

# Business Analytics and Data Driven Decision Making

## Introduction to Dashboard Design

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# AGENDA

# Agenda

- Why do we need Dashboards
- Define Dashboards
- Dashboard design principles
- Visuals and Graph Types

# Visual Analytics Literature

- Literature
  - Ware, C. (2019). *Information visualization: perception for design*. Morgan Kaufmann. (CH 1)
  - Knaflic, C. N. (2015). *Storytelling with data: A data visualization guide for business professionals*. John Wiley & Sons.
  - Few, S. (2006). *Information dashboard design: The effective visual communication of data*. O'Reilly Media, Inc..
  - Wexler, Steve, Jeffrey Shaffer, and Andy Cotgreave. *The big book of dashboards: visualizing your data using real-world business scenarios*. John Wiley & Sons, 2017.

# THE ORGANIZATIONAL CHALLENGE

- Decision makers dilemma
  - Too much data
  - Too little information
  - Delivered too late
- Data presented ineffectively



# Why Dashboard

- Dashboards and visualizations are cognitive tools that improve your “span of control” over a lot of business data
  - Dashboard Transform Data Repositories into consumeable information
  - Visual identification of Trends and Patterns
  - Trigger discussions to evaluate problem and solutions
  - Detect anomalies
  - Help better and timely decision making

# Define Dashboard

*“A dashboard is a **visual display** of the most important information needed to achieve one or more objectives; consolidated and arranged on a **single screen** so the information can be monitored at a **glance**.” (Few, 2004)*

*“**an easy to read**, **often single page**, **real-time userinterface**, showing a graphical presentation of the **current status (snapshot)** and **historical trends** of an organizations key performance indicators (KPIs) to enable **instantaneous and informed decisions to be made at a glance**”. (Brouns et al. 2015)*

*“an emerging performance management system, for example, to **monitor productivity**, analyze cost-effectiveness and **improve** customer satisfaction” (Park, Y., & Jo, I. H, 2015)*

# Dashboard - Automobile industry

- Old vehicle Dashboard



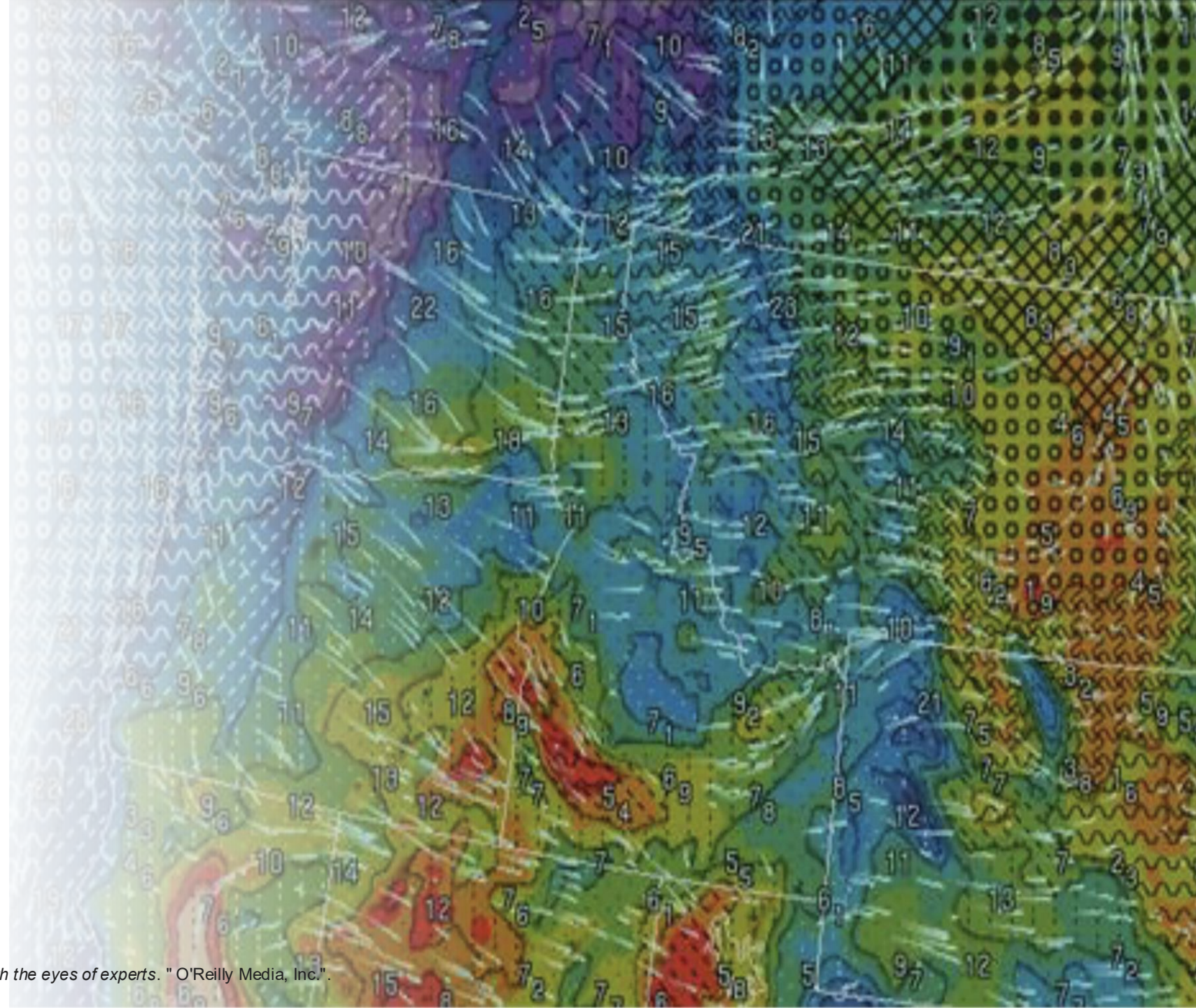
- Modern vehicle Dashboard



# Designing Dashboard

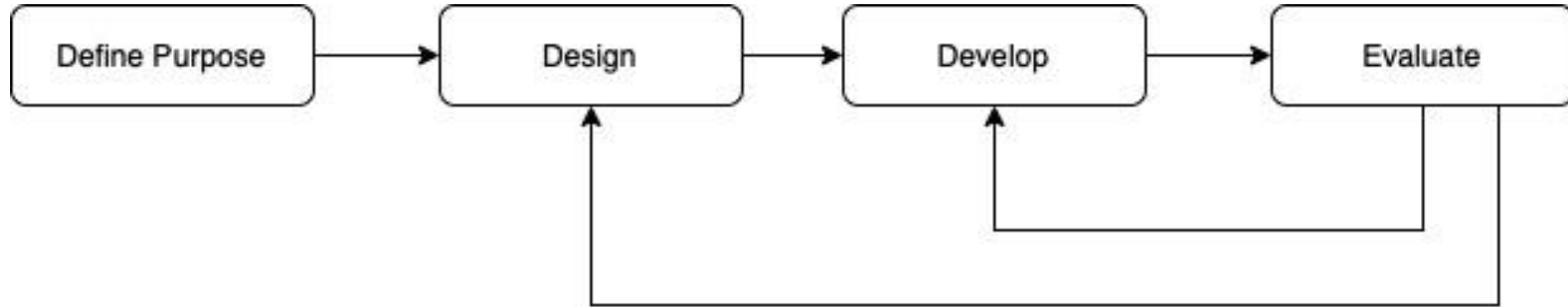
“The need to **squeeze** a great deal of **information** into **small amount of space**, resulting in a display that is easily and immediately understandable”

