How to Write an Excellent Master's Thesis

Jari Saramäki

CS Comms & Coffee 6.3. 2020

https://jarisaramaki.fi/

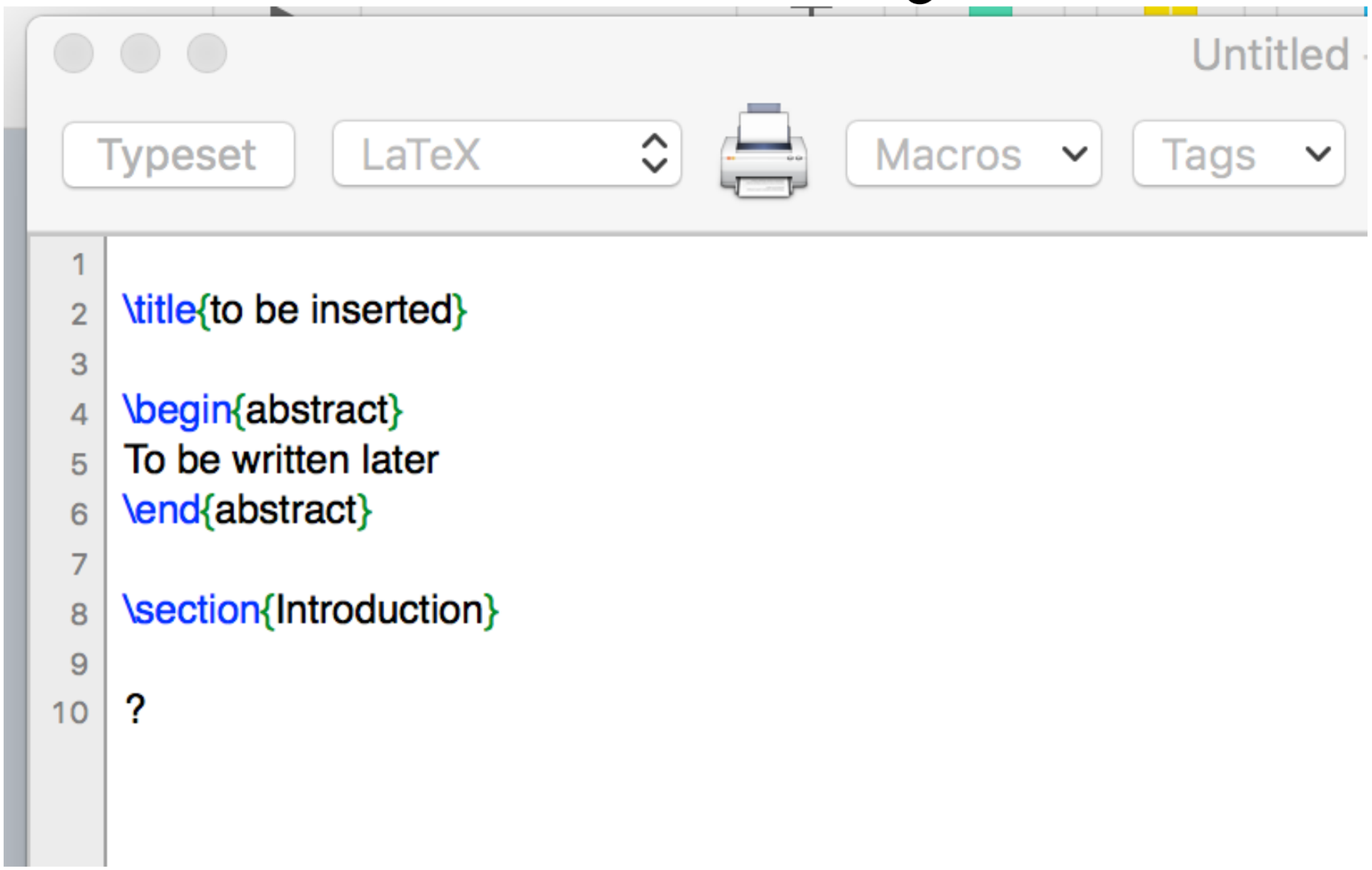
Why to Write a Thesis?

