

Musings on Writing

This document includes writing tips, guidelines, and suggestions. Many are my own, but I incorporate ideas from other people, including (among others) Brent Roberts, Brian Scholl, Daryl Bem, and Roger Brown.

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Structure and organization

The opening: Entice your readers. Establish a controversy, present a real-world conundrum, or reveal a mystery. All are more effective than simply stating your topic because they develop a narrative thread, one that compels readers to seek a resolution. Most boring scientific introductions provide a laundry list of findings, ending with a declarative statement of the paper's goals. Unless your readers find your topic intrinsically interesting, laundry-list reviews feel effortful. Yes, they're informative. But the best writing informs readers without readers realizing that they're learning. By enticing your readers, you establish your topic quickly (critical to any paper) and motivate your organization for the rest of the paper. Your studies or arguments should bring resolution, leading readers to your conclusions. Resolution feels good—you want your readers to be nodding in agreement when they finish your paper.

The flow: Every section of your introduction should build directly on the previous ones, maintaining the narrative flow established by your opening. If your paper is organized as an unsolved mystery, each paragraph should add clues. If your paper is organized as a fiery controversy, each paragraph should add fuel. If a paragraph doesn't contribute, cut it. Daryl Bem suggests the following editing strategy: "If you find a tangent in your manuscript, make it a footnote. In the next revision of the paper, eliminate all footnotes."

The substance: Scientific papers must review the literature, but only the *relevant* literature. Do not describe every study you have ever read on your topic. Just describe those that help motivate your question.

Unlike fiction, scientific narratives are driven by findings, not characters; focus your review on the research—not the researchers—by relegating all researcher names to citations. A researcher's name should appear in the text of a sentence (rather than in a citation) only when your narrative depends on it. For example, you might put Rensink in the text of a sentence if you are trying to distinguish his flicker task from someone else's flicker task. Do not say "Rensink and colleagues (1997) developed the flicker task to illustrate the phenomenon of change blindness." Instead, say: "The flicker task illustrates the phenomenon of change blindness (Rensink et al, 1997)." This approach has the added benefit of avoiding *ad hominem* attacks: You critique the claims rather than the claimants.

The structure: Every clue or controversy in your introduction should resurface somewhere in the method, results, and discussion, ideally with the same level of emphasis. If you spent three pages introducing a topic, but only mention it in passing later in the paper, you either need to (1) cut the introductory material or (2) expand the later material. When in doubt, cut.

The Revision Process

Even the most skilled writers revise their work. In fact, the most skilled writers likely revise their work *more* than inexperienced writers. Revising means more than proofreading. A “proof” of a manuscript is the final version, formatted for publishing; just before a paper goes to print, authors have a chance to read the proof, just to make sure no typos escaped notice. My own manuscripts always undergo at least five major revisions before I would consider submitting them for publication.

To “revise” means, literally, to look again (revision = re + vision). The revision process requires a rigorous evaluation of the choices you made in your writing. Did you choose the best organization for your topic? Did you construct a compelling opening for your paper? Have you picked engaging examples? Can you justify the way you worded each sentence? Does each sentence have a purpose and each paragraph have a point?

As you reconsider your paper, you might rewrite major sections of it, shuffle your organization, combine or split sentences, delete tangents, etc. The revision process *should* take much longer than the writing process. Once you internalize the idea of revision, the writing process becomes far more efficient. If you have writer’s block, anticipating a thorough revision can help you overcome it; there’s no need to fret over each wording choice in your draft if you will be revising it later.

Below I provide some rules of engagement for the revision process, followed by a long list of common mistakes and pet peeves. Finally, I include a revision worksheet that can guide you through the revision process. Formalizing the process in this way guarantees that your paper will receive a thorough revision. With practice, you will internalize these rules and guidelines and spot needed revisions automatically.

