Presenting data guidelines in Leeds

August 2021

"Adopt formats for the presentation of statistics in graphs, tables and maps that enhance clarity, interpretability and consistency"
Code of Practice for Official Statistics

Principles of presenting data

We sometimes use charts, but how well do the charts we encounter actually communicate?

Unfortunately, poor chart design is common. Part of the reason is that charting software, for example, Excel or Infogr.am, help cause bad chart design with poor default settings and unnecessary features.

Chart design should be:

- clear
- concise
- consistent
- targeted at telling a story to a particular audience

Use a chart to:

- show relationships in the data
- highlight patterns and trends
- give an overview when precise individual values are not necessary

Principles specific to Leeds

The most up to date data in the city is used – if this is unvalidated this should be stated but will be published.

All time series charts must be in Statistical Process Control (SPC) form – where an exception is made there must be a strong statistical basis for the decision

Where there are national standards these must be included on all charts

Where there is national or regional benchmarking this needs to be included

What is Statistical Process Control (SPC)?

We all know that measurement is integral to the improvement methodology in healthcare but how do we know whether or not we have actually made a difference and if the care being delivered is getting better, staying the same or getting worse each year? What we do not always take into account is the variation in the way that services are delivered – by individual departments, people and even different types of equipment. All of these differences in the way things are done lead to differences in the way services are delivered.

The main aims of using Statistical Process Control (SPC) charts is to understand what is ‘different’ and what is the ‘norm’. By using these charts, we can then understand where the focus of work needs to be concentrated in order to make a difference. We can also use SPC charts to determine if an improvement is actually improving a process and also use them to ‘predict’ statistically whether a process is ‘capable’ of meeting a target. SPC charts are therefore used:

- As way of demonstrating and thinking about variation
- As simple tool for analysing data – measurement for improvement
- As a tool to help make better decisions - easy and sustainable to use

The way in which data within healthcare is traditionally analysed leads to confusion and inaccuracy. The simple fact that important operational decisions are often made from data where there is limited understanding of the ‘process’ and its ‘variation’ is often worrying. If individuals do not understand variation, they often look at data (as in the chart below) and:

- They see trends where there are no trends
- They try to explain natural variation as special events
- They blame and give credit to people for things over which they have no control
- They can’t understand past performance
- They can’t make predictions or plan for the future
- Their ability to make improvements is limited

Chart colour palette

The blue and grey palette has been designed to be accessible. It has also been designed so that the tonal values for the colours have sufficient contrast difference when printed in black and white.

The chart colour palette is limited to 5 colours for a reason. Showing more than 5 colours makes it less clear to read and understand. If you feel your chart needs more than 5 colours, either:

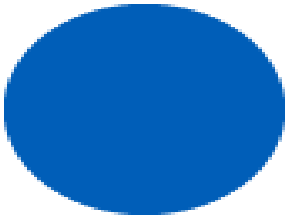
- rethink what you are trying to show
- try a different format - for example, single colour bars rather than a multi-coloured pie

This is the default palette to be used for all charts and is available in corporate templates:

Primary chart colours

Chart blue 1

Hex: #003087
RGB: R0, G48, B135



NHS blue

Hex: #005EB8
RGB: R0, G94, B184

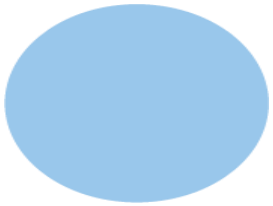


Chart blue 2

Hex: #99C7EB
RGB: R153, G199, B235

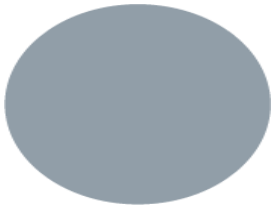


Chart grey 1

Hex: #919EA8
RGB: R145 G158 B168

Chart grey 2

Hex: #DDE1E4
RGB: R221 G225 B228

Background colours

Chart grey 3

Hex: #F8F8F8
RGB: R248, G248, B248

White

Hex: #FFFFFF
RGB: R255, G255, B255

Choosing the right chart type

By making a chart, we're trying to display and highlight relationships between different categories and quantities in our data, so that they tell a story. Different charts are suited to showing different relationships:

Time series

Sets of values for quantities that change over time (weeks, months, years)

Best: Line chart
Also consider: Vertical column chart, point or dot chart (when you don't have values for all

the intervals), box chart (to show distribution change over time)
Do not use: Horizontal bar chart

