



Peer review, risky research, and the incentives scientists face

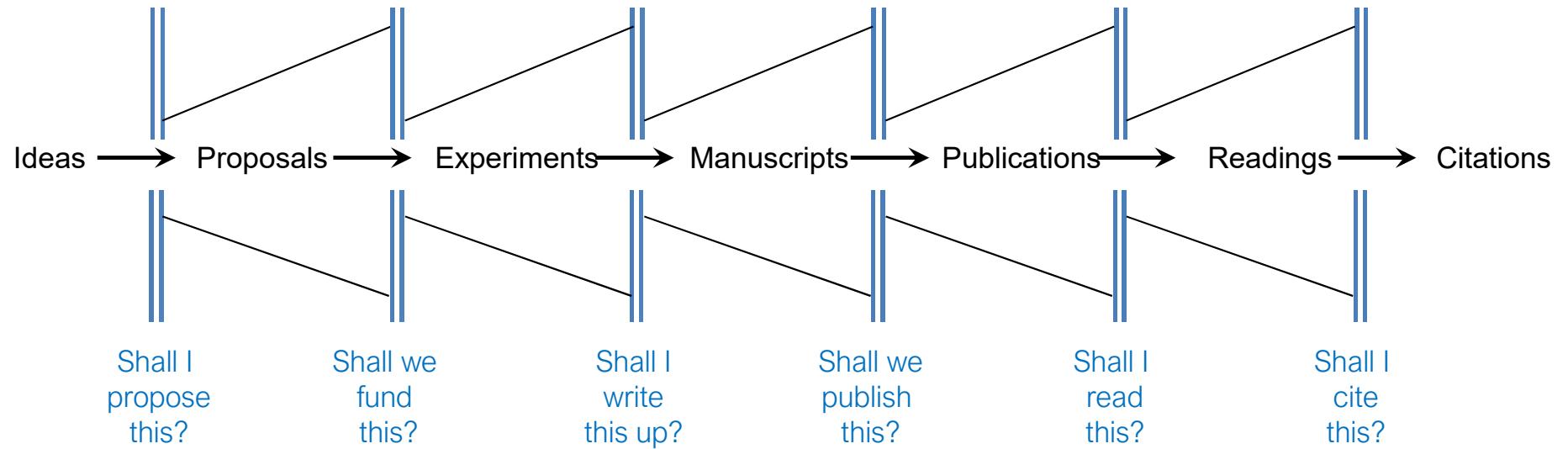
Kevin Gross
North Carolina State Univ.

