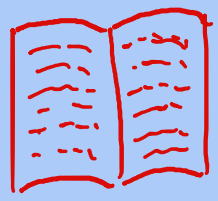
Imagining the Reader

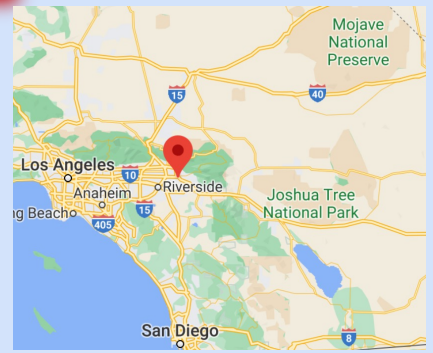
Benjamin C. Pierce
University of Pennsylvania

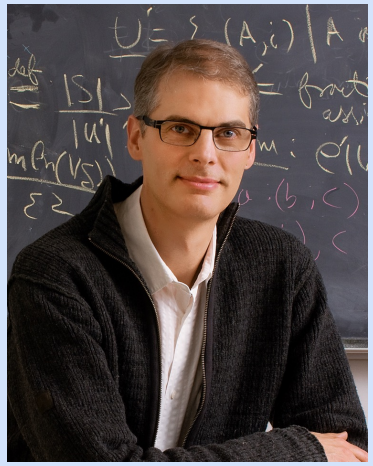


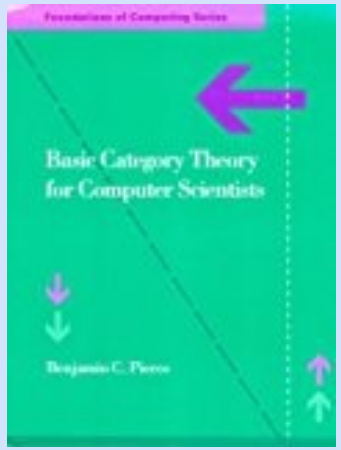
PLMW, January 2023, Boston

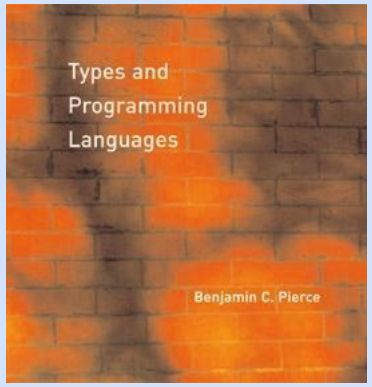
About me

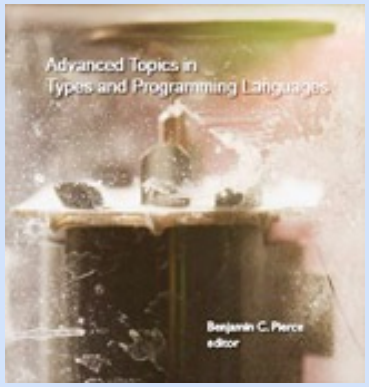
- Grew up in Redlands, CA
  - About halfway between Los Angeles and Palm Springs
- PhD from CMU
  - advised by Bob Harper and John Reynolds
- Postdocs at Edinburgh, INRIA, Cambridge
  - With Robin Milner, Didier Rémy
- Taught at Indiana University for two years
- At Penn since 1998

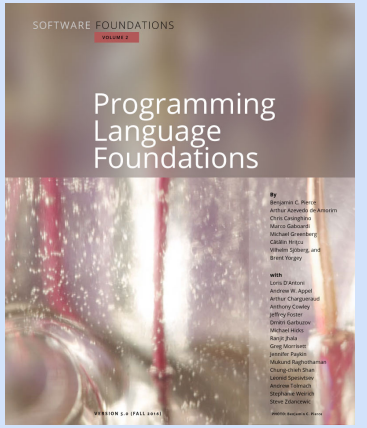












Introductions

Find out from the people on both sides of you:

- Name?
- Hometown?
- How did you travel to POPL?

Please interrupt!

Speaking
Telling
(Leo)
Creating
stuff
Writing

What’s hard about (technical) writing?

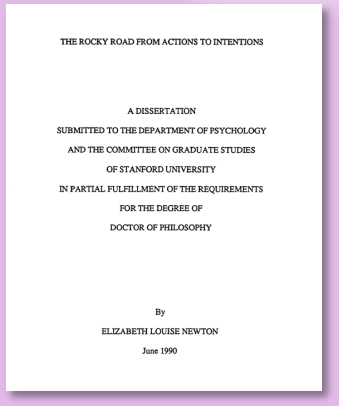
- Think about it a bit
- Discuss with your neighbor
- Talk about it all together

The Curse of Knowledge

In economic analyses of asymmetric information, better-informed agents are assumed capable of reproducing the judgments of less-informed agents. We discuss a systematic violation of this assumption that we call the "curse of knowledge." Better-informed agents are unable to ignore private information even when it is in their interest to do so; more information is not always better.

