

From: Technically Speaking
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Chapter 2

COMMUNICATING COMPLEX TECHNICAL INFORMATION

"Everything is simpler than you think and at the same time more complex than you imagine."

—Johann Wolfgang von Goethe

OVERVIEW

The information explosion does not necessarily mean there has been a knowledge explosion. We are data rich and understanding poor. Your audience needs to understand your ideas before they can accept them. This chapter encourages you to look at the complex data you are presenting and find ways to tame, tailor, and illuminate that information so you are transmitting useful knowledge that will be accepted by your audience.

The mind is only capable of absorbing so much information before it shuts down. A Rear Admiral, a Naval aviator, told me that the pilots of multimission aircraft can be so inundated with computerized information that there are moments during task saturation when they can be dysfunctional (sometimes called a "helmet fire"). The Navy installed a switch on the HUD (heads-up display) of the F-18 that toggles from normal to de-cluttered mode. This enables the pilot to manage the amount of data he receives. This is a first step in limiting the input to keep the pilot at peak performance.

Audiences also become anesthetized when verbally and visually overloaded. A confused mind will say, "No!" The presenter who extracts only the essential information from the vast amounts of available complex data and communicates this in an understandable and useful way will elicit applause as well as sighs of relief from the audience.

All of us must invest an enormous amount of energy in absorbing and processing information. A friend of mine was struggling to learn Akkadian, an ancient dead language. Making sense of the writing was an extremely frustrating task. Her teacher finally admitted that the only way to decipher an Akkadian tablet was to know in advance what it said. He explained that you need to know the subject, context, and jargon so you have a frame of reference and can choose the correct reading of a graphic symbol. When you are caught up in your ideas, it is easy to forget that other people don't have the same experience and familiarity with your technical discipline. Just as my friend needed prior information to learn Akkadian, you will need to provide basic references for your audiences.

Never overestimate your audience's knowledge base; at the same time, never underestimate their intelligence. A computer programmer told me that she had not been working in her field for eighteen months. When she went out for job interviews, she not only didn't know the workings of current software programs, but didn't even understand the acronyms referring to them. She was depressed because she couldn't demonstrate how intelligent she was to the interviewers. They had already predetermined that she was not qualified because she didn't belong to the current "information club." She became competitive only after researching the market and taking time to update her skills. Assume your audience is smart, but not up to date in your discipline.

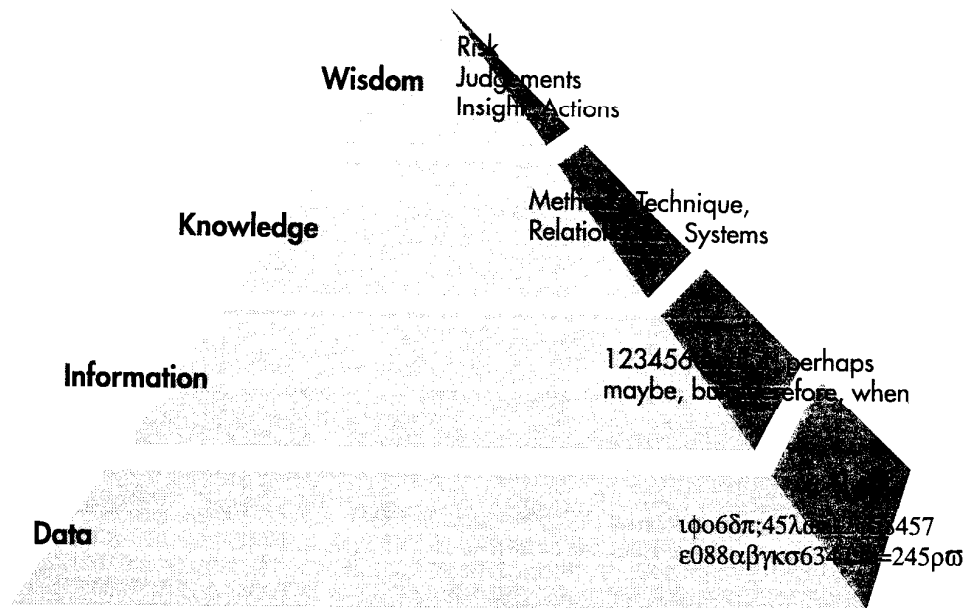
Model communicators make information simple and easy to understand without watering down their ideas. Albert Einstein said, "Everything should be made as simple as possible, but not simpler."