*(Few, 2004)*



# Dashboard Design Process

- Define Purpose
- Design
- Develop
- Evaluate



# Dashboard Design

- Audience
  - Type of Dashboard
  - Stakeholders
  - Sketch Design
    - Tools or Simple Paper/Whiteboard
  - Level of detail
  - Time frame
- Follow guidelines for Visualizations
    - Ware, C. (2019). *Information visualization: perception for design*. Morgan Kaufmann.
    - Knaflic, C. N. (2015). *Storytelling with data: A data visualization guide for business professionals*. John Wiley & Sons.
    - Few, S. (2006). *Information dashboard design: The effective visual communication of data*. O'Reilly Media, Inc..

# Dashboard Development

- Tool selection
  - Validity and adaptability in market (i.e. PowerBI, Tableau and others)
  - Organization's infrastructure
  - Availability of skillset
- Data pipeline
- IT Infrastructure

# Dashboard Evaluation

- Quick feedback is inexpensive
- Get feedback early in the process
- Heuristic and usability Testing

# Dashboard Evaluation – Nielsen's Heuristics

- Visibility of system status
- Match between system and real world
- Consistency and standards
- Error Prevention
- Recognition rather than recall
- Flexibility and efficiency
- Aesthetic and minimalist design
- Help and documentation

<https://www.usability.gov/how-to-and-tools/methods/heuristic-evaluation.html>

# LET'S TALK ABOUT GRAPHS

# Designing a good graph

*“Nobody sets out to make a bad graph. But it happens. Again and again..” (Knaflic, 2015)*



# Knaflic 6 principles for good design

- Understand the context
- **Choose an appropriate and effective visual display**
- **Eliminate clutter**
- Focus attention where you want
- Think like a designer
- Tell a story

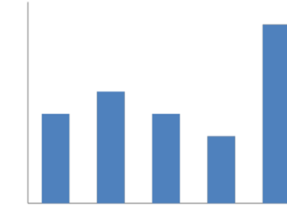
# Choose an effective visual – Types of Graphs

91%

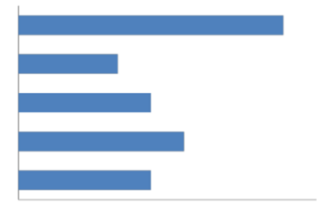
Simple text



Scatterplot



Vertical bar



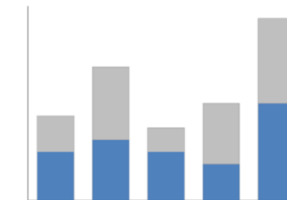
Horizontal bar

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

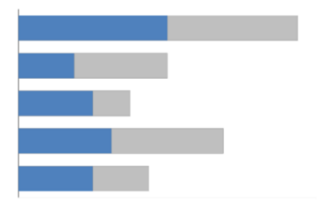
Table



Line



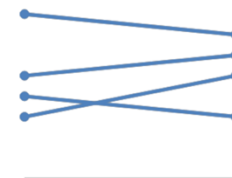
Stacked vertical bar



Stacked horizontal bar

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

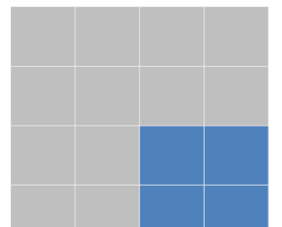
Heatmap



Slopegraph



Waterfall



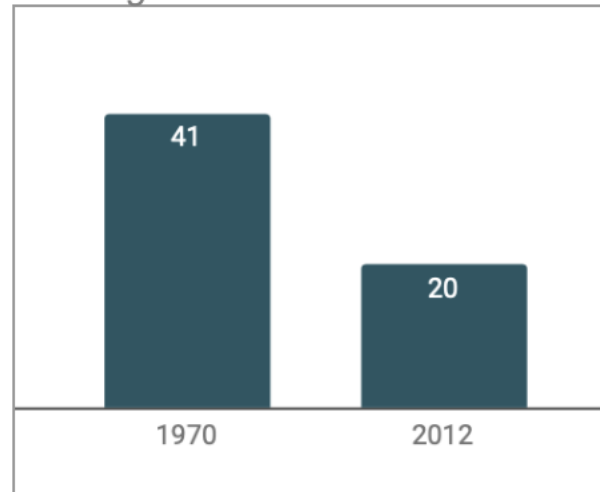
Square area

# Simple Text

- Best to share key Information consisting of couple of numbers
- Display Prominently
- Avoid ambiguity
- Support with subtext

## Children with a "Traditional" Stay-at-Home Mother

*% of children with a married stay-at-home mother with a working husband*



Note: Based on children younger than 18. Their mothers are categorized based on employment status in 1970 and 2012.

# 20%

of children had a **traditional stay-at-home mom** in 2012, compared to 41% in 1970

# Tables

- Suitable for reporting multiple units of measure
- Let the data take a center stage
- Avoid strong borders
- Only suitable for Dashboards not the live presentations

Heavy borders

Group	Metric	Metric	Metric
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Light borders

Group	Metric A	Metric B	Metric
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Minimal borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

# Heatmap

- Type of table with color aid
- Color convey relative magnitude of numbers
- It reduces mental processing to emphasize important numbers

