EFFECTIVE TECHNICAL COMMUNICATION

A Guide for Scientists and Engineers

BARUN K. MITRA
Formerly Professor of English
Indian Institute of Technology Kharagpur

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Principles of Scientific Vocabulary

All big things have little names,
Such as life and death, peace and war,
Or dawn, day, night, love, home.
Learn to use little words in a big way.

—Anonymous

SCIENCE (from the Latin word 'scientia' meaning knowledge) is knowledge arranged methodically or systematized knowledge. Its progress is marked by the emergence of the scientific method, which rests on the rational, accurate, and clear exposition of facts. At its core is a thoroughness of approach that is needed to establish any new finding. For this, the use of appropriate words and sentences is essential.

A sentence is a combination of words, which are the basic units of expression. To communicate effectively with others and to disseminate ideas, views, and observations to a broader community, a scientist or an engineer needs a thorough knowledge of the intricacies of the language. The entire structure of scientific or engineering communication stands on the solid foundation of words. Hence, superficial knowledge of a word and its spelling is of little help. The writer must choose his/her words carefully so as to convey his/her ideas most effectively.

The ability to choose the appropriate words and use these in the appropriate context comes from familiarity with words and their

usage. Thus, a writer should avoid using words with which he/she is unfamiliar.

There are eight principles for choosing appropriate words and phrases in scientific and engineering communication. These have been listed below.

- Use short and simple words.
- Use compact substitutes for wordy phrases.
- Avoid redundant words and expressions.
- Avoid the use of mixed metaphors and other figures of speech.
- Avoid hackneyed and stilted phrases.
- Avoid verbosity in the use of common prepositions.
- Avoid the incorrect use of words.
- Exercise care while using technical terms borrowed from traditional English.

Some examples of each of these principles have been given below.

1.1 Use Short and Simple Words

Any communication by scientists and engineers requires the use of short and simple words, which are more forceful than long words. A short word appropriately used, enhances the clarity of expression.

Examples of a few short and simple words that should be used instead of polysyllabic words are provided below:

Avoidable words	Recommended words
accomplish	do
terminate	end
conflagration	fire
adjacent to	near
cognizant of	aware of
perform	do
vehicle	car

attempt	try
beverage	drink
envisage	foresee
ameliorate	improve
endeavour	try
perchance	perhaps
abhorrence	hatred
viable	workable
deem	think

1.2 Use Compact Substitutes for Wordy Phrases

The use of simple substitutes greatly improves the clarity of written communication. Some examples are given below.

Avoidable usage	*Recommended usage*
Take into consideration	consider
Avail yourself of	use
In view of the fact that	since
In all instances	always
In a very small number of cases	rarely
In view of the fact that	because
Subsequent to	after
In the near future	soon
In spite of the fact that	although
As a consequence of this fact	consequently
A small number of	a few
Despite the fact that	although
At the present time	now
Prior to	before
For the duration of the study	during the study
During the process of	during
Checked for the presence of	checked for
A series of observations	observations
In order to provide a basis for comparing	to compare

Make an adjustment in	adjust
Give encouragement to	encourage
Is equipped with	has

1.3 Avoid Redundant Words and Expressions

The clarity of the text can be improved by completely removing expressions that do not add value to the text. Every sentence should be trimmed down to its essentials. A number of redundancies can creep into a written communication if it is written carelessly.

Examples of expressions that should be avoided have been given below.

- It has been found that
- It is interesting to note that
- As already stated
- It may be said that
- It is worth mentioning at this point

A list of some expressions, parts of which should be removed due to their redundancy, has been given below. The redundant words have been placed in brackets.

- (absolutely) essential
- (advance) planning
- (advance) warning
- (as) for example
- (at) about, at (about): use any one
- at (the) present (time)
- (brief) moment
- during (the course of)
- merged (together)
- reply (back)
- is (now) pending
- eradicate (completely)
- (current) trend
- never (before)

- (new) innovation
- (mutual) cooperation
- (close) proximity
- (necessary) requisite
- (protrude) out
- revert (back)
- (free) gift

There are a number of instances when the verb is capable of expressing the notion of togetherness. In such instances, the expression 'together' is superfluous. The examples below illustrate this point.

- meet (together)
- unite (together)
- connect (together)
- join (together)
- mix (together)

A little thinking can help a writer avoid such redundancies. Some of these redundancies can be used in special cases for emphasis. However, it is for the scientist or engineer to judge the appropriate context and not use them indiscriminately.

