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Editorial

Writing a Scientific Paper: I. Titles and Abstracts

I graduated from the University of Cambridge in 1960 with a B.A. in physics. At that time a requirement of the examination process was a three hour exam in which one was required to write an English essay on a subject chosen from a long list of topics provided. It was also a requirement of admission to the university that one had passed an examination in Greek or Latin. I studied Latin for eight years. After graduation I went to work at A.E.R.E. Harwell, a government laboratory where there were strict limits on what one could publish. Each paper had to be examined, and approved, by my group leader, my department head and a declassification office before it could be submitted to a scientific journal. With my educational background and these additional checks, the writing of scientific papers was always a matter for extreme care. This does not mean that I do not sometimes read my early papers with embarrassment. There were certainly errors and I cannot claim perfection, but I despair at the quality of many manuscripts I receive nowadays. Good science deserves good presentation, not the sloppy accounts I read too often.

Setting aside the issue of language problems, particularly for our Asian contributors, I feel I should give some pointers and advice for writing scientific papers. I intend writing a few Editorials on this subject and hope my experience will be useful to others?

"Let's start at the very beginning – a very good place to start" (Sound of Music): the title and the abstract. Although these items are the first in the paper, they have to be written last. It is impossible to abstract something that has not been written! More than half the papers I receive are returned to the authors for amendments to these items. I have the impression that they are usually added as something necessary to complete the submission, and little or no thought is given to them.

When I started my research career there were far fewer journals and they were all available only in printed form. We used to eagerly await the arrival of the latest edition of, for example, J. Nuclear Materials, and a weekly newsletter informed us of the latest periodicals available in the Harwell library. At that time one held in one's hands the complete paper: title, abstract, text and references. The title and abstract might later appear in Chemical Abstracts, etc. but they were originally never seen in isolation.

The situation today is quite different. The title of a paper accepted for CARBON will appear on the journal website two or three weeks after acceptance and, for a fee, the original submission can be downloaded. A month later, after the manuscript has been typeset and proofed, one is able to download and read the abstract without charge before deciding whether to pay to download the complete manuscript. The publishers tell us that a vast majority of papers today are accessed via the journal website. The number of printed copies of the journal, which used to be around 1500, has now dropped to less that 500. I know that many readers have full access to the journal website through institutional subscriptions, but there are many people who pay to download a manuscript, and because of this it is essential that both the title and the abstract give an honest indication of what the paper contains.

Let me give an example. I recently received a paper whose title indicated that it concerned the preparation of carbon nanoparticles as a filler for polymers. But this was not true! The authors had only examined one polymer. An honest title would have indicated that the paper was about the preparation of carbon nanoparticles as a filler for polyethylene, or whatever polymer had been examined. Always ask yourself whether the title of your manuscript, **seen in isolation**, gives a full and honest indication of the experimental work reported in the paper.

Another recent submission had a title that told me that a material was synthesised "in a gas pressure atmosphere". I had to read well into the experimental part of the paper before I learned that the atmosphere was argon! There was no indication of this in either the title or the abstract. What the author should have said was "in high pressure argon".

Another problem with titles is the way authors think the use of a colon is "cute". A paper entitled "The synthesis of carbon nanotubes using a xxxx catalyst: the effect of the catalyst preparation method" can easily be made more straightforward by writing "The effect of the catalyst preparation method on the synthesis of carbon nanotubes using a xxxx catalyst". The colon is unnecessary [I call such titles

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"colonic", a pun that will perhaps be understood only by native English speakers]. I would willingly accept the title if it were "The synthesis of carbon nanotubes using a xxxx catalyst: I. The effect of the catalyst preparation method". In other words the authors were writing a series of manuscripts on the use of xxxx catalyst with part II being, perhaps, "The synthesis of carbon nanotubes using a xxxx catalyst: II. The influence of reaction temperature". The colon should be reserved for a series of multi-part papers. This does not mean that I approve of this practice. Too many multi-part papers have been divided simply as a means to improve the paper count on the author's CV, and not to improve understanding. The title of this Editorial is an illustration of the correct use of the colon.

As already mentioned, while the title and the abstract come first, they should be written last. One cannot abstract a paper that has not yet been written! The abstract is most important because it is able to give a fuller account than the title of the manuscript's content, and it is available from the website without paying a fee. It should be concise (one paragraph) and precise, indicating to the potential reader two things: (a) what was done, and (b) important results obtained. That's all! It is not the place for history, or discussion of results. Many abstracts received can easily have their first few sentences removed because they give the history, something that should be reserved for the Introduction section of the manuscript. The same can often be said of the final sentence or two. A comment such as "The material may be useful in capacitors" is pure speculation and does not belong in an abstract. Of course, if the authors have done experiments to show its usefulness in this application, it should be mentioned. Phrases such as "we think the effect is caused by..." do not belong in an abstract.

