

# *Visualizing Information*

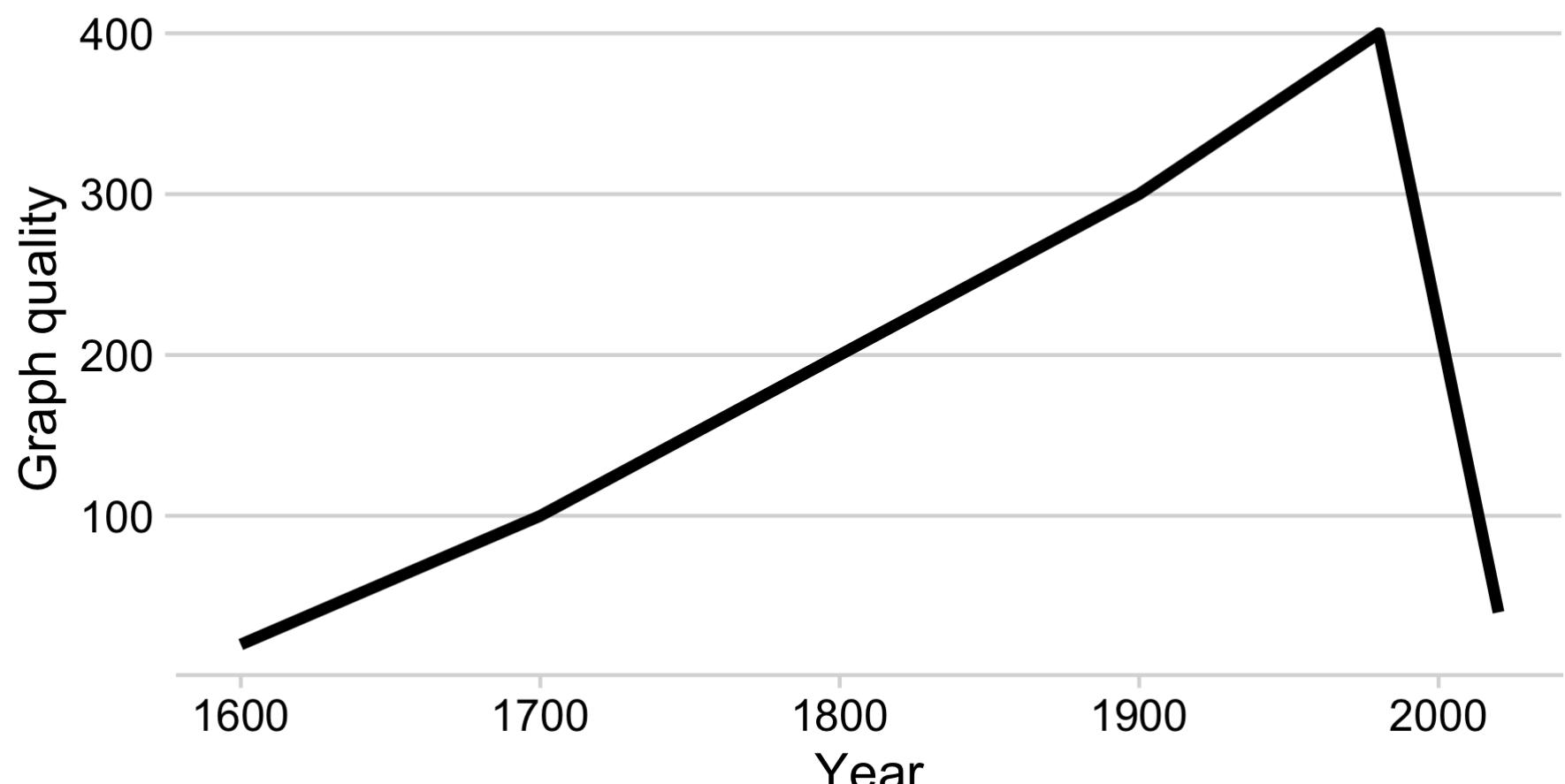
🏛 DTAIS Workshop

👤 John Paul Helveston

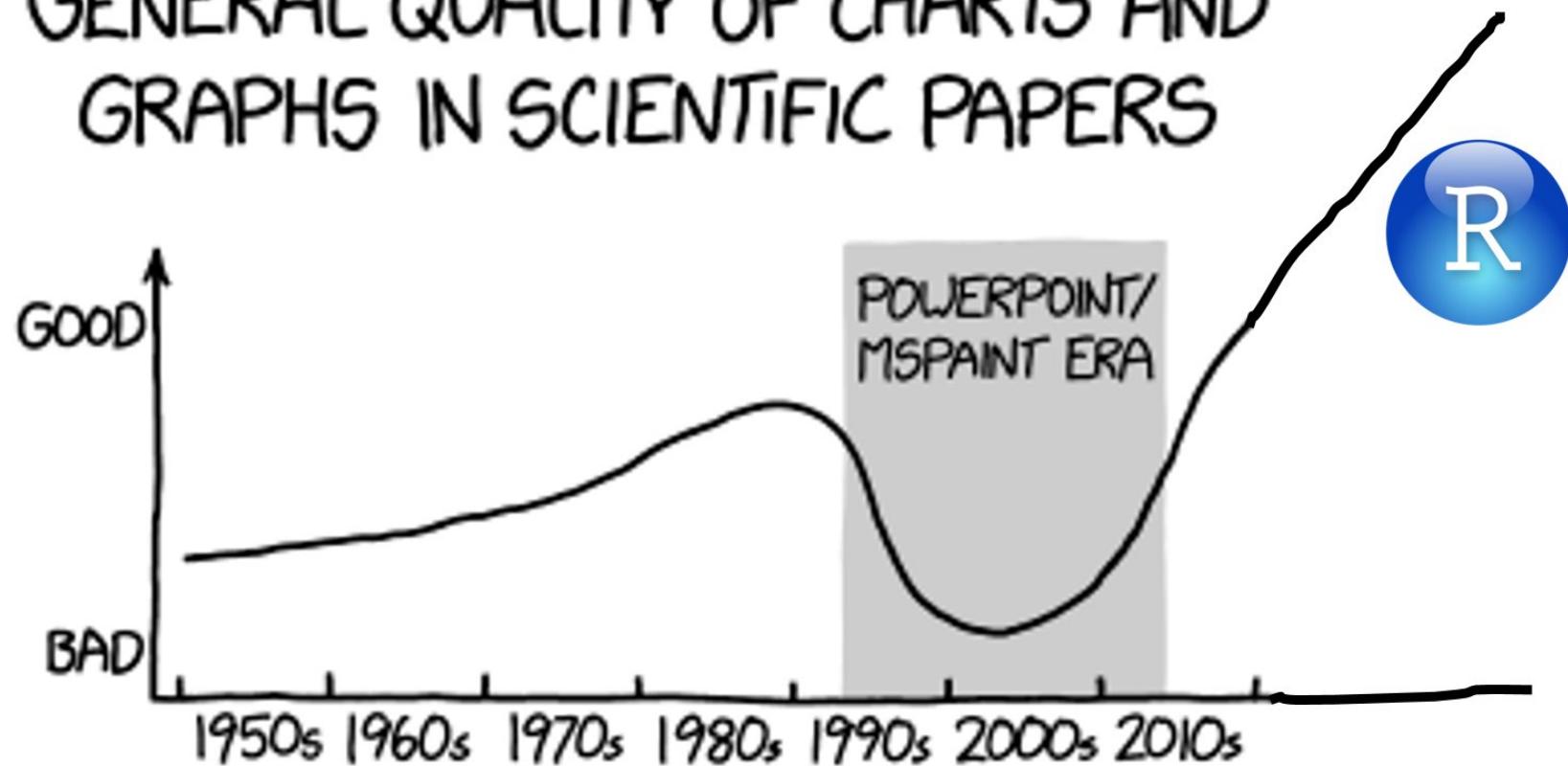
📅 July 12, 2022

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## Graphing quality over time



# GENERAL QUALITY OF CHARTS AND GRAPHS IN SCIENTIFIC PAPERS



From [here](#)

*"Having word processing software  
doesn't make us great writers."*

– Stephen Few

# We don't write paragraphs like this

People **sometimes do** this [use poor graphic choices] because they've seen **similar charts in newspapers** or on the web and they're naively following a **bad example**. People who know better **sometimes do** this **because** they care more about **the visual impact** than the **clarity** of communication. *If we wanted* to tell the **truth in a way** people can easily understand, this **is not** an effective **approach**.

Image from Few (2012, pg. 227)

# We don't write paragraphs like this

People sometimes do this [use poor graphic choices] because they've seen similar charts in newspapers or on the web and they're naively following a bad example. People who know better sometimes do this because they care more about the visual impact than the clarity of communication. If we wanted to tell the truth in a way people can easily understand, this is not an effective approach.

# So don't make graphs like this

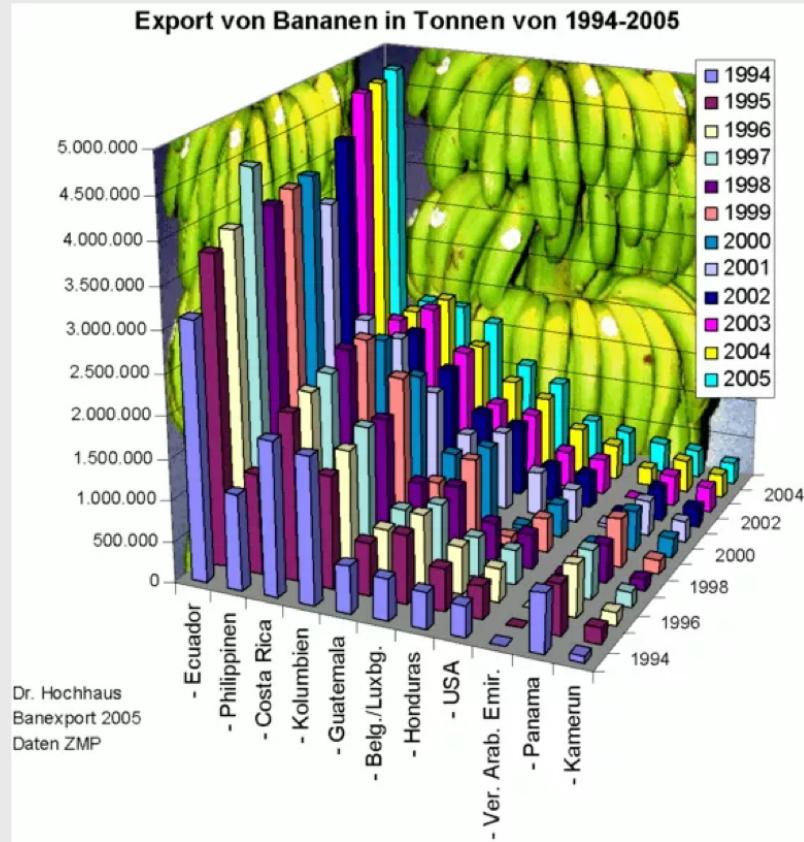


Image from Few (2012, pg. 227)

# *Visualizing Information*

1. The Human Visual-Memory System

2. The Psychology of Data Viz

BREAK

3. 10 Data Viz Best Practices

# *Visualizing Information*

1. The Human Visual-Memory System

2. The Psychology of Data Viz

BREAK

3. 10 Data Viz Best Practices

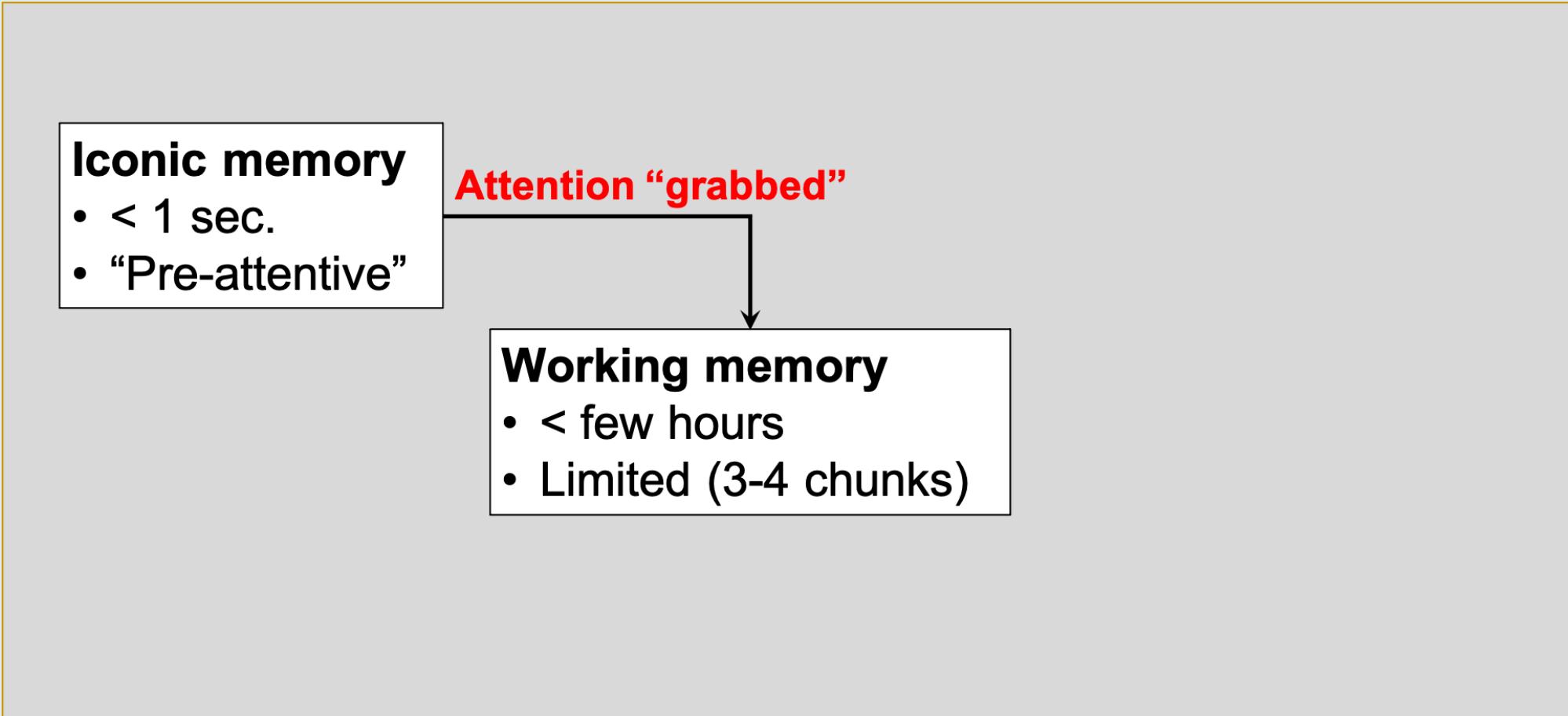
Good visualizations optimize for  
the human visual-memory system

# A (very) simplified model of the visual-memory system

## **Iconic memory**

- < 1 sec.
- “Pre-attentive”

# A (very) simplified model of the visual-memory system



# A (very) simplified model of the visual-memory system

***Effective charts focus on this***

## **Iconic memory**

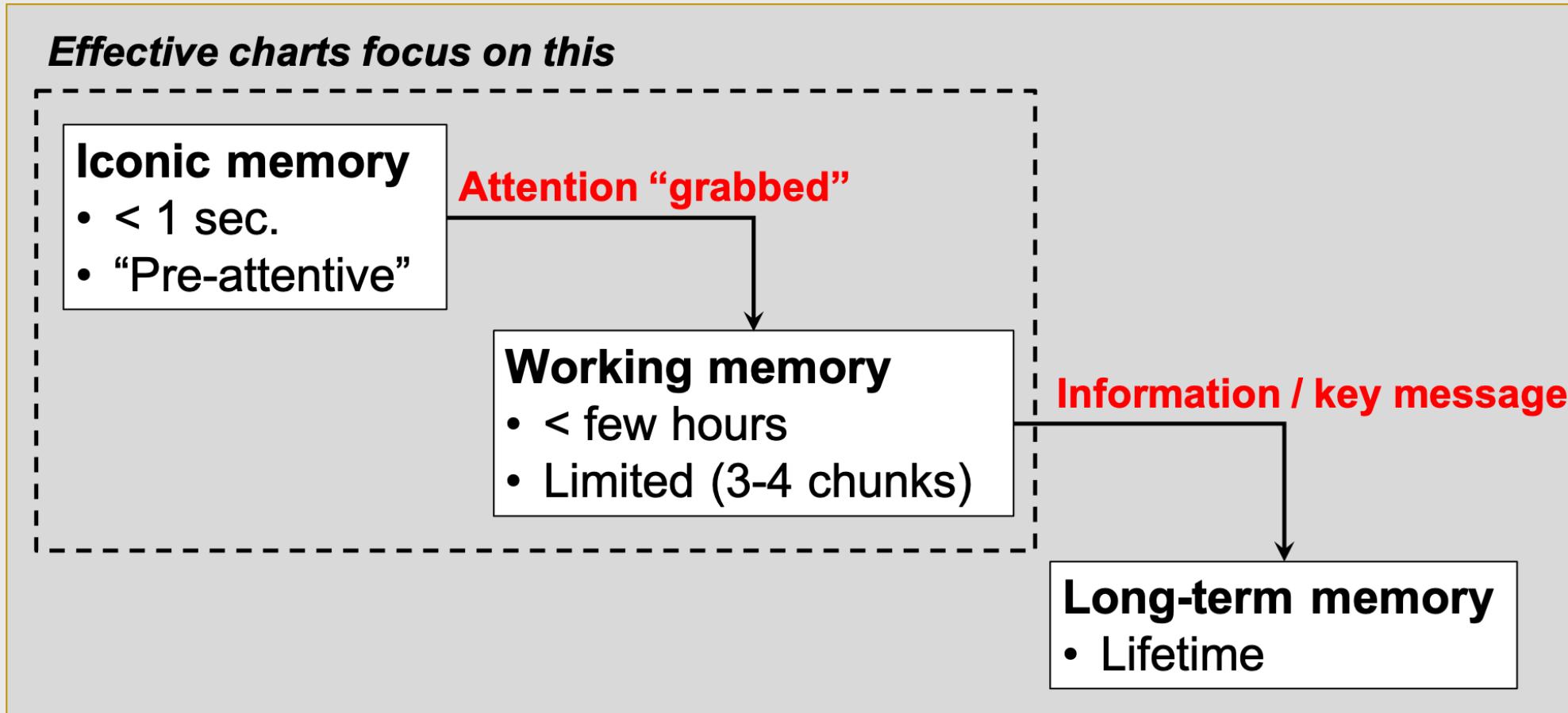
- < 1 sec.
- “Pre-attentive”

**Attention “grabbed”**

## **Working memory**

- < few hours
- Limited (3-4 chunks)

# A (very) simplified model of the visual-memory system



Two objectives of effective charts:

1. Grab & direct attention (iconic memory)
2. Reduce processing demands (working memory)

# The power of pre-attentive processing

Count all the "5"s

# The power of pre-attentive processing

Count all the "5"'s

821134907856412043612  
304589640981709812734  
123450986124790812734  
029860192837401489363  
123479827961203459816  
234009816256908127634  
123459087162342015237  
123894789237498230192

# The power of pre-attentive processing

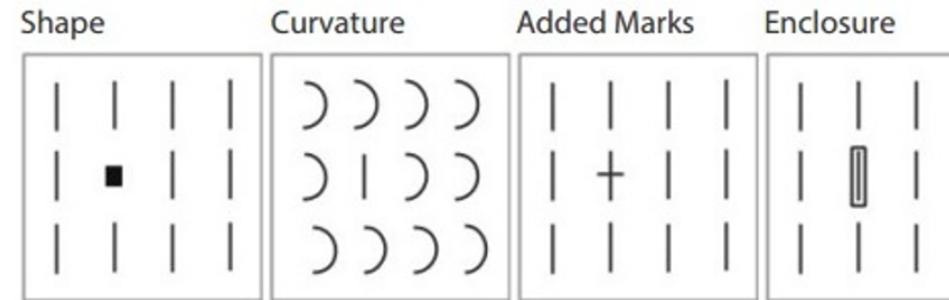
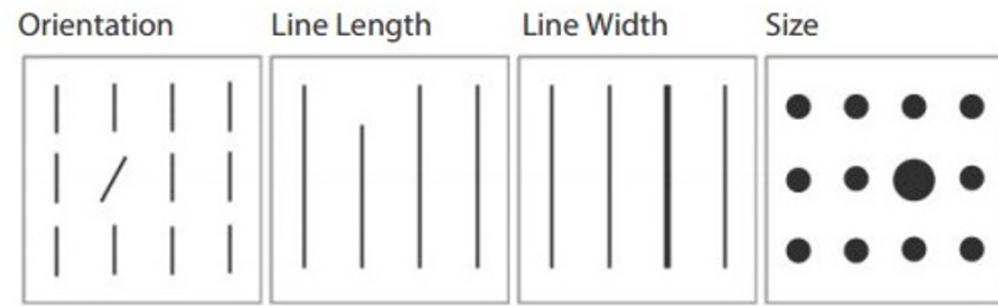
Count all the "5"s

# The power of pre-attentive processing

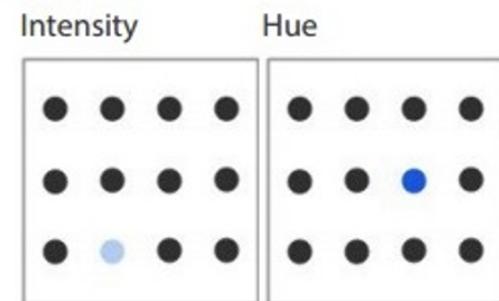
Count all the "5"'s

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304**5**89640981709812734  
1234**5**0986124790812734  
029860192837401489363  
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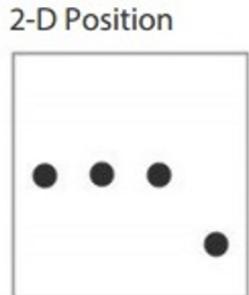
## Form



## Color



## Spatial Position

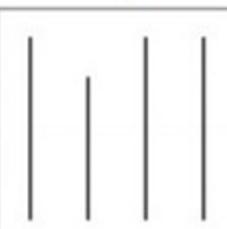


## Form

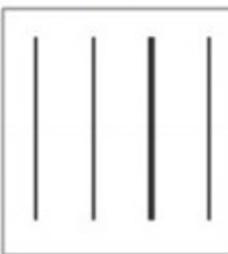
Orientation



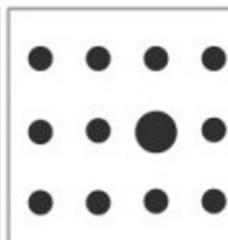
Line Length



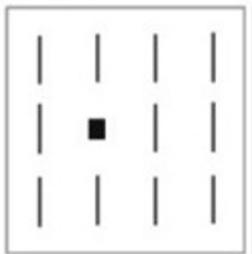
Line Width



Size



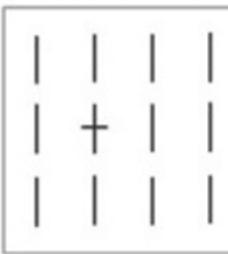
Shape



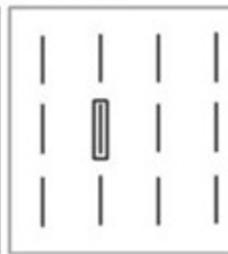
Curvature



Added Marks

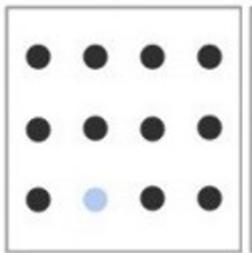


Enclosure

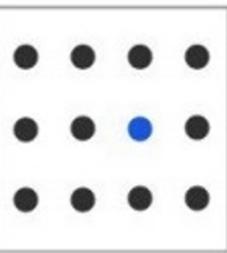


## Color

Intensity

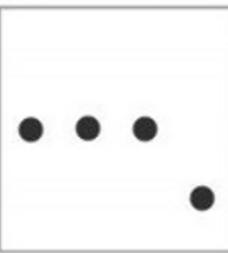


Hue

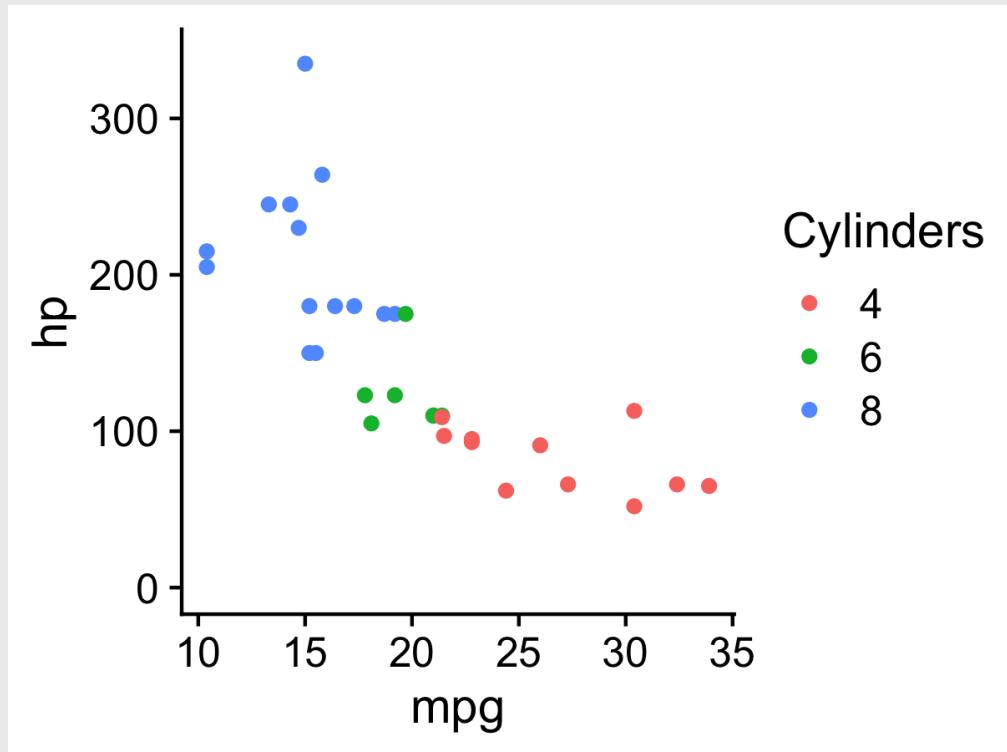


## Spatial Position

2-D Position



# Pre-attentive attributes



## Form

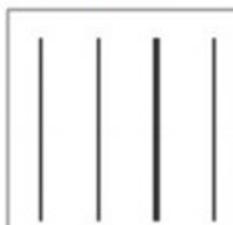
Orientation



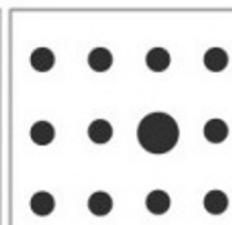
Line Length



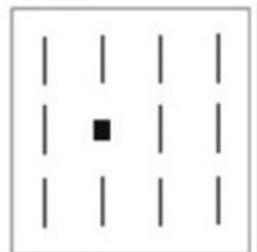
Line Width



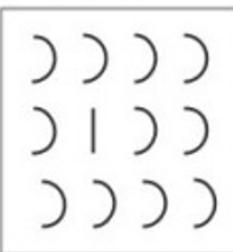
Size



Shape



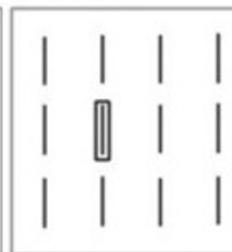
Curvature



Added Marks

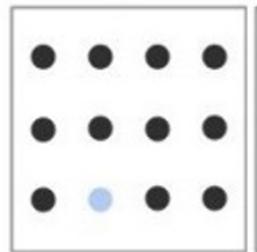


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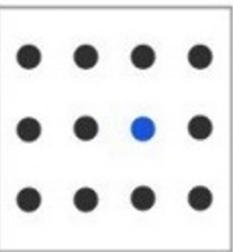


## Color

Intensity

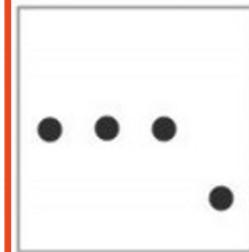


Hue



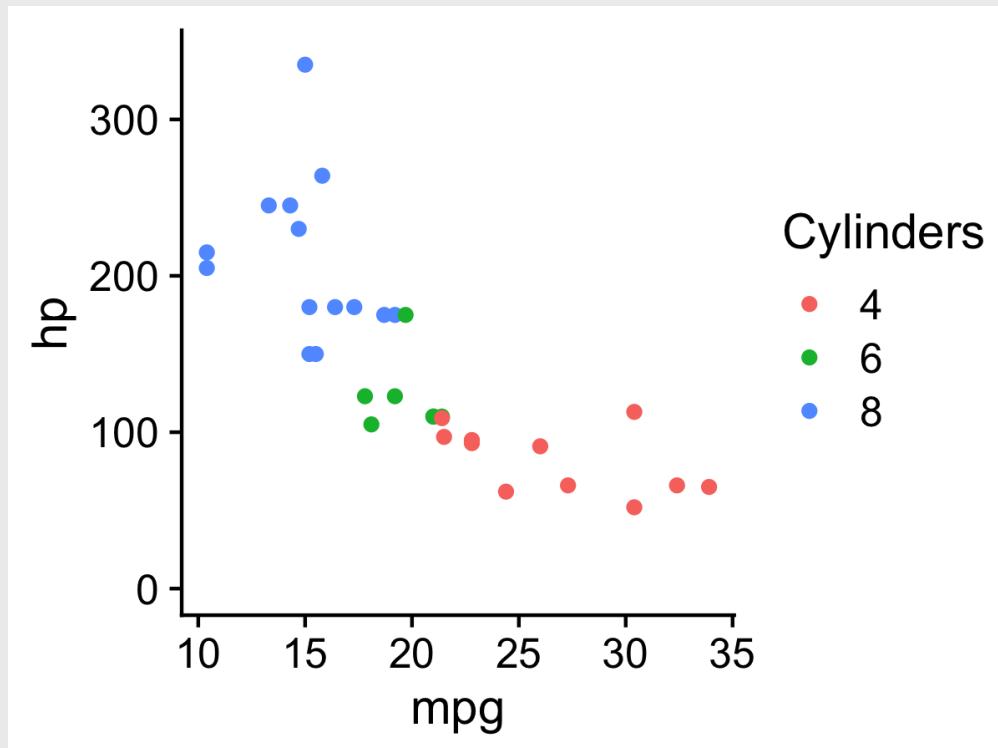
## Spatial Position

2-D Position



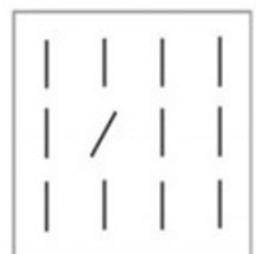
# Pre-attentive attributes

Numerical (ratio) data



## Form

Orientation



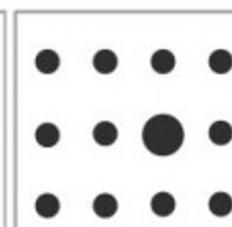
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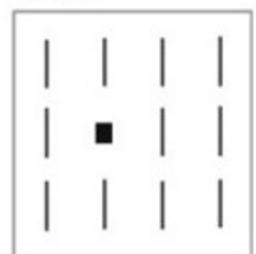
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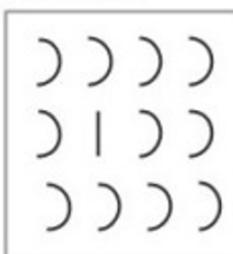
Size



Shape



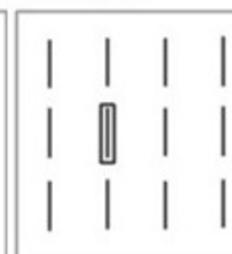
Curvature



Added Marks

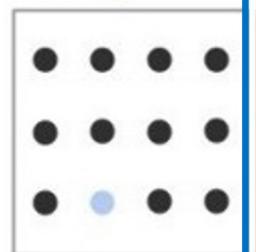


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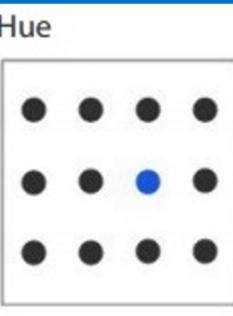


## Color

Intensity

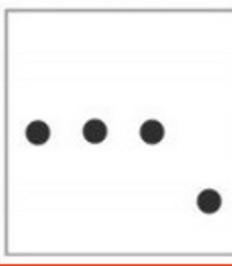


Hue



## Spatial Position

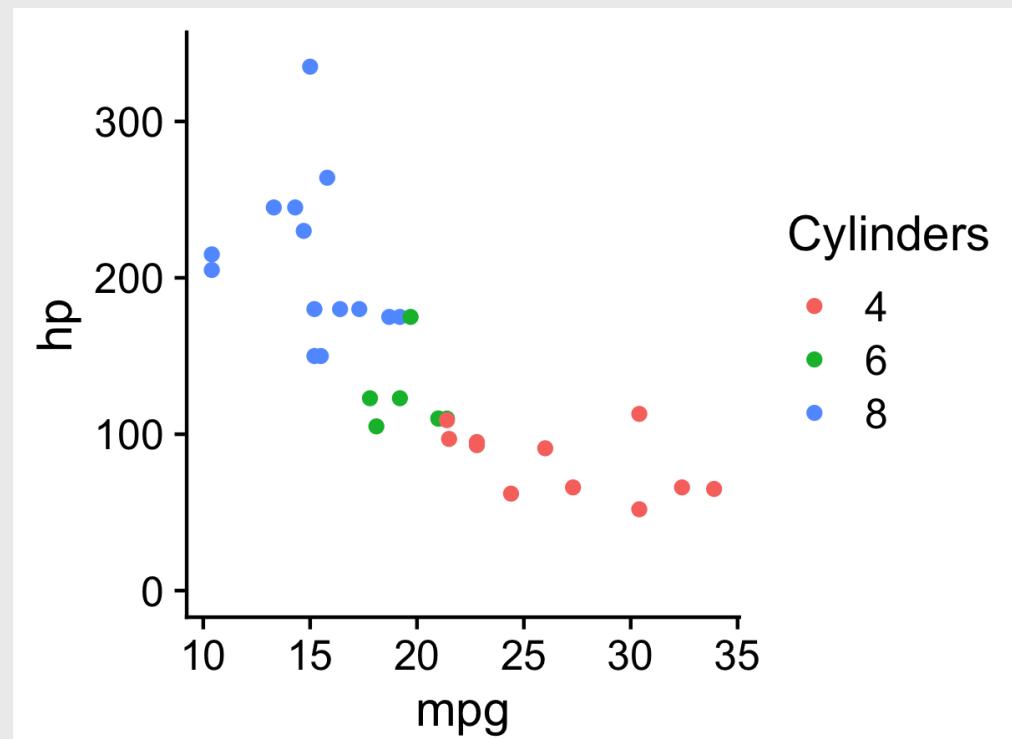
2-D Position



# Pre-attentive attributes

Numerical (ratio) data

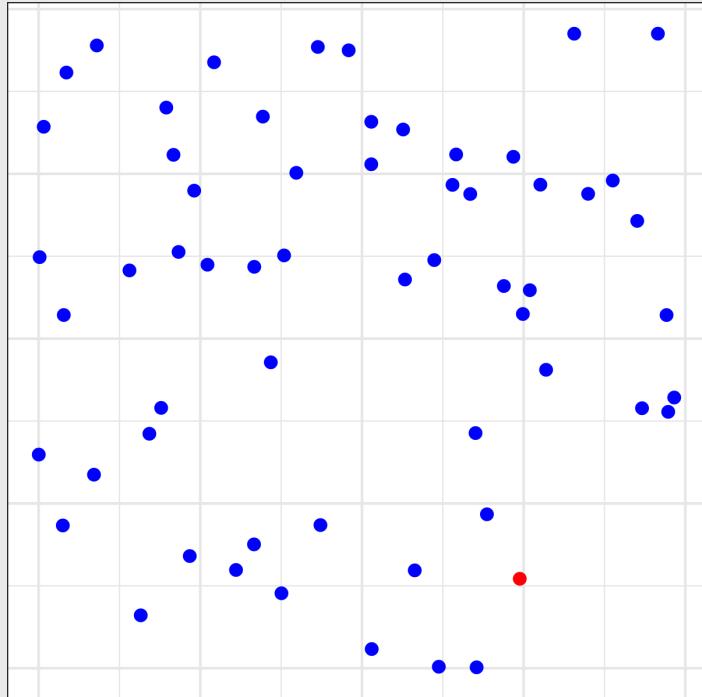
Categorical (ordinal) data



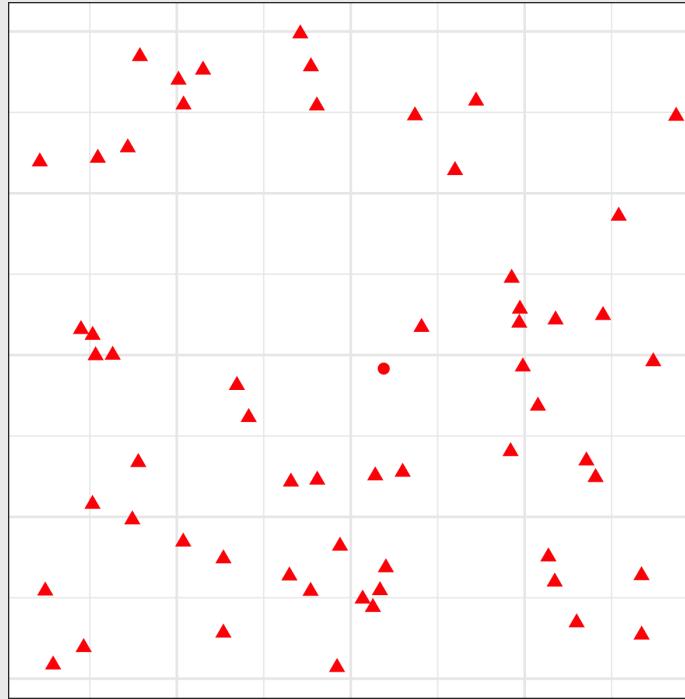
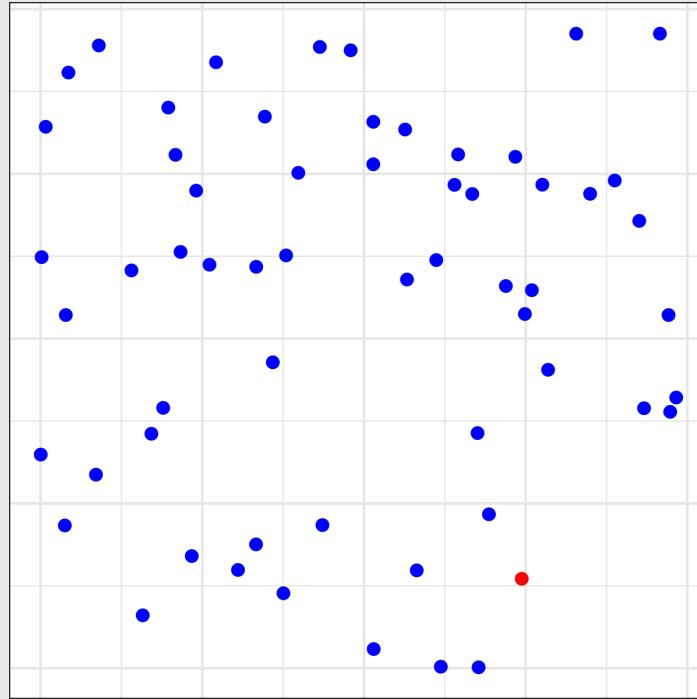
Not all pre-attentive attributes are equal

# Where is the red dot?

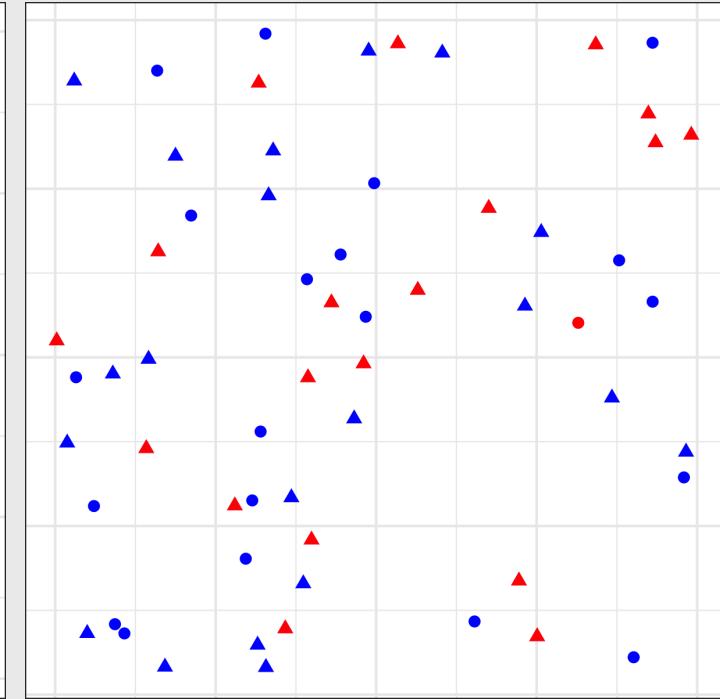
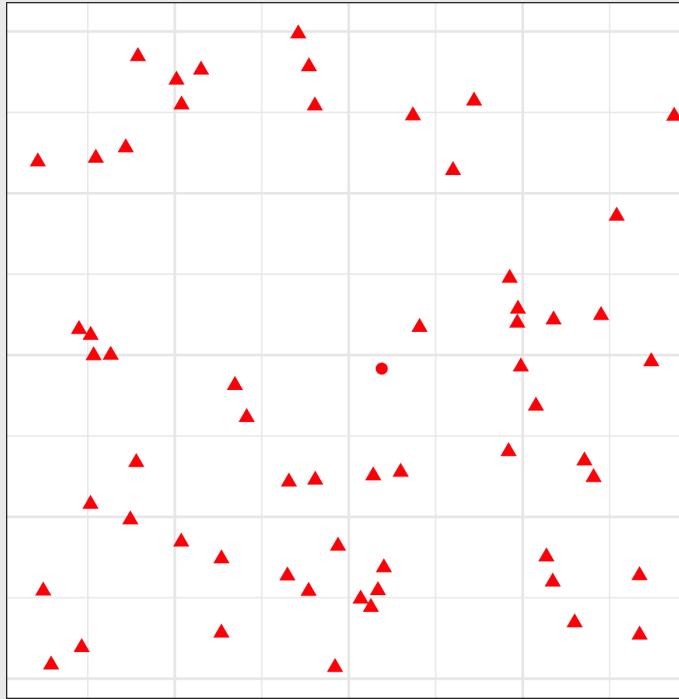
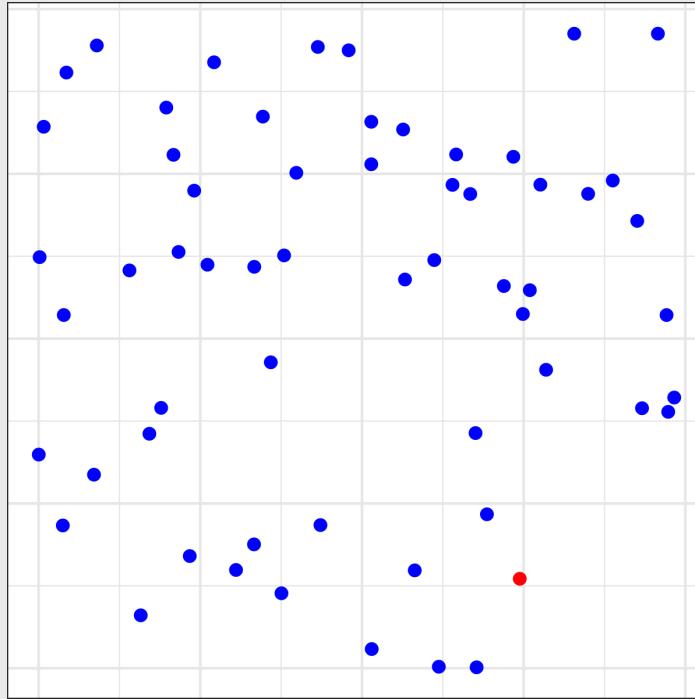
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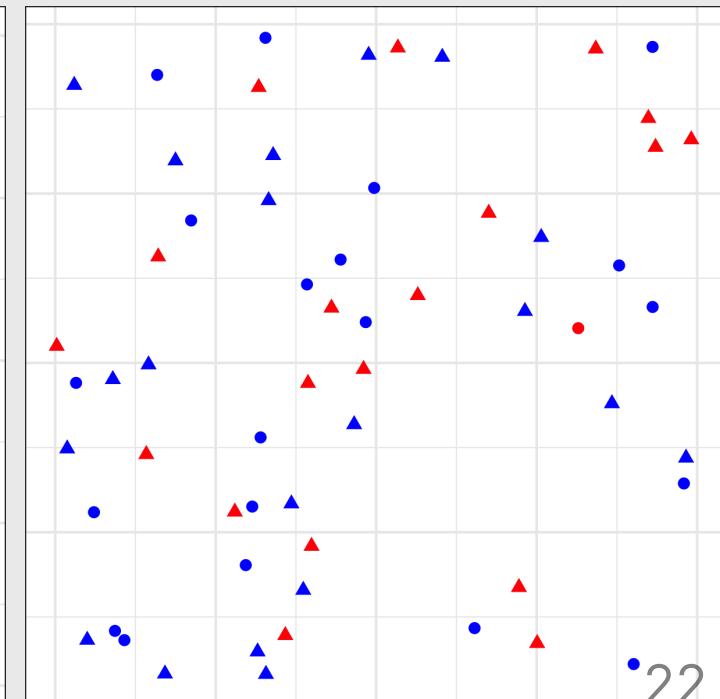
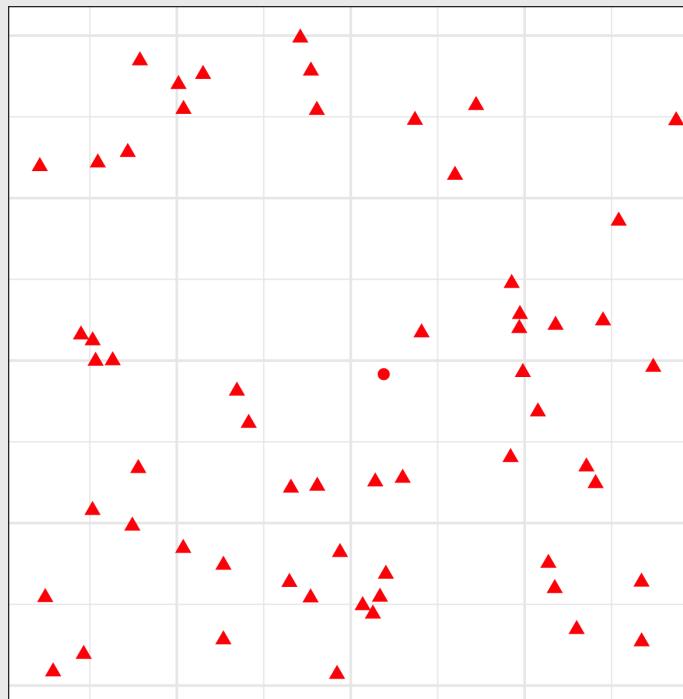
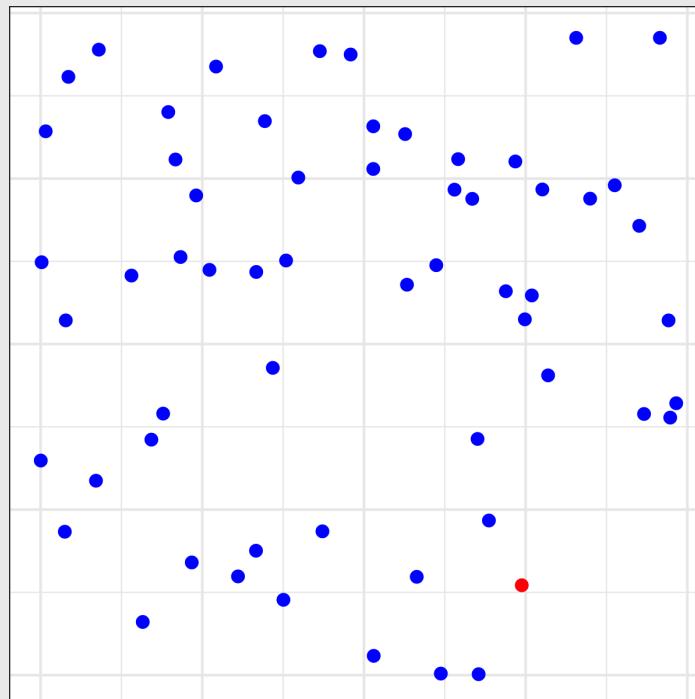


