Tips To Improve Your Technical Writing

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Twelve Tips for Clearer Writing

Beyond applying the good-English basics learned in school, be on guard against ambiguity — and put yourself in your reader's place

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Whether you are preparing a project report, an operating procedure, a proposal, a business letter or perhaps even a manuscript for publication in a technical magazine, it is a safe bet that most of your job-related writing is intended to be expository — your purpose is to describe or explain something, rather than to write fiction or to argue a cause. Three characteristics of good expository writing are: accuracy, relevance for the reader, and clarity.

As early as our first chemistry courses, we engineers learn the importance of accuracy. And ordinarily, the relevance of our writing is assured by the nature of the assignment; for instance, if we are asked to write a project report, we can usually assume that the information will be relevant for its readers.

On the other hand, all of us are far too inclined to take the clarity of our writing for granted. When that happens, both the writing and its readers can suffer.

The essential first step for clear writing is to adhere to the principles of good English (or other language), which we were taught in school: logical organization, good grammar and syntax, proper spelling and punctuation, and so on. But as extensions of those principles, here are 12 suggestions that can significantly improve clarity. Some of them aim to prevent ambiguity, some are ways to put ourselves in our reader's place, and some fulfill both of those functions. Many of them are simply applications of common sense.

1. Think twice whenever writing the word "This"

Consider this paragraph:

Failure to close all the valves can have serious consequences; for instance, the temperature in Reactor 7 can rise above 250°F. This is grounds for an incident report being submitted to the plant manager.

Because "This" is used by itself, as a pronoun, there is a touch of doubt as to WHAT triggers the need for a report to the manager. Probably, the writer refers to the temperature rise. But he or she might have instead meant that the failure to turn off the valves does so. The ambiguity can easily be avoided by turning "This" into an adjective and saying "This failure" or "This rise", as the case may be.

Although such ambiguities surrounding "This" are the more common, a similar problem can arise with the use of "which." Consider this sentence:

The conventional process operates at much higher pressures to minimize the formation of water, which requires additional downstream processing.

It is not clear whether the need for the additional processing is due to the higher pressures or to the formation of water. Again, rephrasing the sentence can get rid of the confusion.

2. In many cases, a complex sentence is simpler

Wherever possible, consider using subordinate clauses (for instance, ". . . that the contractor supplied") instead of prepositional phrases (for instance, ". . . from the contractor") Try reading successively these two ways of saying the same thing:

The test data from the contractor showed a bearing failure on the part of the centrifuge.

versus

The test data that the contractor supplied showed that a centrifuge bearing had failed.

An English teacher would correctly point out that the second sentence is grammatically complex whereas the first one is simple. But most people would probably agree that the second is easier to read, and closer to how we talk. If there were enough space in this article to contrast the approaches in two longer pieces of writing, the advantage of the second would become even more obvious.*

3. When writing about things unfamiliar to your readers, repeat your terms (at least initially) rather than using synonyms, even at the cost of being repetitious
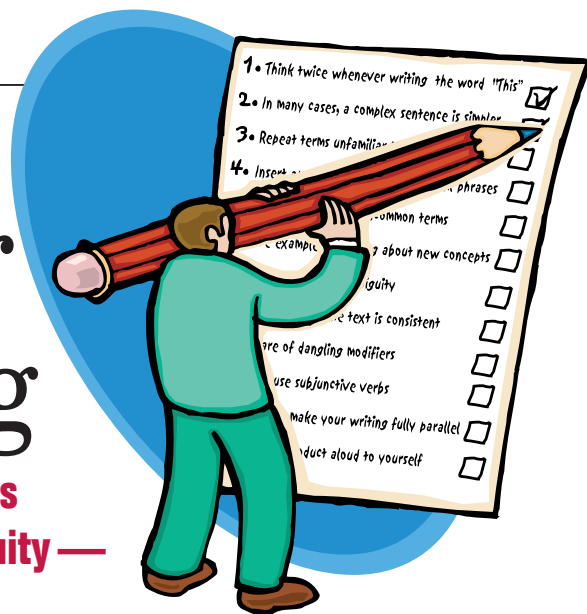
Consider these two statements:

Ethanol and ethylene molecules each contain two carbons, but the olefin has the lower boiling point

and

Lupinine and laurane are both de-

rived from plants, but only the alkaloid seems promising for our project

Both sentences are attractive in that they use synonyms (olefin and alkaloid) to avoid repetition. And if the first one appeared in a manuscript that *Chemical Engineering* was editing for publication, we editors would let that sentence stand as it is, because our typical reader can be expected to know that ethylene, not ethanol, is the olefin. On the other hand, we would edit the second one, by replacing "the alkaloid" with "lupinine" (even at the price of being repetitious), because that typical reader of ours is far less likely to know that lupinine is the alkaloid.

