1 Random Hints for Writing Your Thesis

This is a collection of hints for writing a thesis, with a focus on the technical process of writing, editing and typographic issues.

Version 2017/10

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2 Towards Your Thesis Report

When you write your thesis, you do of course much more than just writing. You study literature, make experiments, build prototypes or perform other research activities to gain some results. In this guide, we focus on the more technical issues of writing, editing and formatting.

The final grade of your thesis is based on the report that you deliver. The report is in most cases the only way the censor learns about your results. It is therefore important that you spend enough effort on the report.

Writing takes time. Probably much more time that you think. It is also an iterative process, and you will probably not be able to finish a section on a first attempt. It takes several iterations until you are satisfied. However, to succeed with version *n*, there needs to be a version *n-1*. You should therefore start to write as early as possible, even if you think that you will be able to write “easier” after you have made more progress with the work of your thesis.

Another reason why it is important to start writing early is to get early and useful feedback from your supervisors. If you deliver them a version only a few days before the deadline, you cannot really benefit from their feedback and learn from it.

Writing and doing research is an iterative process, going through cycles that consist roughly of the following activities:

Goal

1

Planning

Figuring out what to do and why.

2

Research

Doing the literature research and experiments.

3

Thinking

Digesting mentally what you observed.

4

Writing

Finding words for thoughts, results, arguments.

5

Editing

Improving readability and sorting of arguments.

6

Formatting

Setting the text, tables and figures into PDF.

- The writing part is where you formulate your ideas. You can only do this effectively when you have done the research part right, and when your thoughts have matured. However, this does not mean you can only start writing during the last weeks.
- The editing part is where you take written sentences and improve their readability, clarity, style, language. You also structure sentences and paragraphs.
- The formatting part is purely technical. It means to put the edited text into PDF.

In practice, the borders between these activities are more blurred than we describe here. When you start thinking, you will see that you need to do more research, or that you need to conduct some experiments. When you start writing, you may discover that you need to do some more thinking, and so on. In any case, it helps to be aware of the different goals of these activities, and you should at any time be aware of which of the ones you are doing.

3 Planning the Report

There are guidelines, conventions and requirements for a thesis. Some of them are strict, like the treatment of references or rules regarding plagiarism. Follow them. If you are unsure, ask your supervisor or seek help from others.

Conventions, like for instance the structure of the sections, are not so strict, but have proven to work well in many cases. Try to follow them, but keep in mind that your goal, in the end, is simply to present your thesis to the reader as efficient and correct as possible.

One common question is the number of pages the report should have. This is difficult to answer, since the number of pages really does not say anything about the quality of a thesis. In the end, you should use the number of pages that you need to present and discuss your work appropriately.

3.1 The Abstract

The task of the abstract is to summarize the content of the thesis, so that potential readers can decide if they should read it or not.

The most common mistake of abstracts is that writers start to argue for their viewpoint, overly advertise for the remaining parts of the work, and hence not cover the content as a neutral summary. An abstract should summarize in a neutral way. Motivating your work is the task of the introduction, and argumentation should be done in the main part and the end.

3.2 The Introduction

The introduction gives the reader the first impression of your work. Here you can show that you have a clear idea about your thesis. The introduction is also the ideal place to tell the reader what is special about your work and stimulate curiosity.

The introduction should include a summary of the work and its main content and arguments, similarly to the abstract, but in much more depth and also more details. In contrast to the abstract, an introduction should contain a motivation for your work.

After the introduction, the reader must know *why* you have done the work, *why* it is interesting, *what* they main points are and *how* you have structured the presentation and discussion in the remaining chapters.

3.3 The Background Chapters

The background chapter summarizes all subjects that need introduction and are later used in the thesis. Often, one chapter simply called *Background* will do, with sub-sections for each subject that requires introduction. In some cases you may spread the background in two or even more chapters. You may then assign all of them to a part called *Part 1 – Background*, but there are no formal constrains. It is only important that a reader sees clearly what constitutes background material, and that background material is explained before you start describing your own work.

Since you will often start your work by reading other's work that constitutes background material, it is often a good idea to start early writing parts of this section early. Don't be afraid of some of the material does not make it into the final version. It provided a good training for writing.

