The Curse of Knowledge

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About me…

PhD from CMU
  • advised by Bob Harper and John Reynolds

Postdocs at Edinburgh, INRIA, Cambridge

Taught at Indiana University

Now at University of Pennsylvania
Research

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Creating and sharing useful ideas
Research

= 

Creating and sharing useful ideas
sharing

speaking

writing
"Easy reading is damn hard writing" (Hawthorne)
The Curse
The main cause of incomprehensible prose is the difficulty of imagining what it’s like for someone else not to know something that you know.

Steven Pinker, “The Sense of Style”
Dealing with the Curse
(some proven strategies)
Ground your imagination

Pick a “canonical reader”

- Someone you actually know
- With the *minimum* expertise you expect
  - e.g., a beginning PhD student with some coursework in PL
- Imagine explaining your idea to them at the whiteboard
Articulate the Main Idea

Concise summary of the problem and your solution

A “landmark” that can be seen from every part of the paper
State the Contributions

Write them early

*Every bit of the rest of the paper* must relate to them

A concise summary of what the paper *contributes*

- I.e., specific, significant advances that will be valuable to others
- *Not* just a laundry list of what you did
- Make sure it is clear why each point counts as a contribution

Each point should be both *strong* and *falsifiable*
Our contributions are:
• We define the $\lambda_{\text{whizbang}}$ calculus.
• We study its properties.
• We describe an implementation.
• We measure the performance of the implementation.

Our contributions are:
• We present the $\lambda_{\text{whizbang}}$ calculus and prove that it has properties P and Q, settling the open question proposed by Plotkin.
• We explain how to use an insight from quantum logic for the key step in an efficient implementation.
• We demonstrate empirically that our implementation performs within 10% of optimal.
Main idea + contributions = landmarks (for both reader and writer!)
Use a Running Example

A concrete illustration of the main idea

Showing just the essentials, not every subtlety

“Even a simple example will get three-quarters of an idea across” (Ullman)
Main idea + contributions + running example = clear, high-level summary of paper
Teach the related work

Don’t just summarize related papers

Explain how they relate to your work (and to each other!)

Orients the reader and you in the larger landscape
Them good; us even better.

Them bad; us good.
Recap

**Abstract**
- Main idea + brief summary of contributions

**Introduction**
- Motivating example
- Contributions
  
  + Enough background to understand the contributions
  + Nothing else!

**Background**
- Review of required definitions and notations

**Main ideas**
- A more technical whack at the example from the intro

**Details**
- How it all really works

**Related work**

**Future work**
Signposting

Encourage readers (and yourself) to stop every so often, look up, and check where we are and why we are doing what we’re doing

*Can be lightweight:*

- “Generalizing the example from the introduction, we call an expression \( e \) a *frobnosticator* iff…”
Close the loop

Get yourself some actual readers!

- Read to yourself, out loud
- Friends
- The competition
Mechanics
(tricks for increasing bandwidth)
Concision

Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should contain no unnecessary lines and a machine no unnecessary parts. This requires not that the writing make all his sentences short or that he avoid all detail and treat his subjects in outline, but that every word tell.

Strunk and White, *The Elements of Style*
When you think a piece of writing is just about finished, see if you can make it 40% shorter

(Mary-Claire van Leunen)
In this section, we describe some of the highlights of the research area. We discuss some of the most significant, elegant, and useful algorithms, and some corresponding lower bound results.

— Leslie Lamport, Handout on unnecessary prose, in Knuth, Larabee, and Roberts
Flow

Look for opportunities to link each sentence to the previous one.

Use the “main slots” in the sentence (e.g., the grammatical subject and verb) to highlight important information.

Topic, then comment. Given, then new.

—Pinker
“A man arrives from Corinth with the message that Oedipus’s father has died…. It emerges that this messenger was formerly a shepherd on Mount Cithaeron, and that he was given a baby…. The baby, he says, was given to him by another shepherd from the Laius household, who had been told to get rid of the child.”

— Wikipedia (quoted by Pinker)
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— Wikipedia (quoted by Pinker)
Note how the passive voice improves this passage!

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— Wikipedia (quoted by Pinker)
Mathematical Nits

Symbols in different formulas should be separated by words

- Bad:
  \[
  \text{If } \Gamma, x \in S, \Delta \vdash e \in T, \Gamma, \Delta \vdash e' \in S, \text{ then } \Gamma, \Delta \vdash e[e'/x] \in T. 
  \]

- Good:
  \[
  \text{If } \Gamma, x \in S, \Delta \vdash e \in T \text{ and } \Gamma, \Delta \vdash e' \in S, \text{ then } \Gamma, \Delta \vdash e[e'/x] \in T. 
  \]
Mathematical Nits

Punctuate displayed equations as if they were running text

<table>
<thead>
<tr>
<th>Bad</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>It thus follows that</td>
<td>It thus follows that</td>
</tr>
<tr>
<td>$x = y + z + w$</td>
<td>$x = y + z + w,$</td>
</tr>
<tr>
<td>Where $w = 42$. On the other hand</td>
<td>where $w = 42$. On the other hand,</td>
</tr>
<tr>
<td>$x' = a - b - c$</td>
<td>$x' = a - b - c.$</td>
</tr>
</tbody>
</table>
Conventions

Good grammar, choice of words, spelling, and, yes, even punctuation matter.

1. Because problems at this level force readers to spend energy mentally rewriting your prose.
2. Because carelessness at this level turns readers off.

These are all rich subjects, each with its own rules, exceptions, gray areas, and domain-specific tricks. But the essential skills are nowhere near as hard as writing a compiler or doing proofs in higher-order logic. :-) 

Just learn them. ‘Nuff said.

“Literate readers rely on punctuation to guide them through a sentence, and mastering the basics is a nonnegotiable requirement for anyone who writes.” — Pinker
Resources
https://www.microsoft.com/en-us/research/academic-program/write-great-research-paper/
A “new classic” by a cognitive psychologist / linguist

Good advice + reasons why it is good
Wonderful exercises for developing good writing

the full story

the short-and-sweet version
Classic guides to word usage

(lay vs. lie, which vs. that, etc.)
One of several excellent short guides to punctuation (and lots of other issues)
A dated classic
A wonderful collection of advice on writing from famous computer scientists and others

Available online
And if you wonder how Wadler comes up with all those titles…
“I am told there are writers who can tap out a coherent essay in a single pass, at most checking for typos and touching up the punctuation before sending it off for publication. You are probably not one of them. Most writers polish draft after draft. I rework every sentence a few times before going on to the next, and revise the whole chapter two or three times before I show it to anyone. Then, with feedback in hand, I revise each chapter twice more before circling back and giving the entire book at least two complete passes of polishing. Only then does it go to the copy editor, who starts another couple of rounds of tweaking.”

Good writing is mostly good rewriting

Parting thought…

Questions?