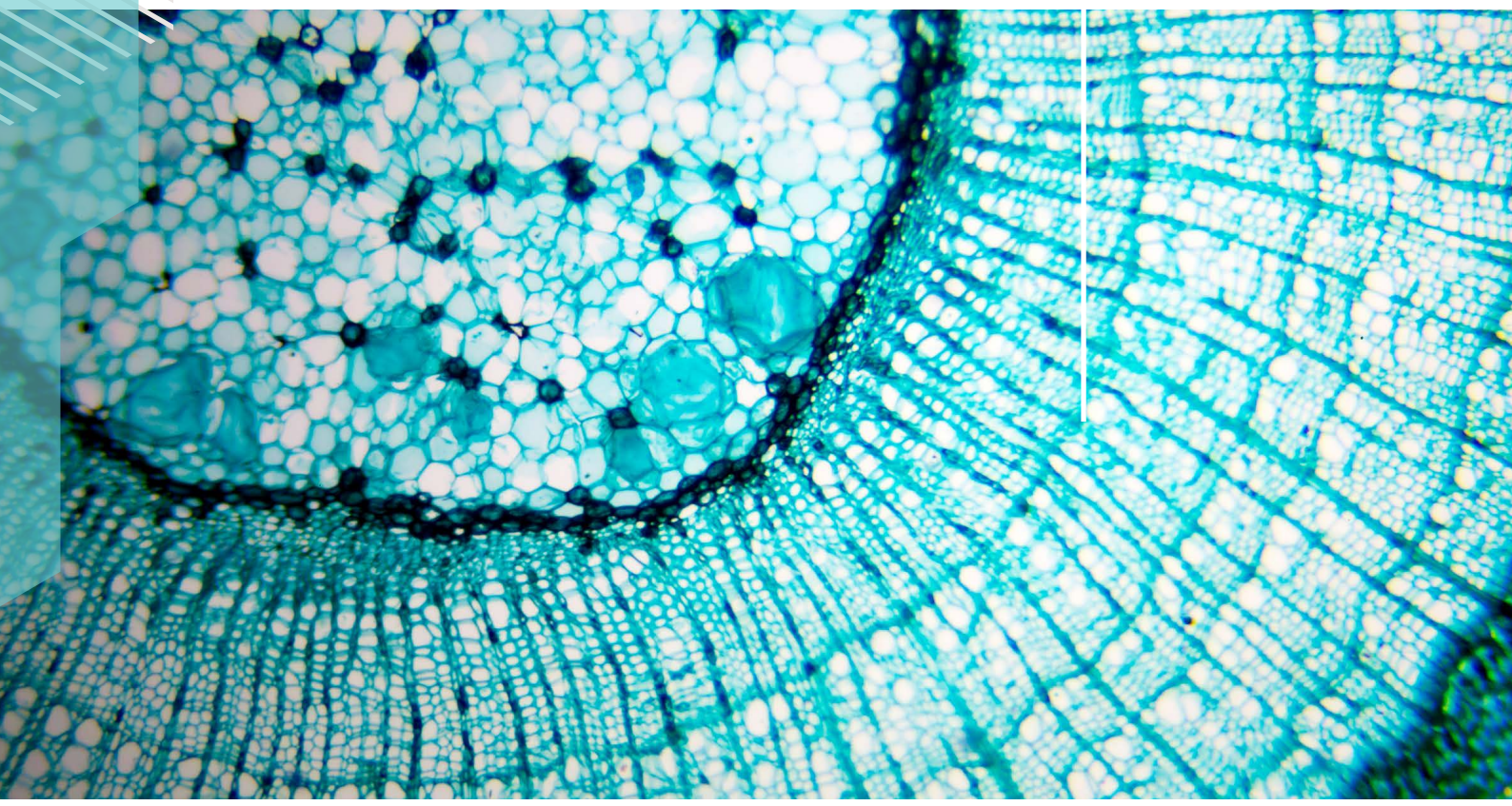
A quick guide to effective data visualisation and infographics



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Why are effective data visualisation and infographics important?

The combination of data and visuals is powerful. This is because:

- good data provide objective, robust information or proof – data can help make decisions more objective, or make a conclusion, instruction or recommendation harder to argue with
- images can generate an emotional response very quickly – think of some of the most moving, frightening or pretty images you have seen.

Using data visualisation and infographics is important because they are effective. A clear graph or an engaging infographic can get your message across quickly and powerfully.

A note about terminology: *data visualisation* is a general term used to refer to graphs, maps, and infographics that are based on specific data; *infographics* refers to a visual display that might be based on data, but might also be based on a message or a process.

Data and information presented through visuals can be immediately understood and persuasive. People often engage more with visual data and infographics than text. A page of text can seem dull, and text is inherently linear – we read through it from end to end. A reader can look at a picture and immediately grasp the message without having to spend time to work their way through it.

Data visualisation can also help you to reach a wider audience. People learn differently and have different levels of literacy – presenting information visually may reach people it would otherwise miss.

What makes a data visualisation or infographic effective?

An effective data visualisation or infographic is clear and engaging:

- Clear means it is accurate and easy to understand. An effective data visualisation or infographic means the audience says 'Now I get it!', not 'I don't know what that's supposed to mean'.
- Engaging means it sparks understanding, interest and action in the audience.

An effective data visualisation or infographic also limits the 'cognitive load' on the audience. This sounds like a complex concept, but it simply means that your audience doesn't have to think too hard to understand your message.

An effective data visualisation or infographic is one that gets its primary message across as soon as the reader looks at it; the message 'hits them in the eye'. If a reader must study the visualisation in detail – decode it, you might say – the visualisation has failed. That is not to say that a visualisation cannot contain secondary messages that become visible on deeper engagement, but the main message should be immediate and self-evident.

An ideal visual makes its primary message immediately available, and is interesting enough to encourage a closer look.

Why is it important to get it right?

It's not just important to use data visualisation and infographics – it's important to get them right.

Because data visualisation and infographics are powerful, you have a responsibility to ensure that they are accurate.

People make decisions based on data. If we present data correctly, and in a way that focuses on the main issues and messages, we can better inform those decisions – especially if the decision maker is time-poor.

We must always be clear and accurate when we present data. We must know what we want to say, be aware of how our message will be perceived, and stay true to the underlying data. It might be easy to exaggerate or skew the data, or get the message wrong – especially if a key part of our message is about subtle things like our degree of certainty. This could lead to poor understanding and bad decisions.

It's also important to get it right because data and infographics are expensive. Research and effective data presentations take time and money to develop. We must make sure the data and the message are right so the money spent is worthwhile and things don't need to be redone. It takes as much time and money to present a badly considered message as a good one.

Learning how to make data visualisations and infographics effective can turn your information into communication.

Getting started

Making an effective data visualisation or infographic involves 2 essential components: the context, and the project itself.

The context

Understanding the context provides the basis for developing effective data visualisations or infographics.

Don't just dive into development. If you want your message to be clear, accurate and immediate, you must know what you are trying to say, and who you are talking to.

Your message or story

Ask yourself what you are trying to achieve. Are you trying to explain what the data show, make a case for change, explain a process, or have your audience understand a key point or change their behaviour?

Before developing a graph or infographic, it is worth spending some time to tease out your aim and your single most important message. What is the one thing that readers must get from your presentation if it is to be successful?

This understanding can drive many of the subsequent decisions in development and design. For example, if you want your audience to know how household fire regulations affect air quality, you might use a simple line graph that marks the year that slow-combustion stoves were banned, and the subsequent falling levels of air pollution.

