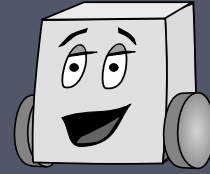


# E11 Lecture 16: Technical Writing



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Fall 2010

*with examples and text from  
<http://www.writing.engr.psu.edu>*

## What remains in E11:

- **Lab this week:** Group Writing of your Final Report
- **Today:** Technical Writing
- **Wednesday, 12/1:** Presentation Skills
  
- **Lab next week:** 5-Minute Presentations and Peer editing
- **Monday, 12/6:** Prof Dodds – CS Robotics Lab Tour
- **Wednesday, 12/8:** Prof Harris – Eng. Outlook
  
- **Due Friday, 12/10:** Final Reports



## Overview

- E11 Final Report Guidelines
- What is technical writing?
- Audience, Purpose, and Occasion
- Style
- Group writing strategies




## E11 Final Report

- Cannot exceed 5 pages (excluding appendices and source code).
- Classmates should be able to understand and replicate your robot based on your report.
- **Must contain:**
  - Overview of your Autonomous vehicle
  - Explanation of your game-playing algorithm
  - Description of your modification
    - Dimensioned drawing of your chassis if you designed a new one
    - Description and bill of hardware for any hardware you added
    - Schematics of any electronics beyond the stock hardware
  - Summary of robot performance, including tests, scrimmage, and final game as well as:
    - Discrepancies with the intended algorithm,
    - Limitations you have observed, and
    - Concrete recommendations for improvements
  - Summary of main lessons you have learned from the project
  - Appendix with your Arduino code



## What is technical writing?

- What is the purpose of creative writing?
  - To entertain
- What is the purpose of technical writing?
  - To inform and/or to persuade
- What are the major goals of technical writing?
  - Clarity
  - Accuracy



## Consider Audience, Purpose, and Occasion

- **Audience:**
  - Who they are
  - What they know
  - Why they will read
  - How will they read
- **Occasion:**
  - Format
  - Formality
  - Politics and Ethics
  - Process and Deadline
- **Purpose:**
  - To inform
  - To persuade



## Your audience will assess:

1. Content
  - The information contained in the report.
2. Style
  - The way information is presented, including structure, language, and illustration.
3. Form
  - The appearance of the information, including grammar, punctuation, spelling, and format.



## Be specific

*From a progress report to the Department of Energy:*

- *Before*: After recognizing some problems with the solar mirrors, we took subsequent corrective measures.
- *After*: After finding that high winds (and not hail) had cracked the ten solar mirrors, we began stowing all mirrors in a horizontal position during thunderstorms.



Generalities are not helpful! Use specifics where reasonable.



## Active versus Passive Voice

- *Before:* A new process for eliminating nitrogen oxides from diesel exhaust engines is presented. Flow tube experiments to test this process are discussed. The percentage in nitrogen oxide emissions is revealed.
- *After:* This paper presents a new process for eliminating nitrogen oxides from diesel engine exhaust. To test this process, we performed experiments in flow tubes. These experiments revealed a 99 percent decrease in nitrogen oxide emissions.



Use active voice where possible, but do not overuse “we” or “the team”.



## Keep It Simple! (sentence level)

- *Before:* Vibration measurements made in the course of the Titan flight test program were complicated by the presence of intense high-frequency excitation of the vehicle shell structure during the re-entry phase of the flight.
- *After:* Vibration measurements made in the Titan flight were complicated by intense high-frequency excitation of the vehicle shell during re-entry.



Think about word “economy”: how many words would you keep if you had to pay per word?



## Keep It Simple, part II (word level)

- *Before*: The goal of this study is to develop a commercialization strategy for solar energy systems by analyzing factors impeding early commercial projects (i.e., SOLAR ONE) and by identifying the potential actions that can facilitate the viability of the projects.
- *After*: This study will consider why current solar energy systems, such as Solar One, have not reached the commercial stage and will find out what steps we can take to make these systems commercial.

 Do not use needlessly complex words.



## Avoid jargon and colloquialisms

- *Before*: Before beginning the experiment, we ran it by the safety coordinator.
- *After*: Before beginning the experiment, we consulted with the safety coordinator.

 Do not use jargon (“the bottom line”) or conversational phrases in technical writing.

