On Systematic Generation of Scientific Papers

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Have you ever struggled through the writing of your scientific papers? If you have, we offer help. Even if you are an accomplished scientific writer, your work probably suffers from consistency gaps as you lapse into a less technical style. Our simple method helps you achieve the consistent style acceptable to the editors of most reputable scientific journals. This method will help you systematically set down your ideas clearly and simply—and then convert them into text that challenges even the most competent readers.

Writing the paper

Central theme. Your scientific paper needs a central theme, i.e., main ideas backed by supporting evidence. To show the power of this technique, we will start with the weakest possible theme—none. Write down your central theme and keep it before you as the focus of your work. (The central theme of our example is shown in Figure 1.) A succinct statement of the central theme is probably a good title for your paper.

The outline. Write down your main ideas and supporting evidence in outline form; our outline is shown in Figure 2.

Simple text. Using the outline as a guide, write the first version of your paper in very simple language. Figure 3 is our result (based on the central theme of Figure 1).

Adding dignity. Once you have written the simple-language version of the paper, the most difficult work is done. The next step is to translate the simple language into acceptable scientific prose that presents a formidable intellectual challenge to your reader. Remember: the more the reader must work to extract your ideas, the more he likes reading your paper. After all, he is smart and enjoys brain-taxing activities.

But how can you learn to translate simple language into intellectually challenging prose? Many books are available on how to write—Flesch, Follett, Gunning, Strunk, etc.—but all their advice is contrary to the scientific writer’s needs. These books are clear, concise, and offer readable advice on how to write. They are written for someone who wants to be able to communicate with anyone. We don’t want to do that; we are writing for an exclusive group of smart, well-educated scientists and engineers. Write for them. Use their language. Offer them an intellectual challenge. The secret to using the rules found in these readable and readily available (but misdirected) books is to break them whenever possible. For example:

- **Use active voice.** This is the advice of many experts on writing. It is good advice if you want to write novels and risk having fan clubs, but active voice is unusual, undignified, and too personal for scientific writing. Therefore, use passive voice: “The sample size was enlarged,” instead of “We enlarged the sample size.” Passive voice makes avoiding first person easy.

- **Be simple and direct.** No, not for scientific writing. The advice to be simple and direct is for those writing to readers with short attention spans and weak intellects. For variety, arrange your subjects, verbs, and objects in as many different orders as you can. You may want to write several intermediate versions of

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I. History
   A. History shows progress
   B. Progress and technology are related
   C. Technology improves
   D. Computers advance with technology

II. People
   A. Teaching and research
      1. Concepts
      2. Theories
   B. Development
      1. People should work together
      2. Computers should think

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“Any clod can have the facts, but having opinions is an art.”
Charles McCabe, San Francisco Chronicle

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your paper to avoid trying to make all the various translations at one time. Figure 4 shows our example translation of the simple language of Figure 3. We have changed to passive voice and introduced a variety of subject, verb, and object orders.

Bigger words. Next, raise the level of the vocabulary. Engineers and scientists are used to big words and jargon. Use them. Advice on the proper use of words, prefixes, suffixes, and jargon is available in the style books, especially those by Follett and Hayakawa. By now, you should know how to convert this well-meaned advice to your own aims. You will also find a thesaurus quite useful in this task. You can look up almost any word in a thesaurus to find a better one with the same meaning. ("Better" means longer and less common.) If possible, replace one word with many redundant polysyllabic words. For example, the noun "thought" can be replaced by "retrospective contemplation" or "active pursuit of insight-yielding recollections."

Robert Gunning's book, *The Technique of Clear Writing*, offers an appendix listing 3000 of the most well-known words. Among them are *able*, *against*, *big*, *cast*, *electric*, and *multiply*. Prose using too many of these words might be so embarrassingly easy to read that no one would admit to having read it (not what you want if you wrote it). Read this list and avoid using too many of its words. Another appendix in the same book lists long words next to simpler alternatives. Among the pairs on this list are: *approximately-about*; *consequence-result*; *imperfection-defect*; *modification-change*; and *utilization-use*. This appendix is difficult to use because it is indexed by the long words. Since scientific writers need to use the list to find more complicated alternatives to plain terms, perhaps Gunning will correct this deficiency in his next edition. Figure 5 shows our more challenging version of the text from Figure 4.