3.4 The Main Part

The main part is made up from the chapters that cover your work. There is no strict rule how these chapters need to be structured, it all depends on what suites your work best. Usually, these will be around five chapters, but more or less is fine.

During the writing process, you may have to revise the structure of the chapters. Sometimes you find that sections can be combined, or that a section should be split into several ones. Changing the section structure is often less dramatic as it may sound. If you have well-written paragraphs (more on that later), restructuring sections is easy.

3.5 The End

The end of your report consists of several elements:

- A discussion of the results.
- A summary of what has been done.
- An outlook into the future, for example future work or improvements.

While the first two are in practice mandatory, the outlook in the future is optional. You may structure these parts as separate chapters, or within a single chapter.

4 Writing

4.1 Getting Started

Getting started with the writing can be difficult, sometimes even uncomfortable. The editor window is empty, and any attempt to write some sensible sentences is followed by doubts if the sentence is good enough, if it can be understood by the reader, and if that sentence should actually exist at all.

There are different techniques to overcome this initial threshold:

- Instead of writing, it may be easier to create a figure of a system or process first. Even a simple sketch of the figure can help to find simple words and sentences to describe it, step by step, from left to right or top to bottom.

- Sometimes it helps to explain an issue to another person and make notes of the comments or formulations that helped to convey a point. It's not uncommon to ask a colleague to serve as such a catalyst and listen to your argumentation. You may return the favor to them another time.

In the end, you have to ask the question which information or issue you want to convey to the reader, write them down, and then refine once you find out what else is needed so that all information is presented in a proper context. A useful skill is to imitate a person that does not know what you know.

Take away all focus from editing issues during this initial writing phase. Don't spend any time on making your document pretty, or be too much concerned about other details that do not affect your arguments. You can take care of this in the later rounds of editing. It may therefore also be wise to use a very simple editor in the initial writing phase, without any formatting or disturbing functions. Some writers also prefer to make the initial sketch of an argument with pencil and paper.

4.2 Writing Style

Developing a good writing style takes time, and it's hard to give any definite answer of what makes a *good* style. In general, a good writing style is one that effectively communicates your message and does not annoy the reader. The most usual annoyances are the following:

- *Too verbose*. It's obvious that you try to use as many words as possible.
- *Too short*. You don't explain things good enough, do not deliver enough examples, explain figures completely.
- *Too formal*. Scientific and technical writing can be precise without being too formal.
- *Too informal*. While we encourage you to use a vivid language, overdoing it may have the opposite effect.
- *Not focused*. Within any sentence, within any paragraph and within every section, it must be clear to the reader what the thesis is about and why the current issue is important.
- *Too complicated*. You explain a subject matter more complicated than it ought to be. Explaining things simple is not easy, but exactly this is what your job as a writer includes, and what is also rewarded.

4.3 Effective Paragraphs

Paragraphs are the ideal units of work when writing. You should try to write a complete paragraph at a time. This may sound surprising, since you may think that the units of work are sentences or entire sections. But sentences are too small to handle when planning a thesis. Developing an argument also takes more than one sentence. Sections, on the other hand, are too large. You may plan to write a section, but only while you develop its paragraphs you will find out if the section works as intended or

not. Therefore, you should focus on paragraphs. When you design paragraphs correct, you will be able to move them and work efficiently with text.

A paragraph discusses a single point only. Further details in the paragraph should only support its main point. A paragraph has a good key sentence at its beginning that summarizes the main idea, and then refines it. The key sentence is often the first sentence of a paragraph. Having proper key sentences makes it easy for the reader to follow your report.

If you have troubles to design a good paragraph, ask yourself which main idea it should communicate to the reader. Formulate a guiding question for the paragraph. This question is only intended for yourself and not contained in the final report. When using LaTeX, you may write this question as a comment above the paragraph.

A subject matter may turn out more complicated and need more than one paragraph to explain it. Vice-versa, if your paragraph is too short or cannot stand on its own, it may belong together with another paragraph.

4.3.1 Tip: Check Your Key Sentences

Highlight the key sentence in a paragraph with a text marker. Now read all key sentences of all paragraphs of a section. Check if they make sense when read after each other. When you see that you get a good overview of the section, and the key sentences by themselves tell a good story, they are fine. If not, improve the paragraphs.

