How to dodge the pitfalls of bad illustrations

Popular articles on social media give tips on making better figures, and embracing stupidity.

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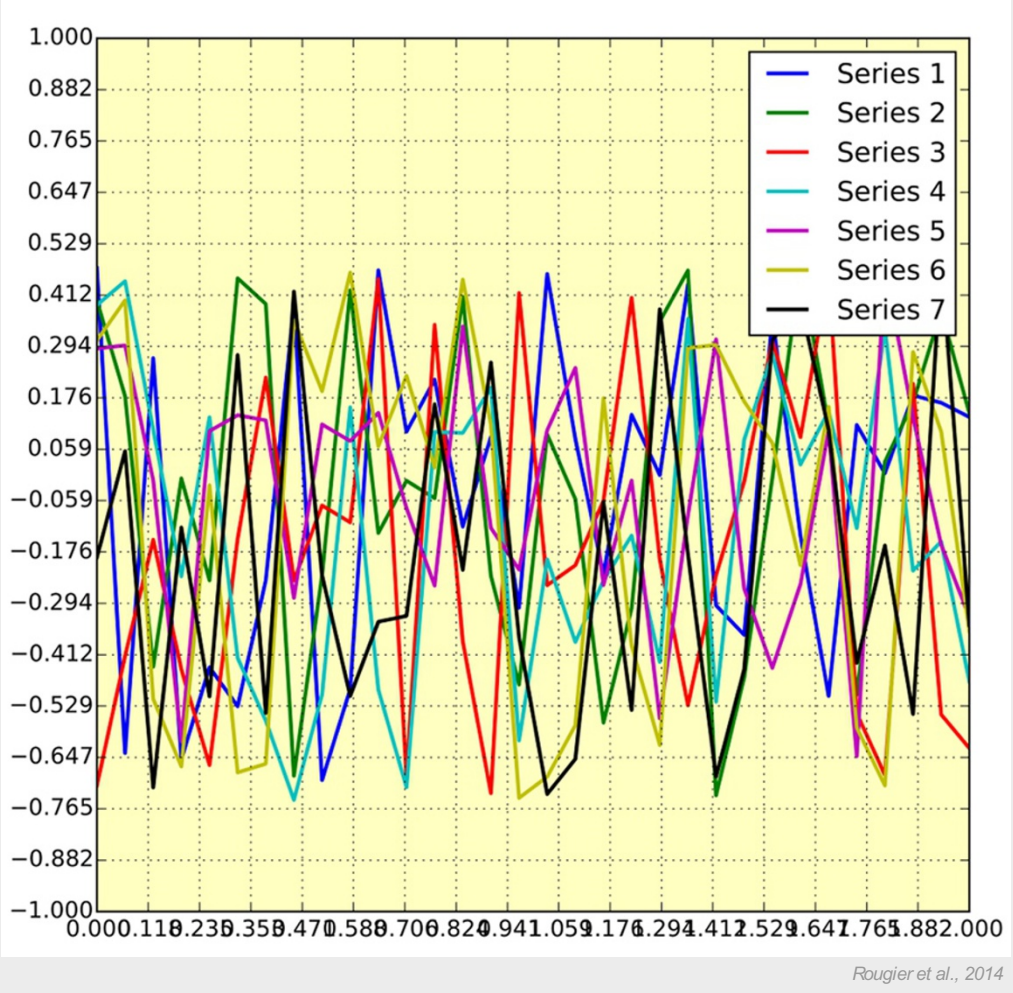
Jumbled charts, misleading graphs, axes to nowhere — illustrations in a paper can go wrong in many ways. Now, a **treatise that attempts to rescue science from bad figures** has been getting rave reviews on social media. Researchers have also been discussing a classic paper extolling the virtues of scientific stupidity.

Using original illustrations — some elegant, some clunky — to prove key points, 'Ten simple rules for better figures'[1] tries to steer researchers away from common pitfalls. The first tip: know your audience. A stripped-down graph that might make sense to your closest colleagues could prove baffling to anyone else. Many researchers on social media were grateful for the advice. Andrew Jackson, an evolutionary ecologist at Trinity College Dublin, tweeted "Magic. Using that in lectures for sure. Incoming students take note!"

