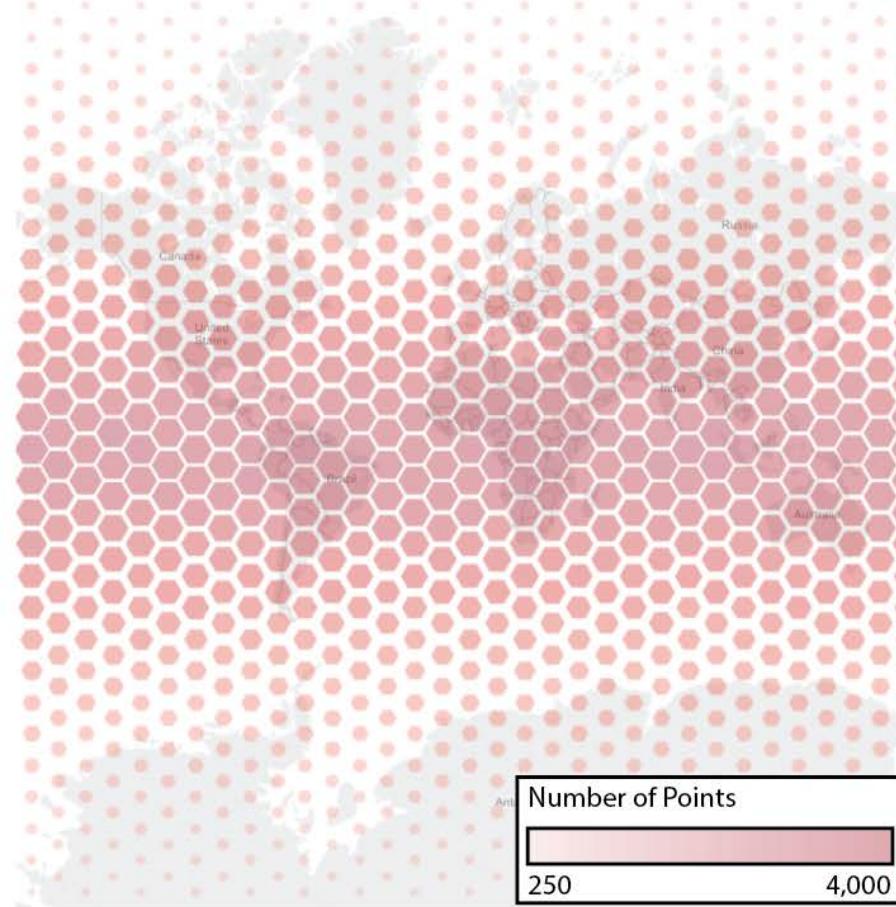
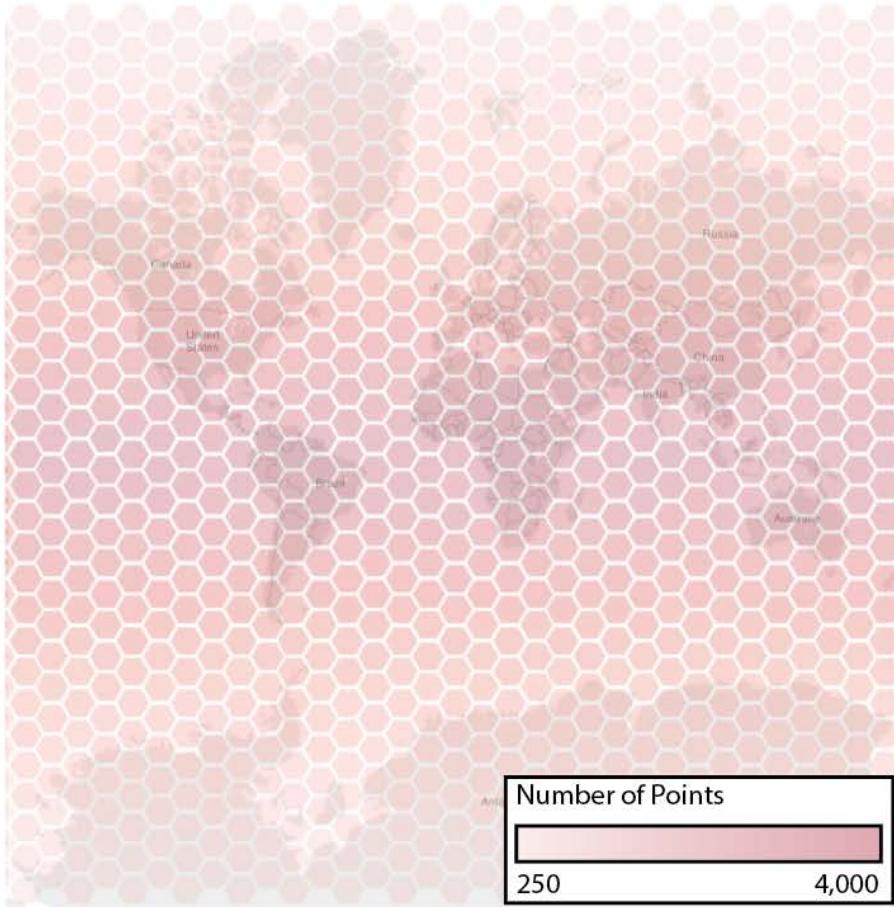
Distances and areas are distorted

