Where do ideas come from?

Ohad Kammar

Mental Strength for Science Unworkshop
17 August 2021


Supported by:

from: Ohad Kammar to: Hongseok Yang 2015-07-17

Dear Hongseok,

from: Ohad Kammar to: Hongseok Yang 2015-07-17

Dear Hongseok,

I hope you are well, that the remainder of the Concurrency Workshop went smoothly, and that you are safely back home.

Concurrency Workshop 2015
Imperial College




Gardner, Donaldson, Wickerson, Raad

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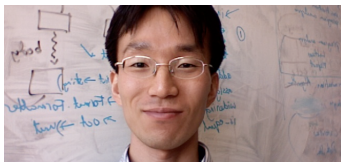
Particle Gibbs with ancestor sampling for probabilistic programs

van de Meent, Yang, Mansinghka, Wood

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Adam Ścibior

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International Workshop on
Higher-Order Programming and Effects
ICFP'15

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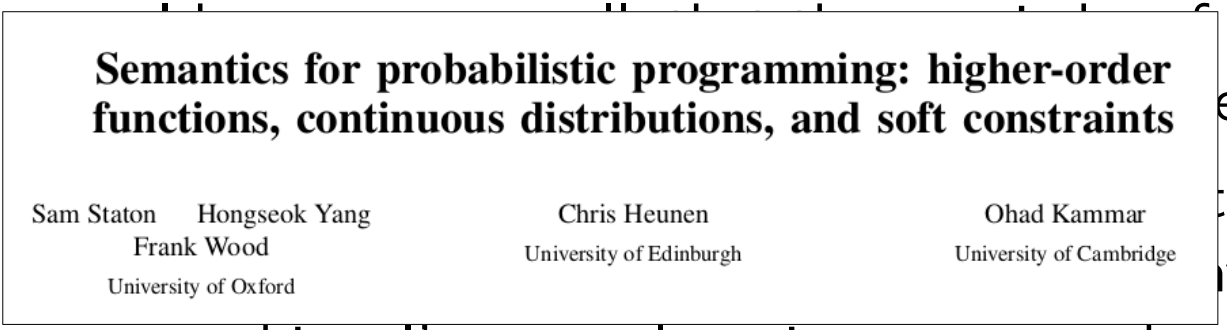

Semantics for probabilistic programming: higher-order functions, continuous distributions, and soft constraints

Sam Staton Hongseok Yang Frank Wood
University of Oxford

Chris Heunen
University of Edinburgh

Ohad Kammar
University of Cambridge

the Concurrency

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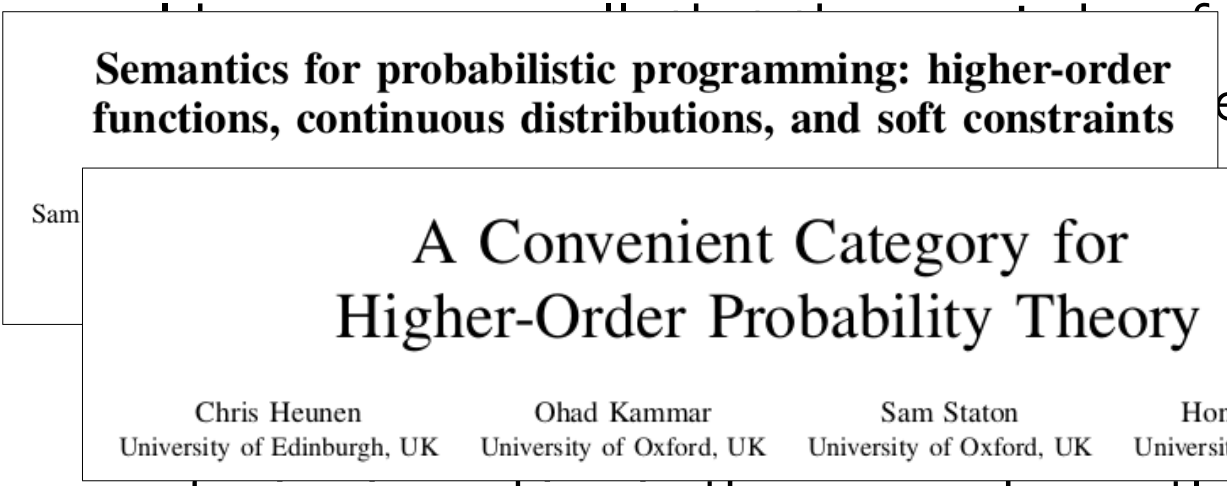

