MSc GFIS

Information Presentation

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Wexler, S. (2017). The Big Book of Dashboards: Visualising your Data using Real World Business Scenarios. Wiley.

Kirk, A. (2016). Data Visualisation. A Handbook for Data Driven Design. Sage.

Objectives:

- Definition of Data Visualisation
- Evolution of Data Visualisation
- Business Reporting
- Dashboards Design
- Data Visualisation Fundamentals
  - Understanding – Audience
  - Representation – Charts
  - Presentation – Colour etc..
- Visualisation Tools

Capabilities of BI

Organisational Memory

Storage of structured information in such a form that it can be later accessed and used for BI

Information Integration

Integration of semi-structured and unstructured information so it can be used by BI
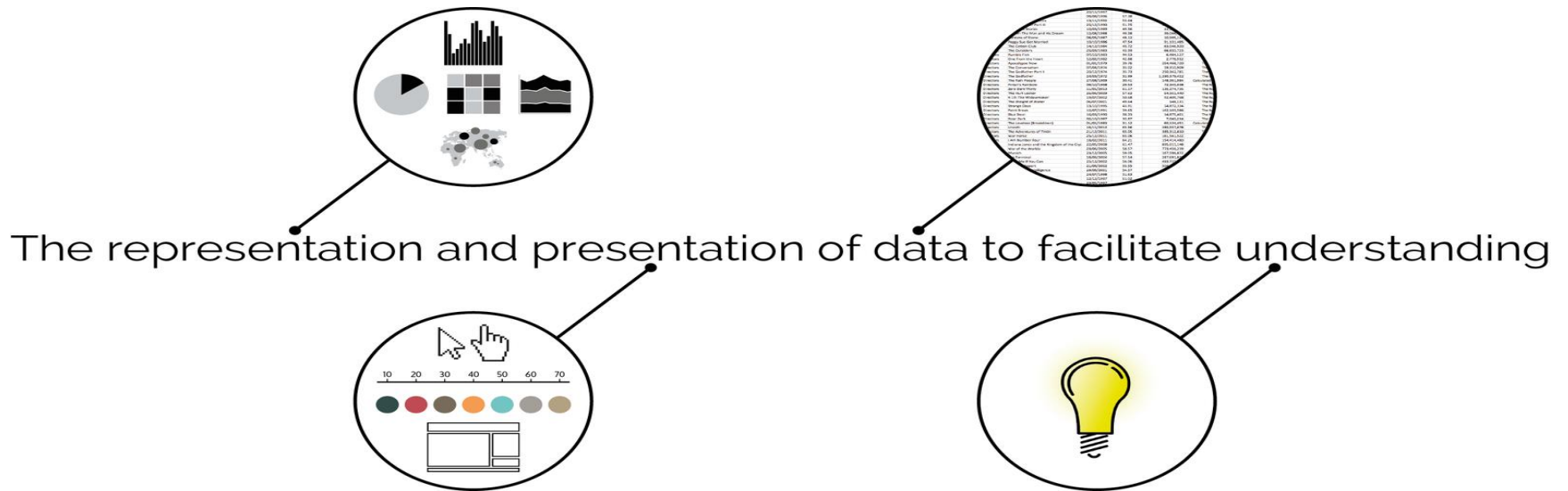
Information Insights

Creating insights means to develop new intuitions for better decision making

Information Presentation

Create visualizations that effectively communicate information

What is Data Visualisation?

The representation and presentation of data to facilitate understanding

Definition explained

*"The representation and presentation of data to facilitate understanding"*

▸ Data: our critical raw material. Without data there is no visualization!

▸ To derive understanding from data we need to see it represented in a different, visual form. This is the act of **data representation**. Representation concerns the choices made about the form in which your data will be visually portrayed, e.g. what chart or charts

▸ The **presentation** of data concerns all the other visible design decisions that make up the overall visualisation anatomy. This includes choices about the possible applications of interactivity, features of annotation, colour usage and the composition of your work.

▸ The goal expressed in this definition states that data visualisation is about **facilitating understanding.**

Visualisation for BI

▸ This concerns the visualisation of business data, mainly for the purpose of communication, information seeking, analysis, and decision support.

▸ How do we get data to the people who need it in a way that makes the most sense to them?

▸ How do we find outliers within the data that need to be managed?

▸ And how do we communicate key performance indicators (KPIs) that are common across the organization in a way that can be understood by all?
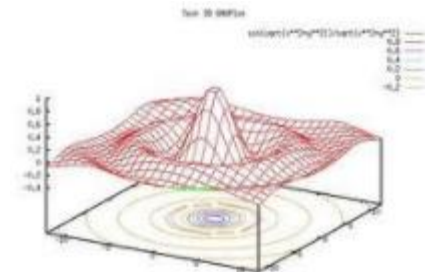
▸ The answer is with Data Visualisation.

▸

Evolution of Data Visualisation

https://apandre.files.wordpress.com/2011/06/originofdv.jpg
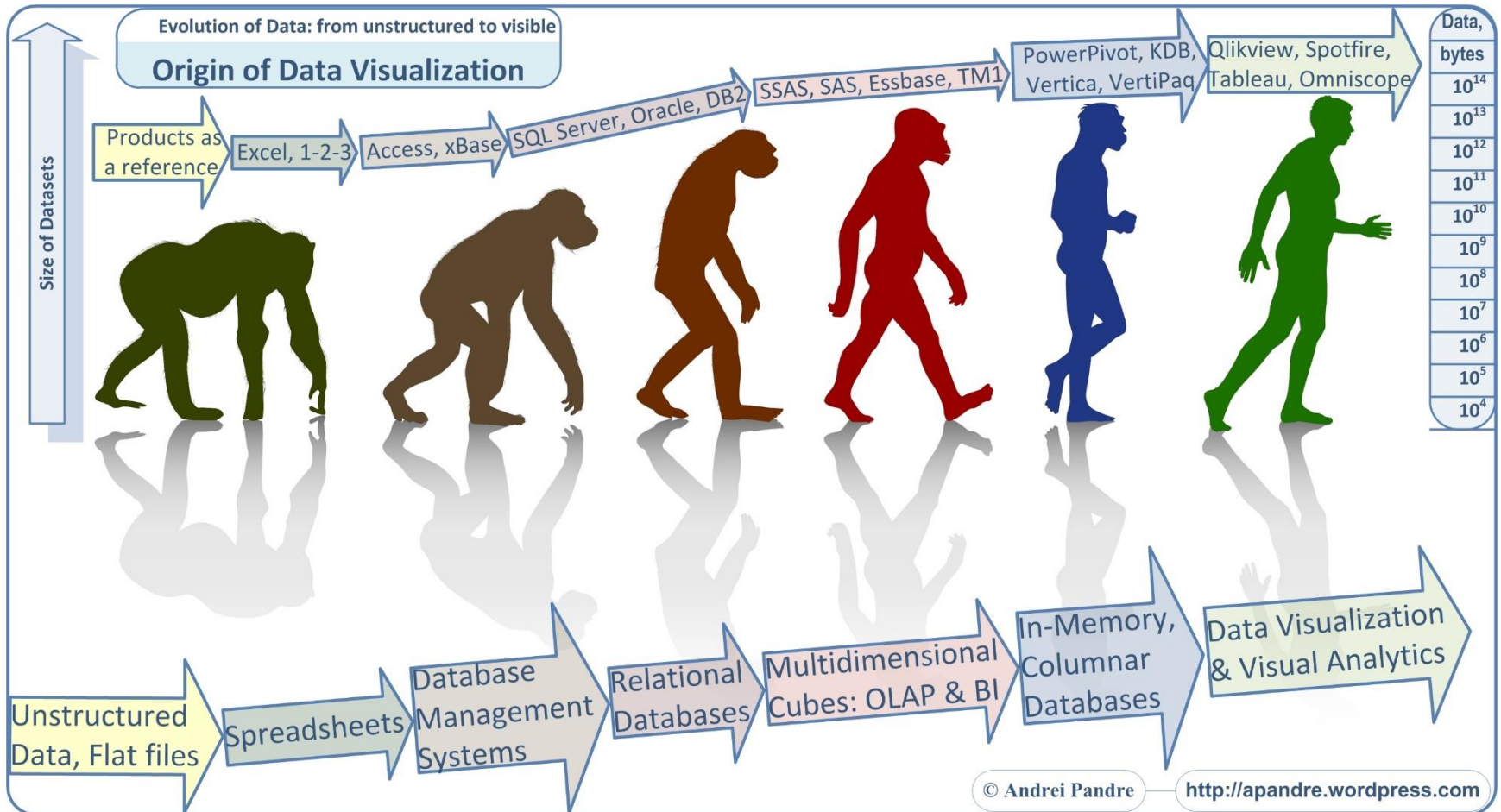
The Focus in Business Intelligence

