Effective Communication

ELEC 3040/ELEC 3050
J. Y. Hung & V. P. Nelson
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Enhancements by Stu Wentworth
Why is this topic important?

- Employers rank communication skills #2 behind technical expertise as desired traits for new engineers
  - 20-25% of engineers’ time spent writing
  - 70-75% of time communicating (reading, writing, speaking & listening)
- Good communication skills enhance professional advancement opportunities
Other reasons/benefits

- Putting thoughts on paper helps organize and refine ideas
- Written material & oral presentations can persuade an audience to support your effort (financially or otherwise)
- Preserve your work as a starting point for future work
Design project documents
(some or all may apply)

- Pre-proposal/project abstract
- Proposal
- Project plan
- Progress reports
- Test plan
- Report on test results
- Design report
- User manual
  - End-user documentation
- Various memoranda
- Engineering notebook

http://www.gocomics.com/theflyingmccoys/2010/02/20/
Seven steps to a successful document

• Divide responsibilities (for “team” document)
• Determine tone, style, length & format
• Develop an outline
• Write a draft
• Revise and proofread
• Review (peer and other) & revise again
• Generate the final document
Divide responsibilities

- Team members write sections with which they are familiar
- Team “editor” integrates sections, ensuring consistency and good flow between them
- Use the same or compatible word processor & related software (charts, schematics, etc.)
- Large industrial projects are often assigned a technical writer to assist the engineering team
Overall look & feel of a document
(need to sell your ideas)

• Match writing style and tone to your audience
  • Peers, managers, technical people, …
  • Use appropriate terminology & use it properly
• Convey to readers your knowledge of the project
• Clearly define report sections with headings
• Avoid use of 1st person in technical reports (unless it’s awkward to avoid it)
  
    Not:    We did this …
   
    Instead: The project team did this …
• Spell out acronyms 1st time used
  
    Ex.   pulse width modulated (PWM) signal …
   
    Then use PWM in the remainder of the document.
Format, layout, fonts, etc
(make it look professional)

- 11 or 12-point font (<14 for section headings)
- Single or 1 ½ line spacing
- Top/bottom margins 1-1.5”, left/right margins ¾ - 1”
- Page numbers (in header or footer) after title page:
  - Arabic numerals for body (1, 2, 3…)
  - Lower case Roman numerals (i, ii, iii, …) for prefatory pages
- Use “bullet points” to break up lists of items, rather than merging them within a paragraph
- Avoid overuse of **bold**, *underline*, *italics*, *color*, & other “special effects” (can be distracting)
  - **Boldface** for section headings
  - *Italicize for emphasis* where necessary
The “body” of a report

- Basic structure (from high school):
  1. Say what you’re going to say
  2. Say it
  3. Say what you said

- Some may read only the introduction and/or conclusions

- Introduce the reader to the problem and provide sufficient context to understand the discussion
  - Give “high level” descriptions before details

- Place supplementary material in appendices (schematics, software listings, etc.)
Report body organization

- Intro - what is the problem to be solved?
- What prior work has been done?
- What is your solution to the problem?
- What alternative solutions were considered, and why were they not used?
- How did you deal with various constraints?
- How was your design implemented?
- How was your design tested?
- How well did the design meet the specifications?
- Overall summary *(might be all that is actually read)*
- Future work – what remains to be done?
Figures & tables

• Each should **contribute** to the discussion – assist reader in visualizing a design/concept/data …
  • Some readers might just flip through figures/tables
• Use a caption to summarize each figure’s content:
  Ex.  *Figure 1. System block diagram*
• Reference figures/tables by number:
  Ex.  *As can be seen in Figure 1, ….  
  Not: *As can be seen in the figure below, ….  
• Figures/tables should be readable with ordinary effort
  • avoid too much detail & small fonts
  • neither too large nor too small
• _Label all axes_ on graphs/charts
References

- Cite published work related to your project
  - Properly credit items from sources used in the report
  - Convince reader you’ve researched the problem
  - Provide additional sources of information
- Number references [1,2] in the order cited in the text [3].
- Provide complete references at the end