It can also save a lot of wasted time. For example, if you are not sure of your message, you might include every step of a process in a diagram – making it longer as well as spending more time on development. If you know that

your key message is ‘Our approval processes make implants safe’, you might only include the safety aspects of the story.

To identify your key message, brainstorm ideas (alone or with colleagues) or write a short, punchy statement (like you would see in a Tweet or Facebook post). Make sure you can sum up your key message in a single sentence. A message, or at least the heart of it, should be short – for example:

Small, inexpensive changes can reduce household energy use.

Handwashing is an effective way to prevent disease.

Better collaboration can save money and support change.

Use the message as a touchpoint throughout development – as you develop, come back to your message and see if your graphic is achieving what you want it to. You can also use the message to test your graphic with friends or colleagues. Ask them what the main message is, and see how closely it aligns with your aim.

If your graph or infographic is part of a larger document or presentation, see how the various visualisations add together to tell an overall story. Do they support the aim of your publication, or are they a distraction?

Try to identify things you *don’t* need or want to say. Trying to say too much is a common error. The more messages you try to convey, the less effective any one message will be.

We must be prepared to throw out the messages or visualisations that are not essential, no matter how much we personally like them, or how hard we worked to produce them.

Your audience

Ask yourself who is your audience, what do they want to know, and what do they understand already.

Understanding your audience can help to shape your message. This means thinking about what they want to know, not just what you want to tell them – ‘pull’ versus ‘push’.

For example, if you want to present information on healthcare regulation, audiences are not asking 'How does healthcare regulation work in Australia?'; they really want to know 'How do I know my hospital is safe?' You may cover similar material in your answer, but focusing on what the audience wants to know will allow you to talk to the audience directly and produce content that is more relevant to their needs.

When you have identified your most important audience, think about their needs so you can tailor the visuals to suit. Consider:

- their current level of understanding of the subject – are they already experts in the field, or in a different field, or are they without specialist knowledge?
- their point of view on the subject – are they for or against, interested or not?
- their feelings on the subject – could it trigger strong emotions because of previous negative experiences with the topic or related subjects?
- how they like to receive information – are they digitally savvy and source their information from websites or social media, or do they prefer printed material?
- how they are influenced – do they 'just want the facts and figures' or do they want to see relatable examples and stories?

Answers to these questions will influence the type of information you include, as well as the text and visual style. Knowing your audience can change:

- the tone – chatty or formal
- the level of detail – high-level key points, or layers of meaning
- the language – what level of readability to aim for
- the type of presentation – a standard scientific graph, or a simple cartoon.

For example, an infographic for early primary school students may:

- use bright colours and a limited amount of text
- use storytelling techniques, like narratives and comics
- include images of young people as protagonists
- use a suitable vocabulary and simple sentences
- deal with relatively simple ideas.

The project

Once you know where you are headed in terms of your aim and audience, you need to think about how you are going to get there. This is the project itself.

Your format

First, think about exactly what you want to produce.

There are many types of visual displays. Do you need a table, a graph, a map or an infographic, and what's the difference?

- A table presents data in a set grid. Use a table if your audience needs to be able to look up or compare individual values, or if showing the precision of the values is necessary.
- A graph presents data visually in a scientific format. There are various standard graph forms, such as line graphs, bar graphs and so on. Use a graph if you want to show trends, change and other patterns over time, or across a large number of categories or groups.
- A map shows how data vary across an area. Geographically distributed data might be best presented on a map. Maps are very useful on the web, because they are great for interactivity and clicking through.
- An infographic presents data or a story using relevant graphics. It moves beyond just graphing to use images that help to convey the message.

Factors that influence your choice of visual display include:

- whether your story is based on a message or data
- the nature of the data (numbers are easier to graph than text responses)
- the data literacy of the audience (are they comfortable with statistics and data?)
- the format of the publication (online or print; poster, pamphlet or report)
- the tone of the publication (eg formal or informal)
- the best-practice ways to present the kind of data you have (eg do you need to compare categories, show change over time, or show a correlation?).

Your constraints

You also need to think about how your data visualisation or infographic is going to be produced. This will depend on several factors:

- Your resources. If your team has graphic design skills, you may be able to produce your visual element inhouse. If you don't, you may need to outsource expertise.
- The products you are developing. Does the product you want match your resources? If you want a simple graph, you are likely to have inhouse resources that can produce it. If you want an interactive infographic, you may need external expertise.
- Your timeline. If you have a short timeline, you may just add a graph to a fact sheet, but a longer timeframe could allow you to produce a suite of infographic posters.

Principles for effective data visualisation and infographics

Some common principles can help you to achieve an effective visual display, whether you are drawing a graph to show how seatbelt use has increased over time or producing an infographic of why seatbelts are important.

Reduce clutter and distraction

It is important that the message or data shines through your visual display. It should therefore be the most prominent and legible item in your display.[1] Reducing clutter can help to achieve this.

Garish, multicoloured or zebra-striped graphs with large amounts of bolded text, heavy lines and effects (eg 3D, perspective, shadow) can bamboozle and repel readers, as well as distort the data.

Stick to the principle 'less is more' and strip unnecessary ink off the page.

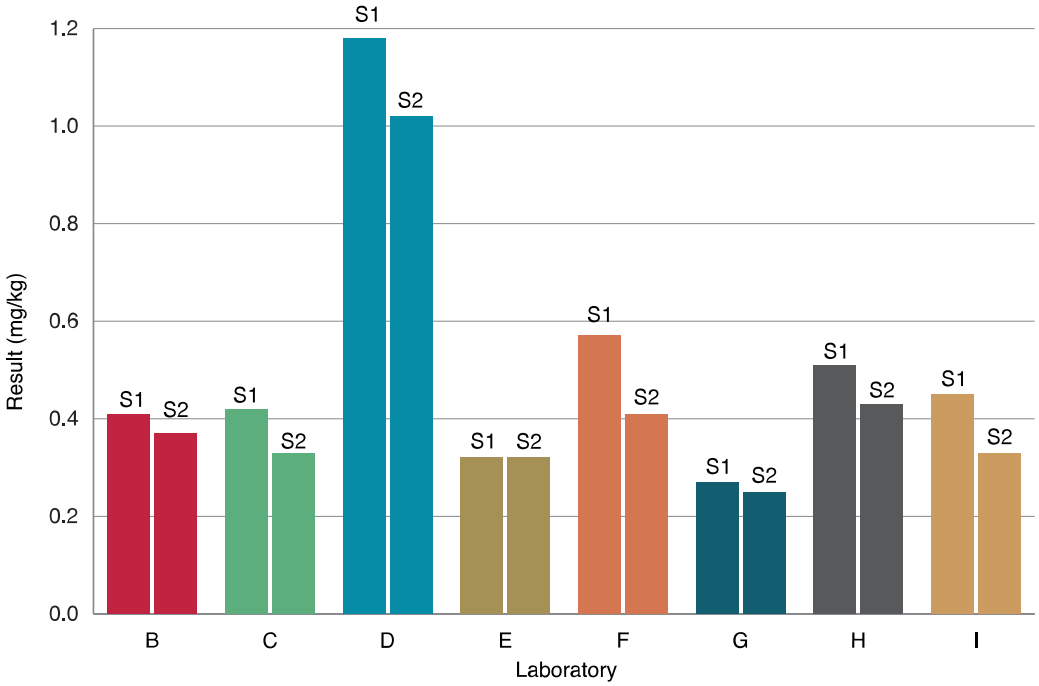
Pay attention to the ratio of data to ink.[2] Your data should use more ink than the nondata elements. This means using paler tints or finer lines for nondata elements, such as grid lines, arrows, borders and shading. Remove citations, caveats, logos, background shading, borders, and other nonrelevant data or graphic elements, wherever possible.

