Engineering Communication
The Power of Persuasion

"Technical ability is obviously crucial to success in an engineering career. But of equal importance is the ability to communicate clearly and effectively. Individuals who rise to leadership positions in organizations generally do so partly because they can express ideas orally and in writing in persuasive, concise ways. Stated another way, it's hard to get a group of people excited about an idea or a new product or a research objective, if these things cannot be communicated in a compelling way."

-James D. Plummer, Dean of the School of Engineering and John M. Fluke, Professor of Electrical Engineering

Nature of Nurture

Can I learn to be persuasive and keep my technical edge?

Fortunately, good persuasive skills can be learned. You should recognize, however, that the conventions of communicating technical information in our profession tend to inhibit the persuasive process

What is persuasion?

- It is a communication process by which you motivate someone else to voluntarily do something you'd like them to
- The key word is "voluntary." Persuasion is not compelling or manipulating others to do what you want. You must present your audience with a legitimate choice of options
- True persuasion occurs when someone not only chooses your preferred option but feels good about it afterwards

Two Dimensions of Persuasion

POSITION AND CONVICTION

- Position involves *intellectual agreement* or for engineers what we consider logic
- Conviction *emotion,* people make decisions on what they feel then test or rationalize their choice with logic

Case Study

FOR EXAMPLE:

You convince the facility manager that the HVAC system is undersized and needs replacement. But then the work is never ordered

Why?

Because while the manager agreed with you intellectually he didn't feel strongly enough about the problem to spend time and money to correct it

You failed to evoke his conviction, which is the motivation to act, what could you have done to change this outcome?

Too much information
What about retention?

WE RETAIN:

- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we both see and hear

3 points to remember

1

- Technical communication stresses the need to be impersonal and objective
- Yet, people are persuaded for personal subjective reasons

2

- Technical communication focuses on provoking intellectual response
- But persuasion is driven by emotional response

3 points to remember

KEY CONCEPT:

- Technical communication emphasizes features, such as the steps of a process, equipment specifications, or specific regulatory requirements

- **People, however, are persuaded by the perception of personal benefits**

4 Ways to Use your powers of persuasion

Ask and listen first.

Want to get someone's attention? Ask him or her a question. Then listen carefully to the response. Ask not only to gain information, but to understand the perceptions and feelings of your audience. This is where the persuasive communication process should start.

4 Ways to Use your powers of persuasion

Start with areas of agreement

Begin the persuasive process by reviewing the values and understandings that you hold in common with your audience. This helps build momentum before you begin discussing differences

4 Ways to Use your powers of persuasion

Establish your credibility

If you are not perceived as credible, your audience is not going to listen to what you have to say. Engineers seek to establish their credibility by describing their credentials and experience. While this is important, the quickest way to credibility is to demonstrate that you genuinely care about your audience

4 Ways to Use your powers of persuasion

Show your passion

People are more persuaded by the depth of your conviction than the facts supporting it. Why should your audience care if it's not apparent that you do?

When you show sincere interest in you topic, others are more likely to be interested as well

Practice:

- Rehearse the presentation thoroughly
- [redacted]
- Don't read from a script or simply recite the content off of your slides
- Pay special attention to time
  - Revise the talk as necessary to stay comfortably within the time limit
  - A good rule of thumb is one to two minutes per slide

Delivery:

- Space-know the room and facilities
  - Physical presence-engage the audience
  - Vocal Presence
- Speak slowly and clearly
- Avoid monotone
- Avoid words such as: "um", "uh", "ah", "like"
- Don't use slang or overly informal style

Making Effective Visuals

- ❑ Clear Concise Message
- ❑ Simple content and format
- ❑ Good contrast
  - Avoid dark or busy backgrounds
  - Don't use more than three colors
- ❑ Avoid font sizes smaller than 20 pt
- ❑ Avoid pictures, diagrams, or text that are not readable by the audience

Tailoring To Each Category's Unique Needs

Engineering: For this cohort, dive into the mechanics of the subject. Use diagrams, flowcharts, and real-world examples. It's okay to get technical, but ensure clarity.

Marketing: Frame your presentation around market implications. Discuss user benefits, potential market share, and competitive advantages. Infographics and market research data can be valuable here.

Investors: Focus on the financials. Discuss projected returns, capital requirements, and potential risks. Comparative analyses with similar products or technologies can also be beneficial.

Two Theoretical Examples

Discussion group exercise

A New AI-driven Product:

1. Engineering: Dive into the algorithms, data training processes, and integration possibilities.
2. Marketing: Highlight how the product stands out in the market, its unique selling points, and potential customer segments.
3. Investors: Showcase projected sales, revenue models, and a comparative analysis with competitors.