- Descriptive analytics – what has occurred?
  - Business reporting
    - OLAP
  - Dashboards
  - Data visualisation

(Sharda et. al. (2018) Business Intelligence, Analytics and Data Science: A Managerial Perspective. Pearson, New York.ISBN 0134633288)

Types of Business Reports

- ## Metric Management Reports
  - Help manage business performance through metrics (SLAs for externals; KPIs for internals)
  - Can be used as part of Six Sigma

- ## Dashboard-Type Reports
  - Graphical presentation of several performance indicators in a single page using dials/gauges

- ## Balanced Scorecard-Type Reports
  - Include financial, customer, business process, and learning & growth indicators

Multidimensional Reporting and Analysis of Data in DW

- **Online analytical processing (OLAP)**
  - Data driven activities performed by end users to query the online system and to conduct analyses
  - Data cubes

- **OLAP Activities**
  - Generating queries (query tools)
  - Requesting ad hoc reports
  - Conducting statistical and other analyses

- **Operations**
  - Slice, Dice, Drill-down, Roll-up, Pivot

▶ **(Sharda et. al. (2018) Business Intelligence, Analytics and Data Science: A Managerial Perspective. Pearson, New York.ISBN 0134633288)**

Performance Dashboards & Scorecards

▸ Dashboards provide visual displays of important information that is consolidated and arranged on a single screen so that information can be digested at a single glance and easily drilled in and further explored

▸ Scorecards - focus on KPIs and compare it to a forecast or target. The display is usually in a table form.

Performance Dashboards

▸ Dashboard design

  ▸ The fundamental challenge of dashboard design is to display all the required information on a single screen, clearly and without distraction, in a manner that can be assimilated quickly

  ▸ Organizational performance- "Three Threes" by TDWI - Download poster

3 Applications	3 Layers	3 Types
Monitoring	Graphical	Operational
Analysis	Summarised	Tactical
Collaboration	Detail	Strategic

Performance Dashboards - Application

▸ Three sets of functionality in every performance dashboard:

1. Monitoring so users can quickly view performance
2. Analysis so users can identify root causes
3. Collaboration so users can discuss the data before taking action

▸ "Three Threes" by TDWI

Performance Dashboards - Layers

▸ Three layers of performance information:

1. Graphical, abstracted views of performance status and trends
2. Summarised, dimensional data that users can slice and dice
3. Detailed data for taking action

Performance Dashboards – Types

▸ Three types of dashboards to support different requirements:

1. Operational dashboards to monitor real-time processes
2. Tactical dashboards to track departmental goals
3. Strategic dashboards to monitor strategic objectives

Do's of Effective Dashboards

▸ Know your audience and their interests

▸ Develop accurate and consistent dashboards

▸ Have up-to-date data

▸ Make the dashboard easy to read

▸ Identify critical metrics (with critical KPIs)

▸ Think "dynamic"

▸ Provide a customizable dashboard interface

Balkan, S. (2014) Dashboards 101-White Paper sponsored by Tableau, presented by Information management. (2019) - www.tableau.com/learn/whitepapers
)

Don't of Dashboard Design:

▶ Don't extend the dashboard beyond one page or screen

▶ Don't present data that is dependent on other data

▶ Don't provide only one level of data

▶ Don't present metrics in a vacuum

▶ Don't expect your first dashboard to be your finest

▶ Don't try to answer every question with one dashboard

▶ Don't have too many metrics

▶ Don't clutter the dashboard with low-value graphics and widgets

Data Visualisation Fundamentals

▶ Remember this definition:

　▶ "The *representation* and *presentation* of data to facilitate *understanding*"

　　▶ Understanding: the goal of DV is understanding
　　　□Audience

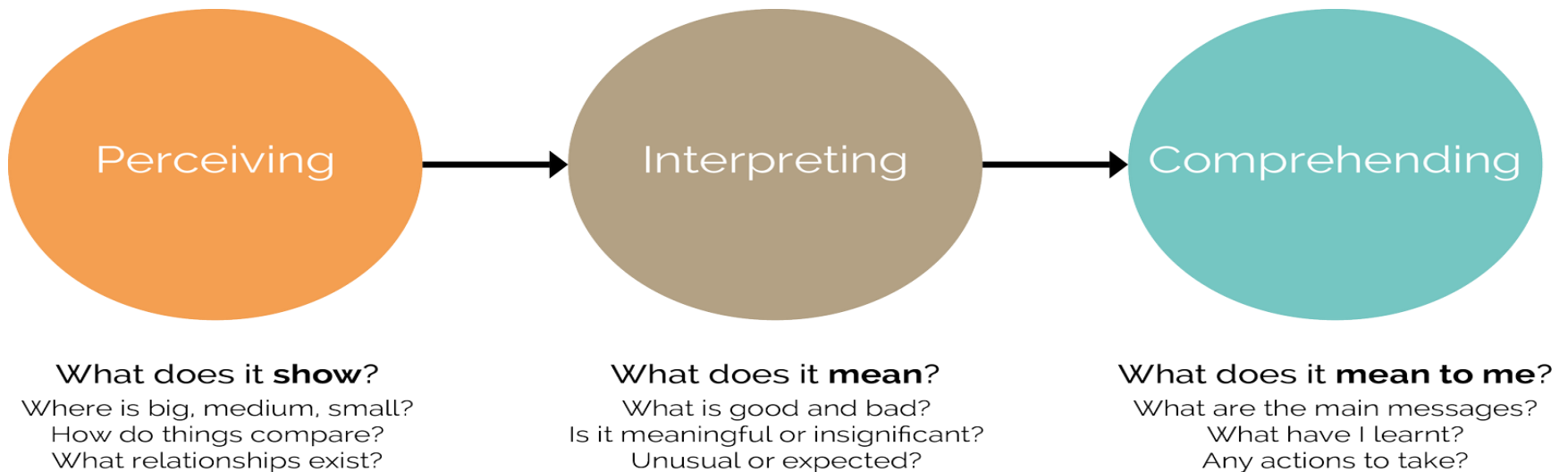　　▶ Representation: is the act of giving visual form to your data
　　　□Charts

　　▶ Presentation: how the visuals are presented…
　　　□Preattentive attributes, e.g. colour, size length

