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Why Is Scientific Writing Unintelligible?

By: Sharon Dunwoody

Among scientists, SETI researchers may be the ultimate communicators: they are trying to contact intelligent life beyond the earth, life that exists only in hypotheses and about which nothing is known.

To that end, SETI scientists painstakingly grope for symbols, sounds, wavelengths that may have meaning to life elsewhere.

Thus it seems ironic that, while so much effort goes into extraterrestrial communication, so little goes into effectively communicating with human beings here on the earth.

In that respect, SETI scientists are no different from other scientists. Most of them do not place a high premium on clarity and simplicity in writing.

No doubt this is partly because clear writing is not an integral element of a scientist's traditional training. Rather, just as one is socialized to certain work habits and theoretical perspectives by one's teachers, so does the budding scientist adopt the communicating styles of other scientists.

Another reason clarity is underplayed in scientific prose is the "commonsense" notion that scientists talk in a very difficult and precise language that precludes simplicity. That certainly may explain the use of complex terms. But such an excuse does not cover the complicated sentences and tortured strings of nouns and adjectives spilling over many a sentence in a scientific paper.

Perhaps the most intriguing attempt to understand why so many scientists lard their prose comes from a researcher at the University of Pennsylvania's Wharton School. J. Scott Armstrong has completed studies that indicate that scientists are *rewarded* by the system for writing unintelligibly.[1] ([1] J. Scott Armstrong, "Unintelligible Research and Academic Prestige: Further Adventures of Dr. Fox," Marketing Department Working Paper Series, The Wharton School, University of Pennsylvania, Philadelphia, PA, 1979.)

Since that's a very interesting sociological notion, let's take a look at Armstrong's studies and his findings in a bit more detail.

Armstrong wanted to test two conflicting hypotheses:

The first one — called the "communication-for-knowledge" hypothesis — was that if the goal of successful communication is to share information with others and if science places a premium on successful communication, then, all other things being equal, journals should prefer articles that are clearly written to those that are not. Academic conferences should look for researchers, noted Armstrong, "who have interesting studies *and* who could present them clearly."

The contrasting hypothesis suggested the opposite: that journals and conferences would prefer less intelligible articles to clearly written ones.

Why? Armstrong based this second hypothesis on findings from a study in which a bogus educator named Dr. Fox delivered a meaningless lecture on three occasions to 55 people, among them psychologists, psychiatrists, educators and administrators. Although the talk — entitled "Mathematical Game Theory as Applied to Physical Education" — contained nothing that made any sense, the audience members later judged the lecture to be clear and stimulating.[2] ([2] D.H. Naftulin, J.E. Ware Jr. and F.A. Donnelly, "The Doctor Fox Lecture: A Paradigm of Educational Seduction," *Journal of Medical Education*, **48**, 630-635, 1973.)

Armstrong reasoned that the audience members had been confronted with a conflict: someone they regarded as a legitimate source was speaking nonsense. They resolved the conflict, said Armstrong, by rationalizing that the talk indeed had been stimulating ... although over their heads!

If such a justification for time spent was actually taking place, Armstrong reasoned, then the greater the unintelligibility, "the greater the need to rationalize about the time spent." The paradoxical result would be that the more unintelligible the paper, the more "scientific" it would be judged by its readers.

If this "Dr. Fox" hypothesis were valid, then researchers who wanted to impress their colleagues should write less intelligible papers, and journals seeking prestige should seek out as much convoluted prose as possible.

Armstrong tested his competing hypothesis in two settings:

In the first study, Armstrong looked at the relationship between the readability levels of various academic journals and their perceived prestige in their fields. Journals in the fields of management, economics and sociology were examined. Prestige rankings were obtained from scientists in the respective fields, and readability was measured by such formulas as the Flesch Reading Ease Test, a measure that uses sentence length and word length to compute a readability score.

If the communication-for-knowledge hypothesis were valid, said Armstrong, then journals that are written more clearly should be judged more prestigious than journals that are difficult to read. The Dr. Fox hypothesis would predict the opposite: the more unintelligible the writing, the more prestigious the journal's rating.

What did Armstrong find? You guessed it. Dr. Fox prevailed strongly in the management journals but to a lesser extent in the sociology and economics journals.

In his second study, Armstrong selected passages from four management journal articles and then rewrote them into varying degrees of reading difficulty without changing their meanings. Management faculty members at three universities were then given various combinations of the passages and asked to rate the "competency of the research" from which each passage came.

Armstrong's analysis of the 32 responses concluded that the sample did indeed rate the easy versions of the passages substantially lower than the harder versions. In other words, respondents felt the clearer passages came from less competent research than did the difficult passages.

Armstrong concluded from the studies that "overall, the evidence is consistent with a common suspicion: *Clear communication of one's research is not appreciated.*"

The fact that Armstrong's two studies represent nearly the entire literature that examines relationships between clarity of communication and rewards in science is indicative of the scant attention given to this area. But, as always, things are

changing. And the 1980s will see increased attention given to clarity in science communication for a number of reasons.

