TECHNICAL COMMUNICATIONS PROGRAM

Technical Info

Engineering 103: Public Speaking & Presentation Skills

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Throughout almost all of human history, people lived in remarkably homogeneous groups. People were in contact with others of similar backgrounds, history, and perspectives. They ate with people who enjoyed the same food, played with people who knew all the same games, and prayed with people of the same religion. The similarities were so numerous that nobody even considered how to communicate with individuals of very different backgrounds.

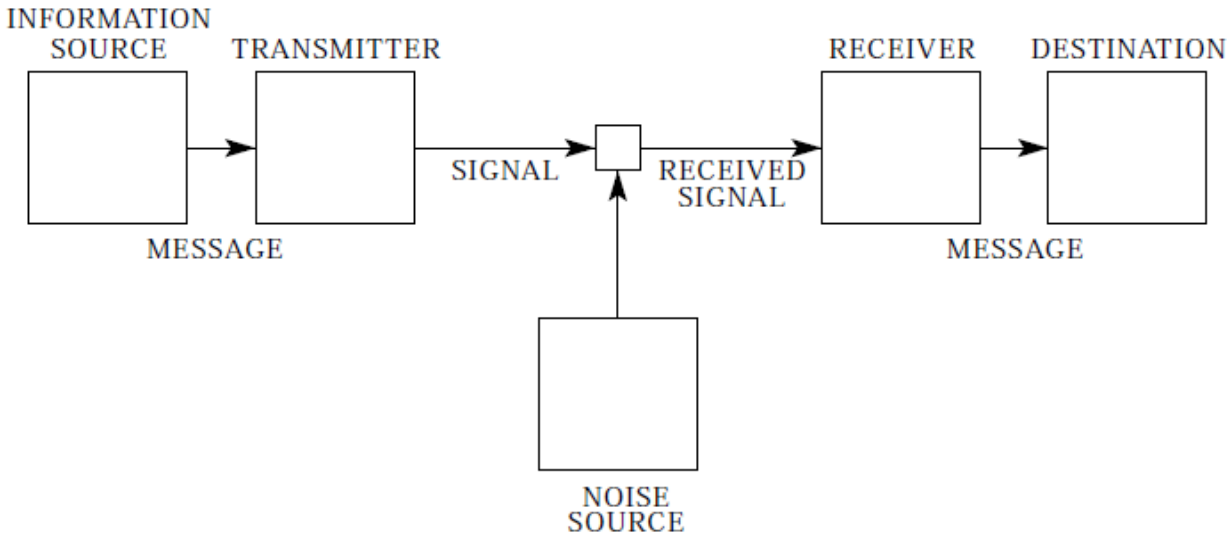
Even as recent as 50 years ago, a workplace typically only involved discussions with one's immediate colleagues; engineers would only talk with engineers, IT would only talk with IT, marketing would only talk with marketing, and so forth, with all groups speaking in a language that only they understood. A manager might make an appearance, acting as an interpreter and bridge to the rest of the company, but aside from that, there was no effort to communicate across various disciplines.

This would change in the 1960s with the structure of the American industry, according to Stanford communication professor Cliff Nass (as quoted by Parker, 2001); businesses began recognizing that they did not have to create a product that met some sort of demand, but instead could create the product first and then convince people that they needed it through marketing later on. Jerry Porras, a professor of organizational behavior and change in the Stanford Graduate School of Business, agrees: "When technologists no longer just drove the product out but the customer sucked it out, then you had to know what the customer wanted, and that meant a lot more interaction inside the company (as quoted by Parker, 2001)."

Regardless of the precise reason for increased interaction among differing fields, the fact remains that such interaction among people of differing fields is happening; for that reason, it is vitally important to understand how to communicate with individuals of all backgrounds. There are basically two things that a speaker must do in communicating with members of different backgrounds: the speaker must ***Interest*** and ***Inform*** their audience. Before discussing techniques to interest and inform an audience, though, it is helpful to discuss the ***Shannon-Weaver Model***, which will provide contextualization of how the communication process takes place, and how messages are *encoded* and *decoded* in such a way that various sources might understand them.