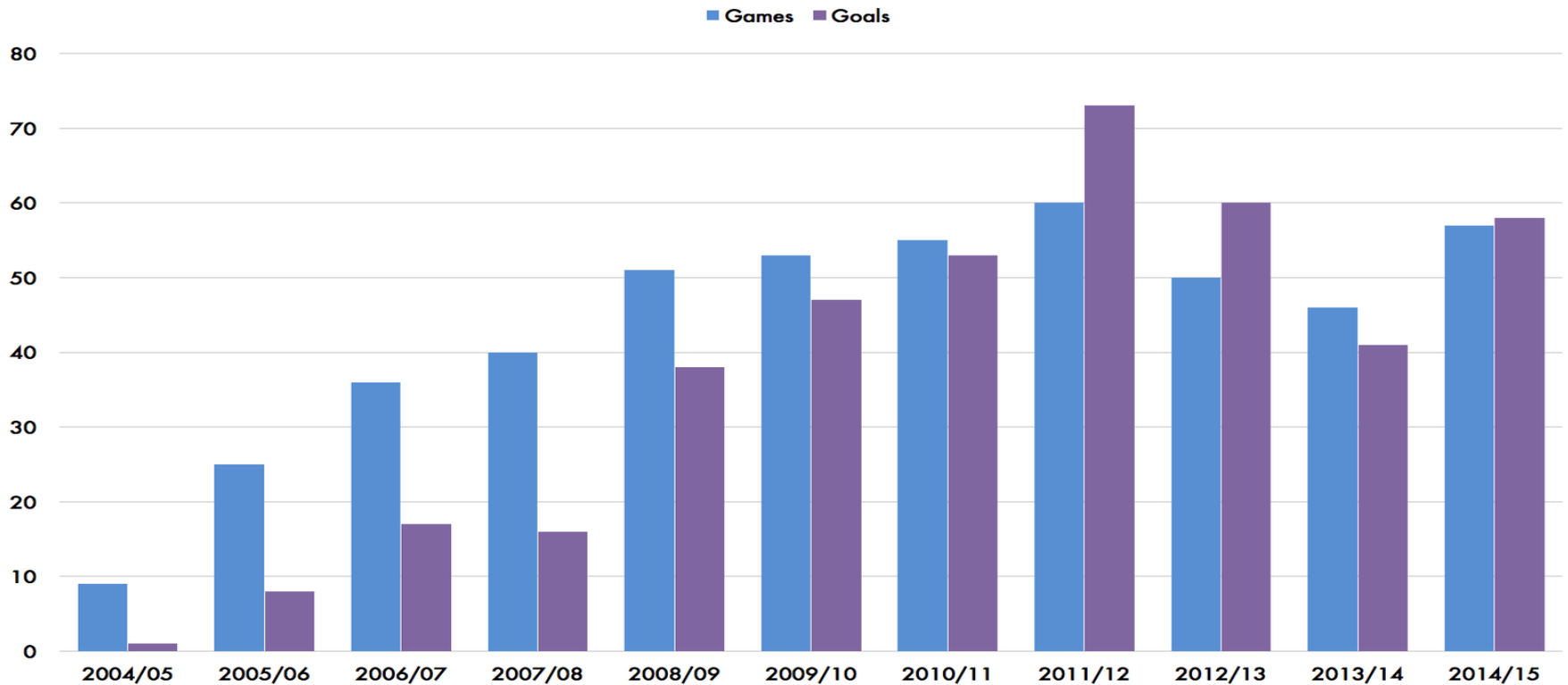Kirk, A. (2016) Data Visualisation

Understanding your Audience

▸ Know your audience and adjusting your presentation to them.

▸ It's not just about understanding, it's about channeling them.

▸ It's about really getting inside their head.

▸ Culture and level of expertise: You don't want to ignore their culture and accessibility issues, and all these other things.

▸ You want to understand it as though you are them.

▸ You'll be less likely to be influenced by bias for instance, because you're going to feel their skepticism, their argument against what you're showing them.

▸ Imagine that you are them, and you'll communicate more meaningfully.

3 Stages of Understanding

Perceiving

Interpreting

Comprehending

What does it **show**?
Where is big, medium, small?
How do things compare?
What relationships exist?

What does it **mean**?
What is good and bad?
Is it meaningful or insignificant?
Unusual or expected?

What does it **mean to me**?
What are the main messages?
What have I learnt?
Any actions to take?
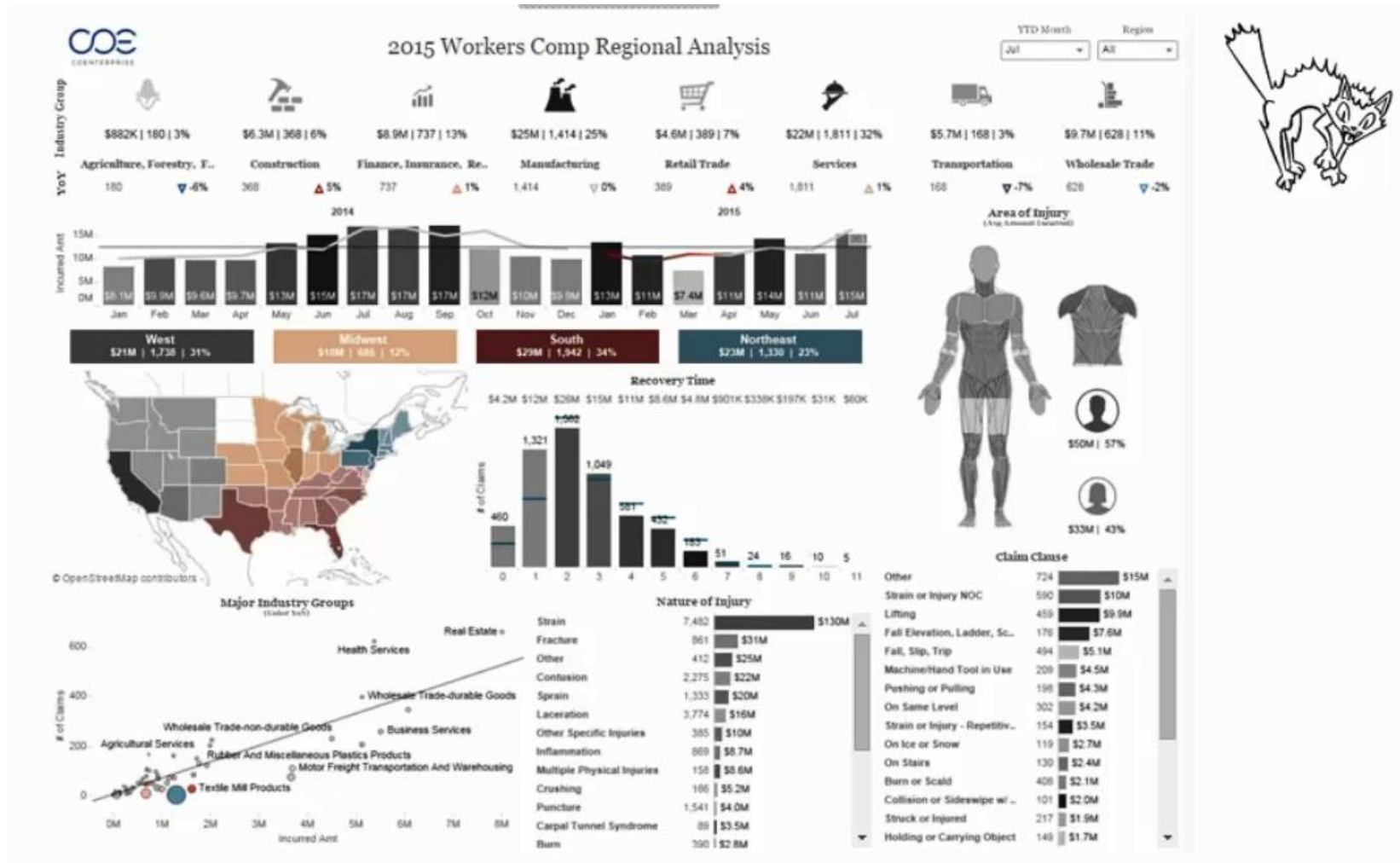
Kirk, A. (2016) Data Visualisation

