42585/42577 - Introduction to Business Analytics

Introduction and Descriptive Analytics

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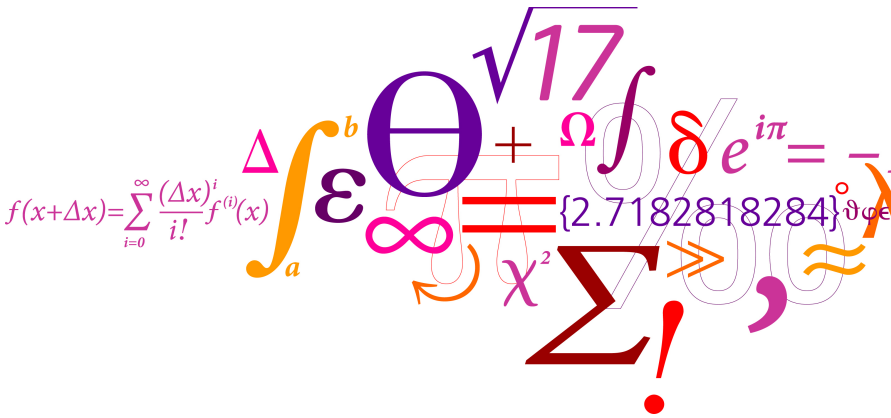

DTU Management Engineering
Department of Management Engineering

Agenda

1. Introduction to course 42585/42577
2. Business Analytics introduction
3. Descriptive Analytics: Data Visualisation
   - Some good chart types
   - Good vs. bad visualisations
   - Today's exercise

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Course aim

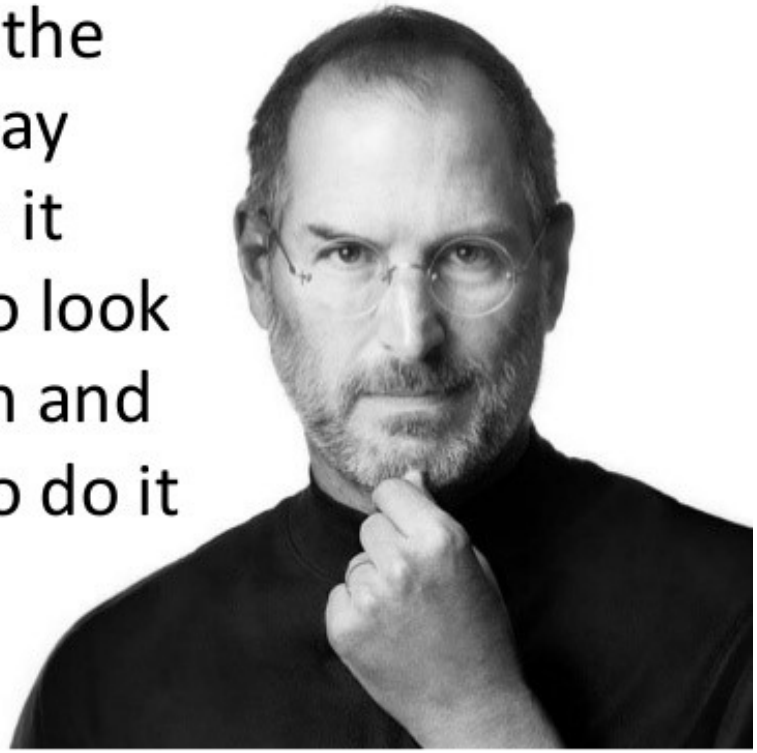
- Provide insight into how real business problems can be solved using business analytics tools

- Fill a few gaps in your analytics tool box and show you how to apply these new tools

Business Analytics (BA) and creativity

"You can't look at the competition and say you're going to do it better. You have to look at the competition and say you're going to do it differently."

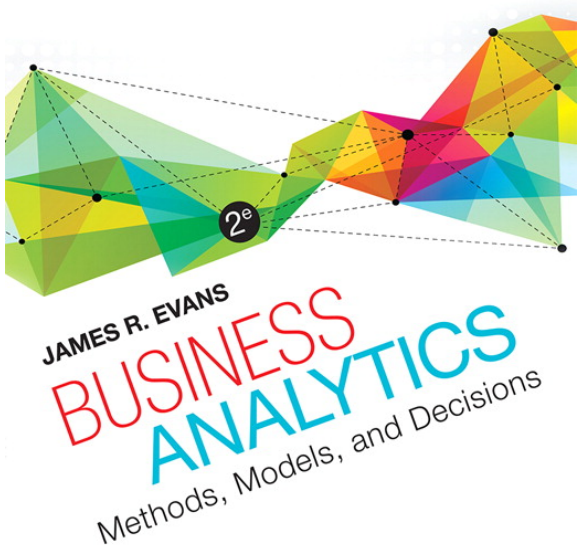
- *Steve Jobs*

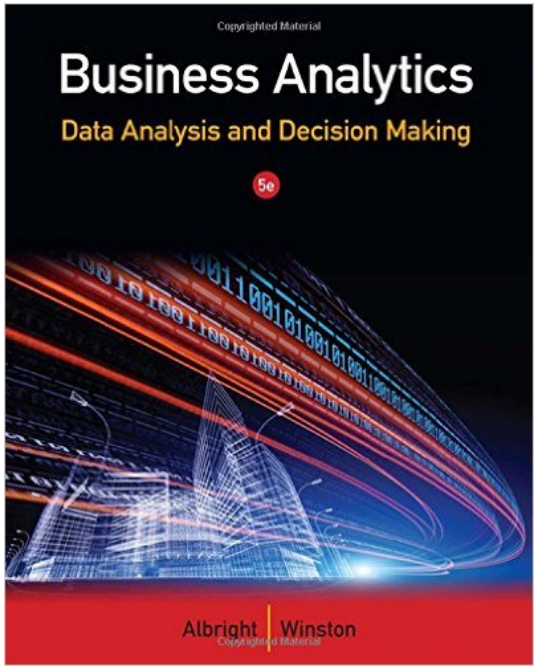


BA is really only limited by the imagination of those who apply it

Course material

- Various book extractions, notes, articles etc. on Inside
- Among others extractions from these two books:





- Course plan on Inside will list curriulum for all lectures

Mandatory project

- Must be done in groups of 3-5 students
- Will be handed out at the lecture March 28 (also on Inside)
- Deadline for handing in: May 6 at 9:00 a.m.
- Part one:
  - Tests ability to apply theoretical methods introduced during course
  - Five questions to be divided between group members
  - Each student has main responsibility for at least one method question
- Part two:
  - Tests ability to analyse a business case and make recommendations on the use of analytics for a specific company
  - Must be done as group work, i.e. all group members share responsibility for this part

Exam and assessment

- Exam:
  - Individual four hours written exam on May 16
  - All aids allowed
  - Part one: tests ability to apply theoretical methods introduced during course
  - Part two: tests ability to analyse a business case and make recommendations on the use of analytics for a specific company
- Final assessment:
  - Overall evaluation of performance in project and exam

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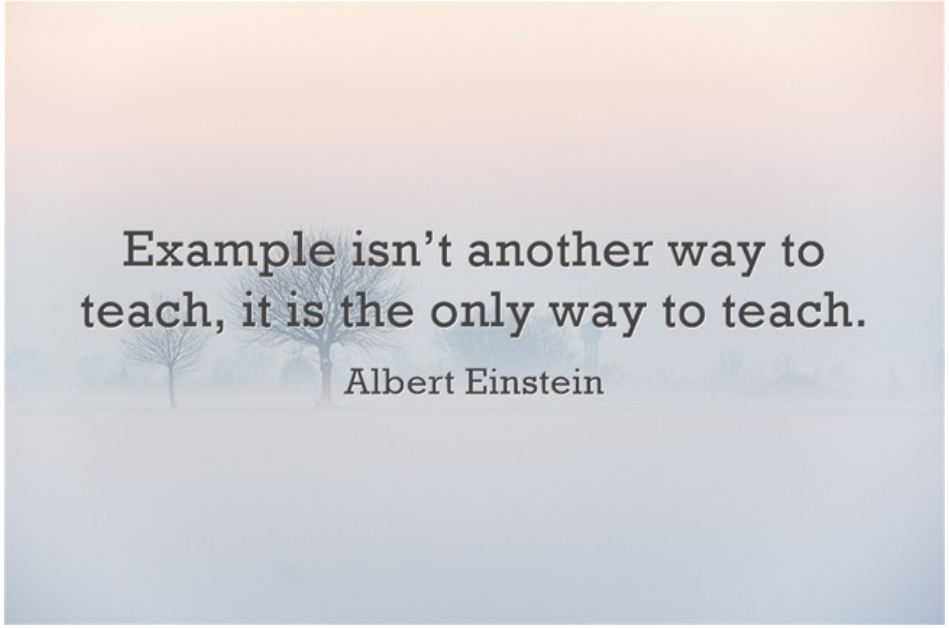
Business Analytics introduction

What is Business Analytics (BA) really?

- What does BA (according to you) cover? (menti.com)

BA - What is it really?



- Two successful IBM cases:
  - Denihan
  - Cincinatti Zoo (also in Evans extraction)

Why Business Analytics?

Trust me, 20 years of management experience

- Globalisation/Internet has increased competition
- Digitalisation (data everywhere) enables analytics

What is BA (formally)?

- Different people/organisations have different perceptions of BA

Wikipedia:

"BA refers to the **skills, technologies, practices for continuous iterative exploration and investigation of past business performance to gain insight and drive business planning**.[1] BA focuses on **developing new insights and understanding of business performance based on data and statistical methods.**"

What is BA (formally)? (continued)

SAS:

"Enabling faster, more accurate **data-driven decisions**: To lead your organization in today's challenging economic climate, you need **fact-based answers** that you and others can believe in. Traditional approaches to decision support have not yielded optimal results."

What is BA (formally)? (continued)

IBM:

"BA helps your organization **recognize subtle trends and patterns so you can anticipate and shape events and improve outcomes**. Not only can you drive more top-line growth and control costs, you can also **identify risks** that could derail your plans - and take **timely corrective action.**"

What is BA (formally)? (continued)

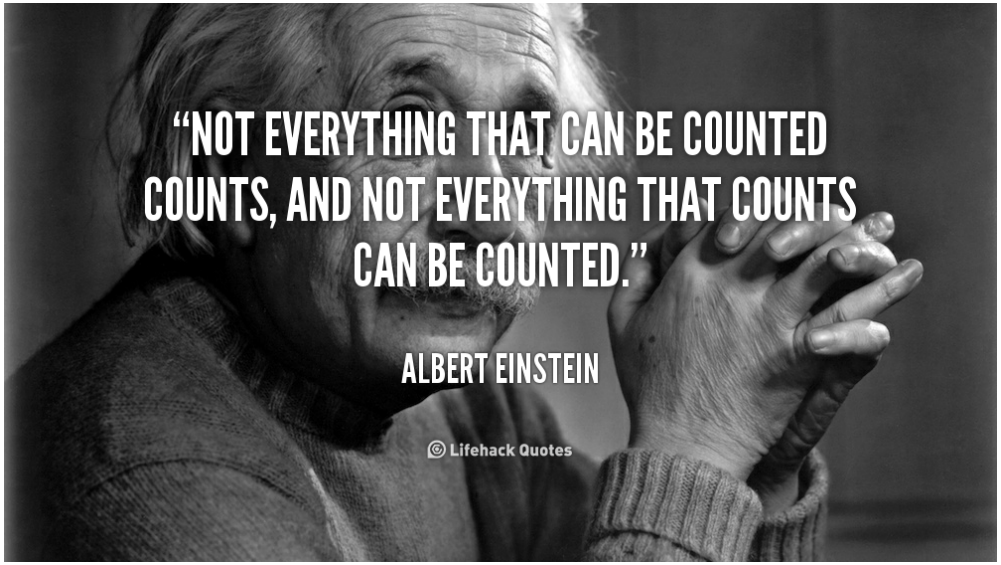
INFORMS:

"In a nutshell, analytics is the scientific process of **transforming data into insight for making better decisions**... Analytics is unique. It's best of breed, employing **highly developed methods** practiced by specially trained professionals. It's powerful, using **advanced tools and technologies** to provide analytical power that **no ordinary software or spreadsheet can deliver out of the box**. And it's **tailored to you**, because analytics offers you the ability to define **your specific challenge** in ways that **make the most of your data** and **uncover your most beneficial options.**"