- To graduate? -ok.

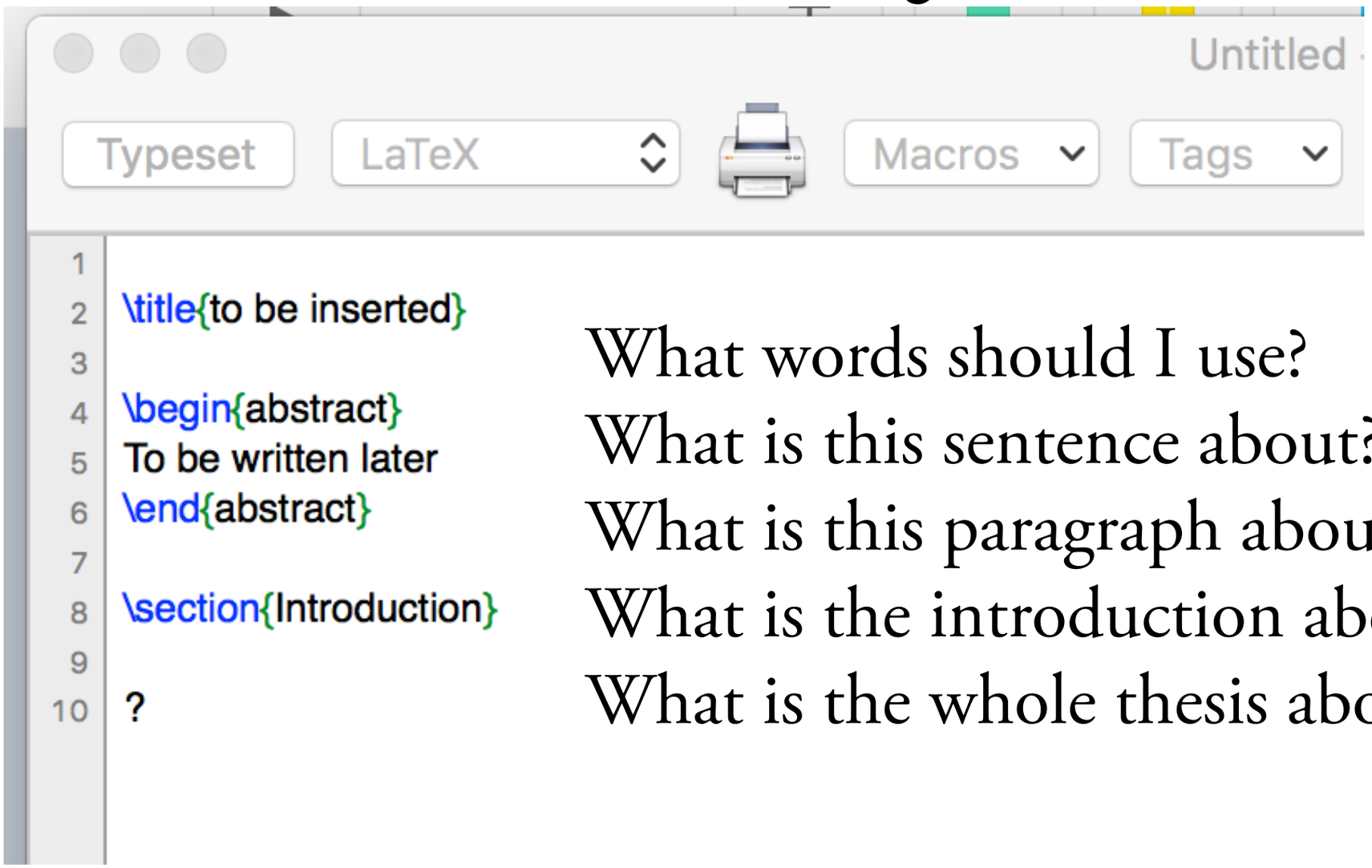
- To show that I have done some work and know the topic well? -ok.