Colin Camerer (University of Pennsylvania)
George Loewenstein (University of Chicago)
Martin Weber (Institut furWirtschaftswissenschaften)
Journal of Political Economy (1989)

When interacting with others, we often fail to anticipate factors in the situation or in our partners that may bias both how we interpret the intentions behind their behaviour and how they likewise analyze our actions and intentions. In particular, if we do not recognize how impoverished our behaviour is relative to our thoughts about our behaviour, we will greatly overestimate the ease with which our partners will be able to interpret this behaviour accurately.



THE ROCKY ROAD FROM ACTIONS TO INTENTIONS

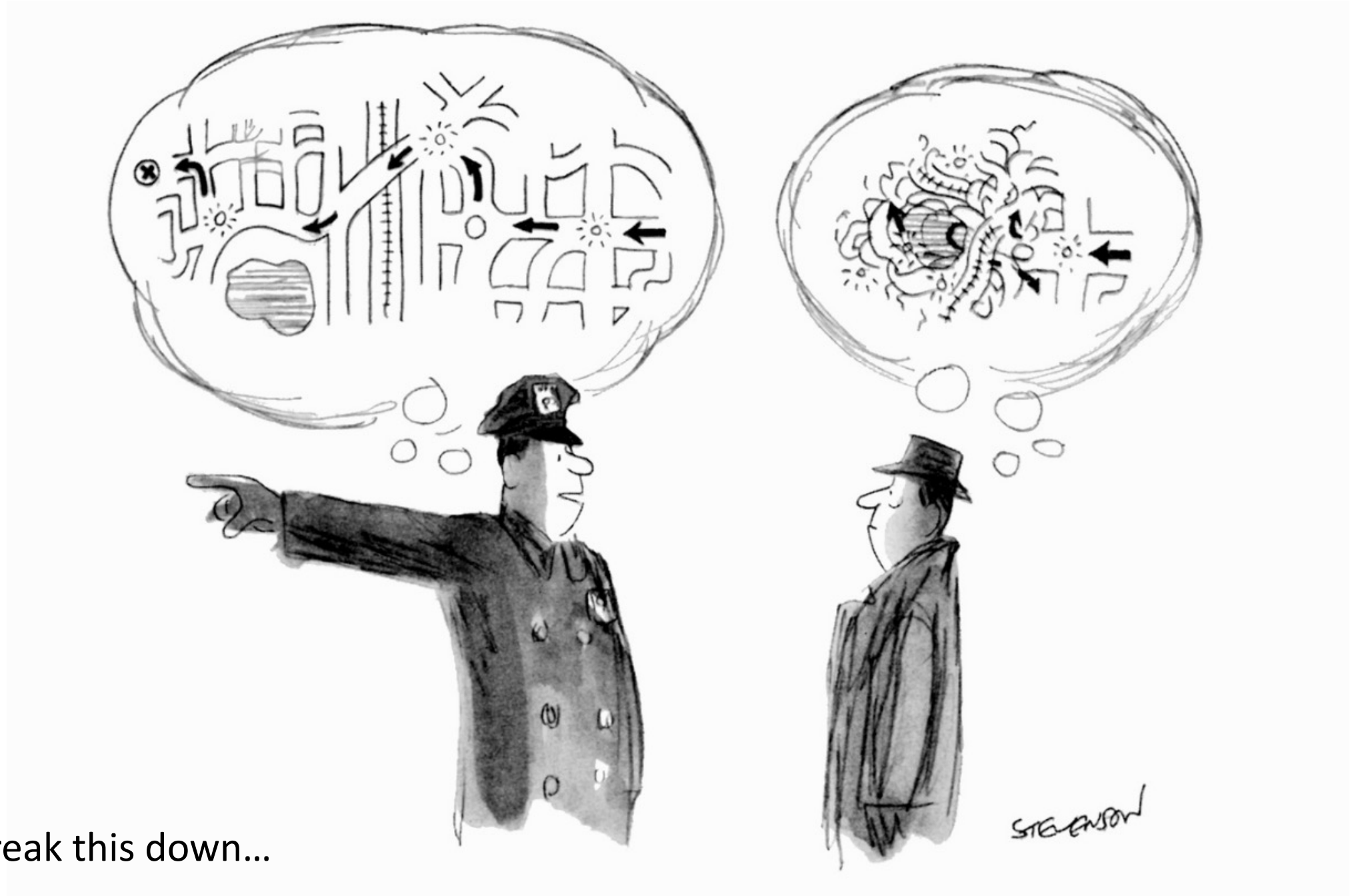
A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF PSYCHOLOGY
AND THE COMMITTEE ON GRADUATE STUDIES
OF STANFORD UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

By
ELIZABETH LOUISE NEWTON
June 1990

-- Elizabeth Newton (Stanford PhD dissertation, 1990)

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"



Let’s break this down…

Lifting the Curse

Strategy

Start with the contributions

Why?

