

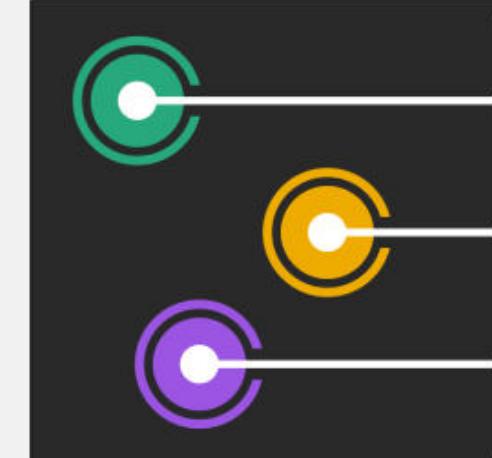
Datenvisualisierung

Wie mache ich das richtig?

Dr. Cédric Scherer // 2. Juni 2023

cedricscherer.com    @CedScherer  z3tt

@ JuGa Summer School 2023



CÉDRIC SCHERER

Data Visualization & Information Design



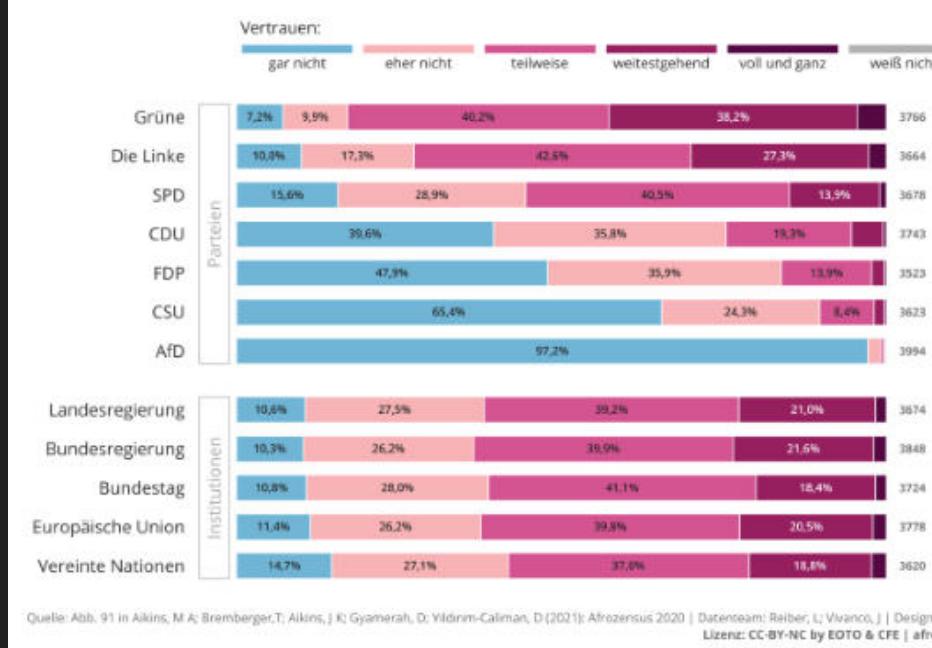
Consulting

Coaching

Coding



Vertrauen der Afrozensus-Befragten in Parteien und politische Institutionen



Politiker rechnen bald mit einer Fortsetzung der Fußball-Bundesliga. Wenn auch nicht im Stadion, so ist es voraussichtlich bald wieder möglich Fußball im Fernsehen zu sehen.

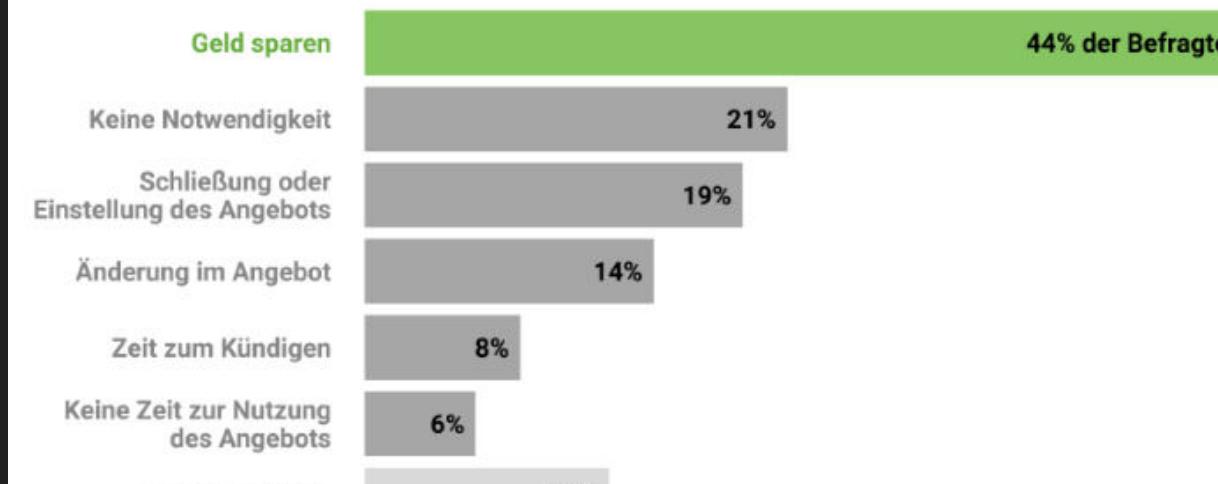
Ich habe **einen** Vertrag mit einem Anbieter für Sportübertragungen.

50% finden das richtig.
16% haben dazu keine Meinung.
34% finden das falsch.

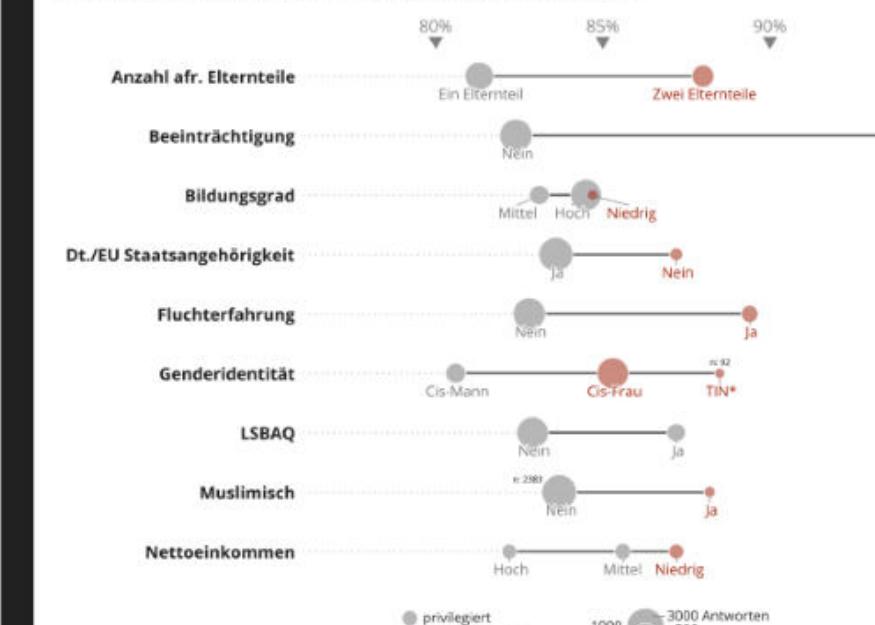
Ich habe **keinen** Vertrag mit einem Anbieter für Sportübertragungen.

31% finden das richtig.
35% haben dazu keine Meinung.
33% finden das falsch.

Was war der Grund während der Corona-Pandemie zu kündigen? (Mehrfachauswahl möglich)



Häufigkeit von Diskriminierungserfahrungen entlang ausgewählter Vielfaltsdimensionen im Bereich „Arbeitsleben“



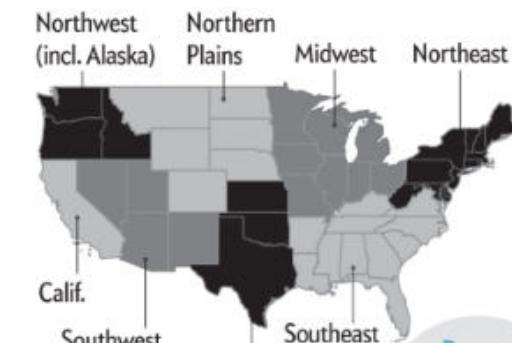
GRAPHIC SCIENCE

Text by Clara Moskowitz | Graphic by Cédric Scherer and Georgios Karamanis

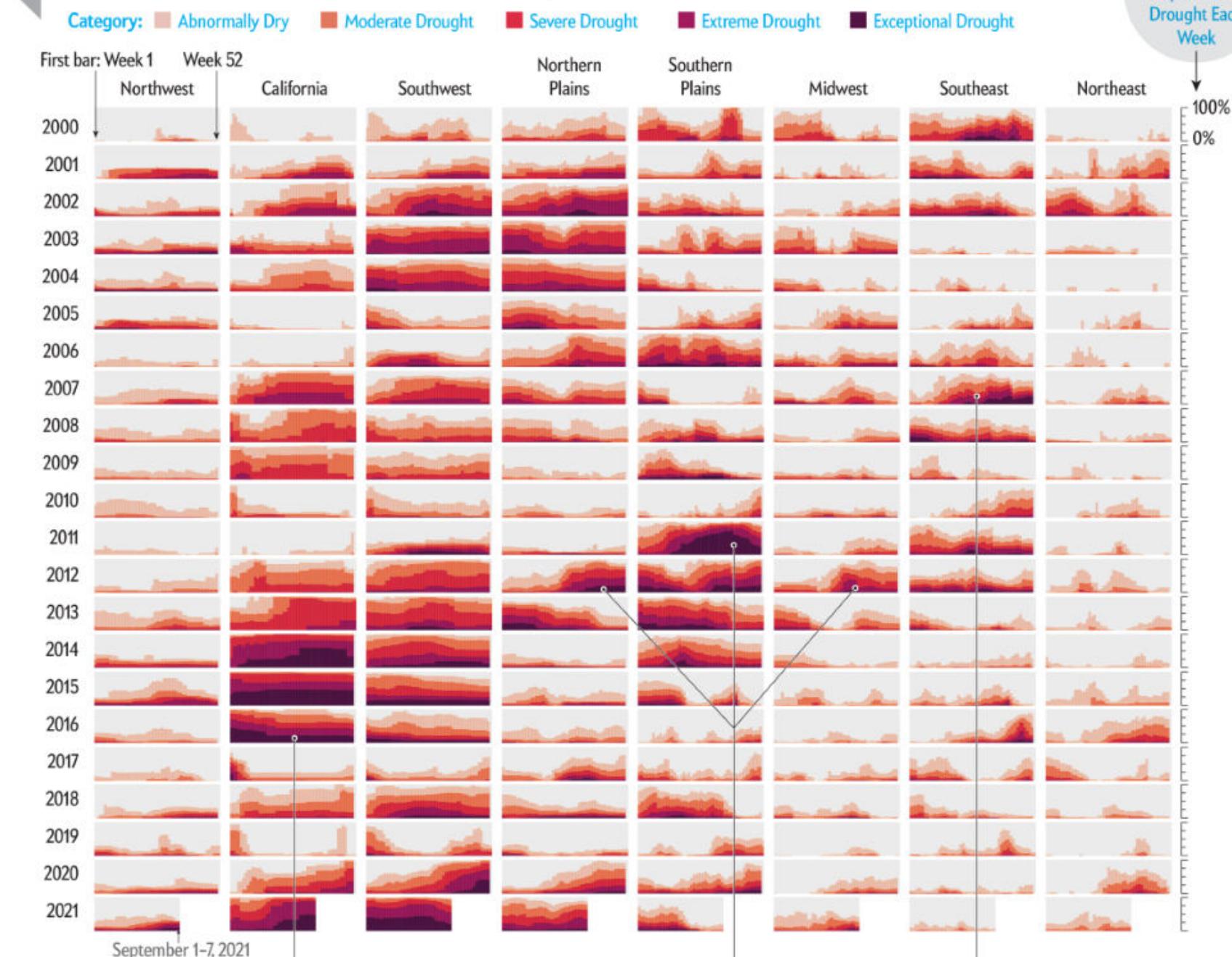
Escalating Drought

Climate change is intensifying periods of extreme dryness, particularly in the U.S. West

For more than 20 years the National Drought Mitigation Center (NDMC) has been monitoring dozens of indices of drought around the country, including satellite measurements of evaporation and color in vegetation, soil-moisture sensors, rainfall estimates, and river and streamflow levels. Although the agency's weekly assessments have identified periods of exceptional drought before, lately dryness has been ramping up. "The changing climate is definitely contributing to more natural disasters, drought being one of them," says Brian Fuchs, a climatologist who oversees the weekly report at the NDMC. "We're seeing more frequent and high-intensity episodes. This year some of these areas in the West have been in drought more than they have been without drought."



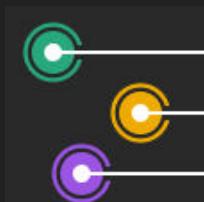
Drought Extent and Intensity by Region over Time

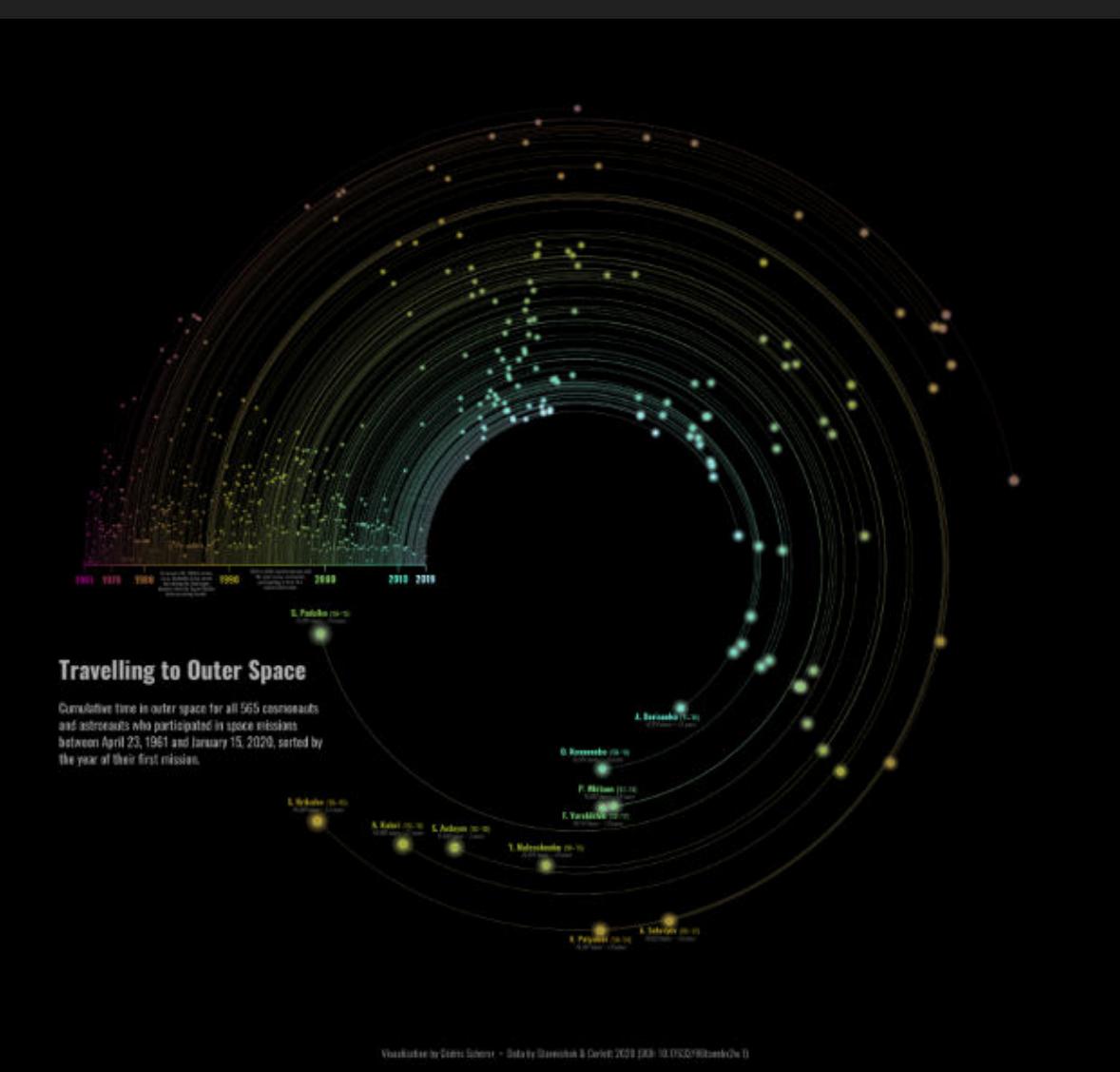
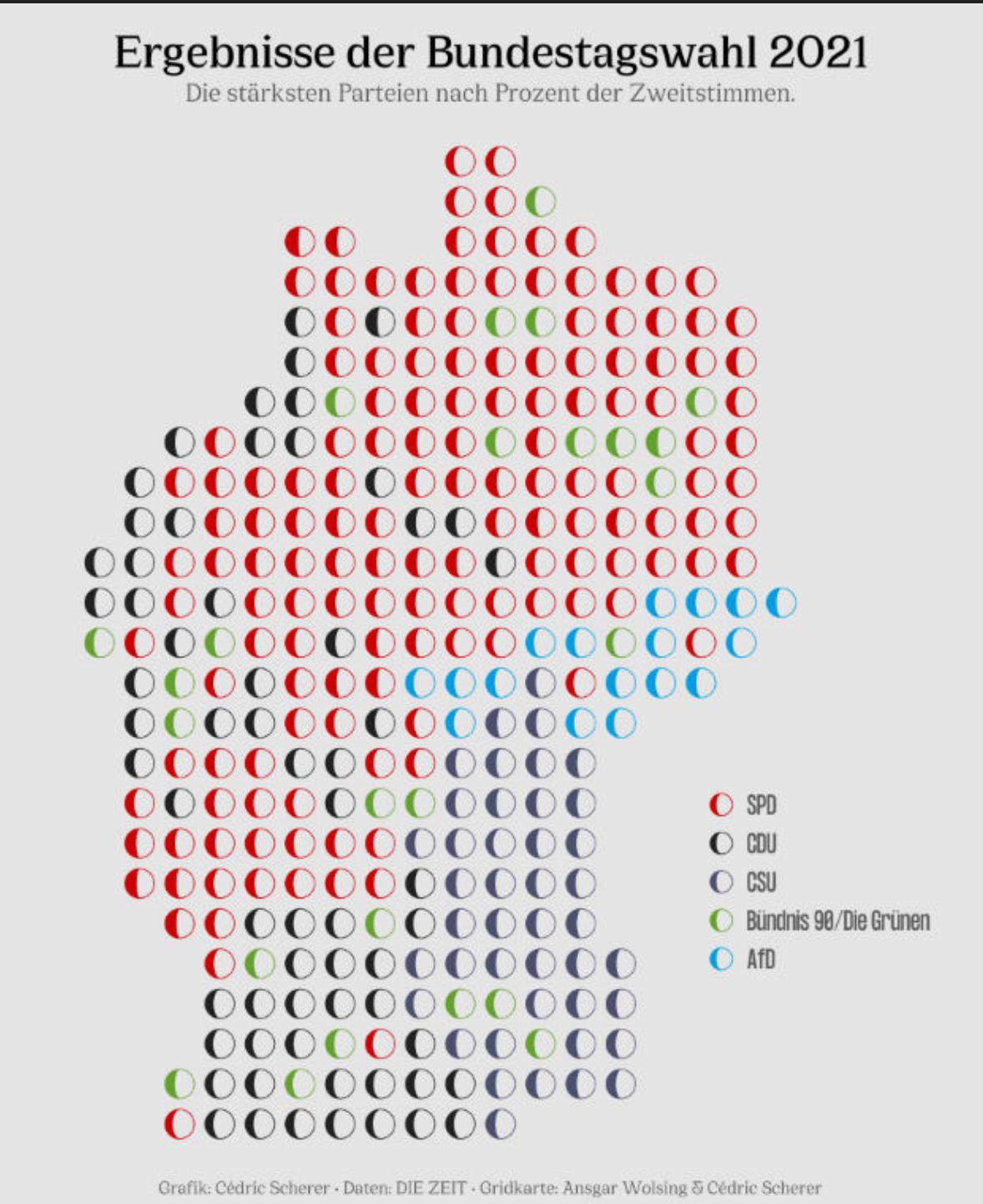
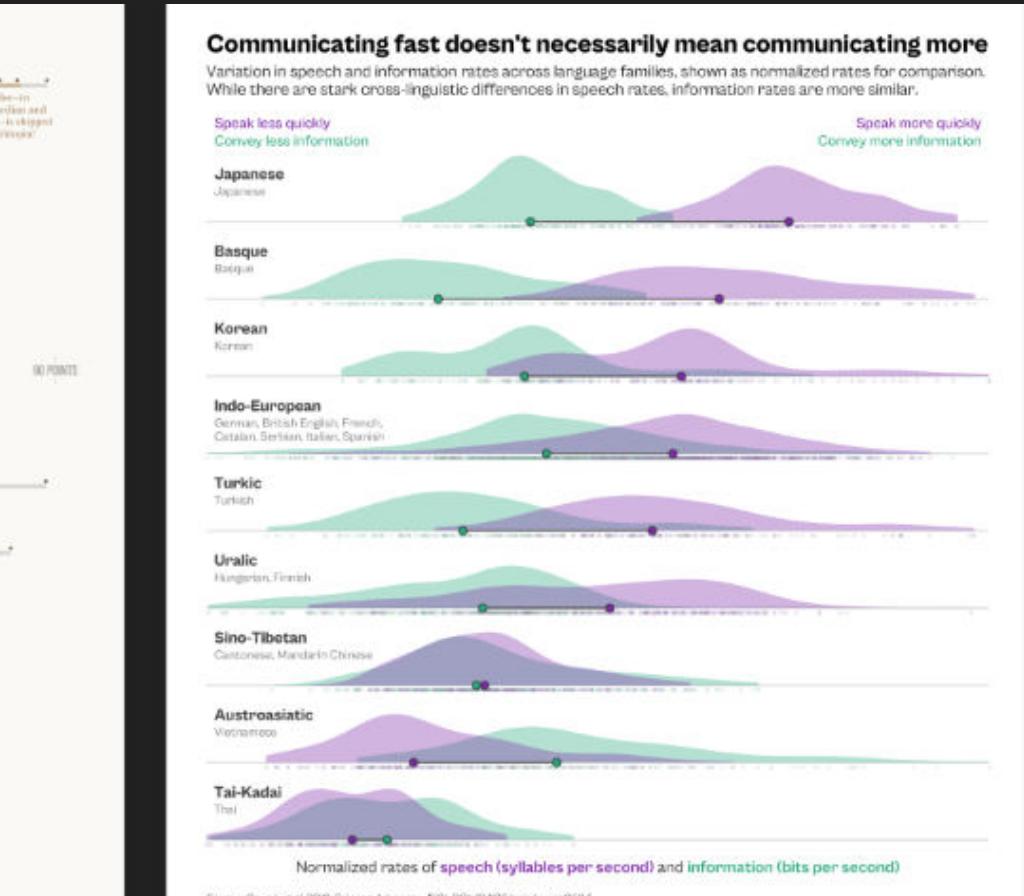
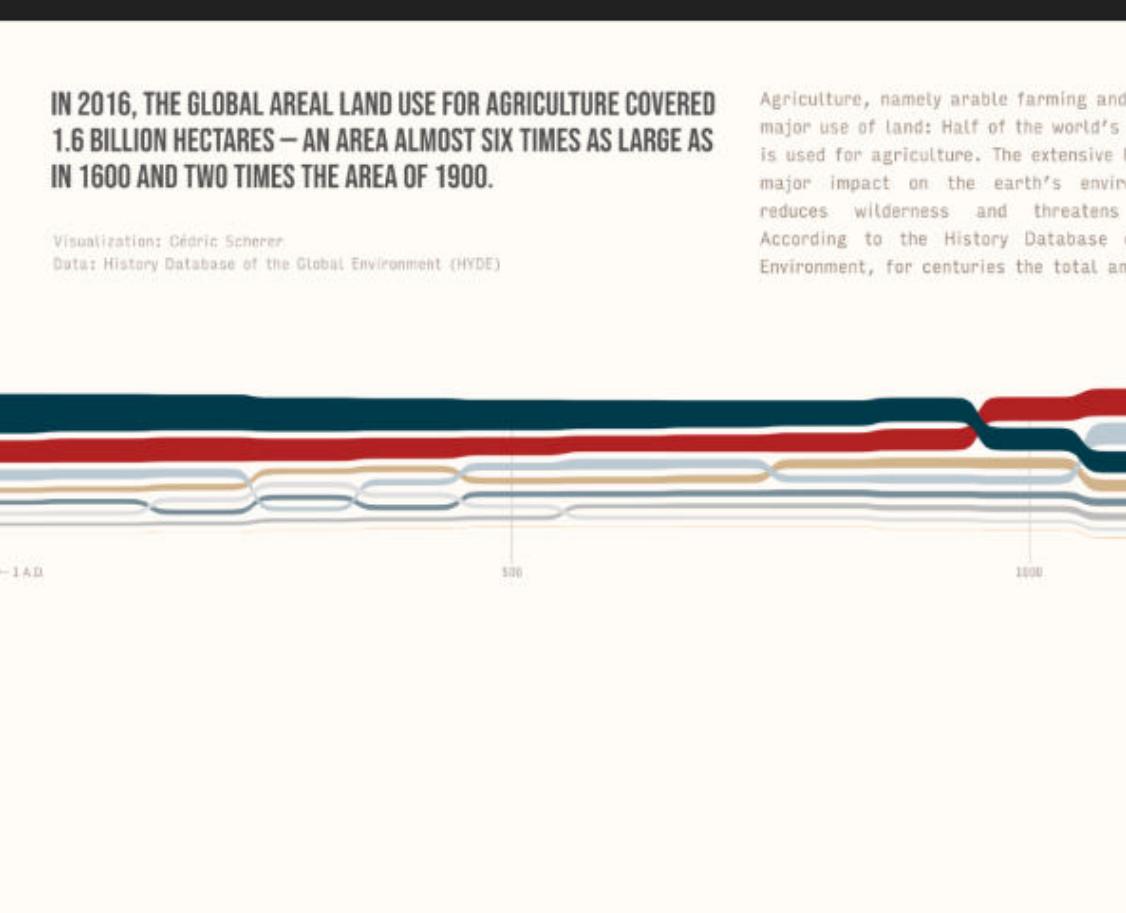
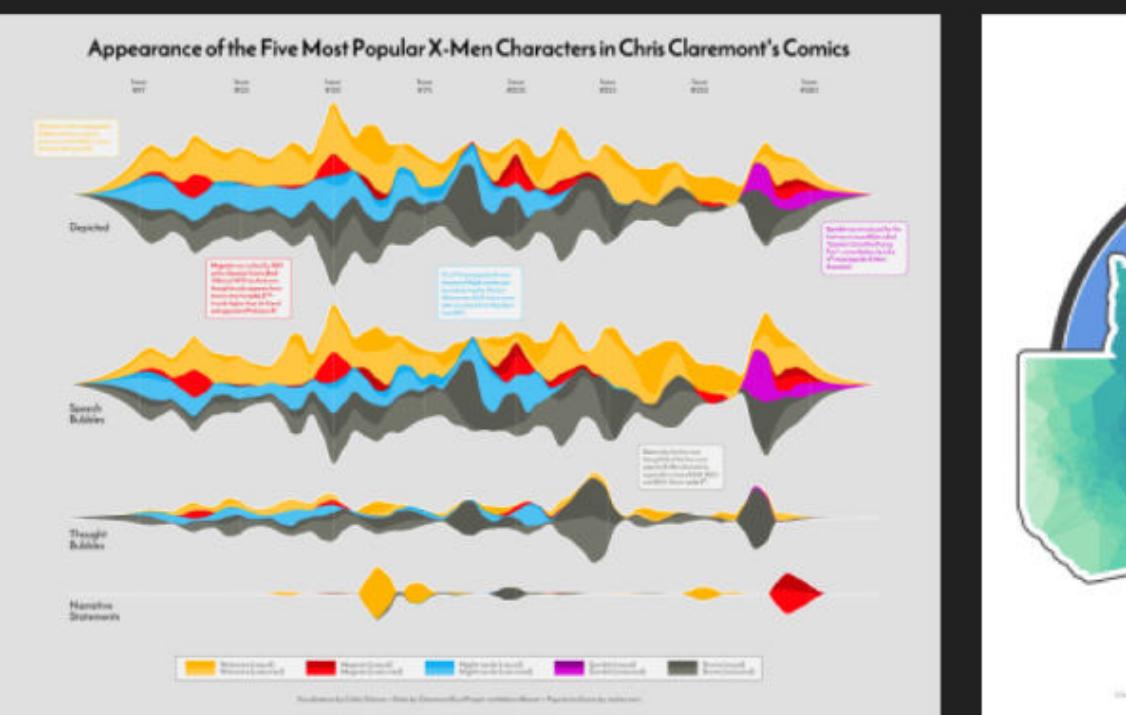
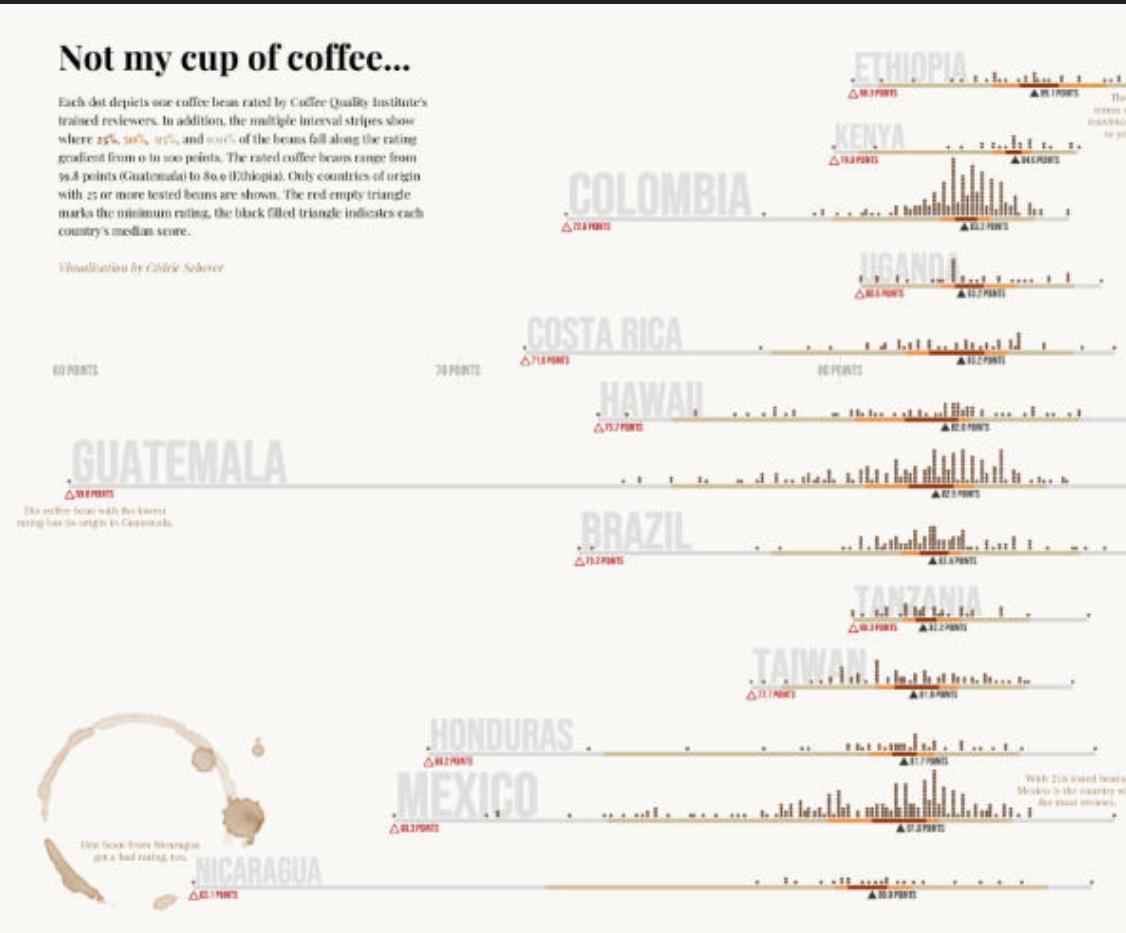
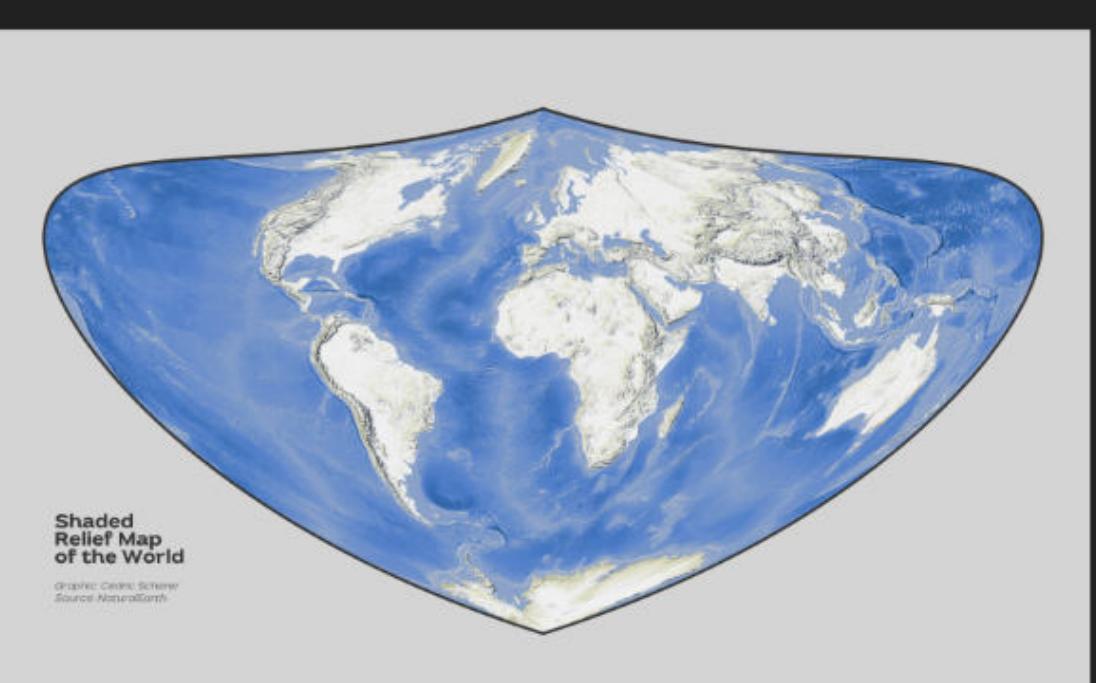
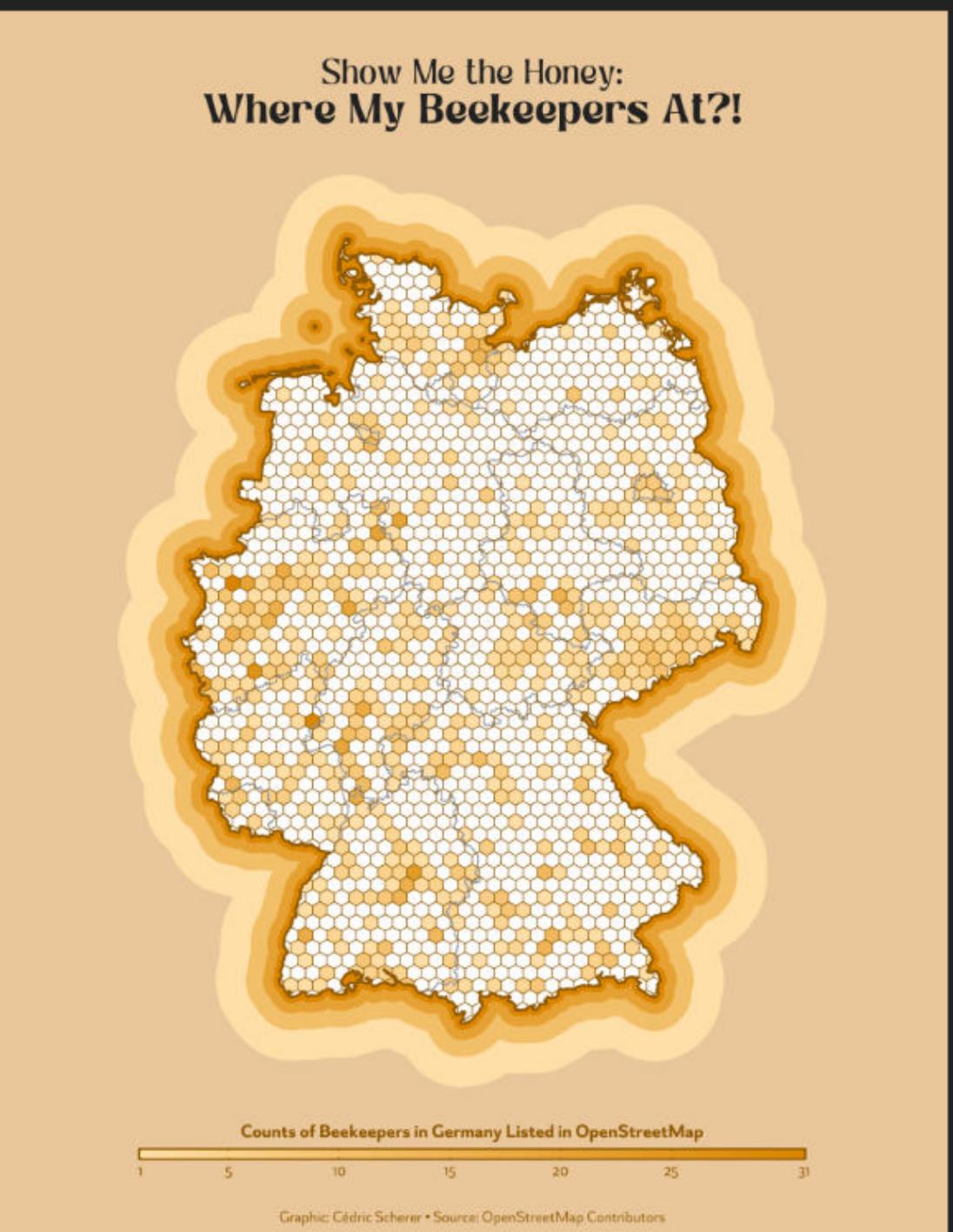
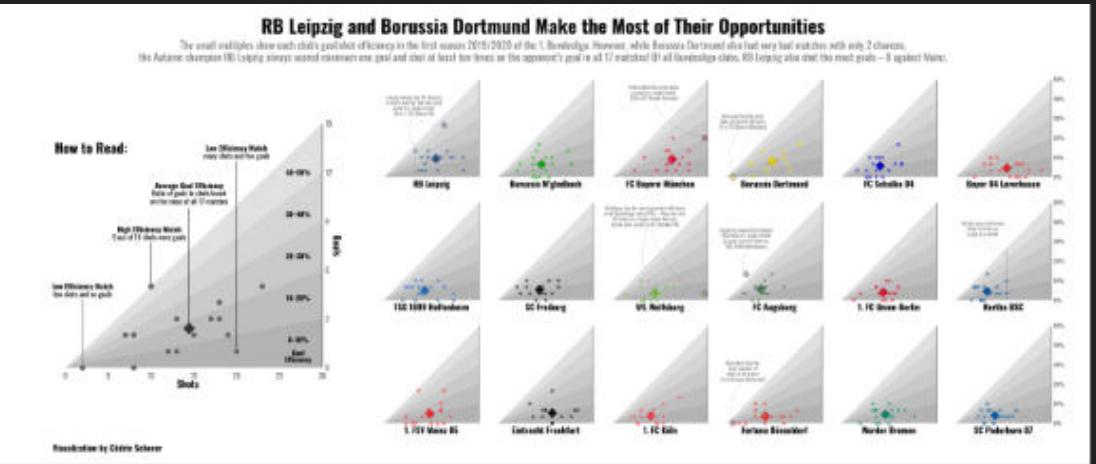


California experienced its hottest drought in recorded history from 2012 to 2016. A warming climate makes the atmosphere thirstier, which increases evaporation and boosts drought.

A drought that originated in the Southern Plains in 2011 eventually spread to the Midwest and Northern Plains when the moisture coming in from the Gulf of Mexico was absorbed by the parched South before it could reach the North.

The Southeast's driest year to date was 2007, when only 31.85 inches of rain fell in Atlanta, 62 percent of its average yearly rainfall.





CÉDRIC SCHERER

Data Visualization & Information Design

Hi, I am Cédric 

Data Visualization Designer, Consultant and Instructor
for Engaging and Effective Graphical Storytelling.

[» Read more about me](#) [» Schedule a discovery call](#)



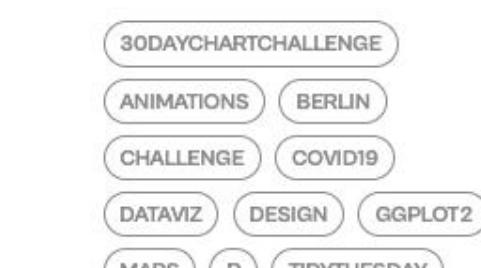
Always coding. Passionate about
design. Worried about nature and
inequality. Proud dad.



Quick Links

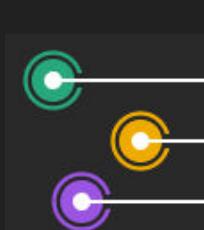
[ggplot2 Tutorial](#)
[Evolution of a ggplot](#)
[rstudio::conf Workshop](#)

Featured Tags



2-Day Workshop on "Graphic Design with ggplot2" at rstudio::conf 2022

End of July, I had the honor to teach an in-person ggplot2 workshop at the rstudio::conf in Washington DC. All course resources are available on the course webpage featuring slides, hands-on R codes, recap notes, and exercises including prepared scripts and step-by-step



Data Visualization

is any graphical representation
of information and data.



Data Visualization

helps to amplify cognition, gain insights,
discover, explain, and make decisions.



Data Visualization

**converts information into visual
forms as quantifiable features.**



Data Visualization

is part art and part science.



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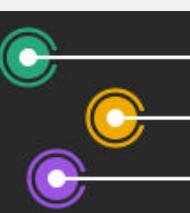


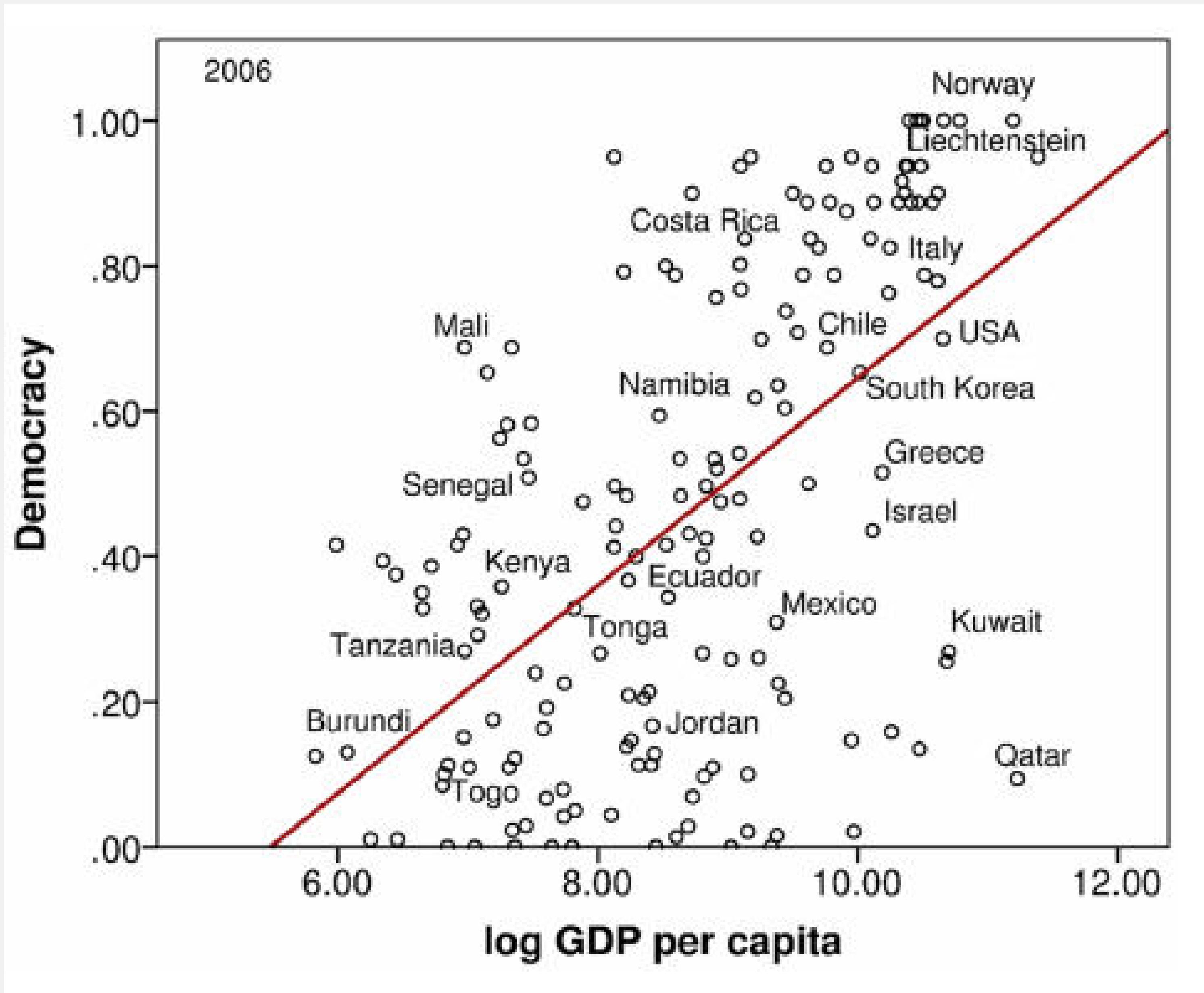
z3tt





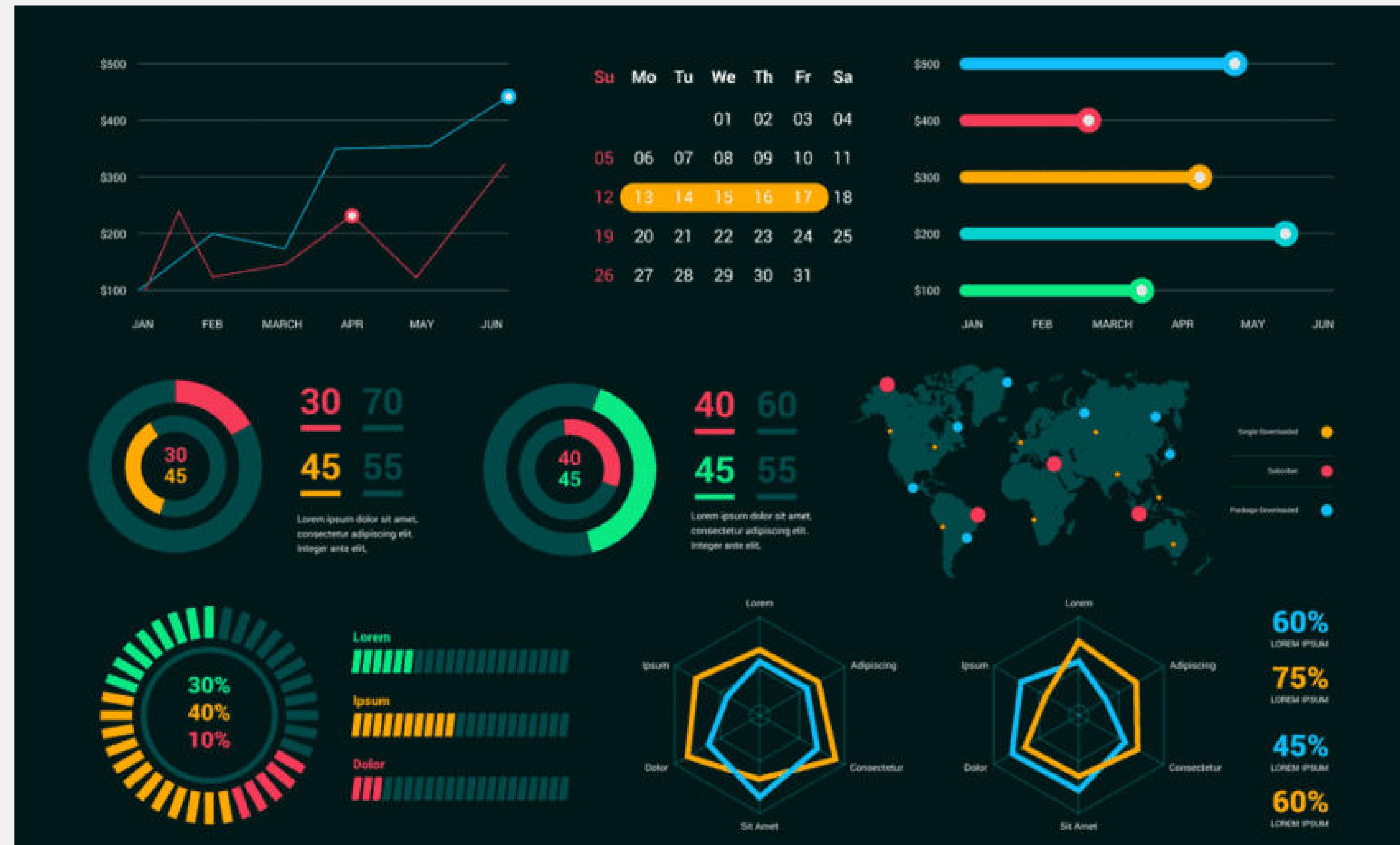
Quelle: eazybi.com



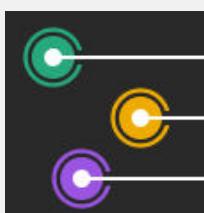


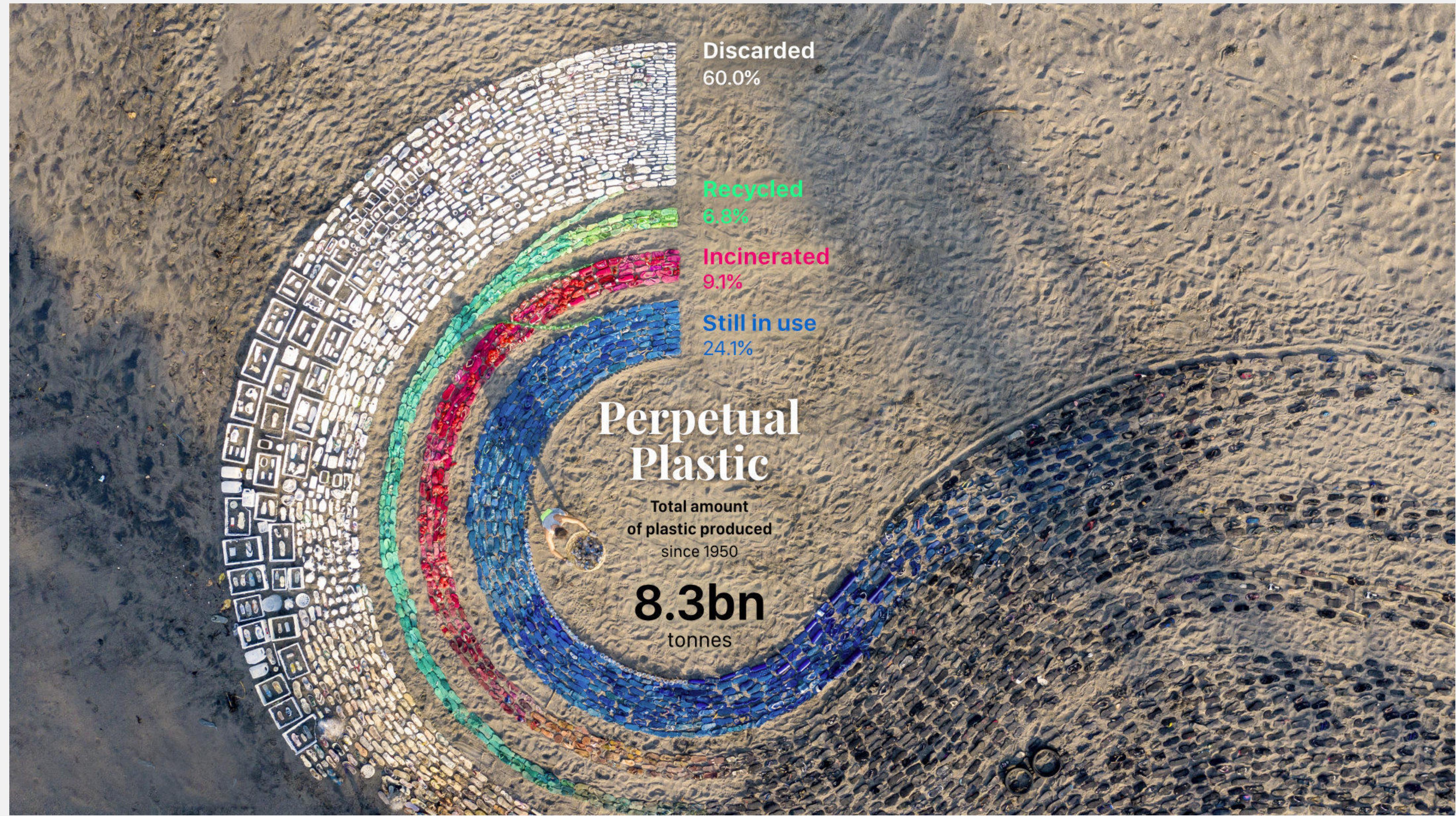
Source: *Ranganathan et al. 2014*





Source: datameer.com





Source: [“Perpetual Plastic” by Liina Klauss, Skye Morét and Moritz Stefaner](#)





Source: “*Patchwork Kingdoms*” by Nadieh Bremer

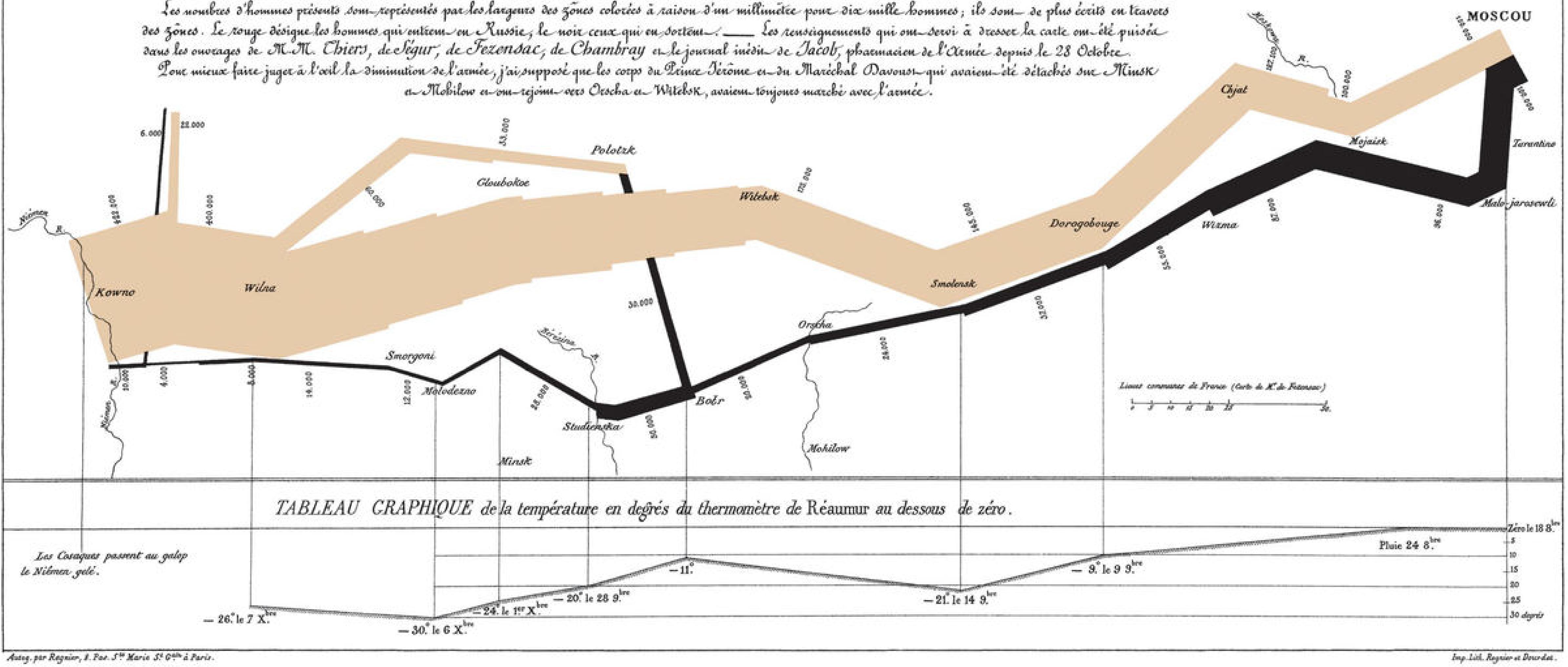


Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dessiné par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

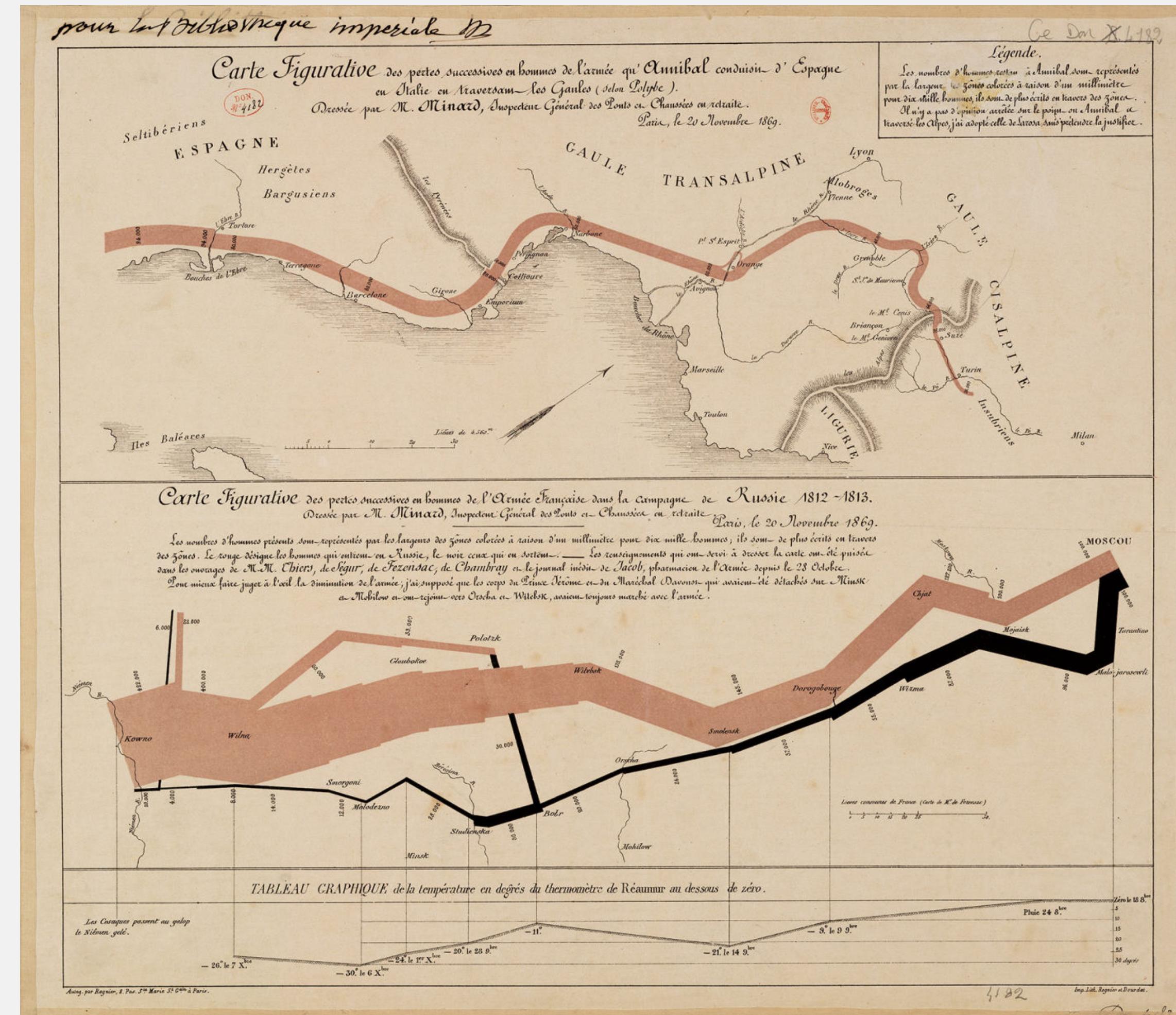
Les nombres d'hommes perdus sont représentés par les larges des zones colorées à raison d'un millimètre pour six mille hommes; ils sont de plus écrits en lettres des zones. Le rouge désigne les hommes qui entrent en Russie; le noir ceux qui en sortent. — Les renseignements qui ont servi à desser la carte ont été puisés dans les ouvrages de M. M. Chier, de Segur, de Fezensac, de Charnbray et le journal intitulé de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout, qui avaient été détachés sur Minsk et Mogilow et qui rejoignirent Osscha et Wilcok, avaient toujours marché avec l'armée.



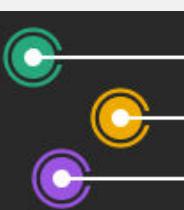
Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813 von Charles Joseph Minard

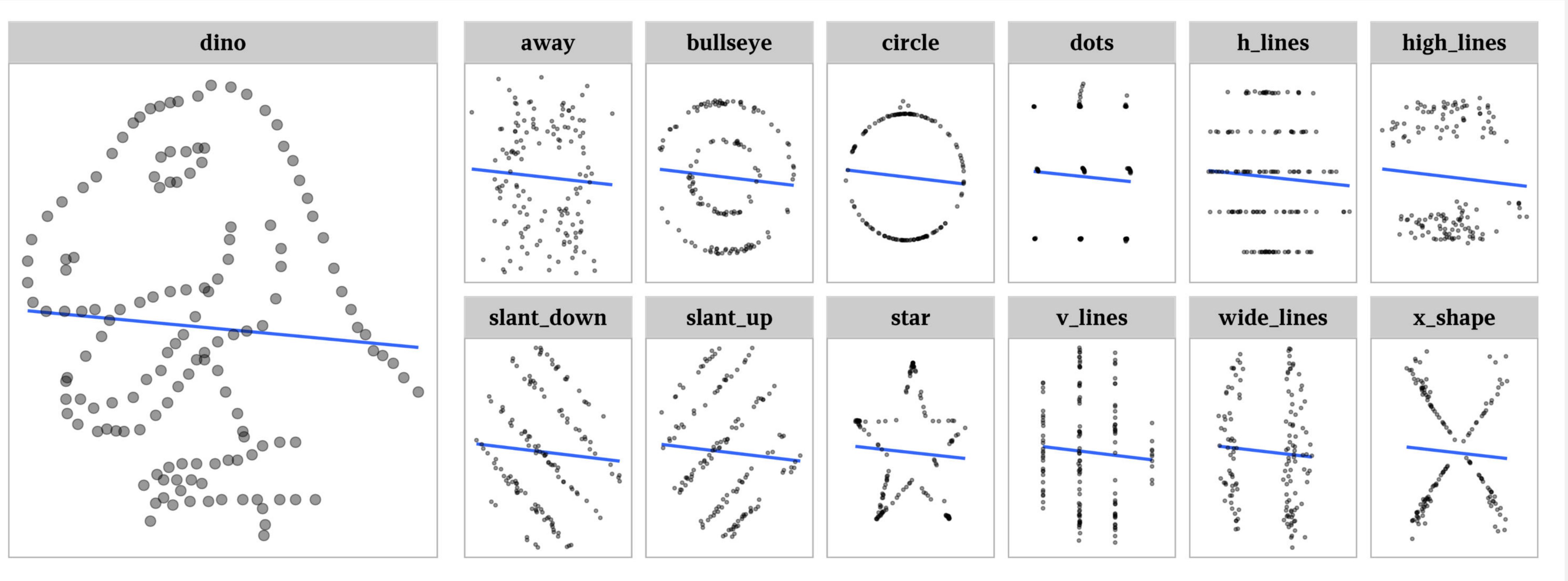




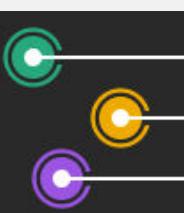
Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813 and Carte figurative des pertes successives en hommes de l'Armée qu'Annibal conduisit d'Espagne en Italie en traversant les Gaules (selon Polybe) von Charles Joseph Minard

- zeigt das Vorrücken der Truppen von **Hannibal** (218 v. Chr.) und **Napoleon** (1812-1813)
- wird oft als **die beste jemals gezeichnete statistische Grafik** bezeichnet





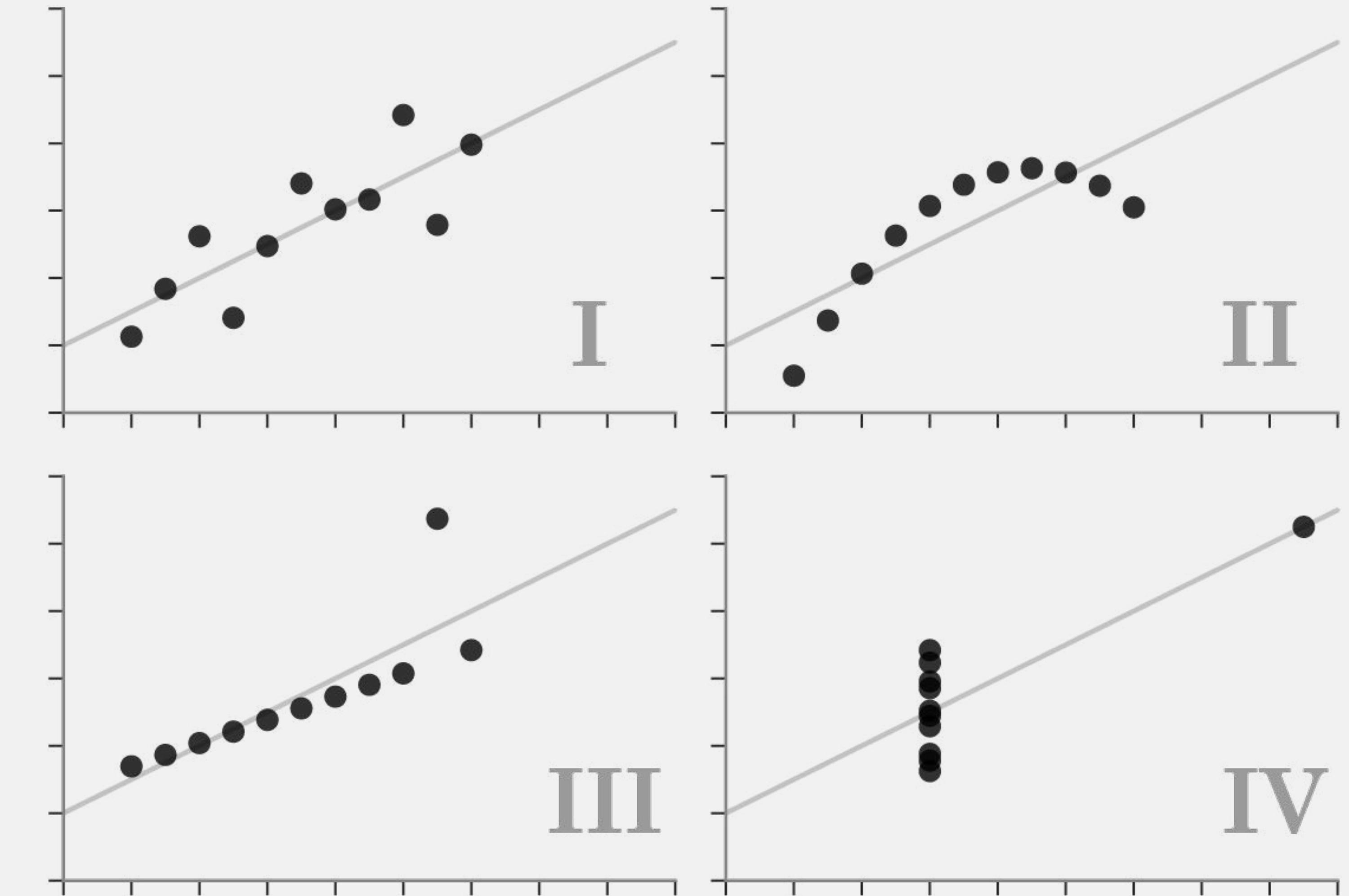
“Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing”
 by Justin Matejka & George Fitzmaurice, ACM SIGCHI Conference on Human Factors in Computing Systems 2017



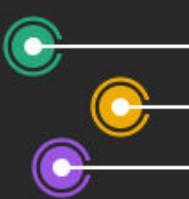
Anscombe's Quartet

**Each dataset has the same summary statistics
but are visually distinct.**

mean, standard deviation, and correlation

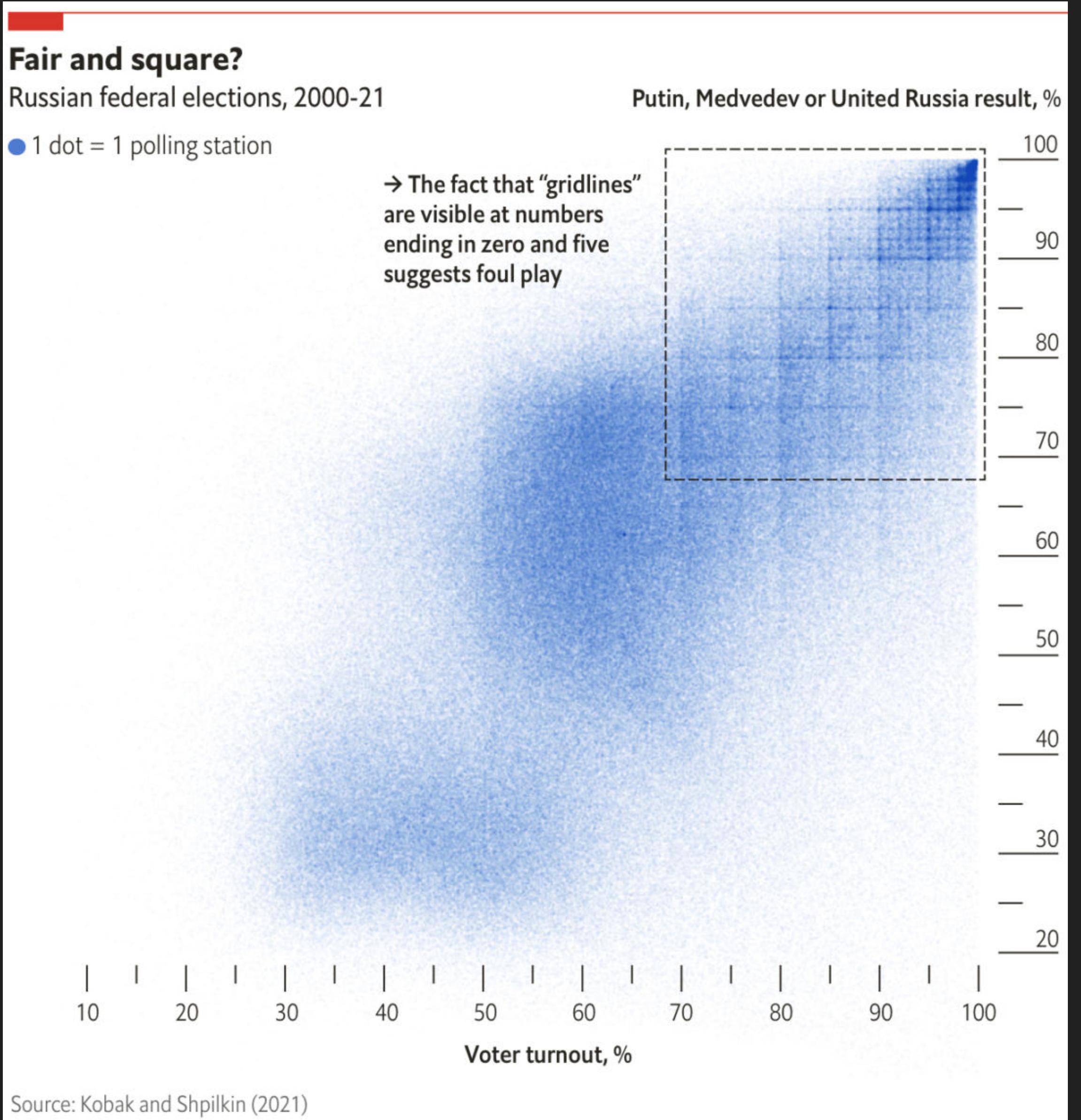


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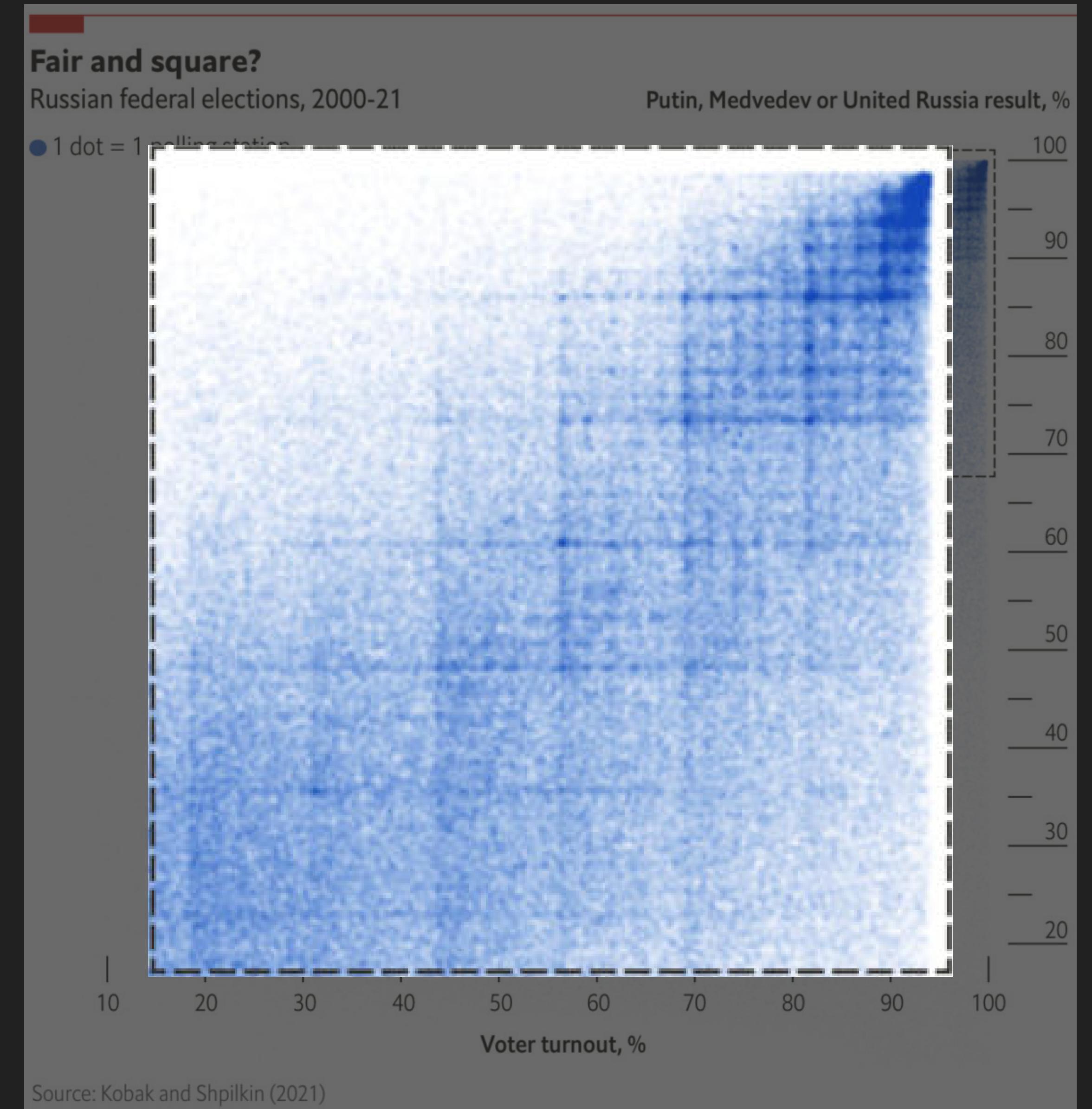
Visualize Your Data

“When Dmitry Kobak and Sergey Shpilkin [...] analysed the results, they found that **an unusually high number of turnout and vote-share results were multiples of five** (eg, 50%, 55%, 60%), a tell-tale **sign of manipulation.**”

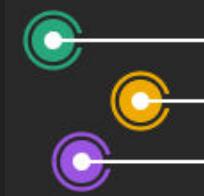
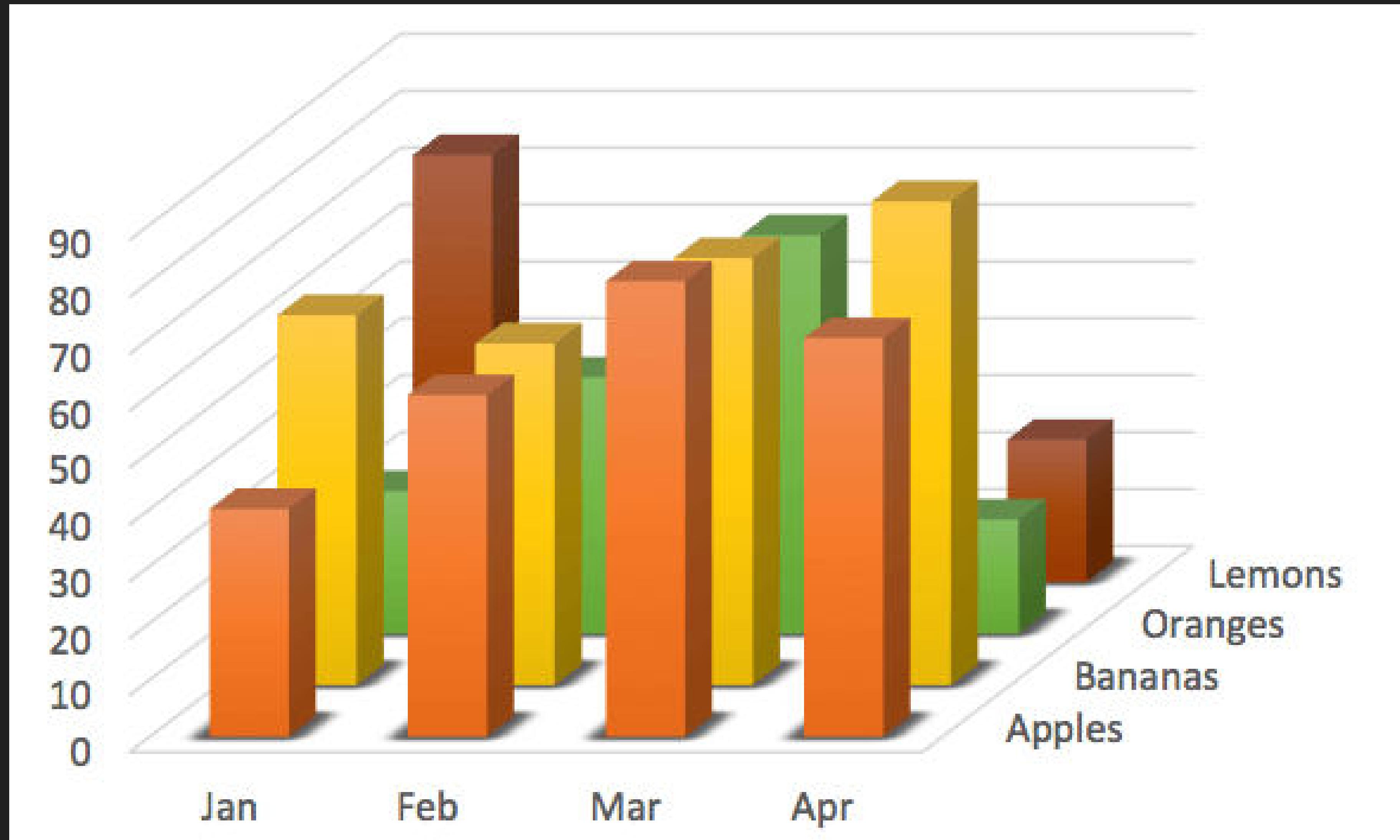


Visualize Your Data

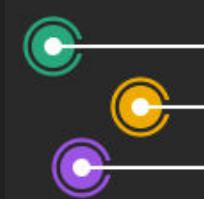
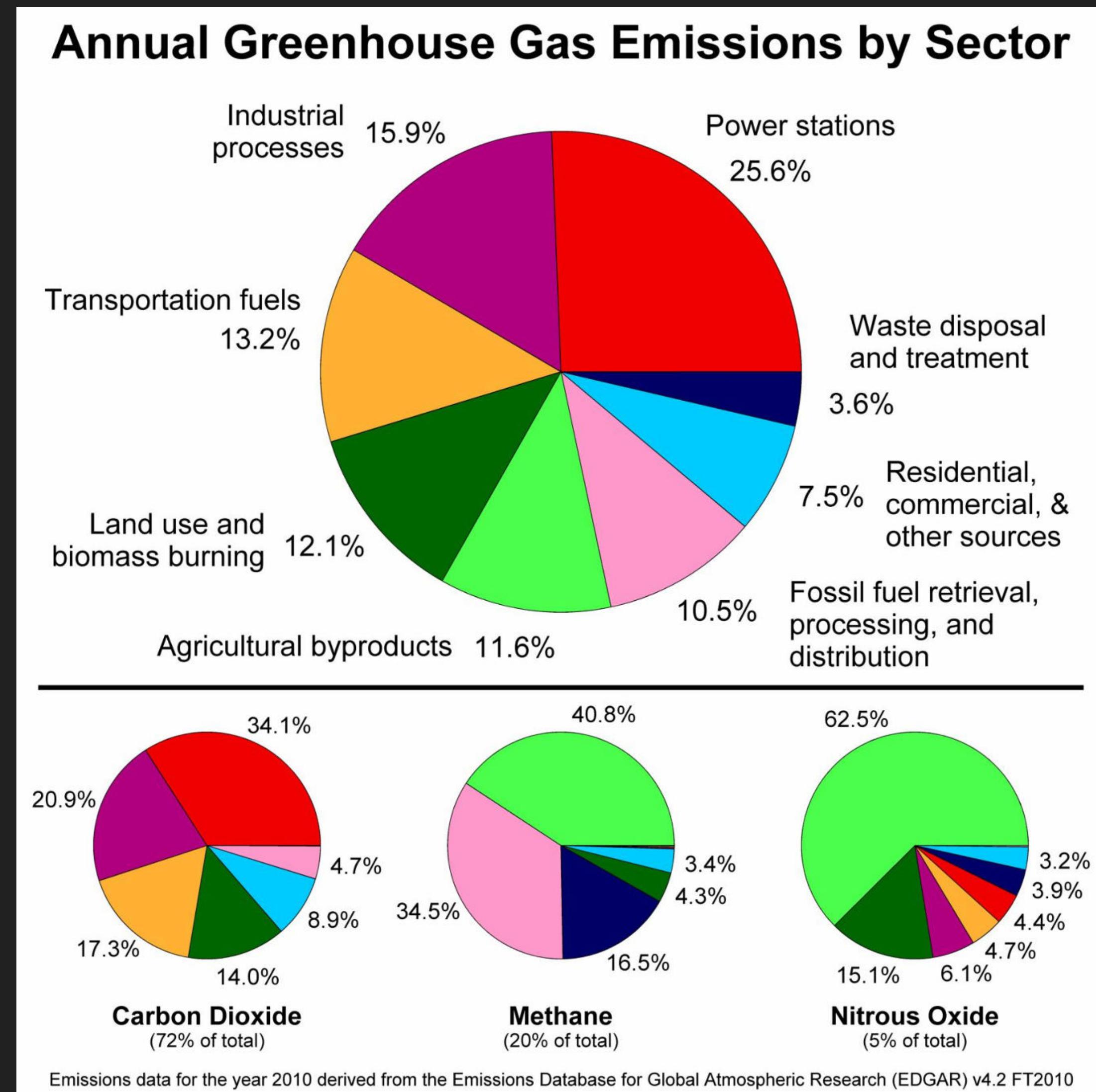
“When Dmitry Kobak and Sergey Shpilkin [...] analysed the results, they found that **an unusually high number of turnout and vote-share results were multiples of five** (eg, 50%, 55%, 60%), a tell-tale **sign of manipulation.**”



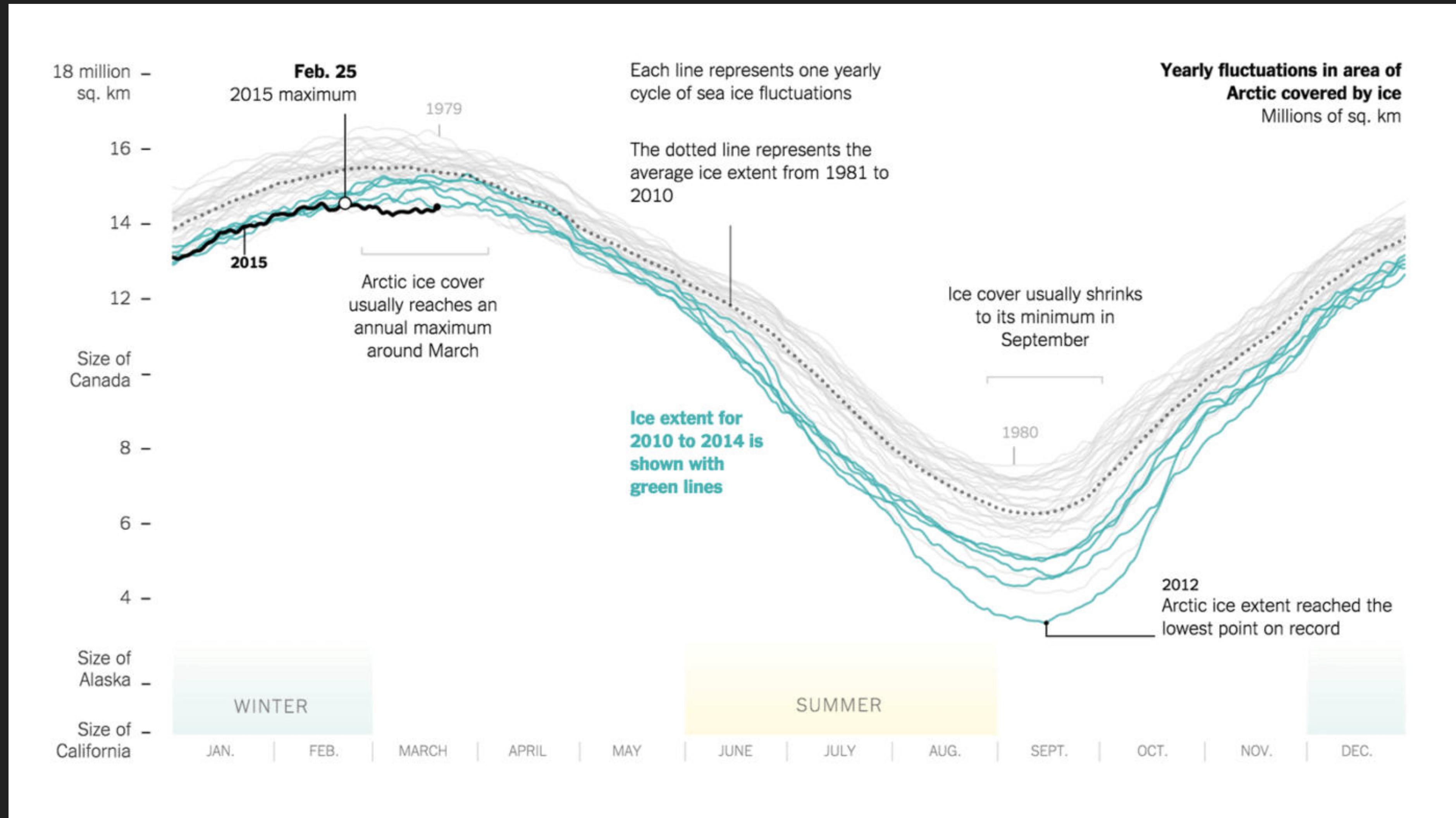
What makes it a bad data visualization?



What makes it a bad data visualization?



What makes it a good data visualization?



“Yearly Fluctuations in Area of Arctic Covered by Ice” by Derek Watkins (New York Times)



What makes it a good data visualization?

- ➔ **INFORMATION** (integrity)
- ➔ **STORY** (interestingness)
- ➔ **GOAL** (usefulness)
- ➔ **VISUAL FORM** (beauty)



Typology of Information Graphics

nach Juuso Koponen & Jonatan Hildén, "Data Visualization Handbook" (2020), Seite 25

Is the **information** conceptual or measurable?

☞ **Type of information:** depict conceptual information <> convert information into visual forms

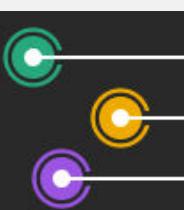
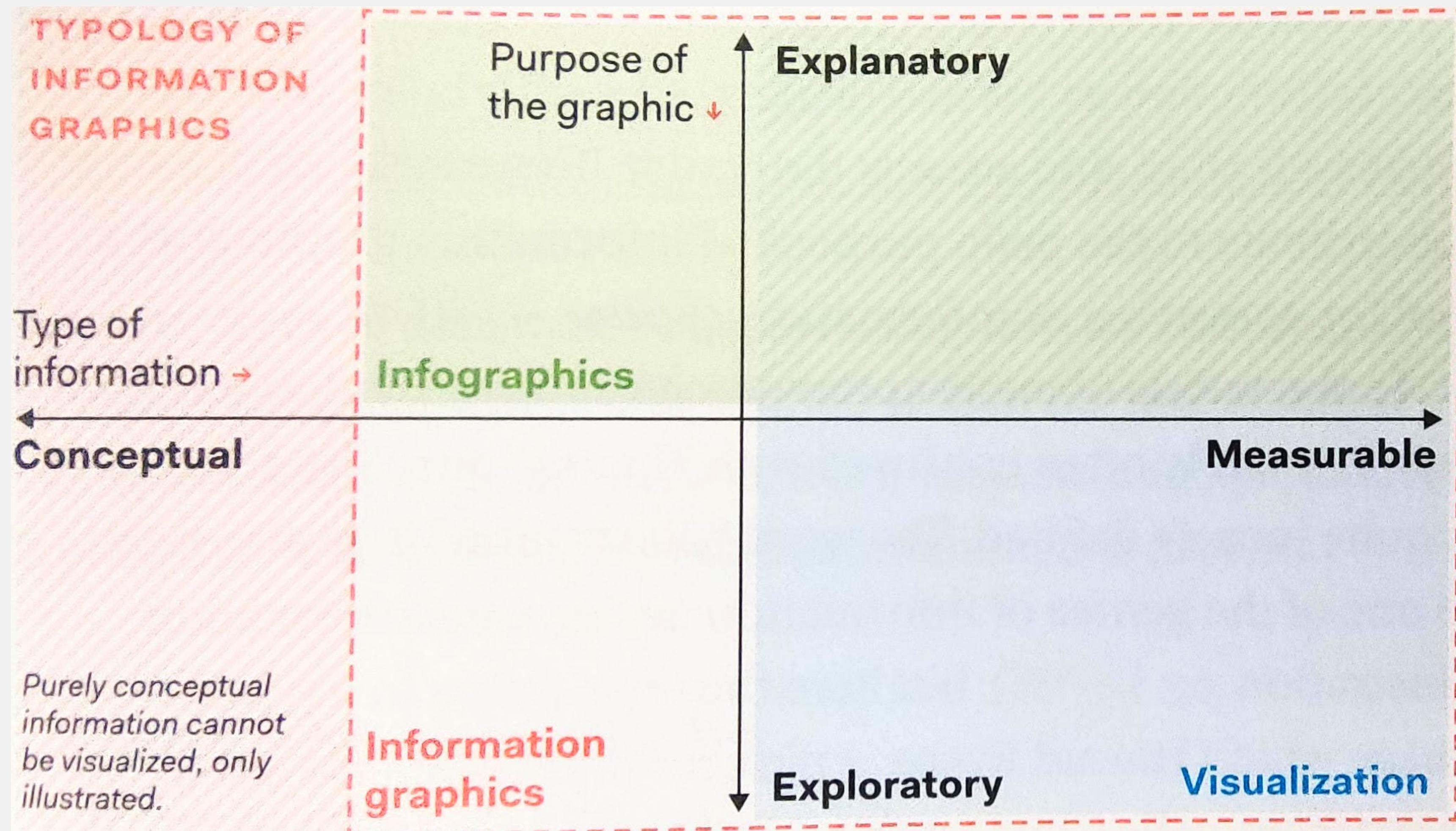
Is the **purpose** to explore or to explain the information?

☞ **Purpose of the graphic:** facilitate discovery <> communicate information



Typology of Information Graphics

nach Juuso Koponen & Jonatan Hildén, "Data Visualization Handbook" (2020), Seite 25



"Visualizations can be designed and experienced in various ways, by people of various backgrounds, and in various circumstances. That's why **reflecting on the purpose of a visualization is paramount before we design it—or before we critique it.**"

Alberto Cairo

Auszug aus dem Vorwort zu "Data Sketches" von Nadieh Bremer & Shirley Wu (CRC Press 2021)



cedricscherer.com



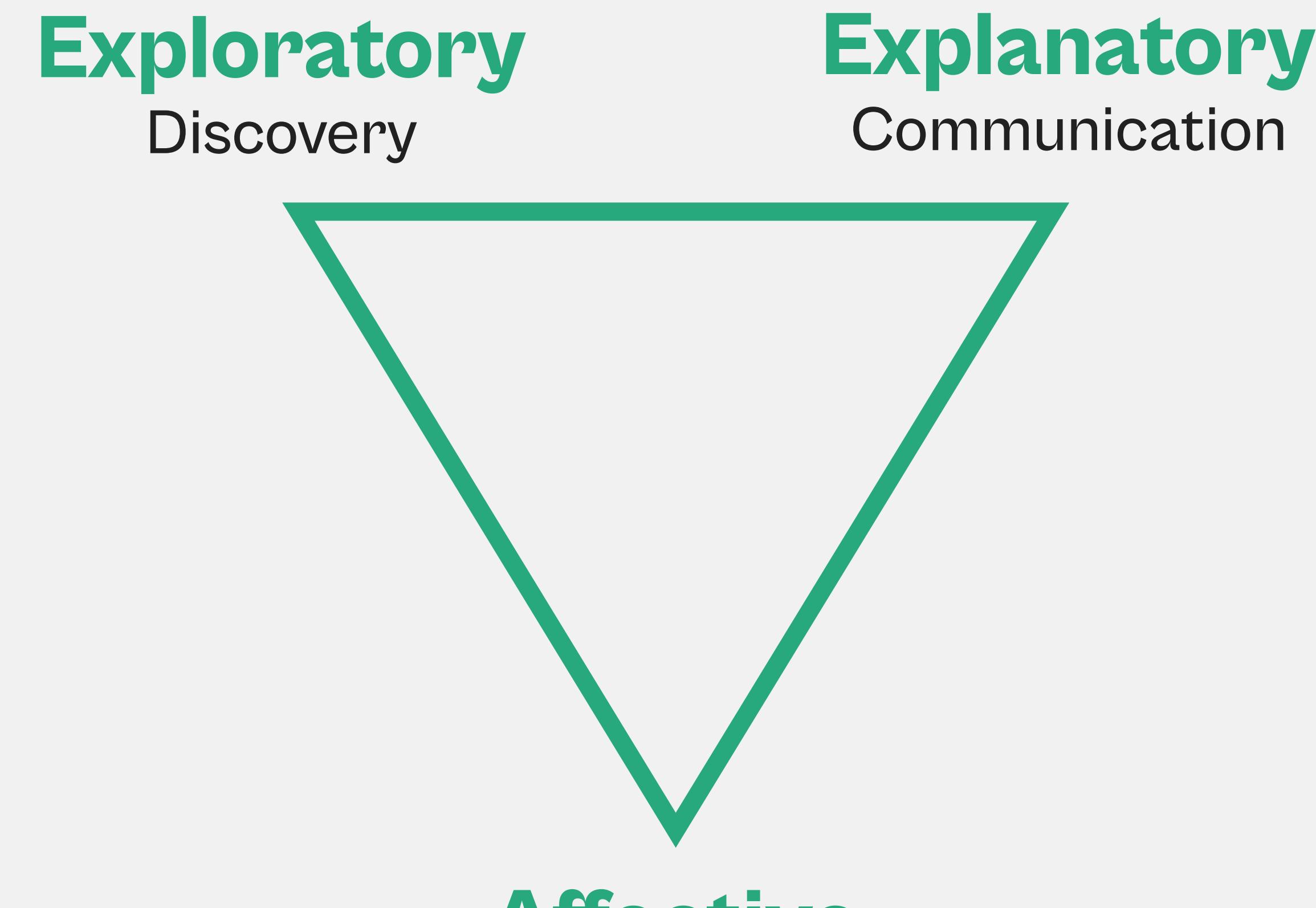
@CedScherer



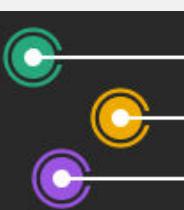
z3tt



What is the purpose?



