

Academic year
2022 - 2023

Your Thesis Title

Ommit subtitle if you don't have one

Student's Full Name

Masterproef
Master of Science in de informatica: software engineering

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University of Antwerp
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Contents

Abstract	8
Nederlandstalige Samenvatting	9
Acknowledgments	10
1 Introduction	11
2 Background	13
2.1 Concept/Technique A	13
2.2 Concept/Technique B	13
3 Method / Experimental Design	15
4 Results / Evaluation	17
5 Threats to Validity	19
5.1 Conclusion validity	19
5.2 Internal validity	20
5.3 Construct validity	20
5.4 External validity	20
6 Related Work	21
7 Conclusion	23
References	25

List of Figures

2.1	University of Antwerp - Logo	13
5.1	Experimental principles diagram showing threats. (1) Conclusion; (2) Internal; (3) Construct; and (4) External.	19

List of Tables

4.1 Fictitious Results	17
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Abstract

English abstract.

Nederlandstalige Samenvatting

Dutch Abstract.

Acknowledgments

Student's personal acknowledgements.

1 Introduction

The introduction is probably the most important section of any academic work. We start the introduction with a small contextualization on the thesis/paper subject. This usually takes 1 to 3 paragraphs for a paper depending on the topic. For a thesis, it is ok to write more paragraphs. Please remember, these are just general suggestions.

After the contextualization, we write one paragraph on the problem or motivation for this research. We can complement with another paragraph to reinforce why the problem is important, or how it affects academia and/or industry.

Citations are very important in academic writing. Try to put at least one citation (preferable more) per paragraph in the introduction's previous paragraphs. Always use a citation when making a strong remark or statement to reinforce the point. Example of citation [1]. For multiple citations put them all in the same cite command [1–4]. And yes, the tilde before the cite command is crucial – it creates a small non-breaking space between the last word and the citation. Remember that citations are annotations, not parts of speech. Therefore do not use a citation as a substantive.

After we successfully introduced the readers to the contextualization and problem/motivation, comes a paragraph clearly stating what is our research. Usually, this paragraph begins with "In this paper/thesis, we ...".

Now the reader understands the basics of our research and what we did to accomplish our goals. The remaining paragraphs in the introduction can now describe a summary of the results, how previous research does not tackle what we did/accomplish, state the contributions for the research, or even an illustrative example of how the research improves the problem we described.

For Git-like repositories, try to put each sentence in a newline. Since Git is line-based, it makes it easier to see changes between versions.

The final paragraph of the introduction is an outline briefly describing the remaining sections. Use the `\ref{...}` command to reference Sections and Chapters. For example, in Chapter 2, we describe... And in Section 2.1, we describe...

We also included a `comments` command which makes it easier for students and advisors to give feedback or ask questions directly on the text. We can hide all comments in the pdf by changing a single line in the main tex file.

2 Background

In a Background section, we describe the main concepts and/or techniques that are important for a reader to better understand the experiments. Usually, we divide the background into several subsections, one for each concept/technique.

Figure 2.1 is just an example of how to use the figure command.



Figure 2.1: University of Antwerp - Logo

2.1 Concept/Technique A

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2.2 Concept/Technique B

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3 Method / Experimental Design

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4 Results / Evaluation

Table 4.1 shows an example of creating a table.

Table 4.1: Fictitious Results

	Precision	Recall	F-Score
Technique 1	0.85	0.77	0.81
Technique 2	0.82	0.81	0.81
Technique 3	0.65	0.93	0.73

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5 Threats to Validity

In any empirical research, we must analyse and categorize the threats to validity of the experiments. The threats are classified into four categories: (1) Conclusion Validity, (2) Internal Validity, (3) Construct Validity, and (4) External Validity. It is important to identify and present the threat and also explain what we did to mitigate or address the threat.

Figure 5.1 shows a diagram of the experiment principles and where lies each threat. Please do not use this image on the paper/thesis. Reviewers are supposed to know where the threats lie, the figure is for students to better understand the threats.

