

# A Small Guide to Writing Your Thesis

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## Background

This is not intended to be a definitive guide to scientific authorship. There are many other guides available that are more comprehensive, both on the internet and in print. I suggest you refer to one or more of them *before* beginning to author a thesis.

This guide was motivated by reading many draft theses and the observation that most first-time thesis writers make very similar mistakes. One goal of this guide is mostly self-serving, it's to avoid me spending my entire life repeating the same advice to every student whose draft thesis I receive. However, following this guide has advantages for both me and the thesis writer. It will allow me to spend my time concentrating on providing clear technical feedback, and not sounding like a tedious tape recording that is played independently of the submitted document. Heeding the advice contained herein is likely to produce a better thesis than simply taking a hit and miss approach.

## Prerequisites

Before submitting a draft to me, I expect the following work to be done.

- **The thesis has a title and an author.** You have seen my office, your thesis will be placed in it at some point. You increase the odds dramatically of your thesis being found again if it is not an anonymous, untitled, pile of paper amongst all the other paper.
- **The thesis has page numbers.** Have you ever tried to piece together a 50+ page document without page numbers? I don't plan to!
- **There are section headings and a table of contents.** Like a long journey, a large document needs navigation aids to help steer the intrepid reader along the way. Don't risk me getting lost trying to find something.
- **There is a bibliography with citations that are correct where cited.** Have you ever tried checking the reference [?/?]

And most importantly

- **The thesis has been spell checked, and proofread for clarity and grammatical correctness.**

If you are too lazy to go to the trouble to provide me with a coherent document mostly free of inconsequential distractions (simple typos, etc.), then I will not read it.

## The Thesis Itself

Simplistically, a *thesis* is a proposition advanced or position taken, that is then substantiated by argument or experiment. A dissertation, the document that embodies the proposed thesis and substantiation, is also

termed *thesis*. However, *thesis* is not a fancy name for a report, or pile of paper. A thesis is expected to contain exactly that described above, a proposed position or solution, and a methodical substantiation.

**Avoid the common mistake of writing a chronological report of all the work you did.** This is a good way to waste my time, and miss your chance to get feedback on the real thesis.

You should also note that a thesis is not a collection of ideas. A thesis has a single theme that is **obvious from the start to the end of the document**. If there is no obvious theme, you should seriously ask yourself why? Potential answers include a simple lack of coherent structure (the thesis is in there, but your hiding it), attempting more than one thesis (avoid tackling too many problems in too little detail), and having no clear thesis at all. Avoid the "build and experiment without clear reason" approach to research, you should identify the thesis prior to starting, not after supposedly finishing.

## Contents

Theses usually have an expected format. You should not stick rigidly to a standard format (show initiative and creativity), however you also should not deviate significantly from it. The more you deviate, the more you will have to lead the reader through your thesis. Don't risk losing the reader by trying to be "clever".

The standard thesis looks something like

1. Introduction
2. Background & Related Work
3. Proposed Solution
4. Experimental Results
5. Analysis
6. Conclusion

Now looking at each section in detail

## Introduction

A reader of the introduction should be able to answer the following questions, although not in any depth.

- What is the thesis about?
- Why is it relevant or important?
- What are the issues or problems?
- What is the proposed solution or approach?
- What can one expect in the rest of the thesis?

State what the thesis is about early. Don't keep the reader guessing until the end of the introduction, or worse, the end of the thesis (don't laugh, I have read draft theses that left me wondering after reading the entire document). You should provide a brief and gentle overview of the thesis topic (or problem) to give the reader enough context to understand the rest of the introduction. Don't overwhelm the reader with detail at the start. You will provide the details later elsewhere in the thesis. Target the level of writing at one of your peers, but not necessarily somebody working in the same area.

State why the topic is important. Address the "so what?" criteria. Why are you working on the topic? Why should somebody else be interested? Your motivation should be obvious after the introduction, but not necessarily provably so at this point.

State what the major issues are in solving your problem. Coherently overview the issues in enough detail to be able to understand they exist, but don't go into details yet or attempt to prove they exist. The overview should be in just enough depth to understand why you might propose the your particular solution or approach you are taking.

Describe your proposed solution or position your taking. Again, you should not go into minute details, nor should you attempt to prove your solution at this point; the remainder of the thesis will describe and substantiate your solution in detail, that what a thesis is :-)

At this point the reader will know what your working on, why, what are the major issues, and what your proposed solution is, but usually only if he takes your word for it. You should outline what the reader should expect in the rest of the thesis. This is not just the table of contents in sentence form, it is an overview of the remainder of the thesis so the reader knows what to expect.

