**Writing Like a (Psychological) Scientist:
A Student Guide to Scientific Writing**

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Abstract

This tutorial paper reviews the scientific writing style used in psychology, with a focus on undergraduate students taking a Research Methods course. I outline four broad principles of scientific writing: (1) clarity, (2) conciseness, (3) literally true, and (4) a focus on scientific evidence. Each principle is analyzed into several components, where writing norms in psychology are also emphasized. I also outline three broad skills needed to achieve this style: (1) revision, (2) attention to detail, (3) and teamwork. Revision is emphasized most heavily—students are encouraged to write naturally and edit with a focus on these principles. In addition to learning about scientific writing, students will learn about the nature of science and scientific thinking as well as learn to be clearer, more effective communicators and to develop habits that will help them both in their writing and more broadly in their professional development.

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Writing Like a (Psychological) Scientist:

A Student Guide to Scientific Writing

Students trying to write scientific papers face a dilemma in psychology. Scientific writing is difficult, and it is central to the science of psychology. Further, professors tend to grade research papers strictly. Research papers are not reflections; they are evaluated for little details. There is also specific style and format for scientific writing that students are expected to achieve—a style that includes a certain way of thinking about evidence, a certain way of writing and phrasing, a certain kind of organization, and even a certain way of formatting documents. However, in my experience, students are rarely taught *how* to achieve this style. Scientific writing is a skill, and unfortunately many professors know how to *do* it but not how to *explain* it¹. The goal of this paper is to explain how to write a scientific document in psychology. You will learn to produce papers that don't look or sound like anything you've written before. You will learn to make your sentences specific, your ideas data-supported, and to write and rewrite to make your ideas clear. You will also learn to pay close attention to instructions, resources, and the APA style manual. Some of this involves a different way of approaching papers—seeing them as a process that unfolds over many drafts and learning to revise for details. Clearly, these are skills that deserve explanation. So get a tool for taking notes, and let's begin!

What I Expect from You

If you're like many students, the focus on writing in science might surprise you. However, writing is central to science. Remember that science is neither pure rationalism (reasoning our way to truth) nor pure empiricism (observing our way to truth). We have to use our reason to think critically about past studies and make sense of them; we then collect data to

¹ To be fair, many professors learn this skill by practice and 'feel,' and it is very difficult to explain how to do a skill that is learned this way. Imagine explaining, step by step, the motions required to chew a bite of food.

test whether our interpretations are correct. This means we must spend time making sense of past research—and we do that when we write and revise our papers. Indeed, the scientific writing style helps us to do it. We force ourselves to be specific, to be literal, to think about and then say exactly what we mean. We force ourselves to back up what we say with evidence. We force ourselves to change what we say when the evidence doesn't support it. We force ourselves to work at the level of tiny details and to pay great attention to those details, to get them right. All of this gets our brains to think in a scientific way. There is a myth that scientists are all lone geniuses who have some natural ability to pull scientific insights out of thin air. This is not true. The human brain is too limited to hold and think critically about all of this information. Instead, we write. Writing helps us get our ideas out, to review past research, and to put it all together in a way that makes sense. Our first drafts are always terrible—a way to 'get our thoughts out'—and often don't make sense. Then, we read them, think through all the mess, and try to sort everything out. After several rounds of reading, thinking, and revising, we have a paper that makes sense of past evidence and makes a contribution to some area of science. In other words—writing (and particularly editing) is when we do the thinking in science. It gets the tangled webs of information and thought in one place and, with time and effort, makes sense of them. Importantly, this cannot be done in one draft—it is the act of writing, sorting, thinking, and rewriting that makes our thoughts evolve.

Allow me to share an example. In my area (guilt and shame research), there are conflicting views of guilt. Some studies suggest that being a 'guilt-prone' person has many benefits; people who are guilt-prone tend to apologize and make amends, which then leads to a greater ability to forgive the self and move on (Carpenter et al., 2016, 2019; McGaffin et al., 2013). However, other studies suggest the opposite (e.g., Strelan, 2007). This is also a big deal,

because there are similar conflicting findings about guilt and depression (Kim et al., 2011); some people might read these studies and think that guilt is problematic for depression, whereas others might find it helpful (very relevant for therapists). Is guilt ‘good’ or ‘bad’ for you? I wanted to solve this mystery. What did I do? I started to write. I sorted the studies into groups based on the conclusion they drew. Then, I looked for a pattern and noticed that they tended to use different methods for studying guilt. Studies that suggested that guilt is ‘good’ for you tended to consider one type of guilt that has properties that may make it beneficial. On the other hand, studies that suggested that guilt is ‘bad’ for you tend to consider a different kind of guilt that has properties that might be associated with mood disorders such as depression. This led my co-author and me (science is a team sport) to conclude that guilt is not necessarily good or bad in and of itself—instead, it may depend on a number of other factors that we then mapped out. This insight did not ‘pop’ into our heads—it took a process of collecting information from past studies, analyzing and making sense of them, and organizing our thoughts. That took several drafts. The first draft was a confusing mess of thoughts, ideas, and notes. That was broken in two. The next draft organized the information but was still a confused mess. By the fourth rewrite, however, we had identified and explained all of the trends described above. We are now submitting to a scientific journal (Carpenter & Giner-Sorolla, 2020).

