

The background of the slide is a scenic landscape. It features a clear blue sky with several birds in flight. Below the sky, there is a view of a lake or reservoir surrounded by green and brown hills. The foreground shows a dirt path leading through grassy terrain.

Peer review, risky research, and the incentives scientists face

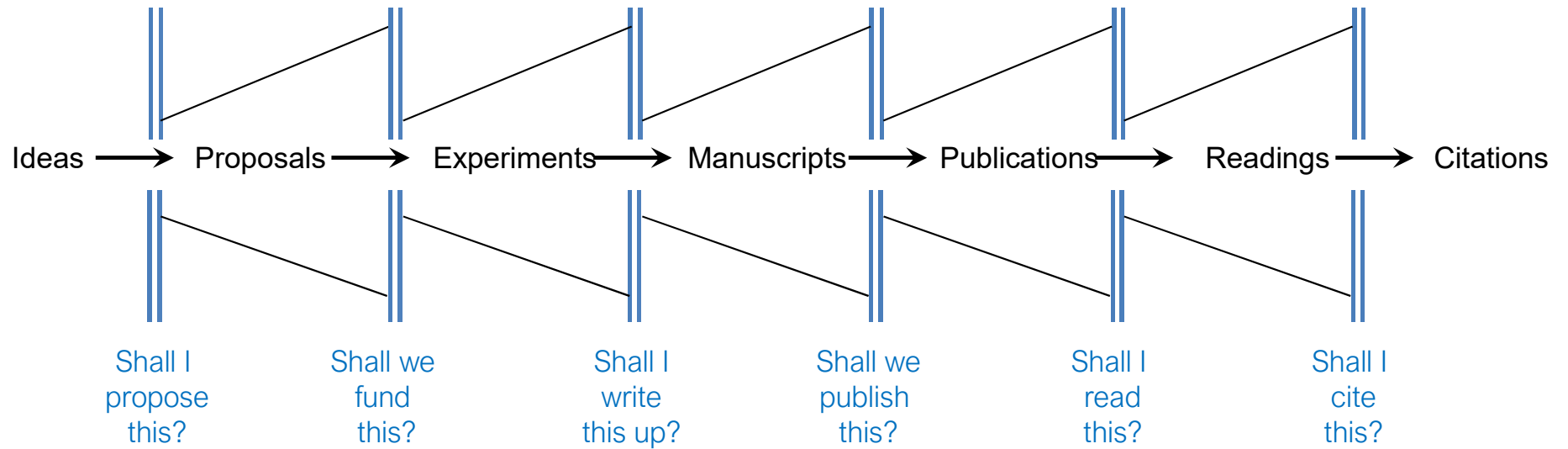
Kevin Gross
North Carolina State Univ.