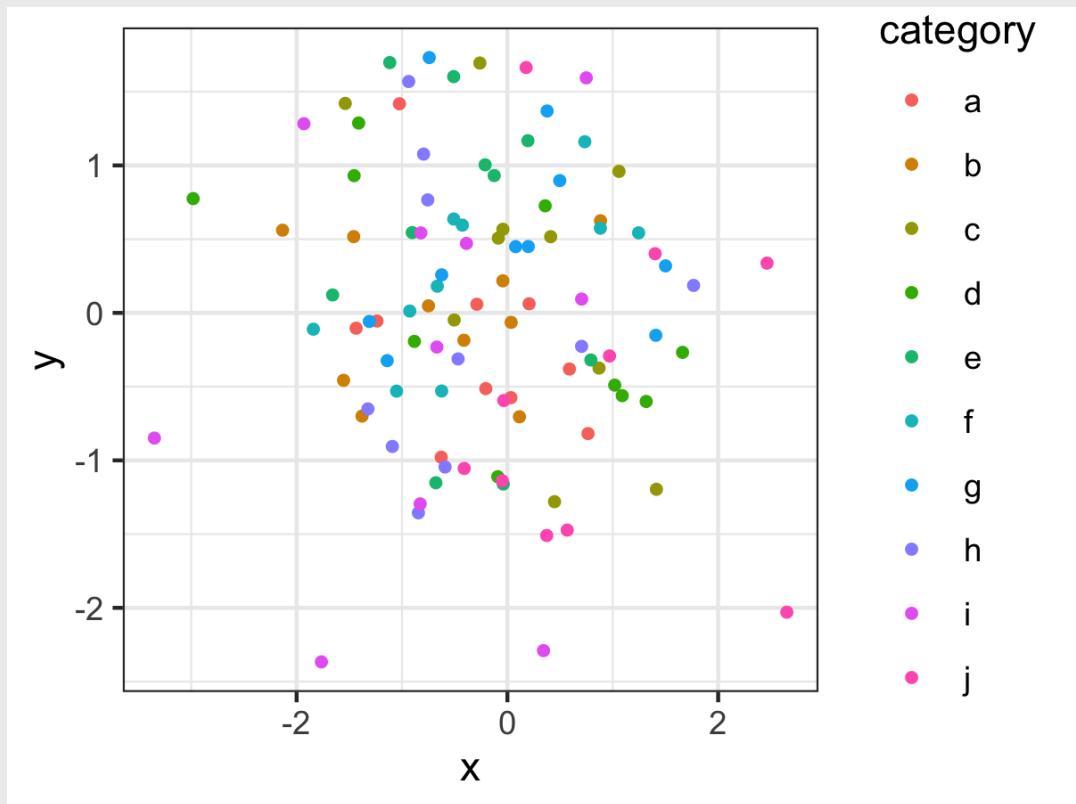
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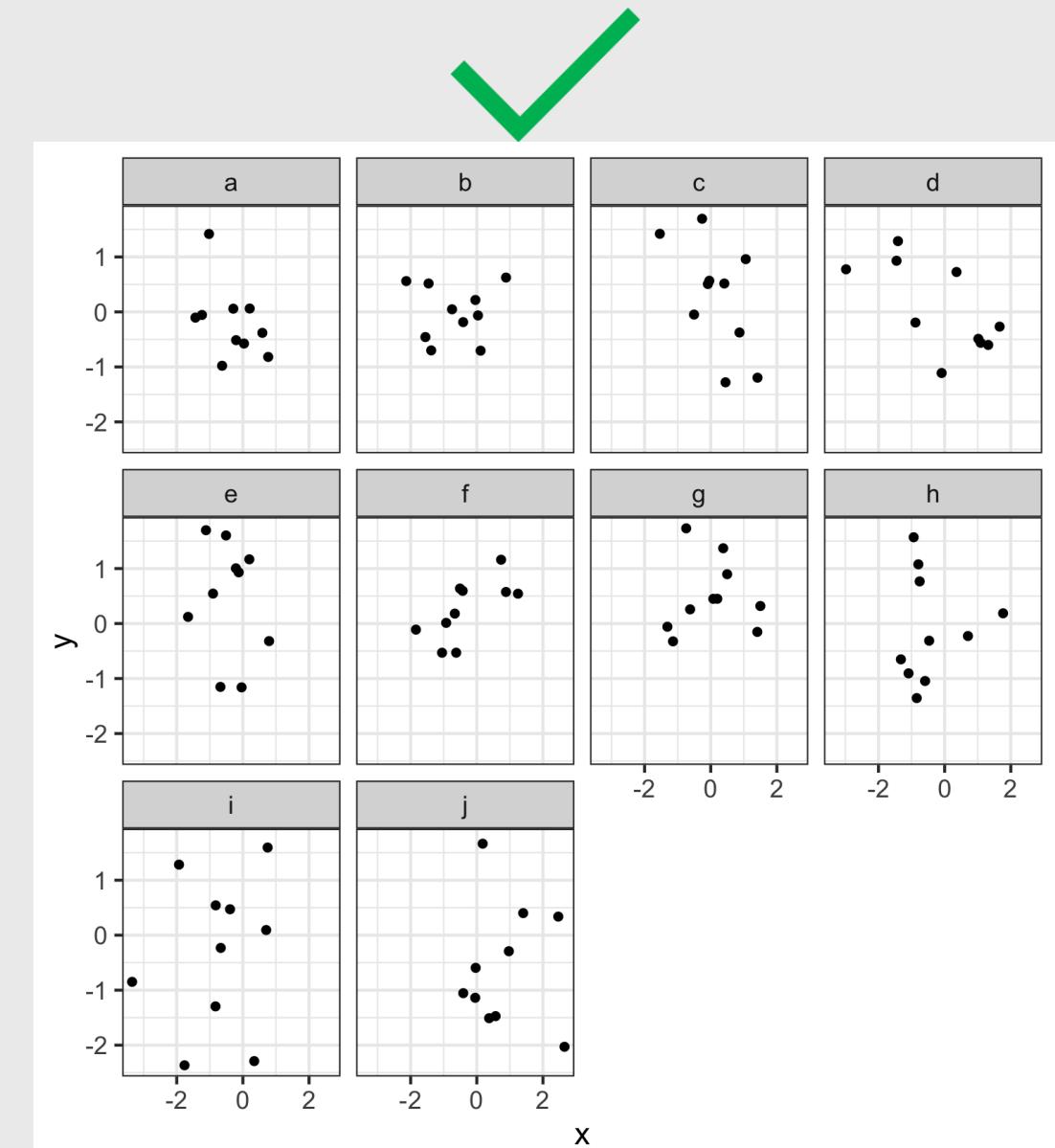
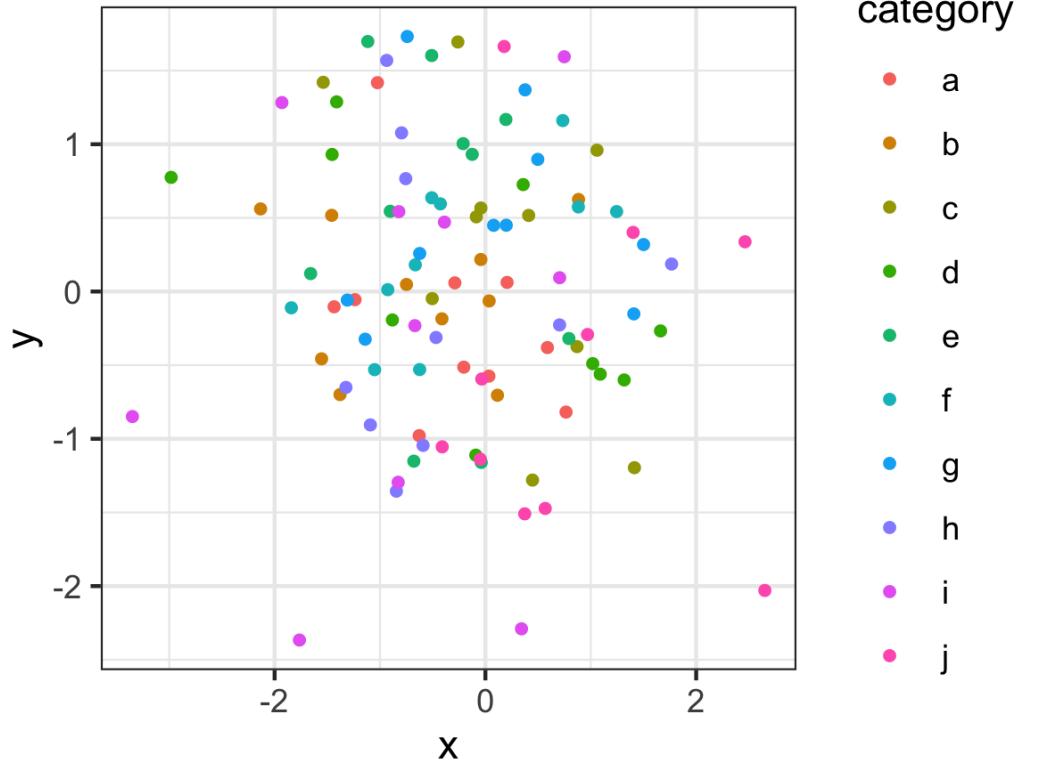


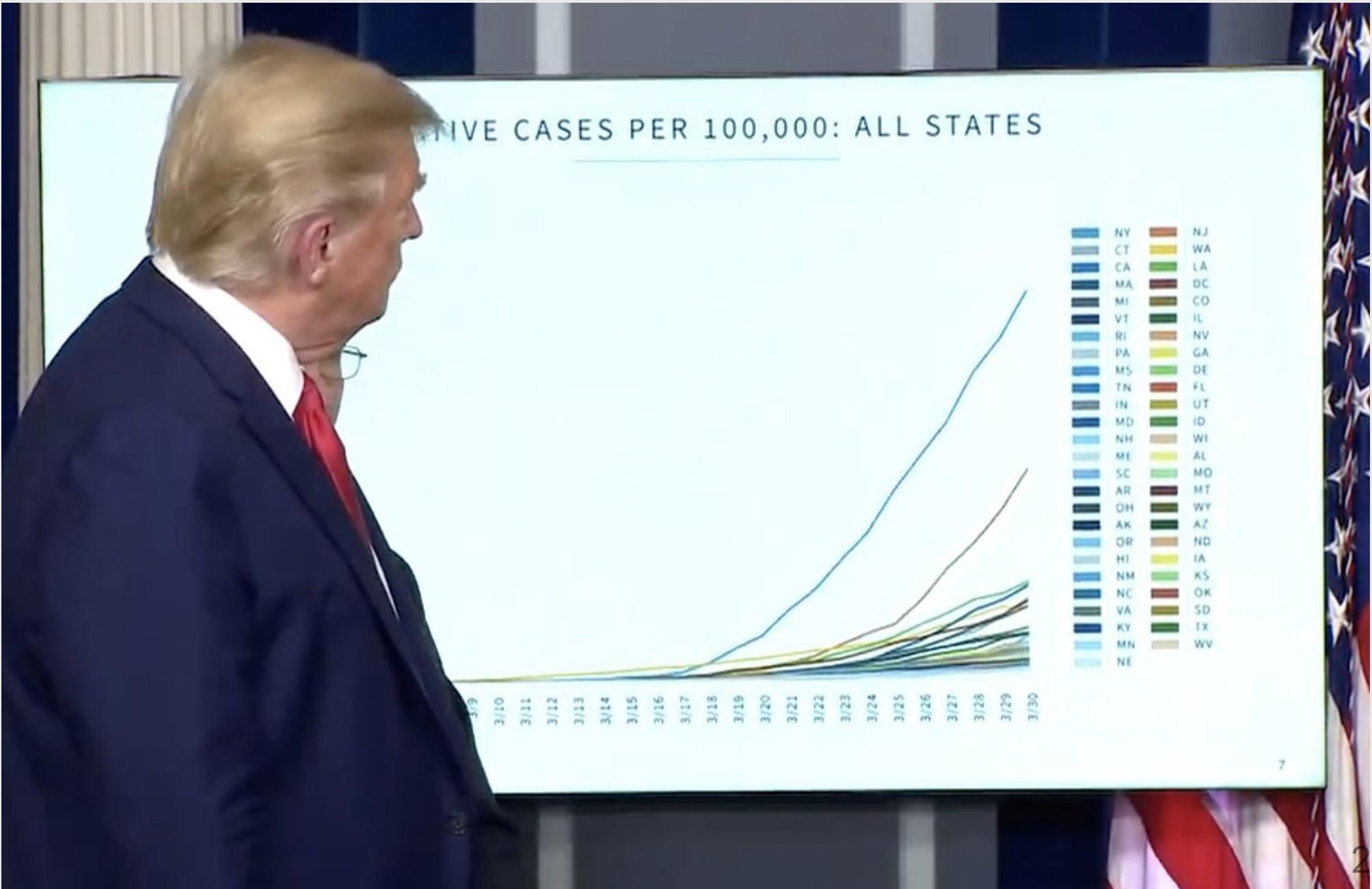
# For categorical data:

1. Hue (color) > shape
2. Less is more (stay in working memory!)









# *Visualizing Information*

1. The Human Visual-Memory System

2. The Psychology of Data Viz

BREAK

3. 10 Data Viz Best Practices

Much of the content in this section is from  
John Rauser's [talk](#) on YouTube

(Always cite your sources)

# Graphical Perception and Graphical Methods for Analyzing Scientific Data

William S. Cleveland and Robert McGill

Graphs provide powerful tools both for analyzing scientific data and for communicating quantitative information. The computer graphics revolution, which began in the 1960's and has intensified during the past several years, stimulated the invention of graphical meth-

mation from graphs; theory and experimental data are then used to order the tasks on the basis of accuracy. The ordering has an important application: data should be encoded so that the visual decoding involves tasks as high in the ordering as possible, that is, tasks per-

**Summary.** Graphical perception is the visual decoding of the quantitative and qualitative information encoded on graphs. Recent investigations have uncovered basic principles of human graphical perception that have important implications for the display of data. The computer graphics revolution has stimulated the invention of many graphical methods for analyzing and presenting scientific data, such as box plots, two-tiered error bars, scatterplot smoothing, dot charts, and graphing on a log base 2 scale.

ods: types of graphs and types of quantitative information to be shown on graphs (1-4). One purpose of this article is to describe and illustrate several of these new methods.

What has been missing, until recently, in this period of rapid graphical invention and deployment is the study of graphs and the human visual system. When a graph is constructed, quantitative and categorical information is encoded, chiefly through position, shape, size, symbols, and color. When a person looks at a graph, the information is visually decoded by the person's visual sys-

tem with greater accuracy. This is illustrated by several examples in which some much-used graphical forms are presented, set aside, and replaced by new methods.

## Elementary Tasks for the Graphical Perception of Quantitative Information

The first step is to identify elementary graphical-perception tasks that are used to visually extract quantitative information from a graph. (By "quantitative information" we mean numerical values

al field that comes without apparent mental effort. We also perform cognitive tasks such as reading scale information, but much of the power of graphs—and what distinguishes them from tables—comes from the ability of our preattentive visual system to detect geometric patterns and assess magnitudes. We have examined preattentive processes rather than cognition.

We have studied the elementary graphical-perception tasks theoretically, borrowing ideas from the more general field of visual perception (7, 8), and experimentally by having subjects judge graphical elements (1, 5). The next two sections illustrate the methodology with a few examples.

## Study of Graphical Perception: Theory

Figure 2 provides an illustration of theoretical reasoning that borrows some ideas from the field of computational vision (8). Suppose that the goal is to judge the ratio,  $r$ , of the slope of line segment BC to the slope of line segment AB in each of the three panels. Our visual system tells us that  $r$  is greater than 1 in each panel, which is correct. Our visual system also tells us that  $r$  is closer to 1 in the two rectangular panels than in the square panel; that is, the slope of BC appears closer to the slope of AB in the two rectangular panels than in the square panel. This, however, is incorrect;  $r$  is the same in all three panels.

The reason for the distortion in judging Fig. 2 is that our visual system is geared to judging angle rather than slope. In their work on computational theories of vision in artificial intelligence, Marr (8) and Stevens (9) have investigated how people judge the slant and tilt (10) of the surfaces of three-dimensional objects. They argue that we judge slant and tilt as

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Cleveland, W. S., & McGill, R. (1985). Graphical perception and graphical methods for analyzing scientific data. *Science, New Series*, 229(4716), 828-833.

# Cleveland's operations of pattern perception:

1. Estimation

2. Assembly

3. Detection

# Cleveland's operations of pattern perception:

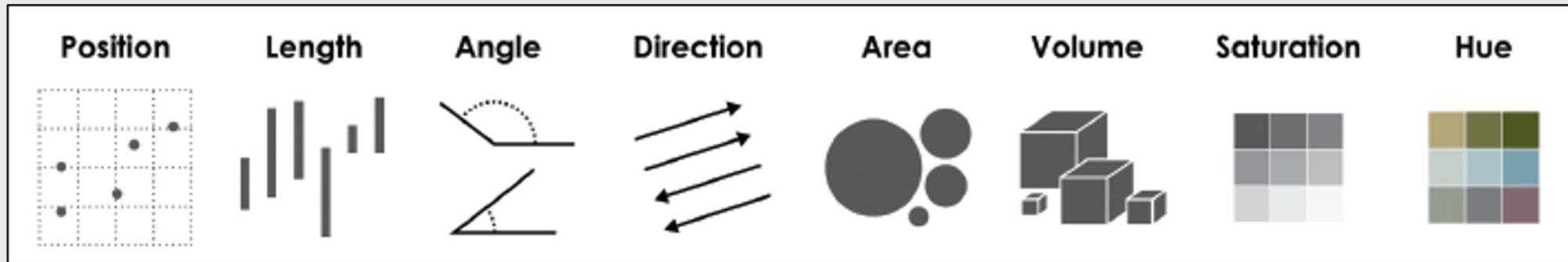
1. **Estimation** ----->

2. Assembly

3. Detection

- **Discrimination** (X equal to Y?)
- **Ranking** (X greater than Y?)
- **Ratioing** (X double Y?)