Many abstracts I receive start like this "In this paper we report a new method for the production of carbon foams from...". Immediately there are three mistakes: (a) "In this paper...", and I thought is was a different paper you were discussing! (b) "...we report..." – surely it could not be another person reporting for you! (c) "...a new method...", but scientific journals do not report old methods. The abstract should start: "Carbon foams were produced from...". This is shorter and gets straight to the point. I have been told that some journals ban the use of "new", "novel" etc. Everything we publish should be new. There is no need to say so.

Another common start to an abstract is something like "The aim of this work was to...". Again, this is not necessary. Perhaps your aim was to achieve cold fusion! The reader wants to know simply what you did and what you found.

Many abstracts contain words that can be deleted with no loss of information. "Detailed" and "careful" are common examples. We expect scientists to do detailed and careful work: there should be no need to say so. "A detailed examination of the Raman spectra shows that..." can be changed to "The Raman spectra show that..." without any loss of information. I have just read an abstract that tells me that a certain composite material "was successfully fabricated". May I assume that if the fabrication were unsuccessful, the process would not have been reported? The word "successfully" can be deleted. Words and phrases such as "also", "moreover", "furthermore" and "in addition" can also usually be deleted without any loss or change of meaning.

Another problem with many abstracts is their vagueness. We may be told that "...the activation energy was determined", but to be told that "...the activation energy was determined to be 270 kcal/mol" is far more informative and precise. Very occasionally one finds a statement such as "...the activation energy was determined to be 270 kcal/mol" in the abstract, but there is no mention of the value in the text! The abstract should be a concise summary of the text, and should not contain any information that is not in the text.

Some abstracts, not many, cite references. This should not be necessary. The author must bear in mind that the reader of the abstract does not have access to the list of references unless the complete paper is downloaded. If it is necessary to cite a reference in an abstract, it must be given in full and not be cited as a number referring to the list of references.

Finally, always remember that the abstract must be able to stand alone. The reader must be able to understand it without reference to the whole paper. For this reason I always read the title and abstract of each submission and make comments on them before I look at the manuscript. I recently asked an author the question, "What does this mean?" about a statement in his abstract. He had used a word that does not exist in any dictionary that I have and I could not even guess what it meant with certainly. How would non-native English speakers understand it? The paper was resubmitted a few days later with no change to the sentence. Again I asked: "What does this mean?" The author replied, a little angry I think, that if I only read the full paper I would discover what it meant, to which I replied that the point of my comment was that it should not be necessary to read the whole paper to discover what was meant in the abstract. This vital point is not understood many authors.

Titles and abstracts are much more important nowadays than they were 10 years ago. The Editor pleads with you to make sure they are accurate and can be understood in isolation. My maxim to keep them "concise and precise" applies more today than ever before.

Editor-in-Chief
Peter A. Thrower

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Editorial

Writing a scientific paper: II. Introduction and references

In my first Editorial in this series, Titles and Abstracts [Carbon 2007;45(11):2143–4], I said: "Although these items are the first in the paper, they have to be written last. It is impossible to abstract something that has not been written! (However) they are usually added as something necessary to complete the submission, and little or no thought is given to them." Now we come to the Introduction that is necessarily at the beginning of the main text but should, I believe, not be written before the other sections. The reason why I am including the References here is because they are inextricably linked to the Introduction, as we shall see.

I am aware that many people, including some of my valuable and highly respected reviewers, will not agree with my thoughts on the Introduction to a paper, and I guess there are essentially two opinions that must be respected. One sees this section as giving a complete introduction to the subject and to the materials and techniques used in the manuscript, and the other as an introduction to the manuscript itself. The first can be very long while the second, much shorter. I find myself in the latter category. What introductory background does the reader need in order to understand the manuscript and place it in context?

Papers on the current "hot topic" of carbon nanotubes (CNTs) are an excellent example. I randomly (honestly!) selected a paper from a past issue of CARBON from the shelf in my office. It concerned CNT growth using CVD, and the first paragraph reads as given below. Any comments I make are not aimed at the authors of this one paper. There are hundreds of papers for which the same comments apply.

