ISA 401: Business Intelligence & Data Visualization

17: Charts Used for Comparisons, Relationships, Distributions and Correlations

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Automated Scheduler for Office Hours

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Learning Objectives for Today's Class

- Identify strengths & weaknesses of basic charts
- Use appropriate charts based on objective
- Avoid using pie charts (never use pie charts)
- Avoid 3D graphs (unless VR changes their utility)

A Catalog of Commonly Used Graph Types

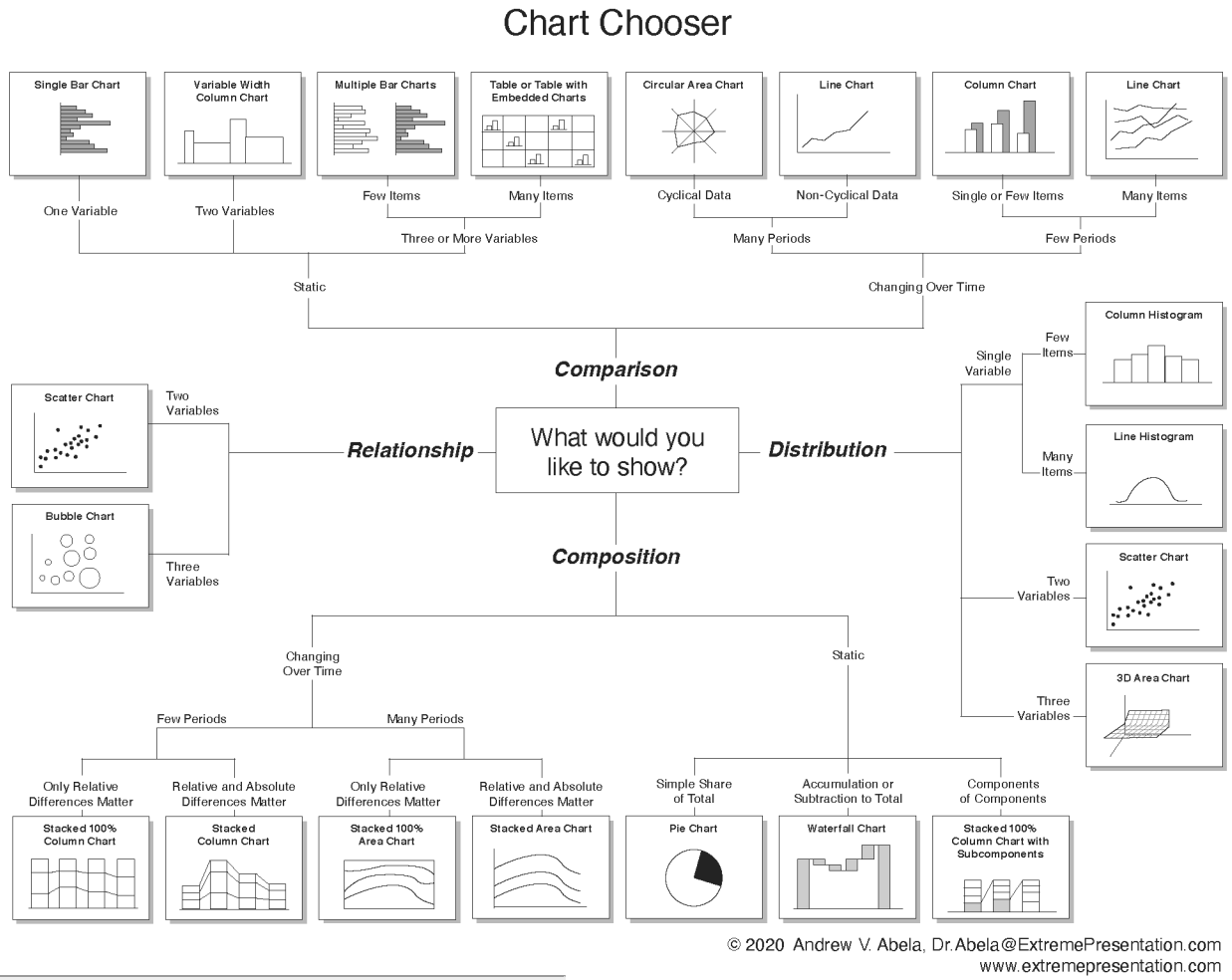
PolicyViz Data Visualization Catalog

Graph Type | Organization | Author

Graph Type	Description /Notes	Organization	Author	Small Multiples	Year	URL	Image

Looker Studio

Chart Suggestions



Source: Chart Chooser, created by Andrew Abela in 2006 and last updated on Sept 06, 2020.

Charts Used for Comparing Data

(Unit of Analysis is Based on a Nominal Categorical Variable)

A Literal Bar Chart

04:00

Activity | Your Solution

Answer the following questions:

(1) How many variables do we have in this graph?

(2) How many observations?

(3) Please discuss the type of variables in the graph? (i.e. nominal, ordinal, etc.)

(4) How is the data encoded in the graph?

(5) Any other comments/observations?

Source: The image is from How Much Does Beer Consumption Vary by Country?, and the data seems to be based on a 2004 report from the Kirin Holdings Company.

A Literal Bar Chart

04:00

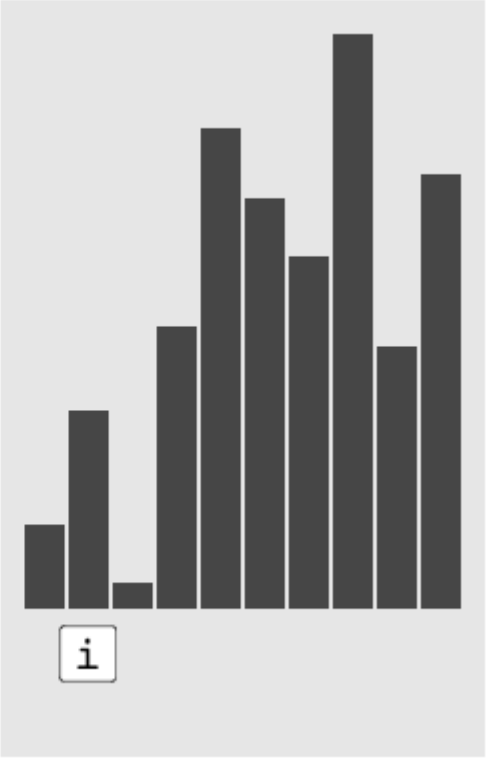
Activity | Your Solution

- Q1: __
- Q2: __
- Q3: __
- Q4: __
- Q5: __

Source: The image is from How Much Does Beer Consumption Vary by Country?, and the data seems to be based on a 2004 report from the Kirin Holdings Company.

Using a Bar Chart to Visualize R Code

```
insert_sort <- function(x) {
  i <- 2
  while(i <= length(x)) {
    j <- i
    while(j > 1 && x[j - 1] > x[j]) {
      j <- j - 1
      x[j + 0:1] <- x[j + 1:0]
    }
    i <- i + 1
  }
  x
}
```



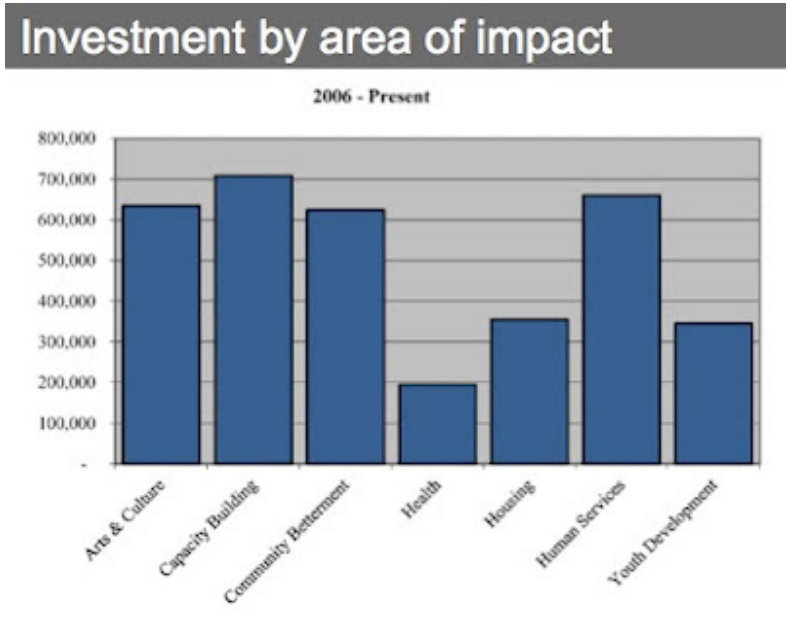
Source: See the amazing watcher package, which allows you to record the state of R function during evaluation. For more details, please click on the link.

