

Effective Dashboards

March 24, 2020

STAT 547M

Principles of building effective dashboards

Principles of Effective Visualizations

Principle

Definition

Examples

- **Proportional Ink**

The amount of ink used to indicate a value should be proportional to the value itself.

Truncating the y-axis on a bar chart to exaggerate the difference between bars violates the principle of proportional ink.

- **Data:ink ratio**

Remove distracting visual elements to focus attention on the data

Lighten line weights, remove backgrounds, never use 3D or special effects, ~~remove~~ avoid unnecessary/redundant labels.

- **Labels & legends**

Use axes labels and titles to highlight/communicate data

Never leave your data column names as axes labels! Generally good to add a title.

- **Overplotting**

With large datasets, points overlap, resulting in large clouds of data

To fix overplotting, could plot just a sample subset of the data, use alpha, and use smaller points. Or, jitter - but check if appropriate!

- **Visualization choice**

Must be informed by the **data** you have, the **research question** being asked and the **audience** that cares.

Pick the simplest plot that best shows most/all of the data needed to answer the research question. If you only have summary statistics, cannot show distributions. Tailor the visualization to your audience (within reason) but don't dumb it down.

- **Colour & Accessibility**

Colour can be used to encode information or for aesthetics/style/design. However, colour can also be distracting if used inappropriately or poorly.

Choose a perceptually uniform colour palette; can be sequential or diverging for quantitative data. Opt for colour-blind friendly palettes. Categorical data can use qualitative colour schemes.

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- **Labels & legend**

**Follow these principles
and you will be 80% there
to making an effective dashboard !!**

Our data column names as axes
are generally good to add a title.

- **Overplotting**

Plotting multiple layers of data, could plot just a sample of data, use alpha, and use smaller markers - but check if appropriate!

- **Visualization choice**

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Principles of Effective Dashboards

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Explanation

Audience Matters (a lot!)

You may need to build dashboards with different views:

- one for a manager/executive
- one for yourself to explore and understand the data
- one for the public

Purpose-driven Dashboards

Every dashboard should have a purpose!

Resist the idea to bake in the “purpose” as a dropdown or menu option. What are the usage scenarios? List your intent/purpose in your dashboard!

Choose defaults wisely

Interactivity with your dashboard should **NOT** be mandatory!
When your audience first arrive at your app, self-sufficient.

Less is more

Resist the urge to “plot everything in every way for every category/option/filter. Go back to the “purpose” of the dashboard, make sure you stay true to that. Put cool charts you want people to look at in an appendix, or build a second app.

Add a narrative and signposts

Have a conversation with your reader, add sign-posts, consider adding a “reset/home/defaults” button so they can always get back to the main point if they mess around too much.

Aesthetics matter!

Styling, branding, colour schemes (including colour-blind friendly), typography, layout, user interface (UI) and user experience (UX) matter a lot! Think hard about them - make good choices, find the right balance between aesthetics and functionality.

Principles of Effective Dashboards

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Build trust in your analysis

Think about ways you can increase transparency of your data sources and analysis methods. Be upfront about missing data and accuracy of your data. Add tooltips so users can check data.

Think about the “onboarding” experience

What happens when users first visit your site? Related to “set good defaults” but more than that: how do they use it?
Where are the controls? What do they do?

Use a consistent layout

Do not burden your users by making them think about the layout of your app and how it’s structured ; should be natural!

Use animations sparingly

Animations can be distracting, use them if you think it will help drive your point home (e.g., prison parole example)

Allow users to filter data (if applicable)

If you start with a giant dataset - say, the gapminder dataset - allow users the ability to filter the data and show data for the country they are interested in; have a good default comp

User testing is critical!

Get someone to look at your dashboard during development.
Ideally someone who will be using it

Resources

- “The end of interactive visualizations”
- “In defence of interactive visualizations”
- “The laws of crappy dashboards”

Other considerations for building dashboards

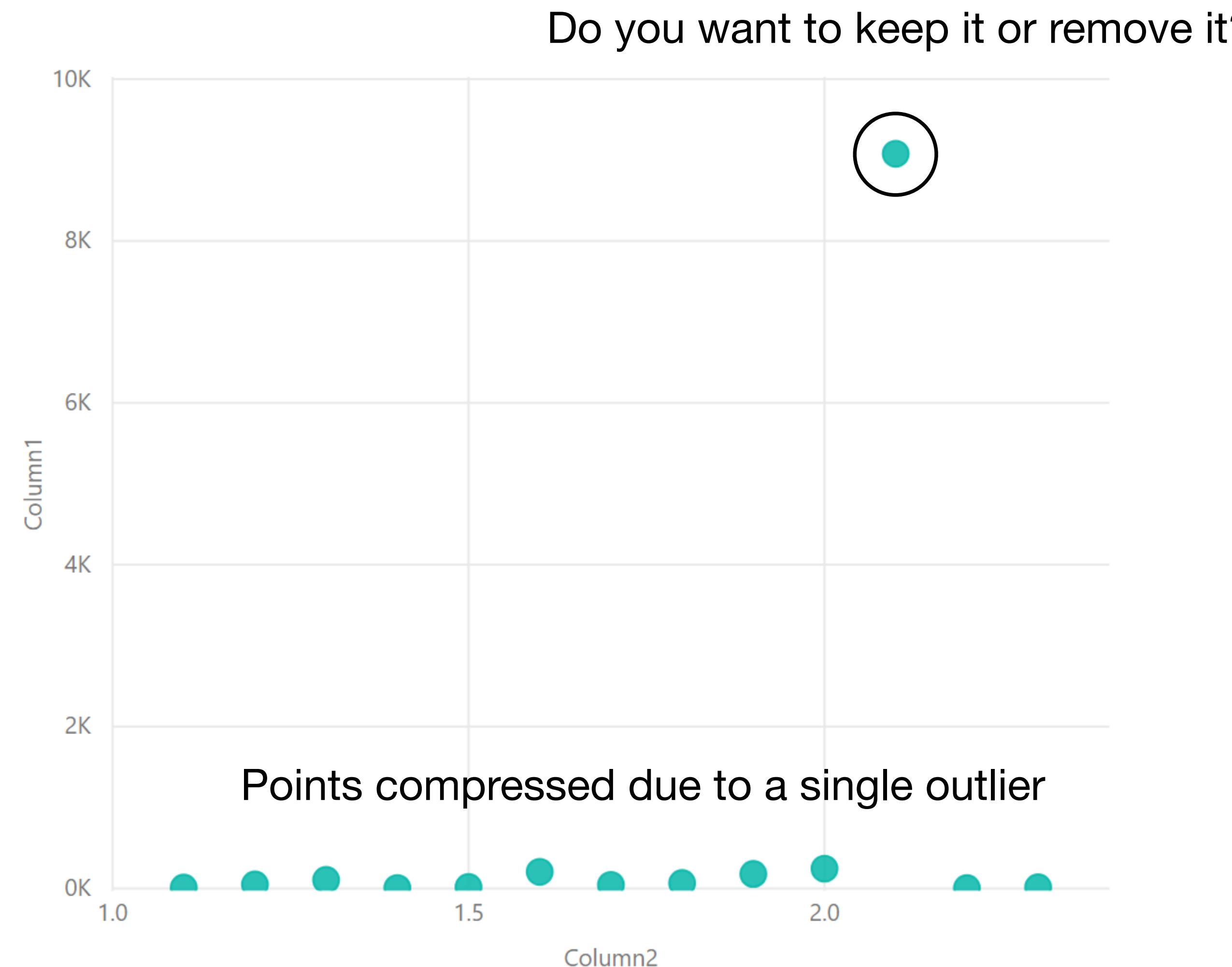
Many ways to speed up dashboards, here are three:

1. Filtering data
2. Strategies for aggregating data
3. Precomputing data

1. Filtering Data

- Are you using all of your data ?
 - If not, set up an reproducible script to drop unused columns, and rows...
 - If yes, add components (dropdowns/slider) to less data is shown overall
- Remember: purpose-driven dashboards. Is all your data useful to answer your research question?

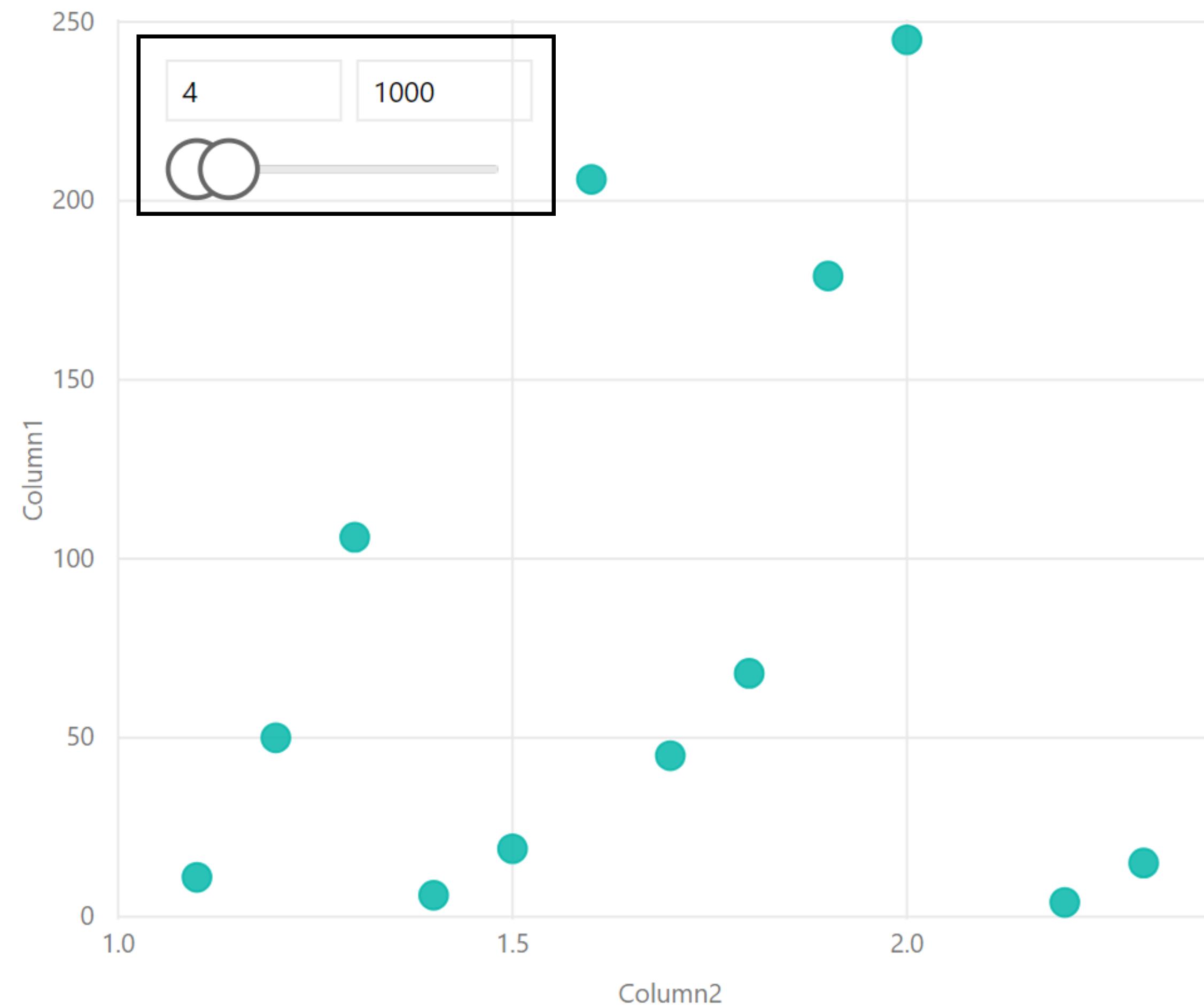
