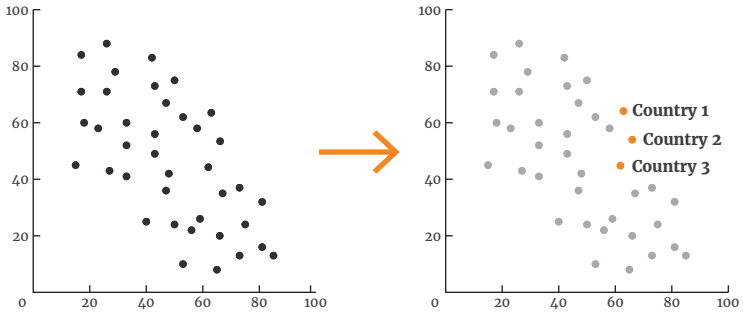
Core Principles of Data Visualization

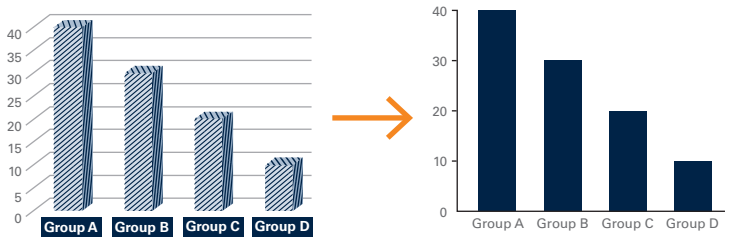
Show the data

People read graphs in a research report, article, or blog to understand the story being told. The data is the most important part of the graph and should be presented in the clearest way possible. But that does not mean that all of the data must be shown—indeed, many graphs show too much.



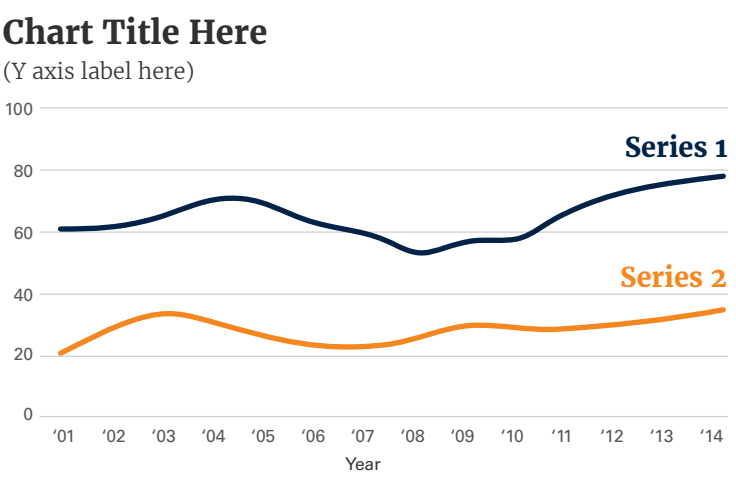
Reduce the clutter

Chart clutter, those unnecessary or distracting visual elements, will tend to reduce effectiveness. Clutter comes in the form of dark or heavy gridlines; unnecessary tick marks, labels, or text; unnecessary icons or pictures; ornamental shading and gradients; and unnecessary dimensions. Too often graphs use textured or filled gradients.



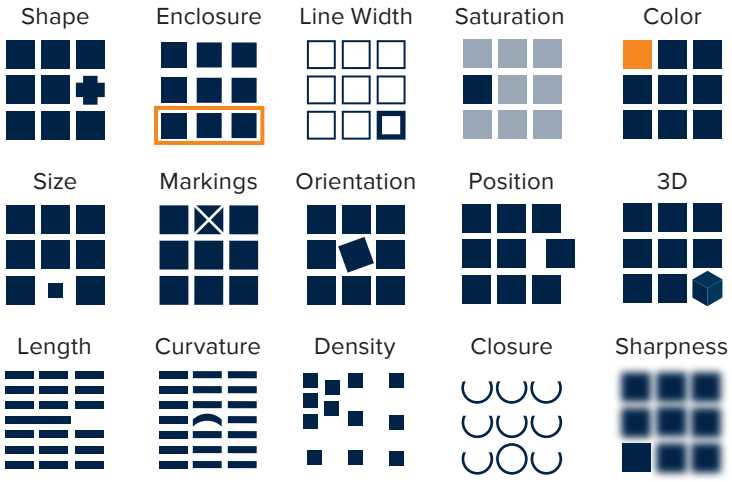
Integrate the text and the graph

Standard research reports often suffer from the **slideshow effect**, in which the writer narrates the text elements that appear in the graph. A better model is one in which visualizations are constructed to complement the text and at the same time to contain enough information to stand alone. As a simple example, legends that define or explain a line, bar, or point are often placed far from the content of the graph—off to the right or below the graph. Integrated legends—right below the title, directly on the chart, or at the end of a line—are more accessible.



