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Infographics as Eye Candy: Review of *World War II in Numbers: An Infographic Guide to the Conflict, Its Conduct, and Its Casualties* by Peter Doyle (2013)

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Abstract

Peter Doyle. *World War II in Numbers: An Infographic Guide to the Conflict, Its Conduct, and Its Casualties*, illustrated by Lindsey Johns (Buffalo NY: Firefly Books, 2013). 224 pp. ISBN: 177085195X.

Doyle's book contains dozens of graphs of statistical data dealing with World War II. Many of these graphs are visually striking. However, they often violate fundamental graphing principles, in that they distort quantitative relationships, use unidentified scales, and often make it difficult to compare quantities. Graphic software makes it easy to create imaginative images, but these can fail to communicate the very information that is the graph's purpose.

Keywords

charts, graphs, World War II, graphic software, visualization

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Cover Page Footnote

Joel Best is Professor of Sociology and Criminal Justice at the University of Delaware. Author of *Damn Lies and Statistics*, Best is an Associate Editor and frequent contributor to *Numeracy*. His most recent books are *The Student Loan Mess* (with Eric Best) and *Kids Gone Wild* (with Kathleen A. Bogle).

The computer revolution has dramatically changed how graphs are produced and consumed. Software packages have made it vastly easier not just to translate numbers into visual images, but to devise all manner of arresting ways of presenting information. Moreover, the Internet favors short pieces, preferably accompanied by dramatic illustrations. Both the ease of creating graphs and the Internet's seemingly endless appetite for visual displays means that we are encountering a lot more graphs, maps, and other pictorial representations of quantitative information.

However, many of those displays aren't very good. *USA Today* became famous for its innovative weather maps that summarized temperatures across the country (Monmonier 1999), even as it achieved notoriety for its frequent use of graphs that embodied all manner of bad practices. It became increasingly easy to spot poor graphs in newsmagazines trying to use innovative computer graphics to make their looks more compelling.

There has also been a booming literature on best—and worst—practices. There are guides for those who might want to make graphs (Harris 1999; Robbins 2005), inquiries into graphing's history and practice (Wainer 2005, 2009), and of course Edward Tufte's books on theory and principles, especially *The Visual Display of Quantitative Information* (1983). One can also find magnificent volumes using graphics to convey substantive information (e.g., Shaw et al. 2008), or to simply celebrate an expanding array of possibilities for making information visible (e.g., Klanten et al. 2008). It has probably never been easier to get excellent guidance on the pathways to good graphing, and warnings about the pitfalls that endanger those who stray.

Which brings us to the book at hand. I bought *World War II in Numbers* because I'm interested in both history and graphs. The back cover promises that the book “brings the statistics of the conflict to life in an innovative, visual way, with graphs, charts, map overlays and high impact infographics.”

When I opened the book and took one look at the first graph, I realized there were going to be problems. The two-page spread features tables listing the populations in the Axis and Allied nations, and accompanies each table with silhouette figures of a woman and a man in 1940s garb (her dress has distinctive shoulder pads, and he's wearing a fedora). The total population of the Axis countries was 222.1 million, about one-sixth the total for the Allies (1,342.8 million) (p. 12). (Why, you might ask, is the Allied total so large? Because it includes both China and India.) And so—you can probably see this coming—the silhouette figures for the Allies are six times as tall and six times as wide as the Axis figures. Which is to say that a six-fold difference in populations is represented by figures whose area is about 36 times as large.

This is, of course, not an unfamiliar error. It was addressed more than sixty years ago in Darrell Huff's classic *How to Lie with Statistics* (1954). It is routinely

covered in guides to good graphing practices. There is really no excuse for educated people making this mistake. People who make graphs should know better. The people who design graphing software packages ought to make it hard rather than easy to produce bad graphs. And editors who review the finished graphs should apply more critical eyes.

