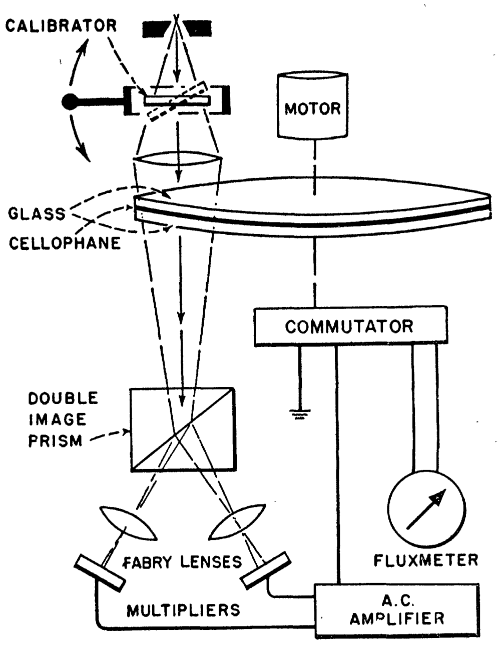


FIG. 4. This line drawing of a polarimeter shows the working parts of the instrument better than the finest photograph. [From *Astronomical Photoelectric Photometry*, published by AAAS, 1953]

spaced without jeopardizing the value of the drawing. When neither device may be resorted to, variation in the thickness of the lines will serve as an aid to readability. For example, if 5-point units are used, every 20th unit may be represented by a heavier line. Scale values are always shown on the horizontal plane, but scale descriptions should be parallel to the enclosing line. Theoretically, all graphs should be scaled from the zero point. Some scientists consider scaling from higher points a breach of form, but a reasonable attitude toward the inclusion of waste space has made scaling from higher points acceptable. For example, if a curve fills only the right-hand portion of the block, the points unrelated to it are cut from the drawing and, thus, the over-all size is reduced.

The use of bar drawings is sometimes more effective than tabular arrangement, especially if it is desirable to show the relation of two items under varying conditions. Block diagrams are also an effective means of conveying an idea, for example, to serve as flow sheets.

Schematic drawings are widely used and are especially valuable to show the working of a piece of machinery or an electric device. For these purposes, the details should be carefully chosen. When the scheme is simplified and the drawing is not cluttered with too numerous details, the effectiveness of the illustration will be increased. Changing the thickness of the line is also a means of emphasizing the important parts of the machine and increasing an understanding of its operation.

In all illustrations, we return to the important admonition to direct them to a single idea and, in line drawings, to keep that idea uncluttered by superfluous bits of information.

## Jargon—Good and Bad

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It is recorded of Lord Rutherford that he "took great pains over his writings, holding that no scientific discovery is complete until it has been expressed in clear and concise language." The obligation to make oneself clear in reporting the results of a piece of research is as great as the obligation to be objective and honest in doing the research.

Although a writer may find clarity hard to achieve, difficulty in expressing one's meaning is not a valid reason for slipshod or muddy writing. An experimental scientist will not hesitate to take whatever pains may be necessary to improve the working of his apparatus, so far as his equipment or funds or technical abilities will allow. A voltmeter must give accurate readings, a meter bar must be of the standard length, a clock must run with a known rate, if the measurements made with these instruments are to be reliable.

In many laboratories, even the superficial appearance of the apparatus is given some thought. An amplifier does not work better because it is housed in a case with a black crackle finish, or because the knobs are arranged in straight rows instead of at random over the face of the panel, but it looks better that way. The neat appearance suggests that the maker is competent, and the user may even find the amplifier easier to operate. The same is true of a piece of writing. It ought to have the best finish that the writer can provide, so that the reader can use it easily and will feel that the maker is competent.

Moreover, as Rutherford held, the research is not complete until the results have been reported. What is the use of research conducted with the best apparatus, at great expense of time and effort and money, if the results of it are not communicated to all who might benefit from knowing them? Publication is the end-product of research. Research without publication is sterile.

How, then, can this last essential of scientific research—the preparation of a report, or the collection of the fruits of a long research program in a book—be best carried out? How can a writer express "in clear and concise language" what he has found out and the conclusions that he has arrived at?

One way in which he can improve the clarity of his expression is to avoid the use of jargon; another way, and one that may improve not only his clarity but his conciseness, is to use jargon well. Let us first agree on the meaning of the word *jargon*. The dictionary defines it as "confused, unintelligible language; gibberish; hence . . . the technical or secret vocabulary of a science, art, trade, sect, profession, or other special group." For our purposes, a few words of this definition will suffice. No scientific writer will admit that he uses confused, unintelligible language, or that he writes gibberish, or even that his vocabulary is secret (no matter what others may say of it). But if the technical vocabulary of a science is jargon, then all writers of or on science use jargon. They must use it, for in no other way can they achieve the clarity and conciseness of expression that Rutherford called for.

