Technical Writing For Engineers

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Spiritual Thought

"Prophets, poets, and thinkers of every age have proclaimed love as the highest of all the virtues. But Zion cannot be established by the lower forms of love… *it* requires charity (*agape*), that pure love of Christ "bestowed" as a gift upon all who will submit to the covenants and the powers of the atonement. It was this kind of love that sustained a Zion society for four generations among the Nephites who experienced "no contention … because of the *love of God* which did dwell in the hearts of the people."

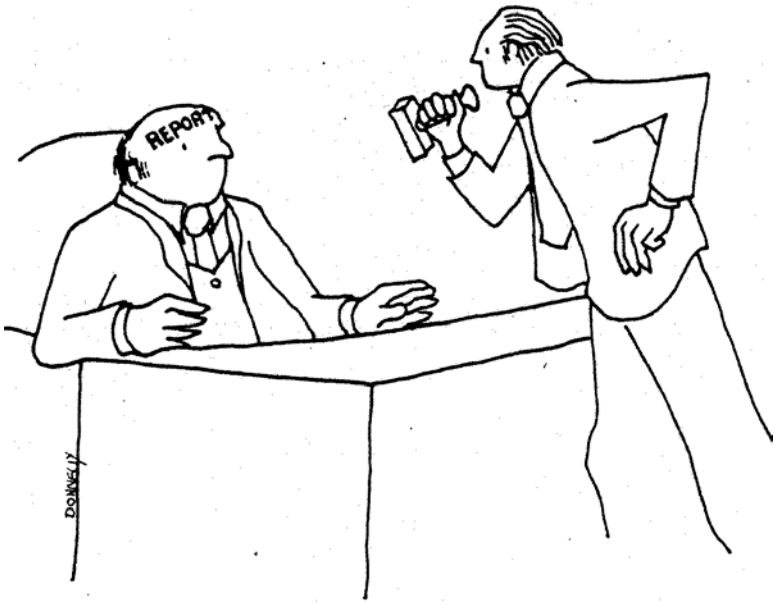
…The entire gospel plan and program of the Church is to engender in us this quintessential quality—love. The pure love of Christ is a sanctifying and cleansing power—the only force powerful enough to make us "THE PURE IN HEART."

…One cannot belong to the Church for long without learning that service is central to the entire workings of the kingdom.

Quinn Gardner

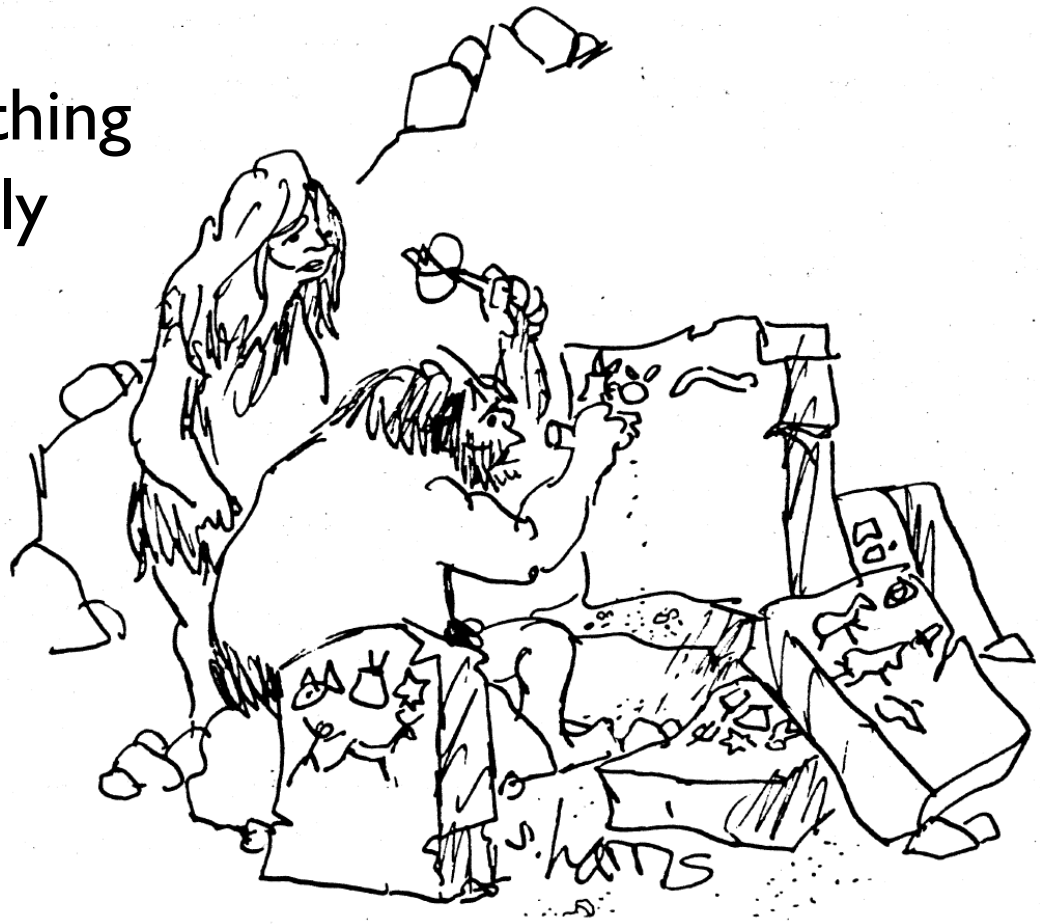
Why Write?

