Epistemic Diversity and Editor Decisions: A Statistical Matthew Effect

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The Importance of Epistemic Diversity

> The history of science has been and should be a history of competing research programmes (or, if you wish, 'paradigms'), but it has not been and must not become a succession of periods of normal science: the sooner competition starts, the better for progress. (Lakatos 1978, p. 69)

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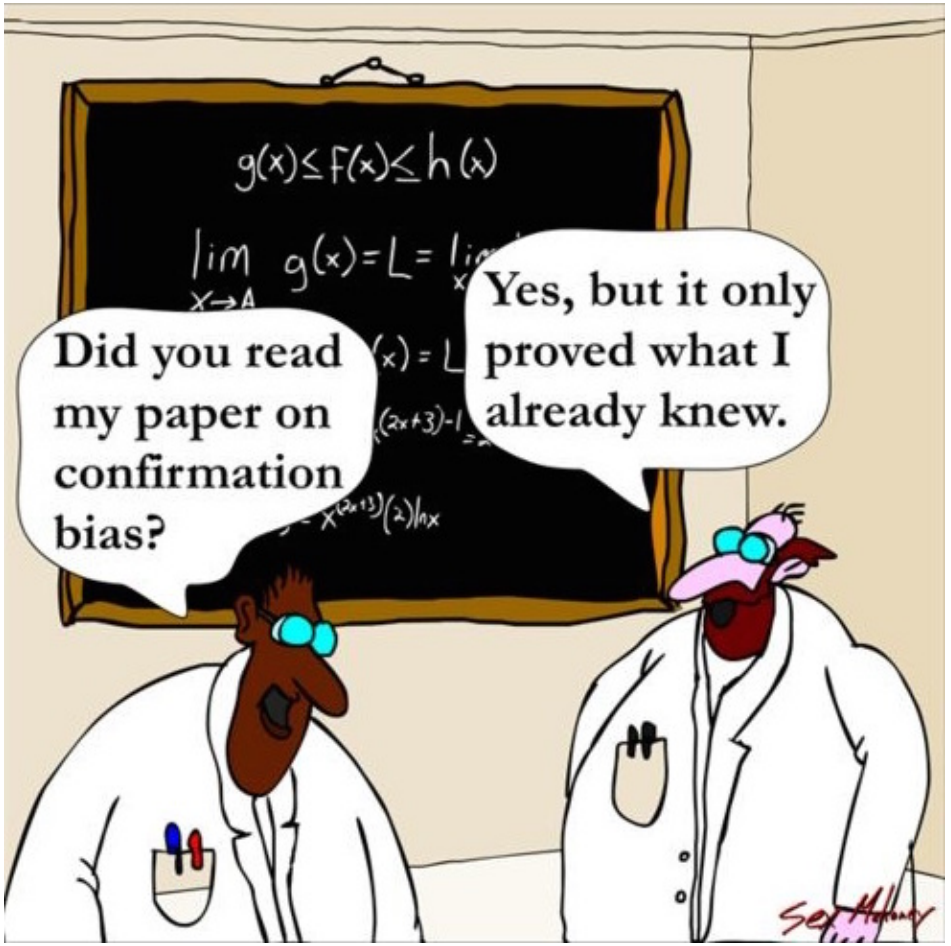
- Journals (editors/peer reviewers) should promote epistemic diversity
- Bias in favor of monoculture is detrimental to progress

Editorial Biases

- Editors' cognitive biases may favor established research program
  - Confirmation bias
  - Anchoring



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Our claim:

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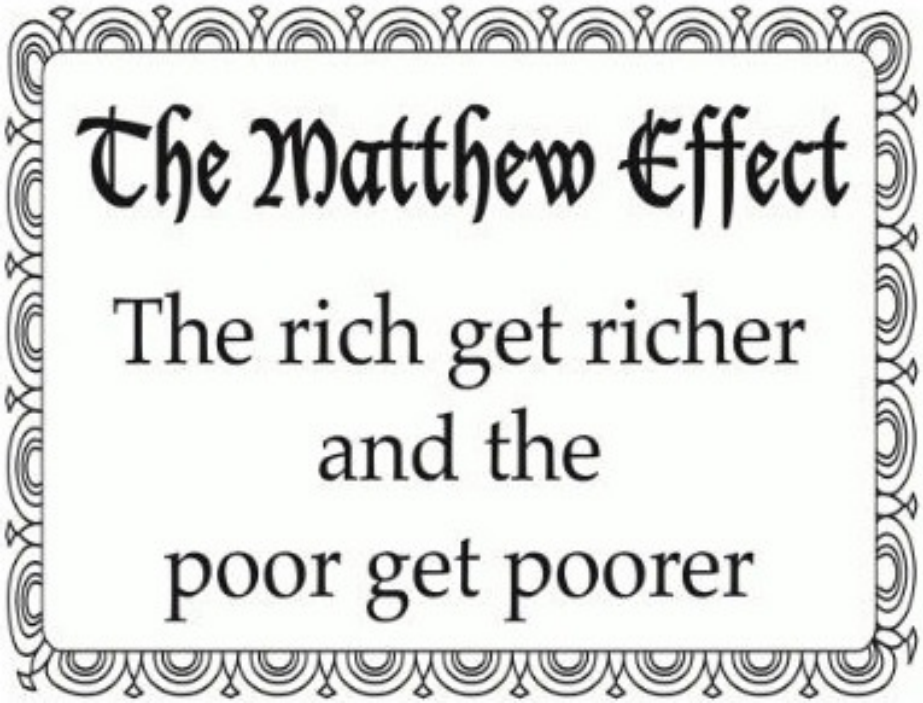
- We call this a statistical Matthew effect (Merton 1968)



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Outline

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Quality and Information

Assumptions of the model: ▸ Formal details

- Each paper has latent quality q
- Less uncertainty for known authors

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- Reviewer(s) estimate quality
- Editor accepts papers of high (posterior) quality

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Bias Favors the Established Research Program

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Dilemma for the editor: despite equal quality distributions

- Either established program receives more exposure
- Or published work from established program is seen to be better

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- Justified?
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- How to prevent this?
- Suggestion: role of editor's prior is unjustified

Outline

Latent Quality Differences

- In this model, problems arise from latent quality differences
- Plausibly, established research program produces higher quality on average
- Novel program may have startup problems

A Different Model of Peer Review

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- Goal is to accept suitable (high quality) papers
- Quality follows "log-concave" probability distribution
- Average quality in established program higher than in novel program

Peer Review Favors the Established Research Program

Result

Peer review works better for established program: greater proportion of accepted papers is suitable, and suitable papers are accepted at a higher rate

Corollary

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- Despite "unbiased" peer review, established program better off

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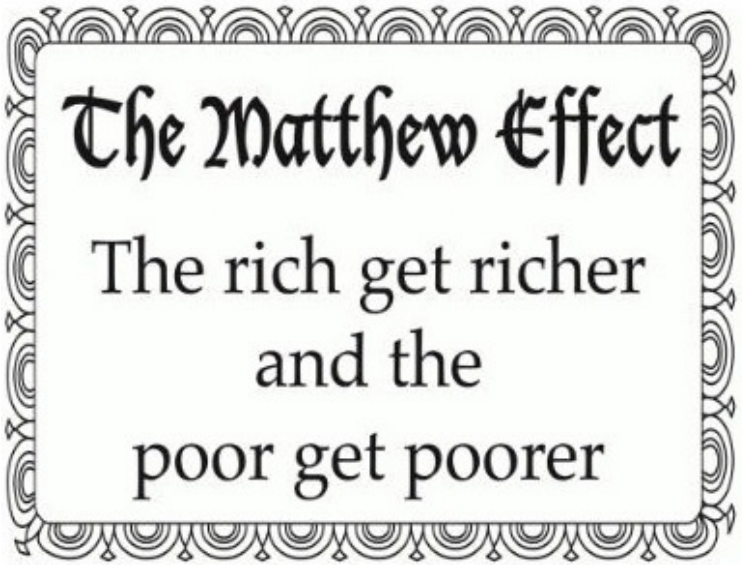
Purely Statistical Biases Versus Other Biases

- Safeguarding epistemic diversity is difficult
- Efforts to curtail cognitive biases must continue, but. . .



