# What I learned on my summer vacation

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Some of you may recall that at the last SEG Annual Meeting in Dallas, I offered a Continuing Education course on technical writing and editing. You probably don't know that the course was canceled — a grand total of two people signed up! Needing a minimum of 15 enrollees to break even ... well, the rest is history. However, all was not lost. I used the preparations for that course to give a similar but somewhat longer course (in English) this past summer at Seoul National University, Korea.

Preparing a course is a wonderful learning experience. My wife, a past editor-in-chief for a magazine, who now earns a living writing books and articles, can attest that I spent my summer vacation devoting a great deal of time to those preparations. It was an effort that has now paid doubly, because it is the seed for this new *TLE* column.

My vacation reading was a series of books on technical writing and editing. Initially, I thought these books would be dry but necessary reading. To my surprise, I found these books particularly enlightening. Being an Associate Editor of GEOPHYSICS since the late 1980s, I thought I had a pretty good understanding of the micro-to-macro elements, characteristics, nuts and bolts, etc. of good technical writing and its cousins: reviewing and editing. I was awed by how much more there is to this craft, art, gift, ability … My eyes were opened to the precept that, although I may have intuited, I never formally inventoried the elements and facets of technical writing.

The eye-opening issues, concepts, principles, insights, recommendations, etc., that struck me most are the essence of this inaugural column. All are important and each could be the subject of a lengthy discussion — some, in fact, may make up future columns. You will notice that I am not trying to wax literary and that I am using a pretty straightforward "list" style. Generally, I'll sacrifice style for the sake of clarity … but that's a story for another day. I've grouped these pearls into the four elements-of-the-task: the document, the writing, the writer, and, yes, the reader, without whom there would be no point in *the writer writing the document.*

Read this list of thoughts — distilled from my notes — and see if there is anything that catches your eye or that expresses what you may have pondered about your or others' writing, editing, and reviewing.

**Technical documents — the goal.** First and foremost, without publication, there is no science. Science done but not disseminated is the same as science not done. This is why technical papers must be written and why they must be useful, usable, and used. If a technical report should *inform* managers, colleagues, and others about work in progress … or if a journal article should have a *useful* life-after-publication … *why are so many technical documents neither useful, usable, nor used?*

But try we must to make them better. A publication may be the only permanent record of work. And good work deserves a valuable archive.

"... An acceptable primary scientific publication is the first disclosure containing clear and sufficient information to enable peers to (1) assess the findings, (2) repeat the work, and (3) evaluate the intellectual process," says Steven Day (*How to Write & Publish a Scientific Paper*, 4th edition, Oryx Press 1994). I find this is a solid base on which to begin to judge a technical document.

In this same vein, a successful technical document encompasses three dimensions:

- Information — complete, clear, and useful
- Persuasion — influences readers
- Ethics — true and accurate

In reading technical documents, especially journal manuscripts, I find that persuasiveness is typically unrecognized, overlooked, or ignored. Most technical writers seem to believe "the science will sell itself." It doesn't! There are very few who, in my opinion, try to convince us of anything, and so they don't.

**Technical writing — tools of the trade.** Poor or weak writing hurts, delays, obscures, and can prevent good science — readers can only know what is written, not what is *intended* to be written. Poor or weak writing also hurts, delays, and can prevent publication.

So what makes a technical document poor or weak? That's a really tough question and, if it were easy to answer, we'd all be great writers! One plausible answer is that the document fails to harness all the fundamentals that can make a document strong:

- Content — Is it worth reading?
- Organization — Is the reader guided and are keypoints emphasized?
- Clarity — Is it a *writer's* paper or a *reader's* paper?
- Style — Is there an economy of words and is it easy to read?
- Visuals — Do graphs, pictures, tables, etc., clarify concepts and relationships?
- Format — Is it accessible and appealing?
- Supplementals — Are appendices and references used wisely and do they broaden the appeal to include readers with varying needs and abilities?

Successful technical writing is more like journalistic than creative writing. The five eternal questions every newspaper hack vies to answer, scientific writers should make their own:

1) What was done?

*(Editor's Note: The "Writer's Block" is a new bimonthly column on technical writing and editing issues by Ken Mahrer, a five-term Associate Editor for GEOPHYSICS. In the author's words: "Writing a column is new to me, so I will be feeling my way along. However, I don't intend this column to be an attempt to teach technical writing — I'm still wrestling with whether or not I believe that is possible. At this point, my intent is to (1) increase awareness of technical writing and editing issues, (2) encourage readers to consider or reconsider their approaches to technical writing and editing, and (3) give readers some tools to be more effective reviewers.")*

2) Who "done" it?
3) Why was it done?
4) How was it done?
5) What was learned?

Even as these questions are answered, there is something else to remember. Technical writing is not simply writing about technical work. As I am trying to show, it has other characteristics and facets, perhaps the most important of which is reproducibility: *Technical work must be reported in sufficient detail to allow a reader to reproduce or verify that work.*

At the core of a lot of weak writing is the mistaken belief on the scientist/author's part that writing a paper wraps up a project. "I'll be glad when this is over!" Not so! Each project really consists of two problems. The first is the project. The second is the reporting: finding the means to encapsulate the project effectively. Typically, the second problem is not recognized as such. It is seen as a necessary and final exercise, not as a specific problem demanding its own specific solution.