Table

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Heatmap

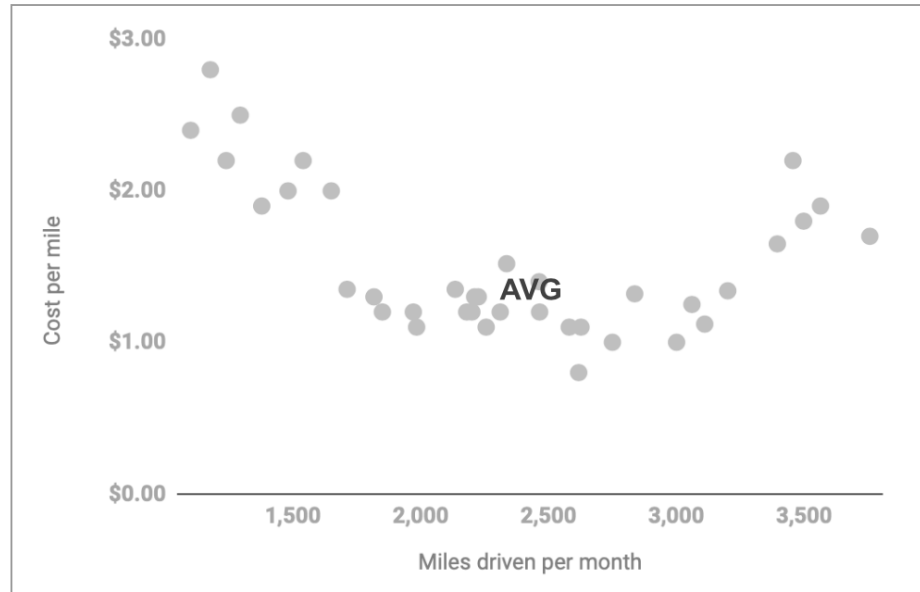
LOW-HIGH

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

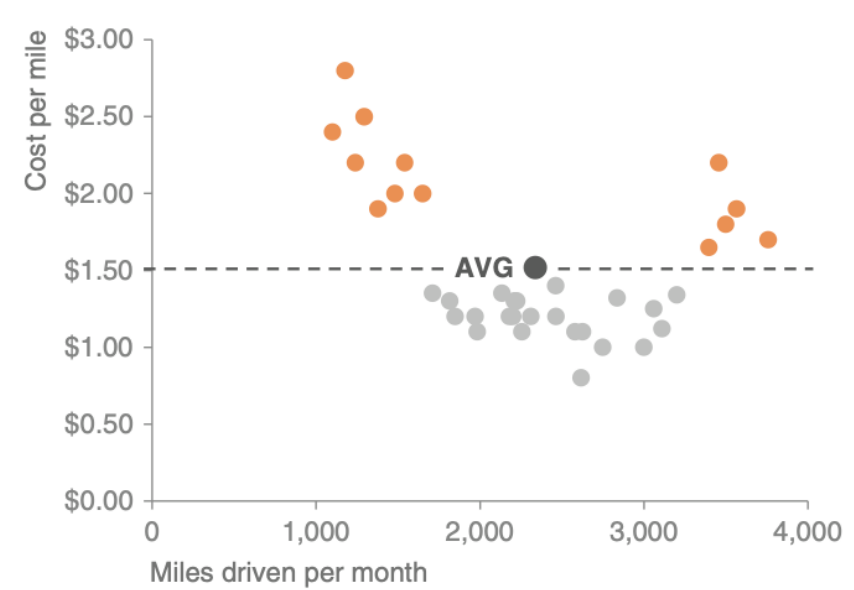
# Scatterplot

- Used to show relationship between two numbers
- Common to use for validating type of relation

Cost per mile by miles driven



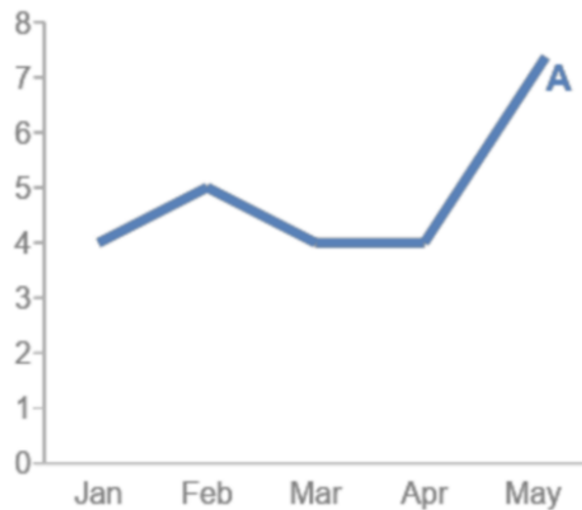
Cost per mile by miles driven



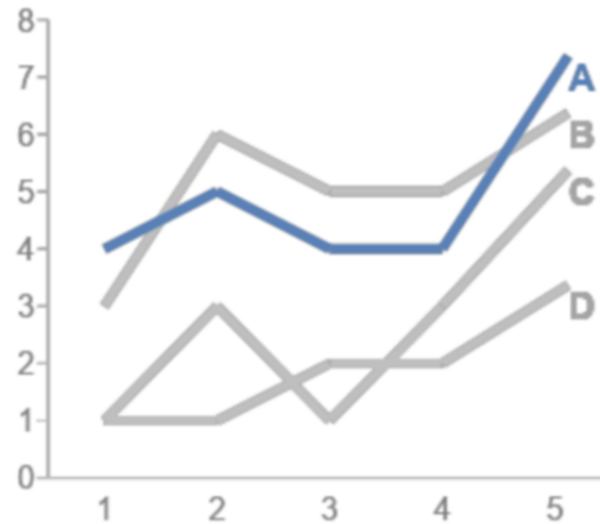
# Line graph

- Used to plot continuous data
- Often continuous data is unit of Time
- Single or multiple series of data