No Business Analytics without data

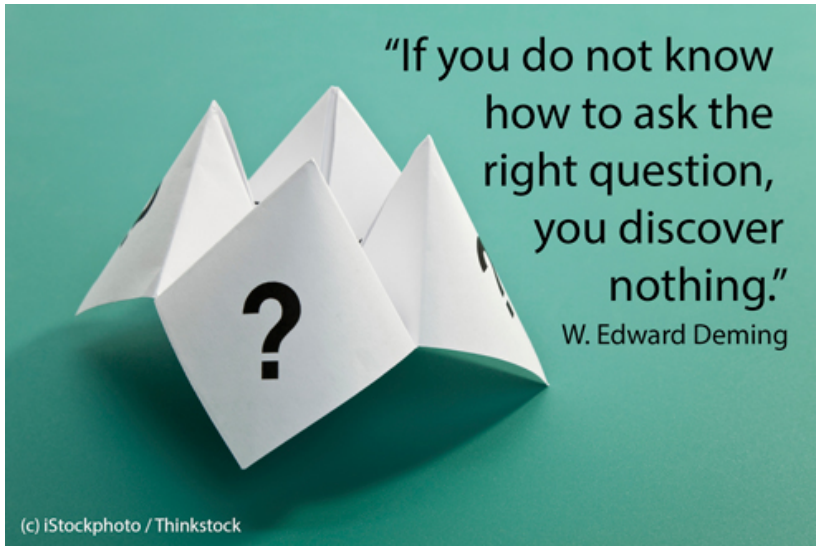
"If we have data, let's look at data. If all we have are opinions, let's go with mine."
- Jim Barksdale, CEO Netscape

Business Analytics high level outline

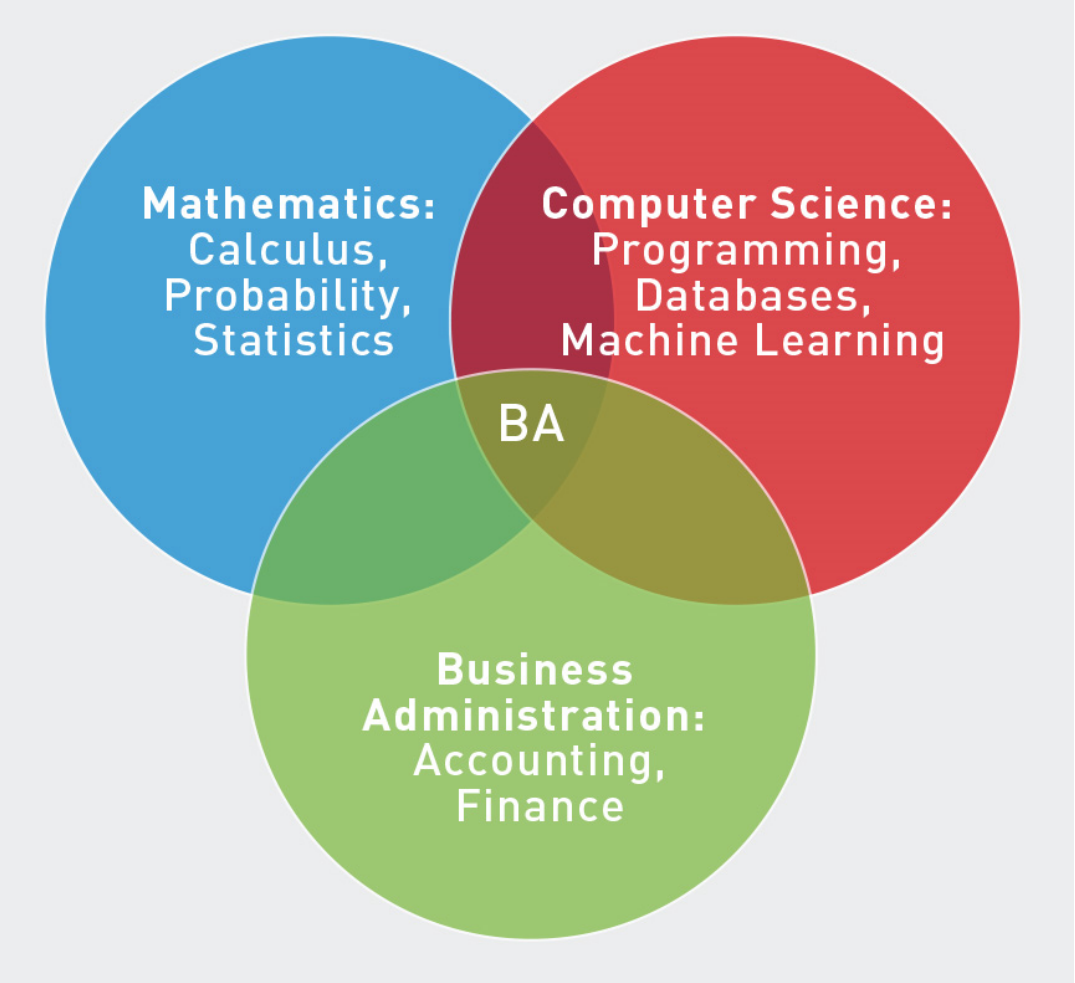


Business Analytics high level outline

Problem formulation → Data → Info → Insight → Action



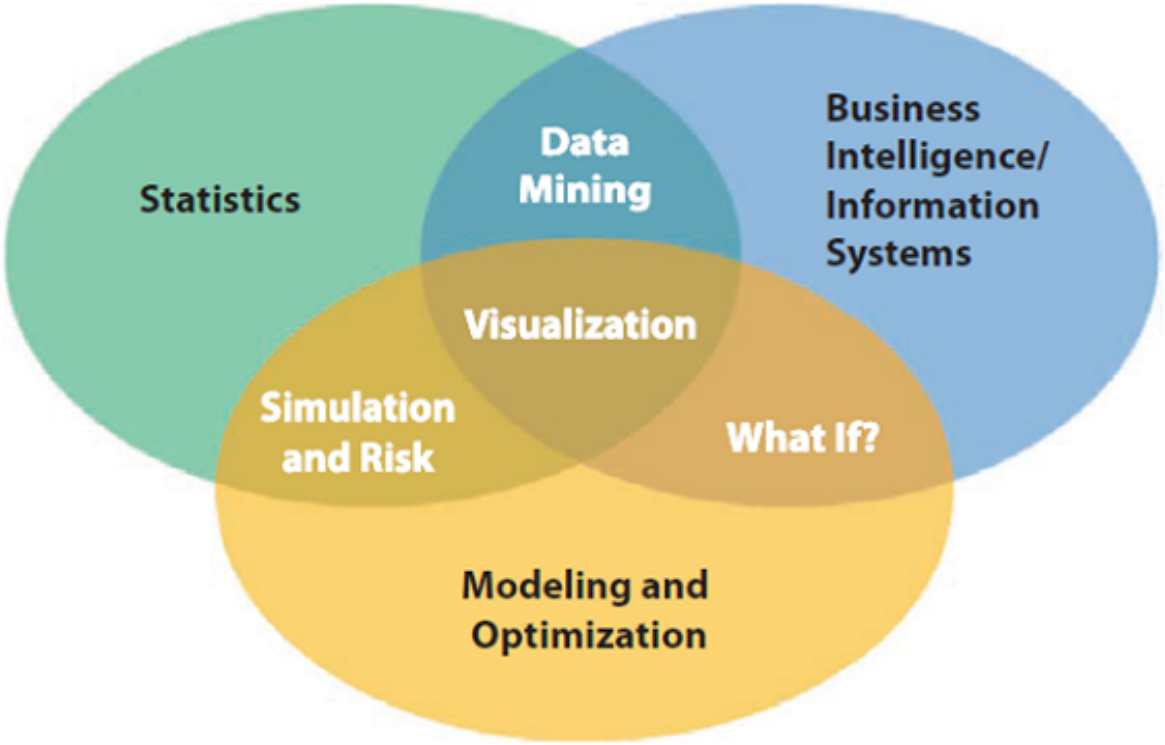
The Business Analytics area



Development of BA

- **Front 1: Introduction and development of computers**
  - Ability to gather, store, analyse and report data in new ways
  - This is called Business Intelligence (BI) (or Information Systems)
    - ★ How many units of each product did we sell last month?
    - ★ Simple rules to detect exception automatically (e.g. transactions above some threshold)
- **Front 2: Advanced statistics** (driven by massive data growth)
  - Where BI summarises data, stats allows deeper understanding, e.g. finds unknown relationships
  - Advanced: regression, forecasting and data mining
- **Front 3: Operations Research (OR)** (Management Science (MS))

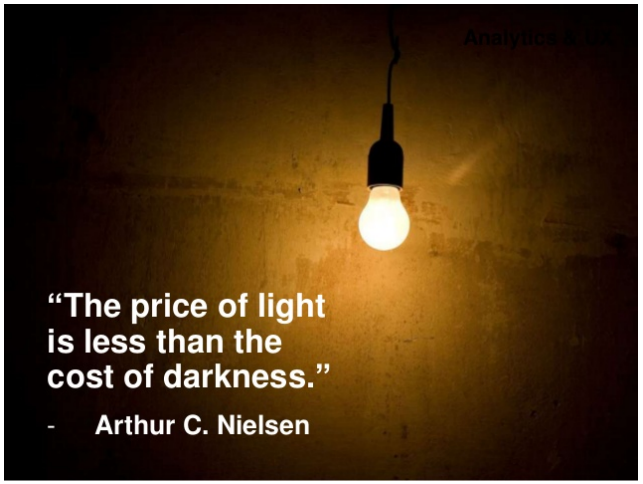
Modern BA



- Core areas are traditional and well known
- Special part lies in intersections
- Visualisation part of what makes BA unique

BA challenges

- Lack of understanding of how analytics is used
- Lack of analytical skills
- Access to good data and information sharing
- Competing business priorities
- Lack of understanding of advantages vs. cost of analytics



BA components

- BA starts by gathering, organising and manipulating data
  - Initial data validation is essential
- Thereafter supported by 3 larger components:
  - Descriptive/Reporting Analytics: What happened?
  - Predictive Analytics: What will happen?
  - Prescriptive Analytics: What should we do?

Descriptive Analytics - What happened?

- Measure and understand previous and current performance
- Most used and best understood type of analytics
- Statistical analysis (explanatory modeling) and data/text mining
- Analyse, manipulate, summarise and interpret data
  - How much did we sell/earn?
  - How many and what type of complaints did we receive?
  - Classification of customers in different segments for marketing
  - Identify patterns and trends in data
- Communicate data through visualisation techniques

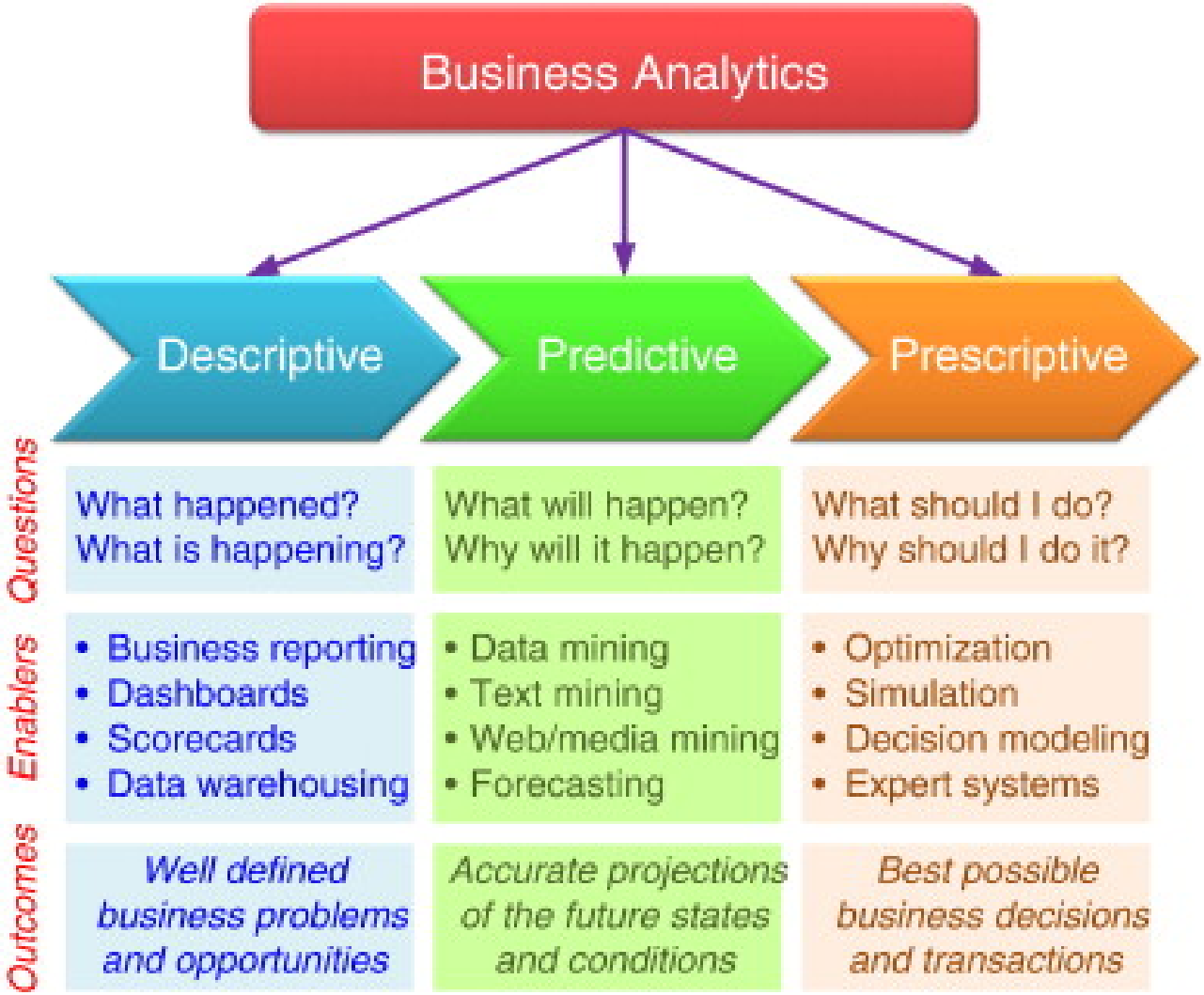
Predictive Analytics - What will happen?