Understanding
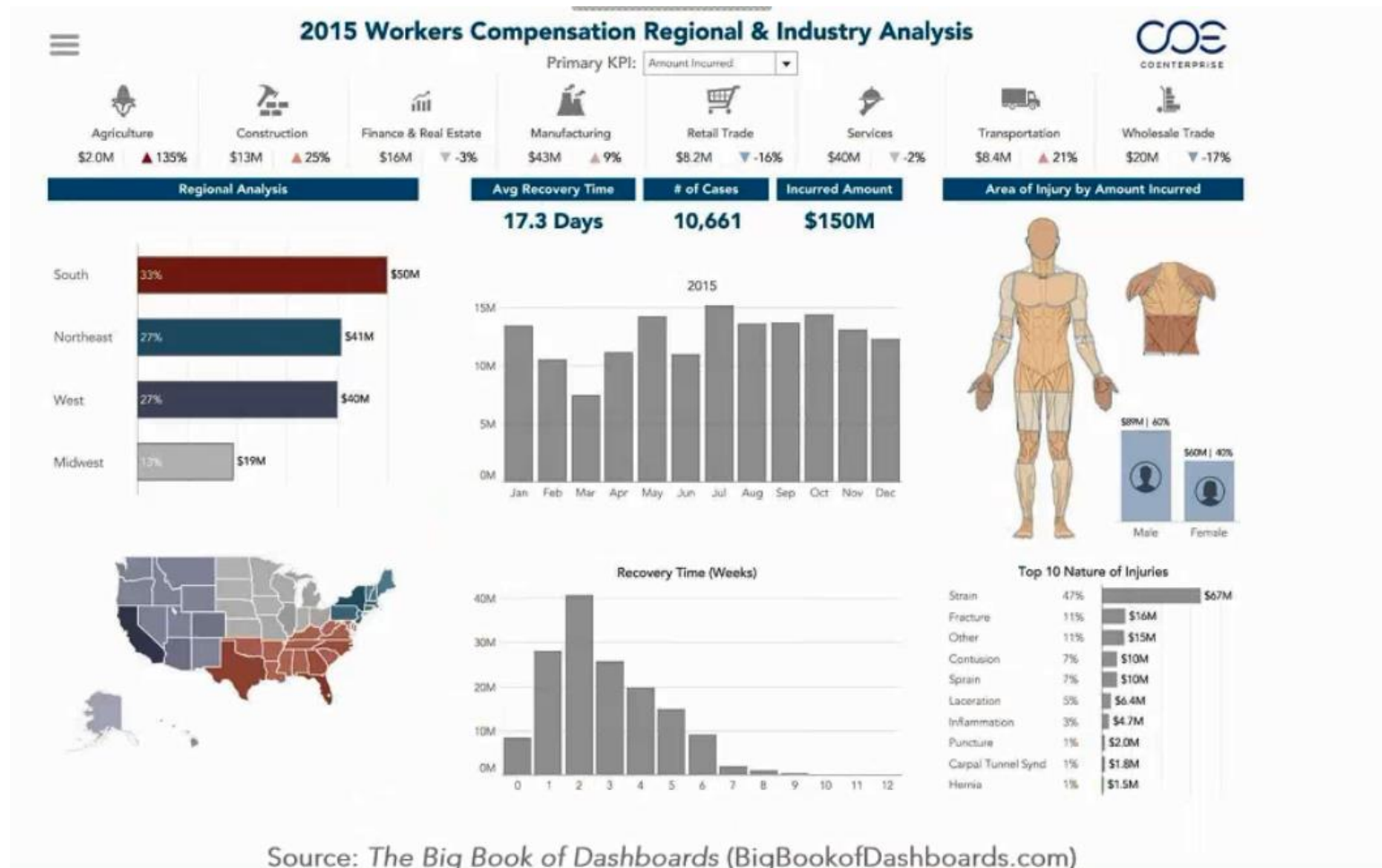

Lionel Messi: Games and Goals for FC Barcelona

Clutter, Alignment and White Space

▸ Clutter is your enemy, ban it from your visuals.

▸ Alignment: In general, the goal is to create clean lines (both horizontally and vertically) of elements and white space.
  ▸ Without other visual cues, your audience will typically start at the top left of the page or screen and will move their eyes in a "z" shape
  ▸ Diagonal elements such as lines and text should be avoided

▸ "There is still some space left on that page, so let's add something there," or worse, "there is still some space left on that page, so let's add more data."
  ▸ No! Never add data just for the sake of adding data—only add data with a thoughtful and specific purpose in mind!

Clutter

Wexler, S. (2017). The Big Book of Dashboards: Visualising your Data using Real World Business Scenarios. Wiley. ISBN 9781119282716

Some Improvement!

Source: *The Big Book of Dashboards* (BigBookofDashboards.com)

Design to a Grid
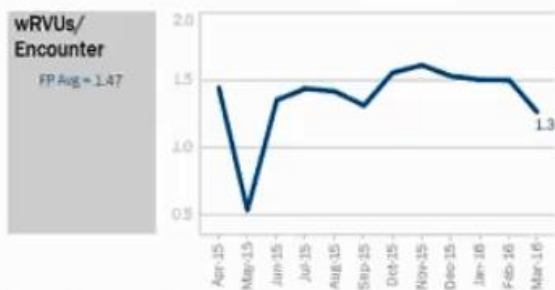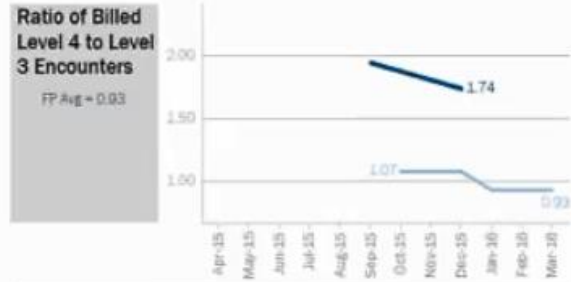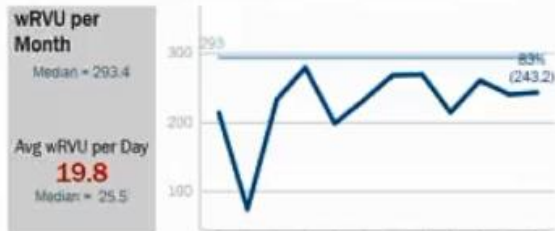
Source: *The Big Book of Dashboards* (BigBookofDashboards.com)

Non-Strategic Use of Contrast

▸ Clear contrast can be a signal to our audience, helping them understand where to focus their attention.

▸ The *lack of clear contrast*, on the other hand, can be a form of visual clutter.

▸ Review this example: this shows the weighted performance index across categories for your company and five competitors.

Weighted Performance Index

Example: Revamped!

▸ **With this design, it is easy to see two things quickly:**

- ▸ We can let our eyes scan across the blue bars to get a relative sense of how "Our business" is doing across the various categories: we score high on Price and Convenience and lower on Relationship.