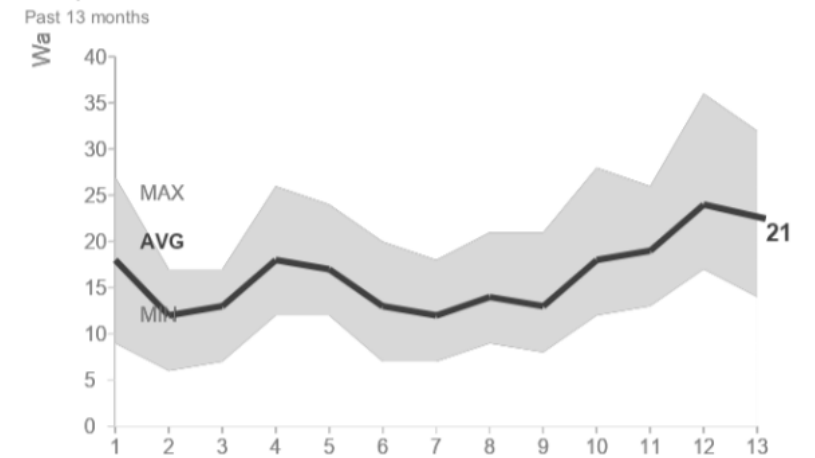
Single series



Multiple series



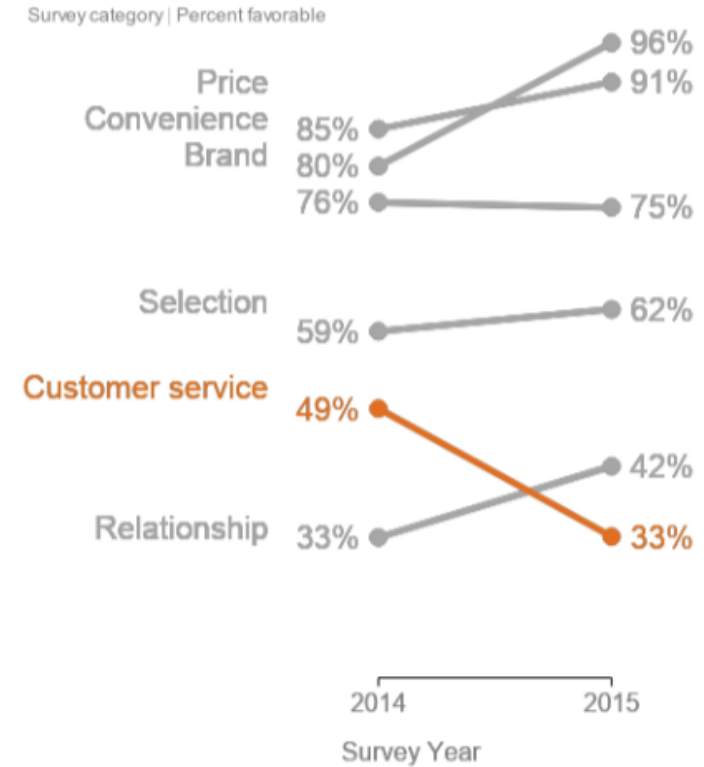
Passport control wait time



# Slope graph

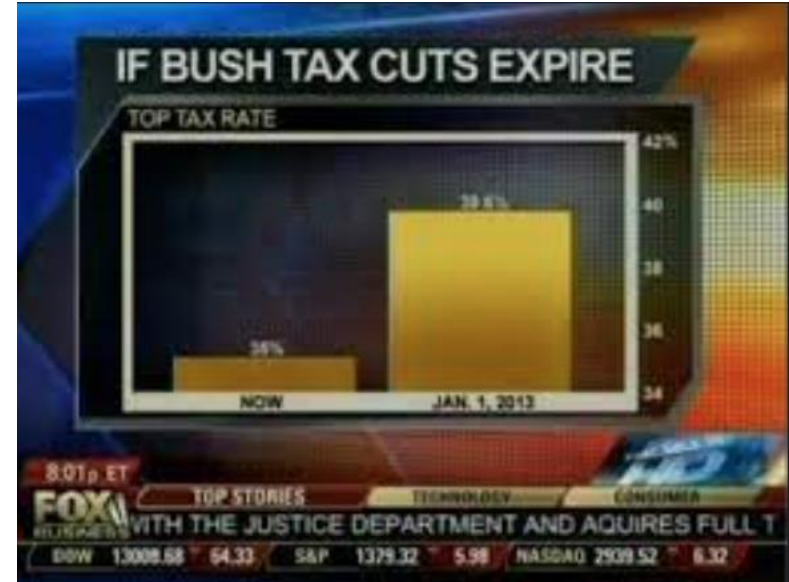
- To compare two time periods or points
- Depicts absolute value as well as relative change

Customer feedback over time

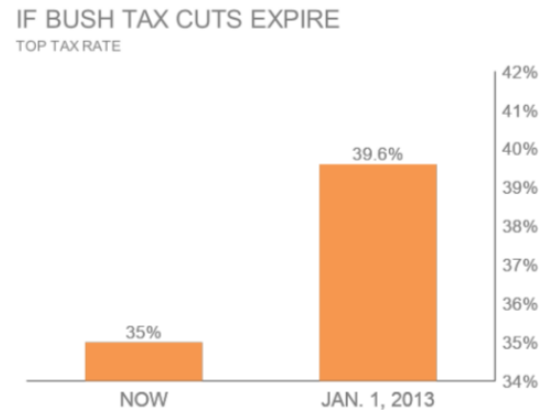


# Bar Charts

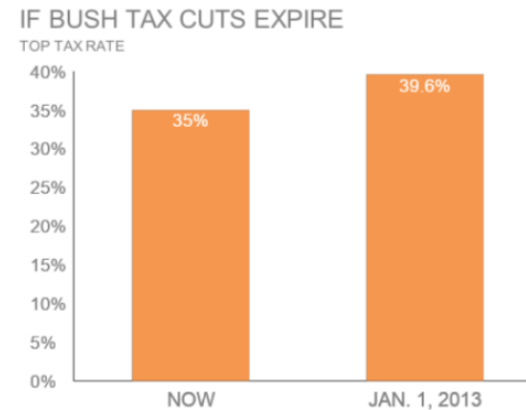
- Used to compare categories.
- Sometimes Bar Charts are avoided because they are common !
- They are very easy to read.
- **Always have a zero baseline!**



**Non-zero baseline:** as originally graphed



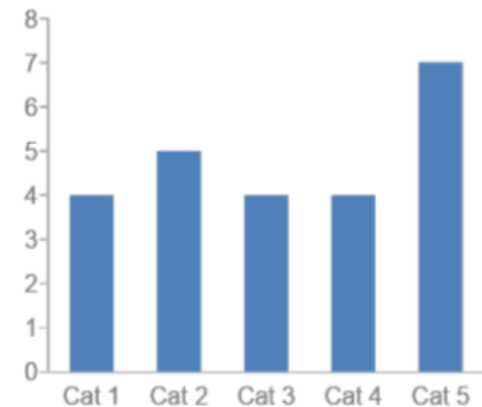
**Zero baseline:** as it should be graphed



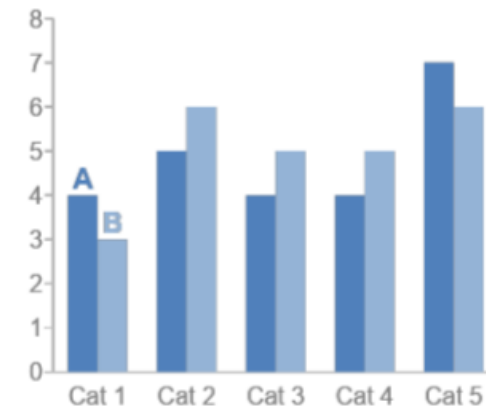
# Vertical Bar/Column Charts

- Can be used for single or multiple series
- Multiple series can clutter the visual
- Order is important to pay attention to

