Good Writing

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It is important that you produce good writing for technical reports and research papers. Good writing will permit your readers to concentrate on your ideas, and may help you to give the impression that you know what you are talking (writing) about. I am not going to define good writing, but will assume that you know good writing when you see it. Instead, I will concentrate on giving you some tips that will help you to produce good writing.

My formula for good writing is simple: once you decide that you *want* to produce good writing and that you *can* produce good writing, then all that remains is to write bad stuff, and to revise the bad stuff until it is good. So we start with two top-level tips for good writing:

- *You must want to produce good writing.*
- *You must believe you can produce good writing.*

My first point is that you can produce good writing only if you want to. It takes lots of hard work, and an unfortunate fact of life is that for most people, it will always take lots of hard work. Your writing will get better with experience and confidence, but it will probably not get much easier. Because good writing requires hard work, your motivation is a key factor—you must want your writing to be good if you are to spend the time and effort required to make it good. So my first point is that good writing starts with your desire to produce good writing.

My second point is that you must believe that you can do it. If you don't have the confidence that you can hammer out a good result, you may rely too heavily on someone else's help, or worse, settle for mediocre results. Almost all documents containing good writing go through initial and intermediate phases, when they are mostly bad.[1] Confidence in the ultimate outcome of your efforts will be essential if you are to keep plugging away at draft after draft in order to convert the bad stuff into good stuff. So even though it won't be easy, you need to have confidence that you can do it.

You have good reason to be confident. Almost anyone who makes it to graduate school (and certainly everyone else) can learn to communicate clearly through the written word. No matter how bad your writing is today, you can make it substantially better.

Now that you are committed and confident, here are some tips that will help you to write the good stuff:

[1] I admit it. There are a few jerks out there who write perfect stuff the first time, and who don't have to work hard to make their writing good. But I'm assuming that you don't belong to this class of disgusting individuals.

Good Writing is Bad Writing That Was Rewritten

Almost all good writing starts out bad. Rather than leave it bad, the good writer rewrites and refines it until it is good, or even very good. This process may take several passes over the same words, sentences, and paragraphs, but a dozen or so passes is typical. This observation, that good writing starts out bad, is important because it has two implications.

The first implication is that when you start a new paper or report, there is nothing wrong with using bad writing. Your goal when you start is to get your ideas down on paper in any form you can. Incomplete sentences, streams of consciousness, lists of ideas, and outlines are all good ways to get started. These methods will help you to figure out what you want to say, which is the main purpose of this phase in writing. You don't have to worry about the writing being bad, because you will revise it later.

The second implication of the idea that good writing starts out bad, is that you will revise the bad stuff until it is good. Unfortunately for most of us, our first exposure to writing was for grammar school term papers or essays. I don't know about you, but I always did those things the night before they were due, and rarely read them once they were written, let alone revised them. My job was to write, my teacher's job was to read, and no one revised. Once you get the idea that you will keep working on a paper, writing and rewriting it, until all the writing is good, the rest is relatively easy. Here's what you should do during all that revising:

Scrutinize each paragraph and revise it until it is a good one. Topic sentences are particularly helpful and important. Try to have one main idea for each paragraph. Paragraphs are good when they say what you want to say, and when all the sentences hang together harmoniously. When you are reading and rewriting your paragraphs, read them out loud occasionally to get a feel for their rhythm.

Scrutinize the glue between your paragraphs. Make sure that your paragraphs fit together nicely. Does each paragraph follow from the last and set up the next?

Scrutinize each sentence and rewrite it until it is a good one.[2] I assume you can tell a good sentence when you hear one, so read your stuff out loud to test it on your ear.

That's all there is to it. Write down everything you want to say. Then grovel over it until it is good. Here are a few other tips that might help.

Spill the Beans Fast

Unlike murder mysteries that keep the reader from knowing *whodunit* until the very end, a research paper should reveal whodunit and whodunwhat as soon as possible. You should summarize your whole story at the very beginning of your paper, without holding anything back. Not only should you describe what you set out to do, but you should also tell your reader what you found out. You should put your best stuff up front, in the title if possible.