1 Kirk A (2012). *Data visualization: a successful design process*, Packt Publishing.
2 Tufte ER (2001). *The visual display of quantitative information*, 2nd edn, Graphics Press, Connecticut.

Use colour wisely

Be restrained with use of colour. It can be more powerful and effective to use a single splash of a strong colour to highlight a key point than to colour the entire graph or have a psychedelic infographic.

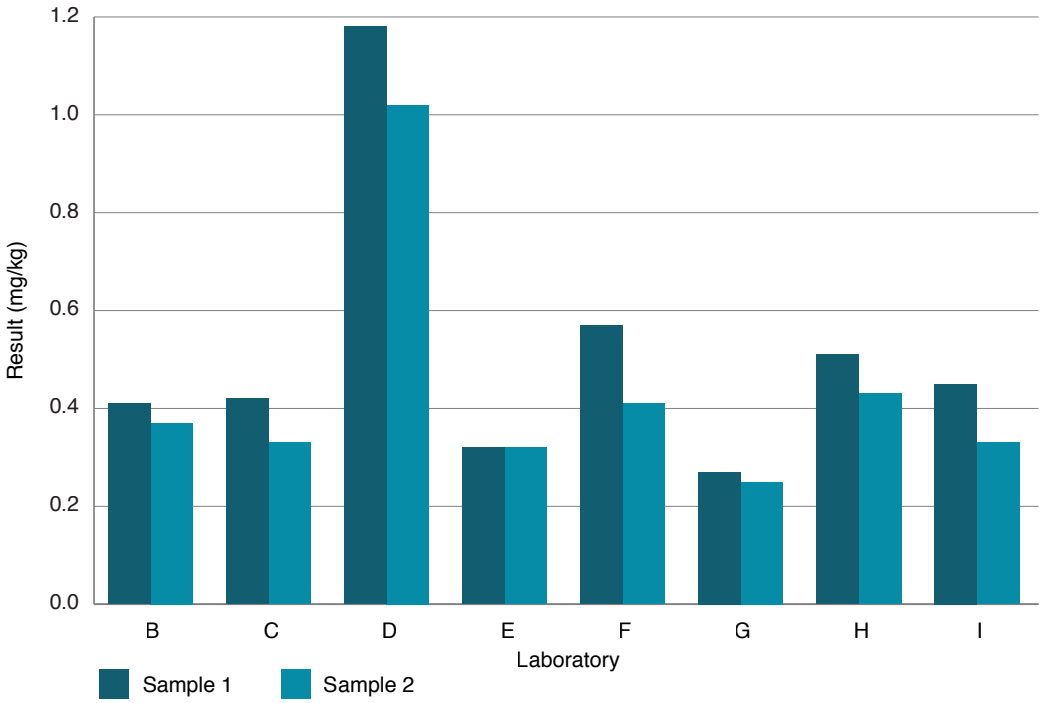
Adjust colours to suit the design concept, provided that this will not interfere with the integrity of the data (such as a map key, or colours relating directly to data or existing schemes). List colours and patterns in the legend in the same order in which they appear in the figure. In a series of figures, use the same colours for the same categories. Ensure that there is enough contrast between colours – steps of 20% tint for monochrome shading – or use patterns or patterned lines (eg dotted, dashed). Avoid zebra striping and rainbow colours.



When applying colour, be aware that some colours can carry cultural meaning, such as green for good, go or environment; and red for bad, stop, warning or heat. Colours also create a psychological response – bright colours are exciting and energetic, and attract attention, whereas pale colours are tranquil and soothing.

Look for opportunities to use colour meaningfully, and be careful not to imply meaning where there is none. For example, you could use 2 shades of

a single colour to indicate different years of data, rather than red and green, unless you want to imply a judgment about the data series.



Point out key messages

The whole aim of your graph or infographic is to convey a message, so don't make your audience work harder than they have to.

Reduce the cognitive load on your audience by making the design show the message, or by simply telling them what the message is.

In graphs, make the key points stand out by using bold, colour or highlighting, or using the design to convey your message.

For example, we have made a study of jellybeans. How heavy are they? What colours do they come in? How many brands are there and which give you the most bean for your dollar? We think about our results and our possible messages, and decide that our main message (at least for this graph) is:

> There are, on average, more yellow jelly beans in a packet than any other colour.

Figure XX shows our (first) graph. It is colourful, and it shows that the yellow column is the tallest. Yet it could be better designed to make our message easier to see.

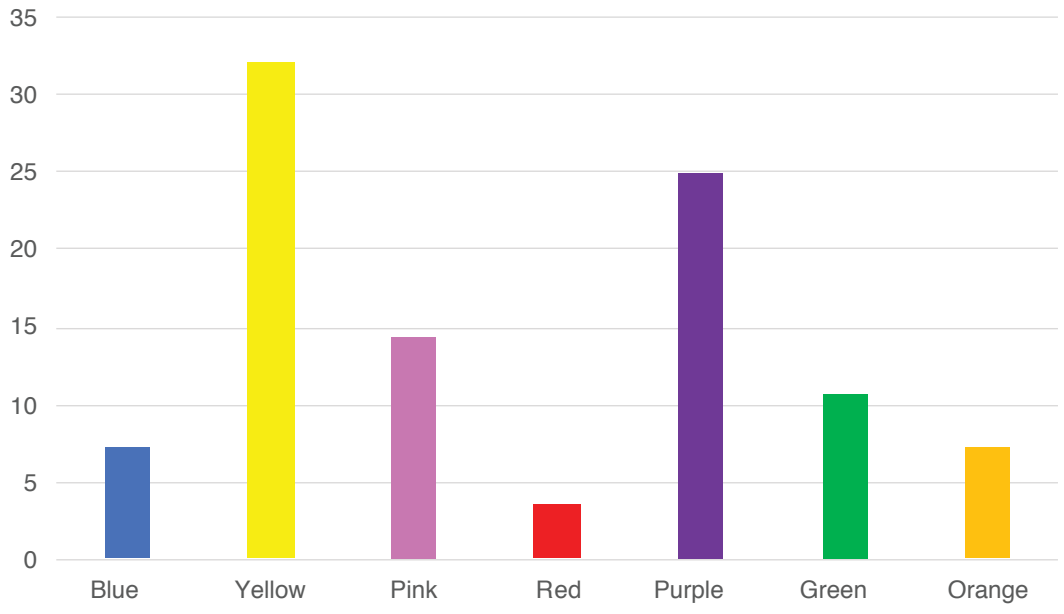


Figure XX Average percentage of jellybeans of each colour in a packet

Most, if not all, of our audience reads from left to right, so we can put more emphasis on the yellow column by putting it first. We can do this because the categories have no intrinsic order, which allows us to reorder them any way we like. If we really want to focus attention on the yellow column, we can make all the other jellybean categories the same neutral colour – in this case, grey. This gives us Figure XY.

