Week 1B: Research 101
Creating & Cultivating Ideas

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Slides adapted from Matthew Hicks’ “Research 101” lectures
Reminders

Sign up for paper presentations by **Tuesday, September 6th**

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STEFAN NAGY
All Sections

Signup sheet here: [https://docs.google.com/spreadsheets/d/1dtoXZnEM36yaQlSgo--qPeEuTzl5jsNyFSkKKePDgsk/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1dtoXZnEM36yaQlSgo--qPeEuTzl5jsNyFSkKKePDgsk/edit?usp=sharing).

Audience: you are not required to read the paper.

- You *are* required to participate in the class discussion of the paper.

Presenters: your job is to *teach* us the paper.

- Contextualize, pros and cons, main contributions, summarizing, identifying key assumptions.
- Prepare a short slide deck (you are free get "inspired" from existing presentations).
- Deliver a 10 – 20 minute presentation (with a 10 minute audience discussion to follow).

Course Syllabus & Schedule: [https://www.cs.utah.edu/~snagy/courses/cs5963/](https://www.cs.utah.edu/~snagy/courses/cs5963/).

Questions? Contact me at snagy@cs.utah.edu.
Assignments page is now live

https://www.cs.utah.edu/~snagy/courses/cs5963/assignments.html

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**CS 5963/6963: Applied Software Security Testing**

**Paper Presentations**

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<td><strong>Signup sheet is available:</strong> <a href="https://www.cs.utah.edu/~snagy/courses/cs5963/assignments.html">here</a> (accessible only via your UMail account).</td>
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**Audience:** you are *not* required to read the paper.
- However, you are *required* to participate in the class discussion of the paper.
Questions?
Ideas
Great ideas underpin great research

- Great ideas can be **ruined by bad execution**
- Great execution **cannot promote a poor idea**
- Great ideas are **context and time sensitive**
Where do great ideas come from?

How to come up with research ideas?

As a very new researcher who is exploring the best way to generate ideas, some guidance on this question would be very helpful. I have found that this is NOT easy; ideas seem to pop out of my Professor every day and I wonder how he does it. This question is broad;

- How do you tend to come up with initial/seed ideas? What is your search method (if you have one)?
- What proportion of your ideas do you think come from; (i) colleagues, (ii) intentionally browsing the literature for inspiration, (iv) conferences, (v) other?
- How do you prioritize research ideas?
- Is there any special, general, or technical skill you have discovered to sift out those ideas that are likely to be unrealistic or impractical in a generation?

https://academia.stackexchange.com/questions/5853/how-to-come-up-with-research-ideas
Where do great ideas come from?

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Where do great ideas come from?

The foundation of all good ideas is **understanding**.
Where do great ideas come from?

**Observation:** That’s odd... ?

**Curiosity:** What happens if... ?

**Challenge:** How do I do... ?

**Transference:** That works there... will it work here?
Don’t publish an idea… publish its *proof*
Research is a process
Research is a (random) process...
Research is a (random) process...
Research is a (random) process...
Research is an **iterative** (and **random**) process
Problems are not ideas
Ideas are born out of problems

- What is the next big problem that society will face?
  - Research thrust, direction, or arc

- What are the open problems in a specific area?
  - Research paper

- What are common yet unsupported assumptions?

- Are there flaws or unnecessary hurdles with existing approaches?
Finding great ideas is like gold mining
Push back on ideas

- Filtering questions:
  - What is the problem you are trying to solve?
  - What critical observations or insights lead to your approach?
  - What is your approach (in less than a paragraph)?
  - What are the key evaluation questions?

- Design a quick exploration to feel for success
Get inspired!

- Read technical papers
- Read blogs and news sites
- Attend technical presentations
- **Talk with your colleagues**
- Volunteer to review papers
- Present already-published work
- Work with those in industry
- **Do something other than research**
You won’t think of an idea twice

- **You will forget ideas**
  - You will forget the nuance behind ideas

- **So... write every idea down!**
  - Technology makes this easy nowadays
  - Desktop .txt file, Google Doc, iOS Notes app, etc.

- **Go through your idea book periodically**
  - Change in skills, interests, resources, news
  - Enhance, delete, and re-rank
  - **Junior researchers:** start documenting your ideas
  - **Senior researchers:** start organizing & grouping your ideas
You have to make a hard choice

What idea should I work on?
You have to make a hard choice

What idea should I work on?
Big vs. Small Ideas

- **Big ideas** (directions, thrusts, arcs)
  - Usually generate alone
  - Occasionally with 1–2 others

- **Small ideas** (one step forward)
  - Generate with collaborators
  - Often are spin-offs of big ideas
  - Help inspire big ideas
Excitement vs. Doability Trade-off

- The best ideas are often **the most uncertain**

- **Questions to ask yourself**
  - Can I learn enough to do it?
  - Will this even work?
  - Will others find this interesting?

- Uncertain ideas often spawn future (more certain) work
Other Considerations

- Advisor (interests, funding)
- Department/lab resources
- Your skills and experience
- Available experts
- Potential collaborators
- How easy to publish/potential impact
- Publication venues

and...
The “First Mover” Advantage

- If you are not the first to an idea, you likely face an uphill battle
- How far behind are you in knowledge, resources, and infrastructure?
When to Detour vs. Commit

- Write distracting ideas down
- Talk with your advisor
- Good ideas can lead to great ideas
- Be prepared to let an idea go
Questions?
Links

- [https://medium.com/digital-diplomacy/how-to-look-for-ideas-in-computer-science-research-7a3fa6f4696f](https://medium.com/digital-diplomacy/how-to-look-for-ideas-in-computer-science-research-7a3fa6f4696f)
- [https://academia.stackexchange.com/questions/5853/how-to-come-up-with-research-ideas](https://academia.stackexchange.com/questions/5853/how-to-come-up-with-research-ideas)
- [https://en.wikipedia.org/wiki/Creativity_techniques](https://en.wikipedia.org/wiki/Creativity_techniques)
- [http://paulgraham.com/startupideas.html](http://paulgraham.com/startupideas.html)