"CNTs are a recently discovered form of carbon with a graphitic lattice and a long, tubular structure [1]. CNTs have been the subject of much interest in recent years, due to their attractive mechanical properties (~1000 GPa Young's modulus) [2–4], tuneable electronic behavior (conducting or semi-conducting depending on tube chirality) [5] and unique dimensions (~1–100 nm diameter, up to several cm length) [6–8]. As a result of these properties, nanotubes have potential applications in many fields, including composite reinforcement [9,10], transistors and logic circuits [11,12] field emission sources [13], and hydrogen storage [14,15]. CNTs can be grown by a variety of means, the most common of which are: arc discharge [16], laser ablation [17], and chemical vapor deposition (CVD) [18,19]."

Now you can perhaps see why I have linked References with the Introduction. We already have 19 references, more than 50% of the total number in the manuscript. These occupy almost a single printed column in the journal, and 15 of them have nothing to do with the thrust of the paper, viz. CNT growth. Is any prospective reader of this paper in CARBON going to be unaware of the "discovery" of CNTs by Iijima [read the Guest Editorial "Who should be given the credit for the discovery of carbon nanotubes?" Carbon 2006;44(9):1621–3] or of their basic structure and properties? If we may assume these facts to be known by any person likely to read the ms, the Introduction could well begin: *"The three most common methods for carbon nanotube (CNT) growth are: arc discharge [1], laser ablation [2], and chemical vapor deposition (CVD) [3,4]."*

Recently I received a manuscript on the production of activated carbon from various agricultural waste materials. The first part of the introduction was simply a catalogue of all (?) agricultural precursors that have been investigated for activated carbon production. Any potential reader of the paper would be aware of the vast number of organic precursors that have been examined for this purpose. There is no need to list them all each time a paper on the subject is written. The paper has been rejected for other reasons, but it serves as an illustration of the point being made here. With such an Introduction one could easily have 50–100 references before one gets started!

Another manuscript reported the production of a flexible carbon "nanobelt" which is, I assume, the same as a nanoribbon. In spite of the fact that the product is not a nanotube, the authors started their Introduction with the famous Iijima paper and proceeded to list all possible production methods and potential applications for carbon nanotubes before considering other nanostructures that have been reported. Of course at this point the paper already had a long list of references, none of which was really relevant to the subject of the manuscript.

The Introduction should consist of a few paragraphs (perhaps no more than two) that define the context for the current work reported. How does this paper relate to what has been done previously? In the process it should point readers to publications to which they may need to refer in order to understand the motives for the current research. That's all!

The depth of background history provided by some Introductions makes me wonder (cynically) why they don't start with the discovery of the electron, and then discuss chemical bonding, Bragg's work on crystal structures, etc. We would all

find such an approach absurd, but many Introductions are nearly as bad.

Two days after writing the previous paragraph I received a manuscript that was almost a perfect example. The paper began by informing us in the Introduction that (I am not quoting exactly): "Carbon is the most versatile element on the earth. Two forms, diamond and graphite, were discovered in the 18^{th} century. There then followed 200 years with no major advances until the discovery of fullerenes in 1985, for which Nobel prizes were awarded. Etc." Not only is this not a suitable introduction for a research paper, it is also wrong. Advances such as mesophase, carbon fibers and filaments are overlooked. Or perhaps the authors did not consider them to be major? This Introduction might (if corrected) be appropriate for a popular science article in a newspaper but certainly not for CARBON.

References are, by definition, items to which a reader may need to refer in order to understand what the authors are doing, and the context in which their research should be placed. Surely there is no need to list standard texts and reference books in References, and if the authors feel they are really necessary there should be some indication of where in the book the referenced information can be found. Many times I ask authors if they expect their readers to read the complete book in order to find the information needed?

Letters-to-the-Editor are necessarily short and should contain no more than 10–12 references. I sometimes see references that give the publication details and then say "and references therein". Such statements are unnecessary. Intelligent readers should (one hopes) know that further references can, if necessary, be found in the papers that are cited. For a Letter-to-the Editor cite no more than a dozen of the most important references. I have seen Letters submitted where the space occupied by references is more than that occupied by the main text, something we sometimes refer to as "the tail wagging the dog"!

Perhaps I could ask those who read this editorial a rhetorical question. When did you last fully read the Introduction to a scientific paper in which you were interested? I suspect the answer would be "months ago" for most of you. In my experience people first read the Abstract, then the Conclusions, and if there is something of real interest they "dig into" the Results and Discussion sections. Many journals print what are considered the less important sections of a paper, and the References, in a smaller font. Perhaps it is the Introduction that most often deserves this treatment?

