

# Some Tips on Writing

Graham Gladwell

1. Write *simply*. We all started reading and writing simply.

The cat sat on the mat.

*not*

The floor covering was utilized for feline occupation.

Say

Heat melts ice.

*not*

The application of external sources of heat to ice results in a change of phase with subsequent increase in liquidity.

2. Put the verb in the *active* voice, wherever possible.

The cat sat on the mat.

*not*

The mat *was sat on* by the cat.

Thus say

Figure 6 shows that ...

*not*

It will be seen from Figure 6 that ...

Again

We may prove that ...

*not*

It may be proved that ...

Again

Fig. 1 *shows* the variation of stress with temperature, and the variation of the temperature with the incident light.

*Not*

In Fig. 1 the variation of stress with temperature and the variation of the temperature with incident light, *are depicted*.

3. Use *simple* words.

<i>not</i> utilize	<i>but</i> use
<i>not</i> alleviate	<i>but</i> help
<i>not</i> facilitate	<i>but</i> make easier
<i>not</i> nomenclature	<i>but</i> names
<i>not</i> terminology	<i>but</i> terms
<i>not</i> subsequently	<i>but</i> after
<i>not</i> initiate	<i>but</i> start
<i>not</i> terminate	<i>but</i> end
<i>not</i> consequently	<i>but</i> therefore

and avoid clumsy phrases.

<i>not</i> prior to	<i>but</i> before
<i>not</i> results in	<i>but</i> leads to
<i>not</i> in the case of	<i>but</i> for
<i>not</i> in that case	<i>but</i> then
<i>not</i> above-mentioned	<i>but</i> these or those
<i>not</i> at the present time	<i>but</i> now
or at this point in time	
<i>not</i> it is essential that we ...	<i>but</i> we must

Sometimes the longer word is the one that we need, but often we use long words where short ones would serve just as well.

Other words to avoid are: methodology, scenario, moreover, constitute, comprise, minimal (often we mean just *few*), basically, implementation, consequent, prioritise.

**Note.** With a word processor you can write **few** or *few*, **bold** or *italics*; you do not have to say ‘few’ or few, which appear clumsy in print.

4. *Balance* sentences.

The cat sat on the mat, and the dog on the chair.

(Notice that in properly balanced sentences we can often leave out parts; we do not need to say the dog *sat*.)

Again, say

The humidity decreases the strain, while the heat increases it.

*not*

The humidity decreases the strain, while *it is increased* by the heat.

The second sentence is not balanced; the first clause is in the active voice, while the second is passive.

5. *Mismatched or misplaced participles*. How many times have you read a sentence such as:

Using equation (1.10), equation (2.4) may be written in the form ...

In this sentence there is *participle*, **using**. A participle always has to have a *subject*. In this sentence, the only candidate for subject is *equation (2.4)*. But *equation (2.4)* does not use equation (1.10), *we* do: the participle, *using*, and subject, *equation (2,4)*, are *mismatched*.

I believe that authors use sentences like this because someone has told them that proper scientific papers and books must be written in an objective form, without using the word *we*. Their sentence does not use *we*, even through the construction they use demands the word!

I labour this point because the misuse of participles constitutes the most common grammatical error found in technical writing. How do we rid ourselves of this error?

First, the personal form of writing is quite acceptable, and indeed has a long and glorious history; Lord Rayleigh often used the personal form. Secondly, the personal form is much easier to use than the objective form. We can use it to write clear sentences without constructions such as *it can be seen that* and *it follows that*.

Go back to the original example. We rewrite it,

Using equation (1.10), we may write equation (2.4) in the form ...

Now the participle is properly matched: using, *we*.

In a way, the participle construction allows us to write fewer words than we normally would. If we wrote out the sentence in full we would write

If *we* use equation (1.10), *we* may write equation (2.4) ...

When we shorten *if we use* to *using*, we leave out the subject *we*, but the participle must have a subject, and we must state it in the second part, *we may write*. The rule is that the subjects of *use* and *may write* must *agree*.

Another example—this one is correct:

Following Hutchinson (1986), we express A in terms of B.

What we mean is

If we follow Hutchinson (1986), we may express ...

Conclusion: When using a participle, ask yourself what is the subject of the participle? (i.e., when *you* are using a participle, *you* should ask yourself, what is the subject of the participle!)

To reinforce the point, consider the odd images created in the following examples of mismatched or misplaced participles:

Dancing on their hind legs, the audience cheered wildly as the horses paraded by.

