The ABCs of Scientific Presentations

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INTRODUCTION

Why are scientific presentations vital? The answer is simple: whenever you are making a presentation, you are also presenting yourself. If you are an engineering student trying to land your first job, your future employers would connect the quality of your presentation to your potential to do a better job. If you are a scientist trying to convince a sponsor to fund your research, your sponsor sees the value of your study through your presentation.

For scientists and engineers, giving a presentation is often frightening, however, engineering professionals are not alone in that respect. According to a national survey, on Americans' top ten list of experiences they most dread, public speaking placed first and death seventh. Many of us remember our childhood terror in school. When singled out by your teacher to speak, did you ever have sweaty palms, shaky hands, dry mouth, quaking voice, and a rapid heartbeat? Adults also experience similar symptoms as stage fright.

A scientist might argue that public speaking is not a necessity of professional life. Admittedly, a company hires engineers primarily because they solve unique technology problems, while a university employs faculty members because they can teach and perform research in their special areas. The story does not stop here, however. If you can be among the few who know how to deliver good scientific presentations, you may be appreciated as a genuine asset beyond your technical expertise.

When I was a graduate student, I attended presentations given by potential faculty candidates. All of the candidates' credentials were impressive. In reality, a candidate's credential is the tool only to obtain an interview opportunity, it does not guarantee the faculty position for which the candidate is applying. Those who delivered the best presentation got the offer. Later, working in industry, I interviewed candidates for scientific positions. Again, it was those who gave a better talk in their technical field that got the offers. More often than not, the best presentation was not even the most closely correlated to the position for which the candidate was applying.

Multiply these stories and you get a sense of how important scientific presentations are. Time and again, I watched graduate students, all working hard and wanting to succeed. A student's inability to make scientific presentations might at first seem a little bend in a twig. As time goes by, the bend exaggerates. Eventually, the bend becomes so pronounced that it interferes with professional well being. At the same time, those who can make better presentations prosper in their career.

In addition to the thrills of general public speaking, scientific presentations pose additional challenges to speakers. For one thing, the audience may not possess the adequate background knowledge to understand a subject, let alone appreciate the value of a finding. For example, a physicist will come to realize that the concept of the refractive index of light is not readily appreciable to the general public. Although there are books and articles on public speaking, there are few sources specific to giving scientific presentations. Because of the uniqueness of scientific presentations, there are keys to public speaking in a technical field. These keys lead to a successful scientific presentation, which is an integral part of professional life.

ARTICULATE THE THEME OF A PRESENTATION

At first glance, a piece of music and a scientific presentation may have nothing in common. But if you love a piece of music, you probably try to memorize its title. Even if you do not, you are more likely to remember the melodies of its theme. Indeed, there exists a profound similarity between a pleasant piece of music and a lively scientific presentation—each has a clear theme.

Many seemingly polished presentations do not have a clear theme. For that reason, audience members may forget what the presentation was about when they leave the conference room. These presentations may state the goal of some research, list results, and draw conclusions. But without a definite theme, these presentations likely leave no impression on the audience.

Theme differs from the title of a presentation. In general, a good title answers two questions for the potential audience—What is the speaker going to talk about and why should I attend? A theme, on the other hand, is the main point that a presenter would like the audience to take home. Two illustrations of the correlation between a title and a corresponding theme are

• Title 1: "On the Common Personalities of Creative People"
  Theme 1: They are all distinct.
• Title 2: "On the Unique Properties of Ice"
  Theme 2: Ice is piezoelectric. Applying a mechanical stress induces electrical dipole moments.

In the two examples, the title and theme are complimentary. Together, they construct the main message. Combining the title and theme, the main message of the first pair is "creative people are all distinct," the second pair is "ice is piezoelectric, applying a stress on ice yields electrical dipole moments."

