Being a productive writer

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June 23, 2020

Writing is one of the most critical parts of being a scholar, and writing effectively will increase your impact and professional opportunities. However, many young scholars do not initially enjoy writing and do not know how to write productively. Fortunately, just like your research methods, writing is a skill that you can learn. Also, just like your research field, scholars have done experiments to figure out what differentiates productive and non-productive writers. This document summarizes some of my strategies for being a productive writer, developed by reading advice from experts, by listening to role models, and by trial and error.

There are many possible barriers to writing as much as you want to. In my experience, three keys to productive writing are *motivation to write, good writing habits, and a plan for what to write*. The next three sections will address those issues.

1 Why write?

It is easier to sit down and write if you believe it is valuable. Consider three reasons why writing is a good use of your time and energy:

1. If you don't write, nobody can learn about the hard work you have done. A paper can be read by people around the world, can be used for decades, and can excite others about pursuing and further advancing your ideas.

2. Writing encourages clear thinking (Booth et al., 2016). Writing down your ideas can help you realize that there was a gap in your logical argument and that more work was needed to finish the project. Even better, these realizations sometimes lead to new research ideas! So writing is not just documentation. It clarifies and advances your research.

3. More crassly, your publication record is critical evidence when academic institutions make decisions to hire you, promote you, and give you awards. Thoughtful institutions will pay more attention to the quality of your work than the sheer volume of papers you write, but if you don't write any papers, then they can't evaluate that quality either. Writing successful proposals is another key part of academic success. So even if you don't buy into my more lofty first two reasons, this is a practical reason.

2 Good writing habits

Just like exercising or eating properly, writing is most easily done if you adopt habits that encourage good outcomes. These ideas may be initially non-intuitive, but I hope the explanations below will be persuasive.

Write frequently, in small doses

Writing is not something you should try to do in eight-hour stretches. First, large uninterrupted blocks of time are difficult to find, and they completely disappear as you get more senior. Second, 'binge-writing' makes you set aside other work, and the need to catch-up on that work later creates a crash and an aversion to future binges.

It is much more effective to write regularly in smaller 30- to 45-minutes chunks. At first, it may seem uncomfortable to stop before you finish a thought or a section. However, if you are writing regularly, you will have something to quickly jump back into the next day, rather than trying to find inspiration to tackle the next big section. And if you follow a strategy of leaving lots of notes in your draft (see below), it is less critical to immerse yourself for a full day in planning the paper.

Write before you are ready

Writing is not something that you start after you have composed a masterpiece in your head. Instead, it is part of the process of developing your ideas. Writing while your research is underway can help you capture ideas while they are fresh, and help you think about other research that would help you support your idea. A key point here is that 'writing' may be working on an outline of a paper or argument, or it may be journaling or other informal writing that is never used in a paper. (You shouldn't spent hours polishing the prose of a paragraph about a half-baked idea.) But these activities keep your writing juices flowing, and help you organize your ideas for when it's time to write the actual paper.

Assume you are going to throw out your prose

When I write, I stay in outline form for a long time, and am relentless in editing and cutting once I start writing prose. This approach can take a little while, but the quality of the resulting work is much better. And this process has an added benefit: I assume that I will later edit first-draft text beyond recognition, so I don't worry very much about getting it perfect. If there are tricky passages in a paragraph, I just leave myself a note to revisit that section, and I keep going.