Rules of engagement

- 1) Print your paper. You can do a lot of editing and revising before you work on a printed version, but you should complete at least one revision on a printed document. The ability to compare pages, make notes, and flip rapidly to right paragraph will help you spot repetition and disorganization. When Chris Chabris and I were working on our book, *The Invisible Gorilla*, I printed a draft of a chapter that had already undergone at least 5 complete revisions from each of us. I thought it was in great shape, but when I printed it, I found two large sections that were nearly identical. When we were editing on a computer, we never noticed the repetition.
- 2) Make an outline from your *finished* draft. Next to each paragraph, write a short phrase summarizing its point. Each paragraph should have just one point, so if you can’t write a summary phrase, you need to revise that paragraph. Look at the completed outline. Does each paragraph follow logically from the one before it? Are any logical steps missing or out of order? Do multiple paragraphs make the same point? Are some topics over- or under-emphasized? Try out different organizations to see if you can make the same points more concisely and compellingly.
- 3) Inspect each paragraph. Does each sentence make a unique contribution to the point of that paragraph? Does each sentence logically follow from the preceding one? Can any sentences be cut without sacrificing clarity? Can you make the same points more concisely by combining sentences?

- 4) Inspect your wording choices. Your goal should be clarity, not complexity. Eliminate unnecessary jargon and avoid attempting to sound scientific. Rewrite passive voice sentences in active voice using powerful verbs. Before submitting a paper, ask a friend who lacks your expertise to read it. They will spot jargon terms and unnecessary complexity that you might miss. They can also spot ways in which your organization places too great a burden on the reader.
- 5) Proofread for typos, spelling errors, and grammar mistakes only after you have completed your revisions.

Common mistakes and pet peeves

- 1) Avoid acronyms. Acronyms require your reader to translate from arbitrary letters to meaningful constructs. That requires effort. You should make life easy for your readers—don't make them work.
- 2) Use active voice. Passive voice might sound more formal, but it's less engaging and requires more effort from your readers. Don't make your readers work. Passive voice does allow you to hide the subject of a sentence, which can be useful ("mistakes were made" hides the fact that you were the one making them...). You can tell a sentence is passive if the word "by" is implied. For example, the last sentence is in the passive voice (...is implied *by the sentence structure*). "Mistakes were made" is passive because it implies "...by someone."
- 3) Don't overuse forms of "to be." In many cases, verbs like is, are, was, and were make your writing passive. The more active your verbs, the more interesting your writing.
- 4) Don't try to sound sciencey. For example, "pre-bipedal ambulatory behavior" can be replaced by "crawling." (That description came from a published journal article!) Journalist Tim Radford makes this point well: "English is better than Latin. You don't exterminate, you kill. You don't salivate, you drool. You don't conflagrate, you burn. Moses did not say to Pharaoh: "The consequence of non-release of one particular subject ethnic population could result ultimately in some kind of algal manifestation in the main river basin, with unforeseen outcomes for flora and fauna, not excluding consumer services." He said "the waters which are in the river ... shall be turned to blood, and the fish that is in the river shall die, and the river shall stink.... No one will ever complain because you have made something too easy to understand."
- 5) Avoid using "one" to mean "people." It sounds formal and archaic. Try rewriting the sentence to avoid using it, and your prose will be more engaging.
- 6) Use parallel structure. For example, "*Active reconstruction* of a past experience differs from *passively hearing* a story about it" lacks parallel structure. Better would be "*Actively reconstructing* a past experience differs from *passively hearing* a story about it." Parallel structure makes it easier for your reader to make the comparison you want them to. On a broader scale, make sure that your organization has parallel emphasis: The topics given emphasis in the introduction should receive comparable emphasis in the discussion.
- 7) Go on a "which" hunt. Roger Brown's advice: Any time you see the word "which," try to rewrite the sentence or check if "that" is correct instead. Content set off by "which" is unnecessary to the central point of a sentence. The sentence should make sense without that content.
- 8) Replace "usage" and "utilize" with "use." Your goal is clarity, not formality. The only difference between "usage" and "use" is that "usage" is worth more points in scrabble.
- 9) Effect and affect are different. In almost all cases, "affect" is a verb and "effect" is a noun. You find an *effect* in your study and you *affect* the outcome by working hard. Check each occurrence of either word in your paper to make sure you've got it right. (The exceptions are when you *effect* a change, meaning "make it happen" and when you are talking about someone's affect or emotional state.)