- Develops perhaps the single most important skill in your career.
  - Engineers must be excellent technical writers
- Conveys important ideas in a lasting way that will preserve your work.
- Hones your thinking
  - Careful thought
  - Critical analysis
  - Others' point of view



Rule #1 of Good Writing

- Revision, revision, revision!!!!
- "There is no such thing as good writing, only good *re-writing*."



An Effective Report is **Logical**

- Technical report logic begins at the word level and extends through the document level.
- Document Level
  - Easy to follow (sectioning and structure)
  - Professional appearance (neat, organized)
- Paragraph Level
  - Coherence in thought (paragraph construction)
  - Makes points quickly (concise)
- Word/Sentence Level
  - Professional Language (spelling, grammar)
  - Unambiguous wording (precise language)

Good technical writing conveys the ideas in such a way that the reader can *easily* and *quickly* understand and is *convinced*.

Document Level Logic

SECTIONING AND STRUCTURE

Full/Complete Reports

- Abstract (for the very busy reader)
  - Includes major details of the report.
  - This is the first place you convince the audience.
- Introduction (what is this all about?)
  - Problem statement (how did it all start?)
  - Objectives (what needed to be accomplished?)
  - DO NOT discuss methods or results here

Full/Complete Report (continued)

- Theoretical/Analytical Background (what principles apply?)
  - How can the answer be determined?
  - Assumptions!!!
- Methods (what did you do?)
- Results/Analysis/Discussion (what did you get, and what does it mean?)
  - Establish the validity of your results
    - Compare to theory, published data, etc.
    - Error Analysis
- Summary/Conclusions (tie it all together)
  - Draw and support your conclusions

Memo Reports

- Most communication done in industry are short!
  - Email
  - 1-2 page memo reports (may be longer)
- Memo reports contain many of the same elements as longer reports, but the purpose is to give the reader the most important information (results, discussion, conclusions) quickly.
- Several sections of a full reports are often combined in memo reports

Sections of Memo Reports

- Heading
  - To:
  - From:
  - Subject:
- Introduction/Objective
- Methods/Apparatus/Procedures
- Results/Discussion
- Conclusions/Recommendations

- Very abbreviated
- May not be needed

Main focus

Proposals

- Common in industry and academia.
- A document that offers to provide service or a product (for money).
- Usually written in response to a request for work.
- Outlines the plans to accomplish the requested work.
- Seeks to persuade the reader to choose the submitting person/company to perform the work.

Sections of a Proposal

- Different organizations will have different requirements.
  - It is **very** important to adhere to the requirements.
- In general, proposals have the following elements.
  - Summary
  - Project Description (Technical proposal)
  - Personnel (Management proposal)
  - Budget (Cost proposal)

Proposals in ChEn 475

- Before beginning any experiment, you are required to submit a proposal, in memo format, outlining your plans.
- This is a very important part of the process.
  - Think through all the details.
  - Communicate a clear plan to the entire group.
  - Work out most the analysis problems before you begin.

Sections of Proposals in ChEn 475

- Overview/Objective (Introduction)
  - Explain the problem background.
  - Clearly define the objectives.
- Theoretical Analysis
  - Explain the design equations
- Experimental Methods
  - Apparatus
  - Details on replicates, conditions,
- Expected Outcomes
  - Estimate ranges of expected measurements
  - Perform *a full sample calculation* using estimates

Progress Report

- Brief update on progress to your boss or sponsor in the middle of your project
- Very common in industry and academia
- Components:
  - One paragraph by email
  - One PowerPoint slide attached
- Content
  - Progress
  - Challenges
  - Needs
  - Preliminary results

Paragraph Level Logic

CONSTRUCTING GOOD PARAGRAPHS

Adapted from http://owl.english.purdue.edu/owl/resource/606/1/ and http://english.byu.edu/writingcenter/handouts/OrganizationStructure/paragraphunity.htm

What is a paragraph?