An example of how redundancies can lead to heaviness in the text is:

> The main cause for the failure of the experiment was that adequate precaution was not taken at the time of the experiment for preventing such kind of accidents.

The sentence can be expressed more simply by using fewer words:

> The experiment failed, as adequate precautionary measures were not taken.

Here is another example:

> If the supply of drawing papers already sent falls short of your demands, application has to be made to the Stores Officer for further supply.

This could be shortened to:

> If more drawing paper is needed, apply to the Stores Officer.

In the example below, a 34-word sentence is shortened to an 11-word sentence without any change in the meaning:

> At the present moment our administrative unit has already initiated the procedure of inviting applications from those who are in a position to offer themselves as candidates for the post of Senior Mechanical Engineer.

This could instead be written as:

> Applications have been invited for the post of Senior Mechanical Engineer.

1.4 Avoid the Use of Mixed Metaphors and other Figures of Speech

Sometimes, the use of metaphors can lead to lack of clarity in a text. Usually, the use of metaphors in scientific or engineering text is bad. The use of mixed metaphors is worse.

For example, the following sentence uses mixed metaphors:

> Instead of beating about the bush put your cards on the table.

It uses two different metaphors: 'beating about the bush' and 'putting one's cards on the table'.

The sentence can instead be written simply as:

> Clearly say what you have to state.

There is a general notion that one should avoid words that may be considered vulgar. The origin of this notion may be traced back to the Victorian era when prudishness was at its peak. (A prude is a person who is excessively modest in his/her behaviour, dress, and speech). This has led to the use of euphemisms, that is, words that are less direct. These words are not distasteful and are never vulgar.

Some examples are listed here.

- In the family way: This should be preferred over 'pregnant' (as used in HR policies for industries, for example)
- Sales representatives: This should be preferred over 'salesmen' (as used in titles used in industries, for example)
- Lower income group: This should be preferred over 'the poor' (as used in certain segments addressed by a firm, for example)

Of course, expressions like 'sales representatives' or 'lower income group' are neutral expressions and should, therefore, be given preference.

1.5   Avoid Hackneyed and Stilted Phrases

Engineers and scientists must try to overcome the temptation to use over-worn phrases and expressions. These expressions are used by greenhorns (first-time writers) to embellish their language. They use these phrases in a naive attempt to show their knowledge.

Here are some common examples of such hackneyed expressions:

- filthy lucre
- olive branch
- strain every nerve
- flying colours

1.6   Avoid Verbosity in the Use of Common Prepositions

There is no dearth of appropriate prepositions to suit any context in the English language. However, the tendency amongst writers is to use imposing expressions instead of simple prepositions. This tendency can lead to an avoidable lack of clarity in communication.

Common examples of these expressions are:

As to: In the sentence, 'The director should give a clear indication

as to the policies he wants to introduce', the simple preposition 'of' could serve the purpose just as well.

In relation to: In the sentence, 'The salaries of the scientists vary *in relation to* their qualifications and experience', the preposition 'with' provides the same meaning.

With regard to: In the sentence, 'The recruitment of only two extra scientists will make little difference *with regard to* the output of work', the preposition 'to' will convey the same meaning.

Since verbose writing obscures the meaning of a sentence and only taxes the readers' time and patience, it should be avoided.

1.7 Avoid the Incorrect Use of Words

Scientists and engineers need to be aware of the specific meanings of the words they use. They have to choose words that can accurately and precisely express their ideas. If a writer uses a word she/he is not absolutely certain about, it can end up creating confusion in the minds of the readers.

Using words accurately is extremely important for scientists and engineers. There are words that are synonymous and are more or less similar in meaning. However, only a writer who is conversant with the different meanings that may be attributed to a word can choose the correct word for the correct context.

Here are some words that describe 'something that happens'. There is a slight difference in the meaning of each word.

Happening: It refers to some unusual or strange incident that has happened.

For example: The employees were afraid of the strange happenings in the vicinity of their company premises.

Incident: It refers to a course of action that may not be very important, yet has the air of something unexpected or unusual that makes one remember it.

For example: I can recall the incident that led to the employee being warned by his supervisor.

Event: It describes a circumstance that is important, because of which it is remembered.

For example: The invention of the integrated circuit was a major event in the history of the electronics industry.