SFI, Nov. 1 2023

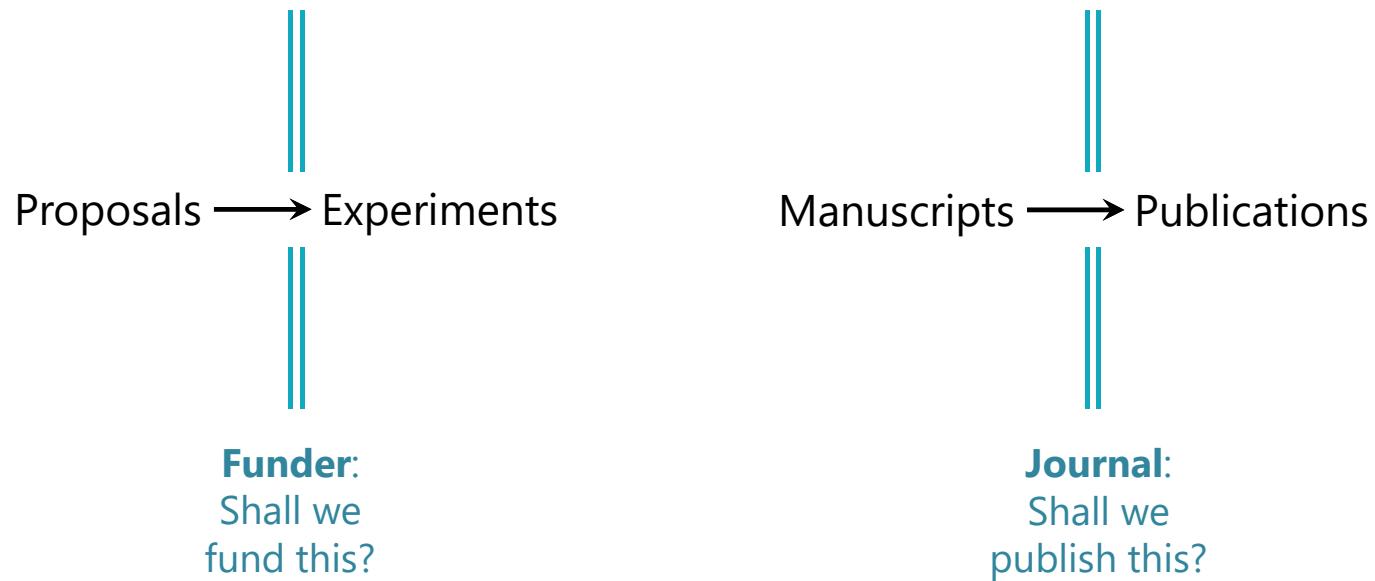
Peer review is a filter



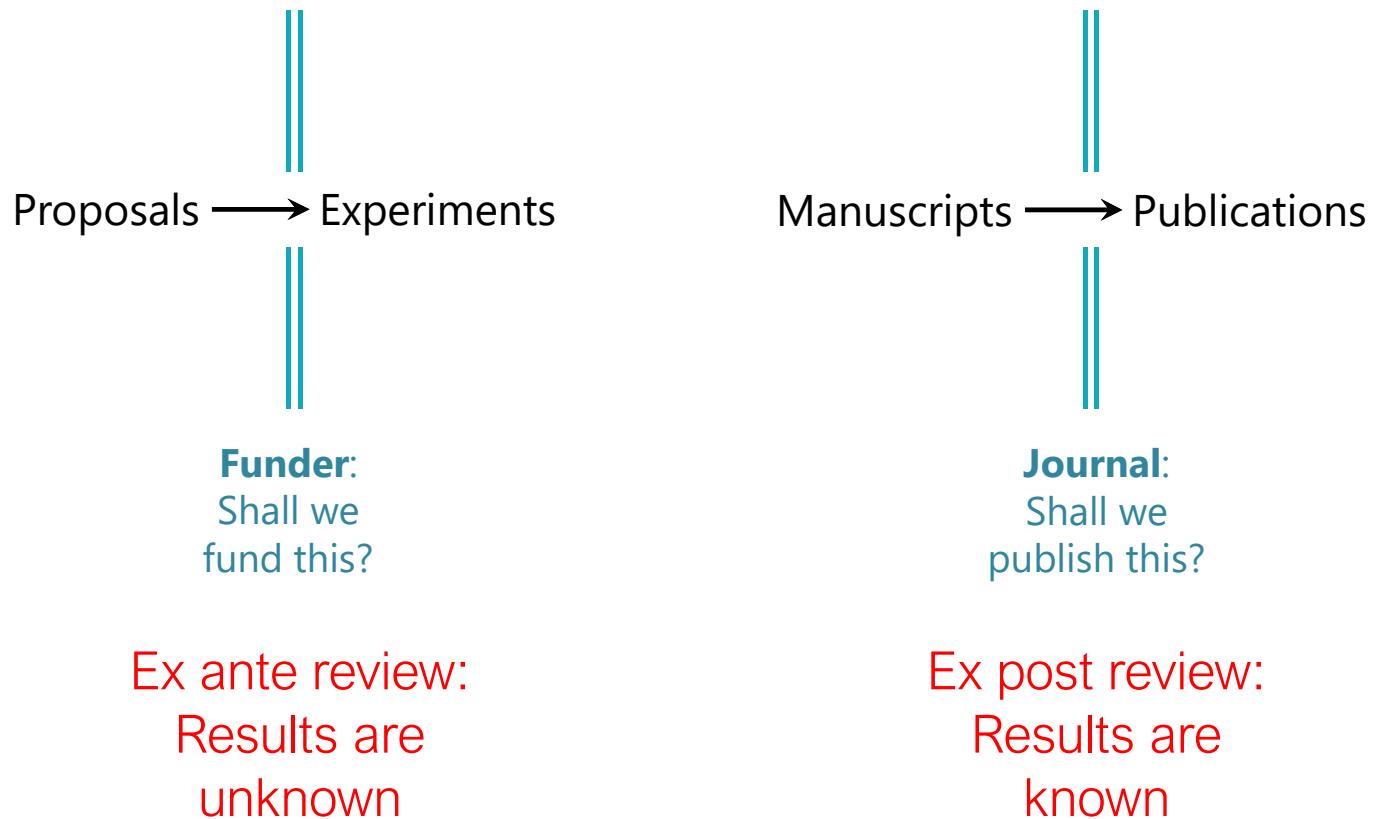
Filters in science

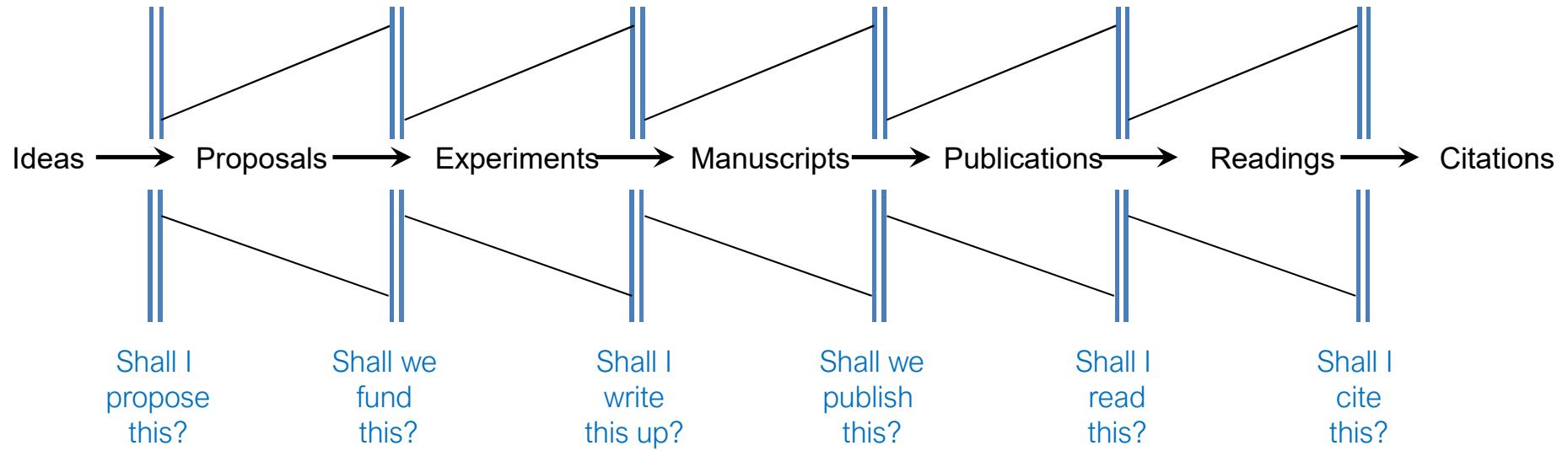


Peer review filters



Peer review filters





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 *AJ 