Why and What for (Four): The Basis for Writing a Good Introduction

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INTRODUCTION

The systematic writing of the introduction of a paper is important because the introduction outlines several important aspects of the paper and because the writing process focuses the thoughts of the author upon the logical organization of his presentation. Most scientists and engineers have received little formal training in writing and write introductions by a "seat-of-the-pants" method that involves mostly intuitive or experiential feelings as to the proper contents and sequence, causing some items to be left out or put out of order. While there is no hard-and-fast rule for writing good introductions, the author has discovered a sequence of five topics that will be helpful to most authors of technical papers. The author has attempted to describe in a systematic fashion the requirements for a good introduction, to list them in a memorable way, and to illustrate their use. The present short note describes the five-point approach and gives some examples of its applications.

BACKGROUND

"Well begun is half done," reads the old English proverb. This adage holds true in the writing of technical papers. Once the scientist or engineer has completed his technical work and sits down to face a pad of paper or a word processor, his work begins in earnest. He has plenty to write about. He has an urge to tell the whole world. Yet how to begin? He ponders, sips coffee, squirms in his chair, smokes nervously, and ponders more. Technology is his forte, not literature. It was rough in college; it is even worse now.

Writing a good introduction is the first step, the "well begun" part of the proverb. Once this is accomplished, the paper does *seem* half done. There may be reams of writing under other sections, such as theory, experiment, results, and discussion, but the introduction is the initial obstacle to overcome if the rest of the paper is to fall into place.

The introduction ought to inform the audience about the author's effort. Certainly, the work was worth doing, wasn't it? Why should the author want to tell me (the audience) about it? Why should I want to read about it? Even if he and I have a personal interest in his subject, why is it worth printing in the archival literature? What is the reader to look for as he reads onward (or decides not to)? The introduction begins to answer these questions, serves to orient the reader, and attempts to convince him to read further. It is the salesman's "foot in the door" translated into literary terms. When written effectively, it also organizes the thoughts of the author so he can write more effectively and complete his task more quickly.

THEORY

To be effective, the introduction should answer the questions "Why and What For (Four)?" Expanded, these questions are:

- *Why* is the topic of interest?
- *What* (1) is the background on the previous solutions, if any?
- *What* (2) is the background on potential solutions?
- *What* (3) was attempted in the present effort (research project)?
- *What* (4) will be presented in this paper?

This mnemonic format really works. The author formalized it by analyzing the introduction to a manuscript written by another ASNT member. That introduction was so logical and complete that it seemed worth summarizing for wider use. The resulting summary was the mnemonic, "Why and What For (Four)," cited above. After twenty years of writing introductions that were incomplete, out of order, verbose, and probably less effectual than they should have been, the author has adopted the above format and finds it very useful.

EXAMPLES

The following are very short examples of introductions written by using the "Why and What For (Four)" method for hypothetical technical papers. Any correspondence between these and the output of real people is purely coincidental. However, by using exaggerated examples, the principles are illustrated.

Ultrasonic Transducers with No Beam-Spreading, by P. Z. T. Backing

Why is the topic of interest? Ultrasonic transducers with no beam-spreading and constant amplitude and phase profiles within the beam would be useful in studies of flaw detection and materials properties. Quantitative nondestructive evaluation could be done expeditiously because the wave impinging upon a flaw would be exactly known and very simple in form. Ultrasonic attenuation and velocity measurements could be made in all sizes of specimens without recourse to beam-spreading (diffraction) corrections and without interference from sidewall boundaries.

What is the background on the previous solutions, if any? Up until the present time, available ultrasonic transducers have produced beam spreading of both the central lobe and the geometrical side lobes of energy. The

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most advanced laboratory techniques to date have produced a Gaussian central lobe that spreads without side lobes. None of the present transducers can produce constant amplitude and phase fronts within the beam.

What is the background on potential solutions? With the advent of microelectronics, the possibility has arisen to build a phased array transducer on a piezoelectric macrochip using a three-dimensional, multi-layer printed circuit for a backing. A small handheld transducer with a 1000 × 1000 array of radiators and 10 circuit elements per array element should be capable of producing the desired phase and amplitude effects.

What was attempted in the present effort (research project)? In the present study, the theory was worked out for the proposed transducer and also for a 10 × 10 array pilot model. This model was built and tested experimentally. The pilot model was evaluated by several electronic and optical methods. Three critical experiments were then performed on quantitative flaw evaluation, ultrasonic attenuation, and ultrasonic velocity, respectively.

