ANALYSING AND PRESENTING DATA
PART 2 – PRESENTING NUMBERS

Professional Development Course Book

Presented by Mark Priadko

INSTITUTE OF
PUBLIC ADMINISTRATION
AUSTRALIA

IPAA
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Learning objectives:

- Understanding terminology and definitions
- Basics in tables and charts
- Presenting numbers and decision-making
- Principles in the design of tables and charts
- Presenting data analysis

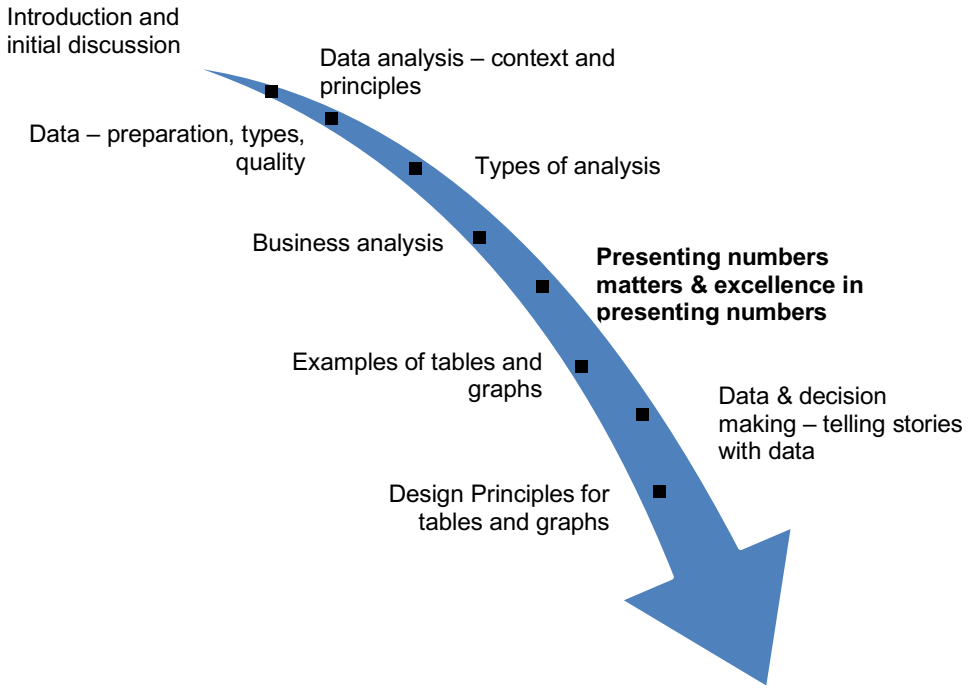
Self-evaluation

My proficiency in presenting numbers is:

List of what I need to know to move up one point on this scale

- .....
- .....
- .....
- .....

These course notes are designed to support the presentation of information in the module. They are based on the knowledge and experience of Mark Priadko. These notes are not designed to present comprehensive documentation of the requirements for presenting numbers.



I better understand a range of analytical techniques and options for presenting data that help me use data in the development of evidence-based policy and in reporting.

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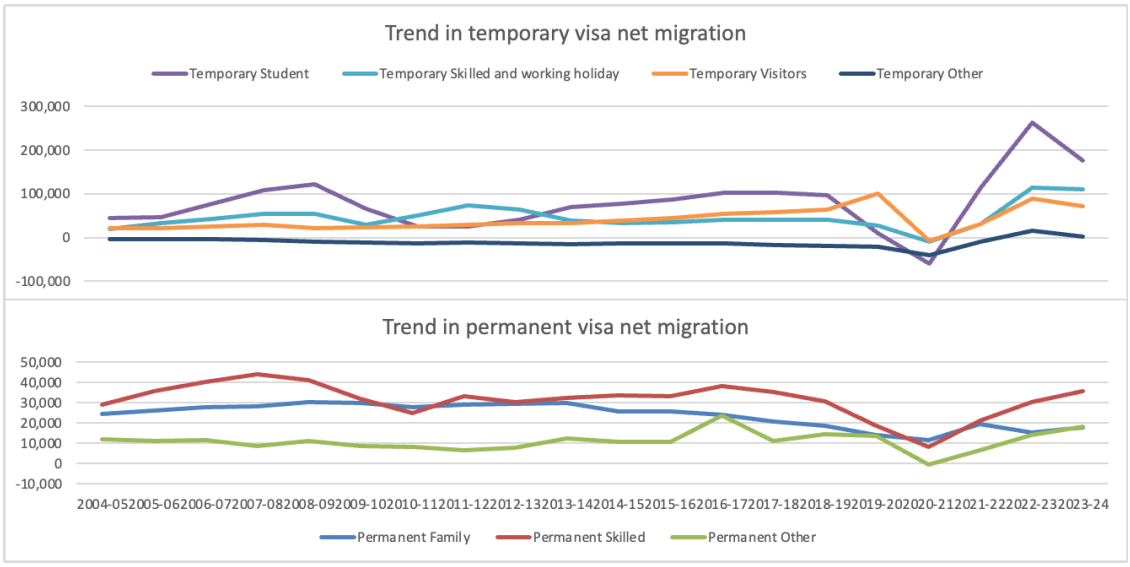
Introduction

Numbers form a fundamental element of presenting evidence in the development of public policy, in preparing reports as part of managing public money, in managing performance and in presenting submissions and proposals. However, many people find numbers difficult to deal with when they are presented to them, causing them to be confused, even disoriented. This often happens because numbers are presented poorly – poorly designed and poorly organised. In this part of the workshop, participants will be introduced to some key principles behind the design, organisation and presentation of numbers.

Data for analysis included line graphs for temporary visas and permanent visas.



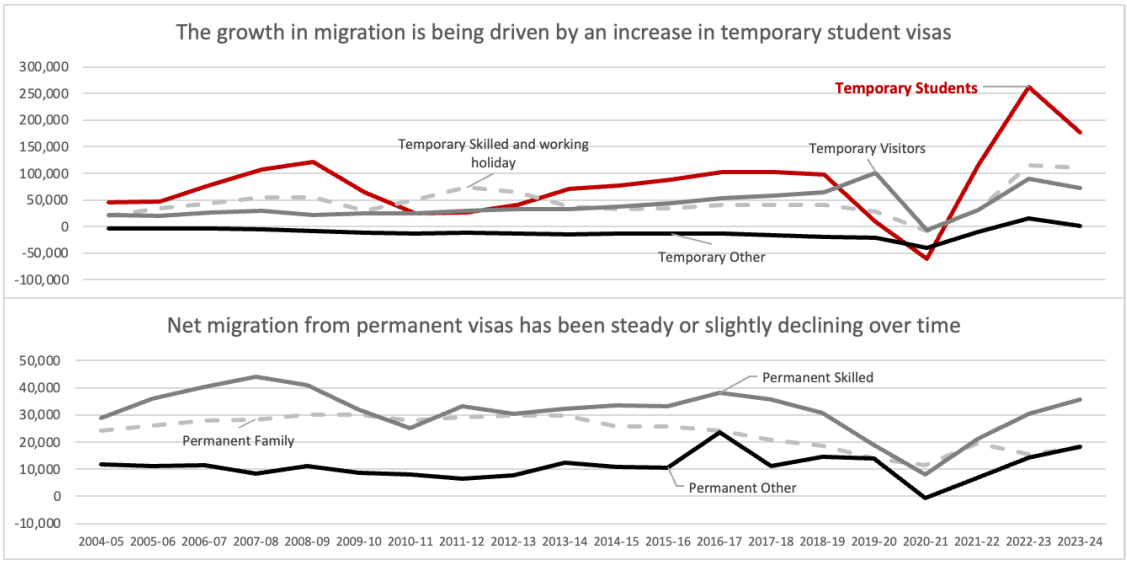
This visual is created by combining two graphs with each sharing the same horizontal axis. It has been done this way to distinguish two categories of visa. If we had combined them into one graph, the higher temporary visa numbers would have dominated the lower permanent visa volumes.

Preparing this graphic requires some data preparation and modification of the standard line graph by deleting the horizontal axis from the top graph and then sizing the two graphs to ensure they are consistent with the horizontal axis.

We can improve the presentation of the graph for it to tell more of a story in the following ways:

- Create more space for the data by labelling each line and deleting the legends
- Use the titles to describe what is happening with the data, rather than just describing the data
- Using one colour to contrast the main line (temporary students) from the other lines, which can be shown using neutral colours like grey and black.

An updated version of the visualisation is shown below.


The growth in migration is being driven by an increase in temporary student visas
300,000
250,000
200,000
150,000
100,000
50,000
0
-50,000
-100,000
Temporary Students
Temporary Skilled and working holiday
Temporary Visitors
Temporary Other

Net migration from permanent visas has been steady or slightly declining over time
50,000
40,000
30,000
20,000
10,000
0
-10,000
Permanent Skilled
Permanent Family
Permanent Other
2004-05 2005-06 2006-07 2007-08 2008-09 2009-10 2010-11 2011-12 2012-13 2013-14 2014-15 2015-16 2016-17 2017-18 2018-19 2019-20 2020-21 2021-22 2022-23 2023-24

Briefing to our Minister

Topic: Analysis of ABS net migration data (2023-24)

Recommendation: It is recommended that you note the findings from the analysis of ABS net migration data (2023-24).

Key Points

In 2022-23, net migration into Australia was 445,230 persons, which equates to an average of 8,562 per week and 1,220 per day across Australia. Net migration in South Australia was 23,160 persons, which equates to an average of 445 per week and 63 per day.

A table showing the top seven countries, with growth over the last ten years, is presented below.

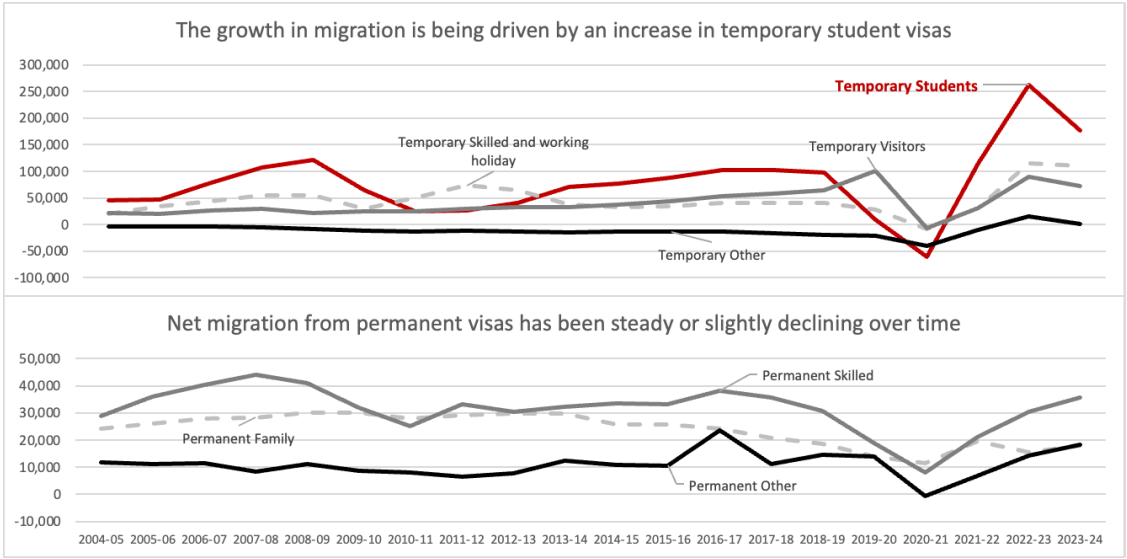
	Australia net migration						South Australia net migration					
Country	Net migration 2013-14	Share of total	Net migration 2023-24	Share of total	Annual growth	change in share	Net migration 2013-14	Share of total	Net migration 2023-24	Share of total	Annual growth	change in share
India	33,340	17.8%	72,350	16.3%	8.1%	-1.5%	1,970	16.9%	5,570	24.1%	11.0%	7.2%
China	30,810	16.4%	49,710	11.2%	4.9%	-5.2%	1,960	16.8%	2,210	9.5%	1.2%	-7.3%
Philippines	12,840	6.8%	32,570	7.3%	9.8%	0.5%	920	7.9%	1,530	6.6%	5.2%	-1.3%
New Zealand	7,240	3.9%	23,620	5.3%	12.6%	1.4%	50	0.4%	460	2.0%	24.8%	1.5%
UK, CIs & IOM	12,270	6.5%	21,200	4.8%	5.6%	-1.8%	480	4.1%	800	3.5%	5.2%	-1.6%
Vietnam	8,750	4.7%	20,660	4.6%	9.0%	0.0%	250	2.1%	1,000	4.3%	14.9%	-0.7%
Nepal	7,310	3.9%	18,880	4.2%	10.0%	0.3%	510	4.4%	1,360	5.9%	10.3%	2.2%
Other countries	75,190	40.0%	206,240	46.3%	10.6%	6.3%	5,530	47.4%	10,230	44.2%	6.3%	-3.2%
Total	**187,750**	**100.0%**	**445,230**	**100.0%**	**9.0%**		**11,670**	**100.0%**	**23,160**	**100.0%**	**7.1%**	

Note: UK, CIs and IOM – United Kingdom, Channel Islands and Isle of Man

Key points to note from the table include:

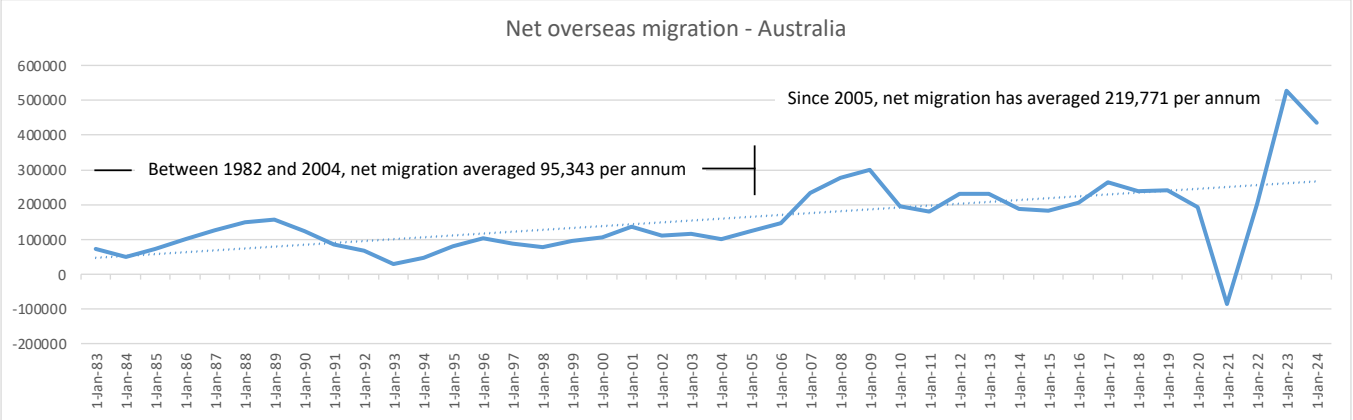
- Strong growth in net migration of 9.0% per annum for Australia and 7.1% per annum for South Australia. Growth has come from all of the top seven countries.
- South Australia has seen high growth in net migration from New Zealand and Vietnam. South Australia has a higher share of its net migration from India (24.1%) compared with the Australian share (16.3%).

The graphs below show the breakdown in net migration by groups for Australia.



The biggest contributor to growth is from temporary visas for students with the growth concentrated in the last two years. Aside from the downturn from COVID-19, the trends in permanent visa migration are steady.

The growth in net migration has been strong since the mid-2000s. The graph below shows the trend in net overseas migration since 1983.



This growth in migration was not forecast by demographers or by the government in 2004. In 2004, population projections for the future were made for 2023. The population in 2022-23 is much higher than what was projected in 2004. The projections at that time underestimated net migration growth. When projections were made, the mid-range estimates (series B) assumed that net migration would be around 110,000 per annum.

The higher than expected net migration has changed the profile of the population by age. The graphic below compares the age profiles for Australia between 1983 and 2023.

The impact of net migration since 2023 has been to increase the number of persons in the population below the age of 40. The net migration has offset the impact of ageing of the underlying Australian population.

Presenting numbers – telling or revealing

A dilemma for a writer is to make choices about the extent to which we tell our readers the story or have the reader discover the story.

When you write to tell rather than write to discover you get straight to the point and present conclusions rather than allowing the reader to deduce anything.

When you tell you will present findings first and support them with facts and data second.

When you write to reveal, you will present facts and data first and findings and conclusions second. Reveal will present the reader with some information in a particular order and in an open-minded way, enabling the reader to draw a conclusion(s). Writing to reveal enables the reader to discover. Discovery requires more structure in our writing. When you write to discover and write to reveal rather than tell, you make the reader part of the experience.

Each has its place.

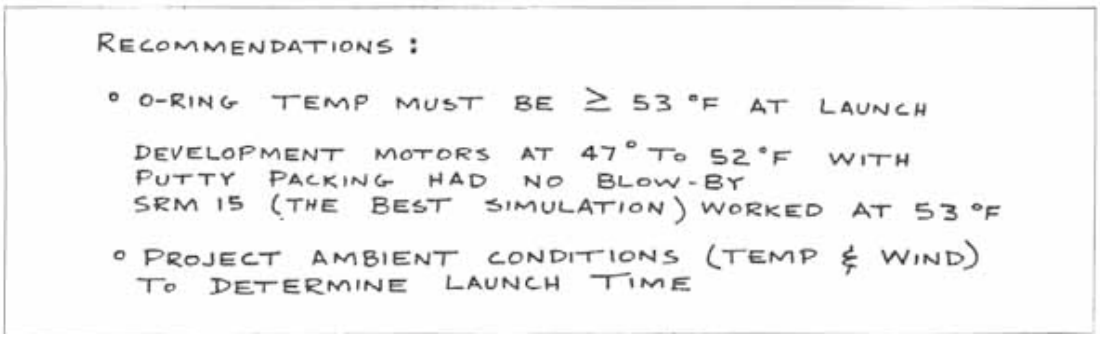
Telling has the advantage of being direct and more succinct.

Telling works well when all you need to do is inform someone.

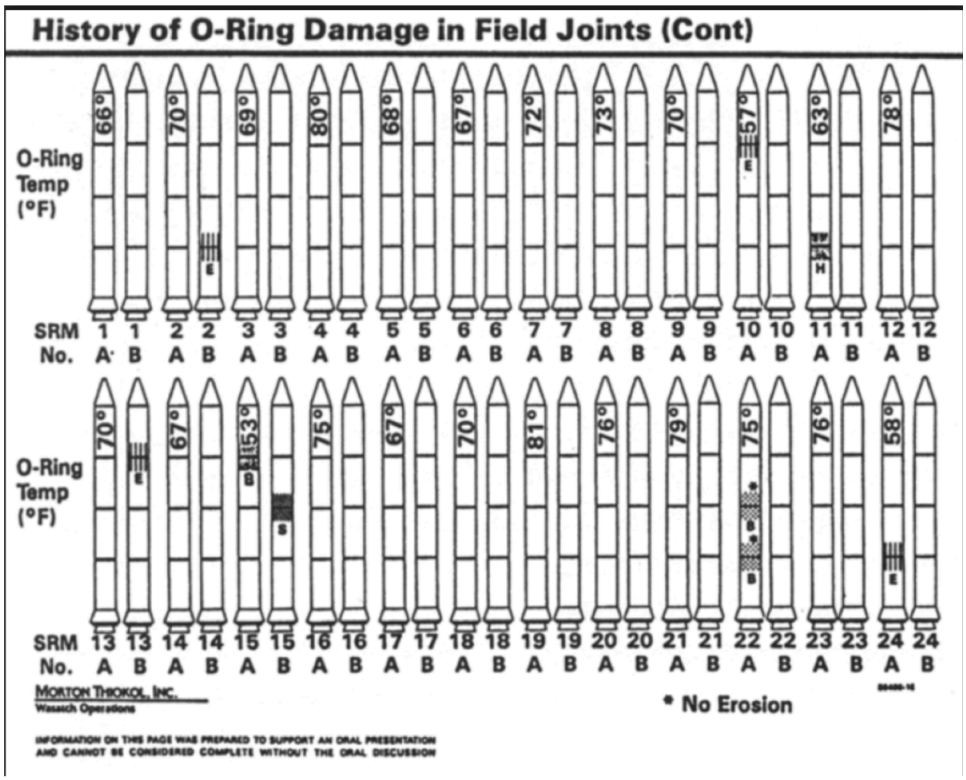
Telling has the disadvantage of being less engaging.

Discovery works well when we need the reader to 'understand' the conclusion of the document by having them draw the conclusions themselves. This means withholding judgement in our writing, allowing the reader to draw conclusions. Discovery writing can also demonstrate an open-mindedness on behalf of the writer.

The presentation of numbers mattered when the Space Shuttle Challenger was launched in January 1986. January is the middle of winter in Florida, where the shuttle was launched. Following are copies of some of the tables that were used in an attempt by engineers to highlight the risks associated with a launch in cold weather, in particular the risks associated with damage to O-rings designed to seal fuel booster rockets.



An example of a graphic used to demonstrate the performance of O-rings under different conditions is presented below.



The critical step in making the link between temperature and O-ring performance was not well communicated. The graph above does not adequately show any pattern between temperature and O-ring performance. Note the order the data is presented – flight number order. It would be more informative to rank the data by temperature.

The engineers at the launch pad produced 13 charts (including the graphic above) but failed to stop the launch.

> *"Yet, as it turned out, the chartmakers had reached the right conclusions. They had the correct theory and they were thinking causally, but they were not displaying causally."* Edward Tufte, Visual Explanations, pg 44

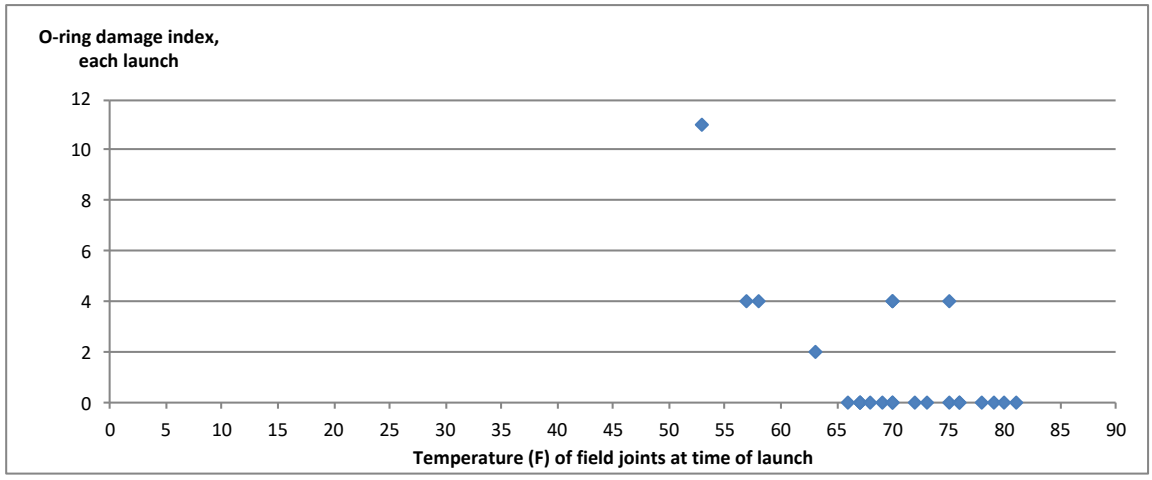
It was observed that the data presented in the 13 charts was very thin.

An alternate presentation was developed by Edward Tufte showing an overall damage score for previous launches. These are presented in the table over the page.

