Displaying Data in Written Documents

A Resource from the Cain Project in Engineering and Professional Communication

All graphics, from simple tables to complex histograms, function best when are organized to highlight and make obvious the results that you are reporting. While your figure or table needs to be able to stand alone (many readers skim the figures in a document to determine whether the rest of the document is worth reading), it also needs to be explained and contextualized in the text. It's in this discussion that you assign meaning to the results, helping readers understand why your results matter.

A few rules apply to all graphics used in a document:

- Number each graphic and include an informative caption that tells readers what they are looking at. In reports, tables are usually captioned above the table (*Table 1. Xxxx.*), while figures are captioned below the figure (*Figure 5. Xxxxx*.).
- Identify graphics correctly. Tables are "tables." Everything else (graph, photo, etc.) is a "figure."
- Refer to graphics in the text, either in the sentence itself (*Table 2 shows…*) or within parentheses [*Apoptosis occurred in 50% of the samples (Figure 2)*.] Introduce figures in text before the reader sees them and include discussion of figures and tables after the graphics appear.
- Think logically about labels and data display. Most readers can't decipher more than four trendline symbols or other abbreviations to indicate your data. Use logical labels or mnemonic abbreviations to aid in comprehension.
- Bigger is better. Be sure that your captions, data points, labels, etc., are readable.
- Place graphics close to the text discussing them for easy reference (unless otherwise specified by a journal or other publication).
- Design graphics for black-and-white printers and photocopiers, even if you will ultimately produce the graphic in color.

Tables

Best for:	Organizing verbal and numeric data. Reference
Not so good for:	Quick overviews Communicating trends

Design tips

- Place units in column headings.
- Minimize or omit gridlines. For multi-line entries or to aid readability, choose narrow or gray lines to delineate data.
- Organize data according to reader expectations. Most readers can more easily compare columns than rows. Western readers also expect to find known information on the left and unknown information on the right.

Line graphs

Best for:	Showing trends or relationships Displaying dense data too busy for a scatter plot Displaying data with evenly distributed x-axis values
Not so good for:	Showing precise data values

Design tips

- Place units in axes labels.
- Use consistent axes and labels for similar data types unless you are specifically trying to call attention to a different relationship or trend in a data set.
- Consider placing tick marks inside graph lines and using axes on the right and top to assist readers in locating specific data points, such as spectral peaks.
- For publication, label specific data points of interest, such as spectral peaks, within the graph.
- If you have multiple lines plotted in your graph, use a key to label them. Place the key in or near the graph for ready reference.

Scatterplots

Best for:	Identifying non-linear relationships Identifying clusters and outliers (out-of-range points) Displaying data with irregularly spaced x-axis values
Not so good for:	Showing precise data values

Design tips: Same as for line graphs.

Bar graphs

Best for:	Plotting categorical data (e.g., species, regions, oceans) that cannot be plotted on line graphs Comparing proportions, amounts, values Displaying data sets that are close together in value (which would overlap in line graphs)
Not so good for:	Showing precise data values

Design tips

- Place units in axes labels
- Spacing between bars should be half the size of bars
- Avoid 3D effects or shading, which can distort readability

Histograms

Best for:	Assessing the shape of a distribution Screening outliers or checking normality

Not so good for: Showing precise data values (histograms are constructed from frequency tables and often group data into categories)

Design tips

- Place midpoints of intervals on horizontal axis
- Place frequencies on vertical axis
- Bars should touch one another (unlike bar graphs)
- Use only with continuous data

Frequency Polygons

Best for: Showing counts/frequency in a visually appealing way
Showing distribution for two sets of data (less cluttered than a histogram)
Not so good for: Showing precise data values (like histograms, frequency polygons are constructed from frequency tables)

Design tips

- Follow tips for histograms
- Use a point (instead of histogram bar) and connect the points with straight lines
- If desired, shade area underneath the line

Pie Charts

Best for: Showing percentages
Not so good for: Most types of data display

Design tips

- Most pie charts are superfluous. They are most useful for showing population distributions, budget allocations, and other percentage-related data.
- Avoid 3D effects or shading, which can distort readability