4.4 Aim for Readability

Formulate your thoughts and arguments as simple as possible. Only if you have understood something, you can express it in simple terms. Or vice-versa, to express something in simple terms, you have to understand it. Most readers are not impressed by complicated formulations, but rather annoyed.

To increase readability, use simple sentences. The writing style of Ernest Hemingway is an example for a simple writing style. Do a web search for *writing rules hemingway*, and read on. Some guidelines are the following:

- Use short sentences.
- Use positive formulations, not negative ones.
- Use active voice.
- Avoid adverbs.

The web application *Hemingway*:1 evaluates with an algorithm how easy it is to understand a text. This application highlights adverbs, passive voice, or sentences that are hard to read.

Sentence in passive voice: *To calculate the speed the following formula is used.* In active voice: *To calculate the speed, we use the following formula.*

4.5 Avoid Jargon

Always make sure that words you use have the proper meaning and that the reader can be understand them. Sometimes you may be tempted to use words that you have read in other places, where they were used in a specific context. When you use them in your thesis, the reader may not understand them. An example is the word "lightweight." It's a word that is easy to use, but it is often not clear what it actually means. Instead, try to use another word or formulation that describes better what you want to say.

4.6 Avoid Unnecessary Adjectives

When you write a text for the first time, you will often use more attributes than necessary. You should only use attributes when they are justified. Therefore, read your text with the adjectives removed. You will often observe that the text without the attributes is clearer.

4.7 Citation of Definitions

Sometimes it seems like a good idea to include a definition of a certain concept, to introduce it to the reader. In most cases, however, this is more boring than helpful. Consider if the citation of a definition really adds anything to your text. Instead, explain a concept with your own words, or describe how your own usage deviates from other meanings of a word.

In the example above, we could have introduced that "jargon" is defined as *"special words or expressions used by a profession or group that are difficult for others to understand"*.:2 This is relevant to the reader, but the definition really does not add anything to the main point.

5 Editing

Proper editing is an important part of your work. It aims at providing your arguments in the best possible way. Don't think of editing as correcting because you somehow did a bad job during writing. Even very talented writers don't produce perfect sentences on their first attempt. Often, several rounds of editing are necessary.

Editing works best on the level of paragraphs. It means to take related sentences and transform them into a readable and effective paragraph, as described above. Whenever you have written a bunch of sentences about a specific idea, finish your work with a round of editing.

To edit, do the following:

1. Decide which sentences belong to the same paragraph. Split or merge paragraphs if necessary.
2. The initial order of your sentences if often not the most optimal one. Sort sentences belonging to the same paragraphs. You will be surprised how you can improve a paragraph simply by reordering its sentences.
3. Identify the key sentence of the paragraph and make sure it comes first, or second if the first sentence is a transition from the previous paragraph.
4. Simplify sentences. Transform long sentences into several short ones. Express your idea in the simplest way possible.
5. Remove unnecessary adjectives, and minimize the use of adverbs.
6. Remove passive voice wherever possible. In fact, only use passive voice when you really cannot use active voice.
7. Trust your spellchecker and fix your grammar.

You will find out that *editing* is different from *writing*. When writing, you focus on the subject of your thesis and your thoughts. When editing, you are mostly concerned with readability. Compared to doing the experiments or writing, editing is a relatively simple task that you can get used to.

Some tips regarding editing:

- It makes sense to edit a paragraph even if you you are not yet sure it's worth keeping it. Sometimes, once you revisit a paragraph at a later time, you find that it works or is better than you thought when writing it in the first place. It may also happen that you get another view on it and know how to make it good. If the paragraph is edited well, this is more likely to happen.
- Only hand out versions of your work to others that are at least edited a first round. You will receive much more useful feedback on paragraphs that do not contain editing errors, simply because one can focus on the actual content.

6 Correct Citations and Plagiarism

The most serious issue is that of plagiarism. Plagiarism happens whenever you use the words of others without marking them correctly, so that the reader is not aware that they are not your own. With *words*, we mean complete paragraphs, sentences, and even parts of sentences. We can distinguish two forms of plagiarism:

- **Intentional:** Some students, luckily a minority, copy intentionally. This is just plain fraud. However, this almost never plays out well since plagiarism is extremely easy to identify for an experienced censor. The consequences for your further studies are quite severe.
- **By Accident:** More often happens a form of plagiarism without bad intentions, but simply because of lack of knowledge, naïvety, or bad craftsmanship during writing. Still, the consequences may be the same.

