

how to address



Reprinted here, for the benefit of those who missed the first performance, is an article by Dr. Darrow which originally appeared in the February 1951 issue of *Physics Today* under the title, "How to Address the American Physical Society".

the APS

By Karl K. Darrow

CONSIDER an actor in a hit show on Broadway, and contrast him with a physicist addressing the American Physical Society. The actor has all the advantages. He is speaking lines written for him by a master of the art of commanding the interest of an audience (remember that we are postulating a hit show). He has a gift for acting, and also a long experience in the art; otherwise he would not be in the cast. Even so, he is not allowed to speak his lines in any way that occurs to him. Every phrase, every inflection, every gesture, even the position that he is to take on the stage, has been tested or even prescribed by a professional director, who does not hesitate to give him mandatory instructions, or even to alter the lines if they seem ineffective.

One might assume that assured of such splendid collaboration, the dramatist would write a play two hours long without a break, and the manager would be content to offer the play in a barn with benches for the seats. This is apparently not the view of those who are experienced in such matters. Ample intermissions are provided, and an act which runs for as much as an hour is sufficiently rare to cause the critics to mention it. Usually the theatre has comfortable chairs and is well ventilated, or even air-conditioned. All this is provided

to induce people to come to a play for the apprehension of which, with rare exceptions, no intellectual effort is demanded.

Now consider the physicist. He has thought out his own lines, and is not always proficient in this not altogether easy art. He has little or no training in the art of elocution, and no director has rehearsed him. His subject requires a considerable amount of mental effort on the part of his listeners. The listeners themselves are usually uncomfortable and sometimes acutely so. This may be because the chairs are uncomfortable, or because the room is hot and stuffy, or because the program has already been running for an hour or more without a break; or two or all three of these conditions may exist together. Laurence Olivier or Helen Hayes might well quail at the prospect of having to sway an audience under such conditions. Under these highly unfavorable circumstances, does the physicist strive to put on a reasonable facsimile of Olivier or Hayes? It may be conjectured that frequently he does not, because of the popularity of the saying that when a meeting of the American Physical Society is going on, the members are in the corridors or on the lawn instead of listening to the speakers. People with tickets to *Turandot* are not standing around on the sidewalks outside of the Metropolitan Opera House when the curtain is up.

Can anything be done to amend this situation? Very

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little, I am afraid; but the following suggestions point in the right direction.

1. *Speak loudly enough to be heard in the remotest part of the room.* Some people sincerely believe that their voices are too weak to achieve this. No doubt this is sometimes the case, but I venture to believe that most of them are wrong. In my youth I was constantly reproached for speaking too faintly, and I thought that I could not help it; experience proved me wrong. I do not think that I could manage a speech in the Metropolitan Opera House without an amplifier, but a physicist is not likely to be asked to speak in so large a hall, and if he were he could count on the presence of an amplifier. In a hall seating three hundred persons or fewer, the amplifier ought to be unnecessary except in pathological cases. If there is an amplifier, do not expect it to transform a conversational tone into a loud one. It is better to go to the opposite extreme, and pretend to yourself that the microphone is not there, even though you are speaking directly into it.

The trick recommended by those who instruct speakers is to look at and speak to the people in the rear row. This is often made difficult by the fact that some of the prominent people in the audience are sitting in the front rows; this is particularly common in University colloquia. If this situation exists, ignore it. If Niels Bohr is sitting in the front row and Joe Doakes in the rear row, speak to Joe Doakes. Bohr will hear you.

2. *Write out your speech in advance, and commit it to memory.* I have heard only one objection (from the viewpoint of the audience) raised against this procedure, and it seems to me groundless. It has been contended that a written speech is dull and lifeless; the implication is that an unwritten speech glitters with sparkling impromptus. But the presence of a manuscript need not prevent the speaker from substituting a sparkling impromptu for something that he has written; and if the impromptu fails to occur to him, the manuscript is there to carry him along. Of course, it is possible to memorize a speech without writing it out; this is recommended to those who hate to write. It is a fact that a good speech is likely to be looser in texture than a good article. No difficulty will arise from this cause if the speaker remembers that it is a speech that he is writing.

There are some who think that it is better to hear an unprepared physicist groping for what he wants to say than a prepared physicist saying what he wants to say. It would be fascinating to see this theory given a trial by the Royal Festival Ballet, but nobody ever will. For an advanced student of the dance it may be instructive to see a dancer fall on her face, pick herself up, and resume her part in the ballet; but for practically everyone else it is acutely embarrassing.

3. *If you cannot memorize your manuscript, read it aloud.* This bit of advice will probably be resented, for we have all suffered from dreary speeches poorly read.

