

# Key Concepts in Data Visualization

*How to Design Effective & Engaging Charts*

**Dr. Cédric Scherer**

MSC Data Visualization Training | March 9 and 11 2021

Photo by Richard Strozyński

# Data Visualization

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

# What Makes It a Good Data Visualization

- **Information** (Integrity)
- **Story** (Interestingness)
- **Goal** (Usefulness)
- **Visual Form** (Beauty)

# VISUAL FORM

*Follow design rules and data visualization principles*



# Colors and Common Pitfalls

# Color Choice & Accessibility

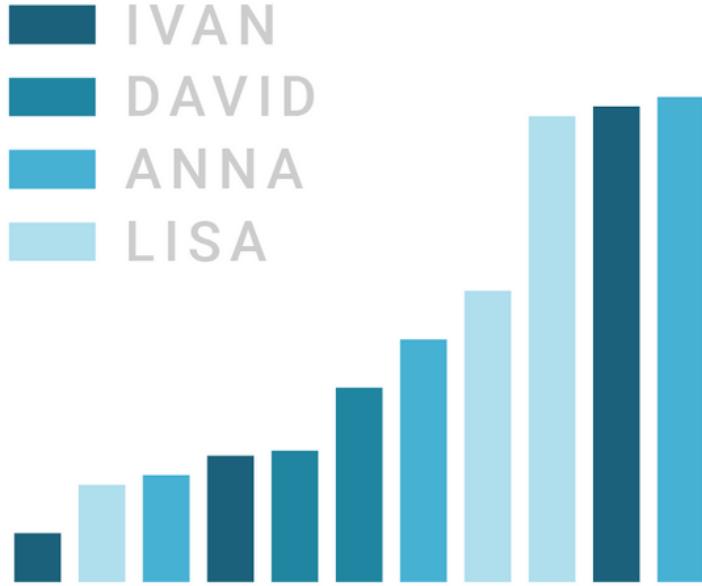
NOT IDEAL



*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

# Color Choice & Accessibility

NOT IDEAL



BETTER



*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

# Color Palette Types

Categorical



# Color Palette Types

Categorical



Sequential: Single-Hue



# Color Palette Types

Categorical



Sequential: Single-Hue



Sequential: Multi-Hue



# Color Palette Types

Categorical



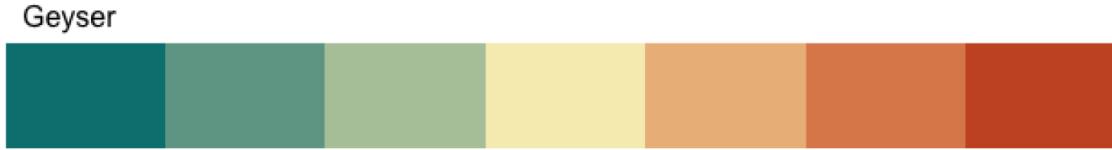
Sequential: Single-Hue



Sequential: Multi-Hue



Diverging



# Color Palette Types

Categorical



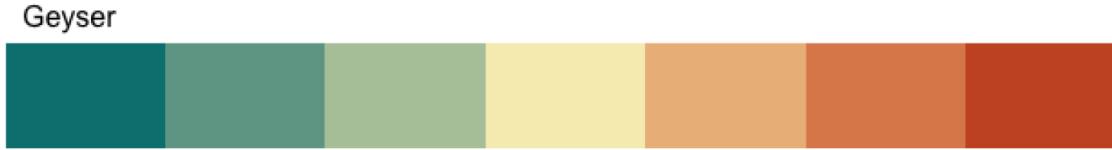
Sequential: Single-Hue



Sequential: Multi-Hue



Diverging



Cyclical



# Color Choice & Accessibility

NOT IDEAL

POOR                    RICH



PEOPLE IN GROUP A

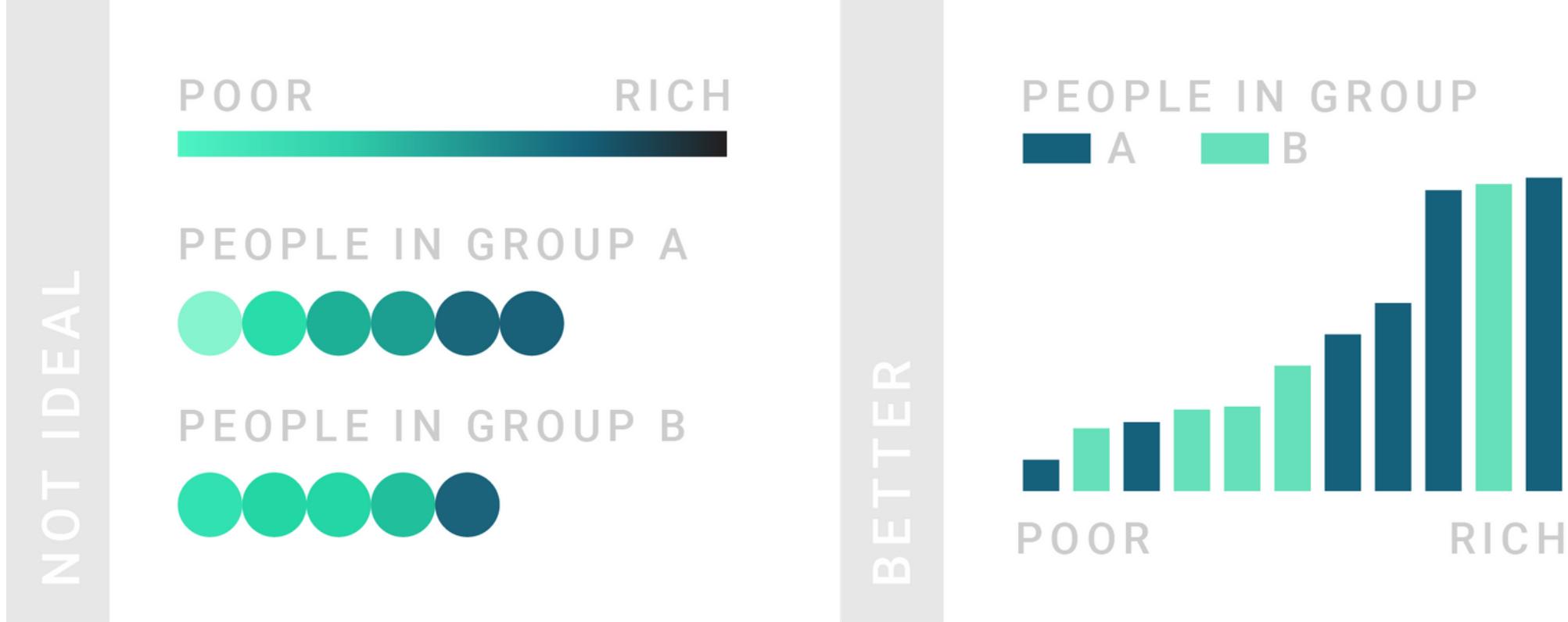


PEOPLE IN GROUP B



*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

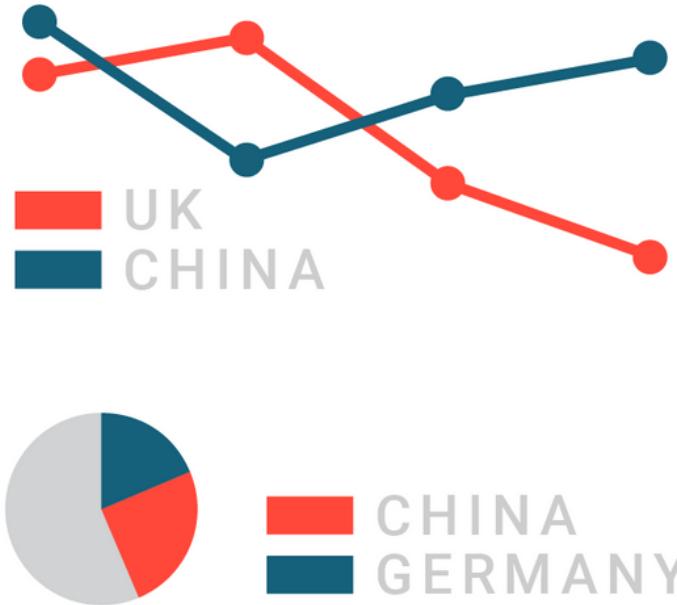
# Color Choice & Accessibility



*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

# Color Choice & Accessibility

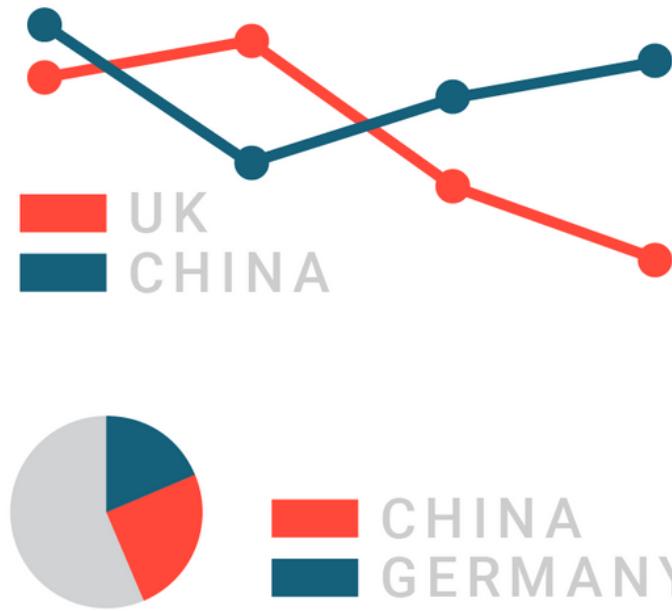
NOT IDEAL



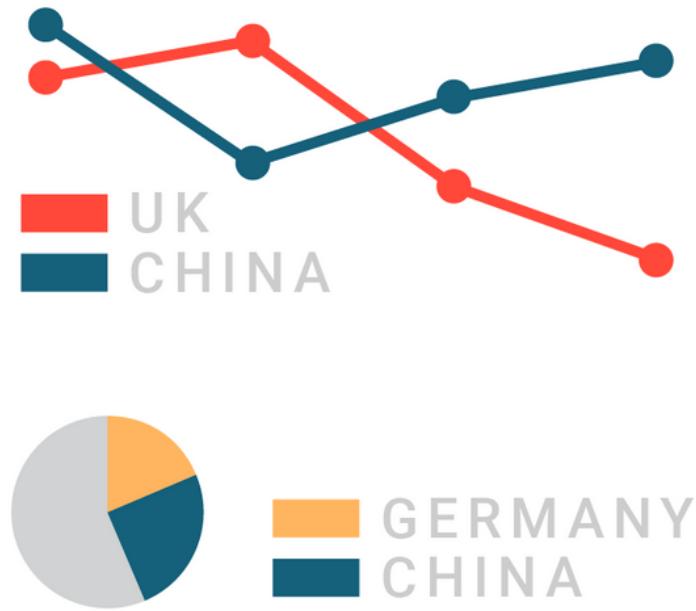
*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

# Color Choice & Accessibility

NOT IDEAL



BETTER



*What to consider when choosing colors for data visualization* by Lisa Charlotte Rost/DataWrapper

## Rainbow Color Map (Still) Considered Harmful

Publisher: IEEE

2 Author(s)

David Borland ; Russell M. Taylor li View All Authors

172  
Paper  
Citations

3  
Patent  
Citations

9091  
Full  
Text Views



# Medical Physics

Current Issue Authors Submissions Advertise Search

[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

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<sup>a\)</sup>](#)

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](#)

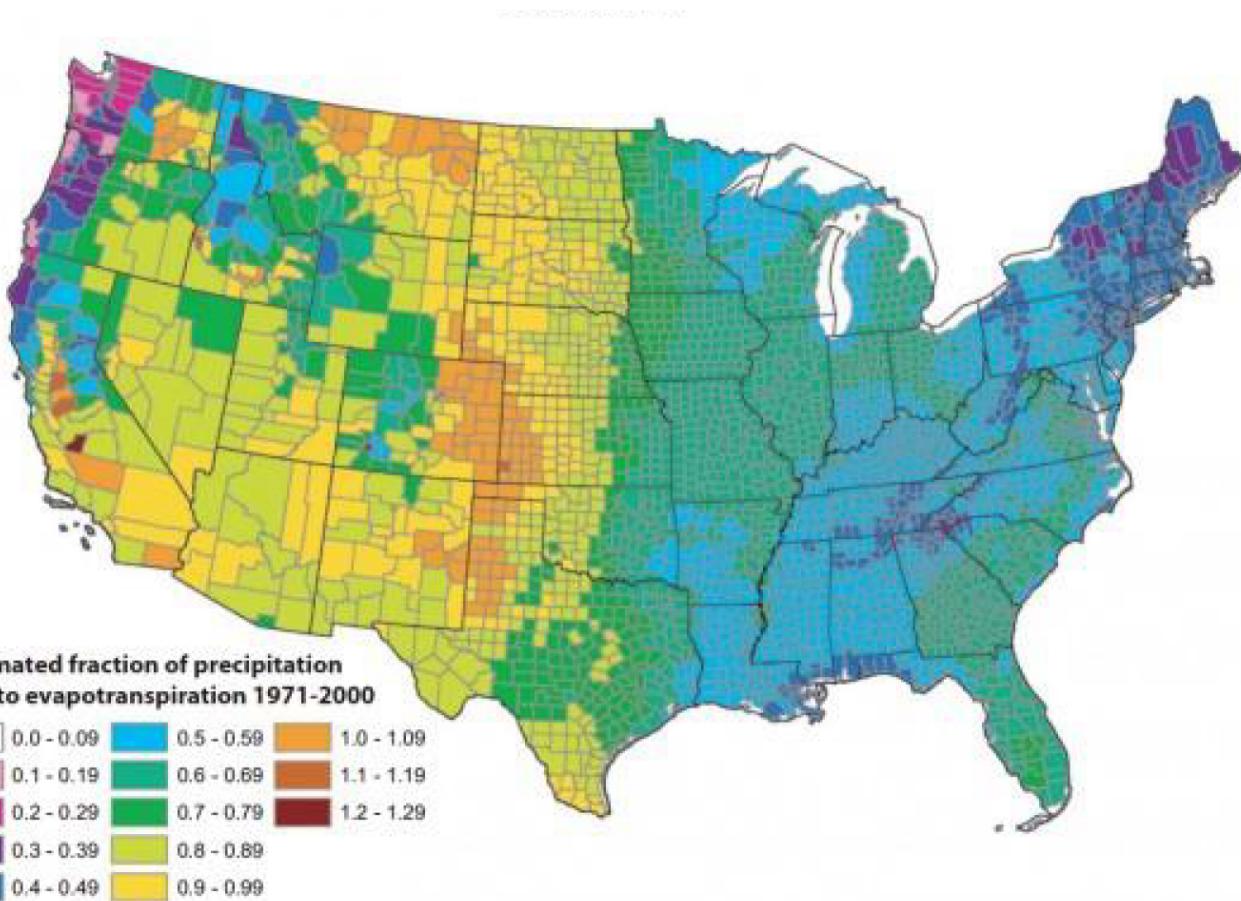


FIGURE 13. Estimated Mean Annual Ratio of Actual Evapotranspiration (ET) to Precipitation ( $P$ ) for the Conterminous U.S. for the Period 1971-2000. Estimates are based on the regression equation in Table 1 that includes land cover. Calculations of  $ET/P$  were made first at the 800-m resolution of the PRISM climate data. The mean values for the counties (shown) were then calculated by averaging the 800-m values within each county. Areas with fractions >1 are agricultural counties that either import surface water or mine deep groundwater.

Source: [eagereyes.org/basicss/rainbow-color-map](http://eagereyes.org/basicss/rainbow-color-map)

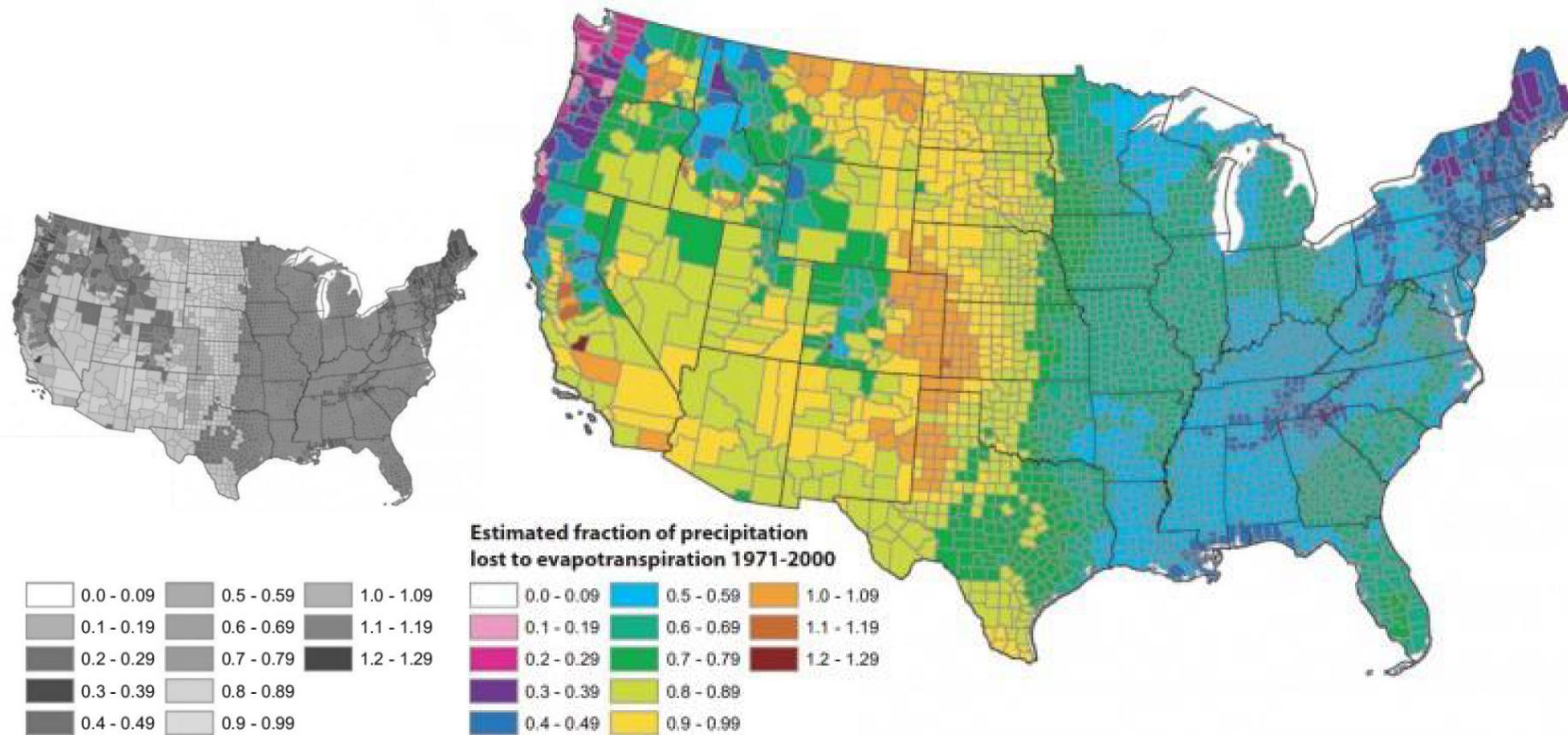


FIGURE 13. Estimated Mean Annual Ratio of Actual Evapotranspiration (ET) to Precipitation ( $P$ ) for the Conterminous U.S. for the Period 1971-2000. Estimates are based on the regression equation in Table 1 that includes land cover. Calculations of  $ET/P$  were made first at the 800-m resolution of the PRISM climate data. The mean values for the counties (shown) were then calculated by averaging the 800-m values within each county. Areas with fractions  $>1$  are agricultural counties that either import surface water or mine deep groundwater.

*Modified from eagereyes.org/basicss/rainbow-color-map*

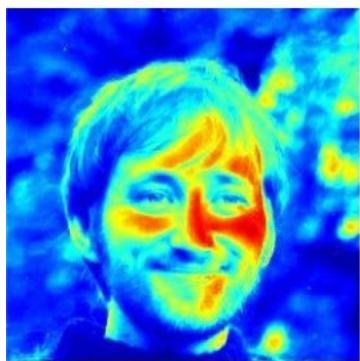


**true-colour Phil**

*Source: [Fabio Cramer](#)*



**true-colour Phil**

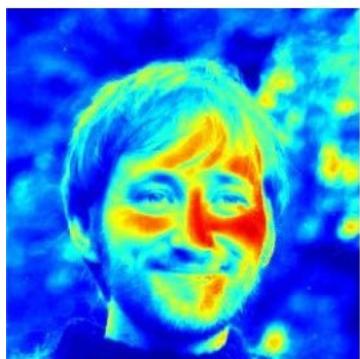


**rainbow Phil**  
*is distorted*

*Source: Fabio Cramer*



**true-colour Phil**



**rainbow Phil**  
*is distorted*



**batlow Phil**  
*is flawless*

*Source: Fabio Cramer*

# Color Choice & Accessibility



Source: [cran.r-project.org/web/packages/viridis/vignettes/intro-to-viridis.html](http://cran.r-project.org/web/packages/viridis/vignettes/intro-to-viridis.html)

# Color Choice & Accessibility



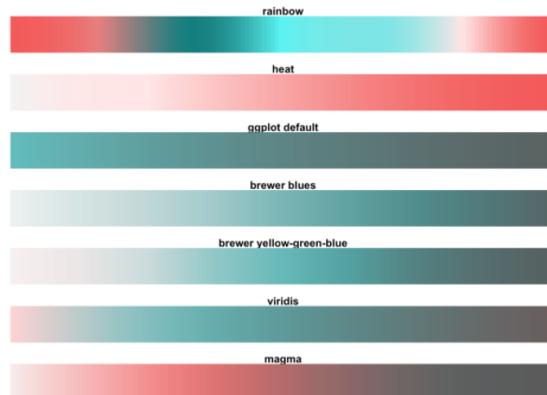
**Deutranopia:** present in 6% of males



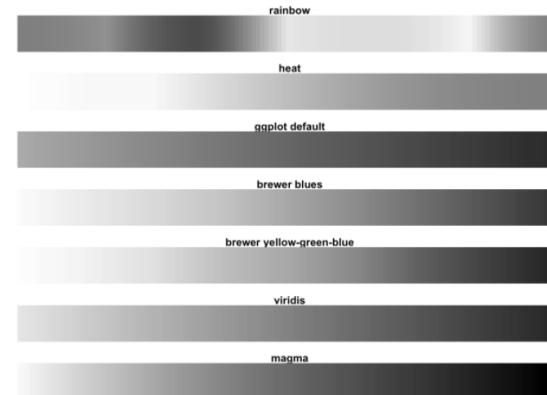
**Protanopia:** present in 1% of males



**Tritanopia:** present in 0.008% of humans



**Monochromacy:** present in 0.001% of humans



... and present in ~75% of university printers! 😊

**To make sure your visualizations work for people with CVD don't just rely on provided color palettes.**

**Instead, test your figures in a color-blindness simulator!**

# Color Choice & Accessibility

Choose color-blind friendly palettes:  
[projects.susielu.com/viz-palette](http://projects.susielu.com/viz-palette)

Test your final visualization:  
[color-blindness.com/coblis-color-blindness-simulator](http://color-blindness.com/coblis-color-blindness-simulator)

Create a CVD-version of your ggplot in R:  
[github.com/clauswilke/colorblindr](https://github.com/clauswilke/colorblindr)

