

# Announcements

- Milestone 3, 4, and Lab 10
- Look for feedback in GitHub issues!
- How to make repos public
- Office hours: please attend!  
(Mine are Today after class)

# **Principles of Effective Dashboard Design**

November 25, 2020

DSCI 301 - Lecture 11

# **Part 1: Dashboards & Principles of Effective Dashboard Design**

# Dashboards are everywhere!



Source: CC4 image

# The “laws” of crappy dashboards

Source: <http://attackwithnumbers.com/the-laws-of-shitty-dashboard>

Law 1

Most software dashboards are crappy

Law 2

If it's called “Dashboard”, it's probably crappy

Law 3

If you don't know what to take away from your dashboard,  
your users will definitely not

Law 4

Not talking to users will result in a crappy dashboard

Law 5

Give users **full control** of your dashboard,  
and users will **fully break** it

Law 6

Just because it was useful in a Powerpoint doesn't mean it's  
useful on a dashboard

Law 7

Just because it moves, does not mean it's not crappy

# Purpose-Driven Dashboards

**Before you build a dashboard, make sure it has a purpose!**

**Do not build one just for the sake of building one and contribute more noise!**

**Questions to ask yourself:**

- What is the research question?
- What is the business question?
- Who will use it (audience matters, a lot!)
- How long will they use it (one-time thing vs. continued use) ?
- Do you have time to build it, maintain it, and make it effective?

- [Home](#)
- [Payments](#)
- [Customers](#)
- [Products](#)
- [Reports](#)
- [Apps](#)
- [Developers](#)
- Viewing test data
- [Settings](#)

## Today

Net volume ▼

\$456,581.14

Yesterday ▼

\$253,702.97

12:00 AM

11:59 PM

USD Balance ▼

\$5,383.52

Available to payout

[View detail](#)

Payouts

\$229,069.82

Expected tomorrow

[View detail](#)

## Analytics

4w ▼

Sep 17, 2019 → Oct 14, 2019

vs.

Aug 20, 2019 → Sep 16, 2019

Daily ▼

[Customize](#)Gross volume -12.0%

\$7.71M

Connect gross volume -55.8%

\$80,414.04

Net volume from sales -12.4%

\$7.31M

Sep 17 Today

Sep 17 Today

Sep 17 Today

New customers -12.3%

128.4K

New connected accounts -93.3%

1

Successful payments -10.4%

154.5K

Sep 17 Today

Sep 17 Today

Sep 17 Today

**Source:** Stripe docs

- [Home](#)
- [Payments](#)
- [Customers](#)
- [Products](#)
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- [Settings](#)



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! y-axis ticks



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Daily ▼



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Today

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Today

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146.5K

Source: Stripe docs

New connected accounts -93.3%

1

15

Sep 17

Today

Successful payments -10.4%

154.5K

172.6K

Sep 17

Today

# Purpose-Driven Dashboards

FiveThirtyEight



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Politics   Sports   Science & Health   Economics   Culture

## Should Prison Sentences Be Based On Crimes That Haven't Been Committed Yet?

By [Anna Maria Barry-Jester](#), [Ben Casselman](#) and [Dana Goldstein](#)

Graphics by [Matthew Conlen](#), [Reuben Fischer-Baum](#) and [Andy Rossback](#)

Filed under [Criminal Justice](#)

Published Aug. 4, 2015



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

- **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**

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

From 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.

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# Principles of Effective Dashboards

## Principle

## 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.

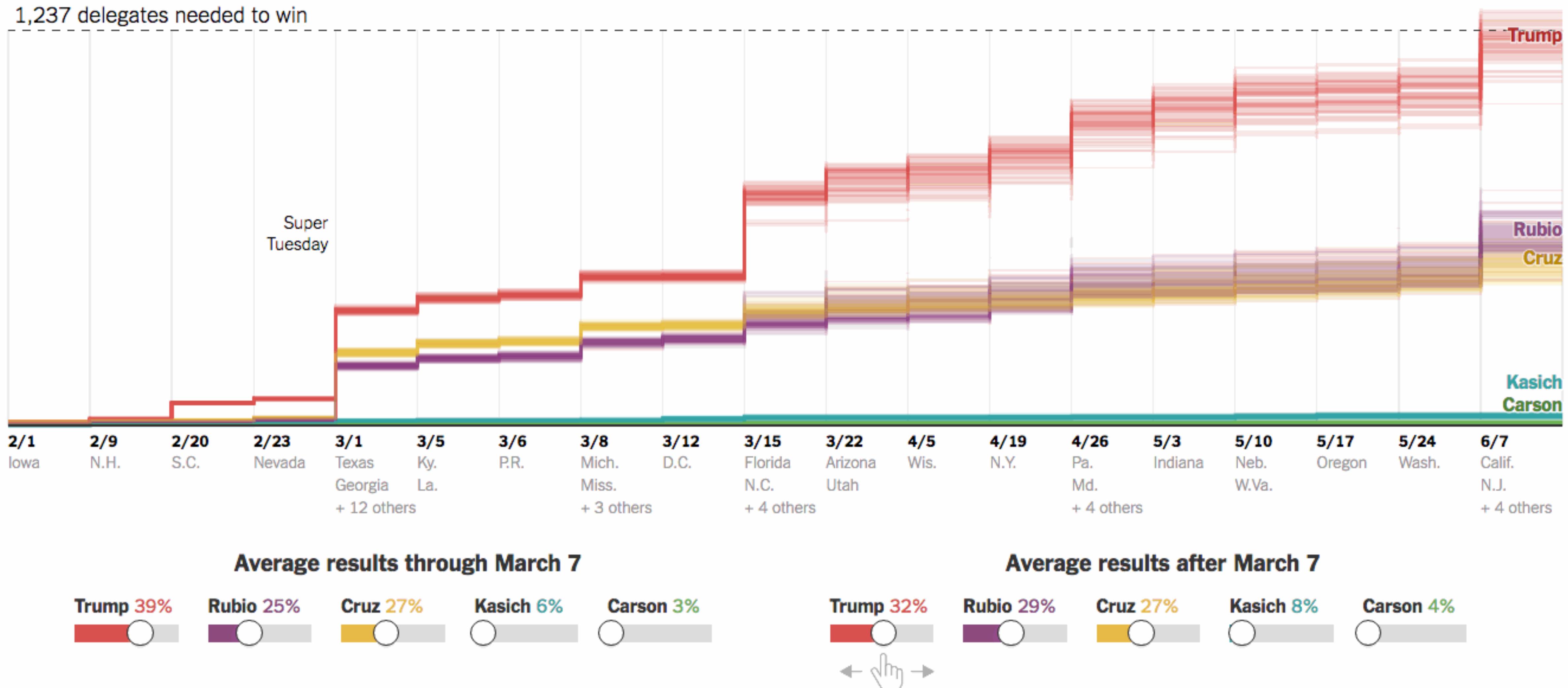
### Add a narrative and signposts

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!

