

Revising Technical Manuscripts to Improve Coherence, Clarity & Conciseness



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Today we are going to look at techniques to revise and polish technical manuscripts.

Plan for time to reflect and revise

You should allow as much time for revision as you do for writing your paper in the first place

Revising concentrates on four elements

1. Clarifying the selection and presentation of ideas, tailored to the audience
2. Organizing the narrative logically
3. Evaluating the use of language (emphasis, tone, vocabulary)
4. Proofreading for mechanical errors



Because we think in words, the act of expressing observation in language—of distilling amorphous thoughts into words—is a powerful tool for clarifying your thinking.

Translating your thoughts into words so that you can communicate them to someone else forces you

- to question your assumptions.
- to look for holes.
- to fill in gaps in your thinking.

Rewriting often takes more time than writing. As you are planning your timeline for completing your paper, build in sufficient time for getting feedback from others and revising the manuscript.

The probability that a first-draft paper, ripped off the printer 30 ns before the deadline, will be acceptable work asymptotically approaches 0.

Revising should proceed in three steps

1. Reading for content and logical organization (ideas)
2. Editing for style (language, tone, emphasis)
3. Proofreading for mechanics (spelling, punctuation, and grammar)

Allow sufficient time for each step!

(it will always take longer than expected)

The Elliott editing equations:

$$t = 4h + \varepsilon \quad [1]$$

$$t = 5(h + a) + \varepsilon \quad [2]$$

Think of the process as zooming in on the manuscript.

I have learned that you can talk and talk and talk to physicists, but if you really want to get their attention, show them an equation. Hence the Elliott editing equations given above.

In Eq. 1, t is the time it actually takes to edit a manuscript, h is the number of hours you think any idiot should be able to do it in, and ε is not necessarily trivial.

Equation 2 is the expression for the time it takes to edit a paper that has multiple authors, where t is the time it actually takes, h is the number of hours you think it should take, a is the number of authors, and ε , again, is not necessarily trivial.

1. Look at the science first (macroscopic scale)

Is the information valid, significant, timely,
and complete?

Is the context clear? What is new and different?
What have you contributed?

Is the information presented at an appropriate
level for the audience and the purpose?

Is the narrative arranged in a logical, coherent
structure?

Do figures, equations, and tables support,
emphasize, and *clarify* the main points?

The first pass is from the **macroscopic** (section) level—look at the *science*.

- Are the main points clearly identifiable and given appropriate emphasis?
- Do figures and tables support and enhance the main points?
- Is the narrative coherent—is there a clearly defined progression from background to hypothesis to method to results to conclusions?

TIP: Cut and paste the first sentence of each paragraph into a new document. Read it aloud. Does it adequately tell your story? Are there gaps or omissions?

See <http://people.physics.illinois.edu/Celia/Lectures/Paragraphs.pdf> for tips on how to build effective paragraphs to incorporate an organic, logical structure in your writing.

- Have you supplied sufficient background so that the reader can understand the significance of your work? Have you provided appropriate context through adequate referencing of prior work?
- Have you made your case? Have you justified your assumptions, anticipated reader questions and objections, and supported your arguments?
- Is it clear what you have contributed?

Provide logical transitions

One section ends with:

*“... **Improved sensitivity** is important because amplifiers and signal processors are nonlinear and thus can mix signals that lie outside the desired band; the mixing generates signals with frequencies that appear as in-band noise.”*

Begin the next section with:

*“To **achieve the improved filter performance**, high-quality epitaxial films of YBCO have been...”*

The logical connection between the two sections is made clear by repeating the idea of **improving performance**

Include summary statements

At the end of each paragraph to lead logically to the next paragraph*

At the end of each subsection

At the end of each section

At the end of the paper

Adding summary statements helps readers follow your logical argument and prompts them to go back and re-read if they don't understand something

*Building Good Paragraphs: <http://people.physics.illinois.edu/Celia/Lectures/Paragraphs.pdf>

Provide summary statements at the end of each major section of the paper.

The old speaker's rule is "Tell them what you're going to tell them. Tell them. Tell them what you told them." That advice is just as valid for paper and reports. Take it from a mother—telling somebody something important three times is *not* overkill.

