



Die Matiker e.V.

Freundinnen und Freunde
der Mathematik und Informatik
an der Universität Paderborn

How to Write a Bachelor's or Master's Thesis

Dr. Harald Selke

The Problem of Writing a Thesis

- What is to be done?
 - Find an interesting topic
 - Narrow down the topic to a question that can be answered within the given time
 - Plan the project: Deadlines, Time management
 - Do your research: Books, Journals, Web, Talks
 - Find a structure: Mind Mapping or other methods
 - Write it all down
 - Present your work
 - Earn the merit and receive feedback

Mind the Tools

- Writing your text
 - TeX
 - Word
 - OpenOffice
 - or whatever you like
- Know your software!
 - Use software that you have used before or learn a new software before you register your thesis!
- Little helpers—not necessarily software
 - Literature and reference management
 - Versioning for text and software (if applicable)
 - Structuring
 - Feedback and Revisions
 - Backup – second site

Plan Ahead and Reserve Your Time

- Bachelor thesis: to be written in parallel to courses, exams, etc.
 - 15 ECTS \triangleq 450 hours
 - Average workload: 18.75 hours per week
 - Usually close to 60 pages
- Master thesis: ideally no other obligations while writing
 - 30 ECTS \triangleq 900 hours
 - Average workload: 37.5 hours per week
 - Usually up to 120 pages

Find an Interesting Topic

- Topics offered by a research group
 - Overview of current work in a group
 - Topics often well-defined; sometimes limited room for own ideas
 - Supervisor is usually interested in a certain result
- Talking with potential supervisors
 - Development of the topic—takes some time
 - Takes into account your motivation as well as that of the supervisor
 - The better your ideas are, the more interesting will the topic be to you
- Bring your own idea
 - Rather the exception than the rule, yet possible
 - Results often not of particular relevance to the supervisor
 - Students tend to think too big
- Cooperation with a third party
 - Serving two masters
 - Works best if the supervisor is involved in a cooperation with the third party

Narrow Down the Topic

- Preparation and planning
 - Bachelor thesis: 90 hours in 4 weeks
 - Master thesis: 150 hours in 4 weeks
- Written agreement on exact topic, objectives, and schedule
 - What is the goal of the thesis?
 - Agreement on objectives: about 10 lines
 - Draft by you
 - Final version in coordination with the supervisor
 - Detailed plan: 2–3 pages
 - Which work packages are necessary?
 - Plan the sequence and time needed for each of the packages
- Register the thesis
- Start working immediately

Plan the Project

- Deadlines
 - Be serious about the deadlines for work packages
 - If you do an implementation, define for how long you will work on it
 - in agreement with the supervisor
 - guideline: maximum 50% of the time
 - You will need longer for writing everything down than you anticipate
 - Plan for two weeks at the end for proofreading
- Time management
 - A plan is a plan is a plan—it is meant to change
 - First draft will most certainly be different from the result
 - Permanently watch your time management and adjust when needed
 - Keep in mind that delays in a work package are provided for in the new plan
 - When serious problems occur: talk to your supervisor—and do it early
 - Take into consideration: courses, exams, job, start and end of terms, absence of the supervisor

From Ideas to Text

- Uncertainty can lead to writer's block
- Look at creativity tools and pick those methods that you find appealing
- The following are just examples, no recommendations!

- Generating Ideas
- Structuring Ideas
- Defining Tasks
- Writing Things Down
- Checking the Structure

- Kompetenzzentrum Schreiben: <http://www.uni-paderborn.de/schreiben/>
- Meet your supervisor at regular intervals

From Ideas to Text: Generating Ideas

- Let your ideas flow—don't judge, don't drop ideas
- Take a note for every single aspect
- Sorting ideas only comes later

