Presenting the Chemical Paper*

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In this paper we urge chemists to improve the oral presentation of their technical papers. If an oral presentation is poor, the audience may not understand or remember what the paper is all about, the valuable time of the listeners will have been wasted, and the speaker will not have promoted his own professional career.

We will point out some common faults of presentations and how they can be overcome. In particular, we will itemize the faults disclosed by an opinion survey, then discuss the means of achieving a good oral delivery, the proper use of visual aids, the necessity for rehearsal, and the way to handle a discussion period. We hope this will encourage chemists to improve their presentations to a level where listeners will be enthusiastic rather than uninterested or outright critical, thus ensuring audience attention and maximum comprehension of the subject matter.

MANY LISTENERS ARE NOT SATISFIED

Before writing the paper, the author asked himself whether a problem really exists. Hundreds of papers are presented at our national ACS meetings. This past fall, more than 1600 papers were on the schedule and were heard by thousands of listeners. If most of these listeners were satisfied with the presentations they heard, there would have been little need for a paper on how to present a paper.

To find out how presentations are received by audiences, the author first interrogated several chemists in person. The majority were far from satisfied with many chemists as speakers.

In broadening the inquiry to include 100 chemists across the country, all levels of responsibility were approached from bench chemists to research directors. The inquiry was made by means of a two-page questionnaire. To find out if the views of chemists differed from those of other disciplines, inquiries were also directed to 50 engineers and 130 other technical professionals chosen at random from fields other than chemistry and engineering. All told, 225 responses were received, an 80% return. This high response clearly shows a widespread interest in the subject.

The survey obviously was not extensive, and the groups canvassed are not claimed to be representative cross sections of the disciplines sampled. Nevertheless, the results can be used to draw some broad conclusions, and to provide a background for the present paper.

Judging from answers to the multiple-choice questions, most of the 225 respondents are fairly well satisfied with presentations, but a sizable minority rate them as poor. Answers to the questionnaire indicate that most listeners prefer high-quality presentations, and few would willingly settle for merely getting the facts.

The majority of the responding chemists also prefer the best presentations, if they have a choice, though the chemists were less demanding in this respect than the other disciplines. In all other respects the opinion of the chemists agreed fairly well with those from the other disciplines.

Specific types of criticisms made by respondents to the questionnaire are listed in Table I. This list combines the criticisms obtained as check marks opposite the multiple-choice boxes with the individial comments written in by many respondents. Those who took the time to add their own comments are probably more interested in the subject than those who merely checked the multiple-choice boxes. Many respondents felt so strongly that they sent in letters. The majority of these were critical of presentations, and

Table I
Criticisms of Oral Presentations
(From 225 respondents of all disciplines)

Criticisms of the Paper
Too many details
Main point of paper not explained
Paper not adequately summarized
Presentation poorly organized
Presentation lacks continuity
Insufficient background or interpretation
Content poor, nothing new, paper not justified
Too long or too short
Too theoretical
Not slanted toward audience
Commercialization and advertising
Criticisms of Delivery
Cannot hear speaker
Dull or unenthusiastic delivery
Poor voice projection, articulation, pronunciation
Reading paper verbatim
Talking too fast, or too slow
Speaker tries to impress audience
Making unnecessary remarks
Criticism of Arrangements
Inadequate room size
Poor ventilation
Improper lighting
Inadequate public address system
Speaker unfamiliar with arrangements
Preprints not available in advance of presentation

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one was in favor of abolishing them altogether. Several chemists wrote letters defending presentations in their own technical societies or in their own divisions of the ACS, as contrasted to what they had heard elsewhere. The Petroleum Division and the Rubber Division were cited as examples of groups in which presentations have been much improved in recent years.

PRESENTATIONS CAN BE IMPROVED

Lack of Interest and Enthusiasm.—Having found a widespread opinion that presentations of chemical papers need improvement, we might well ask why this is so. Chemists have been so successful in solving difficult and complex problems that one wonders why they perform poorly in what may seem to be the relatively simple task of presenting a paper.

The answer may lie partly in the subject matter of chemical papers and partly in the nature of chemists themselves. Chemistry deals with facts and the scientific method. Except for a few momentous discoveries, day-by-day progress in chemistry is likely to be coldly methodical, dry, and lacking in human interest. An unadorned presentation describing such work would consist of only a rather matter-of-fact sequence of logical steps leading to a rational conclusion. Unless enlivened somehow, such a presentation will tend to be dull or even dreary.

Chemists often contribute to the "dryness" of their presentations by deliberately or unconsciously adopting a restrained manner. Like many scientists, they may feel that introducing liveliness into a talk leads to improper interpretations. Or they may fear that any display of enthusiasm would savor of salesmanship or showmanship; whereas science requires impartial objectivity, the elimination of oneself. But in the endeavor to be objective, many chemists suppress the natural sparkle in their personalities. Voices become flat, faces immobile, and whole presentations cold, miserable, monotonous recitals.

Furthermore, through laziness or ignorance of the consequences, the chemist may simply read, verbatim, the printed version of his paper. And even a well-written paper is not suitable for oral delivery in its original form. Finally the chemist, inexperienced in public speaking, may suffer from a certain amount of stage fright. The combined effect of all these factors may result in a presentation of barely adequate or poor quality, generating little or no response from the audience.