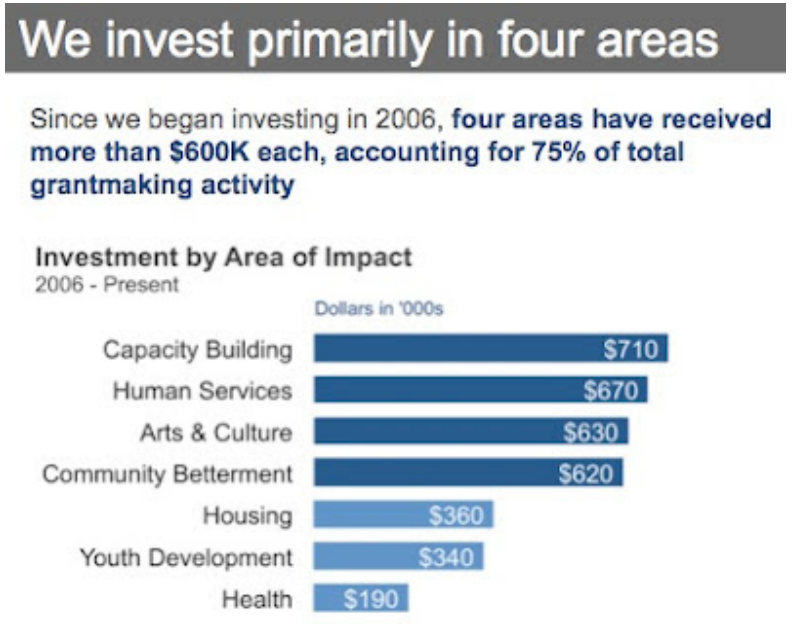
Non-graded activity: Two Bar Charts

04:00

Activity | Your Solution

> *Over the next five minutes, identify **3-4 differences that make the graph on the right better**, and suggest **how you can further improve the graph on the right***





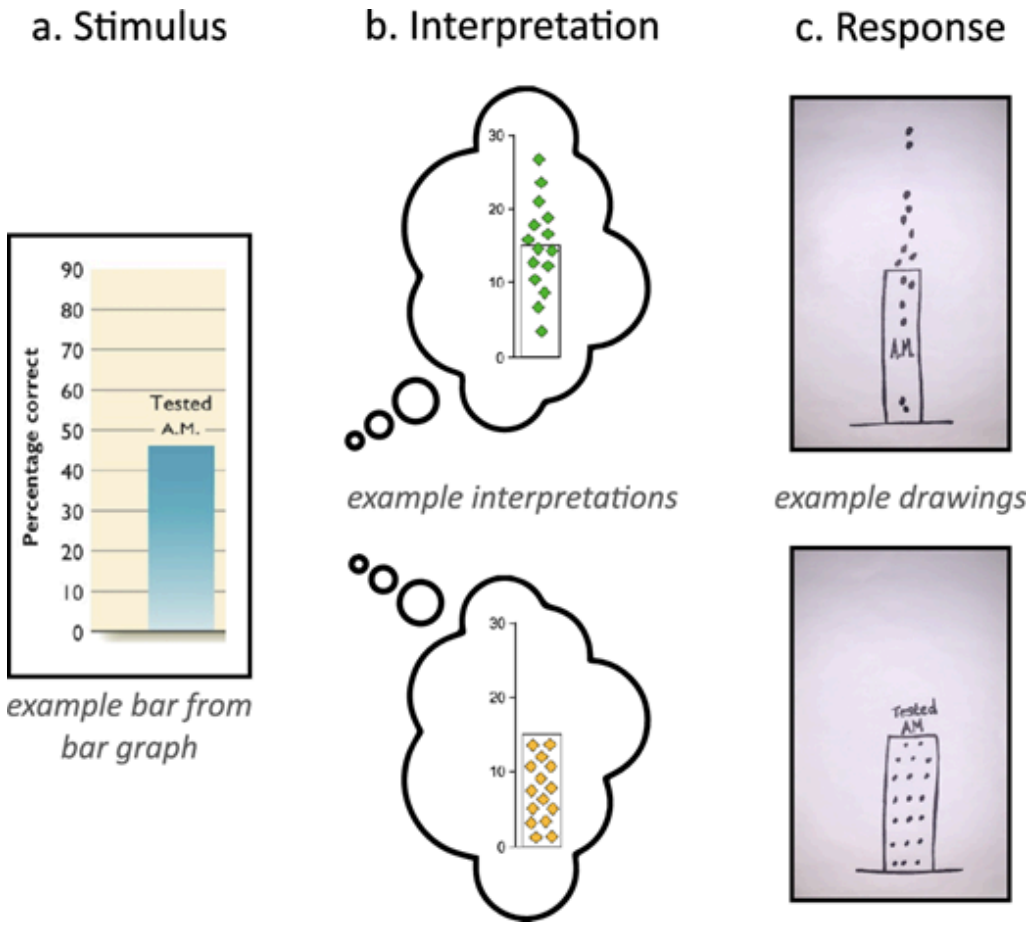
Non-graded activity: Two Bar Charts

04:00

Activity | Your Solution

Insert your differences and suggestions for improvement below.

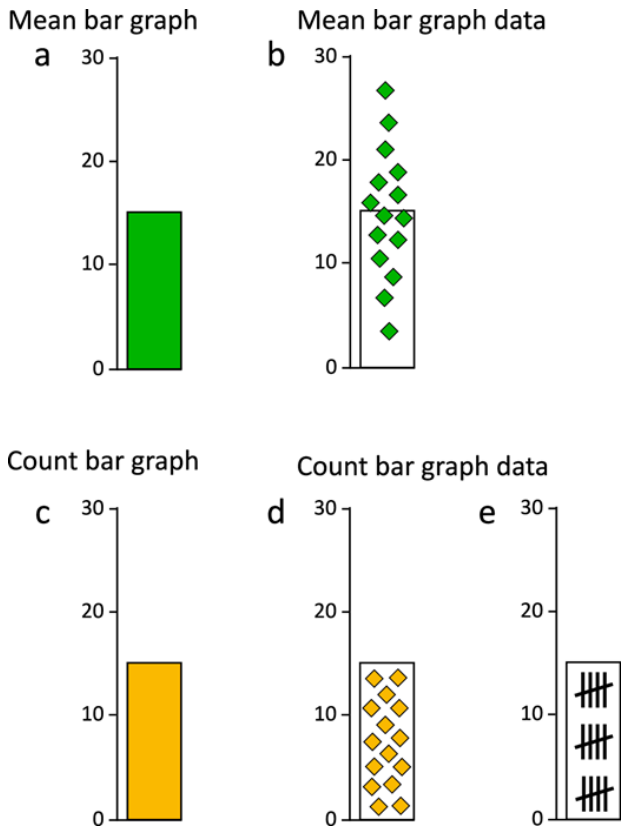
Issues with the Interpretation of Bar Charts



The Draw Datapoints on Graph (DDoG) measure maintains the graph as a consistent reference frame across its three stages.

Source: Kerns and Wilmer (2021). *Journal of Vision*. DOI: https://doi.org/10.1167/jov.21.12.17

Issues with the Interpretation of Bar Charts



Data distribution differs categorically between mean and count graphs. (a) Mean bar graphs and (c) count bar graphs do not differ in basic appearance, but they do depict categorically different data distributions.

Source: Kerns and Wilmer (2021). *Journal of Vision*. DOI: https://doi.org/10.1167/jov.21.12.17

Key Takeaway 1

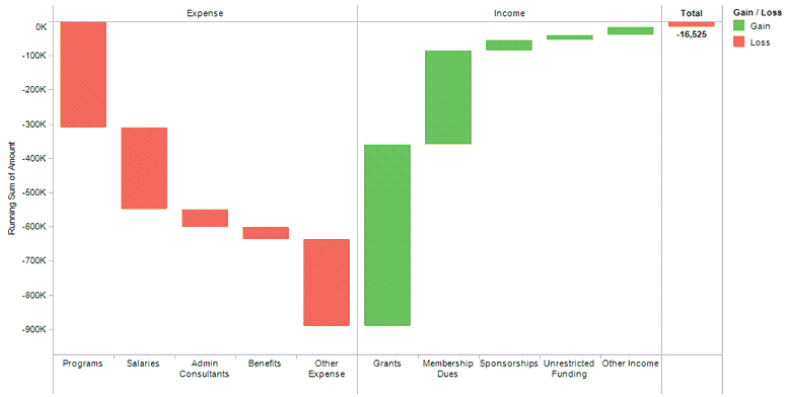
> The typically used **bar** chart should not be to depict means of categorical variables.

Waterfall Charts

04:00

Activity | Your Solution

> *What are the advantages and disadvantages of these two charts? They are using the same exact data. Please try to list 2-4 in each category for each chart.*



