

# *How to write a research paper*<sup>1</sup>

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<sup>1</sup> For 'Language Modelling' 2011

This document is guide to help you write your final paper for Language Modelling. It's only my advice, you certainly don't have to agree with me, or follow it. But just take some time to think carefully about the advice before you dismiss it. I first argue that you should write the various sections in a different order than they will appear in the final paper. I also present a number of things to avoid. I conclude with an excerpt from a short paper about how to write a good abstract.

Research papers that present experimental results have a standard format: Abstract, introduction, background, method, results, discussion, conclusions and/or directions for future research. This is all followed by a bibliography and sometimes also an appendix with the experimental materials, or instructions use, etc. depending on how important these are for explaining the experiment.

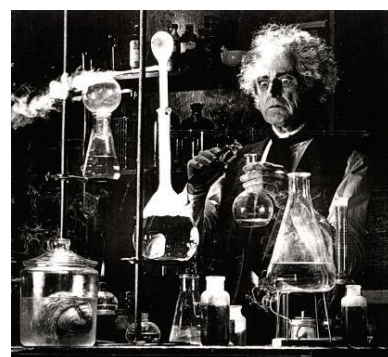
This order is useful. It hopefully presents all information necessary for reading the paper in the order in which the reader will need the information to understand the results. But this doesn't mean that this order is the best order in which to *write* the paper. In fact I would argue that it is certainly not.

Knowledgeable, expert readers who know about your topic and may even be working on the same topic will probably not read your paper this way. They will head right to the Results and Discussion, skim through the Method section and quickly read your conclusions. In writing your own paper you are certainly the expert about your own research. So you will probably want to approach writing in a different order than that which is most useful for a non-expert reader to read the paper in. Below I outline what order I think is most useful for a first draft.

## *Create a document with title*

Create a document for your paper. Give the paper a title. I recommend creating a document with a title even as you are still planning the experiment. Why? This way you have a place to make notes, observations, put ideas, while you are planning the experiment or while you are running it.

What kind of title? Summarize what you have shown or proven or studied in a short sentence. Be specific. E.g. the title 'Strict and sloppy readings in VP-ellipsis' can probably accurately describe



Research takes concentration.

more than half the papers in this year's class. This means it is not specific enough. Recognize that your first title will not be your last because you will improve it. The title is extremely important. For a real conference paper, people will decide whether or not to go to your talk/read your paper based on your title! It needs to be concise and informative, including Results if possible. Consider the following 'Gender biases in pronoun interpretation' is a pretty good title, but 'Male referents preferred as antecedents for gender ambiguous pronouns' is better. Why? Final note: be careful about 'cute' titles. The title needs to contain enough information so that researchers searching for work on your topic will find your paper.

### Method

The second part of the paper you should write is probably the Method section. Here you map out concisely what type of study it was (2 x 2? 2 x 3 design? ) what you measured, what materials you used, how many subjects you had, their mean age, gender, etc. Look at the experimental studies we read in class for an example of how to write a Method section. The nice thing about the Method is that you can begin writing it right away. You can even start writing parts of it before you do the experiment (and you should, because you should be able to explain what factors you are testing before you do the experiment!). As soon as you have done the experiment, you can fill in the remaining information.

### Abstract

Some people believe you should wait until you have finished the paper to write the abstract. I find that writing the abstract helps me focus on what is essential in the paper, and I write several versions of the abstract *as I am working on the paper*, revising it as I add to the main paper. See the two abstracts on the right, one is a initial final draft, the other is the revised final abstract.

I won't give you more information about how to write an abstract: see the reprint of 'Scrutiny of the abstract' by K. Landes as an appendix to this guide. Landes text is the best advice about writing an abstract I've ever seen.

### Introduction

The introduction is crucial for quickly presenting the point of the paper. When writing a paper for a real conference, your readers will either be 1) experts who already know quite a bit about the

Which abstract is better?

**Abstract 1:** A count of sentence connectors in 12 academic papers produced 70 different connectors. These varied in frequency from 62 tokens (however) to single occurrences. Seventy-five percent of the 467 examples appeared in sentence-initial position. However, individual connectors varied considerably in position reference. Some (e.g. in addition) always occurred initially; in other cases (e.g., for example, therefore), they were placed after the subject more than 50% of the time. These findings suggest that a search for general rules for connectors position may not be fruitful.