Finishing touches. The next alterations will drive your prose so far into the mainstream of scientific writing that it will be easily recognized as prototypical.

1. Change plain, positive statements into negative statements that say the same thing. Instead of "It is wet," use "It is not dry."
2. Change some positive words into double-negative phrases. Instead of "better," use "not unimproved."
3. Add plenty of colorful and descriptive qualifiers such as *significant*, *mostly*, *frequently*, and *usually*. These qualifiers can absolutely save your reputation if you have published something that is later proven wrong. Advanced writers inject longer qualifiers such as "seemingly reasonable probability estimate" and "being less than completely satisfactory with respect to specific knowledge."

4. Insert as many superfluous prepositional phrases as you wish. For example, use "along the lines of," "for the reason that," "in the neighborhood of," or "in accordance with" with a noun related to the central theme. This increases the distance between the main words of the sentence.
5. Repeat ideas and words often. Select a whole string of words from your thesaurus; each word has its own subtle meaning variation. When you use all of them, your reader believes you have thought very deeply about the topic. Examples: "predicting future eras," "latent vehicular geographic mobility," and "threshold proximity related affinity."

6. Add connectives, pauses, and conjunctions (such as *however, hence, therefore, and also*) to help the pseudoconversational flow.

7. Make each sentence exceed 20 words. Studies indicate a drop in reading comprehension when this is done.

Figure 5 shows our application of these rules to the paper in Figure 4.

Figure 7 is an overview of the method. It will be difficult at first, but you will improve with practice. Both Flesch and Gunning offer methods for measuring

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**Better Computers**

Much history is recorded. We can read and study history. History demonstrates scientific progress. Scientific progress advances technology. Computers improve as technology improves.

People are involved in the advance of computers. People who do teaching and research spend time thinking about concepts and theories. Other people apply concepts and theories to make better computers. It is a group effort. Better computers can do more work for us.

**Figure 3. Our paper written in simple language.**

**Better Computers**

Much recording of history has been done. History has been read and studied. It has been demonstrated historically that there is scientific progress. Many of the advances of technology have been related to scientific progress. Computers have been improved as technology has been improved.

Advances in computers have been related to the involvement of people. Teaching and research have been done by people who have been thinking about concepts and theories. These concepts and theories have been applied by other people working together on large projects, and better computers have resulted. Better computers can be made to do more work.

**Figure 4. Our paper in passive voice.**

**Improved Computational Facilities**

Voluminous historical transcription has been accomplished. Historical records and tomes have been perused and contemplated. This historical repertoire has demonstrated that scientific progressions have taken place. An abundance of the furtherances of technological improvement have been consanguineous to scientific amelioration. Computational equipment has shown advancement as technological progression has been effectuated.

Enhancements to computers have been interassociated with the involvement of people. Teaching and research have been contributed to by people who have been cogitating about concepts and theories. These conceptualizations and theoretical formulations have elicited application by alternative people working in large project environments and improved computational equipment has eventuated. Enhanced computational equipment enables additional facilitation of work accomplish.
Progressive Advancement Through Technologically Facilitated Enhancement of Computational Equipment

In general, the accomplishment of voluminous historical transcription to record has not been neglected in the past. These important historical records and valuable tomes have been read, perused, examined, pondered, and contemplated retrospectively by more than a few interested people. Also, the contemporary examination of this vast irreplaceable historical repertoire has amply and adequately demonstrated the fact that some very significant scientifically oriented progressions have taken place (a preposterous preponderance perpetrated positively presently). Thus, it has been shown that an abundance of the notable furthers of recent technological improvement has been consanguineous to regular scientific amelioration. Therefore, recent computing and computational equipment and facilities have shown seemingly abnormally high rates of the nature of advancements as this contemporary technological progression has been and is being effectuated.