The Published Paper Must Be Revised for Presentation.—For several important reasons a chemist should not attempt to present a paper in the original form prepared for publication. One obvious reason is that the time available at ACS divisional meetings, usually limits oral presentations to no more than 30 min. Thus, authors must shorten the full-length written paper for oral delivery. While this abbreviation is forced upon authors for a practical reason, it is a fortunate restriction, since most listeners find it difficult to sit still and concentrate for a long period.

Based on answers to the questionnaire, most listeners would prefer a number of 30-min. presentations than a few relatively long ones. The maximum period of comfortable listening depends upon the importance of the subject and the level of interest the speaker arouses. But even with the most substantial paper, a highly capable speaker should not expect to hold an audience over 45 min. When a speaker goes on beyond 45 min., he taxes the physical endurance of the audience and is inviting hostility. Perhaps a formal address longer than 45 min. can be tolerated, but an oral presentation of a technical paper is not an address. Naturally the length of the oral delivery will be determined by the subject matter to be covered, and an arbitrary time allotted to a speaker by a session chairman may prove either too short or too long. Ideally, the speaker should have only enough time to cover his subject without losing the attention of his audience, and with courteous regard for other speakers on the same program. In order to grant more time to papers of substance and less time to those of lesser value, session chairmen might consider reviewing all the papers well in advance of the meeting. With the aid of both the speakers and a committee, the chairman might then allot appropriate periods of time for each paper. This would be preferable to arbitrarily forcing each paper into the same rigid time allotment.

Even though some papers deserve more time than others, once the time schedule has been established, chairmen should be on guard against the speaker who rambles on beyond his time allotment. This practice annoys many listeners who wish to hear papers in more than one session.

Shortening a paper for oral presentation is not the only way in which it should be changed from the written version. In reading to himself a person sets his own pace and pauses for rest and reflection at appropriate places in the text, as he desires. The reader has an opportunity to absorb new information into his past knowledge. He can backtrack to assimilate a particularly difficult or unusual concept, and he may frequently pause to do some thinking on his own before proceeding further.

On the other hand, listening to a presentation allows little or no time for reflection. The listener's attention must conform to the speaker's speed. We are all rather poor listeners. Our minds wander. As listeners we find it hard to concentrate on difficult concepts. Because of this basic difference between absorbing information by eye and by ear, the oral version should be much simpler than the written version.

Finally, the oral version should concentrate on the background and purpose of the investigation, on the significance of the results, and on any plans for further work. The oral presentation should omit all trivial results, unless they are so novel as to arouse real interest. While thus abbreviating his paper, a speaker may, however, offer to discuss details later with those who may have a specific interest.

GIVE THE LISTENERS WHAT THEY WANT

Salesmen succeed best when they offer the goods and services that their customers want. Similarly, chemists should always make their presentations in the manner that the audience prefers.

The Listener Must Be Able to Hear.—Based on responses to our questionnaire, "not being able to hear properly" is the most frequent complaint from listeners. The blame for

this situation cannot be directed entirely at the speaker. Good public address systems can be obtained nowadays, and program chairmen should see that such systems are not only installed but working properly. Then it is up to the speaker to maintain a uniform distance between his mouth and the microphone, particularly when referring to slides. When a speaker plans to point to a slide projection on the screen, he should plan to use either a lapel microphone or a chest microphone in order to avoid undesirable increases and decreases in voice level. Some speakers have the annoying habit of intermittently touching the microphone, thus setting up a distracting crackling sound over the loudspeakers. The speaker should be careful not to be talking at all when he turns away from the microphone, in order to glance at the screen, for example. These precautions are so elemental that they should be easy to observe. As a standard routine, a speaker should become familiar with the microphone set-up before the meeting starts. The program chairman should have an assistant or colleague check the audibility at the back of the room, both before the meeting and during the presentation. If there is insufficient volume, an assistant should increase it without interrupting the speaker, and should be on guard against objectionable howling caused by feedback.

The Listener Must Hear Clearly.—Related to simple audibility are the problems of articulation, pronunciation, voice projection, and vocal quality. These factors are so personal that it is not only embarrassing for the audience to express dissatisfaction on the spot but often difficult even for a colleague to point out a speaker's deficiencies in these areas. Furthermore, many people cannot hear their own mistakes in articulation or pronunciation and certainly have little control over vocal quality. The only practical remedy is help from a professional speech coach. To improve the clarity or distinctness of the voice, speech teachers say we must overcome laziness in speaking. They urge us to make more use of the lips, jaw, and tongue in speaking. Word sounds are formed at the front of the mouth, and consonant sounds are often not heard at all if not carefully articulated. Many texts are available on speaking, but the best way to learn to speak properly is by practice before a critical coach.

Speaking clearly and crisply is more important than raising the volume of the voice. The volume can best be controlled through the public address system. The natural quality of the voice is best at lower levels of volume and can be spoiled by excessive loudness.

