How to produce a Figure

Where does it fit? – A figure is often included in results and discussion sections to convey specific data in a meaningful way, though they can be included in other sections as appropriate.

Before writing – Determine whether a figure is the best method to convey data and its intended message; this requires thoughtful examination of the data and the purpose of presenting the data. Sometimes data can be presented in a single sentence or two, in which case neither a figure nor table is necessary. Other times data is best presented in a table, in which case instructions for producing a table should be followed. Often, a figure is the best method to convey data that supplements the text but does not duplicate it. Graphs are best used to demonstrate trends or patterns in relationships between different variables from models, measurements, and other data. Other figure types, such as a graphic, diagram, or schematic, can be used to illustrate a concept. One can also use images, pictures, and maps to convey visual evidence of a certain phenomenon. One must first determine which type of figure best conveys the intended message.

In preparation for writing, create a draft figure according to the following steps

Graph:

1. Collect all the data that may be presented in the graph.
2. Identify the variables and combinations thereof and create a graph, or multiple graphs, to determine what trend or pattern the data and graph convey.
3. Analyze the trend, pattern or lack thereof so you can write about what the meaning of the data.
4. Plot the independent variable data on the *x-axis* and the dependent variable data on the *y-axis*.
    a. Use different symbols for different data sets.
    b. Markers should be used for experimental or discrete data; do not connect the data points with lines.
    c. Include error bars on data where it is available.
    d. Lines (solid or dashed) should only be used if the data to be plotted is continuous or is part of a theoretical model.
    e. Note that these instructions only apply to plotting the data; annotations and trend line instructions are included below.

Graphic:

1. Determine what message, concept, or idea needs to be communicated.
2. Brainstorm and create various graphics, diagrams, or schematics.
3. Analyze the various graphics to determine if any is able to help convey the intended idea.

Image:

1. Examine the set of available images, pictures, or maps to discern what can be learned from the available evidence.
2. Select an image, or reduced set of images, that most efficiently convey the intended idea.

While writing – To produce a high quality figure that supplements the text, the figure should be created or finalized as part of the writing process. This ensures that the text and figure work together to convey the intended message. Once you are sure that the figure supplements the written text, finalize and format the figure with the following:

- Format **axes**

    - Add appropriate **labels** to each axis and include units if the variables have dimensions (i.e. m, m/s, N, °, etc.)
    - Ensure that axes limits are scaled to include the range of the data, with the data extending over the majority of the range.
- Add a **caption** (sometimes called titles or legends) below the figure. This should start with the word Figure, followed by a figure number that references the order in which the figure appears, as referenced from the main text. This should be followed by a descriptive statement that aids in the interpretation of the figure and provides a complete description of what is included in the figure.
- Include a **key**, sometimes called a legend, to delineate different cases, plotted with different symbols. The key can be above, to the side, below, or inside of the figure.
- As appropriate, **annotate** the figure with text, arrows, and/or in the case of graphs, adding trendlines or other theoretical analysis lines on top of next to plotted data, to aid in the interpretation of the figure and its intended message.
- **Format** the figure according to the requirements of the venue. Most venues require formatting similar to the following:
    - The figure must be of high quality and should have resolutions of 150-600 dpi, that ensure that lines are sharp and images and other features are not pixelated.
    - Overall sizes of graphs may vary, but generally half a page or smaller is appropriate (width of 6.5" or smaller with the height scaled appropriately for visual appeal).
    - Font sizes should be sufficiently large that an average reader does not have trouble reading the text (don't shrink graphs or other images and expect people to read small text).
    - Marker and line sizes and colors, etc. are all chosen to make figures easy to read

After writing – Check to make sure that the main text and figure work together to convey the intended message. Check to see that the figure conveys the message as clearly and simply as possible; do not unnecessarily complicate the figure or include items that are not needed. Check to make sure the figure is referenced in the main text; figures should not be included if they are not referenced in the text. Place the figure in a location in the document that is near the first time it is referenced. Consider your reader and the readability of the document; be careful about interrupting the flow of your document.

