

SOME GUIDELINES FOR THESIS CONTENTS AND WRITING

Chair of Connected Mobility (version 2017-12-13)

For writing the contents of your thesis, numerous common rules apply, some of which are listed below. These are by no means complete but rather provide a first guidance to avoid many pitfalls. This is a snapshot of our guidelines, to be updated once in a while.

1. Structure

- Each thesis has an introduction and a conclusion:
 - The introduction is meant to motivate the subject area (why is this important?), define the problem you are interested in (what are you doing?), and limit the scope (where do you stop?). It also gives an outline of the thesis (which chapters will explain what?) and explains how you are going the approach your subject.
 - The conclusion is meant as a review and not just as a summary. Critically assess your thesis and its results, discuss what you have learned, and point out what next steps would or could be and maybe give your perspective on future development (where meaningful and possible).
 - Find a good first and last sentence: no thesis should start unexpectedly and end abruptly. This usually takes more than five minutes.
- Each chapter has an introduction in which you briefly explain the purpose of the chapter and possibly its structure and relate it to the previous ones.
 - The introduction comes right after the chapter title without additional headline (such as “Introduction”) within a chapter. It is natural that this is the first thing; so there is no point in stating the obvious.
- Each chapter should have a “conclusion”, “summary”, or something similar that reviews the achievements of the respective and relates it to what follows.
- Again, no chapter should start or end abruptly.
- Describe the context and background of your thesis and discuss related work.
- Explain what you are building on and why (and what not and why not).
- Discuss your own contribution: its concepts and approach, its realization, and its assessment.
- Make sure that your own work gets enough room (also in terms of pages). For example, a 70 page thesis should not have 50 pages of introduction, background, and related work, and then only given 10 pages to your own work, followed by 10 pages conclusions and references.
- Make clear that your own contribution is clearly delineated from what has already been there.
- Balance chapters. Introduction and conclusion should be the shortest ones. The others may vary from 5 to 40 pages (depending on the total size of the thesis). Avoid a single

dominating chapter (e.g., one with 40 pages if all others have 5 is an indication that something is wrong).

- Structure into chapters, sections, subsections, and paragraphs.
- Try to avoid more than 3 levels of numbered headlines unless really necessary (if you find it necessary this may tell you that your overall structure needs to be reworked).
 - You may use two levels of unnumbered headlines for further structuring (e.g., bold and italics), optionally peered with bullet or numbered lists.
 - These should not show up in the table of contents.
- Use bullet list or numbered lists to emphasize or list issues for readability but remember to use full sentences even across bullets. Bullet lists do not substitute full text explanations

2. Systematic approach and methods

- The research and/or engineering approach of a thesis roughly follows a general structure—problem statement/definition → method → solution → validation / analysis—and, of course, includes consideration of related work at the appropriate location(s).
 - Note that these may but need not map 1:1 to chapters in your thesis.
 - Note that this refers to the structure of the *written thesis*—the *actual work* is done iteratively bottom-up.
- The depth of these steps may vary depending on your precise subject and the field of research.
- The problem statement sets the frame for your thesis: what you define here as your problem to solve
- MUST be solved in the end (or you need a well-founded answer why it has not been).
- An outline of the problem definition is done (orally) together with your instructor and/or supervisor and you are likely to have prepared a summary of this in a exposé when discussing with your supervisor before applying for the thesis. The problem definition part in the thesis reflects this content in a more formalized manner.
- The method defines your approach to the subject. This part may differ significantly depending on your actual subject: In mathematics, the methods you employ may be straightforward and well-known and require only a few sentences to say what you are doing and why. In techno-economics (or economics and other “soft sciences”), the method is often significant part of the science (and your thesis) and your chosen approach (as well as the alternatives) may not be obvious so that it becomes crucial to extensively elaborate on your method. Engineering theses fall somewhere in-between.
- Your measure should be—again—that your thesis can be understood by others while reading.
- The solution describes what you have done and why, possibly what you have not done (and why not). This is the “meat” of your thesis, i.e. your own contribution to the field.
- Finally, the validation critically reviews what you have done and demonstrates that it achieves the intended goals (i.e., solves the problem). This also points out what could

still be improved and could be subject to next steps in the future (there will always be something!).

3. Headlines

- The basic rule is: headlines are for structuring but the text (at least within a chapter) should be readable and understandable if you delete all the headlines.
- No headline should follow immediately on another. That is, there must always be text between them to motivate, introduce, etc.
- Each headline should fit on a single line (and this should also hold for the table of contents).
- Use meaningful headlines that describe the contents of the following section.
- Propose a meaningful title for your thesis (that can be understood also by those not involved). The title should not contain abbreviations beyond those that are well known by the general public.

