Rethinking the Design of Presentation Slides: The Assertion-Evidence Structure

Recently, much criticism has been levied at PowerPoint's default structure of a topic-phrase headline supported by a bullet list of subtopics. This web page advocates an assertion-evidence structure, in which a sentence headline states the main assertion of the slide. That headline assertion is then supported*not* by a bullet list, but by visual evidence: photos, drawings, diagrams, graphs, films, or equations.

One assumption of the assertion-evidence structure is that slides are, in fact, an appropriate visual aid for the talk. Too often, slides are projected when no visual aid would better serve the audience. Another assumption is that the primary purpose of the slides is to help the audience understand and remember the content, rather than to provide talking points for the speaker. More details about the assertion-evidence structure can be found in The Craft of Scientific Presentations.

Design of Scientific Posters

Poster Samples:
Sample Poster 1
Sample Poster 2
Sample Poster 3
Sample Poster 4

Posters are a special type of presentation. When well designed, they are not simply journal papers paste boards. Nor are they mounted sets of presentation visuals. Rather, posters, when effectively designed, a something in between. This web page discusses the special situation that a scientist or engineer faces wl designing a poster and then suggests some guidelines to address that situation.
The purpose of scientific posters is to present work to an audience who is walking through a hallway or

Poster Links:
[Eastern Kentucky]
[North Carolina State]
[Swarthmore]

Poster Templates:
[PowerPoint (44 x 36 in.)]
[PowerPoint (40 x 32 in.)]
[PowerPoint (32 x 40 in.)]

In poster presentations at conferences, the presenter usually stands next to the poster, thus allowing for passers-by to engage in one-on-one discussions with the presenter. In other situations such as the hallways of laboratories, universities, and corporations, posters are stand-alone presentations for passers-by. For a poster to communicate the work, the poster first has to orient an audience that is not seated, but that is standing. Often the audience has distractions of noise and movement from other people. Given those distractions, a journal article tacked onto a board fails as an effective poster because the audience cannot concentrate for a time long enough to read through the paper. In fact, given the distractions that the audience faces, many in the audience will not even bother trying to read a journal article tacked onto a board.

So what then makes for an effective poster? This question is not easy to address because the expectations by the audience vary significantly fror discipline to discipline. For instance, what an audience of a medical poster session expects differs significantly from what the audience of an engineering poster session expects. Nonetheless, this web-page tries to present some general guidelines that would apply to most situations in sc and engineering.

First, the title of an effective poster should quickly orient the audience. Here are some guidelines for poster titles:

1. Make the title the most prominent block of text on the poster (either center or left justify at the top).
2. Do *not* typeset the title in all capital letters (such text is difficult to read).
3. Use small words such as *of, from, with, to, the, a, an,* and *and* to separate details in the title.

While phrase titles are most common, some scientists and engineers effectively use sentence titles for posters that present one main result. In su state the result in the title and capitalize the words as you would in a sentence. Because the sentence title is a stand-alone, as opposed to being pa paragraph, the period is generally dropped.

Second, the poster should quickly orient the audience to the subject and purpose. One good test is whether the audience recognizes the sub purpose within 20 seconds of seeing the poster. Usually, a poster accomplishes this goal with a well-crafted title and with supporting images. Al make sure that the type is large enough to be read and that enough contrast exist between the color of the type and poster's background. Typogra recommendations can be found in the following[PowerPoint poster template.]

Third, the specific sections such as the results should be easy to locate on the poster. Once readers recognize what the work is, they decide l much energy to invest into the poster. For instance, many will read only the motivation for the work, the objectives (or goals) of the work, and tl final results. Others, who have a deep interest in the topic, will try to read the poster from beginning to end. Given these different approaches to posters, another characteristic of an effective poster is that specific sections are easy to locate.

Fourth, you should design the individual sections of a poster so that they can be quickly read. Given the distractions that occur while readi posters in a symposium such as in Figure 1, the poster should not contain large blocks of text. Neither should the poster contain long sentences.

possible, the sections should rely on images: photographs, drawings, and graphs.
Figure 2 presents a poster that quickly orients the audience to the topic of the work. This poster also identifies the purpose of each section and then supports those sections in a manner can be quickly read. Figure 3 also presents a poster for a conference. Notice that this poster uses a sentence headline to identify the main result of the research.