There is, however, no compelling reason why a manuscript should be poorly read. Lady Macbeth has to read a letter aloud in an early scene of the play; it is one of the high points of the drama. More than forty years ago Ethel Barrymore read a letter aloud in such a way that it is still remembered by elderly playgoers, though the play itself is forgotten. The trouble is largely that most readers glue their eyes to the manuscript for seven-eighths of the time, lifting their eyes from time to time to steal a glance at the audience as though to make sure that it is still there. Reverse the ratio. It is easy to keep your eyes on the audience during seven-eighths of the time and look at the manuscript during the other eighth. For a manuscript which you have composed yourself, it should be extremely easy. Try it and see.

4. *Situate your topic in the general framework of physics at the beginning, and summarize your conclusions at the end.* Even in a ten-minute paper, a minute at the beginning and a minute at the end are not too much to reserve for these purposes. Do not fear to repeat your main points. I shall have more to say on this topic of repetition near the end.

5. *Time yourself.* The members of the American Physical Society are now pretty well trained in the art of giving ten-minute papers, but longer ones are still apt to overrun. This is particularly serious when the closing bell rings when the speaker still has five minutes to go, and these five minutes comprise the conclusions which are the incentive for the paper. The speaker naturally does not want to omit the climax of his speech, and the chairman is seldom ruthless enough to insist.

This is where a manuscript is particularly useful. Timing-marks can be inserted at the end of each page or along the margin, and the speaker (who should constantly be looking at his watch) will then know when he is running behind and will be able to catch up by leaving out relatively dispensable passages. One hundred and thirty words a minute, or say two-and-a-half minutes for a double-spaced typewritten page, is fast enough. In the timing, allow for twenty seconds or thereabouts of silence just after you make each of your difficult points. These gaps will give the audience a chance to think about what you have said; there are no



laws requiring a speaker to be talking *all* of the time at his disposal. The difficulty in timing is greatest when the paper involves blackboard work or slides. Rehearsal is necessary in such cases, and is worth the effort.

6. Aim your discourse toward the average of the audience, not toward the topmost specialists. Too many young theoretical physicists speak as though they were instructing Oppenheimer; too many band-spectroscopists, as if they were addressing Mulliken; too many solid-state physicists, as though the audience consisted of Seitz—and so it goes. This is not quite so flagrant a fault as it was in the days before the meetings of the Society splintered into simultaneous sessions, each attracting its own coterie of specialists; but it is still an error, and anyone who avoids it is doing his bit toward the all-important end of keeping physics from breaking up into a horde of narrow specialties.

There is one specious argument for the procedure which I am deprecating here. The young man may think that the topmost specialist is also the prime job-giver, and therefore is the man whom it is urgent to impress. But in the first place, it seems plausible to suppose that the topmost specialist forms his opinions of the neophytes from their writings and from personal contacts; and in the second place, the job-giver in the audience may be, say, some chairman of a department of physics whose own specialty lies elsewhere, and who is going to assess the young man by his lucidity and not by his profundity. If these entirely reasonable suppositions are correct, the young man is doing himself a disservice by speaking as though he were addressing exclusively those who know more than he.

7. The problem of the blackboard. This is one of the toughest of all problems, and here the theatre is of no use. I have never seen a play in which an actor had to write on a blackboard. I think that an actor would write on the blackboard without saying a word, and then turn to the audience and speak. For a physicist the psychological inhibition against doing this is quite invincible, but at least the attempt should occasionally be made. He can at least avoid the tendency to drop the level of the voice while addressing the blackboard. There are, however, two faults at the blackboard which can often be avoided.

One should write his symbols large enough so that they can be read from the back of the room. I hope I never forget the shock which I once experienced when, having finished what I had fondly supposed to be a good lecture, I went to the back of the room and found

that nothing I had written could be read beyond the middle rows. Sometimes the speaker finds the blackboards to be much smaller than he had reasonably counted on; in such a case he has to choose between altering his presentation and confining his effectiveness to the people in the nearer rows. Sometimes, of course, either the chalk or the blackboard is impossibly bad; the speaker is then helpless unless he is good enough to revise his plans and do the whole speech without the blackboard. One ought also to write his equations in the order in which he speaks them, instead of putting each in the nearest convenient empty spot and dabbing with the eraser to make more empty spots, so that at the end the board is littered with incoherent symbols. One should know in advance just how the board will look at every moment during the discourse, and at the end of the talk the board should carry all of the principal equations arranged in logical order. I am afraid that this is a counsel of perfection.*

8. The problem of slides. Most people who show slides at all show too many and show them too fast. (I suspect that this is often because the speaker has prepared too long a speech and tries to compensate by racing through the slides.) Rare is the slide which can be properly apprehended in less than thirty seconds,



though exceptions do occur. It is impossible to assign a rigid maximum to the number of slides which can be shown effectively. I suggest seven for a ten-minute paper, but I make exception for the cases in which the argument is shown on slides instead of on the blackboard. The one advantage of the blackboard over slides is that the overfast speaker is obliged to slow down as he writes; this advantage can be shared by the slides if the speaker will give them time enough. There is much else excellent advice to be given about slides, but it has all been said by J. R. Van Pelt in the July 1950 issue of the *American Scientist*. This should be required reading for all physicists.

