

The art of data visualisation

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Webinar Material available:
<https://kakiac.github.io/talks>



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Dr Kakia Chatsiou's research focuses on the areas of public administration evaluation, data science and natural language processing. Pushing new boundaries of research, she has worked as an evaluation and data compliance consultant with local authorities (including Essex and Suffolk County Councils and Essex Fire and Rescue Service) as well as voluntary sector organisations.

Dr Chatsiou leads training for policy makers on evaluation practices, text analytics and data sharing and acts as a catalyst for change at both a strategic and operational level. Interested in the ways data and evidence can help us better understand our society, she balances research expertise with sector knowledge, for impact from the grassroots up.



About us

Proudly supporting organisations across the UK

Brought to you by



Business and Local Government
Data Research Centre

Our core mission

Combining fundamental research with applied, for impact that influences policy and informs practice.

- Methodologies and techniques for data science and artificial intelligence
- Local economic growth
- Supporting vulnerable people

Research community



Public sector



Businesses



Already benefiting

Since 2014, we have worked with private, public sector and not-for-profit organisations. By bringing the latest insights out of the university and into society, we have been part of solving real world problems.



These collaborations influence and inform best practice all over the world.

Data analytics support

Data is changing the world around you.
This is your opportunity to use this power to enhance your organisation.

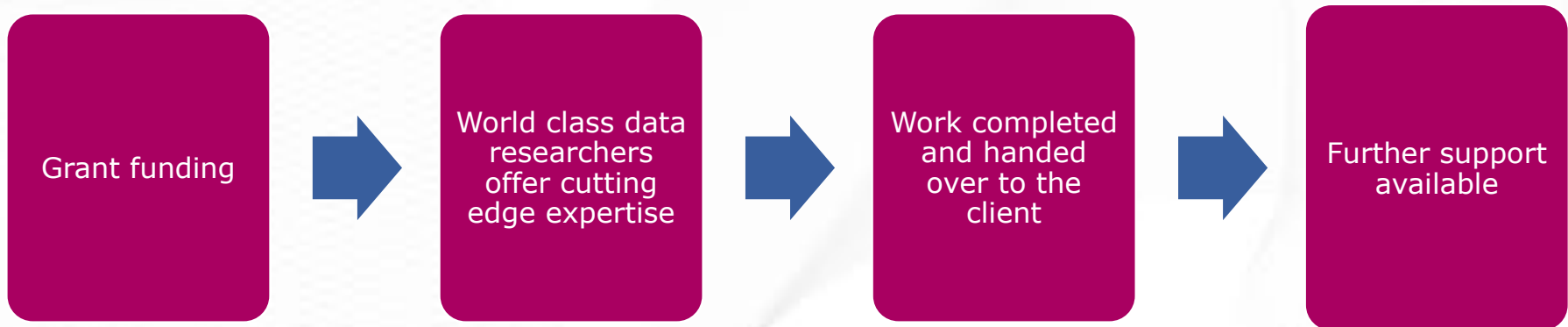
- Training
- Grant funded data analytics projects
- Webinars
- Workshops, challenge labs and events
- Consultation service



Data Analytics Innovation Vouchers

Forward-looking organisations are beginning to realise that it is not enough to analyse their data; they must also act on it.

- We provide grant funding to renowned researchers to solve real-life challenges
- Maximising your data by collecting, organising, linking and analysing various datasets
- Creating proof of concepts, feasibility studies and sharing best practice



Outline

- Data? What do you mean by 'data'?
- Visualising Data
- Choosing the best chart for your data
- Where to get inspiration from?

Data?

What do you mean by 'data'?

People might talk about these data...



- Big data
- Structured, unstructured, semi-structured data
- Time-stamped data
- Spatiotemporal data
- Open data
- Dark data
- Real time data
- Genomics data
- Operational/Administrative data
- High-dimensional data
- Unverified outdated data
- Transactional Data

... but what are data really?



- Excel
- Database
- Word documents
- Paper files
- Bespoke software
- Sales reports
- Feedback forms
- Social media
- Quotes
- Website hits
- Case studies
- Number of calls
- Pathway analysis
- Budgets
- Grants
- Marketing
- Projects and services
- Supply chain reports
- Emails
- Resource costings

