Keep Radar Graphs Below the Radar - Far Below

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The test of a graph's usefulness is its ability to communicate efficiently and effectively. If it expresses the right information clearly and accurately in a way that speaks to your audience, then it is effective. If not, regardless of how pretty it is, it's not only useless, it might even be harmful. If you are using radar graphs to communicate typical business information, you could be making a costly mistake.

Radar Graphs Explained

A radar graph, sometimes called a star or spider graph, is laid out in a circular fashion, rather than the more common linear arrangement. As you see in Figure 1, a radar graph consists of axis lines that start in the center of a circle and extend to its periphery. Each axis can either represent an independent measure related to a single thing (for example, different measures of a cereal's nutritional content, such as protein, fat, sugar, potassium and calories) or a single measure broken into multiple subdivisions of a single category (such as expenses per department). The axes in Figure 1 are of the latter type, each representing a different sales channel for a single measure—sales revenue.

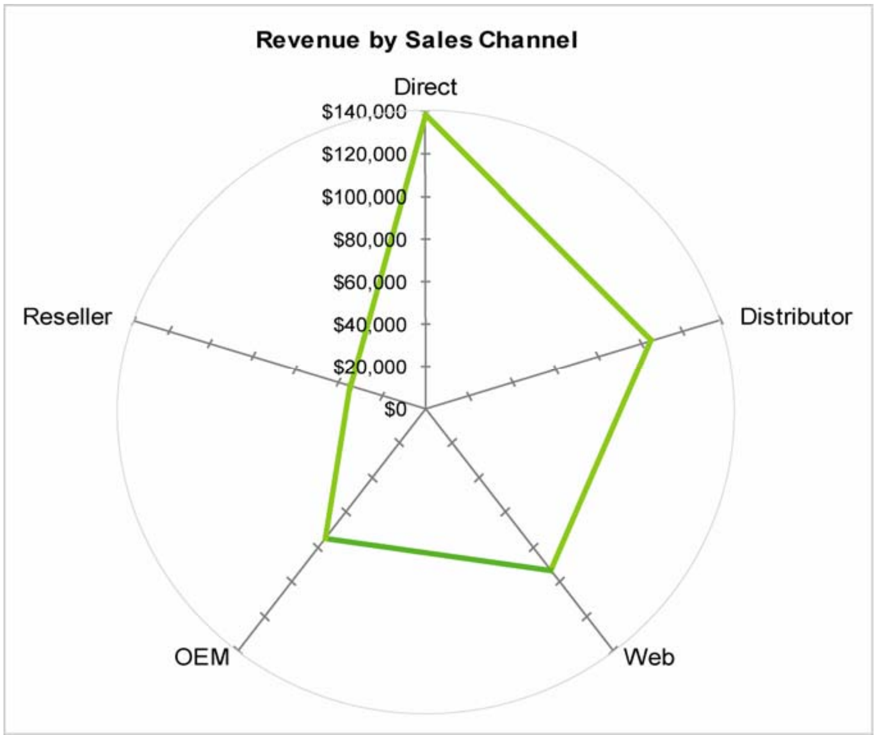

Figure 1: Revenue by Sales Channel (Radar Graph)

The quantitative scales that run along the axes are generally arranged to begin in the center with the lowest value and extend toward the outside with increasing values. The lines that connect the individual values on each axis form a polygon, which is sometimes filled in with color. The data displayed in Figure 1 would usually be shown as a bar graph, as seen in Figure 2. Take a moment to compare the relative ease with which the two graphs can be read. Although the radar graph certainly looks interesting—much cooler than the more familiar bar graph—it takes longer to compare the sales of the various sales channels. Positions along a quantitative scale are much easier to compare when they are laid out linearly along a single vertical or horizontal axis. Also, in a case like this when additional meaning can be displayed by ranking the items, a bar graph supports this nicely, but a radar graph does not because it isn't clear where it begins and where it ends or whether it should be read clockwise or counterclockwise.

