

TECHNICAL WRITING STYLE

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Summary

This short statement of several paragraphs or less tells the reader the major points of the work. Called an Abstract in most scholarly works, this summary is searchable (along with the title) from data bases such as Web of Science and Compendex. Most readers will make a decision about whether to look at the whole document based on this leading statement.

1 Introduction

An introduction has to provide the context for the work, and lead the reader from the general to the more specific, in preparation for the rest of the document. By the end of the introduction, the reader should understand why the work is important and how the paper will proceed.

If a literature review is part of the work, it is typical to include it in the Introduction, or in a section shortly thereafter. The same is true for nomenclature.

2 Structure

The exact format of a paper or report is usually given for conference and journal papers. For 13.017 and 13.018, it is the *content and organization* that are most important. The content should be presented in a linear fashion: start at the beginning and go to the end, e.g., introduction, then methods, then results, then discussion. The document usually ends with at least a paragraph of summary or conclusions. Overall, the goal is to leave no ambiguity, i.e., no possibility that the author will be misunderstood on any point.

The material should be self-standing where possible, in the sense that the reader can follow it without referring to another document; the Introduction is the natural place to bring the reader up to speed.

Given these basic recipes, however, many writers compose freely and with little understanding that the reader has other things to do. Strunk and White have simple advice: Omit needless words [1].

3 English Usage

We expect no grammatical errors and no misspelled words. It is up to you to look up the meaning or spelling of uncertain words, and to find good synonyms for words used too frequently. We urge you to avoid excessive jargon and slang in your writing. If you must use jargon, please define the words early in your report, e.g., "We used the Onset TattleTale Model 8 Controller (TT8) in our work." Slang includes the word "output" when used as a verb; data is a plural. So computers don't output data; they print, transmit, or write them to file. Here are a few other problem areas to keep in mind:

The verb *affect* means to influence. The verb *effect* means to bring about; a synonym for the noun *effect* is consequence.

Everyday means ordinary," but *every day* means all days. The word *anyway* finds similar misuse..

4 Figures and Tables

The tendency seems to be to take shortcuts on figures, letting a program such as Matlab or Excel work with default parameters. This is a mistake, because clear and well-designed figures attract the eye and really do tell "a thousand words." Colors are easily over-used in the presentation of data; a cacophony of overlaid lines of different colors repels the eye! The same can be said for symbols that are not clearly grouped. The work of a figure is generally to convey *variation*; a figure need do no more than this, and it is usually possible with only a few well-considered elements.

In evaluating figures quantitatively, we can consider at least two aspects. First, there is the question of how much data is clearly presented per unit area of space. Tufte [2] illustrates US Government bar charts that achieve a rate of two data per page; on the other hand, some detailed (and very attractive) maps achieve thousands of data per page.

The second interesting aspect is the capability of a figure to express multiple independent and multiple dependent data. The case of (I1,D1) is easy - this is the plot of a single measurement versus time, for example. (I1,D4) can be achieved for example by overlaying lines or offsetting them vertically – carefully annotated to avoid confusion. In certain cases the relationship of the dependent variables to the independent is less important than that between the dependent variables themselves. Here we find *parametric* plots, for example the trajectory of a vehicle in a plane, with positioning error circles overlaid, creating a (I0,D3) plot. It is not uncommon to see effective (I0,D5) plots of this type.

In the case of multiple independent variables, say (I2,D1), the contour and 3D surface plots are most usual, although they frequently fail when used alone. A weakness of the 3D surface plot is that it does not provide look-up capability - one cannot easily read numbers from it. On the other hand, it may display the overall shape of the relationship quite well. The failing of a contour plot

is that with excessive level lines, it can insidiously create apparent data where there is actually none. See Figure 1 for example.

