

Designing understandable data visualizations

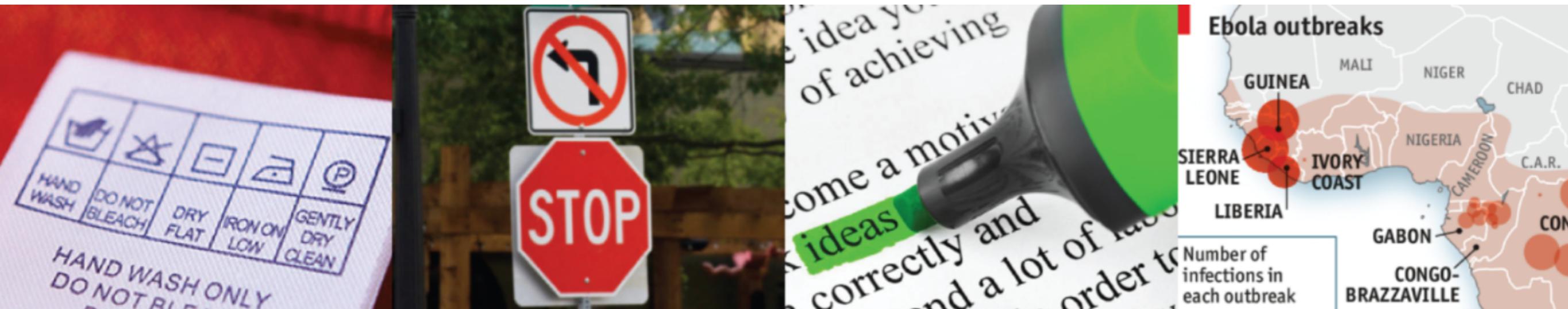
Ana Risteska

trivago, #tech-get-together 2019

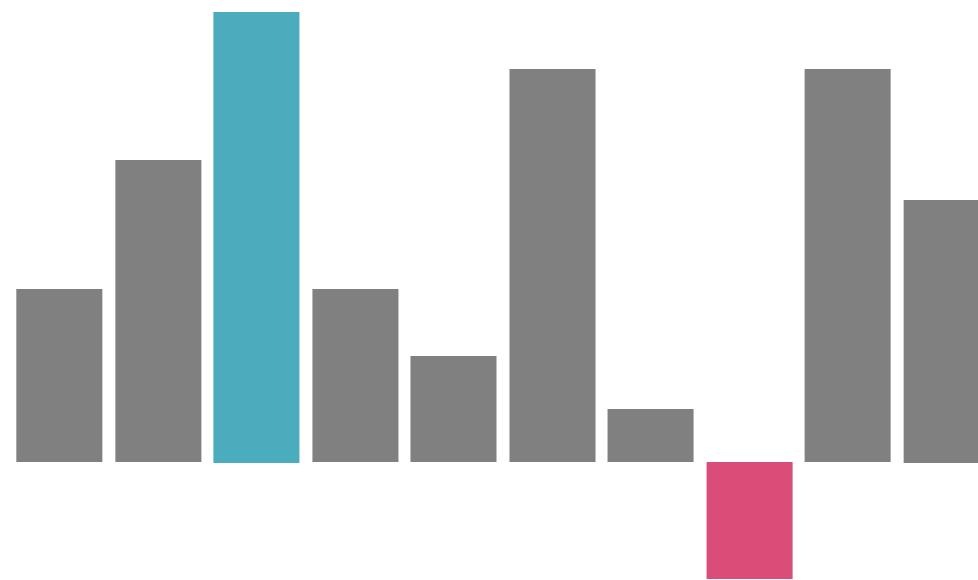
Goal of this presentation

Why is this important?

Visualization is everywhere



Graphics reveal data, help encode
ideas and make differences stand out



How are we able to interpret
data visualizations
so effectively?

Human perception:

Thinking, Fast and Slow - Daniel Kahneman

Human perception:

Interpreting through System 1 & System 2



Human perception:

Interpreting through **System 1 & System 2**

sub-conscious, uncontrolled, effortless, always on



Human perception:

Interpreting through **System 1** & **System 2**

sub-conscious, uncontrolled, effortless, always on

conscious, involves deliberate concentration, requires effort



Human perception:

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Goal:

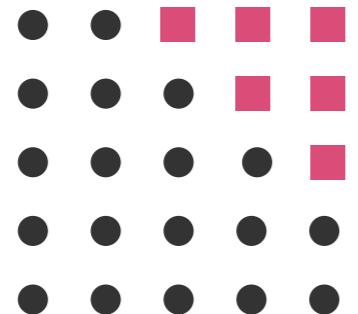
To seek ways to approach System 1, so that we can mobilize System 2 for future processing



Why visualization?

70

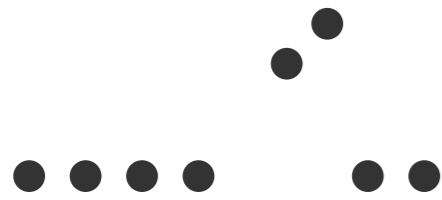
% of the body's sense receptors relate to sight



the human brain is a great pattern seeker

Pre-attentive visual attributes

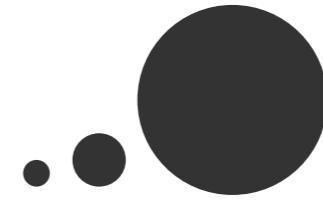
Position



Length



Size



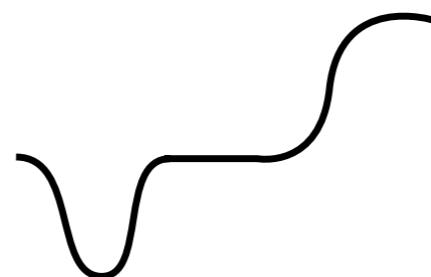
Width



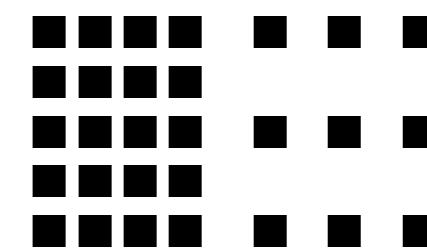
Luminosity



Curvature

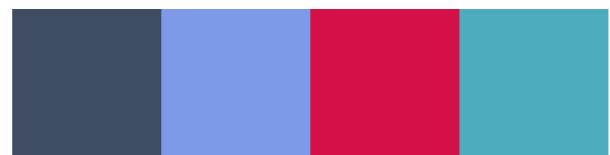


Pattern density

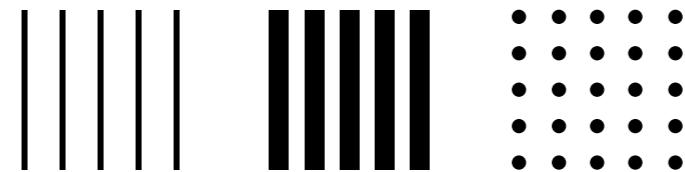


Visual attributes that require attention

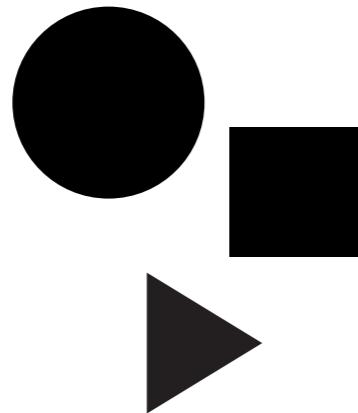
Color hue



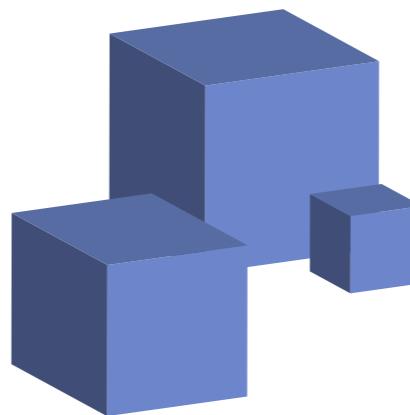
Pattern type



Shape



Volume



Data are values and relationships.
How to capture that?

Know our data and the story we want to tell



Three questions for creating a chart - Lisa Charlotte Rost <https://blog.datawrapper.de/better-charts/>

Know our data and the story we want to tell

My intent is to show:

change over time

distributuion

prediction

ranking

call to action

part to whole

....



Know our data and the story we want to tell



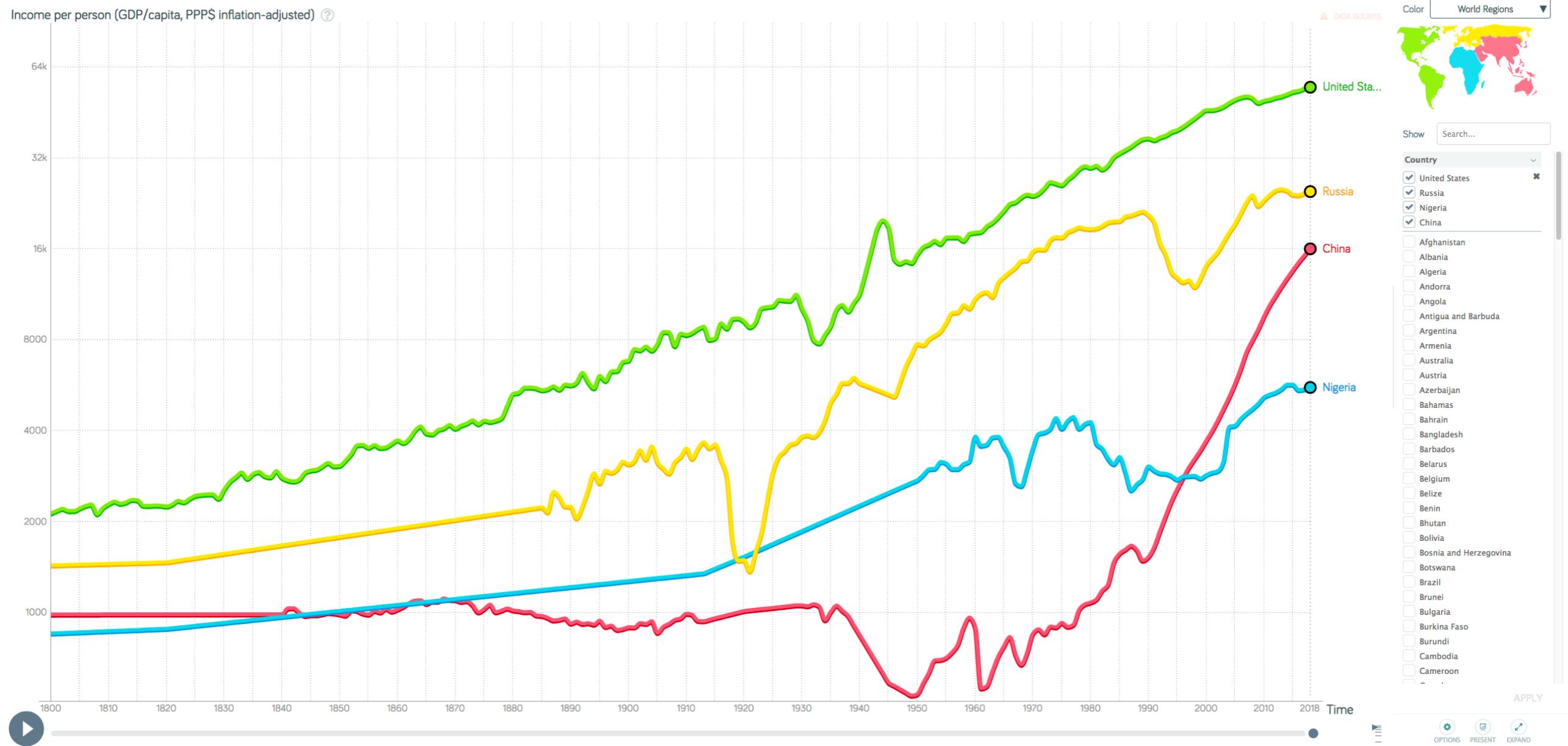
Use the strengths of the visual attributes