# Estimation: Hierarchy for *numerical* data



More Accurate

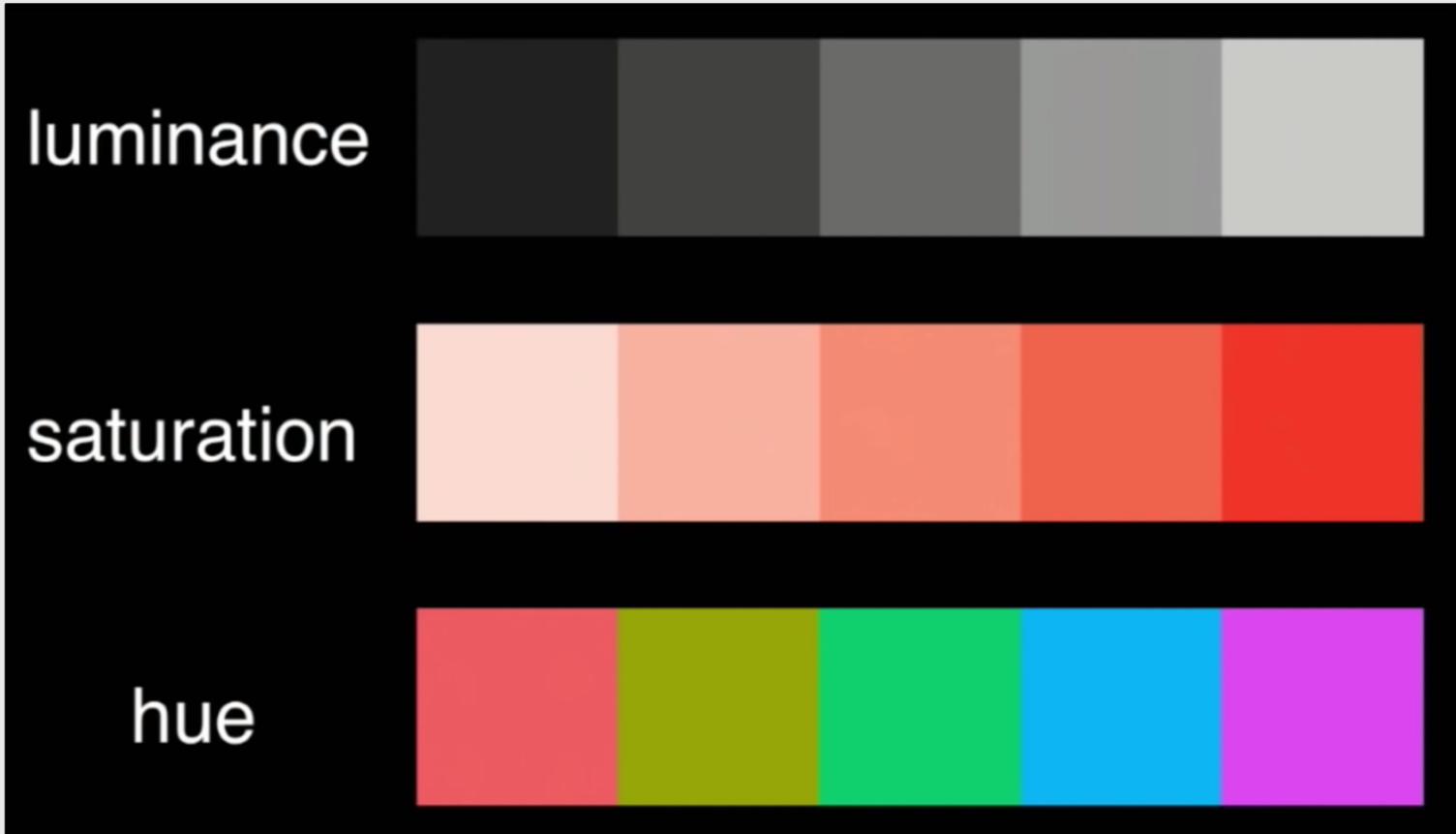
Less Accurate

# Example: Life expectancy in countries in Asia

```
#>          country lifeExp
#> 1      Afghanistan 43.828
#> 2            Iraq 59.545
#> 3        Cambodia 59.723
#> 4       Myanmar 62.069
#> 5  Yemen, Rep. 62.698
#> 6         Nepal 63.785
#> 7    Bangladesh 64.062
#> 8         India 64.698
#> 9        Pakistan 65.483
#> 10       Mongolia 66.803
#> 11  Korea, Dem. Rep. 67.297
#> 12        Thailand 70.616
#> 13        Indonesia 70.650
#> 14         Iran 70.964
#> 15   Philippines 71.688
#> 16        Lebanon 71.993
#> 17        Jordan 72.535
#> 18  Saudi Arabia 72.777
#> 19         China 72.961
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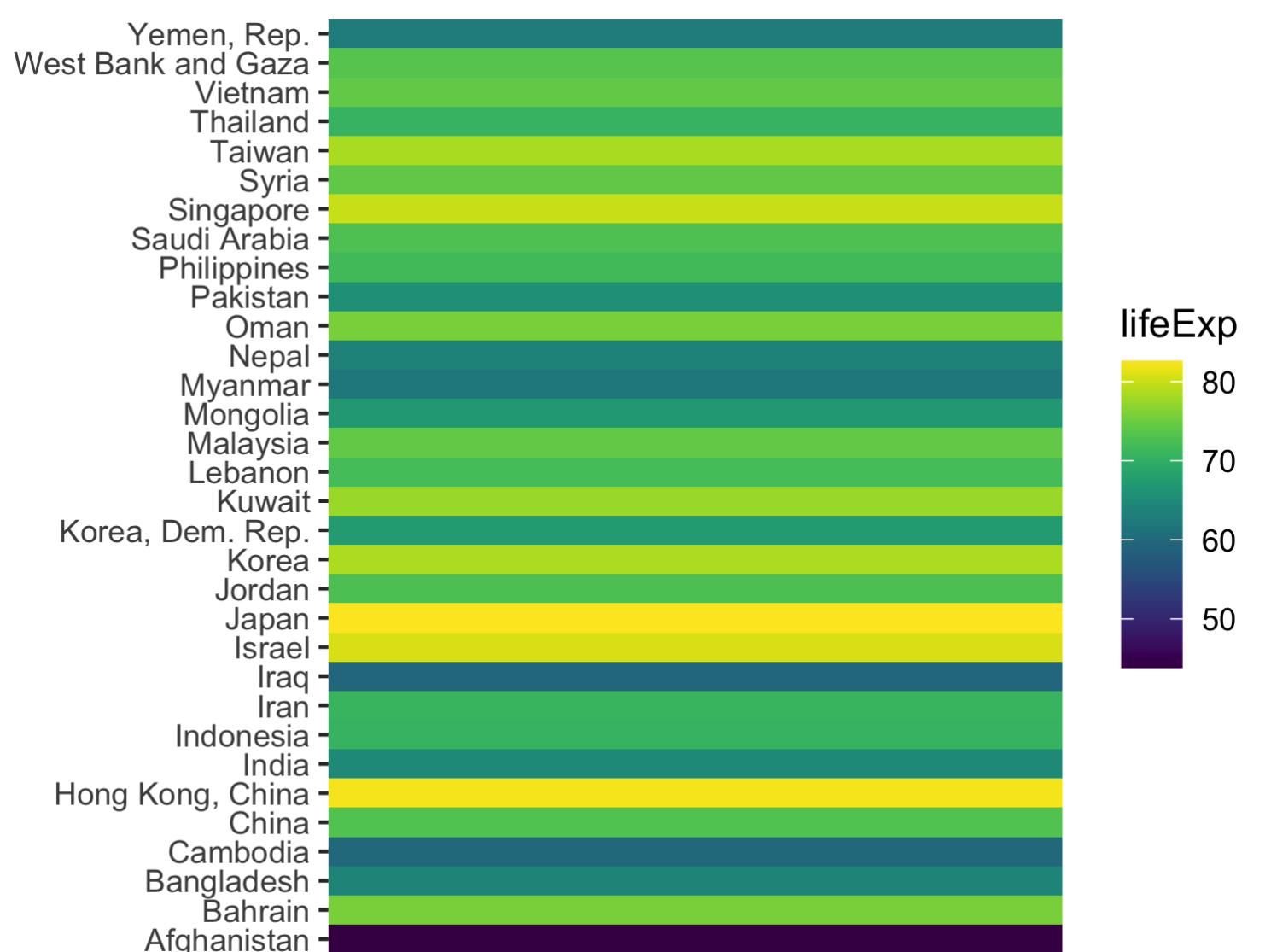
1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. **Color hue**

1. Position on a common scale
2. Position on non-aligned scales
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1. Position on a common scale
2. Position on non-aligned scales
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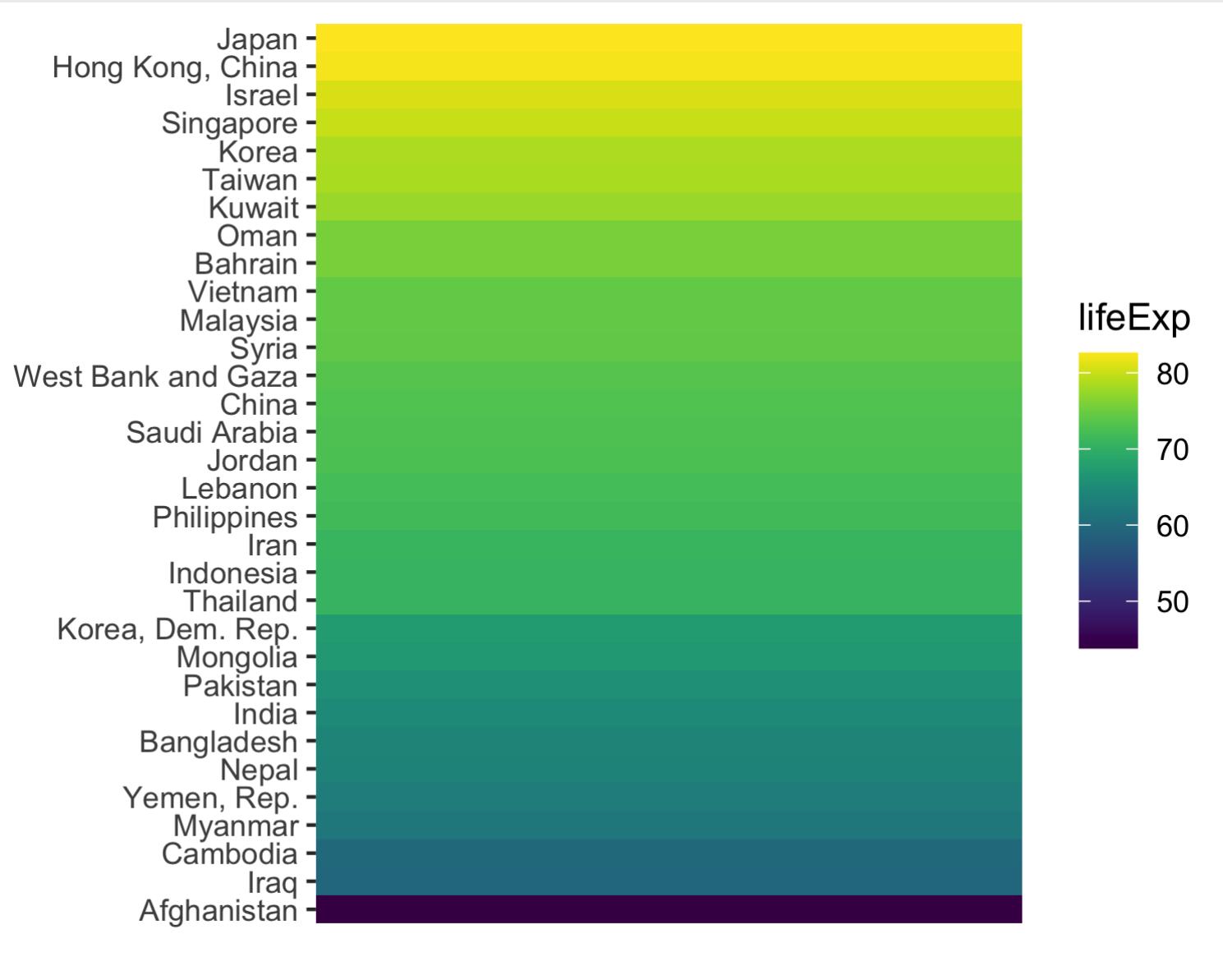
- /  **Discriminate**
- /  **Rank**
- **Ratio**



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. **Color hue**

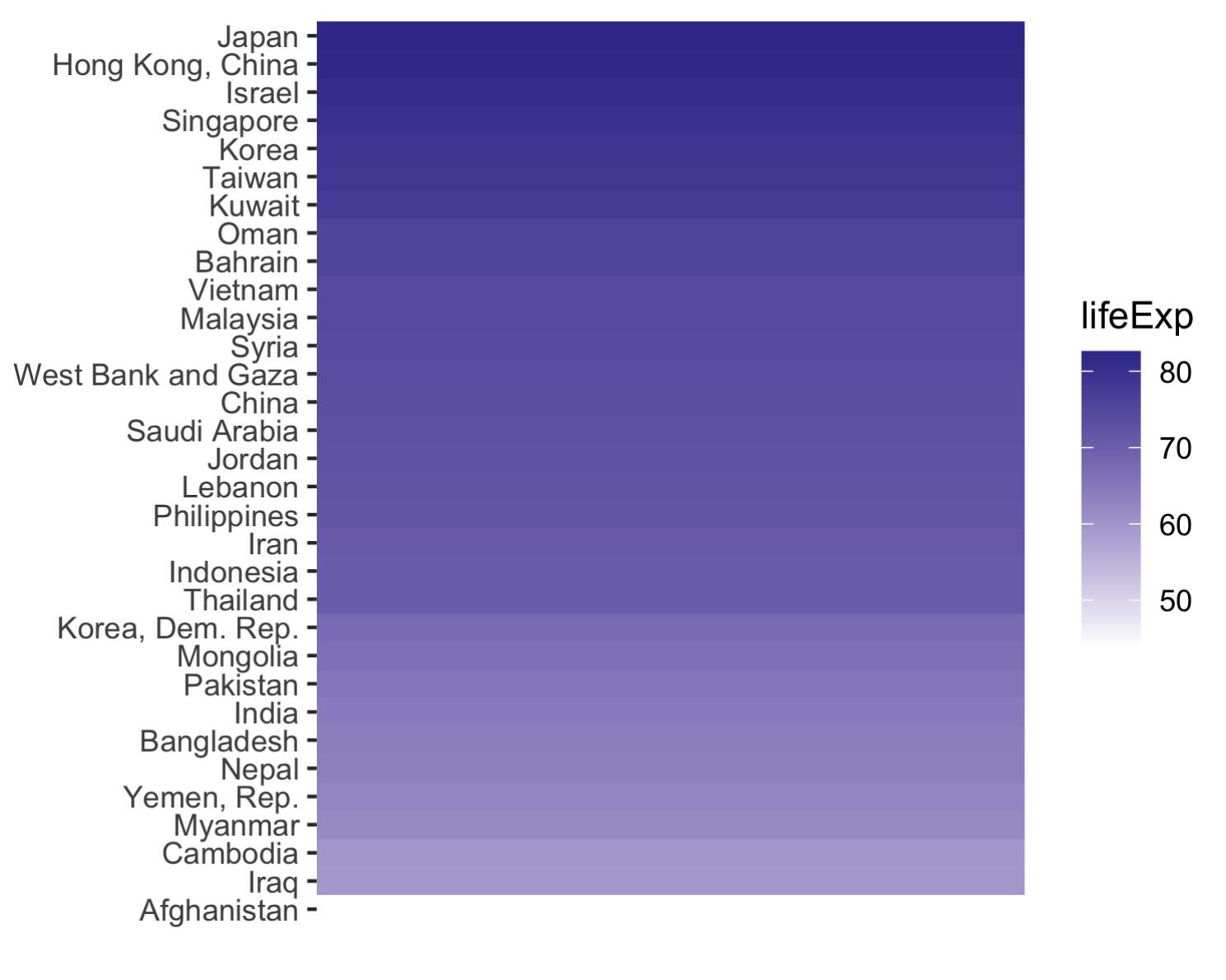
Sorting helps a bit...

- /  **Discriminate**
- /  **Rank**
- **Ratio**



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. **Color saturation**
7. Color hue

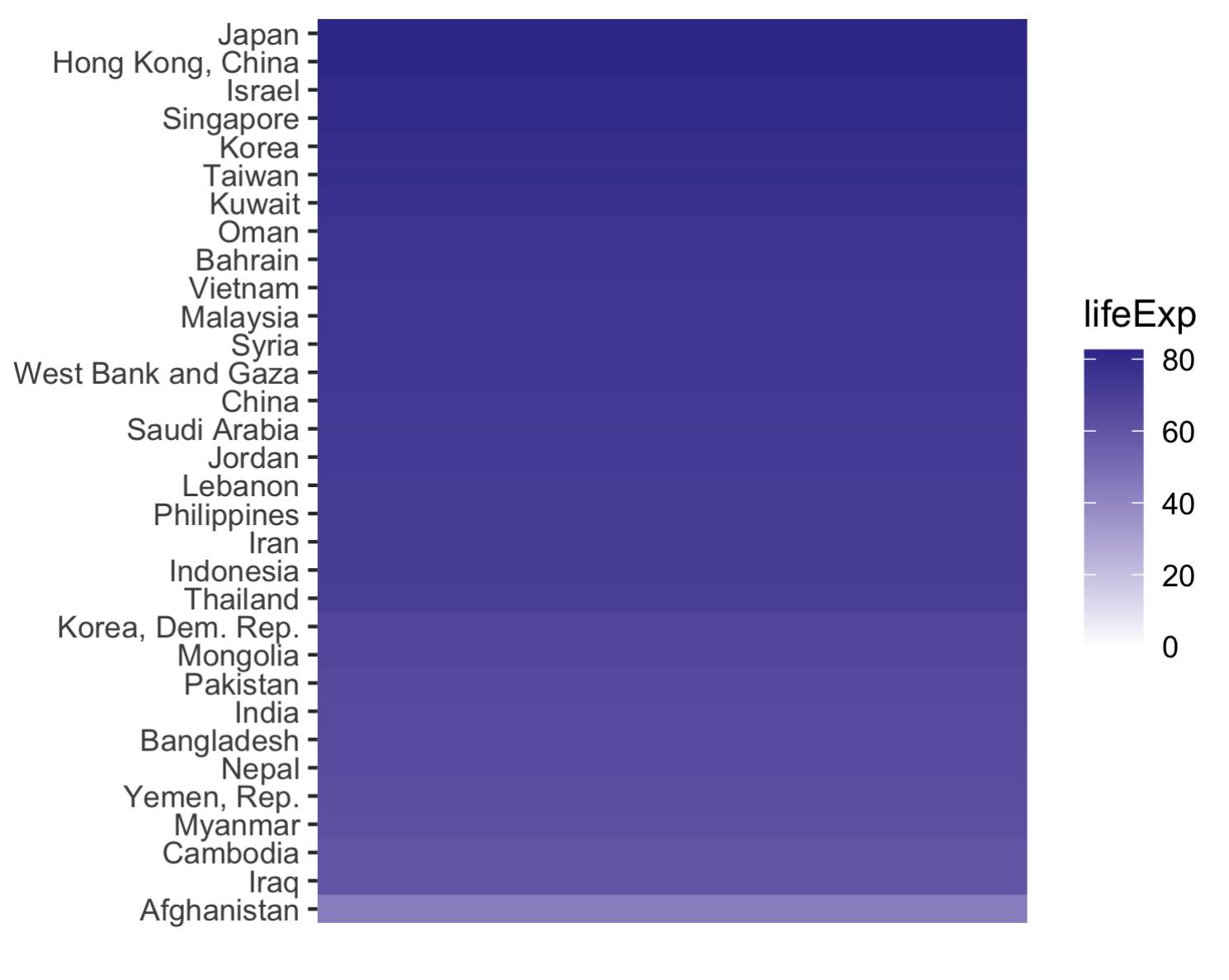
- /  **Discriminate**
- /  **Rank**
- **Ratio**



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. **Color saturation**
7. Color hue

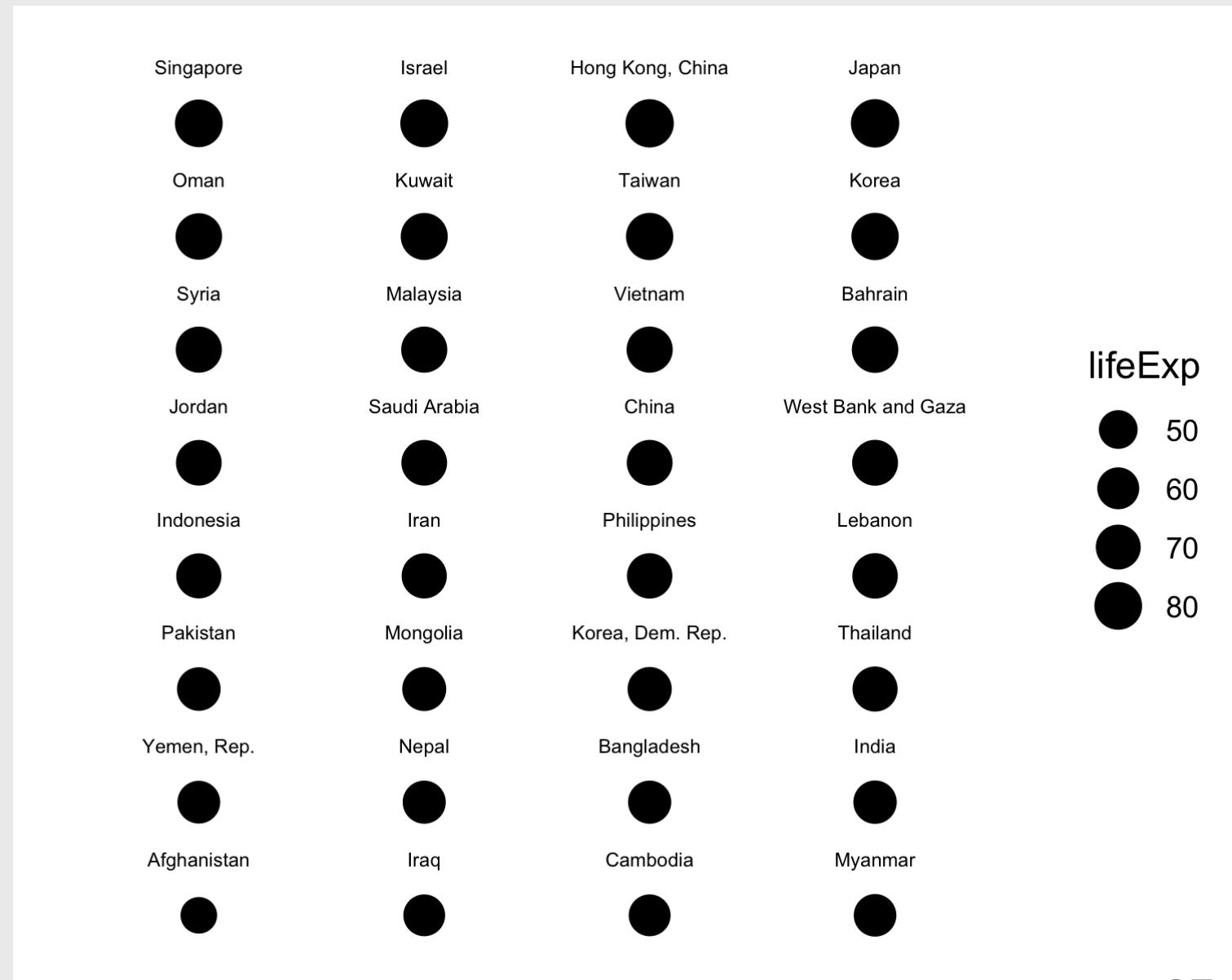
Align to 0 scale:

- /  **Discriminate**
- /  **Rank**
- /  **Ratio**



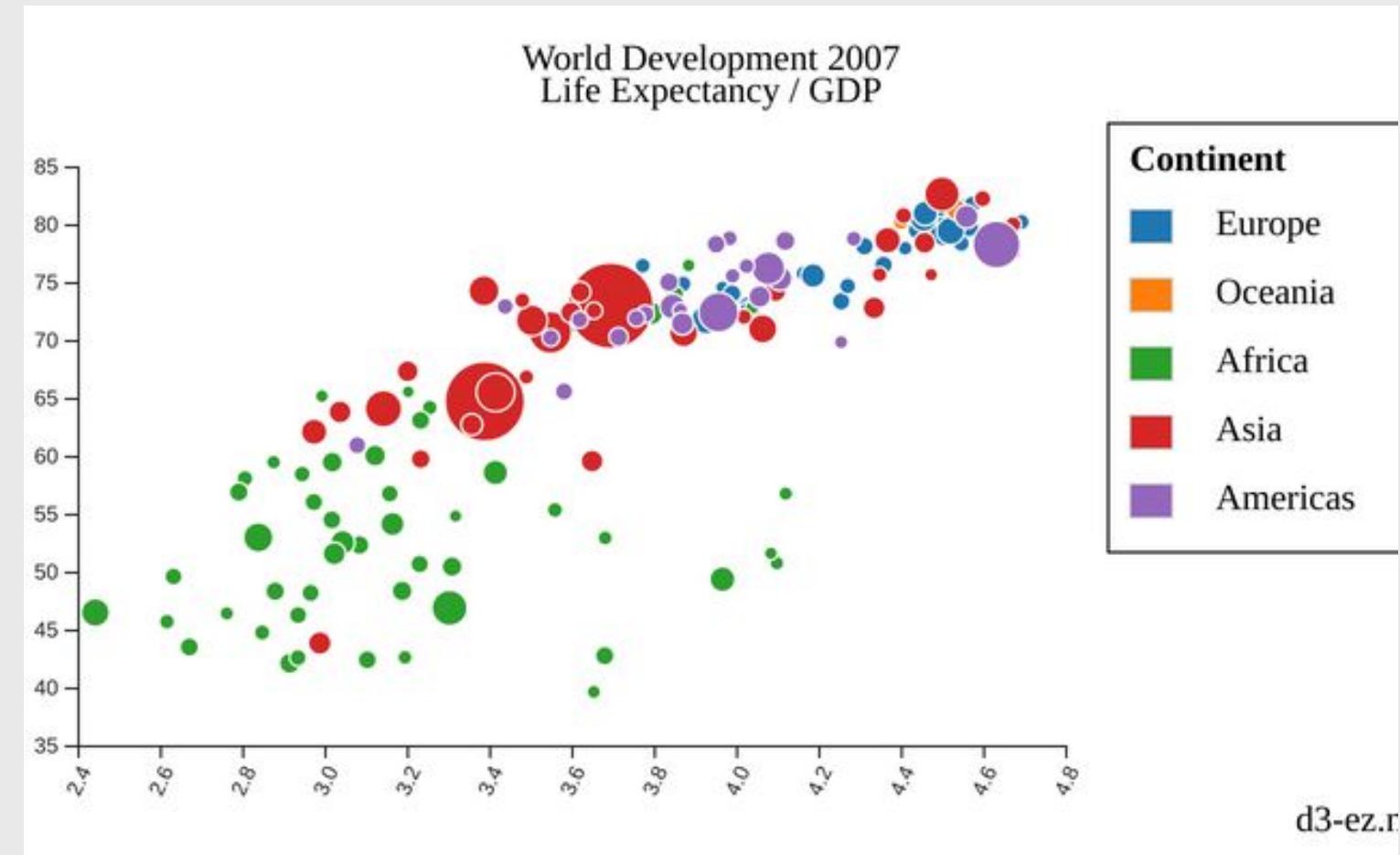
1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. **Area**
6. Color saturation
7. Color hue

- /  **Discriminate**
- /  **Rank**
- /  **Ratio**



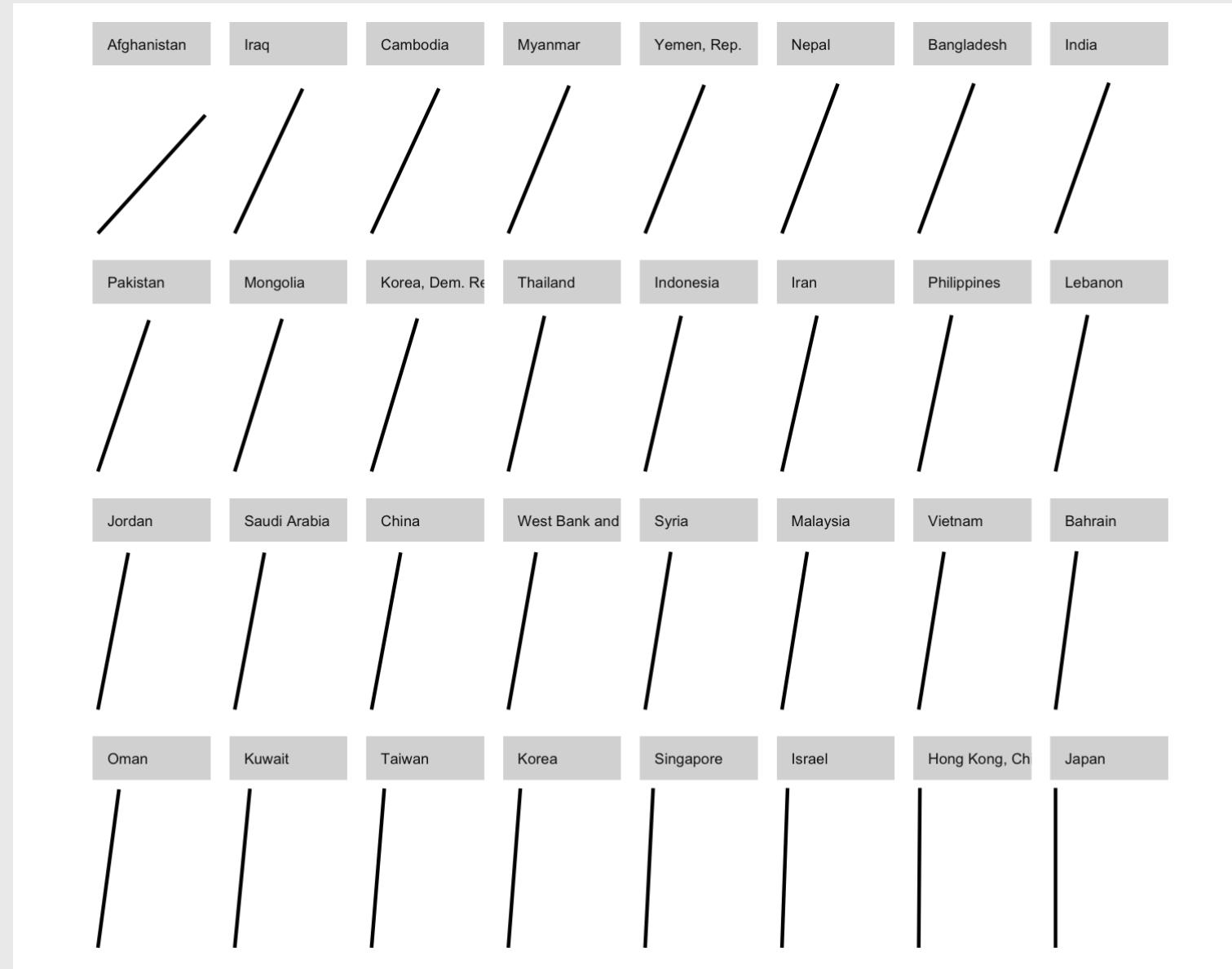
1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. **Area**
6. Color saturation
7. Color hue

Area works okay for "bubble" charts

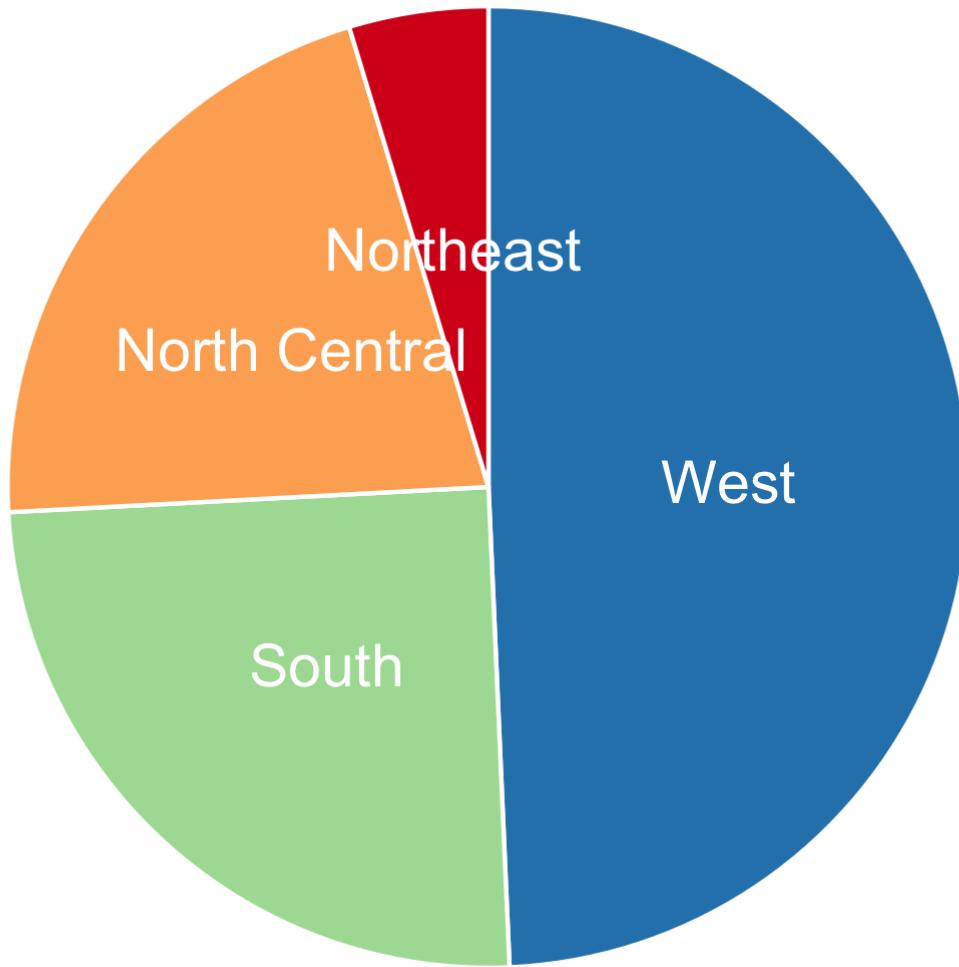


1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. **Angle**
5. Area
6. Color saturation
7. Color hue

- /  **Discriminate**
- **Rank**
- /  **Ratio**



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. **Angle**
5. Area
6. Color saturation
7. Color hue



1. Position on a common scale
2. Position on non-aligned scales
3. **Length**
4. Angle
5. Area
6. Color saturation
7. Color hue

- /  **Discriminate**
- /  **Rank**
- **Ratio**



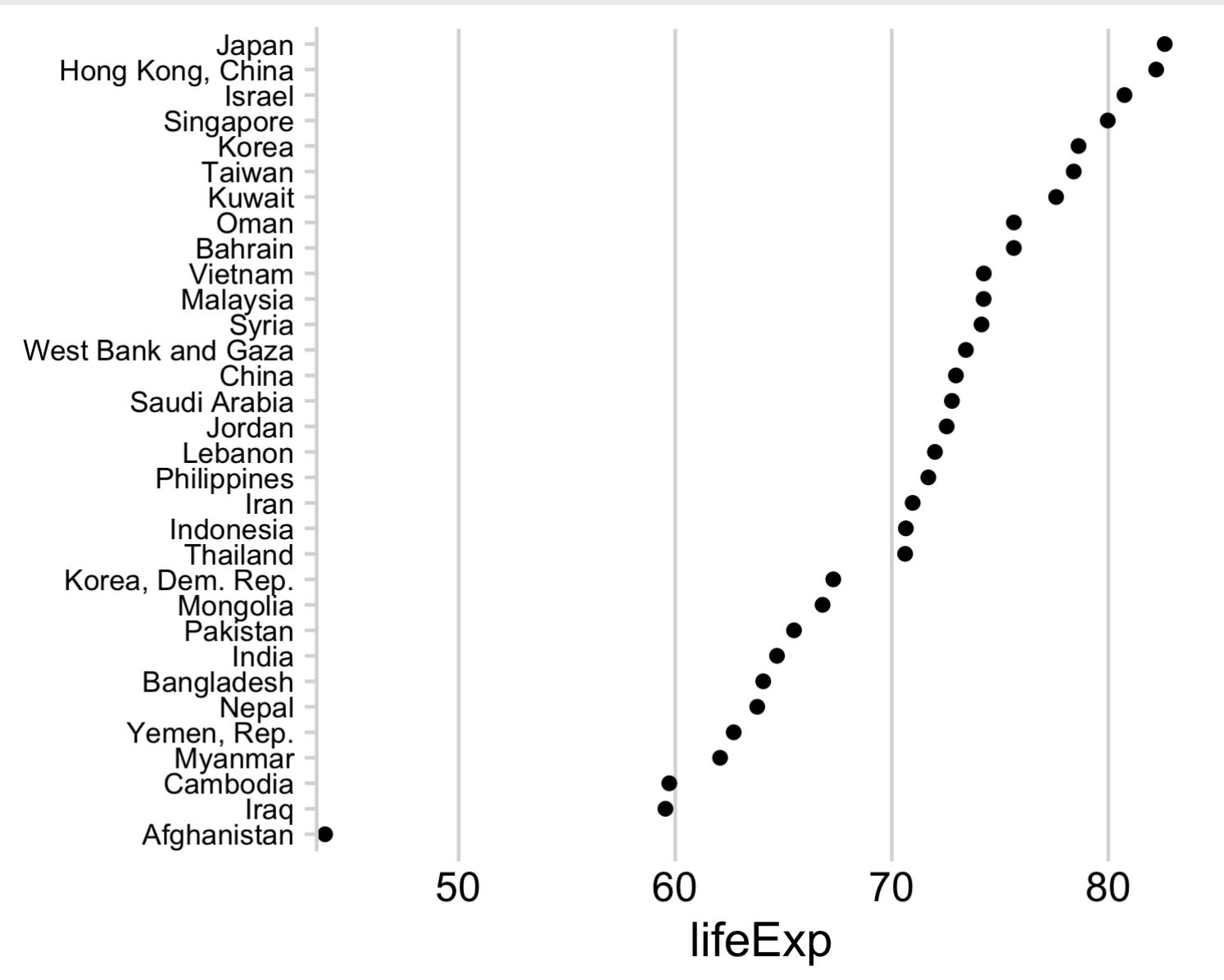
1. Position on a common scale
2. **Position on non-aligned scales**
3. Length
4. Angle
5. Area
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7. Color hue

- /  **Discriminate**
- /  **Rank**
- **Ratio**



- 1. Position on a common scale**
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. Color hue

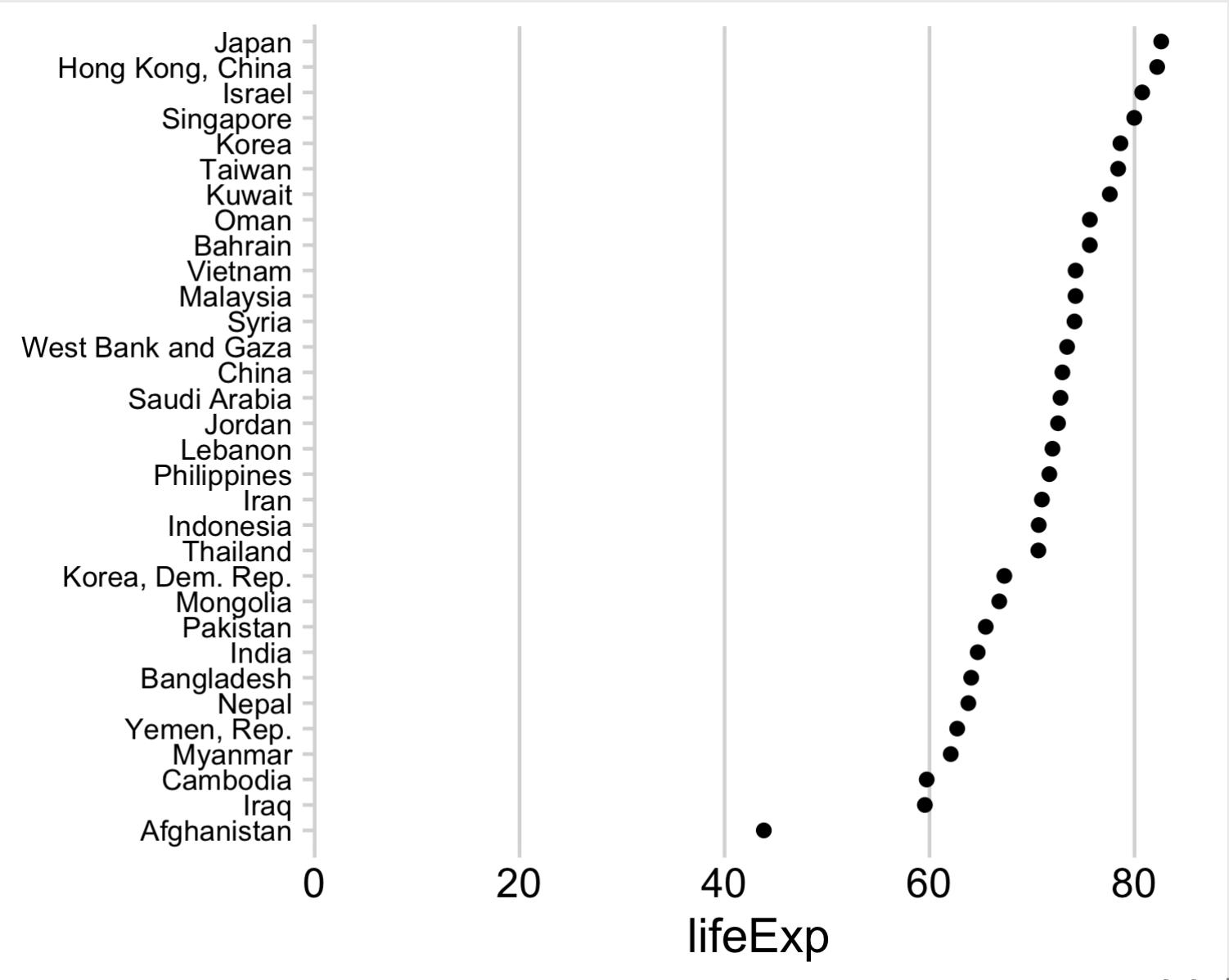
