Peer Review in Practice and Evolution at Science magazine

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Science
Washington, DC, USA

PEERE, Budapest
14 Oct 2014
American Association for the Advancement of Science

Founded in 1848
Non-profit membership society
World's largest general-science society
Serves 10 million individuals through primary membership and affiliations with ~260 scientific societies and academies

Mission: “to advance science and serve society”

Publication of *Science* journals, annual meetings, public outreach, international scientific cooperation, policy advocacy, educational programs, press relations, public understanding
Science
Editor-in-Chief, Marcia McNutt
Founded in 1880
seed money from Thomas Edison

research, news, commentary
readership > 1 million
35-40% corresponding authors non-U.S.
Science Advances, 2015
Open access
Digital only

Marcia McNutt is Editor-in-Chief of Science.

The mission of the nonprofit American Association for the Advancement of Science (AAAS), the publisher of Science, is to advance science for the benefit of all humankind. Science contributes to that mission by communicating the very best research across the full range of scientific fields to an extremely broad international audience. The research enterprise has grown dramatically in the past few decades in the number of high-quality practitioners and results, but the capacity for Science to accommodate those works in our journal has not kept pace. Its editors turn away papers that are potentially important, well written, of broad interest, and technically well executed. Although other journals provide publishing venues for more papers, many authors still desire to be published in Science, a journal known for its selectivity, high standards, rapid publication, and high visibility.

To help meet this need, as well as expand the current content of Science so as to include even more diverse topics in science, engineering, technology, mathematics, and the social sciences, AAAS will be launching, in early 2015, a digital-only journal, Science Advances. Like Science, this new publication is designed to encourage transformative research and serve a wide readership. Our view at AAAS is that science is becoming more integrated and interdisciplinary, and therefore we prefer to provide one additional broad journal rather than a number...
The science publishing landscape

>16,000 journals (Thomson Reuters)
Specialist disciplinary research
Review journals
General multidisciplinary research
Hybrid research/news/commentary
Changing landscape of science journal/research publishing

Data increase
Reader/user habits
Online possibilities
Social media/blogs etc
Open access
Copyright
Science’s Mission Statement

Science seeks to publish those papers that are most influential in their fields and that will significantly advance scientific understanding. Selected papers should present novel and broadly important data, syntheses, or concepts. They should merit the recognition by the scientific community and general public provided by publication in Science, beyond that provided by specialty journals.
Peer Review
- maintain standards
- improve scientific papers
- shared societal responsibility among researchers, reviewers, and publishers
- fundamental to integrity and accountability of science
Raising the bar

Numbers. Lots and lots of numbers. It is hard to find a paper published in Science or any other journal that is not full of numbers. Interpretation of those numbers provides the basis for the conclusions, as well as an assessment of the confidence in those conclusions. But unfortunately, there have been far too many cases where the quantitative analysis of those numbers has been flawed, causing doubt about the authors' interpretation and uncertainty about the result. Furthermore, it is not realistic to expect that a technical reviewer, chosen for specifically when sophisticated approaches are needed. But even when taking added precautions, no review system is infallible, and no combination of reviewers can be expected to uncover all of the ways in which the interpretation of results may have gone wrong. In particular, it is difficult for reviewers to detect whether authors have approached the study with a lack of bias in their data collection and presentation.

I recall a study that I conducted years ago involving a global analysis of some oceanographic features that I was modeling to understand the rheology of oceanic...
Peer review in *Science*: Commentary

**Scholarly Communication: Cultural Contexts, Evolving Models**

Diane Harley

**Promoting Transparency in Social Science Research**


± Author Affiliations
Peer review in Science: News

The Web’s Faceless Judges

PubPeer is the latest forum for free-ranging discussion of published papers. It can only succeed, say its anonymous founders, if participants are able to keep their identities hidden.

I think it’s going to be very hard to stay anonymous forever.

Who’s Afraid of Peer Review?

A spoof paper concocted by Science reveals little or no scrutiny at many open-access journals.

On 4 July, good news arrived in the inbox of Corinne Colagne, a biologist at the Warren Institute of Medicine in Austin. It was the official letter of acceptance for a paper she had submitted 2 months earlier to the Journal of Natural Pharmaceuticals, describing the antimicrobial properties of a chemical that Colagne had extracted from a lichen.

In fact, it should have been promptly rejected. Any reviewer with more than a high-school knowledge of chemistry and the ability to understand a basic data plot should have spotted the paper’s shortcomings immediately. In experiments are so hopelessly flawed that the results are meaningless.

