SUMMARY.

Writing, or presenting orally, a report is a formal way of transferring information. These are some simple overall rules for optimum information transfer, a framework that might help you to put these rules into practice, and some rules of grammar.

RULES FOR INFORMATION TRANSFER.

The information contained in any message is a function of the state of knowledge of the receiver of that message, and may be defined as the change in the state of the recipient's uncertainty about the subject of the message. The first rule to keep in mind is, therefore, to consider above all the present state of the recipient. Usually there is a range of readers or listeners, whose states of prior knowledge will be varied. It is best to key your message to a person with just-below-average knowledge, because then you make the majority of the recipients feel clever, and they will be on your side from the start. (However, beware of being patronizing: it is possible to describe something in simple terms without "talking down").

The second point is related to the first rule: do not on any account interpret your purpose in giving your report as a need to impress. Intellectual arrogance is a sin of the first rank.

And the third rule stems from the second: give as much information right away as you can; maximize the rate of information transfer: don't save the punch line until the end, as if you were telling a story. The title should be as descriptive as possible, even to the point of hinting at the conclusion ("An attempt to design a space ship to land on Jupiter"). Then the summary should tell an executive all he/she wants to know about your work, especially whether it was all worthwhile. Give some background, especially mentioning other people's previous work. Finally present the meat of your work. But put all the detailed stuff in appendices to be referred to by the enthusiasts.

MEMO FORMAT

to:

from:

re:

Then the body of the memo.

SUGGESTED OUTLINE.

Here is a suggested sequence of headings and subheadings.

TITLE PAGE.

TITLE (descriptive but short);

Author(s);

Affiliation(s); and

ABSTRACT.

The abstract should give the essence of the work, including the results, in 100 words or less.

TABLE OF CONTENTS AND OTHER "FRONT MATTER".

The "front matter"--the table of contents, list of figures, tables and symbols, and the foreword, preface and acknowledgements, if any of these are wanted, are usually put after the summary. (These are not needed for articles and short reports. A thesis usually has everything except a foreword and a preface. The list of symbols is sometimes put in an appendix).

INTRODUCTION.

This is usually broken down into subsections, with or without subheadings, such as background; full problem statement; review of other work or approaches to the problem; and a broad statement of the principle of the present approach.

METHOD.

This is your description of your work. It is the main body of your thesis, report or article.

CONCLUSIONS.

Give a full summary of the findings, and perhaps some statements about the success or otherwise of the approach.

RECOMMENDATIONS.

This should spell out the next steps to be taken.
REFERENCES.

When you acknowledge the help received from written material, give the references in standard format (see example) with full details of the publication, and check the accuracy. (Inaccurate or incomplete references cause a great deal of trouble to others). Three or four references are best given in the form of footnotes; more than four are better given in a reference section before the appendices.

Example.


There is virtually no maximum to the number of references which can be listed. It is difficult, however, to conceive of any work rated as "scholarly" with less than the following number of references.

Undergraduate project: 2
BS thesis: 10
MS thesis: 20
Ph.D. thesis: 50

APPENDICES.

Use appendices for reference data or abstruse procedures.

ILLUSTRATIONS

The illustrations are very important: a clear illustration, graph or diagram is worth pages of turgid text, while a confusing diagram is liable to get the reader mad or to lose his/her attention. In written reports don't expect the reader to turn the report sideways just because you've been too lazy to figure out a way of presenting a graph right way up. (You'd feel pretty silly doing this with slides in an auditorium.) Don't pull the wool over our eyes with graphs showing apparently highly significant variations--but with scales which start at high values. If you have to use "false zeroes", show them with a strong break in the axes.

A sketch is often more informative than a line drawing which shows every detail. If you are writing a thesis or report for an advisor, he/she will very likely want to use your illustrations later in a report or proposal. A Xeroxed copy of your thesis may not be good enough: Ask if he/she would like to pay for glossy prints, original negatives or offset copies of all illustrations.

INFORMALITY VS. FORMALITY.

There is a welcome tendency to be more informal over formal reports. It is no longer heresy to use the first person. In fact, phrases such as "it has been found that..." are really uninformative, because they cover up the origin of the work--the reader growls "who found it--you or Einstein?" Use of the first person can lead to greater honesty, the paramount requirement in technical reporting. Tell us exactly what work you did, and acknowledge what help you received from colleagues, reports--even from the instructor (no need to be fulsome or sycophantic about it, though). Obviously in using "I" you have to avoid sounding egocentric: "we" somehow never gets into that odium, which is why the editorial "we" is used.

EDITING.

You should thoroughly edit (read through to correct errors and to improve the writing) your material before passing it on to anyone. Famous authors have stated that they have re-written major works twenty times.

LAYOUT.

Here are some general rules for typing reports, theses and papers, for use when other rules are not specified. We're also including some notes on grammar and word usage.

SUB-HEADINGS (SH).

