Preparing Your Thesis Proposal and Becoming a Ph.D. Candidate

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Acknowledgments

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• Olga Pearce, Texas A&M University
Outline

• Picking a thesis topic
• Deciding to propose
• Writing the proposal
• Presenting the proposal
• Doing what you proposed!
PhD Proposal

• Identify important, unsolved problems

• Show that
  – The problem is solvable
    • I will solve $P \neq NP$
  – “You” can solve it:
    • ability to develop a complex research topic
    • expository skills to explain what you are doing
    • thoroughness to collect and analyse the data.
Part I : Picking a topic

WELL, TAJEL, I THINK IT'S TIME YOU PICKED A THESIS TOPIC.

IT IS?

YOU'VE BEEN HERE A GOOD NUMBER OF YEARS AND NOW YOU SHOULD FOCUS YOUR WORK.

I SHOULD?
Inspiration Versus Perspiration

• There are two main ways to find a topic: inspiration and perspiration.
• Inspiration is great, but unpredictable.
• Perspiration is a lot more dependable.
  – Join a project, build something, and see what’s hard about it. Whatever caused you difficulty has a potential of thesis topic in it.
Writing Your Thesis Outline

1. Aim for a respectable number of chapters:

<table>
<thead>
<tr>
<th>Thesis Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
<tr>
<td>chapter #s</td>
</tr>
</tbody>
</table>

   5 = “That’s it??”
   6-7 = “Not bad”
   8+ = “Are you crazy??”

2. Fill in the “freebies”:

<table>
<thead>
<tr>
<th>Thesis Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
</tr>
<tr>
<td>2. Lit Review</td>
</tr>
<tr>
<td>3. Methodology</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7. Conclusions</td>
</tr>
</tbody>
</table>

   You’re halfway done!

3. Make up titles for the “meat” chapters:

<table>
<thead>
<tr>
<th>Thesis Outline</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Lit Review</td>
</tr>
<tr>
<td>3. Methodology</td>
</tr>
<tr>
<td>4. (that stuff you did your first year)</td>
</tr>
<tr>
<td>5. (stuff you’re supposed to be doing now)</td>
</tr>
<tr>
<td>6. (make stuff up)</td>
</tr>
<tr>
<td>7. Conclusions</td>
</tr>
</tbody>
</table>

   (It’ll be years before you actually have to work on that later chapter, and by then your thesis topic will have changed anyway)

4. Voilà! You just bought yourself another two years

   So, how’s your thesis going?
   I have an outline!

www.phdcomics.com
Multiple research problems

• It's OK to explore multiple problems till you figure out what you like.

• Very narrow domain problems do not typically make a good thesis.
Making a coherent whole

• Research can be messier than you imagine.
• If you are lucky, thesis = $n$ steps to solving a problem
• Thesis = $n$ papers + a story/theme

Think the big picture!
The big picture

• Your responsibility

• Spend a few minutes every day thinking about your thesis.

• Just thinking about the title helps
The thesis title

Too technical

Optimizing Scoring Functions & Indexes for Proximity Search in Type Annotated Corpora.

v/s

Next Generation Search

Too broad

v/s

Next Generation Search via Answer Types

Just right
Attend other proposals (defense)*

*Read other people’s proposals
Find committee members early

- Get to know faculty members through classes and other interaction

- Collaborate with other faculty in your research area and other related topics
  - They will often give you feedback about your progress.
So far ..

- Work on multiple problems (if needed)
- Think about the big picture (the title)
- The outline
- Do some research

Now what? Am I ready to propose?
Part II:
How much (research) is enough?

- Requirements & expectations differ by university 😞
- When to propose: 3rd to 5th year
- Length of proposal: 15 to 150 pages
- Amount of research: 0 to many papers

Get yourself familiar with your department expectations!
When do you propose then?

• You will “know” when you are ready!
  – I have done enough research.
  – I really really want to graduate!
• If not, your advisor should tell you.
• If not …
Again ...

Attend other proposals (defense)*!

Read other people’s proposals*
Under-confidence issues

• The imposter syndrome
  – My 2 papers were just luck! They are not that good!
  – They are good – but they don’t form a thesis
  – I haven’t done enough math! I have no experiments!