Sample Memo Format

Company Name
Company Address
Date of Memo

To: Recipient of Memo

From: Writer of Memo *Writer's Initials**

Subject: Title of Memo in Initial Capitals

Engineers and scientists use memos to make requests, to give announcements, and sometimes to communicate reports. Memos that make requests or announcements are read quickly. For such memos, get to the point in the first paragraph--the first sentence, if possible. In other words, state what you want up front. In the format suggested here, you should single space your memos and use a serif typeface. Skip a line between paragraphs. The following link shows this format in a pdf display.
In memos that make requests or announcements, keep the sentence lengths and paragraph lengths relatively short. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines. Also, keep the total memo length to under one page, if possible.
Sometimes companies use memos to communicate short reports (two pages or more). For these types of memos, the format changes, as shown in the following example. For instance, you often include illustrations, attach appendices, and break the memo's text into sections. If references arise in the

memo, you include a list at the end. In memos that act as reports, the style changes as well. For instance, the sentences and paragraphs are typically longer than in memos that simply provide announcements or make requests.

For all types of memos, space your memo on the page so that it does not crowd the top. Also, send copies to anyone whose name you mention in the memo or who would be directly affected by the memo. Finally, remember that final paragraphs of memos that make requests or announcements should tell readers what you want them to do or what you will do for them.

Attachments.

Copy to:
Name to Receive Copy
Name to Receive Copy

*Initials should be written in ink

University of Wisconsin
September 23, 1997

To: Professor Michael Alley

From: Cindy Reese *CTR*

Subject: Request to Research How Credit Was Awarded for the Discovery of Nuclear Fission

For my EPD 397 project, please grant me permission to study the way in which credit has been awarded for the discovery of nuclear fission. Although Otto Hahn received the 1946 Nobel Prize in Chemistry for the discovery, several people assert that Lise Meitner and Fritz Strassman should have also received credit. In my research, I will attempt to discern how credit should have been bestowed.

This topic meets the criteria for a successful topic in this course. First, I am interested in the topic. As a nuclear engineering student, I realize that the discovery of nuclear fission was perhaps the single most important discovery this century in my field. As a woman scientist, I am also deeply interested in the successes and challenges faced by other women scientists. A second way in which this topic meets the criteria is that it can be quickly researched. A computer search in the library has revealed many sources available on this topic. Attached to this memo is a summary of one such source, *Lise Meitner: A Life in Physics* by Ruth Sime.

This topic also meets the third criterion for a successful topic in this course, namely, that it be technical. The fission of a uranium nuclear involves an understanding of both chemistry and physics principles. By focussing on this single discovery, I believe that I can achieve the fourth crierion for a successful topic: the achievement of depth. Finally, because the library system at the University of Wisconsin offers such a wide array of possible sources, including papers in German, and because many of these sources have been written for audiences more technical than my intended audience, I believe that I can create a project that is unique.

If you have any suggestions for modifying this topic, please let me know. With your permission, I will continue researching.

Attachment.

Summary of Ruth Sime's *Lise Meitner: A Life in Physics**

In *Lise Meitner: A Life in Physics,* Ruth Sime begins following the life of the physicist Lise Meitner from her birth in Vienna in 1878. Meitner's career spanned the golden age of physics. She studied under Ludwig Boltmann in Vienna, worked under Max Planck in Berlin, and was helped by Niels Bohr to find asylum during the Second World War. In her life, she met, corresponded, and worked with many other famous scientists: Albert Einstein, Werner Heisenberg, Marie Curie, Otto Hahn, and James Chadwick.

Her collaboration with Otto Hahn led to her greatest achievement, the explanation for the fission of uranium--an achievement for which, according to the author Sime, Meitner did not receive due credit. Meitner's collaboration with Hahn began in 1907 at the Friedrich-Wilhelm-Universitaet in Berlin. Although Hahn was a chemist, he was interested in radioactivity, a subject that also interested Meitner. Hahn readily accepted working with a woman. However, most of the scientists at the Universitaet did not, and at the Universitaet, Meitner endured ostracism. Nonetheless, Meitner and Hahn did such good work that both were promoted to professors and awarded institutes.

During the First World War, Meitner worked as a nurse on the eastern front, while Hahn helped develop chemical weapons. After the war, the two resumed their collaboration, despite the crippling inflation and weak economic situation that plagued Germany. When the Nazi party came to power in the 1930s, Meitner encountered difficulties because of her Jewish heritage. Although Meitner had long since switched to the Protestant faith, she was still considered a Jew by the Nazi party. In 1938, things became so dangerous for her that she fled Germany and finally found a position at an insitute in Sweden. There, although her personal safety was secure, she had a contentious working relationship with the Institute's professor, Manne Siegbahn.