Shannon-Weaver Model (1948):

The *Shannon-Weaver Model* (sometimes referred to as the *Mathematical Theory of Communication*, *Shannon Theory*, or *information theory*) was originally devised by Claude Shannon in 1948. It was later popularized by Warren Weaver in 1963 when he reprinted Shannon's original 1948 article with his popularization of it. The Shannon-Weaver Model is as follows (Shannon, 1948; Weaver and Shannon, 1963):



If the terms used in the above diagram look as though they refer to telephones, it is because Shannon's work was sponsored by the Bell System, and the names are descriptive of telephonic communication between individuals; nonetheless, this model refers to all communication, whether it take place in person, on the phone, or via e-mail.

All communication starts with an information source. For example, I writing this paper am intending to send you a message; in this case, I am the *information source*. I then *encode* the message and transfer it via various means (in the example of this paper, my keyboard is used for *encoding* the message; examples of *encoders* in other contexts might include my mouth during a speech or a telephone during a phone conversation). After *transmitting* my message, it is subject to *noise*; *noise* is any external factor that makes my message more difficult to understand. It could be quite literal noise (e.g., a loud jet flying past the classroom in the middle of my speech), but it could also be anything that obscures the message or prevents the message from getting to its intended source (in the example of this paper, it could be a smudge on your copy of the paper,

making it difficult to read; other examples of noise might include a text-heavy PowerPoint slide that distracts the audience's attention during a presentation, or static during a phone conversation). My message then moves to the *receiver* (in the example of this paper, you, the reader, are the *receiver*) who *decodes* the message. Ultimately, my message ends up with the *destination*, the person for whom the message was originally *encoded*.

Understanding the Shannon-Weaver Model is quite powerful in considering communication in general, and technical communication specifically. With regard to the former, your goal is always to increase signal and reduce noise; this is precisely what we have taught you all quarter long! We strove to reduce distracting gestures or text-heavy slides (sources of noise) and increase audience retention (through increasing signal). As for technical communication, the notion of *encoding* and *decoding* a message will help you tailor your message for your audience. First, consider what your audience is capable of *decoding*; once you know what they are capable of understanding, you can properly *encode* your message to maximize signal and reduce noise. This means that you can emphasize material that will increase the audience's understanding of your presentation and the terms used therein, and can avoid using terms that will only confuse or detract from the audience's understanding.

Interesting an Audience:

One obstacle to teaching an audience about new, complex information is that the audience may not at all be interested in the subject matter, and if the audience is not paying attention, it will be an impossible task to teach them about your field. Because of this, it is important to get the audience interested in your material early in the presentation; if the audience perceives from the first sentences that they should be interested in and care about your subject matter, then it will be a lot easier to get them listening through the final sentence of your speech.

Here are several techniques for increasing the audience's interest:

Delivery:

This one may seem obvious as we have taught it all quarter long, but just sounding passionate about your subject matter can go a long way in getting others interested in it. Too often, speakers sound as though they do not even care about their own subject matter, and if they do not care, why should the audience? Remember to continue using your voice, gestures, eye contact, and stance in order to convey interest and engagement in your subject matter; in doing so, it will increase the likelihood that your audience will also be interested in your subject matter!

