Guidelines for Effective Oral and Written Communications

Source: Undergraduate Professional Communications Program, School of Electrical and Computer Engineering, Georgia Institute of Technology

Overview: "Communication skills are extremely important. Unfortunately, both written and oral skills are often ignored in engineering schools, so today we have many engineers with excellent ideas and a strong case to make, but they don't know how to make that case. If you can't make the case, no matter how good the science and technology may be, you're not going to see your ideas reach fruition."

George Heilmeier, corporate executive of Bellcore, in Educating Tomorrow's Engineers," ASEE Prism, May/June 1995, p. 12.

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1. First Things First: Establishing Audience and Purpose

Before diving into any project, whether it be an oral presentation or a written report, you must first determine WHY you are communicating and to WHOM you are addressing. Begin by answering the following questions pertaining to purpose and audience:

- Does my audience consist of engineers in my field of expertise who are seeking technical information or will they be offended or bored by elementary details, definitions, or explanations of key concepts?
- Are they engineers from a different field who will need some general technical background?
- Are they a mixed audience made up of experts and laypeople?
- Am I communicating technical information on a level my audience can use and understand?
- Am I using appropriate vocabulary, examples, definitions, and depth of detail?
- Am I expecting more expertise, skill, or action from my audience than I can reasonably expect?
- Why will my audience want to spend time reading this document or listening to my presentation?
- Does my oral presentation/document provide the right level of detail and technology to keep my audience's interest without losing them or boring them?
- What is their current attitude likely to be—positive, neutral, or negative?
- Will my oral presentation/document give them the information they want?

2. Documentation

Once you have gathered all of your materials and are ready to sit down and write, you must keep in mind the importance of accurately citing all sources. Documentation is the system by which you indicate the sources of the information you borrow. By documenting your sources, you are giving formal credit to a person, organization, or publication for an idea or information that is not your own or that is not common knowledge in the field. Documentation is important for the following reasons:

- Enables readers to track down the information so that they can read it for themselves
- Protects the author of the information so that he/she will get credit and acknowledgment for having developed it
- Protects you from accusations of plagiarism (stealing someone else's ideas, words, or organizational patterns without crediting the source)
- Demonstrates to the readers that you have done your homework, that you are "up" on the latest developments in this particular field

Checklist of What to Cite

- Someone else's words (including anything you quote directly, summarize, or paraphrase)
- Someone else's ideas, organizational patterns, or facts
- Someone else's graphs, charts, illustrations, tables, statistics

Checklist of What Not to Cite

- Results of your own field research (surveys, lab experiments, personal observations)
- Common knowledge

Professional engineers use the IEEE system of documentation. This "numbers" system includes a references page at the end of the document which corresponds to the citations in the body of the report, indicating sources of borrowed information.

3. Proper Citation and Use of References—Examples

Example A:
The problem of signal compression is to achieve a low bit rate in the digital representation of an input signal with minimum perceived loss of signal quality. In compressing signals such as speech, audio, image, and video, the ultimate criterion of signal quality is usually that judged by the human receiver. As lower bit rates in the digital representations of these signals is sought, it is imperative that the compression (or coding) algorithm to minimize perceptually meaningful measures of signal distortion be designed, rather than relying on more traditional and tractable criteria such as the mean squared difference between the waveforms at the input and output of the coding system. The characteristics of human perception are of relevance to the optimization of a variety of functions in digital communication networks [5]. For example, one must consider the subjective consequences of communication delay [7], [9], [4], [6], differential delay, and jitter, as in some packet network designs [8], the effects of spatial disparity between audio and visual channels [10], and the effects of imperfect transmission channels [2], [11].

Example B:
The technology and literature of signal compression has evolved independently, with basic and valuable inspiration from Shannon's theory [13], [14] and the rate-distortion theory that followed it [4], [11], [12].

Example C:
In the 1999 IEEE Canandian Conference on Electrical and Computer Engineering, Cook, Faulkner, and Meng discussed the variety of eye detection methods that have been considered by others in the biomedical field: "Sanjay and Harvinder concentrated on real-time removal of eye-blink and eyeball movement artifacts from the forehead EEG recordings. Eadie used a new technique, which involved illuminating the limbus with infrared radiation and measuring the difference in the reflected radiation as the eye moved. Takagi and others constructed a displacement sensor for detection of eyelid movement by using amorphous wire magneto-inductive elements" [15].

Example D:
Figure 1 below shows a lateral and a superior view of the human eye.

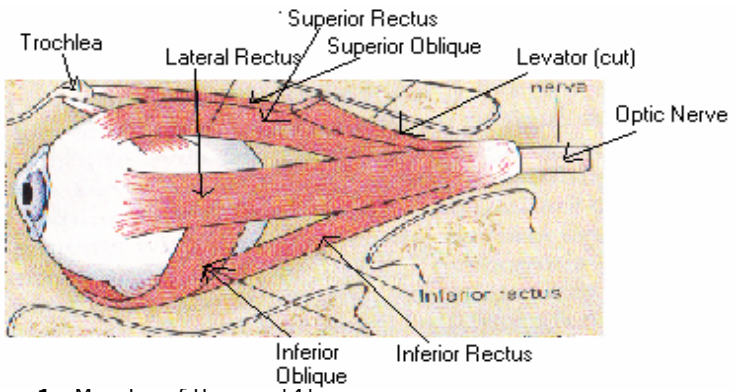

Figure 1. Muscles of the eye [4].