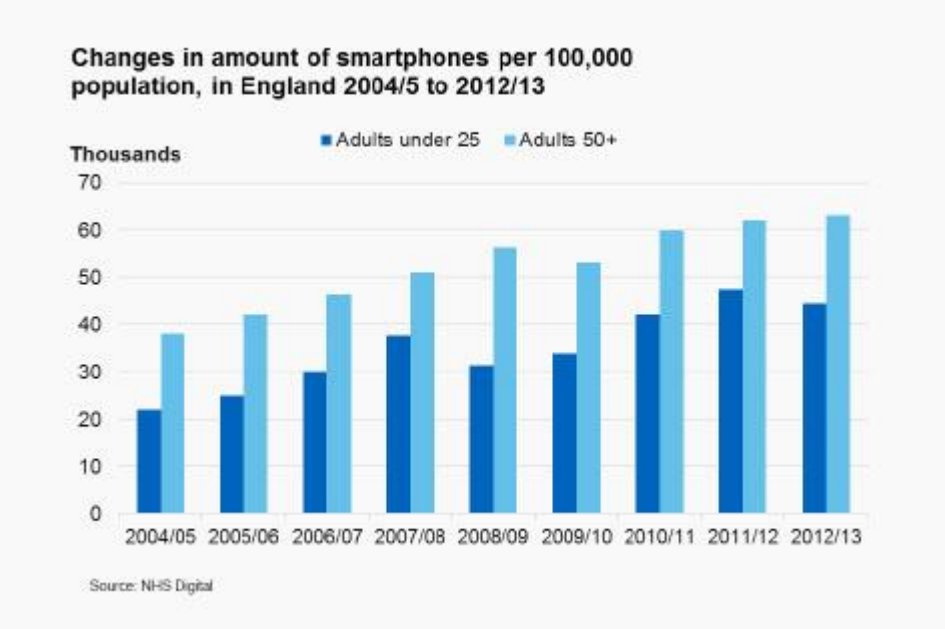
The 2 example charts below compare the number of smartphones per 100,000 population for adults under 25 and over 50, and how that has changed since 2004/05. They use fictional data.

Example 1: column chart

Using a column chart, the change over time aspect is not immediately apparent.

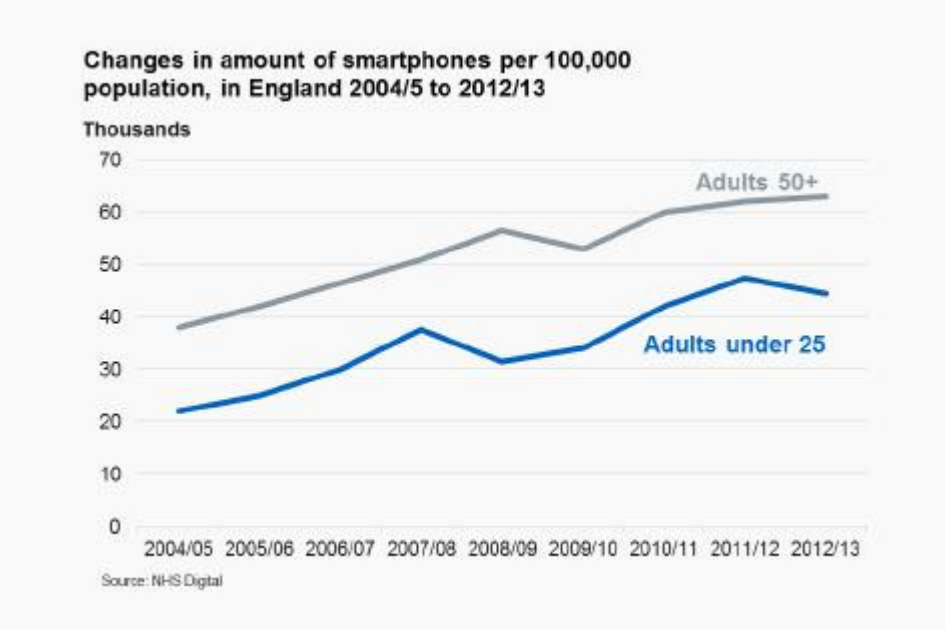
Our eyes focus on gauging the heights of the columns to compare the differences in categories at each interval.

With the column chart, we also have to refer to a colour-coded legend to see which colour columns represent each category.



Example 2: line chart

Using a line chart, the shape of the lines clearly shows the change over time and the lines can be directly labelled – avoiding the need for a legend.