- ▸ Within a given category, we can compare the blue bar to the grey bars to see how our business is faring relative to competitors: winning compared to the competition on Price, losing on Service and Selection.

Performance overview

- ■ **Our business**
- ■ Competitor A
- ■ Competitor B
- ■ Competitor C
- ■ Competitor D
- ■ Competitor E

Weighted performance index | relative rank

- **Price** — 1 of 6
- **Convenience** — 2 of 6
- **Relationship** — 4 of 6
- **Service** — 6 of 6
- **Selection** — 6 of 6

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals
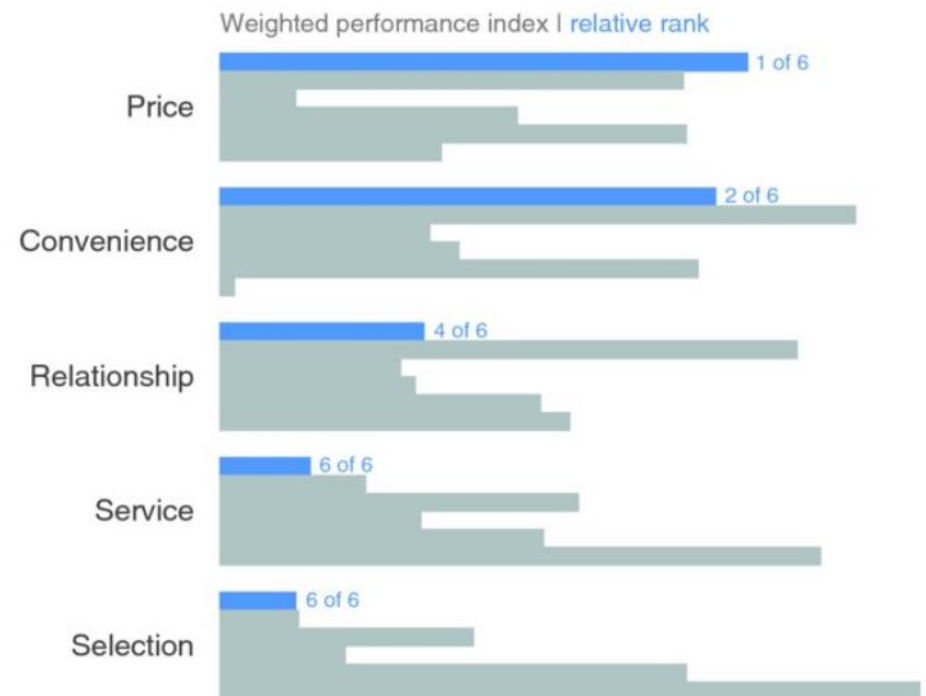
Review this Graph for Clutter!

Consider the lessons we've covered on alignment, white space, and contrast. What things can we get rid of or change? How many issues can you identify?
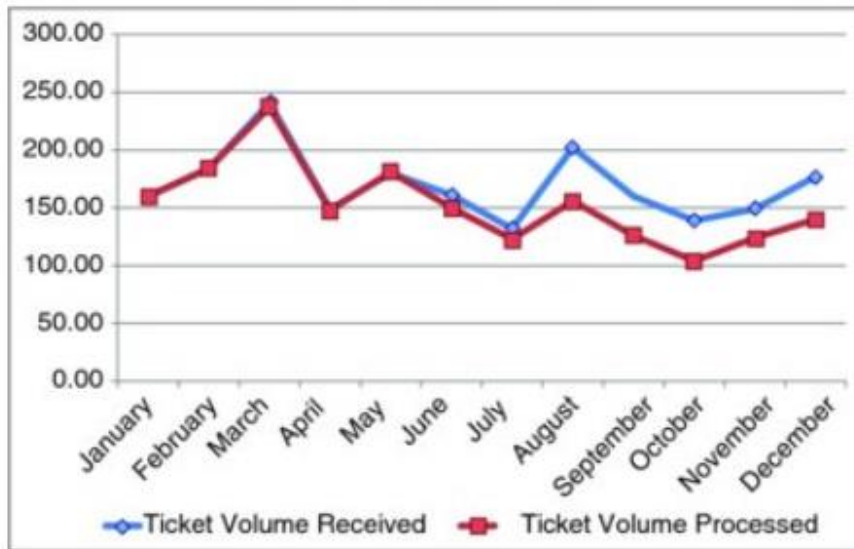
Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

Before and After

Before:

After:

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

Major Changes to Reduce Clutter

▸ Remove chart border

▸ Remove gridlines

▸ Remove data markers

▸ Clean up axis labels

▸ Label data directly

▸ Leverage consistent colour

Representation: Bad graphs are everywhere

- No one teaches us how to tell stories with numbers
- Being able to visualize data and tell stories with it is key to turning it into *information* that can be used to drive better decision making.

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals
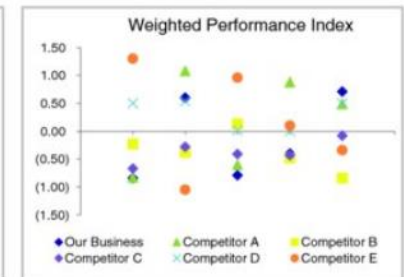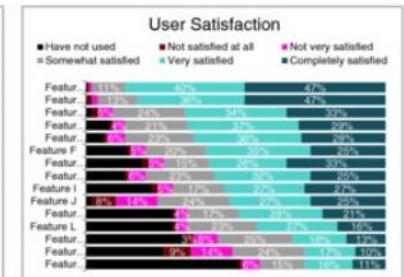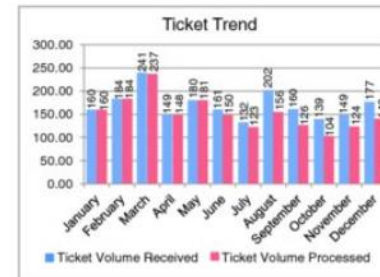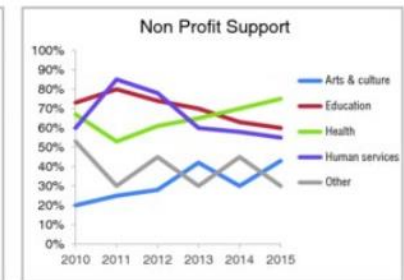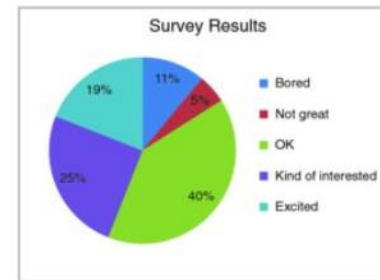
Categories of Visualisation

- Exploratory - Exploratory data visualizations are appropriate when you have a whole bunch of data and you're *not sure what's in it*.
    - Enable drill-down or drill-through to underlying data sources
- Explanatory - By contrast, explanatory data visualization is appropriate when you already know what the data has to say, and you are *trying to tell that story to somebody else*.
    - Apply storytelling
- Hybrids: Exploratory and Explanation - hybrid category involves a *curated dataset* that is presented with the intention to allow some exploration on the reader's part.