- Seek to predict the future
- Time series analysis, regression, data mining etc.
- Extrapolate relationships and patterns from historical data into the future
  - How will different customer segments react to a commercial?
  - How will the price of a specific commodity develop?
  - How will demand for a specific product be next season?
- Opportunity to predict risk and find new realationships in data
  - What will happen if demand drops by 10%?
  - Which customers will default on their loan?
  - Which customers will be most profitable?

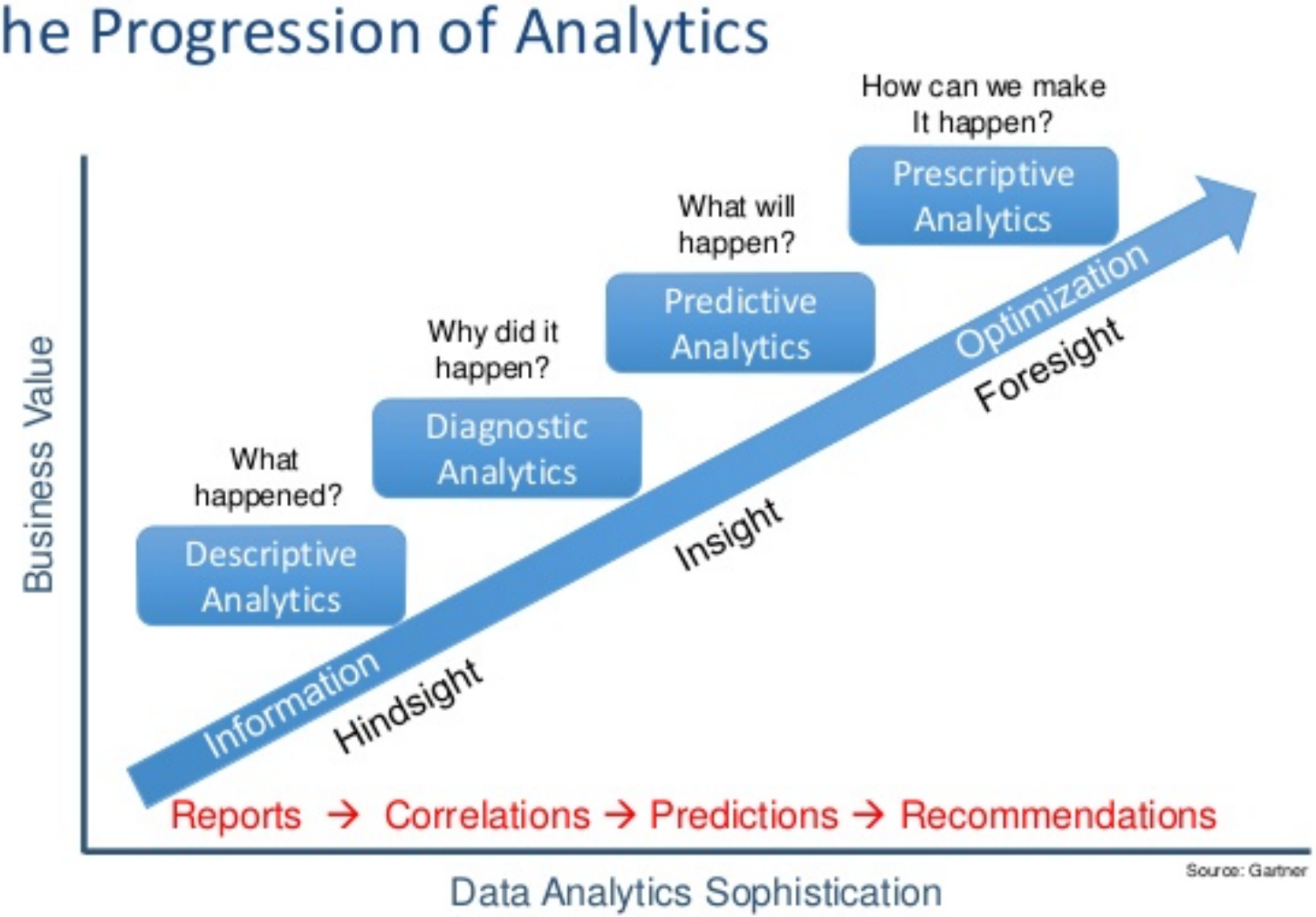
Prescriptive Analytics - What should we do?

- Seek recommendation for future action
- Optimisation (OR), some simulation, decision trees etc.
  - How much should we produce in order to maximise profit?
  - What commercial strategy will maximise our profit?
  - What personel should work at which time to minimise costs?

BA components



BA components



Course plan

Week	Content	Focus
1	Intro to BA, descriptive analytics	Tools + Applied
2	Descriptive Analytics	Tools + Applied
3	Descriptive/Predictive Analytics	Applied
4	Predictive Analytics	Tools + Applied
5	Predictive Analytics	Tools + Applied (TBD)
6	Predictive Analytics	Applied
7	Predictive/Prescriptive	Tools + Applied
8	Prescriptive Analytics	Tools + Applied
9	Prescriptive Analytics	Tools + Applied
10	Prescriptive Analytics	Tools + Applied
11-13	Project, Guest, Exam prep	Applied

New insight into Denihan and Zoo cases?

- What data, which information and insight, and what action?
- Which subject areas and tools?
- What outcome?
- What types of analytics (descriptive/predictive/prescriptive)?

SO much BA software, e.g.

- Introducing course "software buddies"

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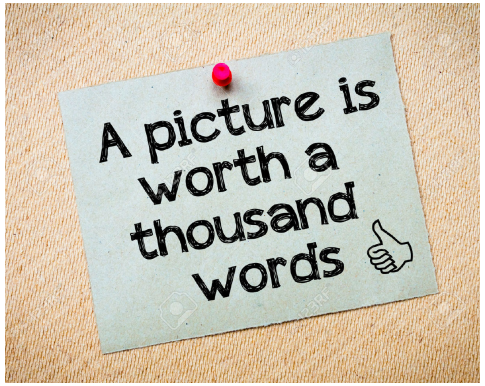
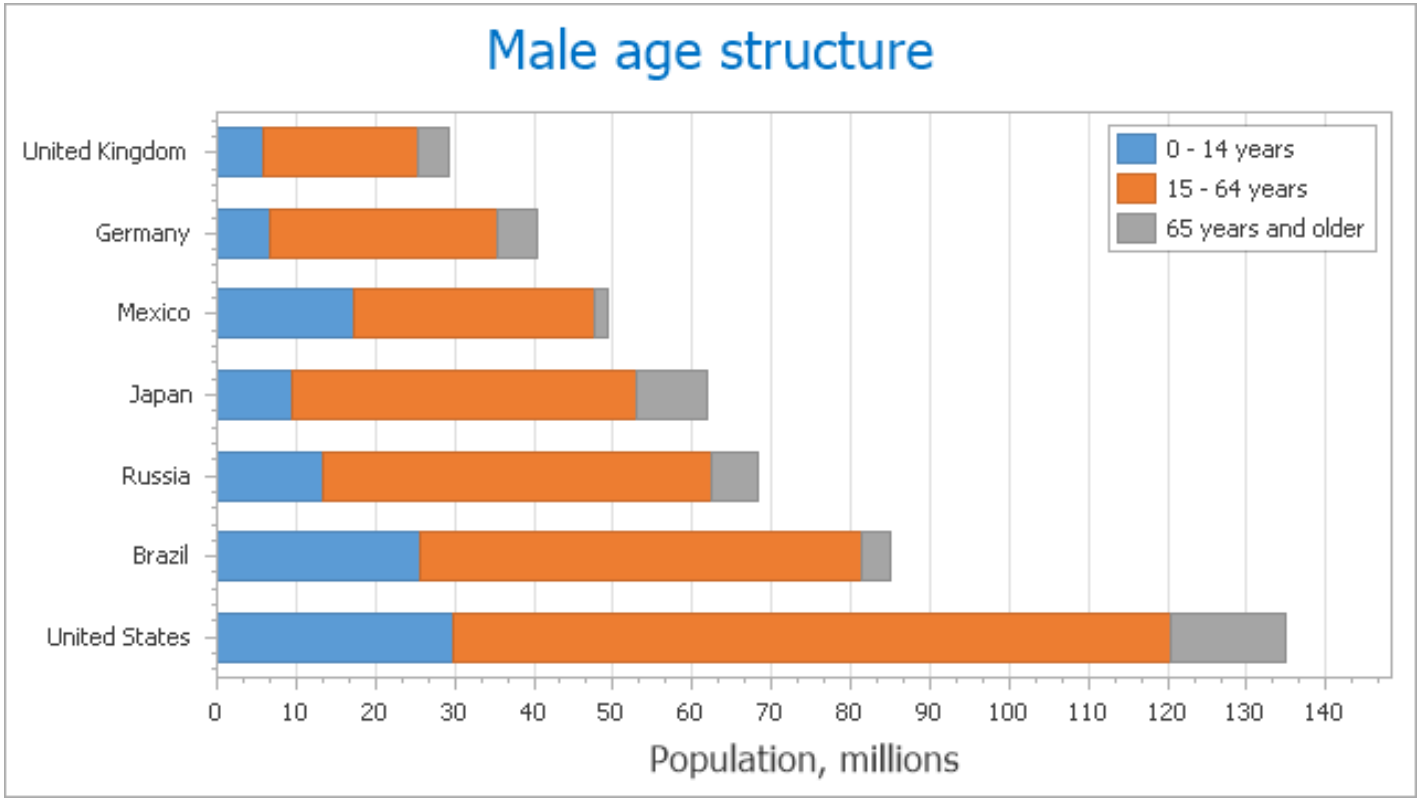
Data Visualisation