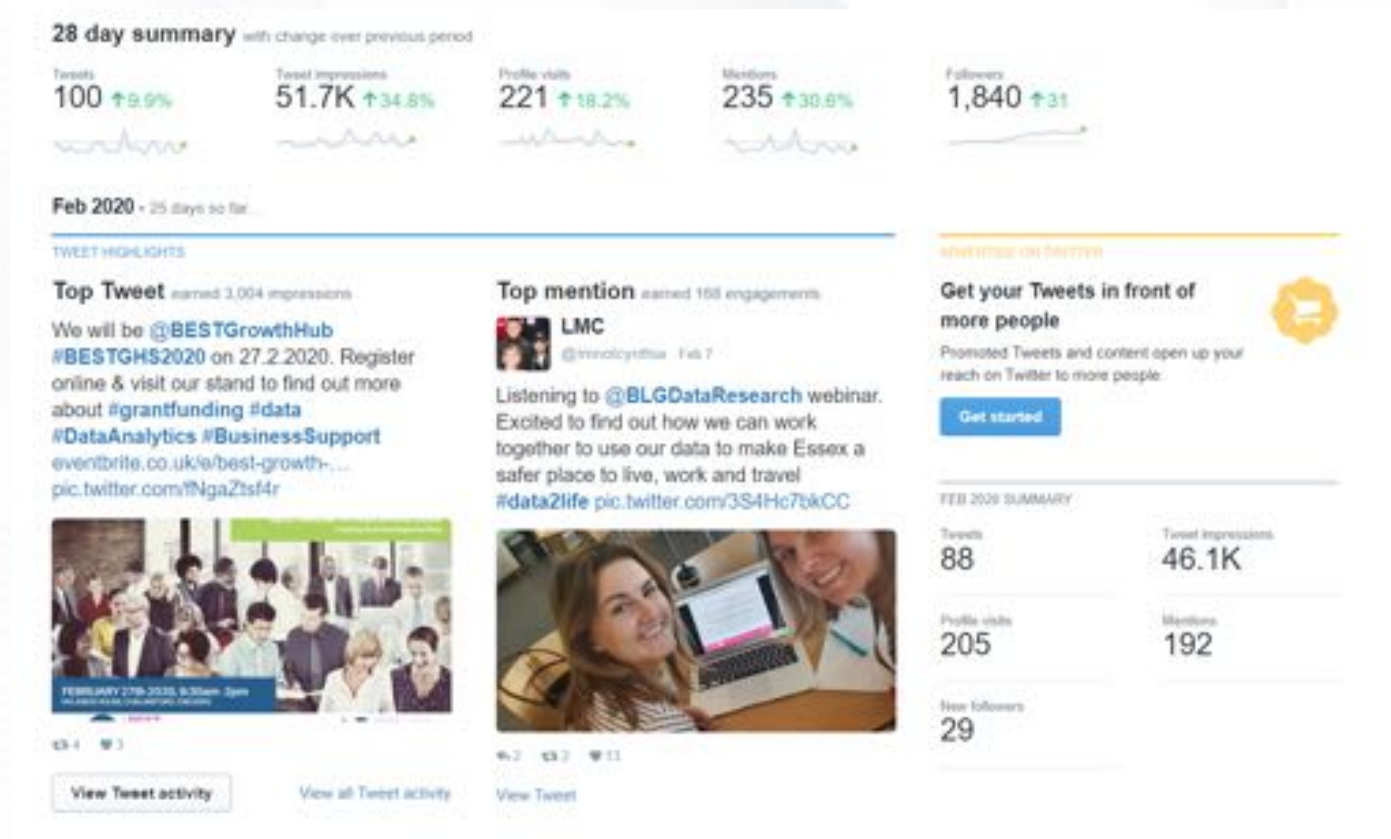
Numbers can be data

Parameter	Target	Candidate A	ABS(Δ)	Candidate B	ABS(Δ)
A	0.80	0.88	0.08	0.80	0.00
B	0.80	0.72	0.08	0.80	0.00
C	0.80	0.84	0.04	0.80	0.00
D	0.80	0.85	0.05	0.00	0.80
E	0.80	0.88	0.08	0.80	0.00
F	0.80	0.93	0.13	0.80	0.00
G	0.80	0.65	0.15	0.80	0.00
H	0.80	0.90	0.10	0.80	0.00
I	0.80	0.95	0.15	0.80	0.00
Deviation			0.86		0.80

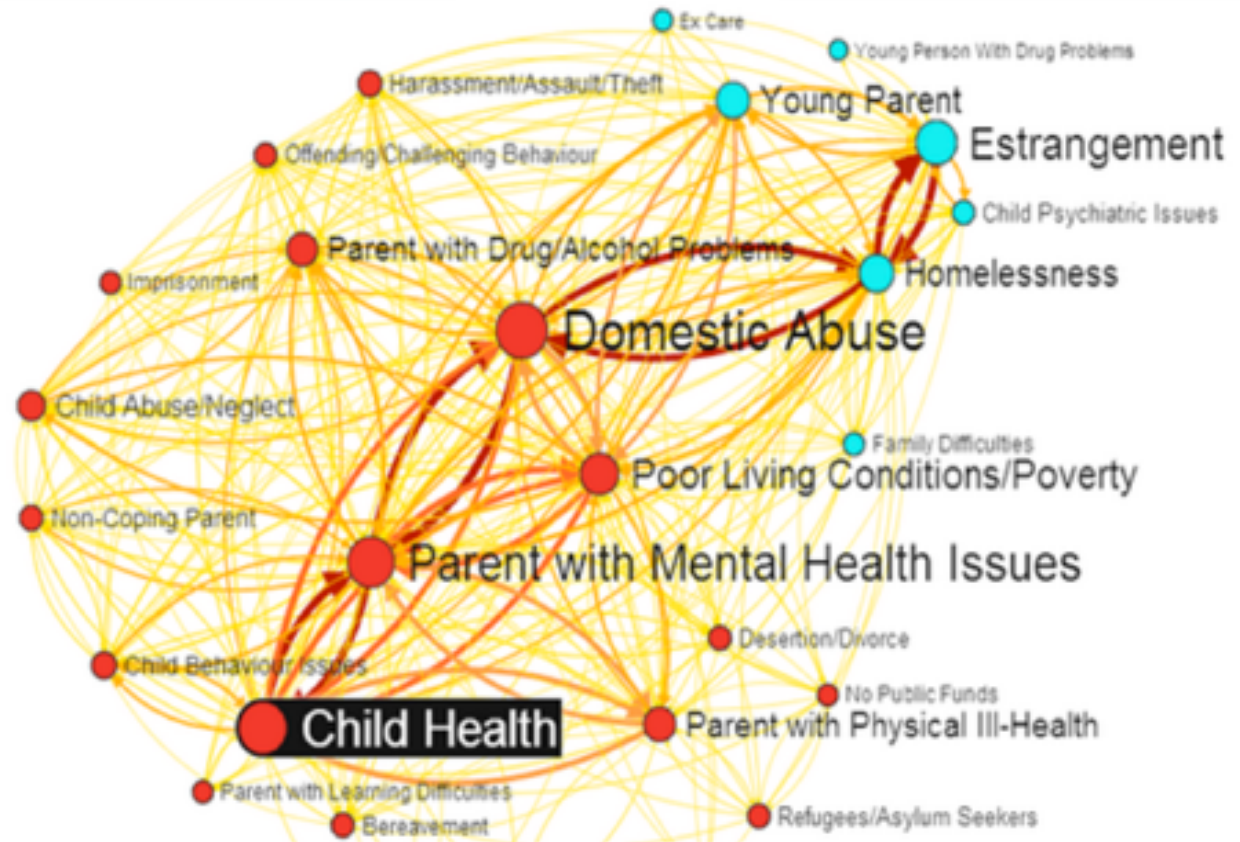
Images can be data



Data can be real-time and dynamic



Words can be data



Types of data

Qualitative

- Text & stories (non-numerical)
- Provide insights into experiences, behaviours or beliefs
- Answers: how? Why?