*The “Vertices of Visualization” by Alberto Cairo,
personal communication (modified version)*



What is the purpose?

Exploratory
Discovery

Explanatory
Communication

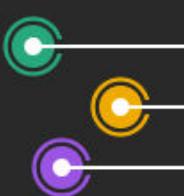
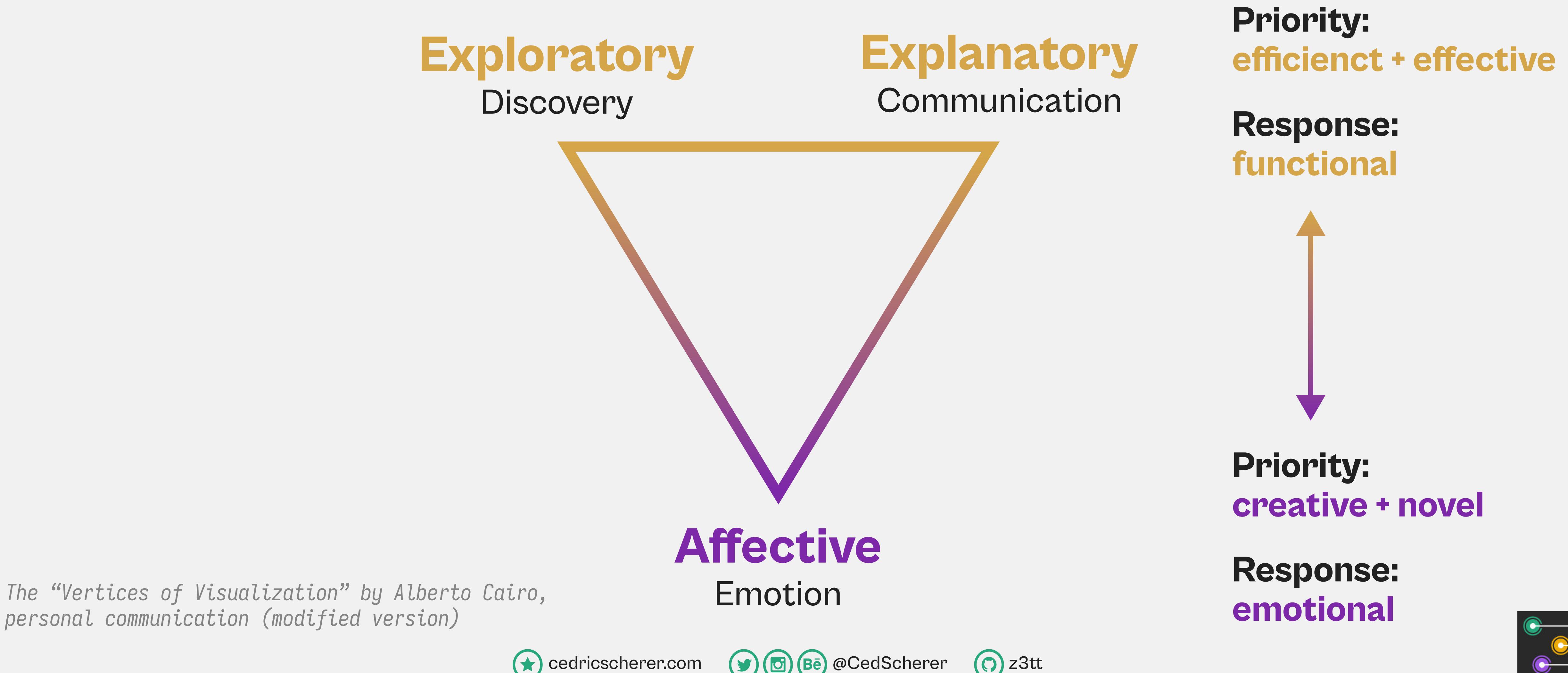
Priority:
efficient + effective
Aim:
functional



*The “Vertices of Visualization” by Alberto Cairo,
personal communication (modified version)*



What is the purpose?



How to Steer Clear of Common Blunders When Working
with Data and Presenting Analysis and Visualizations

AVOIDING DATA PITFALLS



BEN JONES

Founder and CEO, Data Literacy

WILEY



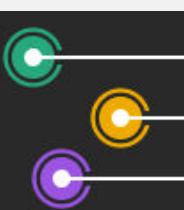
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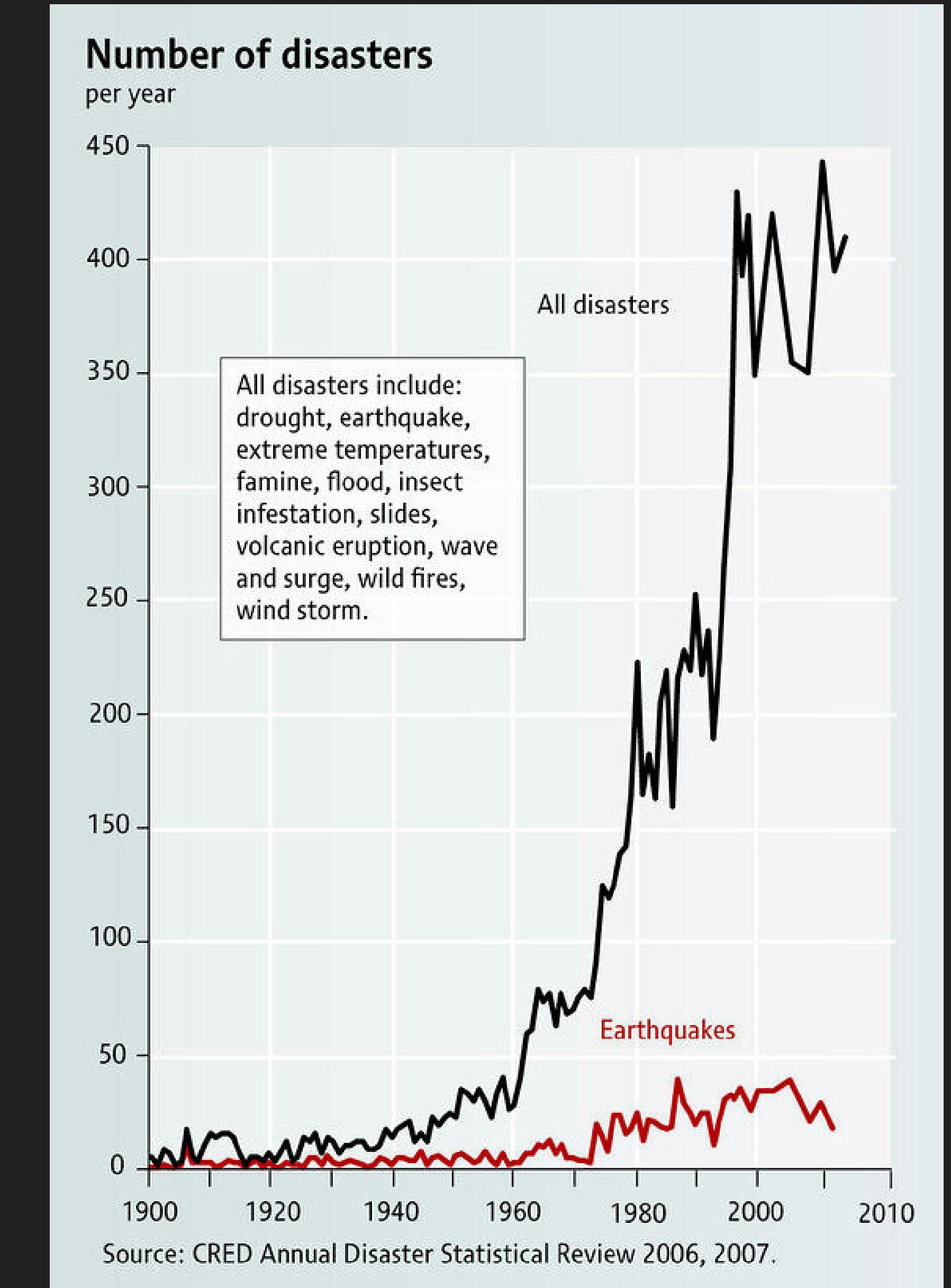
z3tt



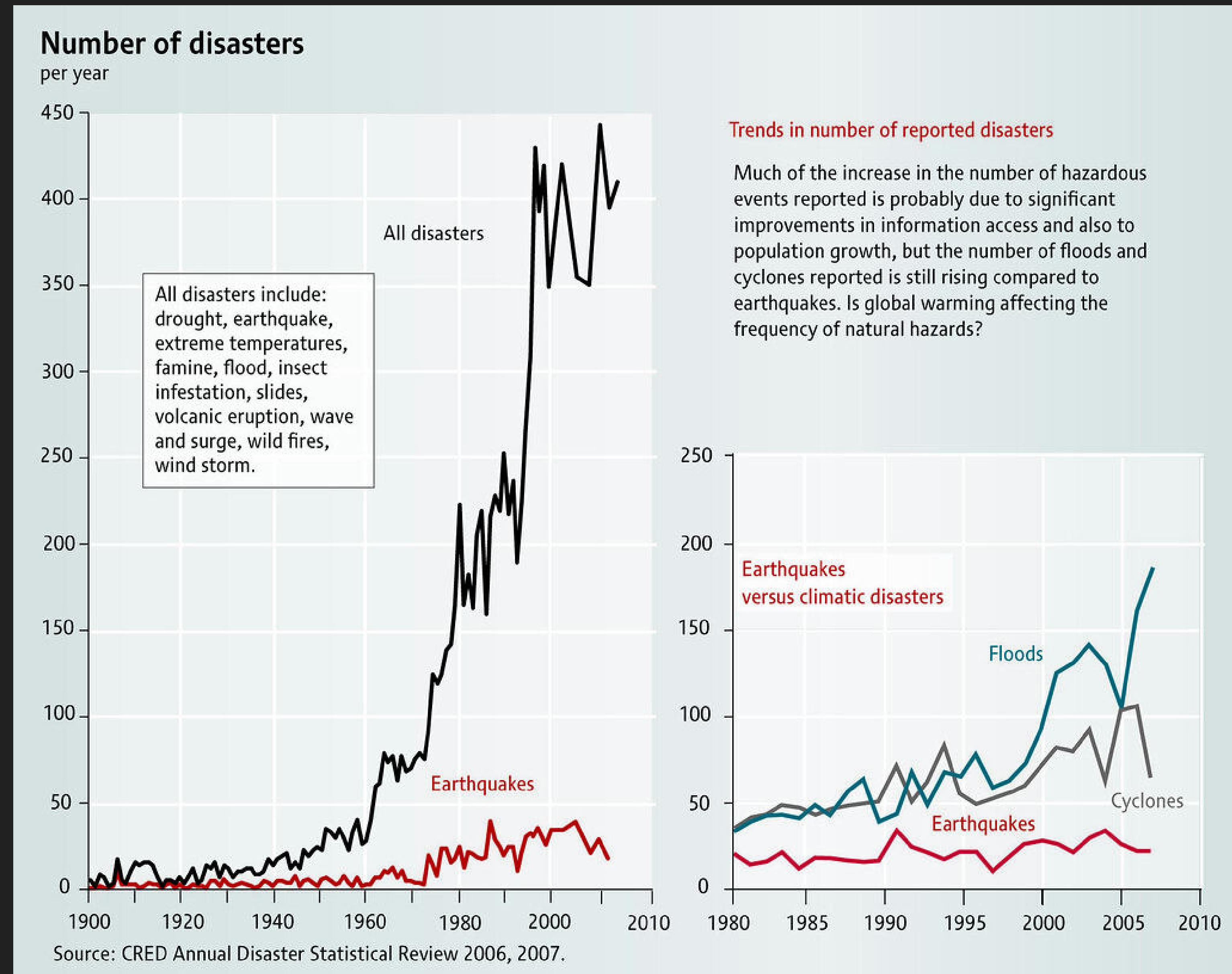
Our data is never a perfect reflection of the real world.

- **only a subset:** not crime but reported crime
- **collected by humans:** guesstimation, precision and errors
- **collected by machines:** precisions and errors

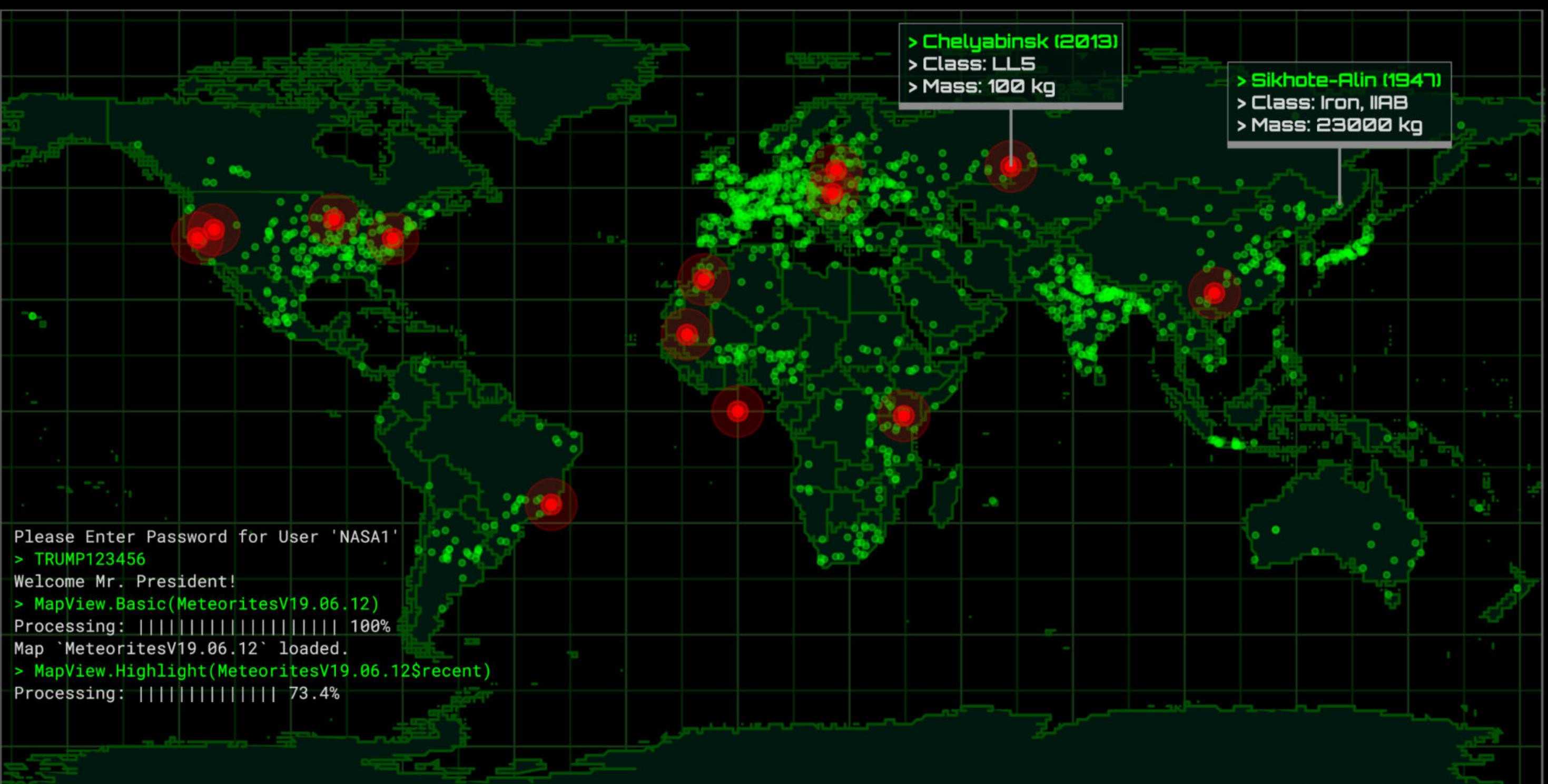




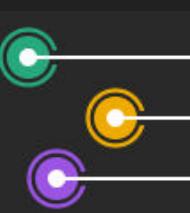
**“Much of the increase
of hazardous events
reported is probably
due to significant
improvements in
information access”**



SPACE OBSERVER 3000 X V3.5.1

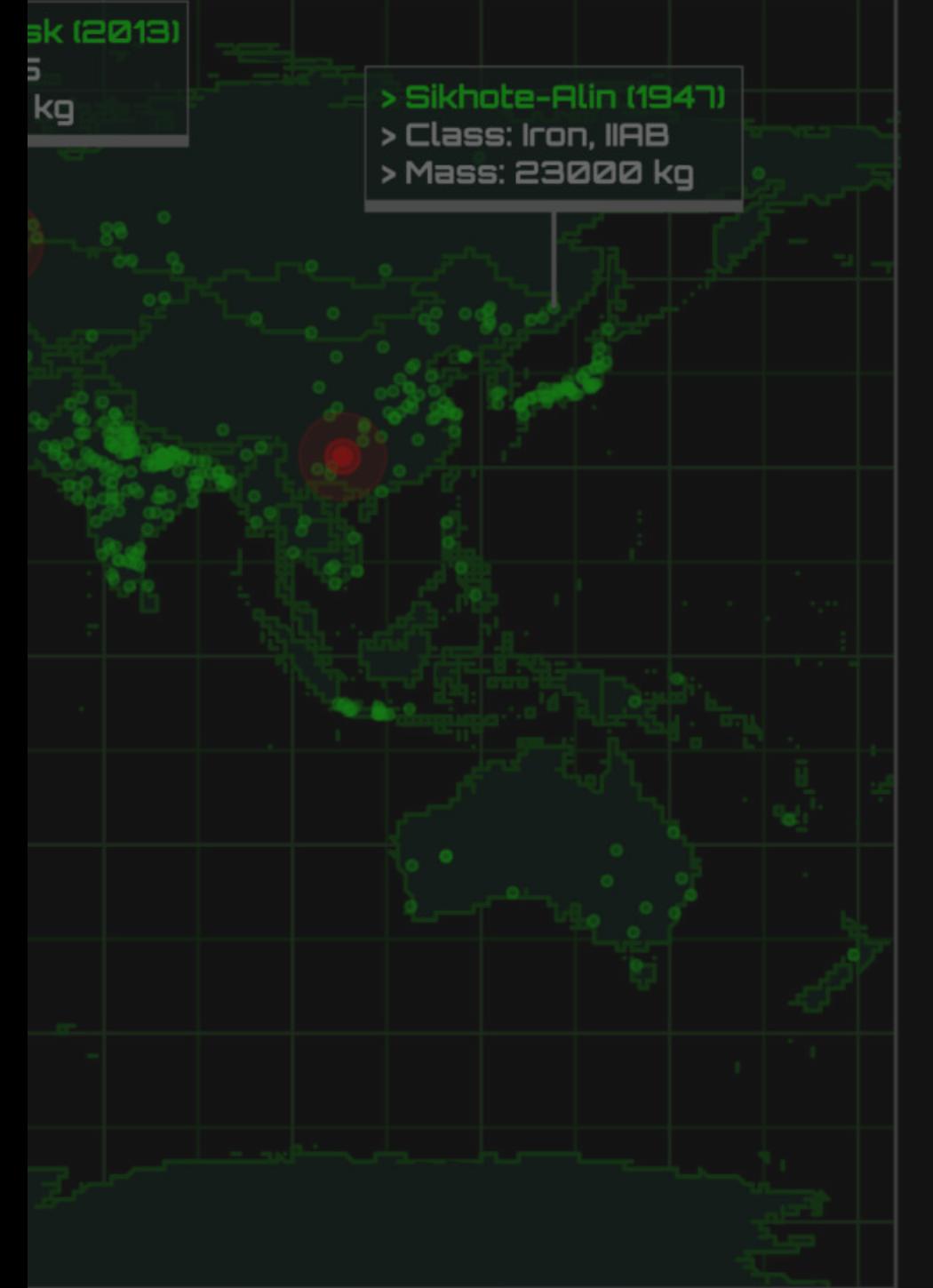
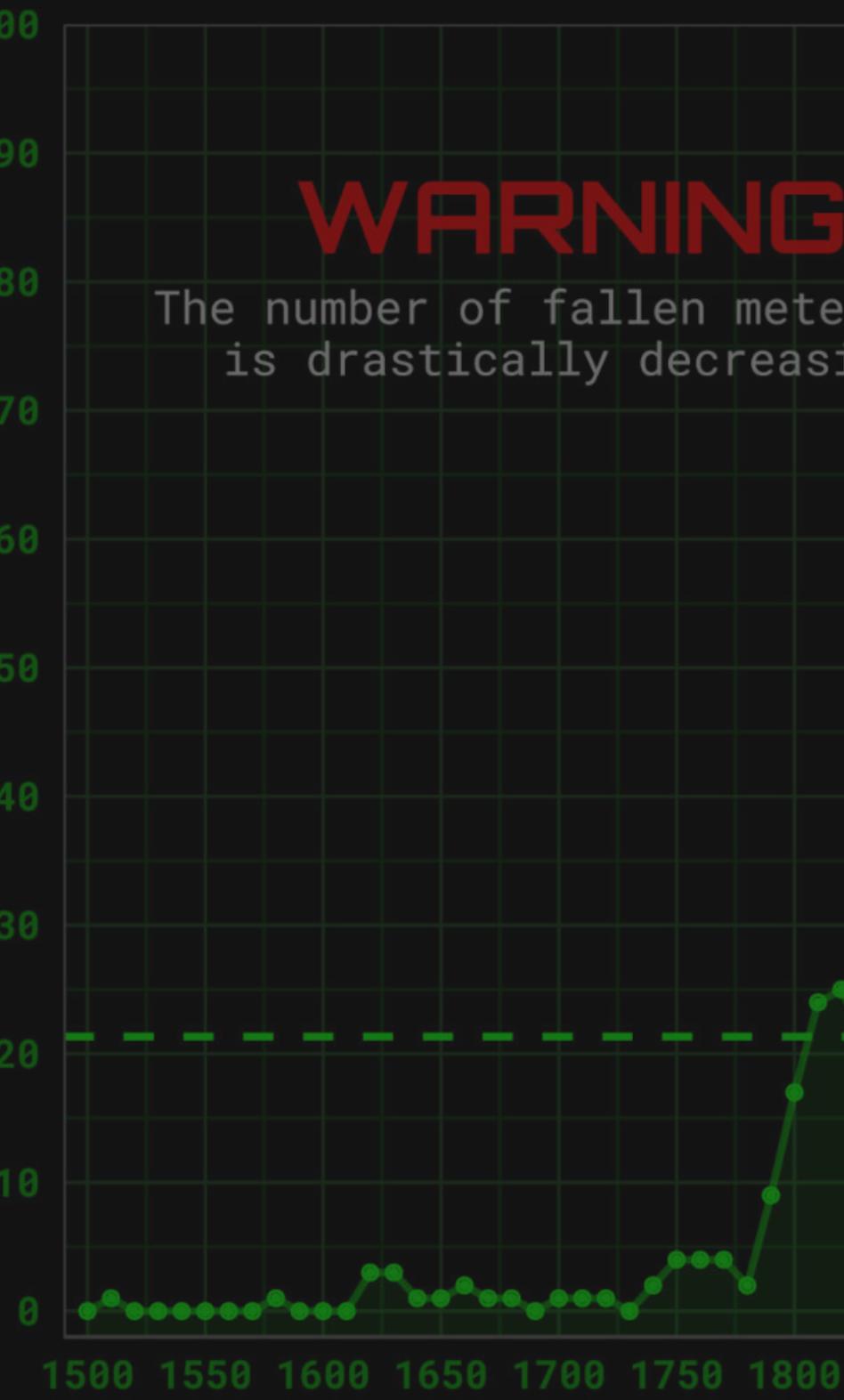


Provided by Cédric Scherer & National Aeronautics and Space Administration (NASA)



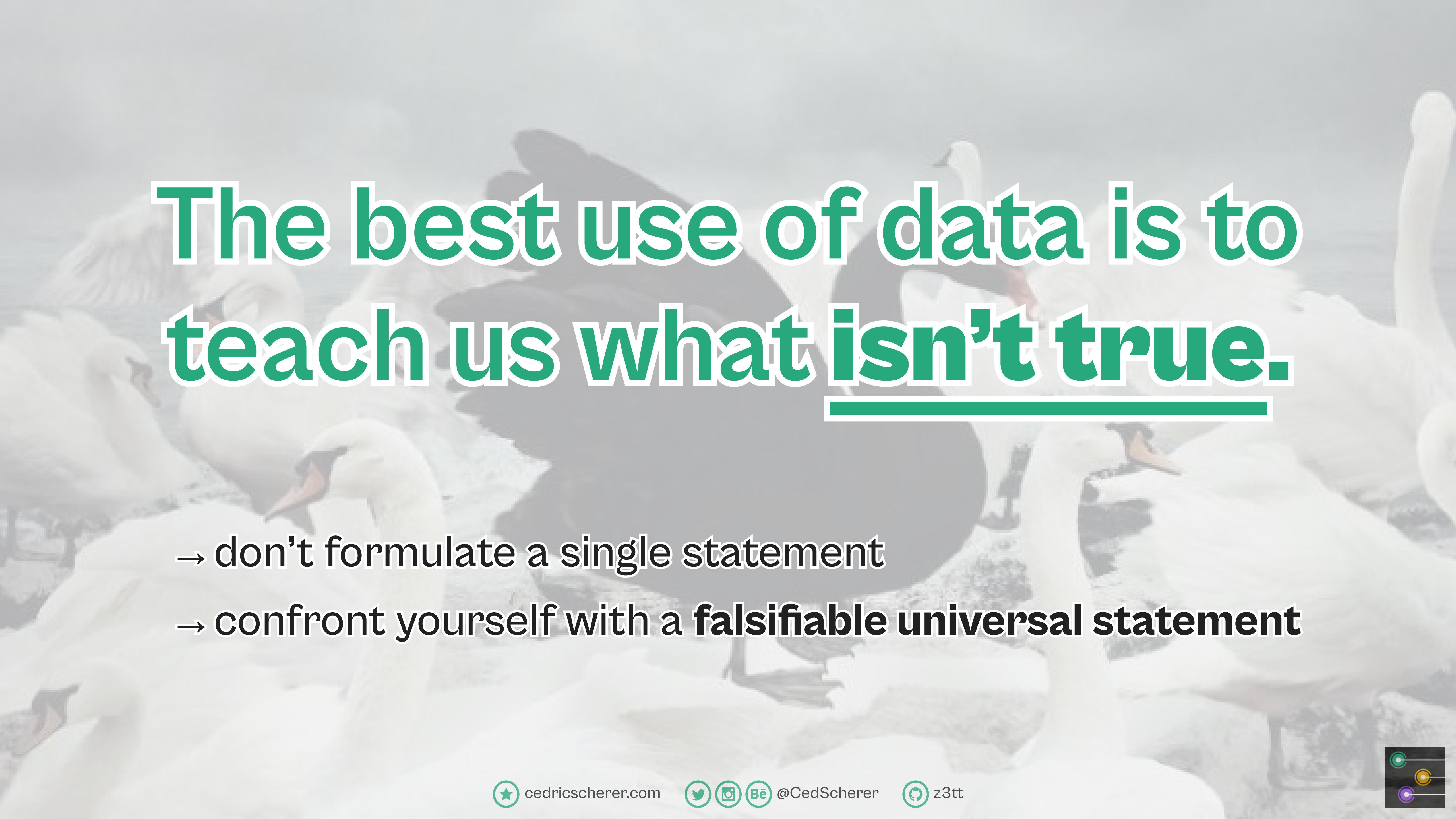
WARNING

The number of fallen meteorites
is drastically decreasing!



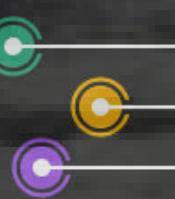
and Space Administration (NASA)

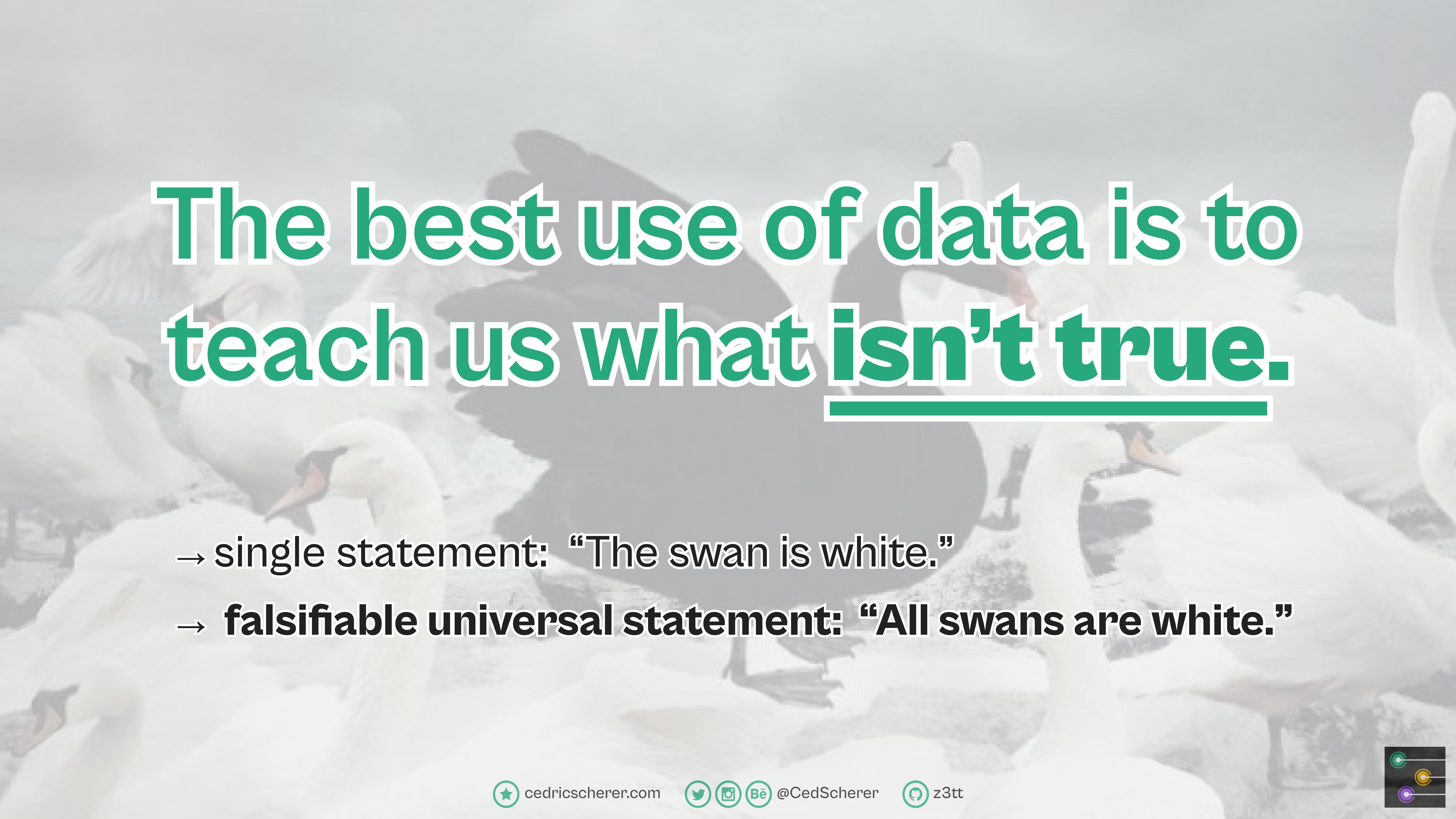




The best use of data is to
teach us what isn't true.

- don't formulate a single statement
- confront yourself with a **falsifiable universal statement**





The best use of data is to
teach us what isn't true.

- single statement: “The swan is white.”
- **falsifiable universal statement:** “All swans are white.”





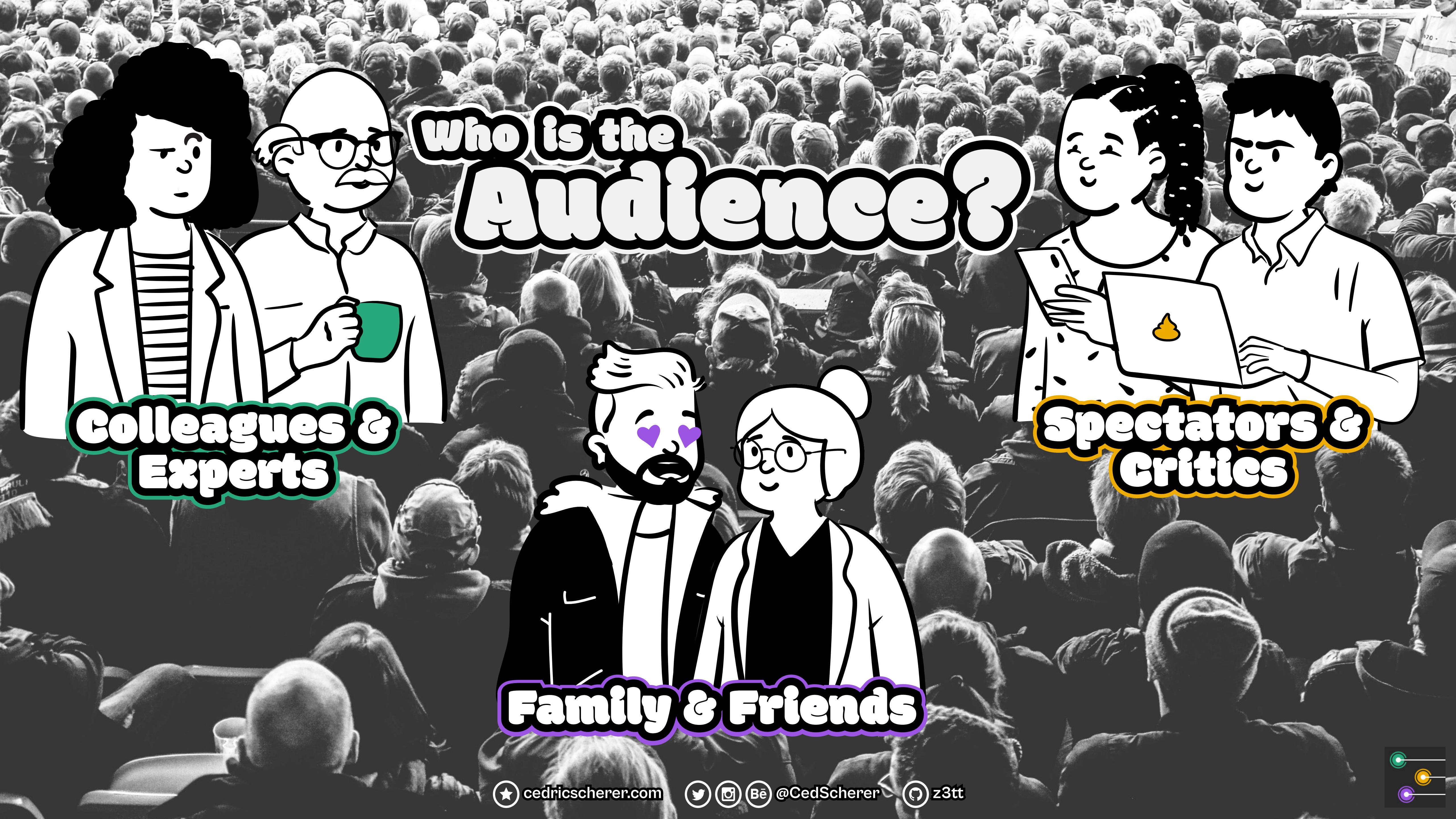
the Audience





Who is the Audience?





Who is the Audience?



Colleagues &
Experts

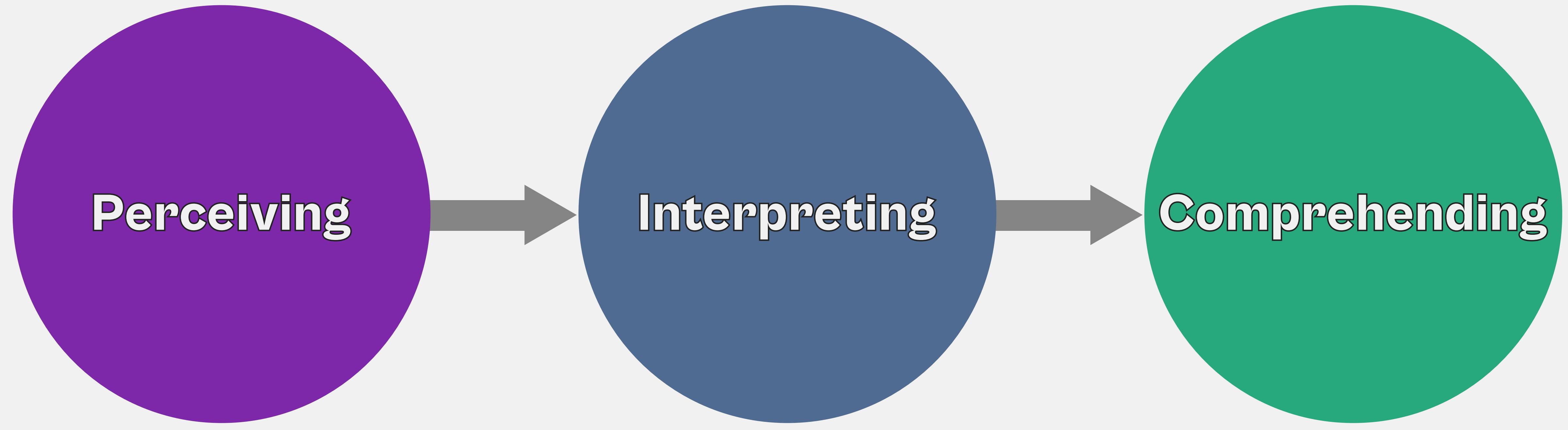


Spectators &
Critics



Family & Friends





Visualiser Control

Viewer Control

Scheme by Andy Kirk



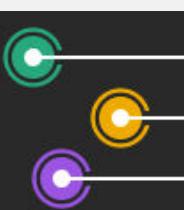
cedricscherer.com

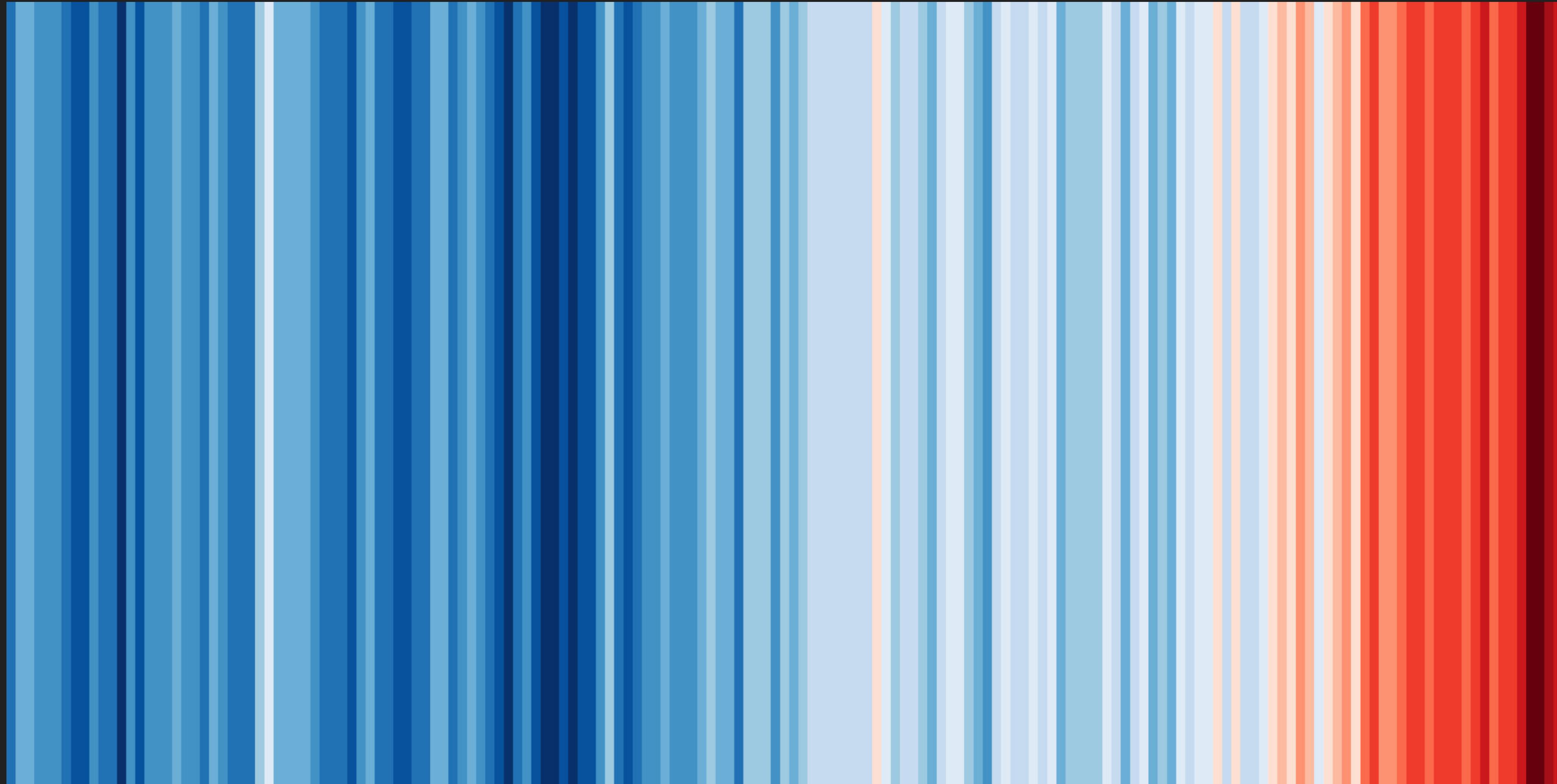


@CedScherer

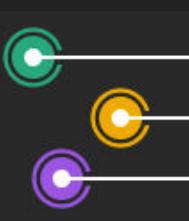


z3tt

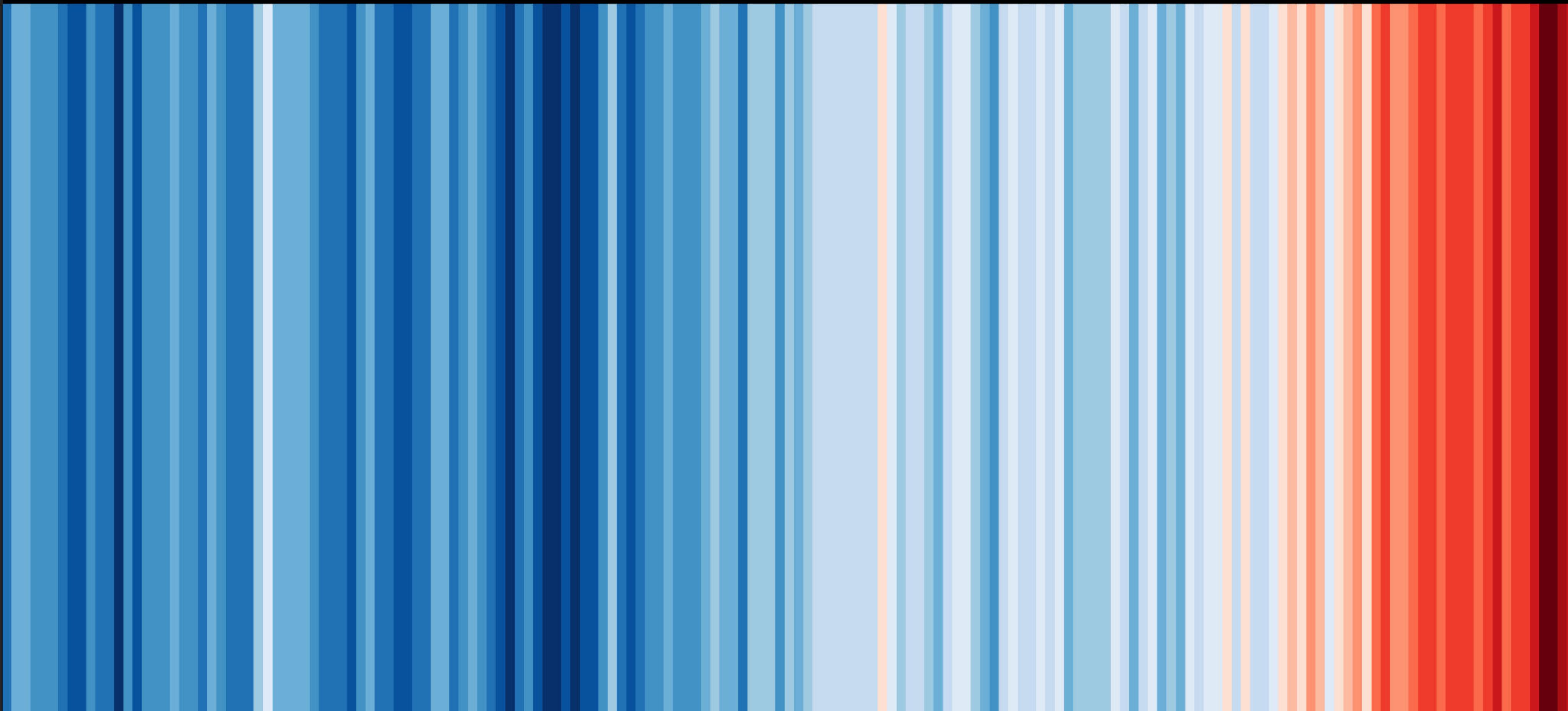




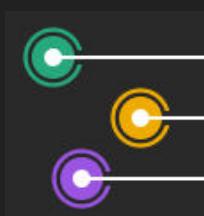
Warming Stripes by Ed Hawkins



Global temperature change (1850-2019)



Warming Stripes by Ed Hawkins



FAQ : Frequently asked questions

What are these graphics?

What do the graphics show?

Why are there no numbers on the graphics?

» These graphics are specifically designed to be as simple as possible, and to start conversations about our warming world and the risks of climate change. There are numerous sources of information which provide more specific details about how temperatures have changed, so these graphics fill a gap and enable communication with minimal scientific knowledge required to understand their meaning.

1

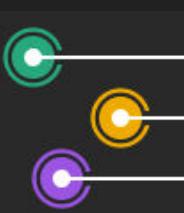
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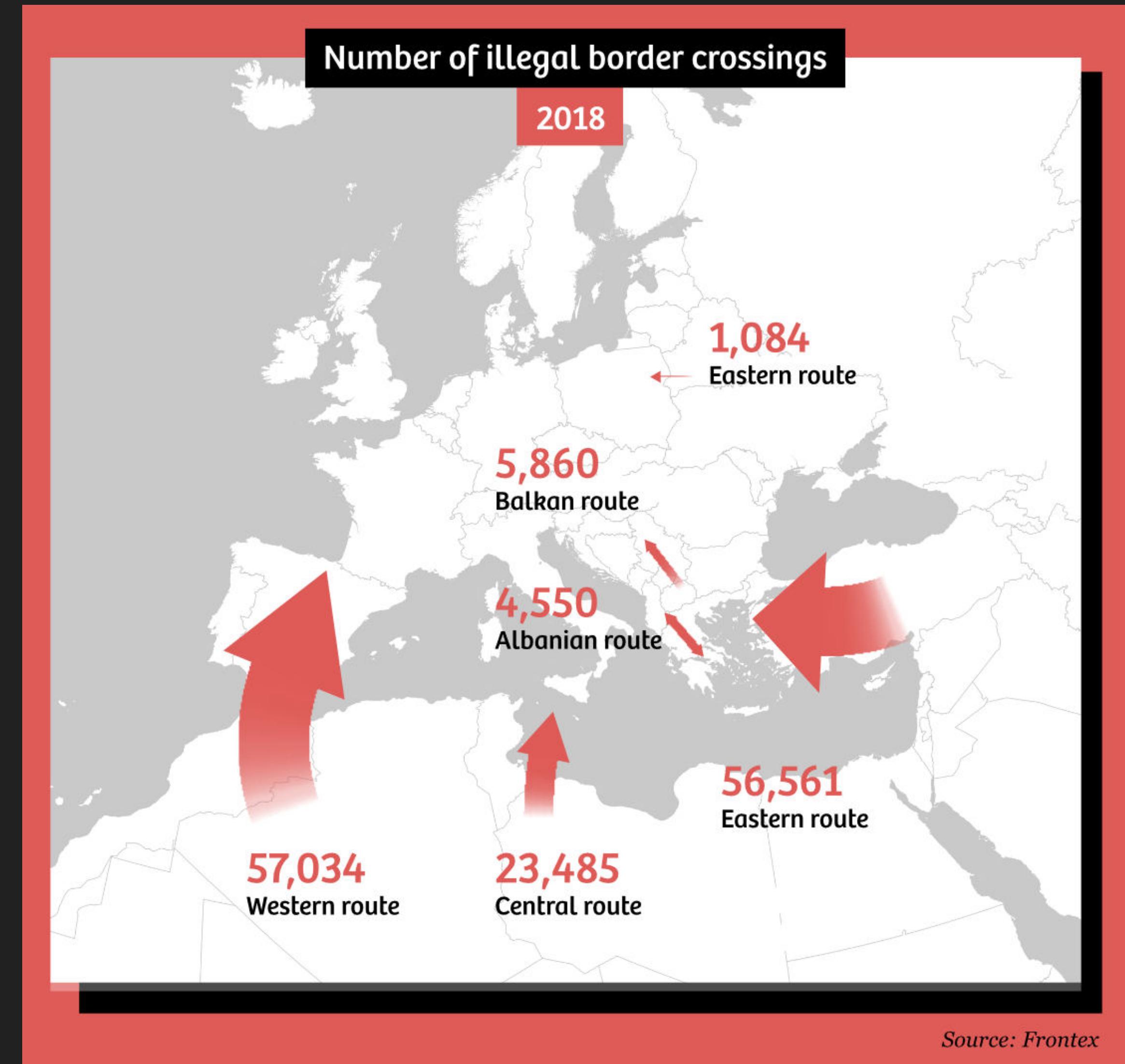
showyourstripes.info/faq



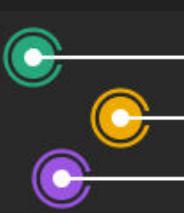
These graphics are specifically
designed to [...] start conversations
about our warming world and
the risks of climate change.

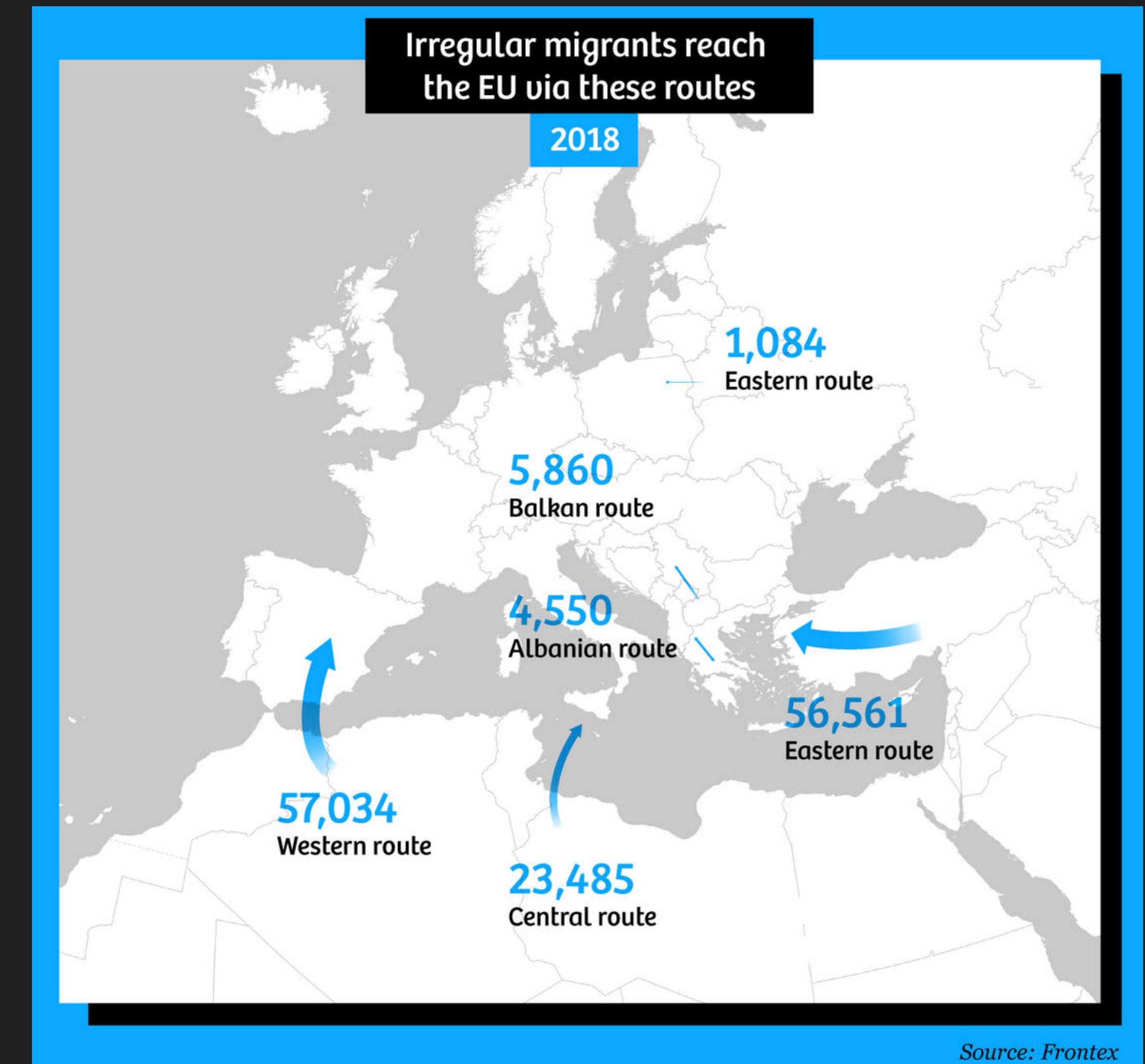
» These graphics are specifically designed to be as simple as possible, and to start conversations about our warming world and the risks of climate change. There are numerous sources of information which provide more specific details about how temperatures have changed, so these graphics fill a gap and enable communication with minimal scientific knowledge required to understand their meaning.





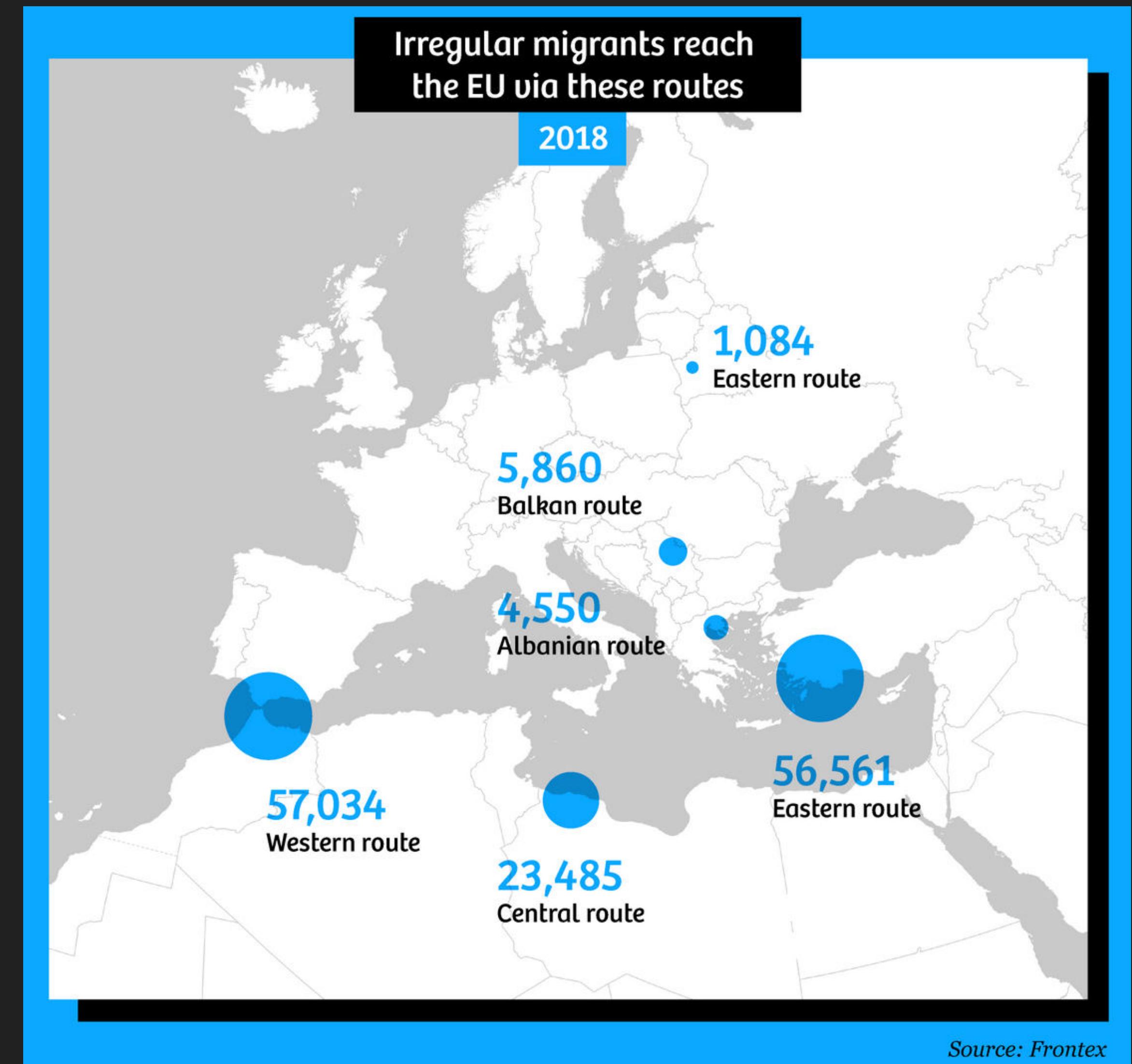
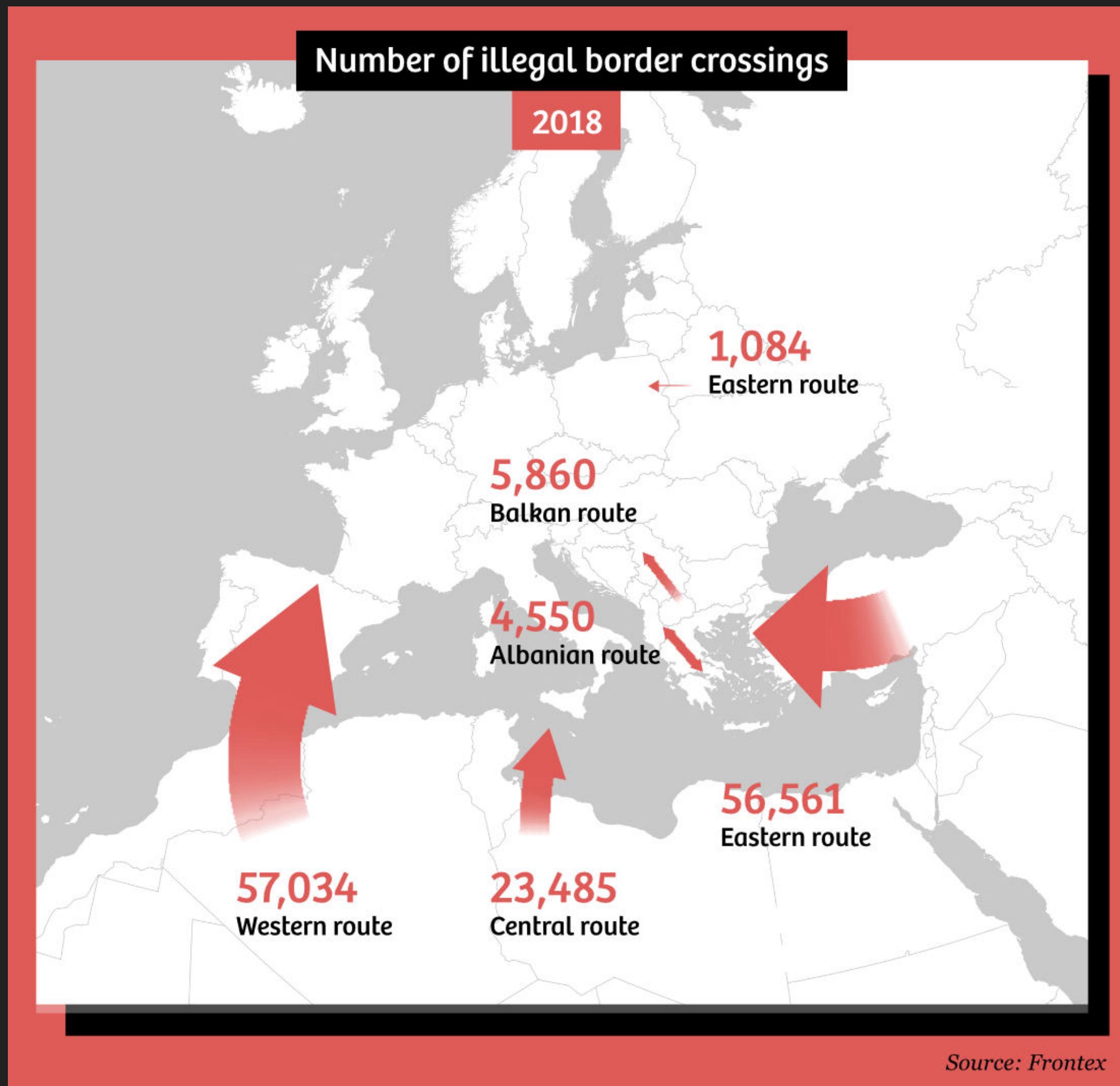
[“How maps in the media make us more negative about migrants” by Maite Vermeulen, Leon de Korte & Henk van Houtum](#)





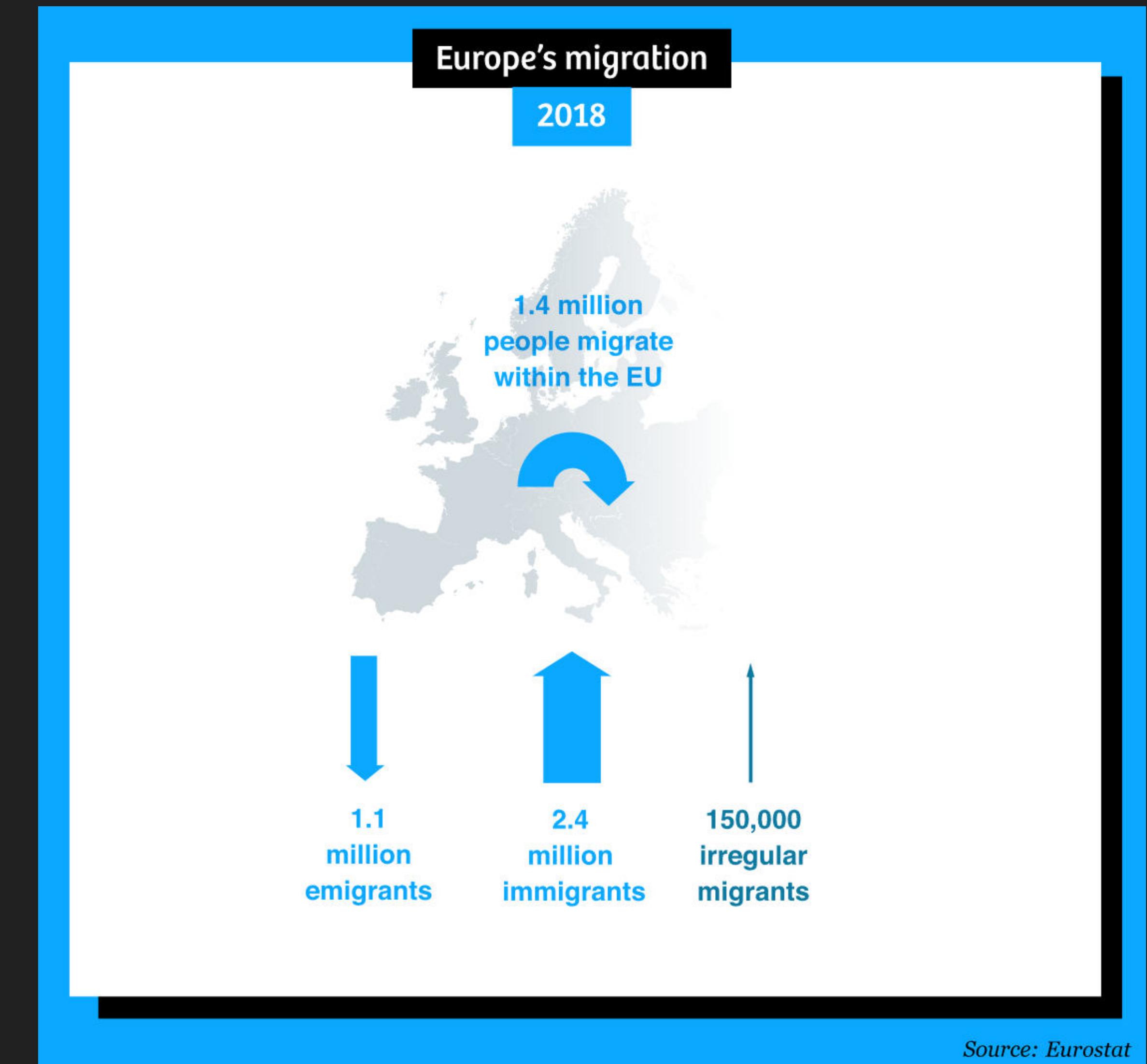
“How maps in the media make us more negative about migrants” by Maite Vermeulen, Leon de Korte & Henk van Houtum





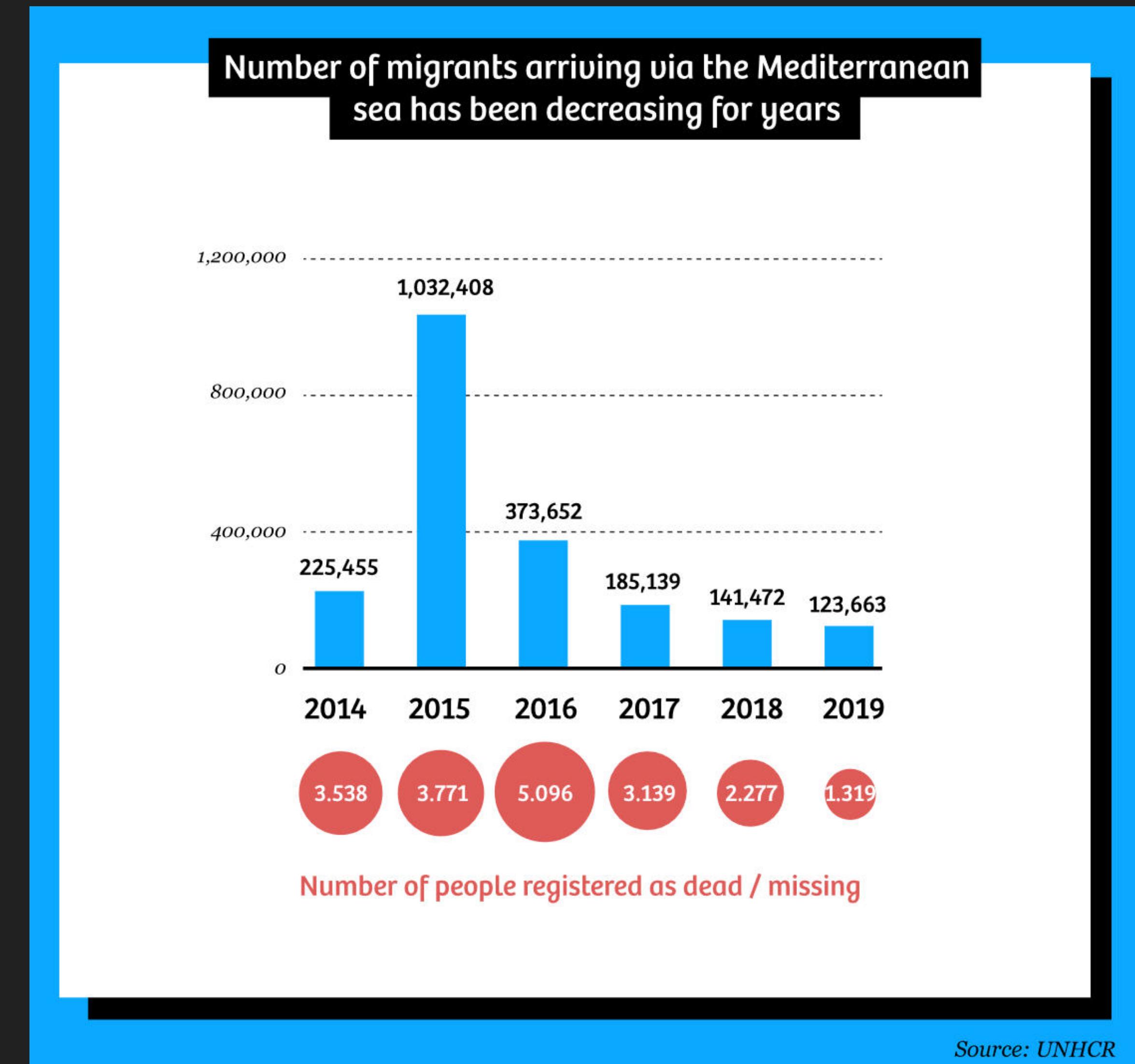
“How maps in the media make us more negative about migrants” by Maite Vermeulen, Leon de Korte & Henk van Houtum





“How maps in the media make us more negative about migrants” by Maite Vermeulen, Leon de Korte & Henk van Houtum

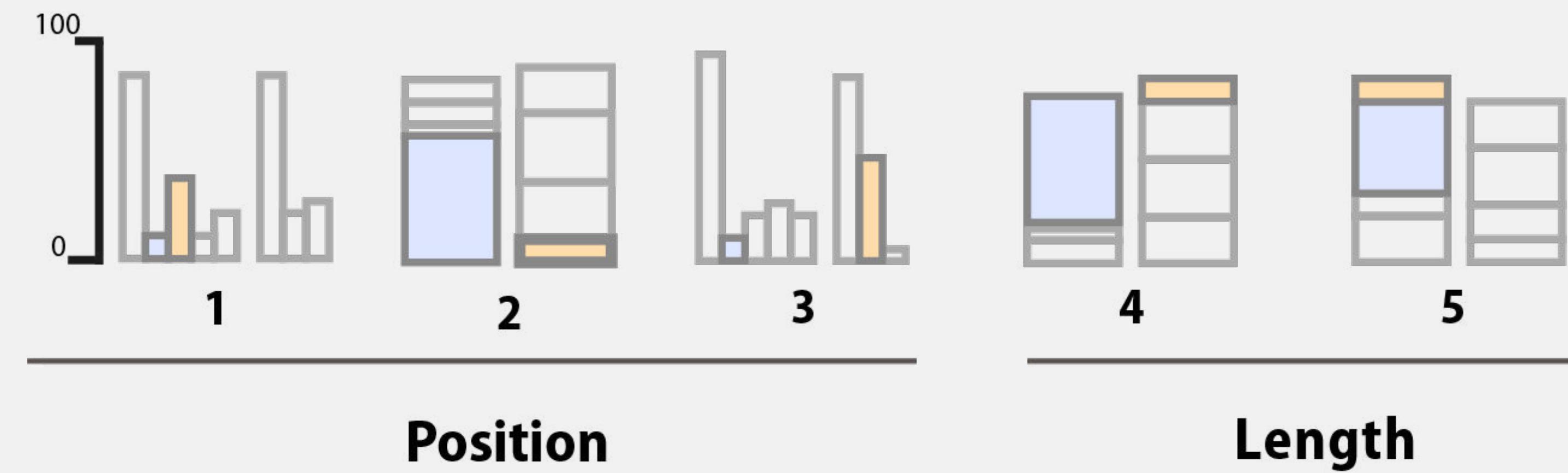
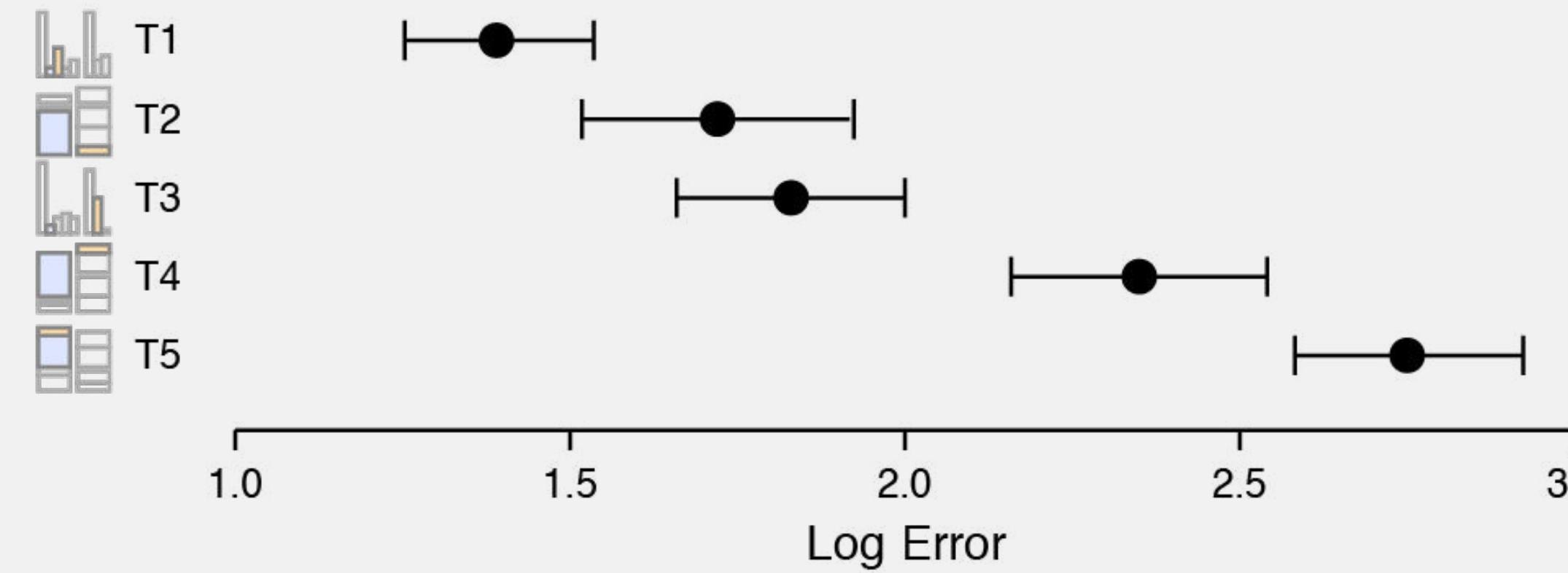




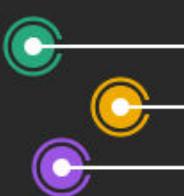
“How maps in the media make us more negative about migrants” by Maite Vermeulen, Leon de Korte & Henk van Houtum



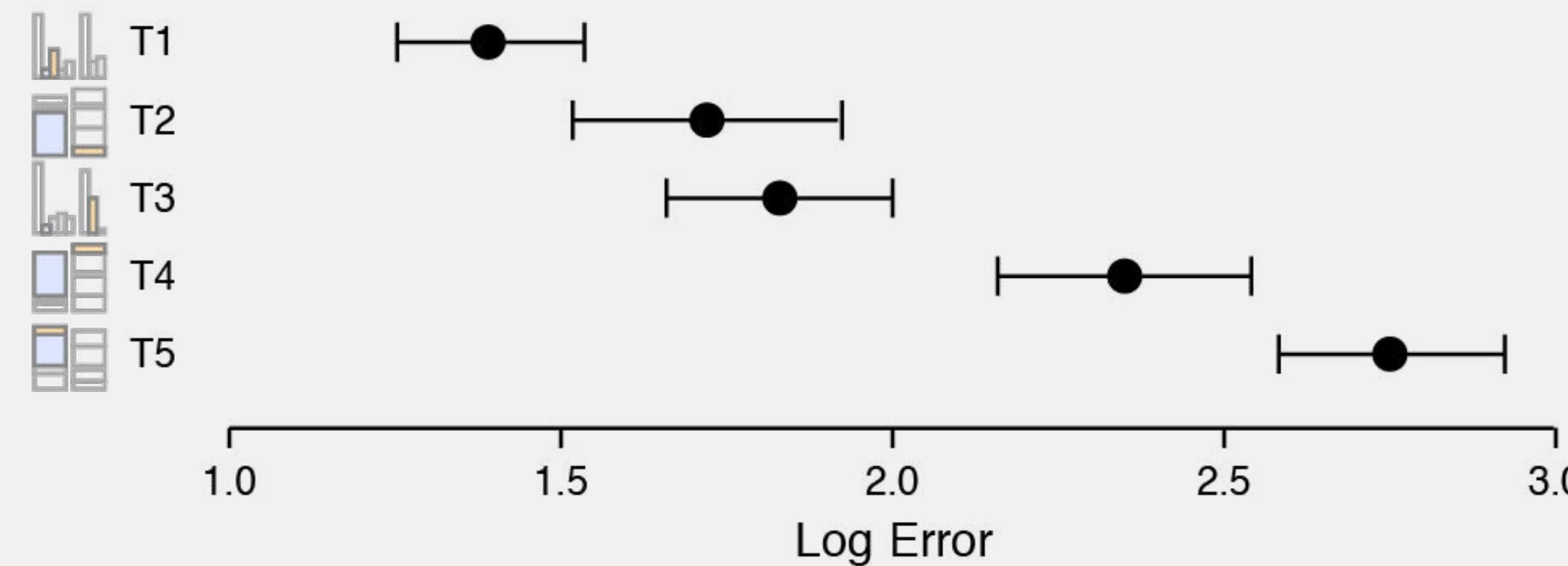
Cleveland & McGill's Results



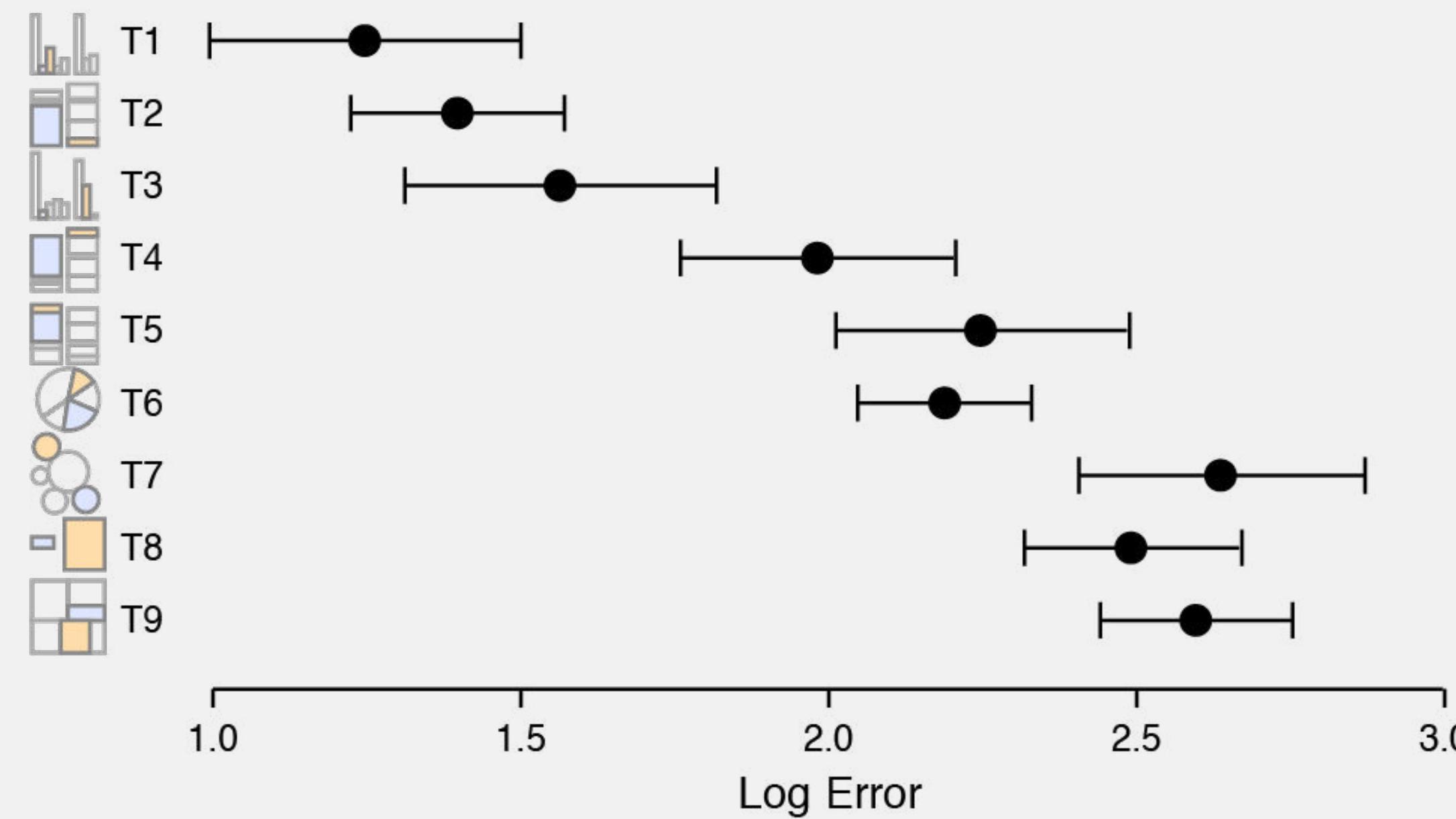
Quelle: Kieran Healy's ["Data Visualization: A Practical Introduction"](#)
Ergebnisse basierend auf Heer & Bostock sowie Cleveland & McGill



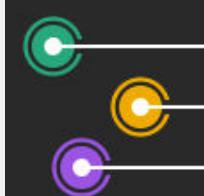
Cleveland & McGill's Results



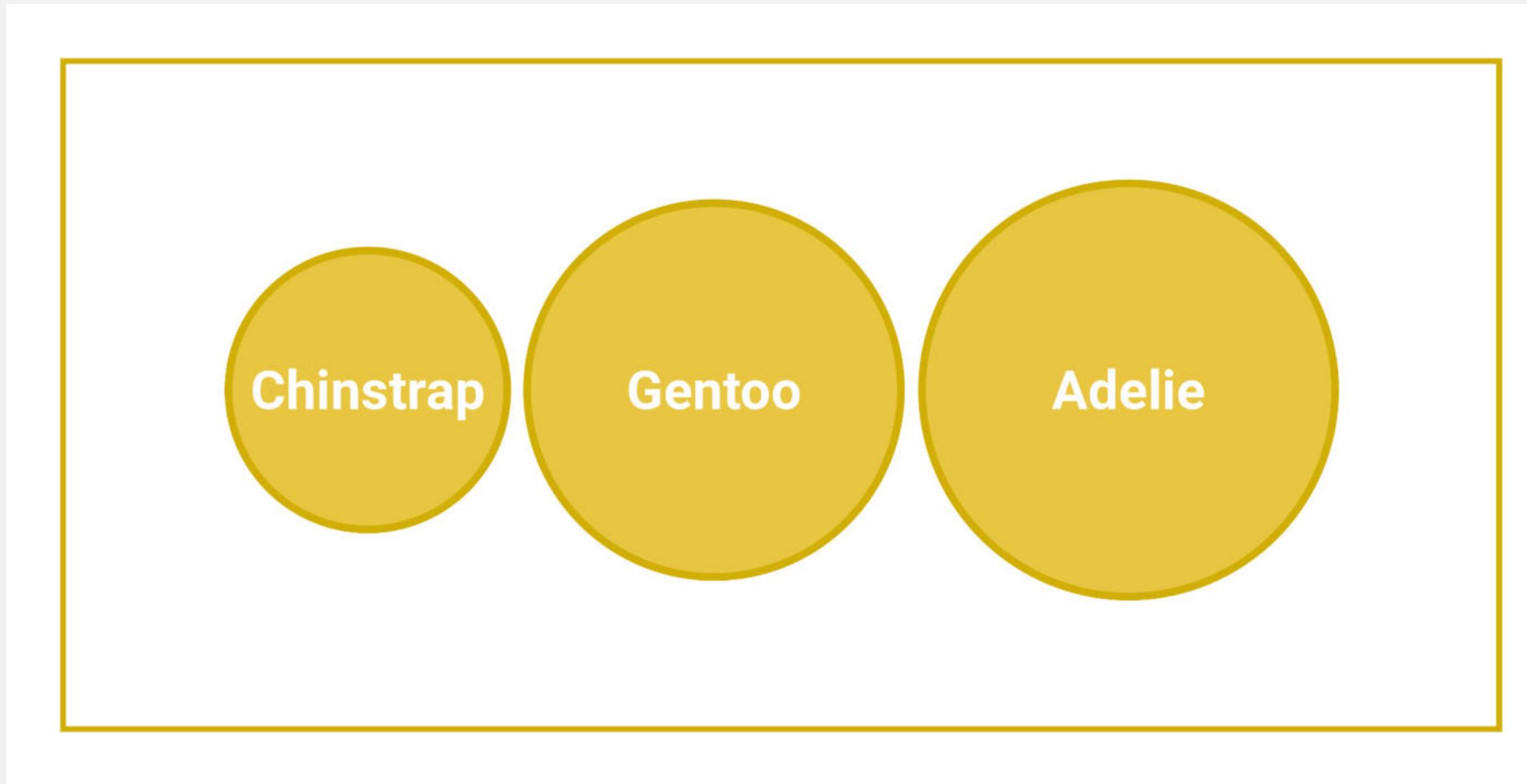
Crowdsourced Results



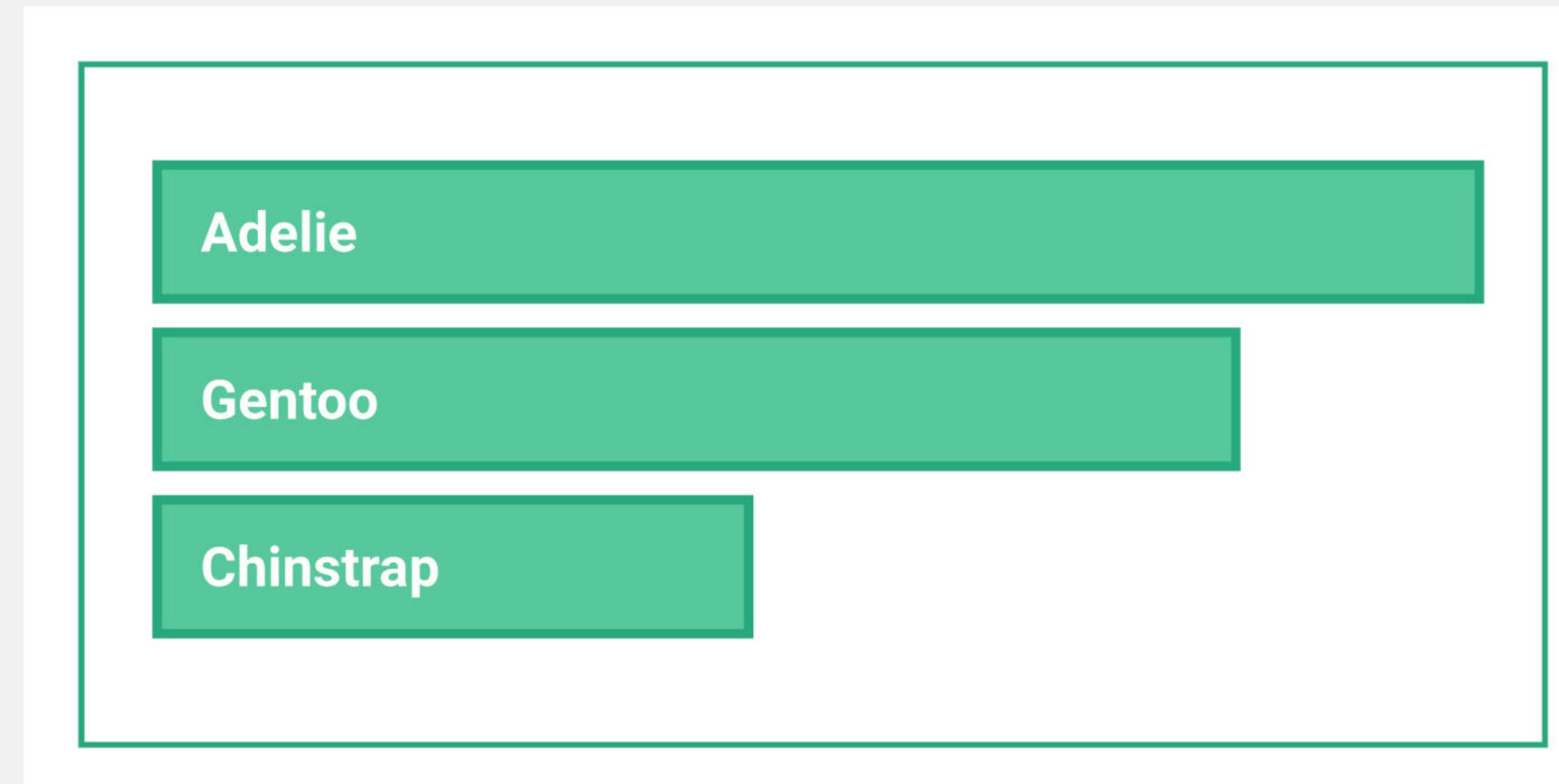
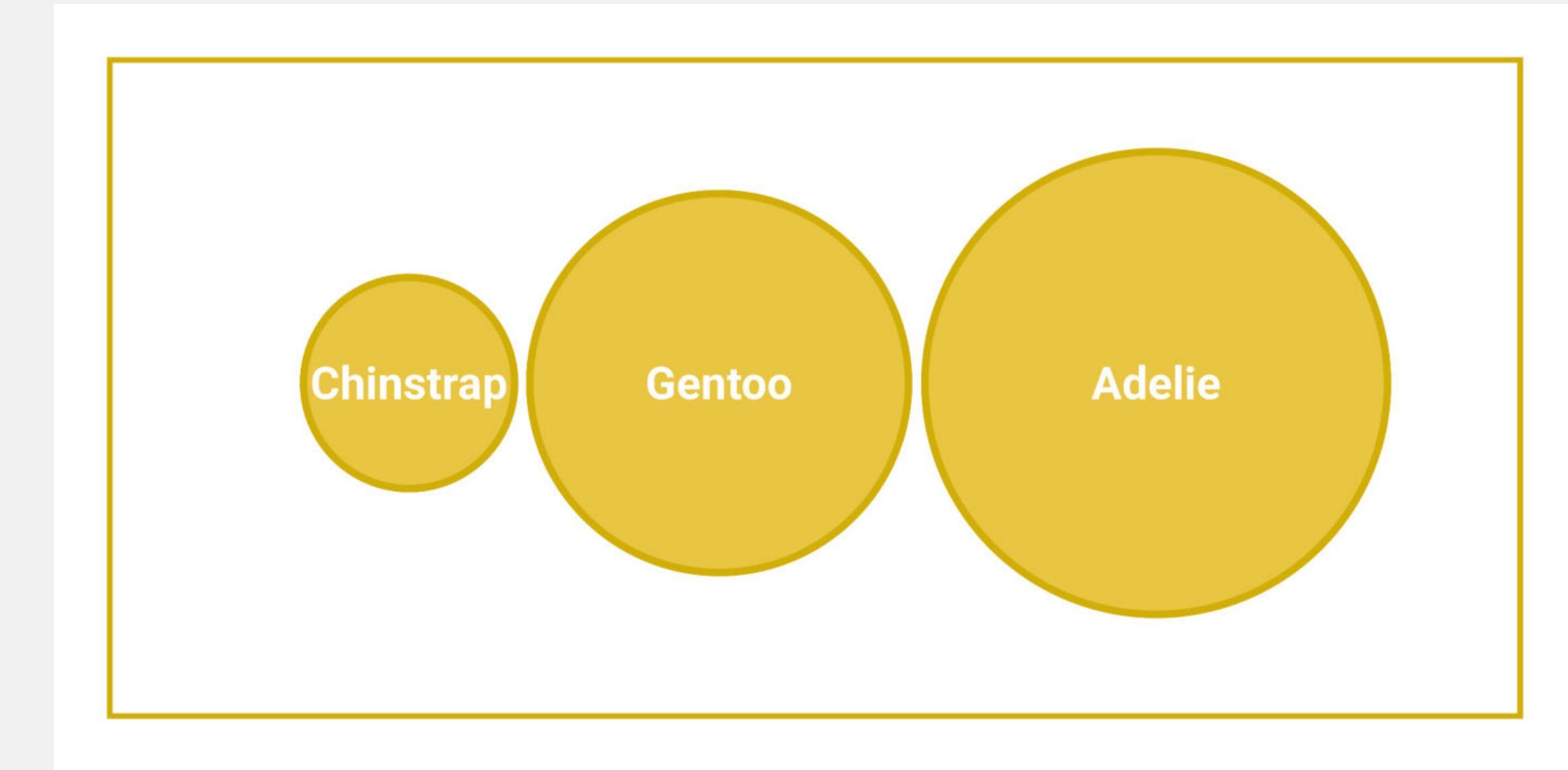
Quelle: Kieran Healy's [Data Visualization: A Practical Introduction](#)
Ergebnisse basierend auf Heer & Bostock sowie Cleveland & McGill



Use area.



Not radius!

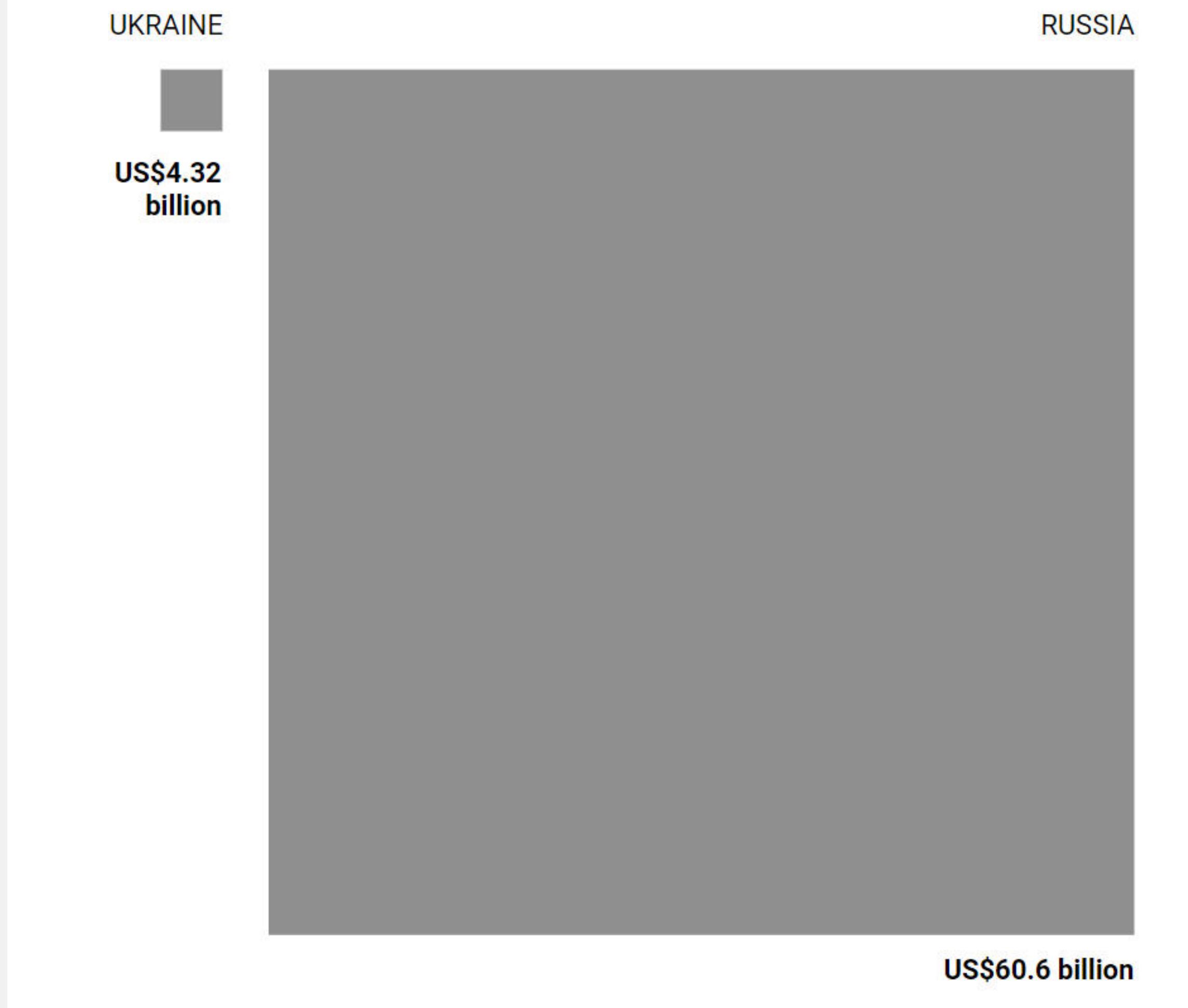


or: bars!