Writers in any field of science are in a very favorable position in comparison with writers in, say, law or international affairs. They have the great advantage of possessing a jargon that has been deliberately constructed to serve their needs. Technical terms have been adopted and defined with the express purpose of giving all writers in the field words that they can use with the assurance that every reader, merely by looking at the definition, can tell exactly what the writer meant. Thus, a single term—a word or a phrase—can be made to stand for a whole paragraph of description. The word *power* in physics, whatever its meaning may be in the ordinary parlance, means "rate of doing work" and nothing else. A second of time is 1/86,400 of a mean solar day, and that is all it is. It is not necessary in scientific writing to use in a single statement all the words that may be construed to have some possible shade of meaning in common, as it seems to be in framing laws or insurance policies. No court is needed to decide what a scientist meant by what he said; he has already said it in the only possible way, and all who know the definitions of the terms he used can understand what he meant.

This is the advantage of jargon properly used. But one man's technical vocabulary is secret to another. Whether or not to use jargon in a particular piece of writing depends on the audience for whom the writing is intended. A physicist writing for other physicists may use the word *neutrino,* or *linear accelerator,* or *synchrocyclotron* without fear of being misunderstood; but if he is writing an article for a popular magazine, he must remember that for most of his readers such words do not have the precision of meaning that he himself gives them. Jargon is good when the reader can reasonably be assumed to know what it means, and bad when he cannot. Even when he does know the meaning of jargon, however, simple words can often be substituted for technical ones. The writer who is so enamored of his jargon, or who has so limited a vocabulary, that he piles up technical terms when simpler ones would express the meaning just as well does his reader a disservice, whether the reader is familiar with the jargon or not.

Part of the tendency toward the abuse of jargon begins when a graduate student prepares for his first colloquium talk. He knows that his audience will contain specialists, both professors and students, in his own field, and others of high competence in related fields. He fears that he will seem to be talking down to them, or not to have command of his subject, if he uses simple terms; so he chooses long ones. This habit, once established, is hard to break, and it leads to the misuse of jargon.

Here is an example of jargon well used: "The frequency separation between the diametral frequencies of the admittance and impedance diagrams affords a useful measure of the coefficient of electromechanical coupling." The vocabulary of this sentence is certainly technical, which makes it jargon, but for those who have the same vocabulary it is both clear and concise. The phrase "frequency separation" could be improved; "separation" does not really mean "distance," even metaphorically. It would be better to say: "The difference between the diametral frequencies. . . ." This use of the word *difference* assigns to it the meaning that it has in arithmetic; this is jargon that the readers to whom the manuscript is directed can be assumed to understand.

Each of the sciences has acquired its own jargon, sometimes by deliberate invention of a new word, but more often by an almost unconscious process of growth and development. There have not been many van Helmonts, to invent such a word as *gas.* But when *electron,* the Greek word for amber, was made to stand for the elementary electric charge, it set the pattern for a multitude of words ending in *-tron*—*neutron, positron, negatron* (now discarded)—for the names of subatomic particles. It may also have had something to do with the sound of names for pieces of apparatus such as *thyratron, cyclotron, betatron.* The word *proton,* without the *r* in *electron,* was doubtless the type for *meson,* which seems to be replacing *mesotron.* Since the two types of meson were distinguished by the Greek letters $\pi$ and $\mu$, the names *pion* and *muon* have come into being. (We may hope that the particles now called simply *V-particles* will never come to be known as *veeons.*)

These words were coined because there was need for a single, unambiguous name for each of the particles as it was discovered, a name that would be short, at least partially descriptive, and incapable of being confused with any other name. They are part of the jargon of physics and they are very useful—to physicists talking to other physicists. They are entirely out of place, however, in a popular article unless they can be defined in simple terms. Too frequently they are introduced into popular writing in a way that implies that the writer knows what they mean but does not think that the reader can really understand. The science writer for a newspaper who tells his reader that "the new particle, called a flyon, is one of the building blocks of nature" gives his reader no help at all by his use of a technical term. On the contrary, the reader cannot escape the feeling that the writer is showing off. It is such misuse of technical terms that makes *jargon* often a word of contempt.