Three Skills

In the narrative above, you can see three major skills that I want you to develop. First, I want you to get used to a process of *drafting and revising* before you submit. You should *never* submit your first draft. Your first draft is when you get the ideas ‘out’; however, your writing is a mess. Ideas are confused, logic is missing, and explanation is weak. Give yourself permission to write a terrible first draft—just write. Once you finish the first draft, you are ready to start

sculpting it into good writing. How do you do this? Take a break—maybe 24 hours—and then *read it*. Imagine you are a naïve reader, and ask how it could be better. You will discover that material that you thought was clear is not clear, sentences don't make sense and are long and confusing, evidence is used badly or not used at all, and it confusing to read. For the first revision, focus on ideas—what needs to be developed more or rethought? What conclusions need more evidence? What is incorrect? What needs to be reorganized or cut? Put in a good-faith effort to rework those things. Then, give yourself a 24-hour break (again) and come back. This is where you focus on little details such as sentences, phrasing, clarity, grammar, APA style, etc. This means you must go through two rounds of revision. The first draft is a confused mess, the second draft is just a mess, and the third draft is ready to submit. This is the fastest way that I know to produce a good research paper; this takes about 4-5 days after the first draft is complete.

The second skill is to pay attention to detail during the revision process (remember: the first draft can be messy). There are many details to attend to. A major area of stumbling is APA style. Students tend to struggle with in-text citations, reference lists, and document formatting requirements (e.g., what is bold? How are headers formatted? Title page? etc.). For a research manuscript, there is specific information required in each section. Students also struggle with the principles of science writing, discussed below. For example, in my own teaching, I often receive papers that state their central conclusions or hypotheses but offer no arguments or evidence in support of those claims (Principle 4, below). These are essentially incomplete assignments. Close attention to detail around (1) APA style, (2) the assignment instructions and required content, and (3) the scientific writing style are essential for a successful paper in psychology. Much of this will take place during revision, which you should budget time for.

When I communicate this, students often tell me anxiously that they just aren't "detail-oriented," that they aren't "good" at details. I would like to lovingly challenge you on this. Nobody is automatically good at details! I really struggled in math classes in high school for this reason; I would make sloppy errors copying equations from one line to the next. Details are a skill that we *work at* by creating *habits and practices*. If you are messing up details, I suggest to you that you need to change your behavior. My math instructor required me to follow a series of habits when working problems—and they worked. The habits and behaviors students need to be successful at research writing include (1) reading and revising your work as outlined above rather than just submitting early drafts, (2) double checking adherence to APA style, required content/instructions, and the scientific writing style, (3) looking up those things when you are unclear², and (4) time management and planning to make space for this work. These are skills; our human nature is to do them badly. However, you can train them, just like any other skill. You cannot expect yourself to be an all-star athlete by 'trying harder'; you need to do the things that actually get you there. These practices and skills are one of *the most valuable things you learn in college*. I cannot stress enough how much employers are looking for these skills. Even if you don't plan to be a professional paper-writer, these are some of the most important things you can put energy into during college. Invest in you.

A final aspect of writing is working in teams—something that may or may not apply to you but I will discuss here. There are several reasons to work in teams. First, a scientific paper is much less content when divided among several people; this allows you to focus on *quality* rather

² I often find that students are unclear or confused on APA style, required content/instructions, and the scientific writing style. If you are taking a class, your instructor has likely given you assignment sheets and documents that address these things; please look them up. Don't trust your memory (you are human), and don't trust classmates (because they don't know, either). I often see groups of students collectively confused, asking each other, coming to wrong conclusions, and making key errors. Please look things up—and if you are still confused at that point, ask your instructor. Don't sabotage yourself by guessing.

than filling space. Second, we all have blind spots; co-authors can tell us when our writing is confusing and ask questions that help us revise. Third, it provides more chances to achieve quality. In a scientific paper, *everyone* is responsible for the *entire* paper—even sections they didn't draft³. The expectation is that every section is read and revised by multiple people.

However, one potential problem is social loafing—everyone expecting someone *else* to do the work (Karau & Williams, 1993). To avoid this, you will need to make responsibilities clear, get commitments up front, and set a plan with your team. Set internal deadlines, make a calendar, discuss who will do what and by when. This is also an important professional skill. Identify the practices that make you a good team member and you will develop yourself and your professional skills.