Flight	Date	Temperature	Erosion Incidents	Blow-by incidents	Damage index
51-C	24/01/85	53	3	2	11
41-B	3/02/84	57	1		4
61-C	21/01/86	58	1		4
41-C	6/04/84	63	1		2
1	21/04/81	66			0
6	4/04/83	67			0
51-A	8/11/84	67			0
51-D	12/04/85	67			0
5	11/11/82	68			0
3	22/03/82	69			0
2	21/11/81	70	1		4
9	28/11/83	70			0
41-D	30/08/84	70	1		4
51-G	17/06/85	70			0
7	18/06/83	72			0
8	30/08/83	73			0
51-B	29/04/85	75			0
61-A	30/10/85	75		2	4
51-I	27/08/85	76			0
61-B	26/11/85	76			0
41-G	5/10/84	78			0
51-J	3/10/85	79			0
4	27/06/82	80			0
51-F	29/07/85	81			0

> *"When assessing evidence, it is helpful to see a full data matrix, all observations for all variables, those private numbers from which the public displays are constructed. No telling what will turn up."*

A scatterplot of data from previous launches shows that the risks associated with O-rings increase as temperature decreases. Before the Challenger, the coolest temperature for a launch with no O-ring damage was 66°F. On the day of the launch of the Challenger, the temperature was 37°F.



While not all of us are involved in the presentation of data in such dramatic circumstances, there are many circumstances when the presentation of data has a significant impact on decisions being made across the public sector.

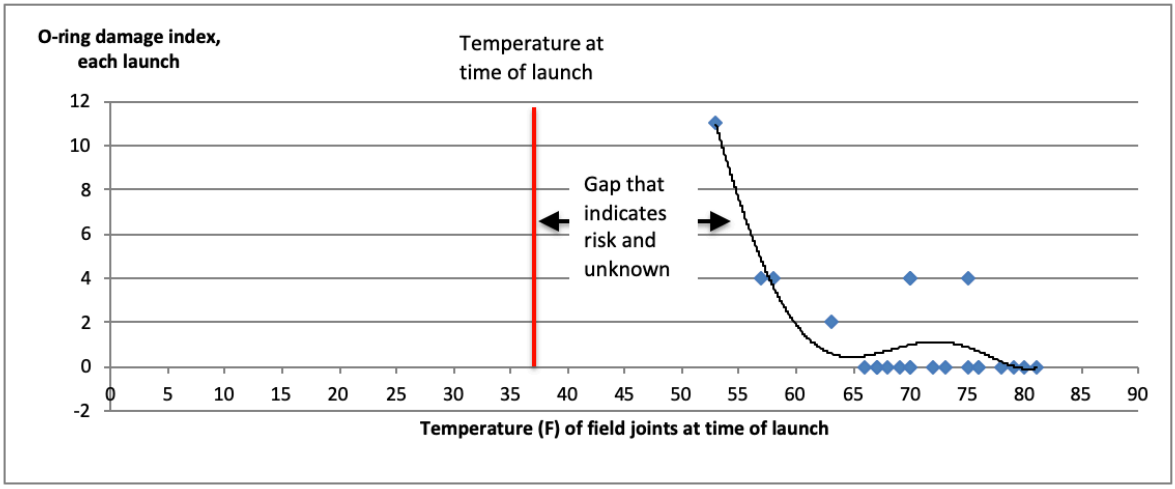
What is critical is that we ensure that the presentation of data reveals evidence and insight rather than just providing information.

> *"Everyone spoke of information overload, but what there was in fact was a non-information overload."* Richard Saul Wurman, *What-If, Could-Be*

Present gaps to reveal/discover

To support decision-making with the graph on the previous page, I would consider adding a couple of elements that highlight factors critical to the decision by revealing gaps with:

- A line of best fit on the data
- A reference point or benchmark for the decision to be made
- Highlight the gap between the data and the reference point.

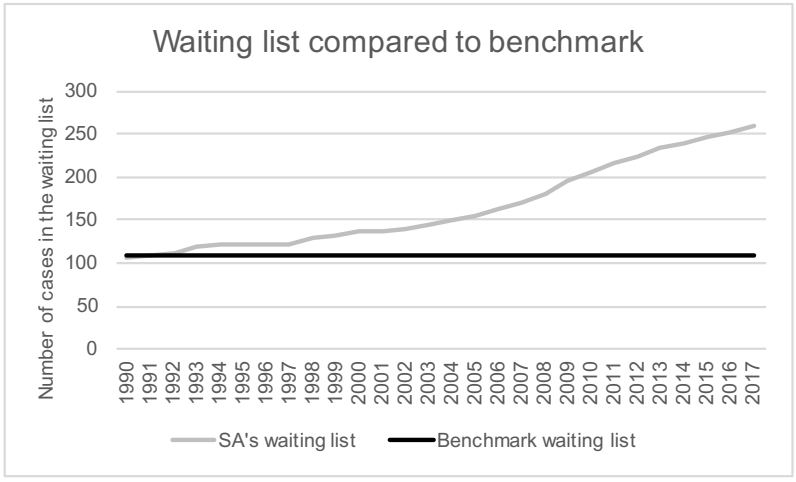


A business case or funding request will usually be based on there being a gap between an ideal or target performance and current or real performance. For example, a business case for more building capacity can be based on revealing a gap in the target (or benchmark) waiting list and the current or project waiting list. Discovery of such a gap can occur by:

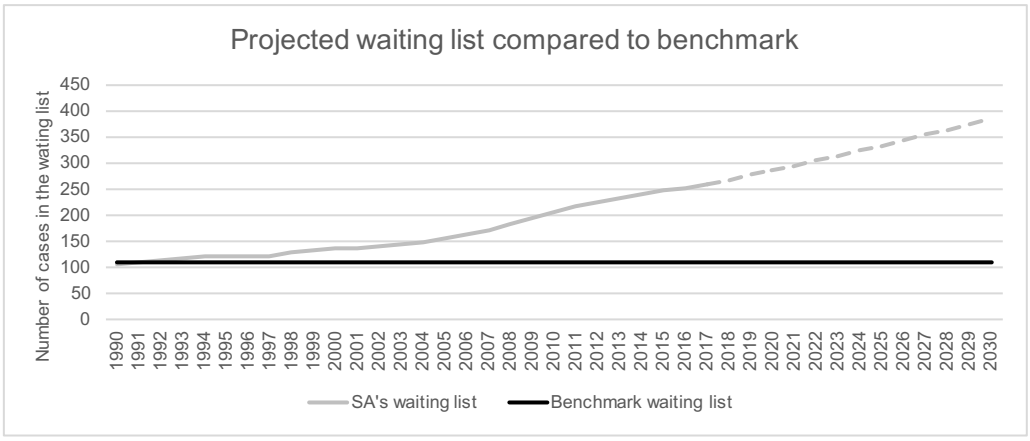
1. Presenting the ideal state – the benchmark or target.
2. Presenting the most recent trend against the benchmark to show any gap between recent performance and the target.
3. Presenting the projected trend based on current assumptions to reinforce the gap between performance and the target.
4. Presenting findings regarding the gap, along with evidence of building capacity as the main reason for the gap
5. Presenting data to show the number of rooms required to close the gap.

Examples of graphs that do this are shown over the page:

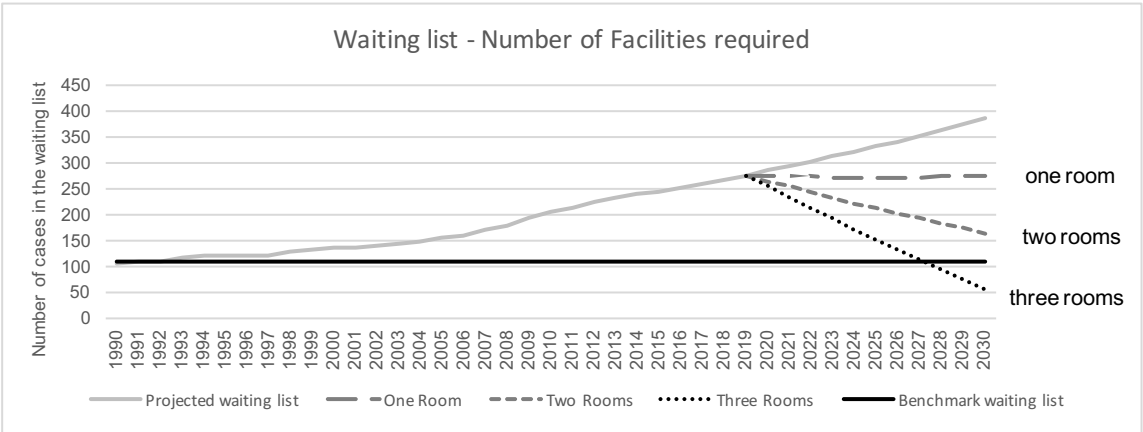
There is a trend growth in the backlog of cases. There has been trend growth in the backlog of cases as shown in the graph below.



Projected growth in the waiting list compared to the benchmark is presented in the graph below.



Modelling has been done of the growth in cases and the growth in the number of facilities (e.g. operating theatres, beds, rooms, offices) required. This modelling has estimated that to increase the number of cases processed to eliminate the waiting list gap from the benchmark, three additional facilities are required, along with extra staff to operate and process cases in these facilities.



Excellence in presenting numbers

From Edward Tufte

Excellence in statistical graphics consists of complex ideas communicated with clarity, precision, and efficiency. Graphical displays should:

- Show the data
- Induce the viewer to think about the substance rather than about the methodology, graphic design, the technology of the graphic production, or something else
- Avoid distorting what the data has to say
- Present many numbers in a small space
- Make large data sets coherent
- Encourage the eye to compare different pieces of data
- Reveal the data at several levels of detail, from a broad overview to the fine structure
- Serve a reasonably clear purpose: description, exploration, tabulation or decoration
- Be closely integrated with the statistical and verbal description of a data set.

Principles of Graphical Excellence

- Graphical excellence is the well-designed presentation of interesting data – a matter of substance, of statistics and design.
- Graphical excellence consists of complex ideas communicated with clarity, precision and efficiency.
- Graphical excellence is that which gives the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.
- Graphical excellence is almost always multivariate.
- Graphical excellence requires telling the truth about the data.

From Stephen Few

"The purpose of quantitative tables and graphs in business is to communicate important information effectively. That's it. Not to entertain, not to indulge in self-expression, not to make numbers interesting through flash and dazzle that you would otherwise deem boring."

"As providers of quantitative business information, it is our responsibility to do more than sift through the data and pass it on; we must help our readers gain the insight contained therein. We must design the message in a way that leads readers on a journey of discovery, making sure that what's important is clearly seen and understood. The right numbers have an important story to tell. They rely on you to give them a clear and convincing voice."

From Sally Bigwood and Melissa Spore

To create lucid, intelligible data graphics, we suggest the following:

Reduce the data: Designing useful data graphics requires decision-making, judging what data is relevant, and what can be ignored. Too much data swamps, confuses and misleads. Think of the needs of your readers. Provide selective, edited demonstration tables – focusing on a specific point – rather than comprehensive tables. Similarly, graphs should focus on an explicit story.

Present refined thought: Persuasive data graphics are the product of time and thought. Serious communicators need time to analyse the data and design it appropriately for the intended audience. A resulting table or graph may look simple but is the result of knowledge, experience and commitment to communicating with others.

Don't overestimate graphs: Graphs are fundamentally simple. Bar graphs show that one thing is larger than another, lines show changes over time and pies show the parts of a whole. Graphs that look complex almost always do so because of overelaborate presentation, not intellectual rigour. The fact is, graphs cannot explain complex messages and complex graphs do not communicate effectively.

Use a table: Saying the public prefers graphs to tables is like saying someone prefers a hammer to a saw. Both are useful tools but they do different jobs. Graphs excel at a single storyline, high contrasts and broad trends; they are less good at detail. Tables are more versatile and can present complex stories. Additionally, tables hold detail conveniently and, when well designed, are easy to read. Yet communicators are sometimes pressured into using graphs when a table is appropriate. People who are interested in your subject will be interested in relevant, readable data however presented.

Remove debris: Gratuitous decoration – data labels, gridlines, shading, borders, tick marks, embolding, etc. – detracts from the message. Emphasise the data, not the decoration. To make your tables and graphs authoritative, keep them simple, small and stripped of clutter. Look at *The Economist*: it serves a highly numerate, serious readership and illustrates articles with small, succinct data graphics with scarcely a gridline or data label in sight.

Steer clear of pie charts and 3-D graphs: The public may like pie charts but they force readers into the mental juggling of comparing triangles arranged in a circle. Most of us think linearly and a simple bar chart presents this data more conveniently. Equally, 3D graphs may be popular, but they tend to distort data – readers do not know which point of the image they should measure from. Avoid them.

Extract from the Article *"Designing persuasive tables and charts".*

Discussion

When and why might you use tables vs graphs?

What type of graphs might you choose and under what circumstances?

Commonwealth spending on school education in 2010-11 was $18,576 million[1]
Commonwealth spending on school education in 2018-19 was $20,379 million

Commonwealth spending on school education has grown in dollar terms, but has it really grown?

Types of numbers

Nominal vs Real

Nominal value refers to a value expressed in money terms (that is, in units of a currency) in a given year or series of years. By contrast, **real value** adjusts nominal value to remove the effects of price changes over time. For example, changes in the nominal value of some commodity bundle over time can happen because of a change in the quantities in the bundle *or* their associated prices, whereas changes in real values reflect *only* changes in quantities.

Most raw financial data is presented in nominal terms. An example for education spending is below.

		nominal $ million	real $ million
Commmonwealth spending on			
Pre-primary, primary and secondary education	2010-11	18,576	18,576
Pre-primary, primary and secondary education	2018-19	20,379	17,610
Growth - eight years		9.7%	-5.2%
Growth - compound annual		1.2%	-0.7%
Indexes			
Australian total CPI - 30 June 2011		99.2	100.0
Australian total CPI - 30 June 2019		114.8	115.7

Sources:
5512.0 Government Finance Statistics, Australia, 2018-19
6401.0 Consumer Price Index, Australia

[1] Source: 5512.0 Government Finance Statistics, Australia, 2018-19

Numbers that summarise

Numbers that summarise help give us focus and help us see the parts and the whole.

Totals - Totals help give the big picture

Measures of summary

- Mean (average) - an average, or central tendency[1] of a data set is a measure of the "middle" value of the data set. Averages give focus.
- Median (middle) - a median is described as the numerical value separating the higher half of a sample, a population, or a probability distribution, from the lower half.
- Mode (most common) - the mode is the value that occurs most frequently in a data set or a probability distribution.

Measures of distribution (or variation)

- Standard deviation - standard deviation is a widely used measurement of variability or diversity used in statistics and probability theory. It shows how much variation or "dispersion" there is from the average (mean, or expected value). A low standard deviation indicates that the data points tend to be very close to the mean, whereas a high standard deviation indicates that the data are spread out over a large range of values.
- Percentage variation

Measures of relationship

- Percentages - a percentage is a way of expressing a number as a fraction of 100, as part of the whole.
- Correlation & dependence - In statistics, dependence refers to any statistical relationship between two random variables or two sets of data. Correlation refers to any of a broad class of statistical relationships involving dependence. Beware, correlation does not mean causation.
- Ratios - a ratio is a relationship between two numbers of the same kind

Measures of growth – growth figures measure change over time.

Options for presenting data

Tables

"A table is a structure for organising and displaying information; a table exhibits the following characteristics:

- *Data are arranged in columns and rows*
- *Data are encoded as text (including words and numbers)."*

Source: Page 40 of *Show Me the Numbers*, Stephen Few

Graphs

"A graph is a method for displaying quantitative information that exhibits the following characteristics:

- *Values are displayed within an area delineated by one or more axes*
- *Values are encoded as visual objects positioned in relation to the axes*
- *Axes provide scales (quantitative and categorical) that are used to assign values and labels to the visual objects."*

Source: Page 42 of *Show Me the Numbers*, Stephen Few

To use tables or graphs?

A common dilemma is whether or not to use tables or graphs in the presentation of quantitative information. Below are some simple principles that can help us determine whether we use tables or graphs.

- Tables are the best way to show exact numerical values. Graphs are the best way to show indicative numbers.
- Tables are preferable to graphics for many small data sets. "Tables usually outperform graphics in reporting on small data sets of 20 numbers or less. The special power of graphics comes in the display of large data sets."
- Tables also work well when the data presentation requires many localised comparisons (e.g. when showing many electorates in an election)
- Graphs are best when making comparisons over time.
- Graphs are best for showing shapes, trends and relationships in and between data.

If in doubt, use a table; they are more versatile and data-rich.

Writing about numbers

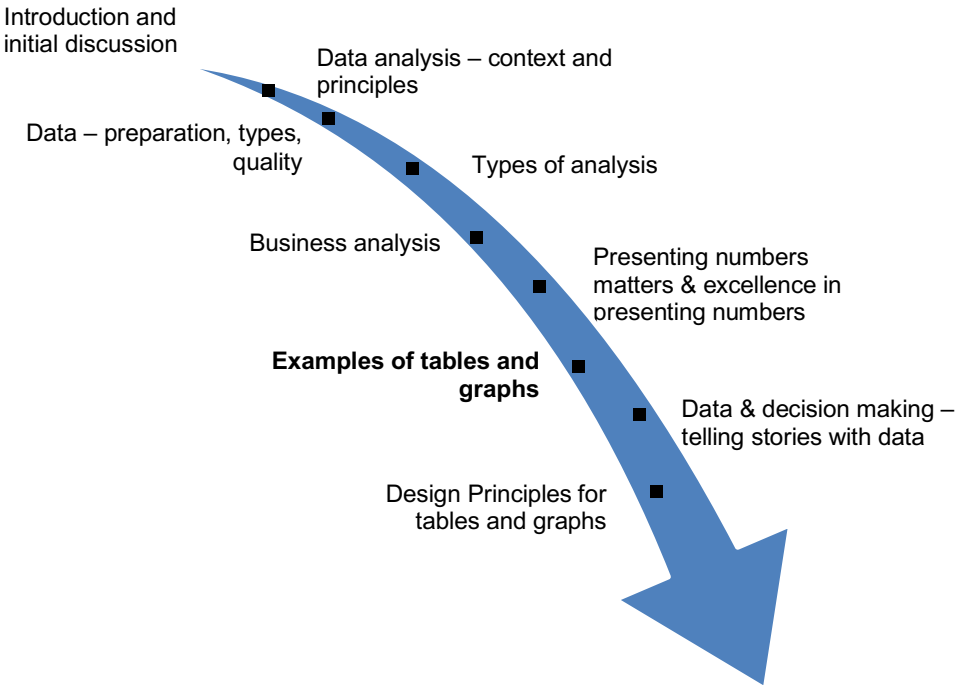
Some conventions regarding the inclusion of numbers among words include:

- Spell out the numbers one to nine and use numerals for 10 and greater
- Do not begin a sentence with a number in numerical form. Instead, write the number out, or recast the sentence. For example:

  Seventeen monkeys were captured

  rather than

  17 monkeys were captured



I better understand a range of analytical techniques and options for presenting data that help me use data in the development of evidence based policy and in reporting.

Basics in Tables and Charts

Anatomy of a table

Title with units identified

Table A.13: General government sector taxes ($million) (a)

	2010–11 Estimated Result	2011–12 Budget	2012–13 Estimate	2013–14 Estimate	2014–15 Estimate
Taxes on employers' payroll and labour force	958	1 049	1 116	1 185	1 258
Taxes on property					
Land taxes	571	603	632	657	684
Stamp duties on financial and capital transactions	904	989	1 089	1 211	1 329
Financial institutions' transaction taxes	—	—	—	—	—
Other	166	171	175	181	186
Total	1 641	1 763	1 897	2 049	2 198
Taxes on the provision of goods and services					
Excises and levies	—	—	—	—	—
Taxes on gambling	402	420	473	458	487
Taxes on insurance	362	387	401	415	429
Total	763	807	874	872	916
Taxes on use of goods and performance of activities					
Motor vehicle taxes	482	509	526	543	562
Total	482	509	526	543	562
Total GFS taxation revenue	3 845	4 129	4 413	4 650	4 933

Note: Totals may not add due to rounding.
(a) Excludes taxes paid by general government entities.

Column headings

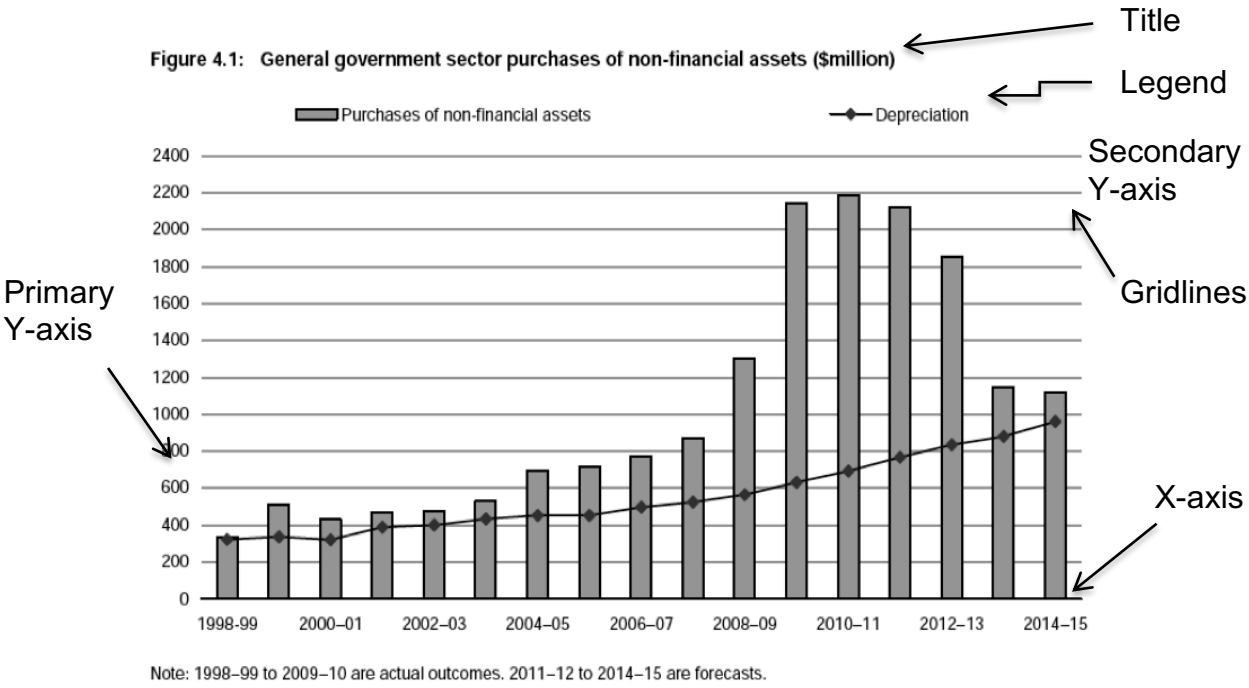
Row headings

Table body (data)

Footnotes

Source: SA Government 2011-12 Budget Statement

Anatomy of a graph



Source: SA Government 2011-12 Budget Statement

Key components of a graph are shown, namely:

- The title,
- the legend,
- gridlines,
- the x and
- y-axis.

The numbers on the y-axis represent the scales on which the data is shown. The area including the data bordered by the x and y axes is called the plot area.