- To make any reader understand what you have achieved and why, and get all excited about it!
  -BEST, contains the above.

Don't be this person



Don't be this person



What words should I use?
What is this sentence about?
What is this paragraph about?
What is the introduction about?
What is the whole thesis about?

You cannot solve these problems all at once!

Q: How to Write an Excellent Master's Thesis?

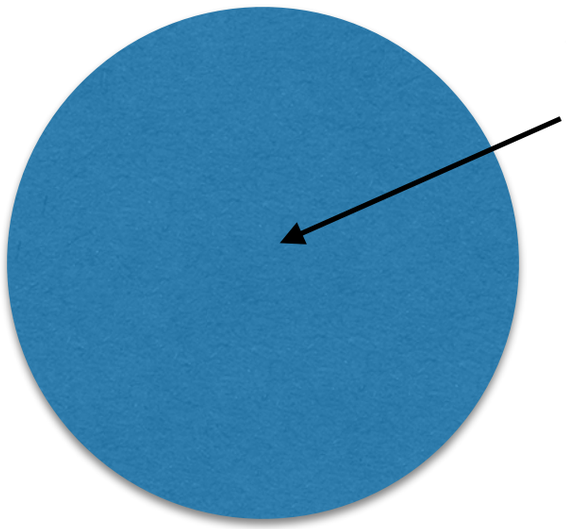
A: From **top to down**, start with **planning** and **thinking**.

Part I

How to Plan an Excellent Master's Thesis

What's your point?

In a nutshell, **this** is what my thesis is about.