Waterfall Charts

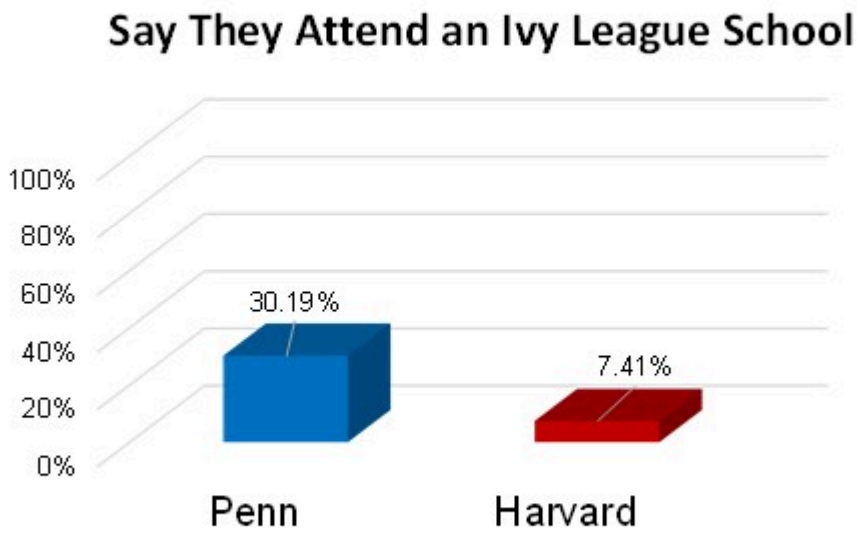
04:00

Activity | Your Solution

Insert your advantages and disadvantages below

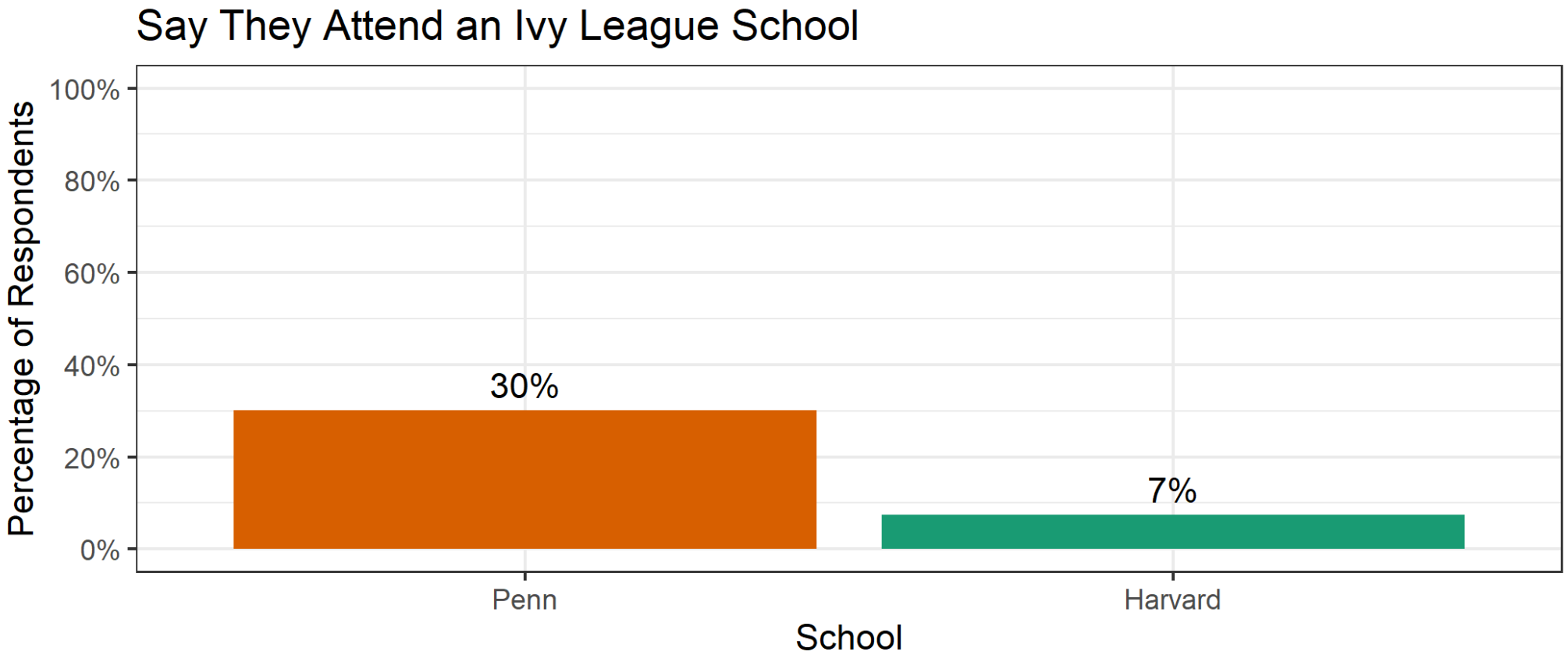
3D Bar Charts are Awful

3D Charts are Awful



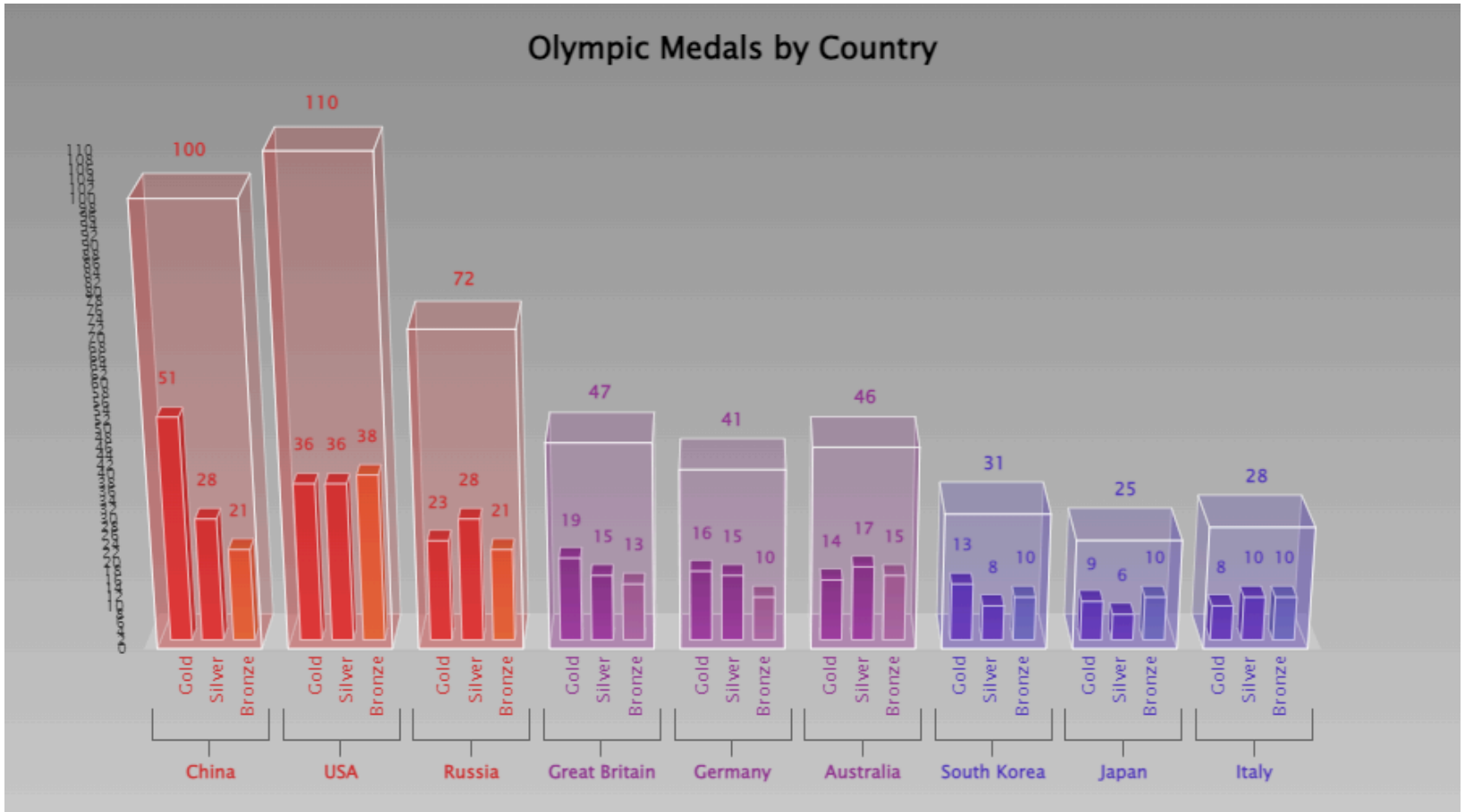
Adam Grant's Plot of the Penn and Harvard Bar Chart

3D Bar Charts are Awful



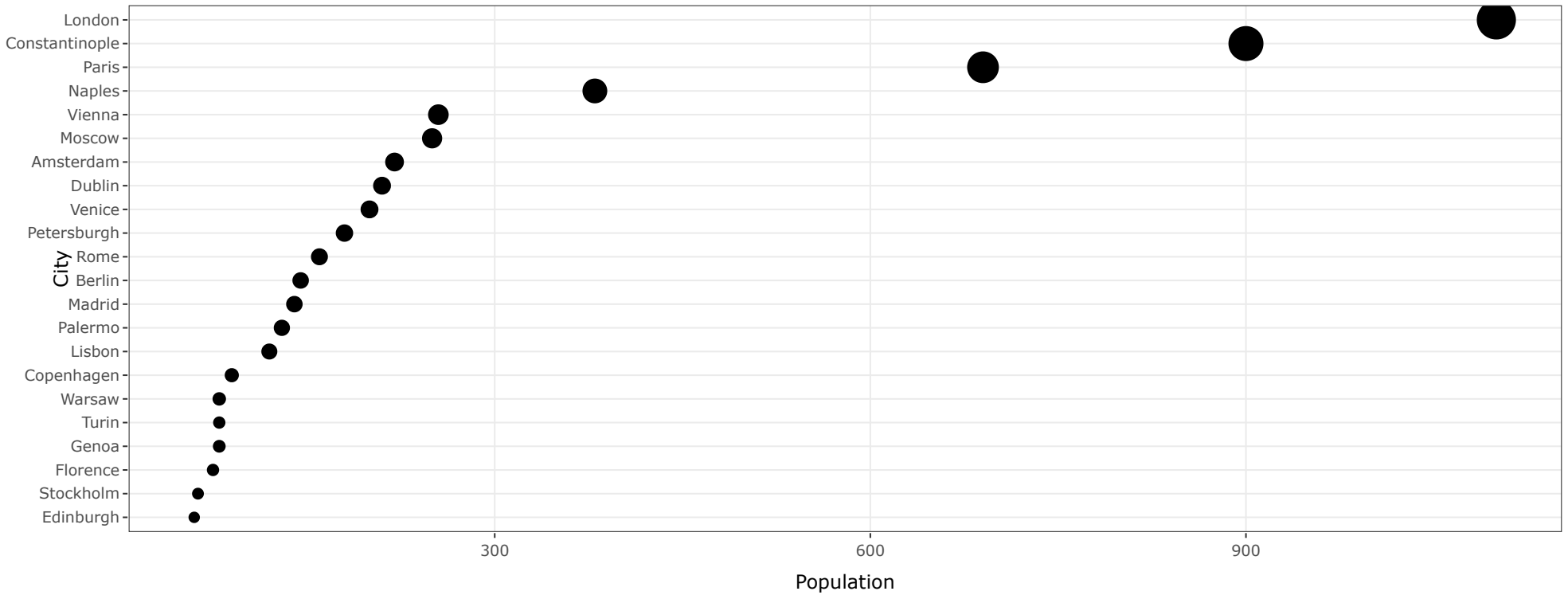
A remake of the plot with colorblind-friendly colors and a 2D bar representation to avoid distorting the data

