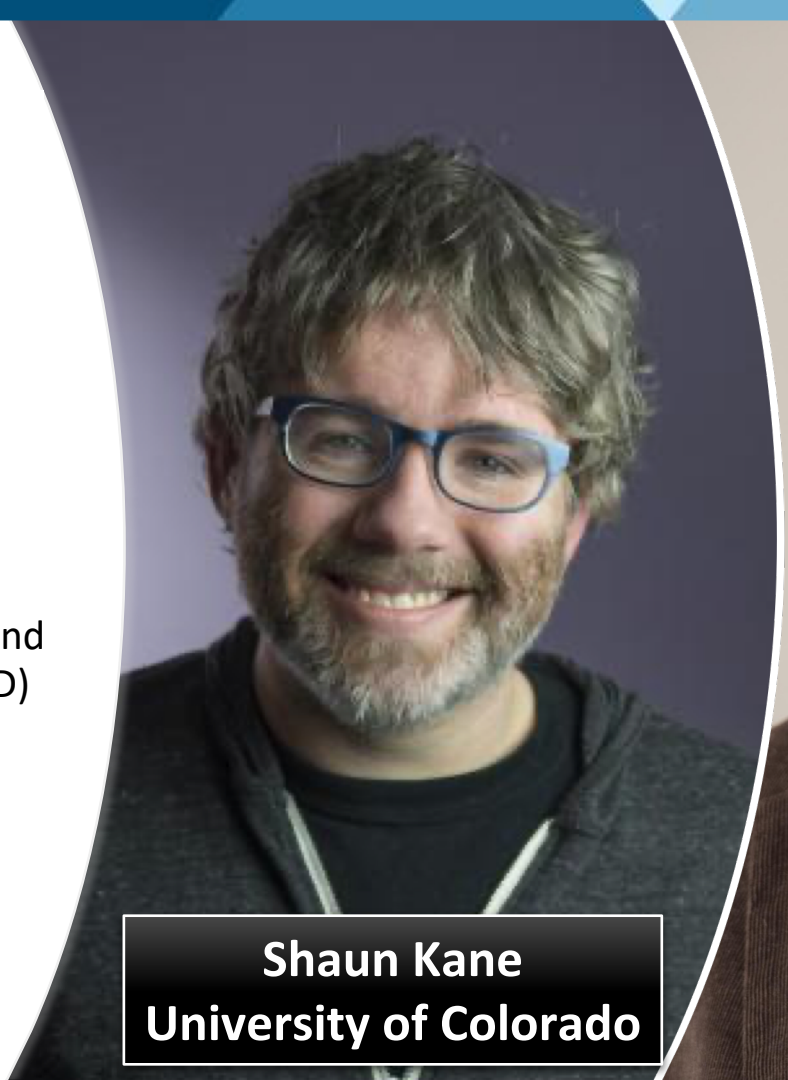
Preparing Your Thesis Proposal and Becoming a Ph.D. Candidate

Grad Cohort for
Underrepresented Minorities and
Persons with Disabilities (URMD)

Austin, TX
March 5-7, 2020



Shaun Kane
University of Colorado

Dorian Arnold
Emory University

CRA-WP
Computing Research Association
Widening Participation

Session Learning Outcomes
(and related topics)

- **Thesis 101**
- Finding an advisor (Saturday 11:20a)
- Finding a research topic (Friday 8:50a)
- **Proposal Process**
- **Proposal Manuscript**
- Publishing Your Research (Saturday 11:20a)
- **Lessons Learned**
- **Additional Resources**
- Presentation & Verbal Communication Skills (Saturday 10:10a)