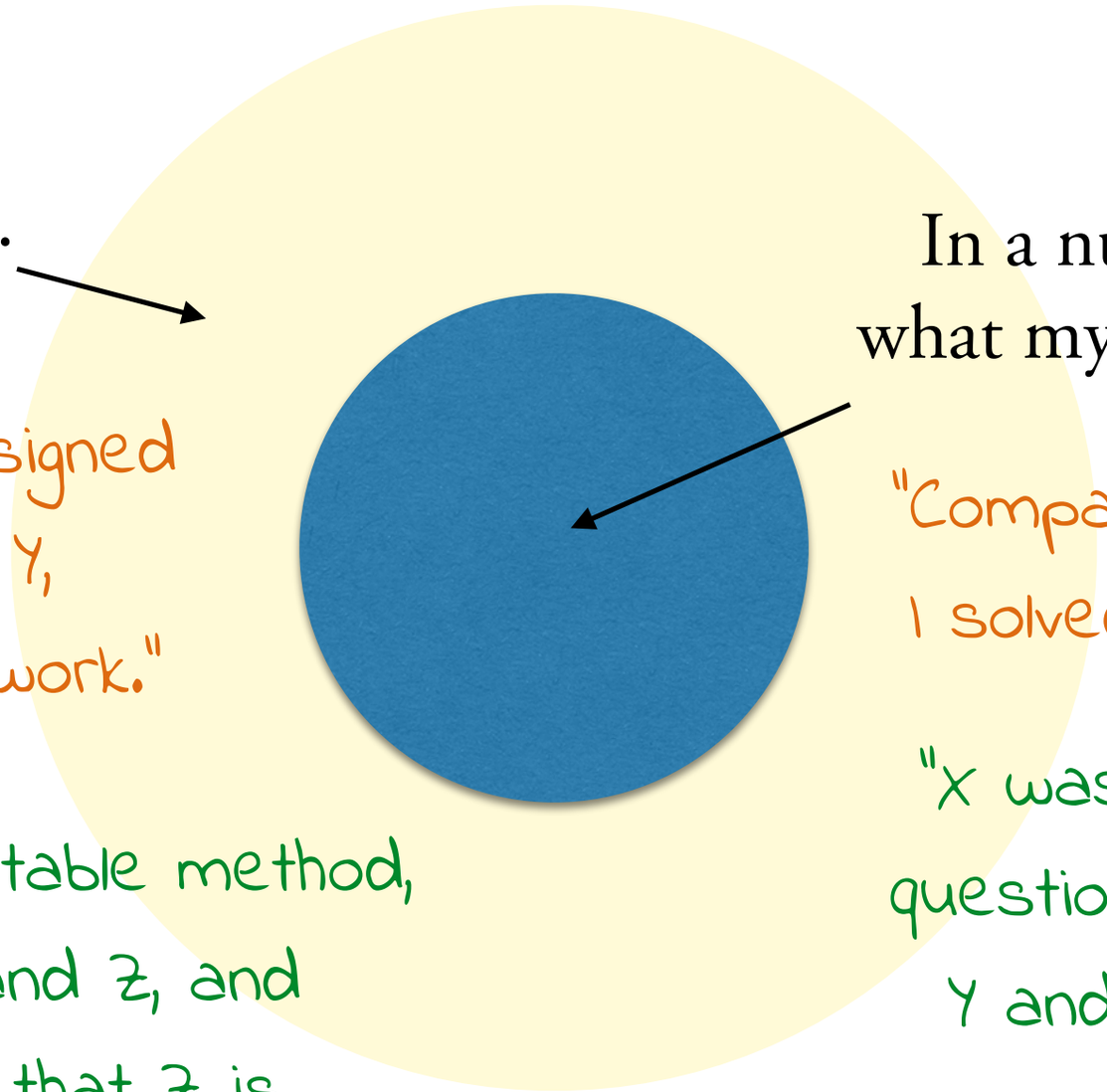


"Company X had problem Y, I solved it with method Z."

"X was an open scientific question, I answered it with Y and the answer is Z."

What Is Needed To Make That Point?

These are the things
that are needed
to support my point.



In a nutshell, **this** is
what my thesis is about.

"To achieve X, I designed
and developed Y,
using the Z framework."

"Company X had problem Y,
I solved it with method Z."

"To pick the most suitable method,
I compared X, Y, and Z, and
the results show that Z is
the winner."

"X was an open scientific
question, I answered it with
Y and the answer is Z."

Why Does Your Point Matter?

This is why my topic,
my problem, and
my solution are important.

These are the things
that are needed
to support my point.

In a nutshell, this is
what my thesis is about.

"While researchers have achieved X, Y has remained an open problem, and its solution would benefit Z."

"Now that we know that X is the most promising way forward, the company can..."

Write the abstract first!

Broad

Narrow

Broad

The broad setting:
field of science, industry, ...

Moving closer to your research question: what and why?

what problem did you set out to solve?

How did you solve it, and what was the outcome?

what immediately follows from the outcome?

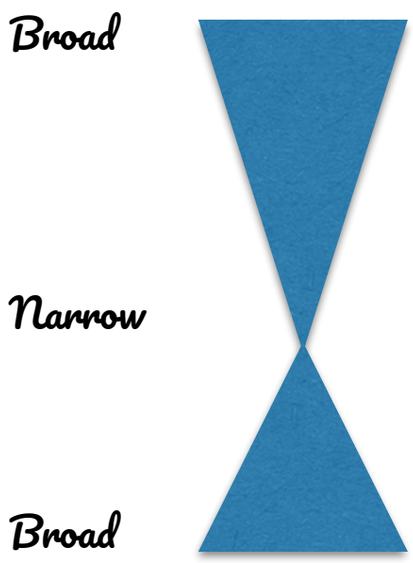
Future outlook, and what may follow from your work

Plan your sections next!

- Next, sketch & plan what goes into each section.

- Plan at the level of paragraphs, if you can! Or, at least, at the table-of-contents-level.