Dealing with outliers



Source: [DSCI 532 lecture slides from 2019/19](#)
Cydney Nielsen

Dealing with outliers

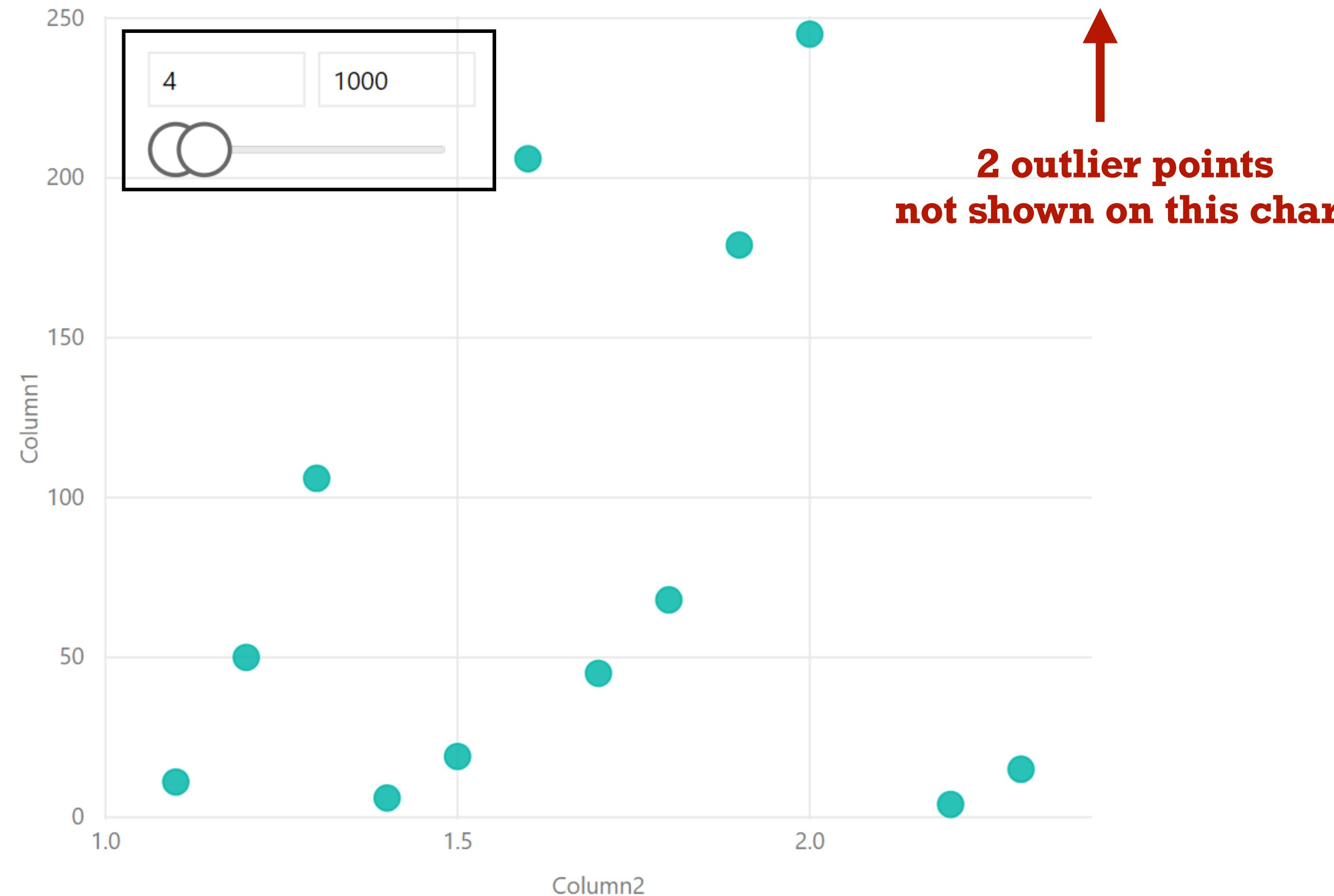
interactive filtering is another solution - appropriate when want to remove outliers



Source: [DSCI 532 lecture slides from 2019/19](#)
Cydney Nielsen

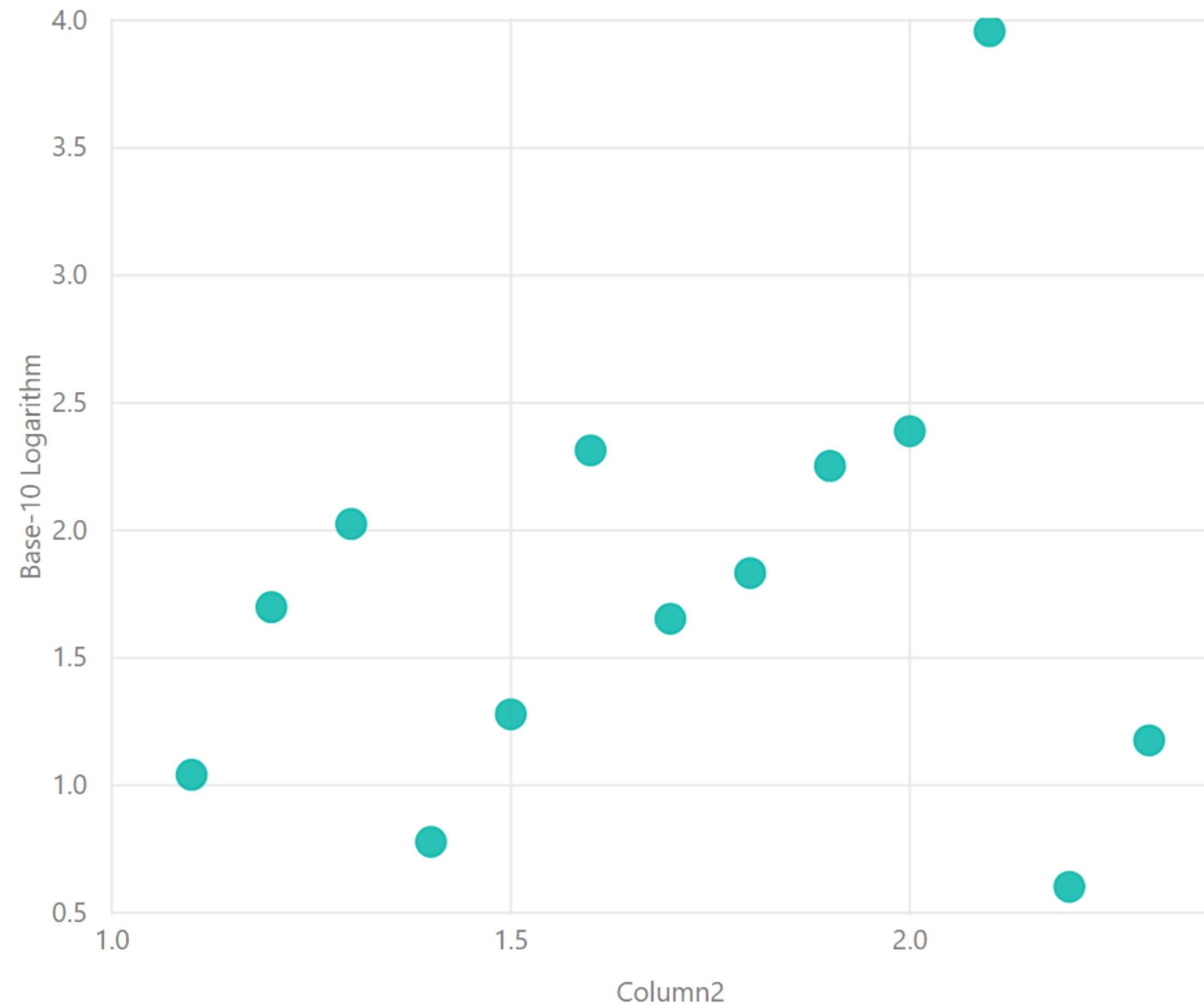
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Dealing with outliers

