NORC at the University of Chicago

Creating beautiful interactive maps with R and JavaScript D3

An open-source workflow

October 17, 2024

Henry Beimers

Agenda

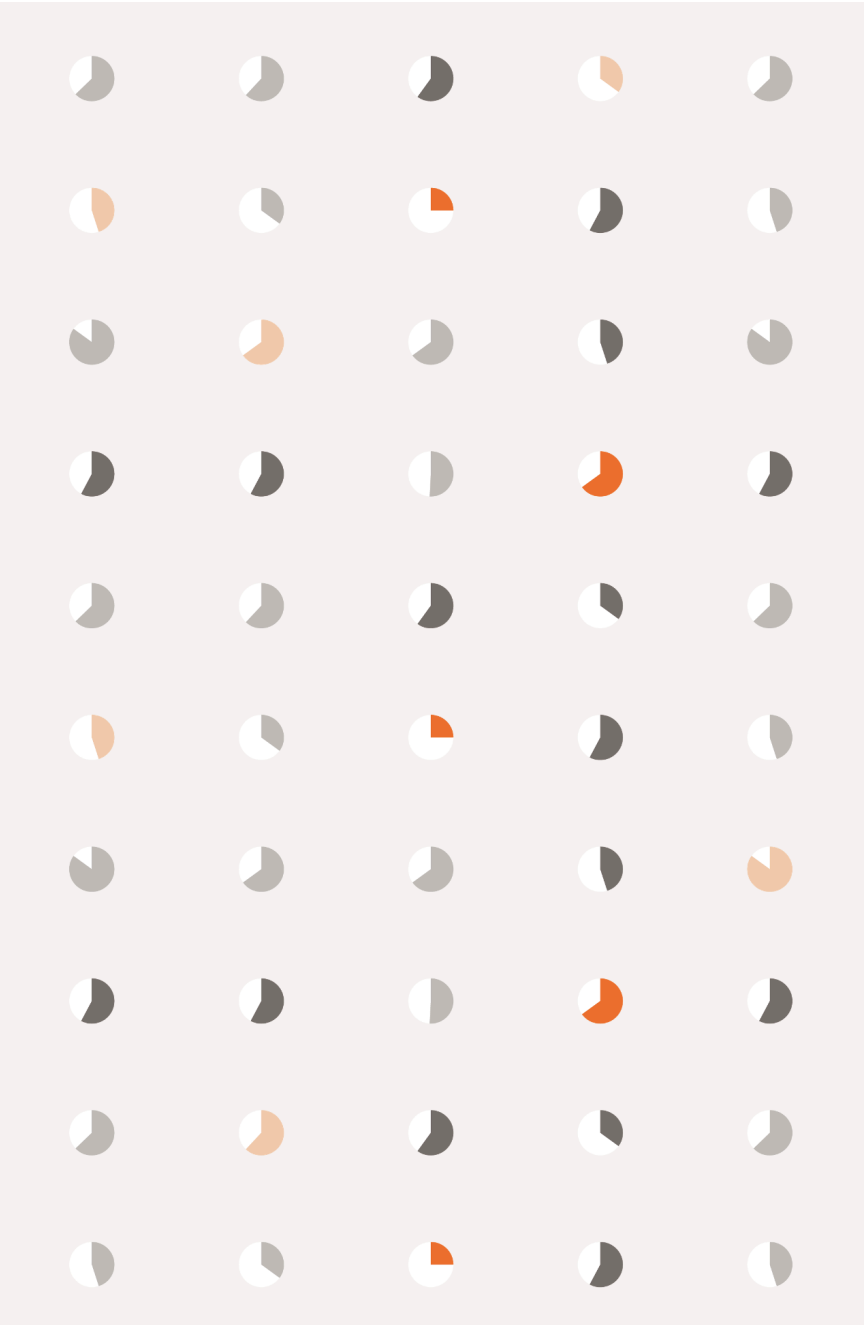
01 Why R and D3?