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A Convenient Category for Higher-Order Probability Theory

Universit

Denotational Validation of Higher-Order Bayesian Inference

ADAM ŚCIBIOR, University of Cambridge, England, UK and Max Planck Institute for Intelligent Systems, Germany
OHAD KAMMAR, University of Oxford, England, UK
MATTHIJS VÁKÁR, University of Oxford, England, UK
SAM STATON, University of Oxford, England, UK
HONGSEOK YANG, KAIST, South Korea
YUFEI CAI, Universität Tübingen, Germany
KLAUS OSTERMANN, Universität Tübingen, Germany
SEAN K. MOSS, University of Cambridge, England and University of Oxford, England, UK
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OHAD K

ZOUBIN

SEAN K. MO

CHRIS HEUN

ZOUBIN GH

A Domain Theory for Statistical Probabilistic Programming

MATTHIJS VÁKÁR, Columbia University, USA
OHAD KAMMAR, University of Oxford, UK
SAM STATON, University of Oxford, UK

Ideas business

- Generate ideas
- Manage ideas

My goal

- **Conceptualise** research ideas
- Suggest **activities**:
  - today
  - beyond

Talk structure

- About me
- Research questions & answers
- Managing ideas
- \+ Breakout groups

Warning

- Conflicting advice
- sampling and survivorship biases

About me

BA CS, *Open University of Israel*. 1999–2005

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Forms of research questions

Examples:

- Fill a gap:

  Gödel's incompleteness theorems

- Bridge seemingly unrelated areas:

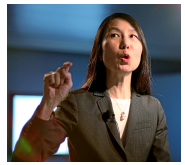
  From parametricity to conservationlaws, via Noether's theorem,

  Robert Atkey

- Conceptualise an intuition:
  Liskov's Substitution principle;

  A behavioral notion of subtyping

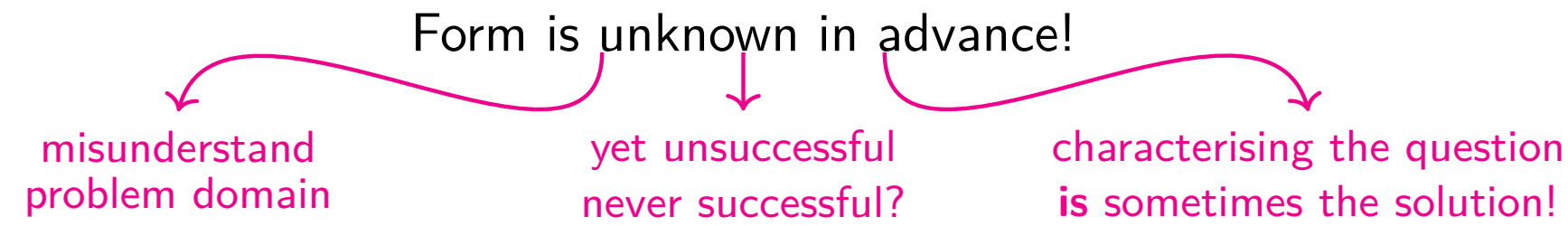
  Barbara Liskov, Jeannette Wing



- Extend knowledge in a new direction:

  Cook-Levin theorem and polynomial time reductions

Forms of research questions



Breakout

Goal: recognise and taxonomise research forms.

1. Think about your past/current research.
   What form of contribution is it?
   Was it always of this form?
2. Think back to a recent seminar, talk, or paper you encountered.
   What form of contribution did it make?
3. Think back to your own past contributions.
   was the contribution always clearly of this form?

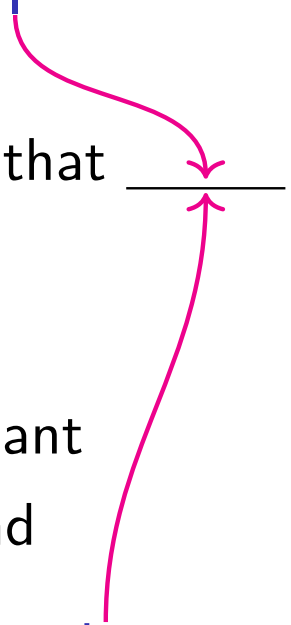
Who cares?