I know because I wrote the paper. Corinne Colagne does not exist, nor does the Warren Institute of Medicine. Over the past 18 months, I have submitted 324 versions of the wonder drug paper to open-access journals. More than half of the journals accepted the paper, failing to notice its fatal flaws. Beyond that headline recall, the data from this sting operation reveal the contours of an emergent Wild West in academic publishing.

From humble and idealistic beginnings a decade ago, open-access scientific journals have mushroomed into a global industry, driven by author publication fees rather than traditional subscriptions. Most of the papers are thinly veiled. The identity and location of the journals’ editors, as well as the financial workings of their publishers, are often purposely obscured. But Science’s investigation casts a powerful light. Internet Protocol (IP) address traces within the raw headers of e-mails sent by journal editors betray their locations. Invitations for publication fools reveal a network of junk journals based mostly in the developing world. And the acceptances and rejections of the paper provide the first global snapshot of peer review across the open-access scientific enterprise.

One might have expected credible peer review at the Journal of Natural Pharmaceuticals. It describes itself as “a peer reviewed journal aiming to communicate high-quality research articles, short communications, and reviews in the field of natural products with desired pharmacological activity.” The editors and advisory board members are pharmaceutical science professors at universities around the world.

The journal is one of more than 275 published by Medknow, a company based in Mumbai, India, and one of the largest open-access publishers. According to Medknow’s website, more than
Race, Ethnicity, and NIH Research Awards

Donna K. Ginther, Walter T. Schaffer, Joshua Schnell, Beth Masimore, Faye Liu, Laurel L. Haak, Raynard Kington

We investigated the association between a U.S. National Institutes of Health (NIH) R01 applicant’s self-identified race or ethnicity and the probability of receiving an award by using data from the NIH IMPAC II grant database, the Thomson Reuters Web of Science, and other sources. Although proposals with strong priority scores were equally likely to be funded regardless of race, we find that Asians are 4 percentage points and black or African-American applicants are 13 percentage points less likely to receive NIH investigator-initiated research funding compared with whites. After controlling for the applicant’s educational background, country of origin, training, previous research awards, publication record, and employer characteristics, we find that black applicants remain 10 percentage points less likely than whites to be awarded NIH research funding. Our results suggest some leverage points for policy intervention.
Peer review in *Science*: Special Issues
The review process: who is involved?

Internal
Staff Editors

External
Board of Reviewing Editors
Referees
30 professional editors
PhD and post-doctoral experience
Maintain connections with field
Board of Reviewing Editors (BoRE)
196 members
56% US, 36% Europe, 5% Asia
65% bio, 26% physical, 9% social/behavioral
48 hour feedback
Are scope, focus and results appropriate for *Science* versus more specialized journal?
Suggest referees
Original research submissions 1997 - 2010

smoothed w/ an 8 week running avg
2013 Manuscript Overview
Total manuscripts: 12163
  Per editor: 400-500
  To BoRE: 72%
  To review: 19%
  Published: 6%
Average time to complete review:
  round 1: 25 days
  round 2: 10 days
Submission to post-review decision: 49 days
Submission to accept: 99 days
Selecting referees

- Editors’ experience
- Board suggestions
- Database records
- Web/literature searches
- Suggested/excluded lists from authors
- Variety of experience levels, backgrounds, institutions, nationalities
what editors ask of referees (1):

• Give a brief synopsis of the paper
• Analyse the quality of the experiments/observations
• Analyse the validity of the analysis/interpretation
• Distinguish from related publications or prior work
• Discuss the paper’s significance and likely impact
what editors ask of referees (2);

to rate the manuscript
   Excellent & Exciting
   Above Average
   Too Specialized
   Mediocre/Poor

to recommend whether the submission should be
   published without delay
   published after minor revision
   re-reviewed after revision
   rejected

referees are given opportunity to provide confidential comments to editor
Conflicts of interest for referees

Friends (or rivals)

Co-workers, collaborators, mentor/student

Financial and consulting affiliations

Intellectual loyalty to or against the theories
Three Rs for Referees

Respect confidentiality/anonymity
do not distribute the manuscript
do not use the knowledge
you gain from the manuscript

Respond promptly
within two weeks

Refrain from emotional bias
respect the author’s independence
Peer reviewer responsibilities toward authors include:

Provide written, unbiased feedback
  in a timely manner
  on scholarly merits and scientific value of work
  document basis for opinion