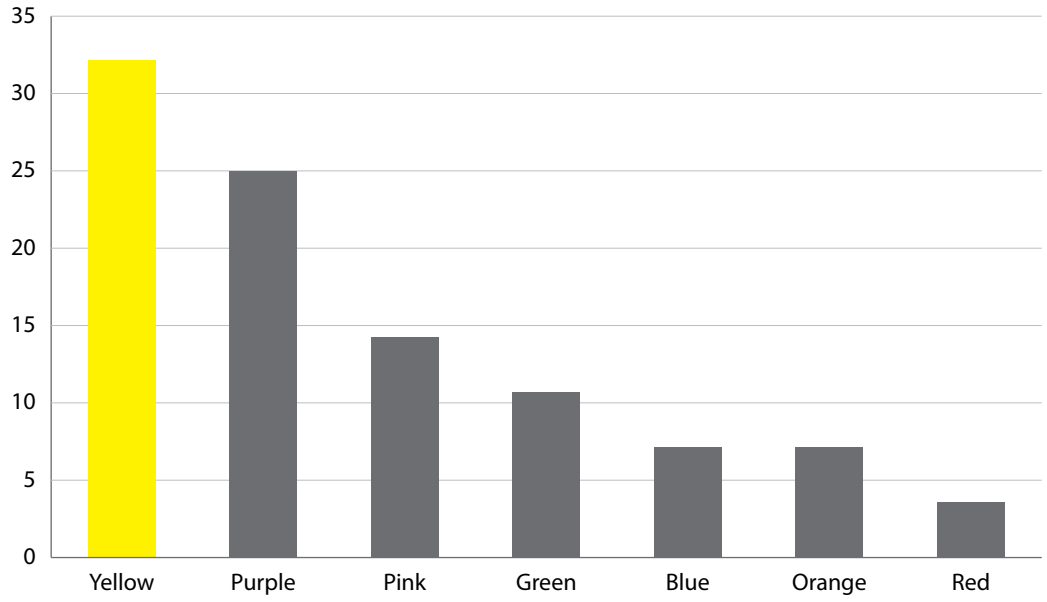


Figure XY Average percentage of jellybeans of each colour in a packet

It is good practice to discuss the key points of a graph and then direct the reader with an in-text reference, rather than just announcing the inclusion of the graph. This highlights the message directly, and makes the text more active and interesting:

> Australian house sizes have increased rapidly over the past 50 years, with Sydney showing the greatest increase in average house size (Figure 1.1).
> not
> Figure 1.1 shows the average house sizes for Australia's capital cities from 1960 to 2010.

In both graphs and infographics, you can reduce cognitive load on your audience by just telling them your message. For example, rather than having a heading of 'Biosecurity', you can have 'Australia strictly controls imports to protect our crops and wildlife', and instead of 'Health guide', you can have 'Steps to reduce your cancer risk'.

Ensure consistency

Having a consistent look within your visual element and across all elements in your content will help the audience to quickly understand the displays.

The consistent look also reduces cognitive load and how much work the audience needs to do to grasp your meaning.

Standardise common elements across similar graphs and infographics (eg font, appearance of legends, data elements, axes, borders, colours, line styles).

Make sure that comparable information is displayed in equivalent formats (eg do not show one year's dataset in a line graph and the same dataset for a different year in a bar graph). Graphs that are to be compared with each other should also have comparable scales and categories, and consistent styling.

Ensure accessibility

We want our information to be available to the widest possible audience. This means we must think about accessibility.[1] This is a priority in government communication.[2]

For data visualisation and infographics, the first thing to consider for accessibility is the design itself.

Choose colour combinations that can be distinguished by colourblind readers (around 8% of Australian males and about 0.4% of females are colourblind to some degree).[3] Set minimum font sizes to help people with poor vision engage with your content. Make sure there is strong contrast between foreground and background colours.

You also need to consider whether the presentation matches the data literacy of your audience. You may need to think about readers and viewers who use English as a second language, children, people with intellectual disability, people with poor literacy or numeracy, and so on. If you are communicating with experts, or within your organisation, these things may not be issues – but you should always consider them.

Finally, any visual element should be supported with alternative (alt) text. Alt text allows users with screen readers to hear a description of the graphics

1 https://www.w3.org/WAI/standards-guidelines/wcag/
2 https://info.australia.gov.au/accessibility
3 https://visioneyeinstitute.com.au/eyematters/colour-blindness/

on the page. Alt text can be added to Word documents, web pages and PDF files. You can also include transcripts of videos and audio resources.

Know when not to visualise

Your first question should be – do you really need to add that graph or infographic? You should be clear on what you are trying to achieve and why a visual element is the best way to achieve it.

Don't add graphs or infographics just for the sake of it – make sure they have a real purpose. Examine your own motivations for including visual elements, and consider how the elements fit with your overall content.

Don't use a graph or infographic when:

- you don't have a message to convey
- you just want to break up or enliven text
- you just found a graph in another publication that has something to do with your topic
- words are enough
- the topic needs the precision and detail only words can give (caveats, definitions, etc)
- the topic or audience needs the precision and detail only a table can give (specific values, etc)
- someone has just heard 'data visualisation' or 'infographic' as the latest buzzwords
- what is really needed is more engaging overall design.

Effective graphs

As well as the general principles for visual design, there are a few tips for achieving effective graphs.

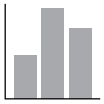
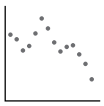
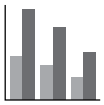
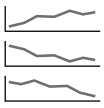
Choosing the right graph

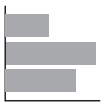
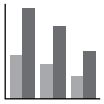
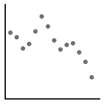
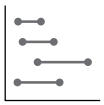
Graphs are the best way to display data when it is more important to convey overall patterns in the data than the individual data values.

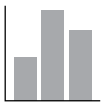
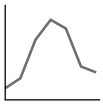
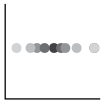
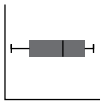
Some data patterns that you might want to show are:

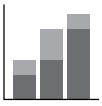
- change over time
- comparisons of groups or categories
- distribution (once, or over time)
- part to whole
- deviation
- correlation (association).

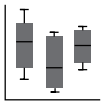
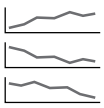
Choose the correct type of graph for your data so that these patterns are clear. More often than not, the simplest graphing option will be best. Readers will engage with, and be persuaded by, the message of your data if the data are presented in a way that matches their understanding of common data patterns – for example, that horizontal lines represent measurements over time.

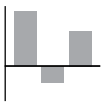
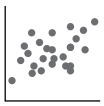
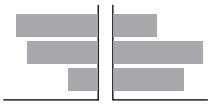
Type of data and relationship	Recommended graph type	Defining features
Change over time Shows how data values for a measure(s) change over time (eg population-adjusted breast cancer diagnoses recorded in Australia every year, for the past 20 years)	 Line graph (for large time series)	Use to highlight trends or patterns in a measure over many time points Use for datasets that include data for more than about 8 time points Lines are connected, consecutive data values Lines always follow a horizontal direction, with time intervals on the *x* axis increasing from left to right, and the measurement variable plotted on the *y* axis Only connect consecutive values – intervals with missing data must be shown as a break in the line
	 Vertical bar graph (for small time series)	Use for time-series data with a small number of time points (around 8 or less) Use to emphasise specific data values, rather than an overall pattern or trend
	 Dot graph	Dots represent data values at each time point. If connected, these dots form a line graph Can be mistaken for scatter plots – consider using a bar graph or line graph instead
	 Dumbbell graph	Connected dots represent 2 time points of data (eg pre- and post-test) for multiple groups
	 Vertical bar cluster graph	Can be used to show data for 2 or 3 time points of data with groups Can be difficult for readers to compare differences across many groups because of distance between groups on *x* axis
	 Trellis of single-category graphs	Consider using a trellis (panel) graph with smaller graphs for each group if you have a large number of groups or categories of data that would appear cluttered on a single line or bar graph Keep the axis range consistent across all graphs to enable comparisons

