

How to Get Started if You Hate to Write



Part I—Outlining

**One thing I've learned in physics,
you have to satisfy both the theorists
and the experimentalists...**



...so this talk has two parts:

- I. a theory of technical writing**
- II. the nuts and bolts of first putting
together a scientific paper**

Close your eyes and picture in your mind your favorite childhood storybook



What made it so attractive to you?

I'm going to guess that book had

- Words you understood
- Interesting, engaging pictures
- A simple, direct storyline
- Clear connections and transitions
- A satisfying ending
- Ideas that captured your imagination and expanded your horizons

Guess what!

Nothing has really changed since you were 5.

**First step, throw out most of what
you've been taught about "writing"**

Scientific writing ain't Shakespeare

**Your purpose is to inform, educate,
and persuade—not to entertain**

**Write with concrete, quantitative
nouns and strong verbs, not
adjectives and adverbs**

Use the simplest word

**Write short sentences and
control your modifiers**

No literary flourishes



Technical writing is a *craft*, not an art

Like any other craft,
you have to learn
the techniques

You have to get feed-
back from experts

The same skills that
make you a good scientist or engineer will
make you a good technical writer

- logic
- precision
- the ability to recognize patterns and sort out what's important



Successful science writing is

Written with the *reader* in mind

Logically constructed—think “linear”

Clearly and succinctly expressed

Precisely and simply worded

Written to inform and
persuade



As you are thinking about your writing task, first ask yourself four questions:



1. What is my *purpose* in writing this document?
What's my ultimate goal?
2. *Who* is going to read it? What do they already know, and what am I going to have to explain?
What do *they* want to get out of this paper?
3. What *one thing* do I want the reader to remember? What's the "take-away" message?
4. What are my space/time/page *constraints*?

“Logic before language”

Two-way relationship
between thinking and
writing—feedback loop

λογική πριν
γλώσσα

Careful, *deliberate* writing assists in
developing logical scientific thought

Scientific writing is a *process*;
good writing evolves as your
thinking matures

Learning to write well will make
you a better physicist



**Novice writers use the
“core dump” method
—inefficient and
produces poor results**



Always start from a plan—always!

- 1. Promotes thinking**
- 2. Easiest way to get started if you don't like to write**
- 3. Gives you control over length and focus**
- 4. Increases the logical persuasiveness* and coherence of your final paper (or talk)**

***“Persuasion in Technical Communications,”**

<http://people.physics.illinois.edu/Celia/Persuasion.pdf>

Use the “reservoir” system*

Create separate reservoirs for

Background

Materials & Methods

Results

Discussion

Refs

Concentrate on facts, ideas, images,
logical connections

Add to your reservoirs as you take
and analyze data

Experiment with different reservoir methods
to find what works best for you



Fill your reservoirs thoughtfully

Is the item really necessary?

To what reservoir does it logically belong?

Content for reservoirs:

Facts, observations, data

Figures and captions

Tables

Analogies

Ideas and speculations

Unanswered questions

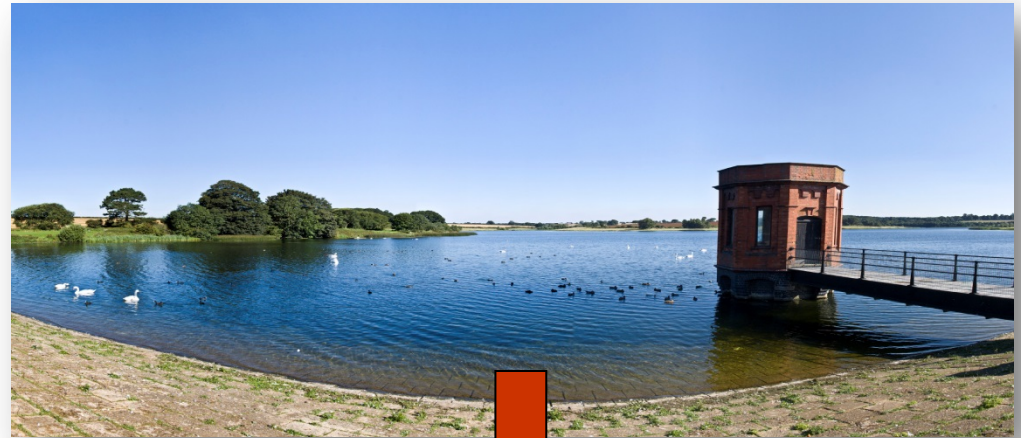
Key words

Felicitous phrases



Now you're ready to start building a coherent narrative

In the next steps, we'll take the **content** of our reservoirs and make a **plan** to guide the building of our paper



RULE #1: Never write *anything* without first analyzing your audience

Who is going to read my paper?

**What do they already know?
(words, concepts, methods)**

**What *don't* they know that
I will have to explain?**



Where might they become confused?

Where can I send them for more information?

What is most important for them to understand?

RULE #2: Tell a good story

Orient the reader with a solid introduction

Emphasize what is new

Use language that is understandable and meaningful for your reader

**Arrange the narrative so the logic is clear—
use transitional statements to guide your reader**

Provide clear, visually interesting, memorable figures

Provide a strong summary; don't just trail off at the end

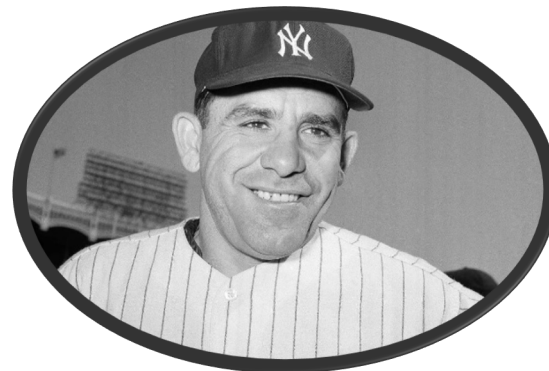


RULE #3: Never write *anything* without first writing a synopsis and an outline!