A Sustainable Energy Solution:

1. Engineering: Detail the technology behind energy capture, storage mechanisms, and efficiency metrics.
2. Marketing: Emphasize environmental benefits, customer savings, and potential branding as a green company.
3. Investors: Present projected cost savings, scalability, and potential for government grants or incentives.

By tailoring content to the listeners' backgrounds and needs, presenters can transform their speeches from mere monologues into engaging, meaningful dialogues.

Zoom Etiquette

- Be professional
- Turn on your camera
- Check lighting
- Adjust camera angle
- Be mindful of background noise and surroundings

Writing

What is different about Technical Writing as compared to "ordinary" writing?

- ❑ Specific, rather than general, targeted audience
- ❑ Intent is to convey factual information, not to entertain
- ❑ Need to be precise (unambiguous) and complete
- ❑ Objective rather than subjective

The Key to Effective Technical Writing

- ❑ Organization

Three More Keys to Effective Technical Writing

- ❑ Clarity
- ❑ Precision
- ❑ Completeness
  - -But not lots of extra meaningless detail
  - -The trick is to convey the right amount of information, without burying the reader with unnecessary trivia

Reader needs to know implications of high level specs — not the details of the specs themself.

Solution: Enhance with graphics

Good graphics support good writing. Include **diagrams or schematics** where they add value and increase reader comprehension. They should be directly referenced within the text and clearly explained in a caption.

Example: Clarity, Precision, Completeness

• Consider the following fragment from a technical report:

The objective of the project is to design and construct a device to handle rock specimens within a magnetically clean environment. To accomplish this task, the device must take a rock sample from a staging area, insert it into the chuck of the transport arm, remove the sample once testing is complete, and then sit it back down

- What is clear about this project?
- What is unclear?

Example-A Better Attempt

The purpose of the project is to design and construct a device to handle rock specimens within a magnetically clean environment. To accomplish this task, the device must take a rock sample from a staging area, insert it into the chuck of the transport arm, remove the sample once testing is complete, and then sit it back down. The chuck is located on the end of the transport arm and holds the rock specimens. The transport arm moves the sample into and out of the magnetometer, a scientific instrument that measures the magnetic fields of the rock sample. The basic magnetometer system is shown in Figure 1.

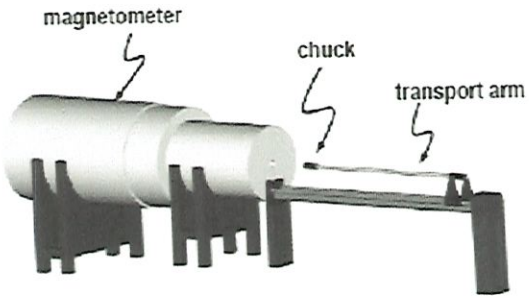

Figure 1 -- Magnetometer System

Another Example:

In this project, a spreadsheet is used to analyze solar oven designs and determine which design has the maximum performance index. Based on the results, the team decided to use four reflectors with an M/L ratio of three and two layers of glazing.

Audience: Students in another class who are unfamiliar with the technical issues & terms.

Another Attempt:

The objective of this project is to design a solar oven that will reach a high temperature at a low cost. The ratio of temperature/cost is the performance index used to evaluate the solar oven.

The basic design selected consists of a cardboard box with a window to an interior chamber. Reflectors wrapped with aluminum foil are used to reflect sunlight into the window, which allows light into the cooking chamber as shown in Fig. 1.

A spreadsheet is used to analyze the temperature generated by different solar oven designs. Among the factors to select are the number of reflectors, the height of the reflectors relative to the window width (called M/L ratio), and the number of layers of glazing used to form the window.

Based on the spreadsheet, the final solar oven uses four reflectors with an M/L ratio of three and two layers of window glazing. The analysis spreadsheet indicates that this design will maximize the temperature in the oven at a low cost. Results from the analysis are shown in Figure 2. This design gives rise the maximum performance index.