3D Charts are Awful: Even This



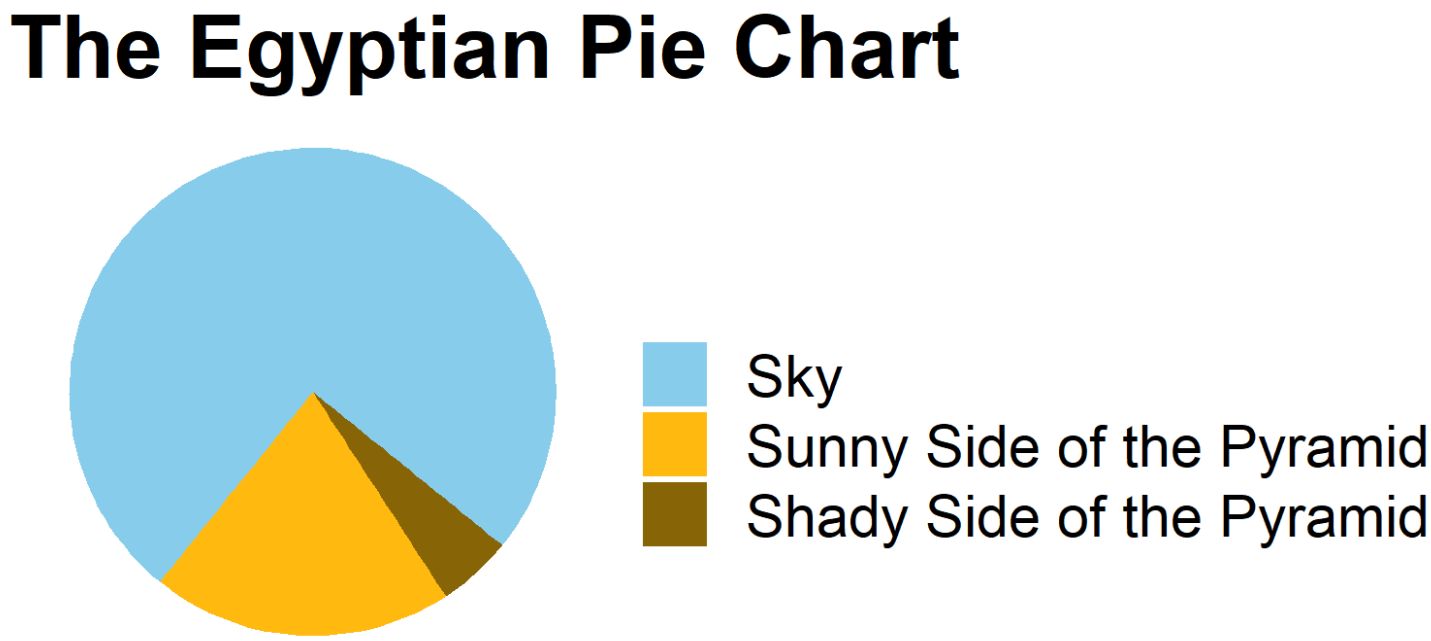
Source: See the interactive version of the chart by clicking here

Dot Charts: Recall the Playfair Example



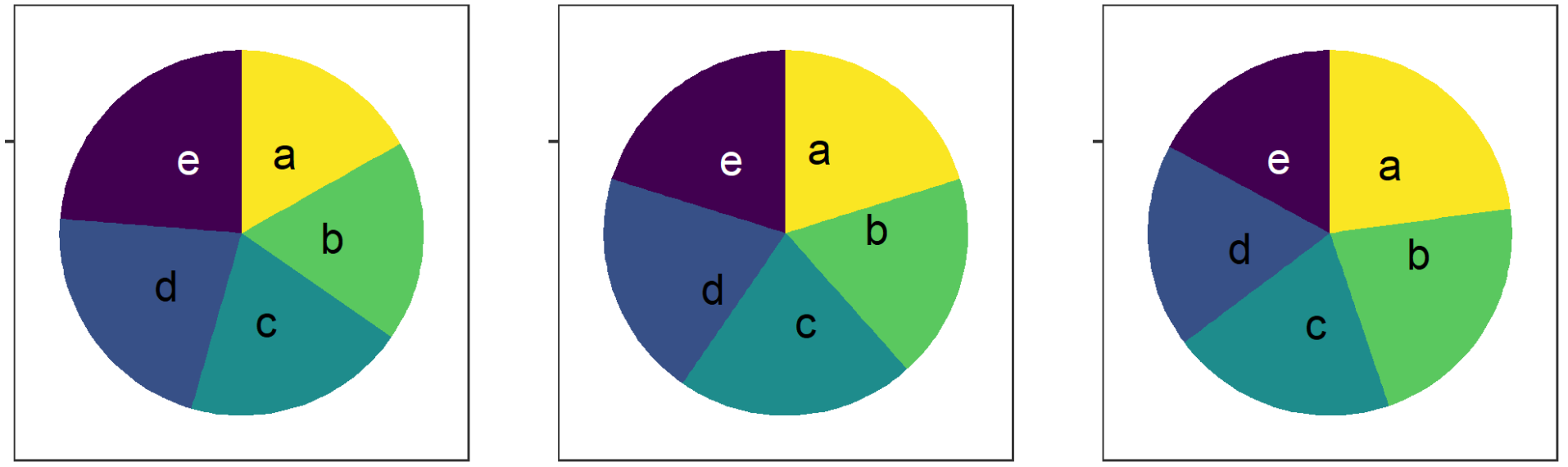
Proportions

My Favorite Pie Chart



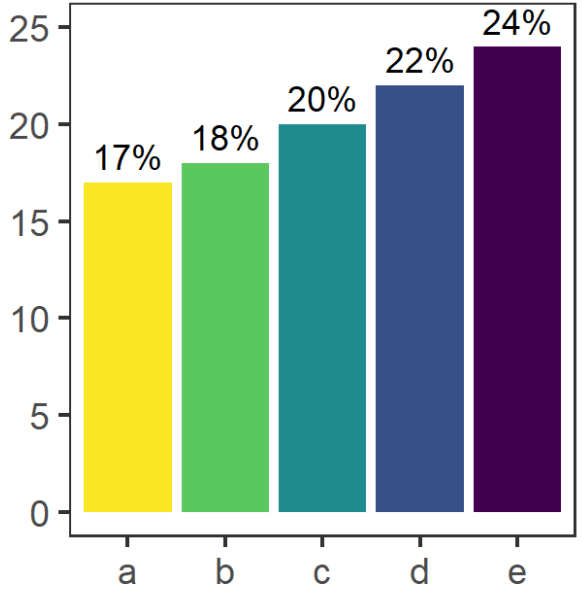
Note: Humor aside, pie charts are almost always awful!!

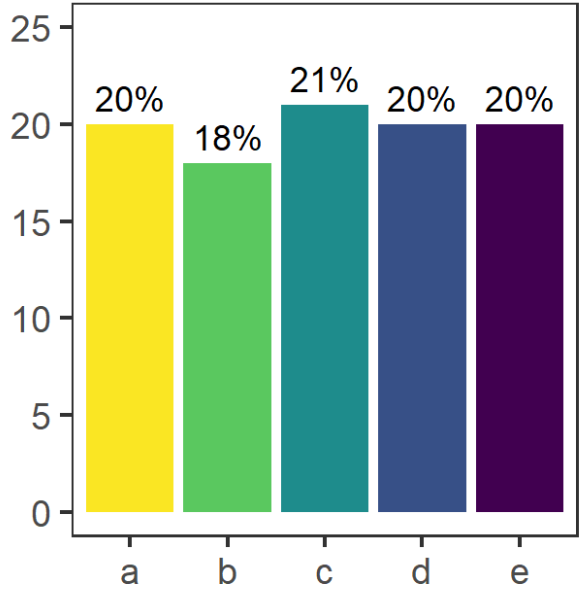
Pie Charts are Awful By Design

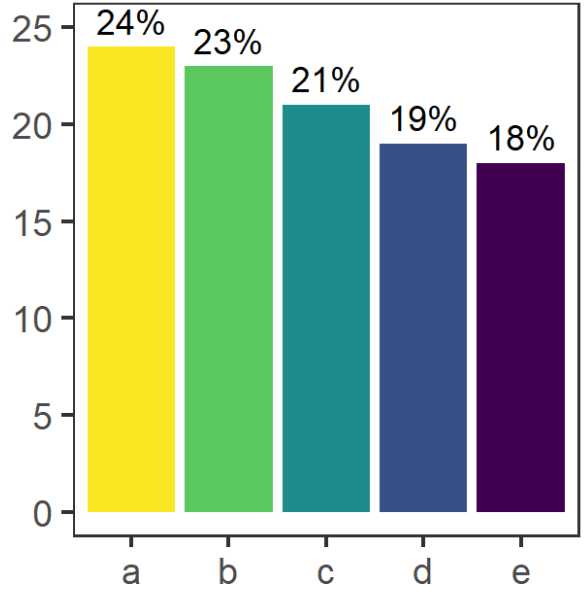


Source: The pie charts generated in this slide are based on the R code provided in From-Data-to-Viz: The Issue with Pie Chart.