**Abstract 2:** Although sentence connectors are a well-recognized feature of academic writing, little research has been undertaken on their positioning. In this study, we analyze the position of 467 connectors found in a sample of 12 research papers. Seventy-five percent of the connectors varied greatly in positional preference. Some, such as in addition, only occurred initially; others, such as therefore, occurred initially in only 40% of the cases. These preliminary findings suggest that general rules for connective position may prove elusive.



topic, or 2) people from the same field, who will quickly be able to grasp the research question. The quickest way to show these readers what your research question is in linguistics is to *show them example sentences* illustrating the phenomenon being studied. This quickly gets them focussed on the problem. My motto: A picture may be worth a thousand words, but an example is worth about 300. It also follows the well known advice: **Don't tell people, show them!**

**This also focuses the paper on what is new.** Researchers are concerned with what new information has been gained. What have you shown that other people have not shown before.

**This also focuses the paper on what you have done.** The first paragraph, column of your paper is equivalent to prime-time advertising, it's equivalent to the best billboard or a front-page ad. Your reader still has energy at this point in the paper, they are paying attention (you haven't yet bored them with a long list of previous studies and references!). Make this space count by making sure it focuses on the new research that you have done, and not a long background piece on what others have done before you. IF I DON'T KNOW WHAT YOU HAVE DONE AND WHY BY THE END OF PAGE ONE, THEN YOU NEED TO REWRITE PAGE ONE.

**Tell the reader why your research is important.** The motivation for your work should also go someplace at the beginning. This can be information about how knowing more about the phenomena studied will help us create essential applications/ will help us understand some specific aspect of human cognition / will help us rule out certain explanations for linguistic reasoning, etc.

## Discussion

I like to write my first draft of the discussion early. Writing is a thinking process for me. Here you want to outline how the results fit (or don't fit) your initial hypothesis and explain why. You can do this even before you have results (in fact it's a well known exercise: you've heard of a 'Gedankenexperiment', right?)

Here's where you will also be relating your results to previous research. If you referenced a paper in the Introduction or Background, it had better be mentioned/discussed again here or in the Conclusions. As I said at the beginning, many readers are going to head straight to the Discussion. This is where the meat of the paper is. This is where you show that you know how your results relate to current theory /previous work, and where you show what the implications are. TIP: YOU WANT YOUR DISCUSSION AND CONCLUSION SECTIONS TO BE AS LONG, OR LONGER THAN YOUR INTRODUCTION AND BACKGROUND SECTIONS. If you have a very long background,



Researchers at MIT prove that rolling shopping carts will almost invariably hit the most expensive car in their vicinity.

and hardly any Discussion, it implies you don't really understand or recognize the relevance of your results.

## Background

I'm exaggerating when I say people are not interested in earlier research and other people's work on your topic. It is essential to embed the current research question and results into previous work. You didn't decide to study the current phenomenon in a vacuum, so explain how it fits with the existing 'conversation'. Let's say we all read paper X about variable binding. If your background summary about paper X is the same as one of your classmates who did another experiment, then both of you need to look again at how Paper X fits with **your research questions**. YOUR SUMMARY AND DESCRIPTION OF PREVIOUS RESEARCH WILL BE UNIQUE TO YOUR OWN SPECIFIC RESEARCH QUESTION. If you simply give a summary that could have been included in anyone's paper, then you haven't thought deeply enough about how the reference relates to your topic.

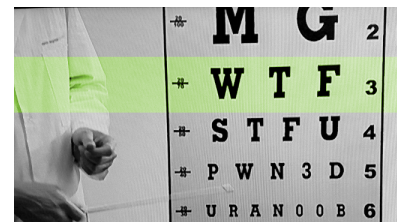
A major problem with writing the Background is trying to decide what to include, and how to limit it. Backgrounds can easily get out of hand, first because there may be quite a lot of previous research that relates to your work. But if you took my advice and wrote a draft of the Discussion section already, determining what is relevant is easy.

Are there references in your background that you don't need in your discussion? Then why are they in your paper? **If you didn't need to refer to it in the Discussion then you don't need to have it in the Background.** Ok, I admit this is a bit extreme. But not entirely. A conference paper is short, it isn't supposed to give a comprehensive introduction to a topic, it is supposed to give you enough information to understand the results of a new experiment and their implications. So if you include background information about the topic from references that you do not need to refer to in the Discussion or Conclusions section, then make sure you do so with good reason.

