

# Preparing Figures for Scientific Presentations and Papers

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**Data** learning



Once your statistical analyses are complete, you will need to summarize the data and results for presentation to your readers

**Data summaries may take one of 3 forms:**

- Text

Some simple results are best stated in a single sentence, with data summarized parenthetically, e.g.:

“Seed production was higher for plants in the full-sun treatment ( $52.3 \pm 6.8$  seeds) than for those receiving filtered light ( $14.7 \pm 3.2$  seeds,  $t=11.8$ ,  $df=55$ ,  $p<0.001$ )”

- Tables

Tables present lists of numbers or text in columns, each column having a title or label

- Figures

Figures are visual presentations of results, including graphs, diagrams, photos, drawings, schematics, maps, etc.

Graphs are the most common type of figure

# Parts of a Graph

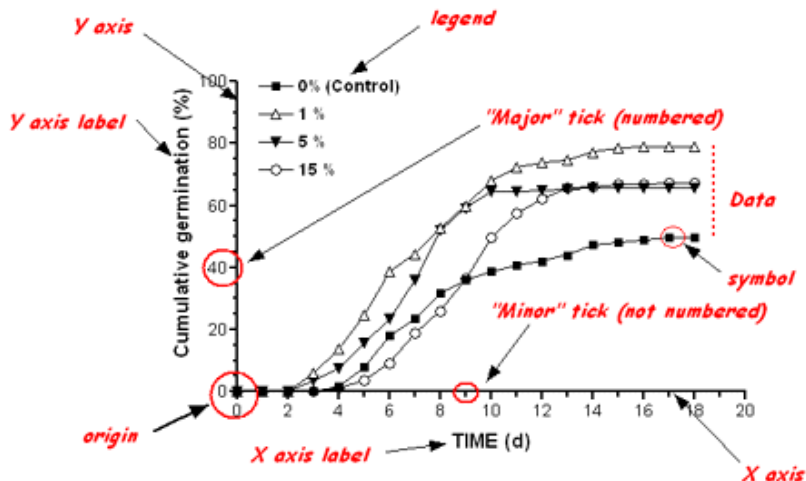


Figure 1. Cumulative germination of *Chenopodium* seeds after pregermination treatment of 2 day soak in NaCl solutions. n = 1 trial per treatment group (100 seeds/trial.)

# What is a Good Figure?

Any figure you present must be sufficiently clear, well-labeled, and described by its caption to be understood by your intended audience **without reading the paper, i.e., it must be able to stand alone and be interpretable**

Overly complicated figures may be difficult to understand in or out of context, so **strive for simplicity** whenever possible

## Features of a good figure:

- **Clarity**
  - Lack of ambiguity and confusion
- **Precision**
  - Truthful results
  - Distortion-free presentation
- **Efficiency**
  - Minimal “chartjunk”

A clear and complete **caption** is essential. Like the title of the paper itself, each caption should convey **as much information as possible about what the figure is aimed to show**

**A good caption must tell about:**

- what results are being shown in the graph(s) including the summary statistics plotted
- context for the results: e.g. the treatment applied or the relationship displayed, etc.
- specific explanatory information needed to interpret the results shown
- parameters or conditions of the experiment (temperature, media, etc.)
- sample sizes and statistical test summaries

**Figure 1.** Height frequency (%) of White Pines (*Pinus strobus*) in the Thorncrag Bird Sanctuary, Lewiston, Maine, before and after the Ice Storm of '98. Before,  $n=137$ , after,  $n=133$ . Four trees fell during the storm and were excluded from the post-storm survey.

**Figure 2.** Accuracy of the SVM model applied to the UK dataset. (A) Accuracy, specificity, and sensitivity of the UK model based on the  $PV > 10$  calculated over 100 cross-validation runs. Accuracy is the total accuracy of the model, which was 89%. (B) Accuracy, specificity, and sensitivity of the UK model based on the  $PV > 20$  calculated over 100 cross-validation runs. Accuracy is the total accuracy of the model, which was 86%. (C) ROC curves. The UK dataset was divided and each one-sixth was tested independently based on the training of the remaining five-sixths of the data. The area under the curve (AUC) value is plotted above each test subset.

