

Are three better than one? An agent-based model of referee behaviour in peer review

Federico Bianchi & Flaminio Squazzoni*

* Department of Economics and Management, University of Brescia, Italy web: www.eco.unibs.it/gecs





Peer review under the spotlight

SCIENTIFIC RESEARCH

End of the peer review show?

Several recent high profile cases have raised questions about the effectiveness of peer review ensuring the quality of published research. Mark Henderson investigates

Istings and advice www.mitrejeb.com



Cases of scientific wrongdoing seem to be rising. But when should researchers blow the whistle? BY VIRGINIA GEWIN

BY VIRCINIA GEWIN supervisor, alerted the US National Cancer Institute to the likely minibles and contracted the iostratisticians Keth Baggerly and Kevin editors of the journal polibiling Pottis work. Research Integrity (ORD) in Product and the second se

Bruce Alberts is the Editor-in-Chief of Science.

Brooks Hanson is Deputy Editor for physical sciences at Science.

Katrina L. Kelner is Deputy Editor for life sciences at Science.

Reviewing Peer Review

PEER REVIEW. IN WHICH EXPERTS IN THE FIELD SCRUTINIZE AND CRITIQUE scientific results prior to publication, is fundamental to scientific progress, and the achievements of science in the last century are an endorsement of its value. Peer review influences more than just science. The Intergovernmental Panel on Climate Change and other similar advisory groups base their judgments on peer-reviewed literature, and this is part of their success. Many legal decisions and regulations also depend on peer-reviewed science. Thus, thorough, expert review of research results-without compensation-is an obligation that scientists shoulder for both science and the general public.

Retraction Watch

Retraction count grows to 35 for scientist who faked emails to do his own peer review with S commerces

Hyung-In Moon, the South Korean plant compound researcher who made up email addresses so he could do his own peer review, is now up to 35 retractions.

- The four new retractions are of the papers in the Journal of Browne Inhibition and Medicinal Chemistry that initially led to suspicions when all the reviews came back ars. Here's the notice, which includes the same language as Moon's 24 ons of studies published in Infomia Healthcare soumals.
 - nding author and publisher hereby retract the following article n publication in Journal of Enzyme Inhibition and Medicinal Chemistry
 - ing Cha, Hyeong-Soc Kim, Haung-In Moon, and Young-Su Cho

nal of Brzyme Inhibition and Medicinal Chemistry (epub ahead of print), 2012, doi 109/14756366,2011,641014

- sity activity of femented Argelicae gigantis by high fat diet-induced obes

mai of Enzyme Inhibition and Medicinal Chemistry (epub shead of print), 2012, doi



Scientific Articles

FDITORIAI



PEERE "New Frontiers of Peer Review" www.peere.org peereinfo@peere.org

journals



The Model

- □ A population of *N* agents (authors & referees)
- Resources, productivity and quality
- Publish or perish
- Selection



Flaminio Squazzoni and Claudio Gandelli (2013)

Saint Matthew strikes again: An agent-based model of peer review an the scientific community structure

Flaminio Squazzoni*, Claudio Gandelli

ARTICLE INFO

Received 24 October 2011

Accepted 19 December 2011

Received in revised form

22 November 2011

Article history

Keywords:

Referees Referee reliability

Peer review

Matthew effect

Agent-based model

Department of Social Sciences, University of Brescia, Via San Faustino 74/B, 25122 Brescia, Italy

system, more than a consequence of evaluation bias.

ABSTRACT Abstract This paper investigates the impact of referee reliability on the quality and efficiency of review. We modeled peer review as a process based on knowledge asymmetries and si to evaluation bias. We tested various levels of referee reliability and different mecha of reviewing effort distribution among agents. We also tested different scientific co nity structures (cohesive vs. parochial) and competitive science environments (high v competition). We found that referee behavior drastically affects peer review and an distribution of the reviewing effort is beneficial only if the scientific community is b Keywords geneous and referee reliability is the rule. We also found that the Matthew effect

allocation of resources and credit is inherent to a 'winner takes all' well functioning scient

This paper investigates the impact of referee behaviour on the quality and efficiency of peer review. We focused on the importance of reciprocity motives in ensuring cooperation between all involved parties. We modelled peer review as a process based on knowledge asymmetries and subject to evaluation bias. We built various simulation scenarios in which we tested different interaction conditions and author and referee behaviour. We found that reciprocity cannot always have per se a positive effect on the quality of peer review, as it may tend to increase evaluation bias. It can have a positive effect only when reciprocity motives are inspired by disinterested standards of fairness.