Strength of writing
  clear, concise, and relevant
  composition, scientific accuracy, originality, interest to readers

Avoid personal comments or criticism

Maintain confidentiality of the review process
  no sharing
  no discussing with third parties
  no disclosing the information in the reviewed paper

(Council of Science Editors 2009)
Peer reviewer responsibilities toward editors include (1):

• Notifying the editor immediately if unable to review in a timely manner and providing the names of potential other reviewers

• Complying with the editor’s written instructions on the journal’s expectations for the scope, content, and quality of the submitted work

• Providing a thoughtful, fair, constructive, and informative critique of the submitted work

• Determining scientific merit, originality, and scope of the work; indicating ways to improve it; and recommending acceptance or rejection using whatever rating scale the editor deems most useful

(Council of Science Editors 2009)
Peer reviewer responsibilities toward editors include (2):

- Noting any ethical concerns, such as any violation of accepted norms of ethical treatment of animal or human subjects or substantial similarity between the reviewed manuscript and any published paper or any manuscript concurrently submitted to another journal.

- Alerting the editor about any potential personal or financial conflict of interest and declining to review when a possibility of a conflict exists.

- Refraining from direct author contact without the editor’s permission.

*(Council of Science Editors 2009)*
The ideal referee:

- Good judgment
- Fully familiar with the relevant literature
- Reasonable expectations
- High standards
- A broad point of view
- Technical expertise in the discipline
- Willingness to learn from the author
- Ability to explain reasons for recommendations
How many referees?

Until recently, 2 was the norm
Now increasingly 3 or more, because:
  More interdisciplinary papers
  More Supplemental Material
  Referee disagreement
  Incomplete review

(and we may need to approach 5-10 to find 3)
How many rounds of review?

Decision to reject usually takes one round of review.

Revised papers are often sent to referees again, especially if they incorporate new data or the referees have asked to see again.
Main principles of selection

- Quality of research
- Scope
- Interest
- Novelty
More than incremental?

- Answer to a longstanding question
- Significant leap forward
- Different way of thinking
- Important application
Common reasons for rejecting a manuscript

Too small an advance

Narrower interest/ belongs in specialized journal

Not convincing, interpretations poorly supported

Results not well interpreted, poor context
Referees can differ:

In-house editorial consultation/decision

Consultation with Editorial Board

Seek additional referee(s)

Consultation with author
Authors can appeal:

Allowed if clear that reject decision was based on substantial referee/error, or substantial new information brought to the table
Post-publication

Letters

Technical Comments

Online comments
Recent/ongoing changes in practice at Science

• All co-authors notified upon manuscript submission, to check authorship.
• Detailed authorship and conflict-of-interest disclosure before acceptance by all authors.
• Senior author must answer question: “I have personally checked all the original data that was generated by my lab or group.”
• Restrictions on data/materials access minimized.
• No unpublished data allowed. All references/data must be available at the time of publication.
Recent/ongoing changes in practice at Science

Statistical Board of Reviewing Editors
Reproducibility
Cross Review
Statistical Board of Reviewing Editors

“… with much help from the American Statistical Association, Science has established, effective 1 July 2014, a Statistical Board of Reviewing Editors (SBoRE), consisting of experts in various aspects of statistics and data analysis, to provide better oversight of the interpretation of observational data.”
Reproducibility

“For preclinical studies (one of the targets of recent concern), we will be adopting recommendations of the U.S. National Institute of Neurological Disorders and Stroke (NINDS) for increasing transparency. Authors will indicate whether there was a pre-experimental plan for data handling (such as how to deal with outliers), whether they conducted a sample size estimation to ensure a sufficient signal-to-noise ratio, whether samples were treated randomly, and whether the experimenter was blind to the conduct of the experiment.”
Cross Review

With the goal of increasing the transparency and efficiency of the review process, *Science* initiated an experiment to look at the effect of cross-review.