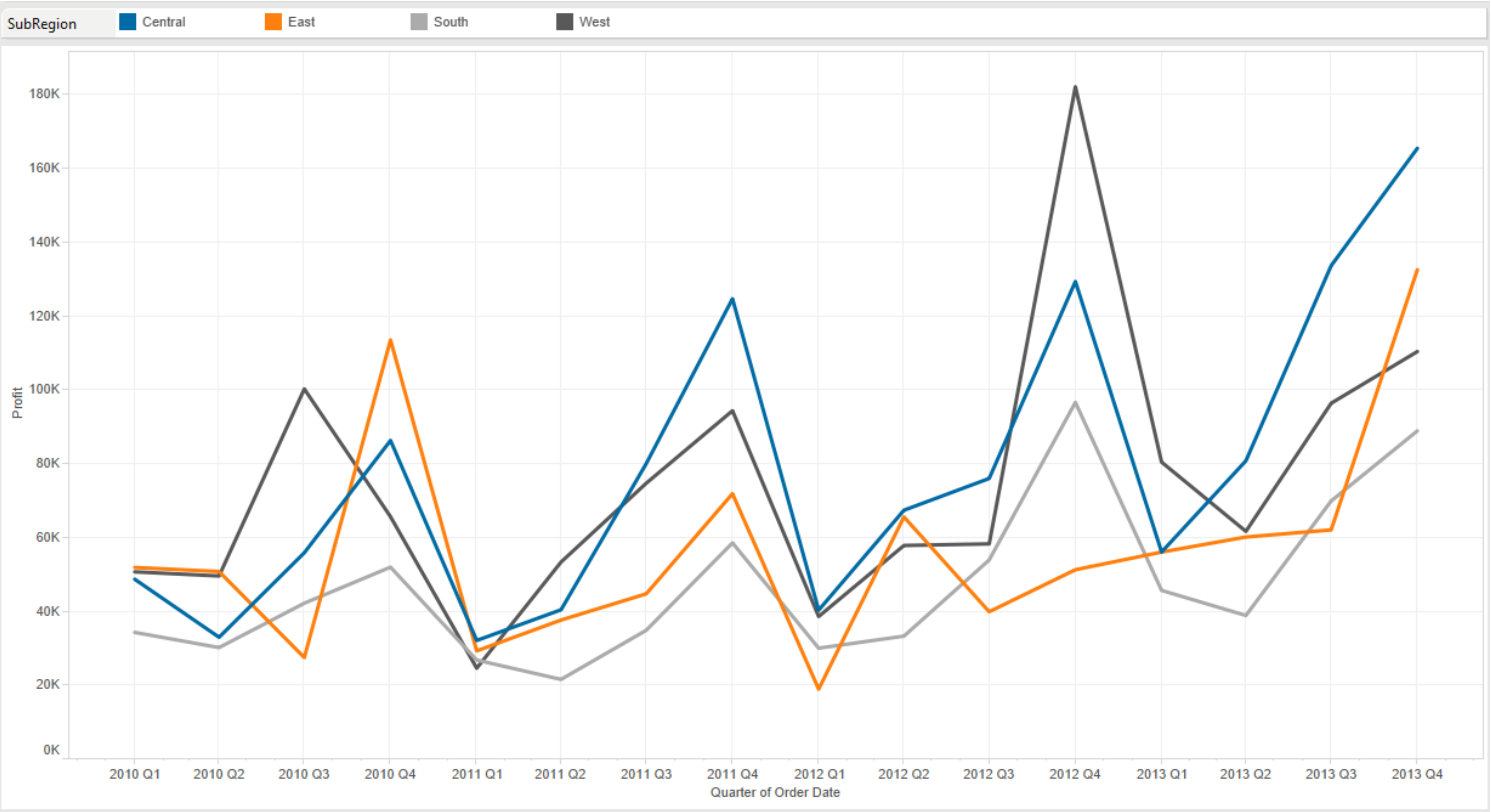
- Visualisation makes it easier to identify trends, patterns, find outliers and compare groups
- Data visualisation is used for both exploring, understanding and communicating data
- Nice examples on www.census.gov/dataviz/

Bar chart



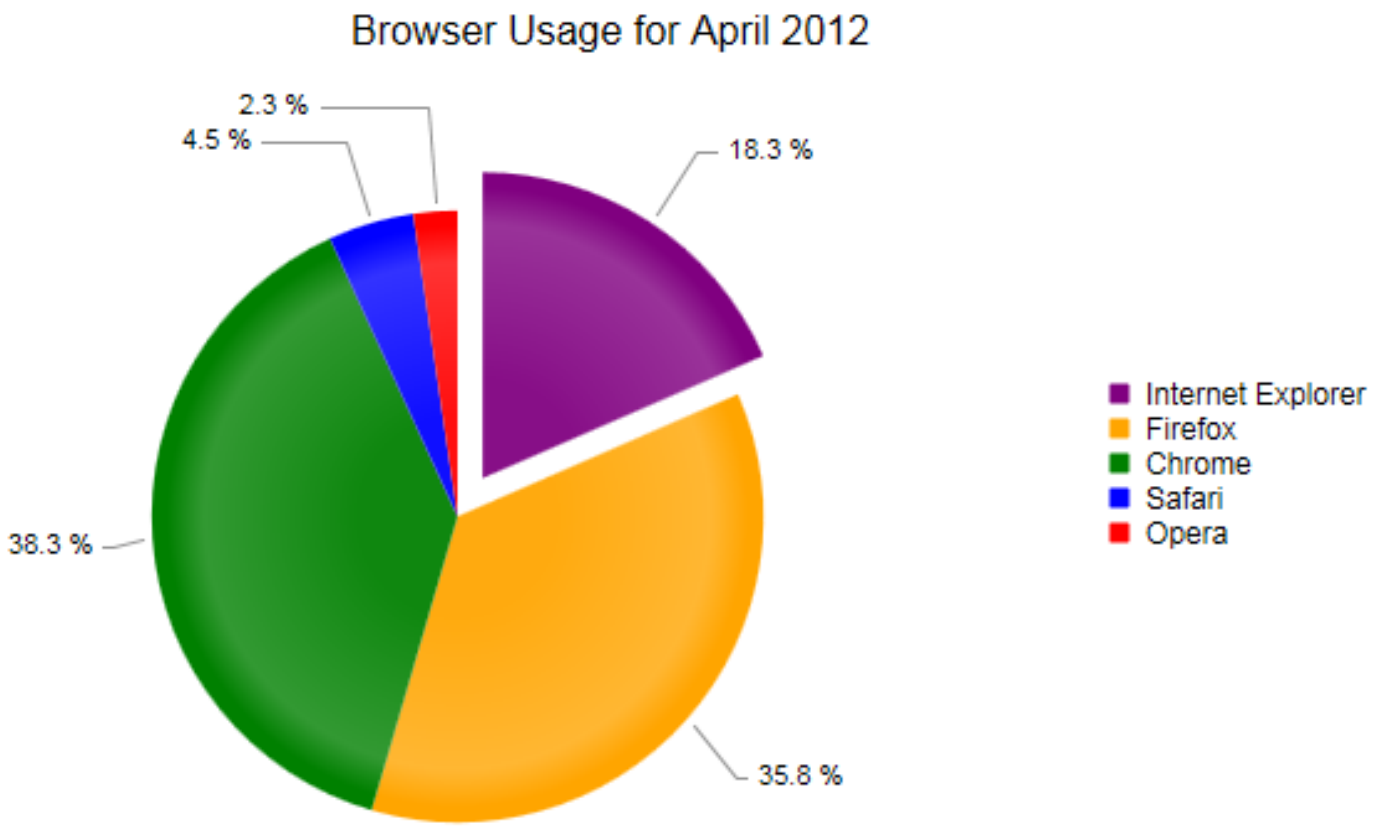
- Can be horisontal or vertical (column chart)
- Can also be stacked to show more dimension (as above)
- Often used to compare data across categories

Line chart



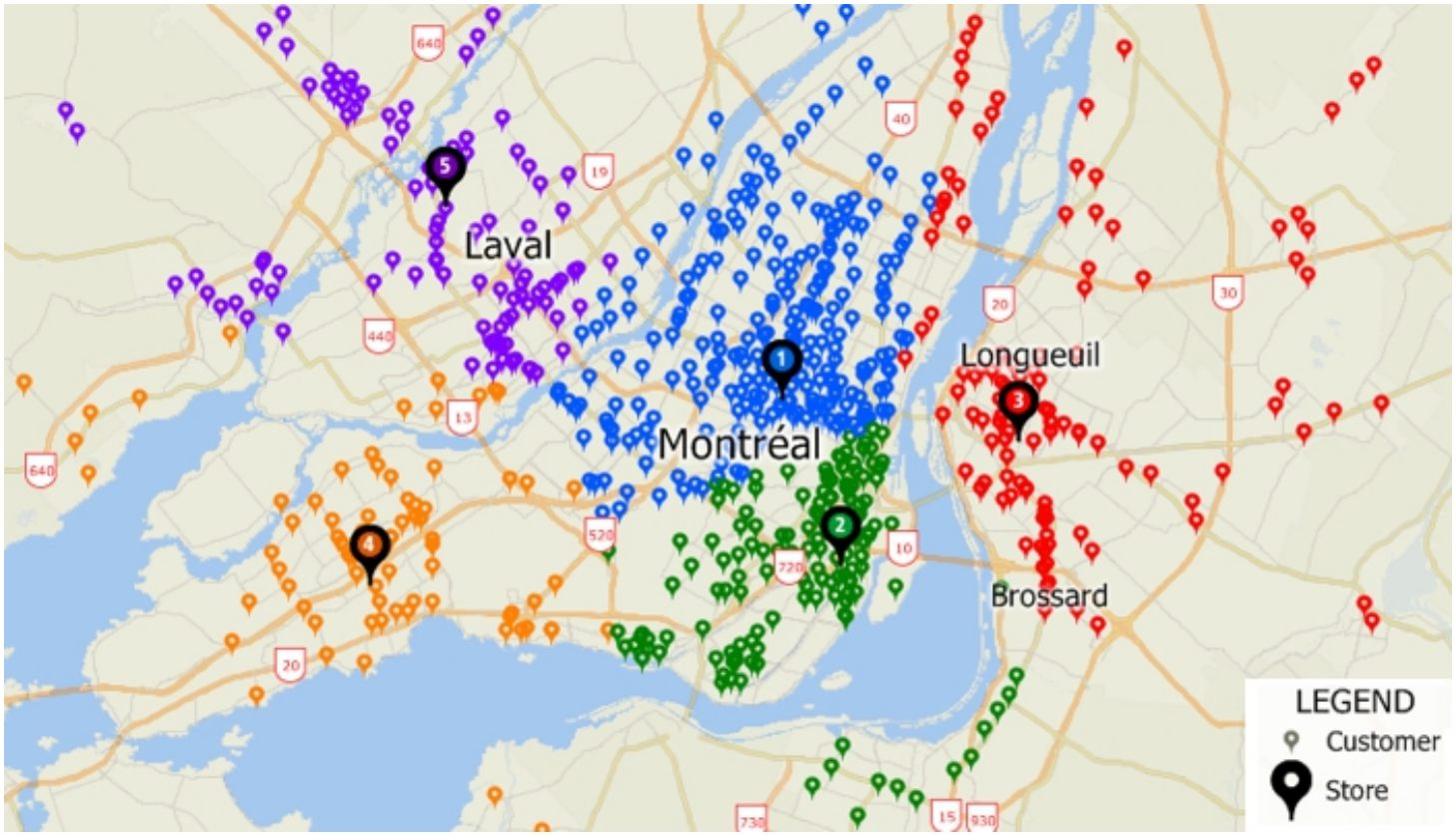
- Shows the relationship between two variables
- Often used for time series data

Pie chart



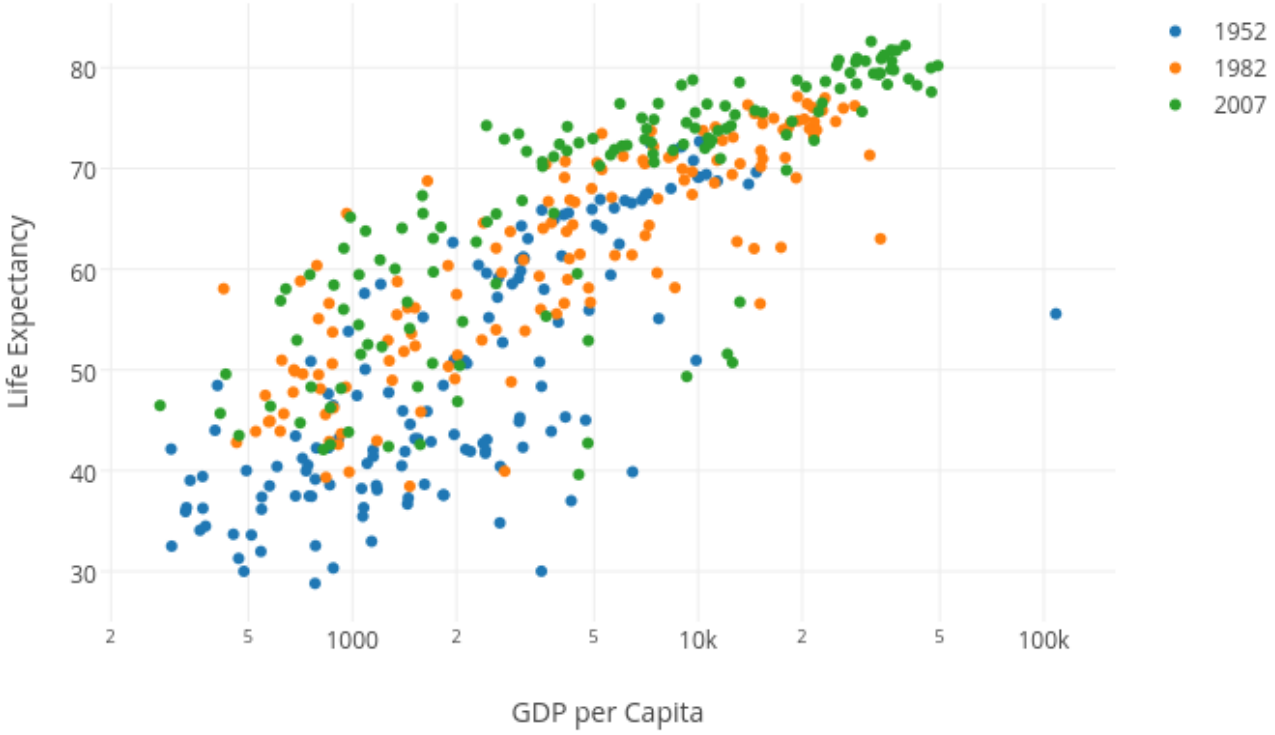
- Should only be used to illustrate relative proportions
- If more than "4" categories, consider bar chart