Different Graphs for different stories

Values can be shown in graphs using the following objects:

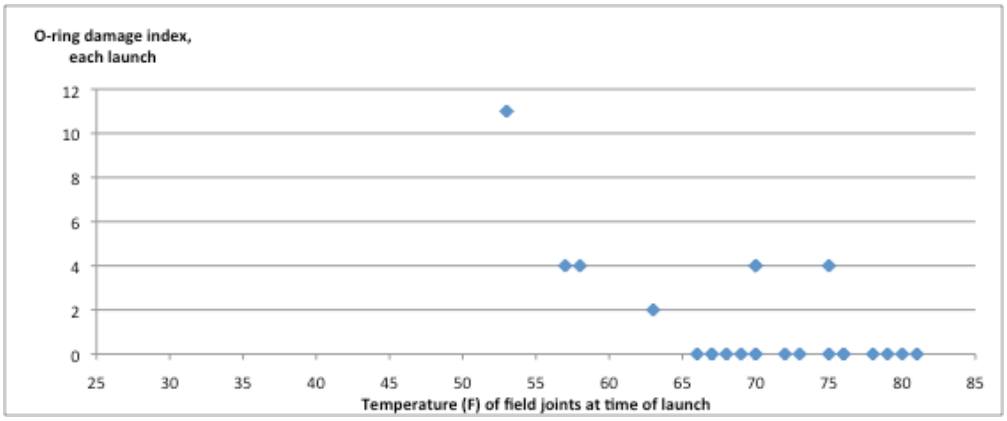
- Points (used in scatter charts)
- Lines (used in line charts)
- Bars (used in histograms or bar charts)
- Shapes (used on pie charts and box plots)

The type of graph we want to use depends on what we want to communicate. The notes will look at different messages best delivered by different graphs. Notes will include graphs for the following types of stories:

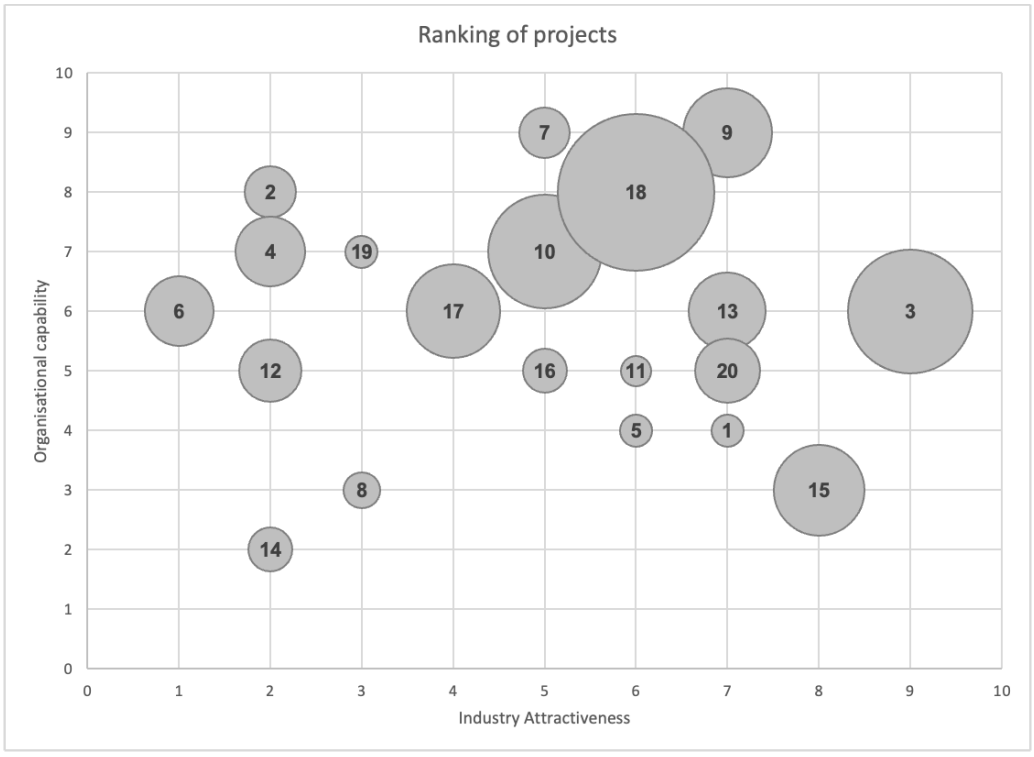
- To show correlation and relationships
- To tell temporal stories (trends and changes over time)
- To show composition and the relationship of the parts to the whole
- To show variations and performance against benchmarks or targets
- To show distribution and summary statistics
- To show locations where events occur

To show correlation and relationships

Scatterplots or point graphs are used to show relationships between multiple pieces of data or show large volumes of data over time. We used a point graph to show the relationship between O-ring damage and temperature.



A bubble chart is a variation on the scatter graph above. With bubble charts, the size of the point can be used to display another variable. An example of a bubble chart used to present the relative ranking of projects for planning is presented below.

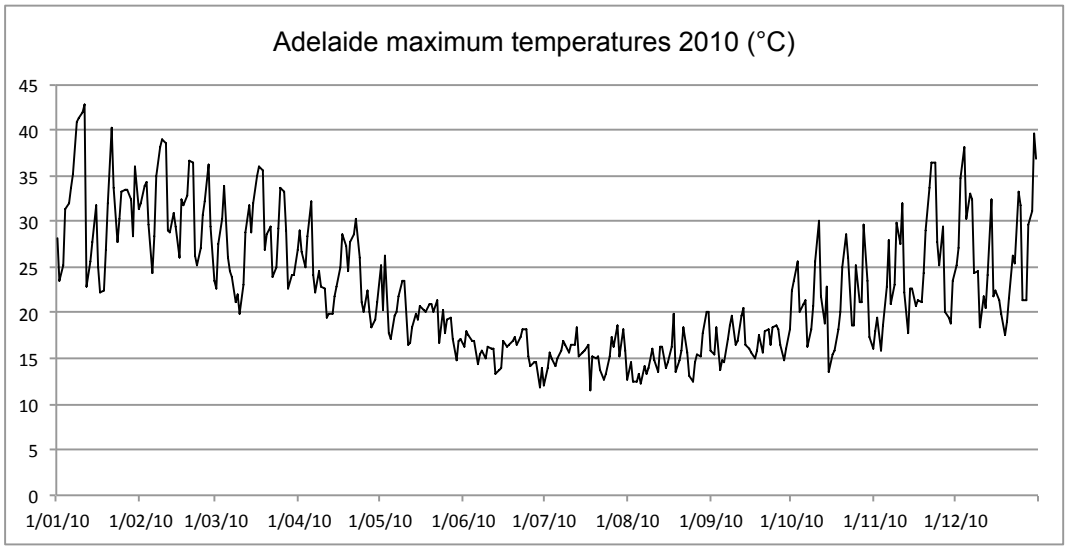


The bubbles show the ranking of projects for a University team with ranking done for organisational capability (vertical axis) and industry attractiveness (horizontal axis). The size of the bubbles reflects the budget for the projects. The visualisation was developed to prioritise project areas for planning. Projects to the left and towards the bottom were culled before projects to the right and near the top.

To tell temporal stories (trends and changes over time)

Line graphs are best for showing trends and volatility over time

The line chart below tracks Adelaide's maximum temperatures throughout 2010.

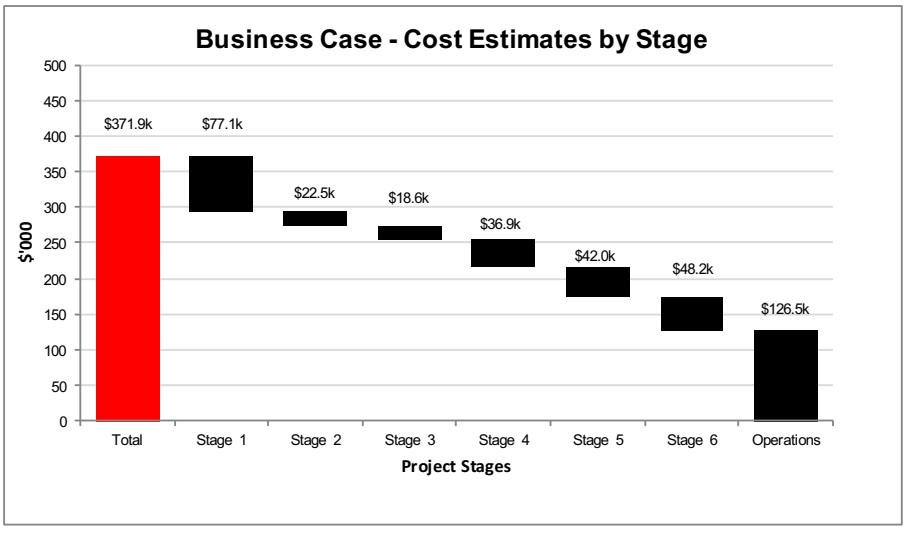


The chart shows not only the broad trends of warmer in summer and cooler in winter, but also shows the extent of volatility that is higher in warmer seasons and lower in late autumn, winter and early spring.

Waterfall Chart

A waterfall chart is a form of data visualisation that helps in understanding the cumulative effect of sequential values. For example, for a project by stage:

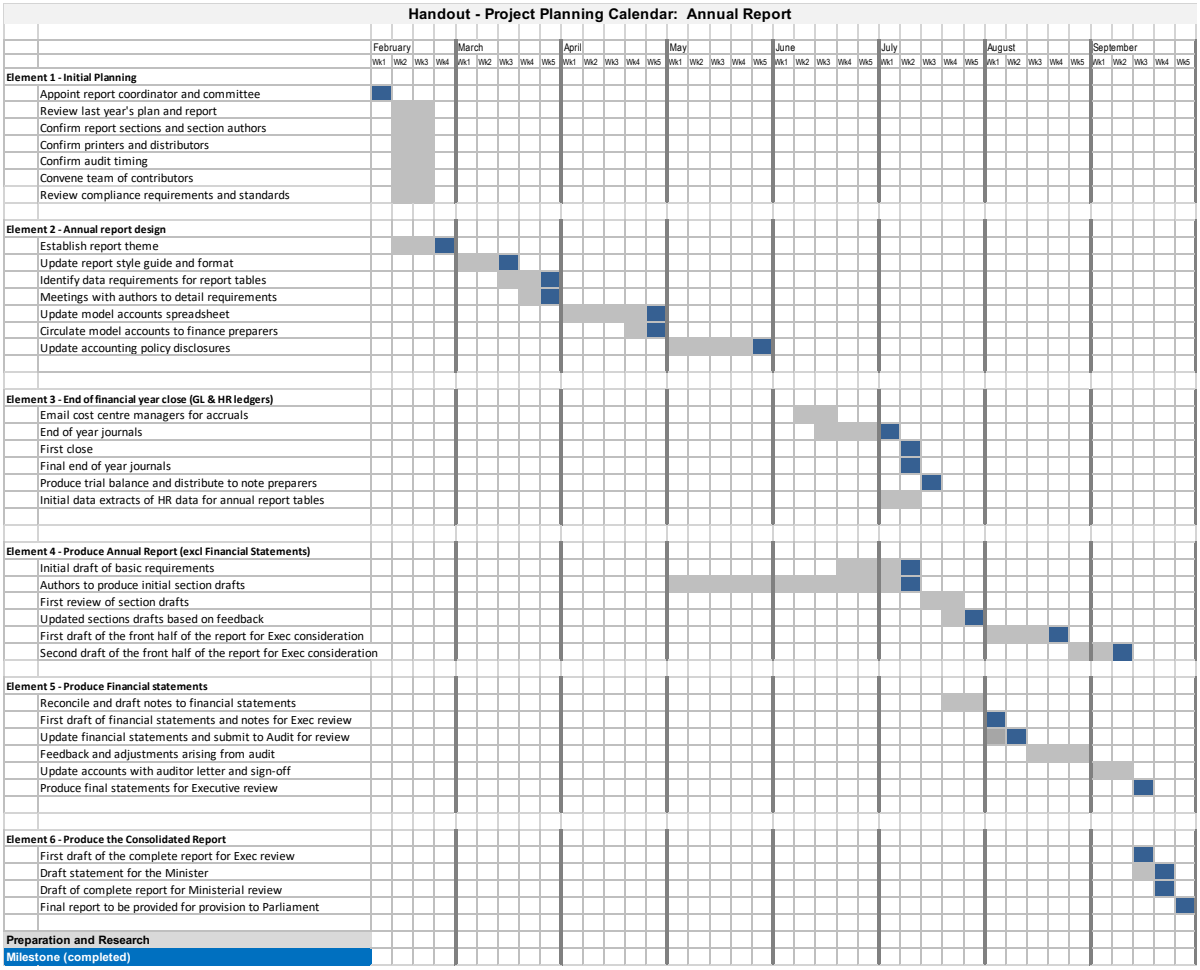
	Total $'000	Stage 1 $'000	Stage 2 $'000	Stage 3 $'000	Stage 4 $'000	Stage 5 $'000	Stage 6 $'000	Operations $'000
Operations	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5
Stage 6	48.2	48.2	48.2	48.2	48.2	48.2	48.2	48.2
Stage 5	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
Stage 4	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
Stage 3	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6
Stage 2	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Stage 1	77.1	77.1	77.1	77.1	77.1	77.1	77.1	77.1



Gantt Chart

Gantt charts are used in project management as a way of showing activities (tasks or events) displayed against time. On the left of the chart is a list of the activities, and along the top is a suitable time scale. Each activity is represented by a bar; the position and length of the bar reflect the start date, duration and end date of the activity.

An example for the production of an annual report is shown below.



Sparklines are small, high-resolution graphics usually embedded in a full context of words, numbers or images.

Edward Tufte has devoted a chapter to the concept of sparklines in his book Beautiful Evidence. Sparklines are ideal for dashboards and presentations that require condensed data displays.

An example of the use of sparklines by Primary Industries and Regions South Australia (PIRSA) is presented below.

	Value $ million			
	2017–18	Change from 2016–17	Change from 2013–14	5 Year Trend
Field Crops Total	**1,897**	↓ **-26%**	↓ **-18%**	
Wheat	898	↓ -24%	↓ -9%	
Barley	373	↓ -1%	↑ 1%	
Other	626	↓ -39%	↓ -34%	
Livestock total	**1,885**	↑ **0.1%**	↑ **41%**	
Beef	628	↑ 4%	↑ 58%	
Pig	176	↓ -17%	↓ -2%	
Sheep	619	↑ 0.2%	↑ 35%	
Chicken	344	↑ 7%	↑ 50%	
Other	118	↓ -7%	↑ 62%	
Dairy total	**217**	↑ **11%**	↓ **-16%**	
Horticulture total	**976**	↑ **1%**	↑ **15%**	
Potatoes	145	→ 0%	↑ 27%	
Citrus	110	↑ 7%	↑ 67%	
Almonds	108	↓ -16%	↑ 3%	
Other	613	↑ 3%	↑ 8%	
Seafood total	**456**	↑ **0.5%**	↑ **9%**	
Southern Bluefin Tuna	122	↓ -0.1%	↑ 7%	
Southern Rock Lobster	124	↑ 7%	↑ 15%	
Other	210	↓ -2%	↑ 6%	
Wool	**568**	↑ **29%**	↑ **78%**	
Wine	**590**	↓ **-10%**	↑ **39%**	
Forestry*	**368**	↑ **14%**	↑ **132%**	
Total primary production	**6,956**	↓ **-7%**	↑ **15%**	

Table 1. South Australia's primary industries' production (farmgate value) by sector and product, 2017–18.

**Most recent production data available for forestry is the 2016–17 data from ABARES.*

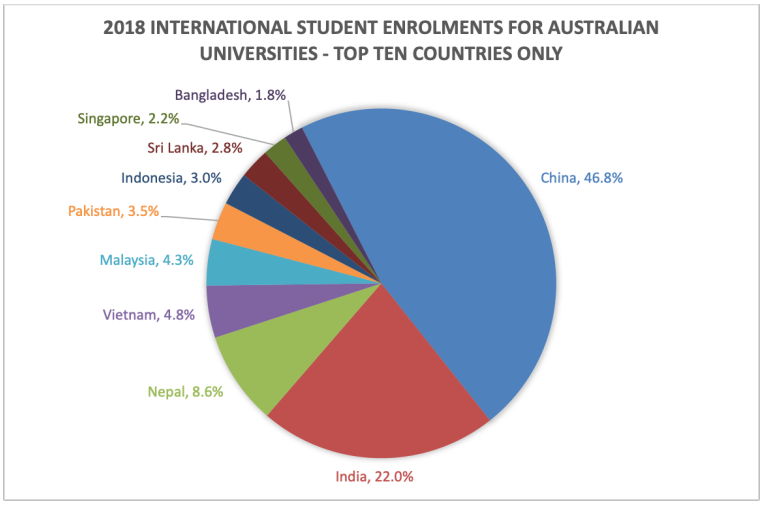
Source: PIRSA Primary Industries Scorecard 2017-18

To show composition and the relationship of the parts to the whole

Pie charts

Pie charts or area charts are used to show compositional data – how the parts relate to a whole.

Country	% share	2018 enrolments
China	46.8%	152,538
India	22.0%	71,681
Nepal	8.6%	28,124
Vietnam	4.8%	15,699
Malaysia	4.3%	13,983
Pakistan	3.5%	11,372
Indonesia	3.0%	9,884
Sri Lanka	2.8%	9,200
Singapore	2.2%	7,323
Bangladesh	1.8%	5,903
Total of top ten	**100.0%**	**325,707**



A donut chart is a version of a pie chart with a hole in the middle.

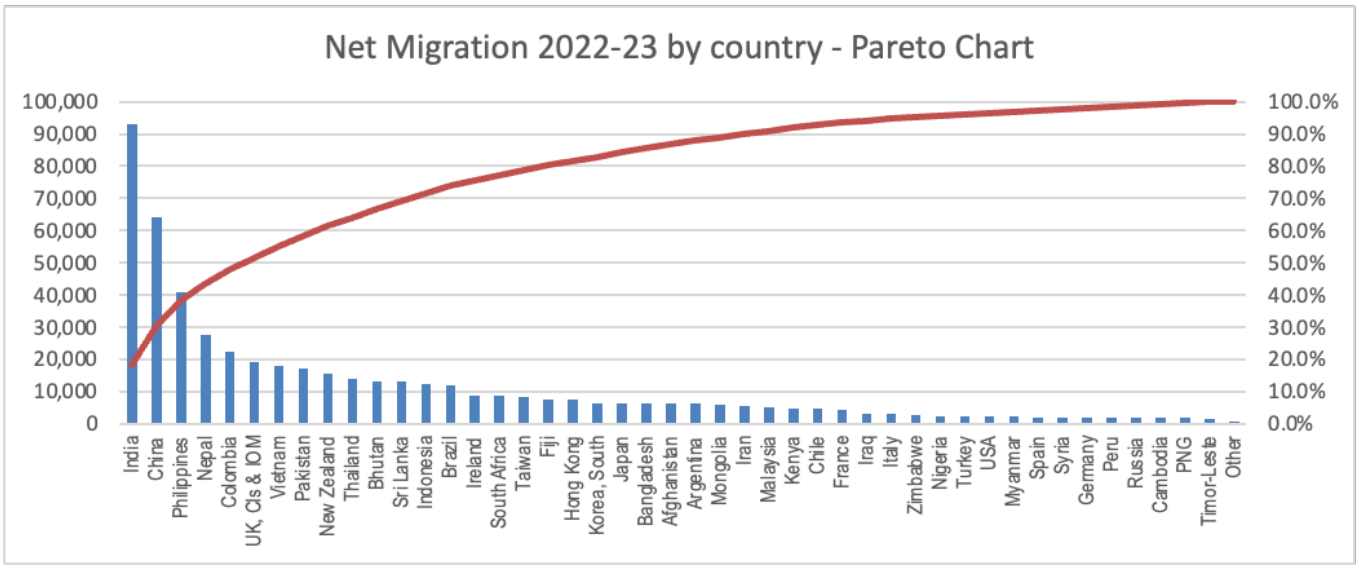
Treemaps can also be used to show composition but do so using rectangles rather than slices. Treemaps will arrange hierarchy and can be used to distinguish subcategories.

Pareto charts

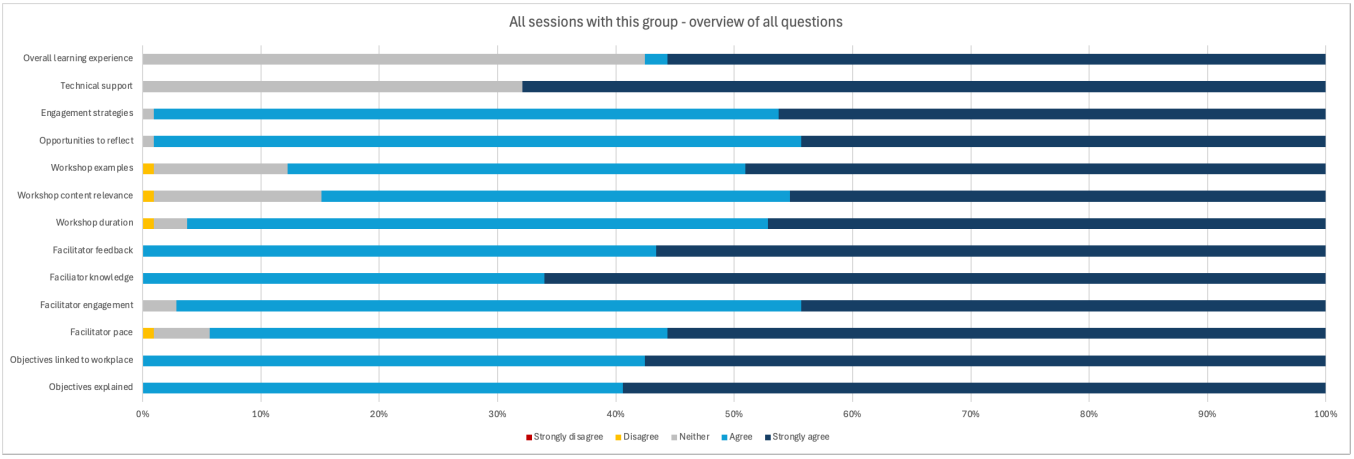
A Pareto chart contains both bars and lines, where individual values are represented in descending order by bars, and the cumulative total of the sample is represented by the curved line.

The 80/20 Rule (also known as the Pareto principle or the law of the vital few & trivial many) states that, for many events, roughly 80% of the effects come from 20% of the causes.

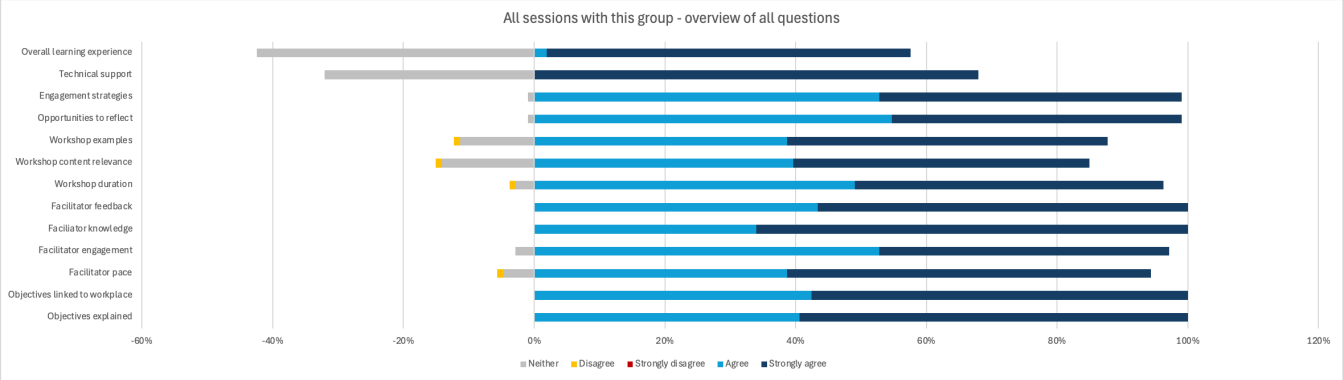
A Pareto chart for Australia's net migration in 2022-23 is shown below.



Survey results usually show the share of each response to the total. This is compositional data. To visualise compositional survey results, we can use stacked area graphs. Three versions are presented below.



