

How to Write a Technical Paper

“Begin at the beginning,” the King said, very gravely,
and go on till you come to the end: then stop.”

LEWIS CARROLL

Young's Laws

1. ***Tell a story, and don't be afraid of I and we*** (active voice—AIP recommends it)

We placed tubes into the cylinder at different levels.

not

Tubes *were placed* into the cylinder at different levels.

Hence, Young's First Law:

Write the way you talk;

then polish

How can you improve on this?

At that point in time, a house in a village was lived in that looked across the river and the plain to the mountains, in the bed of which could be seen pebbles and boulders,

How can you improve on this?

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How Hemingway originally wrote it:

In the late summer of that year we lived in a house in a village that looked across the river and the plain to the mountains. In the bed of the river there were pebbles and boulders,

2. Use short sentences with explicit descriptions

Hence, Young's Second Law:

Write one thought per sentence

(or, at least, one thought per independent clause)

How can you improve on this?

Unknown Writer by Unknown Writer:

Though this individual (called OH62 because she's the sixty-second Olduvai hominid to be discovered) probably had, like other *H. Habilis* specimens, a rather modern head – with a large forehead, indicating greater brain power, and a rather delicate face – her arms dangled to her knees.

(1 sentence, 45 words)

U. W. by M. Y.:

This individual, like other *H. habilis* specimens, probably had a modern head, indicating greater brain power, and a delicate face – but her arms dangled to her knees. She was called OH62 because she is the sixty-second Olduvai hominid to be discovered.

(3 sentences, 42 words)

3. Write for *your readers*, not for yourself

Hence, Young's Third Law:

Write for the uninformed reader

Do not write for someone who *already knows* what you know
(me, your adviser); we probably do not

Write as if for someone *one educational level below* yours
(bright junior in Physics?)

Or in a related field (bright senior in Chemistry?)

Do not assume *anything* is obvious

Data do not stand for themselves; they must be
interpreted

Corollary to Third Law: **Be explicit**

U. W. by U. W. (doesn't tell what's important):

The single-mode, water-cooled, HCN laser beam was directed into the blazed, evacuated, ruled-grating, infrared spectrometer.

(18 words)

U. W. by M. Y. (tells what's important):

The HCN laser oscillated in a single mode [← topic sentence]. The beam was directed into the infrared spectrometer, which was evacuated and used a blazed, ruled grating. [Least important →] The laser was water-cooled.

(30 words; longer but clearer)

How to Organize a Technical Paper

Based on ANSI Standard (Z39.16-1972, Z39.18-1995))

Title and Byline

Abstract or Summary (optional)

Introduction or Objective, including Background

Theory

Procedures, including schematics, wiring diagrams

Results, including Observations

Conclusions (including Discussion or Recommendations)

References

Appendixes

Organization

Pyramid (detective story, magazine article)

Order of *ascending* importance

Important stuff *last*

May keep suspense, but not so good for scientific
paper

Inverted pyramid (newspaper style)

Order of *descending* importance

Important stuff *first*

Good, but conclusions important too

Chronological (review paper, mathematical proof)

Carafe (good scientific paper)

Strong introduction
Including conclusions,
recommendations

No reason
not to give
conclusions

up
front.

Then
order of importance
or chronological order

Strong conclusion, firm recommendations

Getting Started

1. **Procrastinate** as long as possible

Clean up your lab

Clean up your office

Organize your files

2. Do *not* start with a reference to past work

High pass filtering in optical processors was described by Birch¹ and by Swing.² A zero was found in the image of an edge, and it was proposed to use this to measure linewidth. The result was applied to microscopy and an error function was calculated.

Your contribution is buried

Who proposed?

Who applied?

Who calculated?

3. Begin with the most important result of the paper

I want to tell you that + Main Message:

I want to tell you that high-pass filtering can be used to measure linewidths in microscopy.

Write paper

Erase *I want to tell you that*

Reword as necessary

4. Useful openings

Best openings:

Purpose of paper

Summary of results

Problem addressed

Alternate openings:

Background of paper (limited to review or historical paper)

Question (presumably rhetorical question)

And *maybe* for an oral presentation:

Quotation (if relevant)

Joke (but be careful!)