Relevance/WIIFY:

Jerry Weissman, a former TV producer and screenwriter, makes a career out of teaching CEOs to make effective presentations. He argues in his 2003 book, *Presenting to Win*, that a central consideration for every speech you make lies in an acronym that he coined, WIIFY (pronounced whiff-y), which stands for What's In It For You? (a play on the more common refrain "What's in it for me?" but with a shift from "me" to "you" in order to put a focus on what the audience wants. Weissman gives a wonderful example of a technical presentation by Jim Flautt of ThinkDigital; he was tasked with giving this technical presentation to perhaps the toughest audience of all: an audience of first graders! He read the audience perfectly, though, and knew how to appeal to their interests. He started by begging the question: "How many of you have ever seen a submarine that *flies*?" The first graders gasped, momentarily stunned, but Jim had their attention. He then promised that, by the end of the presentation, he would show them a submarine that flies. For fifteen consecutive minutes, he kept their attention as he explained the complexities of submarines, and US Naval procedures. Then, at the very end of the presentation, he clicked a button, and a US Navy submarine was shown going through an emergency surfacing exercise, in which it leapt out of the ocean like a dolphin performing a stunt.

The importance of making your information relevant to your intended audience cannot be understated. There is, of course, a reason why you are doing your research, but the benefit to the audience may not be readily recognizable unless you give the audience some help. Perhaps you are trying to make energy cells more efficient, which eventually will lead to a more sustainable energy. Maybe your research on genes might eventually lead to a greater understanding of how cancer is formed and how it can be treated. There is always a reason why your research is important (or else you would not be doing it), so make sure that the audience will understand why it is important.

Even subtle differences in your messaging can make the message more appealing to the audience; for instance, if your research will lead to a safer automobile, instead of saying "People will experience greater safety and fewer accidents," you can instead say "*You* will experience greater safety and fewer accidents." It may not seem like such a small modification to appeal to self-interests would make a difference, but in 1982, three psychologists (Gregory, et. al.) did a study in Tempe, Arizona where they approached homeowners and explained the potential benefits of cable television (a new technology at that time). One group was presented the following benefits:

> CATV will provide a broader entertainment and informational service to its subscribers. Used properly, a person can plan in

> advance to enjoy events offered. Instead of spending money on the babysitter and gas, and putting up with the hassles of going out, more time can be spent at home with family, alone, or with friends.

Meanwhile, the information given to a second group of homeowners asked them to imagine themselves using cable television:

> Take a moment and imagine how CATV will provide you with a broader entertainment and informational service. When you use it properly, you will be able to plan in advance which of the events offered you wish to enjoy. Take a moment and think of how, instead of spending money on the babysitter and gas, and then having to put up with the hassles of going out, you will be able to spend your time at home, with your family, alone, or with your friends.

The two messages are very similar, but the biggest difference is that the first message never uses the word "you," whereas the second message makes extensive use of it.

Even though the messages are similar, the results are not; 20% of homeowners who received the first message subscribed to cable, while 47% of homeowners in the second group subscribed (more than twice as many as the other group!). Making people consider the benefit to themselves can be quite powerful in making the audience interested in your research. (By the way, notice my use of the word "your" in the previous sentence.)

Background:

George Loewenstein, a behavioral economist at Carnegie Mellon University, is one of the foremost experts on what makes people situationally curious about topics. One of his big suggestions (1994) is that people tend to be curious when they perceive a gap in their knowledge. For instance, I know a lot about presentations, so you could get me curious by saying that a new discovery has been found about speech anxiety, and its remedy is effective in almost all speakers. Using this technique, you have pointed out a gap in my knowledge, and it makes me interested in filling that gap.

This works really well when there are small gaps in a person's knowledge; for instance, if I memorized all but three US presidents, it makes it far more likely that I will want to learn the last three. What if my knowledge gap is more like a chasm, though? What if I only know ten or so US presidents? It might seem that since I have a lot more to learn, I will be interested in learning

more, but it is actually exactly the opposite; people tend to be most interested when they feel like they know quite a bit about a topic, but still have a small gap to fill in order to learn more.

In cases where you are dealing with a chasm rather than a gap of knowledge, you need to first fill the chasm. Give the audience just enough background information that they will become curious to learn the rest.

Robert Cialdini (2005), a social psychologist at Arizona State University, did research on what makes certain scientific articles interesting. He found that one of the most effective techniques in making people interested is simply telling a mystery; give members of the audience just enough information that they can understand the mystery, and stay on the edge of their seats while you resolve the mystery.

