

Framing Your Thesis Project

Fabian Neuhaus

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

Introduction

Where are we?

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

- ▶ Two weeks ago: Identifying a thesis topic
- ▶ This week:
“Great, I have a thesis topic. What now?”

Where are we?

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

- ▶ Two weeks ago: Identifying a thesis topic
- ▶ This week:
“Great, I have a thesis topic. What now?”
 - ▶ More than thesis proposal

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

Why do good students fail at writing their thesis?

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

- ▶ Did not know where to start
- ▶ Spent too much time at reading literature
- ▶ Overwhelmed and depressed
- ▶ Run out of time
- ▶ Half-baked thesis written in 2 weeks

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

- ▶ Ambitious, general topic
- ▶ Thesis contains a collection of 5 different ideas
- ▶ No evaluation
- ▶ Reader is left with the feeling "What was this all about?"

Contributions and Hypothesis

A thesis – no laughing matter?

Writing a thesis is like telling a joke:
it consist of a setup and a punchline.

A thesis – no laughing matter?

Writing a thesis is like telling a joke:
it consist of a setup and a punchline.

The punchline is your **contribution**.
The rest of the thesis is just the setup to support it.

A thesis – no laughing matter?

Writing a thesis is like telling a joke:
it consist of a setup and a punchline.

The punchline is your **contribution**.
The rest of the thesis is just the setup to support it.

Without punchline you have no joke. Without a
contribution you have no thesis.

The punchline structures the setup of the joke.
The contribution structures the rest of the thesis.

Do I need psychic powers?

- ▶ “I haven’t even started my project. How can I know my results (= contributions)?”

Do I need psychic powers?

- ▶ “I haven’t even started my project. How can I know my results (= contributions)?”
- ▶ You don’t
- ▶ But you should have a research question and one or more research hypotheses

Example: Research question vs research hypothesis

- ▶ Research question: How is glacial melting affecting penguins in Antarctica?
- ▶ Hypothesis 1: Glacial melting forces penguins in Antarctica to move to less suitable breeding grounds.
- ▶ Hypothesis 2: Less suitable breeding grounds lead to less breeding activity (measured as a ratio between the number of nests and the number of available adult penguins)
- ▶ Hypothesis 3: Less suitable breeding grounds decrease the survivability of new-born penguins

- ▶ Research question: open, well-defined scientific question
- ▶ Research hypothesis: tentative, falsifiable answer to the question of the research topic
- ▶ Research project: attempt to provide evidence for the hypothesis; hypothesis → contribution

Research question vs research hypothesis

- ▶ Research question: general, stable during thesis project
- ▶ Hypothesis: actionable, may be changed or replaced

- ▶ Literature:
 - ▶ Semantics for weighed argumentation networks for attacks
 - ▶ Semantics for weighed argumentation networks for supports
- ▶ Research question: How do we define a semantics for weighed argumentation networks with both support and attack relationship (= WASA)?

- ▶ Research question: How define semantics for WASA?
- ▶ Research hypothesis:
 - ▶ WASA are defined by straight forward combination of existing work
 - ▶ Desirable characteristics of WASA are combination of characteristics from literature + some additions for the relation between attacks and supports
 - ▶ Convergent semantics may be defined and proofed by combining established techniques

For the sake of brevity I formulated the hypotheses more vague than they should be.

Example from my own research II

- ▶ Research question: How define semantics for WASA?
- ▶ Research hypothesis:
 - ▶ ~~WASA are defined by straight forward combination of existing work~~
 - ▶ WASA may be defined by incident matrix of the graph and a vector for weights
 - ▶ Desirable characteristics of WASA are combination of characteristics from literature + some additions for the relation between attacks and supports
 - ▶ Convergent semantics may be defined and proofed by combining established techniques

For the sake of brevity I formulated the hypotheses more vague than they should be.

Example from my own research II

- ▶ Research question: How define semantics for WASA?
- ▶ Research hypothesis:
 - ▶ WASA may be defined by incident matrix of the graph and a vector for weights
 - ▶ ~~Desirable characteristics of WASA are combination of characteristics from literature + some additions for the relation between attacks and supports~~
 - ▶ Desirable characteristics of WASA may be reformulated in a modular way
 - ▶ Convergent semantics may be defined and proofed by combining established techniques

For the sake of brevity I formulated the hypotheses more vague than they should be.

Example from my own research II

- ▶ Research question: How define semantics for WASA?
- ▶ Research hypothesis:
 - ▶ WASA may be defined by incident matrix of the graph and a vector for weights
 - ▶ Desirable characteristics of WASA may be reformulated in a modular way
 - ~~▶ Convergent semantics may be defined and proofed by combining established techniques~~
 - ▶ Convergent semantics may be defined and proofed by new techniques based on modular characteristics

For the sake of brevity I formulated the hypotheses more vague than they should be.

- ▶ Your research question is "How does social media influence trust in government and journalism?"
- ▶ Develop a research hypothesis

How to find a research question / hypothesis?

Look at the literature:

- ▶ Replicate research with modification
(Goal: Improvement)
- ▶ Apply an existing technique to a new domain
- ▶ Address Contradiction and ambiguity
- ▶ Challenge findings

Based on Alexander Ferworn "Choosing a Computer Science research problem" in <http://www.scs.ryerson.ca/aferworn/courses/CP8101/CLASSES/ChoosingAResearchProblem.pdf>

Research is not

- ▶ simply learning existing knowledge
- ▶ the simple comparison of data sets
- ▶ correlating data sets
- ▶ implementing an existing algorithm

Based on Alexander Ferworn "Choosing a Computer Science research problem" in <http://www.scs.ryerson.ca/aferworn/courses/CP8101/CLASSES/ChoosingAResearchProblem.pdf>


- ▶ “I have a thesis topic. What now?”
- ▶ Formulate your thesis topic as research question
- ▶ Formulate one (or more) research hypothesis
- ▶ Both questions and hypothesis should be crystal clear!

