

Writing readable papers: How to tell a good story

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[The following article is a modified version of the presentation I gave at the 1995 NABS Annual Meeting when I was honoured with the NABS Award of Excellence. I originally prepared it as a talk. In revising for publication, I have tried to retain the flavour of the way I hoped to appeal to the audience. Thus this paper should not be seen as the definitive guide to good writing, but only as one person's view of a persuasive style]

The meeting at Keystone was the 10th anniversary of J-NABS. We gave our journal its name at the 1985 NABS meeting in Corvallis, Oregon. And at that same meeting, I was handed the first manuscript for review.

At that time, I knew as much about writing and editing as many of you who are reading this article. I had written a reasonable number of papers and had reviewed for several journals and granting agencies. I had been an Associate Editor for another journal for five years. Perhaps I had a slightly better knowledge of the conventions and rules of our language, because I taught English grammar when I was a highschool teacher in Winnipeg much earlier in my career; but otherwise my qualifications were not remarkable.

Now, 10 years later, I have been honoured with an Award, which I shall treasure as recognition of my achievements as an editor. I have learned a great deal during my editorship. While J-NABS has been developing, so have I. In this article, I want to share some of the discoveries I have made while editing, and to outline some essential

First, I want to be sure that you do not misunderstand the word "story" in the title. I am not referring to a lie, or an attempt to cover up weak science with cunning prose. Instead, I mean "story" in the sense of an absorbing account of a piece of work that carries the reader along, so that we are sorry when we come to the end of the paper. We are convinced of the relevance and worth of the research, and we are excited about its implications. The thread is coherent and consistent.

How do we learn to write in this way? A few fortunates were well taught when teenagers, but most of us (myself included) had to learn when we were older. In fact, I am still learning, and the following guides are my constant companions.

The elements of style. W. Strunk and E. B. White. Macmillan Publishing Co., New York. 1979

This book is the best small guide anyone can buy. It costs about \$5, is smaller than a standard paperback, and is only 90 odd pages long. Yet it has more gems of advice per page than any other. Everyone should have it.

A treasury for word lovers. M. S. Freeman. ISI Press, Philadelphia. 1983

I bought this Treasury before I became Editor of J-NABS, and have enjoyed it so much that I almost entitled this article "A love affair with words". It deals mainly with problem words, especially pairs

of words that look or sound similar but have different meanings, such as "alternate" and "alternative", "compose" and "comprise", "imply" and "infer".

The Columbia guide to standard American English. K. G. Wilson. Columbia University Press, New York, 1993.

I refer to this book to make sure I do not offend Americans. Because I was born in England and still have an English accent, many people who hear me speak at NABS meetings suspect that I want English English in J-NABS. Not so! All the books I am recommending were written by Americans, as was the highschool text that I used in Winnipeg, which taught me the rules. This book is helpful because it makes the nice distinction between Standard English and Edited English. The latter, which may *seem* more *English* than American, should be used for scientific papers.

Scientific style and format: the CBE Manual for authors, editors and publishers. 6th edition. Cambridge University Press, Cambridge, UK. 1994.

This edition of a well-known American manual was prepared by a committee including Canadians and Americans. It is the best reference for technical aspects of writing, including the appropriate style for symbols, abbreviations, and specialized terms such as those for biochemical and genetic aspects of benthology.

The new Oxford guide to writing. T. S. Kane. Oxford University Press, New York. 1988.

Now we come to the "good story" part of my title. This book, also American in spite of its title, has helped me not only to write better myself but also to be aware of the ingredients of a good story.

The ability to tell a good story is essential in these days of increasing literature and increasing demands on our time. Unless we write in a way that grabs attention and enthralls the reader, we won't have any readers at all. Wordy prose and stodgy rhythm will put readers off after a few paragraphs. Don't destroy several months or years of worthwhile research with an unreadable product!

Let me reiterate what I mean by a good story. Four words are enough: enticing, captivating, persuasive, and stimulating. These words will elicit different responses from different people, but I suggest the following with respect to a paper in a journal:

Enticing: "Hey-this looks neat"

Captivating: "I can't put this down"

Persuasive: "This is for real"

Stimulating: "Wow!"

The stimulating aspect does not have to be "Wow"; but when you write, you should definitely leave your readers with a sense of having gained some worthwhile facts or interpretations.

The four phrases in quotes are deliberately colloquial to attract attention. They also have another characteristic in common: all 14 words (in total) are of one syllable. Colloquial wording is, of course, inappropriate for scientific writing. Simple words, however, often convey a message more effectively than long ones. They also result in a shorter paper which will be less intimidating to readers short of time.

