PRC Summary Papers 4

Peer review: benefits, perceptions and alternatives

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Contents

Executive Overview

1 **Peer review is the process** of subjecting an author's scholarly manuscript to the scrutiny of others who are experts in the same field, prior to publication in a journal. This summary report presents some findings from a new international survey of academics, set within a description of how peer review operates, its benefits, some critiques of peer review and the development of alternative approaches.

2 **Peer review is widely supported by academics**, who overwhelmingly (93%) disagreed in our survey that peer review is unnecessary. The large majority (85%) agreed that peer review greatly helps scientific communication and believed (83%) that without peer review there would be no control.

3 **Peer review improves the quality of the published paper.** Researchers overwhelmingly (90%) said that the main area of effectiveness of peer review was in improving the quality of the published paper, and a similar percentage said it had improved their own last published paper, including identifying scientific errors and missing and inaccurate references.

4 **There is a desire for improvement**. While the majority (64%) of academics declared themselves satisfied with the current system of peer review used by journals (and just 12% dissatisfied), they were divided on whether the current system is the best that can be achieved. There was evidence that peer review is too slow (38% were dissatisfied with peer review times) and that reviewers are overloaded (see item 11 below).

5 **Double-blind review was preferred**. Although the normal experience of researchers in most fields was of single-blind review, when asked which was their preferred option, there was a preference for double-blind review, with 56% selecting this, followed by 25% for single-blind, 13% for open and 5% for post-publication review. Open peer review was an active discouragement for many reviewers, with 49% saying that disclosing their name to the author would make them less likely to review.

6 **Double-blind review was seen as the most effective**. Double-blind review had the most respondents (71%) who perceived it to be effective, followed (in declining order) by single-blind (52%), post-publication (37%) and open peer review (27%).

7 **Double-blind review faces some fundamental objections**. Double-blind review was primarily supported because of its perceived objectivity and fairness. Many respondents, including some of those supporting double-blind review, did however point out that there were great difficulties in operating it in practice because it was frequently too easy to identify authors from their references, type of work or other internal clues.

8 **Post-publication review was seen as a useful supplement to formal peer review**, rather than a replacement for it. Interestingly, this was despite a clear view that it tends to encourage instant reactions and discourage thoughtful review.

9 **Limited support for payment for reviewers**. Respondents were divided on whether reviewers should be paid, with 35% in favour of and 40% against payment. A majority, however, supported the proposition that payment would make the cost of publishing too expensive (52% for, 18% against) and the large majority of reviewers (91%) said that they reviewed to play their part as a member of the academic community.

10 **Mixed support for review of authors' data**. A majority of reviewers (63%) and editors (68%) said that it is desirable in principle to review authors' data. Perhaps surprisingly, given that many reviewers report being overloaded (see below), a majority of reviewers (albeit a small one, 51%) said that they would be prepared to review authors' data themselves, compared to only 19% who disagreed.

11 **Some 90% of authors in the survey were also reviewers**. They reported reviewing an average of 8 papers in the last 12 months. The large majority of reviews (79%) was carried out by a core of active reviewers, who completed an average of 14 reviews per year, nearly twice the overall figure. This group reported it was overloaded – doing 14 reviews per year compared to their preferred maximum of 13 – suggesting there is a problem with reviewer workloads.

Introduction

This report takes a look at peer review: what it is, and how it works in practice; the benefits of peer review; some critiques; and some alternative approaches. It is largely based on a new international survey of 3040 academics, looking at their behaviour and attitudes and perceptions of peer review. This summary report contains only a small fraction of the data available in the full report,[1] which interested readers can find on the Publishing Research Consortium website.

[1] Ware, M. and Monkman, M. (2008) *Peer review in scholarly journals: perspective of the scholarly community – an international study*. Publishing Research Consortium. Available at www.publishingresearch.org.uk

What is peer review?

Peer review, known as refereeing in some academic fields, is (to quote the un-peer-reviewed Wikipedia) a process of subjecting an author's scholarly work, research or ideas to the scrutiny of others who are experts in the same field. In this report we will consider only the peer review of manuscripts submitted to academic journals (the other main use of peer review is for the award of research grants).