At the time that Meitner was leaving Germany, she and Hahn were researching the radioactive decay of uranium. During this time, they communicated often, mostly through letters. Hahn performed experiments with another chemist Fritz Strassman, while Meitner collaborated on the theoretical

aspects with her nephew, Otto Frisch. In the overall collaboration, Meitner's influence was strong. According to Strassman, "she urgently requested that [the] experiments be scrutinized very carefully and intensively one more time...Fortunately, L. Meitner's opinion and judgment carried so much weight that the necessary control experiments were immediately undertaken." According to the author, these experiments "led directly to the discovery of nuclear fission."
In 1946, Hahn received the Nobel Prize for the discovery of nuclear fission. Neither Meitner nor Strassman shared in the award, though. Many scientists at the time considered "[Meitner's] exclusion as neither omission nor oversight but deliberate personal rejection, the work of Manne Siegbahn," who was on the Nobel award committee. Although Meitner visited Germany and Austria several times after the war, she could not bring herself to work there again. She continued studying, reading, and thinking about physics up until her death during the Fall of 1968 in Cambridge, England.

*Sime, Ruth, *Lise Meitner: A Life in Physics* (Berkeley: University of California Press, 1996).

Sample Letter Format

Company Name
Company Address
Date of Letter

Recipient's name
Recipient's title
Recipient's company
Recipient's company address

Recipient's Name:

People read business letters quickly. Therefore, get to the point in the first paragraph--the first sentence, if possible. In other words, state what you want up front.
Single space your letters and use a serif typeface. Skip a line between paragraphs. Because people read business letters quickly, use shorter sentences and paragraphs than you would in a longer document. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines.
Space your letter on the page so that it does not crowd the top. However, if possible, keep your letter to one page. Second pages often are not read. Send copies to anyone whose name you mention in the letter or who would be directly affected by the letter.
Final paragraphs should tell readers what you want them to do or what you will do for them.

Sincerely,

Signature

Name

Enclosure.

cc: Name to receive copy

Sample Letter

934 West Dayton Street
Madison, Wisconsin 53715
October 30, 1997

Mr. Jeffrey Peterson
Manager, Electrical Systems, Midwestern Region
2275 Half Day Road
Suite 300
Bannockburn, IL 60015

Mr. Jeffrey Peterson:

Thank you for the interview at the University of Wisconsin-Madison on Thursday October 30, 1997. I particularly appreciate the time you took to explain the differences between Electrical Systems and other companies. Our discussion strengthened my desire to pursue a career with Electrical Systems.

At your request, I have enclosed my senior design project, which includes a design, cost breakdown, and complete thermodynamic analysis of a plutonium-core reactor. I believe that this project is a good representation of not only what I have learned in my Engineering Physics curriculum, but also what I can produce for Electrical Systems.

Thank you for your consideration, and please feel free to contact me with any further questions. I look forward to the prospect of working with you.

Sincerely,

Roger Bloom

Roger Bloom

Enclosure.

Sample E-mail Format

Subject: Title of E-mail in Initial Capitals

Engineers and scientists use e-mails to make requests, to answer questions, and to give announcements. E-mails are read quickly. For that reason, get to the point in the first paragraph--the first sentence, if possible. In other words, state what you want up front. Be careful about e-mails that make complaints, which are usually better handled in person.

In e-mails, keep the sentence lengths and paragraph lengths relatively short. Sentences should average fewer than twenty words, and paragraphs should average fewer than seven lines. In the format suggested here, you should single space your e-mails, skip a line between paragraphs, and use a typeface that is easily read on a computer. If possible, keep the total e-mail length to a length that can be viewed entirely on the screen.

Because the reader sees only the title of your e-mail in the Inbox or in the folder where it has been filed, give some thought to that title. Choose a title that orients the reader to the subject of the e-mail and, if possible, distinguishes your e-mail from other e-mails about that subject. For example, choose "Proposal Draft for Our ME 440W Design Project" as opposed to "Design Project" or "ME 440W."

With e-mails, send copies to anyone whose name you mention in the e-mail or who would be directly affected by the e-mail. Also, be sure to mention explicitly any attachments. Finally, remember that final paragraphs of e-mails generally tell readers what you want them to do or what you will do for them.

Sincerely,

Your Name
Your Contact Information

Résumés

Résumé Links:

Your correspondence to obtain a job or co-op is perhaps the most important correspondence

Cal-Berkeley Examples
Virginia Tech Examples
Résumé Template (doc)
Résumé Template (pdf)

Job Letter Links:
Cal-Berkeley Examples
Virginia Tech Examples
Sample Job Letter

Site Links:
Writing Guidelines
Writing Exercises

that you do as a student. This section provides links for writing job letters and résumés. In addition, given below is some information about writing a résumé.