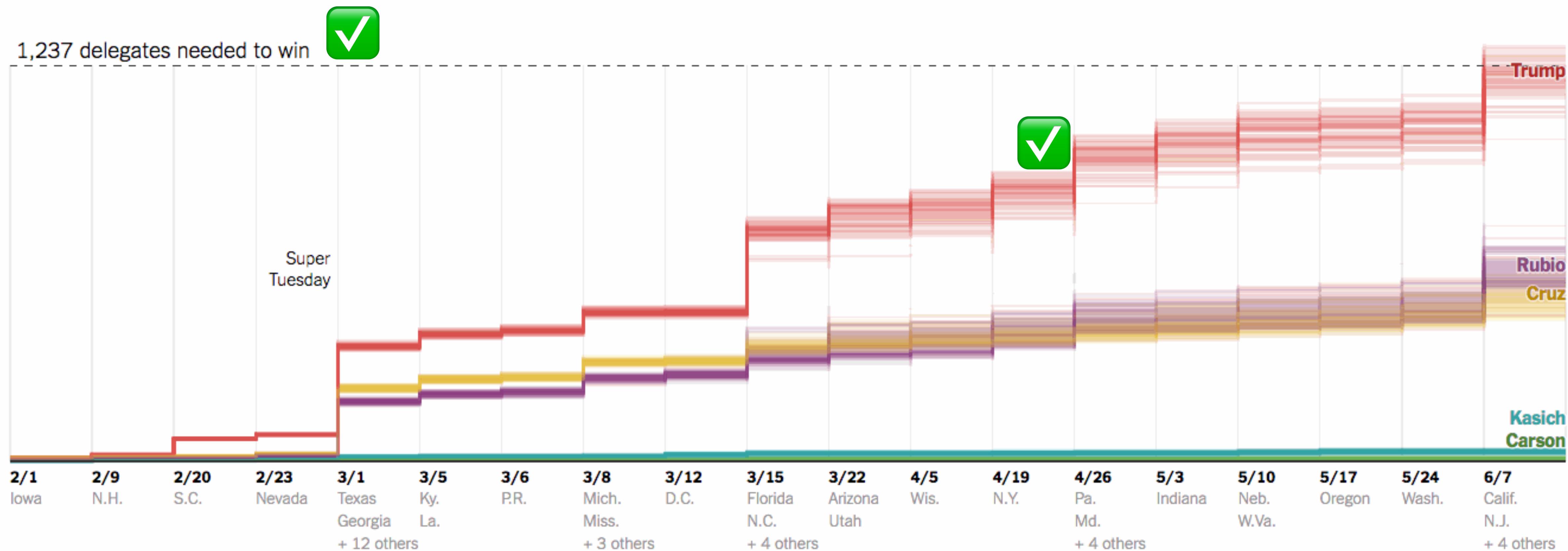
Styling, branding, colour schemes (including colour-blind friendly), typography, layout, user interface (UI) and experience (UX) matter! Think hard about them and make good choices. Find the right balance between aesthetics and functionality.

# Purpose of Interactivity & Dashboards

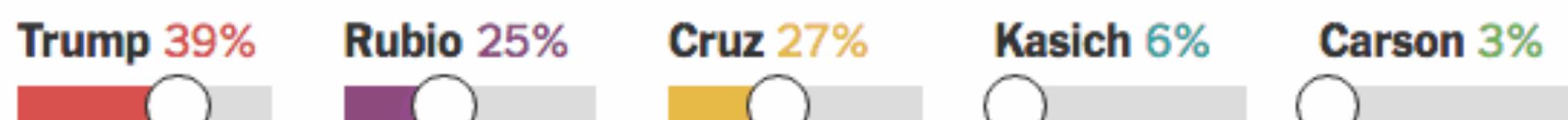


Source: [Delegate Calculator](#) and [Blog post](#)

# Purpose of Interactivity & Dashboards



Average results through March 7



Average results after March 7



Source: [Delegate Calculator](#) and [Blog post](#)

Republican nomination. Here are some presets to get you started:

Rubio with small margins

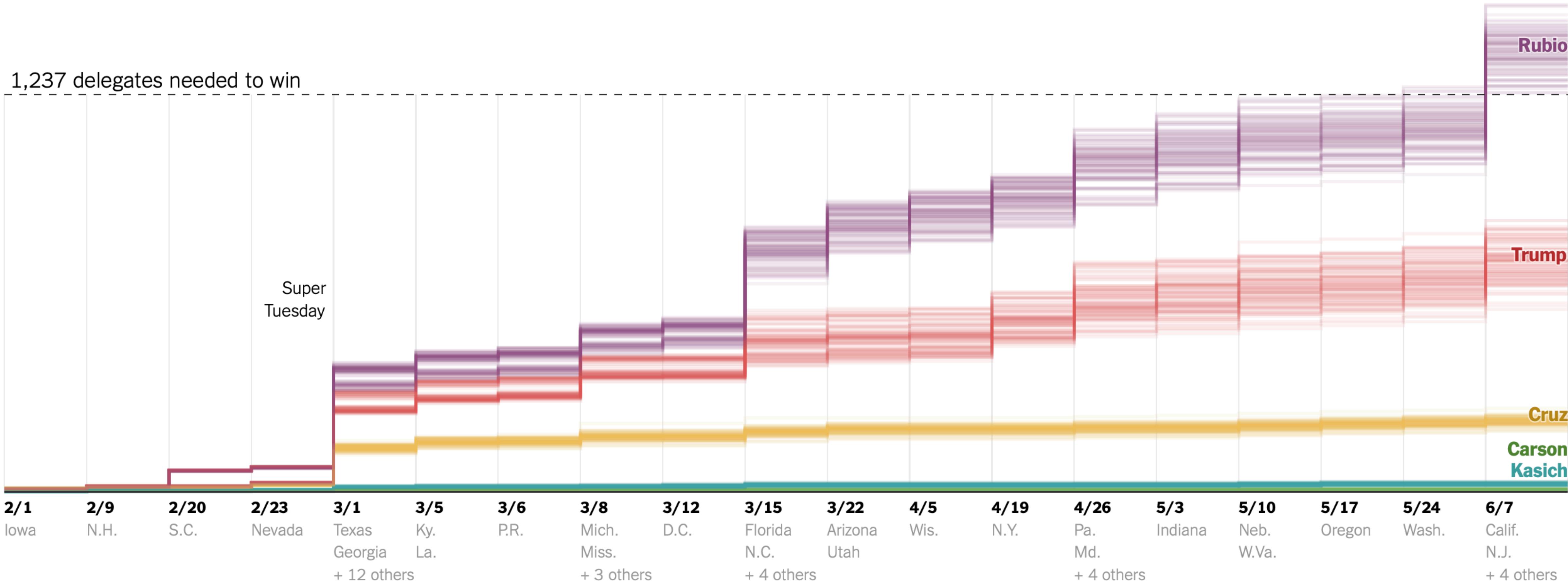
Rubio and Trump head-to-head

Trump wins with huge margins

Cruz makes a comeback

Three-way tie

Trump hits a ceiling



Average results through February 28

Trump 31%

Rubio 34%

Cruz 26%

Kasich 6%

Carson 3%

Average results after February 28

Trump 33%

Rubio 40%

Cruz 18%

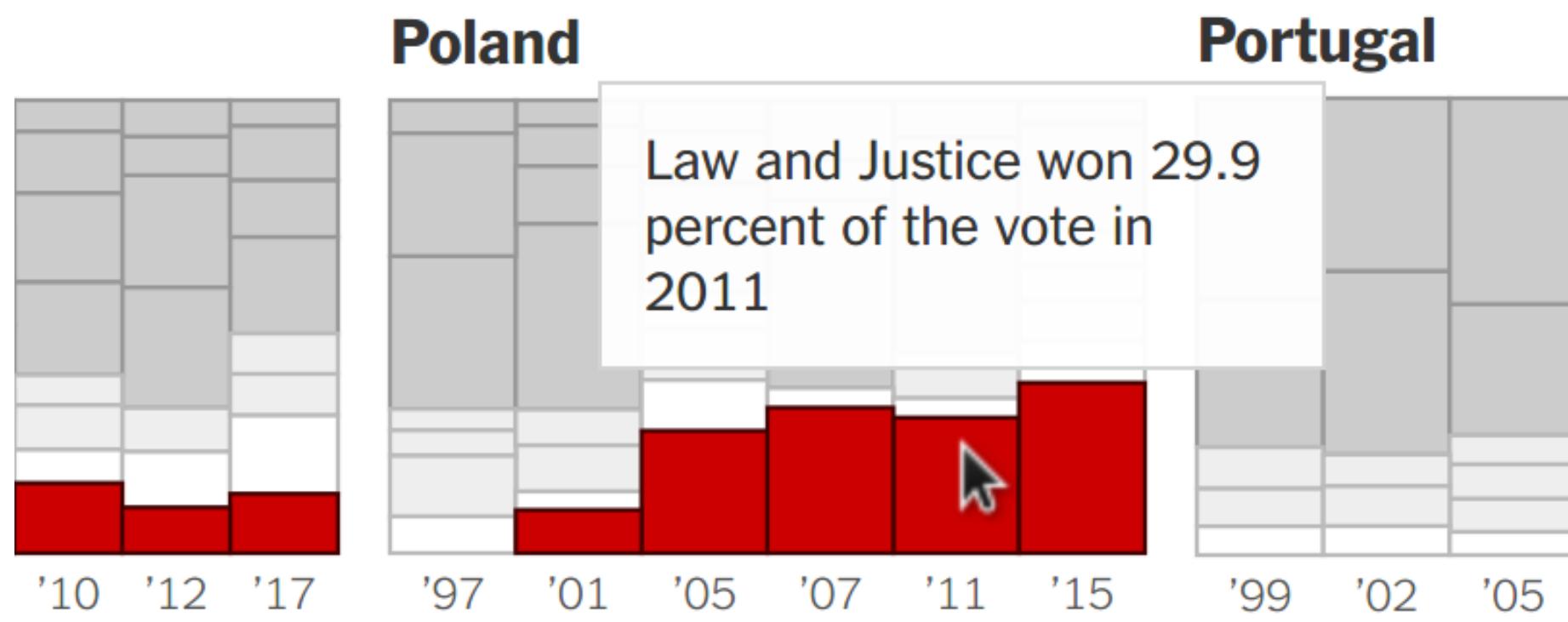
Kasich 6%

Carson 3%

# Purpose of Interactivity & Dashboards

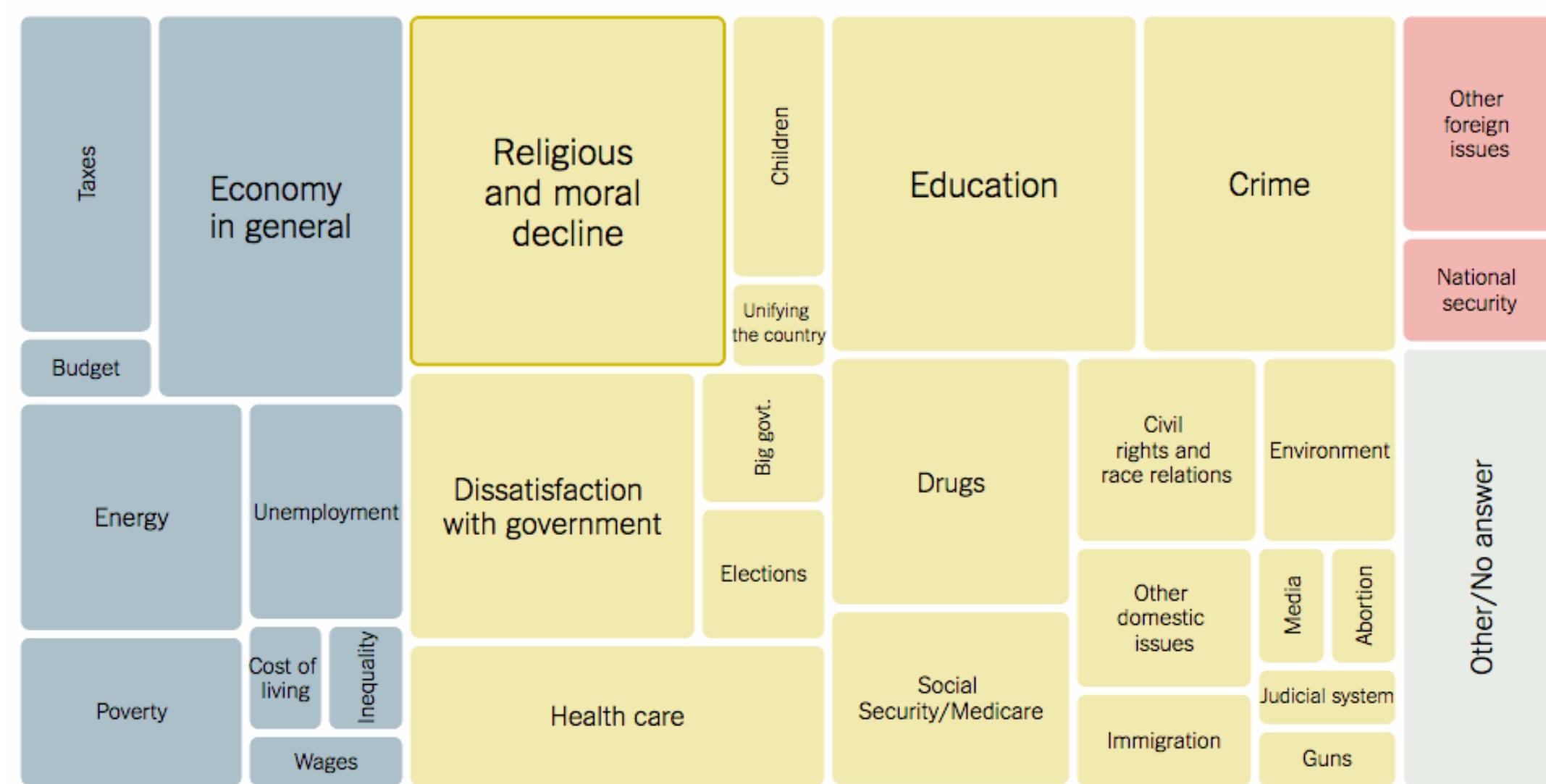
## # 1. Tooltips allow your most interested users to dig deep

Take a look at the following graphic which summarized election results across 20 European countries. Everything you need to see is shown right away. You see the country names, the years and the red bars representing results of right-wing and far-right parties.



## # 2. Interaction allow readers to discover the full dataset

There are cases when you have far more data than fit on a page, which means you have to select which charts to show and which to hide. To avoid cherry-picking we usually try to come up with a selection rule that we apply consistently throughout the piece. For instance, in a recent graphic we decided to show the first poll after the start of the term for each president. Deciding on such a rule is definitely better than just picking charts, but it can still feel arbitrary sometimes. Fortunately we had already set up the graphic in a way that the charts are rendered dynamically. So it didn't cost us much to add in a little bonus feature that allows browsing through the entire dataset.