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Editorial

Writing a scientific paper: III. Experimental

I am writing this Editorial on a Sunday morning at an ambient temperature of around 22 °C while listening to the radio (Bang & Olufsen, Model Beolit 1000) tuned to Classic FM at a frequency of 101.5 MHz. My computer (Apple Macintosh iMac with Intel 2 GHz Core Duo processor, OSX 5.2) has had the "mouse" replaced by a trackball (Kensington Expert Mouse, Model K64325) and uses a word processing program (Word® 2004 from the Microsoft Office for Macintosh 2004 suite). I am sure you are immediately interested! Curious perhaps as to why I am giving you these facts.

If you were interested in radios you would perhaps know that Bang & Olufsen (B & O) is a very expensive and innovative brand of electronic equipment, based in Denmark, and that this model is a portable radio that is over 40 years old. It is not digital but it still produces clear reproduction of all analogue radio broadcasts on MW, LW and SW. Indeed I bought it a few years before moving to the USA in 1969 so that I could listen to the BBC wherever I was in the world. The radio still works perfectly and, believe it or not, it gives me the same programs as any other analogue radio purchased today, regardless of manufacturer, with perhaps even better clarity of reproduction.

As a scientist you will know that the Apple Macintosh range of computers has been innovative in the field of computer design and user interface. You will also know that the word processing program Word® is the most used program of its type in the scientific community. The great majority of electronic submissions to CARBON are produced using this program.

Why do I tell you this? Simply because it is part of the accepted format for writing a scientific paper. But is it important? NO!

The document is the same regardless of computer and operating system used. You cannot tell from reading this Editorial anything about the system I am using, and that is how it should be. The equipment manufacturer and model is irrelevant.

I recently received a manuscript which spent two pages telling me about the makes and models of all equipments used. Two different SEMs, two different TEMs, one of which was equipped with EDS and EELS instrumentation, a Raman spectrometer and a TPD apparatus, etc. The length was even longer because each instrument was given a separate subsection, wasting a lot of space. Was all this information necessary? If the reader wishes to check the authors' results does he need to assemble the same suite of apparatus? Surely not! While I well recognise that different instruments can have different resolutions etc., the make and model are usually irrelevant. If TEM A gives different pictures from TEM B, how do I know which to believe? And if this is the case, surely all results are suspect. In giving such information we are perhaps simply often showing off how rich our laboratories are, or are we simply providing free advertising for the instrument manufacturers?

Some authors will have noticed that in the last year or so I have sometimes deleted such information from manuscripts when I consider it to be irrelevant, and I thought it appropriate that I explain why, and at the same time point out that we should keep our papers short and to the point (concise and precise). Give essential information, and don't pad!

You may have noticed that in the second paragraph I referred to "Bang and Olufsen (B & O)". Why did I include the information in parentheses? Was it necessary? Of course the answer is "no". I never used it again in the Editorial (until now that is). The purpose of placing abbreviations in parentheses is to define them for future use. If you are not going to use them, there is no need to define them! On the contrary, is there really any need nowadays to define TEM and SEM? How many of you did not know what I was talking about when I used these abbreviations earlier? Almost certainly, none of you. But still almost every author who uses results from these instruments insists on making the definitions, sometimes several times.

The point I am trying to make is that we often include irrelevant information in our manuscripts and in so doing we lengthen them unnecessarily. Writing a scientific paper is a serious matter and needs to be approached carefully. Bear in mind that the care taken to write your paper may be seen as an indication of the care taken to do your experiments. Eliminate everything that is unnecessary, and at the same time make sure you include all that is necessary.

This morning's mail included a review of a manuscript in which the authors described a pyrolysis process for carbon fibers. The make and model of the furnace was given but there was no mention of the size. From the time in the furnace and the speed at which the fiber passed through it the reviewer was able to calculate the furnace length as 2.5 Km! Obviously some vital information was missing!

What then is the purpose of the Experimental section? It is certainly important, and a member of our Editorial Advisory

Board wrote a recent letter to ask why the section was in smaller print because he thought it an important component of the manuscript and found it difficult to read. (Such is no longer the case with the new manuscript format.)

The Experimental section has two purposes:

a. To allow readers to repeat the experiments if they wish. This might involve (i) checking dubious results, and/or (ii) preparing identical materials for further investigation, and
b. To convince readers that the work has been done systematically and thoroughly using appropriate equipment.