# Choice of the Color Palette & Accessibility

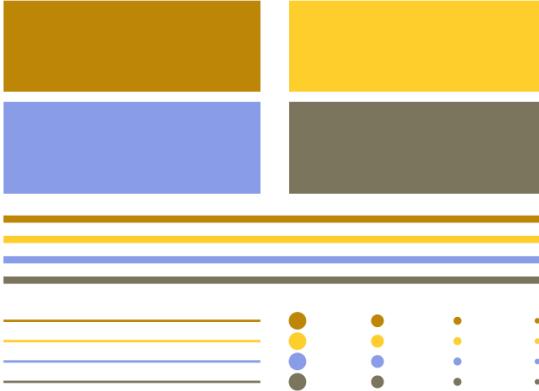
original



deuteranomaly



protanomaly

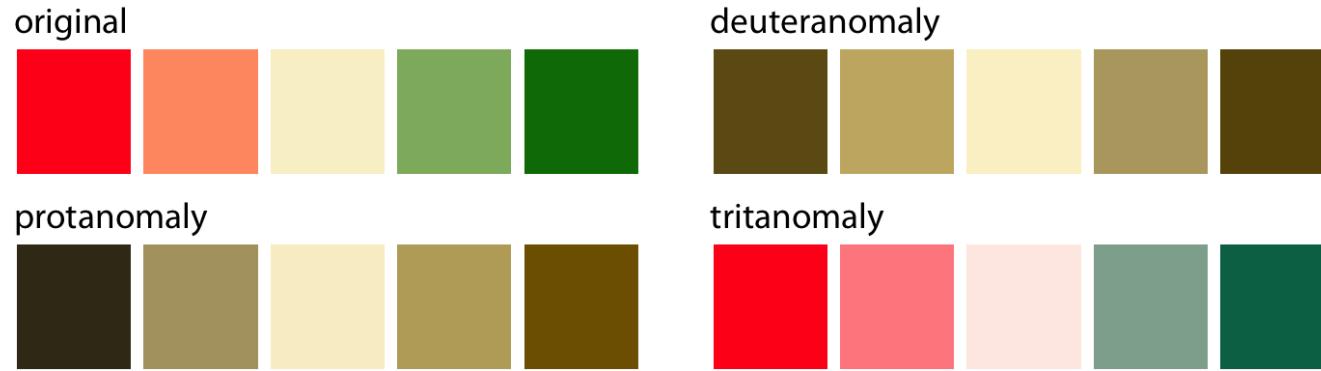


tritanomaly



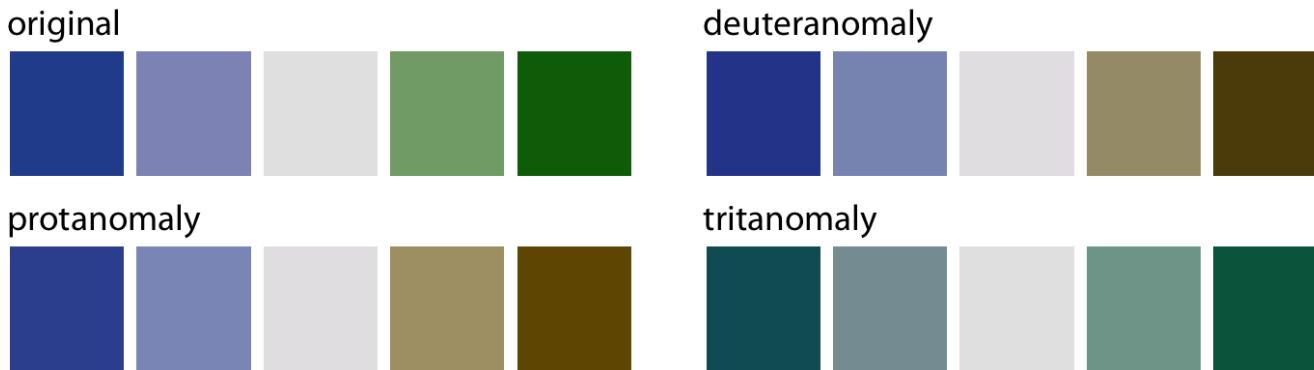
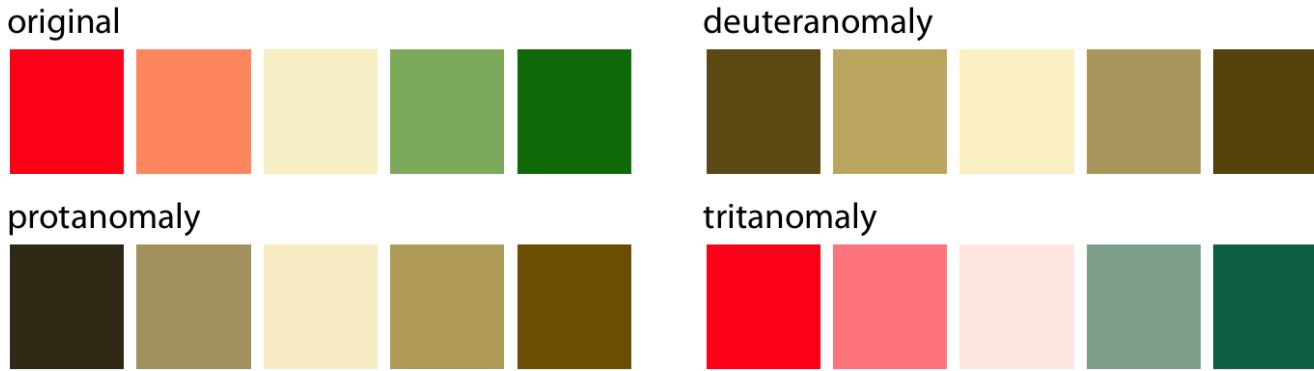
*“Fundamentals of Data Visualization” by Claus Wilke*

# Choice of the Color Palette & Accessibility

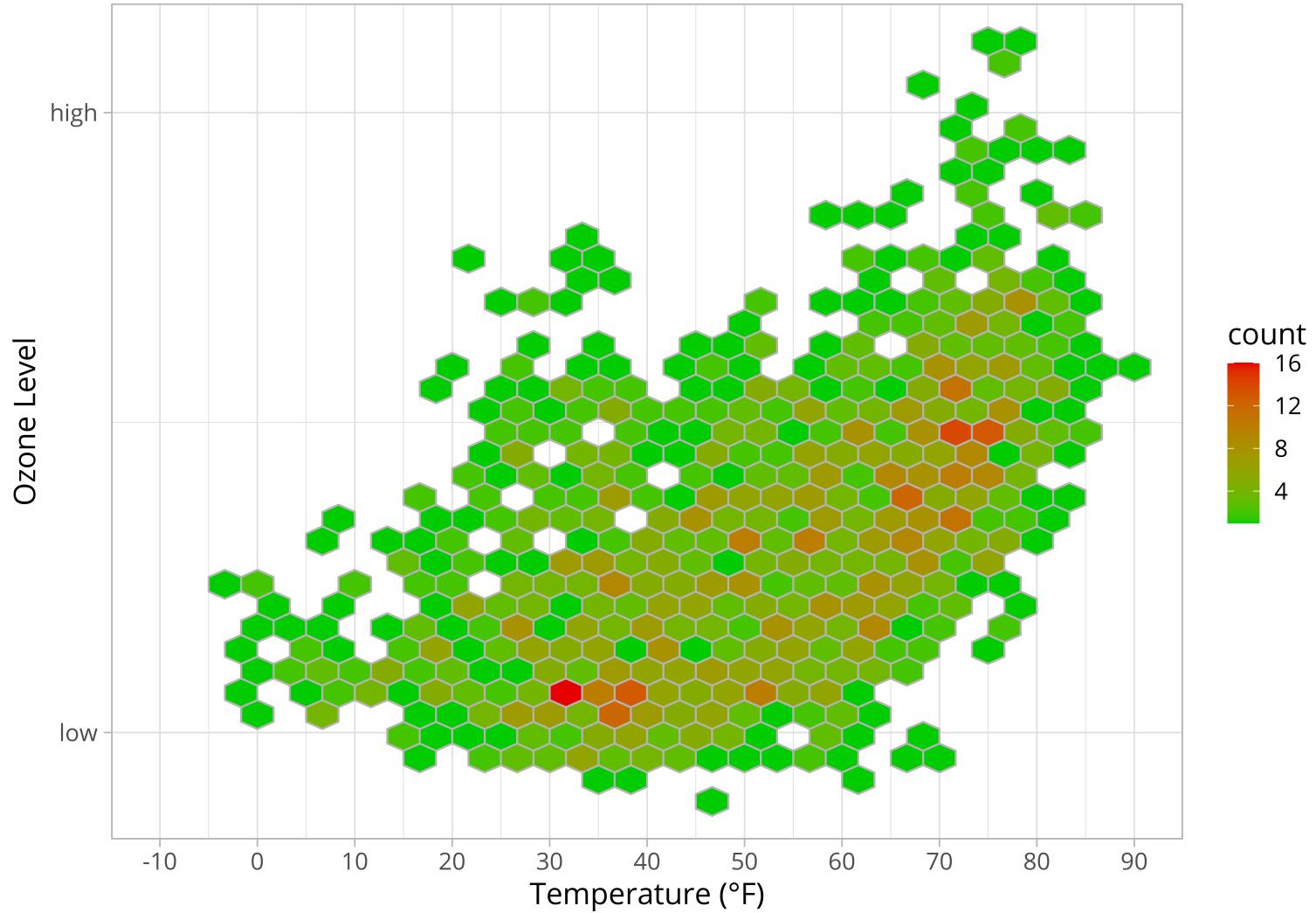


*“Fundamentals of Data Visualization” by Claus Wilke*

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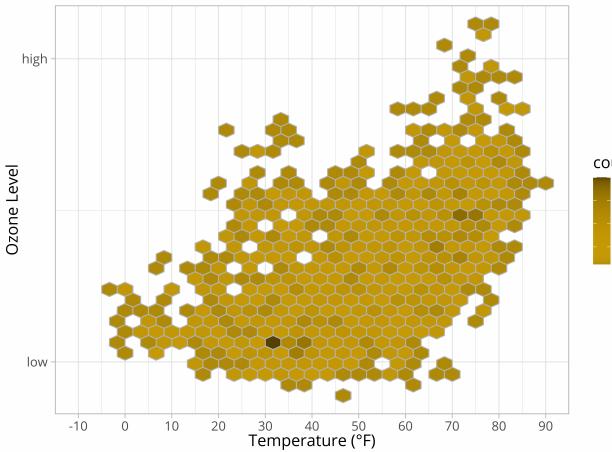


# Color Choice & Accessibility

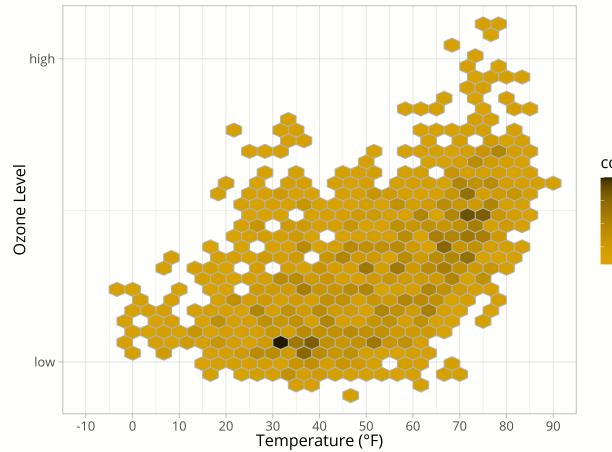


# Color Choice & Accessibility

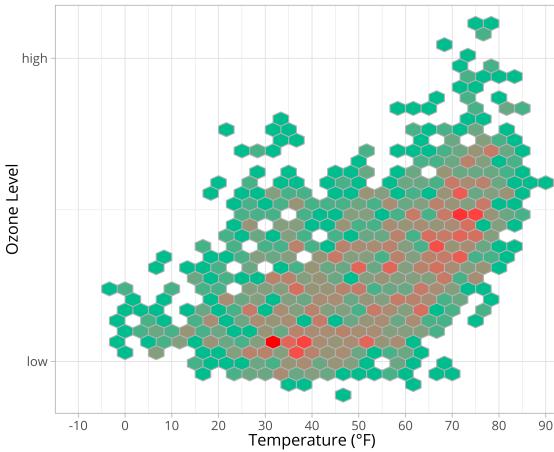
Deutanomaly



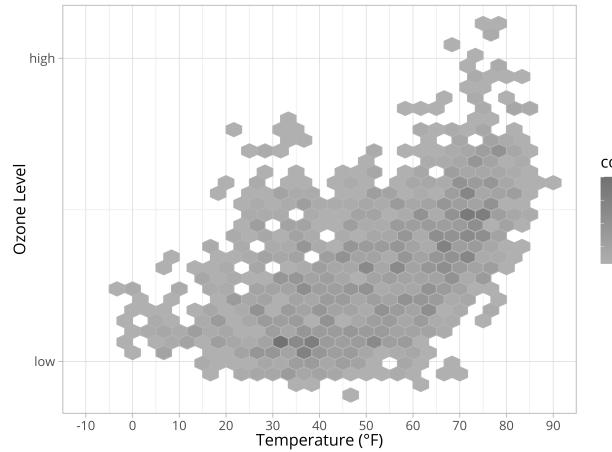
Protanomaly



Tritanomaly



Desaturated



Created with [colorblindr](#)

# Color Choice & Accessibility

## VIZ PALETTE

By: Elijah Meeks & Susie Lu

### PICK

Use Chroma.js

Use Colorgorical

Use ColorBrewer

### EDIT

7 Colors

1 <span style="color: yellow;">●</span> #ffd700	x
2 <span style="color: orange;">●</span> #ffb14e	x
3 <span style="color: red;">●</span> #fa8775	x
4 <span style="color: pink;">●</span> #ea5f94	x
5 <span style="color: purple;">●</span> #cd34b5	x
6 <span style="color: magenta;">●</span> #9d02d7	x
7 <span style="color: blue;">●</span> #0000ff	x

hex  rgb  
 hsl

### GET

String quotes  
 Object with metadata

```
[ "#ffd700",
  "#ffb14e",
  "#fa8775",
  "#ea5f94",
  "#cd34b5",
  "#9d02d7",
  "#0000ff" ]
```

## COLORS IN ACTION

Background color:

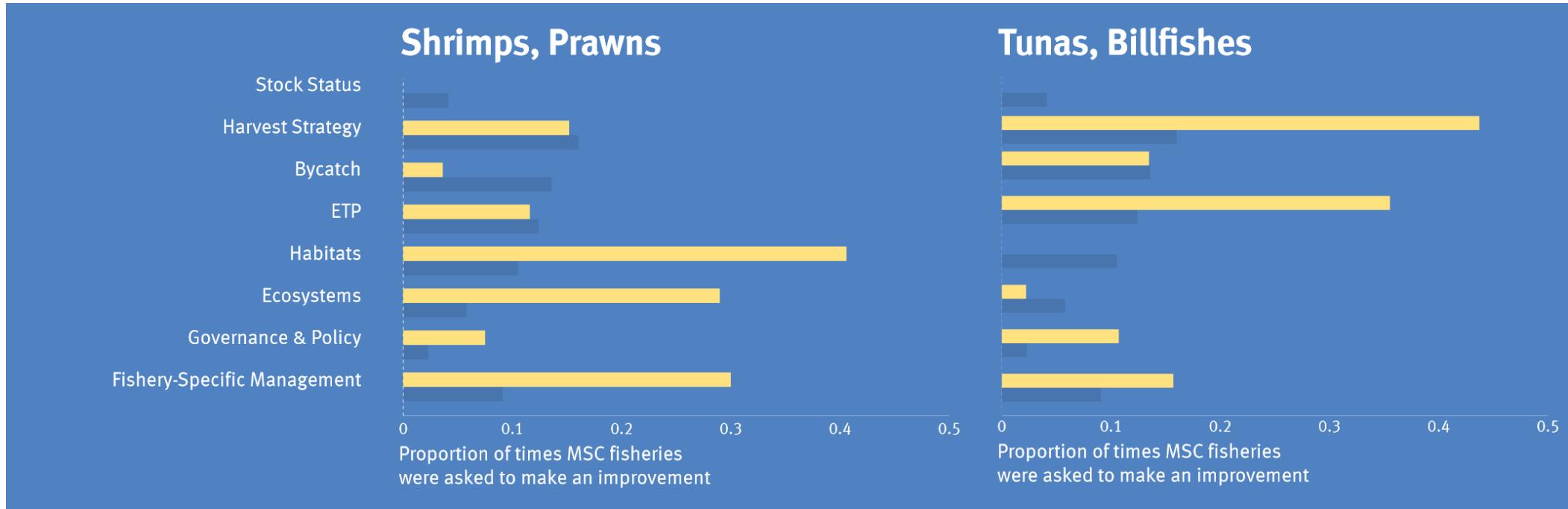
Font color: ● #000000

Charts made with [Semiotic](#)

Color Population: No Color Deficiency - 96% | Deuteranomaly - 2.7% | Protanomaly - 0.66% | Protanopia - 0.59% | Deutanopia - 0.56% | Greyscale

Sample font  Stroke:  Dark  None

# Color Choice & Accessibility



The image is a dense collage of typography-related text elements. At the top, the word 'TYPOGRAPHY' is written in large, bold, white serif letters. Below it, several smaller 'TYPOGRAPHY' words are arranged in a grid-like pattern, some rotated vertically. In the center, there's a large, bold 'TYPOGRAPHY' in a serif font. To the left, the word 'TYPOGRAPHY' is written vertically in a sans-serif font. To the right, there are several decorative ligature characters (such as 'f', 'e', 't', 'd', 'n', 'r', 'l', 'w') and a small 'TYPOGRAPHY' word. At the bottom, the word 'Typography' is written in a large, bold, yellow sans-serif font, followed by the phrase '(and everything text-related)' in a smaller, gray sans-serif font.

# Typography

(and everything text-related)

# The Choice of the Font(s)

- The font(s) should fit the topic and audience - **context matters**.
- **Avoid fancy fonts and squiggle letters.**
- Use ways to **visualize hierarchy**.
- Avoid using **ALL CAPS**.
- Use a **monospaced font with lining for numbers**.

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- Avoid using **ALL CAPS**.
- Use a **monospaced font with lining for numbers**.
- **Consistency is key!**

# How to Visualize Hierarchy

I am important!

I am important, too!

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

Yeah, I know I am kinda boring. Sorry.

# How to Visualize Hierarchy

I am important!

I am important, too!

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

Yeah, I know I am kinda boring. Sorry.

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**I am important!**  
**I am important, too.**

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Yeah, I know I am kinda boring. Sorry.

# Keep it Simple

**Using lots of fonts  
can make for a design  
that is cluttered,  
*overcomplicated,*  
**AND JUST NOT VERY NICE****

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

# The 1I1 Test

1II Calibri

1II Bitter

1II Open Sans

1II Monda

1II Roboto

1II Chivo

1II Avenir Next Condensed

1II Fira Sans

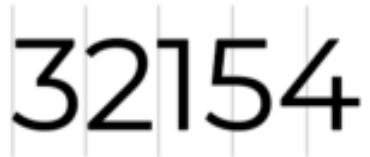
1II Lato

1II Noto Sans

1II Oswald

1II Bahnschrift

# Tabular (Monospaced) Numbers



32154

Montserrat  
proportional numbers



32154

Open Sans  
tabular numbers



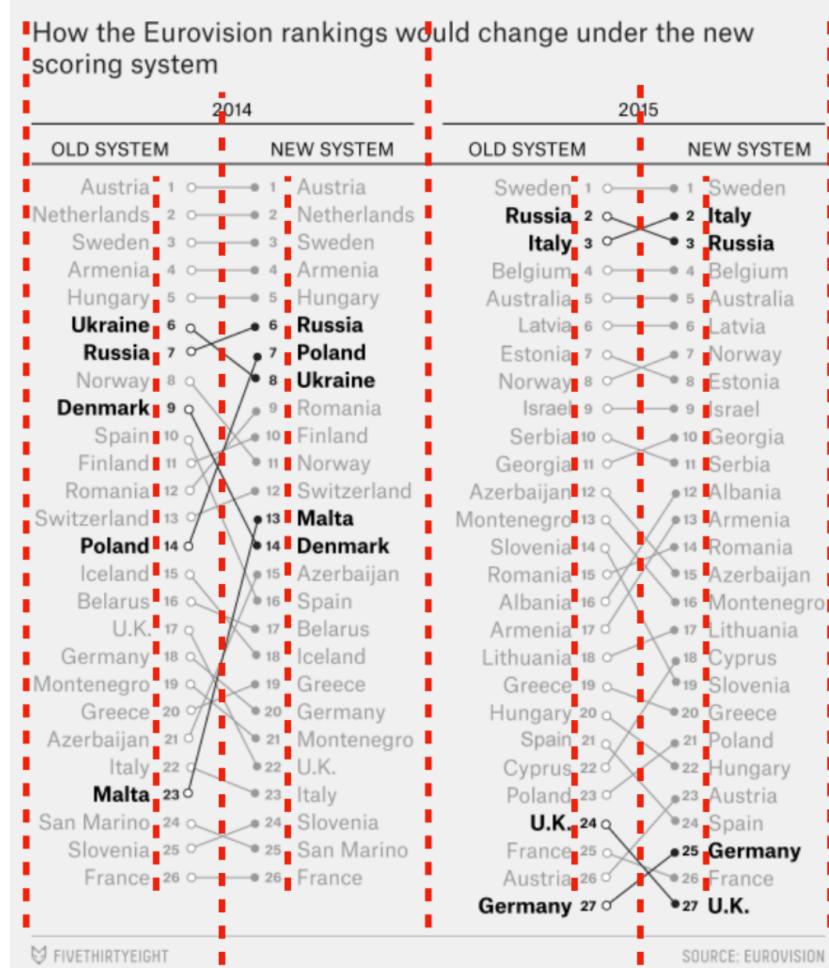
32154

Lato  
tabular numbers

Source: *Choosing Fonts for Your Data Visualization* by Tiffany France

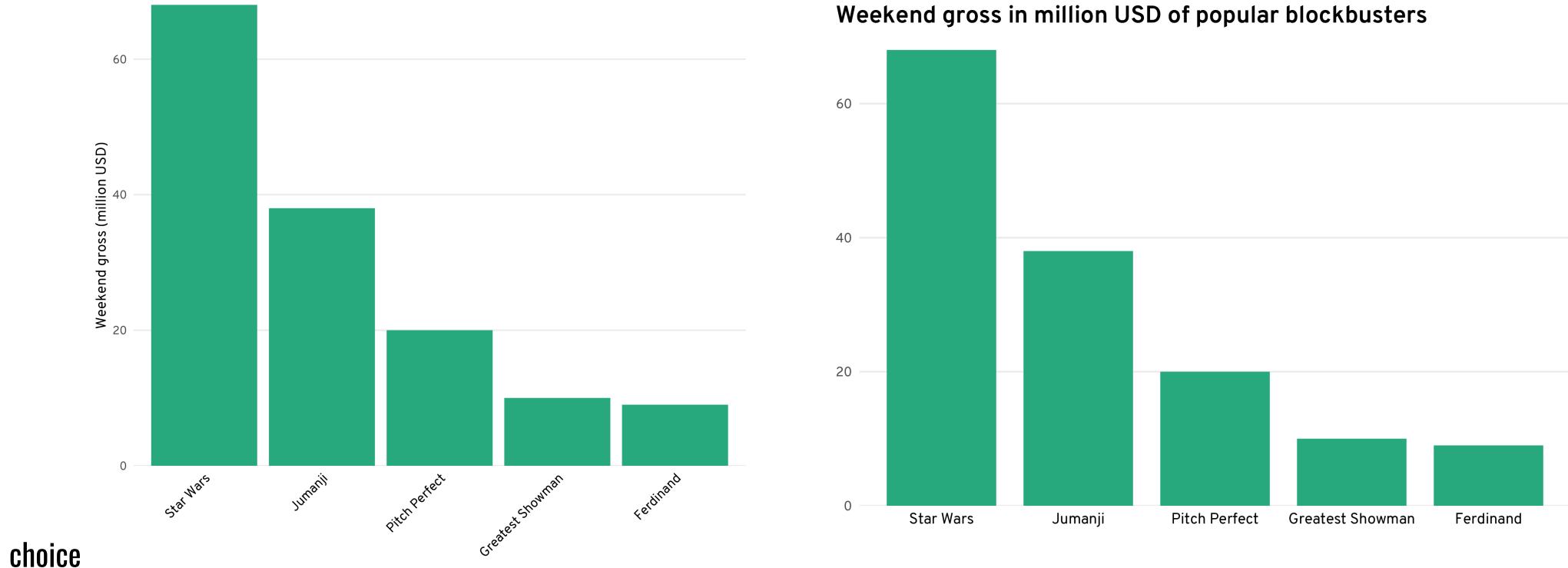
# Allign Your Text

- Left-align most text
- Title should be left aligned
- Labels and subtitles can be center or right aligned