4. Writing in general

- The usual rules for scientific writing (proper citations, references, etc.) apply.
- Define the key terms and concepts in your subject area. A definition is a sentence that has the term, the verb “is” and then the meaning of the term. Another verb such as “means” produces an explanation rather than a definition. Always define terms first and then use them. It is better to define the terms as you need them rather than in a separate section or chapter unless the terms form an abstract model.
- Separate thoughts by using different paragraphs (1 thought = 1 paragraph). Put the most important sentence (the thought/idea) as the first sentence of the paragraph—reading just the first sentence of every paragraph should yield good understanding of the work.
- Do not make paragraphs too long (maybe your thought has more structure).
- Write down what you mean (and make sure it says so).
- Avoid sentences without meaning (just because something sounds or reads nicely does not imply that it has a purpose).
- Never have an unnecessary paragraph in a chapter, or an unnecessary sentence in a paragraph, or an unnecessary word in a sentence. And, say everything essential.
- Write complete English sentences (do not forget the articles where needed).
- Preserve proper punctuation also in or across bullet lists.
- Write in a scientific and strict fashion. Do not use colloquial English or magazine-style of writing (unless there is a good reason to do so).
- For readability, avoid complex sentences. Try to phrase your thoughts as simple as possible.
- Write to the point (and do not fill pages just for the sake of filling them).

5. Proof-reading (for yourself or for others)

- Do not imply meaning. Only evaluate what is really written (the prof will do the same).
- Be most critical and ask yourself what the text really says (otherwise, there is no point in proof-reading in the first place).
- If in doubt about language ask a dictionary or a grammar book (online or offline)
- Taking a step back and allowing a day or a week to pass before re-reading helps to spot issues.

6. If you write in English language (which is the default)

- Take a conscious decision whether to use British or American English (and stick to it).
- Avoid first person singular (“I”); use “we” instead or write from a neutral standpoint.
- Do not use short forms in written language (don’t => do not, can’t => cannot, etc.).
- Avoid passive language.
- Write in present tense unless you really have to express temporal relationships.
- An English grammar book can be very helpful to find the right prepositions.
- Commas: “If in doubt, leave it out.” Relative clauses following the main clause are usually not separated by a comma unless specific semantics shall be expressed. Leading phrase such as “In this thesis,” or “Today,” or “In networking,” are separated by a comma from the rest of the sentence. A relative clause ahead of the main clause is separated from it by a comma.
- Differentiate knowingly between “-”, “–”, “—”, etc.
 - Hyphen (“-”): For hyphenating words (“well-known”, “up-to-date”).
 - En dash (“–”): Indicates duration (“3–5 years”, “October–December”).
 - Em dash (“—”): Used similarly to colons/semicolons/parentheses. Do not put spaces around it.
- Avoid abbreviations. Surely allowed are “i.e.”, “e.g.” (that are separated by a comma on both sides), and “etc.” (which is preceded by a comma).
- Conjunctive adverbs (“however”, “therefore”, “furthermore”) must be separated by a comma (or semicolon if they start a new independent clause). Furthermore, do not always stick them in the beginning of the sentence. You can, instead, move them further into the sentence.
- Use proper spacing if supported by your text tool: the previous bullet shows “i.e.” without a space, but that should be half a space. After a full stop (period), there should be 1.5 spaces before the first word of the next sentence (using two spaces is usually better than one). Depending on which text processing tool you use, this may or may not be an issue to worry about.
- The quality of the text should be comparable to native language.
- Besides the abstract in English, you must have the abstract also in German. On the German abstract, you must provide the German title for the thesis.

7. Figure, Tables, Equations

- Particularly figures help making the text more readable and keep the reader from falling into despair (or, at least, asleep) because of 60 pages of pure text, text, and text.
- But don't write a comic. Use only meaningful figures or tables that really add value.
- Reference explicitly and explain every figure, table, and equation. E.g. one writes: "Figure 1.2 shows ...". Note that all figures and tables are for illustration purposes. Finally, it is the text that matters, i.e. your text should carry all the thoughts that you wish to convey to the reader.
- Use a coherent numbering and labeling scheme for all of them.
- Figures taken from other publications should always be redrawn by you. In case this is not possible (e.g., if the figure is too sophisticated) make sure that you have the rights to copy the figure (by asking the author or publisher for permission, for example). In any case, there should be a clear indication where the image is from (Source: [xyz]) or (Source: derived from [xyz])

8. Formatting

- Use a readable serif font (e.g., Time-New-Roman).
- Make reasonable use of the space on an A4 page and avoid too wide margins.
- Use 11 or 12 point font and at least 1.5 line spacing for copies to the thesis supervisor so that is possible to write between the lines with a pen. You may reformat to one line spacing for the final bound version (preferred).
- Use coloring, shading, or other forms of emphasis, typesetting rules, etc. consistently.
- Make sure that your thesis looks like a final product and not like an early prototype
 - Page breaks are in the proper locations (no orphans or widows).
 - Proper graphics embedded in a scalable format (no bitmaps except for photographs) so that the results do not look like from a dot matrix printer (anyone remembers?).
 - Graphics use sans-serif fonts.
 - Text margins aligned with tables and figures.
 - Use centering or alignment properly and consistently
 - Start each chapter on a new page and leave some white space on the first page of the chapter.
- If you use colors in figures or graphs, remember that your thesis should also be readable and understandable when printed on a black and white printer.
- For the title page, follow the department guidelines. Do not forget to a serial number from the Lab before submission.
- Finally: form follows function: while a proper presentation is important the contents is even more.

9. Common mistakes

- Missing articles: "the", "a", "an"; some languages don't use articles but English does. So don't forget them. Unfortunately, with many papers published by a broad range of

authors, quite a bit of published work is no longer a reference for language learning by reading.

- Graphs missing variances. There must be a way to evaluate the accuracy and statistical relevance of the results.
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