## **Related Work and Background**

The related work section (sometimes called *literature review*) is just that, a review of work related to the problem you are attempting to solve. It should identify and evaluate past approaches to the problem. It should also identify similar solutions to yours that have been applied to other problems not necessarily directly related to the one your solving. Reviewing the successes or limitations of your proposed solution in other contexts provides important understanding that should result in avoiding past mistakes, taking advantage of previous successes, and most importantly, potentially improving your solution or the technique in general when applied in your context and others. In addition to the obvious purpose indicated, the related work section also can serve to:

- justify that the problem exists by example and argument,
- motivate interest in your work by demonstrating relevance and importance,
- identify the important issues,
- and provide background to your solution.

Any remaining doubts over the existence, justification, motivation, or relevance of your thesis topic or problem at the end of the introduction should be gone by the end of related work section.

Note that a literature review is just that, a review. **It is not a list of papers and a description of their contents!** A literature review should critique, categorize, evaluate, and summarize work related to your thesis. **Related work is also not a brain dump of everything you know in the field.** You are not writing a textbook; only include information directly related to your topic, problem, or solution.

## **Proposed Solution**

At this point the reader will have enough background (from the related work and introduction) to begin a detailed problem analysis and solution proposal. You should clearly identify in detail what the problem is,

what you believe are the important issues, describe your proposed solution to the problem, and demonstrate why you believe your particular proposal is worth exploring. Note you might have one or more variants that are worth exploring. This is okay assuming you have time to explore them as they can be compared experimentally if you cannot clearly justify the preference for a particular variant.

You must also clearly identify what the outstanding issues are with your solution. These are the issues that must be resolved by experiment. If you don't need to experiment, you must have **proved** your solution correct. This situation occurs in mathematics, but it is rare in operating systems.

## Experimental Results

The reader now knows your proposed solution(s), understands the problem in detail, and knows what are the outstanding issues. You can now introduce the experiments you used to resolve the outstanding issues in your solution. **You must describe how these experiments resolve the outstanding issues.** Experiments without clear motivation why they were conducted are a waste of paper, give me an interesting novel to read if you really feel compelled to give me dead trees.

Describe the experimental set up in such a way that somebody could reproduce your results. This should be aimed at the level of somebody externally tackling the same problem, using your solution, and wanting to verify your results. This should not be targeted at the level of somebody within the local group, using your code, on our machines. Details such as "do blah on machine X to get machine Y to perform monitor" should not be in a thesis. Such information is useful, but make it available outside your thesis.

Present the results in a comprehensible manner. Describe them in words. **Don't simply include ten pages of tables and graphs.** Again, buy me a book instead. Make sure that the tables and graphs have clear labels, scales, keys, and captions.

## Analysis

This section takes the outstanding issues you previously identified, the experimental results, and analyzes them. Did the experimental results substantiate your solution, and **how do they substantiate your solution.** Where the results what you expected? Did the experiments create new issues? If so, identify them.

By the end of this section the reader should know how your proposed solution worked out. The reader should know what issues were resolved, what the resolution was, and what issues remain.

## Conclusion

Recap on your thesis. It has been a long journey if the reader has made it this far. Remind the reader what the big picture was. Briefly outline your thesis, motivation, problem, and proposed solution.

Now the most important part, draw conclusions based on your analysis. Did your proposed solution work? What are the strong points? What are the limitations?

Significant issues identified in the thesis, or still outstanding after the thesis, should be described as future

work.

## After Completing the Draft

It is normal for most thesis authors to get lost in the details while writing such a large and detailed work. I highly recommend forgetting your thesis for at least a day or so (a week is recommended). Take a break, play sport, learn to parachute, read a book, just do something that distracts you completely from the job at hand. After taking a break, **read the thesis from front to back in one attempt**. Use a pen and critically review your own work, but don't distract yourself from reading by immediately fixing the thesis when you find problems. Ask yourself does the thesis convey the big picture, are the details comprehensible, are there holes in your arguments, is there irrelevant stuff in there, is there relevant stuff missing? You will be surprised what you find the first time you read from front to back after taking a break from the thesis.

At this point you should have a coherent document that you can be proud of, and I am now quite happy to proofread your thesis :-)

## Second Opinions

I recommend getting a second opinion when dealing with any doctors :-)

Here are some links you may find useful in no particular order.

- [How To Write A Dissertation or Bedtime Reading For People Who Do Not Have Time To Sleep](#)
- [How to Write a PhD Thesis](#)
- [Gernot Heiser's Guide to Technical Writing](#)