Examples:

- Focus groups
- Observations
- Interviews
- Document analysis

Quantitative

- Numerical
- Can be quantified and statistically analysed
- Draw connections between factors
- Answers: what? How many? Who?

Examples:

- Surveys
- Questionnaires
- Administrative data

How can data help you succeed?



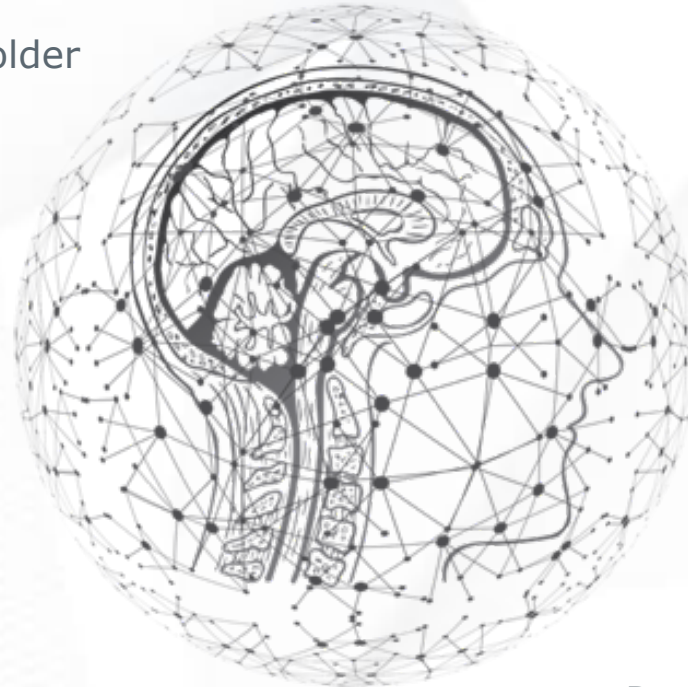
Turning data into knowledge

Data analysis can help your organisation enhance stakeholder engagement

A.I. and machine learning can complement human interventions to reduce risk and manage demand

Internal data can allow you to make savings and improve efficiencies

Data can provide greater market and demographic insight



Open data can be used allow organisations to be true innovators and improve the service user experience

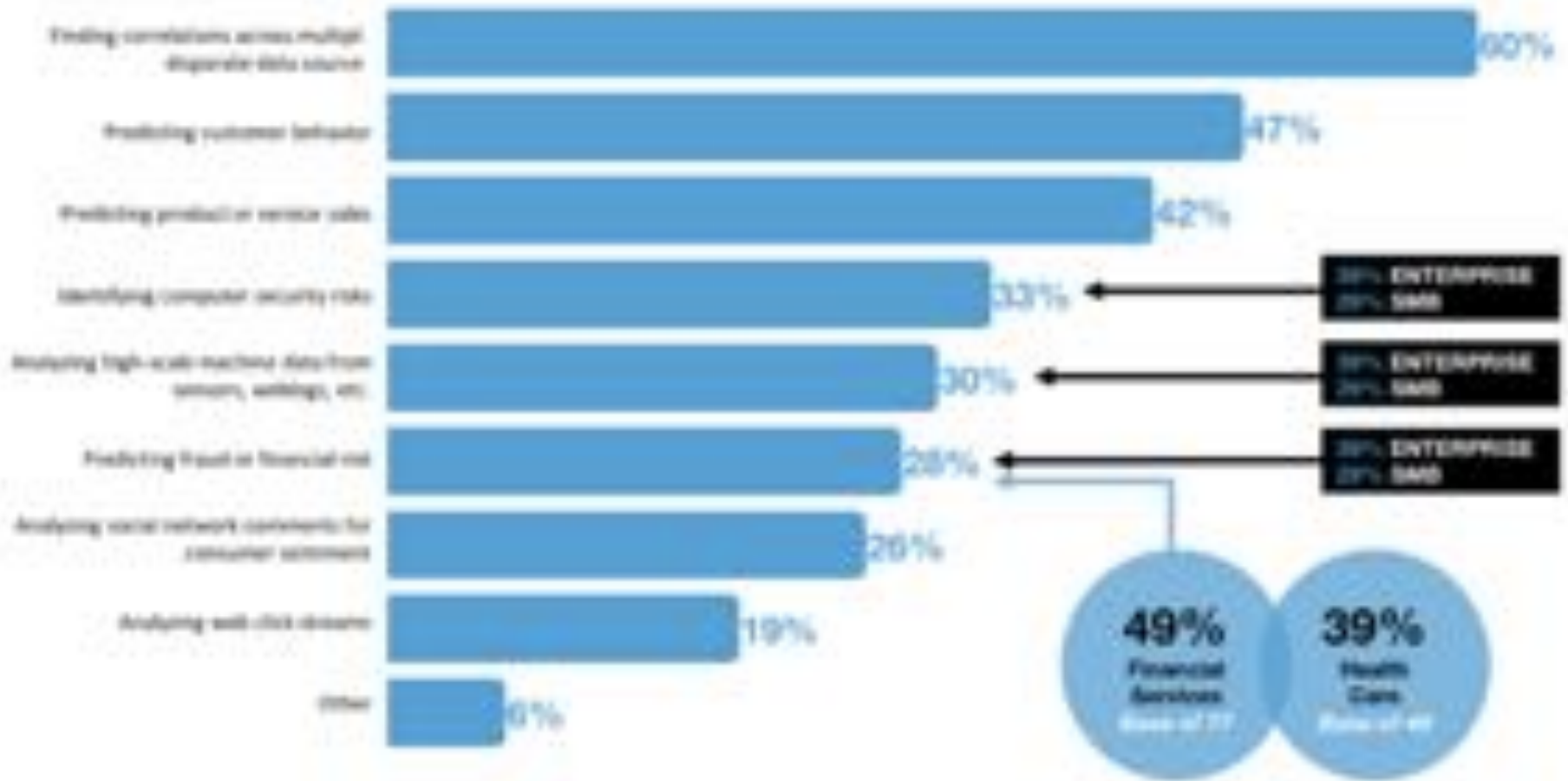
Data can demonstrate impact in order to secure future funding

Data can measure project success and outcomes

Data analysis can predict future demand and identify where services are needed most

Data can help businesses solve challenges

[Enterprise Big Data Framework](#)



Q: What challenges is your organization aiming to solve with its data-driven initiatives?