**Now for a quiz question...
How much time should you
allow for revising a technical
manuscript?**



- A. 1 hour per page**
- B. Depends on how technical the text is**
- C. At least 3× longer than you think it will take**
- D. Doesn't matter—you'll have to revise it again when you get the reviewers' comments**

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**Now for a poll question...
How much time should you
allow for revising a technical
manuscript?**



- A. 1 hour per page**
- B. Depends on how technical the text is**
- C. At least 3× longer than you think it will***
- D. Doesn't matter—you'll have to revise it again when you get the reviewers' comments**

***Your mileage may differ, but plan for plenty of time to reflect.**

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2. Focus on the “style” (mesoscopic scale)



Use precise, unambiguous language

Avoid gratuitous jargon—scale to your audience

Use straightforward, declarative sentences
and keep them short (<25 words)

Use action verbs, not weak verbs of being

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

Eliminate “fluffy” stuff

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

Next, zoom in to the **mesoscopic** (intermediate) level—look at the **words**.

- Is the language clear and unambiguous?
- Have you defined all acronyms and technical jargon that may be unfamiliar to your audience?
- Have you used the simplest word to unambiguously convey your meaning?

Semantics and syntax control clear communication

“Semantics” is the meaning of words;
you must have a vocabulary adequate to
describe things precisely



The difference between the right
word and the *almost*-right word
is the difference between
lightning and *lightning bug*.
—*Mark Twain*



Scale your use of jargon to
the intended audience

Note that words have connotations (overtones of associated ideas or emotions) beyond their literal dictionary meanings, which also affect the appropriateness of word choice.

Avoid “*abstractitis*”

“writing that is so abstruse that even the *writer* does not know what he or she is trying to say”—*Sir Ernest Gowers, GCB*

“The words ...dance before my eyes in a meaningless procession: cross-reference to cross-reference, exception upon exception—couched in abstract terms that offer no handle to seize hold of—leave in my mind only a confused sense of some vitally important, but successfully concealed, purport, which it is my duty to extract, but which is within my power, if at all, only after the most inordinate expenditure of time.” (*Yale L.J.* 167, 169 [1947]).

As defined by Ernest Gowers and quoted by Bryan Garner in *Garner’s Modern American Usage*, *abstractitis* is writing that is so abstruse that even the writer does not know what he or she is trying to say.

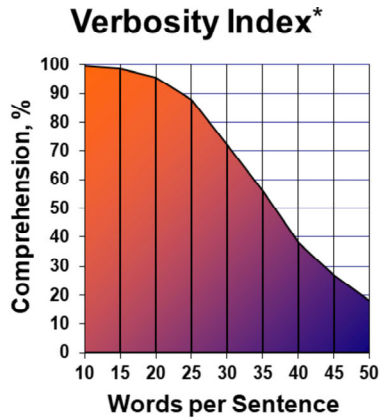
While Gowers in this case was talking about the U.S. Internal Revenue Code, he could easily have been describing many physics papers.

Gowers’ use of a 68-word sentence is a rant for another day.

How to avoid “*abstractitis*”

1. **Clarify**—*replace jargon with accessible terminology; use simple subjects and direct action verbs; de-convolute syntax*
2. **Quantify**—*replace wimpy, qualitative adjectives with quantitative descriptors*
3. **Objectify**—*give concrete examples; use analogies*

Use these techniques to revise for clarity and conciseness



***Illustration only, does not represent actual data. (But it could.)**

- Write shorter sentences**
- Limit the number of modifying clauses & prepositional phrases**
- Keep verbs close to subjects**
- Express ideas in positives, not negatives**
- Avoid indirect constructions; put the subject first**
- Eliminate unnecessary words**
- De-nounify verbs**

We'll look at how to apply each of these editing techniques next.

Write shorter sentences (<25 words)

The following sentence (63 words), while grammatically correct, is impossible to understand on the first reading



“A program of chemical analysis and receptor modeling is proposed in which samples obtained at the EB ENTEK sites will be used to estimate the sources and/or source regions of trace elemental deposition into the area and the effects of specific urban areas on the airborne particulate matter compositions and thus, their potential contribution to the contamination of the area’s water supplies.”

Avoid long strings of nouns used as adjectives, too
mean field anisotropic superconducting reverse bias
toroid magnet <sigh>

Write short sentences—fewer than 25 words.

Avoid long strings of nouns used as adjectives—“mean field anisotropic superconducting reverse bias toroid magnet” (or MASRBTM, to its fans)

Observe the “three preposition” rule.* If you have a sentence that contains more than three prepositions, rewrite it before it wanders off to die.