(Geographic) map



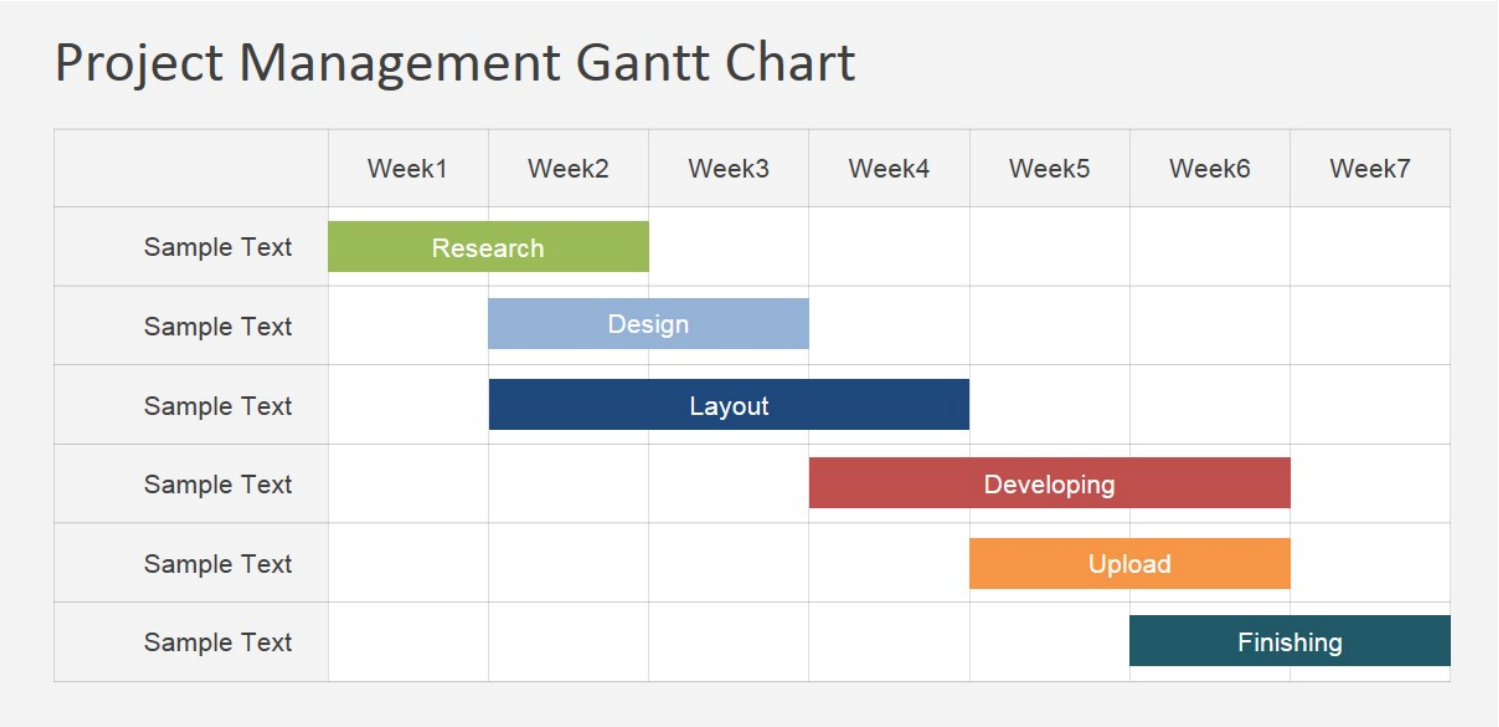
- Maps are often used when data includes locations
- Maps are often combined with other graphs

Scatter plot



- Often used to explore relationship between 2 or 3 variables
- Effective for exploring trends, concentrations and outliers
- Trend lines are often drawn in the plot

Gantt chart

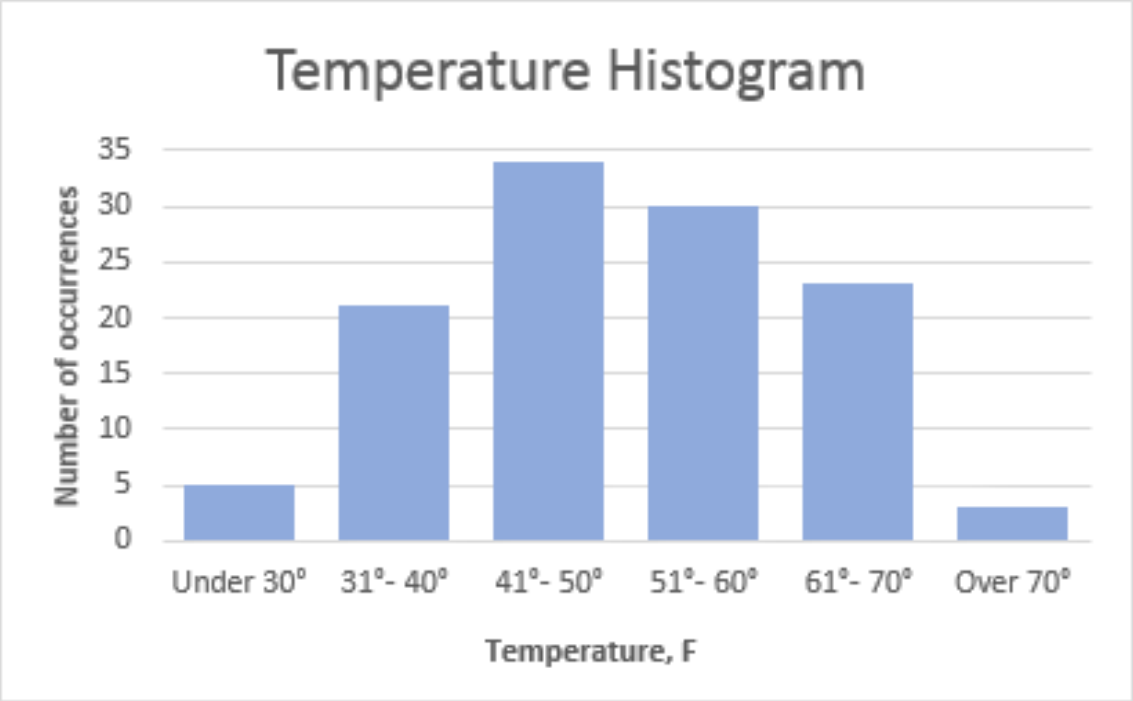


- Special case of (horisontal) bar chart
- Used to illustrate duration and overlaps for project tasks

Bubble chart

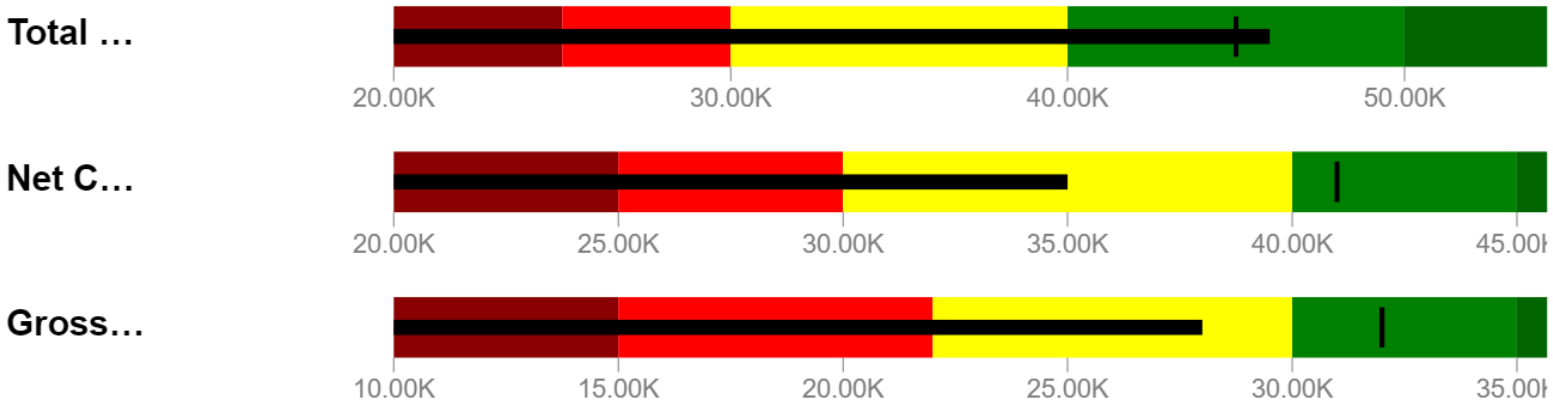
- Often just fancy scatter plots
- Size of data points (bubbles) allow extra dimension

Histogram



- Form of (vertical) bar chart
- Shows frequency of values in data
- Shows the distribution of data

Bullet graph



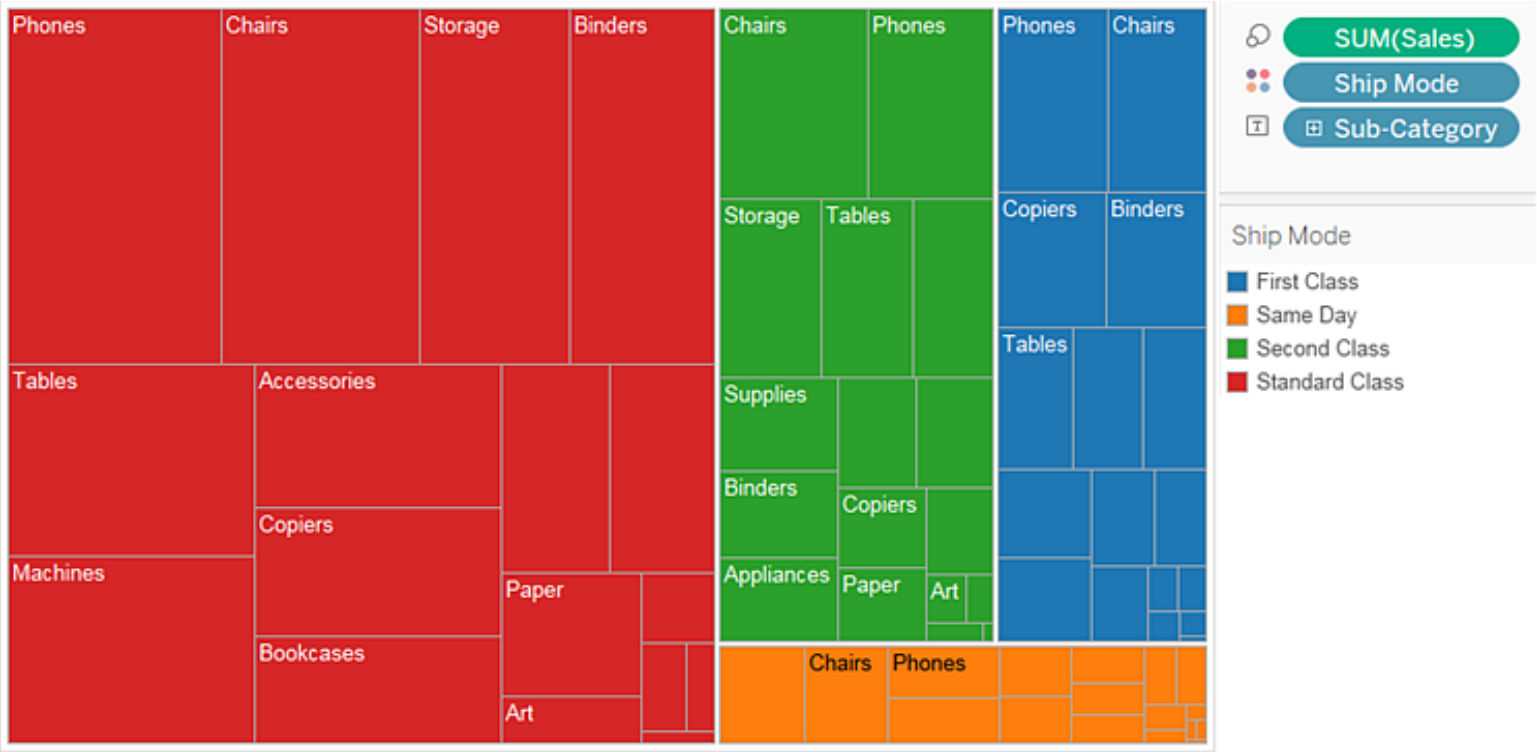
- Variation of bar chart
- Often shows progress towards goal