The most interesting discovery that I made in the course of my interviews is that model communicators illuminate and give insight; they don't dilute scientific and technical information. They don't talk down to their audiences; rather they feel that scientific concepts should be available to everyone. They empower their listeners. They "translate" complex concepts in a way that adds to a person's knowledge. Mike Sundell, Vice President and General Manager for Basic Coatings (an Iowa company that produces wood and metal finishes), said, "I think in terms of bringing technology up to the level of my audience. A lot of audiences are intelligent and sophisticated; they simply haven't been exposed to this specific technology."

Publishing consultant J. Wendell Forbes remarked:

No matter at what level of management we operate, and no matter what our job is, the challenge to all of us is to understand that whatever we are doing, the ultimate goal is wisdom. Even if we are on a production line, our data is what is delivered to us and our wisdom is what we should deliver to the next person. None of us operate exclusively at the wisdom level. We all start with our own equivalent of data and strive to end up with the ultimate satisfaction and reward that we here characterize as wisdom. One person's wisdom is another person's data.

Strive to pass on to your audiences useful knowledge and wisdom that will help them reach their goals.



Wisdom Triangle

Courtesy of J. Wendell Forbes

RECOGNIZING AND RESPONDING TO MULTILEVELS OF KNOWLEDGE

How can you translate complex material so that your audience receives the information easily and can incorporate that knowledge into their experience base? Every individual in an audience has a different world view, and there may be as many levels of knowledge as there are people. An audience analysis will help you understand how to present your material.

Let's say you are going to address three different groups. The first audience may read *Reader's Digest* and *USA Today*. This audience will want and need to know very simplified versions of technical information. A second audience might read *Scientific American*, *Omni*, or *Byte* and attend computer user or environmental focus groups. This level would also include people who give technical business presentations. This audience will feel comfortable with some technical information. Another audience may attend technical conferences that present in-depth information, statistics, product details, demonstrations, references, samples, plots, schematics, and drawings. This audience is interested in the hows and whys. Their reading material might include publications such as *American Institute of Aeronautics and Astronautics Journal*, *Journal of Applied Physics*, and *IEEE Transactions on Geoscience and Remote Sensing*. (IEEE is the Institute of Electrical and Electronics Engineers.)

A researcher should be able to convince a budget review panel that her project is valid and profitable for the company as easily as she would address her peers to describe the details of the process she followed. And she should also be able to adapt that same technical information to a general audience.

The most difficult presentations to prepare are those to audiences who have widely varying levels of knowledge. Begin your presentation by covering some basic information and terms for the people in your audience who have little knowledge of your subject. Periodically mention in-depth points that will keep the interest of the more knowledgeable members of the audience. Always give definitions of technical terms and explain acronyms. If it is necessary to describe a complex concept, give examples that include reference points familiar to everyone. Reiterate your main points in simple terms as you go along. End your speech by summarizing your message in general terms so that your entire audience can reach the same conclusion that you do.

For example, I was asked to coach scientists and engineers from NASA (National Aeronautics and Space Administration) Lewis Research Center who were to speak at their Business and Industry Summit on technology transfer from the space station. These presenters were used to explaining their work in technical settings with homogeneous audiences. Now they were challenged to adapt their message to business audiences with diverse levels of knowledge. They were addressing groups made up of nontechnical executives interested in profits and partnerships and of technical R&D (research and development) specialists who wanted to evaluate product design and development.