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

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 Interests

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

Professional Appointments

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

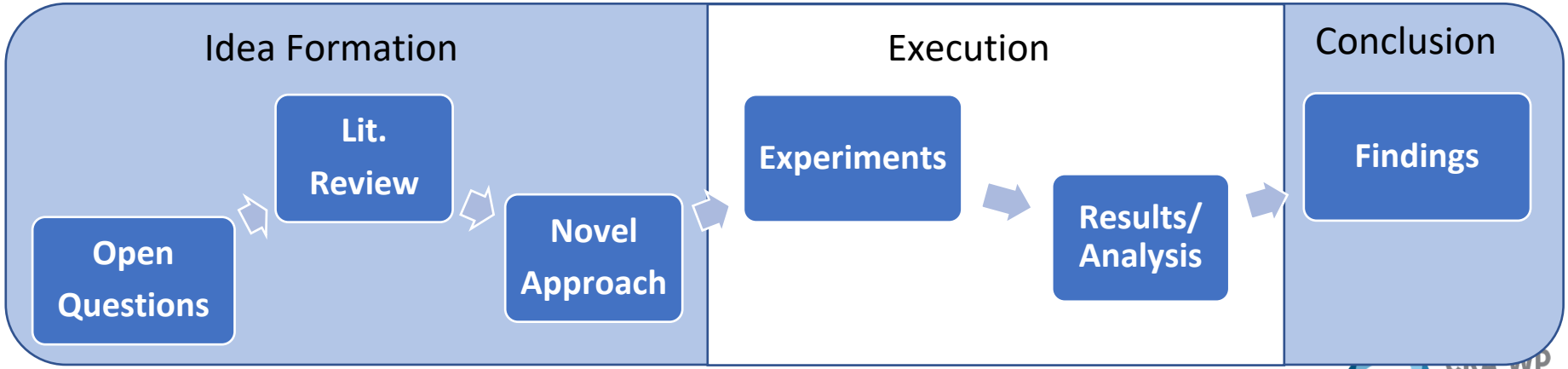
Thesis 101

What is a thesis?

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

a long essay or dissertation involving personal research, written by a candidate for a college degree: a doctoral thesis

Starts with a problem … ends after a comprehensive treatise



Some Dissertation Design Patterns

- Theorems and proofs from first principles
- New algorithmic solution to an existing problem, compared to current techniques
- System that enables new capabilities and an evaluation
- New concepts of human behavior related to technology