Heat map and highlight table

Keyword	Avg. Month	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15
holidays USA	480	480	480	590	390	390	480	480	390	390	320	590	590
holidays Spain	1900	2400	2400	2900	2900	2400	1900	1000	1000	1000	720	2400	1900
holidays Greece	1600	1900	1900	2400	2900	2400	1600	880	590	480	590	2400	1900
holidays Turkey	1600	2400	2400	1900	1900	1900	1900	1300	590	390	590	1600	1300
holidays Italy	1300	1600	1600	1900	1600	1300	1300	720	720	590	590	1900	1600
holidays Croatia	1300	1600	1900	1900	2400	1900	1600	720	590	480	480	2400	1600
holidays Portugal	1300	1600	1600	1900	1600	1600	1300	720	590	480	590	1900	1300
holidays Malta	1300	1600	1300	1300	1300	1300	1300	1300	880	720	720	1900	1600
holidays Egypt	1300	1300	1000	1000	1000	1300	1300	1000	1000	880	1000	2400	1600
holidays Cuba	1000	1300	880	880	880	880	880	880	880	720	1000	2900	1900
holidays France	720	720	880	1000	1000	1000	720	390	320	260	390	880	590
holidays Cyprus	1000	1300	1300	1300	1300	1300	1600	1000	720	480	390	1300	1000
holidays Tunisia	720	880	880	880	880	880	880	720	390	260	260	720	720
holidays South Africa	260	320	320	260	210	260	320	210	210	210	210	320	260
holidays Morocco	590	880	720	720	590	590	720	590	480	390	390	880	590
holidays Mauritius	590	720	480	590	480	480	590	480	390	390	390	880	590
holidays Canary Islands	590	590	390	480	390	210	590	880	880	720	390	1300	880
holidays Japan	210	210	170	170	170	170	260	170	170	210	210	390	170
holidays Sri Lanka	320	320	320	390	260	260	260	390	390	260	320	590	390
holidays Corfu	390	480	480	590	590	590	480	210	170	110	140	720	480
holidays Iceland	390	390	320	320	320	390	320	320	390	390	320	590	390
holidays Austria	170	210	210	170	210	210	170	110	140	70	110	320	210
holidays China	90	70	110	90	90	90	90	110	140	90	70	110	140
holidays Greek Islands	320	320	480	590	590	590	260	140	70	50	70	320	260
holidays Switzerland	140	90	110	140	140	140	170	110	110	70	110	170	110
holidays Norway	170	170	140	170	170	170	140	110	110	140	140	260	170
holidays Belgium	50	40	40	70	70	50	50	30	40	40	20	70	30
holidays Montenegro	210	170	210	260	260	320	210	140	90	70	90	390	260

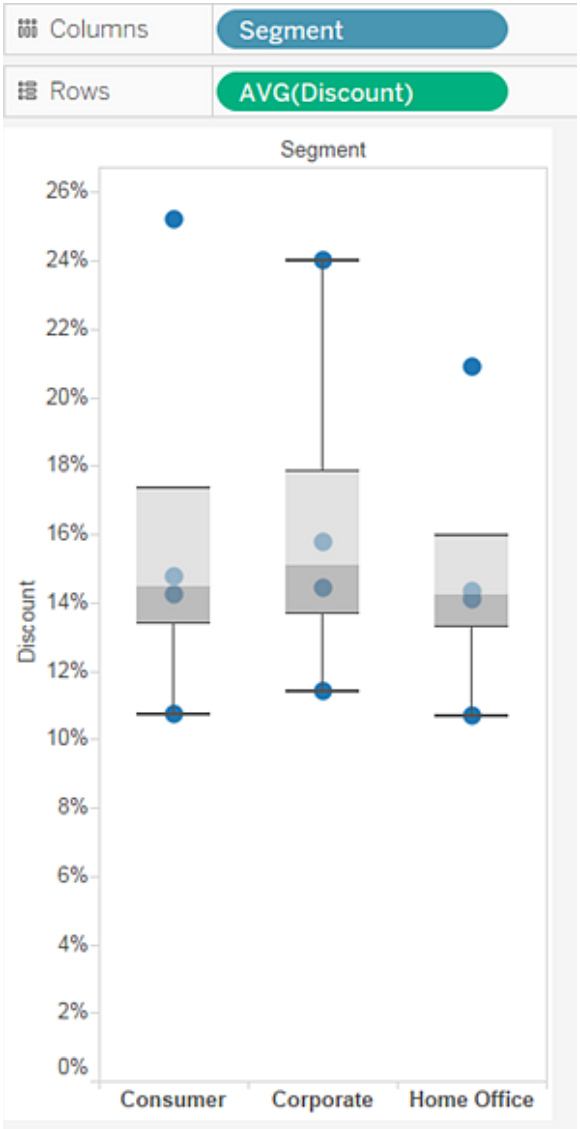
- Good for comparison of continous values across 2-3 categories
- Individual values in table are represented by color
  - How do we then compare across 3 categories?
- Highlight table also has a value in each table cell (as above)

Tree map



- Good for data with multiple levels of categorisation
- Color allows a further dimension (as above)
- Can be combined with bar chart

Finally: Boxplot

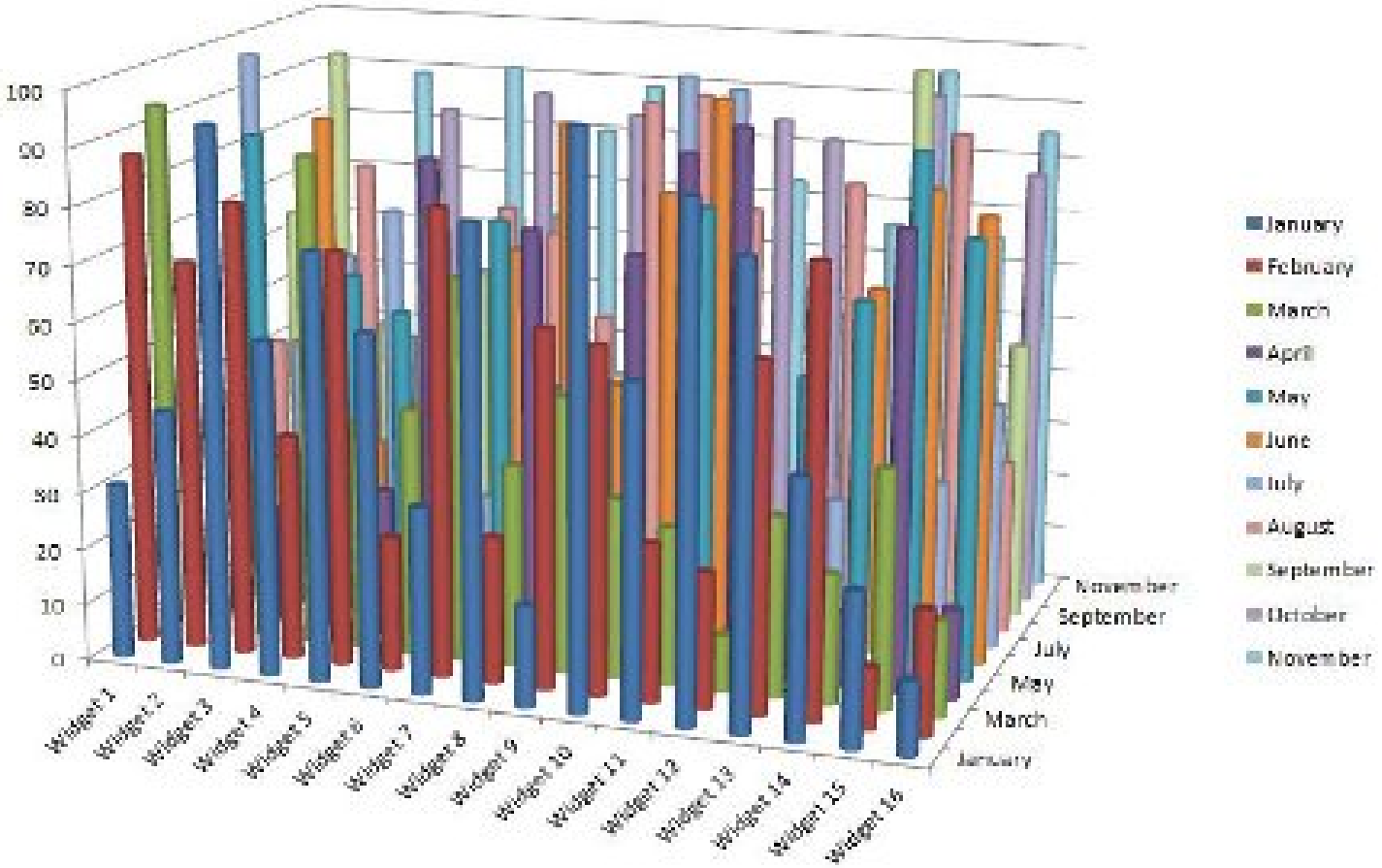


- Used to show (and compare) distributions of data (skewness, outliers etc.)
- Includes median and 1st and 3rd quartiles
- Whiskers show min and max data points (or other measure)
- Note: Candlestick chart not curriculum
- Lots of other charts (also not curriculum)
  - Tornado Chart
  - Gauge Chart (Speedometer)
  - Control Chart
  - Pareto Chart
  - etc.

Good and fancy visualisations

- Combinations, hybrids and animated versions are trending right now
- Lots of research in visualisation of more dimensions and larger amounts of data
- Remember: Less is often more; focus on end-user
- Be true to data and critical of own visualisations! Get feedback!
- "Power of examples" again (guidelines are in curriculum)
- Quick visualisations techniques: Color, size, direction and effects (e.g. blinking)

Good or bad visualisation?