The second version treats agree and strongly agree results as positive and all other responses as negative.



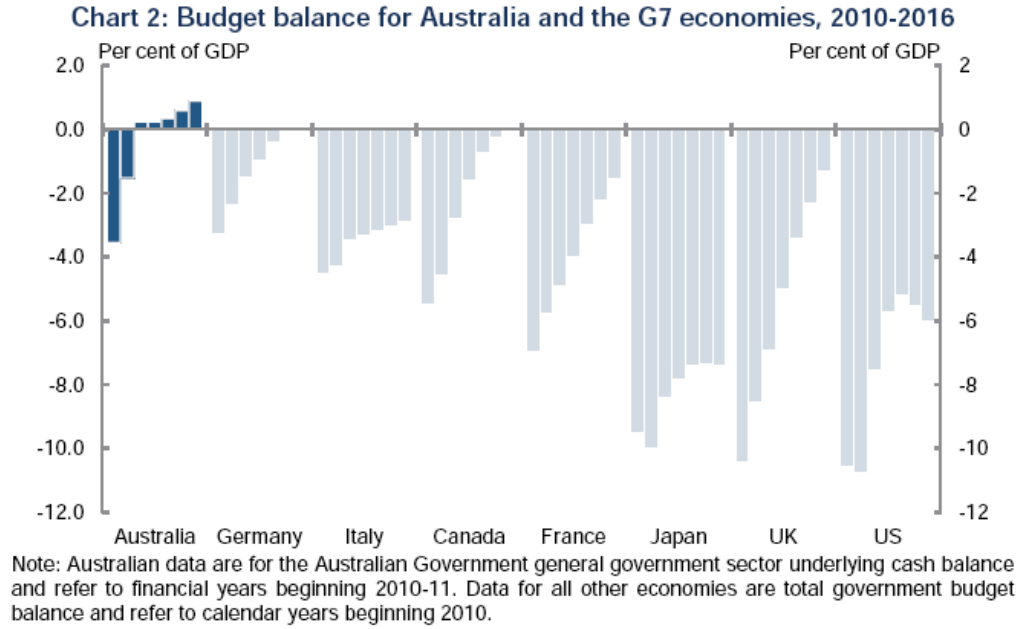
The third version combines these figures with summary statistics (average) and comparisons with other groups or benchmarks.

Summary of feedback from participants across an eight unit program

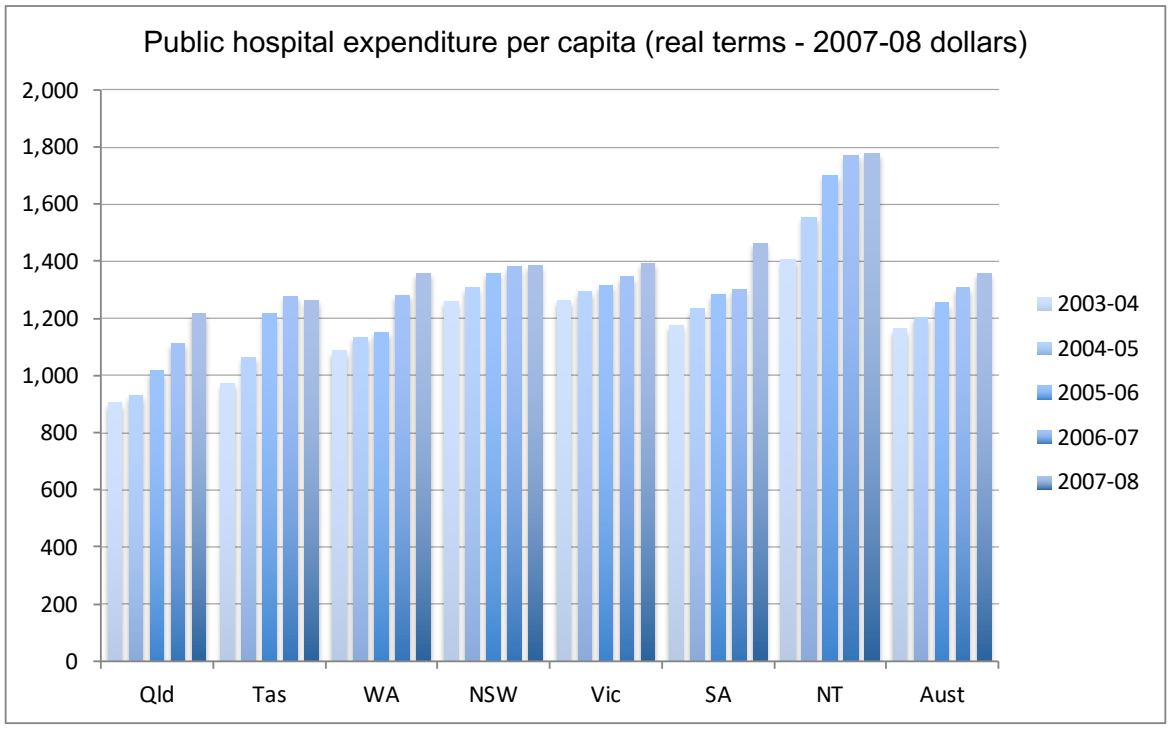
	Average score out of 5	Distribution of responses	Change from previous groups	Difference from other facilitators
		Strongly disagree / Disagree / Neither / Agree / Strongly agree		
Objectives explained	4.6		0.0	0.0
Objectives linked to workplace	4.6		0.0	0.1
Facilitator pace	4.5		-0.1	-0.1
Facilitator engagement	4.4		-0.2	-0.1
Faciliator knowledge	4.7		-0.1	0.0
Facilitator feedback	4.6		-0.1	0.0
Workshop duration	4.4		-0.1	-0.1
Workshop content relevance	4.3		-0.1	-0.1
Workshop examples	4.4		-0.1	0.1
Opportunities to reflect	4.4		-0.1	0.0
Engagement strategies	4.5		-0.1	0.0
Technical support	4.4		-0.3	0.1
Overall learning experience	4.1		-0.2	0.0

To show variations and performance against benchmarks or targets

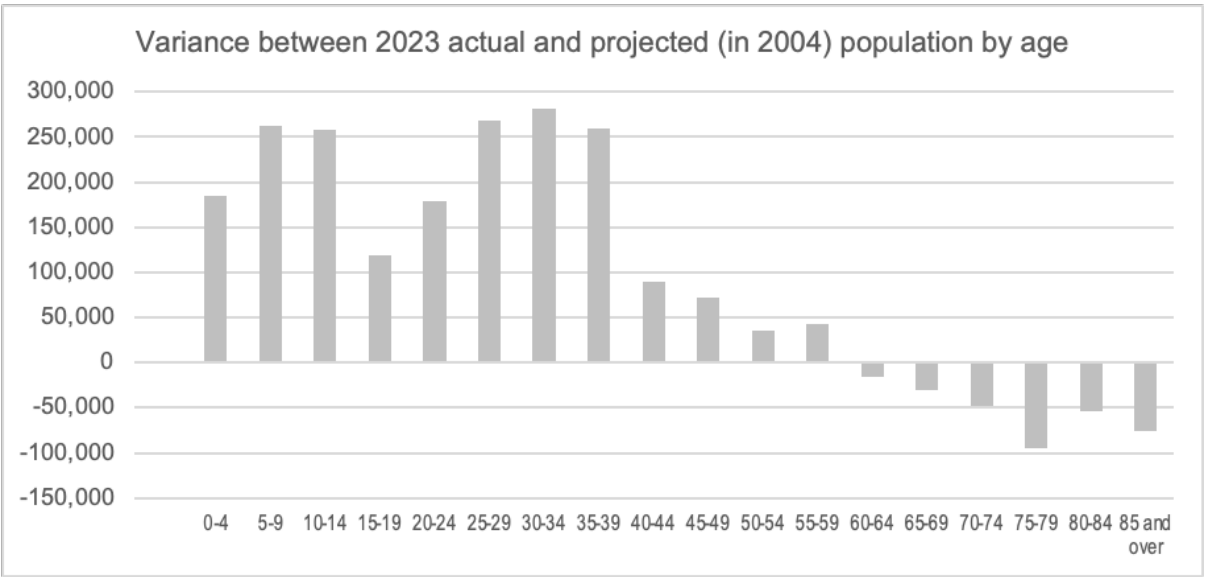
Bar charts are often used to make comparisons between sets of data or comparisons over time. The chart below from the Commonwealth budget papers compares Australia's budget balance with that of G7 countries. The chart shows both comparisons across countries and comparisons over time.



Another example contained in the course resources is below.



For our population data, we can present the variations between projections for 2022-23 made in 2004 and the actual population in 2022-23.



Note the underestimation of population for younger cohorts and the overestimation for older cohorts. This has occurred due to the underestimation of net migration, which has seen increases in population in younger cohorts. The graph may also show that life expectancy has not increased as much as expected, reducing population numbers relative to the projection in older cohorts.

Variation reporting is used frequently in finance. A report showing a summary of monthly variances would appear similar to the graph above, with the horizontal axis showing months.

Control Chart

The control chart (also known as a Shewhart Chart or a Statistical Process Control Chart) is a graph used to study variations in a process over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit, and a lower line for the lower control limit.

An example of a control chart for website visitors is presented below.

The variations within the upper and lower limits are deemed 'normal variations'

The variations outside the upper and lower limits are deemed 'special cause variations' that warrant explanation.

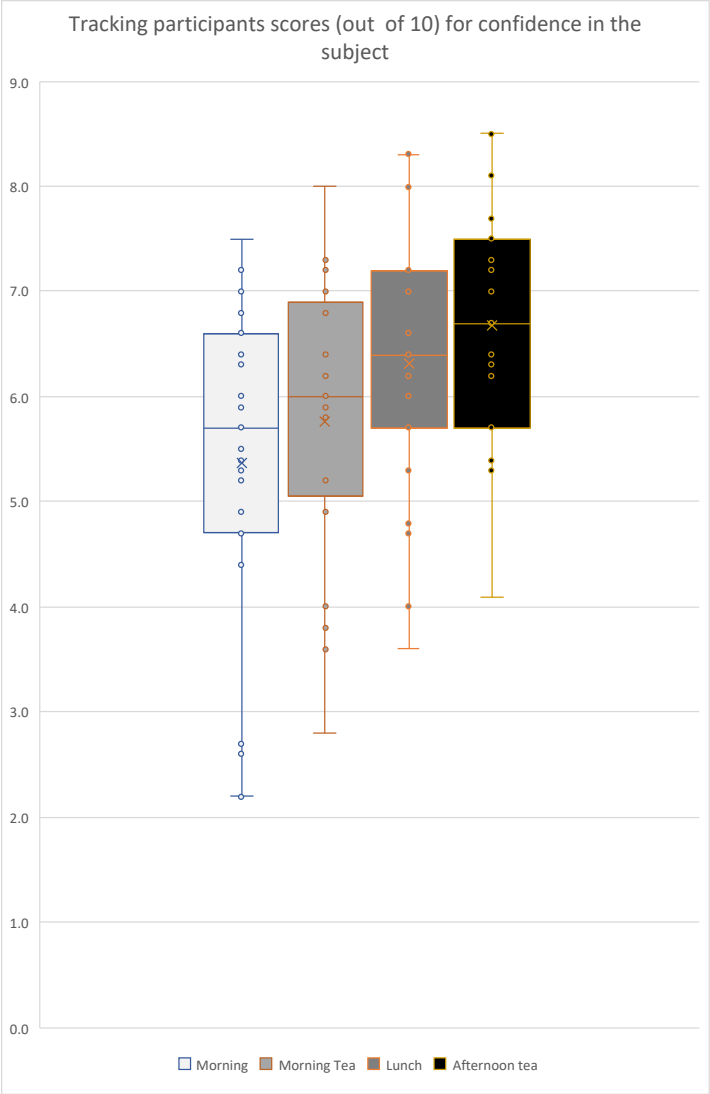
For the example above, the low figure for Friday the 17th could have been caused by the website being down or power issues experienced on that day.

To show distribution and summary statistics

A **box plot** or **boxplot** (also known as a **box-and-whisker diagram** or **plot**) is a convenient way of graphically depicting groups of numerical data through their five-number summaries: the smallest observation (sample minimum), lower quartile (Q1), median (Q2), upper quartile (Q3), and largest observation (sample maximum). A boxplot may also indicate which observations, if any, might be considered outliers.

Following are scores (out of 10) from a survey I conducted with participants in a course at four times in the day. The scores were anonymously provided so no reference is made to participant identification. The box plots for these scores are shown alongside the table.

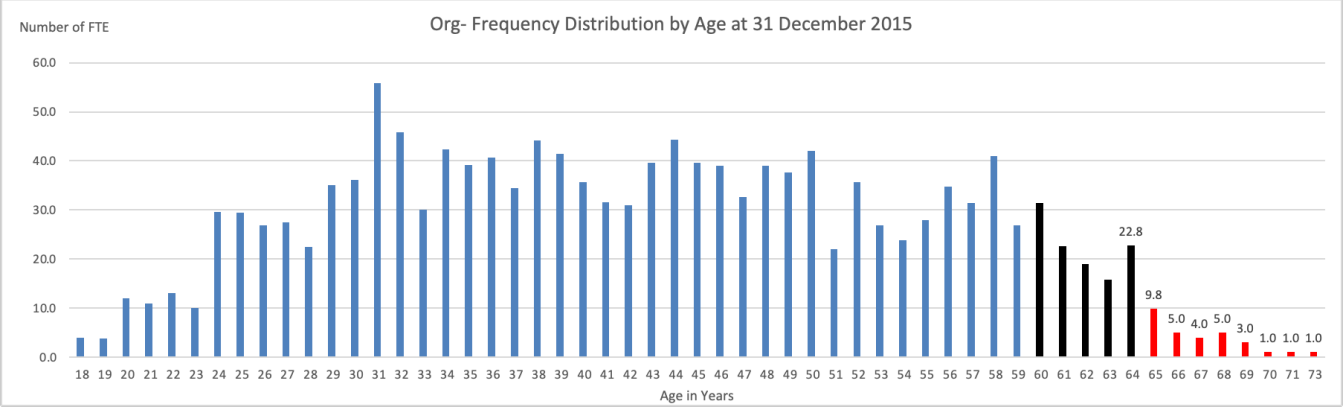
Morning	Morning Tea	Lunch	Afternoon tea
5.4	7.0	3.6	5.3
6.0	7.3	6.2	5.3
5.7	6.2	6.6	6.7
7.0	5.8	6.0	7.3
2.2	5.9	7.2	6.2
5.5	6.8	7.0	6.4
7.5	6.0	6.2	6.4
6.3	4.9	7.0	7.7
2.2	6.2	8.3	7.0
7.2	5.8	6.0	7.5
2.6	5.2	7.0	7.2
2.7	3.6	4.8	8.1
4.9	3.8	4.7	7.5
6.6	2.8	5.3	5.3
5.3	4.0	4.0	5.4
6.4	7.2	7.2	8.5
6.8	6.0	8.0	7.3
4.4	6.4	8.3	6.7
6.4	5.2	6.0	7.3
5.9	8.0	6.4	5.7
6.6	7.0	7.2	8.5
4.7		6.4	6.3
5.2		5.7	4.1
5.37	5.77	6.31	6.68



This data shows that participants reported their confidence increased throughout the day.

Histogram

A histogram is a bar graph of the frequency distribution of measurements. The example below is a histogram showing the distribution of staff by age for an organisation. The graph was used as part of the workforce planning of the business to identify the number of staff at or near retirement, as well as the distribution across lower age brackets.



The graph highlights staff either nearing (in black) or having reached (in red) retirement age.

Heatmap

Heatmaps can be used to show the relative frequency of events or observations. They are commonly used in representing risks.

Below is a heatmap for birthdates between 2007 and 2016 in Australia from the ABS. The lower the number and the lighter the colour, the more popular the birthdate. The higher the number and the darker the colour, the less popular the birthdate.

	MONTH											
DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	363	97	210	294	61	252	36	120	189	4	326	342
2	297	172	72	18	158	233	130	301	121	128	321	334
3	269	146	92	154	264	63	170	218	50	183	333	304
4	59	37	8	32	213	41	213	211	196	280	258	332
5	76	16	10	276	119	81	291	88	185	274	157	348
6	162	116	83	331	56	147	196	79	289	206	281	355
7	71	262	34	104	93	276	200	153	254	131	300	350
8	52	143	260	2	165	295	68	125	171	25	329	347
9	255	141	124	143	165	323	90	263	48	63	321	339
10	272	106	127	230	271	114	218	216	33	136	292	286
11	140	46	24	59	193	95	244	216	250	265	226	316
12	163	6	26	175	159	109	269	90	110	246	179	327
13	259	243	209	320	222	317	265	195	302	237	313	357
14	72	242	152	151	43	330	239	188	83	76	311	351
15	110	78	223	28	199	126	122	220	129	21	344	343
16	159	47	134	9	175	138	54	283	14	206	324	305
17	273	98	75	118	335	69	173	228	1	220	314	159
18	215	11	17	249	225	29	212	204	30	325	303	204
19	185	38	13	253	203	131	306	113	58	275	267	308
20	150	74	45	136	62	103	174	100	108	256	283	346
21	70	245	201	192	40	261	169	237	66	142	337	328
22	35	101	226	82	201	181	39	168	123	85	354	336
23	155	102	99	12	191	194	54	267	3	187	345	349
24	232	94	206	53	296	49	190	279	4	231	338	358
25	85	23	27	361	167	31	156	257	42	315	311	365
26	362	20	15	341	234	139	288	164	80	310	306	364
27	285	44	87	134	96	182	148	177	241	278	319	360
28	240	198	179	105	51	235	133	236	117	224	340	359
29	57	366	287	7	248	184	66	247	114	145	356	282
30	107	na	63	22	251	148	110	318	19	229	352	290
31	299	na	88	na	297	na	178	293	na	309	na	353

Consistent public holiday date

(a) Based on month and day of birth, 2007-2016.
Source ABS 3301.0 - Births, Australia, 2016

The ABS made the following observations from this data:

- Of the five most common birthdays, three are in September,
- Two of the five least common birthdays are in December,

- The least common birthday is 25 December (excluding 29 February, which only occurs in leap years).

"These trends are similar in New Zealand, England and Wales, and the United States," Beidar Cho, the ABS Director of Demography, said. "More babies are likely to be conceived around the Christmas/New Year holidays, resulting in more babies born in September and October. Fewer babies are born on public holidays - possibly a result of doctors scheduling deliveries on non-public holidays."

To show locations where events occur

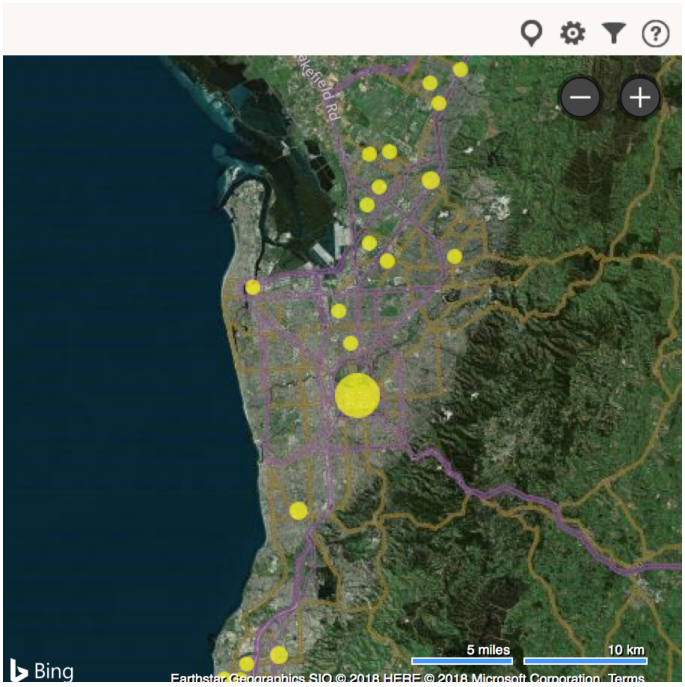
Data on maps is becoming popular with the increased sophistication of technology.

Excel (at least the version I am working with) allows me to map location-based data onto a map using Bing Maps. Below is a summary of crime statistics in South Australia for the first three quarters of 2017-18, showing the top 20 suburbs by number of offences.

Offences by Suburb in Metropolitan Adelaide: Q1 to Q3 2017-18.

SUBURB	# of offences
ADELAIDE	4363
MORPHETT VALE	1246
SALISBURY	1044
OAKLANDS PARK	964
PARAFIELD GARDENS	869
ELIZABETH	864
DAVOREN PARK	771
MAWSON LAKES	753
PARALOWIE	716
NOARLUNGA CENTRE	669
SALISBURY NORTH	649
SMITHFIELD	649
PROSPECT	644
KILBURN	630
CHRISTIE DOWNS	608
MODBURY	594
PORT ADELAIDE	550
CHRISTIES BEACH	532
SALISBURY DOWNS	488
POORAKA	482

Bing Maps has then enabled this data to be presented on a map of metropolitan Adelaide.



Reflection

Other references

Graph selection matrix available at:

Perceptual Edge – Library/other brief publications

Microsoft Power BI – Has a guided learning website.

Other references

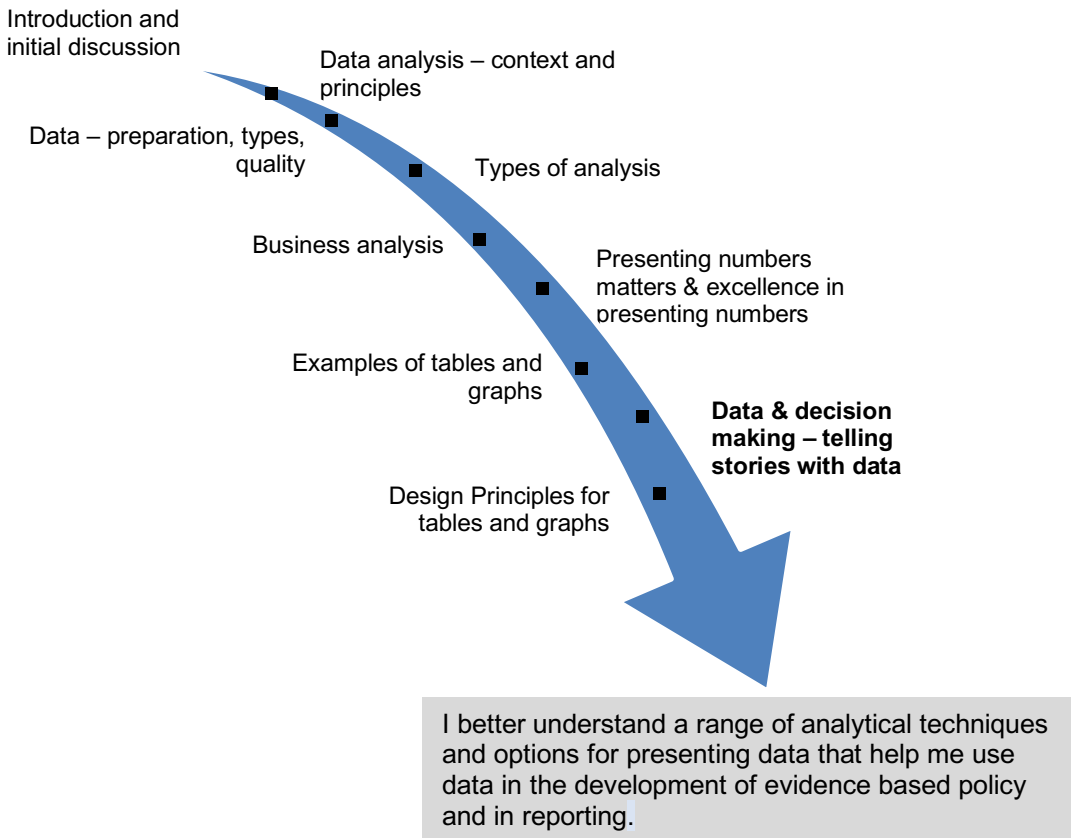
https://datavizcatalogue.com/

https://datavizproject.com/

YouTube resources:

MyOnlineTrainingHub (e.g. Building Excel Dashboards)

Leila Gharani



Discussion

There is a team operating within an organisation. The roles and responsibilities of the team are well defined. The work they do is: Case management, investigations and attending to public enquiries.