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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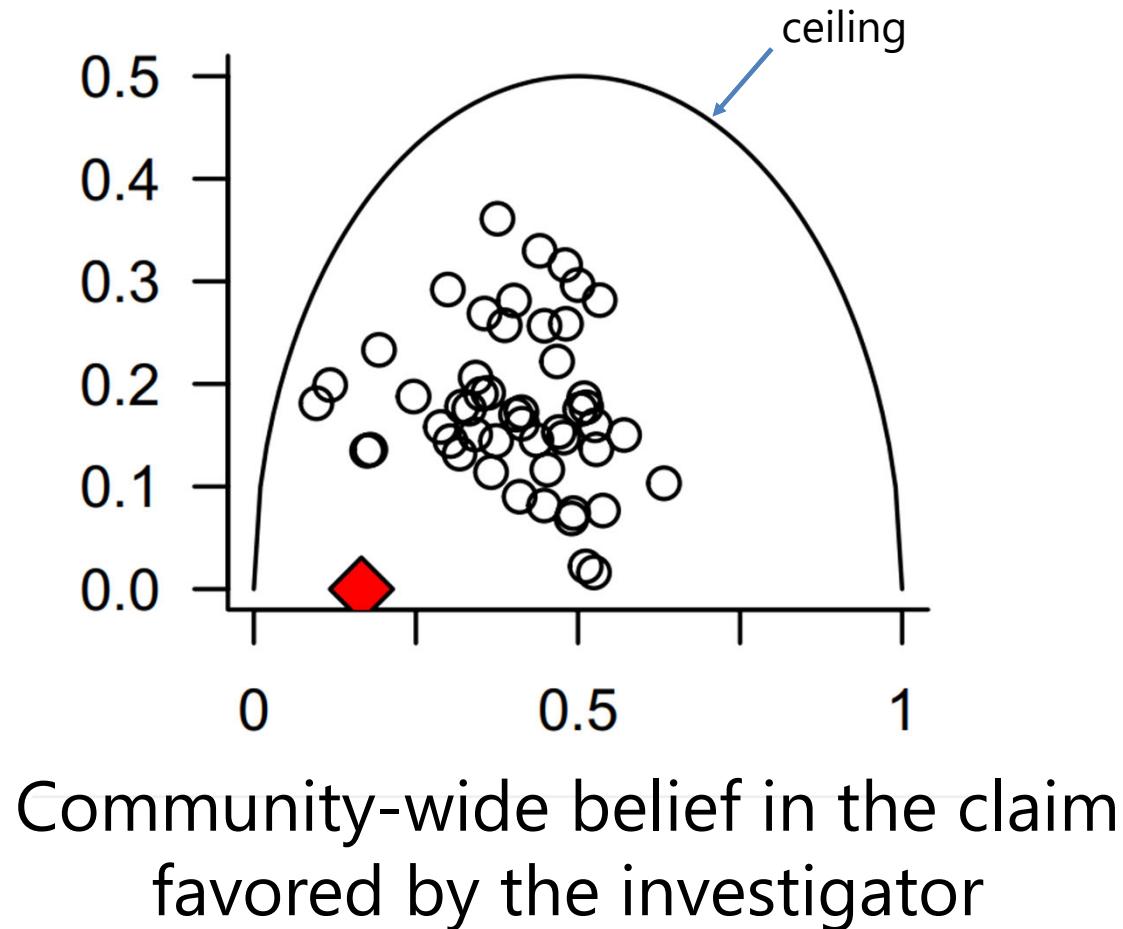
Whose beliefs
will shift after
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outcome?

Whose beliefs will shift upon observing the outcome?

		Their own	Everyone else's
		Epistemically pure	Facing ex post review