One specific example Cialdini covers is by an astronomer who wrote a 20-page paper on the rings of Saturn. The author begins by introducing the mystery: the rings of Saturn are perhaps the most spectacular planetary feature in our entire solar system, and there is nothing else like them. What are they made of, though?

The author then deepens the mystery by asking how three internationally-acclaimed groups of scientists came to three completely different conclusions on the rings of Saturn. One group at Cambridge University proclaimed that the rings were gas. A second group at MIT was convinced they were made up of dust particles. The final group from CalTech insisted that they were comprised of ice crystals.

What did it turn out that the rings of Saturn were actually made of? Dust. Just dust. Well, ice-covered dust, which may partially explain why there was some dispute among the scholars.

Cialdini points out that he does not "care about dust, and the composition of the Rings of Saturn is entirely irrelevant to my life. But, that scientist had me turning pages like a speed–reader." Most importantly, though, Cialdini says that he "will never forget the answer to the mystery."

Because the astronomer gave just enough background to make his readers want to learn the rest, it made it a very powerful means of creating interest in his audience. You, too, should consider how to give appropriate background information in order to garner interest in your topic.

Digital Media:

Digital media can be tremendously helpful in increasing interest on a subject; it can either be something from popular culture (from television shows, news interviews, or advertisements), or

it can be a recording you made yourself in the lab.

Showing the audience some of the context behind your research can also help in terms of creating background information (as per the above section on background). This gives the audience just enough information to care about the rest of your research, and interest them a great deal in your research.

Engagement:

Engagement can be either *inactive* or *active*; *inactive* forms of engagement refer to simply using your powerful delivery to engage the audience, but also helpful are *active* forms of engagement where the audience is encouraged to participate during the presentation. A few examples of *active* engagement include *discussions*, *role plays*, and *demonstrations*.

Discussions

Sometimes in presenting technical information, it helps to elicit responses from the audience and their own perspectives or experiences. For example, if I were creating a software package as an alternative to PowerPoint, perhaps I would begin the presentation by asking the audience about some of their frustrations with PowerPoint. (Ideally, of course, my software package would directly address the audience's concerns!)

Role Plays

This sort of engagement would have the audience simulate a certain process or concept that the speech covers. For example, I remember in high school social studies class where we role played the Hindu caste system; the *Brahmins* (the top of the caste system) were allowed to sit on the tables and did not have to do their homework, the *Kshatriyas* (kings and warriors) were responsible for collecting money ("taxes") from their classmates, the *Vaishyas* (agriculturists and traders) had to bring snacks in for the other students, the *Shudras* (servants) had to do the *Brahmins*' homework, and the *Pariahs* (untouchables) had to sit outside of the classroom. Through this simple role play, it made the lesson come to life, and encouraged us, as students, to learn more about the Hindu caste system.

Demonstrations

Another example from my time as a high school student came in biology class, where I was asked to give a presentation on DNA; rather than simply talking about Watson and Crick (the scientists who correctly identified DNA's double helix structure), I took it a step further by

including a demonstration. It is actually relatively easy to extract DNA from a kiwi fruit (see: Anderson, 2000), and so that is what I did. It was one thing to talk about DNA, but it was another thing when the entire audience could see before their faces the basis of all life on Earth.

Informing an Audience:

Ideally, you have used some of the previously-mentioned techniques to get the audience interested in your subject matter; now you must inform them in such a way that they will understand your information. The idea is not to "dumb it down;" rather, you want them to understand all the complexities of your research, but you must do so in a way that they will comprehend what you are saying. In this context, the audience is intelligent, but uninformed in your field. In other words, the audience does not have the same information that the speaker possesses, and because of this, things should be explained more patiently and simply. This means avoiding use of jargon from the field, and instead using everyday terms in explaining your subject matter. As Albert Einstein once said: "Make everything as simple as possible, but not simpler."

