

RIGHTING SCIENTIFIC WRITING: FOCUS ON YOUR MAIN MESSAGE!

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Abstract

This paper is about how to prepare research papers that are easier to write and easier to read. It draws on what we have learnt from running workshops for scientists about how to publish more readable papers. The key thing is to distil the most important point that needs to be made in a paper and then structure the paper around that point so that readers cannot miss it.

Mind-mapping and a clear understanding of what individual readers need to know are important tools to help distil a main message. Conversely, the traditional structure in which a paper builds to a knockout punch at the end and the traditional impersonal styles of written expression are the two most serious obstacles to the effective use of the main message strategy.

Mastering the main message strategy is the key to writing papers that are easier to understand, and also easier to write.

Focus on your main message or lose your readers

It is no secret that much published science is so poorly written and hard to follow that it often goes unread. Consequently, we probably lose the benefit of a lot of good work. Fortunately, there is much we can do to avoid having this happen to our own papers.

We wrote this short paper because of experiences we have had in running workshops for scientists about how to prepare research papers that are well structured and easy to understand. We found that many scientists make the same errors and also that there are some simple tools that most authors can master to help them write more easily, more directly, and more quickly. This paper tells you about the main ones, particularly the cardinal principle of always highlighting the main point you want your reader to remember. (Both that last sentence and the previous heading state our main message. Our reason for pointing that out to you will become clearer to you when you get further into this paper.)

However, before we get too far into this paper, we want to tell you that we will not be covering what most people regard as 'good style'. There are three reasons for this. First, you already know most, if not all, of what you need to know. Second, others have covered the subject far better than we could ever hope to do (one of the best is Strunk and White's (1972) perennial, slim volume that has been in print since 1935). Third, we find that, once you fix clearly on the main thing that you want to say, a lot of clumsiness and turgidity seems to evaporate.

Mind-maps rule!

How do you decide what to put in and what to leave out? Science is all about collecting lots of information and, at times, it seems that every bit is inter-related; this makes it hard even to impose an order on the information, much less decide what to cut out. This is where mind-mapping (Buzan 1983, Russell 1979) can help.

Many of us unconsciously assume that, because we read words in a linear string, we have to write the same way. However, our brains do not work linearly. Thoughts and ideas pop up haphazardly and are not neatly tied together in a coherent whole. The remedy is to go with the flow and not to fight it. When you want to write a paper, beg, borrow, or steal a dozen large

sheets of white paper from your local fish shop (this could give a whole new meaning to 'food for thought'). Then jot down the essential ingredients and ideas about your paper. Start in the middle of the sheet with the apparent theme of your paper and let things radiate out (once the ideas start flowing, you will understand why you need really big sheets of paper). When one sheet is filled, just move on to another. It is helpful to mark in linkages between elements of the mind-map; sometimes they will occur to you as you add elements, and sometimes it is more appropriate to add them later. If you have co-authors, it is better to make a collective mind-map (for example, the mind-map in Fig. 1 is one the three of us made to get us started on this paper).

Never allow yourself to censor what goes into the mind-map. Never try to order your thoughts or decide which ones are worth writing down, just get them all down and put them any place on the page where they seem to fit. The best way to kill this exercise is to try to arrange your thoughts neatly and to write down only those that seem appropriate. (That is a critical paragraph, so go back and re-read it. About half the scientists we have worked with have difficulty with mind-mapping and the reason is always that they try to censor what they write).

If you let your mind 'free-wheel', after an hour or so you will probably have most of the ideas you need to write your paper (it is a good sign if you also have questions or notes to yourself about points where you need more information).

The next task is to decide what information to use and what to discard. To do this, you need to decide the main point you want to make in your paper and this brings us to the main message strategy.

Distilling your main message

Ask yourself 'if the people who are going to read this paper remember only one point, what would I want that point to be?' Write that one point on your mind-map in 25 words or fewer. (This is an arbitrary limit, but we have found it works well. If you come up with 26 words at one of our workshops, you will be sent away to discard one of them). It can be tough, but you will find the discipline of distilling all your work down to just a few words is really worthwhile. Like being shot at dawn, it really does focus the mind, and clarity of mind is what publishing is all about.

The process is iterative

Although we tell you to first make a mind-map and then decide your main message, it is really a cyclic process. You may need to add to your main mind-map once you have a working version of your main message, and, conversely, doing more work on your mind-map can cause you to revise your main message. Most people find it easier to start the cycle at the mind-map.

Deciding where to start and what to leave out

The next step is to work through your mind-map and number your points in the order that you think will most clearly highlight your main message. A word of warning – if you get through this exercise without having points left over that you cannot use in your paper, you are either forcing irrelevant information into your paper or else you stopped mind-mapping too soon. Mind-mapping should take you beyond the edge of your information; so the sign of success is to have parts of your mind-map that you discard.