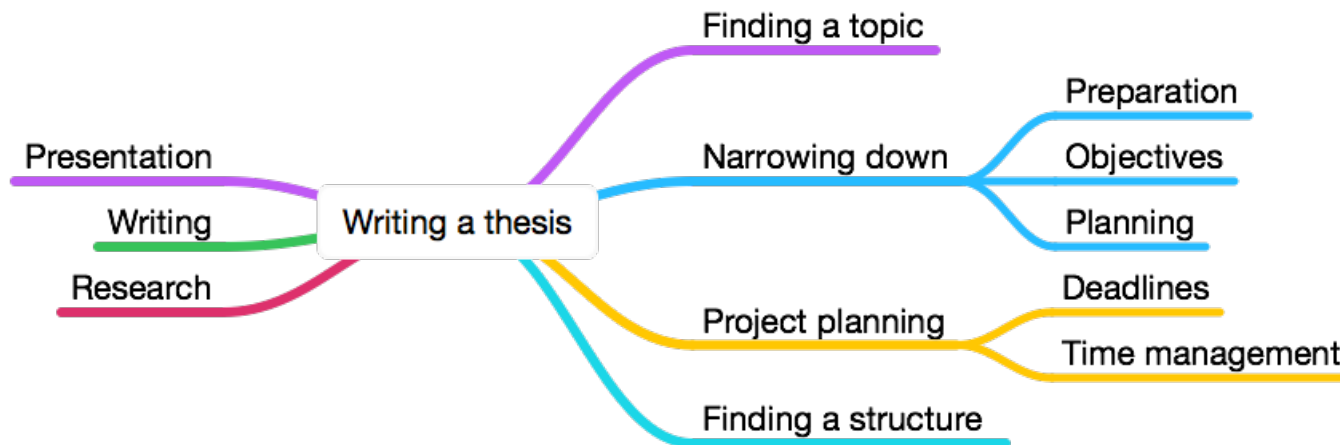


Brainstorming

From Ideas to Text: Structuring Ideas

- Start with a core aspect of your thesis or chapter
- Cluster your ideas and cluster the clusters
- Keep unused ideas somewhere outside the structure
- Switch between top-down and bottom-up as you like

- How to write a thesis
- Finding a topic
- Narrowing down
 - Preparation
 - Objectives
 - Planning
- Project Planning
 - Deadlines
 - Time management
- Finding a structure
- Research
- Writing
- Presentation



Mind mapping

From Ideas to Text: Defining Tasks

- Start with broad tasks and refine them whenever necessary
- Complex tasks can be broken down into new tasks anytime
- New tasks can be added at any time
- Colors can be used for different kinds of tasks



Kanban

From Ideas to Text: Writing Things Down

- Start anywhere, start early
- Don't attempt to write down anything that will not be modified later
- Work on different parts of your thesis simultaneously if you are stuck in one part



Let it snow

From Ideas to Text: Checking the Structure

- For every paragraph, try to boil down its content to one short sentence
- Check if within every section and chapter, the summarized sentences reflect what you are trying to say and if the structure of your argumentation is clear

Outline-Point by Point: Weather

I. Beach and Snow

A. Weather



- A. When choosing to go on a beach vacation, you are hoping for sunshine, warm nights and 80 degree days with no rain.
- B. The heat from the sun combined with the refreshing cool water from the ocean or the pool is ideal for a beach vacation, but make sure you have plenty of sunscreen to combat the harmful rays from the sun.
- C. If a ski vacation is on your horizon, you should plan for fresh snowfall and temperatures in the 30's.



- D. If the weather is in the 30's, there is a good chance that you will be awarded with fresh powder for skiing.

Point by point outline

Structure of a thesis

- Title and abstract give an overview of the thesis.
- The conclusion surveys the results of the presented work.
- The introduction gives an overview of the context and assumptions.
- The introduction states the main results.
- The introduction describes the structure of the thesis.
- Include a list of all references at the end.
- Include appendices, lists of figures and tables etc. only if necessary.
- Include software on a DVD—check with supervisor.

