Write Good Papers

Frédo Durand

I used to hate writing assignments, but now I enjoy them.

I realized that the purpose of writing is to inflate weak ideas, obscure poor reasoning, and inhibit clarity.

With a little practice, writing can be an intimidating and impenetrable fog. Want to see my book report?

"The dynamics of interbeing and monological imperatives in Dick and Jane: A study in psychic trans-relational gender modes."

Academia, here I come!
If you remember nothing else

• Writing matters
• Everyone who can think can write

• Organize your ideas
  – What are your ideas BTW?
  – Hierarchy

• Think about your readers
• Edit & iterate
Writing is critical

• For your career
  – academia and industry

• For your impact

• For the intellectual quality of your research
  – It forces you to better understand what you’re doing
    – and often leads to new project ideas

• In general, communication is critical
  – much of what follows applies to talks
Writing in academia

- Papers
- Fundraising
- Letters of recommendation
- Textbook
- Psets, quizzes
- Task force reports
- Project reports
- Call for paper
- Job descriptions
- Research & Teaching statements
- Misc. Emails
- Degree proposals
<table>
<thead>
<tr>
<th>Writing in industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Project proposal</td>
</tr>
<tr>
<td>• Project specification</td>
</tr>
<tr>
<td>• Technical documentation</td>
</tr>
<tr>
<td>• Progress report</td>
</tr>
<tr>
<td>• Technical papers</td>
</tr>
<tr>
<td>• Cajoling subcontractors</td>
</tr>
<tr>
<td>• Fundraising (VC, government)</td>
</tr>
<tr>
<td>• Feedback &amp; evaluations (e.g. code review)</td>
</tr>
<tr>
<td>• Patents</td>
</tr>
<tr>
<td>• Job descriptions</td>
</tr>
<tr>
<td>• Issue tickets and bug reports</td>
</tr>
<tr>
<td>• Protocols for collaborators/partners</td>
</tr>
<tr>
<td>• Design history</td>
</tr>
<tr>
<td>• Testing and verification plans and reports</td>
</tr>
<tr>
<td>• Contracts</td>
</tr>
<tr>
<td>• Business plan</td>
</tr>
<tr>
<td>• Meeting minutes</td>
</tr>
<tr>
<td>• Email (esp. for remote collaborations)</td>
</tr>
<tr>
<td>• Technical online forums (internal or external)</td>
</tr>
<tr>
<td>• Conference/Meeting reports</td>
</tr>
<tr>
<td>• Many people emphasized the variability in audience and how important it was to be clear to non-experts</td>
</tr>
</tbody>
</table>
Impact

• e.g., some of my algorithms are in Photoshop
• But they didn’t use my code
• They used my articles
  – And actually they screwed some of it up because it wasn’t well described
Badly written papers

- Get rejected
- Have low impact
- Get unfair comparisons because people can’t reproduce them
Writing is Easy & Hard

• Good writing is not just for English Majors
• Good writing doesn’t have much to do with being a native speaker
• Good writing is not about elegance
• Good writing does not come in a single session
Writing

• High-level
  – what ideas?
  – organization of ideas

• Low level [Rob’s talk]
  – The actual prose
  – some local organization of ideas
  – I will not talk about it but there are lots of great resources
Big principles

1. Organize paper & ideas hierarchically
   - Don’t just describe, motivate, organize, justify
   - Be redundant. Big ideas should be repeated
   - Be selective. Small ideas get swept under the rug

2. Think about your readers and what they know

3. Be redundant
   - repeat ideas
   - combine rigor+intuition

4. Iterate, edit
   - Get feedback
   - Prioritize clarity over style
1/ Understand your ideas

• Which ones are important?
  – that you spent time on them is NOT a good criterion
• Which ones are new?
• How do they relate to one another?
• Organize into a hierarchy of ideas

• Again, writing is not literature, it’s about understanding and organizing your ideas
Honesty & expectations

