How should scientists & engineers talk to the public?
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Why am I talking to you tonight? After all, my focus is on "educating the public." I spend most of my time talking to the general public via public radio, and, through my university teaching, to freshmen and sophomores who are not majoring in engineering and science. So, why am I making these brief remarks to you? After all, clearly everyone in this room is one of the enlightened when it comes to science.

I'll be blunt: I'm here on a mission to enlighten you. Not about technology, but about communicating it to the public. I'll tackle, very briefly, three things tonight. First, what exactly, as engineers and scientists, is our message to the public? Second, what form should this message take? And, third, how and by whom should it be delivered? I'll tell you right now the answers to this last question: The mass media and us.

I base my remarks tonight on my experiences working in radio. I've created nearly 200 pieces for public radio, so tonight I'll illustrate my main themes using anecdotes from my own experience.

What should we tell the public?

So, what should we tell the public? Are we experts that proclaim the correct answer to a scientific question? Are we primarily teachers whose goal is to create scientific literacy? Or, is there another role for us? For that matter is our real battle for literacy, or is it against apathy? That's my first topic, and the core of my brief remarks.

There are two temptations that we face when first approaching the public. The first is to be an expert. This is a legitimate and necessary role, especially natural for a professor. But ultimately it's very limiting. A major problem is that "expert mode" distances technology from the listener or viewer. Its says "science is something you cannot understand, you need my help." The role tends to turn off listeners.

Let me illustrate this with a quote from a focus group. To aid the syndication of my radio work, one of my producers did a focus group of program directors at public radio stations across the country. When doing this he shares only the spots with the directors, no information about me. Often, though, after they've given their comments, they'll ask "Who is this guy? Tell me about him." When told I'm an engineering professor, here's what one said:

> "Make certain that program directors don't perceive him as a professor who wants a radio show - -- every school has got one and most of them sound terrible."

Now, of course, I'm called "Bill" on the air, in fact "professor" is never mentioned at all. But I warn you, being viewed as an expert is a hard role to shake. Over the years I've got e-mail messages asking me for advice on building a concrete dome - it was part of a someone's home improvement project - and I've got questions about installing gas lighting.

Hard Scientific Literacy

The next temptation is to engage in what's called "hard scientific literacy." What I mean by this is having a basic toolbox of skills - in mathematics, physics, chemistry, mechanics - that allows a person to delve into almost any technological area. Each of us in this room has such a toolbox. The goal of those who promote hard literacy is to create a public that is a capable as us of making independent, scientific decisions. This has been the literacy goal for the last thirty years or so. Now, there is a fair amount of evidence that this effort has failed to penetrate the consciousness of the American public. In spite of all the efforts, by any reasonable measure we are a nation of scientific illiterates. If you just looked at this on a pragmatic cost/benefit basis the effort would surely be abandoned.

Also, it isn't even clear that this is desired. Here's a quote from a physicist who's worked for thirty years to improve scientific literacy:

> "To make matters worse, we keep insisting that public understanding of science means understanding some basic science *rather than the technology that the public finds more palatable. All this despite the fact that ever since the Enlightenment, society has been sending back the message: give us the useful end products of science, as long as they cause us no real harm; but while we can relate to their technology, we don't require that we understand their underlying science." [from Morris Shamos, Myth of Scientific Literacy, Rutgers, 1997, p. 238]*

So, if it isn't hard literacy we want - or can get - what do we aim for?

Hard Literacy vs. Awareness

We would like adult learners to understand how the scientific enterprise works in our political and economic climate. We want to encourage an appreciative public, one that at least understands how much needs to be spent on science and technology. I think the science and engineering community would be well served by a society that, while perhaps illiterate in science in the formal academic sense, is at least aware of what science is, of how it works, and of its horizons and limitations. You might call this approach "science awareness," rather than literacy.

The objectives of this approach are to help students, and society in general, feel more comfortable with new developments in science and technology. They need not so much to understand the details but to recognize the benefits, and the possible risks of technology.

The real battle: Technological determinism

The argument over hard literacy versus awareness distracts from the main problem. I think that our battle is not so much with literacy, as with technological determinism. By that I mean a belief that technology shapes our lives with a ruthless logic all its own. In fact, which of us doesn't carry in their head an image of a great whirlwind of innovation that sweeps through our world, creating blessings and havoc? This view is only half true, and because of this, dangerous.

Its truth lies in the degree to which science does effect our lives. Never before has such a complex web of technology permeated a culture. For sure, in every century some marvel reshapes the world - the printing press, gunpowder, the cotton gin - but only in the twentieth century have these wonders united into a comprehensive system that seems to overtake us.

This view makes people passive, and so promotes a dangerous apathy. It focuses minds on how to adapt to technology, not on how to shape it. Thus, it removes a vital aspect

of how we live from our public discourse. This creates a pressing need for citizens who understand technological systems. Not just simply to grasp the impressive world of technology, but to exercise the civic duty of shaping those forces that shape our lives so intimately, deeply, and lastingly.

The key here is this: The technical aspects cannot be construed apart from their social context. The values and world views, the intelligence and stupidity, the biases and vested interests of those who design a technology are embedded in the technology itself.