A document that often accompanies correspondence, especially a job application letter, is a résumé. A résumé is a summary of your education, work experience, and accomplishments. Your résumé is important. Employers often use résumés to decide whether to interview you for a job, and proposal reviewers use résumés to decide whether you are qualified to do the proposed work. Therefore, you should highlight your best attributes.

In your résumé, the audience should arrive quickly at the important points. Résumés are often read in less than a minute; therefore, you should format your résumé in such a way that your outstanding characteristics are quickly seen (see the following résumé template). In a résumé, you should be clear and concise. A résumé should be as long as it needs to be, but no longer. If possible, keep your résumé to one page. Second pages often are not read. If, however, you have several publications or much work experience, you may have to use two pages. Because of the speed with which people read résumés, vertical lists are preferable to paragraphs. Remember to keep those lists parallel and to use action verbs where possible. Action verbs, such as "designed," "analyzed," "measured," and "managed," put your accomplishments in the strongest light. Finally, proofread your résumé--no mistakes are allowed.

Laboratory Reports

Sample Reports:
Virginia Tech (1)
Virginia Tech (2)
Virginia Tech (3)

Lab Report Links:
Toronto
Wisconsin

Site Links:
Writing Guidelines
Writing Exercises

Laboratory reports are written for several reasons. One reason is to communicate the laboratory work to management. In such situations, management often bases company decisions on the results of the report. Another reason to write laboratory reports is to archive the work so that the work will not have to be done in the future. This web page presents a commonly used organization for laboratory reports:

You should not assume, though, that this organization will serve all your laboratory reports. In other words, one organization does not "fit" all experiments. Rather, you should pay attention to the organization requested by your instructor who has chosen an organization that best serves your experiments.

Abstract

The abstract presents a synopsis of the experiment. The following guidelines for preparing an abstract arise from the American Institute of Aeronautics and Astronautics (AIAA). Note that although your instructor may define the term "abstract" differently, these guidelines still give you a sense of the stylistic issues, such as whether to include numerical data, that distinguish abstracts:

> The abstract should be written concisely in normal rather than highly abbreviated English. The author should assume that the reader has some knowledge of the subject but has not read the paper. Thus, the abstract should be intelligible and complete in itself; particularly it should not cite figures, tables, or sections of the paper. The opening sentence or two should, in general, indicate the subjects dealt with in the paper and should state the objectives of the investigation. It is also desirable to describe the treatment by one or more such terms as brief, exhaustive, theoretical, experimental, and so forth.
>
> The body of the abstract should indicate newly observed facts and the conclusions of the experiment or argument discussed in the paper. It should contain new numerical data presented in the paper if space permits; otherwise, attention should be drawn to the nature of such data. In the case of experimental results, the abstract should indicate the methods used in obtaining them; for new methods the basic principle, range of operation, and degree of accuracy should be given. The abstract should be typed as one paragraph. Its optimum length will vary somewhat with the nature and extent of the paper, but it should not exceed 200 words.

Included here is a sample abstract for a laboratory report. Note that because this abstract serves a long report rather than a journal article, the abstract is somewhat longer than 200 words recommended by the AIAA.

Introduction

The "Introduction" of a laboratory report identifies the experiment to be undertaken, the objectives of the experiment, the importance of the experiment, and overall background for understanding the experiment. The objectives of the experiment are important to state because these objectives are usually analyzed in the conclusion to determine whether the experiment succeeded. The background often includes theoretical predictions for what the results should be. (See a sample "Introduction.")

Procedures

The "Procedures," often called the "Methods," discusses how the experiment occurred. Documenting the procedures of your laboratory experiment is important not only so that others can repeat your results but also so that you can replicate the work later, if the need arises. Historically, laboratory procedures have been written as first-person narratives as opposed to second-person sets of instructions. Because your audience expects you to write the procedures as a narrative, you should do so.

Achieving a proper depth in laboratory procedures is challenging. In general, you should give the audience enough information that they could replicate your results. For that reason, you should include those details that affect the outcome. Consider as an example the procedure for using a manometer and strain indicator to find the static calibration of a pressure transducer. Because calibrations are considered standard, you can assume that your audience will have access to many details such as possible arrangements of the valves and tubes. What you would want to include, then, would be those details that might cause your results to differ from those of your audience. Such details would include the model number of the pressure transducer and the pressure range for which you calibrated the transducer. Should you have any anomalies, such as unusual ambient temperature, during your measurements, you would want to include those.

