Style exercise

One major issue of style in which I am interested is creating graphics for technical communication. I will also be focusing on using graphics in service-learning projects for my contribution to our group major project. Graphic design is a field of enormous scope, so for this style exercise I decided to focus on a single aspect: creating graphs and charts.

While not all technical writers will be called upon to create charts from tables of data in their work, they should learn how the design of charts influences how the information presented in perceived. Just as word choice is a rhetorical decision, the selection of how to present data in a chart is, as well. Even if writers do not normally create charts from scratch, they should be able to evaluate good design in order to create better documents.

I've chosen to approach this topic from the perspective of bad design, modeling it after Howard Wainer's book on chart design (especially Chapter 1). I think this approach is more interesting to students; presenting examples of obviously bad charts is inherently at least a bit funny, and holds their attention for what could otherwise be a fairly dry subject. I have also included an activity that requires them to create three different charts from the same table of data. Hands-on practice is never a bad idea, and this shows them that, yes, you can make graphs "say" very different things by using different designs.

While I consider this exercise appropriate for a general technical writing class, it could be adapted for a science writing class as well. For example, in a science writing class, you might want to address the implications of log-transforming data (the graphing exercise I've included includes data that have been log-transformed), while for a more general course I suggest not going into detail about this aspect of chart creation. It would be best for a face-to-face class. This activity could also be modified to discuss rhetorical intentions and ethical implications of chart design, a large subject area in and of itself. I chose to focus on the technical aspects of chart creation for this activity.

How (not) to lie with graphs & charts

Objectives

After this exercise, students should be: 1) familiar with principles of good chart design, and 2) able to create clear charts that emphasize the important relationships between the data.

Mini-Lecture

Since graphs and charts are highly visual, I would suggest introducing the topic with a mini-lecture showing several examples of bad chart design using Powerpoint. Wainer defines good charts this way: "The aim of good data graphics is to display data accurately and clearly" (12). His three suggestions for bad design are: don't show much data, show the data inaccurately, and obfuscate the data (12). The presentation outline could be as follows:

- Don't show much data
    - Minimize "data density", e.g., include a lot of white space, or fill a low-information chart with "chartjunk" (excessive shading, complex fonts and fills, etc.)
    - Minimize the "data/ink ratio", e.g., showing obtrusive grids, "hiding" data by manipulating the scale (zooming far out so that differences between values are obscured)
- Show the data inaccurately
    - Ignoring the visual metaphor, e.g., having bars labeled with numbers that don't correspond to their sizes, changing scales between axes of comparative graphs
    - Representing differences using area or volume, when length is what is being compared
    - Graphing data out of context, e.g., not providing a reference point, or zooming in or out of scale to maximize or minimize differences between values
- Obfuscate the data
    - Changing scales in mid-axis
    - Emphasizing the trivial, e.g., calling attention to fluctuations in data instead of highlighting overall trends
    - Ordering data alphabetically (e.g., instead of by smallest to largest value)
    - Creating ambiguous or incorrect labels
    - Including numbers with several decimal places, or using 3-D graphics

To streamline the presentation, you might want to select charts that have multiple errors, and point out several negative factors for each. After examples of bad charts, you should show examples of good charts (alternatively, show a bad chart, then show a "corrected" version of the same data). Good sources for this material include Wainer (1997) and Tufte (1983). Wainer offers criteria for good chart design: avoid "chartjunk", have a high data/ink ratio, and avoid extra dimensions or "worthless" metaphors (46). His suggestions for good design are: examine the data carefully and present them with little adornment, use "reasonable regularity" when creating scales, and "label clearly and fully" (46).

Activity

In order to give the students practice making charts and give them hands-on experience evaluating the effectiveness of chart types, they do this activity. It should probably be done in

groups of three (one chart per student), in order better manage time. They'll need paper, pencils, and a ruler (or something with a straight edge that will let them draw a line).

Step 1: Give students the following table of data showing death rates among smokers and non-smokers at different ages. The data have been log-transformed; you shouldn't go too into depth about what this means, because this will probably derail the activity. (For a simple explanation, you could say that data are often log-transformed when they are widely scattered, in order to make the resulting graph easier to interpret. This is a standard statistical procedure that doesn't change the relative values of the data. You could also compare it to stylistic choices in prose. It *is* a rhetorical choice, but beyond the scope of this activity.)