Articulating the theme of a presentation is not only the first important step, it is also the most difficult. Suppose you have done research on ice for years—you may have obtained much interesting data. Your experiments proved that ice can be crystalline, amorphous, and semicrystalline. The data also indicated the ice is piezoelectric. When invited to give a talk about your research, you probably do not have enough time to cover all your data. Even if you do, your audience will not digest all the points. Thus, as the speaker, you have to choose a theme, such as "ice is piezoelectric." In general, the theme can be, among other things, your most important results, a daring hypothesis you made in solving a particular problem, or a prediction based on your conclusions.

For practical reasons, your theme cannot contain too many points. During a scientific meeting, a typical member of the audience attends 20, even 40 presentations. The majority of these presentations are soon forgotten. Thus, if audience members can still recall one main point of your presentation after returning home, you have succeeded in your presentation. As a general rule, one main point will suffice for a 15 minute presentation, while 2–3 main points can be made in a 30–60 minute presentation.

The theme dictates the entire contents of a presentation, as the presentation expands around the theme. Powerful presentations dramatize their themes. Any equations or tables must be eliminated if they do not contribute specifically to the theme you have chosen, no matter how important they are in their own right. To make your theme even more apparent to your listener, it is suggested that you stress your theme in verbatis, in variations, just as musicians do. When a theme is frequently repeated, a listener does not have to be a profes-


In a scientific presentation, it is often customary to incorporate equations into the talk; however, use them sparingly. Equations make a presentation difficult to understand, and they also slow down the pace of the talk. As an equation-filled visual flashes on the screen, one often hears groans from the floor. When using equations in a presentation:

- Make sure that an equation has to be an integral part of the presentation. If an equation does not contribute specifically to the theme of your presentation, cut it out. Equations alone do not guarantee the scientific validity of a presentation.
- Use the simplest form of an equation. Many equations have vector, tensor forms. Use only the scalar form, and leave the tensor form to the textbooks. Explain every symbol in the equation.
- Do not drag your audience step by step through how you solved an equation. The audience will happily assume that you can do algebra, are proficient in computer programming, and have adequate precision in your numerical calculation.

Instead, a speaker should dramatize the assumptions that lead to the equation, carefully explain the physical meaning of the solution, and clarify the predictions based on the solution.

sional musician to recognize the theme. When the music ends, we may not remember all the melodies we have heard, but we are more likely to recollect the theme. The same principles apply to scientific presentations.

**DETERMINE THE LEVEL OF A SCIENTIFIC PRESENTATION**

In a scientific presentation, a speaker always faces a classic dilemma: at what level should the talk be pitched? This dilemma spells nightmares for many speakers, particularly when the audience consists of both experts and novices. On one hand, the speaker cannot afford to play only to the experts. Besides, being an expert is a relative term; in a given discipline, experts in one branch may not have enough time to keep abreast of the development in other branches. On the other hand, the speaker cannot afford to play only to the novices for the risk of appearing amateurish.

A common mistake is to talk only to the few experts in the audience. The assumption is that only experts’ opinions matter; even though other listeners cannot understand a presentation, they should at least admire the speaker’s esoteric knowledge. Wrong! If you make your presentation so technical that the majority of your audience fails to follow, you may lose a portion of your audience, but at least these people have learned about the subject from your introductory part. By presenting the scientific contents, experts appreciate a few key points in your research and are satisfied knowing that they can follow the speaker to the end of the talk. Most importantly, the entire audience group perceives the speaker as competent and considerate to listeners with varied needs.

**MAINTAIN EYE CONTACT WITH THE AUDIENCE**

A novice speaker looks away from the audience, focusing on the floor, the wall, or the ceiling. Most of us recognize the importance of eye contact; during our everyday life, we look directly at the person to whom we are talking. Let us do an experiment. Begin to talk to someone and purposely look away. You’ll soon realize how awkward this is. In U.S. culture, when a speaker keeps looking away from the audience, the speaker is perceived as insincere, evasive, and incompetent—not a positive image.