

Bad Graphs: Editing Graphs for Readability, Fairness, and Impact

Graph types

Pie chart



Used for:

- Composition of a whole
- 2-5 values only
- Positive values only

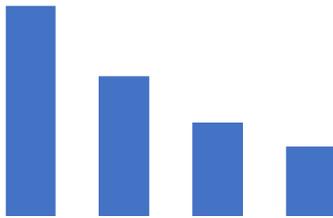
Variations:

- Doughnut chart

Common pitfalls:

- Inappropriate data
- Segments don't add up to 100%
- Segment size doesn't match label
- Too many segments
- 3-D and distortion

Bar graph



Used for:

- Comparison within or between categories

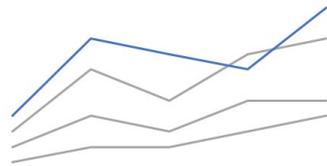
Variations:

- Horizontal bars
- Stacked bars
- Isotype/pictogram
- Waterfall or funnel graph

Common pitfalls:

- Non-zero baseline
- Angled text
- Fancy shapes
- Changing width as well as height
- Dual Y-axes
- 3-D and distortion

Line graph



Used for:

- Change over time or over another continuous variable

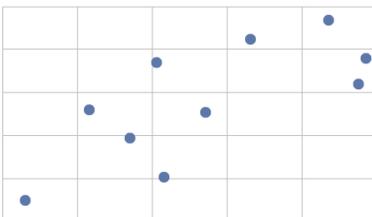
Variations:

- Combine with bar graph
- Slope graph — 2 time points only

Common pitfalls:

- Spaghetti
- Inappropriate X-axis
- Y-axis scale (too big and change is minimized; too small and change looks enormous)
- Dual Y-axes

Scatter plot



Used for:

- Correlation between 2 sets of numerical data (e.g. age vs. height)

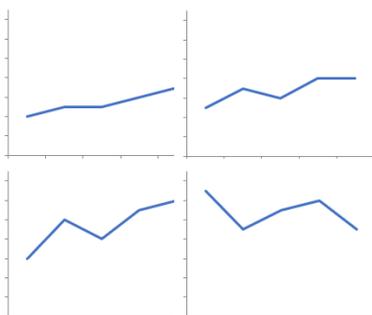
Variations:

- Include trend line
- Bubble graph — add a third variable with area

Common pitfalls:

- Visual clutter
- Complicated legend
- Poorly fitted trend lines can give a misleading impression

Small multiples



Used for:

- Comparing how several different measures changed across the same period

Variations:

- Sparklines — tiny graphs in running text or tables

Common pitfalls:

- Scales not comparable
- Using pie graphs or any graphs that are hard to interpret at a glance
- Unclear labelling

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Common problems and how to fix them

Accuracy

Accuracy problems in graphs may include:

- Graph doesn't match the information in the data table
- Graph does match the data table, but there is an error in the table
- Graph doesn't match the text describing it
- Mislabeled axes or data points
- Incorrect sources — particularly if the graph is one of a series, or has been reused

To fix these issues:

- Check all data points against the data table, the axes, and any relevant text
- Look at outliers — are they true outliers or errors in the data table? If they are true outliers, are they explained?
- Check all titles, axes, labels, and sources
- For pie charts, check the size of each slice and that all slices add up to 100%

Readability

Graph readability problems may include:

- Visual clutter, or what Edward Tufte calls “chartjunk” — 3-D effects, non-standard shapes, gradients, patterns, heavy gridlines, fill colours, decorative graphics
- Trying to fit in too much information
- Poor font or colour choices
- Uninformative titles or labels
- Poorly placed or rotated text
- Poor alignment

To fix these issues:

- Advise the author or graphic designer of any issues with font, colour, or alignment
- Declutter — suggest elements that could be removed or de-emphasized
- If possible, put labels next to the relevant information rather than in a legend
- Consider using a different visual presentation, or using multiple graphs
- Suggest a stronger title and clearer labels

Fairness

Choices that can result in an unfair graph include:

- Cherry-picking data
- Choosing a data type or a graph type that gives a misleading impression
- Distorting the visual presentation to give an inaccurate impression — this can involve stretching, shrinking, or even inverting the Y-axis or suddenly changing scales in the middle of the graph

Approach unfair graphs the same way you would if you encountered bias or cherry-picking in text:

- Highlight issues to the author and, if necessary, the supervising editor
- Explain what makes the graph misleading or unfair and how it will detract from the credibility of the work
- Suggest a fix, such as an alternate presentation or a different data source