A reader should be able to locate a reference from the citation information.
# Writing performance indicators/rubrics

**Program Outcome 8:** Proficiency in communicating ideas and information orally and in writing.

- ELEC 4000 – Senior Design Final Report
- ELEC 3040/3050/3060 – Final Lab Report
- ELEC 3030 – Final Lab Report

<table>
<thead>
<tr>
<th>Performance Indicators</th>
<th>Rubric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 – Unsatisfactory</td>
</tr>
<tr>
<td>Content</td>
<td>Inconsistent or few details that may interfere with the meaning of the text.</td>
</tr>
<tr>
<td>Organization</td>
<td>Little evidence of organization or any sense of wholeness and completeness.</td>
</tr>
<tr>
<td>Style</td>
<td>Limited or inappropriate vocabulary for the intended audience and purpose.</td>
</tr>
<tr>
<td>Grammar</td>
<td>Does not follow rules of standard English.</td>
</tr>
<tr>
<td>Figures/Tables</td>
<td>Figures and tables do not support the text, or are poorly designed.</td>
</tr>
<tr>
<td>Use of sources</td>
<td>Sources consistently not cited for material used in the report.</td>
</tr>
</tbody>
</table>

**COMMENTS:**
Oral Presentations

- Most guidelines for written documents apply
  - Consider who your audience is.
  - What do you want the audience to take from your presentation?
- Plan and practice your presentation & timing
- Use appropriate graphics
- Don’t substitute “glitz” for “substance”
  (especially distracting PowerPoint animations)
- Show enthusiasm & professional demeanor
- Speak to the audience – make eye contact
- Consider, in advance, how you will answer questions
Don’t:
- speak in monotone
- read your slides
- look bored with your own presentation
- use annoying mannerisms
- use placeholders (ok, you know, like, actually, uh...)

Bueller?
Do:
- Personalize your talk (humor, quotes...)
- make eye contact
- speak loudly, vary your tone and pace
- ask questions

- practice!!!
Use a very large font

40 point  28 point  18 point  12 point

• use a small number of lines per slide
• key words & phrases rather than sentences
• poofread for spelling!
• go easy on the equations
• don’t overdo color
Effective Visuals

Help the audience visualize what you are trying to describe

1. Good visibility
2. Simplicity
3. Manageability
Make figures audience-friendly

Can you comfortably read these diagrams?
(example of a bad plot)

**temporal flux vs Plinth Setting for different power inputs**

A lot of wasted space
Temporal Flux Comparison

Input Power (W)

Temporal Flux (Tachyons/cm^3)

- K1(P1=16)
- K2(P2=18)
- K3(P3=20)

(example of an improved, but still poor plot)
Temporal Flux Comparison

Plinth = 16
Plinth = 18
Plinth = 20

Power Feed (GW)
A Wasted Visual

The Temperature Control Project

Introduction

Objectives

Solution

Conclusions
A Better Visual

The Temperature Control Project

1. **Objective** – maintain temp
2. **Solution** – IC sensor, µcontroller, fan control
3. **Future work** – high fan power
Other tips

• don’t downplay your own expertise
• stay within your allotted time…
• but don’t go too fast!
• go over big ideas twice
• consider audience attention span…
Sources of audience distraction:
• Insufficient background for audience to understand the talk
• Confusing/disorganized structure
• Visual aides crowded/unreadable
• Complicated, formal, unnatural speech
• Speaker reads the speech
• Monotonous sentences
Top 10 Tips to an Awful Presentation

1. Go with the flow, because audiences enjoy spontaneity and surprises. Don’t worry about time, since no one minds the duration of really good presentations.
2. Start preparation at 3 a.m., with caffeine and donuts for support.
3. Leave equipment checks to your partner, since you have to concentrate on other things for the presentation.
4. Impress the audience with your erudition.
5. Fiddle with something to hide nervousness.

This slide breaks a fundamental rule: Too much stuff on one slide!
6. Have lots of visuals on hand, and go through them quickly to keep the viewers on the edge of their seats.