The Listener Must Also Understand.—So much has been written and said in the past 15 years about the virtues of clear writing that it is almost axiomatic today to say that a technical paper should be crystal clear in meaning. Technical papers are written for those people who are familiar with the field, who know the vocabulary and have the educational background to understand the subject. What may be clear to an expert in the field may be meaningless to the outsider. When the outsider finds he cannot understand a printed paper he may either not read it at all or go to someone for help. The oral presentation offers a somewhat different problem, since the audience may include not only the experts but some who are marginally interested. (For an example of how specialists may also become impatient with difficult-to-understand oral presentations, see article by T. A. Sawyer.[14])

Perhaps those listeners completely ignorant of the field should not expect to follow an oral presentation in its entirety. But the marginal listeners—who are not experts but who have the education needed for general understanding of the subject—are perhaps not being unreasonable when they expect the speaker to talk at their level.

Here the speaker has a real challenge. The desire to inform rather than impress should be uppermost in his mind. Careful attention to the definition of new terms and the judicious use of explanatory remarks are always welcome to an audience. If a speaker has a wide knowledge of the subject, he need not hesitate making elementary remarks for the sake of clarity. A speaker, for example, will flatter both the experts and the novices by introducing an explanatory statement with some such phrase as "I am sure you are all well aware that. . . ."

Chemists presenting papers at national meetings should realize that many of their listeners are attending the session to learn something new. These listeners hope to understand enough to be able to judge whether the subject justifies further study. For their benefit, chemists should make the extra effort required to present a complex subject in the clearest possible manner.

Give the Listeners the Main Points.—High on the list of listener complaints are presentations with too many details and those in which the main points cannot be sorted out from the numerous details.

Both complaints can be solved by boiling down the printed version into a high-spot summary. For a paper discussing a research project, the audience would like to know:

1. What was done, and why
2. The important results obtained
3. The speaker's interpretation

The first part should not detail the step-by-step procedure: what was done is more important than how it was done. The details of each step may be most important to those who wish to duplicate the work, but they belong in the printed version of the paper, not the oral presentation.

In order to decide what experimental results to present orally, a speaker should ask himself the question: "If I were listening to the paper instead of delivering it, which of the results would I like to hear about?"

The results can be given most readily by graphic means. Certainly no listener wants to hear a recitation of detailed data. But if he is interested in the subject at all, he will want to know what significant results were obtained. He can absorb this most easily from a visual aid used in conjunction with the speaker's discussion. This is the principal justification for the use of slides. Indeed many relationships can be grasped only by visual representation. (A later section of this paper will be devoted to slides.)

Interpretations may be given by the speaker as he proceeds through his disclosure of the data, but the best presentations will conclude with a meaningful over-all commentary. Without some form of general conclusion the listeners may have a feeling of "so what?", *i.e.*, they may wonder "what does it all mean?"

Although these three basic parts may suffice for an oral presentation, the whole performance needs to be tied together by suitable transitional statements. If not so integrated, some listeners may hear the words but not clearly follow the sequence of the story. Transitional state-

ments are like signposts along the highway; they let the listeners know where they have been, where they are, and where they are going. This kind of guidepost information is needed throughout a presentation. A typical transitional sentence could be something like this: "so much for the general experimental approach to the problem. Now let's take a look at the results we obtained." Some teachers refer to these transitional guideposts as "telling the audience what you are going to tell them." We can think of them also as a skeletal framework around which the technical information is arranged. The speaker can also ease the listener's task by briefly outlining the plan of his presentation at the beginning of his talk. The listener will then be better able to recognize the transitional signposts as part of the plan.

Most public speaking teachers advocate some sort of attention-arousing device at the beginning of a talk. In a short oral presentation of a technical paper, this introduction should be brief and to the point. Irrelevant personal information and labored humor are best omitted. There is no better way of getting the attention of the audience than by a simple statement of the purpose of the paper. Without some sort of preliminary orientation the listeners may be confused all through the presentation. Similarly, at the end of a talk, public speaking teachers advocate restating what has already been said in order to etch it into the minds of the listeners. This is often referred to as "telling them what you've told them." In technical presentations this restatement can be a summation of the principal conclusions and interpretations. The summation like the introduction is vital for audience appreciation of a paper's significance. To be effective it should be concise.

Finally, the oral version may well close with a few words on plans for future research, or perhaps with a plea for cooperation from other workers in the field. Such remarks would usually not be given in the published report.

In contrast to the paper describing a research project, the review-type paper surveys results reported by numerous workers in a particular field. Here the speaker must largely forego the "what was done" aspects in order to keep the presentation to a reasonable length. Even with this abbreviation, the review paper tends to be much longer than the research paper. If the speaker is not careful, he may go on for 45 min.

The speaker must realize that the audience can remember only four or five main ideas. In a review paper, the speaker therefore must generalize the results of the several papers covered, presenting a limited number of concepts. If he attempts more than this, he must use every device he can muster to hold the attention of the audience. He must state and restate, clarify and emphasize, explain and interpret, and do it all with enthusiasm. And finally he must come up with a concise, hard-hitting summary. Without these attention-arousing devices the review-type paper will degenerate into a monotonous recitation and the audience will drift into mass slumber.