Type of data and relationship	Recommended graph type	Defining features
Comparing groups or categories Compares data values across independent items, groups or categories (eg unemployment rates for each Australian state and territory)	 Horizontal bar graph	Order bars by size of data values to emphasise differences
	 Horizontal or vertical bar cluster graph	Use clustered bars for subcategories of groups, but limit clusters to 3 or 4 subcategories to enable comparisons across groups
	 Dot graph	Dots represent single data values for each item or group; a column of dots can represent summary values for each group Can be mistaken for scatter plots or time-series graphs – consider using a bar graph instead
	 Dumbbell graph	Connected dots represent 2 related data points on a common scale, for multiple groups Readers can easily judge distance between dots, and differences in this distance across groups

Type of data and relationship	Recommended graph type	Defining features
Single frequency or distribution data Shows how frequency or count values are distributed over the range of a measure (eg range of blood pressure measurements for men)	 Histogram (for measures with a small range)	Use a histogram to show frequency or count values across the range of a measure with few intervals Use as an alternative to a frequency polygon when individual data values must be emphasised
	 Frequency polygon (for measures with a large range)	Use to show frequency or count values across the range of a measure with many intervals Use to emphasise the shape of a distribution
	 Strip plot	Use to show the distribution of a measure for a small population If multiple measurements are recorded for the same value on the distribution, these points should be stacked or shown in a denser tone than other (nonrepeated) points
	 Box plot (horizontal or vertical)	Use to summarise a measure's distribution, rather than all individual data values May be unfamiliar to readers – consider plotting a simple histogram instead

Type of data and relationship	Recommended graph type	Defining features
Part to whole (ie proportions of a total) Shows how data values relate to, compare with, or make up a total measure at 1 or more points in time (eg proportion of Australia's total primary energy supply attributable to each major fuel type)	 Horizontal bar graph	Use to show the value (ie percentage or proportion of an absolute total) of each part for a single population This type of data is often shown as a pie graph, which is NOT recommended for displaying scientific data
	 Horizontal stacked bar graph	Use to show proportions of a total measure for multiple populations or groups Total(s) must add to 100% if parts are percentages, or the total absolute value for other measures
	 Vertical stacked bar graph	Use to show proportions of a total measure over time, for about 8 or fewer time points Use to emphasise changes in the relative size of parts over time
	 Stacked area graph	Use to show proportions of a total measure over time, for around 8 or more time points Use to emphasise changes in the relative size of parts over time

Type of data and relationship	Recommended graph type	Defining features
Distribution of the same measure across multiple time points or categories Shows how frequency or count values are distributed over the range of a measure, for more than 1 population (eg range of blood pressure measurements for men with 5 different medical conditions)	 Line graph with upper and lower bounds	Use to show distributions with a large number of time points – not multiple, discrete populations Summary values (eg median or mean values) for the distributions at each time point are connected to form a line The range (eg upper and lower confidence intervals) for the distribution at each time point are connected to form (typically invisible) lines above and below this line – the areas between the line and these upper and lower bounds lines are shaded Upper and lower bounds may be an unfamiliar feature for readers – consider whether their inclusion adds meaning and whether this outweighs potential misperceptions among readers
	 Strip plot	Multiple distributions are plotted side by side against the same *y* axis White space should separate each distribution See points above for strip plots
	 Vertical box plot	Use to summarise multiple distributions of the same measure May be unfamiliar to readers – consider plotting summary values (eg medians of the distribution) as a bar graph for multiple groups or populations, or a line graph with or without upper and lower bounds for multiple distributions over time
	 Trellis of single-category graphs	Consider using a trellis (panel) graph with smaller graphs for each group if you have a large number of groups or categories of data that would appear cluttered on a single line or bar graph Keep the axis range consistent across all graphs to enable accurate comparisons

Type of data and relationship	Recommended graph type	Defining features
Deviation Shows the difference between data values and a baseline, target or threshold (eg differences between actual rainfall and predicted or previous-year rainfall for each month of a year)	 Vertical bar graph with baseline	Use when the goal is to highlight deviations between measurements and some meaningful baseline or reference Bars (ie data values) above the reference or *x* axis indicate positive differences from the baseline; bars below indicate negative differences The *y* axis can measure absolute differences or percentage change between data values and the reference
	 Line graph with baseline	Use to show differences from a baseline or reference over time when the dataset includes data for more than about 8 time points See points above for line graphs
Correlated measures Shows an association between 2 measures or variables (eg children's age and height)	 Scatter plot	Each dot or data point represents a subject's measurement on *x* axis and *y* axis variables Use to show that data points form a meaningful shape that indicates the type (or lack) of association between 2 variables Consider including a trend line to highlight the type and strength of association Depending on the audience, readers may be unable to interpret scatter plots – consider whether side-by-side horizontal bar graphs would better communicate the association
	 Side-by-side horizontal bar graph	Use to show an association between 2 measures when scatter plots are unfamiliar to readers Most effective for showing linear associations Two aligned bar graphs display each subject's measurement on the first and second measures Order the bars by size on one of the graphs to emphasise the association between the 2 measures

Avoiding pitfalls

Some kinds of graphs or graph designs are not as effective as others. This may be because they add complication, or because they do not mesh well with the natural preferences of the brain. For example, humans find comparing lengths with a common baseline much easier than comparing angles and areas. This means that bar and column graphs are easier to interpret than pie charts.

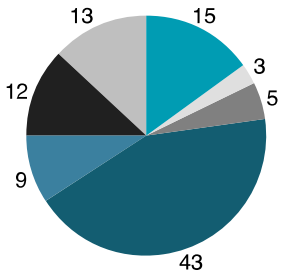
Bad graphs can confuse or distort your messages.

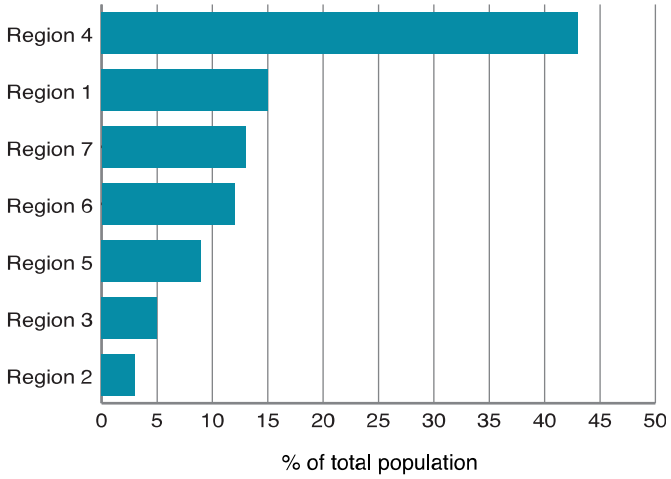
Pie charts

Put down that pie!

Circle or 'pie' charts use pie segments to represent relative proportions of a total measure (ie a part-to-whole relationship). However, the relative size of these segments is difficult for readers to judge and compare.[1] The choice of colour can also influence how well readers can compare the size of sections – sometimes a smaller section will appear larger because it is in a strong colour.

A simple bar chart is usually a better choice if you want people to easily understand and compare values.





1 Few S (2012). *Show me the numbers: designing tables and graphs to enlighten*, 2nd edn, Analytics Press, Burlingame, California.

Unnecessary bells and whistles

Graphs can easily be produced by various software packages, but be careful not to let the bells and whistles lure you into poor practices – just because you can doesn't mean you should.