The objective of one of the speakers was to convince the business people to incorporate a valve design from the space station into their products. He began by giving a general overview of the valve's design and its use in space. Next, he gave an example of the valve's versatility by demonstrating how this design had been adapted to medicine. He displayed a titanium heart valve that can successfully be used as a substitute for a heart transplant. He pointed out some sophisticated technical details about workings of the valve and carefully defined his terminology and acronyms. Then he explained how the design of the heart valve could be applied to improving the design of valves in other products. He ended his speech talking about the cost and performance benefits rather than dwelling on all the complex details that were far too technical for the key decision makers in this business audience.

How Much Detail?

David L. Harten reported in *Reader's Digest's* "Campus Comedy" that a liberal arts student scrawled the graffiti, "Love makes the world go round." Underneath, a physics student added, "With a little help from intrinsic angular momentum."¹ Are you putting off your customers by going into too much detail? Is that why they decided to buy from your competitor? What did your customer *really* want to know? Scientists and engineers who think in precise terms often communicate in the same manner, but you can alienate an audience by talking over

their heads. Avoid exactness if the audience's knowledge level dictates a more general approach. The perceptive expert will seek ways to diminish the gap between his knowledge and that of the audience. If the listener begins to feel ignorant, he will resent the presenter and his purpose.

Give the general idea or major findings before you give the details, the function, and the principles. Alert your audience that you are going to build a skyscraper, not a log cabin. Then you can describe it and show them how step by step. If you are describing characteristics, help your audience by zeroing in on the specifics. Decide how much detail your audience needs to know to do the job, make the decision, advise others, or achieve some clear purpose. While one audience may feel buried in particulars, a technical group of your peers may think that four days of in-depth talks and a four-inch notebook merely skim the surface.

Decoding Tech-Speak Into Concrete Images

There is nothing frivolous about depicting complex scholarly subjects in understandable concrete images. Choose images that are familiar to your audience. A scientist from Dupont said, "Spider silk is the toughest material known. It is also very elastic. On an equal weight basis, it is stronger than steel. It has been suggested that a single strand of spider silk, thick as a pencil, could stop a 747 in flight." Illustrate the application of a theory or demonstrate your conclusion with words that engage the senses of touch, sight, smell, or taste.

Robert M. Price, President of PSD, Inc., clearly illustrates the complexity of parallel processing with this simple comparison:

Without using parallelism, you could simply hire one person with one lawnmower to mow your lawn, but you have a large lawn and it will take one person four hours. To shorten the time, you could contract with four people to do the job: one person for each side of your house. The control is simple: A mows the front, B mows the back, C mows the left side, D mows the right side. In this case, you have used parallel processing to reduce the time needed to mow your lawn from four hours to one.

Let's push this method and hire 240 people to mow the lawn. Can you expect that the job will be done in one minute? Not exactly. The problem is that you must spend a lot of time contacting each of these people and telling them what to do so that they aren't running over each other with their lawnmowers. With 240 workers, the simple job of mowing the lawn becomes a major task of control.

In general-purpose computers, we know how to manage modest levels of parallelism. But we don't know how to manage large numbers of parallel processors effectively.

Avoid “fat” words or abstract words. Quality, change, and productivity are fat words. For example, if you say CADD (computer-aided design and drafting) is a high-quality software program, are you saying that it is faster (how fast?), is more interactive, or has more pixels per inch?

Defining Your Acronyms and Buzz Words

One high-tech trainer told me, “We get so buried in our technical language that we forget that others don’t have any idea what those acronyms are referring to.” An audience may miss the whole object of your presentation because you assume they understand terms basic to your own profession. A nontechnical audience may hear you say ATM and think automatic teller machine instead of asynchronous transfer mode.

An overabundance of acronyms is especially prevalent in government and high-tech circles. TechWeb’s Technology Encyclopedia (www.techweb.com/encyclopedia) lists over 10,000 acronyms.

Use all of the words in an unfamiliar acronym more than once so that your audience can remember exactly what it means. It might be advisable to include a cue sheet or glossary among your handouts.

