

ADVICE TO BEGINNING PHYSICS SPEAKERS

Public speaking is a necessity of professional life. But what do you do if, like many physicists, you're basically a shy person? Here is some advice on how to give talks that won't wreck your career or humiliate your thesis adviser.

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If you're a physics graduate student, it's highly likely that before you receive your degree, you'll be asked to give a talk on your research – possibly at an APS meeting, or maybe just to fellow students. And once you finally graduate, you'll undoubtedly find yourself standing behind a podium. Whatever the situation, it's going to matter that your presentation be well received and that your audience depart with a favorable impression.

Remember: *Whenever you make an oral presentation, you are also presenting yourself.* If you ramble incoherently, avoid eye contact, flash illegible transparencies on a screen, and seem nervous and confused, then your colleagues are not only going to be irritated at having their time wasted, they're also going to question your ability to do your job. However, if you present your ideas clearly and persuasively, with self-assurance and skill, you will come across as a reasonable, orderly person who has respect for the audience and a clear, insightful mind. With this thought in mind, here are a few guidelines to point you in the right direction.

Gauge your audience

The classic dilemma facing scientific speakers is deciding at what level to pitch a presentation when the audience consists of both novices and experts. The most common error is to play only to the experts, the rationale being that the experts' opinions matter the most and that everyone else in the audience will at least leave thinking you're a clever person. Wrong. If you make your talk so technical that only a few can understand it, your audience will resent you not only for wasting their time, but also for violating the implicit contract that a speaker has with the audience to always be clear and understandable.

Experienced speakers generally devote the first half or two-thirds of a presentation to a careful introduction of the topic and save the highly technical material for the last few minutes. In this way, the beginners can understand a significant part of the presentation, and the experts will learn some of the fine points. Most importantly, everyone will end up respecting the speaker as an authority on the subject who is also attuned to the audience and respectful of the varied needs of those in it. I am also appreciative of speakers who summarize at the very end, the key points they'd like me to remember. That way, if I've dozed through part of the talk or just failed to understand it, I at least walk out of the room with the major ideas reverberating in my head.

Fit your talk to the allotted time

Many consider it almost a capital crime for a speaker to exceed her allotted time. It is not unusual for a session chairperson at a conference to be quite abrupt with a speaker who rambles on after the timer has sounded. Even in less formal settings, a speaker who ignores the prescribed time limit will quickly alienate nearly everyone in the audience. *Never, ever, speak past your allotted time.* To do so is extremely egotistical, and even if your audience is courteous enough to let you continue, they will not forgive your rudeness.

But in, say, 10 minutes, how can you possibly convey the significance of the work that you sweated over for the past two years? Rest assured that all speakers wrestle with this problem. The key principle is that virtually any topic can be presented in any amount of time. One could

compress the history of the world into 30 seconds if necessary, or stretch out a treatise on the eating habits of the flea to a yearlong series of weekly lectures. (Admittedly, it's hard to imagine either commanding a very large audience).

Speakers often erroneously assume that very short time limits mean they must emphasize generalities and gloss over specifics. However, you'll almost always give a more lively and interesting talk if you narrow rather than widen the scope of your remarks. Thus if you're giving a lecture to the local astronomy club, it's better to spend your 30 minutes speaking on "The Rings of Saturn" than on "The Planets of the Solar System."

For very short talks, your greatest challenge will be to weed out relentlessly any extraneous subject matter. Any tables or figures or equations that don't contribute specifically to the one or two points you're making must go, no matter how interesting they may be in their own right. Sometimes it seems as if speakers fear their main agenda isn't very interesting, so they desperately try to prop up their talks with diverting little sidelights. Unfortunately, the effect is to distract the audience and make the talk disorganized.

But what should you do if you've got 30 minutes worth of information to convey and you're only allowed 20 minutes on the program: Redesigning the scope of your presentation is the only acceptable solution. What you must *never* do is attempt to squeeze your talk into the permitted time slot by speaking rapidly, flashing through your slides and frantically scribbling on the blackboard. A few years ago I attended a department colloquium during which the speaker, a candidate for a faculty position, zipped through more than 60 transparencies. I can't remember now what his talk was even about, but I can easily recall how irritated I felt and how I never wanted to see him again. And I never have.

Use mathematics and equations sparingly

It is not difficult to integrate equations into your talk if you keep in mind a few simple precautions. First, make absolutely certain that the equations are necessary, and if they're not, toss them out. Equations make a talk harder to understand, they slow the pace, and they are prone to creating confusion. If overdone, they also cause resentment; one literally will hear groans from an audience when a speaker flashes an equation-filled transparency on the screen. Audiences are especially scornful of speakers who load their presentation with equations because of a misguided belief that the mathematics alone will imbue their work with a more scientific or rigorous flavor.