- **Discriminate**
- **Rank**
- **Ratio**



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. Color hue

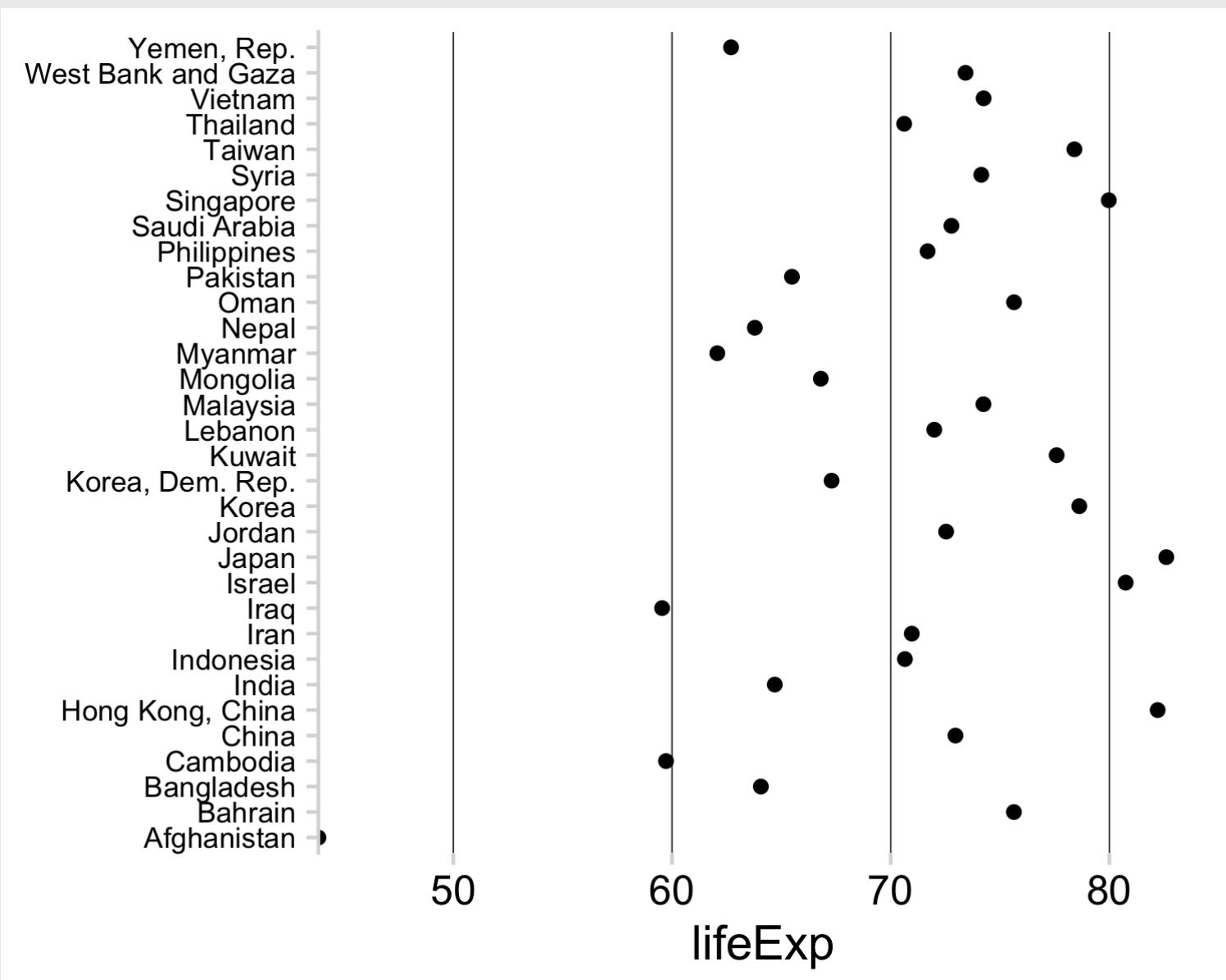
### No need to scale to 0:

- Lowers resolution
- Isn't needed for accurate ratioing



1. Position on a common scale
2. Position on non-aligned scales
3. Length
4. Angle
5. Area
6. Color saturation
7. Color hue

**Sorting still matters!**



# Cleveland's operations of pattern perception:

1. Estimation

2. Assembly

3. Detection

# Cleveland's operations of pattern perception:

1. Estimation

2. **Assembly** -----> **The grouping of graphical elements**

3. Detection

# Assembly: Gestalt Psychology

The whole has a reality that is entirely separate from the parts



**WWF**

# Reification

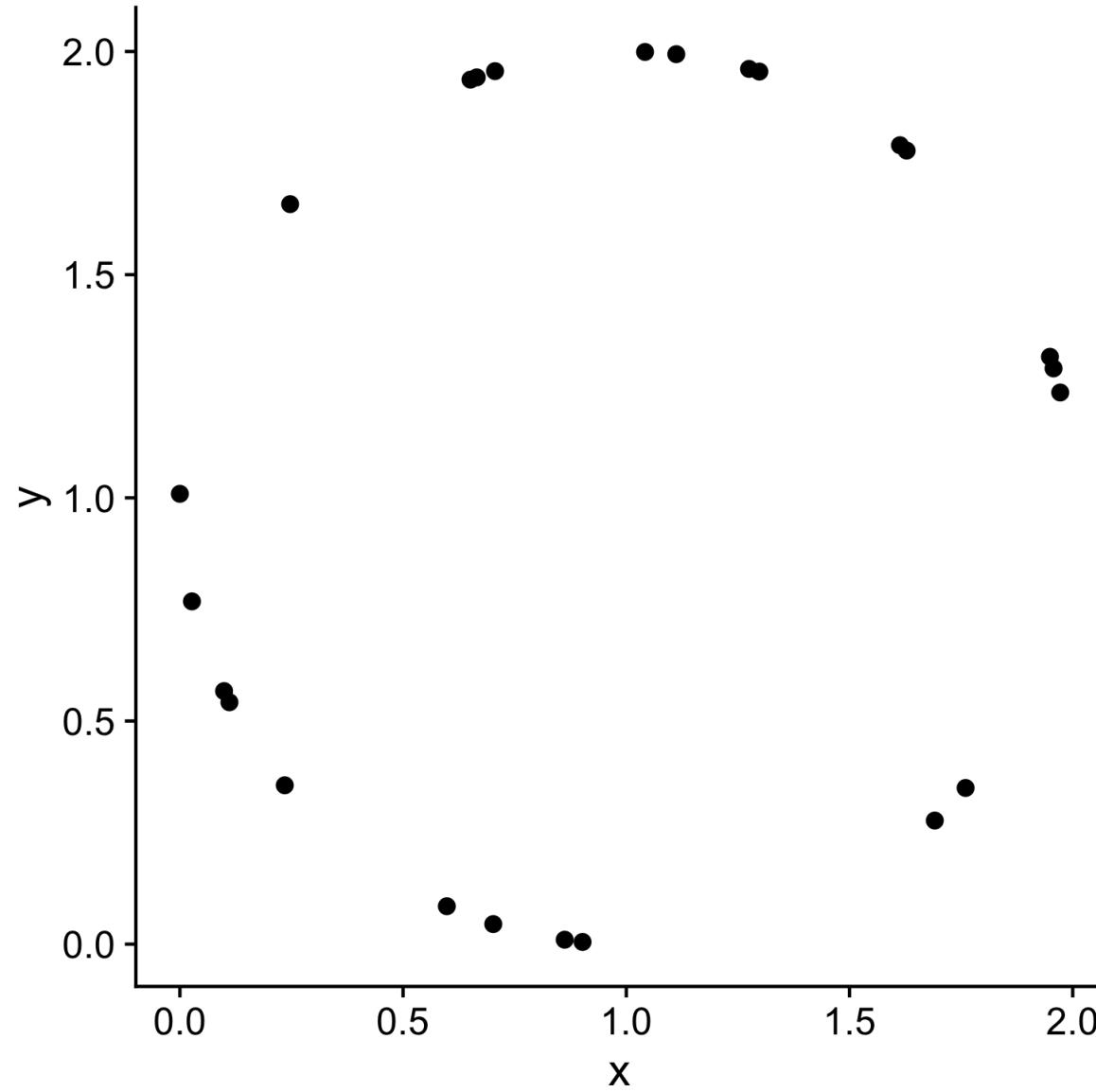


# Emergence



# Law of Closure

Our minds fill in  
the missing  
information



# Prägnanz

We strongly prefer to interpret stimuli as regular, simple, and orderly

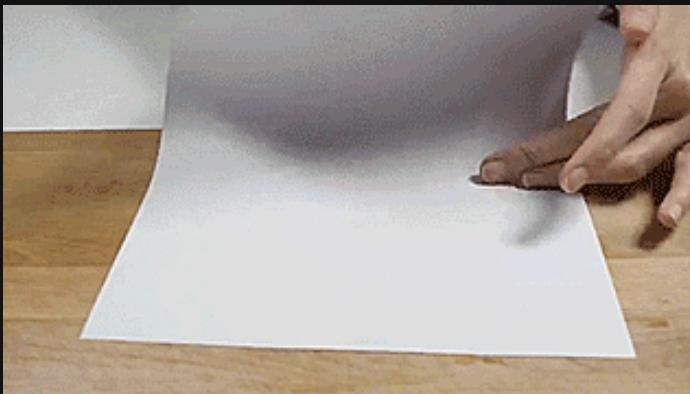
# Prägnanz

We strongly prefer to interpret stimuli as regular, simple, and orderly



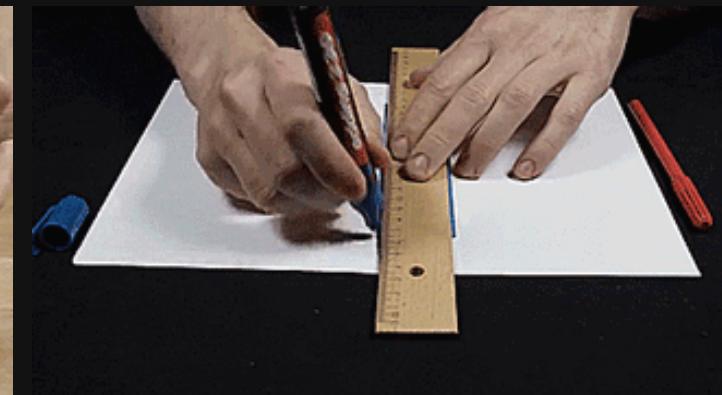
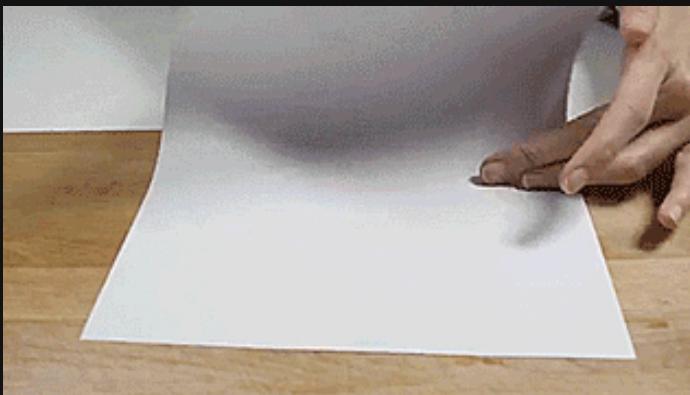
# Prägnanz

We strongly prefer to interpret stimuli as regular, simple, and orderly



# Prägnanz

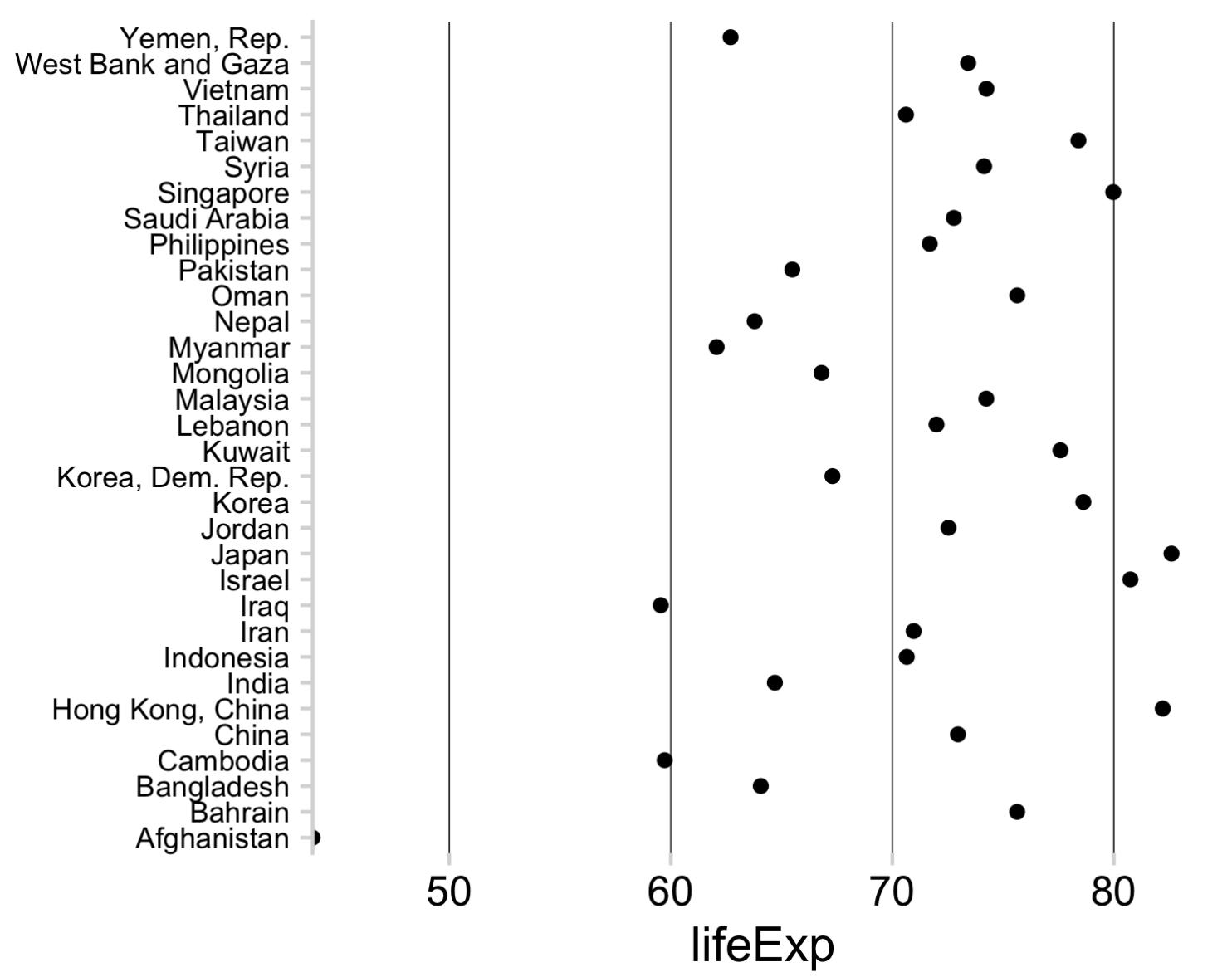
We strongly prefer to interpret stimuli as regular, simple, and orderly



# Prägnanz

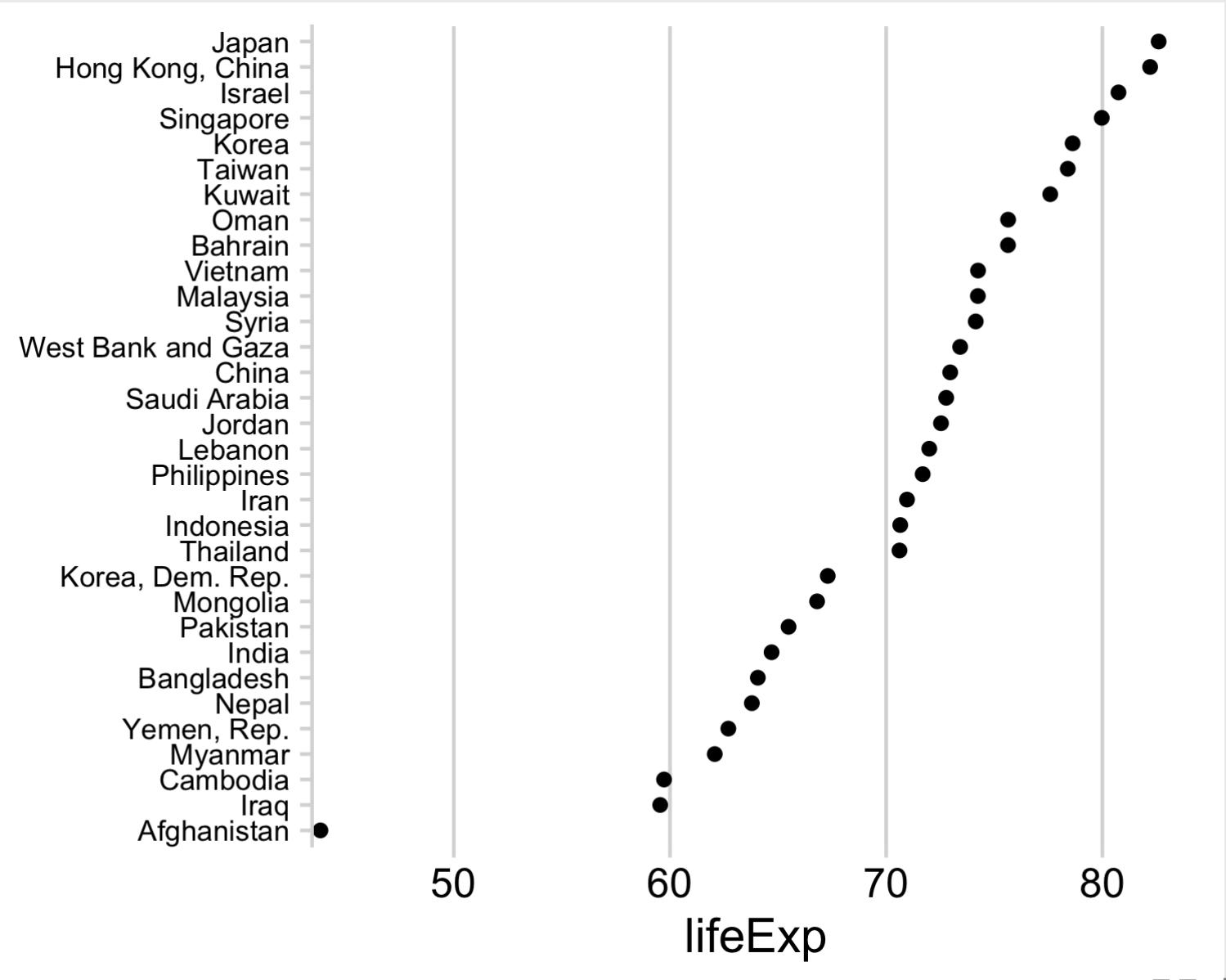
This should cause  
you cognitive pain

It's the graphical  
equivalent of this:



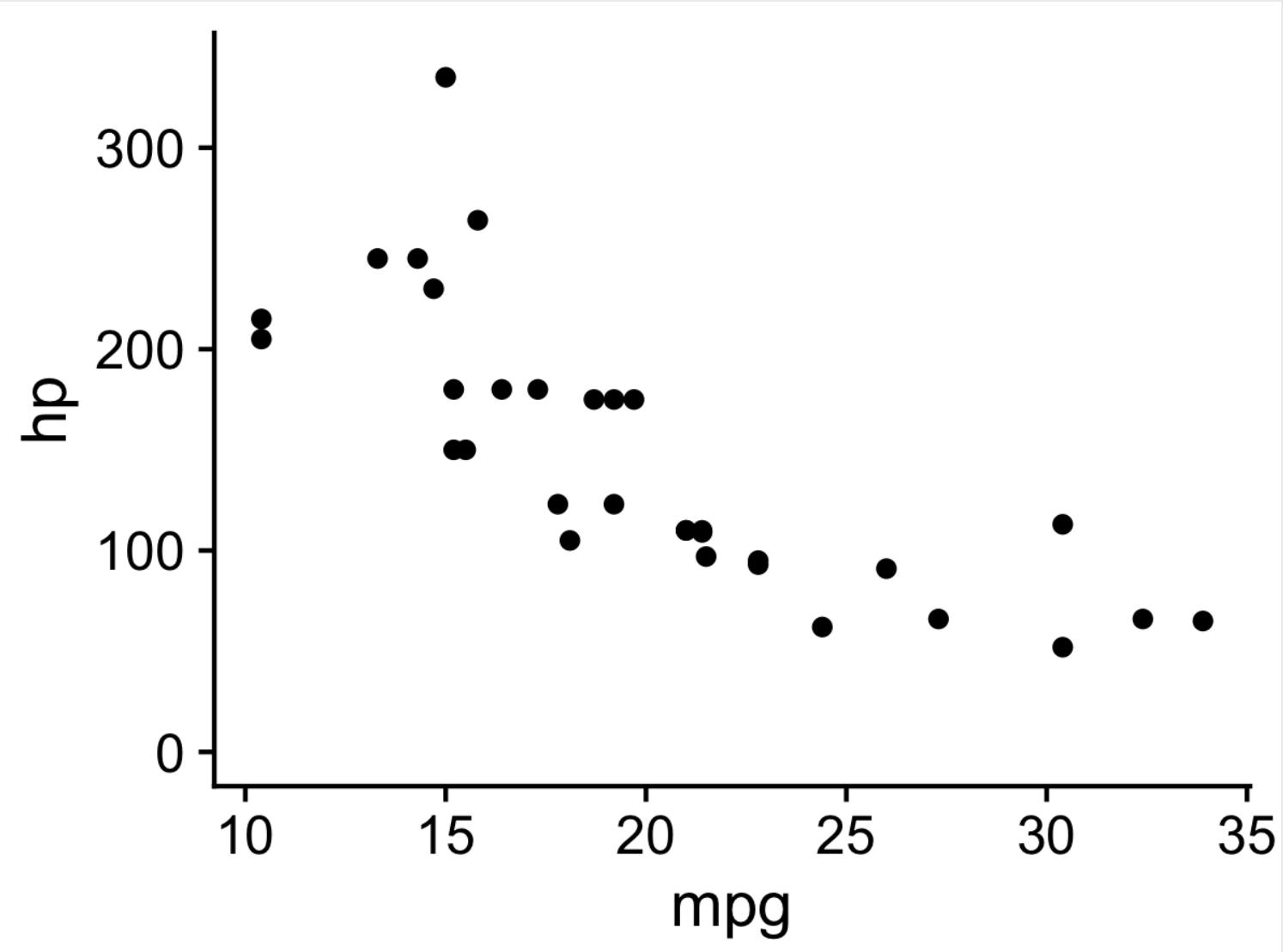
# Prägnanz

This makes our  
brains happy



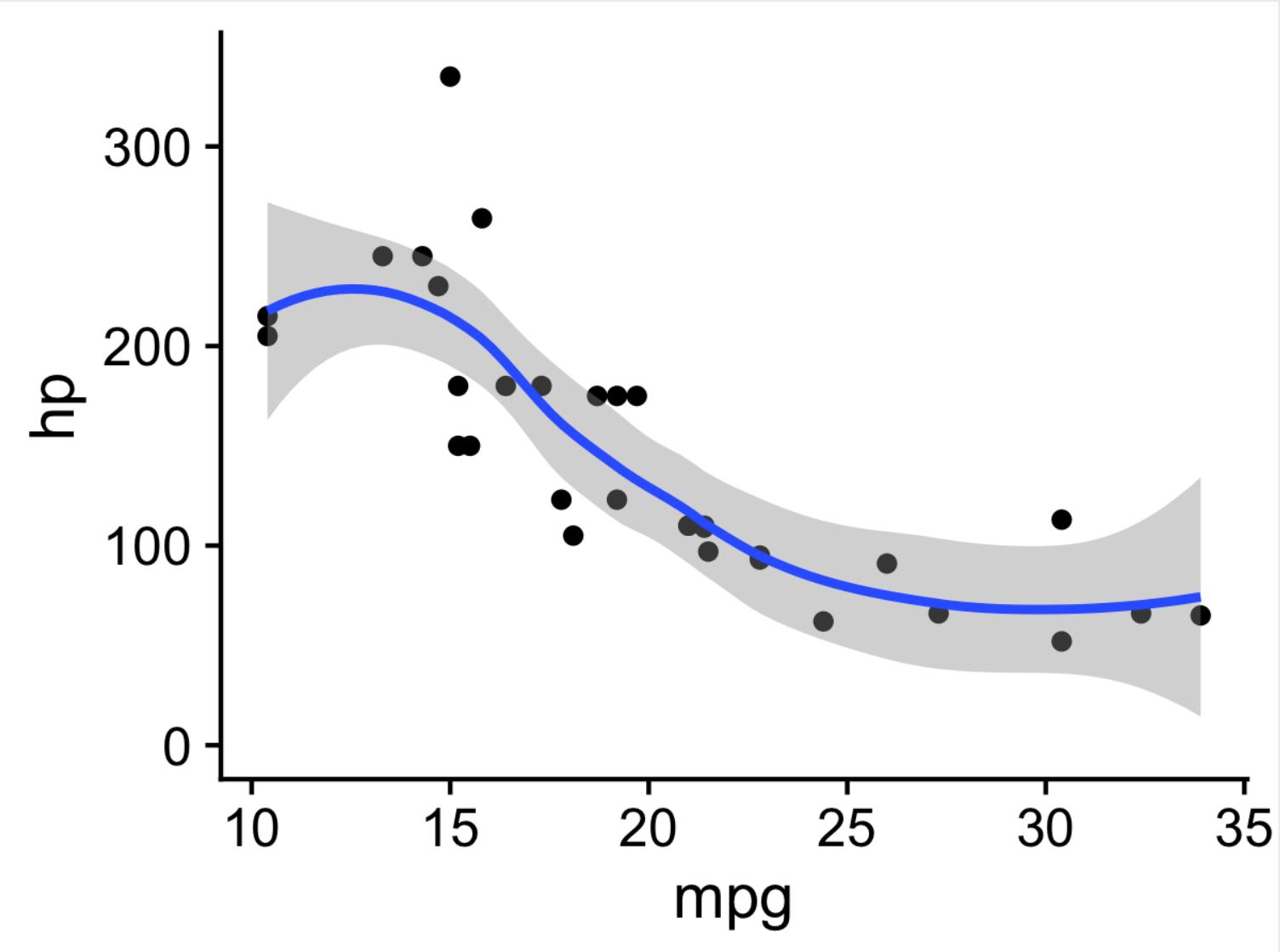
# Law of Continuity

We will group together objects that follow an established direction



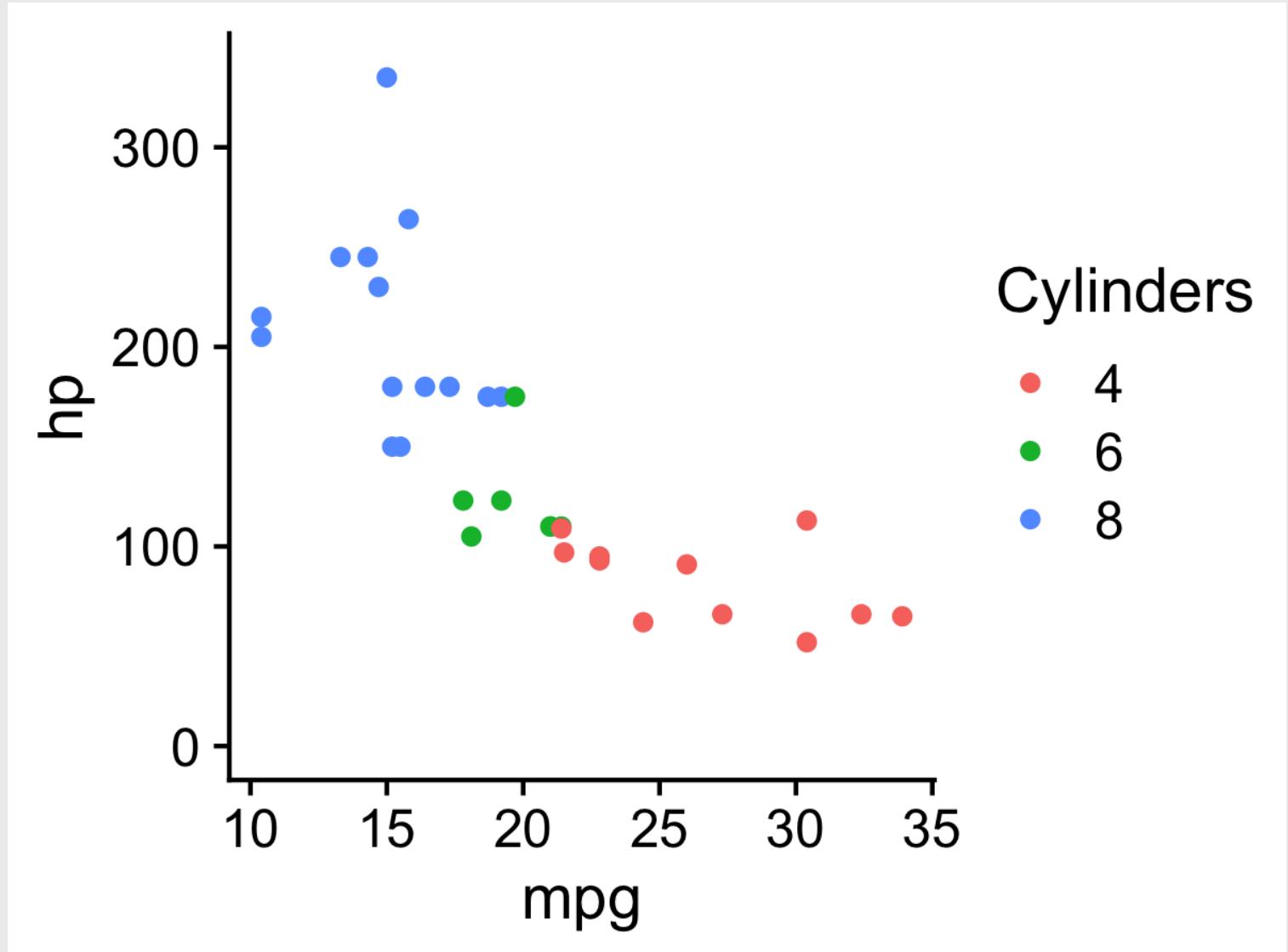
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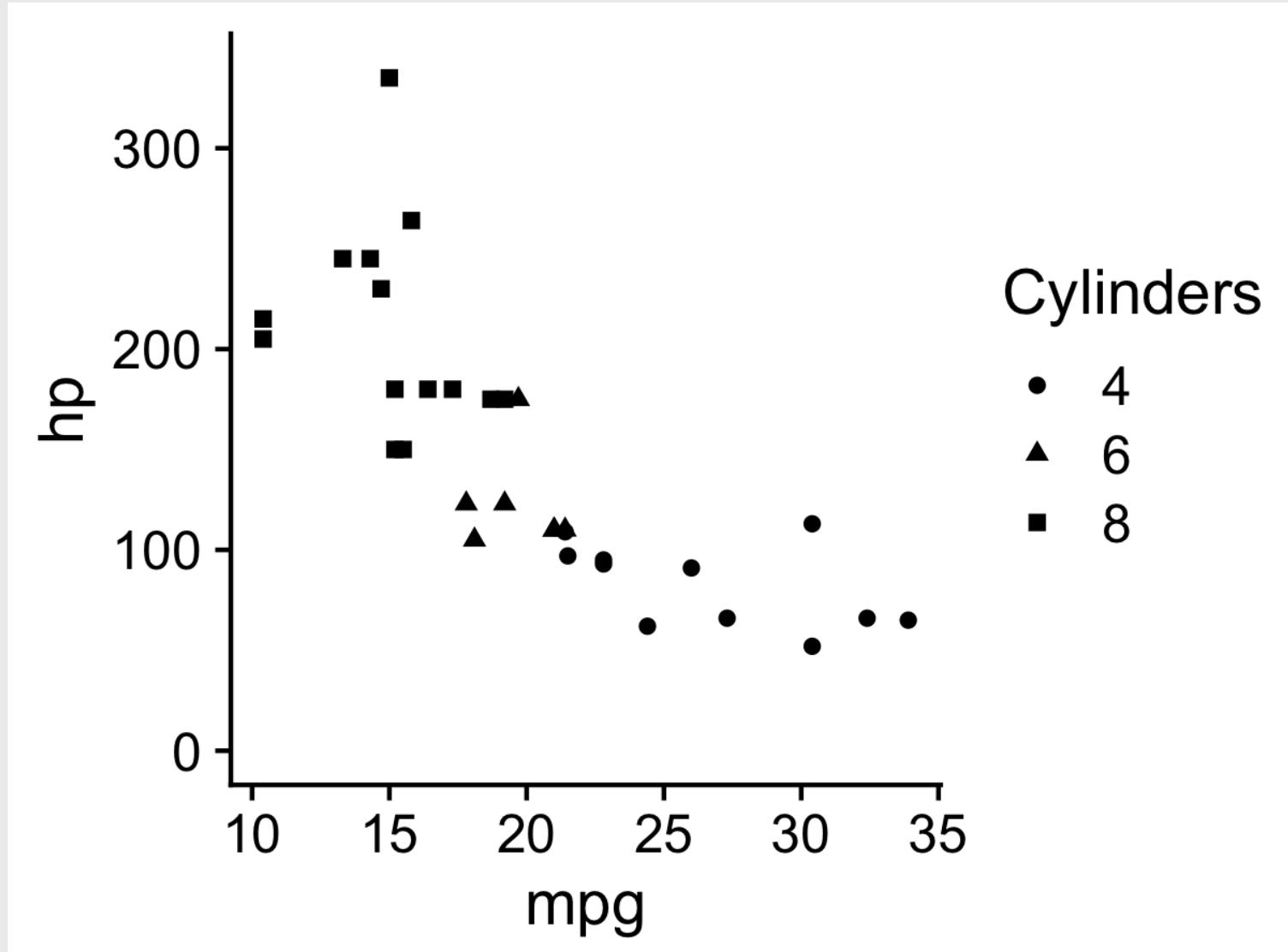
# Law of Similarity

We see elements that are *physically similar* as part of the same object



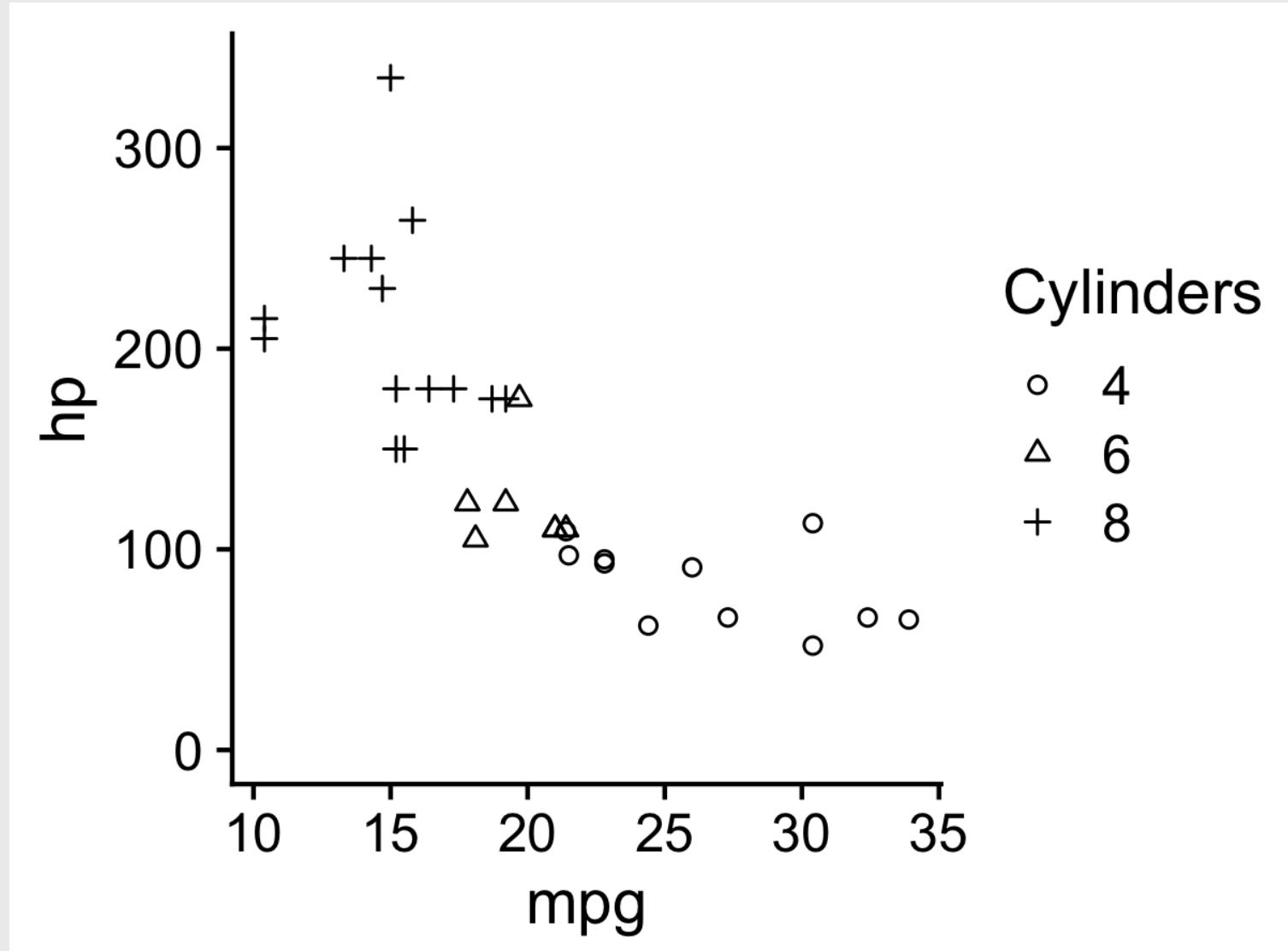
# Law of Similarity

We see elements  
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same object



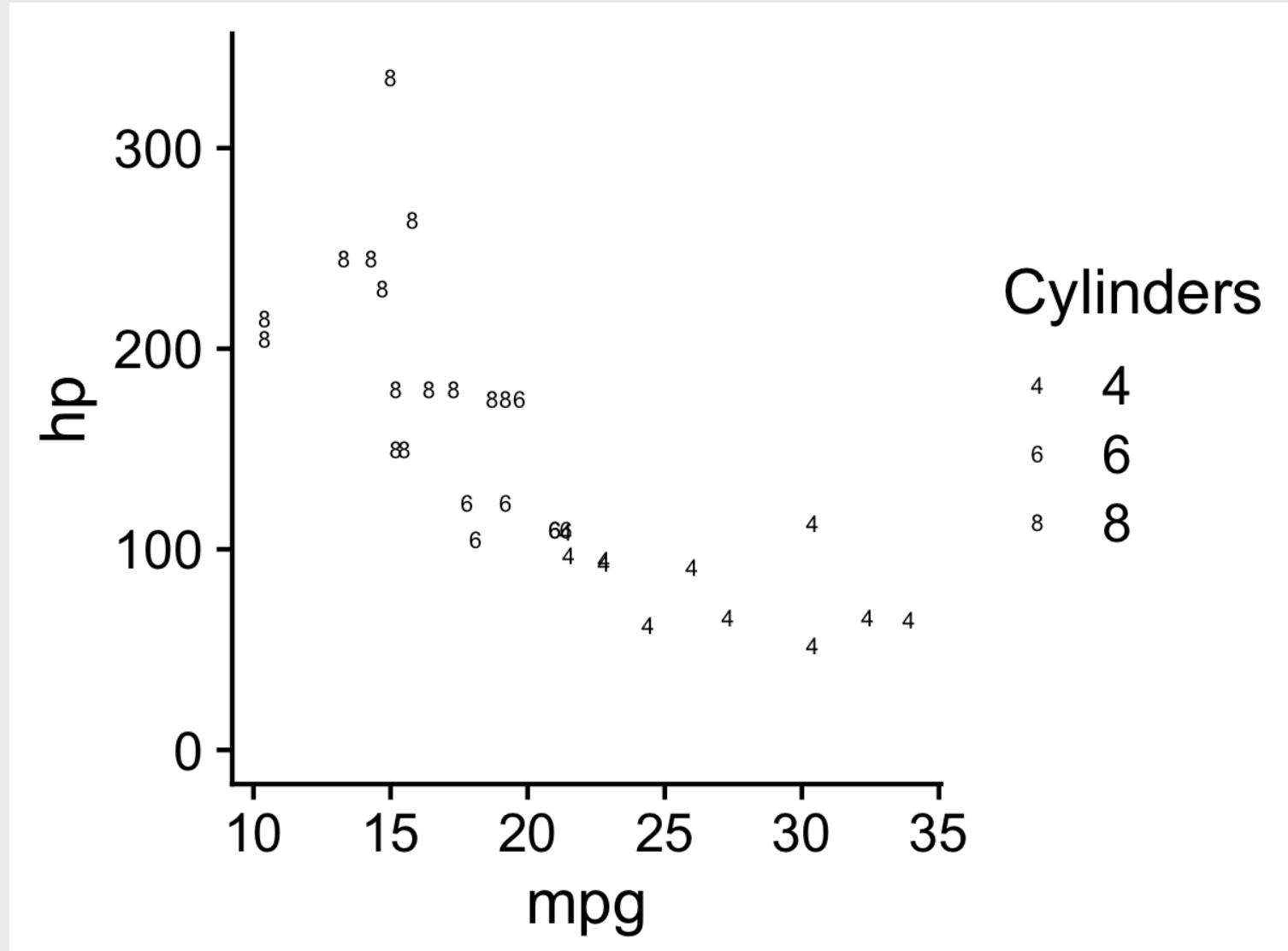
# Law of Similarity

We see elements that are *physically similar* as part of the same object



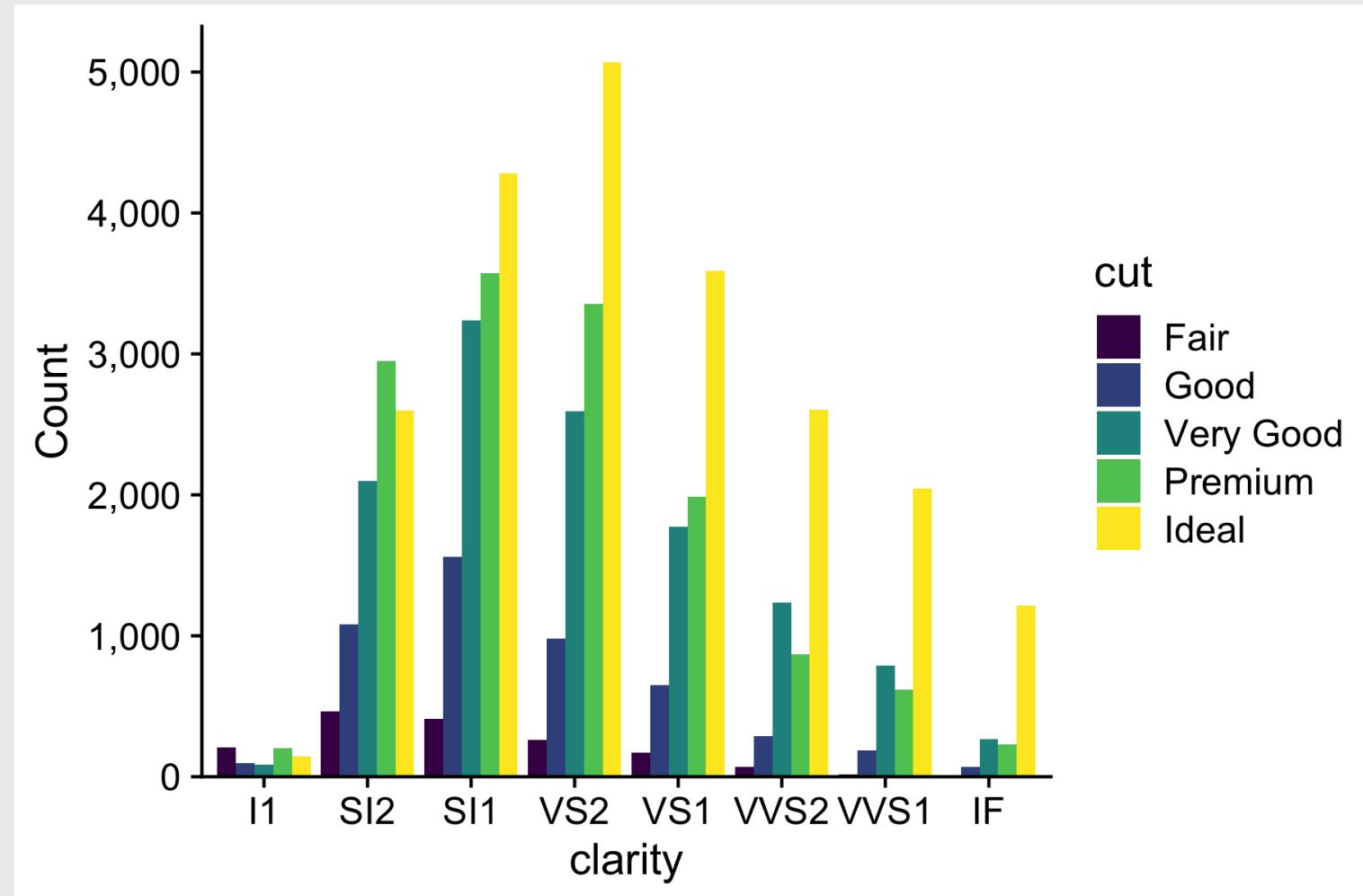
# Law of Similarity

We see elements that are *physically similar* as part of the same object



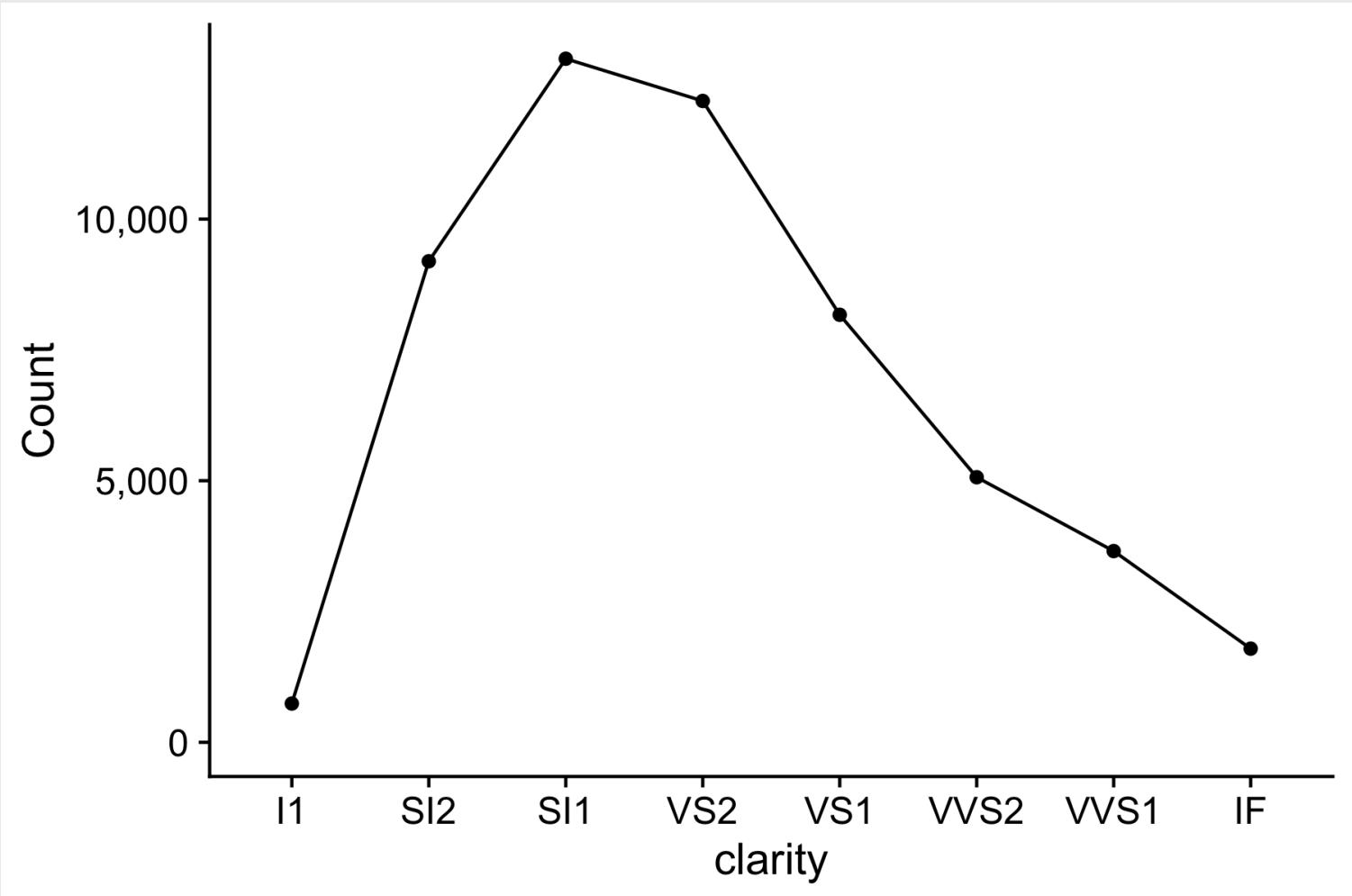
# Law of Proximity

We tend to see elements that are *physically near* each other as part of the same object



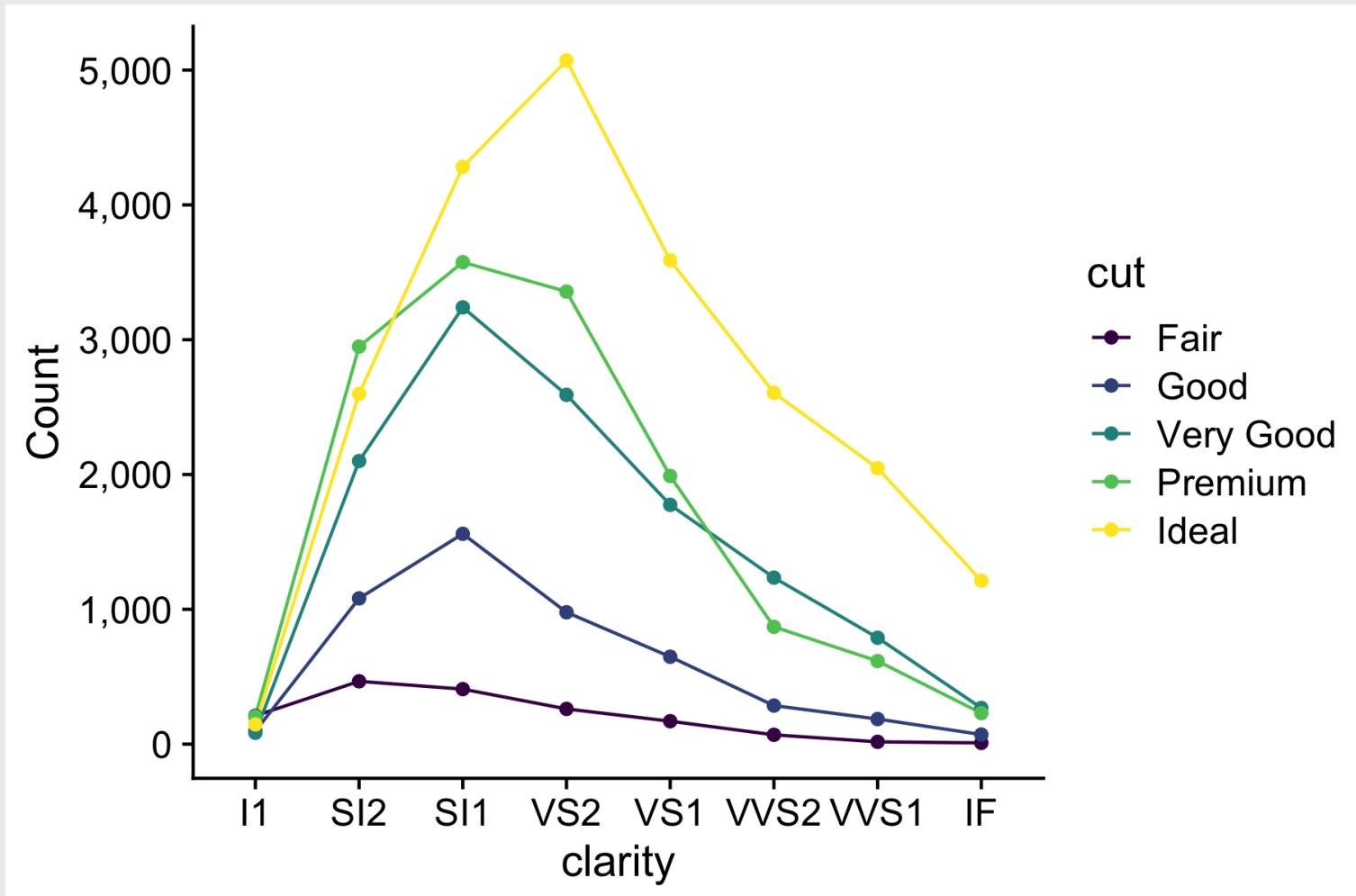
# Law of Proximity

We tend to see elements that are *physically near* each other as part of the same object



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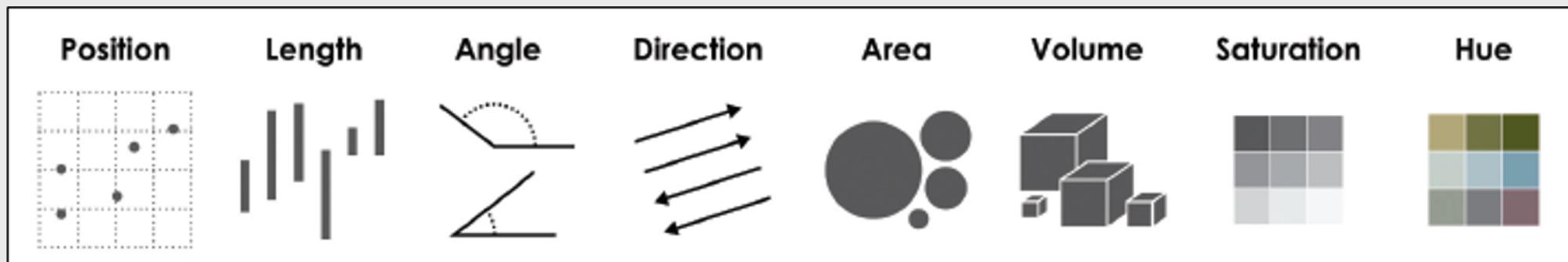
# Cleveland's operations of pattern perception:

1. Estimation

2. Assembly

3. Detection

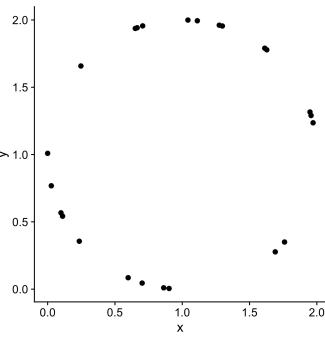
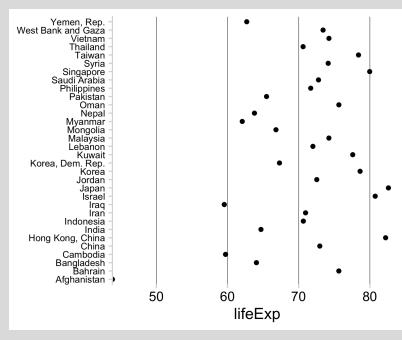
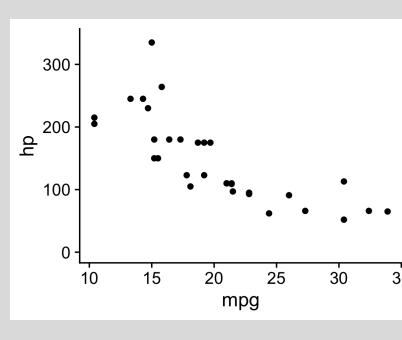