Editorial peer review is said to have begun in the early 18th century; for example, the preface to the first volume of the Royal Society of Edinburgh's *Medical Essays and Observations*, published in 1731, stated: 'Memoirs sent by correspondence are distributed according to the subject matter to those members who are most versed in these matters. The report of their identity is not known to the author.'[2] During the 19th and early 20th century, peer review developed in a fairly disorganized way and many prominent journal editors acted more like newspaper editors, with little interest in formal peer review. Peer review in the systematized and institutionalized form we know today has developed largely since the Second World War, at least partly as a response to the large increase in scientific research in this period.

[2]From Rennie, D. (2003) Editorial peer review: its development and rationale. In F. Godlee, T. Jefferson (eds). *Peer Review in Health Sciences*. Second Edition. pp. 1-13. BMJ Books, London.

In journals peer review, the author's manuscript is usually subjected to some initial checks to assess its suitability for review (for instance, incomplete manuscripts or work that was patently pseudoscience would be declined without review), after which a small number of reviewers are selected. The task expected of the reviewers varies somewhat from journal to journal, but in essence it is usually to assist the journal's editor (who makes the final decision) on deciding whether or not to accept the manuscript for publication. The reviewer will comment on the quality of the work done (for instance, was the experimental design appropriate to the question being studied?) as well as on its originality (what does it add to what we know already?) and its importance (does it matter?).

Types of peer review

There are two approaches to peer review in common use at present. The norm in most academic disciplines, known as single-blind review, is for the author's identity to be known to the reviewers, but for the reviewers' identity to be hidden from the author. (This is the method described above by the Royal Society of Edinburgh in 1731.) The main argument for 'blinding' the reviewers' identity is that it allows them to comment freely without fear of repercussions. Conversely, single-blind review has been criticised for allowing all kinds of bias and other kinds of irresponsibility on the part of reviewers to flourish behind the veil of secrecy. (We shall discuss the criticisms of peer review in more detail below.)

The main alternative is known as double-blind review: in this approach the identities of the author and reviewers are hidden from each other. Because the reviewer does not know the author or their institution, it is argued, they will focus on the content of the manuscript itself, unaffected by conscious or unconscious bias.

A newer approach to dealing with the criticisms of single-blind review is open peer review: in this model, the author's and reviewers' identities are known to each other, and the reviewers' names and (optionally) their reports are published alongside the paper. Advocates of open review see it as much fairer because, they argue, somebody making an important judgement on the work of others should not do so in secret. It is also argued that reviewers will produce better work and avoid offhand, careless or rude comments when their identity is known.

More recently, electronic publishing technology has allowed a variant of open review to be developed, in which all readers, not just the reviewers selected by the editor, are able

to review and comment on the paper and even to rate it on a numerical scale following publication. This post-publication review could occur with or without conventional pre-publication peer review. The benefits are seen to be that it takes account of comments from a wider range of people ('the wisdom of crowds') and makes the review a more living process.

In our survey, we found that the conventional single-blind peer review system was the one most commonly experienced by authors, with 85% saying they had experience of it compared to 45% for double-blind, 23% for open and just 8% for post-publication peer review (Figure 1). This does vary by academic discipline: single-blind review was the norm in life sciences, physical science and engineering, while double-blind review was much more common for authors in humanities and social sciences, and clinical medical and nursing authors had experience of both systems.