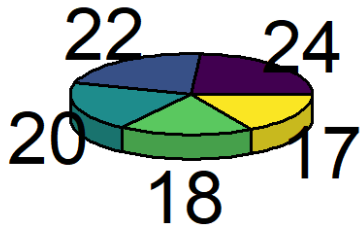
Pie Charts are Awful By Design



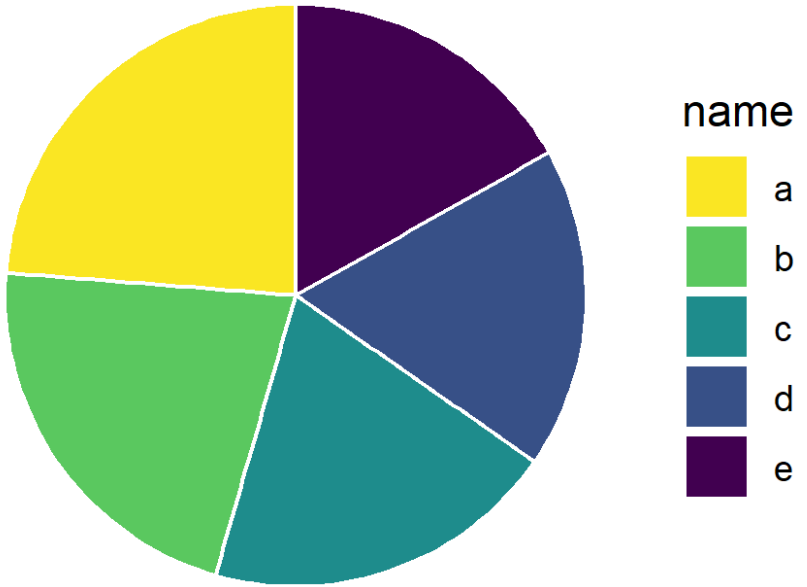




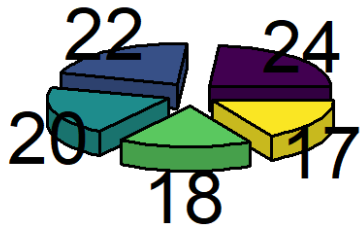
And often made even worse: 3D



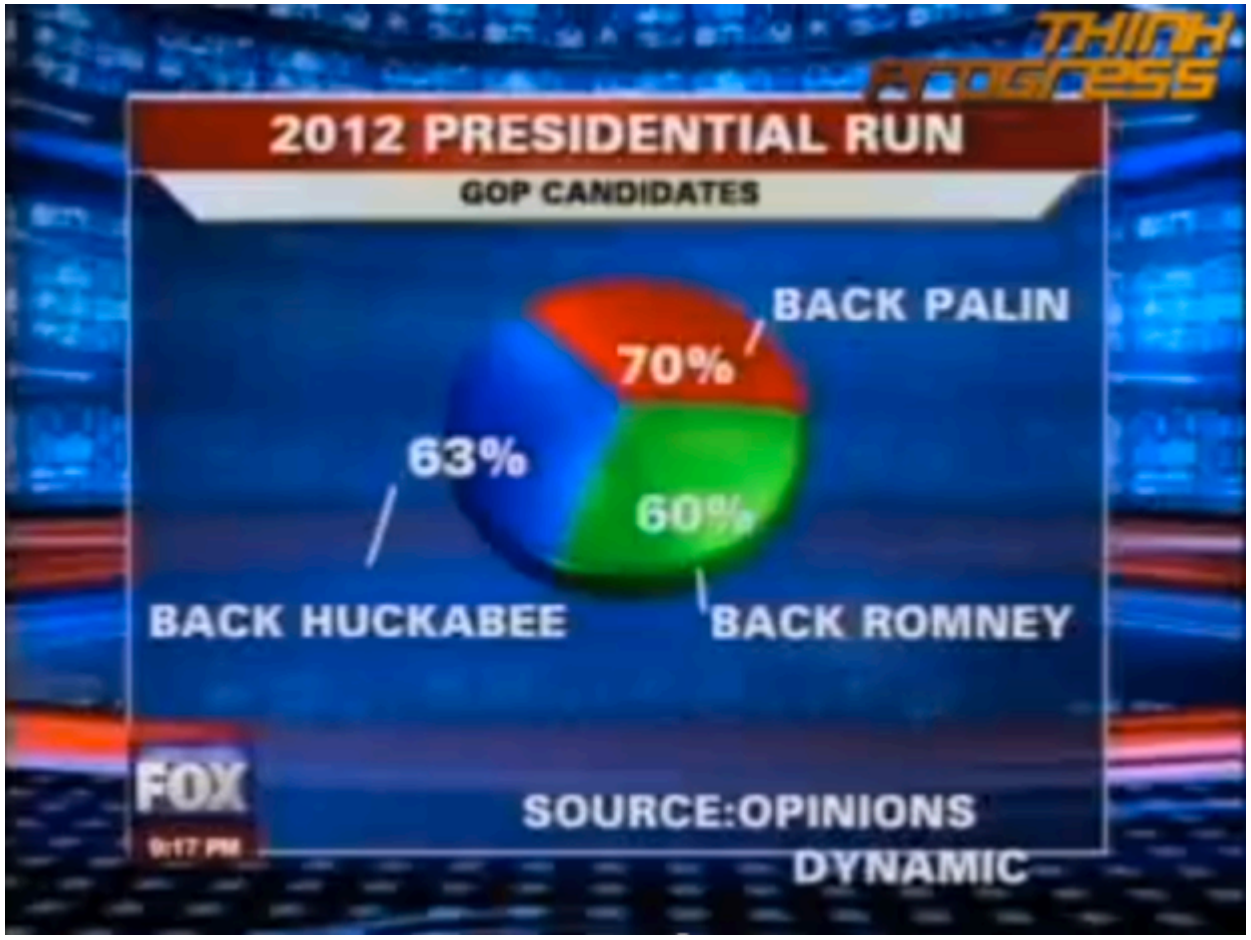
And often made even worse: Side Legend



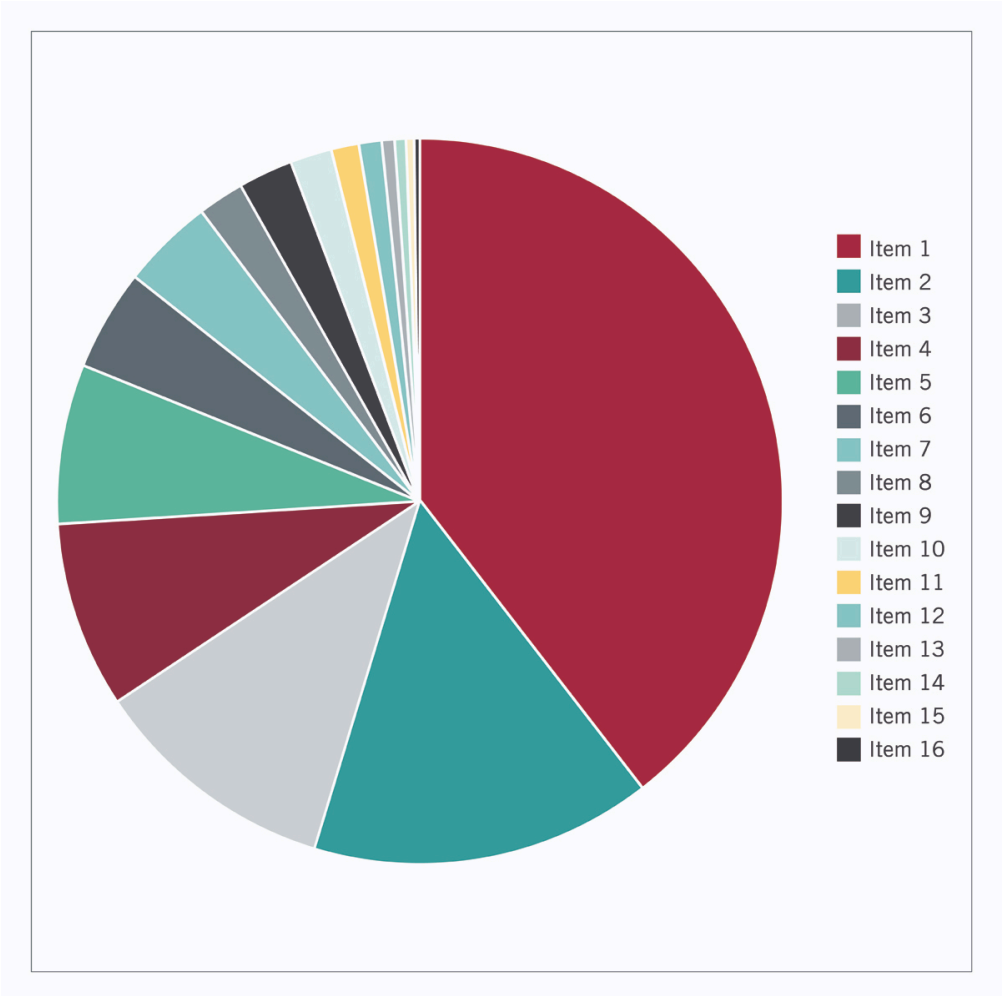
And often made even worse: Exploded Pie



And often made even worse: SUM(%) != 100%



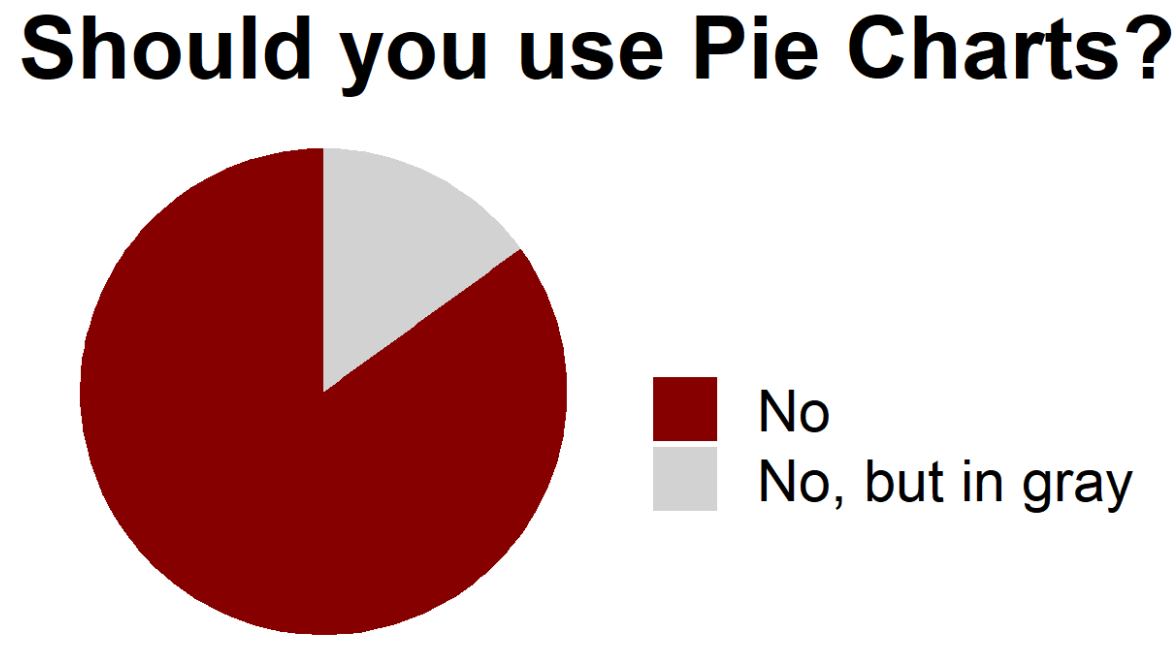
And often made even worse: Many Levels