Wexler, S et. al (2018). Big Book of Dashboards

Example: Storytelling

Before
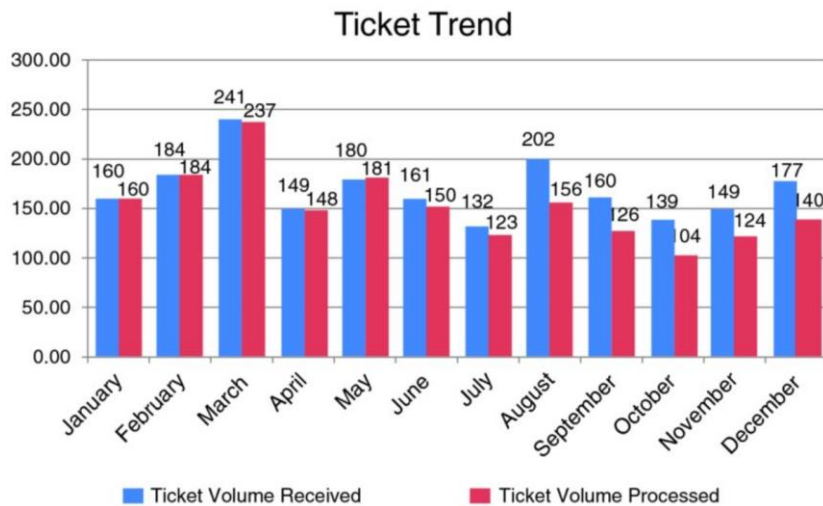
After

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals
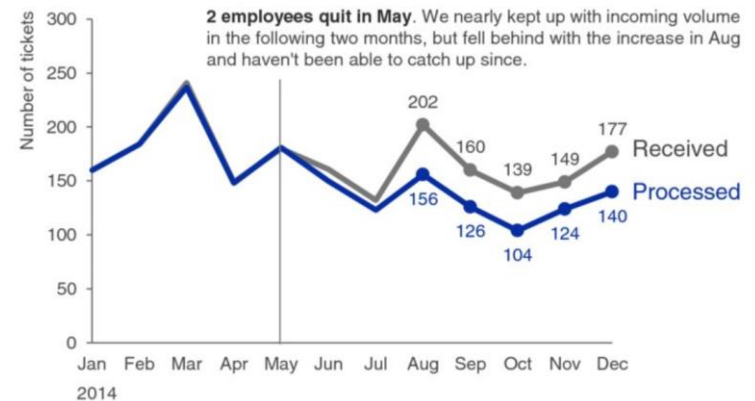
Visual Displays - Graphs

- There are many different graphs and other types of visual displays of information, but a handful will work for the majority of your needs.

- When you have just a number or two that you want to communicate: *use the numbers directly.*

- When you have more data that you want to show, generally a table or graph is the way to go.

- One thing to understand is that people interact differently with these two types of visuals..

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

Simple Text

- When you have just a number or two to share, simple text can be a great way to communicate.

- The fact that you have some numbers does not mean that you need a graph!

20%

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

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

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

41 — 1970
20 — 2012
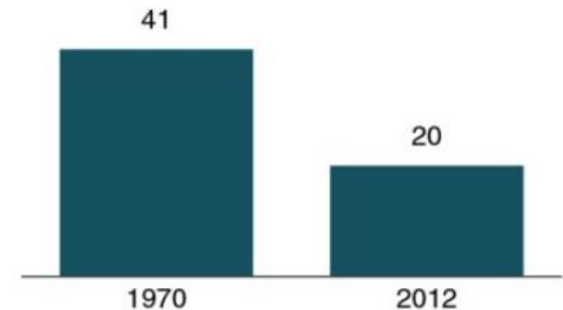
Note: Based on children younger than 18. Their mothers are categorized based on employment status in 1970 and 2012.

Source: Pew Research Center analysis of March Current Population Surveys Integrated Public Use Microdata Series (IPUMS-CPS), 1971 and 2013

Adapted from **PEW RESEARCH CENTER**

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

Tables

- Tables interact with our verbal system, which means that we *read* them.

- Tables are great for reading across rows and down columns or comparing values

- When your communicating to a mixed audience whose members will each look for their particular row of interest.

- Also good when you need to communicate multiple different units of measure, this is also typically easier than a graph.

- Avoid heavy borders, instead use light or none at all.

Heavy 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

Light 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

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

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

Graphs

▸ While tables interact with our verbal system, graphs interact with our visual system, which is faster at processing information.

▸ Sometimes bar charts are avoided because they are common. This is a mistake. Some points to consider:

   ▸ Bar width - bars should be wider than the white space between the bars:

   ▸ Multiple series bar charts should be done with caution

   ▸ Horizontal bars suit categorical data- especially long category names

▸ In most cases pie charts, donut charts, 3D charts and right-hand y-axis should be avoided.

Representation: Types of Charts

- Relationship
- Comparison
- Distribution
- Composition

▶ **(Sharda et. al. (2018) Business Intelligence, Analytics and Data Science: A Managerial Perspective. Pearson, New York.ISBN 0134633288)**

Visualizations

Qlik

Variable width chart
Two variables per item

Table or tables with embedded charts
Many categories

Bar chart horizontal
Few categories

Bar chart vertical

Circular area chart
Cyclical data

Line chart
Non-cyclical data

Many periods

Bar chart vertical
Single or few categories

Line chart
Many categories

Few periods

One variable per item

Among items

Over time

Comparison

Relationship

Scatter plot
Two variables

Scatter plot bubble size
Three variables

What would you like to show?

Distribution

Single variable

Bar histogram
Few data points

Line histogram
Many data points

Scatter plot
Two variables

Composition

Changing over time

Static

Few periods

Many periods

Only relative differences matter

Relative and absolute differences matter

Only relative differences matter

Relative and absolute differences matter

Simple share of total

Accumulation or subtraction to total

Components of components

Accumulation to total & absolute difference matters

Stacked 100% bar chart

Stacked bar chart

Stacked 100% area chart

Stacked area chart

Pie chart

Waterfall chart
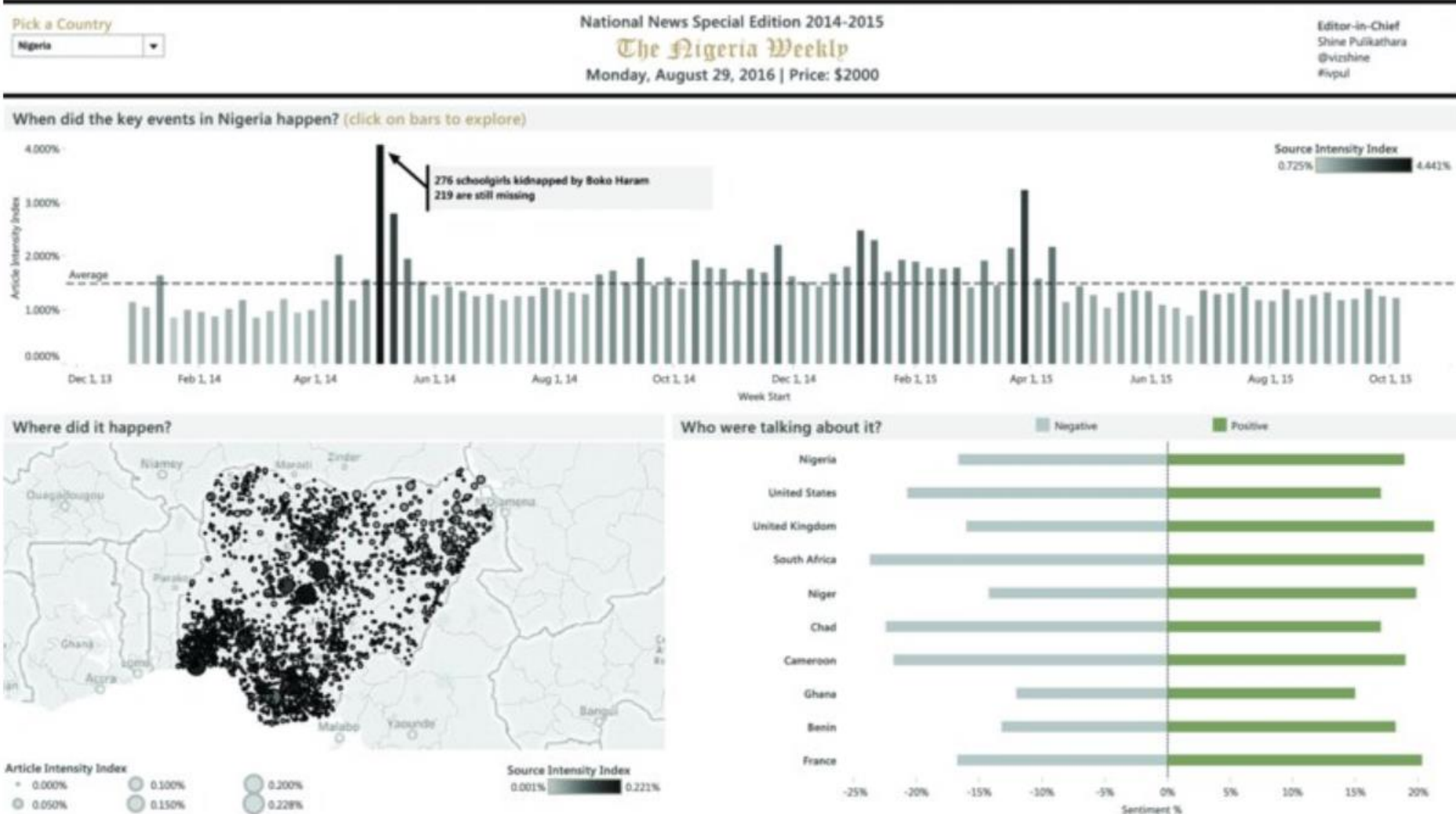
Stacked 100% bar chart w/subcomponents

