Writing Advice

The purpose of this document is to provide some advice about writing scientific/engineering research papers. In this class, I expect that you have some experience with technical writing from undergraduate projects, courses, or even your research. In addition, you need to be sufficiently accomplished in the English language to feel comfortable writing a detailed technical article, as well as how to structure or organize a paper into logical sections. Even armed with this background, I find that students' early research papers often contain small mistakes that make the paper seem sloppy or unprofessional. More importantly, sometimes the writing is not sufficiently clear or coherent to allow a reviewer to understand the technical content. This is not just a language issue – the writing should reflect your clear thinking. Even though the writing may not be representative of the quality of the research, poor grammar and lack of clarity can call into question the validity of the technical aspects of the work. It is difficult for a reviewer of a conference or journal paper to separate the writing from the work itself, so it is important for your technical writing to be up to the high standards of your research. So, here are a number of small (and large) pieces of advice that you should keep in mind when writing future papers.

Writing tips and common mistakes
(some of these are Allison-specific; your research advisor may disagree)

• Parallel ideas should be discussed in parallel sentence structures to make it easier for the reader to follow and compare/contrast. Keep a consistent order (of topics of conditions that you address in different parts of a paper, in figures, captions, etc.) and a consistent point of view (in sentence structure).
• Use consistent terms to describe the same thing. Don't get too creative – repeating the same key terms will help the reader follow the work.
• Signal the research question in your abstract, e.g. "The purpose of this study was to…"
• Grammar and spelling should be impeccable.
• Include the results (not just the process) of the research in the abstract.
• Be consistent with capitalizations and abbreviations throughout your paper. For example, if you use "Fig." in the text, don't also use "Figure".
• Define acronyms on first use.
• Explain everything as clearly as possible. Usually you have more text in first draft and then the text shrinks as you refine.
• Make sure section breaks fall in good places. For example, you don't want a section title to be at the bottom of one page and the text to start on the next page.
• Don't be sloppy with references. Make sure you are consistent with style, abbreviations, etc. Always include complete citation information for your references. Most conference publications have page numbers; don't leave them out.
• Be sure to follow the paper formatting guidelines for the conference or journal.
• Put only one space at the beginning of each sentence. Two spaces are only needed for monospaced fonts, such as Courier. See http://www.webword.com/reports/period.html if you don't believe me. Incidentally, programs like Latex and Word will automatically make the space at the beginning of a sentence a little bit larger – although not as large as two full spaces.

• Use hyphens correctly. Correct: two-degree-of-freedom teleoperation; my robot has two degrees of freedom, minimally invasive surgery, force-feedback device, I love force feedback. Incorrect: two degree of freedom teleoperation; my robot has two degrees-of-freedom, minimally-invasive surgery, force feedback device, I love force-feedback. (For a review of the use of the hyphen, see http://owl.english.purdue.edu/owl/resource/576/01/.)

• If describing a paper with more than three authors, use "Okamura, et al. [1]". Make sure not to use "et. al", et. al." or "et al". Also, if the paper has two authors, just list both their names: "Okamura and Su [2]". When using "et al.", you can put it in italics or not, and you can put a comma after the author name or not. I don't really care as long as you are consistent and you put the period in the right place. (Some publishers do have rules about this.)

• When making a numbered list in a paragraph, consider the numbers as parentheticals and separate using commas. You can use semicolons if there are already a lot of commas in the text. For example "The graduate student took a number of steps to efficiently complete his thesis: (1) He consistently published his work in conferences; (2) He kept up to date with the literature in conferences, journals, and magazines; and (3) He wrote a journal paper for each chapter." Do not use "1." or "1)"

• When there is plenty of space, you can also use real lists, with a separate line for each numbered item. (Or bulleted item if it is a list in which the order does not matter.) In this case I am okay with "1.", but I still dislike "1)"

• I generally prefer to reference equations as "Equation 1" or "Equation (1)", rather than just "(1)". But this isn't a big deal to me.

• For a list of three or more things, put a comma before the "and". For example: "I like running, backpacking, and playing hockey."

• Use "use" rather than "utilize". Why use a longer word when a shorter one will do?