- Typical structure:



1) Introduction
2) Background
3) Methods
4) Results
5) Discussion

1. Introduction

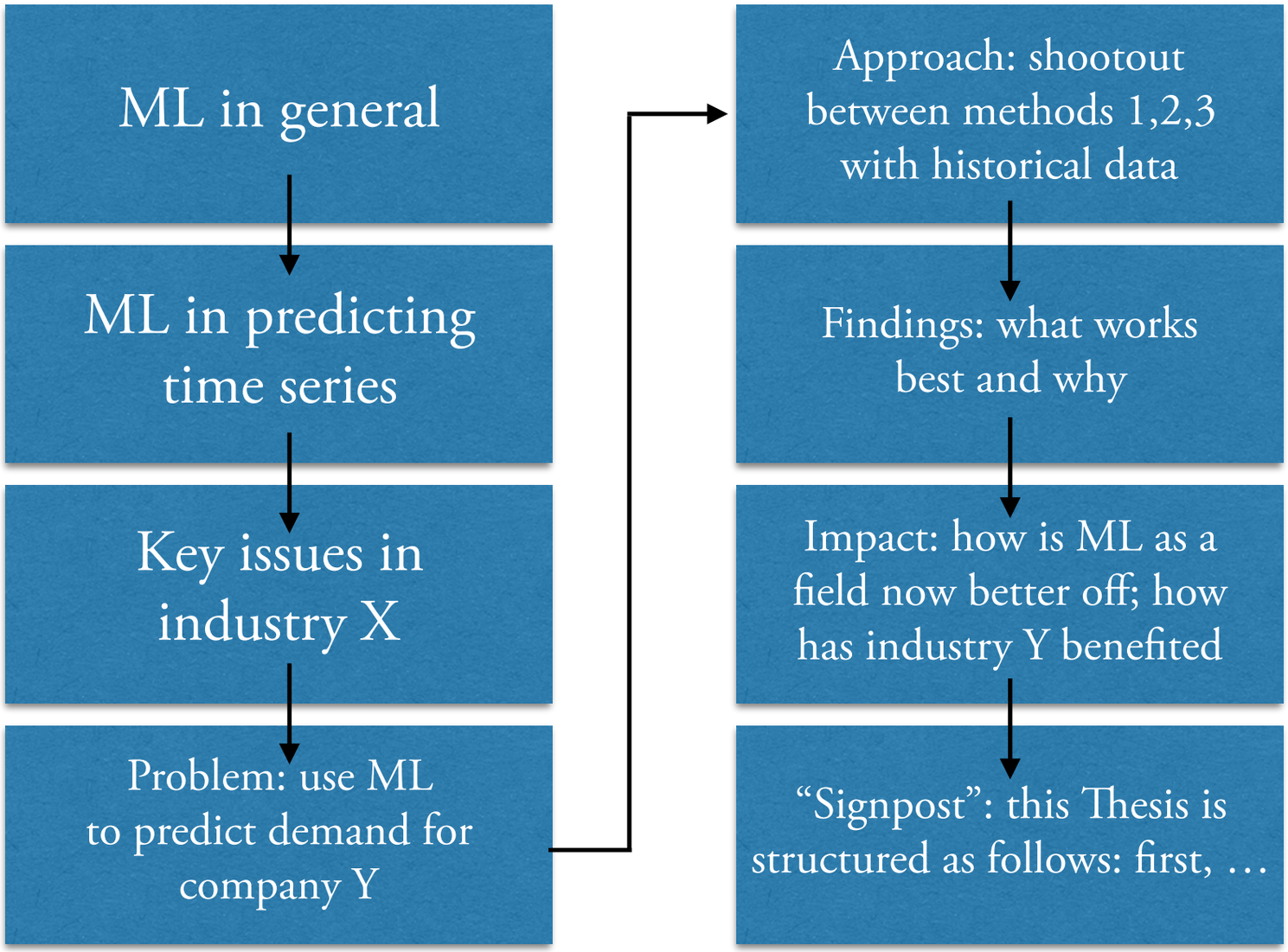
Main thing:
The reader should understand what you have done and why, and what the outcome was, without reading the rest of the thesis.