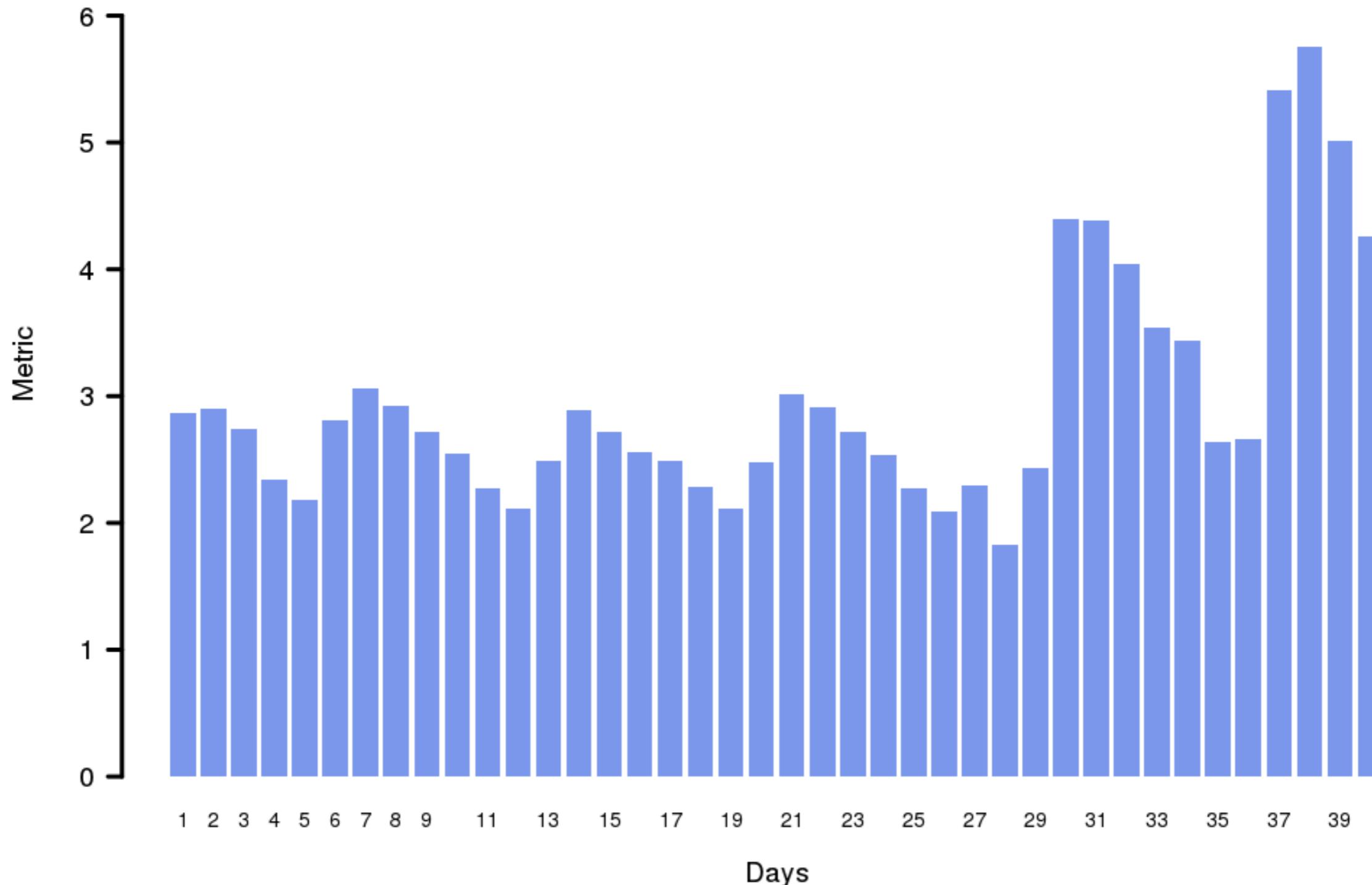
Position

System 1

Position is the most powerful visual encoding



We can detect visual rhythm



Position + Size



FACTS TEACH ABOUT



alpha version

Life expectancy, years

80
70
60
50
40
30
20

1928

Income per person, GDP/capita in \$/year adjusted for inflation & prices

1928

DATA DOUBTS

500 1k 2k 4k 8k 16k 32k 64k 128k



Gapminder <https://www.gapminder.org/>

Color

World Regions



Select

Search...

- Afghanistan
- Albania
- Algeria
- Andorra
- Angola
- Antigua and Barbuda
- Argentina
- Armenia
- Aruba
- Australia
- Austria
- Azerbaijan
- Bahamas

Size

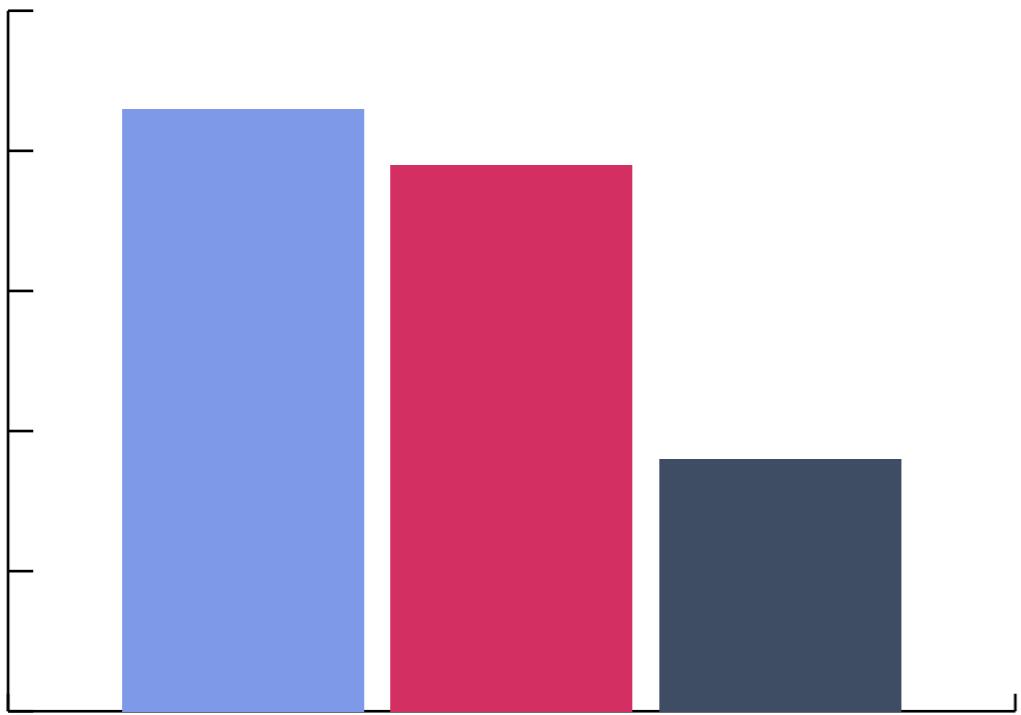
Population

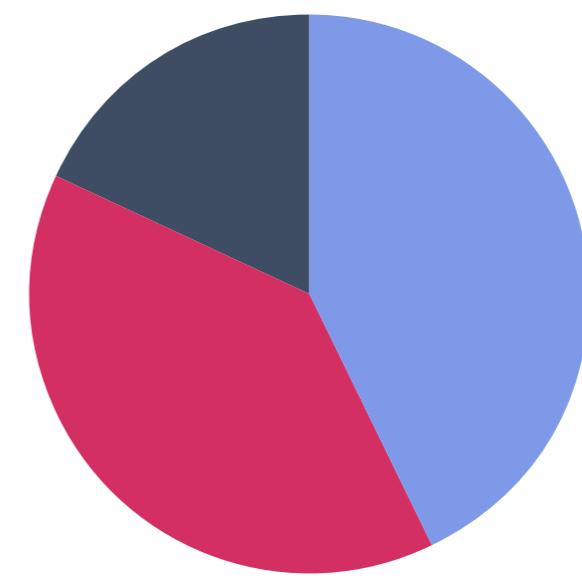
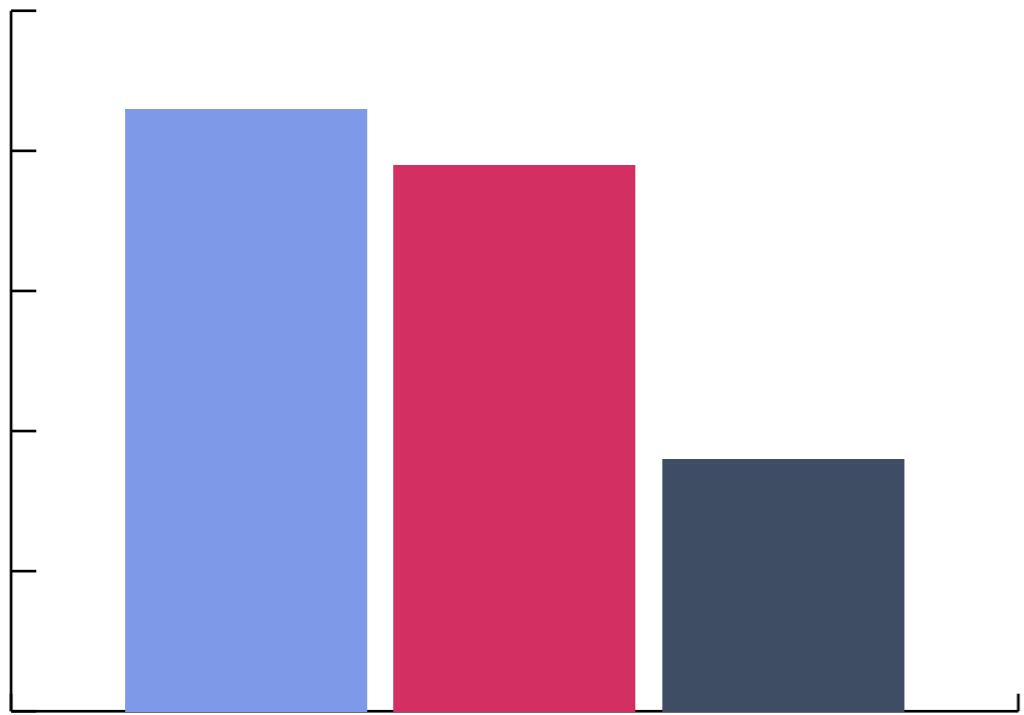
Zoom