There are also situations in between, where it is not clear if the author attempts to cheat or is just a clumsy writer. You must therefore actively work to avoid ambiguous situations. You must not leave it unclear which parts of a text are citations an which are your own words. Always make it obvious which words are taken from others and cite technically correctly.

As a guideline: It should be possible for the reader to highlight with a marker pen exactly those words that you have taken or adapted from other sources. Double-check if it possible for a reader to misunderstand. If yes, mark the citations better. When yo have doubts, ask your supervisor.

6.1 Citing Figures

The rule for words also holds for figures, including illustrations, diagrams and photos. It must be clear if you copied a figure, if you made changes to an existing one, or if developed and developed a figure completely on your own. Include the corresponding information in the caption of the figure.

As a guideline:

- If you take a figure from somewhere else, include the sentence *"Taken from [X]."* in the caption, where X is the proper reference (including, if appropriate, the page number).
- If you take a figure from somewhere else but make modifications to it, include the sentence *"Adapted from [Y]."*
- If you do not refer to any other source, you implicitly state that you have created the figure on your own. Again, it is your responsibility to avoid any misunderstandings.

Avoid Copy/Paste Accidents

Never even copy and paste text from somewhere else into your work without immediately marking it with a reference. In this way, you never come into a situation where you are unsure if a snippet of text originates from you or somebody else.

7 Figures

Good figures are hard to make, but they are valuable when explaining something to the reader. You should therefore invest time to produce good figures.

7.1 Introduce and Explain all Figures

You must introduce all figures in the text. If possible, you should place the figure *after* you have introduced it in the text. Make also sure that you explain all relevant details of a figure. In diagrams, tell the user what the axes are, in which direction time goes or which notation you are using. Spend effort and walk the reader through the figure, element for element.

7.2 Use Long Caption Texts

Captions are text below the figures that explain what the figures shows. Many keep these captions very short, like a single sentence or only a few words. This is a missed chance to explain more details to readers and get them interested in the entire section. Instead, use longer caption texts where it makes sense. Explain for instance all elements in a figure, or point out what is interesting in a figure. Such a more elaborated caption should come in addition to the explanation of the figure in the text. It can also be a summary of the description in the text.

In Latex, the cation for a figure is produced with the command `\caption{}`. The argument of this command is the text that is written under the figure. By default, it is also included in the list of figures, where you usually don't want a long caption. In this case, use the additional argument in the square brackets to provide a short text that is included in the list of figures.

```
\caption[Short caption]{Long version of the caption...}
```

7.3 Orientation

If it is not possible to fit a figure in portrait orientation, consider landscape orientation. Make sure, however, that you turn the figure in such a way that readers have to turn their paper 90 degrees clockwise, as shown in Fig. [fig-orientation].

Proper orientation. Make sure that figures are readable in portrait orientation, or at least as shown above when you need landscape orientation.

More tips for figures:

- Ensure that text in images is readable and not too small.

- Whenever possible, use vector graphics and embed figures in PDF format. In case you need bitmap images, use PNG instead of JPEG, or ensure that JPEG is not compressed so much that compression artefacts are visible.
- Do not use borders around figures.
- Do not use any colored backgrounds.

8 Formatting

This part is probably the easiest, though the most detailed. Once you have good sentences and paragraphs, you should also get the punctuation and spelling right.

8.1 Use LaTeX

For scientific writing, LaTeX is the standard tool for writing. For your needs, standard templates and styles should work quite well.

One of the benefits of LaTeX, apart from its high-quality output, is the fact that it uses normal text files as input, which simplifies versioning and backup. You can for instance easily use Git to manage your report. You can also use any text editor of your choice.

8.2 Placement of Punctuation Marks and Spaces

Place commas and points correctly. Also leave exactly one space between words. Two spaces must never follow each other. The following lines all contain a problem:

…write nicely ,no matter why. …sentence.Next sentence… …two spaces between words.

8.3 Semicolons

When you use a semicolon, there is a big chance that you are using it wrong, or that it is not necessary at all. Therefore, don't use semicolons.

