SOME GUIDELINES ON TECHNICAL WRITING

James R. Wilson
Department of Industrial Engineering
North Carolina State University
Raleigh, NC 27695-7906

<www.ie.ncsu.edu/jwilson>

January 29, 2004
I. Organizing the paper (what to do before beginning to write)

A. Analyze the situation—that is, the problem, the solution, and the target audience.

   1. Formulate the objectives of the paper.

   2. Specify the scope of the paper’s coverage of the subject and the results to be discussed.

   3. Identify the target audience and the background knowledge you can assume for this audience.

   4. Formulate the most logical sequence for presenting the information specified in item 2 to the readers identified in item 3.

      a. For theses and dissertations, see *A Manual for Writers of Term Papers, Theses, and Dissertations* (Turabian 1996).

      b. For proceedings papers and archival journal articles, see:

         • *Writing for Your Peers: The Primary Journal Paper* (Carter 1987) and

         • *How to Write and Publish a Scientific Paper* (Day 1994).
B. Make a detailed outline, and use it as the basis for the formal presentation of your work.

For help in getting started, see:

- *Writing a Technical Paper* (Menzel, Jones, and Boyd 1961) and

Some effective aids in organizing your paper are:

- brainstorming,
- clustering,
- concept maps,
- issue trees, and
- outlining.


1. The introductory paragraph(s)
   
   a. State the precise subject of the paper immediately.

   b. State the problem to be solved.

   c. Summarize briefly the main results and conclusions.

   d. Tell the reader how the paper is organized.
2. The main body of the paper
   a. Include enough detail so the reader can understand what you did and how you did it.

   b. Include a brief section covering notation, background information, and key assumptions if necessary.

   c. Include sections on theoretical and experimental methods as required.

   In documenting an application or case study, you should discuss the development of any relevant analytical or numerical (computer-based) model(s)—including input data acquisition together with design, validation, and actual use of the final model(s).

   For a methodological or theoretical paper that requires substantial mathematical development, see:

   • *Handbook of Writing for the Mathematical Sciences* (Higham 1998) and

   • *Mathematics into Type* (Swanson 1999).
d. Plan the results section to achieve the most effective mix of text, figures, and tables in the presentation of the findings.

For the design of figures and tables, see:

- *The Visual Display of Quantitative Information* (Tufte 1983) and


3. The concluding paragraph(s)

a. Explain how the theoretical and experimental results relate to the original problem and why these results are important.

b. State the final conclusions explicitly in plain language.
II. Writing the paper

A. Prepare an abstract that is concise, complete in itself, and intelligible to a general reader in the relevant field.

The abstract should not exceed 200 words, and it should not contain any references or mathematical symbols.

1. Summarize the objectives of the paper.

2. Summarize the results and conclusions.

3. State the basic principles underlying any new theoretical or experimental methods developed in the paper.

4. For complete instructions on the preparation of scientific abstracts, see:
   
   • *Guidelines for Abstracts* (National Information Standards Organization 1997);
   
   • *Writing for Your Peers: The Primary Journal Paper* (Carter 1987);
   
   • *AIP Style Manual* (American Institute of Physics 1990); or
   
   • *How to Write and Publish a Scientific Paper* (Day 1994).
B. Write the rest of the paper as though you were talking to a group of interested colleagues about your work.

1. Strive for accuracy and clarity above all else.

2. In constructing each sentence, place old and new information in the respective positions where readers generally expect to find these types of information (Gopen and Swan 1990).
   a. Place in the topic position (that is, at the beginning of the sentence) the old information linking backward to the previous discussion.
   b. Place in the stress position (that is, at the end of the sentence) the new information you want to emphasize.
   c. Place the subject of the sentence in the topic position, and follow the subject with the verb as soon as possible.
   d. Express the action of each sentence in its verb.
3. Make the paragraph the unit of composition.
   a. Begin each paragraph with a sentence that summarizes the topic to be discussed or with a sentence that helps the transition from the previous paragraph.
   b. Provide a context for the discussion before asking the reader to consider new information.
   c. Avoid paragraphs of extreme length—that is, one-sentence paragraphs and those exceeding 200 words.
   d. Place the important conclusions in the stress position at the end of the paragraph.

4. Allocate space to a topic in proportion to its relative importance.

5. For methodological and theoretical papers, emphasize the concepts of general applicability that underlie the solution procedure rather than the technical details that are specific to the problem.

6. In documenting applications, emphasize the new insights into the problem that you gained from the study.
7. Use standard technical terms correctly.


Example: the time that a workpiece spends in a manufacturing cell may be called “cycle time” or “flow time” but not “throughput time.”

b. For standard usage of mathematical terms, see *Mathematics Dictionary* (James and James 1992).

Example: a nonsquare matrix cannot be called “orthogonal” even if any two distinct columns of that matrix are orthogonal vectors.

c. For standard usage of statistical terms, see *A Dictionary of Statistical Terms* (Marriott 1990) and *A Dictionary of Statistics* (Upton and Cook 2002).

Example: the probability density function of a continuous random variable may be called a “density” but not a “probability distribution function” or a “probability function.”

d. For standard usage of computer terms, see:

- *Microsoft Computer Dictionary* (1999) and
8. Avoid illogical or potentially offensive sexist language; see Miller and Swift (1988).

9. Avoid strictly the following—
   a. religious, ethnic, or political references;
   b. personal attacks;
   c. excessive claims about the value or general applicability of your work; and
   d. pointed criticism of the work of other people.