SFI, Nov. 1 2023

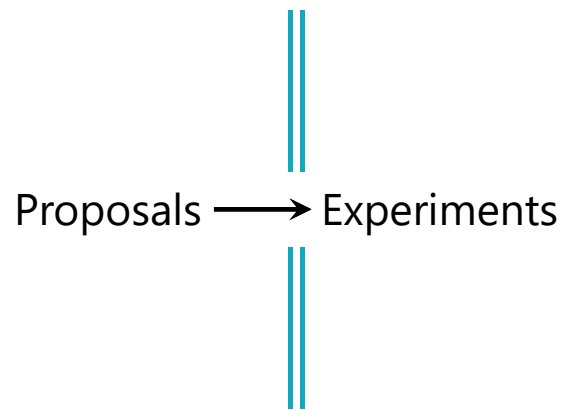
Peer review is a filter



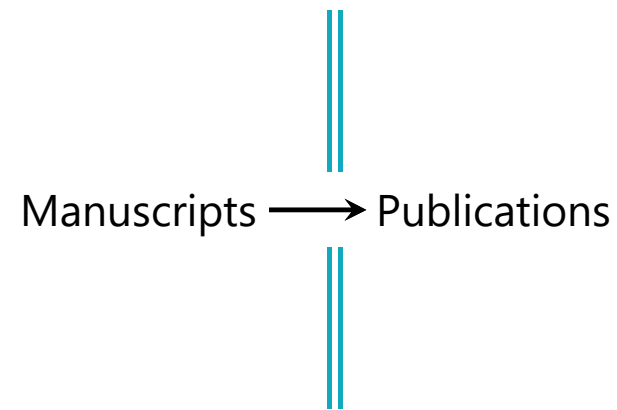
Filters in science



Peer review filters

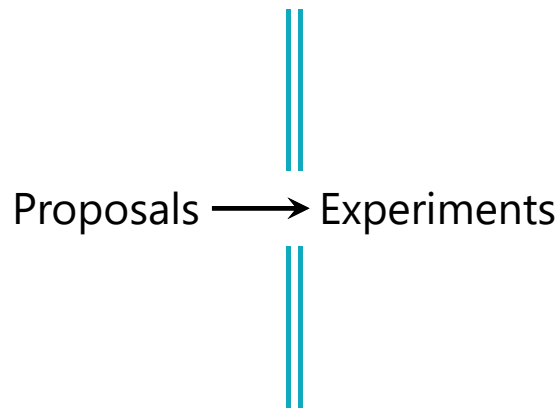


Funder:
Shall we
fund this?



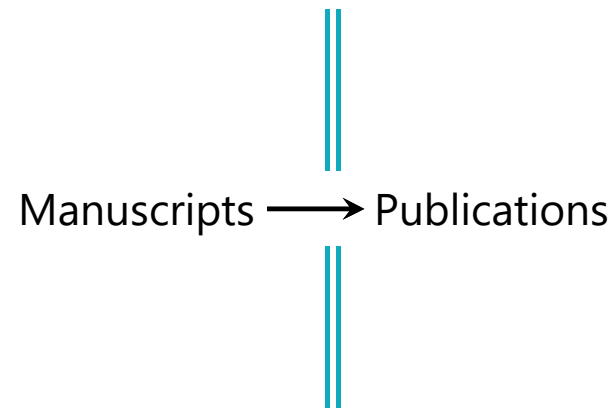
Journal:
Shall we
publish this?

Peer review filters



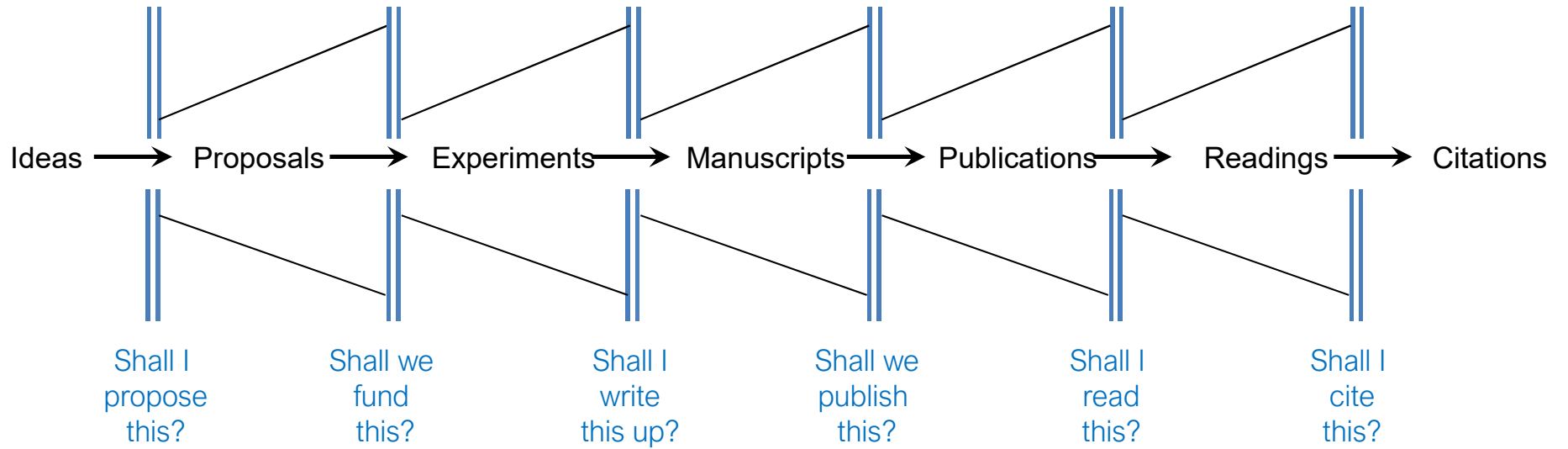
Funder:
Shall we
fund this?