DEFENCE BUDGETS: RUSSIA VS UKRAINE (2020)

The national balance of forces is overwhelmingly in Russia's favour. Russian military spending in 2020 amounted to US\$60.6 billion in 2020. Ukraine's was less than a 10th of that amount.



“Russia attacks Ukraine” von SCMP Graphic (South China Morning Post)



cedricscherer.com



Twitter



Instagram



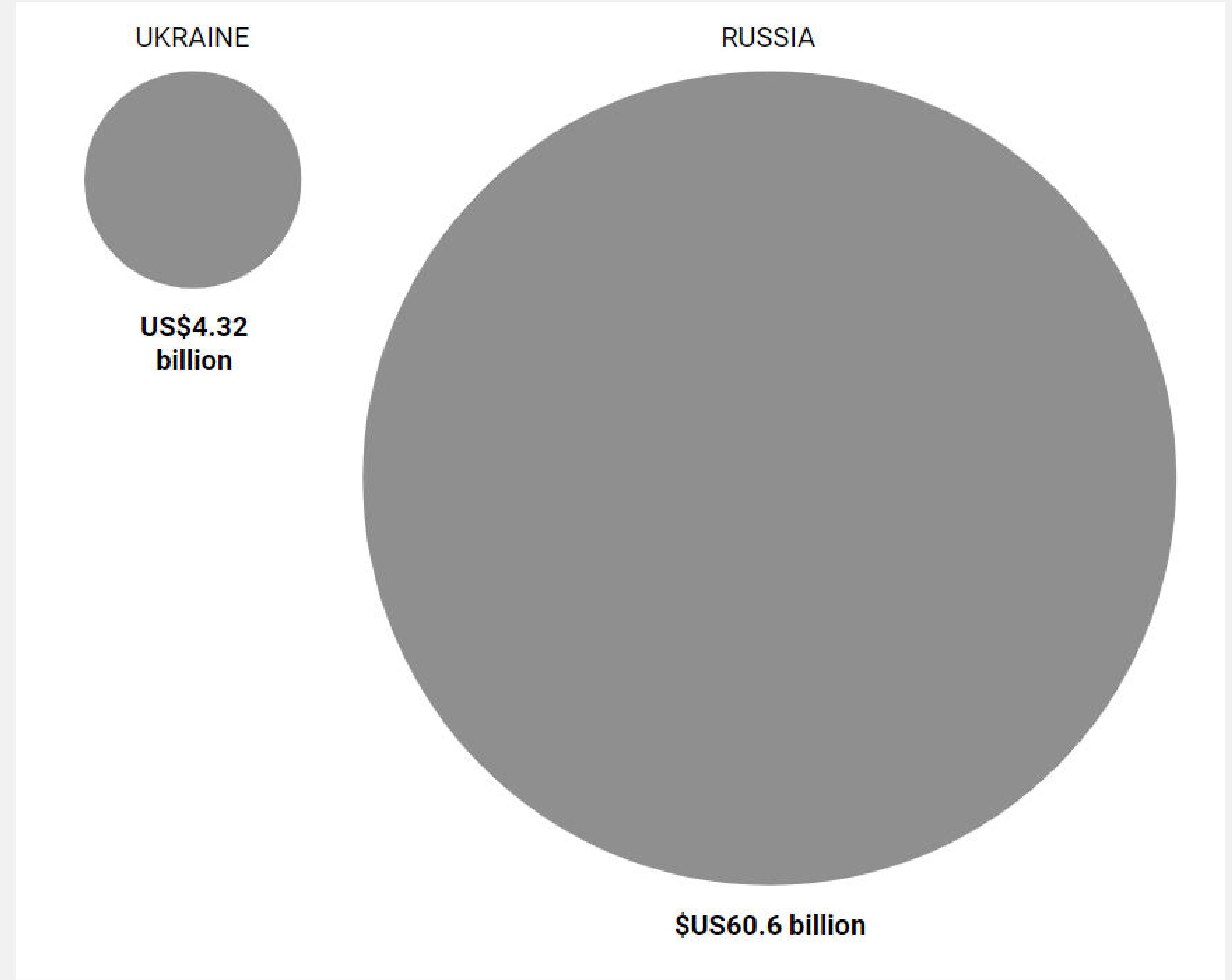
Beamer

@CedScherer



z3tt



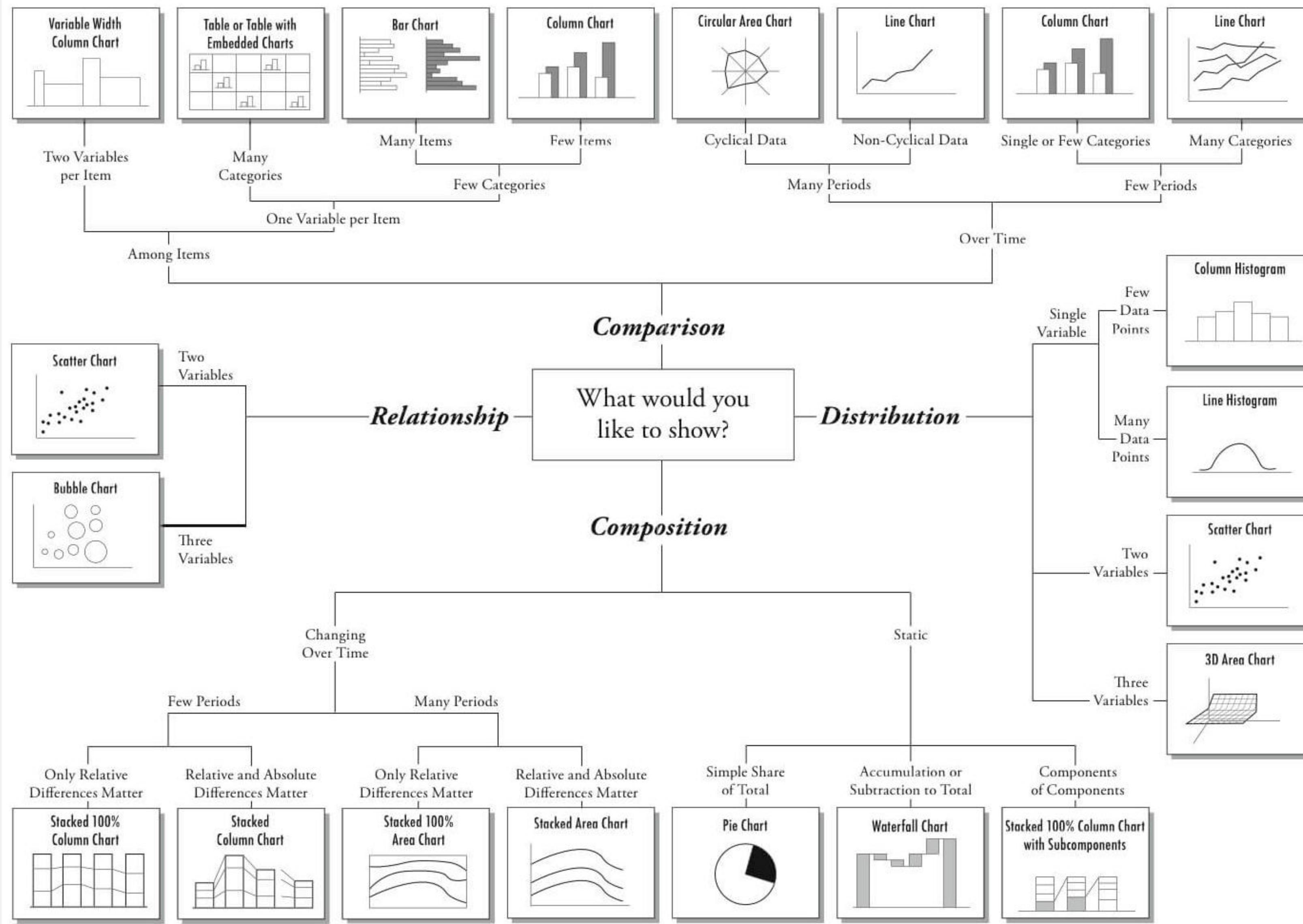


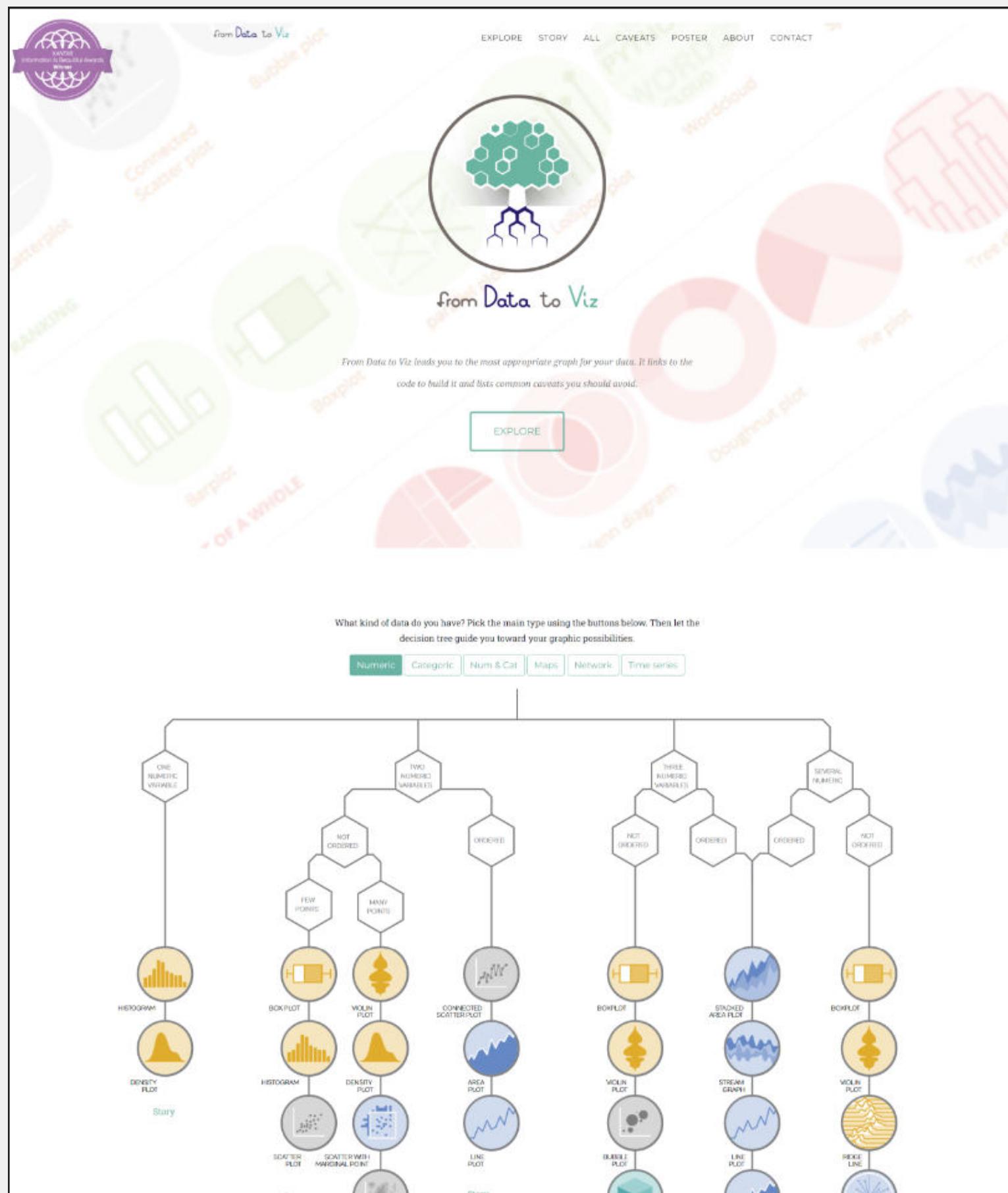
“Russia attacks Ukraine” von SCMP Graphic (South China Morning Post)



Chart Suggestions—A Thought-Starter

www.ExtremePresentation.com
© 2009 A. Abela — a.v.abela@gmail.com

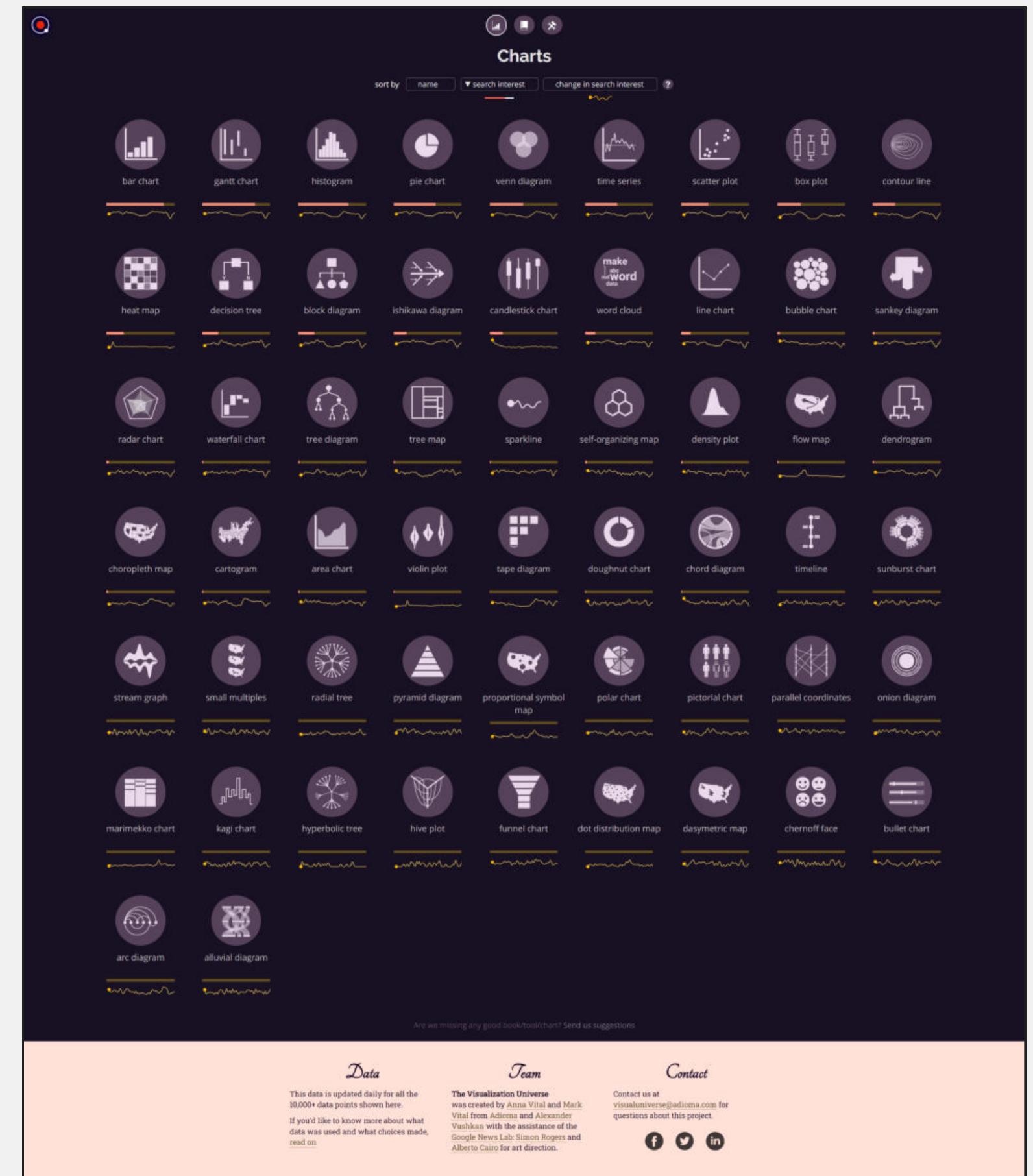




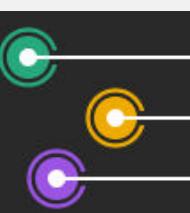
data-to-viz.com



datavizproject.com



visualizationuniverse.com





from Data to Viz

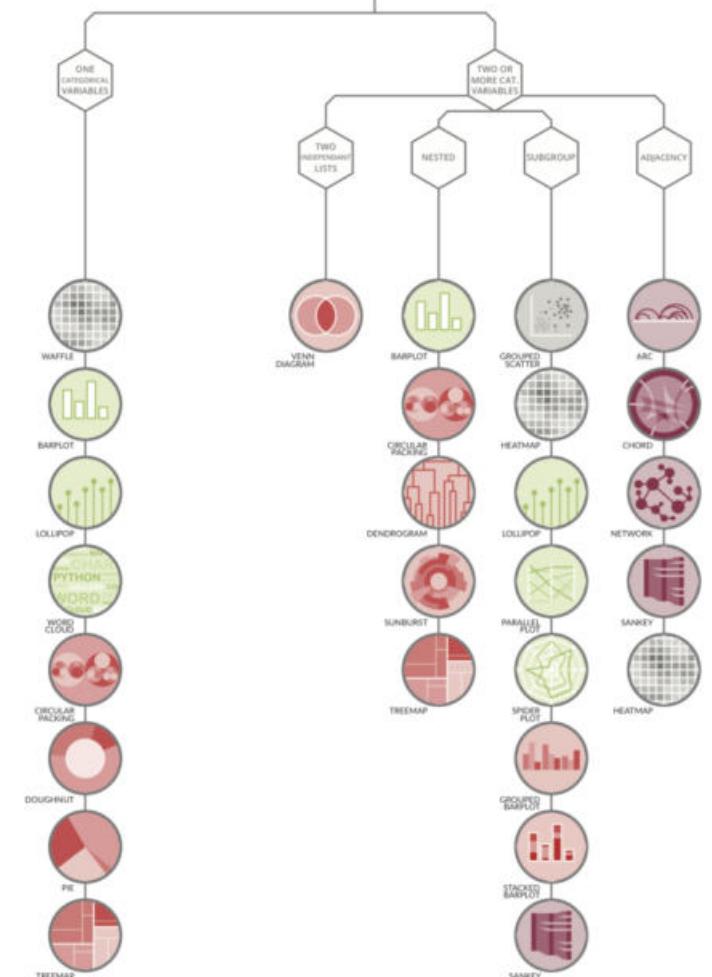
'From Data to Viz' is a classification of chart types based on input data format. It will help you find the perfect chart in three simple steps:

- 1** Identify what type of data you have.
- 2** Go to the corresponding decision tree and follow it down to a set of possible charts.
- 3** Choose the chart from the set that will suit your data and your needs best.

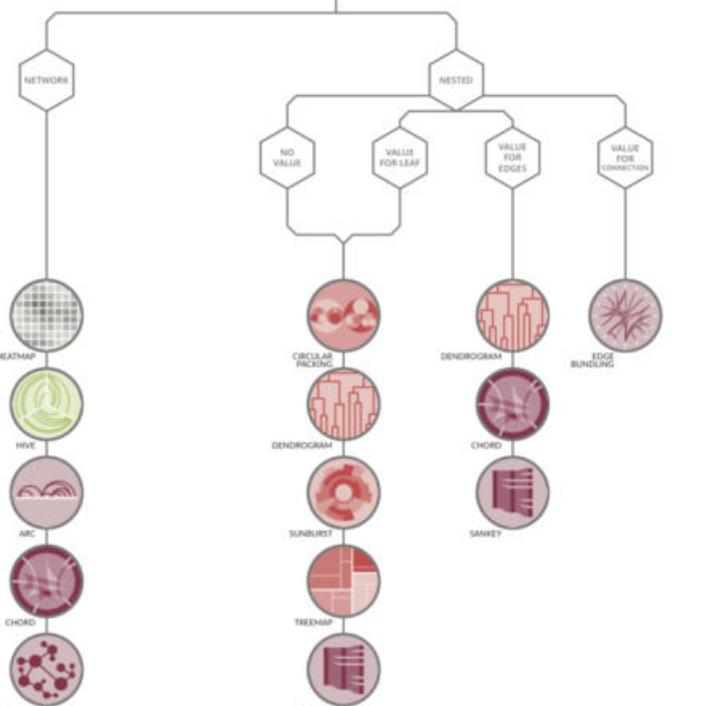
Dataviz is a world with endless possibilities and this project does not claim to be exhaustive. However it should provide you with a good starting point. For an interactive version and much more, visit:

data-to-viz.com

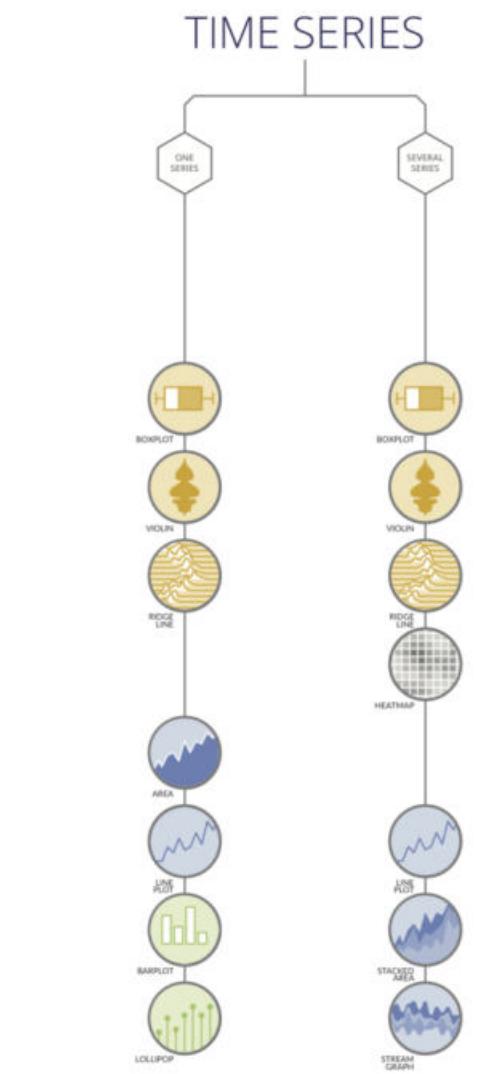
CATEGORIC



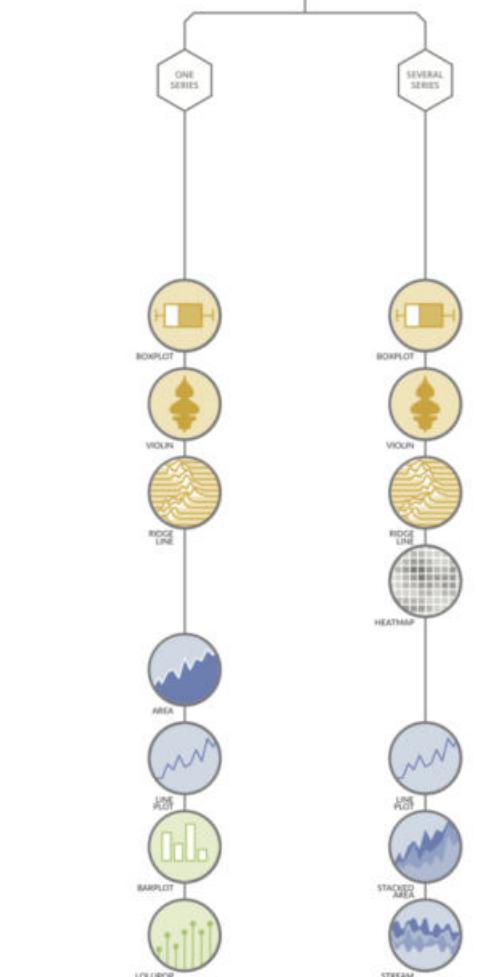
RELATIONAL



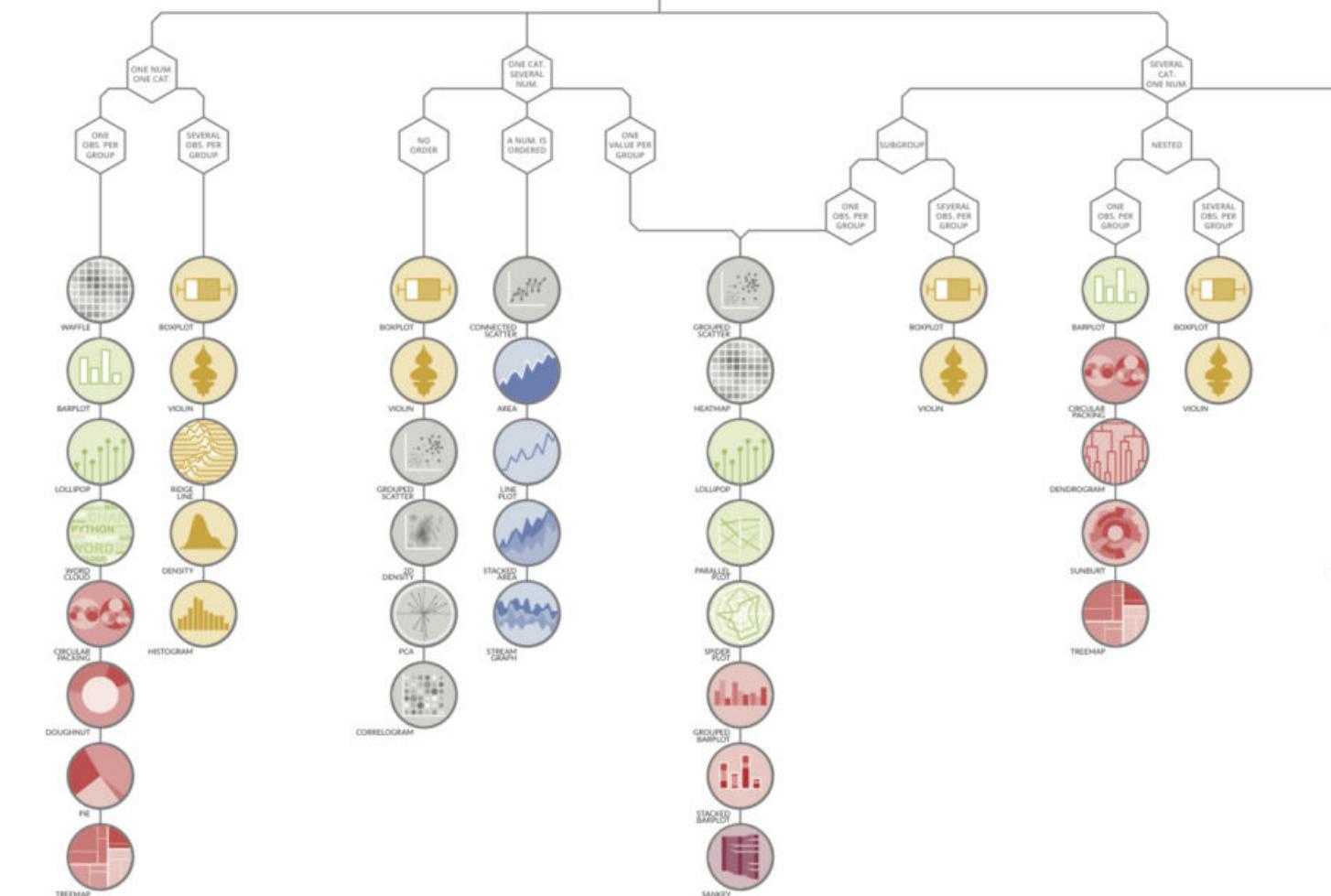
MAP



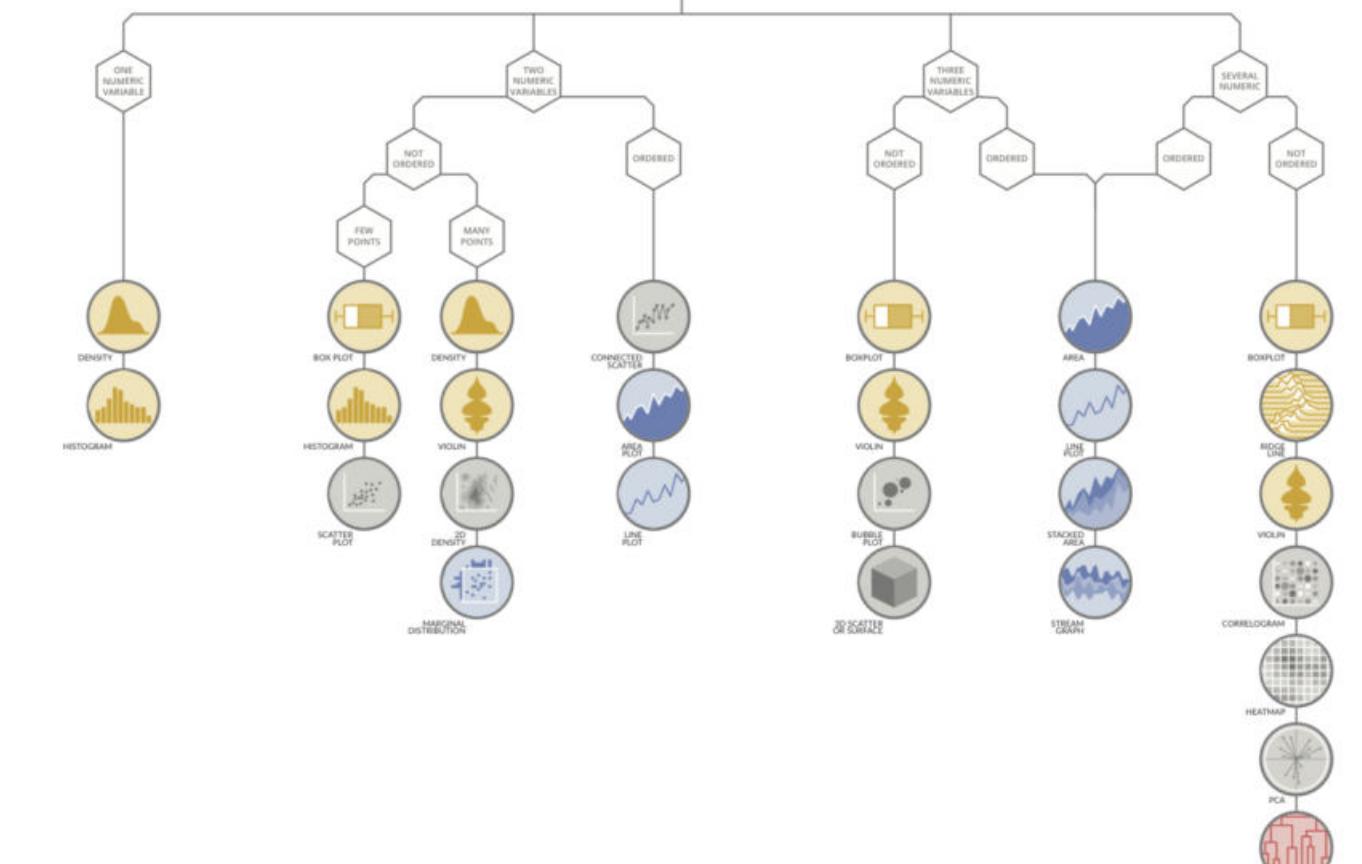
TIME SERIES



CATEGORIC AND NUMERIC



NUMERIC



Source: data-to-viz.com



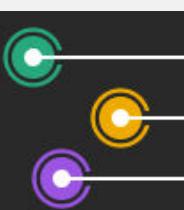
cedricscherer.com



@CedScherer



z3tt



The screenshot shows a modal window for the 'BOXPLOT' visualization. At the top is a yellow circular icon containing a boxplot. Below it is the title 'BOXPLOT' in green. A subtitle reads 'Summarize the distribution of numeric variables'. Under the subtitle is a section titled 'About' in orange, which contains a detailed description of what a boxplot is and how it represents data distribution. Below this is a section titled 'Common Mistakes' in orange, listing three points about potential pitfalls in using boxplots. There is also a 'Code' section with links to R graph gallery, Python gallery, D3.js gallery, and Flourish. A 'Read More' section with a link to a dedicated page is also present. The background of the modal is white, while the rest of the page has a dark grey overlay.

POSSIBILITIES

presented in this website.

Part of a whole Evolution Map Flow

Boxplot

Ridgeplot

Scatter

Connected scatter

Density 2d

Barplot

Lollipop

Circular Barplot

Treemap

Dendrogram

Circular packing

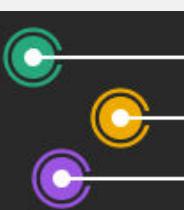
Sunburst

Venn diagram

Doughnut

Pie chart

Source: data-to-viz.com



Group Exercise

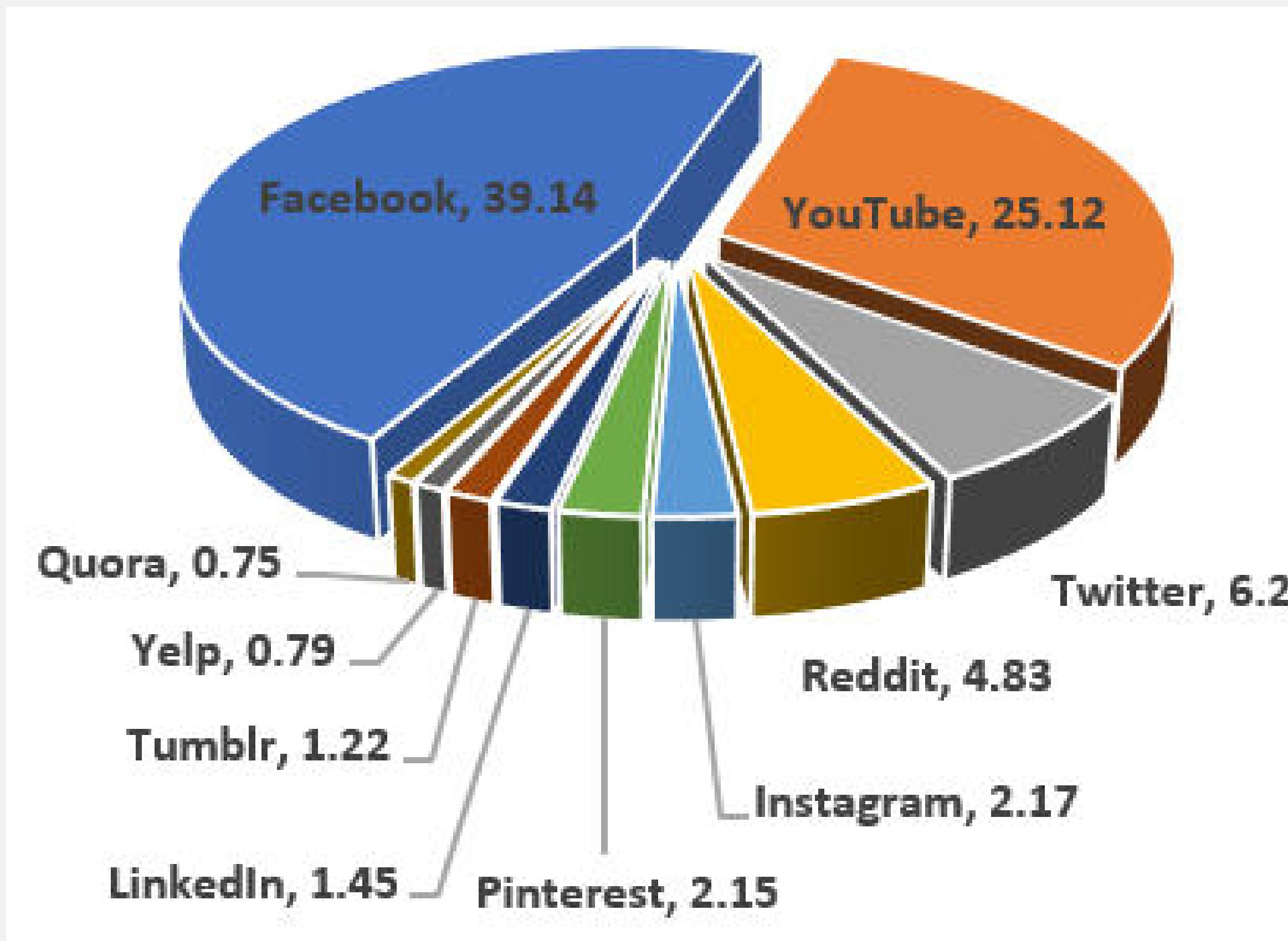
Have a look at the “Chart of Charts” poster

- 👉 Fill one dot for each chart type you have used already to communicate your data

Have a look at the “Chart Choice Helpers”

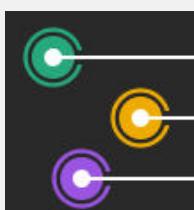
- 👉 Explore and discuss potential chart types for future data visualizations
- 👉 Look up the chart types on the poster you didn't know
- 👉 Are there chart types you find hard to read / understand?

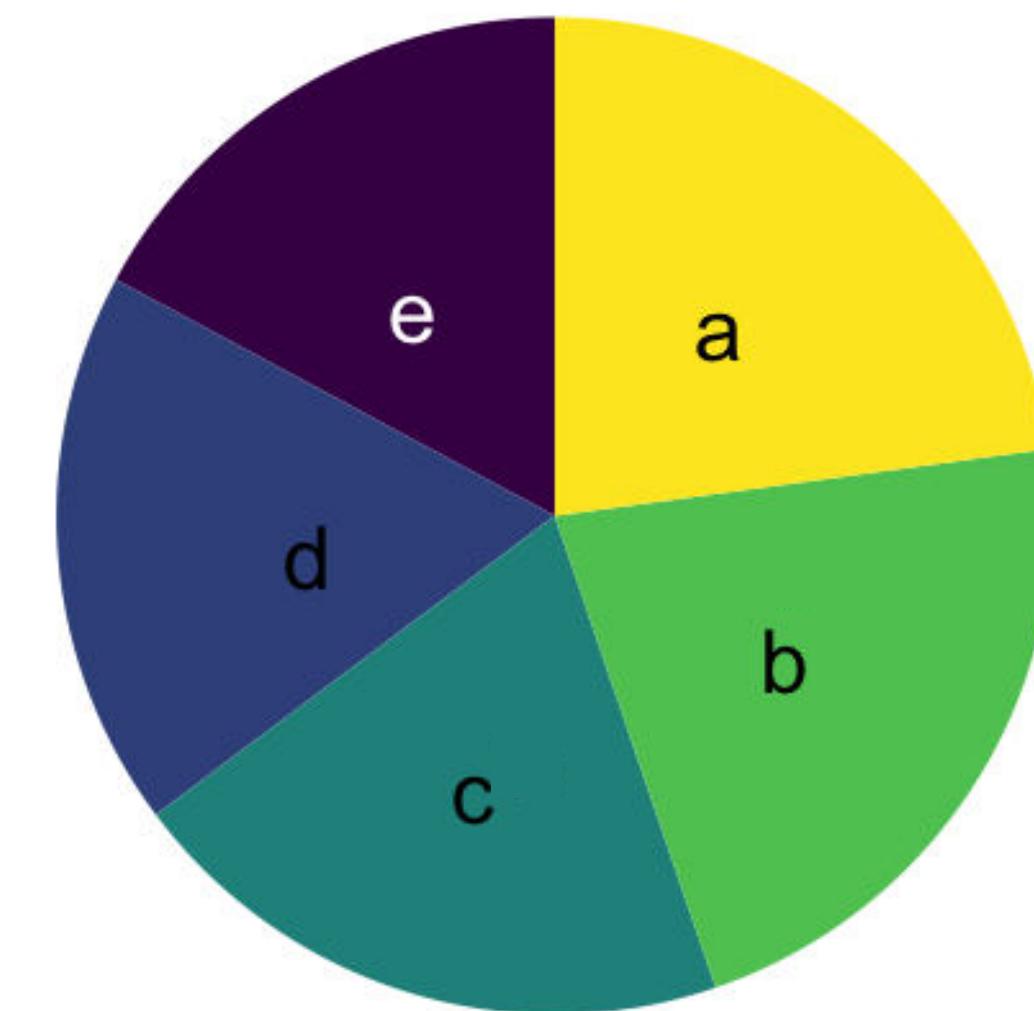
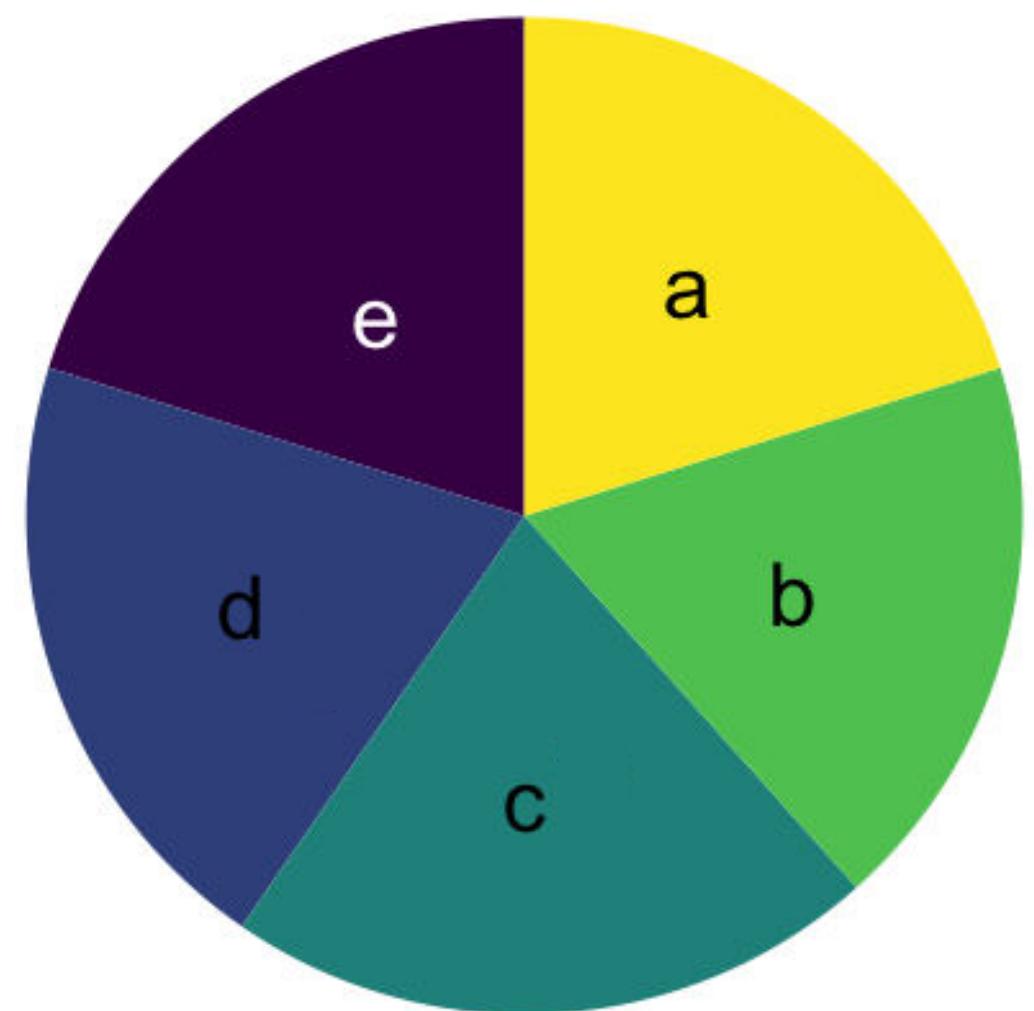
Group Exercise

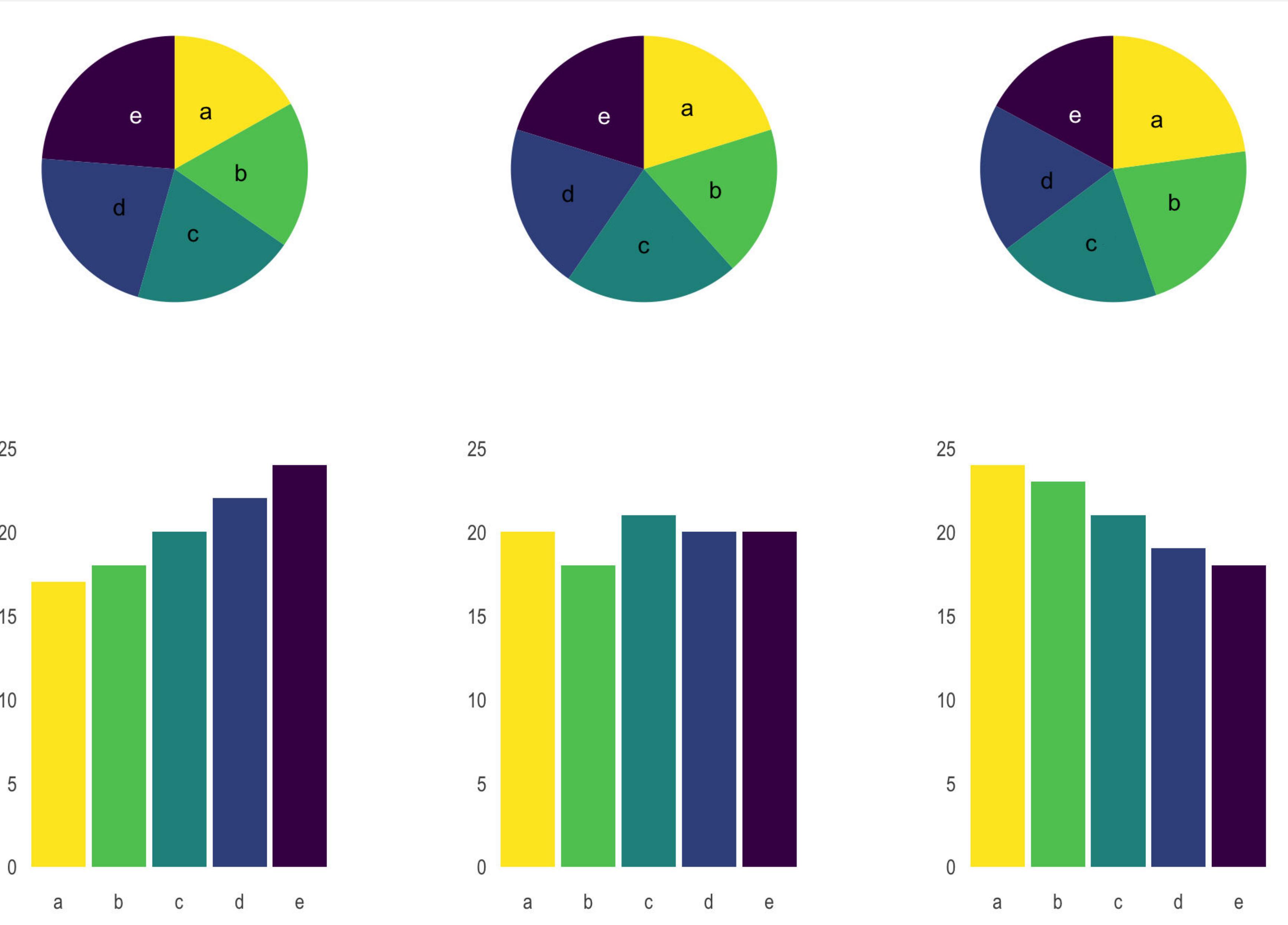


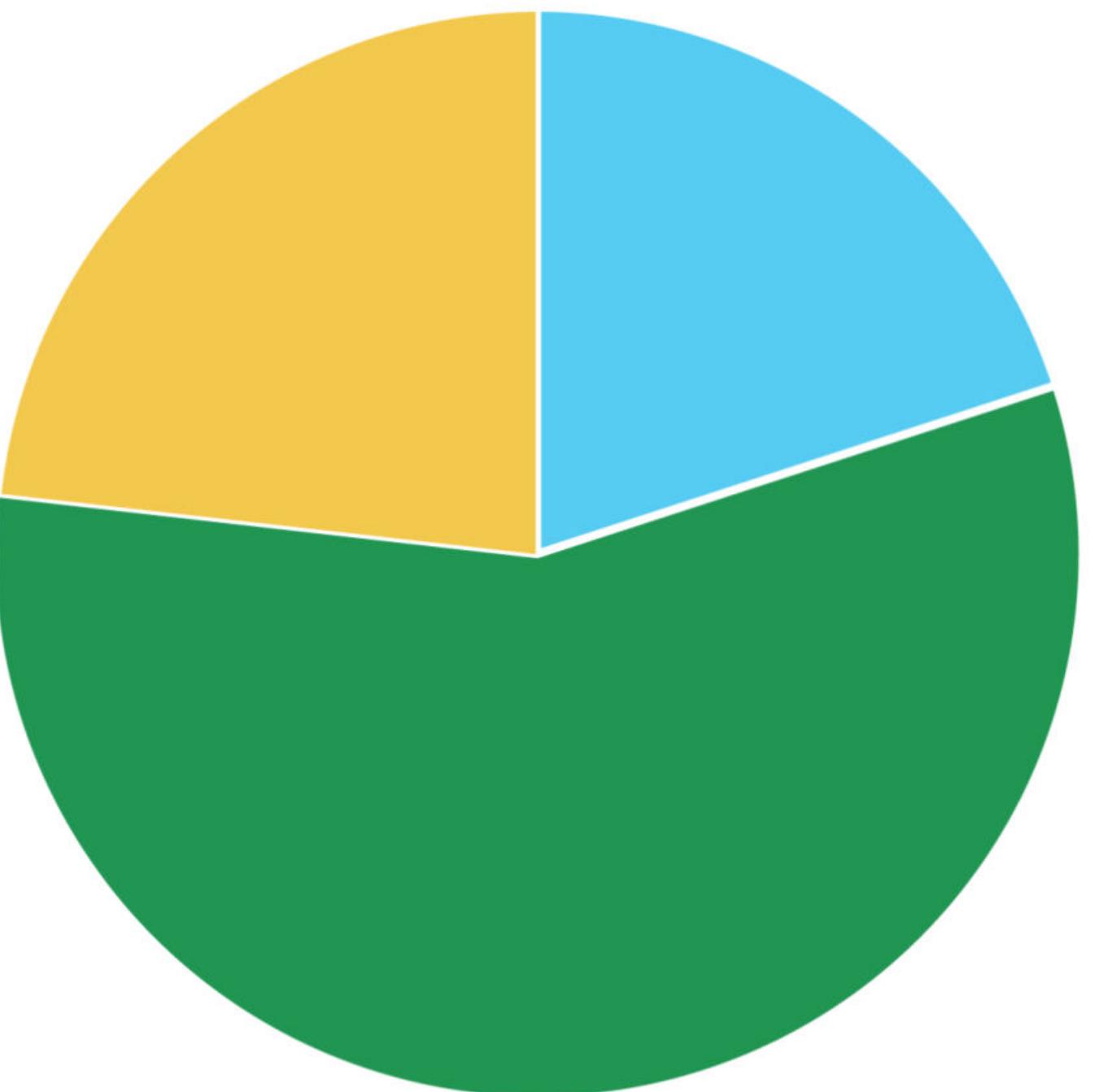
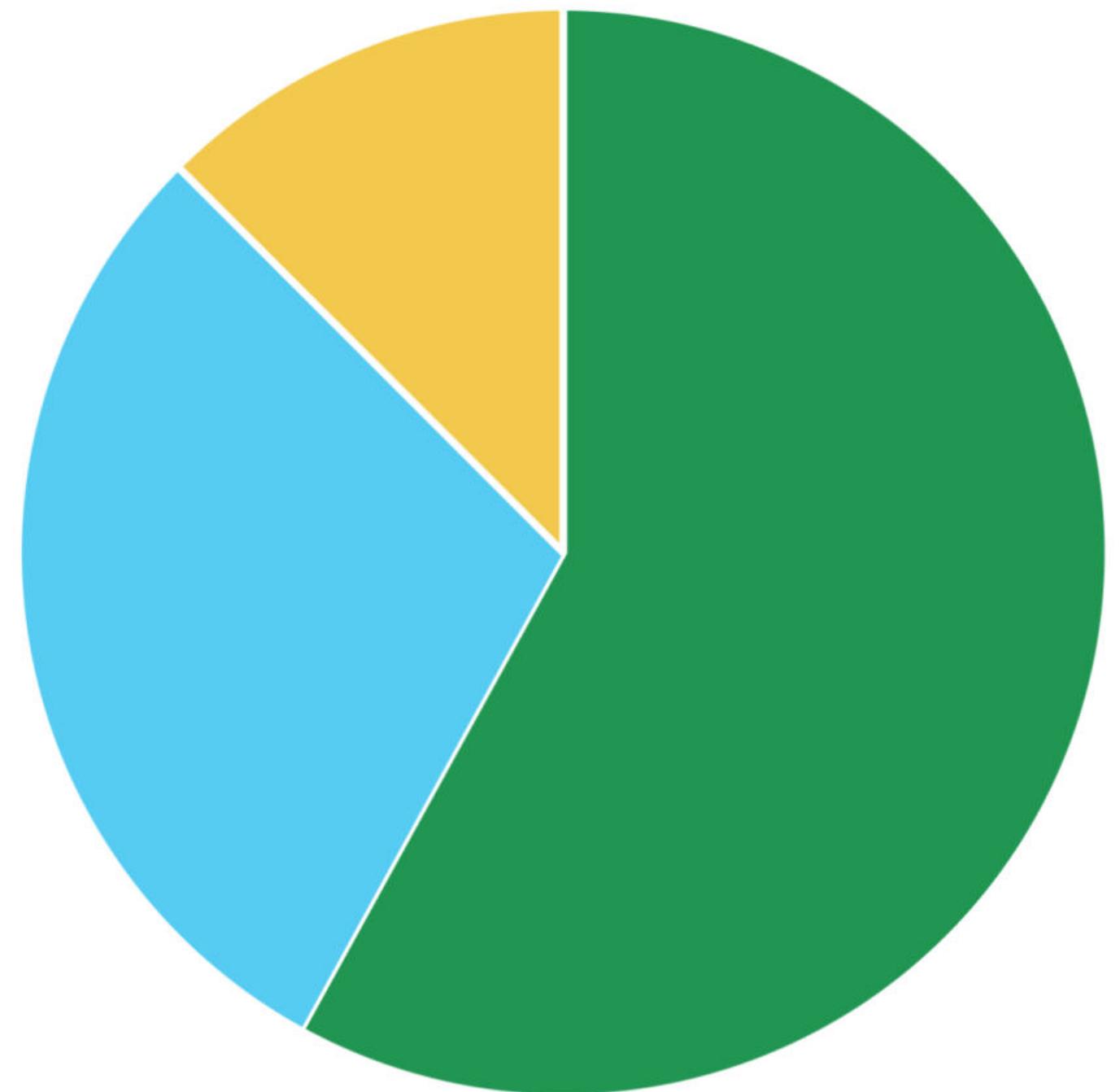
Discuss this graphic

- ➡ What is the main message?
- ➡ Does the chart type work?
- ➡ Is there a better chart type?
- ➡ Draw an alternative version using a chart type that is more suitable!

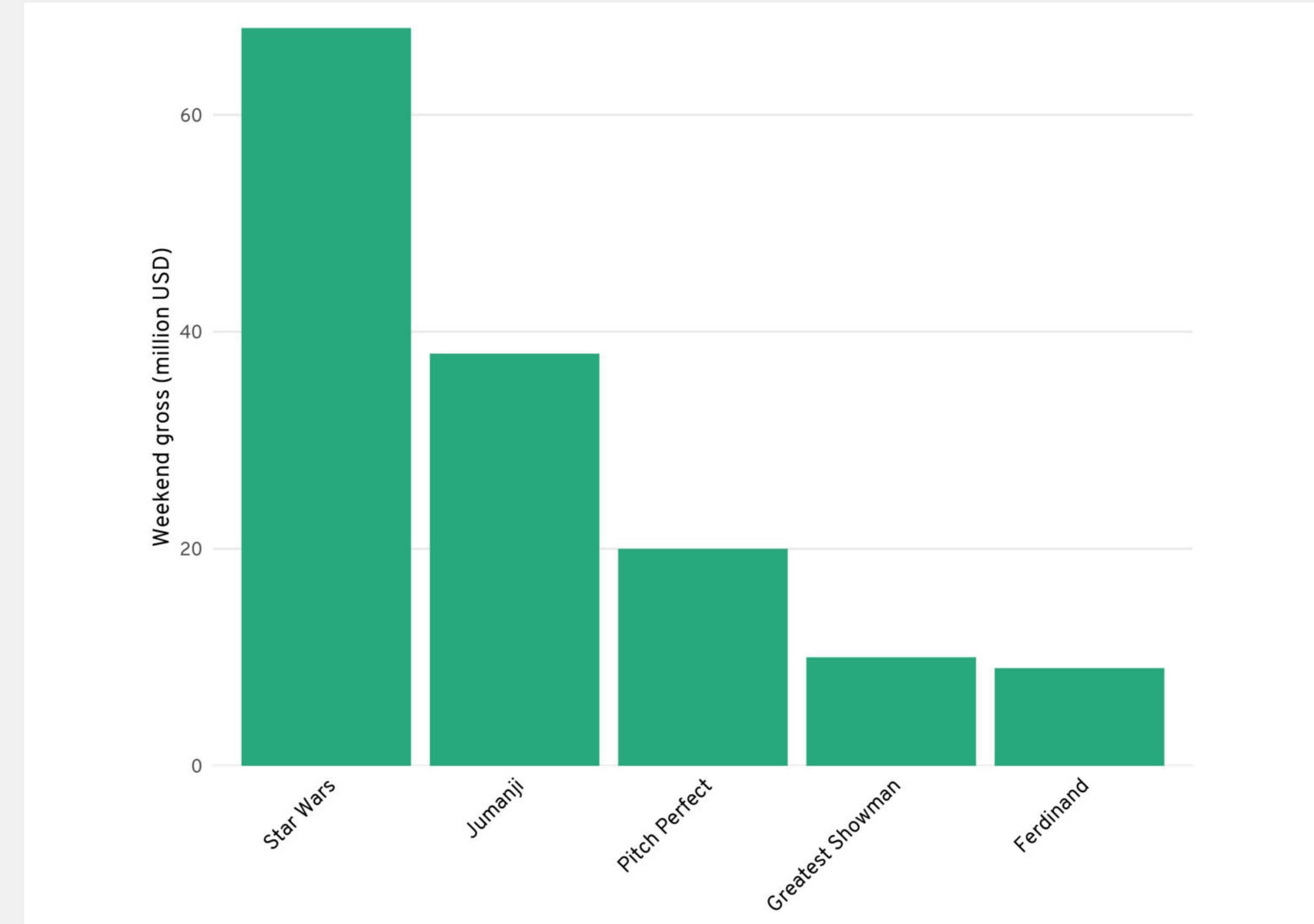
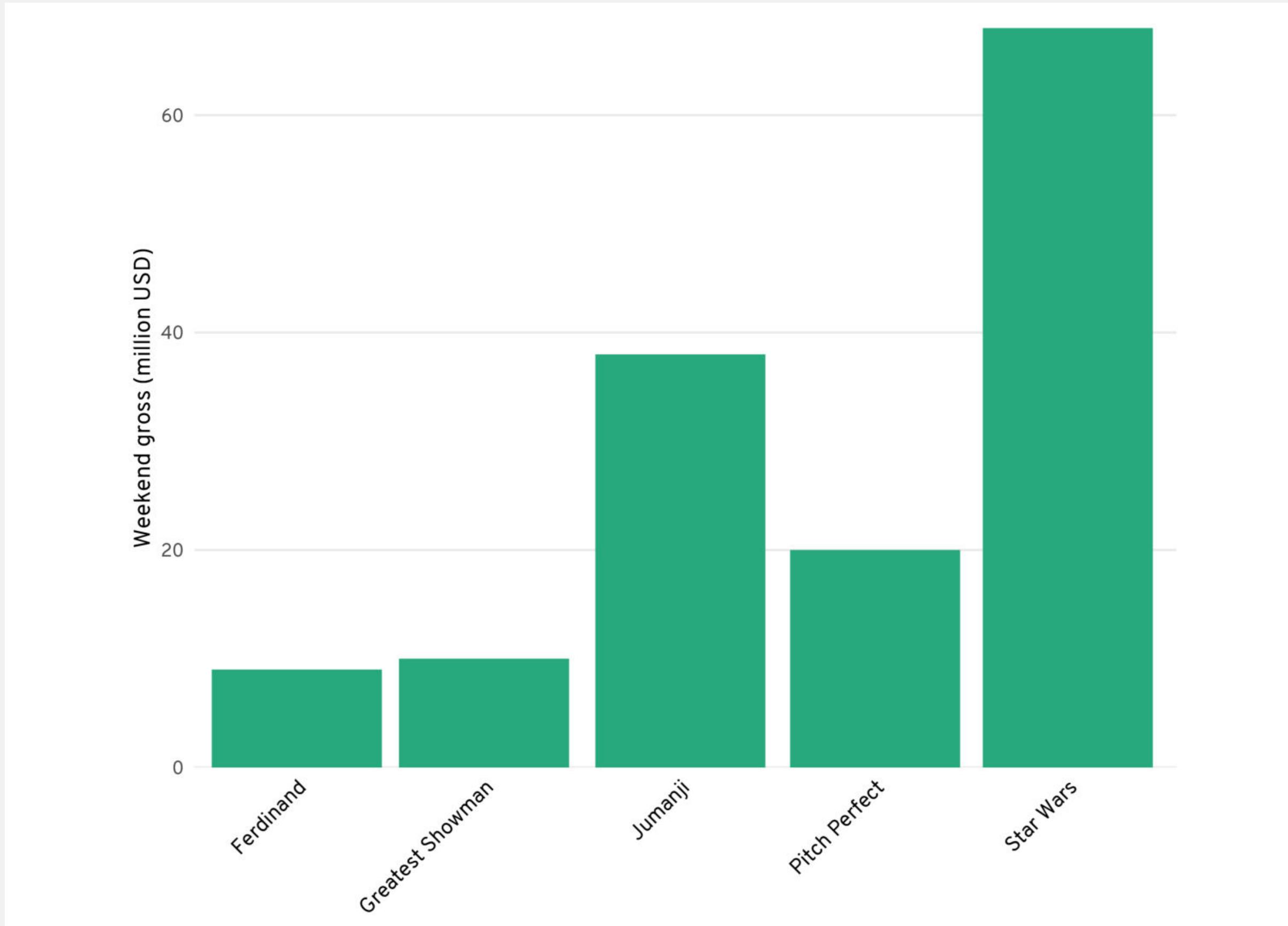




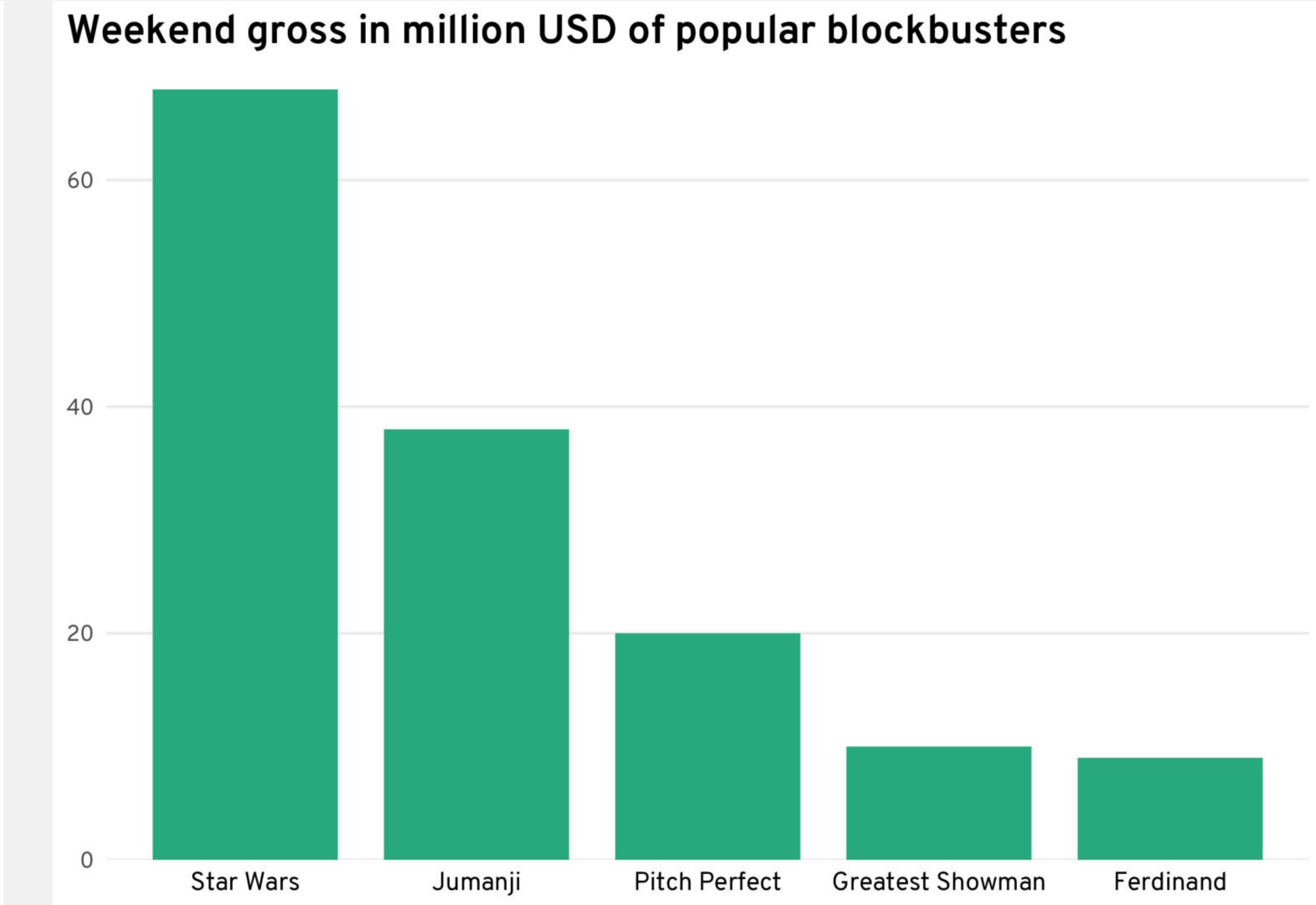
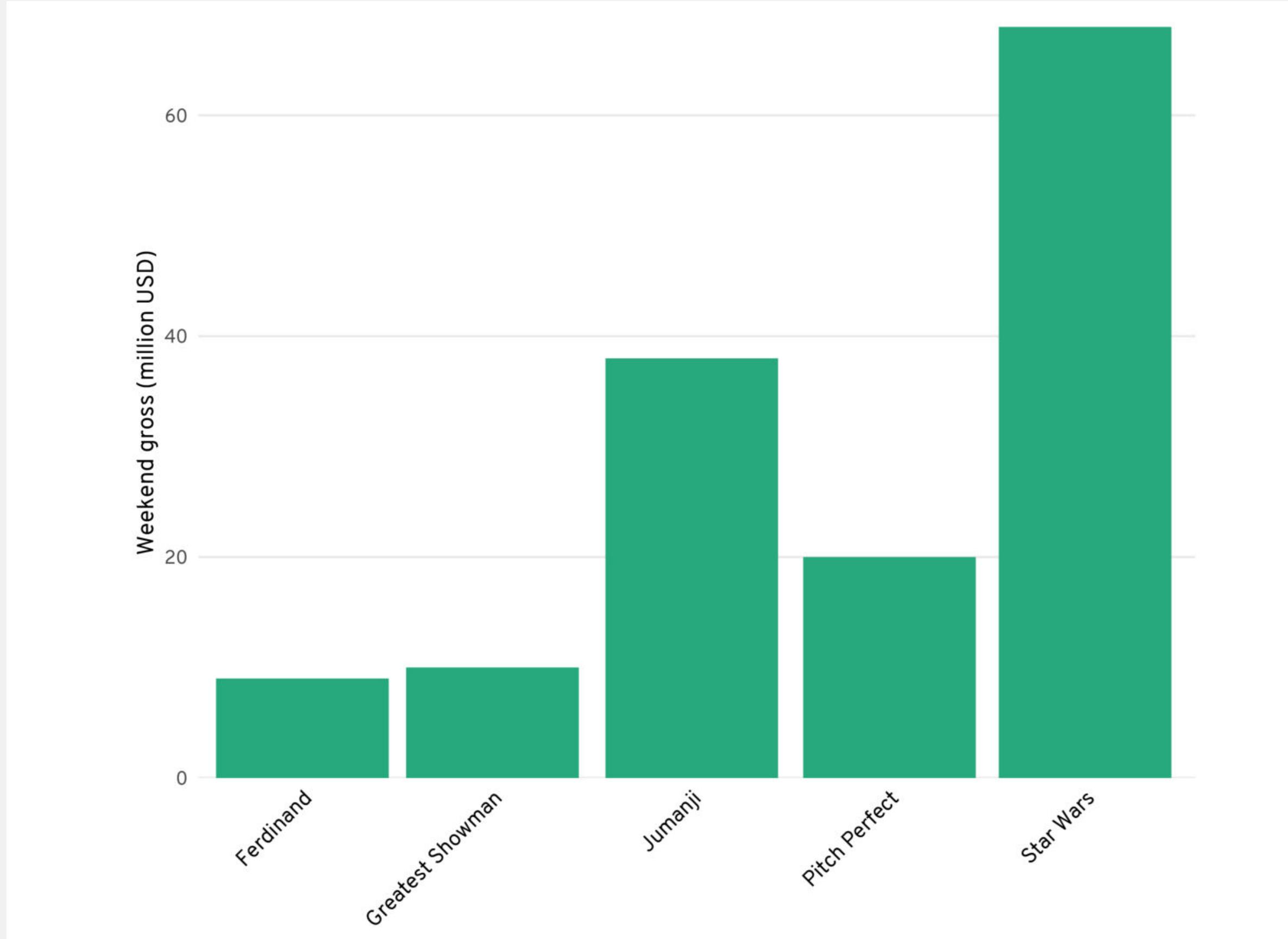




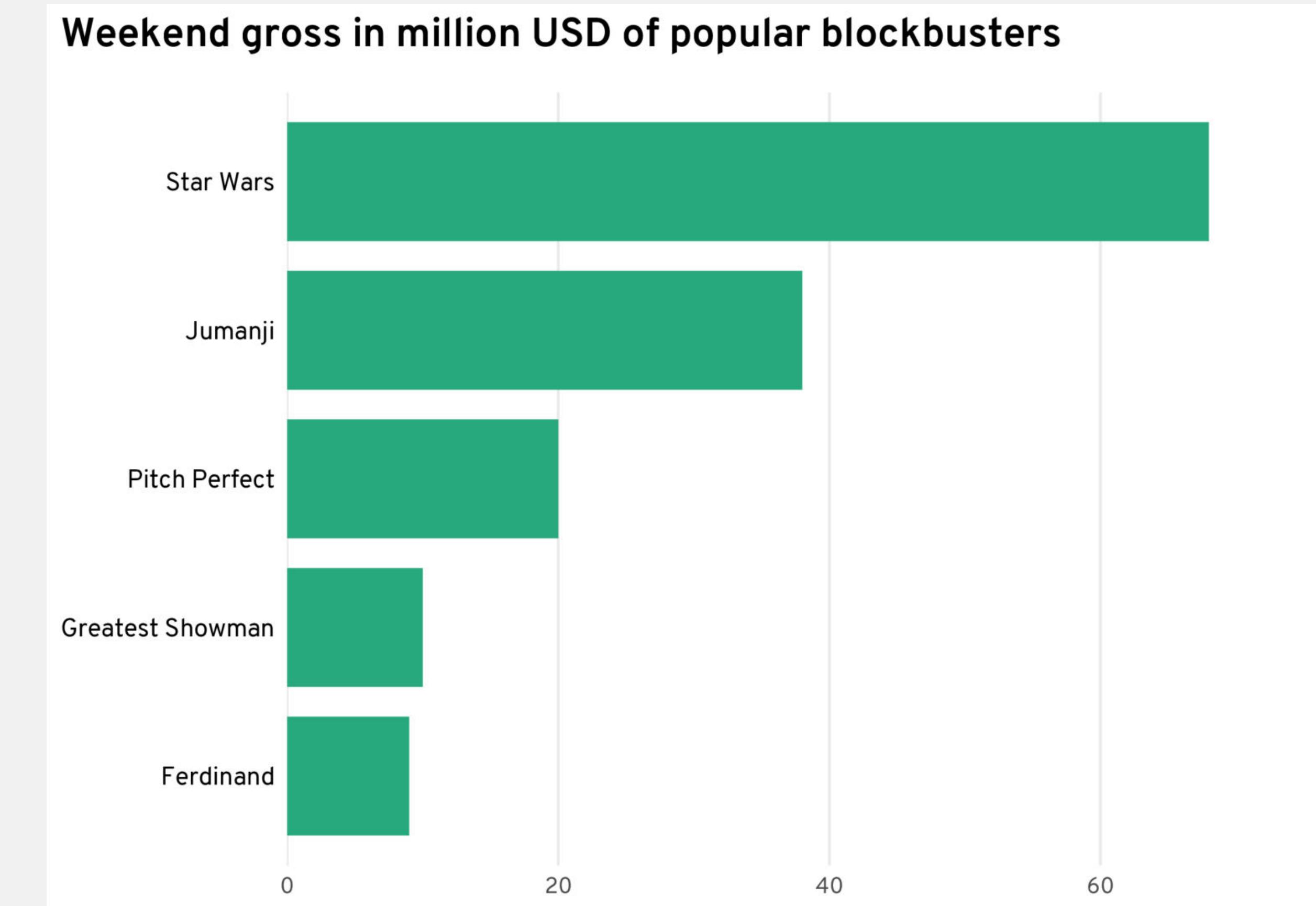
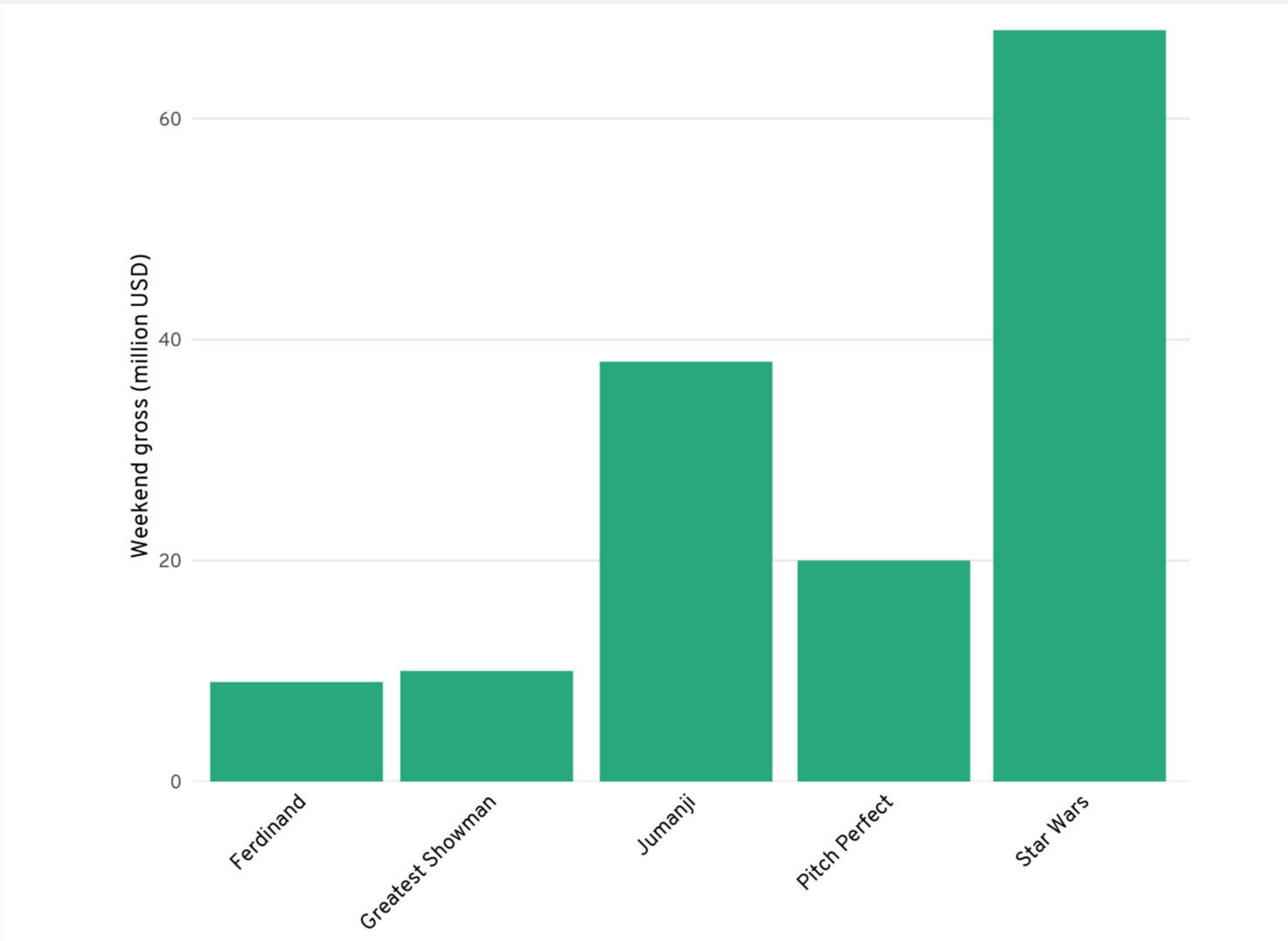
Sort Your Data



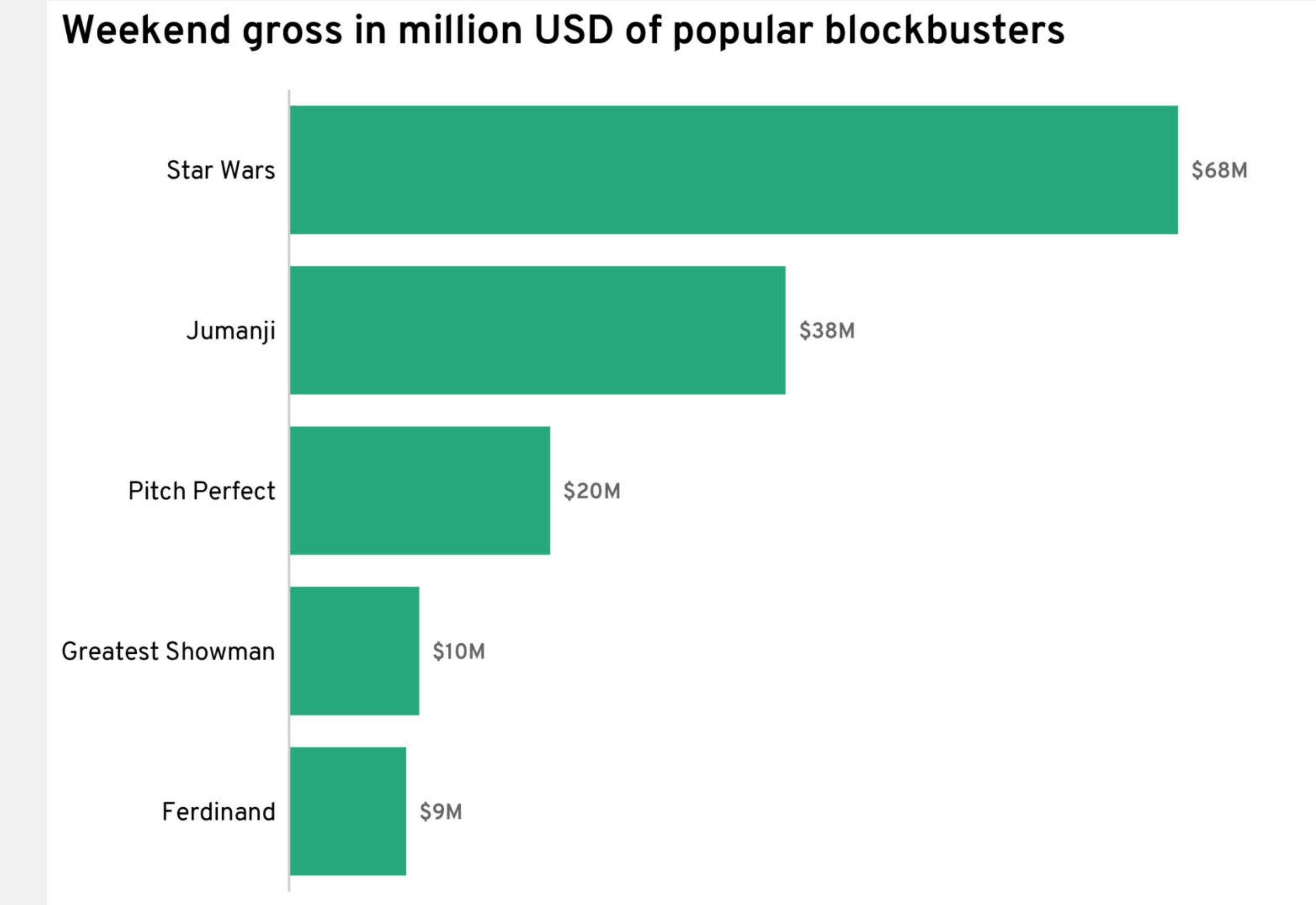
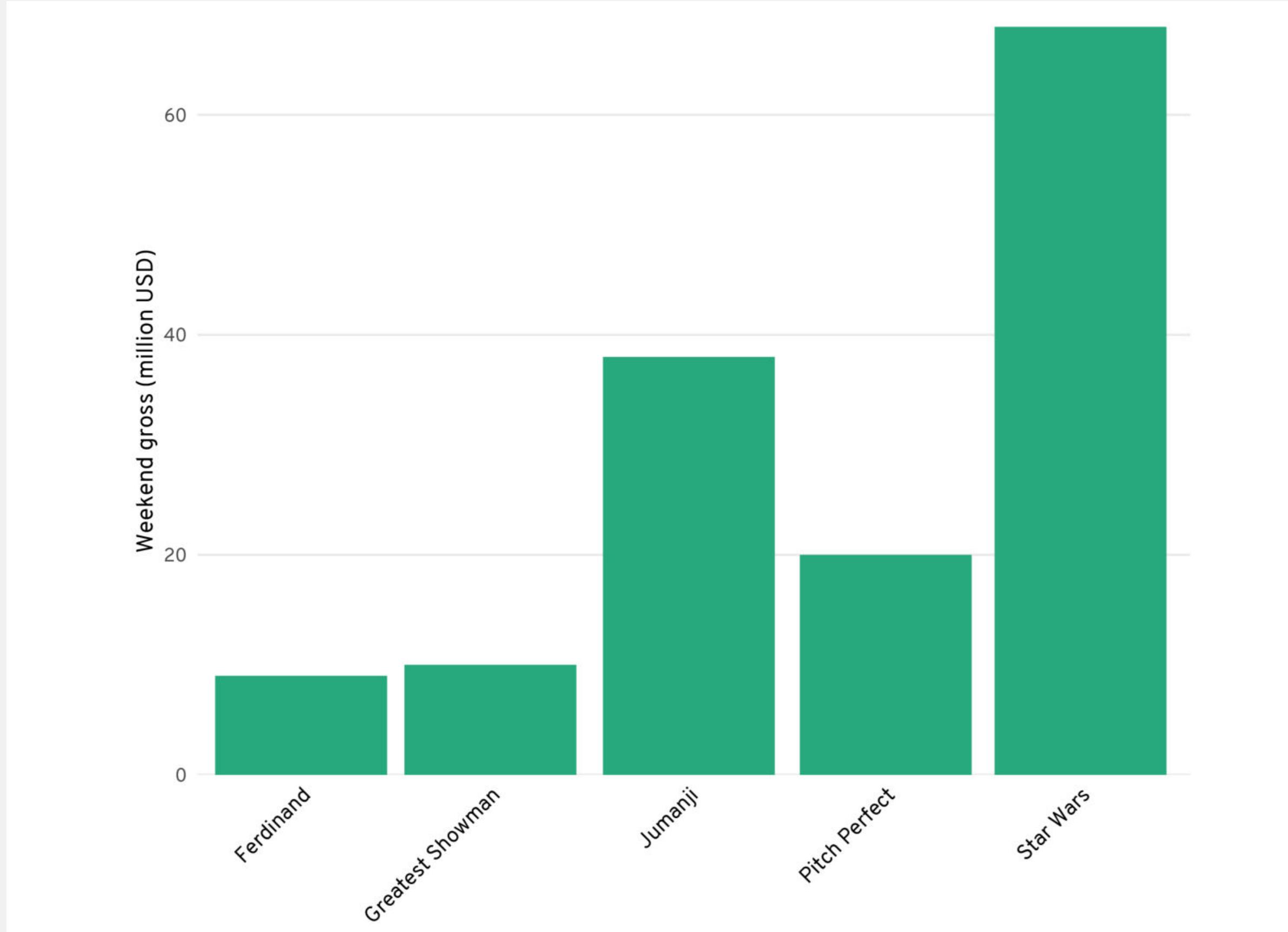
Avoid Rotated Text



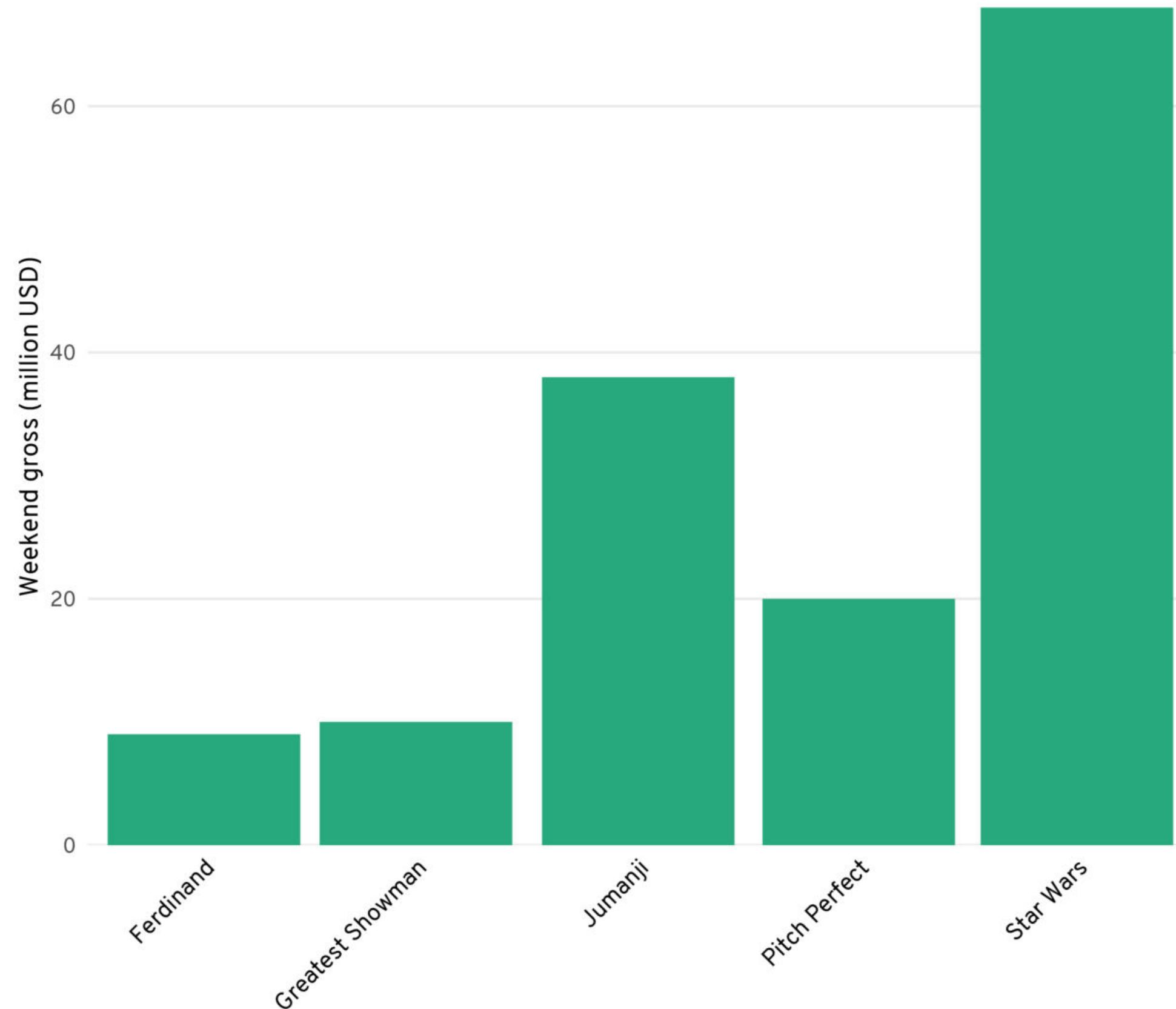
Avoid Rotated Text



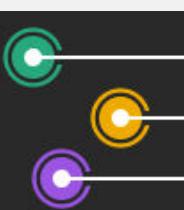
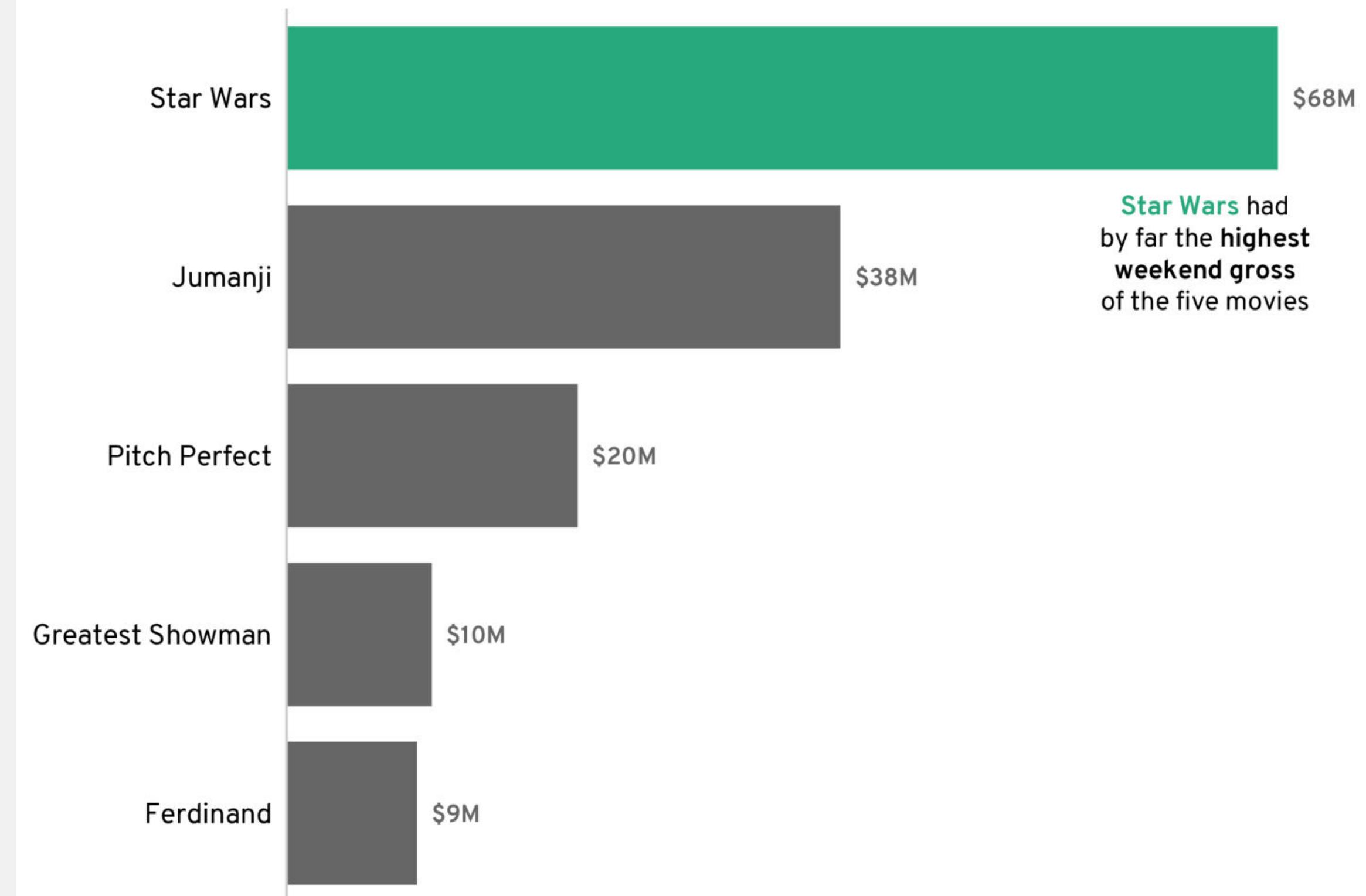
Add Direct Labels



Set Highlights

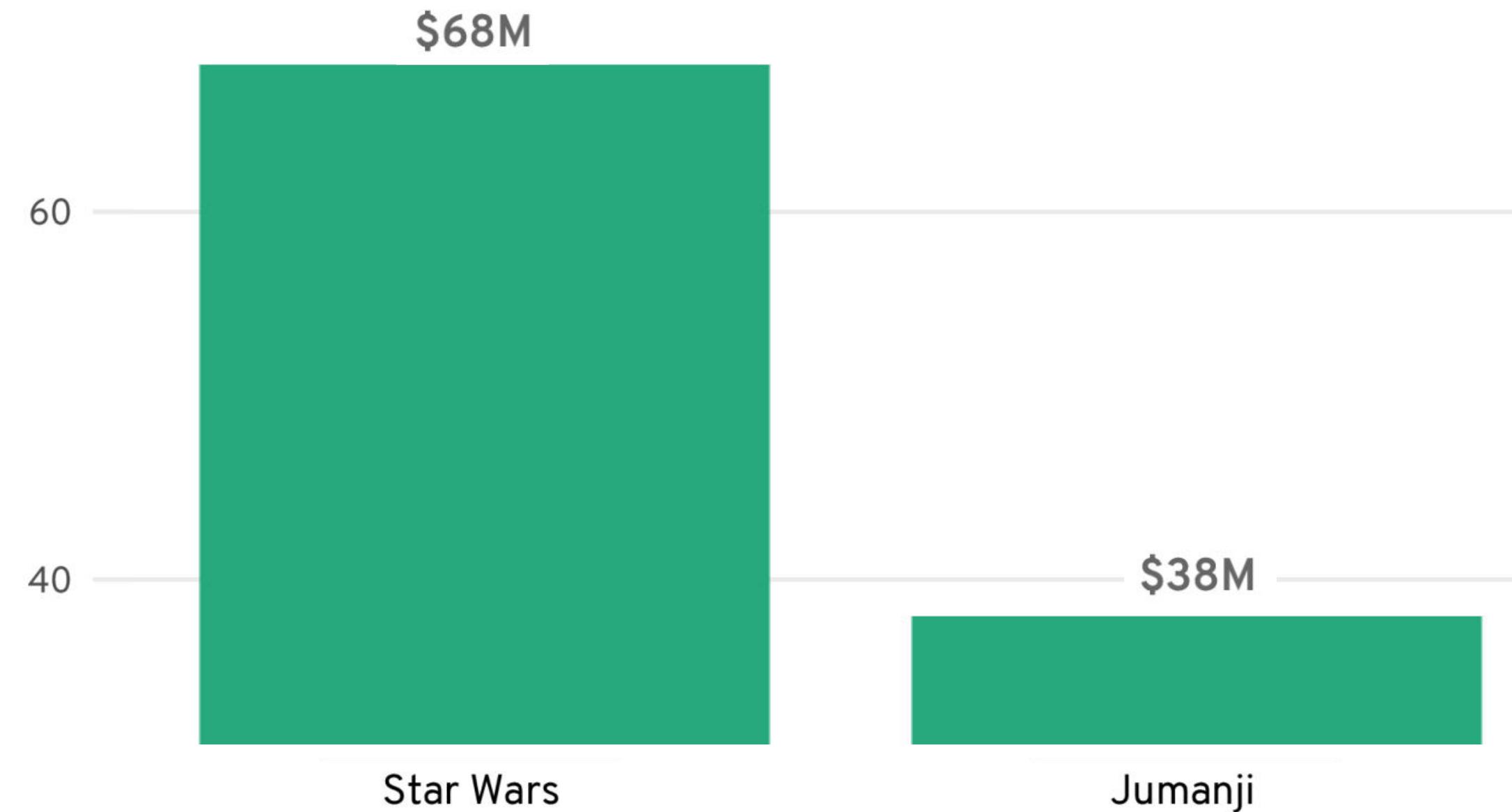


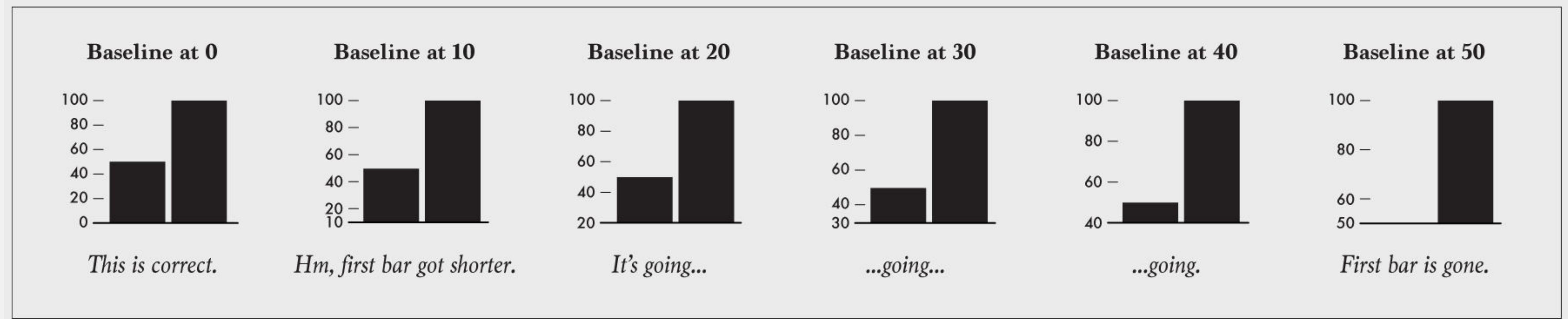
Weekend gross in million USD of popular blockbusters