Avoiding bells and whistles is part of reducing clutter and distraction (see Reduce clutter and distraction). If 3D effects, borders, shadows and SmartArt are not adding anything to the message or how easily your audience can understand it, don't use them.

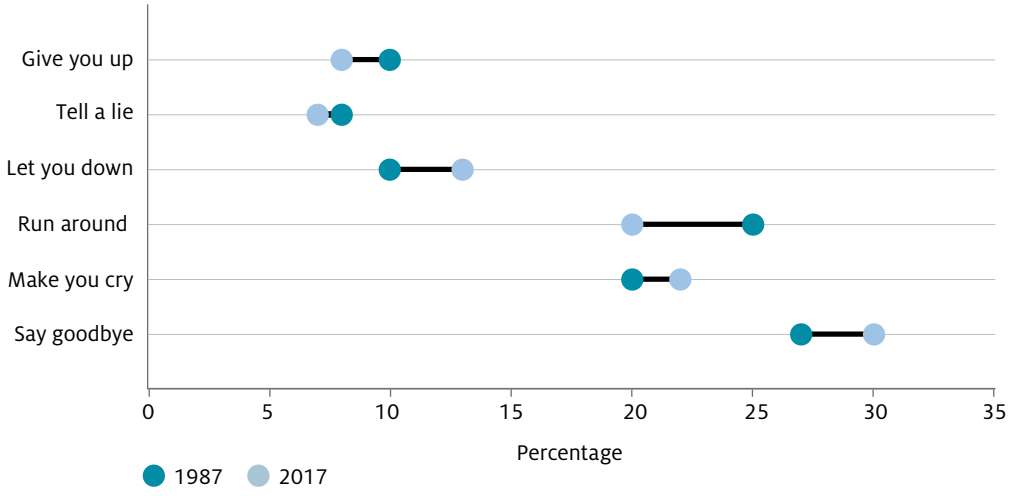
Unfamiliar graphs

Graphs are a scientific format, and require some interpretation to understand. The more familiar the format, the easier it is to understand.

For audiences who are not highly data literate, line and bar graphs may be easier to understand. Even if your audience is data literate, a bar graph may be easier to understand than a dumbbell plot.

Imagine we have, for some reason, studied the proportions of Rick Astley fans that engaged in various unfortunate activities in 1987 and 2017. Did some activities become more popular in 2017 compared with 1987? Some less popular? How might we show that on a graph?

A dumbbell plot is often used for this sort of data in scientific papers.

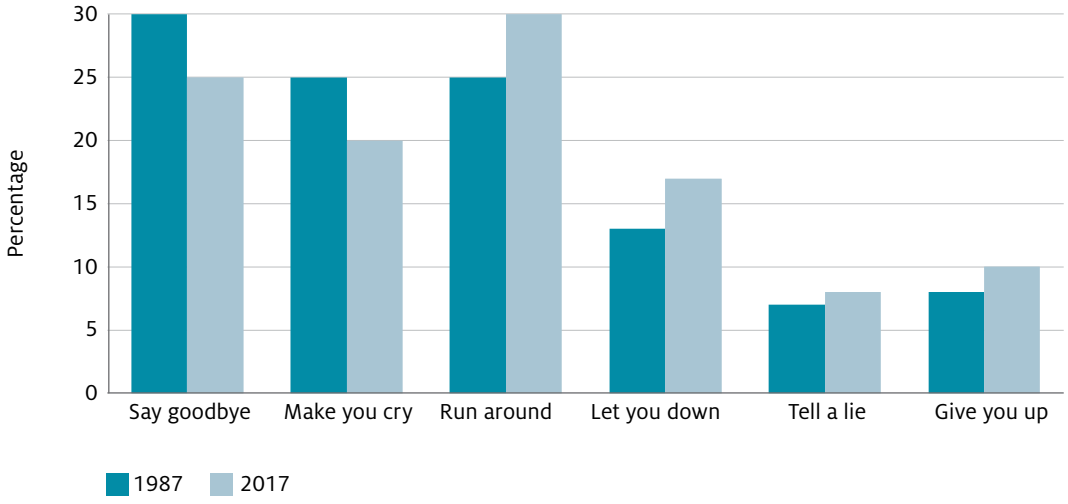


This graph has many off the hallmarks of what is widely considered good design. It gives a lot of information without colouring a lot of the page. That is, it has a high data-to-ink ratio,[1] which means we could not remove much of the 'ink' without removing information.

In the graph, the light dots give the values for 1987, and dark dots give the values for 2017. We can see quickly that 'Run around' changed the most and increased over time, while 'Say goodbye' and 'Let you down' changed the next most and decreased.

But ...

... dumbbell graphs are not common, and many audiences will find them unfamiliar. Even though some theories of design might tell us to use one, we might be better off with something more familiar.



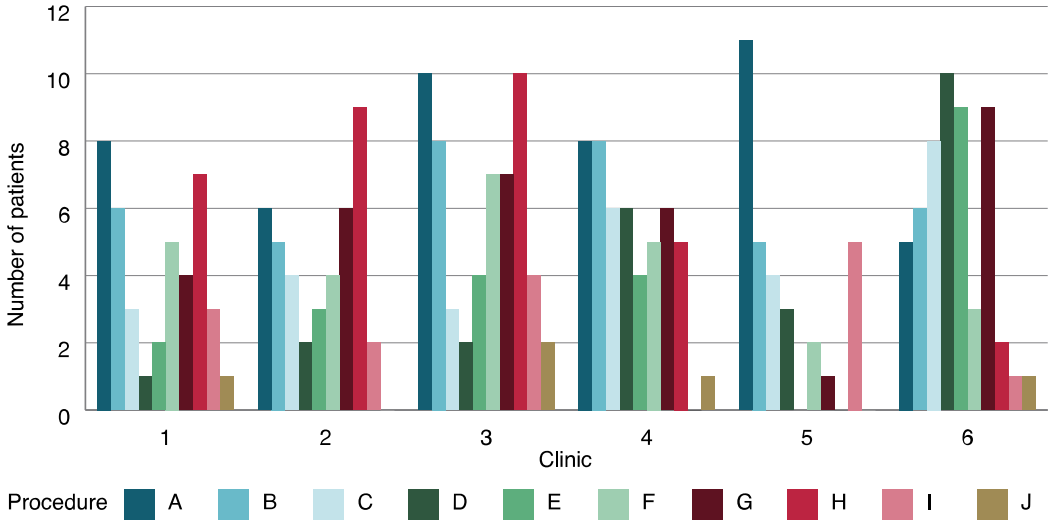
Bar charts like these might be more plain or boring than the dumbbell plot, but they are also more common. We can be fairly confident that our readers will have seen a few before. So if we are writing for an audience who may not be strongly data-literate, we might want to use simpler, more common graphs and diagrams, where possible.