Internal: I

questions and answers that _____

- interested in
- care about
- find useful/important
- want to understand

External: others



Who cares? (Internal/external distinction)

Example

Algebraic foundations for effect-dependent optimisations

with Gordon Plotkin


Internal

Q: What is the semantics of effect systems?

A: A (category theoretic) construction: conservative restriction.

External

Q: How to justify more compiler optimisations?

A: Use an effect-system and its denotational semantics.

Who cares? (Internal/external distinction)

Consequences

Q: I

A: I

I =Internal
E=External
N=Neither

Rev. C: I don't see the point.

Next step: Look for applications / try other communities.

Who cares? (Internal/external distinction)

Consequences

Q:	I	E
A:	I	I

I =Internal
E=External
N=Neither

Rev. C: Quickly degenerates to definitions and theorems.

Next step: Look for alternative (additional) proofs

Who cares? (Internal/external distinction)

Consequences

Q:	I	E	E
A:	I	I	E

I =Internal
E=External
N=Neither

Rev. C: Best paper award!

Next step: Why are **you** doing this?

Who cares? (Internal/external distinction)

Consequences

Q:	I	E	E	N
A:	I	I	E	I/E

exercises/workout
exploratory research.

I =Internal
E=External
N=Neither

Breakout

Goal: use this taxonomy to guide research

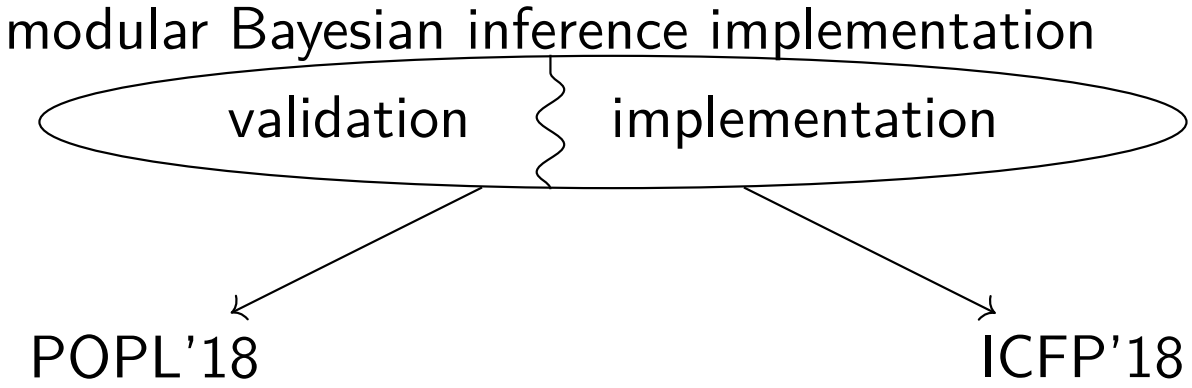
1. Consider the other combinations.
2. Where does your project lie?
   Are you content with this position?
   If not, what would you do to change it?

Who cares? (Internal/external distinction)

dynamic distinction!

Internal

- changing interests
- break into new areas / learn new techniques
- changing goals



External

- Government/industrial interest or funding.
- Charismatic figureheads.
- Different communities

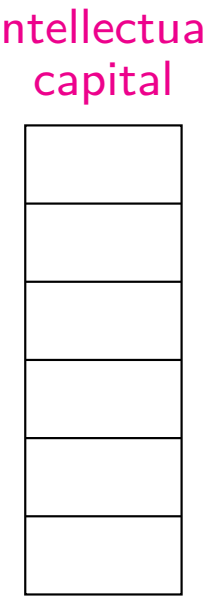
Who cares? (Internal/external distinction)

Breakout

Goal: assess your relationship to your research community.
Review the difference, if any, between your internal Q&A and the external Q&A in your research group, department, and workshops/conferences.