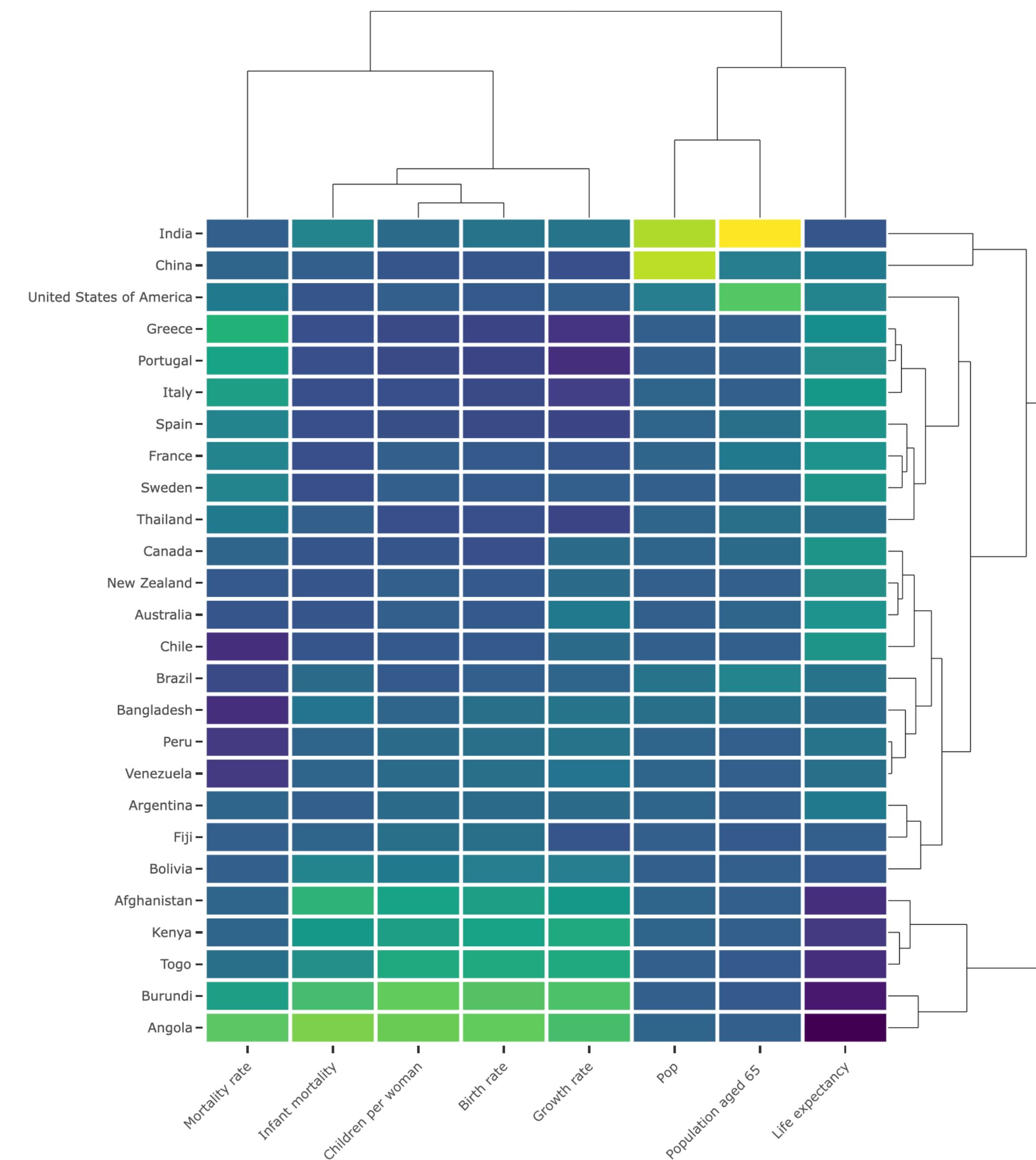
log scale helps - appropriate if you want to keep all points



2. Aggregating Data

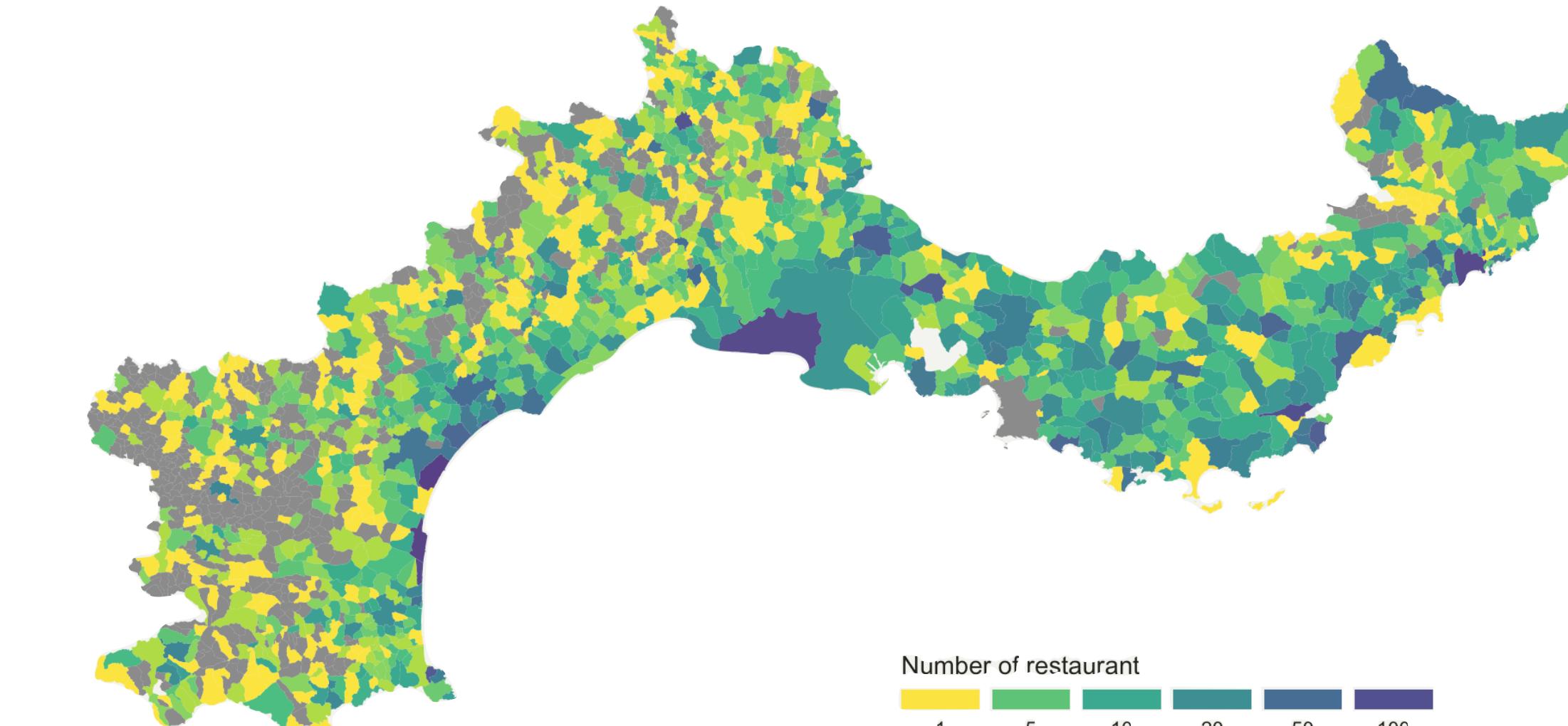
- Consider loading in already-wrangled data rather than doing the wrangling in your dashboard
- Where possible, plot aggregate measures like mean, median, distributions, histograms, density estimates
- Choose visual representations like heatmaps, choropleths, tree maps

