

# *A Guide to Technical Writing.*

## **Excerpts from:**

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A reader's thoughts should move smoothly from each paragraph to the next, 21

A simple, straightforward style is required in scientific and technical writing, 28

Avoid hackneyed phrases and clichés and idiomatic expressions, 17

Consider first the needs of your readers. Who are they? What do they know already? What more do they require in the way of information, explanation and examples?, 3

convey your meaning as clearly and simply as you can, using words, numbers and illustrations, as appropriate, 22

Each sentence should convey a whole thought accurately, clearly and as simply as possible,, 22

each word should be there for a purpose, 18

Emphasis, which is achieved in many ways, is important in all writing, 23

Help readers by providing an informative title, and effective headings and sub-headings, 22

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Omit anything that is irrelevant, and any unnecessary background information, 22

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reconsider each sentence and each paragraph to see if it is necessary, and prune sentences to remove all unnecessary words, 18

Scientists should write direct, straightforward prose, free from jargon, verbosity and other distracting elaborations, 4

specify the limitations of your work, the sources of error and probable errors in the data, and the range of validity of the conclusions. Show an awareness of all sides of a question, 3

The breaks between paragraphs and sentences give readers time for thought, 24

the use of a word twice in a sentence, or several times in a paragraph, or many times on one page, may interrupt the smooth flow of language and experienced writers try to avoid such undue repetition, 16

When using acronyms: (a) write them in full where they are first used in any document (each followed immediately by the acronym in parentheses); and (b) list and explain them at the beginning of a document, 15

Would all who could be expected to use the instructions understand what to do, and by following your instructions satisfactorily complete the task?, 8

## 4 How scientists should write

Scientific and technical writing should reflect the way scientists and engineers think and work and should therefore be in accordance with the requirements of the scientific method.

### Characteristics of scientific writing

#### **Explanation**

Consider first the needs of your readers. Who are they? What do they know already? What more do they require in the way of information, explanation and examples? Always, in scientific writing your purpose is to explain. What is it? What is it for? How does it work? What have you done? Why was it worth doing? How did you do it? What did you find? What do you conclude?

#### **Clarity**

The clear thinking that is necessary for the application of the scientific method (in the statement of a problem, in formulating hypotheses, in planning an investigation and in its execution) should be reflected in the clarity of your writing and in your illustrations (see Figure 4.1).

#### **Completeness**

The treatment should be comprehensive. Every statement should be complete. Every line of argument should be followed through to a logical conclusion. Your writing should be free from errors of omission, but you should show an awareness of the limitations of your knowledge.

#### **Impartiality**

Make clear any assumptions underlying your arguments, for if these are incorrect your conclusions may also be incorrect. Indicate how, when and where your data were obtained, and **specify the limitations of your work, the sources of error and probable errors in the data, and the range of validity of the conclusions. Show an awareness of all sides of a question.** Try not to be biased by preconceived ideas and take care not to overestimate the importance of your work. Neither omit evidence that is against your hypothesis, nor undervalue the findings of other scientists when these seem to contradict your own.

Any assumption, extrapolation, or generalization should be based on sufficient evidence, and should be in accordance with all that is known on the subject. Any assumptions, conjectures, and possibilities discussed, should not be referred to later as if they were facts. Words to watch, because they may introduce an assumption, are: *obviously, surely* and *naturally*.

#### **Order**

Readers will find your message easier to understand if information and ideas are presented in an appropriate order. The requirement for sufficient explanation, for clarity and completeness, and for an orderly presentation of information, is most obvious in giving instructions.

#### **Accuracy**

The scientific method is based on care in planning investigations, care in observation, precision in measurement, care in recording and care in analyzing data. Every investigation should be

repeatable, and every conclusion should be verifiable. No amount of care in analyzing data, or presenting results of the analysis of data, can compensate for lack of care in earlier stages of an investigation or enquiry. Accuracy and clarity in reporting the work also depend on care in the choice and use of words (see Chapters 6 and 7).

### **Objectivity**

Most people respect authority and are reluctant to accept, or even consider, findings or opinions that conflict with existing beliefs. This may be a problem for anyone who has something new to say. In science, statements should be objective (based on evidence), not subjective (based on the imagination or unsupported opinion). So, avoid excessive qualification. Words and phrases that should cause you to think again include *possible, probably, it is likely that, and is better referred to as*. Ask yourself: Have I considered the evidence sufficiently? Is there enough evidence for the qualification to be omitted? If not, further observations may be needed before your work can be reported. The latter possibility seems quite probable.

When no more information is available on any point, the need for further work may be mentioned. Do not reason from lack of evidence against a hypothesis or state an opinion as a fact. Do not mistake a widely accepted opinion for a fact or state the opinion of an authority as if it were a fact. Rely on evidence, not authority.

In scientific writing nothing should be implied or left to the reader's imagination. The novelist, journalist or advertiser, to drive home a point, may repeat, exaggerate or understate a case. None of these techniques is available to the scientist or engineer who must tread a more difficult road and convince readers by evidence clearly presented and by logical argument.

### Anthropomorphic expressions

Scientists should not endow inanimate objects, or even living organisms other than people, with human attributes. They should not, as students preparing written work for assessment or as working scientists and engineers writing scientific papers for a professional audience, use personal pronouns when referring to animals other than people.

Scientists should not write that the results suggest, or that another possibility suggests itself, or that an experiment suggests, because none of these things can suggest. They should not write that the data pointed to the fact (meaning they provided evidence in support of the hypothesis) because data do not point. They should not write from the point of view of numbers, because numbers do not have a point of view. In everyday conversation we may say that a car does not like a steep gradient, but scientists should not allow such expressions of human emotion to creep into their writing.

### **Simplicity**

In choosing between hypotheses, the scientist is asked to prefer the simplest explanation that is in accordance with all the evidence. This basis for choice (that entities must not be unnecessarily multiplied) was suggested by William of Occam, a theologian, in the fourteenth century, and is known as Occam's Razor.

Simplicity in writing (and in illustrations, see Figure 4.2), as in a mathematical proof, is the outward sign of clarity of thought. **Scientists should write direct, straightforward prose, free from jargon, verbosity and other distracting elaborations.**

## Scientific writing

Napley (1975) in *The Technique of Persuasion* advised those advocates who would best serve their clients to present their case in order, with integrity, clarity, simplicity, brevity, interest, and with no trace of pomposity.

Explanation, clarity, completeness, impartiality, order, accuracy, objectivity and simplicity are given here as basic requirements in scientific and technical writing. The writing of considerate authors also has the following characteristics:

<b>Appropriateness:</b>	to the subject, the reader and the occasion. Brevity: showing an awareness of all sides of a question; maintaining a sense of proportion.
<b>Consistency:</b>	in the use of names, technical terms, abbreviations, numbers, symbols; and in spelling and punctuation.
<b>Control:</b>	paying careful attention to arrangement, presentation and timing so that you are always in control — affecting the reader in a chosen way.
<b>Interest:</b>	holding the reader's attention.
<b>Persuasiveness:</b>	convincing the reader by evidence forcefully presented.
<b>Precision:</b>	exact definition supported, as appropriate, by counting or by accurate measurement.
<b>Sincerity:</b>	the quality of frankness, honesty, humility.
<b>Unity:</b>	the quality of wholeness, coherence.