Thesis Statement

a proposition that serves as the basis of a dissertation

clear, arguable, testable, novel

projects an outcome

has a definitive scope

The thesis proposal: (not so) hidden opportunities

a statement of your thesis execution plan

Master sub-field background

Early feedback/advice

Idea refinement

Project Brainstorming

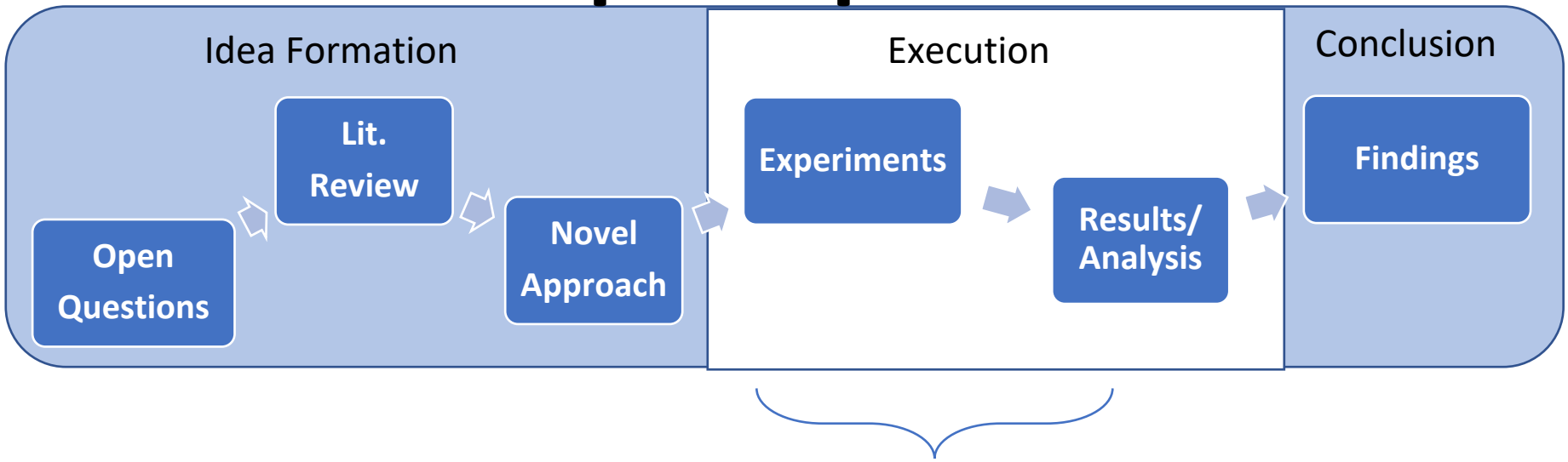
Demonstration of research readiness

Plan endorsement

CRA-WP
Computing Research Association
Widening Participation

The Proposal Process

Proposal process

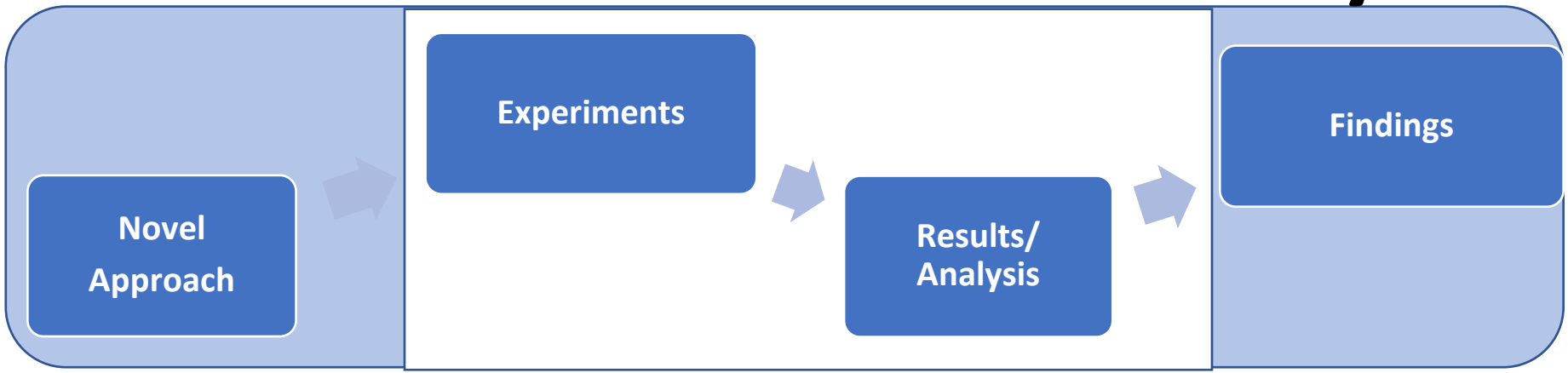


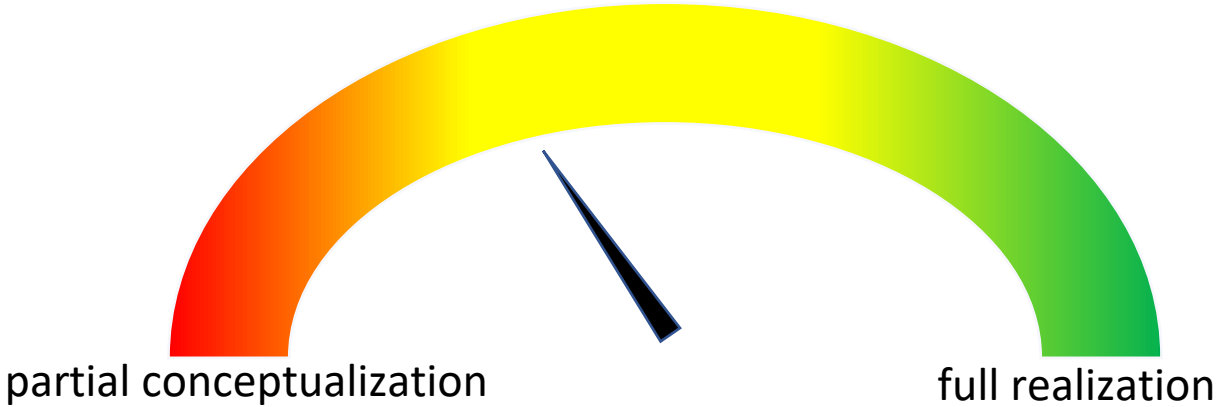
1. Demonstration of feasibility
2. Formal writeup
3. Committee formation
4. Presentation/Defense