Investigator	Whose beliefs are used to anticipate outcomes?		
	Reviewer	Facing ex ante review	Facing ex ante review

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

Disagreement
within the
community



Whose beliefs will shift upon observing the outcome?

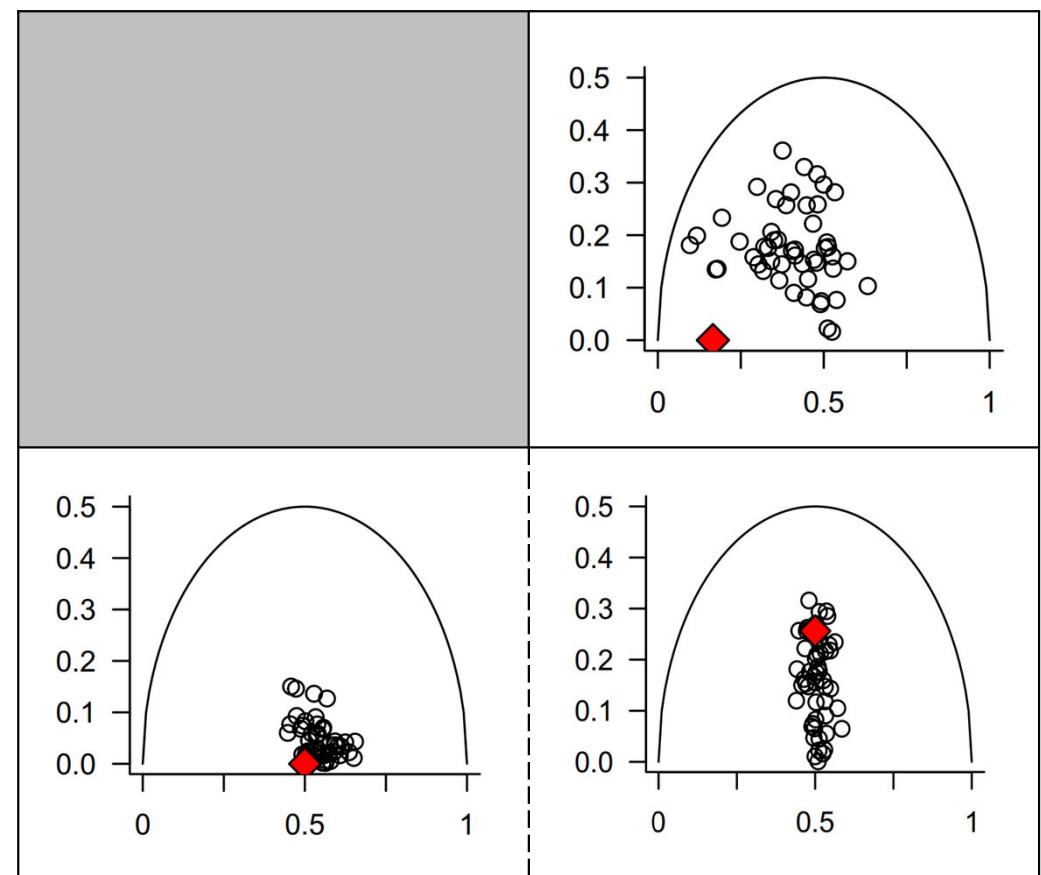
Whose beliefs are used to anticipate outcomes?