If the words used to form the acronym are a meaningless abstraction, then the resulting acronym can be totally vague. For example, everyone knows lasers are something we encounter daily in the barcode scanner in the supermarket. Many people know astronauts communicate with earth through laser beams. Lasers are used heavily in medicine; they can cut and cauterize certain tissues and bore holes in the human skull. However, a recent poll asked over 2,000 adults if lasers worked by focusing sound waves. Thirty-six percent correctly answered that it was false, but 29 percent thought it was true, and 35 percent didn’t know. Even if they knew the acronym stands for *Light Amplification by Stimulated Emission of Radiation*, they might need a further definition of the terms to understand how lasers work.

People are intimidated by jargon but often won’t ask for an explanation. Last year I attended a seminar about doing business on the Web. The presenter did an excellent job of showing how to incorporate the Internet into business strategy. However, he kept mentioning “cookies” during the first two hours of the presentation. For example, he stated that “cookies are the perfect tool to make a portrait of your customers.” Despite the context, it was difficult to figure out exactly what he meant, although “cookies” were obviously important.

During the break, I asked a number of attendees if they were using cookies. “Chocolate chip? Or peanut butter?” one person responded with a laugh. “Haven’t a clue what he’s talking about,” said a puzzled young man. “Didn’t want to reveal my ignorance by asking,” responded another. I went up to the presenter and suggested he explain the term.

When we reconvened, the presenter started off the rest of the seminar by explaining that cookies were one of the newest methods of electronic tracking

and information gathering. He described cookies as files stored in the visitor's computer that hold some information about the computer, record the pages on the site visited, and stores other information the visitor provides when visiting the Web site. The Web site assigns an identifying number to the user, determines the Internet service provider, and documents the path (clickstream) from origin to destination, revealing browsing interests. If the visitor returns to the Web site, this file is—if the visitor permits—sent to the Web site and any new information is added. By examining these cookie files, the site can gain information about its visitors and by tracking their path through the Web site, can identify and respond to their preferences. A perfect marketing tool, indeed!

Meaningful Definitions

“An inventor is an engineer who doesn't take his work seriously.”

—Charles Kettering

Definitions only work when your audience is familiar with references in the definition. What is a Xanadu? If I said that a Xanadu has the tail of an elephant and the neck of a giraffe, you could start to imagine the creature. But if I said that it also had the body of a tripozip, your mind would have a difficult time searching for an association.

George A. Keyworth II, the director of research for the Hudson Institute, added to his audience's knowledge with a thorough definition:

There's one word I want to use that sounds technical, but needn't be. The word is digitization, but think of it as a computer-age version of Morse code, the old Western Union language that had only dots and dashes. Like Morse code digitization consists of only two words. Those two words are the means by which information is made so simple that it can be treated by the computer as nothing more than a series of ones and zeroes to be added and subtracted. But what makes digitization significant is that virtually any kind of information—and by that I mean words, numbers, voice, music, photographs, or movies—can be converted into those streams of ones and zeroes.²

A definition can be made more explicit by comparing it with something familiar. For example, a DVD (Digital Versatile Disc) is about five inches in diameter and stores binary data in video and audio format in microscopic pits on the surface. This two-sided disc has two “layers” on each side and provides more than 25 times more data-storage capacity than a CD or a CD-ROM. A DVD provides higher-quality sound comparable to a good movie theater. The image quality and resolution is twice that of your VHS tapes. Two hours of video or the length of a feature film can be stored on a single layer.

What Is It Like? Similes, Metaphors, and Analogies

Your audience will show discomfort, annoyance, and frustration if they are unable to understand your presentation. No one likes to think that he or she may lack the intelligence to grasp information. Many scientific subjects are hard to describe; they can be difficult to see, touch, measure, or imagine. A presenter should seek to find ways to illuminate a concept in known terms with the least amount of distortion. Aristotle said that people remember information better if it is:

- closely associated with something familiar,
- sequential, or
- contrasts with something they already know.

Comparisons and contrasts are two of the best ways to translate your information clearly to your audience. Similes, metaphors, and analogies are comparisons that often can lead to amazing insights. By using these devices, you can enliven the dullest data and help people discover they know more than they thought they did.