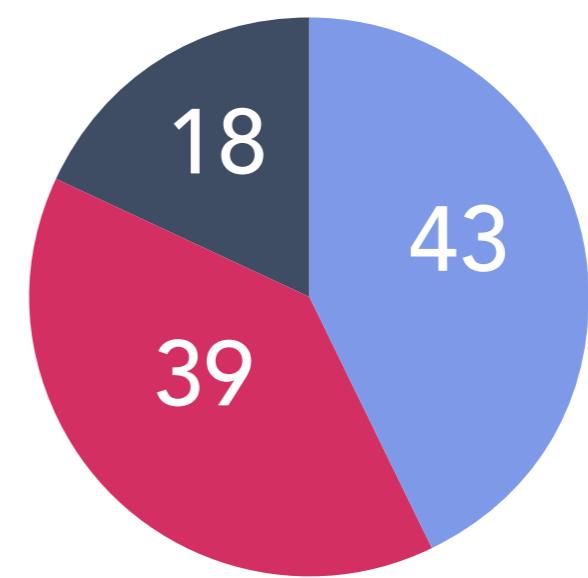
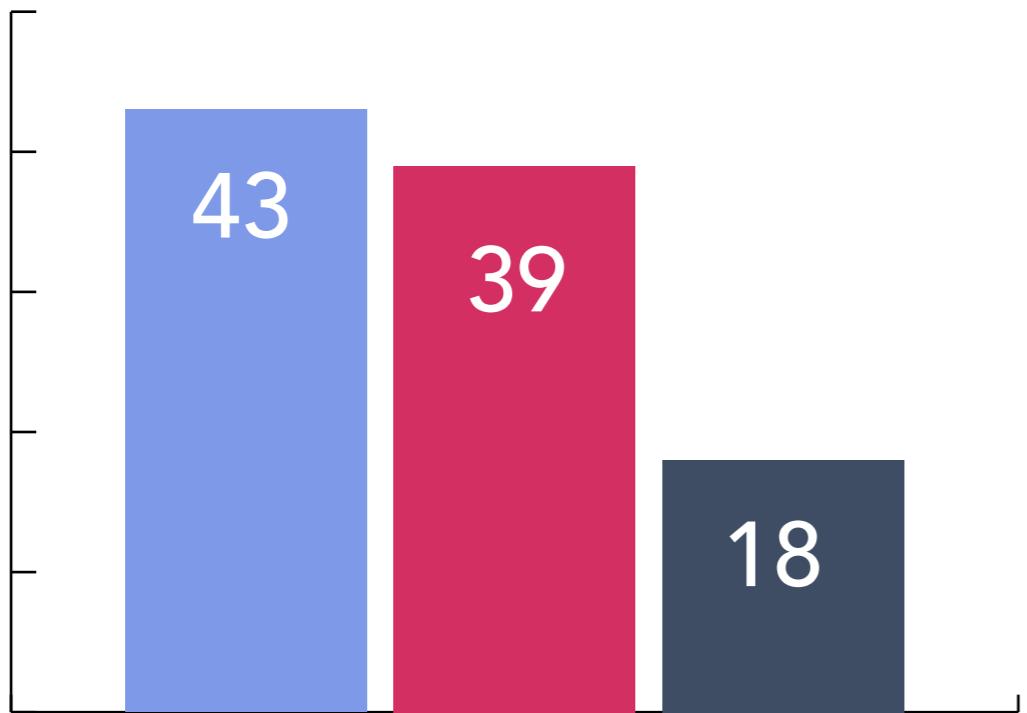


Length

System 1

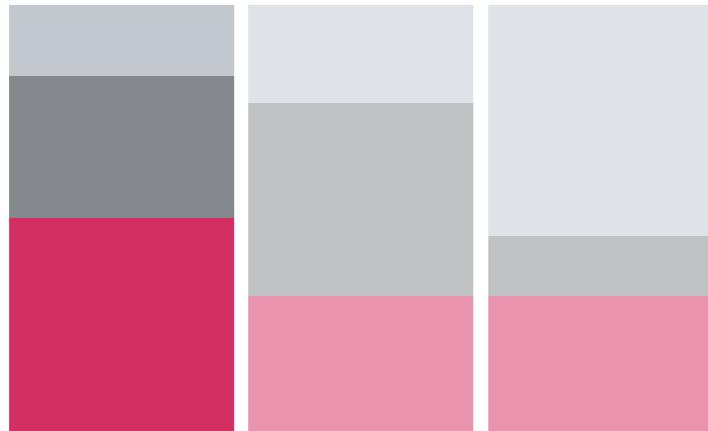






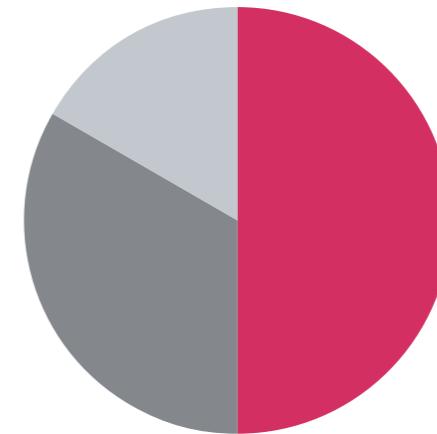
Pie charts. Are they ever okay?