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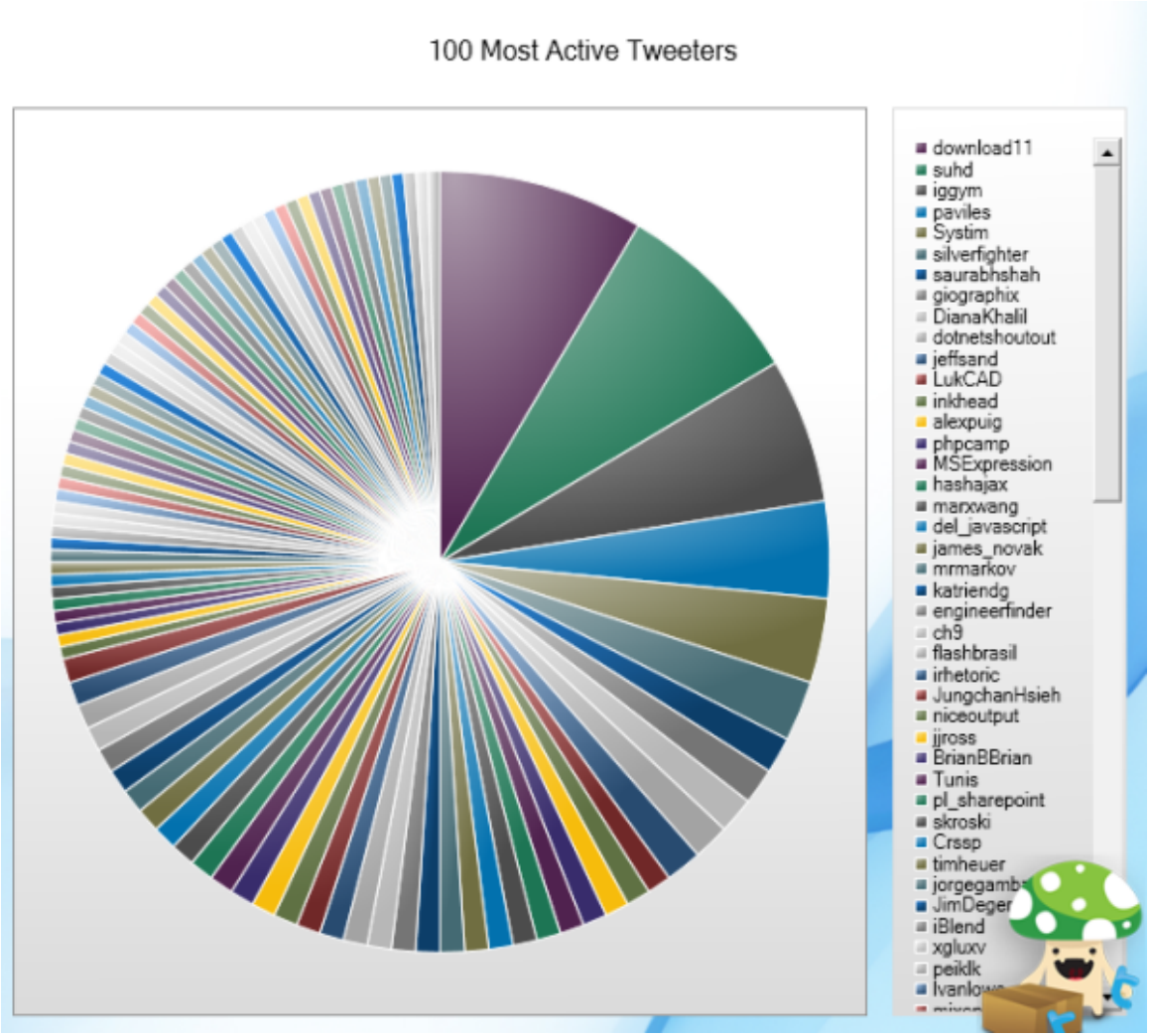

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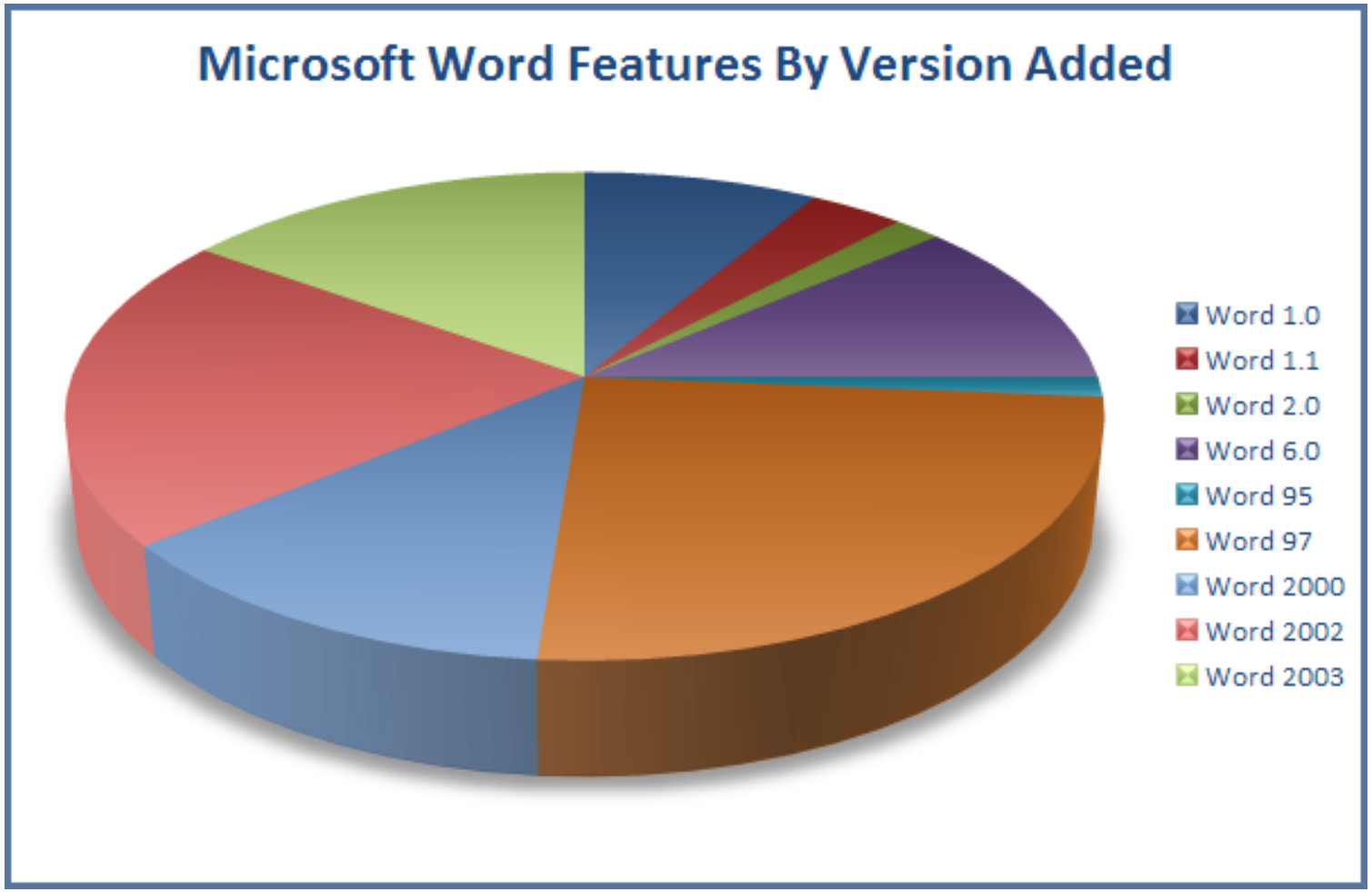

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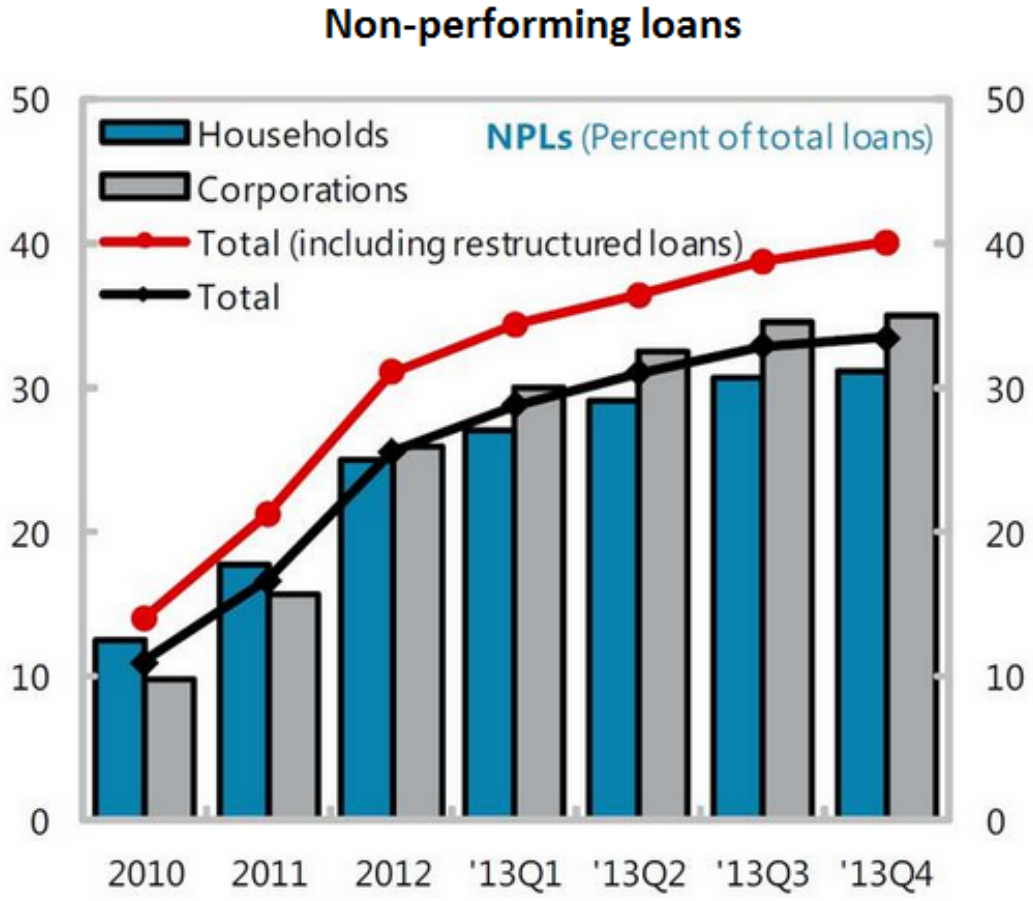
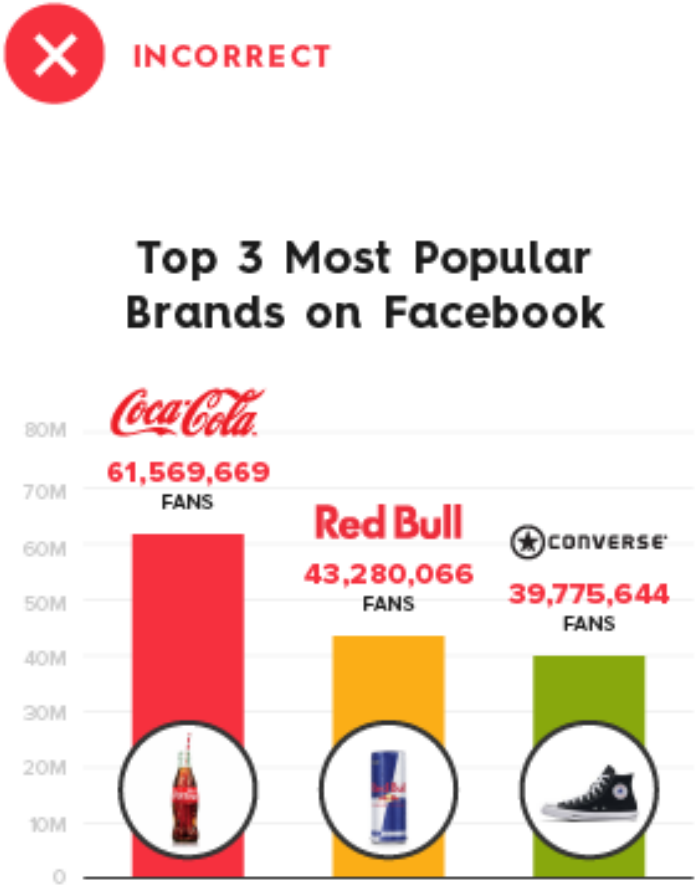
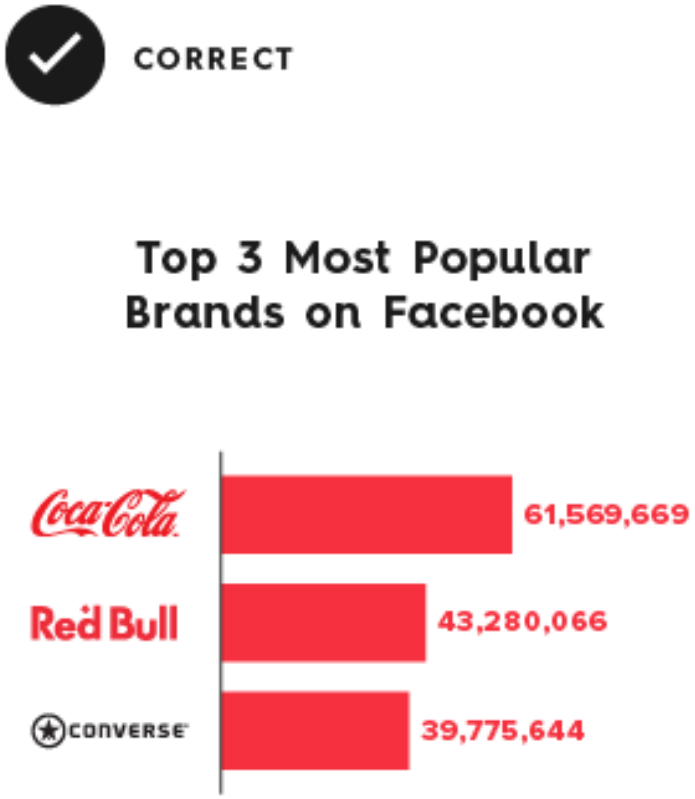


Good or bad visualisation?