## Improve your writing

### **Criticize other people's writing**

Study the following extracts. Detecting faults in the work of others should help; you to improve your own.

#### **Example 1**

*The complaint of the system owners that their users cannot write queries applies, I think, mainly to non-technical users. As their abilities lie outside computer science, it is not surprising that business users cannot construct correct queries.*

#### **SOME FAULTS**

- 1 An opinion is expressed and later stated as a fact.
- 2 The author gives no evidence in support of the implication that **business users** are good cannot construct queries.

#### **Example 2**

*Under present day conditions there can be little doubt that identity theft is perhaps the most important factor in security breaches. It is not necessary to stress the fact that..*

#### SOME FAULTS

- 1 There is excessive qualification in the first sentence.
- 2 In the second sentence the writer is about to stress something which does not need to be stressed.
- 3 If something is stated as a fact, it is not necessary to call it a fact.

#### **Example 3**

*The last ten years have seen changes in data analytics of a magnitude unequalled in any previous period of our history. Such advances have necessitated a monumental expenditure of money and computing resources, and it is interesting to note that whereas in countries like the United States...*

#### SOME FAULTS

- 1 Years cannot see. See *Anthropomorphic expressions*
- 2 *Of a magnitude unequalled* means *unequalled*.
- 3 *In any previous period of our history* is tautological; it should read *in our history*.
- 4 Changes are later referred to as advances.
- 5 Advances do not necessitate.
- 6 Expenditure cannot be monumental.
- 7 The words *it is interesting to note that* can be omitted without altering the meaning of the sentence.
- 8 Are any countries, other than the United States, like the United States?

#### **Example 4**

*Safe and efficient automation of driving is a matter of living up to the physical laws of locomotion in a spatial field. The driver's field of safe travel and his minimum stopping zone must accord with the objective possibilities; and a ratio greater than unity must be maintained between them. This is the basic principle. High speed, slippery roads, night driving, sharp curves, heavy traffic and the like are dangerous, when they are, because they lower the field zone ratio.*

#### SOME FAULTS

- 1 The writer's meaning is not clear. Presumably it is that an automated driver should always be able to stop within the distance that can be seen to be clear?
- 2 The writer seems to have tried to make a simple subject unnecessarily complex.

### **Example 5**

*The application's local database, which contains entries of known vulnerabilities, as well as the methods used to identify them, will therefore be updatable by administrators: entries may be added, edited, and deleted.*

#### SOME FAULTS

- 1 The implication is that because the database has data on vulnerabilities and methods, that it must be updatable. The conclusion is not appropriate or supported
- 2 Not simple. There are too many ideas in this sentence

#### SUGGESTED REVISION

*The application's local database contains entries of known vulnerabilities and the methods used to identify them. Administrators will need to update this information by adding, updating and deleting records.*

### **Example 6**

*The application will be fully operational within the Linux Red Hat environment. Any new features added to the application must not attempt to interact with the operating system in a manner specific to any other version of Linux.*

#### SOME FAULTS

- 1 Anthropomorphic. Features cannot attempt to interact; this gives features agency.
- 2 *In a manner specific to* is confusing. What does it mean to operate in a manner?
- 3 Not simple.

#### SUGGESTED REVISION

*The application will be fully operational within the Linux Red Hat environment. Any new features added to the application must maintain Red Hat compatibility.*

### **Example 7**

*The probability of a team member getting sick is high, given the time period. It's very cold outside and we're in the "flu season" months. We already have students in school getting the flu or cold and calling out of classes. If a member becomes sick and cannot do their work, there are serious effects on the project.*

#### SOME FAULTS

- 1 Given the time period is not a clear reference
- 2 The generalization is opinion-based and not impartial

#### SUGGESTED REVISION

*One risk to the project is the possibility of a team member becoming sick for an extended period. Were this risk to happen, it would have a serious effect on the project. Given the current environment, where many students have succumbed to long bouts of the flu, the project team rates the probability of this risk as high.*

### **Criticize your own writing**

Preparing a set of instructions, using words alone or words supported by effective diagrams, drawings, photographs or samples, provides a good introduction to the essentials of scientific and technical writing.

Consider a set of instructions. Are they complete? Are they arranged in order of performance? Are they numbered to emphasize the separate steps? **Would all who could be expected to use the instructions understand what to do, and by following your instructions satisfactorily complete the task?** Does your set of instructions have all the characteristics of scientific and technical writing considered in this chapter?

## Writing Technical Instructions

<b><i>Stages</i></b>	<b><i>Instructions</i></b>	<b><i>Essentials</i></b>
Think	<ol style="list-style-type: none"> <li>1. Consider who may use the instructions, and how they will be used.</li> <li>2. Ensure you can complete the task well yourself.</li> <li>3. Precede the instructions with any necessary explanation, words of caution, warning or possible danger.</li> <li>4. Give the instructions a concise but informative heading (as above).</li> <li>5. List any materials or equipment required.</li> <li>6. Break the task into steps: the things to be done, explaining the action required, at each step.</li> </ol>	Consideration for the reader  Knowledge and understanding  Safety  Explanation
Plan	<ol style="list-style-type: none"> <li>7 Arrange the steps in order of performance, so that completing the last step completes the task.</li> <li>8 Include photographs, drawings or diagrams, intended to help the user, next to the instructions they illustrate.</li> </ol>	Order  Appropriateness
Write	<ol style="list-style-type: none"> <li>9 Write in the imperative (with each step one instruction or command), as in this list. LI</li> <li>10 Make each instruction as simple as possible.</li> <li>11 Write each instruction as a complete sentence, using words users will not misunderstand, to ensure it is unambiguous.</li> <li>12 State any safety precautions immediately before any step at which special care is needed, preceded by the word CAUTION, the word DANGER or the word WARNING, as appropriate)</li> <li>13 Number the steps, to draw attention to the action required at each step.</li> <li>14 State any observations, to be made at each step, that indicate a satisfactory outcome.</li> <li>15 Express each quantity mentioned as a number and an SI unit of measurement, unless other units are marked on the equipment to be used.</li> </ol>	Simplicity  Clarity  Safety
Check	<ol style="list-style-type: none"> <li>16 Undertake the task, following your instructions, to check that they are accurate, in order of performance, and complete.</li> <li>17 Revise the instructions, if necessary.</li> <li>18 Ask someone else, with experience of the task to undertake the task, following the instructions, and to suggest any improvements.</li> <li>19 Revise the instructions, if necessary.</li> <li>20 Ask at least one other person, with appropriate experience, but who has not previously performed the task, to undertake the task following your instructions, and to suggest any improvements.</li> <li>21 Revise the instructions if necessary.</li> <li>22 End instructions for use within an organization, if appropriate, with a statement indicating to whom users should send comments or suggestions. For example: let me know if you encounter any difficulties or have any suggestions for improving either the procedure or these instructions.</li> <li>23 Sign and date the instructions. In doing this you take responsibility for them. As with any other communication, you should not sign unless you have authority to do so.</li> </ol>	Accuracy  Coherence



## Choosing Words

We write so that we can tell others what we think, but if we use words incorrectly — or use words that our readers do not understand — we shall be misunderstood. Clearly, we must think about words so that we can use them correctly and choose those that we expect our readers to know. Students, and working scientists and engineers, having acquired a large vocabulary, should choose words that convey their meaning, and should try to match their writing to the needs of their readers — each with a different and many with a smaller vocabulary.