Simile

Makes a direct comparison between two dissimilar objects and always uses connective words or phrases such as “like,” “as,” or “as if.” For example, research is *like* a treasure hunt. Leonard Pitts, a *Miami Herald* columnist, recalled his incompetence on the dance floor: “I stood there *like* a totem pole in a body cast.” Fresh, unique similes enliven your language.

Metaphor

Assumes an identity between two things. A metaphor is a condensed simile. For example, research *is* a treasure hunt. Metaphors are useful descriptions that add color and express feelings: “The software marketplace *is* a jungle.” You are substituting an image for an idea. The names of athletic teams are often metaphorical: Cowboys, Seahawks, Pirates.

Analogy

An expansion of a simile or metaphor. It uses the similarity of attributes, uses, or circumstances between two objects or concepts to explain an unfamiliar object or a concept. Whereas similes and metaphors use vivid language to get an audience’s attention, the analogy facilitates understanding by explaining the complex in simple, everyday terms. In the movie, *My Best Friend’s Wedding*, Julia Roberts uses an analogy to explain to her rival that the man they both love doesn’t necessarily want perfection but wants something comfortable and familiar. “As hard as it is to believe,” Julia Roberts’ character says, “some people prefer Jello over crème brûlée.”

Mike Sundell of Basic Coatings, speaking before a nontechnical audience, explained the purpose of adding catalysts and cross-linkers to polymer resins as follows:

To make products dry hard enough for floors, it has always been necessary to add catalysts or cross-linkers. Think of polymer resins in the solution as individual balls. If you tried to walk among the balls, you'd fall through. But if you tied string between them, you'd form a net that would hold your weight. That's what cross-linkers do: They tie the polymers together.

Mike notes that the analogies he uses to make a point early in his sales presentation are sometimes shaped by regional differences in his audiences.

An audience in the heart of New York City is a natural Doubting Thomas with a show-me attitude. They listen differently to you than the people do in the central corn country of Iowa, where they don't lock their houses or cars at night. I check to see how my audience is listening to me and how they react. Then I know how to tailor the rest of my presentation and what type of analogies they will respond to.

University of California Irvine biophysicist Bruce Tromberg is studying the "flight of photons" or how light particles travel through different kinds of tissue. Tromberg compares the photon flight paths to drivers on the freeway: You may switch lanes a lot (akin to light scattering) or make pit stops (akin to being absorbed). After Tromberg's team members shoot light into tissue, they can tell exactly how many times photons changed lanes and how many made pit stops. Their work may lead to doctors using portable laser detectors to learn whether breast tumors are cancerous, diagnose elusive cervical cancers, and map brain tumors—all without surgery.

You may agree that analogies help clarify points and are an excellent way to increase understanding, but how do you make up an analogy?

- Think about the situation or idea you want to describe.
- Think about what you want your audience to feel, think, and do.
- Review your audience's background, particular interests, and knowledge base (Analyzing Your Audience, Chapter 6).
- Find several things in your *unfamiliar* idea, process, sequence, action, or object that have similarities to a *familiar* idea, process, sequence, action, or object. What are the interrelationships?
- Choose familiar objects, actions, places, people, myths, sports, or experiences that do not require further interpretation. Your audience should be able to make an immediate connection and comparison. Note that the impact from the above analogies came from using ordinary, familiar objects.

- Make your analogy short, simple, and fairly general so that your audience can now view the idea in a new way.
- The essential task is to identify analogies that will be meaningful to your specific audience. Carol Bartz, Chairman and CEO of Autodesk, Inc., recognized that her technically literate audience at the Business Week Conference on the Digital Economy was familiar with the Web. She used changes in the exchange of information before and after the Web to explain parallel changes in partnership styles in the digital age.