Opening the Black-Box of Peer Review: An Agent-Based Model of Scientist Behaviour

Journal of Artificial Societies and Social Simulation 16 (2) 3

<http://jasss.soc.surrey.ac.uk/16/2/3.html>

Received: 02-Jul-2012 Accepted: 13-Oct-2012 Published: 31-Mar-2013

Peer Review, Referees, Referee Behaviour, Reciprocity, Fairness

© 2011 Elsevier Ltd. All rights reserved.

PEERE "New Frontiers of Peer Review"

www.peere.org peereinfo@peere.org



(Shiter tools



Scenarios and parameters

- ✓ Fair, random, vs. strategic referees
- ✓ Degree of unreliability
- ✓ Bias excursion
- ✓ 1, 2, and 3 referees

Table 1: The Simulation Parameters

Parameters	Value
Initial scientist resources	0
Fixed productivity gain	1
Number of accepted publications	30
Publication productivity multiplier	[1, 1.5]
Unreliability probability	[0, 0.25, 0.33,
	0.5]
Number of reviewers per author	[1, 2, 3]
Evaluation bias by default	0.1
Author investment for publication	1
Reviewing expenses of unreliable	0.5
reviewers	
Underrating by unreliable	0.1
reviewers	
Overrating by unreliable reviewers	1.9
Velocity of best quality	0.1
approximation	







Results

Pure randomness is not the worst case: when referee reliability depended on previous success/failure of scientists as authors, evaluation bias was 43.32 with one referee, 35.20 with two and 25.74 with three

Table 2: The impact of the degree of unreliability of reviewers and multiple reviewers on the evaluation bias of peer review with multiple reviewers (values in percentage, averaged over 3,000 simulation runs, t = 200).

Degree of unreliability of	. Number of reviewers		
reviewers	1	2	3
0.00 (fair scenario)	5.59	9.87	13.41
0.25 (random scenario)	15.26	12.97	14.86
0.33 (random scenario)	20.95	12.78	13.80
0.50 (random scenario)	28.97	15.92	12.92







Figure 1: Evaluation bias with different reviewer behavior (% values, averaged over 3,000 simulation runs, t = 200).







Trade-off

Table 3: The impact of the degree of unreliability of reviewers and multiple reviewers on the reviewing expenses (values in percentage, averaged over 3,000 simulation runs, t = 200).

Degree of unreliability of	Number of reviewers		
reviewers	1	2	3
0.00 (fair scenario)	36.41	93.16	144.54
0.25 (random scenario)	25.96	57.81	102.04
0.33 (random scenario)	30.13	53.28	93.19
0.50 (random scenario)	29.48	51.11	82.92

Figure 2: Reviewing expenses in the three scenarios (% values, averaged over 3,000 simulation runs, t = 200).







Conclusions

- □ The "luck of the reviewer draw" is not the worst case scenario
- Even minimal strategic behavior by reviewers might have significant implications for the quality of publications (e.g., Thurner and Hanel 2011)
- □ The quality of peer review comes at a serious cost, i.e., a resource drain from researching to reviewing, which could even achieve abnormal, unsustainable levels
- The higher the bias, the more equal is the resource allocation (Squazzoni and Gandelli 2012)
- Next developments
- Mapping reviewer behavior (strategy detection)
- Problems on tracing strategic behavior (across journals?)





Edited by Flaminio Squazzoni Review Editor Andreas Koch Forum Editor Klaus G Troitzsch





Thank you