The habit of writing a word in quotation marks to indicate that it is not quite the right word, or that it is not used in the commonly accepted sense, or that more is implied than is said, is likely to confuse some readers and so is to be avoided in scientific and technical writing. Instead, choose the word or words that convey your meaning precisely and, if in doubt, refer to a dictionary to make sure you are using the right word.

## The Meaning of Words

### Some words commonly confused

To illustrate the need for care, here are some words that many writers con-fuse, and so misuse. Concise comments are included to make clear differences in meaning.

**Accept** (receive) and **except** (not including).

**Advice** (suggestions) and **advise** (to give advice).

**Affect** (to alter or influence) and **effect** (to bring about, or a result).

**Alternate** (to perform by turns), **alternately** (first one thing then an alternative, repeatedly, as with a light flashing on and off), and **alternatively** (referring to one thing as an alternative to another). Strictly, therefore, one thing may be an alternative to another, but with more than two to choose from you have a choice, not an alternative.

**Amount** (mass or volume of something measured) and **number** (of things counted).

**Complement** (to add to or make complete) and **compliment** (to congratulate, or an expression of regard).

**Complementary** (adding to) and **complimentary** (without charge).

**Continuous** (non-stop) and **continual** (repeatedly).

**Council** (a committee) and **counsel** (advice, an advisor, or to advise).

**Data** are facts of any kind, which may be measurements recorded as numbers (numerical data) or other observations recorded as words, whereas **results** are obtained from data by deduction, calculation or processing. It is incorrect, therefore, to speak of raw data, but correct to refer to original observations as original data.

**Dependant** (one who is dependent on another) and **dependent** (relying on).

**Discreet** (prudent, wary) and **discrete** (separate, distinct).

**Disinterested** (impartial) and **uninterested** (not interested).

**Farther** (more distant) and **further** (additional).

**Fewer** (a smaller number of) and **less** (a smaller mass of): for example, it is possible to have fewer people, but not to have less people.

**Imply** and **infer**: a speaker or writer may imply (hint at) more than is actually said or written, and from this the listener or reader may infer (guess or understand) the intended meaning.

**Its** (possessive), indicating that it belongs to someone or something, and **it's** (colloquial) a contraction, meaning either it is or it has.

**Majority** (the greater number; the excess of one number over another) and **most** (nearly all). In an election a majority is the number by which the votes for the winning candidate exceeds those for the candidate who comes second. If you read that 'the majority of writers use word processors', does this mean nearly all writers use them? Does anyone know what proportion of writers use them? Would it be better to say simply that many writers use them? What is the difference, quantitatively, between the majority and the vast majority? Clearly, the word majority is used by some writers — when they are unable to be precise — as a substitute for evidence.

**Parameter** (a characteristic of a population, estimates of which are called statistics) and **perimeter** (a boundary).

**Principal** (first in rank, main, original or capital sum) and **principle** (a fundamental truth, a law of science, or a rule of conduct one is unlikely to break — as in a matter of principle).

**Since** (from that time) and **because** (for this reason).

**Stationary** (not moving) and **stationery** (writing paper).

**Their** (indicates possession, as in their office, in their own time, their suffering) and **there** (used with the verb to be, as in: there is, there are, there was, there were; also used to mean in that place — as in over there).

**Within** (enclosed by) and **in** (inside). Many people use the word within when the word in would serve their purpose better: for such people, apparently, the word in is 'out'. Something may be within these walls or within the bounds of possibility, but unless some such limits are intended the word *in* should be preferred.

**Your** (possessive) and **you're** (colloquial, meaning you are).

Other words commonly confused are: **admitted** (for **said**), **anticipate** (for **expect**), **always** (for **everywhere**), **center** (for **middle**), **centered** around (for **centered on**), **degree** (for **extent**), **either** (for **each** or **both**), **except** (for **unless**), **fortuitous** (for **fortunate**), **generally** (for **usually**), **if** (for **although**), **importantly** (for **important**), **improvement** (for **alteration** or change), **informed** (for **influenced**), **lengthy** (for **long**), **less** (for **fewer**), **limited** (for **few**, **small**, **slight** or **narrow**), **myself** (for **me**), **minor** (for **little**), **natural** (for **normal**), **optimum** (for **highest**),

**percentage** (for **some**), **quite** (for **entirely** or **rather**), rudimentary, **same** (for **identical** or **similar**), **secondly** (for **second**), **singular** (for **notable**), **sometimes** (referring to place instead of time), **superior** (for **better than**), **transpire** (for **happen**), **view** (for **opinion**), **virtually** (for **almost**), **volume** (for **amount**), **weather** (for **climate**), and **while** (for **although**).

### Other words commonly misused

The following words, like the measurements recorded by engineers and scientists, should contribute to precision in scientific and technical writing

**Approximate(ly)** means very **close(ly)** and should not be used if **about** or **roughly** would be better.

**Currently** means now, and the shorter word should be preferred, but in most sentences the word *currently* can be deleted. For example, *We are currently . . .* means *We are . . .* (and *We are currently in the process of . . .* also means *We are . . .*).

**Hypothesis.** If in science something that is not understood (a problem) is stated as a question, a hypothesis is a possible answer to that question (a possible solution to the problem) supported by evidence and capable of being tested by an experiment.

Hypotheses, theories and laws are not facts, but attempts to explain or state what seem to be facts. The scientific method depends on the formulation of hypotheses. There may be conflicting hypotheses and if one gains general acceptance it may come to be known as a theory.

Non-scientists may use the words *theory* and *idea* as if they were synonyms but scientists should consider what meaning they wish to convey and use the following words, which are not synonyms, with care: **assumption, conjecture, expectation, fact, guess, hypothesis, idea, impression, law, notion, opinion, presumption, speculation, supposition, surmise, theory** and **view**.

**Literally** (meaning actually) is a word used incorrectly to affirm the truth of an exaggeration, as in 'His eyes were literally glued to the television screen'.