And yet, graph after graph in this book features differences in the sizes of icons—human figures, tanks, airplanes, circles, whatever—displayed by proportionally increasing both height and width. On page 27, There is a circle with a diameter of about 14 mm. (i.e., quite a bit smaller than a dime) that represents the just over 1 million Japanese troops killed in the Second Sino-Japanese War. This is accompanied by a caption: “The number of civilians who died in the struggle was staggering: 22,000,000. The corresponding representative circle is so large it won’t fit on this page.” Actually, of course, there is plenty of room for a circle that has 22 times as much area, just not for a circle that has a diameter that is 22 times as long.

While that familiar error is repeated many times, what is particularly striking is the novel ways this book finds to translate simple tables of figures into visually exciting yet incomprehensible displays. For example, consider the starburst-shaped graph on page 99 (illustrating Japanese aircraft losses at the battle of Kohima). At the graph’s center is a dime-sized circle. The circle is divided into thirds, each devoted to a month between March and May, 1944. For each month there are six wedges emerging from the circle representing different sorts of aircraft losses. The smallest number represented is 5 (denoted by a wedge that is roughly 16 mm. long), the largest number is 100 (a 110-mm. wedge) (see Figure 1 for examples of three different wedges from this graph). It is impossible to figure out how the various numbers translate into these shapes. Is it the area each wedge covers, or is it the length of the wedges (and, if so, should we imagine that the wedge begins at the edge or the center of the circle)? Is there perhaps a logarithmic scale at work? And of course there is a larger question: why exactly should we care about month-to-month categorizations of Japanese aircraft losses? The reader suspects that the choice of graph topics was driven less by their importance than by the availability of a data set that could be graphed. The sources for the numbers are not given.



Figure 1. How do the numbers of aircraft losses at the Battle of Kohima relate to the sizes of the wedges in this sunburst?

Or consider the graph on page 43, illustrating German, Polish, and Soviet forces deployed during the invasion of Poland through the use of crystal-like wedges (see Figure 2 for the Russian data). In this graph, the leftmost reddish wedge denotes the number of Russian infantry divisions (33), the rightmost gray wedge portrays the number of Russian troops (466,516). It is impossible to guess how these numbers were translated into these shapes.

A seemingly more conventional display appears on pages 116-7, which illustrates the specifications of nine rifles carried by Allied troops. Figure 3 depicts the American's Springfield rifle. At first glance, this seems to be a conventional bar graph, but on closer inspection, we realize that the top bar denotes weight in pounds, the second the rifle's length in feet, the third muzzle velocity in feet per second, and the bottom bar is effective range (again in feet, but obviously using a different scale than the second bar). Therefore, there can be no meaningful comparisons among the lengths of what seem to be bars in a bar graph.



Figure 2. How do the 33 divisions (leftmost wedge) and the 466,516 troops (rightmost wedge) relate to their graphic representations?



Figure 3. How can you compare the “bars” representing the four statistics of the Springfield rifle? Look closely at the units and then the numbers.

In fact, both Figures 2 and 3 illustrate a common approach: separating the graphic elements to be compared. Figure 2's graph has separate clusters of crystal shapes for German, Polish, and Russian forces. If one wants to know, say, whether the Germans had more infantry divisions in the field than the Poles, one needs to compare the sizes of the reddish wedges in the different clusters. Alternatively, one can simply glance at the small table on page 42, which neatly summarizes all the numbers that become those bewildering shapes on the facing

page. Similarly, if you're wondering whether the Springfield rifle was unusually light or heavy, you must go to each of the other eight graphs on pages 116-17 (and perhaps the six graphs showing Axis rifles on page 115) to learn that it was, in fact, lighter than some and heavier than others. In other words, the decision to separate comparable data into different displays actually makes it harder to make sense of what is being conveyed. Worse than merely producing unnecessary "chartjunk" (Tufte 1983), these choices add "extraneous cognitive load" that makes it harder for readers to comprehend the information being conveyed (Chandler and Sweller 1991).

I could go on, but the point should be clear. Graphs are supposed to present information in a way that makes it easier to understand the data, but this book features a large collection of visual displays that leave the viewer confused. Data that can be presented in simple tables are turned into eye candy—perhaps engaging, but ultimately just empty calories.

The computer revolution has given us ready access to vast amounts of information, but of course there is no guarantee that the information we locate is actually valuable, or that it will be translated into displays that illuminate, rather than confuse.

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