What will be presented in this paper? In this paper, the theory will be presented for both arrays. Construction details of the pilot model will be given. The most relevant results of its evaluation will be shown, and projections will be made concerning the expected improved performance of the 1000 × 1000 array. The results of the three experiments will also be enumerated, and comparisons will be made with results found using presently available transducers. Some fundamental limitations will be pointed out.

A New Method for Transporting Potable Water, by Aquus Transductus IV

Why is the topic of interest? Potable water is in short supply in several cities while it is abundant in the adjacent provinces, particularly in the mountains not far distant. It would be advantageous to transport the available water from the locus of supply to the locus of need without the continual burden on human and animal transport systems presently employed.

What is the background on the previous solutions, if any? Previous facilities such as wells and cisterns are proving inadequate for the urban population. Ox carts with large barrels are an interim measure, but they are of limited utility because they overburden the roads and cannot be relied upon in seasons when the oxen are needed for farming. Terra cotta pipe, used first in Crete by the Minoans, is usable only for short distances. It cannot withstand the hydrostatic pressure in a valley when the line of flow is down one hill and up another. Previous proposals for elevated aqueducts have been rejected as infeasible because of the short span bridged by a single lintel stone. See, for instance, the width of the gateway of the Temple of Agamemnon and the number of columns needed in the Parthenon.

What is the background on potential solutions? The proposed solution is an improved elevated aqueduct based on a new invention—the "arch." The "arch" is a structure of fitted stones describing a circle in the vertical plane. It can span a gap at least one order of magnitude longer than is possible with the largest practical lintel stone. Masonry structures, which can support great loads, can be built on top of the arch. The load-bearing capability of an arch is derived from the exact angles of the faces of the stones within the circle. The resolved forces from the load above and including the arch are thus transmitted perpendicularly to the faces of the stones, resulting in a stable structure because there are no shearing forces on the joints and essentially no flexural forces on any stone, the nemesis of a lintel. The arches can be built atop columns, so the gentle slope of an aqueduct can be maintained above variable terrain with only I/X as many columns as needed previously. This should result in a cost saving, making the new design feasible.

What was attempted in the present effort (research project)? In the present effort, an experimental aqueduct, XVIII stadia long, was built from the south branch of the North River to the eastern cistern of Westium. The cistern was enlarged, and control gates were constructed. The facilities were manned by the MCMXVI Engineers. This having been done, the aqueduct was operated for XIV months.

What will be presented in this paper? This paper will give the theory of the "arch," the method of calculating the angles of the faces of the stones including the "keystone," and the details of the masonry construction. Also, flow data for the rainy season and the dry season will be presented, demonstrating successful operation.

CONCLUSION

The "Why and What For (Four)" method of writing introductions to technical papers can be applied to most subjects. The reader will note that the first paragraph of this article contains five sentences that apply the five points of the method to the present subject—writing introductions. The two tongue-in-cheek introductions shown are more extensive examples. If authors choose to use the "Why and What For (Four)" method, they and their readers will reap the benefits of clarity, conciseness, simplicity, and completeness.

Write a Good Technical Report

GAEL D. ULRICH

Abstract—A *good* **technical report can have an important effect on a wide range of people. Here are some techniques to help you prepare, choose a suitable structure, provide the right amount of information in the right places, and make your points with clarity. An informal style—using "I" and "we," for example—is acceptable for technical reports and publications. To improve your writing, read good writing by others and invite criticism of your own; practice is important.**

IN the beginning, the story goes, God, after creating humankind, was defining the professions. "Anticipating that squabbles would ultimately develop between chemists and chemical engineers, He decided to settle the issue once and for all, dictating to His typist, 'All a chemical engineer does is *right*.' Unfortunately the typist misspelled the last word" [1]. At times, many of us might agree that all a chemical engineer does is *write*. Some feel we don't even do that very well and that we're getting worse. In a recent survey of educators and industrialists, for instance, some respondents complained that language skills among chemical engineering graduates had deteriorated severely in recent years. Others, according to the reporter, felt simply that the skills were not better than before—abominable [2].