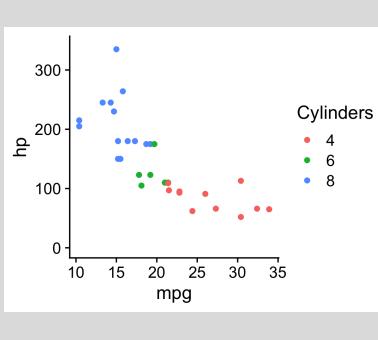
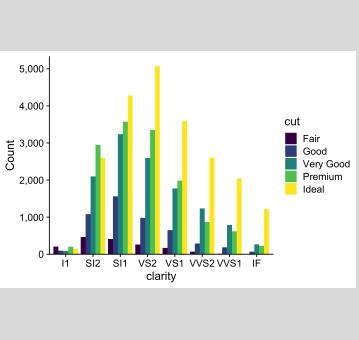
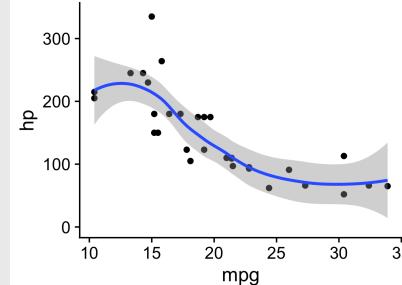
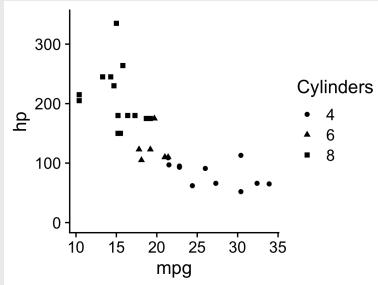
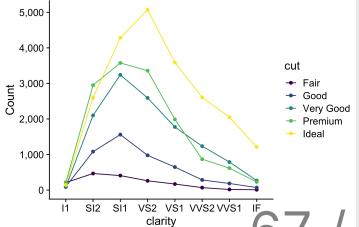
# Estimation: Hierarchy for *numerical* data



More Accurate

Less Accurate

# Assembly: Gestalt Psychology

Law of Closure	Prägnanz	Law of Continuity	Law of Similarity	Law of Proximity
Fill in the missing information	We like regular, simple, and orderly	Group together objects with established direction	Physically <i>similar</i> = same object	Physically <i>near</i> = same object
 				
				

# Cleveland's operations of pattern perception:

1. Estimation

2. Assembly

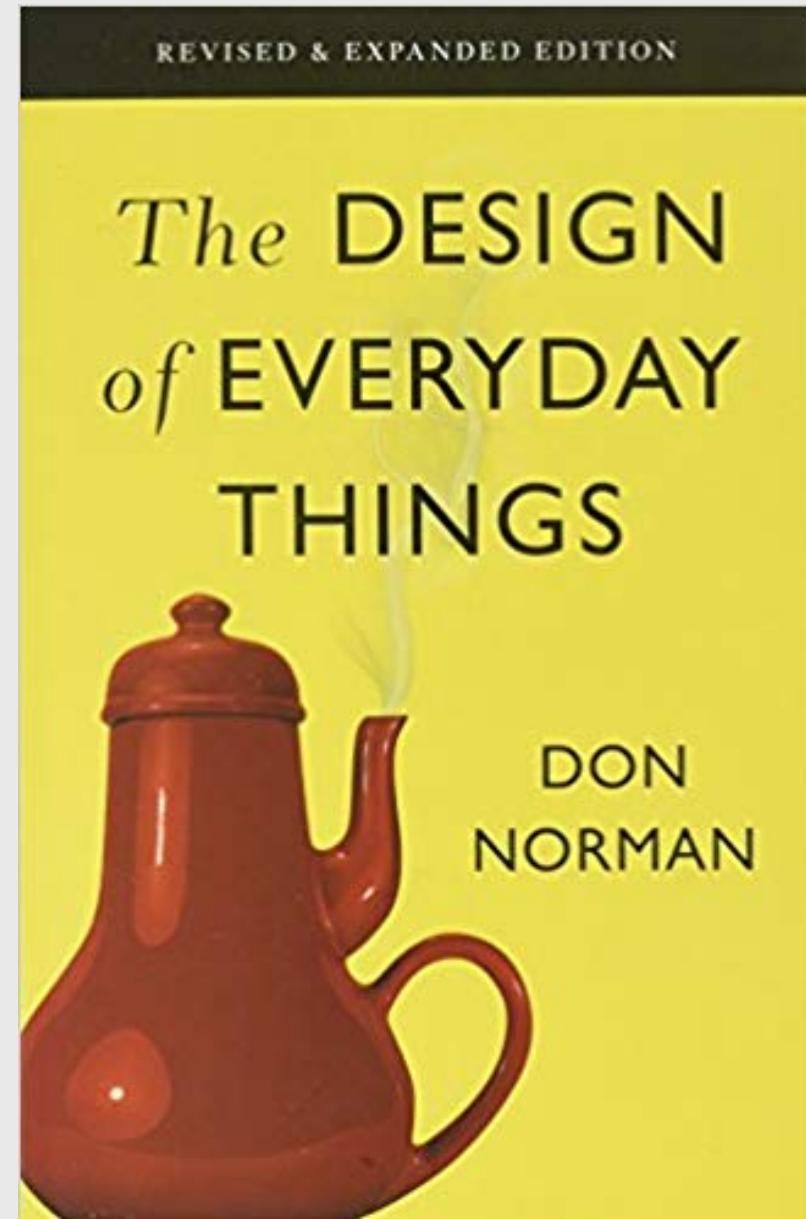
3. Detection ----->

**Recognizing that a geometric object  
encodes a physical value**



# Norman door (n.):

1. A door where the design tells you to do the opposite of what you're actually supposed to do.
2. A door that gives the wrong signal and needs a sign to correct it.



# Norman door

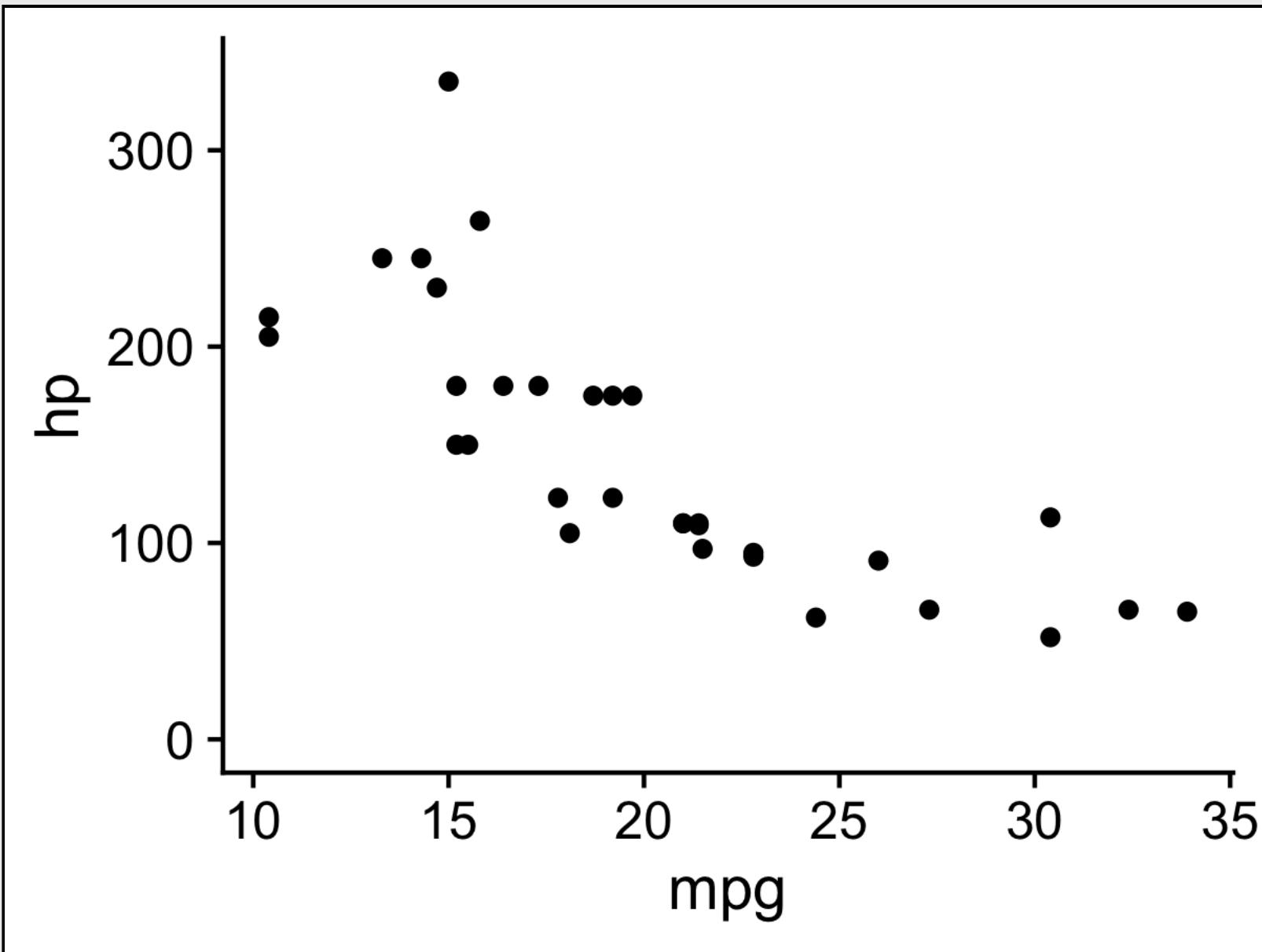


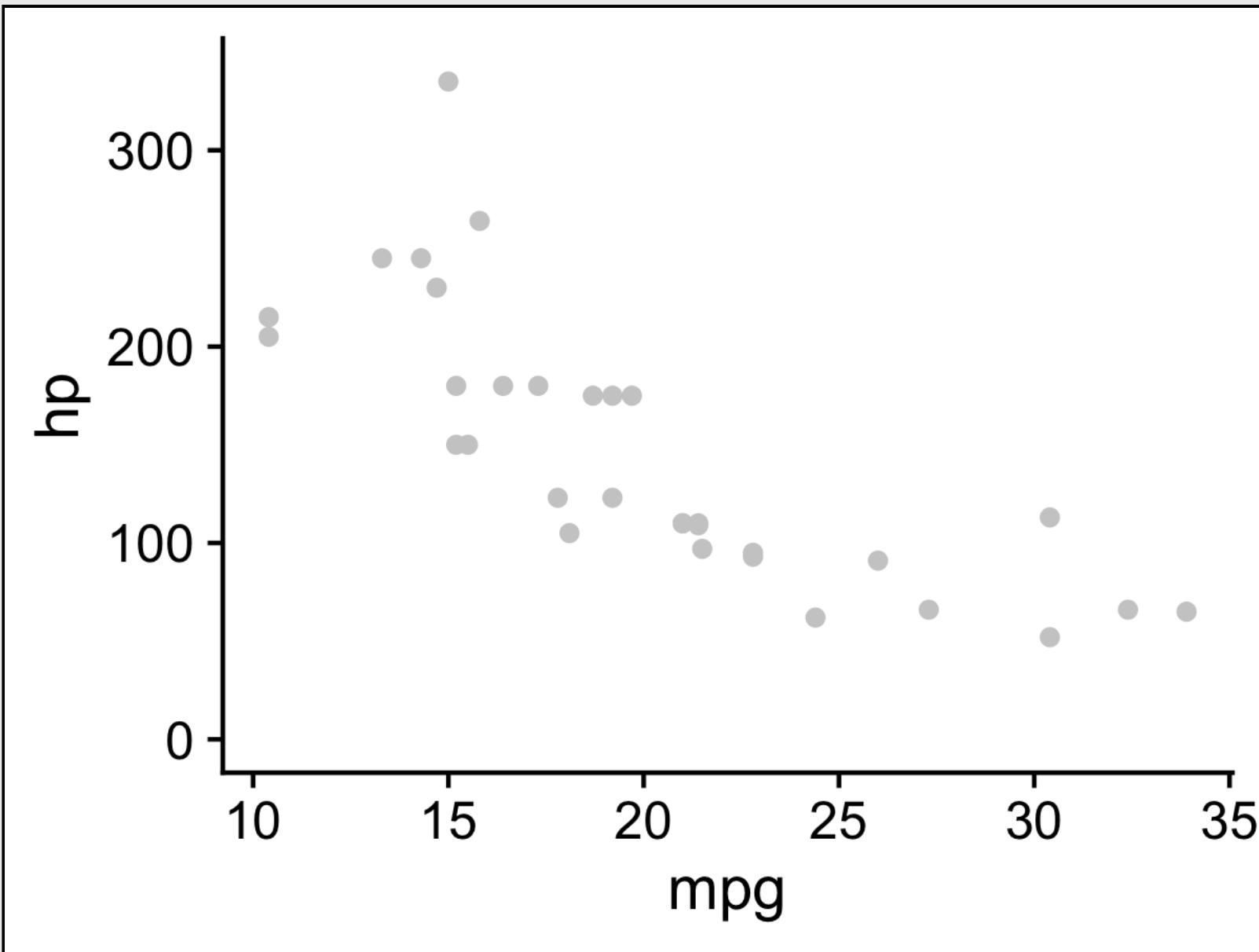
# Norman door

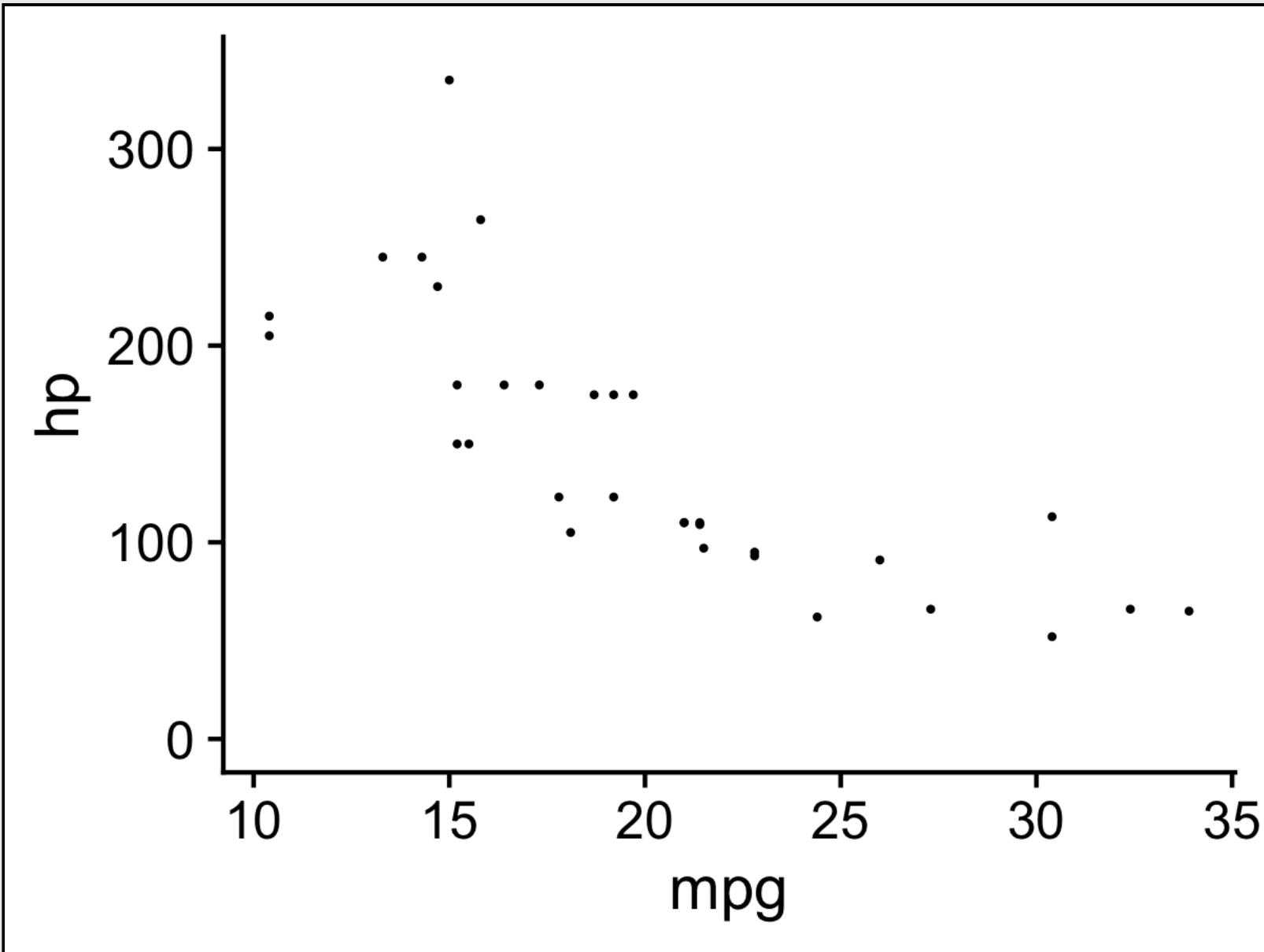


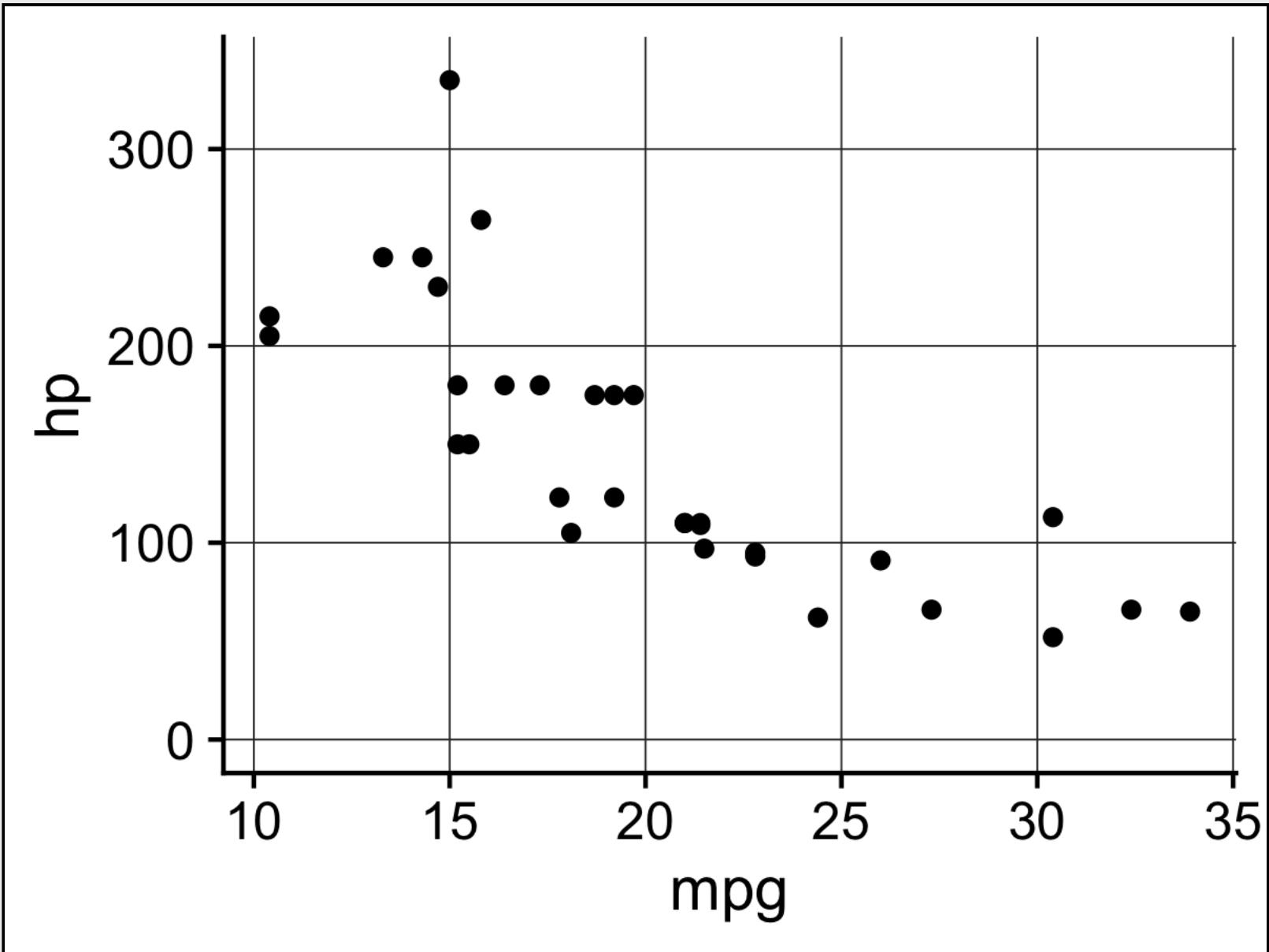
# Non-Norman door

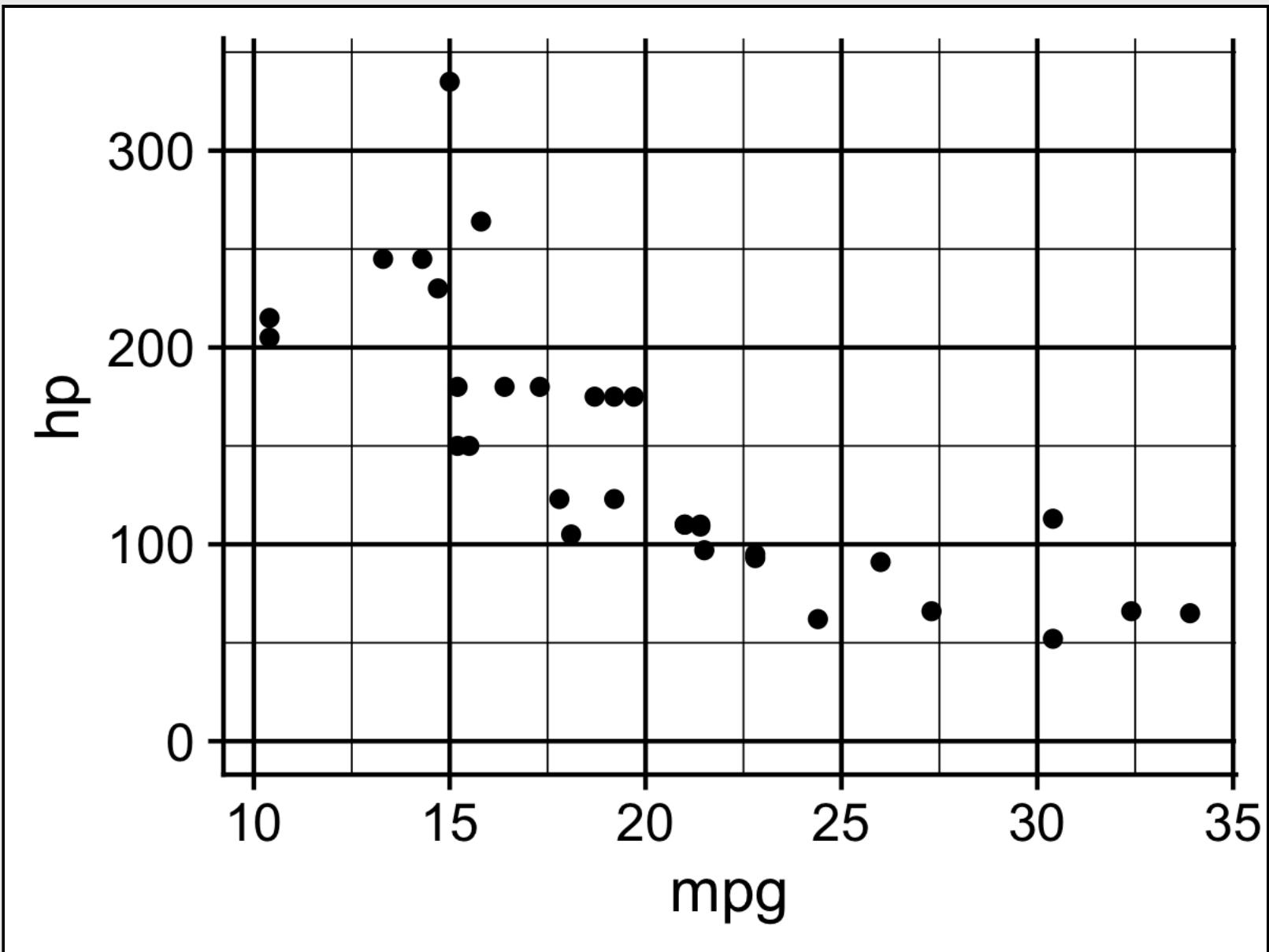


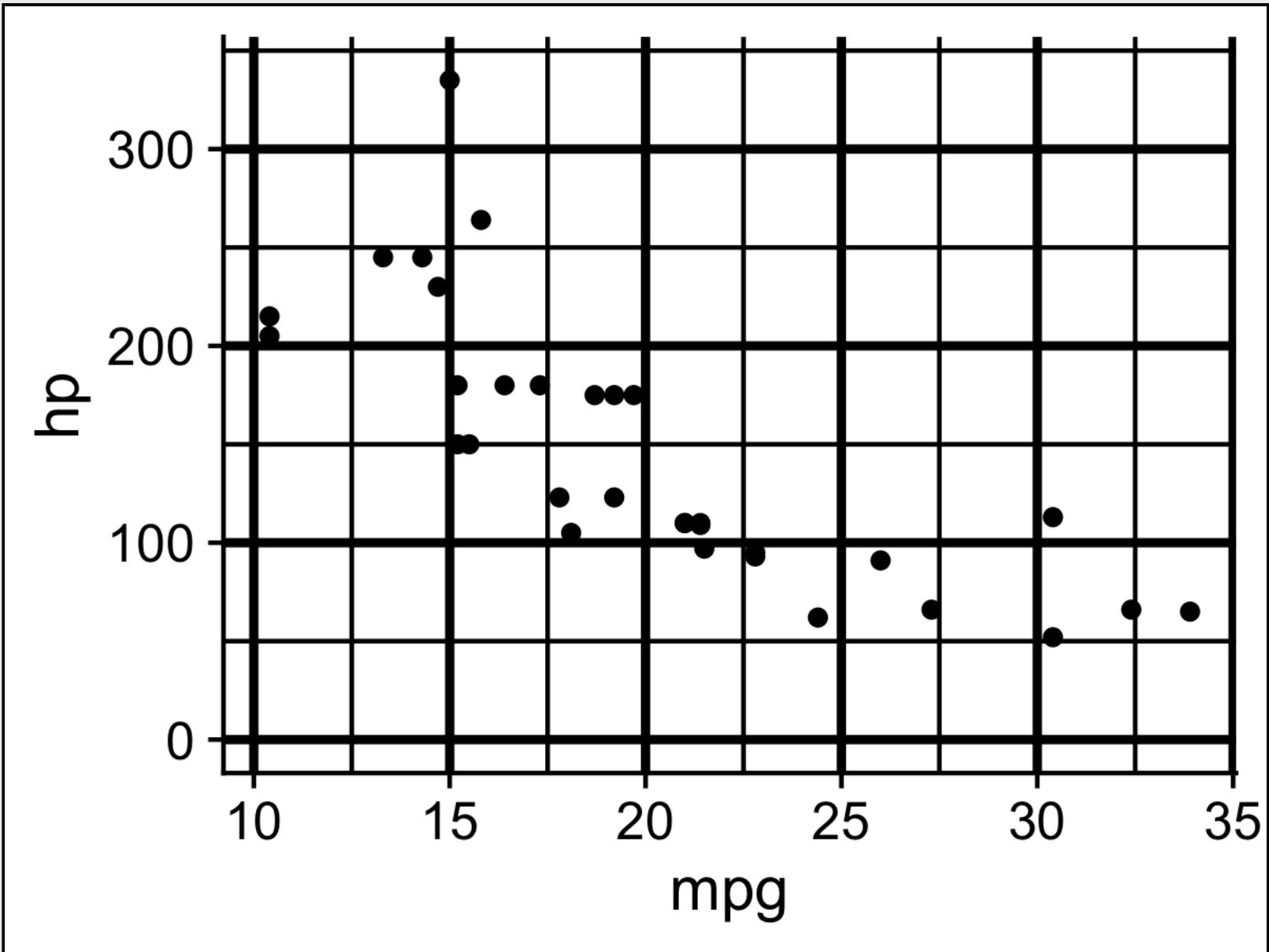




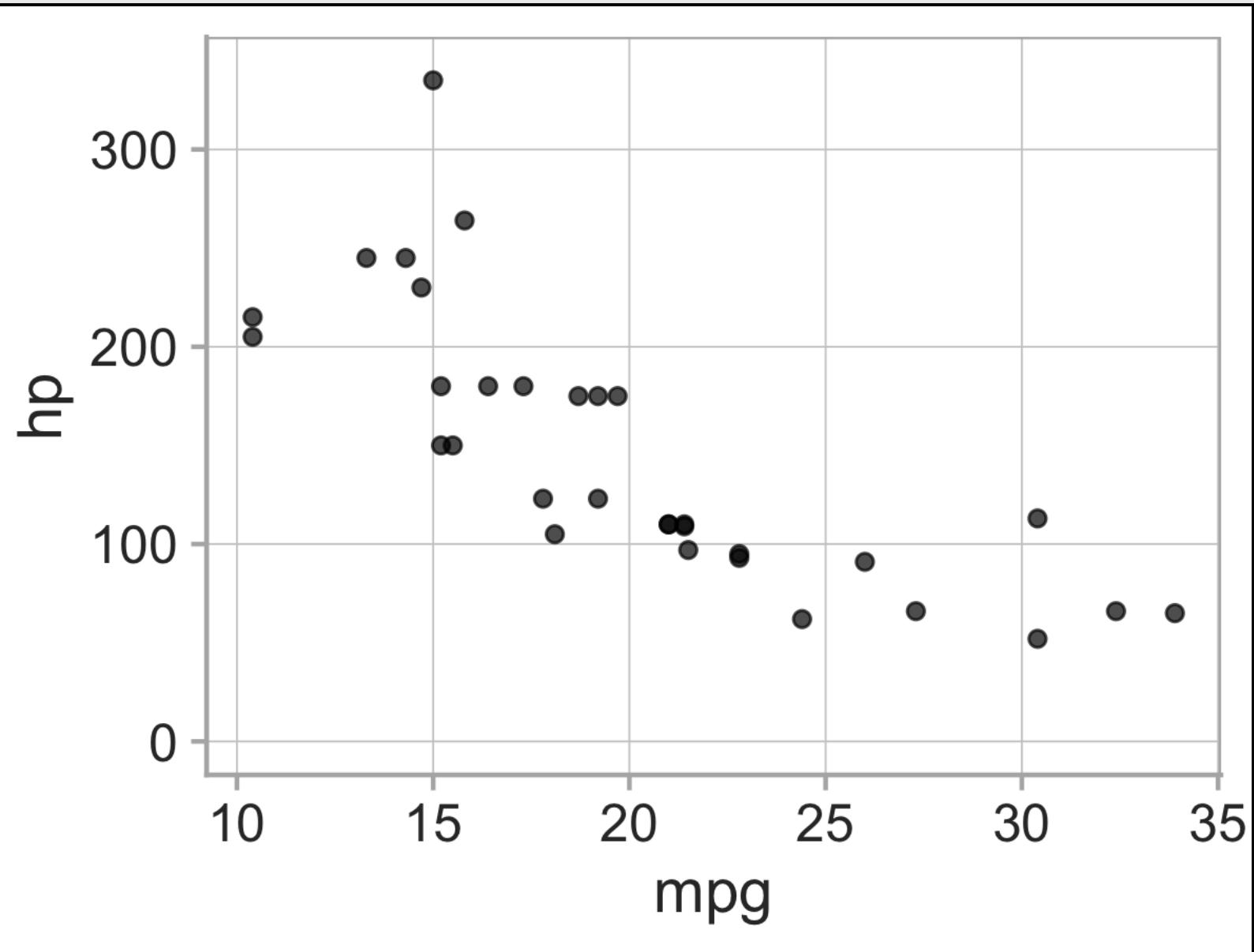








The white circles you see at the intersections is called the "**Hermann Grid illusion**"



# Break!

Stand up, Move around, Stretch!

05 : 00

# *Visualizing Information*

1. The Human Visual-Memory System

2. The Psychology of Data Viz

BREAK

3. 10 Data Viz Best Practices

# 10 Data Viz Best Practices

1. Remove chart chunk
2. Don't make 3D plots\*
3. Don't lie
4. Don't use pie charts for proportions\*
5. Don't stack bars\*
6. Rotate and sort categorical axes\*
7. Eliminate legends & directly label geoms\*
8. Don't use pattern fills
9. Don't use red & green together
10. Consider tables for small data sets

\*most of the time

# 10 Data Viz Best Practices

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\*most of the time

*"Erase non-data ink."*

— Ed Tufte



Figure 1.6: 'Monstrous Costs' by Nigel Holmes, in Healy, 2018

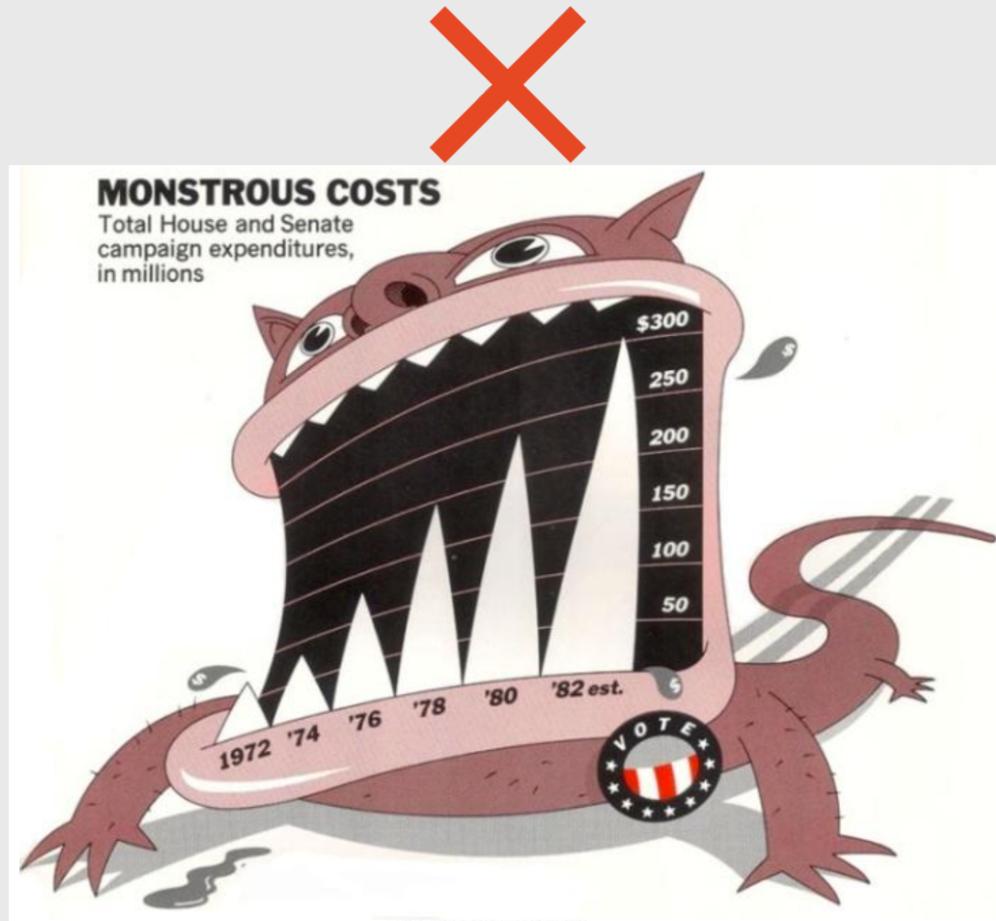
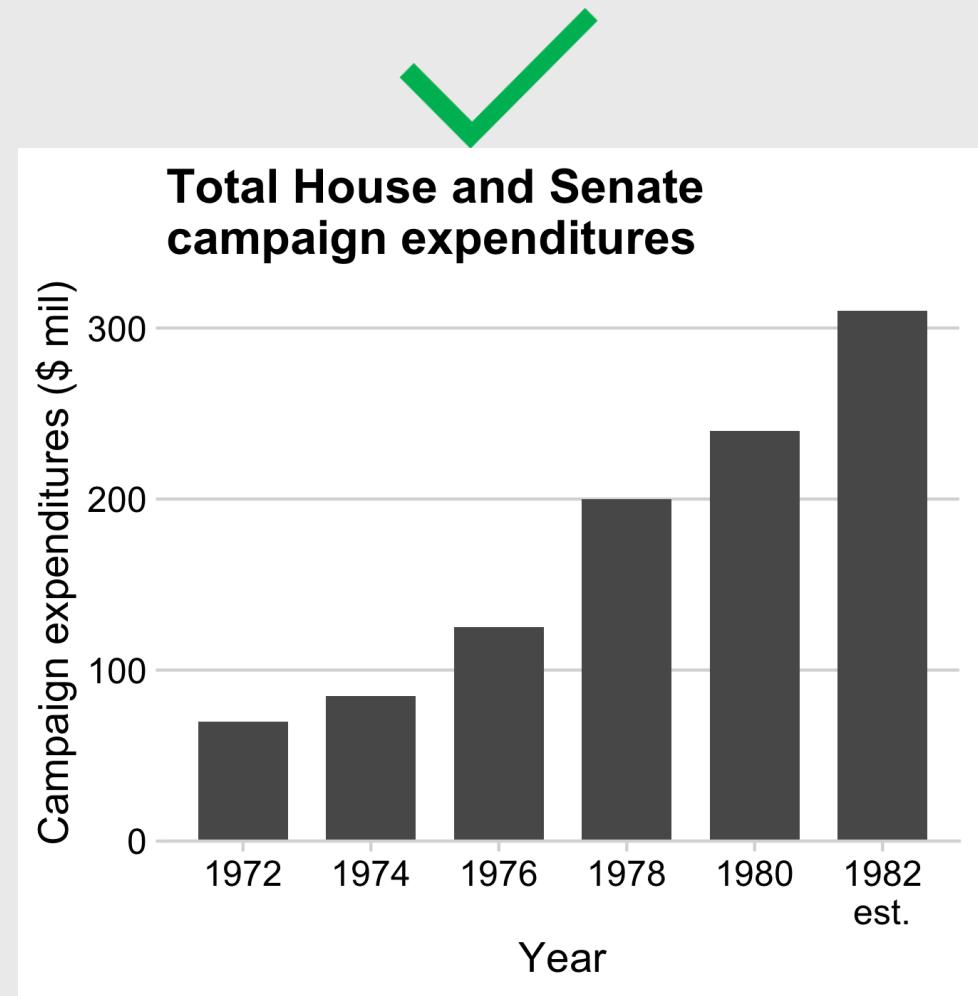


Figure 1.6: 'Monstrous Costs' by Nigel Holmes, in Healy, 2018



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

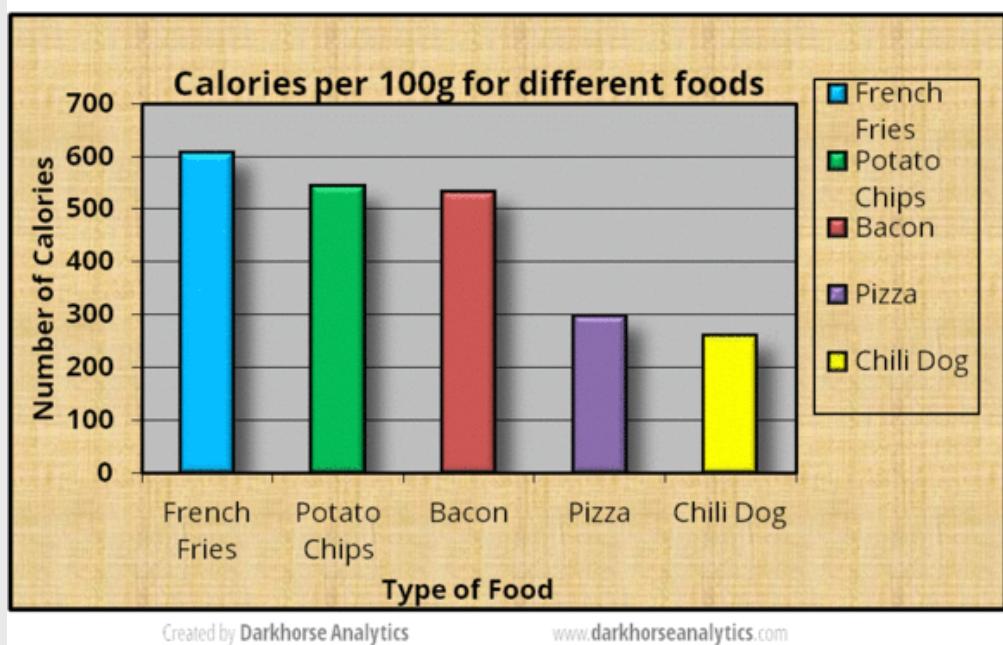
Created by Darkhorse Analytics

[www.darkhorseanalytics.com](http://www.darkhorseanalytics.com)

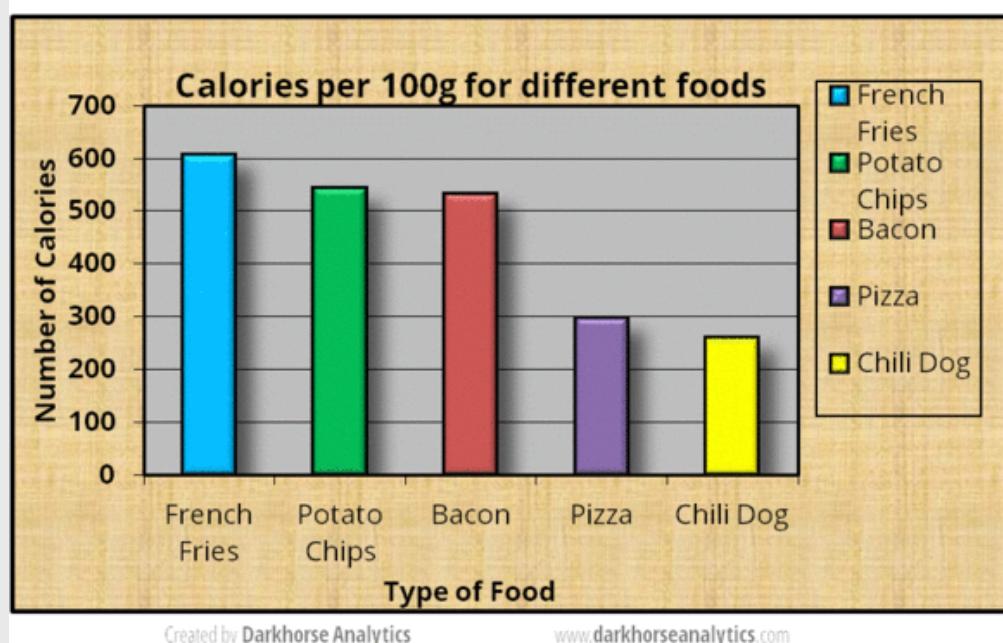
Figure 24.1: From Data Looks Better Naked by Darkhorse Analytics



Before



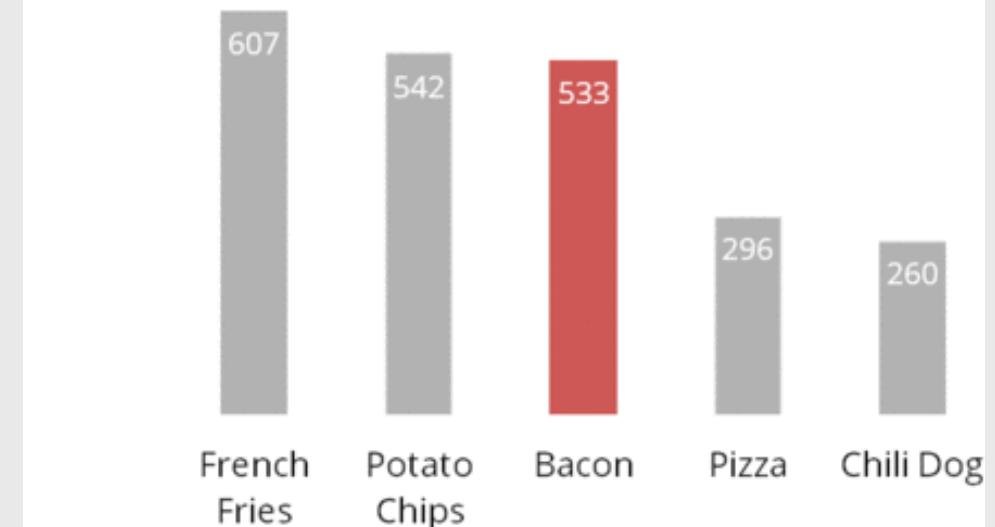
Before



After



Calories per 100g



Created by Darkhorse Analytics

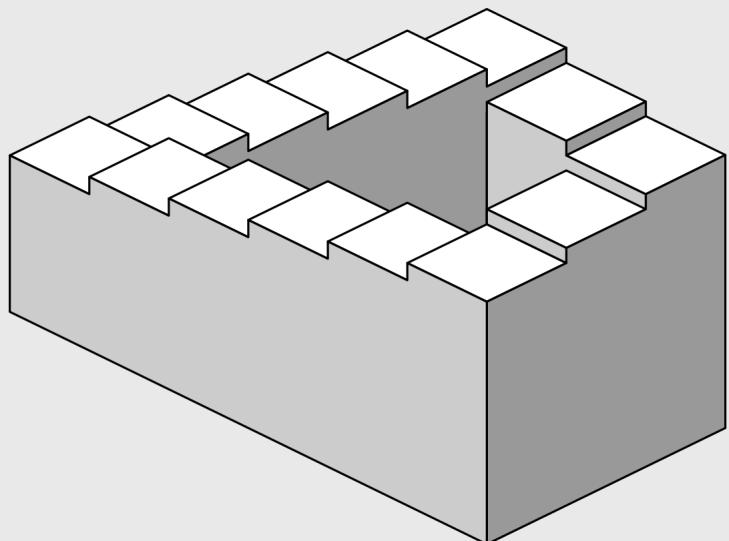
[www.darkhorseanalytics.com](http://www.darkhorseanalytics.com)

# 10 Data Viz Best Practices

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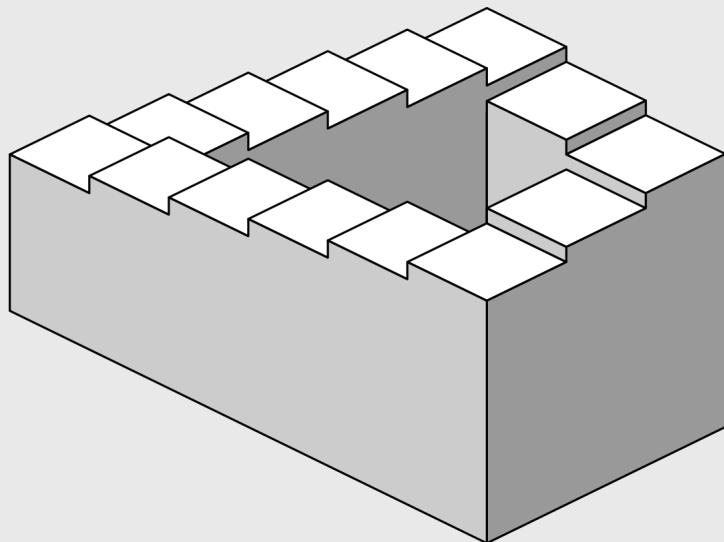
\*most of the time

Humans aren't good at  