9. The problem of the "jargon". Some people ascribe the difficulty of understanding science to what they call the "jargon". This seems to imply that scientists use long technical terms out of perversity, when they could just as well use short familiar words. This is absurd. If I am giving a speech on a subject involving entropy or a synchrocyclotron, less than nothing will be gained

* The "vu-graph" and other devices have come in since this paragraph was written, but the blackboard is not likely to vanish.



if I avoid the word *entropy* or the word *synchrocyclotron* by some cumbersome periphrase or by some vivacious popular word which does not mean the same thing. Entropy is entropy and a synchrocyclotron is a synchrocyclotron, and there is no synonym for either. On the other hand there is nothing to prevent me from giving a brief definition of either. It does not have to be a complete definition: I may say that entropy is $\int dQ/T$ between certain limits of integration, or that a synchrocyclotron is a cyclotron in which the frequency is modulated so as to overcome the obstacle arising from the change of the mass of the nuclei with their speed. It may be objected that a person who does not know in advance what these words mean is unable to profit by the discourse. This view fails to take account of the fallibility of human memory. The listener may have forgotten what the words mean; he may even be able to recover the meanings during a few seconds of groping, but during these few seconds the speaker will go so far ahead that the gap cannot be closed. I have often observed that the place at which I lost contact with a speaker was the place at which he used a word which made me stop and ponder. It seems worth-while to avoid such dangers as far as possible.

There is a sense in which physics is afflicted by what may be called jargons, though I should prefer to call them private languages. This is a phenomenon of recent years. Formerly physicists were few and far between, and one who did not make himself understood to his fellow-physicists a thousand miles away did not make himself understood to anybody. Nowadays many physicists do team work in large groups. In every such group a private language arises, characterized first of all by omissions. Relevant facts and even essential steps in an argument can safely be omitted within the group, because everybody knows them. In addition, the group invents all sorts of abbreviations, nicknames, and pet names for such things as parts of an apparatus, cosmic-ray tracks of various aspects, irregularities in crystal lattices, phenomena of hole-conduction, and even basic concepts of physics. No dictionary contains these terms; they travel by word of mouth, and often they do not travel fast enough. When they are spilled out before a meeting of the Society, disaster may ensue if they are not defined. Facility of travel and interchange of personnel are doing much to retard the development of a Berkeley language, an Oak Ridge language, a Murray Hill language, and the like; but the danger is always with us.

10. Style. The concept of style being vague and the teaching of style lying in the province of another profession, I confine myself to two remarks.

Textbooks of style advise the writer, and therefore inferentially the speaker, to strive for a proper proportioning of long words with short, and (what often comes to the same thing) of words of Greek, Latin, or French origin with words of Saxon origin. Now, a scientific article is perforce overloaded with words which are both long and of Greek or Latin origin. This sug-

gests that whenever the speaker has an option, he should choose the short word over the long and the Saxon word over the Greco-Latin. If a sentence contains such words as *ferromagnetism* or *quantization* or *electrodynamics*—not to speak of the atrocious *phenomenological*—it is really amazing how much the sentence will gain in grace and fluency if all the other words are colloquial and short. This policy also tends to bring out the necessary long word in bold relief.

It is said that the style of our forerunners was largely formed by the King James Bible, and that the style of our contemporaries is influenced by *The New Yorker*. Neither of these publications can have much influence on those who do not read them. The suggestion is that physicists should not confine their reading to their professional literature. Read novels; read poetry; read essays; read history as written by notable writers; read Winston Churchill; and read Rebecca West—or if you simply will not go beyond the writings of scientists, read the Braggs and Eddington and Jeans and Bertrand Russell. Failure to observe this precept is partly accountable for the fact that it is seldom possible to tell from the style of an article in *The Physical Review* who wrote the article, and for the further fact that scientists who try to write something for the general public so often do it badly.

11. A suggested experiment. I have proposed, *inter alia*, that a speaker should speak slowly, show his slides slowly, define his private-language terms, and repeat his main points. To anyone who deprecates this advice I suggest the following experiment.

Choose an article in *The Physical Review*; let it be in your own field if you will, lest the result of the experiment be too frightful. Sit down in an uncomfortable chair, and read the article—but read it according to the following prescriptions. Read straight through from beginning to end at the rate of 160 to 180 words per minute. Never stop to think over anything, not even for five seconds. Never turn back, not even to refresh your memory as to the meaning of a symbol or the form of an equation. Never look at an illustration until you get to the place where it is mentioned in the context; and when you get to that place, look at the illustration for ten or fifteen seconds and never look at it again. If this is not the way that your listeners will apprehend you when you give a paper, you are an outstanding speaker.