**Often.** People who eat mushrooms often die (but people who do not eat them die only once). In the last sentence, and in each of the following extracts, the word often is used incorrectly:

- *'The houses were large in size and often inadequately heated.'* This should read: *The houses were large, and many were inadequately heated.'*
- *'One reason why reports are often not well written is . . .'* This should read: *One reason many reports are...'*
- *'People often may not know the meaning of words which seem obvious to you.'* This should read: *Many people may not understand words familiar to you...'*
- *'When people see a word processor for the first time they are often amazed.'* This should read: *Many people are amazed when they see...'*

The word each of these writers needed to convey the intended meaning was many, not often.

**Progress** means a move forward or a change from worse to better, but this word is misused deliberately by many people in attempts to persuade others to accept changes that are clearly not improvements. Indeed, the most outrageous suggestion acquires a certain respectability if someone calls it progress (Orwell, 1946).

**Range:** the largest and smallest of a sample, or the difference between these measurements.

**Refute** should be used in the sense of proving falsity or error, not as if it were a synonym for deny, reject or repudiate.

**Significant** is a statistical term with a precise meaning, so care is needed in using it in other contexts if readers are to know whether or not you mean statistically significant.

**Sophisticated** was once an uncomplimentary word implying sophistry and even artfulness but has been over-used to mean complicated or to imply, for example, that a new instrument or technique is, in some usually unstated way, an improvement.

**Statistics** are numerical data systematically collected, and the results of the analysis of such data.

**Viable** is a term denoting the capacity to live, but in other contexts not viable may mean too expensive or will not work.

**Vital** means essential to life and should not be used in other contexts.

### Grandiloquence

You may use words that both you and your readers understand yet write sentences that are difficult to read. For example, **long involved sentences with many long words make for hard reading**. If you try to impress people by using long words, your studied avoidance of shorter, more appropriate words is more likely to annoy, amuse or confuse than to impress.

Fain would I fathom thy nature specific, Loftily poised in the ether capacious, Strongly resembling a gem carbonaceous.

This anonymous version of a well-known nursery rhyme pokes fun at grandiloquence:

*Scintillate, scintillate, globule aurific,  
Fain would I fathom thy nature specific,  
Loftily poised in the ether capacious,  
Strongly resembling a gem carbonaceous*

Some people seem to think that scholarly writing must be hard reading, and that a pompous style is necessary to demonstrate their cleverness to the world. In your writing, prefer a short word to a long one, unless the long word will serve your purpose better.

<b><i>Instead of this ...</i></b>	<b><i>prefer this ...</i></b>
accomplish	do
additional	extra
anticipate	expect
breakthrough	discovery
commence	begin
conjecture	guess
consider	think
considerable	much
construct	build

<b><i>Instead of this ...</i></b>	<b><i>prefer this ...</i></b>
guidelines	guidance
hypothesize	suggest
indication	sign
initiate	start
modification	change
possess	have
preventative	preventive
represents	is
shortly	soon* later

<i>Instead of this ...</i>	<i>prefer this ...</i>
demonstrate	show
encounter	meet
endeavour	try
excepting	except
exhibit	show
fabricate	build
firstly	first

<i>Instead of this ...</i>	<i>prefer this ...</i>
subsequently	later
sufficient	enough
upon	on
utilization	use
within	in
virtually	almost
currently	now

## Superfluous words

Try not to use two words if only one is needed. In particular, words with only one meaning should never be qualified. Facts, for example, are things known to be true (verified past events, things observed and recorded, data ). So it is wrong to refer *to the fact that* energy may be involved, to write that the *evidence points to the fact*, or to say that someone *has got the facts wrong*, and to speak of the *actual facts* is to say the same thing twice.

Tautology – saying the same thing twice using different words

<i>Incorrect</i>	<i>Correct</i>
every individual one	every one
the reason for this is because	because
reverted back	reverted
related to each other	related
each individual person	each person
in actual fact	in fact
in the rural countryside	in the countryside
a specific example	an example
an integral part	a part
give positive encouragement	encourage
We are currently in the process of	We are

<i>Incorrect</i>	<i>Correct</i>
I tentatively suggest	I suggest
completely disappear from sight	disappear
different varieties	varieties
in two equal halves	in halves
symptoms indicative of	symptoms of
or alternatively	alternatively
grouped together	grouped
superimposed over each other	superimposed
percolate down	percolate
eradicate completely	eradicate

## Technical terms

In studying any subject we acquire a vocabulary of specialist or technical terms that makes for easy communication between specialists, but which may not be understood by other educated people with different back-grounds and different interests. Before using a technical term, therefore, consider whether or not it will help your readers.

The use of technical terms unnecessarily, or without explanation, may indicate that the writer has not considered the needs of the readers, or not realized that some educated people may not understand the terms — or the words used for something different from their commonly accepted meaning.

Writers who use technical terms after considering their readers' needs make two assumptions that may not be justified: first that readers are familiar with the thing named, and second that they will recognize it by its technical name (Flood, 1957).

Use technical terms when they are needed, not to impress non-technical readers, who are likely to ignore any thoughts, or lack of thought, concealed by a smoke-screen of professional jargon. Wherever possible, replace a technical term by an everyday word if this can be done without altering the meaning of the sentence.

If books, magazines and articles in newspapers intended to popularize science include unnecessary technical terms, and other words that some . readers find difficult, they serve as barriers — not bridges — between specialists and other educated people.

If you are writing for non-scientists, or using terms that are defined differently by different people, any necessary terms must be sufficiently explained in simple language. Help your readers by relating a new word to familiar words, by indicating the nature of the thing named, by providing a brief explanation or derivation in parenthesis, by a negative interpolation, or by explaining the concept fully before giving its name (Flood, 1957).

If a technical term is used as a substitute for an explanation, it gives no more than an impression of knowledge (see Beveridge, 1968). For example, the behavior of an animal may be described as instinctive, but few scientists attempt to define the word instinct. Other words that sound like technical terms, but cannot be defined are libido in psychology and ore in geology. Unless a word can be defined clearly and then used with accuracy and precision, it may conceal our ignorance and obscure the need for further research, and so should have no place in scientific writing.

Many technical terms play an essential part in the prose of science. If they are widely accepted they contribute to an economy of words, and should be part of the common language used by scientists everywhere.

## Abbreviations, contractions and acronyms

An abbreviation, a shortened form of a word, may have several meanings (for example, adv. = advent, advocate, adverb, advertisement) so even after referring to a dictionary of abbreviations, a reader may have to rely on the context in trying to decide which meaning was intended. This is also true of acronyms, which comprise the initial letters of successive words and may be pronounced as if they were words: for example, Linux/Apache/MySQL/PHP (LAMP). Furthermore, abbreviations and acronyms in common use in one country may not be understood in another.

So it is best to avoid abbreviations if you can. **When using acronyms: (a) write them in full where they are first used in any document (each followed immediately by the acronym in parentheses); and (b) list and explain them at the beginning of a document.**

## Using Words

Unlike the novelist who is trying to paint pictures with words, leaving much to the reader's imagination, your intention in writing about science or engineering is to convey information without decoration: to express your thoughts as clearly and simply as you can.

