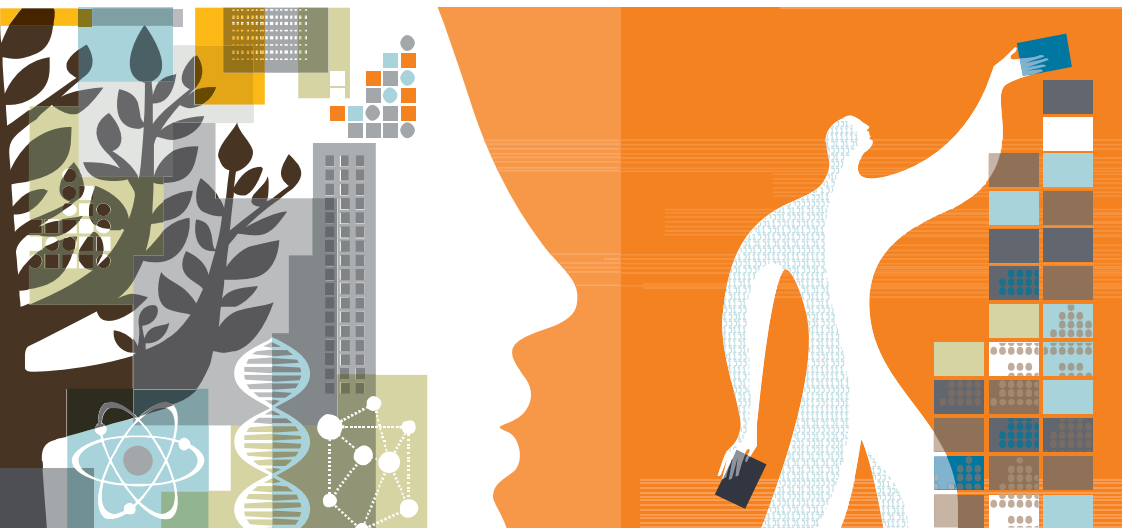


Researcher Academy

Elements of Style for Writing Scientific Journal Articles



Stephen M. Griffies NOAA/Geophysical Fluid Dynamics Laboratory, Princeton, NJ, USA
and Associate Editor, *Ocean Modelling*

William A. Perrie Fisheries and Oceans Canada, Bedford Institute of Oceanography,
Dartmouth, NS, Canada and Editor-in-Chief, *Ocean Modelling*

Gaëlle Hull Elsevier, Oxford, UK

[December 2013]



Contents

Introduction

Why you cannot ignore manuscript language

Section I

Basic rules of manuscript language

Section II

Classic errors to avoid

Section III

Always remember your readers

Section IV

Cross-references and figure captions

Section V

Writing and rewriting: Playing the peer-review “game”

About this document

- We offer some rules for writing scientific journal articles.
- We focus less on the structure of an article, and more on styles and practices helping transfer scientific information, ideas, and understanding from the author to reader.
- Some material is borrowed from the classic Elements of Style by Strunk and White (1918, available at http://en.wikisource.org/wiki/The_Elements_of_Style) supplemented by experience from Editors of the journal Ocean Modelling.
- Further material is borrowed from the essay: The Science of Scientific Writing by Gopen and Swan, published in American Scientist in 1990. It is freely available at <http://www.americanscientist.org/issues/pub/the-science-of-scientific-writing>.

We thank the following people for many useful comments and suggestions on drafts of this document:

Venkatramani Balaji, Maria Benito-Herrero, Carolina Dufour, Blair Greenan, Bill Li, Joe Majkut and Liuqian Yu

The most important rule

Write for the busy reader who is easily distracted.

- Most readers have little time to penetrate the full contents of an article.
- Readers will use almost any excuse to put down the paper, particularly when encountering poor writing that leads to reader fatigue and frustration.
- Make each sentence, paragraph, subsection, section, figure, derivation, etc. coherent and easily digestible nuggets of information.
- Your job as a writer is to communicate information and knowledge in a compelling and well written manner.