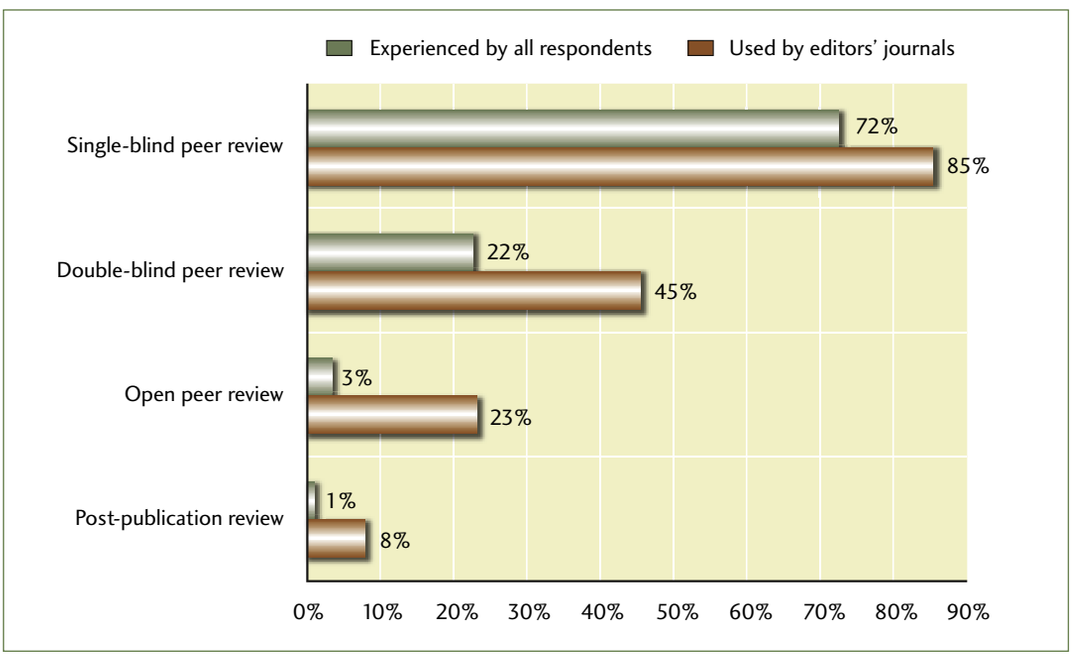


Figure 1
Types of peer review experienced by authors and used by journal editors

Peer review durations

The peer review process inevitably takes time. The survey looked at this from the perspective of authors, reviewers and editors.

Authors reported that the peer review process took an average of 80 days, with the longest times in humanities and social sciences. They were evenly split on whether or not the length of time from submission to decision was satisfactory, and it was clear that the authors experiencing the longest delays were the least satisfied. For review times of 30 days or less, about two-thirds of respondents were satisfied with the time; this drops sharply at 3–6 months to 19%, and to 9% for review times in excess of 6 months.

Editors reported average submission-to-acceptance times of roughly 130 days, split roughly equally between the initial peer review stage to first decision, and subsequent revision stages. Nearly three-quarters (72%) reported times of 6 months or below. Times were shortest in medical and nursing journals, and longest in humanities and social sciences journals. Most editors were happy with reviewing times on their journals, but a substantial minority (around a third) was unhappy.

The overwhelming majority of editors (98%) gave their reviewers a deadline for responding, with the average deadline being about 34 days, and with 63% of editors giving 30 days or less. Deadlines were shorter in medical and nursing research, and longest in humanities and social sciences and physical sciences and engineering.

