

The Art of Writing Introductions

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Why should I, or anyone, read your paper or care about your results? Answering these questions is what a great introduction to a mathematics research paper should do. I am sure most people have, on numerous occasions, picked up a paper that looked promising based on its title, only to abandon it after skimming through the introduction that was either short and unenlightening, or long, confusing, and unhelpful. Some papers are so important that people will read them no matter what, but the majority will be read and appreciated, to whatever extent that they are, based on how good the introduction is. What can you do to maximize the chance people will appreciate your work?

The best way to figure this out is to read lots of introductions to papers and carefully think what works well and what does not. But let's discuss a few important ideas to get you started writing masterful introductions! First and foremost, **the introduction should clearly state, in a theorem environment, what your main results are**, so with a quick glance, experts can see what is really in the paper. If a theorem is not mentioned in the introduction, then assume that few if any will read it. The statements should be as precise as possible, though on some occasions some paraphrasing or simplifications might be appropriate if the precise statements involve new technical definitions or ideas that would be hard to work into the introduction. The goal should be that anyone can get the main idea of the result by reading your theorem and possibly the adjacent paragraphs. Just by way of contrast, I point out that there are many papers that state no theorems in their introduction, but refer to dozens sprinkled throughout countless pages of the paper, so the reader is left flipping back and forth to try to even get a sense of what is in the paper (assuming they even take the time for that, which is

probably unlikely). This is not ideal, but it also brings us to an important caveat of this advice, and probably all advice: rules are made to be broken! While reading the above paragraph you might think, "Wait, I know amazing papers that don't state theorems in their introduction." This is true, such papers exist, and great writers can get away with this in some very limited situations. However, in the majority of cases it would be best not to try this.

Moving on, a common problem writers have, especially early in their career, is to overestimate what everyone will know about their work and how it fits into the research world. Assuming that everyone will understand the context of your work, and why it is really interesting, is not a good idea. Most work is focused on some part of a bigger program or problem, and even experts in a field might not, in any given moment, recall the subtleties and details to every interesting problem in their field. So tell them, and all the other readers who will have no chance of appreciating the context without some help from you. **Explain the big picture.** How does your work fit into a larger research program. Why is this a significant advance. What are new ideas or techniques that you introduce. What is surprising about the results. What is the key takeaway. All of these things should be made clear in your introduction. Don't assume the reader will sort this all out themselves. They won't. Remember, people will often interpret the results in your paper exactly the way you tell them to interpret them (or at least that will be their best possible interpretation). It is especially important to keep this in mind if you are working at the juncture of two or more fields, where it is quite likely that a reader might, at best, be familiar with one of the fields.

Another helpful point is **make sure the introduction is broken into digestible pieces.** What I mean by this is that if your introduction is more than a page or two it would be helpful if important ideas and different results are highlighted by sectioning them into meaningful pieces. This can be done through the use of subsections, theorem

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and definition environments, figures, and other such markers that indicate when new ideas or results are coming into play. Make it easy for readers to find the parts of your introduction in which they are most interested, or when they've decided they understand or don't care about one topic or idea in your paper they can move onto the next without difficulty.

While this may seem to contradict with other ideas above, **it is best to try to keep your introduction as brief as is reasonably possible.** People are busy and will only devote so much time to a paper, so do not tax their attention span. For example, when discussing context and background it is easy to get carried away. If something is a tangent to the main ideas and is not that important to the paper, then it is probably best to leave it out. If there are common, but not universally known definitions, don't define them in the introduction. Just use them and refer to a background section for details about terms that are not completely standard in the field. A rule of thumb is that if you think a person in the field has a good chance of knowing the definition, then assume they do for the purposes of writing the introduction.

Let me reiterate, the best way to improve your crafting of introductions is to read many papers and critically think about what you liked about them and what you didn't like about them. Then think about how you can use these insights in your own writing. Another important tool is to ask for constructive feedback on your papers from colleagues, especially more senior ones. But most importantly, think carefully about what you are doing while writing your introduction and what you are trying to accomplish. Good introductions can elevate the community's appreciation of your work and quite possibly you, so make sure to write great ones.



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Credits

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