Key Takeaway 2

> Please do **NOT** use pie charts.

- If you need any further evidence, please check *?pie()* in R. Even statistical software are recommending against using pie charts!!

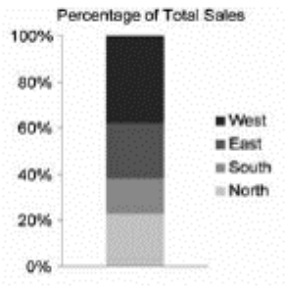


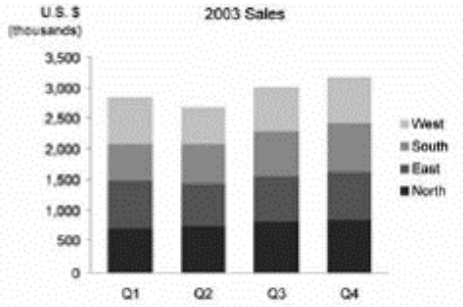
Stacked Bar Charts

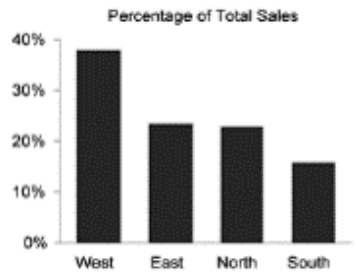
04:00

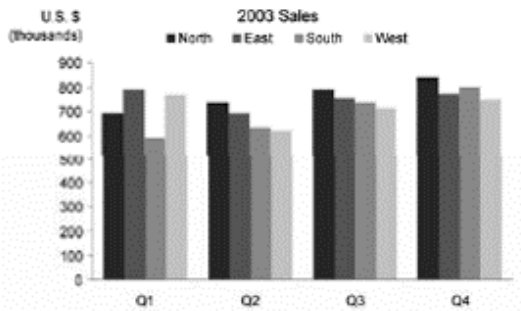
Activity | Your Solution

> *When it is best to use the four charts below? They are using the same exact data.*