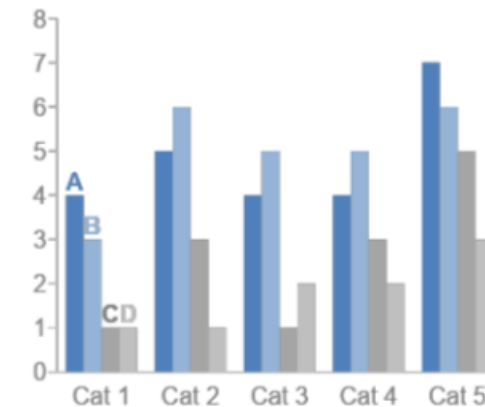
Single series



Two series



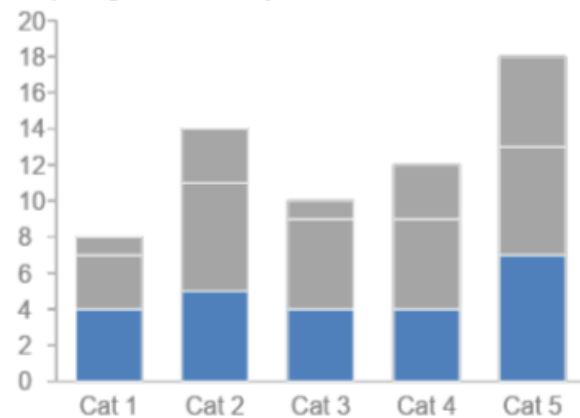
Multiple series



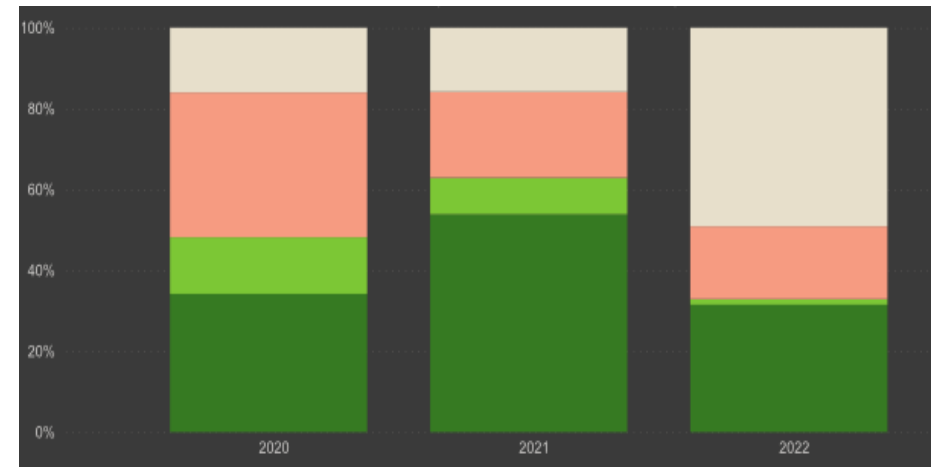
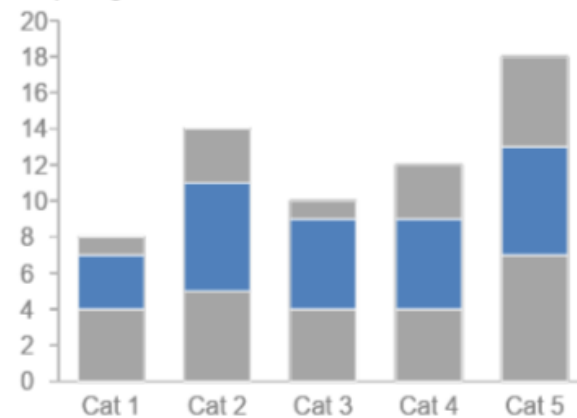
# Stacked Vertical Bar Chart

- Allow to compare Totals across main categories
- Compare relative sub categories at same same time
- Comparing other categories than bottom ones can be harder
- Can be absolute values or 100% to represent relative percentages

Comparing **these** is easy



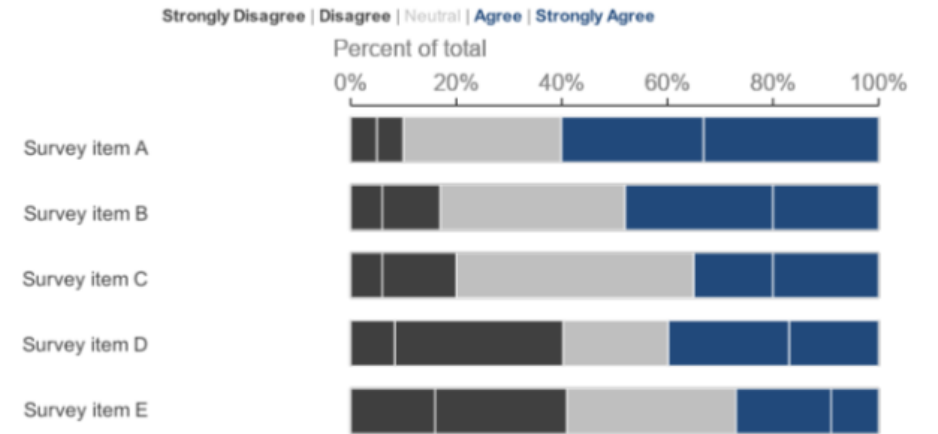
Comparing **these** is hard



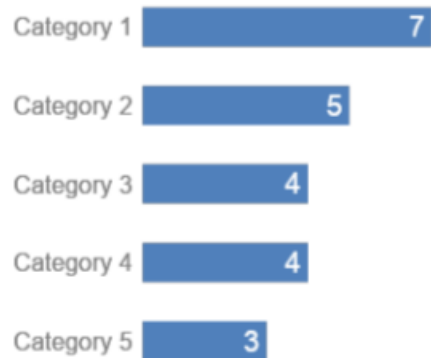
# Horizontal Bar Charts

- Flips vertical bar to horizontal
- The best solution for comparing categories. i.e. **Long Category name**
- Can be single, multiple and stacked

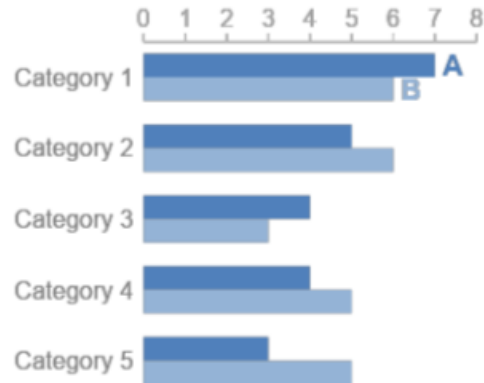
Survey results



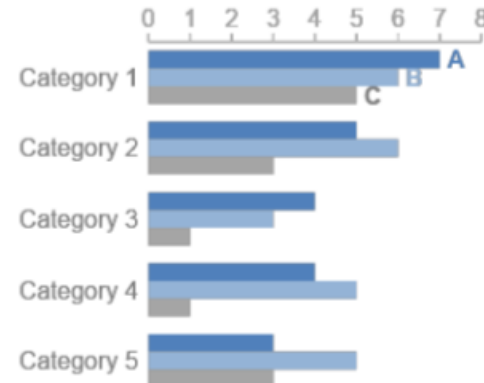
Single series



Two series



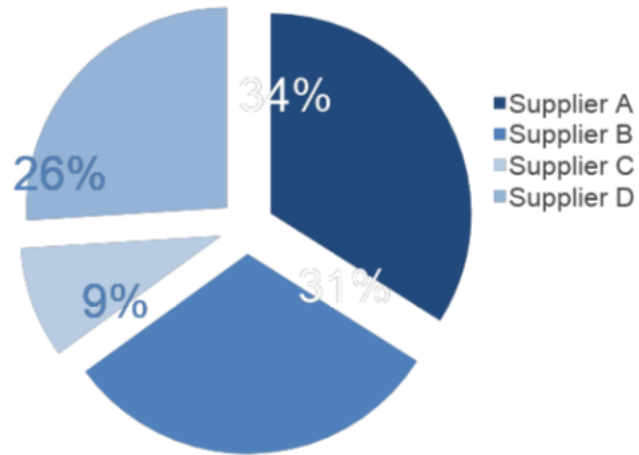
Multiple series



# Pie Chart – Avoid

- Documented to be Evil (Knaflic, 2015)
- They have high chance of being interpreted wrong
- Why use them when we have better alternatives