[2] I said I wouldn't give details of what makes good writing good, but I can't resist saying a few things. Of course, the grammar must be perfect. Avoid run-on sentences. I get particularly annoyed by sentences that use words with unclear antecedent. For instance, there might be three "it"s in one sentence, each referring to something different. Instead of using the word "it", substitute exactly the same words that were used to name "it" in the first place. There is nothing wrong with repeating the same phrase several times in one sentence or a paragraph to improve the clarity. For some reason we are taught to randomly vary wording to avoid repetition. This practice makes binding antecedents much harder. Another pitfall is to write "*the* whatsit," when no whatsits have yet been mentioned.

Now this tip about spilling the beans fast makes real sense. Assuming that you are writing the paper because you did something very clever and you want everyone to know about it, then you might as well start letting them know at the beginning of your paper. Most folks aren't going to hang around to read the whole thing anyway, so you have your best shot at revealing how devilishly ingenious you are if you do it right away:

- *Spill the beans in the title,*
- *Spill the beans in the abstract,*
- *Spill the beans in the introduction, and*
- *Spill the beans in the body.*

When you are spilling the beans at the beginning of your paper, don't just *refer* to your results, *give* your results. Use simple summaries of your most important points. For instance:

Wrong way: In this paper I will give you my formula for good writing.

Right way: My formula for good writing is simple—once you decide that you *want* to produce good writing and that you *can* produce good writing, then all that remains is to write bad stuff, and to revise the bad stuff until it is good.

I find it useful to spill the beans at the end of the introduction. This is a good place for bean spilling because the introduction has provided the reader with the background needed to understand the message, and because a simple statement of the message at this point improves the transition from introductory stuff to the main exposition. If you do a good job of spilling the beans in the introduction, then the introduction stands on its own, summarizing the entire paper.

Don't Get Attached to Your Prose

Suppose you've worked very hard on a sentence that was giving you trouble. Not only did you fix the problem, but you made the sentence into the best sentence you've ever written, probably the best sentence anyone has ever written in the entire state of Pennsylvania, a real prize-winner. It has a melodious ring and mellifluous rhythm that will make you famous. Unfortunately, after some other revisions to your paper and some more thinking, you find that your prize-winning masterpiece doesn't say quite what you intended to say, or that it is part of a paragraph that must now be eliminated for some other reason. What to do? (Multiple choice:) Maybe if you move the sentence to another paragraph you can make it sound true and keep it.

Who cares what the paper says anyway. If it sounds good, go ahead and use it.

Give up this year's prize for great literature and flush the damn thing.

I've used all three methods, but only the last one really works. So here's a technique that will help you to discard a good sentence or paragraph that doesn't really belong in your paper: Create a special file called PRIZE_WINNING_STUFF.TXT. Move all deleted text to this file. Should you find a new home for your special sentence later, either in this paper or some other paper, you are assured that it will still be in good health, available for resurrection at an instant's notice. I find that using a *refuse file* for all the well-written text that I don't need permits me to get on with the task of telling my story, without worrying too much about losing potentially valuable intermediate results. By the way, I've often been surprised at how positively mediocre a prize-winning sentence can sound when read a year later.

Just as you can get attached to your prose, you may get attached to a clever idea or argument that does not really fit in the paper. My advice is the same: flush.

Getting Unstuck

There usually comes a point in writing a paper when you get stuck. You try generating several descriptions or statements, but nothing you write seems to work. Getting stuck is frequently an indication that you don't have a clear idea of what you want to say, or you don't fully understand some of the things you planned to explain. This is normal—it takes more understanding to explain clearly what you did, than it took to do it.