Occurrence: This is a formal word that indicates a happening that is either common or rare.

For example: These days, having an open office is a very common occurrence.

For example: Robbery is a rare occurrence in this small town.

Each of these words has a unique meaning. In scientific or engineering communication, it is important not to use such words interchangeably. Likewise, the word 'keep' is not the same as 'put', as shown in the following example:

The teacher *keeps* the book on the shelf.

The teacher enters the classroom and *puts* the book on the table.

Similarly, 'humid', 'damp', and 'moist', or 'pliable' and 'flexible', or 'permeate' and 'percolate', do *not* express the same meanings.

There are some words that have become so popular that writers use them indiscriminately, ignoring their precise meaning. The word 'blueprint', for example, has become an attractive alternative to 'scheme' or 'plan'. But this term, which comes from engineering technology, actually stands for the *final* stage of paper design.

There are many instances in which ponderous words are misused only because the writer does not know its meaning. Some examples are:

Syndrome: This term, which is gaining popularity, can be easily misused by a writer who is not certain of its meaning. The word 'syndrome' is a medical term. It actually means a group of symptoms, which collectively suggest a particular disease. The syndrome itself is not a disease.

Synergism: The precise meaning of this word is 'the simultaneous collective action which an effect greater than the sum of the

individual effects'. It does not mean just collective action, which it is erroneously used to refer to sometimes.

Catalyst: This is a very popular term, which should be used with discretion to avoid incorrect usage. Catalysis is the speeding up of the role of chemical reaction by the addition of some substance, which undergoes no chemical change itself. A catalyst is the agent that brings about this change. This context, which includes 'no change to itself', should be borne in mind before using this word.

There are many other such words, such as conductivity, frequency, anodise, pneumatic, alignment, backlash, impedance, permeability, servo-mechanism, etc., that should be used in proper perspective. The language of science and engineering is never static; it is dynamic. Hence, the scientist or engineer must keep track of these words and their *current* meaning prior to using them.

1.8 Exercise Care while using Technical Terms Borrowed from Traditional English

Common English words are used increasingly to express various scientific and engineering matters. A majority of these words are used in Computer Science and Engineering. A scientist or an engineer writing a document must ensure that these scientific or engineering terms are used appropriately and not confused with their traditional meanings.

Some examples of scientific or engineering terms that have roots in traditional English, have been provided below.

Heap	A temporary data storage area where random access is possible.
Hierarchy	It denotes the method in which data is organized in a step-wise order.
Howler	A buzzer that helps the telephone exchange operator detect whether the telephone user's handset is on the receiver.

Junction box	An electrical unit where it is possible to get a number of electrical wires connected together.
Packet	A group of data bits that can be transmitted together as a group.
Specific	The electrical charge of an elementary particle divided by its mass.
Warm up	When a machine, after being switched on, is in the process of reaching its optimum state.
Idle	A particular state of the engine in which, though running, it does not provide power to move any vehicle or aircraft.
Hang	The particular state when a computer is held in an endless loop and fails to respond.
Footprint	The area covered by any transmitting device such as an antenna or a satellite.
Jump	A term in computer parlance when a programming command is given to direct the processor to a different section of the programme.
Declare	A term used to define a computer programme variable.
Half-life	The time taken for half the atoms in a radioactive isotope to decay.
Inductive	The production of electrical current in a conductor by a change of magnetic field.
Thread	A programme in a computer consisting of many independent smaller sections or heads.
Mouse	A small hand-held input device in a computer. It is used to control the position of the cursor on the computer screen.

To conclude, English written by engineers and scientists must be simple and precise. Long, abstract, fancy, and redundant phrases must be avoided. Short and simple words build the structure, followed by sentences, paragraphs, and ultimately the whole text of the communication. Hence, the choice of words is of great

importance. It has to be kept in mind that scientific or engineering writing has a definite objective. Its main purpose is to communicate something. Hence, the words and sentences that are used should be simple, clear, brief, and unambiguous. Without these attributes, communication of any sort is bound to become boring, stilted, and foggy. Words, if used appropriately, go a long way in building the structure of sentences and paragraphs.

A quote from H.W. Fowler reveals the basic rules to be followed in the case of written communication:

Prefer the familiar word to the far-fetched.
Prefer the concrete word to the abstract.
Prefer the single word to the circumlocution.
Prefer the short word to the long.
Prefer the Saxon word to the Romance.