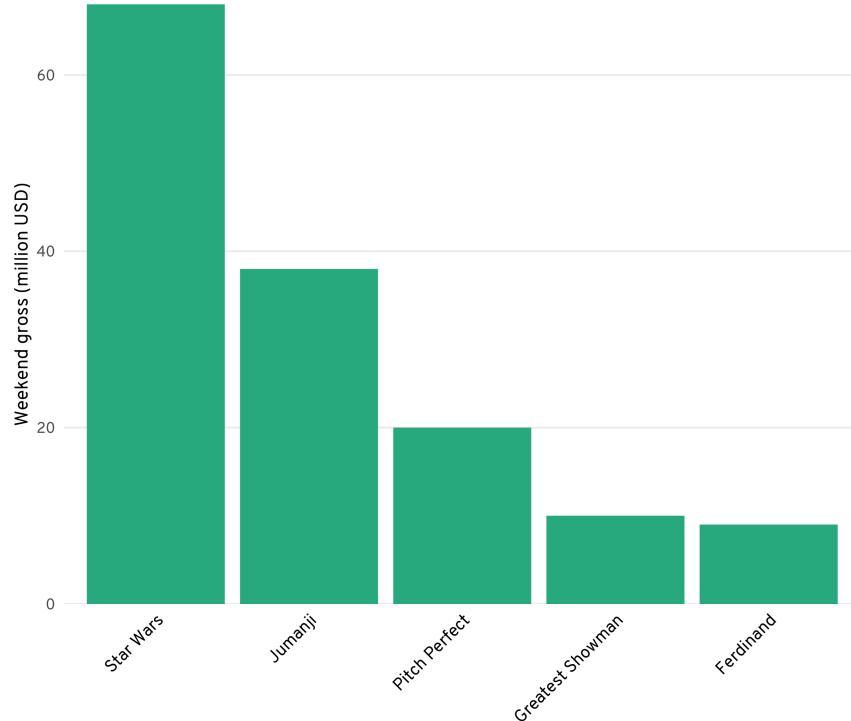
Source: Will R. Chase

# (Don't) Rotate Your Text

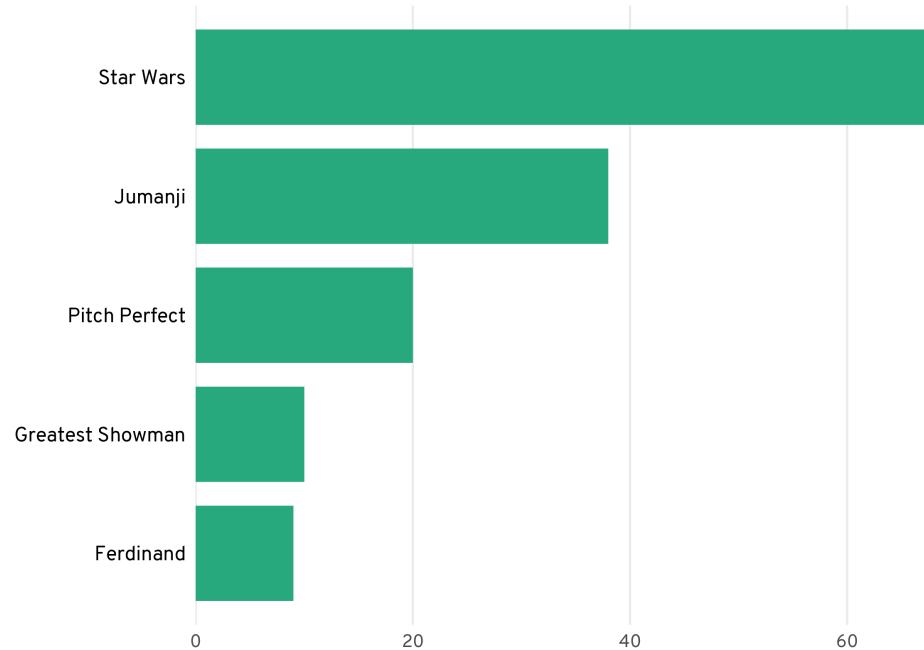


Modified from “**Fundamentals of Data Visualization**” by Claus Wilke

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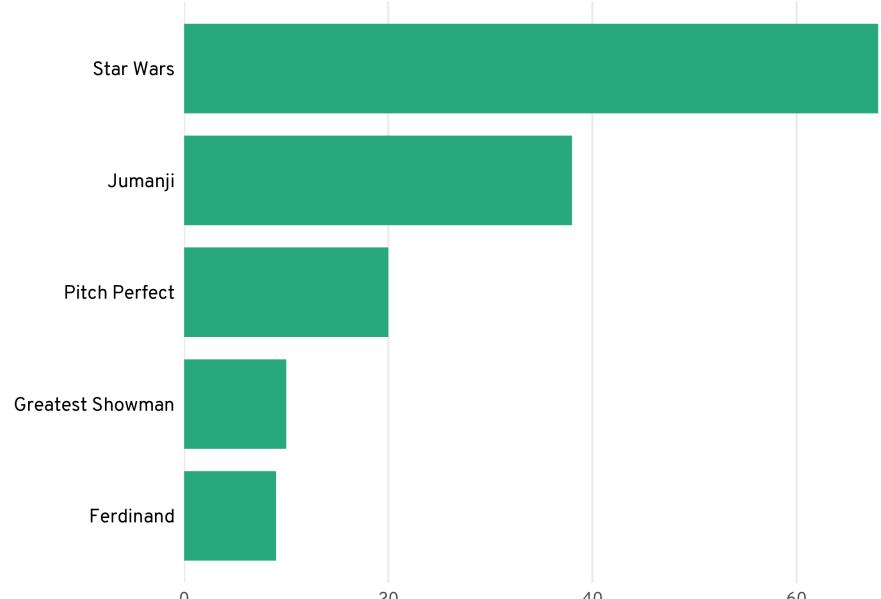


Weekend gross in million USD of popular blockbusters

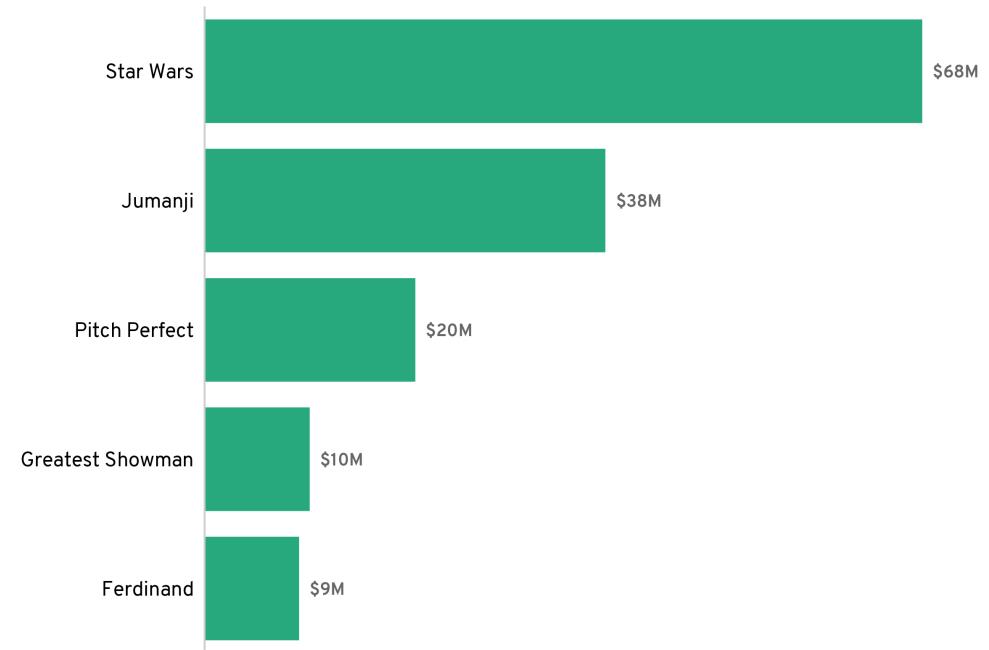


# Use Annotations

Weekend gross in million USD of popular blockbusters

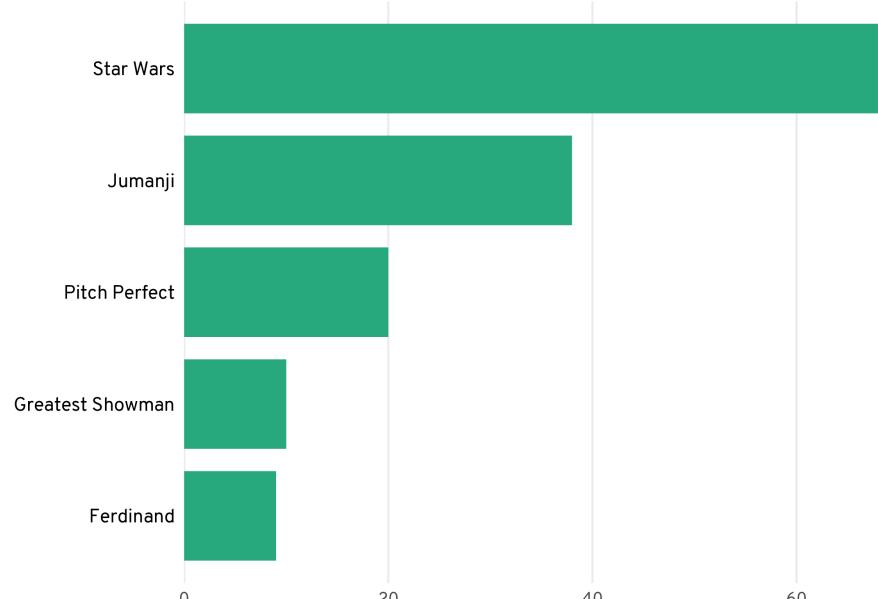


Weekend gross in million USD of popular blockbusters

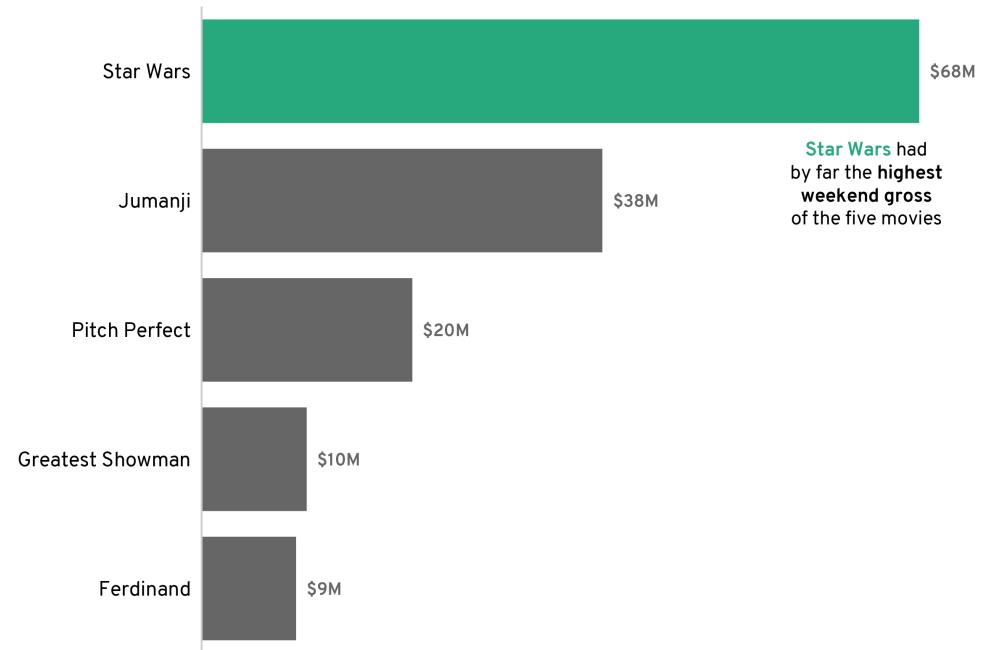


# Use Annotations

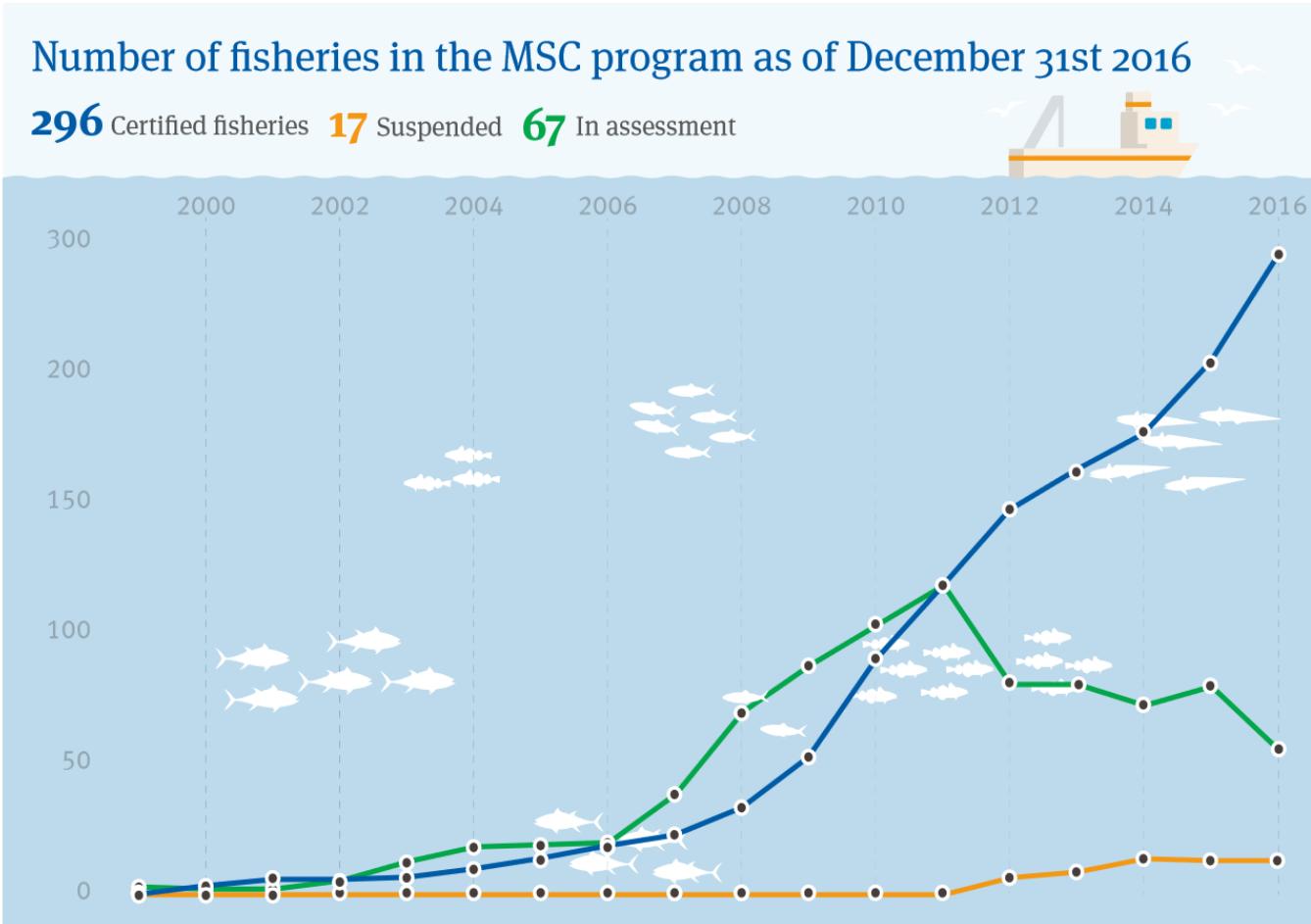
Weekend gross in million USD of popular blockbusters



Weekend gross in million USD of popular blockbusters



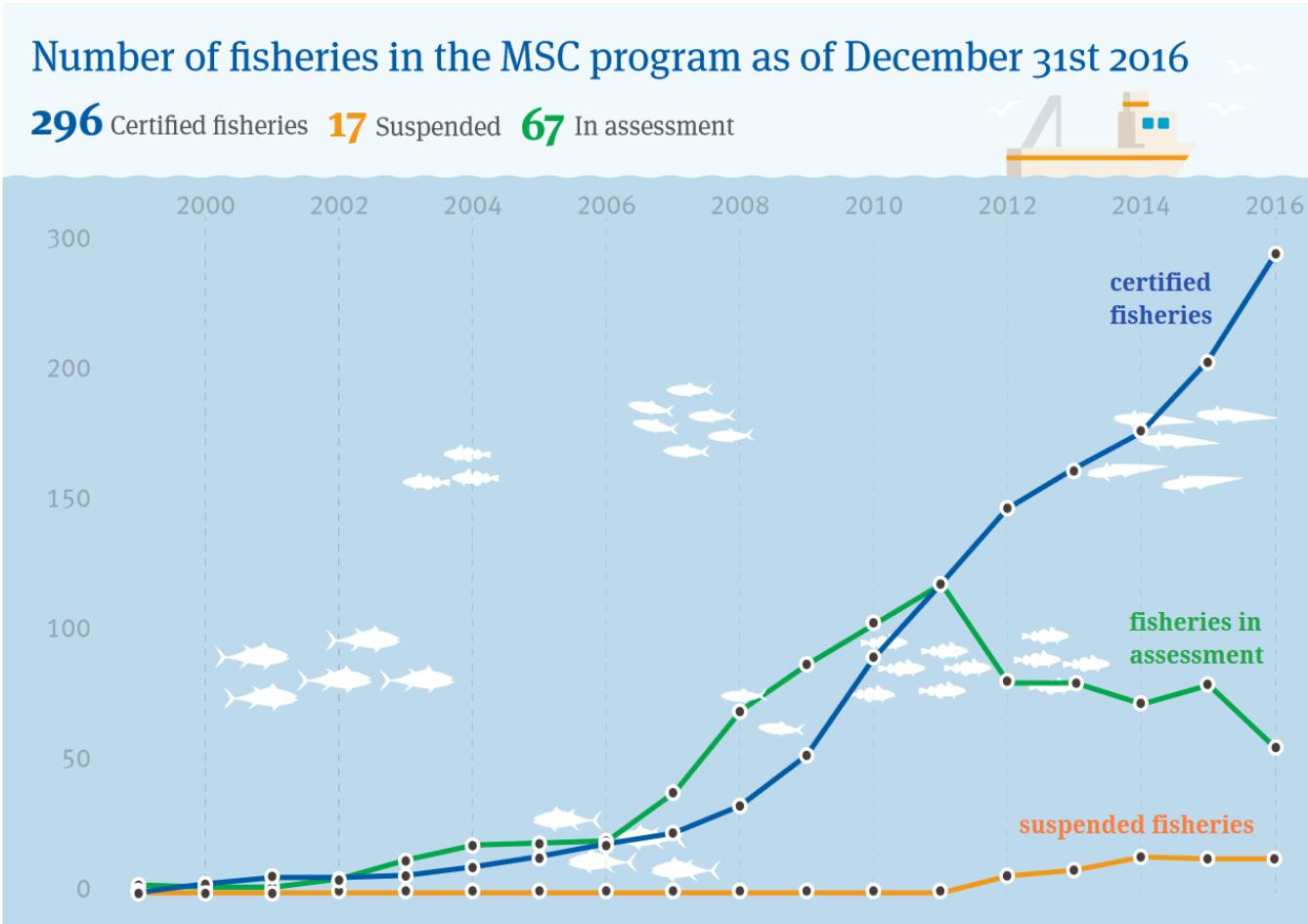
# Use Annotations



**100s**

of fisheries are  
not yet ready for  
assessment and  
are engaged in  
pre-assessment  
activities and FIPs

# Use Annotations

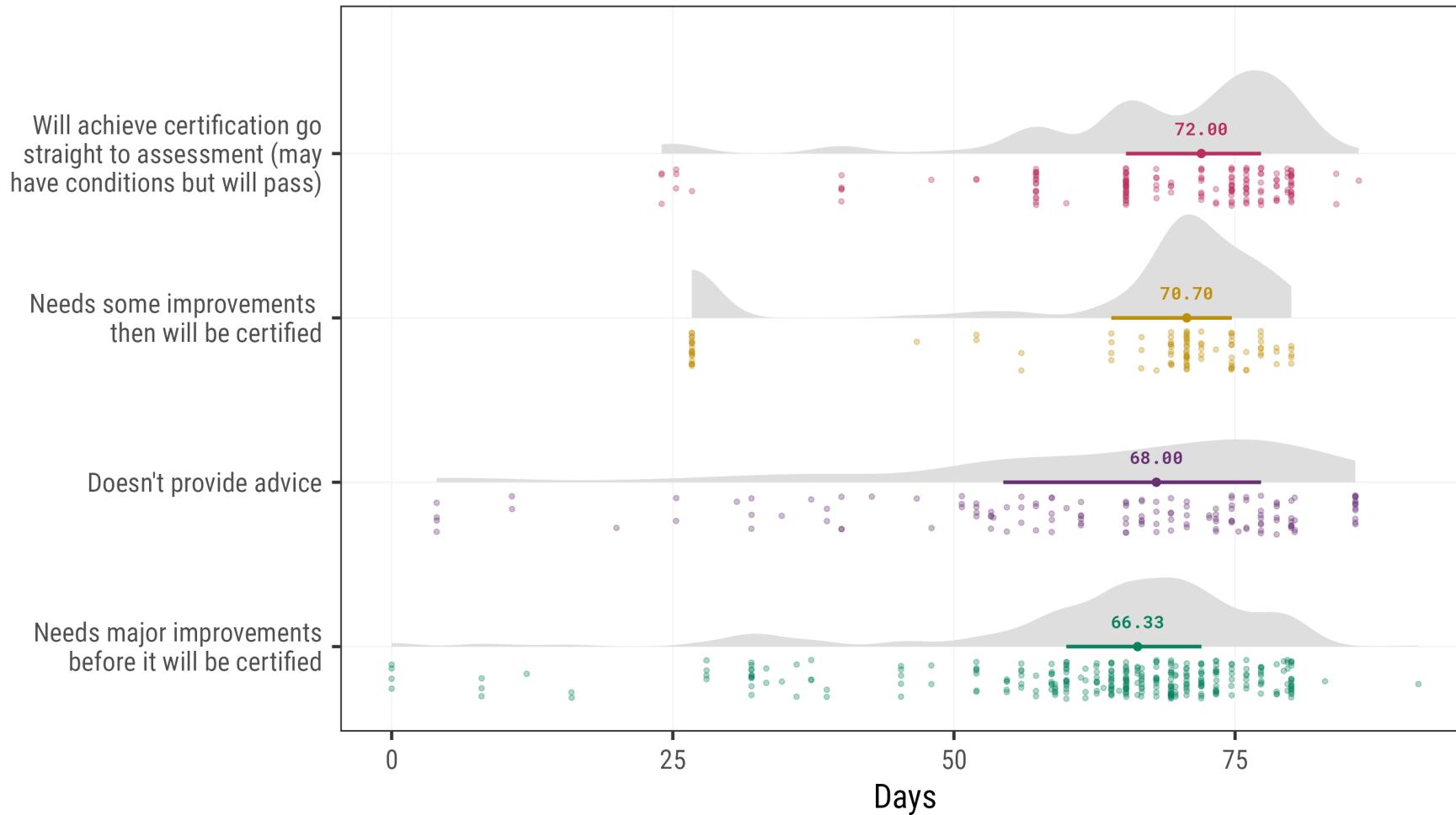


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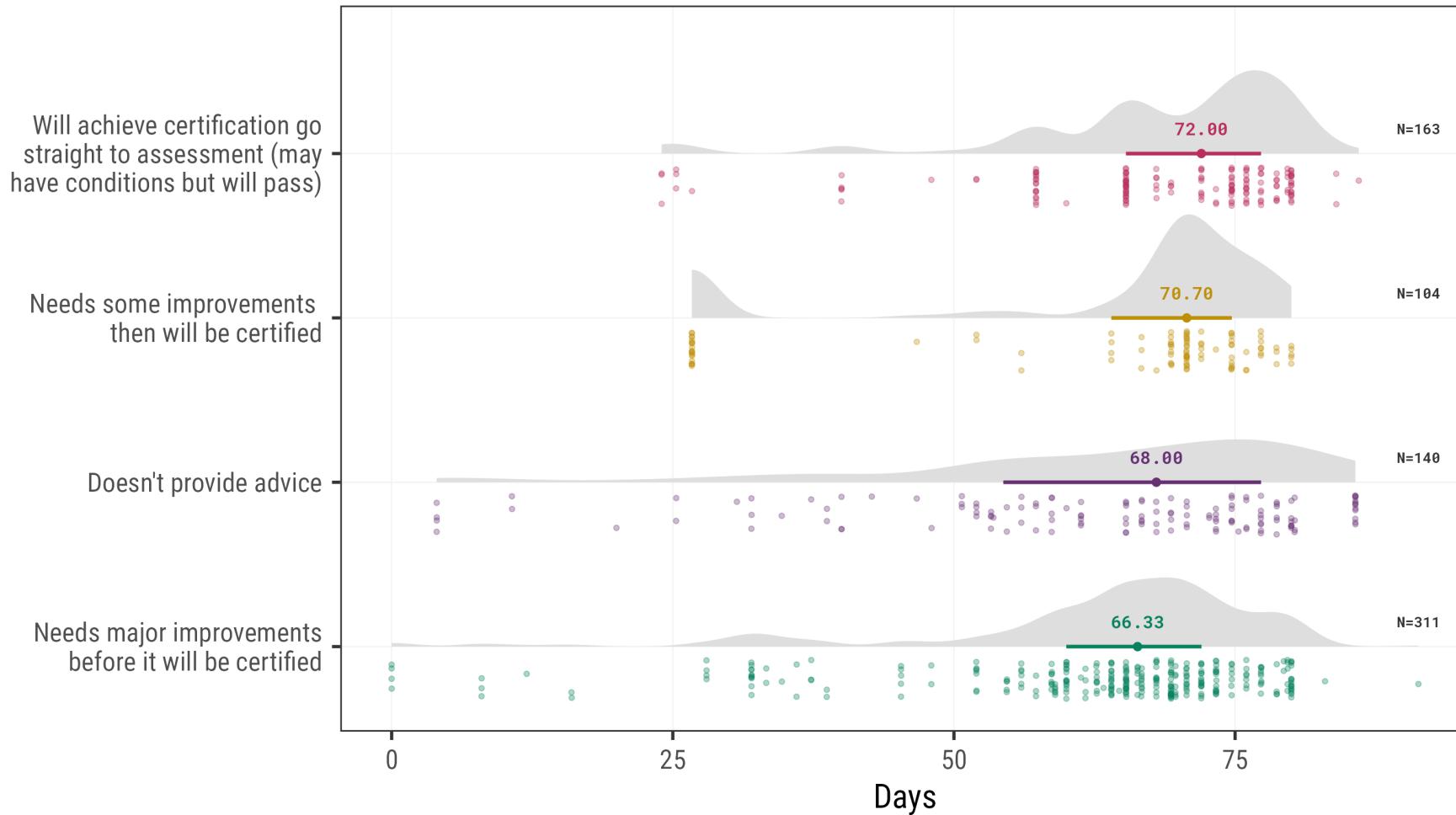
# Use Annotations