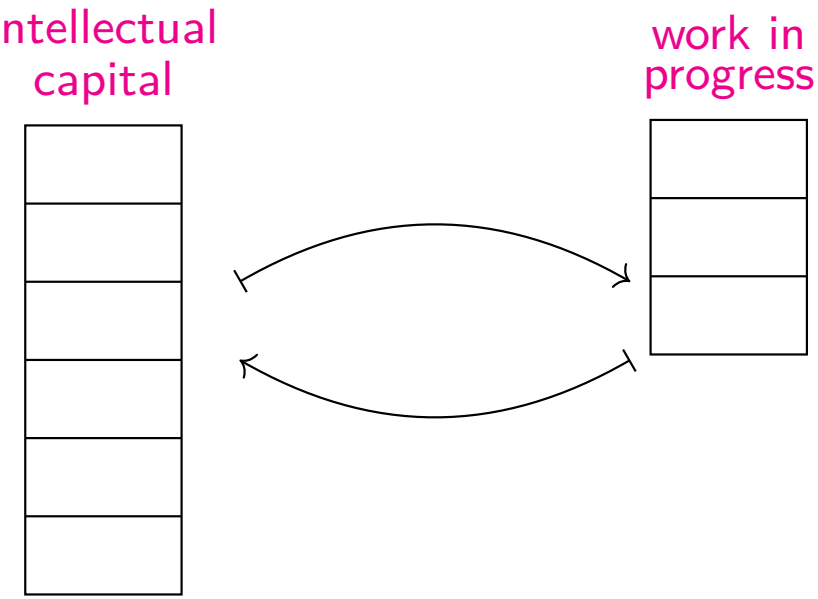
1. Where do you find a close fit?
2. Where do you find the largest difference?
3. Have your internal Q&A changed over time?

Managing ideas



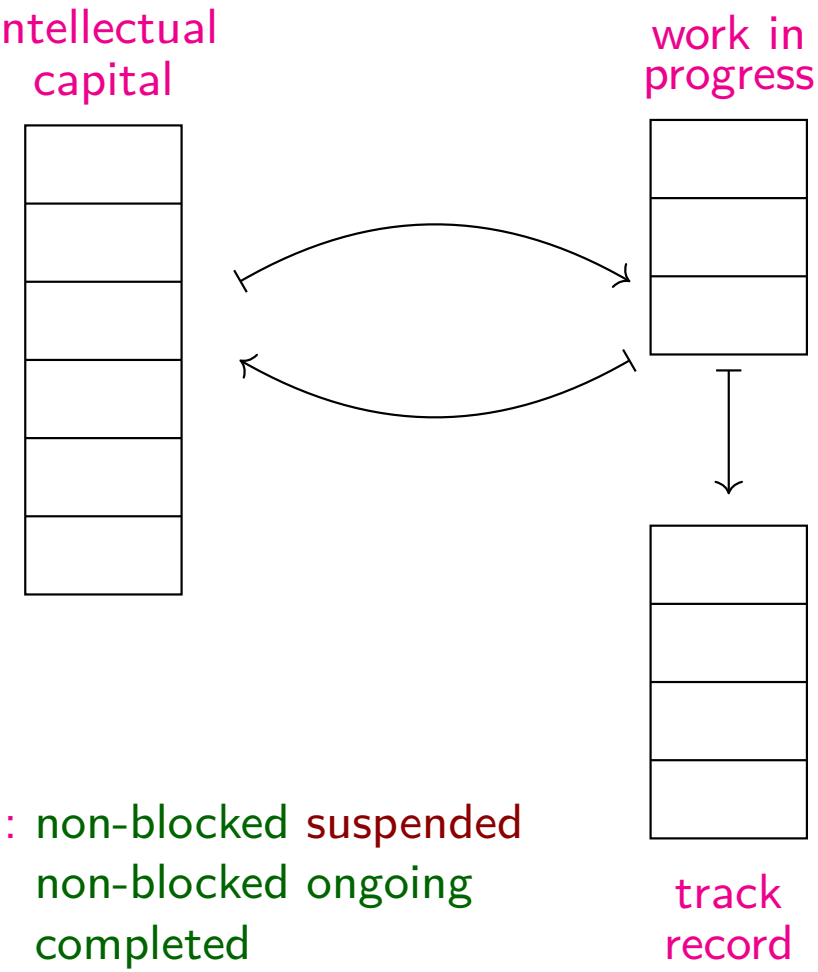
intellectual capital: non-blocked suspended