Ranking

Comparison of quantities ordered from highest to lowest (or lowest to highest)

Best: Horizontal bar chart
Also consider: Vertical column chart, point or dot chart, box chart
Do not use: Line chart

Part-to-whole

Comparison of quantities that are subdivisions of a whole, for example, regional figures that make up a national total

Best: Horizontal bar chart
Also consider: Line chart (to show part-to-whole change over time)
Do not use: Vertical column chart, point or dot chart, box chart

Deviation

Comparison of the difference between two sets of values, for example, the difference between projected and actual spend

Consider: Horizontal bar chart, vertical column chart, line chart, point or dot chart
Do not use: Box chart

Distribution

Comparison of how sets of quantities are distributed from the lowest to highest values within a certain range, for example, number of A&E attendances by age group

Best: Vertical column chart
Also consider: Horizontal bar chart, point or dot chart, line chart, box chart

Correlation

Comparison of two sets of values to see whether there is a relationship between them, for example, income and obesity

Useful: Horizontal bar chart, point and dot charts
Do not use: Vertical column chart, line chart, box chart

Nominal comparisons

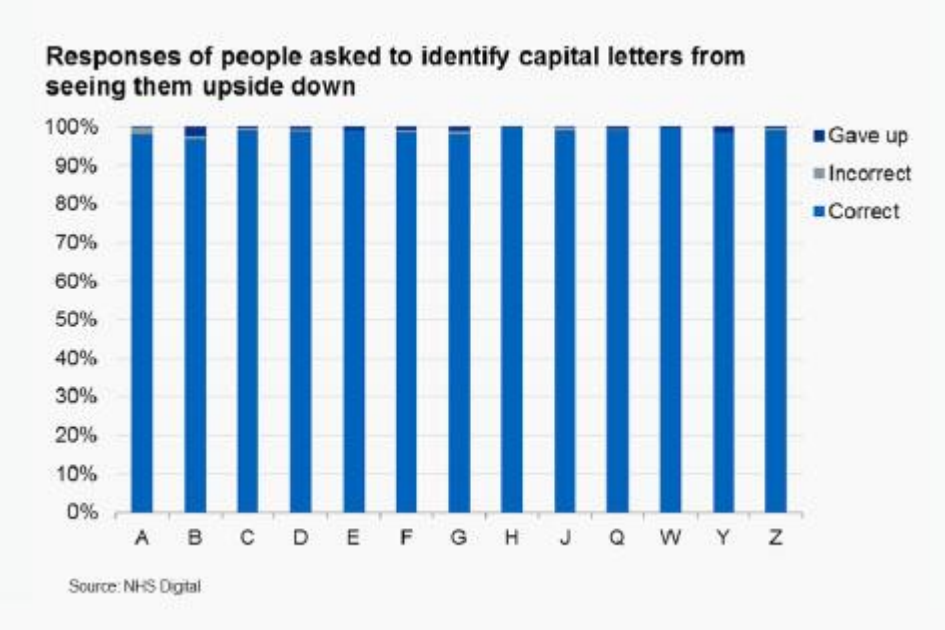
Comparisons between items that have no particular order, for example, the number of midwives, health visitors, and school nurses

Best: Horizontal bar chart
Also consider: Point or dot chart, vertical column chart
Do not use: Line chart, box chart

Principles of chart usage

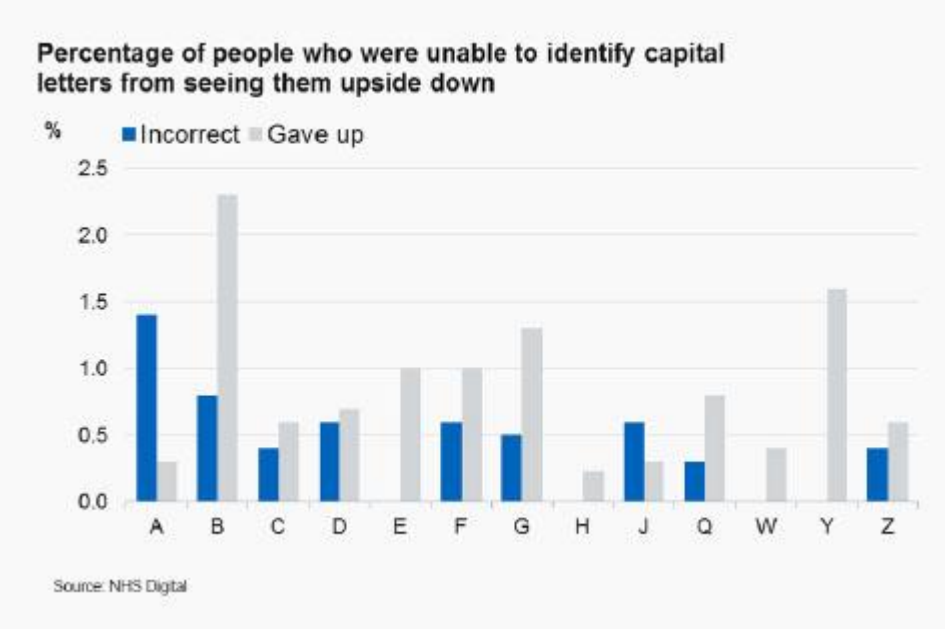
Do not try to show everything

In the chart below, all the responses of people asked to ‘identify capital letters from seeing them upside down’ are displayed in a stacked column chart. It is clear that most people responded correctly for most letters.