P2 Score (combined)



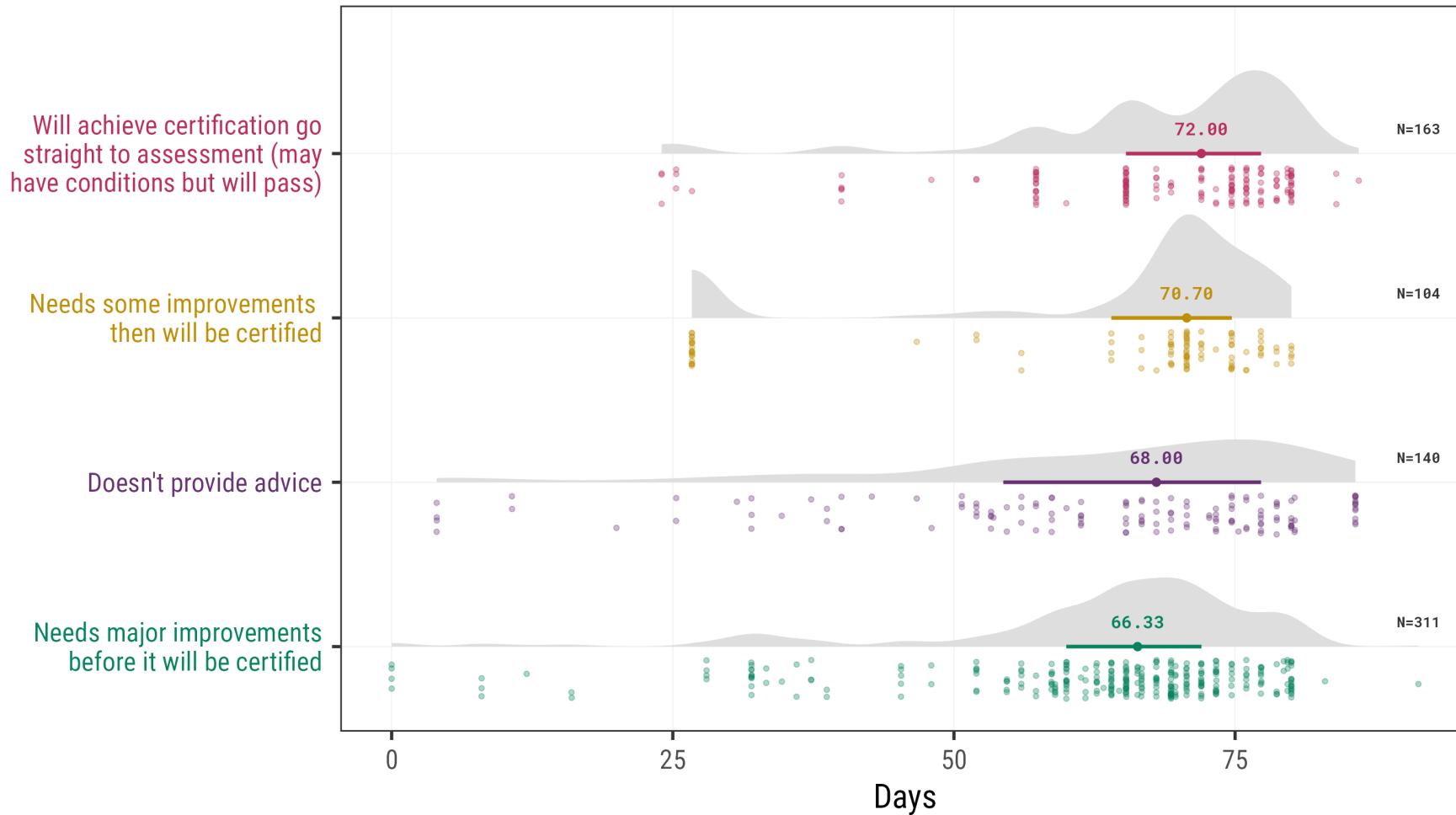
# Use Annotations

P2 Score (combined)



# Use Color Consistency in Labels

P2 Score (combined)

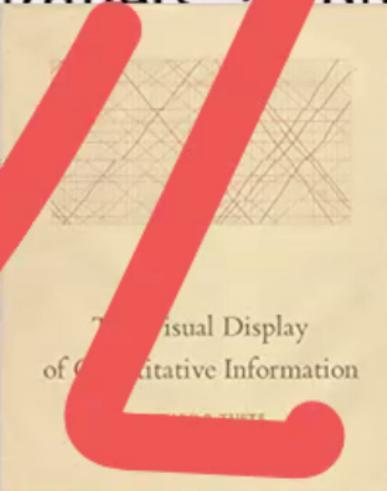


# Chart Design Principles

Graphical integrity is more likely to result if these six principles are followed:

The presentation of numbers or physically measured on the surface of the graphic itself should be directly proportional to the numerical quantities.

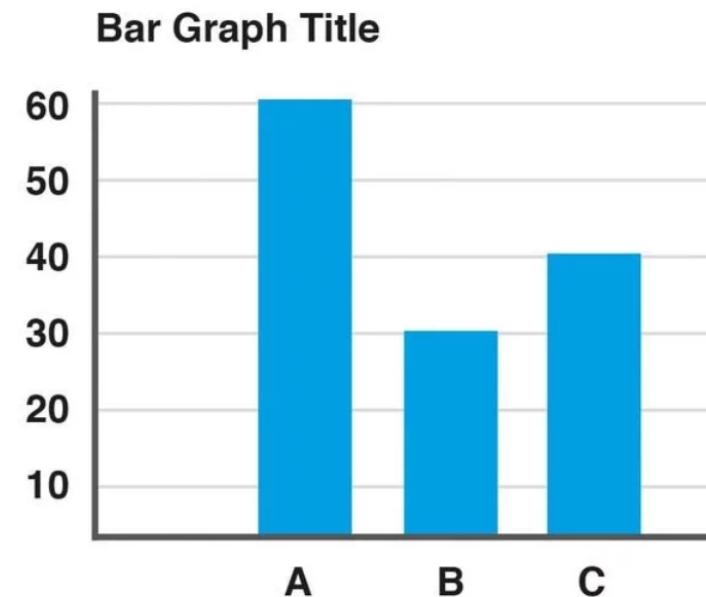
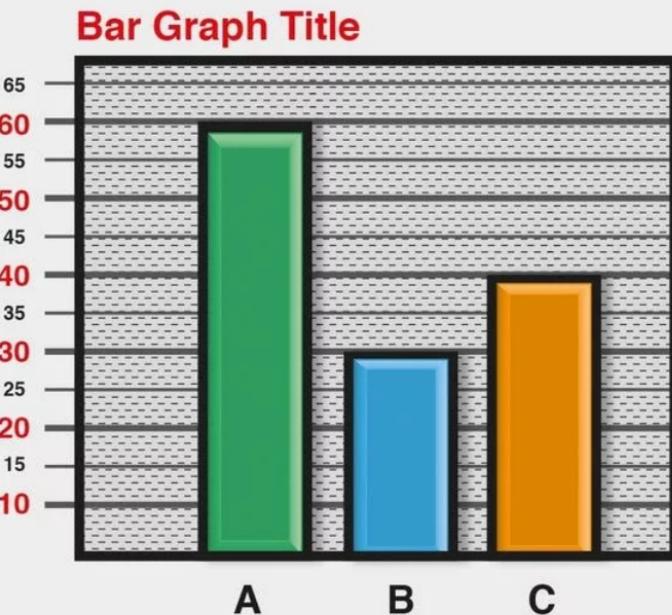
Clear, detailed, and color-coded legends should be used to defeat graphical distortion and the data on the graphic itself. Label important events in the data.

The image shows the front cover of a book titled "The Visual Display of Quantitative Information" by Edward R. Tufte. The cover is light beige with a grid pattern. The title and author's name are printed in a small, serif font at the top. Below the title, there is some smaller text and a copyright notice.

Show data variation, not design variation.

In time-series displays of money, deflated and standardized units

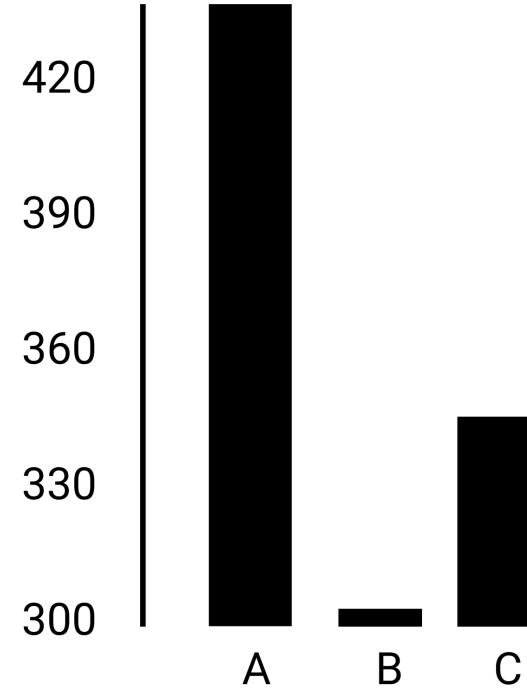
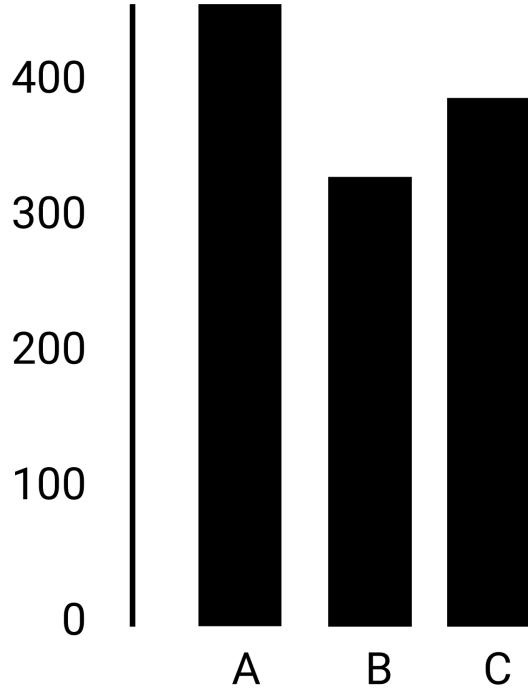
# Don't Clutter Your Plot



*Source: canva.com*

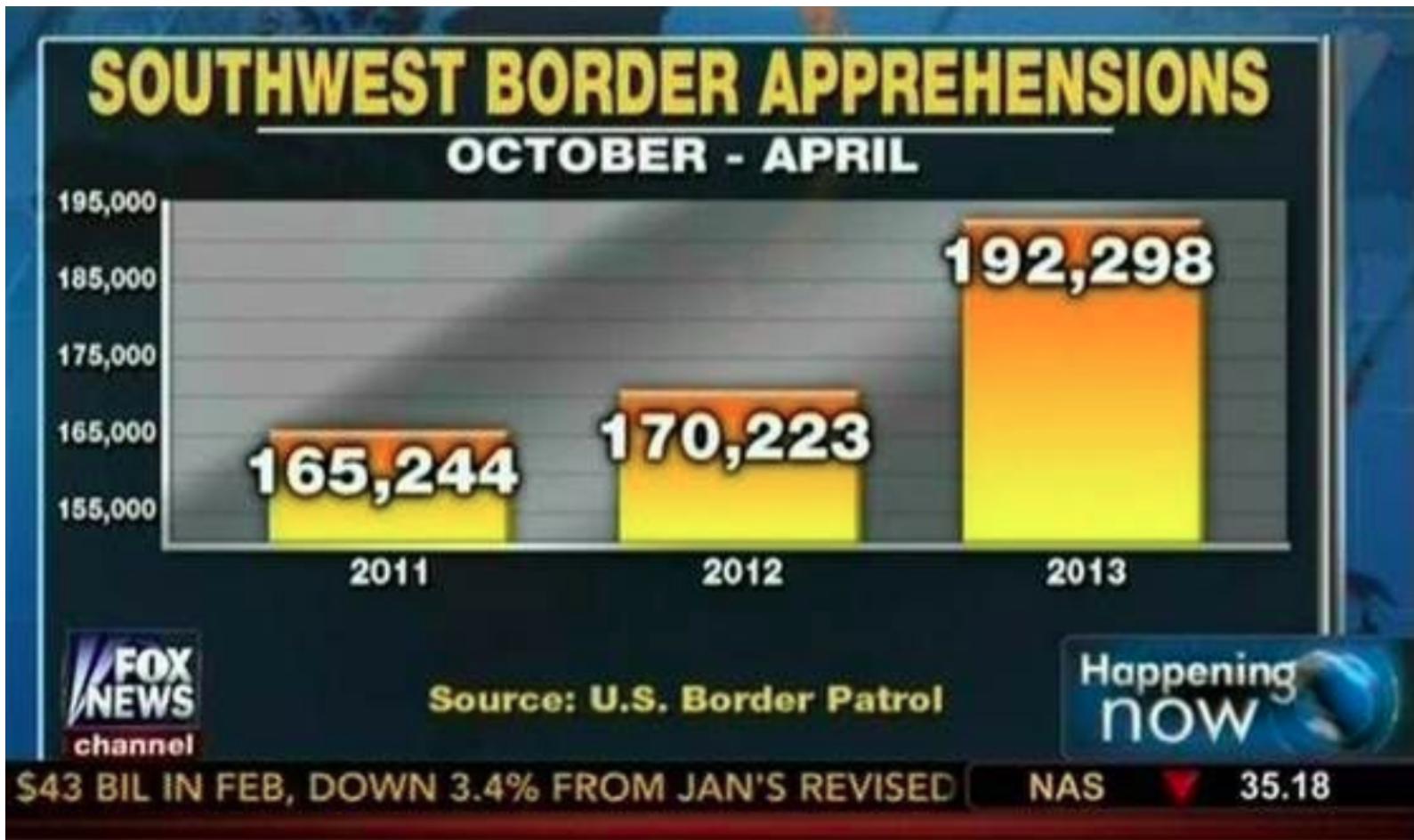
**Remove**  
to improve  
(the **data-ink** ratio)

# Start at Zero



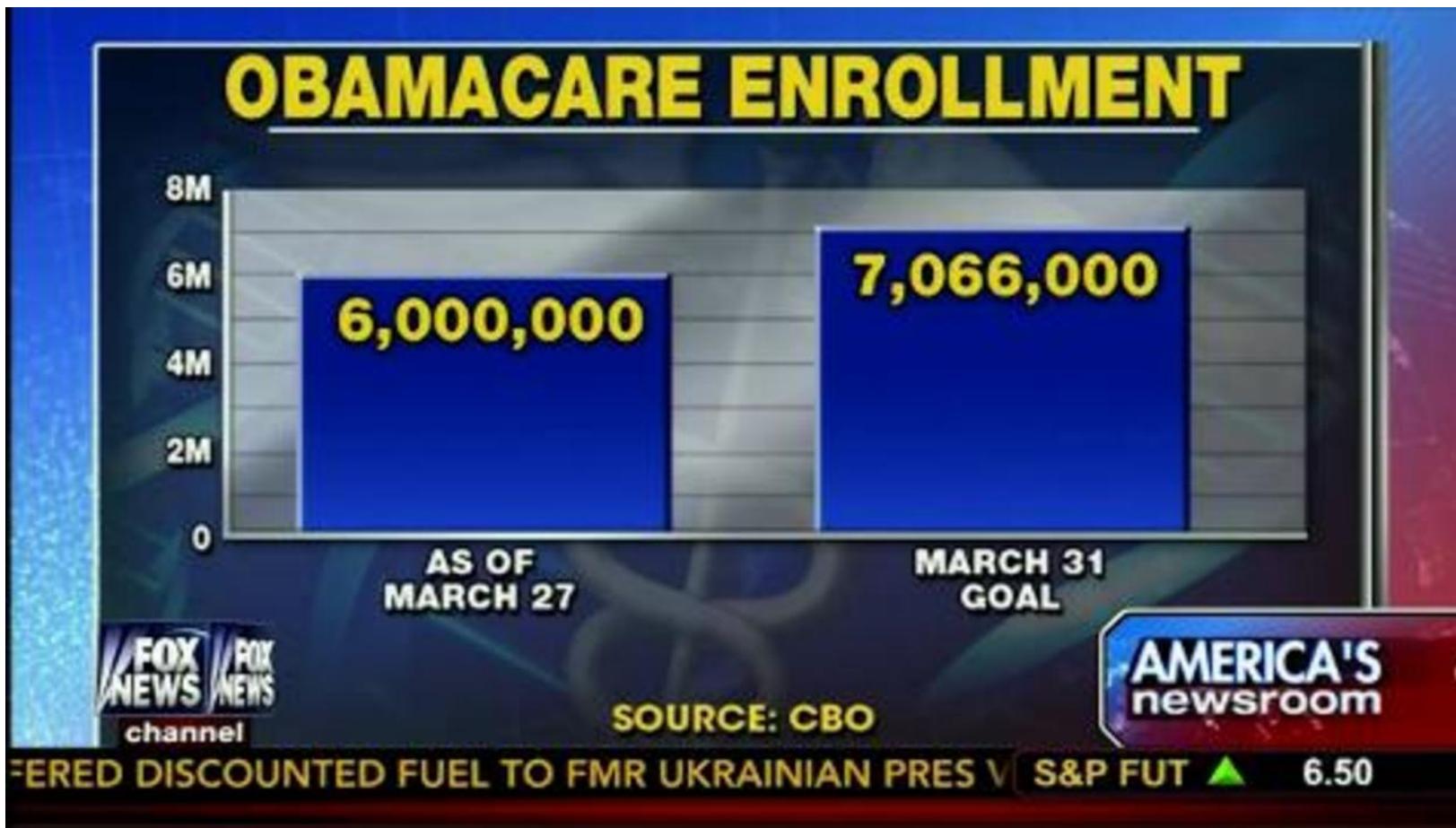
*“Hands-On Data Visualization” by Jack Dougherty & Ilya Illyankou*

# Always Start at Zero



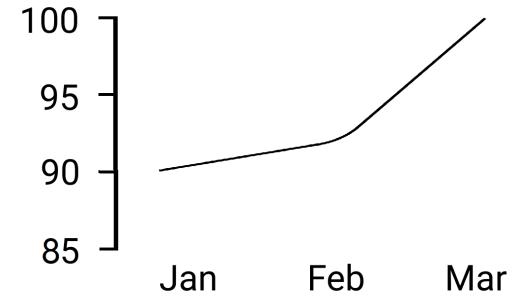
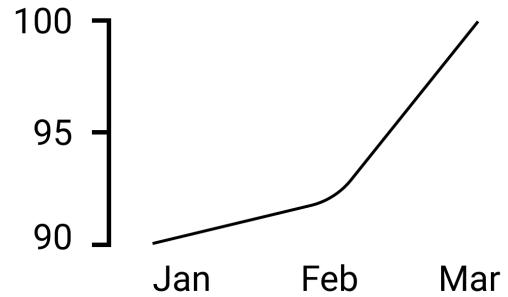
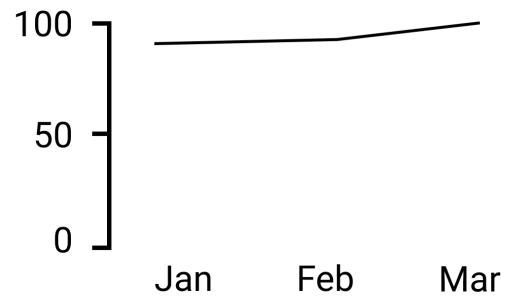
Fox News