The team and their leaders are struggling with their work and are experiencing high levels of stress. They have raised this with senior management and made a plea for additional resources to address their situation. Senior management is not convinced that additional resources are required and believes there could be other reasons why the team is struggling with their work and experiencing high levels of stress.

We are asked to review the team and produce a report on the resource adequacy or otherwise of the team.

What data could we analyse and include in the review and report?

Data & decision-making

I present data to help others through some or all of the stages below.

1. To inform
2. For discussion/discernment
3. To get a decision made.

The distinguishing feature between the first three stages above is the extent of change and action arising from it.

No change required	Change required but how is not yet clear	Change required and understood
Information	**Discuss/Discern**	**Decide**
More telling		*More revealing/discovery*
Can use infographics		*Use well understood graphics*
Recommends - Noting	Recommends – direction for further work	Recommends – action to implement change

Information

Data designed for this purpose lets leaders know that previously approved projects or changes are on track.

Data and Reports designed to provide leaders with assurance will usually recommend that the reader note the contents of the report and will not demand any approvals or recommend any new action.

Examples will include status reports on finances, operations, and compliance reports where progress is within acceptable tolerances and no decision-making or action is required of the recipients.

Data for Discussion and Discernment

When an issue has arisen that will ultimately require a change in the way a service is delivered or a policy change, but the detail of the change is not yet fully developed, a discussion paper can be provided to examine current opinions and evidence on the issue. This type of report and this data should make recommendations on what further work or steps are required to get a resolution or to be able to recommend the specific changes that are required.

Discussion papers may be necessary for controversial, complex or high-risk issues where there is no clear solution apparent at the time or for issues that are of a large scale that involve careful consideration in the development of options and before a final decision is made.

Examples will include reports on matters of strategic importance like changes in the business model, policy changes, adding or cutting services or major investment projects that need to be discussed amongst leaders before a final decision.

Analysis and Data for Decision-making

If an organisation is dealing with problems where research has been made into the changes necessary, executive teams will rely on advice as to how to go about dealing with problems or making changes.

In this respect, our analysis and data will be included in reports that provide the information necessary to prompt and support decision-making.

Reports designed to prompt or support decision-making will make recommendations that seek approval to make changes or undertake new work.

Examples: Proposals for organisational initiatives or campaigns, business cases to proceed with a project, recommended changes in policy, findings and recommendations from a service or functional review.

The review of the Office for Case Management has revealed the following data:

	As at 30 June 2018					
	NSW	**VIC**	**QLD**	**WA**	**SA**	**TAS**
Number of open cases	1,700	550	500	230	265	65
Number of new cases in the financial year	500	550	250	90	110	27
employees devoted to cases	***50***	***28***	***14***	***7***	***4***	2
Indicative case load	34.3	19.5	35.7	32.9	66.3	32.5
targeted case loads	**35**	**30**	**35**	**35**		**30**
new cases per case manager	10.1	19.5	17.9	12.9	27.5	13.5

What do we conclude from this table?

Telling a Story with Numbers

Presenting data to others to help them make decisions requires that we can tell a story of change with the data we have.

To tell a story we have to make choices about what of our analysis to include and what to exclude. We have to help our readers discover without them experiencing all the difficulties we have or without having to digest all the data we have.

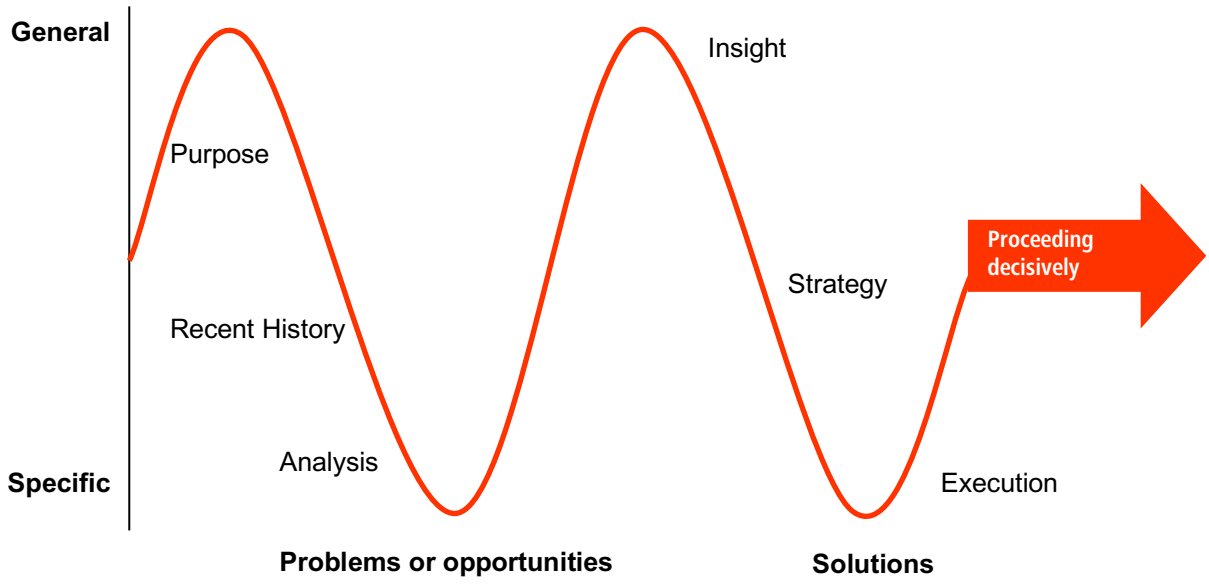
The choice of what to include and how to include it is our narrative.

> *"Narrative is the choice of which events to relate and in what order to relate them – so it is a representation or specific manifestation of the story, rather than the story itself."*
>
> Source: http://beemgee.com/blog/story-vs-narrative/

The PRAISE narrative structure is designed for reports or briefings that require the reader to be convinced of the need to change and act differently.

The centrepiece of this narrative structure is that a change is needed and the reasons to support the change have been researched and analysed. Within the structure, we provide our evidence.

PRAISE = Purpose, Recent History, Analysis, Insight, Strategies, Execution



The structure is designed for readers to be able to follow a flow or logic that makes high-quality decisions easier to make based on the substance of the evidence that we have brought together.

"The purpose of an evidence presentation is to assist thinking", Edward Tufte, Beautiful Evidence.

PRAISE summarises the readers' journey through our report, helping them think through our issue or proposal.

The PRAISE model proposes that there are six elements to what we present to enhance transparency in our communication with others. These six elements are:

- **P**urpose – The purpose section presents a quest or goal that matters to the reader. This is an important means by which to involve them in this story. It will impact their goals or the goals and outcomes by which they will be judged. We are using the goals and outcomes as a means to engage with our readers and decision-makers – they get a sense of purpose.
- **R**ecent History – some background to our organisation, unit, issue, problem or opportunity is the subject of our thinking. This will include the events that have led up to where things are now and previous attempts to approach this subject.
- **A**nalysis – we present facts and data that capture our observations and show necessary detail. This can include detailing options we have considered and eliminated.
- **I**nsight – our diagnosis and assessment, where we draw conclusions from the history and analysis included earlier. In problem-solving, the insight will be the main diagnosis of the root cause of the problem.
- **S**trategy (or **S**olutions) – we outline what the appropriate strategies/responses are given the conclusions we have drawn. This can also include some options and the process of reaching a preferred solution.
- **E**xecution – we detail the next steps. This can include specific instructions to remedy what we have found.

The purpose and insight section of our presentation should ensure that the receiver understands the context for, and the importance of, what we are presenting and can draw some conclusions about what and why change is required.

The analysis and execution sections will be where we present details and specifics regarding the data we have collected and regarding how the recommended response should be executed.

In delivering presentations, PRAISE can give us some guidance as to the pace and detail we want to work with.

The purpose section is deliberate, the recent history and analysis can be more fast-paced and detailed, the insight requires us to get our audience to stop and think more reflectively while the last two elements can grow in speed to give the sense of momentum associated with getting a decision made and getting on with making things happen.

So where does presenting numbers fit in this decision-making model and process? The following section will outline the typical types of numbers to be presented in each section and use an example – the Office of Case Management. Consider this to be an office where there are concerns about workload being too high but there are no clear guides or benchmarks in place.

For the Review of the Office of Case Management

Purpose

The State Government has made clear public statements demonstrating its commitment to better protect the most vulnerable members of our community and break the cycle of disadvantage. Legislation has created the Office for Case Management (the Office) that plays an independent and leadership role in meeting the Government's policy commitment.

The services delivered by the Office are of high public value. We value that each member of our society will be protected and supported when confronted with difficulties and dealing with disadvantages that could occur to any of us at any time and at no fault of our own. The importance and value of the Office are reinforced by stakeholders. In addition to the case management services provided, value the independence of the Office and the advocacy it offers on behalf of vulnerable persons.

Recent History

The Office was created in 1983 with 6 FTEs and grew to 9.5 FTEs in 1995 following a restructure. A successful budget bid in 2016 increased the staffing to 10.5 FTEs. The funding model for the Office allows for inflation growth but does not allow for changes in activity. The tables below show that in the last four years, demands for all services have grown rapidly: case management (11.7% per annum), investigations (17 % per annum), enquiries and outreach have grown rapidly.

Figure 1: Growth in cases

	As at 30 June						Average
	2014	2015	2016	2017	2018	Growth %	Growth pa %
Open cases - beginning of year	150	170	190	200	240		
New cases	100	110	100	130	125	25.0%	5.7%
Number of cases closed	80	90	90	90	100	25.0%	5.7%
Open cases - end of year	170	190	200	240	265	55.9%	11.7%

Figure 2: Growth in investigations

	As at 30 June						Average
	2014	2015	2016	2017	2018	Growth %	Growth pa %
Investigations during the year	136	195	227	226	255	87.5%	17.0%

Figure 3: Growth in enquiries

	As at 30 June					
	2014	2015	2016	2017	2018	growth since 2015 %
Number of public enquiries	3,229	3,642	3,611	4,594	4,955	36.1%
Composition of public enquiries						
Category 1	Not available	1,118	910	1,038	1,096	-2.0%
Category 2		755	688	920	806	6.8%
Category 3		554	540	739	894	61.4%
Category 4		116	260	184	290	150.0%
Category 5		210	302	548	943	349.0%
Category 6		411	239	282	277	-32.6%
Category 7		129	154	213	147	14.0%
Other calls		860	978	1,072	1,106	28.6%
		4,153	4,071	4,996	5,559	33.9%

Totals differ as some calls relate to multiple topics.

Analysis

Analysis has been performed of the workload and the way work is done in the Office and has concluded that workloads are growing rapidly and that the Office has taken steps to improve its efficiency and effectiveness. The benchmarking analysis presented below shows that when compared to interstate offices, workloads in South Australia are excessive.

Figure 4: Interstate workload comparison

	As at 30 June 2018					
	NSW	**VIC**	**QLD**	**WA**	**SA**	**TAS**
Number of open cases	1,700	550	500	230	265	65
Number of new cases in the financial year	500	550	250	90	110	27
employees devoted to cases	***50***	***28***	***14***	***7***	***4***	2
Indicative case load	34.3	19.5	35.7	32.9	66.3	32.5
targeted case loads	**35**	**30**	**35**	**35**		**30**
new cases per case manager	10.1	19.5	17.9	12.9	27.5	13.5

Other legislative requirements of the Office have been set aside to enable it to deal with the demands of increasing caseloads.

Insights

The functions of the Office specified in the legislation are not being performed to the extent required with flow-on impacts associated with failures to exercise a duty of care and failures to comply with legislative requirements. This is a risky situation for the Office and the Government. The stresses within the system present real and present risks of public failures to meet legal obligations and exercise duties of care that are likely to trigger litigation.

The root causes are the growth in demand, which is outside the control of the government, and a deficient funding model that is within the control of the government. A funding model and budget process that ignores growth in caseloads and that requires the Office to repeatedly bid and negotiate additional funds is at odds with the independence of the role. It is also at odds with the legally binding nature of the cases being managed and appears to ignore the duty of care implications of resource shortfalls.

Strategy

Addressing these shortcomings requires a revised approach to the structure, resource base and funding model of the Office. A revised structure for the Office consisting of 18.5 FTEs is recommended along with a supporting resource plan. This structure and resource plan have been recommended based on a reasonable caseload and based on the reinstatement of positions required for education and community programs that were part of the original structure of the Office. It is recommended that the funding model for the Office be changed so that the Office receives a level of funding linked to demand for its services as a case manager, without compromising its duty of care or compromising the standard of its services.

The table below details the additional resources required over the forward estimates.

	2018-19 $	2019-20 $	2020-21 $	2021-22 $	2022-23 $
Salaries and wages	20,014	799,312	811,298	823,924	837,203
ongoing	13,014	799,312	811,298	823,924	837,203
once off	7,000	0	0	0	0
Supplies and services	5,442	158,920	118,045	122,708	127,469
Internal expenses	-3,730	11,732	12,367	13,014	13,674
Capital expenditure	-4,000	1,100	1,100	1,100	1,100
Total expenditure	17,726	971,064	942,810	960,747	979,446

Execution

Recommended actions to implement this strategy include:

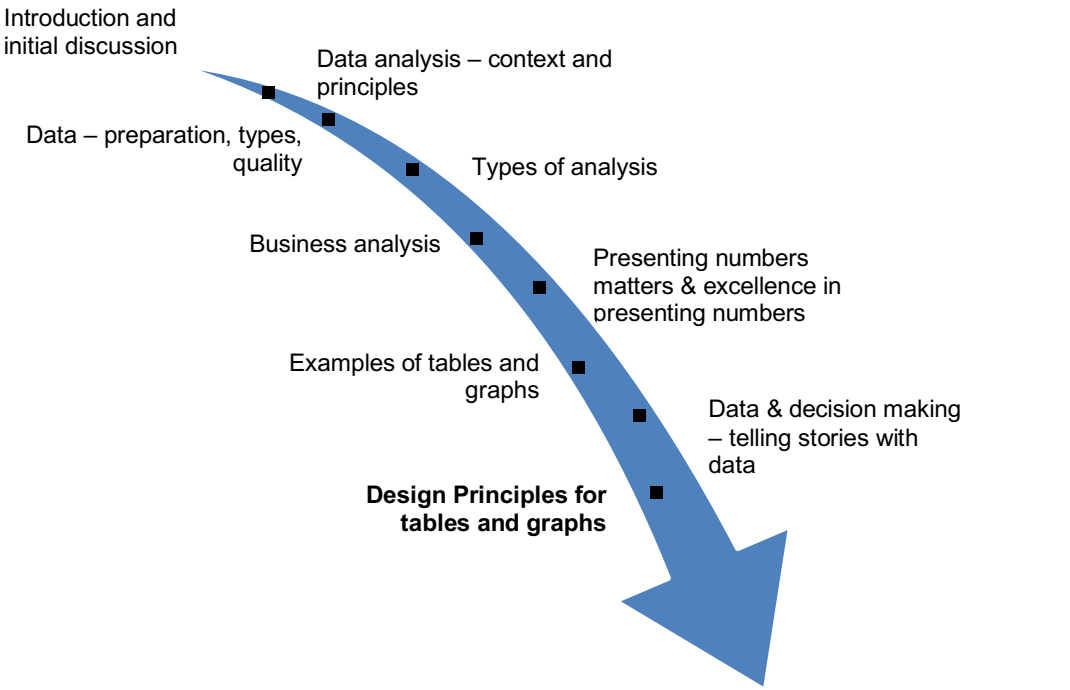
Immediately:

1. Submit a budget bid for the amounts shown above to the Treasurer
2. Immediately revise the case manager job and person specs to broaden qualifications and add decision-making skills to the personal skills requirement
3. Recruit additional case managers to address caseload excesses.
4. Develop a job and person specification for the Business Manager position

Within 6 months:

1. Recruit a Business Manager
2. Seek agreement on a revised approach to funding the office (as detailed above) with the Treasurer
3. Seek to have the remuneration of the Chief Executive Officer considered by the Remuneration Tribunal
4. Review the classifications of:
    a. The Lead Case Manager
    b. The Office Administration staff
5. Develop job and person specifications for the position of Liaison Officer to the Authority
6. Develop an accommodation plan.

See Appendix 2 for an example of the PRAISE model applied to the infrastructure case study introduced earlier.



I better understand a range of analytical techniques and options for presenting data that help me use data in the development of evidence based policy and in reporting.

Design Principles

Please direct your attention to the table below. The numbers are from the SA Pinkbook which shows annual figures on road statistics.

Year	Fatal crashes	Fatalities	Casualty crashes	Casualties	All crashes	Vehicles on Register ('000)	Licence Holders ('000)	Population ('000)	Vehicle kilometres travelled
1987	230.000	256.000	8619.000	11721.000	42240.000	834.900	865.400	1394.200	
1988	206.000	223.000	7881.000	10541.000	37373.000	846.200	880.000	1408.000	12794.600
1989	201.000	222.000	7815.000	10405.000	40067.000	862.600	900.700	1424.600	
1990	186.000	225.000	7606.000	10260.000	39844.000	883.500	923.300	1439.100	
1991	166.000	184.000	6506.000	8804.000	35961.000	895.700	944.000	1446.300	12637.900
1992	141.000	164.000	6258.000	8059.000	35756.000	904.500	943.700	1456.500	
1993	191.000	218.000	6467.000	8287.000		916.000	947.100	1460.700	
1994	145.000	163.000	6410.000	8169.000	38830.000	931.100	964.000	1466.100	
1995	164.000	182.000	6448.000	8341.000	39300.000	945.400	974.800	1469.400	13195.000
1996	162.000	181.000	6509.000	8676.000	38939.000	959.200	978.500	1474.300	
1997	124.000	149.000	6426.000	8371.000	38867.000	969.300	994.700	1481.400	
1998	152.000	168.000	6926.000	9074.000	39586.000	994.800	995.300	1489.500	13974.000
1999	132.000	153.000	7418.000	9833.000	41742.000	1009.900	1011.500	1497.800	13081.000
2000	151.000	166.000	7717.000	10154.000	40603.000	1011.100	1025.300	1505.000	13153.000
2001	136.000	153.000	7734.000	10256.000	40788.000	1022.700	1045.100	1511.700	15085.000
2002	138.000	154.000	7591.000	10083.000	40130.000	1044.600	1046.900	1518.700	14855.000
2003	135.000	156.000	7096.000	9227.000	30375.000	1034.300	1052.000	1527.400	14963.000
2004	128.000	139.000	6720.000	8765.000	21952.000	1049.200	1072.400	1532.700	15241.000
2005	124.000	147.000	6190.000	8019.000	20820.000	1064.900	1093.600	1542.000	14533.000
2006	104.000	117.000	6187.000	7947.000	20273.000	1085.000	1042.300	1568.200	15535.000
2007	108.000	125.000	6467.000	8429.000	21289.000	1106.500	1073.100	1584.200	14212.000
2008	87.000	99.000	6697.000	8490.000	21468.000	1171.200	1093.500	1601.800	14212.000
2009	104.000	119.000	6229.000	7849.000	21327.000	1201.100	1134.700	1624.600	14212.000

Source: Road Crashes in South Australia 2009

In groups, please discuss how the presentation of this table could be improved.

Principles of design in tables

The most glaring from the table on the previous page will include:

1. The font (type and orientation used)
2. Number formats, including the use of decimal points
3. The use of gridlines and fill
4. Spacing.

Fonts

Use fine fonts that are more easily legible, rather than broad fonts that crowd up the space we are using.

Be consistent in the use of fonts within tables. I prefer to use Sans-serif fonts like Arial, Arial Narrow or Verdana in tables as they use up less space.

Wherever possible, use a horizontal orientation of the data.

Number formats

For large numbers, comma-separate the figures.

Use rounding to provide clarity and conserve space.

Only use decimal points where absolutely necessary and then minimise their use.

Right-justify numbers so they are aligned. This also creates natural space between columns.

> *"The level of precision should not exceed the level needed to serve your communication objectives and the needs of your readers."* Stephen Few

Correcting fonts and numbers alone means the table now looks as follows.

Data Trends, South Australia 1987-2009

Year	Fatal crashes	Fatalities	Casualty crashes	Casualties	All crashes	Vehicles on Register ('000)	Licence Holders ('000)	Population ('000)	Vehicle kilometres travelled (million)
1987	230	256	8,619	11,721	42,240	834.9	865.4	1,394.2	na
1988	206	223	7,881	10,541	37,373	846.2	880.0	1,408.0	12,795
1989	201	222	7,815	10,405	40,067	862.6	900.7	1,424.6	na
1990	186	225	7,606	10,260	39,844	883.5	923.3	1,439.1	na
1991	166	184	6,506	8,804	35,961	895.7	944.0	1,446.3	12,638
1992	141	164	6,258	8,059	35,756	904.5	943.7	1,456.5	na
1993	191	218	6,467	8,287	na	916.0	947.1	1,460.7	na
1994	145	163	6,410	8,169	38,830	931.1	964.0	1,466.1	na
1995	164	182	6,448	8,341	39,300	945.4	974.8	1,469.4	13,195
1996	162	181	6,509	8,676	38,939	959.2	978.5	1,474.3	na
1997	124	149	6,426	8,371	38,867	969.3	994.7	1,481.4	na
1998	152	168	6,926	9,074	39,586	994.8	995.3	1,489.5	13,974
1999	132	153	7,418	9,833	41,742	1,009.9	1,011.5	1,497.8	13,081
2000	151	166	7,717	10,154	40,603	1,011.1	1,025.3	1,505.0	13,153
2001	136	153	7,734	10,256	40,788	1,022.7	1,045.1	1,511.7	15,085
2002	138	154	7,591	10,083	40,130	1,044.6	1,046.9	1,518.7	14,855
2003	135	156	7,096	9,227	30,375	1,034.3	1,052.0	1,527.4	14,963
2004	128	139	6,720	8,765	21,952	1,049.2	1,072.4	1,532.7	15,241
2005	124	147	6,190	8,019	20,820	1,064.9	1,093.6	1,542.0	14,533
2006	104	117	6,187	7,947	20,273	1,085.0	1,042.3	1,568.2	15,535
2007	108	125	6,467	8,429	21,289	1,106.5	1,073.1	1,584.2	14,212
2008	87	99	6,697	8,490	21,468	1,171.2	1,093.5	1,601.8	14,212
2009	104	119	6,229	7,849	21,327	1,201.1	1,134.7	1,624.6	14,212

Source: Road Crashes in South Australia 2009

Note: n/a - complete data not available for that year

Gridlines and Fill

Gridlines and fill are defined as non-data ink. A key principle in presenting numbers is to minimise non-data ink because it can distract the reader from the data you are aiming to present.

Start by eliminating all fill and then try to use the least number of gridlines, and even then, make them grey rather than black.

More gridlines or very light fill may be necessary where there are a number of columns and rows and are used to help the reader distinguish these rows and columns.

The table below eliminates all shading and eliminates vertical lines. Vertical lines are not necessary as the white space between columns is a natural separator.

Data Trends, South Australia 1987-2009

Year	Fatal crashes	Fatalities	Casualty crashes	Casualties	All crashes	Vehicles on Register ('000)	Licence Holders ('000)	Population ('000)	Vehicle kilometres travelled (million)
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1988	206	223	7,881	10,541	37,373	846.2	880.0	1,408.0	12,795
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1990	186	225	7,606	10,260	39,844	883.5	923.3	1,439.1	n/a
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Source: Road Crashes in South Australia 2009

Note: n/a - complete data not available for that year

However, even horizontal lines can be either eliminated or toned down.