7. Pack the visuals with data, so the audience can read anything that you forget to discuss.

8. Emulate a professor: Give the audience everything – and the kitchen sink!

9. Avoid eye contact, as it might distract you.

10. Take no questions from the audience, since questions open tiresome debate.

*Also too much stuff on one slide!*
### ABET EAC Student Outcome 3

*Graduates will demonstrate an ability to communicate effectively with a range of audiences.*

#### (ELEC 3040/3050 Oral Presentation)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Student</th>
<th>Partner</th>
<th>Advanced</th>
<th>Competent</th>
<th>Developing</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nonverbal Skills</strong></td>
<td></td>
<td></td>
<td>Eye contact holds audience attention; seldom or never looks at notes.</td>
<td>Consistent eye contact with audience; occasional return to notes.</td>
<td>Minimal eye contact with audience, reading mostly from notes.</td>
<td>No eye contact with audience; entire report read from notes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Movements seem fluid and help the audience visualize.</td>
<td>Movements/gestures enhance articulation.</td>
<td>Very little movement or descriptive gestures.</td>
<td>No movement or descriptive gestures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Displays relaxed, self-confident nature, with no mistakes.</td>
<td>Displays little or no tension; quickly recovers from minor mistakes.</td>
<td>Displays mild tension; has trouble recovering from mistakes.</td>
<td>Tension and nervousness obvious; has trouble recovering from mistakes.</td>
</tr>
<tr>
<td><strong>Verbal Skills</strong></td>
<td></td>
<td></td>
<td>Consistently strong, positive feelings about topic.</td>
<td>Occasionally shows positive feelings about topic.</td>
<td>Shows no feelings about topic.</td>
<td>Shows negative interest in topic.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Strong voice, precise pronunciation of terms; all audience members can hear presentation.</td>
<td>Clear voice, mostly correct pronunciation of word; most audience members can hear presentation.</td>
<td>Quiet voice and/or incorrect pronunciation of terms; audience may have difficulty hearing.</td>
<td>Mumbles, incorrectly pronounces terms; speaks too softly for a majority of audience members to hear.</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td></td>
<td></td>
<td>Strongly enhances presentation effectiveness.</td>
<td>Technically correct; generally supports the presentation.</td>
<td>Mundane or commonplace; partially supports presentation effectiveness.</td>
<td>Unclear, technically weak or incorrect; minimally supports presentation effectiveness.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Especially appropriate for the audience.</td>
<td>Mostly appropriate for the audience.</td>
<td>Sometimes appropriate for the audience.</td>
<td>Often inappropriate for the audience.</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td></td>
<td></td>
<td>Organizational pattern is clear, consistently observable, and exhibits strong cohesiveness.</td>
<td>Organizational pattern is clearly and consistently observable; may have some extraneous content.</td>
<td>Organizational pattern is intermittently observable; extraneous content evident.</td>
<td>Organizational pattern is not observable. Poor choices of content.</td>
</tr>
<tr>
<td><strong>Visuals</strong></td>
<td></td>
<td></td>
<td>Excellent visuals that enhance understanding of presented information.</td>
<td>Appropriate visuals used and explained.</td>
<td>Visuals used, but not well-explained; some content difficult to view.</td>
<td>Little or no visuals, too much content on slides, or slides unreadable.</td>
</tr>
<tr>
<td><strong>Subject Knowledge</strong></td>
<td></td>
<td></td>
<td>Demonstrates full knowledge of all information.</td>
<td>Demonstrates reasonable knowledge of information.</td>
<td>Uncomfortable with some information.</td>
<td>Does not have grasp of most information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Answers all questions with clear explanations and elaboration.</td>
<td>At ease; gives expected answers to most questions, without elaboration.</td>
<td>Able to answer only rudimentary questions.</td>
<td>Cannot answer questions about subject.</td>
</tr>
</tbody>
</table>
References

- Practical Engineering Design, Maja Bystrom & Bruce Eisenstein, CRC Press, 2005
- Writing and Speaking in the Technology Professions: A Practical Guide, 2nd Ed., David F. Beer (Editor)