Six different muscles are responsible for controlling eye movements: four rectus muscles (superior, inferior, medial, and lateral) and two oblique (superior and inferior). These muscles enable the eye to rotate about all three axes of rotation, and the movement is defined as horizontal, vertical, or torsional [1].

The What, When, Where, and Why of Textual References

- To indicate just the source, put the source number in brackets [1]. This tells the reader to check the references page for source 1.
- To indicate the source and the page, add a colon and the page number [1:26]. This tells the reader that the borrowed information came from source 1, page 26.
- To indicate that the borrowed information came from a range of pages, add a hyphen and the end page number [1:26-39].
- To indicate that the borrowed information came from separate pages, not a range, use commas [1:26, 29, 33].

4. References Page

At the back of the report is the list of **sources cited** within the body of the document. The sources listed on the References page are arranged and numbered according to their occurrence in the report; they are not listed alphabetically. For example, if the first borrowed information that occurs in your report comes from a journal article by Zeigler, then Zeigler would be [1]. If the next borrowed information comes from a book by Bourgeois, Bourgeois would be [2]. If, several pages later, you need to cite Zeigler again, you would not use [6] (thinking this is your sixth citation). Instead, you would cite Zeigler as [1].

Sample Reference page

REFERENCES

[1] N. Ahmed, T. Natarajan, and K Rao, "Discrete cosine transform," IEEE Trans. Computers, pp. 90-93, Jan. 1974.

[2] A. J. Ahumada, Jr., "Putting the visual system noise back in the picture," J. Opt. Soc. Amer. A, vol. 4, no. 12, pp. 2372-2378, Dec. 1987.

[3] R. M. Boynton, Human Color Vision. New York: Holt, Rinehart, Winston, 1979.

[4] M. Stroh, "Gust work: meteorologists decipher the winds with radar," Science News, vol. 142, pp. 28-29, July 11, 1992.

[5] T. Land, "Web extension to American Psychological Association style (WEAPAS)," [Online document], 1996 Mar 31 (Rev. 1.2.4), [cited 1996 Sept 14], Available HTTP: http://www.nyu.edu/pages/psychology/WEAPAS/

[6] R. C. Booth, B. E. Daymond-John, P. E. Sturges, and M. G. Wilson, "Temperature tuning of $LiNbO_3$ electrooptic waveguide TE-TM mode convertors," Electron. Lett., 20, 25, pp. 1045-1047, 1984.

5. Oral Presentations

Most of the same rules for successful written communications also apply to oral presentations. The most important thing to master is audience analysis. The speaker who follows this advice will be recognized as a professional, someone who is prepared. Understanding the needs of your audience and being sensitive to those needs will make you a credible communicator.

Power Presenting: Secrets the Pros Know

- Know your audience
- Be prepared (for the unexpected)
- Arrive early
- Be yourself
- Presenting, not speech giving
- Make use of visuals
- Maintain eye contact
- Be ready for unexpected questions

Engineering Your Presentations—Some Do's and Don'ts

Do…

- Analyze your audience so your talk will be appropriate to their needs and expectations. Finds ways to get their attention and interest right away—and keep it! Keep in mind that they will have a short attention span, so use visuals and be energetic.
- Show interest in your topic. Enthusiasm is contagious; if you seem disinterested in what you are presenting, your audience will have a "don't care" attitude as well.
- Create a context for your talk. What is the subject? Introduce your topic before jumping into specifics. State the purpose so your audience knows what to expect.
- Stay within your time frame. The best way to do this is to decide what the most important points are and organize your materials carefully. *"Patience is a virtue, but in business, time is money."*
- Create supporting graphics that are easy to read. Use at least 24 point font for overheads, keep each slide to eight lines of text or fewer, and use color when possible.
- Prepare handouts that enhance or emphasize the material you are presenting.
- Make use of clear transitions to keep your audience in tune with where you are in the talk. Verbal cues such as first, next, for example, consequently, and finally help your audience follow along.
- Repeat key points. Remember the old adage, "Tell 'em what you're going to say, say it, then tell 'em what you said."
- Maintain eye contact. This helps to establish a rapport with your audience and creates a sense of intimacy with larger groups.
- Be prepared for unexpected questions. If you don't know the answer, simply say you don't know. Think of the Q&A time as an opportunity to have a group conversation/discussion about your topic. Be natural, not nervous.

Don't…

- Read from note cards or carefully script out your talk.
- Overwhelm your audience with excessive visuals or overheads that are too complex, too small, or too hard to understand.
- Speak too softly.
- Speak too slowly or too rapidly.
- Speak in a monotone.
- Use verbal fillers ("uh," "umm," "like," "yunno").
- Pace nervously.
- Turn your back to your audience or block the screen.
- End your presentation abruptly.