Definition	Basic Rules
• A paragraph is a collection of ***related sentences*** dealing with a ***single topic***.	• Keep one idea to one paragraph. • If you begin to transition into a new idea, begin a new paragraph. • If a single paragraph becomes long, consider elaborating on each point in separate paragraphs.

Example

- Saner, Wisconsin is the snow-mobile capital of the world. The buzzing of the engines fills the air, and their tank-like tracks crisscross the snow. The snow reminds me of Mom's mashed potatoes, covered with furrows I would draw with my fork. Mom's mashed potatoes usually made me sick; that's why I was playing with them. I like to make a hole in the middle of the potatoes and fill it with melted butter. This behavior has been the subject of long chats with my analyst.

What could the author have focused on?

Elements of a Paragraph

- In addition to being restricted to one topic, effective paragraphs should contain each of the following:
  - A Topic Sentence
  - Adequate Development
  - Coherence

A Topic Sentence

- Every paragraph should have a topic sentence.
- The topic sentence explains, in a general way, what the paragraph is about.
- The best way to make sure your reader understands is make the first sentence the topic sentence.

Adequate Development

- The topic of the paragraph should be fully discussed.
- Beware of paragraphs with only two or three sentences.
- Method to create well-developed paragraphs
  - Use examples/illustrations
  - Cite data
  - Define terms
  - Compare/Contrast
  - Evaluate causes and reasons
  - Examine effects
  - Analyze the topic

Coherence

- Coherence is the trait that makes the paragraph easily understandable.
- This is often referred to as “flow.”

Example-Non Coherent

- The means by which Asian companies have sought to compete with American products in market segments in the Western Pacific region will constitute the objective of the first phase of our study. The labor costs of our Asian competitors and their ability to introduce new products quickly are the main issues to be examined in detail. A plan that will demonstrate how American industry can restructure its operations so that it can better exploit unexpected market opportunities, particularly in the Pacific Rim, will be developed from this study.

A study is being done, but what is being studied and what is expected?

Example-Coherent

- In the first phase of our *study*, we will examine *market segments* in the Western Pacific region to determine how *Asian companies* have competed with *American* products. The *study* will examine, in detail, *labor costs* and the ability of *Asian competitors* to introduce new products quickly. By *studying* these elements, we will develop a plan that will demonstrate how *American industry* can restructure its operations so that it can better exploit unexpected *market opportunities*, *particularly in the Pacific Rim*.

Tips For Writing Coherent Paragraphs

- **Repetition of words**
  - *study*, *market*, *Asian*, *American* are repeated multiple times
- **Related words**
  - *Asian companies* → *Asian competitors*
  - *market segments* → *labor costs*

Tips – Transitional Words

- Use transitional words to link ideas from different sentences.
- Transitions (found in bold in this paragraph) are functional words or word groups, **even** whole paragraphs, that connect and show relationships between ideas in a piece of writing. **Moreover**, they show on paper that writers are aware that a reader can't read their minds. Anything that does this job, **then**, is a transition—even if it is a punctuation mark, **such as** a dash, colon, or semicolon; if it connects or shows relationships, it is a transition.

Linking - Poor

- Experiments show that important tasks can be accomplished with a hand axe. *Homo erectus* possessed other tools suitable for some purposes. The hand axe was costly to produce in terms of time, labor, and skill, and required larger blocks of fine-grained, faultless stone. Flint and basalt are fine-grained, faultless stones. The hand axe presented a hazard.

Linking - Better

- Experiments show that **this** important task can be accomplished with a hand axe. **But** *Homo erectus* possessed other tools suitable for that purpose. **Compared with these,** the hand axe was costly to produce in terms of time, labor, and skill, and required larger blocks of fine-grained, faultless stone, **such as** flint or basalt. The hand axe **also** presented a hazard.

Problems with "Linking"

A memo was received September 1 requesting this information. The objective of this report is to present the best method for delivery of an equimolar mixture of carbon dioxide and argon to purge oxygen out of the welding environment in the MIG welding process. The compressibility of carbon dixoide and the equimolar mixture is given at 25°C for a range of pressures from 100 to 750 psia.

By isothermally increasing the volume by a set amount and measuring the new pressures compressibility factors were able to be determined.

Yikes! Too jumpy!