Title

Abstract

Introduction

- What is it all about?
 - Motivation
 - Definition of the problem
 - Methods used
 - Main results
 - Conclusion
- Structure of the thesis

Body

Conclusion

- Summary
- Assessment of results
- Relation to the context
- Future work
- Reflection

Rules, rules, rules

- Writing for an audience, not for yourself
- Ease the process of reading
 - Rules of language
 - Make your words comprehensible: no jargon, no journalese
 - Rules of grammar
 - Make your text understandable
 - Rules of typography
 - Make your text readable
 - Rules of argumentation
 - Make your thoughts intelligible
 - Rules of scientific discourse
 - Make your argumentation and design decisions comprehensible
- Reading your thesis should be somewhat pleasant
- Mistakes are at least annoying to any reader familiar with the rules

Rules of language and grammar

- You are not writing for a computer magazine, nor for a newspaper or a novel.
- You are writing not to express yourself but to make your reader understand what you were thinking when writing your thesis down.
 - Be more or less specific.
 - Who needs rhetorical questions?
 - Contractions aren't necessary.
 - One-word sentences? Eliminate.
 - Do not use excessively long sentences but use complex sentences whenever the argumentation requires them; your readers are not dumb.
 - If there is a relationship between two arguments, use linguistic means to clarify that relationship instead of letting the reader guess about its nature.
- Tense is important.
- Commas are, too.
- Dashes are as well.

It's is not, it isn't ain't, and it's it's, not its, if you mean it is.

If you don't, it's its.

Then too, it's hers. It isn't her's.

It isn't our's either. It's ours, and likewise yours and theirs.

Rules of typography

- Typesetting is
 - not a question of art, but one of simple readability of text.
 - not a question of software but a question of professionalism—just like grammar.
- The content determines the layout.
- General guidelines:
 - Be consistent in the use of all elements.
 - Align items with the eye not with the ruler.
 - Use as few design characteristics as possible but as many as necessary.
 - Design these elements so that they can be distinguished easily.
 - Be aware of the rules and conventions—down to micro-typography.
 - Length of dashes: - – —
 - Quotation marks: „...“, »...«, “...”

Letters

- Typefaces
 - Sans-serif typefaces usually work best for slides and headlines.
 - Serif typefaces usually work best for longer texts.
 - Combining typefaces is not easy.

Times Century Schoolbook Garamond

- Often-used type sizes
 - Body 10 to 12 pt
 - Footnotes and long quotations 2 pt less
 - Headlines 24, 18, and 16 pt without any further emphasis
 - Cover-page 36, 48 or 72 pt