Ex ante review:
Results are
unknown



Journal:
Shall we
publish this?

Ex post review:
Results are
known



Thanks!

- Ex post and ex ante review encourage different types of science.
- Ex post review allows investigators to leverage their private beliefs. Ex ante review does not.
- Ex ante review criteria are often subtly ambiguous. Sharpening them can aid investigators.

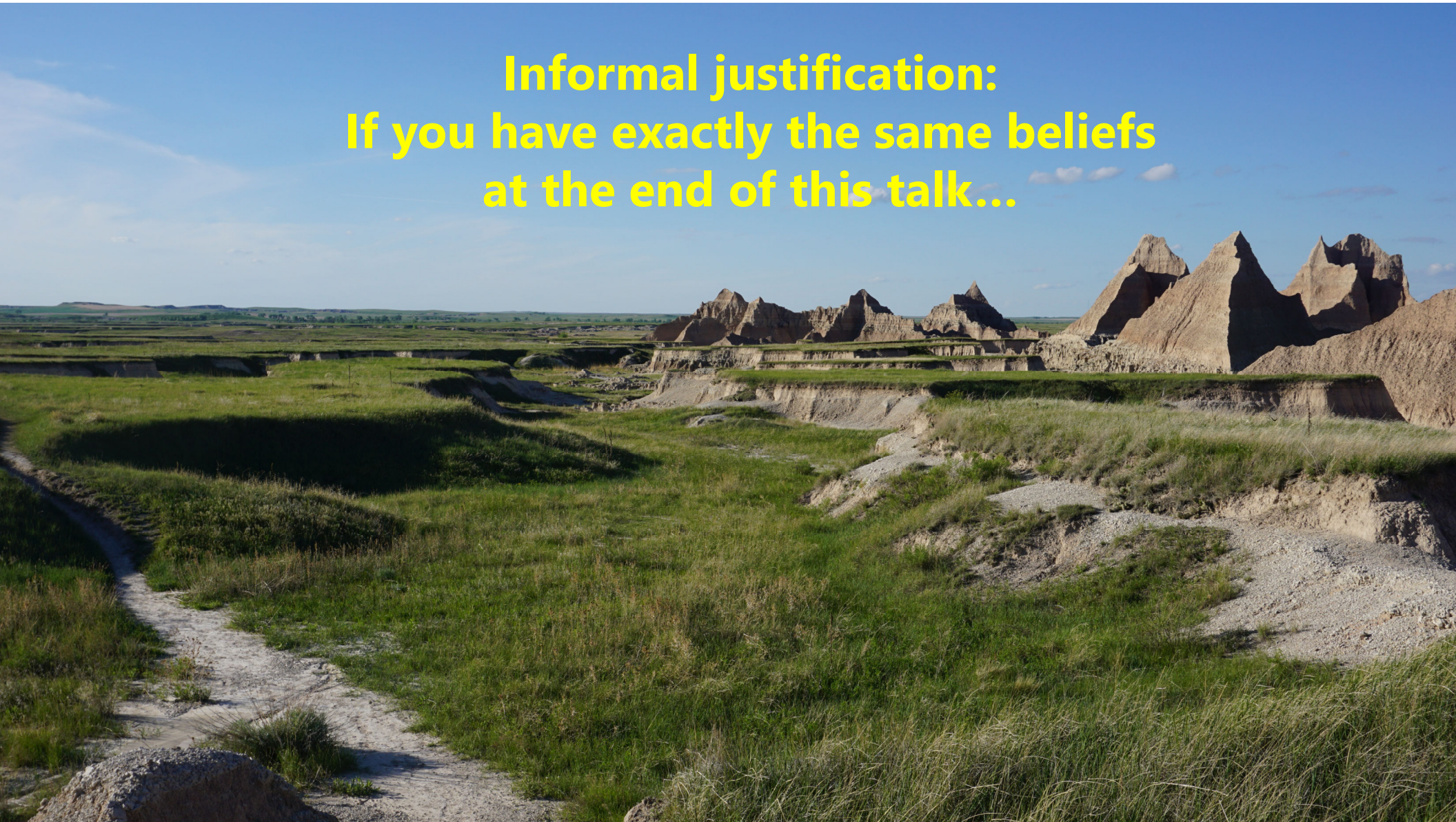
$$\text{value of experiment} = \sum_{\text{outcomes}} \left(\begin{array}{c} \text{probability} \\ \text{of an} \\ \text{outcome} \end{array} \right) \times \left(\begin{array}{c} \text{value of} \\ \text{outcome} \end{array} \right)$$