Managing ideas



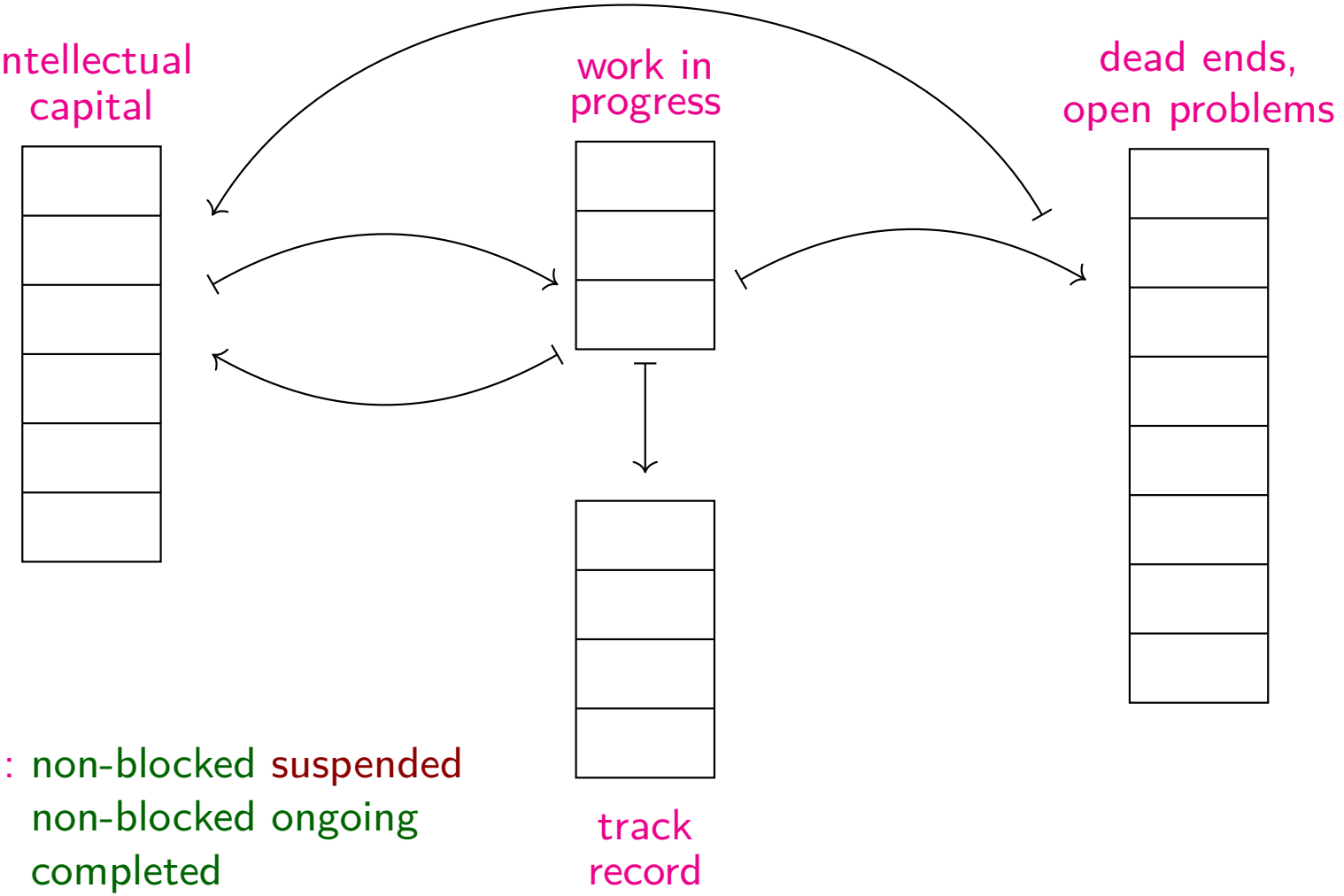
intellectual capital: non-blocked suspended
work-in-progress: non-blocked ongoing

Managing ideas



intellectual capital: non-blocked suspended
work-in-progress: non-blocked ongoing
track record: completed