### Words in context

In a dictionary each word is first explained and then used in appropriate contexts to make its several meanings clear. This is necessary because words do not stand alone: each one gives meaning to and takes meaning from the sentence, so that there is more to the whole than might be expected from its parts. It is the function of the words in a sentence to tie one another down so that the sentence as a whole has only one meaning.

#### **The repetition of a word**

Some people have favorite words and phrases (for example, also, apparently, case, found, incidentally, in fact, quite). However, **the use of a word twice in a sentence, or several times in a paragraph, or many times on one page, may interrupt the smooth flow of language and experienced writers try to avoid such undue repetition.** But the so-called elegant variation that results can be overdone. For example, in one paragraph on a sports page of a newspaper a team may be referred to by the club's official name, by the color of the team's shirts, and by the name of the club's ground. So, a reader has to be familiar with all these names to understand the message.

In scientific writing the right word should not be replaced by a less apt word for the sake of elegant variation. Instead, be consistent: always refer to a spade as a spade. You may also repeat a word to emphasize a point. For example, in the last paragraph the word *by* was used three times in one sentence — to draw attention to each of the items in a list — although only the first *by* was actually needed to make sense.

Words that must be used with care, or ambiguity may result, include: *this, that* and *it; he, him, his, she* and *her; former* and *latter; and other* and *another*. If it helps to make your meaning clear at first reading a noun should be repeated.

#### **The position of a word**

In a sentence, the position of a word may reflect the emphasis you wish to put upon it. An important word may come near the beginning or near the end, and in either position it may help to link the ideas expressed in successive sentences.

The position of a word may also transform the meaning of a sentence. For example, the word *only* is well known for the trouble it may cause when out of place (see Table 7.1). Consider, also, the meaning of each of the following sentences:

- We only eat fish on Fridays.
- We eat only fish on Fridays.
- We eat fish only on Fridays.

- We eat fish on Fridays only.
- Only we eat fish on Fridays.
- We do not eat meat on Fridays.

The meaning intended in the first sentence is probably that conveyed by the last, which does not include the word only. In conversation most people would probably take this meaning, not from what was said but from the context, the intonation and the accompanying facial expression.

If any words in a sentence are misplaced, the meaning conveyed may not be the meaning intended. So, ensure that what you write does express precisely what you mean. Do not expect readers to waste their time trying to guess what you probably meant.

Only – a word out of place

<b><i>What the author wrote</i></b>	<b><i>The corrected version</i></b>
The standard only stipulated that	The standard stipulated that only
The chemical was only manufactured in Europe.	The chemical was manufactured only in Europe.
Some functions can only be performed when online.	Some functions can be performed only when online.
In this book those points of grammar only are discussed which will help you to ensure accuracy.	In this book only those points of grammar that will help you to ensure accuracy are discussed.
The census only takes place every ten years.	There is only one census in each decade
The information is only used for	The information is used solely for

Consider the following sentence from a newspaper:

*Meat Inspectors were reprimanded and downgraded after a consignment of beef from the local market was shown to be contaminated by environmental health officers.*

The words *by environmental health officers*, which are out of place, could be inserted after *reprimanded*, or after *downgraded*, or (to give the meaning presumably intended) after *shown*.

### **Idiomatic expressions**

George Orwell (1946), in an essay on Politics and the English Language, complained about the thoughtless use of hackneyed phrases (for example, *with regard to* 'like the sections of a prefabricated hen-house').

**Avoid hackneyed phrases and clichés and idiomatic expressions**, in which the words have a special meaning, not only because some readers may misunderstand them, but also because such ready-made phrases make less impact than would a fresh turn of phrase. Instead, choose words that convey your own meaning precisely.



<b><i>Idiomatic expression</i></b>	<b><i>Prefer</i></b>
break new ground	start something new
leave no stone unturned	make every effort
in the pipeline	in preparation
take on board	note
a different ball game	another matter
see the light at the end of the tunnel	making progress

## Circumlocution

A more common fault in writing than the use of the wrong word, or of words in the wrong place in a sentence, is the use of too many words. Although a summarizing or qualifying phrase may help the reader, any unnecessary words can only confuse, distract and annoy. Also, when too many words are used, time, paper and money are wasted (for example, in word processing, printing and advertising).

In revising any composition, therefore, **reconsider each sentence and each paragraph to see if it is necessary, and prune sentences to remove all unnecessary words**. Short messages will take less time to type and to read —and should increase your chances of receiving replies that are comprehensive, concise and to the point.

### **Verbosity**

A well-constructed sentence should have neither too many words nor too few; **each word should be there for a purpose**. A verbose sentence, the result of lack of care in writing or revising, includes extra words that make it more difficult for the writer to convey the meaning intended or to evoke the desired response. Lack of care in sentence construction may also cause a writer to use hackneyed phrases or clichés in preference to more appropriate words.

In lectures on the art of writing, Quiller-Couch (1916) advised those who would write straightforward prose to prefer concrete nouns (things you can touch and see) to abstract nouns, and listed *case, instance, character, nature, condition, persuasion, and degree* as examples of abstract nouns that should be used sparingly and with care. Other indicators of jargon are: *area, angle, aspect, fact, field, level, process, situation, spectrum, time, and type*. Of course there is nothing wrong with any of these words when used to convey meaning.

### **Reasons for verbosity**

Tautology, circumlocution, ambiguity and verbosity arise from ignorance of the exact meaning of words, from lack of thought when writing, and from lack of care when revising. Also, people may use too few words when they speak, or too many words when they write, if they have not considered the difference between speaking and writing.

In conversation we may use more or fewer words than are needed in writing. On the one hand, we use words to separate important ideas, we repeat things for emphasis, and we correct ourselves in an attempt to achieve greater precision. The extra words give listeners time to think. On the other hand, in conversation we take short cuts, leaving out words, and so use fewer words than would be needed in writing. This is possible because as we talk we also communicate without words, by a

body language in which 'every little movement has a meaning of its own' — and we see when the listener has understood and we have said enough.

Circumlocution: the use of many words if fewer would be better

<b><i>Circumlocution</i></b>	<b><i>Better English</i></b>
in virtually all sectors of the environment	almost everywhere
on a dawn to dusk basis	from dawn to dusk
An increased appetite was manifested by all the rats	All the rats ate more
the reading and learning process	reading and learning
We are in the process of making	We are making
during the month of April	in April
on a theoretical level	in theory
on the educational front	in education
It consists essentially of two parts ...	It has two parts ...
I myself would hope	I hope

<b><i>Circumlocution</i></b>	<b><i>Prefer</i></b>
Such is by no means the case	This is not so
Most importantly of all, ...	Most important..
The physical process of writing is ...	Writing is .
Th process of revising	Revising
I am in the process of ...	I am .
We are looking to find .	We are seeking .
on a regular basis	regularly
In no case did any of the seedlings develop lesions	None of the seedlings developed lesions
There really is something of an obligation upon us to ...	We should ..

