F08 Data Visualisation as a Powerful Means of Communication
Examples from the IFoA Working Party

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Data Visualisation

Today’s talk
• What is data visualisation?
• Who are we?
• Background to working party and our vision
• Non-actuarial examples
• Our blog – https://dataviz-wp.blogspot.com
• Actuarial examples
• Next steps and getting involved
• Questions
What is Data Visualisation?

• The main goal of data visualisation is to communicate information clearly and effectively through graphical means (Friedman)
• Important stories live in our data and data visualisation is a powerful means to discover and understand these stories, and then to present them to others (Few)
• Data visualisation gives you answers to questions you didn’t know you had (Shneiderman)

Who are we?

• Rob Black (Chair) Standard Life
• Aidan Smith Government Actuary’s Department
• Anees Aslam BUPA
• Florian Gomez Partner Re
• Julian Ellacott Just Group
• Lloyd Richards Crowe (crowe.com)
• Martin Cairns Aviva
• Paul Teggin Bank of England/PRA
• Will Mirams EY

Background to Working Party

The working party


Further examples in:

*Data Visualisation for Business Insight* (Ellacott and Teggin, 2013)


Data Visualisation – Our Vision

We have in mind a picture of an actuary at their desk with some data and asking themselves how best to summarise and present it.

Our vision is that, through the work of the working party, the actuary should have:

• A modern library of different visualisation techniques
• An understanding of which visualisations work well for different purposes (eg, data investigation vs reporting to management)
• Domain-specific examples of helpful practice (eg, pensions, investment, life or general insurance)
• An understanding of how to produce the visualisations, including tools and techniques (not just Excel)
• An understanding of the principles of developing and improving data visualisations
• Awareness of caveats that should be associated with data visualisations
Florence Nightingale (1855) – Coxcomb chart  
Source: https://commons.wikimedia.org/

Francis Galton (1881) – Isochronic map  
Source: https://en.wikipedia.org/wiki/Isochrone_map
London Tube Map – Harry Beck (1931)

Source: https://londonist.com/

“Beast from the East” – BBC (2018)

Snow warnings for the UK
- Severe weather possible
- Potential risk to life and property
- Risk to life likely

Wednesday 28 February
Thursday 1 March
Friday 2 March

Source: Met Office
Daily source of electricity generation in the UK (2018)

GB electricity generation over 48 hours from Sat 15 September 2018 to Mon 17 September 2018

Source: https://www.mygridgb.co.uk/last-48-hours

https://dataviz-wp.blogspot.com
Data Visualisation

General approach

For each data visualisation example

• Problem statement
• Suggested approach
• Rationale and commentary
• Applicability and alternatives
• Implementation
• Resources
• Comments from others
Example: Correlation Matrix

Problem Statement
Correlation matrices are often large, complex and visually off-putting. The objectives of the visualisation are to:

- Present a correlation matrix in a way which is straightforward to engage with
- Make it easy to locate the material assumptions
- Make it easy to identify possible inconsistencies between correlation assumptions

Example: Correlation Matrix – Before

| Market risk | Equity returns | Credit spreads | Interest rates - real | Interest rates - nominal | Corporate default risk | Country default - rating | Market risk | Credit risk | Operational risk |
|-------------|---------------|----------------|----------------------|-------------------------|-----------------------|-------------------------|-------------|-------------|-----------------|}
|             |               |                |                      |                         |                       |                         |             |             |                 |
Example: Correlation Matrix

Suggested Approach: We suggest a hybrid of the following techniques:

- **Bar charts to illustrate the materiality of individual risks**, measured by undiversified capital requirements. Colour is used to collate risks into categories.

- **Shading of alternate rows and columns** to lead the eye to the row and column headings, and borders around correlations within each category that align to the bar charts.

- **A table of values to show the correlation assumptions** – this can be triangular because the matrix is symmetric, and the values of 1.0 on the diagonal are omitted. The typography is designed to emphasise visual differences between zero, positive and negative values.

- **Ellipses to visualise the sign and magnitude of each correlation**, in the space created by restricting the numerical assumptions to a triangle. These help with seeing patterns.
Example: Display a Large Number of Client Recommendations

Problem Statement

• A large number of recommendations (eg, in a consultancy report) can immediately appear overwhelming.

• Ranking recommendations by impact and importance, as well as grouping by area to which the recommendation applies (eg, validation function, finance function), allows for focus on the “quick wins”; recommendations that have maximum impact for minimum effort.

Suggested Approach: We suggest a hybrid of the following techniques:

• An overall heatmap plotting numbered recommendations by impact and importance, split into High/Medium/Low sections

• A coloured background to ease identification of relative importance, particularly enabling a user to rapidly identify “quick wins” – recommendations that are low effort and high impact

• Pre-requisites plotted graphically to identify dependencies between recommendations

• Separately, a collection of bar charts show the number of recommendations corresponding to High/Medium/Low impact and effort, and grouped by area to which the recommendation applies, to enable a high level view on where to focus resources
Example: Display a Large Number of Client Recommendations

Problem Statement
- A large number of incidences occurring over a long timeframe can make it challenging to spot trends.
- The example shown is for daily incidence reporting over a year, but is adaptable to other timeframes

Example: Visualise Daily Incidences
Example: Visualise Daily Incidences

Suggested Approach: We suggest a hybrid of the following techniques:

- **Listing the number of incidences each day**, with days arranged in a calendar format (conditional formatting is used to identify at a glance relatively better/worse days)
- **A calendar is included** alongside to enable quick reference to specific dates
- **Daily/weekly averages** are shown above/beside the calendar listing
- **Daily/weekly average charts** are shown at the top
Data Visualisation: A Checklist

• Does the information within the visualisation answer the initial question posed by your audience?
• Can your audience understand and interpret the visualisation within 15 seconds? If not, then it’s possible that your graph is too complicated.
• Have you chosen the right type of visualisation? There is nothing wrong with a simple pie chart or bar chart!
• Will the user asks a subsequent question after viewing your visualisation? If so, then do we need some supplementary visualisations, eg a separate graph or overlaid line graph?
• Would your visualisation benefit from any form or data grouping? For example, would plotting cash flows in annual buckets be clearer than monthly buckets?
• Does the visualisation make due consideration to all your users, eg a visualisation with lots of different colours may not be received well by individuals who are colour blind.
• Is the style and design of your visualisations sufficient future-proof, or may it change next month? Users get used to seeing certain types of information. If the visualisation changes month-on-month then the communication may be weaker.

Resources that have helped us

Books

- [The Visual Display of Quantitative Information](https://flowingdata.com/)
- [Show Me the Numbers](https://informationisbeautiful.net/)
- [How to Lie with Statistics](http://economist.com/blogs/graphicdetail)
- [Information Design](http://www.jmoon.co.uk/)

Websites

- https://flowingdata.com/
- https://informationisbeautiful.net/
- http://economist.com/blogs/graphicdetail
- http://www.jmoon.co.uk/
Next steps and getting involved

• Please visit our blog – https://dataviz-wp.blogspot.com
• Registered users can submit full blog posts of your own
• Anyone can comment on the site in general, via “Give us feedback” page, or specific visualisations
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• Top level bullets should be round and second level bullets should be dashes. Further levels should alternate accordingly
• Always write in sentence case unless a proper noun is used and do not use ampersands (&)
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