

CHOOSING A DISSERTATION TOPIC

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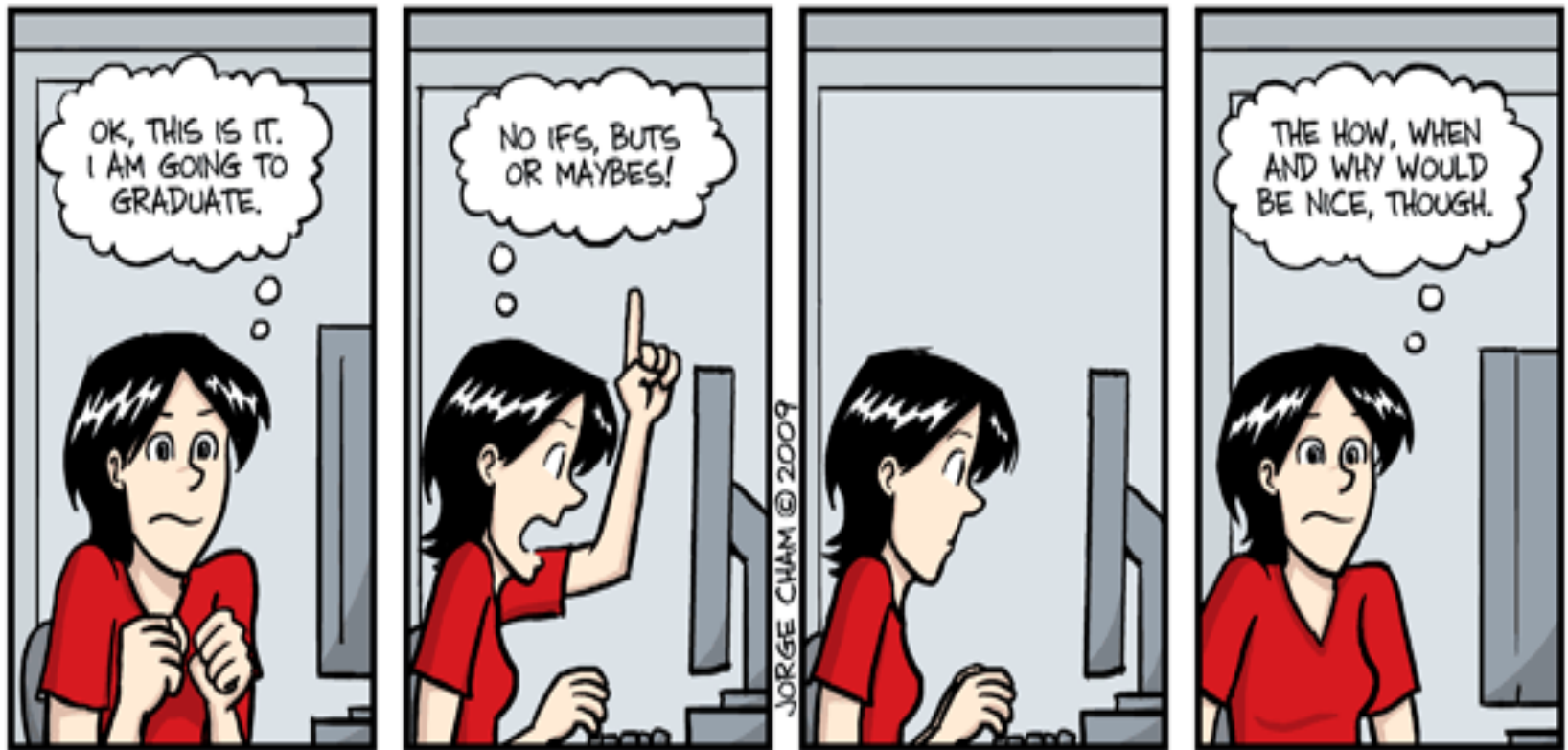
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Some slide content courtesy of Ming Lin