The long words I see most often, and the changes I make when editing, are as follows:

Long	Short	Comments
Exhibited	Showed, had	The shorter words are sufficient to describe characteristics or behaviour
Indicated	Showed, suggested	The long word is ambiguous, whereas the short words have specific meanings
Located		This word is usually not needed at all
Majority	Most	Note that if "majority" is essential, it should refer only to countable items
Methodology	Methods	"Methodology" is rarely meant
Utilize	Use	The long word just sounds impressive
Utilization	Use	Ditto

To achieve a readable style, you have to develop a sense of what sounds right. One way to do this is to read. Read anything but scientific papers and newspapers. Yes, rather few scientific papers are good models. Even J-NABS is not perfect, because believe it or not, I do allow readers to retain most of their style. Read fiction. Include books by good modern writers as well as the more serious classics. You will gradually absorb a sense of when rules can be broken. An incomplete sentence is, on occasion, an effective punch; improperly used, it is bad grammar.

Punctuation, when understood with sensitivity, leads to ripples and pools of narrative flow. Yes, I'm deliberately playing on the theme of streams, because we all know that streams flow irregularly. The fast and slow reaches are part of their fascination. In writing, ripples are forceful points of the narrative and long sentence runs. Pools are short sentences. Pools are breaks in the flow of words, sometimes providing a welcome interruption in a spate of ideas. Clarification results as ideas settle.

I have learned a lot by reading fiction. I read books for relaxation and for the story, although I will admit that I am rarely able to ignore structural style, and some authors make me itch to edit. Indeed, I wonder how some so-called editors in the novel publishing business were ever hired. My favourite thriller writer has a superbly lean style. He uses simple words and frequent short sentences that create a fast pace. His opening sentence is always captivating. I am caught up in the story because his style invites involvement.

I am not suggesting that we should all mimic the thriller writer. That style is absolutely inappropriate for scientific writing. I do, however, encourage you to explore the art of writing. When you realise you have enjoyed a story or an article, ask yourself: Why have I enjoyed reading this paper? What absorbed me? What made it easy to read? Then sit down and plan your own paper, asking first: For whom am I writing this paper? Why should they be interested? What key points will they gather? How will they apply the information?

Instead of concentrating on how quickly you can get a paper out of your word processor, think about the person you are "talking to". You should plan to appeal to the reader, not to a promotion committee or a granting agency. Forget about how good this paper will look on your CV; forget about being *impressive*. Think about readers like you.

How should you set out to write a paper? Everyone has a favourite place where they compose, a particular mood, and various levels of orderliness or relaxation. I remember mentally wording the opening of my first paper, based on part of my Master's thesis, when I was climbing Mount Washington in New Hampshire. More recently, I seem to have more success when I've had a drink or

two. When I've dropped a few inhibitions and have stopped worrying about the perfect prose, the words seem to come to mind more easily and the story flows along.

Don't strive to write a paper. Write your thoughts first; correct the style later. Concentrate on the story and make sure you don't lose the thread as you go along. Imagine you are explaining what you did-and why-to a friend who is a scientist. If your friend were to say "What do you mean?", you would rephrase your account more simply. *Use those simple phrases!*

Keep in mind your sense of excitement when you undertook the research. I'd rather read a paper with verve than one written meticulously with respect to syntax. Even editors need to be stimulated. Don't be so scientific and impersonal that your paper has no heart, no spark. Use the first person and the active voice frequently. You may have been taught that scientific work should be reported in the third person. You must, of course, report objectively, but this concern does not mean that you have to distance yourself so far from the work that you lose sight of the thrill of the hunt. If you do, so will your readers. Readers need to empathise. They need to see in their minds what you did, and where, and why. Even multiauthored papers can afford to stretch the truth a little and say "We did.....", although every individual may not have been involved in that particular aspect. Give the paper a single soul.

If some of you reading this paper are now saying "But science should not be written like that", my reply is "Why not?" We need to be encouraged to keep up with the literature in even our own specialty, let alone broader topics that we know we should explore but don't, because we lack time and concentration. We have to find a solution; hence my proposals. I am not recommending chattiness, just more natural reporting.

To illustrate the style I would like to see, I have chosen a topic (just my imagination, not based on fact) that I hope will appeal to the diverse benthological interests of my readers. First, I show three titles. Which one to use depends on the thrust of the paper and the particular audience you are trying to reach.

1) The number of setae on the posterolateral larval integument of Cricotopus species (Diptera: Chironomidae)

This title is appropriate for specialists in taxonomy and systematics. It describes concisely the content of the paper, and makes no attempt to look beyond this description.

2) Using setae of Cricotopus larvae (Diptera: Chironomidae) to identify species differing in pollution tolerance

Here, the author is implying a purpose in the paper beyond the simple description. There is nothing wrong with this title, but it could be more persuasive.

3) Setae on Cricotopus (chironomid) larvae: a taxonomic tool for biomonitoring

I think this title would appeal to applied benthologists who might not be attracted by title #2. The words are simpler (note the anglicized name of the family) and the message is clear.