1 https://speedwell.com.au/en/insights/2019/the-manifesto-of-the-data-ink-ratio

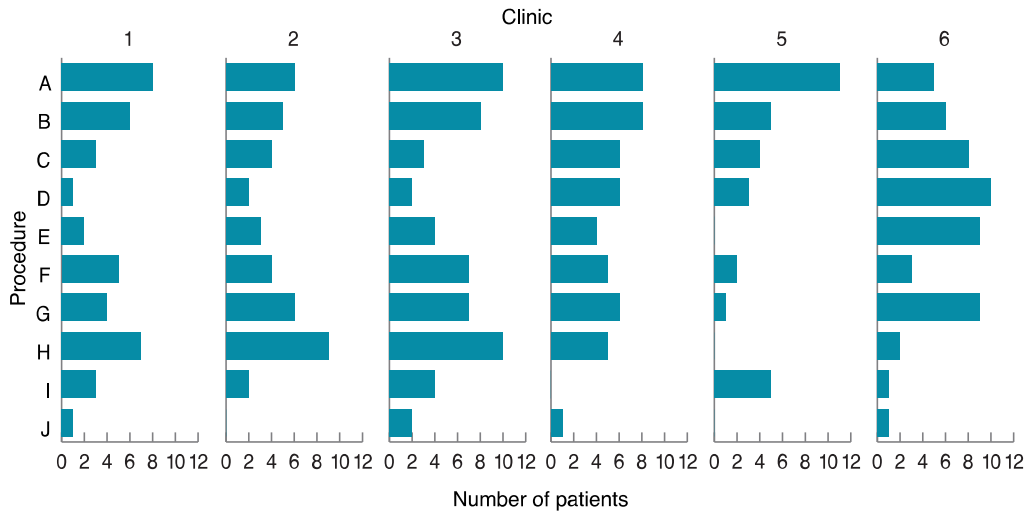
Multiple graphs in a single layout

Sometimes it is better to show more than 1 graph, rather than squeeze a large amount of information into a single graph. Think about the overall layout and how the reader will view the graphs in relation to other graphs. You may want readers to notice a similar pattern of data values across 2 or more graphs, or make a series of comparisons for the same population across several graphs. These similarities or comparisons are encouraged when you use the same design and scale for all graphs, and align the graphs vertically or horizontally on the page.

So rather than



we present



In the first example, it is difficult to compare the common categories shown by the colours. In the second example, it is easier to compare common categories as they are displayed horizontally across several graphs.

Axes that distort the data

Discontinuous or exponential scales are sometimes used on axes when the range of data values is very wide – that is, very small data values need to be compared with very large data values. A discontinuous axis skips a number of intervals at some point along the axis before continuing. An exponential axis has unevenly spaced intervals, becoming smaller with distance away from the origin.

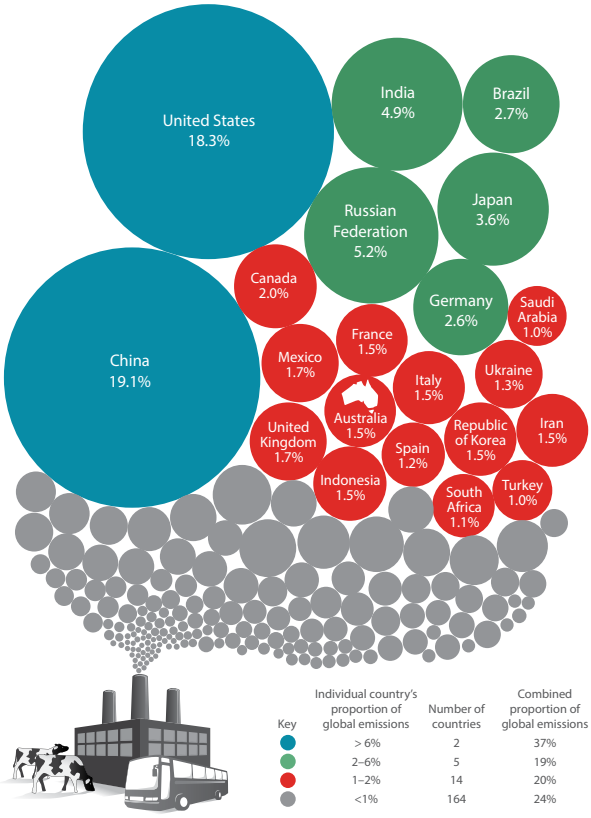
These axis scales are not readily understood by most readers and may give a distorted visual impression or, worse, misrepresent the message of the data.

Find another way to depict the values so that their full scale and the contrast between them are clear – perhaps as 2 different graphs, or a combination of an overall graph and a zoomed-in graph of the critical portion that you want the reader to notice.

Effective infographics

'Infographic' is a broad term. Understanding the different types is the first step to making a clear and effective infographic:

- **Message infographic –** used to help readers understand an idea or concept. The message should be one you can sum up in a sentence. Think about what you want your audience to remember (take-home message), or what you want them to do (call to action).
- **Process infographic –** used to explain how a process, or a key part of a process, works. Process infographics lead the user through something (eg tracing decision points in a flowchart). They can be simple or complex, plain or technical, and more or less designed.
- **Data infographic –** used to show interesting data when a graph or map is not engaging enough or cannot capture enough aspects of the data (eg greenhouse gas emissions shown as different-sized clouds for different industries). They are based on real data, and should show it accurately.



Choosing the right metaphor

Once you know the message and audience (see The context), the next step is developing compelling images to support and explain the story. Often, this means finding an overarching metaphor for the story you're telling.

There's no magic formula to this. Take the message, then … create ideas. Brainstorm – alone or with colleagues – write, scribble, try your ideas out with friends and colleagues. Sketch, sketch, sketch!

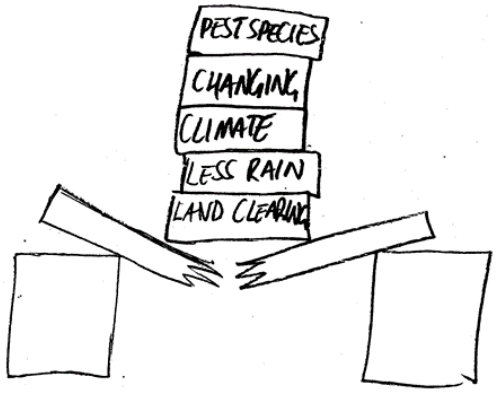
The main thing to remember is that you are looking for a logical connection between your message and the visuals. For example:

- links or connections could be shown with chains or handshakes
- growth can be shown with a tree or an increasing balloon
- a linear process could be a river
- a repeating process could be a circle
- advances can be steps or pathways toward a goal.

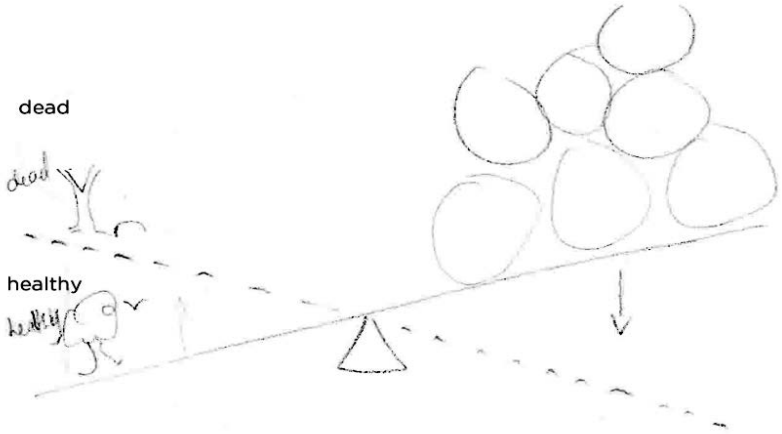
Even if the concept is more complex, the process is the same. Play around with ideas until you have one that your audience will find easy to understand.

For example, we might be reporting on the environment, and our key message is that an ecosystem can cope with 1 disaster or even 2, but not all of them at once – a forest might cope with drought *or* pollution *or* deforestation *or* fire, but not all of them.

