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DRUIDIC KNOWLEDGE ON WRITING A THESIS

UNFINISHED LECTURE NOTES

"NOT ALL THOSE WHO WANDER ARE LOST"

BILBO BAGGINS

Contents

Introduction

We have all been there—facing that empty stack of papers or pixels for that matter, ultimately facing the daunting task of writing a scientific thesis.

THIS GUIDE distills years of experience into practical advice for crafting a clear, coherent, and compelling thesis. It covers essential aspects such as structure, writing techniques, formatting, and common pitfalls to avoid.

FEEDBACK IS INVALUABLE in this process. If nothing is expected, Feedback is. If you have suggestions, corrections, or additional tips, please reach out. Your contributions will help enhance this guide for future readers.

THIS DOCUMENT IS A LIVING WORK AND SHOULD NOT BE CONSIDERED COMPLETE—there are approaches I have tested and refined, others I am still exploring, some I will adapt based on new insights, and perspectives I thought I understood but continue to evolve.

CONTRIBUTE - This project is open for contributions, via GitHub https://github.com/Quillstacks/ThesisWork to report issues and suggest improvements, submit a pull requests.

Preamble

Best Practices

SELECT A TOPIC that aligns with your interests and career goals. Ensure the topic is feasible within the given timeframe and resources. To discuss a potential topic with a supervisor, prepare a brief proposal outlining your research question, objectives, and methodology.

MANAGE YOUR RESPONSIBILITIES when engaging in a cooperation between industry and academia. Students must manage both tasks carefully, as this is a great way to learn what is of interest to the practitioner, the requirements for the thesis and the external position may differ at times.

ENSURE THE SUPERVISOR'S research interests and expectations align with your thesis work. Look for supervisors with a strong track record in guiding successful theses. Reflect on whether you prefer a hands-on or hands-off mentorship style and choose accordingly.

TEMPLATES, there are usually always templates provided by your institution, or Professor, make use of them.

READ THIS GUIDELINE, really this will take you a long way. A nice side-effect is that feedback and discussion rounds will be more focused on content than formatting or structure - your work and you can only benefit from that.

To GET your template click here. Also for you, if you want to find guidance on thesis structure.

START EARLY and divide your work into manageable efforts, with clear artifacts. Do the same for your writing - for same page you will need a whole day. Start early, get a first prototype or draft down, and iterate. The first thing you want to have is an outline of your thesis structure.

Then go for your full introduction part, which helps you clarify your problem statements and targeted contributions.

A GREAT FIRST OUTLINE can be your table of contents.

WRITE IN ENGLISH at all cost. This is research, you are writing to be read and to make an impact with your contribution. Don't handicap yourself by writing in a language that is not widely understood in the scientific community. Make use of our lingua franca - English.

READ YOUR THESIS You should have read your own thesis multiple times before submitting it. You should have read it for flow, for structure, for content, for formatting, for appearance, for typos, for grammar, for punctuation - you name it. You should have someone else read it as well, preferably someone who is not familiar with your work.

CHECKLISTS are your friend.

USE LATEX to write your thesis. Personally, I can recommend Visual Studio Code combined with the extensions LaTeX Workshop (for TeX support) and LTeX (for spell and style checking).

ESTABLISH A PLAN, it is crucial to establish a personal schedule and workflow. Unlike regular coursework, writing a thesis comes with no fixed timetable. You must decide for yourself when and how long to work, and set your own milestones. Do not underestimate the importance of planning and executing the plan. Develop a routine that fits your productivity peaks and other commitments.

STAY ORGANIZED, keep track of your sources, notes, and drafts. Your thesis document, can help a lot in this, but should not be the only place where you structure, plan and document your experiments and work.

BACK UP YOUR WORK. Use version control to be able to recover your work. Back up regularly, better automatically. And this is not only about your writing, but also your code, data, and any other digital artifacts you create during your research.

CONSTANT DRIPPING wears away the stone. Constant progress, even if small, accumulates over time and leads to significant results. Work on your thesis every day, and avoid long breaks. Thoughts need time to mature and incubate in your brain, even when you are not actively working on your thesis.

MOTIVATION FLUCTUATES. This is normal. Progress is not linear, so frustration and self-doubt are part of the game. Embrace it, this is not only you. In such times it is even more important to stick to the routine, divide work into small manageable tasks, and celebrate small wins. Welcome to the grind.