When you are stuck, try making a list of the points you want to make. An outline can be very useful when you're stuck, especially if you have already begun to write text. You may find that you can write good paragraphs that clearly express parts of your story, but you still have trouble with the overall organization of your paper. For instance, after generating several pages of text you read them to find that they ramble and repeat, and that parts of your story are missing. You can't figure out what you are trying to say. At this point you should make a new outline and reorganize using the following procedure:

- *Write down the topic of each paragraph you have written, in a two or three word phrase.*
- *Shuffle and organize the topics into a coherent outline, adding or deleting topics as necessary.*
- *Rearrange the paragraphs of text according to the organization of the revised outline. You may need to add new text for new topics.*
- *Go back to paragraph and sentence refinement.*

This procedure will often help you to figure out what you've done, what is missing, and what needs to be done to get back on the right track. Occasionally, you may even try this on a sentence-by-sentence basis.

One way to get stuck writing is to lose track of where you are and get lost. I get lost when I've written a lot of text but the organization of the paper has not yet gelled. A way to get unstuck in this case is to line up all the pages of your paper face up on a big table or the floor, so you can see the whole paper at once. This will help you see the overall organization and the balance among the various sections. You will also see the arrangement of figures and their proximity to the sections of text. I find looking at the whole paper at once provides me with a map of the paper that says "You Are Here."[3]

Another means of getting unstuck is to keep at it. I frequently get stuck during the first three or four days of a new writing project, presumably because I still don't know what I want to say and because I have not yet abandoned some of the more exciting half-baked topics I had in mind. I find, however, that my productivity eventually improves if I keep working on the project, day after day. I seem to lose ground in terms of productivity when I skip writing days.

[3] It may be possible to carry this technique to far: I have a friend who photocopied all 554 pages of her Ph.D thesis at 1/4 scale, hoping for an organizational overview.

An important step in producing good writing is to get feedback from a friend or colleague about your work. I have two more tips for this aspect of good writing: you should husband your readers and trust them.

Husband Your Readers

Serious review of your writing by someone other than yourself is an essential ingredient in making your writing clear and good. However, readers who will carefully review your work are a precious resource that you must husband. It is difficult to get someone to read your stuff carefully even once, and you probably have only a very few friends who are devoted enough (or demented enough) to do it twice. Most readers are only effective for one reading anyway, because they know too much about what you are going to say by the time they attempt a second pass.

Ideally, you shouldn't show your paper to anyone until you've written all the sections and fixed every problem you know about. Every sentence should have good grammar. Include all the figures, at least in sketch form. Circulate a draft to just one or two people at a time. It is unpleasant to go to work when everyone in your building is hiding from you because they haven't gotten around to looking at today's draft of your paper yet. The basic idea is that you as the writer should do whatever hard work you can do in preparing your paper. Don't waste your readers on obvious grammar and typo problems. Your readers should be saved for the special task of giving you a fresh perspective on what you have written, and for revealing what is not clear.

There is an important exception to this rule. You may find it useful to get help with the overall organization of your paper in the early stages of its development. The purpose of this sort of review is to focus on the broad thrusts and concepts in your technical exposition, rather than on the details or wording. The best source of this kind of feedback is someone with a broad and mature view of your research area.

Trust Your Readers

When you get comments back from your readers, trust what they tell you. If they get confused at a particular point, don't argue with them, explaining why what you wrote is actually clear, and they just didn't get it. Rewrite that part to overcome whatever confused them. You'll be surprised to find that more than one reader will get stuck at the very same place in your paper, even if you have an arguement of why what you wrote is perfectly clear. When a reader marks a word or sentence in your paper, they are telling you *something is wrong here.* It is not necessary that you take the specific remedial advice the reader offers. Their suggested fix may be good, or you may be able to generate a better one.

The urge to ignore many of your reader's corrections will be strong. Just as you were reluctant to discard prize-winning sentences, changes that accommodate your readers comments may disrupt text that you were happy with, or even downright proud of. However, tough toenails: you must make the changes. Afterward you can go back and repair your desecrated text.

That's all there is to it. Now you can produce good writing. My main points are:

- *You must want to produce good writing.*
- *You must have confidence that you can produce good writing.*
- *Good writing is bad writing that was rewritten.*

- *Spill the beans fast.*
- *Don't get attached to your prose.*
- *Outlining helps to get unstuck.*
- *Husband your readers.*
- *Trust your readers.*