£20m



'We used our database to understand supporter motivations'

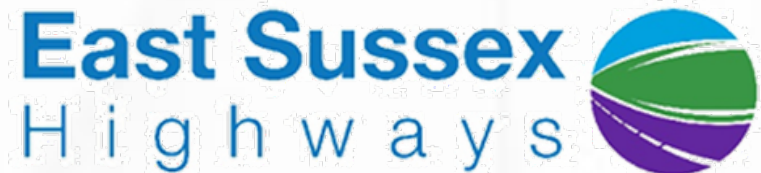
Katherine Blaize-Smith
Senior Marketing Programme Manager

Data made the world's biggest coffee morning even bigger

Case Study: East Sussex Highways

Ability to predict road/pathway deterioration, allowing resources and funding to be allocated more effectively.

Cost and time savings.



Visualising Data

The background features a vibrant pink and purple color palette. It is composed of several layers of abstract, wavy, and grid-like patterns. A prominent feature is a large, dark purple, curved shape that resembles a stylized letter 'C' or a thick brushstroke, set against a lighter pink background. Below this, there are more intricate patterns, including a fine grid of small squares and larger, flowing lines that create a sense of depth and movement.

What is data visualisation?



Data viz is a graphical representation of information and data.



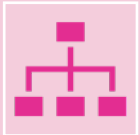
With visual elements like charts, graphs and maps, data visualisation tools provide an accessible way to see and understand trends, outliers and patterns in data.



Essential part of working with data

You can summarise large amounts of information into an easy to digest format
“one picture is a thousand words”
No need to see the raw data

Things to consider when creating a data viz



What are the types of measures, features or categories that you intend to plot?



Who is the audience?



What is the story you would like to tell to the reader?

What makes a good visualisation?

McCandless (2014) (Knowledge is beautiful)

1. Information (data) +
2. Story (concept) +
3. Goal (function) +
4. Visual form (a metaphor) =

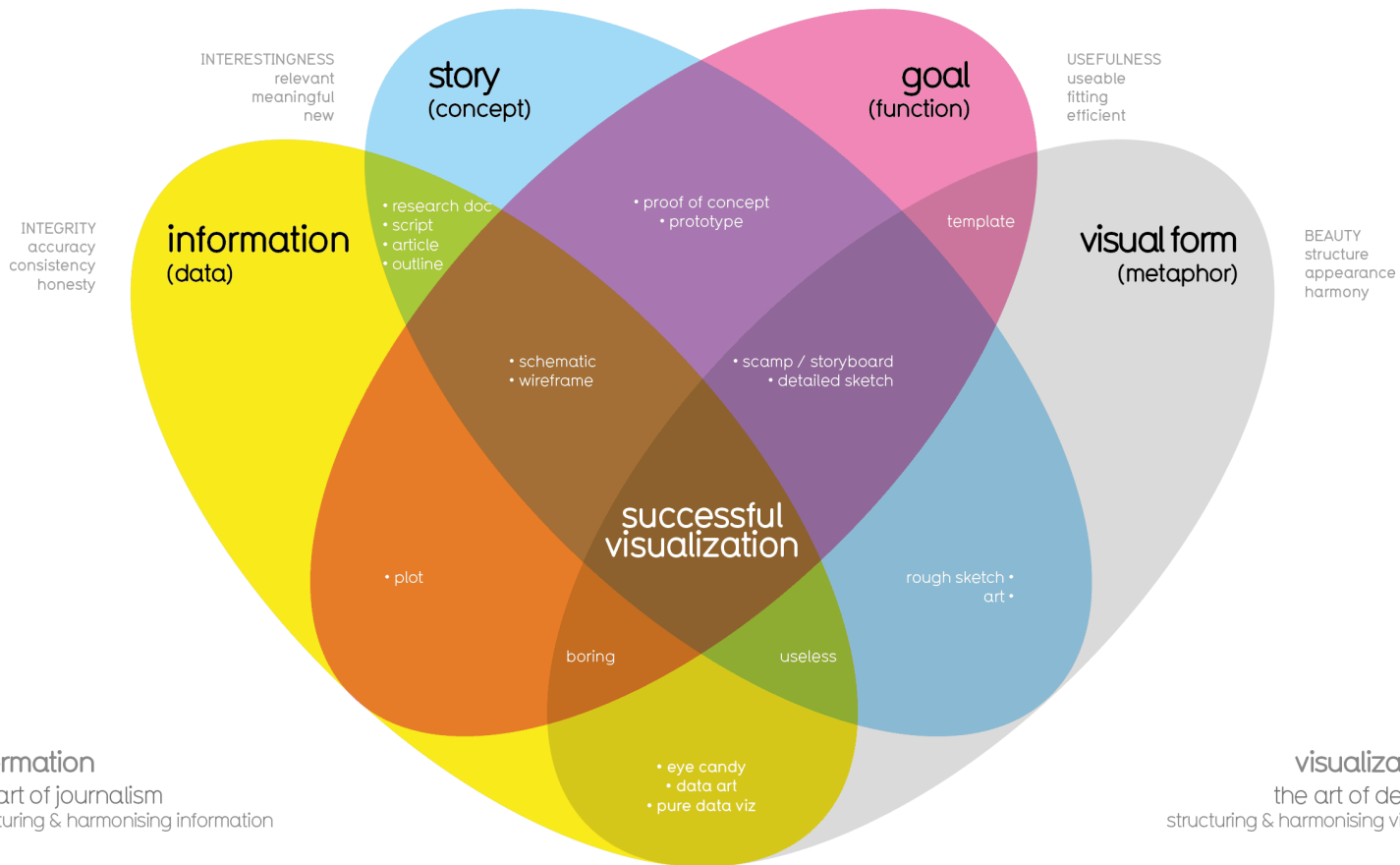
A successful visualisation

What makes a good visualisation?