# Principles of Effective Dashboards

## Principle

## Explanation

**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

**DATA 301**

**Teaching Evaluation**

**(On Canvas)**

**20 minutes**

# **Part 2: Speeding up Dashboards**

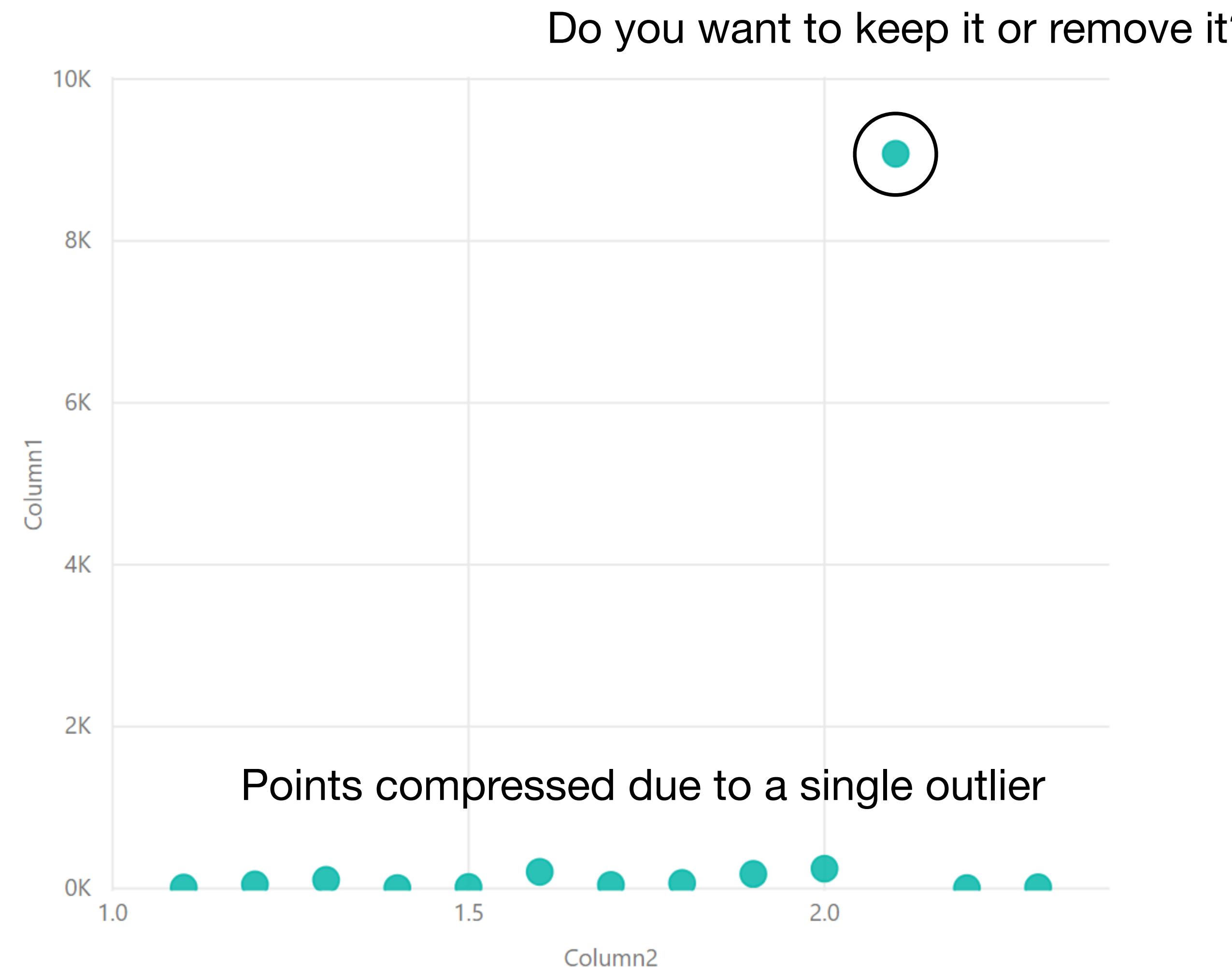
# Many ways to speed up dashboards, here are three:

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

# 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?

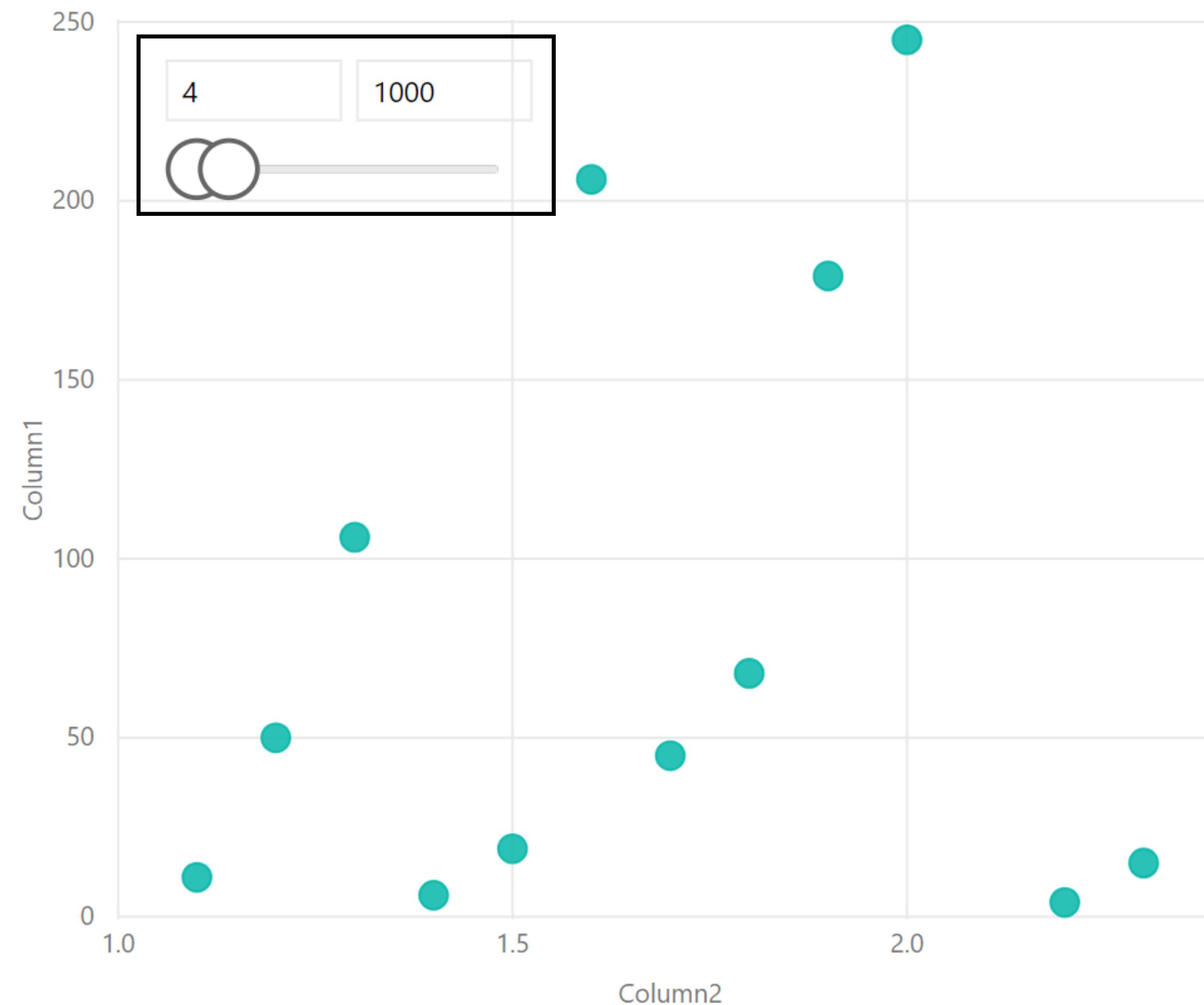
# Dealing with outliers



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

# Dealing with outliers

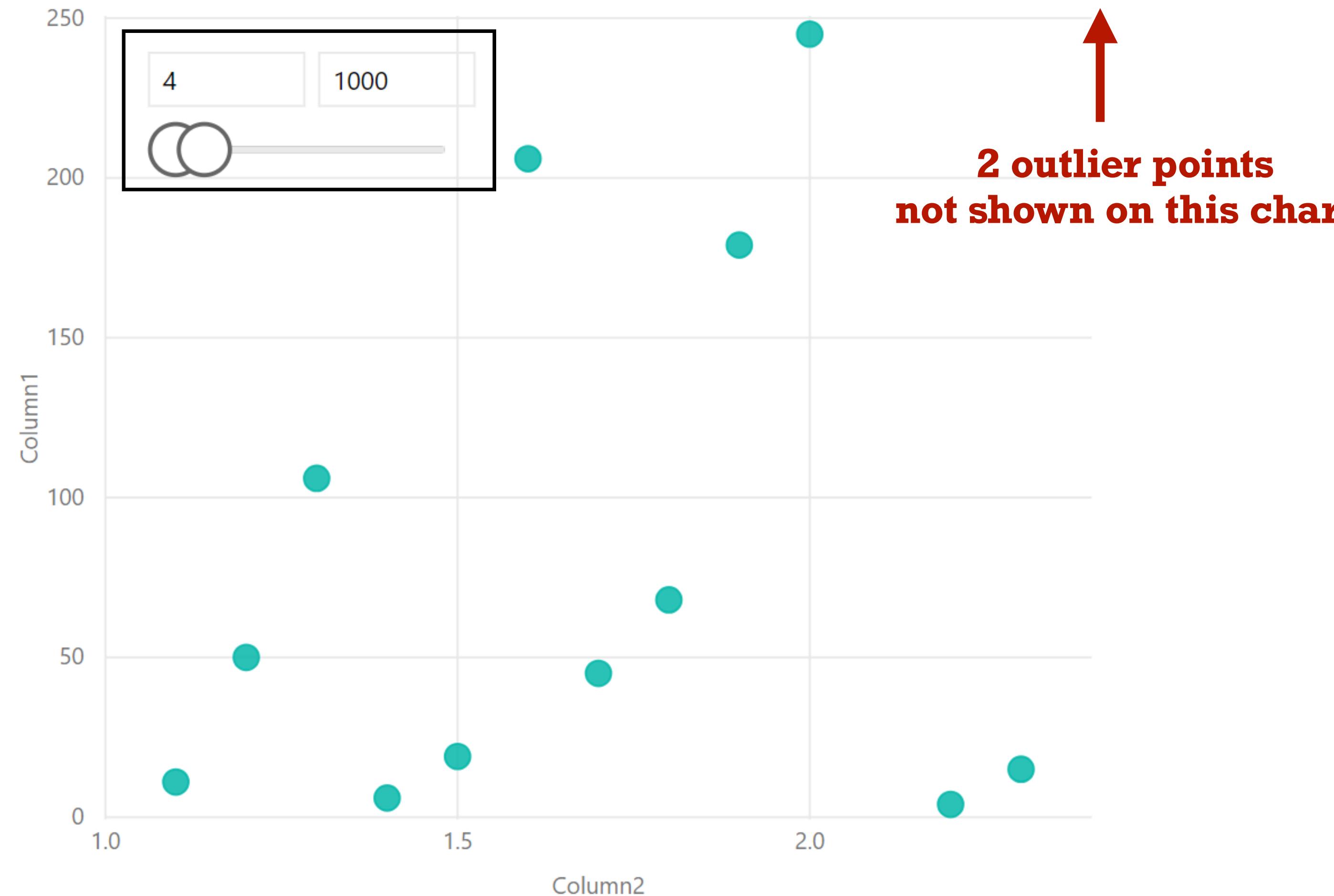
interactive filtering is another solution - appropriate when want to remove outliers



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

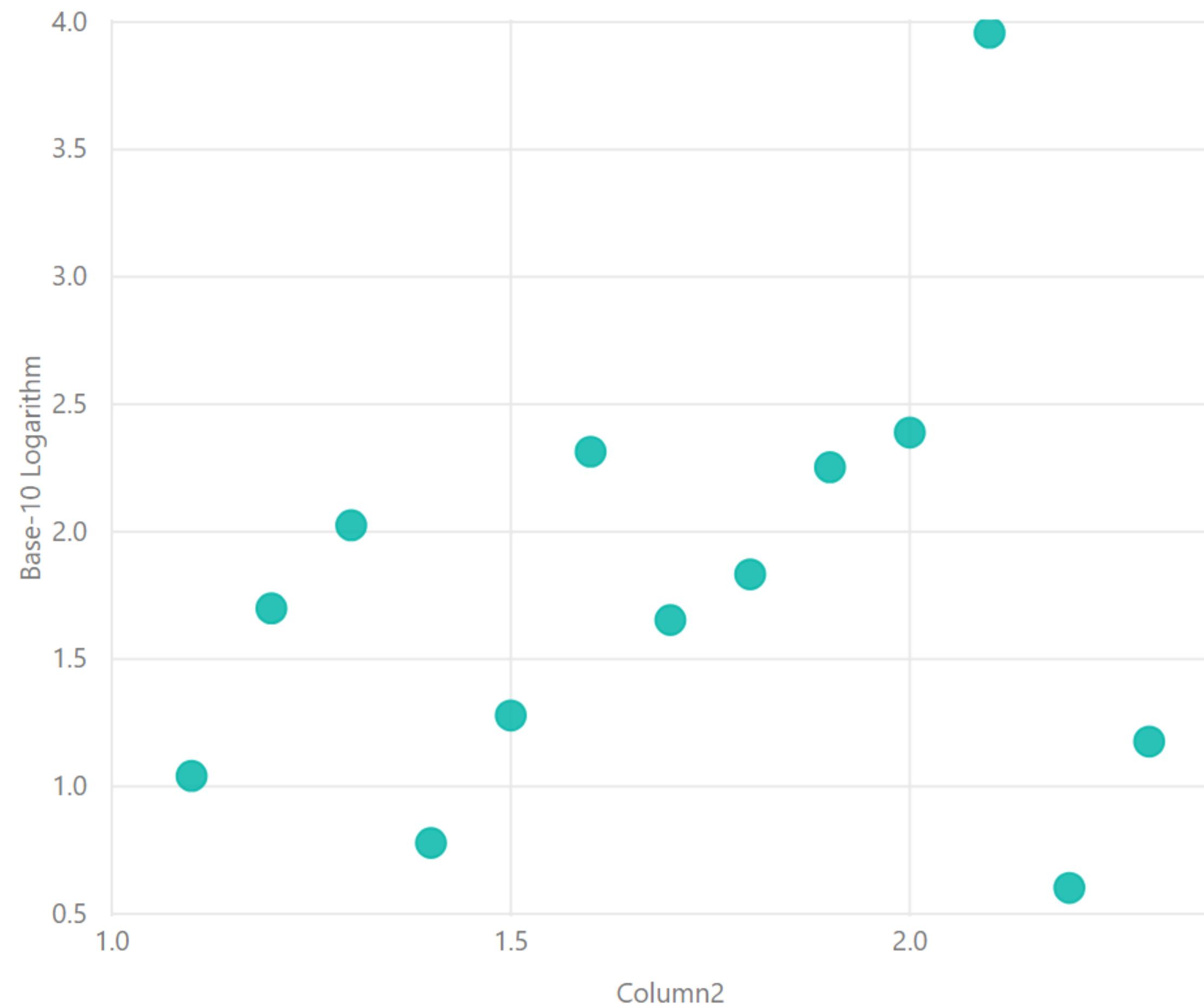
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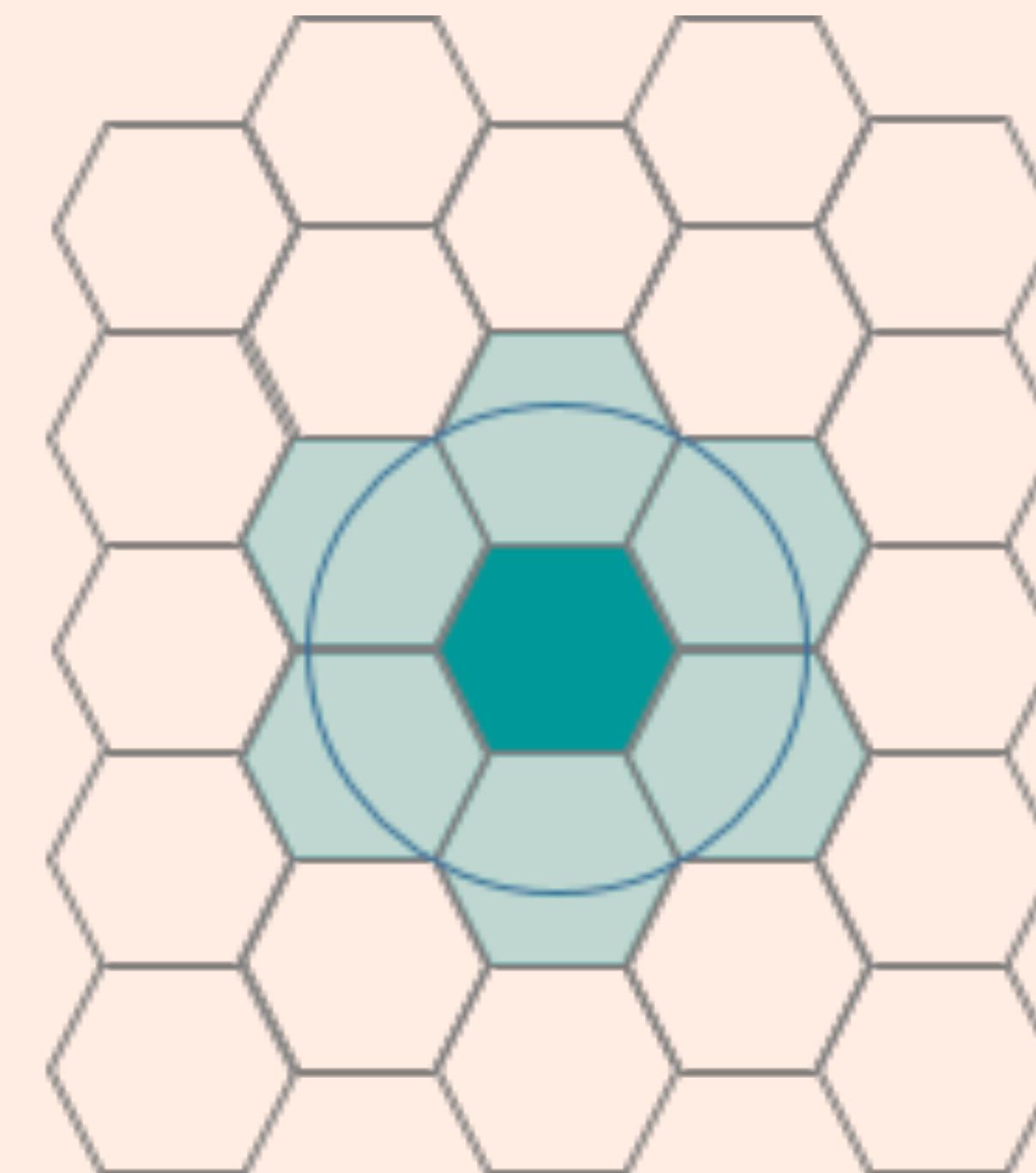
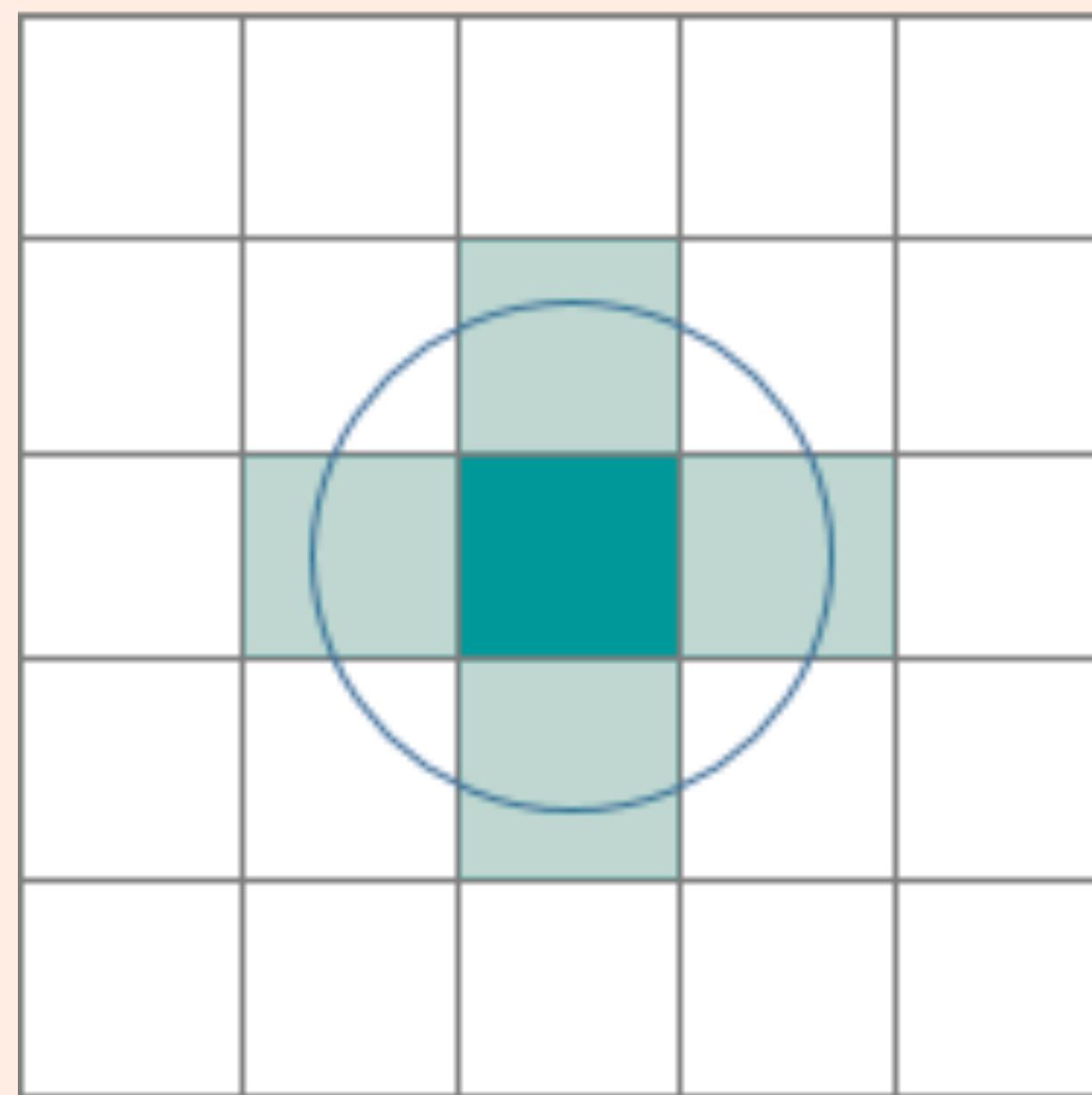


# Dealing with outliers

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



# Why Hexagons?



## Hexagons:

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

# 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

- 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!

# **Q&A**

# **Additional Reading**

# Resources

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

# Resources

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



**Paul Cothenet** @paulcothenet · May 30

Thanks for resharing. In 5 years I sadly don't think any of the above has gotten out of fashion :D

# **Part 3:**

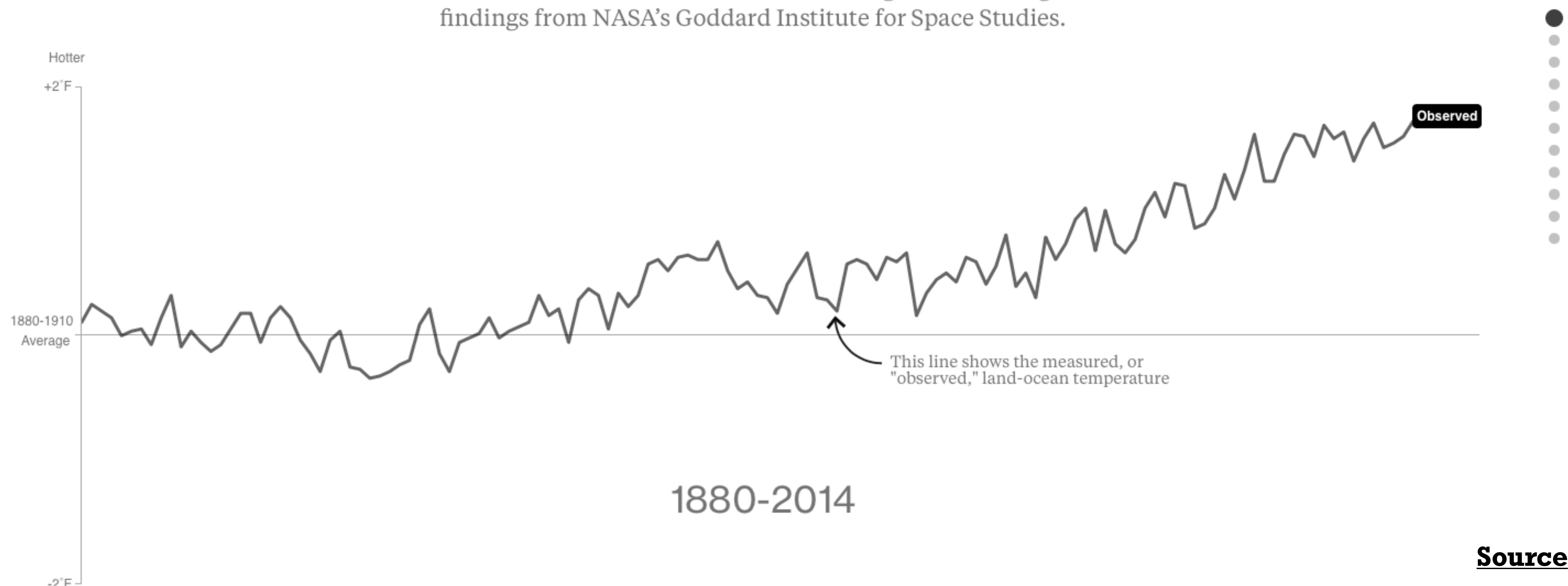
# **Dashboards case study**

## **(Optional)**

# 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.

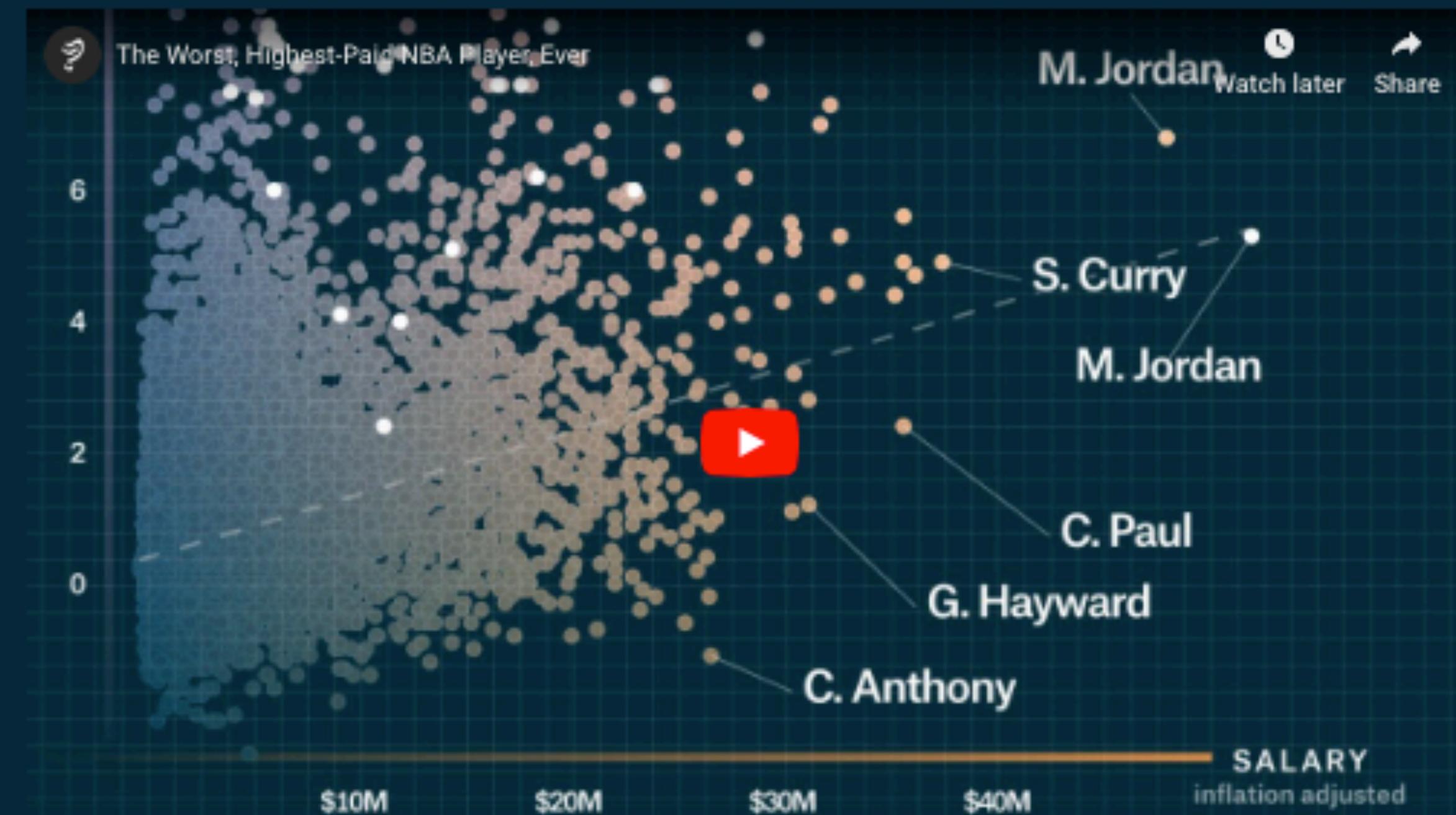


# Finding the Worst, Highest-Paid NBA Player, Ever

Using advanced NBA stats to rank player performance against pay.

by [Matt Daniels](#)

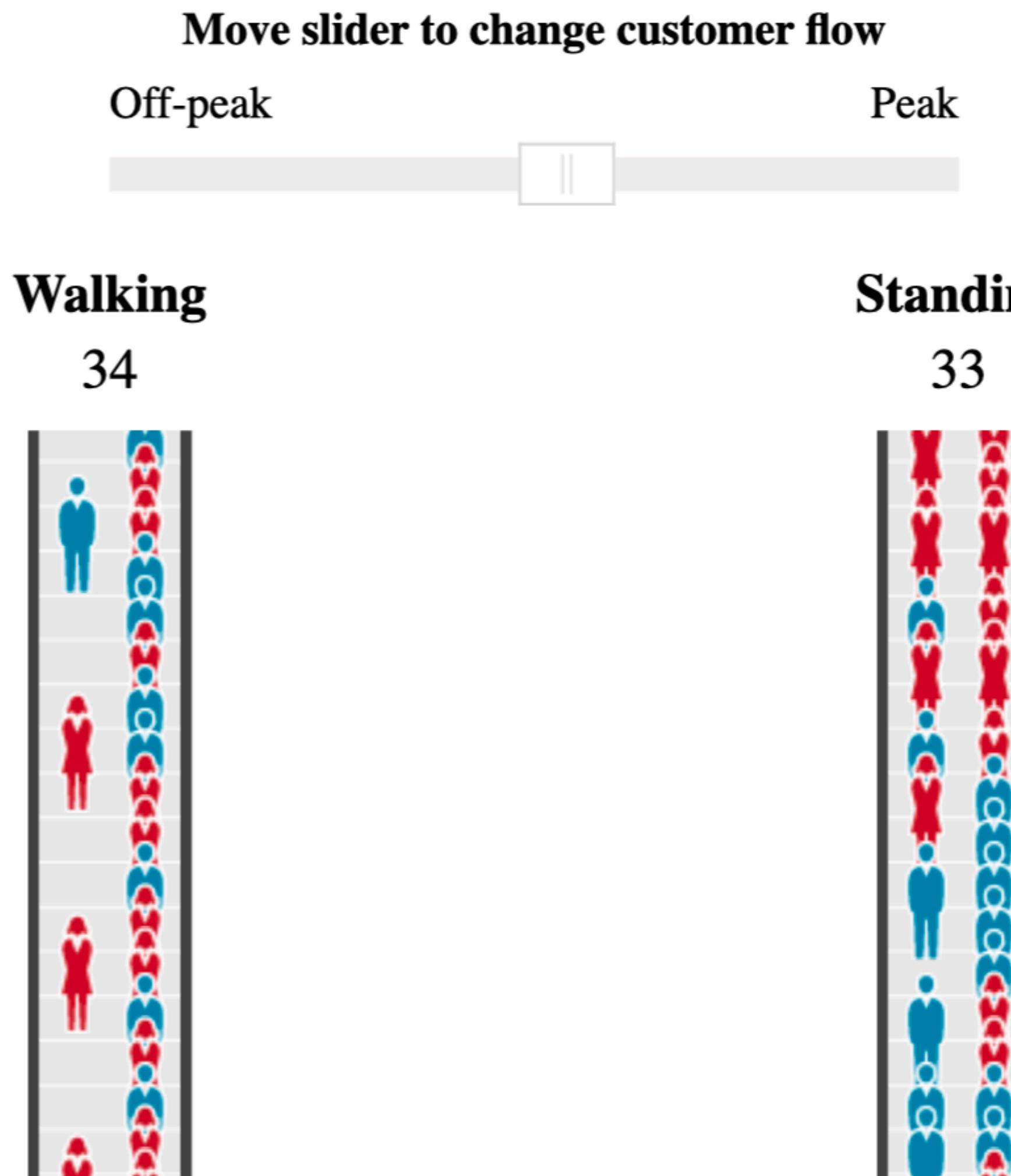
[Watch the Video](#)



[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.

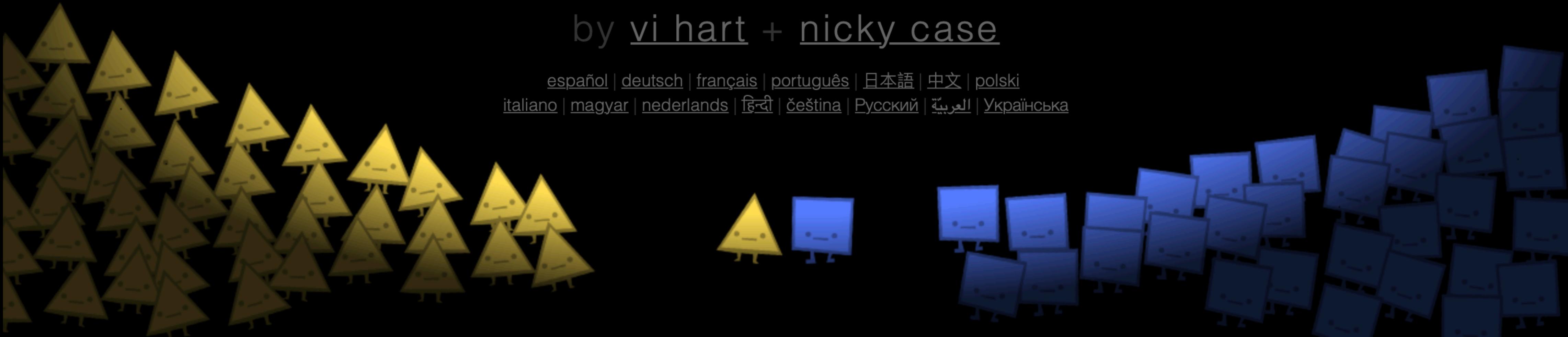
**Source**

# PARABLE OF THE POLYGONS

A PLAYABLE POST ON THE SHAPE OF SOCIETY

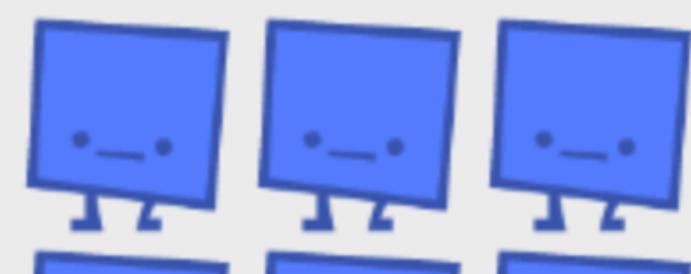
by [vi hart + nicky case](#)

[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**

It's a bad match  
because ...



**DUP** 9

Reset



**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 ★

Twitter maartenzam

[Source](#)