I have heard some managers in industry claim that communication skills are more important than technical competence. I do not agree. Communication would be unnecessary if there were no technical result to report. (It does, indeed, require exceptional writing or speaking skill to camouflage an inept or incomplete engineering job.) But I do agree with a variant of the managers' statement: "Many exceptional engineering jobs go unappreciated because of poor writing or speaking." With this in mind, let us consider the elements of effective writing.

PHILOSOPHY OF TECHNICAL REPORTING

Unlike politicians, engineers should write with the hope that readers will find their errors. It is much less embarrassing and painful for an engineering mistake to be found in print before it appears in fact. Thus, a technical report should be designed with clarity as the major goal.

Basic honesty is a key ingredient of clear writing. If there is no concrete result or recommendation, say so. Perhaps your most important contribution will be to expose a question or a mistake. Such honesty may not always pay off immediately, but a reputation for integrity is worth the wait. Reports intended to reveal rather than obscure will be better understood by others and, when deserving, will be defended by them.

MECHANICS OF REPORT WRITING

An outline does wonders to initiate the writing process. Professional or experienced writers often outline their work mentally, not formally. However, judging from the indictment in the first paragraph of this chapter, you should prepare a written outline if you are a student or an engineer. As an example, a skeleton outline of this chapter is shown in the box. (Of course, the real outline is scribbled on three sheets of paper with numerous insertions and marginal notations.) As you prepare your outline, think about the audience. Van Ness and Abbott [3] caution that readers of most technical reports

1. Are busy or at least believe so.
2. Have a background similar to yours but know much less about the project in question.

Other reader characteristics may prevail under various circumstances. In fact, the abstract and summary of a report are often designed for administrators and business people with nonengineering backgrounds.

"Joe, we need your report. Is it about ready?"

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Outline
Chapter Nine
REPORT PREPARATION

- I. Introduction
  - (Attention) "Skills no better than before–abominable."
    - A. Importance of communication skill.
      - 1. More important than technical skills? Hogwash.
      - 2. "All an engineer does is write (right?)."
    - B. Philosophy of writing.
      - 1. Honesty.
- II. Mechanics of report writing
    - A. Outline.
      - 1. Reader identification.
      - 2. Who, What, When, Where, Why, How?
      - 3. Write conclusions first.
      - 4. Review literature or calculations.
      - 5. Write thoughts on sheets of paper.
    - B. Structure.
      - 1. Cinnamon roll.
      - 2. Dangers of rigid format.
      - 3. Sample outline.
        - a. Purpose of section.
          - i. Present technical information.
          - ii. Define, recommend, encourage, promote action.
          - iii. Data repository.
        - b. Sample format (see Table I)
    - C. Length.
      - 1. Long enough to reach the ground.
      - 2. 50-mile hike.
- III. Style and technique.
  - (Interest) Hydrochloric acid to clean pipes.
    - A. First person, humor, informal versus formal.
    - B. Fog Index.
    - C. How to improve.
      - 1. Practice, practice, practice.
      - 2. Invite criticism.
      - 3. Read good writing appreciatively.
      - 4. Read bad writing critically.

Some suggestions by Bolmer [4] for preparing a speech are also appropriate for prose. At each juncture, ask the magic questions: Who? What? When? Where? Why? How? The answers will usually lead you to the next step. Bolmer also suggests writing or identifying the conclusions first (asking the same questions) to provide focus in the outline. Next, review your notes and write prominent thoughts, quotations, and ideas on slips of paper. Do not then cast them into the air and pick them up randomly from the floor. Instead, organize them as your mind directs. In the shuffle, some ideas might appropriately land in the wastebasket.

Report Structure

Composing a report is much like baking cinnamon rolls. A cook does not put dough in one pile, raisins in another, cinnamon and sugar in a third, and then bake the ingredients separately. Neither does one place all the materials in a blender and atomize them into a uniform mass. Instead, individual elements are assembled wisely and in proper proportion to yield an interesting, attractive, and tasty result. So is a report organized to provide mental nourishment, impetus, and satisfaction.