Source: InformationisBeautiful.net

What Makes a Good Visualization?

explicit (implicit)



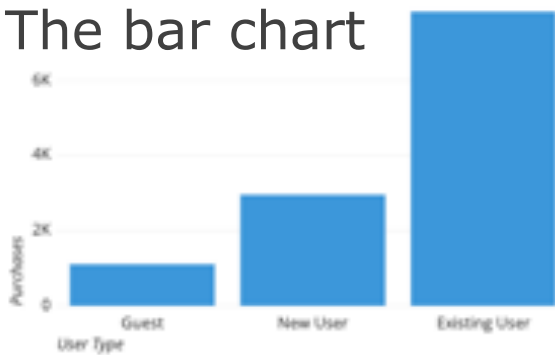


Choosing the best chart for your data

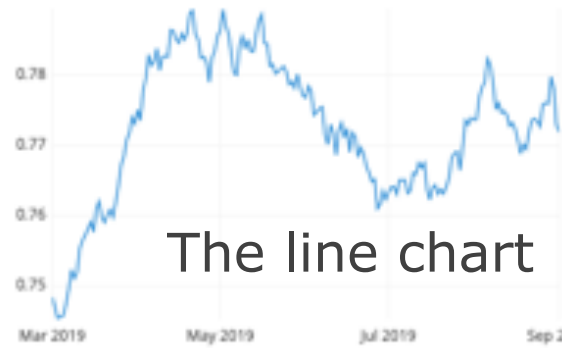
The Fantastic Five

Purchases by User Type

The bar chart



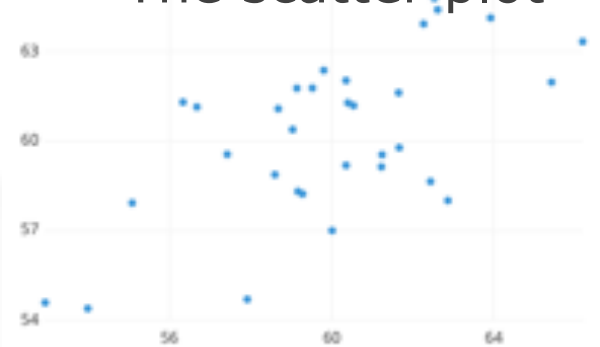
ZZD to QQY Exchange Rates



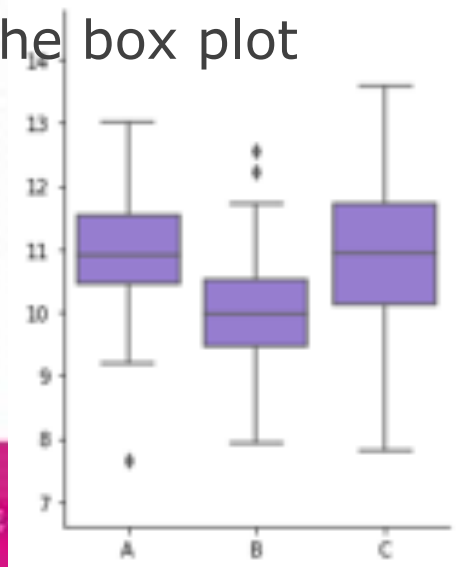
The line chart

66

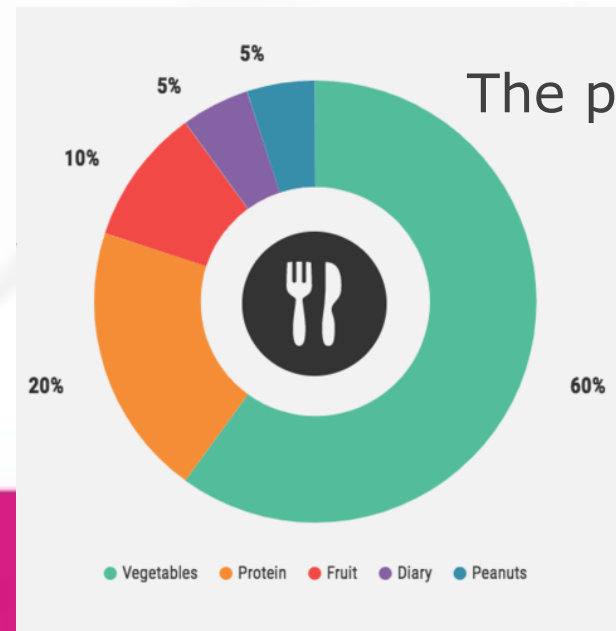
The scatter plot



The box plot

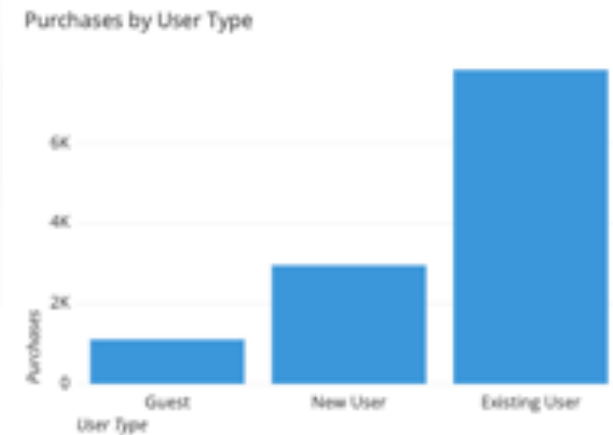


The pie chart



The bar chart

- Values indicated by length of bars
- Each bar is a measured group
- Can be vertical or horizontal
- Horizontal might be good if you have lots of bars to plot



Bar charts - tips

Start the y-axis
at zero

Our eyes are sensitive to the area of bars on a chart. If those bars are truncated, the viewer might draw the wrong conclusions

Label the axes

gives your viewer context

Put value labels
on bars

This helps to preserve the clean lines of the bar lengths.