Here are several techniques to use in informing your audience:

Organization:

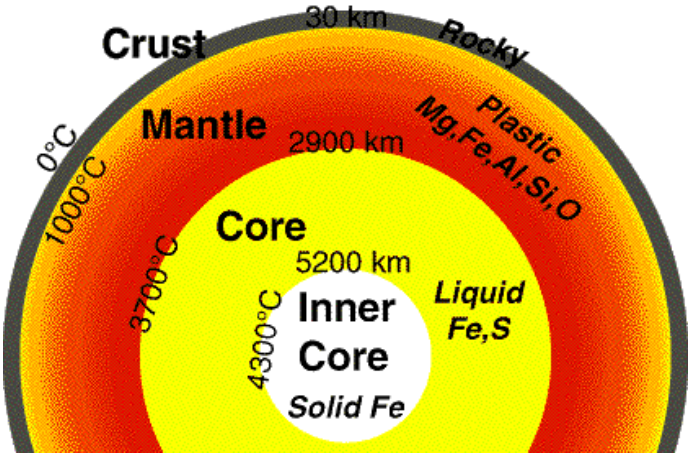
Just as before, you should still craft an effective introduction, body, and conclusion, with all your body points in an order that makes sense (based on, e.g., chronology, cause and effect, spatial representations, etc.); however, there are a couple of other things to consider in organizing a technical presentation.

First, remember that the speaker is at the end of his or her investigation, whereas the audience is at the beginning of theirs. This means that the speaker must not skip any steps, and instead ensure that the audience is given sufficient background information to understand the nature of the speaker's research. The amount of background information given should be inversely proportional to the audience's familiarity with the subject matter; that is, people within the field will not require much background information at all, while people who are completely unfamiliar with the subject matter will require a lot of background information!

Second, be aware of where you place information, and how much time you devote to certain topics. Without prior knowledge of the field, the audience might be tempted to place undue weight on certain elements of the presentation simply because they were placed toward the beginning or end (rather than the middle) of the speech, or because the speaker devoted a lot of

time toward a certain idea. Make sure that in ordering your speech, you put the most important ideas in an appropriate area of the speech, and devote a greater amount of time to them, and a lesser amount of time to the less important details.

Visual Aids:



It can be very difficult to describe certain, complex processes or technologies simply by using one's words and hands. As such, visual aids can be very effective in describing certain technical information. For instance, how much more difficult would it have been to describe the Shannon-Weaver model if I had not put a picture of the model in this paper? As another example, I could try typing up all the layers of the Earth, what chemicals they are made up of, the respective temperatures of each layer, and the distance of the layers from the surface of Earth; I could do that, but it would be a lot easier simply to show the diagram above (Louie, 1996).

Analogies/Comparisons:

Using an analogy to associate the unknown with the known can really help in increasing the audience's understanding on a certain subject matter. There was an episode of *Futurama* where the cast of *Star Trek* was captured by an alien named Melllvar, who has no physical mass and is made up of nothing but electric energy; in that episode, the following exchange took place (Groening & Shinagawa, 2002):

> **Fry:** Usually on [Star Trek], they came up with a complicated plan, then explained it with a simple analogy.
>
> **Leela:** Hmmm... If we can reroute engine power through the primary weapons and configure them to Melllvar's frequency, that should overload his electro-quantum structure.

Bender: Like putting too much air in a balloon!

Fry: Of course! It's all so simple!

I may not understand what Leela meant when she referred to rerouting engine power and configuring it to Melllvar's frequency, but I do know what happens when too much air is blown into a balloon; by using this simple analogy, it helps me to understand the process that Leela was referring to.