I see three primary purposes of a design report:

1. To present technical information.
2. To serve as a repository of data.
3. To promote or define action.

The first two might be viewed as the dough, the third as cinnamon and raisins. Unfortunately, I cannot give you an exact recipe for composing a report. A rigid outline for all reports and situations is stifling. However, for a beginner, a skeleton format may be helpful. The format illustrated in

TABLE I
SAMPLE FORMAT FOR A TECHNICAL REPORT

Division	Section	Purpose: Present Information	Purpose: Data Repository	Purpose: Promote or Define Action
I. Beginning procedural section (front matter)	Letter of transmittal Title page Table of contents Abstract			
II. Summary	Summary			
III. Body	Introduction (background, literature survey, theory, etc.) Method of approach (procedure) Results Discussion of results Conclusions Recommendations			
IV. Concluding procedural section (back matter)	References Appendix			

Table I is discussed in detail. As you read about each section, think which of the foregoing purposes is satisfied. (I have provided space in Table I to keep score; I divulge my ratings later.)

I like to think of a report as containing four divisions: a beginning procedural segment, the summary, a body, and an end procedural segment.

• *Front Matter*
The beginning procedural segment usually contains a *letter of transmittal, title page, table of contents,* and *abstract.* It is much like the pages at the beginning of this book numbered in lowercase roman numerals. (This section is known as "front matter" in the publishing business.) In many reports, especially brief ones, some of these components are unnecessary. In a short or letter report, the title, abstract, and beginning of body may appear on the first page.

• *Summary*
The *summary* is an isolated section because it is often circulated separately to a wider audience that includes managers and nontechnical readers who are concerned with action and recommendations rather than computational detail. Because of its political impact and importance in decision making, the summary should be written most carefully, emphasizing vital conclusions and recommendations. Supporting data must be summarized and presented clearly and interestingly to a less sophisticated reader. Illustrations should be used effectively but sparingly. Since the summary is based on the broader report, it is, of course, written last. It appears, however, near the front of the finished document as shown in Table I.

• *Body*
Asking who, what, when, where, why, and how leads smoothly to an efficient outline for the report body. An *introduction* of some sort is necessary to bring the reader "up to speed." Historical or chronological structure is ofttimes effective in this section. If appropriate, *literature survey, theory,* and other topics may be folded into an introduction or inserted as separate sections.

To evaluate your report, a technical reader must understand how you derived the results. A section on *approach* or *procedure* serves this need. It should be written in a way that permits a reader to duplicate experiments or calculations independently if necessary. In a design project, pivotal assumptions and bases should be included and, where appropriate, explained. More common assumptions are listed in the appendix or not at all. Detailed calculations should not be placed here or in the appendix. They belong in your files. Representative sample calculations should be in the appendix.

A key structural role is played by the *results* section.

Information vital to the final conclusions and recommendations is found here. Peripheral data should be in the appendix or in your files. Inclusion of unnecessary detail obscures vital results.

The results section is followed by the *discussion* or *discussion of results*. This is where logical conclusions are exposed. Many authors fail to develop and manipulate their data enough. One table in my book, for example, was assembled from ten sources. I spent hours arriving at a format, days defining the details. This single table required more than a week's hard labor. The original ten sources could easily have been reprinted directly but I wanted focused data, not diffuse data. Many engineers do not invest enough energy in massaging results. They are satisfied with detailed tabulations of numbers when refined charts or curves would tell the story better.

The *conclusions* and *recommendations* sections represent the apex of your report. As you outline these sections, think, analyze, and ask the magic questions. Skilled technical writers, not unlike popular authors, often use suspense to create a climax. Since preceding sections have created a focusing effect, this segment can be concentrated and brief. Often conclusions and recommendations are combined into a single section. Sometimes recommendations are presented as a numbered list of statements.

How you say it *does* make a difference. We could imagine someone walking down a corridor, stopping at each door, knocking, and politely stating, "My senses perceive a conflagration at the extremes of this structure. I advise you to depart with haste." A real messenger would, of course, race up and down the hall screaming "Fire! Fire!" Provocations and emotions created by screaming "Fire!" in a technical report sometimes cause regret. On the other hand, we want readers to sit up, take notice, and, in many cases, act. Of the two approaches illustrated, a tone nearer "Fire!" is suggested.

• *Back Matter*

The final procedural section will not be opened by many readers, yet it serves a fundamental role in supporting the report. Not only should we be considerate of our more technical readers who will read this section but also want to help them find any mistakes that might be present.

References can be presented in any logical, consistent format so long as they are clear and unambiguous. The format used in this book should be acceptable in most reports. As a reader, I find article titles informative and recommend their inclusion. Sometimes, authors try to impress readers by citing exhaustive lists of nonpertinent references. This creates the same result as unnecessary detail in the text—foggy and misleading communication.

