PRISM

Lecture 4 - Writing a Paper

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Today

- Was going to give pointers on how to write papers
  - But what can I possibly say in 30 minutes?
- Instead:
  - What's different about academic writing?
  - Useful resources (much more out there than you can get through)
  - What to do as a beginning researcher: think about questions of communication as you read papers

Scientific Writing

What's different from the writing you've done so far?

- Higher standards
  - Highly competitive conference/journal submission
  - Need to convince skeptical readers
- You know way more about the topic than your readers
  - It's hard to remember what it's like not to know something
- Much more information to convey
  - 8 page limit is a surprisingly difficult constraint to meet!
- Need to make clean, informative figures
- Papers go through many rounds of revision, with feedback from your colleagues
- You need to be attuned to subtle LaTeX cues that readers rely on

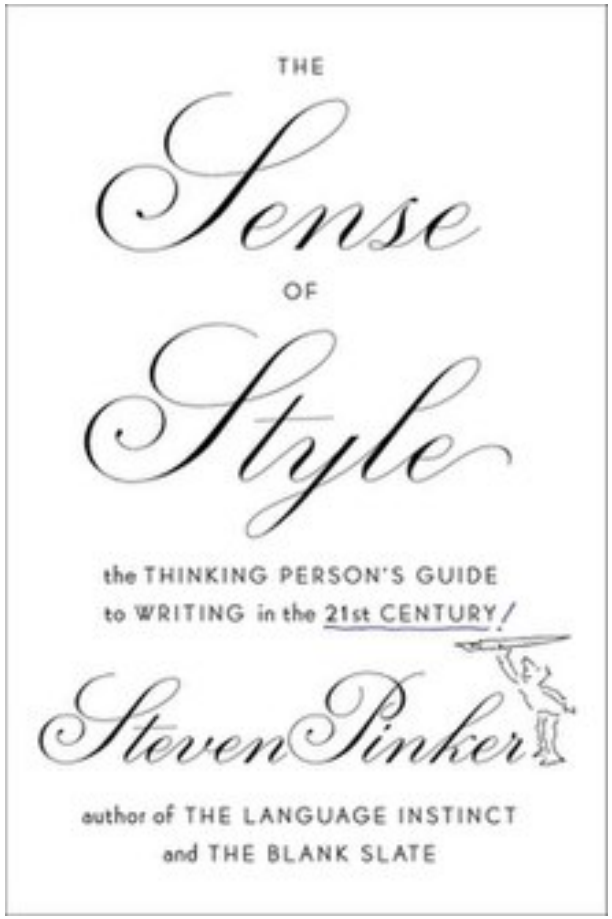
$$logp(x) \text{ vs. } \log p(x) \qquad \mathbf{R} \text{ vs. } \mathbb{R}$$

$$\epsilon \text{ vs. } \varepsilon \qquad +\ldots+ \text{ vs. } +\cdots+$$

Books on Scientific Writing

The Sense of Style, by Steven Pinker

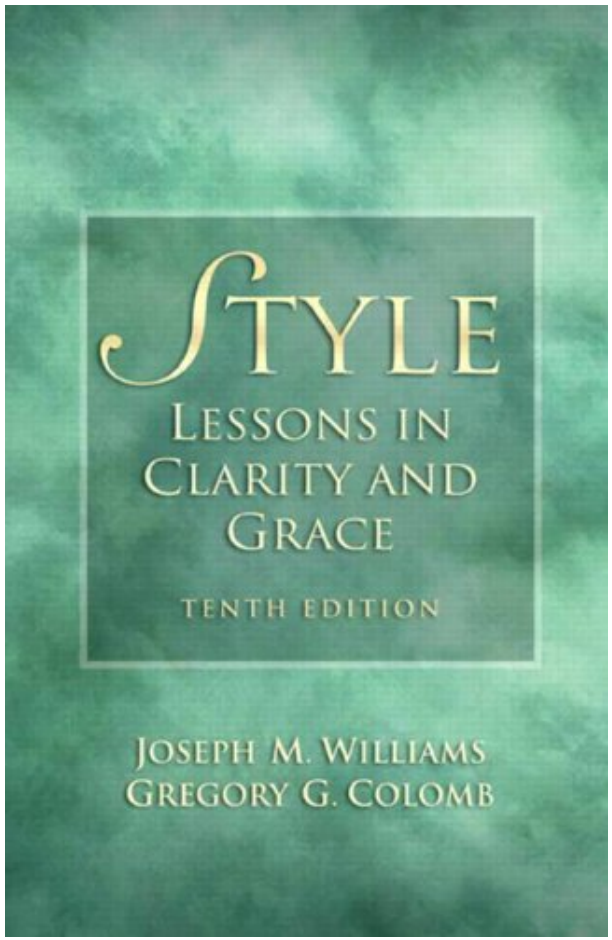
- Pinker is a psychologist (of language) at Harvard, and one of the best popular science writers
- This book is about scientific writing, especially aimed at non-experts, and brings in some insights from cognitive science
- Gets you to think about what's going through the reader's mind
- Fun to read (even the parts about grammar!)