4. When writing about matters not familiar to your audience, give high priority to inserting appropriate connectors or link phrases between sentences or paragraphs

This suggestion can prove to be the most beneficial one in this article. Conversely, a habitual neglect of it can can make your writing far more complicated than it need be.

For one mild example, try rereading the last paragraph under Suggestion 3, immediately above, but with "And" and "On the other hand" omitted. Note that the paragraph becomes somewhat less clear, especially when the reader goes from the second sentence to the third.

For another example, consider the following:

In Germany, there are several important rivers. The Rhine carries a considerable amount of barge traffic. The Seine is likewise important.

To avoid not only ambiguity but possible inaccuracy for a reader not familiar with European geography, add two link phrases:

In Germany, there are several important rivers. For instance, the Rhine carries a considerable amount of barge traffic. Elsewhere in Europe, the Seine is likewise important.

Various examples of link words and connectors appear in the box, on p. 75.

In many instances, not merely a phrase but a transitional sentence can prove valuable for clearly linking two paragraphs, or two sections, of a piece of writing.

5. Take care to define uncommon terms (including jargon and acronyms), even if they are familiar to you. And, define them the first time they appear

A risk for all of us is that the longer we are involved with a concept, the less aware we are that the concept is unfamiliar to others, and therefore needs defining in text.

For many years, for instance, I wrote this magazine's coverage of coal gasification. When writing the early articles, I almost instinctively defined unfamiliar terms, because they were unfamiliar to me as well. Unfortunately, the more years I wrote about gasification, and the increasingly familiar the "uncommon" terms thus became to me, the more often I needed reminding that some readers were newcomers to gasification and, thus, needed the definitions.

At *Chemical Engineering*, we occasionally receive a manuscript in which an uncommon term is, in fact, defined — but not until the second or third time that it appears. Obviously, it should be defined the first time, unless the circumstances are unusual.

6. When writing about concepts that are new, unfamiliar or abstract, try to include examples

In the following sentence, the phrase in parentheses makes the message more clear.

Measures that increase the transmembrane pressure (such as the use of a pump to raise the feed pressure) will raise the resistance of the polarized boundary layer.

Sometimes, clarity can be gained by using "contrary examples;" for instance, by pointing out what something is NOT:

Concentration polarization is the buildup of macrosolutes near the membrane wall when polarized material becomes the flux-limiting step in transmembrane flux. It does not occur when the feed pressure is instead the flux-limiting step.

7. Guard against the ambiguity that may arise with words that can have multiple functions

A great number of English words can serve as either a noun or a verb, depending on the context. And, most if not all nouns can also serve as adjectives. Usually, the intended function of a given word is obvious. But sometimes the writer's intent, and the writing, can be made more clear by very simple insertions. For instance,

report supply cost figures . . .

becomes clearer after the addition of one word and one piece of punctuation:

report the supply-cost figures . . .

In particular, insertion of "the" is a simple, effective way to signal to the the reader that the word following is not being used as a verb.

8. Make sure that the text and its supporting materials are consistent. And explain anomalies that appear in those materials

In many cases, it happens that a report is written by one engineer whereas a table, graph, flowsheet, site plan or photo to accompany the report comes from another source. Once these illustrative materials are in hand, make sure that nothing in them contradicts what the textual material says.

For instance, if the text says that there are nine common causes of pump failure, make sure that the corresponding table does, indeed, list nine, not eight or ten, causes. If your text says that the maintenance costs doubled between 1990 and 2000, make sure that the corresponding graph does show a doubling.

Furthermore, take care that the display materials do not raise any questions of their own, apart from the need for them to agree with the text. For instance, if all but one of the numbers in a column in a table are successively smaller as the reader reads down the column, is that exception accurate or instead, maybe, a keyboarding error? If the number is, in fact, accurate, should the text or the caption explain why the exception arises?