A dissertation starts with a problem

- The problem must be novel
 - It should excite you
 - It should be significant
-
- ... and you should be able to solve it

Topic = Problem + Approach

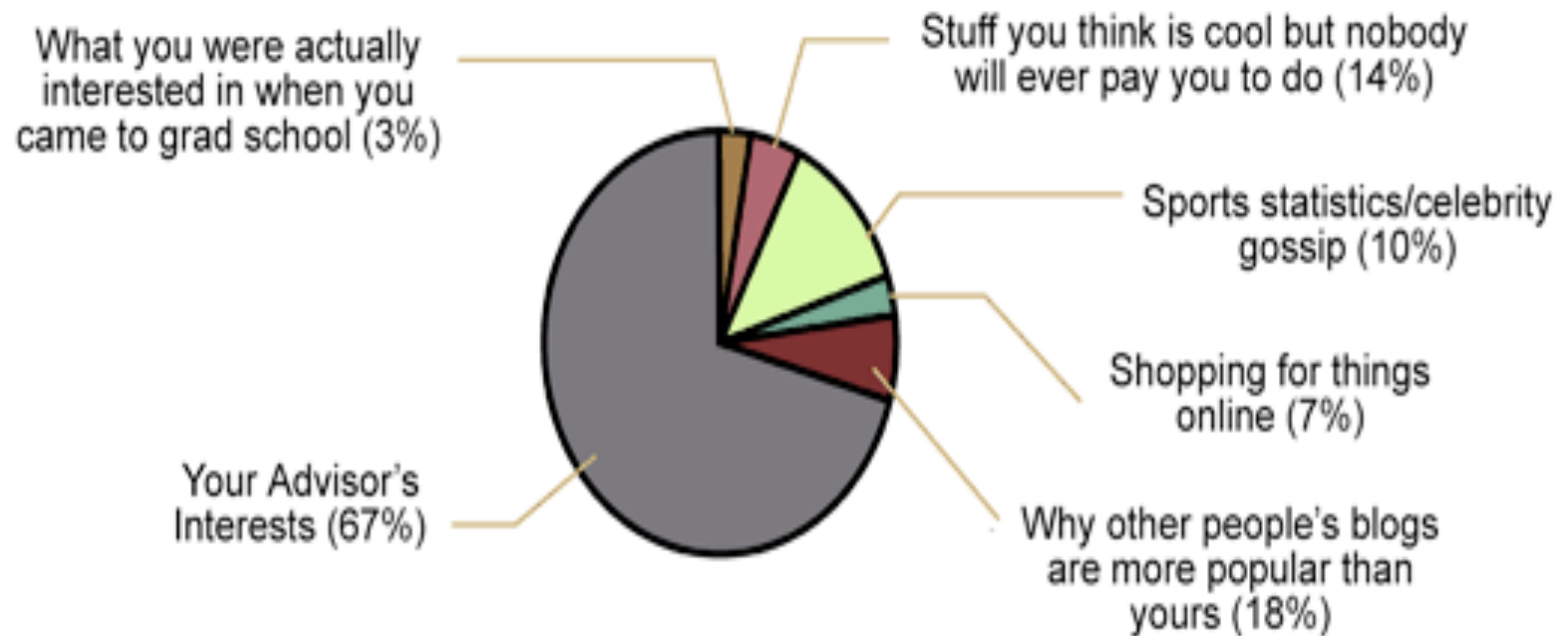
Inspiration versus Perspiration

- There are two main ways to find a topic to work on: inspiration and perspiration.
- Inspiration is great, but unpredictable.
- Perspiration is a lot more dependable.

Techniques for finding a problem

- Talk to your advisor and/or faculty who teach courses you find interesting
- Talk to the postdocs/graduate students involved in interesting research
- Get involved in a research project
 - Build something, and see what's hard about it.
Whatever caused you difficulty has a potential of thesis topic in it.
- Read papers, possibly in the context of a research reading group
- Read other proposals and dissertations
- ...