Investigator

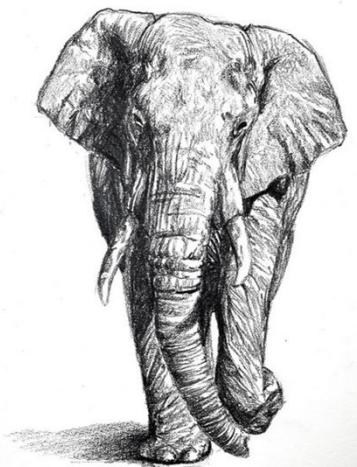
Reviewer

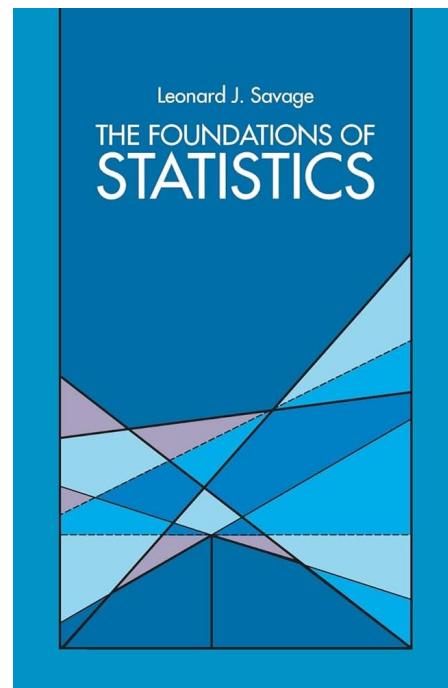
Their own

Everyone else's



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

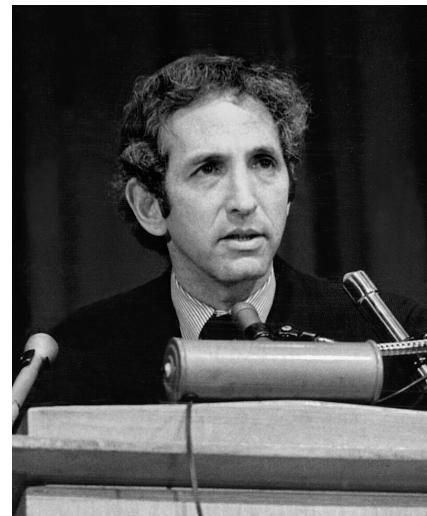




Imprecise probability

A photograph of the Badlands National Park in South Dakota. The foreground is covered in tall, green grass and patches of light-colored sand. In the middle ground, several large, jagged, light-brown rock formations rise from the ground. The sky is a clear, vibrant blue.

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



Daniel Ellsberg

Learning (to disagree?) in large worlds

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^a HEC Paris, France

^b Tel Aviv University, Israel

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

II *(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.* **II**

Thanks!



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