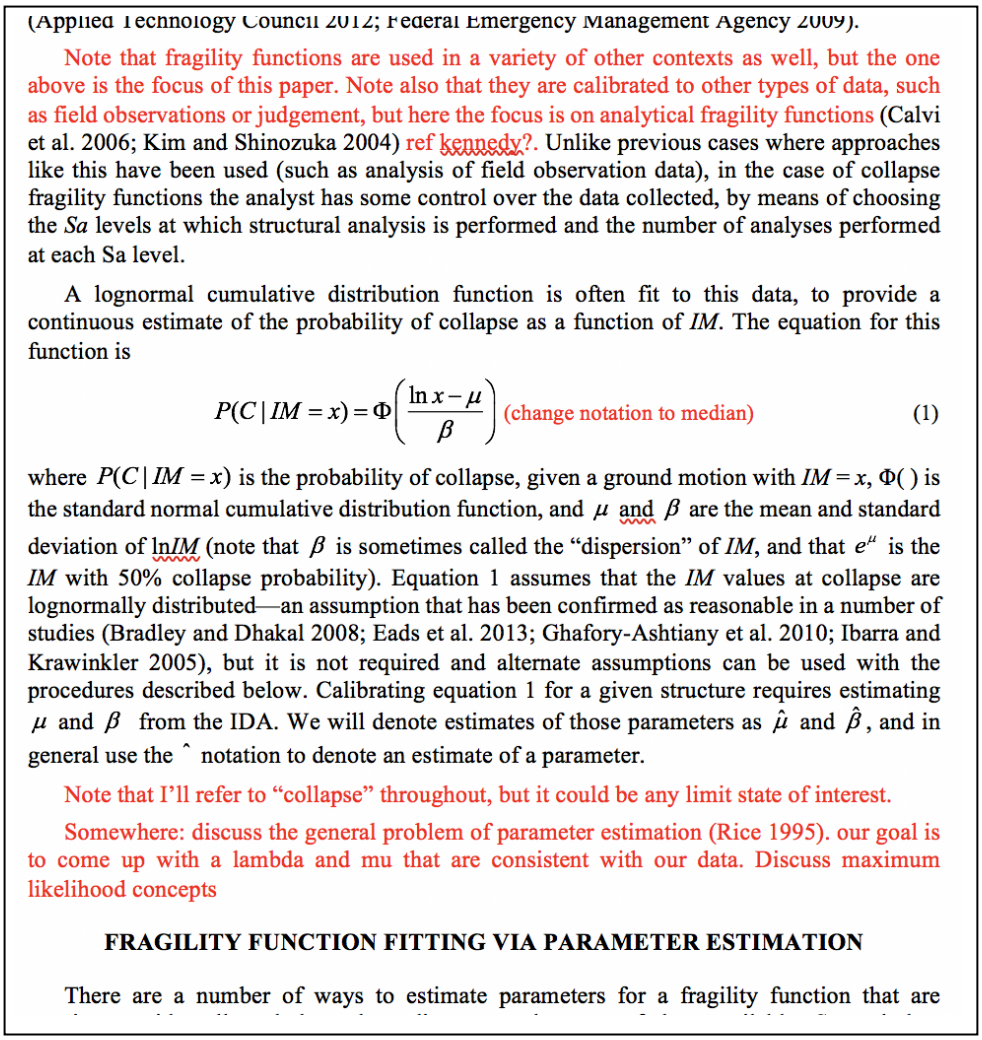
This strategy helps a lot with writer's block, because it takes away the pressure to write perfectly. It also separates the *creating* task from the later *refining* task. Those two tasks are quite distinct, and I find it impossible to do them both simultaneously.

As an exercise, try quickly writing a paragraph of text about your current research project (describe a key method you are using, why the work is important, or what your most exciting finding is). Assume that you're going to throw it away afterward, and take no more than five minutes. In the end, if you find a useful sentence or two–great! If there is nothing useful, that's fine too. You only spent five minutes on this, and you assumed you would throw it out. Maybe it provides some insight into a part of your work that you can't yet clearly explain. Or maybe it gives you an idea for an alternate way to describe your work next time. This type of exploratory writing can be informative, and it starts building the idea in your head that not every word you write has to be saved for your paper.

Leave lots of notes in your drafts

When you are writing, you probably have a constant internal dialog going. I ask myself questions like, 'Should I include an extra equation here to explain this calculation?' and 'Should I include a reference to to related work by Jane Doe?' and 'Do I need to explain concept X before I get to the discussion in this section?' The challenge is that addressing these questions usually takes me away

from the next idea I was planning to write about, but remembering those issues is also distracting. My solution is to just quickly write the questions into my document, and then get back to my main thought. I write notes to myself in red text, as this is quick to do and the notes are easy to find later (see Figure 1). You could also use the 'Comment' feature in your word processor, or put a symbol in front of the note–whatever is easy and fast would work fine, as long as you use the same system consistently.



(Applied Technology Council 2012; Federal Emergency Management Agency 2009).

Note that fragility functions are used in a variety of other contexts as well, but the one above is the focus of this paper. Note also that they are calibrated to other types of data, such as field observations or judgement, but here the focus is on analytical fragility functions (Calvi et al. 2006; Kim and Shinozuka 2004) ref kennedy?. Unlike previous cases where approaches like this have been used (such as analysis of field observation data), in the case of collapse fragility functions the analyst has some control over the data collected, by means of choosing the *Sa* levels at which structural analysis is performed and the number of analyses performed at each Sa level.

A lognormal cumulative distribution function is often fit to this data, to provide a continuous estimate of the probability of collapse as a function of *IM*. The equation for this function is

$$P(C \mid IM = x) = \Phi\left(\frac{\ln x - \mu}{\beta}\right)$$ (change notation to median) (1)

where $P(C \mid IM = x)$ is the probability of collapse, given a ground motion with $IM = x$, $\Phi(\,)$ is the standard normal cumulative distribution function, and μ and β are the mean and standard deviation of ln*IM* (note that β is sometimes called the "dispersion" of *IM*, and that e^{μ} is the *IM* with 50% collapse probability). Equation 1 assumes that the *IM* values at collapse are lognormally distributed—an assumption that has been confirmed as reasonable in a number of studies (Bradley and Dhakal 2008; Eads et al. 2013; Ghafory-Ashtiany et al. 2010; Ibarra and Krawinkler 2005), but it is not required and alternate assumptions can be used with the procedures described below. Calibrating equation 1 for a given structure requires estimating μ and β from the IDA. We will denote estimates of those parameters as $\hat{\mu}$ and $\hat{\beta}$, and in general use the ^ notation to denote an estimate of a parameter.