Much like the abstract, but longer, and emphasizing context.

1. Introduction

- A short section, typically a few pages.
- Introduces the reader to the setting and context (and some of the key literature).
- Gives an idea about the state-of-the-art (what is known and what is unknown).
- Motivates the research question of the thesis.
- Presents the research question clearly.
- Presents the methods and key result in a condensed way.

1. Introduction - a fictitious example



2. Background

Main thing:

After reading this section,
the reader should be able
to understand the rest of the thesis.

Remember: the reader doesn't know what you know.

2. Background

- A longer section (up to 25 pages perhaps, depending)
- Structured into subsections
- Provides deeper background and a more detailed literature survey
- Discusses the state-of-the-art: what is known and what is not
- Can contain general theory or methodological frameworks

2. Background: an example

This thesis is about network analysis of brain imaging data.

Basics of network analysis →

Basics of neuroscience →

Connecting the two topics →

From "Internal connectivity and topological roles of nodes in functional brain networks" by Elisa Ryyppö, 2018

3. Methods

Main thing:

The reader should understand
what you have done and
be able to try to
replicate your results

The scientific method: any result can be verified or falsified!

3. Methods

- Length: as many pages as it takes, with sub(sub)sections
- Use schematics and figures to provide an overview before presenting the details!
- Motivate all choices of methods! State your reasoning. Clarity is key!
- Discuss limitations already at this stage.
- Materials, data, etc are also discussed in this section.

3. Methods

How **not** to begin a Methods subsection

Method X entails computing Z and then…

Way better, isn't this?

To do A, we need a method.
We have chosen X because…
Method X entails…

Reading the Methods section is always hard. Be gentle to your reader and guide her hand.

4. Results

Main thing:

Be clear. Be logical.

Think of the Results section as a court case in some TV drama (but build your case with honesty and integrity).

4. Results

- Length: as many pages as it takes, with sub(sub)sections…

- For writing, it may be useful to divide results into
  1) the main result,
  2) auxiliary results,
  3) "nice-to-know" results

- Auxiliary results lead to the main result or provide setting (e.g. key statistics of your data set) or validate your approach/methods/data quality

- Structure your section so that the main result is apparent!

4. Results: a fictitious example

auxiliary

Statistics of training set

main

Results for methods 1,2,3

Validation that 3 works best

nice-to-know

Example: Applying 3 to some other data

4. Results: interpretation

- Three levels of knowledge:

  1. Pure data: this is what my plots show

  2. Facts that everyone would agree on: my plot shows that X is mostly above Y

  3. Interpretations: X being above Y is in line with the hypothesis that…

- Always make it clear whether you talk about data, facts, or interpretation.

4. Discussion (and future outlook)

- Length: 2-10 pages

- Wrap up and condense results and their meaning

- Discuss limitations (don't dwell on them, but rather be honest about what one can now be sure about and what not)

- Discuss impact: what follows from your work now? What future doors does it open? Do you have future research suggestions?

- [Note: in some fields, results are interpreted in Discussion, not in Results].

Part II

How to Write an Excellent Master's Thesis

(now that you have a plan...)

Write a Crappy First Draft!

- *"To write is human, to edit is divine"* -Stephen King

- Productive writers first write crappy drafts quickly

- Only then do they edit them to perfection.

- Be a productive writer. Quick and dirty first, edit later. Do a pass on your entire thesis before polishing anything.

Paragraphs

- **<u>One paragraph is about one thing only!</u>**

- 1-2 first sentences define the topic of the paragraph.

- Last 1-2 sentences conclude the paragraph and lead to the next paragraph.

- Do not stray off the path! No tangential sentences! Split long paragraphs ruthlessly!

