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Designing Effective Graphs

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ABSTRACT

Actuaries, like other business professionals, communicate quantitative ideas graphically. Because the process of reading, or decoding, graphs is more complex than reading text, graphs are vulnerable to many sources of abuse. To underscore this vulnerability, we give several examples of commonly encountered graphs that mislead and hide information. To help creators design more effective graphs and to help viewers recognize misleading graphs, this article summarizes guidelines for designing graphs that show important numerical information. When designing graphs, we recommend that creators: (1) avoid chartjunk, (2) use small multiples to promote comparisons and assess change, (3) use complex graphs to portray complex patterns, (4) relate graph size to information content, (5) use graphical forms that promote comparisons, (6) integrate graphs and text, (7) demonstrate an important message and (8) know your audience.

Some of these guidelines for designing effective graphs, such as (6), (7) and (8), are drawn directly from principles for effective writing. Others, such as guidelines (3), (4) and (5), come from cognitive psychology, the science of perception. Guidelines (1) and (2) have roots in both effective writing and in graphical perception. For example, the writing principle of brevity demonstrates how eliminating pseudo three-dimensional perspectives and other forms of chartjunk improve graphs. As another example, the writing principle of parallel structure suggests using small multiple variations of a basic graphical form to visualize complex relationships across different groups and over time.

To underscore the scientific aspect of graphical perception, we examine the process of communicating with a graph, beginning with a sender's interpretation of data and ending with a receiver's interpretation of the graph. In keeping with scientific tradition, this article discusses several studies in the literature on the effectiveness of graphs.

We conclude that the actuarial profession has many opportunities to improve its practice, making communication more efficient and precise.

Keywords and phrases: Data analysis, graphical perception, visualization, chartjunk, information processing.

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