02 When should I use *r2d3*?

03 Basics of *r2d3*

04 Examples

05 Additional Topics



r2d3 is an R package that allows the user to generate D3 visualizations with R

The D3 JavaScript library

- **D**ata **D**riven **D**ocuments
- Industry standard for creating interactive graphics
- Used for creating custom interactive data visualizations

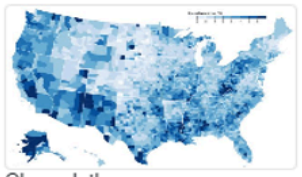
The *r2d3* R Package

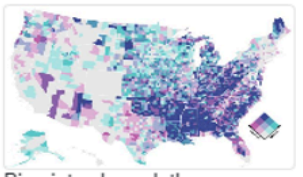
- Allows the programmer to pass data from R to a JavaScript file, and for that JavaScript file to render a graphic in R

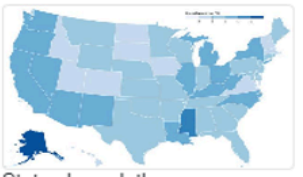
Use *r2d3* (*d3.js*) for complete control over your map's appearance

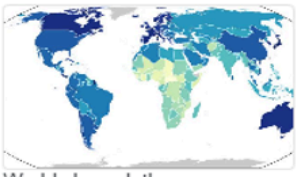
Maps

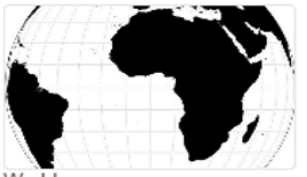
D3 implements a dizzying array of geographic projections. It works great with GeoJSON, TopoJSON, and even shapefiles.

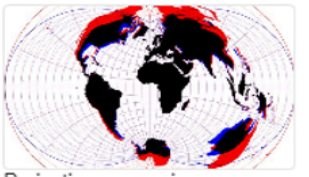

Choropleth

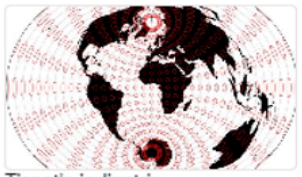

Bivariate choropleth


State choropleth


World choropleth


World map


Projection comparison


Tissot's indicatrix


Web Mercator tiles

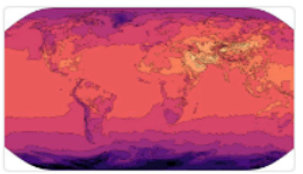

Raster tiles

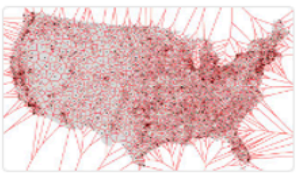

Vector tiles


Clipped map tiles

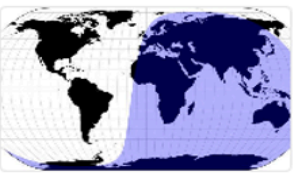

Raster & vector

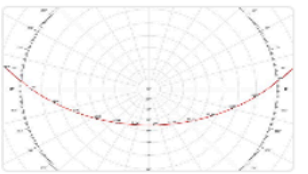

Vector field

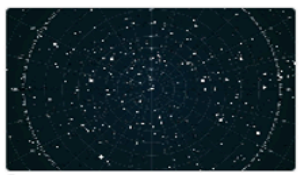

GeoTIFF contours


U.S. airports voronoi


World airports voronoi


Solar terminator


Solar path


Star map


Non-contiguous cartogram

r2d3 should be used when generating interactive, highly specialized maps

For creating static maps in R

- *ggplot2* if possible
- Use *r2d3* only if making a map requiring more customization