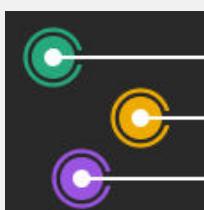
Always Stat at Zero

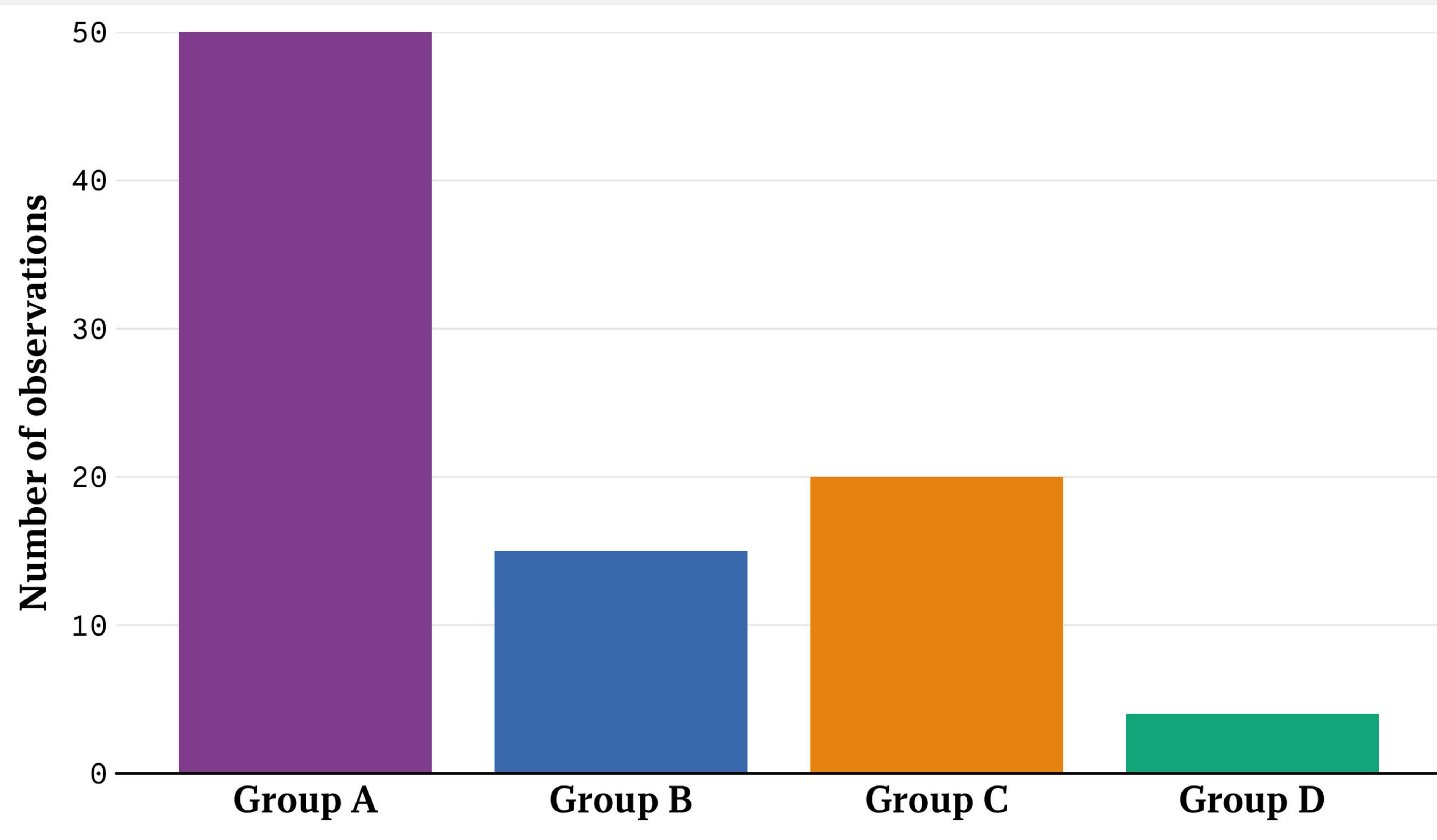
Weekend gross in million USD of popular blockbusters





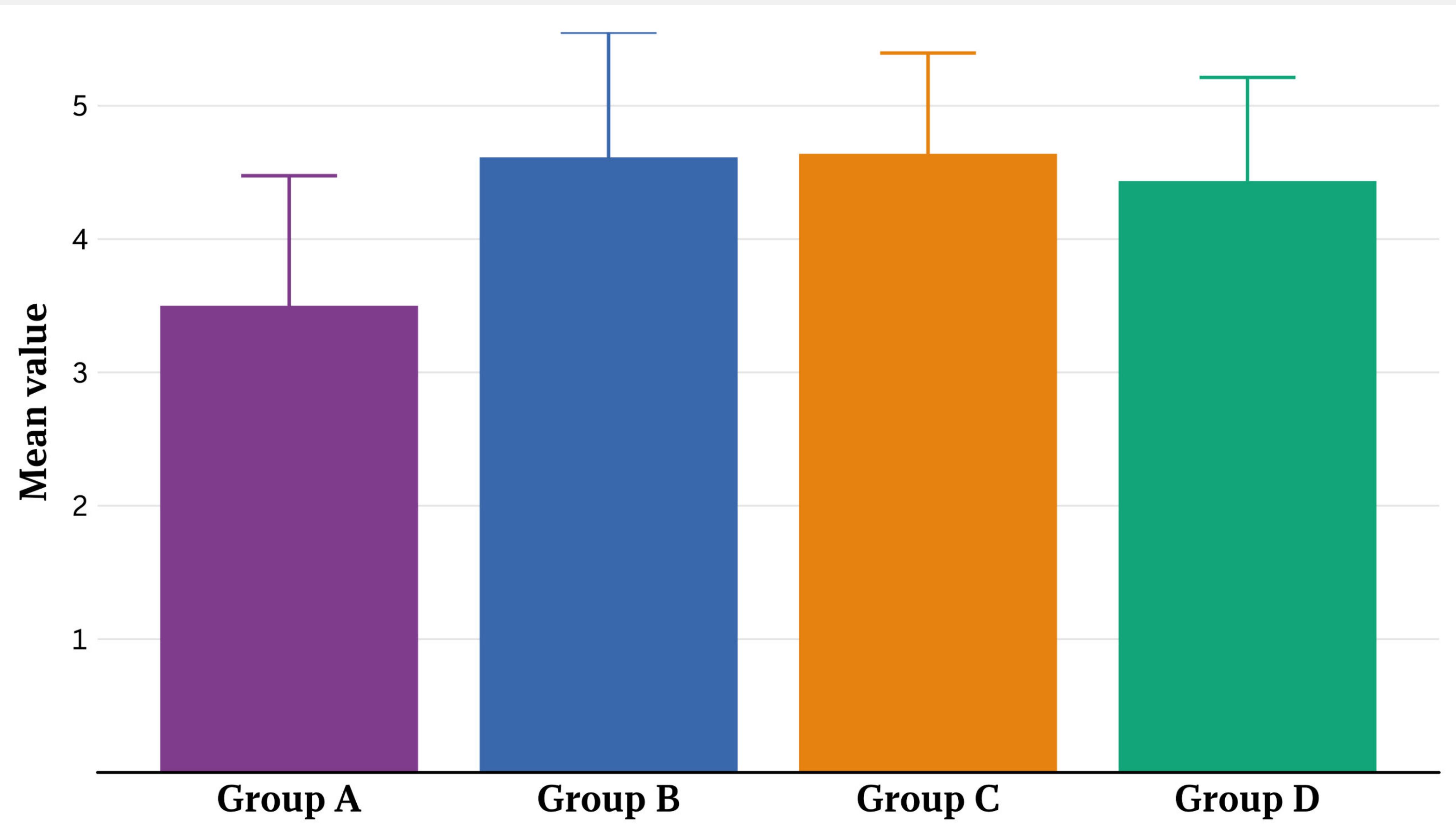
Source: Nathan Yau (flowingdata.com)





My webinar “Beyond Bar and Box Plots” for USGS Data Science [[Slides](#) | [Recording](#)]





My webinar “Beyond Bar and Box Plots” for USGS Data Science [[Slides](#) | [Recording](#)]



PERSPECTIVE

Beyond Bar and Line Graphs: Time for a New Data Presentation Paradigm

Tracey L. Weissgerber^{1*}, Nataša M. Milic^{1,2}, Stacey J. Winham³, Vesna D. Garovic¹

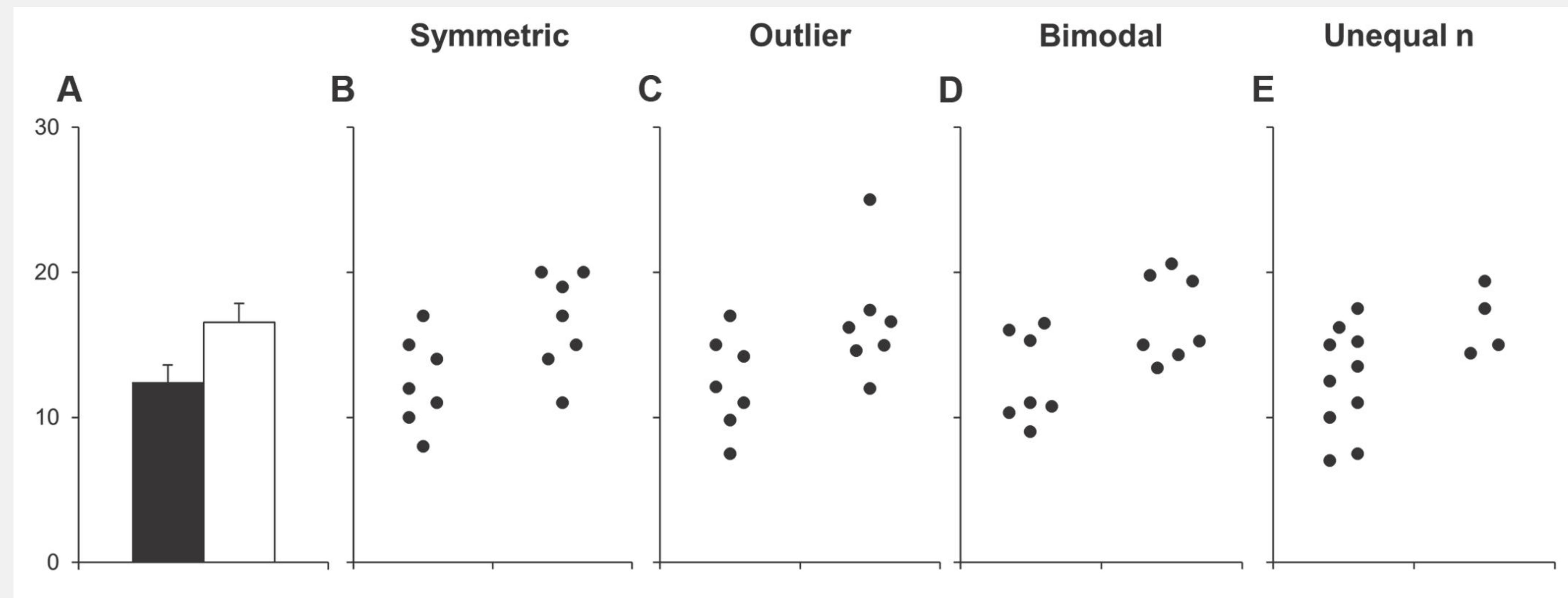
1 Division of Nephrology & Hypertension, Mayo Clinic, Rochester, Minnesota, United States of America,

2 Department of Biostatistics, Medical Faculty, University of Belgrade, Belgrade, Serbia, **3** Division of Biomedical Statistics and Informatics, Mayo Clinic, Rochester, Minnesota, United States of America

* weissgerber.tracey@mayo.edu

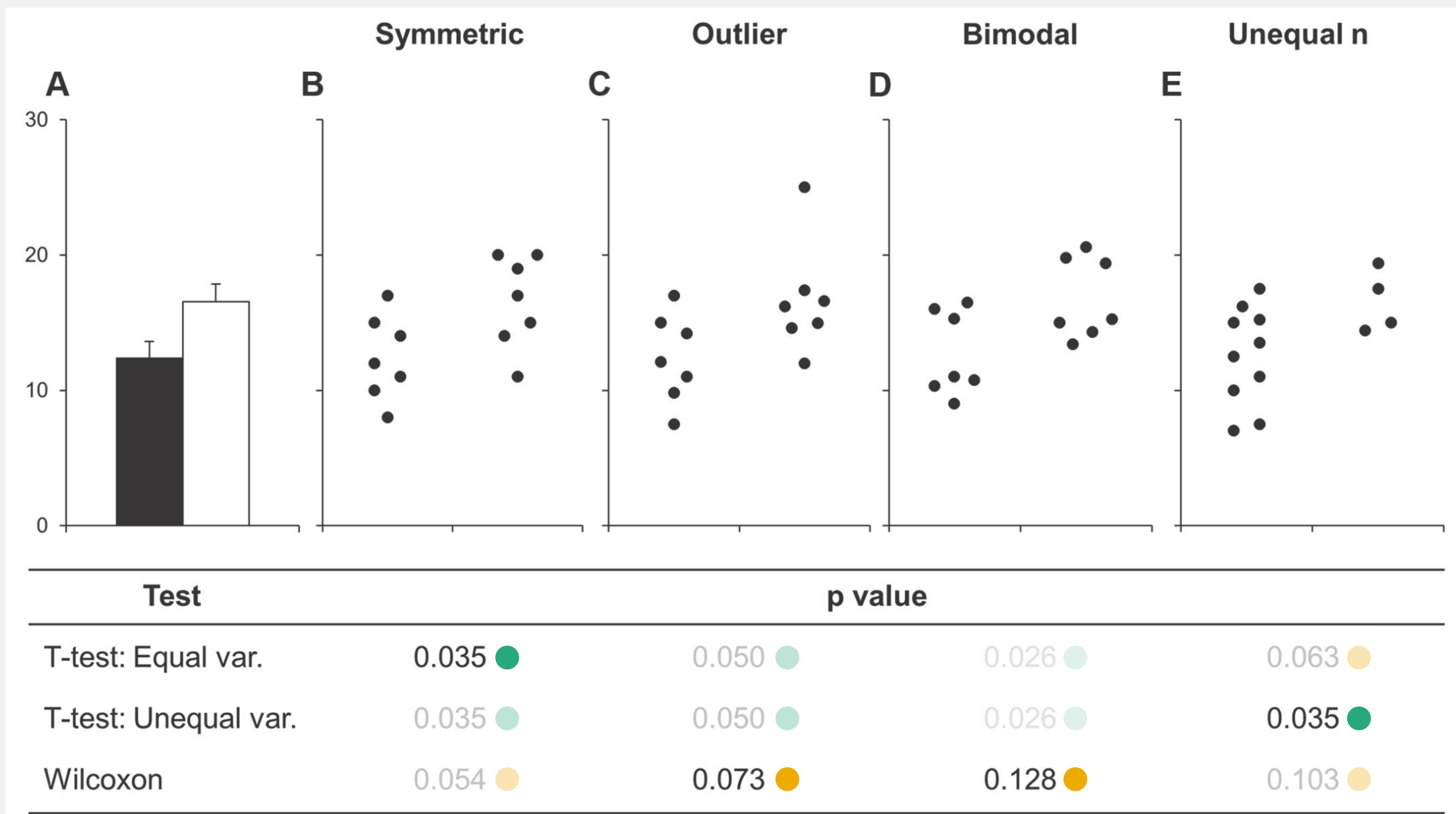
Weissgerber et al. (2015) PLoS Biology



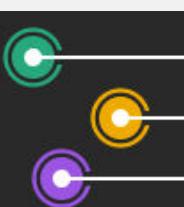


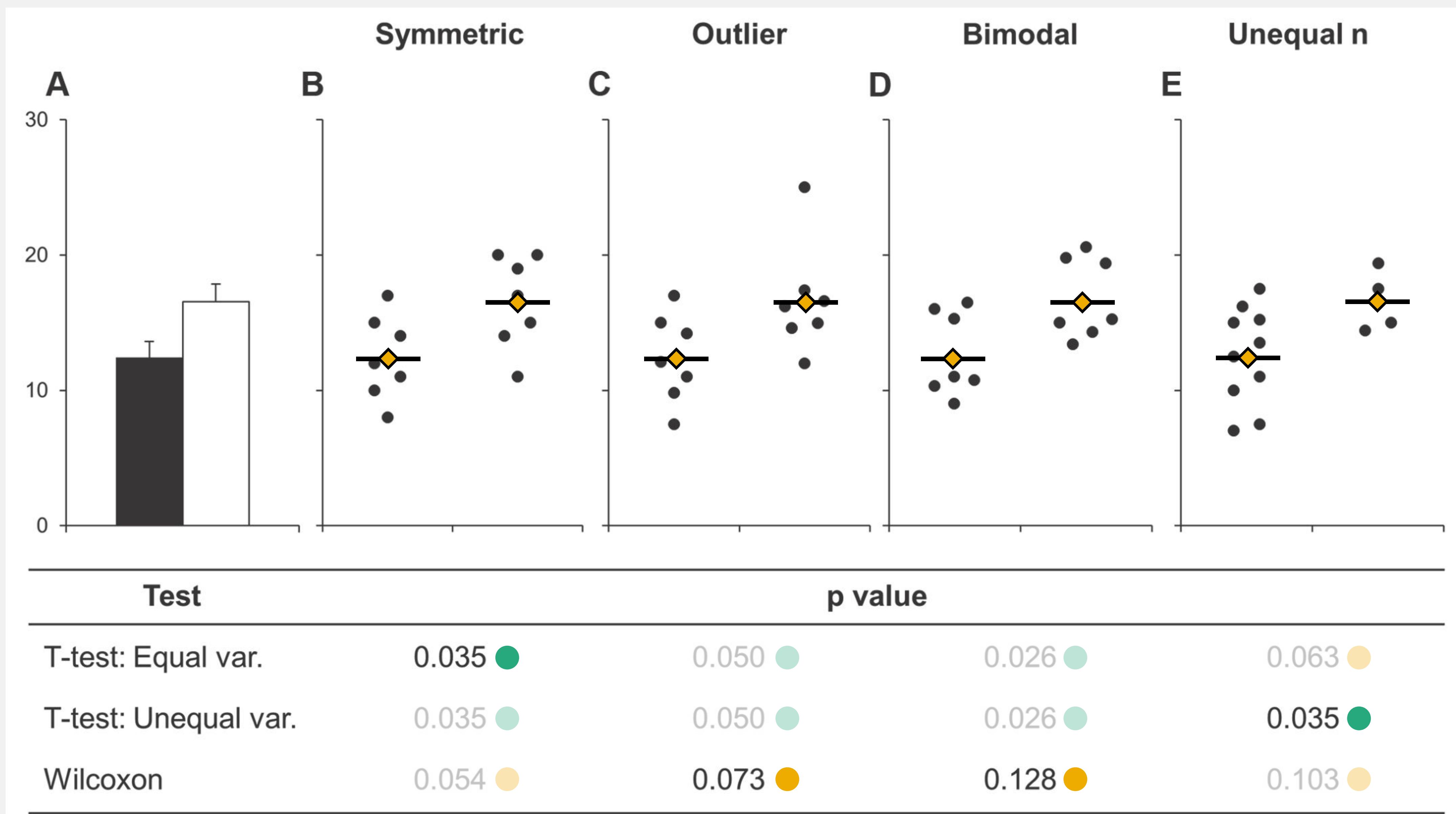
Weissgerber et al. (2015) PLoS Biology





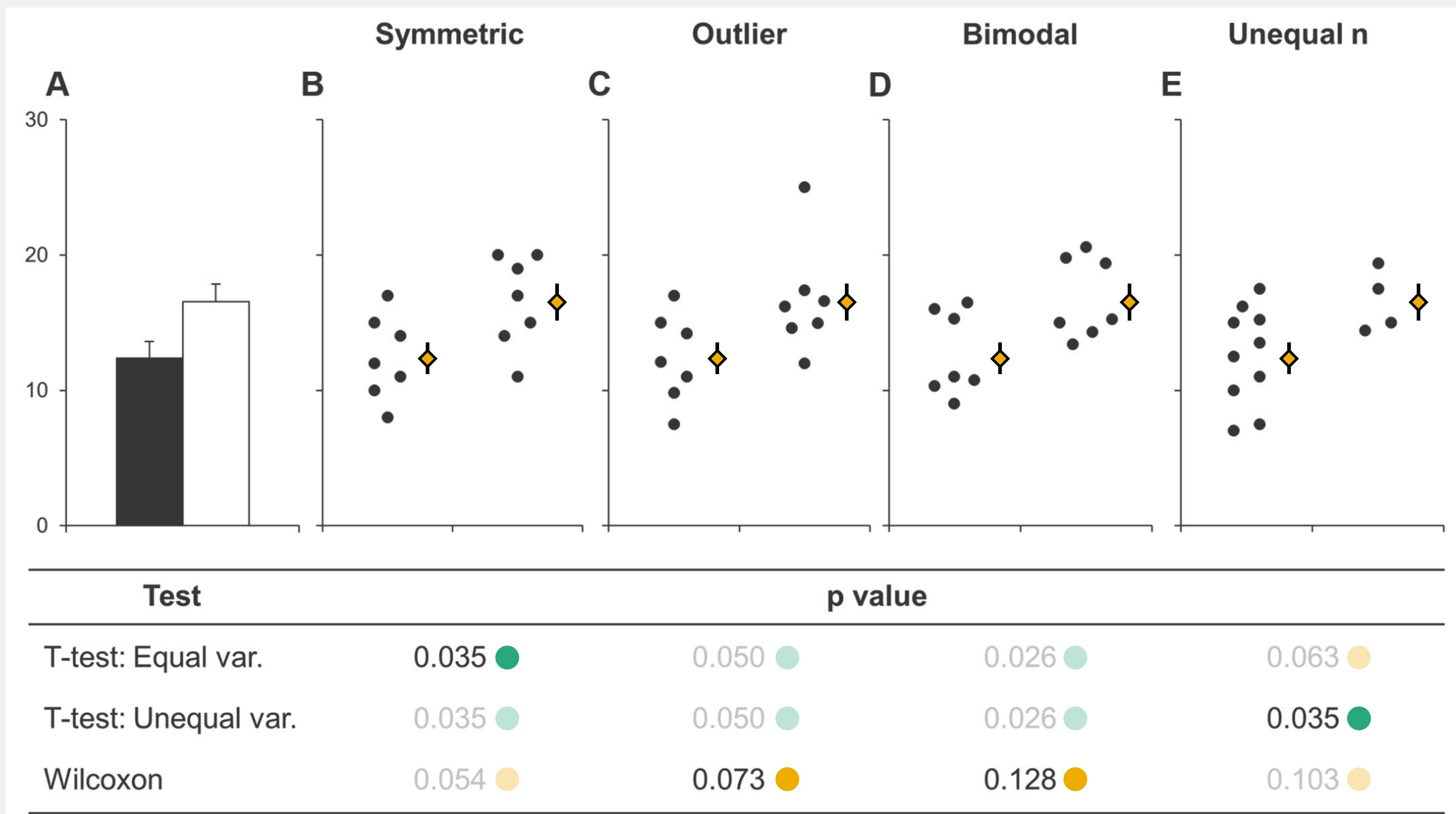
Modified from Weissgerber et al. (2015) PLoS Biology



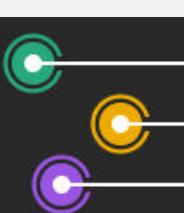


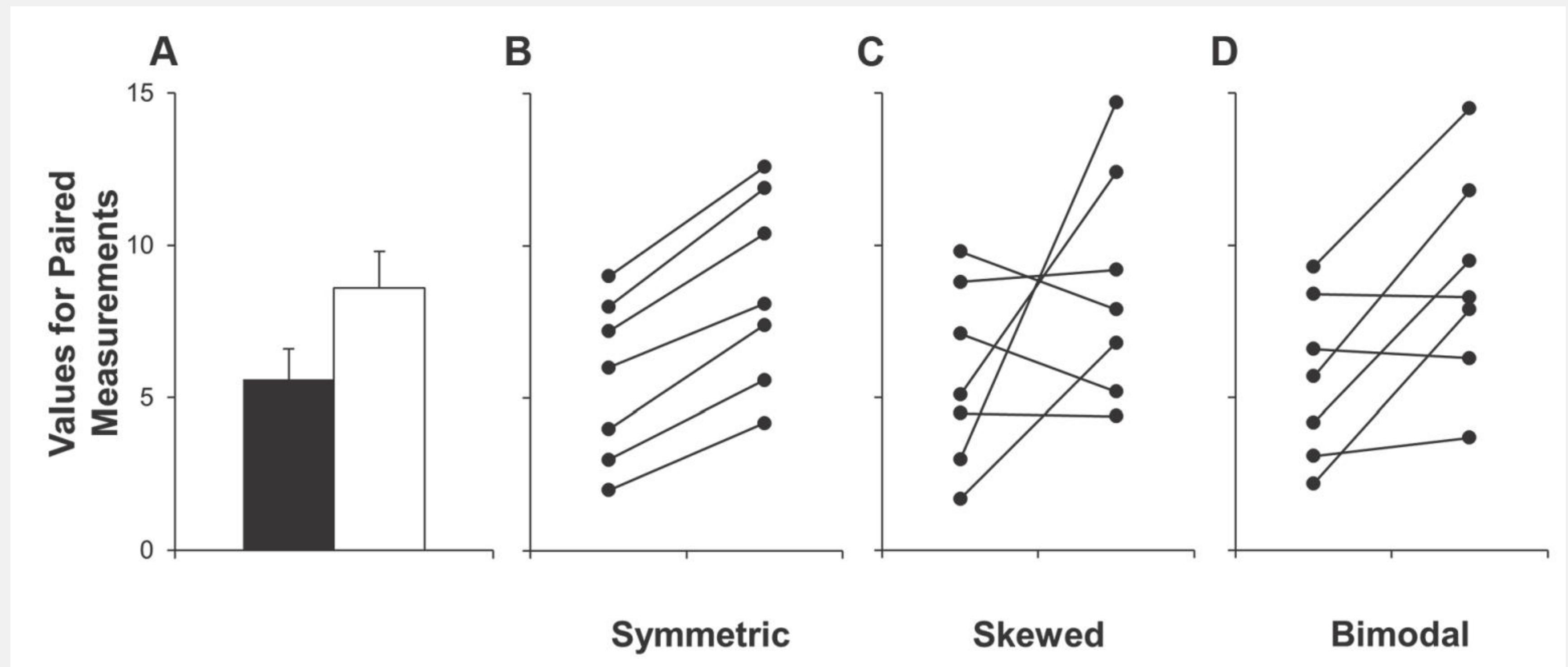
Modified from Weissgerber et al. (2015) PLoS Biology





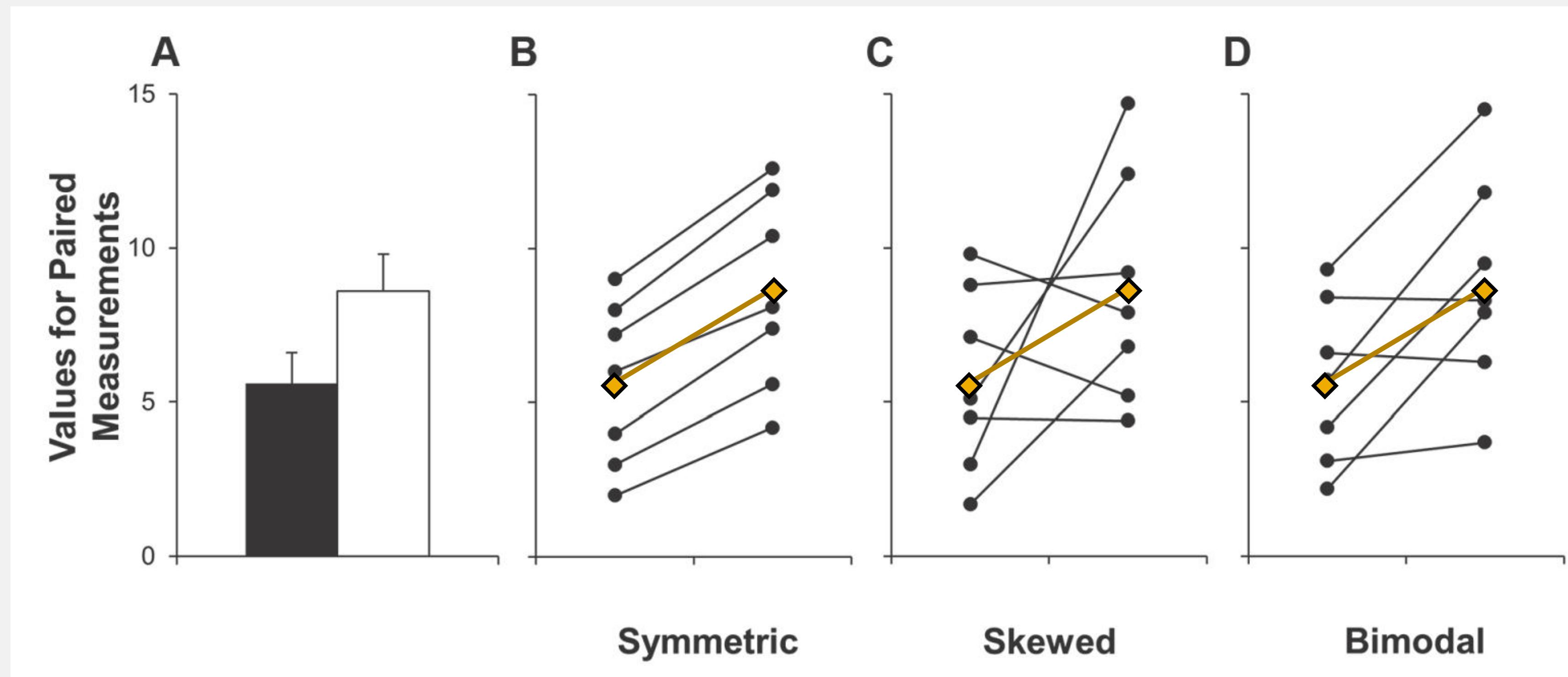
Modified from Weissgerber et al. (2015) PLoS Biology





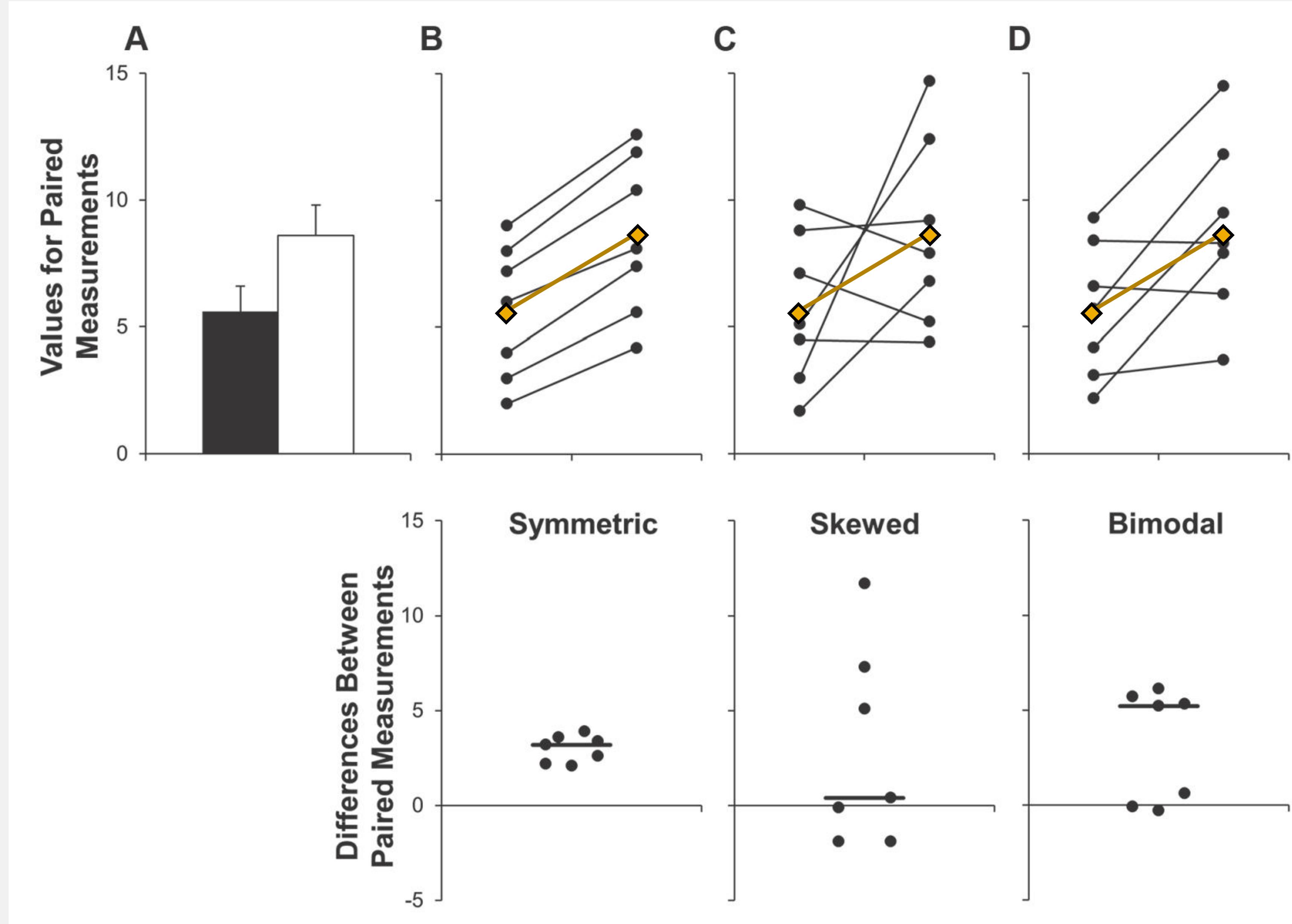
Weissgerber et al. (2015) PLoS Biology



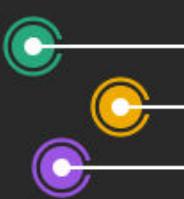


Modified from Weissgerber et al. (2015) PLoS Biology





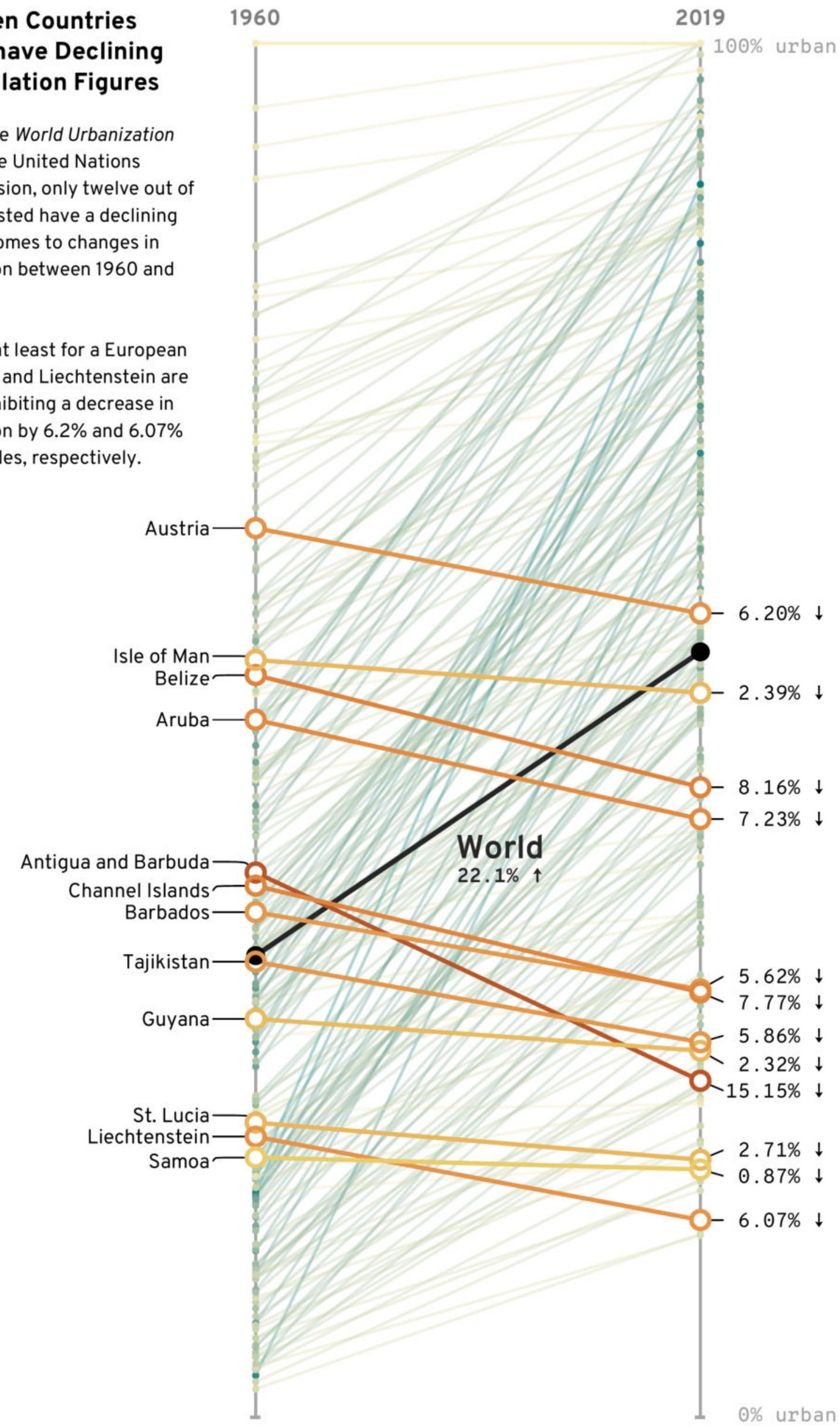
Modified from Weissgerber et al. (2015) PLoS Biology



Only a Dozen Countries Worldwide have Declining Urban Population Figures

According to the *World Urbanization Prospects* by the United Nations Population Division, only twelve out of 218 countries listed have a declining trend when it comes to changes in urban population between 1960 and 2019.

Surprisingly—at least for a European citizen—Austria and Liechtenstein are among those exhibiting a decrease in urban population by 6.2% and 6.07% within six decades, respectively.

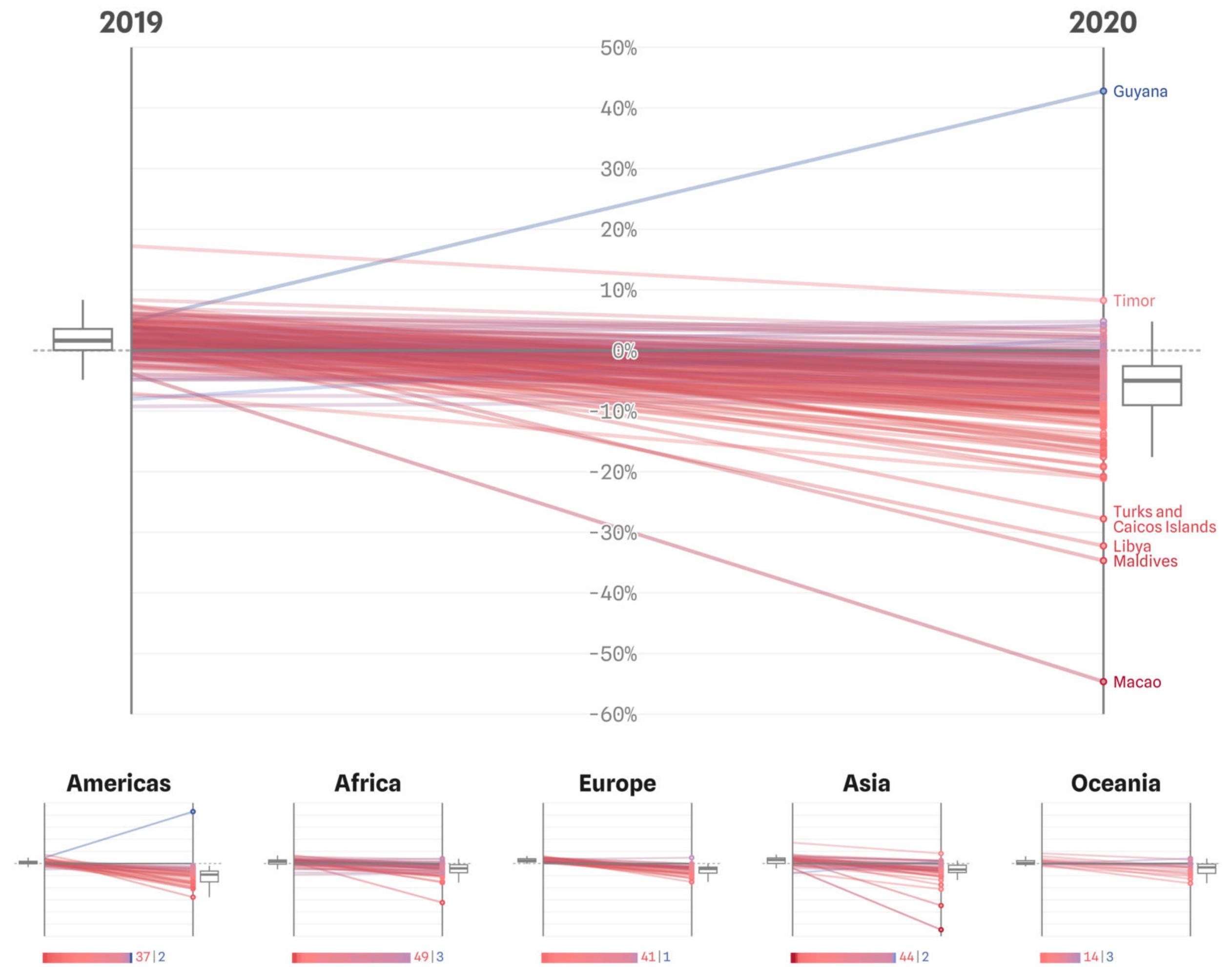


Visualization by Cédric Scherer | Data: United Nations Population Division. World Urbanization Prospects: 2018 Revision. | #30DayChartChallenge 2021 Day 5: Slope



Average income has decreased in 185 countries from 2019 to 2020, with GDP per capita growth turning negative in 72% of these cases.

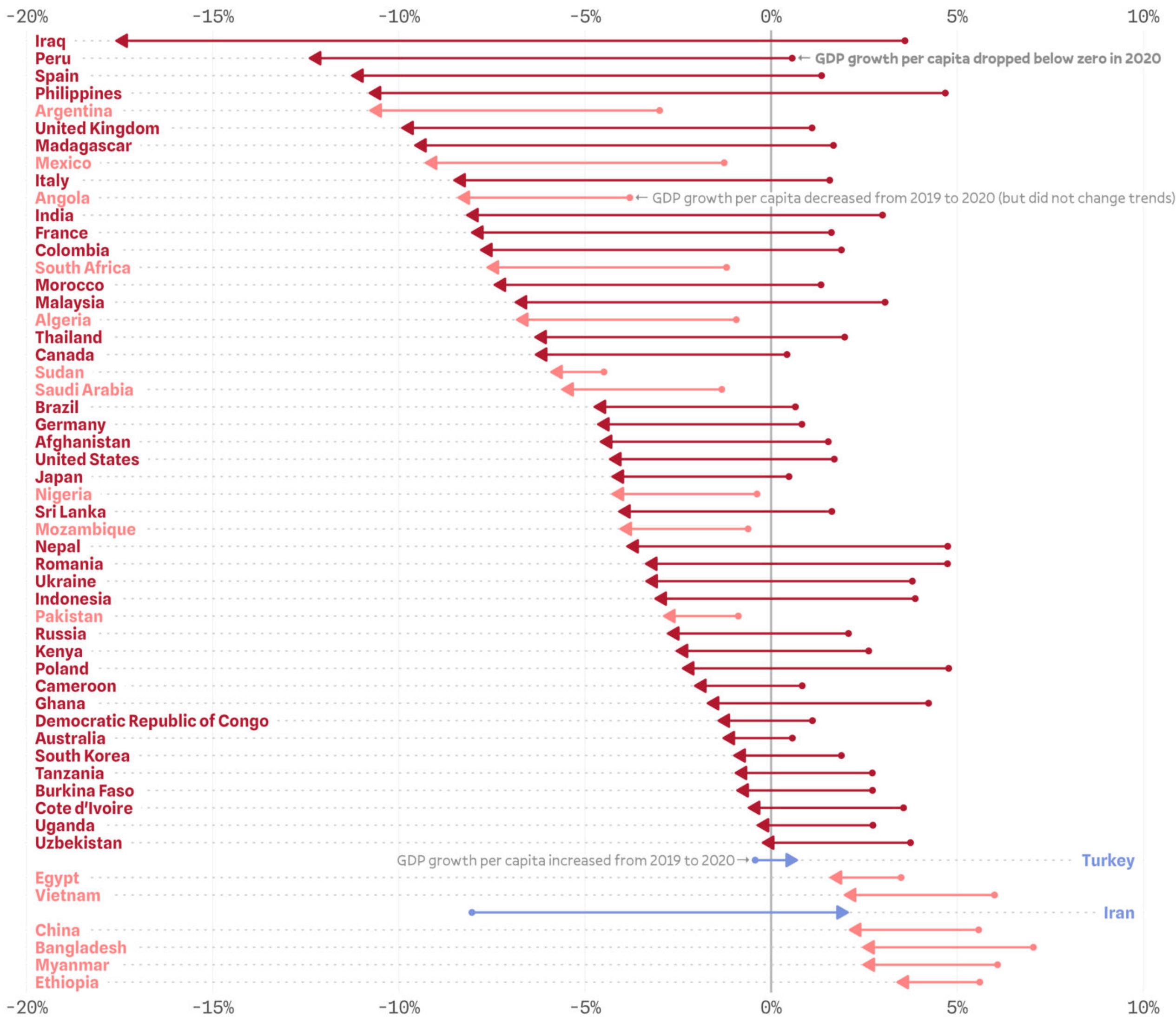
185 | 11
Countries that experienced a **decline** or **increase** in annual change in GDP per capita growth (inflation adjusted)



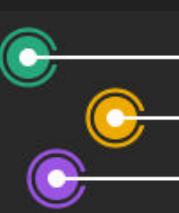
Graphic: Cédric Scherer • Data: World Bank and OECD via OurWorldInData



Average income has decreased in almost all countries from 2019 to 2020, with GDP per capita growth turning from positive to negative in most cases.

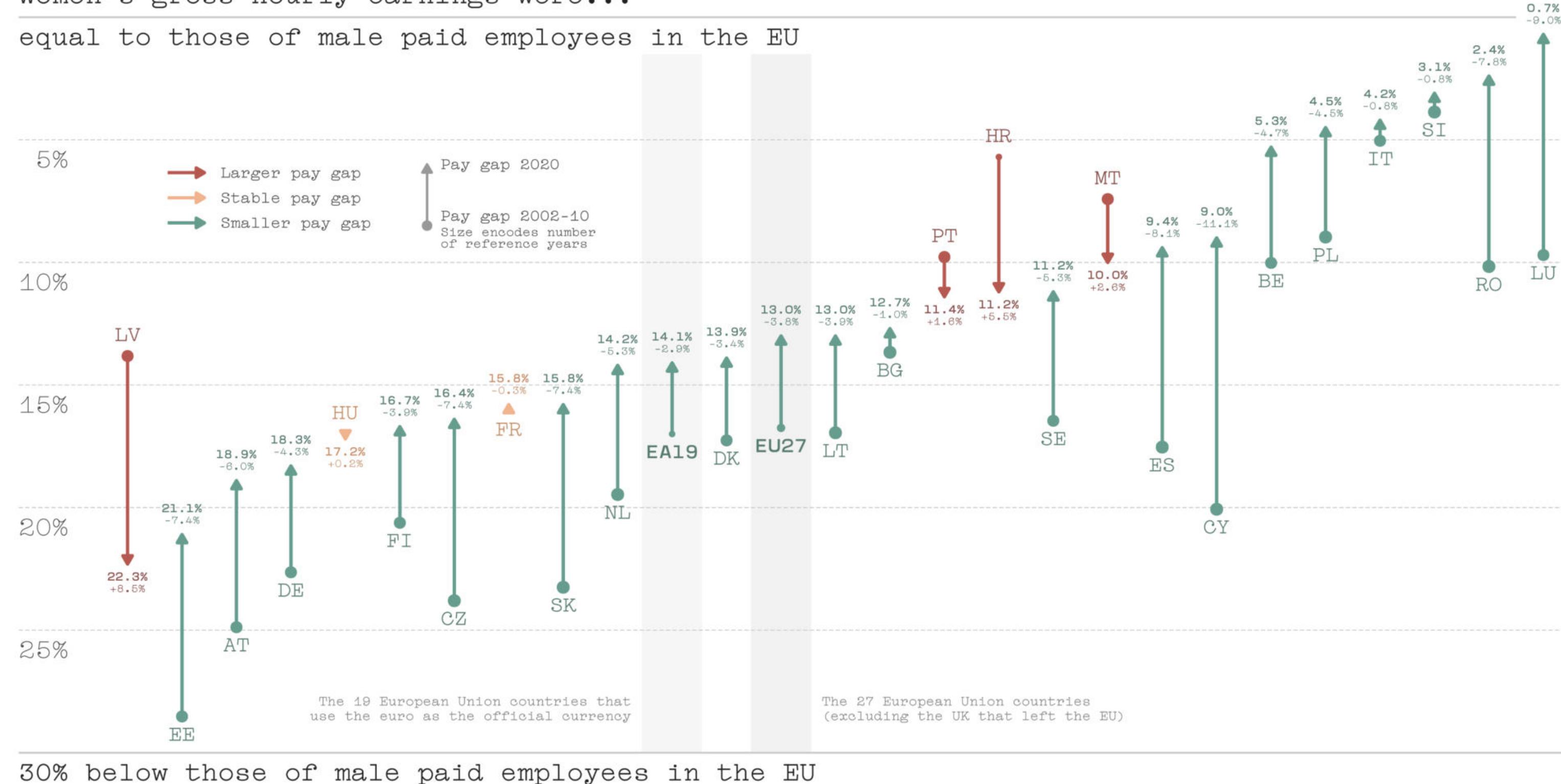


Graphic: Cédric Scherer • Data: World Bank and OECD via OurWorldInData • The graphic contains countries that inhabit more than 20M people.



Women's gross hourly earnings were...

equal to those of male paid employees in the EU



30% below those of male paid employees in the EU

In 2020, women's gross hourly earnings were on average 13% below those of men in the EU. Many countries were able to decrease the pay gap between male and female employees: most notably Luxembourg with the smallest gap in 2020 of 0.7% and Romania with a decrease of 13.6% within 18 years to 2.4%, ranking second. However, in several countries the pay gap was almost **stable** (Hungary and France) or even increased (Latvia, Portugal, Croatia, and Malta) compared to the gap in the reference period from 2002 to 2010 for all years available via Eurostat.

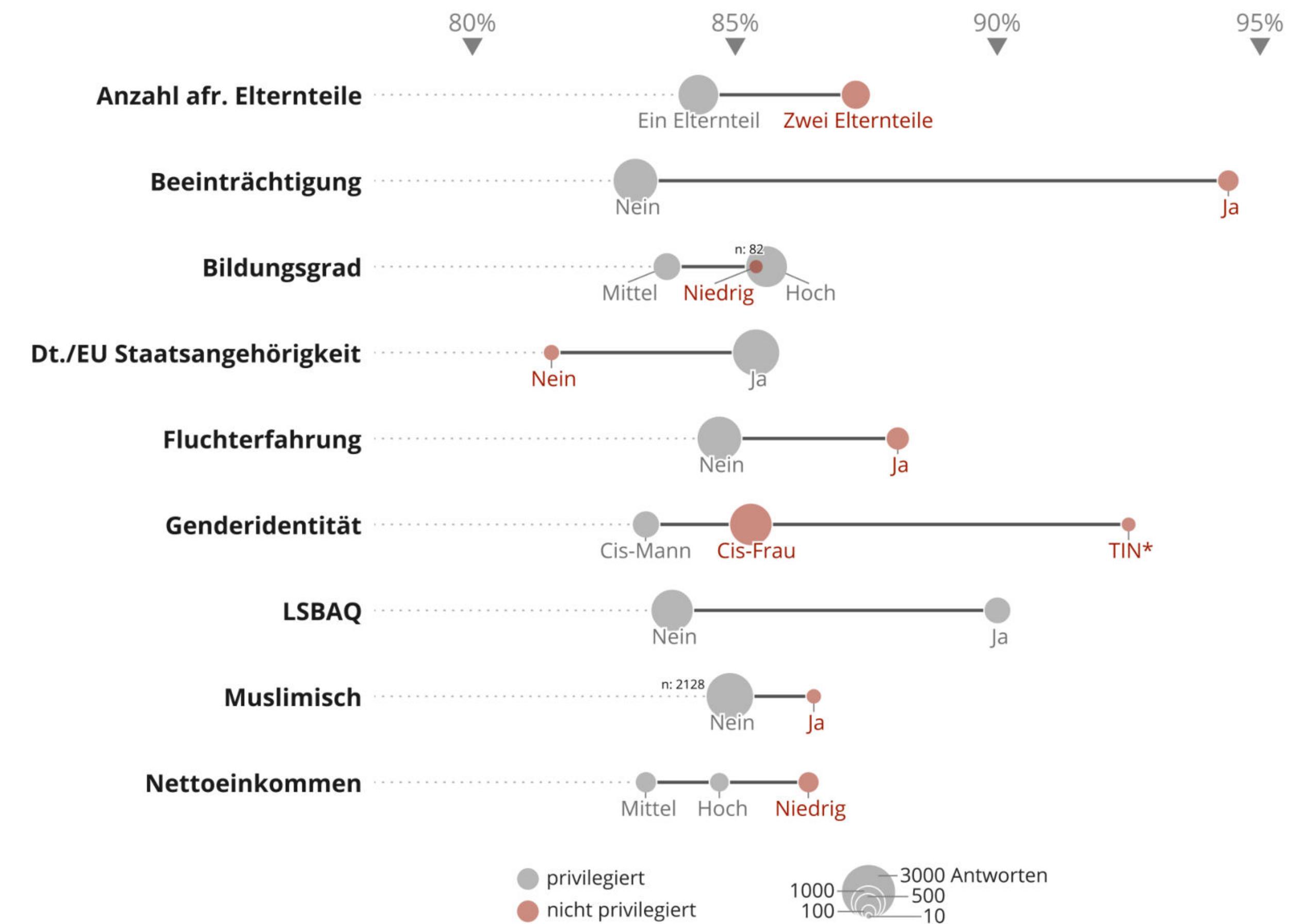
As an unadjusted indicator, the gender pay gap gives an overall picture of the differences between men and women in terms of earnings and measures – a concept which is broader than discrimination in the sense of: *equal pay for work of equal value*.

Graphic: Cédric Scherer • Data: Eurostat (SDG_05_20; no data for Greece and Ireland) • #InternationalWomensDay2022

"The Pay Gap in Europe", persönliches Projekt zum Internationalen Frauentag 2022



Häufigkeit von Diskriminierungserfahrungen entlang ausgewählter Vielfaltsdimensionen im Lebensbereich „Medien und Internet“

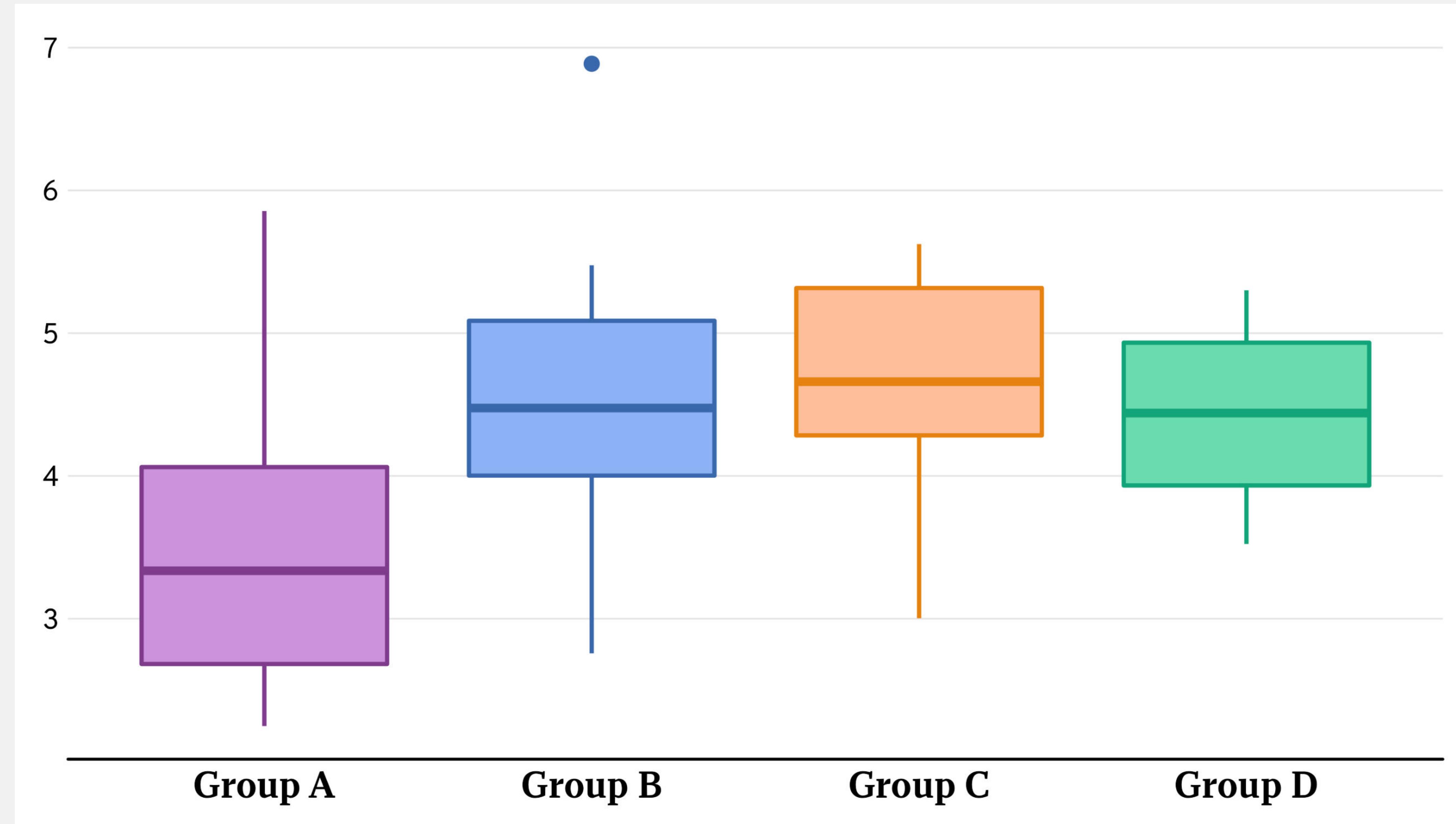


Lesebeispiel: LSBAQ-Befragte des Afrozensus geben im Vergleich mit heterosexuellen Afrozensus-Befragten häufiger an, im Lebensbereich „Medien und Internet“ in den letzten zwei Jahren Diskriminierung erlebt zu haben.

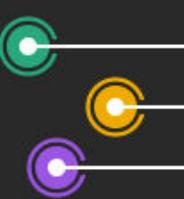
Quelle: Abb. 46 in Aikins, M A; Bremberger, T; Aikins, J K; Gyamerah, D; Yıldırım-Caliman, D (2021): Afrozensus 2020 | Datenteam: Reiber, L; Vivanco, J | Design: Scherer, C
Lizenz: CC-BY-NC by EOTO & CFE | afrozensus.de

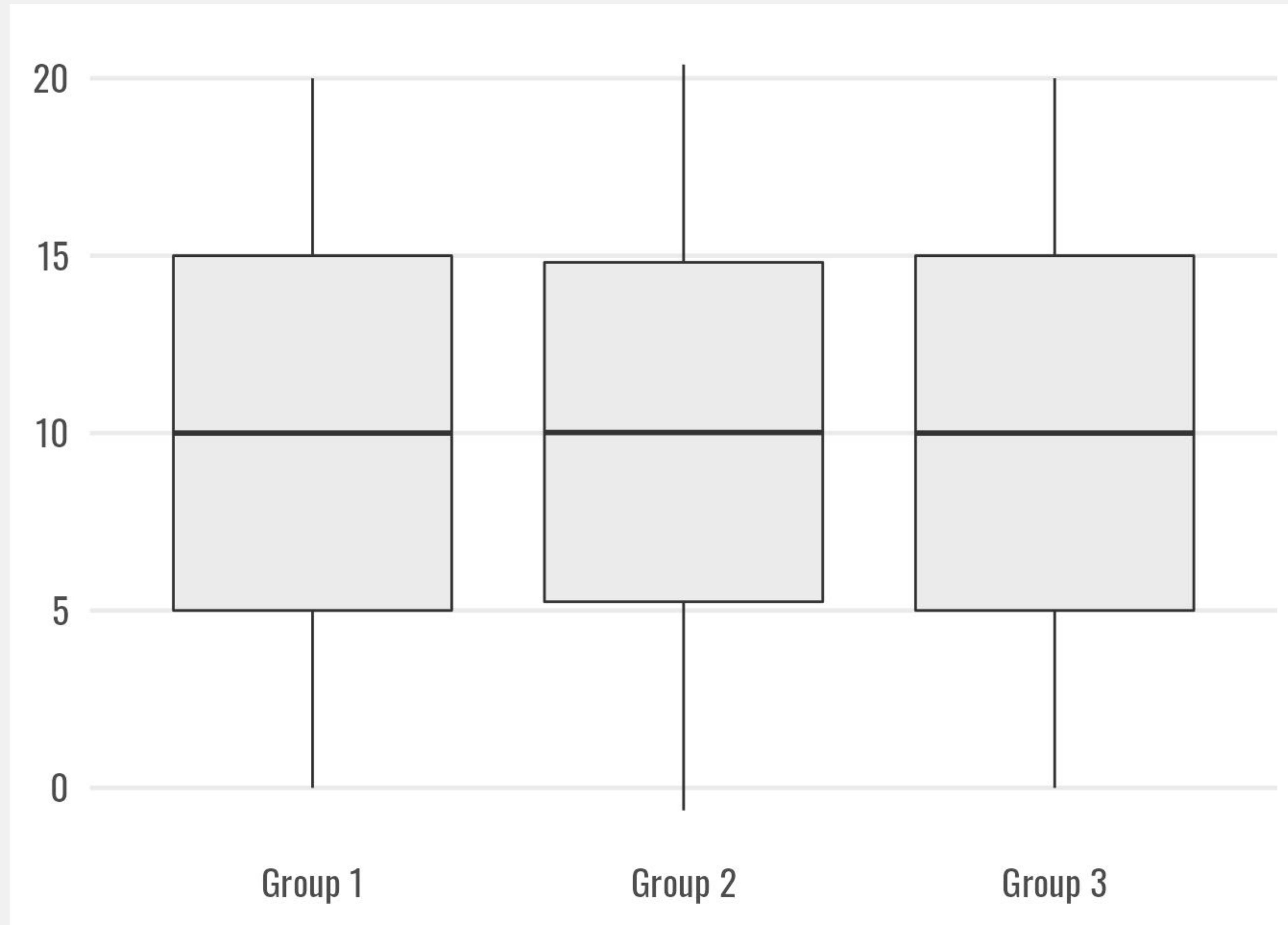
Abb. 46 “Afrozensus 2020” von Citizens For Europe & EOTO e.V.





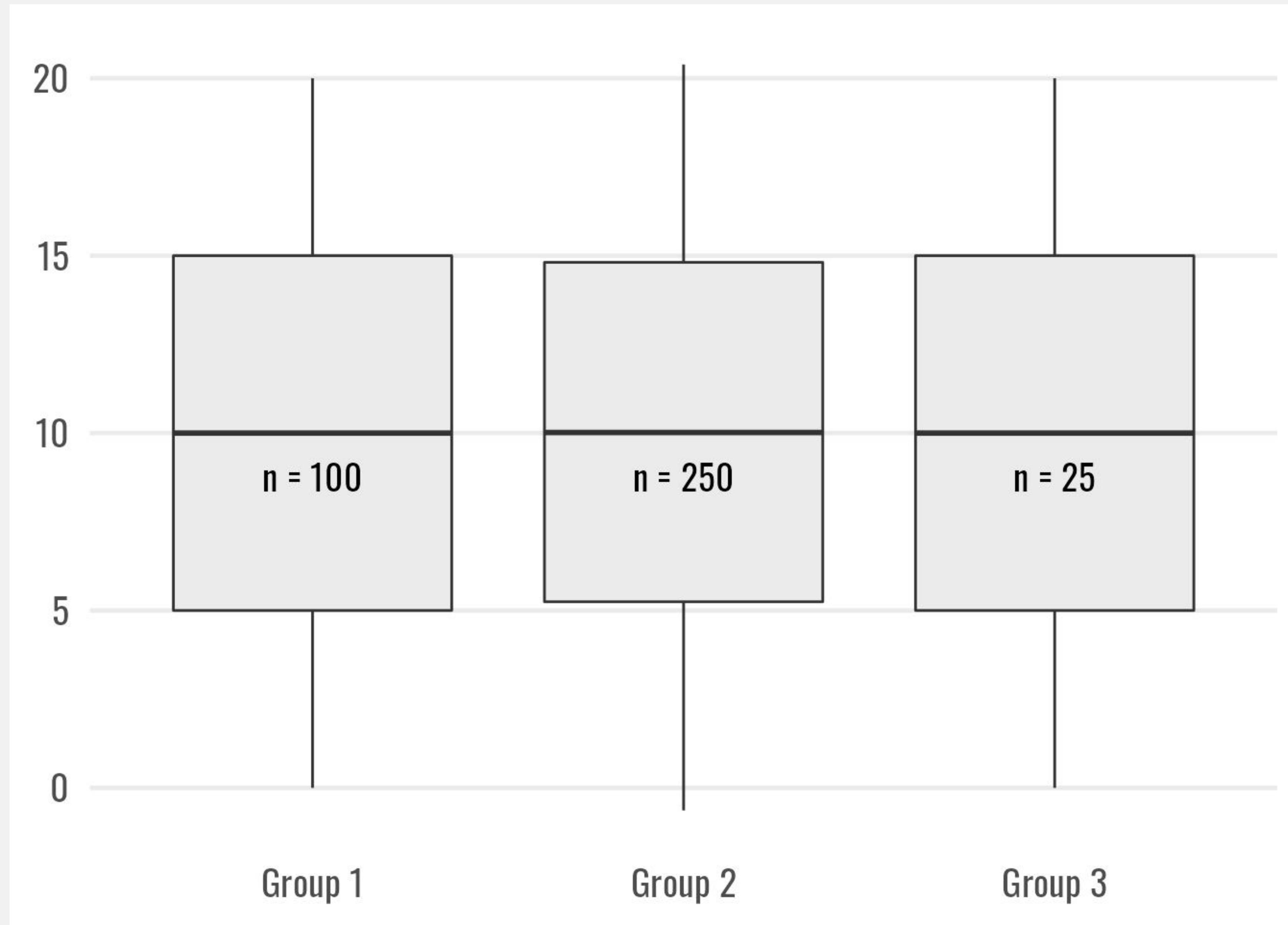
My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]



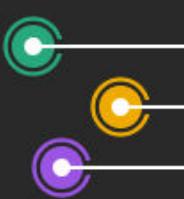


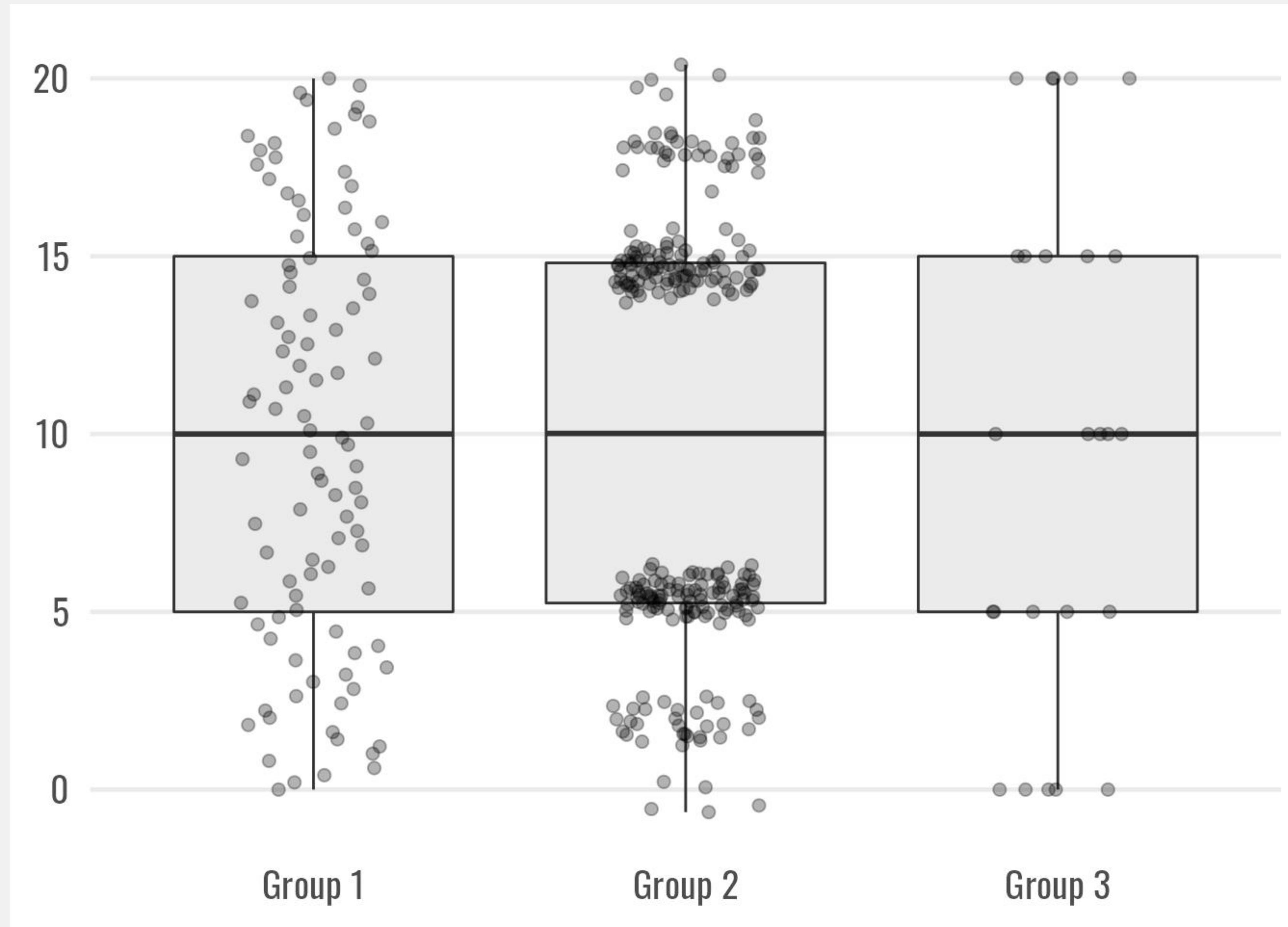
From my blog post "[“Visualizing Distributions with Raincloud Plots \(and How to Create Them with ggplot2\)”](#)





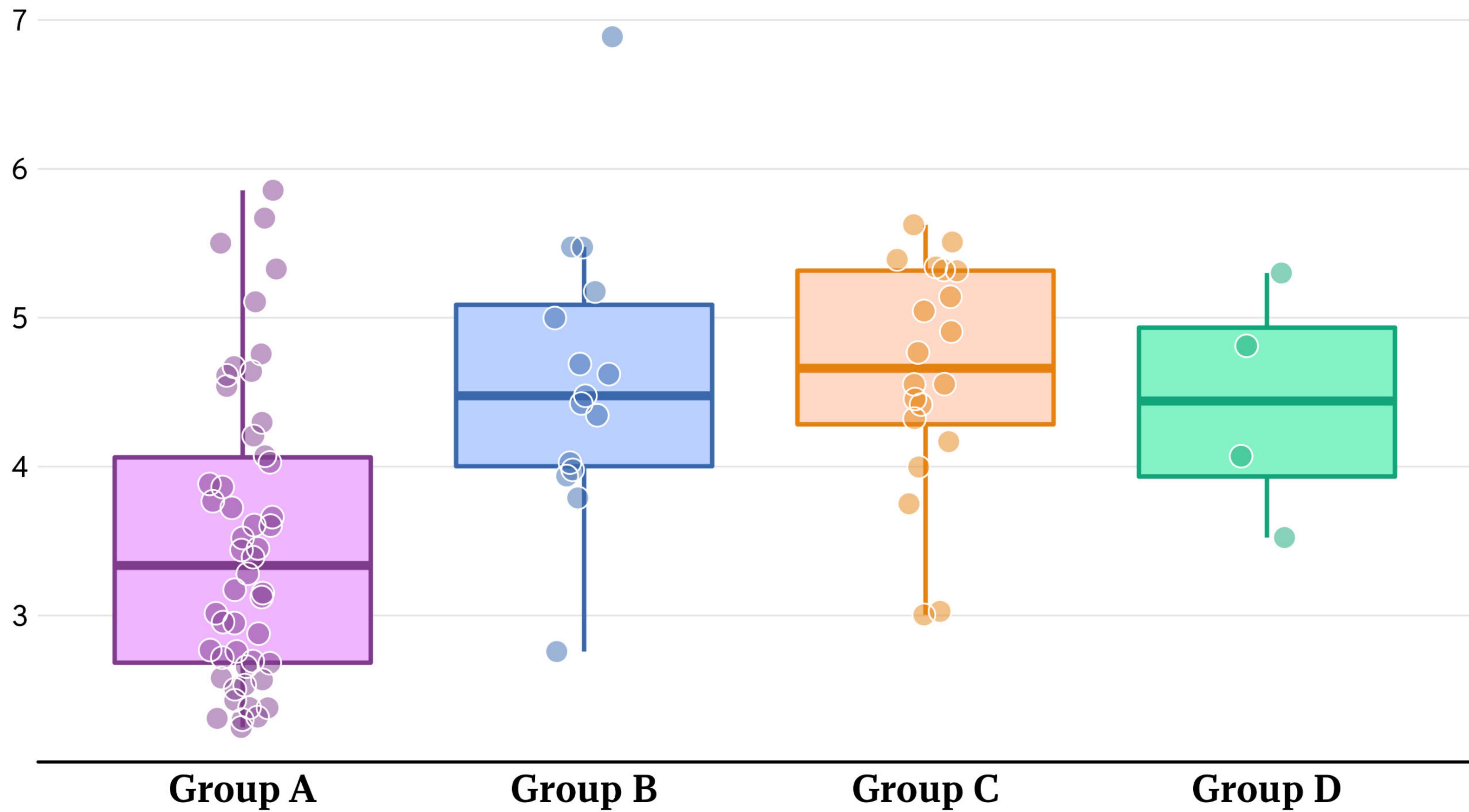
From my blog post “[Visualizing Distributions with Raincloud Plots \(and How to Create Them with ggplot2\)](#)”





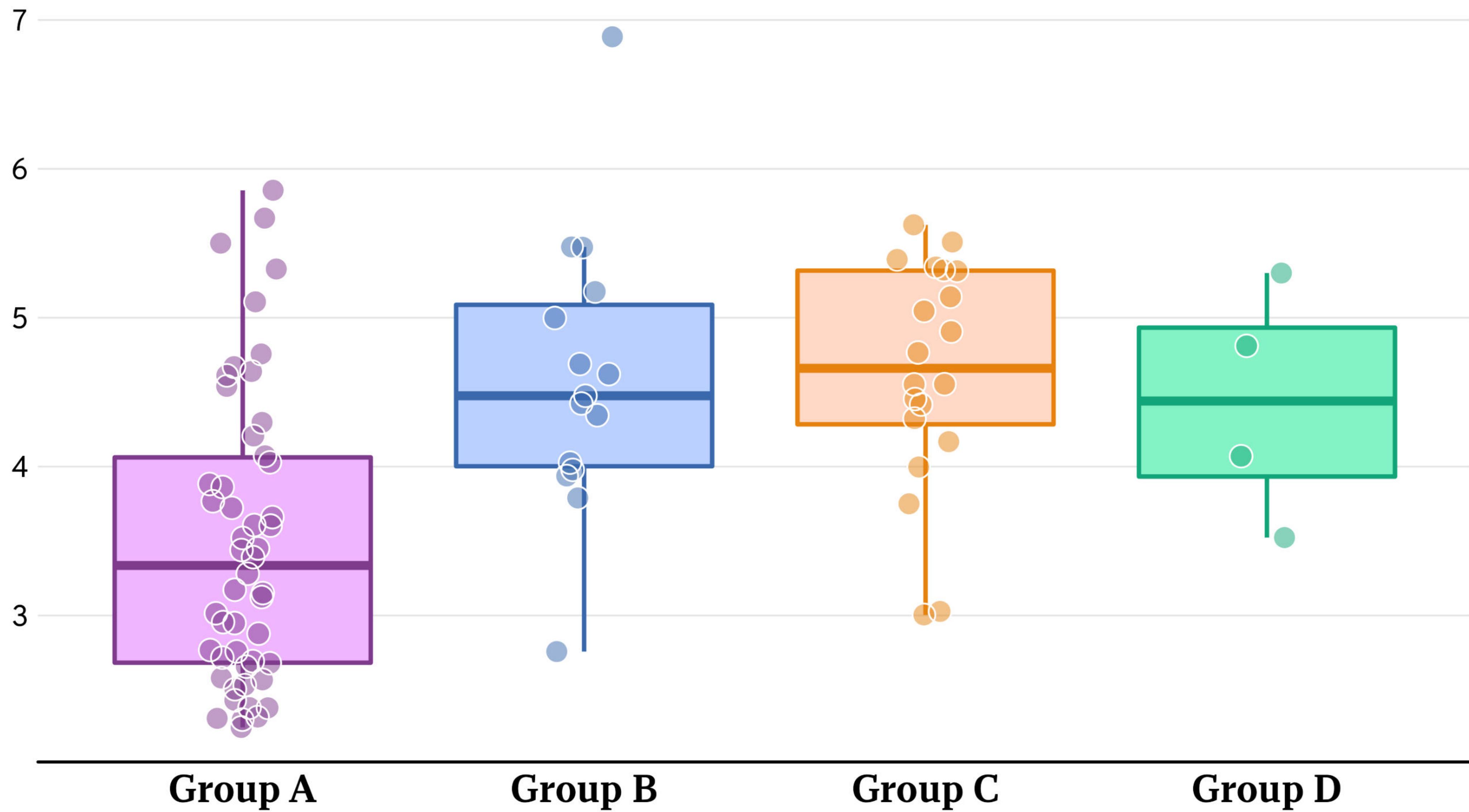
From my blog post “[Visualizing Distributions with Raincloud Plots \(and How to Create Them with ggplot2\)](#)”





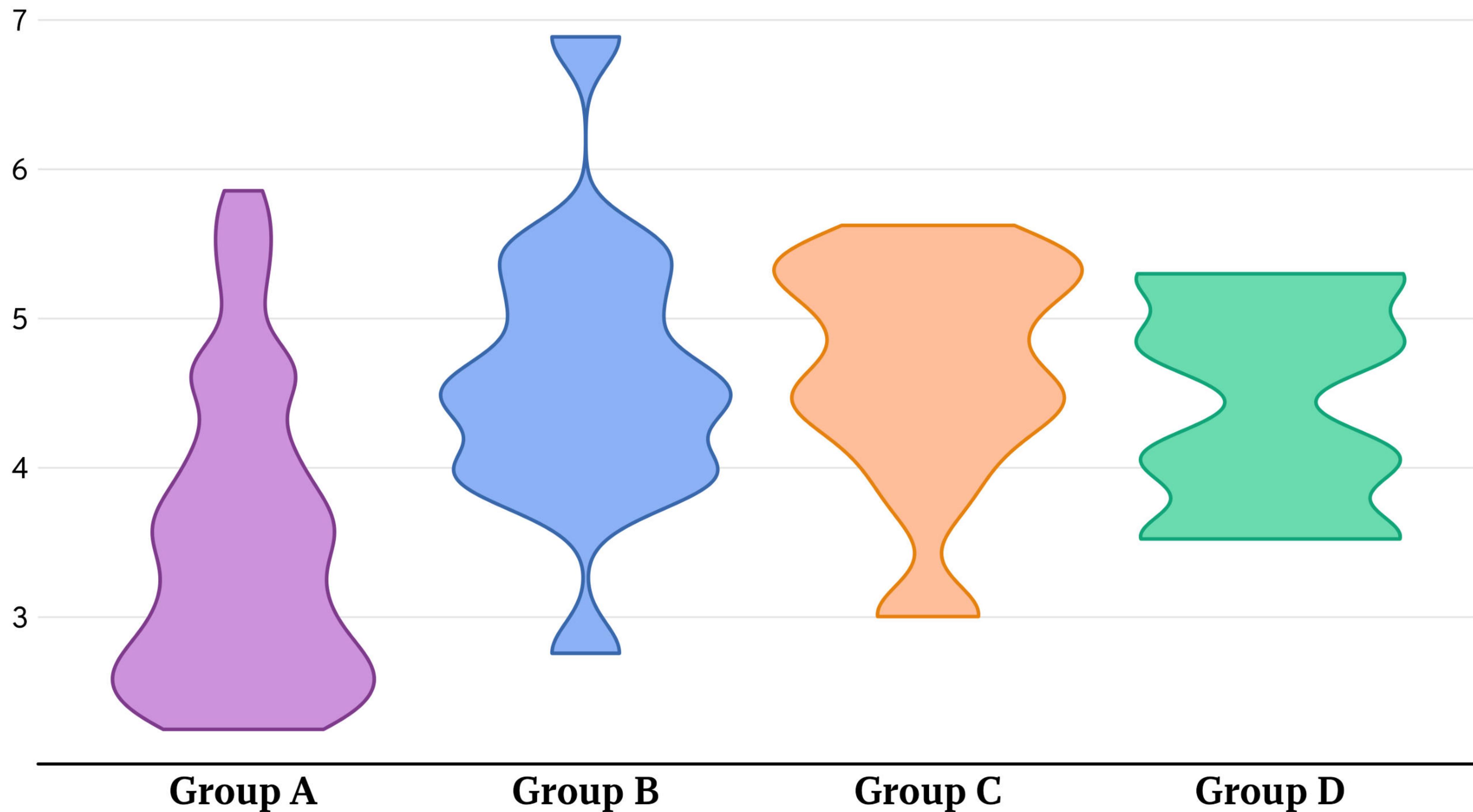
My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]





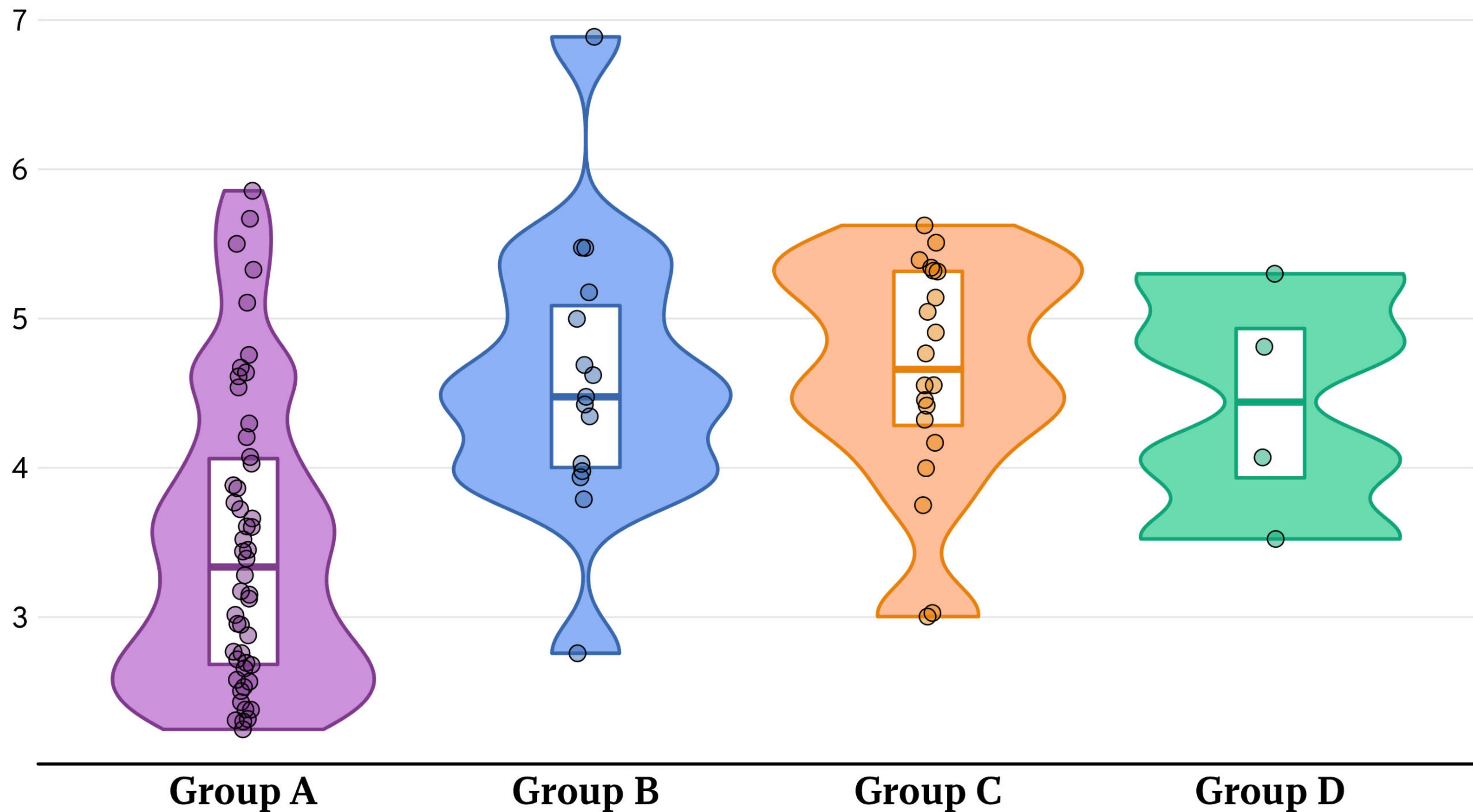
My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]



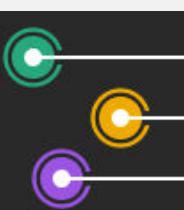


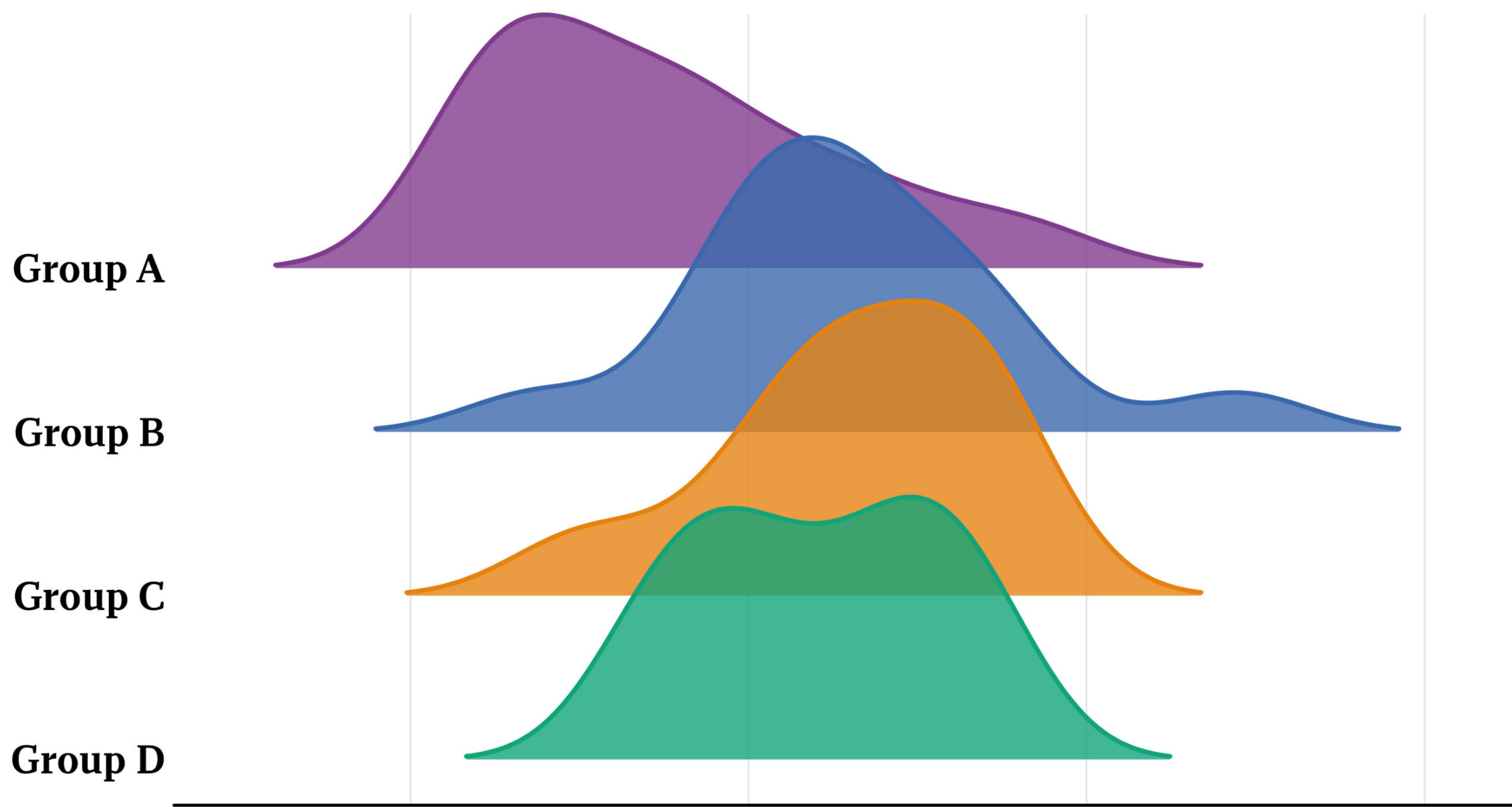
My webinar “Beyond Bar and Box Plots” for USGS Data Science [[Slides](#) | [Recording](#)]





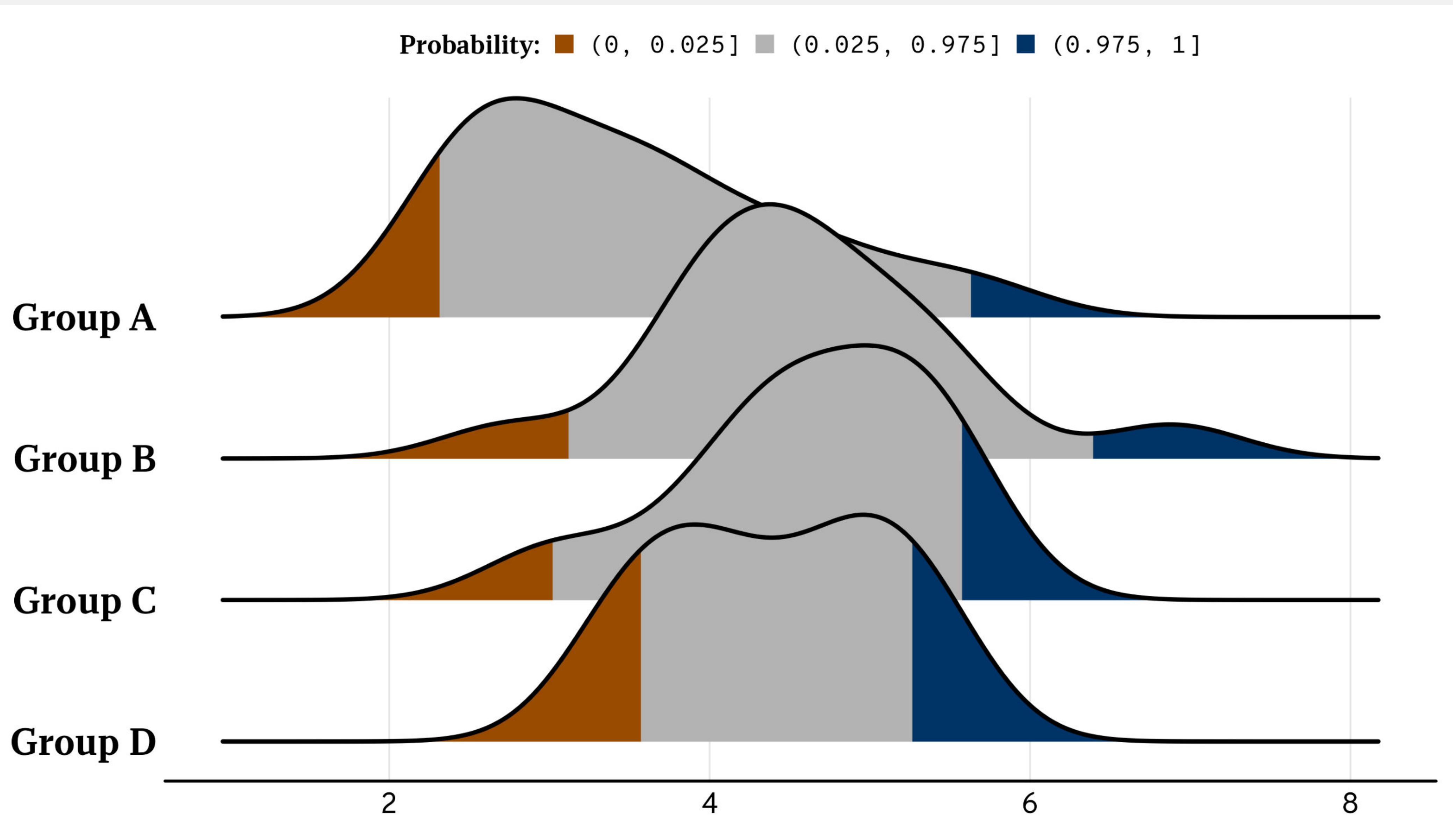
My webinar “Beyond Bar and Box Plots” for USGS Data Science [[Slides](#) | [Recording](#)]





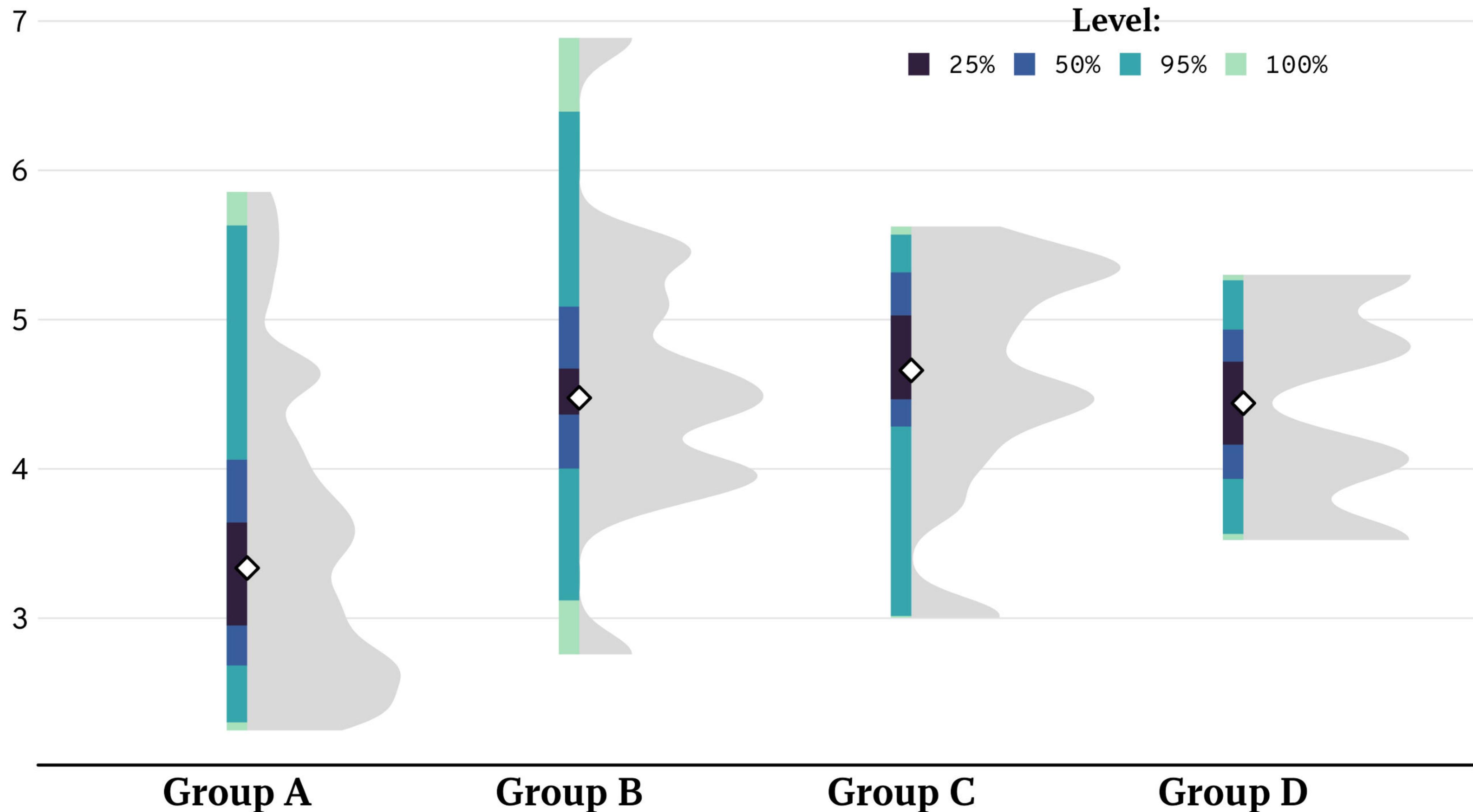
My webinar “Beyond Bar and Box Plots” for USGS Data Science [[Slides](#) | [Recording](#)]





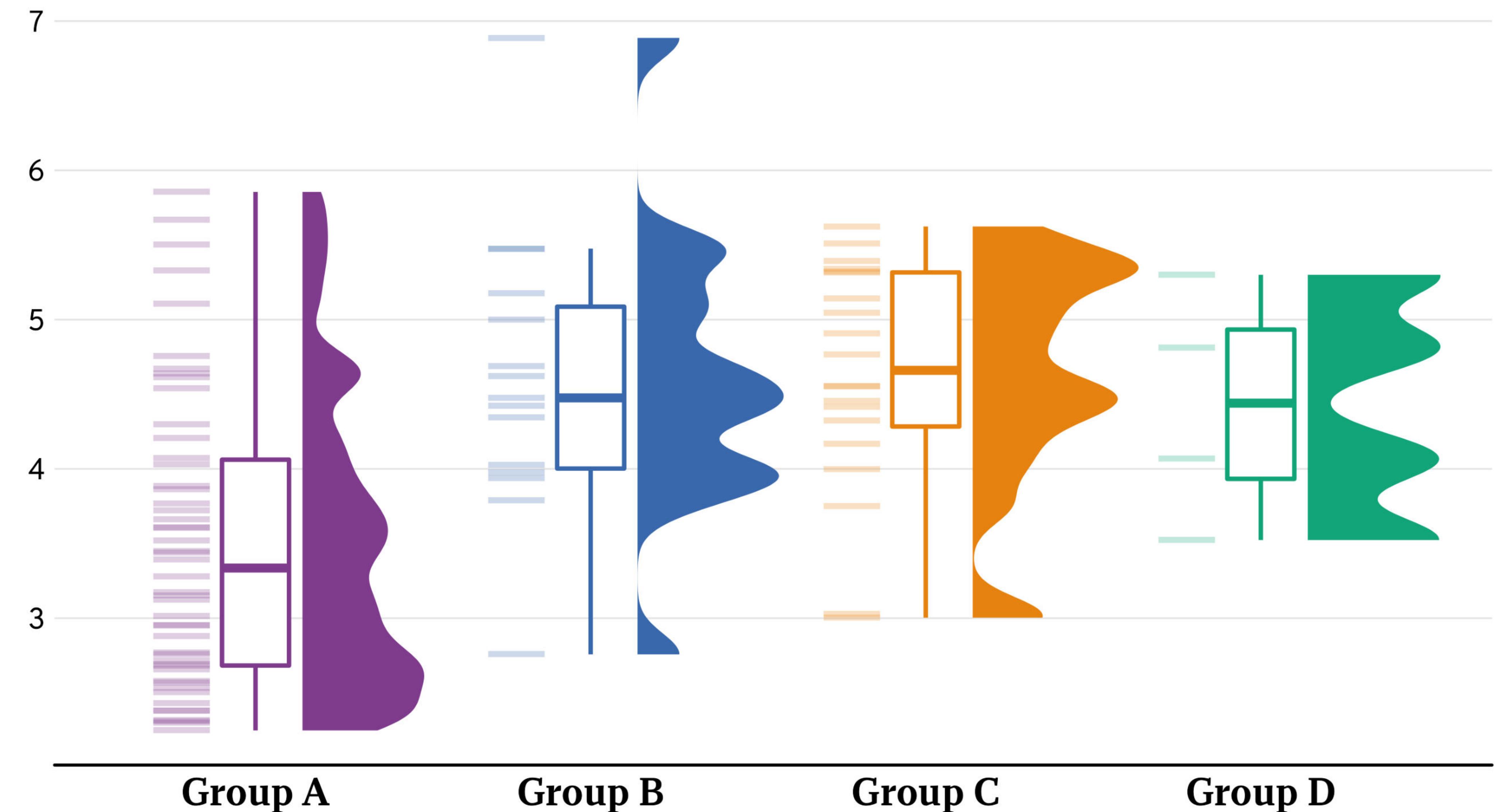
My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]





My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]



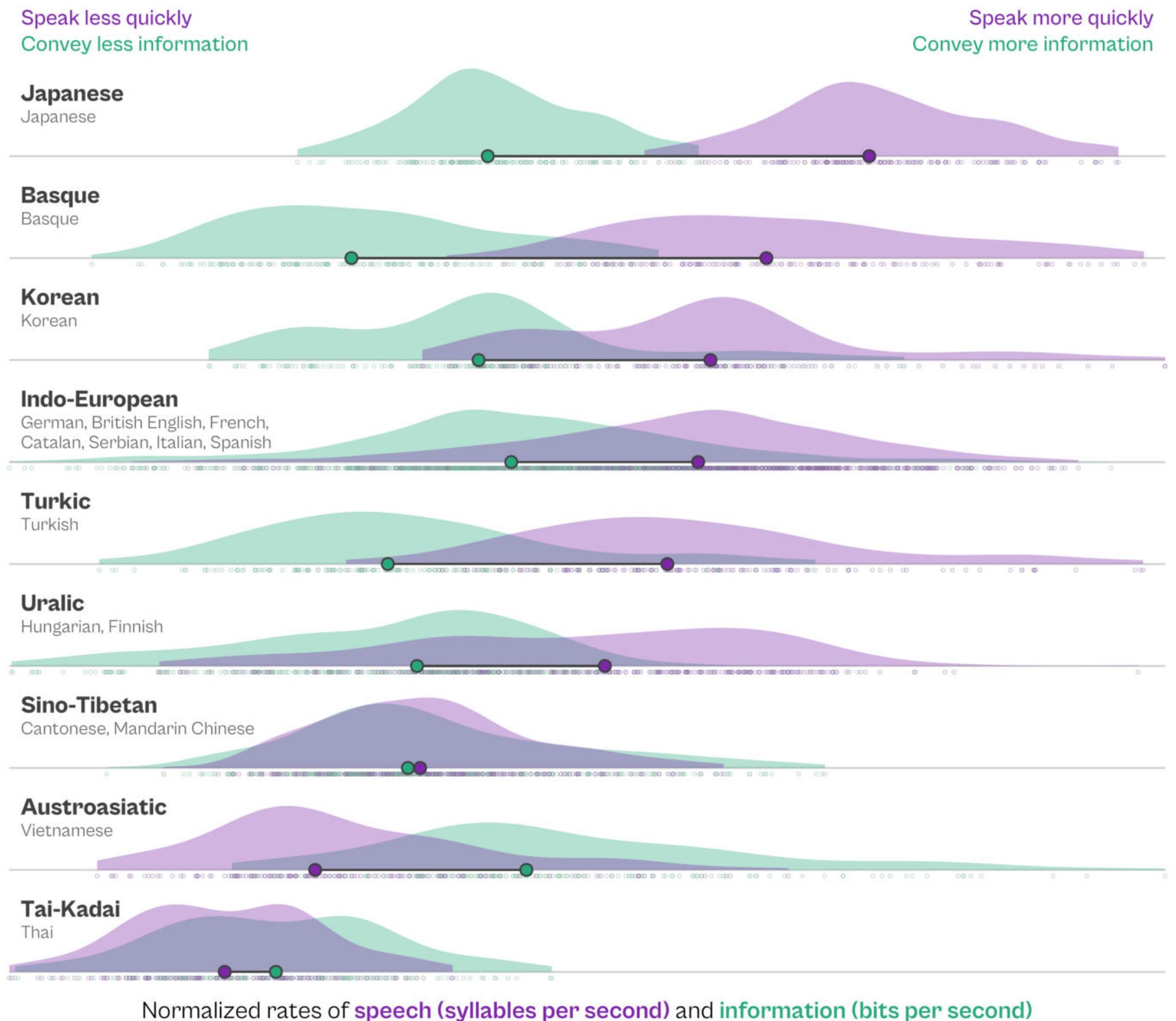


My webinar “*Beyond Bar and Box Plots*” for USGS Data Science [[Slides](#) | [Recording](#)]



Communicating fast doesn't necessarily mean communicating more

Variation in speech and information rates across language families, shown as normalized rates for comparison. While there are stark cross-linguistic differences in speech rates, information rates are more similar.