Visual over-emphasis of high latitude regions

Visual and spatial analysis (radial selection, hex bins, measuring distances & directions, etc.) become questionable across large areas

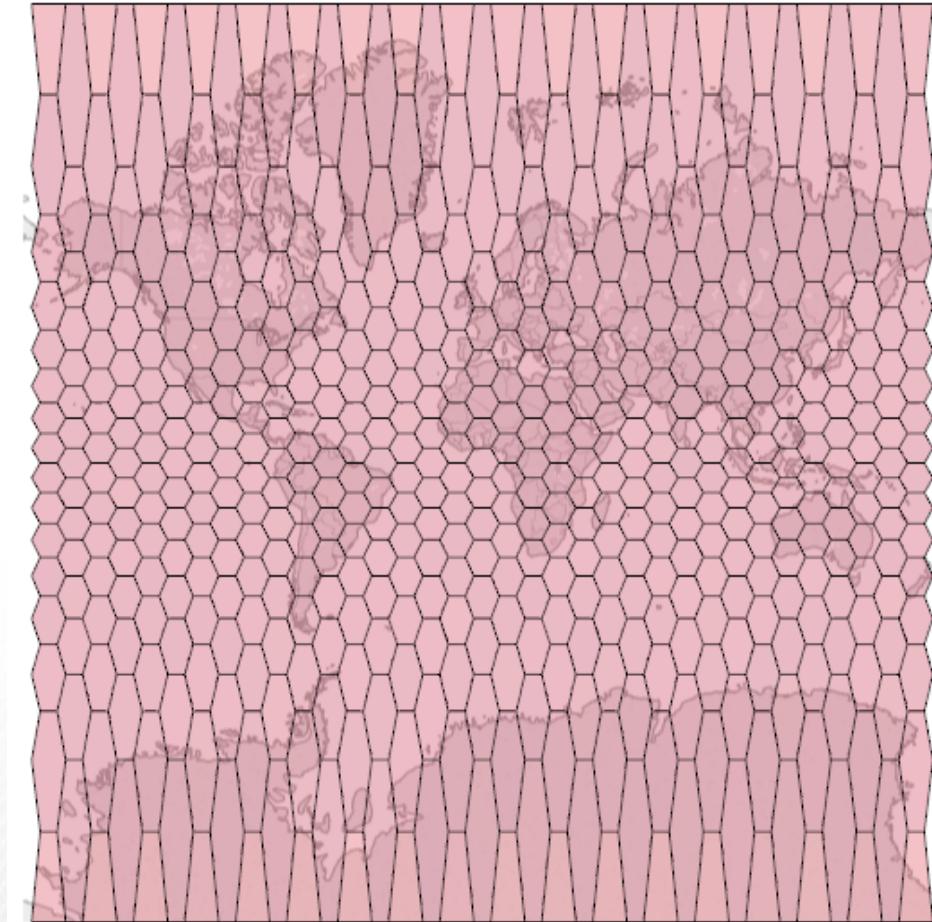


One quick note on my fave map type with a big projection problem – hexbins



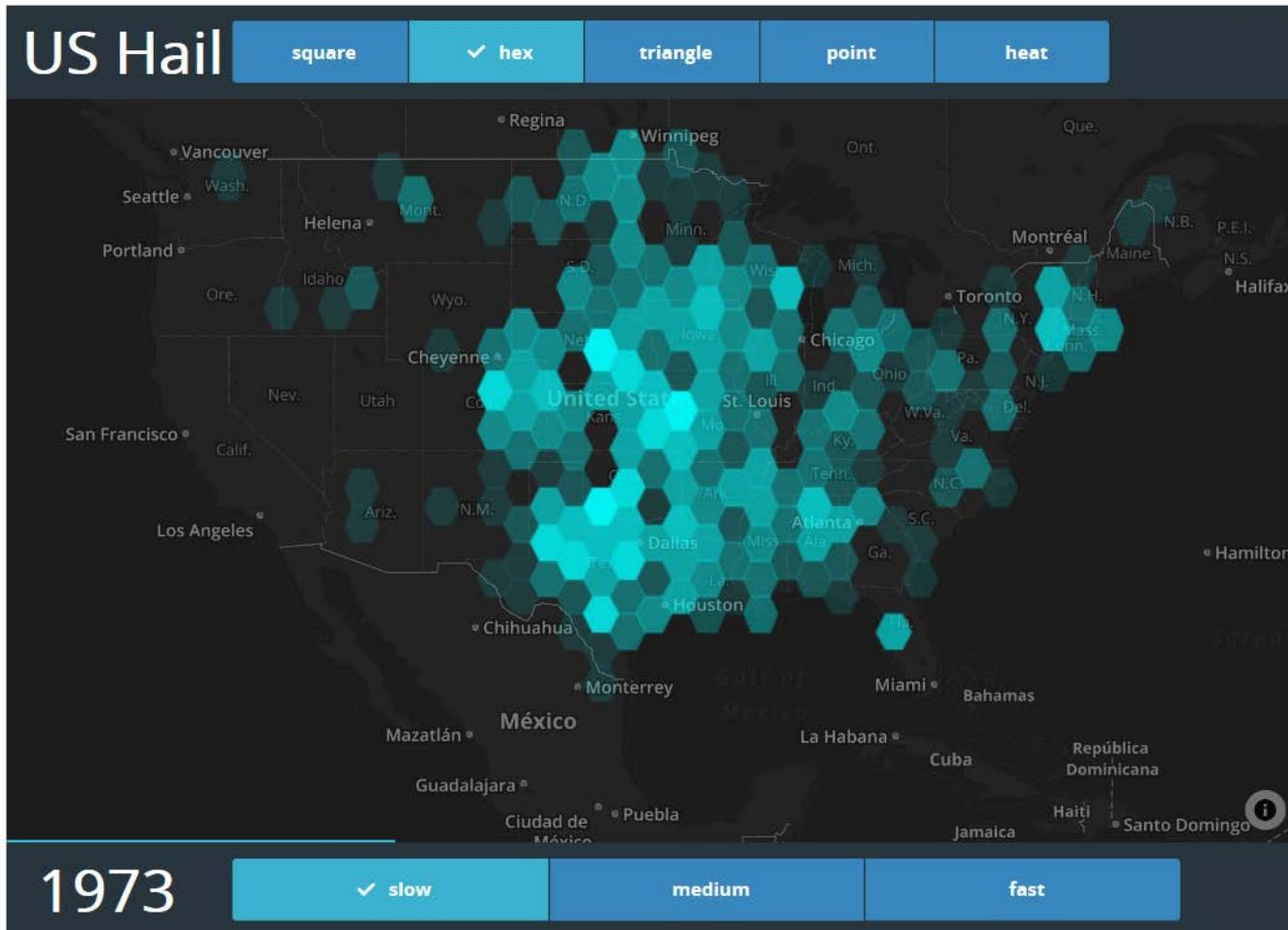
One quick note on my fave map type – anything in hexbins

