

Grid Lines in Graphs are Rarely Useful

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Grid lines are commonplace in business graphs today but they are almost always "chartjunk"—visual content that adds no value, serves no purpose and distracts from the real data.¹ However, there are a few exceptions. In this column, I'll describe the few times that grid lines actually help graphs to communicate.

Most software that supports the creation of graphs automatically includes grid lines as the default format, but it ought to be the other way around. You should need to intentionally add grid lines in those uncommon circumstances when they actually serve a purpose. Unlike data tables, graphs are not meant to provide precise quantitative values. Graphs reveal patterns, trends, relationships and exceptions via the shape of the data that would be difficult to discern from a table of values. Grid lines are rarely needed in graphs to help readers assign accurate numeric values to the data; the approximate values that can be perceived without the aid of grid lines are almost always adequate.

Quantitative and Categorical Scales

Graphs are constructed using axes—lines that serve as boundaries for the space in which the data is displayed, along which scales appear to assign meaning to the data. Two major types of scales appear in graphs: quantitative and categorical. Quantitative scales assign numeric values to equidistant locations along an axis. They enable you to interpret the quantitative values in the graph—encoded as bars, lines or data points—by matching the position of these visual objects to a marked position along the scale line. Categorical scales assign labels to positions along an axis to identify what is being measured, such as sales regions, business departments and so on. Most graphs contain two axes called the X-axis (horizontal) and the Y-axis (vertical). Usually one provides a quantitative scale and the other a categorical scale. The distinction between quantitative and categorical scales relates to the use of grid lines in graphs, which you will soon see.

Circumstance 1: Increasing precision when graphs are large.

Two of the circumstances in which grid lines are useful involve lines that correspond exclusively to quantitative scales. The first involves those situations when a bit more precision in the interpretation of the quantitative values is needed beyond what can be achieved based on the tick marks along the quantitative scale. Because the purpose of graphs is not to provide precise quantitative values but rather to display the shape of the data, usually the only instance grid lines are needed to enhance quantitative precision is when the graph extends so far from the quantitative scale line that it is difficult to align the data at the other end of the graph. Figure 1 provides an example of this situation. With 24 months along the categorical scale, it would be difficult to adequately align the quantitative

scale for the months late in the year 2004 with the Y-axis on the left without the assistance of the grid lines.



Figure 1: Increasing precision on large graph

Circumstance 2: Enhancing the perception of small differences.

The other situation related exclusively to quantitative scales can only be understood when you know a bit about visual perception. Take a look at the left-hand graph in Figure 2. If you were trying to compare the values for the months of February and May to determine which is greater, you would struggle. When examined in relation to the baseline of the graph (the X-axis), the difference between the heights of the two bars is not easily perceived. This phenomenon is explained by Weber's Law, which states that we perceive the difference between variations of a visual attribute, such as height, as a ratio (a percentage difference) rather than an absolute value. The heights of the bars for February and May differ only by roughly two percent -- the difference between the values of 101 and 103 along the quantitative scale. Now look at the same data in the right-hand graph of Figure 2. The addition of grid lines makes the difference between the two bars stand out more clearly, because, when compared to the grid line at the value 100, the second bar is now three times as high. Grid lines are useful when you need to detect subtle differences between quantitative values that are too far from the baseline.