Source: Coupé et al. 2019 *Science Advances* 5(9). DOI: 10.1126/sciadv.aaw2594

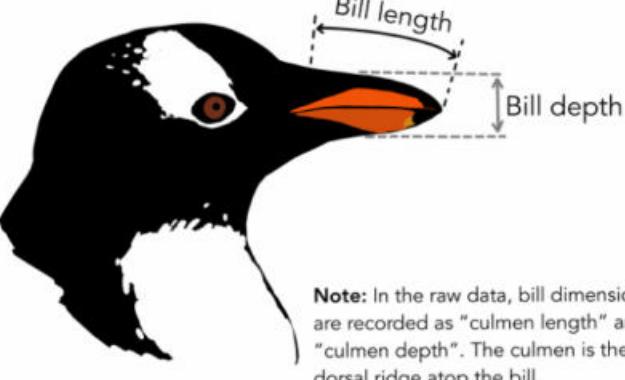
Graphic: Cédric Scherer • Large dots show the median rates for each language family. Small dots show single estimates.

“Communicating fast doesn't necessarily mean communicating more”, #30DayChartChallenge Contribution



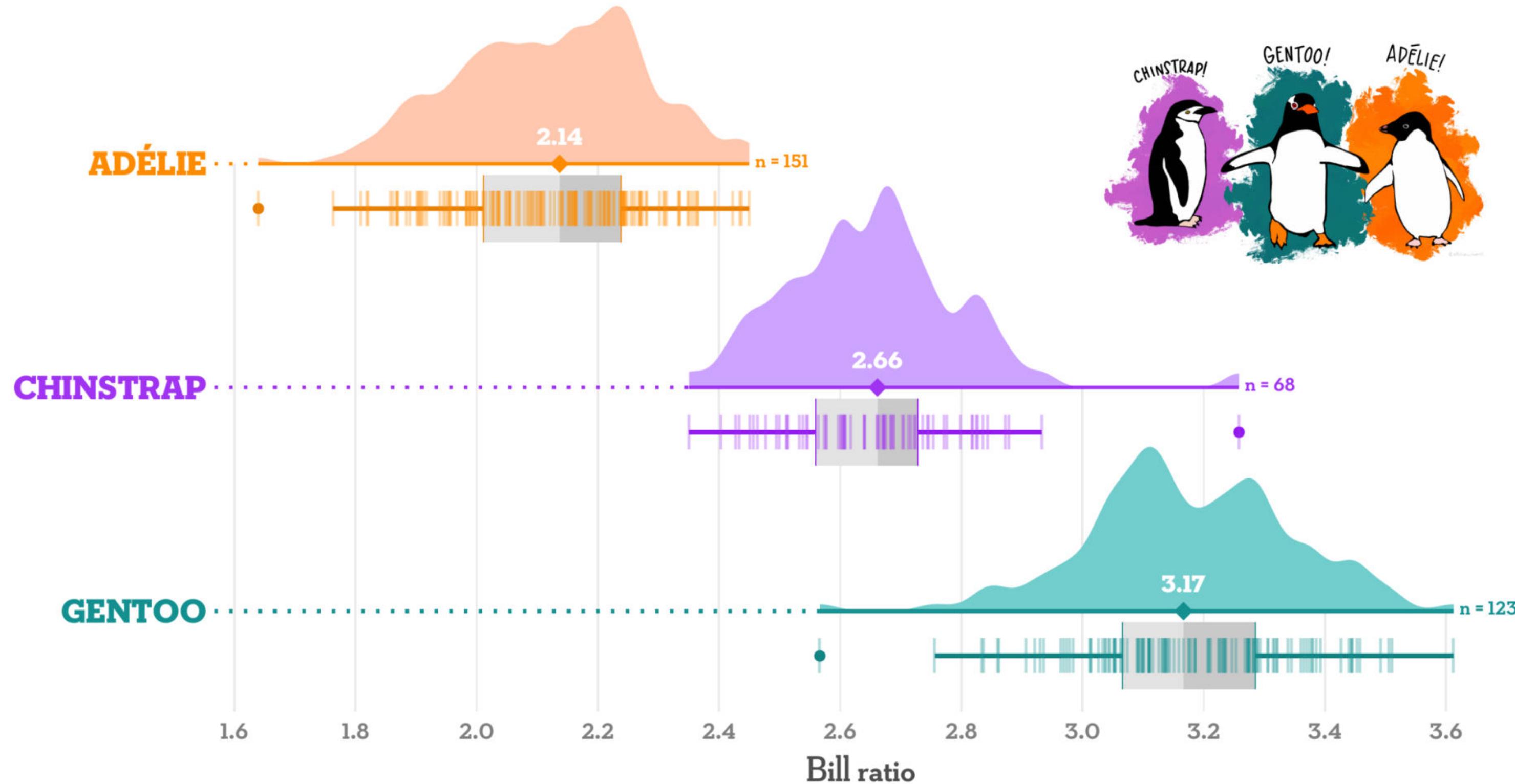
BILL DIMENSIONS OF BRUSH-TAILED PENGUINS

Pygoscelis adélieae (Adélie penguin) • *P. antarctica* (Chinstrap penguin) • *P. papua* (Gentoo penguin)



Note: In the raw data, bill dimensions are recorded as "culmen length" and "culmen depth". The culmen is the dorsal ridge atop the bill.

Distribution of the bill ratio, estimated as bill length divided by bill depth

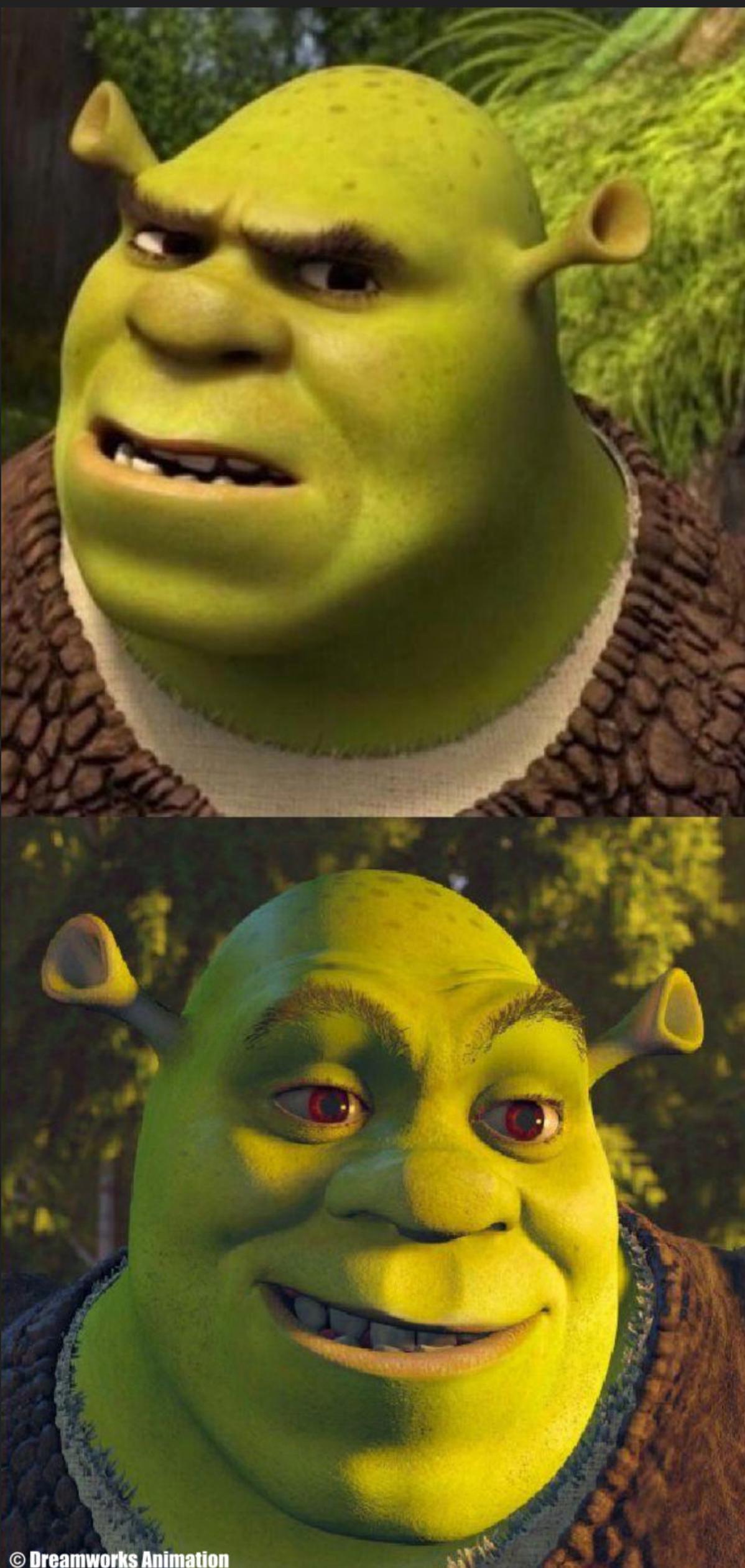


Note: In the original data, bill dimensions are recorded as "culmen length" and "culmen depth". The culmen is the dorsal (upper) ridge of a bird's bill.

Visualization: Cédric Scherer • Data: Gorman, Williams & Fraser (2014) DOI: 10.1371/journal.pone.0090081 • Illustrations: Allison Horst

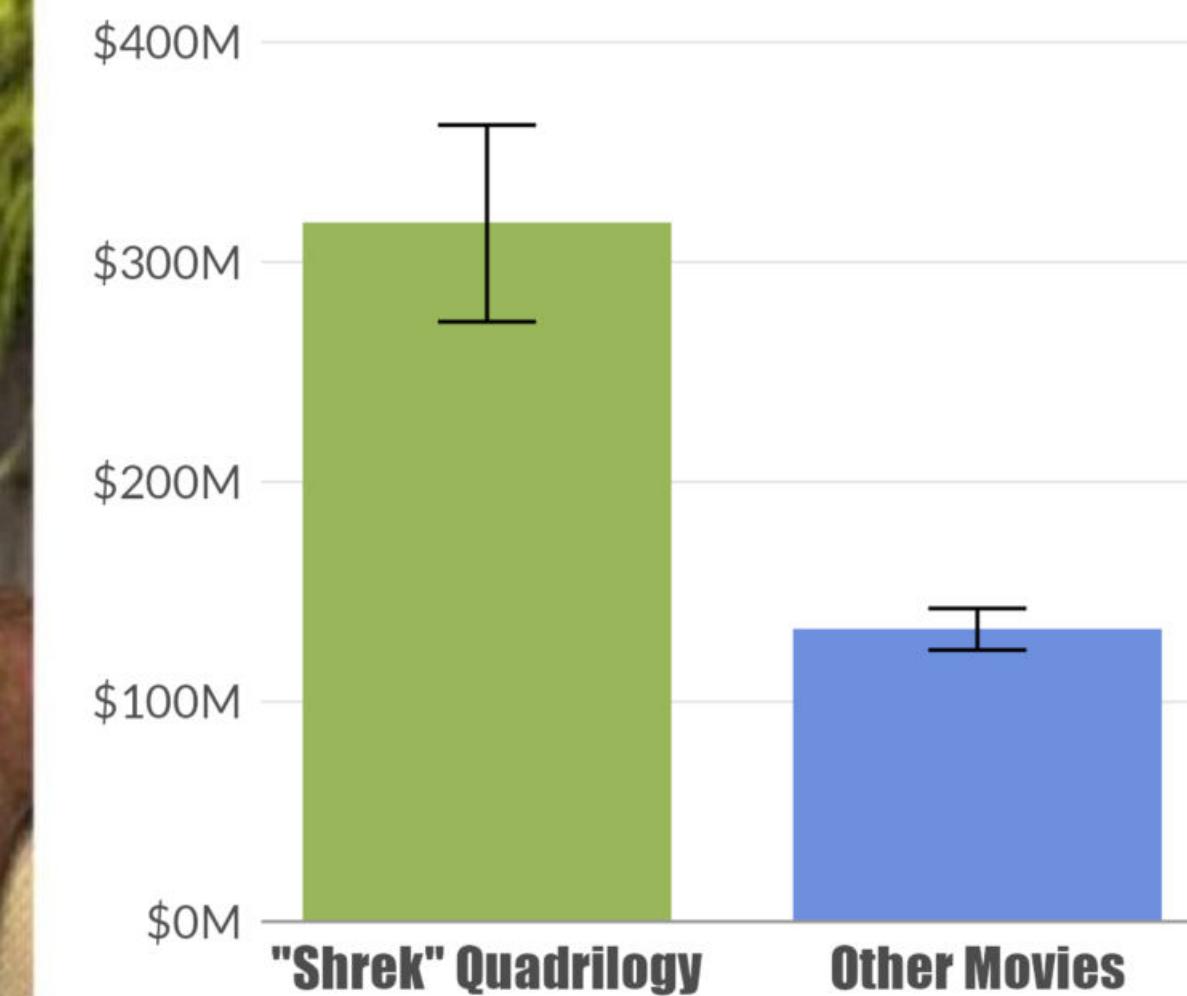
From my blog post "[Visualizing Distributions with Raincloud Plots \(and How to Create Them with ggplot2\)](#)"



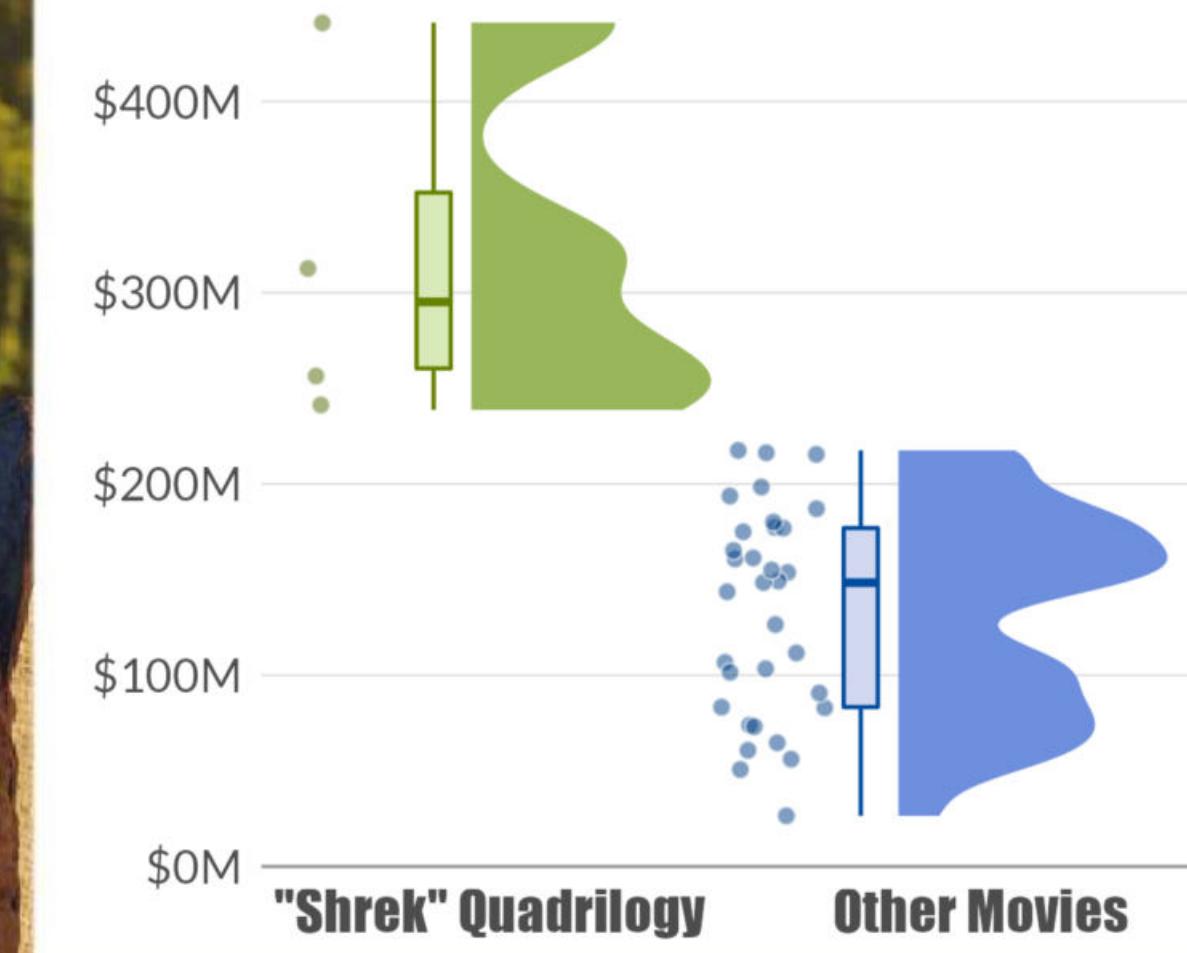


© Dreamworks Animation

Domestic Box Office of DreamWorks Movies



Domestic Box Office of DreamWorks Movies



Why Dynamite Plots Are Terrible—and Why You Should Use Something Else | Cédric Scherer | #30DayChartChallenge 2021 | Day 27: Educational



Not my cup of coffee...

Each dot depicts one coffee bean rated by Coffee Quality Institute's trained reviewers. In addition, the multiple interval stripes show where 25%, 50%, 95%, and 100% of the beans fall along the rating gradient from 0 to 100 points. The rated coffee beans range from 59.8 points (Guatemala) to 89.9 (Ethiopia). Only countries of origin with 25 or more tested beans are shown. The red empty triangle marks the minimum rating, the black filled triangle indicates each country's median score.

Visualization by Cédric Scherer



The coffee bean with the lowest rating has its origin in Guatemala.



One bean from Nicaragua got a bad rating, too.

NICARAGUA

△ 63.1 POINTS

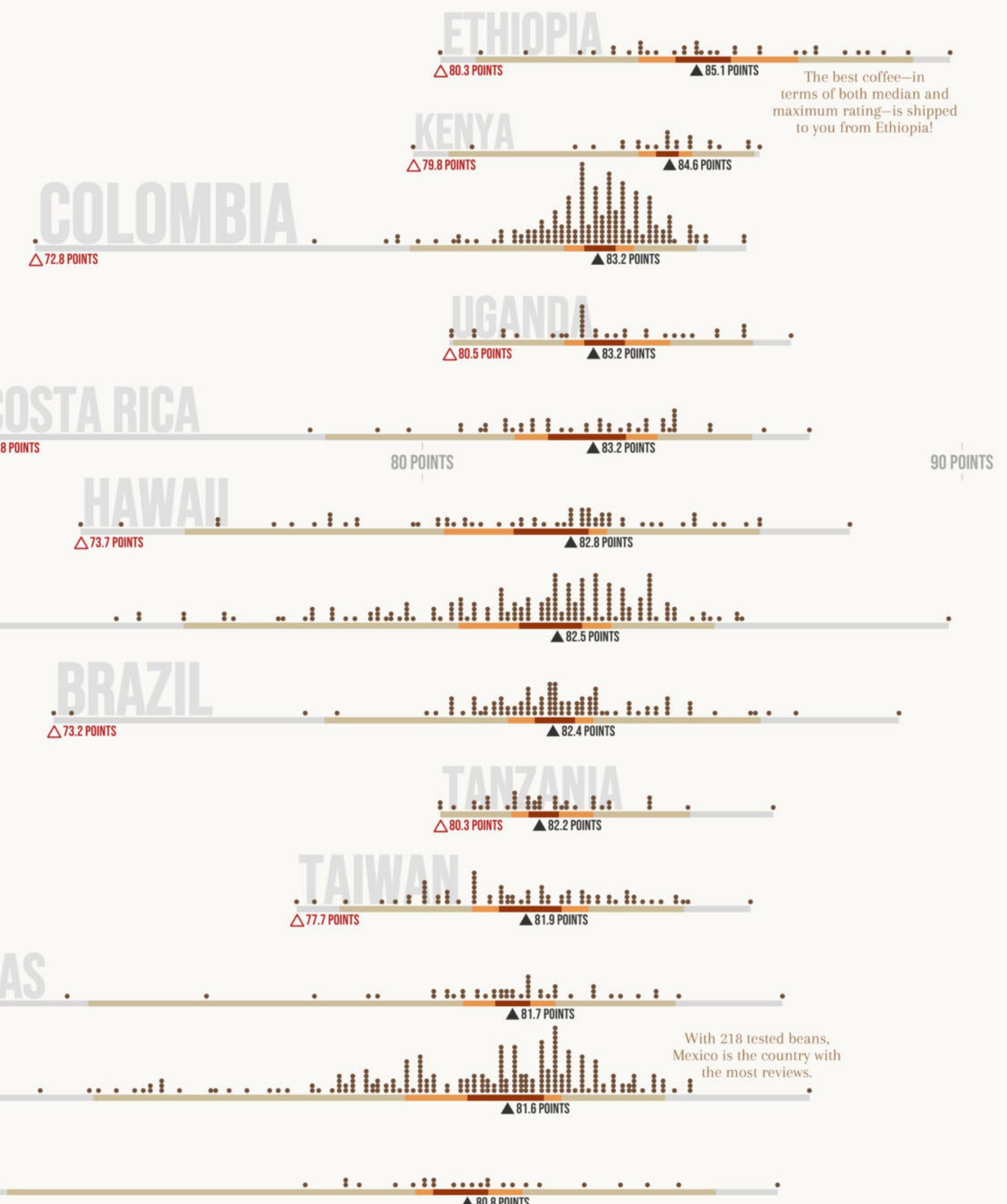


HONDURAS

△ 69.2 POINTS

MEXICO

△ 68.3 POINTS



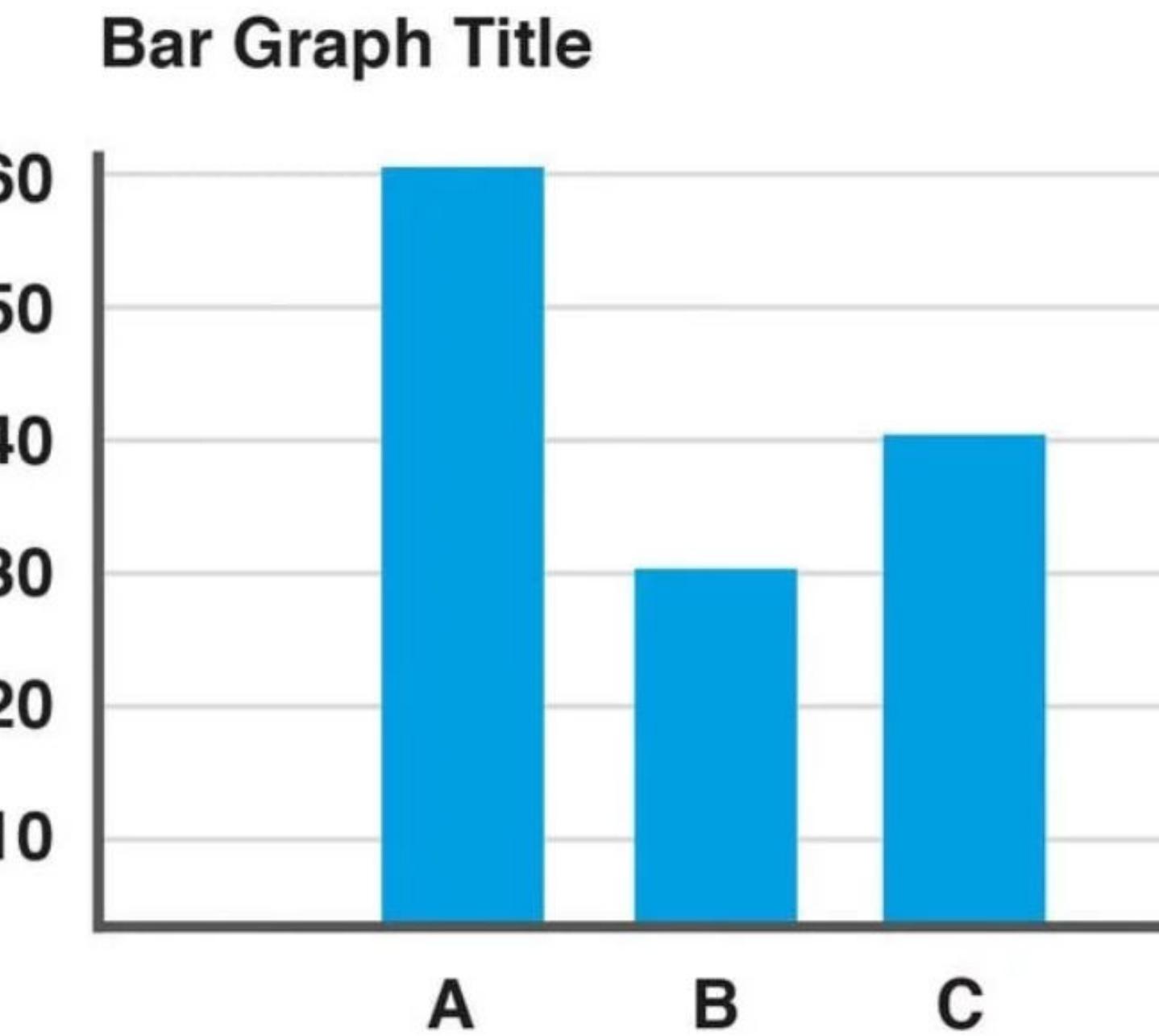
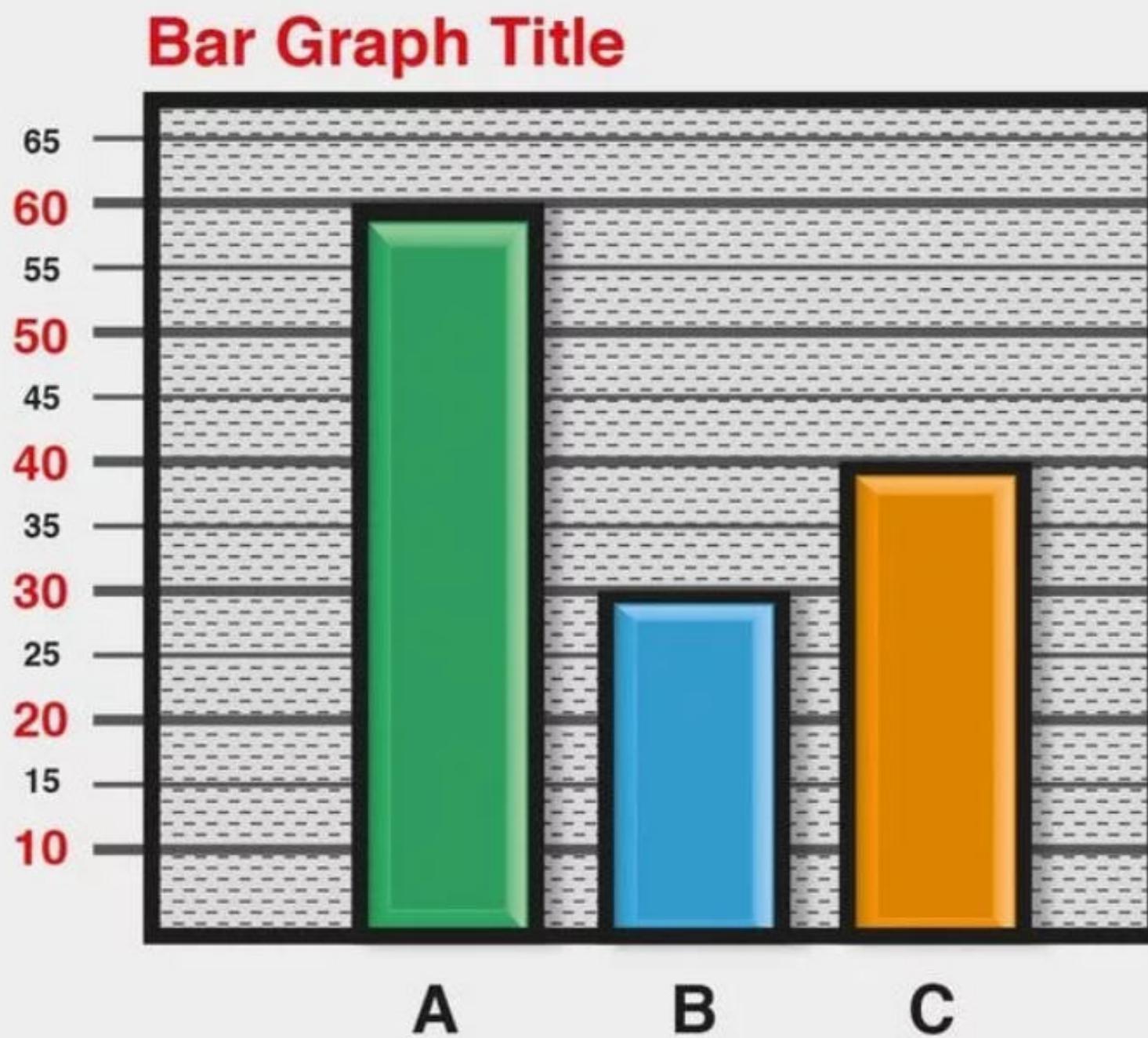
"Not my cup of coffee", #TidyTuesday Contribution





Guide the
View (e8)

Decluttering



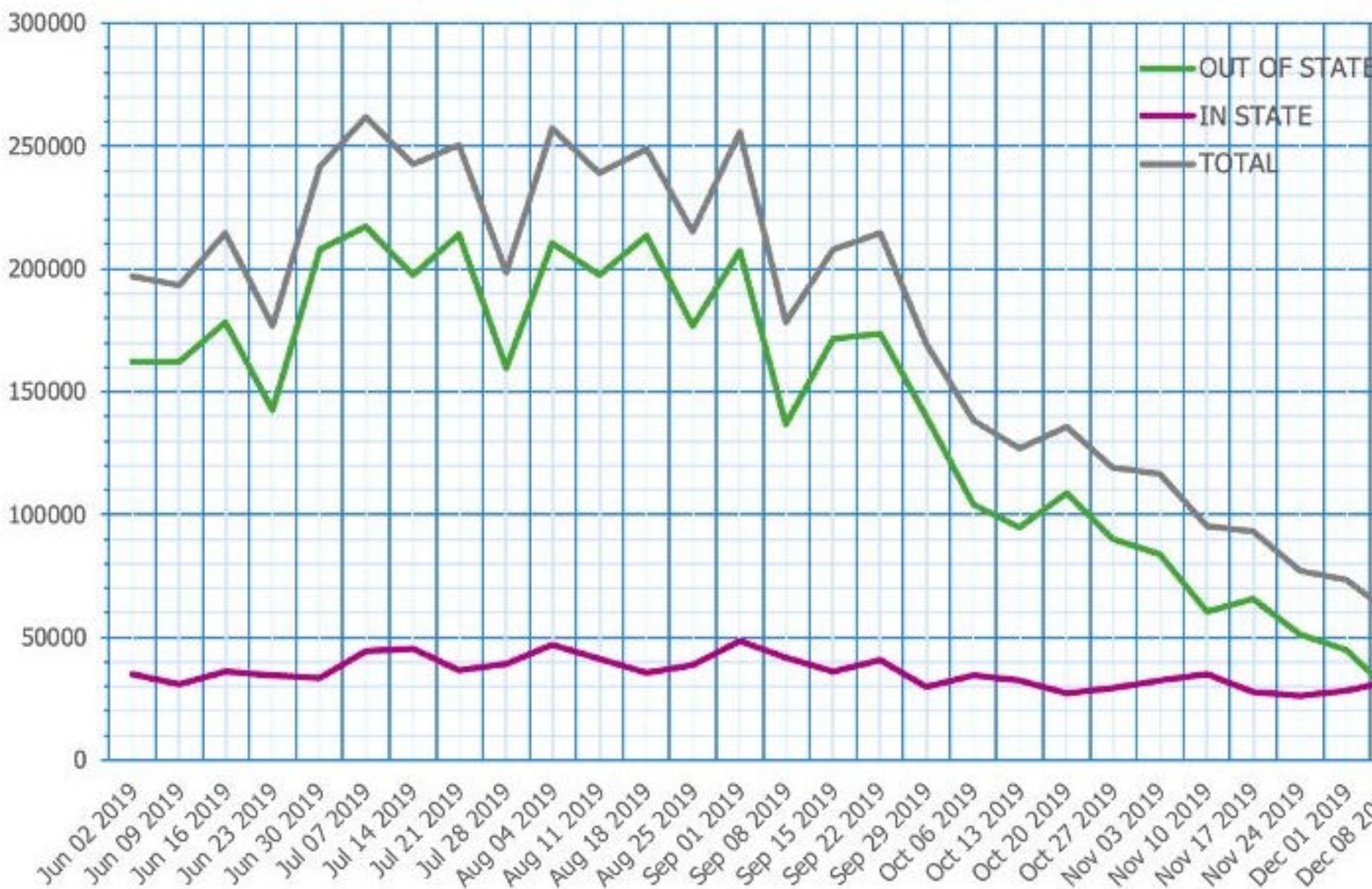
Source: canva.com



Decluttering

BEFORE: SPOOKY SKELETON

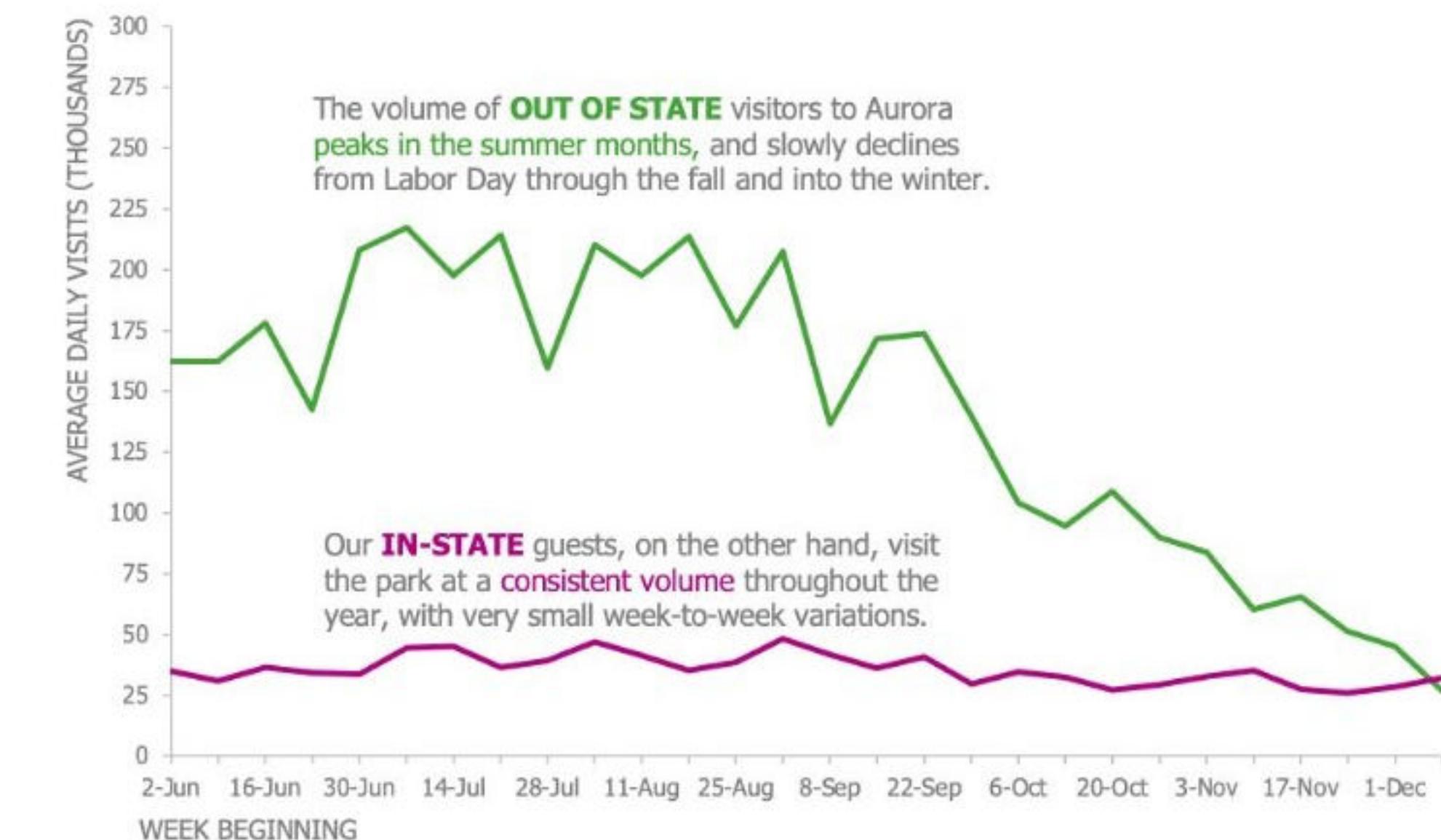
Daily Average Park Visitors By Week



AFTER: GOOD BONES

Daily visitors to Aurora Park in summer/fall 2019

VALUES ARE CALCULATED WEEKLY AS A 7-DAY AVERAGE

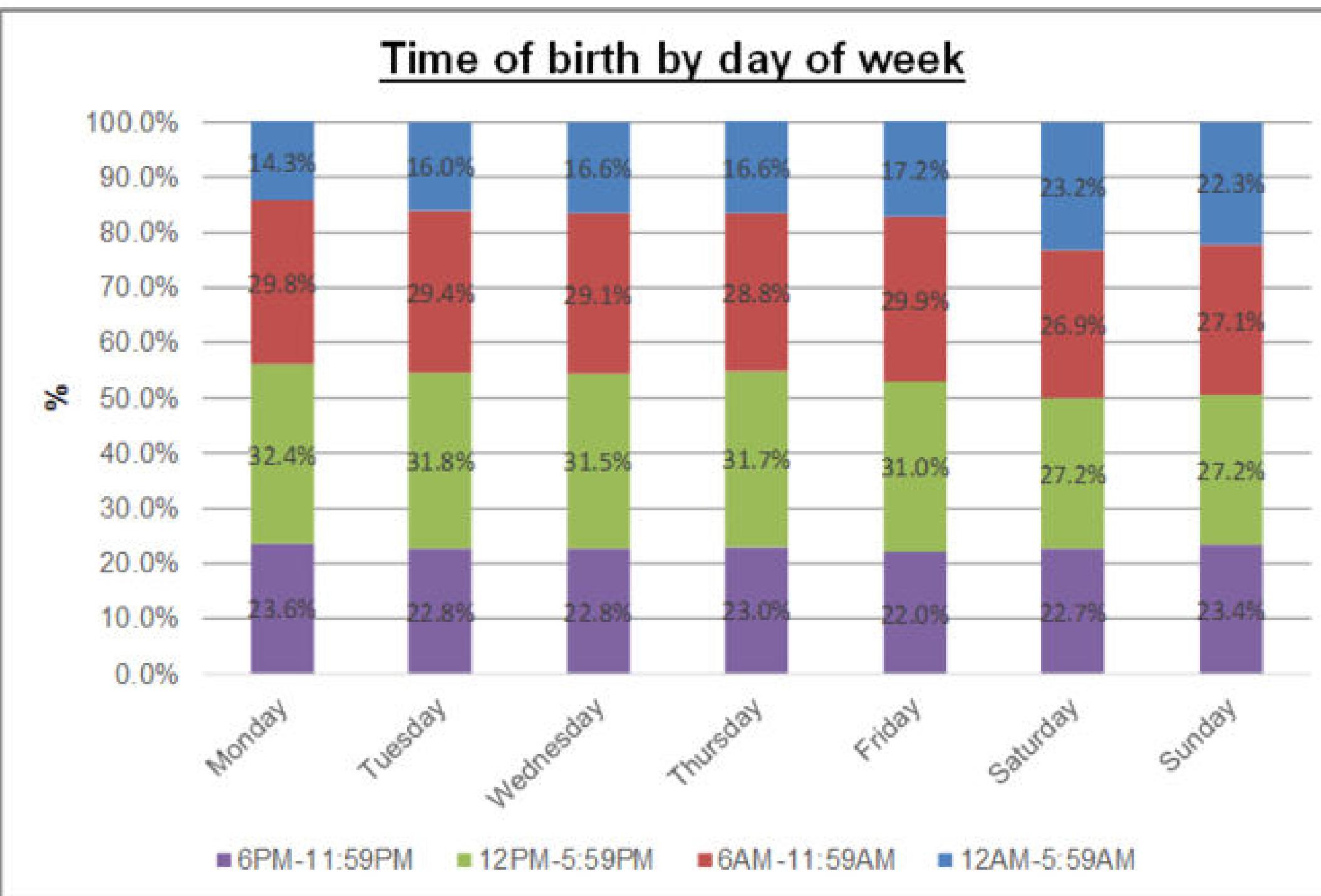


“Your graph Skeleton Shouldn’t Be Scary” by Mike Cisneros ([Storytelling With Data](#))



Decluttering

BEFORE

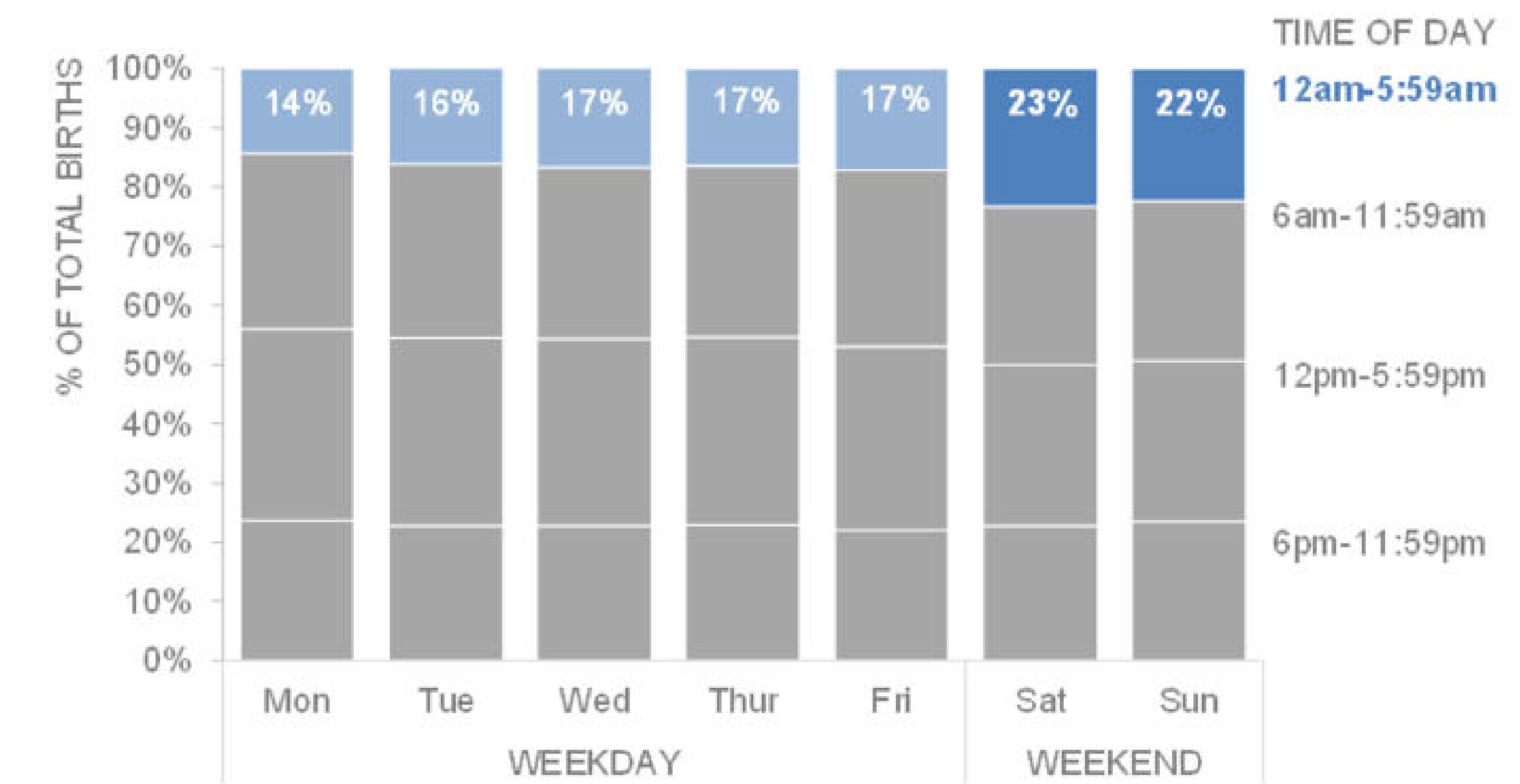


Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

AFTER

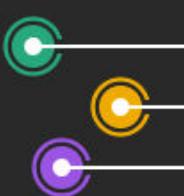
When babies are born

Weekend deliveries are more likely to be in early morning, compared to weekdays

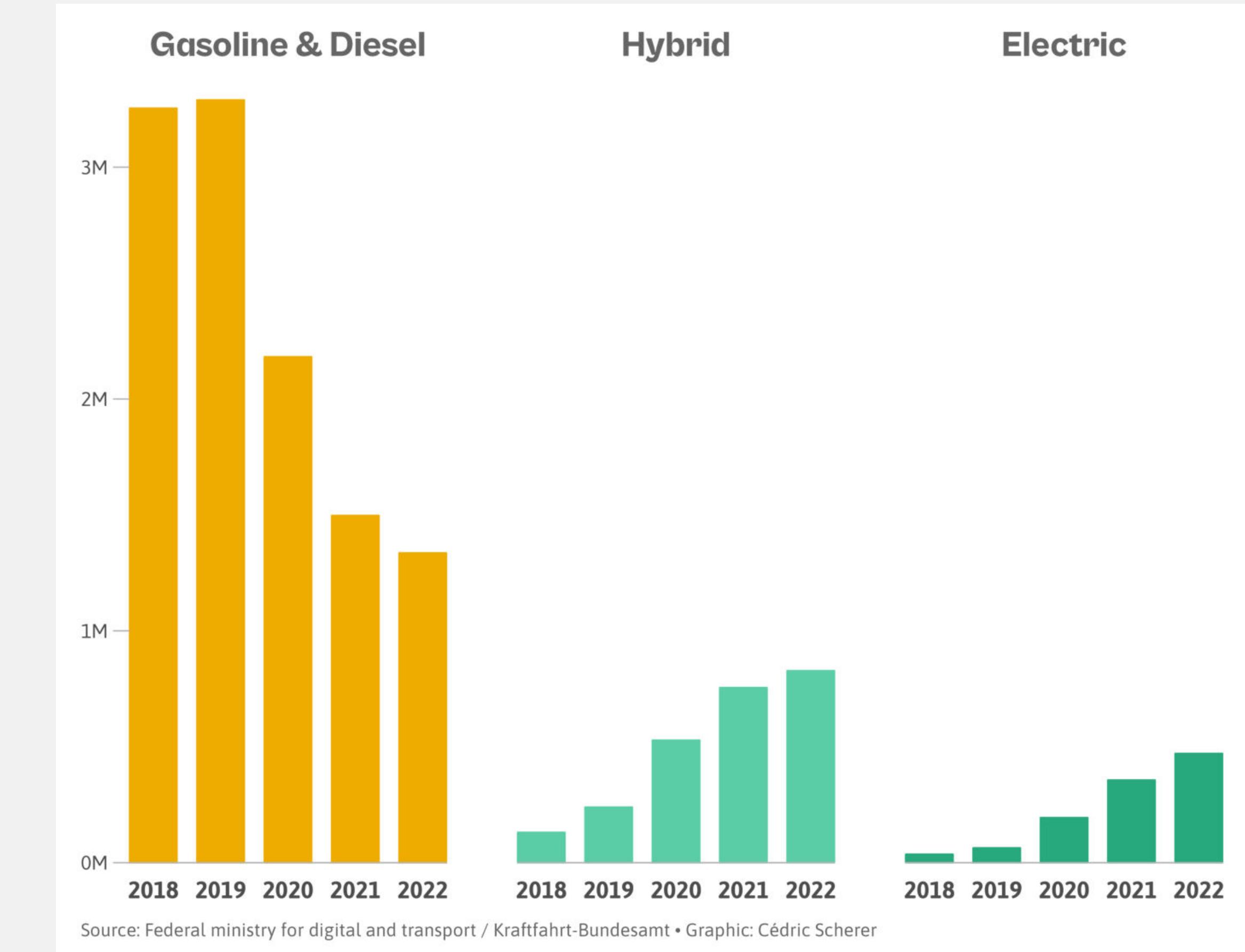
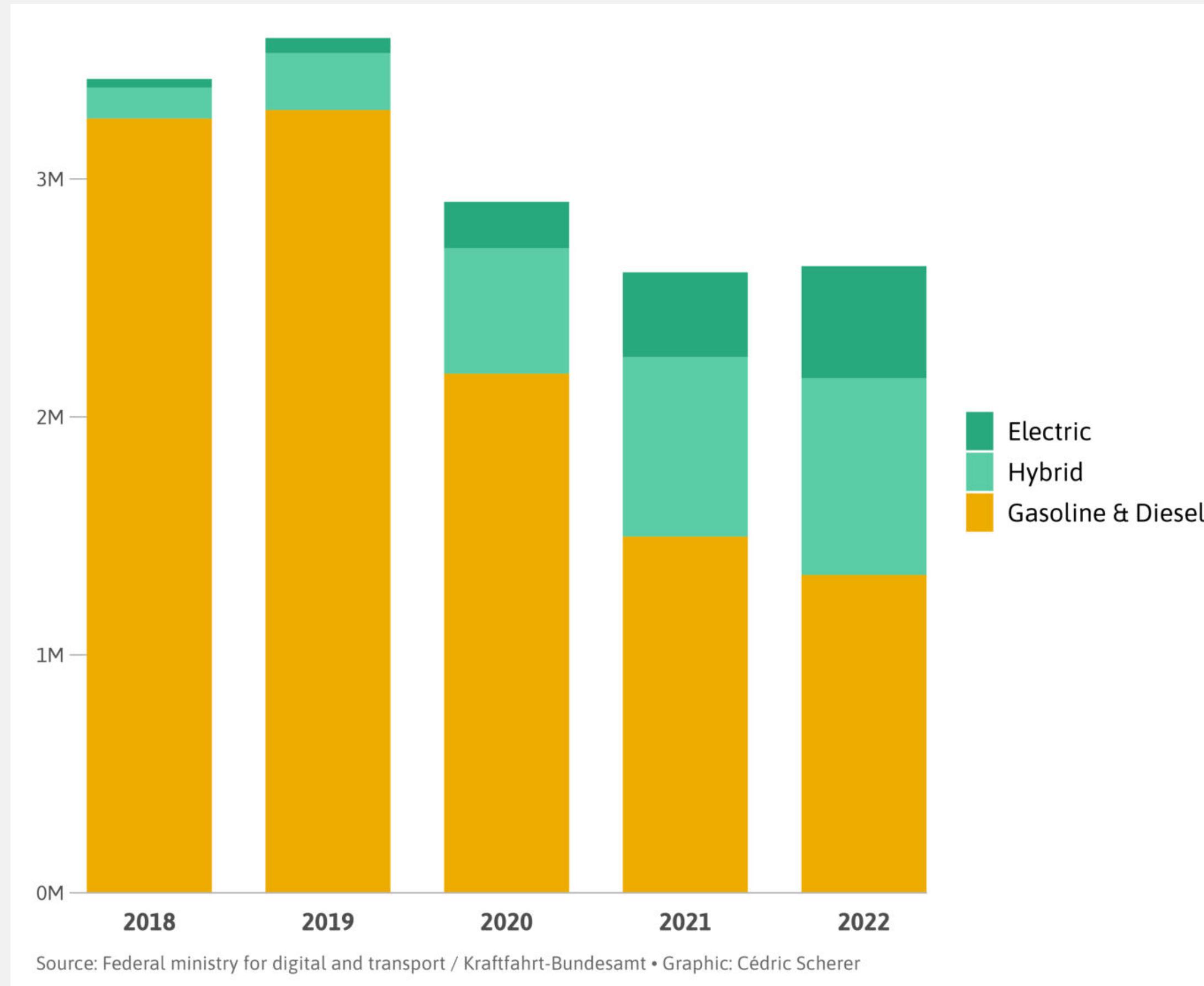


Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

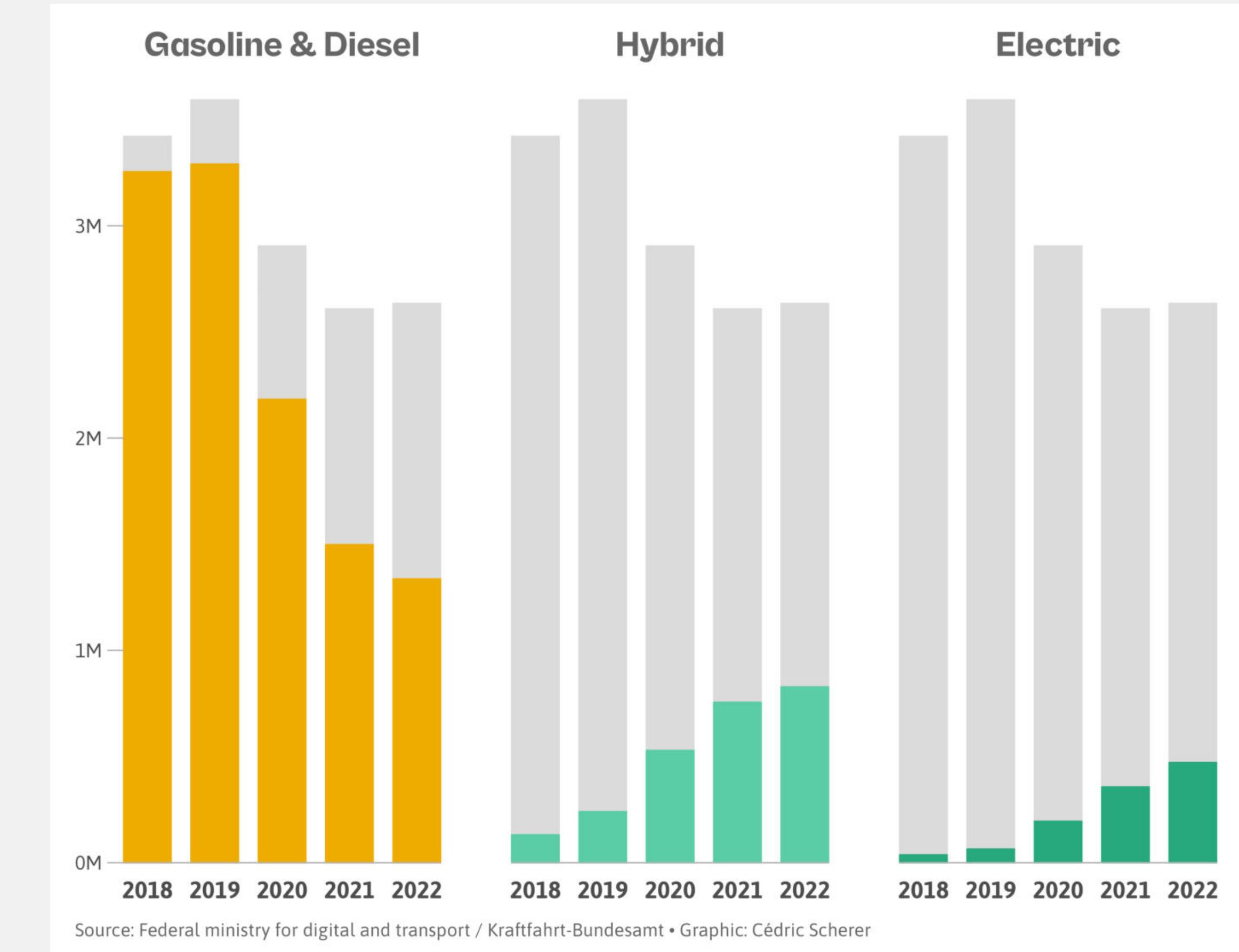
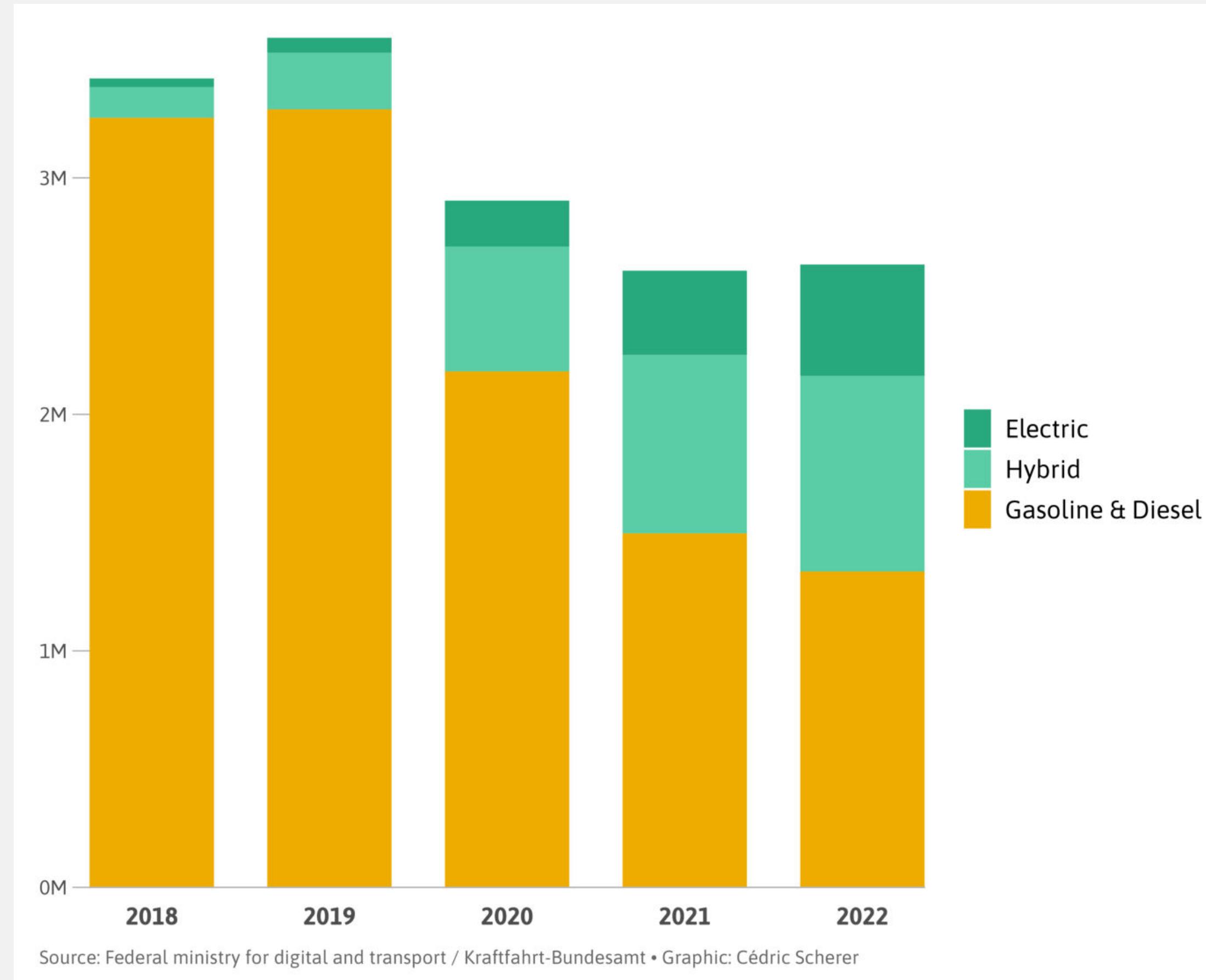
“Declutter! (and Question Default Settings)” by Elizabeth Ricks (Storytelling With Data)



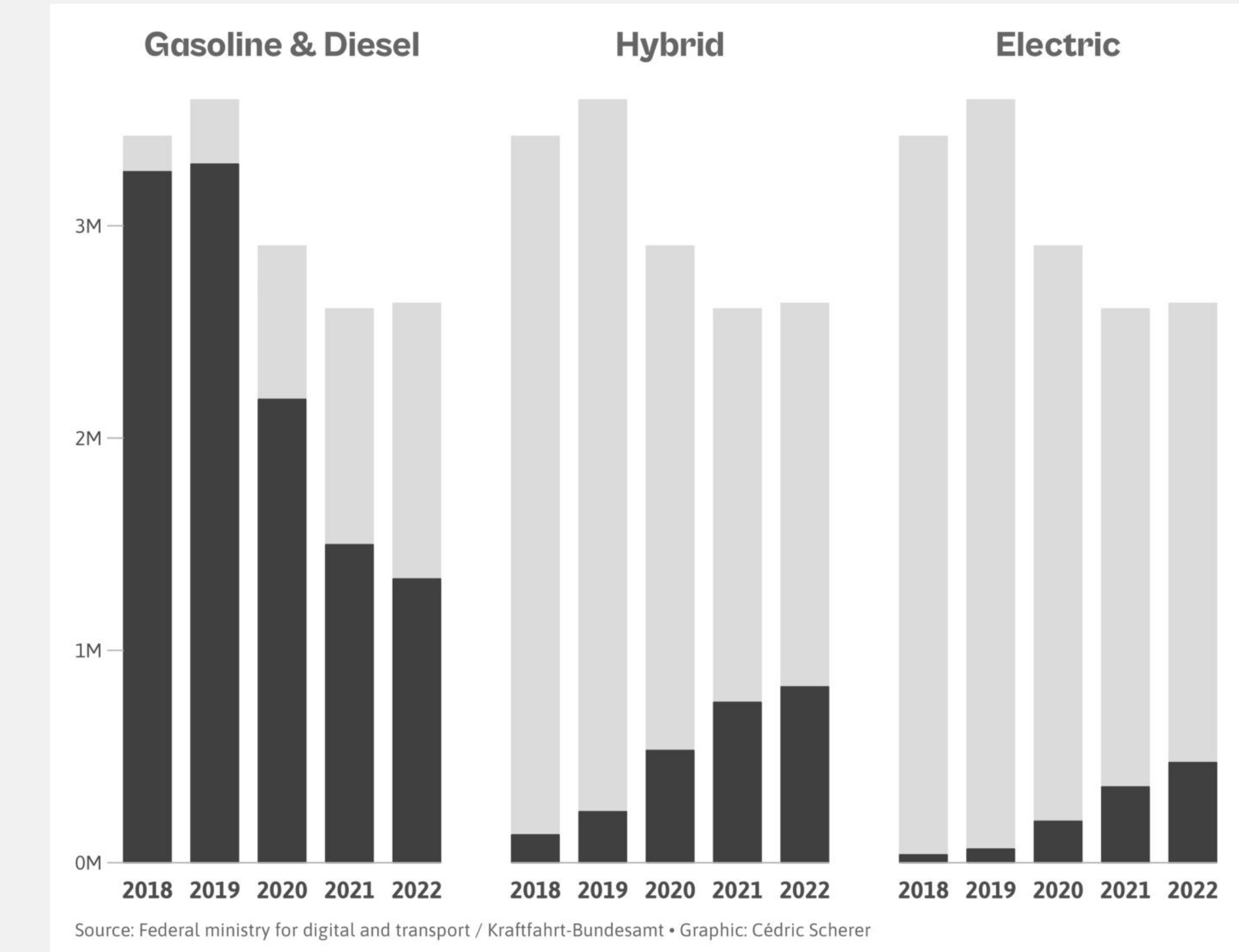
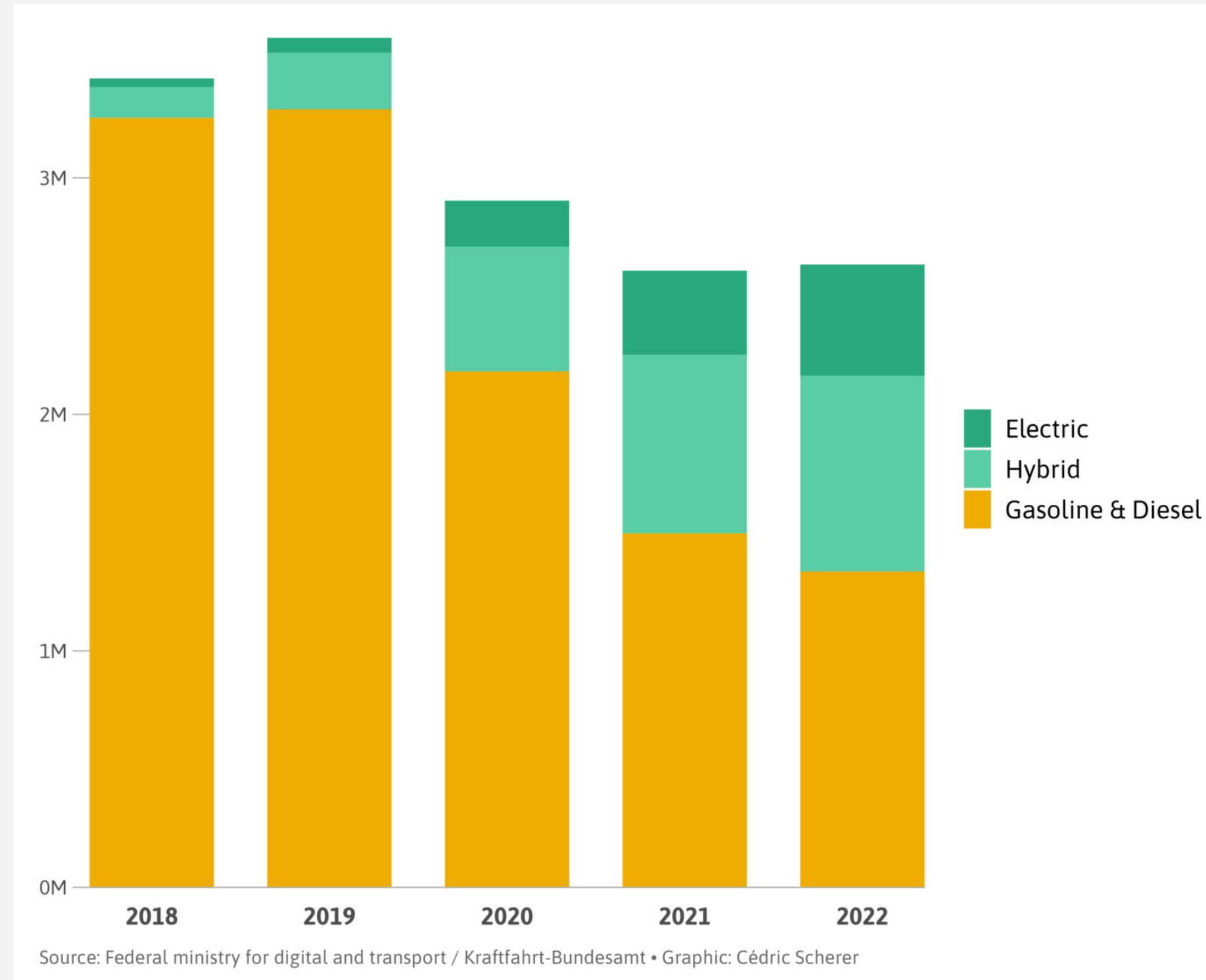
The Power of Small Multiples



The Power of Small Multiples

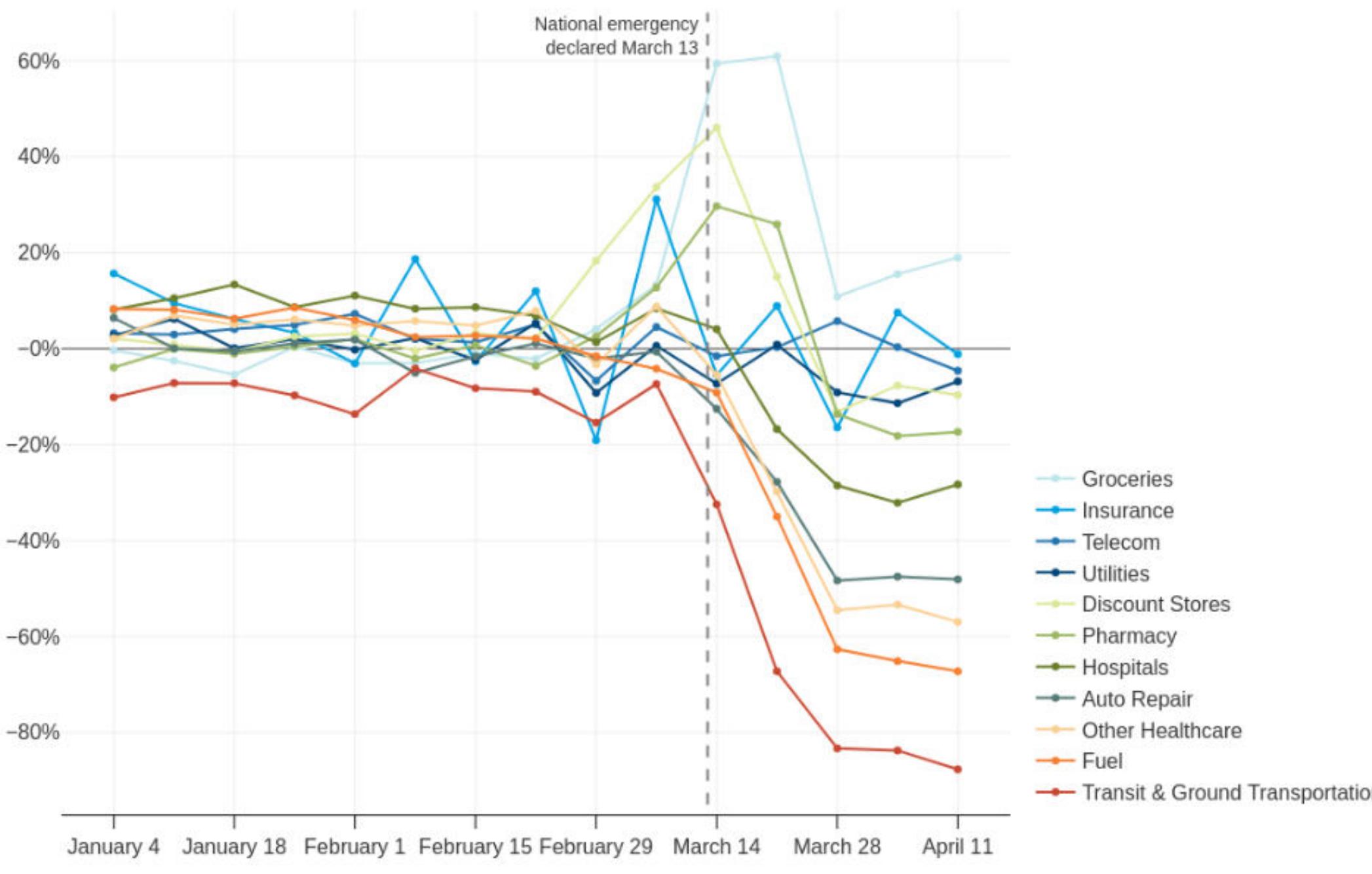


The Power of Small Multiples

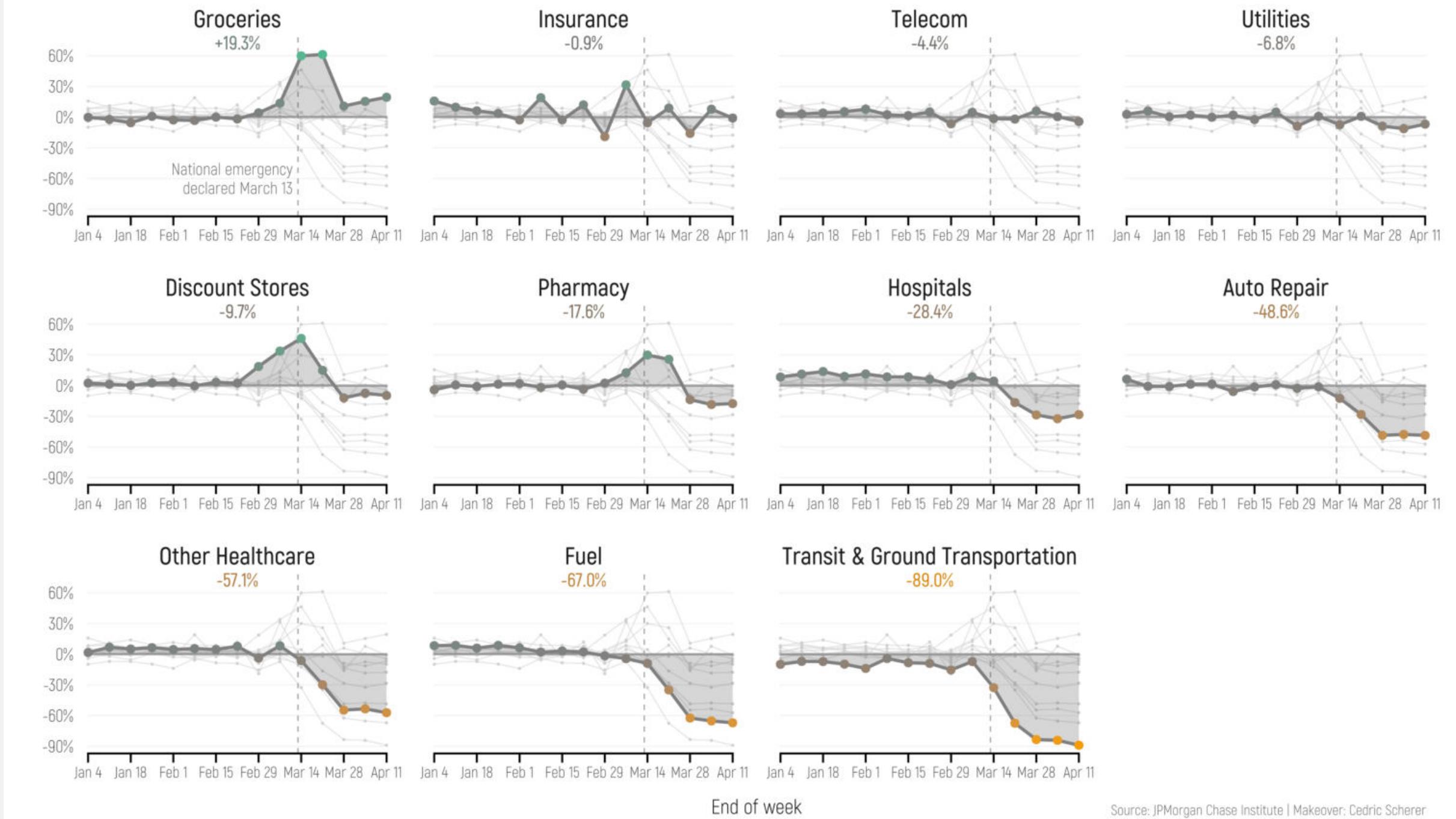


The Power of Small Multiples

Year-over-year percent change in spending by essential category



Most essential categories experienced **negative trends** in year-over-year percent changes in spending after the National Emergency was declared. Only groceries were found to have an overall **positive trend**.

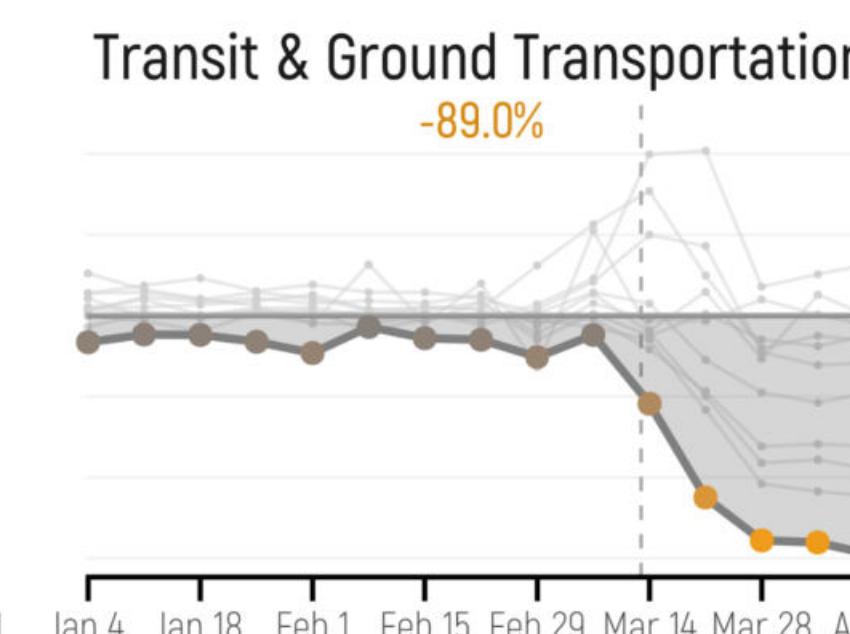
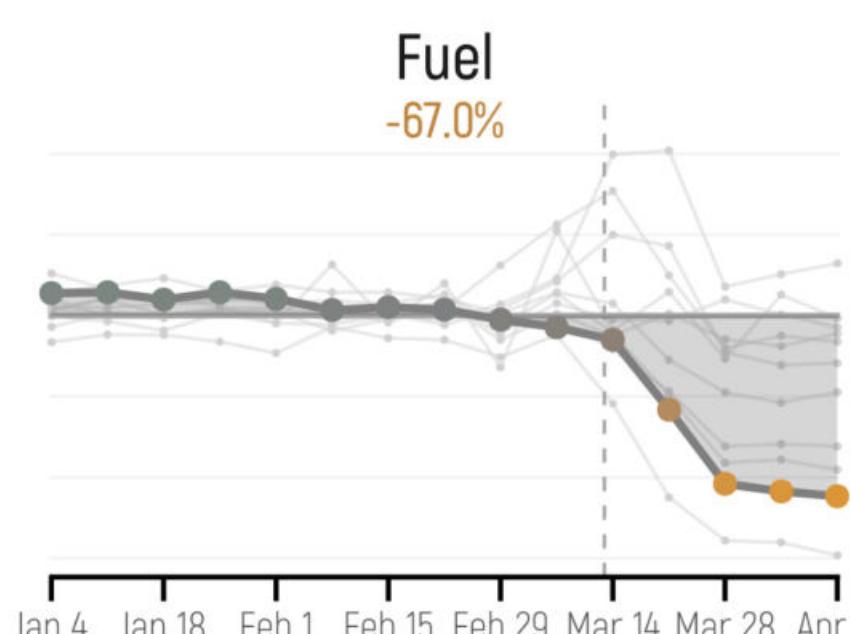
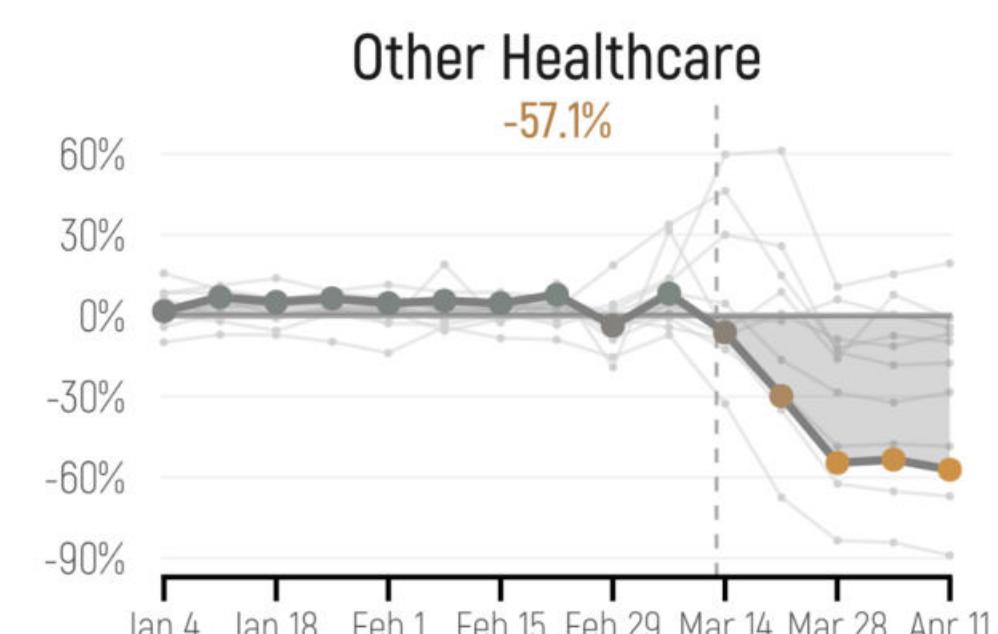
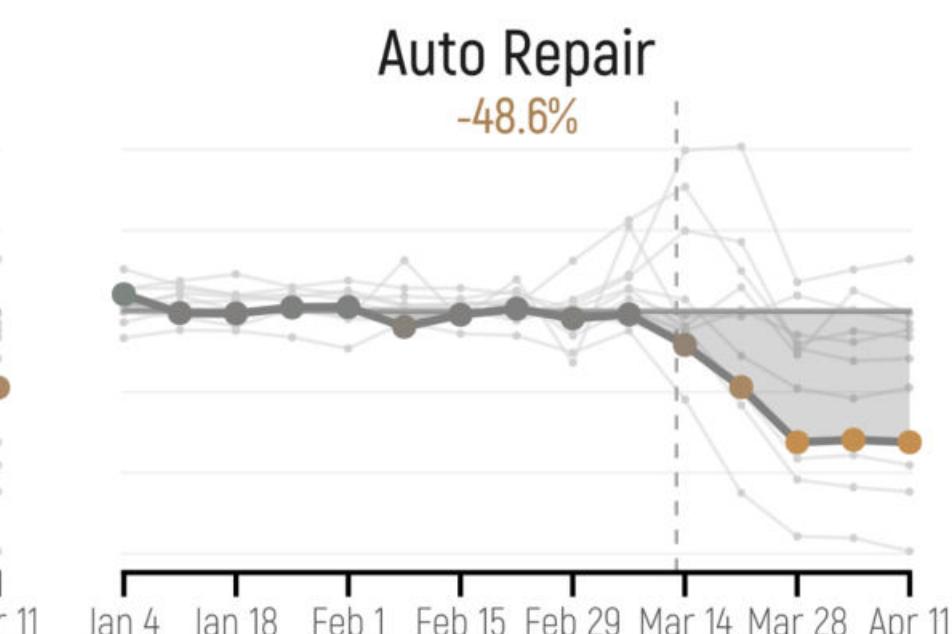
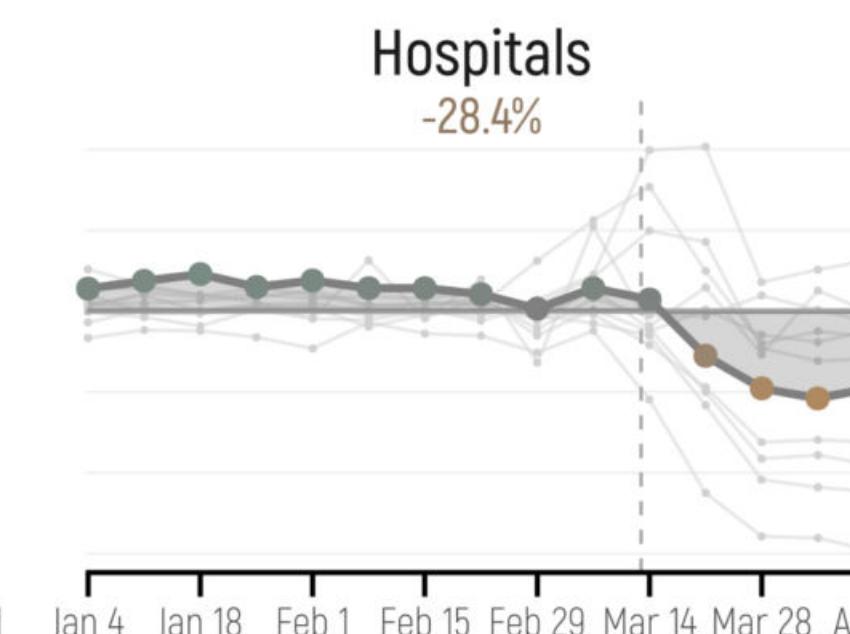
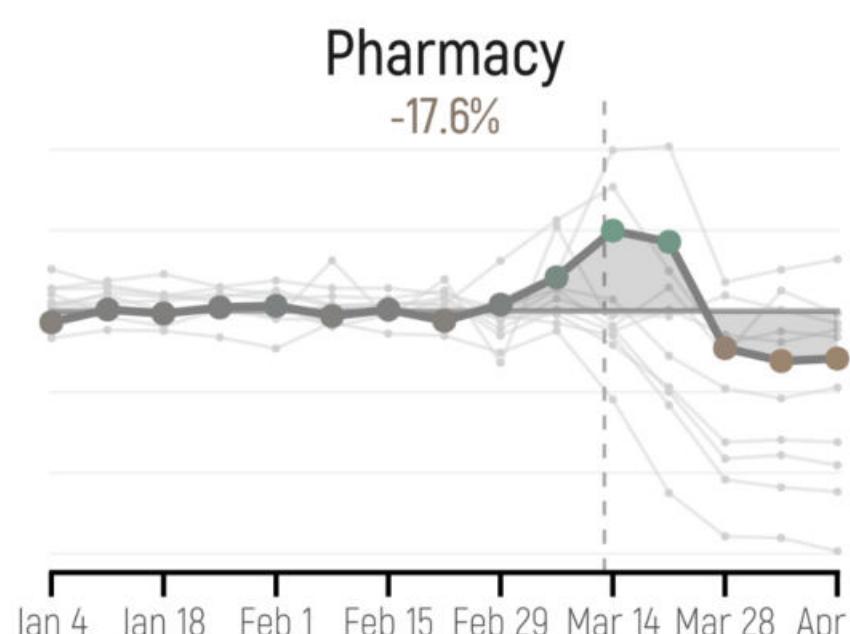
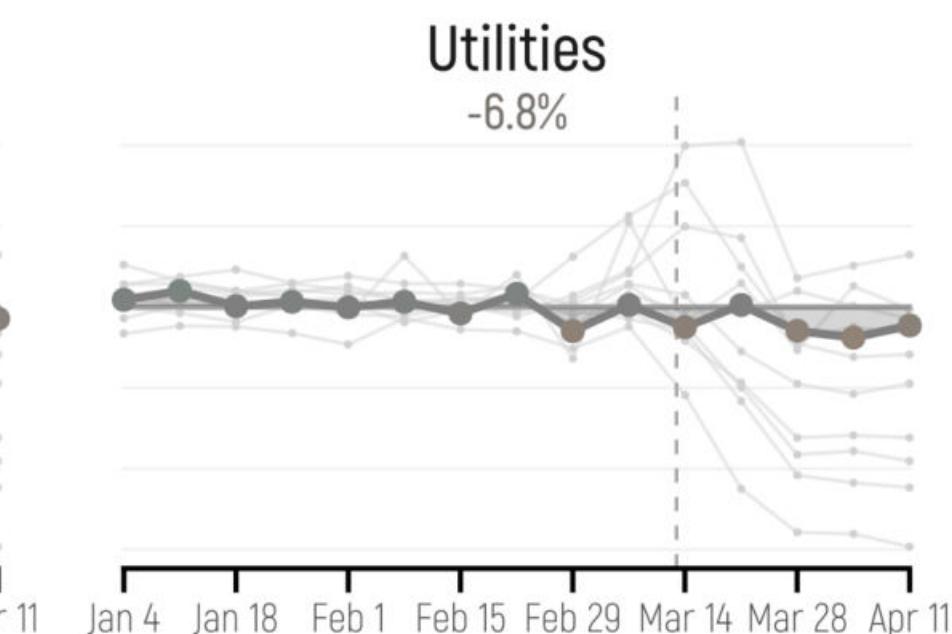
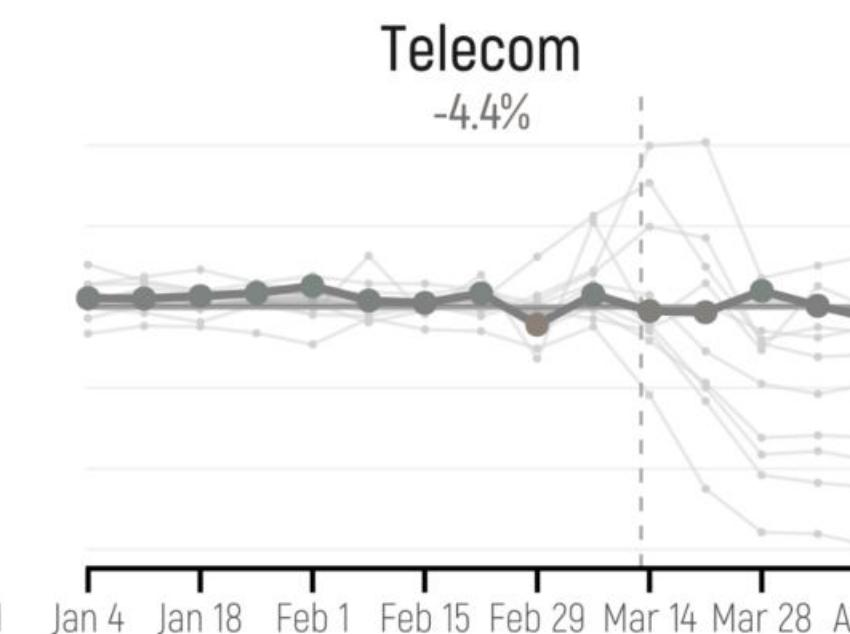
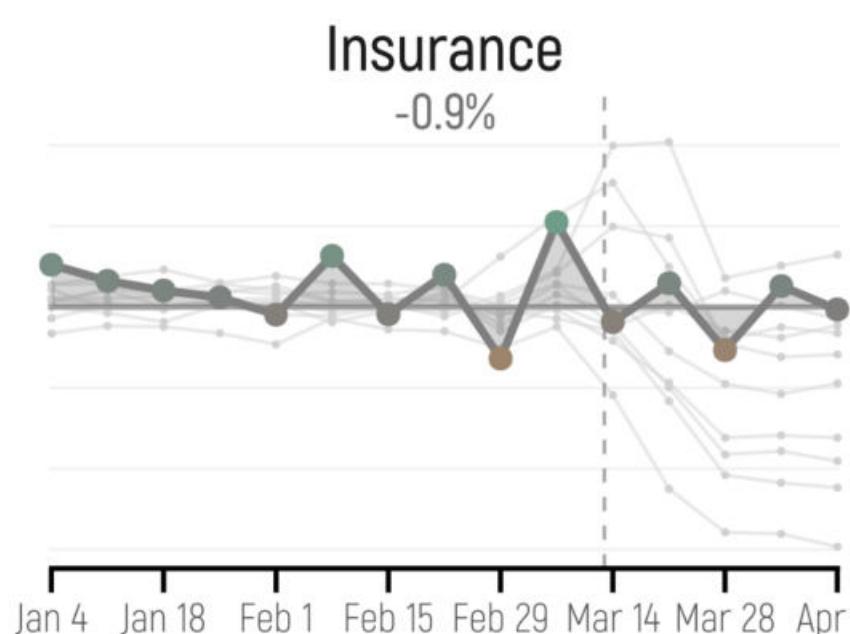
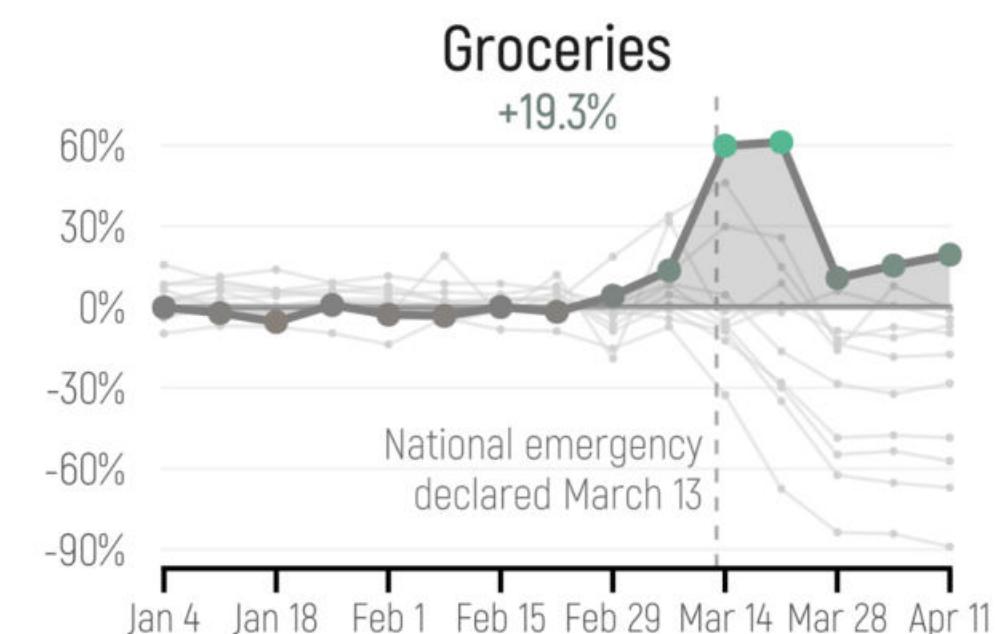


Originalgrafik vom JPMorgan Chase Institut

Umgestaltung mit “Small Multiples”

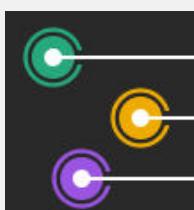


Most essential categories experienced **negative trends** in year-over-year percent changes in spending after the National Emergency was declared. Only groceries were found to have an overall **positive trend**.