- 10) “Less” refers to an uncountable amount of some substance (less sand, less water, less time). “Fewer” refers to countable units of some substance (fewer grains of sand, fewer cups of water, fewer seconds, fewer than 10 items in the express lane).
- 11) Use “first” and “second” rather than “firstly” and “secondly.” Adding “ly” adds the following phrase to any word: “in an X sort of way.” So, “hopefully” means “in a hopeful sort of way.” Firstly would mean “in a first sort of way.” It doesn’t make sense. Similarly, you should say “most important” rather than “most importantly” to convey that something is the most important idea. “Most importantly” means “in a most important sort of way.”
- 12) Count your hands. Don’t say “on the third hand...”
- 13) “While” implies a temporal relationship. If you want to contrast two ideas, use “whereas” or “although.” For example, “My wife went fishing while I baked a cake” or “Although Kevin likes Barney, I find purple dinosaurs disturbing.”
- 14) “Since” implies a temporal relationship. (e.g., Since getting sick, I’ve lost 5 pounds). Use “because” to describe a causal relationship (e.g., Because I’ve been sick, I’ve been eating less).
- 15) Avoid using consecutive contrast words (e.g., but rather, yet although, but despite). You can almost always drop the first of them (e.g., rather, although, despite).
- 16) Use first person. Just make sure that the pronoun you use corresponds to the number of authors. Use “I” for single-authored papers (unless you’re the Queen).
- 17) Reaction time and response time are not interchangeable. Reaction time refers to how quickly you can react to a stimulus without having to make a decision. For example, if your task requires a key press as soon as a green light flashes, it measures *reaction* time. If your task requires a decision between different response options (press one key for green and a different key for red), it measures response time.
- 18) Avoid starting sentences with “X has Y that...” In most cases, you can cut phrases like “it has been shown that” or “research has found that” and just start the sentence with whatever follows “that.”
- 19) Never use the word “this” without an antecedent. You often can make the antecedent clear by adding a word (e.g., “this *finding*”). If you can’t state the antecedent in a word, it’s ambiguous.
- 20) Don’t use the word “obtain” as an intransitive verb (e.g., “We ran the experiment and the predicted results *obtained*”). It sounds formal and jargony. Obtain requires a direct object (e.g., “We obtained good results with our procedure”).
- 21) Avoid unnecessary qualifiers. They weaken the impact of your description. For example, don’t use phrases like “more true” or “brilliant genius”—something either is true or it isn’t, and what genius isn’t brilliant?

- 22) You can and should always cut the word “very.” As Mark Twain put it, “Substitute “damn” every time you're inclined to write “very”; your editor will delete it and the writing will be just as it should be.”
- 23) Eliminate the adjective forms of “certain” and “specific.” These words are vague. For example, “Certain findings are inconsistent with my conclusions” is vague. Which findings?
- 24) Cut verbose wording. For example, “I feel that in regard to that statement, he may have been a bit erroneous in his thinking” can be replaced by “he was wrong.”
- 25) Cut the words “I think,” “I feel,” and “I believe” from your papers. You’re the author. If you’re stating an opinion, readers know you own it.
- 26) Eliminate the adjective and adverb forms of “clear” and “obvious.” If you have to say something is obvious or clear, it probably isn’t. Let your reader decide if your claim is obvious or clear. Telling them doesn’t help.
- 27) You likely lack IRB approval for murder. When describing procedures for throwing out data from bad subjects, make sure that you are eliminating the data, not the subjects. Don’t say: “We eliminated three subjects due to poor accuracy levels.” Instead say: “We eliminated data from three subjects due to poor accuracy levels.”
- 28) If you ever find yourself saying “As noted above” or “As discussed earlier” you need to reorganize your paper.
- 29) Don’t use the word “random” to mean “arbitrary.”
- 30) Don't say something is interesting without explaining why it is interesting. Better yet, don't say it—show it.
- 31) Minds and brains don’t see, interact, explore, or perceive. People do. Don’t say “the brain sees.” Don’t use the phrase “in the brain” unless you are drawing a distinction with another organ. Also, unless you are distinguishing humans from other species, don’t use phrases like “the human brain” or “the human mind.” Just use “brain” or “mind.”