Efficiency and clarity are traits of an effective *appendix*. Sometimes, students dump their raw calculations here to prove the work was done and to impress the teacher. As a reader, I am confused, discouraged, and angered by this strategy. Writers often fail to separate the wheat from the chaff. In almost every case I have seen, computer printout is chaff and should not be included in the report. Raw calculations are also chaff and should remain in your files. They do serve nicely, nonetheless, as a useful outline for preparing the appendix. Illustrative and sample calculations selected critically from your work provide effective support to more focused information found in the report body. An effective appendix demands the same kind of creativity as any other part of the report. Sometimes even good authors are careless with this section.

By the way, in my opinion, purpose 1 (to present information) applies to the letter of transmittal, title page, and table of contents in Table I. The abstract, summary, discussion of results, and conclusions accomplish the same end and promote or define action (purpose 3) as well. Purposes 1 and 2 generally suit the introduction and approach sections. Action is promoted and defined primarily in recommendations. References and the appendix serve as data repositories.

I reemphasize that the outline is only a suggestion; the nature of the project—and your personality—shape the structure of the report. This reminds me of my first 50-mile backpacking trip. I had listened to a man who frequently hiked in California's Sierra Mountains. He stressed the importance of lightweight packing and illustrated it by telling how he took only three pair of socks. He wore two pair and carried the other. When camping for the evening, he changed socks and washed out the sweaty ones; laying them on a warm stone. The next morning, they were dry and ready for the day's hike.

I tried the same technique on a trip in the Appalachian Mountains in New England. What succeeded in dry California failed miserably and odorously in the Northeast. (Where does one find warm rocks in the rain?) Consider the situation in designing a report. Is yours a three-sock or a nine-sock project?

Report Length

The question of report length might be answered the same way Abraham Lincoln answered a query about a man's legs. He said they should be long enough to reach the ground. A report should be long enough to tell the story.

Length is also somewhat dependent on audience and other circumstances. Many of us, infatuated with our own writing, tend to inflate its length. The old saying "Length of a graduate thesis is inversely proportional to the data it contains" is boringly valid at times. It's as though there was a minimum weight limit. Even though I am considered sparing with words, a ruthless but respected critic eliminated about 20 percent of what was originally drafted for this chapter. The improvement was worth the pain.

STYLE AND TECHNIQUE

Some years ago, a New York plumber discovered that hydrochloric acid was dandy for cleaning clogged drains. He sent his suggestion to the National Bureau of Standards.

"The efficacy of hydrochloric acid is indisputable," the Bureau wrote back, "but the ionic residues are incompatible with metallic permanence."

"Thank you," replied the plumber. "I thought it was a good idea too."

Finally, someone at the Bureau wrote, "Don't use hydrochloric acid! It eats hell out of the pipes!"

No doubt, crisp language communicates ideas efficiently. No one knows how many years scientific and technological progress has been retarded by foggy writing. Communication professionals have been criticizing the characteristically formal impersonal language of science for years. Yet, we still encounter unpleasant examples in our professional literature. Fortunately, promising trends are evident and we find more humor and use of first person in modern technical prose. Van Ness and Abbott wrote [3]:

> For many years the dominant attitude with respect to scientific and technical writing was that it should be impersonal, because science and technology were said to be impersonal. This forced adoption of the passive voice and promoted the lifeless syntax, the witless style, to say nothing of the grammatical mistakes of technical prose. We repudiate the whole of it. Not only does habitual use of the passive voice make for dull writing, it forces a convoluted style almost impossible for an engineer to make concise, precise, and grammatical. *I* and *we* are not four-letter words; they are entirely acceptable in technical reports and publications. We do not suggest that every sentence start with *I* or *we*; one seeks variety. If you are too humble or shy to bring yourself to write *I*, use *we*, in the sense of you, the reader, and I, the writer. *One* also has its place. Do not think you can avoid responsibility for what you write by adopting an impersonal style. No way; your name is on the title page. Take some pride in it; you are the expert.

The entire article is a useful guide for engineers.

I remember speaking, not long ago, with a student who went to work at DuPont. As a new recruit, he spent his first month on the job in a writing course. Instructors emphasized informal personal style because it makes written communication so much more effective. If the largest U.S. chemical corporation believes in it, we should feel free to promote it.

In the following example, the information about a project is written at different levels of formality:

> This experiment was designed to define the relationship between temperature, time, and location in the curing of a polyurethane automobile bumper. It was initiated because of failures in certain applications.

