

Some pointers for clear scientific writing

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I went to Grinnell College. I wrote papers regularly for every class I took, including classes in math and science. My professors marked my papers without mercy, correcting grammar, style, punctuation, and usage. Learning to write clearly and efficiently was the most important outcome of my undergraduate education. It is how I have earned my living ever since.

I will critique your lab reports in a similar way. Reviewing students' dissertations, theses, and reports in the past required marking the same errors over and over again. I decided I could save myself a lot of effort and you a lot of red ink if I were to identify where students frequently go wrong. I will cover those shared mistakes specifically. I will then offer some general recommendations for improving your writing.

1 The common errors

1.1 Excessive use of leading dependent clauses

Graduate students are excessively fond of sentences that read something like this:

“Although there are differences in soil water among study areas, their most important similarity is vegetative cover.”

This is an example of a dependent clause that leads a sentence, an almost certain way to weaken it. It puts the most important idea in the back seat, obscured by the less important idea. Try this instead:

“Study areas were similar in vegetative cover, although there were difference in soil water among them.”

I have read documents written by students where *every* sentence in a long paragraph announced itself with a dependent clause. Used sparingly, these can be useful by changing the cadence of your writing, preventing a monotonous tone. Limit yourself to no more than one per paragraph and no more than two per page.

1.2 Excessive use of,

I think students use dependent clauses because someone told them that these constructions improve “flow” in their writing. This was probably the same person who told them to link sentences with “However, ...”, “Alternatively...”, “Moreover,...”, “In contrast....”, and my all time worst favorite “Not only.....”. Initiating sentences this way can be effective if done occasionally. I have read papers that had 13 of these opening shots in a sequence of sentences. Ugh.

1.3 Excessive use of unfamiliar abbreviations

Students often abbreviate words in a vain effort to make their writing more compact. For example,

“Different subpopulations of fallow deer in Point Reyes National Seashore (PRNS) were treated with silastic implants containing levonorgestrol (SIL) or with injections of medroxyprogesterone acetate (MPA).”

Unfamiliar abbreviations are false economy. The reader soon requires a glossary to penetrate the paper. Irritation results. Here is some good advice: don’t irritate reviewers of your proposals and papers. Familiar abbreviations are fine, for example, DNA, ANPP, MCMC, AIC etc. What is familiar, of course, depends on your audience.

1.4 Using nouns as adjectives

Another false economy results from cramming nouns together, forcing them against their will to be adjectives. The only thing this saves is an occasional preposition. For example, avoid impenetrable constructions like “invasive plant management procedures.” Use “procedures for managing invasive plants” instead.

1.5 Excessive use of the passive voice

Someone started the rumor that good scientific writing must use the passive voice, favoring

“The data were analyzed using a Bayesian hierarchical approach.”

over

“We analyzed the data using a Bayesian hierarchical approach.”

The later is almost always better. I tend to mix passive and active voices in my papers and proposals simply because doing so creates welcome variety.

1.6 Sentences of the same length

Readable paragraphs are composed of sentences that vary in length, some short, some long. I often dissect long sentences during revision to achieve a varied tempo in my prose.

1.7 Emphasis by font

I frequently read proposals, sometimes papers, where the author wants to call my attention to important points by italicizing them or bolding them or bolding and italicizing. Underlining also appears for this purpose. For example.

“The proposed work will *transform* the field of population ecology by developing ***new methods for identifying individual animals using DNA in feces.***”

An occasional (very occasional) use of italics can be effective but excessive use is a sure way to create a shrill tone in your writing. I feel that the author is shouting at me after a few pages of this. Reading is exhausting. The other problem with excessive emphasis by font is that the reader may conclude that the only thing he or she needs to read is the italicized stuff. You don’t want that conclusion.

Your words will reveal the importance of your ideas if they are important. A font change will not make them so if they are unimportant.

