

Preparing Your Thesis Proposal

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Dorian in One Slide



Professional Preparation

- Ph.D., CS, U. of Wisconsin
- M.S., CS, U. of Tennessee
- B.S., Math/CS, Regis U. (Denver, CO)
- A.S., Math/Phys/Chem, St. John's College (Belize)

Professional Appointments

- Assoc. Professor, Emory University, '17 -
- Asst./Assoc. Professor, U. of New Mexico, '09-'17
- Summer Faculty, Sandia Labs, '13
- Affiliate Research Scientist, New Mexico Consortium (LANL), '11-'13
- Visiting Scientist, Lawrence Livermore Lab, '09.
- Research Associate, U. of Tennessee, '99—'01.

Professional Interests

- Extreme-scale distributed systems/HPC
- Application fault-tolerance
- Software tools and infrastructures
- Adaptive runtime systems
- Resource management and scheduling

Personal Interests



Shaun in One Slide

- PhD, U of Washington 2011
- Assistant Professor, UMBC 2011-2014
- Assistant Professor, CU Boulder, 2014-
- Superhuman Computing Lab:
superhuman.cs.colorado.edu
- Research: HCI+accessibility, innovative accessible technology, making fabrication tools easier to use, tangible interaction
- Non-work activities: reading comic books, working with electronics, hanging out with 3 cats and human family, exploring beautiful nature in Colorado



In this session ...

The Final Years:

- **Part I: The Thesis Proposal Process**
 - Activity: Are you ready to propose?
- **Part II: From Proposal to Defense**
 - Activity: Your thesis statement or elevator pitch
- Complementary sessions at this workshop:
 - The Early Years: “Finding an advisor ...”
 - The Mid Years: “Finding a research topic ...”

Inspired by CRA(-W) presentations from [Susan B. Davidson](#) and [Ming Lin](#)!

Session Format (for each part)

- **Determine** the most to interesting topics (via live polls)
- **Offer** insights on popular topics
- **Interact** with audience via in-person and electronic questions
- **Participate** in a hands-on activity

ask questions at sli.do

Part I: Proposal Preparation

About the proposal

- Often the most challenging part of the PhD
 - May be your first time planning a series of research steps
 - May involve a more active research role
- A time to think through the next steps of your research
 - Anticipate potential challenges, minimize surprises
- A time to convince your committee about your upcoming work
 - Address tough questions now, or you might have to revisit them during the dissertation defense

Shaun's Lessons Learned

- Face the difficult problems early
 - You'll have to face them at some point; might as well get them out of the way
- Communicate with your committee
 - It's OK to get feedback before the proposal and before the defense
- Get feedback from your peer group
 - "Dissertation Support Groups" can be very helpful
- Build good routines
 - In what location do you do your best brain work?
 - What time of day do you work best?
 - What distractions do you need to take care of so you can focus?
 - What else do you need (food, exercise, idle time, family)?

Dorian's Lessons Learned

- A well-written proposal document goes a long, LONG way
 - thorough related work section minimizes “surprises”
 - many parts used repeatedly in publications and presentations
- Everything will take longer than you project (nothing took less time)
- Think about the end from the very start
 - what experiences/milestones are needed to land your dream job?
- Read proposal/dissertation documents and attend defenses
 - from your research group and young stars in your field
- You can't do it on your own: you need support from
 - advisor, research team members, other professors, colleagues, family and friends, others going through the same process

Proposal Preparation Topics

- What is a thesis/dissertation
- Dissertation vs. single project
- Dissertation design patterns
- What is a thesis proposal
- Thesis statement
- The proposal process
- Forming a committee
- The proposal document
- Proposal structure
- Writing tips
- Elements of a complete proposal
- Presenting the proposal
- Common pitfalls

sli.do Poll: Top 5 proposal preparation topics

sli.do: Event #J160

What is a thesis or dissertation?