# Formatting Figures. Figure Size and Font Size

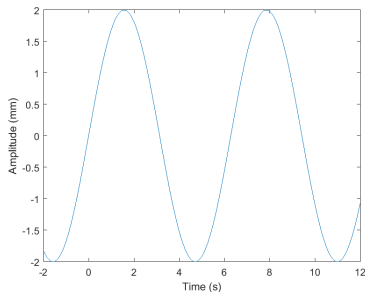
- **Figure size**

A figure shouldn't use more space than necessary

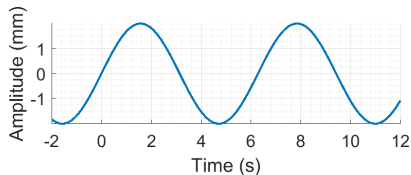
- **Axes font size**

Font size of axes and labels should be comparable to the font size of the main text in the paper

**Wrong**



**Good**



# Formatting Figures. Line Style and Markers

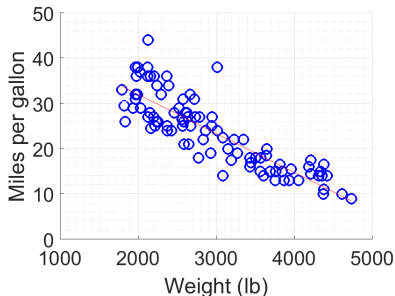
- Line Style

Lines should be sufficiently thick

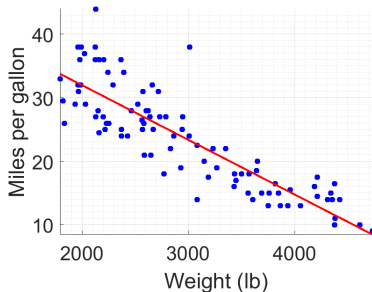
- Markers

Be careful when using markers: they must not hide informations (do not cover important pieces of the graph)

**Wrong**



**Good**



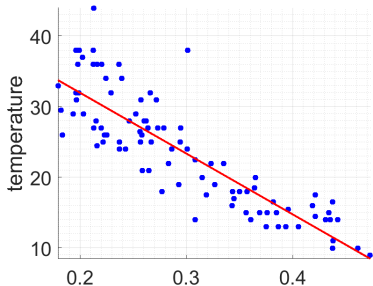


# Formatting Figures. Labels

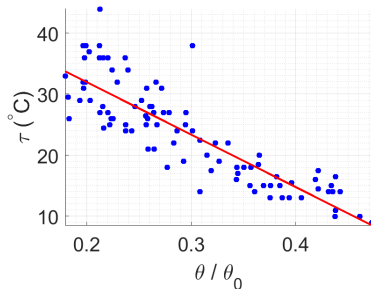
- Labels

- First letter of labels should be capitalized
- Units should be specified in parentheses
- Use  $\text{\LaTeX}$  symbols in labels
- Take care about labels font size

Wrong



Good

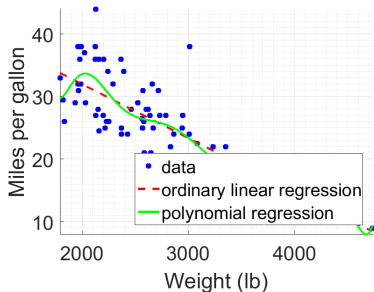


# Formatting Figures. Legends

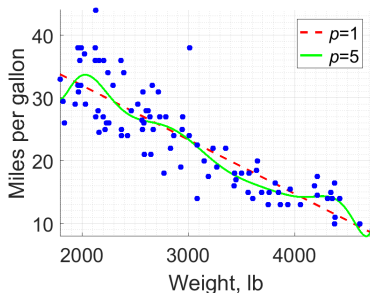
- **Legends**

- Symbols and shapes used in graph can be identified in the legend or in the caption
- Legends should be located so as to do not cover important pieces of the graph
- Use  $\text{\LaTeX}$  symbols in legend
- Take care about legend font size