The Scientific Writing Style

For the rest of this document, I want to teach you about the scientific writing style. I will first walk you through four major principles of scientific writing; I will then give examples of specific ways people violate them and how you can follow them successfully in your writing based on my experience grading papers. Remember, too, that these principles may be hard to follow when writing first drafts, even for professional scientists. However, because we still need to achieve this style, *be sure* to plan time for revision and pay close attention to these four principles when revising—both in your sections and in group-members' sections.

The four principles are as follows: scientific writing is (1) clear, (2) concise, (3) literally true, and (4) based on scientific evidence. First, it is clear. The paper should make sense to a reader, and the writing should be straightforward, free of fluff, and say exactly what it means.

³ This is actually a rule in science, part of the International Committee of Medical Journal Editors (ICMJE) guidelines, which state that all authors are expected to be responsible *all* the content of a paper. When I contribute to a scientific paper, I become responsible for everything in that paper.

The reader should not have to work to understand what the paper is trying to say, because the paper should say it directly. To do this, we may have to clarify our own thinking and revise accordingly. Second, a scientific paper is concise; it should use the fewest words possible to accomplish its goal. When revising, scientists are ruthless word cutters. Extra words water down the important content and make writing harder to read. Third, a good scientific paper is literally true. Scientists don't use metaphor, imagery, or figures of speech. The goal of our paper is to have every sentence and phrase be literally true. This means that the reader can trust what the author says and that no interpretation is required. Finally, a good scientific paper is based on scientific evidence. In life, we often give 'hot takes' and conclusions without supporting arguments or evidence. In science, we don't do that—our conclusions require evidence-supported arguments that would convince a skeptical reader. Further, when we use evidence, we must cite it (and that means looking up information and verifying it). Lastly, we require *scientific* evidence—so our papers may be more limited in scope than what you might consider in a philosophy class. This keeps us accountable for having truthful, scientific, well researched papers that hold up to scrutiny, which is the gold standard in science. Edit for these four principles and you will be well on your way to having readable scientific papers that state ideas clearly. Let's review them in detail.

Principle 1—Clarity

As a first principle, scientific writing should be clear: it should make sense to a reader. Alternatively, to put it differently, a reader should not have to work to understand what you are *trying* to say because you should spell it out clearly for the reader. My first drafts fail at this; they are not clear. Ideas are not stated directly, terms are presented without explanations, and sentences are jumbled mess that certainly *sound* like writing but do not actually make sense

together. Somewhere in that jumbled mess is good content, but it needs to be rewritten. Here are some principles we follow to do this.

Principle 1.1—Make Ideas Clear. Good scientific writing has clear ideas. A reader can sit down, read the writing, and understand the ideas that the author is trying to communicate. This requires, however, that the *author* is clear about what ideas they want to communicate. Talk out your paper ideas, your arguments, your research question, your thesis or hypothesis, etc. with other people (one reason you have a group; you can always get a consult from your professor as well). Explain it to someone and try to make it make sense. If you can't *say* it clearly, then more thinking is needed, so keep thinking about it. What are you trying to say? How can it be said simply? One strategy I use is to take notes as I think—sometimes I even record myself talking through my ideas on my phone. Alternatively, I have a phone call or meeting with a co-author and we process together. Another strategy is to draft on a computer and then go back and revise to clarify the thinking. In that case, I read my rough drafts and imagine myself as the reader. When I'm revising, I ask myself, "what am I trying to say here?" Often, I delete whatever I have on the page and say *that* instead.

Principle 1.2—Have an Objective and State It in the First Paragraph. You may have been taught to have a 'thesis' statement in your first paragraph. In scientific writing, you may have a thesis, a hypothesis, a research question, or an objective—whatever you have, clarify it with your group and state it clearly at the beginning of your paper. This may sound boring, but it's helpful to be explicit about what you're trying to do in a big paper. Otherwise, when you write, you will also have a hard time producing a cohesive paper⁴. Something clear will help both

⁴ I have seen situations where everyone has a different understanding of the paper and the final product does not make sense together. Everyone should be on board with the essentials of the paper—the question, the theory/hypothesis, the design, etc.

you and your reader. For example, adding this sentence at the end of the first paragraph would help me know what should be included in a paper about guilt: “In this paper, we review major competing theories of implicit cognition; we then argue that these theories are not competitors at all and instead are compatible with one-another.” A sentence like this suggests an outline, and that outline helps me invest my time wisely. It also helps your reader—the reader knows what the goal is and therefore knows what to expect when reading. Give the reader a one- or two-sentence “take home” claim from your paper, and put that at the beginning. You will save everyone time and energy. I would write this sentence together in your group so everyone knows exactly what you are trying to say (see Principle 1.1).