Heat Maps



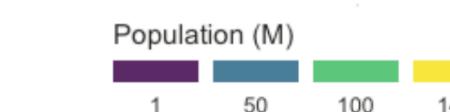
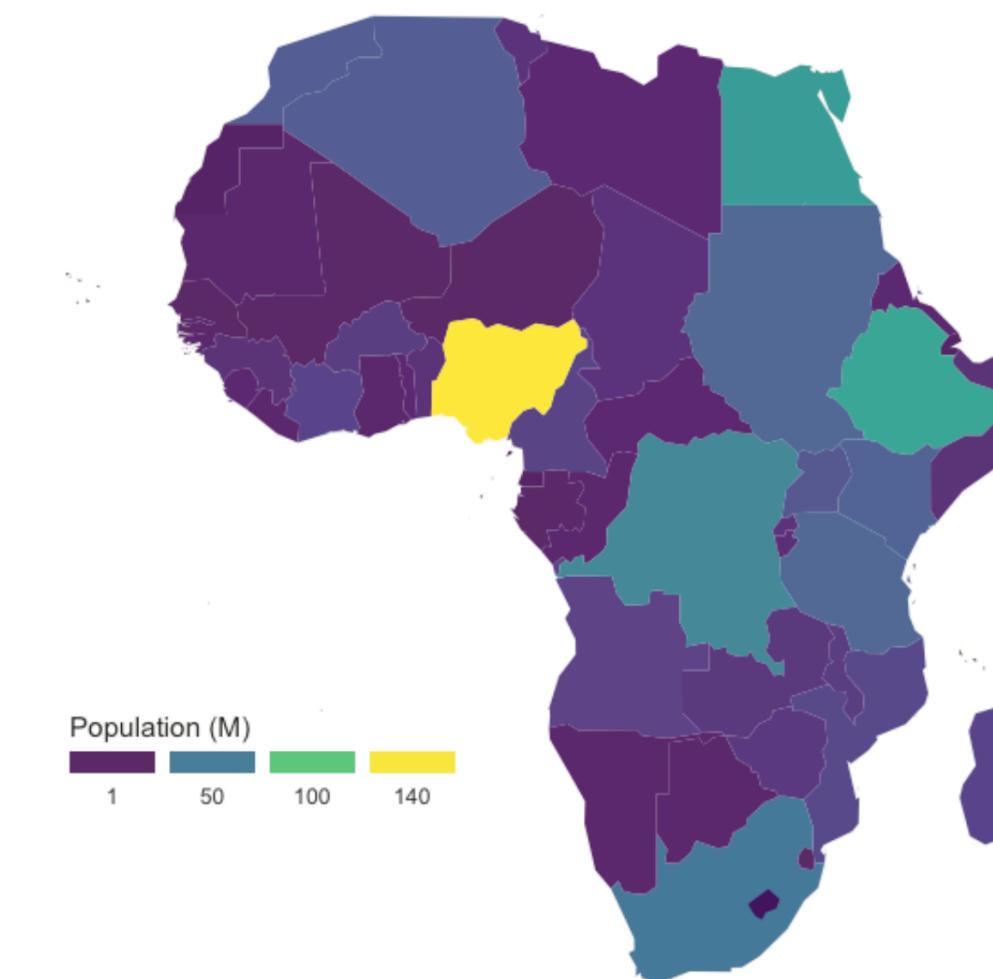
Choropleth