INTRODUCTION

Why you cannot ignore manuscript language

Why is language important?

Poor language quality can delay or block publication.

It is important to take seriously the presentation of your manuscript, especially the language you use to communicate results. Clarity in writing reflects on clarity in thought. Science is far more than mere fact recording. Written communication is key to transmitting knowledge and rendering an impact on the field.

Without clear and proper language, readers will not grasp the full message or impact of your work. Even though the findings you report might be cutting edge, poor language quality, including errors in grammar, spelling or language usage, could delay publication or lead to outright rejection of the paper.

Always use proper English.

Use proper English throughout the entire manuscript, and do not forget the captions and headings in figures, charts, graphs, and photos.

Do publishers correct language?

No; it is the author's responsibility... but resources are available.

Often authors assume that the publisher will correct the language of their manuscript after it has been accepted, but this assumption is not correct. It is actually the author's responsibility to make sure a paper is in the best form possible.

Doing so means correcting the rudimentary issues related to grammar and spelling, as well as providing a clear, logical, and connected story-line.

Though publishers do not correct language, they do often provide resources for authors who are less familiar with the conventions of international journals. Please check your publisher's Guide for Authors website for more information.

Some publishers may also perform technical screening prior to peer review. If the quality of the language of your paper does not meet a journal's minimum standards, it can be returned to you for improvement.

SECTION I

Basic rules of manuscript language

Manuscript language: overview

Manuscript language should be:

→ Accurate → Concise → Clear → Objective

Prevent spelling errors by using a spellchecker in English. Additionally, other common language errors involve:

- Tenses
- Sentences
- Grammar
- Paragraphs

You should always read the journal's Guide for Authors to check for any additional language specifications.

Manuscript language: tenses

Take care to use the proper tenses when describing your work and findings. Being consistent and correct in your use of tenses makes your paper easier to understand.

Present tense:

Use the present tense for known facts and hypotheses, for example, "*the average life of a honey bee IS 6 weeks...*"

Past tense:

Use the past tense for describing experiments that have been conducted and the results of these experiments, for example "*The average life span of bees in our contained environment WAS 8 weeks...*"

Remember:

Avoid shifting tenses within a unit of text: paragraph, sub-section or section.

Manuscript language: grammar

Use the active voice to shorten sentences.

The passive voice can be used in the Methods section of a paper but otherwise, the active voice will usually shorten sentences and make them more dynamic and interesting for the reader.

Use the active phrase "*we found that...*" freely, which is a quick signal to the reader that you are describing one of your results. This expression is also much more concise and to the point than writing in the passive voice, as in, for example, "*it has been found that there had been...*"

Avoid abbreviations and acronyms.

Avoid contractions such as "it's", "isn't", or "werent" which are not often used in professional writing.

- Avoid abbreviations/acronyms except for very well-known ones.
- Avoid acronyms as replacement for citations.
- Avoid acronyms in the abstract and conclusion.

Eliminate redundant words or phrases.

- *due to the fact that* → *because or since*
- *immediately apparent* → *apparent*
- *in the case that* → *in case*
- *and also* → *and*
- *in order to determine* → *to determine*
- *to try and determine* → *to determine*

Double-check unfamiliar words or phrases.

Manuscript language: sentences

To write a successful manuscript, first be aware of the **sentence structure** you use.

Write direct and short sentences.

The average length of sentences in scientific writing is only about 12-17 words.

Include only one piece of information per sentence.

Sentences should be constructed in short, factual bursts. Long and complicated sentences tend to confuse readers.

Avoid making multiple statements in one sentence.

Convey only a single idea per sentence. Link sentences together within a paragraph to provide a clear story-line.

Keep related words together.

Closely place the subject and verb to allow the reader to understand what the subject is doing.

Pay attention to the order in which you write a sentence.

The "stress position" within a sentence contains new information to be emphasized. The "topical position" contains "old" information leading up to the point of emphasis. The topical position comes before the stress position.