When the procedure is not standard, the audience would expect more detail including theoretical justification for the steps. Given below is such a procedure--this one for an experiment devised to determine whether the frictional torque associated with a multi-turn film potentiometer is strictly the Coulomb friction between the slider and the film [Counts, 1999].

> The test performed on the potentiometer was accomplished by winding a string around the potentiometer shaft, attaching a mass to the string, and letting the mass fall. The change in resistance of the potentiometer with time indicated the acceleration of the mass. In this experiment it was assumed that the constant Coulomb friction torque was the only friction affecting the potentiometer. If this assumption were true, the friction force from the torque would be $F_f = T/r$ (where *T* is the torque and *r* is the radius of the potentiometer's shaft). Likewise, the gravity force would be $F_g = mg$ (where *m* is the mass tied to the string and *g* is the gravitational acceleration). A force balance then gives
>
> $$T = mr\,(g-a),$$
>
> where *a* is the acceleration of the mass. If the assumption holds that the only friction affecting the potentiometer was constant Coulomb friction, then each mass would undergo a constant acceleration.
>
> The potentiometer measured voltage versus time for the masses as they dropped, but the measurement of interest to us was position versus time. For that reason, a 'calibration' was performed before we measured any data. In the calibration, the potentiometer's initial voltage was measured. Then the string was pulled a set distance (2 inches), and the voltage was recorded. This process of pulling the string a set distance and recording the voltage continued another two times (see Appendix A for the results). To determine the relationship between voltage and position, the differences in the voltages were averaged and divided by the length. The resulting relationship was 0.9661 volts/inch.
>
> Five different masses were used to test the assumption of constant acceleration. For each mass, the string was rolled up on the shaft, the oscilloscope was triggered, and the shaft was released. As each mass dropped, the oscilloscope collected the potentiometer's voltage versus the time. After obtaining plots for each mass, we used the voltage-position relationship, mentioned above, to convert the data from the form voltage versus time to the form position versus time squared.The residuals of the data determined whether the assumption of constant acceleration

was valid.

Results and Discussion

The heart of a laboratory report is the presentation of the results and the discussion of those results. In some formats, "Results" and "Discussion" appear as separate sections. However, P.B. Medawar [1979] makes a strong case that the two should appear together, particularly when you have many results to present (otherwise, the audience is faced with a "dump" of information that is impossible to synthesize). Much here depends upon your experiment and the purpose of your laboratory report. Therefore, pay attention to what your laboratory instructor requests. Also, use your judgment. For instance, combine these sections when the discussion of your first result is needed to understand your second result, but separate these sections when it is useful to discuss the results as a whole after all results are reported.
In discussing the results, you should not only analyze the results, but also discuss the implications of those results. Moreover, pay attention to the errors that existed in the experiment, both where they originated and what their significance is for interpreting the the reliability of conclusions. One important way to present numerical results is to show them in graphs. (See a sample "Results and Discussion" section.)

Conclusions

In longer laboratory reports, a "Conclusion" section often appears. Whereas the "Results and Discussion" section has discussed the results individually, the "Conclusion" section discusses the results in the context of the entire experiment. Usually, the objectives mentioned in the "Introduction" are examined to determined whether the experiment succeeded. If the objectives were not met, you should analyze why the results were not as predicted. Note that in shorter reports or in reports where "Discussion" is a separate section from "Results," you often do not have a "Conclusion" section. (See a sample "Conclusions" section.)

Appendices

In a laboratory report, appendices often are included. One type of appendix that appears in laboratory reports presents information that is too detailed to be placed into the report's text. For example, if you had a long table giving voltage-current measurements for an RLC circuit, you might place this tabular information in an appendix and include a graph of the data in the report's text. Another type of appendix that often appears in laboratory reports presents tangential information that does not directly concern the experiment's objectives.

If the appendix is "formal," it should contain a beginning, middle, and ending. For example, if the appendix contains tables of test data, the appendix should not only contain the tabular data, but also formally introduce those tables, discuss why they have been included, and explain the unusual aspects that might confuse the reader. Because of time constraints, your instructor might allow you to include "informal" appendices with calculations and supplemental information. For such "informal" situations, having a clear beginning, middle, and ending is not necessary. However, you should still title the appendix, place a heading on each table, place a caption beneath each figure, and insert comments necessary for reader understanding. (See a sample appendix.)