8.4 Footnotes

Footnote marks at the end of sentences should be placed *after* the period, like in this sentence.[3] In LaTeX, the necessary code looks like this:

```
...this sentence.\footnote{...}
```

8.5 Quotation Marks

Correct quotation marks are produced in Latex by the following characters “`quoted''` to produce “quoted.” Note that each quotation mark consists of two characters.

When a quotation mark happens at the end of a sentence, include the period within the quotation marks.

Wrong: “quoted”.

Correct: “quoted.”

8.6 Parentheses

Using parentheses (like these) can in some case clarify some issue. Avoid using too many of them, since it makes a sentence harder to read.

8.7 Paragraphs

A paragraph consists of several sentences that are grouped together. A paragraph only consisting of a single sentence is probably too short, or the sentence is too long.

There are only two ways to separate paragraphs from each other, and within your report you have to stick to one of these two:

- Paragraphs are separated by spaces between them.
- Paragraphs are separated by an indentation of the first line, but without additional space.

The former is typically used for publications on the web that are read in a browser, while the latter is often used for publications on PDF and paper. It is not allowed to simply start a new line, but without either extra space between the paragraphs or without the indentation.

8.8 Citations

Citations must always be grouped within their brackets, that means [1,2] instead of 1,[2]. If numbers are used, they should in the end be sorted so that the numbers are sorted in increasing order.

To have a proper blank between the text and a citation, use a tilde and write `...means~\cite{QUOTE1,QUOTE2}`.

Figures that are not produced by the author for that specific document must be also cited within the caption of the figure.

Citations at the end of a sentence must still appear within the sentence, that means before the period.

Websites should not be included as footnotes, but as proper citations, just as other publications.

8.9 Emphasis

In general, avoid `typewriter` text and use `\emph{...}` to *emphasize* words with special meaning. Also, underlining words was only okay in days when italic font variants weren't available.

8.10 Abbreviations

The following abbreviation are used when referring to elements in the text: *Fig. 1*, *Tab. 2*, *Sect. 3*, *Chapt. 4*. When these words stand in the beginning of a sentence, do *not* abbreviate them. To separate the words correctly from the numbers, use the tilde and write `Fig.~\ref{fig}`. Note there are no spaces between the point and the tilde.

8.11 Guillemets

Guillemets are easy to get with the package `\usepackage{aeguill}` and the commands `\guillemotleft` and `\guillemotright`.

8.12 Trademarks

Do not add any trademark signs.TM They have no meaning in your report, but look really silly.

8.13 Empty Section Starts

Avoid empty starts of sections, that means that a lower-level section follows a higher-level one without an intermediate paragraph. Such an intermediate paragraph helps the reader to understand the structure of the document. Leaving it away is a missed chance to explain things and capture the attention of the reader.

8.14 Capitalization

Capitalize section and chapter headings, consequently and correctly. The website http://titlecase.com helps you with proper capitalization.

Wrong: Proper Capitalization Of the Right Words is Your Own Responsibility

Correct: Proper Capitalization of the Right Words Is Your Own Responsibility

8.15 Units

Use a space between numbers and the subsequent unit. In LaTeX, write the following to keep the space smaller than between other words: `...5\,ms...`

Correct: The timer is set to 5 ms.

Wrong: The timer is set to 5ms.

An exception is the percent sign, for which we find different practices. I suggest that you do *not* add a space between a number and the percent symbol, i.e, write 30% instead of 30 %. Note that you need to escape the percent sign in LaTeX, i.e., write `30\%`.

9 Other Style Issues

9.1 Model and Program Names

Names of Java or UML classes should be written in normal english form, that means for instance *state machine* instead of *StateMachine*. When it should be made clear that a specific name is meant, the name should be printed emphasized, to make clear that you write about the UML class *StateMachine*. Since most programming languages use American English (UML refers to *behavior*, not *behaviour*), you may want to use American English for the entire text.

9.2 Avoid Referring to “He” or “She”

Avoid referring to gender in examples. Usually this is possible by using plural. For instance *“…users may operate their phones…”*

1. http://www.hemingwayapp.com
2. Merriam Webster. Merriam-Webster, Inc. Archived from the original on 29 March 2013. Retrieved 29 March 2013.
3. Footnote with correctly placed mark.