In-Class Work: Figures for Scientific Paper & Talk

1. Graphical Information:

I will start with a general introduction to graphical information and its importance in academia and beyond. I will use slides of Prof. Ibrahim Sulai, who gave a presentation on graphical information in Phys 310 (see link on our webpage). Prof. I. Sulai is summarizing in his slides the book by Edward R. Tufte, "The Visual Display of Quantitative Information," 2nd ed. (Graphics Press, Cheshire, Connecticut, 2018). Meanwhile Edward Tufte has published further books on graphical information, the newest is called "Beautiful Evidence."

2. Figure-Requirements: Practice Example

I will walk you through a set of tools how to use xmgrace to fullfill the following list of requirements for figures for scientific papers and talks. I will show you the main tools using the following data (of the driven damped pendulum mini-projects II)

```
~kvollmay/share.dir/inclass2021.dir/out7_A1.049.dat
~kvollmay/share.dir/inclass2021.dir/out9_bifurc_th0omega19.dat
```

Copy either one of your main project results or the above data into your working directory. (However, ensure not to overwrite your own data of the mini-project II.)

Mini-Intro to Xmgrace:

Some of the following commands you have already used. They are here included to provide you with a complete set of xmgrace tools.

• To get started with xmgrace type on the command line `xmgrace &`. To pull in a dataset use `Data` → `Import` → `ASCII` and under Selection add `out7_A1.049.dat` then click `OK`.
Or alternative is to type in the terminal window (on the command line)
`xmgrace out7_A1.049.dat`
To pull in several data sets you would list them on the commandline (separated by spaces).

• I will show to you below several commands within xmgrace. To save an xmgrace session, you use within xmgrace `File` → `Save As` (Note: When you save for the first time, it is important that you use `Save As` instead of `Save`, because the latter overwrites the datafile.) and add to the end of the Selection directory the xmgrace-file name, which should end with `.xmgr`, e.g. `out7_A1.049.dat.xmgr`
To open a previously saved xmgr-file, you either use on the command line `xmgrace out7_A1.049.dat.xmgr` (or replace the according xmgrace-filename), or you use `xmgrace &` and then `File` → `Open` and edit again in the Selection section.

• To make an eps-file, use within xmgrace `File` → `Print setup` and change PostScript to `EPS` and give the filename (it should end with .eps), or if you had saved the xmgr-file before, then already the same name with the .eps ending is suggested. This only sets up the printing, to get the eps-file printed use `File` → `Print`.

Requirements for Figures:

In the following I will comment on the following requirements for scientific figures and I will show you how to fullfill these requirements when using xmgrace.

- no title
- axes:
  - label axes (large enough, neat font-tools via clicks and via commands, location of axis label)
  - axis width thick enough
  - number of tick marks large enough
  - tick label size large enough
  - tick marks width and size large enough
  - choose wanted x-range and y-range (main features visible)
- legend (or equivalent with labels) large enough and each set should be labeled (or clear trend of which parameter was varied and in which range) and should not cover data
- label for major parameter large enough (in talk in figure, in paper if not in figure then in figure caption)
- symbols large enough and distinguishable and lines thick enough and distiguishable (keep in mind potential color blind person in audience) and in case of error bars thick enough error bars (labeled: see legend)
- in paper figure caption for each figure (should include all used parameters)

Further xmgrace-tools:

- extra cool fonts: italics, greek, boldface, superscript, shift (switch to italics with `\f{1}` ,to greek with `\x`, to boldface with `\f{2}`, back to default of roman with `\f{0}`, to get superscript `\S` and back to normal `\N` and to subscript with `\s` and to horizontally shift use `\h{0.4}` and vertically `\v{0.3}` where you adjust the amount of shifting by changing 0.4 and 0.3)
- position & size of figure (so that in paper no white frame)
- storing info in file.xmgr (highly recommended)
- printing eps-file (prepare and print; and epstopdf)
- pull in further data-set via block-data
- how to recycle figure via deleting data and replacing with new data or via change of xmgr-file
- arrows and labels etc. (drawing objects)

- symbols: filled and open symbols
- if time: insets
- (not xmgrace but useful: keep logfile for how you made data and where they are)

3. Your Figures

For the rest of the class work on the figures for the result section of your second paper. Please ask if you need any further tools, because I could show you several further xmgrace-tools. Also please ask in case you would like to discuss further ideas for your main project analysis.