South of France Restaurant concentration
Number of restaurant per city district



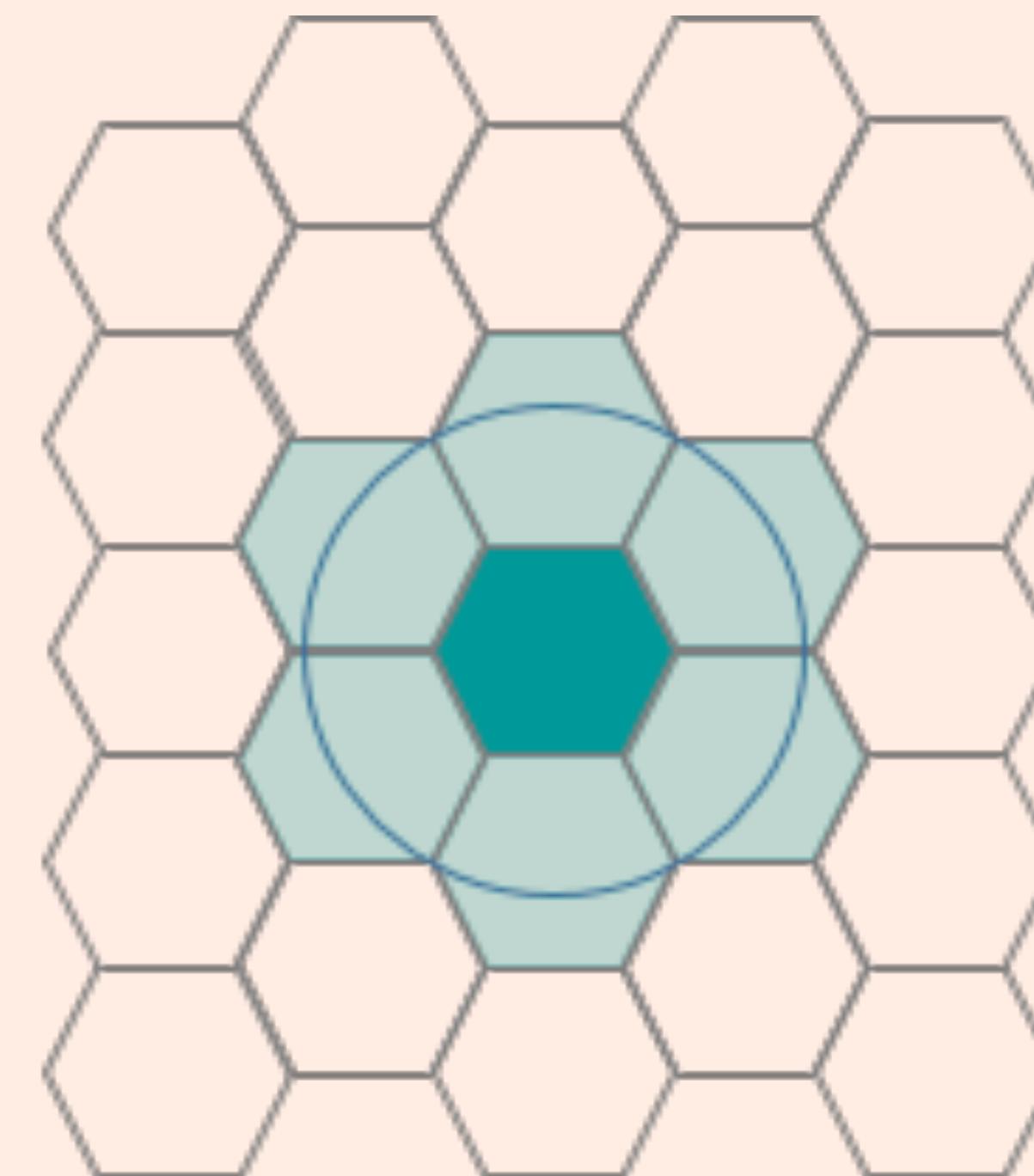
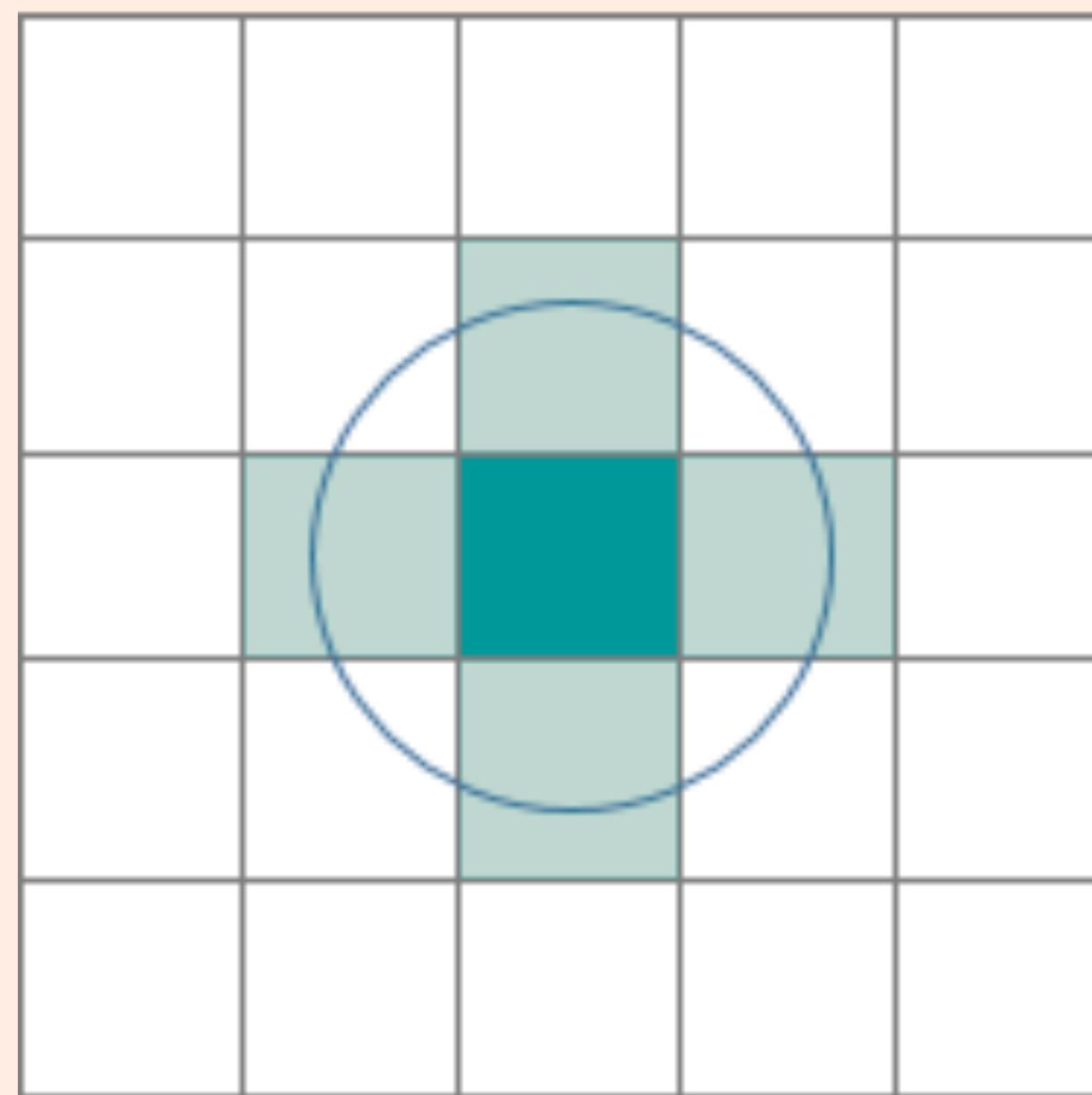
Data: INSEE | Creation: Yan Holtz | r-graph-gallery.com

Real boundaries



Cartogram

Why Hexagons?



Hexagons:

- Reduce sampling bias
- Curves in data more naturally shown
- Grids draw our eyes to straight, unbroken parallel lines

3. Pre-computing Data

- Use vectorized functions and avoid loops at all costs!
- Setup a script/notebook to do any heavy wrangling and processing outside your app
- Load data at app start; **re-structure** your data to serve queries!

Summary

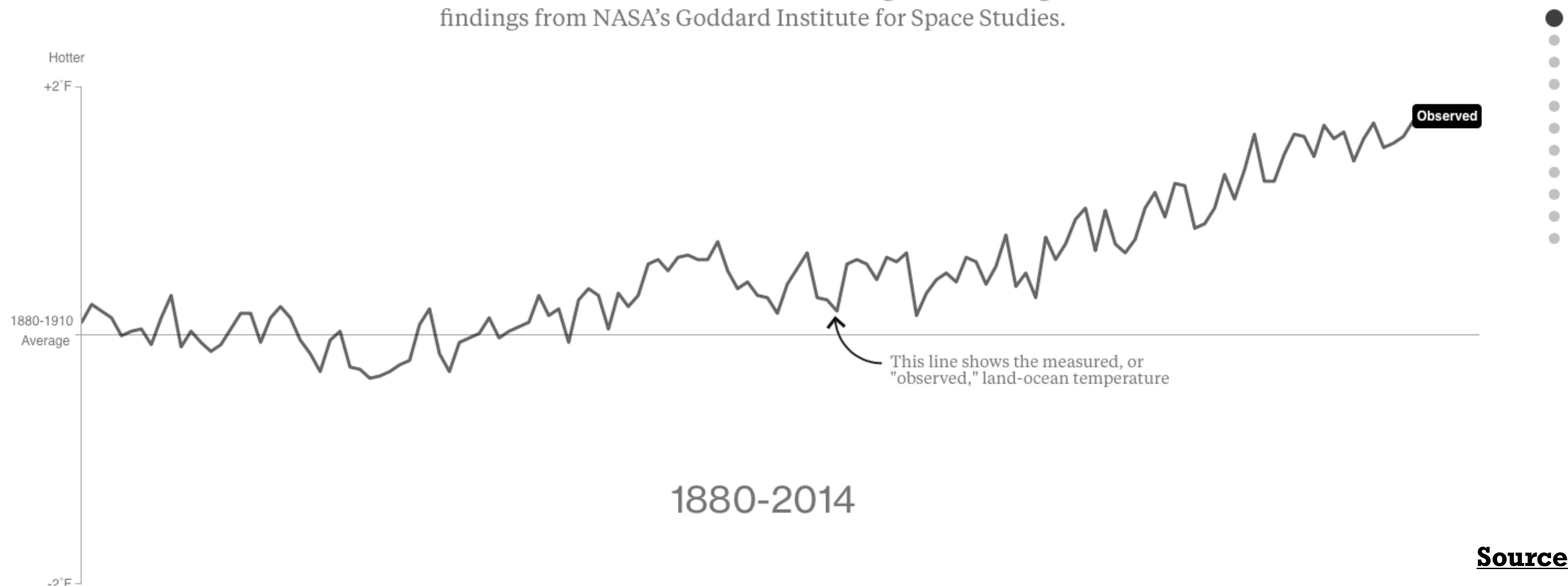
- Speed-up dashboards by precomputing, filtering, and aggregating data
- Use vectorized functions and packages like **purrr** and **dplyr**
- Practicing Dash callbacks in R
- Examples of story-telling with excellent dashboards