Additional instructions can be found at the following resources:
http://abacus.bates.edu/~ganderso/biology/resources/writing/HTWtablefigs.html

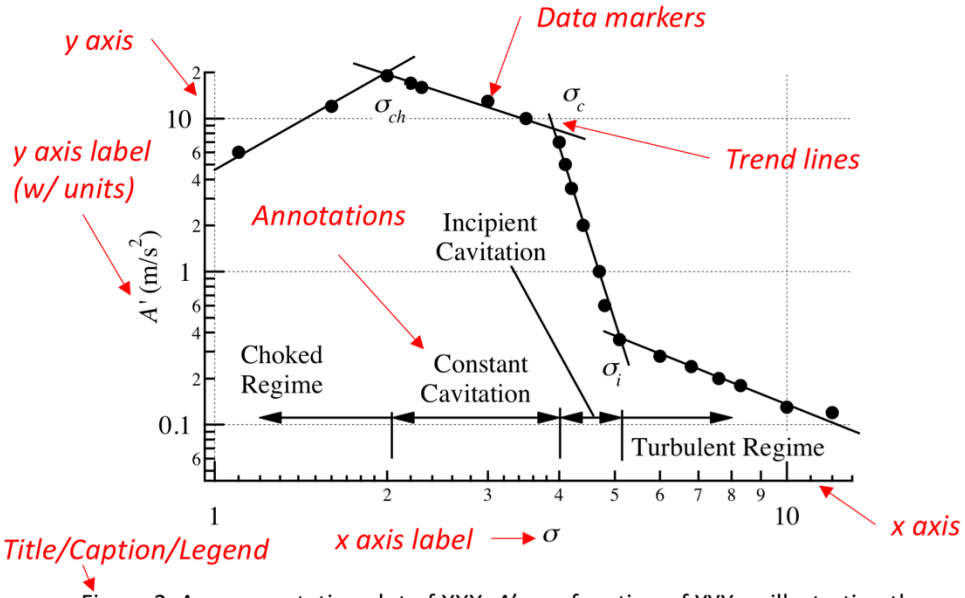

Figure 2. A representative plot of XXX, *A'* as a function of YYY, σ, illustrating the four different cavitation regimes described in the text. Markers represent data from the present study and solid lines represent trend lines for the respective cavitation regimes shown, with the intersection points of the lines corresponding to the critical cavitation number values discussed in the text.

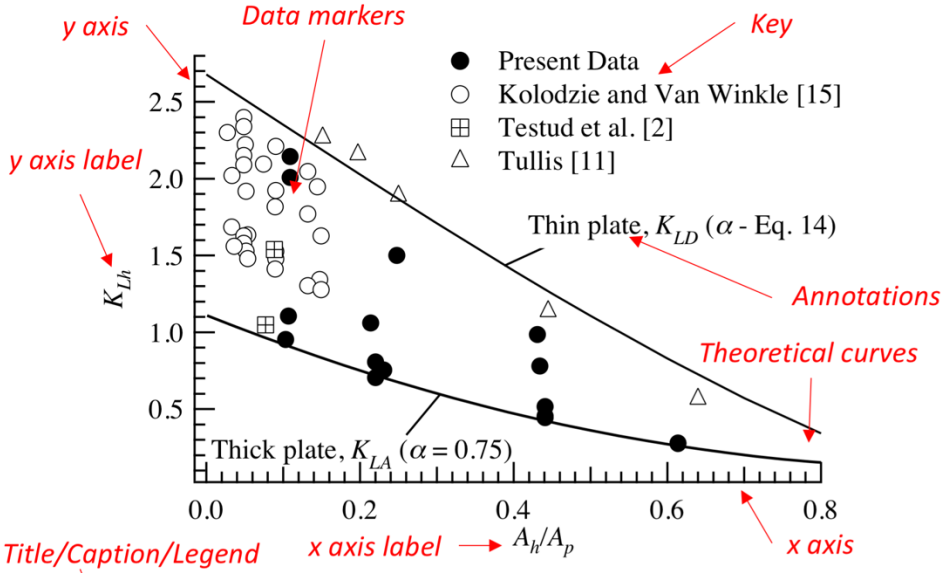

Figure 8. Loss coefficient, K_{Lh}, vs. the total through area ratio, A_h/A_p, for 16 perforated plates. Included are solid lines corresponding to the theoretical attached model, K_{LA}, and a theoretical detached model, K_{LD} predictions. Data from Kolodzie and Van Winkle [15], Testud et al. [2], and Tullis [11] are also included for comparison.