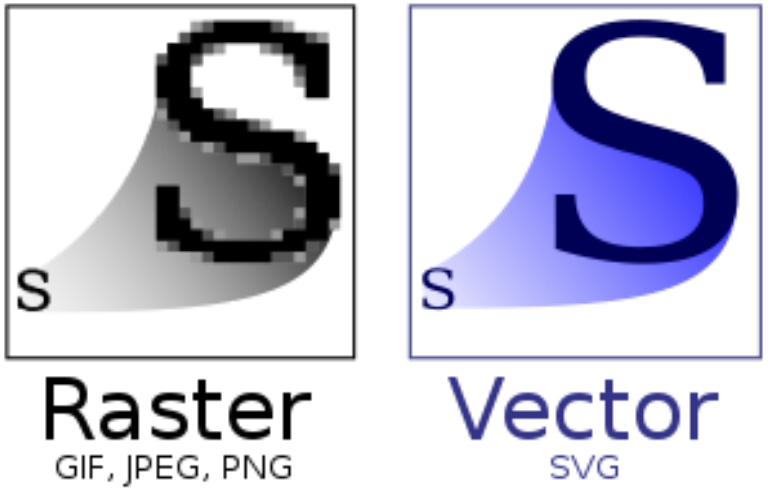
For creating interactive graphics

- Use leaflet in R or JavaScript if possible
- Advantages of *r2d3* over the *leaflet* library
- D3 better for data viz, adaptability, less traditional mapping

r2d3 interactive graphics can be shared in any format that can run JavaScript

D3 graphics can be displayed in HTML documents

- Website
- Shiny App
- R markdown, quarto, or Shiny HTML document (i.e. flexdashboard R package)



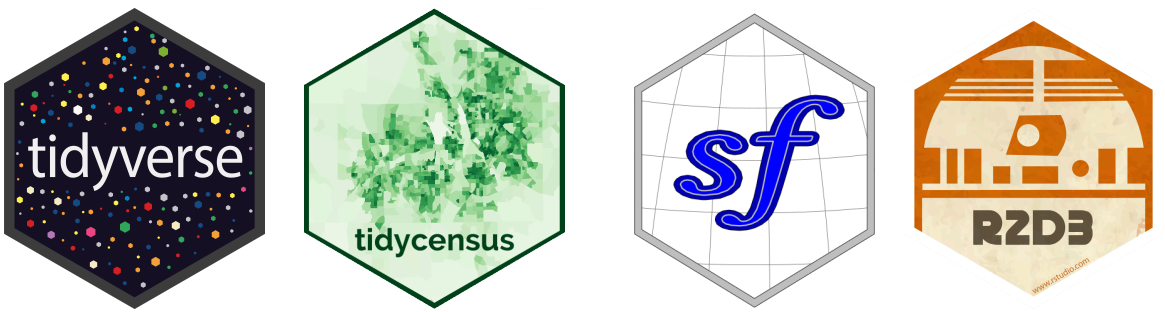
D3 graphics are by default SVG graphics

- Easier for 508 compliance

Suppose you need to display a map of median home values for Pierce County, WA, but need to quickly see different levels of geographic aggregation within the county:

- Build an **interactive map** which can easily be toggled between geographic levels
- Include **tooltips** with GEOID and an estimate for median home value

```
library(tidyverse)
library(tidycensus)
library(sf)
library(r2d3)
```



Get data at the census tract and block group level using `tidycensus`[1]

```
map_data_cbg <- tidycensus::get_acs(geography = "cl
                                    variables = "B
                                    state = "WA",
                                    county = "Pier
                                    geometry = TRU
  dplyr::select(GEOID, estimate, geometry) %>%
  dplyr::mutate(level = "cbg")

map_data_tract <- tidycensus::get_acs(geography =
                                      variables =
                                      state = "WA"
                                      county = "Pi
                                      geometry = T
  dplyr::select(GEOID, estimate, geometry) %>%
  dplyr::mutate(level = "tract")

all_data <- bind_rows(map_data_cbg, map_data_tract
```

GEOID	estimate	level	g
530539400012	797800	cbg	[ob
530539400071	304900	cbg	[ob
530530713062	395900	cbg	[ob
530530713043	285400	cbg	[ob
530530605003	634200	cbg	[ob
530530714091	296900	cbg	[ob
530530614003	353800	cbg	[ob
530530715043	322900	cbg	[ob

1–8 of 811 rows

Previous **1** 2 3 4 5 ... 102 Next

1. *Source: ACS 5-year estimates 2018-2022*

The `r2d3()` function


```
shiny::selectInput("geogs", "Geography:", choices = c("cbg","tract"))
shiny::selectInput("na_color", "NA color:", choices = c("gray","darkgray","lightgray"))

r2d3::d3Output("choroMap")

output$choroMap <- r2d3::renderD3({
  r2d3::r2d3(data = all_data,
             script = "d3_map_example.js",
             options = list(na_color = input$na_color,
                            geog = input$geogs,
                            zoom = TRUE))
})
```