1.8 Respectively

Banish “respectively” from your writing vocabulary. A good rule of thumb for clear writing is to avoid using phrases and words that you would never use in literate conversation. How many times in your life have you used “respectively” when you were talking? It inevitably sounds stiff, stilted, and overly formal. It is unnecessary. For example,

“The highest density of moose (0.74/km²) was estimated for the high density stratum, but estimated densities in the medium and low strata were the reverse of those predicted

(0.39/km² and 0.49/km² for the medium and low, respectively; Table 2).”

can be re-written with greater clarity:

“The highest density of moose (0.74/km²) was estimated for the high density stratum, but estimated densities in the medium and low strata were the reverse of those predicted, 0.39/km² for the medium strata and 0.49/km² for the low strata.”

1.9 The essence of writing is rewriting

Do not believe that you can produce any document you can be proud of on the first or even the second writing. Strong prose emerges only from rewriting. I have folders on my computer that contain more than 20 drafts of manuscripts and proposals. (You need not write 20 drafts of lab reports.)

1.10 Usage

- The word data is plural. The word datum is singular. Avoid making yourself look uneducated by saying the “data shows” or “the data is.” Ignore nonsense on the web asserting “When data is treated as a noncount noun (items cannot be counted), the singular makes sense.”¹ All scientific style manuals assert otherwise.
- The word criteria is plural; criterion is singular.
- Don’t use while to mean although. Why? Because while can produce ambiguous sentences. For example, “While Martin was a student, he worked twenty hours a week.” Nothing wrong with that unless you mean “ Although Martin was a student, he worked twenty hours a week.” These may be subtly different but they are different.
- Don’t use since if you mean because for the same reason.
- Use that for defining clauses; which for describing clauses. This is a very common error. For example “The laws that govern society...” should not be written as “The laws which govern society because “govern society” defines the laws, it does not describe them. It would be fine to write “The laws, which I wrote about earlier...” is fine because the phrase after the command

¹Also note the distracting dependent clause, which should lead you to suspect you are in the hands of a hack.

describes laws it doesn't define them. There is lots of material on the web about this. Read it if you don't understand the difference between describing and defining clauses.

- Use fewer to compare things that can be counted; less for things are measured by weight, volume, time etc. Fewer birds were encountered when there was less time for observations.
- Farther to mean distance, further to imply change, progress, etc.
- I and me. There is no more certain way to make yourself appear illiterate than to say something like "The program officer gave the proposal to the other reviewers and I." Eliminate "the other reviewers and" and how does the sentence read? I am not going to go into this in detail. There is a ton of material on the web. Study it if you are uncertain on when to use me vs I. Getting this right might prevent your cover letter for a job application going into the reject pile.

2 How to improve your writing

Your ability to write is not conferred in your DNA. You can become a better writer, often a much better writer, by doing some simple things. You cannot write well if you don't read well. Literate, well educated people read all the time. Reading prose written by masters gives you an "ear" for strong words, sentences, and paragraphs. Your writing improves by osmosis. I recommend John McPhee, Elizabeth Kolbert, Joan Didion, Ernest Hemingway, Joseph Conrad, Lewis Thomas and Sam McNaughton, among others. (Only two these are scientists. Which ones?) I also recommend subscribing to the New Yorker and reading it every week. There is no more pleasant way to improve your writing.

There are also more direct approaches. You should not escape graduate school without having read Strunk and White's enduring gem, "The Elements of Style." Pound for pound, there is no more useful book on the planet for aspiring scientists. It contains a trove of enormously helpful advice, despite being slightly larger than a deck of 3 x 5" cards. Serious students seeking clear composition will also study Williams, J. M. 1990. *Style: Toward Clarity and Grace*. University of Chicago Press, Chicago, which provides a more in-depth treatment of how to write lucidly and economically. I recommend it highly. Other books I like are Elizabeth Gordon's lighthearted "The Deluxe Transitive Vampire: The Ultimate Handbook of Grammar for the Innocent, the Eager, and the Doomed" and William Zinsser's "On Writing Well."

You cannot succeed as a scientist if you cannot write. Writing is your most important interface to the world. Transformative research buried in incomprehensible papers and proposals will not advance your career. The return on investment in improving your writing is large.