1. Because the contributions are the hardest part to get right
2. Because everything else flows from the contributions

What are the Contributions

A concise summary of what the paper is and why the reader should care about it

- *Not* just a laundry list of what you did

Usually 3-4 separate points

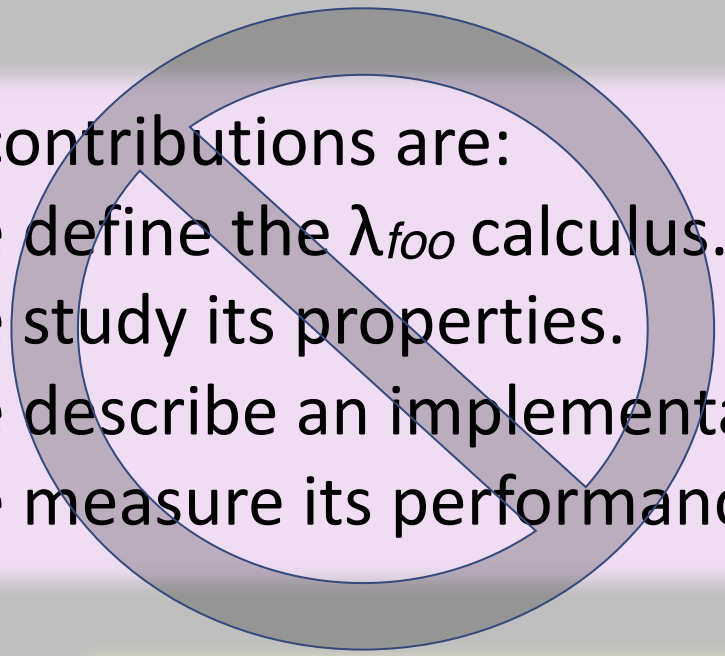
- Each point should make as strong a claim as possible
  - (but no stronger)
- Every point should be falsifiable

What is a contribution

1. Novel
2. Useful
3. Challenging

Our contributions are:

- We define the λ_{foo} calculus.
- We study its properties.
- We describe an implementation.
- We measure its performance.



Our contributions are:

- We present λ_{foo}, a calculus of hyperkinetic computation, and prove that it is confluent and strongly normalizing, settling an open question by Plotkin.
- We explain how to use an insight from 5-sorted logic for the key step in an efficient implementation.
- Experiments show that our implementation performs within 10% of optimal.

Contributions are the bedrock of the paper

Every word in the paper must serve the contributions

- **Abstract**: Technical statement of contributions, for experts
- **Intro**: Just enough information for your audience to understand the contributions
- **Everything else**: Relation to contributions must be crystal clear to the reader (and you)

Revise the contributions continuously

You probably won't *really* understand what you've contributed until late in the process!

Strategy

Pick a canonical reader

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

Strategy

Teach the Reader

Teach with the introduction

Introduction

=

Motivation + Main idea + Contributions

(and nothing else!)

Teach with a running example

A concrete illustration of the main idea

Showing just the essentials, not every subtlety

Often, it can also serve to set up the contributions in the introduction…

"Even a simple example will get three-quarters of an idea across"

– Jeff Ullman

Teach with the related work

- Don’t just *summarize* related papers
- Explain how they *relate* to your work

  … and to each other!
- Orient the reader *and you* in the larger landscape

Be generous to others

"Them bad; us good!"

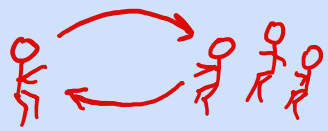
"Them good; we build on their insights to reach even higher!"

Recap: Paper structure

1. Abstract
2. Introduction
   - Motivation (simple version of the running example)
   - Main idea
   - Contributions
3. Background
   - Review of definitions / notations
4. Main idea
   - A more technical cut at the running example
5. Body
   - The gory details
6. Related work
7. Future work