Circumlocution: some phrases which should not be used if one word would be better

<b><i>Circumlocution</i></b>	<b><i>Prefer</i></b>
on account of the fact that	as
if it is assumed that	if
a sufficient number of	enough
a greater length of time	longer
during the time that	while
it may well be that	perhaps
using a combination of	from
are found to be in agreement	agree
make an examination of	examine
undertake a study of	study
take into consideration	consider
it is apparent, therefore, that	hence
in conjunction with	with
after this has been done	then
have been shown to be	are
for free	free
carry out experiments	experiment
come to the conclusion	conclude
in all other cases	otherwise
aimed at	for

<b><i>Circumlocution</i></b>	<b><i>Prefer</i></b>
in between	between
in regard to	about
in order to	to
a proportion of	some*
at a later date	later*
at an early date	soon*
in the nature of	like
it would appear that	apparently
to say nothing of	and
has an ability to	can
a large number of	many
for the purpose of	for
until such time as	until
in connection with	about
located on	on
provided that	if
spell out in depth	explain
count up	count later
later on	seal
seal off	for

\* if possible, be precise. Say how many, say when.

The writer, to allow for the lack of direct contact with the reader, must use as many words as are needed to convey the intended meaning. Emphasis is usually made without repetition, and necessary pauses come from punctuation marks and paragraph breaks.

In writing, as in speaking, use words with which you are familiar and try to match your style to the occasion and to the needs of your readers. Write as you would speak to the audience you have in mind but recognize that good spoken English is not the same as good written English. If a good talk is recorded and then typed verbatim, the reader may find that it is not good prose.

The use of more words than are needed, in writing, may result from a confusion of thought, a failure to take writing seriously, or laziness in sentence construction and revision. All these things are likely when a document is dictated unless it is revised in typescript. Few people are able to dictate any-thing other than a short routine communication, so that it reads well and conveys the intended meaning, unless they are prepared to spend time converting the typescript into good prose. But most people, if they take the trouble, can write better than they normally talk — because in writing they have more time for thought and the opportunity to revise their work.

Responsibility for revising a typescript cannot be delegated: only the writer knows the meaning intended and whether or not the reader is likely to be affected in the desired way. Before signing any document, therefore, its author must be satisfied with its content and style.

Apart from lack of care, there are other reasons why people fill their writing with empty words. Some seem to think that restatement in longer words is explanation. Others are trying to make a little knowledge go a long way. And others may even be trying to obscure meaning because they have nothing to say, or do not wish to commit themselves:

Wordiness may also result from affectation, from the studied avoidance of simplicity, in the belief that Latin phrases, long words and elaborate sentences appear learned (McCartney, 1953). In encouraging direct, straightforward prose, George Orwell (1946) asked writers to be positive, to avoid double negatives (for example, to prefer *possible* to *not unlikely*) and complained about the use of words like *categorical* and *phenomenon* to dress up simple statements and support biased judgements.

In scientific and technical writing, to be read only by specialists, it is not necessary to express complex ideas in language a layman could understand, and it is not necessary to make simple ideas seem complex. Simplicity is the outward sign of clarity of thought. Wordiness is therefore a reflection on a writer's thinking, and a means by which writers conceal their meaning even from themselves.

In an essay *On Style*, Samuel Coleridge (1772-1834) wrote that 'If men would only say what they have to say in plain terms, how much more eloquent they would be'; and Simeon Potter (1966) that 'We shall be effective . . . as writers if we can say clearly, simply, and attractively just what we want to say and nothing more.'

Another cause of verbosity is that some scientists think objectivity is achieved by writing in the passive voice, or they wish to avoid using personal pronouns and write in the passive voice (for example, 'the following results were obtained') when the active voice (for example, 'I observed' or 'we found') would be more direct. Almack (1930) wrote: 'Only in the preface is the first person permitted; the remainder of the thesis should in common decency be written in the third person.'

McCartney (1953), however, considered the prejudice against the use of personal pronouns in scholarly writing unwarranted; and Kapp (1973), referring to the need for commenting and connecting words, used the first person freely: 'I must confess, on reading what I have myself written I have frequently caught myself committing the same sin of omission.'

A writer's reluctance to use the first person increases the number of words required and can make the writing less rather than more objective. *We found* or *I found* communicate something of the excitement of discovery and make clear who was involved. However, never write *we found* when you mean *I found*. The use of the word *we* (for *I*) should be reserved for monarchs, editors and pregnant women.

The first person is to be preferred to such expressions as *it was found that*, which may leave the reader wondering who made the discovery. Similarly, it is not always clear who is meant by *the author* or *the writer*.

### **The need for comment words and connecting words**

A reader's thoughts should move smoothly from each paragraph to the next, but many introductory phrases and connectives can be deleted without altering the meaning of a sentence or disrupting the smooth flow of language. If you omit such superfluous phrases, your writing will be more direct and easier to read — and so be more likely to serve your purpose.

Too many words may be used, in a report, in text references to tables and diagrams (for example, the introductory phrases: 'It is clear from a consideration of Table . . . that . . .'; and 'Figure . . . shows that . . .'). These words are superfluous; and they may cause the reader to think that in the table or figure it is necessary to note only one thing. It is better to say whatever you wish to say about the table or figure and then to refer to it by its number (in parenthesis), as in this book. It is also unnecessary in the heading to a table or the legend to a figure, to write: 'Table showing . . .' or 'Figure showing...'

However, in practicing an economy of words, do not make the mistake of using too few words. In addition to the words needed to convey meaning, include comment words (for example: *clearly*, *even*, *as expected*, and *unexpected*) and connecting words (for example: *first*, *second*, *then*, *therefore*, *hence*, *however*, *on the contrary*, *moreover*, *as a result*, *nevertheless*, *similarly*, *so*, *thus*, *but*, *on the one hand*, and *on the other hand*) to help readers follow your train of thought.

Where necessary, provide reminders to ensure the readers always know why what you are saying is relevant to your message. Your message should neither be obscured by a haze of superfluous words nor deprived of words needed to give it strength.

The rule must be to use the number of words needed to convey each thought precisely (without ambiguity), and to ensure that brevity is not achieved at the expense of accuracy, clarity, interest and coherence. In scientific writing clarity and simplicity are not the only considerations, but if you intend to be widely understood you will usually want to convey your message as clearly and simply as you can.

## Helping Your Readers

Consider not only what your readers want to know, but also what you need to tell them, by way of explanation or example, to ensure that they understand. **Omit anything that is irrelevant, and any unnecessary background information.** Only students, who may be expected to display their knowledge, should include details that they expect their readers will already know. At work you are not trying to score marks: you are conveying your knowledge to people who require no more information than will satisfy their immediate needs.

