

## **IN PRESS, ADAPTIVE BEHAVIOR**

### **Positive Assortment for Peer Review**

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We suggest that the introduction of positive assortment (the pairing of individuals with similar characteristics) to the peer review process would increase the speed of reviewing, improve the quality of reviews and decrease the burden on reviewers. In assortative reviewing, each reviewer is given a score based on speed of reviewing, the usefulness of the review, the rate of reviewing, or any other priority of the journal editor. Authors submitting manuscripts are then paired with reviewers who have similar scores to themselves. This is a no-cost solution that aligns reviewers' incentives by accounting for the benefits provided to the scientific community and returning them in-kind. This assortative reviewing system can promote rapid, high quality and high volume reviewing at a benefit to the scientific community at no financial cost.

Every scientist who has submitted a journal article for peer-review knows how frustrating it is to wait for long overdue reviews. So, out of empathy, one might expect these same individuals to rapidly return manuscripts that they are invited to review. The fact that they do not, as any editor could attest, is the byproduct of a system with misaligned incentives. As with other so-called public goods dilemmas (e.g., why does anyone contribute to public radio, or vote?), the costs of reviewing a manuscript are direct and specific to the reviewer, but the benefits are not, creating a tragedy of the commons in the peer review process (Hochberg, Chase, Gotelli, Hastings, & Naeem, 2009). Everyone would be better off if respected scientists reviewed manuscripts quickly, carefully, and regularly. However, any given reviewer incurs a cost by taking on a review, providing a thoughtful evaluation, and

prioritizing that review over other responsibilities. The benefits associated with reviewing: keeping abreast of recent work, exercising critical thinking skills or (for junior scientists) learning about the review process, rarely outweigh the costs associated with reviewing. In other words, the incentives in the current peer review system simply aren't aligned to promote rapid reviewing and reward reviewers for their contributions to the peer review process.

In a letter that appeared in PLOS One, Hauser and Fehr (2007) proposed that negative incentives be used to improve the peer review system; in particular, they call for the punitive delay of manuscripts from slow reviewers, motivated by their "intuition is that it is the cost to the negligent reviewer that is most important." Many commentaries on this letter called for an alternative approach focusing more on positive incentives, but most of these

entailed a financial cost to journals, such as providing payments to quick reviewers. Is there another way to positively incentivize conscientious behavior on the part of reviewers that does not rely on financial transactions or punitive measures? Here we offer a no-cost solution that aligns reviewers' incentives by accounting for the benefits provided to the scientific community and returning them in-kind.

What better way to fix the scientific review process than by appealing to scientific principles, in particular, those that have been shown to increase cooperation and achieve stable and productive groups? A long history of work in theoretical evolutionary biology has noted that positive assortment, or the pairing of individuals with those having similar prosocial characteristics, is an essential ingredient in the recipe for promoting cooperation (Hamilton, 1970, 1972, 1964a, 1964b; Maynard Smith, 1964). Further, a number of more recent models have shown that positive assortment can promote the stability and productivity of groups in the short-term through positive feedback between individual level behaviors and the quality of shared public goods (Aktipis, 2008; Pepper, 2007; Pepper & Smuts, 2002). Can we employ a version of positive assortment in the review process to promote prosocial behavior (rapid, high quality, high volume reviewing) and increase the cooperativeness and productivity of scientific communities?

We suggest that journals introduce assortative reviewing, matching individuals by characteristics that are relevant to the review process. In assortative reviewing, each reviewer is given a score based on speed of reviewing, the usefulness of the review for the editorial process, the rate of reviewing (perhaps relative to one's own rate of submission), or any other priority of the journal editor. Authors submitting manuscripts are then paired with reviewers

who have similar scores to themselves. This solution can promote rapid, high quality and high volume reviewing at a benefit to the scientific community at no financial cost to participating journals.

A central feature of this proposal is the introduction of an accounting system for the benefits that conscientious reviewers provide. These benefits are currently distributed unsystematically, at best. By commodifying the benefits that reviewers provide, this assortative reviewing system will enable individuals to accumulate 'reviewer capital' in the form of a high score by rapidly reviewing manuscripts, taking on more manuscripts than they submit and providing high quality reviews. This system could promote a more pleasant and efficient review process for all involved, perhaps even generating a glut of reviewers anxious for opportunities to raise their scores before submitting manuscripts for review.

Indeed, assortative reviewing could go a long way towards solving the 'tragedy of the reviewer commons.' Rather than relying on reviewer goodwill to reduce unfair burdens on reviewers, as suggested by Hochberg et al. (2009), assortative reviewing will generate individual-level incentives for conscientious behavior on the part of both authors and reviewers. Not only will reviewers have the incentive to return manuscripts quickly and take on their fair share of reviewing, authors will have incentives to be more conservative in their submissions, so as not to spend their 'reviewer capital' unnecessarily.

Assortative reviewing could be implemented on a journal-by-journal basis, allowing editors to decide the relative weighting of speed, review quality and review volume based on the journal's priorities or current needs. In addition to the role of the reviewer capital score in matching reviewers and authors, this score could be made a publicly accessible record.

Reviewer capital score could become a component of academic reputation as well, being listed on individual's CVs along with journal reviewing responsibilities.

In contrast to the current peer review system, this assortative reviewing system aligns the benefits for the individual with the benefits for the community. Indeed, the scientific community stands to benefit in many ways from this proposal: Beyond the obvious predicted increase in the speed of dissemination of scientific findings, this proposal may increase the pool of regular reviewers (thereby decreasing the burden on each reviewer), reduce the number of low-quality submission by authors and improve the quality (or fit) of reviews. Editors may find that some undesirable aspects of their jobs are also reduced, perhaps increasing the attractiveness of editorial positions. As with other systems matching individuals with similar prosocial characteristics, the scientific community could become a more cooperative and productive group with the introduction of assortative reviewing into the peer review process.

We recognize that there are a number of practical concerns with implementing assortative reviewing, such as editors having a small pool of qualified reviewers for a given paper, the need to develop protocols for papers with multiple authors, and challenges in communicating information among journals. Many of these concerns might be most appropriately worked out by implementing assortative reviewing on a journal-by-journal basis. Not only would this simplify the initial implementation of assortative reviewing, it would also allow the system to be refined based on the needs of a given journal or journal editor. Further, some of these concerns might actually be ameliorated by the implementation of assortative reviewing: For example, it is not unlikely that the pool of qualified reviewers will expand when reviewers realize they can

accumulate reviewer capital volunteering to act as a reviewer.

We hope that this commentary will stimulate discussion about the use of positive assortment as an incentive for improving peer review among the scientific community as a whole. Our next steps include developing a model of peer review that will allow journal editors to assess the potential impact of assortative reviewing under reasonable assumptions about reviewer and author behavior for their particular journal. We plan to populate such models with agents representing typical reviewers and explore the speed of reviewing, the willingness of reviewers to take on manuscripts and other outcomes of interest. We invite interested journal editors and members of the peer review community to work with us to develop these tools in ways that will be most valuable to editors and publishers as they contemplate implementing positive assortment for peer review.

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