Strategy

Close the loop

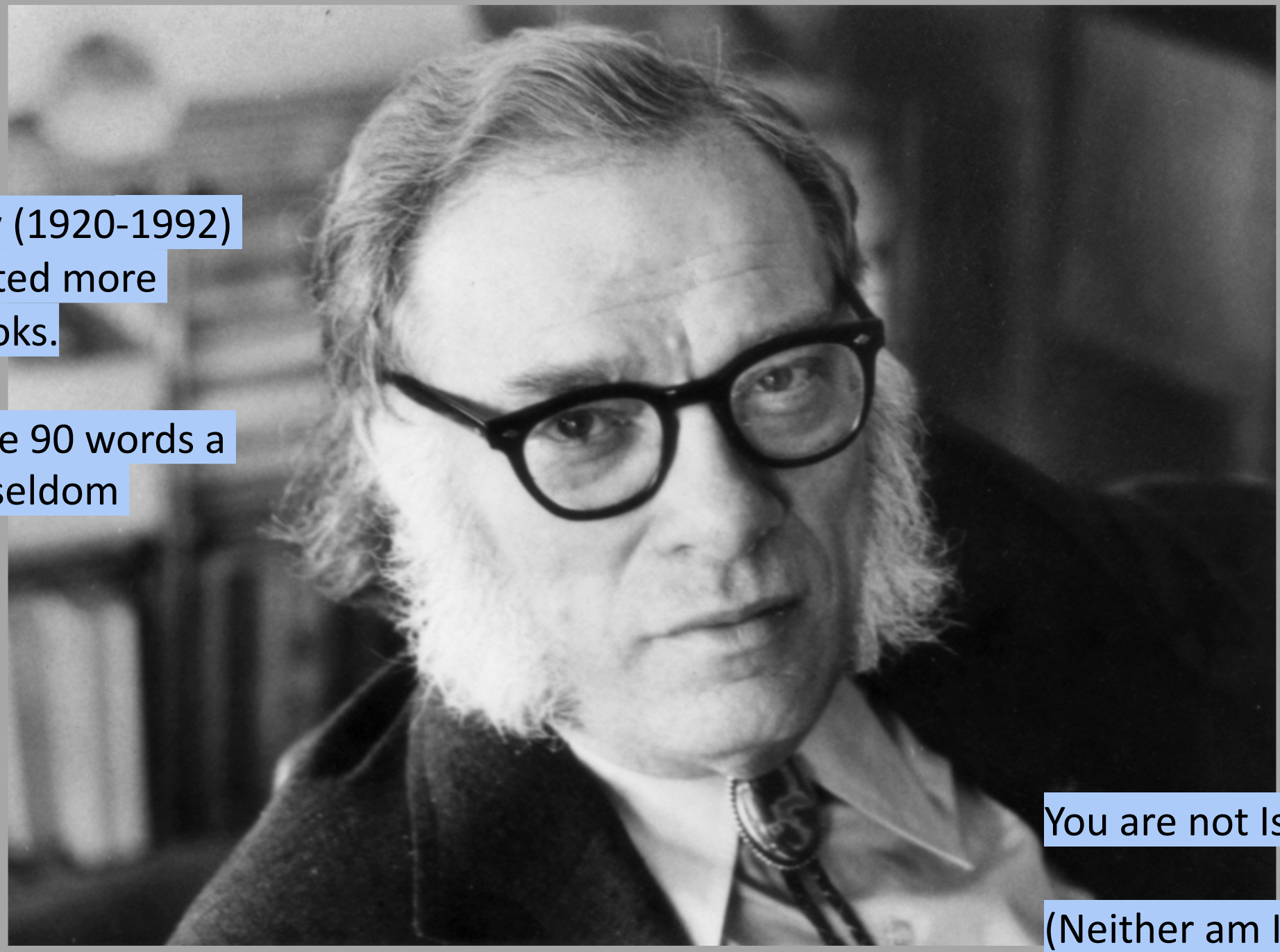


Get yourself some actual readers!

- First read it to yourself, out loud
- Then ask your friends to have a look
- Then ask the competition

Strategy

Rewrite



Isaac Asimov (1920-1992) wrote or edited more than 500 books.

He could type 90 words a minute and seldom revised.

!!

You are not Isaac Asimov.

(Neither am I.)

“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.”

-- Steven Pinker

Good writing is rewriting.

— Truman Capote

Strategy

Compress

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 writer 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

Before

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

After

In this section, we discuss some of the most significant algorithms and lower bound results

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

My favorite writing exercise

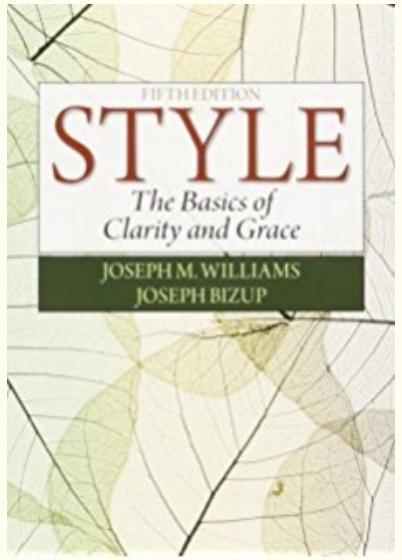
- Start with a page or so of text that you've already polished
- Cut 25% of the words
  - …without cutting any of the ideas
- Cut the result again by a third
  - … now you're probably cutting useful details, but try to keep the most important ones
- Cut the result again by half
  - … now you're really cutting into the meat, but try to keep what's essential

