The intentional search for meaning: developing technical editing skills

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Abstract

The purpose of technical editing is to prepare specific information, for a specific medium, to help a specific audience, accomplish a specific goal. What defines technical editing is its purpose—to help readers act—not the scientific discipline in which it is found. Still, traditions of technical editing differ greatly by subject matter (nuclear physics, field biology), document types (scientific articles, computer user manuals), audiences (regulatory agencies, consumers), and specific publication conventions (writing instruction manuals, documenting experiments). Because technical editing developed in the physical sciences and engineering, the term often refers only to editing in those fields. However, whereas technical editors in industry often enter the profession with degrees in technical communications, editors in other scientific fields typically receive little or no professional training in editing. Accordingly, I describe here four techniques proven to be effective in training technical editors in any branch of science. A basic technique involves applying 12 specific and evidence-based ‘edits’ that improve comprehension. In an intermediate technique, ‘structured editing,’ described here for the first time, editors follow a structured process of analysing and revising a text by completing four sequential tasks. An advanced technique—shortening a 250-word abstract to 100 words without losing content—will develop critical thinking and sharpen language skills. Finally, I describe a collaborative technique based on ‘deliberate practice,’ in which a small group of editors discusses a text in detail, in long sessions, over extended periods, to develop a high degree of skill.

Keywords: editing, training technical editors, technical writing, education

Introduction

It seems clear that whatever most technical editors have learned, they have had to assemble for themselves, picking it up by a kind of apprenticeship and by analogy—both for the Do’s and for the Don’t’s.

Florence E Wall, 1948

In 1948, when Ms Wall spoke these words, training in technical editing was indeed hard to find. Today, in the physical sciences and engineering, more than 100 North American universities offer degrees in technical communication that range from certificates to PhDs. In contrast, I know of no academic writing and editing programmes specific to life science or social science disciplines, other than a few for medical writing and editing. Even then, fewer than 10 US universities offer such programmes, almost all awarding only certificates and focusing on regulatory writing (not editing). Unconfirmed estimates are that Europe has about 30 degree programmes in technical writing and editing and fewer than 10 university courses in medical writing and editing. As described above, unlike many technical editors in industry who enter the profession with degrees in the field, editors in other fields typically lack formal training in technical editing. Some have backgrounds and even PhDs in composition, literature, or journalism. These disciplines develop writing skills but do not address the perspectives and skills of technical editing. In fact, literary, journalistic, and technical writing-editing differ in important ways, (Table 1) including having separate degree programmes, professional societies, and career tracks. All of these differences mean that specific training in technical editing is desirable.

What defines technical editing is its purpose—to help readers act—not the scientific discipline in which it is found. Still, traditions of technical editing do differ greatly by subject matter (nuclear physics, field biology), document types (scientific articles, computer user manuals), audiences (regulatory agencies, consumers), and specific publication conventions (writing instruction manuals, documenting experiments). Nevertheless, the fundamental editing skills are the same. So, for current and future technical editors, I describe here four techniques to develop editing skills.

Why do editors need specific training?

Editing: the art of ‘cutting things out without cutting anything out’

Donald W Bush 1995

The writing we learn in school is not the writing we do in science. In school, we wrote term papers for an audience of one (the instructor), who knew more about the topic than we did, and who did not have to the use the information we provided. Our writing was graded (appropriately) on how well we expressed our thoughts and on the ‘quality’ of our writing, usually its grammatical correctness and organization. In contrast, in science, we write technical documents for a few to a few thousand people who know less about the topic than we do and who have to use the information we provide. In science, technical documents are judged by what readers are able to do with what they read. Thus, writing and editing in the sciences require a perspective and skills that differ from those needed to complete most academic writing assignments (Table 1).
In school, we may not learn technical writing, but we do learn to revise our writing. In fact, ‘there are no good writers, only good rewriters.’7 But revision by an author is not the same as editing by an editor. Editors and authors approach the same text differently:2 Whereas authors focus primarily (but not only) on topics and content, editors focus primarily (but not only) on readers and presentation. Skilled editors have several goals:

- Verify that the text fulfils its intended purpose(s) and addresses the primary audience.
- Confirm that the information is relevant, accurate, complete, and accessible.
- Make sure the writing is clear, organized, concise, and grammatically correct.
- Help readers understand, find, remember, and use information.
- Try not to assume that the text makes sense until it proves that it does.
- Insist on understanding the author’s meaning.
- Look for what is missing, vague, or ambiguous.
- Edit everything (for example, captions, graphs, images, headings)
- Are able to justify every proposed edit and revision.
- Stay visually aware of tables, images, and graphic design and know when these visuals need to be edited, replaced, or removed.
- Check basic arithmetic, such as sums and percentages.
- Evaluate the entire document for its clarity and organization, its effectiveness and usefulness to readers, and its compatibility with standards in the scientific literature or its adherence to the house style of a sponsoring organization.