Managing ideas

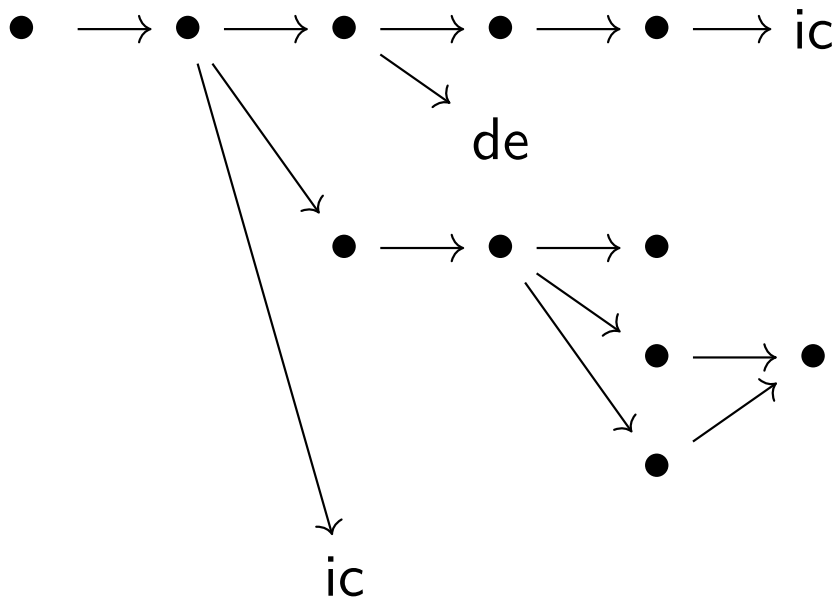


intellectual capital: non-blocked suspended
work-in-progress: non-blocked ongoing
track record: completed
dead ends: blocked

Managing ideas

Generating ic and de with wip

calculate, prove, program, verify, experiment!



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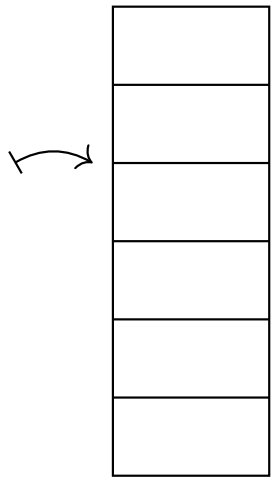
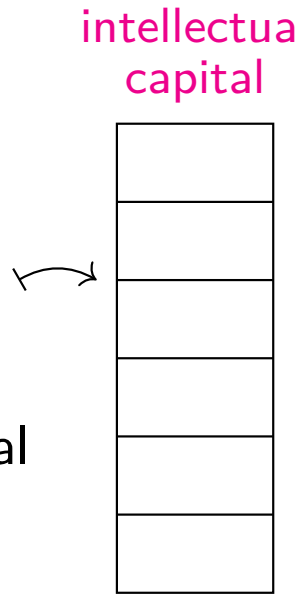


Managing ideas

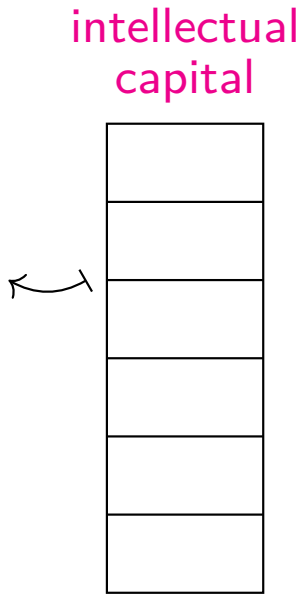
Generating ic

- wip
- collaboration, esp. 1:1
- networking
- sparks of inspiration
- technical reading (papers/books/grants)
  - reading groups
  - reviewing
- taking courses summer schools
- writing notes and papers
- giving talks/seminars
- teaching
- going to talks/seminars
  - detailed and technical (seminars, tutorials, workshops)
  - high-level (conferences, invited talks)
- supervising researchers
  - students
  - interns
  - postdocs
- writing grants & project proposals



Managing ideas

Consuming ic



- supervising researchers
  - students
  - interns
  - postdocs
- writing grants & project proposals

Managing ideas

wip

A small and focussed:

- Quicker completion
- Higher-quality ic

Completion criteria:

- communicability
- usability
- substantiality
- self-contained
- published/shared/executed/used.

"Go for the most-publishable unit."
Peter Sewell

"Publication is a form of attainment."
Gordon Plotkin

Managing ideas

Role of track record

- You're doing great work!
- evidence-based sense of achievement
- confidence building
  - you in yourself
  - others in you:
    - peers
    - students, interns, postdocs
    - potential funders
    - governments
- Reputation $\rightsquigarrow$ generated ic
- also builds your cv

Role of dead ends

- asking hard questions (in seminars, in person)
- writing survey papers
- reviewing papers
- identify breakthroughs
- taking advantage of new developments
- Identifying external questions

Managing ideas

Breakout

Goal: take stock and ownership of your ideas pipeline

1. Work out your ic, wip, and tr (de might be too much!).
2. What is limiting your ic generating abilities?
   Is it necessary?
   Is it necessary **now**?
3. What **new** activities can you try to generate ic?