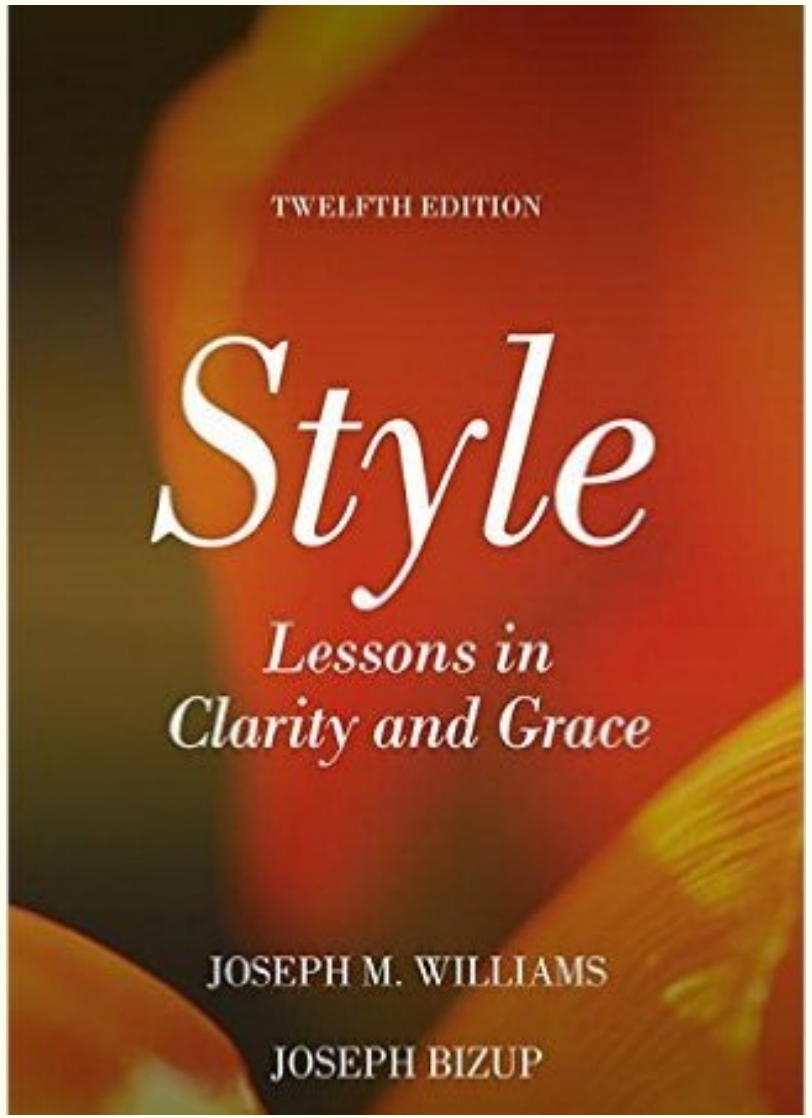
Resources

Wonderful exercises for developing writing skills, at many levels of scale (from sentences to documents)