Title

Most widely read part of paper

Informative but short

Begin with *key word* (not Theory, Study, Investigation)

Single-transverse-mode double-pulsed Q-switched ruby
laser for high depth-of-field holography: theory and
experiment

But keep it *short*:

High-coherence ruby laser for double-pulse
holography

Abstract

1. Second-most widely read part of your paper
2. Use *informative abstract*, or short summary of paper

Saturable dyes for laser Q-switches degrade with time. The blue light from the flashlamp causes the degradation of the dye, and the dye's life may be extended by replacing the cell's windows with red filters.

Do *not* use (inaptly named) *descriptive abstract*

Saturable dyes for laser Q switches are found to degrade with time. The cause of this degradation is discussed and a possible solution is proposed and demonstrated.

Informative abstract *gives information* about paper

Descriptive abstract *gives little or no information*

Sometimes OK for mathematical, theoretical papers

Abstract (cont.)

3. Avoid

Narrowly technical terms

Unfamiliar abbreviations or acronyms

References

4. Make sure abstract

Stands alone

Can be understood *without reference to paper*

Introduction

1. Not list of references in sentence form
2. When appropriate, direct it at uninformed readers
3. May (in this course, *should*) include both results and conclusions

Conclusions

1. Do not regurgitate paper

Especially not a very short paper

2. Highlight results or draw conclusions here

3. State conclusions firmly

We have used photothermal deflection to measure the loss in a waveguide.

We remember! Instead write

Photothermal deflection is a promising technique for measuring the loss in a waveguide.

Appendix

A vestigial portion of a book, for which no one has yet discovered a function

Place for hairy derivations, equipment lists, stuff that only specialists will read

References

1. Follow style manual of the publication

2. In this course, pls use *AIP format*

Title of each reference (aid to reader)

Inclusive pagination (very useful to know length of paper)

These are worth fighting the editor for!

3. Use APS format if you are writing for an APS journal

3. Callouts in text:

Superscript *after* period or other punctuation:

... a recent study of the pinhole camera.¹

a function of T.²

not

a function of T².

Where possible put reference at *end of sentence*:

... a recent study of the pinhole camera.¹

not

... a recent study¹ of the pinhole camera.

but

... studies of the pinhole camera by Young,¹
Franke,² and Nilsson.³

4. Examples of references or endnotes in AIP style:

3. M. Young, "Pinhole optics," Appl. Opt. **10**,
2763-2767 (1972).

Inclusive
pagination

Title

8. Constance Holden, "Twins reunited," Science
80, November 1980, pp. 54-58.

*Note the difference between a technical journal
and a magazine article*

5. Ronald W. Clark, *Einstein, The Life and Times*
(Harry N. Abrams, New York, 1984).

Book titles set
in *italics*;
article titles in
roman

7. David R. Williams, "Mars fact sheet," *Mars
Home Page*, [http://nssdc.gsfs.nasa.gov/
planetary/factsheet/marsfact.html](http://nssdc.gsfs.nasa.gov/planetary/factsheet/marsfact.html), date accessed
[or last updated], 2/13/00.

2. M. Young, "The Bible as a science text," *Rocky
Mountain Skeptic* (to be published).

5. AIP capitalizes articles like this (initial cap only):

“Imaging without mirrors or lenses: The pinhole camera
and its relatives”

but books and reports like this (caps and lowercase):

*Optics and Lasers, including Lasers and Optical
Waveguides*

6. Do not confuse the authors with their article:

Equation (4) is derived in Morrison et al.

Equation (4) is derived *in the paper by* Morrison et al.

Equation (4) is derived *by Morrison and his colleagues.*

7. Square bracket style (since you asked):

... a recent study of the pinhole camera [7].

or

... a recent study of the pinhole camera [YOUNG,
1972].

(listed in alphabetical order)

You may use (either) square bracket style, but please show
the reference list in AIP style or (if you are working in
Engineering) IEEE

Do not use MLA

Private communication

Almost completely useless

Use instead *acknowledgements* if at all possible

If you must, give *contact information*

Acknowledgements

Thank people who

Helped you

Read your manuscript

Gave unpublished results

Seek permission before you publish unpublished results

To be published

Please be *sure* that you are really going to publish it

Ms nearly ready or actually submitted

Title, authors fixed

Journal preferably fixed

AIP says it *must have been accepted* or you may not cite it

(bit extreme)

Footnotes or Endnotes

Distracting, interfere with flow of article

Say it in the text!

Except for a *note added in proof*