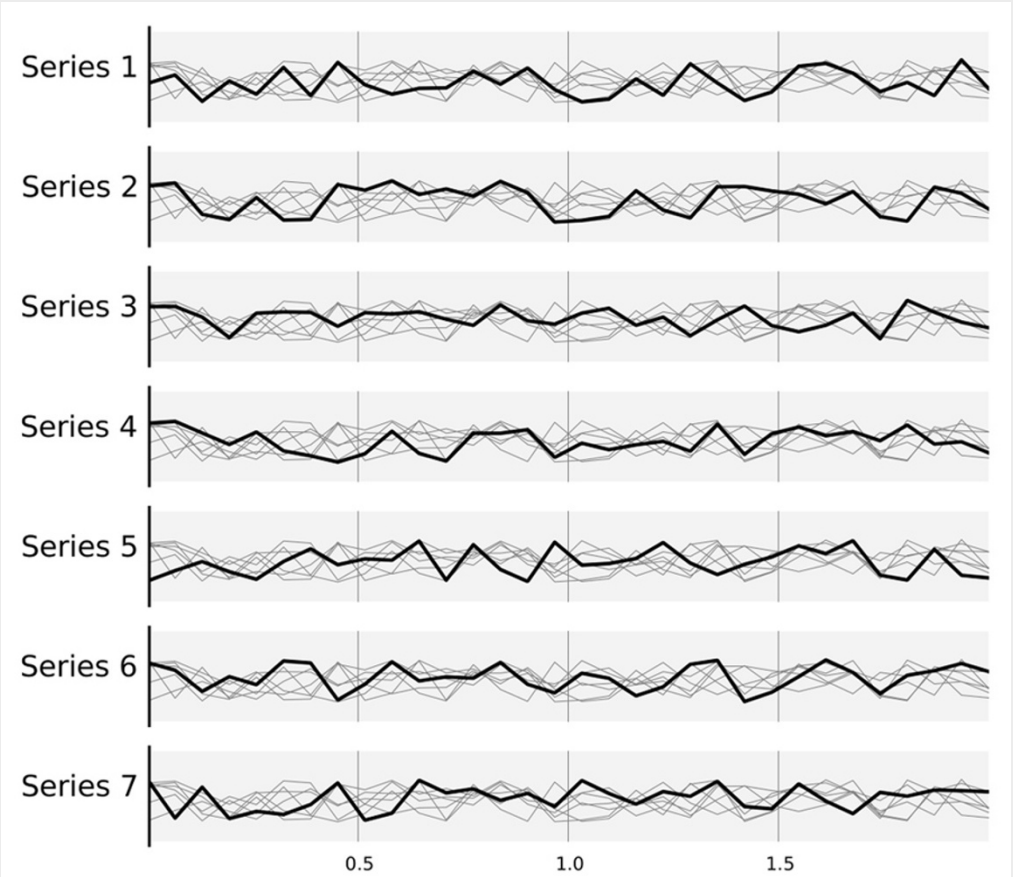
The paper includes a striking example of "chartjunk," an illustration that jams labels, colours and data points far past the point of coherence.