the full story

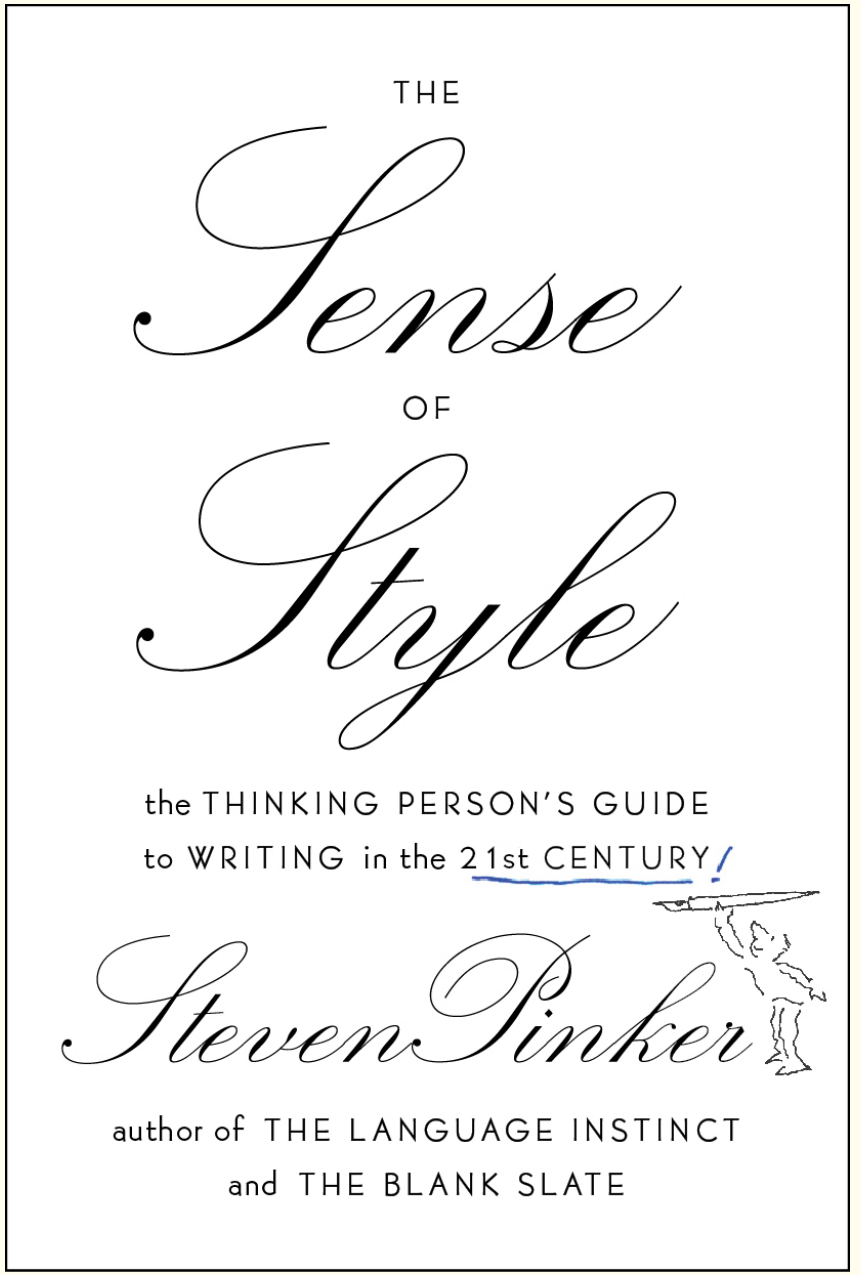
the short-and-sweet version





A “new classic” by a cognitive psychologist / linguist

Good advice + reasons why it is good

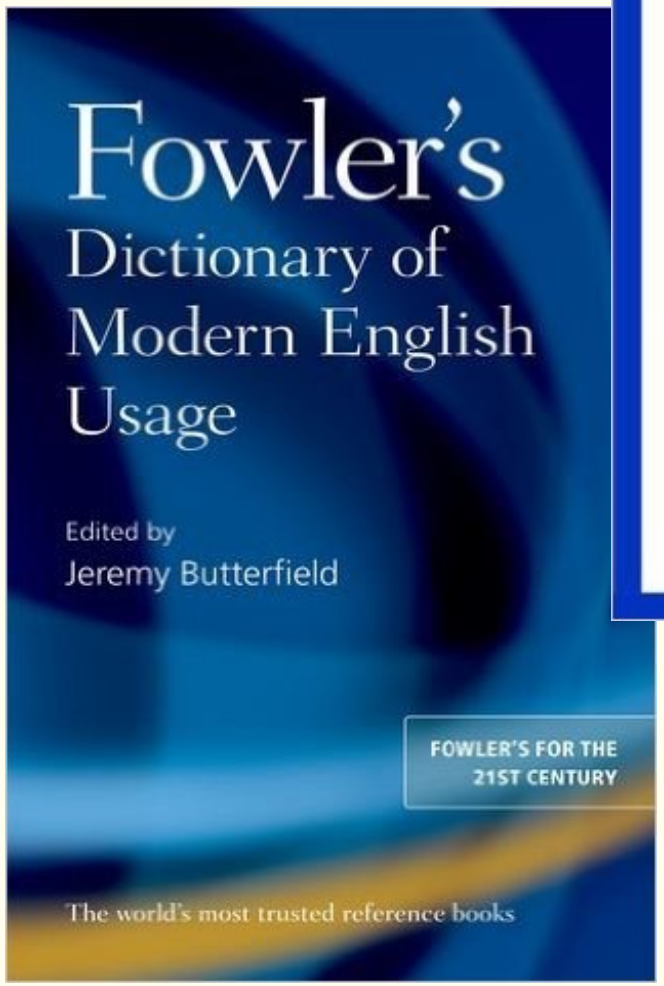


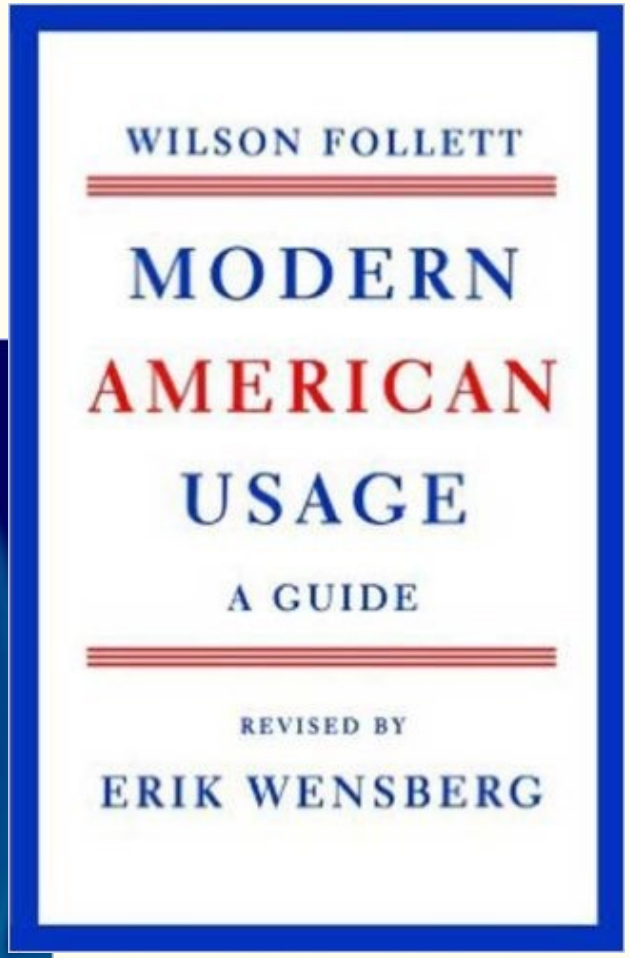
An excellent talk on writing by one of our great expositors.