Next Step: The Grandmother Test

Write your grandmother¹ and explain in 5 plain, jargon-free sentences

- ▶ your research question,
- ▶ why it is interesting, and
- ▶ your hypothesis.

If she understands what you want to do, you are in great shape!

¹If she has a degree in computer science ask another relative. 

Preconditions for success

1. Are you interested in your topic?
2. Do you have the necessary background knowledge?
 - ▶ Rule of thumb: not less than two relevant courses
3. Did you allocate sufficient time to work on the hypothesis?

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

Thesis proposal

- ▶ You have a research question
- ▶ You have a hypothesis (or several)
- ▶ Next: A thesis proposal =
plan how to get from hypothesis to contribution

Benefits of a Thesis Proposal

Framing Your Thesis
Project

Fabian Neuhaus

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

- Communication with advisor

- ▶ Communication with advisor **is a secondary benefit**
- ▶ Master plan for thesis project that
 - ▶ breaks down project in little tasks
 - ▶ provides a structure for the thesis itself
 - ▶ helps you to decide what is important for the thesis
 - ▶ prevents you from getting lost

Typical content of a thesis proposal

- ▶ Working title
- ▶ Motivation
- ▶ Statement of the research question
- ▶ Formulation of the research hypotheses (= expected contributions)
- ▶ Methodology and evaluation
- ▶ State of the art
- ▶ Relevance, originality, benefits
- ▶ Project plan
- ▶ Preconditions

What is the project about?

- ▶ Should be a precisely characterize the project
- ▶ Elegance is not important at this stage
- ▶ Be specific

What context and background is the motivation for the project?

The motivation may vary significantly from field to field. Ideally, there is a practical problem that motivates your research. In this case:

- ▶ Use example that illustrates the problem that motivates the research question
- ▶ Why is the problem important?
- ▶ Who would benefit if the problem is solved?

What exactly is the research question?

- ▶ It should be a clear, focused, concise, complex and arguable question
- ▶ It should be formulated as jargon-free and concise as possible
- ▶ It should be clear why an answer to the research question addresses the motivation

What is (are) your research hypothesis (hypotheses)?

- ▶ Explain your tentative answers to the research question
- ▶ What are the criteria that allow you to decide whether the hypothesis is validated?
- ▶ Any hypothesis needs to be falsifiable, thus use exact language

What methods (means) are going to be used to evaluate the hypothesis?

- ▶ What are the methods for evaluating the hypothesis?
- ▶ What are the activities that need to be performed to make that happen? E.g., literature research, surveys, experiments, implementation of tools, development of new theories etc.
- ▶ How is the data analyzed?
- ▶ Your methodologies need to be suitable to find evidence for and against your hypothesis
- ▶ Avoid biasing your results by the setup

What is the state of the art that is relevant to your topic?

- ▶ Provide an overview of work that is immediately relevant to your research question, in particular work on the same hypothesis
- ▶ The goal is not to provide a full literature review, just to make sure that you are aware of the relevant literature

What progress is promised by your project?

- ▶ Given the state of the art, what is different and new?
- ▶ What would be the benefits? (E.g., solution of a practical problem, new scientific opportunities, happy users)

Who is doing what when?

- ▶ What are the milestones and deadlines?
- ▶ Are there cooperation partners?
- ▶ Is the existing work that one can reuse?

Is there anything that you need to check before you commit to this plan?

- ▶ Access to important datasets?
- ▶ Special software licenses?
- ▶ Support of cooperation partners?
- ▶ Legal issues (privacy law, intellectual property rights)?
- ▶ Funding requirements?

Introduction

Contributions and
Hypothesis

Thesis proposal

From thesis proposal to
thesis

1. Title
2. Abstract
3. Introduction
4. Body of the text
5. Conclusion
6. Bibliography

1. Title
2. Abstract
3. Introduction \approx motivation, question, contribution
4. Body of the text
5. Conclusion
6. Bibliography

1. Title
2. Abstract
3. Introduction \approx motivation, question, contribution
4. Body of the text
5. Conclusion \approx summary of contribution
6. Bibliography

1. Title
2. Abstract
3. Introduction \approx motivation, question, contribution
4. Body of the text \approx setup for contribution: structure is logical consequence of the thesis proposal
5. Conclusion \approx summary of contribution
6. Bibliography

- ▶ Research project = execution of project proposal
- ▶ Cycle through 4 kinds of activities
 - ▶ Refining research hypothesis
 - ▶ Reading of literature
 - ▶ Performing research activities (e.g., coding, experiments, analysis)
 - ▶ Writing of thesis
- ▶ Emphasis on activities change over time
- ▶ BUT: writing starts at the beginning

- ▶ Thesis:
 - ▶ Heart of thesis = contribution
 - ▶ Rest = setup for contribution
- ▶ Project proposal
 - ▶ presents planned contribution as combination of research question and hypothesis
 - ▶ motivates contribution as novel and interesting
 - ▶ lays out how to substantiate the contribution
 - ▶ better communication with advisor
 - ▶ actionable plan for work on thesis