Such language has no place in scientific discourse under any circumstances.
C. For each table, compose a caption that briefly summarizes the content of the table.

Comment explicitly in the text on the significance of the numbers in the table; do not force the reader to guess at your conclusions.


D. For each figure, compose a caption (or legend) that explains every detail in the figure—every curve, point, and symbol.

For elaboration, see the *AIP Style Manual* (American Institute of Physics 1990) or chapter 14 of Day (1994).
E. Revise and rewrite until the truth and clarity of every sentence are unquestionable.

1. For questions about the rules of English grammar and usage, see
   • *The Careful Writer: A Modern Guide to English Usage* (Bernstein 1965);
   • *The New Fowler’s Modern English Usage* (Fowler 1996);
   • *The Little, Brown Handbook* (Fowler and Aaron 1998);
   • *Sin and Syntax: How to Craft Wickedly Effective Prose* (Hale 1999);
   • *Woe is I: The Grammarphobe’s Guide to Better English in Plain English* (O’Conner 1996);
   • *The Elements of Style* (Strunk and White 2000); and
   • *Webster’s Third New International Dictionary of the English Language, Unabridged* (1976).
2. If you use English as a second language, see

- *Communicating in Science: Writing a Scientific Paper and Speaking at Scientific Meetings* (Booth 1993);

- *The Little, Brown Handbook* (Fowler and Aaron 1998); or


3. For guidelines on editing your own work, see *Line by Line: How to Improve Your Own Writing* (Cook 1985).
F. Prepare a complete and accurate set of references that gives adequate credit to the prior work upon which your paper is based.

1. The author-date citation system is strongly recommended; see chapters 16 and 17 of *The Chicago Manual of Style* (University of Chicago Press 2003).

2. For papers in psychology and related fields, see the *Publication Manual of the American Psychological Association* (American Psychological Association 2001).

3. Bibliographic formats for electronic references:

   • On the World Wide Web, the document
     
     <www.nlc-bnc.ca/iso/tc46sc9/standard/690-2e.htm>

     contains several helpful examples.

   • See *The Columbia Guide to Online Style* (Walker and Taylor 1998), which is regularly updated at
     
     <www.columbia.edu/cu/cup/cgos/>

     on the web.

   • See also pages 208–214 of *The ACS Style Guide: A Manual for Authors and Editors* (Dodd 1997).

   • For papers in psychology and related fields, see
     
     <www.apastyle.org>

     on the web.
4. Completeness, accuracy, and consistency of your references are more important than strict adherence to a particular citation system. Using the information provided in your list of references, the interested reader should be able to locate each document that you cite in your paper.

G. To ensure that a thesis or dissertation conforms to the university’s requirements for format and organization, consult the *Thesis and Dissertation Guide* (North Carolina State University 1994).

- This pamphlet can be purchased from the NCSU Bookstore, and it is also available via
  
  <www.fis.ncsu.edu/grad_publicns/thesdis.htm>
  
on the web.

- Information on preparation and submission of electronic theses and dissertations is available via
  
  <www2.acs.ncsu.edu/grad/ETD/> 
  
on the web.
III. Achieving a natural and effective style

A. In *The Elements of Style*, Strunk and White (2000) succinctly express the gist of the matter of writing style:

   Style takes its final shape more from attitudes of mind than from principles of composition, for, as an elderly practitioner once remarked, “Writing is an act of faith, not a trick of grammar.”
   … Style *is* the writer.

B. Contrast the following descriptions of an experiment in optics:

1. I procured a triangular glass prism, to try therewith the celebrated phenomena of colors. And for that purpose, having darkened my laboratory, and made a small hole in my window shade, to let in a convenient quantity of the sun’s light, I placed my prism at the entrance, that the light might be thereby refracted to the opposite wall. It was at first a very pleasing diversion to view the vivid and intense colors produced thereby.

2. For the purpose of investigating the celebrated phenomena of chromatic refrangibility, a triangular glass prism was procured. After darkening the laboratory and making a small aperture in an otherwise opaque window covering in order to ensure that the optimum quantity of visible electromagnetic radiation (VER) would be admitted from solar sources, the prism was placed in front of the aperture for the purpose of reflecting the VER to the wall on the opposite side of the room. It was found initially that due to the vivid and intense colors which were produced by this experimental apparatus, the overall effect was aesthetically satisfactory when viewed by the eye.
C. To achieve a natural and effective writing style, adhere to the following principles (Menzel, Jones, and Boyd 1961):

1. Write simply.

2. Use the active voice.

3. Use plain English words rather than nonstandard technical jargon or foreign phrases.

4. Use standard technical terms correctly.

5. Avoid long sentences and extremely long (or short) paragraphs.

6. Avoid slavish adherence to any set of rules for technical writing, including the rules enumerated here.

7. Remember that the main objective is to communicate your ideas clearly to your audience.
References


Engineering and Management Press. 2000. *Industrial engineering*


In technical writing, every word must have a place in the sentence and a meaning. Use direct statements and an active voice, avoiding past tense as much as possible, except in the executive summary, where past tense is always used. Some acronyms, like "scuba" (self-contained underwater breathing apparatus), have become so accepted that their original derivations have been lost and the acronyms have been added as new words to the English language. Using uncommon acronyms and initialisms makes reading harder for all but a few specialists; therefore, be selective and limit their use.