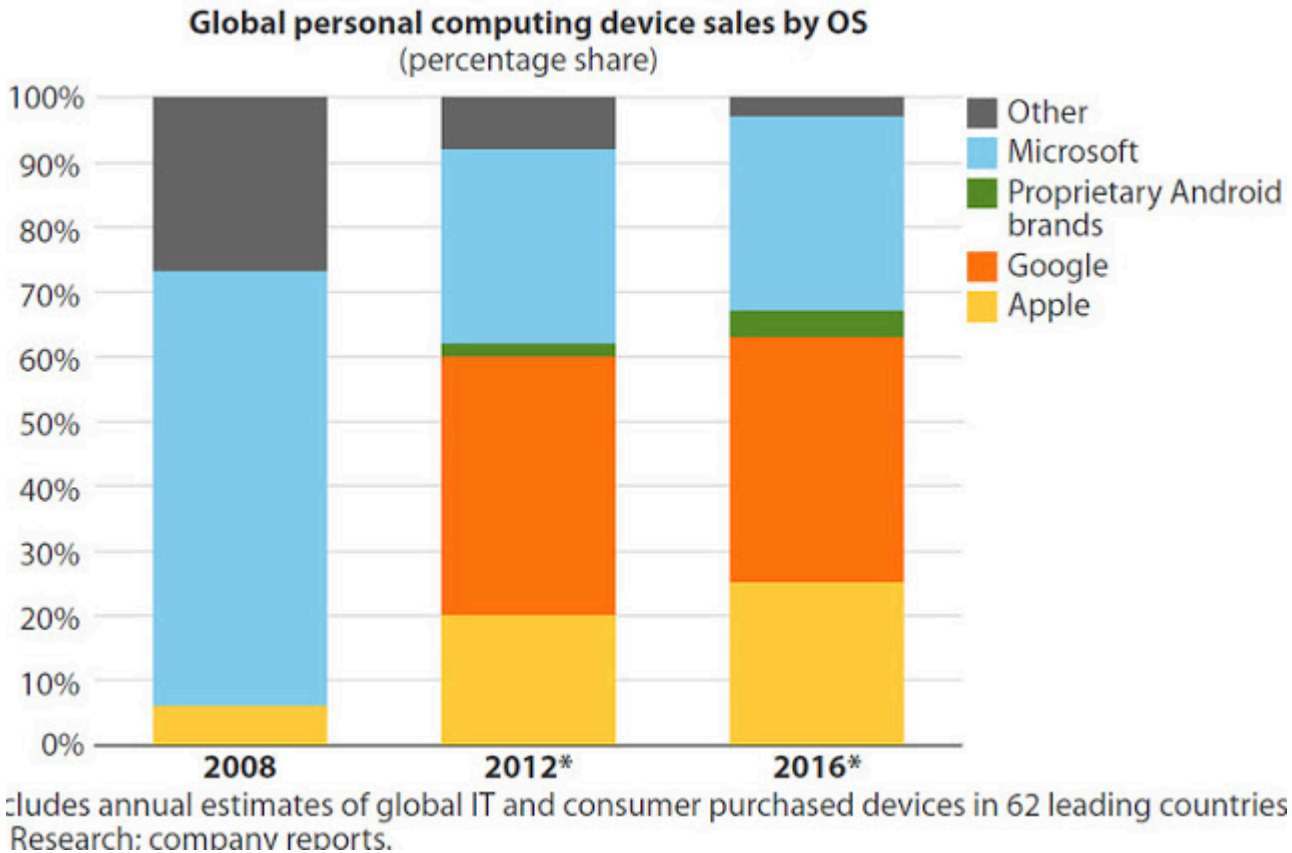
Stacked Bar Charts

04:00

Activity | Your Solution

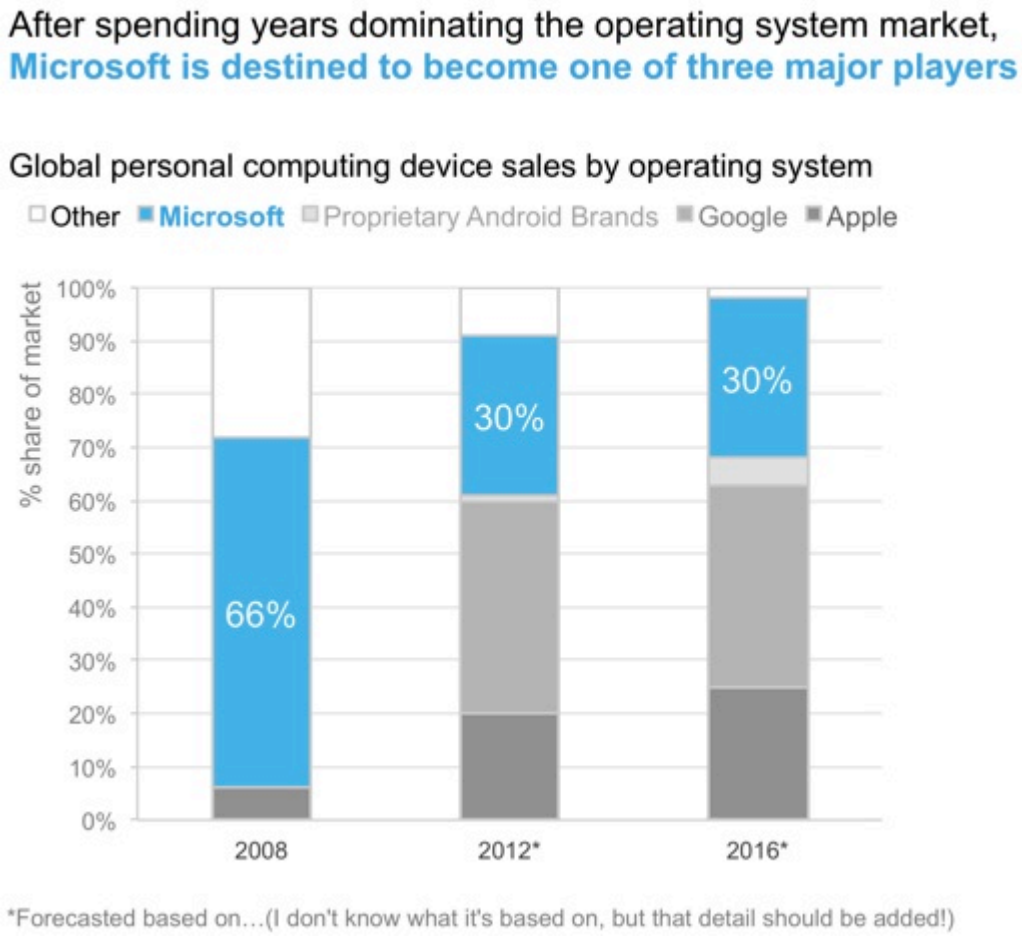
Insert best usage scenario for each chart below

A Note on Stacked Bar Charts



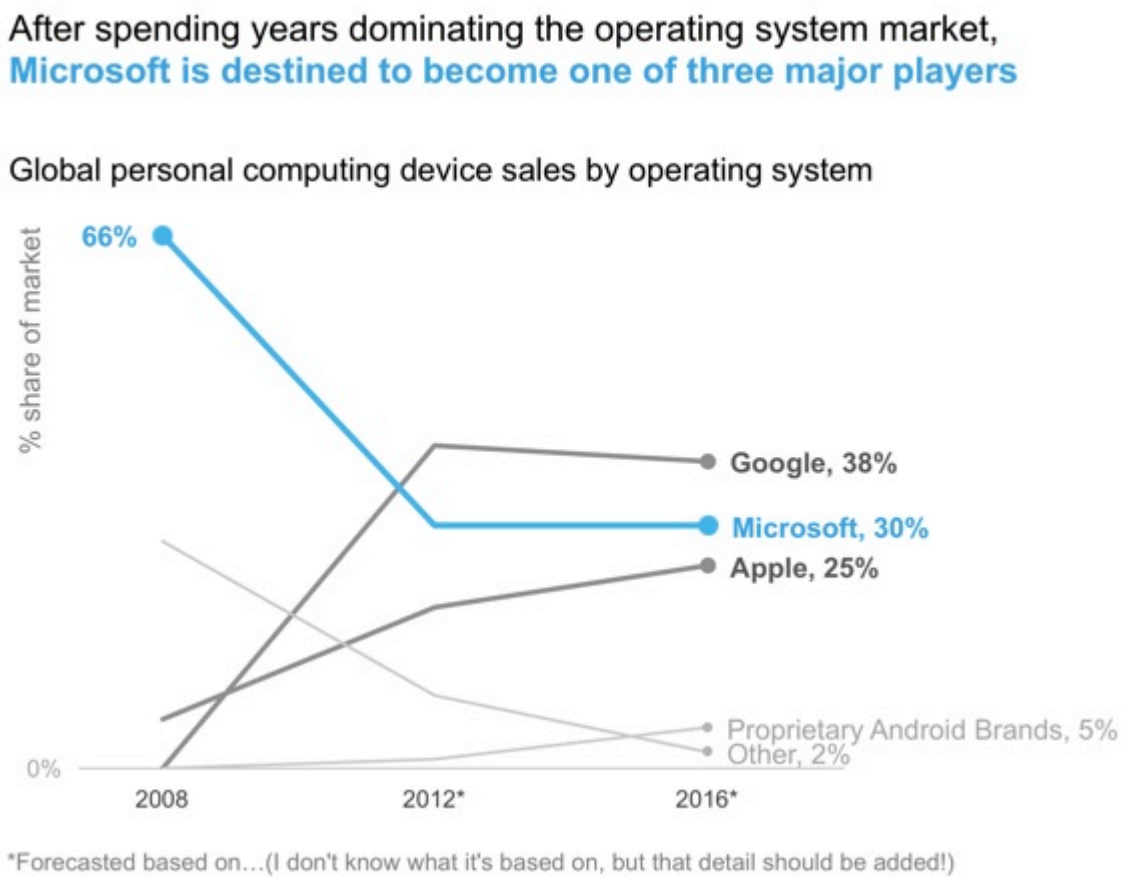
Source: Storytelling with Data: To Stack or Not to Stack