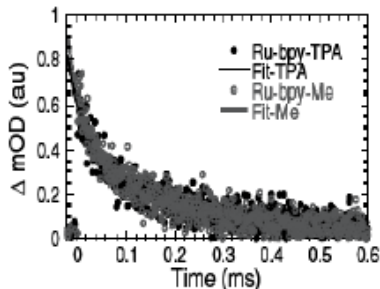
**Wrong**



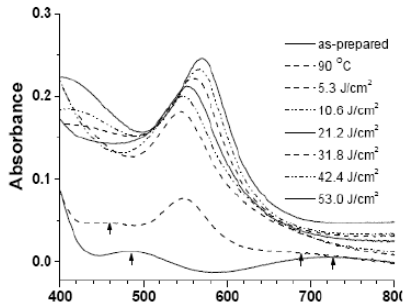
**Good**



## Wrong Figures. Examples

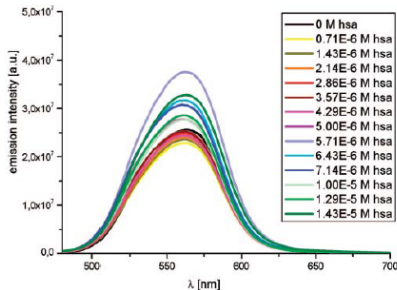


Can you see Fit-TPA and Fit-Me curves?

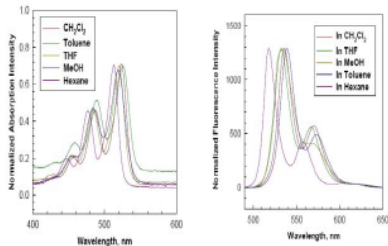


Can you distinguish these curves?

# Wrong Figures. Examples

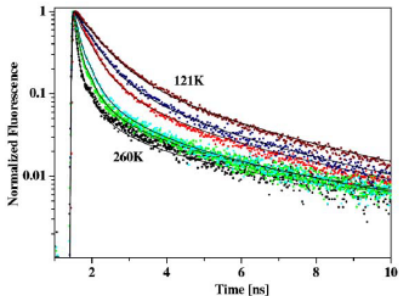


Similar looking colors, too many curves on the graph

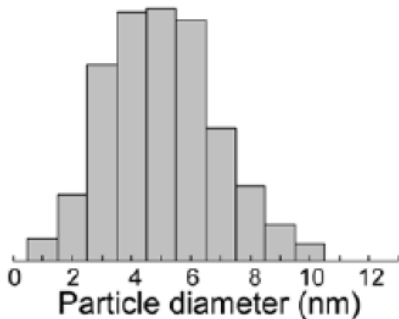


Can you read legend or labels and identify the curves?

# Wrong Figures. Examples

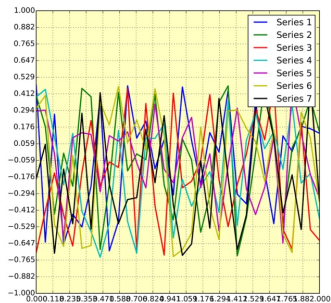


What is the significance of colors?