**Scientists value results that
shift scientific beliefs.**



Davis, *Philos. Soc. Sci* 1971
Goldman & Shaked, *Philos. Stud.* 1991
Frankel & Kasy *AEJ Micro* 2022

**Informal justification:
If you have exactly the same beliefs
at the end of this talk...**



$$\text{value of experiment} = \sum_{\text{outcomes}} \left(\begin{array}{c} \text{probability} \\ \text{of an} \\ \text{outcome} \end{array} \right) \times \left(\begin{array}{c} \text{value of} \\ \text{resulting} \\ \text{belief shift} \end{array} \right)$$

$$\text{value of experiment} = \sum_{\text{outcomes}} \left(\begin{array}{c} \text{probability} \\ \text{of an} \\ \text{outcome} \end{array} \right) \times \left(\begin{array}{c} \text{value of} \\ \text{resulting} \\ \text{belief shift} \end{array} \right)$$

value of belief shift =

amount by which a Bayesian updater perceives that their forecasts of empirical phenomena have improved

$$\text{value of experiment} = \sum_{\text{outcomes}} \left(\begin{array}{c} \text{probability} \\ \text{of an} \\ \text{outcome} \end{array} \right) \times \left(\begin{array}{c} \text{value of} \\ \text{resulting} \\ \text{belief shift} \end{array} \right)$$

Whose beliefs are used to anticipate outcomes?

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Whose beliefs
will shift after
observing the
outcome?

Whose beliefs will shift upon observing the outcome?

Their own

Everyone else's

Investigator

Epistemically
pure

Facing ex post
review

Whose beliefs are
used to anticipate
outcomes?