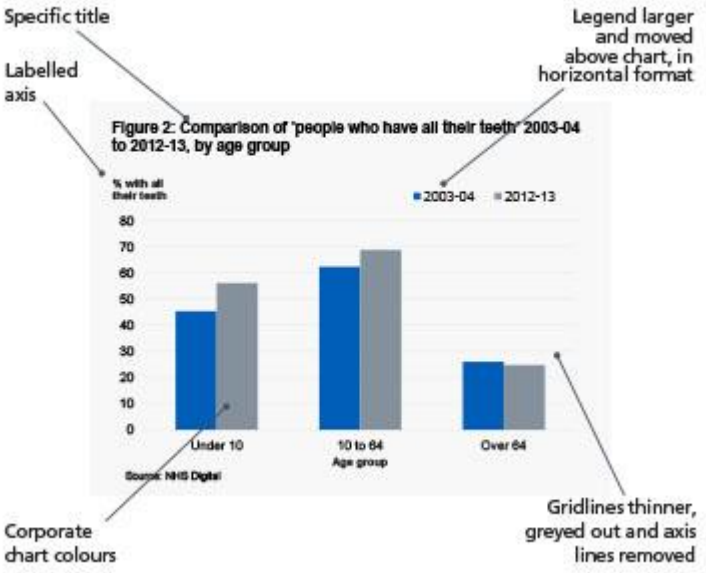
However, the interesting people here are those that responded incorrectly or gave up. The format used makes these categories nearly impossible to see.

By only charting the ‘incorrect’ and ‘gave up’ categories, we can start to see which letters were hardest to identify upside-down. Using a comparative column chart places all quantities on the same baseline, so they are easy to compare.

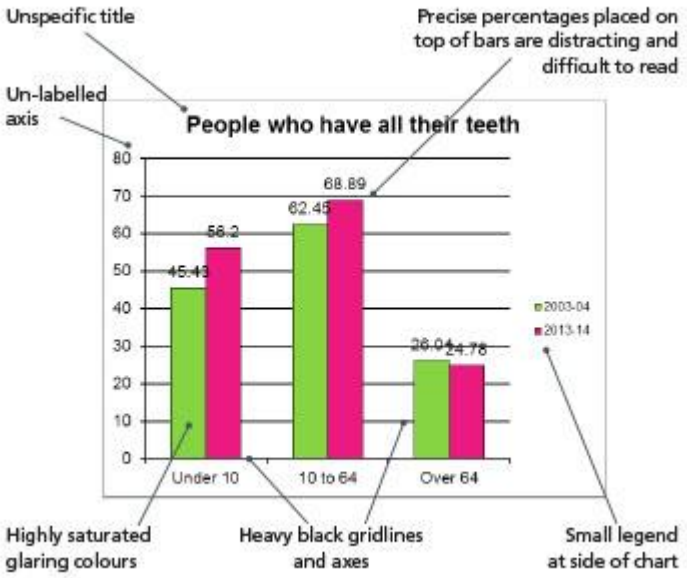


Keep things simple

- emphasise the data and de-emphasise or remove ‘non-data-ink’, for example, gridlines, borders, axis lines - manually adjust the settings if necessary and do not rely on standard presets
- have a clear, descriptive title stating exactly what the chart is showing
- directly label, wherever possible, to avoid unnecessary cross-referencing with colour-coded legends
- label your axes appropriately - for bar charts, always start axis numbering at 0 - for line charts, if you must start at a value other than 0, clearly show the break in axis