Your Research Interests:



Types of dissertations

- A theory consisting of a body of theorems and proofs from first principles
- A new algorithm to solve a existing technical problem evaluated against current techniques
- A new system that makes something possible that was not before
- A new problem, with spectrum of solutions that can be compared/contrasted
- ...

Is it a good topic?

- Explain your problem and approach to people.
 - **Poorly formulated:** If it takes half an hour or more for anyone to understand what the problem and approach is, then *you* don't understand it.
 - **Poorly motivated:** No one thinks the problem matters.
 - **Unconvincing:** Everyone thinks the approach is obvious or an incremental idea over what is already being done.

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!

Multiple research problems

- It is OK to explore multiple problems until you figure out what you like.
- If they are related enough, you may be able to bundle them together with a coherent story to create a dissertation.

The big picture

- Finding a dissertation topic is your responsibility
- Spend a few minutes every day thinking about your dissertation.
- Just thinking about the title for your dissertation helps



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YOUR THESIS PROPOSAL

Martha Kim
Associate Professor
Columbia University



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What is the Proposal?

A statement of your planned thesis with a write up of your approach, contributions to date, and planned work.

An opportunity to

- Brainstorm and plan
- Focus and clarify your thoughts (in writing)
- Establish contact with a committee
- Get feedback from the committee

Proposals take work, can be stressful, are ultimately valuable.



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A Good Proposal Should Answer:

- What **problem** are you 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 **evaluate** your work?
- What do you need to do to **complete** your work?



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Requirements and Expectations Vary

- When: 3rd to 5th year
- Length of document: 15 to 150 pages
- Amount of research: 0 to many papers

Attend proposals. Read them. Learn your department's expectations.



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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 the promise of your approach
- When you have some notion of the major sub-problems to be solved
- When your advisor recommends



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Forming Your Committee

- Talk with your adviser about selecting committee members
 - Internal v. external
 - Technical expertise
- Often, but not always, this will be your defense committee
- Get committee approved



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YOUR THESIS COMMITTEE

Also known as: an impossibly difficult group to get together in one room but who nevertheless hold your future in their hands depending on their ability to reach a civilized consensus.



Your Professor

Simultaneously your biggest ally and your worst enemy. Will be the first to suggest you do more work.



The Guru

Only here for the free cookies. Don't forget to bring cookies.



**Adversary
The Adversary**

Has bitter rivalry with your Professor and will argue the exact opposite view. Work this to your advantage.



**The
Strawman/woman**

Nice guy.
No opinions.



**The Assistant
Professor**

Still doesn't believe just a few months ago they were on the other side just like you. Pretends to be an adult.

NONE OF THEM WILL ACTUALLY READ YOUR ENTIRE THESIS.

How Long Should a Proposal Be?

- For the National Science Foundation (NSF)? 15 pages
- Yours could be
 - Shorter, and more concise
 - Longer, with more detail



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Example Organization

- **Introduction (problem statement and importance)**
- **Background and State of the Art**
- **Proposed Research**
 - **Subsections on each contribution**
- Evaluation Plans
- Research Plan
- Summary of Expected Contributions



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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



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Background and State of the Art

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

- Good rule of thumb on Background: Include terminology and information on as needed basis. Let your story drive this section.

- Rule of thumb of State of the Art: Proceed from most to least closely related. Give enough to form complete picture of context and novelty.



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Proposed Research

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



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A Couple Tips on Writing

- Make key points early and clearly. (Topic comment rather than comment topic.)
- Tell the story in a visual way, with each caption highlighting the key insights from the figure.
- Use references to give appropriate credit. This is part of scholarship.



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A Couple Presentation Tips

- Before
 - Attend other presentations
 - Practice many times
 - Practice Q&A
- During
 - Thank committee, and introduce self and background
 - Have friend take note of questions
 - Be open to suggestions
 - Don't be afraid if you don't have the answer. Acknowledge it and ask for guidance.
 - Be confident. Do not look to advisor for answers.



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Challenges, Frustrations, Misconceptions

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



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