Are you ready to propose? →

CRA-WP
Computing Research Association
Widening Participation

Demonstration of Feasibility

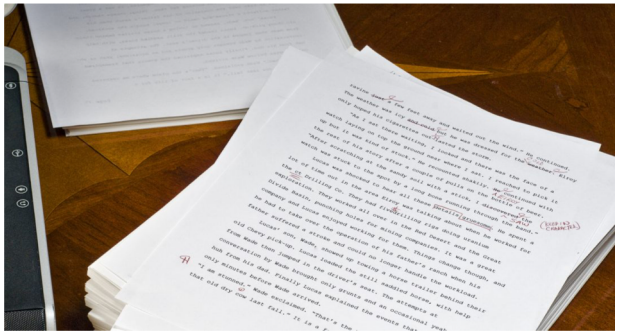




CRA-WP
Computing Research Association
Widening Participation

Proposal Document

- A formal, comprehensive, refined exposition
- Written basis of proposal defense
- Jumpstart to dissertation manuscript
- Length will vary



(One) proposal structure

1. Introduction

   motivation; scope; thesis; research questions; methodology; expected contributions

1. Background and Related Work

2. Proposed Research

   Detailed plan for each question with expected outcomes.
   Include preliminary results.

1. Milestones and Timeline

A strong research proposal …

Motivates …

- background for the target set of challenges
- inspiration for why the targeted challenges are important
- unresolved challenges by related works

Describes …

- the specific target problems and questions
- a hypothesis for resolving the problems
- anticipated outcomes
- an evaluation methodology
- the set of tools and resources needed to implement methodology
- sufficient feasibility of the proposed methodology

Committee Formation

- Things to consider
  - Program requirements
  - Your advisor's perspective
  - Expertise: Subtopic? Topic area? Discipline?
  - Networking/exposure opportunity
  - External committee members
  - Personalities
  - Final dissertation committee

Presentation/Defense

- Your proposal defense is an examination!
- Understand the culture and expectation from your advisor and peers
  - What is the session format?
  - How long should it be?
  - Is it open or closed to the public?
  - Should I bring food?
  - Possible outcomes

From Proposal to Defense

Publishing your thesis work

Implicit or explicit program/advisor publication requirements?

- papers published? written? researched?

How do I turn my publications into my thesis document?

When are you finished?

Easiest answer: *When the proposal is fully executed.*

Hardest answer: *When your advisor/committee says so.*

Truest answer: *When you are able to convince your advisor and committee!*

Pitfalls and Pointers

Writing tips

- Iterate, iterate, iterate
- Get feedback from advisor, lab mates, committee …
- Learn from others
  - Get prior examples of proposals and dissertation documents
  - Attend proposals, defenses, and job talks
- Writing consultants and groups

Presentation Tips

- Practice, practice, practice …
  - with self, advisor, lab mates, peers
- Know your timing
  - You can’t present it all!
- Anticipate the questions
  - Minimize the “unknown unknowns”
  - Master the technical bases of your work
  - Know the limits of your work
  - Have contingency plans for high risk activities

Proposal process pitfalls

- Vague or incomplete proposals …
  - will haunt you later!
- Committee members haven't seen your work before the proposal
  - May request significant changes before passing/approving
- Long, unfocused document
  - Too long; didn't read
  - plan may be too complicated or unresolved

Dissertation Process Pitfalls

- Getting scooped
- Unexpected results
- Unexpected obstacles
- Unexpected degree of difficulty
- Deviation from proposal plan
- Advisor challenges (incompatibility, departure, etc.)
- Life
- Burnout

Dorian'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)?

Shaun'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

Additional Resources

Activity: Thesis Proposal Preparedness

Activity: Next Steps

Activity: Elevator Pitch

Judith Olson's 10 Questions

Heilmeier Catechism

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

1. 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?

Activity II: Checklist for next steps

- Pair up with a neighbor

- Make a list of next steps
  - Questions to ask your advisor
  - Papers to read
  - Potential committee members to talk to
  - Dissertations (and proposals) to read
  - etc.

Activity III: 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?

Judith Olson's 10 questions

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?
6. Where will you publish these results?
7. What will you be doing in 5 years?

Can you answer these questions for your current research interest?

CRA-WP
Computing Research Association
Widening Participation

Heilmeier Catechism - DARPA

- What are you trying to do? Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What is new in your approach and why do you think it will be successful?
- Who cares? If you are successful, what difference will it make?
- What are the risks?
- How much will it cost?
- How long will it take?
- What are the mid-term and final “exams” to check for success?