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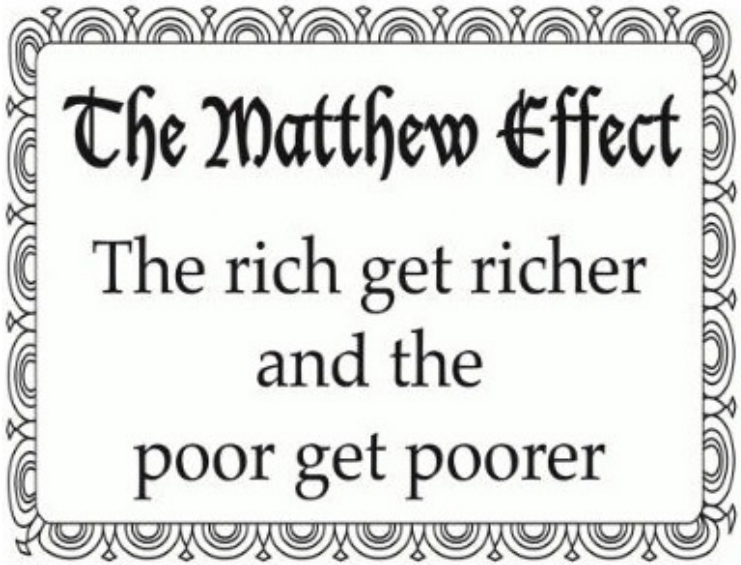
Purely Statistical Biases Versus Other Biases

- Safeguarding epistemic diversity is difficult
- Efforts to curtail cognitive biases must continue, but. . .
- Peer review may favor established research programs even in their absence
- What can be done about this?



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Differential Treatment

- Proposal: solicit extra reviews for close calls

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- Additional reviews required more often for novel research program
- Safeguarding epistemic diversity requires differential treatment

Multiple Dimensions of Evaluation

- Objection: notion of quality is too idealized
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- Reply: selection involves implicit unidimensional scale
- Does not avoid bias

Abolish Peer Review

- Proposal: abolish peer review altogether
- ArXiv model of publishing

Thank You!

Thank you for your attention!

Questions?

References I

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Quality and Uncertainty

- Submitted paper has latent quality q
- Identity of author is relevant to quality
  - Editor's prior for known author: $\pi(q \mid K)$
  - Editor's prior for unknown author: $\pi(q)$
- Distribution of quality is the same for research programs H and L
  - Research program of author is irrelevant to quality:
  - $\pi(q \mid K, H) = \pi(q \mid K, L)$ and $\pi(q \mid H) = \pi(q \mid L)$
- But authors from program H more likely to be known
  - Editor may belong to program H

Peer Review

- Editor solicits reviews
- Reviewer report R independent of research program and identity of author (given q)
- Editor updates beliefs about q
  - Posterior for known author: $\pi(q \mid K, R)$
  - Posterior for unknown author: $\pi(q \mid R)$

Acceptance and Utility

- Editor must accept (A) or reject ($\neg A$) submission
- Editor selects only for quality
  - Utility of acceptance equals quality q
  - Utility of rejection is some fixed value q^*

$\Longrightarrow$ Editor accepts if and only if posterior mean exceeds q^*

A Different Model of Peer Review

- Quality q follows the same log-concave distribution in both programs
  - $f(tq + (1-t)q') \geq f(q)^t f(q')^{1-t}$
  - E.g., normal, uniform, exponential, gamma
- Reviewer report R unbiased: independent of research program (given q)
- Editor must accept (A) or reject ($\neg A$) submission
- "Frequentist" editor: accept if and only if reviewer report exceeds q^*
  - Identical decision procedures:
  - $D_H = A$ if $R > q^*$ and $D_L = A$ if $R > q^*$
- No distributional assumption on R except: conditional probability of acceptance increasing in q
  - $\Pr(R > q^* \mid q)$ increasing in q