These are all capitals, underlined, at the left margin, as in the sub-heading of this paragraph. Sub-headings are sometimes called "second-level headings" and marked "2". Full or first-level headings are all capitals, centered, and underlined.
Sub-sub-headings (SSE).

These have an initial capital only for the first word (and for proper names). Don't capitalize subsequent words unless they would be capitalized in a sentence. Left-justify and underline. These are third-level headings, sometimes marked "3".

Sub-sub-sub-headings. These are left-justified and underlined, initial-capital only, and run into the paragraph. They are fourth-level headings, sometimes marked "4".

SPACING.

Use single spacing unless otherwise specified. The left margin should be about 1-1/2 inches and the others about an inch. (The left margin is larger to allow for binding. For back-to-back work, even-numbered pages need a larger right margin.) Leave a space of one or two lines between paragraphs.

LISTS.

Lists can be given as a series of independent phrases, titles, sentences, and so forth. The list must follow a sentence with a period, not a colon. Each item must start with a capital letter and end with a period.

Alternatively, a list can be given as a sentence, in which case the list starts following a colon; each item except the last ends with a semi-colon; and after the last semi-colon (after the last item but one) there should be an "and".

Here is an example given in the two permissible styles of writing lists.

"Brayton-cycle efficiency depends on several factors:
1. the overall temperature ratio;
2. the compressor pressure ratio;
3. the sum of the relative total-pressure losses; and
4. the component process efficiencies."

In that form, the list is given as one sentence. This form cannot be used if any of the items in the list itself contains a separate sentence, or at least a period. The second form of list (see below) is, I think, less elegant, but it can be used for all cases.

"Brayton-cycle efficiency depends on several factors.
1. The overall temperature ratio.
2. The compressor pressure ratio.
3. The sum of the relative total-pressure losses.
4. The component process efficiencies."

In this form, it is correct to use a period, and incorrect to use a colon, after "factors", which implies that the sentence is continuing with something which complements, balances or opposes the first part of the sentence.

SEMICOLON.

One use of a semi-colon is as a higher order of comma. A comma could have been used at the end of each item of the list in the first style given above. However, using a semi-colon allows one to include a comma in the item listed without risking confusion as to which phrases belong to which factor.

"The apparatus consisted of a venturi flow meter; three rotameters, one for each of three overlapping flow ranges; and the test pump itself."

WORDS THAT ARE OFTEN INCORRECTLY USED.

HOWEVER.

The word "however" is analogous to a semi-colon in that it can be regarded as a higher order of the word "but". When it is used to introduce a second or later part of a sentence that is in opposition to the first part, it should follow a semi-colon rather than a comma. Here is an example.

(Correct.) "The apparatus functioned well in most respects; however, there were minor problems with water in the manometer lines."

(Wrong.) The apparatus functioned well in most respects, however, there were..."

ALTERNATE.

Alternate means "occurring by turns; one after the other." It is often incorrectly used as a synonym for "alternative", which means "a choice between two or more things." The same errors propagate into the
adverbs "alternately" and "alternatively".

**ENORMITY.**
This means "great wickedness". It does not mean "great size," as is often assumed.

**DATUM (singular); DATA (plural).**
"Datum: a real or assumed thing, used as a basis for calculations." "Data" is a plural word: "the data were analyzed."

**CRITERION (singular); CRITERIA (plural).**
A criterion is a standard, rule or test by which a judgement of something may be formed. The singular and plural forms are frequently confused. The same is true of phenomenon (singular), and phenomena (plural).

**PRINCIPAL and PRINCIPLE.**
These are frequently confused, but they have very different meanings.

"Principal" means first in rank or in significance. "Principle" means a fundamental truth, law, doctrine, or motivating force, upon which others are based.

**AFFECT and EFFECT.**
"Affect" is a transitive verb, meaning "to influence, to produce a change in, to have an effect on."

"Effect" is usually used as a noun, meaning "a result; anything brought about by a cause or agent." Occasionally it is used as a transitive verb, meaning "to accomplish; to bring about," as in "to effect a change." This has a meaning which is very different from "to affect a change."

**ONLY.**
"Only" modifies the word that follows it. It is frequently wrongly placed in front of the verb when it is in fact meant to modify a noun.

"The measurement accuracy was high: errors were only found in the temperature readings." The writer meant "...errors were found only in the temperature readings."

**POMPIOUS PADDING.**
Here are some phrases that add greatly to the length and tedium of written or spoken material without contributing one jot or tittle to its impact.

"It is to be noted that..."
"It must be emphasized that..."
"The reader should be aware that..."
"Readers are warned that..."
"Realize that..."
"Recall that..."

The best treatment for these condescending admonishments is simple excision.

Another pomposity is borrowed from Metro-Goldwyn-Mayer: the use of "present" instead of "show" or "give".

"In figures 1-3 we present the results of our research."

**TENSES.**
When one is writing about work done in the past that produced results that were still new at the time of writing, it is possible to use a variety of tenses that can confuse and/or irritate the reader.