Most importantly, editors can protect authors from the problems of ‘reading over’—skipping past text that is presumed to be correct but is not—and of ‘reading in’—assuming that needed information has been presented when it has not. Authors are at higher risk for making these mistakes because they are reading familiar content and are looking for accuracy, whereas editors are at lower risk because they are usually processing less familiar content and are looking for consistency.8

The basic technique: 12 evidence-based edits

If all grammarians in the world were placed end-to-end, it would be a good thing.

Judith A Tarutz, 19929

Several specific grammatical forms (hereafter, ‘edits’) can make a text easier to understand.10 Research has established the effectiveness of the 12 edits described below.11-15 Applied together, they can substantially improve the clarity of a text. In addition, applying these edits as part of skilled editing can reduce the length of many texts by up to 30% without losing content.14,15

Below, examples are italicized, and in the sentences, the subject is CAPITALIZED, and the verb is underlined.

Edit 1. Prefer shorter sentences.

Although shorter sentences are often associated with better comprehension, no studies show that simply shortening sentences improves comprehension. Complexity is the real problem.11,12 Shorter sentences simply have fewer opportunities to become complex. Although long sentences can be understandable, consider keeping them to fewer than, say, 25 words.

Edit 2. Keep the verb close to the subject.

The more words between the subject and verb, the greater the chance they will interfere with understanding the subject-verb relationship, which is key to effective communication.11,12 Compare the following sentences:

| Characteristic | Literary, academic, or creative writing | Popular writing/journalism | Technical writing |
|----------------|----------------------------------------|-----------------------------|-------------------|
| Purpose of writing | General: to entertain, enthrall, evoke, soothe, challenge; inform | General: to report and comment on ‘news’; to inform; to entertain | Specific: to provide specific information to help a specific audience accomplish a specific goal |
| Readership | Usually general: a diverse public often differentiated by genre (for example, juvenile fiction; humour) | Usually general: a diverse public often differentiated by market sector (for example, business; world news) | Usually more specific: readers with similar interests and backgrounds in an organization or profession |
| Qualities of the content | Text must engage readers, usually in both content and presentation (style) | Text must engage readers, usually in both content and presentation (style) | Text must provide information needed by readers to perform their tasks |
| Motivation to read | Reading is optional, so the text must therefore be interesting to read; sensationalism can be a value; readers self-select | Reading is optional, so the text must therefore be interesting to increase ‘depth of read’; sensationalism can be a value; readers self-select | Reading is often required or even assigned; readers often self-select when the topic is of interest |
| Evaluation criteria | How well readers enjoy what they read; popularity of the text over time; evaluations by literary critics | How well readers enjoy what they read; financial success of newspaper or magazine; critics’ evaluations of the topics covered and how well they are covered | How well readers understand, find, remember, and use information; usability testing evaluates how well the text accomplishes these goals |
“Every STEP of the procedure, including the criteria for selecting patients, the surgical approach, the operative technique, and the postoperative nursing care, had to be evaluated.”

“Every STEP of the procedure had to be evaluated, including the criteria for selecting patients, the surgical approach, the operative technique, and the post-operative nursing care.”

**Edit 3. Avoid using empty words and clauses.** (A clause is a phrase with a subject and a verb and is thus a complete sentence.) ‘Empty’ words and clauses have no useful information, but readers still have to process them, which takes time and can lead to misunderstanding. In this sentence, “IT appears that the data have been reported correctly,” the words ‘IT appears’ are the subject and verb of a complete sentence (a clause) but provide no useful information. Without the empty words, the sentence becomes, “The DATA appear to have been reported correctly.”

