

Novelty vs Replicability

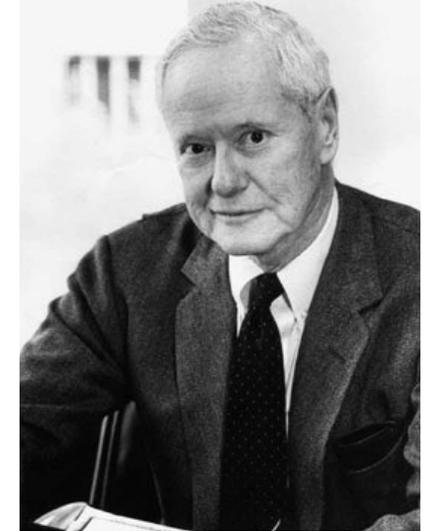
Virtues and Vices in the Reward System of Science

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The Reward System of Science



Merton

The Priority Rule : The first scientist making a novel discovery is rewarded with prestige and recognition. Second runners get nothing (Merton, 1957)

Newton vs Leibniz over Calculus

Montaigner vs Gallo over HIV

Lauterbur vs Damadian over MRI

MIT vs UC Berkeley over CRISPR

The Reward System of Science

The priority-based reward system incentivizes an efficient division of cognitive labor (Kitcher 1990, Strevens 2003, 2011)

Worry: This story is too optimistic

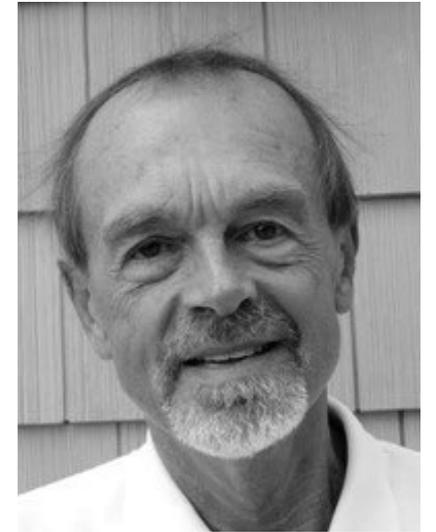
This story depends on strong assumptions about replicability of findings

Replicability crisis!

In this talk:

I look at the interplay between the priority rule and replicability

I criticize Kitcher-Strevens' idea that the priority rule is beneficial for science



Kitcher



Strevens

Plan

1. The Reward System of Science

Virtues according to Kitcher-Strevens's model

2. The Replicability Principle

3. Vices in the Reward System of Science

The Reward System of Science: The Priority Rule

According to Merton (1957) and Strevens (2003, 2011)

(1) Only the first scientist making a discovery is rewarded.

(2) Scientists' reward is *prestige*.

(3) Prestige comes in different forms:

- eponymy e.g., Huntington's, Parkinson's, Alzheimers'.
- prizes, e.g., Fields Medal, Nobel Prize.
- promotion.



And in the twentieth-century:

(4) Scientists establish priority via peer-reviewed journal publication.

Virtue 1: PR Incentivizes Scientific Production

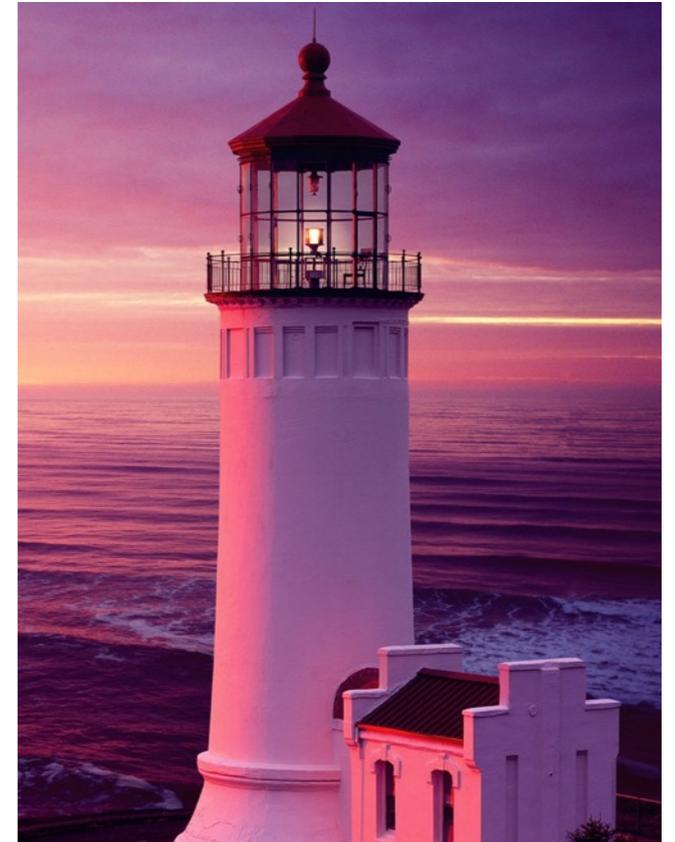
Economists of science problem: A market economy does not provide incentives to produce scientific findings.