## Avoid ambiguity

- *Before:* We examined neat methanol and ethanol and methanol and ethanol with 10% water.
- *After:* We examined four fuels: neat methanol, neat ethanol, methanol with 10% water, and ethanol with 10% water.



Ambiguity is frustrating for the reader, and in industry could even end in a lawsuit!

## Avoid storytelling

- *Before:* First, we used a co-current heat exchanger design due to simplicity. However, heat transfer was not sufficient and the design would need to be large, so we then switched to a counter-current heat exchanger design. Next, we calculated the heat transfer coefficients for the flow conditions described above using the equation below.
- *After:* A counter-current shell-and-tube heat exchanger design was chosen to maximize heat transfer and minimize heat exchanger size. The heat exchanger coefficients were calculated for turbulent conditions using the following correlation:

$$Nu_D = 0.027 Re_D^{4/5} Pr^{1/4} \left( \frac{\mu}{\mu_s} \right)^{0.14} \quad (3)$$



Focus on final outcomes and justifications; the order in which you attempted and most failed attempts are not relevant!



## What's wrong with this paragraph?

- Mount St. Helens erupted on May 18, 1980. A cloud of hot rock and gas surged northward from its collapsing slope. The cloud devastated more than 500 square kilometers of forests and lakes. The effects of Mount St. Helens were well-documented with geophysical instruments. The origin of the eruption is not well understood. Volcanic explosions are driven by a rapid expansion of steam. Some scientists believe the steam comes from groundwater heated by the magma. Other scientists believe the steam comes from water originally dissolved in the magma. We need to understand the source of steam in volcanic eruptions. We need to determine how much water the magma contains.



## Flow via varying sentence openers

- **Subject-verb:** Mount St. Helens erupted on May . . .
- **Prepositional phrase:** In minutes, the mountain emitted . . .
- **Adverb:** Recently, debate has arisen . . .
- **Dependent clause:** Although the exact time of the eruption surprised scientists, evidence had been collected . . .
- **Infinitive phrase:** To understand, we have to . . .



## Revised paragraph

- Mount St. Helens erupted on May 18, 1980. Its slope collapsing, the mountain emitted a cloud of hot rock and gas. In minutes, the cloud devastated more than 500 square kilometers of forests and lakes. Although the effects of the eruptions were well documented, the origin is not well understood. Volcanic explosions are driven by a rapid expansion of steam. Recently, debate has arisen over the source for the steam. Is it groundwater heated by magma or water originally dissolved in the magma itself? To understand the source of steam in volcanic eruptions, we need to determine how much water the magma contains.

## Choose Between Tables and Graphs Wisely

Table 2. Blood glucose levels

Time (hour)	Normal (mg/dl*)	Diabetic (mg/dl)
midnight	100.3	175.8
2:00	93.6	165.7
4:00	88.2	159.4
6:00	100.5	72.1
8:00	138.6	271.0
10:00	102.4	224.6
noon	93.8	161.8
2:00	132.3	242.7
4:00	103.8	219.4
6:00	93.6	152.6
8:00	127.8	227.1
10:00	109.2	221.3

\* decaliters/milligram

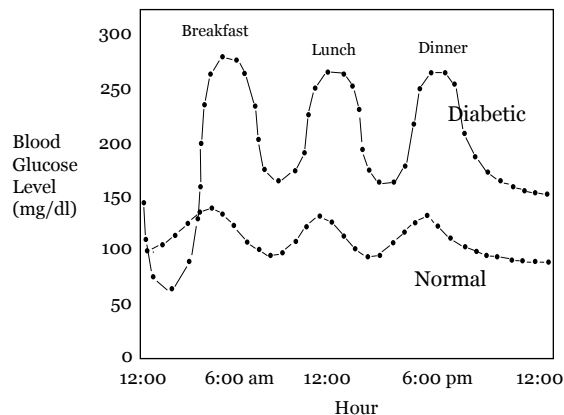


Figure 11. Blood glucose levels for normal individual and diabetic

Citation for illustrations: Carlson, Gary, "Implantable Insulin Delivery System," *Sandia Technology*, vol. 6, no. 2 (June 1982), pp. 12-21.