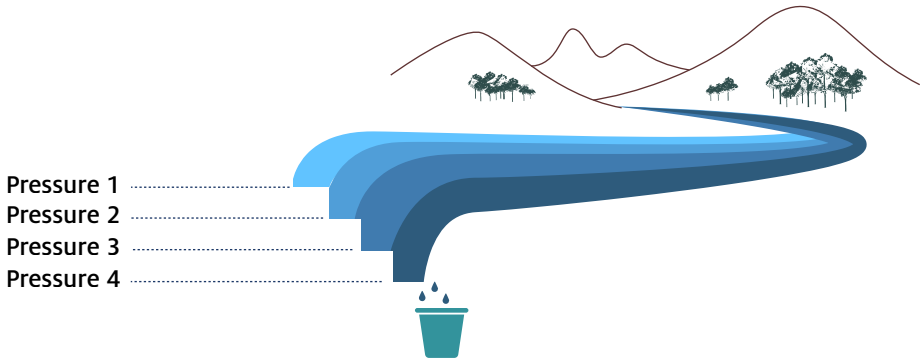
Maybe the metaphor is weights (books? reports about these problems? we're not sure yet – it's a sketch) piling up on a shelf or table until it all becomes too much.



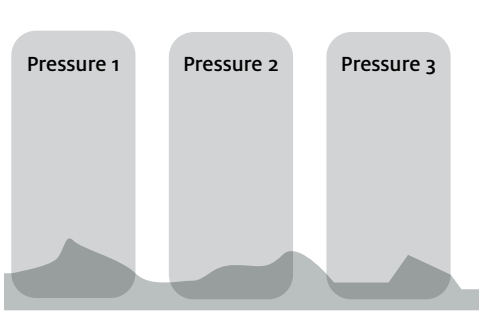
Maybe the metaphor is a seesaw, with the weight on 1 end building up until it tips.



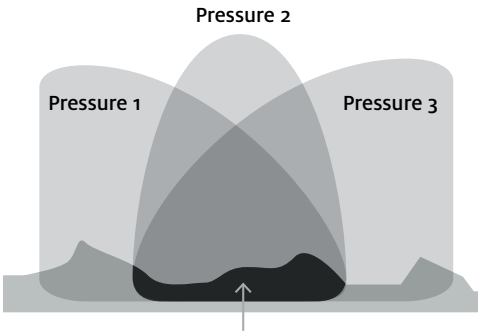
Maybe the metaphor is a river running out of water – each demand on it for water is acceptable on its own but if we make all the demands at once, it slows to a drop.



Or maybe the metaphor is overlapping pressures, inspired by Venn diagrams and stained glass. We might get plenty of light through 1 piece of darkened glass, but, if we have 3 layers, things look pretty dark.



Resilient environment with isolated pressures

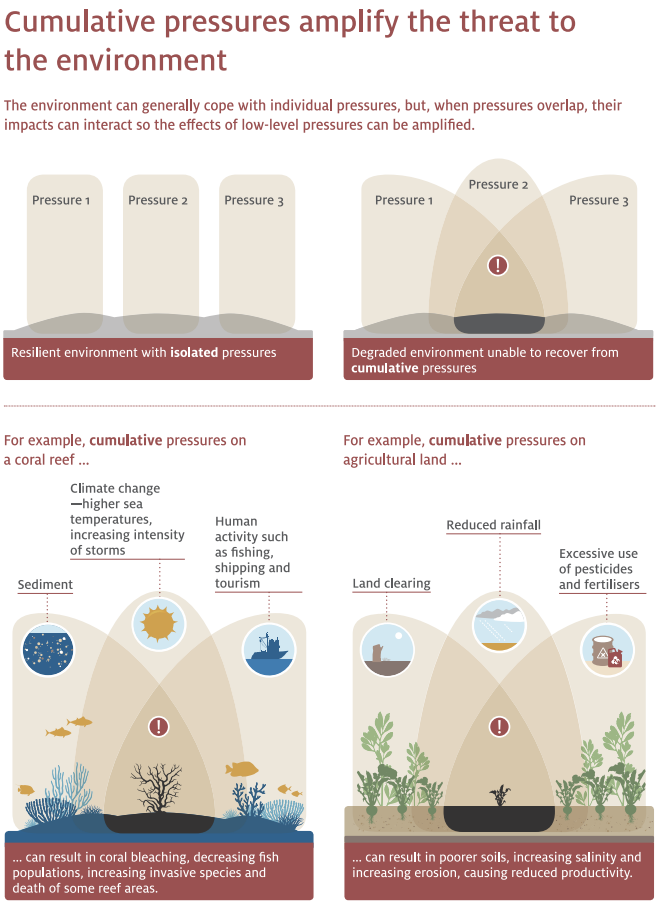


Degraded environment unable to recover from cumulative pressures

All these visual metaphors come about through being playful and not being too critical in the initial brainstorming stages. Eventually, 1 idea must be chosen, and then it will be developed and presented. And sometimes only then will we see if it really works.

The final infographic (from the 2016 state of the environment report) shows the complete solution:

- The story is broken up into steps. More simple things are better than 1 complicated thing.
- The top row explains the metaphor with very simple examples and no clutter or misleading extras.
- The bottom row elaborates and gives examples (applies the metaphor to a couple of cases).
- The withered little plant in the last panel is very sad; we've got black (= bad) with empty space around it (nothing to distract from the central message).
- High-contrast exclamation marks are used to focus attention on the degraded environment.



Avoiding pitfalls

Authors can fall into the trap of wanting an infographic to enliven their work without thinking about what they want to say or what the infographic is to achieve. This is a recipe for poor infographics, and can cause some common pitfalls:

- **Too many messages.** The most common problem we see with infographics is a desire to cover all aspects and details of the concept. Instead, identify the key message you want your audience to understand, and focus on that. This might mean omitting some details, simplifying complex ideas, or breaking them down into several parts or steps.
- **Too much text.** Reading large blocks of text slows the reader's interaction with the infographic and weakens the overall message. Brief, effective text that is well matched to the graphics works better. Extra details can always be added to the text that accompanies the infographic.
- **An infographic that isn't an infographic.** Icons can improve document navigation and interest, but a dot-point list with icons is not an infographic. Infographics should convey a particular narrative or process, not just comprise a list.
- **One infographic when several are needed.** Breaking down a complex idea into separate panels, or even separate infographics, can improve understanding. This is useful if the message is actually a bundle of separate ideas. It's also useful if you find yourself hoping for '1 summary infographic'. Such an infographic can be impossibly complicated, and you may need to either simplify the message or come up with a linked set of infographics.
- **Trying to be too close to real life.** Sometimes authors want icons or graphics to show an object that looks exactly like 'the real thing'. However, this can impede understanding. Audiences can often more readily recognise a cartoon icon of an object than a real-life drawing of the same object. Visuals and icons don't need to be realistic to prompt the audience to think of a certain thing – for example, younger computer users recognise the 'save' symbol in many computer applications even though they may never have used a floppy disk.

Resources

If you would like help with data visualisation, infographics, content development or processes:

- Biotext are content experts specialising in complex content, including health and biomedical science, environment and agriculture. We provide content strategy and design, writing, editing, information design, data visualisation and infographics.
- Our *Quick guide to effective content* provides many tips on reaching your audience and running a content project.
- Biotext training courses are available in 'Fundamentals of data literacy and visualisation', 'Writing and editing complex content' and 'Infographics'.
- The *Australian manual of style* is a comprehensive online resource that provides practical information on how to engage your audience, and write, edit and show information. This can be used alongside the Australian Government *Style manual* and your organisation's style guide to create clear and consistent technical content.