

Research Tools and Methods for the Mathematical Science

Lecture 2: Writing

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April 7, 2015

Proof by Lost Reference: "I know I saw this somewhere ..."

There are three rules for writing a novel. Unfortunately, no one knows what they are.

W. Somerset Maugham

Word-smithing is a much greater percentage of what I am supposed to be doing in my life than I would have ever thought.

Donald Knuth [KLR89, p.54]

Why write?

Obviously

- We write to tell people about our work
- We write to get jobs, grants, ...
- We write to teach (notes, tutes, assignments, exams, ...)

I'm not going to try to teach you grammar (I'm not that good at it anyway), or how to be a brilliant writer – just some things that help me.

When

When do you plan to start writing your thesis?

Why write, redux

Not so obviously, writing clarifies our own thoughts

In writing, you clarify your own thoughts, and strengthen your conviction. Indeed you probably grasp your thoughts for the first time. Writing is a way of thinking. Writing actually creates thought, and generates your ability to think: you discover thoughts you hardly knew you had, and come to know what you know. You learn as you write.

Sheridan Baker, 1985

Writing brings out gaps in your understanding, by forcing you to focus on steps in your thinking that you might otherwise skip.

Nicholas Higham, 1995 [Hig95, p.2]

How can I tell what I think till I see what I say?

E. M. Forster

Why write, redux, part II

Not so obviously, we write to collaborate

- We'd all like to work together in person
 - ▶ not always possible
 - ▶ communicating through email is easy
- Talking is good, but often imprecise
 - ▶ writing things makes them concrete, and exact
- Writing partial results can help you move forward by showing structure and gaps
- There is a social component to the acceptance of a mathematical argument
 - ▶ we (almost) never write out a proof in full predicate logic
 - ▶ we jump “obvious” steps, and use higher-level logic
 - ▶ acceptance depends on the care of the prover and reader

Writing for the Mathematical Sciences

- Writing is hard (at least for me)
 - ▶ we didn't start maths degrees because we loved writing
- The best way to learn is to do
 - ▶ write a lot
 - ▶ when you aren't writing, read a lot [KLR89, p.74]
 - ★ remember what you liked, and didn't like
- Other tools
 - ▶ read about how to write (books and the Internet)
 - ▶ get feedback, from **anyone** who will read your stuff

Getting started

- Procrastinate tomorrow
 - ▶ avoid distractions (non-work and work)
 - ▶ don't wait until you're "ready" or in the "mood"
 - ★ action inspires motivation as much as the other way around

Writing is purely a matter of inspiration. Writing is my profession, so I ensure that I am inspired from 9:00 to 5:00, Mondays to Fridays.

W. Somerset Maugham

- Get rid of the blank page
 - ▶ bullet point, cartoons, ...
 - ▶ if you can't write something good, write something crap
- Start small
 - ▶ write something easy 1st, and build up to harder things
- Stop reading, thinking, experimenting (for a little while)
 - ▶ write what you have now

Lots of this advice comes from [GK10]

Getting it finished

- Procrastinate tomorrow
- Snack write
 - ▶ little but often
 - ▶ have a place to write (quiet, undisturbed, ...)
 - ▶ set times to write
 - ▶ only write
- When is it good enough to show people?

Getting it finished

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 - ▶ only write
- When is it good enough to show people?
 - ▶ never, so just do it
 - ▶ you need feedback, particularly when you are starting out
 - ▶ the feedback may be negative: get over it
- Plan time for editing
 - ▶ your supervisors are busy and won't give you instant feedback
 - ▶ give them your work (very) early
 - ▶ remind them (nicely)
 - ▶ don't let them delay you (keep working)

Lots of this advice comes from [GK10]

Various Tasks

- Writing a paper
- Writing a project or technical report
- Writing a review/survey article
- Writing a talk/slides
- Writing a thesis
- Writing a project proposal (for a grant, ...)
- Writing a critical review (of a manuscript)
- Writing a job application, CV, ...
- Writing a reference letter

They are all different, but have some commonalities. That's what we'll look at today.

Common Themes

things that apply, whatever the task

- Know your audience
- KISS (Keep it Simple Stupid)
- Good English
- What's your story?
- Logic isn't just for proofs
- Don't waste my time
- Write, rewrite, rewrite, rewrite, ...

We'll look through these in some more detail

Know your audience

- respect your audience
- cater to them
- don't waste their time
- remember that you are just one draw on their attention
- give them something to take away

Above all, remember the Golden Rule – do unto others ...

KISS

Most (of my) writing is too verbose. A major and tedious task of an editor is to remove unnecessary or unimportant words (often qualifiers that Engineers and Mathematicians may feel were important for precision, but which are really just ways to weasel out of saying something definite) that might otherwise clutter up and extend sentences beyond the bounds of a reader's limited tolerance, leading the reader to feel that it is just too much work to go on, and at some point you stopped reading this so I can say pretty much anything I like from now on, not to mention the fact that you probably forgot what I was saying at the start of the sentence.