WHEN NOTHING ELSE WORKS, fall back to what I call productive procrastination—organize notes, format your writing, polish figures.

When you get stuck there are a few strategies:

- Solve an easier version of the problem first.

- Use another approach or method.

- Talk to peers, supervisors, or mentors for fresh perspectives.

Brief Note on the Use of AI

"The use of AI does not change the fundamental principles of academic integrity. AI tools should be regarded as supplementary resources, similar to calculators, and used with responsibility and understanding." [1].

AI is here to stay, it is to be understood as a tool, a tool you need to gain proficiency with. As such I encourage you to explore the use of AI tools in your thesis and research work while being mindful of their limitations. Do not rob yourself of valuable learning experiences. In the following we will outline some guidelines and guardrails to follow.

Whitelisted AI allows for the use of AI without further documentation requirements, as proposed in [2].

- Spell and grammar checking

- Thesaurus tools

- Translation assistance (excluding direct quotations)

- Simple proofreading (reviewing structure and logic, suggesting reformulations)

- Error checking in code

- Support in the general understanding of models, graphs, tables and/or illustrations

AI usage beyond those whitelisted need examiner approval. Their use must be made transparent, and follow basic principles of adacemic integrity.

AI can be cited as such, *"Sure feel free to cite me (ChatGPT [Large Language Model], 2025)."*

[1] C. for Control and U. o. F. Integration of Grids, INATECH. *Master's Thesis Preparation Guideline*, 2025

In short. When you try to hit a nail with a hammer, you can not blame the hammer if you end up hitting your thumb. It will have been you. This should not stop you from using the hammer in the first place.

Just ask yourself: Am I producing original and thoughtful work? You should be able to answer with yes.
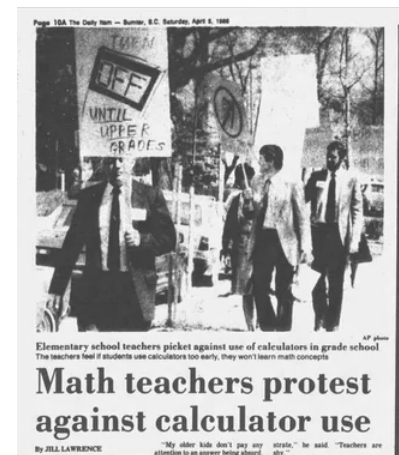

Figure 1: Math teachers protest against calculator use in 1966.

[2] R. Department of Economics, Institute for Environmental, E. Spatial Economics, Faculty of Business, and K. U. Social Sciences. *Guidelines for Writing a Thesis or Seminar Paper*, oct 2025. URL https://www.bw.uni-kiel.de/en/economics/study-programmes/thesis-guidelines.pdf. Accessed: 2024-06-10

Format

As you will be using a template to write your thesis, you will be adhering to a predefined format already. This includes specifications for margins, font size, line spacing, and citation style. But this only gets you so far.

The last mile is up to you, your attention to detail and your diligence. Sadly this is where many theses fail to deliver on a basic expectation, this is completely unnecessary - this is something to grind your way out.

Great formatting requires diligence, the good news is, this *only* requires diligence.

On Length

Brevity is valued -so you should write as little as possible, as much as necessary.

On being concise:
  Embrace short sentences and paragraphs, no fill-words.
  Equations and figures can condense information by a lot.
  Focus on the core aspects.

As a rule of thumb,

- A title or header should have no more than 13 words.

- A sentence should have around 15–20 words, maximum 25 words.

- A paragraph or subsection should ideally be around 75–140 words, maximum 200 words.

- A section should ideally be around 1,200–2,000 words, maximum 2,800 words.

- A chapter should ideally be around 2,400–4,800 words, maximum 6,000 words.

- A thesis should ideally be around 12,000–18,000 words, maximum 24,000 words.

On Hierarchy

Subsections should be numbered using a decimal system that reflects their hierarchical position within the chapter (e.g., 1., 1.1, 1.2, 2.1, etc.). If there is a need for further subdivision, use a third level of numbering (e.g., 1.1.1, 1.1.2). Dividing only makes sense if,

a) you end up with at least two subsections when you divide a section.

b) you avoid going deeper than three levels of hierarchy to maintain clarity.

c) there is enough and distinct content to justify it.

MARGIN NOTES, in general these should be used to provide supplementary information, clarifications, or additional context that enhances the main text, yet would disrupt its flow otherwise. They should be concise and directly relevant to the adjacent content.

On Fontstyle

When using the Tufte-LaTeX template, the font styles are predefined. However, here are some general guidelines for using font styles effectively in your thesis:

• Bold is used for emphasis, such as highlighting key terms or concepts when they are first introduced. Especially the key (first) term in lists.

• Italics are used for emphasis within a sentence, for foreign words, or for direct quoting.

• Underlining is generally avoided in academic writing, as it can be confused with hyperlinks in digital documents. Instead, use italics or bold for emphasis.

MARGINNOTES, typically use a smaller font size, which is predefined in the Tufte-LaTeX template. Ensure that the font style in margin notes is consistent with the main text for a cohesive appearance. Shy away from using italic, bold styles - when needed use *newthought* all caps.

QUOTES

> This is a block quote example. Block quotes are used for longer quotations that exceed a certain length (usually more than four lines of text). They are typically indented and may use a smaller font size to distinguish them from the main text.

Lists

When using lists, whether numbered or bulleted, ensure they are formatted consistently throughout the thesis. Use parallel structure for list items, meaning that each item should be readable as a standalone phrase or sentence. Use numbered lists for sequences or steps that require a specific order, and bulleted lists for items that do not have a particular sequence. Use alphabetic lists when you need to reference items individually within the text, but they do not have a specific sequence. Use appropriate punctuation at the end of each list item, using commas or semicolons for items that are phrases, and periods for complete sentences.

Figures and Tables

Figures and tables should be numbered consecutively throughout the thesis for easy reference. They should be placed as close as possible to the first point of reference in the text - that also means there is at least one. Each figure and table should have a clear and descriptive caption that explains its content and relevance. Keep it concise 2-3 sentences. For further guidance on visualizing data effectively, refer to Tufte's principles on the visual display of quantitative information [3].

Tufte's Principles for Effective Figures (for comparison see Fig. **??**):

- **Maximize the Data-Ink Ratio:** Use as little non-essential ink as possible (including colour usage). Every mark should represent data or support its understanding.

- **Erase Non-Data Ink (Chartjunk):** Remove decorative elements such as borders, heavy gridlines, 3D effects, shading, clip art, etc. If it doesn't convey information, it shouldn't be there.

- **Erase Redundant Data-Ink:** Don't repeat information unnecessarily—avoid duplicate labels, overly dense tick marks, thick axes, repeated symbols. Keep only what's needed.

- **Emphasize Clarity and Precision:** Be accurate, honest, and exact in visual encoding—use proportional scales, correct baselines, avoid distortion and misleading area/volume effects. Clarity over decoration.

- **Use Small Multiples:** Present multiple comparable graphics with consistent design. Useful for comparing groups, showing changes over time, or exploring multidimensional data.

Keep each item of a bullet point list,

- readable on its own.
- parallel in structure.

Aphabetical lists make items,

a) referencable.
b) not necessarily ordered.

These items definitely,

1. follow a specific,
2. sequence.

[3] E. R. Tufte. *The Visual Display of Quantitative Information*. Graphics Press, Cheshire, CT, 2 edition, 2001

- **Integrate Words, Numbers, and Graphics:** Place labels near the data, integrate text directly into the plot, and avoid legends unless unavoidable. Visual and textual explanations should coexist naturally.
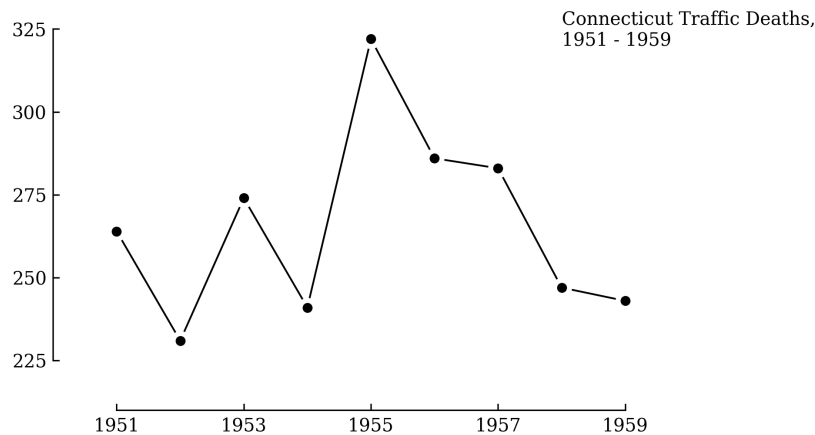

Connecticut Traffic Deaths, 1951 - 1959

Figure 2: Basic line graph after Tufte. Data emphasized, axes info in title, minimal ticks, reduced non-data ink.

WHEN REFERENCING figures and tables in the text, use their assigned numbers (e.g., "as shown in Figure 2.1" or "see Table 3.2") - LaTex does that for you. If you want to keep it short it is also acceptable to write (see Fig. 2.1) or (see Tab. 3.2).

Category	Value 1	Value 2
Example A	42	3.14
Example B	17	2.71

Table 1: Example of a well-formatted table with a clear, concise caption. Make sure to go *full width* for tables and figures, and embrace *horizontal lines*, while avoiding vertical lines.

ENSURE that all figures and tables,

- reference source information if they are not original.

- are relevant to the content and contribute to the reader's understanding.

- are referenced in the text before they appear.

- are still interpretable in grayscale, when using colour.

DESCRIPTIVE meaning, that it answers the question, What am I looking at and why is it important?. Not, "on the x-Axis we have time in seconds.

A good example:
Figure 2.1: Overview of AI adoption trends across industries, illustrating the rapid increase in usage and highlighting key sectors driving innovation.

Mathematical Notation and Equations

PRESENT MATHEMATICAL NOTATION clearly and consistently. Define all symbols and units on first use. Often it is helpful to include the equation into a sentence, such as "The relationship between force $\mathbf{F}$, mass m, and acceleration a is given by Newton's second law, expressed as:

$$\mathbf{F} = m \cdot a. \tag{1}$$

Notice how the equation is part of the sentence and ends with a period. When embedded into a sentence use a comma if the sentence continues after the equation. When displaying equations, center them on the page and number them consecutively for easy reference (e.g., Eq. 1, Eq. 2).

ON NUMBERS AND UNITS. Numbers should be written consistently, using either words (until twelve) or numerals based on context. Always include units with numerical values, using the International System of Units (SI) where applicable.

Code

WHEN INCLUDING CODE in your thesis, it will be pseudo-code. For everything else use proper references to code repositories, e.g., GitHub, GitLab, Bitbucket. Ensure that any code snippets included are well-documented and formatted for readability.

RUNS ON MY MACHINE.
  Is not acceptable, make sure to host your solution (or a meaningful part of it). At least provide a Docker container or similar means to reproduce your results fast and reliably.

CODE PLAYS A VITAL ROLE in your research. Think of code as a means to communicate, make your contributions transparent, reproducible, and extendable for future studies. Thus it is best practice to host your code in a public repository, providing a clear README file, usage instructions, and documentation of dependencies and environment setup.

Algorithm 1: Pseudo-code for Gradient Descent Optimization

Require: Initial parameters θ_0, learning rate ϵ, loss function $L(\theta)$
  1: $t \leftarrow 0$
  2: **while** not converged **do**
  3:     Compute gradient: $g_t \leftarrow \nabla_\theta L(\theta_t)$
  4:     Update parameters: $\theta_{t+1} \leftarrow \theta_t - \epsilon g_t$
  5:     $t \leftarrow t + 1$
  6: **end whilereturn** θ_t

Abbreviations

ABBREVIATIONS need to be defined upon their first use in the text. Ensure that abbreviations are used consistently and appropriately, avoiding overuse which can hinder readability. In titles, headings, and figure and table captions, abbreviations are not to be used.

For example, Artificial Intelligence (AI). Thereafter, the abbreviation can be used throughout the document.

Punctuation and Signs

PUNCTUATION in English clarifies meaning and aids readability.

Key marks include: capital letters (start sentences, proper nouns), full stops (end sentences), question marks (indicate questions), exclamation marks (emphasis, in doubt don't), commas (lists, clauses, speech), colons (introduce lists/explanations), semi-colons (link related clauses), quotation marks (direct speech, highlight words), dashes/brackets (extra info), and numerals (full stops for decimals, commas for thousands) [4].