https://www.microsoft.com/en-us/research/academic-program/write-great-research-paper/

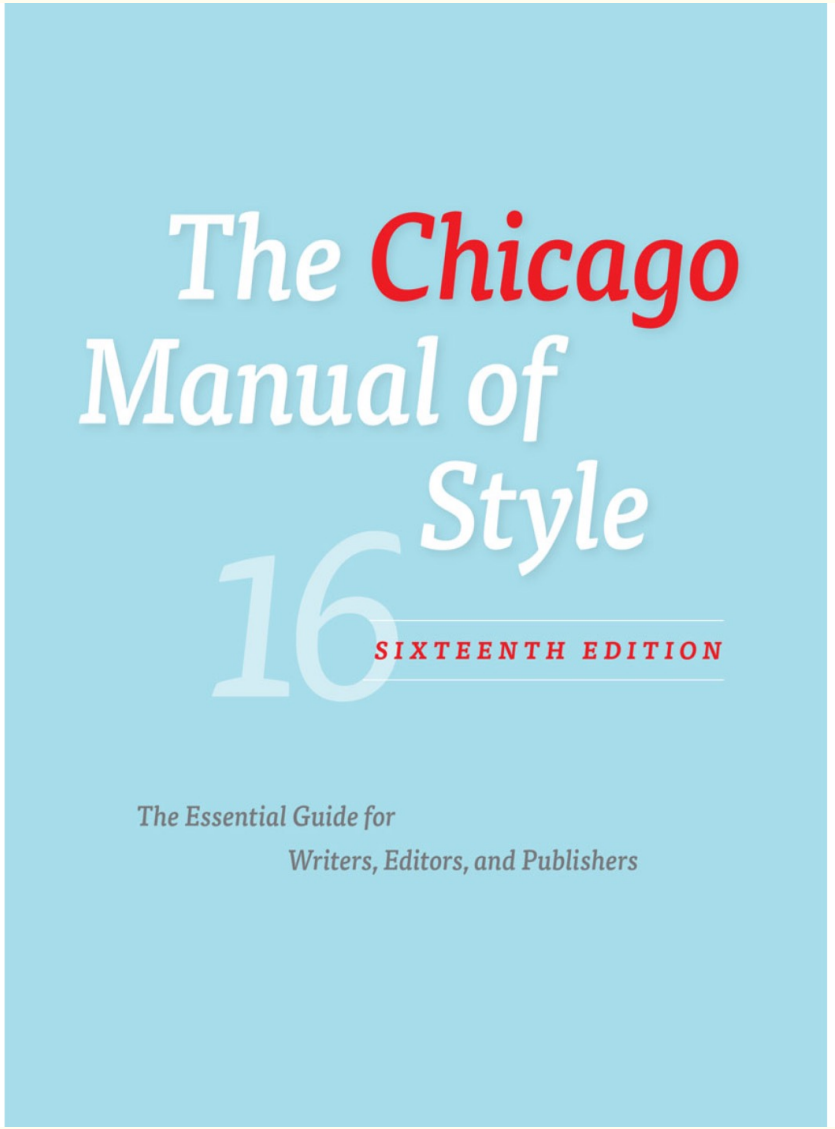
Classic guides to word usage

(*lay* vs. *lie*, *which* vs. *that*, etc.)





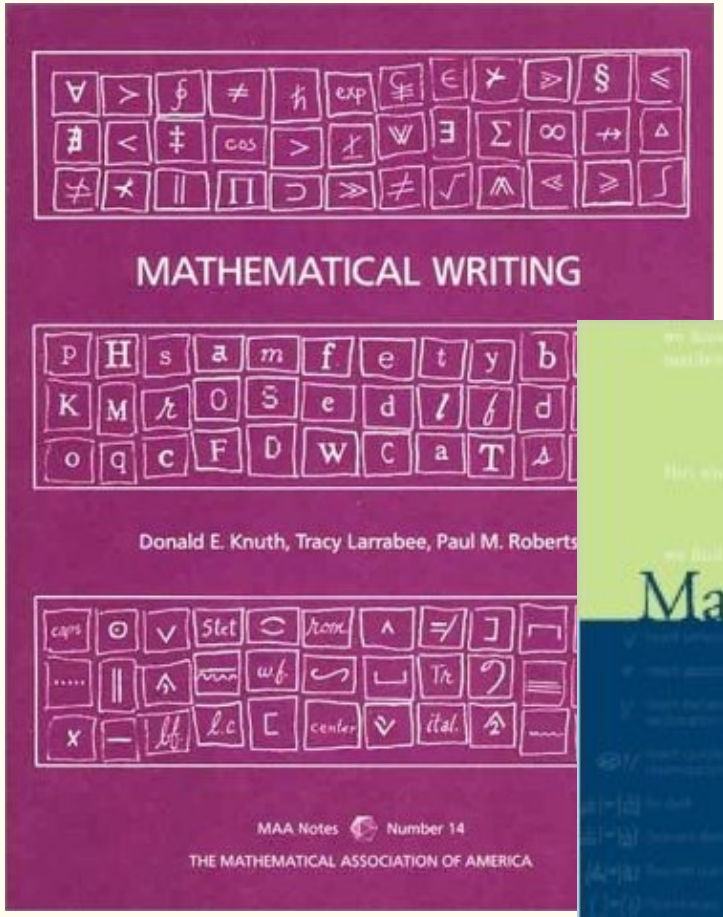
One of several excellent guides to punctuation and many other issues