Speaking Is Better Than Reading.[**]—The presentations that are received most enthusiastically are extemporaneous. (In this paper the term "extemporaneous" describes a style of delivery in which the speaker is fully prepared on the subject, short of memorization. In contrast, an impromptu presentation would be given on short notice with little preparation.) Audiences feel more comfortable when they are "talked to" rather than "read to." This preference is readily understandable. Speaking rather than reading requires that the speaker verbalize his thoughts. It is an entirely different mode of communication than reading the printed page. This difference is deeply rooted in our entire life experience. We learn to think and express ourselves in words from early childhood. Later we learn to write, a discipline that involves rules of syntax, and although the words may be the same as in speech, the expressions are different and form a different kind of language. If written material is recited or read aloud, the expressions are stilted and communication of thought is hindered. Speaking extemporaneously requires complete freedom in the use of language, freedom from the restrictions forced on us in writing. Usually a chemist will not venture into speaking naturally unless he is sure of himself and experienced enough to feel quite confident he can do it without embarrassment. Accordingly, those who do so are usually accomplished speakers, and already know the great advantage of this type of presentation. To those chemists who have not yet attempted it we urge that the extemporaneous delivery be their goal. The results in terms of gratified listeners will be worth all the efforts required to achieve a satisfactory delivery, and the chemist's own reputation and confidence will be enhanced.

Extemporaneous speaking is more acceptable than reading aloud because it is likely to be couched in simpler language. (The last sentence expressed orally might come out in this version: people like talking instead of hearing something read because it's simpler.) Extemporaneous speaking is natural, casual, and unaffected. It is directed right at the listeners, not at the room. In a sense, it flatters the audience, because it shows that the speaker is doing something just for those present. Extemporaneous speaking allows the speaker to continuously "look the audience in the eye," just as in social conversation. It is a technique that tends to establish rapport between speaker and audience.

Chemists who have not yet presented a paper extemporaneously are advised to enlist a colleague or a speech coach to listen to several trial runs. Some industrial corporations today provide professional speech teachers to coach employees who are scheduled to present a paper. Chemists are urged to accept the help of these professional coaches to give them added confidence. And it is axiomatic that overcoming stage fright and gaining confidence on the rostrum is the first requirement for a successful oral presentation.

Because chemists favor an orderly arrangement of their material, they usually prefer to have written notes with them on the rostrum. Such props are entirely acceptable to an audience, and indeed are the usual practice. Such notes should preferably be headings only, not complete sentences. The briefer and less formal the notes, the greater the chance that the presentation will be natural and relaxed. When a speaker uses notes he may, in a sense, establish a closer personal relationship with his listeners, since they may be taking notes.

Even Reading Can Be Improved.—Although listeners prefer the naturally delivered talk, many authors feel that the only way to deliver a paper is by reading verbatim

[**] The author acknowledges suggestions from Prof. Henry C. Schneidewind for some of the ideas expressed in this and the succeeding subsection.

from a prepared script. No matter how much they may be urged to speak freely, many chemists will still continue to "read" a paper rather than go through what to them is the painful procedure of a truly extemporaneous presentation. The principal reasons for their choice appear to be lack of confidence, fear that something will be left unsaid or spoken inaccurately, and sometimes limitations imposed by corporate patent departments.

What do listeners feel about papers that are read aloud from the printed page? Two of the phrases used by respondents were: papers that are read aloud are deadly, and reading aloud from the printed text is an insult to the audience. These are strong condemnations. The chemist who plans to read a paper should realize that the audience will have some built-in prejudice against him at the outset. To soften this attitude, he should be willing to devote enough time to modify the paper in whatever way is required to make its presentation acceptable.

To overcome the complaint of deadliness, we suggest that the author prepare the script in the most conversational style possible. To do this well, he should say the sentences to himself as he writes them, and he should listen for heavy formal phrases and slow, cumbersome expressions. These should be culled out of the script. He should introduce contractions accepted in casual speech, such as "it's" for "it is" and "don't" for "do not." He should mark the text where there should be appropriate pauses and use marginal notations to indicate where inflectional changes would be desirable. In short, he should try to write the script just as he would speak it.

Finally, when preparing a script for reading aloud, some attention should be given to syntax. Historically, the use of personal pronouns has been frowned upon in scientific papers, and the passive voice has been preferred. However, this style of writing is far too slow and weighty, too formal and pedantic when used in speech. For example, a sentence such as the following is quite typical in an ACS journal: "As part of a comprehensive study of carbinol condensations with the ferrocene nucleus, a previous investigation has dealt with the condensation of ferrocene with representative α-arylcarbinols in the melt phase, rapid, almost quantitative reaction being exhibited by the limiting case of triphenylcarbinol, decreasing to slow, very slight conversions with primary α-aryl-substituted alcohols."[10]

But in reading aloud, the same information might better be expressed in this simpler way:

"Dr. Trifan and I have been studying carbinol condensations with the ferrocene nucleus. In 1962 we reported that triphenylcarbinol reacted rapidly and almost quantitatively with ferrocene. But we found only slight conversions using primary α-aryl-substituted alcohols."

We doubt that chemists are any better or worse than other technical people in reading aloud. From listening to those radio and television performers who make their living reading from prepared scripts, we must all agree that reading can be done with great proficiency. Remember that these professionals have received a wealth of criticism and years of coaching by speech teachers. Reading aloud is a skill that is akin to acting, though a good speech coach will tell us not to read a script like an actor. Instead, we should put into the delivery enough expression to convince the listeners we believe in what we are saying. We must be sincere. Our expression must reflect the person behind the words. It is more important to be genuine and fumble over a word now and then, than to make a polished delivery, letter perfect, sounding as if we had just come from an elocution lesson.