Principle 1.2—Explain It (Think for the Reader). Once you know what your paper is trying to say, don’t forget to say it. It may be tempting to assemble a bunch of facts into paragraphs to show the reader that you know those facts. However, your paper is meant *to be read*. Think about the kind of paper you would prefer to read. If you’re like most people, you would rather the author *explain and spell out* what they are trying to say. Read this paragraph and tell me if you have any idea what it’s saying:

“Hom et al. (2016) found that two-thirds of their firefighter sample (N=483) reported stigma-related barriers to seeking mental health treatment. In a study of 2,383 firefighters, 22% indicated that stigma prevented them from using behavioral health services (Steffen et al., 2010). In addition, Gulliver et al., (2017) found that fear of breach in confidentiality and stigma were rated as the second and third greatest barriers to behavioral health programs in fire service.”⁵

The goal of this paragraph was to establish that stigma is an important topic, worthy of research, and to lay the foundation for a new study. However, it didn’t say any of that—the reader is left to guess what the author might mean, and the paragraph is a mess of facts with no explanation. We need to explain to a reader the importance of information, add narration, make points, and *spell*

⁵ Example adapted from Carpenter et al. (2020).

out our thinking in writing. When we add citations and information, we should ask: why are we sharing this? What do we want to say about it? Why is it important for the reader to know it?

Add this information and suddenly this becomes an effective paragraph:

“Stigma is a consistent problem for fire-service professionals, which can keep them from seeking help. For example, Hom et al. (2016) found that two-thirds of their firefighter sample reported stigma-related barriers to seeking mental health treatment. Similarly, Steffen et al. (2010) found that 22% of firefighters did not use behavioral health services due to stigma (Steffen et al., 2010). Recently, Gulliver et al. (2017) found that stigma was the third greatest barrier to access of behavioral health programs in fire service. Addressing stigma is an important goal for those seeking to increase help-seeking among firefighters.”

The first paragraph only *gives* information; the second paragraph has a claim (stigma is a problem) and then *uses* information to support that claim. It uses narration throughout (“For example,”) to signal that to a reader, and it ends with a take-home conclusion (addressing stigma is important). This is *essential* thinking and content for a research paper, but it may be hard to add the first time through. Look to add this when revising.

Principle 1.3—Organize. Would you believe that when I first wrote this document, it was a long list of writing rules? I recently read it and thought, “this could use new organization.” Breaking writing into sections by topic, adding themes and principles, and using APA-style headers all help to make a large paper manageable—both for readers and writers. Look closely at how papers do this.

Principle 1.4—Write for a Naïve Reader. You are *not* writing this paper as an assignment for your professor (say this out loud, to yourself, several times). In science, papers are written to be read by someone wanting to learn about the topic. Imagine you have one of these readers—they are naïve and don’t know your assignment, the goal of your paper, the definitions of psychology terms, or anything *unless you tell them*. If you write a sentence such as, “In our article, the authors...” then the reader will have no idea what you are talking about. What

article? Don't assume the reader knows what you are doing—you need to tell them! For example, this is a clear way to write for a naïve reader:

“This paper reviews a study by Exline et al. (2011), which tested the effectiveness of an apology intervention designed to increase self-forgiveness. We assess its validity and find the study was well designed, but with key limitations.”

Tell the reader what is going on, or they will be immediately lost. If you start your article-review paper with “In this study, ...” my first response will be: “What study? We haven't introduced a study.” Explain the context to the reader. This principle also applies to the subject matter. Do not assume your reader is familiar with the topic. If you write about the “endowment effect” or “state-dependent memory,” please explain what those things are *the first time you mention them*. This also applies to acronyms. Just because you are familiar does not mean your reader is.

Principle 1.5—Avoid Jargon, When Possible. Jargon—technical terms and acronyms—shuts people down. In a recent study (Shulman et al., 2020) found that this content is difficult to process (people have to stop and wrestle with it) and this causes people to think they aren't good at science. Use simple language when possible. Can you tell what this paragraph is trying to say?

“The study examined the role of activating events in the activation-behavior-cognition sequence, specifically testing the degree to which activating events lead to action tendencies that have maladaptive consequences for the organism.”

Somehow, it gets worse with acronyms:

“We tested the role of NBEs and NSEs in repair sequences.”

I get that we need terminology. However, when possible, explain things simply. A scientist I follow on Twitter (Barbaro, 2020) once shared that a paper she was reading *could* have used the phrase “a conversation” but instead wrote “from one individual to another via verbal information transfer.” Which would you rather read? If you must use technical terms (and sometimes we

must), be sure to define them for a reader when you first use them (Principle 1.4). Remember that your goal is to make sense—to communicate clearly to your reader, a human being.

Principle 1.6—Clarify Meaning Around Vague Words. Vague words are unclear.