Helvetica Futura Gill Sans Verdana

- Emphasis by italics;
no bold face, no underlining

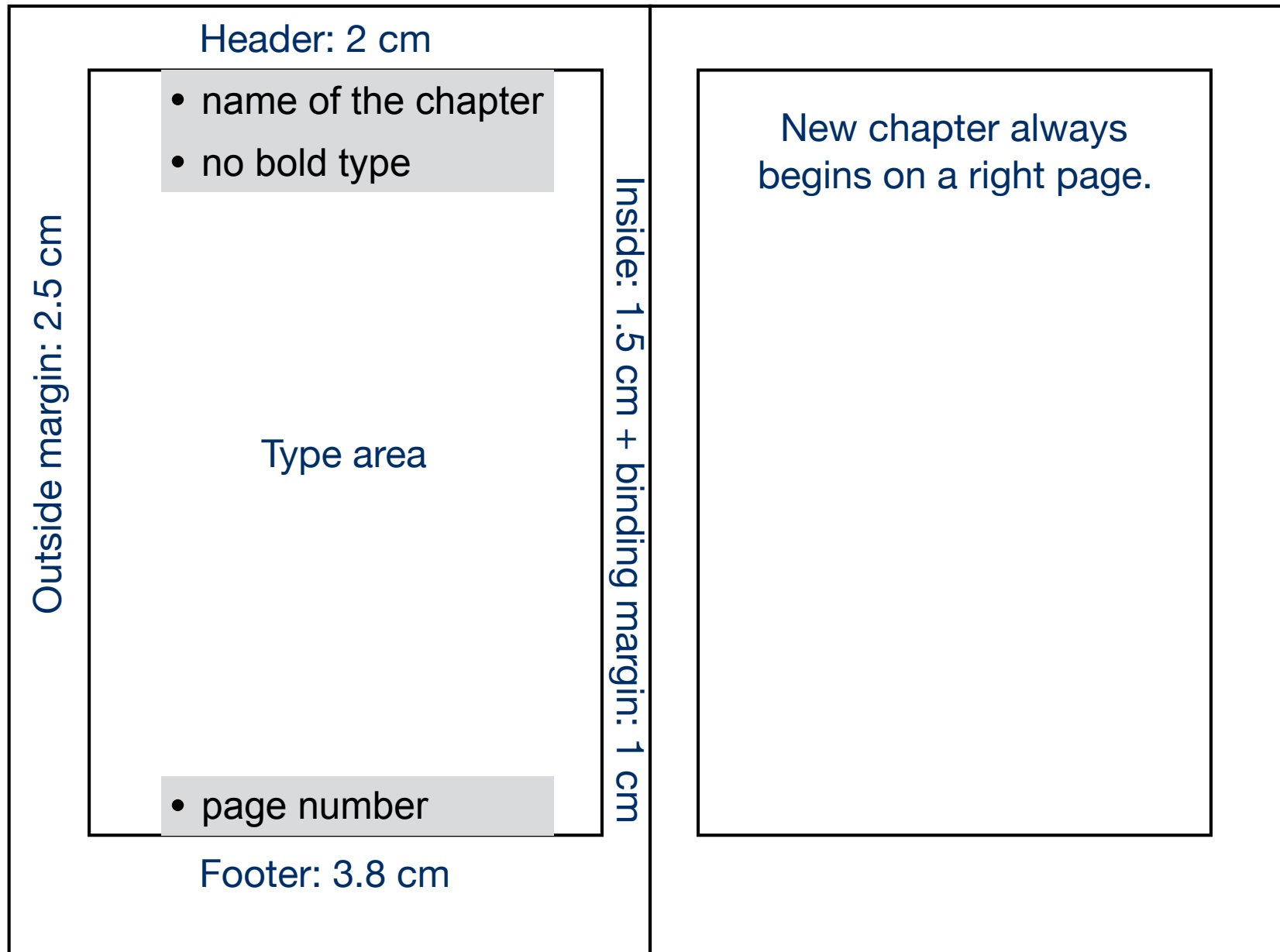


Paragraphs

- Do not use a linespacing of 1.5 times.
- Often, a 2 to 3 pt leading (Durchschuss) is a good idea—depending on the type size and the length of the lines.
- Typography experts recommend to use no extra space between paragraphs but to use an indent for the first line of 0.5 to 0.7 cm.
- Use either justified setting (Blocksatz) or draft setting (Rauhsatz).
 - Watch out for maximum word distances in justified setting.
 - Linespacing should be larger than the maximum word distance.

▼
Der Zeilenabstand ist größer
▲ als der Durchschuss. ▲

Pages



Rules of scientific discourse

- State your questions clearly and enable the reader to follow your arguments.
 - State of the art: Where are you starting from?
 - What are the problem and the objectives?
 - Do not make claims, do not make statements.
 - Make arguments, give proof or evidence and name your sources.
 - You don't get "paid" for a brilliant idea, but for solid argumentation!
 - Present your solutions and let the reader understand what your achievements are.
 - Do not just describe the result.
 - Describe alternatives you considered.
 - Compare your results to those of others.
 - Name your methods and why you used them—and not other methods.
 - Draw conclusions and let them have an effect on what follows.
- Be clear in your terminology and know who your readers are.