"A Prandtl-type manometer was built that consists of two vertical columns and a travelling saddle that will elevate the sight glass."

One has to take a more distant view and to write in a tense that will be valid for a reader who may come upon one's work long after the problems of the moment have disappeared. It is safest to use the past tense throughout. Occasionally authors use the present tense with success, but it takes more skill.

**NUMBER CONVENTIONS.**
When numbers are used in the text, it is usual to write out (whole) numbers from one to twelve (or less frequently from one to twenty) and to use figures for higher numbers. However, figures should not be used to start a sentence.

Decimal numbers below unity should have a zero preceding the decimal point: 0.015, rather than .015.
S.I. UNITS.

Many organizations now require that S.I. units be used first, with the "US" units following in parentheses. The effect can be ridiculous if carried out too rigidly. "For a collecting tank we used a 208.75-litre (55-gallon) drum." One certainly should not take the accuracy of the conversion to more figures than the original. It would be acceptable to call a 55-gallon drum a 200-litre drum, and a one-inch pipe a 25-mm pipe, and so on.

FIGURE AND TABLE HEADINGS.

The usual convention is to have the figure title in all-caps below the figure.

FIGURE 45: TWO-PHASE-FLOW DATA FOR A CENTRIFUGAL PUMP.

Table headings are usually put in all-caps at the top center of a table.

FIGURE 45 TWO-PHASE-FLOW DATA FOR A CENTRIFUGAL PUMP.

The column headings are usually in all-caps also.

FIGURE AND TABLE ORIENTATION.

Unless there is some extraordinary reason for having them sideways, all figures and tables should be upright on the page so that the reader does not have to keep turning the paper through ninety degrees.

CAPITAL LETTERS.

Avoid pompously sprinkling initial capitals throughout your work to make it look like holy writ.

"I am the President."
"The Author is a Professor of Mechanical Engineering."
"We used the Second Law of Thermodynamics to make an Availability Analysis."

These should all be in lower case, except for the first letters of the sentences.

MULTIPLE NEGATIVES.

Two or more negatives in a sentence can leave the reader confused. The headline in the following BOSTON GLOBE story caught my eye. Did Judge Tauro allow or prevent nude dancing?

"NUDE-DANCING CASE - US District Judge Joseph L. Tauro has refused to issue a restraining order which would have prevented the Boston Licensing Commission from enforcing a 60-day suspension of the license of the Omega Lounge in Park Square..."

HYphenATION OF COMPOUND MODIFIeRS.

A compound modifier is a combination of adjectives and nouns used collectively as an adjective. It is much easier to read something when compound modifiers are tied together by hyphens. This practice also eliminates ambiguity. There is no doubt about what is meant by "soft ice cream", and hyphens are not used. But if you hear that your best friend has been hit by a "soft ice cream truck" you assume that he/she could have been hurt because it wasn't the truck that was soft, but the ice cream. Obviously, here, there isn't really any ambiguity, but it still allows the eye and brain to comprehend faster if the compound modifier is tied together as in "soft-ice-cream truck".

Hyphens can avoid ambiguity when numbers are used as adjectives. "The device has three foot long rubber straps..." or "three-foot-long rubber straps...."

"Three dimensional drawings" probably means "three-dimensional drawings." If the alternative is meant, it is probably better to turn the phrase around: "three drawings giving dimensions."

Some phrases are so ponderous that even when they are correctly hyphenated these still tend to leave the reader breathless. For instance, a recent MIT mechanical-engineering-department publication mentioned an "...evaluation of high rise office building conventional and solar assisted air conditioning and heating systems performance." If this is not to be re-written, it requires a large number of hyphens to make it marginally comprehensible at first reading. It would be better to simplify it to: "...evaluation of the performance of conventional and solar-assisted air-conditioning-and-heating systems for high-rise office buildings."

Here are some other examples that need hyphens.

"A new pollution free tracked air cushion air driven rapid transit vehicle."
"An officer stalked a black walnut tree thief for 38 days." (Headline in Christian Science Monitor).

"The design of a four stroke cycle single cylinder gasoline air cooled engine cylinder."

"Paste on switches could control overhead lighting."

**EQUAL AND IDENTITY SIGNS.**

The use of the equal sign (=) in equations is obvious. It is often misused in place of the identity symbol (≡), which should be used for definitions.

**PLACEMENT OF ILLUSTRATIONS.**

Two alternative arrangements are used: all illustrations can be collected at the end of the report; or each illustration may be placed in the text immediately after it is first referred to.

**PAGINATION.**

Pages should be numbered, including appendices and illustrations. Then, if the person making copies drops two or three of the originals, he/she has a good chance of getting them back into the correct order. A larger proportion of reports are being reproduced "back-to-back" than in the past. Therefore, putting the page numbers at the top center or the bottom center is safer than using the top right-hand corner.

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(I would appreciate receiving corrections and suggestions for improvement of this guide).