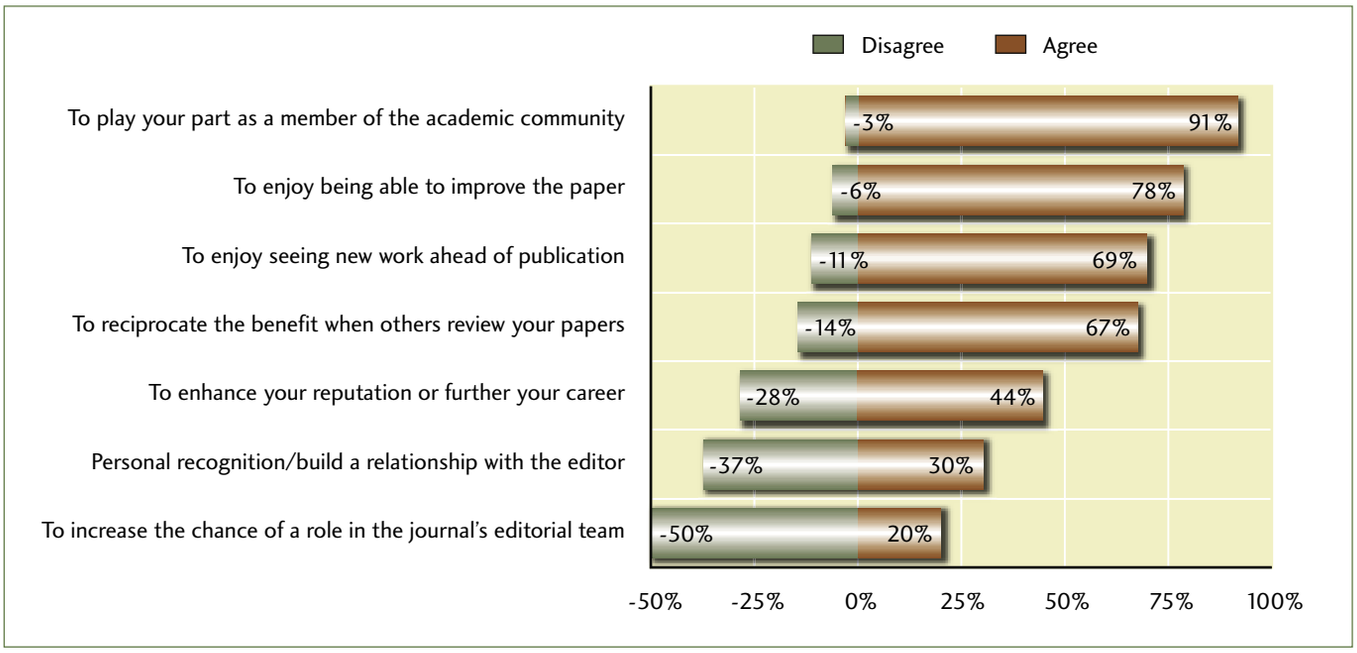


Figure 2
Reasons for reviewing

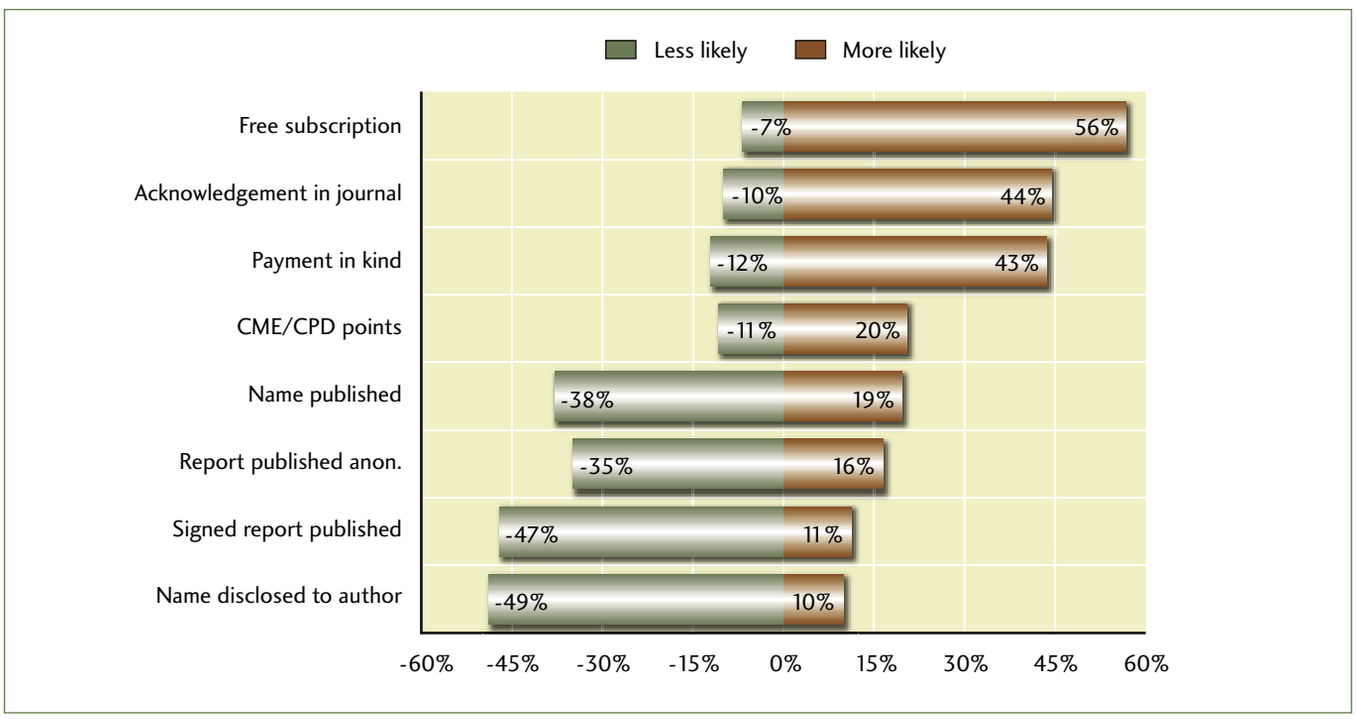


Figure 3
Factors affecting reviewers' likelihood to review for a journal

The reviewer's perspective

Researchers reported reviewing regularly for 3.5 journals and for a further 4.2 journals occasionally. On average, reviewers said that they reviewed about 8 papers in the previous 12 months. This average figure disguises the distribution of reviews among reviewers. We identified the group of reviewers who reported doing 6 or more reviews in the last 12 months ('active reviewers'), and this group managed nearly twice as many papers as the average. This meant that although active reviewers made up just 44% of reviewers in our survey, they were responsible for 79% of reviews.