The Result

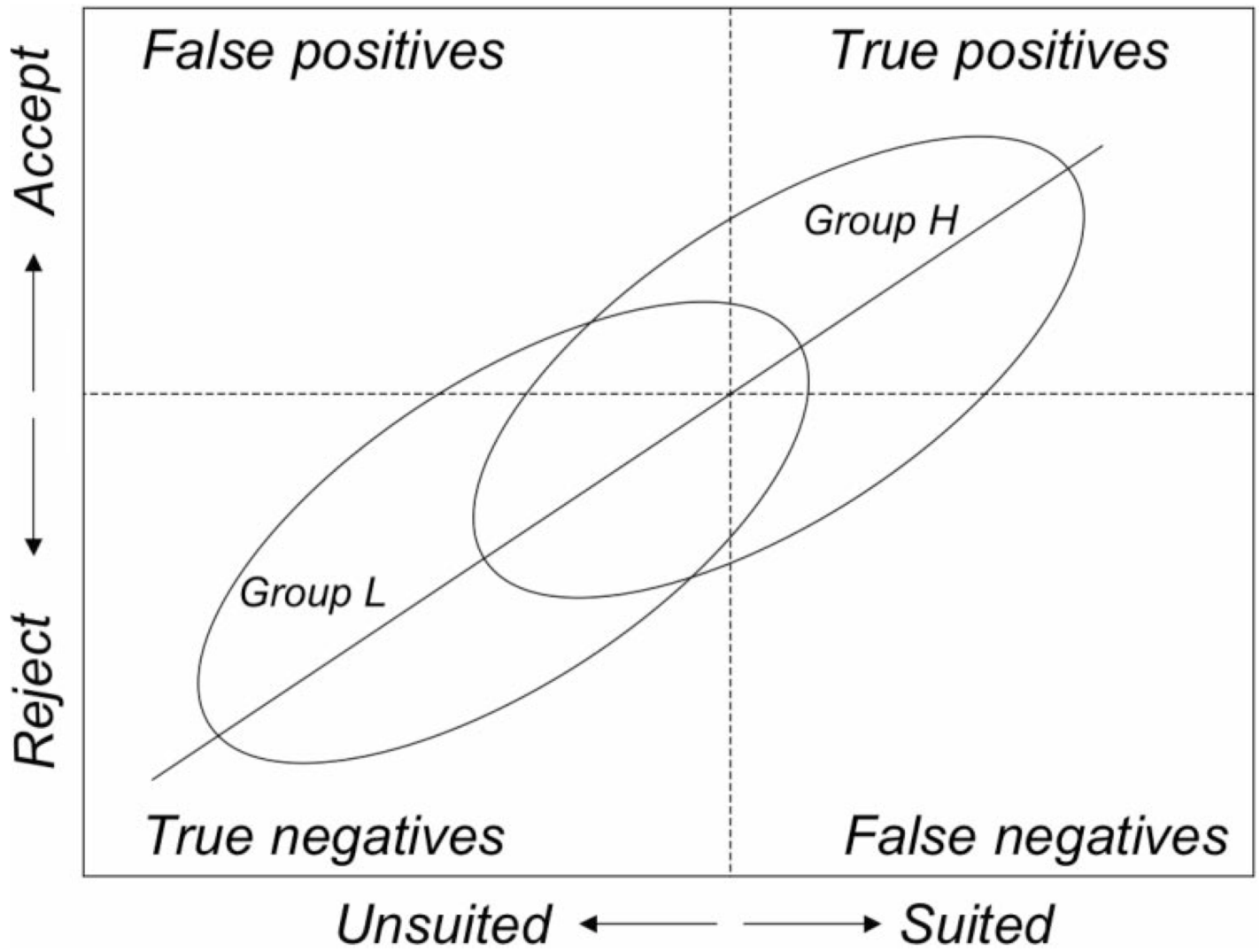
A submission is suitable (S) if its quality q exceeds threshold t

Theorem 1

A greater proportion of accepted papers from program H is suitable: $\Pr(S \mid D_H = A) > \Pr(S \mid D_L = A)$. *Conversely, suitable papers from program H are accepted at a higher rate:* $\Pr(D_H = A \mid S) \geq \Pr(D_L = A \mid S)$, *with strict inequality unless the distribution of quality is exponential.*

- Generalizes Borsboom et al. (2008)
- Generalization also considers different variances

Why Does This Happen?



Addressing the Problem