Design Reports

Design Links:
Sample Presentation
Nebraska (EE 494)

Site Links:
Writing Guidelines
Writing Exercises

Design reports are written to introduce and document engineering and scientific designs. In general, these reports have two audiences. One audience includes other engineers and scientists interested in how the design works and how effective the design is. Another audience includes management interested in the application and effectiveness of the design. This web page presents a commonly used organization for design reports:

- Summary,
- Introduction,
- Discussion,
- Conclusions, and
- Appendices.

Although this organization serves a wide variety of design reports, your instructor may very well modify this organization to serve your particular audience and purpose.

Summary

The summary, sometimes labeled the abstract or executive summary, is a concise synopsis of the design itself, the motivation for having the design, and the design's effectiveness. The author should assume that the reader has some knowledge of the subject, but has not read the report. For that reason, the summary should provide enough background that it stands on its own. Note that if the summary is called an abstract, you are usually expected to target a technical audience in the summary. Likewise, if an executive summary is requested, you should target a management audience in the summary. For an example summary, see the following "Executive Summary."

Introduction

The "Introduction" of a design report identifies the design problem, the objectives of the design, the assumptions for the design, the design alternatives, and the selection of the design being reported. Also included for transition is a mapping of the entire report. Note that in longer reports, the selection of design is often a separate section. For an example, see the following "Introduction."

Discussion

The discussion presents the design itself, the theory behind the design, the problems encountered (or anticipated) in producing the design, how those problems were (or could be) overcome, and the results of any tests on the design. Note that this part usually consists of two, three, or four main headings. In regards to the actual names of these headings, pay close attention to what your instructor requests. Also consider what would be a logical division for your particular design. For an example section, see the following"discussion."

Conclusions

The "Conclusions" section summarizes the design and testing work completed and assesses how well the design meets the objectives presented in the "Introduction." Note that if the design does not meet the objectives, you should analyze why the design did not succeed and what could be modified to make the design a success. Besides summarizing the work and analyzing whether the objectives were met, the "Conclusions" section also gives a future perspective for how the design will be used in the future. For an example, see the following "Conclusions."

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Progress Reports

Related Links:
Reports
Sample Report

Site Links:
Writing Guidelines
Writing Exercises

Once you have written a successful proposal and have secured the resources to do a project, you are expected to update the client on the progress of that project. This updating is usually handled by progress reports, which can take many forms: memoranda, letters, short reports, formal reports, or presentations. What information is expected in a progress report? The answer to this question depends, as you might expect, on the situation, but most progress reports have the following similarities in content:

1. *Background on the project itself*. In many instances, the client (a manager at the National Science Foundation, for instance) is responsible for several projects. Therefore, the client expects to be oriented as to what your project is, what its objectives are, and what the status of the project was at the time of the last reporting.
2. *Discussion of achievements since last reporting*. This section follows the progress of the tasks presented in the proposal's schedule.
3. *Discussion of problems that have arisen*. Progress reports are not necessarily for the benefit of only the client. Often, you the engineer or scientists benefit from the reporting because you can share or warn your client about problems that have arisen. In some situations, the client might be able to direct you toward possible solutions. In other situations, you might negotiate a revision of the original objectives, as presented in the proposal.
4. *Discussion of work that lies ahead*. In this section, you discuss your plan for meeting the objectives of the project. In many ways, this section of a progress report is written in the same manner as the "Plan of Action" section of the proposal, except that now you have a better perspective for the schedule and cost than you did earlier.
5. *Assessment of whether you will meet the objectives in the proposed schedule and budget*. In many situations, this section is the bottom line for the client. In some situations, such as the construction of a highway, failure to meet the objectives in the proposed schedule and budget can result in the engineers having to forfeit the contract. In other situations, such as a research project, the client expects that the objectives will change somewhat during the project.

For an example, see the following progress report.

Theses and Dissertations

Thesis Links:
Sample Title Page
Sample Abstract
Sample Contents
Sample Excerpt
Sample Thesis

Thesis Templates:
Chapter Template (doc)
Chapter Template (pdf)

Site Links:
Writing Guidelines
Writing Exercises

In engineering and science, a thesis or dissertation is the culmination of a master's or Ph.D. degree. A thesis or dissertation presents the research that the student performed for that degree. From the student's perspective, the primary purpose of a thesis or dissertation is to persuade the student's committee that he or she has performed and communicated research worthy of the degree. In other words, the main purpose of the thesis or dissertation is to help the student secure the degree. From the perspective of the engineering and scientific community, the primary purpose is to document the student's research. Although much research from theses and dissertations is also communicated in journal articles, theses and dissertations stand as detailed documents that allow others to see what the work was and how it was performed. For that reason, theses and dissertations are often read by other graduate students, especially those working in the research group of the authoring student.
This web page presents some format and stylistic suggestions for writing theses and dissertations. For reference, this discussion includes a sample thesiswritten at Virginia Tech [Pang, 2002]. In viewing this sample thesis and all thesis excerpts on this page, please be aware that different universities have different format guidelines.