Supplier Market Share

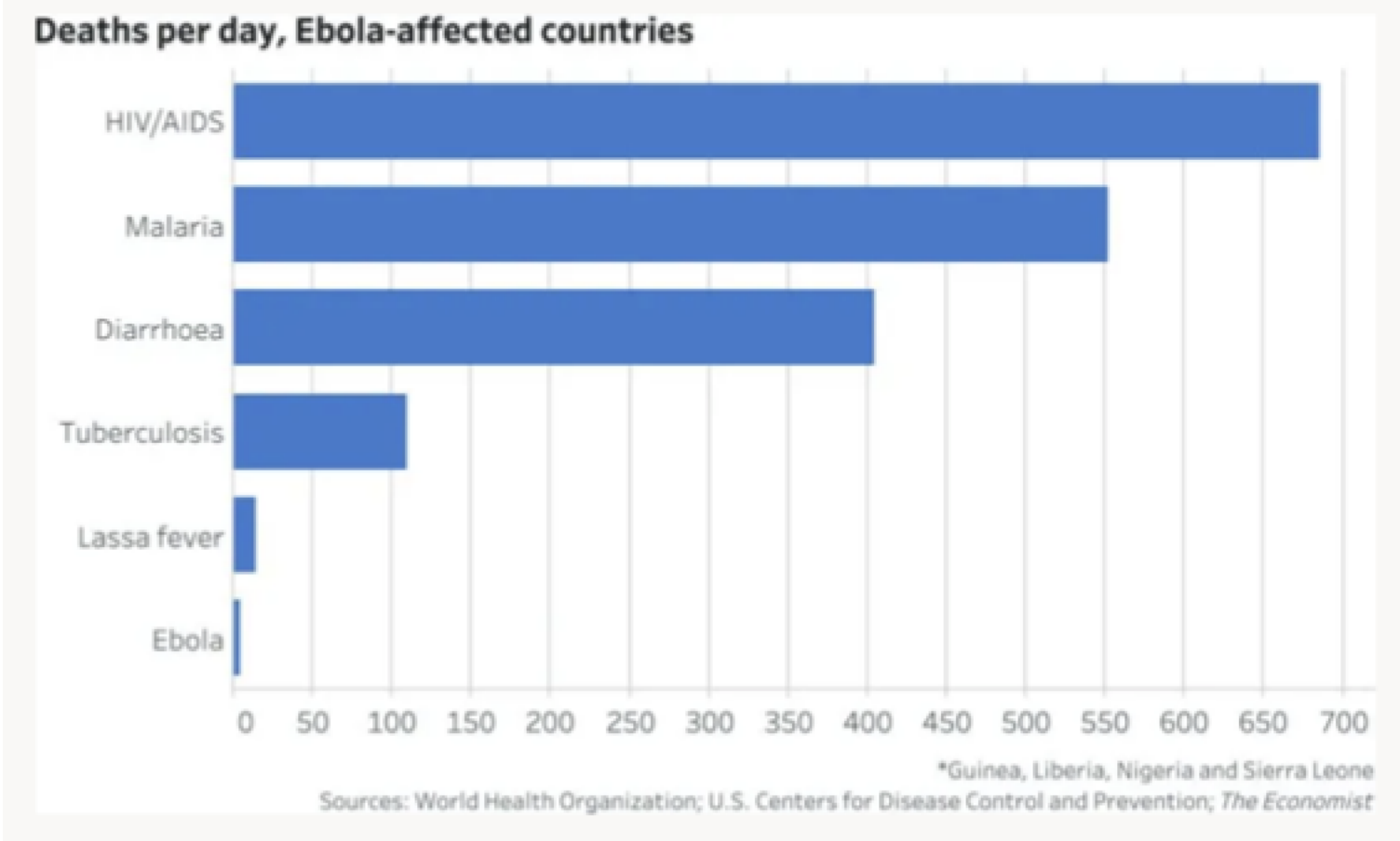
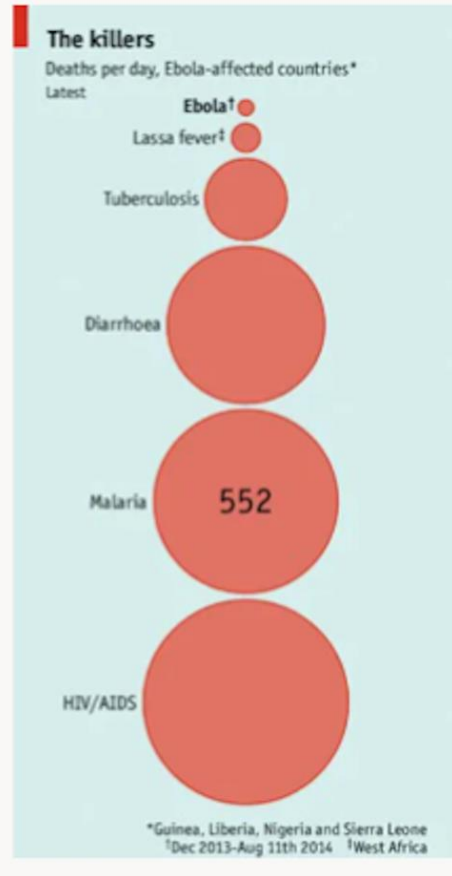