Materials:

By bringing in materials used to conduct the research, a speaker can help the audience understand the entire process better. For example, I remember a student talking about a new suturing device (a medical device used for "stitching" people back together after surgery) that she and her lab-mates had developed; in presenting, she brought in both her own suturing device as well as a traditional suturing device. She showed the audience the finer point on her suturing device as compared to the traditional suturing device, and explained that a finer point meant that there were not as large of holes put in the patient's skin; this means that it would speed up the healing process and reduce scar tissue. All of this was illustrated quite nicely by bringing in the two different suturing devices, letting us observe the differences, and then explaining how the differences would make one preferable over the other. In doing so, she made it easier for all of us to understand why a finer point is better for suturing.

Concreteness (Examples):

In general, abstractions are great for people within a field, but seldom make sense to people outside of the field; for that reason, it is hugely important to illustrate abstract principles in concrete terms.

Beth Bechky did her Ph.D. dissertation (1999) on how communication took place between engineers and assemblers at a corporation. Whenever a machine broke down, the assemblers would go up to the engineers, who would draw out an abstraction of the machine to show how to fix it. When the assemblers (understandably) got confused by the drawing, the engineers responded by making the drawing more detailed and complex, which only confused the assemblers further. While the engineers were perfectly comfortable communicating in the abstract, all the assemblers wanted was for someone to come down and show them which screw to turn; they were looking for concrete advice.

One tremendously effective way of taking your abstract principles and making them concrete is through use of examples. In the context of this paper, I have given you examples from a consultant, various scholars, my high school teacher, a high school presentation, my students, and even a cartoon! Sometimes it is difficult to understand information that is presented in the abstract, and it helps a great deal to bring it to the concrete with a few salient examples.

Although there are a lot of abstract theories and principles in just about any field, it is very important to make sure that you convey them in concrete terms to people outside of your field.

Break Down Components to their Key Parts

Sometimes it is difficult to understand a complex concept, machine, or method if it is all being explained at once; in such cases, it makes sense to break down the whole into individual parts. For instance, in describing the *Shannon-Weaver Model* above, it is a lot easier to break it down into its individual parts (i.e., source, transmitter, receiver, etc.) than it is to describe the whole model at once.

In general, it is best to start with the whole, so that the audience has an overall framework into which they can fit the individual parts. After explaining the whole, make sure to put the parts in an order that makes sense (e.g., from the inside of the machine out, from top to bottom, in order of importance, etc.)

Another student I had was talking about tunnel boring machines (the machines used to make the giant tunnels that we drive through on freeways everyday); he used both an *analogy* as well as broke down the machine into its key parts. He pointed out that a tunnel boring machine is like an earthworm; when making a tunnel, the earthworm uses its head to drill into the earth, and then its body solidifies the earth and prevents it from collapsing. A tunnel boring machine works exactly the same way; it has a head to drill into the earth, and its body solidifies the earth and prevents it from collapsing.

Conclusion:

Throughout almost all of human history, people have lived in remarkably homogeneous groups; however, things have now changed. Instead of remarkably homogeneous groups, we live remarkably fragmented lives. Who we eat with, play with, and pray with are people we may have never met before, and the number of people we interact with in a single day may exceed the number of people that ancient humans had contact with in a lifetime.

Most importantly, workers are now encouraged to interact with people holding radically different positions, backgrounds, and training, and although it can be difficult to communicate with such people, it is also hugely important to do so in today's work environment. By being able to ***Interest*** and ***Inform*** an audience of different backgrounds, you ensure that your technical information is likely to be utilized in the most effective manner by the people around you, and also ensure that you get due credit for your hard work!

Acknowledgements:

Special thanks to Nick Oza and Midge Eisele for brainstorming ideas with me on how to interest and inform an audience. In chatting with people whose backgrounds were different than mine, it enhanced my understanding of how technical communication takes place.

Thanks also to Mr. Tom Klaameyer, the social studies teacher who came up with the Hindu caste system simulation, and to Mr. Joe Wilson, the biology teacher who encouraged me to take my presentation on DNA one step further. Great educators deserve praise, and these two deserve the highest.

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