End of week

Source: JPMorgan Chase Institute | Makeover: Cedric Scherer



GRAPHIC SCIENCE

Text by Clara Moskowitz | Graphic by Cédric Scherer and Georgios Karamanis

Escalating Drought

Climate change is intensifying periods of extreme dryness, particularly in the U.S. West

For more than 20 years the National Drought Mitigation Center (NDMC) has been monitoring dozens of indices of drought around the country, including satellite measurements of evaporation and color in vegetation, soil-moisture sensors, rainfall estimates, and river and streamflow levels. Although the agency's weekly assessments have identified periods of exceptional drought before, lately dryness has been ramping up. "The changing climate is definitely contributing to more natural disasters, drought being one of them," says Brian Fuchs, a climatologist who oversees the weekly report at the NDMC. "We're seeing more frequent and high-intensity episodes. This year some of these areas in the West have been in drought more than they have been without drought."



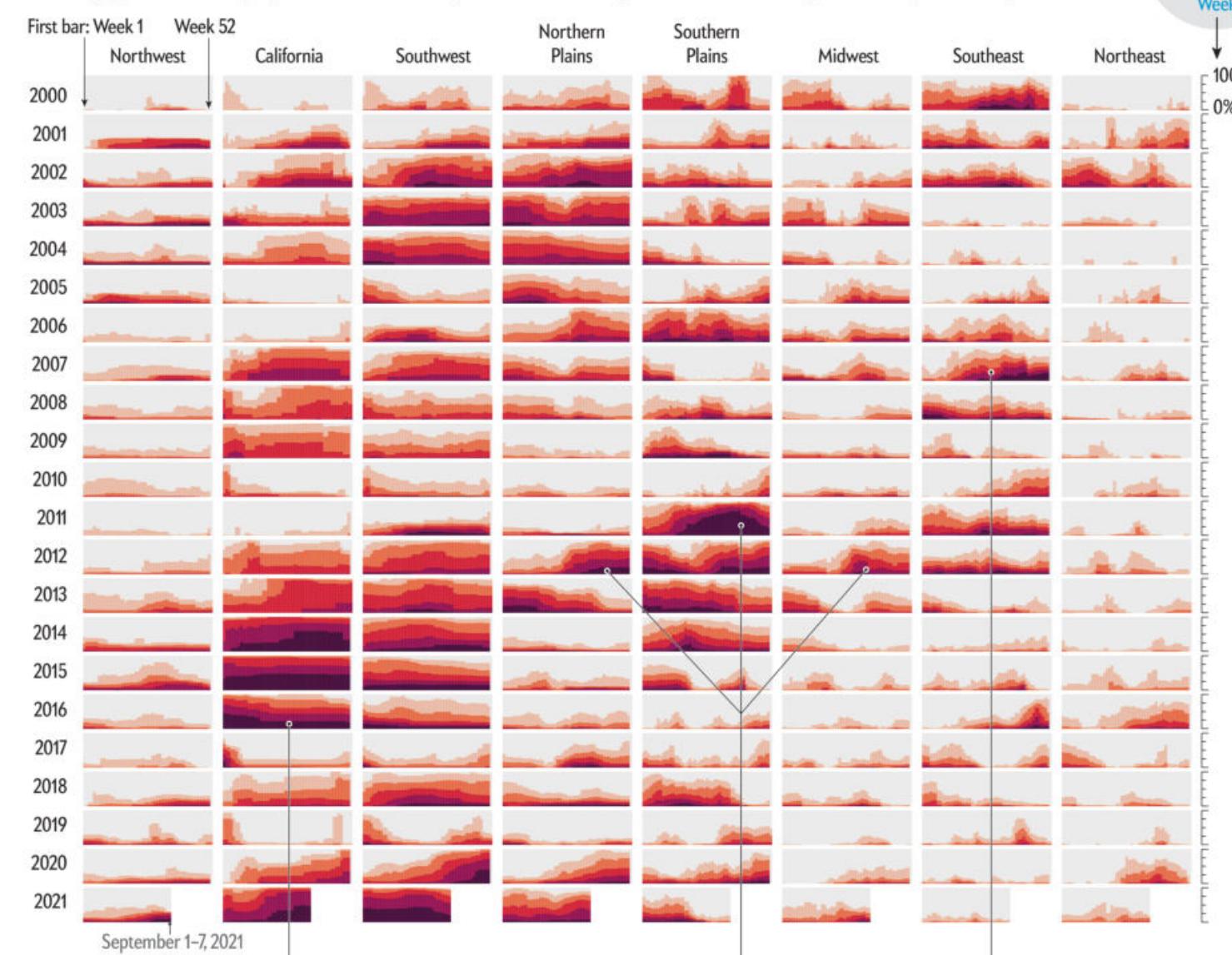
Percent of Region That Experienced Drought Each Week

100%

0%

Drought Extent and Intensity by Region over Time

Category: Abnormally Dry Moderate Drought Severe Drought Extreme Drought Exceptional Drought



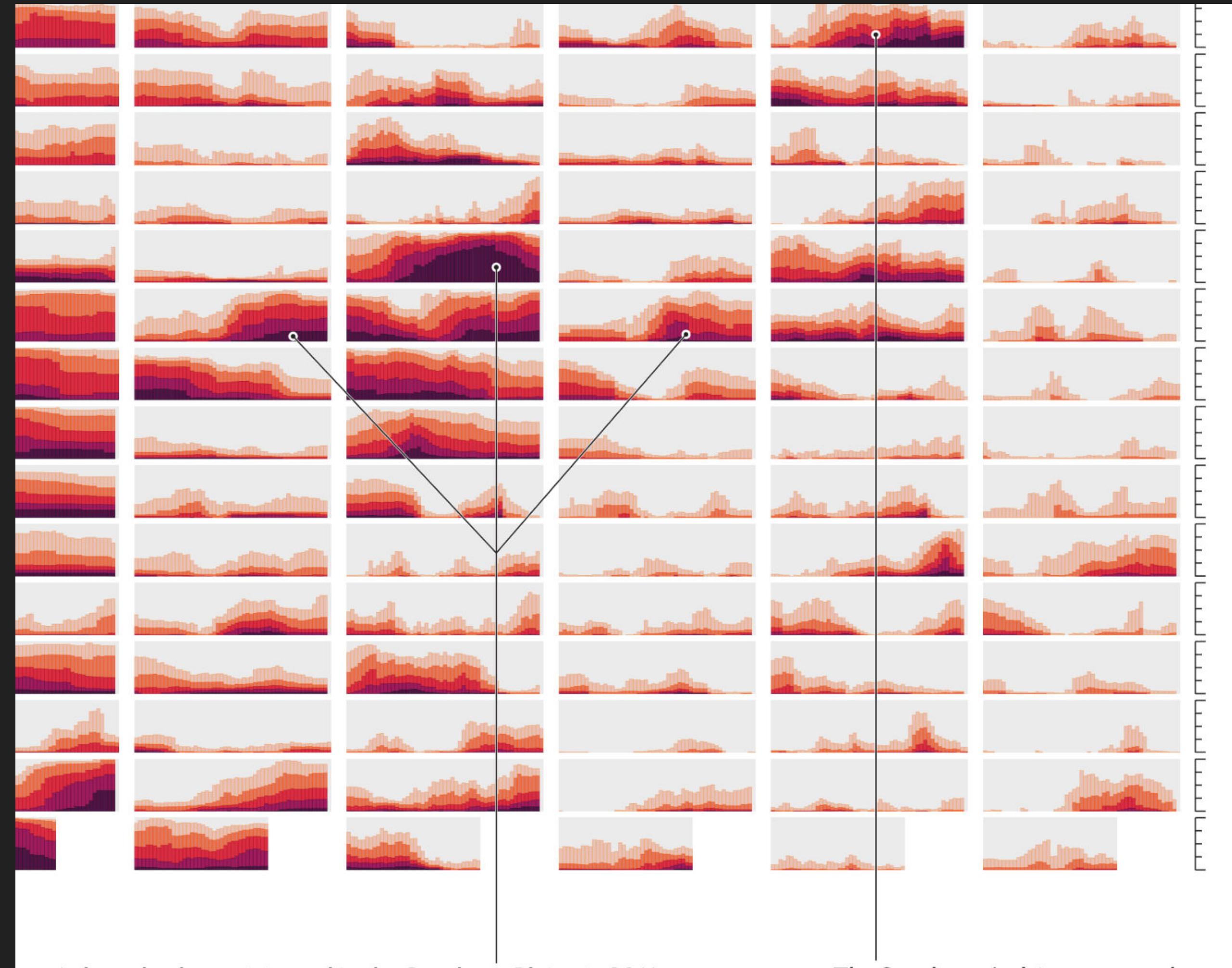
California experienced its hottest drought in recorded history from 2012 to 2016. A warming climate makes the atmosphere thirstier, which increases evaporation and boosts drought.

A drought that originated in the Southern Plains in 2011 eventually spread to the Midwest and Northern Plains when the moisture coming in from the Gulf of Mexico was absorbed by the parched South before it could reach the North.

The Southeast's driest year to date was 2007, when only 31.85 inches of rain fell in Atlanta, 62 percent of its average yearly rainfall.

74 Scientific American, November 2021

Source: U.S. Drought Monitor; jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, U.S. Department of Agriculture, and National Oceanic and Atmospheric Administration (data)



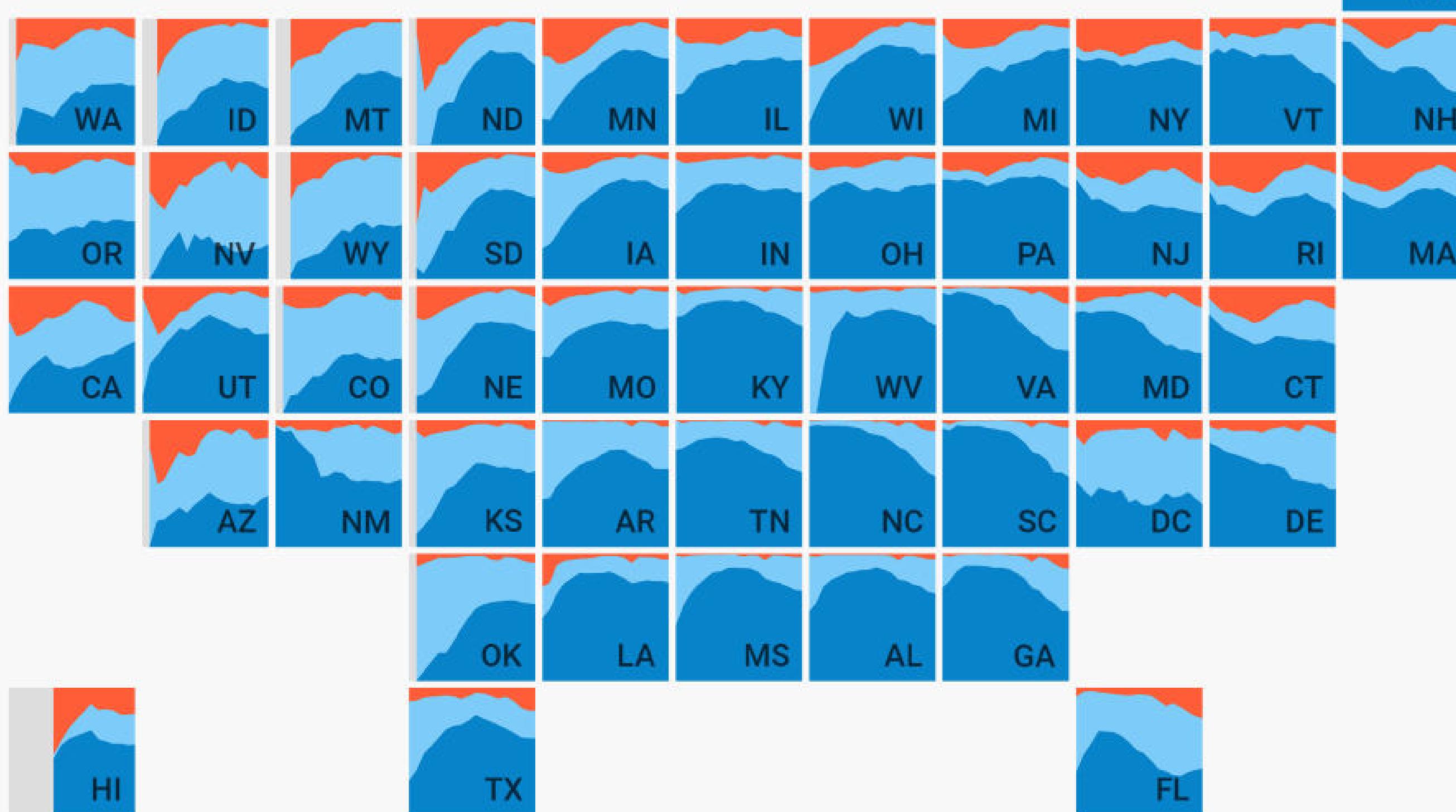
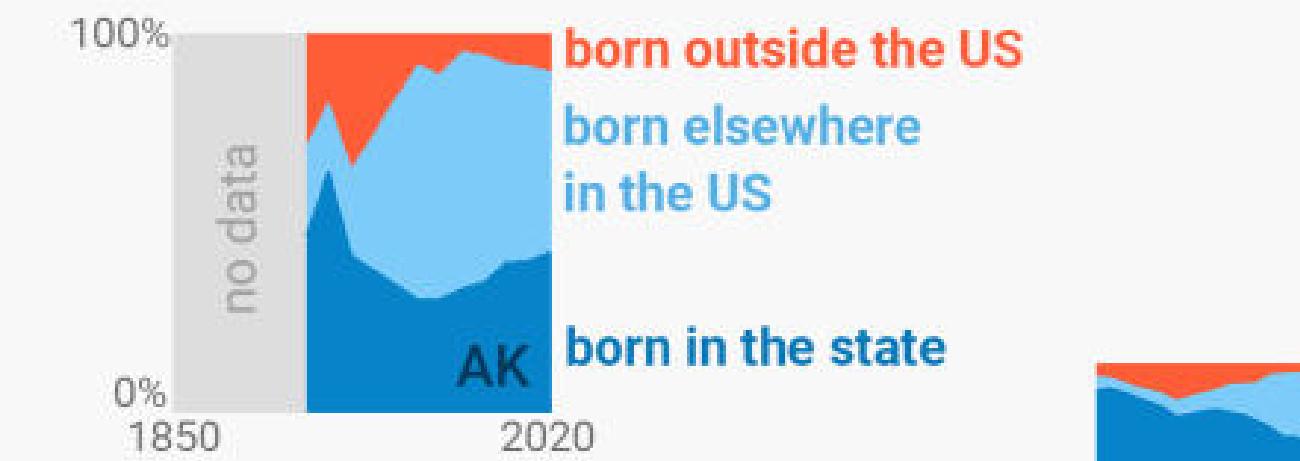
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"Escalating Drought", zusammen mit Georgios Karamanis für den Scientific American, Ausgabe Nov 2021



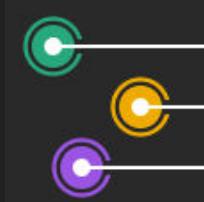
Where are Americans born?



1POINT21
INTERACTIVE

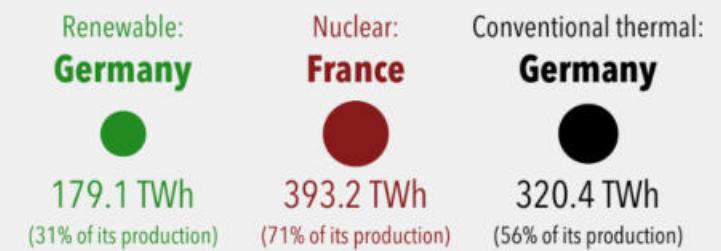
source: Steven Ruggles, Sarah Flood, Sophia Foster, Ronald Goeken, Jose Pacas, Megan Schouweiler and Matthew Sobek.
IPUMS USA: Version 11.0 [dataset]. Minneapolis, MN: IPUMS, 2021. <https://doi.org/10.18128/D010.V11.0>

“Where are Americans born?” von @ErinDataViz

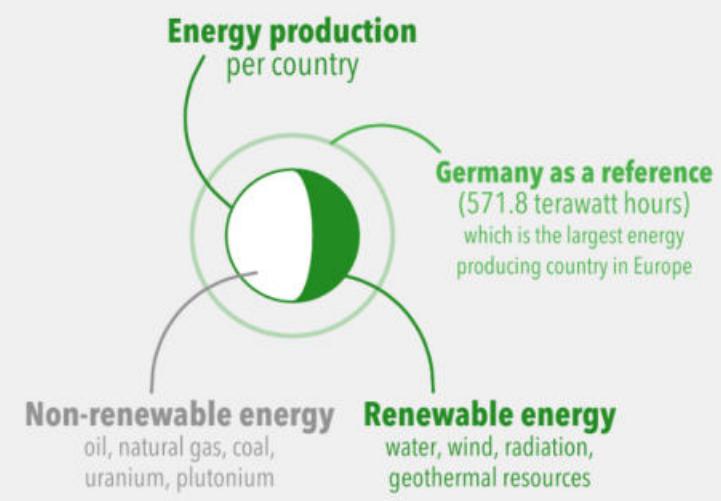


How European countries generated electricity in 2018

Germany is the largest energy producing country in Europe. It generates the most renewable and conventional thermal energy, representing 31% and 56% of its overall production respectively. **France** is the second largest energy European producer and by far the largest nuclear energy provider: 71% of its production is based on nuclear fission to generate heat.

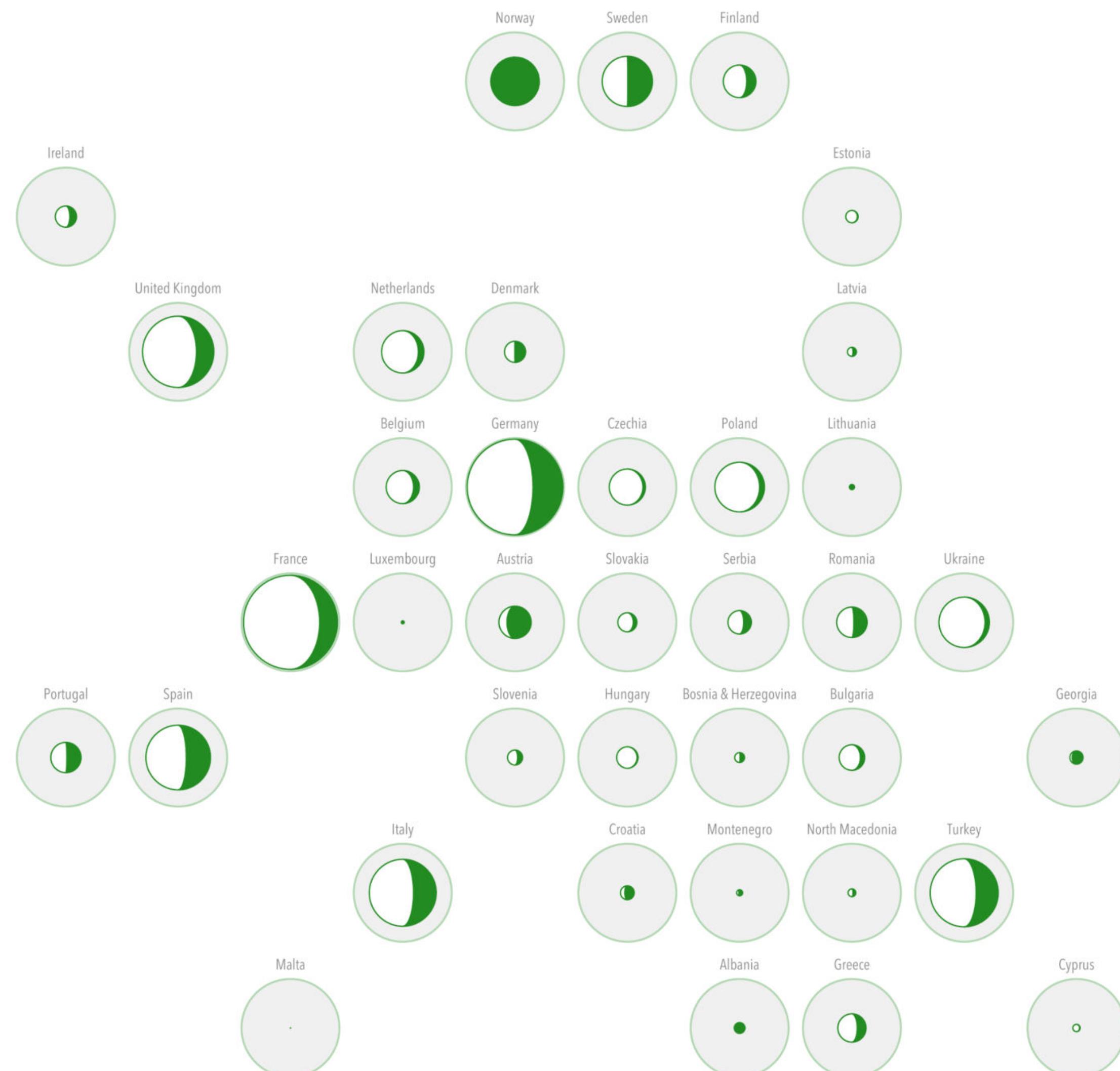


Renewable energy is energy that comes from resources that are naturally replenished such as sunlight, wind, water, and geothermal heat. Unlike fossil fuels, such as oil, natural gas and coal, or nuclear power sources such as uranium and plutonium, renewable energy regenerates naturally in a short period of time.

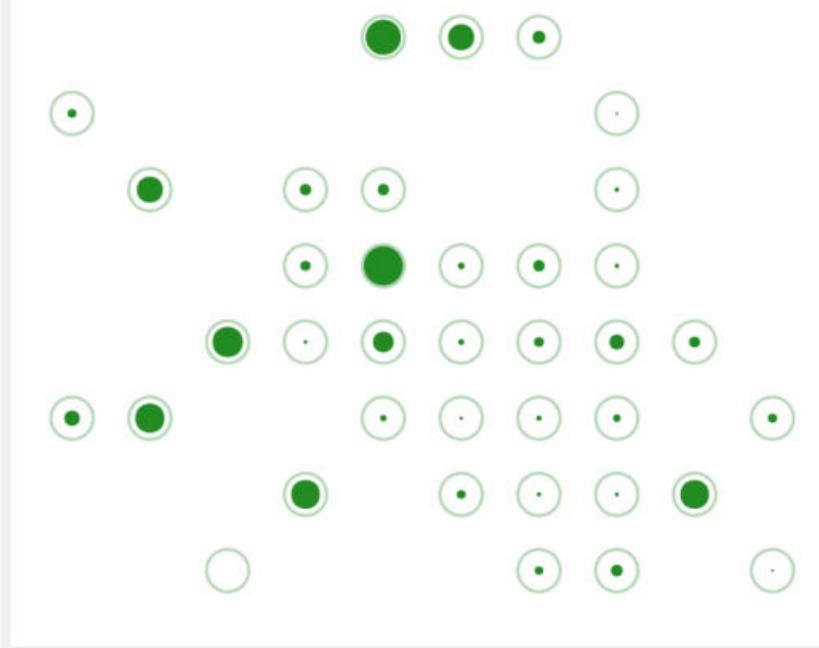


Norway had an electricity production almost entirely made up of renewable energy (98%). This makes Norway the second largest producer of this energy type in Europe. Interestingly, most of the renewable energy is produced by hydro power that take up 95% and only 3% by wind. In contrast, twelve European countries were reported to produce less than 20% of their energy with renewable resources: **Malta** (0%), **Hungary** (5%), **Estonia** (6%), **Czechia** (7%), **Cyprus** (9%), **Ukraine** (9%), **Poland** (10%), **Netherlands** (13%), **Bulgaria** (17%), **Belgium** (18%), **Slovakia** (19%), and **France** (19%).

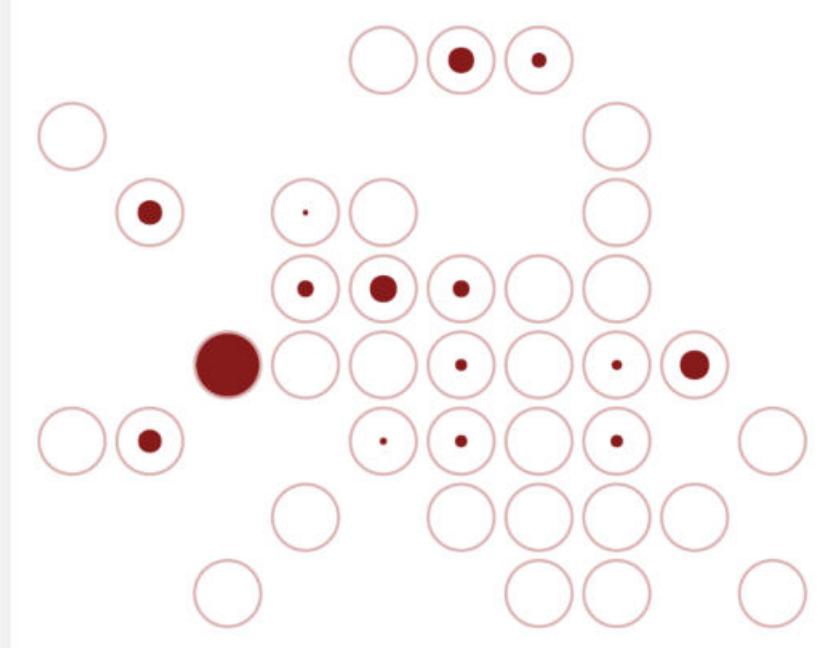
Note: Energy production is mapped to the area of the circles.
Visualization by Cédric Scherer • Data by Eurostat



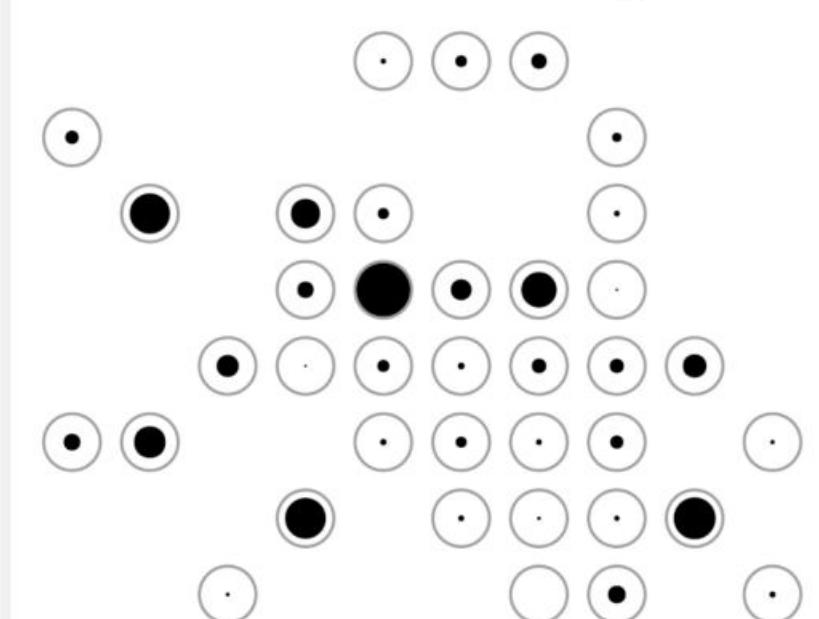
Renewable energy



Nuclear energy

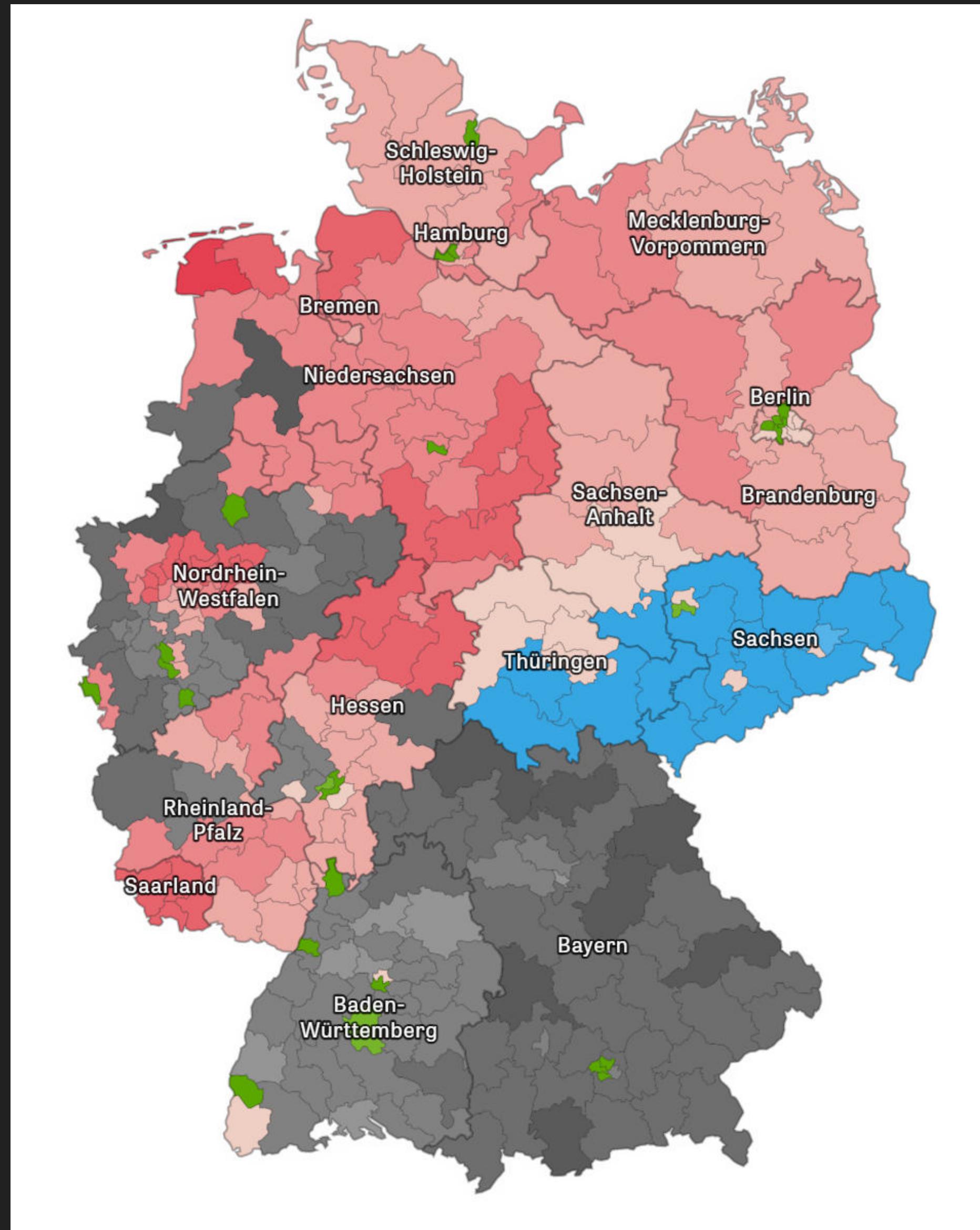


Conventional thermal energy



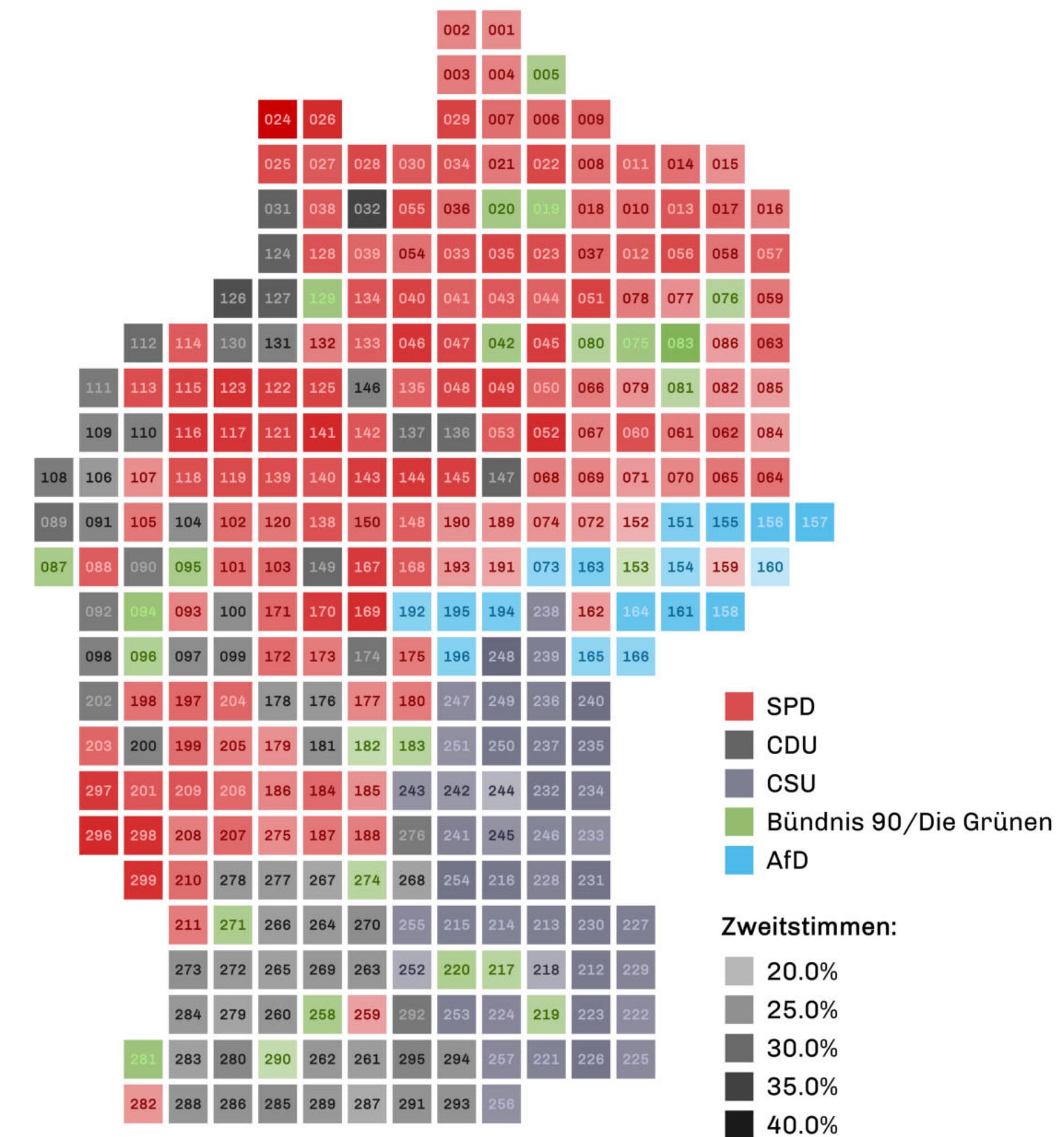
“How European countries generated electricity in 2018”, #TidyTuesday Contribution





Ergebnisse der Bundestagswahl 2021

Die stärksten Parteien nach Prozent der Zweitstimmen.

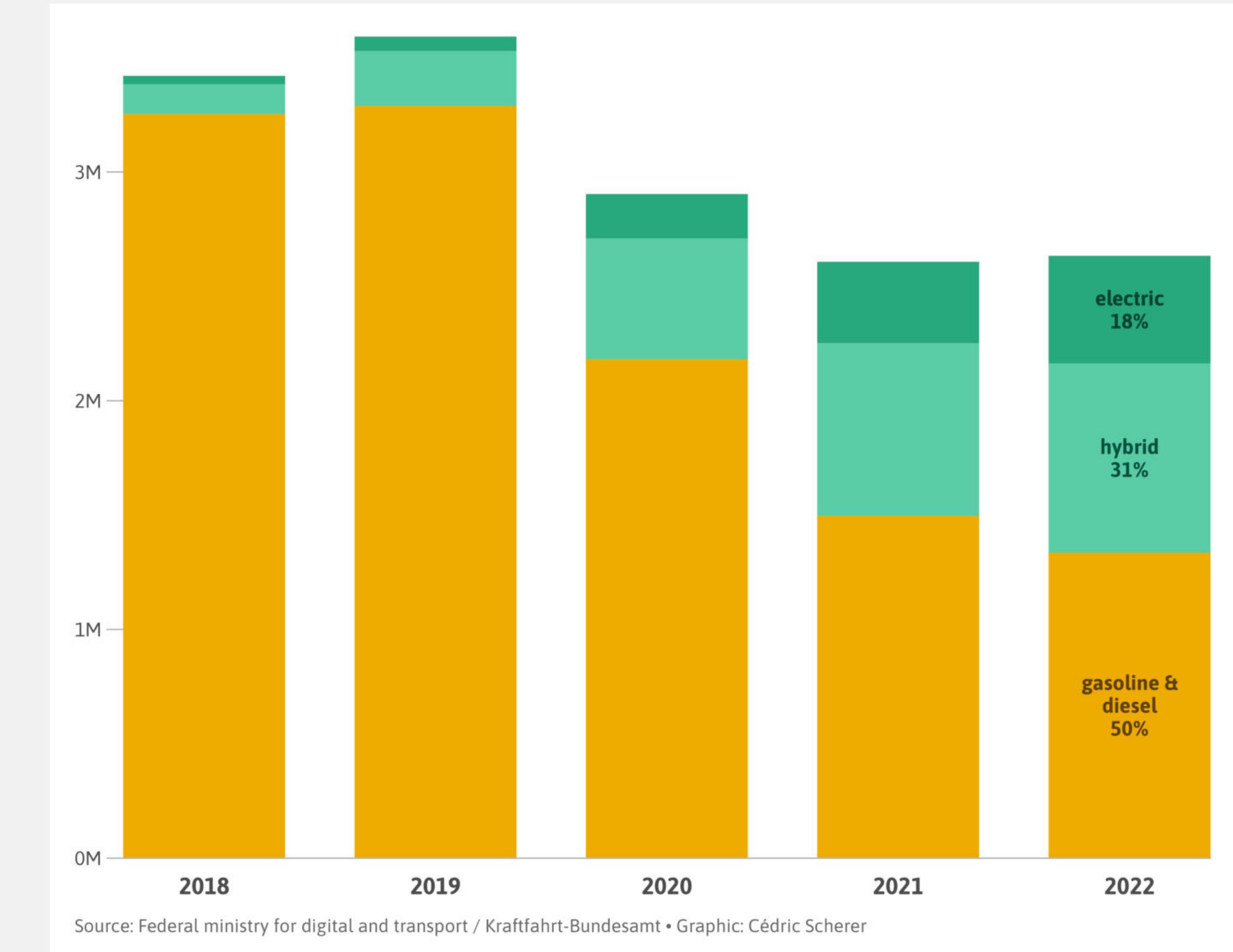
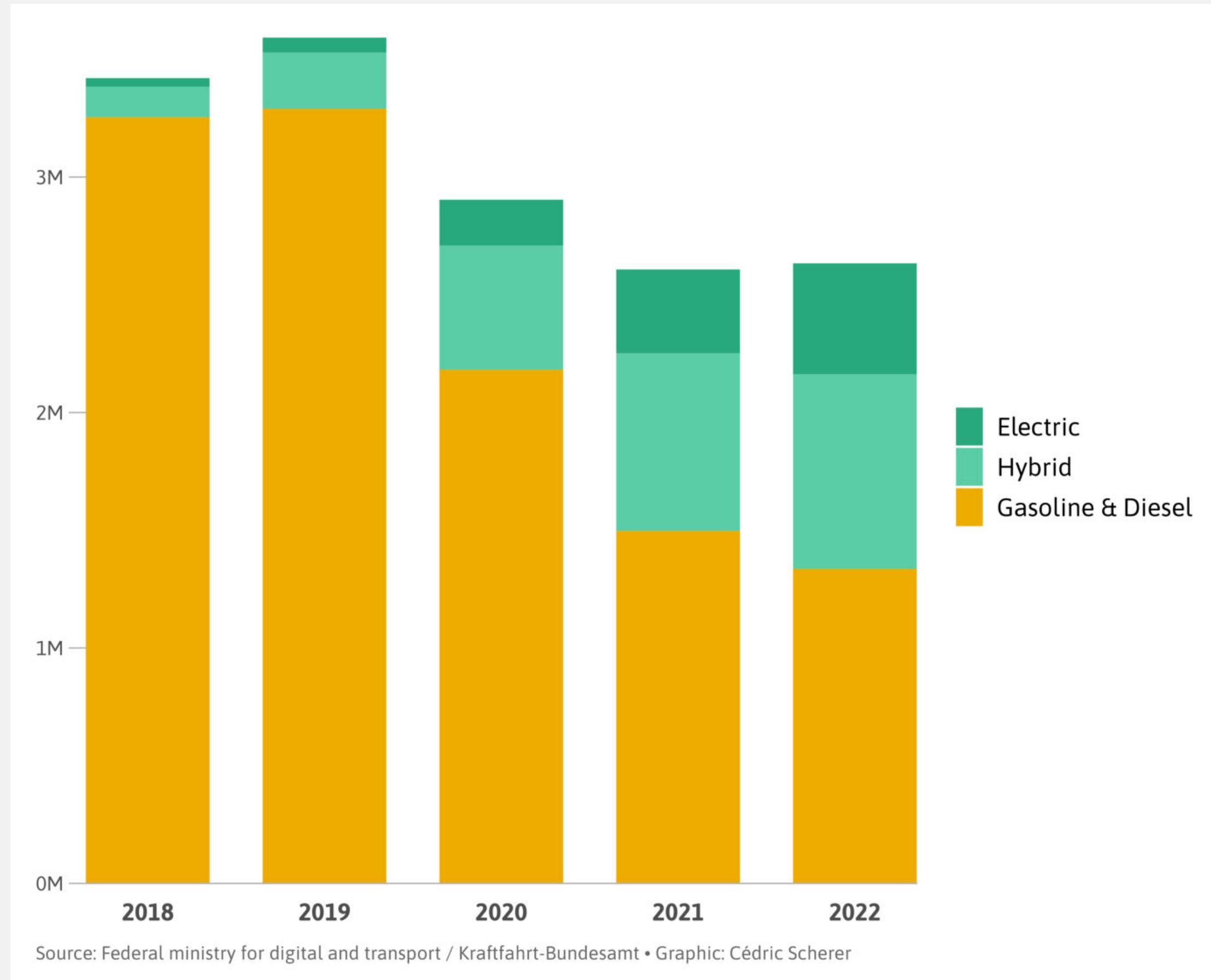


Grafik: Cédric Scherer & Ansgar Wolsing • Daten: DIE ZEIT

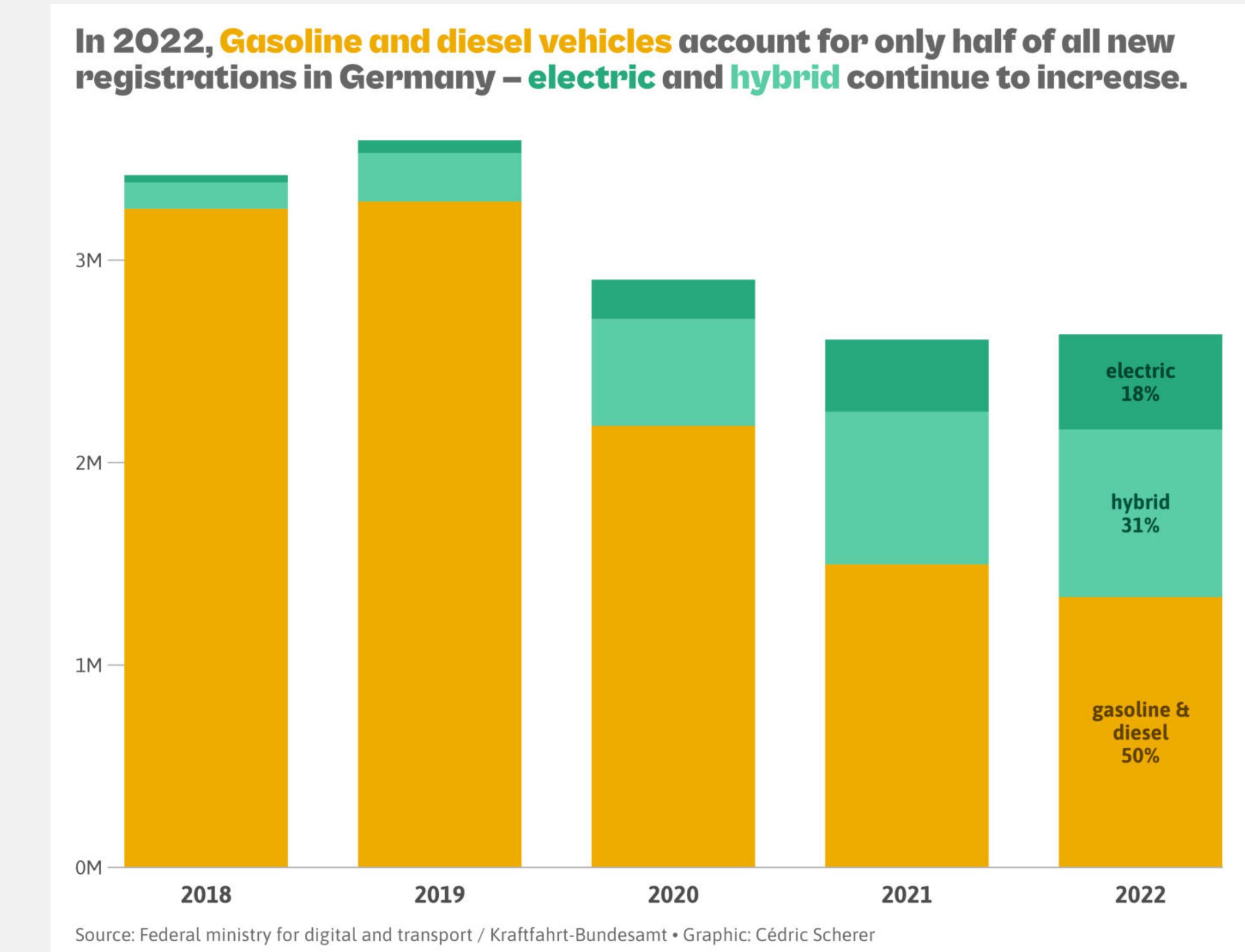
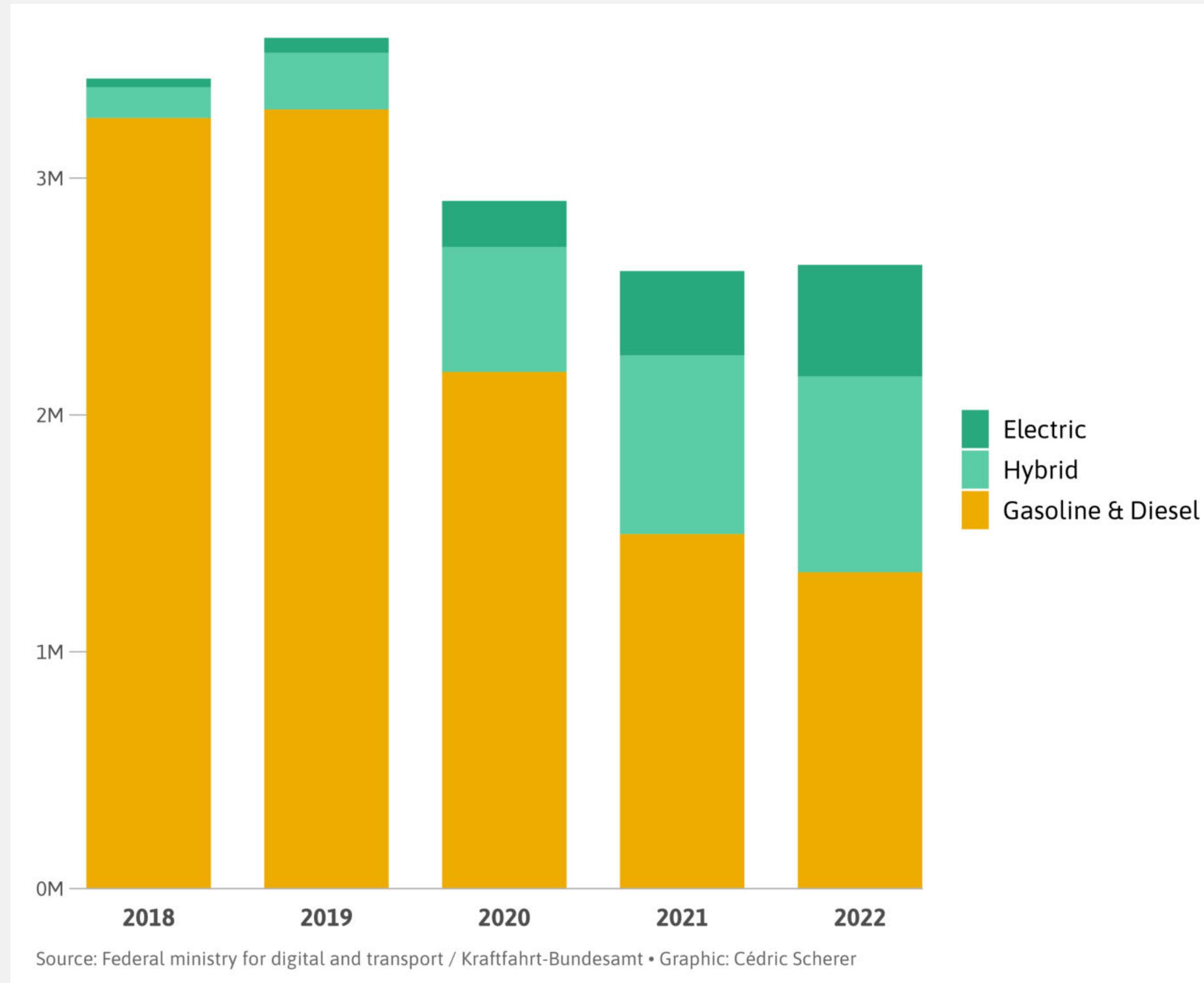
Links: Choropleth-Karte von Die Zeit | Rechts: Kachel-Karte ("Tile Grid Map") von Cédric Scherer & Ansgar Wolsing



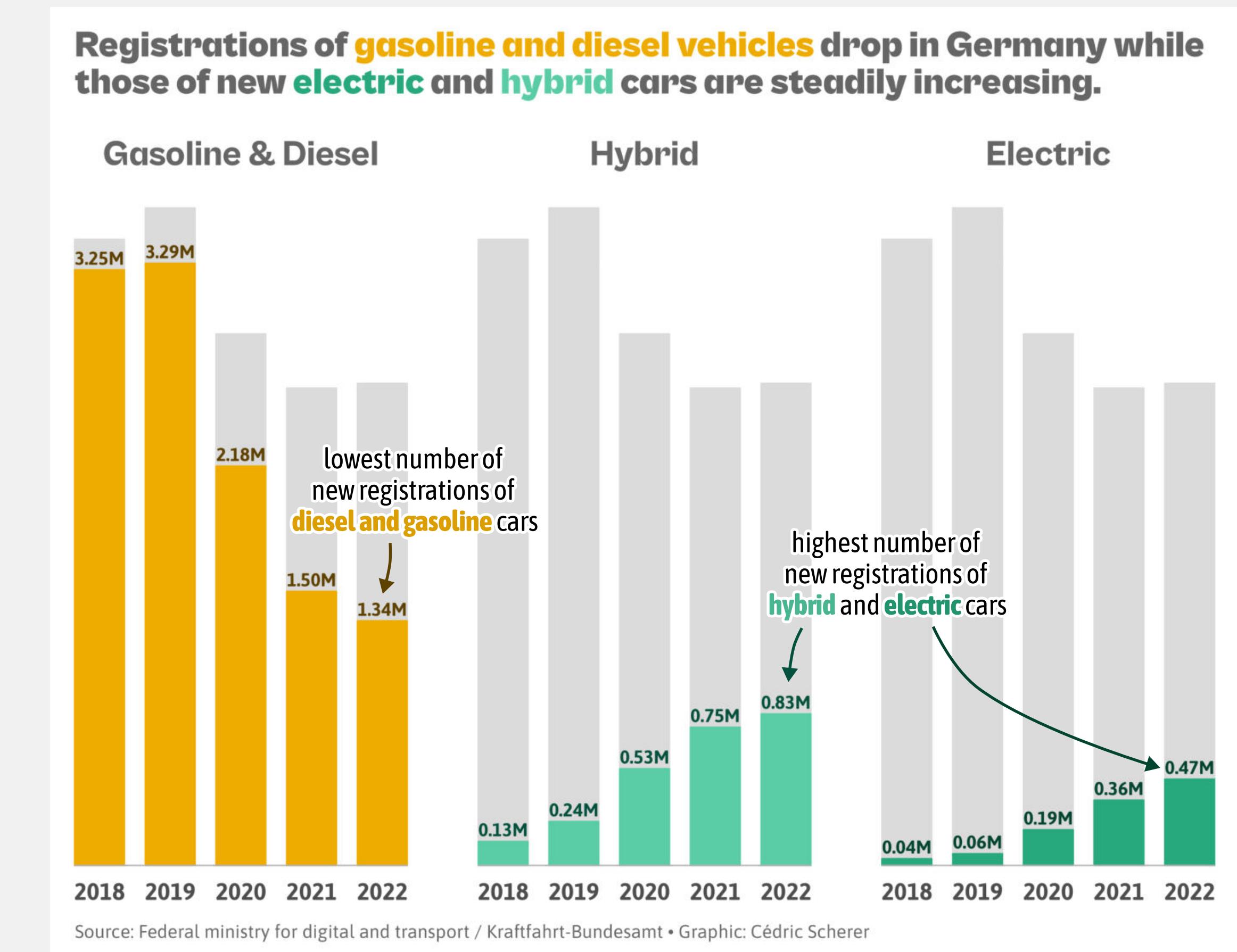
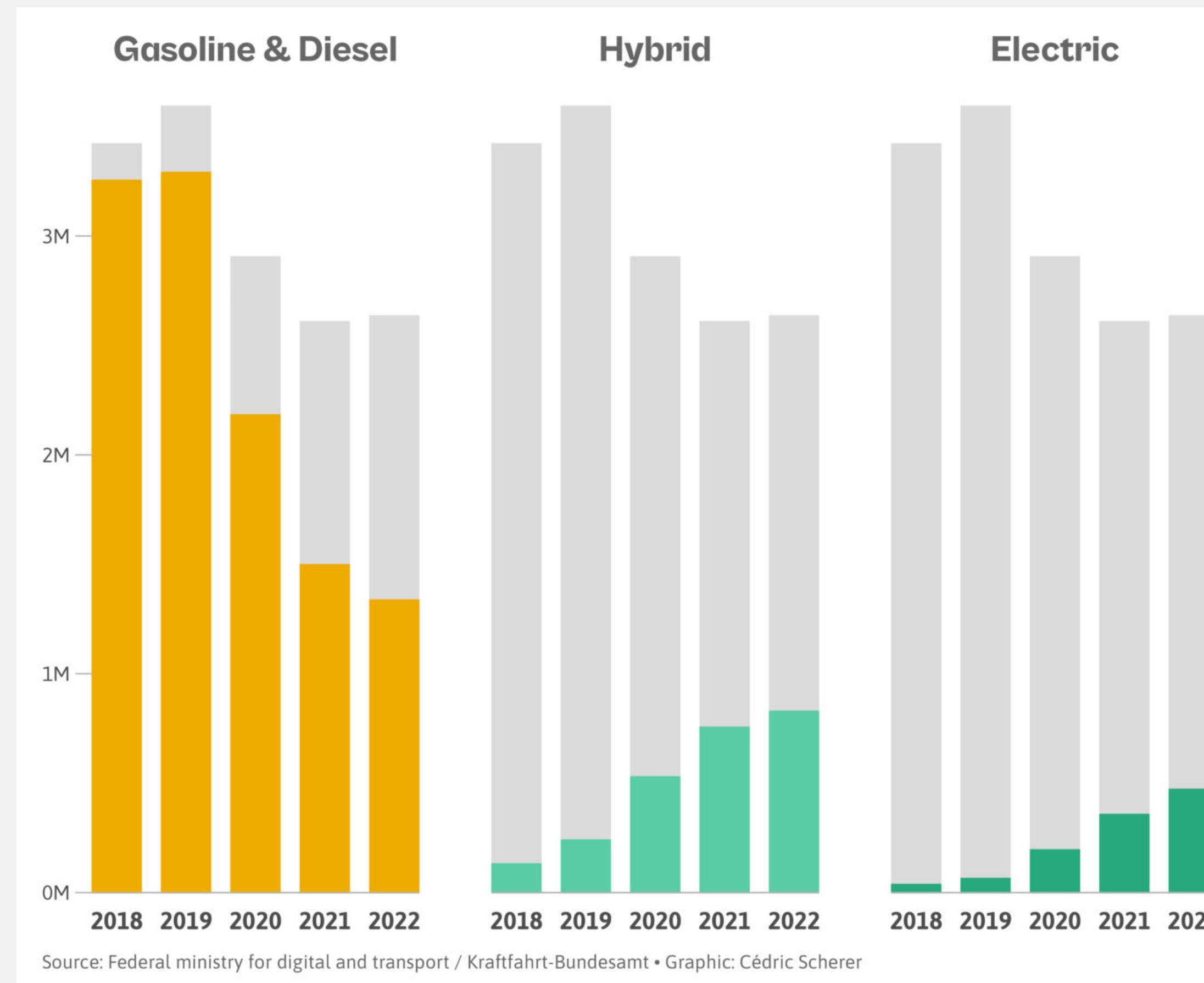
The Power of Annotations



The Power of Annotations



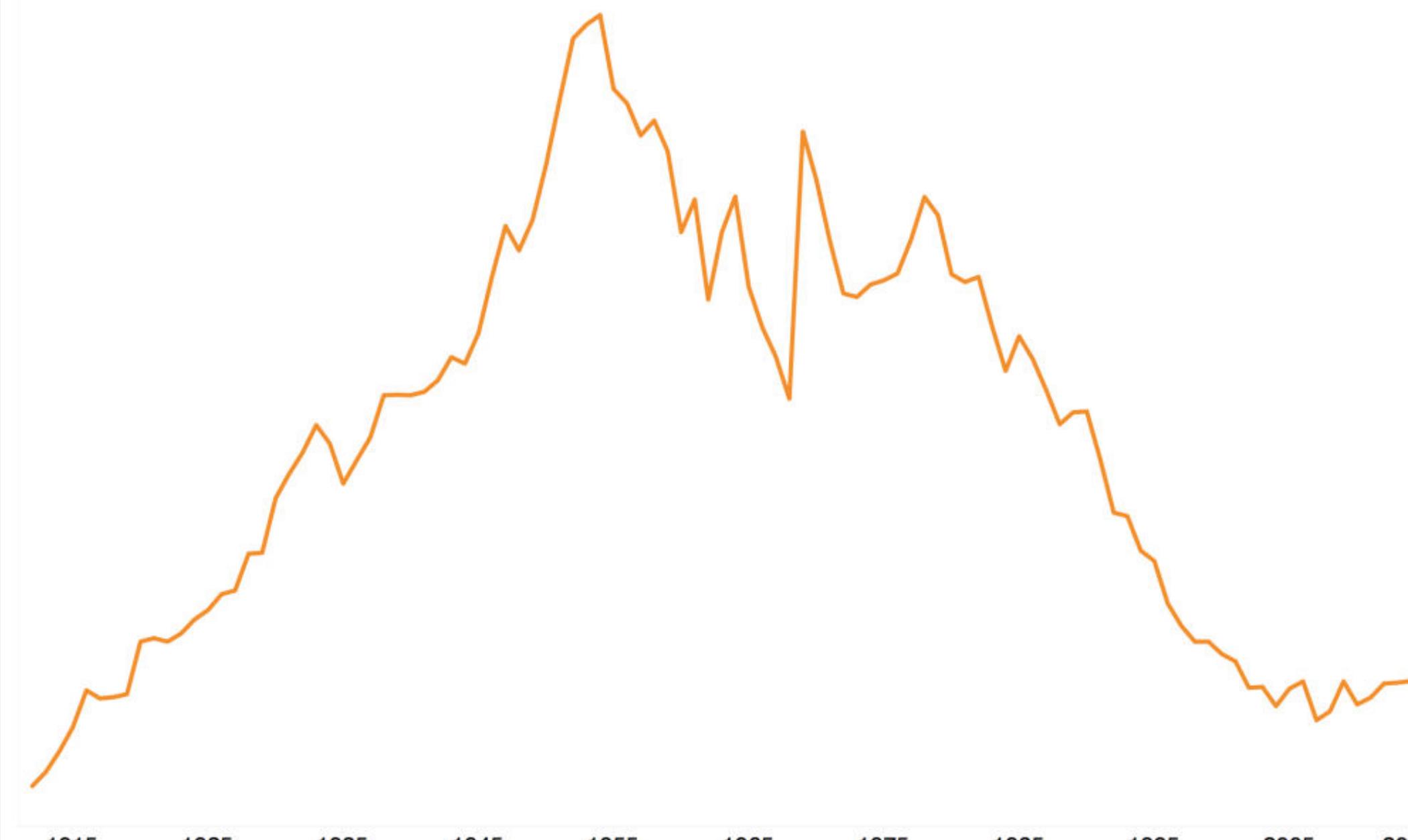
The Power of Annotations



The Power of Annotations

Rise and Fall of the name **Neil** in the USA
Births 1912-2015

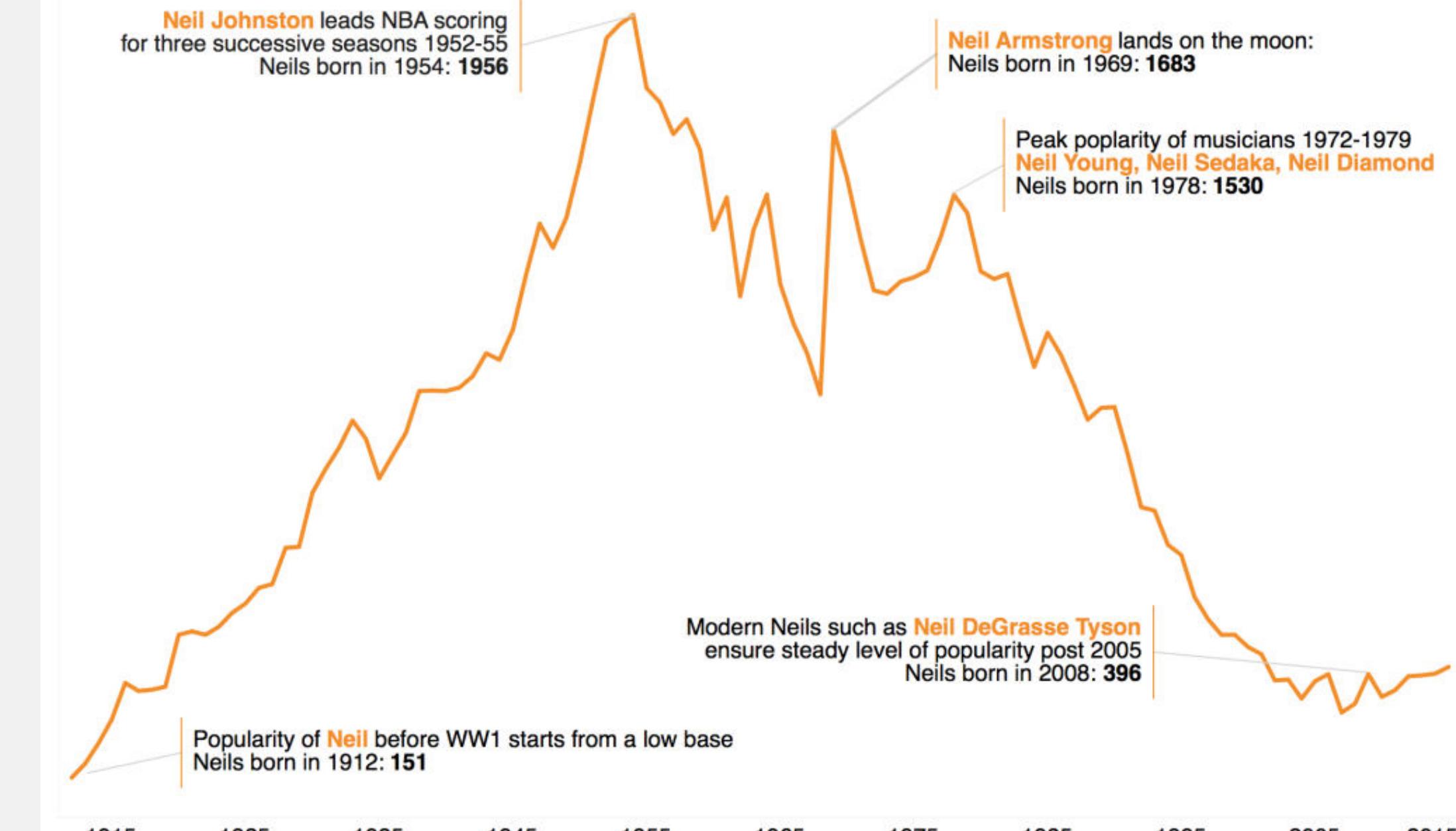
Source: data.gov



Visualisation: @theneilrichards

Rise and Fall of the name **Neil** in the USA
Births 1912-2015

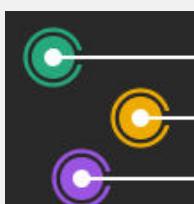
Source: data.gov



Visualisation: @theneilrichards

#SWDChallenge

“Is white space always your friend?” by Neil Richards



Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



Zeitreihe mit Beschriftungen von William Playfair from "The Commercial and Political Atlas and Statistical Breviary" (1786)



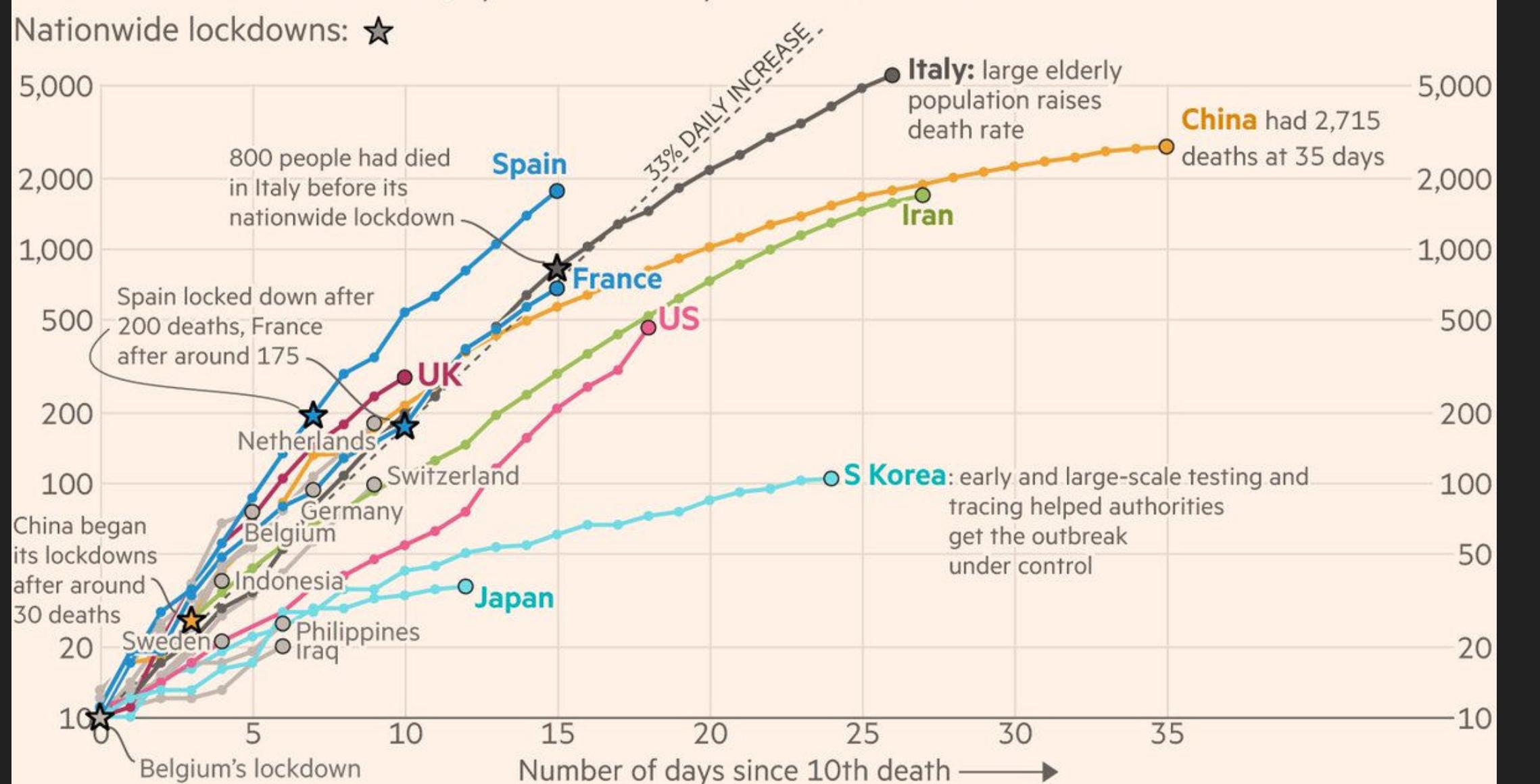
“The key thing we do is to add a title to the chart, as an entry point and to explain what is going on. **Text and other annotations add enormous value for non-chart people.”**

~ John Burn-Murdoch, Financial Times

Coronavirus deaths in Italy, Spain and the UK are increasing much more rapidly than they did in China

Cumulative number of deaths, by number of days since 10th death

Nationwide lockdowns: ★



FT graphic: John Burn-Murdoch / @jburnmurdoch

Source: FT analysis of Johns Hopkins University, CSSE; Worldometers; FT research. Data updated March 23, 09:00 GMT

© FT

Covid has grown gradually less lethal over the pandemic, mainly due to immunity, but it remains more dangerous than flu on average

Evolution of Covid-19's infection fatality ratio* in England, relative to seasonal flu

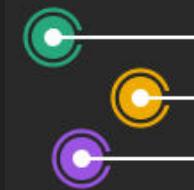


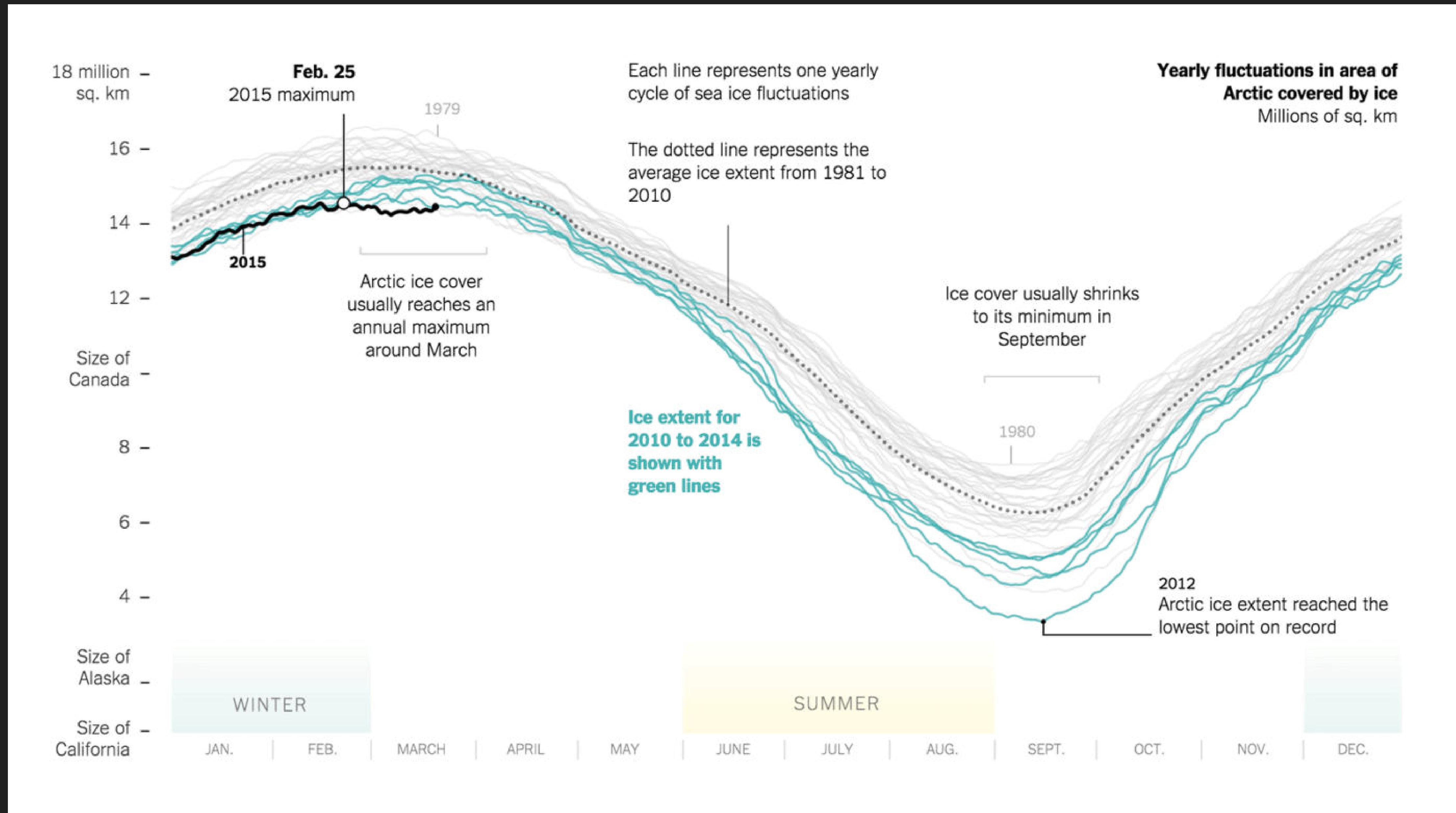
*Covid IFR calculated using ONS death cert. mentions and ONS infection survey. **IFR for seasonal flu as calculated for New Zealand in BMJ

Source: ONS. Based on prior work by Dan Howdon

FT graphic: John Burn-Murdoch / @jburnmurdoch

© FT

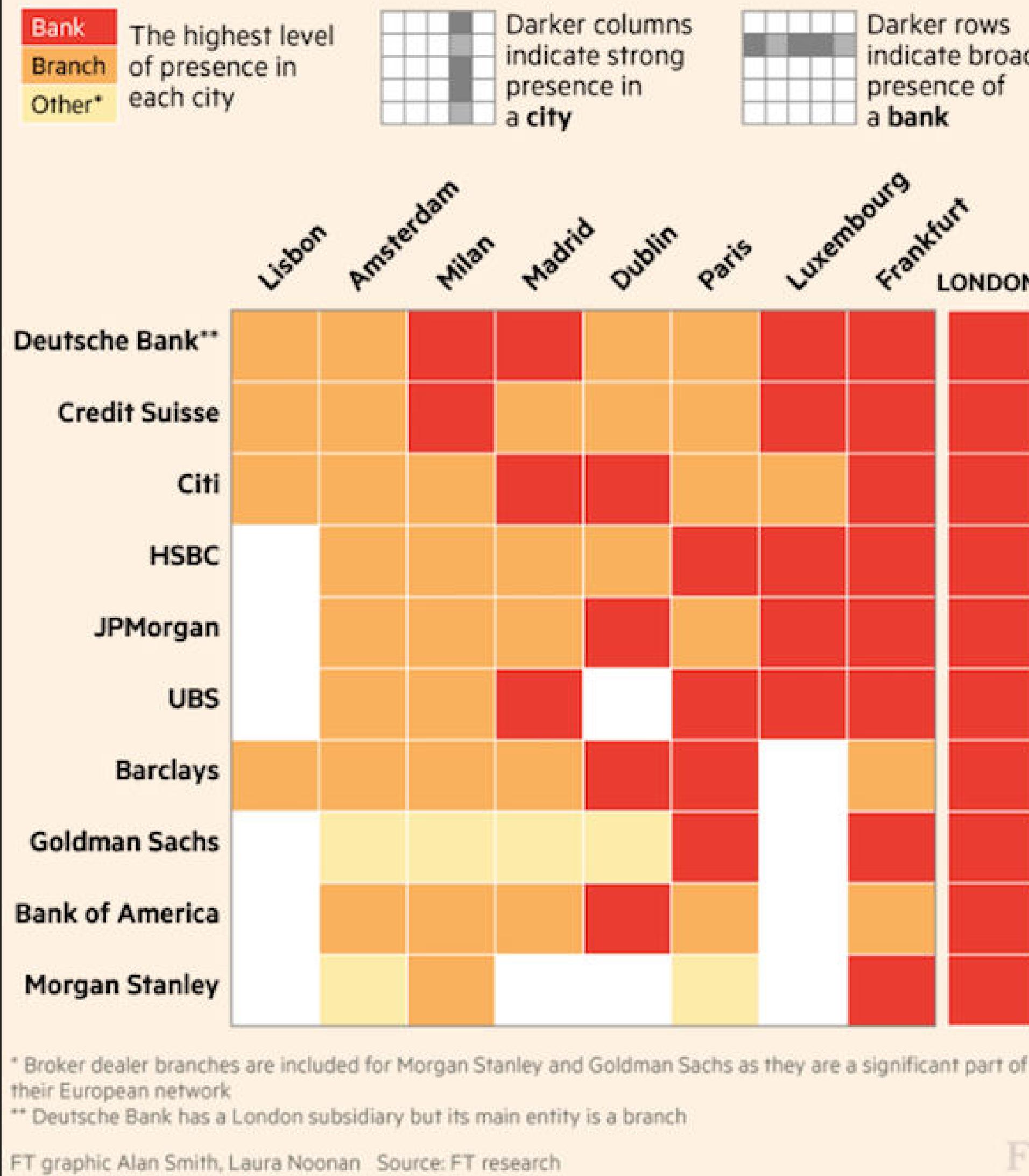




“Yearly Fluctuations in Area of Arctic Covered by Ice” by Derek Watkins (New York Times)



The Brexit banking matrix: The contenders lining up for London's crown



“Frankfurt vies for UK banking jobs post-Brexit” by Alan Smith und Laura Noonan (Financial Times)



Supplementary supermarket shopping

1

People who do most of their food/grocery shopping at this supermarket...

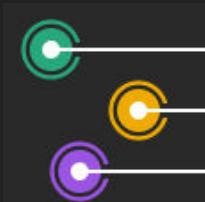
2

...also regularly shop at this supermarket

So, for instance,
27% of people
who do most of
their grocery
shopping at Aldi
also regularly
shop at
Morrisons.

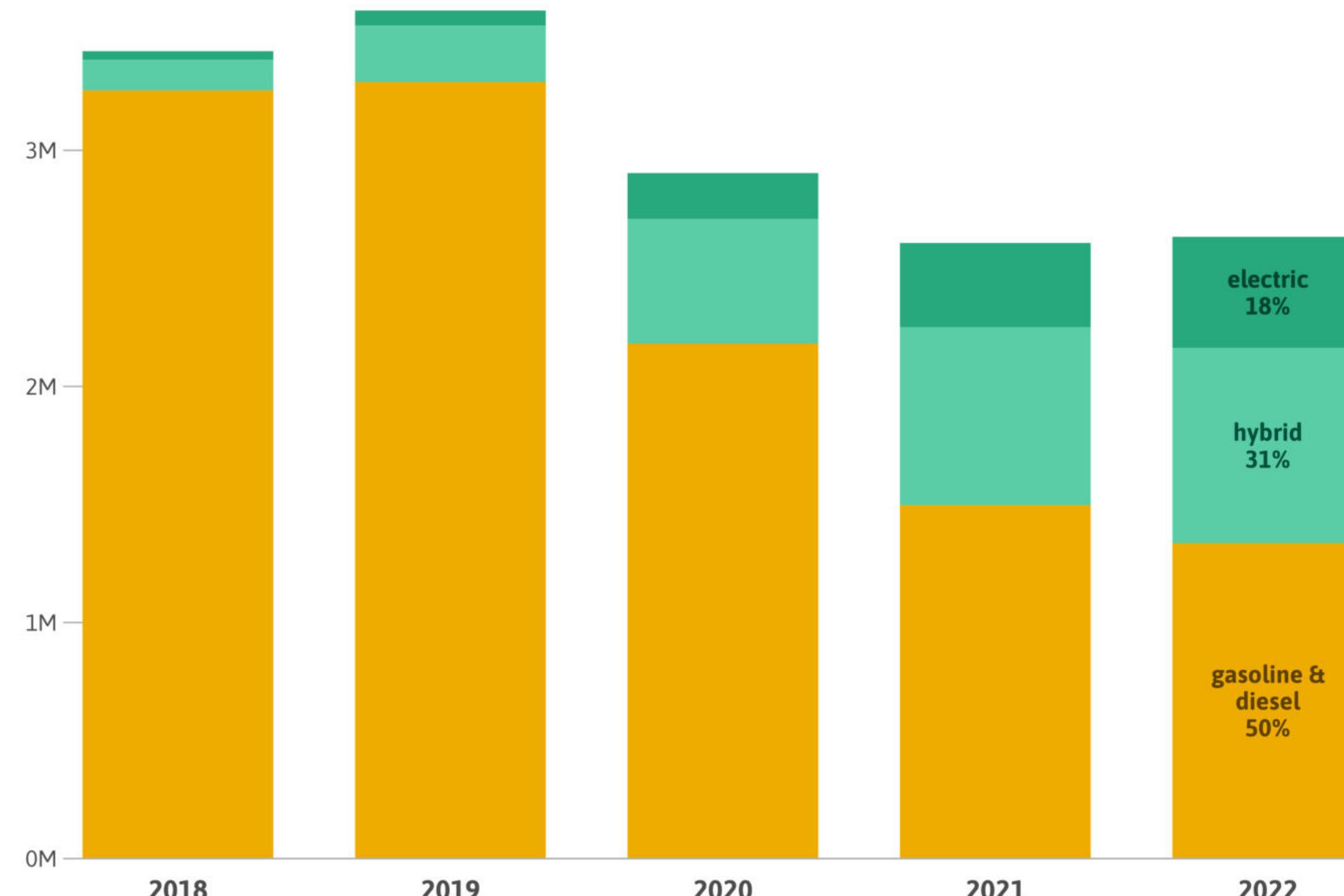
	Aldi	Asda	Iceland	Lidl	Marks & Spencer	Morrisons	Sainsbury's	Tesco	The Co-operative	Waitrose
Aldi		36	26	34	17	33	23	28	22	16
Asda	38		34	32	19	29	20	27	20	11
Iceland	18	22		20	12	19	14	17	12	7
Lidl	25	24	26		13	24	20	24	21	17
Marks & Spencer	9	12	9	9		17	28	17	17	37
Morrisons	27	26	21	25	22		20	22	20	13
Sainsbury's	26	25	20	33	47	29		32	31	39
Tesco	45	39	42	44	43	37	42		42	40
The Co-operative	15	15	11	17	18	17	20	19		20
Waitrose	5	5	6	9	30	7	21	11	14	

"Tesco is the nation's primary AND secondary supermarket" by Matthew Smith (YouGov)



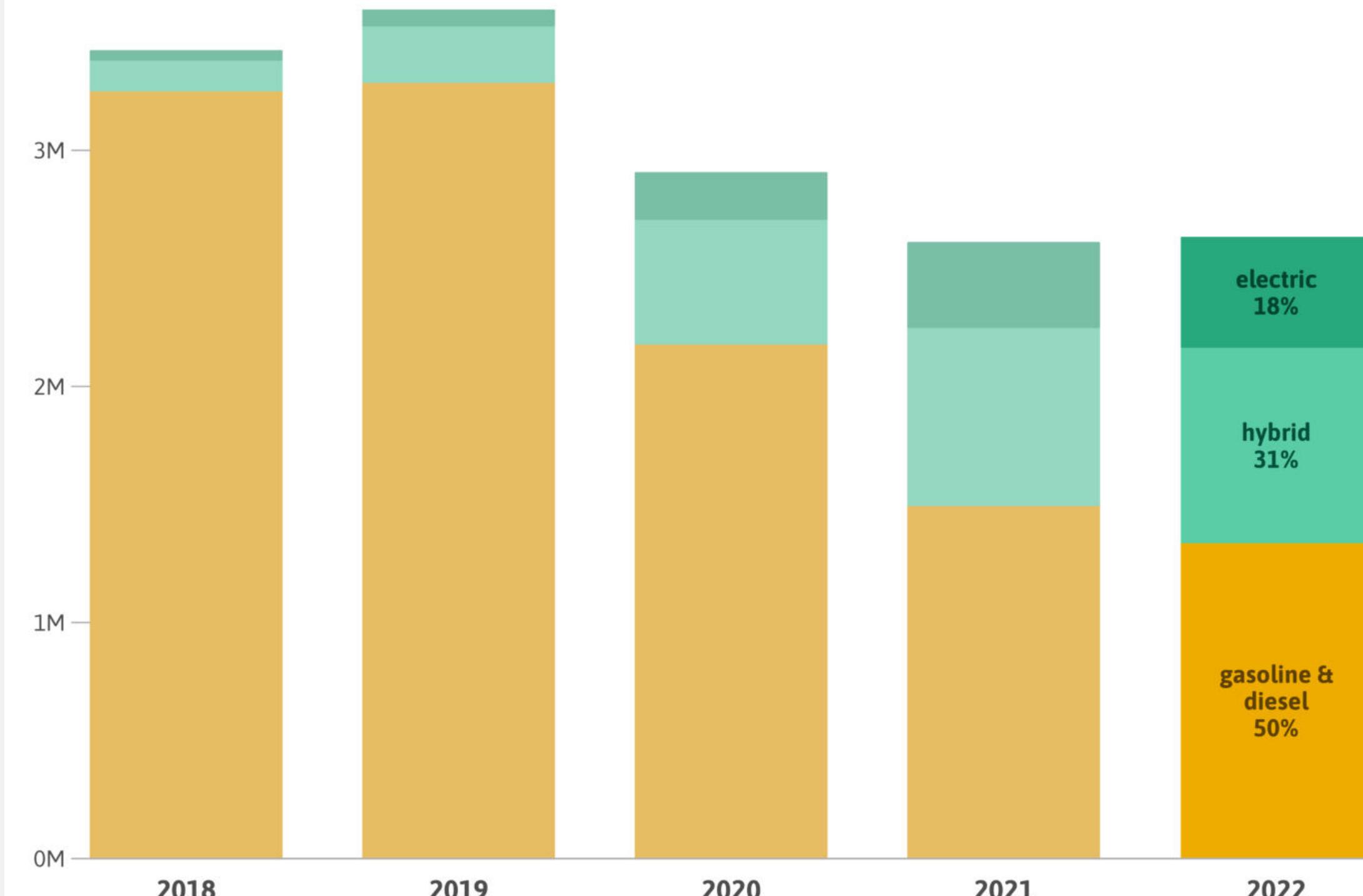
The Power of Colors

In 2022, Gasoline and diesel vehicles account for only half of all new registrations in Germany – electric and hybrid continue to increase.



Source: Federal ministry for digital and transport / Kraftfahrt-Bundesamt • Graphic: Cédric Scherer

In 2022, Gasoline and diesel vehicles account for only half of all new registrations in Germany – electric and hybrid continue to increase.