This sentence suggests that the audience is dancing on its hind legs, which is not the meaning the writer intended. To solve the problem, place the participle close to the noun it modifies.

Dancing on their hind legs, the horses were cheered wildly by the audience.

or

The audience cheered wildly as the horses, dancing on their hind legs, paraded by.

Here are two more examples of misplaced participles:

While being constrained by court officials, the judge sentenced the kidnapper.

Munching on leaves, the children were fascinated by the giraffe.

I suggest that you rearrange the sentences to show that it is not the judge who is being constrained nor the children who are munching.

The same principle applies to participles ending in -ed.

Packed tightly in a can, Joan had difficulty removing the anchovies.

The dangling participle here (packed) suggests that Joan is packed in the can, rather than the anchovies.

Kicked carelessly under the bed, they finally found his shoes.

Rewrite these sentences so that they say what the writer intended.

Insistence on grammar may appear to be pedantic, but the rules of grammar have been derived so that statements can be made clearly and logically. Just as there are rules which allow us to assign an unambiguous meaning to algebraic expressions like  $a + 1/b$ , so there are rules of grammar which allow us to interpret collections of words unambiguously.

Note that there is another part of speech: a gerund. This is a participle used as a noun. Here is an example of the use of a gerund.

Laughing is more fun than crying.

Both laughing and crying are gerunds. The sentence has the same structure as

Candy is more fun than medicine.

*Candy* and *medicine* are nouns.

Another example is

Analysing gives general results, computing gives particular ones.

*Analysing* and *computing* are gerunds here.

6. In English, there are four principal punctuation marks: comma, semi-colon, colon and period. The previous sentence shows one way in which the colon is used: to start a list.

There is an important rule governing this use of a colon: the clause before the colon must be complete.

Thus we *can* say

Matter has three states: gas, solid, liquid.

or

The three states of matter are as follows: gas, solid, liquid.

(The first of these two sentences is the simpler one.)

We *cannot* say

The three states of matter are: gas, solid, liquid.

The clause before the colon is incomplete.

We could leave out the colon entirely, and say

The three states of matter are gas, solid, liquid.

The colon is also used to mean *namely*, or to say *this is what I mean*.

Thus

A cat is furry and purry: it has fur and it it purrs.

Or

The deformed solid is honeycombed: it is full of holes.

The comma and semi-colon are used to divide items in a list; the comma is used for simple items, and the semi-colon for items such as sentences which themselves contain commas.

We can write in many ways:

Water occurs as a solid, a liquid and a vapour.

Water occurs as a solid, a liquid, and a vapour.

Water occurs as a solid, ice; as liquid; and as a vapour, steam.

We use the semi-colon to separate two or more related clauses.

Thus

A cat is furry and purry; it also has sharp claws.

Note that in the previous cat example, the second sentence merely explained the first; we used a colon. In the new example, the second sentence says something extra; we use a semi-colon. Thus, for another example

The deformed solid is honeycombed; this leads to a loss of strength, and possibly to necking.

Note that in these last two examples we could have used a period rather than a semi-colon; the semi-colon tightens the link between the two ideas.

Of course, we could have said

A cat is furry and purry, but it also has sharp claws.

Note that we almost always, but not always, use a comma before but.

7. Avoid the words *he* and *him*. In modern jargon, this means, *be gender neutral*. Thus, say,

We leave the reader to find particular examples,

*not*

We leave the reader to find *his* particular examples.

8. Think twice before using the words *obvious* or *obviously*. What may be obvious to you may not be obvious to me, and *vice versa*. Be careful with *clearly* for the same reason.
9. There are some sentence constructions in which it is difficult to make the subject agree with the verb.

Thus, purists say that

A number of persons *was* present,

is correct, because *a number* is singular. However, the sentence sounds pedantic. The alternative, *Many* people *were* present, is much simpler, and avoids the difficulty. Avoid using *a lot of* for the same reason; anyway, this is a rather colloquial usage.

It is correct to say

A series of experiments *was* conducted.

10. There are some strict plurals. *Data* is plural, the plural of *datum*, Latin for *given*. Other Latin pairs are addendum, addenda; corrigendum, corrigenda; focus, foci. The strict plural of formula, formulae, is reserved for pedants; the rest of us use formulas. One index, two indices; appendix, and appendices. Criterion, from Greek, is singular; its plural is criteria.

11. Avoid repetition. Consider the following sentence.

Composite materials are used by many industries such as sporting, nuclear, electronics, shipping, automotive, *to name just a few*.

