Studying and Conducting Research

EC Mentoring Workshop, 2024

Speaker: Bo Waggoner, University of Colorado

Outline

0. Intro

1. Personal maintenance and development

2. Learning and studying

3. Exploring the frontier

Not discussed:

- **Collaboration** - see How-To talk #3 today!

Polls

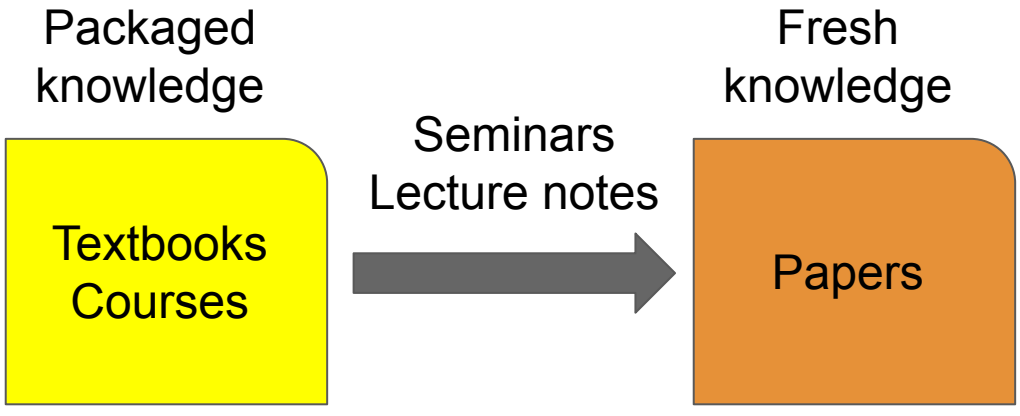
- **Stage of career:** pre-PhD / early PhD / mid-late PhD / post-PhD
- **Research experience:** have read papers / have written a paper
- **Field of study:** Computer Science / Econ / other

Production of knowledge

Packaged knowledge

Textbooks
Courses

Production of knowledge



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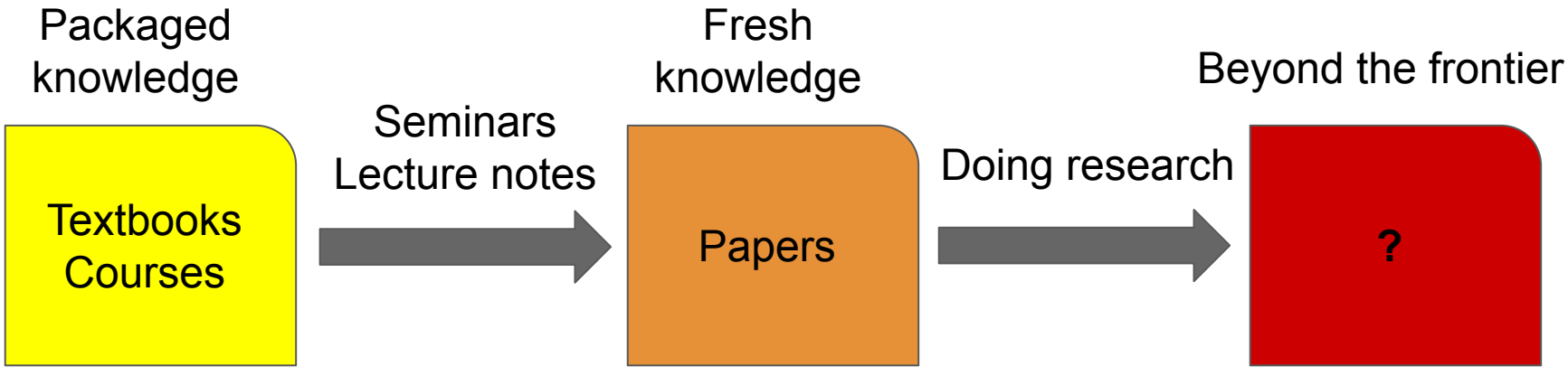