• Be sure you are using the correct one: principle vs. principal, effect vs. affect, etc.

• Data is generally plural.

• I like to include equations as part of the grammar of the text. This means that there may be commas, periods, etc. after equations -- even if they are not inline with the paragraph text.

• Avoid footnotes.

• I.e. means "in other words". E.g. means "for example". (My mnemonic is "for eggsample".)

• Make sure your paper prints out clearly, with all text (and figures), equations, and tables clearly legible.

• Often your advisor will cover a first paper draft you have written with red ink. Don't be offended – he or she is trying to help you to write well. If your advisor edits your paper electronically, be sure to go back and see what he/she changed. Otherwise, you won't learn…
Figures

- I'm very picky about figures. Straight lines should be perfectly straight. Angles should be exact. They should be neat, as simple as possible, and elegant. One way to make nice line drawings of real-world objects (such as the hand) is to take a digital picture, import it into a vector graphics program such as Adobe Illustrator, Inkscape, or Corel draw, and trace over it. Learn how to use Photoshop or a similar program to adjust contrast or remove background from images.
- Use schematics instead of or in addition to photographic images when possible. Sometimes a nice drawing is better than a photograph.
- Label components in a schematic or image, unless it is completely clear to the naive reader what is shown in the figure.
- Plots: Usually, a plot generated using Excel or Matlab will be created by default with a gray background or border. Modify this before exporting to a file format suitable for insertion into your paper. Often, an Excel or Matlab plot will need to be imported into a drawing program such as Adobe Illustrator to be edited by hand to make it look right. Include units on axis labels in parentheses.
- Use detailed captions for figures. Often when people read papers, they read the abstract and then flip through to look at the figures and captions. Don't use generic captions like "Experimental setup", "System", "Plot of velocity vs. time". Rather, your caption should tell the reader what is interesting about the figure. For example, what will the reader learn by examining the figure?
- A classic figure caption format is for the first "sentence" in the caption to not really be a sentence, but more like a long title. For example, use "Experimental setup for measurement of tissue stiffness." and then follow up with the details, e.g. "A robot is used to place a probe on the tissue surface and indent several millimeters, then displacement and force data are recorded."
- Place figures near but after the text that references the figure. I usually like to place all figures at the top or bottom of the page (not in the middle). I think it makes the paper look much neater and easy to follow.
- Figures can be made larger or smaller to help you get the flow of the document right (e.g., not have section breaks in awkward places) and to get the paper within page limits.

Oh no, your paper exceeds the maximum number of pages allowed! What do you do??
Notes specific to LaTeX

- When using LaTeX, if you use a period for a reason other than the end of a sentence, add a "\" after it to prevent it from spacing as if it was the beginning of a sentence. For example: "Dr.\Okamura", "e. g.\", and "et al."
- Often, you will not want non-single-letter subscripts (like "friction" in f_{friction}) and regular text (like "if", "and", or "otherwise") italicized within the math environment of LaTeX. To prevent this text from being italicized, there are several ways to this, depending on your LaTeX compiler. You can wrap the text in \text{*}, \text{rm *}, or other commands I don't remember...
- Whenever possible, use vector graphics for text and line drawings. This way they will always have the highest resolution possible when scaled.

Notes specific to Microsoft Word

- While I prefer LaTeX, Word can be especially useful for collaborations on a single document, due to the "track changes" feature.
- For figures, create a textbox. Then convert to a frame. Paste the image into the frame, and set its layout to "inline". Add the caption text in the frame below the image. Remove the border from the frame. In the frame settings, it usually helps to lock the anchor and uncheck the "move with text" box. If the frame needs to be moved to a new page, it can be cut and pasted.
- You can use a program like EndNote to help you keep track of your references.
- You can use MS Word features to automatically number figures and figure references. Same for sections and equations.

Resources for writing papers

(I don't agree with everything in here, but it is interesting nonetheless. For example, I actually like to write the abstract first. It helps me identify the most essential points I want to make, to keep in mind throughout the paper.)

Resources for reviewers (it is also good to think about the reviewer's perspective!)


Cartoons (not real advice!) from http://www.phdcomics.com/