

Communications in Physics

Benjamin Bederson

For the past 50 years, I have been preparing articles for publication in physics journals, as well as presenting talks at physics meetings of various sizes and configurations. This statistic does not by itself qualify me as an expert in communications in physics, but at least it is impressive enough to justify my concern over the general problem of the quality of the presentation in physics articles and talks. It is certainly true that this quality ranges all the way from magnificent to downright miserable, and that, on this scale, there are individuals who rank consistently at one end or the other, with most of us somewhere in between. This problem is particularly fresh in my mind as I recall tortuous sessions at departmental colloquia and conferences, where truly important material was subject to what in earlier, less subtle days might have been identified as Chinese water torture.

In a possibly quixotic effort to make a dent in what may be one of the most intractable problems in all of science, a small workshop was assembled last spring at the University of Chicago to consider means of addressing it. (Some unexpended funds from an earlier meeting that had been squirreled away by Ugo Fano were used to support the workshop.) Attending was a mix of editors, science writers and working physicists (see box). These dedicated individuals eventually came up with a written list of recommendations, which is being transmitted to the publications board of the American Institute of Physics for its consideration. Most of the present piece is a summary of the workshop's report, paraphrased in part but adhering closely to its spirit. (I restrict my discussion here to physics,

although I strongly suspect that other science fields experience a similar problem.)

Research articles are intended primarily to communicate scientific information to the reader or listener, and therefore content must dominate over quality of presentation. Poor presentation, however, can be and frequently is a major obstacle on the road to progress. We are all familiar with the

damental obstacle to clarity of presentation cannot be overcome by decree, even though brevity, properly utilized, can be a benefit rather than a handicap. Grammatical and presentation transgressions by non-English writers also contribute to the communications problem, but these are not the principal cause of the difficulties.

Oral presentations are, if anything, even less accessible than written papers, partly because there is no peer review for talks, and also because even more effort on the part of the presenter is required to transmit concepts and results with clarity in an allotted time, which is generally too short for the purpose. Although inspiring speakers certainly exist in physics, we are all familiar with the speaker who mumbles, fumbles through papers, uses undefined technical terms, never explains just exactly what is being plotted against what and, as

final punishment, laces his or her talk with incomprehensible acronyms. Often, far too many overheads, densely packed with poorly displayed equations, are shown. The overheads themselves are frequently recycled from previous talks, with afterthoughts scribbled along the sides. And finally, there is the ultimate transgression of exceeding one's allotted time.

One cannot belittle the fundamental obstacles that lie in the way of remedying communications difficulties. Separate subcultures and specialized languages have inevitably arisen within the physics community; this is a problem that is to some degree intractable. Another difficulty stems from an ingrained cultural feature of our community, which views communication as a one-way transmission of information. Bearing this in mind, speakers and authors need to evaluate their intended audience and ensure that the presentation is in harmony with the audience's capacity to comprehend the material.

Participants in the University of Chicago workshop on improving scientific communications

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Ugo Fano, University of Chicago
Christopher G. Fasano, Francis Marion University
James Glanz, *Science*
Mitio Inokuti, Argonne National Laboratory
Nghi Q. Lam, Argonne National Laboratory
John C. Light, University of Chicago
Robert H. Romer, Amherst College
Steven J. Rothman, Argonne National Laboratory
Phil Schewe, American Institute of Physics
Bertram Schwarzschild, *PHYSICS TODAY*
Anthony F. Starace, University of Nebraska

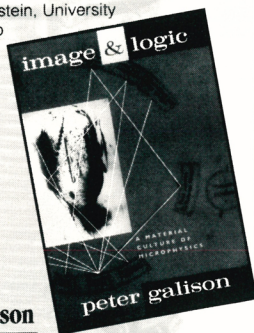
frustration that accompanies attempts to read articles that are obfuscated by impenetrable jargon, overlong sentences, undefined quantities and acronyms and the many other transgressions that are inflicted on us by, sad to say, many of us (I do not exclude myself from this motley crew). Complete books exist that attempt to educate writers and speakers. For example, as pointed out at the workshop by Robert Romer, editor of one of our more literate physics journals, the *American Journal of Physics*, who among us would not profit from a few hours with William Strunk Jr and E. B. White's *Elements of Style*?