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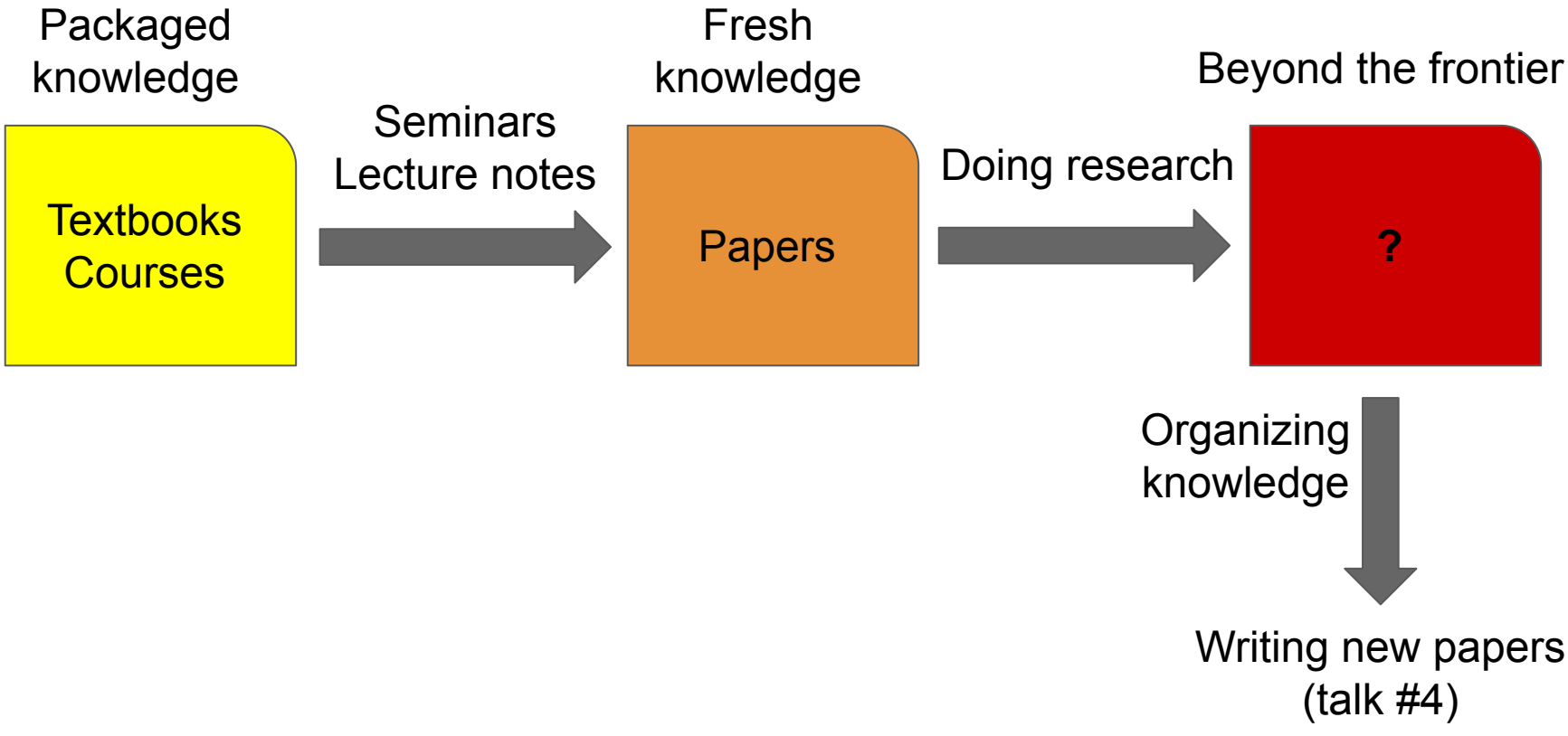