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networking

1:1 conversation

external Q

internal A

teaching

collaboration

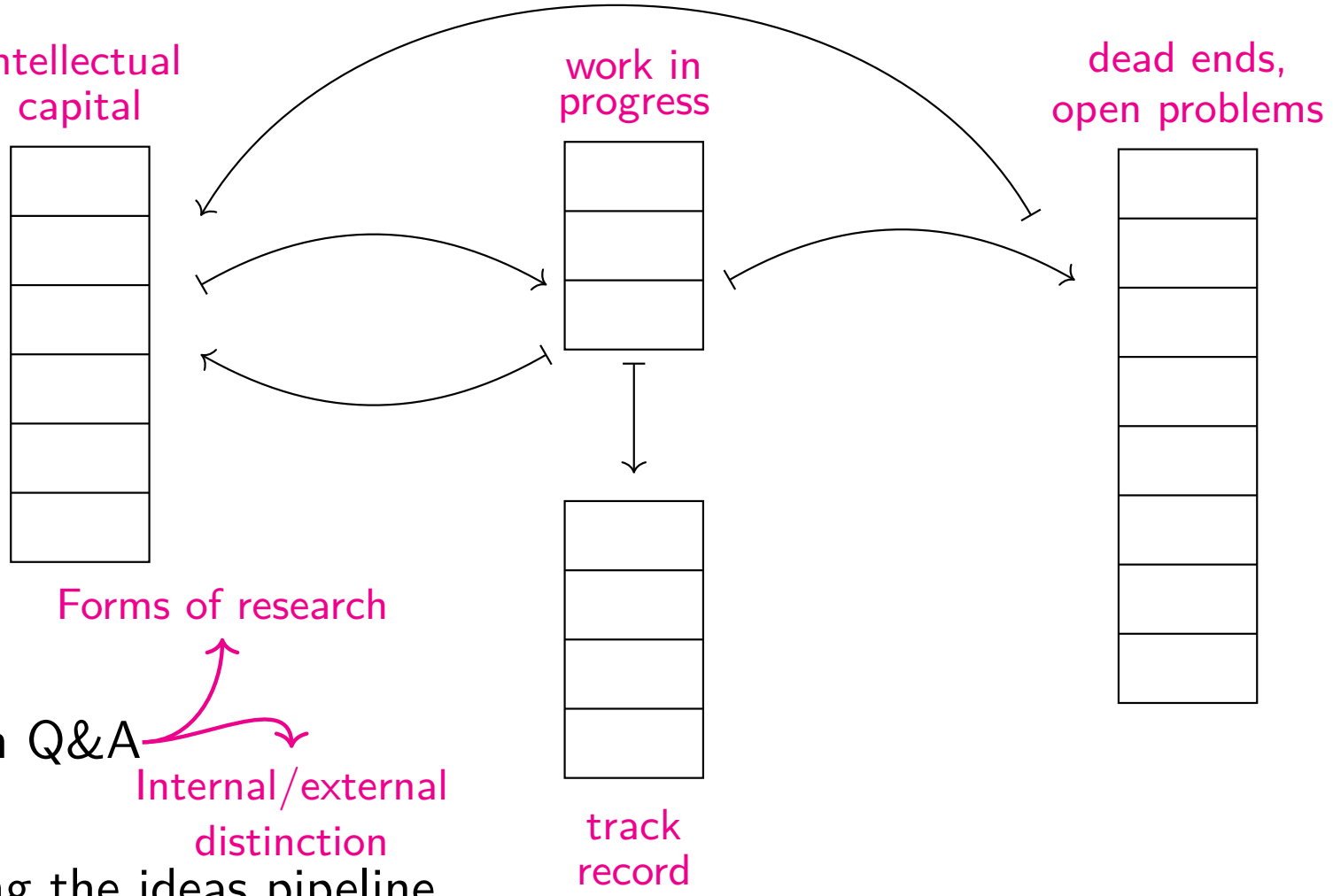
give talks

workshop

internal Q

collaborative visit

Summary



- Research Q&A
- Managing the ideas pipeline