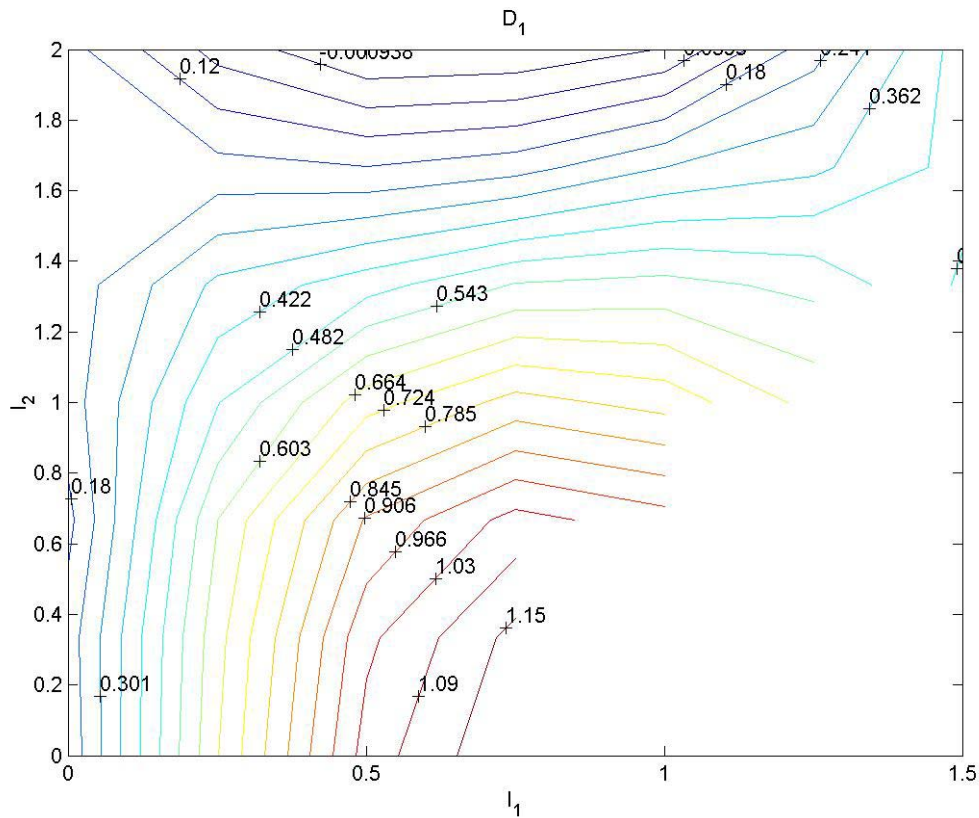


Figure 1: Where is the data? There are too many colors and jagged numbers also.

Tables should not be forgotten as a good alternative to figures; this is especially true for more than two independent variables. A single figure of (I3,D1) scope will usually require three-space, which quickly gets messy. An alternative is to use subplots, wherein different values of an independent variable are shown. This is one typical way to bring the time dimension onto the printed page, for example.

Figures and tables need to be self-standing, i.e., they contain all the information needed to read them. They should be referenced from the text.

5 Sources and References

It is a temptation today to use web-based sources of information because this is the first place we look as novices. Insofar as the topic is current and relevant, and *can be considered the original source*, this is acceptable. You are expected in the general case, however, to *pursue original sources, and cite them properly*. There are the multiple issues of: acknowledging the originator of an idea or a data set, referencing a source that is known to be permanent (unlike many web

sites!), and referencing a source that is known to be of high quality. This last aspect is achieved through peer review in most journals.

Non-internet references you give should include the following data, intended to allow a reader to locate the material easily:

Book: Author(s), year, title, publisher, publisher location.

Journal: Author(s), year, title, journal name, volume, number, beginning and ending pages.

Conference: Author(s), year, title, conference name, editor(s).

Unpublished: Author(s), year, title.

Because internet resources are often ephemeral, please include authors' names and affiliations if at all possible.

References are usually indicated by short codes, e.g., "[1]", in the text, and then listed in detail in a separate section at the end of the document.

References

[1] Strunk, Jr., W., and E.B. White 1972. *The elements of style*. Allyn and Bacon: Boston.

[2] Tufte, E.R. 2001. *The visual display of quantitative information*. Graphics Press: Cheshire, CT.