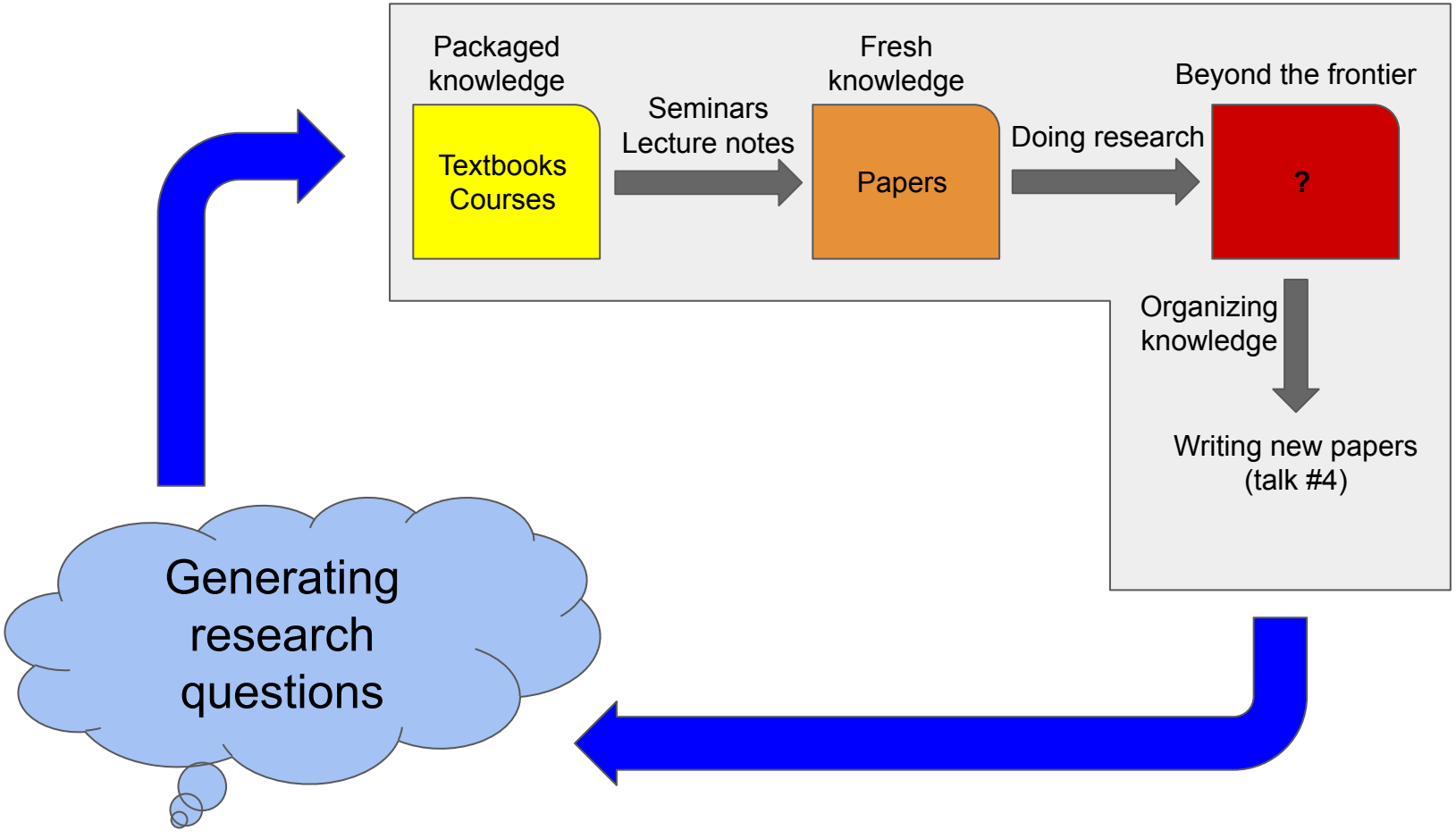
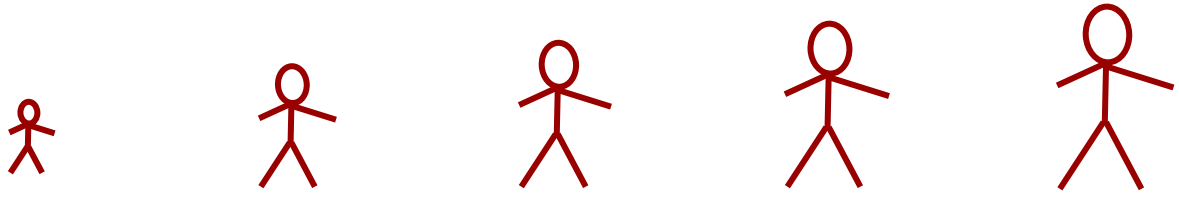