Reviewers say that they took about 24 days to complete their last review, with 85% reporting that they took 30 days or less. They spent a median 5 hours (mean 9 hours) per review. Active reviewers and those in the English-speaking regions reported spending considerably less time per review than less frequent reviewers and those from Asia and the Rest of world.

We asked reviewers to state the maximum number of reviews they were prepared to undertake. The average figure for all respondents was 9 reviews. This compares to the average of 8 reviews completed in the last 12 months. Overall, therefore, there would appear to be at least some slack in the system. This apparent position of comfortable capacity breaks down, however, when the distribution of reviews is taken into account. Active reviewers (responsible for 79% of all reviews) proposed a maximum of 13 papers, compared to their average of 14 reviews done in the last 12 months, suggesting there is a problem of reviewer overloading.

Why reviewers review

We were interested to explore the reasons why reviewers review, and what incentives were offered and which were effective.

In general, respondents preferred to offer more altruistic explanations for why they reviewed (see Figure 2), with substantially the most popular reason being 'playing your part as a member of the academic community'. Self-interested reasons such as 'to enhance your reputation or further your career' or 'to increase the chance of being offered a role in the journal's editorial team' were much less frequently advanced. The most common rewards for reviewing reported by editors were reviewer receptions at conferences and waiver of author charges (e.g. publication, page, colour, offprint charges) (both 39%). Monetary payment was rare at only 5% of editors, though more common than credits for continuing professional development (2%). Payment was most common in humanities and social sciences journals (9%).

From the reviewers' perspective, the incentives they said were most likely to encourage them to act for a journal were (see Figure 3):

- a free subscription to the journal (56% said this would make them more likely to review for the journal)
- acknowledgement in the journal (44%)
- payment in kind by the journal, for example waiver of colour or other publication charges, free offprints, etc. (43%).

Payment for reviewers

Reviewers were divided on whether they should be paid for each review they completed: 35% agreed that they should, while 40% disagreed. Those from the Anglophone regions were the most opposed to payment, whereas researchers from Asia and from Europe were on balance just in favour (44% for, 32% against).

There was less support for the idea that payment would reduce the objectivity of peer review (28% for, 43% against) but a majority for the proposition that payment would make the cost of publishing too expensive (52% for, 18% against).

For the most part, respondents' views on these questions appear to be personal matters, independent of their field of research. As already noted, respondents

preferred to give altruistic reasons for reviewing. Women throughout the survey tended to express more altruistic positions than men; their responses here are consistent with that position, with women being less inclined than men to think reviewers should be paid, and more inclined to see the downside.

Role of the editor

The function of the editor is to select the most appropriate manuscripts for publication in their journal and to ensure they are edited and presented in the best way for the journal's readership. Their precise role varies considerably from journal to journal; for some larger scientific journals the reviewers may be selected and managed by an editorial team at the publisher's office with the editor only becoming involved once the reviewer reports are received (or in some cases, only if there is a dispute between reviewers to be adjudicated), while other editors are much more hands-on, appointing, selecting and chasing up the reviewers themselves.

In the survey, we found that editors said that the number of papers they handled (i.e. the number on which they made accept/reject decisions) was about 50 per year. The majority (59%) handled 25 or fewer papers but there was a small group (11%) of much busier editors handling more than 150. Editors assigned about 2.3 reviewers per paper. Selection of the reviewers by the editor themselves was only the third most popular option (reported by 28% of editors), well behind selection by a member of the editor's team (73%) and by a member of the publisher's staff (43%).

Online manuscript submission and tracking systems were used by about three-quarters of editors. Their use was more common in life sciences (85%) and markedly less common in humanities and social sciences (51%).

Editors reported that the average acceptance rate for their journals was about 50%, which is consistent with other studies (Figure 4). About 20% of submitted manuscripts are rejected prior to review (either because of poor quality (13%) or being out of scope (8%)) and another 30% are rejected following review. Of the 50% accepted, 41% are accepted subject to revision. Acceptance rates were lower in humanities and social sciences, and higher in physical sciences/engineering journals.