After a chemist has written his oral script, he should practice delivering it in possibly three ways. First he should recite it to himself. At this stage he may stumble over phrases that are difficult to express and over words hard to pronounce aloud, and these should be reworked. For example, a phrase such as, "Are you copper-bottoming them or alumining them?", while acceptable for eye reading should be avoided in the oral version. Next he may wish to read his script to a tape recorder and play it back to himself. Finally he should try it on others—his wife, a colleague, or a friend.

In reading aloud the most serious fault is burying the nose in the text. In the endeavor not to make a single error in reading, a worse error is committed by the reader: he fails to look at the audience. This fault can be overcome by first having the script in large type, easy to follow, and second by much practice in reading the particular script aloud, thus becoming perfectly familiar with every word. The aim should be to look at the audience most of the time, and only occasionally refer to the script, and then for complete thoughts or, if possible, for whole sentences.

Finally the reader should inject some changes of pace into his reading (but avoid unnatural jerkiness), should include some gestures, and should avoid a dead-pan face and a dreary tone. In short, a reader should endeavor to put as much sparkle or natural inflection into his reading aloud as he would into his everyday conversation.

Put Sparkle in the Voice.—Lack of enthusiasm in the voice was one of the principal complaints written in voluntarily by chemists on the questionnaire. How can an audience be expected to show any enthusiasm for a paper when the speaker shows no enthusiasm for delivering it? Because of their scientific training, which emphasizes objectivity of attitude and frowns on any demonstration of emotion, chemists often suppress enthusiasm in their presentations. But there is a wide gulf between undesirable emotionalism and simple enthusiasm. Chemists should allow their natural enthusiasm for their work to come through in their voices when they give a paper. Enthusiasm can be shown by a pleasant facial expression, by a smile instead of a scowl, and by an occasional change of tone in the voice. As many respondents to the questionnaire expressed it, imagination and enthusiasm will carry almost all audiences, or enthusiasm will often overcome a poor presentation.

Enthusiasm, however, like a smile, must be sincere to be convincing. One must feel enthusiasm to convey it to others. This matter is related to what some public speaking teachers call presence, that aura emanating from a speaker which holds the listener's attention. Without this quality in a speaker, the audience simply hears words, but with it the audience focuses attention on a living person and communication is vastly improved.

Rostrum Manners.—A number of minor faults that can be classified under the heading of manners are perhaps typical of the inept speaker and indicate his discomfort. Some of these are mentioned here.

Leaning on or clutching the lectern, fiddling with the face, the lapels, the microphone, or the microphone cord, or any display of nervous tension—these are minor bad habits that tend to distract the audience.

VISUAL AIDS

Because of time limitations at an ACS meeting, use of a blackboard, as ordinarily done by a teacher in a classroom, is impracticable. The question of visibility for a large audience also prohibits the use of a blackboard or turn-over charts. Consequently, the projected image from a slide to a screen has become the standard visual aid used at technical meetings. The comments in this paper are confined to slides.

In spite of years of exposure to slide projections, and not withstanding the availability of many papers, pamphlets, and instruction manuals on how to make good slides, chemists still are not obtaining maximum value from this type of visual aid. The results from the questionnaire indicate clearly that slide viewers feel some improvements should be made.

On the average, the respondents felt that roughly one-third of the slide presentations at technical meetings are poor and that half are only adequate. This is regrettable in view of the number of bulletins and papers issued during the past 10 or 15 years exhorting technical people to upgrade the quality of slides used at meetings. The specific complaints made against slides by the respondents are listed in Table II.

Slide Making Instructions are Available.—Ample instructions have already appeared in previous papers[1-7] and have been published by all the major technical societies to show speakers how to prepare satisfactory slide copy. The American Chemical Society has covered this subject thoroughly in its Bulletin 8, "Suggestions on How to Organize, Present, and Illustrate a Technical Paper,"[16] a revised edition of which was issued in 1961.

Table II
Criticisms about Visual Aids
(From 225 respondents of all disciplines)

Criticisms of Slides
Too much on a slide
Characters too small to be read
Slide layout too complex
Poor definition, poor photography
Main points of slide not emphasized
No color on slide
Slides too elemental
Criticisms of Use of Slides
Too many slides for time available
Slide on screen for too short or too long a time
Using unnecessary slides
Not enough slides for adequate illustration
Slides not adequately explained
Poor coordination of slides and talk
Speaker not skilled in slide presentation
Slides used in place of speaker's notes
Criticisms of Projections and Facilities
Projector not adequate
Projectionist not adequately briefed
Slides in wrong sequence, upside down, etc.
Not enough light to take notes

Many of the larger corporations have graphic arts sections that know how to make good slides. Those chemists who do not have such services available should take the time to obtain one of the available slide manuals and learn how to prepare their own slides. The present paper is not intended to give all the necessary instructions for making good slides, but it will point out some of the major factors and some new techniques.

Copy Must Be Visible.—Just as a speaker must be heard and understood by his audience, so a projected slide image must be at the minimum, clear, legible, and understandable. Without these attributes, the projection of a slide is a futile gesture.