50% is perceived slower,
but flow can be emphasized better



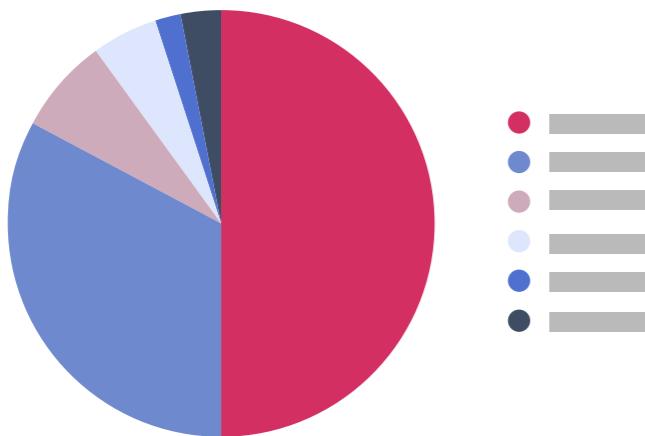
50% on a pie chart is perceived faster

VS



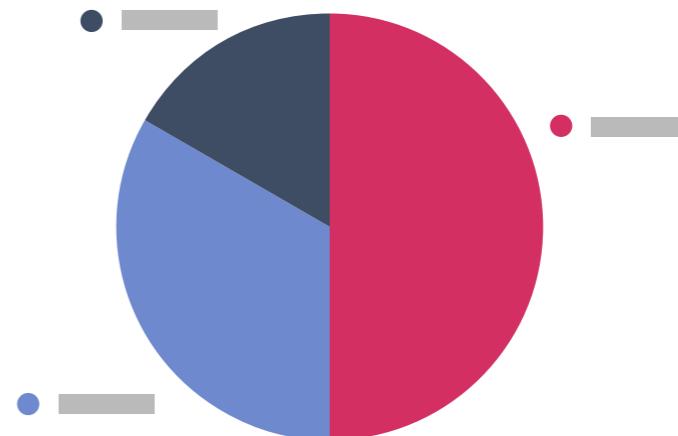
Pie charts with many values

When > 7 values, refactoring needed



VS

Two largest values, and others as one group



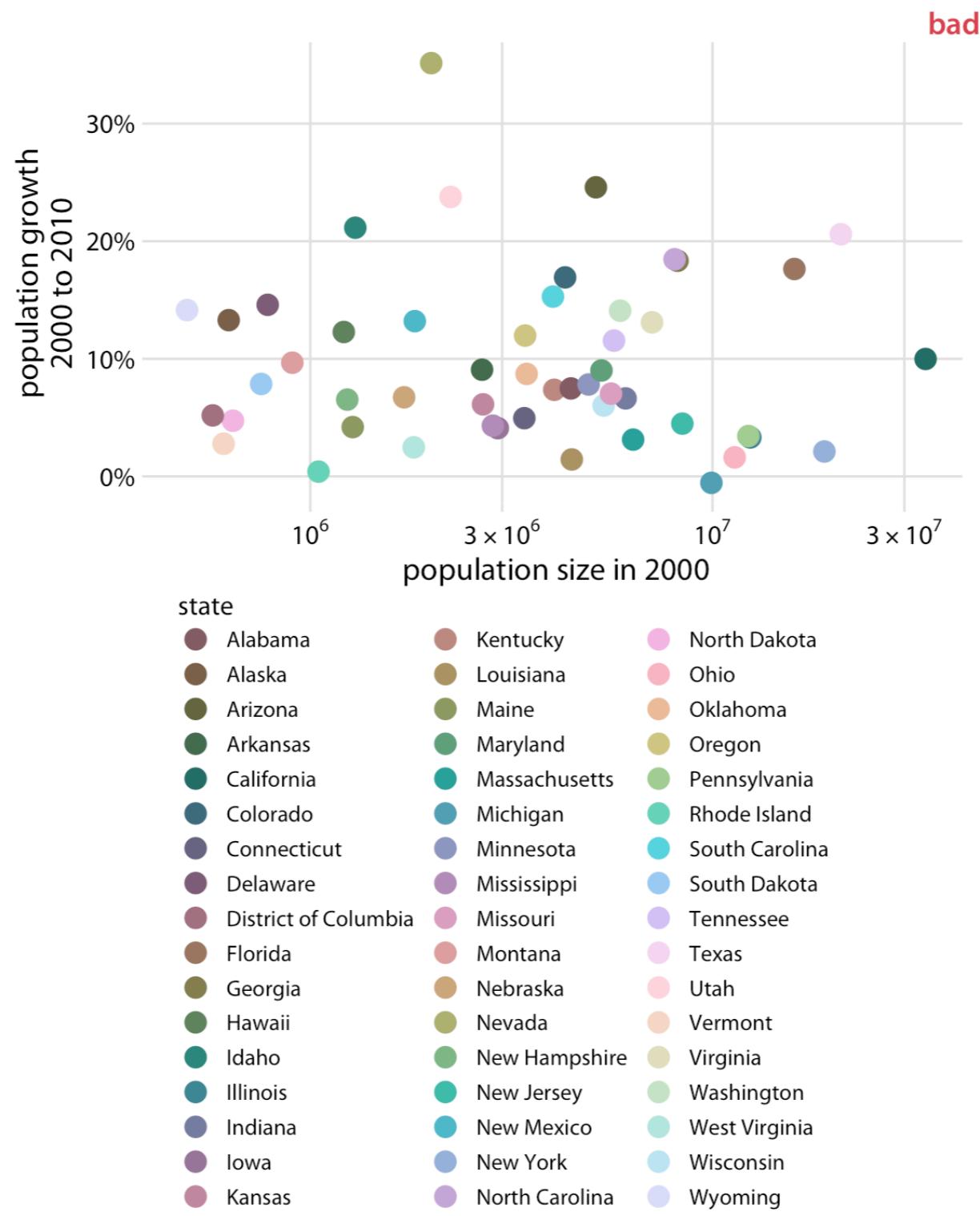
Color

System 2

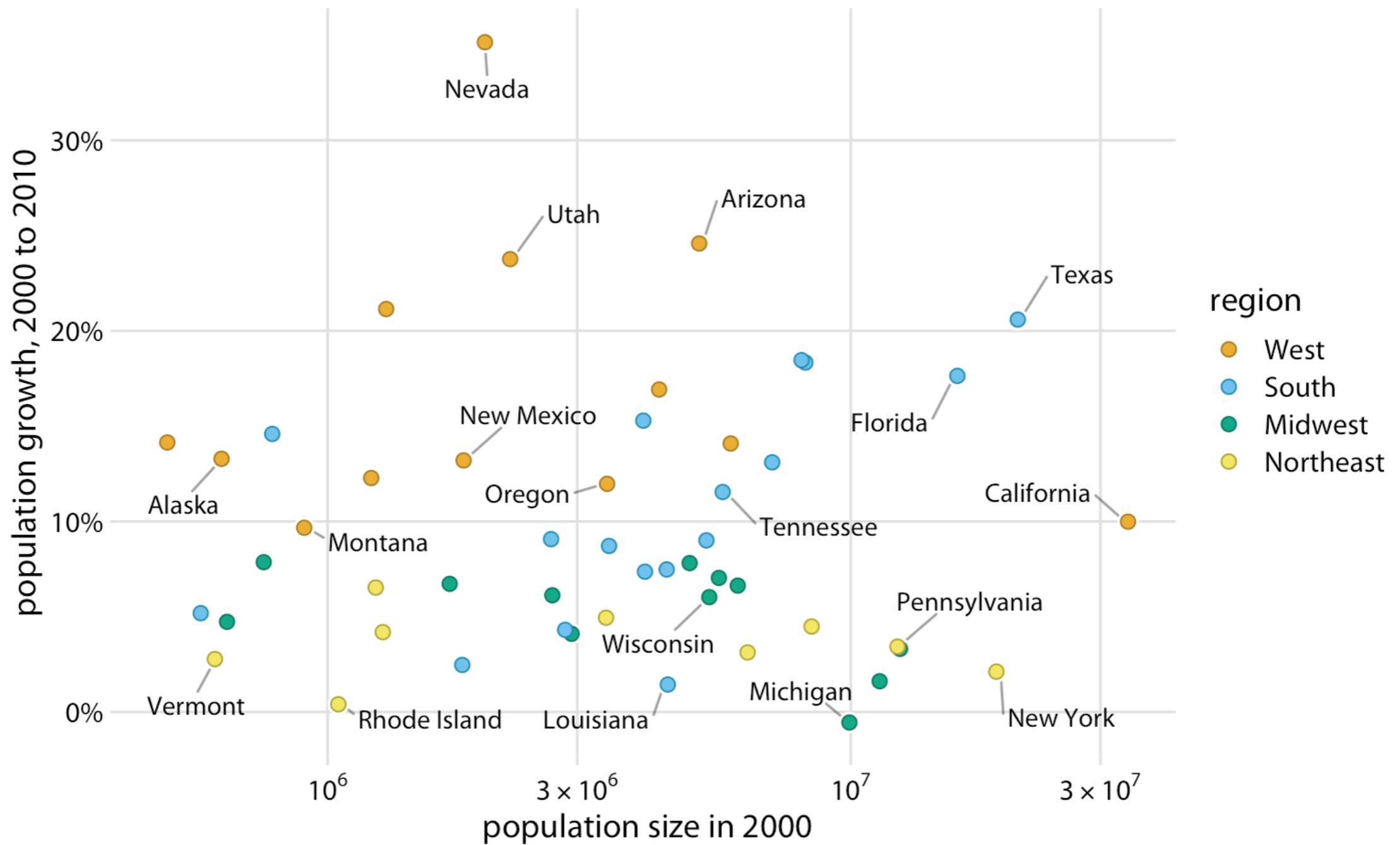
Color is to distinguish categories

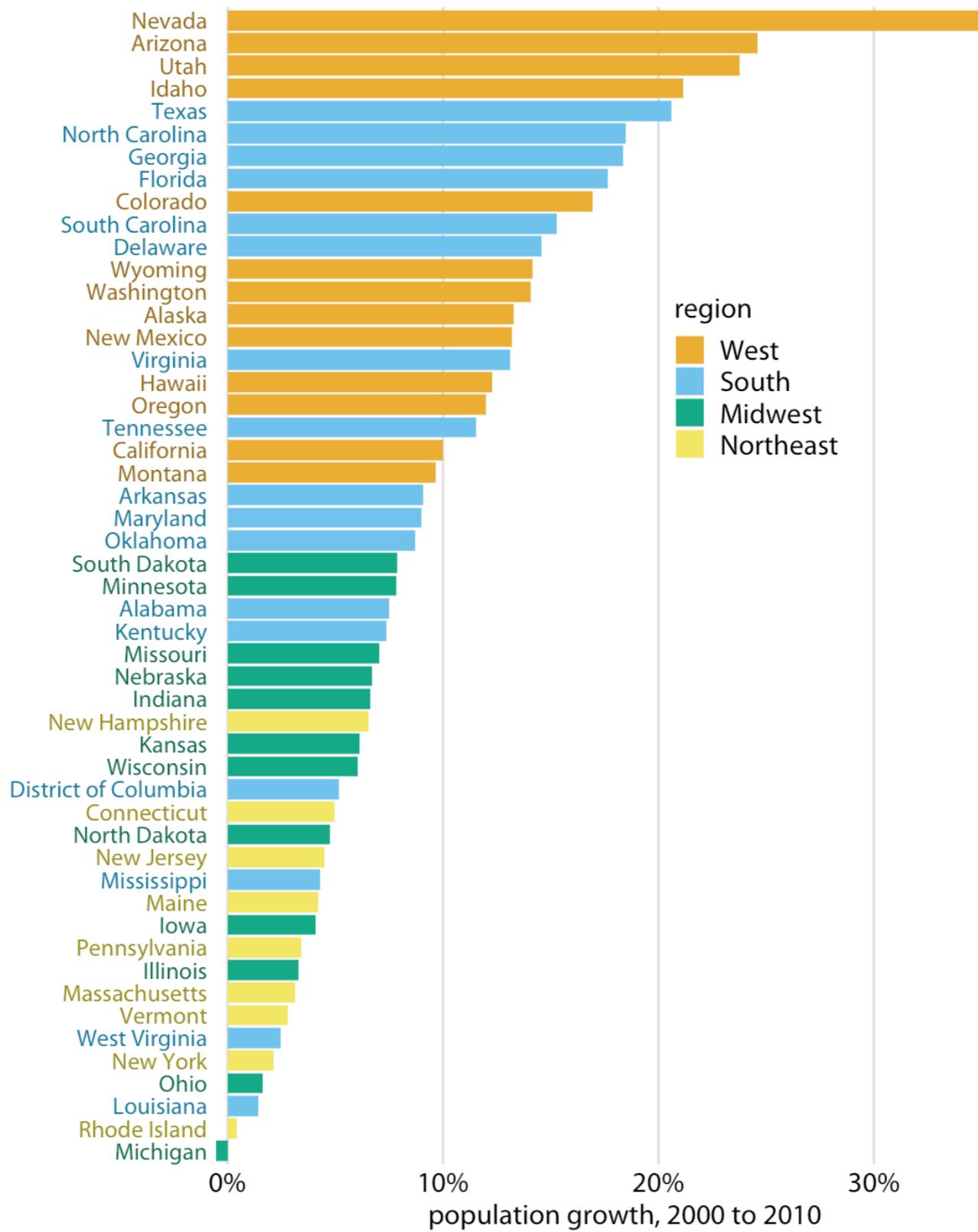


When there are way too many categories...



Introduce grouping





Distinctive categories



Distinctive categories



The highlights among many

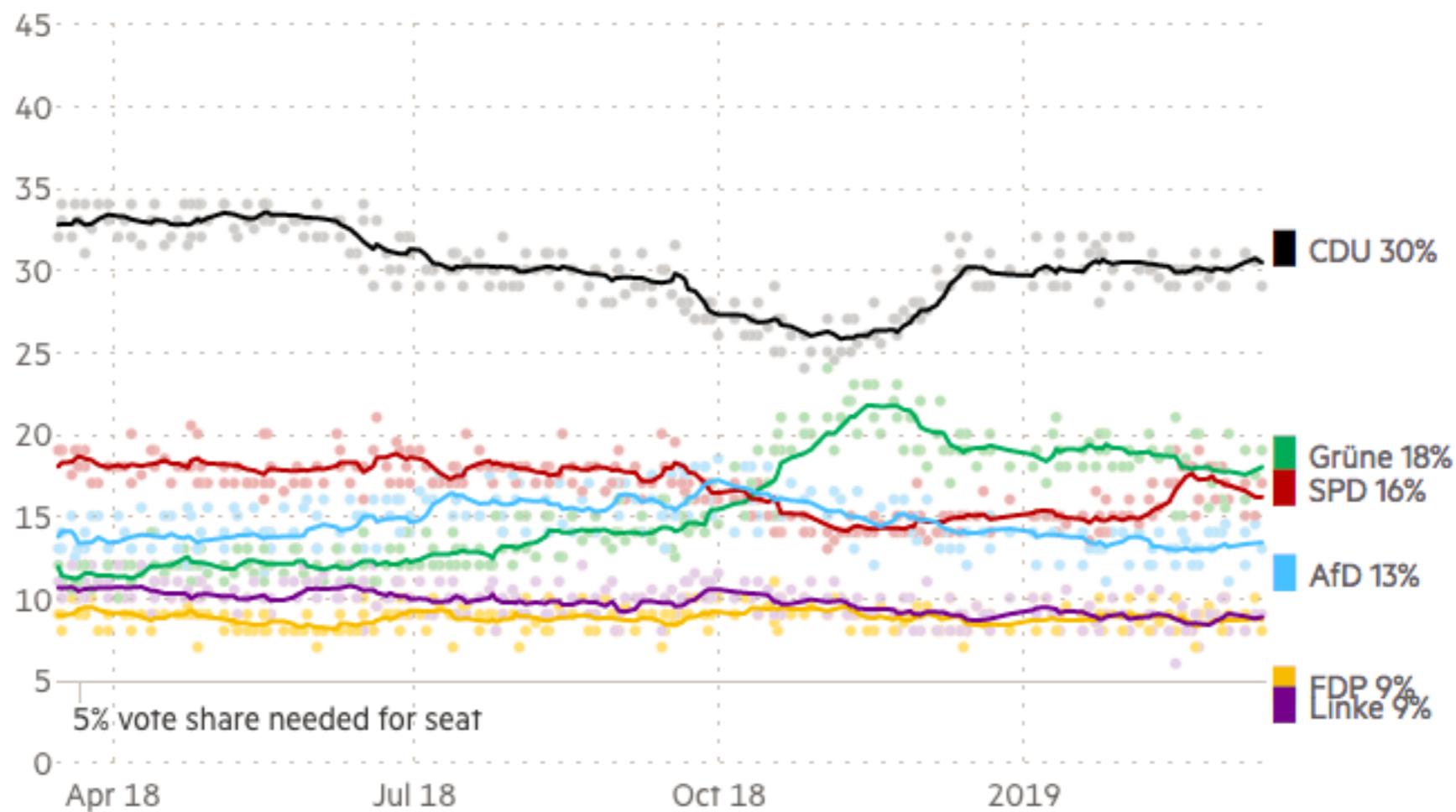


German politics polltracker

Lines represent weighted averages

Points represent polls

Voting intention, share by party (%)



Source: Wahlrecht.de, updated 09:31, Mar 15 2019

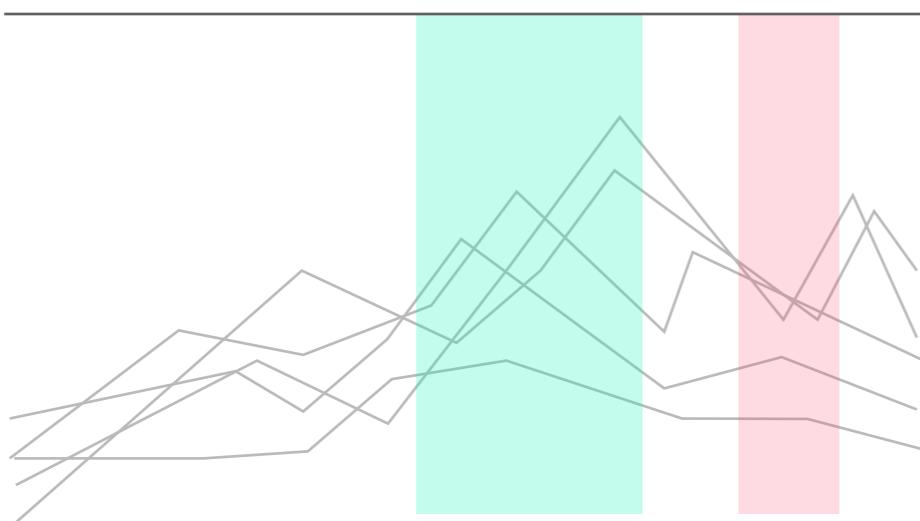
Graphic: Anna Leach, © FT



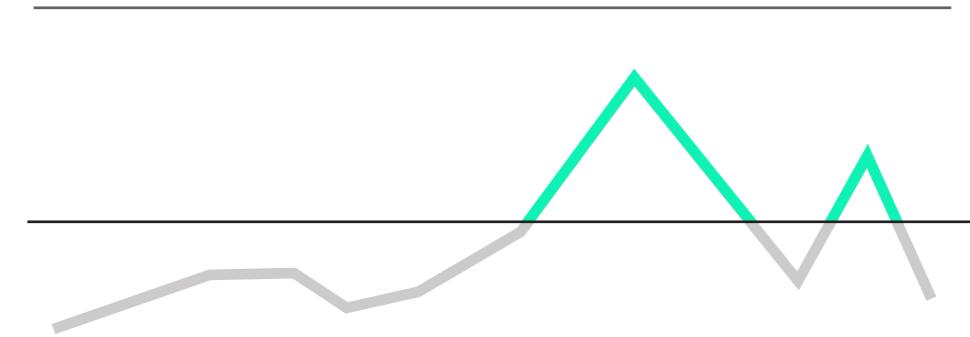
<https://ig.ft.com/germany-poll-tracker/>