**The writer — craft and creativity.** Technical writing is an integral part of every technical professional's career; typically, we spend one-fifth or more of our time pushing pen, keys, or mouse. Ironically, most of us have never studied technical writing. From this, it would seem that, unlike our other professional skills, technical writing comes to us by magic or osmosis or is transferred with the handshake when we receive our degree(s). (I'm as guilty as everyone else!)

Although writing may come easily to some, most authors in all fields face the dreaded "writer's block" (there, I worked it in!), struggle to add pizzazz to an otherwise bland or heavy subject, are dissatisfied with the outcome, and fall prey to endless rewrites. Conscientious technical writers have those worries and some additional ones. Technical writers can very easily *lose sight* of their effort and trip over common pitfalls:

1) Not matching the writer's objectives with readers' needs and interests
2) Including more information than is needed
3) Adding irrelevant and uninterpreted information
4) Implementing a confusing organization
5) Using jargon and vague technical expressions
6) Being wordy
7) Using poor visuals

However the work is handled and published, the fact remains, *if the reader is confused, the writer has failed!* No one but the writer is accountable for this failure. Still, frustrated writers who reply to questions or comments by saying, "Read my paper more carefully" aren't rare.

An example comes to mind involving a long, multiple-chapter technical report I edited some years ago. After spending more than 10 days editing, I went to the author and explained that I had spent so much time on his report because it was hard to read. Among its many flaws it particularly lacked flow, continuity, or logical development. For example, key, new topics were cavalierly used in the early chapters but were not referenced or explained until later chapters. The author's reply surprised me. He calmly said, "That's the readers' problem, not mine. The information is there. Let 'em figure it out!"

To this I can only say: *The burden of proof is on the writer, not the reader!*

Successful writers have a good conceptional understanding of their readers' profiles. They don't de facto direct their writing to one famous expert. Instead, they recognize that:

1) The reader is not a captive audience.
2) All readers are not the same.
3) All readers are not like the writer.

**The reader — our target.** Here are some insightful notes I jotted during my summer reading.

1) Understanding is a complex process combining a reader's knowledge, attitude, and reading behavior.
2) A reader extracts new information and tries to associate it with some given or previously known information (Haviland and Clark, "What's new? Acquiring new information as a process in comprehension," *J. Verbal Learning & Verbal Behavior*, 1974).
3) "Readers do not simply read, they interpret," (Gopen and Swan, "The Science of Scientific Writing," *Am. Scientist*, 1990).

Readers have needs. Part of a successful document is meeting these needs. From a document, the reader should gather:

1) What information is important
2) Where to focus attention
3) What to be thinking about
4) What to remember

5) What "it" looks like
6) How "it" is organized or related
7) How the work was done
8) What the work means

Readers also have interests. Successful documents explicitly address these interests, just as they handle the readers' needs. Particularly compelling is the question in every reader's mind: How will this work or information help me?

Furthermore, readers have expectations. They expect an efficient document that sorts, organizes, and interprets information suiting their needs, interests, and abilities. Writers who don't recognize this don't get read!

Our electronic world of Internet, databases, faxes, etc., has greatly expanded readership beyond a few select specialists within the discipline of the author. Successful writers recognize this expanded market for their work and write with it in mind.

A *user-friendly* document is built by recognizing how hard a reader must or will work to "get the message." A user-friendly document stays within the reader's limits for:

- Orientation and efficiency — quick, clear, concise, and unambiguous
- Accuracy — objective, bias-free, ethical
- Comprehensiveness — complete, self-contained, accessible, verifiable
- Interest — useful and applicable
- Correctness — grammar, syntax, punctuation, word usage

Now you know what I did and learned on my vacation. I hope you gained something from reading it. I also hope that the next time you read a strong or weak article or document, you recognize the items and elements that make it strong or weak. This is especially true when either I or one of my co-Associate Editors asks you to review a manuscript for GEOPHYSICS. Thanks for your interest. I hope I can continue to deserve it.

*Kenneth D. Mahrer, when not musing over manuscripts (he's been an Associate Editor for GEOPHYSICS since 1989) or sweating over being a new columnist, maintains a flexible, eclectic professional career — i.e., a résumé way of saying repeated unemployment has led to diversification. He willingly admits his proclivity to do "just about anything for a buck!" Presently, he is a senior research scientist at the Denver Research Institute, working on geophysics and — proving his versatility — law enforcement projects. He is also an associate research professor in the Engineering Department, where he teaches whenever asked, and an active adjunct professor in the Physics Department, both at the University of Denver. Prior to this stop, Ken worked on a variety of projects including electromagnetic detection of near-surface anomalies and containments, characterization and longevity predictions for the DOE High-Level Nuclear Waste Repository at Yucca Mt., Nevada; the development of an impulsive borehole seismic source; and the research and commercial development of microseismic monitoring of hydraulic fracturing. After receiving bachelor's and master's degrees in physics, Mahrer received his PhD in geophysics "shortly after the plates began to move" (i.e., when plate tectonics research was first getting big at universities and dinosaurs no longer ruled Earth).*