No lines are required at the beginning or end of the table, and rather than using black colour for lines, grey can be used, putting less emphasis on the lines and more on the data.

Data Trends, South Australia 1987-2009

Year	Fatal crashes	Fatalities	Casualty crashes	Casualties	All crashes	Vehicles on Register ('000)	Licence Holders ('000)	Population ('000)	Vehicle kilometres travelled (million)
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1992	141	164	6,258	8,059	35,756	904.5	943.7	1,456.5	na
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1998	152	168	6,926	9,074	39,586	994.8	995.3	1,489.5	13,974
1999	132	153	7,418	9,833	41,742	1,009.9	1,011.5	1,497.8	13,081
2000	151	166	7,717	10,154	40,603	1,011.1	1,025.3	1,505.0	13,153
2001	136	153	7,734	10,256	40,788	1,022.7	1,045.1	1,511.7	15,085
2002	138	154	7,591	10,083	40,130	1,044.6	1,046.9	1,518.7	14,855
2003	135	156	7,096	9,227	30,375	1,034.3	1,052.0	1,527.4	14,963
2004	128	139	6,720	8,765	21,952	1,049.2	1,072.4	1,532.7	15,241
2005	124	147	6,190	8,019	20,820	1,064.9	1,093.6	1,542.0	14,533
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2008	87	99	6,697	8,490	21,468	1,171.2	1,093.5	1,601.8	14,212
2009	104	119	6,229	7,849	21,327	1,201.1	1,134.7	1,624.6	14,212

Source: Road Crashes in South Australia 2009

Note: n/a - complete data not available for that year

Principles of data graphics

Regardless of whether information is presented in tables or graphs, there are some principles for the presentation of data.

"Five principles in the theory of data graphics produce substantial changes in graphical design.….:

Above all else show the data.

Maximise the data-ink ratio.

Erase non-data-ink.

Erase redundant data-ink.

Revise and edit."

The Visual Display of Quantitative Information, pg. 105

A summary of this data is presented as a graph in the "Towards Zero Together" document.

Figure 1 Road deaths and serious injuries, South Australia, 1981-2010

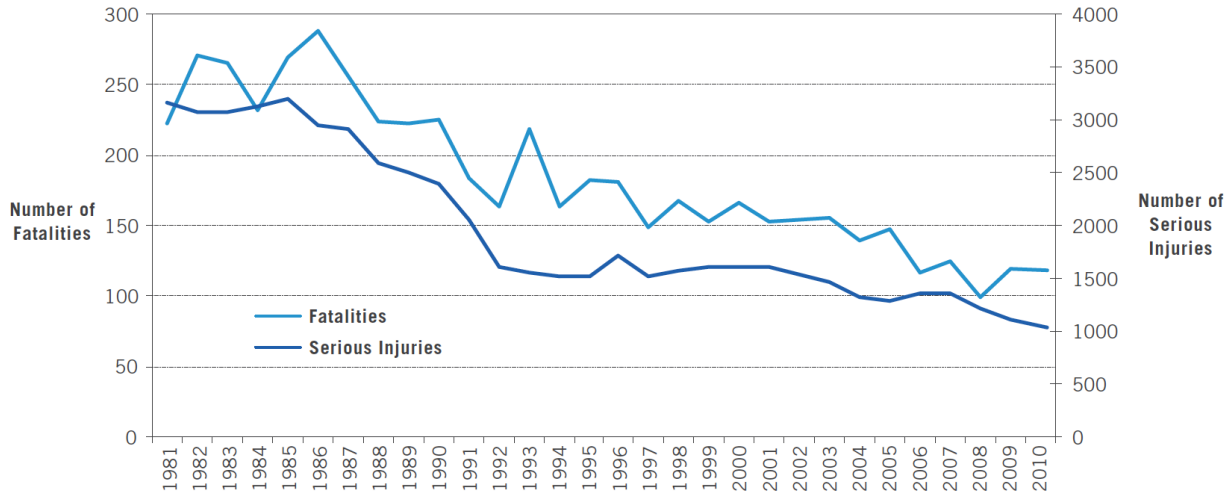
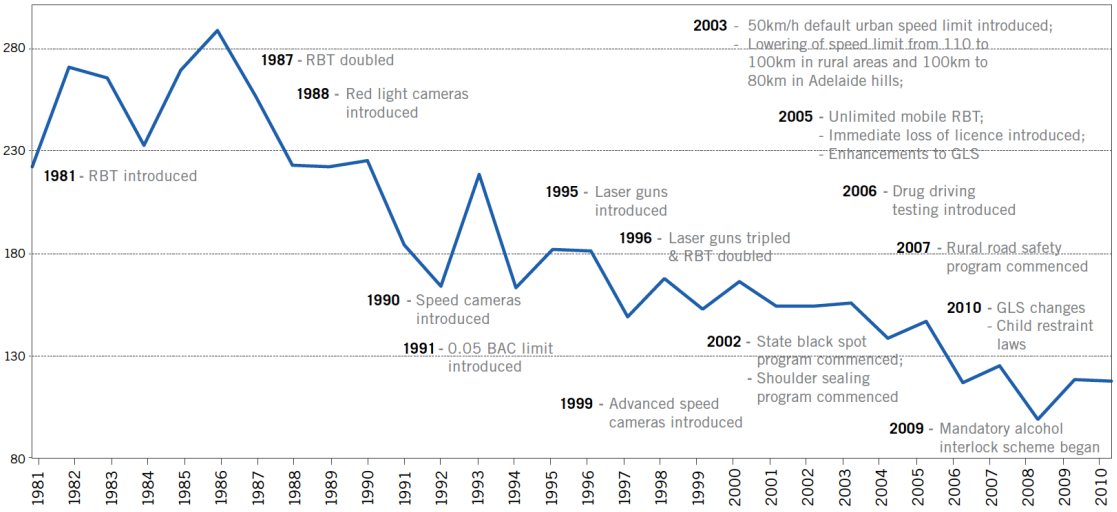


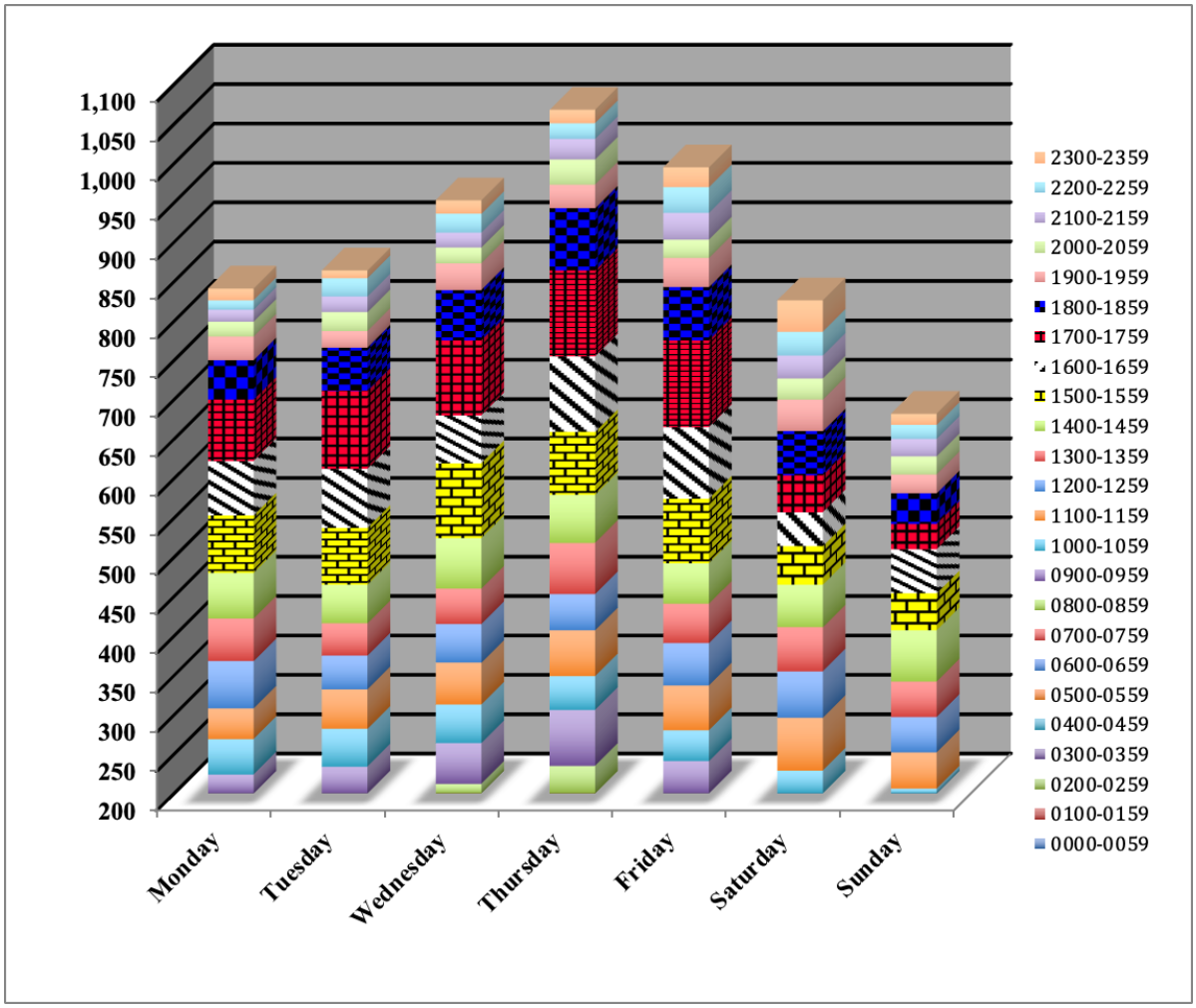
Figure 3 Fatalities with major initiatives, South Australia, 1981-2010



Are there any issues with the way information is presented in the graph above?

Consider the following graph.

Casualty crashes by day of week and time of day, South Australia 2009



Source: Road Crashes in South Australia 2009

In groups, please discuss how the presentation of this table could be improved.

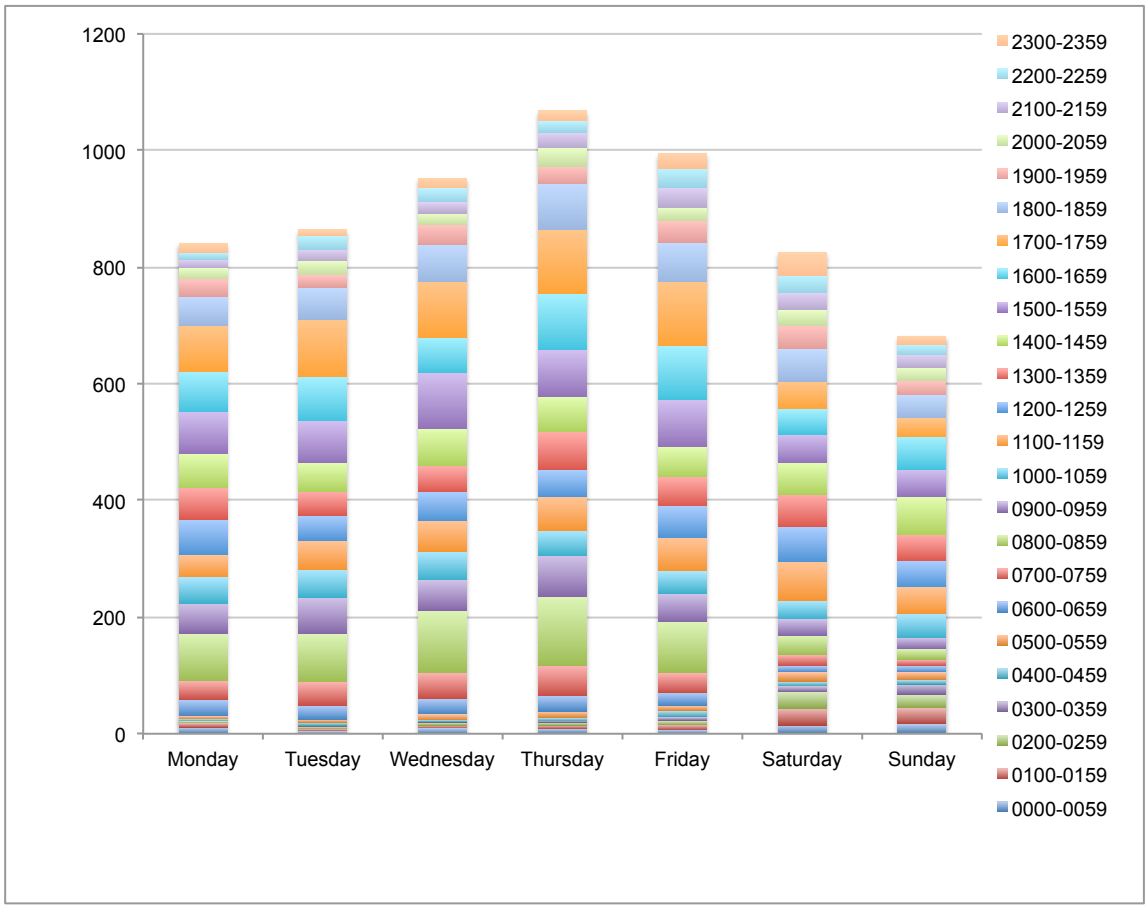
Principles of design in graphs

Improvements could include:

- Maximise the data-ink ratio and minimise non-data ink – as with tables, use fine fonts not bold fonts, keep gridlines light, and minimise the use of ink filling non-data spaces.
- Integrity in scales – When you set the bottom on the y-axis scale to a value greater than zero, you will either lose data or exaggerate values in the graph. Either compromises graphical integrity.
- Avoid 3D – Using three dimensions can distort the appearance of the data and exaggerate value. It should be avoided.
- Avoid Moiré effects - these come from using patterns as a means to distinguish data. These effects serve to interact with the natural tremor in our eyes to produce the distracting appearance of vibration and movement.
- Colours – rather than using bright colours that distract the eye, use softer pastel colours and, if possible, colours that relate to the subject being displayed. In maps, this is done by showing water as a soft blue while land is shown as a soft green for pasture and yellows or browns for desert.

Modifying these will result in the following chart:

Casualty crashes by day of week and time of day, South Australia 2009



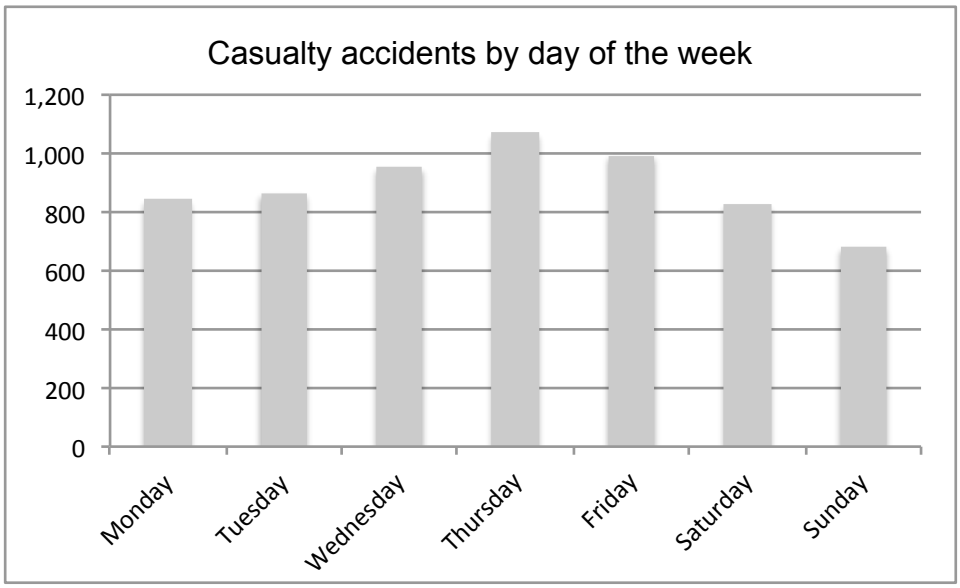
Source: Road Crashes in South Australia 2009

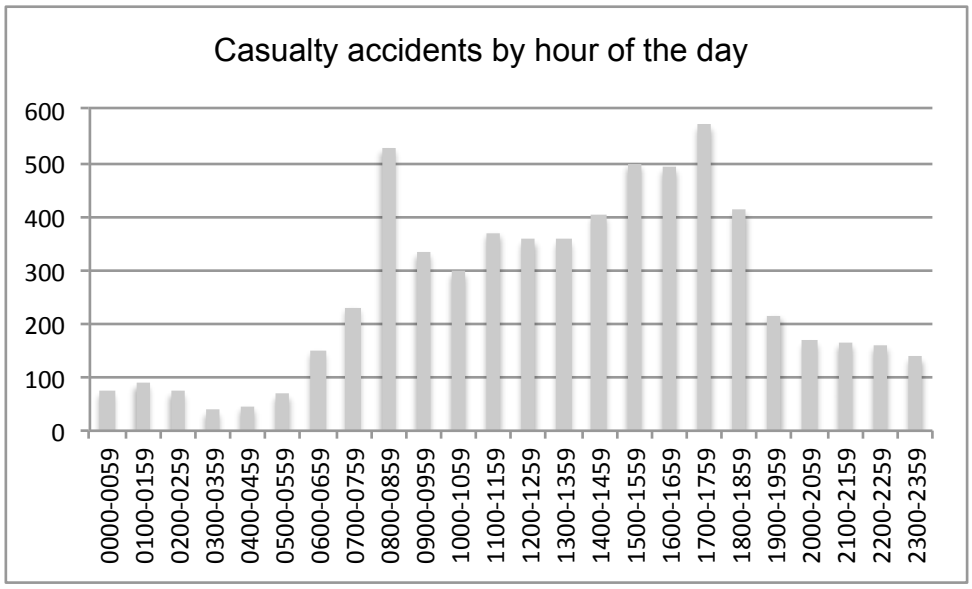
However, this graph still suffers from having too many data categories. The graph tries to compare and stack 24 data categories across seven days of the week. A critical question for this graph is

what data relationships it wants to show. In this case, data comparisons may be better made with a table than with a chart.

Following are some different versions of graphs for this data.

1. The KISS group (Keep it simple silly) will suggest that the graph above is trying to represent two main points which can be presented in two very straightforward graphs.

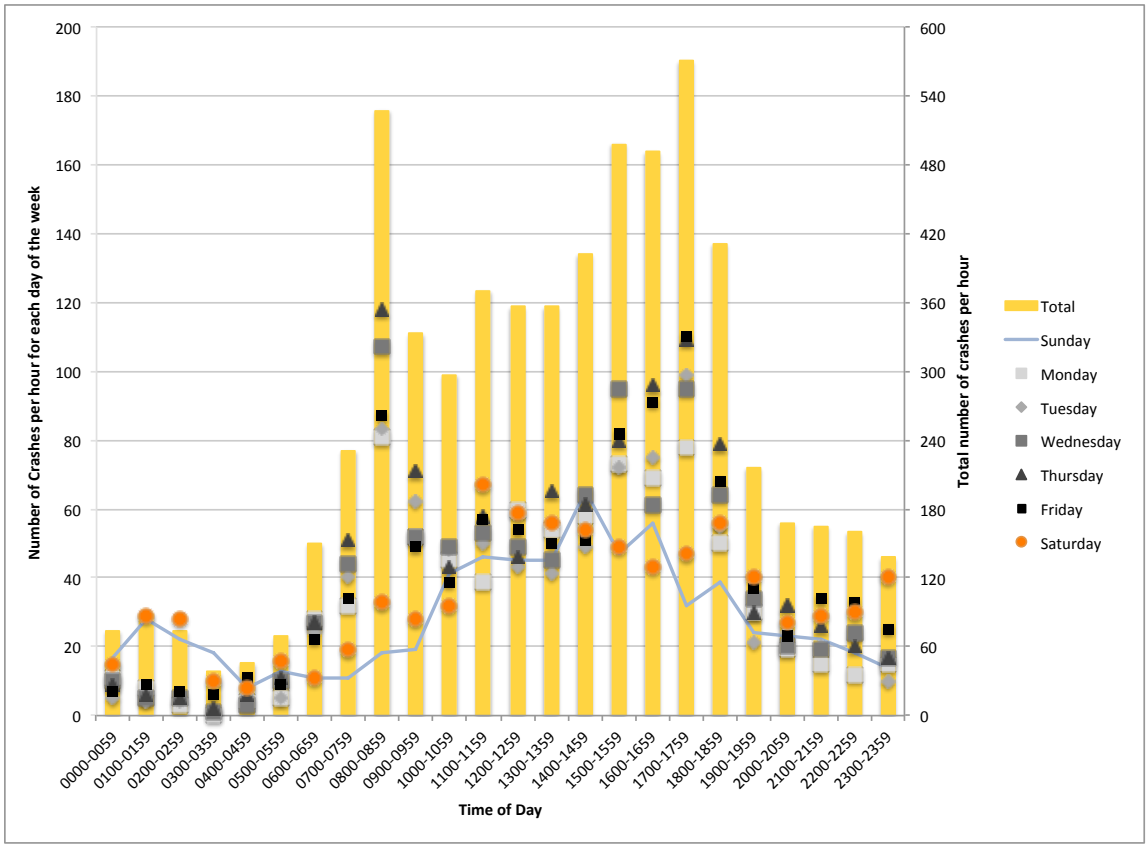




2. The second perspective will be from the KICK group (Keep it Complex Knucklehead), who advocate that the data should unashamedly show as much detail as possible but using a straightforward design rather than the clumsy design we saw earlier.

An example of a graph that attempts to demonstrate as much data as possible without having an overly complicated design is over the page.

Casualty crashes by day of week and time of day, South Australia 2009



This graph attempts to show as much of the data as possible but with as simple a design as possible. It attempts to:

- Show the main indicator which is total accidents by time of day
- Show each day at each time of the day that enables comparison of each day.
- Uses as few colours as possible, using shades of grey and shapes to distinguish weekdays and showing weekends quite distinctly differently.
- Uses two scales to enable unlike data levels to be presented – left left-hand y-axis presents the total by day of the week, while the right-hand y-axis shows accidents by hour of the day.

After all this, maybe a table is better. If we are seeking an exact answer about the time of day and day of the week, a table will give us this detail better than a graph will.

Conditional formatting can be used to present that table as a heat map, highlighting, in red, the larger numbers.

Casualty crashes by day of week and time of day, South Australia 2009

Time of day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
0000-0059	11	5	10	9	7	15	17	**74**
0100-0159	8	4	5	6	9	29	28	**89**
0200-0259	3	4	5	5	7	28	22	**74**
0300-0359	0	1	1	2	6	10	18	**38**
0400-0459	4	6	3	6	11	8	8	**46**
0500-0559	5	5	10	11	9	16	13	**69**
0600-0659	28	24	27	27	22	11	11	**150**
0700-0759	32	40	44	51	34	19	11	**231**
0800-0859	81	83	107	118	87	33	18	**527**
0900-0959	52	62	52	71	49	28	19	**333**
1000-1059	45	48	49	43	39	32	41	**297**
1100-1159	39	50	53	58	57	67	46	**370**
1200-1259	60	43	49	46	54	59	45	**356**
1300-1359	54	41	45	65	50	56	45	**356**
1400-1459	58	49	64	61	51	54	65	**402**
1500-1559	73	72	95	80	82	49	47	**498**
1600-1659	69	75	61	96	91	43	56	**491**
1700-1759	78	99	95	109	110	47	32	**570**
1800-1859	50	55	64	79	68	56	39	**411**
1900-1959	30	21	34	30	37	40	24	**216**
2000-2059	19	24	20	32	23	27	23	**168**
2100-2159	15	20	19	26	34	29	22	**165**
2200-2259	12	23	24	20	33	30	18	**160**
2300-2359	15	10	17	17	25	40	14	**138**
Total	**841**	**864**	**953**	**1,068**	**995**	**826**	**682**	**6,229**

Combining text and data

It is one thing to ensure that the presentation of tables and the presentation of charts facilitates clarity in reading. However, it would be a tragedy to see excellence in tables and charts offset by the confusion created by poor linking to data in accompanying text.