Avoid: *"This ocean basin was warmer during 2012 than any period found in the observational database, based on our analysis of recent ship-based measurements."*

Write: *"Based on our analysis of recent ship-based measurements, this ocean basin was warmer during 2012 than any period found in the observational database."*

Put statements in a positive form.

- Positive: "He usually came late."
- Negative: "He is not very often on time."

Manuscript language: paragraphs

- Have one paragraph for each distinct topic.
- Begin a paragraph with a topic sentence, and end in conformity with the beginning.
- Avoid a succession of loose sentences.
- Parallel structures are simpler to parse as a reader. Retain consistent tenses within each paragraph.
- Provide a logical transition from one paragraph to another to render a clear flow, thus guiding the reader from one topic to another.
- Paragraphs are similarly constructed to sentences, bringing the reader from the "familiar" at the start to new ideas towards the end.
- Fill logical holes empathizing with a smart reader who genuinely wants to understand the flow of ideas.



SECTION II

Classic errors to avoid

Avoid using "this" unqualified.

Avoid: "We found *this* to be the most important facet of the ocean's dynamical response."

Write: "We found *this* feature of the thermocline to be the most important facet of the ocean's dynamical response."

- What does "this" refer to? If the reader must guess, then the guess could be wrong.
- Even when it is "obvious" what "this", "that", "these", or "those" refer to, the author serves the reader well by clearly qualifying.

Avoid too many successive prepositional phrases.

Avoid: "We ran a model simulation of the ocean for research into the evolution of the thermocline."

Write: "We ran an ocean model simulation to conduct research into thermocline evolution."

- Run-on prepositional phrases are awkward to read.
- They can rapidly lead to reader fatigue.

Avoid subjective or redundant words or phrases that will date the paper.

- "high resolution"
- "new result"
- "latest finding"

Avoid subjective or judgmental adjectives.

Avoid: "We use a *simple* model of the ocean's thermocline to describe the dynamical response."

Write: "We use an *idealized* model of the ocean's thermocline based on approximating the continuous stratification with two immiscible fluid layers to describe the dynamical response."

- "Simple" has meaning to the reader only when the authors explain the opposite "complex" or "realistic" or "complete".
- Readers should not be asked to read the mind of the authors, nor to share the authors' opinion.

Avoid expressions of belief.

Avoid: *"We believe this model result to be true."*

Write: *"We show through our analysis that this model result is consistent with the empirical evidence."*

- Communication of science is not about conveying belief.
- Rather, it is about logically developing lines of evidence that lead one to a hypothesis, theory, or conclusion based on the evidence.

Avoid loose statements and back to back adverbs.

Avoid: *"The ocean model simulation ran quickly and cheaply."*

Write: *"The ocean model simulation required 1200 hours using 100 computer processors."*

- What is "quickly" and "cheaply"?



SECTION III

Always remember your reader

Abstract: the key points

- The abstract provides a concise summary of the key aims and results.
- If it is not clear and interesting, readers often will read no further.

What am I about to read?

The introduction

- The introduction should lay the ground-work for why the paper is worth reading, and describe where the work fits within the existing literature.
- Introduce the novel elements of the paper in the introduction, thus providing motivation for the reader to penetrate the main text.
- Do not over-burden the reader by making the introduction too long. Get to the key parts of the paper sooner rather than later.

What did I just read?

The discussion and conclusion

- Readers need to know what they have read and why it was significant.
- Remind the reader why this paper was worth reading and publishing.
- Concluding sections also provide a venue to set the stage for future research directions.