Preattentive Processing

Effective data visualization taps into the brain's **preattentive visual processing.** Because our eyes detect a limited set of visual characteristics (such as shape and contrast), we combine various characteristics of an object and unconsciously perceive them as comprising an image. Preattentive processing refers to the cognitive operations that can be performed prior to focusing attention on any particular region of an image. In other words, it's the stuff you notice right away.



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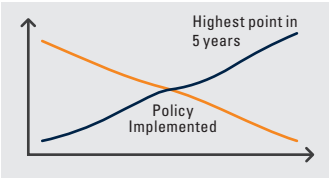
Audience

Always consider your audience—whether they need a short, written report, a more in-depth paper, or an online exploratory data tool.

Include annotation

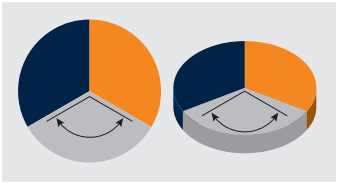


Add explanatory text to help the reader understand how to read or use the visualization (if necessary) and also to guide them through the content.

Use pie charts with care

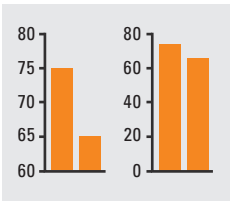
We are not very good at discerning quantities from the slices of the pie chart. Other chart types—for example, bars, stacked bars, treemaps, or slope charts—may be a better choice.

Avoid 3D



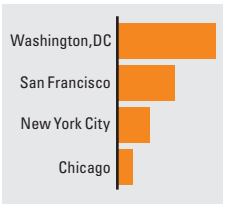
Using 3D when you don't have a third variable will usually distort the perception of the data and should thus be avoided.

Start bar and column charts at zero



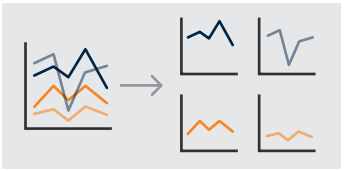
Bar and column charts that do not start at zero overemphasize the differences between the values. For small changes in quantities, consider visualizing the difference or the change in the values.

Make labels easy to read



When applicable, rotate bar and column charts to make the labels horizontal. If possible, make vertical axis labels horizontal, possibly below the title. In general, make labels clear, concise, and easy for your reader to understand.

Try small multiples

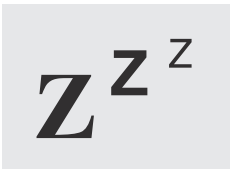


Breaking up a complicated chart into smaller chunks can be an effective way to visualize your data.

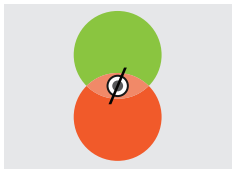
Use maps carefully

Use maps carefully, always being sure it is the geographic point you are trying to make. Column and bar charts, for example, are often better at enabling comparisons between geographic units.

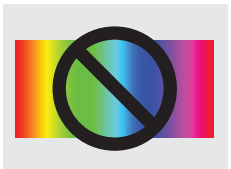
Color and font considerations



Avoid default colors and fonts—they all look the same and don't stand out.

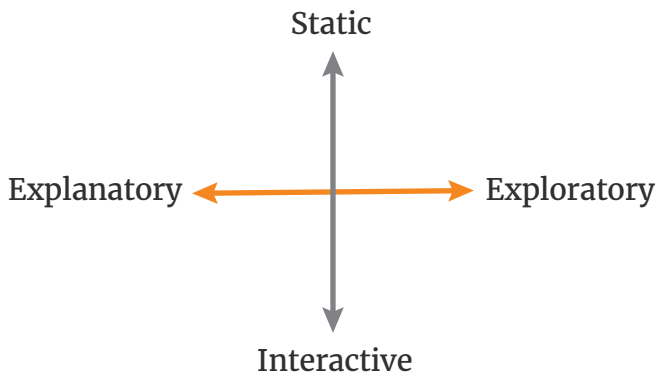


Consider color blindness—about 10% of people (mostly men) have some form of color blindness.



Avoid the rainbow color palette—it doesn't map to our number system and there is no logical ordering.

Visualization Mapping: Form and Function



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