Building the framework to support the text

Now you are nearly ready to start writing the body of your paper. However, it is all too easy to lose the focus and get bogged down in the main text. To avoid this, we have found that doing

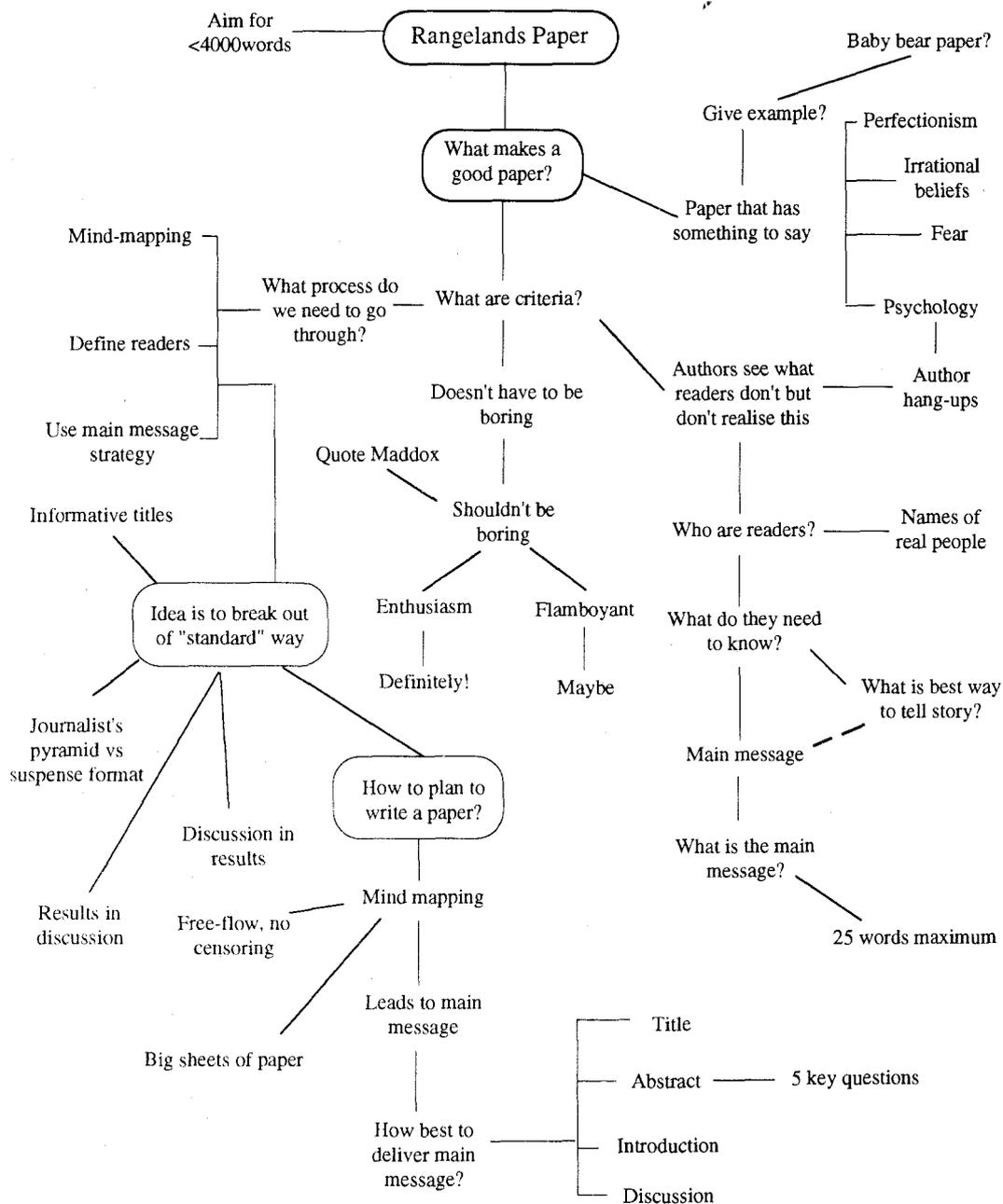


Fig. 1. This is part of the mind-map we made to start this paper. It was hard to present to you because, by their very nature, mind-maps tend to make sense only to the people who write them (the logic in the links is not always obvious and the terms are not always self-explanatory). Our original was much more cluttered, much messier, and much less legible than this cut-down version, but we think it will still give you an idea of how a paper can take shape in a mind-map if you compare the structure and headings in the text with the elements of the mind-map. Notice that the mind-map pushed beyond the limits of what we eventually decided to cover in this paper, particularly in the top right-hand corner.

the following four things at the outset helps create a structure to keep your text on the straight and narrow:

first, write down the names of three or four people whom you want to read your paper (more about this in the next section);

second, write your main message under the names of your intended readers (and remember that 26 words is too long!);

third, write down a working abstract (we show you how to do this later);

finally, write down the working title. (It is acceptable to do steps 3 and 4 in the reverse order.)

