



On the intersection of desirability, reachability and sleeping disorder: the role of the final thesis in the maturation of a student

Whathave I. Learned

Bachelor thesis (Student ID 450100)
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Cover photograph: Example of a fossil in a reef. Source: somewhere from the internet ...

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Abstract

Place your abstract text here

Attention! In \LaTeX you **use an empty line to create a new paragraph**. This leads to the first line of the new paragraph being indented (apart from the first of a section). This is intentional and nice! If you disagree, you can redefine the settings (`parindent` and `parsep`¹), but PLEASE NEVER use the double-backslash to end a paragraph! That is bad style and can get you into all sorts of incompatibility problems.

So: no `\\` to end paragraphs!

And while we are at it: \LaTeX has a few notational standards differing from ordinary writing programmes. For example, **quotation marks** are typically *not* correctly displayed! Although tedious, use ``` (i.e. backticks) and `'` (i.e. apostrophes) to achieve “this” (i.e. typographically satisfactory quotation marks).²

When you cross-reference a figure, you don’t want the number to be separated from the word by a new line, but rather keep “Fig.” and “3” together. To do so, \LaTeX offers a **non-breakable space**, using the tilde (`~`), like so: `Fig.~\ref{fig:studysite}`. (A breakable forced space would simply be two curly brackets around an empty space, i.e. `{ }`, as I used every time after the \LaTeX -command above.)

If you want to **display code** (of virtually any programming language, including R, Matlab, C/C++, Java, Python, \LaTeX), you should have a look at the `listings` package.³

¹As demonstrated here: <https://texblog.org/2012/11/07/correctly-typesetting-paragraphs-in-latex/>

²<https://www.maths.tcd.ie/dwilkins/LaTeXPrimer/QuotDash.html> For German text, use `”` and `”`, i.e. with the normal quotation mark: <https://tex.stackexchange.com/questions/38965/problem-with-using-quotations-in-german-document?rq=1>.

³<https://en.wikibooks.org/wiki/LaTeX/SourceCodeListings>, <https://texfaq.org/FAQ-codelist>

Chapter 1

Introduction

Start your introduction here...

Possibly cite some work of others, too (Adiku & Stone 1995). To do so, you have to fill a file (the bibliography, recognisable by the `.bib` ending) with appropriately formatted references. It would be daft to not use BibDesk or JabRef or other software to manage your references and produce this file for you. Then, you cite the references, and the **natbib** package allows you flexibility (with/out parentheses, only the year, etc). The actual style of the bibliography in your thesis is determined by the command `bibliographystyle`, and there are only few defaults. The main differences are between author-year styles (e.g. `apalike`) and numbered (e.g. `ksfh_nat`). Thousands of styles float the internet, recognisable as `.bst`-files, and typically every journal has a different one, every book series re-invents the styles, and you can spend years optimising what is, essentially, not so super important.

Bibliography settings

Just like in any other writing software, references are collected and managed in a dedicated programme (a reference manager, e.g. Zotero, BibDesk, JabRef, ...). This results, for \LaTeX , in a `BibTeX` file, recognisable by the `.bib`-extension, with a readable but very structured content. When you import a publication into the reference manager, the title may be unformatted; italics (e.g. species names) and capitalisation (countries, Names) may well be lost, and you need to put them back in. Eventually, your `BibTeX`-file should have entries that look like this:

```
@article{Dormann1997,
  Author = {Dormann, Carsten F},
  Journal = {Zeitschrift f{"u}r {"o}kologie und Naturschutz},
  Pages = {26--36},
  Title = {Sandrohr (\emph{{C}alamagrostis epigejos} (L.) {R}oth) in {T}rockenrasen des
{B}iosph{"a"}renreservates {S}chorfheide-{C}horin: {B}estandsstruktur, {"o}kologische
{A}uswirkungen und {P}flegemassnahmen},
  Volume = {6},
  Year = {1997}
}
```

You will note that all capital letters in the title need to be surrounded by braces “{ }” to prevent conversion to lower case. Italics, such as the species name here, need to be explicitly emphasised. Diacritic symbols may require special representation, although not if you have set your input encoding correctly (see preamble of this document).

Of course you can use the more flexible `Bib \LaTeX` instead of `BibTeX`, and of course there are some small things to know about the entry types in either. But this should get you started with papers. For books, there is `@book` and for chapters there is `@incollection` (do not

use @inbook, which does not allow you to specify the editors). I try to squeeze everything into these three types of references.

Pay attention to correct capitalisation of your references. Typically, and preferably, Book Titles should be in capitals, as should Journal Names, while journal publications should be lower case, as should be the titles of book chapters. Once your .bib-file is set up correctly, this is all taken care of by the bibliography style of your choice.

Finally, do **not** print both DOI and URL in the bibliography, they are typically near-identical. Check the internet for how to suppress URL in this case (although I think the style used here does that automatically, at the expense of also suppressing the DOI).

To add flourish, you can use so-called “fleurons” to separate paragraphs of the introduction (or discussion) that are really different but have no separate section titles. In novels these are typically changes of scenes within a chapter. The most common fleurons are leaves (🌿), asterisks (*) or wiggles (〰), but I like fleurons related to the topic of your work, so for one on elephants you could do this:



After such a large gap, you should continue without indented first line! Most supervisors may find such embellishments distracting, unscientific bauble (and they are, but hey, life is also fun). So better check with them before submission!

A word on fonts

A good font (or actually: typeface) will disappear behind the content. Virtually all books and newspapers use a serif font (Times New Roman, Garamont, Baskerville, Palatino), and for a good reason. The little ticks at each letter (the “serifs”) link up the letters and allow for faster reading. In the old days, such typefaces were designed in such a way that you could cover the lower or upper half of the letter and still recognise it. Try that with a “sans serif” typeface!

Similarly important is that the most common sans-serif typeface today, Arial/Helvetica, does not distinguish between 1, l and I! Imagine that! I don’t want to have to second-guess what a symbol may mean, and yes, I have seen cases where I wasn’t sure.

So, please, do me and any other reader the favour to stick to a plain, easily readable font! (This one is called “Libertine” and is closely modelled on Times; most people will not see any difference between the two, except for the beautiful ligatures, e.g. “Th”, “fl” and “Qu”.)

For those few people whose work will be assessed by me (Carsten Dormann, Uni Freiburg), here are some general but personal thoughts on what makes a great piece of science.

I think of science as composed of (at least) two parts: *handcraft* and *intellect*. The handcraft is important to “get things right”. It is what you (hopefully) learn to a large extent at university, from designing experiments, to various methods of collecting data, lab work, plotting, analysing, to writing it all up in a standardised (and thereby easily accessible) way. Handcraft includes issues such as reproducibility and publishing ethics.

Intellect is where the actual “science” happens, it is the progress in understanding the world, the increase in knowledge, the broadening of the mind and the trimming down on possible ways things could interact. I see handcraft as the stuff that every baker has to do, too: get the dough set up tastily, have the right ingredients, the right temperature in the oven, a clean working surface, safe working conditions, etc. The baker also should work reproducibly (from day to day) and “publish” (read: sell) his/her results.

It is harder to describe what is a “good”, intellectual science contribution. As first approximation, I think science is stuff that will still be correct in, say, 500 years. I am not against short-term benefits of science, don’t get me wrong, but those are largely engineering, i.e. applying in exceedingly smart ways our *current* knowledge to problem solving. There is no demeaning in calling

an activity “engineering”: it is of vital importance for all our societies, our everyday life and our future. It is (or at least can be) highly creative and responsible, challenging and demanding the highest level of intelligence. During engineering projects, a lot of still-valid-in-500-year-stuff is being produced, i.e. science is “done”.

In a science degree, however, this is not the typical approach to “doing science”.¹ Here, understanding the inner workings is the goal, not an application, or problem solving activity, however worthy. And the key (only?) approach that has over a few centuries proven useful for “doing science” is “the Scientific Method”. This is based on a theoretical understanding, from which we derive hypotheses that are then tested.²

For a BSc, MSc or other scientific work, this has substantial consequences. First, it requires the author to lay out the **theory**. Without theory (or model or process understanding) one cannot derive (“deduce”) hypotheses. Into how much detail of said theory one has to go depends on the actual hypothesis to be tested. If your theory is that the moon was formed from the same material as the earth, and you want to test the hypothesis that thus the mineral composition is the same for both celestial bodies, well, I guess you can keep it short and focus on *which* minerals you want to investigate and *why those*. On the other hand, I would like to know what makes you want to test such a theory, and while you can simply cite some authority on the subject, it is better practice to recount the actual arguments and facts so far.

Next comes the formulation of hypotheses that could be used to test this theory. Obviously a good theory makes an awful lot of statements, so we cannot, in a lifetime, test all of them. Typically the department where you work determines which hypotheses you will test. (This sounds like a really stupid reason, but in real life a lot of things are really stupid.) And, luckily, it is actually not such a bad reason. Your department (or your supervisor’s department) will have experience in a certain way of hypothesis-forming and -testing, will have certain lab facilities, data, collaborations, expeditions and so forth. Hence even though the best way to test a theory may be a specific hypothesis, it will simply be out of reach (think: explode a planet, fly at 90% the speed of light or speak fluent Khoisan). It is IMHO extremely important to be aware of these constraints and limitations! You should be able to answer to any journalist with the best possible way to test a theory, and why you couldn’t use that approach. Don’t even pretend that your approach is anywhere near optimal or even decent. We all are aware of how limited our possibilities are, and grandiosing our ways (if that is a word) is silly, self-deceiving and transparently wrong.

It is very useful, and hard, to go through all the possible outcomes of your hypothesis-testing and work out *in advance* what you learn from it. If there are 120 ways why you don’t get a positive finding, well, then you don’t actually learn much from such a negative finding. Since most easy hypotheses have been tested over the last few hundred years of science, you will most likely find your hypothesis rejected. That is, in itself, fine. But it is only fine if you still learn something from it, if it narrows down possibilities. If, say, you find that a higher plant species richness does *not* lead to a higher monkey density in a Madagascan forest, well, there may be hundreds of reasons why it didn’t. This is no intellectual progress. It is not the lack of a positive finding, it is the lack of a *conclusive* negative finding that will bother reviewers! If, in contrast, you visited one of the 10 candidates for a meteorite impact crater responsible for the Permian-Triassic extinction event, and you found the isotop composition not to be consistent with this site being “it”, well, then we actually learned something (for the next 500 years)!

¹I am aware that many politicians think that this is how science *should* be done, that science is only to directly benefit the university, the society, the economy. Also, I am aware that some thinkers (in a wider sense of the word) suggest that most actual science progress is serendipitous, and hence engineering is all we need. I just happen to disagree, possibly for selfish, stupid or conservative reasons.

²If unfamiliar with the Scientific Method, do read it up on Wikipedia or alike. By all means, also read the criticism levelled at this approach. Keep in mind, though, that “the hard sciences” (physics, chemistry and friends) use this approach as their bread-and-butter epistemology. Don’t reject it just because you don’t like it or find it wanting for some reason. It has a very good track record!

Where, you may ask, was the “intellect” in the last example? Good point! That was indeed handcraft research, not intellectual science. Note that this is a document for BSc and MSc theses, not the Noble Price. And for a, say, MSc thesis I would be very happy to read the theoretical reasoning, the derivation of what to expect if this site *were* the impact crater, to see the discussion (and quantification) of the uncertainty of the isotope measurements and thus the strength of the rejection of this site. It would, to me, demonstrate that you had worked scientifically. Would you get full marks? Alas, no. The missing bit was the curiosity driven, creative advancement to theory. Not everybody will be able to do that. In fact, I doubt that I have made substantial contributions to this still-valid-in-500-years-stuff (and I certainly never got full marks after leaving school). But that is exactly what a full marks means: exceptional, outstanding, dazzling! And few of us are geniuses worthy of full marks, sorry. You can become a good scientist, contributing to advancing the work on the still-valid-in-500-years-stuff even without being a genius (at least that’s what I keep telling myself).

So I guess what I’m saying is: Don’t expect exceedingly good marks from me.

Chapter 2

Methods

You may want to start with a few, brief sentences of what you actually did, before going into the details over the next sections.

2.1 Site

2.2 Species

Remember that Latin species names are set in italics, and only the genus name is capitalised: *Lacerta viridis*.

2.3 Statistical Analysis

Describe the methods and measurements that you used here.

- Units (m, kg, s) should be separated by a space from the value, except for % and ° (or " and ' for geographical coordinates): "We weighed all bolders in the vicinity of the south pole (−90°N 0°E) to an accuracy of 5 g, i.e. to an accuracy below 0.1%." There is a some variation to this, and my comment refers to how it is most commonly practiced in the UK. The Scientific Unit group advises for spaces for all but plane angles: <https://physics.nist.gov/cuu/Units/units.html>. This is a good page to briefly go through for all other types of unit and number styles.
- Write "a 2 km × 2 km grid" or, if you must, "a 2 × 2 km² grid", and not "a 2 × 2 km grid" (because the units need to be correct; see also the last link to the SI units webpage).
- In the text, you can use `\textsubscript` instead of the math mode (`$... $`) like so: CO₂ vs CO₂. Same goes for `\textdegree` and `\textmu`.
- In equations, text should be displayed as text, not as mathematical symbols: n_{total} or $df_{\text{residuals}}$, not n_{total} or $df_{residuals}$.
- Note that numbers may look different (are of different size!) in text and math mode, as does the minus: -2.0°C vs −2.0°C. Use the math mode consistently for numbers when these indicate an actual mathematical numeral, not an English word (such as 1776 or chapter 5, where you should use the text mode). For units and number representation you can use the package **siunits** for maximal standardisation: 2.34 × 5.67 or −2 °C. I regard this as overkill in most situation, though.

2.4 Use of “artificial intelligence” software

For this thesis, I employed a range of software tools (“AI”).

ChatGPT (version 4.0) for language improvement: I uploaded chunks of text I had written in German into ChatGPT and prompted it thus: Translate into British English. Condense text and reduce repetition of words. Write in abstract, scientific style. Replace colloquial expressions. The resulting output was adapted and modified by me to ensure correctness of content and scientific language.

StarCoder (version X.Y) for supporting code writing: In LM Studio (version Y), I uploaded Python code I wrote for my analysis and prompted it thus: Check code for potential errors. Simplify code for faster execution. Additionally, I found a solution to one of my coding problems on StackOverflow (thelinktotheforumentry) in C++ and used StarCoder to translate it into Python: Translate the following C++ code into Python3 code, using as few additional packages as possible. The resulting code was tested for functionality and then used as part of the code reported in the appendix.

Elicit (version xy) for summarising the results of my GoogleScholar literature search: Find common themes and hypotheses in the following PDFs and summarise each in fewer than 1000 words. These summaries were not used directly in the thesis, but they were used as starting point for developing the introduction and identify the most promising research hypotheses for this thesis.

2.5 Own contribution, and that of others

Please make absolutely clear what *you* have done, and what others have done! If, for example, samples were sent to a different lab for analysis, then this should be stated in two different aspects: what was done in that other lab, and what kind of data you received back. The latter will explain how much post-processing had to be done on your side.

Author contributions are demanded in many scientific journals, in various styles and formats. The key point is to let the reader know what you did, and what you did not. You don’t have to put this into a table, but it has to be communicated clearly. Typical elements of such author contributions may include:

1. conceived the idea
2. developed the formal theory
3. designed the experiment
4. recruited the subjects
5. supervised the experiment
6. carried out the experiment/simulations/measurements
7. verified the methods
8. collected the data
9. analysed the data
10. wrote the first draft
11. contributed to writing the manuscript

Non-relevant parts are “secured the funding for the project”, “supervised the PhD researcher” and “made some comments along the way” or “listened to a half-baked version presented in a seminar”. (If we are talking about a manuscript, such minor contributions should not lead to (“honorary”) co-authorship, according to funding guidelines of the DFG and many other funding bodies.)

Chapter 3

Results

Describe your results here...

Results are typically accompanied by tables and figures. These are, in \LaTeX , so-called “floating environments”, meaning they are placed where they look nice, typically on the next page, top, or, if there is enough space, this page, bottom.

The table is a bit of a nightmare in \LaTeX , unless you use the editor’s help to construct a template. Here (Table 3.1) is a simple table in a floating environment. Note how nicely you can refer to figures using labels and referencing. For tricks on how to merge columns or landscape tables or multi-page tables or define the widths of a column or use different line types for top and bottom, please search the internet: it is all possible, somehow.

And here an example of a floating picture (Fig. 3.1). The more text you write, the better the floating objects are separated. So don’t let this ugly example deter you.

You can try to force \LaTeX to place a float HERE, but typically this does not improve the output and is against the “philosophy” of not investing time into the layout itself.

Table 3.1: The caption of a table always goes *above* the table.

effect	df	<i>P</i> -value
rain	1	< 0.001
human population density	1	0.051
residuals	5223	



Figure 3.1: The caption of a figure always goes *below* the figure: we wouldn’t pay attention to text, if there is a picture to look at!

Chapter 4

Discussion

Try to write introduction and discussion in a way that the reader doesn't really require methods and results. To do so, you have to use the first (few) sentences of the discussion to recapitulate your findings.

Discuss your results here, ideally structured into various sections, of which one is:

4.1 English style

Personally, I am used to British English and the following points relate to my view of how Britons use and write English. There are a few things that seem to be established (more or less) in scientific writing, but rarely adhered to by non-native writers.

- “Data” is plural (of singular “datum”): “Data *were* collected in June.”
- “like” is mostly a verb in science, not a preposition. In a comparative setting use “such as” instead: “Stars, *such as* our sun, shine brightly.”
- The verb “to fit” has as past and participle “fit” and “fitted”, respectively. However, it is now common to write “The model was fitted.” There is some discussion, when to use “fit” and when “fitted”. But “fit” is still correct, too.
- Commata are used to make text more comprehensible. There shouldn't be too few or too many. Recently, a pandemic of putting a comma after “i.e.” or “e.g.” has taken hold. If you want a reader of the text to make a brief pause, then do use a comma, otherwise don't. Do **not** put a comma after every first word in a sentence! “Tomorrow I'll read this book.” - no comma required!
- “that” is very rarely preceded by a comma: “It was last night's rain that brought down most of the leaves.”
- “that” does *not* refer to people: “The person *who* handed me the coffee fully embraced the concept of politeness.”
- For an awful lot of animals, male, female, young and groups have specific, dedicated terms (see, e.g., here: <https://www.adducation.info/mankind-nature-general-knowledge/collective-nouns-for-animals/>). Please use them. “Baby” only refers to the young of the apes (i.e. gorilla, chimpanzee, orangutan, gibbon and human). Similarly, try to avoid human terms for animals when technical terms exist: “The gravid horse jumped over the lazy fox.”
- Paragraphs should not run for more than half a page.

- The position of an apostrophe is not arbitrary. And an apostrophe is not a back tick. “Every single user’s trust is important, as we need all users’ compliance.”

4.2 Conclusions

Your conclusions summarise your main findings as presented in the Discussion chapter. Put them here...

Acknowledgements

And of course include your acknowledgements here: my supervisor was always there for me, taught me so much and hence will receive eternal praise and gratefulness. Actually, I rarely saw him/her and that was just as well.

Bibliography

Adiku, S. G. K. & Stone, R. C. (1995). Using the Southern Oscillation Index for improving rainfall prediction and agricultural water management in Ghana. *Agricultural Water Management*, 29(1), 85–100.

Appendix A

This is Appendix 1...

Put appendix text here

Appendix B

This is appendix 2...

Put appendix text here...

Selbstständigkeitserklärung

Erklärung

Ich versichere hiermit, dass ich die vorliegende Arbeit ohne fremde Hilfe selbstständig verfasst und nur die angegebenen Quellen und Hilfsmittel benutzt habe. Wörtlich oder dem Sinn nach aus anderen Werken entnommene Stellen habe ich unter Angabe der Quellen kenntlich gemacht.

(I hereby declare that I have composed this document unassistedly and that I only used the sources and devices I declared. Passages taken verbatim or in meaning from other sources are identified as such and the sources are acknowledged and cited.)

I hereby declare that all IT/AI-supported writing, analysis, and programming activities that directly led to material (text, results, display items, programming code) used in this work are listed in the methods with the name of the tools/products used and their version number, a list of all prompts used by me (as verbatim copies), a description of the range of functions of these tools used, and a description of exactly how the results of these tools were used in this work. I declare that I have quality-checked and edited the content created with the IT/AI-supported tools before using it in my thesis, and remain solely responsible for the scientific content of my work.

Freiburg, May 2021