Source: 25 Tips to Instantly Improve Your Data Visualization Design





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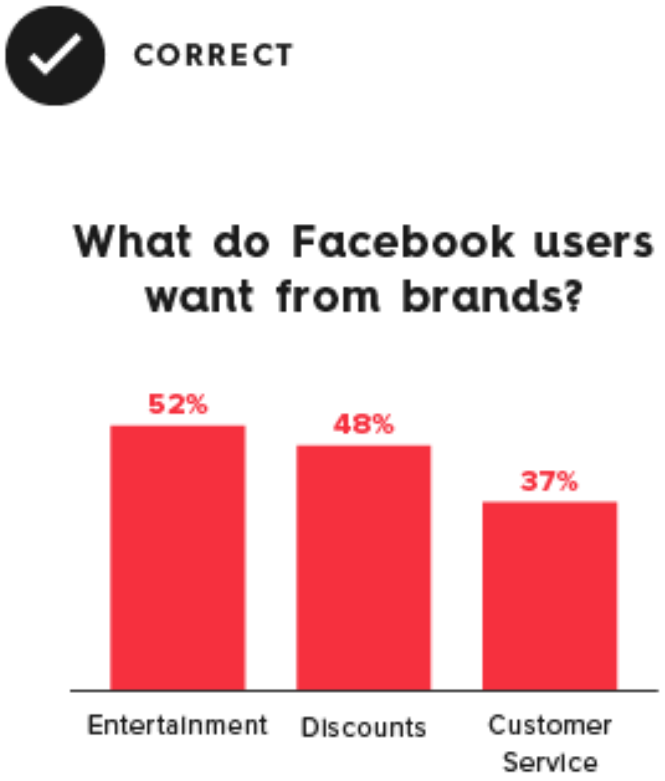
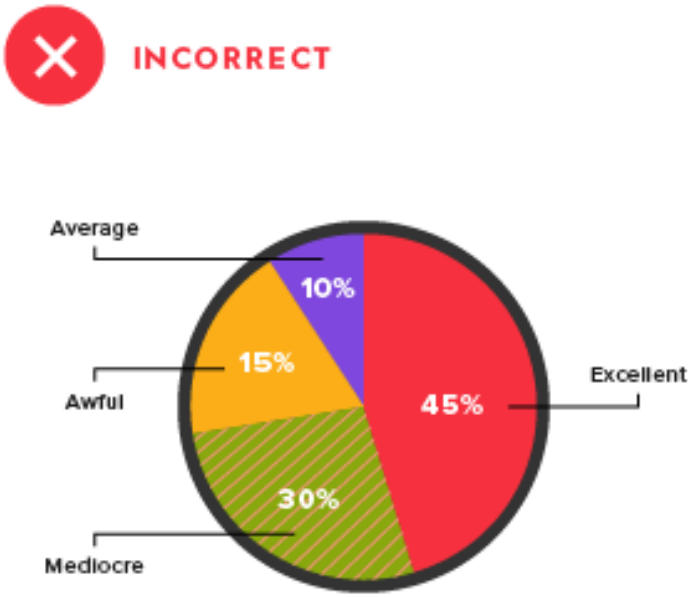
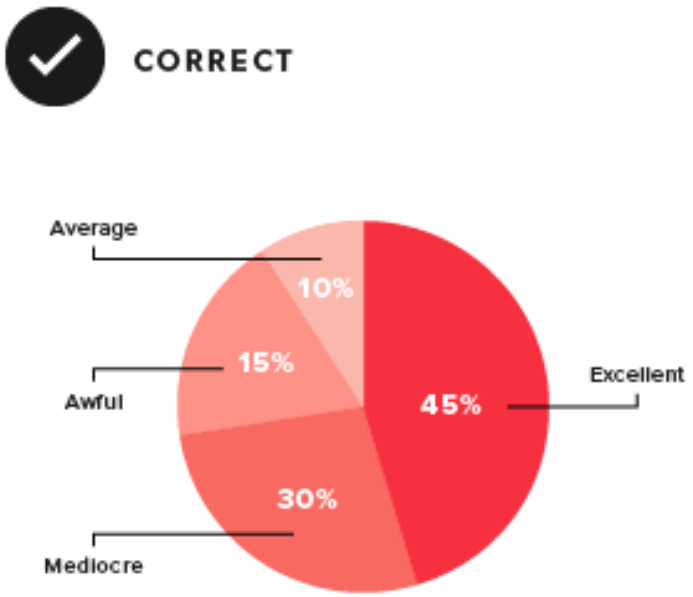
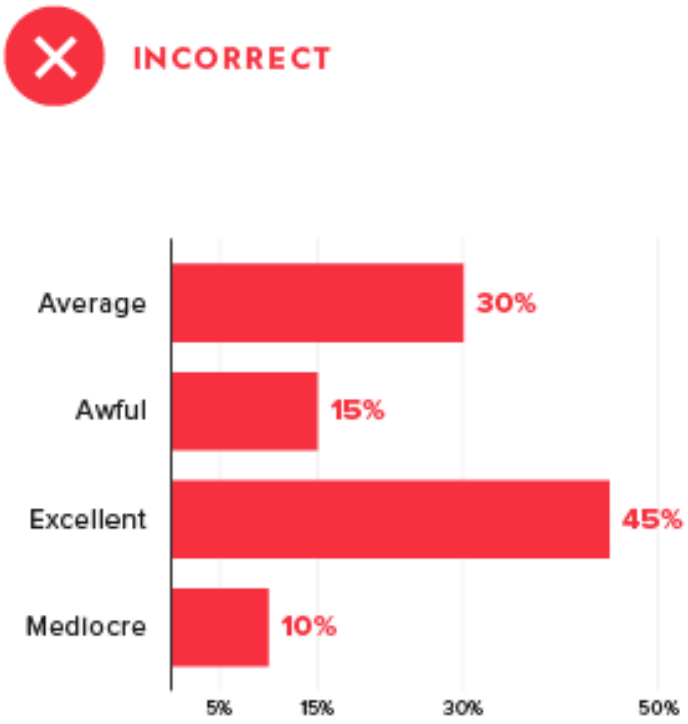


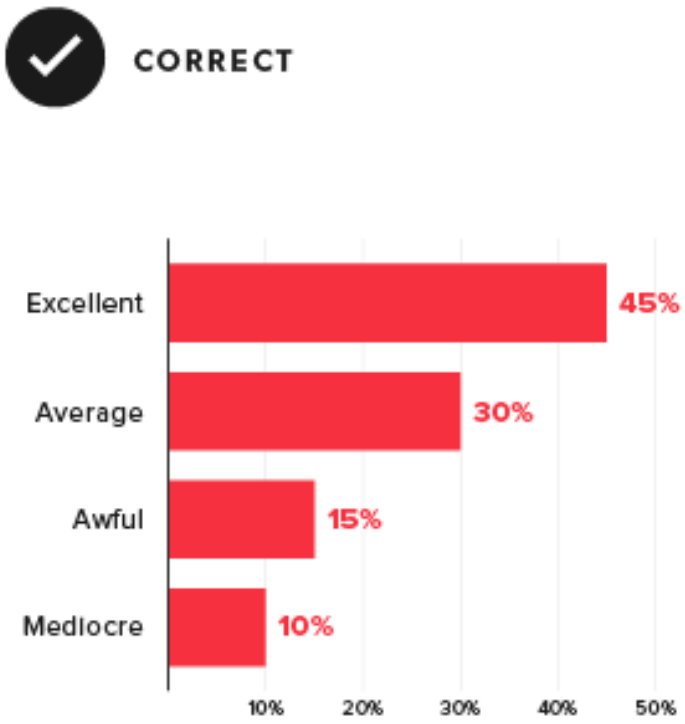
Good or bad visualisation?





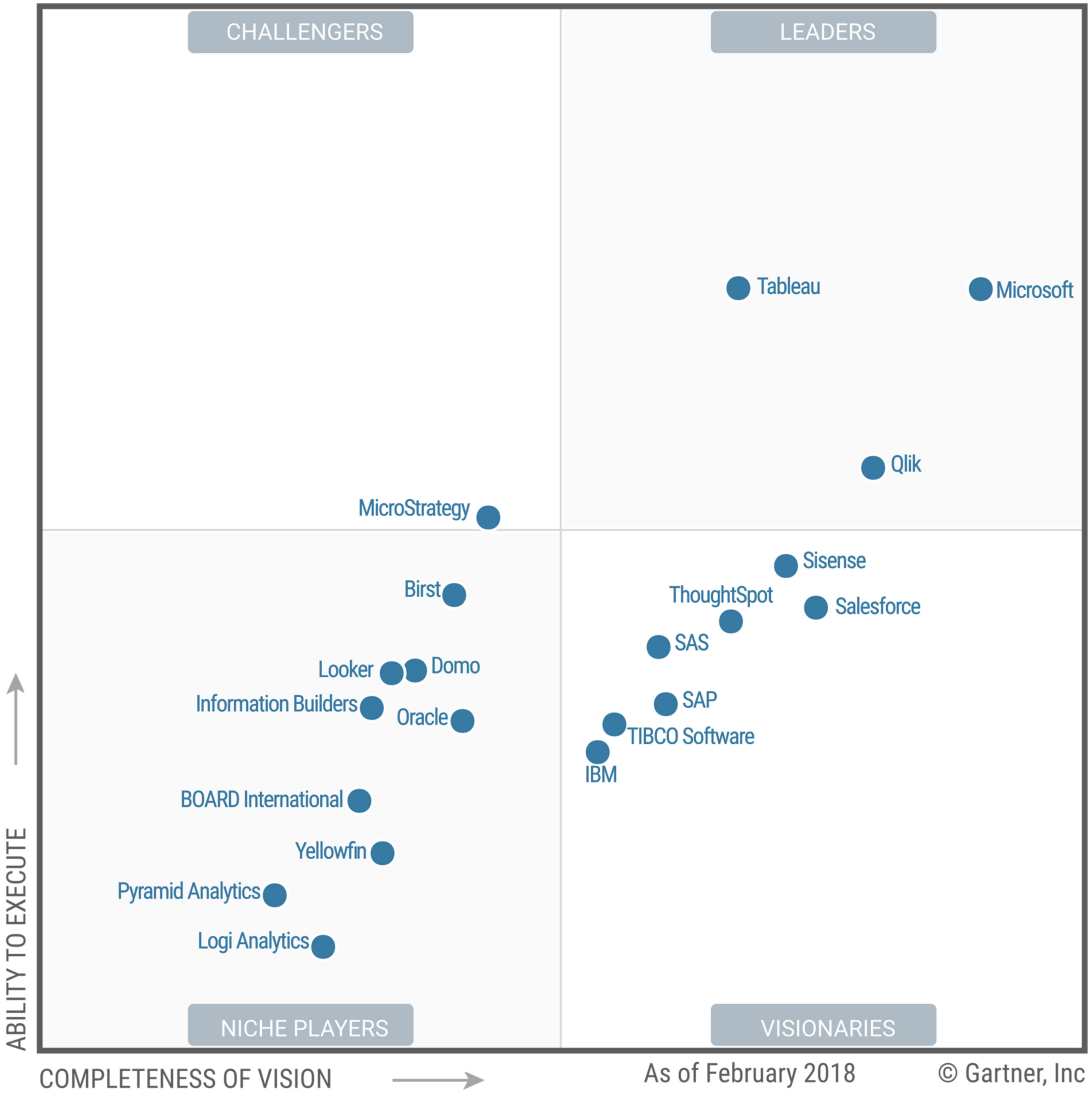
Good or bad visualisation?





Descriptive analytics software

Figure 1. Magic Quadrant for Analytics and Business Intelligence Platforms



Source: Gartner (February 2018)

Exercise: Location for new Sticks Kebob Shop

- Sticks Kebob Shop wants to expand with new restaurant
- Need to decide on a location
- Therefore need to understand their customer base
- Did survey of customers and non-customers
- Available on Inside: Survey data and case description

Exercise: Location for new Sticks Kebob Shop

- Your job today: Analyse survey data to help decide on location
  - How do people choose a fast food restaurant? What is important? (location, price, selection etc.)
  - Who do you think Sticks' customers are, and what is their motivation for visiting Sticks?
  - What does the survey data tell us about the differences between customers and non-customers?
- Make necessary assumptions and use info from case description
- Are there questions we cannot answer? What data/info would we need to answer these?
- We will continue work on this case the following weeks
- Please take an inspirational tour around the room
- If you want to use Tableau, their webpage has instructional videos (also YouTube) and there is a student license