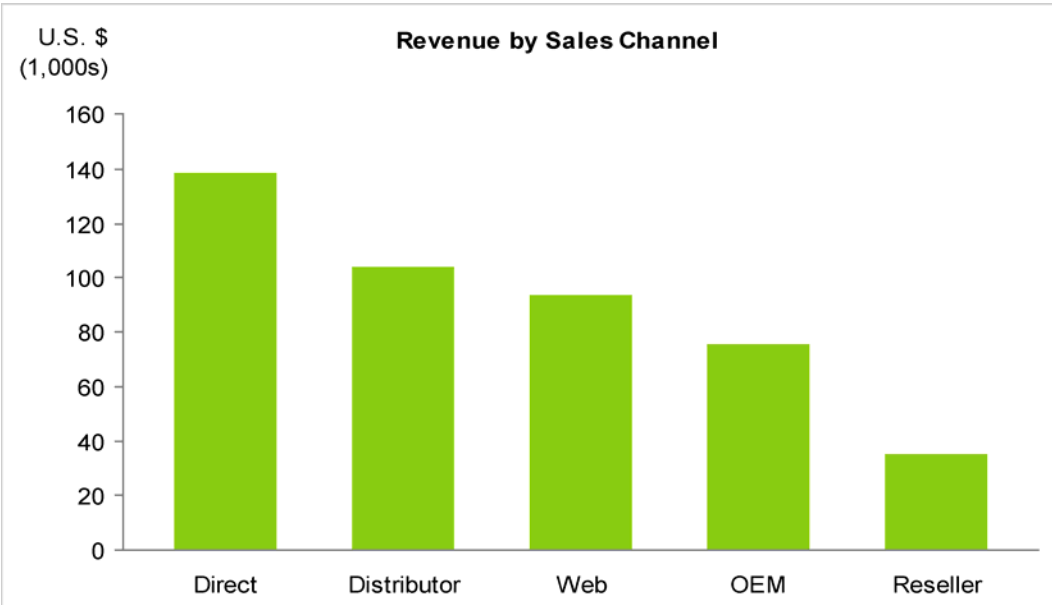

Figure 2: Revenue by Sales Channel (Bar Graph)

Potential Justifications for Using a Radar Graph

Radar graphs are more difficult to read than bar and line graphs, so you should avoid them except in circumstances when they offer clear advantages that offset the disadvantages. Most people use them gratuitously, but here are three reasons that I've either heard or personally considered as potential justifications for using them:

- The data consists of multiple measures that require different quantitative scales, which a bar graph cannot accommodate.
- The objective of the graph is to assess the symmetry of the values rather than to compare their magnitudes.
- The data fits a circular display because it is intuitively circular in nature or by convention.

The Merits of Each Claim

By definition, a radar graph may have different quantitative scales along each of its axes, although many software products require that all the axes share the same scale. Assuming that your software supports multiple scales in a single graph,if you wanted to compare several competing companies, you could profile them using measures such as the following: annual revenue, stock price, annual profit percentage, number of employees and customer satisfaction. The first two measures both involve money, but the huge difference in revenue amounts and stock prices would prevent you from using a common quantitative scale. The number of employees is a count, profit is expressed as a percentage, and customer satisfaction is probably measured using a rating scale (e.g., 1 to 5). Figure 3 illustrates how a radar graph might handle this challenge for the comparison of five companies.