- Short sentences are good.
- Avoid jargon for jargon's' sake.
- Edit your work.

An Example (from [Gow86, p.46])

This appeared in the Lancet

Experiments are described which demonstrate that in normal individuals the lowest concentration in which sucrose can be detected by means of gustation differs from the lowest concentration in which sucrose (in the amount employed) has to be ingested in order to produce a demonstrable decrease in olfactory acuity and a noteworthy conversion of sensations interpreted as a desire for food into sensations interpreted as a satiety associated with ingestion of food.

An Example (from [Gow86, p.46])

Wouldn't you prefer

Experiments are described which demonstrate that a normal person can taste sugar in water in quantities not strong enough to interfere with his sense of smell or take away his appetite.

KISS, part II

Everything should be as simple as it can be, but not simpler.

Albert Einstein

- Often, you will be given the advice “Avoid fancy words” [SW99]
 - ▶ Perhaps, prefer [Gow86, p.47]
 - ★ familiar to far-fetched
 - ★ concrete to abstract
 - ★ single word to circumlocution
 - ★ short to long
 - ★ Saxon to Romance
 - ▶ But English has a delightful level of subtlety: we can say
 - ★ “dance” or “caper”
 - ★ “have intercourse” or “fuck”
 - ★ “teach” or “enlighten”and half the fun and beauty of writing is choosing the exact right words
- Jargon has its place: would you rather say
 - ▶ a “relatively small carnivorous mammal with fur, retractile claws and a distinctive sonic output”, or

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- Jargon has its place: would you rather say
 - ▶ a “relatively small carnivorous mammal with fur, retractile claws and a distinctive sonic output”, or
 - ▶ a cat (paraphrased from Ralph P. Boas, “Can we Make Mathematics Intelligible?”, 1981)

Good English

- Almost all scientific writing is currently in English
- A necessary condition for a good paper is that it be well written
 - ▶ this is not a sufficient condition, but almost!
- Writing for a scientific paper isn't really any different to writing anything else [Rub]
 - ▶ maybe it needs to be more precise
 - ▶ maybe a little less lyrical or whimsical
- There are many tools to help you write well
 - ▶ style/readability guides [Gov90, Str99, SW99, DuB04]
 - ★ The Chicago Manual of Style
 - ★ Guide to Grammar and Style by Jack Lynch
 - ▶ academic writing guides [Hig95, GK10]
 - ▶ books and essays on general writing [Gol12, Gow86]
 - ★ Politics and the English Language, George Orwell
 - ▶ Apps
 - ★ e.g., <http://www.hemingwayapp.com/>

Good English, part II

Beware: “good English” is terribly hard to nail down

- The rules are complex
 - ▶ [Bry90] quotes many mistakes in English in English grammar manuals.
- Exceptions are rife, even if only because violating the rule draws attention (hopefully in a way that was intended)
- English changes:

King Charles described it [St Paul's Cathedral] as “awful, pompous, and artificial” — and he was intending it to be complimentary.

Tom Burton [Bur95, p.5]

- Most of the rules were just made up at some point
 - ▶ Shakespeare signed his own name with 6 different spellings, none of them “Shakespeare”
- Madly following the rules leads to dry colourless prose of value only to dry colourless people

Good English, part IIa

an example: the comma

I have spent most of the day putting in a comma and the rest of the day taking it out.

Oscar Wilde

- Bitter feuds are fought over the comma
- There are many rules, and many pitfalls
 - ▶ “Ingredients: lettuce, tomato, goats, cheese”
 - ▶ “Slow children crossing”
 - ▶ “The cold, wet, crying boy” or “The wet, crying, cold boy”

<http://www.vappingo.com/word-blog/the-importance-of-punctuation/>

- I have been accused of “jazz” commas (that don’t follow the rules) but my rule is listen to what you are saying, and use commas where they make sense as breathers.

Good English, part III

- You need to learn good grammar and style
 - ▶ at least in order to abuse it well
- The ear you get from reading is better than reading style guides, but you need to read a lot
- I prefer to think about the “meta-rules”
 - ▶ the things I am talking about here
- Be consistent (except when you don't want to be)
- Learn the rules that people care about in your domain
 - ▶ some people are sticklers for some particular set of English grammar
 - ▶ just deal with it

What's your story?

- Writing needs structure

- ▶ beginning
- ▶ middle
- ▶ end

and this applies to at every level

- ▶ thesis/book/article
- ▶ section
- ▶ paragraph

- More than this, we need a narrative

- ▶ what is the story you are telling
- ▶ how do you get from A to B to C ...
- ▶ sections need to connect
- ▶ new ideas can't appear from the blue

Logic isn't just for proofs

- You need to develop ideas logically
- Support your statements
 - ▶ provide references (we'll talk more about these later)
 - ▶ provide data
 - ▶ provide logical arguments
- One idea builds on another towards your results
- Don't omit steps (space permitting)
 - ▶ words like “obviously” and “clearly” are flags that the writer can't support an argument

Don't waste my time (again)

- Avoid weasel words and phrases
 - ▶ buzz-phrase generator [Gow86, p.89]
- Avoid padding
 - ▶ by means of \Rightarrow using
 - ▶ in order to \Rightarrow to
 - ▶ in the vicinity of \Rightarrow near
- Avoid outlines
 - ▶ for short works, e.g. most papers
- Avoid motherhood statements, e.g., “Motherhood is good”

Write, rewrite, rewrite, rewrite, ... [KLR89, p.73]

Easy writing makes hard reading

Ernest Hemingway

What is written without effort is in general read without pleasure.