Imagine that you read a scientific paper and the author stated that the “the p -value was iffy” with no further explanation. As a reader, you are left to guess what this means! It is much better to state exactly what is meant: “The p -value was .04, which raises concerns about the validity of the finding.” Notice how this requires no interpretation because it spells out exactly what the author is trying to say. This is your goal when writing. Don’t say that “the study had a decent sample size”—because a reader doesn’t know exactly what that means. Don’t say that “college students drink a lot of coffee”—because people have to interpret how much “a lot” is. Don’t say that “the result was really significant”—this requires interpretation. Instead, be specific. Use numbers and exact language, and spell out exactly what you mean. This is difficult when drafting and often a major focus of revision. If we fail to do this, readers either have to *stop reading to think* or *only adsorb some of what you meant*. Either way, the process is unpleasant and makes the paper harder to understand. Whatever you are trying to say, *you need to spell it out for your reader* (and possibly yourself first; Principle 1.1). In doing so, it might feel like you are stating the obvious—but you need to do it. It’s not obvious to your reader.

Principle 1.7—Rewrite Complex Sentences. When your brain is trying to wrestle with all the information it found and put it in a paper, sentences struggle. I know you don’t normally write long, confusing sentences—but somehow research papers tend to include sentences that sound like this:

“Women report greater feelings of shame but also-repair oriented guilt, greater than that of men, resulting of different kinds of self-forgiveness, consistent with work by Fisher and Exline (2006), which found that women, relative to men, report greater effort required to

self-forgive.”

I want you to read that and try to make sense of it. I have attempted several times—I wrote it—and I still cannot understand it. Somewhere in there is important information about gender differences but it needs to be rewritten. This should be three or four sentences. Further, there is not enough information here—it implies the first finding (gender differences in guilt and shame) mirrors the second one (gender differences in effort) yet that doesn’t make sense without more explanation. The writing makes it hard to notice, but the sentence actually makes no sense. Sentences like are actually common when we read complex studies and try to summarize findings for our papers. This is fine when drafting, but we need to clean up our mess before submitting.

Principle 1.8—Eliminate Nonsense. Similarly, some sentences just don’t make sense. Consider this sentence:

“The choice overload bias is the bias that people have when choosing based on number of discrete options.”

This sentence literally makes no sense. I don’t care how many times you read it or how much thinking you do; it actually does not make sense. It probably made sense in our heads when we wrote it, but the intended meaning didn’t make it to the page. That’s ok, but now it’s time to revise or cut. This happens to me and it will probably happen to you. There is simply too much going on in our heads when we put words on a page.

As a final note, I often find that issues with principle 1.7 (vague wording), principle 1.8 (complex wording), and principle 1.9 (nonsense) often go together. It is hard to spot nonsense in vague wording, because by nature it is so vague that it may not appear ‘wrong.’ In the previous example, it is technically correct that the choice-overload bias (Iyengar & Lepper, 2000) does

take place when considering a number of options. However, even if it isn't technically wrong, it's 'nonsense' because a reader cannot make sense of it. Vague and complex wording hide nonsense easily—we cannot think critically about something unless we can first think *clearly*. This is why all of your writing should be clear, simple, and easy to understand. We cannot begin to evaluate and craft our ideas until we can first get our language out of the way.

Principle 1.9—Consistency in Terms. You may have been taught to vary your language in a writing class to avoid repetition. For example, in a paper about guilt, you might think it is good to alternate between the words “guilt,” “remorse,” and “regret.” Please never do this in science. The reason is that in science, every term has a precise meaning. For example, psychologists spent decades trying understand the differences between “guilt” and “shame.” Whereas early authors used them interchangeably, Lewis (1971) drew the distinction, later advanced by Tangney (c.f., Tangney & Dearing, 2002; Tangney et al., 2007). There is now a robust area of psychology that tests how these emotions are different. If authors start using several similar words to mean the same thing, it can be very difficult to know whether these are supposed to be *different* things that are similar or the *same* thing. This will confuse a reader. Pick a term for each concept and stick with it.

Principle 2—Conciseness

Good scientific writing is concise—it uses the fewest possible words to convey meaning. This might surprise you, given Principle 1. After all, many of the elements of Principle 1 add length. However, this is why we need to be concise. Readers only have so much time and attention—we need to spell out exactly what we mean, and we don't have space for *anything else*. Further, if we add unnecessary words or distracting content, the meaning becomes harder to find. Thus, we are ruthless word cutters when we revise. Let's unpack this principle.

Principle 2.1—Cut Fluff. The education system has taught many of us that the goal of writing is to fill space in exchange for points. In this environment, many of us have developed a strategy of adding ‘fluff.’ I define fluff as content that does not add information but takes up space. Imagine a scientific study about a forgiveness study that begins with:

“Since the dawn of time, forgiveness has been important to humankind. In all the realms of human emotion, nothing is so impactful as a forgiving spirit. When we hurt another, we incur a stain on the soul; a wound has opened that is both spiritual and relational. We must mend that wound. This requires work, hard work, to do. We struggle to overcome our own egos and latent narcissism to forgive others or even to forgive ourselves. Self-forgiveness may be the hardest of all. Although we may grapple with our own inner demons when we transgress, apologizing may be a soothing balm for the soul.”