Scientific findings are public goods (Arrow 1962).

Solution:

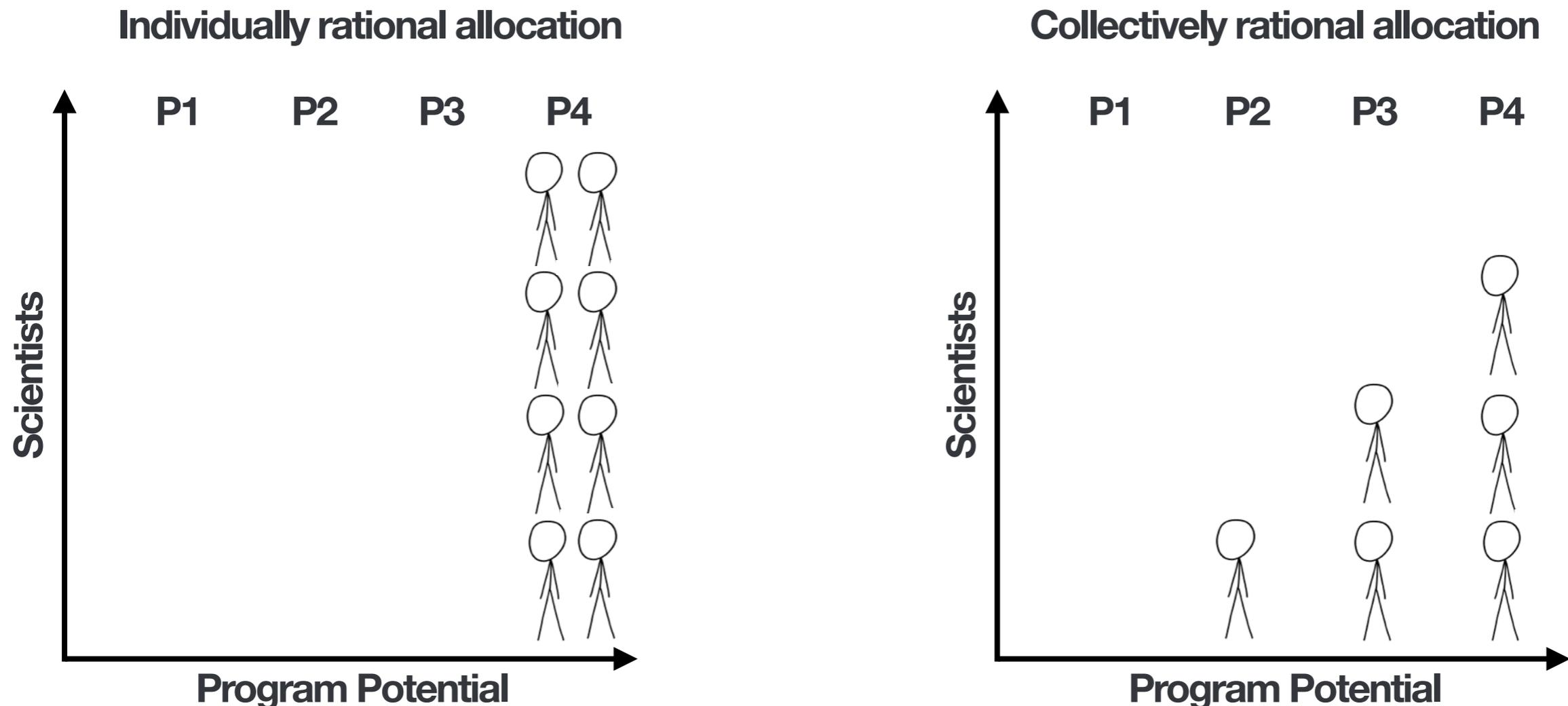
Priority is a form of property right (Stephan 2012).

Interest in priority motivates scientists to produce and share knowledge.



Virtue 2: PR Incentivizes the Division of Cognitive Labor

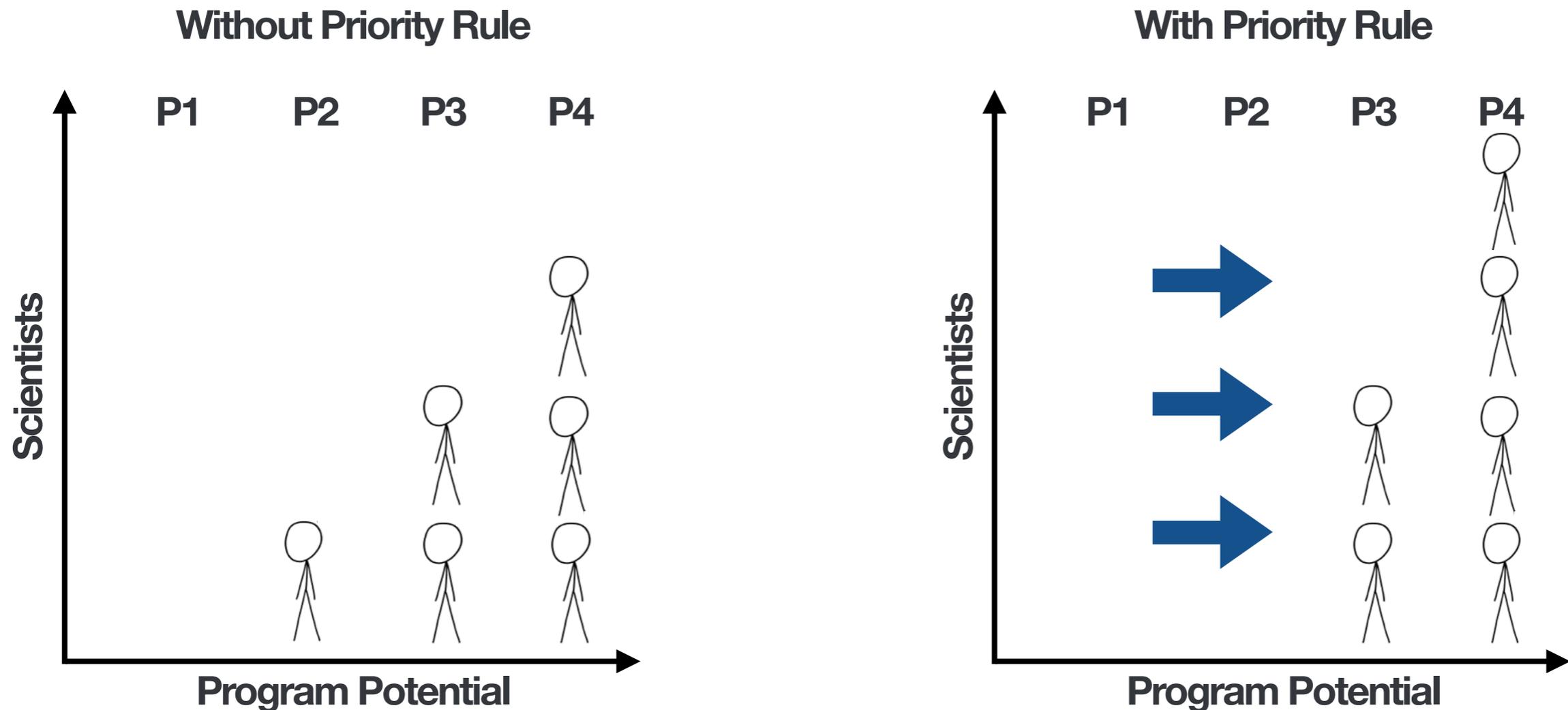
Kitcher's concern : how to best allocate resources among different scientific projects.



Solution: scientists who are both truth-driven and credit-driven approach the collectively rational allocation.

Virtue 2: PR Incentivizes the Division of Cognitive Labor

Strevens: Priority rule incentivizes an *efficient* allocation of labor



Under PR more scientists join higher-potential programs, maximizing science's payoff to society.

“Give me scientists who crave credit, some voice on high seems to declaim, and I will give you a system for allocating credit that arranges those scientists so as to produce the greatest amount of pure knowledge” (Strevens 2011)

Problem: This story assumes replicability

Plan

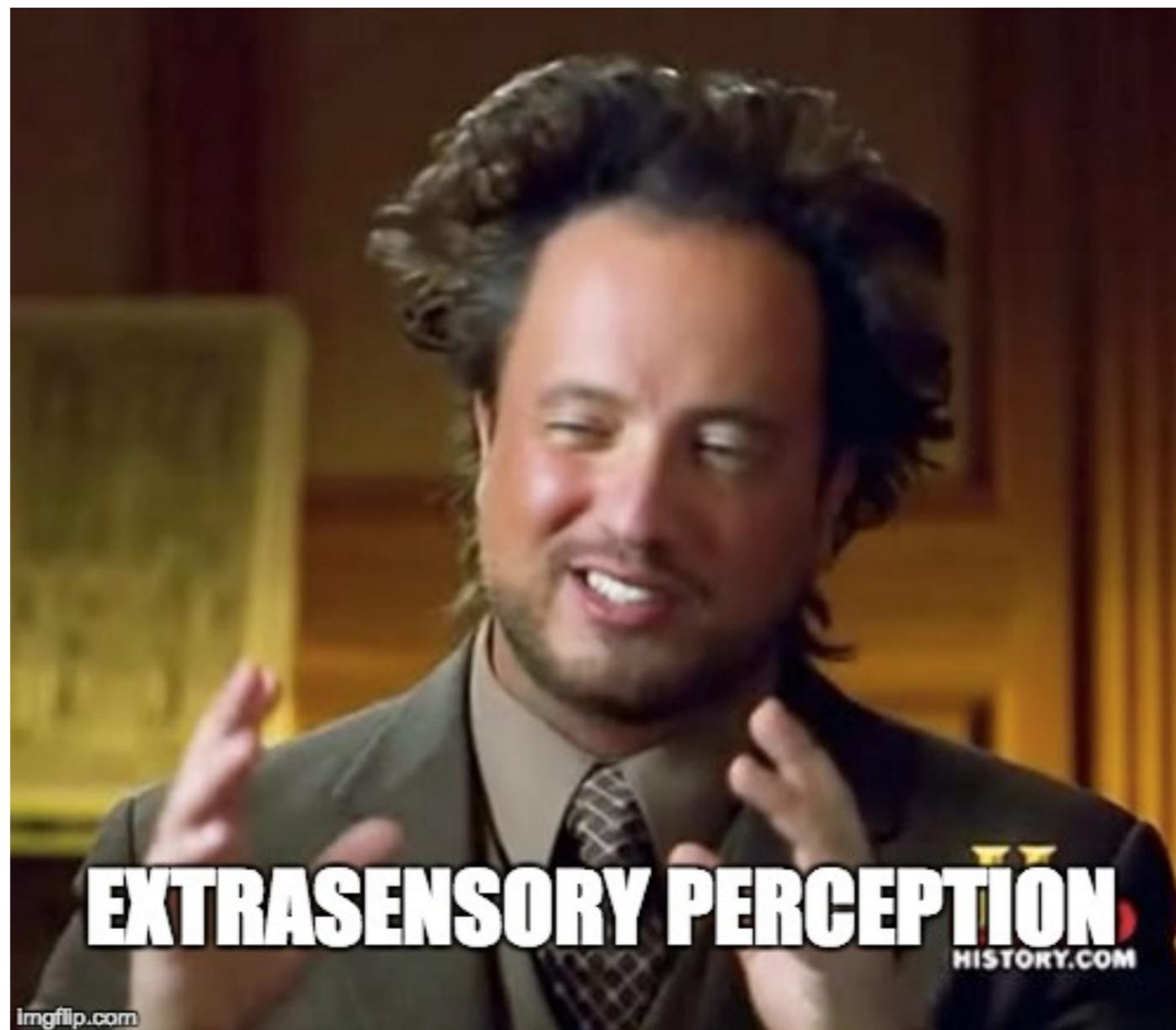
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The Priority Rule incentivizes scientific production.

Kitcher-Strevens's model: The Priority Rule incentivizes the division of cognitive labor.

2. The Replicability Principle

3. Vices in the Reward System of Science



Bem 2011 Extrasensory Perception Experiment

1. VISUALIZATION EXERCISE



PIZZA, DOG,
LAWYER, JACKET,
TREE, TOMATO,
BIRD, DOCTOR,
SPINACH

2. PRACTICE EXERCISE

PIZZA, DOG,
TOMATO, DOCTOR

3. FREE RECALL TEST



PIZZA, DOG,
TOMATO, TREE

1. VISUALIZATION EXERCISE



PIZZA, DOG,
LAWYER, JACKET,
TREE, TOMATO,
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2. FREE RECALL TEST



PIZZA, DOG,
TOMATO, TREE

3. PRACTICE EXERCISE

PIZZA, DOG,
TOMATO, DOCTOR

Participants would “remember” words that they would practice *later* !
($p = 0.002$, $d = 0.42$)

Bem 2011 Extrasensory Perception Experiment

Journal of Personality and Social Psychology
2011, Vol. 100, No. 3, 407–425

Feeling the Future: Experimental Evidence for Anomalous Retroactive Influences on Cognition and Affect

Daryl J. Bem
Cornell University



Daryl Bem

scious, cognitive or affective. This article reports 9 experiments, involving more than 1,000 participants, that test for retroactive influence by “time-reversing” well-established psychological effects so that the individual’s responses are obtained before the putatively causal stimulus events occur. Data are presented

Most researchers’ reaction: there is something wrong. But what?

Bem’s study passes the current methodological standards.

The study was refereed by two editors and four reviewers.

The findings are not a lucky shot: 9 experiments, 1000 participants.

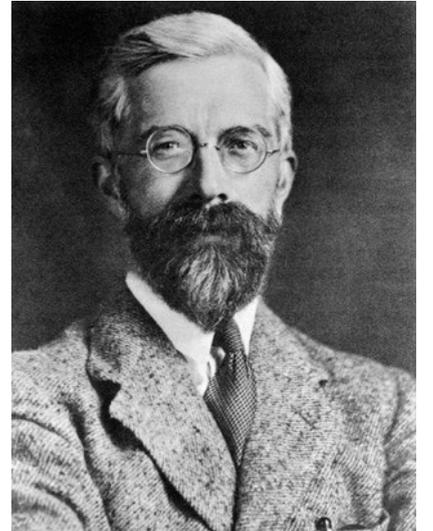
The Replicability Principle

Replicability is the gold standard of scientific findings.

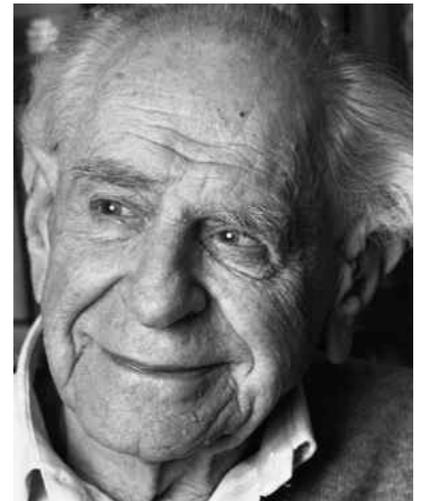
“Non-reproducible single occurrences are of no significance to science.” (Popper, 1959)

Suppose experiment E produces result F , then

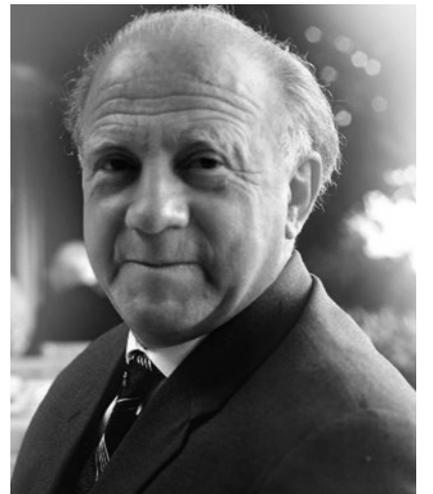
(RP) F is a scientific finding only if *in principle* a replication of E produces F .



Fisher



Popper



Heisenberg

How can scientists ensure the replicability principle?

Hypothetical replicability: If E were repeated, then we would obtain (roughly) the same finding F.

Actual replicability: E has been repeated, and we have obtained (roughly) the same finding F.

Why actual replicability?

Successful replication attempts rule out common possibilities of error

Selective reporting (Rosenthal 1979)

Questionable Research Practices (Simmons et al 2011, Kerr 1998)

Experimenter's unconscious biases.

Fraud (Fanelli 2009)

Plan

✓ 1. Virtues in the Reward System of Science

The Priority Rule incentivizes scientific production.

Kitcher-Strevens's model: The Priority Rule incentivizes the division of cognitive labor.

✓ 2. The Replicability Principle

3. Vices in the Reward System of Science

Priority Rule systematically rewards findings regardless of their actual replicability.

Priority Rule systematically disincentivizes replication of others' findings.

Vice 1: Priority Rule Systematically Rewards Findings Regardless of their Actual Replicability

Recall: Scientists establish priority via peer-reviewed publication.

The peer-review process guarantees hypothetical replicability.

But what about actual replicability?

39% in psychology research (Open Science Collaboration, 2015)

11% of “landmark” oncology findings (Begley et al., 2012)

Citation counts to the replicable and non-replicable papers are roughly the same.

Vice 1: Priority Rule Systematically Rewards Findings Regardless of their Actual Replicability

Problem in Strevens' story

Winners-contribute-all: “the first discovery brings great benefits to science or society, while the second discovery brings nothing at all.” (Strevens 2011).

But winners don't contribute all

The reward system does not guarantee actual replicability.

Vice 1: Priority Rule Systematically Rewards Findings Regardless of their Actual Replicability

How does science ensure actual replicability?

Answer 1: It is the original researcher's responsibility.

But... Successful replication attempts by the same researcher are not convincing.

Answer 2: Others in the community ensure actual replicability.

Vice 2: Priority Rule Systematically Disincentivizes Replication of Others' Findings

Assume Priority Rule: Second runners get nothing.

If a replication succeeds, then it is not rewarded. Even if its epistemic contribution is important.

If a replication fails, then it is rewarded. E.g. being the first proving someone else wrong.

In practice the credit-driven scientist is not incentivized to replicate:

A failed replication qua negative result is difficult to publish.

Rules for inferring the null are controversial (Machery 2012).

Negative results are rarely published (Begley and Ellis, 2012, Fanelli 2012).

Replication attempts are rare ~1% (Makel et al., 2012, Smith, 1970, Evanschitzky et al., 2007)

Back to Bem's ESP story:

2011

Bem publishes his article in *JPSP*.

Methodological debates. (Inconclusive).

2012

Ritchie, Wiseman, and French performed a three-lab replication study, which turned out to be unsuccessful.

JPSP and rejects their replication attempt. The journal does not accept direct replications.

Psychological Science rejected the paper on the same grounds.

Galak et al. publish a meta-analysis of replication attempts in *JPSP*.

2014

JPSP changes editorial policies about negative results.

Bem attributes the failures to replicate to the experimenter effect.

2015

Bem et al. publish a meta-analysis of 90 precognition experiments.

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Conclusion

In Kitcher-Strevens' story, priority rule incentivizes an efficient division of cognitive labor.

This story is too optimistic.

To work, this story requires replicability of findings

Theoretical argument: if you reward priority you can at most ensure hypothetical replicability but not actual replicability.

Empirical argument: Meta-scientific evidence shows that many rewarded findings are not replicable at all.

Meta-philosophical upshot: rational reconstructions in social epistemology of science can greatly benefit from empirical evidence.

Thank you!

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