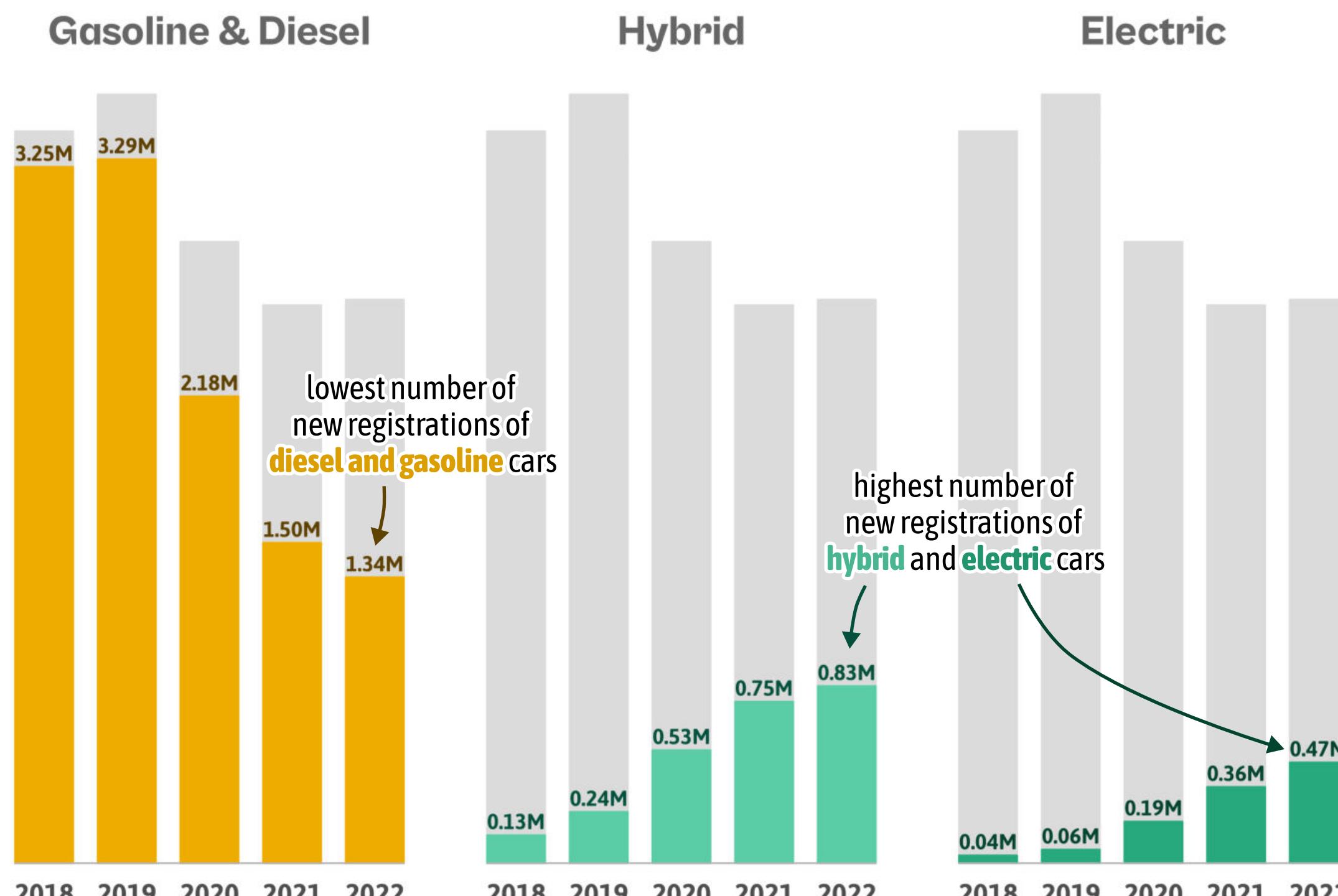


Source: Federal ministry for digital and transport / Kraftfahrt-Bundesamt • Graphic: Cédric Scherer



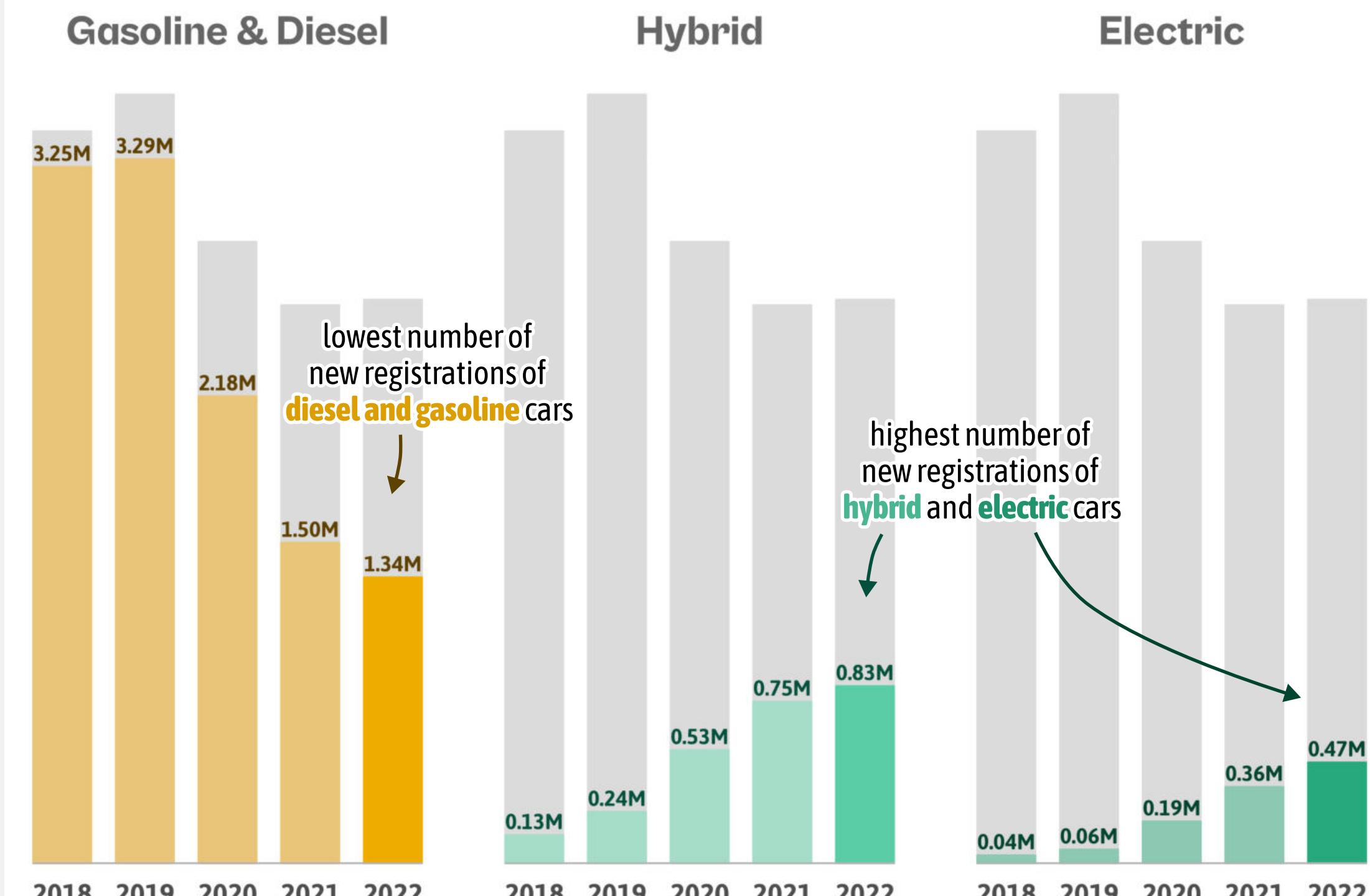
The Power of Colors

Registrations of **gasoline and diesel vehicles** drop in Germany while those of new **electric** and **hybrid** cars are steadily increasing.



Source: Federal ministry for digital and transport / Kraftfahrt-Bundesamt • Graphic: Cédric Scherer

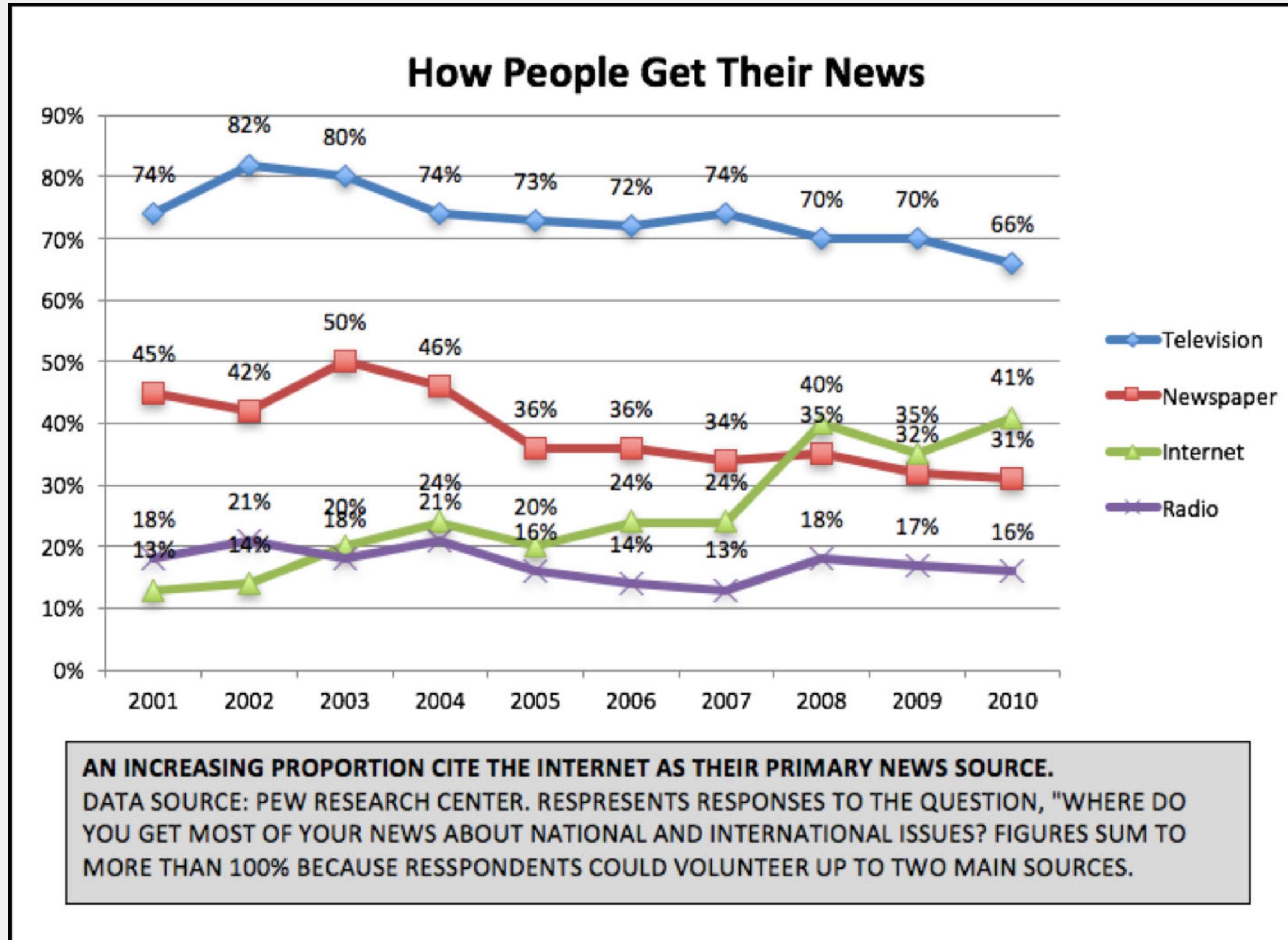
Registrations of **gasoline and diesel vehicles** drop in Germany while those of new **electric** and **hybrid** cars are steadily increasing.



Source: Federal ministry for digital and transport / Kraftfahrt-Bundesamt • Graphic: Cédric Scherer



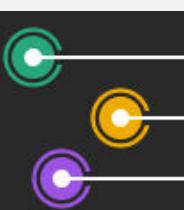
Group Exercise



Source: *StorytellingWithData*

Declutter this graphic

- 👉 What is the main message?
- 👉 Is all the data relevant?
- 👉 What would you change?
- 👉 How can you highlight the **increase**?
- 👉 Draw a decluttered version!



COLORS

and Pitfalls

Hue

color family



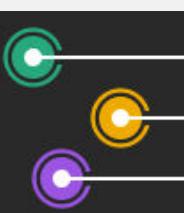
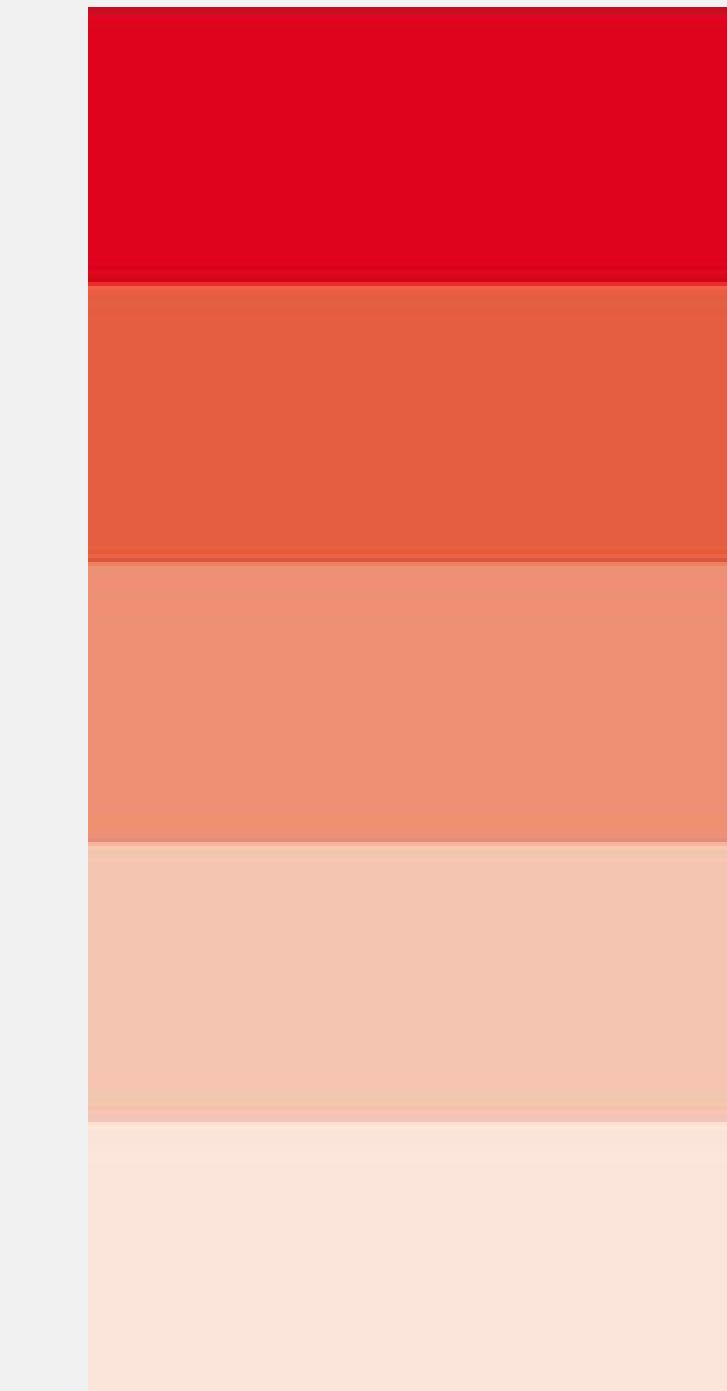
Chroma

colorfulness



Luminance

lightness / brightness





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z3tt



NON Uniform Distances



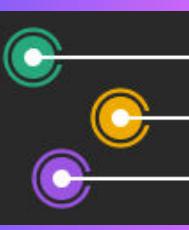
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[z3tt](https://github.com/z3tt)



[Med Phys.](#) 2015 Jun; 42(6): 2942–2954. Published online 2015 May 20. doi: [10.1118/1.4921125](https://doi.org/10.1118/1.4921125)

PMCID: PMC5148121 | PMID: [26127048](https://pubmed.ncbi.nlm.nih.gov/26127048/)

Effect of color visualization and display hardware on the visual assessment of pseudocolor medical images

Silvina Zabala-Travers, Mina Choi, Wei-Chung Cheng, and Aldo Badano^{a)}

10 March 2017

Interpretation of the rainbow color scale for quantitative medical imaging: perceptually linear color calibration (CSDF) versus DICOM GSDF

[Frédérique Chesterman](#), [Hannah Manssens](#), [Céline Morel](#), [Guillaume Serrell](#), [Bastian Piepers](#), [Tom Kimpe](#)

[Author Affiliations +](#)

[Proceedings Volume 10136, Medical Imaging 2017: Image Perception, Observer Performance, and Technology Assessment; 101360R \(2017\)](#) <https://doi.org/10.1117/12.2253885>

Event: [SPIE Medical Imaging](#), 2017, Orlando, Florida, United States

IEEE Computer Graphics and Applications

Rainbow Color Map (Still) Considered Harmful

March/April 2007, pp. 14-17, vol. 27

DOI Bookmark: [10.1109/MCG.2007.46](https://doi.org/10.1109/MCG.2007.46)

Authors

David Borland, University of North Carolina at Chapel Hill

Russell M. Taylor II, University of North Carolina at Chapel Hill

Education and communication

Rainbow color map distorts and misleads research in hydrology – guidance for better visualizations and science communication

Michael Stoelze¹ and Lina Stein²

¹Faculty of Environment and Natural Resources, University of Freiburg, Freiburg, Germany

²Department of Civil Engineering, University of Bristol, Bristol, UK



[Med Phys.](#) 2015 Jun; 42(6): 2942–2954. Published online 2015 May 20. doi: [10.1118/1.4921125](https://doi.org/10.1118/1.4921125)

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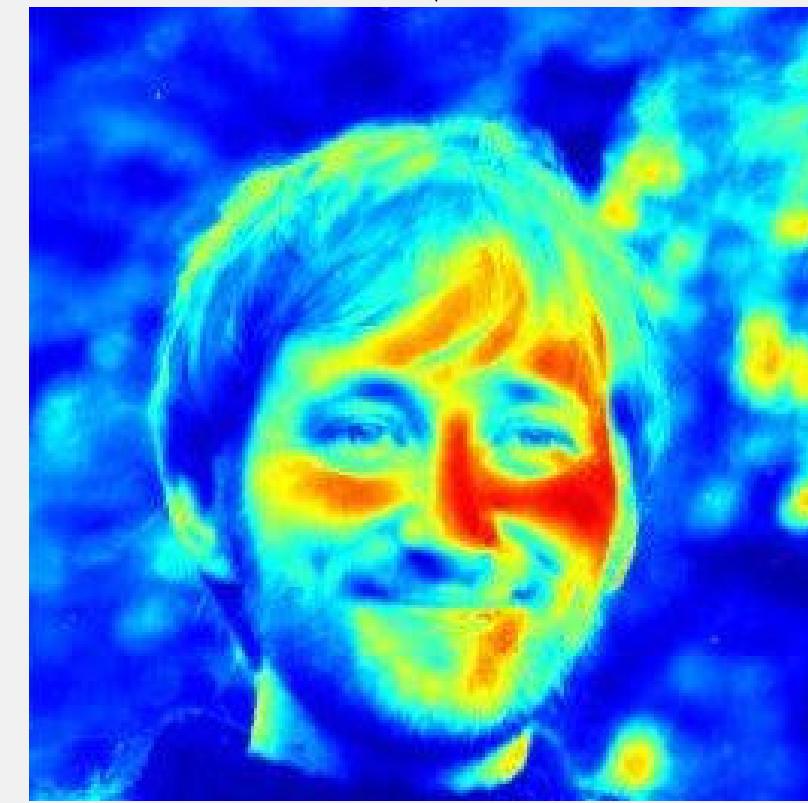
“The ad hoc manner in which color is handled and the lack of standard approaches have been associated with suboptimal and inconsistent diagnostic decisions with a negative impact on patient treatment and prognosis.”

Zabala-Travers, Choi, Cheng & Badano 2015 Med Phys.

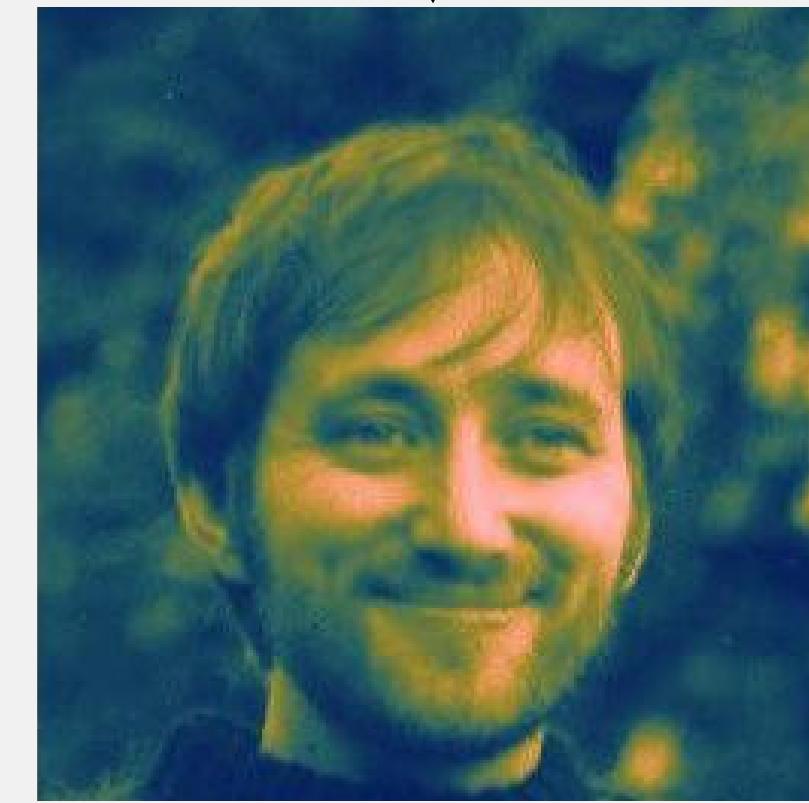




true-color Phil



rainbow Phil



batlow Phil

Source: *Fabio Cramer* (*modified*)



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z3tt



Turbo

Rainbow



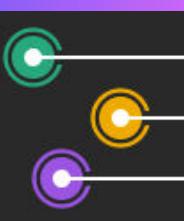
cedricscherer.com



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[z3tt](https://github.com/z3tt)



Turbo

Jet



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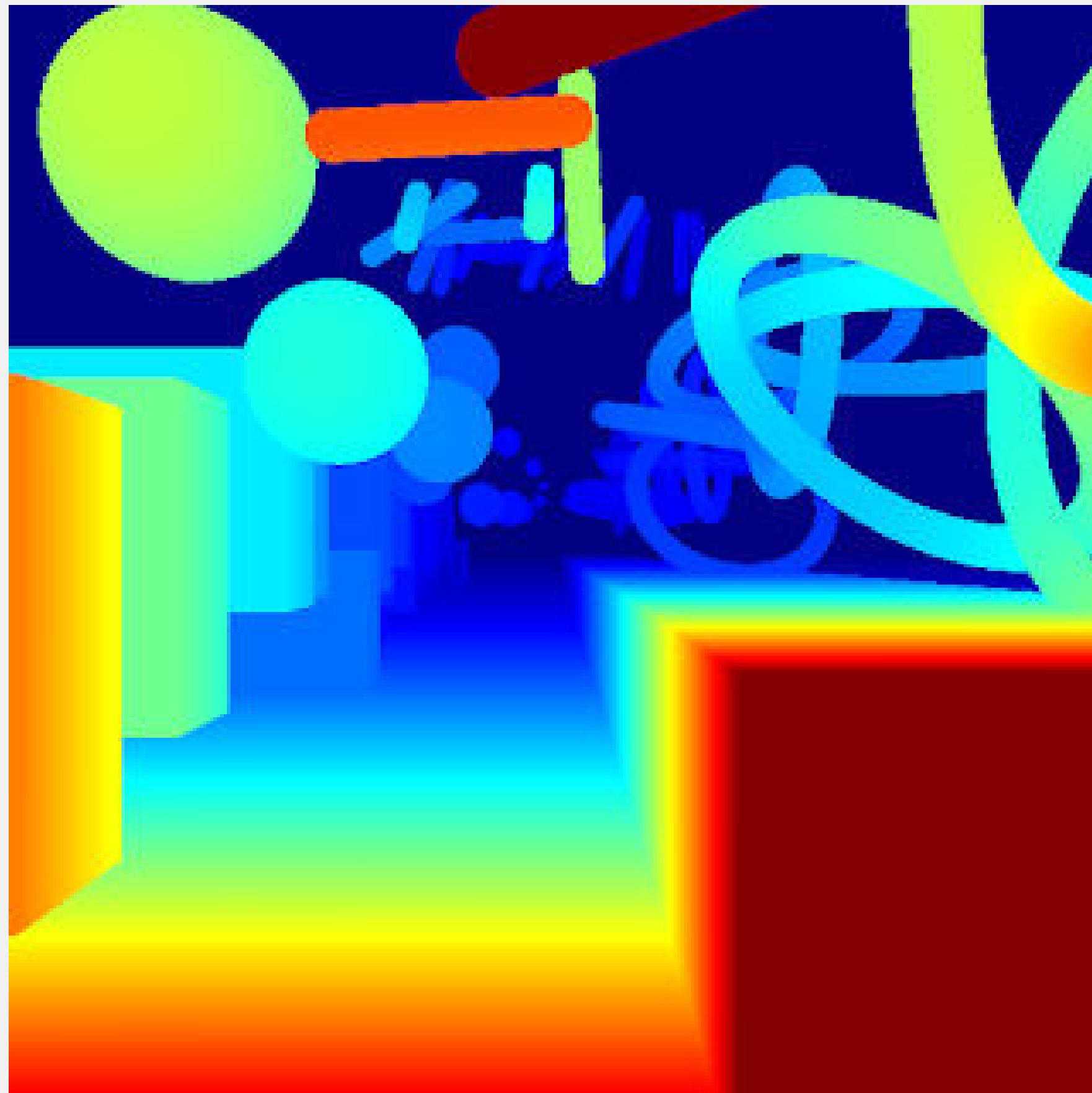
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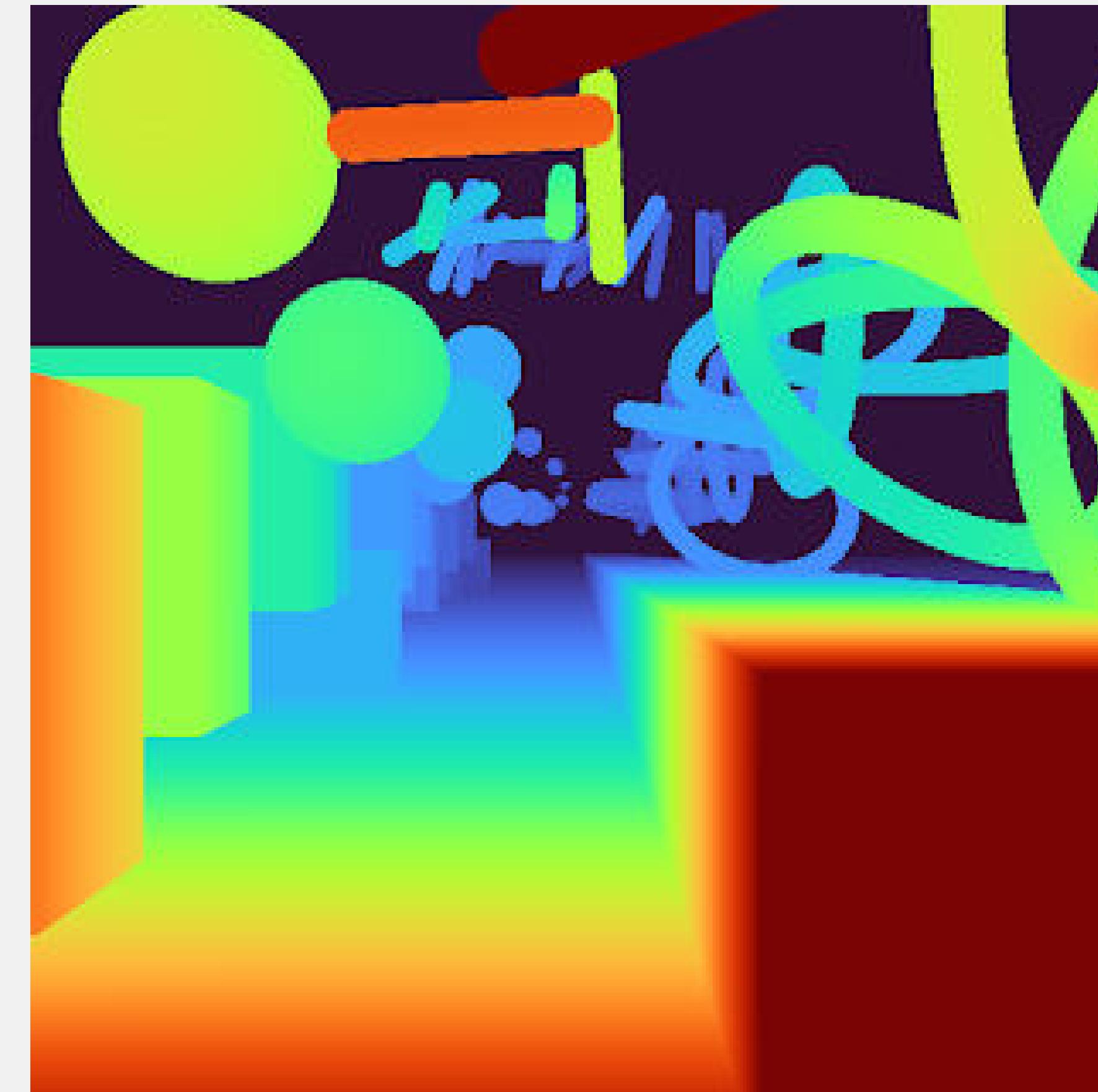
z3tt



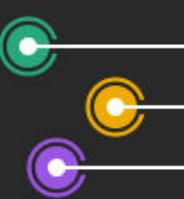
Jet



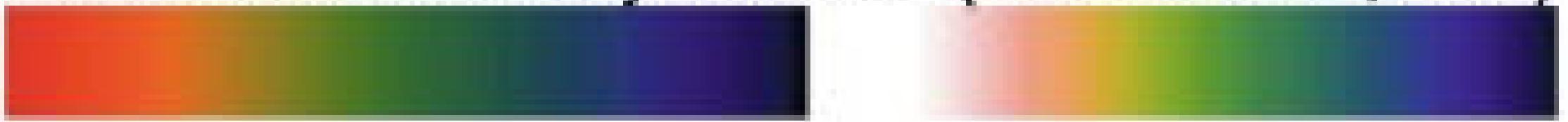
Turbo

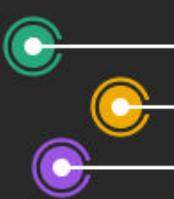


[“Turbo, An Improved Rainbow Colormap for Visualization” by Anton Mikhailov \(Google Research\)](#)



modification with examples

	luminance variation	false boundaries	color vision deficiency sensitive
isoluminant rainbow (e.g. Brewer, 1997; Kindlmann et al., 2002; Rogowitz & Kalvin, 2001; Szafir et al., 2016a) 	addressed		
luminance and chromaticity correction (Sisneros et al., 2016) 	addressed	addressed	
adjusting color distribution to fit it to data (Wang et al., 2021) 		addressed	
Turbo (Mikhailov, 2019) 		addressed	addressed



Color Palette Choice

Sequential

Palette



Desaturated



*Use to encode
**numerical information
with order***

*use highest contrast for
most important information*

either single- or multi-hue

Diverging

Palette



Desaturated



*Use to encode
**numerical information
with critical midpoint***

*ensure a meaningful midpoint value
and use balanced extremes*

*combination of
two sequential palettes*

Modified from the `{colorspace}` R package vignette



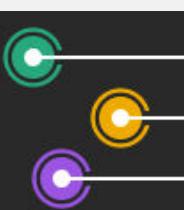
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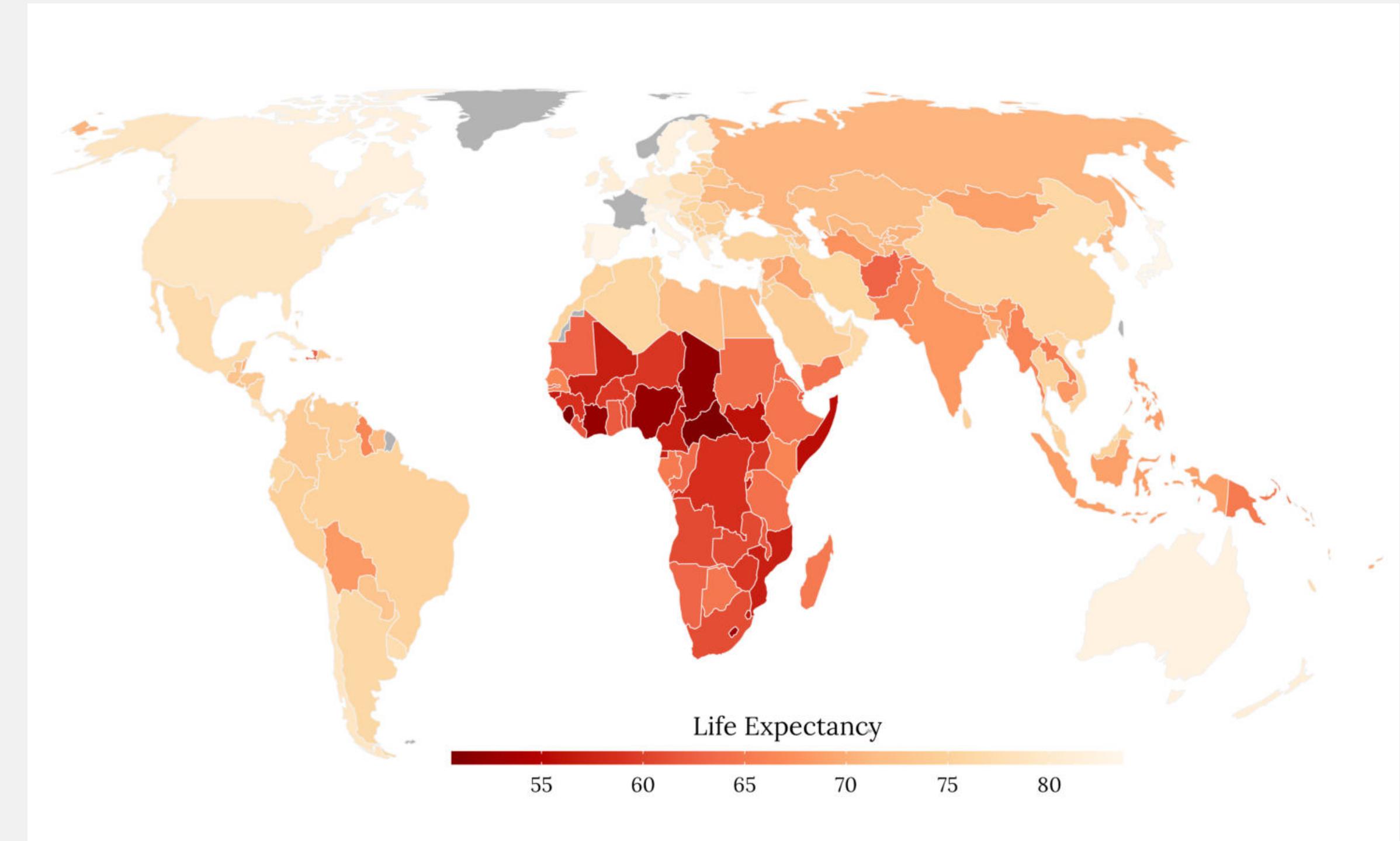
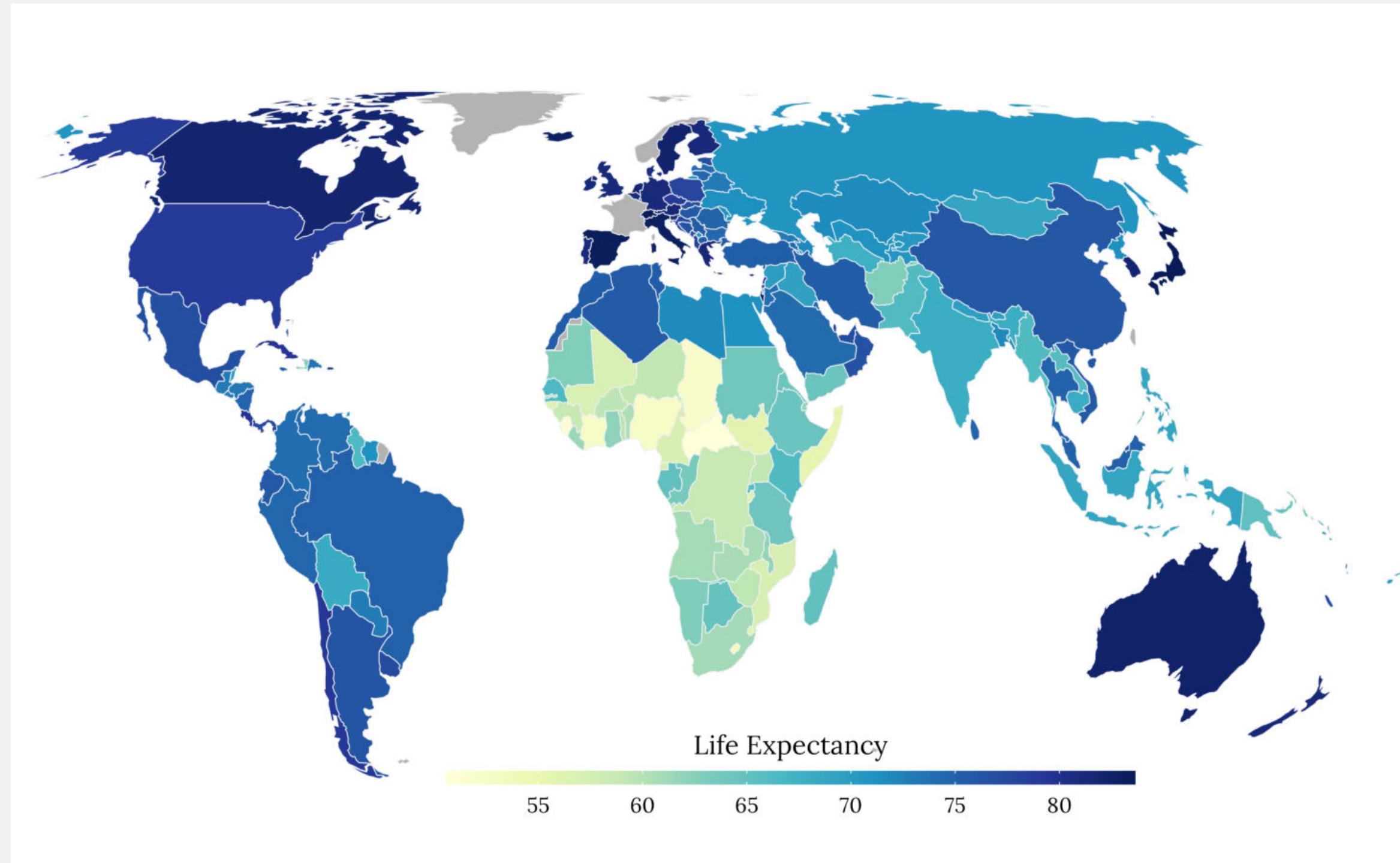
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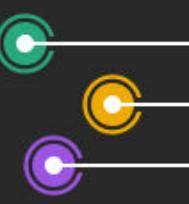
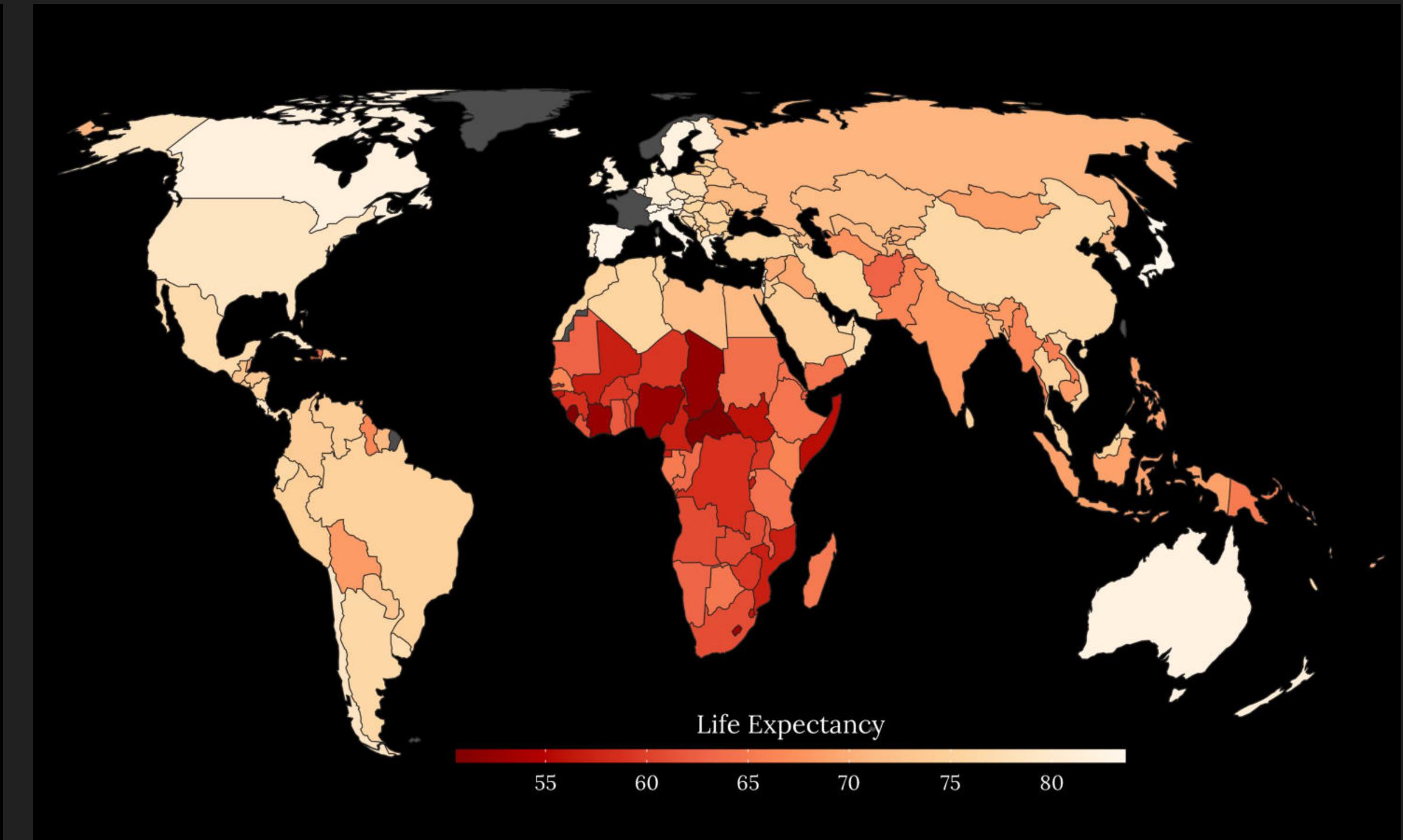
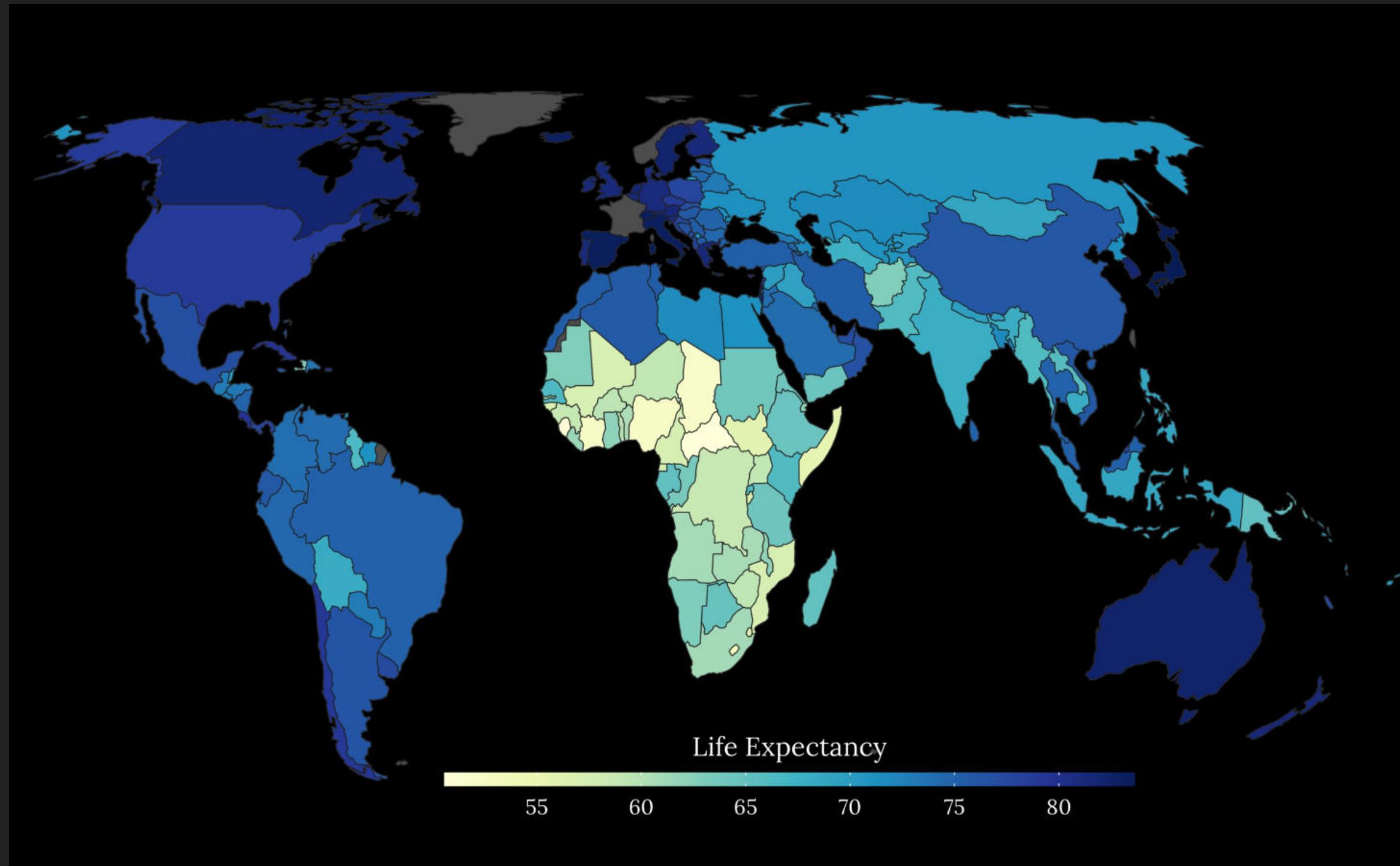
z3tt



Dark Equals More?



Dark Equals More?



Color Palette Choice

Sequential



*Use to encode
**numerical information
with order***

*use highest contrast for
most important information*

either single- or multi-hue

Diverging



*Use to encode
**numerical information
with critical midpoint***

*ensure a meaningful midpoint value
and use balanced extremes*

*combination of
two sequential palettes*

Modified from the `{colorspace}` R package vignette



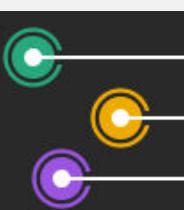
cedricscherer.com



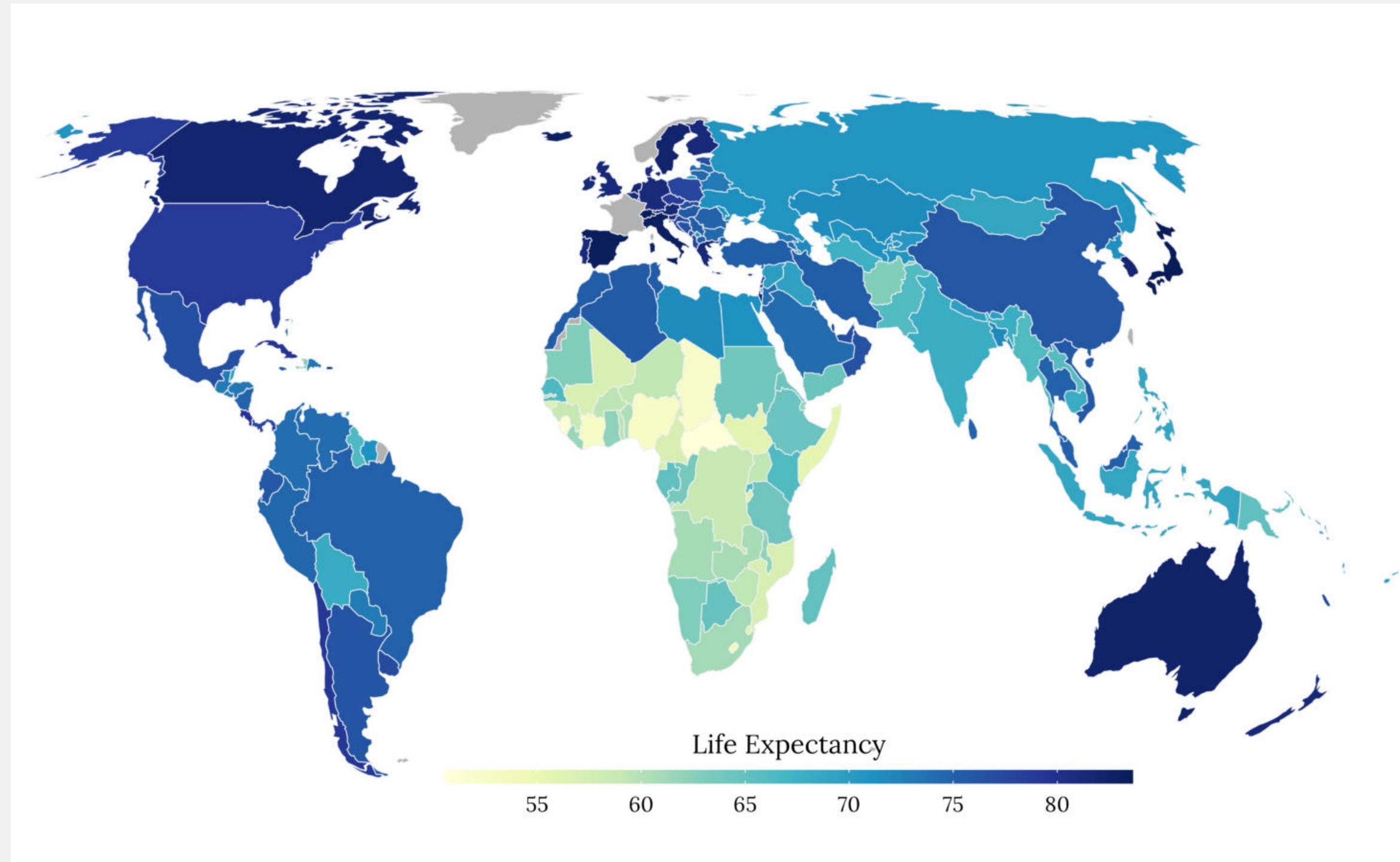
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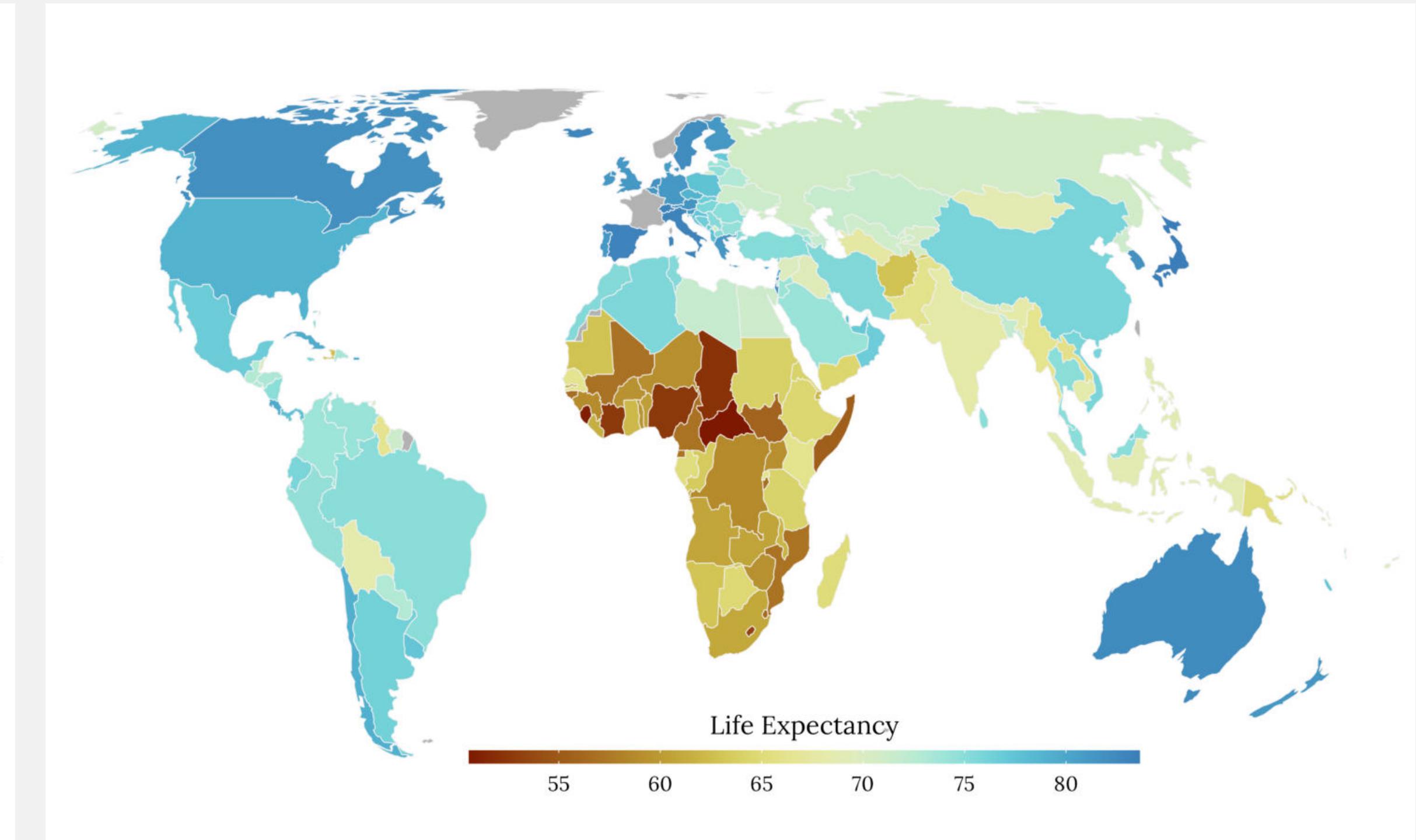
z3tt



Sequential or Diverging?



multi-hue sequential

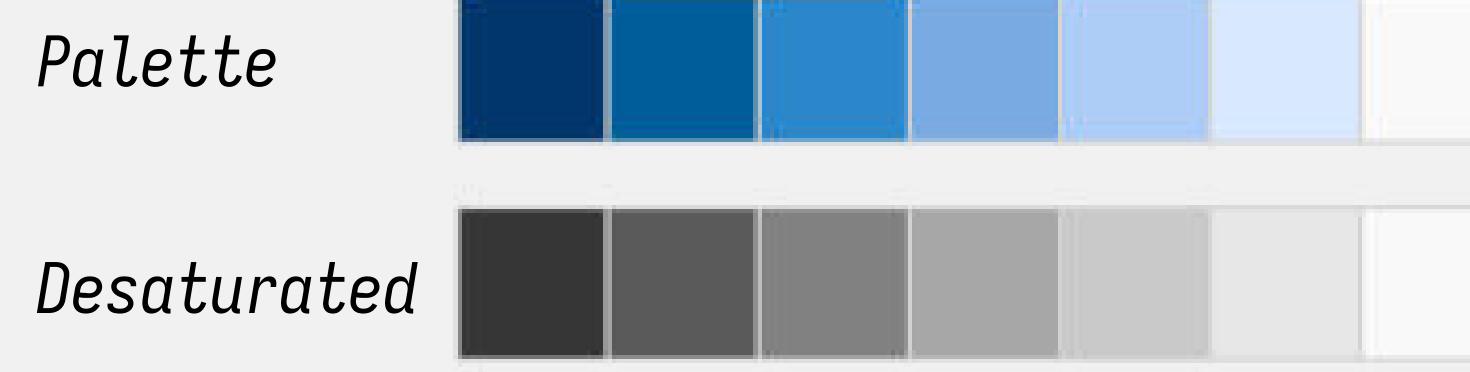


diverging



Color Palette Choice

Sequential



Use to encode
**numerical information
with order**

use highest contrast for
most important information

either single- or multi-hue

Diverging

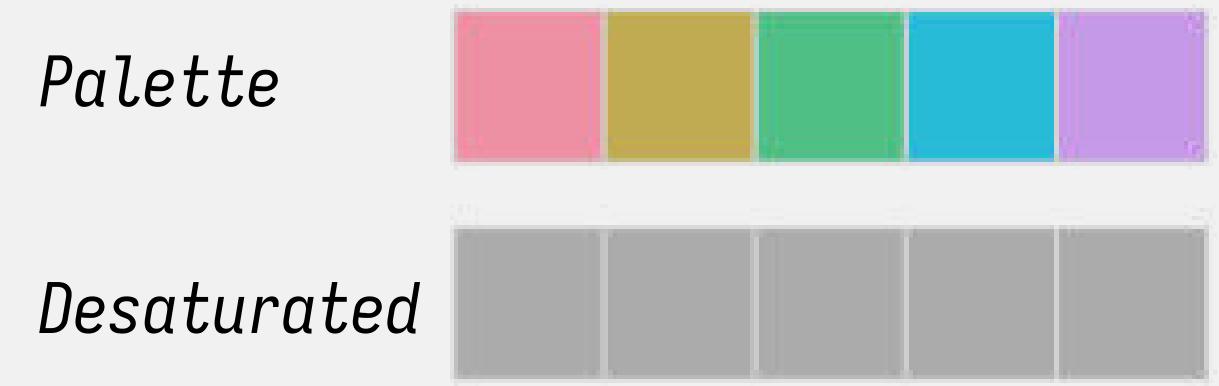


Use to encode
**numerical information
with critical midpoint**

ensure a meaningful midpoint value
and use balanced extremes

combination of
two sequential palettes

Qualitative



Use to encode
categorical information

pick distinct colors with
the same perceptual weight

limit categories to 6-8

Modified from the `{colorspace}` R package vignette



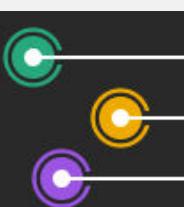
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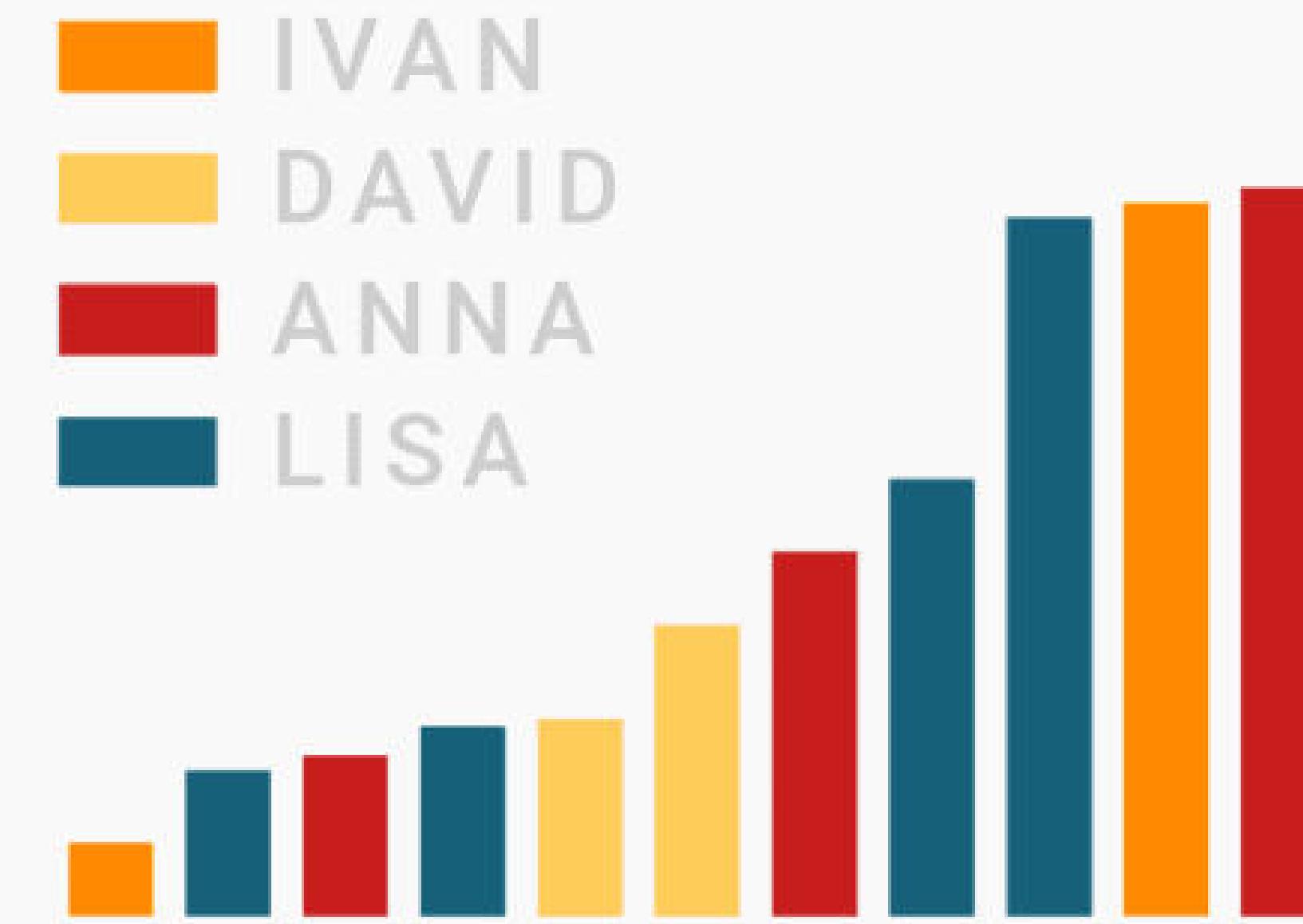
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z3tt



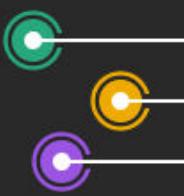
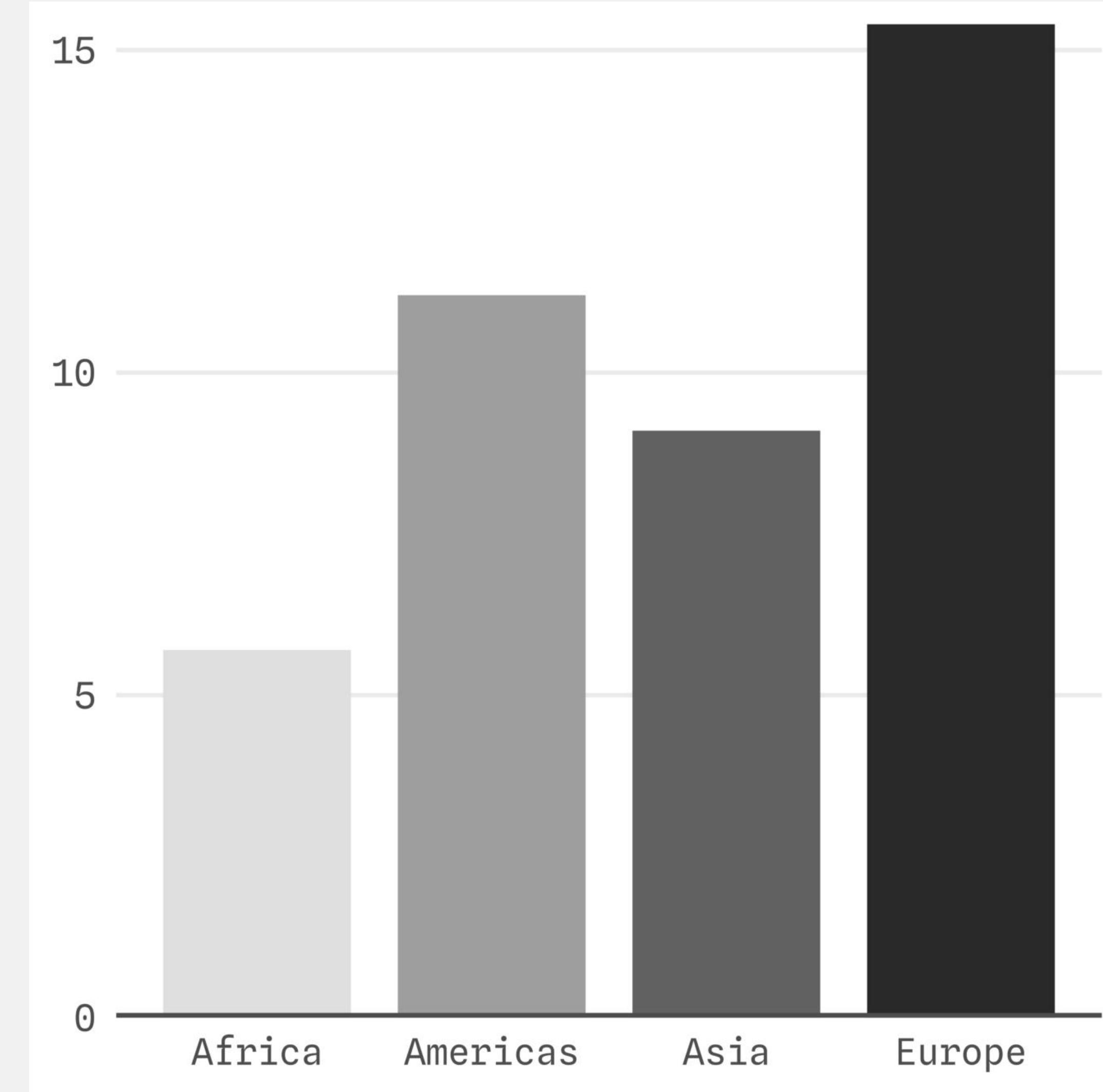
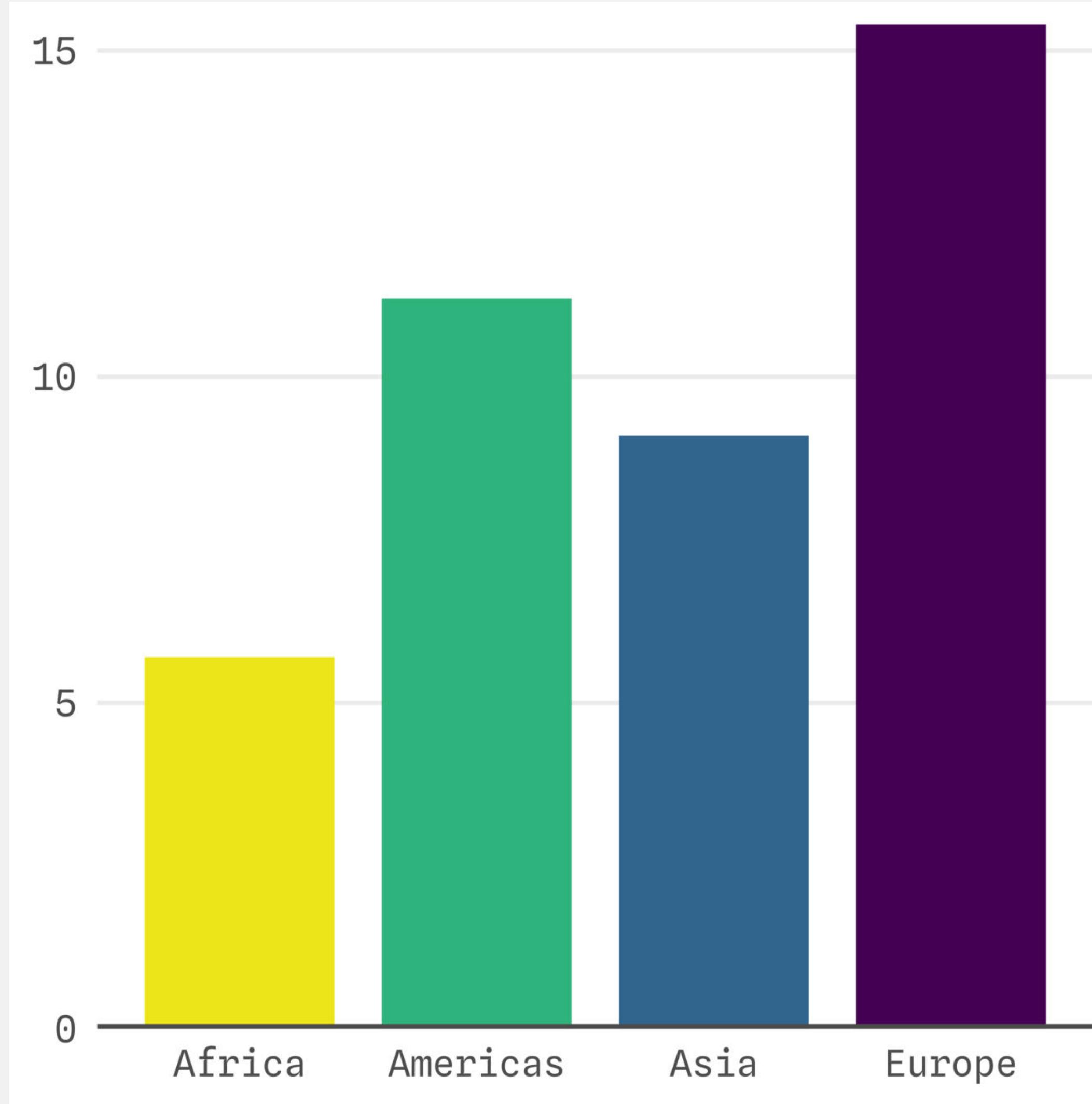
Sequential or Qualitative?



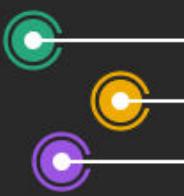
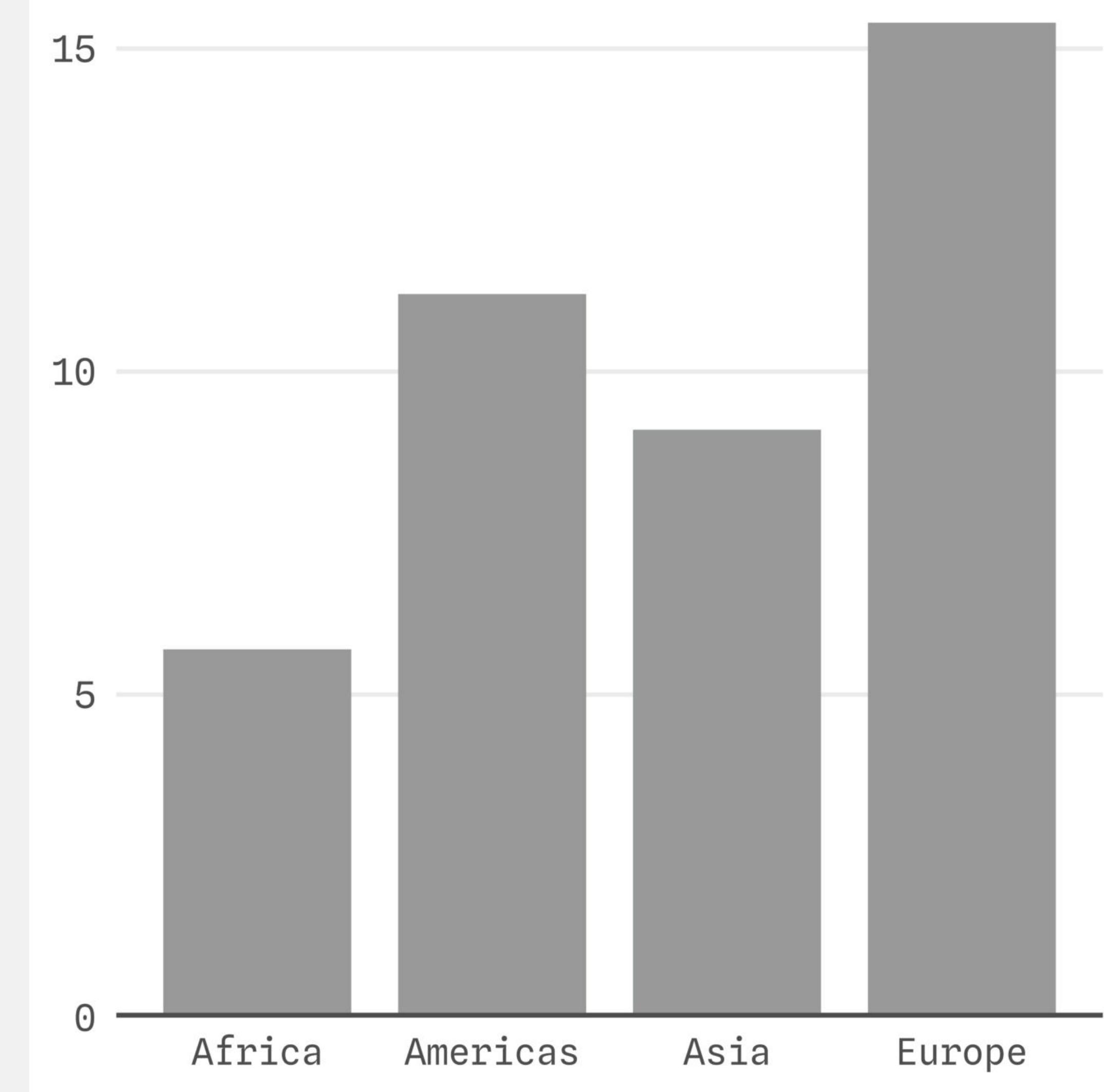
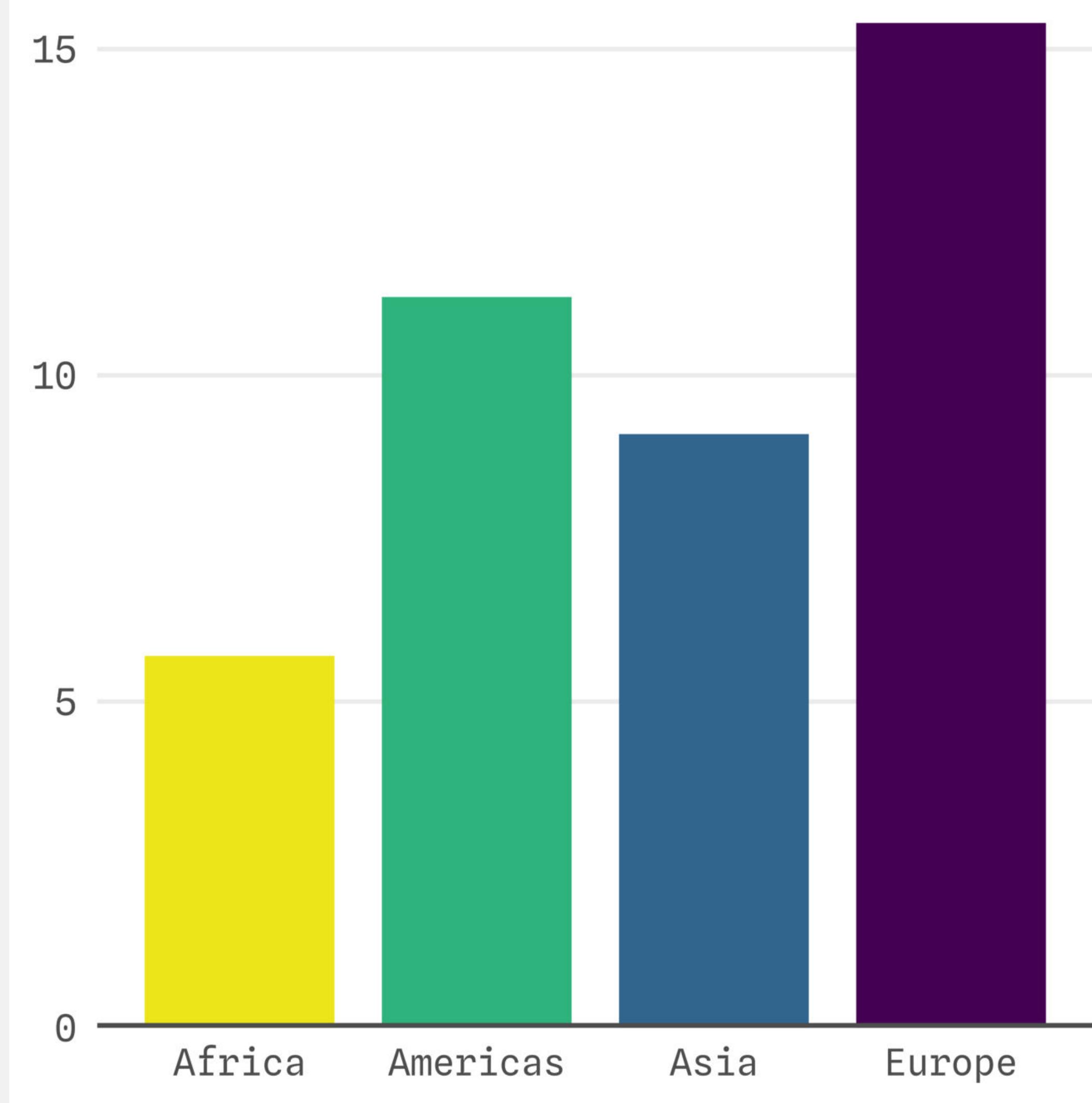
Source: “[When to use sequential and when to use diverging color scales](#)” by Lisa C. Muth / DataWrapper



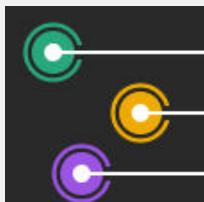
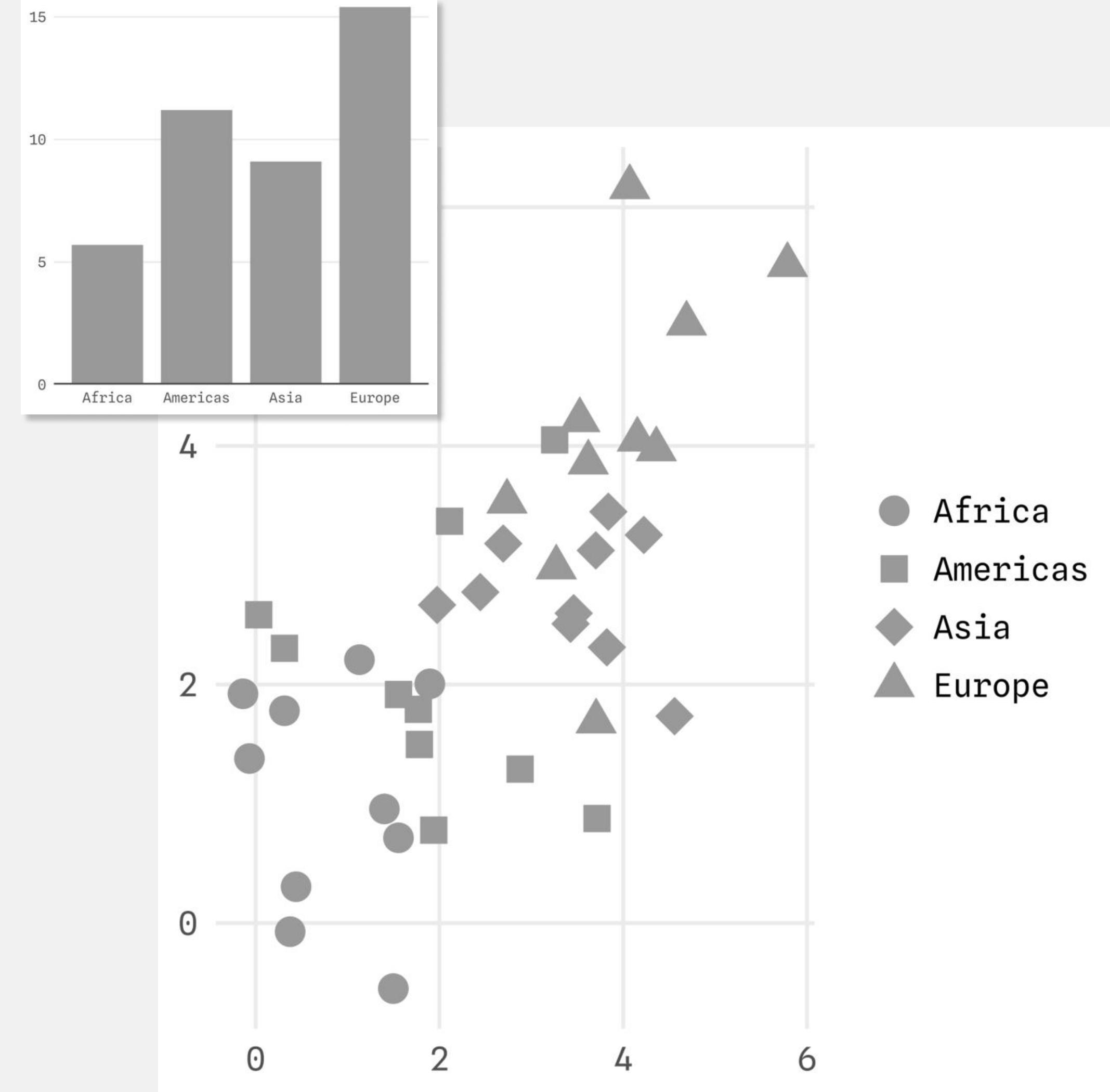
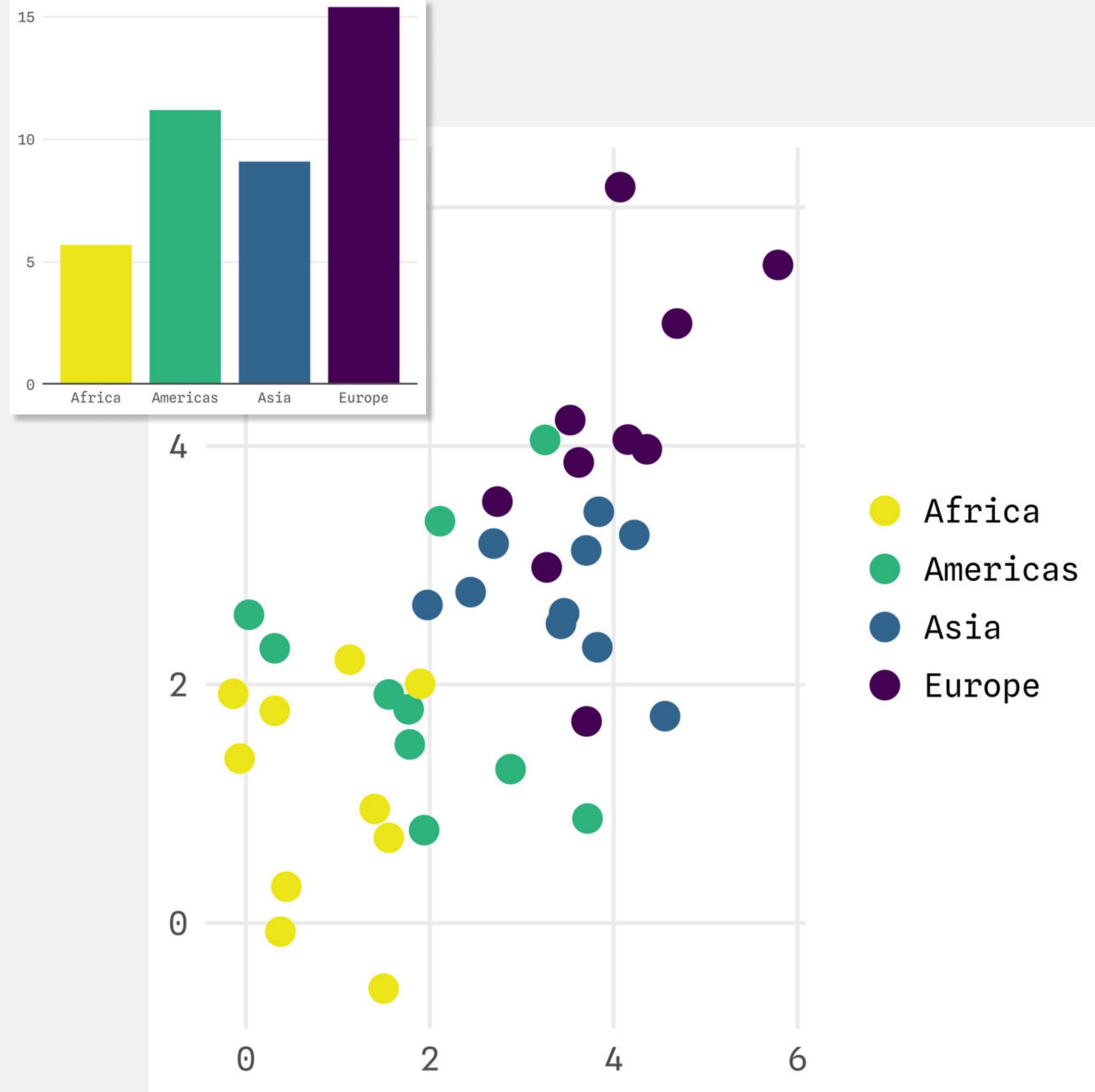
“Viridis is THE perfect color palette!”



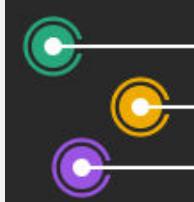
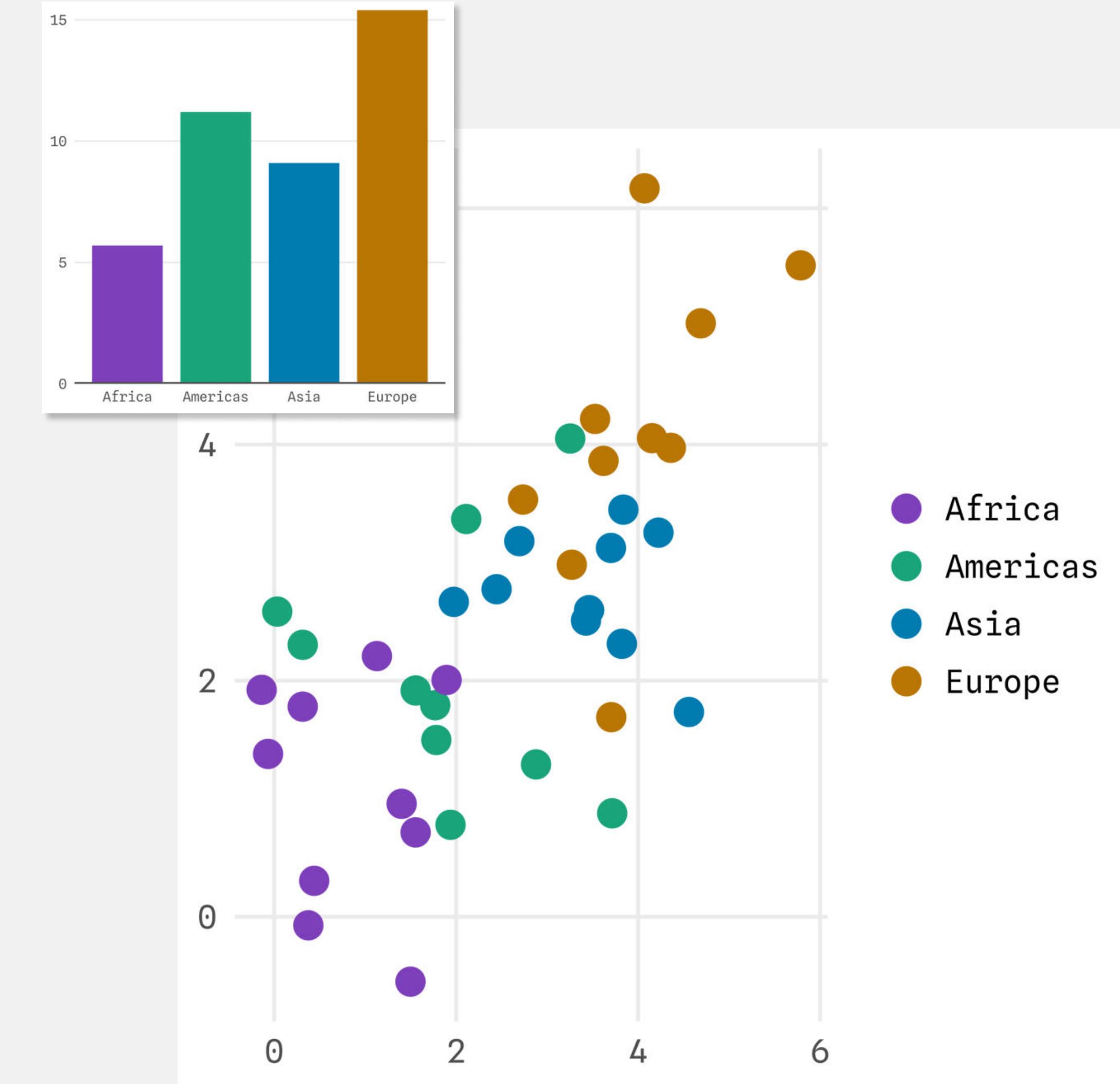
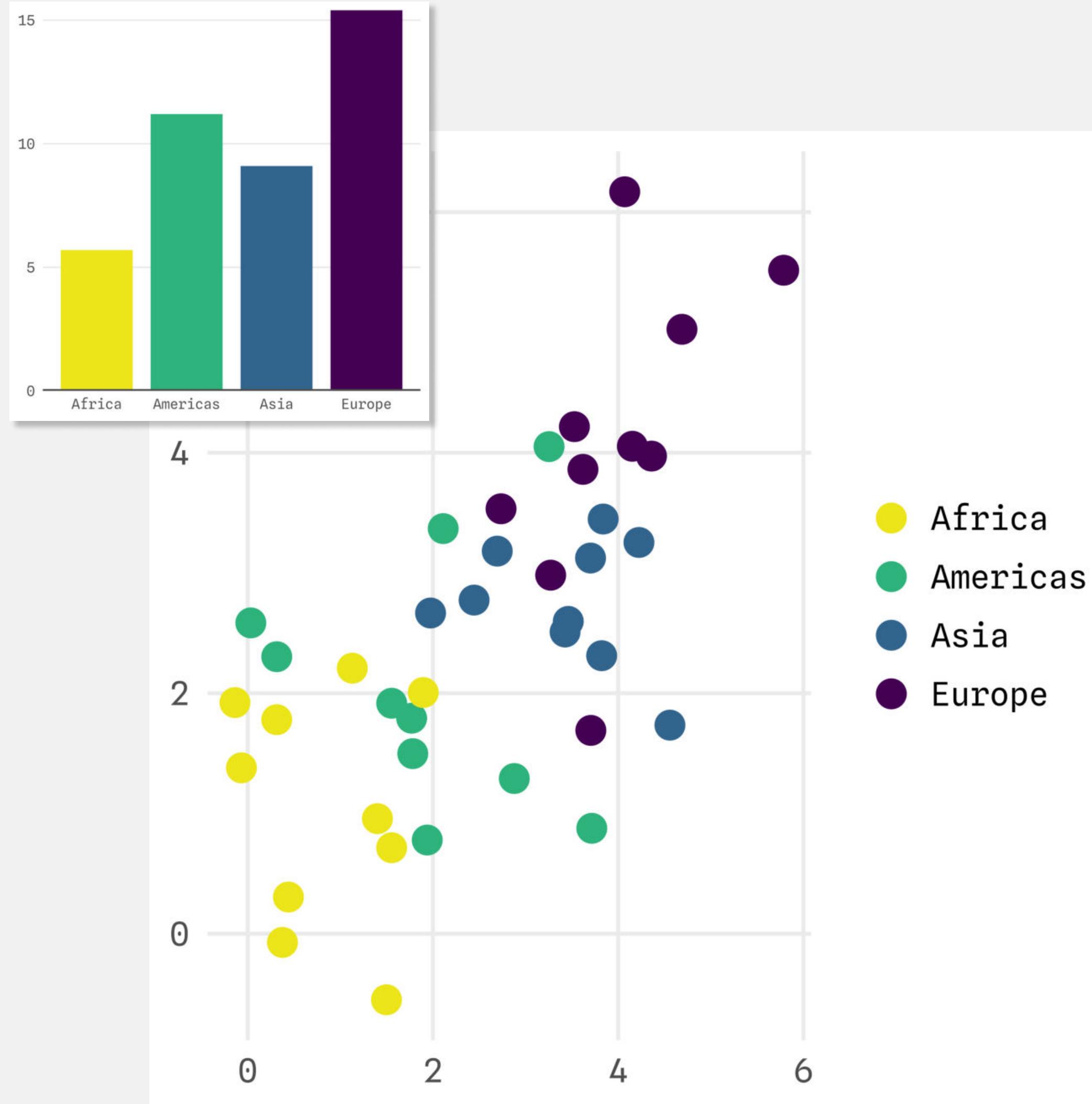
“Viridis is THE perfect color palette!”



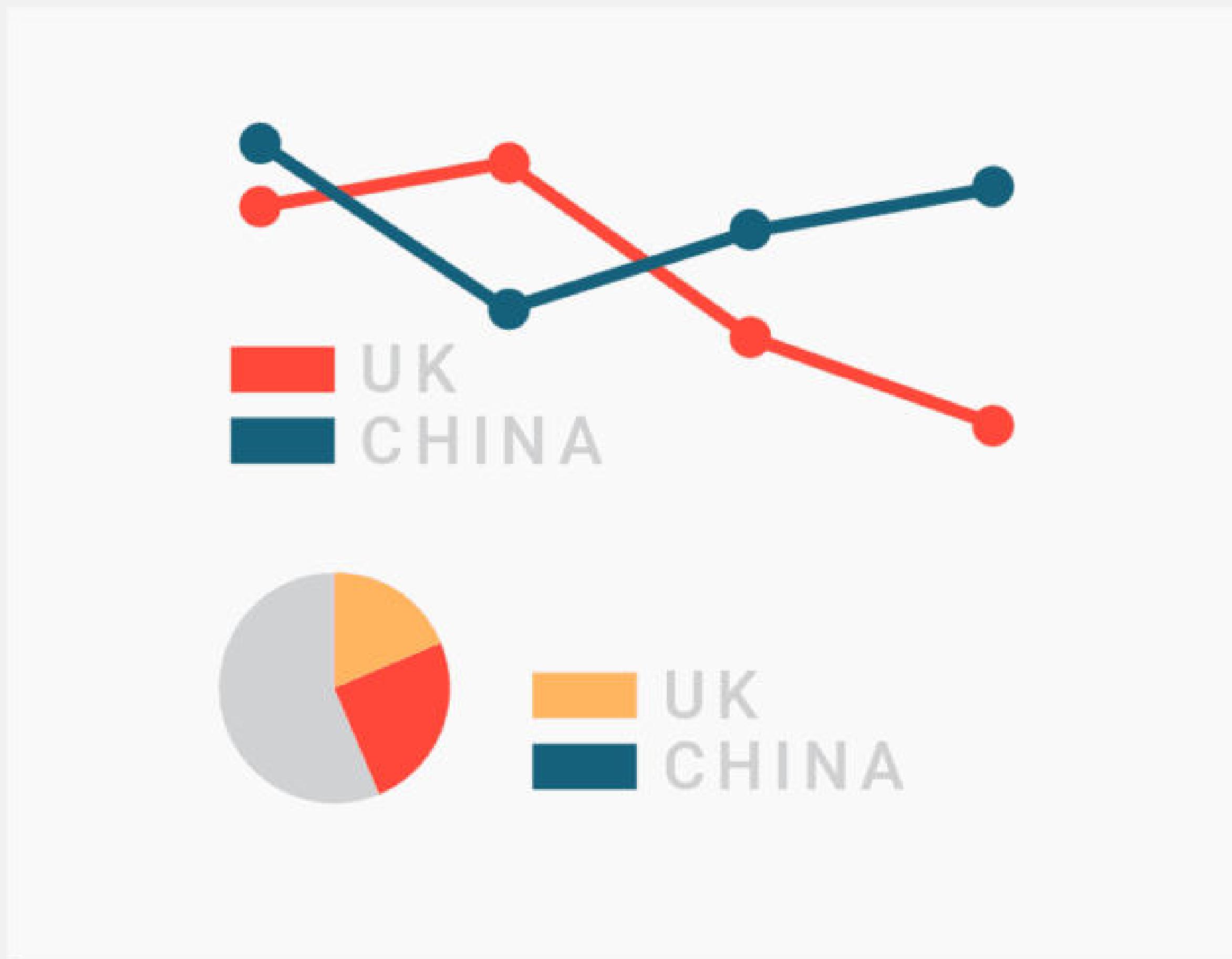
“Viridis is THE perfect color palette!”



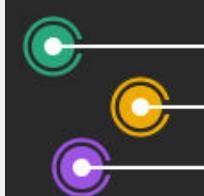
“Viridis is THE perfect color palette!”



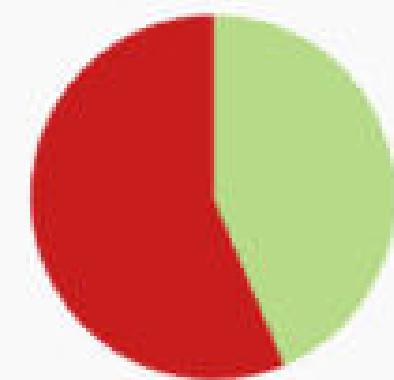
Use Colors Consistently



Source: “[When to use sequential and when to use diverging color scales](#)” by Lisa C. Muth / DataWrapper



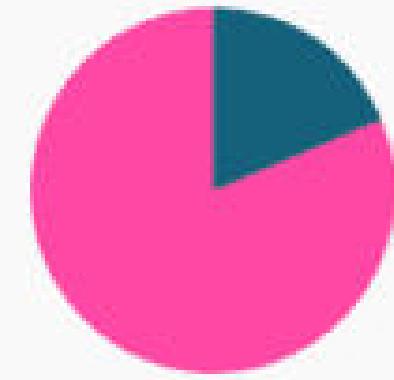
Use Intuitive Colors (?)