I occasionally see opening paragraphs like this. It is poetic but it adds no information to the study. Nothing is cited. Language is vague and non-literal (“Since the dawn of time”—do we have a study for that?!). The paragraph refers to the reader of study (violates Principle 3) and draws upon nonscientific claims (violates Principle 4). Language is also more complicated than it needs to be, making exact meaning unclear (violates Principle 1). However, these are not the paragraph’s biggest problems. The biggest problem is that it doesn’t appear to say anything helpful: after you read it, do you know what the aims, basis, and rationale of the study are? If you were trying to understand the study, would this paragraph help you? Instead, it sounds like the author knew the topic of the study, added some flowery reflection, and moved on. That is not a good use of space. Consider now this replacement paragraph:

“The present study examines the effect of apology on self-forgiveness. People often hurt one another in close relationships (Exline et al., 2011), and offenders must work through a process of self-forgiveness (Hall & Fincham, 2005). We consider factors that may help offenders in this process. One unanswered question is the role of apology—does apologizing help offenders to forgive themselves? Although some have suggested this may be the case (Hall & Fincham, 2005), evidence to date is mixed (e.g., Ranganathan & Todorov, 2010). We seek to clarify this in the present study by experimentally testing whether apologizing to hurt parties helps offenders forgive themselves.”

This paragraph is much better. If you were trying to understand the goals of the study, *this* paragraph would help you. It is therefore a good use of space, and we don't have time for anything else. It does what it needs to do and then it ends. The lesson I want you to take from this is that you do not need to "fill space" in a research paper—doing so will only obscure the important content. Every paragraph has a purpose. If you simply achieve that purpose, the paper will naturally fill itself. If you are struggling to fill space, my guess is that your content and ideas are unclear (work on Principle 1).

Principle 2.2—Cut Unnecessary Words. We often fill our sentences with words we don't need. Consider this example about a fictitious study examining antidepressants:

"Johnson and Johnson (2002) discussed evidence for three risk factors found to be associated with antidepressant use ..."

This can be shorter:

"Johnson and Johnson (2002) discussed three risk factors associated with antidepressant use ..."

Or even:

"Johnson and Johnson (2002) discussed potential risks of antidepressants."

If you're like most people, the last one is probably your favorite. This is because the first one has unnecessary words—such as "found to be"—that clog up the sentence. Your brain reads them, yet they do not add meaning. Because brains are lazy, the sentence becomes harder to understand or readers start skimming. If there are too many extra words, a reader gets to the end and says, "I have no idea what I just read." Cut all unnecessary words; try to boil the sentences down to *just* the important content. Your writing will improve rapidly.

Principle 2.3—The Citation is the Title and Authors Have Only Last Names. One rule in science is to always refer to papers by their APA-style citations, *never* by their titles. I sometimes read a student paper that says:

“In a study by Dr. Julie Exline and colleagues entitled, ‘Reparative behaviors and self-forgiveness: Effects of a laboratory-based exercise,’ the researchers found that ...”

We do not do this in science. Simply refer to the article by its citation:

“Exline et al. (2011) found that ...”

This is much shorter and is the correct style for scientific writing. Similarly, whenever you cite or discuss a work by an author, use only their last name and make it a citation. For example, I would never refer to “a study by Dr. Julie Exline and colleagues” Instead, I simply say “Exline et al. (2011).” This keeps writing concise and avoids confusion.

Principle 3—Literally True

A third principle of scientific writing is to be literally true. Our papers aim to be the truthful keepers of the scientific record. In fact, the collection of scientific papers published in scientific journals *is the scientific record*. We therefore must be very careful that we only include content that is literally true. Further, this content needs to be read by people in many different cultures or languages. Figures of speech and incorrect wording need to be changed to their literal meaning—this allows science to progress and be understood by scientists around the globe.

Principle 3.1—Be Literal. Scientific writing is literal, yet we often do not talk or write that way. In scientific writing, don’t refer to “low-hanging fruit” unless there is actually produce hanging at some low height. Don’t tell me someone “drank the Kool-Aid” unless someone actually consumed a physical beverage. Don’t say someone “thought outside the box” unless someone was not in a container when thinking. Or, if you do say these things when *drafting*, be sure to change them when *revising*. These imply a meaning that you need to spell out for a reader

(see Principle 1). One problem with fluff or poetic language is that it is often *entirely* non-literal. Consider the ‘fluff’ paragraph I provided above—it is filled with metaphor and non-literal language. Consider the opening sentence, “Since the dawn of time, forgiveness has been important to humankind. ...” Humans have not existed since the dawn of time, so I know that this cannot be true. Further, does time even ‘dawn’? Revise your sentences to say, literally, what you mean.

