How to write a scientific report

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January 17, 2003

Abstract

The standard outline of a scientific report is demonstrated. Some guidelines on scientific writing are presented. The main result is a set of recommendations on how to attract the attention of readers. An appendix discusses typography and LaTeX.

Keywords: scientific writing, standard outline, LaTeX

1 Introduction

This section should present the problem addressed by the researcher. The main results should also be indicated.

An overview of and comparison with related research could also fit in here. (Alternatively, there could be a separate section on "Related work", or comments on related work could be made at various places where they fit in naturally.)

Try to make the text *easy to understand*. You may be afraid of explaining too much. However, there is a much larger risk that your text is incomprehensible to other than experts. Before you write: imagine the reader? Who is she? What is her background? What would she like to know about the problem and your work? A good idea is to begin by formulating a large number of questions that you think the reader would ask. These questions can help you to structure your text, finding the right level of explanation.

Not only should the introduction be pedagogical. It should also be *journalistic*. The typical reader reads selectively. If the title and abstract indicate that the report is of relevance to her, then she will continue by reading the introduction and the conclusions. If these sections are really interesting, she may go on to read the details, but normally she will skip those.

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Note that "journalistic" should not be interpreted as being imprecise or unscientific. "Journalism" is rather a matter of answering the reader's questions in *her* order of priority. For example, she would not be interested in knowing what termination criterion you used in your iterative method, before she knows what problem you are trying to solve, what method you chose, and why you chose that particular method instead of alternative approaches. Here, the questions you wrote down initially could help you. Arrange the questions in what you *think* is the reader's order of interest. Answer the questions in that order, and it is likely that your text will be attractive to the reader.

It is important to emphasize your own contributions. Thus, in the overview of related work, concentrate on the relation between your own and previous results. Instead of writing a detailed description of each of the related reports, you summarize it in a *few* words, followed by a reference.

> **Example**
> Interesting recent contributions are presented in [4, 5, 6]. Contrary to these, our algorithm takes the communication costs explicitly into account. Furthermore, none of these algorithms are designed to handle composite grids. Berger and Bokhari [1] mention composite grids with one, rectangular main grid, covering the entire domain. Our algorithm is applicable to more general composite grids.

2 Details

Normally, there are several sections between "Introduction" and "Conclusions", describing the details of your work. This can include several things, for example:

- More details about the problem.
- A description of the method or approach you used to solve the problem.
- Discussions about alternative approaches, and why you did *not* choose them.
- Your results.
- Experiments to corroborate theoretical results.
- Examples or case studies to illustrate your theory, or to give additional insight.

A difficulty in writing about the details is to find a good balance between completeness and readability. The reason for making a very complete account of details and arguments, is a wish to make everything *clear* to the

reader. However, too many details may make the overall picture more obscure to the reader.

Clarity and stringency *is* a virtue for a scientific writer. Paradoxically enough, in order to achieve this, you may have to omit some details and arguments. Your list of questions may help you to find the right balance. Continue to answer them in the reader's order of priority. Cut out details that you think are of little interest to most readers, and of minor relevance to your results.

You have two tools to your help, references and appendices. Instead of going into details on a particular point, you may mention it briefly, and give a reference to a publication where the details can be found.

> **Example**
> In addition, we have to pay special attention to solutions with $|z| = 1$. For further details, see [2] and [3].

Other details, for example the proof of some lemmas, may go into an appendix. Then, they are available to the really interested reader. At the same time, they do not break our main line of reasoning.

3 Summary and conclusions

Here, you summarize once more. Make it briefly and use a different phrasing than in the abstract and introduction.

The conclusions are important. First of all, most readers will start with the conclusions, and only if those seem very interesting they will go on to the details.

Secondly, the evaluation of which conclusions to draw from your experimental results, case studies or theorems, is an essential part of the *scientific* work. If you write about experimental results without telling the reader what *you* conclude from these results, then your report could hardly be called scientific.

Plans for future research often come as a natural consequence of the conclusions. This could be interesting information for your reader, and could be included at the end of this section.

Acknowledgements

Here, you express your gratitude to persons who are not co-authors, but nevertheless contributed to your work in an essential way. (Do not thank your parents, unless (a) you are writing a doctoral theses or a book, or (b) they actually contributed to the scientific results.)

Example

Thanks to A. Nonymous for her constructive comments on an early draft of this report.

References

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Appendix: Typography and LaTeX

Material about typography is of relevance for an article on scientific writing. However, it does not fit naturally into the main text. It would obscure the even more important issue of how to write to attract the reader's attention, to get through with your message.

Thus, I have chosen to discuss typography in an appendix. Enthousiasts in the field would probably disagree with this choice, arguing that a bad typography is a serious obstacle to attracting readers.

I agree with this opinion. A problem in this respect is that typography is very difficult. Most persons have more training in writing than in typography. Furthermore, it is natural that the writing is done by the researcher, who has something to tell. Typography, on the other hand, could be left to expert typographists.

LaTeX provides an intermediate alternative. It is a language for specifying the typographic structure of a document, *without* specifying the *details* of the typography. You write the text yourself, using an ordinary text editor,

and putting in LaTeX commands in the text to indicate its structure (sections, theorems, quotations, mathematical formulas, etc.). Then, you run the text file through a LaTeX "compiler", which performs the actual typesetting. For example, a theorem will be typeset according to typographical principles that are built into LaTeX. A human typographist would probably do a better job, but the result is much better with LaTeX, than if you did it yourself (unless you happen to have a natural talent for it).

LaTeX is easy to learn. For a first impression, the text file containing the original of this document is provided as a supplement.