Supplier Market Share

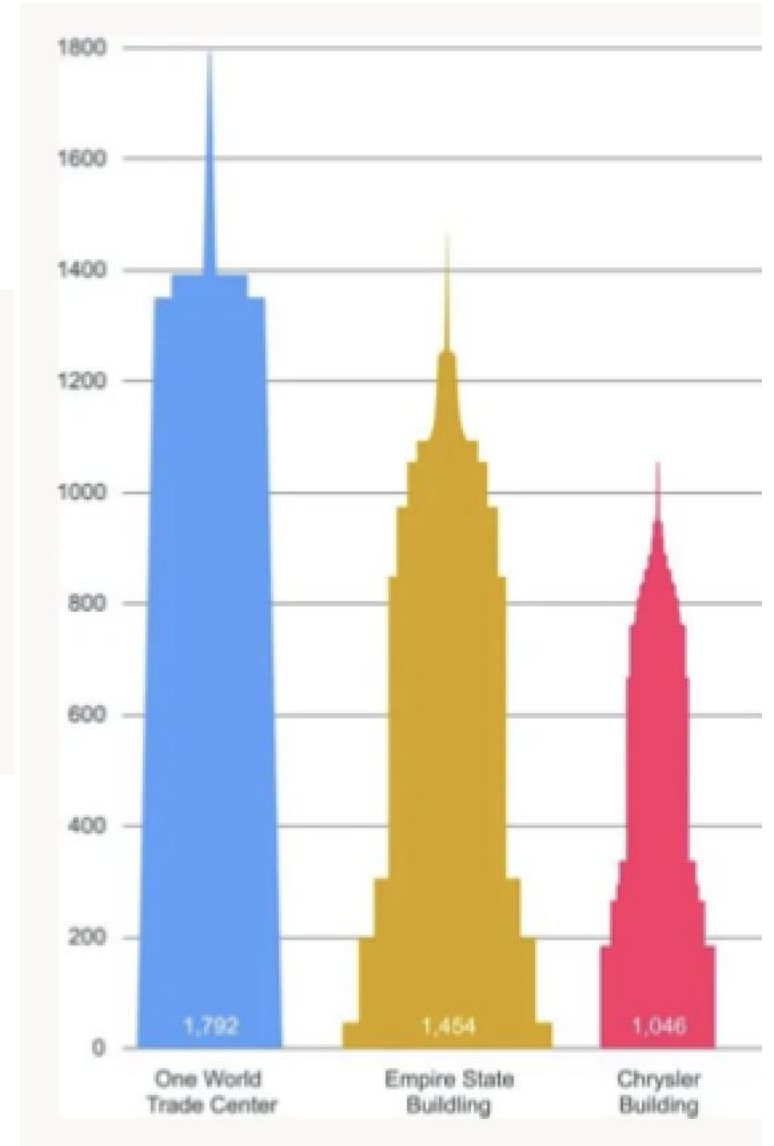
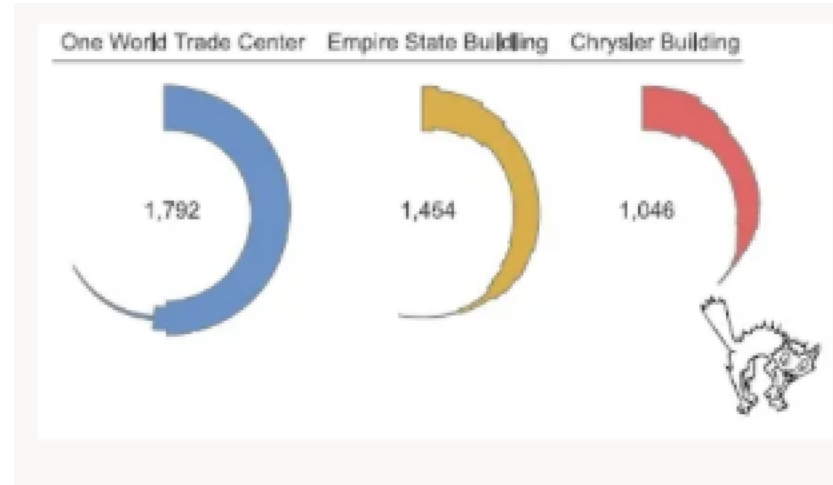
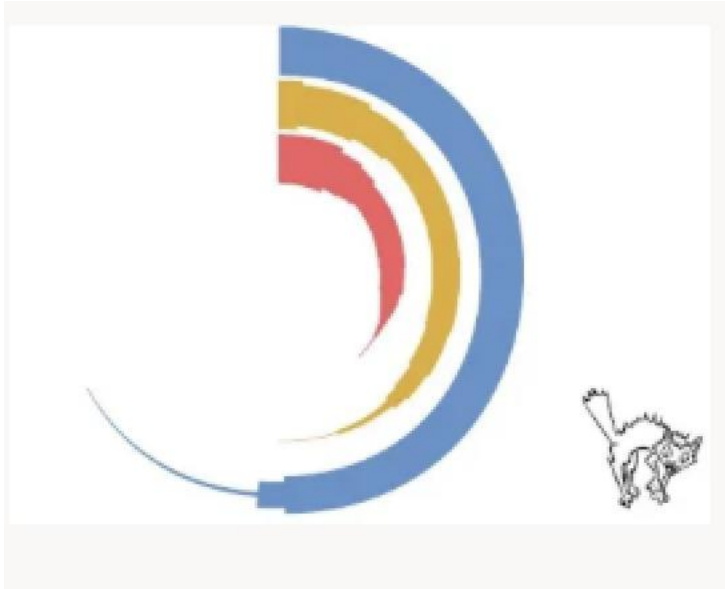


Total 100%

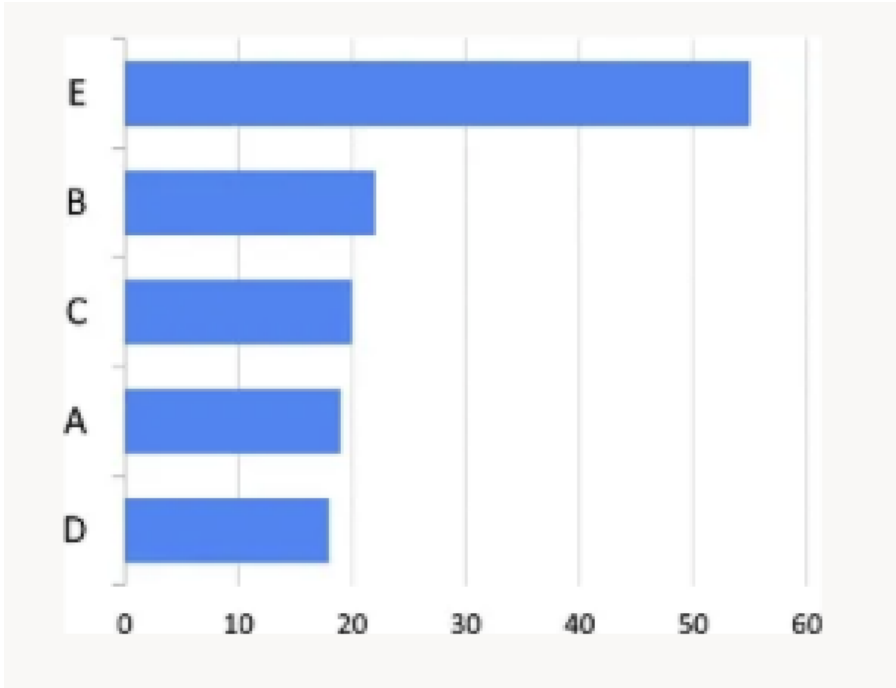
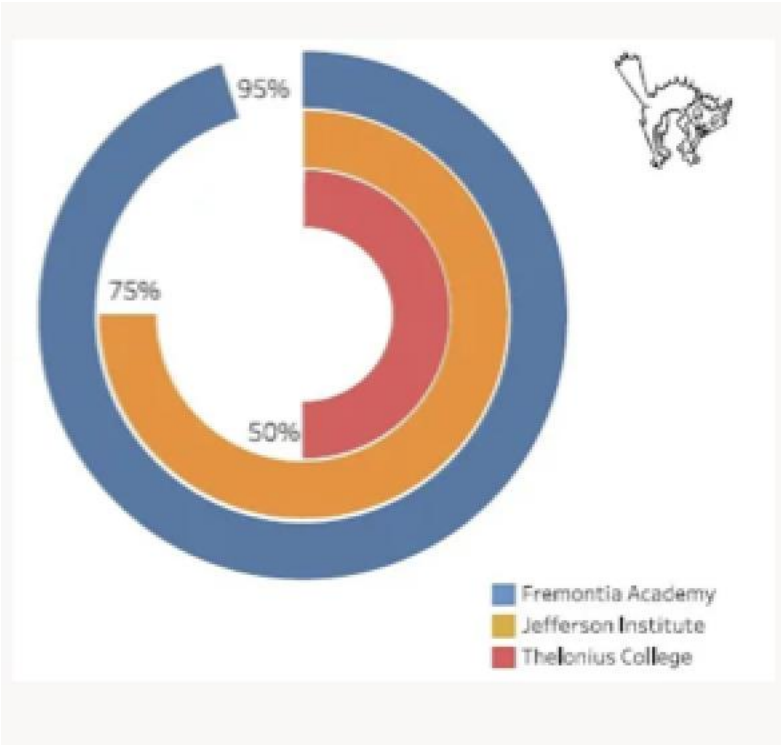
# Pie Chart – Avoid