A statement or theory put forth as a premise to be maintained or proved

An essay or dissertation involving research, written by a degree candidate

A final demonstration of one's ability to be an independent researcher.

Starts with a problem ... and ends with a comprehensive treatise

- Identify compelling, **open questions** or problems
- Read **background literature** to understand state of the art and field
- Conceive **novel approach** to answer questions or solve problems
- **Execute research** to observe analytical or empirical outcomes
- **Analyze outcomes** to **draw conclusions**
- **Present/defend** your assertions and findings in oral and written forms

Dissertation vs. a single project

- Planning your dissertation involves identifying not just the next step, but looking several steps ahead
 - This may require understanding where things might go in an unexpected direction, and planning out how to deal with that
- Often, a dissertation involves a series of steps that explore a single topic from multiple directions
 - Using different data, user groups, methods, or technologies
 - **Triangulating** the parts to achieve a greater whole

Dissertation design patterns

- A dissertation may fit into one of these patterns:
 - A theory comprising theorems and proofs from first principles
 - A new algorithm to solve an existing and well-known problem, compared to current techniques
 - A new system that enables people to do something new, along with an evaluation of how real people use it
 - A series of studies that illuminate something new about human behavior as it relates to technology

What is a thesis proposal?

a written statement of your thesis/dissertation plan

Your opportunity to:

- To demonstrate your readiness for in-depth research
- To brainstorm a (mini) research agenda
- To refine ideas into an execution plan
- To demonstrate (to yourself and others) your agenda's feasibility
- To maximize success by getting (early?) feedback and advice
- To get an endorsement of your thesis plan

Your advisor's/committee's opportunity to:

- to assess your readiness/preparedness to do in-depth research
- to learn about a particular sub-field and its challenges
- to learn about ideas for addressing sub-field's problems
- to give feedback and advice

Thesis Statement

a (hypothetical) proposition that serves as the foundation of your dissertation

- defines the scope of your investigation
 - focuses and bounds your work
 - do only what's “necessary to assess your thesis statement”
- specifies the stance of your work
- presents a set of clear, arguable, and provable assertions
- should be (somewhat) fixed: the proposed work may change, but carefully consider changes to your central thesis

Elements of a strong thesis statement: a problem, a solution approach, a projected outcome, testability/provability, uniqueness

The proposal process

1. Identify a research topic or area
2. Identify some open research questions or problems
3. Develop an approach to address the open issues
4. Gather sufficient evidence of feasibility
5. Form a committee
6. Write proposal document
 - Get iterative feedback from the committee
7. Prepare your talk
 - Practice a lot
8. Defend your proposal
9. Celebrate 🎉

Forming a committee

- Work with your advisor!
- Factors to consider
 - Add committee members that can lend helpful expertise
 - Your advisor should help identify complementary interests
 - A committee member will learn your work deeply and may become a good letter writer/job reference
 - There are departmental and university requirements
 - Some departments encourage external committee members

The proposal document

- A formal, refined exposition of your planned dissertation
- The written counterpart to your proposal defense
- An opportunity to get a jump-start on your dissertation document
 - the final document may just be filling in details and results
 - consider adopting the final style requirements
- The length of your document will depend on
 - Advisor, committee and department culture
 - how far along you are
 - you may include prior papers as appendices or even inline
 - A 5-year NSF project proposal is 15 pages!

(One) proposal structure

1. Introduction

What is the dissertation about? Who cares? What is the thesis? What are the research questions?

2. Related Work

What fields and areas does your research build on? What are the gaps in current knowledge? Does your work address these gaps?

3. Proposed Research

May include prior research. Clearly detail what you intend to do and what will be learned. Have separate subsections for each component of the research. Show how work addresses research questions.

4. Research Plan and Timeline

How long will this take? Consider where might you get stuck or delayed.