Writing shorter paragraphs will also help your reader follow the logic of your narrative. For more information on how to write strong paragraphs, see

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

*With thanks to Stephanie Teich-McGoldrick of Sandia National Laboratories, who first introduced me to the three-preposition rule.

Keep verbs **close to their subjects**

Several schemes ranging from minimal computational cost and poor accuracy to high computational cost and high accuracy **can be employed**.

*Several schemes **can be employed**, ranging from minimal computational cost and poor accuracy to high computational cost and great accuracy.*

A program to be used in conjunction with a PC data acquisition card **was written**.

*A program **was written** for ~~use with~~ a PC data acquisition card.*

One of the pitfalls of using the passive voice is the tendency by amateurs to maroon the verb at the end of the sentence. Avoid this practice.

**Recast *negative expressions*—
a positive is easier to understand
and is usually more concise**

**Although some data supported the hypothesis, it
could not be concluded that output scaled linearly
with current.**

Output appeared to scale nonlinearly with current.

**Arcing under high-current operation could not be
avoided without the use of the insulated feedthrough.**

***The insulated feedthrough prevented arcing,
even during high-current operation.***

Ideas expressed as positives are almost always easier to process and grasp quickly. Readers must undergo a second step of deciphering ideas presented as negatives; they have to backtrack to figure out what something *is*, if you tell them what it is *not*. Don't make your readers work this hard.

Avoid beginning clauses with “There are...” or “It is...” —put the subject first and plunge right in

“Aside from the point defect corresponding to the cone’s vertex, **there is** a ‘focal’ set consisting of the two parabolic segments $x^2 = b|y| + b^2/4$.”

“In addition to the point defect corresponding to the cone’s vertex, a ‘focal’ set occurs that consists of the two parabolic segments $x^2 = b|y| + b^2/4$.”

Train yourself to spot “There is...” and “There are...” sentences and rewrite them in the passive voice, which puts the important point first in the sentence (“front loads”).

Make sure *indefinite pronouns* refer to the correct antecedent

Non-commutative geometry is obtained when the latter equation fails and is replaced by another equation, as in the case of the quantum Hall system. The interpretation of this effect in superstrings is startling, however, because *it* is a fundamental theory of spacetime, and *it* means that we cannot think of spacetime in terms of ordinary smooth geometry, as in general relativity.

or *any* antecedent...



Ideally, a pronoun should refer to the noun immediately preceding it. Don't make the reader go back several sentences to determine what "it" you mean. By the same token, you may not use a pronoun until you have first used the noun to which the pronoun refers.

Avoid the big A's—amphibologies and anthropomorphism

Beware of words with multiple meanings

A sintered mixture for the experimental heating rod was prepared from martensitic steel and 5% nickel. *This element* proved to be unsatisfactory.

A subtle but important *point* about the series of *points* generated is that they are not statistically independent *points*.

Don't give human traits to inanimate objects

The substrate *tells* the YBCO how to align during growth.

The dial *needs* to be set at ...

The dial doesn't care...

Be sure to use the right word

Alternate or alternative?

Ability, capacity, capability?

Affect or effect?

Principle or principal?

Optimal or optimum?

Biannual or biennial?

Compliment or complement?

**Bryan A. Garner, *Garner's Modern American Usage*
(New York, Oxford University Press, 2003)**

**Theodore Bernstein, *The Careful Writer*
(New York, Atheneum, 1965)**



**Ms. Particular's Micro-Lectures on Style and Usage
(<http://people.physics.illinois.edu/Celia/MsP/MsParticular.htm>)**

No more naked “*this*”es—just don’t

In some pellet designs, the average ionic charge, Z , and the laser intensity, I , are large enough that the distribution function is predicted to be non-Maxwellian (flat-topped). **This** has important consequences: reduction of the absorption rate, electron flux, and modification of the continuum x-ray emission rates.

A certain amount of energy is required to cause an electron to spin flip when it is beside another electron. Thus, the energy required is double **this** and is provided by the incident photons.

“This means that...”  *i.e., or thus*

Eliminate fluff

**Redundancies and
wordy expressions**

Pointless modifiers

Tautologies

**Generalities that sound important
but contain zero meaningful content**



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

“Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts.” W. Strunk Jr. and E.B. White, *Elements of Style*, 3rd ed. (Needham Heights, MA, Allyn & Bacon, 1979), p. 23.