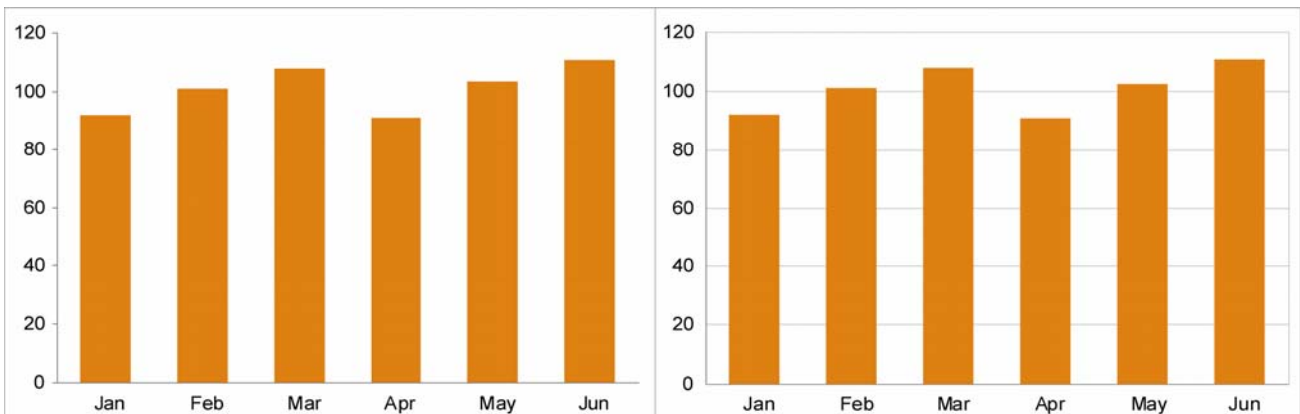


Figure 2: Enhancing perception of small differences

Circumstance 3: Assisting the comparison of values along the categorical scale.

Normally, our eyes need no assistance at all to align data in a graph—bars or data points with or without a line connecting them—with their labels along the categorical scale. There is one situation, however, due to a quirk in visual perception, which benefits from the assistance of grid lines. Take a moment to look at the left-hand graph in Figure 3 and compare the difference between domestic and international revenues in the month of February to those in the month of May. It looks pretty obvious that the difference is less in May—right? Even though this appears to be the case, domestic and international revenues actually differ by exactly 700 in every month. The fact that it doesn't look this way is due to the inclination of visual perception to compare the two lines where they're closest, rather than in direct vertical alignment with the corresponding months. In a case such as this, the addition of vertical grid lines corresponding to the months along the categorical scale, illustrated in the right-hand graph, helps our eyes compare the two lines at the proper positions along each.

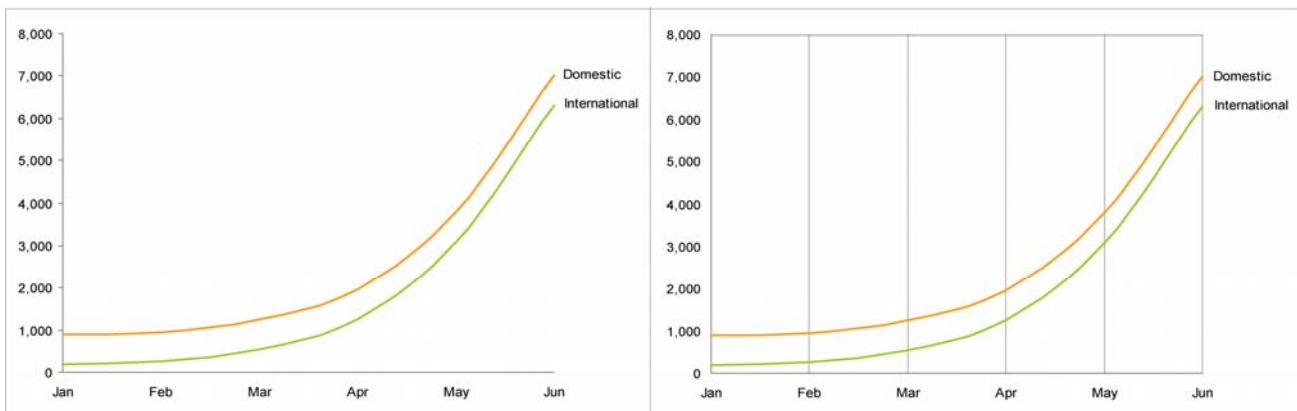


Figure 3: Assisting the comparison of values

Circumstance 4: Narrowing focus to a specific area.