# Always Start at **Zero**?



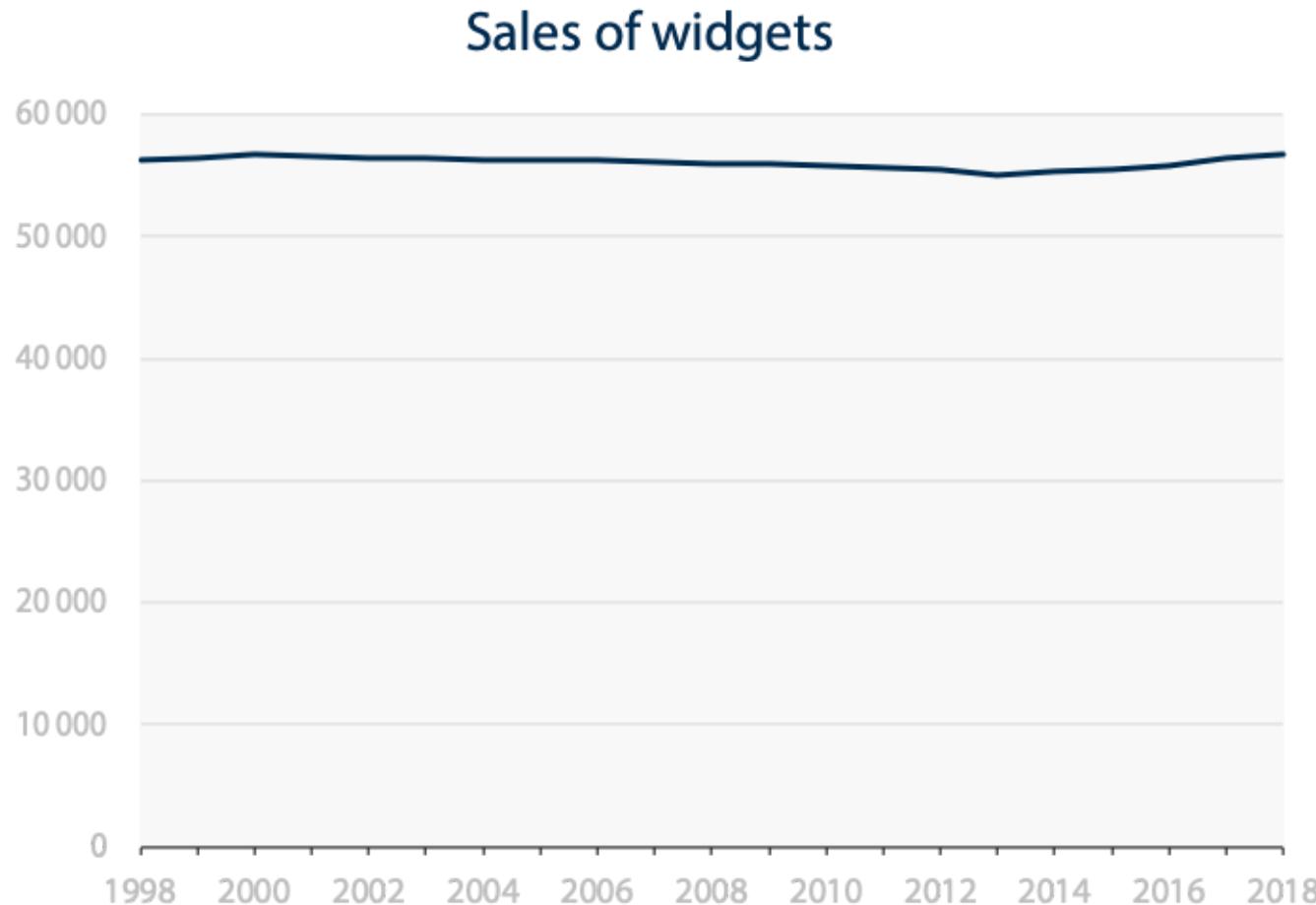
Fox News

# (Always) Start at Zero?



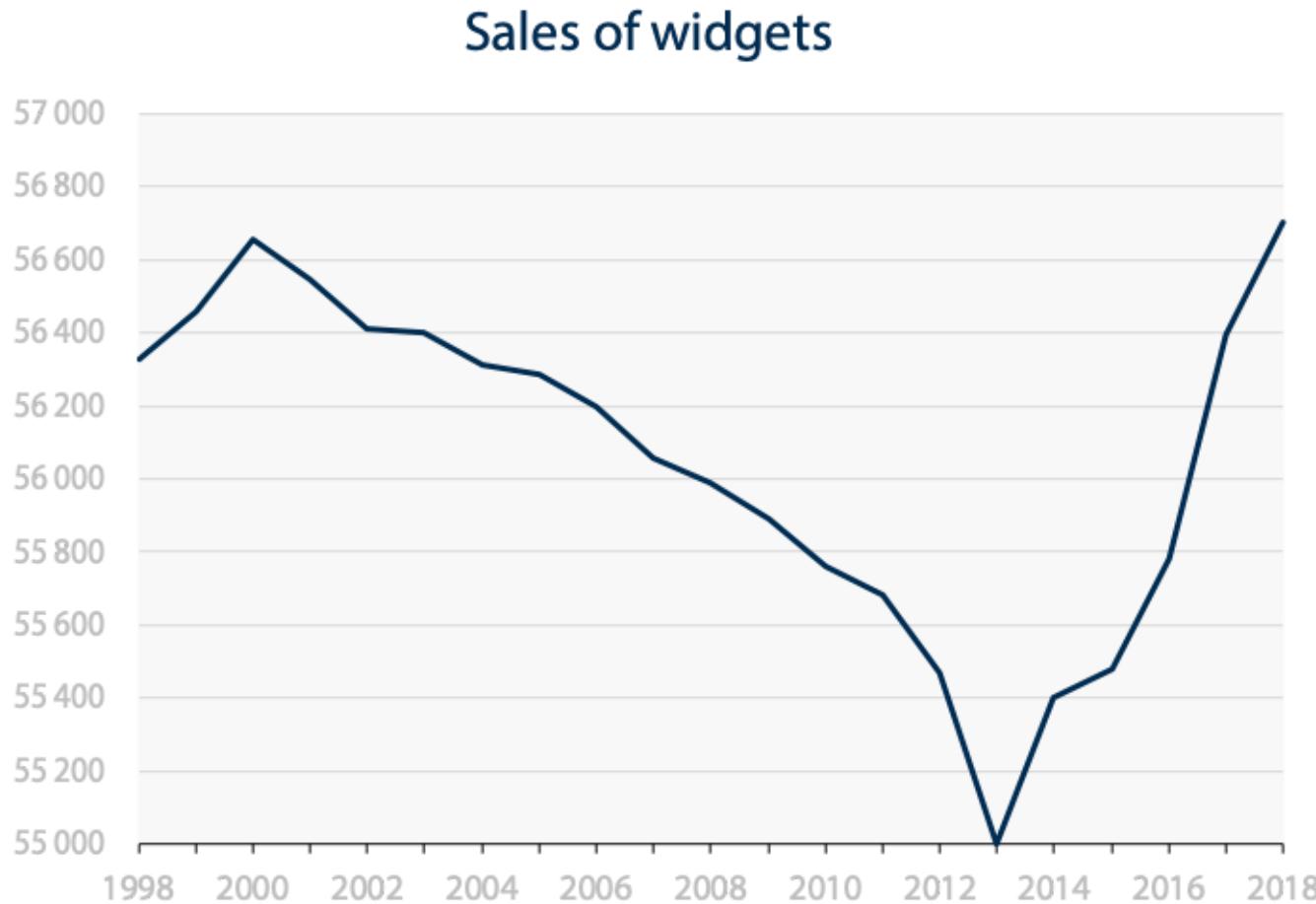
*“Hands-On Data Visualization” by Jack Dougherty & Ilya Illyankou*

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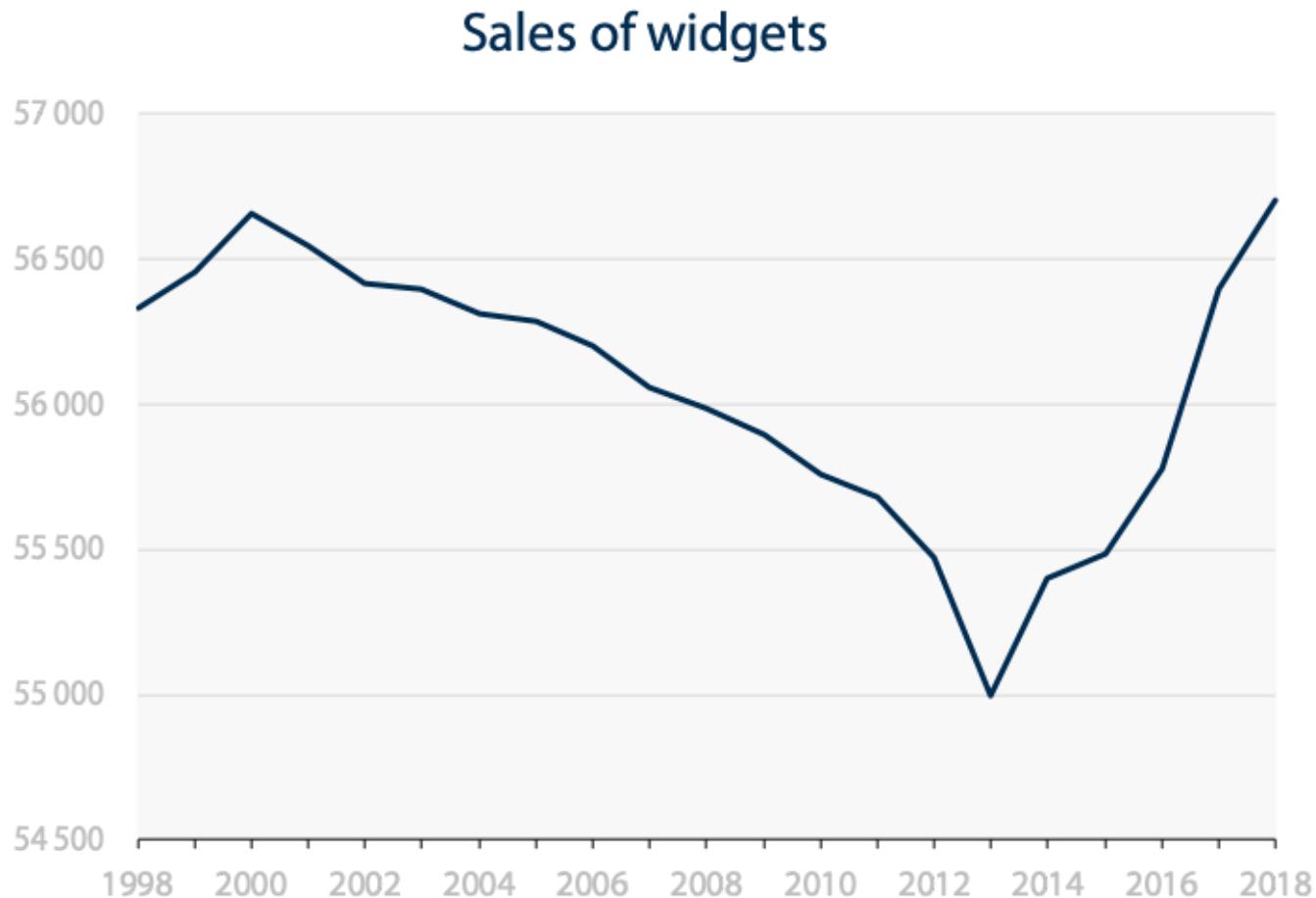
*Francis Gagnon, Voilà*

# (Always) Start at Zero?



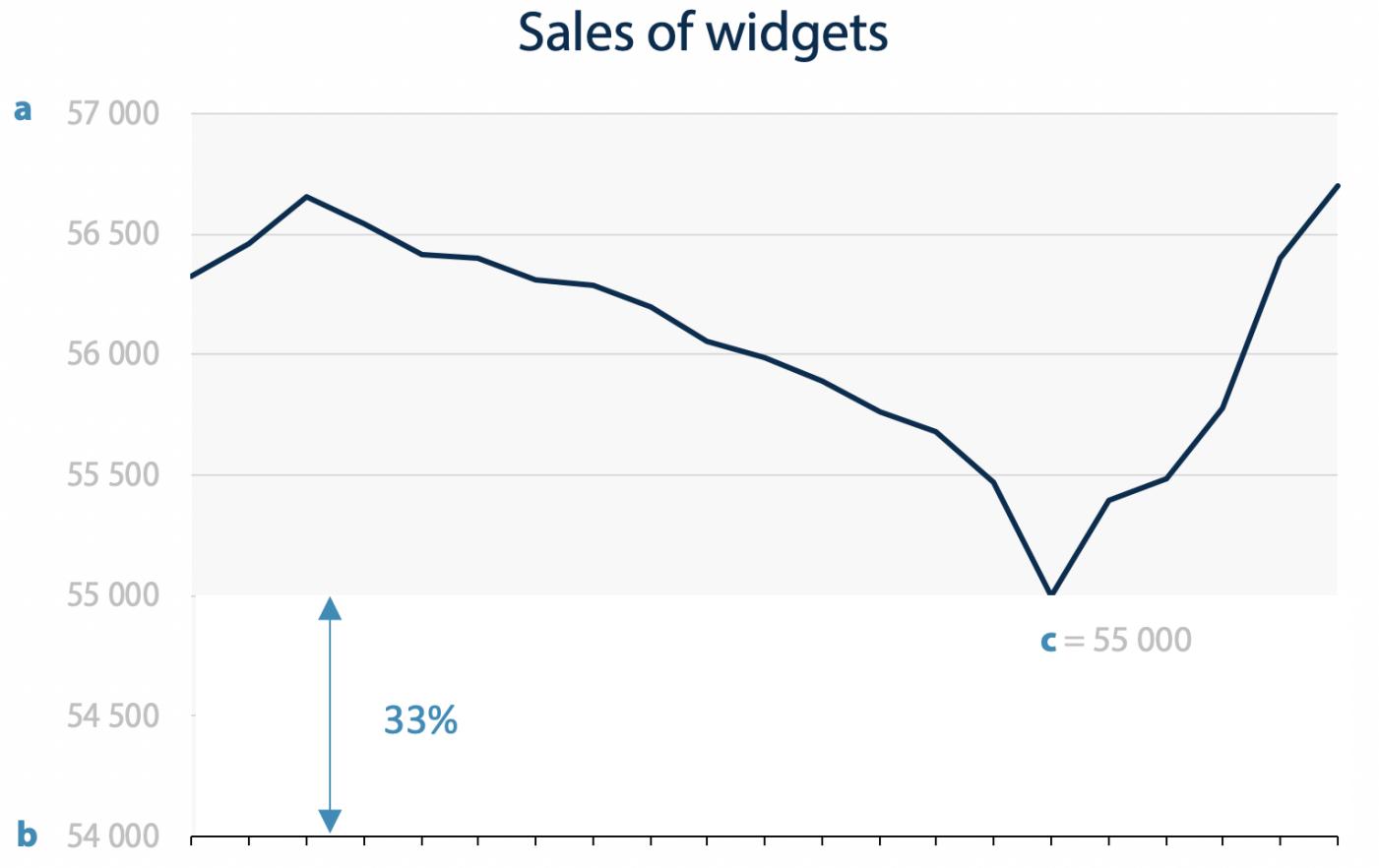
Francis Gagnon, Voilà

# The Golden Ratio



*Francis Gagnon, Voilà*

# The Golden Ratio



*Francis Gagnon, Voilà*

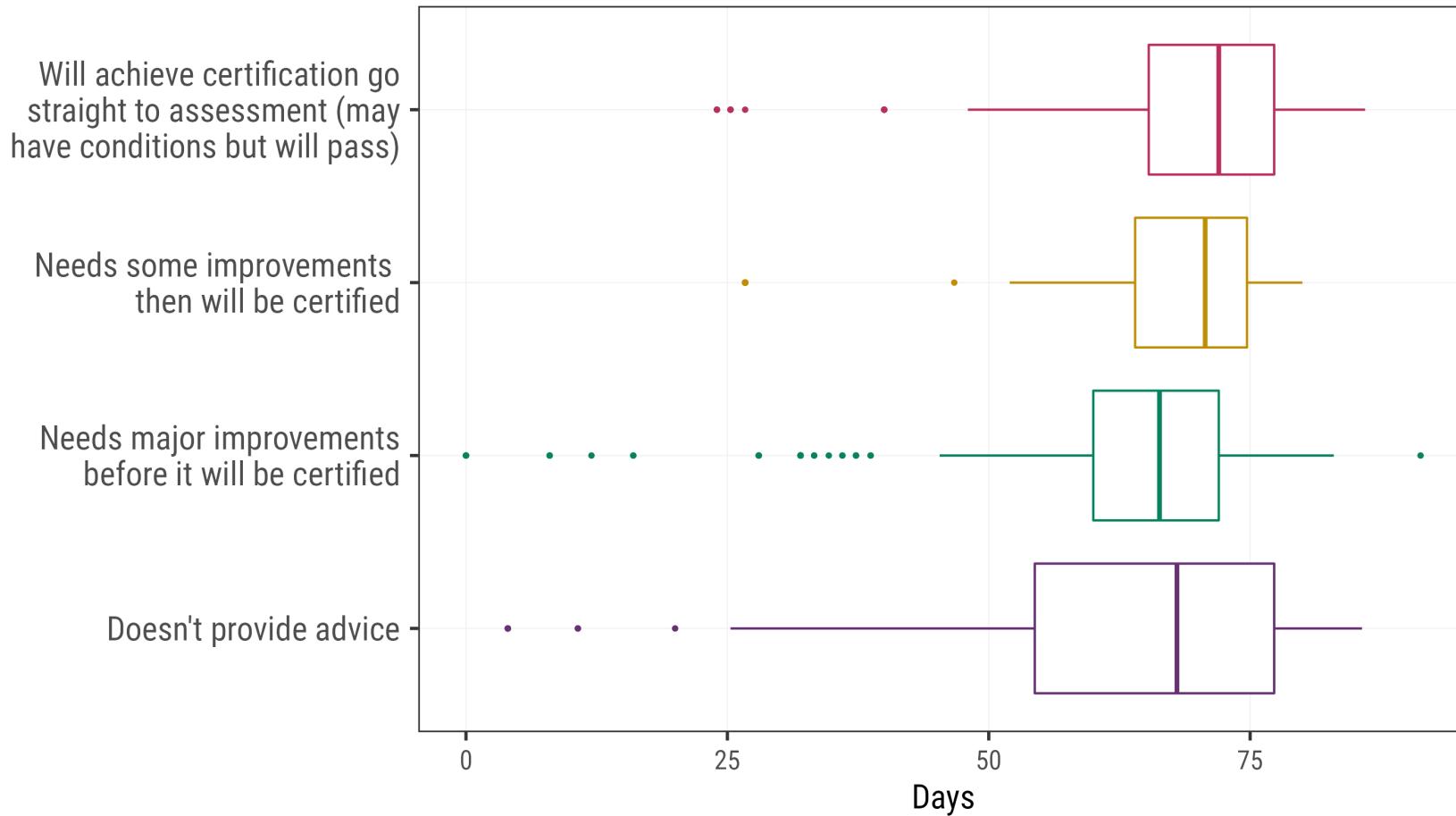
# Order Your Data



*“Hands-On Data Visualization” by Jack Dougherty & Ilya Illyankou*

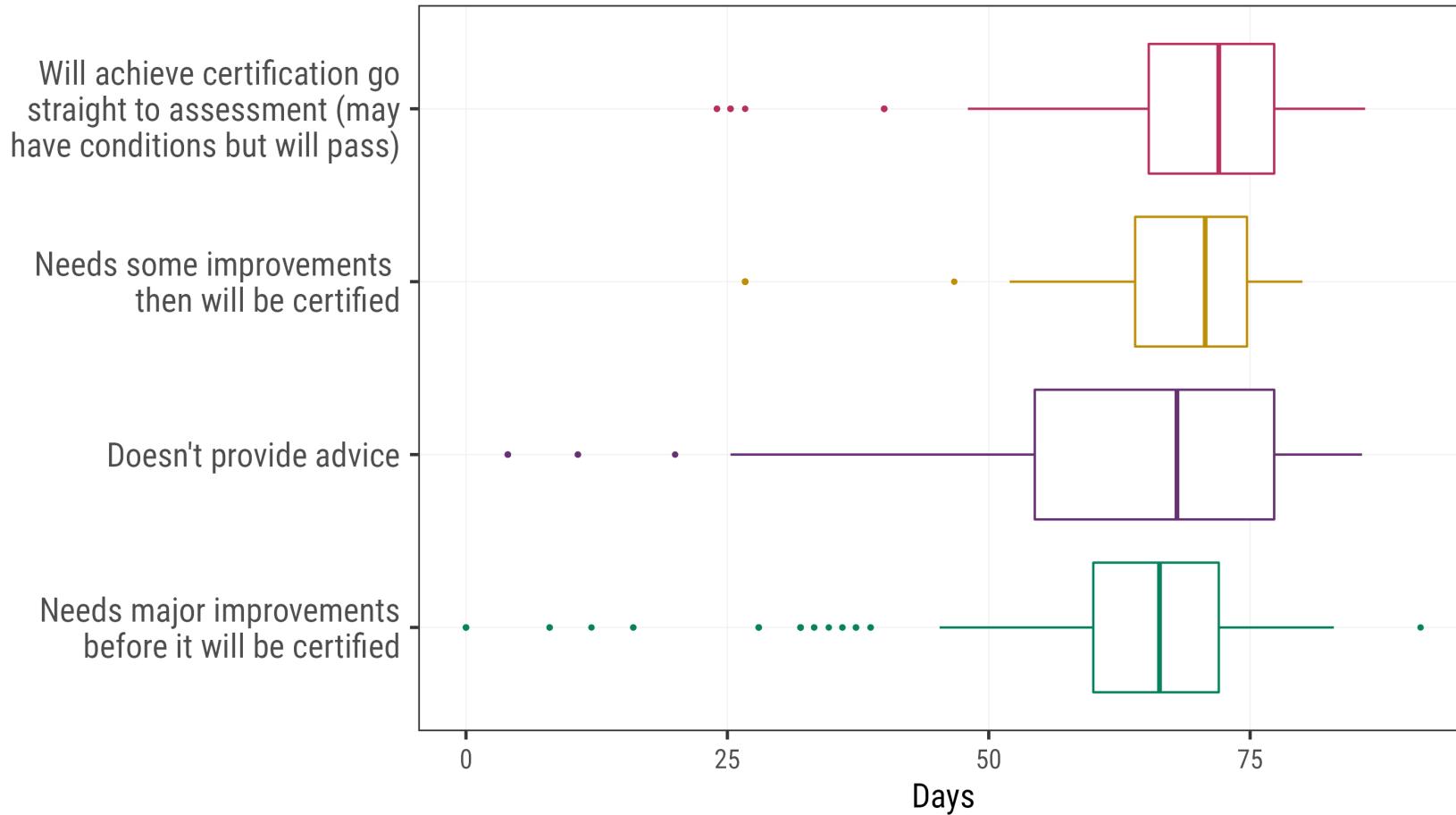
# Order Your Data

P2 Score (combined)



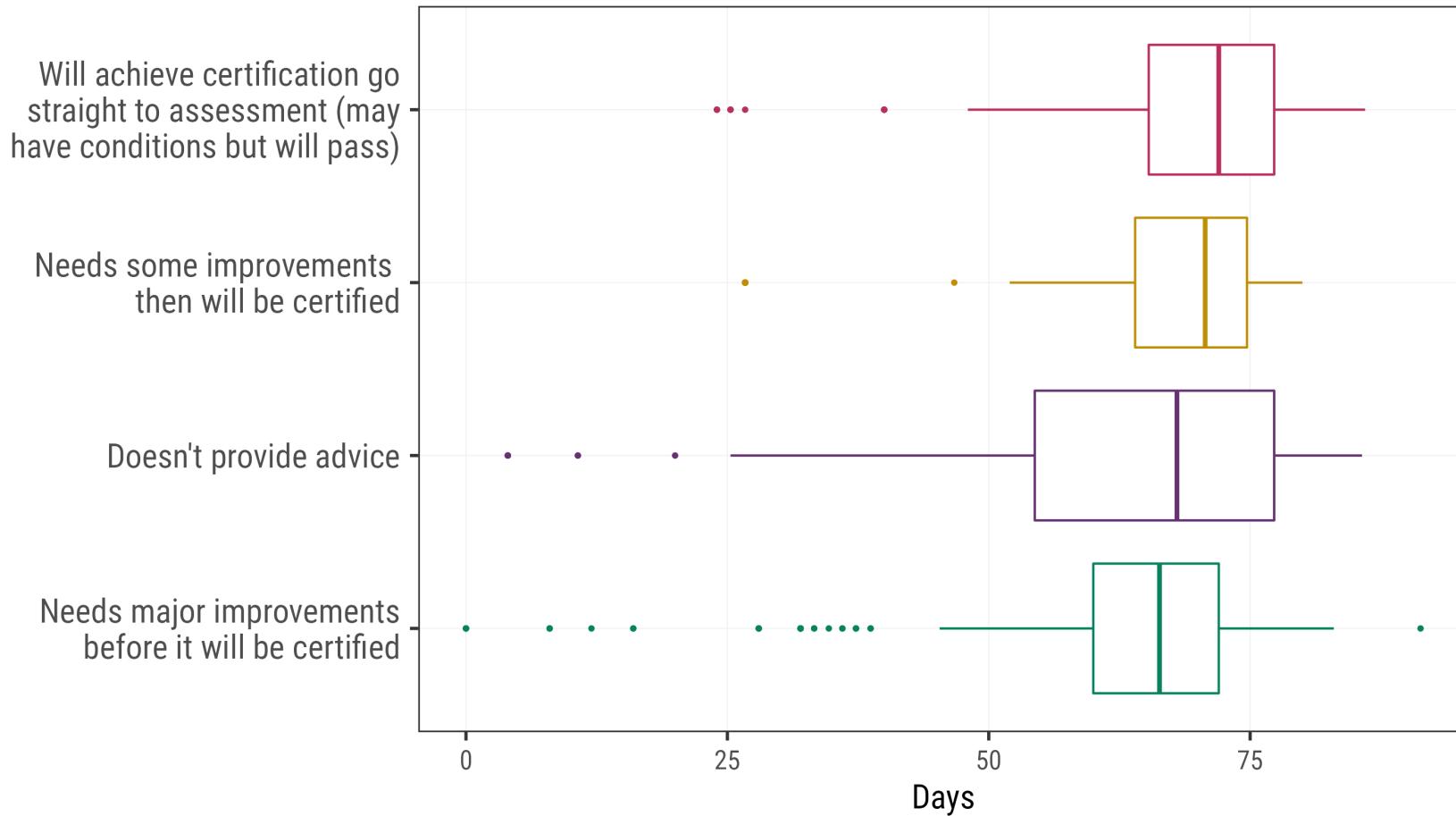
# Order Your Data

P2 Score (combined)