Fix clearly on your intended readers

We meant it when we said to pick three readers by name. Do not write down things like 'other rangeland ecologists', 'graziers', 'soil scientists', or whatever. They must be real people with real names, and you must know them. If you remember nothing else from this paper, please remember that skilful and successful authors write from an understanding of the needs of their readers. We cannot write to meet the needs of people we do not know.

When you choose readers, be aware that the people you choose can restrict the relevance and appeal of your paper and that many of us do just that by not giving the matter much thought. To give you an example, a fisheries biologist monitoring fish populations might write just to three colleagues who are also fish biologists. Alternatively, that same biologist might write to other colleagues including the economist who is trying to calculate the economics of the fishery, the engineer designing the dam that will discharge fresh water at unnatural times and so alter the population dynamics of the fishery, the petroleum geologist who needs to know about fish populations in an area that might contain oil, or to the environmental scientist concerned about possible disruptions to the marine ecosystem. This is a matter that every author needs to consider carefully, but it is also one that most of us overlook.

Your chosen readers should create another feedback loop. Check that your main message fits with your interpretation of your readers' needs and interests. If there is a mismatch, then either you have chosen inappropriate readers or your main message is wrong. Either way, you can go no further until the two 'click', otherwise the rapport needed for effective communication will be missing.

The working abstract

A working abstract helps establish a target for your paper and provides a focus for what you want to say. If you find that the text of your paper starts to get out of step with the working abstract, either change the text or change the abstract (that is why we call it a working abstract). The same goes for the working title.

Getting the working abstract is as simple as answering five questions:

- what did you do?
- why did you do it?
- what happened?
- what do the results mean?
- what is your work good for?

These questions seem logical enough, but it is surprising how many abstracts fail to answer the last two and many miss the second question as well (Salager-Meyer 1991).

Allow yourself thirty words for each question. Again, the discipline of getting down to a handful of words is useful. It is not important that you answer the questions in the order that we present them, but we have found that this is the easiest order for most people.

The main text (at last!)

Now you can start writing the main text. For many people, the easiest order is materials and methods, results, discussion, introduction, abstract/summary, and (finally) title. Feel free to vary this, but be sure that you review the sections in that order before you finish the first draft. This is because the results depend on the experimental methods; the discussion depends on the results obtained; the introduction not only outlines the problem but also primes the reader about what to expect in the rest of the text (and so depends on what you decide to put in the following text); the abstract (or summary) both condenses the main body of the text and bridges between the text and the title; and the title condenses the whole document so it has to come last.

Lindsay (1984) has given a good account of what should or should not go in each section, so we shall not go into detail on these matters. However, if you are tempted to combine your results and discussion, think twice. We have yet to see the paper that combined results and discussion at the outset without losing most of the discussion. If you truly feel you need a combined results and discussion, write them separately and combine them only after you have written a complete first draft.

The other point we want you to understand about the main text is that there are guidelines but no rules. The only real test is what works, and what works is whatever gets the information from your head into your readers' heads. A skilled author can put results in both the materials and methods and the discussion, and put discussion in both the results and the materials and methods (to give you just a few examples of the 'violations' that are possible). You may want to dispute this and, if so, we guess that your reasons would be that you have never seen it done and that it runs counter to the notion of having separate sections. In a way, we would have to agree that you are right, but there is a twist. The test for applying our 'no rules' approach is that if you can see that it has been done, it hasn't been done well. Skilful authors do break the rules, but the measure of their skill is that it is not obvious that they have done it. Next time you read a really good paper, go beyond the content and analyse how the authors make their arguments – you may be surprised at what pops up in the 'wrong' section.

The main reason for information to appear in the 'wrong' section is that one of the arts of writing is to lead readers to your conclusion and the way to do this is to anticipate readers' questions and answer them as they arise, rather than save all the answers until the end. Once you start to anticipate, you will find information needs to appear outside its accepted section, but, if you do it well, it will not seem out of place so nobody will notice, much less object. This underlines the importance of having a set of real people as your intended readers. If you are not anticipating the questions that might be asked, particularly in your introduction and discussion, then it is unlikely that you understand the real needs of your readers.

Strategic use of the main message

Your main message can be used at strategic points to ensure that your reader cannot miss what you have to say.

It should appear in at least four places.

- The title (title and main message may be identical – we hope you can see how close the two are in this paper).
- The abstract (or summary – we use the terms interchangeably in this paper). The main message should emerge in answering the five questions that make an abstract. If it is not there, it is hard to imagine that you could have answered the questions properly.
- The discussion. Put it at the start of the discussion because the best strategy is always to lead with your best shot. We often tend to lead up to the main message, but that is always a mistake. Good writing comes quickly and clearly to the point. With longer discussions, it is usually a good idea to restate the main message at the end to remind the reader (but choose different words).