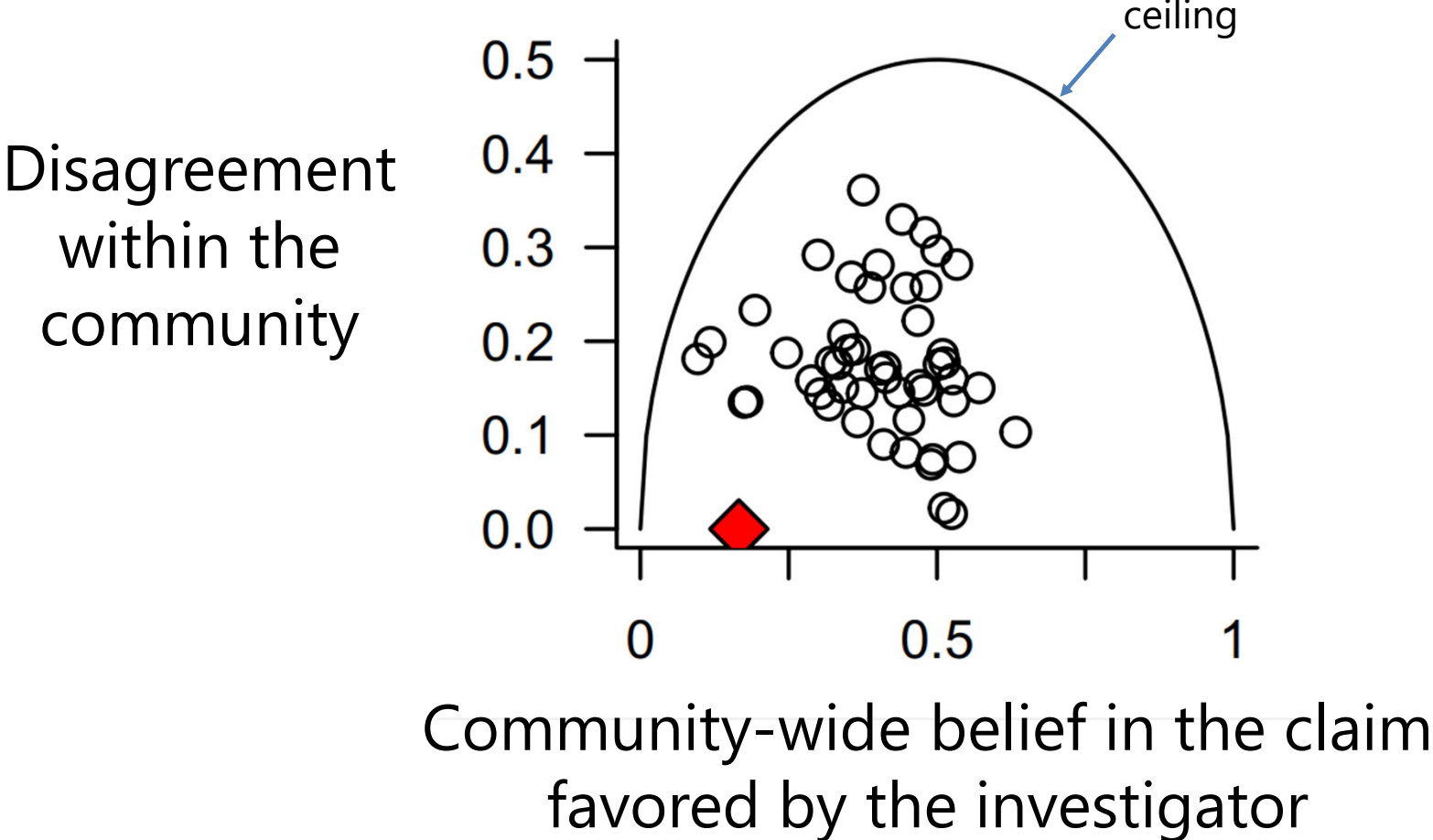
Reviewer

Facing ex ante
review

Facing ex ante
review

	Epistemically pure	Facing ex post review
	Facing ex ante review	Facing ex ante review

Scientific activity in a simulated community, when facing ex post review:



Whose beliefs will shift upon observing the outcome?