Correct chart layout and design



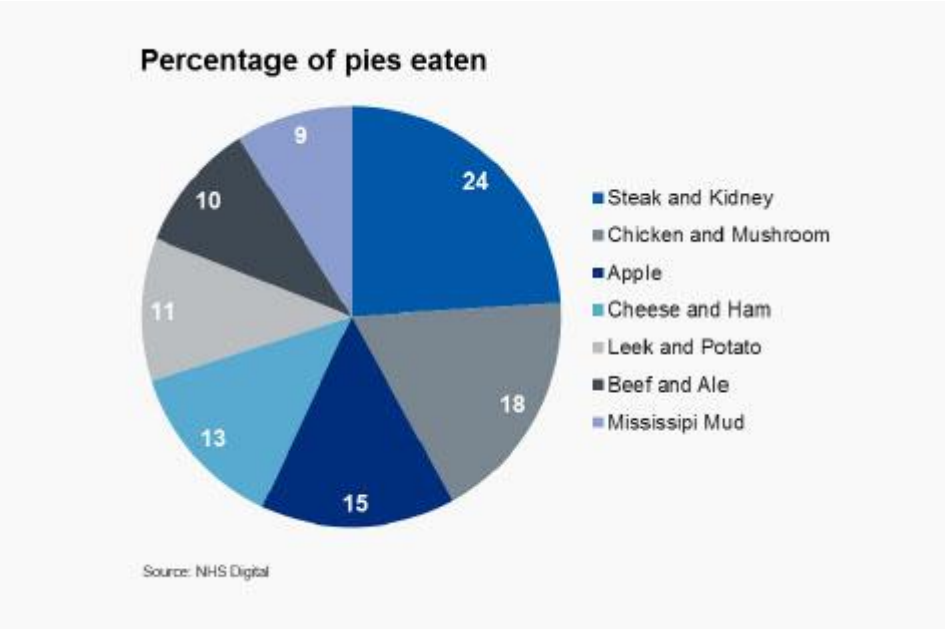
Incorrect chart layout and design

Charts to use with caution

Use pie charts with caution

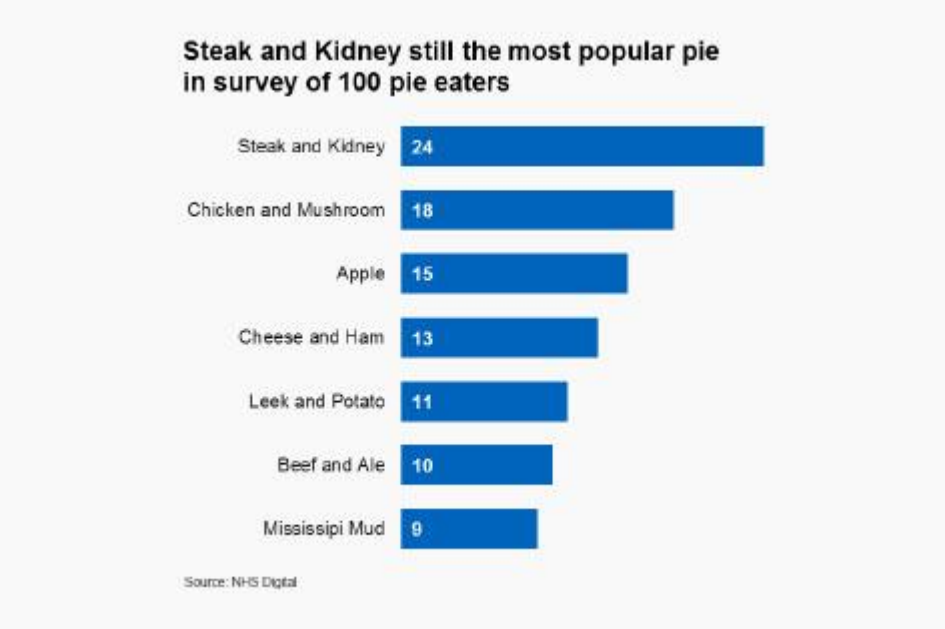
The problem with pie charts is that humans are very bad at judging and comparing areas and angles, but good at judging and comparing lengths and widths. In ‘Designing with Data’, Brian Suda states that “the most effective pie charts comprise only two items”.

The more slices a pie has, the more trouble people will have understanding it. More colours are needed which means the tonal contrast between them becomes difficult to distinguish.



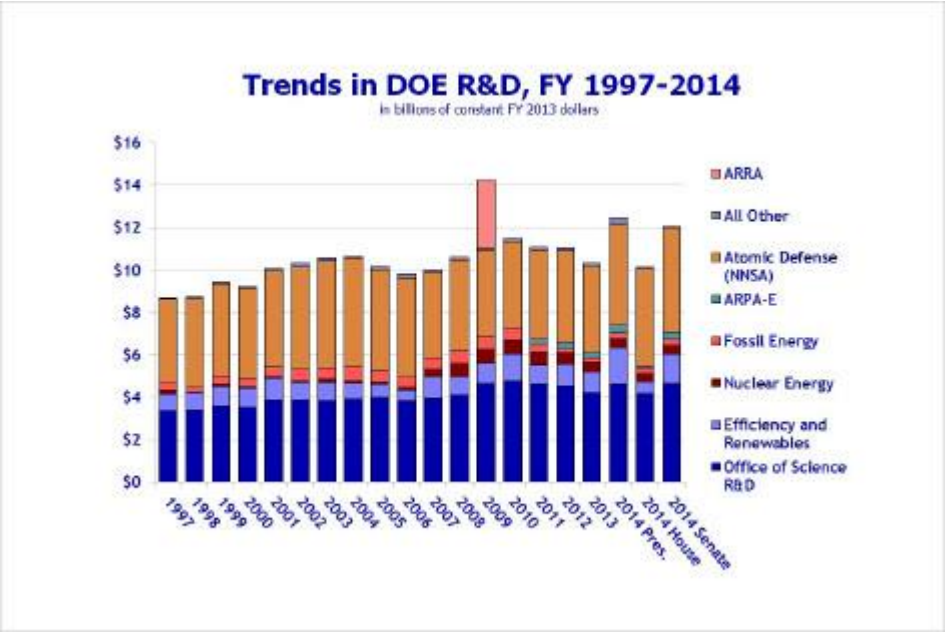
A bar chart will usually do the job better, and only one colour is needed.

Only use a pie chart where there are few quantities to compare and there are sufficient differences in values to be able to see clearly.



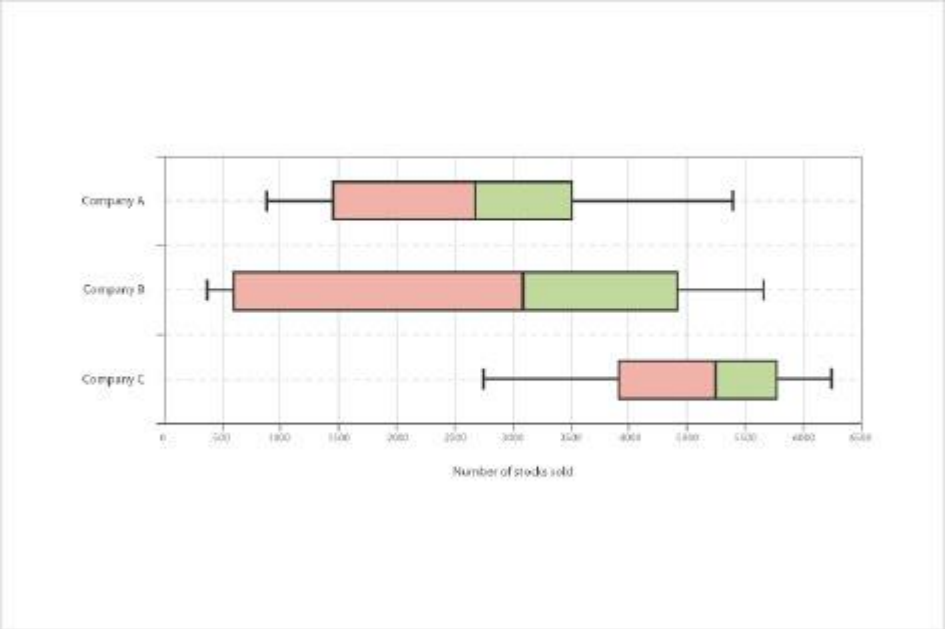
Use stacked column and stacked bar charts with caution

The problem with stacking bars or columns is that only the quantities at each end share a baseline, making those in the middle difficult to compare. The problems are compounded when very small values appear among larger values. For clarity, it may be best to focus on particular quantities that tell the story and omit others.



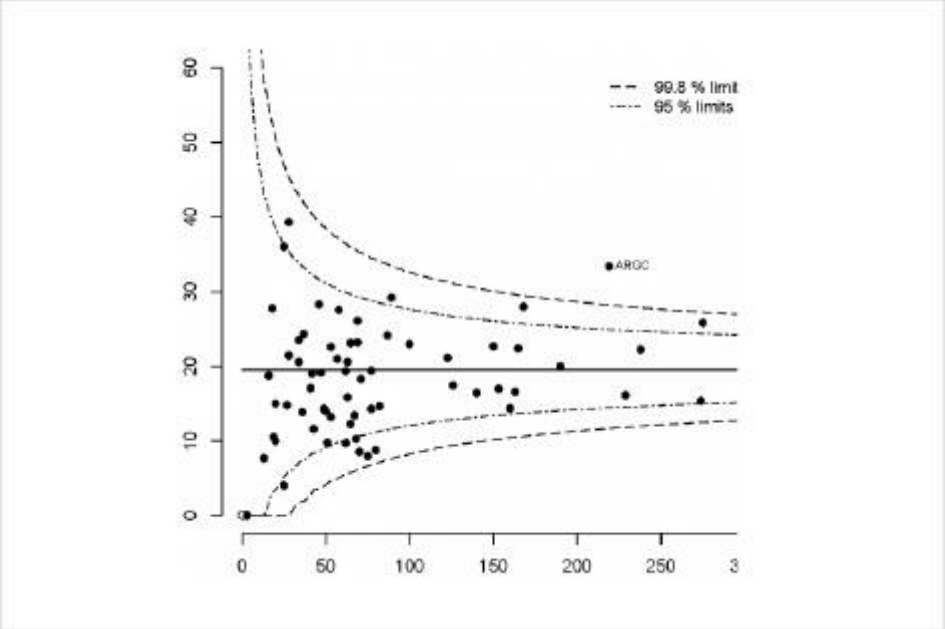
Use box and whisker charts with caution

Only use for specialist audiences who will be familiar with this type of chart and the use of quartiles.