Second, remember that the goal of your talk is not to impress your audience with your proficiency in doing algebra. There is seldom any need to drag your audience step by step through a derivation or the solution to an equation. Audiences will happily assume that you can solve equations, so forget the algebra and focus instead on the assumptions that led to the equation, the technique that you used to solve it and a careful explanation of the relevance of the solution to your topic.

And finally, keep in mind that audiences need a bit of extra time to assimilate mathematics, so try to make their job as easy for them as possible. It's particularly important to define any unfamiliar symbols and to avoid cumbersome notation. If you're only going to use the scalar form of an equation, then write it out using that notation and leave the generalized tensor version for the textbooks. And don't just plunk down the equation and then stand there like a tombstone for 60 seconds while your audience studies it. You should always talk through any equation you show your audience. For example, as you're writing out $E = mc^2$ on the blackboard, you should say something like, "And so now we see that the energy E is equal to the mass of the object multiplied by the square of the speed of light."

Be sensible about transparencies

The overhead projector has in the past decade become the visual aid of choice for physicists. Experienced speakers often have strong opinions about the optimal number of transparencies for a talk – typically 3 to 6 for a 10-minute presentation, 10 to 15 for a half-hour talk. Although you needn't adhere to hard and fast rules, as a practical matter you should allow several minutes for an audience to absorb each transparency. You'll thus want to avoid transparencies that have only one or two lines of information, just as you'll want to avoid those so jam-packed that they overwhelm you audience.

You needn't write out full sentences on your transparencies (although you should certainly *speak* in full sentences). In other words; if you're planning to say, "Our measurements showed that the period of the pendulum was independent of the mass of the pendulum bob," then your transparency should read, "Period was independent of mass." But don't get carried away. It has lately become fashionable to use "bullets" in presentations, and one often sees transparencies that are meaningless lists of words, abbreviations and sentence fragments. The general rule is that the transparency text should be concise enough to be self-explanatory, but no more than that.

Learn where the light switch, focus control and pointer are located *before* your talk. Also give some thought to where you'll stand, because you'll often be blocking the view of part of the audience if you stand beside the projector; if that's the case, stand next to the screen and use a pointer. Make sure you've got a table to set your transparencies and notes on, because you won't present a very dignified image if you're down on your hands and knees shuffling through your papers in the dark.

Practice your talk

Unless you're an unusually gifted speaker, you'll need to rehearse your talk in front of your classmates, colleagues, spouse or friends. It is not enough to think through your remarks, because you won't be able to duplicate the stress you'll feel in front of a real audience. And unless you actually speak aloud, you won't discover the difficult transitions, the hard-to-verbalize ideas or the convoluted lines of reasoning that may trip you up later on. With a bit of practice you'll usually find that your delivery smoothes out and that you'll be able to expand your talk more than initially seemed possible. However, you must resist the temptation to speak too quickly just because your words have become familiar to you.

I recommend that you avoid writing out your talk and then reading or reciting it. Although speakers in nonscientific fields often read prepared papers, it is considered bad form in scientific and technical circles, where a more extemporaneous presentation is preferred. If you're using transparencies, they can probably serve as your notes; otherwise just jot down the outline, key ideas and transitions on note cards or a tablet.

While you practice, try to be attuned to any nervous mannerisms. Avoid wringing your hands, pacing back and forth, fidgeting with your microphone strap or jangling the keys in your pocket. We've all attended talks where the speaker was so skittish that we felt like jumping up and clamping our arms around him to calm him down. If you're really panicked, try taking a few deep breaths, gripping the sides of the podium with both hands and distributing your weight equally on both feet.

Dress appropriately

What you choose to wear for your talk is, of course, a delicate subject, and I don't want to sound like your mother. Nevertheless, other people *do* form an impression of you based in part on your appearance, and so my advice is at least to consider what statement your clothing is making. At

the very minimum, you should avoid looking like you just dragged yourself out of bed or staggered out of the hotel bar (even if true). To play it safe, you'll want to dress neatly and appropriately.

For men, this means that you shouldn't wear cutoffs and running shoes if most of your male colleagues are wearing sports coats and ties. And don't overdo it either; if you dress like a Wall Street banker, you'll look amateurish and unsophisticated. (Incidentally, it is highly recommended that you check you fly *before* you walk on stage, not when you're standing up there in front of 300 people.)