Tree map

Pre-attentive Attributes

▶ Preattentive attributes signal where to look.

▶ If we use preattentive attributes strategically, they can help us *enable our audience to see what we want them to see before they even know they're seeing it!*

▶ This is done through colour, size and positioning:

  ▶ Size matters. Relative size denotes relative importance.

  ▶ If you're showing multiple things that are of roughly equal importance, size them similarly.

  ▶ Alternatively, if there is one really important thing, leverage size to indicate that: make it BIG!

  ▶ Eye tracking – where our eyes view first – research has found we view the top left first, less emphasis on bottom right position.
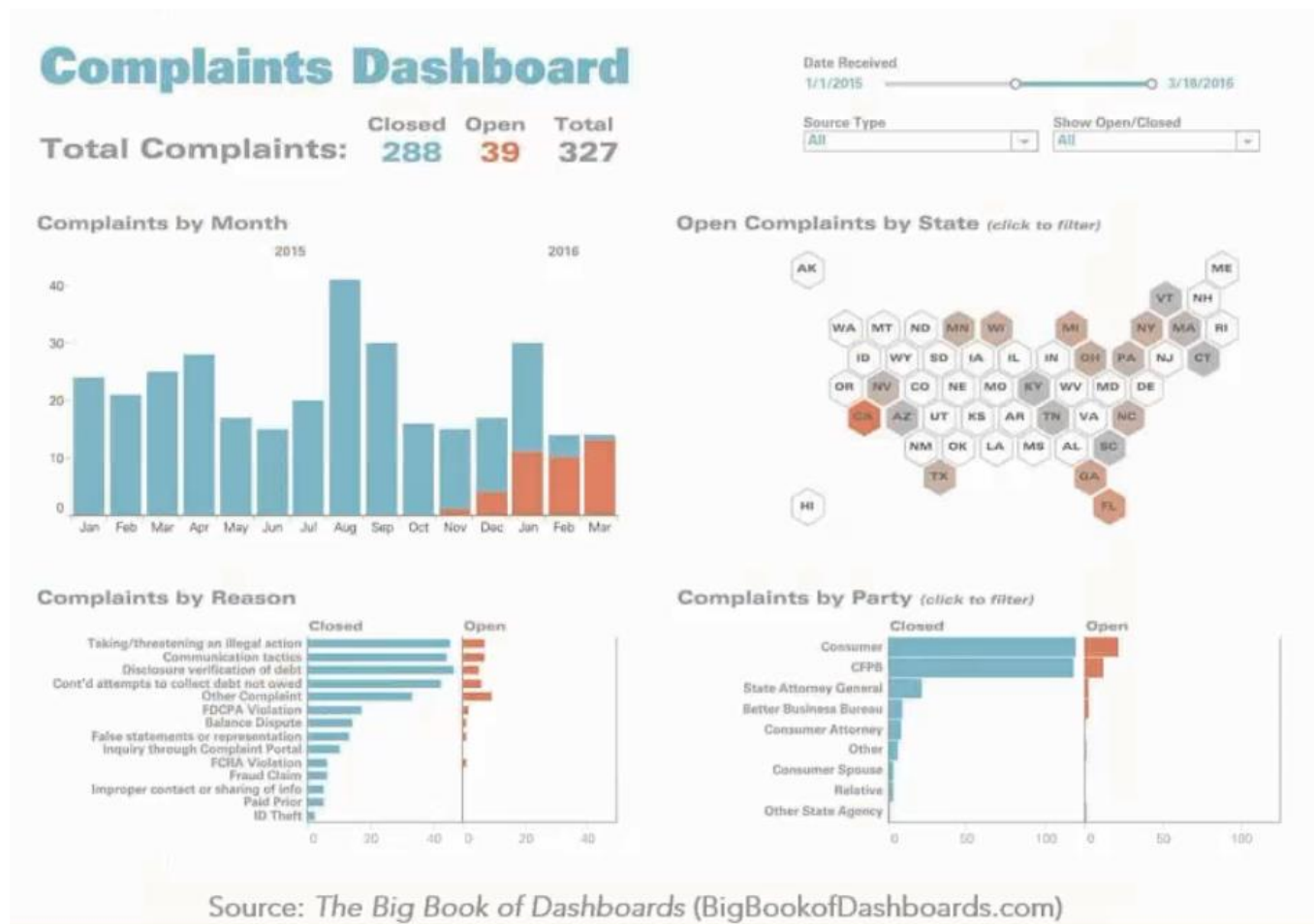
  ▶ Colour is discussed next…

▶ **Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals**

Presentation: Colour

▸ Colour is one of the most important things to understand in data visualization and frequently is misused.

▸ Colour should be used purposefully and sparingly.

  ▸ Colour can be used to draw the attention of the reader, highlight a portion of data, or distinguish between different categories.