Format

The format of a thesis or dissertation encompasses the layout and typography of the document. For instance, questions of format would include how much line spacing to have (single, space and a half, or double), where to place page numbers (bottom centered, bottom right, or top right), and how to format chapter titles, main headings, and subheadings. For these questions, there is no universal format in engineering and science. For that reason, each student should check the guidelines given at his or her institution. To look at a sample set of guidelines, see the following example, which is for electronic theses and dissertations (ETDs) at Virginia Tech.

With a thesis or dissertation, the format also encompasses the names of the sections that are expected: Abstract, Acknowledgments, List of Figures, List of Tables, Nomenclature, Glossary, and References. Given in the following link is a sample table of contents that shows where these sections typically occur in the document.

Style

In a thesis or dissertation, the style is the way in which the author communicates the research. Most important for style is that the writing be both precise and clear. Clarity calls for avoiding needless complexity and ambiguities (see Chapter 5 in *The Craft of Scientific Writing*). In the words of Albert Einstein, you should be "as simple as possible, but no simpler."

Being clear does not mean that the writing is informal. In other words, you should avoid colloquial language such as using an ampersand when the word*and* is appropriate (in other words, write *research and development*, not*research & development*.) Also, many committees frown upon the use of contractions, such as *don't* or *can't,* that would be readily accepted in a less formal document such as an e-mail. Another word that many committees frown upon, because of its informality, is the word *you.* While this word is appropriate for instructions and correspondence, it is seldom, if ever, appropriate in theses or dissertations (note that the implied *you* is certainly acceptable in clauses such as *see Figure 1*). In regard to the first person pronouns *I* or *we*, judicious use is widely accepted, especially to make the writing more active (see Chapter 6 of *The Craft of Scientific Writing*) or to assume responsibility for assumptions or actions. Be forewarned, though, that despite its acceptance by most committees (and journals), an occasional committee remains opposed to use of the first person, even when that use is judicious.

Another stylistic question concerns how wide an audience the document should target. Given the main purpose of a thesis or dissertation, the primary audience for the document is the thesis or dissertation committee. For that reason, while an author might include appendices and a glossary to reach a wider audience, the text portion of the document is usually aimed for the committee. For that reason, a thesis or dissertation written to a multi-disciplinary committee is broader in style than a thesis or dissertation written to a committee within a single discipline.

Yet another consideration for theses and dissertations concerns how much depth the author should go into. Certainly, the author should go into enough depth to allow someone to repeat the work. Moreover, the author should provide enough depth that the committee can follow the author's argument. Along those same lines, the author has to provide enough detail to persuade the committee that the work warrants the degree. Some authors, however, go too far in this direction by including details of almost every bolt that they turned. A balance has to be reached, and a good way to determine that balance is to submit a title page, table-of-contents, and sample chapter early in the writing process (see pages 70-73 in *The Craft of Editing*).

Proposals

General Proposals:
Proposal Guidelines
Sample Proposals
Proposal Checklist

Design Proposals:
Proposal Guidelines (Penn State)
Proposal Template (Penn State)
Sample Proposal

Site Links:
Writing Guidelines
Writing Exercises

A proposal is a plan for solving a problem. Engineers and scientists write proposals to do such things as research turbulent boundary layers, design turbine blades, and construct jet aircraft engines. The audience for a proposal usually includes both managers and engineers. These audiences view proposals in different ways. For instance, managers review proposals to see if the plan for solving the problem is cost effective. Engineers and scientists, on the other hand, review proposals to see if the plan is technically feasible.

Proposals may be solicited or unsolicited. In a solicited proposal, a company or agency advertises that it desires the solution to a problem. In most cases, this company or agency sends out a request for proposals, often called an RFP, that presents a problem which needs addressing. For example, if the Department of Energy desires research on reducing nitrogen oxide emissions from diesel engines, then the Department announces its request, often in periodicals such as the Commerce Business Daily. A company then reads the announcement and proposes a plan for doing the research. In an unsolicited proposal, however, there is no request. Instead, an engineer on his or her own initiative recognizes a client's problem, writes a proposal that first makes the client aware of the problem, and then presents a plan for solving that problem. Unsolicited proposals often occur within a company. For example, an engineer or scientist may write a proposal to his or her division supervisor suggesting a new computer system to handle that division's work.