Rougier et al., 2014

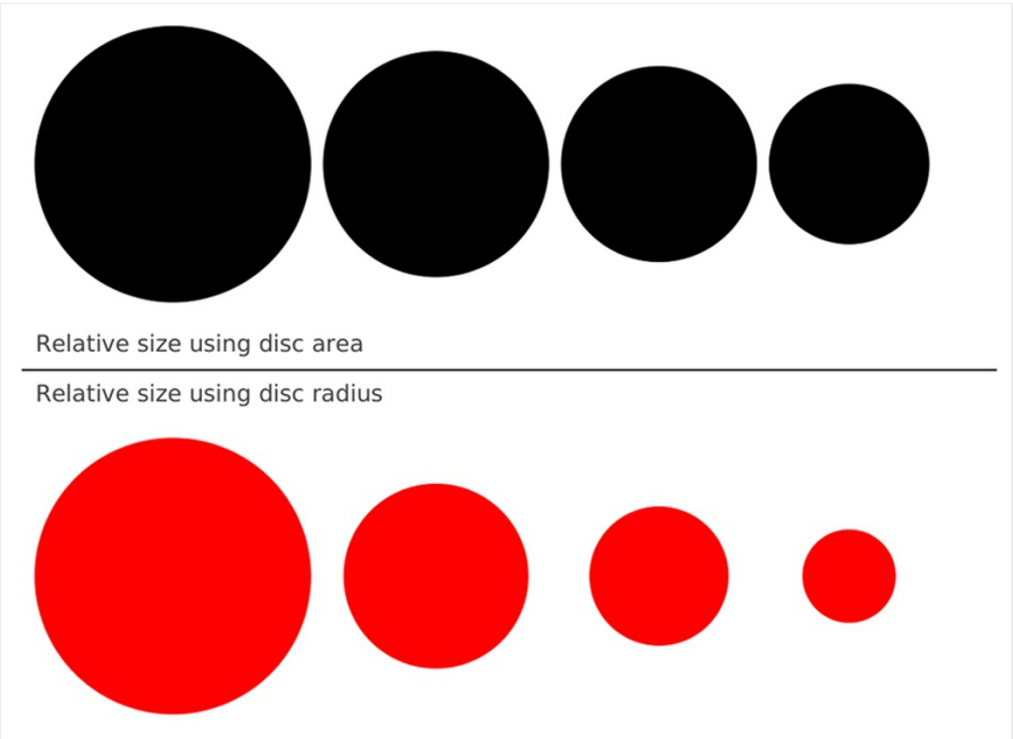
The authors call it "one of the worst possible designs" for the data, a hypothetical series of seven samples. The x-axis labels are impossible to read, the legend covers up part of the graphic and the mishmash of colours certainly doesn't help.

As an alternative, the authors propose a figure that presents each series separately, with lighter background images for the other series. It's not colourful, but it's comprehensible.



Rougier et al., 2014

In another example, the authors show how charts can be misleading. Both sets of circles represent the values 30, 20, 15 and 10. Area is used to show the values for the black discs, but radius is used for the red discs. Visually, the results appear quite different.



Rougier et al., 2014

It may be tempting to produce a really beautiful figure, but the authors caution that an eye-catching graphic can still fail to convey the information needed. “Remember, in science, message and readability of the figure is the most important aspect while beauty is only an option,” they write.

When asked for further comment, Jackson said that proper use of visuals is one of his top issues as a researcher and a teacher. He asks his students to draw mock-up figures before they even run an experiment. “It forces them to think about units and the practicalities of how they will collect the data,” he said. “I tell them, ‘If you can’t draw your hypotheses before you start, then don’t start.’”

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Researchers are still talking about a 2008 paper[2] with another important message for young scientists: **It’s occasionally OK to be stupid.** Written by Martin A. Schwartz, a microbiologist at the University of Virginia in Charlottesville, the paper argues that any research worth doing will be full of unknowns. “Focusing on important questions puts us in the awkward position of being ignorant,” he writes. He adds that researchers must learn to acknowledge and embrace ignorance before they can make real progress. “We don’t do a good enough job of teaching our students how to be productively stupid.”

Shlomo Argamon, a computer scientist at the Illinois Institute of Technology in Chicago, recently tweeted a link to the essay, adding:

Oren Tsur, a computer science and linguistics researcher at Harvard University in Cambridge, Massachusetts, replied: “True, but you always get the feeling that some of your colleagues actually know what they are doing.”

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References

1. Rougier, N. P., Droettboom, M. & Bourne, P. E. *PLoS Comput. Biol.* **10**, e1003833 (2014).
2. Schwartz, M. J. *Cell Sci.* **121**, 1771 (2008).