## Results

This should be fairly short. If you did a statistical test, you should present the results following a standard style. Most of you had a 2 x 2 design, and used an ANOVA. The American Psychological Association has clear guidelines for presenting the results. See the document on Nestor about this.

Often, results are clearer if they are presented in some graphic for-



If you are having trouble figuring out what the point of your work was, try asking yourself some 'wtf-questions'. I find it works best if you imagine someone asking you in an aggressive tone:

- WTF was your research question?
- WTF did you show?
- WTF should I care?
- WTF does this mean?
- WTF are you making me read about this old work?  
(replace 'W' = 'WHAT' or 'WHY' as necessary)

mat. Think carefully about what type of graphic is most informative. Bar charts are frequently used. Pie charts are pretty but have the problem that if you have more than two variables, it's difficult for people to judge the difference. The easiest way I have found to make graphics is on a website for children:

(<http://nces.ed.gov/nceskids/createagraph/>)

### *Conclusions and Directions for Future Research*

What is the take-home message? What did we learn about human cognition from the work you did? What questions remain unanswered? What new questions have come up because of your research results?

### *Things to avoid in your paper*

#### *Plagiarism*

This should go without saying, but often new writers are confused about what plagiarism is.

- If you copy someone else's words without identifying it as a quote, it is plagiarism.
- Even if you translate something to Dutch/English, it is still plagiarism.
- If you change the words around, and replace some words with synonyms, this is also often plagiarism.
- Paraphrasing someone else's ideas also requires referring to them.

Now some ideas or theories need to be explained using special terms. It's impossible not to use wording that someone else has used, without changing the meaning essentially. You need to weigh accuracy against originality. Make sure you give sufficient references and this will be fine.

#### *Vagueness*

Be as specific as possible. Here's an abstract from an earlier paper from this course, with my comments:

*First the problem of establishing coherence in a discourse is introduced together with influential factors from the literature. I will comment on some recent research and propose a new experiment to overcome these critics. This experiment is described and assumed to have less confounding factors.*<sup>2</sup>

In an earlier class I got a paper where the writer tried to introduce Centering Theory: 'Another well-known theory about pronoun resolution is Centering Theory which is extensively explained by Grosz, Joshi, and Weinstein (1995). Centering theory is motivated by two related facts about language. 1) the coherence of a discourse does not depend only on semantic content but also on the type of referring expressions, and 2) the existence of garden path effects, in which pronouns appear to be resolved before adequate semantic information has become available. (Grosz, et. al. 1995 in Kehler 1997). ' This is an exact copy of the beginning of a paper we read. This is plagiarism.

<sup>2</sup> All excerpts from student papers are used with permission of the writers.

**My comments:** Too vague. Instead of saying you are going to introduce x and y, **say what x and y are**. K, M, and N claim that the way that coherence is established in discourse influences **WHAT?** Please don't tell me you will comment on recent research. Of course you will comment on some recent research, otherwise you wouldn't be writing a standard conference paper! Tell me how **your results** relate to existing knowledge. Don't write things that are completely predictable. Instead say what recent research is relevant because it says Z, Y, D, etc. Don't propose a new experiment, you **DID** an experiment. Tell me about the experiment you actually did, say what it tested **and what the results were**. From the abstract I should already know what factors you tested, why they are relevant and new and what your results are.

*What we did was to repeat the coherence research, correcting the previous omissions.*

**My comment:** BE MORE SPECIFIC: We repeated the study of X by asking subjects to judge experimental materials designed to increase the causal support between etc. etc...

*The results show a significant main effect in reading time for the pronoun syntactic category for the region including the pronoun and the following word.*

**My comment:** Significant in what direction? faster or slower for what type of pronouns.

*We attempt to improve these stimuli and stage a similar experiment. However, our results show an insignificant and minimal effect and seem to reinforce Frazier and Clifton's claims. It seems that, correctness of syntax may have a different influence on sentences with different coherence relationship giving perhaps some place for Kehler's theory, but it does not seem to be a dominant one as Kehler claims.*

**My comment:** Say exactly what the significant results were. What do you mean by minimal effect. (omega test?) Also: do the results really reinforce Frazier and Clifton's claims? Do they really have a CLAIM? Also: the syntax is not incorrect if it is passive-active, it's just less preferred, so don't write 'correctness of syntax'...it's more simplicity of the syntactic form. You say that you improved somehow on Frazier and Clifton with your materials, but you don't say in what way. This is a major point. This is what makes our research original! Change the vague description to something more specific.