1 - all first round reviews received
2 - blinded reviews made available to all reviewers
3 - 48 hours to make any additional comments.
Cross Review

Editor Evaluation

adding unnecessary time in 28% of cases
neutral in 29% of cases
helpful in 43% of cases

unnecessary mainly when the decision was clear

helpful effect was seen mainly in an increase in confidence in the decision, rather than skewing the decision pattern
Cross Review

Reviewer Evaluation (n=164) (on a scale of 1=low through 5=high)

62% rated 4 or 5 the positive impact cross-review has on effectiveness of review process in general

63% rated 4 or 5 the positive impact cross-review has on fairness of review process

66% rated 4 or 5 the extent to which they found the other reviewer comments informative

39% said reviewer comments somewhat changed their overall judgment of manuscript and 61% said it did not change judgment at all

81% wanted cross-review to be a routine practice at Science
Cross Review

Lessons learned:

Provided additional support for editor decisions and gave some help in guiding the revision process

Provided some help in cases of split reviews

Was not useful in submissions with clear accept/reject decisions

Will promote transparency in Science’s review process, which is valued by the scientific community

Could help in educating reviewers and in enhancing reviewer accountability
2013 Accepted Author Survey

How pleased were you with the overall peer-review and editing process on your recent Science paper? (n=436)

Not pleased  1.6%
Somewhat pleased  8.5%
Extremely pleased  49.8%
2013 Accepted Author Survey

To what extent did the reviewer comments improve the quality of your paper? (n=436)

No improvement  1.1%
            3.2%
Marginal improvement  19.3%
            51.1%
Significant improvement  25.2%
2013 Accepted Author Survey

Did your editor provide guidance necessary to interpret and respond to the reviewers’ recommendations? (n=436)

Yes       64.4%
Somewhat  25.9%
No         9.6%
### 2013 Accepted Author Survey

How did Science’s handling of your paper compare to other journals in which you have published in the past 2 years? (n=436)

<table>
<thead>
<tr>
<th></th>
<th>Very</th>
<th>About the same</th>
<th>Very Favorably</th>
</tr>
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<tbody>
<tr>
<td>Speed of handling</td>
<td>2.8%</td>
<td>9.4%</td>
<td>23.6%</td>
</tr>
<tr>
<td>Thoroughness of reviews</td>
<td>0.9%</td>
<td>2.3%</td>
<td>34.2%</td>
</tr>
<tr>
<td>Quality of Editorial guidance</td>
<td>1.6%</td>
<td>1.9%</td>
<td>26.6%</td>
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</table>
Despite pitfalls of the peer review system, *Science* maintains (in common with other scientific journals) that it will remain the primary means of validating research for publication. Recognition of the potential pitfalls is the key to ensuring that the system works well, and that errors and poor scientific practices are minimized.
This marks the end of the formal presentation on Science policy and practice.

The slides that follow do not reflect any position of Science, but instead were offered by Brad Wible as topics related to scientific communication that he found personally interesting and which might be useful to the PEERE group.
Who’s Afraid of Peer Review?

A spoof paper concocted by Science reveals little or no scrutiny at many open-access journals

On 4 July, good news arrived in the inbox of Gennaro Colagru, a biologist at the Weiser Institute of Medicine in America. It was the official letter of acceptance for a paper he had submitted 2 months earlier to the Journal of Natural Pharmaceuticals, describing the antioxidant properties of a chemical that Colagru has extracted from a lichen.

In fact, it should have been promptly rejected. Any reviewers with more than a high-school knowledge of chemistry and the ability to understand a basic data plot should have spotted the paper’s shortcomings immediately. If experiments are so hopelessly flawed that the results are meaningless.

I know because I wrote the paper. Gennaro Colagru does not exist, nor does the Weiser Institute of Medicine. Over the past 10 months, I have submitted 301 versions of the wonder drug paper to open-access journals. More than half of the journals accepted the paper, failing to notice its fatal flaws. Beyond that headline result, the data from this stinging operation reveal the contours of an emerging Wild West in academic publishing.

From humble and idealistic beginnings a decade ago, open-access scientific journals have mushroomed into a global industry, driven by author publication fees rather than traditional subscriptions. Most of the players are murky. The identity and location of the journals’ editors, as well as the financial workings of their publishers, are often purposefully obscured. But Science’s investigation casts a powerful light. Internet Protocol (IP) address traces within the raw headers of e-mails sent by journal editors betray their locations. Invoices for publication fees reveal a network of bank accounts based mostly in the developing world. And the acceptance and rejections of the paper provide the first global snapshot of peer review across the open-access scientific enterprise.

One might have expected credible peer review at the Journal of Natural Pharmaceuticals. It describes itself as “a peer reviewed journal aiming to communicate high-quality research articles, short communications, and reviews in the field of natural products with desired pharmacological activities.” The editors and advisory board members are pharmaceutical science professors at universities around the world. The journal is one of more than 270 published by Medknow, a company based in Mumbai, India, and one of the largest open-access publishers. According to Medknow’s website, more than
The Web’s Faceless Judges

PubPeer is the latest forum for free-ranging discussion of published papers. It can only succeed, say its anonymous founders, if participants are able to keep their identities hidden.