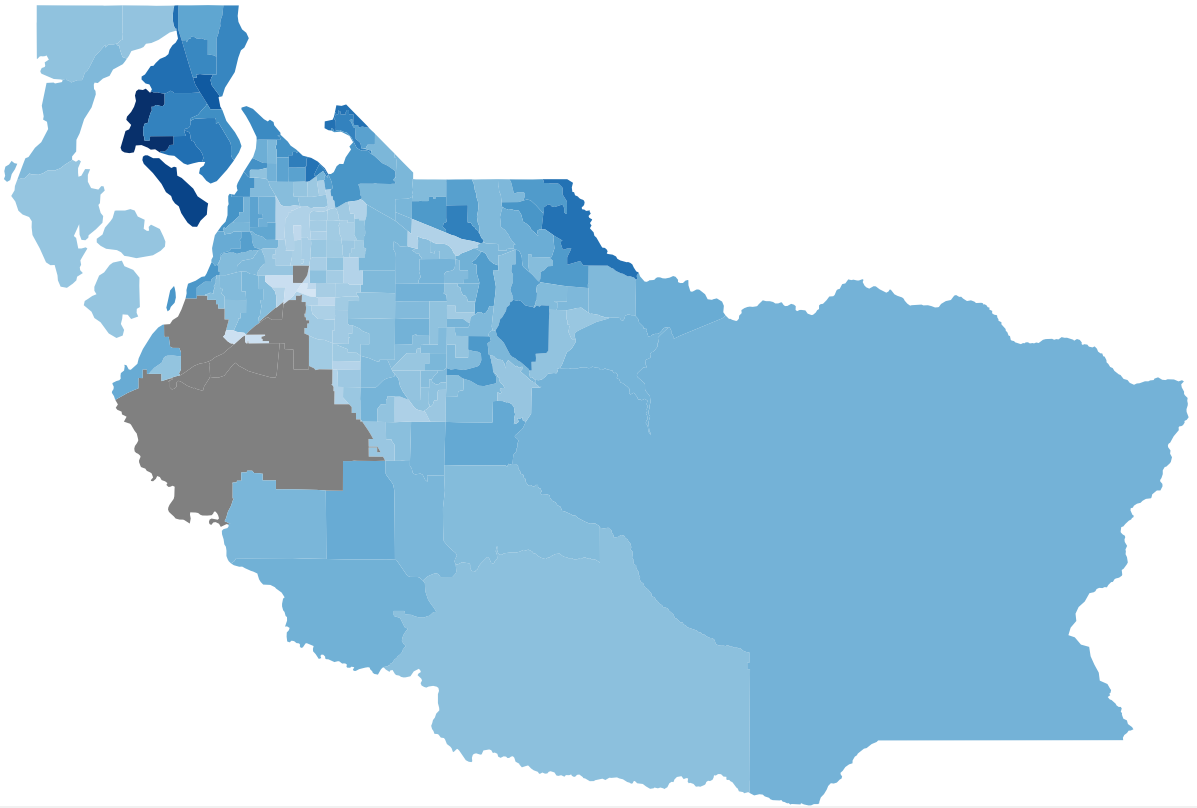
The `r2d3()` function

Geography:

tract

NA color:

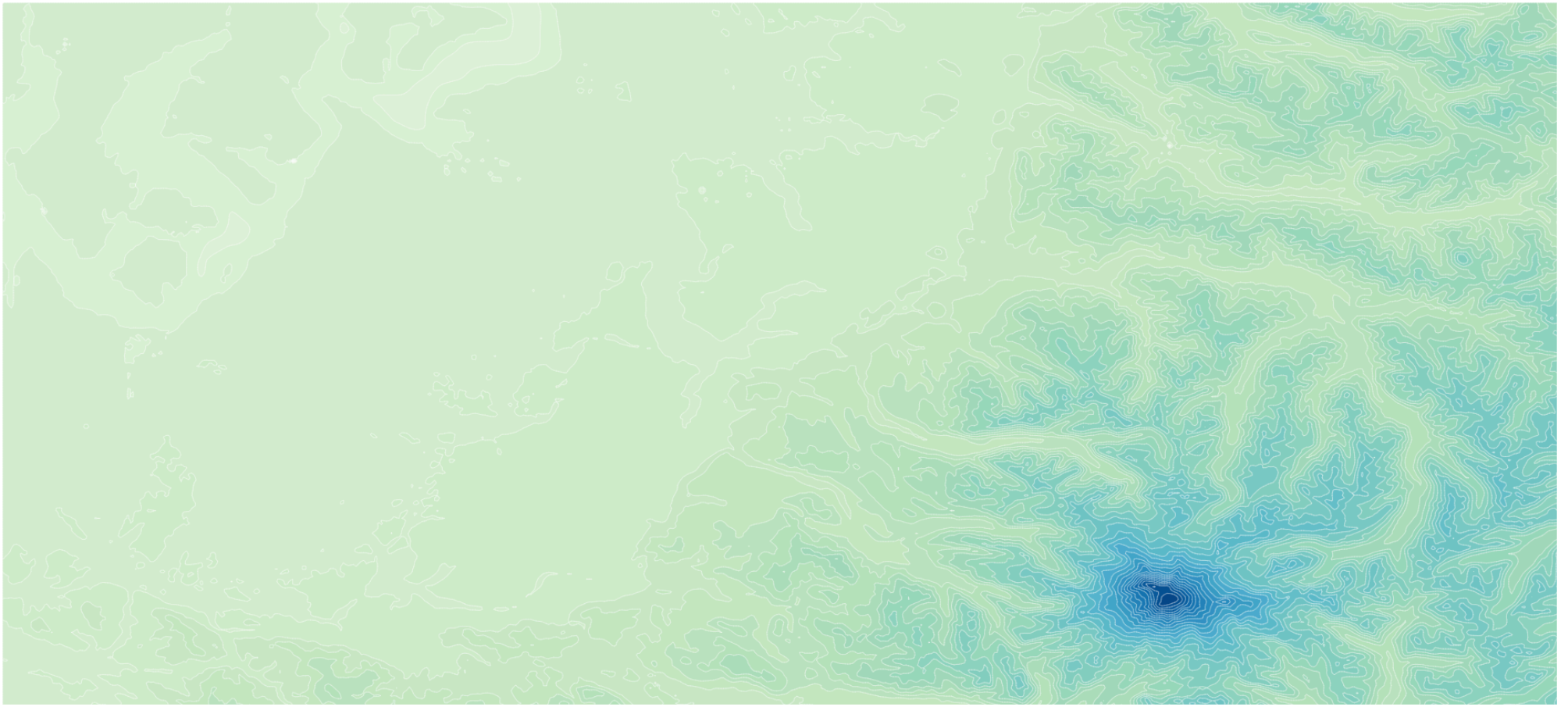
gray

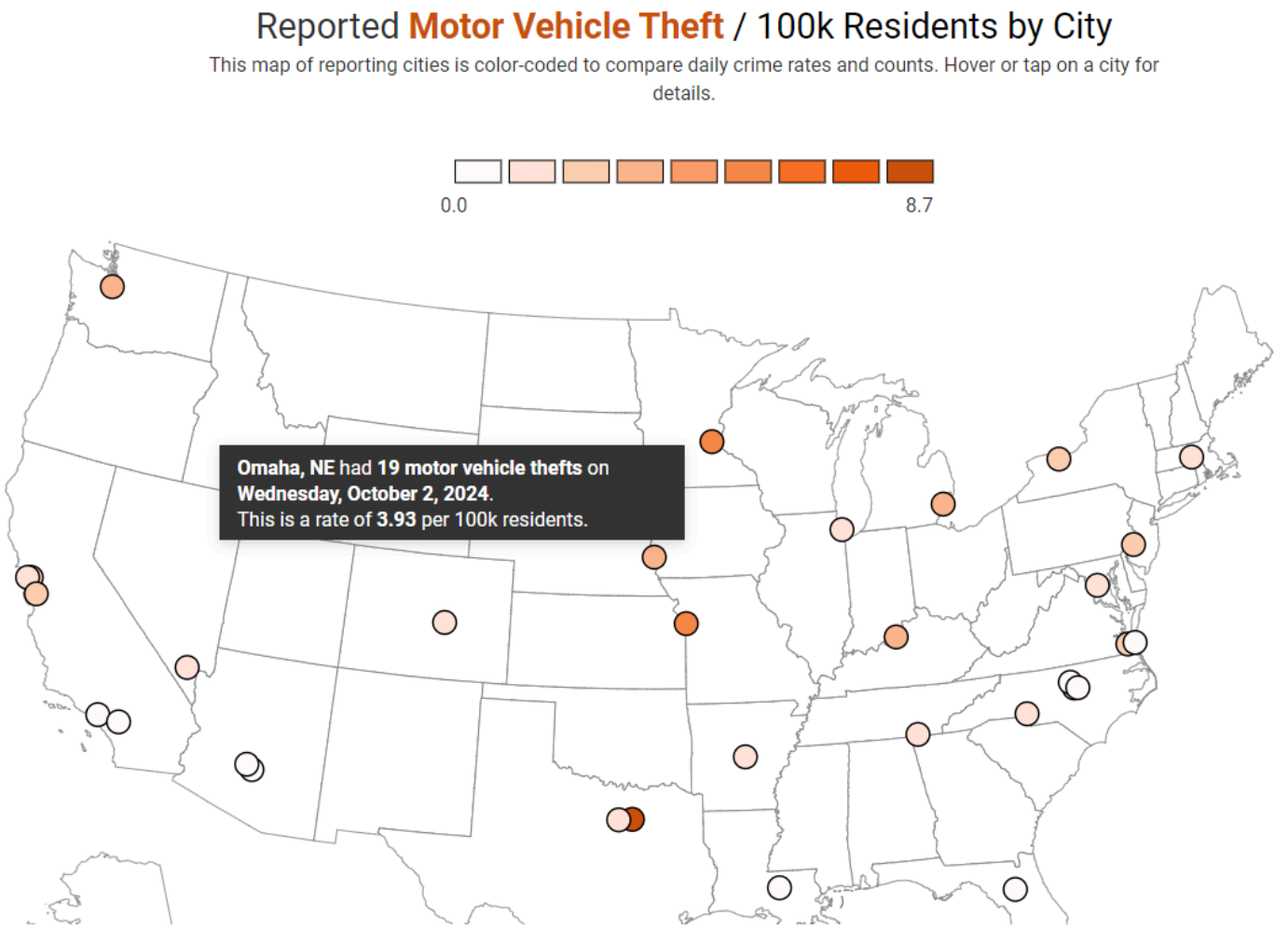


JavaScript Code

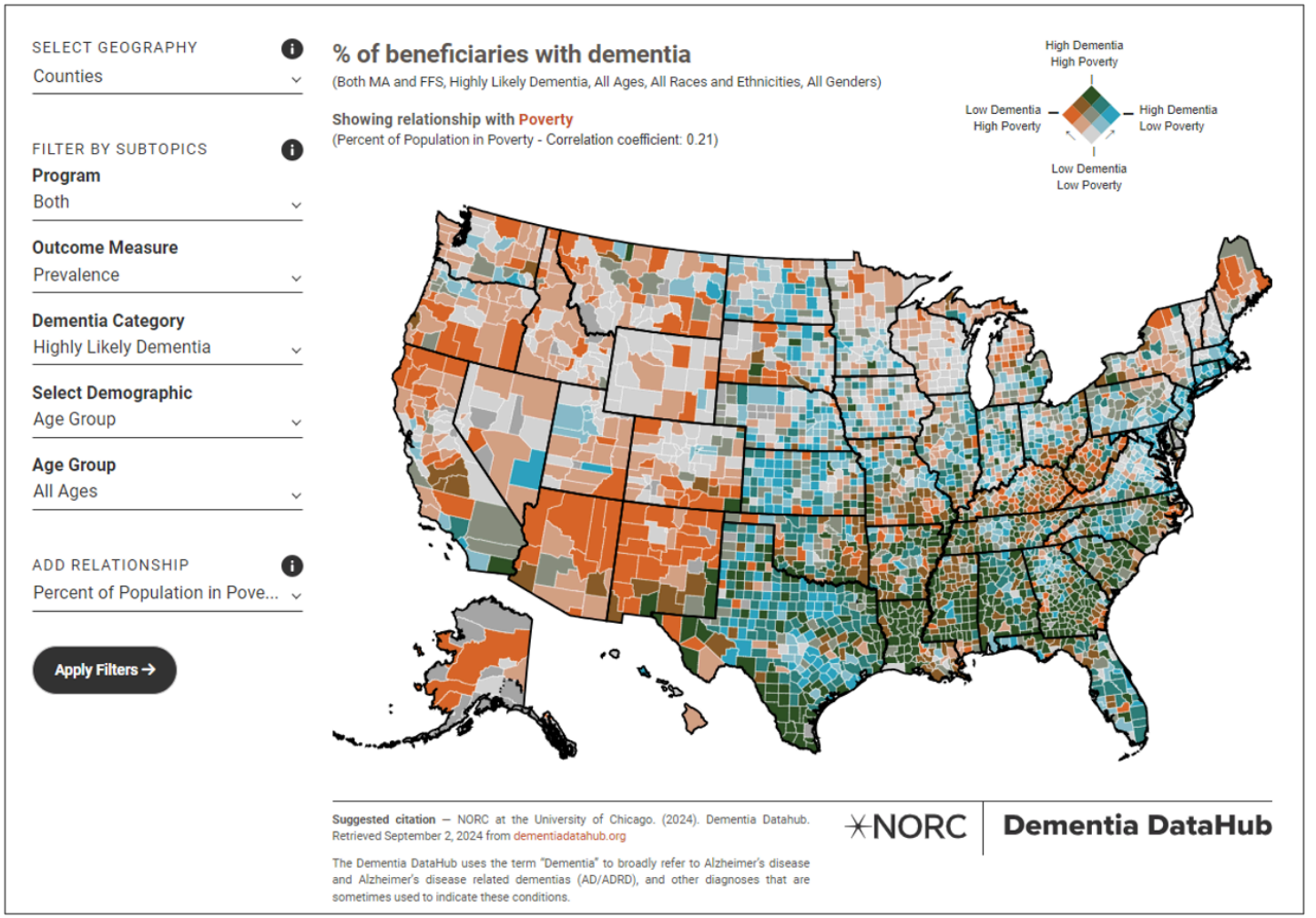

```
// Remove previous svg
svg.selectAll("g").remove();

// Transform data into json-style format
var filteredData = {
  "type": "FeatureCollection",
  "features": data
    .filter(d => d.level === options.geog) // Filter to the selected geography
    .map(d => ({
      "type": "Feature",
      "geometry": d.geometry,
      "properties": {
        "GEOID": d.GEOID,
        "estimate": d.estimate,
        "level": d.level,
      }
    }))
};

// Define the D3 map projection
var my_projection = d3.geoMercator().fitSize([width, height], filteredData);
var path = d3.geoPath().projection(my_projection);
```

Raster to Vector




Reported Motor Vehicle Theft / 100k Residents by City
This map of reporting cities is color-coded to compare daily crime rates and counts. Hover or tap on a city for details.
0.0
8.7
Omaha, NE had 19 motor vehicle thefts on Wednesday, October 2, 2024.
This is a rate of 3.93 per 100k residents.

https://dementiadatahub.org



Resources

- *r2d3* Documentation
- *r2d3* with *Shiny*
- Leaflet + D3
- DEM to Contour
- http://square.github.io/intro-to-d3/
- https://www.dashingd3js.com/d3-tutorial
- https://www.d3indepth.com/

Thank you.

Research You Can Trust™

NORC at the University of Chicago

Link to slides:

https://github.com/hbeimers/NACIS_2024_HenryBeimers