• Get a mentor.
• Talk to your friends and colleagues.
To summarize

• Do good research
• Think about the big picture
• Talk to other people
• Attend other people’s proposals
Allright, Prof. Smith. Let's cut to the chase.

What do I have to do to get you to sign off on my thesis?
Part III:
WRITING A Ph.D. PROPOSAL
What is a PhD Proposal really?

• a succinct write-up of your proposed research goals, strategies, justification, contributions
What is a PhD Proposal really?

- a succinct write-up of your proposed research goals, strategies, justification, contributions
- a brainstorming and planning process
- a good time to get feedback and direction from experts
What is a PhD Proposal really?

• a succinct write-up of your proposed research goals, strategies, justification, contributions

• a brainstorming and planning process

• a good time to get feedback and direction from experts

• Sometimes a stressful period of graduate school
Why write a PhD Proposal?

• Focus your research direction
  – Writing can clarify your thoughts
• Establish contact with committee
• Obtain feedback from committee
• An important step towards graduation!
• Side effect: Proposal writing experience
Challenges, Frustrations, Misconceptions

• “The proposal is just a hurdle. I can just propose ideas off the top of my head now and then figure out what I really want to do later.”
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• “How can I propose something when I don’t know the details yet?” – the unknown path

• “I don’t know how to organize the different parts of the research on the page.”

• “I am not ready yet. I might as well solve the problems and then present them”
What does a good Proposal Accomplish?

The proposal should clearly answer:

• What is the **problem** you are studying?
• Why is it **important**?
• What **results** have you achieved so far and why do they matter?
• How is this **substantially different** from prior work?
• How will you systematically **evaluate** your work?
• What do you need to do to **complete** your work?
When is the best time to write/present a Proposal?

• When you have a clear idea of the problem you want to solve
• When you have some preliminary work done to demonstrate promise of your approach
• When you have some notion of the major subproblems to be solved
• When your advisor recommends
What would help before I start writing?

• Think about what YOU want to accomplish
• Write a succinct thesis statement/hypothesis
• Discuss your ideas to others
• Presented parts of the research at seminars, conferences etc.,
• Think about 3-4 major contributions/papers
• Formulate these contributions in writing
How do I get started writing?

• Look at examples in your department, with same advisor, in same overall topic (from a distance)...
  – Breadth of project proposed
  – Separation into subprojects
  – Writing style: problem statement, hypothesis
  – Organization
    • Overall outline and flow
    • Within each proposed project section
  – How they motivated their topic and expected contributions
Think about the Audience

• Your Committee
  – Not necessarily all in your general topic area
  – Not familiar with your specific problem
  – Not aware of your prior work
  – Not aware of your skills, infrastructure

• Implications
  – Background: terminology, problem,…
  – State of the art related to your problem
  – Convincing motivation for importance
  – Demonstration of feasibility/promise of success
Organization

• Introduction
  – Problem statement and importance
• Background and State of the Art
• Proposed Research
  – Subsections on each research contribution
• Evaluation Plans
• Research Plan
• Summary of Expected Contributions
The Introduction

• Motivation and general, high level problem for non-experts to appreciate
• Quick overview of what state of the art does not address and the current needs
• Thesis statement – specific open problem and proposed strategy
• Brief overview of key insights and why is promising approach
• List of expected contributions of dissertation
The Background

• What level is it presented?
• How much is included?
• How is it organized?
The Background

- What level is it presented?
- How much is included?
- How is it organized?

A good rule of thumb:

Include terminology and background on an as-needed basis – let the rest of the proposal drive the background section.
State of the Art

• Which works need to be included?
• At what level of detail are they described?
• What order are they best presented?
• How do I nicely discuss limitations?
State of the Art

• Which works need to be included?
• At what level of detail are they described?
• What order are they best presented?
• How do I nicely discuss limitations?