Revision Worksheet

Go through this revision worksheet in order, checking a box only after you have completed that step or verified that you addressed it. The revision/editing process should take longer than the original writing process. By following these revision steps, your paper will be more concise, more precise, and easier to read.

Preparation

- Print your paper
- Create an outline from your paper, with a short phrase summarizing each paragraph

Organizational Level

- The point of your paper is clear from the outline
- The structure of your argument is clear from the outline
- Each phrase in the outline follows logically from the one before it
- Each phrase in the outline is needed for your core argument (no tangents)
- The paper has no “GoTo” statements (e.g., “discussed below” or “as noted earlier”)
- The opening paragraph grabs the reader’s interest and establishes the topic
- The final paragraph draws a conclusion and places it in a reasonable context

Paragraph Level

- Each paragraph has only one point
- Each sentence contributes to the one point of the paragraph
- Each sentence follows logically from the one before it
- No sentences are redundant
- All lists and arguments have a parallel structure

Sentence Level

- Rewrite passive sentences in active voice
- Search for sentences with forms of “to be” (e.g., is, are, was, were) and rewrite them with a more powerful verb
- All lists and arguments within a sentence have a parallel structure
- No sentences start “X has Y that...” (e.g., Researchers have shown that...)
- Researcher names are in parenthetical citations and not in the body of the sentence
- No sentences can be combined or condensed to cut wordiness
- Pro Tip:* Make sentences within a paragraph vary in structure and length
- Pro Tip:* Show it, don’t tell it. Give an example to illustrate your point rather than just stating your point. Show that the result is interesting rather than stating that it is.

Word Level (general)

- Find and replace all acronyms
- Verify that any jargon terms are both necessary and defined

Word Level (search and destroy)

- Search for “which” — either rewrite the sentence or check if “that” is correct
- Search for “effect” and make sure it is a noun (it almost always should be)
- Search for “affect” and make sure it’s a verb (unless you are writing about emotion)
- Search for “firstly” and replace with “first” (do the same for “secondly,” etc.)
- Search for other words ending in “ly” (e.g., importantly, hopefully) and make sure you mean “in an X sort of way” (e.g., “importantly” means “in an important sort of way”)
- Search for “less” and replace with “fewer” if you are referring to something countable
- If you are the sole author, search for “we” and replace with “I”
- Search for “reaction time” and make sure you don’t mean “response time”
- Search for “random” and make sure you don’t mean “arbitrary”
- Make sure you don’t have more than two hands (e.g., on the third hand)

Word Level (principled pet peeves)

- Search for variants of “usage” and “utilize” and replace them with “use”
- Search for “since” and make sure you mean “at a later point in time”
- Search for “while” and make sure you mean “at the same time as”
- Search for double contrasts (but rather, yet although, etc) and cut one word
- Search for “this” and make sure it is immediately followed by an antecedent
- Search for “obtain” and make sure it has a direct object (“obtain results” but not “results obtain”)
- Search for “one” and rewrite the sentence if you are using it to mean “people.”
- Search for “very” and cut it
- Make sure descriptive adjectives are needed (e.g., eliminate “brilliant” from “brilliant genius”)
- Search for “certain” and “specific” and either make the noun more explicit or rewrite the sentence (e.g., “certain findings” is vague)
- Search for and cut phrases like “I think,” “I feel,” and “I believe.”
- Search for “clear” and verify that your claim actually is clear (it probably isn’t)
- Search for “obvious” and verify that your claim is obvious (it probably isn’t)
- Search for “interesting” and make sure your reader would also think it’s interesting
- Search for “human brain” and eliminate “human” if you’re not directly contrasting humans with another species
- Search for “brain” and “mind” and make sure you’re talking about the brain or mind and not the whole person (brains and minds don’t see or explore)

Final Check

- grammar check
- spell check
- typo check