However, irrespective of certain speculative aspects, these positive enhancements, going to the very nature and implementation of computing equipment, have not at all been without the interassociated and continuing involvement of concerned, technologically oriented, competent people. These people, in the fields and careers associated with education and research, have been making significant and lasting contributions, however, by cogitating, thinking, and rumination about conceptualizations and abstract theoretical formulations. These conceptualizations and abstract theoretical formulations have, for instance, in almost every circumstance of significance, elicited eventual application to the real world by alternative career people, and relevant and important improvements to computing and computational equipment and facilities have eventuated. Obviously, advancements in the area of project management have contributed not in insignificant measure to this success. Prevention of the impinging of enhancements to computational equipment would (if actually allowed) prevent the additional positive facilitation of work and task accomplishment by these greatly and affirmatively improved facilities.

Figure 6. Pièce de résistance.

If you intend to write many noteworthy scientific papers, we recommend starting a couple of files to collect inspiring materials. Our file of creative scientific words contains such pearls as *utilizability*, *systematization*, *pluggability*, and *nonendurable*. Another file holds the most prototypical scientific papers. We could list several authors who are world-class champions of this style, but will refrain rather than risk omitting someone worthy of mention.

There are many sources of good example papers. Most prestigious scientific journal articles and many books are written in this style. If you work for a large company, your technical report center is probably a gold mine. It actually seems as if some authors can write text like that of Figure 6 in a first draft! You may envy these people their talents; we prefer to collect their work as inspirational material.

![Central Theme](image1)
![Outline](image2)
![Simple Text](image3)
![Adding Dignity](image4)

- use passive voice
- vary sentence structure

![Bigger Words](image5)

- use equivalent negative statements
- use double-negative phrases
- add qualifiers
- insert prepositional phrases
- add redundant meanings
- add connectives, pauses, and conjunctions
- use long sentences

Figure 7. Procedure for writing scientific text.
Over the past, a number of studies have appeared which use methodologies to evaluate &field &phenomenon. Examples include &reference1[i], &reference2[i], and &reference3[i]. Studies of this kind involve theory, observation, and manipulation of &data, in contrast to studies on &related phenomenon, or on material, social, intellectual, and spiritual expression of the human drama.

Such studies contain a not insignificant promise for impacting the potential construction, selection, and use of &NSF grant reason in a number of different ways. For example, the work of &reference1[i] lends support to the claim that &A is superior to &B as a method for representing &C. Often, such work may lead to further refinement. In the study just mentioned, &A was found to be superior to &D in spite of the fact that the linkages were unclear.

Another impact which such studies may have is the provision of quantitative information of the relative effectiveness of &NSF grant reason. The work of &reference1[i] provides comparative figures on costs for each operating mode, as well as showing that the differences were small compared to individual differences. Similarly, the work of &reference2[i] provides an order of magnitude estimate of the benefits of &field methodologies.

Figure 8. Experimental scientific template.

If you have a natural aptitude for this writing style, consider changing to a field with more competitive writers, such as the humanities. To those few geniuses of this writing style, we recommend the challenges of government work, where you can test your talents against the writers of the Federal Register and taxpayer publications.

Writing will always be difficult, even for those who have mastered our effective and proven method. Someone should look into computer-aided writing. Someone is. We are.

CAW – Computer-Aided Writing

Our research is attacking the difficulty of scientific writing on two fronts. First, we are working to help authors write scientific papers in an interactive session with a computer. We are trying to organize a data base that allows associative query by example to provide thesaurus words, to help find bigger words, to aid in spelling, to suggest prepositional phrases and conjunctions, and to give rules for passive-voice sentence construction. This is advanced scientific text processing.

Second, we have a much more ambitious project. We are trying to create a number of template scientific papers. These papers will be quite sophisticated, with passive-voice construction, repetition of ideas, and other features of scientific papers. They will lack only the nouns associated with the topic. The scientific author will eventually be able to supply topic nouns to the computer and see the scientific paper produced automatically. In an interactive session with the computer, you will look at a variety of papers composed automatically by applying the same noun set to a number of different templates. It will then be a simple matter to select the best.

Scientific writing as we know it will cease! This important research work is still in the early stages (we are preparing NSF grant proposals). Figure 8 is a portion of an experimental template we are developing. We expect work in the CAW area to expand exponentially in the near future.

Annotated bibliography

We nominate these books for the Hall of Fame.


Strunk, William, Jr., The Elements of Style, Macmillan, New York, 1959. If you read only one, read this one.


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