Books on Scientific Writing

Style: Lessons in Clarity and Grace, by Joseph M. Williams and Gregory G. Colomb

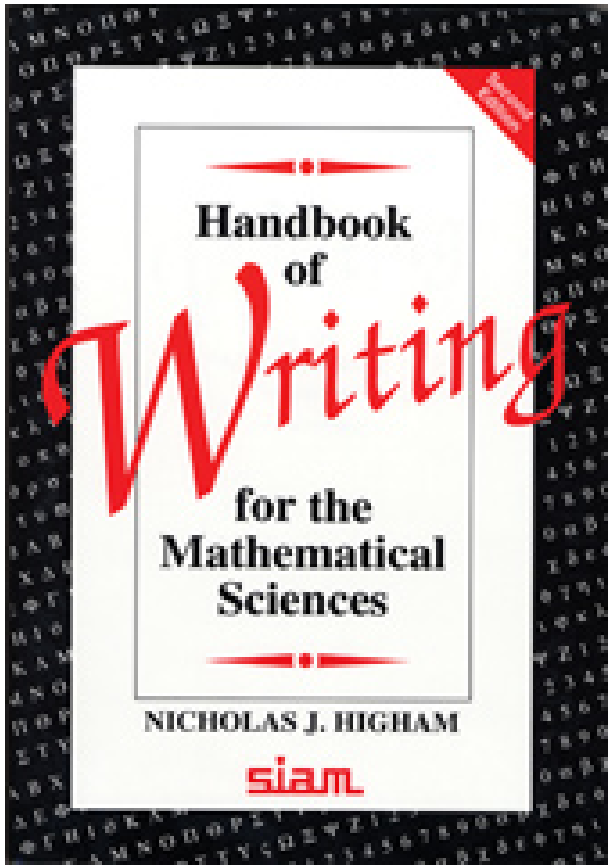
- About the mechanics of writing: how to organize your thoughts on a page
- How to organize words into sentences, sentences into paragraphs, etc.
- You may think you're done with this sort of thing, but I think 90% of you would still benefit from it



Books on Scientific Writing

Handbook of Writing for the Mathematical Sciences, by Nicholas J. Higham

- Covers issues specific to mathematical writing, e.g.
  - how to structure a proof
  - choices of mathematical notation
  - whether something should be a Proposition, Theorem, Lemma, etc.
  - how to punctuate equations
- Also helpful advice in general



Other Resources

- MIT AI Lab (Section 6): `http://dspace.mit.edu/bitstream/handle/1721.1/41487/AI_WP_316.pdf`
- Phillip Guo: `https://pg.ucsd.edu/publishing-academic-papers.htm`
- Michael Ernst: `https://homes.cs.washington.edu/~mernst/advice/write-technical-paper.html`
- Mary Shaw: `http://www.cs.cmu.edu/~Compose/shaw-icse03.pdf`
- CMU writing course: `http://spoke.compose.cs.cmu.edu/write/Default.htm`

General Advice

- Please check out these resources on your own time. Writing is a surprisingly important skill for research, and takes lots of practice
- In the meantime, as you read papers, think about them from a rhetorical perspective, so you get a sense for what does and doesn't work
- E.g., ask yourself
  - Who is the intended audience? (Experts in this sub-subfield? Computer scientists in general?)
  - What are the main points the author is trying to get across, both explicitly stated and implicit?
  - Did they succeed? Why or why not?
  - Was the paper easy for you to follow? Why or why not?
  - If there are figures, do they convey the information clearly? Why or why not?
  - Does the paper make you want to keep reading? Why or why not?

Sections of the Paper

Sections of a Paper

Now I'll talk about the goals of the individual sections. As you read papers, ask yourself if the authors succeeded in these goals.

Introduction

- Should convey:
  - the problem they're trying to solve
  - the previous approaches, their strengths, and how they fall short
  - the authors' approach and how it's novel
  - the main evidence that it succeeded
- Should persuade the reader:
  - that the problem is interesting, important, and difficult
  - that the authors' approach is a plausible one
- Should get to the point with minimal preamble

Sections of a Paper

Background

- Should introduce any nonstandard notation that will be used in the paper
- Should explain all the ideas an expert reader would need to understand the paper
- Should cover only what's needed for the paper (in order to get to the main contribution as soon as possible)
- Should be mathematically precise

Related Work

- Should reference all the work that's clearly relevant
- Should clarify how the current work is related to past work, but also how it goes beyond it
- Often this section is written defensively (e.g. cites papers by potential reviewers)

Sections of a Paper

Methods

- The main technical meat of the paper
- Should explain the novel algorithms, theoretical results, etc.
- Should motivate all of the design choices
- Should present ideas in the most sensible order
- Should be organized such that the reader can read it linearly
- Should be mathematically precise and make assumptions and approximations explicit
- Should make it completely clear which parts are novel contributions
  - Failing to do so is a common writing mistake that can tank a conference submission
- Should anticipate the reader's objections or misconceptions

Sections of a Paper

Experiments

- Not meant to be read linearly — often the figures and tables contain the important information
- Should highlight the questions the experiments are meant to answer
- Should explain the experimental methodology in enough detail for the reader to replicate
  - In practice, many details needed only for reproducibility, rather than understanding the logic of the experiments, are relegated to the Appendix
- Should justify the experimental design choices
- Should highlight and interpret the main findings
- Should discuss alternative explanations for the findings and how they're controlled for

Sections of a Paper

Discussion/Conclusions

- Short (1–2 paragraphs)
- Recaps the main contributions and findings
- Similar to the introduction, except that the reader is better informed after having read the paper
- May highlight new, interesting directions opened up
  - but be careful of suggesting things the reviewers will say you should have done!
- Authors are allowed to speculate a bit here