Eliminate *unnecessary* words

the results *tend to* suggest
they are *both* identical
estimated to be about 0.75 mg
such as copper, iron, *and etc.*
divided into two equal halves
bright yellow *in color* and elliptical *in shape*
 $\Lambda = \lambda/2\theta$, *and vice versa*
given *the fact that* $\tau_\alpha = \sigma q_\alpha \int n(s) ds$
were reexamined *in order* to confirm the presence
It is known that nanocrystallites can form shear bands

“A phrase such as “*it is interesting to note that*”
adds no information and only delays getting to
the point of the sentence.” *Scientific Style and Format*

Replace *wordy expressions*

due to the fact that	<i>because</i>
in the near future	<i>soon</i>
a very limited number of cases	<i>few</i>
it appears to be indicated that	<i>apparently</i>
in spite of the fact that	<i>although, despite</i>
subsequent to	<i>after</i>
at the present time	<i>now</i>
in consequence of this fact	<i>thus</i>
as compared with	<i>versus</i>
in combination with	<i>with</i>

Change nouns ending in *-tion*, *-ment*, and *-ance* back into verbs

The most common use for Raman spectroscopy is for the observation of phonons. (13 words)

Raman spectroscopy is most commonly used to observe phonons. (9 words)

We proceeded to make an arrangement of the superconducting islands on the substrate with the STM tip. (17 words)

We arranged the superconducting islands on the substrate using the STM tip. (12 words)

The superconducting islands were arranged on the substrate using the STM tip. (Better?)

Many English words derived from Latin change verbs into the nominative form by adding *-tion*, *-ment*, and *-ance* suffixes to the verbs. Thus *act* (v.) becomes *action* (n.), *arrange* (v.) becomes *arrangement* (n.), and *perform* (v.) becomes *performance*.

An easy way to improve the conciseness and vigor of your writing is to be on the alert for these nouns and change them back into the verbs they came from.

3. Now for proofreading (microscopic scale)



Editing concentrates on ideas and expression

Proofing concentrates on mechanics

The importance of *proofreading* cannot be overstated

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PHYSICAL REVIEW LETTERS

22 APRIL 1996

**Effect of Filamentation of Brillouin Scattering in Large Underdense Plasmas Irradiated
by Incoherent Laser Light
[Phys. Rev. Lett. 75, 4413 (1995)]**

T. Afshar-rad, L. A. Gizzi, M. Desselberger, and O. Willi

We regret that in the printed version of the manuscript, Figs. 2(a)–2(c) were interchanged with Figs. 3(a)–3(c). In addition, the published Fig. 3(d) was incorrect. As the principal conclusion of the article was based upon a comparison of Figs. 2(a) and 2(b) to Figs. 3(a) and 3(b), this error may have prevented many readers from comprehending the Letter. We are therefore reprinting it correctly below.

You do not want to be these authors. Believe me.

Proofreading examines the manuscript one word at a time

Acronyms, mathematical symbols, and special characters are defined at first usage

Format and typography are consistent and conform to manuscript preparation rules

Technical writing conventions are observed

Grammar and usage are flawless

Punctuation and spelling are *perfect*



TIP 1: Always proofread from a hard copy

TIP 2: Start at the bottom right-hand corner and read backwards and up

Maintain witless consistency throughout the text

**Terminology—always call the same things by
the same names**

Typography—use of italics and boldface

Expression of numbers

Definitions of symbols or special characters

Legends in figures

Style of subheadings, captions, table titles

Use of color



People expect a change to *mean* something!

If you talk for four pages about a “solar collector” and suddenly introduce a “solar absorber” on Page 5, a careful reader will wonder if something qualitatively different is being described.

Present a professional-looking document

Select an appropriate font and size

Use no more than two font styles

Automatically hyphenate the document to avoid annoying white spaces in fully justified lines

Position graphics strategically

Select an attractive page layout

Adequate white space

Clean, uncluttered appearance

To recap:

**Focus on important ideas,
logical structure,
precise language,
“mechanical errors”
—in this order**



Eliminate digressions and redundancies

Pay attention to transitions and reader cues

Proofread from a hard copy

Distill, distill, distill...



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Notes: