



SCIENCE

Department of
Kinesiology

Metascience

KINESIOL 1E03 - Motor control and learning

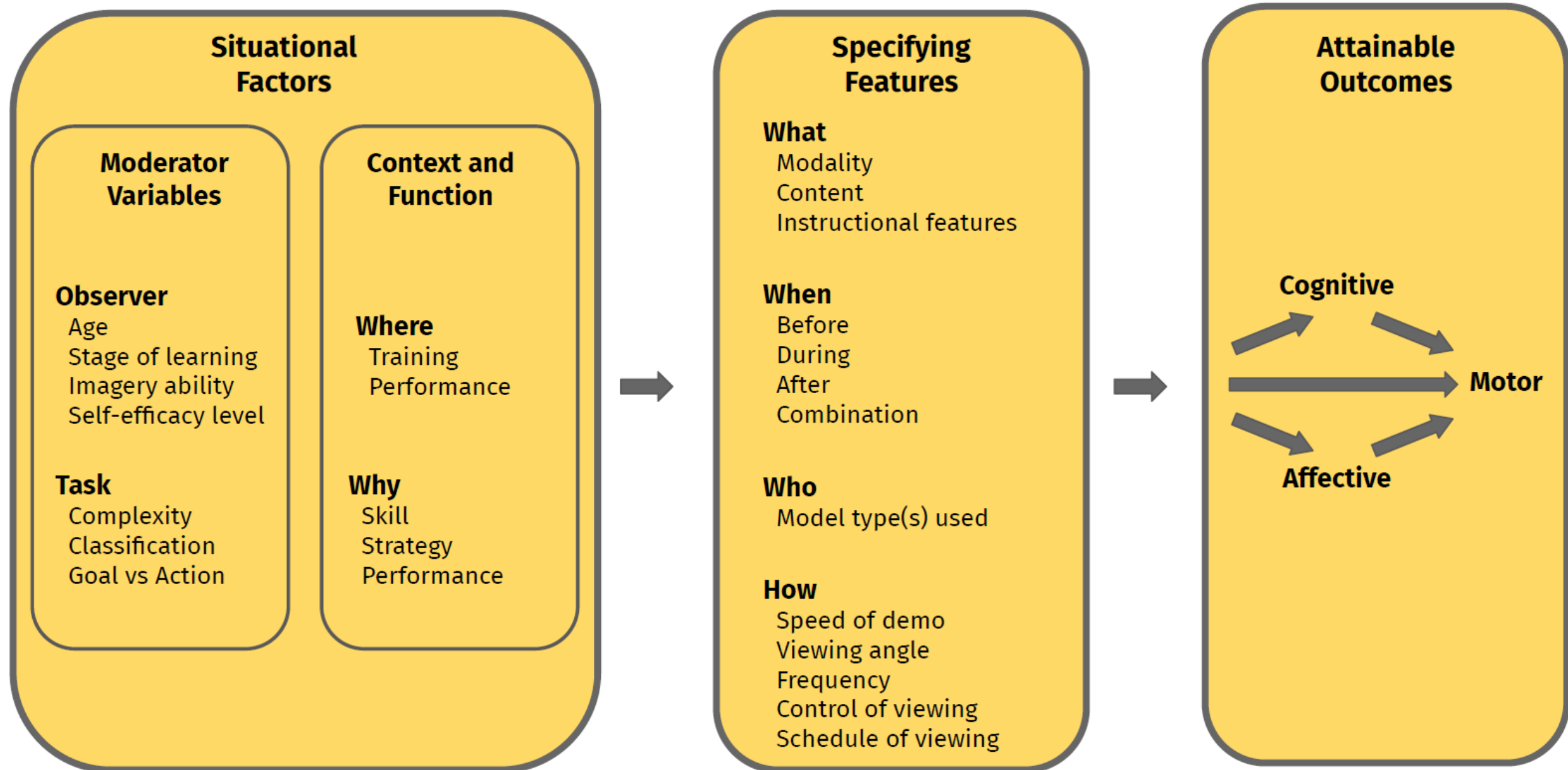
Brad McKay

Fall 2022

Lecture 20

Review from last lecture

An applied model for the use of observation



Why do we observe?

Skill: Improve skill performance and learning

Strategy: Develop and execute sport strategy

Performance: Reach optimal levels of mental arousal

Types of models

Skilled/Expert: Performs the skill with no errors

- Aids in **error correction**



Unskilled/Novice: Will make errors during the skill

- Aids in **error detection**



Learning: Will begin at an unskilled level and progress throughout practice to a skilled level

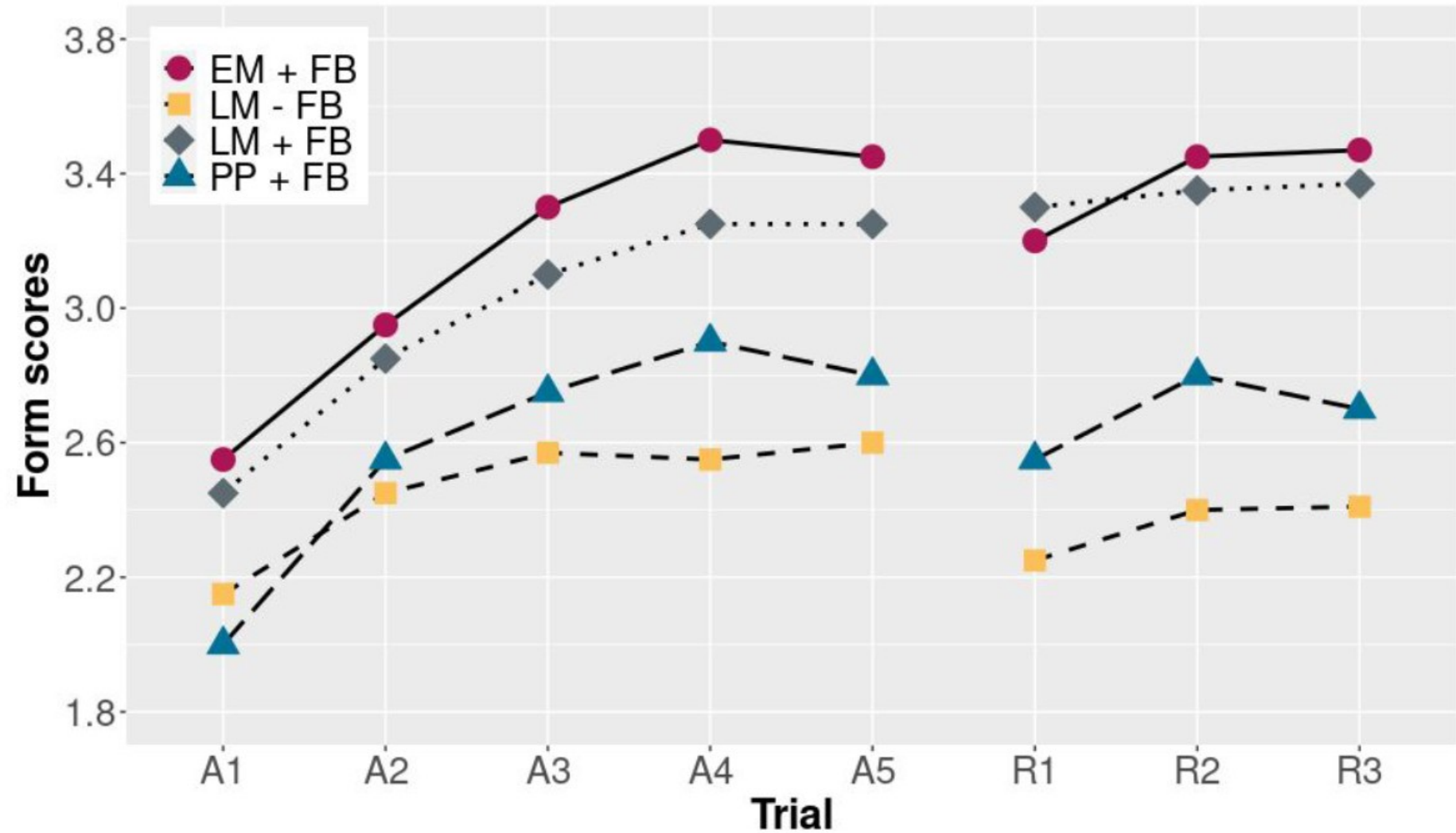


Expert and learning models are effective, but the learning model is only effective when feedback is provided

Task: Free squat

Groups:

1. **Expert model with feedback**
2. **Learning model NO feedback**
3. **Learning model WITH feedback**
4. **Physical performance with feedback**



Combining self-observation with an expert model improves retention compared to self-observation alone

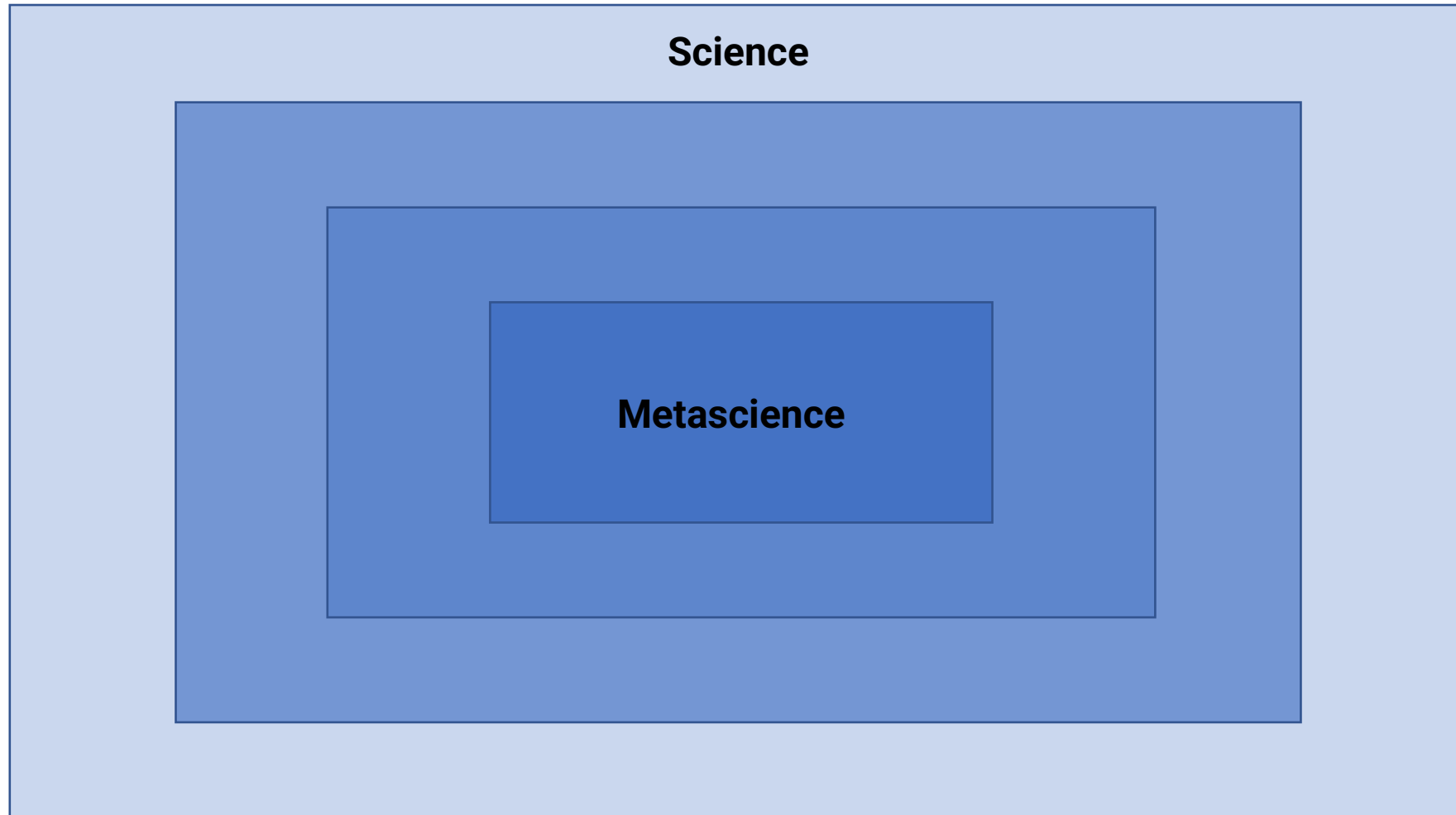
Task: Gymnastics skills

Conditions:

1. **Self-observation** - watch themselves
2. **Mixed model** - watch themselves and an expert



Any questions?



Learning objectives

1. Describe the broad areas of focus in **metascience** research.
2. Compare and contrast **reproducibility, replication, and evidential value**.
3. Describe **open science** and the potential for **methods reform** to improve the evidential value of research.
4. Explain the current **incentive structure** in academia and its impact on science.
5. Discuss the common thread that underpins metascience research.

Learning objectives

1. Describe the broad areas of focus in **metascience** research.
2. Compare and contrast **reproducibility, replication, and evidential value**.
3. Describe **open science** and the potential for **methods reform** to improve the evidential value of research.
4. Explain the current **incentive structure** in academia and its impact on science.
5. Discuss the common thread that underpins metascience research.

Take-home message:

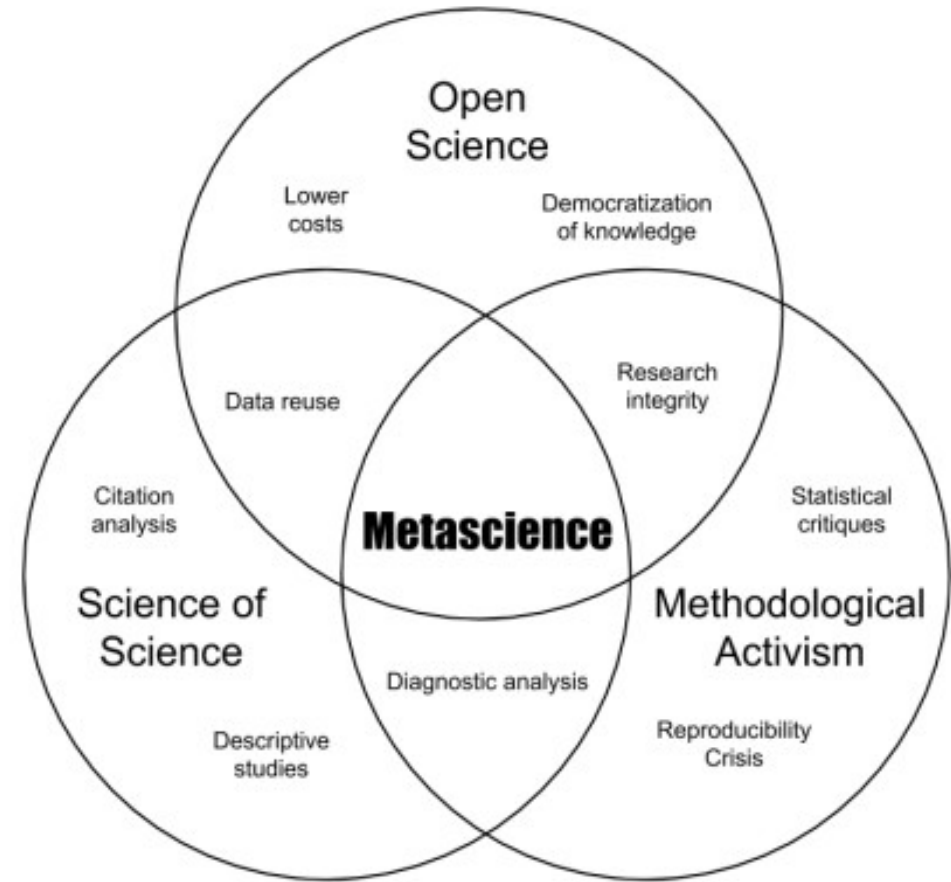
Metascience investigates the process of science, including the methods, incentives, evidence, equity, and effectiveness of existing systems.

What is metascience?

Metascience is the scientific study of science itself.

The three strands of metascience: **science of science**, **open science**, and **methodological activism**.

Modern metascience has emerged as a reaction to the **replication crisis**.



What is the replication crisis?

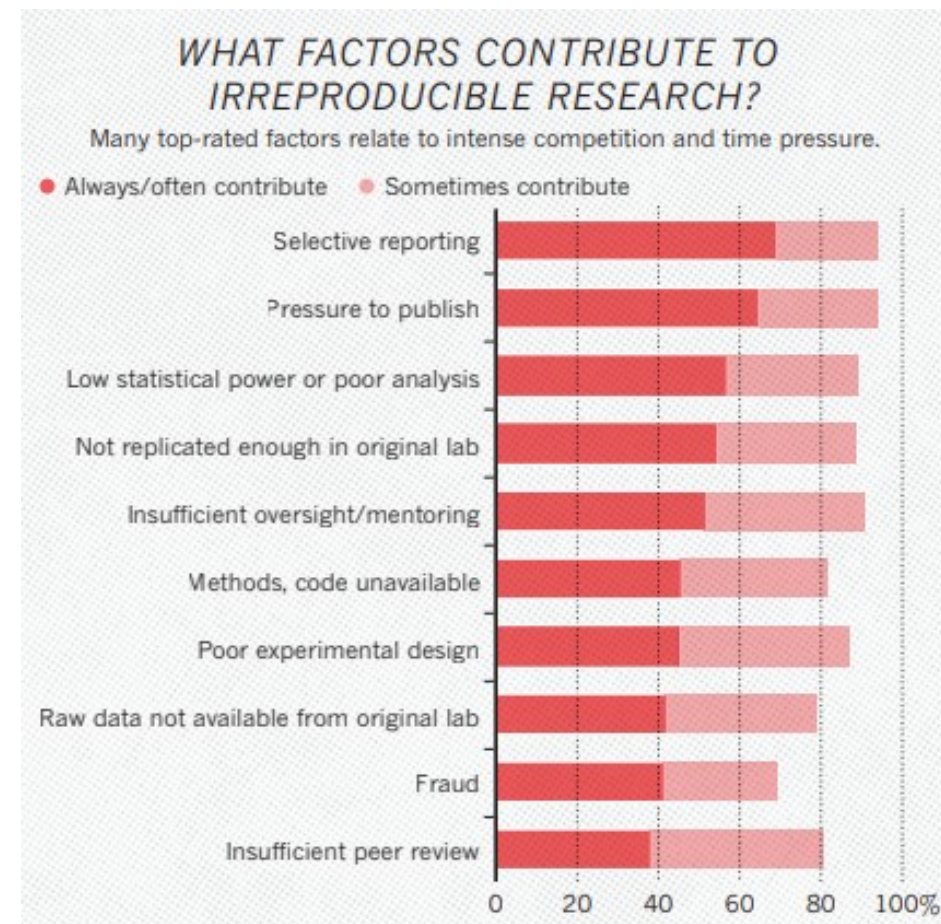
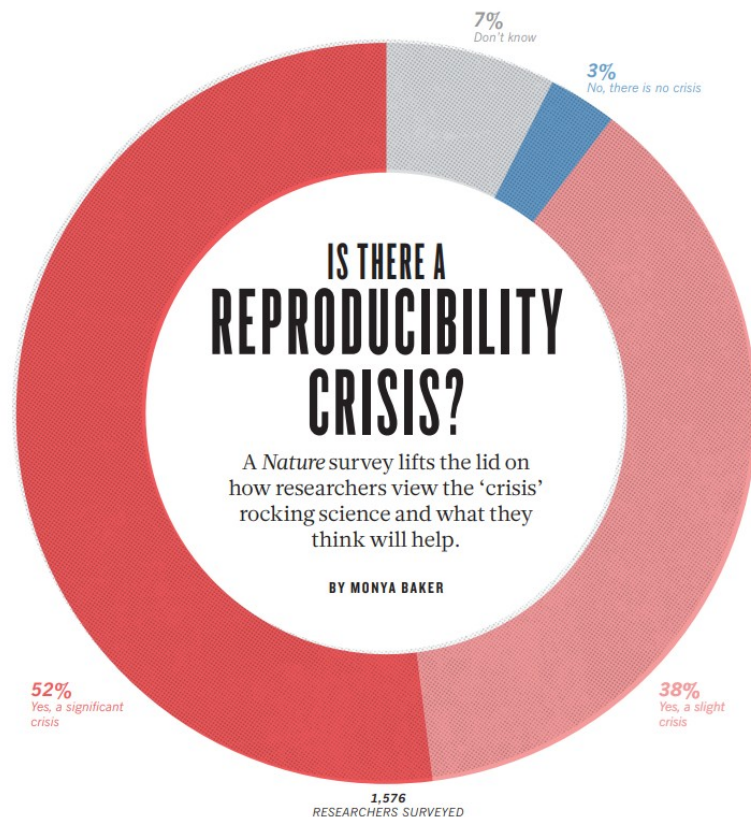
Replication refers to repeating a study with a new sample and observing the same substantive result.

Reproducibility refers to repeating a procedure with the same materials or data and producing the same result.

Evidential value is a function of the predictive power of reported results.



What is causing the replication crisis?



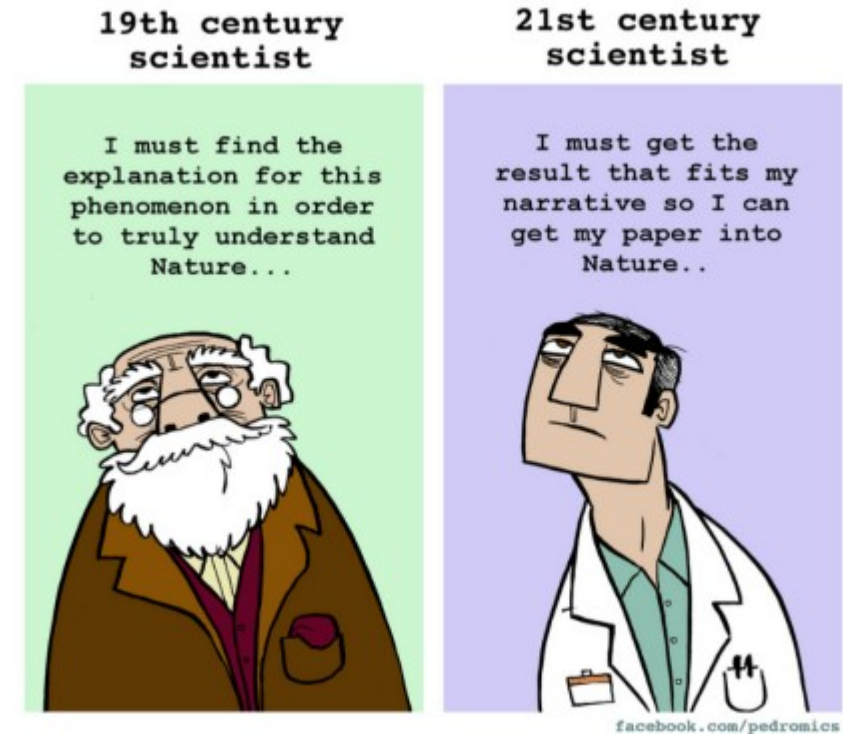
The problem of perverse incentives

Your professors are hired and promoted based on their **research output and acquired funding**.

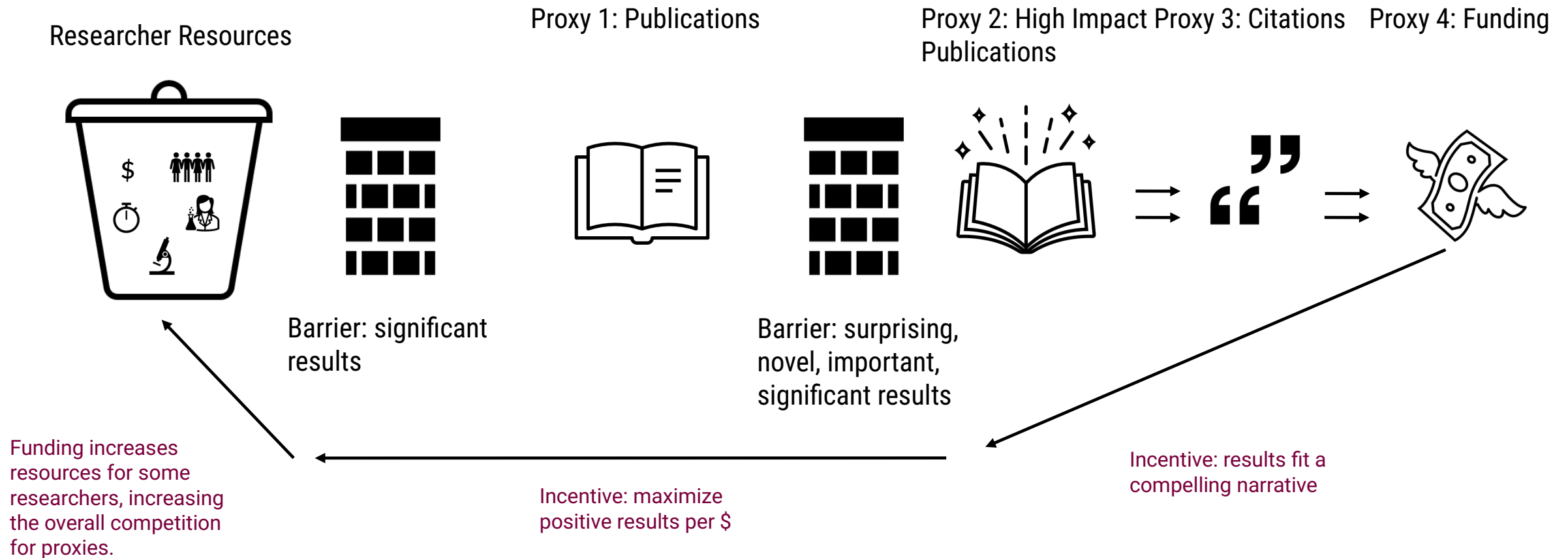
Since each researcher is so specialized, it is difficult to judge the quality of their work. Instead, universities and funders rely on **proxies**.

Proxies include number of **publications**, publications in **high impact** journals, **citations**, and **grants** awarded.

The proxies become the **incentives**.

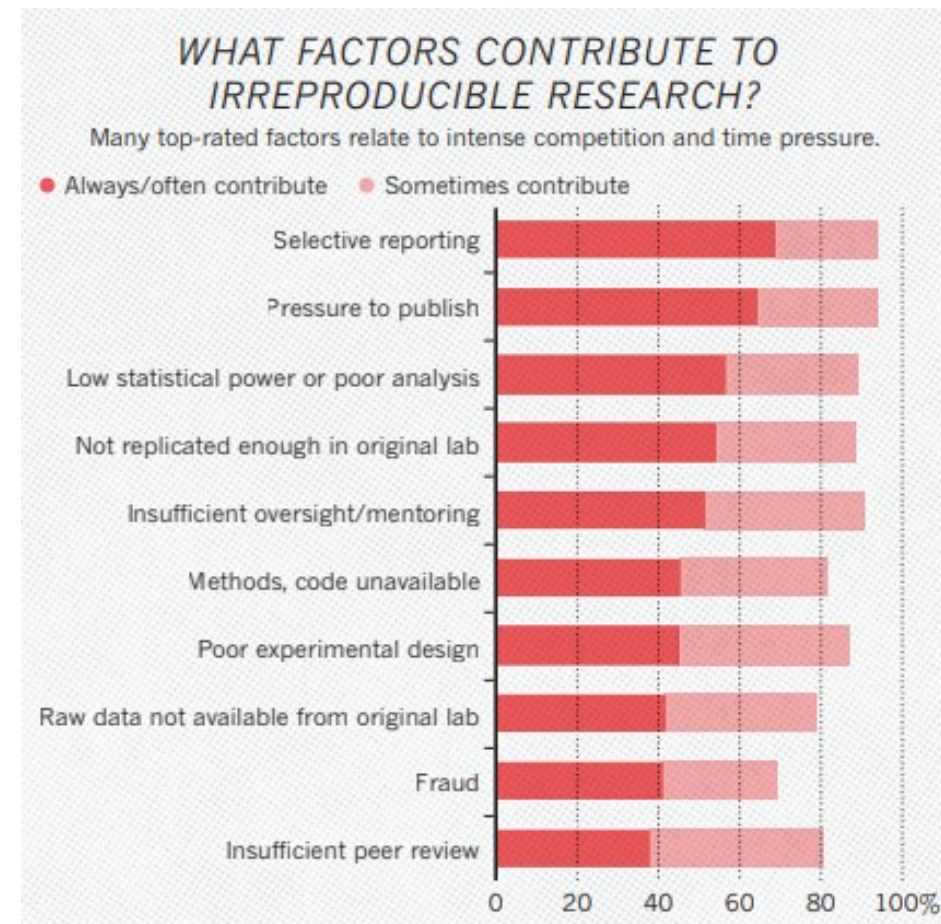


The perverse incentive feedback loop



The replication crisis in psychological science

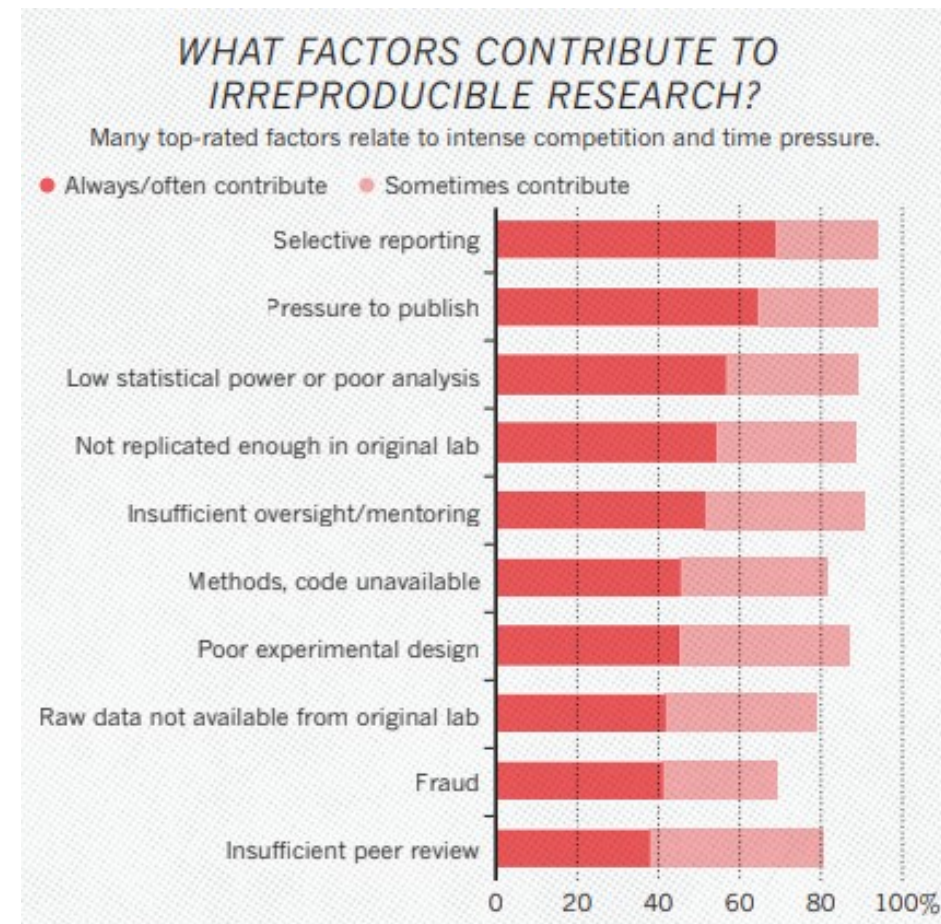
The four horsemen of the Apocalypse



The replication crisis in psychological science

The four horsemen of the Apocalypse

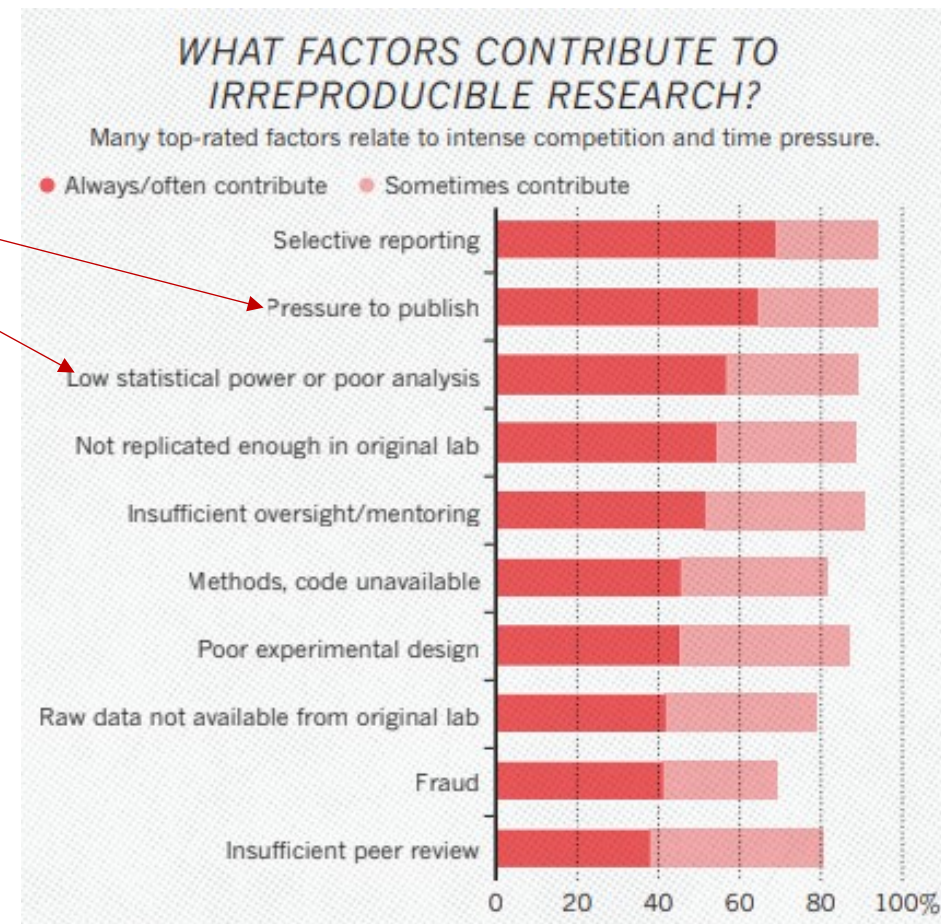
Publication bias Low power P-hacking HARKing



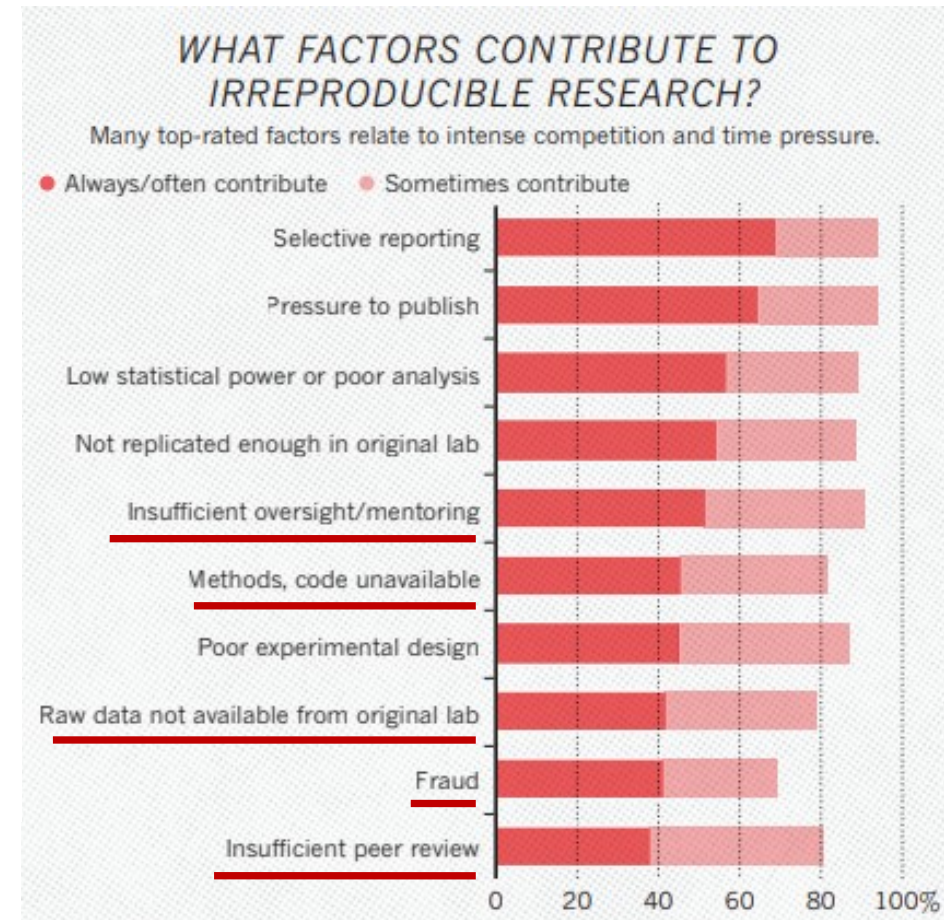
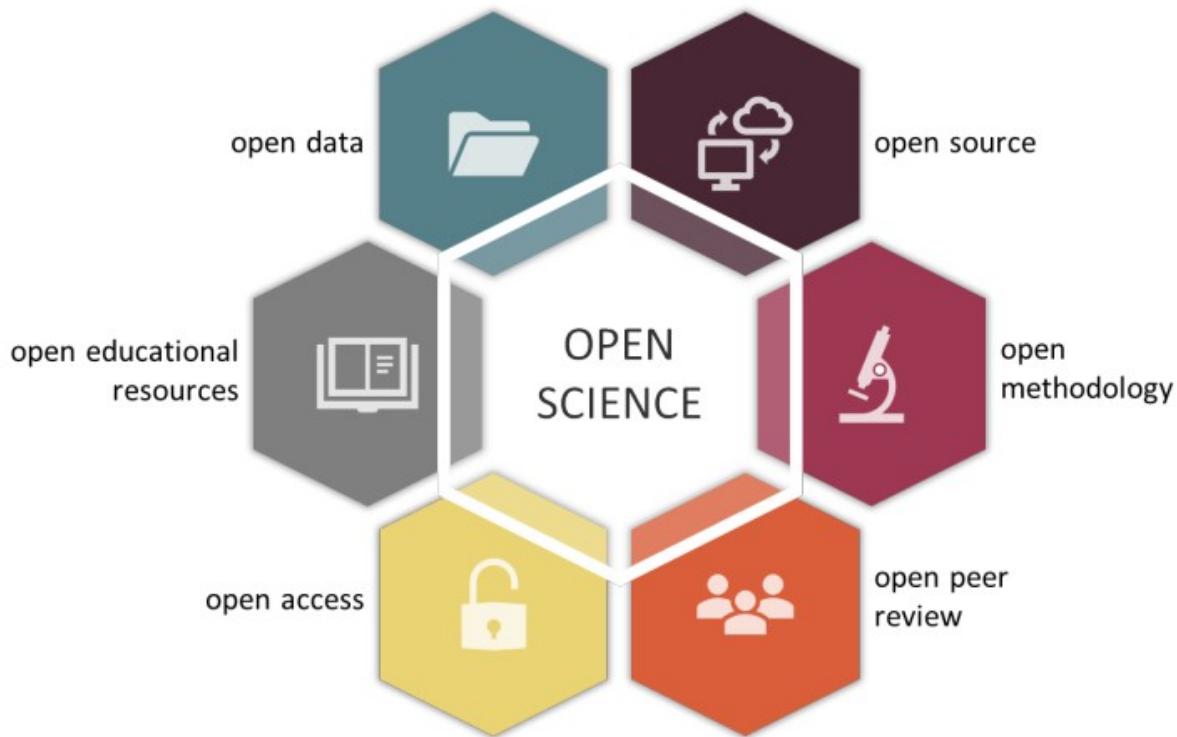
The replication crisis in psychological science

The four horsemen of the Apocalypse

Publication bias
Low power
P-hacking
HARKing



The open science movement



Open science reforms

Methods reform: Preregistration, registered reports, open materials, open data.

Incentive reform: **Badges** to signal best practices have been followed.



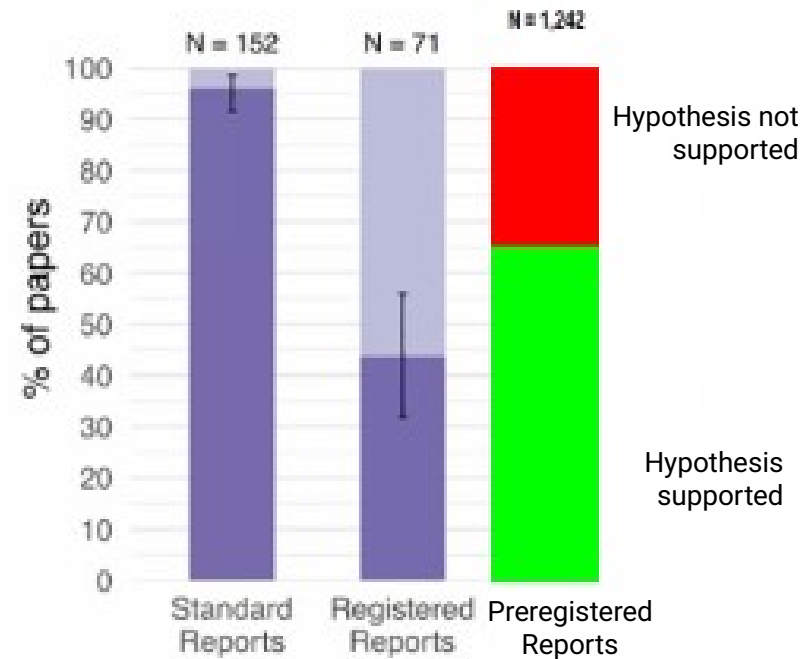
Effectiveness of methods reforms

Percentage of positive results

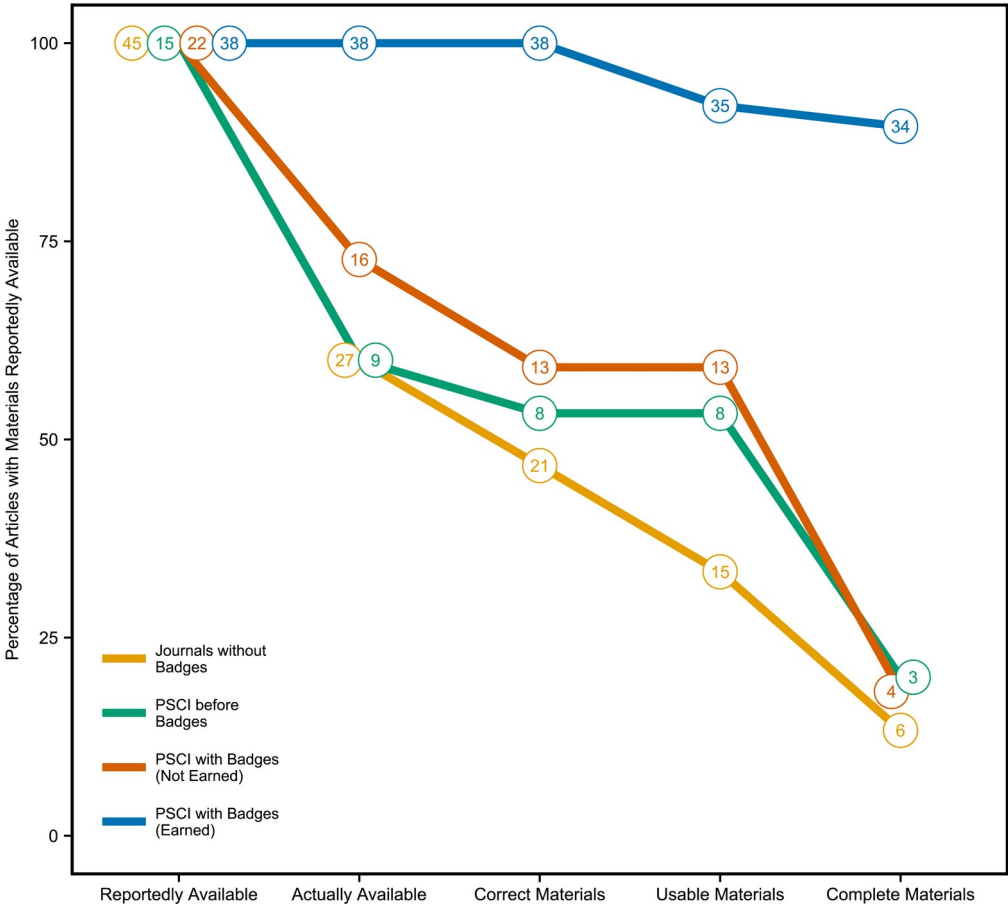
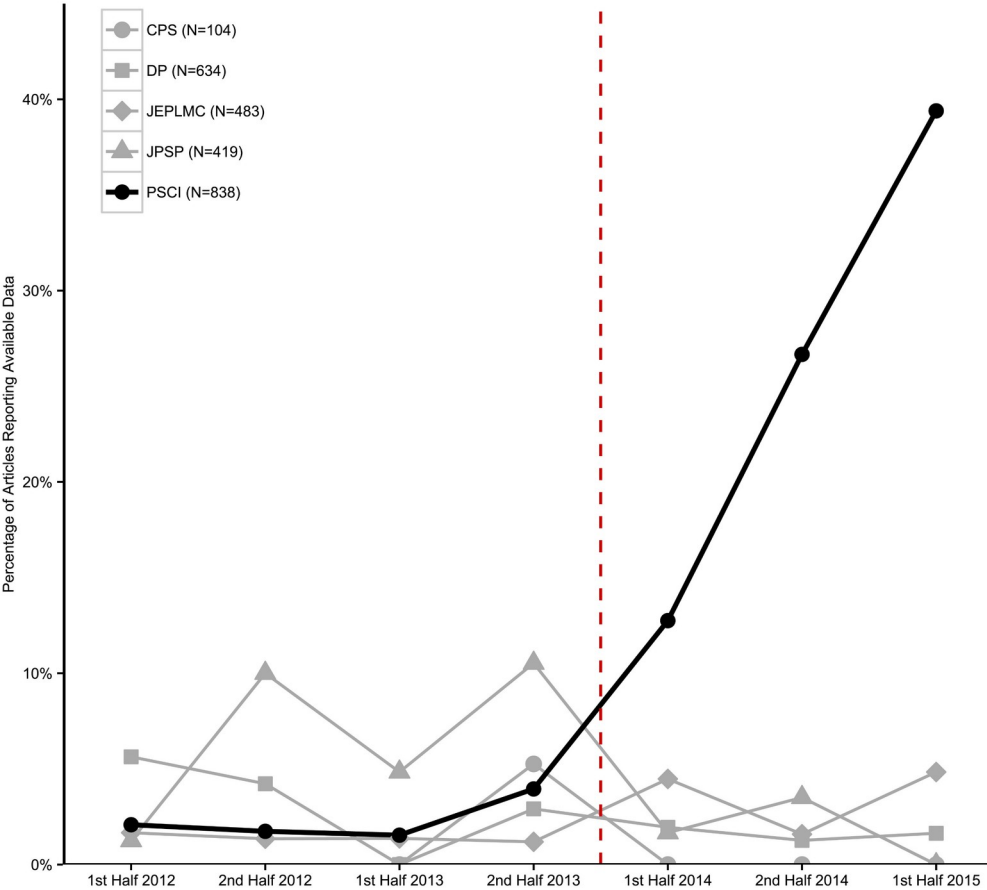
Standard reports: 96%

Registered reports: 44%

Preregistered reports: 65%

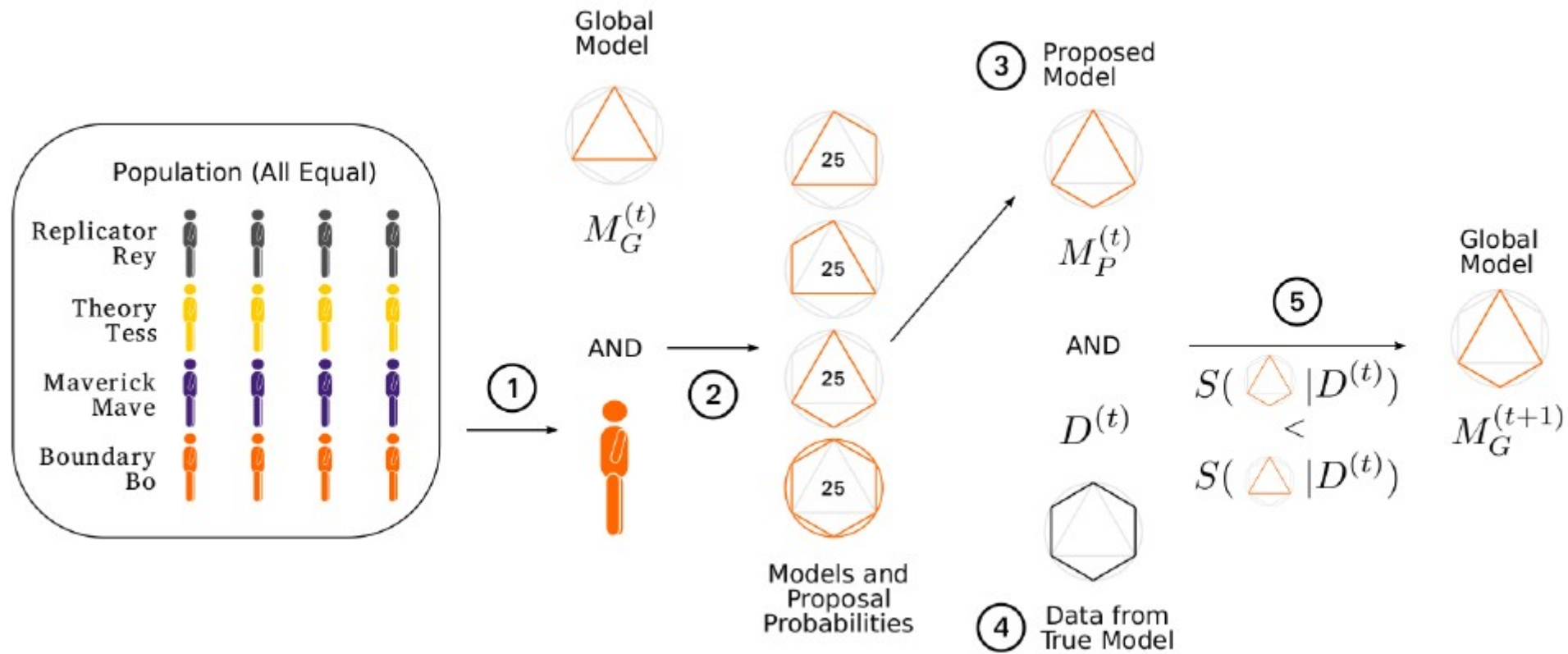


Effectiveness of incentives reforms



Source: Kidwell et al., 2016 <https://doi.org/10.1371/journal.pbio.1002456>

Simulating scientific discovery



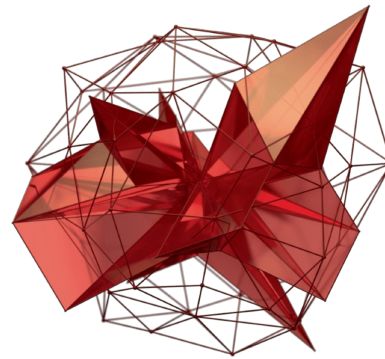
Simulating scientific discovery

Simulation was an **idealized** framework.

The fastest way to get to the true model was to have a **diverse population** of scientific strategies.

Replicability is a **necessary but not sufficient** condition for finding and sticking to the truth.

False results, errors, and **biases replicate too**, not just true results.



METASCIENCE

The Emerging Field of Research
on the Scientific Process.

Learning objectives

1. Describe the broad areas of focus in **metascience** research.
2. Compare and contrast **reproducibility, replication, and evidential value**.
3. Describe **open science** and the potential for **methods reform** to improve the evidential value of research.
4. Explain the current **incentive structure** in academia and its impact on science.
5. Discuss the common thread that underpins metascience research.

Take-home message:

Metascience investigates the process of science, including the methods, incentives, evidence, equity, and effectiveness of existing systems.

What questions do you have?



www.cartermaclab.org



@bradmckay8



@MotorMeta