For women, the same general rule applies: Don't look like a slob, but don't dress to the nines, either. Most career counselors suggest not overdoing the jewelry, staying away from frilly blouses and dresses, and avoiding tight or otherwise revealing clothing and very high heels. Your best bet is a tailored, comfortable dress, skirt and blouse, or suit. Power suits are a bit obvious however; you may as well wear a sign around your neck saying "I've read *Dress for Success*."

Interact with your audience

When you finally present your talk, be sure not to ignore the people watching you. Don't stare like a zombie into the space above their heads, and don't focus intently on your transparencies or the floor or your shoes or a spot on the wall. Experienced speakers pick out several friendly faces and establish eye contact with them, turning first from one person to another and making sure that no section of the room is ignored. If you try this, you'll find that the targets of your attention will smile and nod pleasantly, affirming the points you've made and increasing your self-assurance. You'll also have a better sense of whether to speed up or slow down, or to repeat yourself.

And don't forget to speak up. Inexperienced speakers frequently use too soft a voice, as if subconsciously hoping nobody will hear them. If this happens, members of the audience will usually shout out, "Louder!" but you may as well save yourself this small embarrassment. No matter how well you have prepared your remarks, your talk will be a disaster if your audience can't hear you.

At the end of your talk, you'll generally be asked to respond to questions from the floor. Inexperienced speakers often dread this moment, because it seems they run the risk of being humiliated or exposed as an ignoramus or having their entire presentation invalidated by a questioner's allusion to an unfamiliar paper. Nearly everyone feels this anxiety, which is why horror stories abound of, for instance, the mean-spirited Nobel laureate who delights in embarrassing junior colleagues with withering, *ad hominem* comments at major conferences.

Actually, it's not difficult to escape from the question session with your dignity intact, provided you never fail to be solicitous and respectful of your questioner and you avoid getting into public arguments. The general idea is that you – and not your questioner – are in the dominant position in the room. From the perspective of the audience, the scales are tipped so strongly in your favor that if you display even a hint of argumentative or condescending behavior, you'll be viewed as a bully and lose the sympathy of everyone in the room. (You'll also run the risk of provoking friends of the questioner to spring to the rescue and really nail you). With that general precaution in mind, here are a few specific guidelines to ensure your survival:

- Let your questioner finish the question. Some speakers get so excited and nervous that they interrupt the questioner in mid-sentence to blurt out an answer to the question they *think* is being asked. This habit is very irritating to the audience, who may not be as adept at reading minds as you. It's far better to bite your tongue and let the questioner drone on; you can use the free time to collect your thoughts.

- Be prepared to rephrase the question: If the room is large or the questioner has a weak voice, you should always repeat the question for the benefit of the audience. It also is important to rephrase succinctly if, as frequently happens, the questioner is confused or disorganized. Your goal should be to make the questioner seem as intelligent and perceptive as possible, even if the person is a complete dunderhead.
- Keep your answers short. Stick to the point and don't use the answer as an opportunity to digress to a related subject. Usually a protracted answer sends the message that you aren't really sure of yourself and so are trying to cover all the bases. A wordy response makes a bad impression on the audience, especially if it's near the end of the session and they're anxious to meet their friends at the lobby bar.
- Confess your ignorance. If you should be thrown a curveball, don't respond defensively or with irritation. It's far better to say, "I'm sorry, I'm not familiar with that paper" or "I haven't considered that point yet." Of course, if you find that you've never read *any* of the papers or considered *any* of the points raised by your questioner, then perhaps you should consider another profession.
- Deflect hostile questions. One day you may encounter an angry or aggressive questioner. Although the experience is distressing, there's really no need to panic. Remember that nobody likes a public display of belligerence, so the audience will instinctively take your side. No matter how angry you feel, you must resist the temptation to fight back with a snappy retort or put-down. And *never* argue with your questioner. Instead, simply say something like "I'm sorry, but it appears we have a difference of opinion. This probably isn't the proper forum for a debate, but I'll be happy to discuss the matter with you in private." There will be plenty of time later for you to get even with the creep.

Now a final bit of advice. Everyone knows that a good joke or two can liven up a presentation. However, unless you're a naturally funny person, I'd recommend laying off the canned humor. The little anecdote that sent your good-time buddies into convulsions the night before over a pitcher of beer may have quite a different effect on the stone-faced strangers watching you in the cold light of morning. That's one lesson you don't want to learn firsthand. Trust me.