### *Confusing the reader*

Don't confuse the reader. I know. If you are yourself confused, this will be hard not to do. But keep working on the topic, talk to others about it, keep rewriting, until you are no longer confused. Then keep



rewriting your paper until it is no longer confusing. How do you know for sure?

- Ask someone else to read your paper.
- Read your paper aloud to yourself. You will very quickly see some things that are terrible.
- Have an electronic reading program read your paper aloud to you.
- Reverse outline your paper (create an outline from the paper. Check the outline...does it make sense?)
- Try some free writing techniques. (Look it up)
- Having trouble with one section? Get a blank page. Rewrite it. Compare versions.
- Remember: **Writing is Revising**. Only a handful of people have the skill and experience to write about research (a very difficult topic) without having to rewrite. Most of the work of writing is rewriting.

## Appendix

### Scrutiny of the Abstract

K. Landes, Copy from GEOPHYSICS,<sup>3</sup> Vol. 17, No. 3 (July 1952), 645. Previously in AAPG Bull., Vol. 35, No. 7 (July 1951), 1660.

**Abstract** *The behavior of editors is discussed. What should be covered by an abstract is considered. The importance of the abstract is described. Dictionary definitions of "abstract" are quoted. At the conclusion a revised abstract is presented.*<sup>4</sup>

PRESUMABLY NEW EDITORS, like new senators and small children, should be seen and not heard. But unfortunately the Association has elected (the electorate had no choice) an editor who is a nonconformist. For many years I have fretted over the inadequate abstract, and now perhaps I can do something about it—but not by keeping quiet. Many of the abstracts appearing in the publications, Including the meeting programs, of the A.A.P.G. can best be described by the use of a homely word that refers to an infestation by a certain minute organism. The abstract appearing at the beginning of this note is in that category. I regret to say that it is not an extreme case. My collection contains several that are worse. Dean Russell of Louisiana

"In my own writing I average about five pages a day. Unfortunately, they are all the same page." Alley, 1997.

<sup>3</sup> Yes, he wrote it for Geophysicists, but it applies equally as well to humanities abstracts.

<sup>4</sup> This is the first version of the abstract for the following text. It is typical of many abstracts.



State refers to such abstracts as "expanded titles." They could also be looked upon as a table of contents, in paragraph form, with "is discussed" and "is described" added so as to furnish each subject with the verb necessary to complete the sentence. The reader is left completely in the dark not as to what the paper is about but as to what it tells! The information and the interpretation contained therein remain a mystery unless the reader takes the time to read or listen to the entire paper. Such abstracts can be likened to the "teasers" which your local movie manager shows you one week in the hope of bringing you back next week. But the busy geologist is more likely to be vexed than intrigued by the coy abstract.

To many geologists, especially the tyros in exposition, the writing of an abstract is an unwanted chore required at the last minute by a rule-ridden editor or insisted upon even before the paper has been written by a deadline-bedeveled program chairman. However, in terms of the market reached, the abstract is the most important part of the paper. For every individual who reads or listens to your entire paper, from ten to five hundred will read the abstract. It is much better to please than to antagonize this great audience. Papers written for oral presentation should be prepared with the deadline the abstract date instead of the delivery date. Later discoveries can be incorporated within the paper—and they would miss the program abstract anyway.

My dictionary describes an abstract as "a summary of a statement, document, speech, etc." and "that which concentrates in itself the essential qualities of anything more extensive or more general, or of several things; essence." The definition I like best has been set in italics. May all writers learn the art (it is not easy) of preparing an abstract containing the essential qualities of their compositions! With this goal in mind I append an abstract that I believe to be an improvement over the one appearing at the beginning of this discussion.

**Revised Abstract** *The abstract is of utmost importance for it is read by 10 to 500 times more people than hear or read the entire article. It should not be a mere recital of the subjects covered, replete with such expressions as 'is discussed' and 'is described.' It should be a condensation and concentration of the essential qualities of the paper.*



Geologists in Antarctica. 1911