Note that I'll refer to "collapse" throughout, but it could be any limit state of interest.

Somewhere: discuss the general problem of parameter estimation (Rice 1995). our goal is to come up with a lambda and mu that are consistent with our data. Discuss maximum likelihood concepts

FRAGILITY FUNCTION FITTING VIA PARAMETER ESTIMATION

There are a number of ways to estimate parameters for a fragility function that are

Figure 1: One of my draft papers, showing drafted text (in black) with interspersed comments and questions (in red).

There are many benefits to this system:

- The notes give me reminders to go back later and think about these issues, so I don't have to remember them in my head.
- The questions are great helpers with writer's block, because when I pick up my draft without a specific writing goal, I can choose one of the notes to resolve, and I immediately have a writing prompt.

- The questions can also be useful for my co-authors to see. They can quickly see if I am unsure about a particular section, and they might have advice that helps resolve a question before it is turned into polished writing.

3 Have a plan and a vision

A third key ingredient to productive writing is to have a vision for what you are trying to accomplish and plan for how to do it. To get to my vision, I spend lots of time thinking about the objectives and scope of my planned paper. I also spend lots of time defining the audience, and thinking about what they will be interested in. My goal is to visualize a specific person, and state why they would be interested in reading my paper (e.g., 'Leo would be interested in my paper because it solves a problem that he pointed out in his recent paper X'). This is discussed further in my companion document, 'The process of writing a paper.'

If you start writing before you know who you are writing to or what you are trying to convey, it is incredibly hard to write! Rankin (2001) states that most writing problems can be resolved by stepping back and re-examining your purpose, audience, and voice.

The comments in this section relate specifically to writing papers. Feel free to free-write without a plan as you are trying to think through your ideas. But when you start a paper that will eventually be read by others, be sure to first figure out this plan and vision.

4 Improve your skills

If you are motivated, have good habits, and have a plan (discussed in the previous sections), you will be in great shape. The next thing you can do to be productive is to improve your technical skills.

4.1 Get formal training

Writing involves many technical details related to developing outlines, formulating persuasive arguments, organizing content within paragraphs, and structuring sentences. I can't teach you all of these things here, but learning those concepts will make you a better and more confident writer. My institution has a Technical Communication class focused on technical writing that I encourage all my advisees to take. For me, my undergraduate degree was at a Liberal Arts school where I did a lot of writing, and that training has helped me tremendously. You shouldn't view training as something that you need before you can start writing, but if you work to get formal training in parallel with your research work, you will find the effort worthwhile.

4.2 Read other people's writing

Spend time reviewing your peers' writing. In fact, you should volunteer to review! This serves several purposes.

1. By reading drafts from more mature writers, you can learn by observing how they progress through drafts. Reading only finalized manuscripts doesn't give you much indication of how the author got to that product, so seeing intermediate drafts can be very informative.

2. Reading poorly written material helps you realize what you should avoid in your own writing.

3. When you have helped your peers to edit their work, it's easy to ask them to return the favor and edit your work.

Reading both good and bad writing, and critically assessing it, is incredibly valuable. A formative moment in my career was volunteering to participate on a National Science Foundation proposal review panel as a first-year faculty member. A few days of reviewing proposals gave me insights such as:

- 'This writer used clear section titles and tightly focused the discussion in each section, so I could quickly understand the idea, and quickly locate the material that addresses any questions I have.'
- 'This writer avoided jargon and acronyms, and it is much easier to read than others.'
- 'This writer thinks they are showing off with all these equations, but they never stated their goals and assumptions, so I can't understand anything.'
- 'This writer tried to put key concepts in bold text, but they seem to have indiscriminately put bold text on 20% of the words, so now I'm just distracted by all the font changes rather than being able to read their ideas.'

Two days of listening to other panel members critique the same proposals helped me confirm or refine my impressions. That one experience was as valuable as all the prior advice I had gotten on writing proposals.

5 Further reading

There are many good books and references available from people who research this topic and are more expert than me. Boice (2000) describes empirical data on what makes faculty productive writers. It is equally relevant for grad students. Silvia (2007) has lots of practical tips on productivity. Professor Ramsey provides an interesting guide to technical writing at `https://www.cs.tufts.edu/~nr/pubs/two-abstract.html`

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