Punctuation marks should be placed inside quotation marks if they are part of the quoted material, and outside if they are not. In terms of visual appearance, punctuation and other signs can not be at the beginning of a line, bind signs to a word by making use of   in LaTeX.

EXAMPLES:

- Capital: Dr David James is the consultant at Leeds City Hospital.
- Full stop: We went to France last summer.
- Question mark: Why do they make so many mistakes?
- Exclamation: Listen!
- Comma: It's important to write in clear, simple, accurate words.
- Colon: There are three main reasons: economic, social, political.
- Semi-colon: Spanish is spoken throughout South America; in Brazil the main language is Portuguese.
- Quotation: She said, "Where can we find a nice Indian restaurant?"
- Dash: Our teacher – who often gets cross – wasn't cross at all.
- Brackets: Thriplow (pronounced 'Triplow') is a small village.
- Numerals: 7,980 (thousands), 6.5 (decimal)

[4] C. Dictionary. Punctuation, 2025. URL https://dictionary.cambridge.org/grammar/british-grammar/punctuation

Line and Page Breaks

WIDOWS AND ORPHANS are to be avoided at all cost. A widow is a single word or short line that appears at the end of a paragraph and is left alone at the top of a new page, after a table or figure or column. An orphan is a single word or short line that appears at the beginning of a paragraph and is left alone. To prevent widows and orphans, adjust the text by rewriting sentences or changing spacing, e.g. \vspace.

Writing

Write with the reader in mind.

Good scientific writing is an art form - it is clear, specific, concise, and coherent. An indepth treatment of style and writing is delivered by Steven Pinker [5]

Be Clear

It is crucial to establish a central idea or line of thought that runs throughout your thesis. This theme should be reflected in the title, table of contents, and in the relevance of every sentence and section to your main research question. Always make clear to the reader how each part of your work connects back to your problem statements.

Explicitly discuss links between different results and highlight the contributions of your work connecting back to your problem statements. If any word, sentence, paragraph, or section does not support your central theme or research question, it should be omitted.

Be Specific

Always argue based on results and sources - and whenever possible quantify. Avoid vague expressions such as *"the results are good ..."* or *"I feel that ..."*. Also avoid imprecise statements such as *"Under certain assumptions, we get the following result ..."* or *"It is generally known that ..."*. Of course, you must document any facts, claims and opinions that you have borrowed from the literature. Nevertheless, when leaning on sources, make sure to give them context, and elaborate on their essence to enable a clearly structured argument.

Be Concise

Each sentence should convey a single thought clearly and directly. Each paragraph should develop a complete idea [6].

A thesis is usually not read in linear sequence. But rather Abstract - Problem Statement - Conclusion.

And only then will the inclined reader go for the methods and results sections in depth. Make sure to not loose them on the way.

[5] S. Pinker. *The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century.* Viking, New York, 2014

When referencing your own chapters or sections, make use of \ref{sectionname}, avoid forward references.

[6] C. for Control and U. o. F. Integration of Grids, INATECH. *Master's Thesis Preparation Guideline*, 2025

- Use active voice where possible.

- Eliminate redundant phrases (e.g., "in order to" → "to").

- Prefer simple words over complex ones (e.g., "use" instead of "utilize").

- Break long sentences into shorter ones.

- Avoid filler words (e.g., "very," "really," "just").

- Avoid "we" or "I" unless necessary.

- Ensure orthographic and grammatical correctness!

Be Consistent

Consistency is key throughout everything in your thesis. You decided for a specific word choice, a specific notation, a specific nomenclature - stick to it.

ESPECIALLY when you decided on a specific terminology. Avoid synonyms to achieve creative variation, such as drug, medication, etc. in favour of semantic consistency for the reader.

Concluding

WRITING A SCIENTIFIC THESIS IS A PROCESS that demands clarity, structure, and diligence. By following established best practices, working smart and maintaining academic integrity you can produce a thesis that is both impactful and accessible. Remember, the journey is iterative—embrace feedback, stay organized, and let your work reflect expertise, craftsmanship, and thoughtful originality.

YOU CAN LOOK FORWARD TO SCROLLING THROUGH YOUR THESIS, it will be oddly satisfying.