Sentences

- The beginning of a sentence is its **setup** ("Topic position"). It tells what the sentence is **about**.

- The end of a sentence is the **resolution** ("Stress position"). This is what the reader focuses on, so **place important material at the end**.

- It is easier to read text where **sentences begin with familiar words/material and end with new things**.

- The beginning of the sentence also provides a **link to the previous sentence**.

Sentences

- Keep your **subject and verb close**! (Writing short sentences helps).

- Avoid the **passive voice**! ("The passive voice should be avoided!")

- How to spot passive voice? See if you can insert "**by zombies**" after the verb without violating grammar.

Sentences

- Use **verbs** that **describe** actions!
  - **Very clunky:** There is a dependence between X and Y
  - **Still clunky:** X is dependent on Y
  - **Better, isn't it:** X depends on Y
  - **Best by far:** X grows linearly with Y

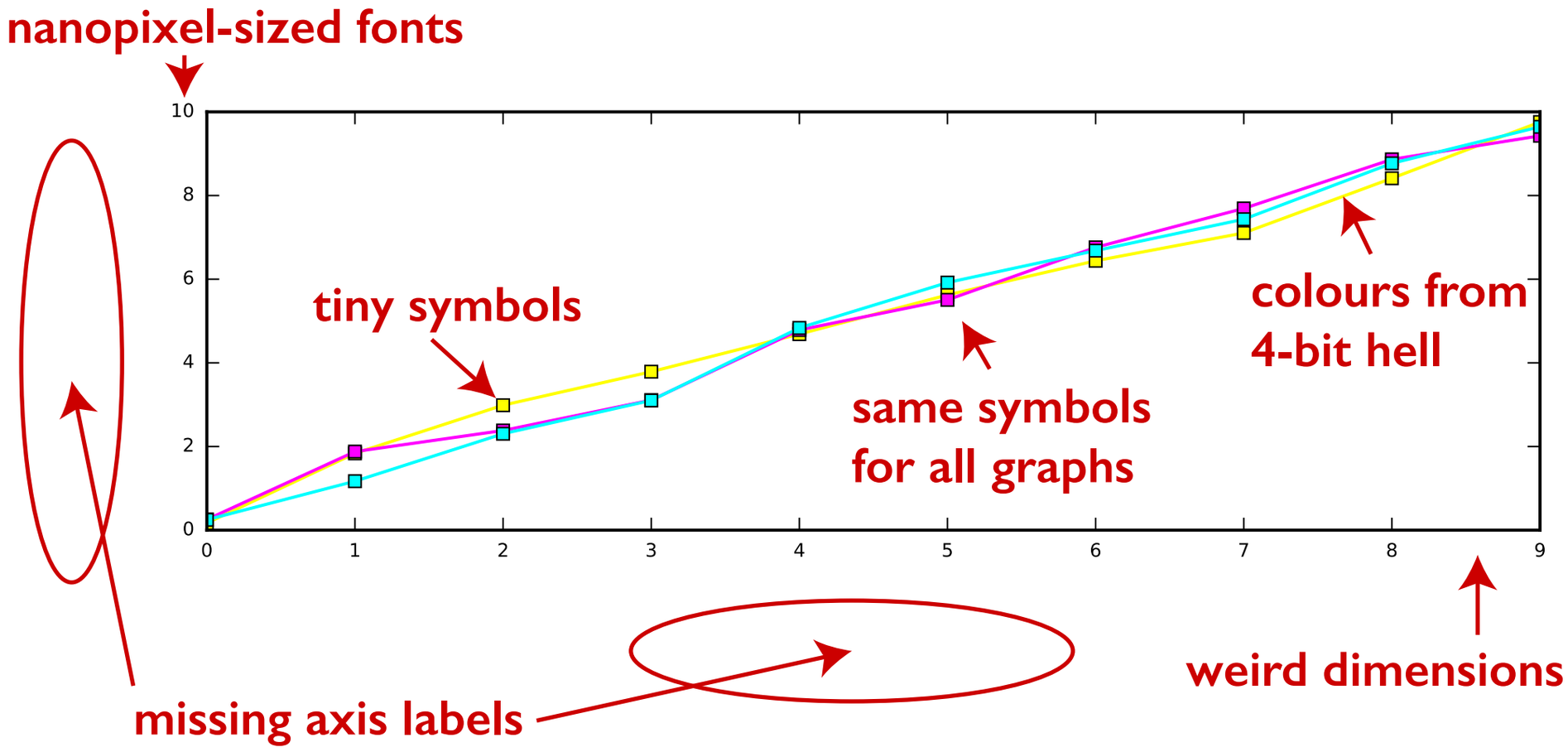
Figures