Principle 3.2—Correct Wording Regarding the Reader. In this document, I am intentionally referring to ‘you’ and ‘we’—I am giving *you* instructions and trying to point out that *we* all have similar struggles while writing. However, we should not refer to the reader in a scientific study. I sometimes see a hypothesis like this:

“We hypothesize that your level of forgiveness will be related to your level of stress.”

In this case, you are not actually hypothesizing about the reader, so this is incorrect. In psychology, it’s common to shift the focus to variables and remove the ‘person’ altogether:

“We hypothesize that forgiveness will negatively correlate with stress.”

If you *do* want to talk about people, do so directly. In psychology, I commonly see people use the word “individuals.” (e.g., “As individuals experience stress, they tend to respond by”).

Principle 3.3—Correct Word Use Around Hypotheses. A hypothesis is an educated prediction that we test with a study. Therefore, when stating hypotheses, use words such as “predict” or “hypothesize”:

“We predict that guilt will decrease following apology.”

“We hypothesize that guilt will decrease following apology.”

I sometimes see people use words such as “guess,” “believe,” or “think.” These words do not imply that you are stating a formal hypothesis, and they might imply that you lack evidence⁶. Further, remember that a hypothesis is not the same as a research question. It would be incorrect to say, “Our hypothesis asks if stress correlates with depression.” Your hypothesis is the prediction you wish to test, with data and statistics, in a study.

Principle 3.4—Correct Word Use Regarding Your Claims. If an author has an idea about psychology, we typically don’t call that a hypothesis. If you want to state a conceptual claim about psychology you can use words such as “propose,” “theorize,” “suggest,” etc.:

“We propose that apology reduces guilt following transgression”

“We suggest that apology reduces guilt following transgression”

“We theorize that apology reduces guilt following transgression”

The idea here is that you make it clear to the reader that this is *your idea*⁷. Sometimes a student omits this and simply states their claim as fact (e.g., “Apology reduces guilt following transgression”). The problem with this is that it is unclear who is saying this—is this the *author’s* idea or is it a finding from a past study. One solution is to add hypotheticalal language: (e.g., “Therefore, apology may reduce guilt following transgression”). However you handle this, be sure that it is clear what is your analysis and what is evidence from past studies.

Principle 3.6—Correct Word Use Regarding Time. In science, studies take place in the past. Therefore, make sure that past studies are written in past-tense language. Thus, Freud *argued*, Exline *found*, and Greenwald *suggested*. Write that “Strelan (2007) found that...” rather

⁶ Relatedly, when you state hypotheses or arguments, simply state them. Avoid writing a narrative or journal of your thought process (e.g., “As I thought about my topic....”).

⁷ We don’t call these hypotheses, because they are not written as predictions (we are not predicting what results we will find in a study).

than “Strelan (2007) *finds* that....” This is because we only know what people said *at the* time; we do not know what is current.

Principle 3.7—Correct Worse Use Regarding Proof. The words “prove” and “proof” mean absolute certainty with no possibility of error. This means that a scientific study can *never* prove a claim, because there are always sources of error. Never say that a study proves its hypothesis; instead, we can say that a study *supported* its hypothesis or found evidence consistent with its theories. Similarly, we never prove a theory ‘true’; our theories are simply the best fitting explanations we have so far. Unless you are doing work in mathematics, you are probably not proving anything in your writing. Avoid the use of ‘proof’ entirely. Instead, we can talk about support for ideas, strength of evidence, etc.

Principle 4—(Scientific) Evidence Based

The fourth principle of scientific writing is that it is based on scientific evidence. This means that we cannot simply ‘say stuff’ without evidence—the contents of our papers should aim to be as truthful as possible on the basis of scientific evidence. We do not simply state conclusions or ‘hot takes’; we back up our ideas with evidence. We also do not rely on metaphysical content that cannot be scientifically tested. We focus our writing on what is testable and back our claims up with scientific evidence. This is science, after all.

Principle 4.1—Claims Without Evidence (You Need a Paragraph). One reason students struggle to fill papers is that they state a claim (“Apology may reduce guilt”) and don’t know what else to say. If this is your central idea, claim, theory, or hypothesis, then you need to *support it*. Add a paragraph (or several) with evidence for why this is a reasonable thing to

believe⁸. Don't fill your papers with "hot takes," conclusions and perspectives without evidence. Don't make bold statements such as "the study lacked internal validity" without going into detail *why* that is correct and supported with multiple pieces of evidence that you then explain. Students writing a research proposal sometimes struggle here—I often hear students concerned that no past studies have tested their prediction yet. This is fine! If no studies have tested your claim, this means you are testing something new! However, there are still *reasons and evidence* to suspect your idea *may* be true. Find those reasons. Find that evidence. Put them in paragraphs. Convince a reader that your idea has a good shot at being true. The nice thing about science is that it's ok to be wrong—and if we do our research with integrity, the data will tell us.