Referring to the work of others

- Take notes along the way:
 - When you read something of interest, copy it into your notes
 - together with a reference to the source with the exact page number!
 - If possible, mark the passage of interest in the source paper.
- Give references
 - when quoting a short or long passage from another publication
 - when summarizing statements of another publication
 - when interpreting statements from other publications
 - when using other publications to strengthen your point

Context of references

- Keep the context of the referenced source in mind and do not distort the statement.
- Always use primary sources, giving precise information on where the statement is to be found—in general this means stating the page.
- Secondary sources may only be used when there is no way of obtaining or understanding the primary source.
 - Make clear that you only read the secondary source!
- Long quotations are rarely necessary. If you need one, format it in a way that the quotation can be easily identified.
- Do not use quotations instead of own statements and arguments.
- Do not alter anything within a quotation with the exception of abbreviations, additions or emphasizing:
 - Identify abbreviations by “...”, additions in square brackets
 - Identify emphasis by “emphasis by the original author” or “emphasis by me”.
 - Errors and typos in the source must not be corrected “[sic!]”.

Making a reference

- Reference the source
 - within the text
 - The notion of an external memory is explained in Keil-Slawik (1990).
 - The notion of an external memory (cf. Keil-Slawik, 1990) ...
 - or in footnotes—which should only be used for references and short remarks
 - see also Engbring, Keil-Slawik, Selke (1995), pp. 12ff.
- Choose the way of referencing to ease reading and ask your supervisor for their preferences: [42], [GS90], (Gibson, Sterling 1990), ...

List of references: Books

- Hamm, Ingrid; Müller-Böling, Detlef (Hrsg.): *Hochschulentwicklung durch neue Medien: Erfahrungen – Projekte – Perspektiven; mit einer Bestandsaufnahme über Multimedia-Projekte an deutschen Hochschulen*. Verlag Bertelsmann Stiftung, 1997.
- Höök, Kristina; Munro, Alan; Benyon, David (eds.): *Workshop on Personalised and Social Navigation in Information Space*. SICS Technical Report T98:02, Kista, Sweden, 1998.
- Jonassen, David H.; Mandl, Heinz (eds.): *Designing Hypermedia for Learning*. NATO ASI Series F, vol. 67. Springer, 1989.
- Riehm, Ulrich; Wingert, Bernd: *Multimedia – Mythen, Chancen und Herausforderungen*. Arbeitsbericht Nr. 33, Büro für Technikfolgenabschätzung beim Deutschen Bundestag (TAB), 1995.

List of references: Contributions

- Brennecke, Andreas, et al.: Das Lehren mit elektronischen Medien lernen – Erfahrungen, Probleme und Perspektiven bei multimedialgestütztem Lehren und Lernen. *Wirtschaftsinformatik* 39 (6), 563–568 (1997).
- Keil-Slawik, Reinhard, et al.: Multimedia in der universitären Lehre. Eine Bestandsaufnahme an deutschen Hochschulen. In: I. Hamm, D. Müller-Böling (Hrsg.): *Hochschulentwicklung durch neue Medien: Erfahrungen – Projekte – Perspektiven; mit einer Bestandsaufnahme über Multimedia-Projekte an deutschen Hochschulen*. Gütersloh: Verlag Bertelsmann Stiftung 1997, S. 73–122.
- Klemme, Michael; Kuhnert, Ralf; Selke, Harald: Semantic Spaces. In: Höök, Munro, Benyon (1998), pp. 109–118.

- Online sources:
 - Author and Title of the document
 - Last date of change (when available)
 - Make sure the document will be available to the reader

The front matters

- Cover page
 - Set headings in type size 36, 48 or 72 pt
 - Organise all elements into 3 groups
 - Title plus subtitle (if any)
 - Type of thesis (Master's thesis, Seminar paper etc.)
 - Author, affiliation, date
 - Do not use logos if no one requires you to do so.
 - Ask the supervisor and the Prüfungssekretariat for specific requirements.
- Table of Contents
 - Subsections to third or fourth level maximum.
 - Including page numbers.
- Appendices if necessary:
 - Large tables
 - Source code