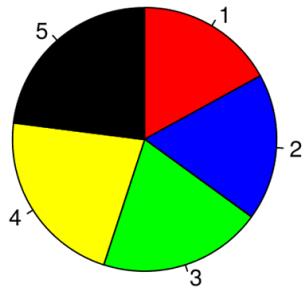
# Order Your Data

P2 Score (combined)

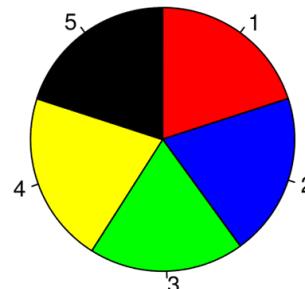


# Beware of Pie Charts (almost ever)

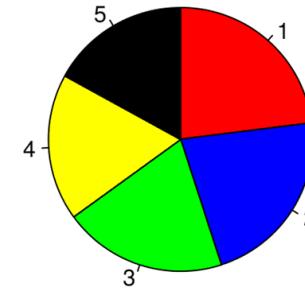
A



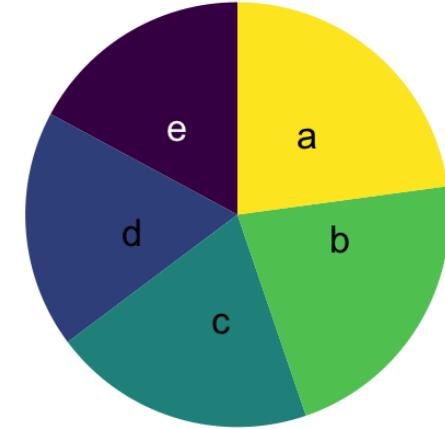
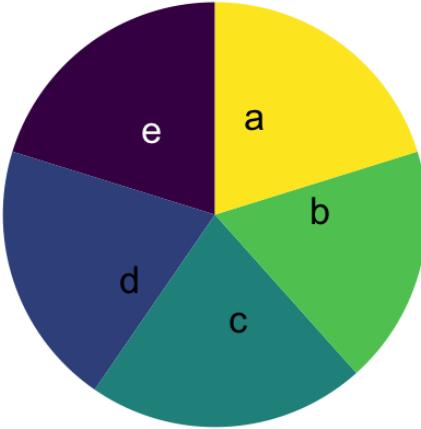
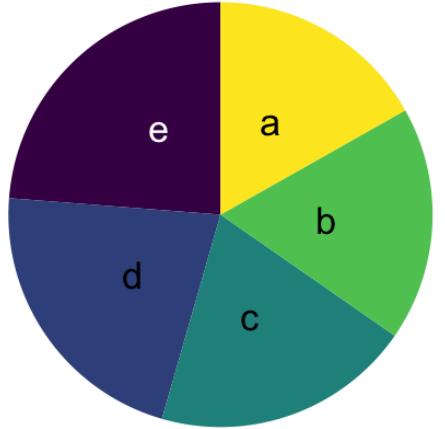
B



C

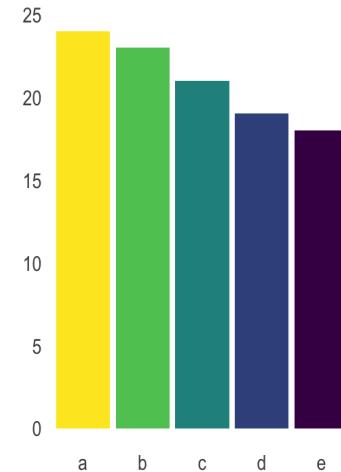
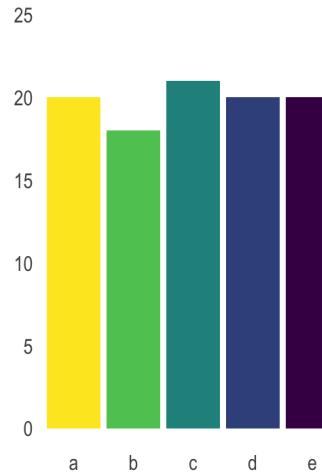
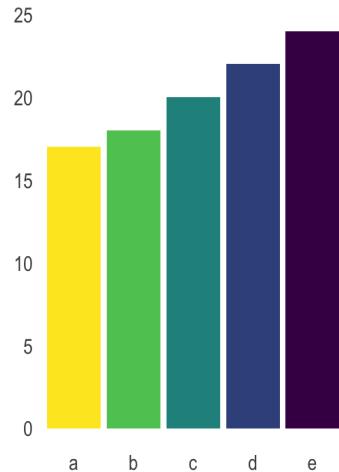
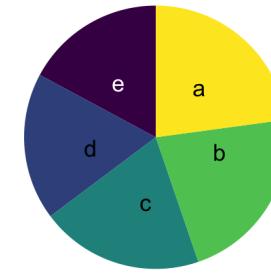
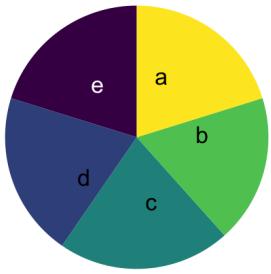
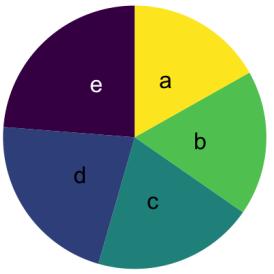


# Beware of Pie Charts (almost ever)



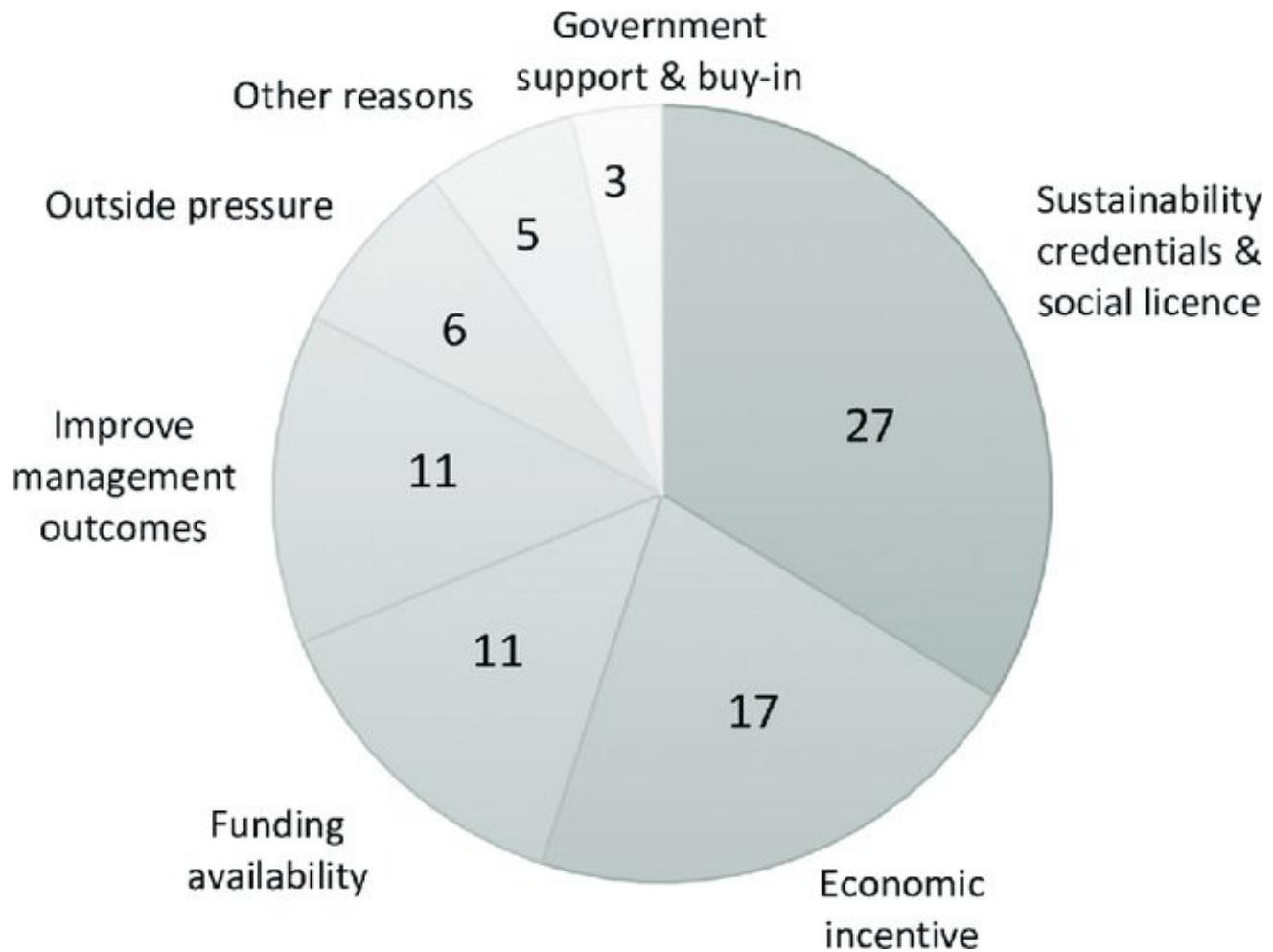
*From Data to Viz*

# Beware of Pie Charts (almost ever)

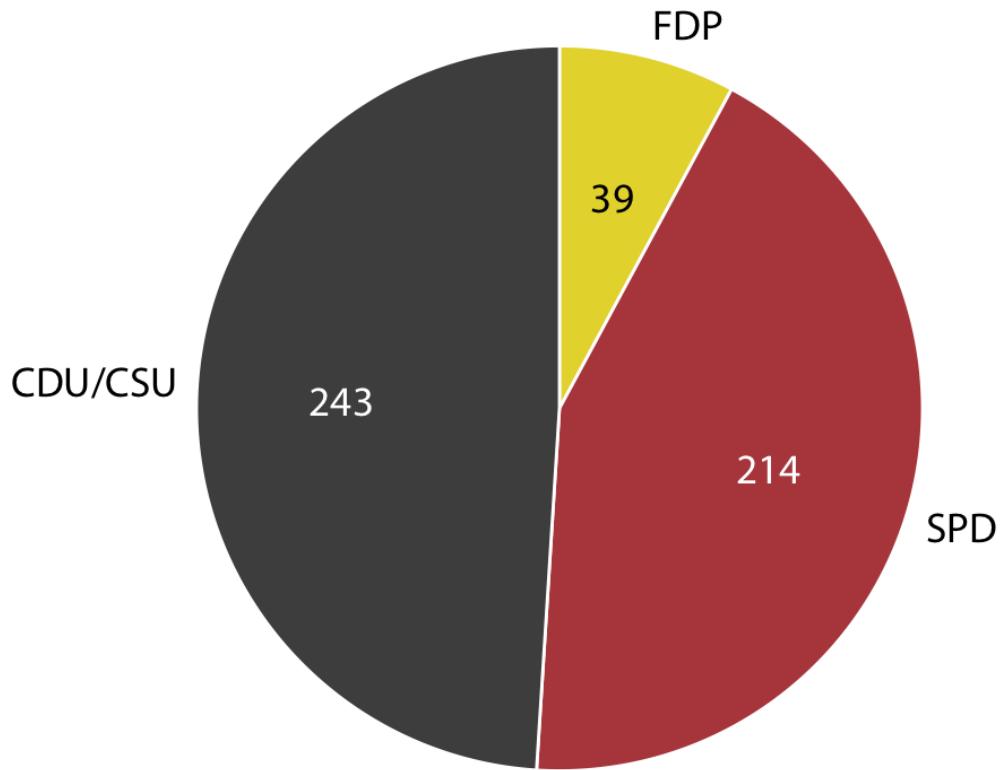


*From Data to Viz*

# Beware of Pie Charts (almost ever)

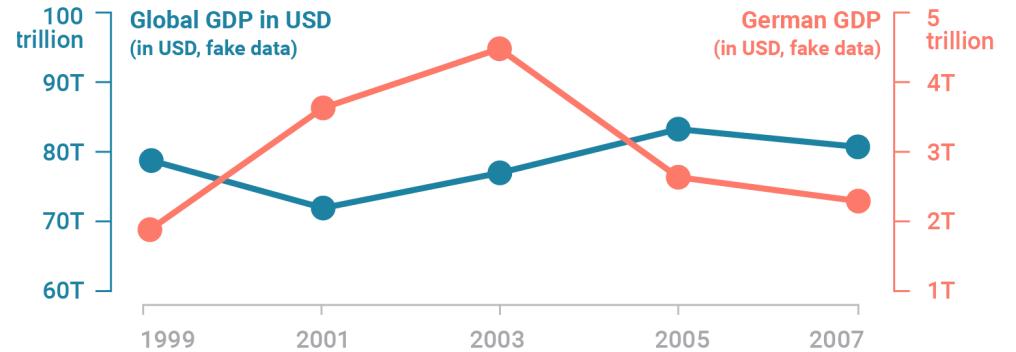


# An Use Case for a Pie Chart



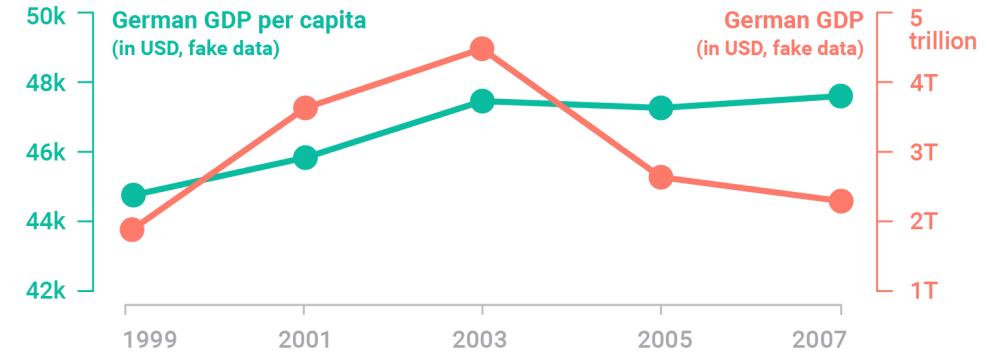
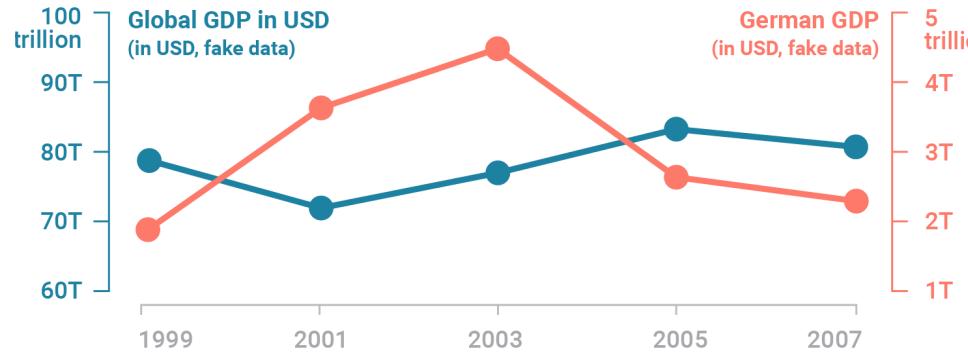
*“Fundamentals of Data Visualization” by Claus Wilke*

# Avoid Dual Axes



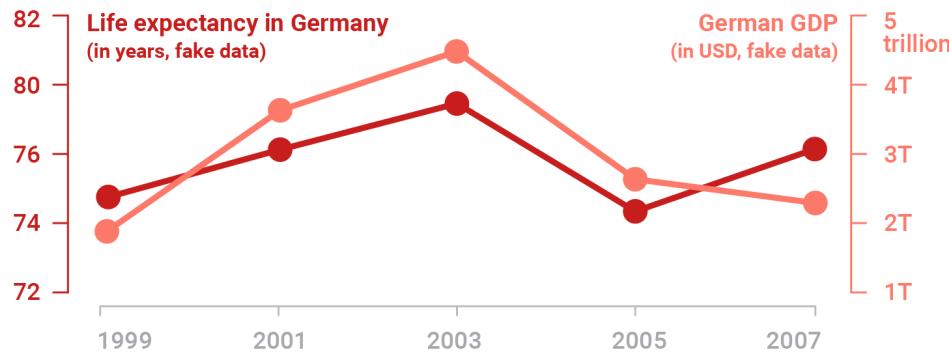
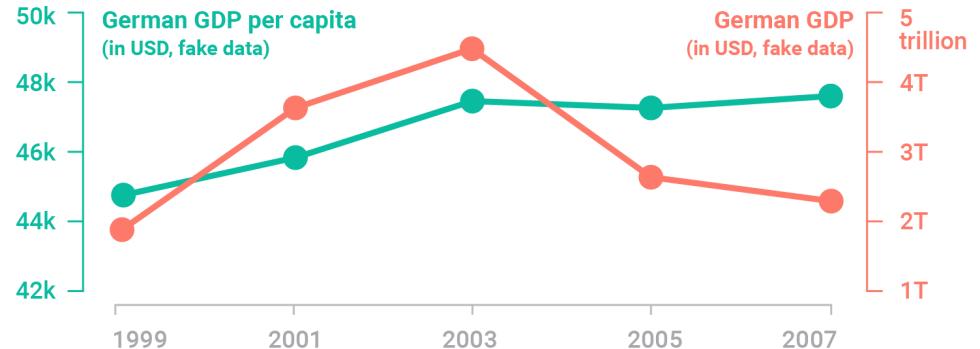
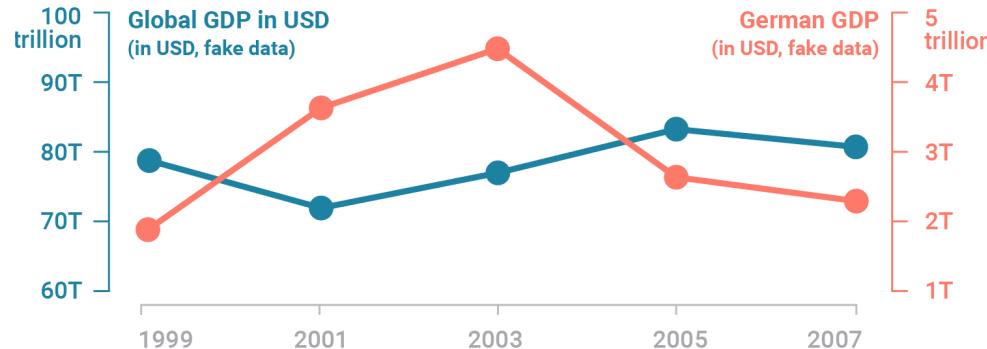
*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

# Avoid Dual Axes



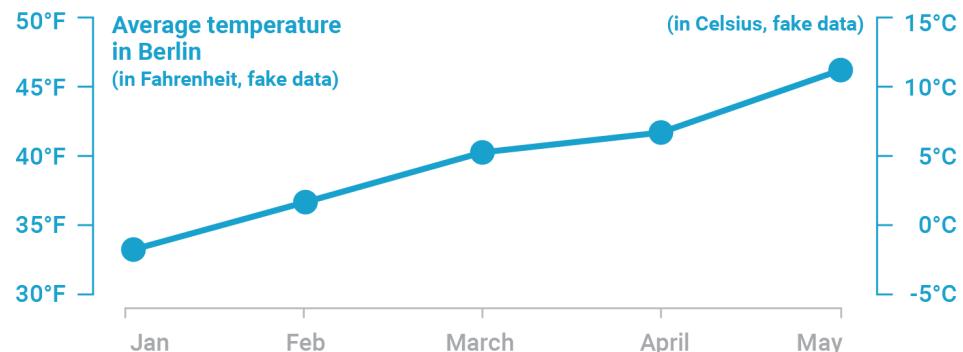
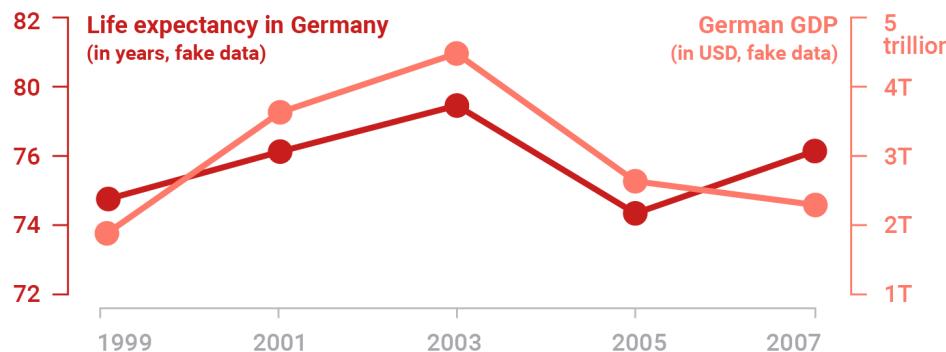
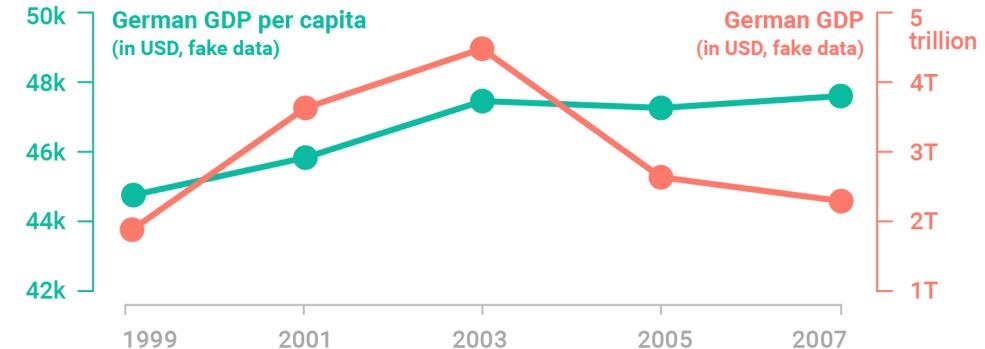
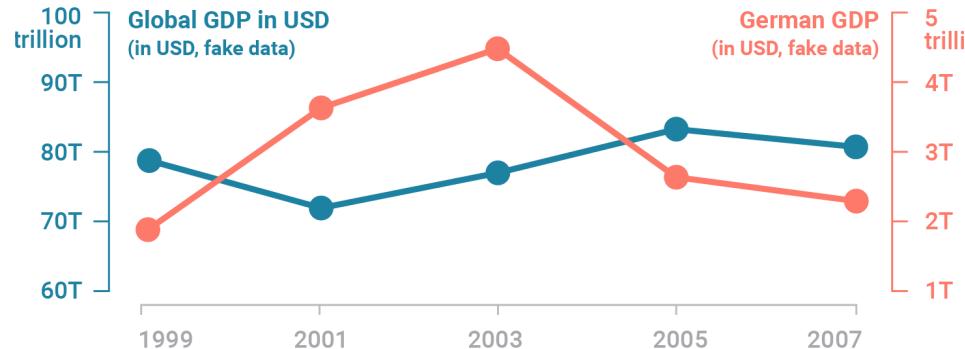
*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

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*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

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*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

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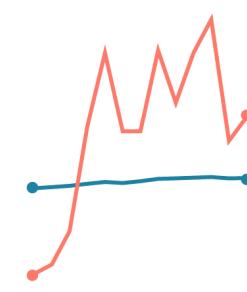


*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

# Avoid Dual Axes



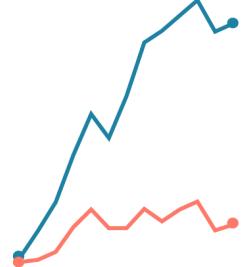
Orange steady,  
Blue massively increasing.