Available online

A dated classic

A wonderful collection of advice on writing from famous computer scientists and others



Available online

Lesson plans for study groups…

Instructor's edition

Teach Technical Writing in Two Hours per Week

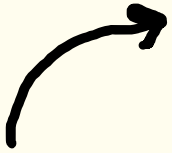
Norman Ramsey
Harvard University

October 25, 2006

Preface

Many students at American universities have trouble with technical writing. To help stu
dents over this trouble, we often use inefficient methods. These methods, like other aspect
of graduate education, sometimes remind me of medieval apprenticeships. For example

Student's edition



Learn Technical Writing in Two Hours per Wee

Norman Ramsey
Harvard University

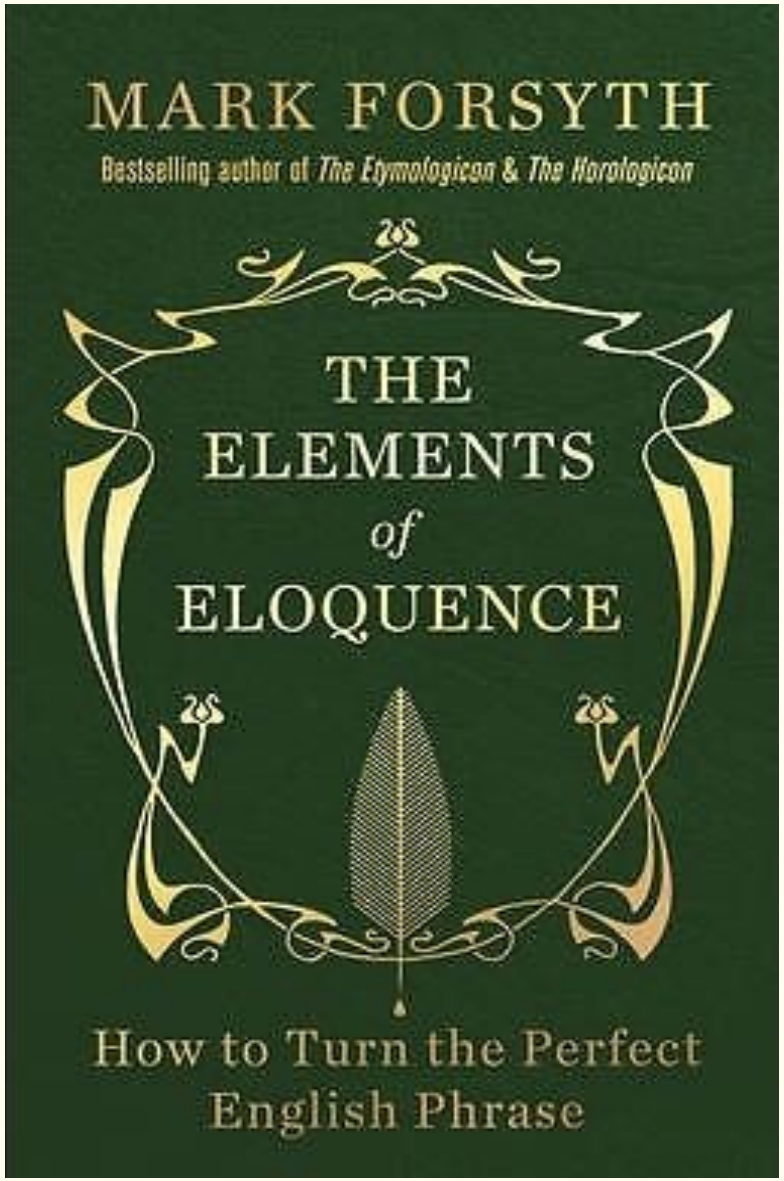
October 25, 2006

Preface

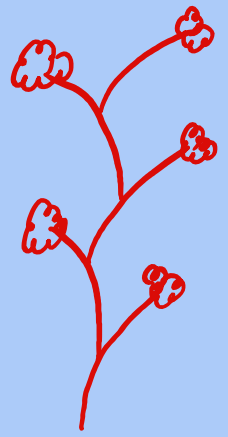
You may have difficulty writing, or you may have heard from professors or review
your writing is hard to follow. Or you may have studied writing only in the co
literature, and have trouble translating your skills into a technical setting. Enough
have these difficulties that I have invested significant effort in helping students
comfortable, fluid, clear technical writers.

This booklet explains how to study technical writing in the context of a weekl

And if you were wondering how some people come up with those astonishingly memorable titles…



Thank you!



Get clear in your own mind

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Close the loop

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