Trish Groves (deputy editor of the *BMJ*) has written[3] that an obvious way to improve any journal's peer review system is to 'Tell authors and reviewers what you want from them. . . . Give reviewers clear briefs, including guidance on what to include in the review'. In the light of such common sense advice, it was somewhat surprising to find that 30% of editors did not provide reviewers with a checklist. The use of checklists was somewhat less common in humanities and social sciences journals (45% not using). Where editors did provide checklists, the most common questions involved the study methodology (87% of checklists), relevance, importance and paper length (Figure 5).

Groves also wrote[4] 'Reviewers have also told us they want feedback on their performance so that they can learn and improve.' This seems another common sense position but only 28% of editors in our survey reported that they gave feedback to reviewers on the quality of their reports. The most common feedback given was just the publication outcome.

[3] Groves, T. (2006) Quality and value: how can we get the best out of peer review? *Nature* (Nature Peer Review debate). doi:10.1038/nature04995

[4] *ibid.*

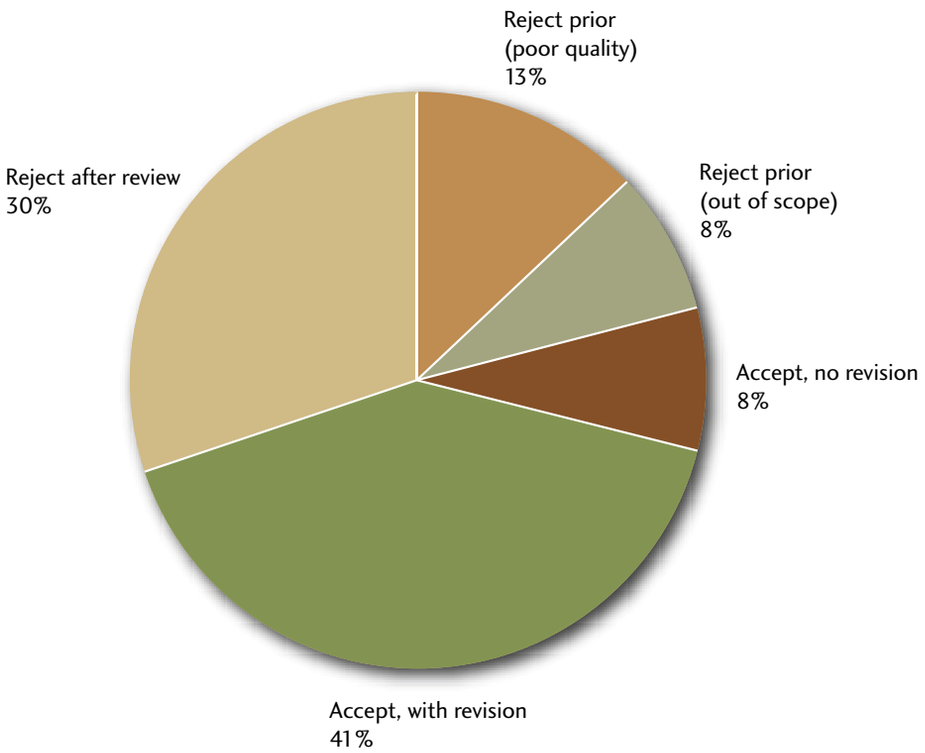
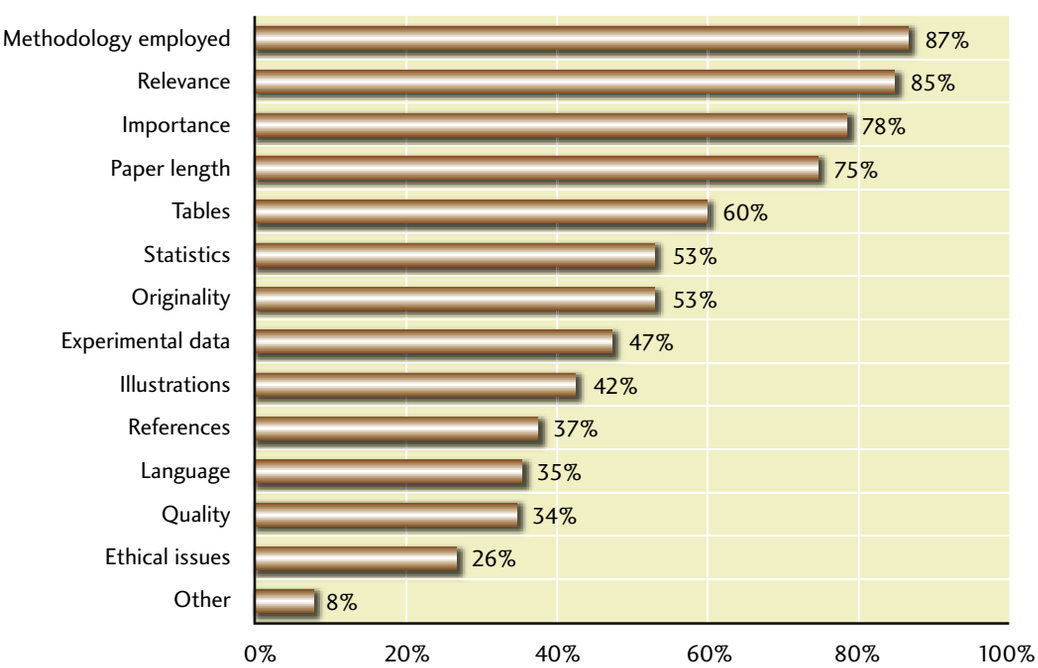