Because of this the section should contain ALL information needed for another person to repeat the experiment. This means details of sample preparation, sources of materials, purity, particle size, times and temperatures and synthesis of intermediates. It should also include details of important experimental parameters used in analytical and measurement techniques, such as voltages, wavelengths and strain rates.

In some respects the Experimental section is analogous to a recipe in a cookery book. It lists ingredients and procedures but does not specify the use of particular equipment.

What then should we do with instrumental details? The answer surely lies in the technology that is now available to us. Looking back over the last 25 years as Editor-in-Chief of CARBON Journal one sees two major changes. One is the electronic submission process and the other is the availability of Supplementary Material on the website. The first of these began as an option but is now a requirement. The second is an option that, in my opinion, should be made a requirement. One of its components should be a list of the equipment used. This would free space in the journal and would in no way devalue the manuscript.

A final point concerns the way people describe instruments, especially electron microscopes, both scanning and transmission. Many of you will know that I started research on graphite nearly 50 years ago by studying neutron radiation damage in natural single crystals of Ticonderoga graphite using a transmission electron microscope. In those days the "workhorse" of electron microscopes was the Siemens Elmiskop I. The best resolution was around 10 Å (1 nm). To us it was a "high resolution" instrument, certainly much higher that some of the early instruments where 5 nm was as good as one could get. Nowadays I am often told that both a TEM and a HRTEM (high resolution) were used, (or an SEM and a FESEM) and this morning I came across a paper in press for another journal that promises "super resolution". Is "super" better than "high"? The resolution is what is seen on the micrograph, and that depends on many factors, especially the magnification at which the micrograph was taken. A picture taken at 5000× on a HRTEM cannot show high resolution. Surely it is enough to say that "the samples were examined by transmission and scanning electron microscopy" and to give instrument details in the Supplementary Material? I have often asked the question "at what point does an instrument become high resolution?" and have never received a clear answer. One person said that it was high resolution when it was capable of lattice resolution, but that only raises the question: "which lattice?" I wonder whether anybody makes a low resolution transmission electron microscope, and why is there no high resolution scanning electron microscope? Scientists can be very inconsistent!

I am convinced that the Experimental section of almost all papers could be significantly shortened. It should concentrate on providing the information that the reader really needs to have in order to be satisfied on the above two points, and provide a list of equipment used in the Supplementary Material section. Surely that is enough!

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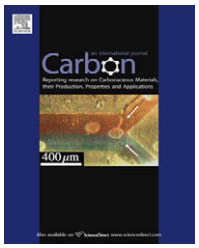

Editorial

Writing a scientific paper: IV. Results and discussion

I have waited several months before writing this episode of my "Writing a Scientific Paper" series of Editorials. The reason is simple: each paper requires a different approach and each paper can have its own problems. Rather than write extensively about the subject (one could write a book) I have decided to illustrate this article using some examples, some of which are personal.

The Results and Discussion section of a scientific paper is the most important. Research is about results, and it is these that the reader has come to the paper to discover. It is on these results that opinions are formed and future research planned. I have previously indicated that the Introduction should be short, and much of the Experimental Details section relegated to "Supplementary Material" but the results, and the deductions the authors make from them, are paramount.

The first thing one must decide is whether results and discussion should be separate or combined. There can be no fixed rule, however, my experience is that it is better to separate them if it is possible to do so. In some cases it is necessary to discuss one set of results in order to logically proceed to one's next experiment or investigation, and in such a case the two are intertwined and separation is difficult. Here are some suggestions on how to write this part of your paper.

Present data clearly. The first thing one must do is to give a clear presentation of the results. If there are numerical data they should be presented in a sensible manner, either in table or graph form. There should be no need to do both, and one must always remember that it is now possible to present a graph, which is more immediately appreciated, in the paper and include the numerical data in a table in the Supplementary Material section. The writer should always bear in mind that while numerical data should be absolute, the discussion may be subjective. Another reader may have a different interpretation of the results.

Ensure results are sensible. One statement that I have had to make on several occasions is that if scientific data are acquired correctly the results should be sensible.

I recently received a paper claiming an improved product yield of 7474.3% more than previously reported results. My initial (cynical) reaction was that surely the calculator did not stop at five significant figures – most go to nine or more! I questioned the figure, and the author returned the paper, correcting it to 7474%. A little thought would have told the author that his claim was for a 75× increase. If his yield were the maximum 100%, it would mean that the best result earlier researchers had obtained was less than 1.4%. Surely something was wrong! Dependence on a calculator without thinking about the sense of the result was something I encountered often during my university career, and I am surprised to see how often it still occurs.