Bins defined by ‘equal’ units of
latitude and longitude



One quick note on my fave map type – anything in hexbins

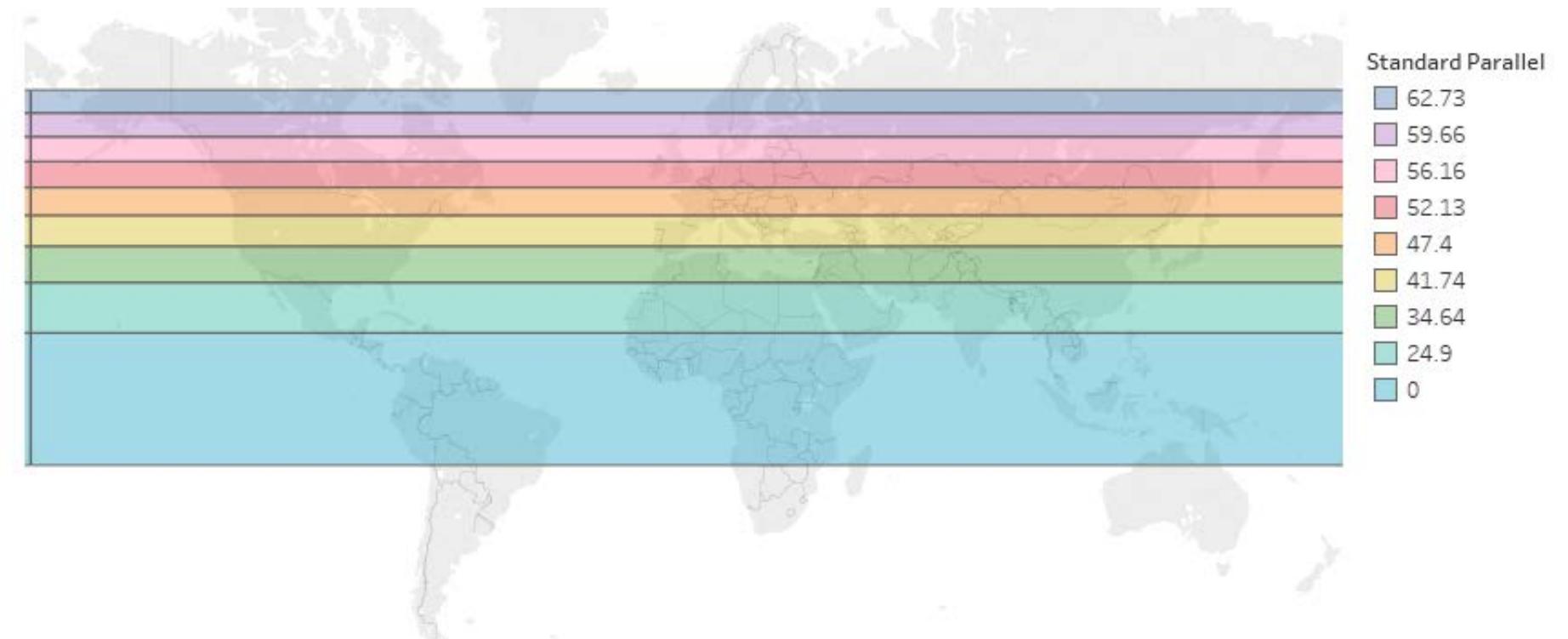
This really happens!