Avoid using too
many colors

Avoid "rainbow effect". Using a single color, or varying shades of the same color, is a much better practice. You can highlight one bar in particular if that is the message you want to get across.

The line chart

- Show changes in values across continuous measurements e.g. over time
- Line up = positive changes
- Line down = negative changes
- Good for projections or future outcomes
- Can have multiple lines (or combine with bar chart)



Line chart - tips



Clearly label your axes - Make sure the viewer knows what they are evaluating.



Remove distracting chart elements - Grids, varying colors, and bulky legends can distract the viewer from quickly seeing the overall trend.



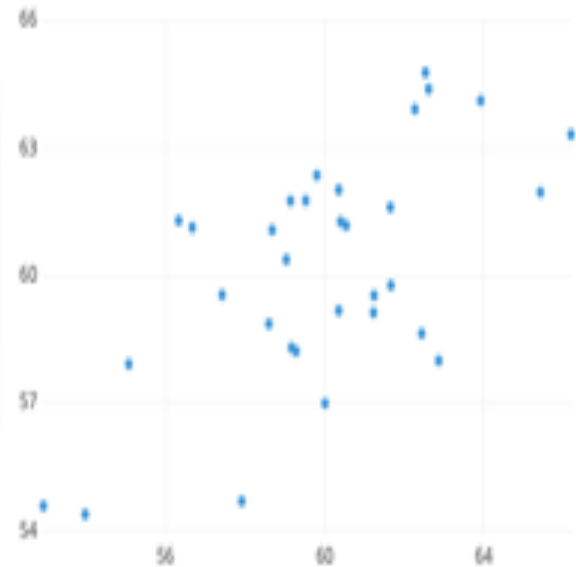
Zoom in on the y-axis if your data set starts above zero - In certain cases, changing the scale of the y axis makes it easier for.



Avoid comparing more than 5-7 lines - You don't want your chart to become cluttered or hard to read. Visualize the data you need to tell your story, nothing more.

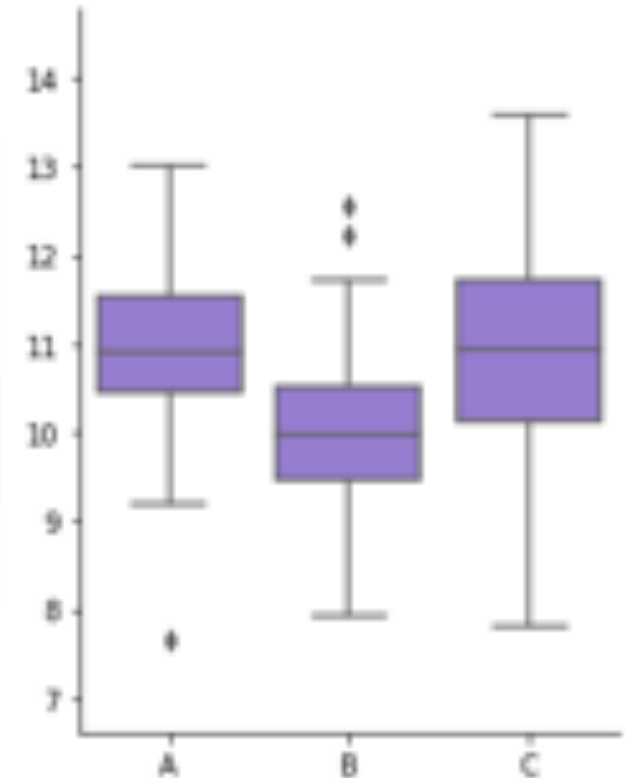
The Scatter plot

- Displays values for 2 numeric variables (one for each axis)
- The way the dots are concentrated in space shows relationship between the 2 vars
 - e.g. strong or weak correlation,
 - positive or negative relationship,
 - linear or non linear relationship
- Outliers are also shown
- Gaps in the data can be identified too



The box plot

- Whiskers summarise distribution of values within measured groups
- Positions of box and whisker ends show where the majority of data lies
- Useful when comparing multiple groups to one another



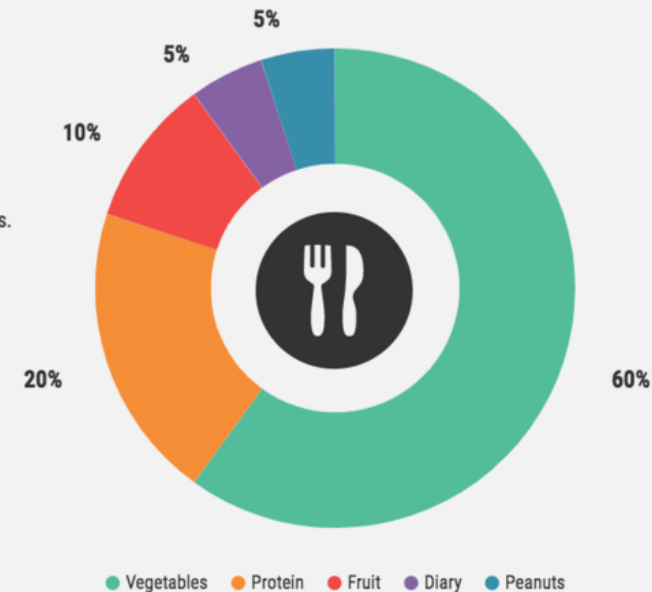
The Pie chart

- Best at comparing parts of a whole
- Order segments from greatest to least
- Start the first segment at 12:00 and continue clockwise
- If possible limit to 7 segments

Source: [Venngage.com](https://venngage.com)

A Healthy Diet

Developing healthy eating habits isn't as confusing or as restrictive as many people imagine. The essential steps are to eat mostly foods derived from plants—vegetables, fruits, whole grains and legumes (beans, peas, lentils)—and limit highly processed foods.