This section presents a sample proposal request and corresponding sample proposals that respond to that request (a checklist for proposals accompanies this scenario). Notice that the request for proposals included here discusses the format that the proposals should follow. This discussion of format occurs often in proposal requests because requesters of proposals have to evaluate the proposals. If submitted

proposals follow the same format, particularly in regards to length and order of information, then the evaluation process is simplified.
For a proposal to succeed, you need a good idea. No amount of crafted writing can make up for a weak idea. Even though you might have a strong idea, there is no guarantee that your proposal will succeed. You should also understand your constraints--especially the constraints of audience and format. Having a good idea and knowing your constraints is still no guarantee for success. The review process for a proposal has many uncontrollable variables such as politics. Nonetheless, if you have a strong idea, then crafting the writing of that idea to meet the constraints will improve your proposal's chances for acceptance. For information about the style of proposals, see Chapter 13 of *The Craft of Scientific Writing*.

Instructions

Instruction Links:
Sample Instructions

Site Links:
Writing Guidelines
Writing Exercises

Instructions tell people how to perform a process. Because processes are so common in engineering, engineers often write instructions. For example, you may have to write specifications to technicians on how to machine a drive shaft, or you may have to write a software manual for computer users on how to run a contour-plotting program. You may even have to instruct the public on the safety precautions for using a snow blower that your company manufacturers. Each of these three examples points to the importance of well-written instructions in engineering. If the specifications for the drive shaft are unclear, your company may have to resubmit the job (at your company's expense). If the software manual is disorganized, users of the program may waste valuable time searching for a command. If the safety precautions for your company's snow blower are ambiguous, someone could be injured. Money, time, and health often depend of the quality of the writing in instructions.

In engineering, the formats of instructions can vary from single-phrase cautions on clothing to thick handbooks on procedures in nuclear submarines. Instructions have four unusual aspects of style. First, instructions often include numbered steps. Using numbered steps with white space between each step allows readers to perform a step of the process and then quickly find their place in the instructions. Also, instructions include the use of the imperative mood, in which the subject is an understood *you* (for example, "Learn the basic procedures of first aid"). Note that you do not use the imperative mood in every sentence; however, you often use it for important steps. In the language for instructions, you also use cautions to warn readers of difficult or dangerous steps. Finally, with instructions, you use more illustrations or examples than with other types of documents. The following example is a set of instructions for what to do in case of a snakebite. For more discussion about the style of instructions, see Chapter 14 of *The Craft of Scientific Writing.*

In putting together a set of instructions, you might have to write or present as part of a group. Collaboration presents challenges to group members: connecting the different ideas of the group members, making the language read as if it were from "one voice," and choosing a consistent format for the final product. Although collaboration on a document or presentation presents challenges to the group members, it also has advantages. One advantage is that working in a group broadens the range of ideas that the document or presentation can incorporate. Another advantage is that collaborative work allows the group to draw from the various writing and editing strengths of the members. In a successful group effort, you find a strategy that accents the advantages and mitigates the disadvantages.

Journal Articles

Engineering and science journals are a primary means by which engineers and scientists present their work. Journal articles are similar to formal reports in content, but differ in format. For instance, the formats for journal articles usually have space for only type of summary, and the size of that summary is limited. For that reason, the summaries in most journal articles are usually descriptive or combinations of informative and descriptive. Another instance in which journal formats vary from formal reports is that the author has little or no room for appendices. Therefore, the author has less opportunity to tailor the document for multiple audiences. What some journals such as *Scientific American* do provide in their formats, though, are sidebars or side articles that allow the author to present deeper explanations or discussions of branch issues.

The *Undergraduate Engineering Review* is a new journal that has two primary goals. The first goal is to provide undergraduate engineering students with a forum for presenting their views on current engineering topics. The second goal is to set a standard of writing excellence for the undergraduate engineering community. The following are format guidelines for articles submitted for consideration to the *Undergraduate Engineering Review*. In the*Undergraduate Engineering Review,* there are articles and briefs. The documents arise primarily from assignments submitted by undergraduate engineering students in their communication courses. Submission to the journal occurs through recommendations of participating instructors at the University of Texas who teach those courses. For a teacher to submit an article, a brief, or an essay, the teacher must have a computer copy of the report, article, or brief with all the artwork imbedded (scanned or drawn). Instructors at other universities are encouraged to establish similar on-line journals at their respective institutions.