  ▸ Consistent use of colour is very important

▸ **Wexler, S. et al. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios, Wiley**

2015 Tableau Iron Viz Competition Winner.

▶ **Wexler, S. Big Book of Dashboards: Visualizing Your Data Using Real-World Scenarios**

Consistent Use of Colour

Source: *The Big Book of Dashboards* (BigBookofDashboards.com)

Use of Colour in Data Visualisation
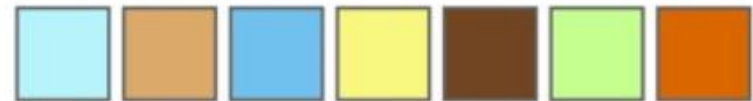
SEQUENTIAL
color is ordered from low to high

DIVERGING
two sequential colors with a neutral midpoint

CATEGORICAL
contrasting colors for individual comparison
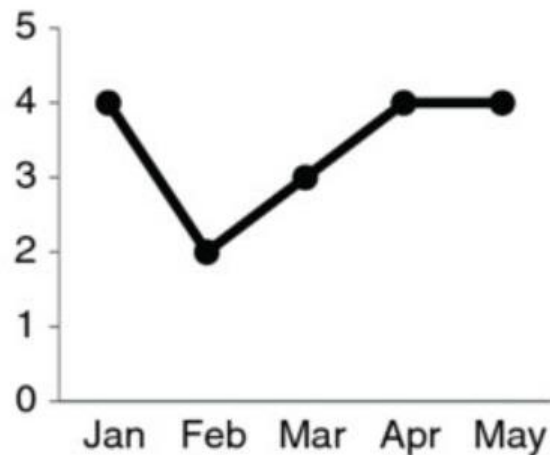
HIGHLIGHT
color used to highlight something

ALERT
color used to alert or warn reader

▶ **Wexler, S. et al. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios, Wiley**

Colour - background
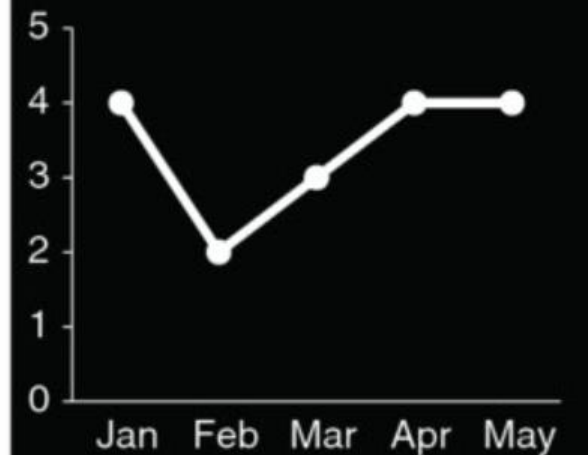
▸ Which is best?

White background | Blue background | Black background

Colour Vision Deficiency (Colour Blindness)

▸ Based on research (Birch 1993), approximately 8 percent of males have Colour Vision Deficiency (CVD) compared to only 0.4 percent of females.

▸ This deficiency is caused by a lack of one of three types of cones within the eye needed to see all Colour.

▸ There are three types of CVD:
   1. *Protanopia* is the lack of long-wave cones (red weak).
   2. *Deuteranopia* is the lack of medium-wave cones (green weak).
   3. *Tritanopia* is the lack of short-wave cones (blue). (This is very rare, affecting less than 0.5 percent of the population.)
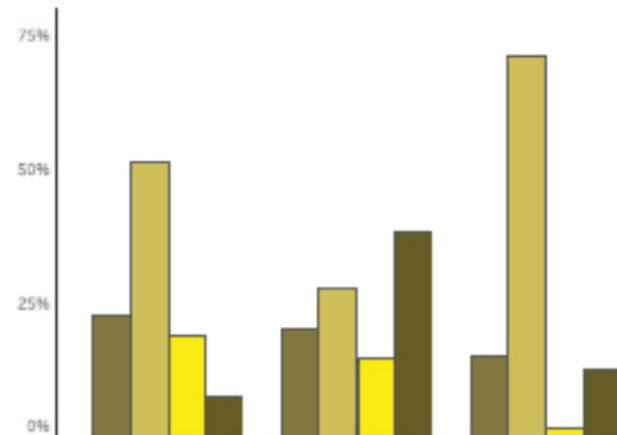
CVD- poor choice of colour!
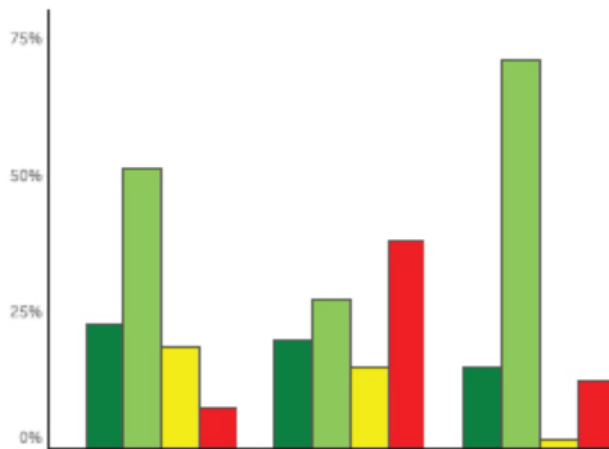
Protanopia simulation

Colour-Blind Friendly – blue/orange

Color-blind-Friendly Blue and Orange

Protanopia Simulation

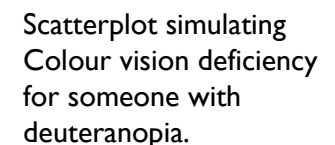# Deuteranopia Simulation
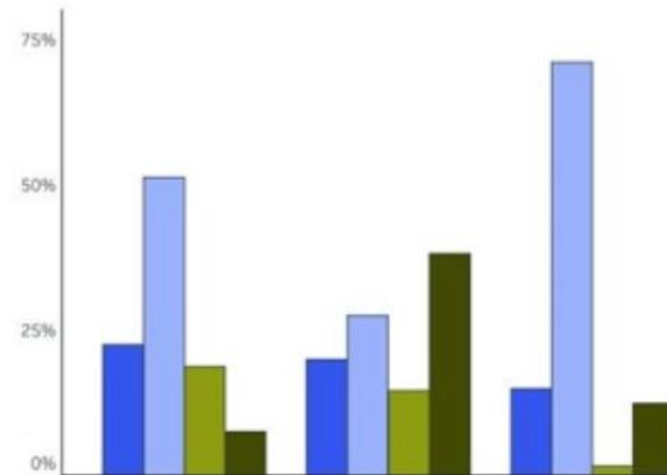
▸ Shows another scatterplot, this time using blue, purple, magenta, and gray.
When applying deuteranopia simulation, the dots in the scatterplot appear to
be a very similar Colour of gray.

Scatterplot simulating
Colour vision deficiency
for someone with
deuteranopia.

Nussbaumer, K. (2015). Storytelling with Data: A Data Visualisation Guide for Business Professionals

CVD Resources:

▸ If Colour is used to encode data and it's necessary for readers to distinguish among Colours to understand the visualization, then consider using Colour-blind-friendly palettes.

▸ Here are a few resources that you can use to simulate the various types of CVD for your own visualizations:

   ▸ **Adobe Illustrator CC.** This program offers a built-in CVD simulation in the View menu under Proof Setup.

   ▸ **Chromatic Vision Simulator (free).** Kazunori Asada's superb website allows users to upload images and simulate how they would appear to people with different form of CVD. See http://asada.tukusi.ne.jp/webCVS/

   ▸ **NoCoffee vision simulator (free).** This free simulator for the Chrome browser allows users to simulate websites and images directly from the browser.

The 7 Best Data Visualisation Tools For 2018
by Brendan Marr

- **Microsoft Power BI -** PowerBI is an all-in-one BI and analytics platform

- **Tableau** is often considered the gold-standard of data visualisation tools

- **QlikView** is another very popular option for building and sharing visualisations based on any data used by an organization

- **Sisense** is another end-to-end analytics solution with a powerful suite of visualisation tools.

- **FusionCharts** enables the creation of richly interactive JavaScript-based charts

- **Plot.ly** is popular with prog lang like R and Python

- **Carto** is specifically focused on creating graphics which take the form of maps

Resources:

- "Three Threes" by TDWI

- Tableau Dashboards – some guidelines

- Webinar: The Big Book of Dashboards By Steve Wexler, Jeffery Shaffer and Andy Cotgreave

- Qlik – Choosing Charts