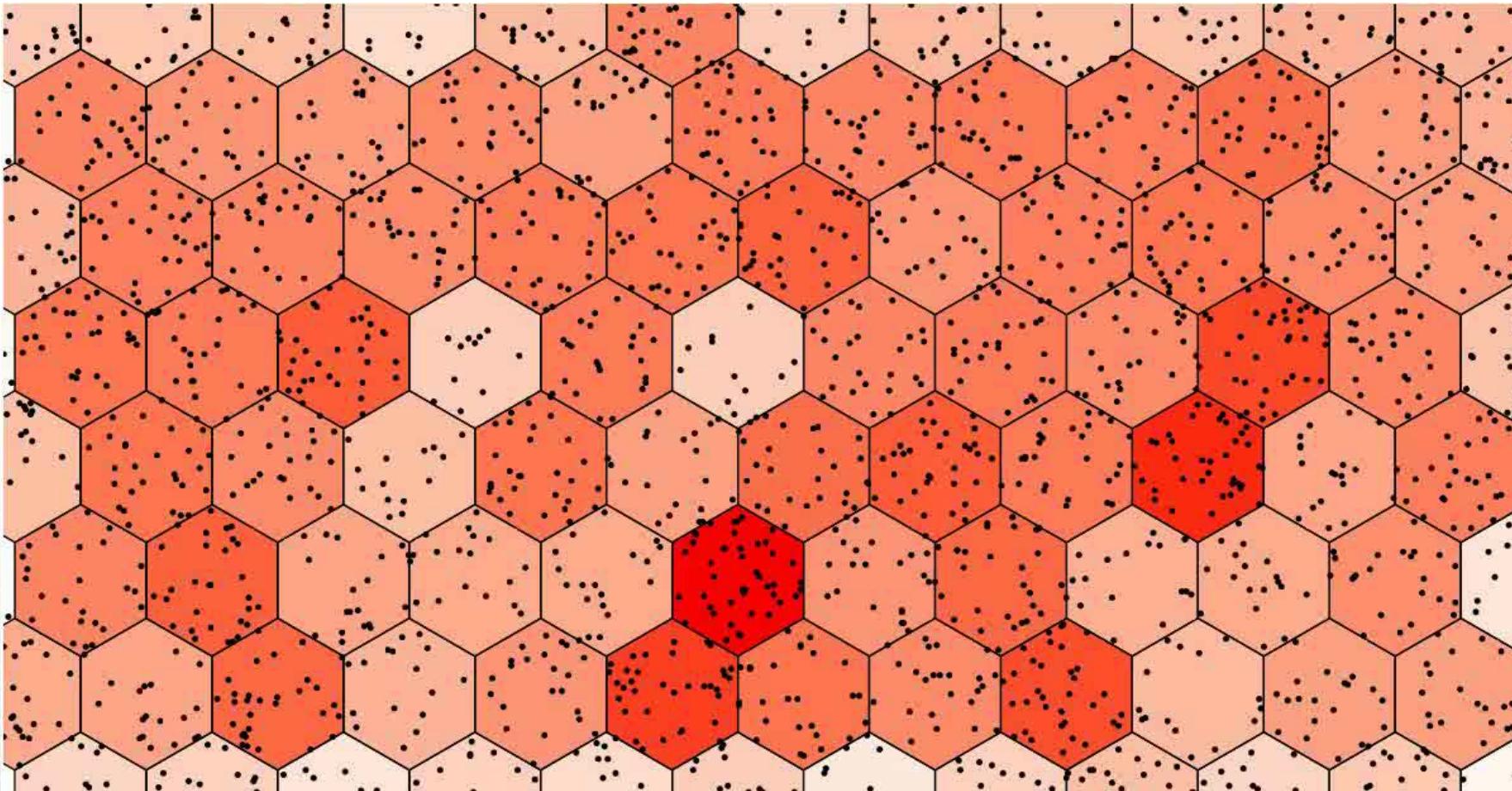
I'm not going to stop you, but I will warn you...

Given an allowable ‘flation’ (k) of scale factor - e.g., 5% error

For the standard parallel, φ_I



Another issue, while I'm here...



Math it out if you care about accuracy of your bins...

“Shapes on a Plane:
Evaluating the impact of projection distortion on spatial binning”

Download from:

<http://research.tableau.com>



...and that should be enough to be dangerous

Do you have pressing map questions?

Sarah Battersby -
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