Pie Charts - tips

- Make sure your segments add up to 100 - Sounds obvious, but this is a common mistake.
- Keep it clean and consistent. Compare just a few categories to get your point across. If the pie slices have roughly the same size, consider to use a bar or column chart instead.
- Avoid using 3-D imagery or tilt your pie chart - This often makes your data impossible to read, because your viewer is trying to quickly compare angles.

How to choose the best chart for your data?

Source: Venngage.com



INFORM



COMPARE



CHANGE



ORGANIZE



RELATIONSHIP

How to choose the best chart for your data?

Is the purpose of your visualisation to:

1. Inform?
 - You are trying to convey a data point?
2. Compare?
 - You are trying to compare categories or show composition?
3. Show Change?
 - You would like to depict change over time or by location?
4. Organise?
 - You are trying to show groupings, rankings or processes?
5. Reveal relationships?
 - You are showing groupings rankings or processes?

1. If you are trying to inform, use...

Source: Venngage.com



These convey data points very clearly!

AIRBORN ILLNESS'S



25%

of people have an efficient immune system to fight off a **few airborne pathogens.**



50%

of people have an efficient immune system to fight off a **many airborne pathogens.**



75%

of people have an efficient immune system to fight off a **most airborne pathogens.**

2. If you are trying to compare, use...

Source: [Venngage.com](https://venngage.com)



BAR CHART
Categories (many)



BUBBLE CHART
Categories (few)



PIE CHART
Composition



STACKED BAR CHART
Composition, over time or
across categories

To help you compare categories or show
composition

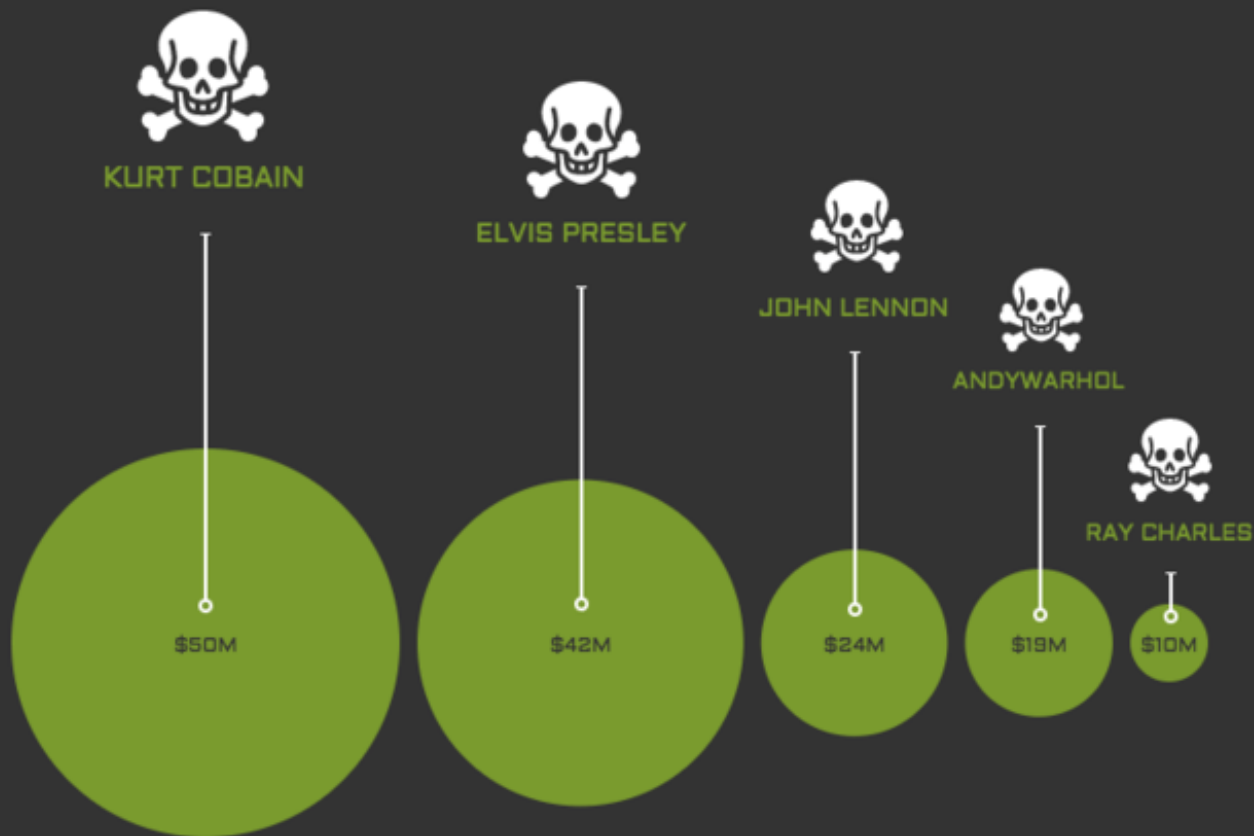
2. If you are trying to compare, use...

Source: [Venngage.com](https://venngage.com)



To help you compare categories or show composition

ANNUAL INCOMES *of* DEAD CELEBRITIES



Source: Venngage.com

Comparing multiple values

- Bar charts are the best!
- You might need more than one bar charts if too many relationships

Source: Venngage.com



3. If you are trying to show change, use...

Source: Venngage.com



LINE CHART

Many series over time



AREA CHART

Few series over time



TIMELINE

Distinct events in time



MAP CHART

One series by location

To help you show change over time or by location

Use a map series to show changes in location data over time

Source: [Venngage.com](https://venngage.com)

Market Segmentation Report

Geographic Analysis

From 2015 to 2017, we saw dramatic growth of our customer base across the **Midwest** and the **West Coast** of the United States. Our 2018 goal is to target the **Eastern Seaboard**, including New York, Florida, and North Carolina.