Examples of effective dashboards

What's Really Warming the World?

By Eric Roston  and Blacki Migliozzi  | June 24, 2015

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Scroll down to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.

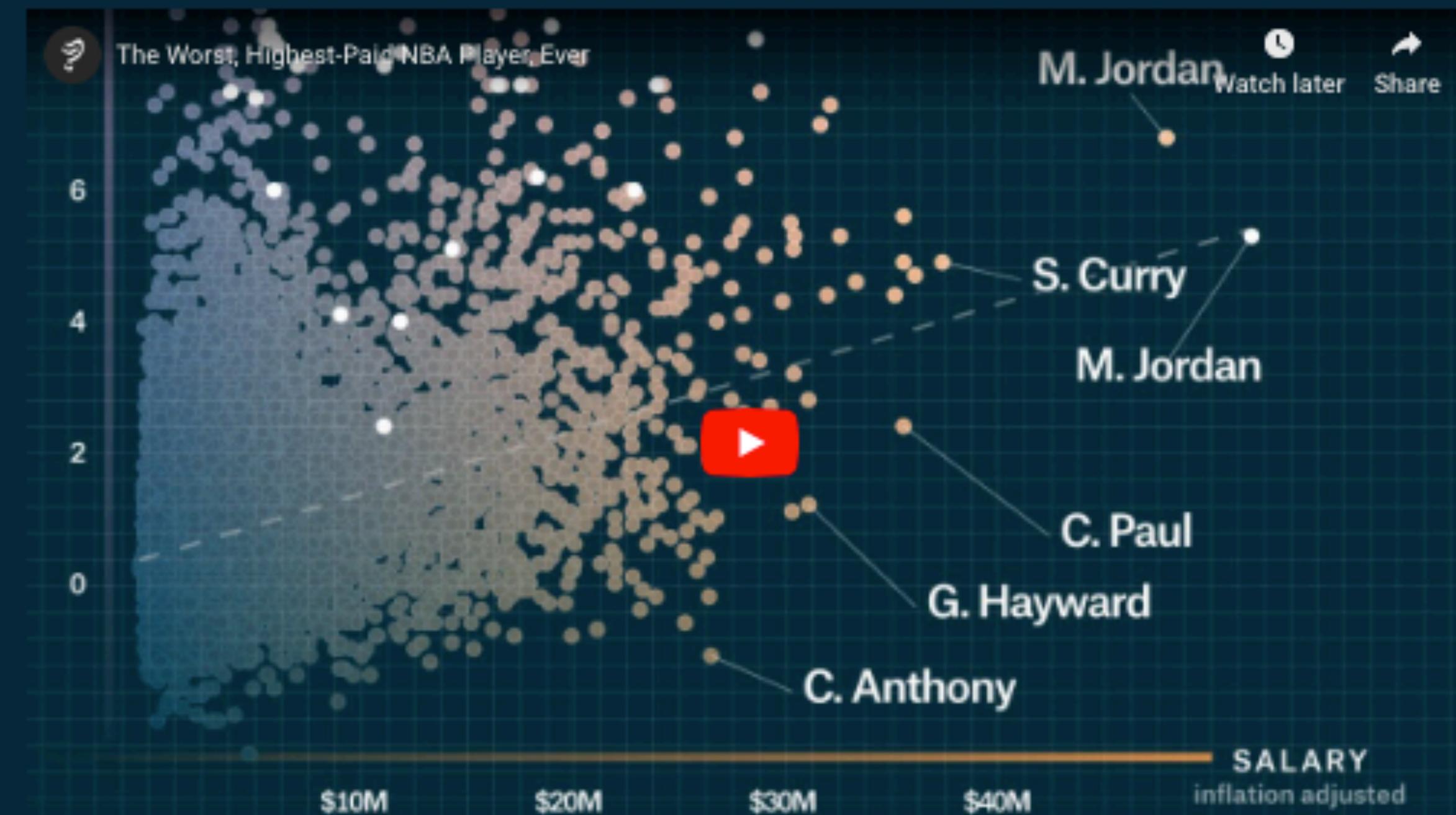


Finding the Worst, Highest-Paid NBA Player, Ever

Using advanced NBA stats to rank player performance against pay.

by [Matt Daniels](#)