Samuel Johnson

A work of art is never completed, only abandoned

Leonardo da Vinci

I love deadlines. I like the whooshing sound they make as they fly by.

Douglas Adams

But know when to stop – you also have to be efficient.

Read stuff

...

*He was my North, my South, my East and West,
My working week and my Sunday rest,
My noon, my midnight, my talk, my song;
I thought that love would last for ever: I was wrong.*

*The stars are not wanted now: put out every one;
Pack up the moon and dismantle the sun;
Pour away the ocean and sweep up the wood.
For nothing now can ever come to any good.*

W.H.Auden, "Stop all the clocks, cut off the telephone"

Just for interest

The Bulwer-Lytton Fiction Contest

Worst starting sentence ...

- “It was a dark and stormy night; the rain fell in torrents – except at occasional intervals, when it was checked by a violent gust of wind which swept up the streets (for it is in London that our scene lies), rattling along the housetops, and fiercely agitating the scanty flame of the lamps that struggled against the darkness.”
Edward George Bulwer-Lytton, Paul Clifford (1830)
- “As he told her that he loved her she gazed into his eyes, wondering, as she noted the infestation of eyelash mites, the tiny deodicids burrowing into his follicles to eat the greasy sebum therein, each female laying up to 25 eggs in a single follicle, causing inflammation, whether the eyes are truly the windows of the soul; and, if so, his soul needed regrouting.”
Cathy Bryant, Manchester, England, 2012 Winner.

Just for interest

Very Short Stories

Stories in 6 words:

<http://www.wired.com/wired/archive/14.11/sixwords.html>

- “For sale: baby shoes, never worn.”, Hemingway
- “Gown removed carelessly. Head, less so.”, Joss Whedon
- “Longed for him. Got him. Shit.”, Margaret Atwood

Just for interest

100 Great Books in Haiku, David Bader

Sing, Goddess, of how
brooding Achilles' mood swings
caused him to act out.

Illiad, Homer

Chorus: Poor bastard.
Oedipus: This is awful!
Blind Seer: Told you so.

Oedipus Rex, Sophocles

Summary

- Writing is more important than you think
- Becoming a good writer is a lifetime's work - get going
- Some strategies to help

Assignment

Pick a novel and read it. Something with a good page count.

Further reading I



Bill Bryson, *Mother tongue*, Penguin Books, 1990, Absolutely mandatory reading for everyone.



Tom Burton, *Words, words, words*, University Radio 5UV, 1995.



William H. DuBay, *The principles of readability*, Impact Information, Costa Mesa, California, 2004, http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_ERICExtSearch_SearchValue_0=ED490073&ERICExtSearch_SearchType_0=no&accno=ED490073.



Maria Gardiner and Hugh Kearns, *Turbocharge your writing: How to become a prolific academic writer*, Thinkwell, Flinders Press, 2010.



Lisa Goldman, *The no rules handbook for writers*, Oberon, 2012.



Australian Government, *Style manual for authors, editors and printers*, 4th ed., Australian Government Publishing Service, 1990.

Further reading II



Sir Ernest Gowers, *The complete plain words*, Penguin, 1986, revised by Sidney Greenbaum and Janet Whitcut.



Nicholas J. Higham, *Handbook of writing for the mathematical sciences*, SIAM, 1995, Wonderful book with lots of good advice. Slightly out of date on the computing parts, but otherwise still very relevant.



Donald E. Knuth, Tracy L. Larrabee, and Paul M. Roberts, *Mathematical writing*, Mathematical Association of America, 1989,
jmlr.csail.mit.edu/reviewing-papers/knuth_mathematical_writing.pdf,
contains a huge amount of very good advice, but loosely organised (just reports of a set of lectures).

Further reading III



Adam Ruben, *How to write like a scientist*,

http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2012_03_23/caredit.a1200033, Amusing satire on common flaws in scientific writing.



William Strunk, Jr., *The elements of style*, Bartleby, 1999, First published W.P.Humphrey Press, 1918, <http://www.bartleby.com/141/>, Later became Strunk and White, see

http://en.wikipedia.org/wiki/The_Elements_of_Style. See commentary on <http://chronicle.com/article/50-Years-of-Stupid-Grammar/25497>.



William Strunk, Jr. and E.B. White, *The elements of style*, 4th ed., Longman, 1999.



Simon Winchester, *The meaning of everything: The story of the Oxford English Dictionary*, Oxford University Press, 2003.