The ever-increasing volume of scientific literature and the consequent requirement of editors to make presentations shorter often result in articles that read more like telegraph messages than like the fully developed presentations we, at least in our memories, believe was the way physics used to be presented. Editors generally cannot allow lengthy articles. This fun-

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There is certainly no panacea in dealing with the communications problem. Even so, the workshop timidly offered some modest suggestions to authors, speakers and editors.

For written presentations, clarity of presentation, generally listed as a criterion for acceptance in instructions to referees, should be more strongly emphasized. The reasons for initiating the research should be stated clearly at the beginning of the article. Conclusions and accomplishments should be spelled out at the end.

One relatively simple improvement in current practice could readily be implemented: abstracts. They should be understandable, for the most part, by the general readers of the journal, even those who are not experts in the article subject. While there are certainly differences of opinion on what a properly prepared abstract should contain, it should at the minimum include a brief, intelligible summary that projects the importance of the full article. Thus, authors should put more effort into abstract preparation, even at the cost of making these marginally longer.

Editors—as harried as they already are—can play an important role in improving the quality of writing simply by raising the consciousness of authors to its importance. Editors should be encouraged to return for rewriting papers that are acceptable on scientific grounds but are not written in satisfactory form. Indeed, they should be allowed to turn down papers that, even after revision, are unacceptable because of bad organization or tortuous prose. Of course, this means that the editors will have to be supported by their editorial boards.

Periodically, special inducements are offered for good writing, such as modest rewards for the best-written articles. Occasional editorials could also help. Unfortunately, the most effective inducement—booby prizes for the worst papers—are probably impractical.

As for oral presentations, here are some suggestions offered by the workshop. Begin your talk by providing the context of the subject you will present. Why did you choose this problem, out of many? State what background is needed to understand the significance of your work and its results. Reduce your presentation to its essentials. Do not have more material than you can cover and than the audience can absorb comfortably. In general, the large majority of your audience will not be interested in points of detail; let these be addressed later, through questions from the audience.

The subject is one you have been working on for months, maybe years.

The audience has not had that benefit. Remember that you possess, or should possess, great enthusiasm for the subject. The audience generally does not match this enthusiasm, at least not at the beginning of the talk. Remember that you are in full possession of the specialized jargon related to the subject. Audiences should be led carefully and gently through this thicket.

With regard to overheads, use a large type size and coordinate the colors to avoid a confusing appearance. Try not to scribble afterthoughts, arrows and so on during one talk and then use the same overheads in other talks. If recycling is unavoidable, do take the trouble to ensure consistency of notation and logical presentation in each talk you present.

Do not overstay your welcome! Talks scheduled for one hour should not take 75 minutes. Do not ask the audience to stay a little longer because you simply have to tell them something very important. And finally, develop a sixth sense so that you can judge whether or not the audience is with you, and adjust your talk accordingly.

Many commentators, both within and outside the physics community, have noted and generally deplored the ongoing difficulties with scientific communications. I choose one quote, from Karie Friedman, assistant editor of *Reviews of Modern Physics*:

What sets a first-rate scientific article apart from the thousands of forgettable publications that appear in the literature every year? For a very few, content alone ensures that the paper will be widely cited. But for most, it is the way the article is written. A good article puts us in touch with a good mind (or a team of good minds) at work, whose quality is revealed by clarity, economy, order, and perhaps wit. These rather abstract qualities are warmed by the author's effort to share his or her interest in the subject as if speaking with a colleague, presenting the work not as a series of cut and dried results, but as an ongoing process by which understanding is sought. The reader whose interest is thus engaged can then share the author's satisfaction as a solution begins to emerge.

I acknowledge with many thanks the other workshop participants, especially Ugo Fano, upon whose initiative the workshop was organized and who has acted as a silent partner in this piece. ■