Forbes

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I help people communicate data clearly with graphs.

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A Histogram is NOT a Bar Chart

A reader need go no further than page two of Leland Wilkinson's *The Grammar of Graphics* before reading, "We will also come to realize why a histogram is not a bar chart and why many other graphics that look similar have very different grammars." The figures below show an example of a histogram and a bar chart. Histograms are used to show distributions of variables while bar charts are used to compare variables. Histograms plot quantitative data with ranges of the data grouped into bins or intervals while bar charts plot categorical data. This post expands on these differences and mentions several other differences between histograms and bar charts.

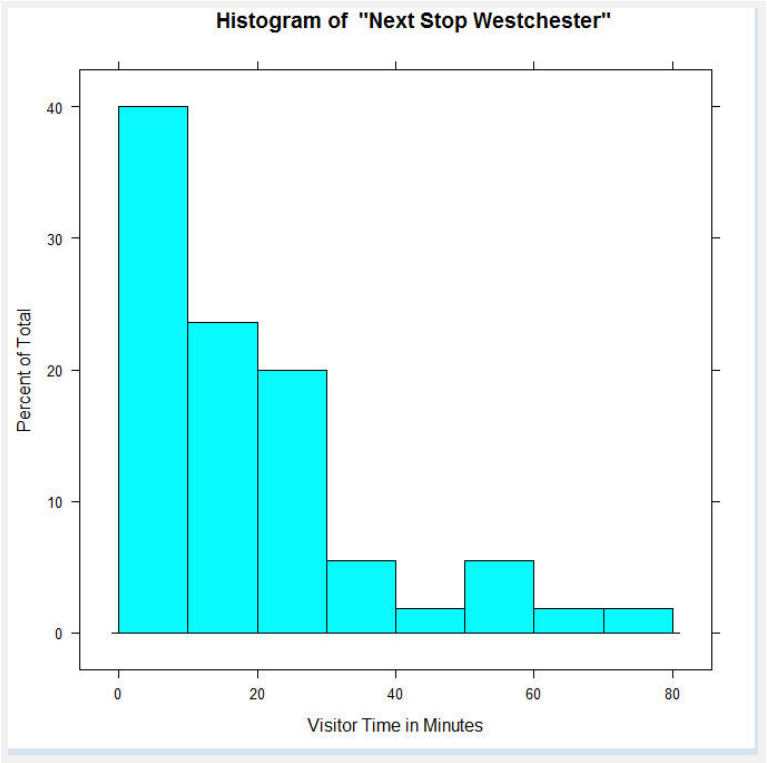

Figure 1. A histogram showing the distribution of times visitors spent at one museum exhibition.

Notice that the horizontal axis of Figure 1 consists of binned times: the first bin includes visits from 0 up to and including ten minutes, the second bin from 10 up to and including 20 minutes, and so on. The vertical axis shows percentages. The area of each bar gives the percentage of all visitors who spent the amount of time shown in the corresponding bin. The sum of all areas

equals 100%. Note that it does not make sense to rearrange the bars of a histogram.

