Extending ArXiv.org to Achieve Open Peer Review and Publishing

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Today’s peer-review process for scientific articles is unnecessarily opaque and offers few incentives to referees. Likewise, the publishing process is unnecessarily inefficient, and its results are only rarely made freely available to the public. This article outlines a comparatively simple extension of arXiv.org, an online preprint archive widely used in the mathematical and physical sciences, that addresses both of these problems. Under the proposal, editors invite referees to write public and signed reviews to be attached to the posted preprints, and then elevate selected articles to ‘published’ status.

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1. THE STATUS QUO

In the system of peer review that is currently used in the sciences, an editor invites one or more referees to review an article submitted to a scientific journal. Based on the referees’ recommendations, the editor will accept the article, demand modifications, or reject it. Referee reports are generally made available to the article’s author in anonymized form only and are not otherwise published. (Some journals also anonymize the article to be refereed, even though ascertaining the true author of a submission is usually a simple matter of using an Internet search engine.)

The system as described is completely opaque to outside observers. Neither the quality and timeliness of reviews, nor the standards of a journal’s editors, nor the extent of modifications made after initial review, nor the number of times an article has been rejected by other journals is publicly available.

Apart from professional integrity, referees have little legitimate incentive to produce timely, fair, and high-quality reviews. Since the reviews are not published, referees are not accountable for their work and...
cannot use it to bolster a case for professional advancement or to improve their general standing in the academic community. Probably the biggest (and most problematic) incentive for referees is the accumulation of editorial goodwill, to be expended during future article submissions. It is also conceivable that some referees reject articles whose authors they dislike or whose approaches or results interfere with their own research agenda. Finally, editors may circumvent the peer-review process altogether in order to promote their own or their associates’ work. Several case reports of dysfunction and breakdown of the peer-review process in the mathematical and physical sciences have recently appeared in the literature.¹

Authors, editors, and referees are not paid for their work in this publication process. Nevertheless, publishers often charge exorbitant fees for the resulting product, journals that have typically ended up being hidden away in university libraries, inaccessible to the public who funded the research in the first place. Independent workers, as well as researchers in poor countries, have thus often been cut out of the research loop entirely.

The need for a system of open electronic publishing of scientific articles has long been recognized.² Several electronic journals have now been created. Some of these charge readers for access, others are free to read but charge authors for publication, and still others are free for all parties involved. Perhaps the biggest success of the open-access movement was a 2007 US law requiring all research supported by the National Institutes of Health to be submitted to an openly accessible archive one year after publication.³

Internet-based alternatives to the prevalent peer-review and publishing process have been discussed by Stevan Harnad and Michael Nielsen.⁴ A trial in open peer review at the journal Nature in 2006 generated widespread debate about the concept;⁵ the final report concluded that while the general concept was received enthusiastically, participation in and satisfaction with their particular model of open commentary were disappointing.⁶

2. arxiv.org
The Web site arXiv.org (formerly http://xxx.lanl.gov) is an electronic archive of freely accessible research preprints.⁷ It was started by physicist Paul Ginsparg in August 1991 and has since become an indispensable
tool for researchers in physics, mathematics, and, increasingly, computer science and quantitative biology. Authors submit their articles to the archive prior to peer review and official publication by a scientific journal; the preprints are posted on the Web site in perpetuity after superficial moderator review. To participate, authors need an affiliation with a recognized academic institution or an endorsement by an established author. Interested parties can sign up for regular e-mail announcements containing the abstracts of new preprints in their chosen fields.

Once a manuscript has been peer-reviewed and accepted for publication, authors should ideally post an updated version to the archive. Not all authors remember to do this, and some journals explicitly prohibit the practice, claiming a copyright on the final result of peer review.9 Consequently, arXiv.org in its present incarnation and similar preprint archives in other fields do not serve as authoritative open-access repositories of peer-reviewed research.

3. A PROPOSED SOLUTION

To address the problems outlined in section 1, I propose the following extension to the arXiv.org preprint archive. A new class of users is created, the ‘editors.’ Each editor works for an electronic journal. Authors, after having uploaded a preprint to the archive, may elect to submit their article for review and official publication to one of these electronic journals. An editor of that journal then decides whether the article is appropriate for the journal in terms of scope and quality. If it is not, this decision is publicly attached to the article, and the process ends; if it is, the editor invites one or more referees to write public reviews, to be attached to the article. The article author may subsequently post a public rebuttal to the reviews. Based on the referee reports and rebuttal, the editor decides whether to accept, demand changes to, or reject the article. The original article, reviews, rebuttal, and publication decision are published in perpetuity. If the article is accepted, the author posts a final version to arXiv.org; as a peer-reviewed and officially published article, it is visibly set apart from mere preprints and added to the electronic journal’s collection of published articles. Rejected articles may be submitted to another electronic journal.

Reviews should be signed with the referee’s full name and affiliation. This maximizes transparency and allows referees to receive academic credit for their work. However, some reviewers may be reluctant to
participate in such a system, perhaps because they hesitate to openly reject the work of friends or influential researchers or because they do not want to call attention to their ignorance of some of the issues discussed in the reviewed article. Therefore, it would probably be necessary to offer referees the option of publishing their reviews under a pseudonym. Over time, such a pseudonym might naturally develop a reputation as a solid reviewer, completely divorced from the writer’s real-world identity. Using a straightforward cryptographic scheme, a referee could prove to selected others that he or she owns a certain pseudonym; in this way even pseudonymous referees could receive academic credit for their work at the time of tenure or promotion decisions.

Some electronic journals may wish to develop a process for attaching notes to published articles—for instance, to point out prior work, mistakes, or scientific misconduct discovered after publication. It will also be desirable to attach a moderated discussion forum to each article, as a natural gathering place for interested researchers. The quality of these forums would serve as a criterion to differentiate electronic journals from one another. The pseudonyms used for refereeing could also be used to sign forum contributions.

One may hope that the proposed system will engender several desirable consequences. The act of refereeing will rise in prestige in accordance with its importance to the scientific process. The quality of referee reports will improve. Outside evaluations and comparisons of the standards and practices of different electronic journals will become possible. The process becomes completely transparent, and its results are made freely available.

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NOTES
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6. ‘Overview: Nature’s Peer Review Trial,’ Nature (December 2006), available at http://www.nature.com/nature/peerreview/debate/nature05535.html

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8. See, e.g., Elsevier’s policy on electronic preprints, http://www.elsevier.com/wps/find/authorshome.authors/preprints