We need not add *to name just a few*, because we said, *such as*.

12. Use short sentences. Do not utilize concatenations of verbal constructions of interminable length! Goethe said, *All great ideas are simple*. Often we cannot say just what we mean in one simple sentence. Then consider using a number of simple sentences to give shades of meaning.

The strain depends on the stress. The dependence is not always linear. Sometimes, as shown in Fig. 1, the material hardens with age. At other times, as shown in Fig.2, it softens. Whether it hardens or softens depends on whether there are particles of carbon in the iron. Carbon produces hardening. (This is an extreme example of short, modifying sentences; the statements may or may not be true statements about iron!)

If you would like to see how a master of English writes a long sentence, read the first passage of Charles Dickens' *The Tale of Two Cities*. It starts, *It was the best of times, it was the worst of times, ...*



13. Define technical terms when you introduce them. Place them in italics and index them. For example

A matrix is said to be *symmetric* if  $a_{ij} = a_{ji}$ .

Here I assume that I have already defined a matrix and the notation  $a_{ij}$ .

Or

The *receptance* is the ratio of the transforms of the measured displacement and the excitation force.

You can be more formal, using

**Definition 1.1.2** A Matrix  $A(m \times n)$  is said to be **symmetric** if it is square, i.e.  $m = n$ , and  $a_{ij} = a_{ji}$ ,  $i, j = 1, 2, \dots, n$ .

14. Write logically. If you write logically, a reader should be able to *follow* you without necessarily *understanding the content* of what you write. Logic is independent of content: if  $A \implies B$  and  $B \implies C$ , then  $A \implies C$ ; this holds regardless of the contents of the statements  $A, B$  and  $C$ .

Take a matrix example. Suppose you state

**Theorem 1.2.1** *If  $A$  is symmetric and positive definite, then its eigenvalues are real.*

This theorem is true, but misleading. All that is needed for the conclusion is that  $A$  should be symmetric. The logic is

$A$  is symmetric  $\implies$  eigenvalues are real

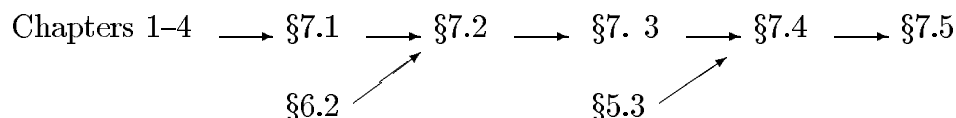
$A$  positive definite  $\implies$  eigenvalues are positive

Remember too that if  $A \implies B$ , then  $\text{not } B \implies \text{not } A$ , and *not*,  $\text{not } A \implies \text{not } B$ .

15. Try to give a *self-contained* account, i.e. derive all the results you need as you go along. Sometimes this will not be possible or desirable. Then give complete, easily accessible, references so that the reader can find the information.
16. Give adequate references. *Do not* say, Johnson and Perry experimented with this ... *Say* Johnson and Perry (1984) experimented with this ... You may also use Johnson and Perry [42] or Johnson and Perry [JP84], as in Latex.

See the section on making a reference list.

17. Put the chapters in logical order. Chapter 1 should not require information given in Chapter 3. Some books, e.g. Golub, G. H. and Van Loan, C. F. (1983) *Matrix Computations*, John Hopkins, Baltimore, give reading paths at the beginnings of chapters:



If you do not give a reading path, tell the reader whether or not Chapter 3 is needed for an understanding of Chapter 5, etc.

18. Use a *simple* format for the book.
- (a) For those using Latex or similar system. Follow the system.

Use a short title for the book

*Crystals and their Applications*

*not*

*An Introduction to Crystallography with Applications to Industrial Processes*

Similarly, use short section headings

An introduction to crystal terms

*not*

An introduction to crystallographic terminology

Place the chapter number and title at the top of the left hand (even numbered) page and the section number and title at the top of the right hand page. Thus on the left

1. Structure of Crystals

and on the right

1.1 Crystal terms

- (b) For those without a text production system.

I suggest the following format.

- i. Choose a *short* title for the book.

*Crystals and their Applications*

*not*

*An Introduction to Crystallography with Applications to Modern  
Industry*

- ii. Label Chapters 1, 2, 3, ...

Chapter 1 INTRODUCTION TO THE STRUCTURE OF  
CRYSTALS

Use capitals.

- iii. Label Sections 1.1, 1.2, etc.