distinguishing 3D space



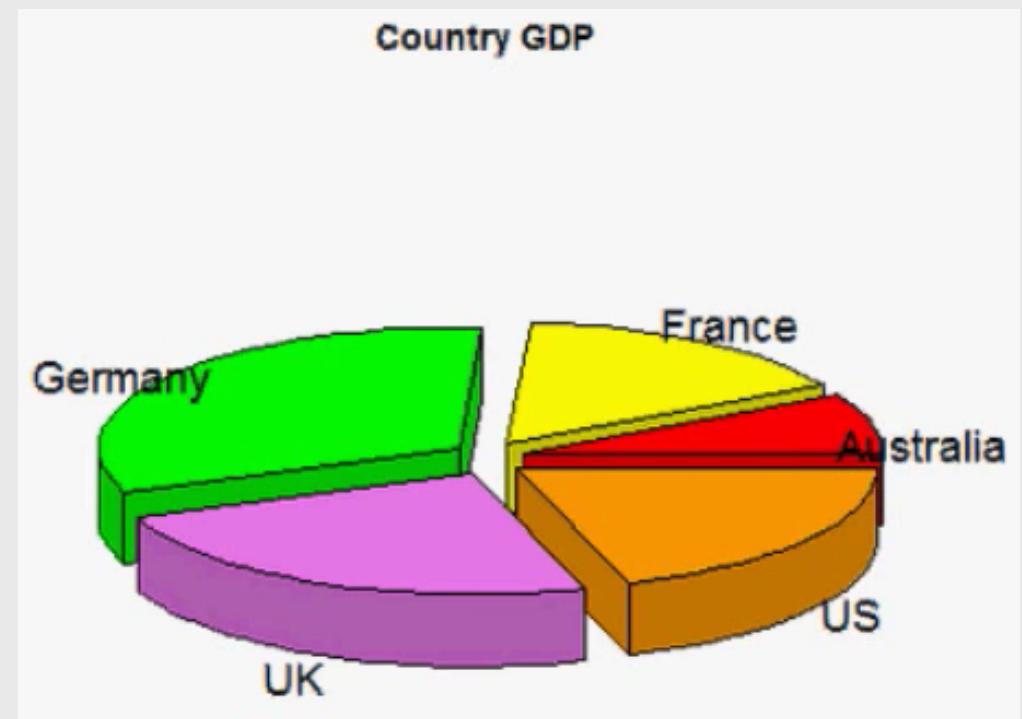
Penrose Stairs, made famous by  
M.C. Escher (1898-1972)

Humans aren't good at distinguishing 3D space

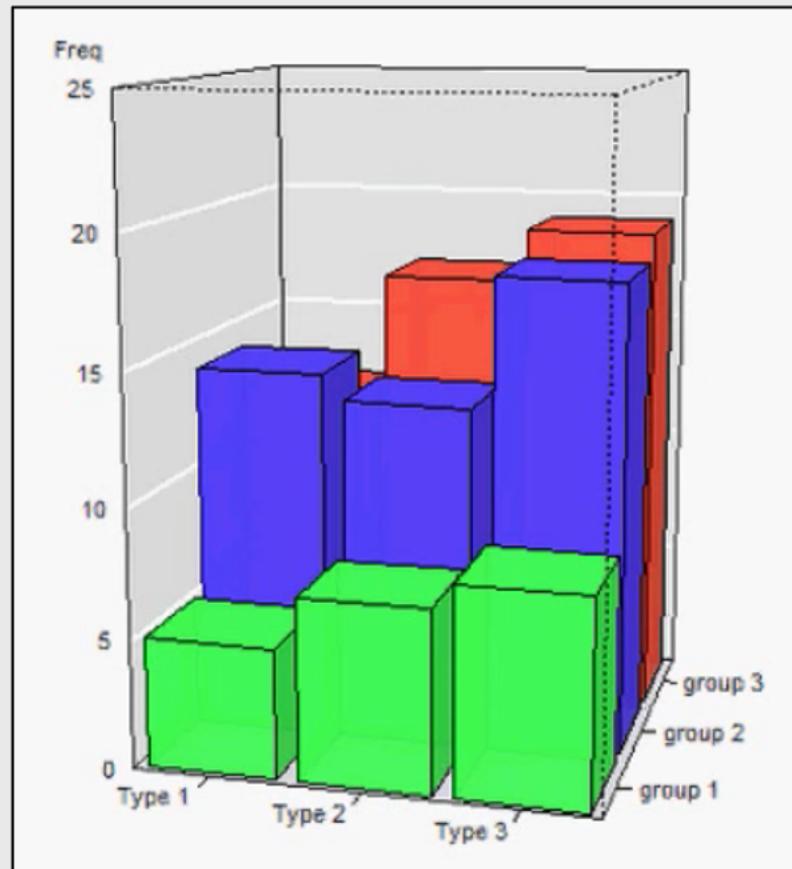


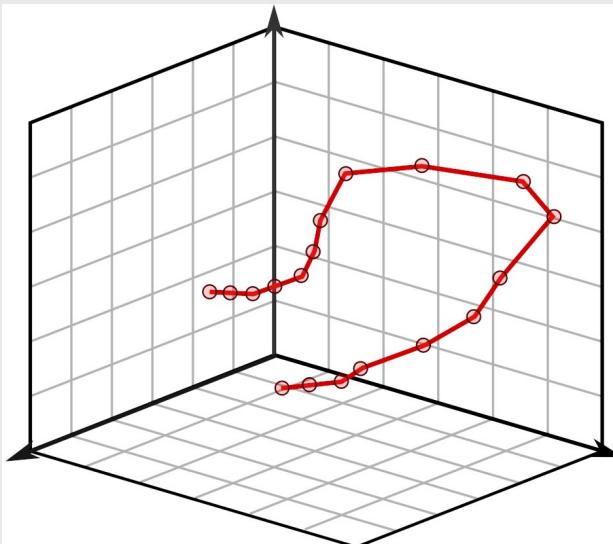
Penrose Stairs, made famous by  
M.C. Escher (1898-1972)

Ink proportions !=  
true proportions



# Occlusion: geoms are obscured



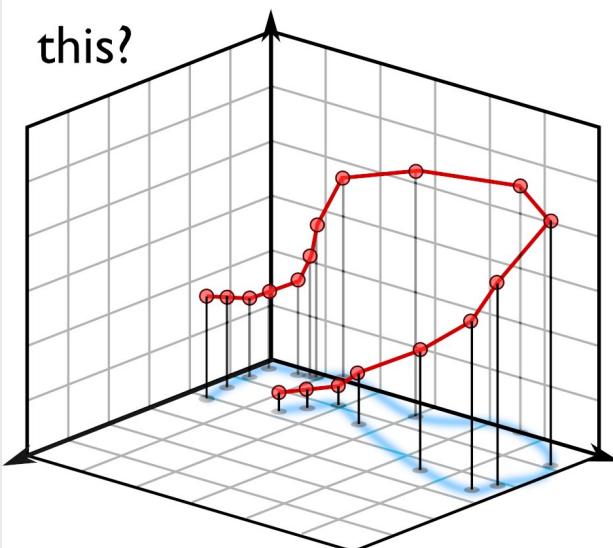


Please never do this.

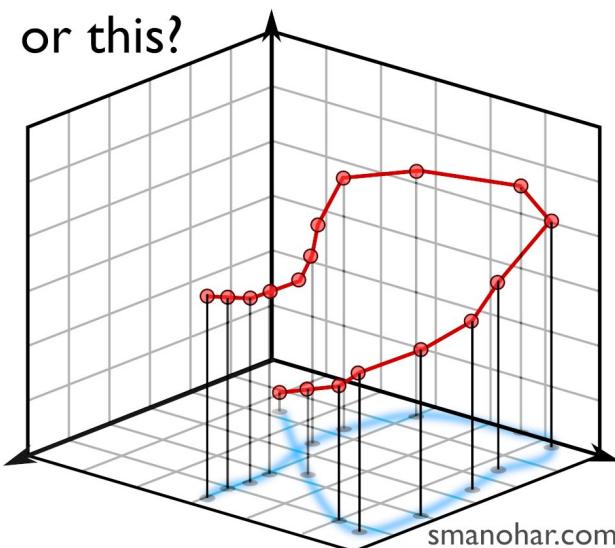
3D plots are ambiguous  
without a projection.

Each point has a whole line  
of possible 3D locations.

Do you mean...



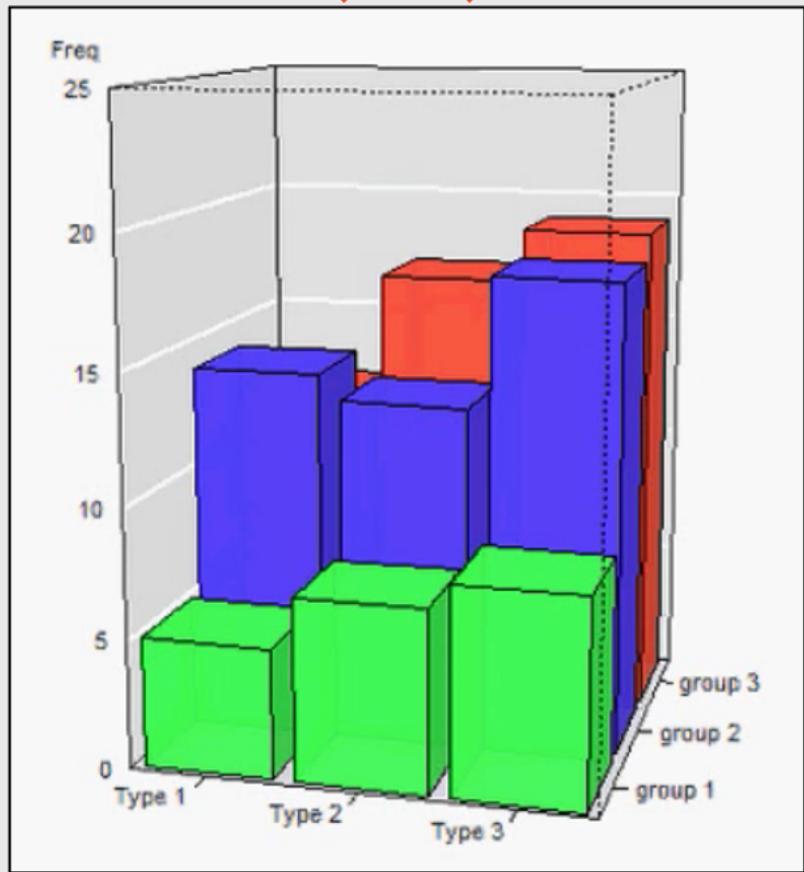
this?

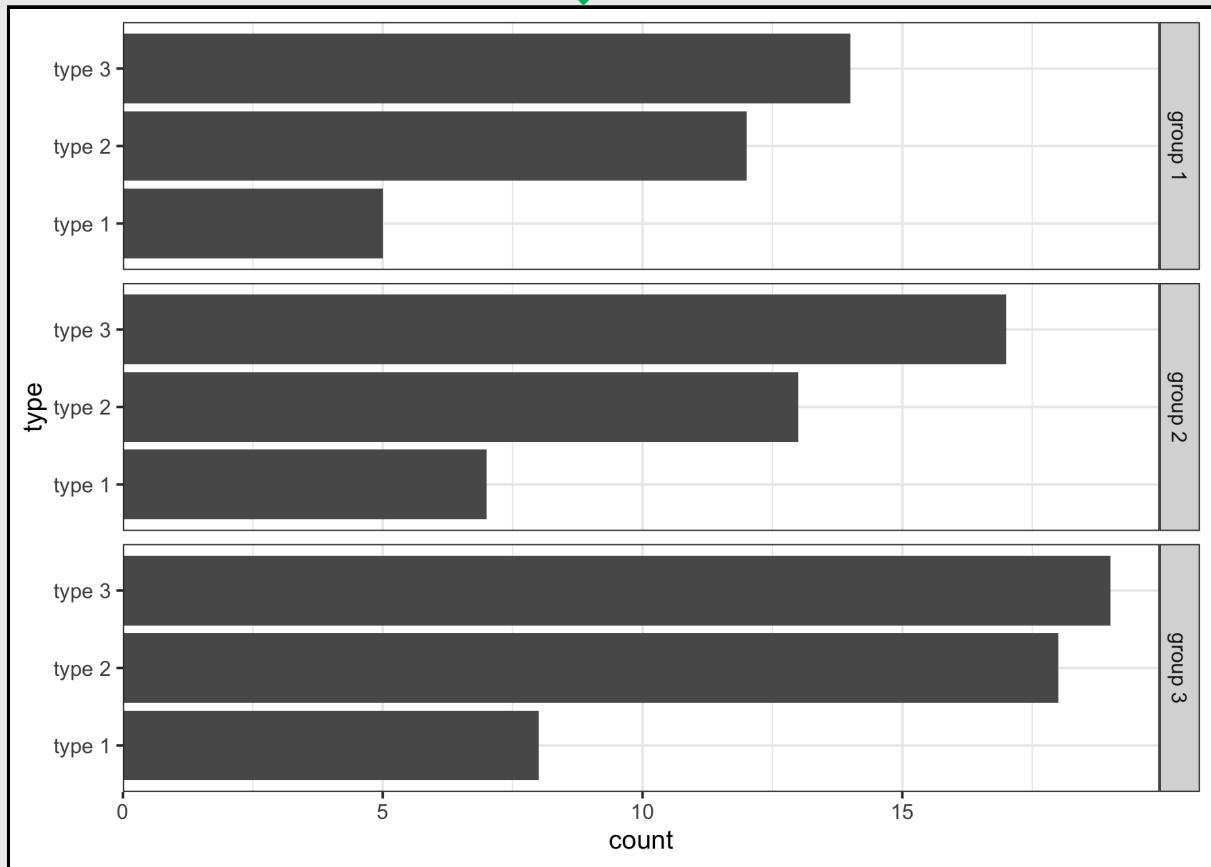
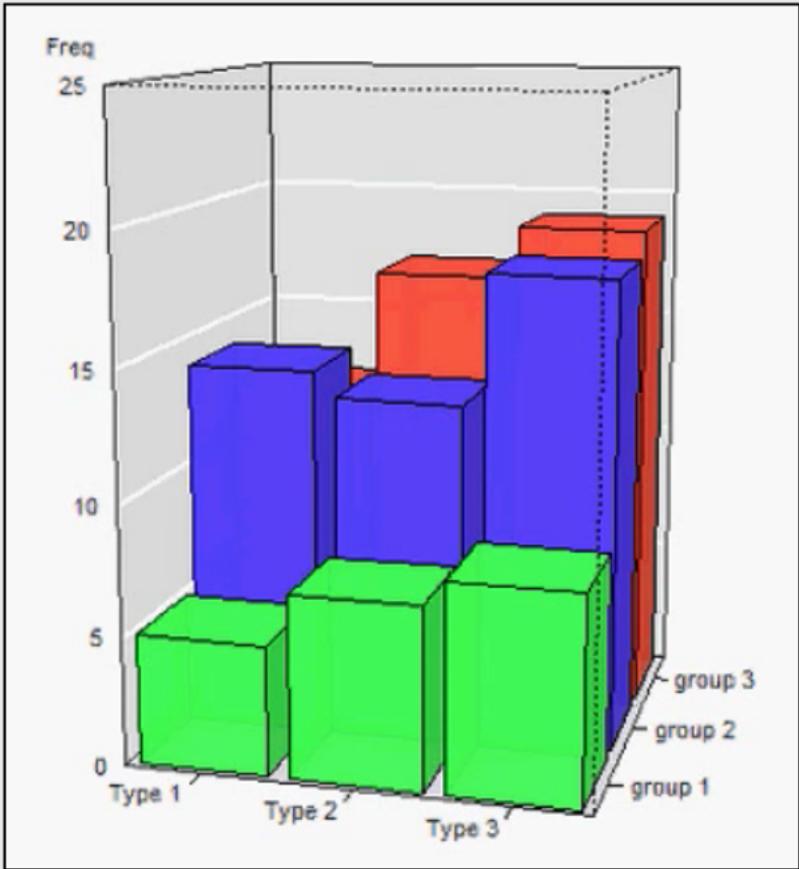


or this?

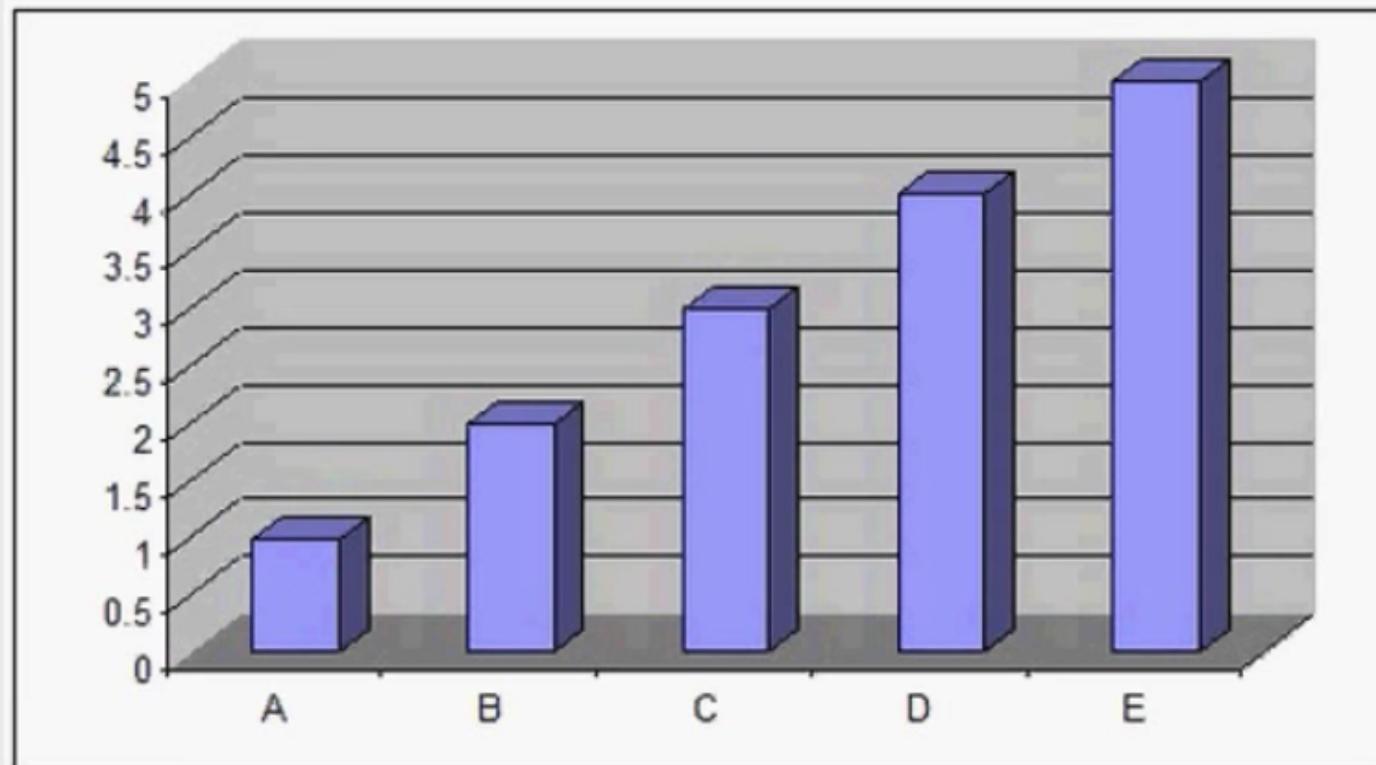
# Multiple interpretations

+

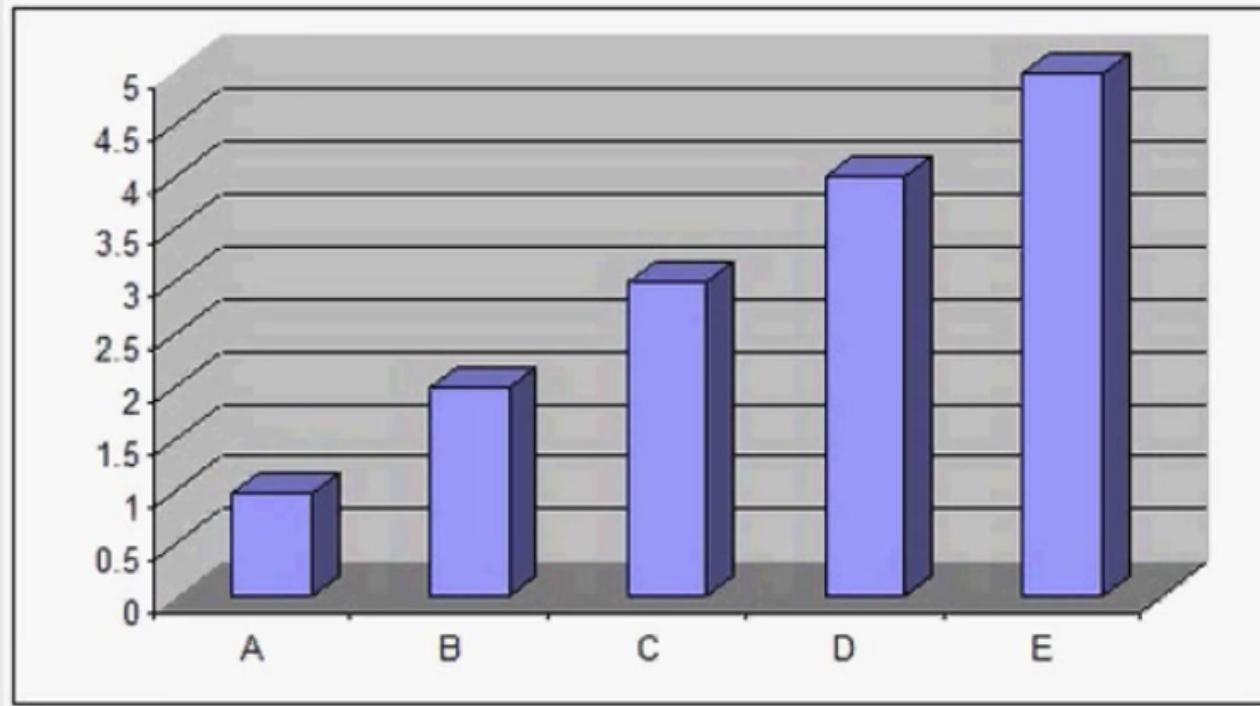




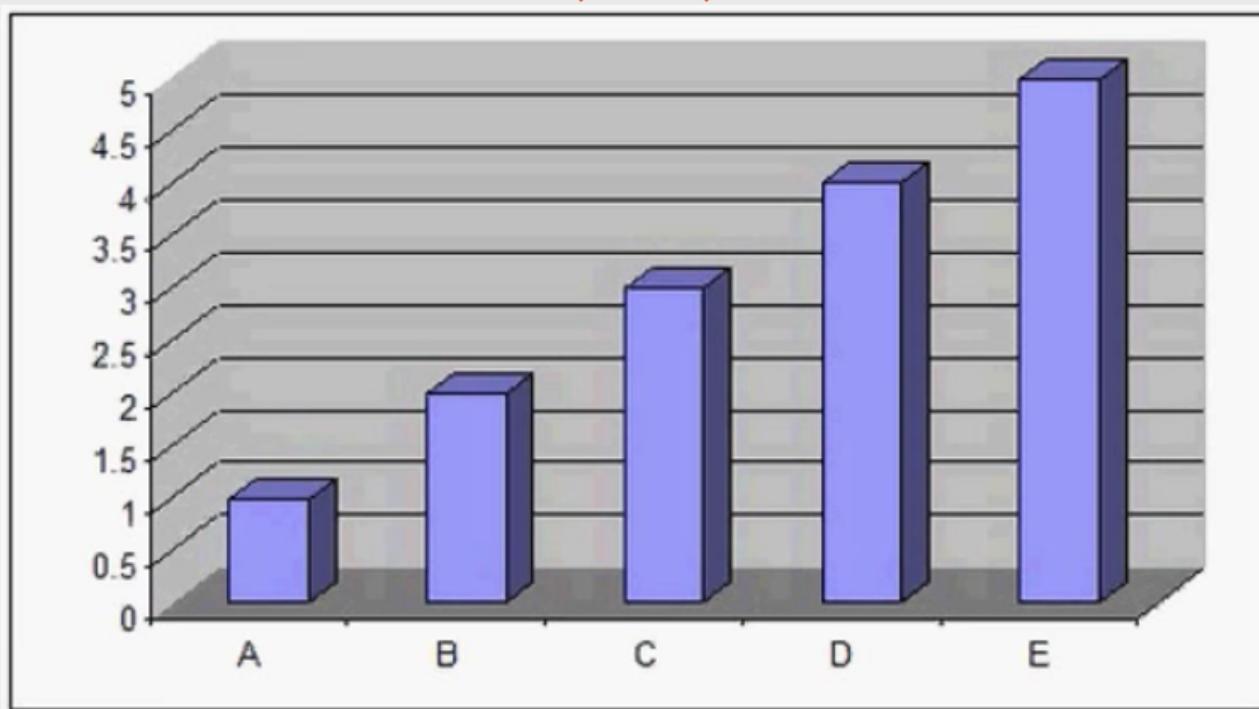
The third dimension distracts from the data  
(this is what Tufte calls "chart junk")



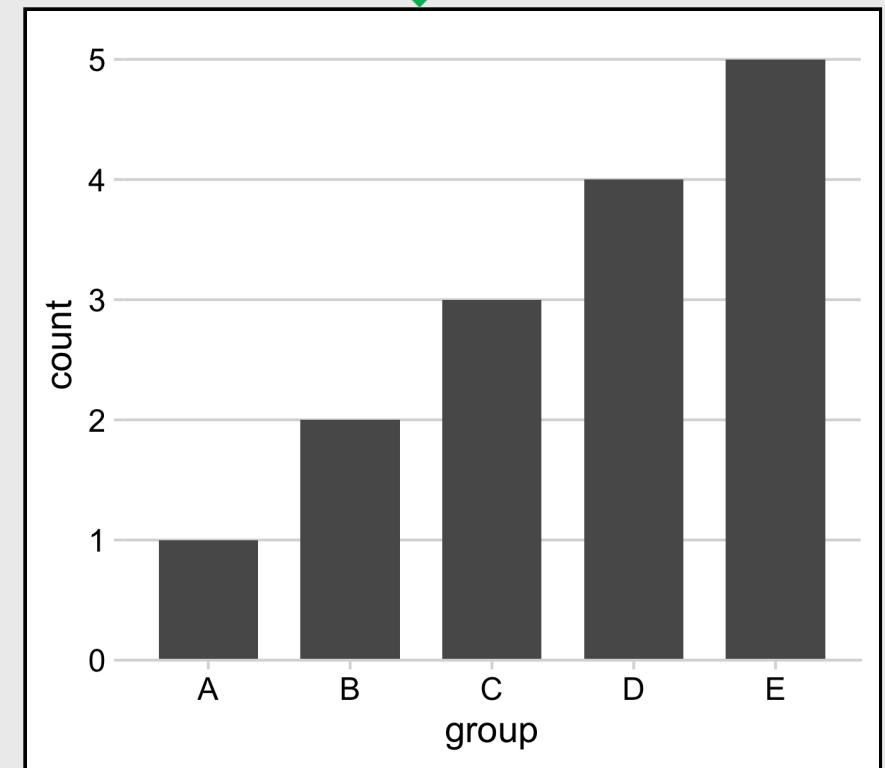
✗



✗



✓



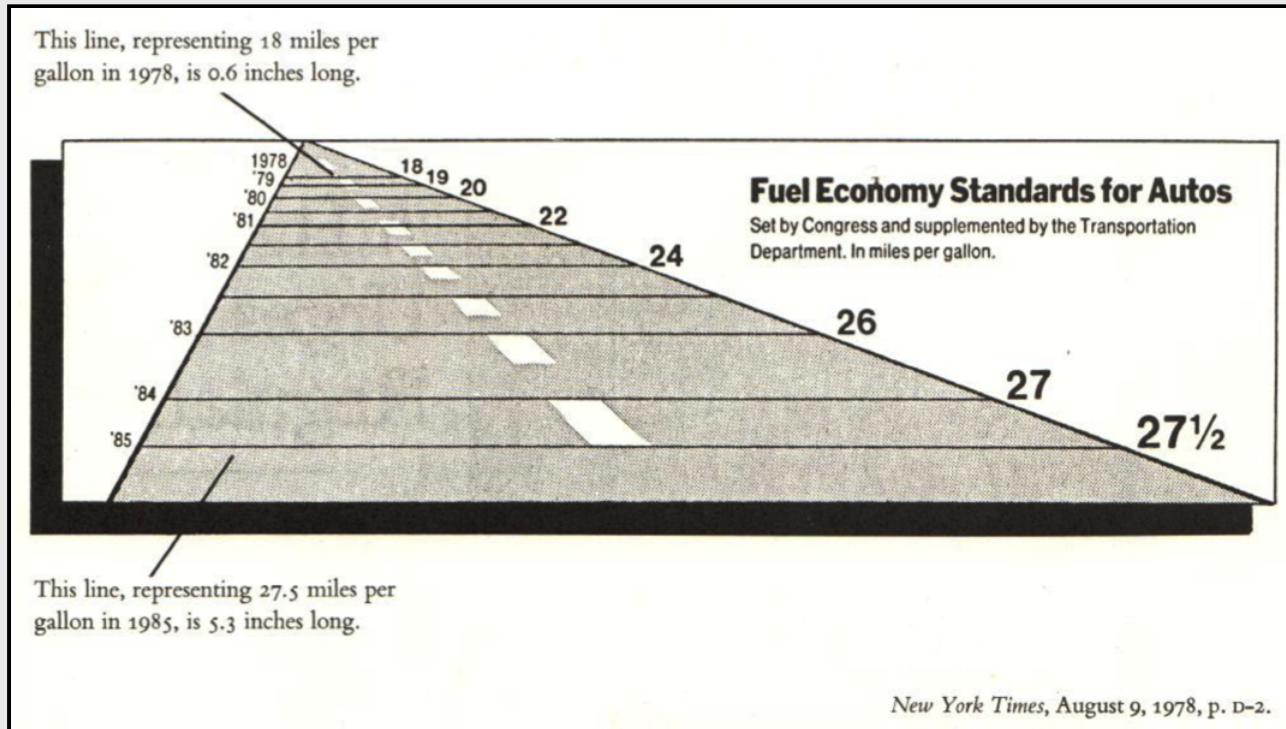
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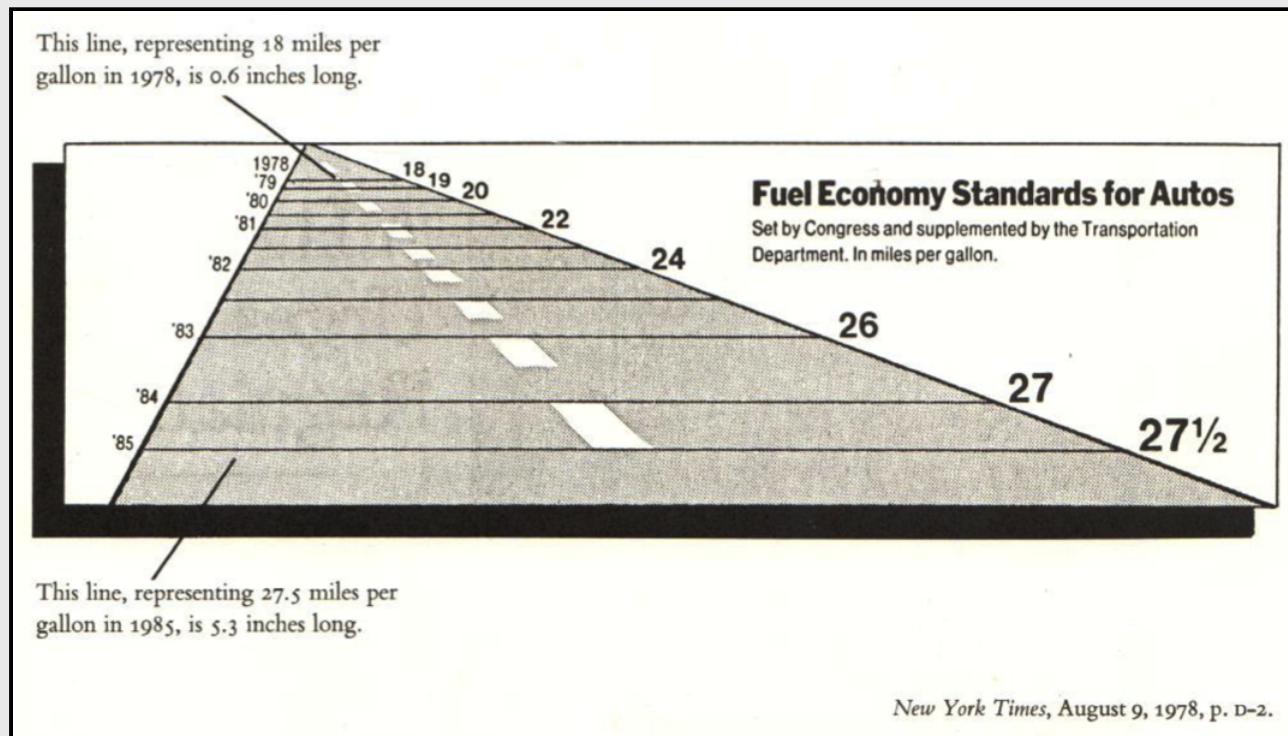
**"Lie Factor"** =  $\frac{\text{Size of effect in graphic}}{\text{Size of effect in data}}$

$$\text{"Lie Factor"} = \frac{\text{Size of effect in graphic}}{\text{Size of effect in data}} = \frac{\frac{5.3 - 0.6}{0.6}}{\frac{27.5 - 18}{18}} = \frac{7.83}{0.53} = 14.8$$

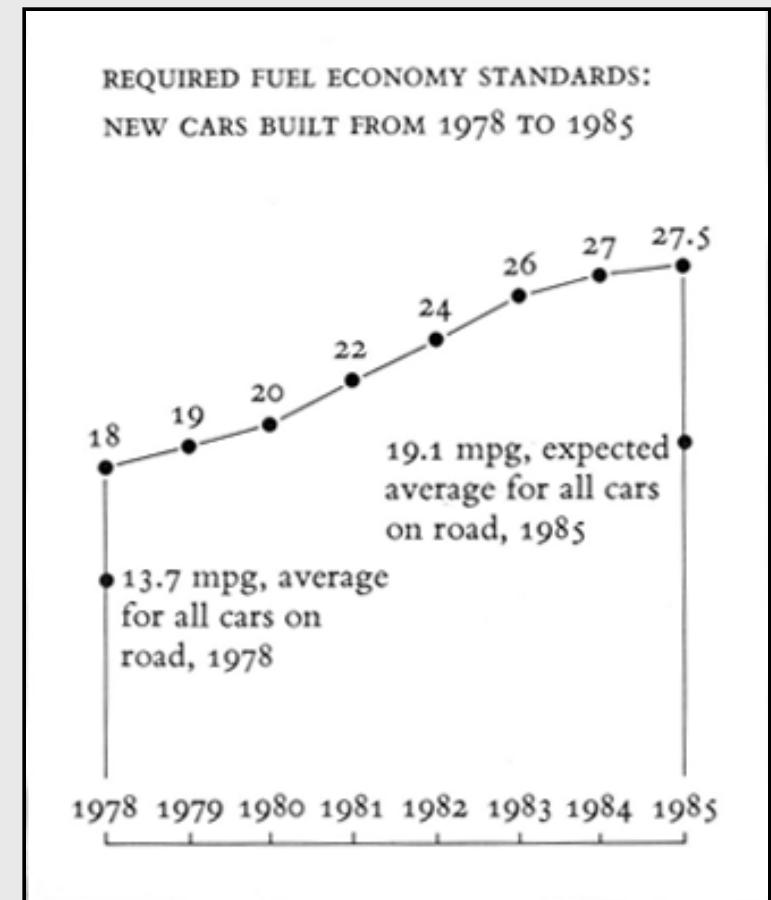


Edward Tufte (2001) "The Visual Display of Quantitative Information", 2nd Edition, pg. 57-58.

$$\text{"Lie Factor"} = \frac{\text{Size of effect in graphic}}{\text{Size of effect in data}} = \frac{\frac{5.3 - 0.6}{0.6}}{\frac{27.5 - 18}{18}} = \frac{7.83}{0.53} = 14.8$$



Edward Tufte (2001) "The Visual Display of Quantitative Information", 2nd Edition, pg. 57-58.



Bar charts should always start at 0

# Bar charts should always start at 0

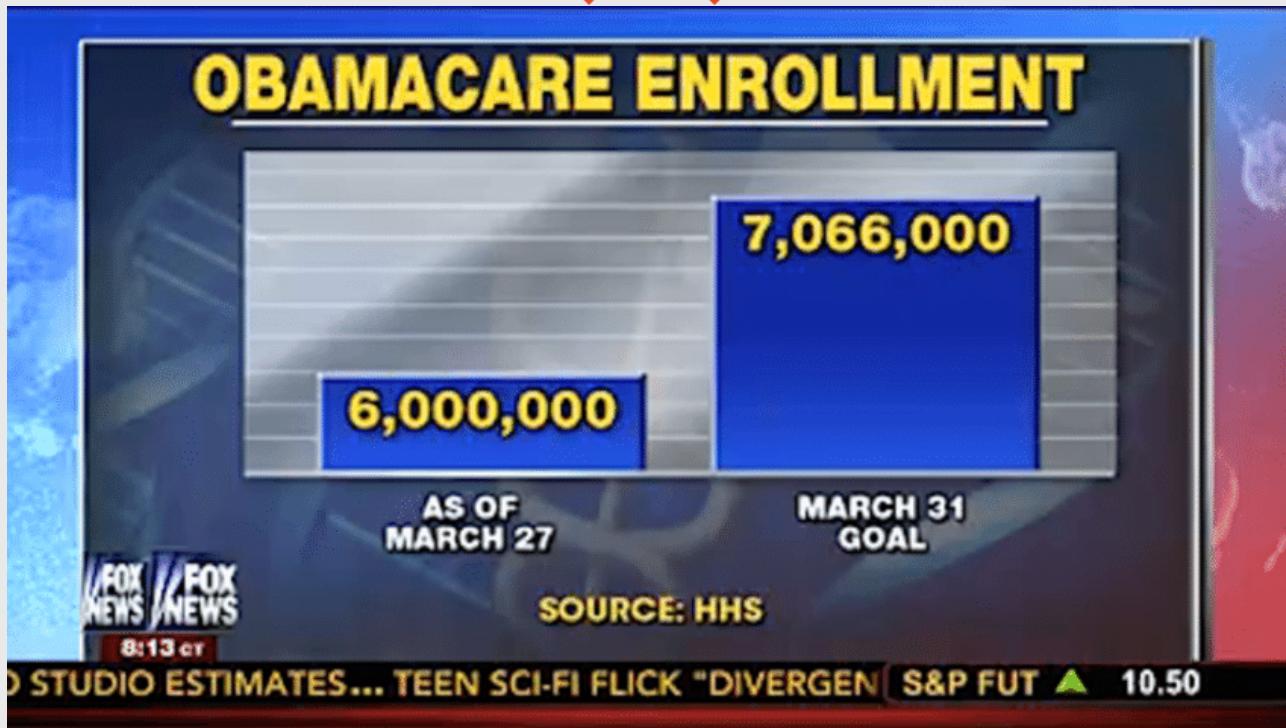


Image from <http://livingqlikview.com/the-9-worst-data-visualizations-ever-created/>

# Bar charts should always start at 0

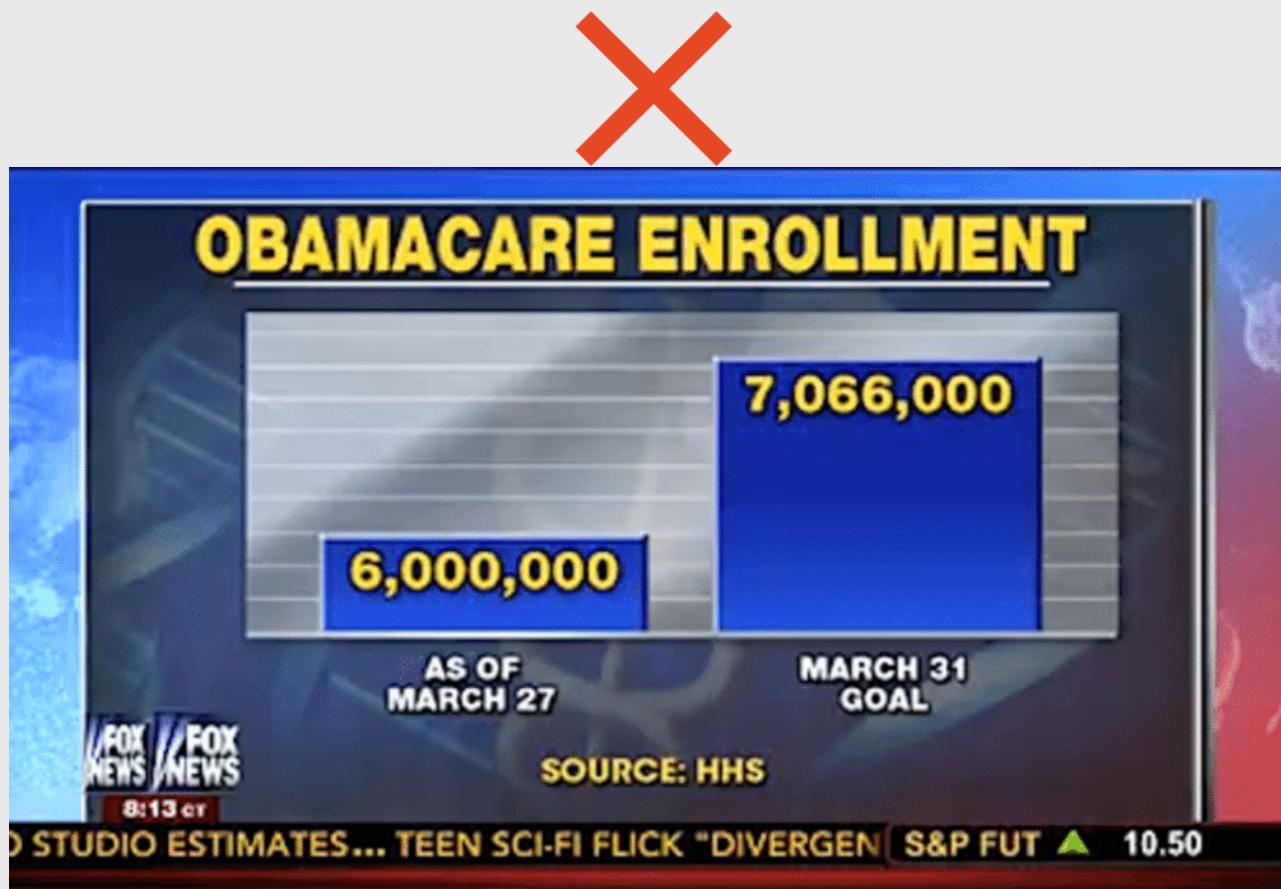
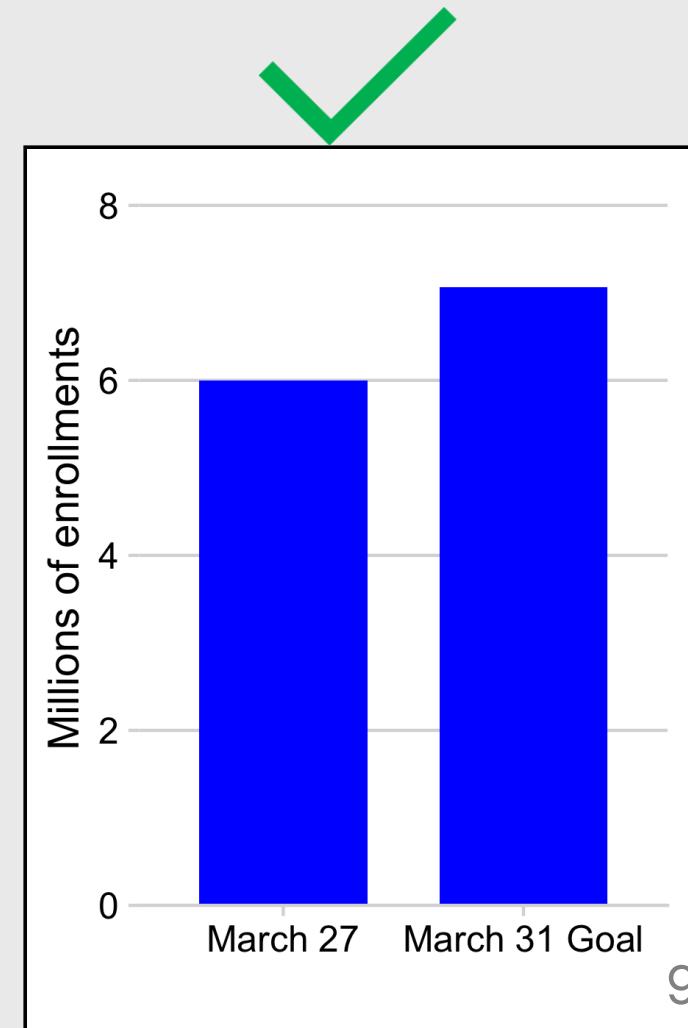


Image from <http://livingqlikview.com/the-9-worst-data-visualizations-ever-created/>



Don't cherry-pick your data

# Don't cherry-pick your data

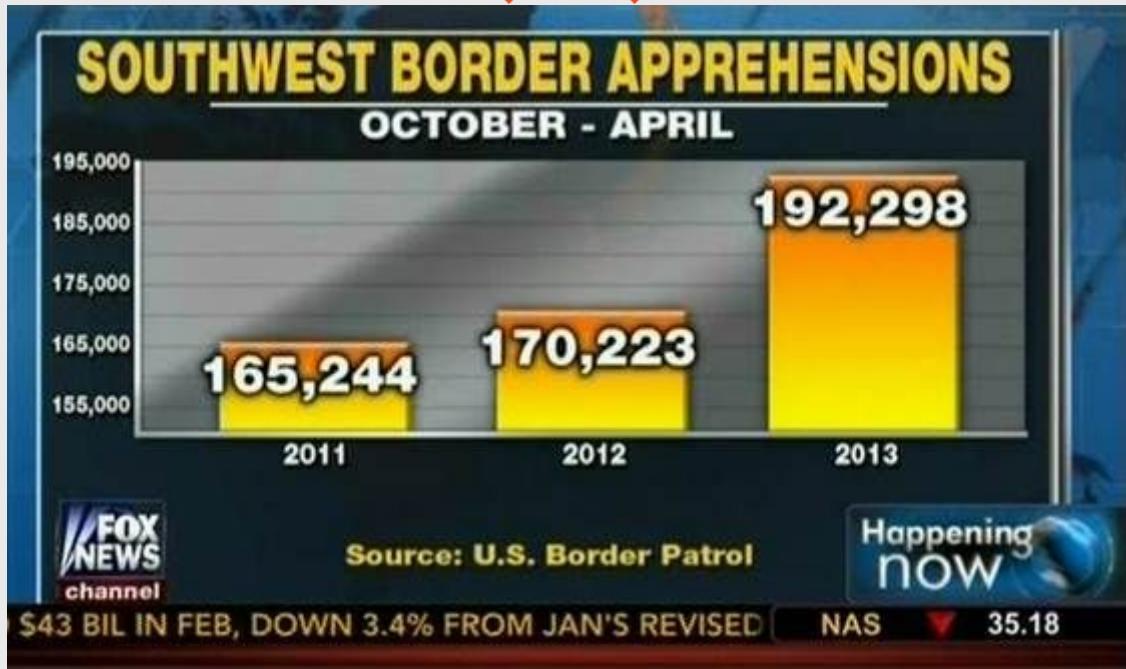


Image from <https://www.mediamatters.org/fox-news/fox-news-newest-dishonest-chart-immigration-enforcement>

# Don't cherry-pick your data

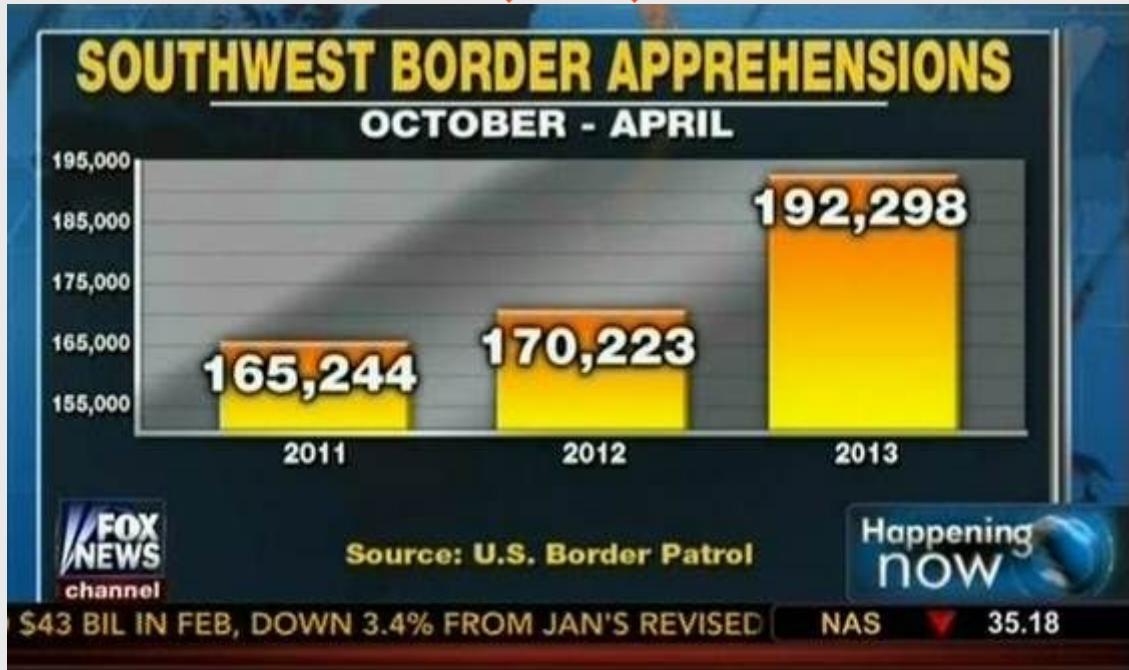
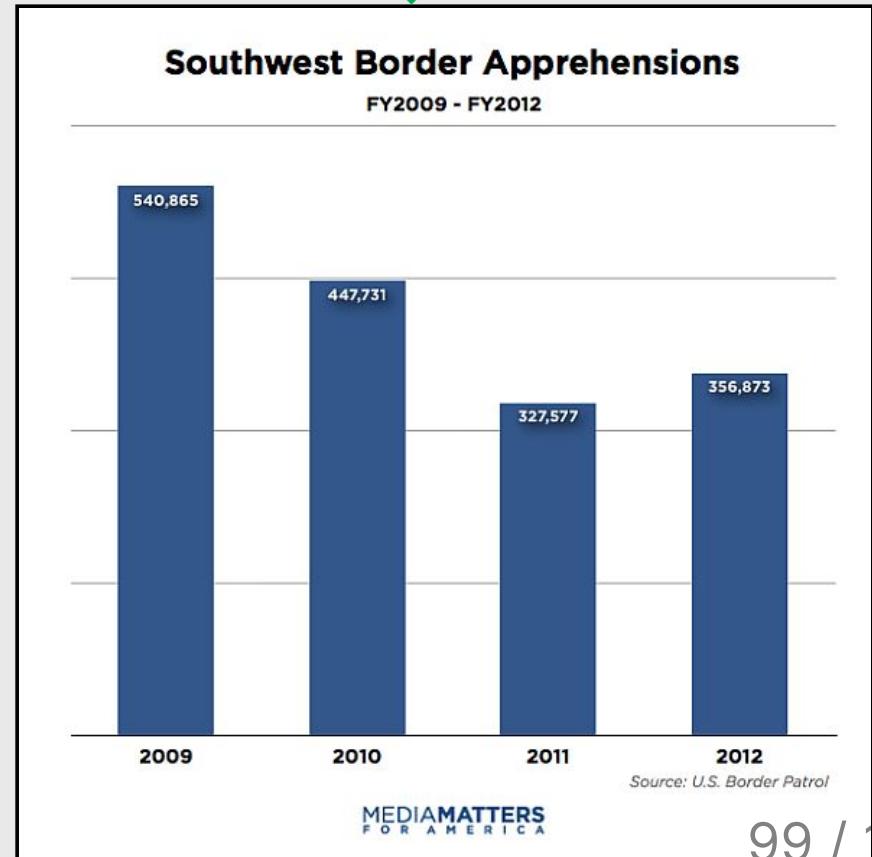


Image from <https://www.mediamatters.org/fox-news/fox-news-newest-dishonest-chart-immigration-enforcement>



# Make sure your chart makes sense

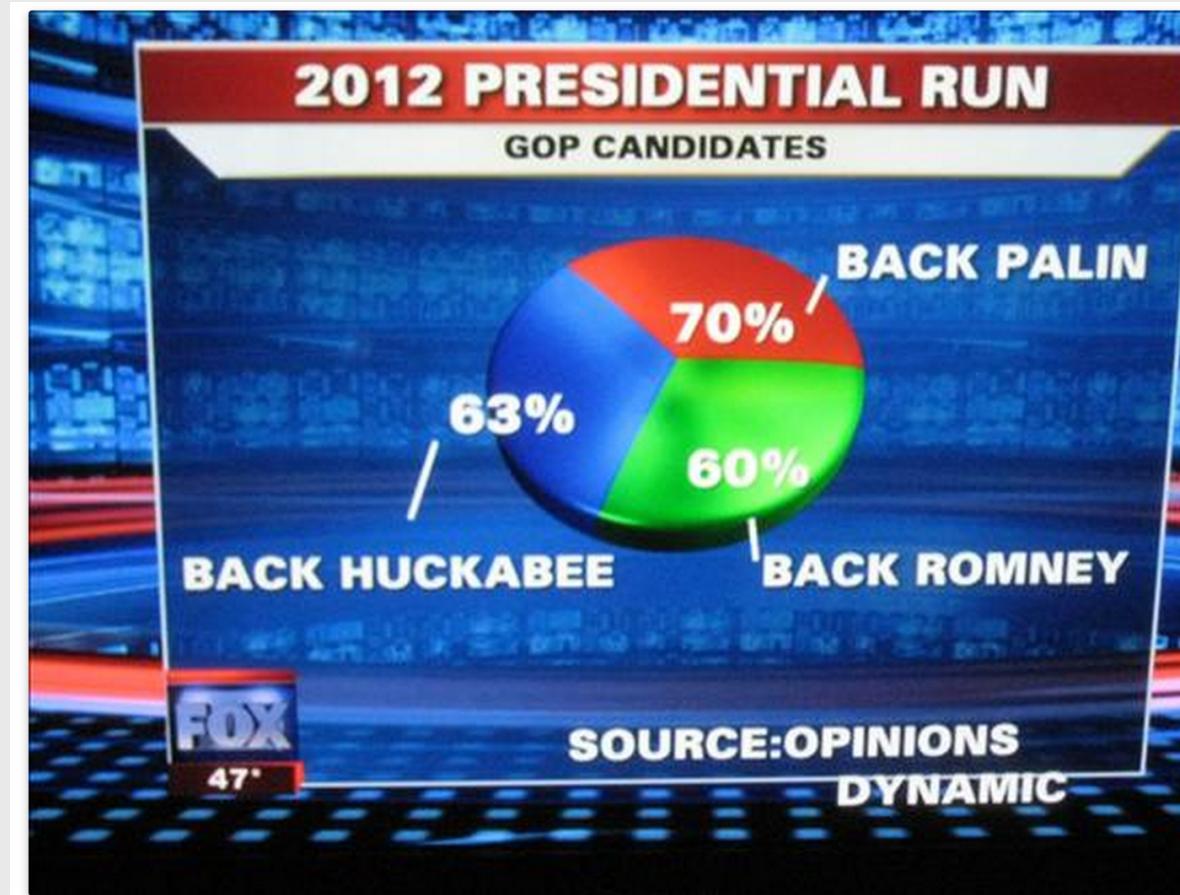


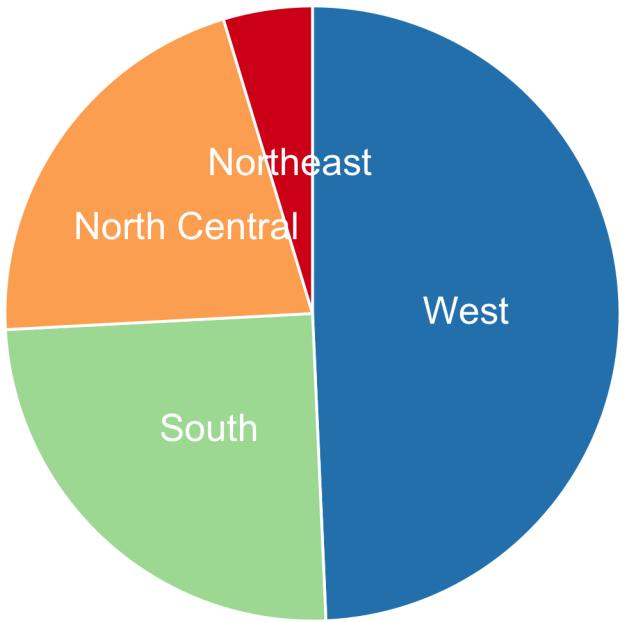
Image from <http://livingqlikview.com/the-9-worst-data-visualizations-ever-created/>

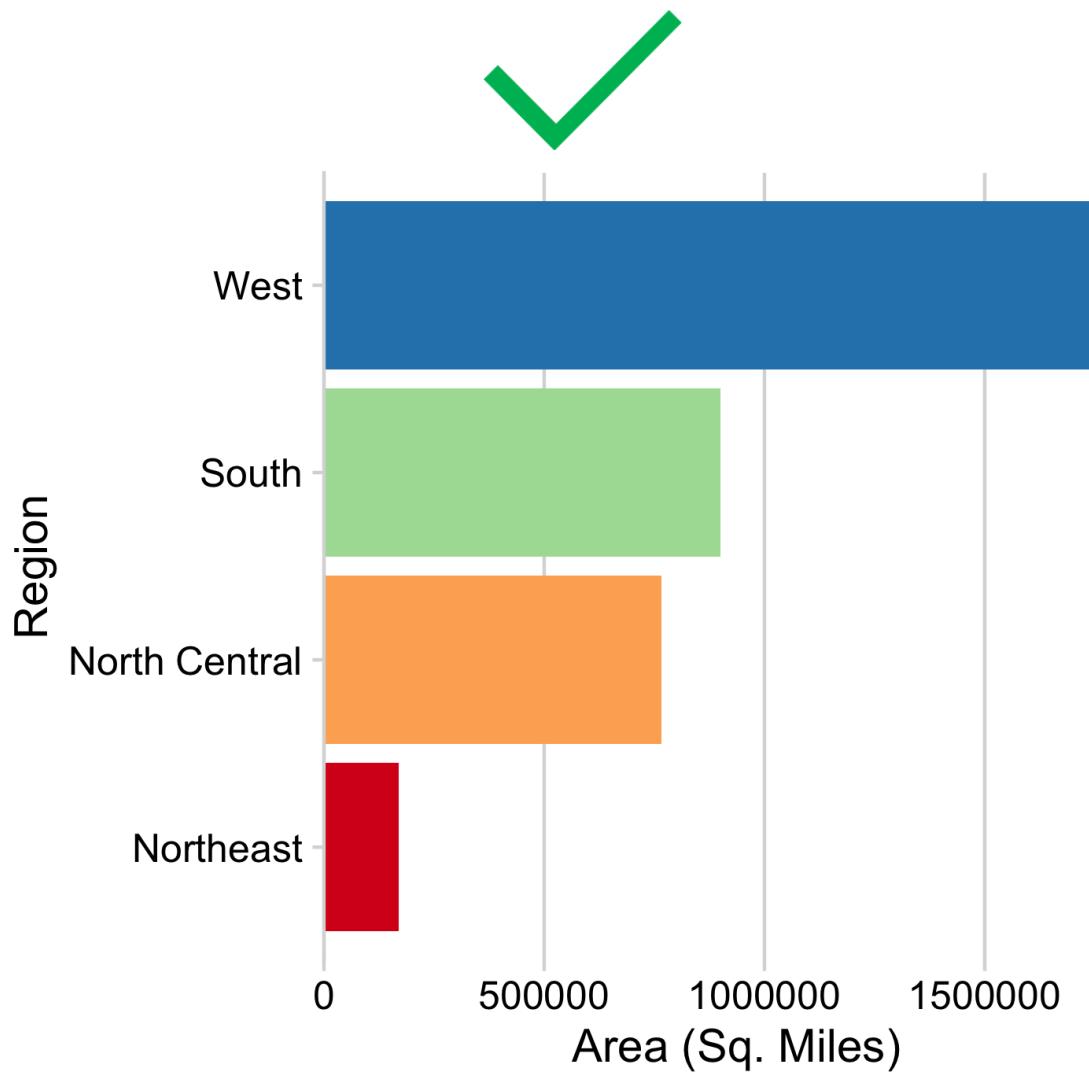
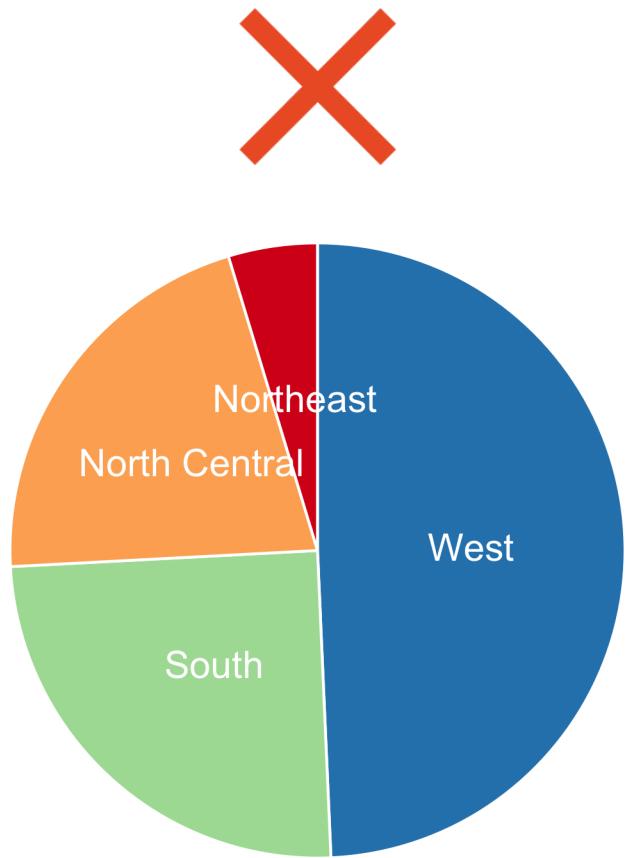