Impact

A graph that is otherwise fine may still fail to support the story. Warning signs include:

- The graph is visually uninteresting — nothing much changes
- The graph and the text are answering different questions
- The graph uses poorly chosen data categories

Possible fixes include:

- Suggest a more interesting or relevant title
- Identify other information in the text that could make a better graph
- Suggest different or additional data
- Suggest a different visual presentation, such as using a table or giving a graphic treatment to a single number

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Editing checklists for each editorial stage

Question	Development	Copy editing	Proofreading
Are there any obvious problems with the graph, such as distortion, clutter, or missing information?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the graph easy to read and understand?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the graph match the data table?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are there any mathematical errors in the graph or the data table?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are there any obvious outliers? Are they true outliers, or mistakes? Are they discussed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does the graph match the text?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Is the graph consistent with other graphs in the document?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Have decisions about format and presentation been documented in the project style sheet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are there other factors that could help explain the patterns in this graph?	<input type="checkbox"/>		
Are there other sources of information that could lend depth and richness to this graph?	<input type="checkbox"/>		
Does this graph raise other questions that the author could explore?	<input type="checkbox"/>		
Is there other information in this document that could make a good graph?	<input type="checkbox"/>		
What story is this graph telling, or what question is it trying to answer? Does anyone care?	<input type="checkbox"/>	<input type="checkbox"/>	
Is this the appropriate type of graph for this data?	<input type="checkbox"/>	<input type="checkbox"/>	
Is the level of detail appropriate for the audience and the medium?	<input type="checkbox"/>	<input type="checkbox"/>	
If the graph requires extra context to be understood, is that context provided?	<input type="checkbox"/>	<input type="checkbox"/>	
Are the following required elements in place?			
Title is clear and descriptive		<input type="checkbox"/>	<input type="checkbox"/>
Data labels are clear and descriptive		<input type="checkbox"/>	<input type="checkbox"/>
Axes and scale are appropriate and clearly shown		<input type="checkbox"/>	<input type="checkbox"/>
Information source(s) is/are shown		<input type="checkbox"/>	<input type="checkbox"/>
What happens if the graph is printed in black and white or read by someone with limited colour vision?		<input type="checkbox"/>	<input type="checkbox"/>
If there are multiple graphs in the document, are they in order? Are the cross-references correct?		<input type="checkbox"/>	<input type="checkbox"/>

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What to read next

Books

Cairo, Alberto. *The Functional Art: An Introduction to Information Graphics and Visualization*. New Riders, 2013.

— — —. *How Charts Lie: Getting Smarter about Visual Information*. W.W. Norton and Company, 2019 (in press).

Huff, Darrell. *How to Lie with Statistics*. (Irving Geis, illustrator.) W.W. Norton and Company, 1954. Available at: archive.org/details/HowToLieWithStatistics

An entertaining classic that discusses sampling bias, statistical shenanigans, and various ways to lie with (among other things) graphs.

Kriebel, Andy, and Eva Murray. *#MakeoverMonday: Improving How We Visualize and Analyze Data, One Chart at a Time*. Wiley, 2018.

Nussbaumer Knaflic, Cole. *Storytelling with Data: A Data Visualization Guide for Business Professionals*. Wiley, 2015.

Tufte, Edward. *The Visual Display of Quantitative Information*. 2nd ed. Graphics Press, 2001.

— — —. *Beautiful Evidence*. Graphics Press, 2006.

Tufte has Opinions. He's considered one of the eminences of information design and his books are beautifully illustrated and highly readable, but his suggestions aren't always the most practical.

Wainer, Howard. *Graphic Discovery: A Trout in the Milk and Other Visual Adventures*. Princeton University Press, 2004.

This is a historical overview of data visualization. It's full of great anecdotes — did you know that William Playfair, inventor of the pie chart, bar graph, and line graph, helped to storm the Bastille?

Wong, Dona M. *The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures*. W.W. Norton and Company, 2013.

Websites

flowingdata.com (a website and blog by Nathan Yau, a statistician who focuses on information design and data for non-professionals)

junkcharts.typepad.com (a blog by Kaiser Fung, “the web’s first data visualization critic”)

makeovermonday.co.uk (creating better, more creative visualizations every week)

storytellingwithdata.com (Cole Nussbaumer Knaflic’s website)

thefunctionalart.com (Alberto Cairo’s website)

viz.wtf (WTF Visualizations, a rich source of graphs that make you go...well, you get the idea)