A good rule of thumb:

Enough to give complete picture of context and novelty
Most closely related to least related.
Problem, strategy, limitations – show how still an open problem
Proposed Research

• Overview of project – diagram or flow chart?
• Specific projects in steps
• For each –
  – Assumptions
  – Problem Statement (including input and output)
  – Strategy & Overall Approach
  – Details known now
  – Plans for remaining challenges
  – Evaluation plan
Evaluation Plans

Experiment Design:
  – Questions you will target to judge success of your approach
  – Independent variables – what is being varied/compared
    • Eg, your technique versus other techniques
  – Dependent variables and Measures – what is being measured
    • Effectiveness – precision and recall, speedup
    • Cost – overhead
  – Subjects – which programs, loops, ...
  – Methodology
    • Design choices
    • Justification
Research Plan

- What steps do you plan to take next?
- After that? E.g. Future work
Expected Contributions

• Summary of contributions to the state of the art – intellectual/scientific merit

• Broader impact on the topic area, the field of computing, and the society
General tips on Writing: Diagrams

- Tell the story in a visual way
- Explain the key ideas
- Together they should present the main concepts and results
- The picture should be self-explanatory
- Each caption should clearly explain the associated diagram by itself
General tips on Writing: References

- Thorough survey
- Key references must be included
- Avoid having mostly self-citations
- Be generous & gracious
- Give appropriate credits
Part IV:
PROPOSAL PRESENTATION
What is the role of the Committee?

• Throughout the process ...
  – Guidance and Understanding of what to expect
  – Feedback
  – Eventually, reference letters

• At the proposal
  – Make sure you know your stuff, have thought about the issues
  – Make sure you have the right topic/focus/questions/plan

• At the defense
  – Make sure you know your stuff and that you’re ready to fly on your own
Selecting the PhD Committee

• PhD advisor

• Faculty in the topic area to provide useful direction

• Faculty outside topic to provide high level feedback

• External member – someone in research area who could write a ref letter or provide suggestions
Proposal Presentation Tips

- *Attend* others’ presentations before yours
- *Thank committee*, introduce yourself and background
- *Practice* presentation *many* times
  - Have someone take notes of questions
- Be polite during interruptions with questions
- Be open to suggestions
- Prepare for questions
- Don’t be afraid to have no answer for a question. Ask for direction/help on those questions.
- Be confident. Don’t look to advisor for answers.
Example Questions at Proposal Defense

– Topic: too large, too small; doable in the timeframe; focus; What are the can of worms that are beneath the surface (difficult to implement or evaluate)?
– Evaluation (plan, statistics, validity)
– Related work
– Practicality/scalability
– Limitations and possible ways to address them
– Vision of where this can go...
– Certain people have go-to questions.
– Watch your committee members on other committees
Summary: Ph.D. Proposal Process

1. Select your committee with your advisor
2. Create abstract of your proposal
3. Invite your committee members, sending them the abstract and predicted timeline
4. Get committee approved by department (if required)
5. Write proposal and iterate with advisor
6. Give proposal to committee
7. Prepare presentation of proposal
8. Prepare for hard questions – reread proposal as committee member
9. Set proposal defense date
10. Present and defend proposal
11. Celebrate this big milestone!
12. Thank committee, meet with advisor to discuss questions and directions
13. Move forward on research
Part IV: Completing Your Dissertation

You’ll have many tasks in completing your dissertation

Plan your research, and regularly revisit reevaluate, and revise these plans

— Map out what needs to be done, the order in which you will pursue each part of your thesis, etc.
Completing Your Dissertation

Take the initiative in your own research

– Usually start out taking advice
  • Advisor and committee set most of goals for your work
Completing Your Dissertation
Take the initiative in your own research

– Want to end up being a colleague of your advisor and committee
  • Should know your research area better than anyone else (even your advisor)
  • Should be able to defend your work/decisions
  • Should set directions for next subgoals
Completing Your Dissertation

Communicate your results along the way

– Identify publishable pieces of your work
– Make appropriate contacts along the way
  • Workshops and conferences
  • Intern or visit with a research group
  • Electronic communication with researchers
– Publish/present your work only with advisor’s approval
– Understand “rules” for authorship
Completing Your Dissertation

Develop good presentation skills (oral and written)

– Get feedback for your presentations
– Practice, practice, practice
  • To your research group
  • To your department
  • At conferences
For Completing Your Dissertation—Remember

• You’ll have many career options—so understand requirements for various careers and plan accordingly

• You’ll have many tasks in completing your dissertation—so understand and become accomplished in them

• You’ll often have difficult and stressful times—so remember that drive—not brains—distinguishes great scientists
Open Discussion

• Questions?
• Concerns?