In the returns from the questionnaire, the two principal complaints can be grouped under the one general heading: inability of the viewer to see the characters on the screen. This inexcusable fault stems primarily from the mistaken notion that a table or chart that is readable in a report can be photographed unchanged and make a satisfactory projection on the screen. This is a great fallacy.

Overcoming this fault is not a matter of photography but is a problem in layout. Usually it is a matter of boiling down, simplifying, and reducing the copy to a minimum. By these means, all the characters on the original layout can be increased in size.

A simple rule to follow in laying out slide copy, no matter what the size of the original layout sheet, is to make the smallest character no smaller than one-thirtieth the over-all height of the layout. (This ratio will provide superior projection. Adequate projection can be achieved with a ratio of 1:40.) In addition, the screen-image size (and, therefore, the screen itself) must be proportioned properly for the size of the room. The simple rule on image size is to have the over-all width of the image no less than one-sixth the distance from the screen to the back row of the auditorium. The rule on the size of the characters must be observed by the chemist or whoever makes his slide copy. Observing the rule on image size is the responsibility of the chairman of the meeting. If both rules were to be followed at all meetings, the complaints of not being able to read the slide image on the screen would disappear.

Ruled lines and curves should also be proportioned on the original layout to obtain maximum legibility. Main curves or flow lines should be heavy (about $\frac{1}{16}$ in. wide), and grid lines much lighter (about $\frac{1}{64}$ in. wide) when plotting on a standard 8½ by 11 sheet.

By using the one-thirtieth rule for controlling the size of the characters on the layout, it is possible to obtain legible slide projections with typewriter copy. The trick is to keep the size of the layout quite small—actually down to about 3 by 4 in., roughly the size of the finished slide itself. Even so, the majority of good slides today are made with either hand-lettered characters (preferably made with mechanical lettering guides) or by other means.

One of the best modern techniques is to use a photo device (such as Film-O-Type) which allows the image of a letter from a negative film to be transferred by light to a positive strip of printing paper. Thus words can be composed letter by letter in appropriate sizes on a single

strip of paper which can then be cut up and pasted on to the layout.

Another modern technique for avoiding hand lettering is the dry transfer of commercially preprinted wax-backed letters from a transparent plastic sheet onto a layout sheet by burnishing with any smooth tool. The letter is positioned over the layout sheet with the help of preprinted guide lines. (Two commercial styles of preprinted letters are Letraset and Prestype, both available in artist supply stores.) The dry transfer technique is superior to the photo transfer system in that the letters may be placed exactly where needed without the intervening steps of cutting and pasting.

Slides Should Be Simple.—Even though the characters are large enough to be read from the rear row of the room, an author may still commit the fault of showing a slide that is too complicated. Because of time limitations, slides usually are not on the screen for more than a minute or so. The speaker should realize that in this short space of time, viewers who are entirely unfamiliar with the subject must read and understand what the speaker may have been working with for months. He must often do this while also listening to the speaker. Thus if the first objective in slide making is legibility, the second should be simplicity and clarity.

To obtain simplicity, and thus assure clarity, each slide should if possible express only one central idea. A slide should not attempt to present masses of data. These should be restricted to the printed version of the paper.

Emphasize the Central Idea.—With a slide layout that is simple, emphasis on the central idea is more readily achieved. Thus the speaker can more easily achieve the main purpose of a slide—transmitting information or concepts to the viewer by graphic means. Emphasis may be achieved by using bolder lines or characters for the central idea, or by use of color. Color applied to a curve on a graph will heighten the interest of the slide and attract greater attention. However, excessive use of color for the sake of color distracts the viewer and leaves no clear impression. Thus, color should be used with restraint for maximum effect.

Color can be applied effectively and at reasonable cost to a negative slide (white lines with black background). The original chart is made in black ink on a white background and the photographic negative is used for the slide itself. The lines or characters to be colored are simply washed with a suitable dye on the film negative itself before it is bound in glass.

To achieve a highly professional appearance and thus increase viewer interest, a new technique for emphasizing with color uses commercial color film. The steps involved are outlined below.

From the original black-on-white layout, a high-contrast photographic negative is prepared, but the lines or characters to be colored are opaqued out on the negative, leaving only the copy that will appear white on the finished slide. The copy to appear in color is traced from the original layout onto a clear acetate sheet, using pressure-sensitive tape and letters in the actual colors desired.

The positive color slide is made by two exposures. The first exposure is to the acetate sheet backed up by a piece of art paper having a muted color suitable for showing up the brighter-colored lines and letters on the acetate sheet. The second exposure is to the high-contrast negative, set up in a suitable frame to obtain proper registration with the first exposure. The negative may be brightly illuminated on the side away from the camera in order to burn out the color on the positive slide.

This process gives a positive color slide, with vivid color for those lines and characters needing emphasis, but no color (*i.e.*, clear white) for lines and characters so selected. The background will be in the pleasant, muted color chosen. Needless to say, this type of colored slide should be made only when the cost ($7–8 per slide) is justified.

Color slides can also be produced quite economically and rapidly by drawing and lettering by hand in colored crayon directly on a matte acetate sheet of actual slide size. The crayon markings are then sprayed with clear lacquer to seal them in permanently. The acetate sheets can be purchased with the proper size of opaque mask around the edges, and can be used without being bound between glass plates.[9]

Use Slides to Best Advantage.—The best slide can be a distraction if certain aspects of projection are overlooked. Some of the faults that cause complaints are: leaving the slide on the screen when the speaker is not referring to it in his talk, use of far too many slides, not taking sufficient time to explain a slide to the viewer, the speaker turning his back on the audience, and the speaker reading directly from a slide.