**Edit 4. Prefer the active voice.**
The most common sentence structure in English is subject-verb-object, a structure called the ‘active voice’: The NURSE corrected the chart. Native English speakers are used to having the subject come before the verb, so the relationship between subject and verb is usually clear in the active voice.\(^\text{1,12}\) However, keeping the subject of the sentence consistent with the topic of the surrounding text is sometimes useful. The five sentences below mean the same, but the subject of each reflects the larger topic consistent with the topic of the surrounding text is sometimes useful. The five sentences below mean the same, but the subject of each reflects the larger topic around the sentence: “Changes in costs caused medics to respond quickly.,” “The timely RESPONSE by medics decreased the costs.”

**Edit 5. Be careful when using the passive voice.**
In contrast to the active voice, the structure of a sentence in the ‘passive voice’ is ‘object-verb-subject’: The CHART was corrected by the nurse.\(^\text{1,12}\) The passive voice also always uses a form of the auxiliary verb ‘to be’: is, were or has, have, or had been. (See the last two sentences in the above table.)

Some journal editors still require authors to write in the passive voice, usually because they think the passive voice is somehow more ‘objective’. It is not. “The CHART was corrected by the nurse” is no more objective than “The NURSE corrected the chart”; there is nothing subjective in either sentence.

Contrary to common belief, the passive voice is grammatically correct and acceptable, especially when describing research methods. It is usually as easily understood as the active voice, even though the subject is not in the usual place. The problem comes when the passive voice is combined with nominalizations, as discussed below.

**Edit 6. Use nominalizations only when necessary.**
A nominalization is a verb that has been changed into a noun: ‘to examine’ becomes ‘an examination’. Many nominalizations are common and useful: an amendment (to amend), a breath (to breathe), an injection (to inject). However, when the verb of a sentence is nominalized, it has to be replaced with a new verb, which is typically weaker.\(^\text{1,12}\) In the following 23-word sentence, the nominalizations are in bold:

“The CREATION of such guidelines, including the development of interventions, requires an assessment of the literature, along with characterization of potential risk factors.”

Using the verb form of these nominalizations, the revised sentence becomes:

“CREATING such guidelines, including developing the interventions, requires assessing the literature and characterizing potential risk factors.”

‘Creating’ in this sentence is a gerund, a verb serving as a noun, and is used appropriately here as the subject of ‘requires’. This 15-word sentence is 35% shorter than the original.

**Edit 7. Be careful about using the passive voice and nominalizations in the same sentence.**
When the expected verb of a sentence has been hidden as a nominalization, and because the passive voice makes the subject of the sentence harder to find, sentences in the passive voice that contain nominalizations can greatly reduce comprehension;\(^\text{1,12}\) it takes time to sort everything out:

“REGENERATION of the resin bed is achieved by a calcium chloride solution.”

Revised:

“The resin BED is regenerated by a calcium chloride solution.”

Or, in the active voice:

“A calcium chloride SOLUTION regenerates the resin bed.”

Unfortunately, nominalizations encourage the use of the passive voice, so this combination is common.

**Edit 8. Make the units of a sentence parallel when possible.**
Patterns help readers know what to expect. Compare these two sentences:

“RESEARCH was conducted to determine whether the drug was safe and effective and whether it was well-tolerated for long-term administration.” (20 words)

“The DRUG was assessed for safety, effectiveness, and long-term tolerability.” (10 words; 50% shorter)

**Edit 9. Use personal pronouns (‘I,’ ‘we,’ and ‘us’) where appropriate.**
(Here, pronouns are in bold.) Which sentence do you prefer?
In this chapter, the AUTHORS summarize their research on synthetic ligaments. READERS interested in synthetic menisci should see Chapter 17.

In this chapter, WE summarize our research on synthetic ligaments. For our research on synthetic menisci, [YOU] see Chapter 17.

Some journal editors still do not allow authors to use ‘I’ and ‘we’ because, again, these words are somehow ‘less objective’. However, most readers know that ‘we analysed the data’ is as objective as ‘the authors analysed the data,’ and everyone knows who the authors are. Personal pronouns have been encouraged in medical writing since at least 1900, and there are good reasons to use them in all branches of science and technology.11,12,16

Edit 10. Make sure every pronoun has a ‘referent’ or an “antecedent”; the word the pronoun represents. (Pronouns are in bold.) Consider this sentence,

“Animal STUDIES suggest that flow through capillary beds depends on diastolic times and pressures. Given that these are greater in cardiac patients, THEY may cause hyperperfusion.”