Principle 4.2—Know When to Cite. In general, every statement of fact must have an APA-style citation (usually, to a published article). In scientific writing, we cannot say "apology is an important part of forgiveness" without a citation. We document every fact, every claim, every piece of information. Because this can majorly disrupt our flow when writing, it is common for people to add a placeholder while drafting. So, when you *draft*, feel free to write:

"Apology is an important part of forgiveness (CITATION)"

... as long as you later go back, verify that it is correct, and revise it with a citation or examples:

"Apology is an important part of forgiveness (Fehr et al., 2010)."

"Apology is an important part of forgiveness. For example, studies find that apology by offenders is associated with forgiveness by victims (Fehr et al., 2010), and apologizing to hurt parties may even help offenders forgive themselves (Carpenter et al., 2014)."

⁸ One might say that the *entire* introduction to a paper as making the argument that your hypothesis is important and reasonable to believe, or that your research question is important and reasonable to ask. Background is included primarily to give context, so that the hypothesis/question makes sense, and so it is clear how this work builds on what has come before.

As a general rule, then, remember that evidence needs citations. This is why papers have so many references! Part of working on a research paper involves reading papers, verifying claims, and documenting them.

Principle 4.3—Focus on Evidence. To make scientific writing stronger, try focusing on findings when discussing research. People often talk about the *fact that research was done* rather than the findings. It is much less informative to talk about the *fact* that research was conducted than to tell me what it *actually found*. Read through the following examples.

Thus, instead of saying:

“A study was done by Johnson et al. (2010) examining religion and prejudice and the effect of priming”

Refocus the sentence on what it found:

“Johnson et al. (2010) found that priming religion increased prejudice.”

Do you see how the first one is not helpful? It doesn’t say anything. Great, Johnson et al. ran a study, but what did it find? I have no idea. Similarly, instead of saying:

“Carpenter et al. (2014) studied links between apology and forgiveness.”

Say:

“Carpenter et al. (2014) found that apology was associated with increased forgiveness.”

If you want to do both (e.g., if a study is especially important or if you wish to discuss methodological details), you can introduce it first and then present the findings:

“In a longitudinal study, Reitz et al. (2016) examined the impact of feeling valued by others on self esteem. They found that feelings of social worth fluctuated over time, and this was associated with”

If a study is particularly important, or if I don’t have very many studies to discuss, I like to use this method and go into more detail about the paper.

Principle 4.4—Avoid the Metaphysical. As a final element of this principle, remember that scientific writing is *scientific*, and that means it is limited to those areas where science operates. There may well be a spiritual ‘soul’ or spiritual truth to ethical principles, but this is sadly off limits to psychological science. We can only use as evidence in a scientific paper that which can be measured, tested, and empirically supported. This is the final reason why the ‘fluff’ paragraph in Principle 2.1 is not appropriate for a scientific paper:

“Since the dawn of time, forgiveness has been important to humankind. In all the realms of human emotion, nothing is so impactful as a forgiving spirit. When we hurt another, we incur a stain on the soul; a wound has opened that is both spiritual and relational. We must mend that wound. This requires work, hard work, to do. We struggle to overcome our own egos and latent narcissism to forgive others or even to forgive ourselves. Self-forgiveness may be the hardest of all. Although we may grapple with our own inner demons when we transgress, apologizing may be a soothing balm for the soul.”

If I were to take the author literally (and we always do in science), their writing implies the existence of many things that cannot be scientifically tested—souls, spirits, demons, and so on. Perhaps these are metaphors; perhaps the author believes in these things. There is a kind of poetry to this writing, but it is not scientific. Does this make science somewhat limited? Yes, it does. However, the history of modern medicine, technology, and the like should be enough to convince us that—regardless of your beliefs—science is useful.

Conclusion

This document contains all⁹ the wisdom I have for you about scientific writing in science. If this feels like a lot, it is. However, it boils down to just a few principles—be clear, be concise, be literal, and rely on scientific evidence. You should know that *nobody* nails this in the first draft. I have used myself as the example—my first drafts are a *mess*. There is absolutely no shame in that. However, the key to producing good scientific writing is *revision*. Read your

⁹ I have a little more, but I will reserve that for graduate students

paper and revise it. A professional scientist will go through many, many revisions. Assuming that you are an undergraduate student, I am not asking you to put in the same effort as a professional scientist. However, for undergraduate students, a good expectation is to put in your best effort over two rounds of revisions, to focus on quality, and work together as a team (if applicable) to produce the best work you can in the limited time you have. I also want you to develop habits that will help you wrangle details on large projects—habits such as planning ahead, looking up questions as you go, and double-checking your work. Consider these exercises in project management, critical thinking, and clear writing—skills that are vital to your professional development. Ultimately, the goal is to invest in you. I hope this document has helped in that regard.

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