To overcome these complaints, the speaker should observe some elementary practices of good slides projection. The slide should be on the screen only while it is being referred to, the slide should be interpreted for the audience, and the speaker should not turn away from the audience while he is speaking. There are two methods of avoiding this last mentioned discourtesy. An electric pointer operated by a colleague in the front row can be used to project an illuminated arrow at the appropriate spot on the screen and at just the right time. Coordination of words and pointing can be perfected by practice. But the speaker will only amuse and distract his audience if while using an electric pointer himself, he lets the lighted arrow flit all over the room. Another method is to have different colored arrows on the slide itself, and these may be referred to by the speaker as he interprets the slide, a copy of which should be available to him on the lectern.

In discussing any projected image on the screen, the speaker should not refer to it as a slide, but might better use a descriptive term such as graph, chart, table, etc.

One little courtesy that can be tendered to the audience is the provision of some light in the auditorium during slide projection. This practice permits viewers, to take notes during the slide projections and is much appreciated by the viewers, especially when preprints are not available. The level of light that can be used depends upon the brightness of the image on the screen as provided by the slide projector. For a photographic type of slide, the best viewing may require that the room illumination be quite low, whereas for a slide of white lines and characters on a black background, a much higher level of light can be tolerated in the auditorium. With the typically good, high-wattage projectors currently used in national ACS meetings, there is no need to have the room in total darkness. Some pre-

liminary checking should be done by the meeting chairman with the projectionist to see how much room illumination can be tolerated with the slides to be used and still have legible slide images on the screen.

One of the annoying practices observed at large meetings is intermittently turning the lights off and on at the speaker's request when a slide is either on the screen or not on the screen. A better practice is to leave the lights on low once they have been dimmed for the first slide and not to call for the lights to be turned on again until the speaker concludes his paper. A gradual dimming of the lights by means of a rheostat is much preferred over a sudden change in light intensity.

The chairman should be certain in advance of the meeting that the projection equipment is suitable for the room size and for the slides to be used by the various speakers. But each speaker also has the responsibility to see that the projectionist is properly briefed on the slides to be used and the method of signaling for successive slides. Certainly a signal system is preferred to an oral order from the speaker, and such systems are almost universal today in large national meetings. Obviously the speaker is obligated to give the proper slides to the projectionist and to see that they are arranged in the correct order and position for projection.

HAVE A REHEARSAL

The best combination of oral presentation and slide illustration can only be achieved through considerable practice. Just as every oral presentation should be rehearsed before a speech coach, so also should the slide projections be reviewed by a critical group of colleagues. The combined performance of speaking and projecting should be given a thorough dress rehearsal before a group or committee not afraid to offer constructive criticism.

The "dry run," as many technical people refer to the rehearsal of a paper, is becoming standard practice in many industrial organizations. There should be three types of critics at these rehearsals. The technical critic will want to check on the accuracy, completeness, and clarity of the technical material presented. At least one critic should be an expert on visual aids. Finally, one critic should be a trained speech coach, or at least have experience along these lines.

To help evaluate an oral presentation, a check list can be used by the critics, such as the example shown in Fig. 1.[13,17] For the experienced speaker a single dry run should suffice. For the chemist who has not had prior experience, several rehearsals might be required to raise the presentation to a level acceptable to a large audience.

It has been suggested that committees set up by the ACS divisions run preliminary previews of all oral presentations, including the slides, to see that the quality measures up to minimum standards. This admittedly would not be easy to do, since it would require that speakers submit their slides a month or so before the meeting. However, the benefits passed on to the viewers by the elimination of wholly inadequate slides would be worth the effort required. The same end would be achieved if all organizations with which speakers are associated would exercise their own privileges of reviewing oral presentations in advance, as is now done by many large companies.

THE DISCUSSION PERIOD

Many chemists feel that discussions following papers at national ACS meetings have not been as worth while as they could be. This unfortunate reaction is evident from the comments made on that section of the questionnaire (see Table III). For while an overwhelming majority of respondents feel that discussions could be either helpful or most important, many of them added comments to the effect that there are not enough discussions, that chairmen should do more to stimulate discussions, or that the entire manner of handling discussions should be improved.

Table III
Criticisms of Discussions
(From 225 respondents of all disciplines)

Discussions not properly planned
Discussions are poorly handled
Difficulties with large audiences
Discussions tend to freeze up
Not enough time allotted for discussion
Excessive complimentary and uncomplimentary remarks about the paper
Using discussion as opportunity to give a paper

Chemists like other respondents, want a chance to direct some questions to the speaker. Questions are good for the speaker because they help him gauge audience response to his paper. They are good for the listeners because they can inquire about points of interest that were omitted from the brief oral presentation. Finally, questions tend to bring the audience and the speaker together in a more casual way than can be accomplished in a straight talk.