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"I think it's going to be very hard to stay anonymous forever."
—PubPeer Founder
P-Curve: A Key to the File Drawer

Uri Simonsohn
University of Pennsylvania - The Wharton School

Leif D. Nelson
University of California, Berkeley - Haas School of Business

Joseph P. Simmons
University of Pennsylvania - The Wharton School; University of Pennsylvania - Operations & Information Management Department

April 24, 2013

Journal of Experimental Psychology: General, Forthcoming

Abstract:
Because scientists tend to report only studies (publication bias) or analyses (p-hacking) that "work", readers must ask, "Are these effects true, or do they merely reflect selective reporting?" We introduce p-curve as a way to answer this question. P-curve is the distribution of statistically significant p-values for a set of studies (ps < .05). Because only true effects are expected to generate right-skewed p-curves — containing more low (.01s) than high (.04s) significant p-values — only right-skewed p-curves are diagnostic of evidential value. By telling us whether we can rule out selective reporting as the sole explanation for a set of findings, p-curve offers a solution to the age-old inferential problems caused by file-drawers of failed studies and analyses.
P ≠ NP

Vinay Deolalikar
HP Research Labs, Palo Alto
vinay.deolalikar@hp.com

August 6, 2010
Journals weigh up double-blind peer review

Anonymity of authors as well as reviewers could level field for women and minorities in science.

Daniel Cressey

15 July 2014

Evaluating research papers without seeing the authors’ names could reduce the effects of conscious or subconscious bias.
The PeerJ Mission

To solve our greatest challenges we need a 21st century update to knowledge-share and scholarly communication. PeerJ's mission is to help the world efficiently publish its knowledge.

We do this through Internet-scale innovation and Open Access licensing to save academics' time, money, and to maximize recognition of their contributions.

PeerJ provides academics with two Open Access publication venues: PeerJ (a peer-reviewed academic journal) and PeerJ PrePrints (a "pre-print server"). Both are focused on the Biological and Medical Sciences. Q&A + annotations provide a second route to gaining credit for knowledge-share.

PeerJ starts at $99 - for lifetime publishing, and public PeerJ PrePrints are free to publish. It is always free to read, download, and reuse PeerJ articles.

Learn how it works, or see our submission guidelines and

Fig 1. Juvenile green turtle severely afflicted with fibropapillomatosis (CC-BY 4.0)

FEATURED ARTICLE

Eutrophication and the dietary promotion of sea turtle tumors

SEPTEMBER 30, 2014 - Researchers investigating the tumor-forming disease fibropapillomatosis in turtles believe that the disease may be linked to the consumption of arginine-enriched macroalgae in eutrophied coastal waters - Read more
The Episciences.org project is involved in the open access movement.

The main idea is to provide a technical platform of peer-reviewing; its purpose is to promote the emergence of epijournals, namely open access electronic journals taking their contents from preprints deposited in open archives such as arXiv or HAL, that have not been published elsewhere.

The editorial boards of such epijournals organize peer reviewing and scientific discussion of selected or submitted preprints. Epijournals can thus be considered as “overlay journals” built above the open archives; they add value to these archives by attaching a scientific caution to the validated papers.

The project proposes an alternative to existing economic models, without competing with traditional publishers.

The objectives are to achieve free journals and implement free access to electronic versions of articles. The epijournals could be new titles or existing ones wishing to join the platform. The Episciences.org platform will host epijournals of all scientific subjects.

Epijournals can be either new titles created from scratch, or existing ones wishing to join the platform with a compatible publishing policy.

The authors are not requested to sign restrictive agreements and retain their copyrights on their papers.

The Episciences.org platform is hosted and developed by the CCSD.
Reproducibility Project: Psychology


Date Created: 2012-04-01 11:49 AM | Last Updated: 2014-10-13 01:33 PM

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**home**

Do normative scientific practices and incentive structures produce a biased body of research evidence?