> About five percent of the bumpers we manufacture for the new Z cars are dropping from the vehicles at subfreezing temperatures. In a crash program to salvage our contract with Studebaker, Jean Doe assigned Dan Jordan and me to analyze the curing process and isolate any flaws.

Unfortunately, not all organizations tolerate informal technical documents. You may find the need to aim your language somewhere between that befitting an automobile purchase agreement and that in a letter to an intimate friend. However, grammar, punctuation, spelling, clarity, and precision of writing at any level of formality can be improved. As guides to the technical rules for good English expression, references 5 and 6 are recommended.

A recent article in *Science 82* [7] discusses the Fog Index used by Douglas Mueller, a writing consultant. It is a measure of writing clarity. As reported in that article, big words and long sentences are the two major culprits. The Fog Index puts these factors into a simple formula that tells how many years of schooling are needed to read a sample easily. The first letter to the plumber has a Fog Index of 26. To understand it requires a Ph.D. and seven years of postdoctoral study. The second letter, with a Fog Index of 6, should be clear to a sixth grader.

The article continues to describe how to calculate a Fog Index. My 12-year-old son Thatcher, intrigued with the challenge, computed indices for two important recent documents created in our family. A selection from the preface of this book scored 15, low enough for students with 12 years of grammar and high school and three years of college. My wife's recent book on colonial history rated 11. According to *Science 82*, she wins.

> At what Fog Index should a writer write? "A low one," says Mueller. The nation's largest daily newspaper, *The Wall Street Journal*, got that way by lowering its Fog Index to 11. *Time* and *Newsweek* also average 11. *The New Yorker* usually comes in under 12. Technical journals range a lot higher, but most are notoriously hard reading, even for specialists. Good technical memos, according to a recent study at Bell Laboratories, average only 14. "The truth is," says Mueller, "no matter what Fog Index your readers can tolerate, they prefer to get their information without strain." Mueller says he's never met anyone, in any field, who couldn't lower his Fog Index to 15. "Einstein could. It's easy. Just keep your average sentence length under 20, cross out every useless word, and never use a Big Word unless you absolutely need to. Remember: The less energy your reader wastes on decoding your language, the more he'll have left for your brilliant ideas" [7].

Some examples, prominent and otherwise, were also given. From a business letter:

> We might further mention that we would be glad to furnish

any one of these whistles on a trial basis, to the extent that if the smaller size was not adequate enough, it could be returned in lieu of the purchase of a larger size, depending upon actual operation and suitability of your requirements for signal distance and audibility. (Fog Index: 28)

Translation:

If your whistle isn't loud enough, send it back and we'll give you a bigger one. (Fog Index: 6)

From the scientific journal *Nature*:

The current fashion for environmental impact assessment (EIA) is partly explained by the continuing force of the environmental protection movement in Western countries. That movement is now under severe pressure from economic recession, and there are signs that impact assessments themselves will play a decreasing role in planning and development. Certainly, this is the message that emerges from the U.S.A., where the emphasis is switching back to the costs of environmental protection. (Fog Index: 17)

Opening of the Gettysburg Address:

Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war, testing whether that nation or any nation so conceived and so dedicated can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. (Fog Index: 10)

Matthew 6:9–13 (King James version):

Our Father which art in heaven, Hallowed be thy name. Thy kingdom come. Thy will be done in earth, as it is in heaven. Give us this day our daily bread. And forgive us our debts, as we forgive our debtors. And lead us not into temptation, but deliver us from evil: For thine is the kingdom, and the power, and the glory, for ever. Amen. (Fog Index: 4)

Knowing the facts of good style does not necessarily create good writing. A reporter is said to have asked a famous football coach the secret of his success. He said there were three reasons: (1) practice, (2) practice, (3) practice. (A bystander added, "But it helps if the players are big and fast.") By analogy, to improve writing skills, you should write, write, write. (But it helps if you have grown up in an articulate family, studied debate for eight years, and taken a minor in English.)

Not only must you write, but also you should swallow your ego and invite expert criticism. In a less threatening vein, read quality writing by others and try to understand why it is good. When it is necessary to read bad writing, read it critically, noting errors and problems in margins as you observe them. Rewrite passages to see if you can improve them. (If the writer is your professor or a corporate vice president, it might be wise to destroy the marked copy.)

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