Use funnel plots with caution

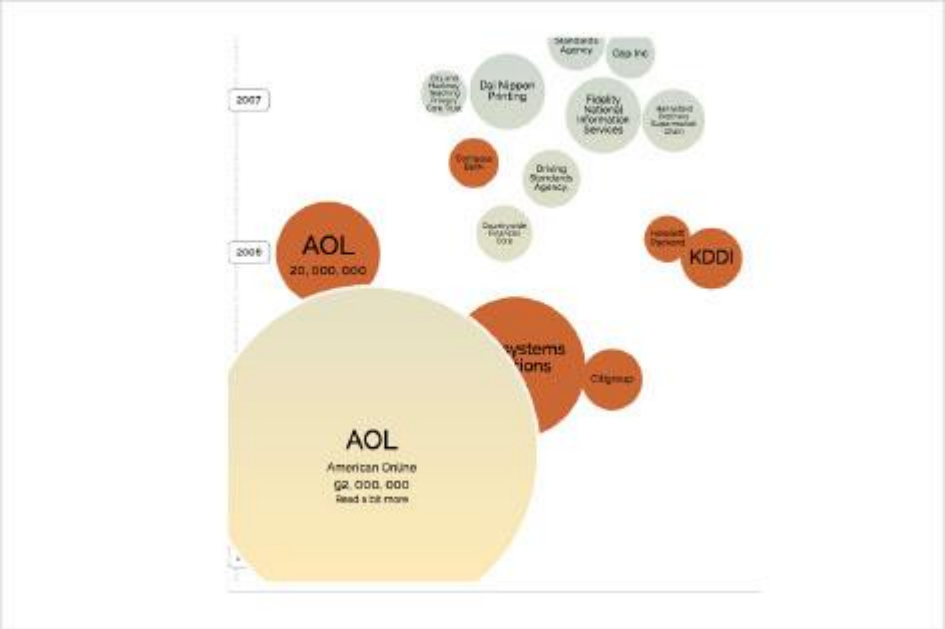
Only use if you are sure that your audience is familiar with them and will be able to interpret the chart correctly.



Use bubble charts with caution

A common mistake with bubble charts is using the diameter of circles as the measure of size. This distorts the data, making things appear twice as big as they should be. It is the

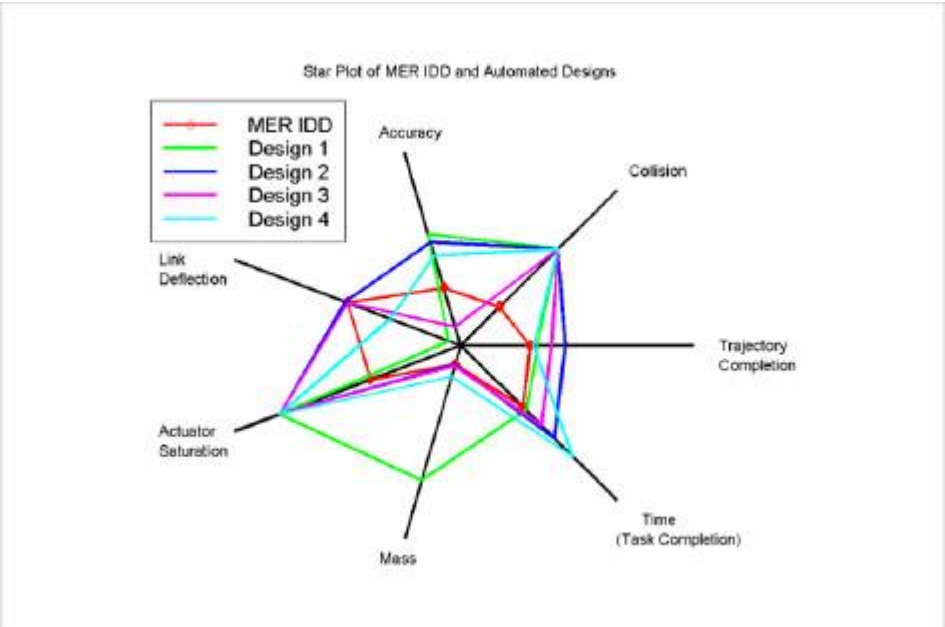
area of the circles that should be compared. Caution is also needed as most people are unable to judge areas of circles accurately.