Distinguish the absolute from the subjective. While numerical results should be absolute, there are other results that are subjective. This is particularly true of e.g. microscopic observations. Many will know that I spent years examining neutron radiation damage in single crystal graphite using a transmission electron microscope (TEM). Several times colleagues told me "microscopists can prove anything". The reporting of such results relies on the integrity of the author. When I retired from active research I abandoned scores of unusual micrographs of things that had been observed only once, and for which there was no obvious explanation. They might have made interesting posters for an office wall but had no place in a scientific paper. I was once taken to task by a reviewer who wanted me to "prove" my observations and conclusions. My answer was that he had to trust me. I had more than a hundred supporting photographs, but could only include one or two in the paper.

Another criticism I faced was the question of whether the material had been altered by the preparation processes. In order to examine any material by TEM it is necessary to have a thin sample and there is always the possibility that the act of preparing the sample can somehow change what it contains. Is the TEM sample representative of the bulk? In graphite it is possible to prepare such a sample by simple cleavage (recently re-discovered by the graphene community!), but does the cleavage change, in my case, the distribution of the radiation damage observed? There is some evidence to suggest that this may happen.

Never extrapolate too far. My first research project involved looking at samples that had been irradiated in a high fluence test reactor. The act of irradiation was difficult. Samples could be inserted and removed from the reactor only when it was "shut down" and this was outside our control. The main purpose of our research program was to investigate physical

property and dimensional changes in bulk synthetic reactor graphites and continuous monitoring was impossible. On one occasion we had samples that showed shrinkage when the first measurement was taken and growth on the next measurement. We had two data points in addition to the original. Did the material contract and then expand, or was the dimension oscillating, or doing something else? You can draw many different curves through three points!

Later techniques allowed measurements to be made at shorter discrete fluence intervals. The data points were now so close together that there was really no need to draw a line. It is now well known that the neutron irradiation of polycrystalline graphite can produce an initial shrinkage that eventually turns round to become a growth, which is a very important phenomenon for designers of graphite-moderated nuclear reactors to consider.

Today there is major interest in carbon nanotubes (CNTs) but precisely controlling their structural parameters is currently impossible. Many different parameters may be used to characterise them: diameter, length, number of walls, chirality, etc. I have seen several papers that contain results from only two different nanotubes with the authors jumping to unjustified conclusions. Let us say the authors examine CNTs with two different aspect ratios and find that those with the higher aspect ratio produce higher strength CNT/polymer composites. To now generalise, and say that the higher the CNT aspect ratio the higher the composite strength *may* be correct, but many more data points are necessary to validate the statement.

I used the following analogy to make this point to one author. I have two cars, both from the same manufacturer and both powered by gasoline (petrol). Any difference in performance is therefore not due to either of these two variables. Car A is faster than car B. What are some of the obvious differences between the two? Car A has a four-cylinder engine, two seats and metallic paint. Car B has a six-cylinder engine, five seats and non-metallic paint. Nobody would suggest that the fewer the number of cylinders in the engine, the faster the car! Similarly with the other parameters I have mentioned, but this is the "logic" that is behind some of the submissions received by CARBON.

Make discussion systematic. A big problem with many manuscripts is the way the discussion is allowed to ramble so that readers are never aware of where they are being led. Sometimes the conclusion comes as something of a shock! In today's world of electronic gadgetry it is perhaps helpful to think of the "Discussion" of a scientific paper as having a similar purpose to a satellite navigation unit (SatNav). You use the SatNav to guide you from the origin of your journey to the place you wish to go, sometimes via selected landmarks. You expect the instructions to be clear and logical. You do not want the unit to take you round the world. While it might be able to suggest alternative routes and diversions, you usually use it to give you a route from A to B. In the same way the main body of a paper should lead the reader on a logical path from the results to the conclusions. The inclusion of too many diversions and alternative routes on a SatNav is confusing and annoying, and the same is true of a scientific paper. When you write your paper, "map out" a logical path and stick to it.

Learn from others. One thing that never ceases to amaze me is the fact that many submissions are prepared as if the writer had never read a good scientific paper, even though 50 may be cited! One sometimes wonders whether the author has ever read any of them carefully. As with many things in life, we can learn most from the experience of others and/or trying to do it ourselves, rather than from textbooks. You learn to write papers by reading other peoples' papers, and by writing them yourself. I hope that Editorials such as this may help, but learning by doing is what is really important.

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