The Reproducibility Project: Psychology is a crowdsourced empirical effort to estimate the reproducibility of a sample of studies from scientific literature. The project is a large-scale, open collaboration currently involving more than 150 scientists from around the world.
What Policies Increase Prosocial Behavior? An Experiment with Referees at the Journal of Public Economics

Article Citation


DOI: 10.1257/jep.28.3.169

Abstract

We evaluate policies to increase prosocial behavior using a field experiment with 1,500 referees at the Journal of Public Economics. We randomly assign referees to four groups: a control group with a six-week deadline to submit a referee report; a group with a four-week deadline; a cash incentive group rewarded with $100 for meeting the four-week deadline; and a social incentive group in which referees were told that their turnaround times would be publicly posted. We obtain four sets of results. First, shorter deadlines reduce the time referees take to submit reports substantially. Second, cash incentives significantly improve speed, especially in the week before the deadline. Cash payments do not crowd out intrinsic motivation: after the cash treatment ends, referees who received cash incentives are no slower than those in the four-week deadline group. Third, social incentives have smaller but significant effects on review times and are especially effective among tenured professors, who are less sensitive to deadlines and cash incentives. Fourth, all the treatments have little or no effect on rates of agreement to review, quality of reports, or review times at other journals. We conclude that small changes in journals' policies could substantially expedite peer review at little cost. More generally, price incentives, nudges, and social pressure are effective and complementary methods of increasing prosocial behavior.
NIH PEER REVIEW:
CHALLENGES AND AVENUES FOR REFORM

Pierre Azoulay
Joshua S. Graff Zivin
Gustavo Manso

Working Paper 18116
http://www.nber.org/papers/w18116

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2012
Information, Bias, and Efficiency in Expert Evaluation: Evidence from the NIH

Danielle Li
Northwestern University†

First draft: Aug 1, 2011
This draft: Sept 25, 2012

Abstract

Experts may have more information about the potential of projects in their area, but may also be biased. This paper develops a framework for separately identifying the effects of bias and information on expert evaluation and applies it in the context of peer review at the National Institutes of Health (NIH). I find that while reviewers are biased in favor of applications from their own subfield, they are also more informed about their quality. On net, the benefits of information tend to dominate, indicating that policies designed to reduce conflicts of interest may also reduce the quality of funding decisions.
Abstract:
Since 2005, and with generous support from the A.W. Mellon Foundation, The Future of Scholarly Communication Project at UC Berkeley's Center for Studies in Higher Education (CSHE) has been exploring how academic values—including those related to peer review, publishing, sharing, and collaboration—influence scholarly communication practices and engagement with new technological affordances, open access publishing, and the public good. The current phase of the project focuses on peer review in the Academy; this deeper look at peer review is a natural extension of our findings in Assessing the Future Landscape of Scholarly Communication: An Exploration of Faculty Values and Needs in Seven Disciplines (Harley et al. 2010), which stressed the need for a more nuanced academic reward system that is less dependent on citation metrics, the slavish adherence to marquee journals and university presses, and the growing tendency of institutions to outsource assessment of scholarship to such proxies as default promotion criteria. This investigation is made urgent by a host of new challenges facing institutional peer review, such as assessing interdisciplinary scholarship, hybrid disciplines, the development of new online forms of edition making and collaborative curation for community resource use, heavily computational subdisciplines, large-scale collaborations around grand challenge questions, an increase in multiple authorship, a growing flood of low-quality publications, and the call by governments, funding bodies, universities, and individuals for the open access publication of taxpayer-subsidized research, including original data sets.
"Open" disclosure of innovations, incentives and follow-on reuse: Theory on processes of cumulative innovation and a field experiment in computational biology

Kevin J. Boudreau, Karim R. Lakhan

DOI: 10.1016/j.respol.2014.08.001

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Open Access

Highlights

• All of society's innovation systems are "open" in the sense of supporting disclosure, transfer and reuse to downstream innovators in one way or another.
• We distinguish innovation systems according to whether they implement a policy of intermediate or final disclosure.
• We theorize the choice between intermediate and final disclosure creates a tradeoff between incentives-versus-reuse and also transforms the search process (by shaping the level of independence of search and experimentation by innovators across different solution approaches).
• We demonstrate sharp first-order tradeoffs in a field experiment in which 733 expert algorithmic problem solvers competed under alternative disclosure regimes.

Abstract

Most of society's innovation systems -- academic science, the patent system, open source, etc. -- are "open" in the sense that they are designed to facilitate knowledge disclosure among innovators. An essential difference across innovation systems is whether disclosure is of intermediate progress and solutions or of completed innovations. We theorize and present experimental evidence linking intermediate versus final disclosure to an 'incentives-versus-reuse' tradeoff and to a transformation of the innovation search process. We find intermediate disclosure has the advantage of efficiently steering development towards improving existing solution approaches, but also has the effect of limiting experimentation and narrowing technological search. We discuss the comparative advantages of intermediate versus final disclosure policies in fostering innovation.