5. Summary of Expected Contributions

*How does this work, together, transcend the sum of its parts?
Show that this work will answer your research questions.*

Proposal writing tips

- Write early and often! Always be writing – brainstorming, streaming consciousness, rough drafting, fine-tuning, ...
 - Iterate, iterate, iterate
- Get committee feedback before the defense (if possible)
- Learn from others
 - Ask your advisor, committee members, and peers for their proposals and dissertation documents
 - Attend proposals, defenses, and job talks
- Clarity is essential! Be clear about what has been done, what you will do and expected outcomes
- Include a **thesis statement** and specific **research questions**
- Leverage writing groups in your department, institution or community

Elements of a complete proposal

A strong research proposal

- Motivates
 - background for the target set of challenges
 - inspiration for why the targeted challenges are important
 - unresolved challenges despite other related works
- Describes
 - specific target problems and questions
 - a hypothesis for resolving the problems
 - anticipated outcomes
 - a methodology to evaluate the hypothesis
 - tools and resources needed to implement methodology
 - sufficient plausibility and feasibility

Presenting/Defending your proposal

- Practice a lot!
- Get feedback from your peers and advisor (if allowed)
- Be mindful of timing - a talk that is too long or too short might irritate the audience
- Anticipate possible questions, and come up with answers to them
- All research has limitations - be confident about your choices in planning the research, and explaining the decisions you've made

Proposal pitfalls

- Vague, ambiguous proposal that doesn't address important questions
 - These will come back to haunt!
- Not keeping committee members updated with works and drafts
 - They may request significant changes before approving proposal
- Long, unfocused proposal document or presentation
 - Too long; didn't read
 - Your research plan may be too complicated, or likely unresolved
- Rightsizing:
 - Scope: Too narrow or too broad
 - Timeliness: Too current (technology-specific) or too abstract
 - Size: Too incremental or too big
- **The key is communication (with advisor) and diligence**

Activity I: Thesis Proposal Preparedness

Outcome: an objective self-assessment of your readiness to propose (and proposal elements to work on if not ready)

1. Complete answers on Activity I handout
 - a. We will walk through each survey question
 - b. Elaborate with details or notes in the space provided
2. Assess your overall preparedness
 - a. Was the process illuminating?
 - b. Do you think the outcome accurately reflects your preparedness?
 - c. Were you surprised by the outcome?

Part II: From Proposal to Final Defense

Dissertation Process Topics

- Publishing your thesis work
- Pitfalls and contingencies
- Dissertation committee
- Knowing when you're finished
- Dissertation defense

sli.do Poll: Top 5 final dissertation topics

sli.do: Event #J160

Publishing your thesis work

Are there publication requirements?

One universal publication requirement: submit thesis document for publication (by your institution)

Other implicit or even explicit publication “expectations”:

- “n publications”
- “m publications; n publication-quality works”, where $0 < m \leq n$

How do I turn my publications into my thesis document?

- One extreme: “The giant staple”
- Another extreme: “The giant shredder”
- In the middle: New unifying front/back matter, publications intact
- Also in the middle: refactoring publications with unifying prose throughout: front, back and middle

Your mileage (aka advisor/committee) will vary! Understand the expectations.

Pitfalls and Contingencies

- Getting scooped
- Unexpected results
- Unexpected obstacles
- Unexpected degree of difficulty
- Deviation from proposal plan
- Life
- Burnout
- Challenges w/ advisor (incompatibility, departure, etc.)

When are you finished?

Easiest answer:

When the proposal plan is complete

Hardest answer:

When your advisor/committee says so

Truest answer:

When you are able to convince your advisor and committee that you have sufficiently completed a sufficient exploration with sufficient results and sufficient analysis of a sufficiently substantial body of work

Dissertation Committees

In principle, this committee can be completely different from your proposal committee (including advisor). In practice, this is not a very good idea!

Reasons to maximize proposal and dissertation committee overlap:

- The proposal committee endorsed your thesis plan
- The proposal committee should not require full re-indoctrination

The Dissertation Defense

Everything from the proposal defense still holds and ...