Figure 4
Ultimate fate of submitted manuscripts

Figure 5
Items used in reviewer checklists provided by editors



The benefits of peer review

What are the benefits of peer review? In one view, there are benefits for all players in the system: editors are supported in their decisions by the views of experts; authors benefit from the assistance offered by reviewers and from the status conferred on them by publication in journals with high peer review standards; readers benefit because of the filtering that peer review provides and by the 'seal of approval' that peer review is thought to provide; and even reviewers (who do the bulk of the work for no direct recompense) benefit to some extent (e.g. in seeing work prior to publication).

Looking beyond the interests of the particular stakeholders, there are three main benefits advocated for peer review:

- improvement in the quality of published papers;
- filtering of the output of papers to the benefit of readers;
- a 'seal of approval' that the published work meets certain standards, in particular for lay readers.

Let's look in more detail at these proposed benefits.

Improvements in quality

There are a number of ways in which peer review might improve the quality of published papers, of which the most important are:

- the very fact of a quality hurdle or threshold, which will motivate authors to improve the quality of their work prior to submission;
- the peer review process, in which reviewers' comments and criticisms are addressed by the author by revising the manuscript. Testing of work through the criticism of peers is in a broad sense at the heart of the scientific method.

Perhaps surprisingly, there is little scientific evidence to support the use of peer review as a mechanism to ensure quality (see below, under *Critiques of peer review*). In our survey, however, the large majority of authors (around 90%) were clear that peer review had improved their own last published paper and a similar proportion agreed with the more general statement 'peer review improves the quality of the published paper'.

Respondents who said that peer review had improved their last paper were asked which aspects of the paper had been improved, and in each case by how much (using a 1–5 scale). The results are shown in Figure 6.

Some 64% of respondents reported that peer review of their last published paper had identified scientific errors, demonstrating real value being added by peer review, and 78% said it had identified missing or inaccurate references.

'Made suggestions on presentation' was the most highly rated aspect; 94% of those who said their paper had been improved reported improvement in this area, and 55% rated the improvement at 4 or 5 out of 5. The language or readability was also frequently cited (86% reported some improvement in this area).

Those with good access to the journals literature reported less improvement in identifying missing of inaccurate references than those with worse access. This is what we might expect to find and illustrates one way in which restricted access to literature can affect researchers.

There was somewhat less improvement reported regarding the identification of statistical errors than for other benefits, although 51% still reported some improvement. Is this because authors are less likely to make statistical errors than other

kinds, or because reviewers are less likely to spot them? Given that some studies have shown that published papers are rife with statistical errors (e.g. Emil Garcia-Berthou and Charles Alcaraz found statistical inconsistencies in 38% of papers in *Nature* and 25% in the *BMJ*[5]) the latter seems a more likely explanation.

[5]Garcia-Berthou, E. and Alcaraz, C. (2004) Incongruence between test statistics and P values in medical papers. *BMC Medical Research Methodology* 4: 13.