Blue steady,  
Orange increasing.



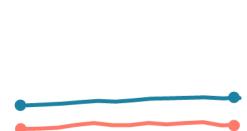
Both started at the same  
level, but Orange increased  
far more than Blue.



Both started at the same  
level, but Blue increased far  
more than Orange.



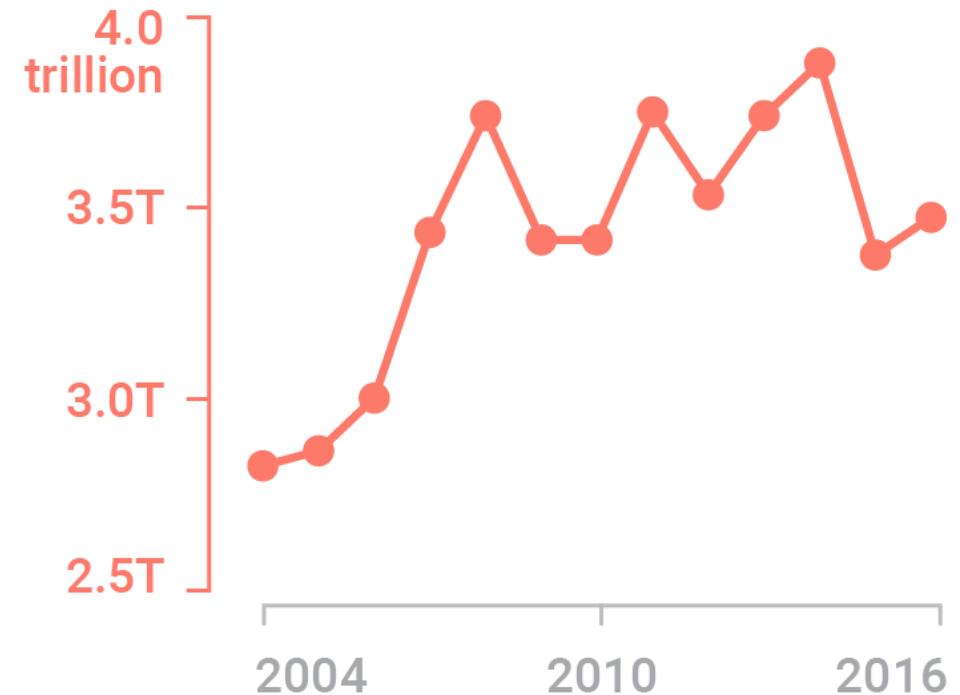
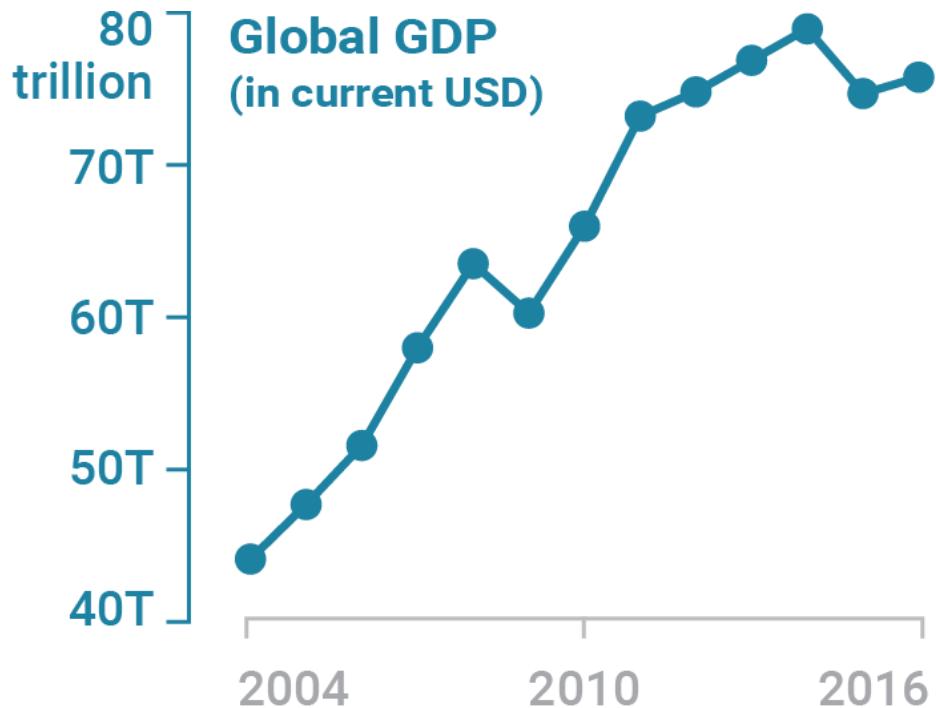
Both started with the  
same increase, then Blue  
raced to the top.



Both steady.

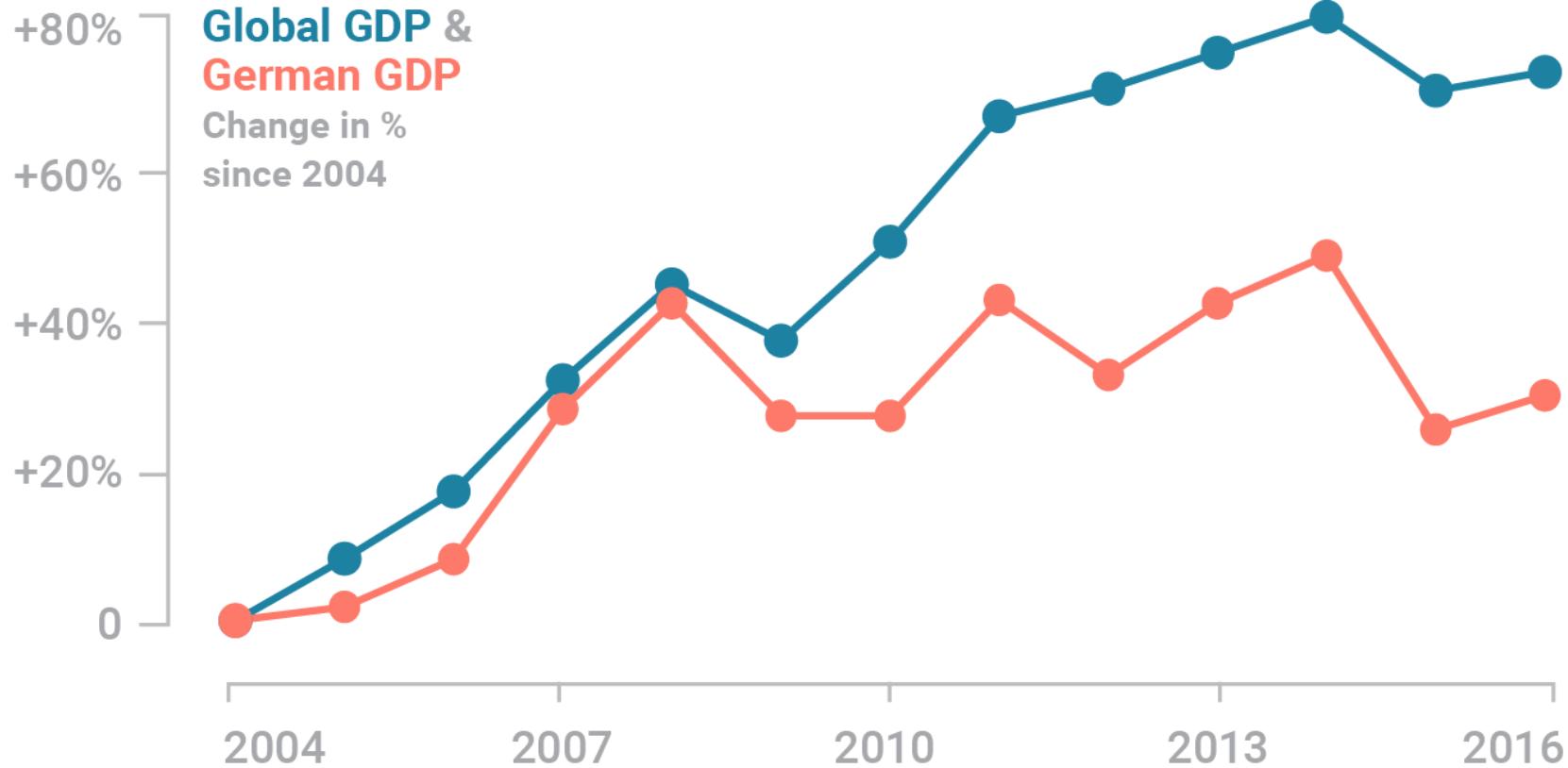
***Why not to use two axes, and what to use instead*** by Lisa Charlotte Rost/DataWrapper

# Avoid Dual Axes



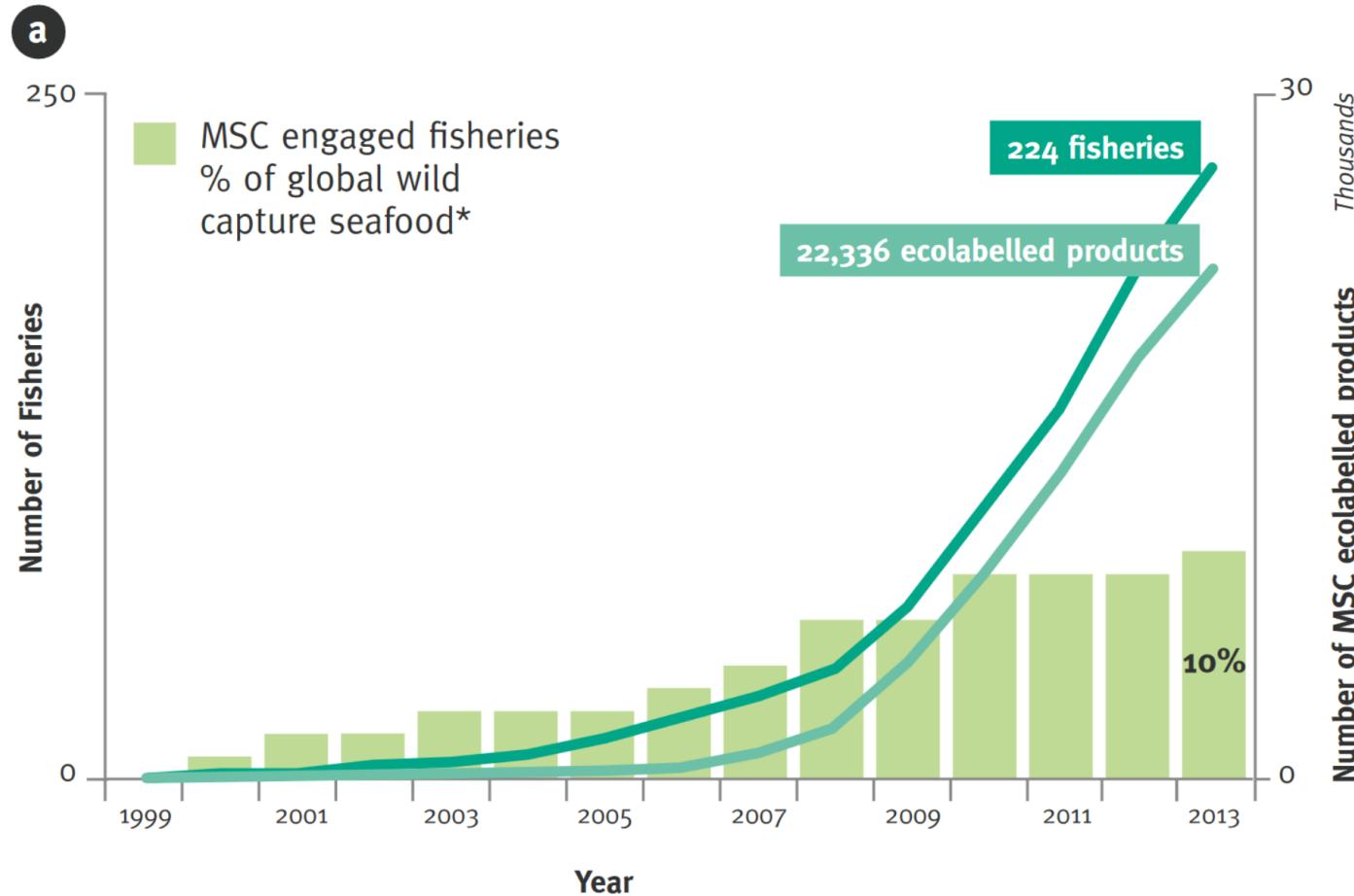
*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

# Avoid Dual Axes

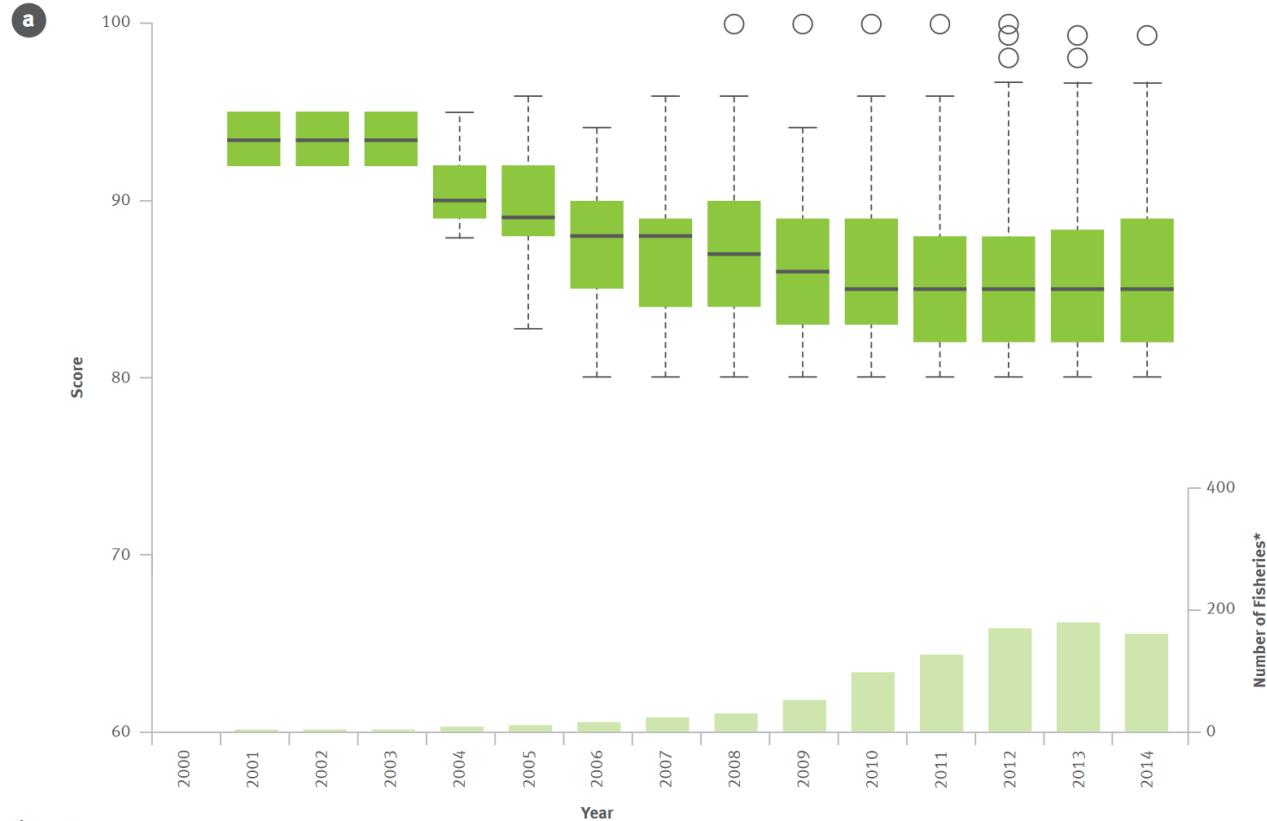


*Why not to use two axes, and what to use instead* by Lisa Charlotte Rost/DataWrapper

# Avoid Dual Axes



# Avoid Dual Axes



**Figure 1.1**

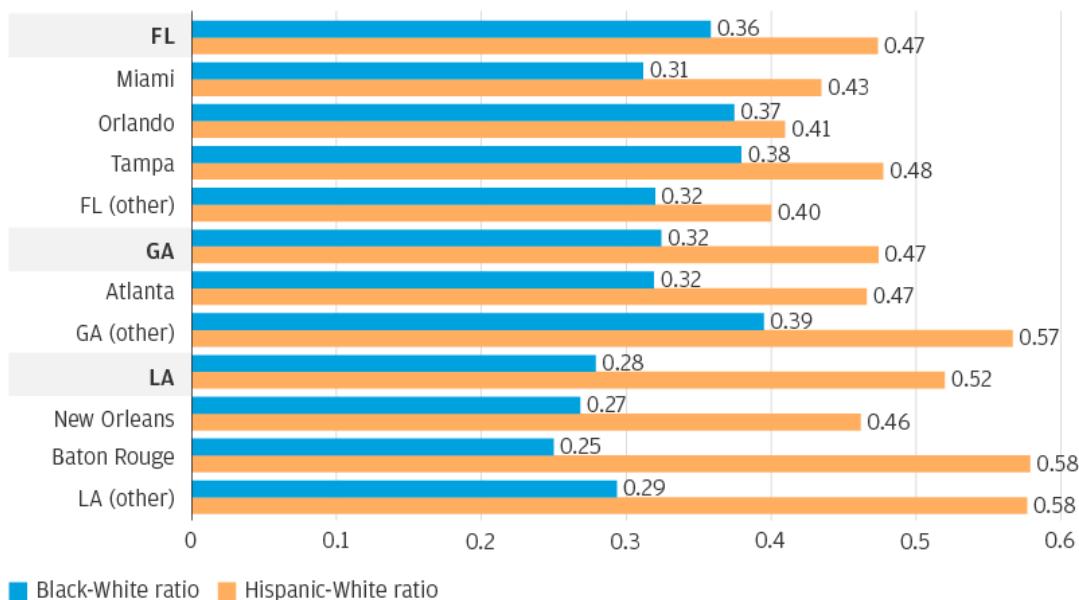
Figure 1.1 Median, interquartile range, and maximum and minimum scores of certified fisheries at time of certification (a) Principle 1: Sustainable fish stocks; (b) Principle 2: Minimising environmental impact; and (c) Principle 3: Effective management. Pale green bars represent the number of fisheries\* scored by year.

# RECAP

# How to improve this visualization?

**Finding Four:** Across geographies, the financial outcomes of Hispanic families vary the most, while the financial outcomes of Black families vary the least. Black-White gaps in financial outcomes are largest in Louisiana, while Hispanic-White gaps are largest in Florida.

Black-White and Hispanic-White ratios of annual median liquid assets (2018), by geography



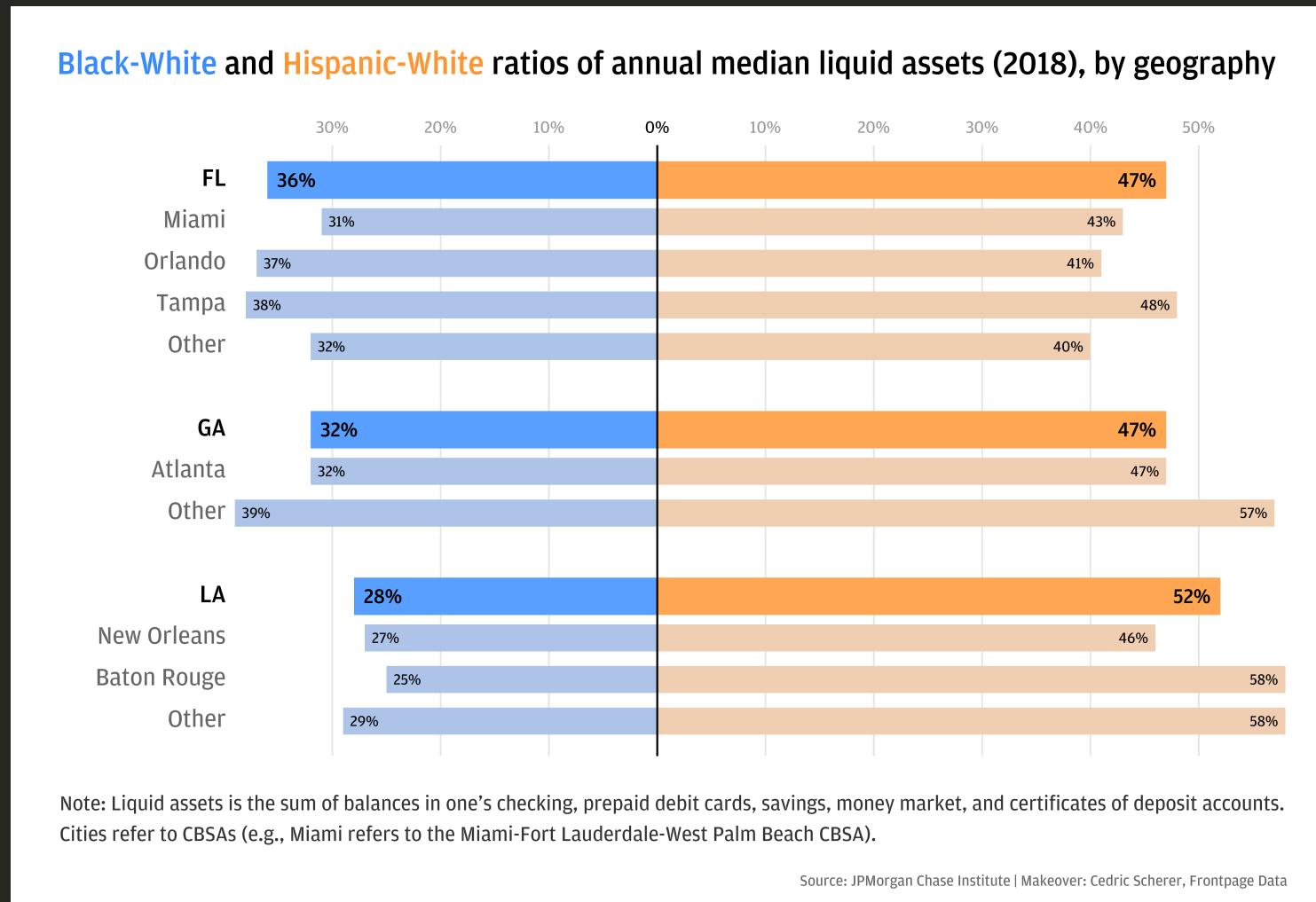
■ Black-White ratio ■ Hispanic-White ratio

Note: Liquid assets is the sum of balances in one's checking, prepaid debit cards, savings, money market, and certificates of deposit accounts. Cities refer to CBSAs (e.g., Miami refers to the Miami-Fort Lauderdale-West Palm Beach CBSA).