Analyzing your audience. Find out as much as you can about your readers. Consider their age, education, interests and occupations, so that you can anticipate any difficulties — and their likely feelings on reading your message. Some readers may not use English as their first language. Some may be experts in the subject of your composition. Others, although experts in other subjects, may be interested in the possible applications of your work —and be involved in decision-making.

Whatever you are writing, therefore, **convey your meaning as clearly and simply as you can, using words, numbers and illustrations, as appropriate**, so that all those for whom the document is intended will understand at first reading at Least the parts relevant to their work.

## Writing for easy reading

***Designing your message.*** Your writing should be appropriate to the subject, to the needs of your readers and to the occasion. **Each sentence should convey a whole thought accurately, clearly and as simply as possible**, so that your readers take your meaning and always feel at ease. They are most likely to follow your arguments, understand your evidence, and remember your conclusions, if they can relate anything new to their existing knowledge and interests.

***Communicating your purpose.*** **Help readers by providing an informative title, and effective headings and sub-headings.** Help them to see the connection between sentences, paragraphs and sections. Sometimes a word is enough; sometimes much more explanation is required.

***Obtaining a response.*** Present information in an appropriate order. Include all essential steps in any argument; give evidence in support of anything new; give examples and explain why any point is particularly important. No statement should be self-evident, but do not leave your readers to work out any implications. Be as explicit as necessary.

***Fulfill your readers' expectations.*** For example, always follow the words first by second; on the one hand by on the other hand; whether by or; and not only by but also. If you list a number of items, mention all or none of them in the sentences that follow: if only some are mentioned readers may be wondering about the others when they should be thinking about your next topic.

## How to begin

If you know what you wish to communicate but have difficulty in getting started, look at the opening sentences in similar compositions by other people. Begin, for example, with: a summary, recommendations, a statement of a problem, a hypothesis, necessary background information that leads directly to the problem or hypothesis, an example, a definition, a question, an answer to one of the readers' six questions, an idea that has received some support (then explain why it is incorrect), an accepted procedure (then explain the advantages of an alternative).

The best starting point, for the subject and your readers, will probably be obvious once you have prepared your topic outline. However, it is better to begin than to spend too much time trying to decide how to begin. Your first paragraph can be revised, if necessary, when your first draft of the whole composition is complete. The only rules about beginning are: (a) come straight to the point, with an effective heading or title; and (b) if possible, refer briefly to things you expect your readers to know, and build on this foundation.

## Control

In each document you write, pay careful attention to presentation — to the arrangement of your material, order and timing — so that you are always in control: communicating information and affecting your readers in a chosen way. Maintaining control depends first on your knowledge and understanding, and then on careful planning — which helps you to present your thoughts in an appropriate, ordered and interesting way. Good headings and sub-headings, especially in a long composition, are signposts that help readers along and — if they are not reading the whole composition — help them to find just the information they require.

## Emphasis

The title, headings and sub-headings emphasize the whole and its parts. **Emphasis, which is achieved in many ways, is important in all writing** and is present whether or not the writer is in control. But you can use emphasis effectively only if you know how to make important points stand out from the necessary supporting detail.

Beginnings and endings are important. The first and last paragraphs (the introduction and conclusion) will be read by most people. Then in each paragraph the first and last words capture most attention. In planning a composition you have to decide on the order of paragraphs, and you may number them in your topic outline. But remember that your plan is for you, not for the reader who requires only the results of your thinking and planning.

So, omit such superfluous introductory phrases as: *First let us consider . . .*; *Secondly it must be noted that . . .*; *An interesting example which should be mentioned in this context is . . .*; *Next it must be noted that . . .*; *In conclusion it must be emphasized that . . .* Also, omit other unnecessary introductory phrases and connecting phrases.

Never begin a paragraph with unimportant words; and end each paragraph effectively. Similarly, in a sentence emphasis falls naturally on the first and last few words: so use these words to convey

information or to make connections — to help readers understand your message and follow your train of thought.

A reader's or listener's attention can be captured and held by saying things in threes: a technique over-used by some politicians. It is no accident that in ancient times there were three Graces, and in the Christmas story three wise men. Saying things in threes encourages the reader or listener to anticipate what is to be said next and makes it easy to remember what has been said.

Items of comparable importance can be emphasized by repeating an introductory word, by numbering, or by indentation. However, if a sentence has been properly constructed, so that it reads well, emphasis will fall naturally on each part. Similarly, if a composition has been well planned it will be well balanced, with an obvious beginning, middle and end, and each paragraph break will serve to emphasize that one topic has been dealt with and it is time to start thinking about the next.

If appropriate, plan effective illustrations to convey the essential points. In writing, use more forceful language for important points than for any supporting detail; and check your first draft to ensure you have emphasized them sufficiently. In your topic outline you may underline words or phrases to remind you of points you intend to emphasize in your composition, but in the composition itself do not underline for emphasis. Underline only those words that in a book or journal would be printed in italics.

### **Sentence length**

Long involved sentences may indicate that you have not thought sufficiently about what you are trying to say. If as you revise your composition you find a long sentence that is difficult to read, consider how it can be improved. Perhaps it should be broken into two or more shorter sentences.

**The breaks between paragraphs and sentences give readers time for thought;** and in a newspaper the length of paragraphs, sentences and words is intended to match what the editor thinks are the readers' needs. In some newspapers each paragraph is one short sentence. In others the paragraphs are longer, some sentences are longer, and a wider vocabulary is used.

However, although short sentences are the easiest to read, a long sentence, if it is properly constructed, may be easier to read than a succession of short ones. There is no rule that a sentence, when read aloud, should be read in one breath. Good prose is seldom written in short sentences. An opinion can be clearly expressed, even in a long sentence.

Sentences vary in length. Short sentences are effective for introducing a new subject, long sentences for developing a point, and short sentences for bringing things to a striking conclusion.

### **Rhythm**

Good prose, like speech, has a varied rhythm that contributes to the smooth flow of words in a sentence, gives emphasis to important points, and makes for easy reading. In contrast, badly

constructed sentences may irritate readers and make them less receptive to your message. So it is a good idea to read your writing aloud, and to revise any parts that do not sound well.

## Style

Some may feel that style is not important in scientific and technical writing; but style is not something that can be added to writing as a final polish. It is part of effective prose. Graves and Hodge (1947), in *The Reader Over Your Shoulder*, emphasized: (a) clarity, completeness, consistency, order, simplicity, sincerity and consideration for the reader as basic requirements; (b) that all connections should be properly made; and (c) that although written for silent reading, effective prose should sound well if read aloud.

Because the way you put words together reflects your own personality and your feeling for words, it would be a mistake to try to copy someone else's style. In writing about science, a good style depends upon your intelligence, imagination and good taste; on sincerity, modesty, careful planning, and attention to the requirements of scientific writing. You are familiar with these things as part of the scientific method. In effective prose the excitement of discovery may also be communicated.

Rhythm, while not essential, will make for easier reading, and badly constructed sentences may irritate readers and make them less receptive to your message.