# 10 Data Viz Best Practices

1. Remove chart chunk
2. Don't make 3D plots\*
3. Don't lie
4. **Don't use pie charts for proportions\***
5. Don't stack bars\*
6. Rotate and sort categorical axes\*
7. Eliminate legends & directly label geoms\*
8. Don't use pattern fills
9. Don't use red & green together
10. Consider tables for small data sets

\*most of the time

**X**



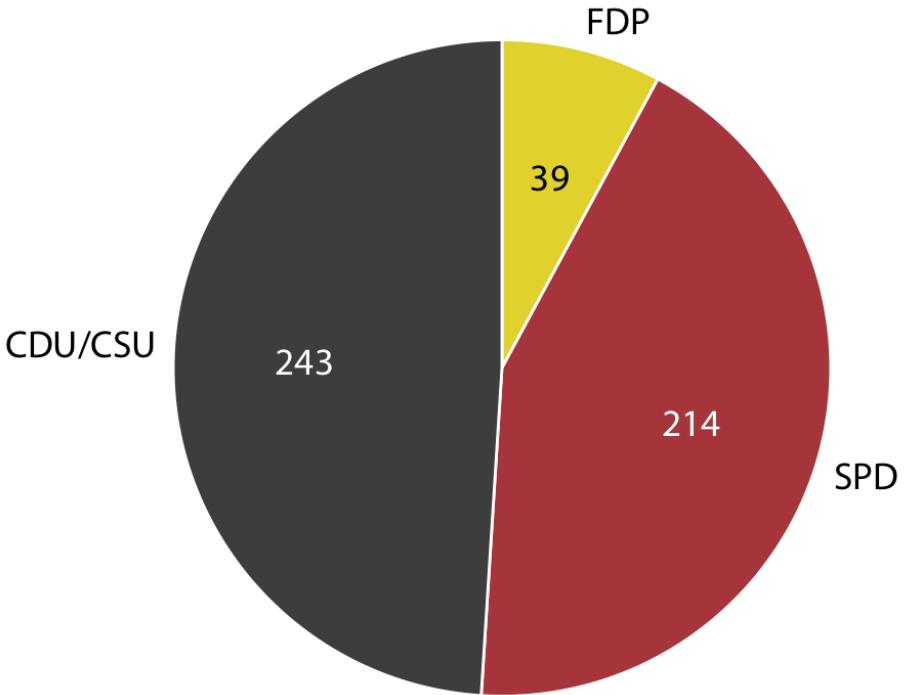


# Exceptions:

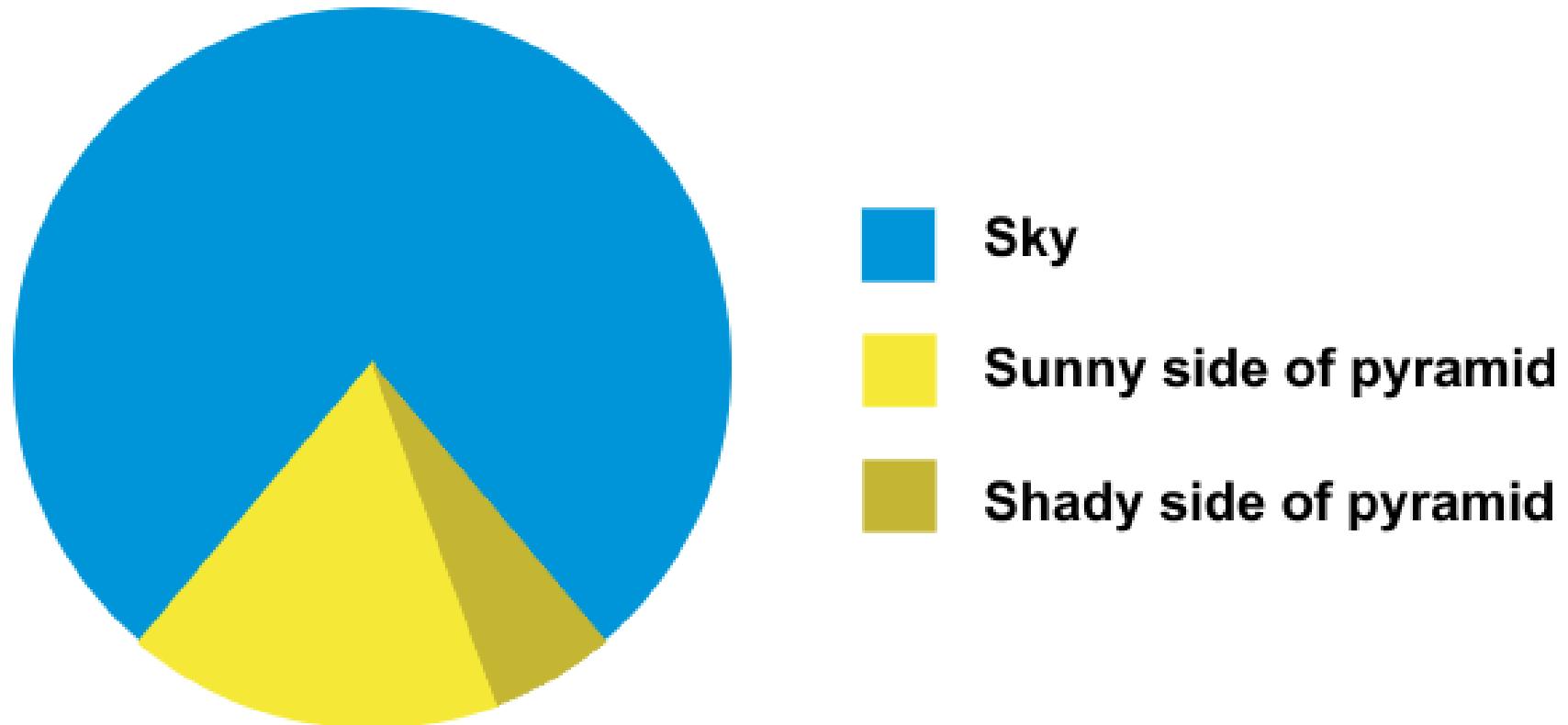
- Small data
- Simple fractions
- If sum of parts matters

# Exceptions:

- Small data
- Simple fractions
- If sum of parts matters



# Best pie chart of all time

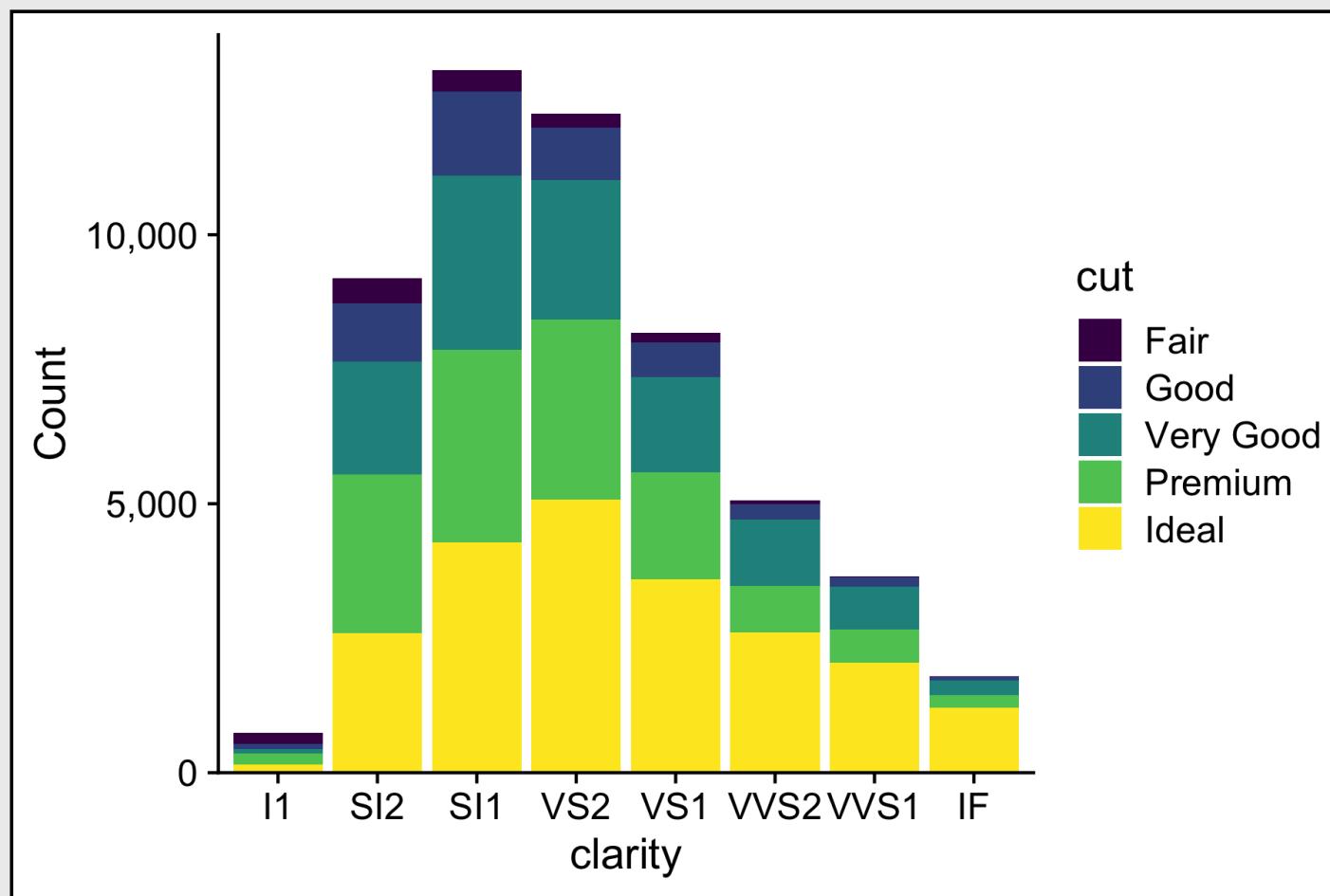


# 10 Data Viz Best Practices

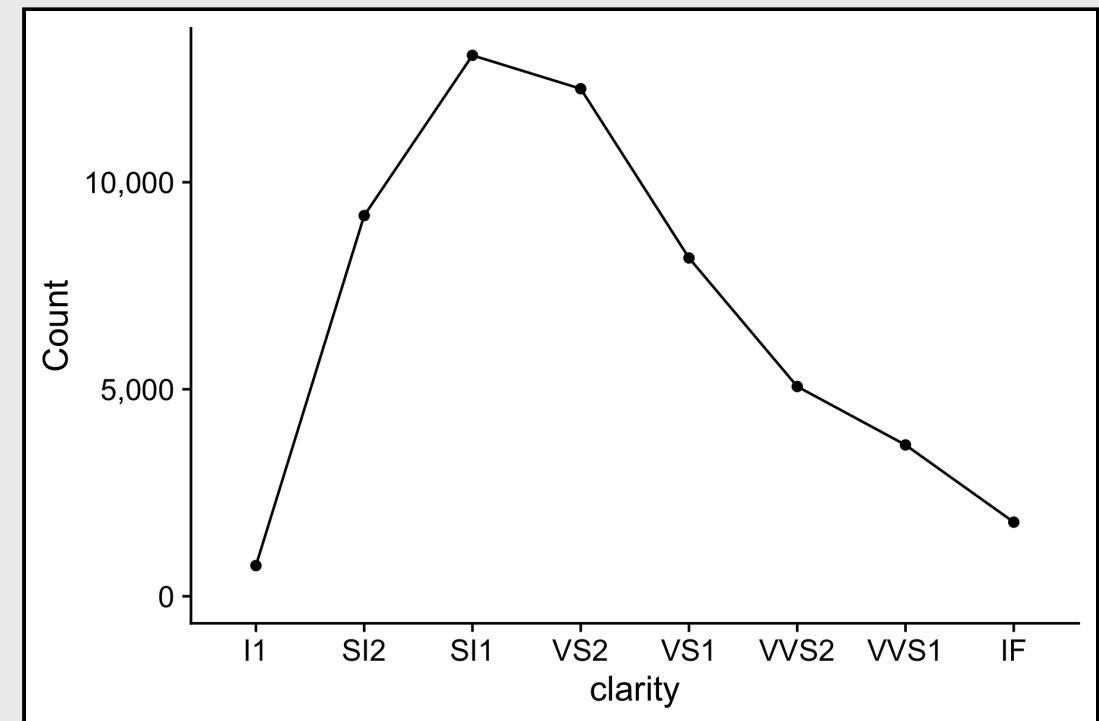
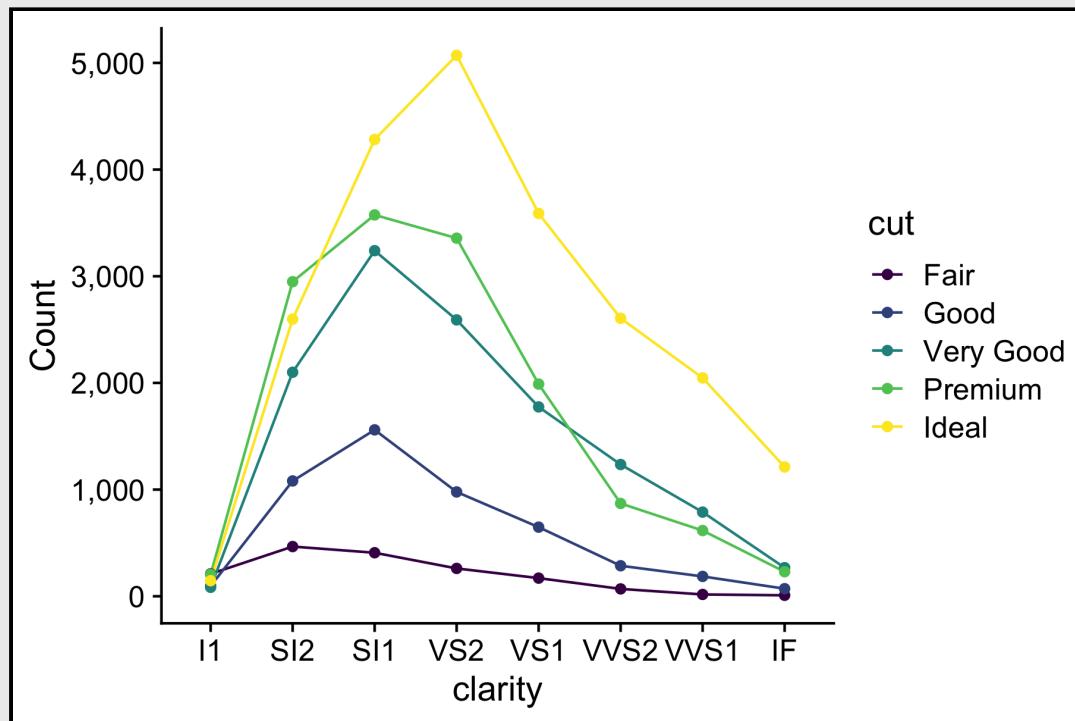
1. Remove chart chunk
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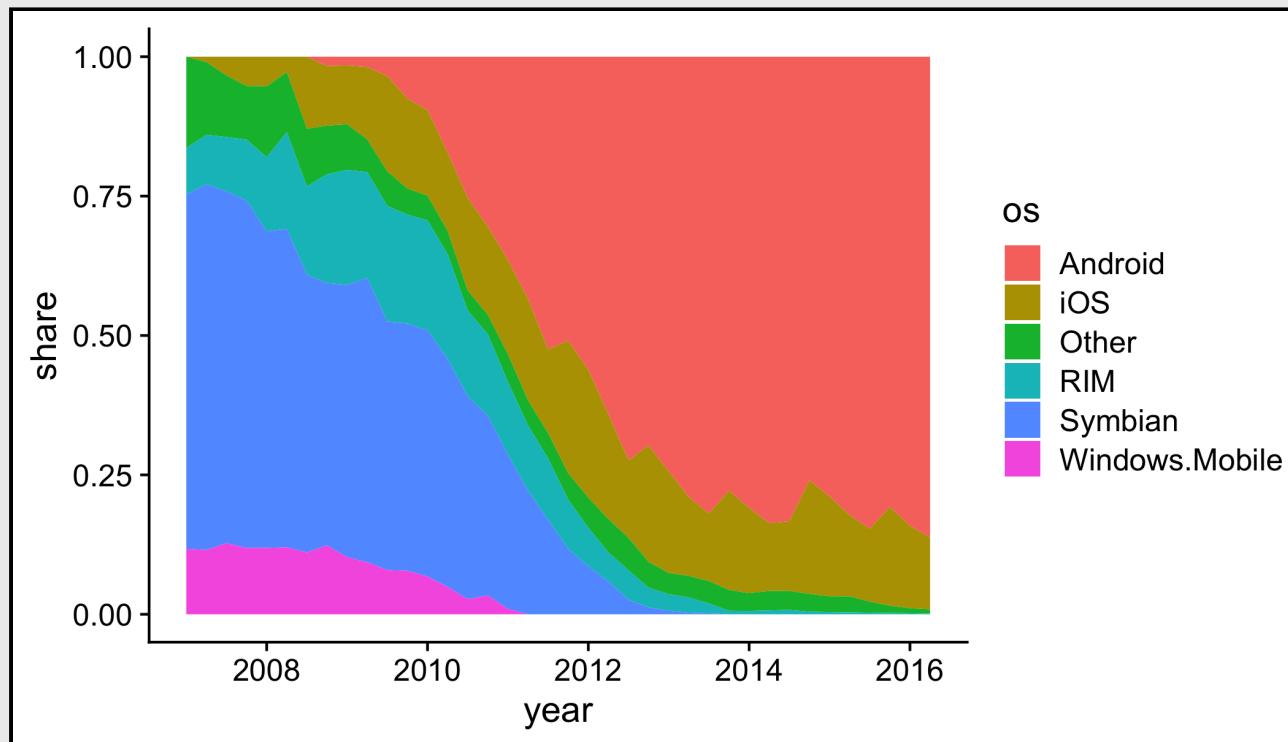
# Stacked bars are rarely a good idea



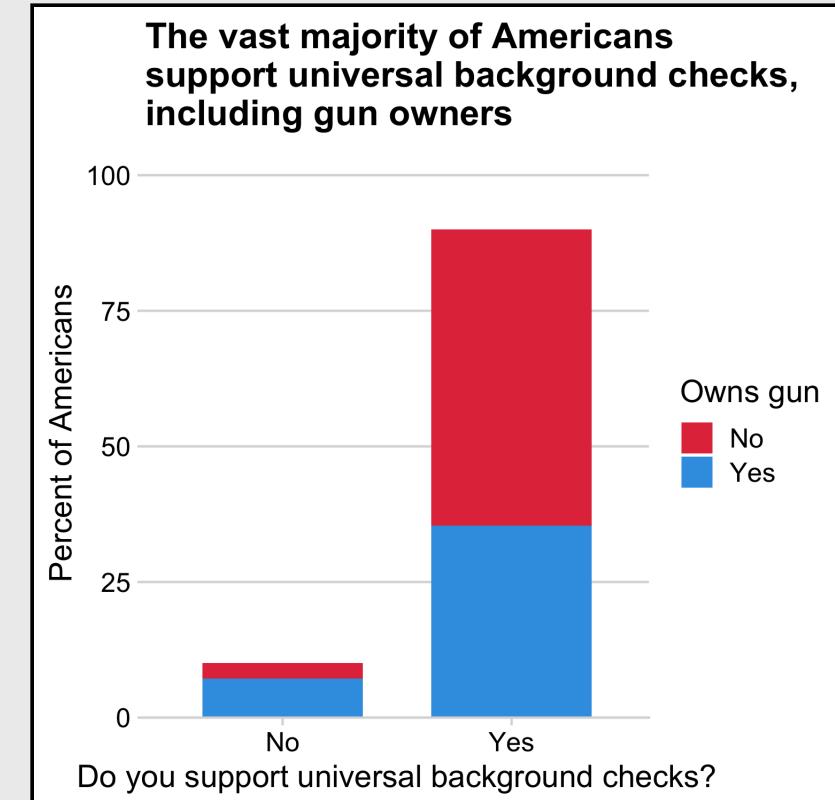
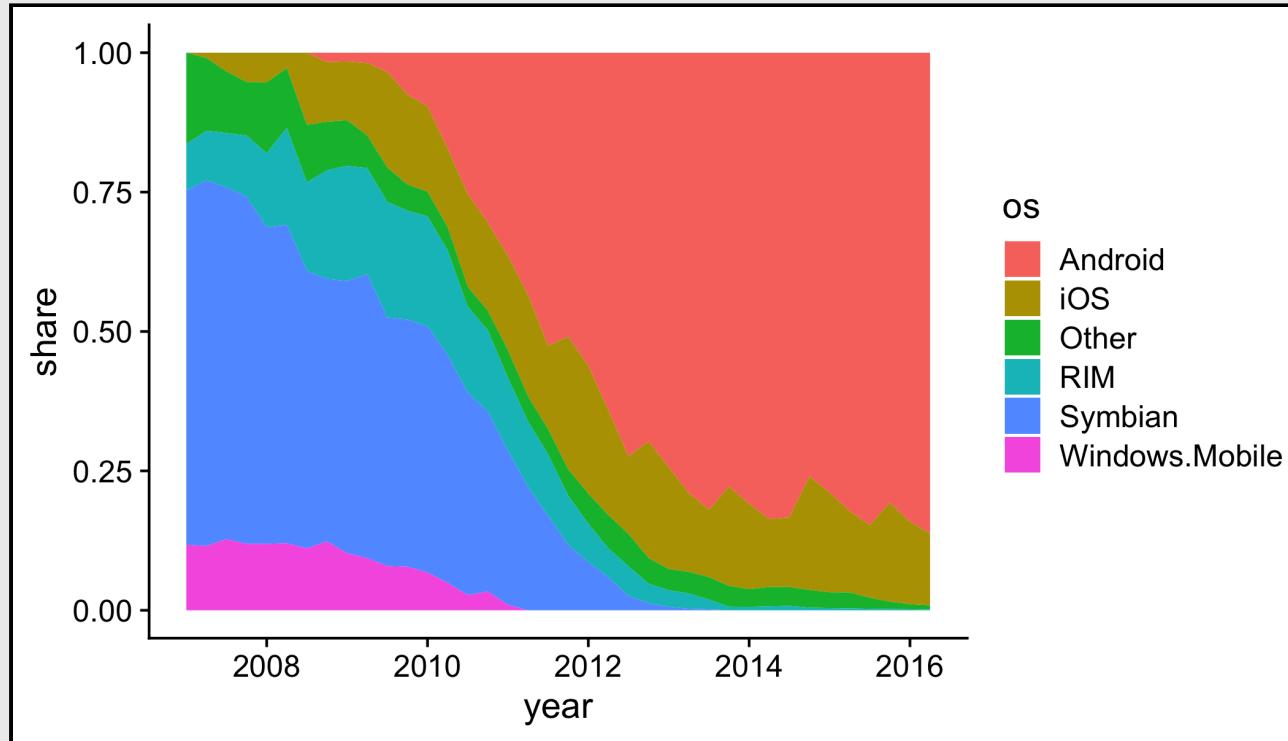
# "Parallel coordinates" plot usually works better



Exception:  
When you care about the *total* more than the categories



# Exception: When you care about the *total* more than the categories

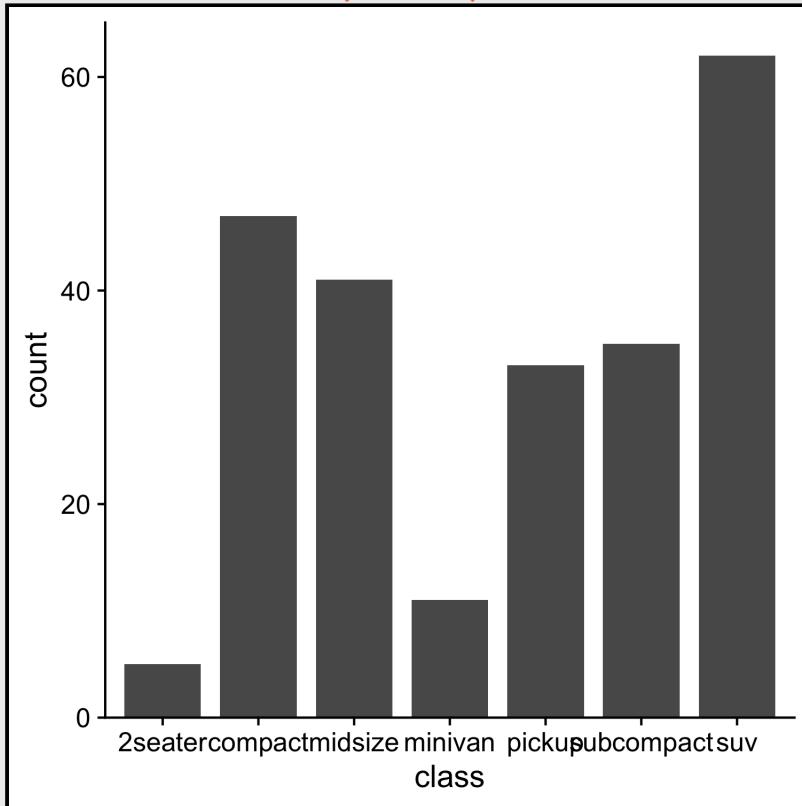


# 10 Data Viz Best Practices

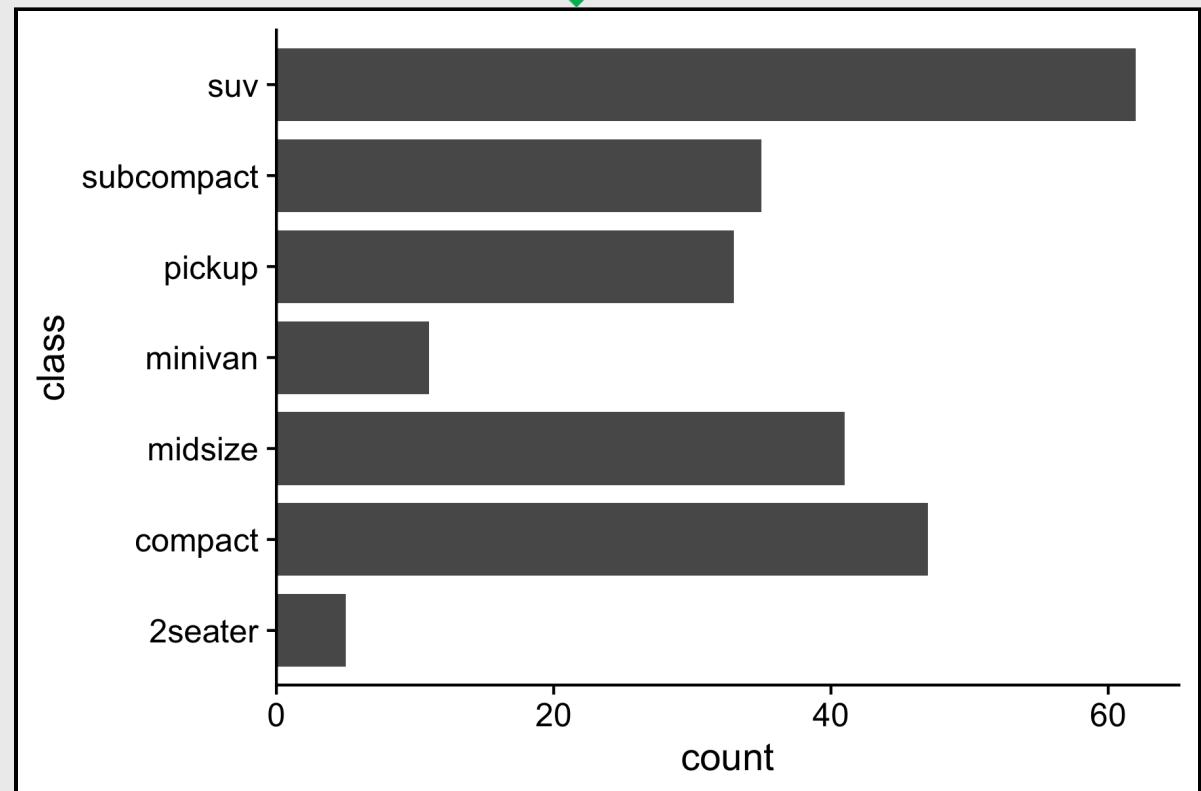
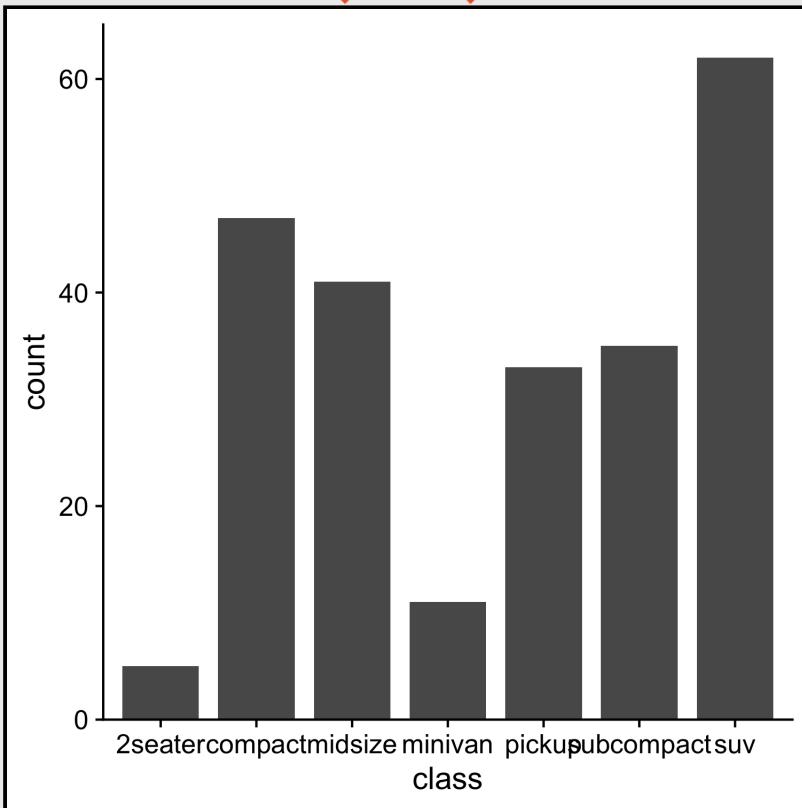
1. Remove chart chunk
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3. Don't lie
4. Don't use pie charts for proportions\*
5. Don't stack bars\*
6. **Rotate and sort categorical axes\***
7. Eliminate legends & directly label geoms\*
8. Don't use pattern fills
9. Don't use red & green together
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\*most of the time

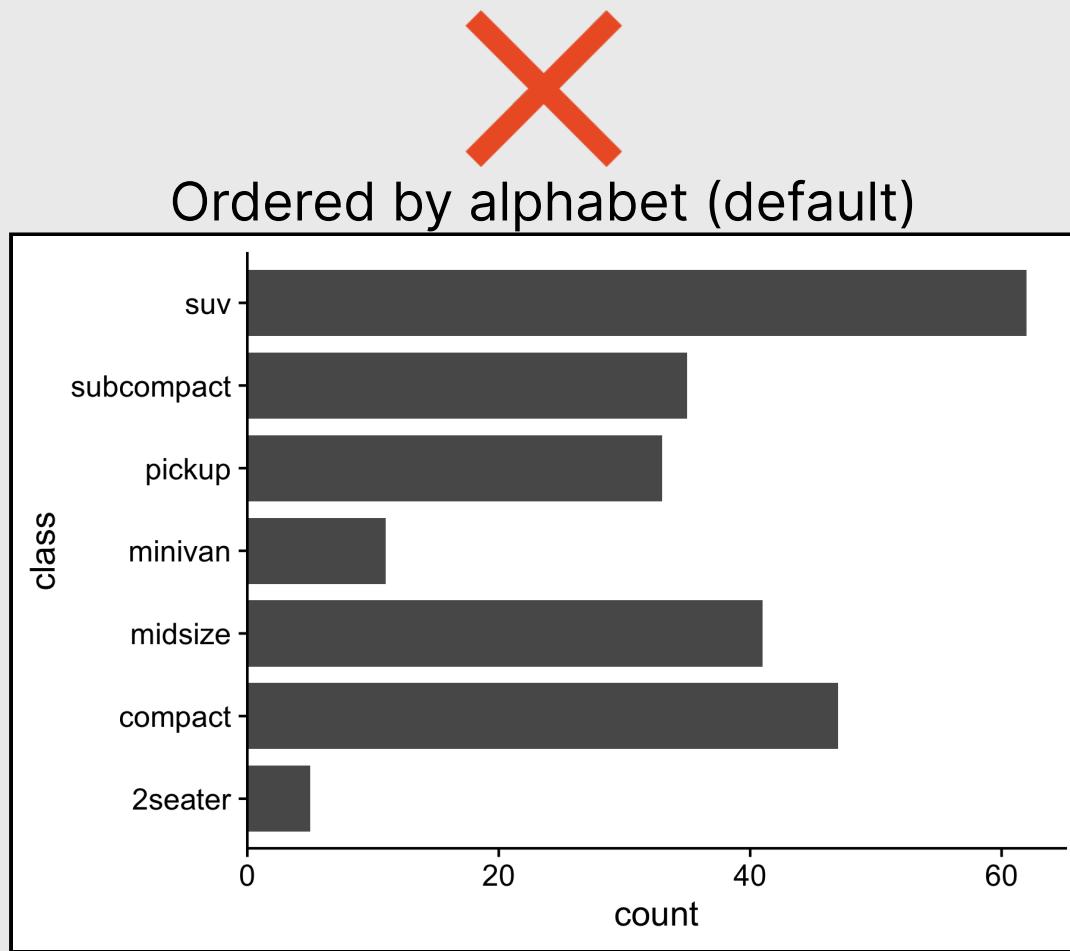
# Rotate axes if you can't read them



# Rotate axes if you can't read them



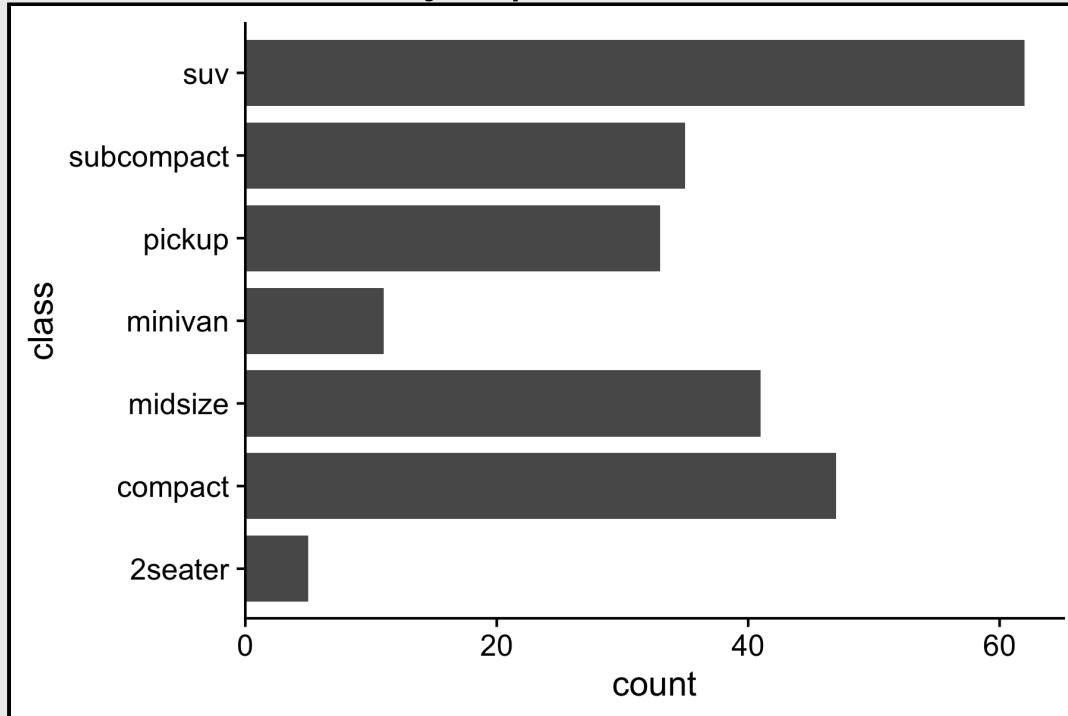
# Default order is almost always wrong



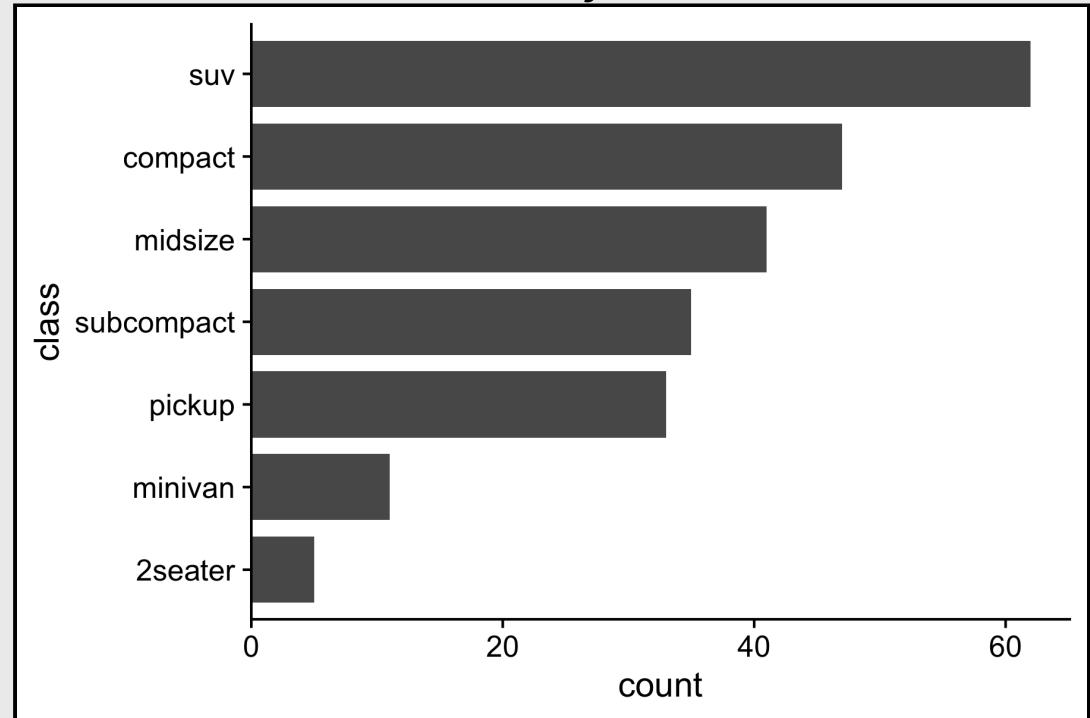
# Default order is almost always wrong



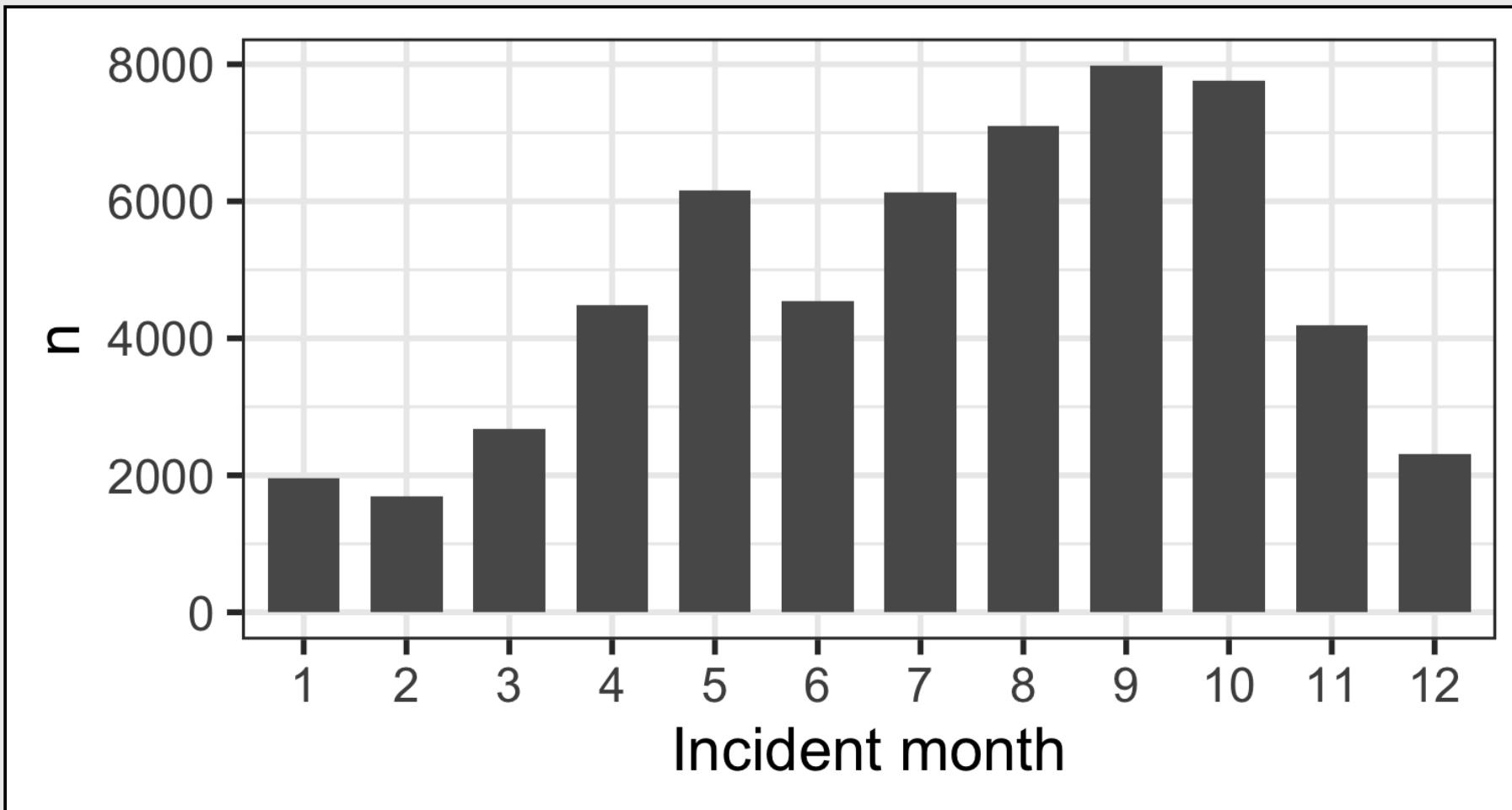
Ordered by alphabet (default)



Ordered by count



# Exception: Ordinal variables

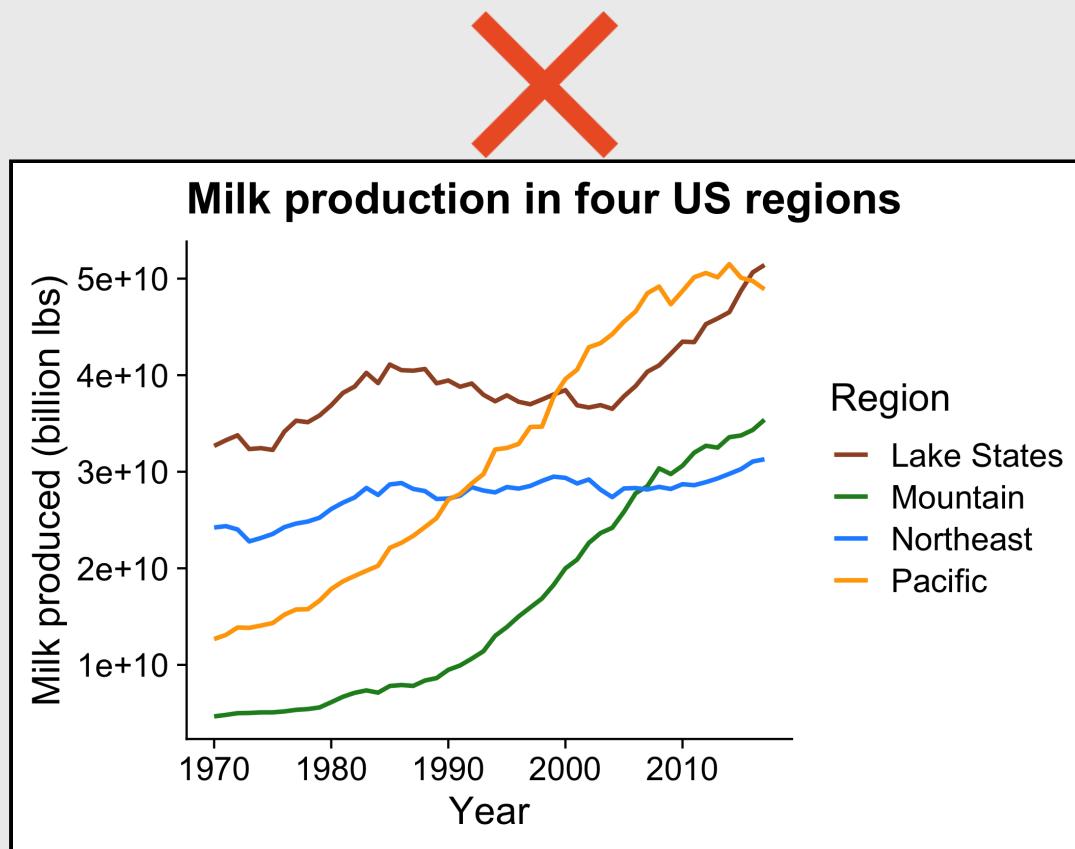


# 10 Data Viz Best Practices

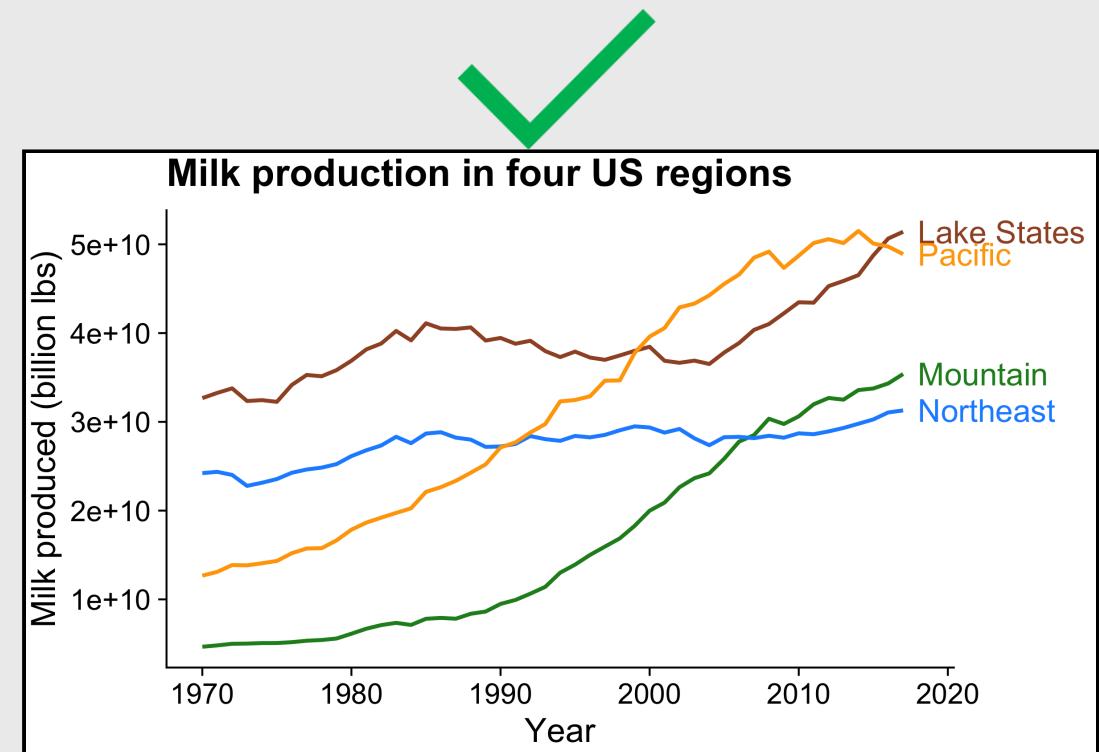
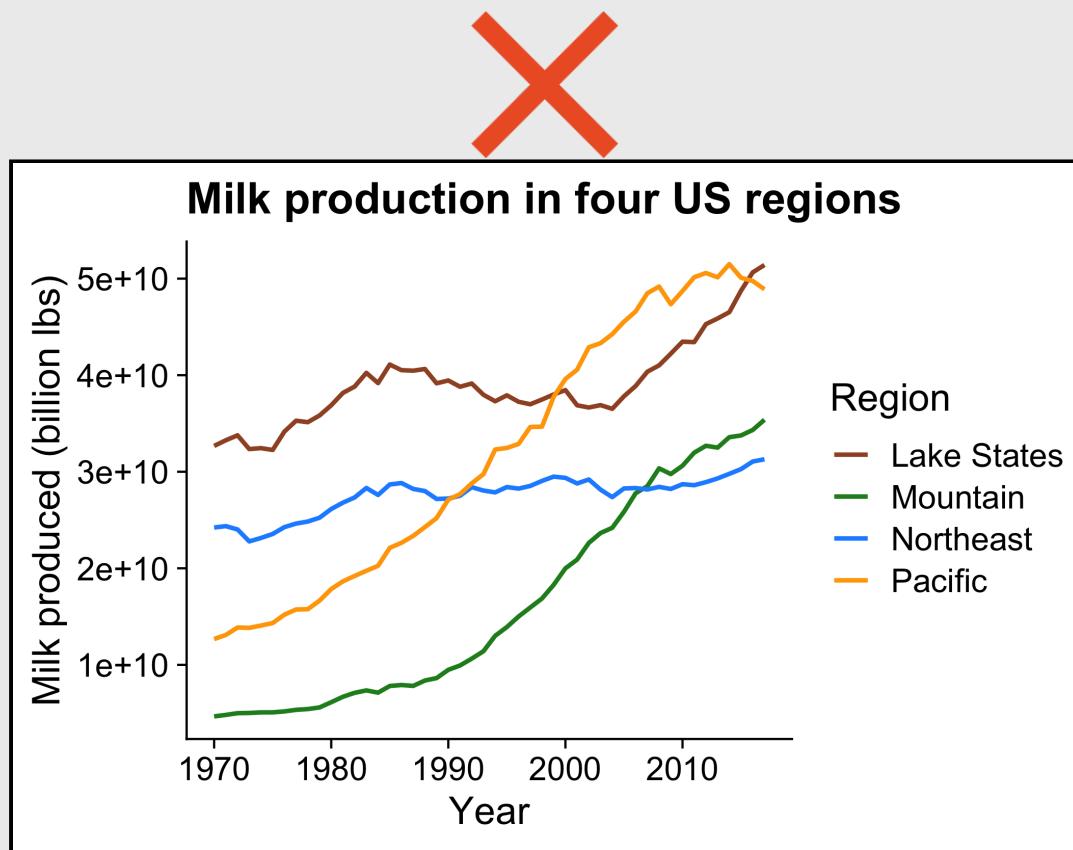
1. Remove chart chunk
2. Don't make 3D plots\*
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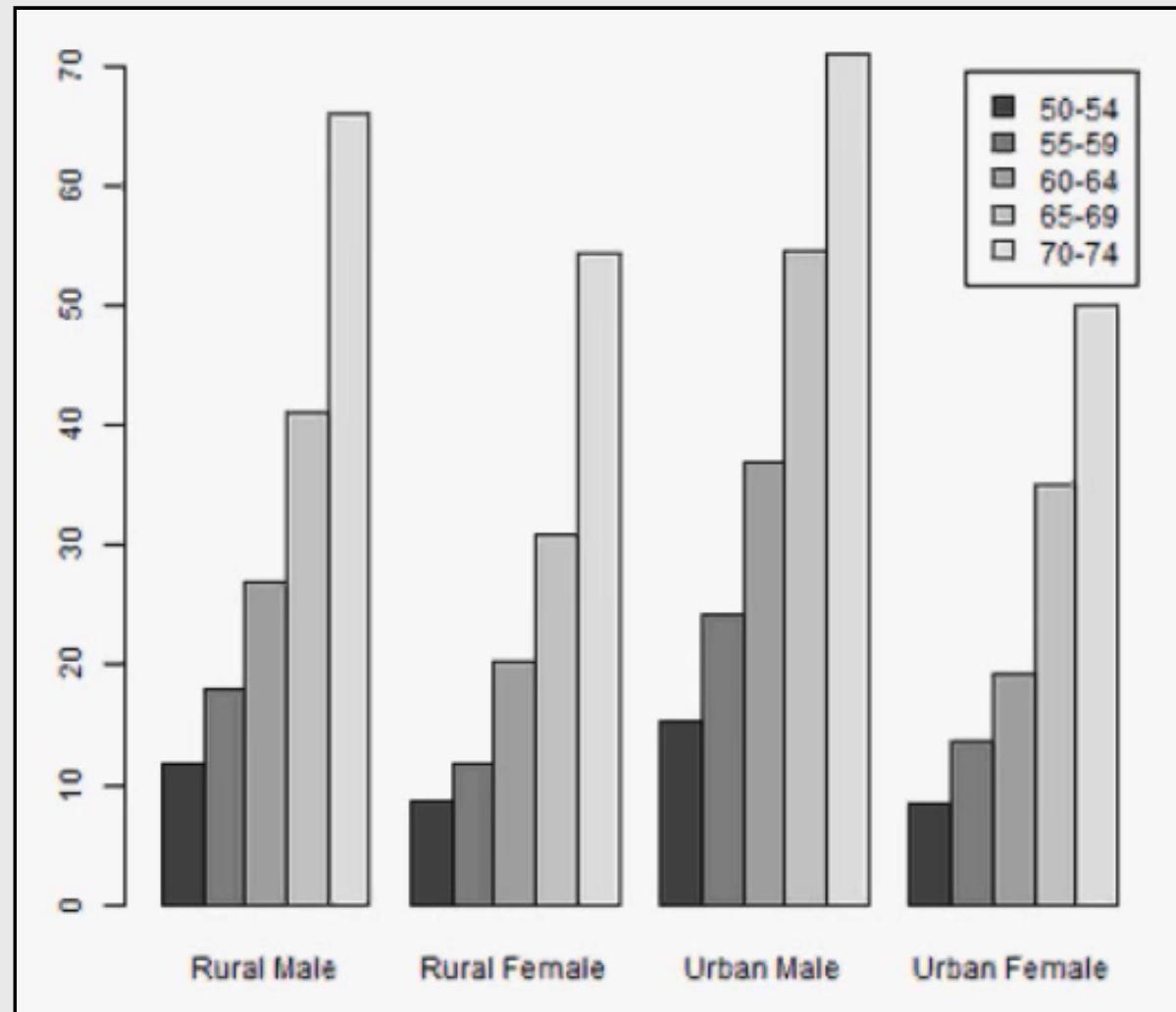
# Directly label geoms



# Directly label geoms



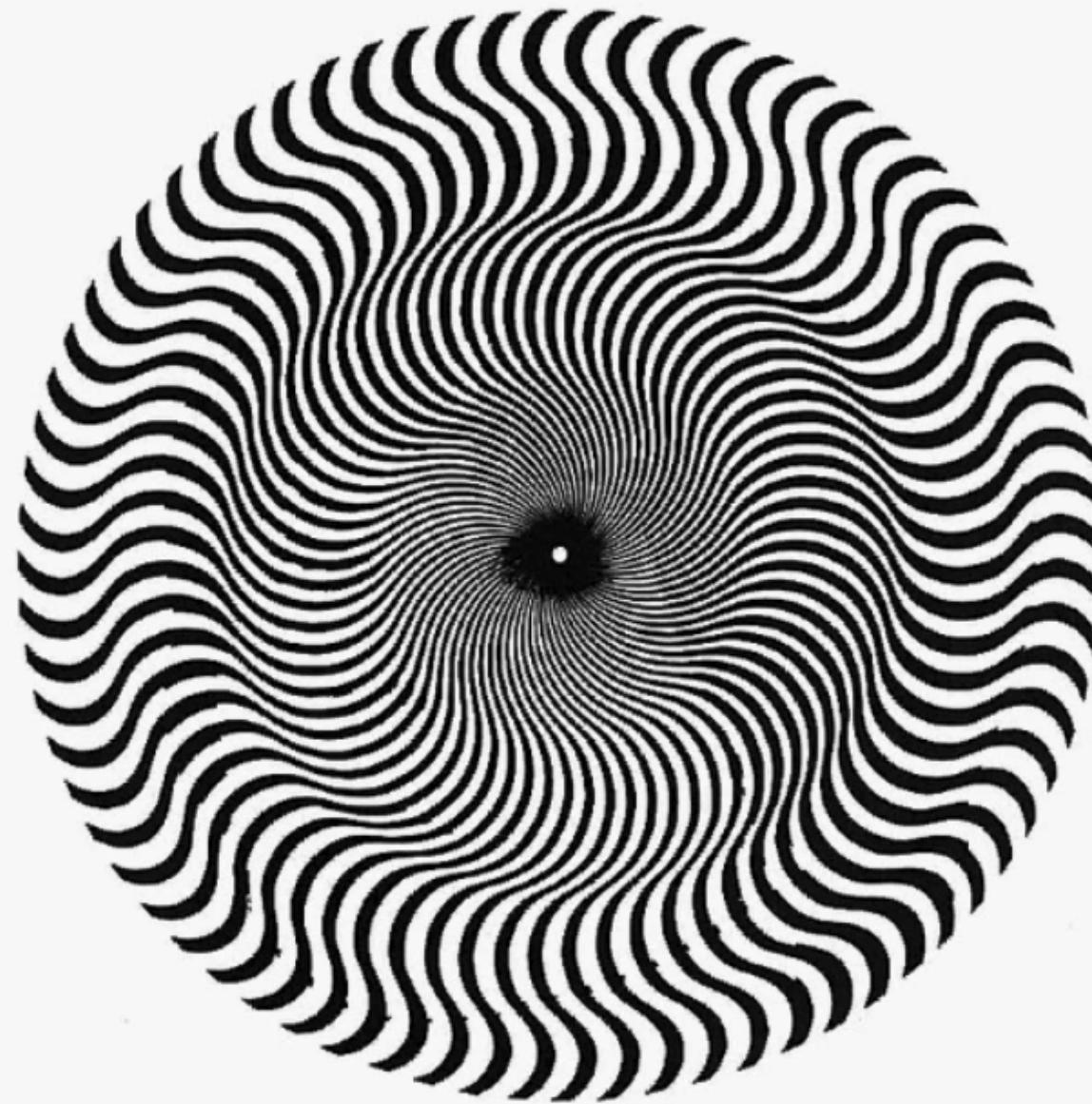
# Exception: When you have repeated categories



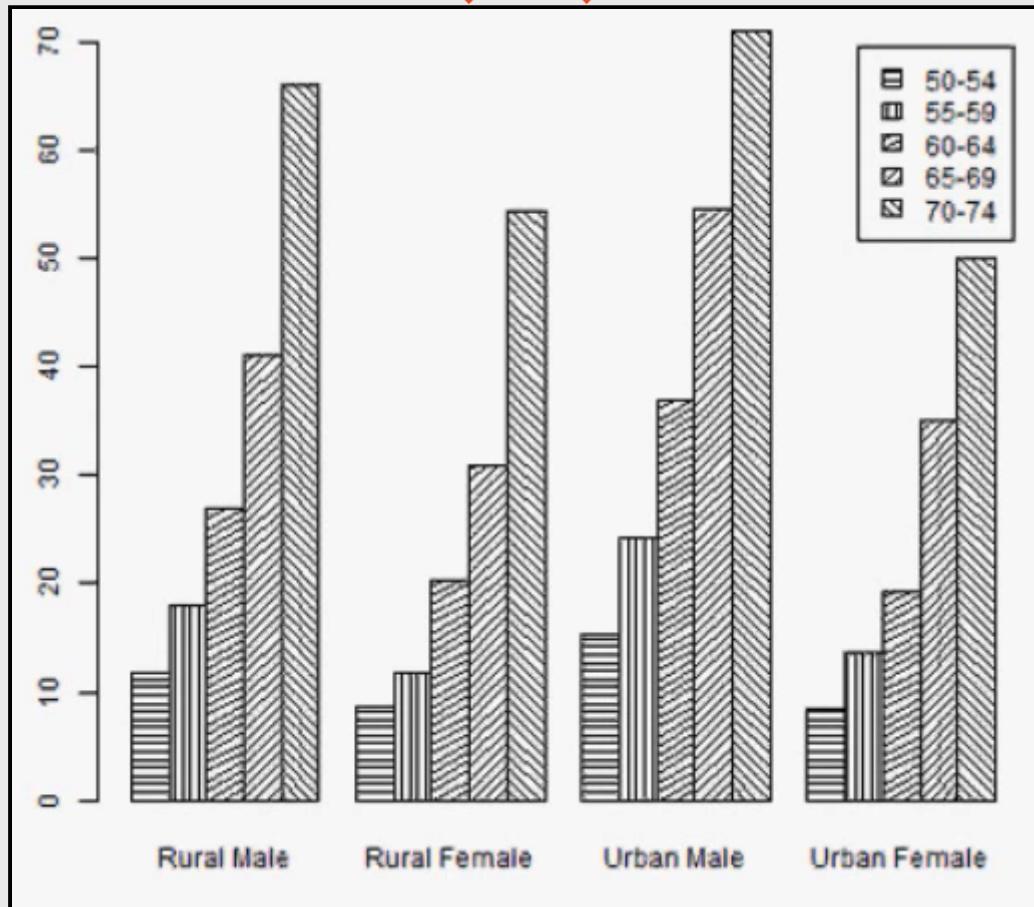
# 10 Data Viz Best Practices

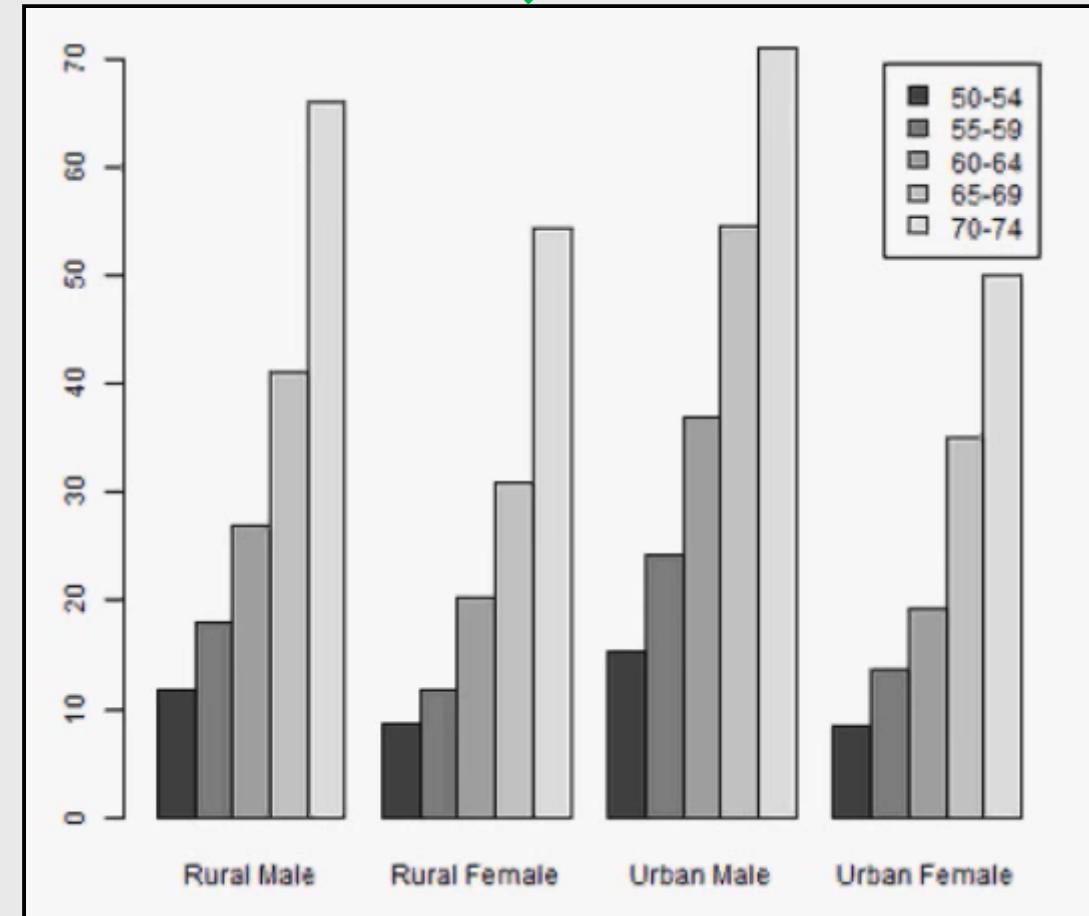
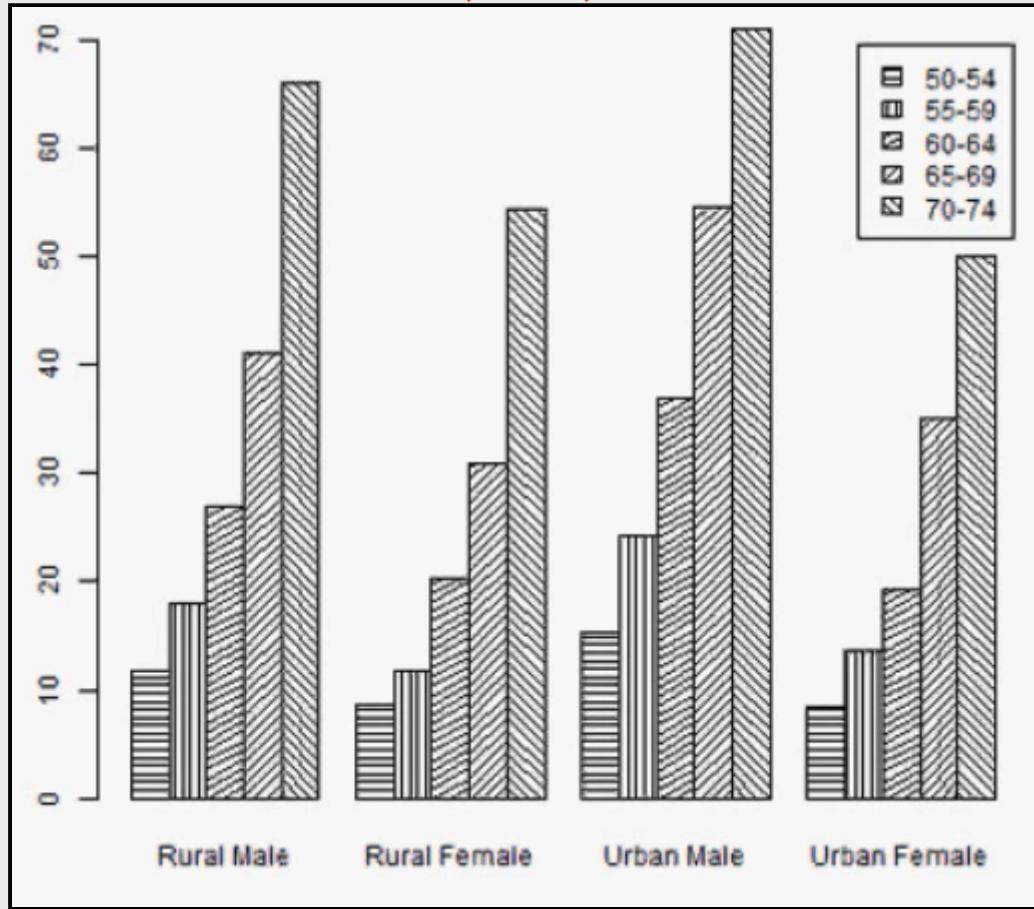
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\*most of the time



+





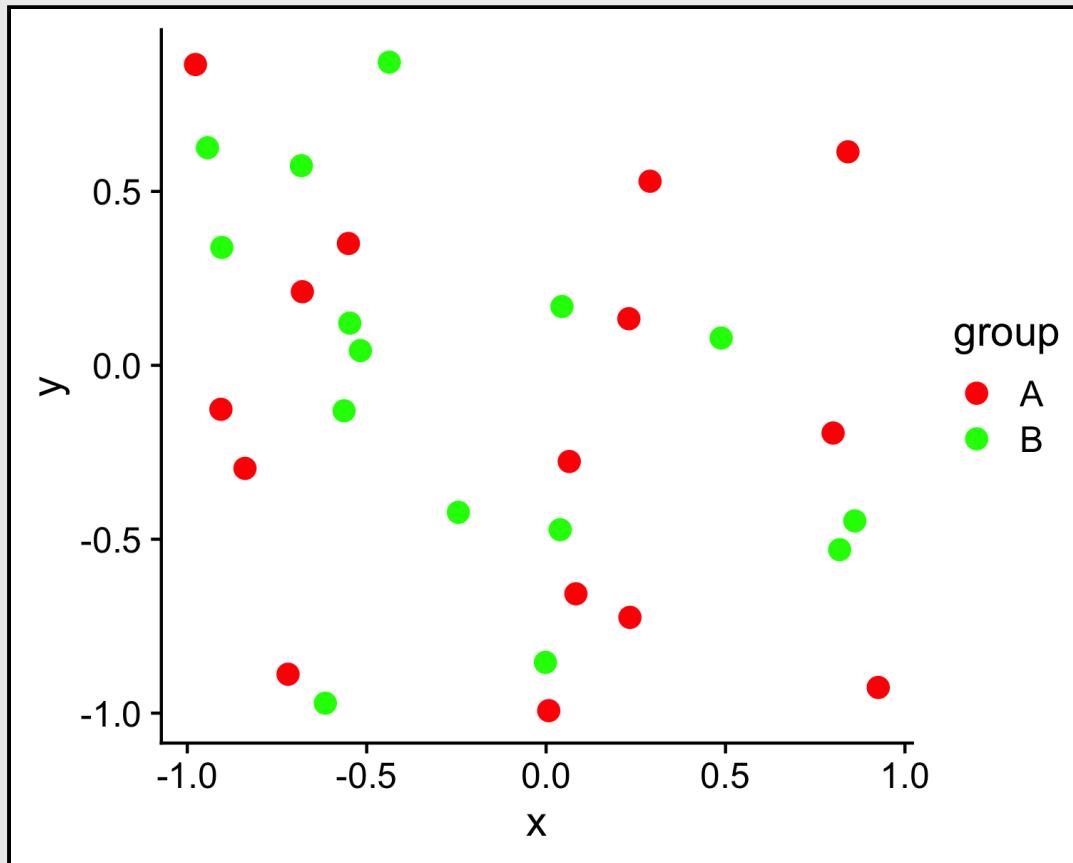
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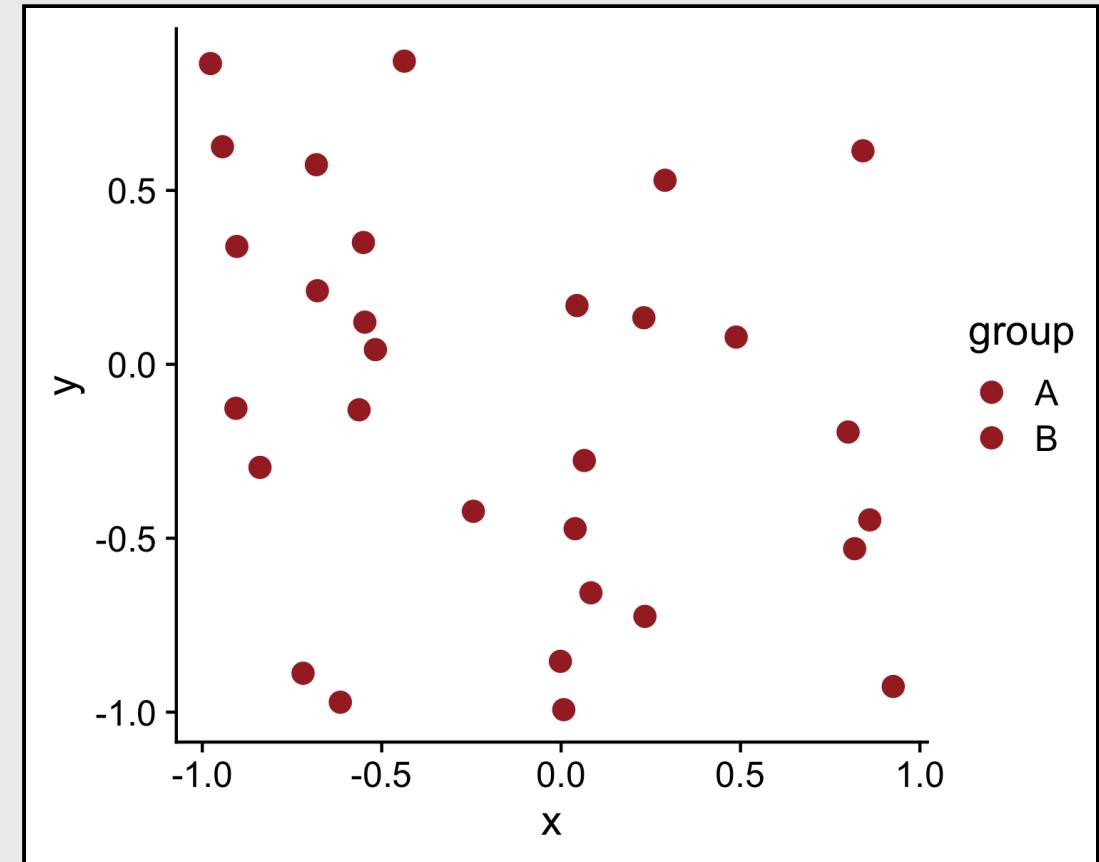
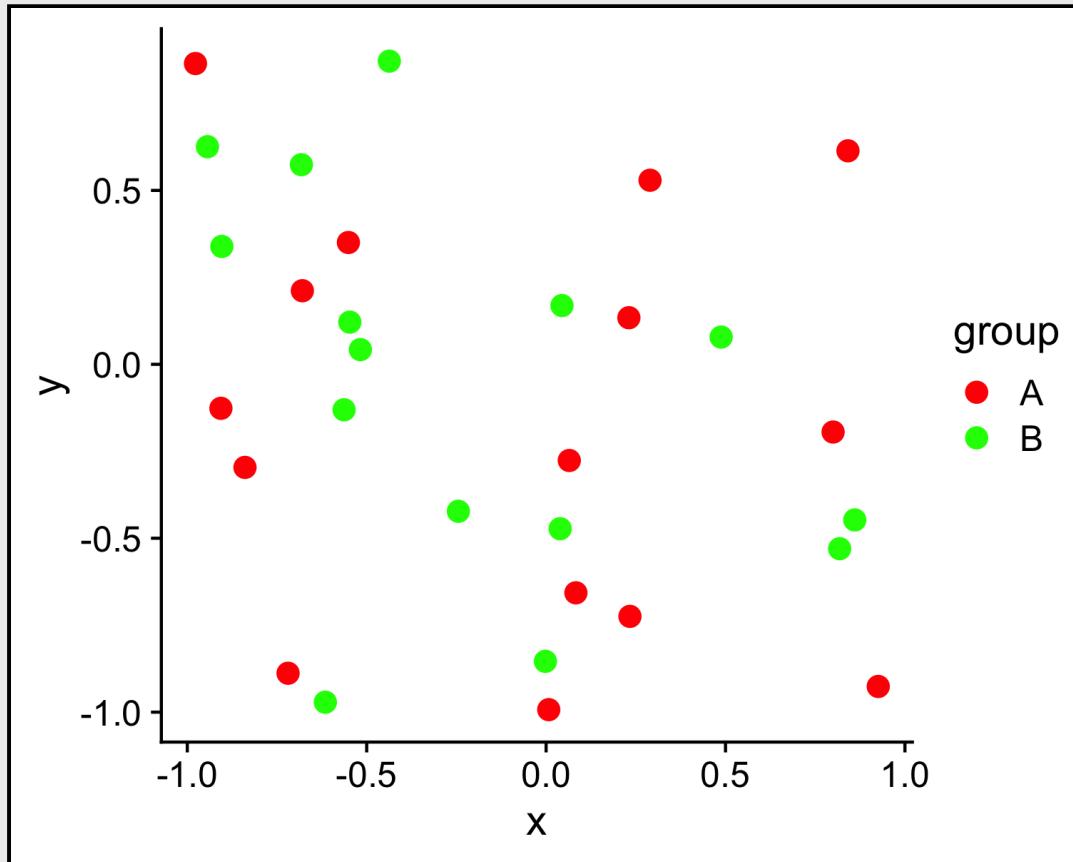