SECTION IV

Cross-references and figure captions

Thorough cross-referencing

- Cross-reference equations, figures, and sections both by their number and by their name.



$$\frac{d}{dx} J_r(x) + \sum_{\alpha} \phi_{\alpha}(x) \phi_{\alpha}(x) = \sum_{\alpha} \sum_{\beta} \phi_{\alpha}(x) \phi_{\beta}(x) + \sum_{\alpha} \sum_{\beta} \nu \phi_{\alpha}(x) \phi_{\beta}(x);$$

$g = 1, 2$

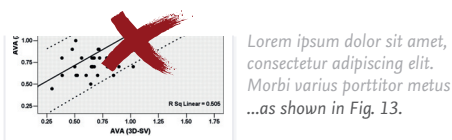
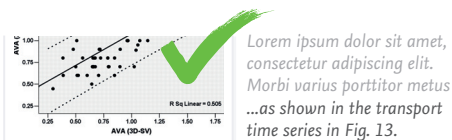
Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Morbi varius porttitor metus ...as seen in the continuity equation (12)...



$$\frac{d}{dx} J_r(x) + \sum_{\alpha} \phi_{\alpha}(x) \phi_{\alpha}(x) = \sum_{\alpha} \sum_{\beta} \phi_{\alpha}(x) \phi_{\beta}(x) + \sum_{\alpha} \sum_{\beta} \nu \phi_{\alpha}(x) \phi_{\beta}(x);$$

$g = 1, 2$

Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Morbi varius porttitor metus ...as seen in equation (12)...




Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Pellentesque ut feugiat eros, at mollis ex. Donec porttitor mattis varius ...as discussed in the methods Section 2.
Pellentesque ultricies aliquet felis vitae feugiat.



Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Pellentesque ut feugiat eros, at mollis ex. Donec porttitor mattis varius ...as discussed in Section 2.
Pellentesque ultricies aliquet felis vitae feugiat.

- Asking the reader to page back in the text intensifies reader fatigue.
- Put your head in the reader's head to determine when it is useful to provide "hand-holding" in a discussion or a derivation, whereby you identify useful cross-referencing.

Figures and captions

Figures can be the most important part of a paper. Produce clear and high quality figures along with thorough captions.

- Avoid excessive numbers of figures: judiciously select those figures that clearly support the presentation.
- Allow the reader to digest a figure's main points without reading the text.
- Produce high quality figures, even on the first submission!

When available, embed figures within main text of the submitted manuscript to avoid reviewers needing to page back/forth, which in turn breaks the reading.

SECTION V

Writing & rewriting - playing the peer-review "game"

Extensive fine-tuning

Write science as E. Hemingway wrote his literature. Scientists are storytellers too!

"My aim is to put down on paper what I see and what I feel in the best and simplest way."

E. Hemingway

- Can you identify the beginning, middle, and end?
- What is the "take home message" or "iconic figure" of your paper?
- Be aware of each word forming a sentence; each sentence forming a paragraph, each paragraph forming a section...

Edit → Read → Edit → Read → Edit → etc.

- Consider the manuscript from a different perspective between each Edit → Read cycle: e.g., read in a different location; read it as an interested and smart non-expert. Patience will reduce time with reviewers/editors, and will enhance the paper's readability and impact.
- Solicit "friendly" reviewer comments from colleagues, and be sure co-authors have read the manuscript. Ask readers to comment on the "style" of the manuscript as well as the substance.
- Writing rules can be selectively broken without sacrificing clarity. But it is important to know and to respect the rules so to understand when they are usefully broken.

Honestly deal with mistakes.

There are times when the reviewer (or the author!) identifies a significant problem/mistake during the review process.

- Mistakes are embarrassing. But they are far more embarrassing if published! So be thankful the mistake was found during review.
- If the basis for the paper is undermined by a mistake, then do not try to justify publishing. There may be another path towards a publishable story.
- Avoid publishing an incomplete or half-baked story. Readers will be reticent to read your next paper.
- Quality over quantity is the ideal.

And finally: Do not give up if you believe in your work.

Reviewers are generally not as knowledgeable on the subject of the manuscript as the author.

- Some influential papers that break new scientific ground may be rejected merely because reviewers do not appreciate the results. Be patient and persistent.
- Nonetheless, reviewer comments are almost always useful, even if they are wrong!
- Some critical or wrong reviewer comments result from poor writing that leads to reviewer misunderstanding and reviewer frustration. Rethink your writing.
- Let comments sit, especially negative or harsh comments. A poorly written rebuttal can lead to needless (and sometimes emotional) correspondence with the editor and reviewer.