Color is to highlight

Emphasis on periods



Emphasis on change of value



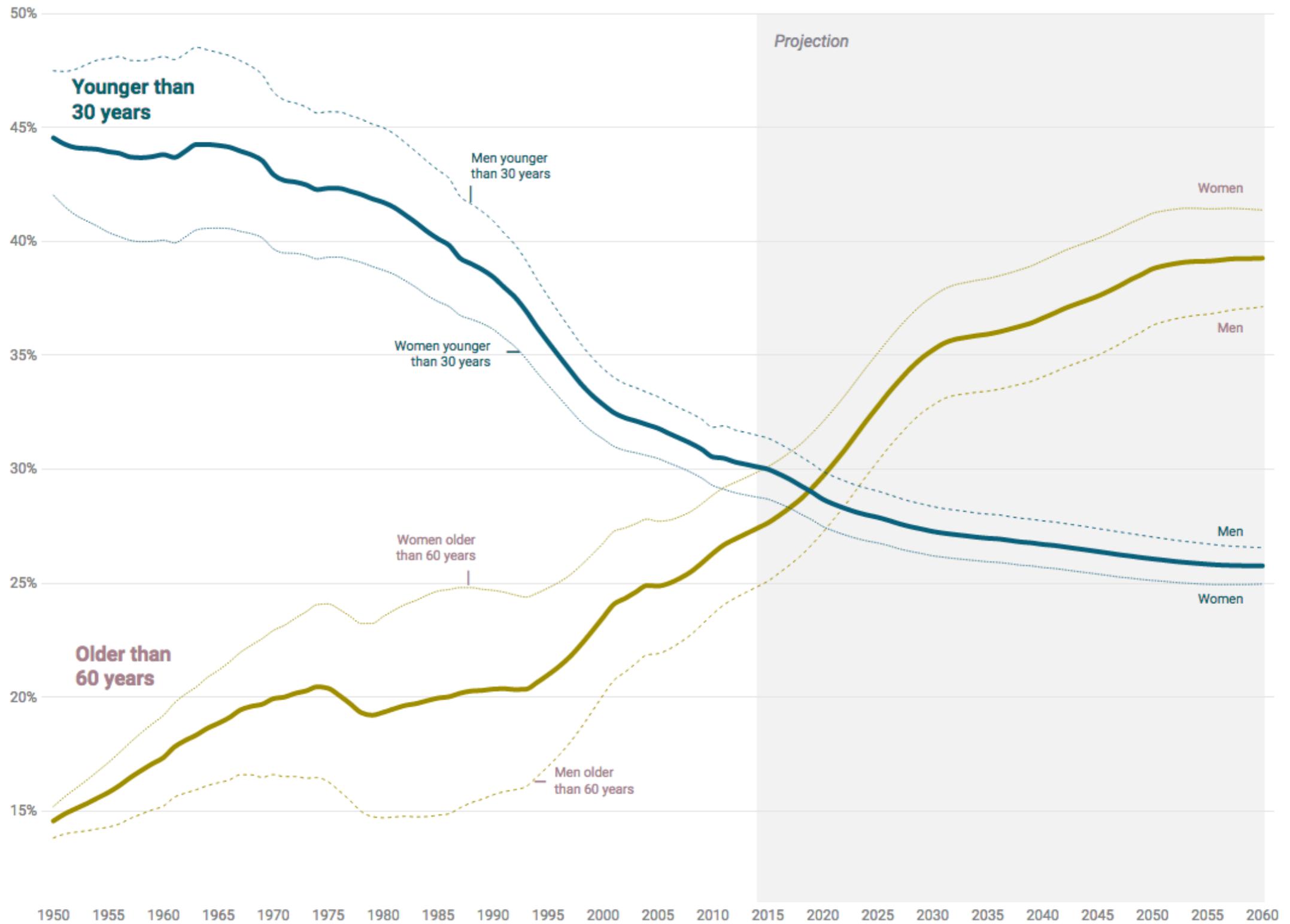
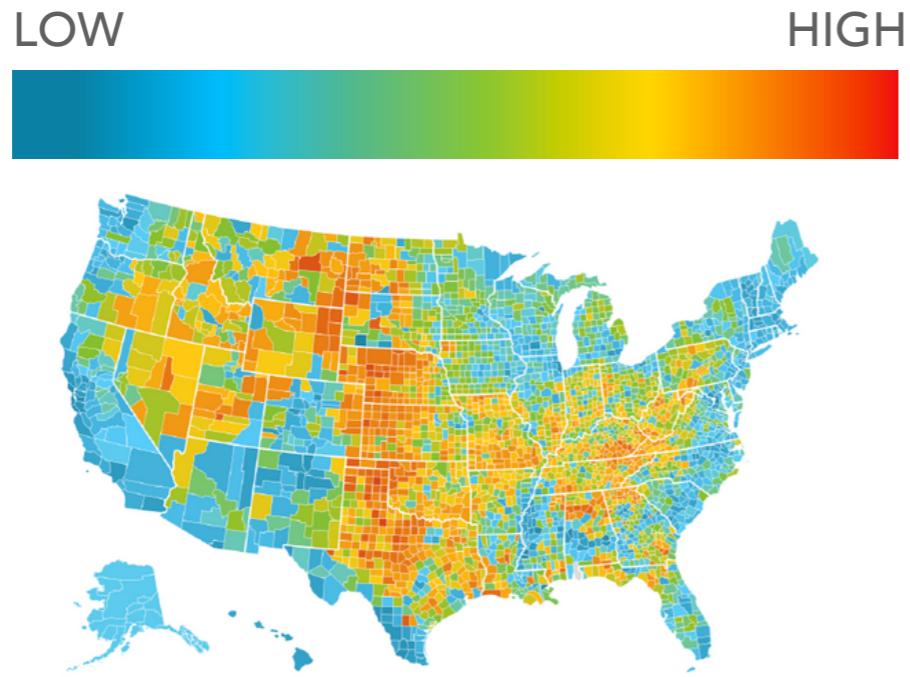


Chart: Lisa Charlotte Rost, Datawrapper, <https://app.datawrapper.de/chart/WHFnd/visualize?tpl=BUxYG>

Using color to represent value



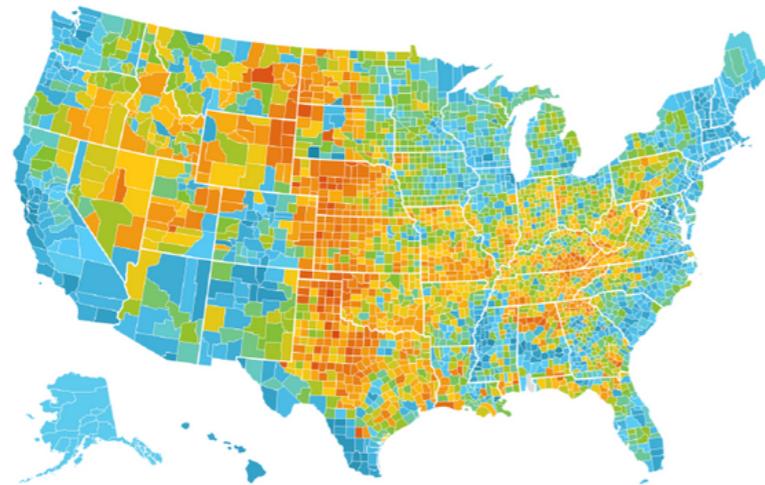
What to consider when choosing colors for data visualization <https://blog.datawrapper.de/colors/>

Using color to represent value

LOW



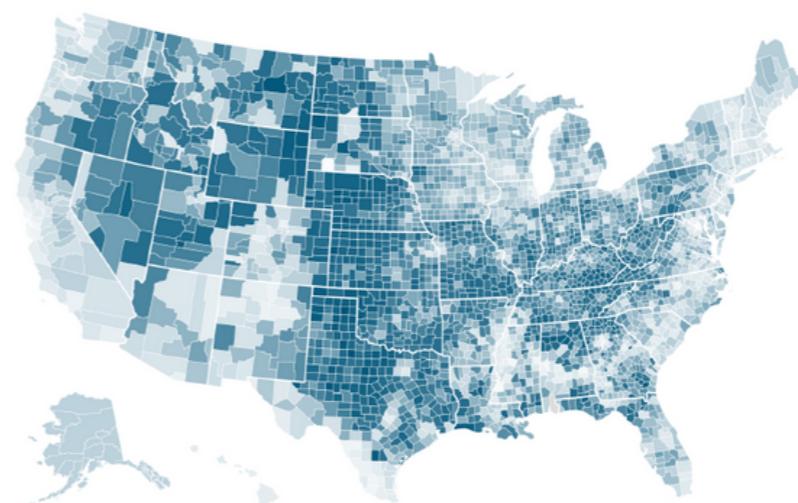
HIGH



LOW



HIGH



VS



What to consider when choosing colors for data visualization <https://blog.datawrapper.de/colors/>

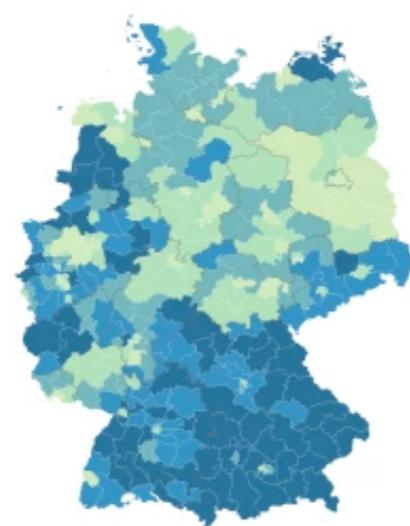
Encoding low or less (vs more):



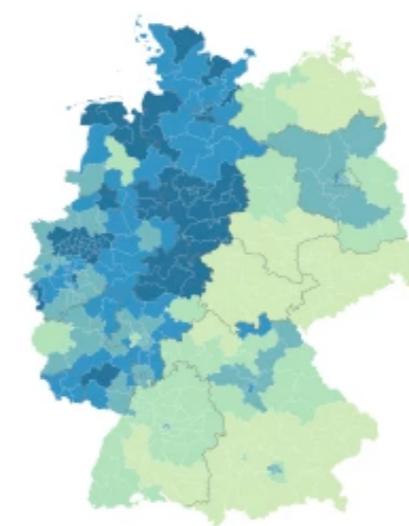
Use light or cool colors. Their lightness should always be closer to the background color.

Party loyalties are often defined by old borders

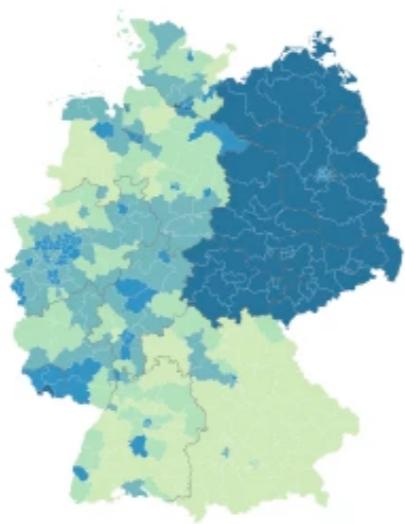
MORE SUPPORT ▶



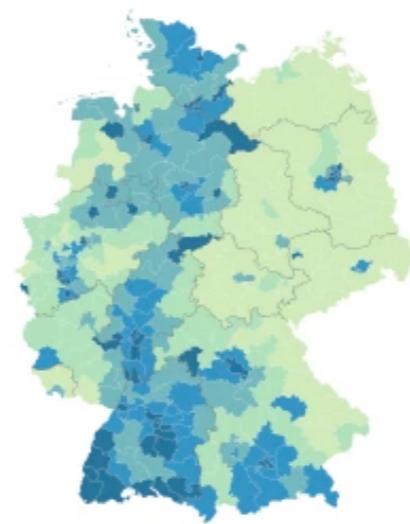
party 1



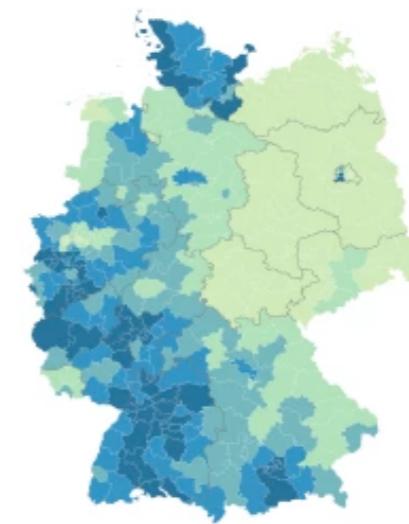
party 2



party 3



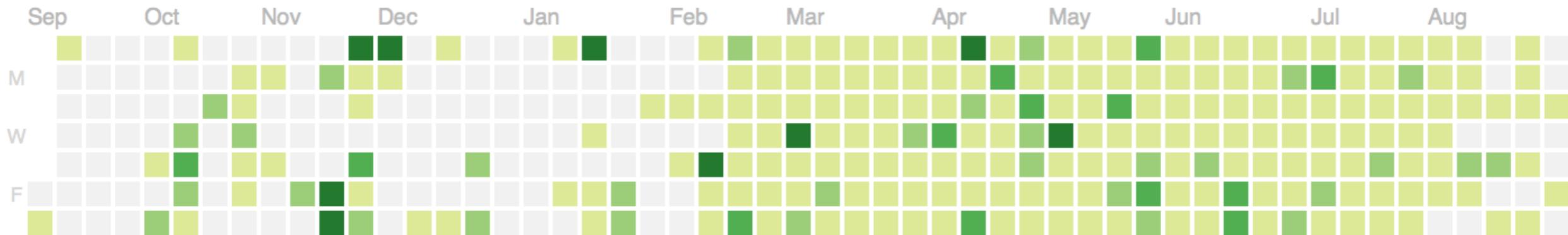
party 4



party 5



Your Contributions



[?](#) Summary of Pull Requests, issues opened and commits. [Learn more.](#)

Less More

1,337 Total

Sep 14 2012 - Sep 14 2013

177 days

February 21 - August 16

0 days

Rock - Hard Place

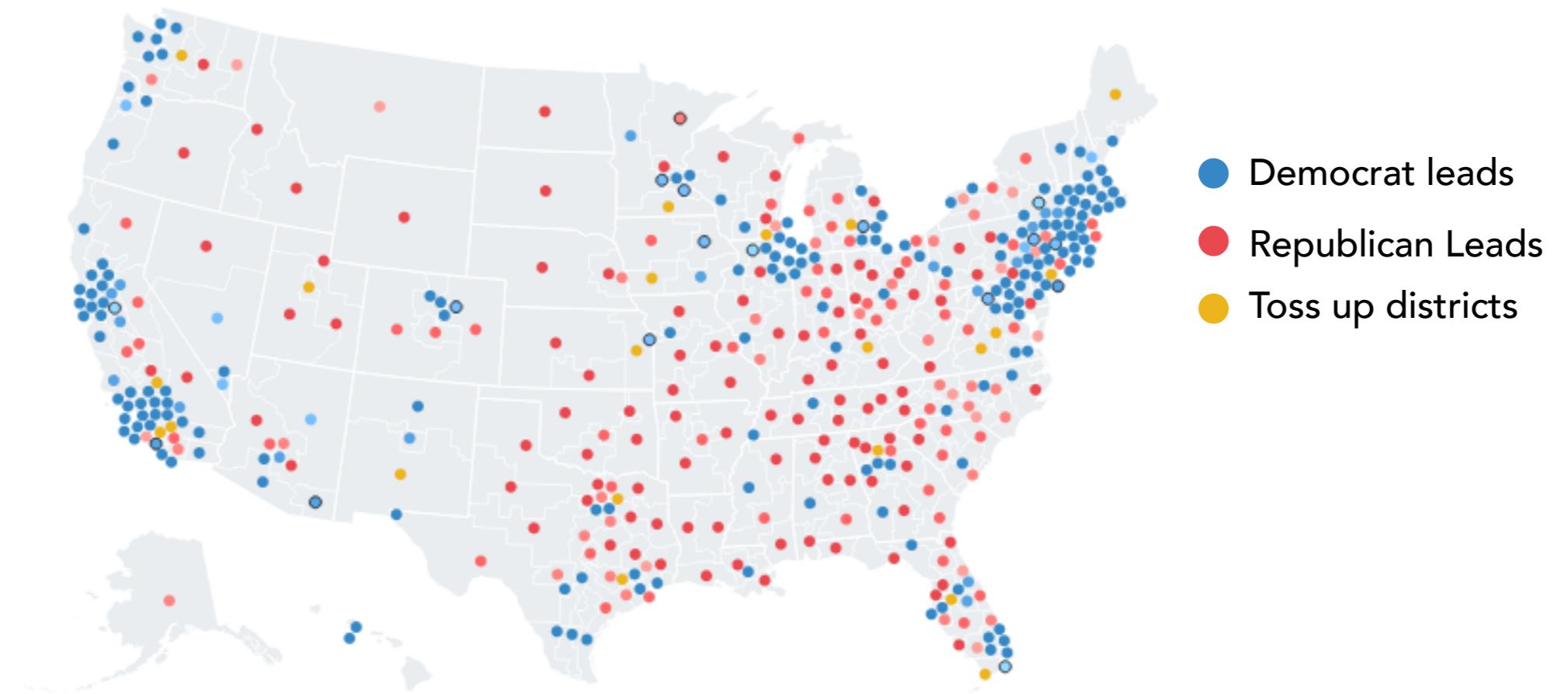
Year of Contributions

Longest Streak

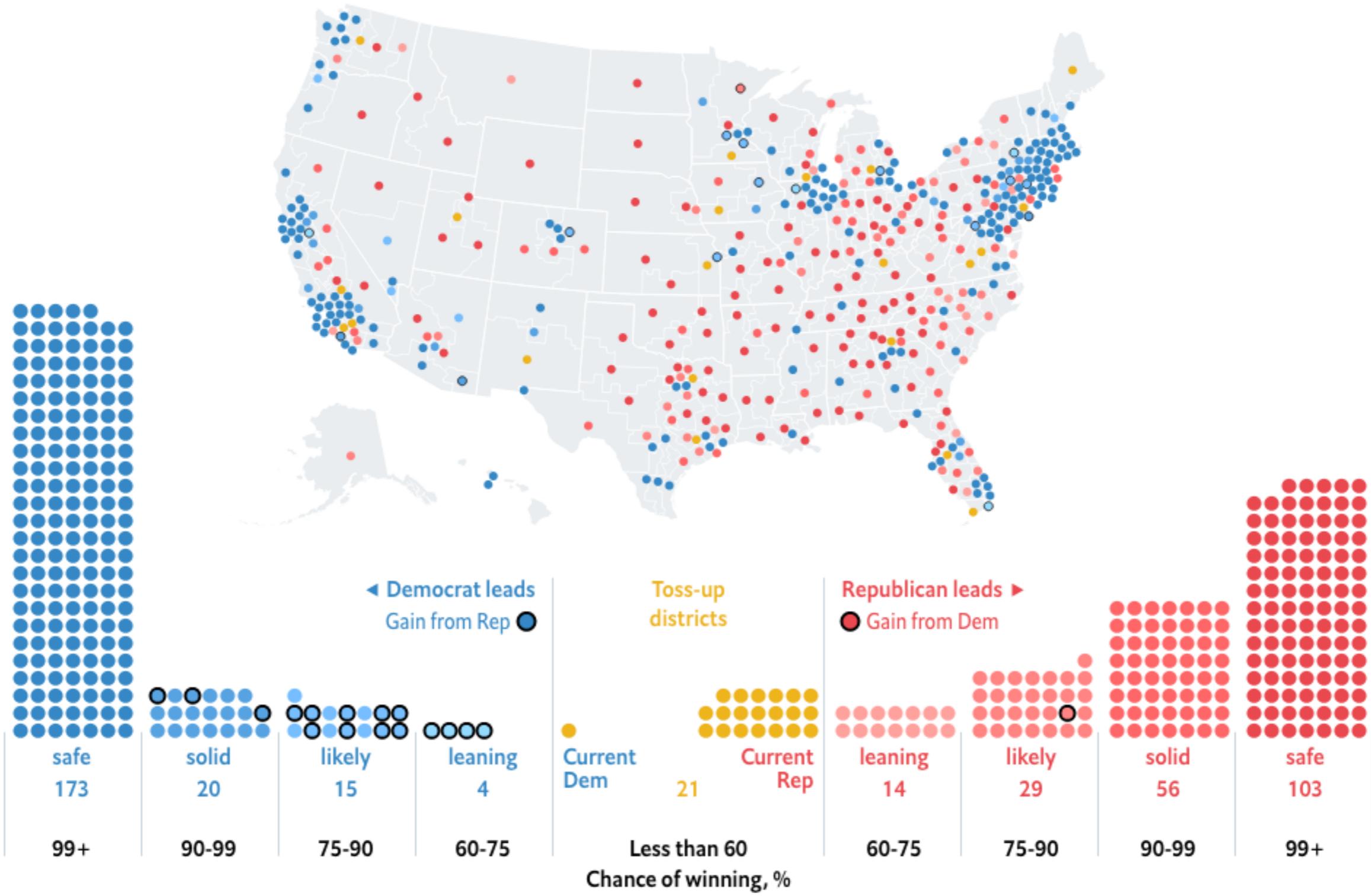
Current Streak



<https://github.com>



<https://www.economist.com/graphic-detail/2018/05/24/whos-ahead-in-the-mid-term-race>



How to choose colors?

Use tools: Company's styleguide, ColorBrewer, Color Oracle, Contrast

Colour Palette

Lightest	trv-maincolor-01-lightest trv blue lightest #e5f2f6	trv-maincolor-02-lightest trv orange lightest #fdf3e5	trv-maincolor-03-lightest trv red lightest #9eceea	trv-maincolor-05-lightest trv green lightest #ecf3e6	trv-maincolor-04-lightest trv juri lightest #ebeced
Very Light	trv-maincolor-01-very-light trv blue very light #bfdfea	trv-maincolor-02-very-light trv orange very light #fce3bf	trv-maincolor-03-very-light trv red very light #f1d1cb	trv-maincolor-05-very-light trv green very light #cfe0bf	trv-maincolor-04-very-light trv juri very light #cdd0d2
Lighter	trv-maincolor-01-lighter trv blue lighter #7fbfd6	trv-maincolor-02-lighter trv orange lighter #9c77f	trv-maincolor-03-lighter trv red lighter #e4a497	trv-maincolor-05-lighter trv green lighter #a0c280	trv-maincolor-04-lighter trv juri lighter #9ba2a6
Light	trv-maincolor-01-light trv blue light #3f9fc1	trv-maincolor-02-light trv orange light #f6ab3f	trv-maincolor-03-light trv red light #d67763	trv-maincolor-05-light trv green light #71a340	trv-maincolor-04-light trv juri light #697379
Regular	trv-maincolor-01 trv blue #007fad	trv-maincolor-02 trv orange #f48f00	trv-maincolor-03 trv red #c94a30	trv-maincolor-05 trv green #428500	trv-maincolor-04 trv juri #37454d



Accessibility

Don't just rely on specific color scales. Instead, test your figures.

