Preparing Your Results for Publication

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You've done some work, finished a project, maybe a thesis. Now it is time to start thinking about turning your results into a paper. The main reason you want to do this is so that other people can see (and maybe even start using) your results. So make your paper as readable as possible! How well the paper is written will not only influence whether people will read the paper, but also how closely they read it, and what impression they will have of the paper (and you!) afterwards. The following are some guidelines I've given to students in the past. You may not want to follow them in exactly this order, but I think eventually you will want to think about all of these aspects.

Before we start, let me say that there are several general resources on **writing mathematics**, e.g. Paul Halmos' paper "How to Write Mathematics," or David Goss' "Some Hints on Mathematical Style." I urge you to read some of them and consider the advice given there. I will not repeat any of it here.

Your first step on the way to a paper is probably to write up the **mathematical skeleton** of your paper, i.e., the core statements and their proofs. If you have written a thesis, consider yourself lucky—you have already done this part! If not, then even if you think you know how to prove a result and have good notes, it can still take a lot of additional headache (and time!) to put all the details into writing. Sometimes not all of this will make it into the final version of the paper, but it will still be valuable to have. What you consider obvious right now after working on something for a long time may not look so obvious to you when

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someone emails you with a question about it ten years down the road. The order of the different pieces is likely to change as you are writing the paper, but it will be easy to move things around as needed and fill in additional text. This is also a good time to plan notation and terminology you are going to use.

Now, decide what the **story** is you'd like to tell. There is usually more than one way to present a result and the work that leads to it. If you are describing a framework developed to prove a particular theorem, keep in mind that it may be more broadly applicable, and if so, make sure to point this out. Moreover, a consequence may be more striking to a wider audience even if mathematically weaker than your main result. Talk about your work to other people. Consider giving a talk at your home institution. This will force you to come up with a way to "pitch" your story. You might also receive helpful feedback on your results and comments on connections to other existing work. During the process of writing, you may find that your conception of the story has changed, and this may change the idea of how to best present it.

Next, the **structure of your paper** needs to be well thought out. It should reflect the story you've decided to tell and help the reader understand your work. Keep the logical flow simple, and try to create a clear path to your main result. For example, avoid having to reference results that are stated later, and make it easy to skip technical details on a first reading. Breaking your paper up into sections can help the reader navigate. (In that case, every section should have its own—short—introduction.) But don't dissect your paper so much you destroy its flow. A ten or fifteen page paper is unlikely to benefit from subsubsections.

Next, think about your **audience**. In books, one often finds a little paragraph about who this is aimed at and what the reader is assumed to be familiar with. While you

probably don't want to put it into your paper, you should ask yourself that exact same question and have a clear answer in mind while you're writing. This will help you be consistent, which in turn will make the paper easier to read. Not having thought about this is one of the more common mistakes in writing a research article. There are many papers that assume familiarity with some advanced concept but at the same time give definitions of more basic terms. It may help to think about how you would explain things to a particular person in your intended audience. Thinking about your audience is especially important when you work at the intersection of various fields. If you write only for people who are familiar with all those areas, your audience will be small. So try to write for a bigger audience. This does not necessarily mean you need to start giving lots of definitions, sometimes just adding a few references and additional explanatory text can go a long way. If your work falls into more than one field and the results are independent enough, you may also want to consider turning it into more than one paper.

From my experience, the **introduction** is best written once the main body of your paper is finished. Your introduction provides the context for your paper and explains the big picture—it is a very important part of your paper, and there is a separate article in this issue devoted to it. At the end of your introduction, consider including a little paragraph explaining the structure of the manuscript, as a quick guide to the reader. And whether here or at the end of the paper: Do not forget the acknowledgments!

Once you've written your first version, wait a week. Then read it again. You are likely to see things that could be improved, e.g., things that are not quite right, unclear, repetitive, left unsaid, should be moved around, proofs that could be simplified, etc. Fix it! You may want to do this process more than once. After that, you should **obtain feedback**. Find someone to read your draft—a fellow graduate student or postdoc, or a mentor, or just anyone who you know might be interested and knowledgeable enough to plough through your manuscript. Ask them to look for anything from general comments to typos. When I was a graduate student, my advisor (and in fact, all the postdocs working in his group) gave me drafts to comment on, and I learned a lot from that, a win-win. It's also a good idea to post papers to the arXiv preprint server at least a couple of weeks before submitting them to a journal. You might get some initial comments from the community, and those can improve your paper. For example, someone may point out a related reference that you had not looked at. (This also reduces the chances of upsetting a not-referred to researcher who may end up being your referee.)

There are many factors going into **which journal** you want to send your paper to. Among them are the importance of your work, whether it is suitable for a very general journal or better fits into a more specialized one, but also practical points like the length of the paper. Get advice from a more senior member in your community if you are unsure. Especially for early career researchers, the time aspect (from submission to report, from positive report to decision by the editors, from acceptance to publication) is important. The AMS publishes this information for a number of journals. Many journals do pre-reports, so at least if your paper is rejected for somewhat general reasons, you will find out soon and can resubmit elsewhere.

Some results are so important that people will have to use them and cite the papers they were published in, regardless of how well they are written. For most of us, these are the exceptions. So do not underestimate the importance of spending time and effort to write your papers well. The mathematicians who do read your work will thank you for it!

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