Age	**Death rate (smokers) per 10,000 man-years (Log scale)**	**Death rate (nonsmokers) per 10,000 man-years (Log scale)**
42	3.4	2.9
48	4.0	3.3
52	4.5	3.6
58	5.0	4.3
62	5.2	4.5
68	5.7	5.0
72	6.0	5.4
75	-	5.9
78	6.6	6.4
80	6.9	6.3

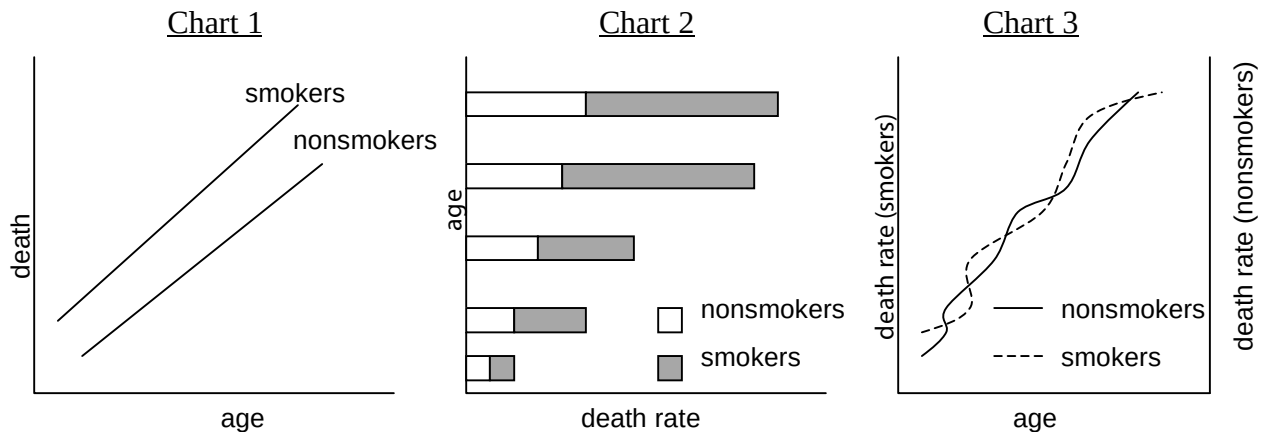
After looking at this table, they should each answer this question:

- What do you think is the most important relationship among the data? *(Should be that smokers always have a higher death rate than nonsmokers.)*

Step 2: Students will create three charts with this data. This part of the activity might take a fair amount of time (15-20 minutes) if students haven't created charts lately. You will probably want to use the chalkboard to sketch out the axes for each of these graphs to model what they should look like. This will help speed up this part of the activity.

1. A line chart of age (x-axis) vs. death rate (y-axis), with the data in two series (they should use circles for smokers and x's for nonsmokers). After plotting the points, they should use their ruler to draw a straight line representing the trend for each series (smokers & nonsmokers).
2. A column chart of death rate (x-axis) vs. age (y-axis), with non-smoking data on the left of each age column and smoking data stacked to the right of it (see example below). They should use different shading to represent smokers vs. nonsmokers, and include a legend.
3. A double y-axis graph, with age as the x-axis, nonsmoking death rate on the left y-axis, and smoking death rate on the right y-axis. The scale on the left y-axis should go from 2 to 7, and the right axis from 3 to 7 (both axes should be the same height). They should use circles for smokers and x's for nonsmokers. After plotting the points, they should draw lines between sequential points for each series (smokers & nonsmokers)- they shouldn't use the ruler for this & the lines will be zig-zaggy.

The charts should look something like this (only include the axes in your demonstration, so as not to "give away" the results):



Step 3: Students should evaluate the charts, using the principles of design they have learned. All three show the same data, but the way the data are presented makes very different rhetorical statements. Some questions you could ask include:

- After charting these data, what do you think is the most important relationship among the data? *(Should be that smokers always have a higher death rate than nonsmokers.)*
- Which of these charts most clearly emphasizes the important relationship between the data? *(# 1)* Which most obviously emphasizes trivial relationships? *(# 2, or possibly 3)*
- Which of these charts clearly manipulates scale to obfuscate the data? *(# 3)*
- If you were creating a chart for a public health agency, which type of chart would you use? Why? What are the ethical implications of your choice?
- If you were creating a chart for a tobacco company, which type of chart would you use? Why? What are the ethical implications of your choice?

Depending on time factors and whether you have asked students to work in groups, it might make sense to have a class discussion at this point. Students would be evaluated on both the accuracy of the charts they've created (this gets at Objective 2) and how well they are able to evaluate chart design (Objective 1).

References

Tufte, Edward. *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press, 1983.

Wainer, Howard. *Visual Revelations: Graphical Tales of Fate and Deception from Napoleon Bonaparte to Ross Perot.* Mahwah, NJ: Lawrence Erlbaum and Associates, 1997.