Life cycle of contributions



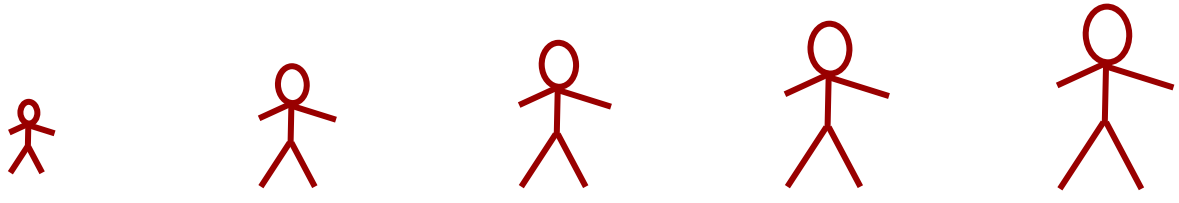
1. Personal maintenance and development

“Growth mindset”



“Growth mindset”

- **Expect to learn and change.**
  - You’re *supposed* to not initially know things or be good at stuff…
  - …but you *cannot* believe that is permanent…
  - …nor accept your current limitations.



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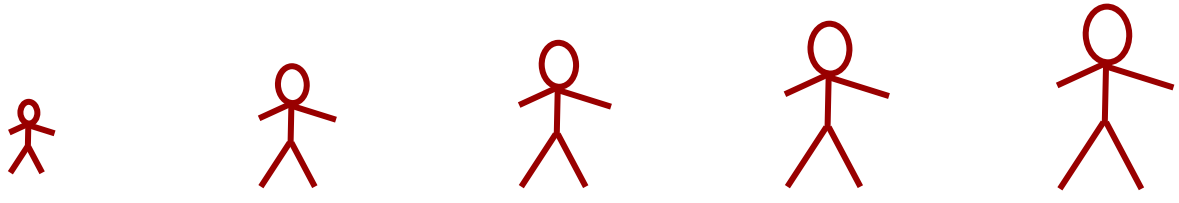
- **Examples:**
  - Tools: LaTeX, git, Mathematica, python, LLMs, …
  - Fields of study: Game theory? Real analysis? Spectral graph theory? ML? Etc.
  - Public speaking, writing, organizational skills, …

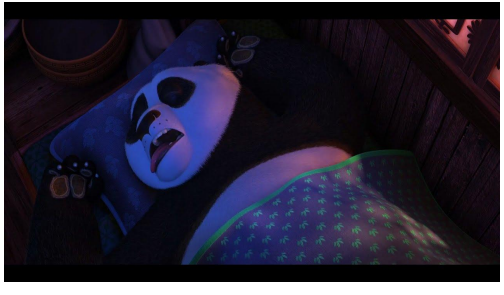


Enjoy what you do

- **To do a PhD, you have to enjoy and care about research.**
  - There are many styles and niches in the research community. Try things.
  - Passion for a field *develops* over time.
  - Be open to possibilities and prepared for serendipity!

Take care of yourself

- **Treat yourself like an athlete / chess player / musician / etc**
  - Sleep, nutrition, exercise
  - Your job is to improve your brain. Take that seriously!



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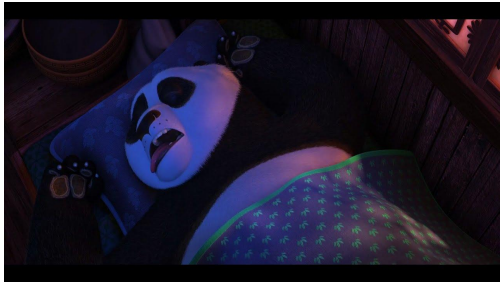
- **Be aware of common challenges**
  - Imposter syndrome
  - Mental and physical health
  - Burnout
  - **The default state in research is “stuck”**



2. Learning and studying

Getting up to speed

- **Stock your toolbox**
  - Take courses
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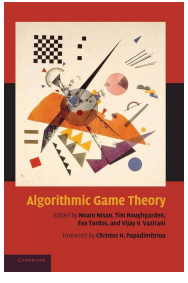
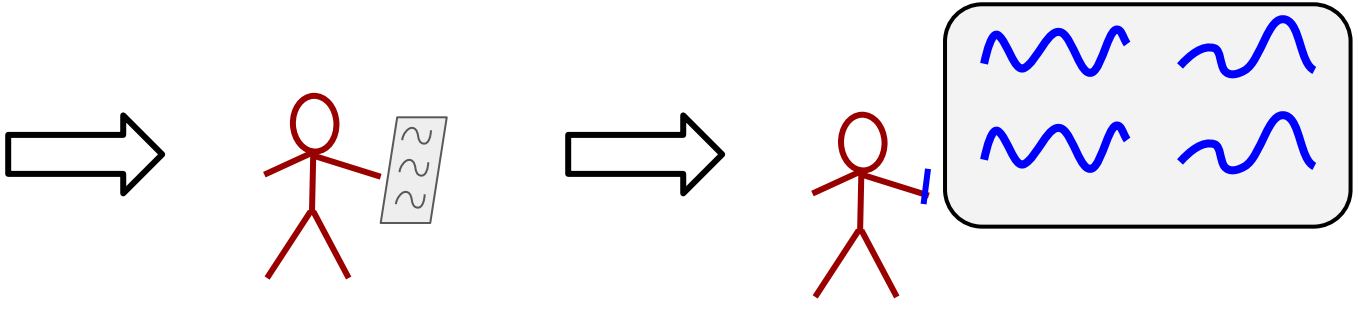
- **Talk to people about the problem**
  - Get ideas for references or approaches

Deep understanding of the state of the art

- **Fully understand the key tools you need**
  - E.g. be able to reproduce crucial parts of papers (theorem statements/proofs/etc)
- **Teach or explain**
  - Write expository notes or posts
  - Lead reading groups or present papers





3. Exploring the frontier

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  - Give yourself room to play and rediscover…
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  - Get stuck
  - Try a different approach (e.g. simulations instead of theory)
  - Solve examples
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  - Go back
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  - Go around: change the problem, ask a new question
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- **Learn to ask good research questions … this takes time!**

Questions?

Reach me: Bo Waggoner <bwag@colorado.edu>