Questions can be prearranged by the chairman if selected listeners have access to the paper prior to the meeting. In fact, this practice is standard in some of the engineering societies, and in some instances the speaker receives prior knowledge of what the discussors will say. This practice tends to make the discussions more formal, and may actually inhibit off-the-floor questions. To start questions flowing from the audience in an informal manner, the chairman can have two colleagues direct stimulating questions to the speaker, with an understanding in advance that the questions and answers will be simple and brief. Once the dead silence has been broken by these planted questions, more questions will be spontaneously generated.

The chairman should be on guard against discussions becoming papers of themselves. This can be handled by a word of caution from the chairman as he opens the meeting for discussion. The chairman must also be responsible for gauging the total time that should be permitted for questions as they develop. Arbitrarily and abruptly cutting off a lively discussion is undesirable, though the chairman should try to end the discussion period while interest is still evident rather than letting it wither and die. As a rough guide, no single question and answer should take more than 3 min. and the total time for all questions should not exceed half the time taken by the original presentation. Only in rare and perhaps controversial presentations will a discussion period run to this length.

GM
GENERAL MOTORS INSTITUTE

FIFTH-YEAR ORAL REPORT EVALUATION [17]

Cooperating Unit Copy

1

Name of Student_____ Date_____

Subject or Title of Report_____

_____

Cooperating Unit_____ Where Held_____
(TYPE OF ROOM CONFERENCE AUDITORIUM OFFICE)

No. Attending_____ Approximate Length (exclusive of question period)_____

INSTRUCTIONS TO USERS:

Below are twelve items on which to appraise the student's presentation. Please indicate your appraisal with an "X" in one of the segments on each line. A mark on the left of the line indicates **little or no need of improvement**, and a mark to the right of the line indicates **much need of improvement**. Marks between suggest varying degrees of needed improvement. Keep in mind that a student may be high in some areas and low in others. Your thoughtful appraisal will be appreciated.

Speech Section GMI

	DON'T SEE HOW HE COULD IMPROVE ON THIS ITEM		SATISFACTORY, BUT COULD IMPROVE.		NEEDS TO IMPROVE GREAT DEAL ON THIS ITEM
1—How clearly did he explain the plant situation that gave rise to the problem?					
2—How well did he state the problem?					
3—How well did he help you to understand the problem-situation in terms of such factors as sub-problems, causes, or difficulties?					
4—How clearly did he explain the methods used in solving the problem?					
5—To what extent did he make clear how the final solution remedied the basic difficulties and thus answered the problem?					
6—How easily could you follow the path of his organization from beginning to end?					
7—How effectively did he use specific data to develop and clarify his ideas?					
8—How effectively did he use visual aids, such as charts, models, slides, or mechanical parts to make himself clear?					
9—How confident and communicative was he in presenting his report?					
10—How skillfully did he handle the question-and-answer period?					
11—How well did the student get and hold your interest throughout the report?					
12—How clear and effective was this student's presentation, as a whole?					

Signature_____

Position_____

Figure 1.

How to Answer Questions.—Unless the chairman provides a microphone for use by questioners from the floor, or requests the questioners to come to the lectern, the chairman should repeat the question for all to hear before the speaker answers. The answer should be directed to the entire audience. The speaker should treat all questions with equal courtesy and consideration, and never reveal any trace of chagrin or belittlement even though a question may annoy him. Above all he should avoid argument from the lectern even though the questioner may appear to be deliberately goading the speaker. Answers should be as brief as possible, so as to allow time for others to ask questions. If the speaker does not understand a question, it is best to ask the chairman or questioner to repeat it. If the speaker simply does not know the answer, it is better to admit it, or refer it to another person present, or suggest where the answer might be available.

Some questions may have reference to one or more slides. To be prepared for these the speaker should always have on the lectern a list by number of the slides he used. He can then call for "Slide Number 6" say, from the projectionist and avoid tedious searching and frequent incorrect projections.

CONCLUSION

The primary justification for any oral presentation of a technical paper is the transmittal of information from speaker to audience. Even though information may be conveyed by a poor talk, most listeners prefer presentations of the highest quality. Although no amount of cleverness in a presentation will make up for a paper of poor content, a weak presentation is poor publicity for a good paper.

In a group of about 280 professional technical people canvassed, the general opinion is that considerable progress has been made in recent years in some technical societies, and in certain divisions of the American Chemical Society, to upgrade the quality of oral presentations. Even so, the majority of those questioned feel that relatively few papers are well delivered. Thus, there still appears to be ample room for improvement.

Many of the complaints heard from chemists concern problems that should be fairly simple to overcome. Most of these criticisms are directed at speakers, but the responsibility should also be shared by chairmen of meetings. The ways to remedy many of the complaints have already been published in the form of papers, or in bulletins issued by the technical societies themselves. Since the remedies are already clearly defined, it remains for chairmen to follow up more closely on speakers before a meeting to see that they are doing a satisfactory job of preparing for their presentations. Chairmen also have the responsibility of improving discussion periods, for although most listeners like discussions, many feel that they are far from satisfactory under present conditions.

A secondary justification of an oral presentation is personal publicity for the author. If a paper is well delivered, the audience will respond enthusiastically. This enthusiasm will help to promote more personal contacts for the speaker with his listeners and thus expand the speaker's circle of professional friendships. A good presentation of a good piece of technical work is fine publicity for the speaker. Young chemists would do well to learn well the art of oral presentation and practice it whenever the opportunity is presented.

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