When using text to discuss a table, ensure that the data referred to in the text is consistent with than included in the table.

General government expenses by function ($m)

	2005-06 Outcome	2006-07 Outcome	2007-08 Outcome	2008-09 Estimated result	2009-10 Budget	Growth since 2005-06
Health	3,064	3,356	3,687	3,896	4,151	35.5%
Education	2,846	2,940	3,180	3,446	3,833	34.7%
Housing and community amenities	933	969	1,021	1,502	1,656	77.5%
Public order and safety	1,036	1,074	1,151	1,267	1,332	28.6%
Social Security and Welfare	673	748	812	874	912	35.5%
Transport and communications	734	745	805	756	842	14.7%
Recreation and culture	299	291	371	300	298	-0.3%
Other economic affairs	176	178	195	289	285	61.9%
General public services	206	184	187	199	218	5.8%
Agriculture forestry, fishing etc	207	193	212	198	203	-1.9%
Mining and mineral resources	84	95	100	92	103	22.6%
Fuel and energy	44	40	43	52	49	11.4%
Other purposes	739	734	650	780	866	17.2%
Total expenses	**11,040**	**11,547**	**12,414**	**13,650**	**14,749**	**33.6%**

A **bad** example when discussing the table above

> *Total government expenses have increased by over 8% per annum since 2005-06. There has been a large growth in Housing & Community Amenities (by around 19% per annum) and Health (by around 9% per annum) while expenses on agriculture, forestry and fishing have fallen by nearly 2% since 2005-06.*

A **good** example when discussing the table above is:

> *Total government expenses have increased by 33.6% between 2005-06 and the 2009-10 budget. There has been a large growth in spending on housing and community amenities (77.5%), other economic affairs (61.9% growth) and Health, Education and Social Security (all around 35%) with small declines in agriculture forestry and fishing (-1.9%) and recreation and culture (-0.3%).*

If you wish to discuss annual growths or dollar increases and decreases, include them in the table so the reader can quickly reconcile the data with the text. If they have to do the calculations to confirm their reading, it will slow up their reading, or at worst, stop them.

Where possible, put commentary and explanation of data with the data in the tables or charts. If this is not possible, put data explanations immediately above or below that data or chart. These suggestions are designed to stop unnecessary reading interruptions for the reader.

NOTES

Reflection

What has been my most important learning and why?

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Visual Explanations

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Beautiful Evidence

Stephen Few

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Show Me the Numbers

Signal

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The Data Loom

Sally Bigwood & Melissa Spore

Website: www.plainfigures.com

Book: Presenting Numbers, Tables and Charts

Appendix 1: Narrative structures

Some examples of basic non-fiction narrative structures:

- Past – Present – Future
- Beginning – Middle - End
- Why, What, How and What's next
- Context – Discussion – Findings - Recommendation

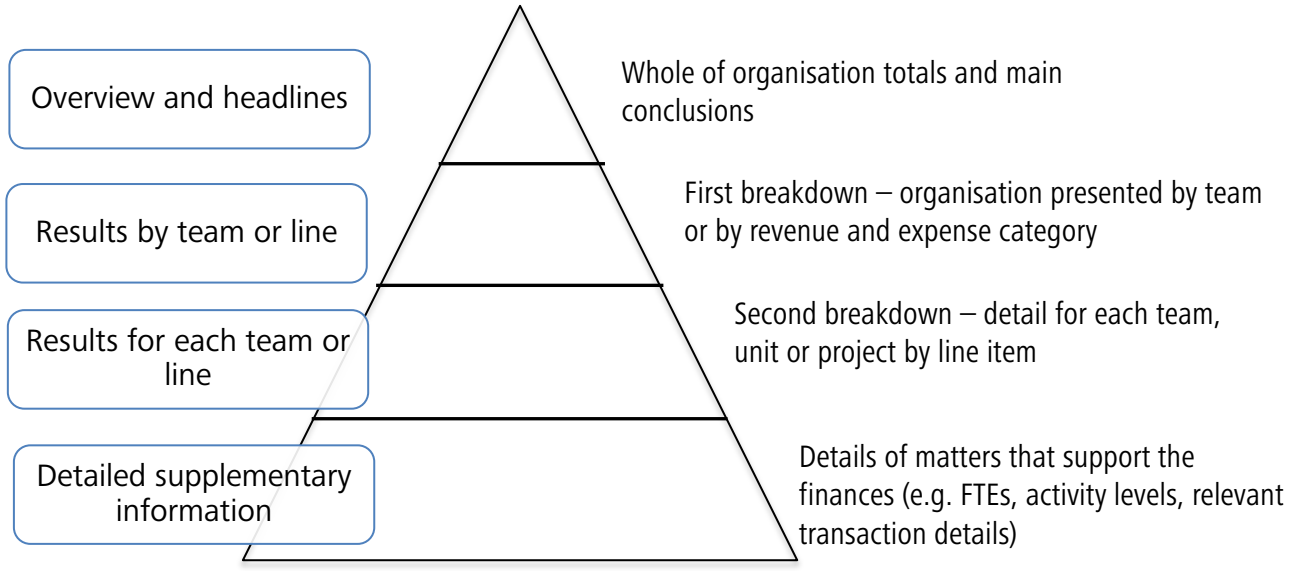
More detail on five structures follows:

- Pyramid structure for information papers
- 4Ps structure
- Shawn Callaghan's Clarity Story
- SOAP
- PRAISE as a narrative structure.

Pyramid Structure for information reports (Telling)

This structure for information reports is designed to ensure time-poor decision-makers are firstly provided with summary information and conclusions and then gradually introduced to increasing levels of detail that explain the results and support the conclusions.

An example for a finance report is below.



4Ps structure

The 4 Ps to consider are:

1. **Position**: This is like the Background section in a government template. It summarises the circumstances that have resulted in the need for action.
2. **Problem**: This is like the Discussion section in a government template. It outlines the problem that needs to be solved.
3. **Possibilities**: This is an analysis of all the possible solutions to the problem and their associated risks and benefits.
4. **Proposal**: This is the recommended course of action supported by evidence and with details about what the reader needs to do next.

* Ros Jay, How to Write Proposals and Reports that Get Results (Pearson Educational Ltd., 1999)

Shawn Callaghan's Clarity Story

In his book, *Putting Stories to Work*, Shawn Callahan includes a narrative structure for telling stories of change. He calls them clarity stories. He states:

"Human beings like reasons, and the clarity story gives people a reason….

The clarity story has a simple four-part framework:

Part 1 'In the past….' (how things were before the change happened)

Part 2 'Then something happened…' (the event/s that caused the problem or opportunity)

Part 3 'So now…..' (the decision/s made to counter the problem or take advantage of the opportunity

Part 4 'In the future….' (the likely outcome)"

SOAP (used in Healthcare)

The SOAP note (an acronym for subjective, objective, assessment, and plan) is a method of documentation employed by healthcare providers to write out notes in a patient's chart, along with other common formats, such as the admission note.

Subjective - information provided by the subject (patient) regarding his/her experience and perceptions about symptoms, needs and progress toward goals

Objective – information observed and gathered by the professional on vital signs, examinations and results from tests and scans.

Assessment – the diagnosis and judgements made about the subject's conditions and progress made over a period of time.

Plan – What steps will be taken and what will be done to treat the subject or to better understand the subject's condition.

PRAISE as a narrative structure (Discovery)

The PRAISE narrative structure is designed for reports or briefings that require the reader to be convinced of a need to change and act differently.

The centrepiece of this narrative structure is that a change is needed and the reasons to support the change have been researched and understood.

The PRAISE narrative structure is designed to support decision-making by guiding the reader towards insights that reveal the need for, and the reasons for, change in an organisation. Change can include:

- New investments
- Changing a business or service delivery model
- Decommissioning a site or service
- Adding products or markets or eliminating products or markets.

PRAISE is shorthand for a narrative structure with six components:

1. Purpose
2. Recent History
3. Analysis
4. Insight
5. Solution
6. Execution Plan (next steps)

The PRAISE narrative structure is derived from the psychology of supporting people in thinking through and identifying change and from marketing, and its focus on the central insights behind campaigns.

This structure and model have been influenced by three sources:

1. A counselling method that is designed to help people reach meaningful decisions that translate into action
2. A system used for developing advertising campaigns designed to influence others and
3. Approaches for decision making developed by Daniel Kahneman (Thinking Fast and Slow) - we employ two thinking systems.

The counselling methodology is attributed to Dr William Glasser. It is a method that is based on the principle that a person will act with conviction when they make their own well-informed decision. A decision that is related to a purpose they believe to be important, analysis of what is happening now, their evaluation of whether that is working, some ideas about what can be done and a commitment to specific action.

The system used for marketing campaigns can be found in the book *One Great Insight is Worth a Thousand Good Ideas* by Phil Dusenberry. In that book, the author details his system – RAISE – Research, Analysis, Insight, Strategy, and Execution around a brand. PRAISE is a variation of this.

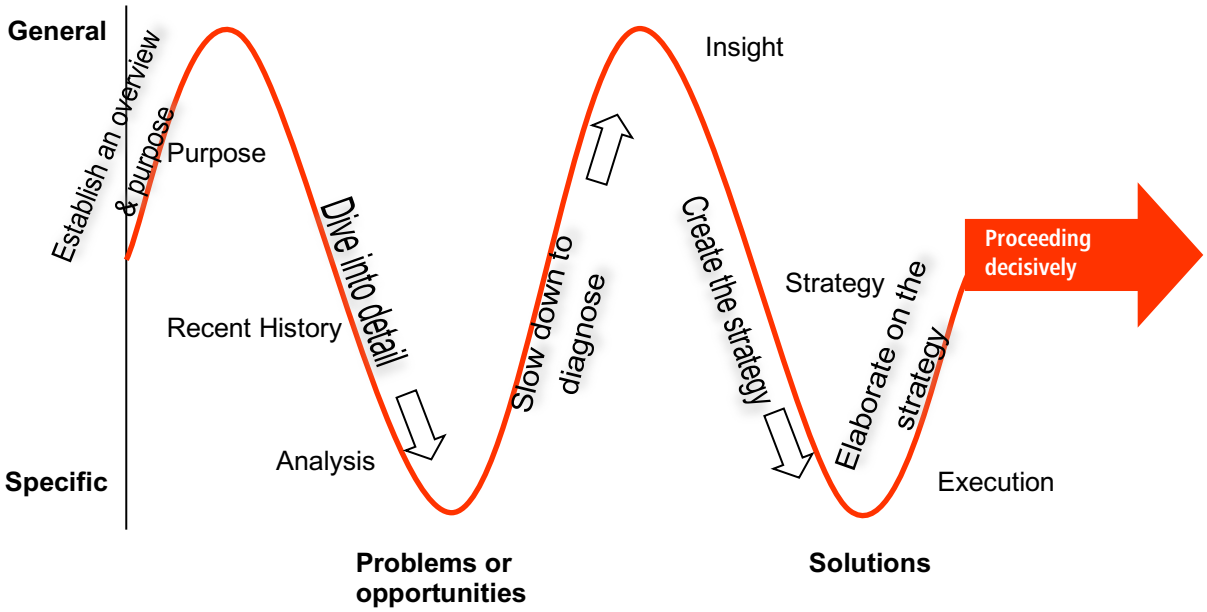
The two thinking systems popularised by Daniel Kahneman are:

- System 1 operates automatically and quickly, with little or no effort and no sense of voluntary control.
- System 2 allocates attention to the effortful mental activities that demand it, including complex computations. The operations of system 2 are often associated with the subjective experience of agency, choice and concentration.

The structure is designed for readers to be able to follow a flow or logic that makes high-quality decisions easier to make based on the substance of the evidence that we have brought together. The structure is also designed to address our three questions:

- Why is this subject matter relevant and important?
- Why is there a need to change?
- Why has the recommended change been selected?

The structure combines the fast/high-level thinking with the slow, more detailed thinking about how the situation has come to be (past and present) and how we propose to resolve it. The PRAISE narrative structure can be presented as guiding our readers through the thinking process in the following diagram.



PRAISE summarises the readers' journey through our report

The PRAISE model shows that there is a balance between problems and solutions and between summary/high-level information and detailed information.

The purpose and insight section of our report should ensure that the receiver understands the importance of what we are presenting and can draw some basic conclusions about what needs to change and why.

The analysis and execution sections are where we present details and specifics regarding the evidence we have gathered and how the recommended response should be executed.

Appendix 2: A basic case for infrastructure

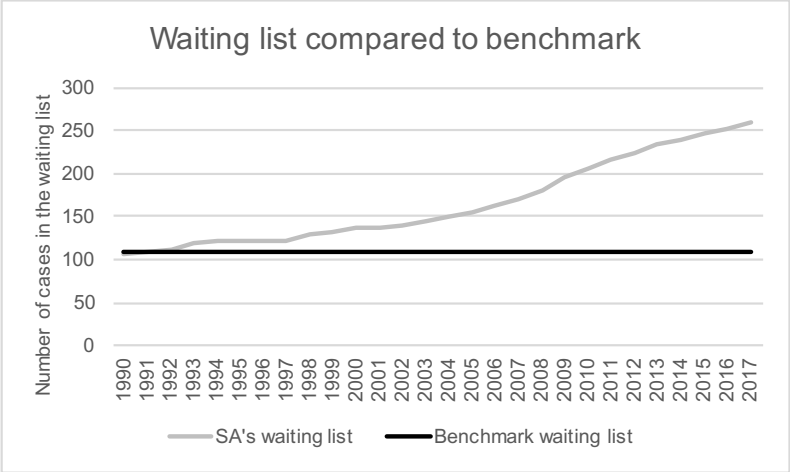
Purpose

The Office for Case Management exists to meet legislative requirements to process cases on behalf of the Government. The processing of these cases is important to maintaining public faith in this public system (e.g. health, housing, legal). Containing waiting lists is critical to achieving good public outcomes and Government policy outcomes.

The Government has made strong policy commitments to ensuring excellence in the management of cases and to maintaining public faith in the system. There are accepted Australian benchmarks for the size of the waiting lists being managed by the Office. There are well documented standards of excellence in managing cases and there are well documented standards guiding the use and age of case management infrastructure.

Recent History

There has been significant growth in the number of cases being processed by the office, evidenced by trends in case numbers. In the last ten years, there have been policy changes that have served to further increase the number of cases. Several measures have been put into place to improve the way cases are processed through the system and they have made the growth lower than it would otherwise have been. However, the growth in the number of cases is greater than the growth in processing cases. There is a trend growth in the backlog of cases. There has been trend growth in the backlog of cases as shown in the graph below.



Infrastructure is a critical ingredient in the processing of cases. The infrastructure capacity necessary to support the processing of cases was created over 25 years ago. There has been no material growth in this infrastructure capacity over that time.

Analysis

Projections for case management growth will see South Australia performing well below benchmark with the growth in cases continuing to exceed the processing of cases. There will be a major growth in waiting lists that will materially impact the effectiveness of the system and public faith in it.

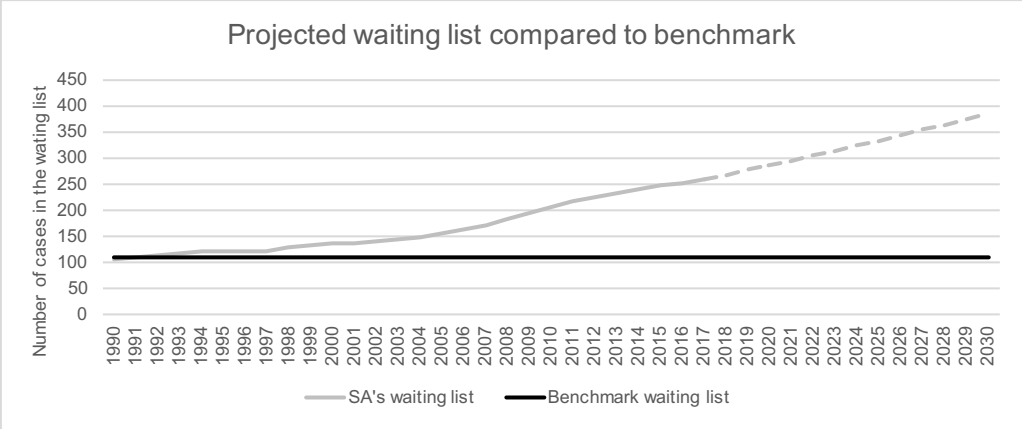
There has been an analysis of the current case management process that can improve processing times slightly but will not address the growth in waiting lists.

There has been an analysis of the utilisation of existing infrastructure assets. It is difficult to increase the utilisation of existing infrastructure given the constraints on its use. These constraints

occur due to the age of the infrastructure and due to the need to ensure basic quality standards in the processing of cases.

Alternate methods (e.g. 24-hour use of infrastructure and 24-hour processing of cases) have been considered but are not feasible.

Projected growth in the waiting list compared to the benchmark is presented in the graph below.



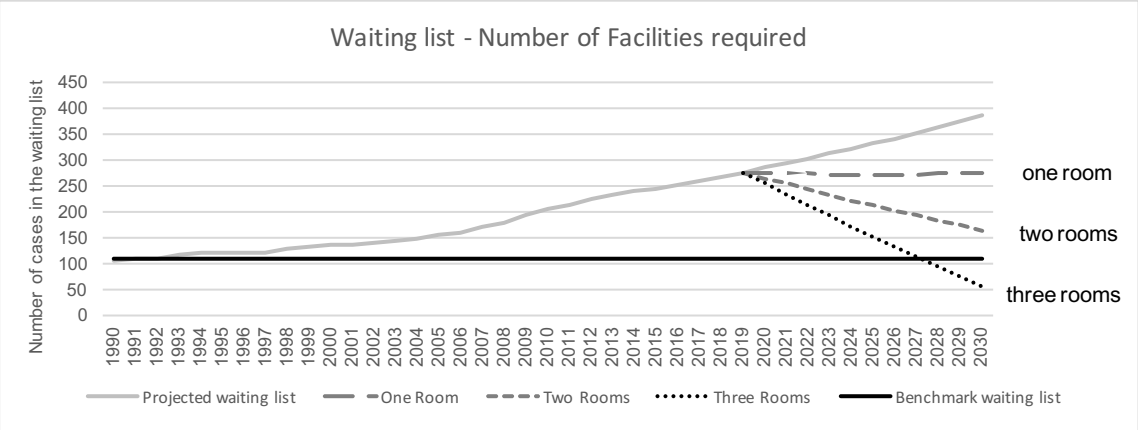
Insights

To meet waiting list targets there needs to be an increase in the number of cases processed. Changes of policy and changes of practice have been implemented but have not addressed backlogs. Alternate ways of increasing case processing have been explored but they will not address backlogs.

Increased infrastructure capacity and a commensurate increase in staff to process cases are required to achieve the goal of reducing the backlog and maintaining public faith in the system.

Solution

Modelling has been done of the growth in cases and the growth in the number of facilities (e.g. operating theatres, beds, rooms, offices) required. This modelling has estimated that to increase the number of cases processed to eliminate the waiting list gap from the benchmark, three additional facilities are required, along with extra staff to operate and process cases in these facilities.



There are options for increasing the processing capacity

- Build the capacity (new building)
- Renovate existing assets to create capacity

- Rent or lease capacity.

Each of these options has been evaluated based on cost, timeliness, feasibility and risk. The recommended option is for a new building, near the existing infrastructure, with three new rooms.

Execution (proceeding with our project)

A major infrastructure project is proposed with the outcomes detailed in the previous section. To ensure continuity of service, it is proposed that a separate project team be established within the agency to undertake these works.

The immediate work of the project team will be to:

- Procure more detailed designs and costings
- Navigate a range of government approval processes (Cabinet, Parliamentary Works)
- Seek specific planning approval for this initiative.

Appendix 3: Presenting cost and activity analysis

I was asked to help a team of scientists who had been asked to deliver their services with less money. They were part of a government department and had been given a savings target by the Government.

There is a range of scientific services that operate across State and Federal Governments. In the State Government examples include pathology and radiology services within the Health and Human Services Department, Forensic sciences within the Justice Portfolio, and food, plant and biosecurity services within the environment and primary industries sectors. In the federal government, examples include the CSIRO, the Bureau of Meteorology and aspects of customs.

The initial reaction from the scientists was that they could not achieve their savings targets through efficiencies. Improving their services was an ongoing task and they were continually finding ways to deliver their services more efficiently.

They were confused by the allocation of a savings target without regard for the services they delivered. They had not been consulted on the amount of savings or their implications. My assistance was sought to help them work through this task. In the first instance, I made it clear to them, that all parts of government have savings targets allocated to them. It is a reasonable thing for the leaders of an organisation to expect ongoing improvement and efficiencies as well as governments making decisions to reallocate money due to changing demographics or economic realities like lower taxation income.

My first piece of advice is not to get caught up in why they had been allocated savings or the politics of their savings target. Our goal was to achieve a line of sight between the financial parameters of their business and the service parameters of their business so the implications of the savings targets would be clear to them, to their department and the Government. I wanted to understand the full cost for the delivery of their services and the relationship between these costs, the revenues of the business and the activity of the business.

We started by viewing their business as a series of functions or services. Most businesses do this naturally and the result of this can be seen from organisational structures.

All organisations of any size can be distilled down into two functions:

- Function One: Produces and delivers the outputs of the business (e.g. Laboratory services, tests, freight to deliver)
- Function Two: Supports function one (e.g. Finance, HR, ICT)

The first function incurs direct costs and the second function incurs indirect costs. The second function is often described as an overhead. Both functions are necessary in any business.

We started by understanding the structure of their business and how the finances were allocated across the various functions of their business. It was important to be able to have both a historical view of their finances by function and to have a forward-looking view of their finances by function. The second area is often not that well understood.

I wanted to develop a representation or a financial exhibit of their overall business showing the revenues and expenses of each function.

We developed an initial financial graphic of the business that looked as follows:

	Team one	Team Two	Team three	Team four	Corporate ICT	Corporate Exec/Finance/HR	Total
Labour	x	x	x	x	x	x	∑ Labour
Goods procured	x	x	x	x	x	x	∑ Goods
Services procured	x	x	x	x	x	x	∑ Services
Sub total expenses	X^1	X^2	X^3	X^4	ICT	EFH	**Total Costs of Running the business**

The graphic showed the total expenses for the business as the sum of the expenses across each team (from left to right) and the sum of expenses across the different categories of expenses (from top to bottom).

The scientists had structured their business and their finances in this way and we were able to construct the above table quite easily.

To get a better line of sight, we needed to understand the full cost of delivering the services from each of the teams. To do this, we need to allocate or attribute the corporate costs across each of the teams. Attributing ICT expenses can be done by identifying the ICT requirement of each team (number of computers, machines or data usage from each team). Other corporate costs are often attributed to teams based on the number of FTEs in each team as a % of the total of the four service delivery teams. I wanted to develop a second financial exhibit that looked like the one below.