Charts to avoid

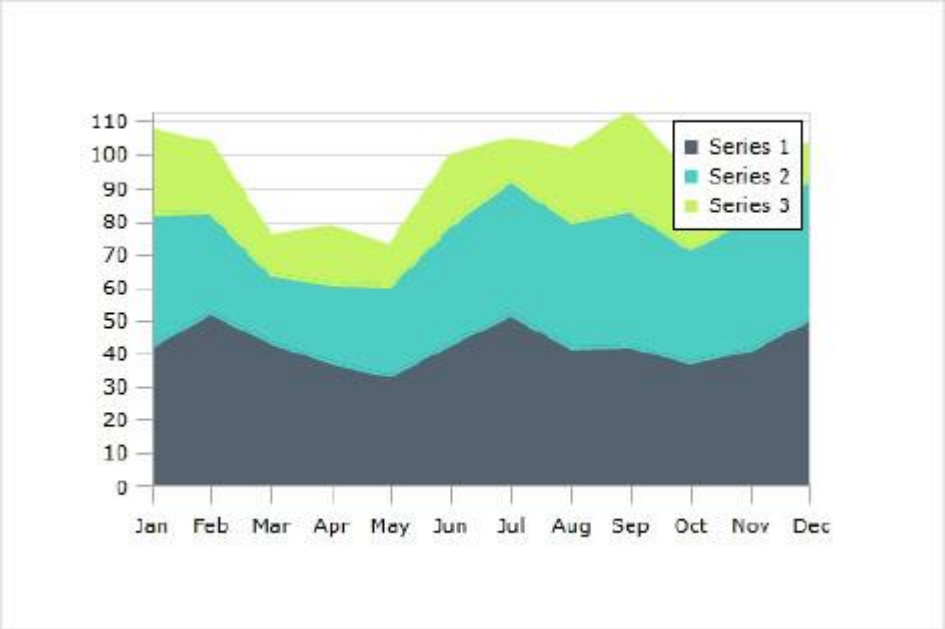
Avoid using radar plots

Radar or spider charts can be confusing and should be avoided. They have a number of axes around a centre point and even if plotted correctly, the resulting polygon shapes are difficult to read and communicate poorly in most cases. Comparative column charts are a better alternative.



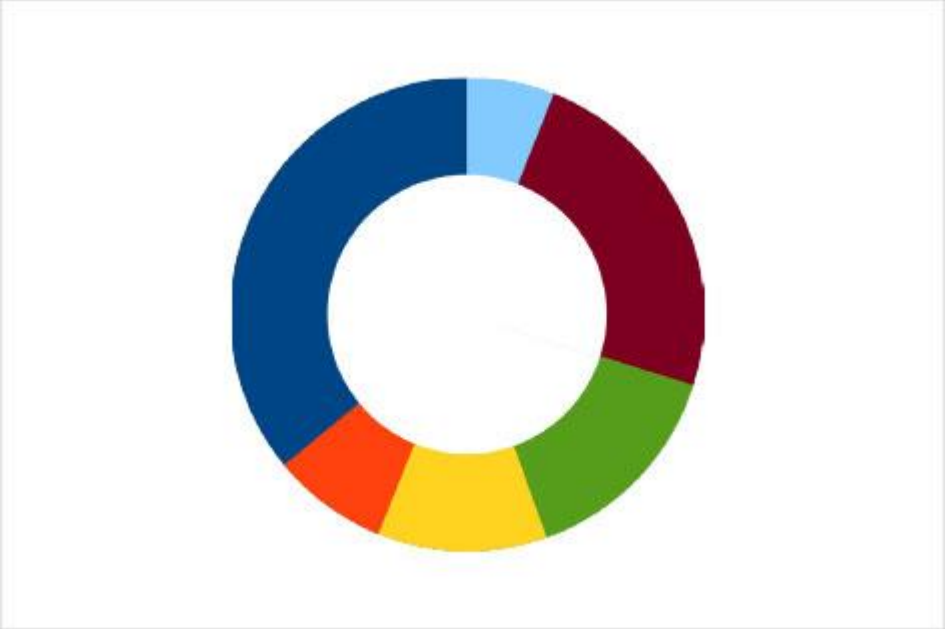
Avoid using area graphs

The interpretation of area graphs can be difficult if there are more than 2 variables shown and should, therefore, be avoided. Some areas are obscured by others, giving a misleading visual impression.



Avoid using doughnut charts

A doughnut chart is a pie chart with a hole through the middle. This makes it even more difficult to compare quantities and should, therefore, be avoided.



Charts to never use

Never use 3D charts

With the perspective effect, it is impossible to tell whether the income bars are higher than the expenditure in the chart below.