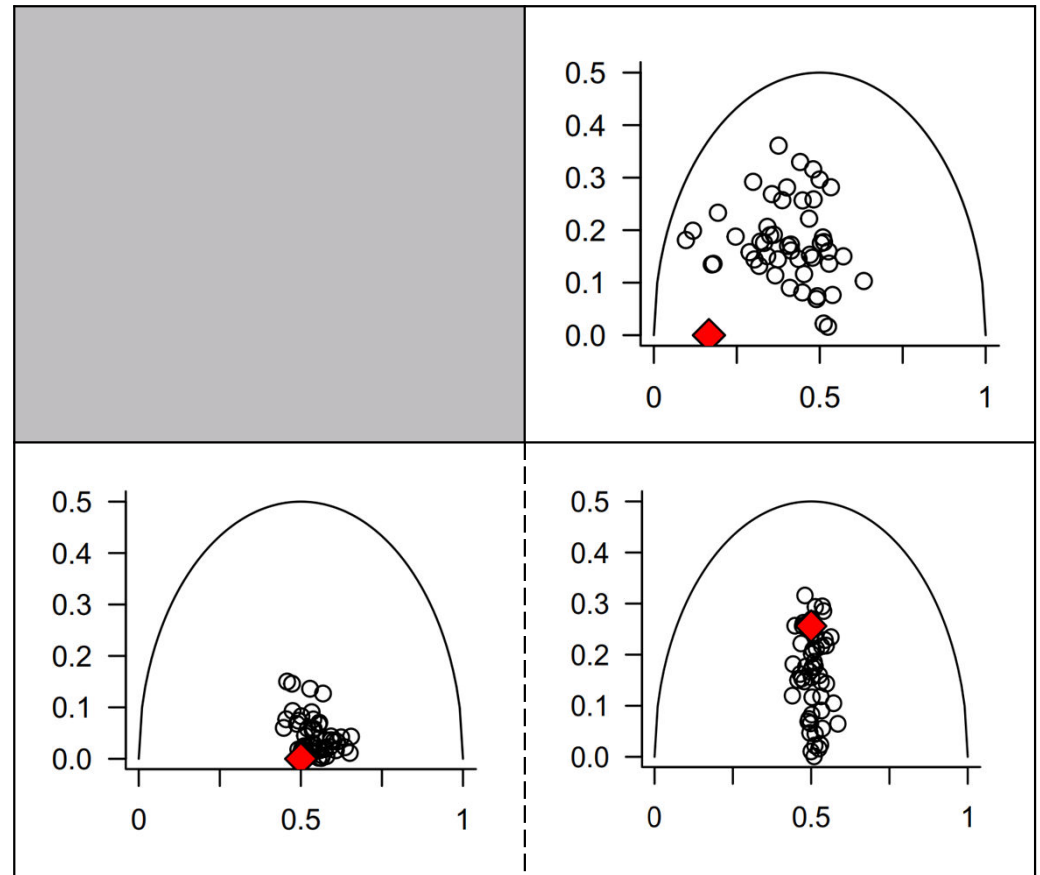
Their own

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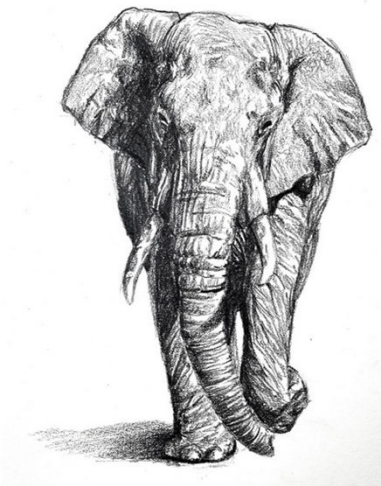
Investigator

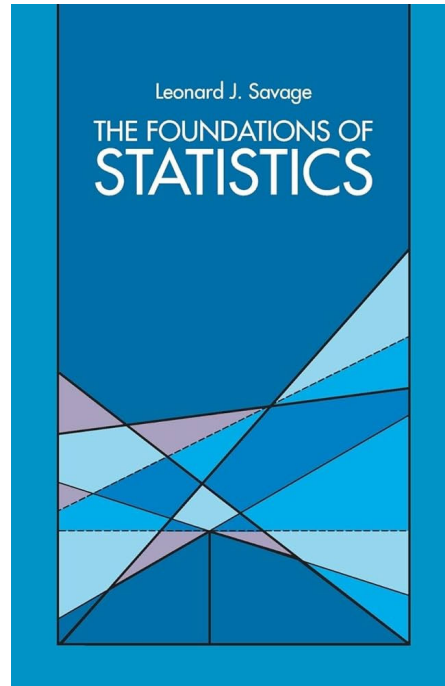
Whose beliefs are used to anticipate outcomes?

Reviewer



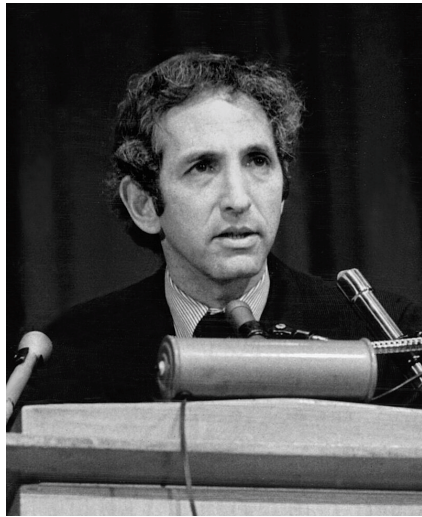
Does ordinary probability provide a sufficiently expressive language for scientific beliefs?





Imprecise probability

Choquet capacities, Dempster-Shafer belief functions, fuzzy logic, possibility theory, lower previsions, generalized Bayes, robust Bayes,...



Daniel Ellsberg

Learning (to disagree?) in large worlds ☆

Itzhak Gilboa^{a,b}, Larry Samuelson^{c,*}, David Schmeidler^b

^a HEC Paris, France

^b Tel Aviv University, Israel

^c Department of Economics, Yale University, United States of America

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(In large worlds), there is no analogous merging result for non-Bayesian beliefs, even with common support. Indeed, no learning rule invariably ensures learning, leaving ample room for persistent disagreement. However, ...there are intuitive learning rules that lead people with different models to a common view of the world (and hence to agree) if the data generating process is sufficiently structured, even though different agents employ various different modes of reasoning and potentially shift between modes of reasoning as they learn which is the most appropriate. //

Thanks!



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krgross.github.io