Here, what do ‘these’ and ‘they’ refer to? Capillary beds or diastolic times and pressures? Their referent is missing or ambiguous. ‘Empty’ words and clauses (Edit 3) are often pronouns without referents: ‘these arc’, ‘that was’, ‘who does’. Below, the bolded meaning of ‘they’ is clear, despite following ‘patients’.

“Animal STUDIES suggest that flow through capillary beds depends on diastolic times and pressure. Given that diastolic times and pressures are greater in cardiac patients, THEY may cause hyperperfusion.”

Edit 11. Use only a few common, standard, abbreviations. Abbreviations can save a writer time and effort, but they can potentially confuse and frustrate readers.17 Abbreviations must be defined at first mention because the same abbreviation may be defined at first mention because the same abbreviation may potentially confuse and frustrate readers. However, most readers know that ‘we analysed the data’ is as objective as ‘the authors analysed the data,’ and everyone knows who the authors are. Personal pronouns have been encouraged in medical writing since at least 1900, and there are good reasons to use them in all branches of science and technology.11,12,16

Table 2. The four tasks of structured editing

| Characteristic | Task 1. Determine the literal meaning | Task 2. Sharpen the wording | Task 3. Determine the likely intended meaning | Task 4. Recommend the wording that conveys the author’s intended meaning, meets readers’ needs, and follows publication standards |
|---------------|--------------------------------------|-----------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Questions to ask about the text | What do the words actually say? | What changes would better express the authors meaning? | What did the author likely intend to say? | What changes will better convey the author’s meaning, meet the readers’ needs, satisfy peer reviewers, and meet journal’s requirements? |
| The goal of the task | Determine the meaning of the wording out of context | Edit the wording to more clearly communicate the meaning developed in Task 1. | Determine the meaning of a sentence in the context of the entire text. | Revise the wording to more clearly communicate the author’s meaning developed in Task 3 and reconcile this meaning with other information required to understand and document the research and to meet the needs of readers, peer reviewers, and journal editors. |
| Example of wording | ‘The outcome was negative.’ | ‘The result of the study was negative.’ | ‘The difference between groups was not significant.’ | ‘The mean difference in blood pressure between groups was neither clinically important nor statistically significant (9 mm Hg, 95% CI, 2 to 16 mm Hg).’ |

Editing can be approached in several ways. Technical editors often work with levels of edit.20 Briefly, each level of edit (the number varies, usually from two to nine) consists of content that (mostly) can be edited independently of other levels. For example, an ‘integrity’ edit will verify all cross references, and a ‘language’ edit will address copy-editing issues. Editorial passes is a more general approach in which the text is edited in several beginning-to-end ‘readthroughs’ and improved during each pass.21 Yet a third approach (new to me) is to follow a checklist of 410 specific editing tasks relevant to technical texts, such as verifying that the axes of graphs are labelled and that the text has an appropriate degree of formality.22

Here, I describe ‘structured editing,’ which involves four sequential tasks completed in at least two passes through a text (Table 2). Editors complete two tasks during the first pass.

The intermediate technique: structured editing

Edit technical manuscripts systematically; strive to be as organized and as efficient as possible.

Joseph E Mancuso, 199219

In this sentence, the echo words are in bold:
The hospital installed its new computer system in 2015 and upgraded it in 2018 to accommodate the new diagnostic categories. The system and the new categories have presented medical staff with new reporting problems. These problems are the subject of today’s meeting.

The mean difference in blood pressure between groups was neither clinically important nor statistically significant (9 mm Hg, 95% CI, 2 to 16 mm Hg)."
Several studies have been carried out reporting that appropriate nurse staffing in intensive care units has a positive effect on reduction in the rate of nosocomial infection, bed sore, duration of mechanical ventilation and hospital stay.

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Several studies have been carried out reporting that nurse staffing in intensive care units, if controlled for nursing skill mix and case severity mix, can lower the incidence of nosocomial infection and bed sore and shorten the duration of mechanical ventilation and hospital stay.
The advanced technique: shortening

I would never use a long word when a short one would answer the purpose. I know surgeons who ‘ligate’ arteries. Other surgeons only tie them, and it stops the bleeding just as well.