- Do not lie
- Discuss limitations
- Make sure readers have the right expectations
  - as early as title
Paper structure

• Abstract

• Intro

• Related work
  – but some people like it at the end. Depends it it helps or confuses
  – Can include required background

• Overview

• Technical sections

• Results & discussion

• Conclusions
2/ Understand readers

• Contextualization!
  – You have context that they don’t have
• That background do they have?
• They don’t read sequentially
  – they sometimes want to check a particular point many months later.
• Some like math, some like intuition
Context story

• Denny’s teddy bear is usually in the closet
• Anantha has hidden it under the bed
• Where will Denny first look for his teddy bear?
Context story

• Denny’s teddy bear is usually in the closet
• Anantha has hidden it under the bed
• Where will Denny first look for his teddy bear?

• Small children think he’ll look under the bed
  – They don’t understand that Denny doesn’t know what they know

• If Denny is the audience of your paper, don’t assume he knows the bear is under the bed!
Understand readers

• Just because you know what you mean doesn’t mean people know what you mean
3/ Redundancy

- Repeat the important ideas multiple times
  - maybe refining them and relating them to current discussions
- Rigorous + intuition
- Just because it’s in the paper doesn’t mean
  - it’s at the right place
  - it’s clear
  - it’s repeated enough
• The beautiful part of writing is that you don't have to get it right the first time, unlike, say, a brain surgeon.
  – Robert Cormier

• Good Writing is Bad Writing That Was Rewritten
  – Marc Raiberts
Edit

• Corollary: writing takes time, start early
• Be critical
• Think about alternatives
• Get external feedback
  – not just co-authors
Getting started

• Avoid writer’s block:
  – The first draft doesn’t need to be perfect
  – And actually it won’t
  – remember: it’s all about editing

• Outline
  – sections, subsections
  – a couple of bullets per section
  – central equations, pseudocode

• Figures

• I advise against writing sentences too early.
If you remember nothing else

- Writing matters
- Everyone who can think can write

- Organize your ideas
  - What are your ideas BTW?
  - Hierarchy
- Think about your readers
- Edit & iterate
Paper structure

- Abstract
- Intro
- Related work
  - but some people like it at the end. Depends it helps or confuses
  - Can include required background
- Overview
- Technical sections
- Results & discussion
- Conclusions
Introduction and abstract

• Motivation
  – need or opportunity
• Context
• First overview of your contributions, focusing on big ideas and silver bullets
• Consequences & benefits
• Possibly summary of contributions (what ideas are new)
  – can be useful when you only modified some parts of a bigger technique
Overview

• Forget what you thought an overview was
  – I hate “In section we introduce blah, in section 2....)

• The overview should give people a high-level understanding of the elements of your work and how they fit together. It’s a roadmap of the technique, not a roadmap of the paper.
  – Although hopefully there is some correlation between the overview and the paper organization

– It is often helped by an overview figure
Related work

- Focus on how they inform, motivate and differ from your work
- Can provide a self-contained introduction to the field
- Sometime also add a tutorial on required background that is uncommon in the field
- Be generous. Don’t piss off people.
Results

- Your results should support your claims
- Be critical
- again, get external feedback
Future work: Don’t

- Why would you discuss your future research?
- Only useful as a discussion of current limitations.
If you remember nothing else

• Writing matters
• Everyone who can think can write

• Edit & iterate
• Think about your readers
• Organize your ideas
  – What are your ideas BTW?
  – Hierarchy
Resources about high-level writing

- [http://people.csail.mit.edu/fredo/FredoBadWriting.pdf](http://people.csail.mit.edu/fredo/FredoBadWriting.pdf)
- [http://www.americanscientist.org/issues/pub/the-science-of-scientific-writing/1](http://www.americanscientist.org/issues/pub/the-science-of-scientific-writing/1)
- [http://www.cs.cmu.edu/~pausch/Randy/Randy/raibert.htm](http://www.cs.cmu.edu/~pausch/Randy/Randy/raibert.htm)