In my work, I look at the entire technical, social, political, economic, and cultural context of the things that surround us. This includes the innovators, inventors, engineers, entrepreneurs, and business people who make technology happen.

So, we see the general message we want to deliver. Let's look at the form of that message.

What form should our message take?

This brings me to my second point: We must present our message in a way that resonates with the public. How to do this?

The answers comes from a G.K. Chesterton quote, which is posted on the file cabinet in my office. Over the years I've collected quotations about writing, and reaching readers, listeners and viewers. I've laminated them and rotate them on and off a file cabinet by my desk where I write. This is one of my favorites, and in fact is up there most of the time. Chesterton writes: "The only two things that can satisfy the soul are a person and a story; and even a story must be about a person."

This is the key. Look at very successful shows like *60 minutes*, or even better NBC's *Dateline*. They always tell a story, using, to my taste, too much suspense. They usually have a strong narrative, or at least a strong human interest angle.

Look for a moment at the scientific disciplines that are extremely popular: Astronomy and evolution. They both have superb popularizers - Carl Sagan and Stephen J. Gould - but also they seem to the public to place us in the world. They answer questions like: Who are we? And what is the purpose of life? So, the message to any technologist who wants to reach out, is to place technology in context.

When I'm tempted to just explain how something works, I recall another quote that often rotates on and off my file cabinet. Ambrose Bierce in his 19th century Devil's Dictionary - which is essentially a list of literary barbs - defined "inventor" as,

> *Inventor, n. A person who makes an ingenious arrangement of wheels, levers and springs, and believes it civilization.*

This is what we must avoid when talking to the public.

To overcome this in my radio work I often tell the story of an inventor or innovator who created some everyday object. I've talked of the invention of the microchip, scotch tape, the Ping golf putter, and nylon. I'll use a story that reveals how technology is changing the listener's life, or has dramatically changed our society. I've discussed the impact of the typewriter, the match, and how color film is embedded with cultural bias. Whenever possible I like to link up technology with art, music and especially literature. I've shared how J.R.R. Tolkien felt about technology, and what his Lord of the Rings might mean for us today; I've delineated how the creative process of an engineer is closely linked to that of a painter. And, at times, I help listeners understand the news of the day. It isn't a mode I use often, but after the September 11th attacks I tried to put technology and terrorism in perspective, and after the anthrax attacks I described anthrax and its toxicity in detail.

So far I've talked about the message, and about the form of that message, but without distribution neither of these is of much value. That brings me to my third point: We must, as a profession learn to use mass media.

Engineers and mass media

When we step from the lecture hall to the studio we have entered into a foreign land. I still recall my first trip to a studio. As I shuffled my papers, a technician asked "do you like the microphone close to your mouth or far away?" I asked what difference it made. He said "well, some of our commentators like the microphone close because that way you can hear all the saliva, tongue clicking and other mouth noises, others like it far away because it gives a nice clear sound, although somewhat unnatural." I had him put the microphone half way between near and far.

This highlights that we really need to understand a particular medium to use it to reach out. To give you an idea of the type of analysis I'm talking about let's look briefly at radio.

Radio is an intimate medium. We tend to be alone when we listen to it. People listen in their cars, they listen as they wake up, or while eating in their breakfast nook. What this tells us is that radio must sound like a conversation, albeit one sided.

Now, I'd lectured for years, in a room much like this. So, for my first commentary I just went into the studio and lectured to that microphone. The pieces were terrible. I would never use the voice that I'm using now in a conversation with, say, my wife. The image that I must create is one of sitting in a kitchen, having a cup of coffee, and just chatting about the technology behind swim suits, or the color mauve, or whatever the topic of the day is. Most people think the hard part is coming up with topics. While that is work, the difficult part is sounding conversational.

I did several things to sound conversational. One was to take voice lessons for about two years. I worked with a wonderful voice teacher in Pittsburgh before I came to Illinois. That seems like a way to learn how to sound like an announcer, but it's really just a way to learn how to sound like yourself! (I've written an article about my experiences - you can find it at my web site at www.engineerguy.com/articles/html/kran.htm.) Next, I studied radio for months. I listened to the most compelling people on radio - Charles Osgood, for example. I taped their pieces, then listened carefully, often using a stop watch to see exactly how they structured their stories.

I could go on giving many examples of how radio works, but my point here is this: If you're going to work in a medium, you need to understand it as best as possible.

Conclusions

There are several important messages from my remarks tonight. I hope you'll remember these three points: First, we need, as a profession, to think deeply about what message we want to communicate to the public about technology. I've suggested here that we concentrate for the adult learner on awareness, rather than hard core literacy. Second, we must present that message in a way that resonates, most often this is in the form of a story. And third, the work is too important to be left to journalists and others. We, as practicing engineers and scientists, must learn to use the mass media to effectively deliver our messages.

Thank you for inviting me to talk to you tonight. To show my appreciation I have a gift for each of you. I've brought with me copies of my remark, and I've brought CDs of some of my radio pieces. Thanks for listening.