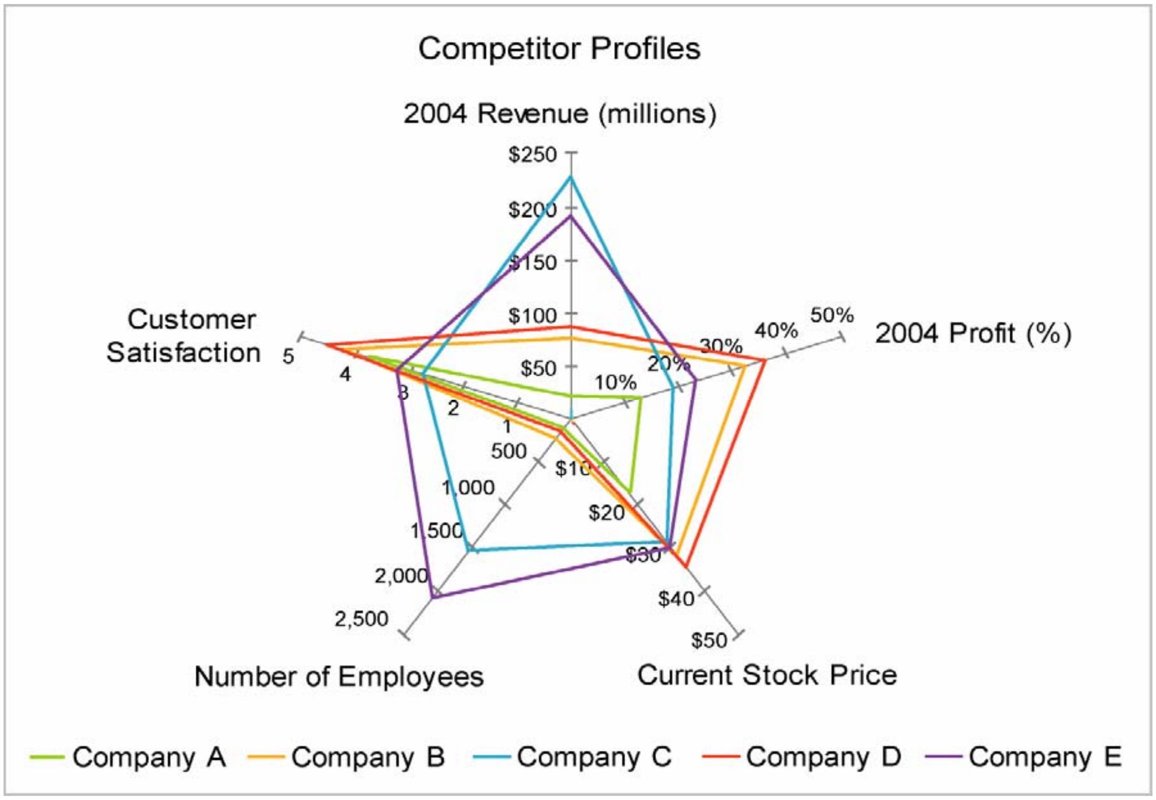

Figure 3: Competitor Profiles (Radar Graph)

If you find this graph easy to read, you have a talent that I sorely lack. You can imagine how completely unreadable it would be if the polygons profiling each of the companies were filled in with color. My answer to this particular data display challenge would be to construct five bar graphs, one for each measure (revenue, profit and so on), and either place them side by side with the bars running horizontally or one above the other with the bars running vertically. This would enable a simple comparison of all companies for each measure as well as all measures for a single company. There are better ways to display multiple measures with different scales than a radar graph.

One of the problems with radar graphs is that we tend to prefer polygons with symmetrical shapes. In Figure 3, the polygons representing companies C and E are more symmetrical than the others and are thus more appealing, whether consciously or not. One of the justifications for the use of radar graphs tries to take advantage of this tendency by using them when symmetry in the data is what you're looking for above all else. Try to imagine that you are comparing resorts in preparation for a long-awaited vacation, and you've decided that you care more that the resort is balanced in all its features (for example, price, room quality, restaurant quality, available activities and service) than that it rates higher overall than the others. If you use a five-point rating system for each feature and compare a few resorts using a radar graph, you should be able to see which has the most symmetrical set of ratings. My biggest objection to this justification for radar graphs is that you almost never care more about something being more well rounded (symmetrical) than you care about the magnitude of the ratings. A resort that consistently rates poorly in all areas is certainly not better than one that rates exceptionally well in all areas but one. Even if you did care primarily about symmetry, this is easy and a lot less messy to see on a bar graph as a series of bars of approximately the same length.

The last justification involves data that, by its very nature or convention, is thought of as circular. The one possibility that comes to mind involves measures taken at equal intervals throughout the day, such as hourly, when the purpose of the graph is to display time-related patterns. For instance, if you want to show how Web traffic, measured as the number of page hits, exhibits particular patterns at particular times of the day, a radar graph might work. When people think of hours, they think of a clock, which is circular. When used in this way, the axes of the radar graph would correspond to hours, resulting in a display that looks like a 24-hour clock, as shown in Figure 4.

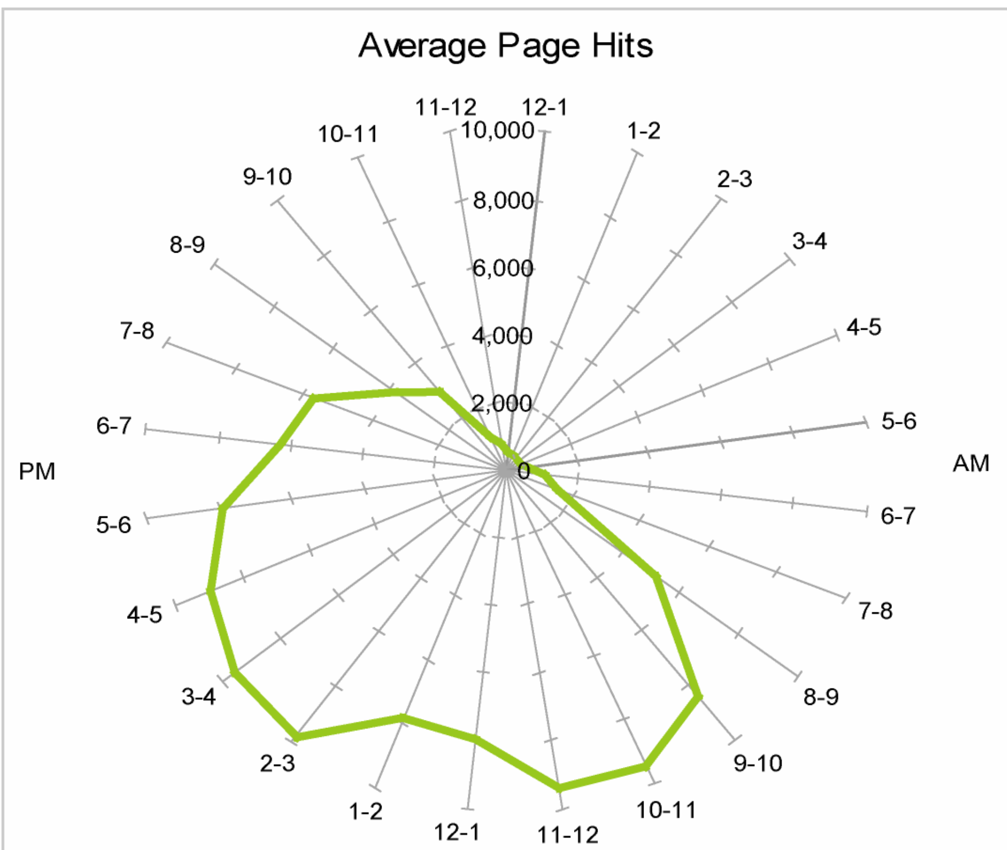

Figure 4: Average Page Hits (Radar Graph)

As you can see, however, a 24-hour clock requires a perceptual adjustment. A regular line graph with the hours running horizontally from left to right is easier to read, but the one advantage offered by the radar version is the way it displays the continuous nature of time by not forcing a disconnection of the line at the end of the day from the beginning of the day, where 11:59 p.m. meets 12:00 a.m. This one advantage motivates me to ease up just a bit on my repugnance toward radar graphs in those instances when there is a real advantage to displaying the cyclical nature of the hours in a day.

If you've run across an effective use of radar graphs that I've failed to mention, by all means let me know and I'll amend my story.

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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 of articles at www.perceptualedge.com. Between articles, you can read Stephen's thoughts on the industry in his blog.