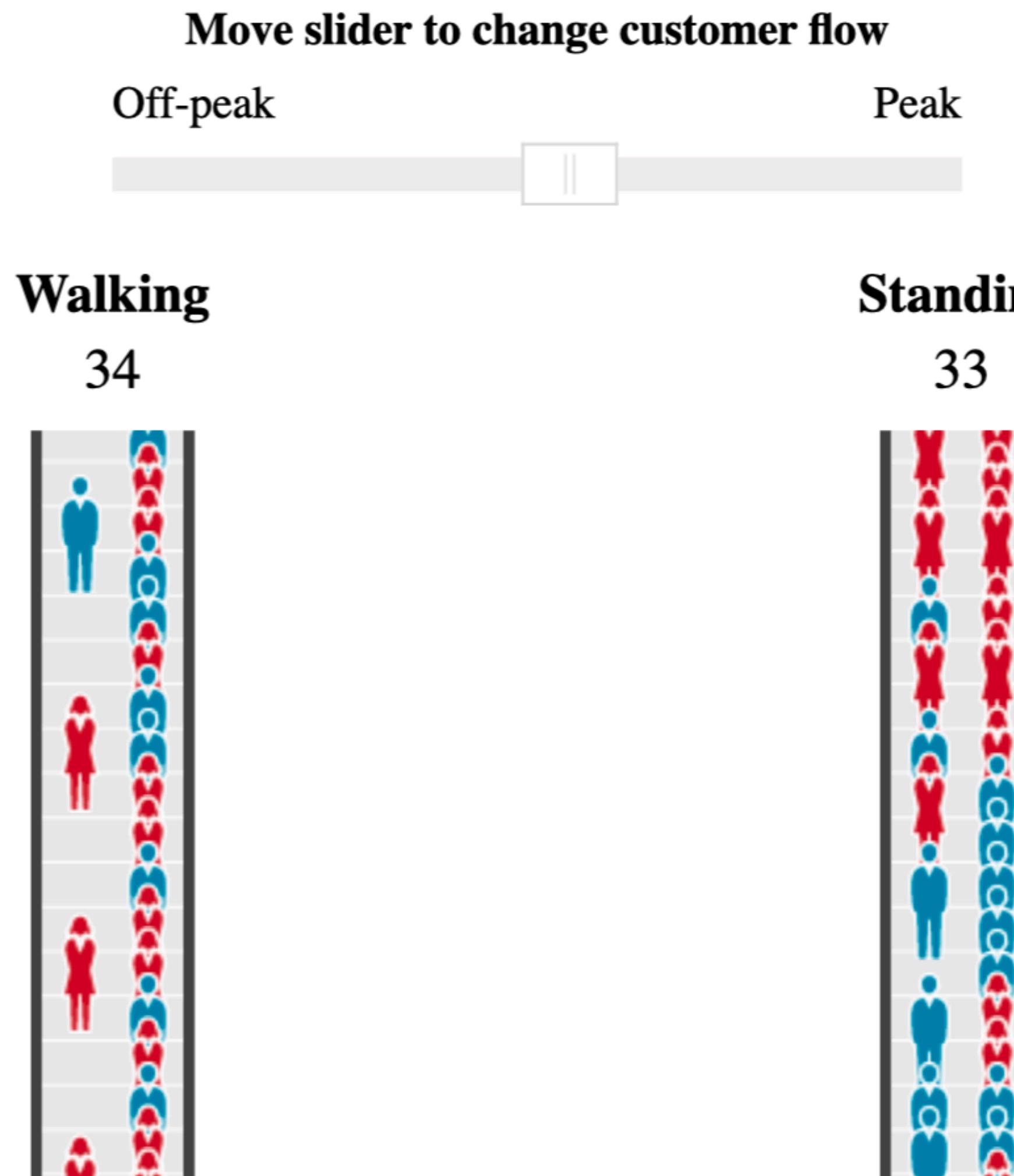
[Watch the Video](#)



[Source](#)

Does standing on both sides of the escalator work? Test it with our interactive simulator

The interactive below shows how the trial helped ease congestion - showing the number of people reaching the top of each escalator, and based on figures provided by TfL.



Source

You Draw It: How Family Income Predicts Children's College Chances

By **GREGOR AISCH, AMANDA COX and KEVIN QUEALY** MAY 28, 2015

How likely is it that children who grow up in very poor families go to college? How about children who grow up in very rich families?

We'd like you to **draw your guess** for every income level on the chart below.

If you think the chances of enrolling in college (or vocational school) are about the same for everyone, you should draw something like this: — . If you think the odds are especially harsh for children from the poorest families, but higher for middle- and higher-income children, your drawing would instead look like this:

↙ . Or here is one for a situation in which chances level off after a certain income threshold: ↘ . Or for one that spikes ↗ or dips ↘ for the very richest.

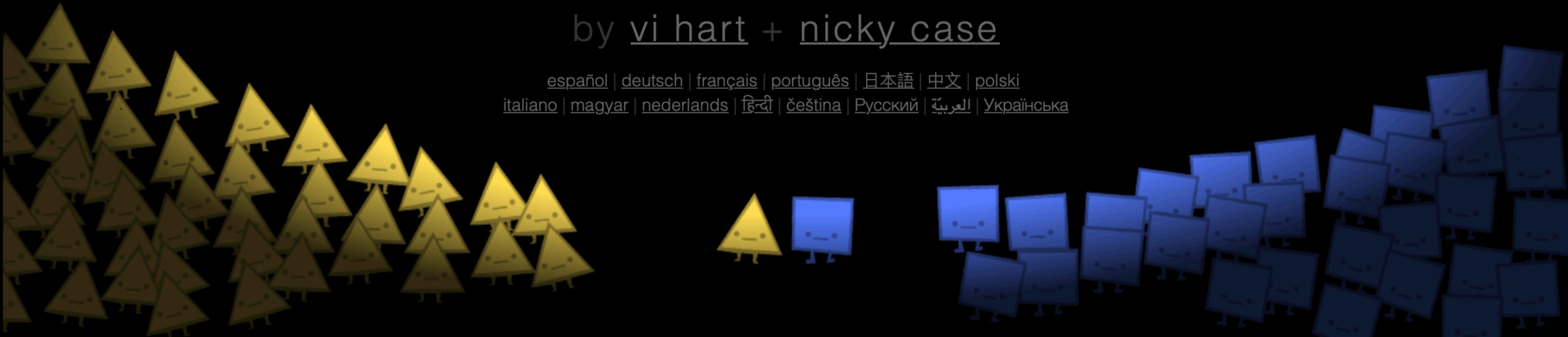
Source

PARABLE OF THE POLYGONS

A PLAYABLE POST ON THE SHAPE OF SOCIETY

by [vi hart + nicky case](#)

[español](#) | [deutsch](#) | [français](#) | [português](#) | [日本語](#) | [中文](#) | [polski](#)
[italiano](#) | [magyar](#) | [nederlands](#) | [हिन्दी](#) | [čeština](#) | [Русский](#) | [العربية](#) | [Українська](#)



This is a story of how harmless choices can make a harmful world.

These little cuties are 50% Triangles, 50% Squares, and 100% slightly shapist.
But only slightly! In fact, every polygon *prefers* being in a diverse crowd:



[Source](#)

Can you form a stable government?

Combine parties as best you can to form a workable government. You need 323 votes, probably, to survive a confidence vote, but you may find that some parties get along together better than others



Choose your parties

Start by dragging either Labour or Conservatives



Ukip 3



SNP 52



PC 3



SDLP 3



Green 1

You have

582 seats

Reset

It's a bad match
because ...



DUP 9



Source

Great list of fantastic interactive dashboards!

Rock 'n Poll

The power of Explorable Explanations

Maarten Lambrechts
@maartenzam

Mediafin

DataHarvest 2016

1



Dataharvest I: Rock 'n Poll

⌚ 4 years ago ❤️ 1 ⚗ 5,583



maartenzam PRO ★

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[Source](#)

Summary

- Building good dashboards is **HARD**, you are fighting an uphill battle in the industry because of all the bad dashboards with terrible defaults
- But it is **WORTH IT**, dashboards are excellent for **exploring data, showcasing important results, and creating a more data-aware society**
- Audience matters! Context matters! Research questions matter!