One final situation involves grid lines that correspond to both the quantitative and categorical scale, creating a true grid that subdivides the graph into sections. If you were examining the left-hand graph in Figure 4 (a scatter plot), it would be difficult to focus exclusively on the space that displays the values between 65 and 70 inches in height along the vertical axis and from \$40,000 to \$45,000 along the horizontal axis. The grid lines that appear in the right-hand graph, however, make this task easy. Because the use of data points alone to encode values in a graph, such as the dots in Figure 4, is usually reserved for scatter plots, this final use of grid lines applies solely to this type of graph.

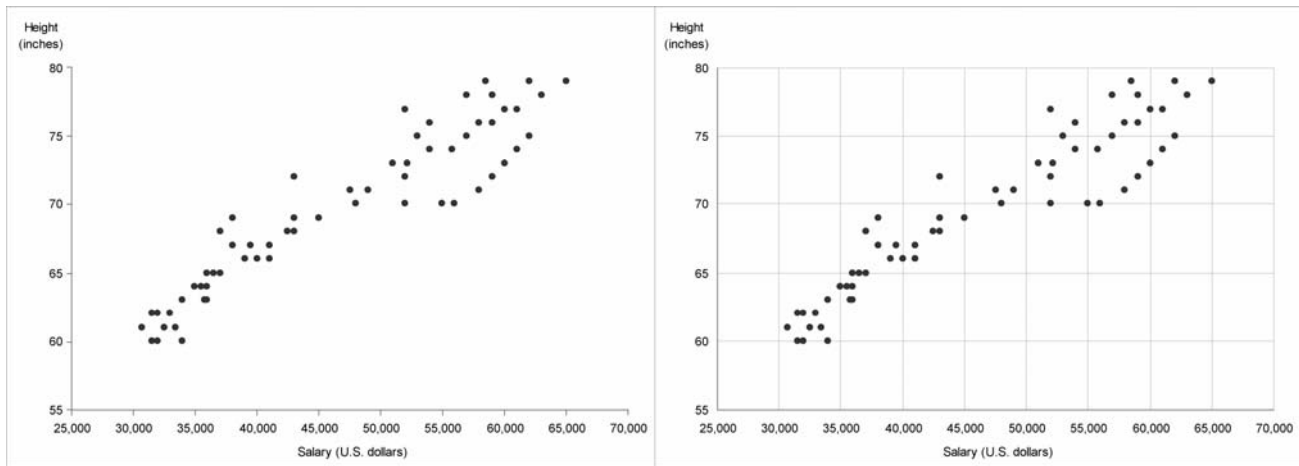


Figure 4: Narrowing focus

Subtlety is Key

My final point is important: when you do include grid lines, you should render them just visible enough to serve their purpose. As you see in the examples that I've provided, very light grid lines do the job quite well. Any content in a graph that isn't data, but rather is used to support the data in some way, such as grid lines and axes, should be visually muted in comparison to the data so it does not distract from the data. Graphs have one purpose, as Edward Tufte eloquently declared way back in 1983: "Above all else show the data."²

References:

1. The term "chartjunk" was originally coined by Edward R. Tufte and appears in *The Visual Display of Quantitative Information*. Graphics Press: Cheshire, CT, 1983.
2. *Ibid.*, p. 92.

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About the Author

Stephen Few has worked for over 20 years as an IT innovator, consultant, and teacher. Today, as Principal of the consultancy Perceptual Edge, Stephen focuses on data visualization for analyzing and communicating quantitative business information. He provides training and consulting services, writes the monthly *Visual Business Intelligence Newsletter*, speaks frequently at conferences, and teaches in the MBA program at the University of California, Berkeley. He is the author of two books: *Show Me the Numbers: Designing Tables and Graphs to Enlighten* and *Information Dashboard Design: The Effective Visual Communication of Data*. You can learn more about Stephen's work and access an entire [library](http://www.perceptualedge.com) of articles at www.perceptualedge.com. Between articles, you can read Stephen's thoughts on the industry in his [blog](#).