The Web...is open and accessible.... In the past you had a better chance to control what your partner knew about your company. Like opening and closing a faucet, you had the option to manage information flow to a few people or a few organizations at a time. Now, it's more like a floodgate—stuck in the open position.... In the past, you could shape a message and deliver it. Now you need to keep shaping and reshaping information in play as it evolves and changes. It's like changing a tire while the car is moving.... Openness means that spin control is ongoing and carried out in real time.

One of my clients, Mike Carson, an engineer from EBASCO (Electric Bond and Share Company), was summoned to be an expert witness in a court case. He was testifying about the condition of the utility system, including the poles and other equipment, and the extent of depreciation in the utility district. It costs \$2,481 to install a new utility pole. According to the tax laws, a pole has no “book value” after thirty-five years, yet in the dry climate of northern California, poles may last twice as long as this. Therefore, the question was, What is the value of the average utility pole? The complex information would have overwhelmed a jury of ordinary citizens.

I asked Mike to think of something that the jury could relate to that would compare with the depreciation of telephone poles, as described above. We started to work out an analogy with a house depreciation and replacement cost. However, we were concerned that some of the members of the jury might not be homeowners and that they wouldn't recognize the relationship. We abandoned that analogy, and Mike suggested that almost everyone has bought and sold a car. Book value and depreciation rates would be familiar to them. When the attorney asked Mike to explain, he said, “It is similar to the depreciation of a car,” and proceeded to make a clear comparison.

Because science and technology are constantly changing, new ideas and information can sometimes be explained only in terms of what we already know. Similes, metaphors, and analogies are useful tools to clarify communications.

FAILURE TO COMMUNICATE

If the response you receive from your audience indicates that your material is hard to follow, ask yourself why it is obscure. Do you avoid analyzing and interpreting because you fear making inappropriate value judgments? Are you concerned that your views will conflict with those of a superior? Is using tech-speak your way of conforming and insulating yourself from others, especially outsiders? Are you overly conscious of criticism and therefore qualify every statement? Of course, one final possibility (and one that I hope isn't true) is that you haven't done your homework and have nothing insightful to say about your topic.

Your audience will appreciate your efforts to decode and interpret complex information. A judge who was presiding over a difficult trial said that the defense lawyer presented layers and layers of documentation that included federal antitrust litigation, laws from two state jurisdictions, environmental issues, and contract and employee rights litigations. She noticed that the jurors' eyes glazed over in confusion and boredom as they attempted to follow the bewildering onslaught of facts, statistics, and details over a six-week period.

The defense attorney gave a long and tedious closing argument, reciting multiple facts from the case and complex legal theories. After making a simple presentation in his closing argument, the plaintiff's attorney advanced toward the jury. "What we have here," he stated, "is a classic case of a fox getting caught in the henhouse. Now all you have to do is decide how much the fox has to pay," and he sat down. The jury members relaxed with a sigh of relief. They understood this language. The plaintiff was awarded the largest amount of damages in a state court in the history of Washington.

Some people can make the trivial complex. What is simple is always a matter of subjective assessment. What is understood becomes simple. Programming your VCR isn't simple if you're not sure how to do it. However, piloting a helicopter might be simple if you've been thoroughly trained.

An audience that doesn't understand the data you are presenting will remember little. Nor will they be persuaded to buy your product, fund your research, accept your bid, or be influenced by your ideas. Use distinctive language that does not obscure meaning. Understanding is a prerequisite to acceptance. Take responsibility for the audience's ability to understand your topic.

KEY IDEAS

- Empower your audiences by illuminating complex information.
- Strive for clarity and use concrete words and examples.
- Associate new information with the familiar so that your audience can see relationships.
- Use stories and analogies; they will be remembered longer than dry facts and statistics.
- Never underestimate the intelligence of your audience.

Notes

1. David L. Harten, in “Campus Comedy” column. Reprinted with permission from the September 1986 *Reader’s Digest*. Copyright © 1986 by The Reader’s Digest Assn., Inc.
2. George A. Keyworth II, “Goodbye Central: Telecommunications and Computing in the 1990’s,” *Vital Speeches of the Day* (April 1, 1990).