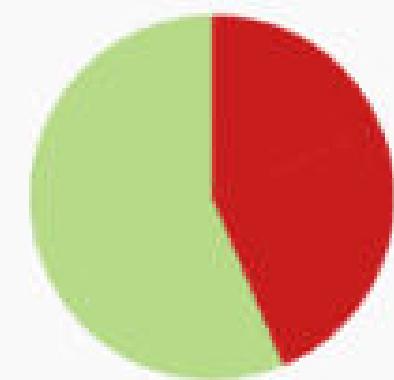
GOOD
BAD



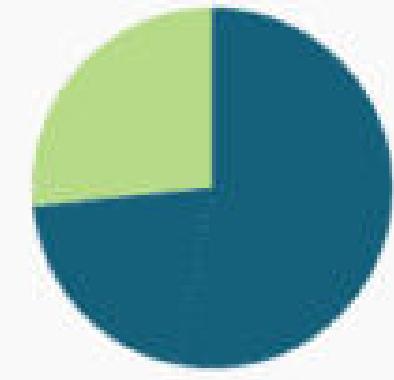
FOREST
LAKE



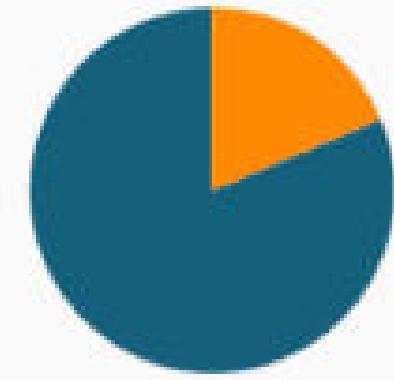
FEMALE
MALE



GOOD
BAD



FOREST
LAKE



FEMALE
MALE

Source: ["When to use sequential and when to use diverging color scales"](#) by Lisa C. Muth / DataWrapper



Ensure Readability for Color-Blind Persons

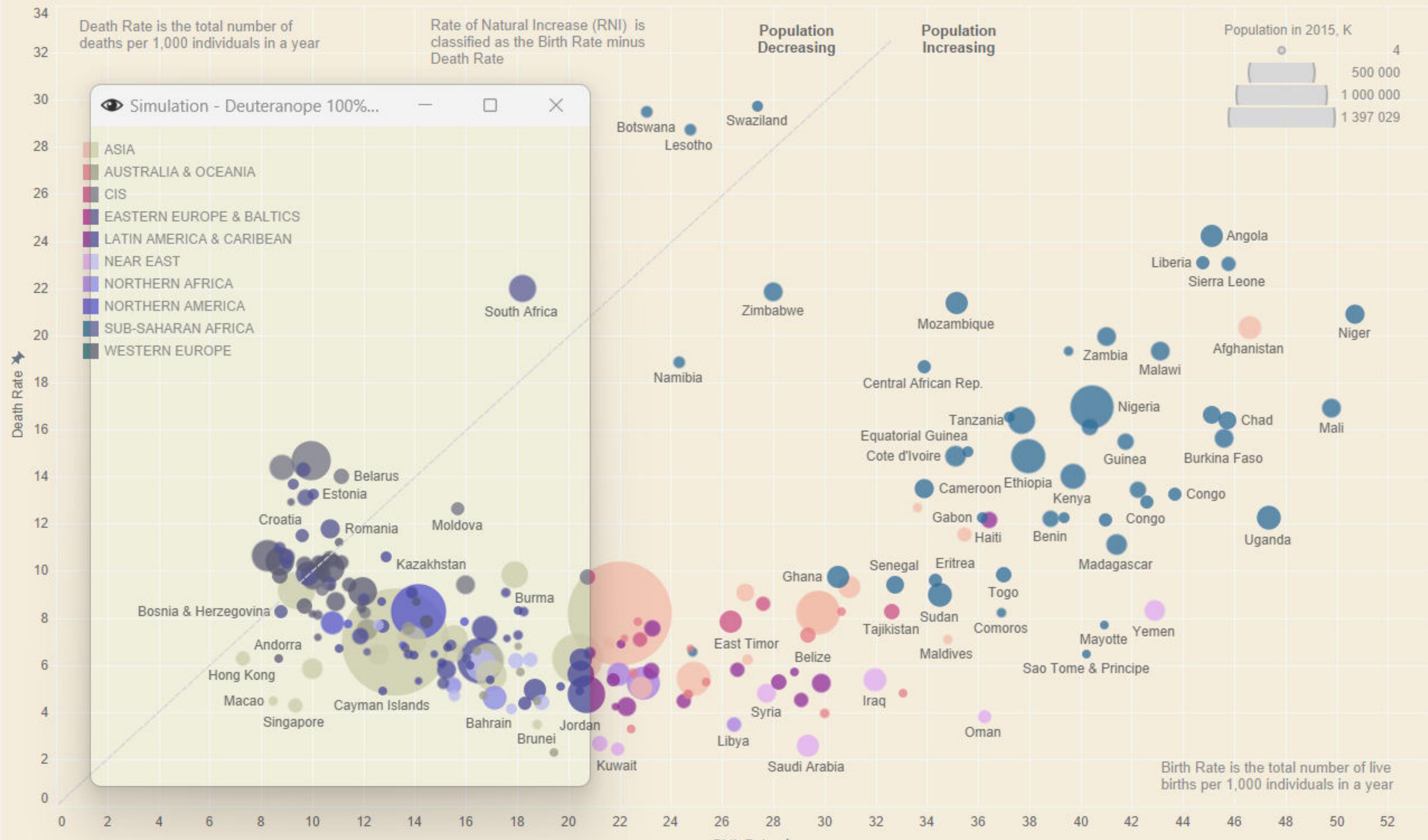


Source: [“Fundamentals of Data Visualization” by Claus O. Wilke](#)

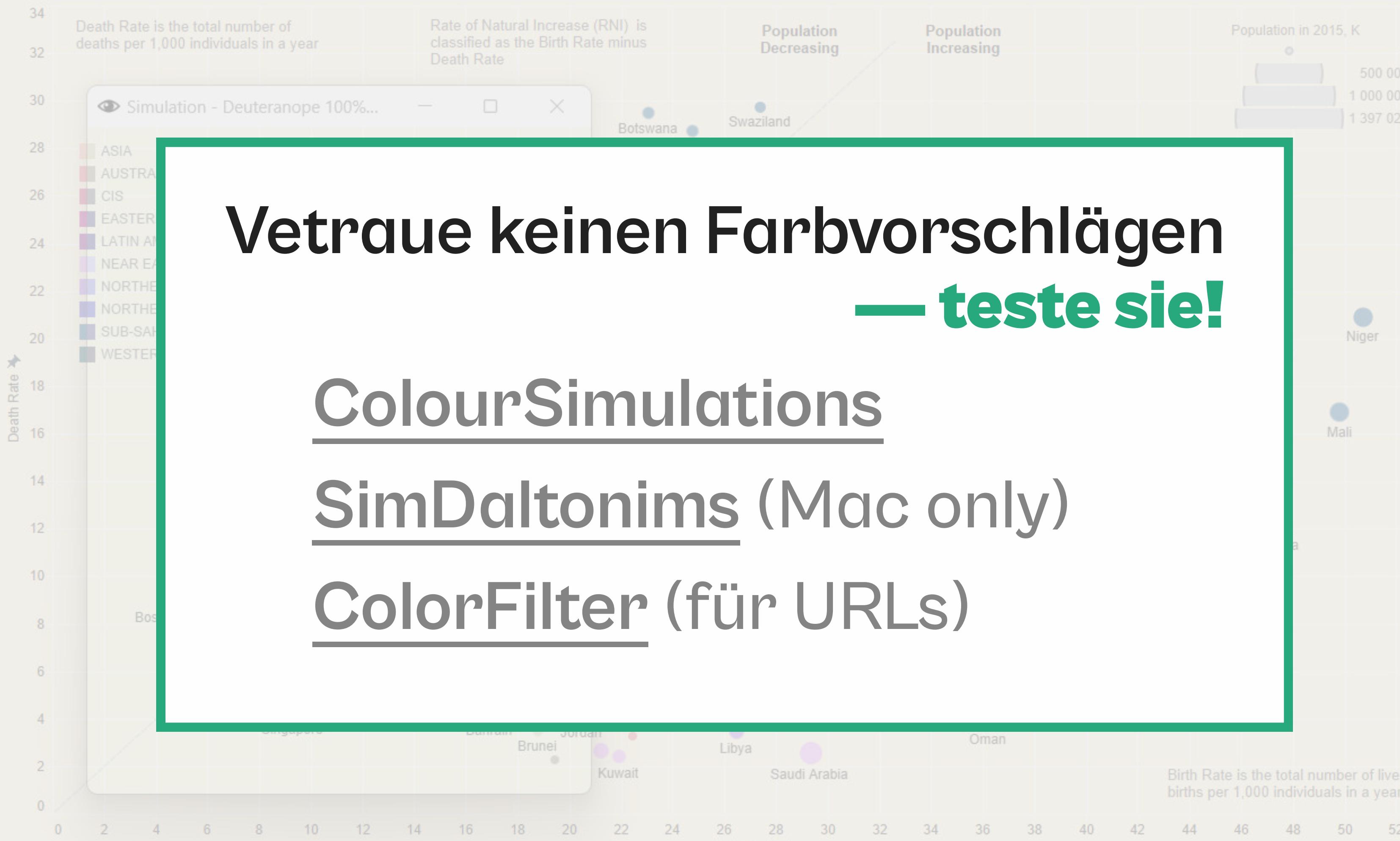


Natural Increase in the World

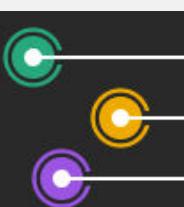
Birth / Death Ratio
0,6 □ 11,4 □ -6,42 □ 35,65 □ Natural Increase



Natural Increase in the World



Beitrag zur SWDchallenge von Alex Varlamoff — getested mit einem Farbblindheitssimulator

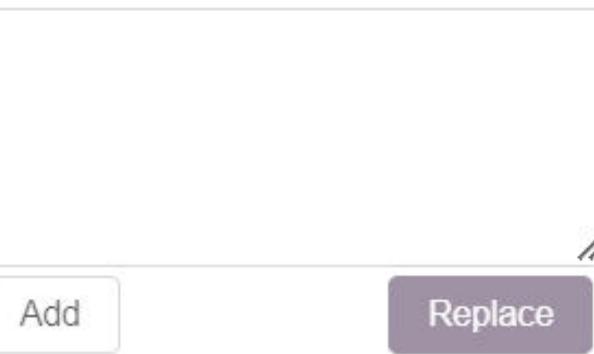


VIZ PALETTE

By: Elijah Meeks
& Susie Lu

PICK

Use Chroma.js



Add

Replace

Use Colorgorical

Use ColorBrewer

EDIT

≡ 1 ● #2a9571 ↗

x

≡ 2 ● #8fb9bf ↗

x

4 Colors

≡ 3 ● #dfb468 ↗

x

≡ 4 ● #4b8cd8 ↗

x

#hex rgb

hsl

GET

String quotes
 Object with metadata

```
[ "#2a9571",
  "#8fb9bf",
  "#dfb468",
  "#4b8cd8" ]
```

#hex rgb

hsl

Background color: #eeeeee ↗

Font color: #212121 ↗

Charts made with [Semiotic](#)

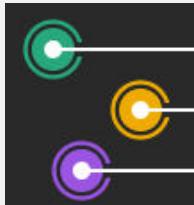
COLORS IN ACTION

Color Population:

No Color Deficiency - 96% Deuteranomaly - 2.7% Protanomaly - 0.66% Protanopia - 0.59% Deuteranopia - 0.56% Greyscale



[Viz Palette](#)

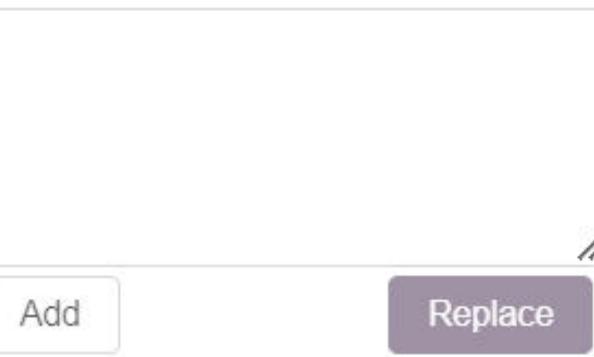


VIZ PALETTE

By: Elijah Meeks
& Susie Lu

PICK

Use Chroma.js



Add

Replace

Use Colorgorical

Use ColorBrewer

EDIT

≡ 1 ● #2a9571 ↲

x

≡ 2 ● #8fb9bf ↲

x

4 Colors

≡ 3 ● #dfb468 ↲

x

≡ 4 ● #4b8cd8 ↲

x

#hex rgb

hsl

GET

String quotes
 Object with metadata

```
[ "#2a9571",
  "#8fb9bf",
  "#dfb468",
  "#4b8cd8" ]
```

#hex rgb

hsl

Background color: #eeeeee ↲

Font color: #212121 ↲

Charts made with [Semiotic](#)

COLORS IN ACTION

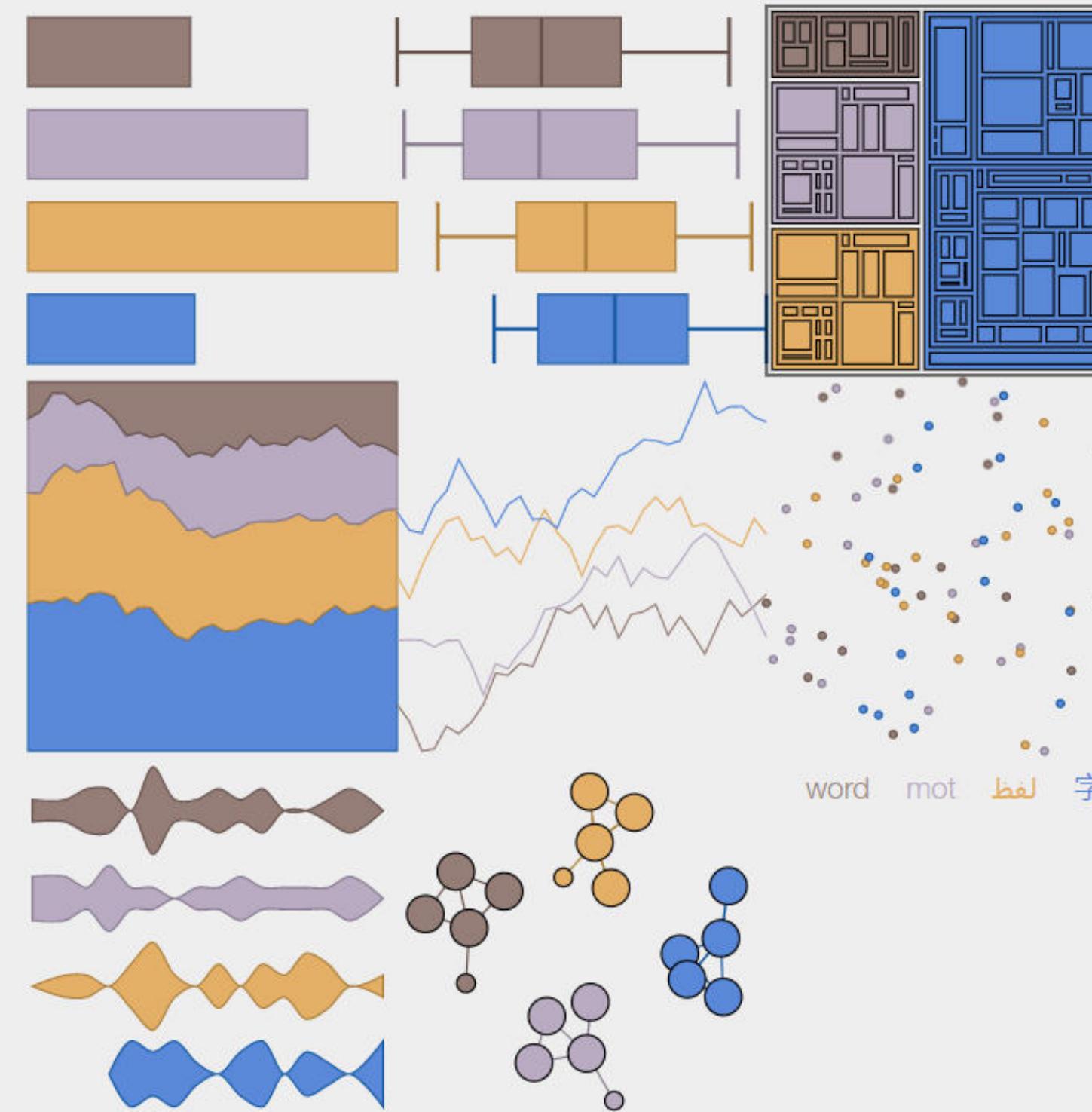
Color Population:

No Color Deficiency - 96% Deuteranomaly - 2.7% Protanomaly - 0.66% Protanopia - 0.59% Deuteranopia - 0.56% Greyscale

Sample font

Randomize Data

Stroke: Dark None



[Viz Palette](#)

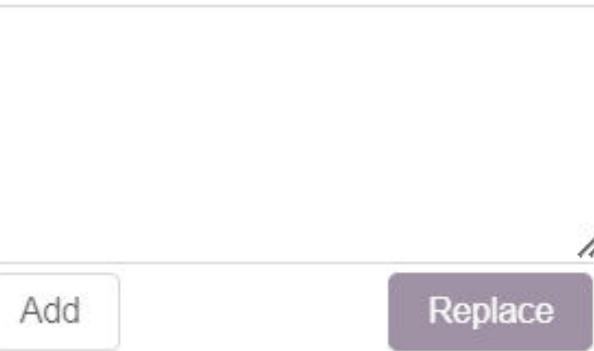


VIZ PALETTE

By: Elijah Meeks
& Susie Lu

PICK

Use Chroma.js



Add

Replace

Use Colorgorical

Use ColorBrewer

EDIT

≡ 1 ● #2a9571 ↗

×

≡ 2 ● #8fb9bf ↗

×

4 Colors

≡ 3 ● #dfb468 ↗

×

≡ 4 ● #4b8cd8 ↗

×

Add

● #hex ○ rgb

○ hsl

GET

String quotes
 Object with metadata

["#2a9571",
 "#8fb9bf",
 "#dfb468",
 "#4b8cd8"]

● #hex ○ rgb

○ hsl

COLORS IN ACTION

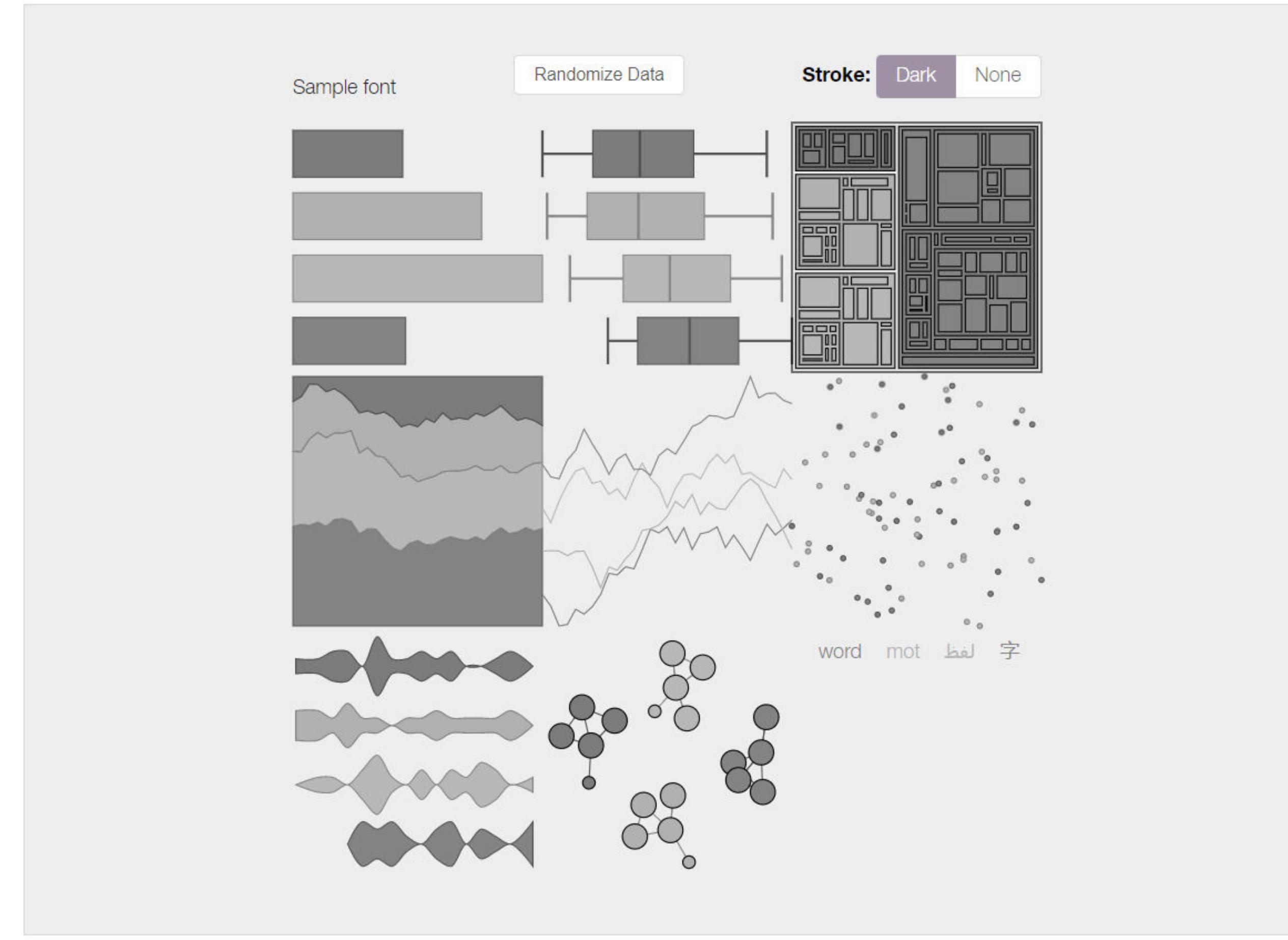
Background color: ● #eeeeee ↗

Font color: ● #212121 ↗

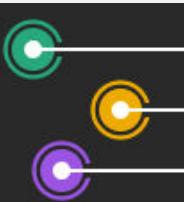
Charts made with [Semiotic](#)

Color Population:

No Color Deficiency - 96% Deuteranomaly - 2.7% Protanomaly - 0.66% Protanopia - 0.59% Deuteranopia - 0.56% Greyscale



[Viz Palette](#)

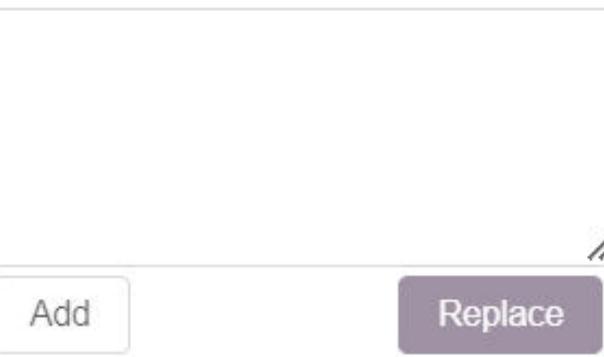


VIZ PALETTE

By: Elijah Meeks
& Susie Lu

PICK

Use Chroma.js



Use Colorgorical

Use ColorBrewer

EDIT

- ≡ 1 ● #2a9571 [🔗](#) ×
- ≡ 2 ● #8fb9bf [🔗](#) ×
- 4 Colors ≡ 3 ● #dfb468 [🔗](#) ×
- ≡ 4 ● #4b8cd8 [🔗](#) ×

hex rgb

hsl

GET

hex rgb

hsl

String quotes

Object with metadata

```
[ "#2a9571",
  "#8fb9bf",
  "#dfb468",
  "#4b8cd8" ]
```

COLORS IN ACTION

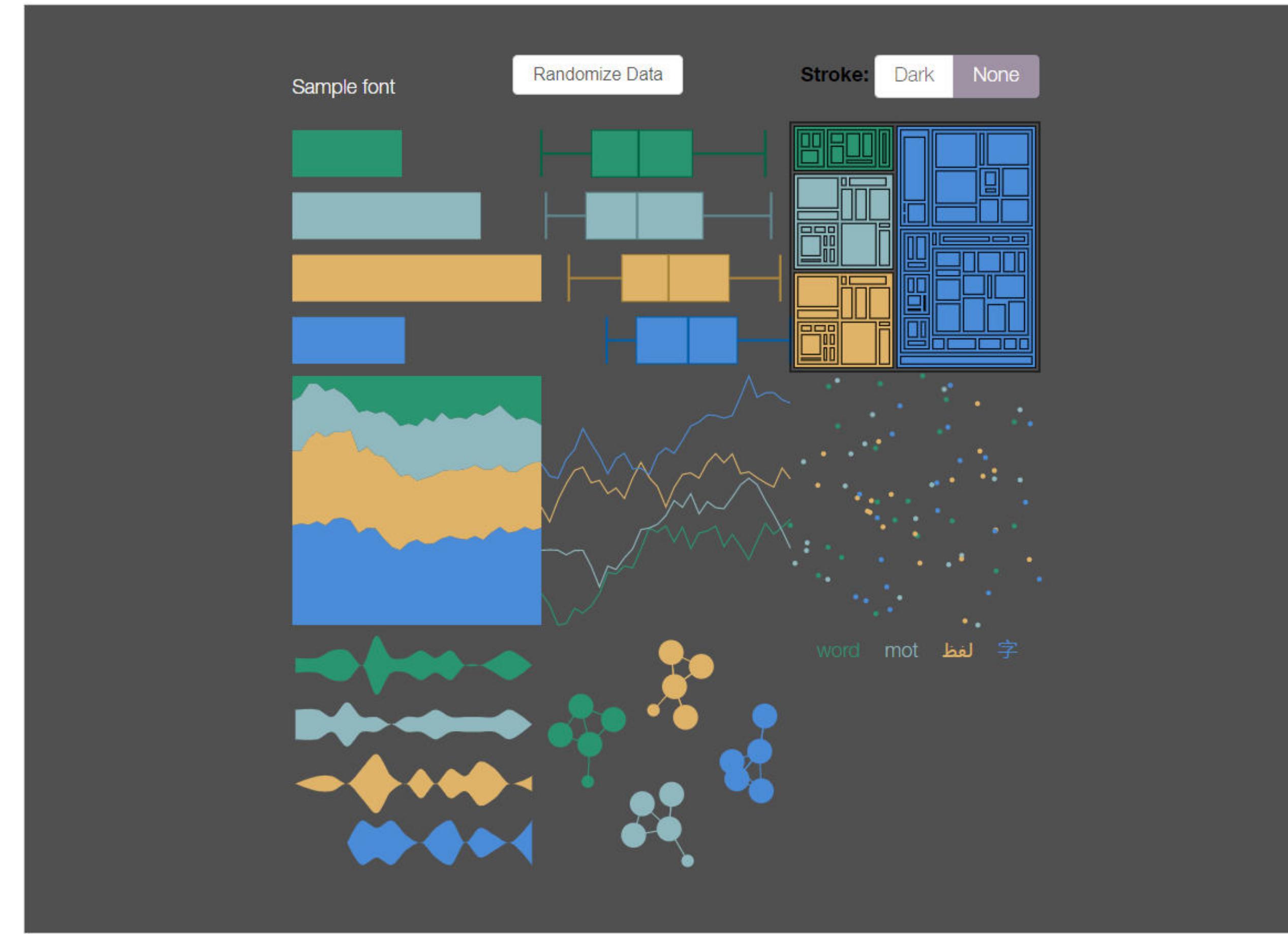
Background color: ● #505050 [🔗](#)

Font color: #fefefe [🔗](#)

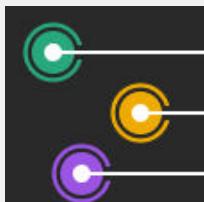
Charts made with [Semiotic](#)

Color Population:

No Color Deficiency - 96% Deuteranomaly - 2.7% Protanomaly - 0.66% Protanopia - 0.59% Deuteranopia - 0.56% Greyscale



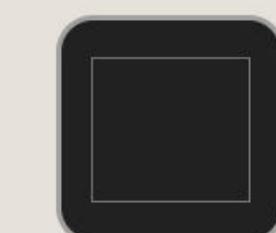
Viz Palette



APCA Contrast Calculator

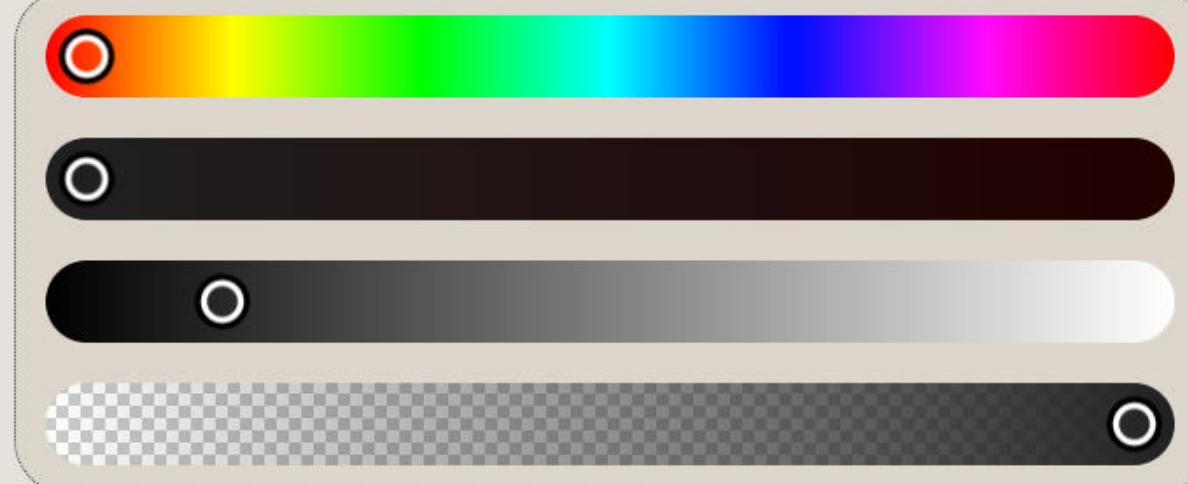
MYNDEX
RESEARCH

TEXT / ICON COLOR



#212121 · rgb(33, 33, 33)

212121



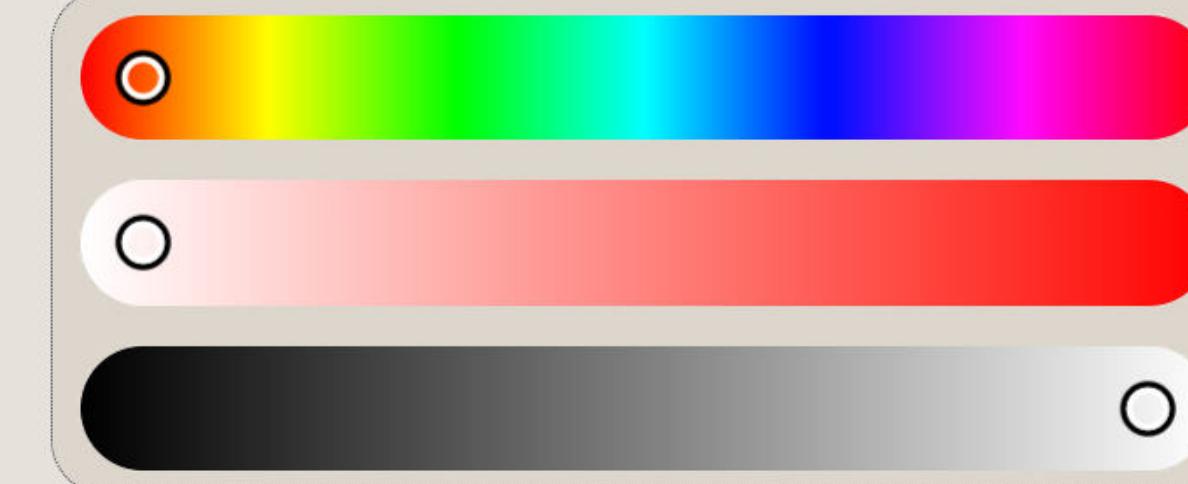
CONTRAST
Lc 103.1

BACKGROUND COLOR



ffffff · rgb(255, 255, 255)

ffffff



All font sizes are in CSS px • Reference font shown with colors at actual size & weight

USAGE	200	300 (Light)	400 (Normal)	500	600	700 (Bold)
SMALL BODY TEXT ONLY	26px The lazy afternoon frolicked	18.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	15px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	14.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	13.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	12.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was

The [Myndex APCA Contrast Calculator](#) displays modern contrast ratios for various combinations of text size and font weight



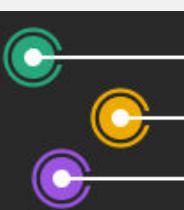
cedricscherer.com



@CedScherer



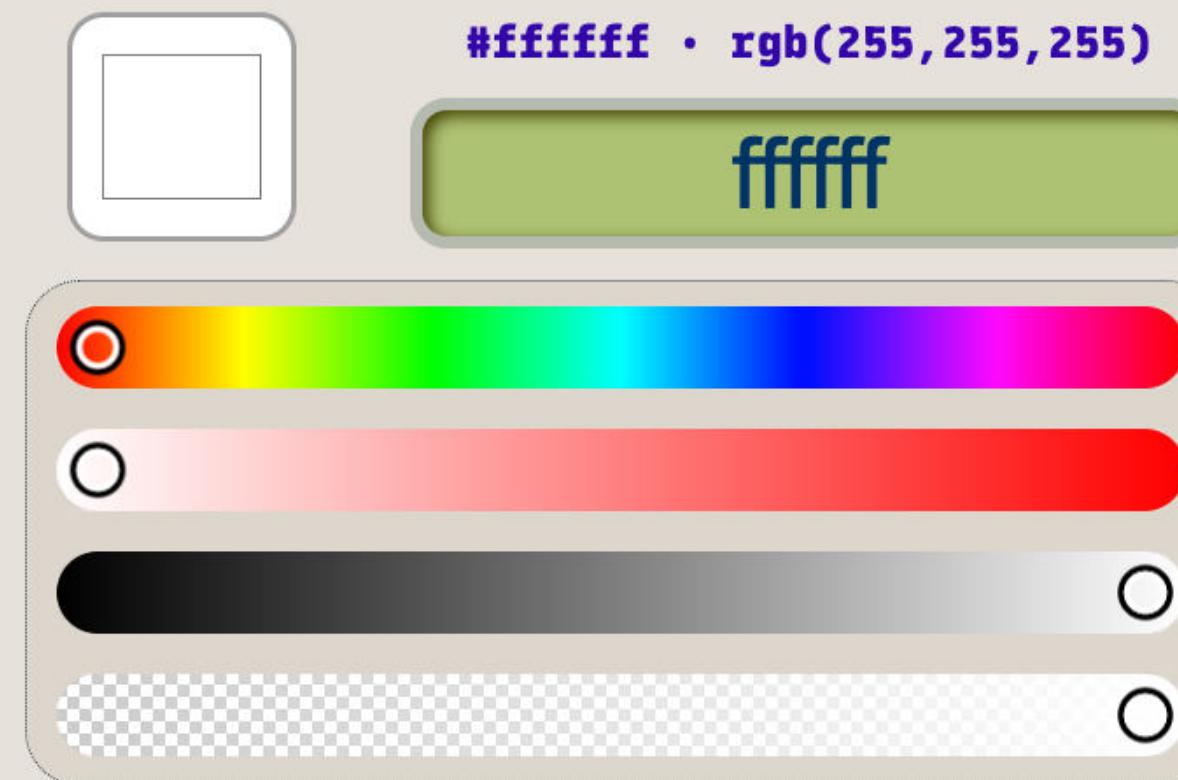
z3tt



APCA Contrast Calculator

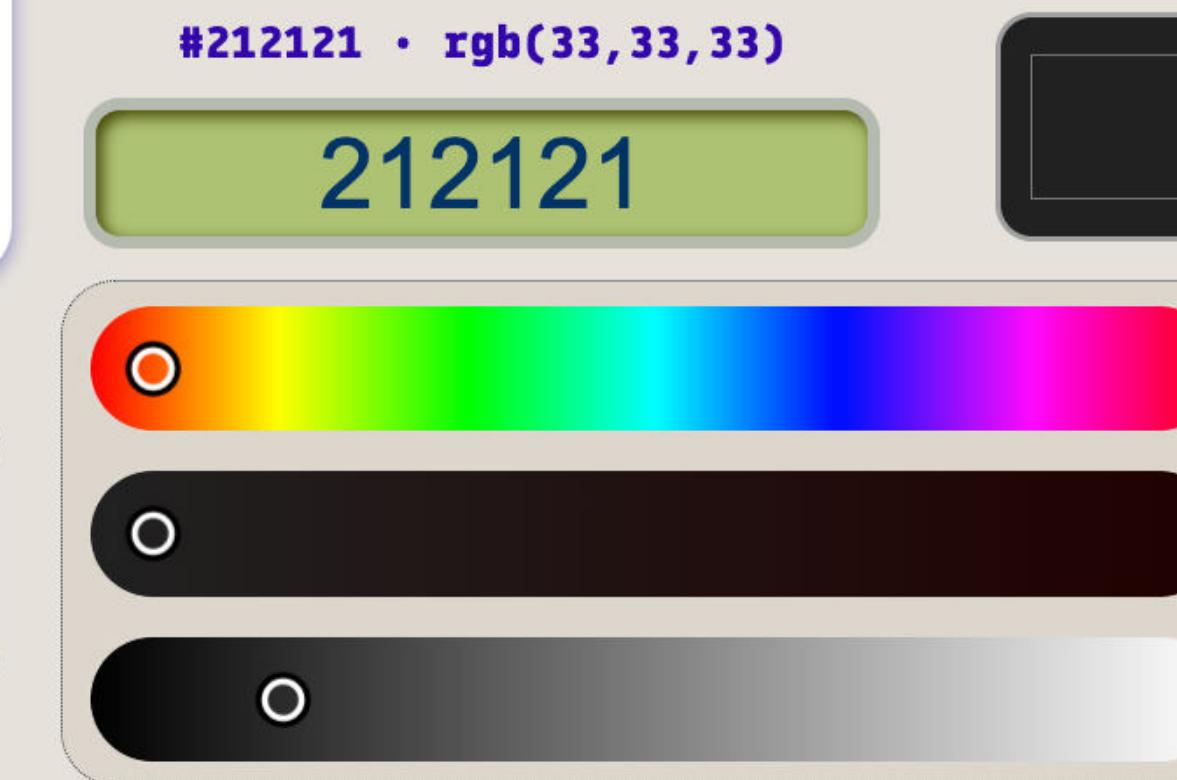
MYNDEX
RESEARCH

TEXT / ICON COLOR



CONTRAST
Lc -105.6

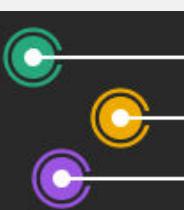
BACKGROUND COLOR



All font sizes are in CSS px • Reference font shown with colors at actual size & weight

USAGE	200	300 (Light)	400 (Normal)	500	600	700 (Bold)
SMALL BODY TEXT ONLY	25px The lazy afternoon fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	18px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	14.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	14px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	13px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was	12px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the world. The fox saw the slumbering dog and tried to wake him, but the dog was

The [Myndex APCA Contrast Calculator](#) displays modern contrast ratios for various combinations of text size and font weight



APCA Contrast Calculator

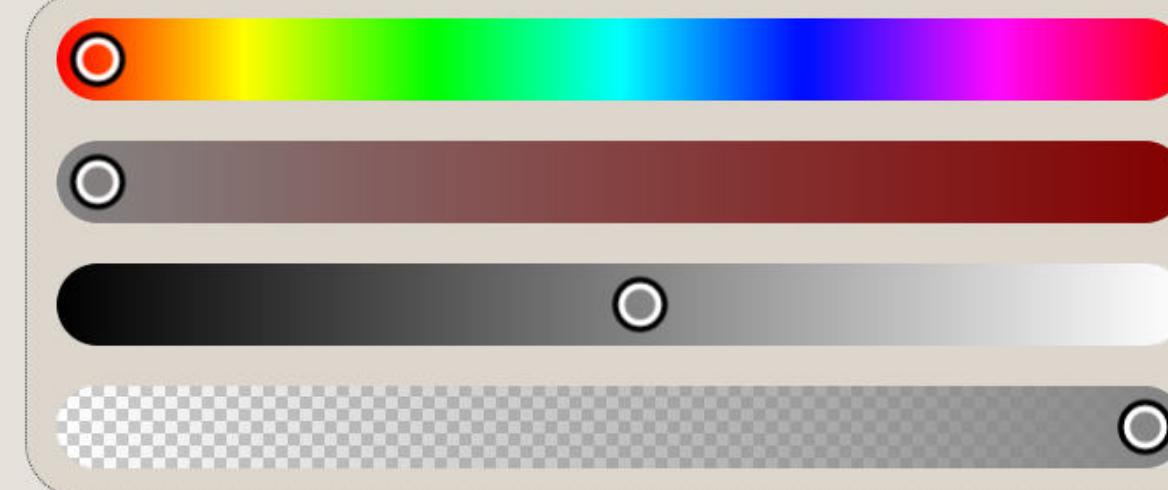
MYNDEX
RESEARCH

TEXT / ICON COLOR



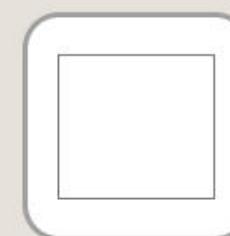
#848484 · rgb(132,132,132)

848484



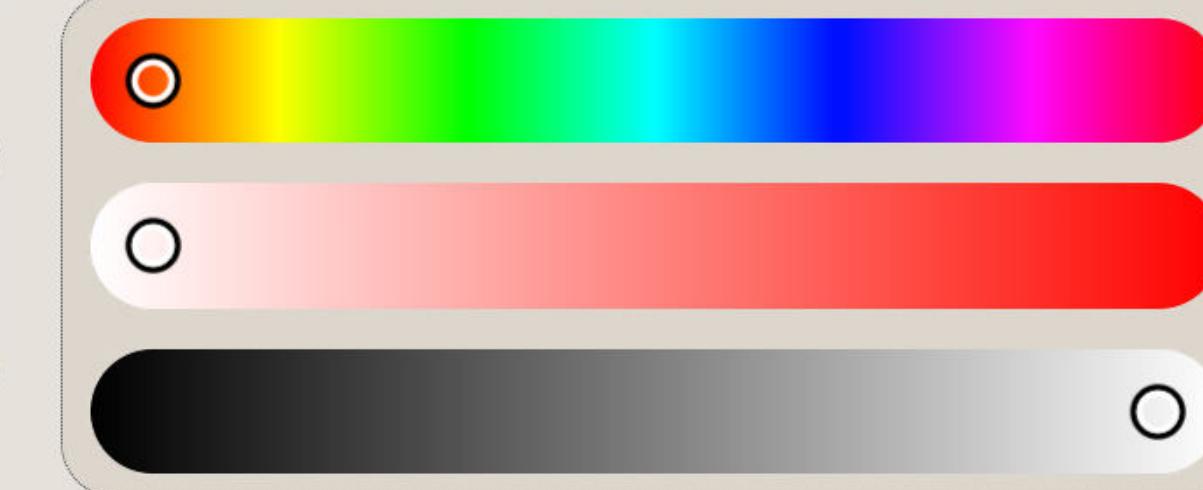
CONTRAST
Lc 65.0

BACKGROUND COLOR



fffffff · rgb(255,255,255)

fffffff



All font sizes are in CSS px • Reference font shown with colors at actual size & weight

USAGE	200	300 (Light)	400 (Normal)	500	600	700 (Bold)
FLUENT TEXT OKAY	46px Sam	32px The lazy grey dog frolicked freely in the afternoon sun without a care in the fox saw the slumbering.	22px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the fox saw the slumbering.	19.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the fox saw the slumbering.	17.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the fox saw the slumbering.	15.5px The lazy grey dog slept in the afternoon sun, but the frisky fox frolicked freely in the field of flowers without a care in the fox saw the slumbering.

The [Myndex APCA Contrast Calculator](#) displays modern contrast ratios for various combinations of text size and font weight



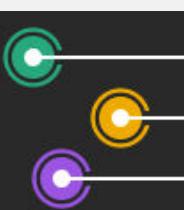
cedricscherer.com

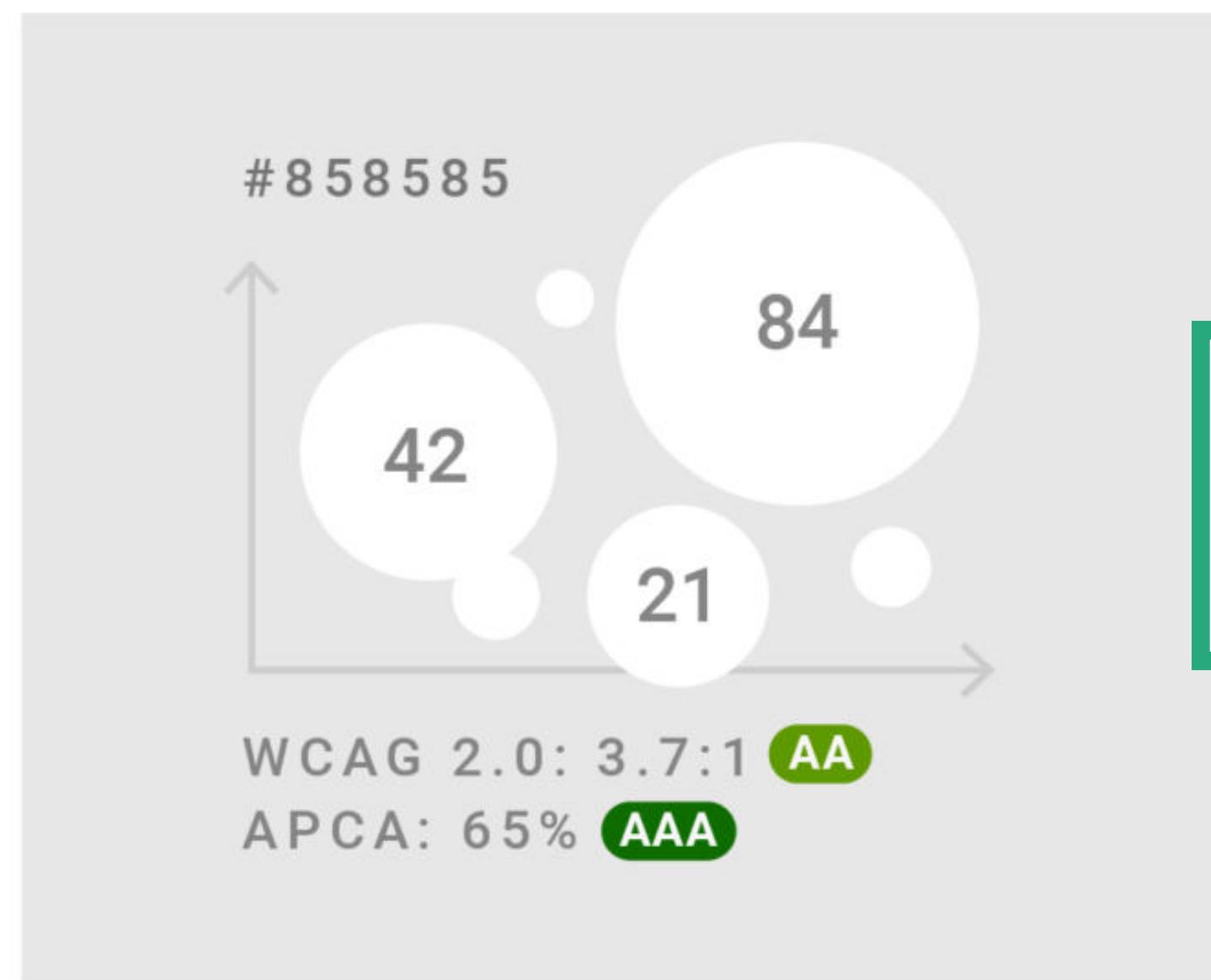
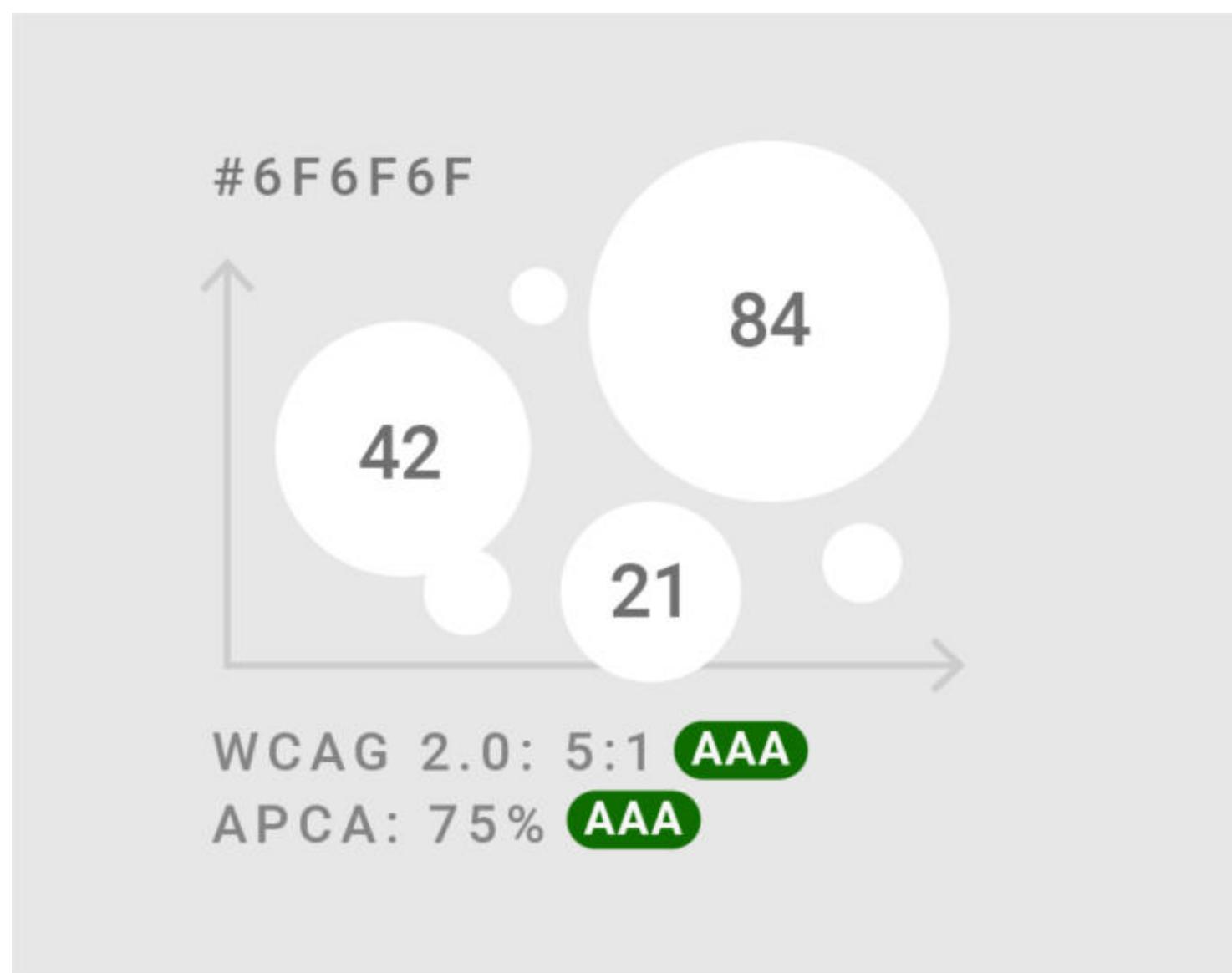


@CedScherer

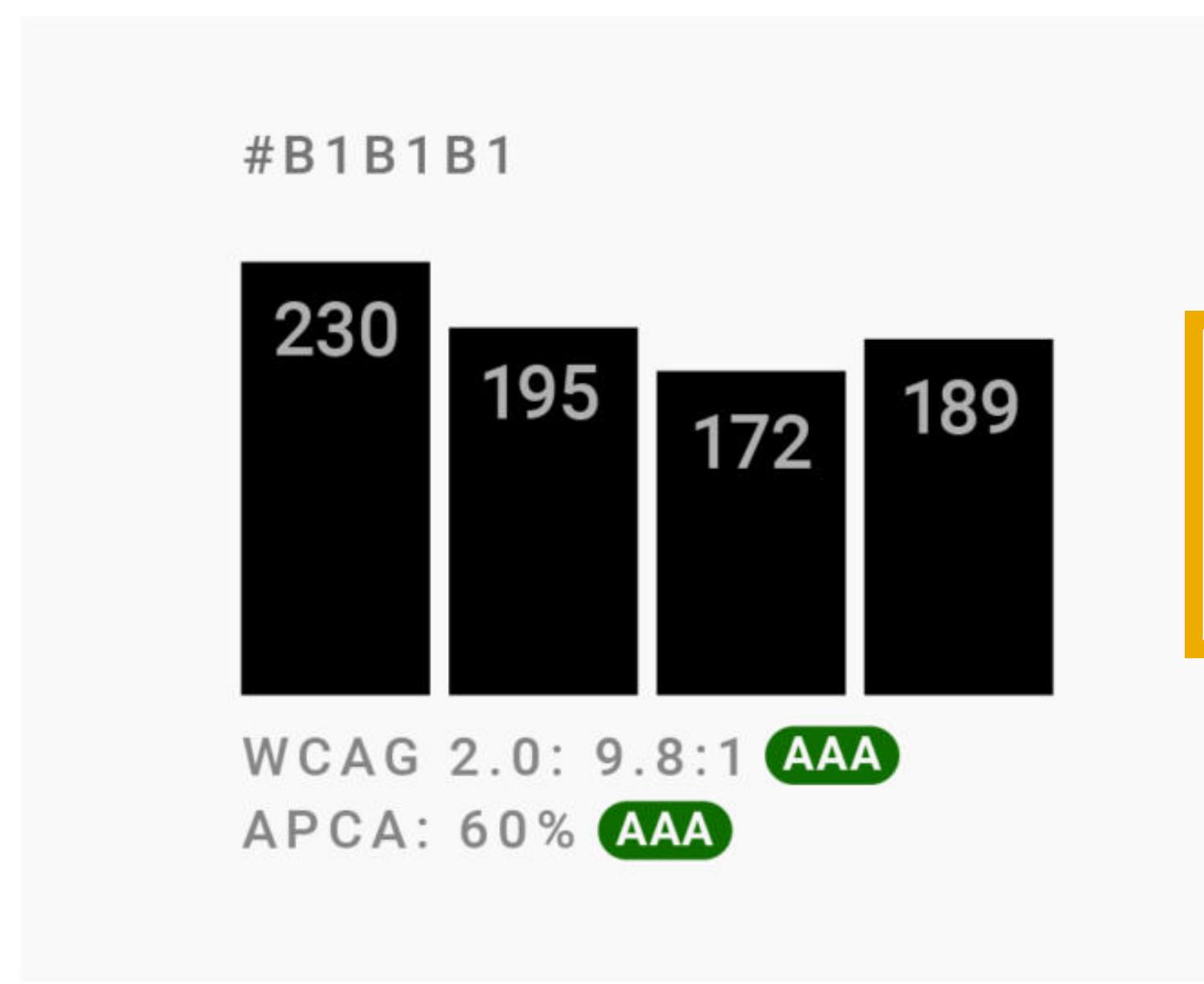
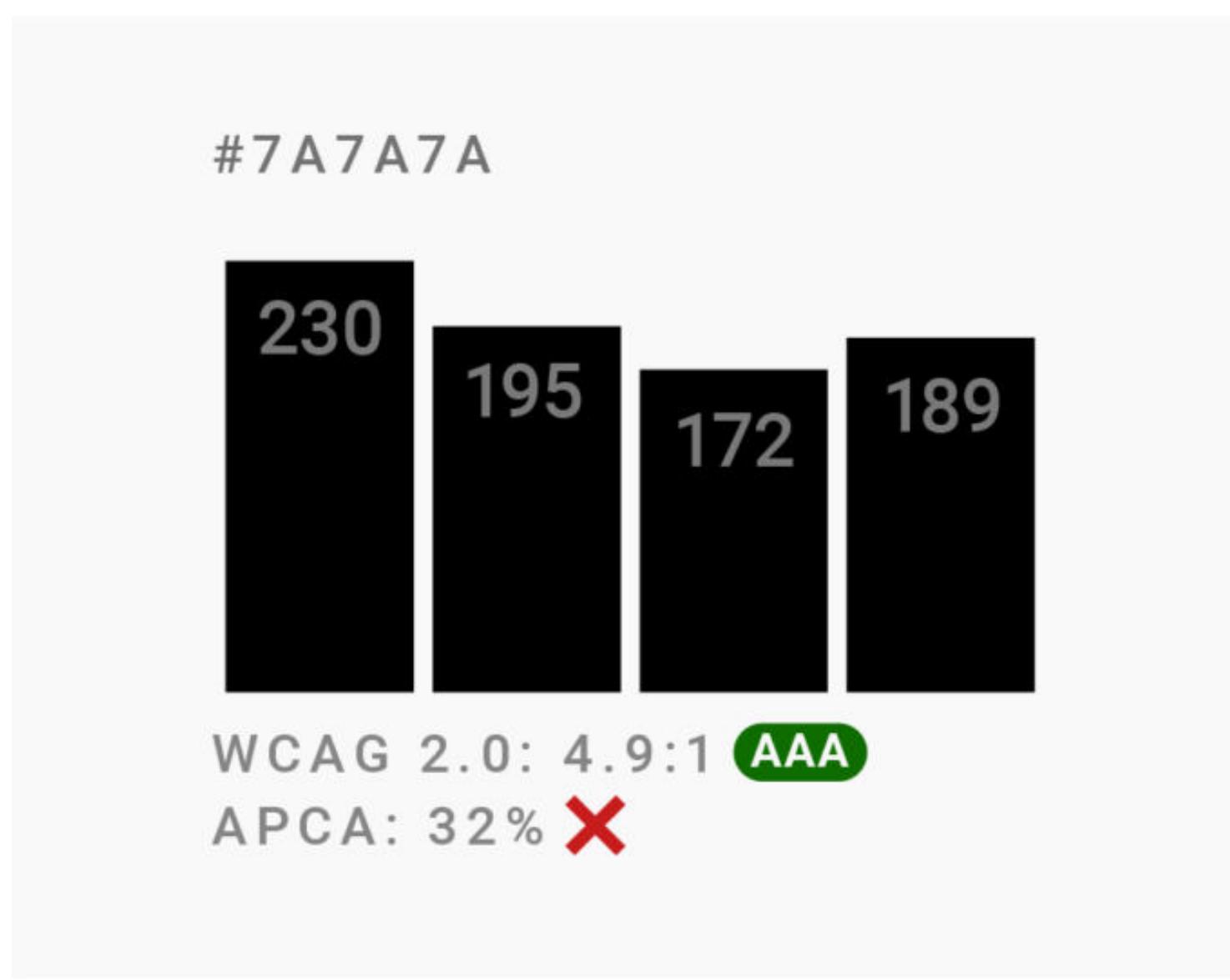


z3tt





APCA allows for lighter gray on light backgrounds...



... but also requests lighter gray on dark backgrounds

“It’s time for a more sophisticated color contrast check for data visualizations” by Lisa C. Muth / DataWrapper



APCA Contrast Calculator

MYNDEX
RESEARCH

TEXT / ICON COLOR



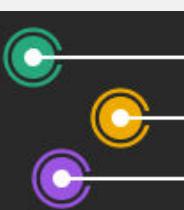
BACKGROUND COLOR



All font sizes are in CSS px • Reference font shown with colors at actual size & weight

USAGE	200	300 (Light)	400 (Normal)	500	600	700 (Bold)
LARGE & SUB-FLUENT TEXT	82	65px Sampl	36px The lazy grey afternoon su	30px The laz	26px The lazy afternoon	22.5px The lazy grey dog si afternoon sun, but t frolicked freely in th

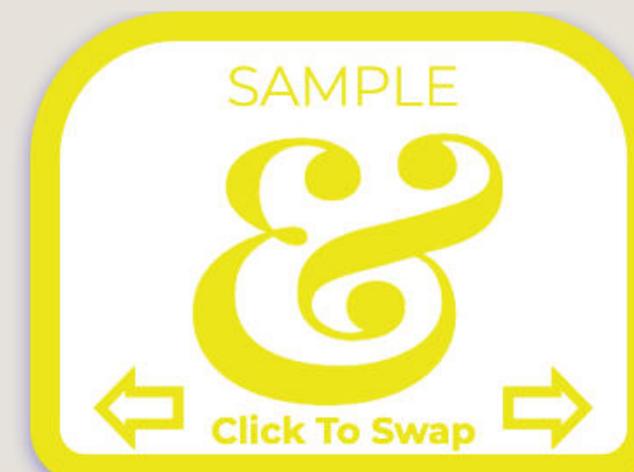
The [Myndex APCA Contrast Calculator](#) displays modern contrast ratios for various combinations of text size and font weight



APCA Contrast Calculator

MYNDEX
RESEARCH

TEXT / ICON COLOR



CONTRAST
Lc 16.2

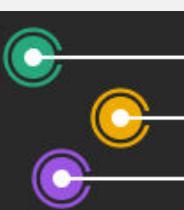
BACKGROUND COLOR

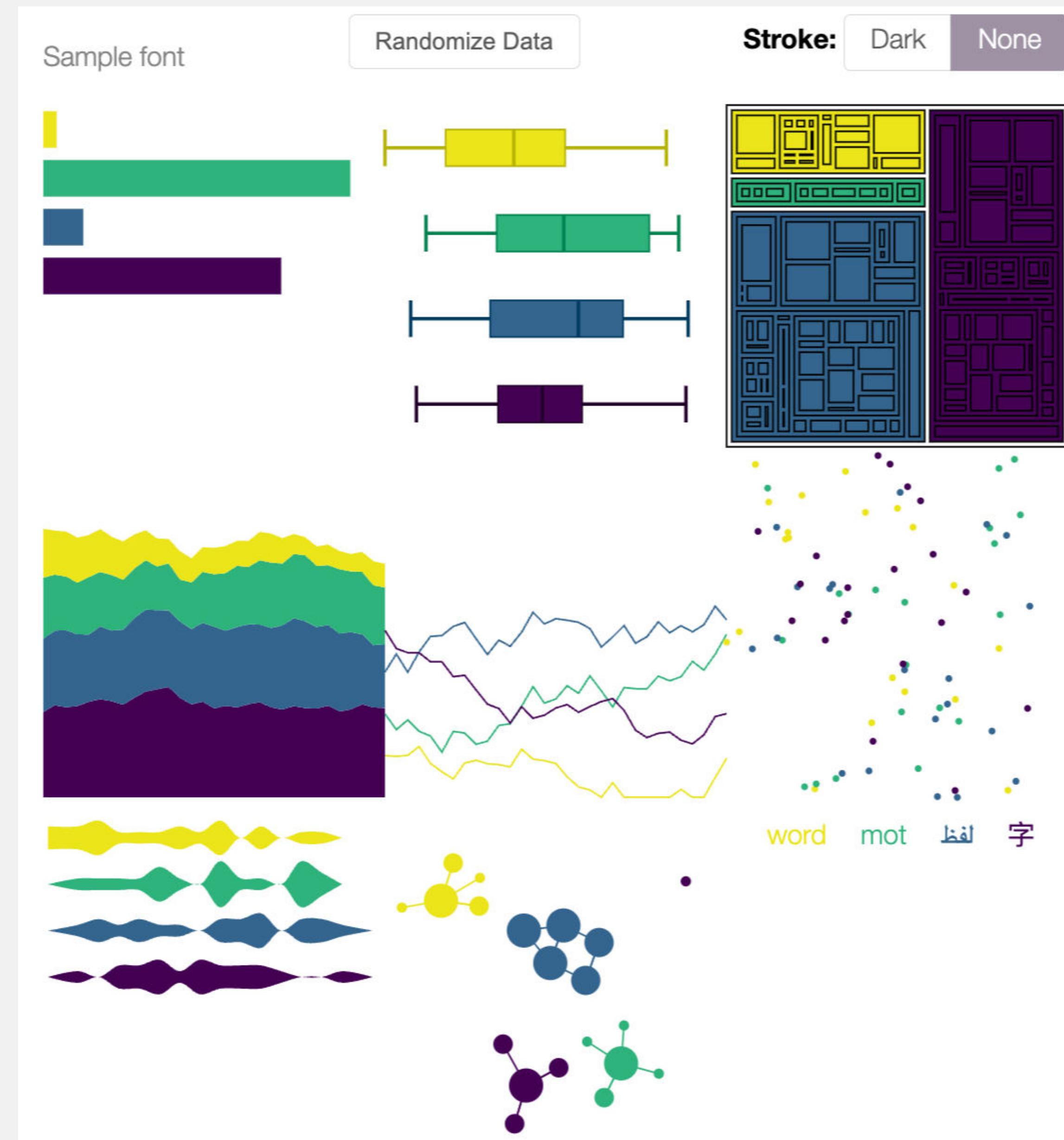


All font sizes are in CSS px • Reference font shown with colors at actual size & weight

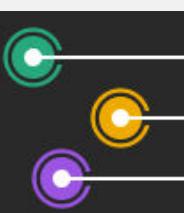


The [Myndex APCA Contrast Calculator](#) displays modern contrast ratios for various combinations of text size and font weight





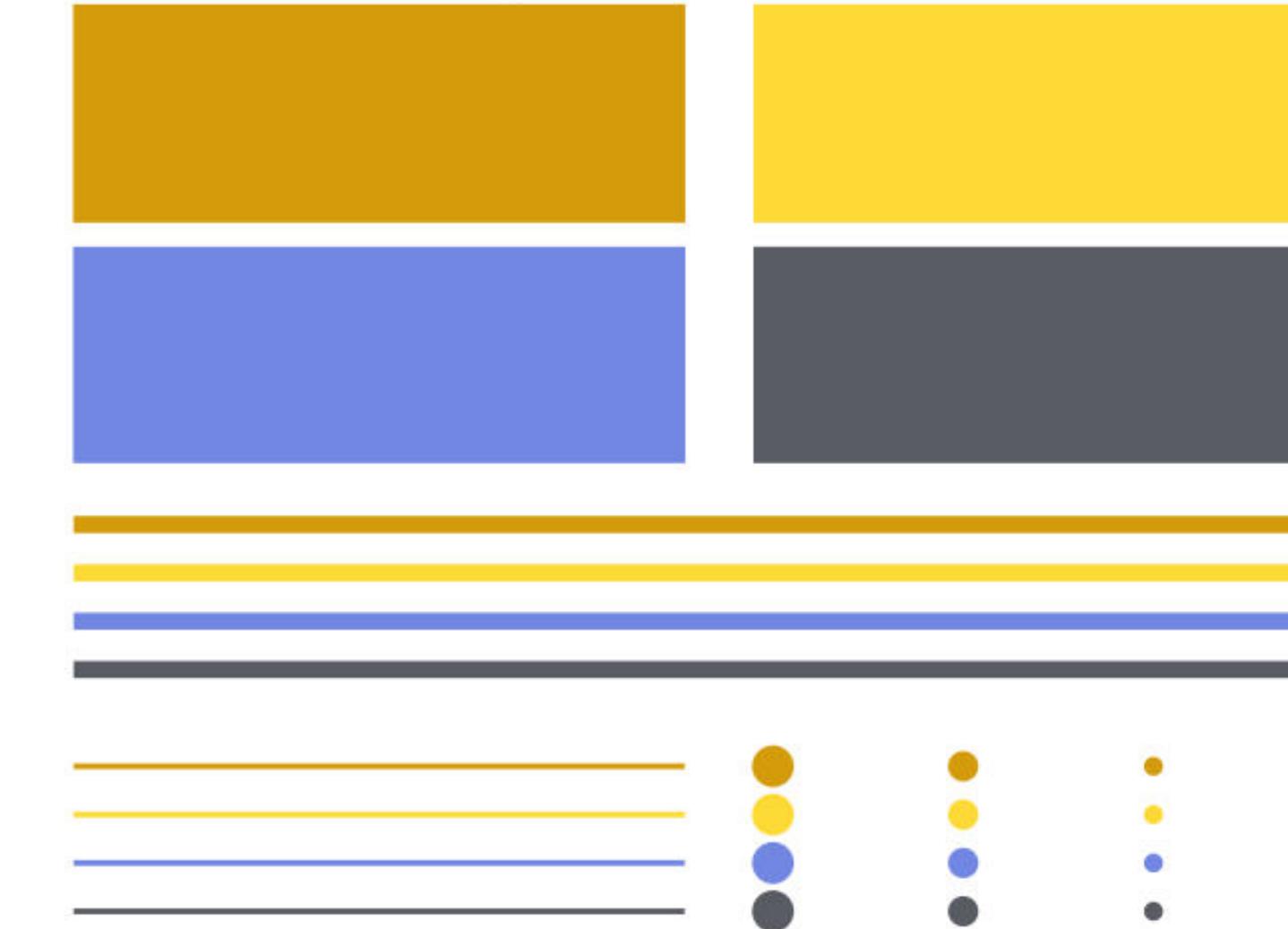
Viz Palette



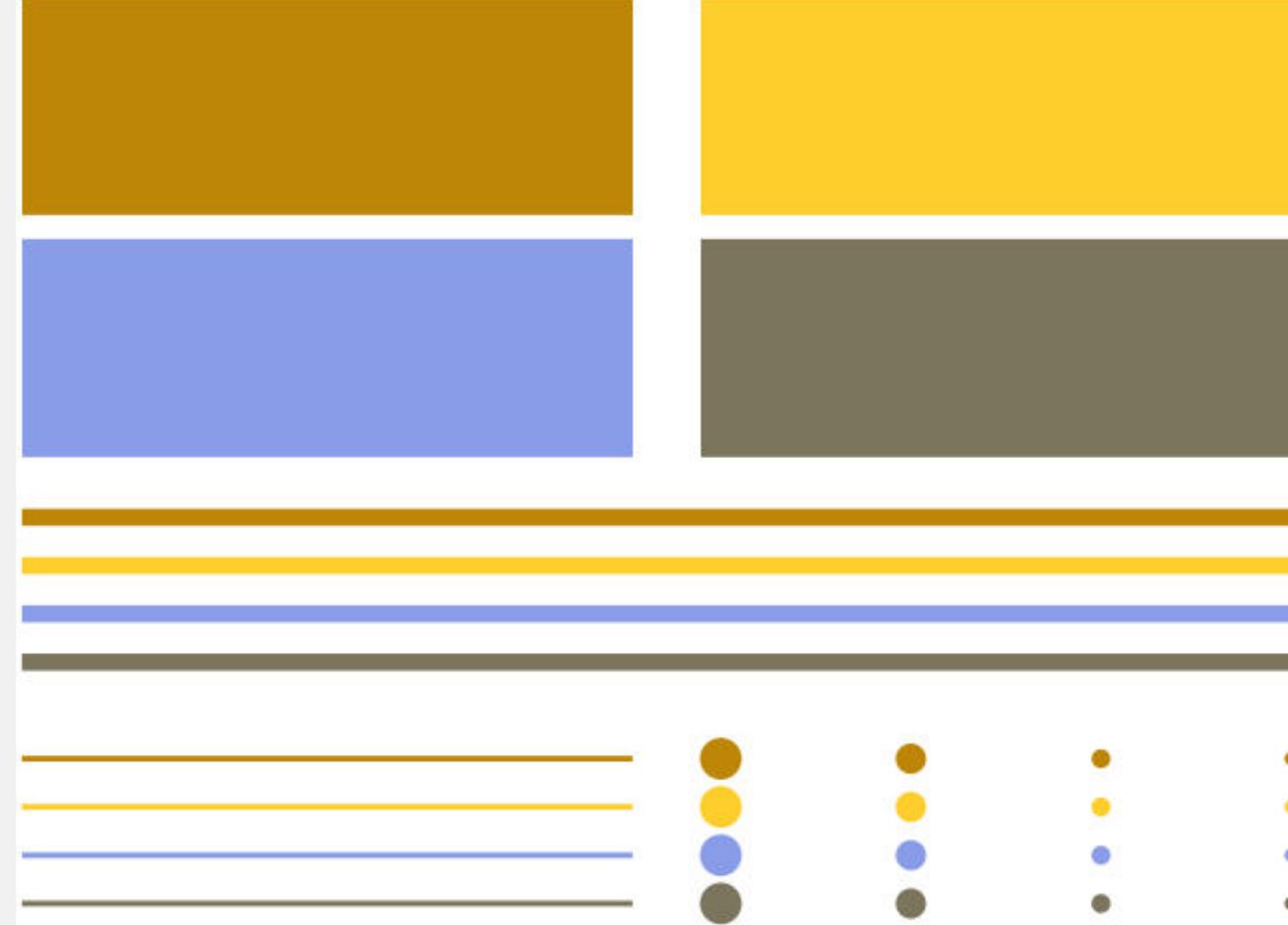
original



deuteranomaly



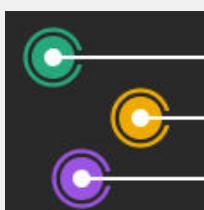
protanomaly

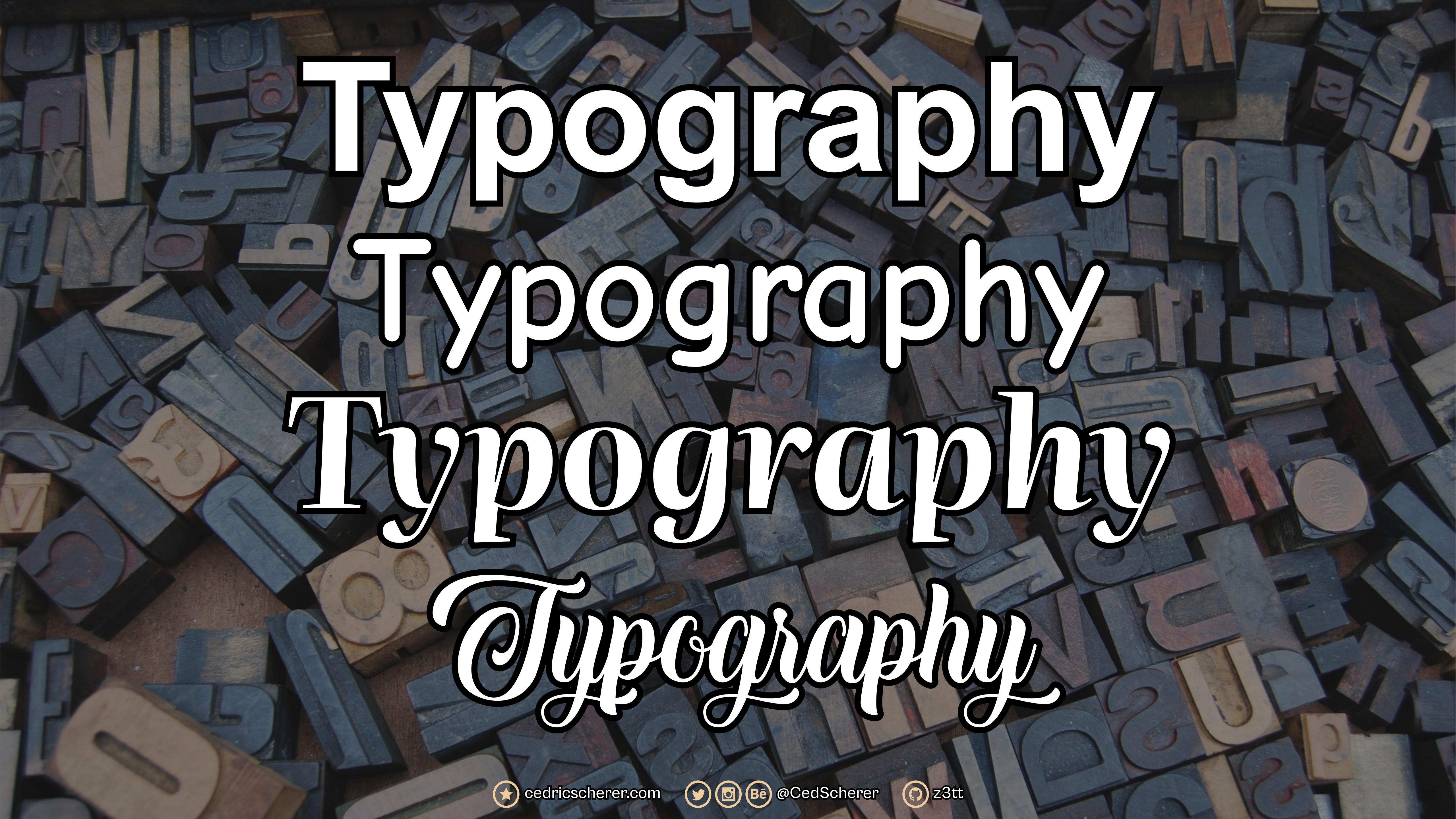


tritanomaly



Source: “*Fundamentals of Data Visualization*” by Claus O. Wilke





Typography

Typography

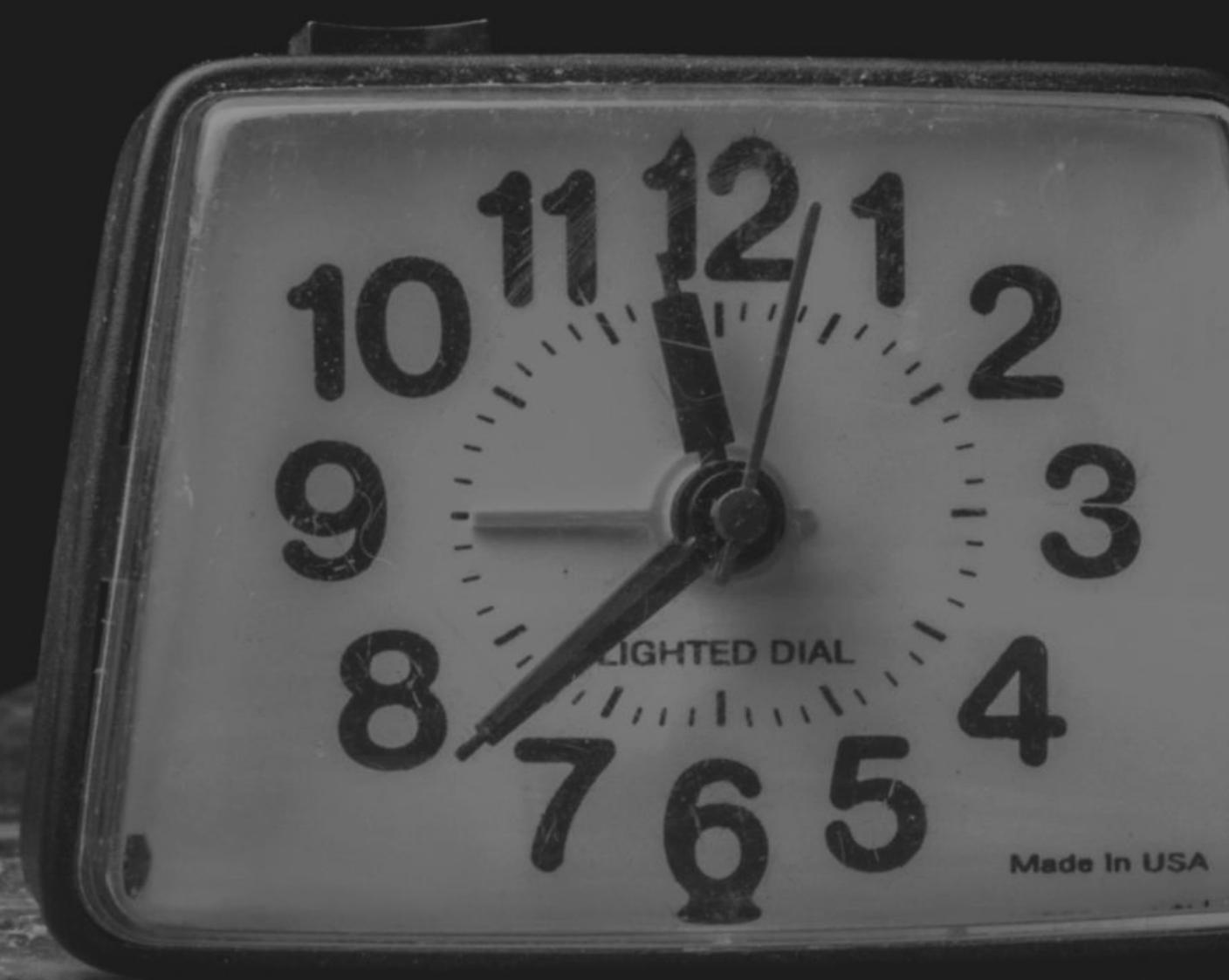
Typography

Typography

Typography



I'll be waiting for you!



cedricscherer.com



@CedScherer



z3tt

I'LL BE WAITING FOR YOU!



I'LL BE WAITING FOR YOU!

I'll be waiting for you !



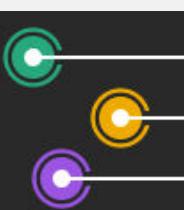
The Choice of the Typeface

- 👉 **Context matters:** font(s) should fit the topic and audience
- 👉 Use different sizes, weights and colors to **visualize hierarchy**
- 👉 Avoid using **ALL CAPS** and too many different styles
- 👉 Use **tabular typefaces** for numbers



The Choice of the Typeface

- 👉 **Context matters:** font(s) should fit the topic and audience
- 👉 Use different sizes, weights and colors to **visualize hierarchy**
- 👉 Avoid using **ALL CAPS** and too many different styles
- 👉 Use **tabular typefaces** for numbers
- 👉 **Consistency is key!**



The 1ll Test

1ll Calibri

1ll Open Sans

1ll Roboto

1ll Lato

1ll Oswald

1ll Cabinet Grotesk

1ll Cabin

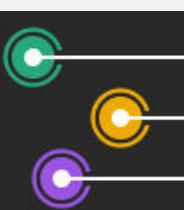
1Il Monda

1Il Chivo

1ll Fira Sans

1Il Noto Sans

1ll Amulya



Proportional Numbers

123.45
678.90

Tabular Numbers

123.45
678.90



*Using a lot of fonts
and different sizes
makes your design look
cluttered
overcomplicated
AND JUST NOT VERY NICE.*

*But if you just use
a small selection of
typefaces, styles and sizes
you can keep your design
cleaner, clearer
and just much easier to digest.*



Visualize Text Hierarchy

I am important!

I am important, too.

Oh, hi there. Thanks for reading me...

Hey, also look at me!



Visualize Text Hierarchy

I am important!

I am important, too.

Oh, hi there. Thanks for reading me...

Hey, also look at me!



Visualize Text Hierarchy

I am important!

I am important, too.

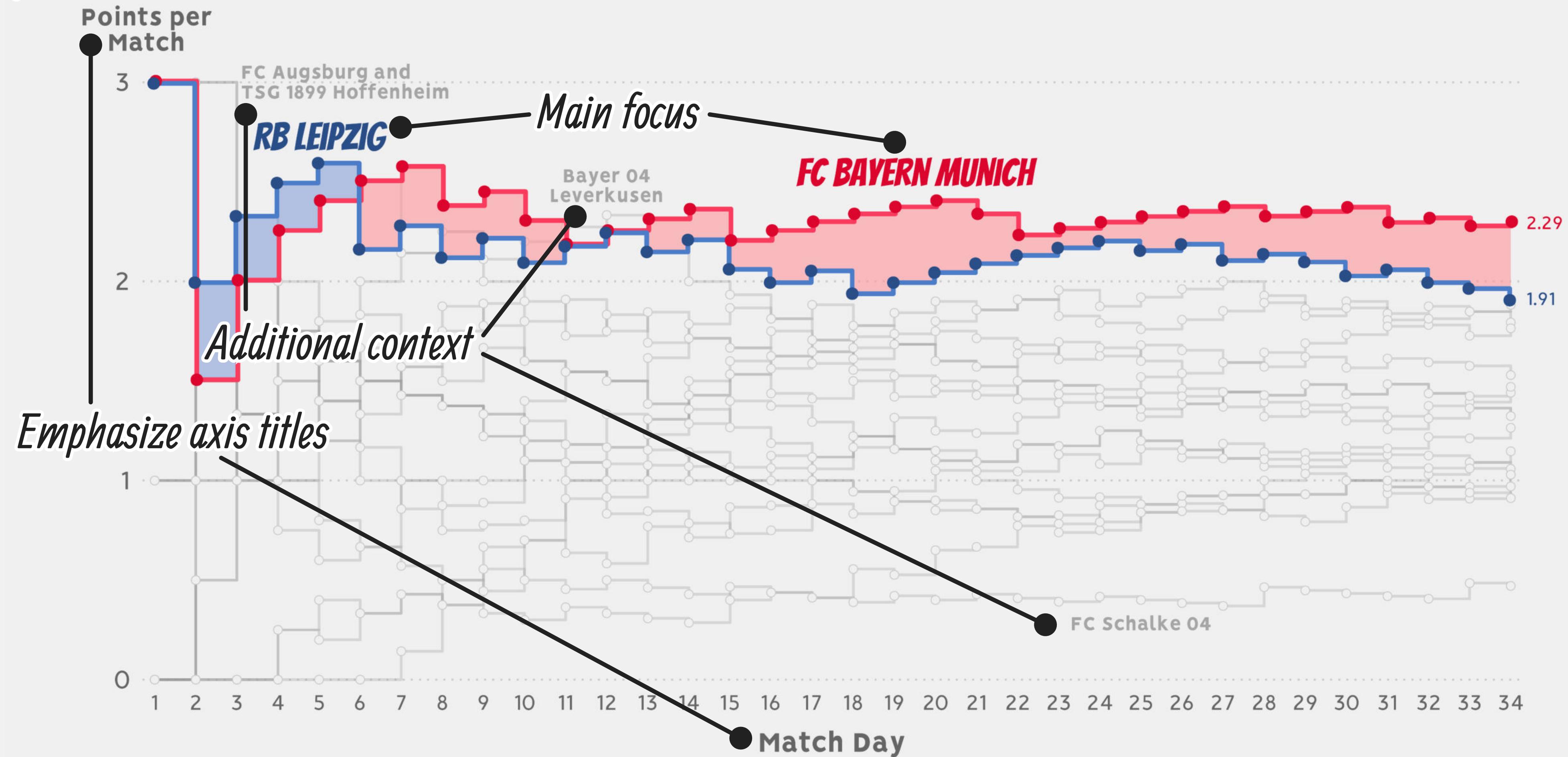
Oh, hi there. Thanks for reading me...

Hey, also look at me!



Bold primary summary —● **Bayern Munich's Road to the 31st Championship**

Lighter secondary information incl. color highlights



Small, light credit

Visualization: Cédric Scherer



Wrap-Up



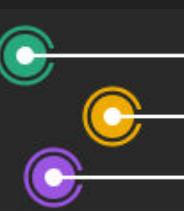
cedricscherer.com



@CedScherer



z3tt



Information

Understand your data and be accurate.

Story

Be clear about the message of your visualization.

Goal

Select charts that successfully transport your story.

Visual Form

Present information in a logical, coherent way.



Guide the View(er)



tell a story, do not “let the data speak for itself”



use a suitable goal that transports the main finding



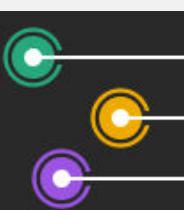
use colors correctly and wisely



add annotations, supporting text, and visual cues

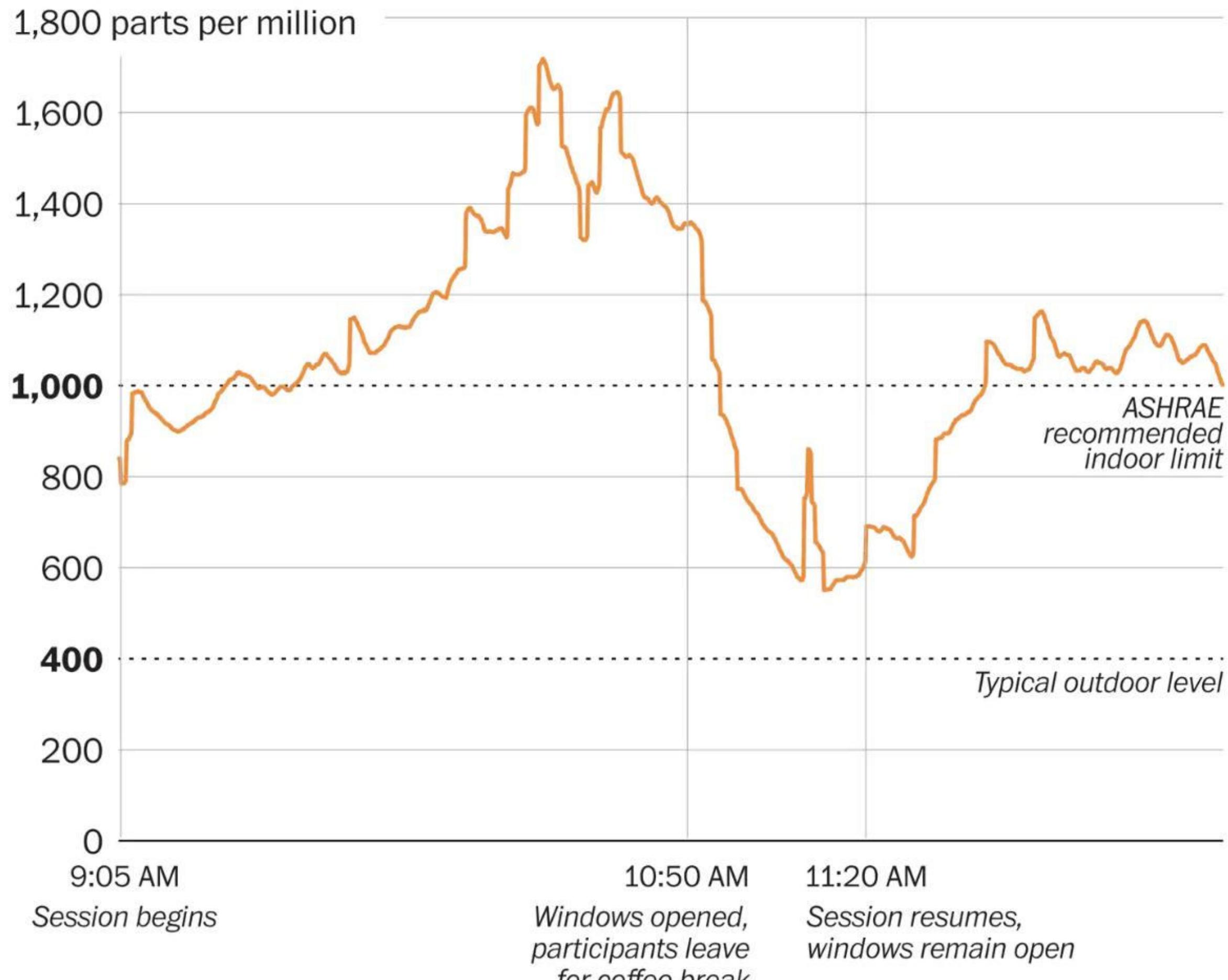


aim to work with direct labels, not legends



Clearing the air

CO₂ levels in an occupied conference room on June 4, 2019



Source: Adam Ginsburg

THE WASHINGTON POST

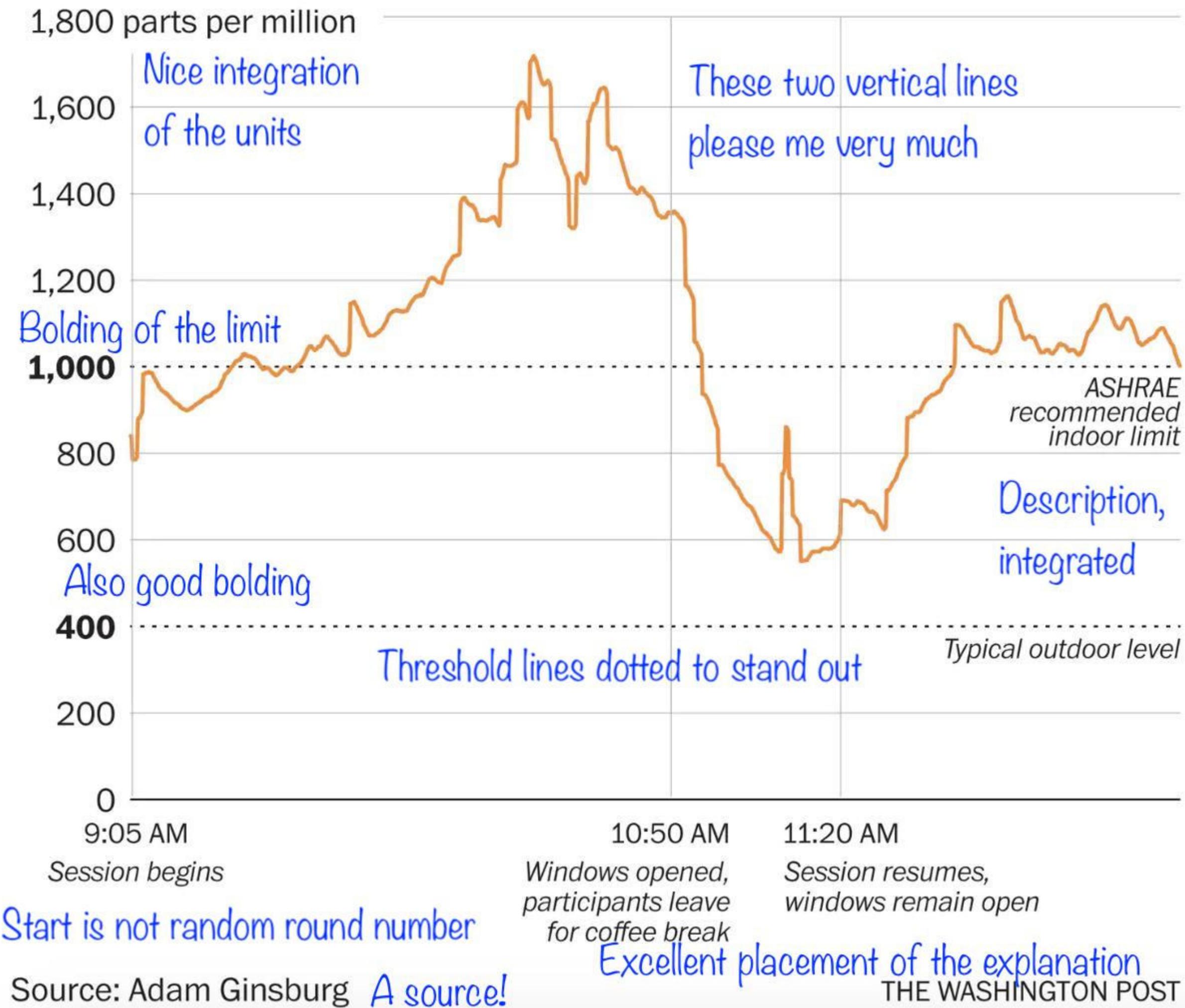
“Clearin the Air” by Adam Ginsburg (Washington Post)



Clearing the air

Fun and helpful title

CO₂ levels in an occupied conference room on June 4, 2019
Units and metho in a subtitle, NOT in vertical text on the side



...with notes by Francis Gagnon (Voilà)



Survey:

survey.mdc-berlin.de/129849



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Thank you!



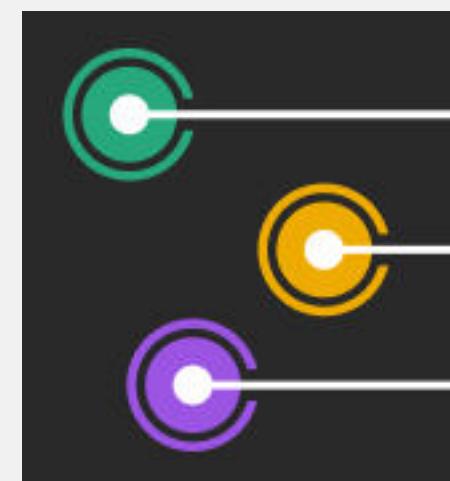
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