## Other things to consider:

- Hints on word choices:
  - “in order to” can almost always be replaced with “to”
  - “utilize” -> “use”
  - “implement” -> “build”
  - “very” is very unnecessary and can almost always be deleted
- A picture (figure, table, diagram) is worth a thousand words.
  - If possible, draw figures yourselves. If not, you must cite the source of your figure.
  - Make sure to label tables and figures (number and title) and refer to them in the text.
- Use transition sentences
  - When beginning a new paragraph or section, use a transition sentence to tie in with the previous paragraph/section.

<i>STRATEGY</i>	<i>PROS</i>	<i>CONS</i>
<p>person (hopefully the “best” writer in the group) writes the entire report with little help from everybody else.</p> <p><i>(BAD METHOD)</i></p>	<ul style="list-style-type: none"> <li>• You won't have to worry about agreeing on a single voice</li> <li>• If this person is a good writer with a good understanding of the project, the report will probably be pretty decent</li> </ul>	<ul style="list-style-type: none"> <li>• This person will hate all of you</li> <li>• This person will not sleep at any point during the month of April</li> <li>• Nobody else will have a say in what goes in the report</li> <li>• Everybody's specialized technical knowledge will be lost forever</li> </ul>
<p>group leader splits up the report into sections and assigns it out to the group members. Each person writes their own section, then the sections are cut-and-pasted together.</p> <p><i>(BAD METHOD)</i></p>	<ul style="list-style-type: none"> <li>• Each person contributes more or less equally</li> <li>• Nobody ever has to read the entire report</li> </ul>	<ul style="list-style-type: none"> <li>• Your advisor, liaison and client will hate all of you</li> <li>• Whoever edits the reports before they go out to the clients will not sleep at any point during the months of May or June</li> <li>• Your report may lack quality and integrity</li> </ul>
<p>follow Method 2, but then have the best writer in the group read and edit the entire report before turning it in.</p> <p><i>(ONLY SLIGHTLY BETTER METHOD)</i></p>	<ul style="list-style-type: none"> <li>• The report will have a single voice</li> <li>• Everyone's specialized technical knowledge and/or unique perspectives will be included (unless the editor chops that part)</li> </ul>	<ul style="list-style-type: none"> <li>• A tremendous amount of time will be necessary to edit everything</li> <li>• Your chosen editor may happen to be a poor editor</li> </ul>
<p>group writes an extensive outline together and spends lots of time on the front end deciding who the group is, what tone is appropriate, what information is appropriate, etc. Everyone then writes his or her own sections. Finally, everyone takes a turn reading and commenting on the entire report and a final editor implements suggested changes.</p> <p><i>(GOOD METHOD)</i></p>	<ul style="list-style-type: none"> <li>• Relatively little time is necessary in the editing stage</li> <li>• The workload is pretty equal and nobody gets stuck doing the lion's share.</li> <li>• Everybody has a say in what information goes in the final report and how it is presented</li> <li>• Having everyone edit virtually guarantees a correctly spelled title</li> </ul>	<ul style="list-style-type: none"> <li>• This method takes lots of time on the front end. Granted, it's well worth it, but if you're late getting started this may be a difficult method to implement at the last minute</li> <li>• You will spend lots of time in a little room together with your team. Order pizza.</li> </ul>
<p>group writes the introduction, conclusion and all other sections together as a group. The other sections are then written individually. Everyone then reads and comments on the full report and a final editor implements everything.</p> <p><i>(YET ANOTHER GOOD METHOD)</i></p>	<ul style="list-style-type: none"> <li>• See Method 4</li> </ul>	<ul style="list-style-type: none"> <li>• See Method 4. But order Chinese food instead</li> </ul>
<p>group members lock themselves in a room and write the report, from beginning to end, together.</p> <p><i>(BUT MORE THAN SLIGHTLY INSANE METHOD)</i></p>	<ul style="list-style-type: none"> <li>• The report has a single voice</li> <li>• Everyone has a say in what the final report looks and sounds like</li> <li>• Everybody suffers equally</li> </ul>	<ul style="list-style-type: none"> <li>• Order both pizza and Chinese food. This is a huge time commitment and you will be stuck in a small room with your teammates for at least a week.</li> <li>• It is difficult to remain sensitive to others' feelings when stuck in a small room with your entire team for long periods of time. You may all hate each other before you're done.</li> <li>• This will not be fun, and the resulting report may show it.</li> </ul>