**1.1 An introduction to crystal terms**

Use **bold** lower case letters. Note that I did *not* write

**An introduction to crystallographic terminology**

- iv. In each Section 1.1 label equations (1.1.1), (1.1.2), etc; figures Fig.1.1.1, Fig.1.1.2; tables as Table 1.1.1, Table 1.1.2, etc; theorems as Theorem 1.1.1, Theorem 1.1.2, etc. With this system it is easy to insert or delete an equation; the change will affect the equation numbers in one section only.

If you use a numbering such as Fig.1 or Fig 1.1, it is not immediately clear in which section it appears.

Try to avoid using a numbering like 3.3.2 for subsections, or even 3.3.2.4.

If you would like to see how confusing a number system can be, consult Courant, R. and Hilbert, D (1953) *Methods of Mathematical Physics*, Interscience, New York.

(On p. 260 you see 7. *Variable Domains*; you have to look back to p.257 to see that is part of §12, which in turn is part of Chapter IV.)

- v. A reader should be able to see the Chapter and Section numbers immediately on looking at any page. Generally, the left hand (even numbered) page should have the chapter number and title at the top, while the right should have the section number and title at the top. Both titles may be shortened.

Thus, on the left

1. Structure of Crystals

and on the right

1.1 Crystal terms

19. Make an *index*. If you are using an automatic system you must label the words you want indexed *as you construct the text*. Others must do this manually.

Keep the index simple. Try to limit the index to entries and one, or at most two, levels of subentries.

matrix – 2  
    symmetric 4  
        eigenvalues of 6

You could avoid the second sublevel by doing this:

matrix – 2  
    symmetric, see symmetric matrix

then

symmetric matrix – 4  
    eigenvalues of – 6

Use *multiple* entries. Note that you will have to construct multiple labels in the text.

space  
    – inner product  
inner product  
    – space  
aluminum  
    – titanium alloys  
alloys  
    – aluminium-titanium

Theorem  
    – Bolzano-Weierstrass Theorem

WKB method 56

Wolters, Kramers and Brillouin, see WKB method

Try to anticipate what words the reader will use to find a piece of information. Remember, the index is an integral part of a book. A good index can vastly increase the value of a book. A book without an index is like a library without a catalogue, a train service without a schedule, or a concert without a programme.

20. Make a reference list.

- (a) For those people who use an automatic system like Latex.

Follow one of the possible systems. Make an author index as well as the regular reference list.

You may choose to list particularly helpful references for further reading at the end of each chapter. If you do, repeat the references in the main list at the end of the book.

- (b) For those people who have no automatic system, I suggest the following simple system.

If the references are cited as Johnson and Perry (1983) in the text, I suggest that the references should be listed as follows. Note that there are four types of references: journal papers, books, articles in collected volumes, and conference papers; each has its own reference format.

Johnson, A. B. and Perry, B. C. (1984) The interaction between cavities in metals, *J. Appl. Mech.*, 24, 196-231, [71].

Pierce, A., Berry, B. and Cotton, C. (1989) *The Structure and Composition of Alloys*, McGraw-Hill, New York, [142,193].

Bingham, R. (1996a) Phase transformations, in Collins, T. W. (Ed.) *Metals and Their Uses*, Longford Press, Sevenoaks, [156,217].

Abdullah, M. and Chen, H. (1994) Piezoelectric transducers for vibration measurements, in Haight, T. (Ed.), *Proceedings of the International Symposium on Vibration*, Bangalore, Sept. 7-11, 1993, Wiley, New York, p. 269, [210,312].

List the references in alphabetical order, by first author. List references by iden-

tical authors chronologically; list multiple papers by identical authors in the same year as 1991a, 1991b, etc.

Note the numbers in the square brackets; they indicate the pages in the book where the reference is cited. You could, of course, produce a separate author index, instead of, or in addition to, this. An author index would have the form

Johnson, A. B. 71

Perry, B. C. 71

or

Perry, B. C., see Johnson, A. B.

You may choose to list particularly helpful references for further reading at the end of each chapter. If you do, repeat the references in the main list at the end of the book.

Avoid using the system used by many authors<sup>1,2</sup>. Here 1,2 refer to the footnotes or to references listed at the end of a chapter. With this system it is difficult to find just where a reference in the list is actually cited. The square bracket system is easy to install and to use.

Some authors use, *the result is found in [46]*. This does not tell you *who* found the result, or *when*. Also, if you, the author, have to insert a new reference, you may have to change the the numbering throughout.