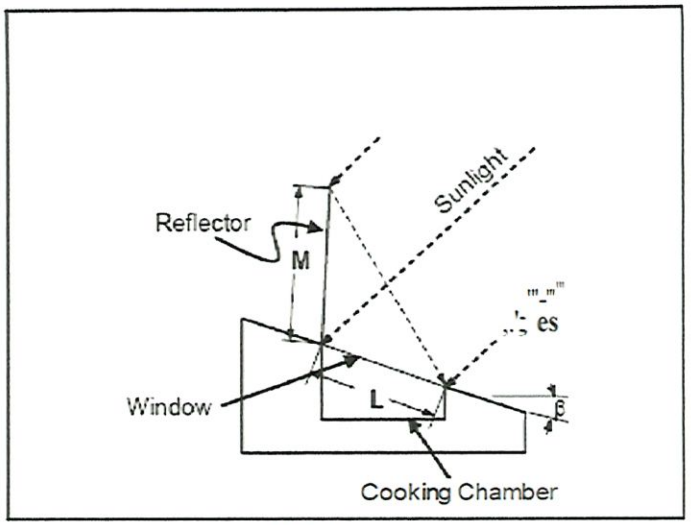

Figure 1

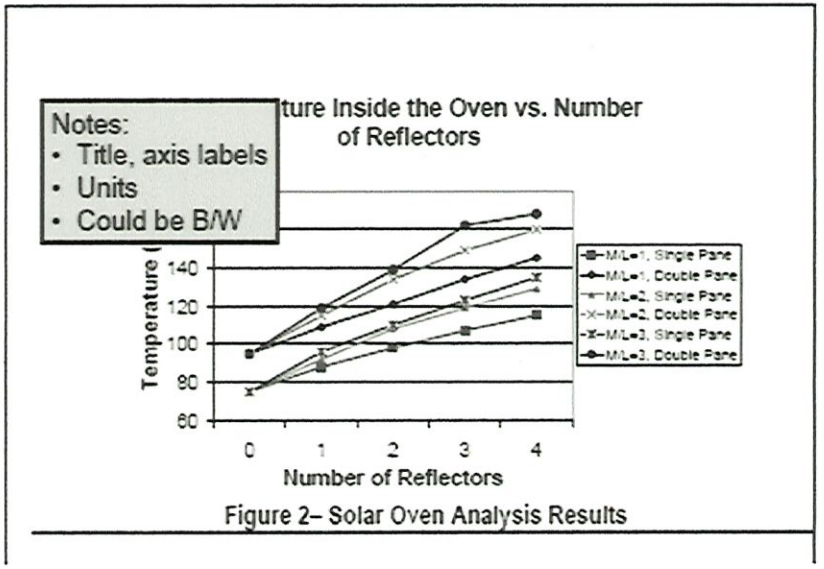

Figure 2– Solar Oven Analysis Results

To: Recipient's Name <email address>

From: Your Name <email address>

Subject: Title that specifies the topic and perspective on that topic

Attachment: Name of attached file

Recipient's Name:

People read email quickly. Therefore, get to the point in the first paragraph—the first sentence, if possible. In other words, state what you want up front. *

Be sure to give the person receiving the email the proper level of respect. Do not write "Hey." Do not address people by their first name unless you are friends, colleagues, etc.

In this email format, which comes from www.craftofscientificwriting.com, you should use single line spacing and skip a line between paragraphs. Because people read email quickly, use shorter sentences and paragraphs than you would in a longer document.
Final paragraphs should tell readers what you want them to do or what you will do for them.

Sincerely,

Your Name

_____

Your Name
Your Department
Your Institution
Your Phone Number

* Do not start with 'I hope this email finds you well'

Remember, the internet is forever…

Morals ≠ Ethics

Morals are ideas or opinions that's driven by a desire to be good.

An **ethical code** is a set of rules that defines allowable actions or correct behavior.

LAW VS. MORALITY: DON'T CONFUSE THE TWO

Legal & Moral	Legal & Immoral
Illegal & Moral	Illegal & Immoral

EXAMPLES OF THE CATEGORIES

Legal & Moral	Designing a system to be safe.
Legal & Immoral	Not tipping when the service was good
Illegal & Moral	Parking in a no parking zone, to come to the aid of an injured person
Illegal & Immoral	Killing an innocent person.

THE ESSENCE OF ANY ENGINEERING CAREER

- Engineering is one of the important professions in society.
- Engineers *don't just build things and develop processes.*
- Engineers build things and make processes *in order to better society.*
- In order to make society better engineers have to reflect constantly on the products and processes that they make.

INTEGRITY AS AN EXAMPLE

- A building has structural integrity when it is designed in way such that it appropriately responds to the stresses and loads that it is designed to act under.

- Just as a building can have poor integrity or good integrity. A person can also.

- A person has integrity when she/he can follow the codes he/she is supposed to follow under the stresses and loads of his/her role.

THE ENGINEERING CODE OF ETHICS

The Engineering Code of Ethics has three major components:

- **The Fundamental Canons:** which articulate the basic components of ethical engineering.
- **The Rules of Practice:** which clarify and specify in detail the fundamental canons of ethics in engineering.
- **Professional Obligations:** which elaborate the obligations that engineers have.