Source: JPMorgan Chase Institute

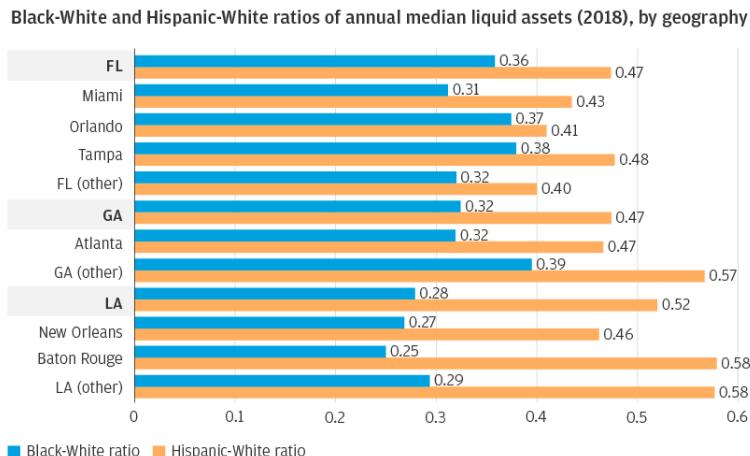
[View the Text Version >](#)

# How to improve this visualization?



# How to improve this visualization?

**Finding Four:** Across geographies, the financial outcomes of Hispanic families vary the most, while the financial outcomes of Black families vary the least. Black-White gaps in financial outcomes are largest in Louisiana, while Hispanic-White gaps are largest in Florida.



Note: Liquid assets is the sum of balances in one's checking, prepaid debit cards, savings, money market, and certificates of deposit accounts. Cities refer to CBSAs (e.g., Miami refers to the Miami-Fort Lauderdale-West Palm Beach CBSA).

Source: JPMorgan Chase Institute

[View the Text Version >](#)

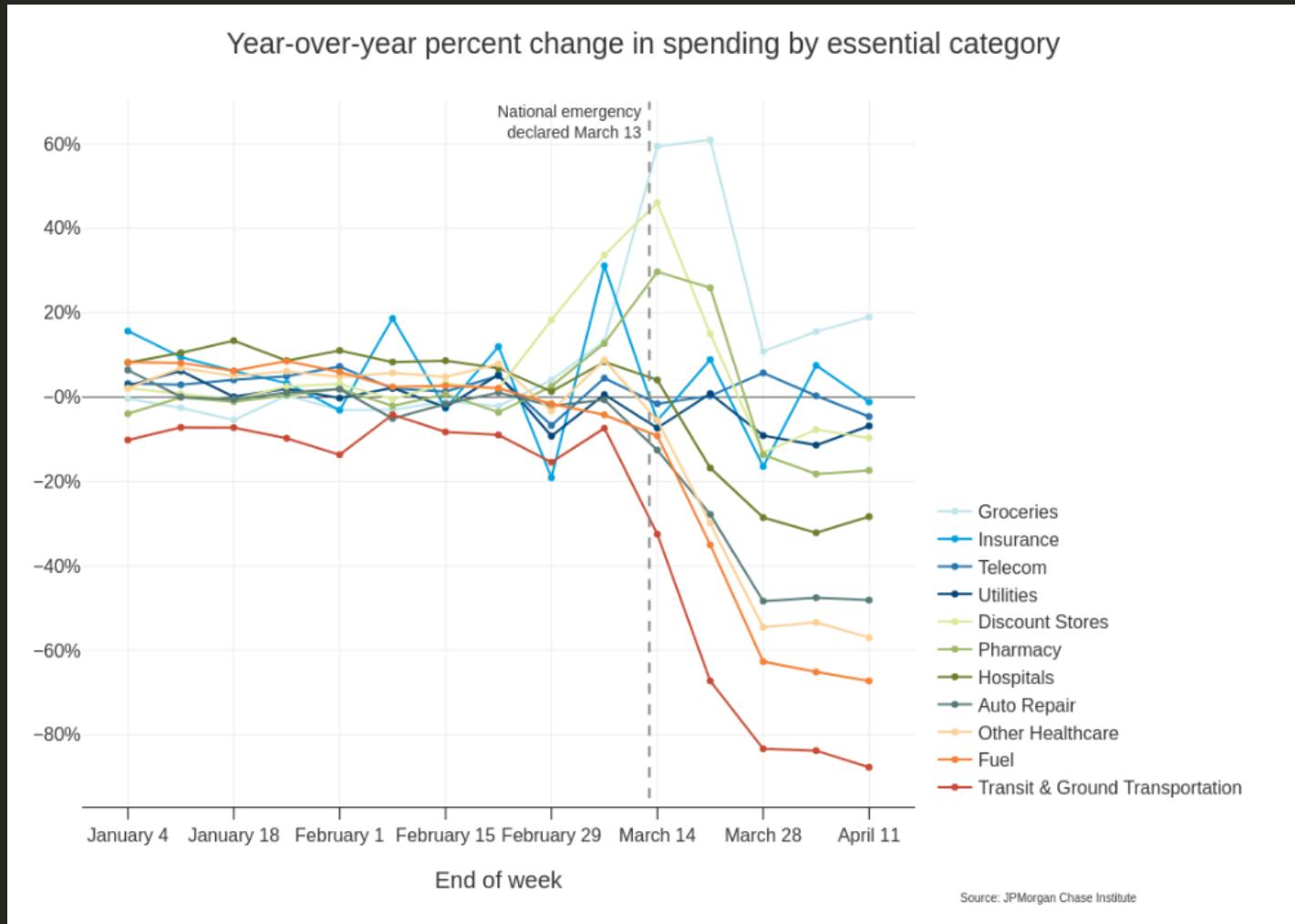
Black-White and Hispanic-White ratios of annual median liquid assets (2018), by geography



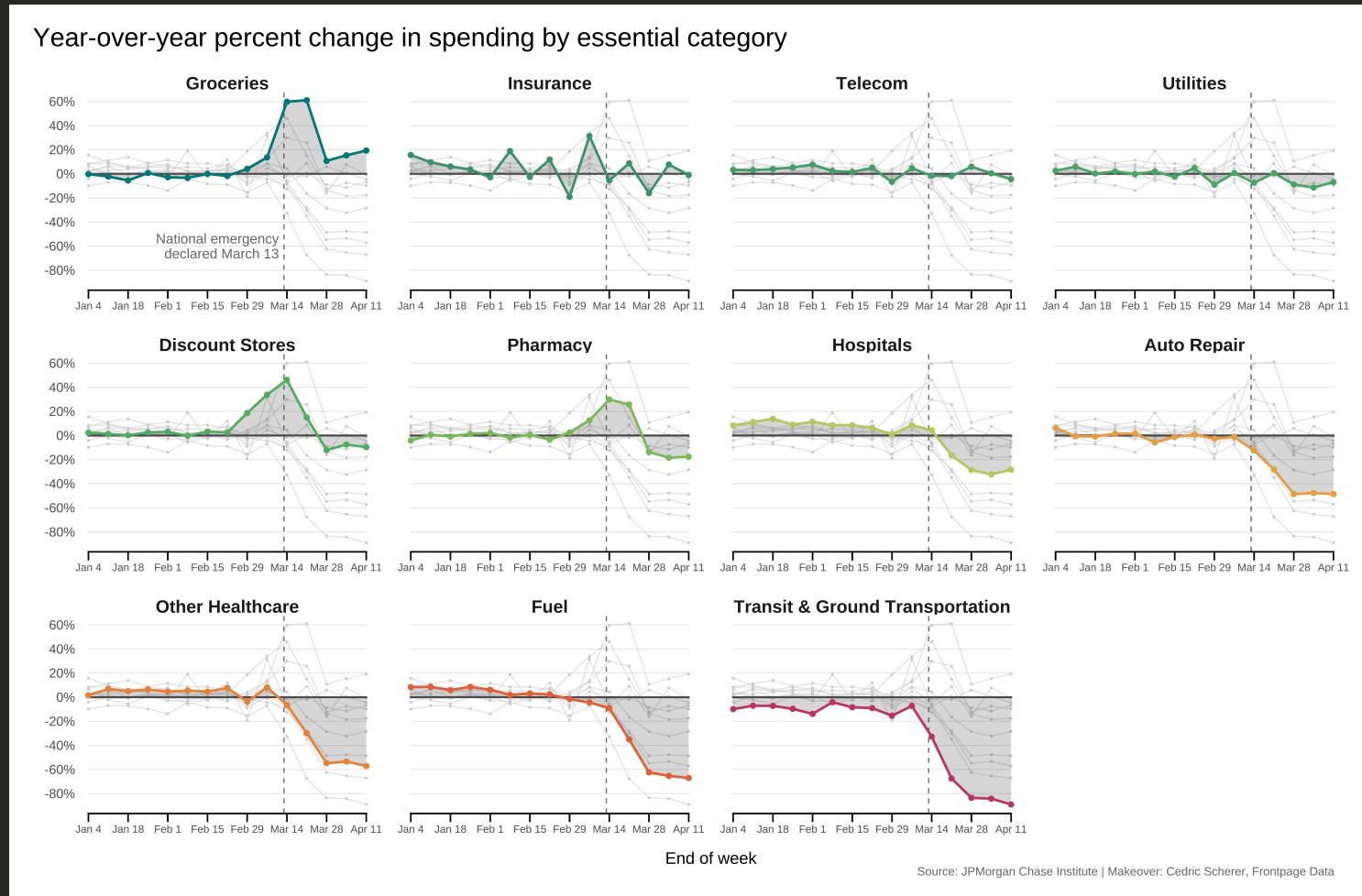
Note: Liquid assets is the sum of balances in one's checking, prepaid debit cards, savings, money market, and certificates of deposit accounts. Cities refer to CBSAs (e.g., Miami refers to the Miami-Fort Lauderdale-West Palm Beach CBSA).

Source: JPMorgan Chase Institute | Makeover: Cedric Scherer, Frontpage Data

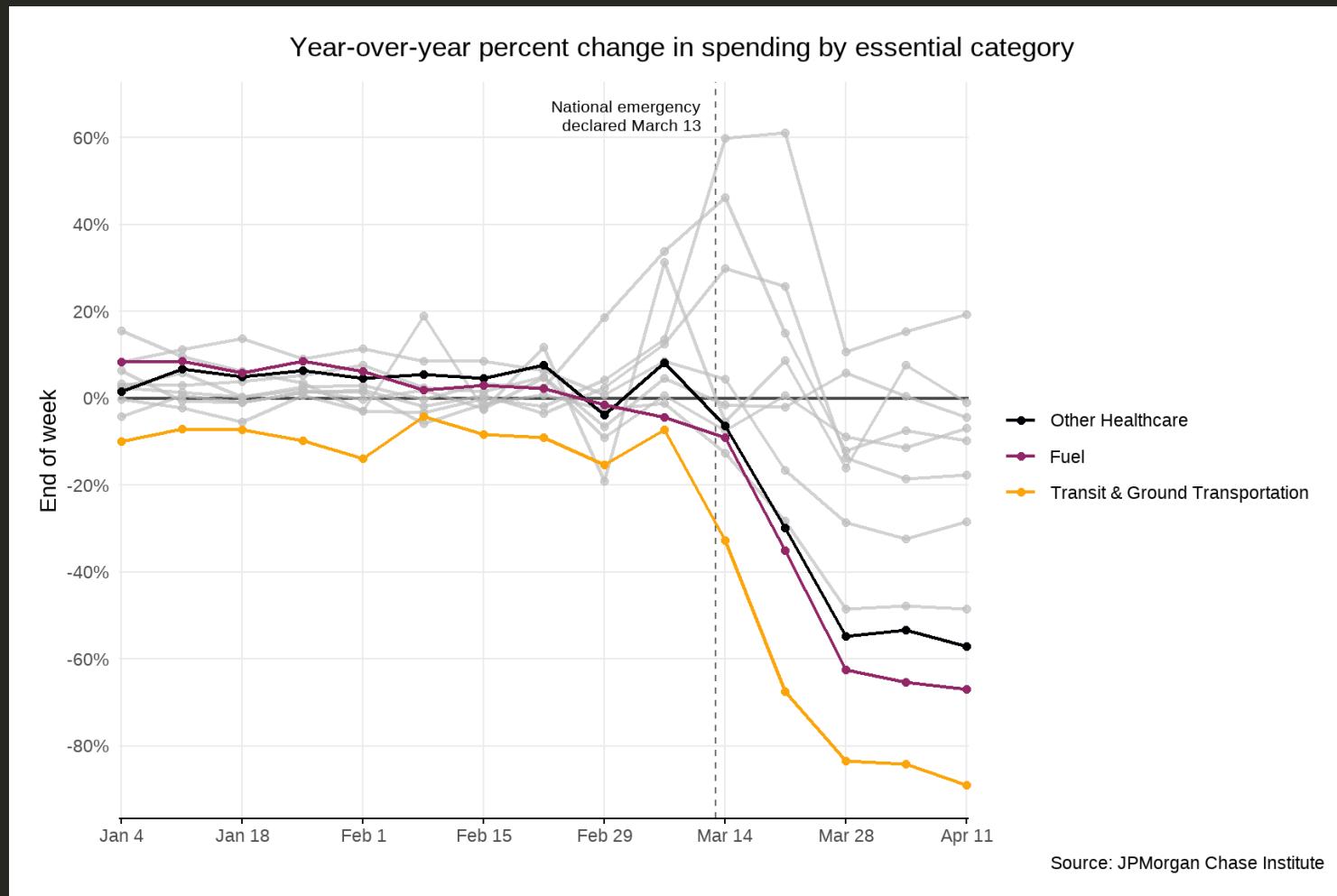
# How to improve this visualization?



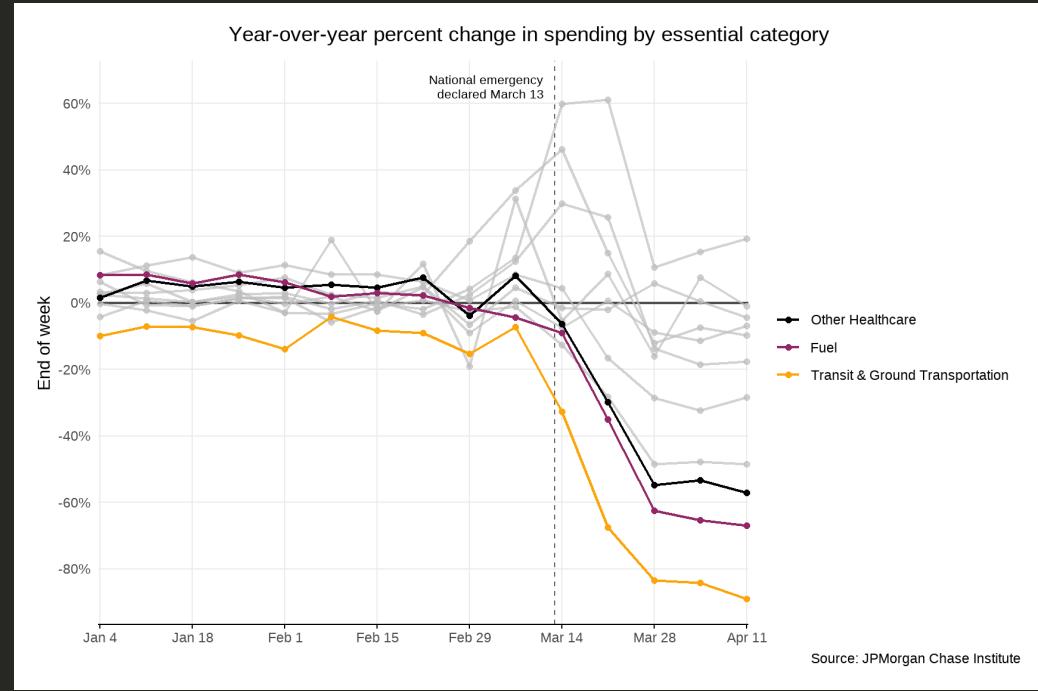
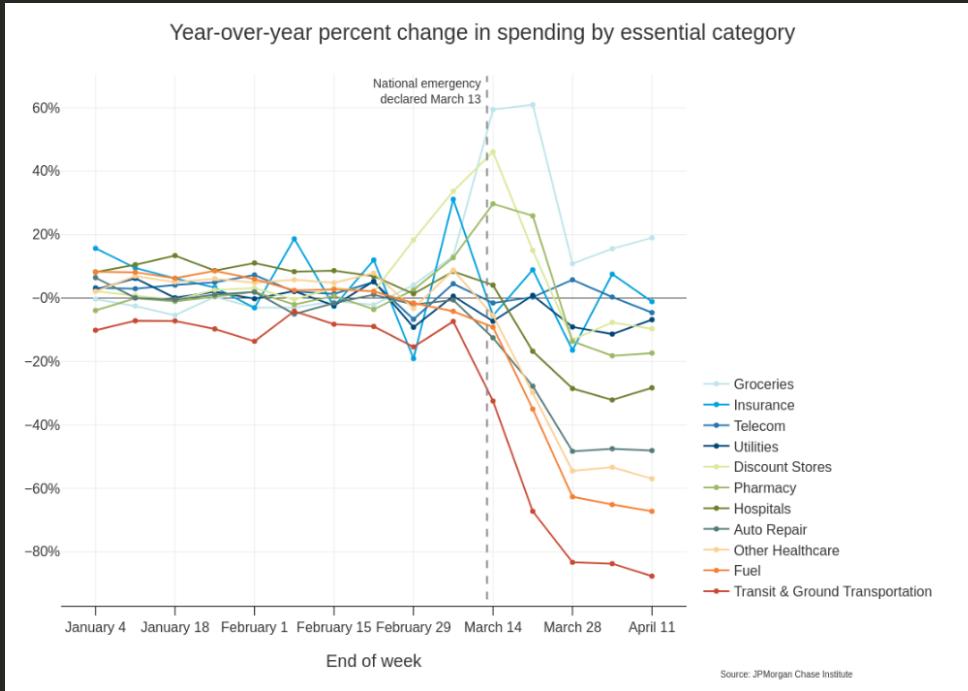
# How to improve this visualization?



# How to improve this visualization?



# How to improve this visualization?



# How to improve this visualization?

Table 1: Change in household wealth 2018–19 by region

	Total wealth	Change in total wealth		Wealth per adult	Change in wealth per adult	Change in financial assets		Change in non- financial assets		Change in debts	
	2019	2018–19	2018–19	2019	2018–19	2018–19	2018–19	2018–19	2018–19	2018–19	2018–19
	USD bn	USD bn	%	USD	%	USD bn	%	USD bn	%	USD bn	%
Africa	4,119	130	3.3	6,488	0.4	1	0.1	164	6.6	35	7.7
Asia-Pacific	64,778	825	1.3	54,211	-0.3	539	1.5	672	1.9	386	4.2
China	63,827	1,889	3.1	58,544	2.6	88	0.2	2,273	7.5	471	10.9
Europe	90,752	1,093	1.2	153,973	1.2	127	0.8	1,156	2.0	190	1.4
India	12,614	625	5.2	14,569	3.3	37	1.4	708	6.9	120	11.5
Latin America	9,906	463	4.9	22,502	3.2	193	4.0	340	5.7	70	5.0
North America	114,607	4,061	3.7	417,694	2.7	3,934	3.6	1,353	3.8	626	3.8
World	360,608	9,087	2.6	70,849	1.2	4,319	2.0	6,666	3.7	1,898	4.0

Source: James Davies, Rodrigo Lluberas and Anthony Shorrocks, Global wealth databook 2019

# How to improve this visualization?

**Table 1: Change in household wealth 2018–2019 by region**

Overall total wealth and mean wealth per adult refer to 2019 only. Triangles pointing upwards indicate the highest proportional change per category triangles pointing downwards the lowest change.

	TOTAL WEALTH			WEALTH PER ADULT		FINANCIAL ASSETS		NON-FINANCIAL ASSETS		DEBTS	
	OVERALL (USD bn)	CHANGE^ (USD bn)	(prop.)	MEAN (USD)	CHANGE (prop.)	(USD bn)	CHANGE (prop.)	(USD bn)	CHANGE (prop.)	(USD bn)	CHANGE (prop.)
World	360,603	9,087	2.6%	70,849	1.2%	4,319	2.0%	6,666	3.7%	1,898	4.0%
North America	114,607	4,061	3.7%	417,694	2.7%	3,334	3.6%	1,353	3.8%	626	3.8%
Europe	90,752	1,093	1.2% ▽	153,973	1.2%	127	3.0%	1,156	2.0%	190	1.4% ▽
Asia-Pacific	64,778	825	1.3%	54,211	-0.3% ▽	539	1.5%	672	1.9% ▽	386	4.2%
China	63,827	1,889	3.1%	58,544	2.6%	88	2.0%	2,273	7.5% △	471	10.9%
India	12,614	615	5.2% △	14,569	3.3% △	37	1.4%	708	6.9%	120	11.5% △
Latin America	9,906	463	4.9%	22,502	3.2%	193	4.0% △	340	5.7%	70	5.0%
Africa	4,119	130	3.3%	6,488	0.4%	1	1.0% ▽	164	6.6%	35	7.7%

Source: James Davies, Rodrigo Lluberas and Anthony F. Shorrocks, Global Wealth Databook, 2019 | Makeover: Cedric Scherer, Frontpage Data

# How to improve this visualization?

Table 1: Change in household wealth 2018–19 by region

	Total wealth		Change in total wealth		Wealth per adult		Change in wealth per adult		Change in financial assets		Change in non-financial assets		Change in debts		
	2019	2018-19	2018-19	2019	2018-19	2018-19	2019	2018-19	2018-19	2018-19	2018-19	2018-19	2018-19	2018-19	
	USD bn	USD bn	%	USD	%	USD bn	%	USD bn	%	USD bn	%	USD bn	%	USD bn	%
Africa	4,119	130	3.3	6,488	0.4	1	0.1	164	6.6	35	7.7				
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Source: James Davies, Rodrigo Lluberas and Anthony Shorrocks, Global wealth databook 2019

Table 1: Change in household wealth 2018–2019 by region

Overall total wealth and mean wealth per adult refer to 2019 only. Triangles pointing upwards indicate the highest proportional change per category triangles pointing downwards the lowest change.

	TOTAL WEALTH		WEALTH PER ADULT MEAN (USD)	CHANGE (prop.)	FINANCIAL ASSETS		NON-FINANCIAL ASSETS		DEBTS	
	OVERALL (USD bn)	CHANGE^ (USD bn)			CHANGE (USD bn)	(prop.)	CHANGE (USD bn)	(prop.)	CHANGE (USD bn)	(prop.)
World	360,603	9,087	70,849	1.2%	4,319	2.0%	6,666	3.7%	1,898	4.0%
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Source: James Davies, Rodrigo Lluberas and Anthony F. Shorrocks, Global Wealth Databook, 2019 | Makeover: Cedric Scherer, Frontpage Data

# 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

→ Follow design rules and data visualization principles.

## Design for Your Audience

- Choose charts based on your goal not tradition or novelty (only).
- Make sure your visualization is accessible for everyone (colors, readability).
- Use visual contrast to highlight important information.
- Provide meaningful labels and titles.

## Be Honest

- Show raw data if possible.
- Don't truncate bar charts. Add spacing to truncated axes.
- Be consistent with axis scaling.

## Lend A Helping Hand

- Use annotations and direct labels instead of/in addition to text and legends.
- Order your data, either by value or intrinsic ranking.
- Reveal information step by step (if applicable).

## Books

- “[Fundamentals of Data Visualization](#)”, an open-access book by Claus Wilke
- “[Data Visualization](#)”, an open-access book by Kieran Healy
- “[Avoiding Data Pitfalls](#)” by Ben Jones
- “[The Functional Art](#)”, “[The Truthful Art](#)”, and “[How Charts Lie](#)” by Alberto Cairo
- “[Storytelling with Data](#)” by Cole Nussbaumer Knaflic
- “[Data Visualization Handbook](#)” by Juuso Koponen & Jonatan Hildén
- “[Info We Trust: How to Inspire the World with Data](#)” by RJ Andrews

## Blogs

- “[Nightingale](#)”, the journal of the Data Visualization Society
- “[Chartable](#)”, the blog by DataWrapper

## Chart Choice Helpers

- [From Data to Viz](#)
- [DataViz Project](#)
- [Visualizaiton Universe](#)
- [Material Design](#)

## Color Choice Helpers

- [Viz Palette](#) by Elijah Meeks & Susie Lu
- “[How to pick more beautiful colors for your data visualizations](#)” by Lisa Charlotte Rost