Next, I shall illustrate an imaginary introduction. This section is the part of the paper most likely, after the title, to win or lose readers. Don't burden the introduction with dozens of references. Sometimes, the many citations make us wonder why another paper is necessary at all! If you are extracting a chapter from a thesis or dissertation, remember that you are no longer having to prove yourself to examiners. In the academic document, evidence that you have consulted an appropriate body of literature is an essential part of the qualifying process. In a paper, however, you need only provide the right setting for your own work, with particular emphasis on the hole in our knowledge that you are going to fill.

Here is a concise introduction-the background and objective in a nutshell.

Our inability to identify chironomid larvae to species has hampered pollution assessment for 70 years [two or three key references]. My paper describes easily seen features of Cricotopus species that will make biomonitoring cheaper and more effective.

Now I will show you a series of alternatives, sentence by sentence, which collectively are providing the same introductory purpose and leading to the same objective, but the first alternative is longwinded and the second paraphrases the first in simpler words.

Long: There have been many environmental impact assessment studies that have enumerated particular macroinvertebrates for the purpose of revealing the severity of pollution. [A string of references]

Short: The severity of environmental pollutants is often judged according to numbers of particular macroinvertebrates. [A few references]

Use "There are/were/have been...." phrases sparingly; a strong subject (the real one) is usually far more effective. Notice how the short version has fewer pompous words and less jargon. I continue:

Long: A number of authors have found that there are significant differences among chironomid species with regard to impact tolerance. [A string of references]

Short: Species of chironomids differ significantly in their tolerance of pollution. [A few references]

The short sentence has almost half the number of words as the long sentence, and avoids the vague "a number of" (better words would be "several" or "some"), as well as other unnecessary words.

Long: It is well known that impaired sites often support more chironomid individuals than pristine sites.

Short: Chironomid density is often higher at polluted sites than at clean sites.

If the fact is so well known, why say it? At least remove the "It is well known" phrase. Also avoid words like "support" (which seems to reflect some authors' reluctance to use a simple word like "have") and "pristine" (which is often used to describe an apparently undisturbed site, although the true pristine condition may be unknown).

Long: This has been incorporated into water resource quality management decision making programs.

Short: This distinction is used to assess and manage water quality.

Note that "this" has been defined and that the long final phrase (which, with its many noun adjectives, I have actually seen in print) has been reworded in understandable terms.

Long: However, it has been shown that identification to species is not cost effective in routine biomonitoring programs.

Short: Identifying these species, however, has been too expensive for routine biomonitoring.

My editing in this case has not greatly changed the length, but it has replaced some jargon words (cost effective, programs) with the truth!

Long: In order to address this problem, a new methodology was utilized to reveal setal characteristics exhibited by larval Chironomidae.

Short: To find a solution, I used a new stain for chironomid setae.

My wording is shorter, avoids the unnecessary "in order...", and substitutes simpler and definitive words for the second half of the sentence.

Long: The procedure described in this paper will facilitate laboratory processing and render biomonitoring procedures more effective.

Short: Easier detection of identifying setae will make biomonitoring cheaper and more effective.

The second sentence describes the potential of the method in more direct terms.

The examples above show how the Introduction to my imaginary paper could be made clearer as well as shorter. Even the shorter form, however, has seven sentences, whereas my original concise Introduction had only two. Admittedly, the concise form was extremely brief and might be criticized by readers who are used to seeing more background material. You have to decide how brief you could be while still preparing readers adequately for your story. In any case, I hope you have got the message.

Remember that your data are only worth anything if people read about them, realise what they mean, and want to build on them. If you cannot retain a reader's interest long enough for those data to be appreciated, the paper and data will die.

When you have written a captivating and persuasive paper, don't neglect the final steps in the preparation of a manuscript. Always read it over to check for errors, and don't depend on a spell checker. The most blatant example of neglect that I remember was by an author who overlooked the spell checker's substitution of "liable" for "labile" (the spell checker did not recognize "labile"). As his paper focused on labile carbon in a stream ecosystem, this error caused the referees some amusement, but also some concern for the author's attention to detail. One referee pointed out that the author was liable for considerable criticism, showing her exasperation. The editors were also exasperated; we are, after all, only human.

And because we are only human, we sometimes make mistakes ourselves. I am ready to admit that I myself have exasperated many of my authors. I hope I have not put too many of you off, even if some of you have said "Don't send your treasured paper to J-NABS; Rosemary will scribble all over it". I also know that I don't have all the answers. So I do not advise you to tell a colleague: "Send your troublesome paper to J-NABS; Rosemary will rewrite it for you". Such a hope is wishful thinking!

To finish, I thank all authors who have written the papers that have made J-NABS a success, and the referees and Associate Editors who ensured high quality. Thank you all for your contributions to our science.

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