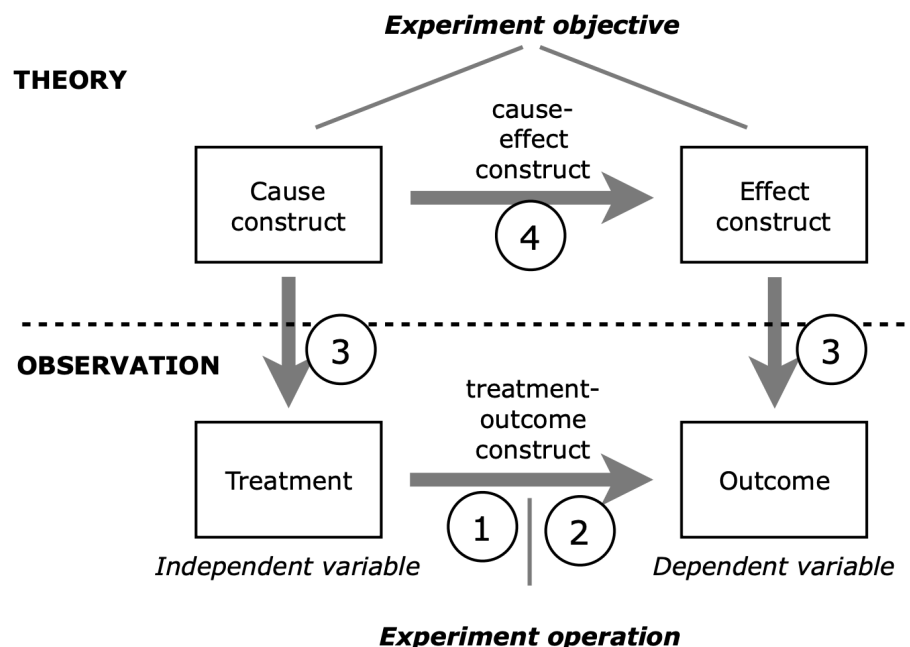


Figure 5.1: Experimental principles diagram showing threats. (1) Conclusion; (2) Internal; (3) Construct; and (4) External.

5.1 Conclusion validity

Conclusion validity is the degree to which conclusions we reach about relationships in our data are reasonable.

- It affects the ability to draw correct conclusion about relations between treatment and outcome.
 - + Choice of statistical tests
 - + Choice of sample size
 - + Measurement of the experiment

- Low Statistical Power
 - + If power is low, there is a high risk that an erroneous conclusion is drawn.

5.2 Internal validity

Are there any other factors that may affect the results?

- Were phenomena observed under special conditions
 - + in the lab, close to a deadline, company risked bankruptcy, ...
 - + major turnover in team, contributors changed (open-source), ...
- Similar observations repeated over time (learning effects)
- Correlation does not imply causation.

5.3 Construct validity

Do the operational measures reflect what the researcher had in mind?

- Time recorded vs. time spent
- Execution time, memory consumption, ...
 - + noise of operating system, sampling method
- Human-assigned classifiers (bug severity, ...)
 - + risk for “default” values
- Participants in interviews have pressure to answer positively

5.4 External validity

To what extent can the findings be generalized?

- Does it apply to other languages? Other sizes? Other domains? Other systems?
- Background & education of participants
- Simplicity & scale of the team
 - + small teams & flexible roles vs. large organizations & fixed roles

6 Related Work

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7 Conclusion

The first paragraph of the conclusion is usually a short review of this paper/thesis goals, problems, and context.

After that we generally cover the following main points in the next paragraphs:

- **Summary of Results.** In a paper/thesis, we probably have many pages in previous sections presenting results. Now in the conclusion, it is time to put the most important results here for the reader. Especially research with measurable results, we highlight the numbers here.
- **Main Findings / Conclusions.** Many times, we have a result but based on its number we can draw a conclusion or formulate a finding on top of it. Even if it was previous discussed in an earlier section, we need to re-state here.
- **Contributions.** If we presented/discussed the main contributions of this research in the introduction, then we need to do again in the conclusion. Do not repeat verbatim what was written in previous sections. In the conclusion, we expect contributions to be more detailed and linked to the results/findings when possible.

Avoid generic conclusion sentences that could be applied to anything. For example, "Our technique showed good results which were beneficial to answer our research questions. Our work can be used by other researchers to better understand our domain." Instead, go for more specific detailed results. For example, "Our technique showed a precision of 75% which was 15% higher than the baseline comparison. Based on this we can see that ..."

The final paragraph (or paragraphs) of the conclusion is about future research. We can create a separate subsection for it if there are multiple paragraphs dedicated to future work. Just be aware, it is not a good sign if future research content is longer than what we wrote for the previous paragraphs in the conclusion.

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