On your graphs, are both (or all three) scales labeled unambiguously?

On diagrams, are all major objects and streams labeled, and do the flow directions for the streams make sense? (Once in a long while, this magazine receives a flow diagram that includes, for instance, a vessel with several outgoing streams but no incoming ones.)

9. Beware of dangling modifiers, and keep in mind that they come in many guises

A dangling modifier is a modifier that does not, in fact, modify the noun or pronoun to which the structure of the sentence assigns it. Consider first this exaggerated example:

Barking furiously, the cat was chased by the dog

The sentence structure dictates that "Barking furiously" should modify the subject of the sentence, but "cat", not "dog," is the subject. So, "Barking furiously" is a dangling modifier.

That sample is obviously poor writing. But note how easy it is to slip into more-subtle dangling modifiers, as in these examples — the first of which is a paraphrase from a recent issue of a highly regarded newspaper:

A student of Niels Bohr, her research covered a wide range of fields. (Better: *A student of Niels Bohr, she did her research in a wide range of fields.*)

or

Taking our seat in John's convertible, the rain began.
(Better: *Taking our seat in John's convertible, we felt the rain begin.*)

or

Installed 20 years ago, the poor condition of this reactor makes it unsuitable for the project.
(Better: *The poor condition of this reactor, which was installed 20 years ago, makes it unsuitable for the project.*)

or

Installed 20 years ago, the readings from the instrumentation on this reactor are erratic.
(Better: *This reactor, which was installed 20 years ago, has instrumentation that gives erratic readings; or, if it is the instrumentation, not the tank, that is 20 years old, This reactor has instrumentation that was installed 20 years ago and gives erratic readings.*)

Note that by the time we descend to this last example, we encounter writing that is not merely imprecise but fully ambiguous.

My colleague, Senior Editor Deborah Hairston, points out that many dangling modifiers arise when the principal clause of the sentence is passive, as in the cat-and-dog example above. This kind of situation can be remedied by making the sentence active instead: *Barking furiously, the dog chased the cat.*

10. Do not use subjunctive verbs, like "would," unless the situation calls for it

Consider this paragraph:

Numerous process situations can increase the risk of inadequate head at the pump suction. These would include, for instance, high fluid temperatures and a low elevation for the feed tank.

Now, high temperatures and low tank elevations do, in fact, increase the risks of inadequate head. But the presence of "would" (perhaps employed by some authors so as to make sentences seem less assertive?) implies a contrary-to-fact situation. So, "would" should simply be omitted.

On the other hand, "would" is quite properly used in this sentence:

If the elevation of this feed tank were low [but it isn't], we would have a risk of inadequate head.

11. Be sure to make your writing fully parallel

First, read the following:

The heat transfer coefficient on the condensing side is significantly higher than on the cooling side.

Then, note that adding one word makes the sentence a bit clearer:

The heat transfer coefficient on the condensing side is significantly higher than that on the cooling side.

Similarly,

All of these operating costs are comparable to reciprocating compressors.

is much improved by rephrasing:

All of these operating costs are comparable to those of reciprocating compressors.

These two examples are especially apt because the missing word or phrase is, in many cases, "that" or "that of" or "those of."

12. After you think you have finished writing, read your product aloud to yourself

It is surprising how many violations of clarity can emerge during this simple exercise.* Most prove easy to fix.

In closing . . .

Keep in mind that the goal of these 12 suggestions *is to improve clarity in expository writing*. If you are writing for other purposes, such as composing a poem or a love letter, some of the suggestions may do more harm than good.

In any case, they are presented with the hope that they will be useful in your career progression. Inadequate university training in communication has often been a major lament of employed engineers — and of their employers. That being the case, developing a reputation for clear writing may help give that career a sizable boost. ■

Author

Nicholas P. Chopey is Editor-in-Chief of *Chemical Engineering* magazine. He has been on its editorial staff since 1960, serving in a variety of positions. Previously, he was a process engineer with Esso Standard Oil Co. (today, Exxon) in New Jersey, and a photo intelligence officer in the U.S. Air Force. He is editor of the "Handbook of Chemical Engineering Calculations," published by McGraw-Hill; its Third Edition is scheduled for release around the end of this year. A member of AIChE, he holds a bachelor's degree in chemical engineering from the University of Virginia as well as a master's degree in economics from New York University.