Oliver Wendell Holmes, Sr (1809–1894)

An excellent training exercise for technical editors is to shorten a 250-word abstract to 100 words (a 60% reduction) without losing content. A trained editor can shorten texts without losing content because untrained writers (authors) typically do not know which features of a text can be routinely shortened or how to shorten them. Some common examples are below; there are many more.

- Use prefixes instead of qualifying words:
  Original: Most neurons had not completely developed.
  Revised: Most neurons were underdeveloped.

- Replace phrases with single, more specific, words that have the same meaning:
  Original: Experiments 1 and 2 were run at the same time.
  Revised: Experiments 1 and 2 were run simultaneously.

- Put common elements first in a list to avoid repetition:
  Original: Median BMI was reduced by 8% in the treatment group, by 6% in the usual-care group, and by 4% in the placebo control group.
  Revised: Median reductions in BMI by group were: treatment, 8%; usual-care, 6%; and placebo, 4%.

The collaborative technique: mentor-guided analytical thinking

Good editors need two basic skills. They need to know ‘what is right,’ and they also need to know how they know it’s right.

Charles Kemnitz, 1994

Mentor-guided analytical thinking is how I was trained to be an editor in 1975. The process involves a mentor, who may be an experienced editor or supervisor, guiding a small group of participants (seven at most; three is optimal) for hours at a time, over weeks or months, in considering and discussing the implications of each word, phrase, punctuation mark, and idea of a text and then proposing changes; in other words, completing the tasks in structured editing. One participant interprets the meaning, strengths, weaknesses, and implications of a sentence, which the group then discusses. When the discussion is over, the next participant takes the second sentence, and so on. Analysing a single paragraph can take hours but it is usually time well spent.

The mentor directs the discussion in several ways:

1. Guides participants to ‘attend’ to the important aspects of both the content and the presentation of a text. The process teaches them what to look for and what to question. The discussions literally go through a text one idea at a time. The goal is to sharpen critical thinking skills and the awareness of unconscious assumptions participants make when reading a text.

2. Uses the Socratic method—the oldest and still the most powerful technique for developing critical thinking—to continually challenge and lead participants in exploring the qualities and options of various aspects of the text. The mentor rarely offers solutions and instead asks probing questions, such as ‘So what?’, ‘If this part of the text is true, what must have been true before and what must be true later?’, ‘What does this word really mean?’, ‘What is the author really saying and why?’, ‘What assumptions is the author making?’ and ‘What do you need to know to really understand this sentence?’

3. Helps participants stay on track during prolonged and intense sessions. Learning to attend to new things involves breaking down less-effective patterns of thinking and developing more-effective ones. The session goes until most participants reach the point of confusion, which is the point at which old thought patterns are challenged and new patterns are being developed.

4. Has participants, on their own time, revise that portion of the text discussed in the session. Revising the text up to, say, three times, and improving it each time, helps participants apply what they have learned and to see how they are developing as editors.

5. Ideally, works with participants as described above at least once a week over several months. The process can be simplified by having, say, weekly discussions about a text for an hour, led by a member of the group who simply directs the conversation without necessarily serving as a mentor.

Mentor-guided analytical thinking is an example of ‘deliberate practice,’ a process identified in studies of how experts become experts. Deliberate practice asserts that expert performance differs qualitatively from normal performance; that experts have characteristics and abilities that non-experts do not have; and that the difference between experts and non-experts is the result of a long-term, deliberate effort to improve performance. The process itself requires learners to:

- be motivated and willing to improve their performance
- attend to the task and exert effort to improve performance
- receive immediate and informative feedback about their performance
- repeatedly perform the same or similar tasks over long periods.

Conclusions

Few people are so devoid of life that they read technical manuals, reports, and proposals for amusement.

Judith A Taratz, 1992

Editors have jobs because “most writers try to economize the mental effort of the writer, not the reader.” Of course, editors, working as editors, are neither writers nor readers, but they are responsible to both and are the link between those who create ideas and those who use them. Thus, their goal is not to find every weakness in the document but to provide edits that will cause the author to produce the best possible document.
Competing interests
Tom Lang is an associate editor of *European Science Editing* and self-employed as Tom Lang Communications and Training International.

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