4. If you are trying to organise info, use...

Source: [Venngage.com](https://venngage.com)



LIST
Process (simple)



FLOW CHART
Process (complex)



VENN DIAGRAM
Groupings



MIND MAP
Groupings &
connections

To help you show groupings, rankings or processes

4. If you are trying to organise info, use...

Source: [Venngage.com](https://venngage.com)



To help you show groupings, rankings or processes

5. If you are trying to show relationships, use...

Source: Vennqaqe.com



SCATTER PLOT
Relationship between
two continuous
variables



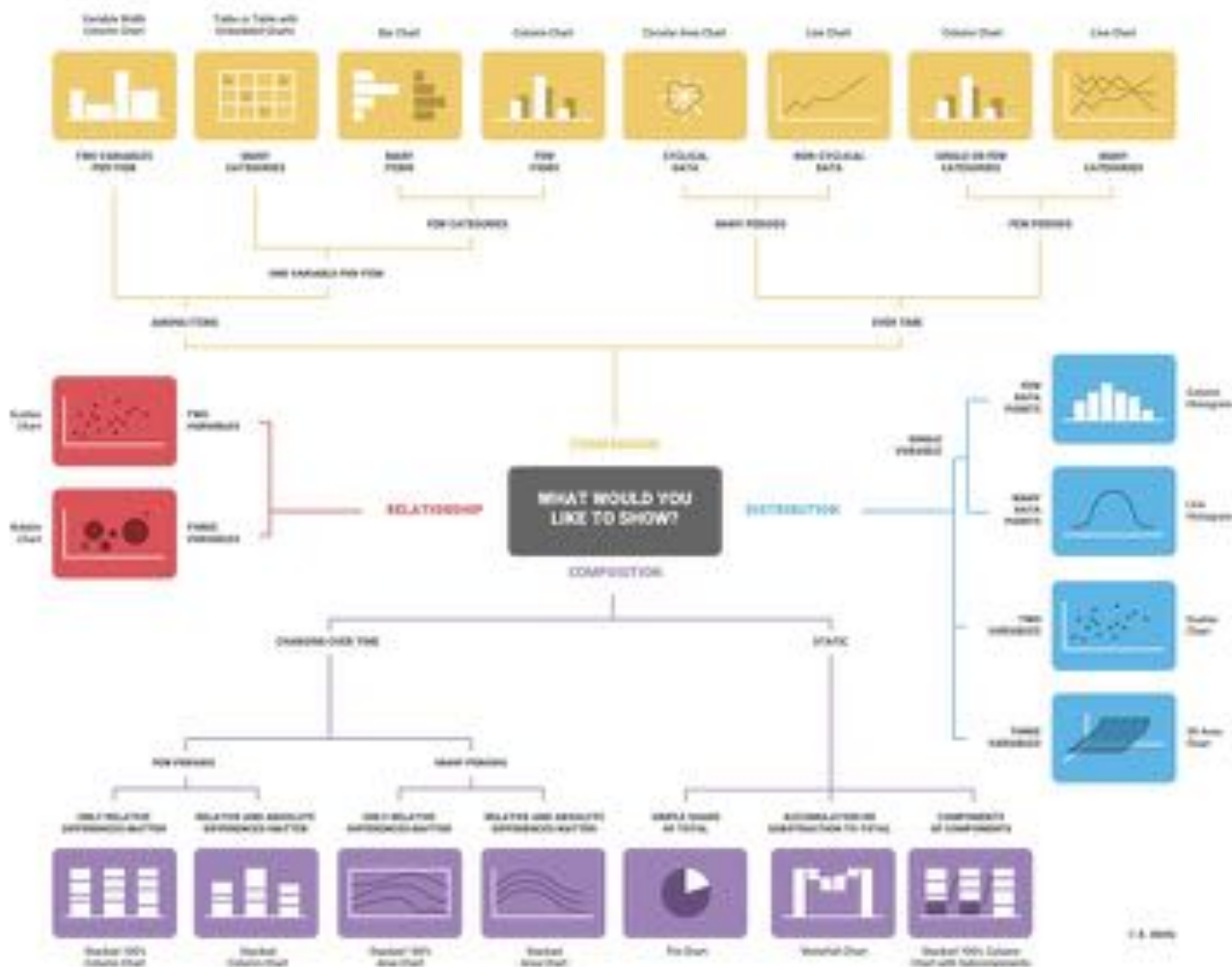
HISTOGRAM
Distribution of one
variable



MULTI-SERIES CHART
Relationship between
multiple series over time

To help you reveal relationships like correlations or distributions

CHART SUGGESTIONS - A THOUGHT-STARTER



Where to get inspiration from?

- <https://informationisbeautiful.net/>
- <https://looker.com/blog/different-types-graphs-charts-uses>
- <http://selection.datavisualization.ch/>
- https://infovis-wiki.net/wiki/Main_Page

Remove to improve the **pie chart** edition

Q & A session



Tell us what you thought of this session:
<https://bit.ly/BLGVisualisationSurvey>

Additional Material & Resources

- [Envisioning Information](#) by Edward R. Tufte (January 1990)
- [Presentation Zen](#): Simple Ideas on Presentation Design and Delivery (Voices That Matter) by Garr Reynolds (December 2011)
- [Show Me the Numbers](#): Designing Tables and Graphs to Enlighten by Stephen Few (June 2012)
- [Storytelling with Data](#): A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic (October 2015)

Additional Material & Resources

- How to create effective infographics (Venngage)
 - <https://venngage.com/templates/infographics/chart-types-30a6a1a8-ecae-4479-9a46-5fe23ea0d448>
- Chartio
 - <https://chartio.com/learn/charts/essential-chart-types-for-data-visualization/>
- Looker.com:
 - <https://looker.com/blog/different-types-graphs-charts-uses>
- Infogram:
 - <https://infogram.com/page/choose-the-right-chart-data-visualization>
- Hubspot.com
 - <https://blog.hubspot.com/marketing/types-of-graphs-for-data-visualization>
- Information is Beautiful:
 - <https://informationisbeautiful.net/>
 - <https://informationisbeautiful.net/visualizations/what-makes-a-good-data-visualization/>
- <https://eazybi.com/blog/data-visualization-and-chart-types>

Thank you

Join in the conversation online:

@BLGDataResearch #Data2Life



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Data Research Centre



YouTube: ESRC Business and Local Government Data
Research Centre



Email: BLGDataResearch@essex.ac.uk