## Capturing and holding your readers' interest

In writing about science or engineering in a book, in an article for a journal, in a project report, or in describing an experiment, your interest in your subject should be conveyed to your readers.

A novelist, whose business is words, takes great care over the choice and use of words. Consider, for example, how in the first paragraph of a good novel the author captures the readers' interest and begins to tell the story. You will find no superfluous words. In writing about science you start with the advantage that your readers are already interested, but to maintain their interest you must present information at a proper pace. If readers understand, they will want to move quickly to the point; but they must understand every word, every statement and every step in any argument. If they have to refer to a dictionary, or read a sentence more than once, before they can understand your message, you may lose their attention.

Readers are directed away from an explanation or argument by anything irrelevant, by unnecessary detail, by explanation of the obvious, and by needless repetition. They lose interest if statements are not supported, as appropriate, by evidence or by examples. Science depends upon evidence and you must not attempt to gain acceptance of your views by reiteration. Use cross-references to avoid repetition and to provide necessary reminders. When you repeat anything deliberately, using different words, either for emphasis or to help to clarify a difficult point, use a phrase such as *in*



*other words or that is to say.* Otherwise, after studying both sentences, readers may be left wondering if they have failed to appreciate some difference in meaning.

Approach people through their interests rather than your own. They will be most interested in themselves, in other people and in things as they affect people. Scientists will be most interested in their own specialty and in developments likely to have a bearing on their own work. Other people are likely to be interested in the application of science and technology to human welfare, in the impact of discoveries on society, and in pure research when this is concerned with our origins and our place in the universe.

In an internal report or journal article the style of writing is usually direct and the link between paragraphs is achieved mainly by their orderly arrangement. In a magazine with a wider readership more explanation and interpretation is needed; and in a newspaper attention is maintained by reference to familiar things, by including examples, anecdotes and analogies, and by providing attractive illustrations.

## Using good English

Looking critically at other people's writing will help you to improve your own, but do not be afraid to put pen to paper for fear of making mistakes. English is bad only if it does not express the thought intended clearly and accurately in words appropriate to the context. However, even if a sentence is grammatically correct, superfluous words make for hard reading. In scientific and technical writing clarity depends on the use of words readers will understand and expressing thoughts as simply as you can.

Poor writing may result from distraction, from not knowing what to say, from not considering how to present information, from insufficient care in the choice and use of words, or from not allocating sufficient time to thinking, to planning, to writing, and to checking and if necessary to revising the work. Poor writing is also to be expected from a writer who has nothing to say, or who does not wish to express an opinion, and is so inconsiderate as to try to put up a smoke-screen of words that gives the impression that something is being said, but only obscures meaning.

## **Obstacles to effective communication**

Communication is not easy: an effort is needed on the part of the writer if the reader is to be interested, informed and affected in a chosen way. Failures in written communication between educated people may result, for example, from: (a) lack of practice on the part of the writer; (b) the writer's unwillingness to devote enough time to thinking, planning, writing and revising; (c) failure to establish contact with readers at the start; (d) lack of attention on the part of readers, especially when the writing deviates from their interests; (e) the readers' preconceived ideas, and their refusal to accept new ideas or to consider evidence that conflicts with their existing beliefs.

## Rules for efficient communication

To write well most people need to be alone, free from disturbance, and time for thought.

- 1 Before starting to write, decide whom you hope to interest, why you wish to interest them, what must be said, and how you should say it. Readers are most likely to understand grammatically correct English, and be interested in evidence (summarised in tables and effective illustrations).
- 2 Write about things you know, if you have something interesting to say.
- 3 Plan your work so that information and ideas can be presented in an appropriate order, and so that the whole composition has the qualities of balance and unity.
- 4 Write for easy reading. Begin well. Keep to the point. Be clear, direct and forceful. Maintain the momentum of your writing, if possible by writing at one sitting.
- 5 Check your work, and revise it if necessary.

## Improve your writing

### Learn from people who write well

In starting to play any game you can learn much by watching experts. Similarly, reading good prose will influence the way you write, just as the way you speak is influenced by the speech you hear.

Read books by successful authors and study the techniques of journalists who write well — to see how to capture attention, how to match your writing to the needs of your readers, and how to write clear, concise, vigorous and vivid prose. Consider, for example, the purpose and scope of a leading article in a newspaper, or an article that interests you in a magazine. The title captured your interest. Does the opening sentence make you want to read on? Try to reconstruct the author's topic outline by picking out the topic for each paragraph. Is each paragraph relevant to the title? Are the paragraphs arranged in an appropriate order? Do they lead to an effective conclusion?

Study one paragraph. Note the ideas presented in each sentence. Which is the topic sentence? Are all these ideas relevant to the topic? Why are they presented in this order? Is it the most effective order in helping the writer to make a point (in helping the reader to understand)? Can you distinguish facts from opinions? Are the opinions supported by evidence? Is the article biased in favour of a particular point of view?

What is published in a newspaper is likely to be well written and persuasive, and to interest the people who normally read that paper, but if you compare accounts of one event in different newspapers you will probably find that they tell very different stories. This is because eye-witnesses of one event see and remember different things and are influenced by their own previous experiences. Then, the stories submitted by reporters are edited to fit the space available in the paper, to match the readers' interests, and to suit editorial policy.

**A simple, straightforward style is required in scientific and technical writing.** As you study the writing of others, and consider how your own writing can be improved, remember that there is no one correct way to write. Read for pleasure, not to copy someone else's style. The way you write should reflect your personality and your feeling for words.

### **Learn by writing**

Evans (1972) includes editing exercises, each with three versions of a news item. Version A: the story as it appeared in print. Version B: the story edited to remove superfluous words and improve the English. Version C: rearranged and re-written to bring out the human interest.

Most people can improve their writing by considering the advice of more experienced writers, and from colleagues willing to read and comment on their work, but the best way to learn is by writing. Think before you write, plan your work, try to write without interruption, check your work carefully, and revise each composition until you are satisfied that it will serve your purpose. Your writing will improve.

### **Check your writing for readability**

Flesch (1962), in *The Art of Plain Talk*, graded writing simply, according to average sentence length, as very easy to read (less than 10 words), difficult (more than 20 words) and very difficult (30 words). Accepting this as a rough guide to readability, it is worth calculating the average sentence length in a few paragraphs of a document you have written recently. When writing documents that will be read only by your colleagues, you may know they all can cope with long sentences that some people would find difficult to read. But remember, when writing for a wider audience, that some people have difficulty with even short words in short sentences. So, prefer a short word to a longer word if the short word will serve your purpose; and try to ensure that every sentence is carefully constructed, grammatically correct and easy to read. Try to convey your message as clearly and simply as you can.

With a word count, using a word processor, it is easy to estimate the average length of words used in a document (by dividing the number of characters by the number of words); and Pullin (2001) suggests that an average of four to six is satisfactory, but that the nearer the score is to four the more readable the document is likely to be.