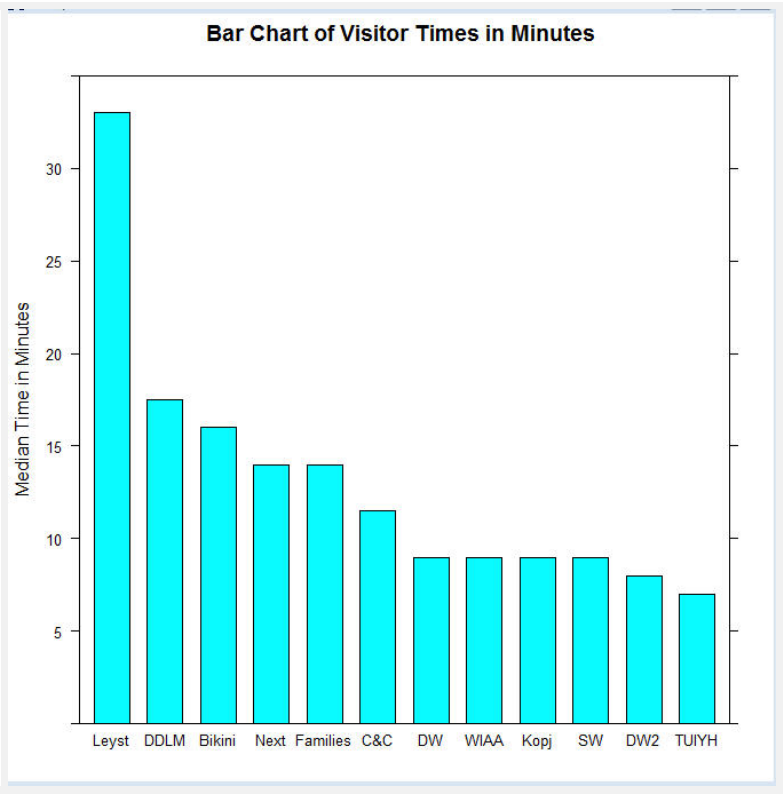

Figure 2. A bar chart comparing the median times visitors stayed at each of 12 museum exhibitions.

The bar chart of Figure 2 compares the median times visitors stayed at each of 12 exhibitions. The variables on the horizontal axis are categorical; they provide the names of the exhibitions. The vertical axis indicates time in minutes. The height of each bar represents the median time for that exhibition. Bars of a bar chart can be rearranged at will. Many graph designers order the variables alphabetically while ordering by size is usually more informative.

So far we have mentioned three differences between histograms and bar charts: histograms are used to show distributions of variables while bar charts are used to compare variables. Histograms plot binned quantitative data while bar charts plot categorical data. Bars can be reordered in bar charts but not in histograms.

Note that there are no spaces between the bars of a histogram since there are no gaps between the bins. An exception would occur if there were no values in a given bin but in that case the value is zero rather than a space. On the other hand, there are spaces between the variables of a bar chart.

The bars of bar charts typically have the same width. The widths of the bars in a histogram need not be the same as long as the total area is one hundred percent if percents are used or the total count if counts are used. Therefore, values in bar charts are given by the length of the bar while values in histograms are given by areas. Wikipedia includes examples of histograms with bars of unequal width such as in Figure 3.

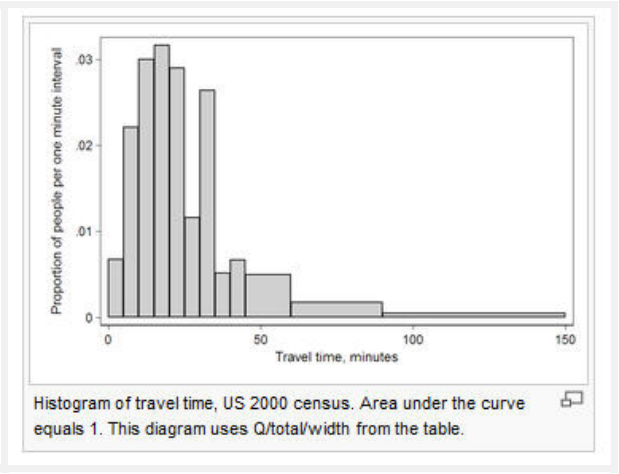

Figure 3. Histogram with unequal width bars. Source: Wikipedia

Bar charts and histograms are introduced before high school. Here is a sample of a lesson for children covering some of the points made in this post.

I used a vertical bar chart, also called a column chart, in Figure 2 to facilitate comparisons with histograms. Otherwise, I would have preferred using a horizontal bar chart to allow room for the full names of the exhibitions. I was forced to abbreviate the names to avoid run-on or slanting labels.

Although histograms are made up of bars, they are not bar charts. Make sure to edit the histogram if your software produces gaps between the bars. Histograms show distributions, bar charts compare categorical values. Next week we will discuss another chart form that is superior to histograms for comparing distributions and provides more information than bar charts do for comparing variables.

The data in Figure 1 and 2 come from the book *Paying Attention: Visitors and Museum Exhibitions* by Beverly Serrell. It includes the times visitors spent at a number of museum exhibitions. Other figures based on these data appear in *Creating More Effective Graphs*.

This article is available online at:
http://www.forbes.com/sites/naomirobbins/2012/01/04/a-histogram-is-not-a-bar-chart/