- The introduction. The introduction sets the scene for what follows and that means more than just laying out a general direction. A first-rate introduction not only poses the question, it also shows the shape and form of the answer.

How to sabotage your paper

The introduction is the place where authors are most reluctant to put their main message. Their reason is invariably a desire to lead up to a knockout punch at the end and a fear of spoiling it by telling readers what to expect at the start. This is as wrong-headed as it is common, and is probably one of the main reasons that so much science is hard to follow.

Some people also think they are prohibited from making the same point more than once and so fail to use the main message to guide a reader through a manuscript. However, none of us remember everything we read, nor do we understand every point when it is first made. Strategic repetition is the key to getting any message across. Skilful authors choose words in such a way that the repetition is interesting, not boring.

In case you missed it, here is the punchline again

Having got this far into our paper, we hope you now understand that readable science is built on both knowing who your readers are and being able to present and repeat your main point in such a way that they cannot fail to grasp it. In short, know your readers and know the essence of what you want to say to them. (If we did that well, as you read that paragraph it was not immediately obvious that we told you our own main message twice in a row (three times if you count the heading), but with different words each time. This is also an example of embedding the main message at strategic points in the text to make it hard to miss.)

On 'good style'

It is pointless worrying about writing style unless you have something to say and that is why we make such a big issue of distilling the main message. (It is also why so much writing training is a waste of time – it focuses on how to make elegant sentences without considering whether the sentences are likely to add up to anything.)

There are hundreds of books on this topic so we shall not try to duplicate their efforts, but we can tell you something about style that you will not find in those books, and that is that we are our own worst enemies. Time and again, we meet authors whose writing sounds like it was written by a computer because they have crazy rules about the way they think they can or cannot write. (We use the word 'crazy' deliberately, but it may help you to know that irrational personal rules are everywhere. We have laboured under them ourselves and, having got rid of them (fingers crossed), we appreciate just how crazy they were).

John Maddox (1983)(an editor of *Nature*) touched on these issues when he wrote "The style of written science most often gives the greatest offence. But if the objective is simply to convey information unambiguously, why should it matter if some sentences are inelegant, even downright clumsy? Because the readers even of the scientific literature share with readers of daily newspapers and detective stories the habit of paying most attention to the sentences that can most easily be understood... But does not a vivid style simply serve to advertise an author's individuality? This objection to stylish writing is common but misplaced. 'Evidential support for this hypothesis has been provided by...' is more and not less pompous than 'I have found support...'. The missing element in much of the scientific literature is the unwillingness of authors to accept... that they should positively seek to persuade potential readers of the interest of what they have to say. A description of the reasons why a piece of research was undertaken and an assessment of its importance (which may be frankly subjective) are obvious ingredients of a persuasive article. So too may be a little enthusiasm."

We take ourselves too seriously to write clearly

The keys lie in pomposity and enthusiasm. We often take ourselves too seriously and this makes our writing pompous and turgid. The essence of a good writing style is to write it as you would say it. If you cannot say it aloud and have it sound natural, then you don't have it right. Mastering endless rules from grammar books does no good if we are not relaxed enough in ourselves to say 'well, this is what I have done and this is what I think it adds up to' and to commit that to paper. Only when we can do that are we likely to have a style that will interest others. In short, if you are having trouble with your writing style, look inside yourself and not to textbooks for the answer.

As scientists, we think of ourselves as detached observers, separate from the system we observe. This is a liability when it comes to reporting what we do, because it strips our writing of the enthusiasm it needs to have to be effective. We are all human beings and we have feelings and emotions and they influence our work (if it is not fun and exciting, why do it?). Moreover, they provide the window through which we communicate with others. If our writing style says 'I am here, but I am not really here', our words become colourless and flat and give readers little incentive to read them. But if they say 'hey! this is interesting stuff and here is why I think you would like to know about it', we get much closer to effective communication. For many of us, this means letting go of our scientist's mask.

What makes an interesting paper, what makes a good paper?

Assuming that the science is sound, the answer to both questions is the same. A good paper tells the reader what it is all about and does so as early as possible (that is why we mentioned the idea of a main message so often – remember that cryptic sentence near the start?). A good paper also conveys some of the enthusiasm that its authors felt for the science when they did it. We are not unfeeling, detached observers of the world. We are living people with visions and enthusiasms – without them, our words die on the page.

The bottom line

Our parting advice to you is this. To write good science, be absolutely clear about what you want to say, then capture it with words that say 'right or wrong, here is what I want you to know'. (Our main message again, but in different words).

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