Y-axis is missing

# Wrong Figures. Examples



Chartjunk

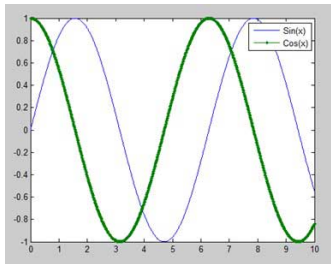


Figure contains window-specific gray border

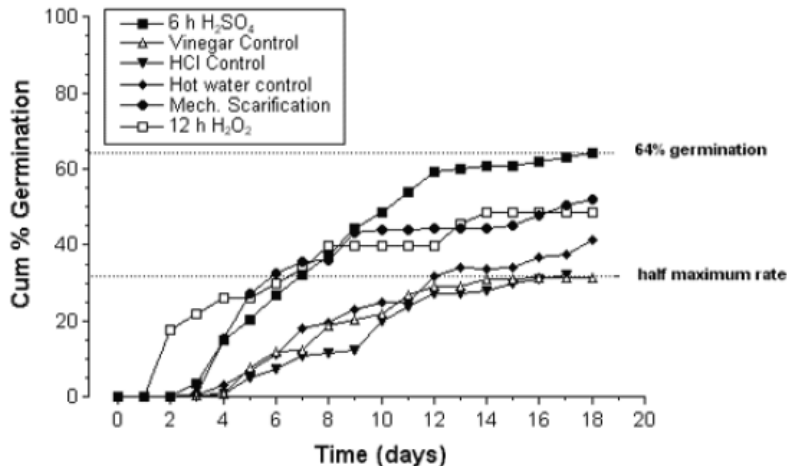


Figure 2. Cumulative germination of gourd seeds following various pregermination treatments.  $n = 100$  seeds per trial.

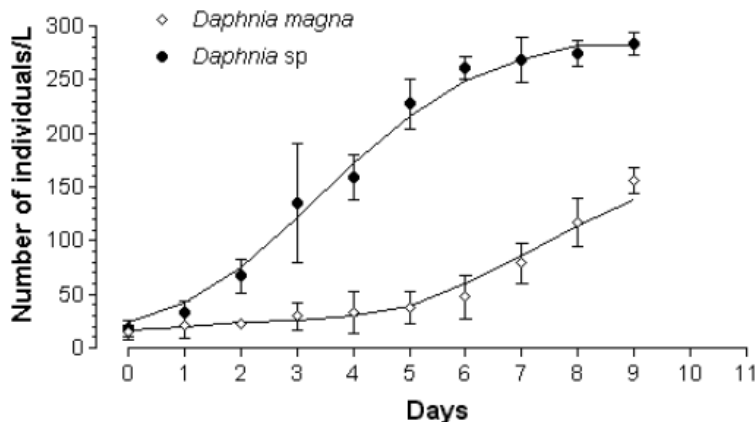


Figure 2. Mean population density ( $\pm 1$  standard deviation) of two species of *Daphnia* following artificial eutrophication of a small farm pond by application of organic fertilizer. Six replicate 1 L water samples were drawn from 50 cm depth at 1100 hr each day.



- **Captions are not optional.** The caption explains how to read the figure and provides additional precision for what cannot be graphically represented
- Choose **proper type of graphical representation** (e.g. XY line plot, bar, scatter plot, etc.)
- **Don't use a title for figures included in a paper**; the legend conveys all the necessary information and the title just takes up extra space. However, a larger font title can be used **for posters or projected images**
- Bolding all characters in graph often makes it more difficult to read. **Use bolding in graph only for emphasis**
- **Use color effectively.** Avoid colors that don't reproduce well (dark backgrounds, yellow or other light colors)
- **Avoid chartjunk** (e.g. use of too many colors, too many labels, confusing visual elements, useless grid lines, etc.)

- Tufte, E. R., Schmieg, G. M. (1985). The visual display of quantitative information. American Journal of Physics, 53(11), 1117-1118.
- Tufte, E. R., Robins, D. (1997). Visual explanations.
- Rougier, N. P., Droettboom, M., Bourne, P. E. (2014). Ten simple rules for better figures. PLoS computational biology, 10(9), e1003833.
- Okabe, M., Ito, K. (2002). How to make figures and presentations that are friendly to color blind people. University of Tokyo.
- Gustavii, B. (2017). How to write and illustrate a scientific paper. Cambridge University Press.