# Pie Chart – Avoid



# Pie Chart – Avoid



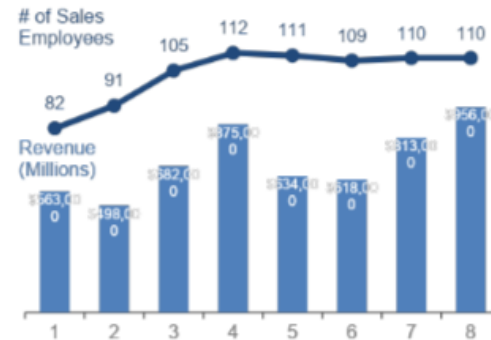
# Secondary y-axis

- Used to compare entirely different units against same axis.
- It can be useful however need to be designed carefully

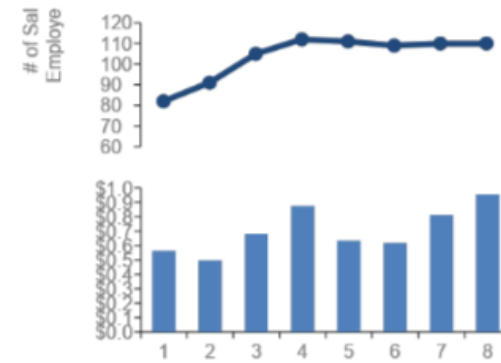
Secondary y-axis



Alternative 1: label directly

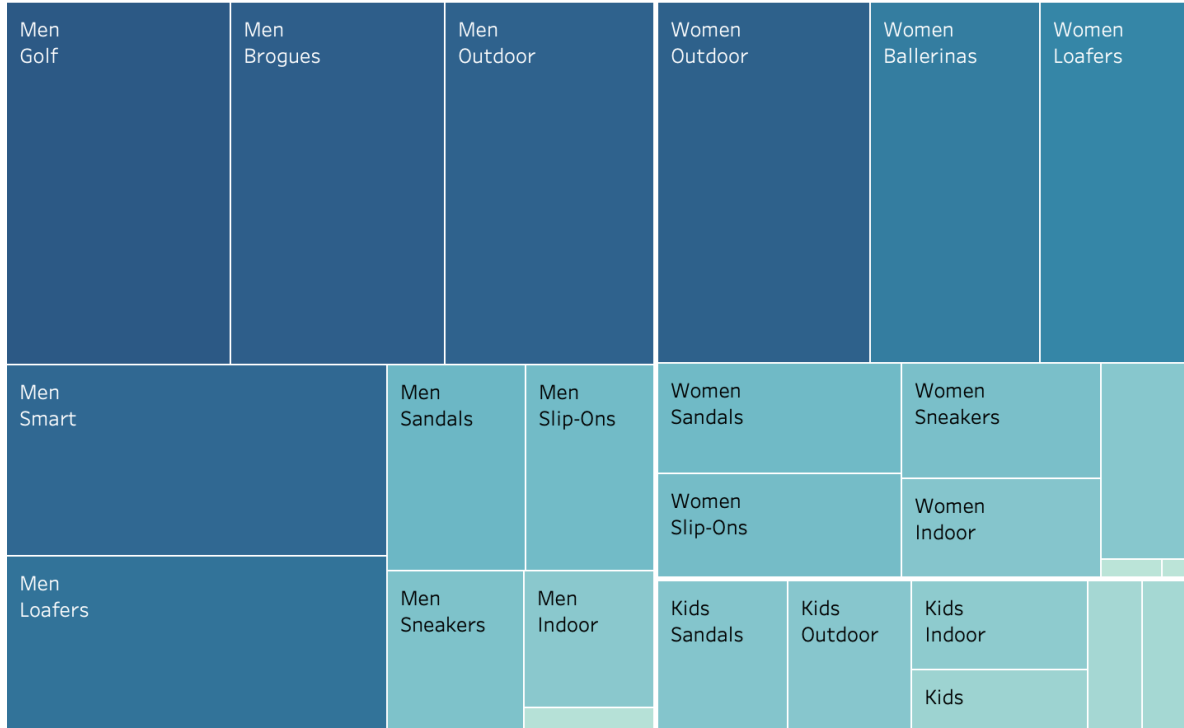


Alternative 2: pull apart vertically

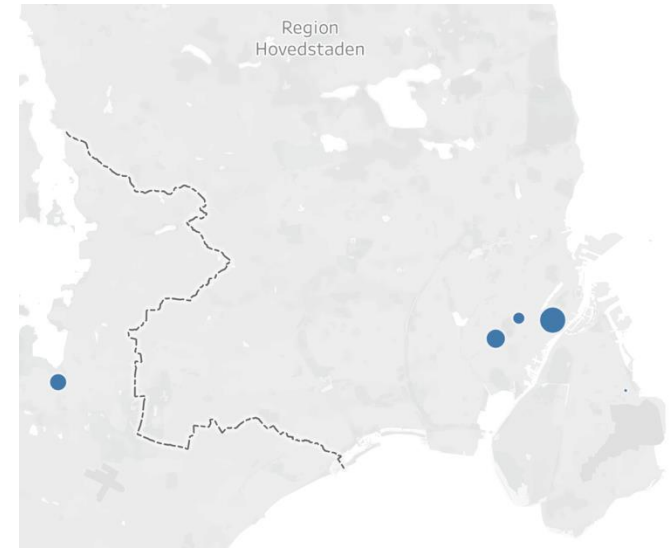


# Other Graph Types

Shoe Sale Per Category



Area Chart



Geographical Chart

Shoe Categories By Total Sale



Bubble Chart