- a defense of work done, not work to be done
- you have to be selective:
 - describe the entire body of work at a high-level
 - deep dive into 1 or 2 elements (best results? highest impact?)
- you may not have all the answers, but
 - there should be only “known unknowns”, no “unknown unknowns”
 - you should be painfully aware of your work’s merits and limitations
- your advisor may be less vocal than during your proposal defense
 - you should be able to defend your work
 - you should be able to control the session and your soon-to-be peers

Activity II: Elevator Pitch

Outcome: an effective elevator pitch or thesis statement

1. Using the Activity II handout as a reference, construct a written elevator pitch or thesis statement
2. Pair up with your neighbor
3. Each partner recite your research elevator pitch or thesis statement
4. Give feedback to your partner:
 - a. Does it make sense?
 - b. Is the problem interesting?
 - c. Is the solution approach clear?
 - d. What questions might you have about the work?

Part III: The Next Steps

Post-workshop Action Items

Now the rest is up to you ...

Sometime today, complete Activity III to identify imminent action items

Additional Resources: Judith Olson's 10 questions

Can you answer these questions for your current research interest?

1. What is the problem?
2. Who cares about this problem? Why is it important?
3. What have other researchers done to address this problem?
4. What is your approach to this problem?
5. What, specifically, will you do?
6. What do you expect will happen? What results do you already have?
7. What do your results tell us about the problem? What does this mean?
8. Who cares about these findings?
9. Where will you publish these results?
10. What will you be doing in 5 years?

The End

Thank you!

Good Luck!!!

Strategies that might help

- When you complete your dissertation, you will be considered one of the world's top scholars in **X**. What do you want X to be?
- **Make connections and mashups.** Lots of research ideas involve combining two disparate threads, or bringing an existing approach to a new context
 - Read papers and see talks outside your narrow research area
 - Practice applying an idea from one project to a new context
- **Imagine the end state.** Try writing out titles and abstracts, or preparing slides. As Stephen Covey says, “Begin with the end in mind.”

Activity C: Checklist for next steps

- Pair up with a neighbor
- Make a list of next steps to take after this workshop
 - Questions to ask your advisor
 - Papers to read
 - Potential committee members to talk to
 - Dissertations (and proposals) to read
 - etc.

Finding a problem

- Read **a lot**. Read in your core area to identify gaps in our current understanding. Read in other areas to identify new strategies and places to bring together different research threads.
- Attend job talks, dissertation proposals, and defenses. Learn about how people talk about your research area, the current state of the art, and unresolved problems.
- Talk to your advisor, graduate students, and others
- Get involved in a research project
 - Even if it's not in your main area of interest

How NOT to find a problem

- Don't wait around for inspiration
 - It usually won't just show up
 - Waiting doesn't help you get publications or build collaborations
- Instead, work on something while you figure out what your thesis will be about
 - You'll learn skills that will be useful in your own work
 - You may find interesting problems or approaches within that work
- You can discuss possible projects with your advisor while you refine your ideas for the thesis

Analyzing your approach

- What is your approach?
- How does it leverage your skills?
- How do you know it will work?
 - If it doesn't work, what does that tell us?
 - What will you do instead?
- Why hasn't anyone tried this before?
 - Do you have a new way of solving the problem?
 - Did something change in terms of technology that enables a new solution?
 - ... or maybe this is a problem that people aren't all that interested in solving?

How do you know if your idea is good?

- Talk about it, get feedback, and iterate (many times)
- Ideally, the thesis should be interesting to a range of people, not just your labmates
 - Other graduate students and faculty
 - Other people you know
- Accept that it is going to require lots of iteration
- Where can it go wrong?
 - Poorly formulated or unclear problem
 - An unconvincing problem that doesn't excite people (not a real problem, too incremental)
 - Vague or undefined approach

Do you actually want to work on this?

- Completing a dissertation will take many hundreds of hours
- Do you want to spend this much time working on this problem?
- It is important for the research community to be interested in your project, **but you need to be interested also**