	Team one	Team Two	Team three	Team four	Corporate ICT	Corporate Exec/Finance/HR	Total
Labour	x	x	x	x	x	x	∑ Labour
Goods procured	x	x	x	x	x	x	∑ Goods
Services procured	x	x	x	x	x	x	∑ Services
Sub total expenses	X^1	X^2	X^3	X^4	ICT	EFH	**Total Costs of Running the business**
ICT allocated	ICT	ICT	ICT	ICT	-ICT		0
Exec/Finance/HR allocated	EFH	EFH	EFH	EFH		-EFH	0
Total attributed expenses	Y^1	Y^2	Y^3	Y^4	0	0	**Total Costs of Running the business**

We now had a display of the total expenses associated with each team in the business.

My next request for an improved line of sight was to include some measures of activity or output for each of the teams. For the scientists, the measures of activity could have included:

- The number of tests performed
- reports produced
- cases managed
- investigations conducted.

The scientists did have measures of their activity, although they were nervous about how well these captured some of the subtleties of their work. For instance, those who performed tests would comment that they had simple tests and more complex tests. They should not be counted as the same. We could address this by establishing the concept of a standard test and then estimating that complex tests were the equivalent of three standard tests. Now we could combine the different tests into one meaningful measure of the number of standard tests performed. This activity data can be included in our graphic and can be used to calculate the average cost per item. This is shown in the graphic over the page.

	Team one	Team Two	Team three	Team four	Corporate ICT	Corporate Exec/Finance/HR	Total
Labour	x	x	x	x	x	x	∑ Labour
Goods procured	x	x	x	x	x	x	∑ Goods
Services procured	x	x	x	x	x	x	∑ Services
Sub total expenses	X^1	X^2	X^3	X^4	ICT	EFH	**Total Costs of Running the business**
ICT allocated	ICT	ICT	ICT	ICT	-ICT		0
Exec/Finance/HR allocated	EFH	EFH	EFH	EFH		-EFH	0
Total attributed expenses	Y^1	Y^2	Y^3	Y^4	0	0	**Total Costs of Running the business**
Activity Measures							
Tests performed	Z^1						
Cases Managed		Z^2					
Reports produced			Z^3				
Investigations conducted				Z^4			
Average cost ($) per							
Tests performed	$=Y^1/Z^1$						
Cases Managed		$=Y^2/Z^2$					
Reports produced			$=Y^3/Z^3$				
Investigations conducted				$=Y^4/Z^4$			

We are now establishing a line of sight between the expenses of the business and the activity of the business. With this line of sight, the scientists were now able to demonstrate the impact of the budget savings on their activity levels. A reduction in the budget for team one will translate into that team performing fewer tests or managing fewer cases which will likely impact the waiting time for tests or cases.

Another benefit of this line of sight is that the scientists have developed parameters for their business that can be benchmarked. As a minimum, they can benchmark their current and future performance against their past performance. They can also benchmark their performance against that of other enterprises to find and identify opportunities for improvement or to identify where they have achieved high standards of efficiency or effectiveness. The main benefit of external benchmarking is that it acts as a trigger to evaluate performance and to find ways to improve, from the examples of comparable businesses.

The scientists modelled these impacts and provided a submission back to the Government to demonstrate the impact of the budget reductions. They modelled the impact on the number of tests performed and estimated the increased waiting times arising from the reduced activity. There are functions of government where the speed and waiting times for scientific tests will impact other services. Examples will include the speed of pathology tests in moving patients through hospitals, and DNA tests in progressing police investigations and court trials.

An example of the outcome of this work is provided in the following graphic.

	Team one	Team Two	Team three	Team four	Corporate ICT	Corporate Exec/Finance/HR	Total
	$'000	$'000	$'000	$'000	$'000	$'000	$'000
Labour	300	400	350	500	100	300	1,950
Goods procured	400	200	300	200	300	100	1,500
Services procured	500	100	500	300	200	300	1,900
Sub total expenses	1,200	700	1,150	1,000	600	700	**5,350**
ICT allocated	116	155	135	194	-600		0
Exec/Finance/HR allocated	135	181	158	226		-700	0
Total attributed expenses	1,452	1,035	1,444	1,419	0	0	**5,350**
Activity Measures							
Tests performed	751						
Cases Managed		94					
Reports produced			143				
Investigations conducted				66			
Average cost ($) per							
Tests performed	1,933						
Cases Managed		11,016					
Reports produced			10,095				
Investigations conducted				21,505			
Impact of $100,000 reduction	52 less tests	9 less cases	10 less reports	5 less investigations			
Est increase in waiting time	2 days	1 week	1 week	2 weeks			

This final graphic provides a line of sight between expenses and their relationship with activity and their relationship with a performance indicator like waiting times.

In the case of the scientists, the Government received their submission and feedback from other agencies was such that they wanted to avoid the impact of increased waiting times in one of the services. The increase in waiting times in other services was not ideal but deemed tolerable.

The Government then reinstated some of the savings requirements, seeking to quarantine some key functions from the impact of savings.

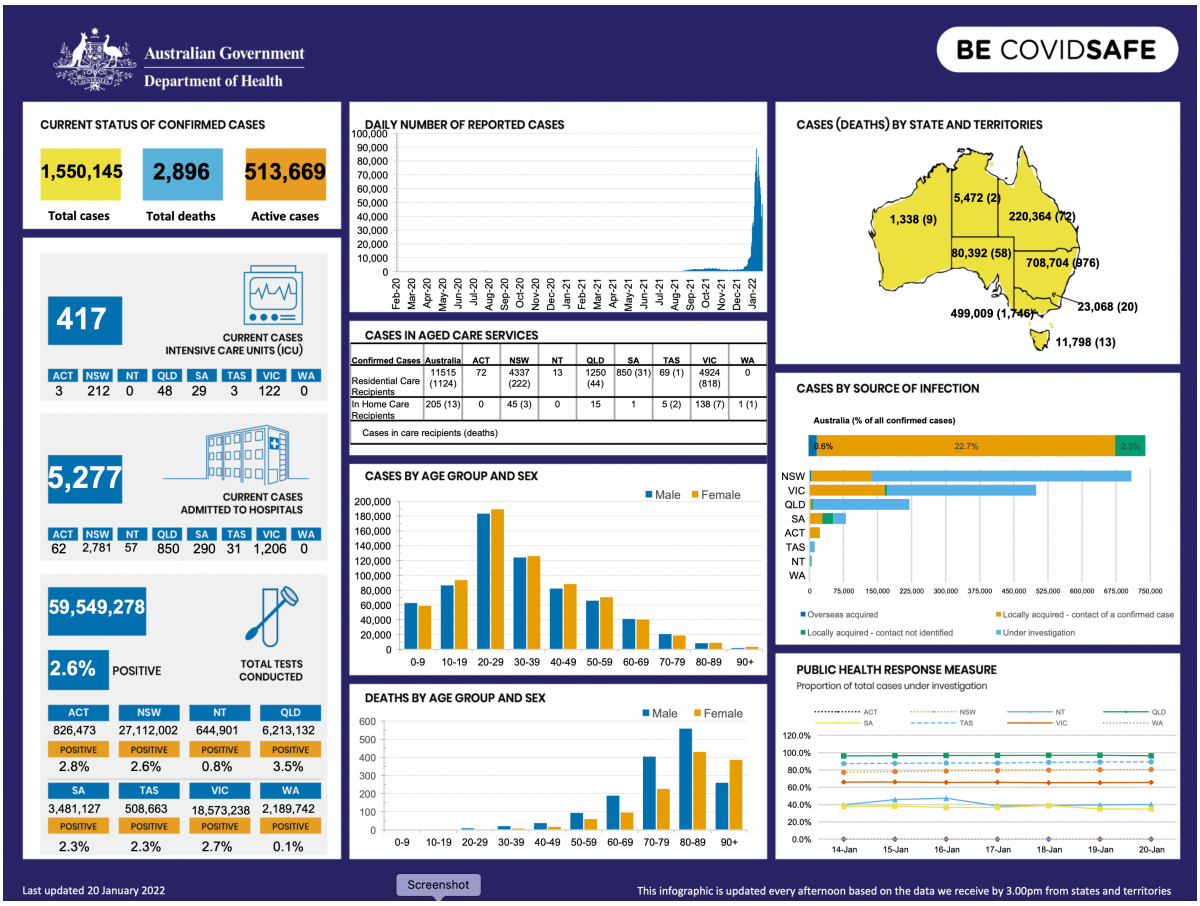
The example shows the value of having a line of sight between finances, activity and outcomes and increases the financial clarity for the business. The example also shows business model clarity and financial clarity at work. In this case, the financial clarity served as a defence against budget cuts for one team in the business. For other teams in the business, the financial clarity serves to help manage expectations about service levels, demonstrating that the savings would impact service volumes and waiting times.

Appendix 4: Some thoughts on dashboards

Another variant in presenting numbers is to present a range of data in different forms in close proximity using a dashboard.

> *"A dashboard is a business tool that displays a set of PIs (performance indicators), KPIs (key performance indicators), and any other relevant information to a business user. Dashboard data is often displayed in real-time after retrieval from one or more data sources in a business. Dashboards are interactive, allowing an executive to drill into particular aspects of the display or switch between facets or views of the data."*

Dashboards are typically software tools that are used online but can also be translated into the presentation of reports for decision-makers.



Above is an example sourced from: https://www.health.gov.au/sites/default/files/documents/2021/01/coronavirus-covid-19-at-a-glance-20-january-2022.pdf

There is a risk that dashboards can put the flashy presentation ahead of the data and distract the readers. There is a high risk of chartjunk with this form of data presentation.

> ***"Chartjunk** refers to all visual elements in charts and graphs that are not necessary to comprehend the information represented on the graph, or that distract the viewer from this information."* Tufte, Edward R. (1983). The Visual Display of Quantitative Information.

When I present examples of dashboards to participants, common feedback includes:

- I don't know where to start looking
- It is overwhelming

- It feels cluttered.

At their worst, a dashboard can appear to be a data dump or data 'vomit'. Someone has used the dashboard to empty their analysis into one place but without regard for how the reader will navigate or understand it.

With bad design, readers will be turned off of our dashboards and turn away or, if they try and look, they will feel lost. We would rather they feel welcomed to our display and enjoy a smooth journey through what the data is saying.

The same thought process is used by people designing physical environments and buildings. They want people to feel welcome to the place and to find it easy to navigate and find their way around. These professionals (urban planners, architects and graphic designers) use the term wayfinding.

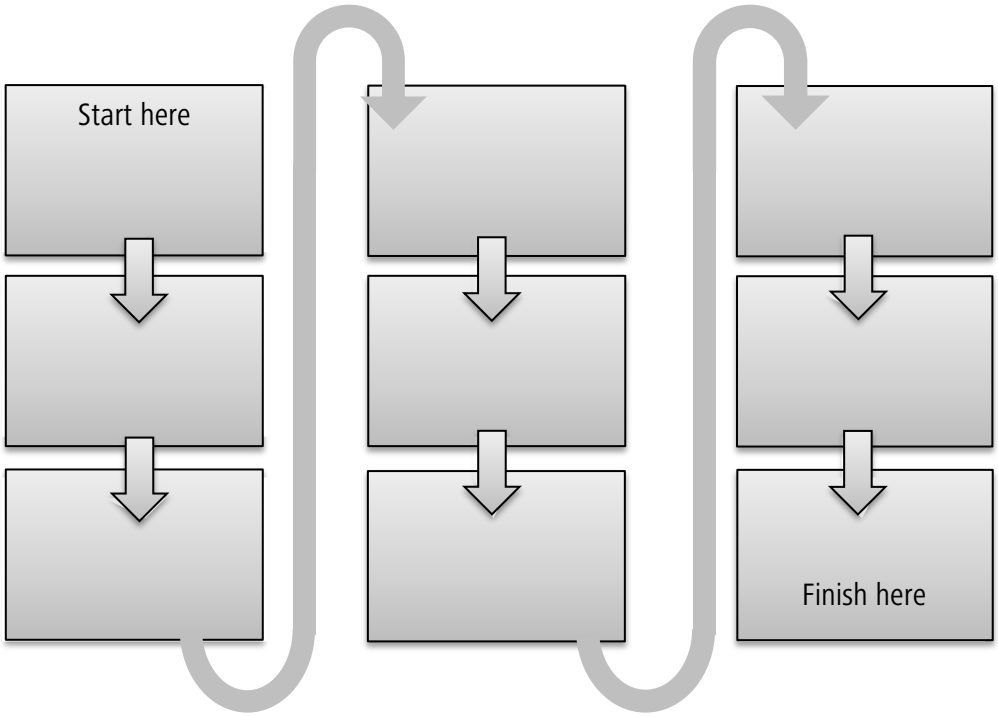
> *Wayfinding can be defined as spatial problem-solving. It is knowing where you are in a building or environment, knowing where your desired destination is, and knowing how to get there from your present location. (source: Wayfound Victoria)*

I believe the term can also be applied to spatial problem-solving with graphic displays. In the definition above, we can include among 'environment', dashboards or data displays.

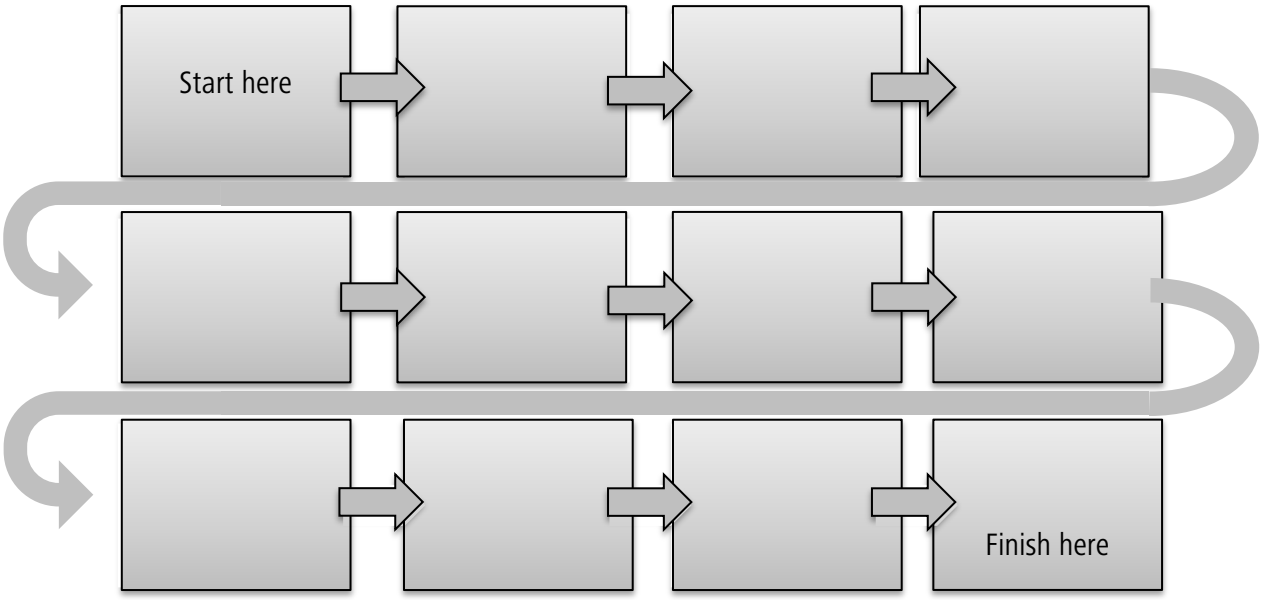
Some thoughts to help our readers navigate:

- It is important for the reader to be given a guide as to where to commence by the use of signals like 'You are here' or 'Start here'.
- The use of text boxes to help describe the data and to guide the reader through the dashboard. More advanced tools like Power BI and Tableau enable 'hover points' that provide more detailed text for a reader when their mouse hovers over a label or data point. The use of hover points is more limited in Excel.
- Use a specific design that will help the reader follow a path. Some examples include:
    - Academic design (in columns)
    - Comic book design (in rows)
    - Hub and spoke design

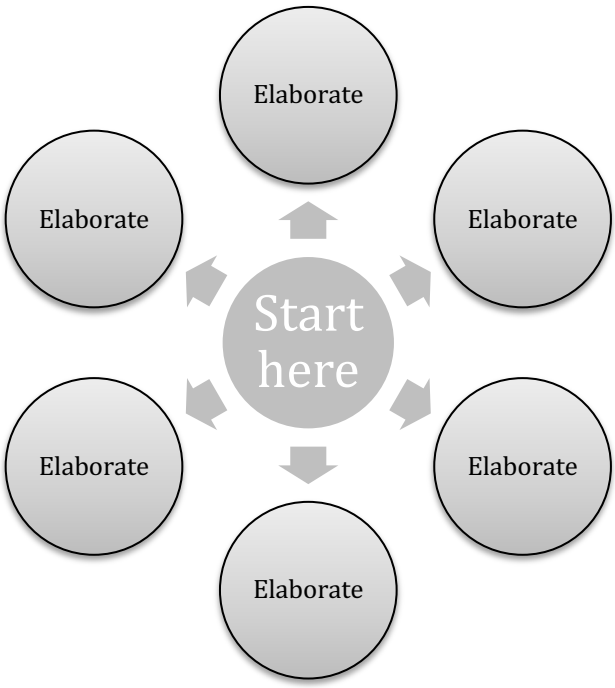
Academic design (working in columns)



Comic book Design (working in rows)



Hub and spoke design



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Appendix 5: Bullet graphs

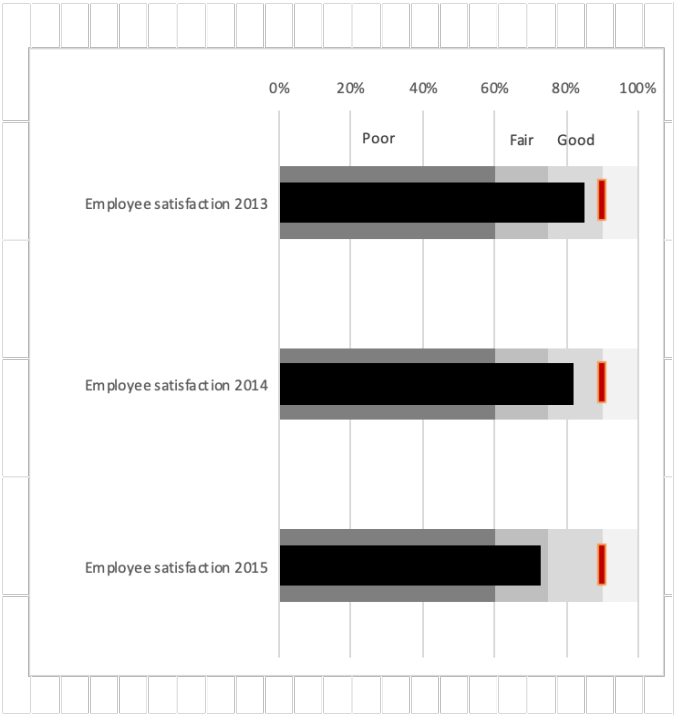
Bullet graphs support the comparison of the featured measure to one or more related measures (for example, a target or the same measure at some point in the past, such as a year ago) and relate the featured measure to defined quantitative ranges that declare its qualitative state.

They were developed by Stephen Few to replace the meters and gauges that are often used on dashboards

The bullet graph consists of five primary components:

- Text label
- A quantitative scale along a single linear axis
- The featured measure
- One or two comparative measures (optional)
- From two to five ranges along the quantitative scale to declare the featured measure's qualitative state (optional).

The example below is a bullet graph for an employee satisfaction survey result over three years.



The graph shows the result (the featured measure in black) compared to a target (red line at 90%) and scales poor, fair and good.

Appendix 6 – Numbers in tables

See below a table from a government report.

Case study 3.1 – Comparison of price scoring formulas on tender outcome

Formula 1: 2.5 + 5(pretender estimate – tender price)/ pretender estimate

Formula 2: 5 – 5 x % deviation from avg (median + pretender estimate) / (-2) if negative

Formula 3: 5 x (lowest price / tender price)

Bidder	Price	Quality score	Total score with F1	Total score with F2	Total score with F3
1	8000	2.47	3.72	3.34	3.72
2	29000	3.25	3.72	4.01	3.60
3	26000	3.16	3.77	4.10	3.55
4	16000	2.62	3.71	3.73	3.25
5	10000	2.11	3.36	3.05	3.08
6	21000	2.34	3.17	3.55	2.81
7	15000	2.83	3.95	3.92	3.48
8	11000	1.89	3.14	2.86	2.77

In this scenario:

- bidder 7 wins with formula 1 (4th lowest price, 3rd best for quality)
- bidder 3 wins with formula 2 (2nd most expensive, 2nd best for quality)
- bidder 1 wins with formula 3 (cheapest tender, 5th best for quality)

Source: Office of the SA Productivity Commission

Comments?

My observations

- Left Justification rather than right justification of numbers
- Too many borders and inconsistent use of borders (none at the bottom)
- Borders, when used, can be lighter
- Rows are too high leaving too much space
- Column widths leave too much space
- No comma separation of the price
- General principle – don't use shading. For case studies and recommendations, use a border to distinguish them from the rest of the document rather than shading.

Correcting for these, the table now looks like this.

Bidder	Price	Quality Score	Total Score with F1	Total score with F2	Total Score with F3
1	8,000	2.47	3.72	3.34	3.72
2	29,000	3.25	3.72	4.01	3.60
3	26,000	3.16	3.77	4.10	3.55
4	16,000	2.62	3.71	3.73	3.25
5	10,000	2.11	3.36	3.05	3.08
6	21,000	2.34	3.17	3.55	2.81
7	15,000	2.83	3.95	3.92	3.48
8	11,000	1.89	3.14	2.86	2.77

Going further:

- Distinguish titles
- Reduce repetition
- Highlight winners

Bidder	**Price ($)**	**Quality Score**	**Total Score**		
			With F1	**With F2**	**With F3**
1	**8,000**	2.47	3.72	3.34	**3.72**
2	29,000	**3.25**	3.72	4.01	3.60
3	26,000	3.16	3.77	**4.10**	3.55
4	16,000	2.62	3.71	3.73	3.25
5	10,000	2.11	3.36	3.05	3.08
6	21,000	2.34	3.17	3.55	2.81
7	15,000	2.83	**3.95**	3.92	3.48
8	11,000	1.89	3.14	2.86	2.77

And further again, we could highlight rankings.

Bidder	Price ($)		Quality Score		Total Score					
					With F1		With F2		With F3	
1	8,000	1st	2.47	5th	3.72	3rd	3.34	6th	3.72	1st
2	29,000	8th	3.25	1st	3.72	3rd	4.01	2nd	3.60	2nd
3	26,000	7th	3.16	2nd	3.77	2nd	4.10	1st	3.55	3rd
4	16,000	5th	2.62	4th	3.71	5th	3.73	4th	3.25	5th
5	10,000	2nd	2.11	7th	3.36	6th	3.05	7th	3.08	6th
6	21,000	6th	2.34	6th	3.17	7th	3.55	5th	2.81	7th
7	15,000	4th	2.83	3rd	3.95	1st	3.92	3rd	3.48	4th
8	11,000	3rd	1.89	8th	3.14	8th	2.86	8th	2.77	8th

And finally, see if another narrow font improves (e.g. Arial and Arial narrow for rankings)

Bidder	Price ($)		Quality Score		Total Score					
					With F1		With F2		With F3	
1	8,000	1st	2.47	5th	3.72	3rd	3.34	6th	3.72	1st
2	29,000	8th	3.25	1st	3.72	3rd	4.01	2nd	3.60	2nd
3	26,000	7th	3.16	2nd	3.77	2nd	4.10	1st	3.55	3rd
4	16,000	5th	2.62	4th	3.71	5th	3.73	4th	3.25	5th
5	10,000	2nd	2.11	7th	3.36	6th	3.05	7th	3.08	6th
6	21,000	6th	2.34	6th	3.17	7th	3.55	5th	2.81	7th
7	15,000	4th	2.83	3rd	3.95	1st	3.92	3rd	3.48	4th
8	11,000	3rd	1.89	8th	3.14	8th	2.86	8th	2.77	8th