It is not necessary to multiply examples of bad jargon, for they are all too common and well known. The careless or downright wrong use of the words of a scientific jargon is a consequence of the disregard, or even ignorance, of the properties and characteristics of the English language. One of the sufferers both from jargon ill-used and from slipshod language is the reader who may be expert in a science but to whom English is not his mother tongue. The intelligent foreigner will be able to understand this sentence from a medical paper on blood grouping, "The grouping sera may be prepared by immunizing rabbits and drying and using them in the powdered form," but why should he have to stop and straighten out such a statement?

Editors of scientific writing, whether technical reports, research papers, books, or popular articles, have obligations to both author and reader. For the sake of the reader, the editor must help the author to say what he means in the simplest way; to eschew jargon when it is merely high sounding, for then it is bad jargon; to use technical terms in technical writing when they lead to clearness and conciseness, for this is good jargon; to recognize the advantages of acquiring "the habit of paying all words the compliment of respecting their peculiarities." Good writing comes hard, but the gain is worth the labor. There is sound advice in the words of Isaac Watts:

> Smooth be your style, and plain and natural,
> To strike the sons of Wapping or Whitehall.
> While others think this easy to attain,
> Let them but try, and with their utmost pain
> They'll sweat and strive to imitate in vain.

## Publishing as Applied Science

**Ralph B. Smith**
*McGraw-Hill Publishing Company, New York*

The advancement of science depends upon publications that keep scientists in communication with one another. The advancement of civilization depends upon publications that keep the rest of mankind in communication with scientists.

If such verdicts tempt you to a good yawn, can I stop it with an accusation: That our publications often overlook their own dependence upon some of the science that they communicate. I feel that I am in a particularly good spot to see that publishing must apply science to its own job and that this application must go far beyond the mechanical and chemical processes which put that job into print.

I work for 27 publications that are read principally in the United States and eight publications that are read only in foreign countries, four of them in foreign languages. Dealing wholly with the world's work, not one of them offers a reader escape from his work. They provide entertainment only if they lapse into entertaining errors. No professional society lassos an audience for the words of any one of them—not a sinful practice, but not a practice at all in our case. Not one of them enjoys a franchise to channel to its reader group through its pages all the wisdom of the research or convention papers that emanate from the wise men of that group. Most decisive, not one of these publications may put into its audience a single customer who has not paid to come in and who cannot go out if he does not like the show. This is true for the whole line—from *Business Week* with its 250,000 readers to *Electrical Wholesaling* with its 9000—from the "horizontal" papers, such as *Electronics* or *Product Engineering,* to the "verticals," such as *Coal Age* or *Textile World.*

This is free enterprise with a vengeance. It is free of any protection against bankruptcy if its editors fail to ascertain what selection of content and what choice of presentation techniques will bring into their show enough of the people and only the people who should be there. It is no enterprise in which to play hunches, gamble on sheer editorial intuition, trust to tradition, or bet that habits do not change.

Nor is any business, industrial, professional, engineering, or science publishing enterprise whose journals are not simply given away to people on its advertisers' prospect lists. The cold facts that, perhaps, hit us first in our exposed position must also blow upon the somewhat less naked society and institutional publications. Indeed, I imagine that an ill-wind blowing upon them from some quarter of reader-discontent can be noisier, if not more disturbing, than the quiet dropping of renewal percentages that has been our historic warning of trouble. I am told that hell hath no fury like a dues-paying professional society member grown scornful of his society publication.

But complaints and cancellations come too late, and their absence is no proof that we are being read today —much less that we shall be read 5 years from today.

We are all meeting new competition for time— from new channels of communication and from new distractions. Our news trickles through a rising flood of information from other sources. Our readers are harassed by an acceleration of the tempo of living and of the rate of change. This is an unconventional world in which to do the conventional publishing job, and the whole situation seems to be forcing upon us— despite our present unprecedented success—the question of how much we know *scientifically* about *what* our readers now want of us and *how* they want it.

We at McGraw-Hill believe that we still have a lot to learn and a lot that we can learn by applying scientific research to reading. For a long time, we have been sending out Research Department interviewers to ask scientifically selected samples of our "populations" what they have read and what they have skipped in particular issues of our magazines; then calculating how all the pages of these issues stack up in relative headline-readership, starting-readership, and complete readership; then collating our information to determine how results for every page were influenced by type of content, by technique of presentation, and by classification of reader. We are now proceeding to code our accumulation of such data on punch-cards under a great variety of categories to get better and faster answers.

Our individual magazines are—and long have been —supplementing such reader-traffic field-studies by somewhat less valid, but still suggestive, mail surveys that poll readers on the relative interest of their various articles and departments.

We are also engaged in split-run experiments. This rather new research technique involves splitting the