First, research does exist that begins to examine the effects of simpler writing on both reader enjoyment and information gain. In one study, two mass communication researchers prepared different versions of articles in three subject areas: enzymology, polymer chemistry and plasma physics. Then they gave the articles to three types of readers: low science aptitude students at a junior college, medium science aptitude students, and scientists. The most interesting finding was that, while the two college student audiences enjoyed the easier versions of the articles but not the hard versions, *the scientists actually enjoyed all versions about equally. And what's more, the scientists enjoyed the easiest version more than either of the two student groups did!*[3] ([3] G. Ray Funkhouser and Nathan Maccoby, "Communicating Specialized Science Information to a Lay Audience," *The Journal of Communication*, **21**, 58-71, March 1971.)

But as writing is simplified, doesn't one lose information? Does simpler writing increase enjoyment at the expense of information gained?

Not according to one recent study. Another mass communication researcher asked college students to read one of three versions of a psychology journal article. The three articles varied only in language simplicity. Like the previous authors, this researcher found that reader enjoyment increased as the writing became simpler. But he also found that information gain *remained the same* for all three versions; *readers were learning just as much from the simpler version as they were from the most difficult one.*[4] ([4] Alan Hunsaker, "Enjoyment and Information Gain in Science Articles," *Journalism Quarterly*, **56**, 617-619, Autumn 1979.)

Although these studies were conducted only in university settings, the findings are suggestive. It seems that even scientists enjoy simpler writing, and simpler prose — carefully done — need not result in a sacrifice of information.

The federal government in recent years also has taken a renewed interest in successful communicating through its emphasis on dissemination of research results. The National Science Foundation has served notice, for example, that it will tend to look more favorably upon research proposals that build dissemination plans into the study design. Translation: research findings need to get out not only to other scientists but also to policy makers and the interested public. The more

effort you are willing to put into "popularization," the happier we will be.

Suddenly, successful communication is becoming part of the reward system.

The National Science Foundation is emphasizing clearer communication of science in other ways, too. For the first time this year, the NSF-funded Chautauqua Short Courses program for science teachers will include a course devoted to strategies for effective communication of scientific information to various publics.[5] ([5] Information about this course, "Science, the Media and the Public," and about the other courses being offered in the 1980-81 Chautauqua Short Courses program can be obtained from Joseph M. Dasbach, Office of Science Education, American Association for the Advancement of Science, 1776 Massachusetts Ave., NW, Washington, DC 20036.)

Finally, more scientists are developing personal interests in learning to communicate effectively. Universities have realized the need, and — as is the case with the Massachusetts Institute of Technology — some have set up writing programs for their science students. Also in some cases, the need to communicate has resulted in specialty publications, such as **COSMIC SEARCH**, which emphasize clarity and simplicity.

If you are interested in improving your skills in communicating with earthbound life, what can you do?

• Numerous textbooks now offer excellent instruction in clear writing. One such text, by Monroe, Meredith and Fisher, argues that scientists "ought to be good writers," that scientific analytical and organizational skills can be turned to writing if writing can be broken down into logical steps and itself treated as a science.[6] ([6] J. Monroe, C. Meredith and K. Fisher, *The Science of Scientific Writing* (Dubuque, Iowa: Kendall/ Hunt Publishing Company, 1977).)

• Universities throughout the country offer courses in both science writing and technical writing (the latter can be viewed as learning to write clearly for one's peers, the former learning to write clearly for educated nonscientists). In fact, a national directory of such courses and degree programs now exists.[7] ([7] Sharon M. Friedman, Rae Goodall and Lawrence Verbit, *Director of Science and Communication Courses and Programs* (Binghamton, NY: Department of Chemistry, State University of New York at Binghamton, 1978). Copies of the directory are $4.95 prepaid from Science Communication Directory, Department of Chemistry, State University of New York, Binghamton, NY 13901.)

If you are not interested in an entire course, at least you can be put in touch with individuals who specialize in science communication.

• Research in science communication is beginning to snowball. At least two publications try to keep up with such research. *SCIPHERS*, a quarterly newsletter for teachers of science communication, provides an annotated bibliography devoted solely to science communication studies. And *Science, Technology, & Human Values*, a journal devoted to the study of science in society, also picks up research reports for its annotated bibliography.

Communicators strive to share perceptions with others. The more accurately those perceptions are shared, the better. It is imperative that SETI researchers spend at least as much time groping toward successful communication with intelligent life on earth as they do trying to connect with intelligent life beyond.

SCIPHERS can be obtained by sending $8 for a one-year subscription (four issues) to Joye Patterson, Co-editor, SCIPHERS, School of Journalism, University of Missouri, Columbia, Missouri 65201.

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Marshall H. Cohen of the California Institute of Technology and a group of other radio astronomers at the Jet Propulsion Laboratory and the University of California, Berkeley, have proposed a transcontinental radio telescope to consist of an array of 10 dishes each 25 meters in diameter to be situated throughout the U.S. including Alaska and Hawaii. Called a Very Long Baseline Array (VLBA), this scheme would, according to the report, in effect, "transform the entire country into an immense radio telescope" and would make possible finer detailed radio maps of celestial objects including distant quasars.

Radio Amateurs interested in starting a round-table among **COSMIC SEARCH** subscribers should contact Frank Taylor, WB6SAE, 4312 Opal, Cypress, CA, 90630.

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