Colour Palette

Lightest



Very Light



Lighter



Light

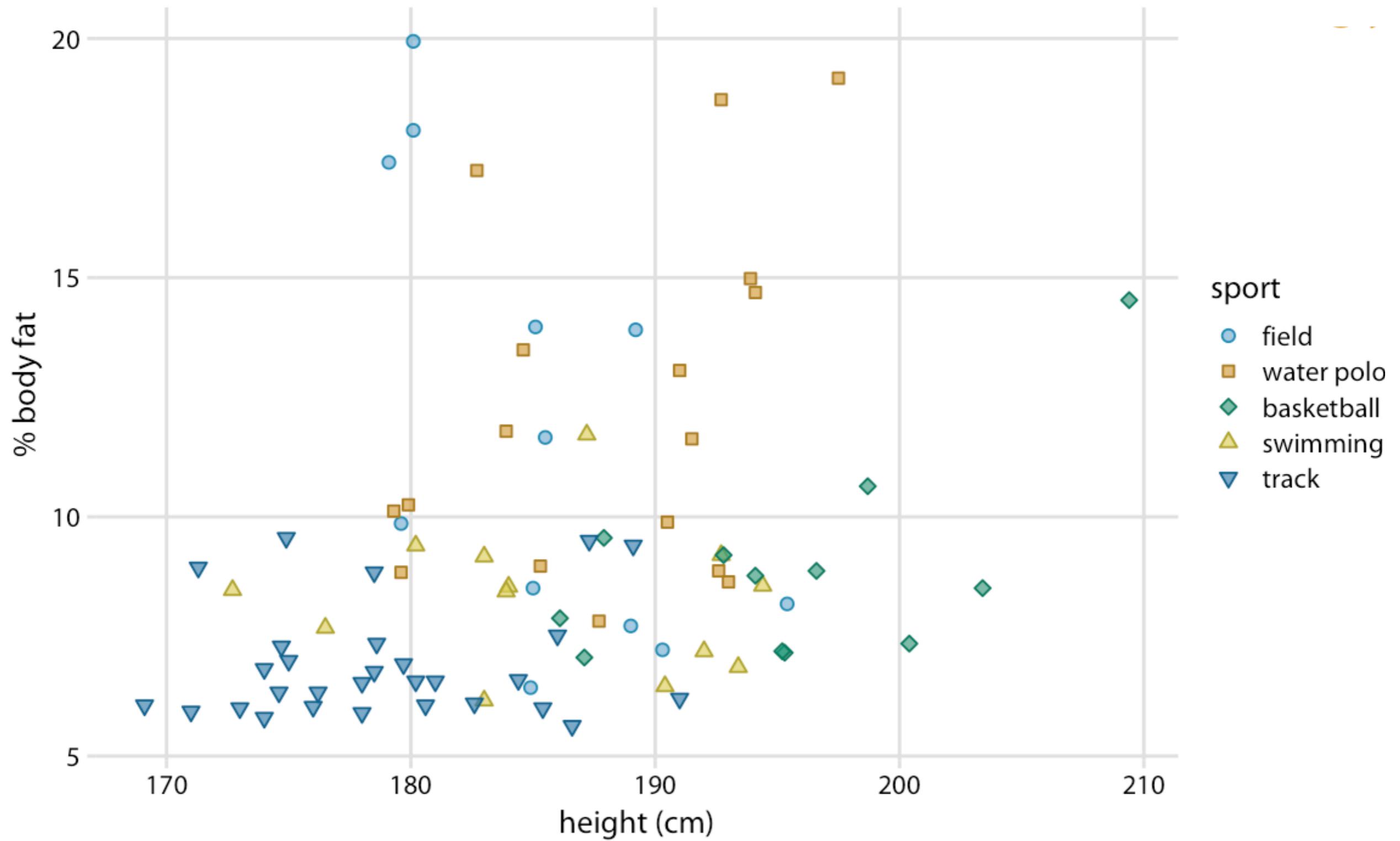


Regular

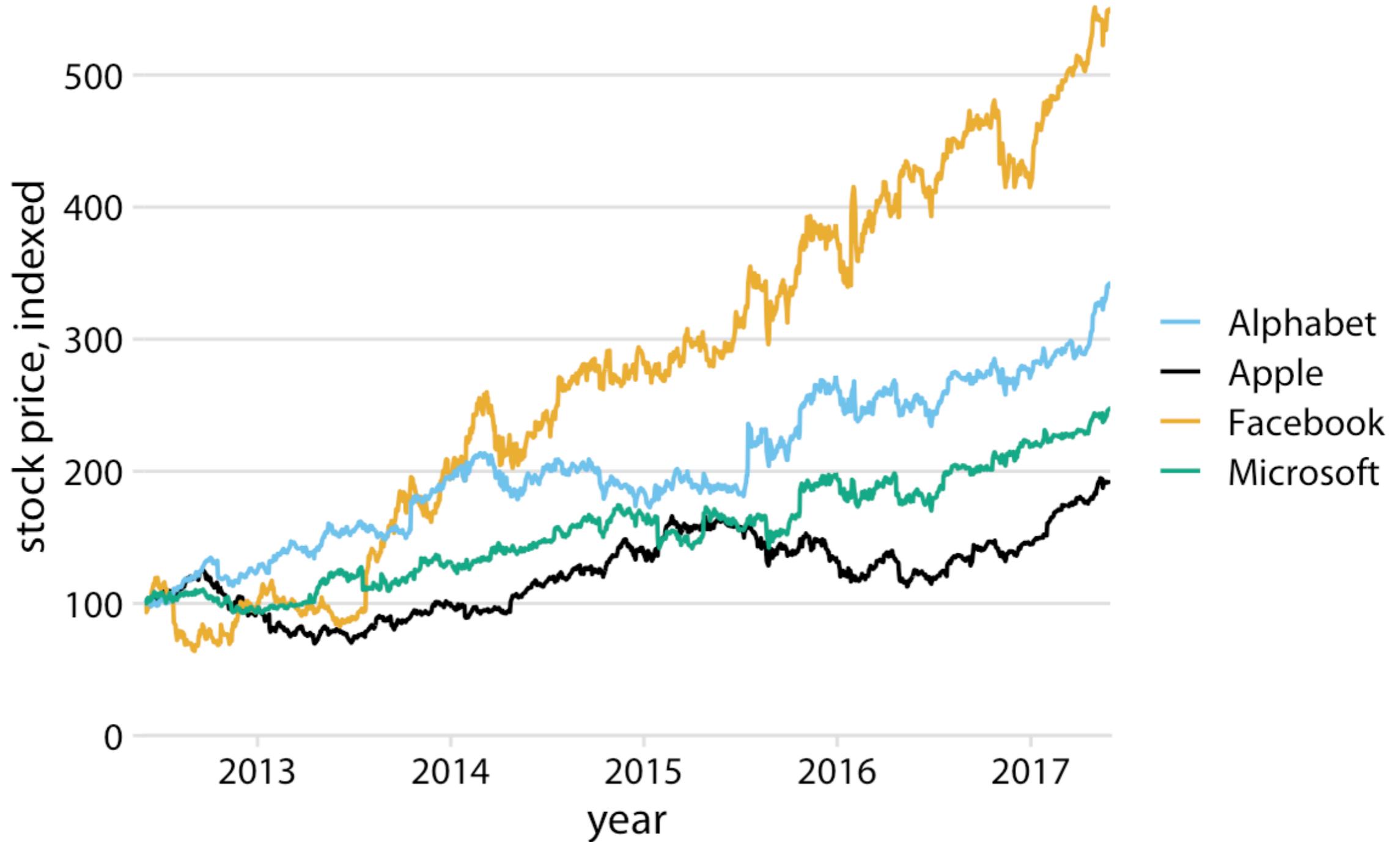


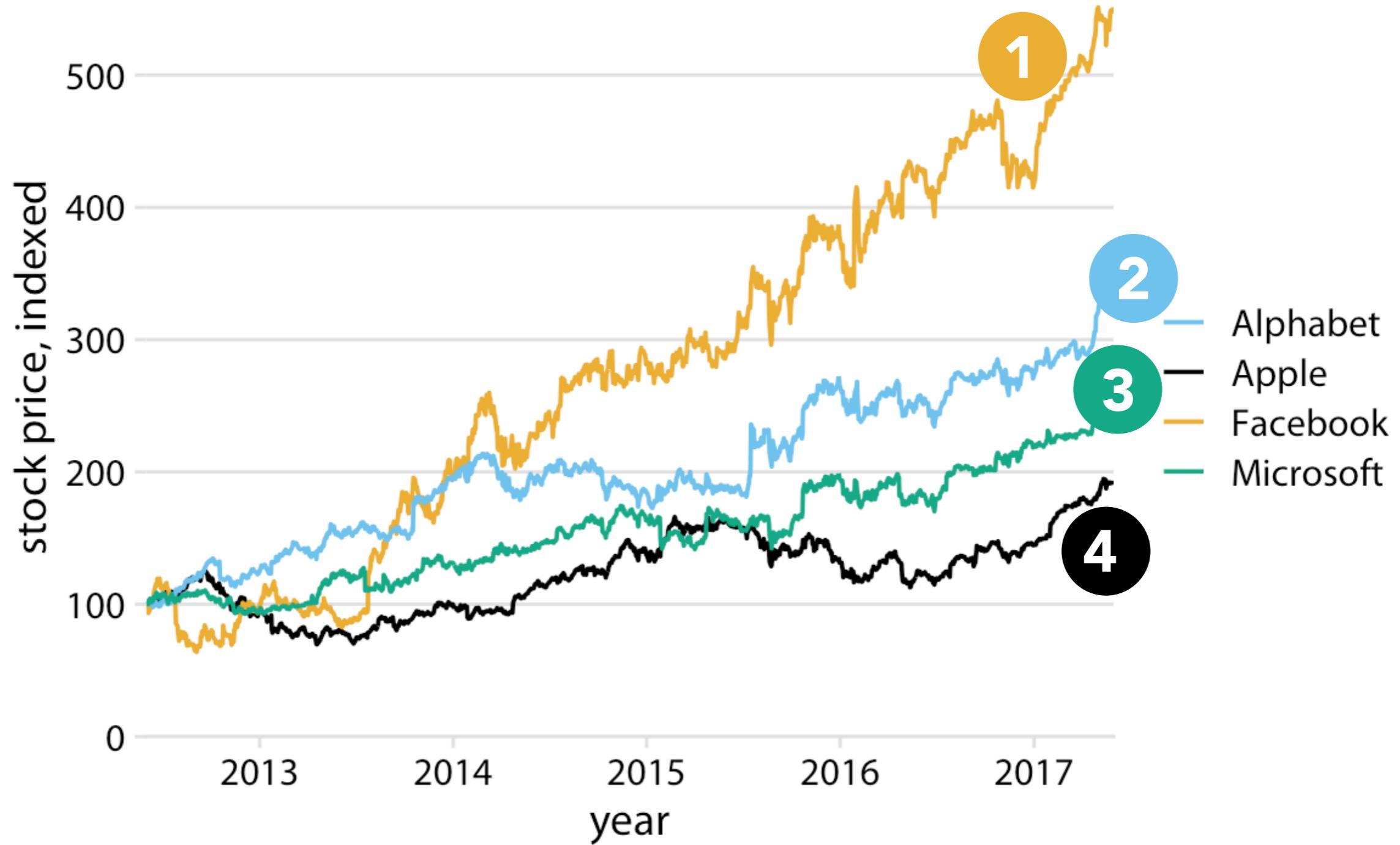
Refine and annotate

Small text, low contrast :(

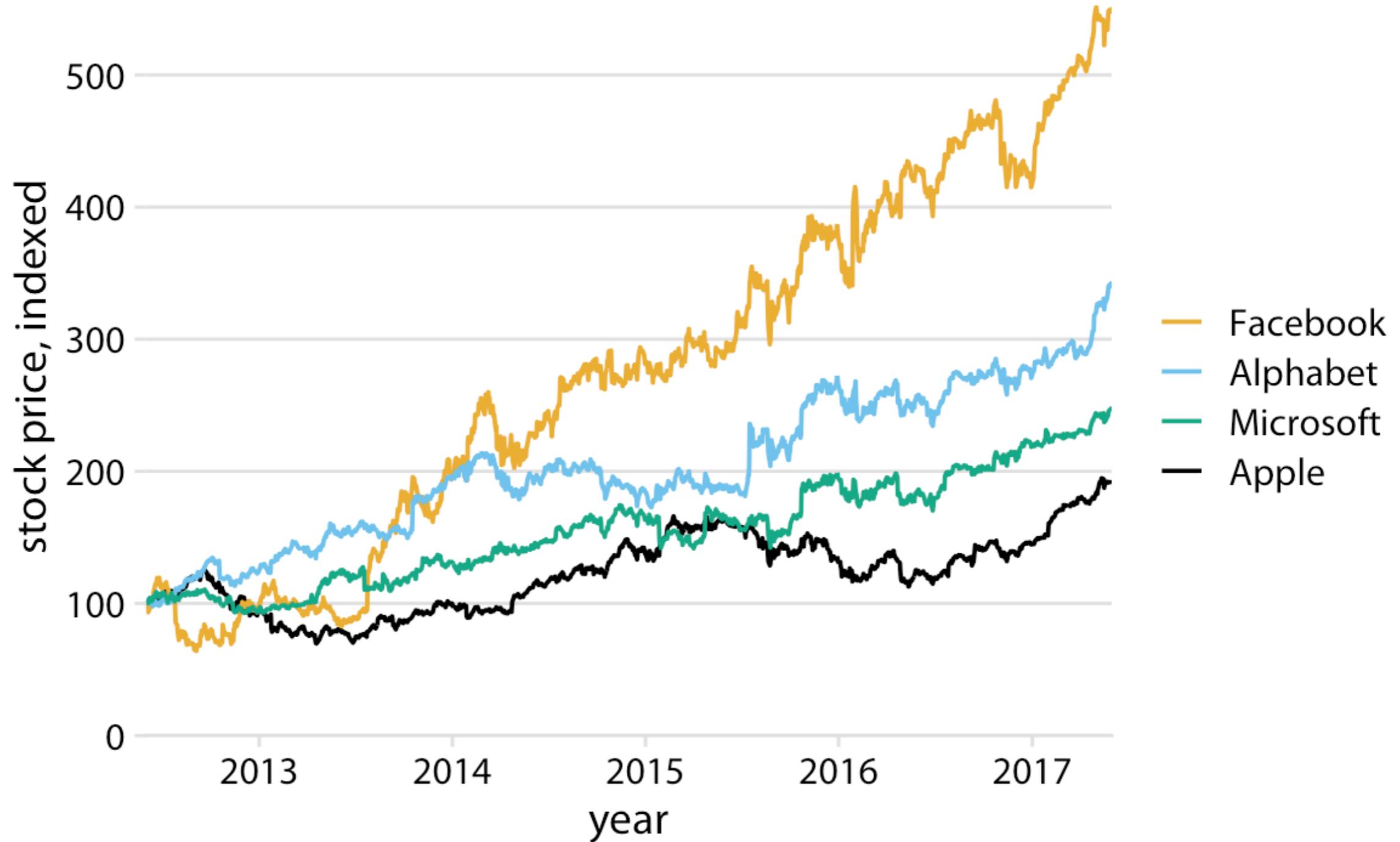


Unsorted legend items :(



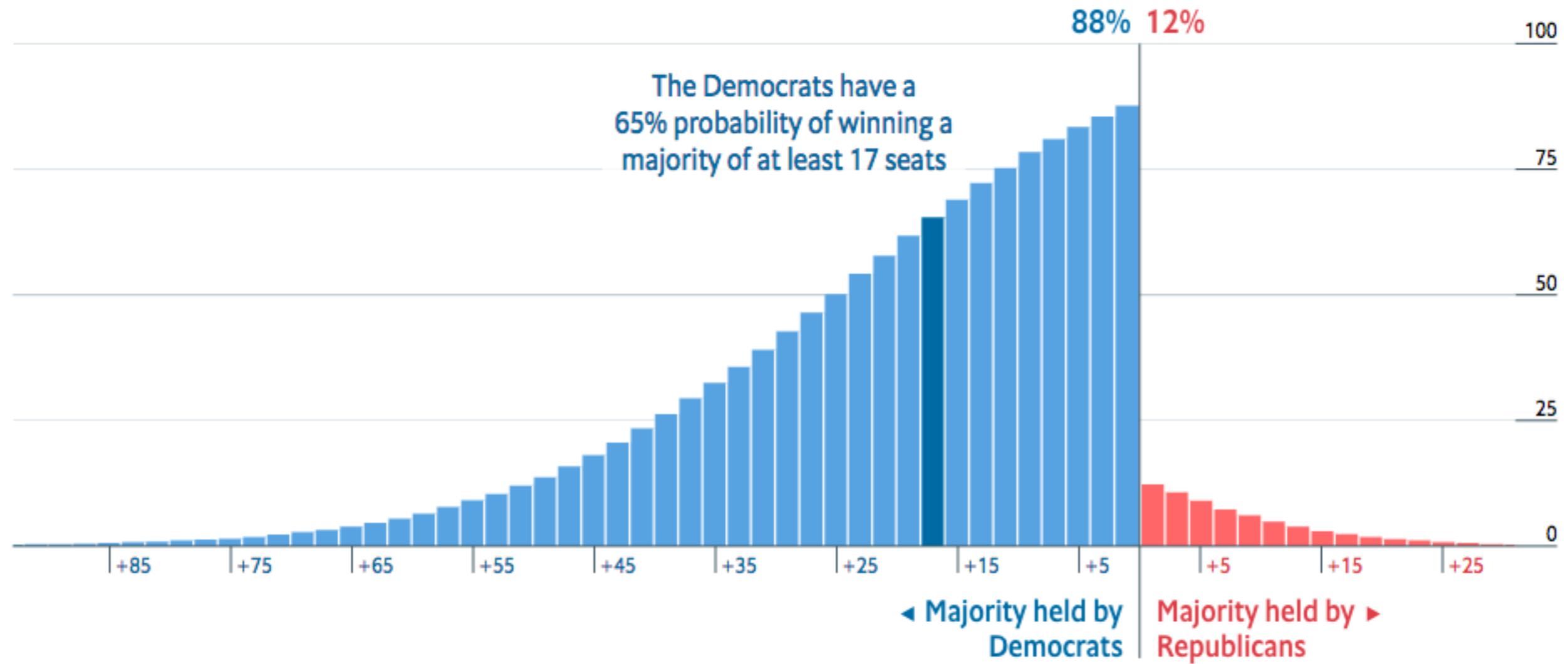


Sorted legend items



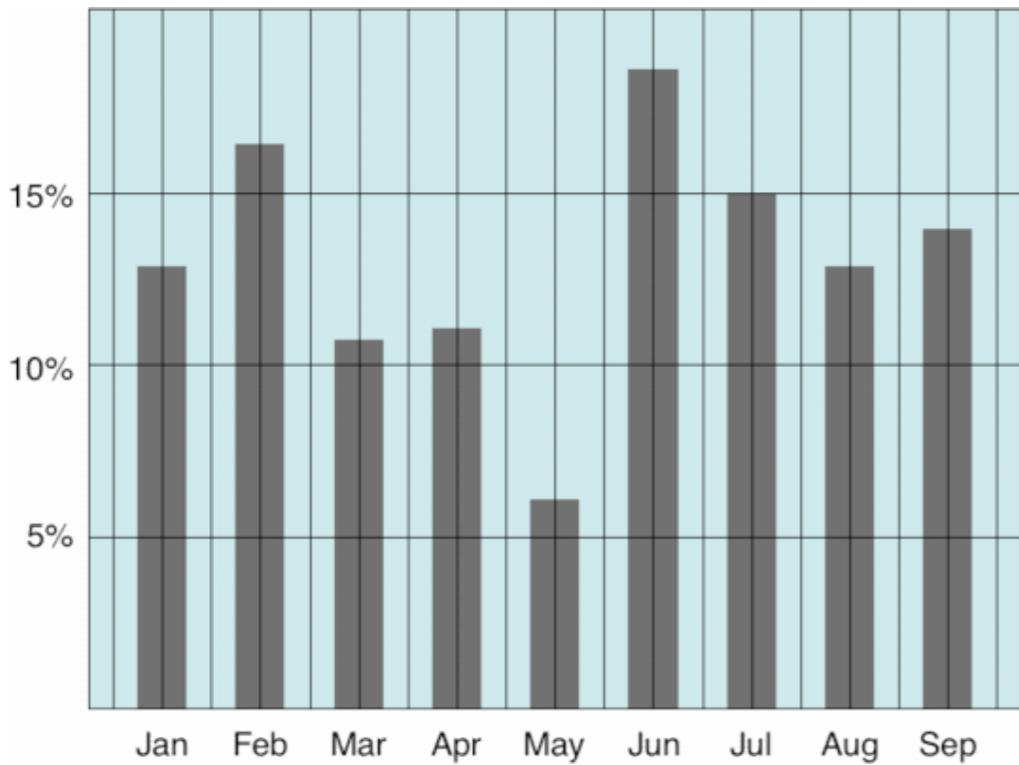
Label and explain

Chance of winning a majority of at least this many seats, %

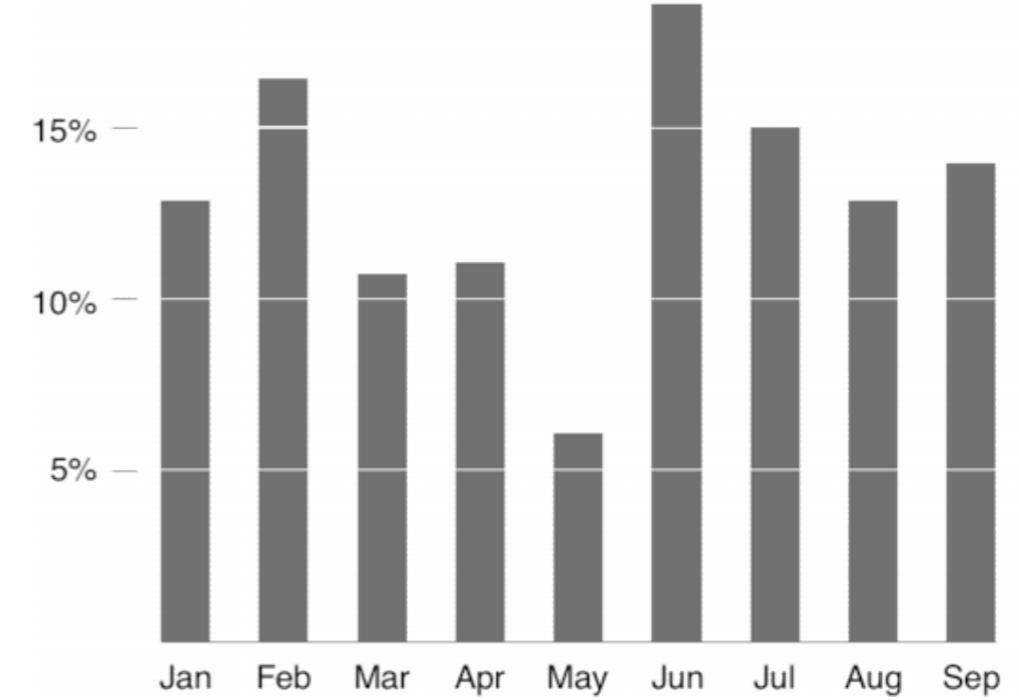


No ink without a reason

The border, the background color and
the grid lines are all unnecessary data ink



VS



Σ

HYPOTHESIS

Know our data and the story we want to tell



HYPOTHESIS

Know our data and the story we want to tell

PROOF



Use the strengths of the visual attributes



HYPOTHESIS

Know our data and the story we want to tell

PROOF

Use the strengths of the visual attributes

EXPLAINING

Include legends and descriptions



Thanks! \o/



<https://github.com/anarisris/presentations/tgt2019.pdf>

@_anaris

<https://thebark.com/content/doggie-bags>