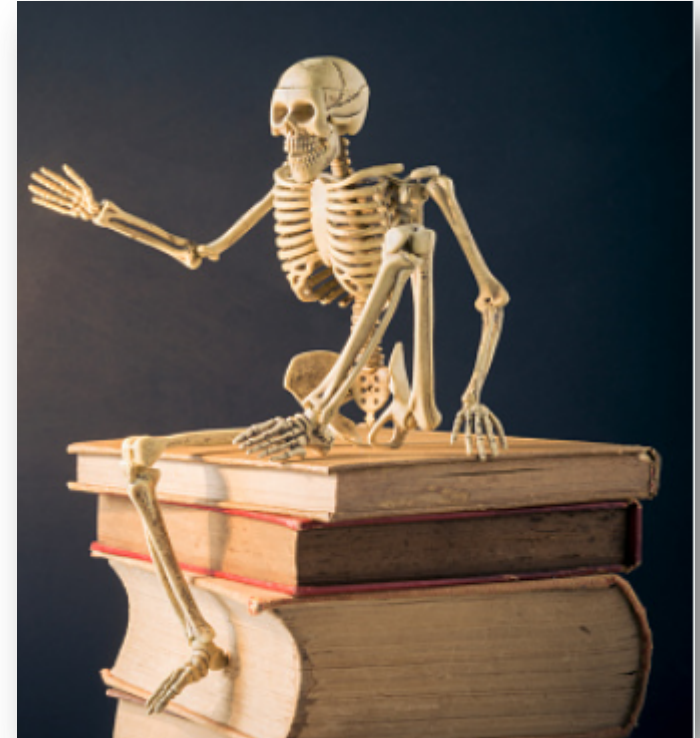
“If you don’t know where you are going, you might wind up someplace else.”

—Yogi Berra



Start out with a five-sentence synopsis

1. What was the goal?
2. How does it fit into the context of prior work?
3. What method(s) did you use?
4. What were your results?
5. What do they mean?



Answer each question in one coherent sentence

The synopsis is the skeleton that will hold up the rest of your story

Next, make an outline to avoid an amateur's mistakes



Using chronological instead of analytical order

Devoting the most ink to the parts that took the longest to do

Including superfluous or discursive information

Omitting discussion of assumptions

Failing to provide logical transitions

Each sentence in your synopsis becomes a section of your outline

Your outline should accommodate the standard model of physics papers

I. Background and Introduction

II. Methods/Procedure

III. Results

IV. Discussion

V. Conclusions

VI. Acknowledgments

VII. References

Make outlines for §I. through §V.

Writers use two kinds of outlines— “topic” and “sentence”

Topic outlines use short phrases

- CO₂ underground storage—motivation
- Advantages of deep saline formations
- Convection could provide “stirring”
- Boycott effect

A topic outline is a good way to get started,
but it may not be detailed enough for
science writing

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Sentence outlines use full sentences (duh!)

- Deep saline aquifers (DSAs) are underground salt-water reservoirs capped by impermeable rocks.
- DSAs offer large storage capacity for carbon capture and sequestration.
- Sequestered CO₂ rises and forms a separate layer that restricts dissolution.

Practice full-sentence outlining

Improved clarity

Improved logical argument

Improved cohesiveness; better transitions

Improved conciseness

Improved control of length

Improved writing efficiency

Improved reader experience



This slide is an example of a “topic” outline—the order that the points are presented in doesn’t really matter

Tips for writing a sentence outline

Make your sentences as specific and quantitative as possible.

If you have two closely related sentences, combine, differentiate, or eliminate one.

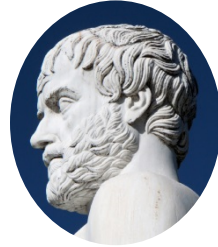
Make a logic map of your sentences; can you show a linear progression of your ideas?

Devise a method that makes it easier to move sentences around and “see” the overall structure of the paper.

This slide is an example of a “sentence” outline—use it for writing projects (papers, proposals, talks) where it’s important to show a logical progression of your ideas

Commit to writing incrementally

Think “feedback loop”



Write in increments:

1. Construct a preliminary outline, based on your initial goals for the project
2. Write portions of the “results” and “discussion” sections while you’re taking and analyzing data
3. Add to your references as you go
4. Make your figures and tables early

Advantages:

- More complete, persuasive paper
- Finished result faster, giving you more time to edit and polish



A close-up photograph of a person's hand holding a black pen, poised to write on a piece of white lined paper. The paper is placed on a wooden surface. There are faint red markings and lines on the paper, suggesting a process of editing or rewriting. The text "Expect to rewrite—many times" is overlaid in a bold, dark blue font.

Expect to rewrite—many times

To recap...



Think



Plan



Write

Think first

Analyze your audience and know your purpose

Commit to writing incrementally—start filling
your reservoirs while you're still taking data

Make an outline and *use* it

Writing well is a learned skill!



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<http://physics.illinois.edu/people/Celia/>