- Use figures to tell the story (schematics for methods, plots for results)

- Pro tip: learn to use a vector graphics editor (Inkscape, Adobe Illustrator, etc)

- Be consistent with style and colour usage (same colour should always mean the same thing)

Figures: don't be this person



Part III

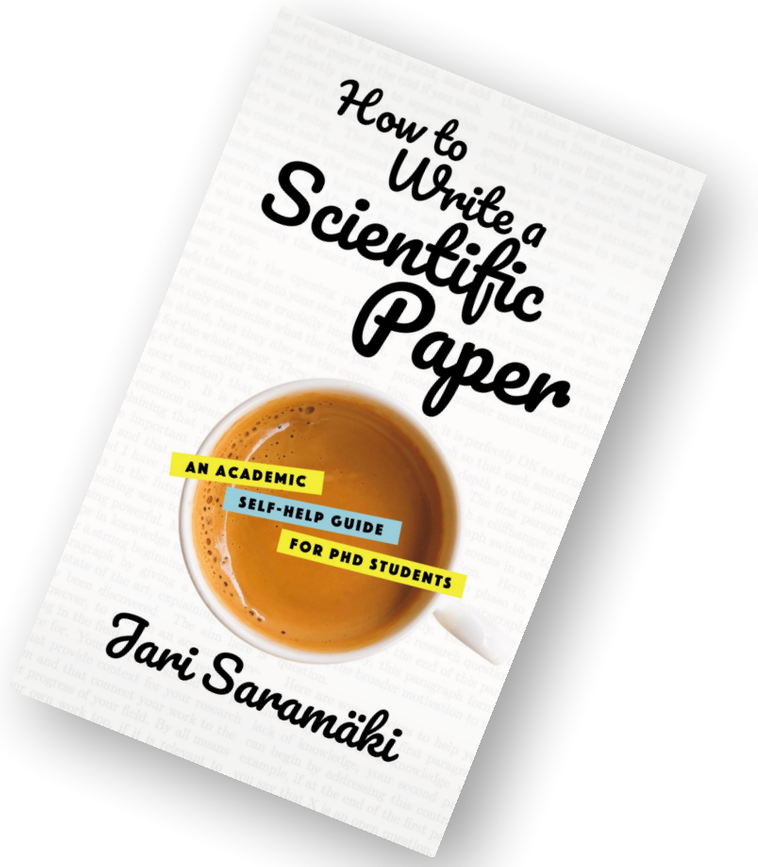
How to Edit an Excellent Master's Thesis

(now that you have a crappy draft...)

Editing

- Do at least two passes of edits
- On the first pass, focus on <u>flow, clarity, and structure</u>.
  - Add signposts wherever needed: words and sentences to guide the reader
  - “We will first present the general summary statistics for our data, and then move on to…”
- On the second-Nth pass, focus on <u>details</u>
  - One paragraph = one point. Split long paragraphs
  - Shorten sentences and cut out words that are not needed.
  - Remove jargon, remove passive voice.

The End



For these slides, see https://jarisaramaki.fi/
For a book on writing scientific papers, see https://books2read.com/howtowriteapaper