\*most of the time

10% of males and 1% of females are color blind

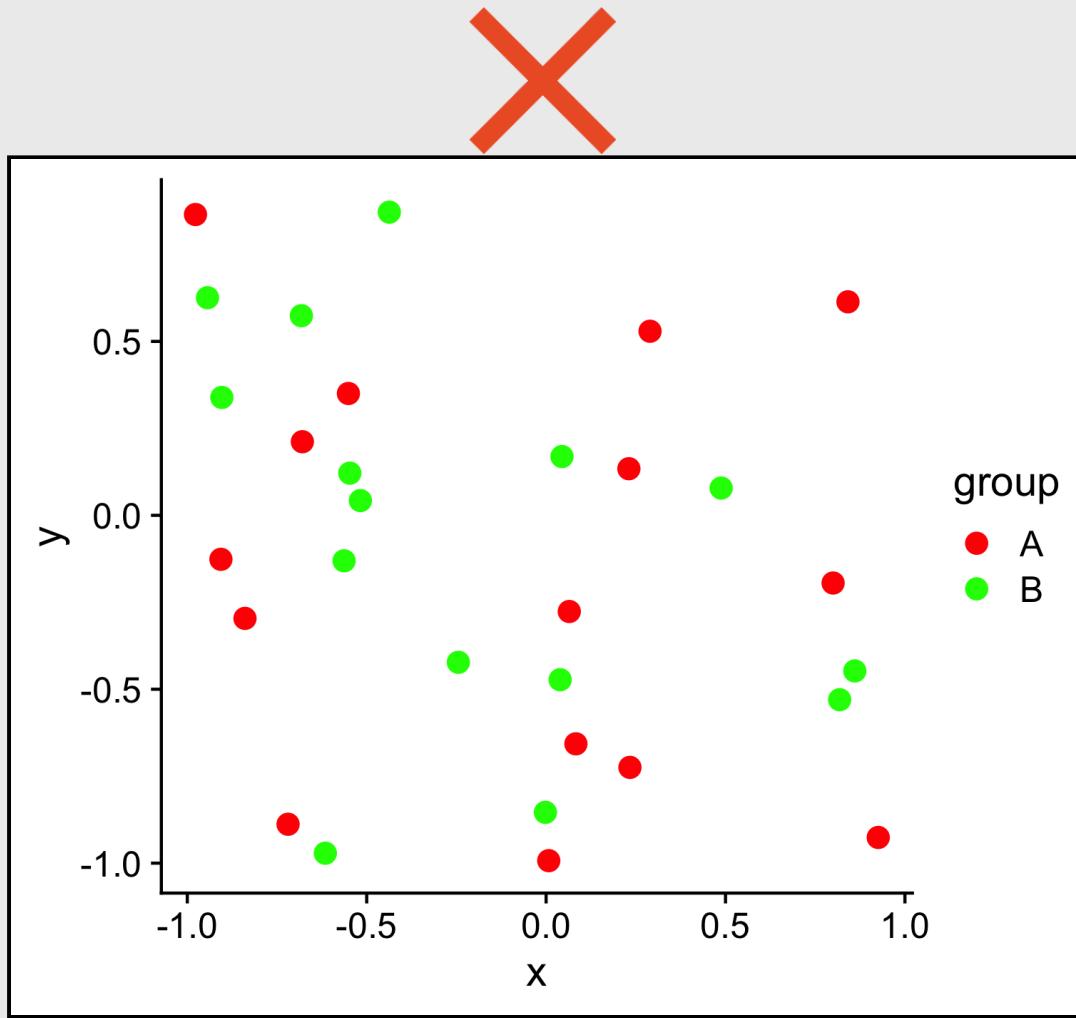
# 10% of males and 1% of females are color blind



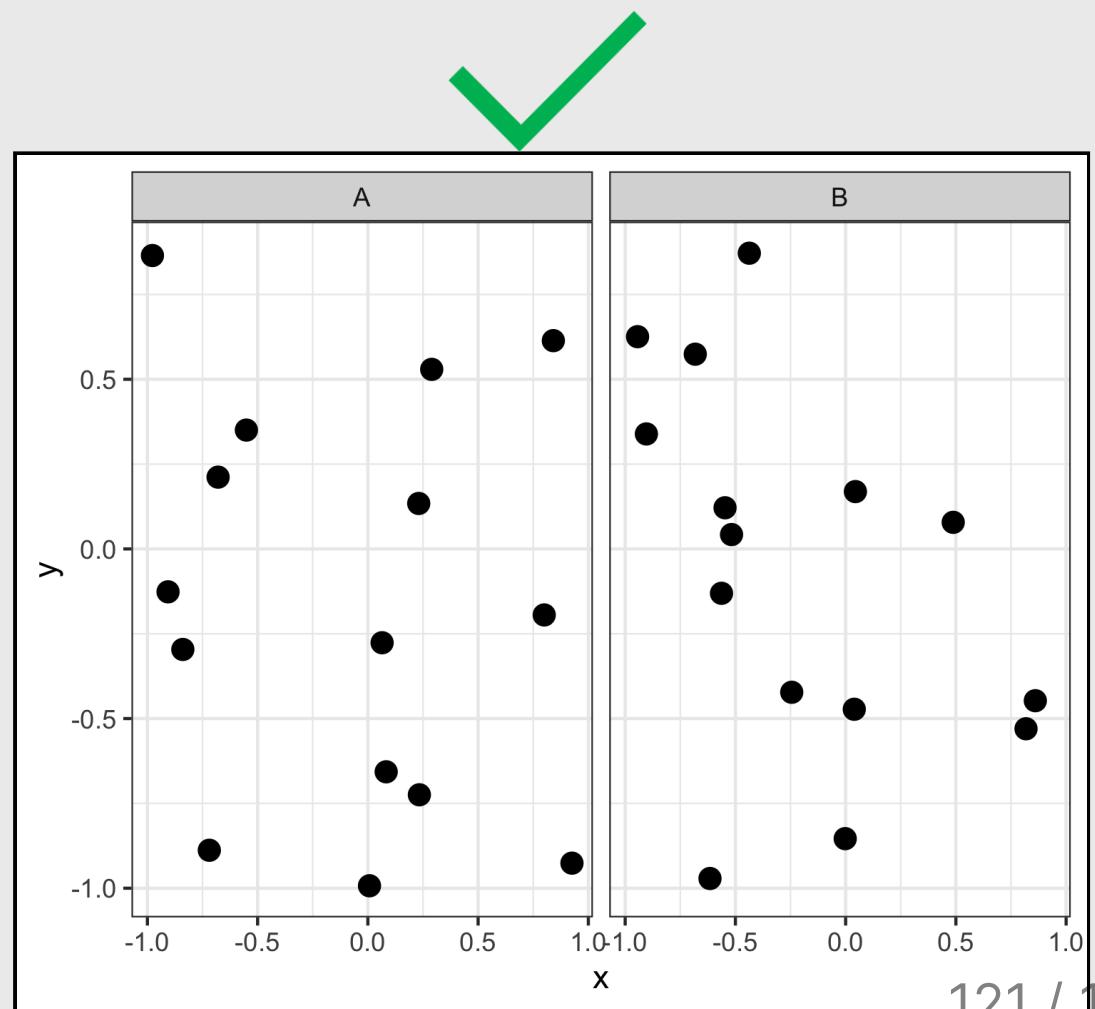
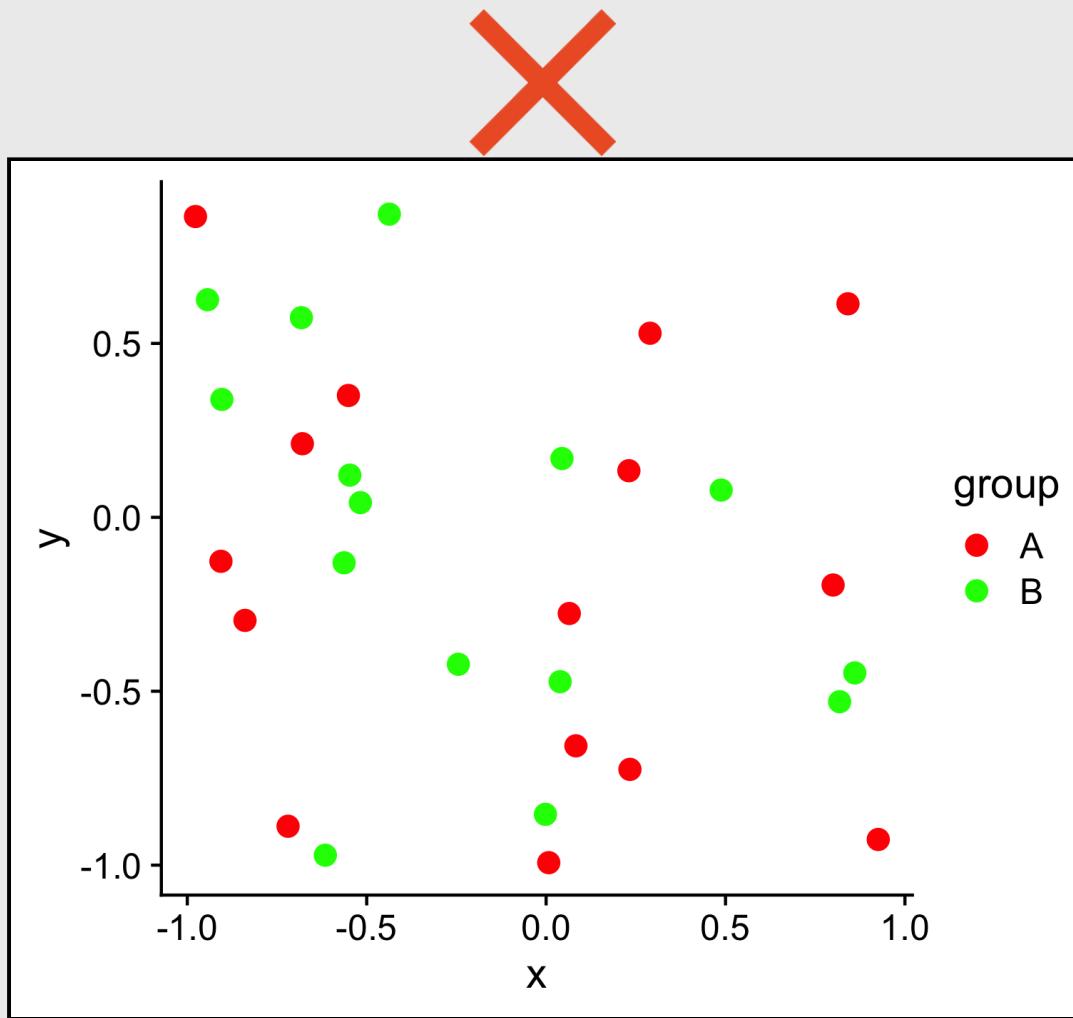
# 10% of males and 1% of females are color blind



# Facets can be used to avoid color altogether



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# 10 Data Viz Best Practices

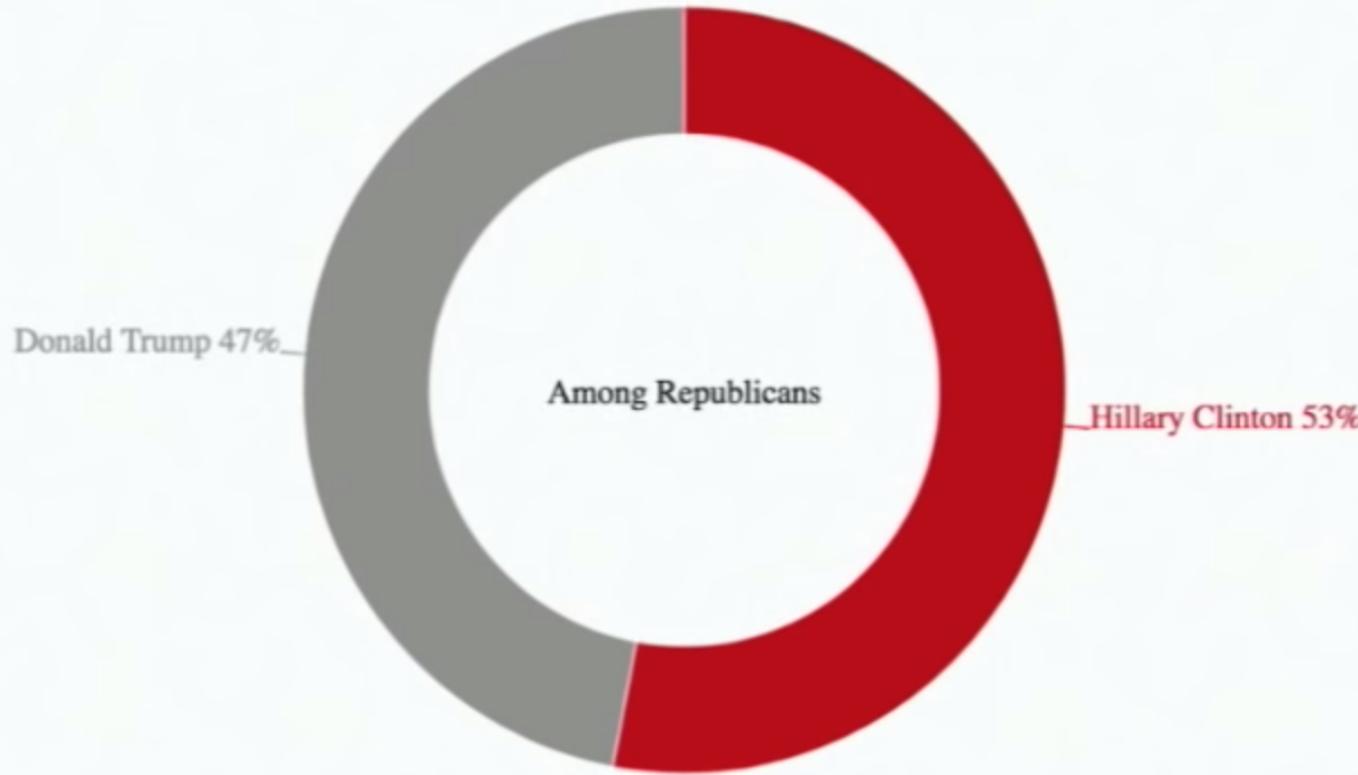
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# Who do you think did a better job in tonight's debate?

Among Republicans

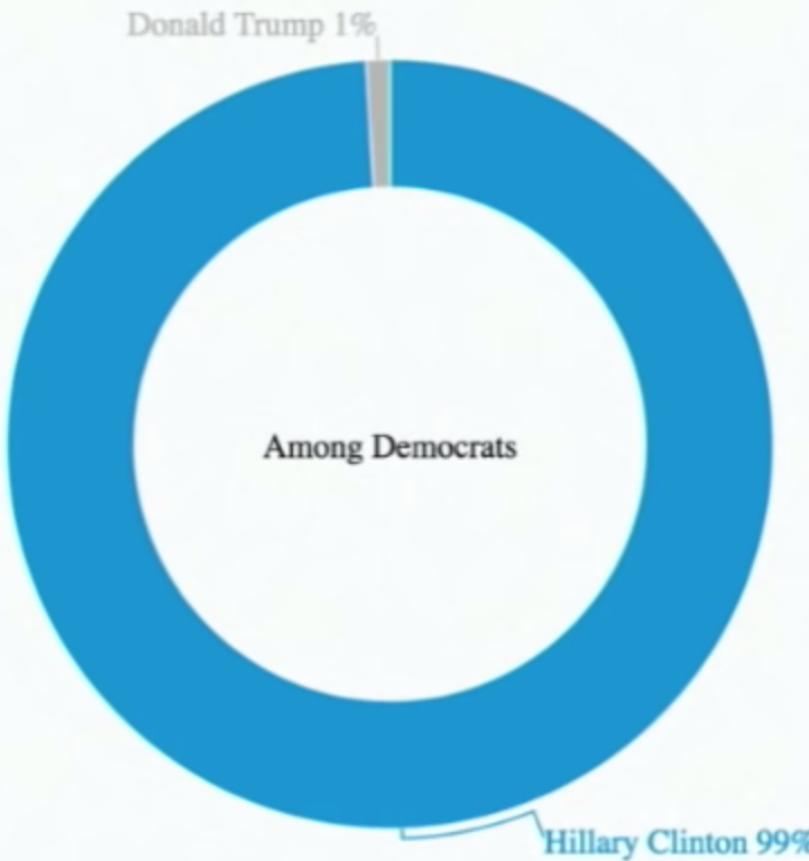
Among Democrats



# Who do you think did a better job in tonight's debate?

Among Republicans

Among Democrats



# Who do you think did a better job in tonight's debate?

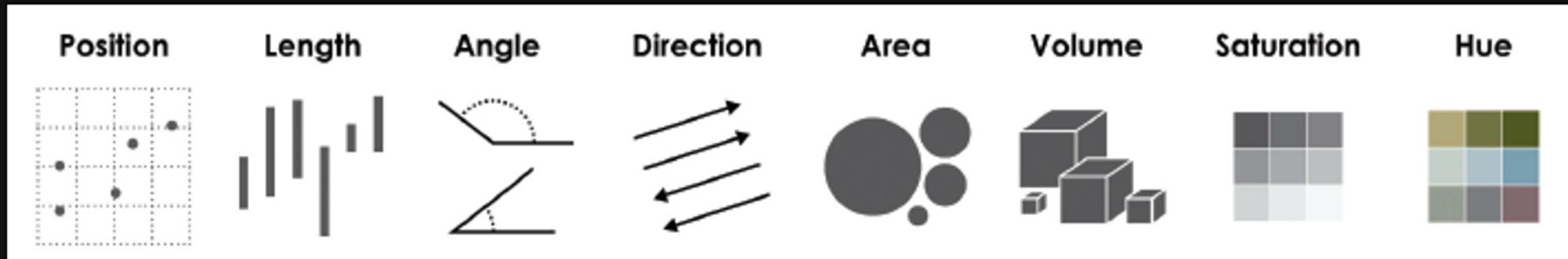
	<b>Clinton</b>	<b>Trump</b>
Among Democrats	99%	1%
Among Republicans	53%	47%

# Your turn - go [here](#)

10:00

For your "bad" visualization:

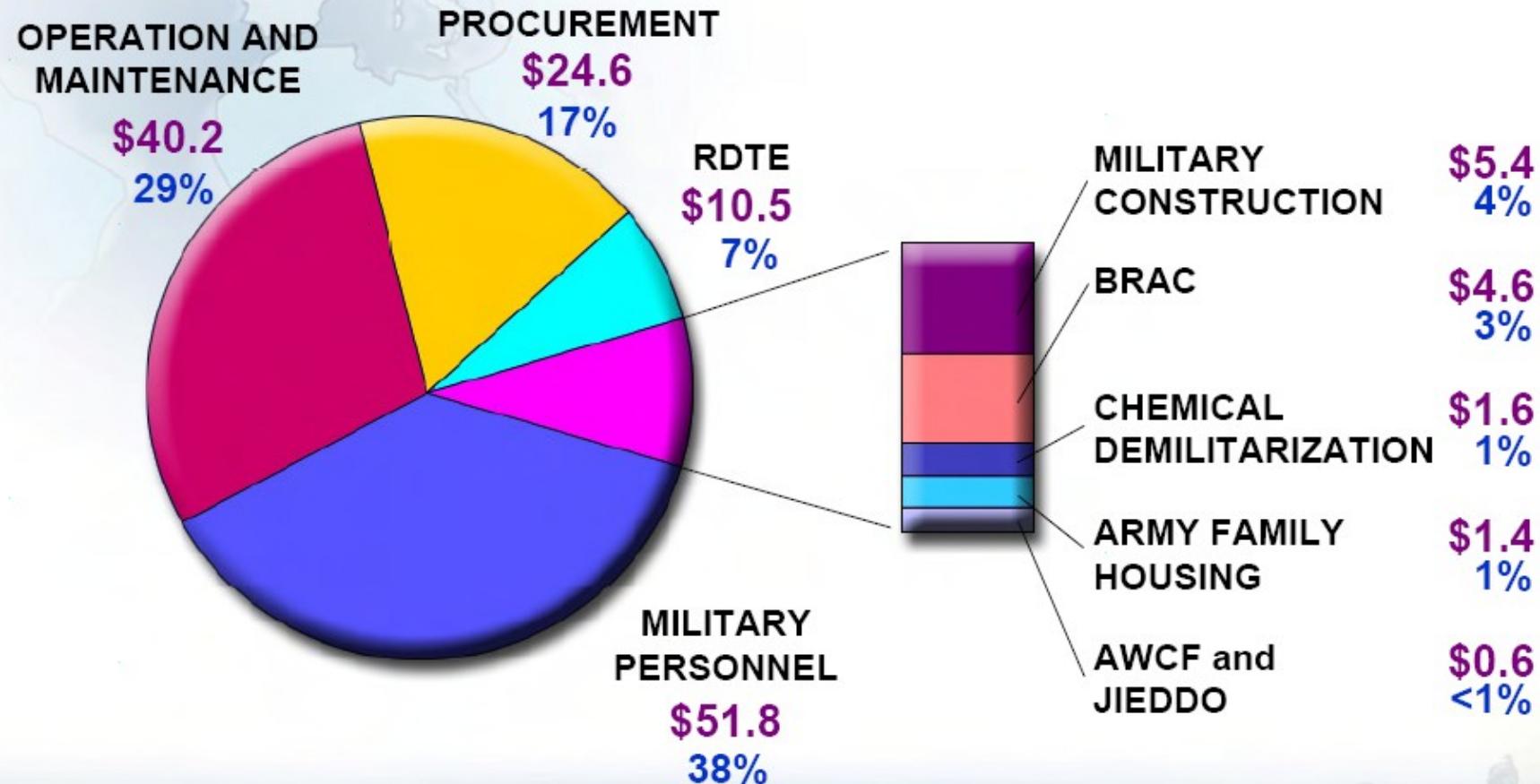
- 1) Identify where the graphic falls on Cleveland's pattern recognition hierarchy

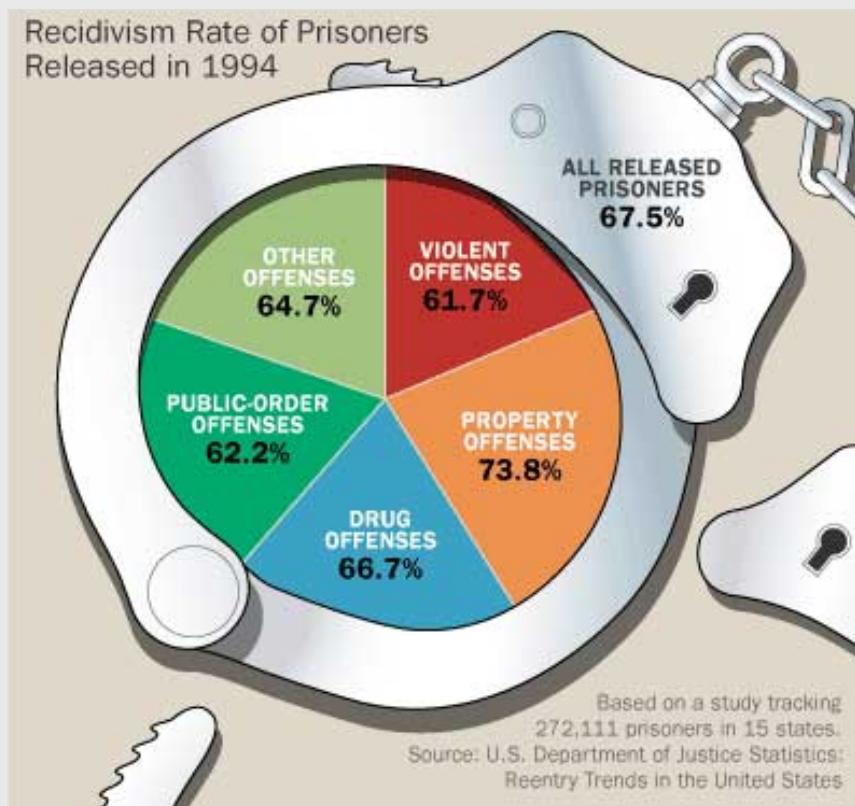


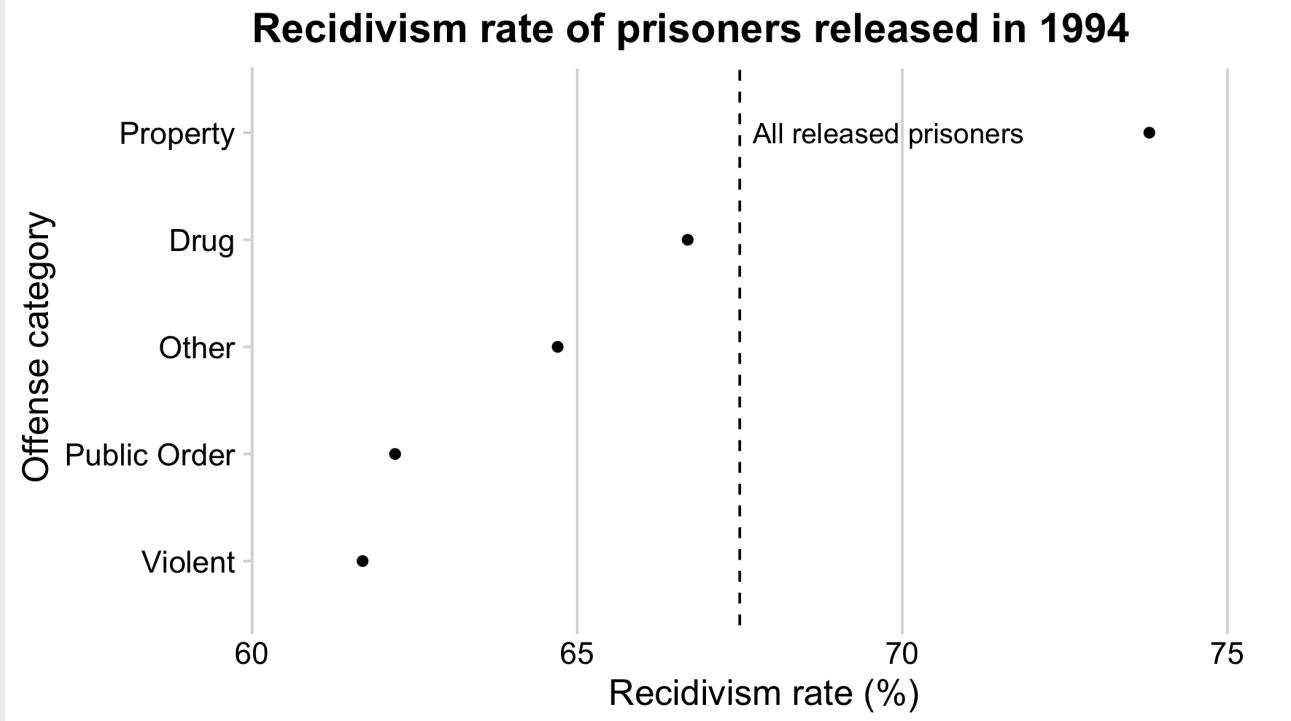
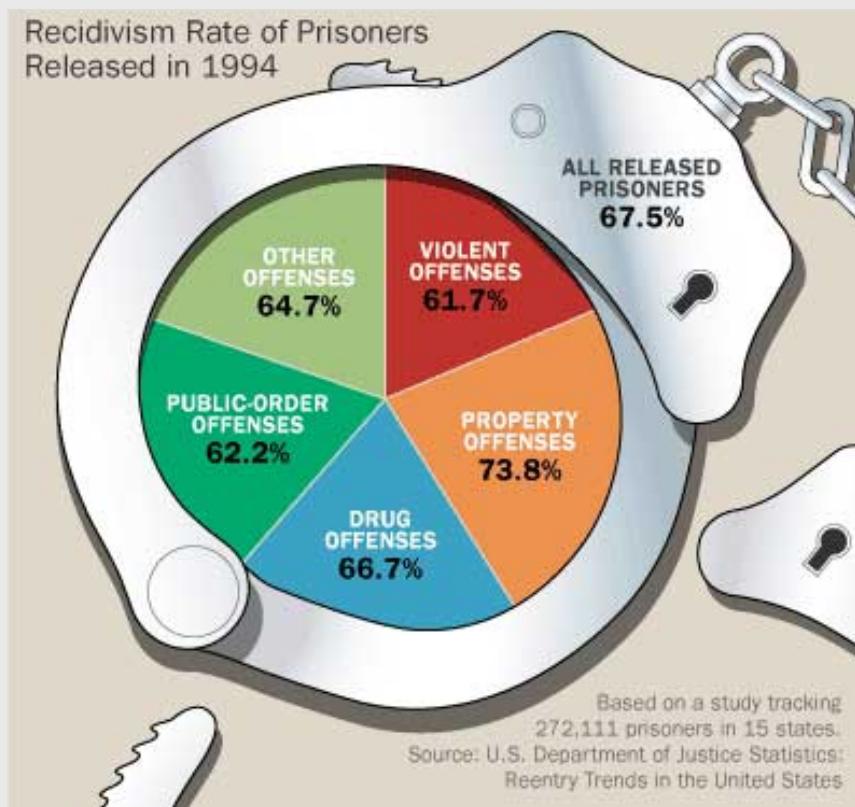
- 2) Any design rules that are broken
- 3) Suggest at least two improvements

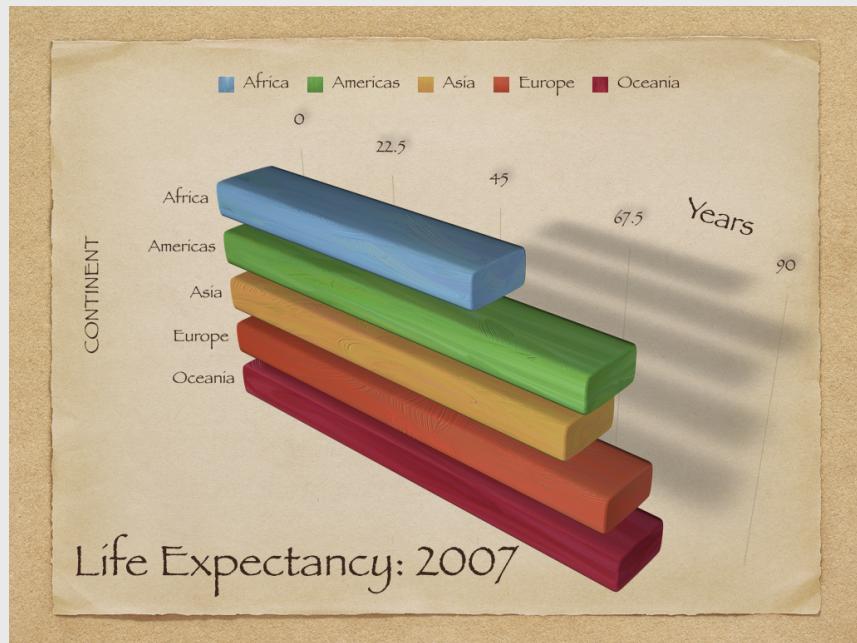


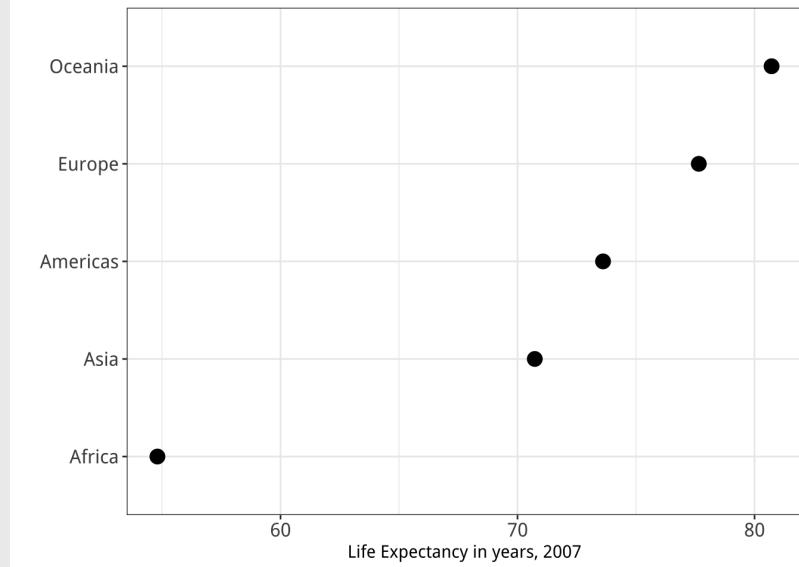
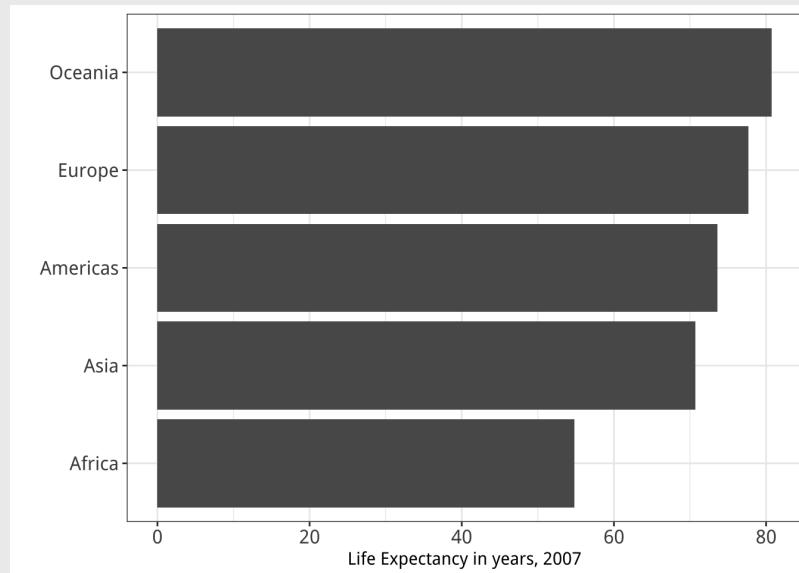
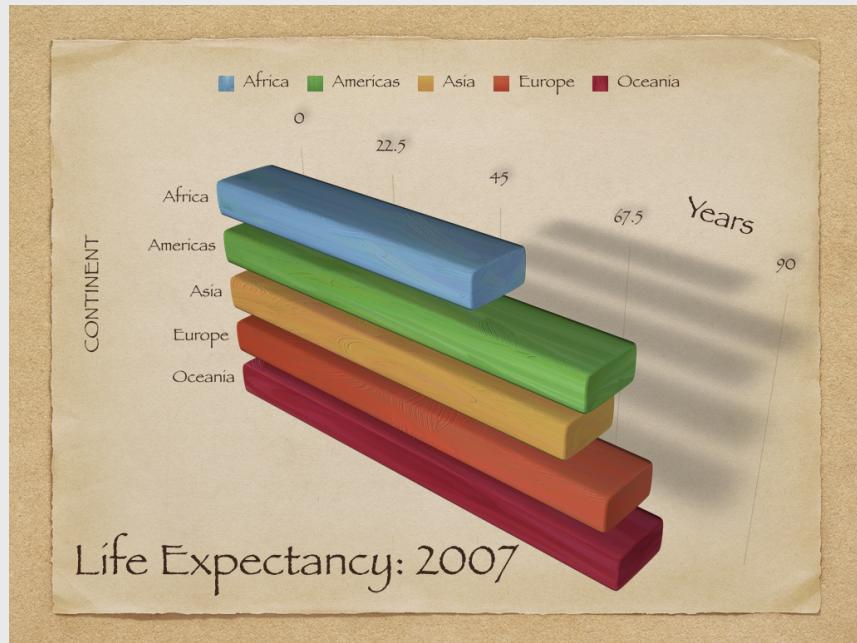
# FY09 Obligation Authority





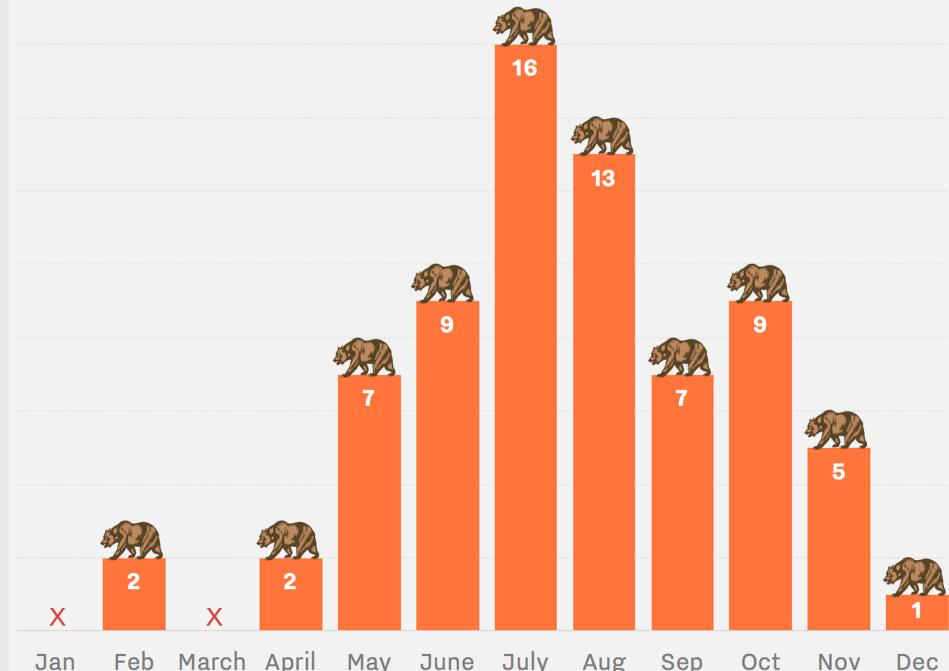






## Most fatal bear attacks occur in July and August

Total fatal bear attacks (grizzly, black, and polar), 1900 to present

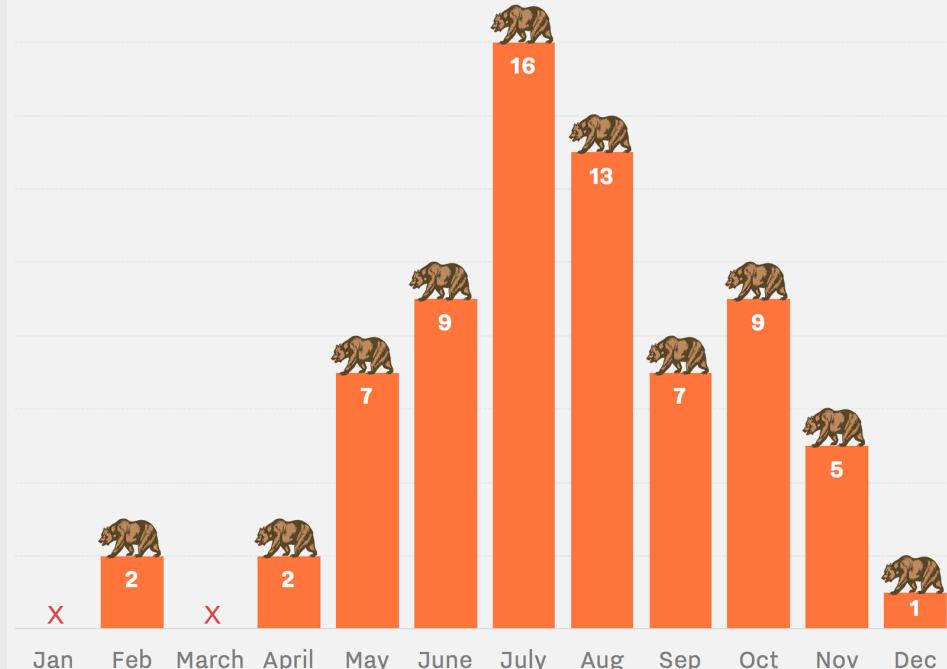


Source: News archives, Wikipedia

Vox

## Most fatal bear attacks occur in July and August

Total fatal bear attacks (grizzly, black, and polar), 1900 to present



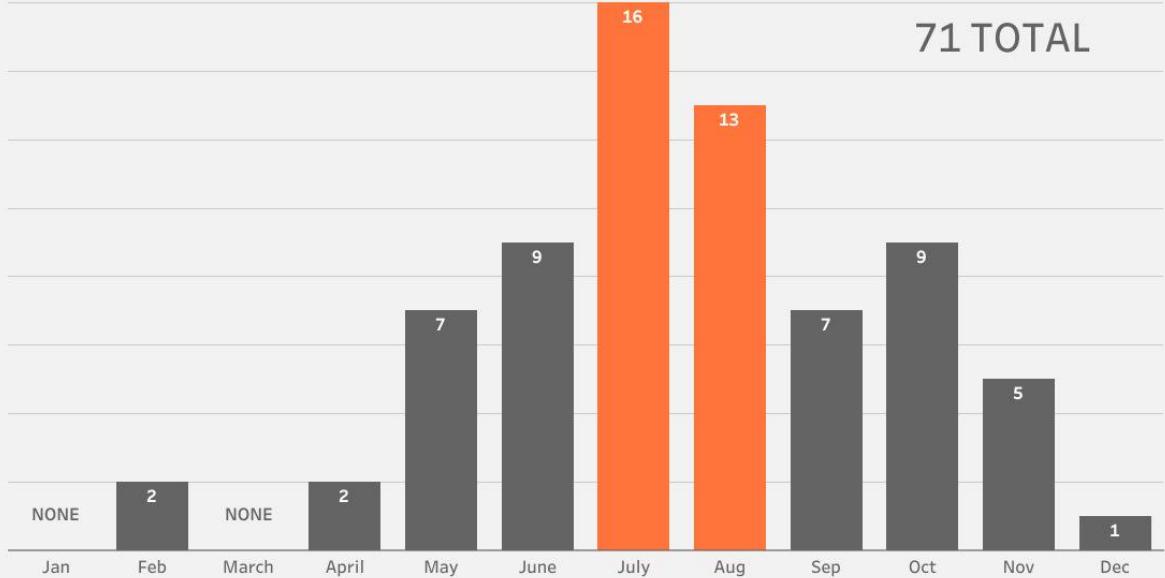
Source: News archives, Wikipedia

Vox

## BEAR ATTACKS IN U.S. PARKS & WILDERNESS AREAS

Most fatal bear attacks occur in July and August

Total fatal bear attacks by grizzly, black and polar bears from 1900 to present



Source: News archives, Wikipedia (as of 10/2016)

Created by Jeffrey A. Shaffer | MakeoverMonday 2019WK21



Hillary Clinton

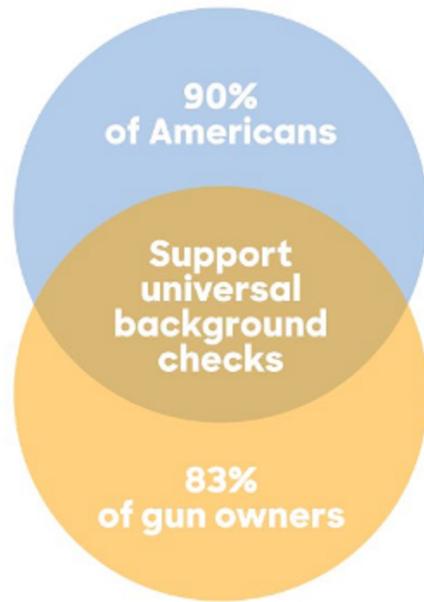
Follow

Dear Congress,

Let's get this done.

Thanks,

The vast majority of Americans



RETWEETS  
2,308

LIKES  
5,333





Hillary Clinton

@HillaryClinton

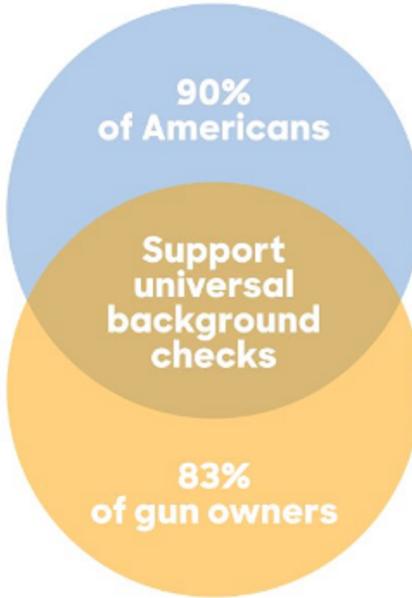
Follow

Dear Congress,

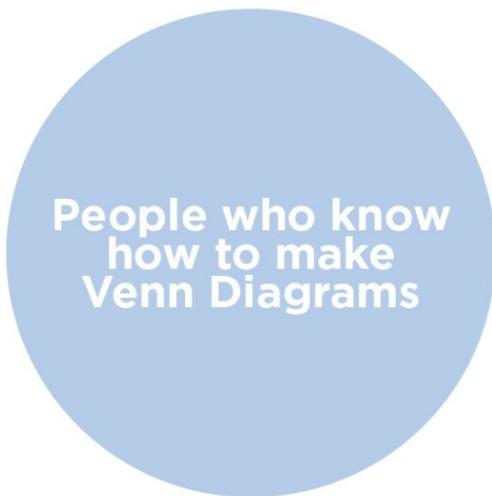
Let's get this done.

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RETWEETS 2,308 LIKES 5,333



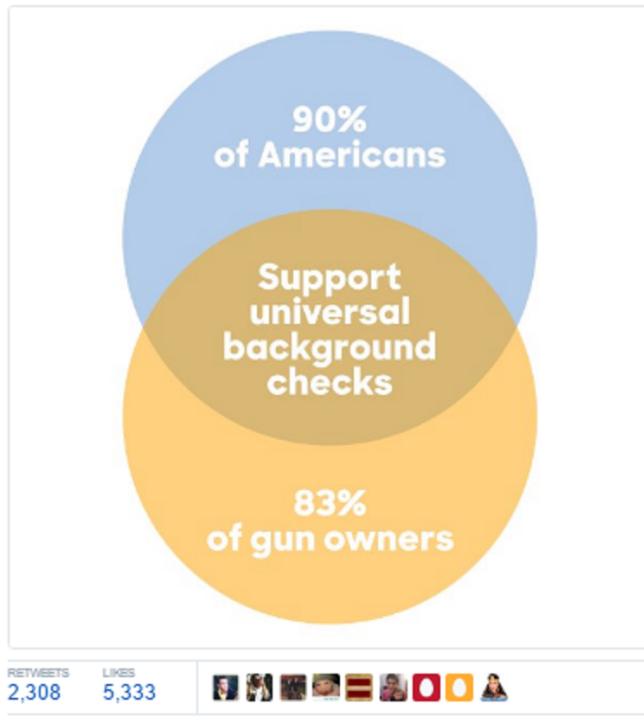


Dear Congress,

Let's get this done.

Thanks,

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Follow

People who know  
how to make  
Venn Diagrams

Hillary's graphic  
design staff

**The vast majority of Americans support universal background checks, including gun owners**