A Note on Stacked Bar Charts



Source: Storytelling with Data: To Stack or Not to Stack

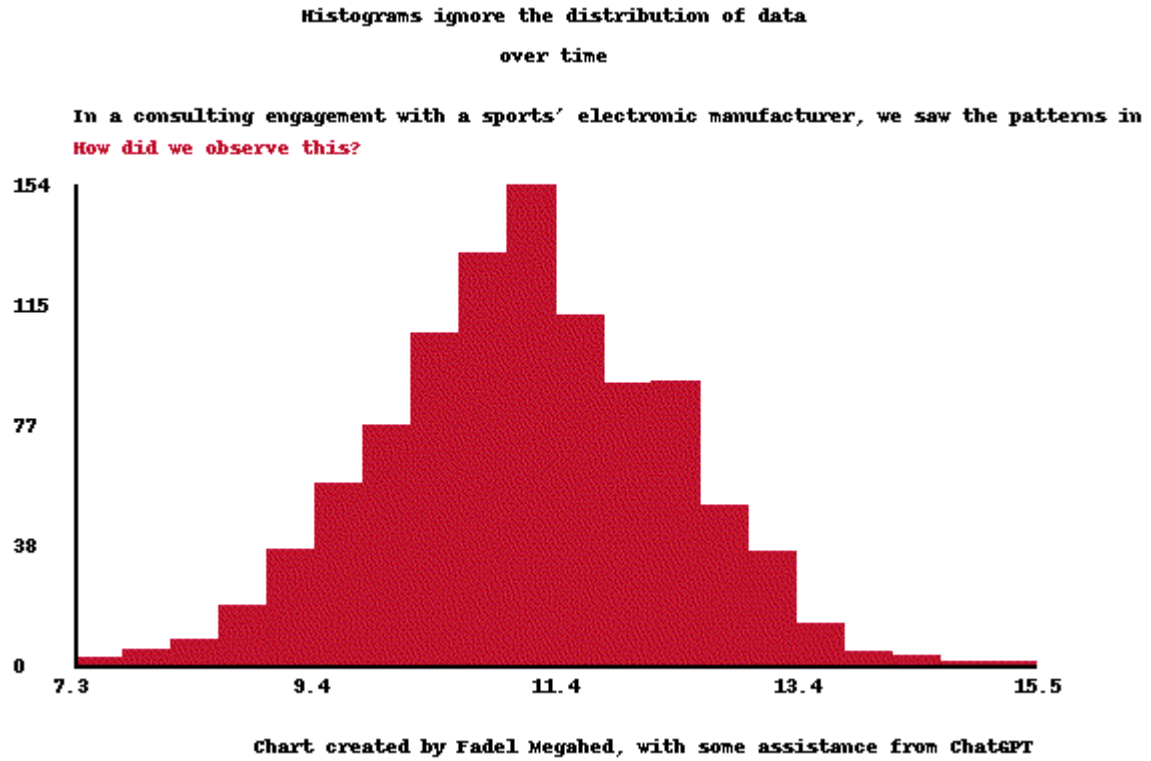
A Note on Stacked Bar Charts



Source: Storytelling with Data: To Stack or Not to Stack

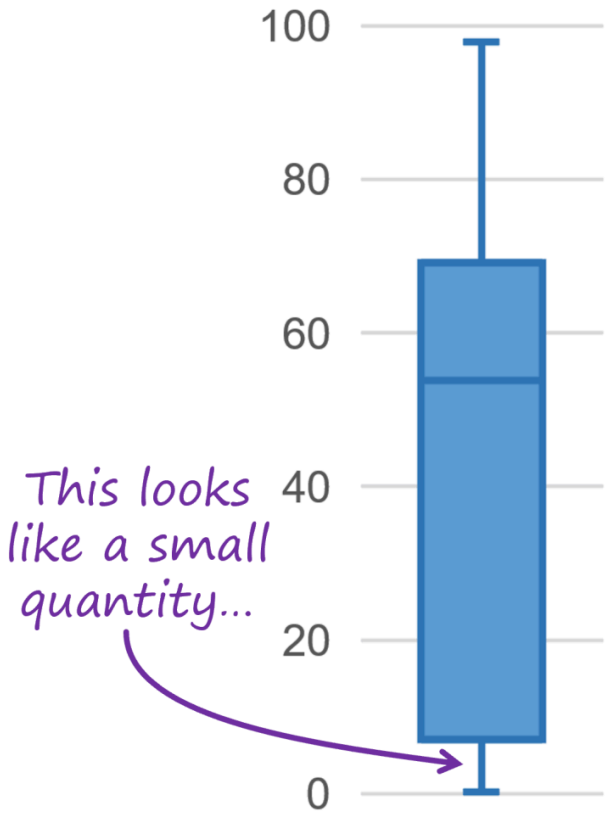
Distributions and Correlations

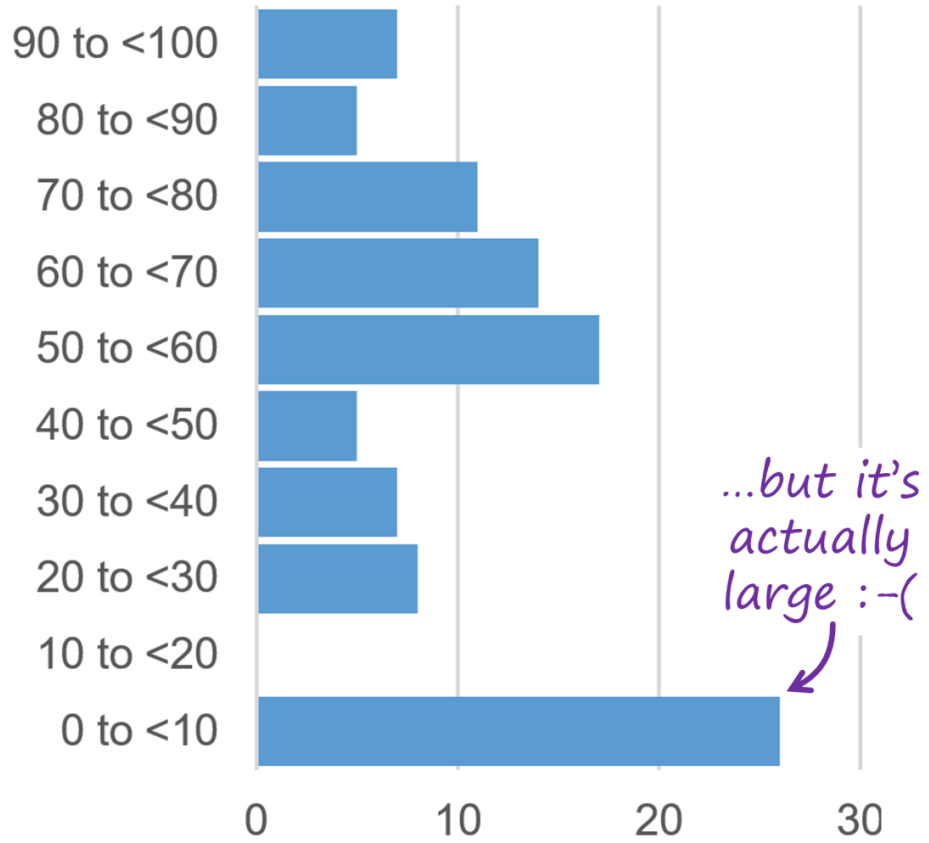
Issues with Histograms



Source: In a quality improvement project with a major manufacturer of electronic devices, we discovered an issue in the customer's seemingly 'normal' data.

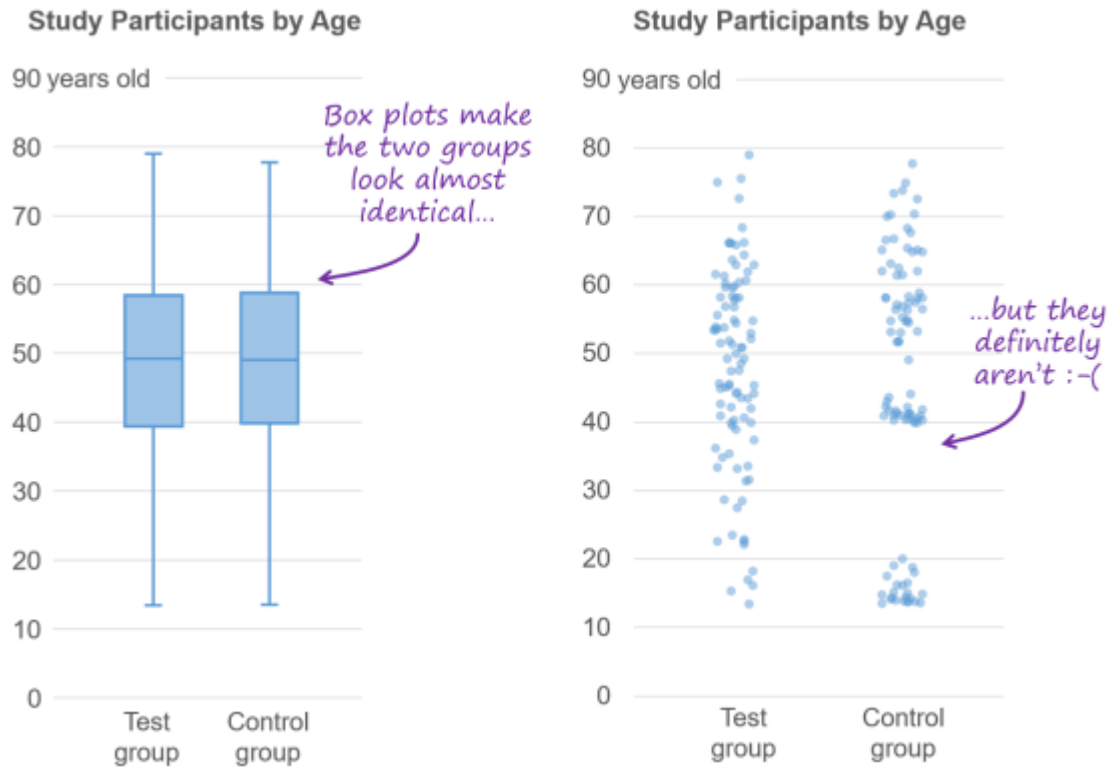
Issues with Box Plots





Source: Nick Desbarats (2021) I've Stopped Using Box Plots. Should You?

Issues with Box Plots

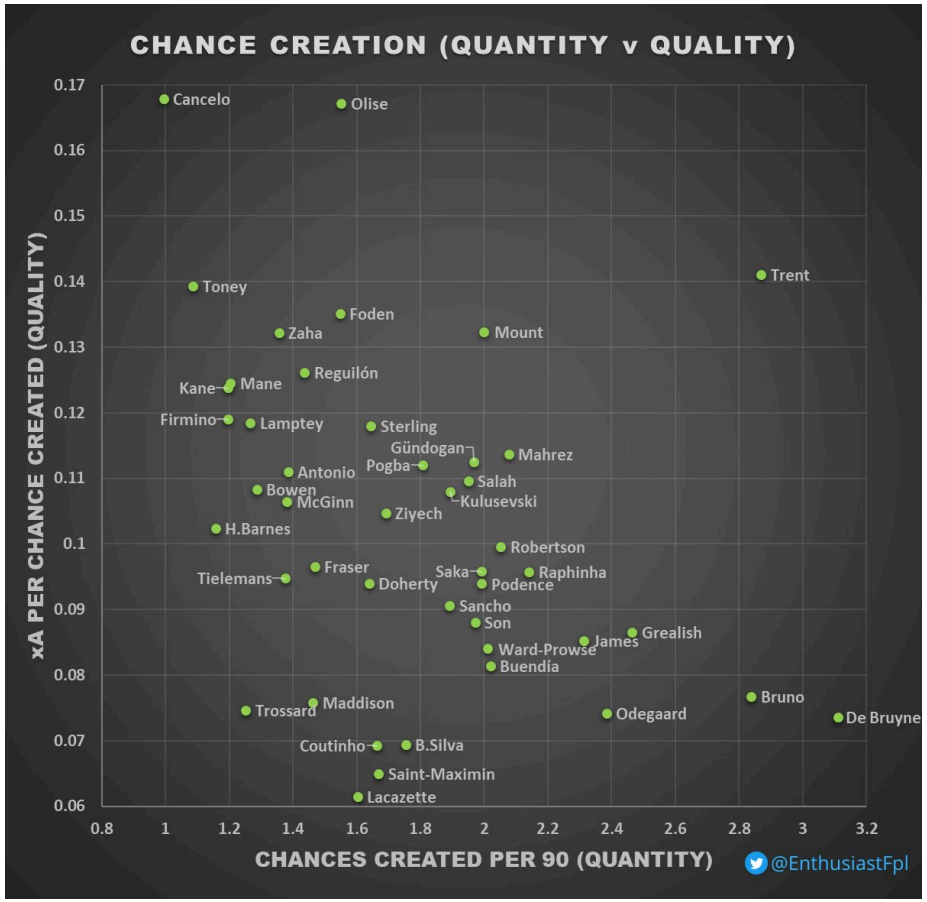


Source: Nick Desbarats (2021) I've Stopped Using Box Plots. Should You?

Key Takeaway 3

> To capture the variability in a dataset, the use of box plots **may not be** appropriate!!!!

Scatter Plots



Source: Chart created by @EnthusiastFpl and shared on on March 25, 2022.

Recap

Summary of Main Points

- Identify strengths & weaknesses of basic charts
- Use appropriate charts based on objective
- Avoid using pie charts (never use pie charts)
- Avoid 3D graphs (unless VR changes their utility)