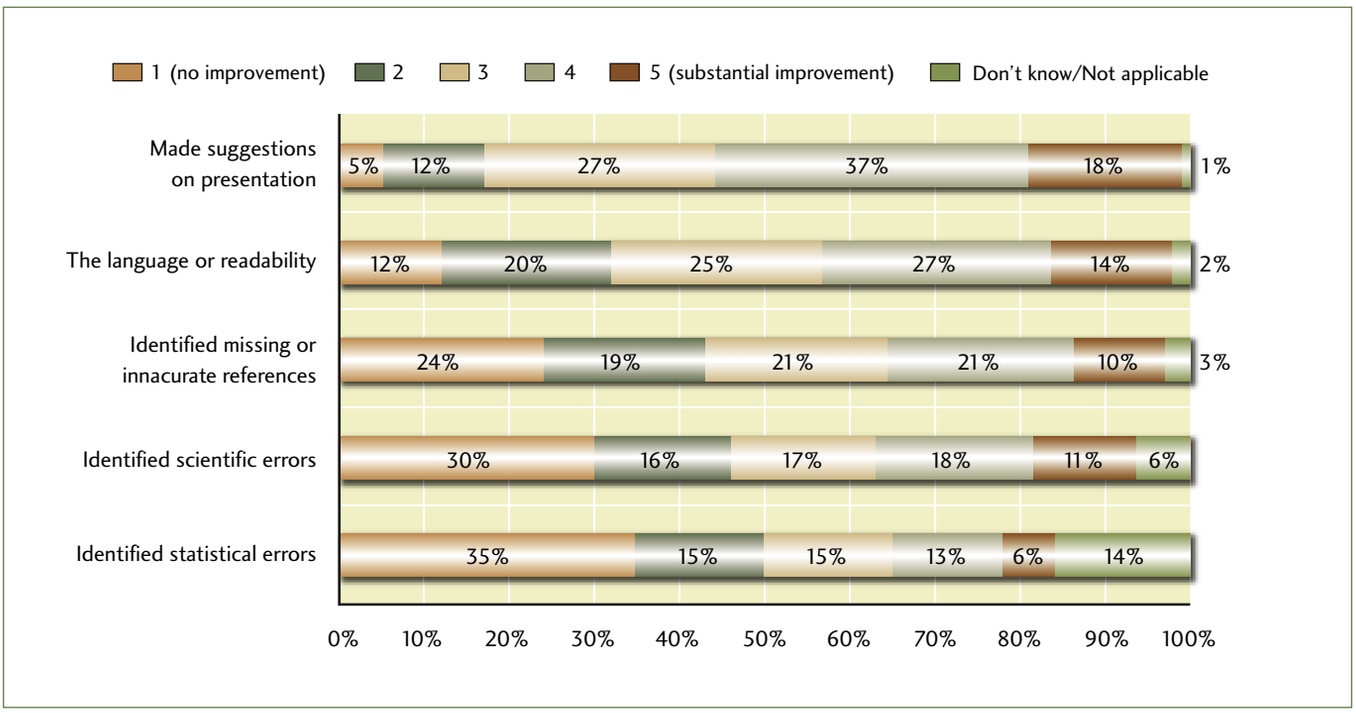


Figure 6
Improvements made by peer review to authors' last published paper

Peer review as a filter

There are two senses in which peer review and the journal system in which it is embedded can filter research outputs for the benefit of readers.

First, peer review could be seen to filter out bad work from the literature, by rejecting it for publication. 'Bad work' here could mean poorly conceived or executed, or of minimal originality or interest, or 'bad' in the moral sense, for instance involving academic fraud or plagiarism. Work that does get published in a peer-reviewed journal is seen to have met some quality threshold or gained a 'seal of approval'. Groups promoting better public understanding of science will often use peer review in this way; for instance, the UK group Sense About Science promotes understanding of peer review, which it calls the 'essential arbiter of scientific quality.'[6]

[6]See http://www.senseaboutscience.org.uk/index.php/site/project/29/

There are, however, at least two problems with this position. Because the peer review standards of different journals vary, it is widely believed that almost any genuine academic manuscript, however weak, can find a peer-reviewed journal to publish it if the author is persistent enough. Manuscripts rejected by one journal are routinely submitted to another, probably one with a lower rejection rate. Acceptance by a peer-reviewed journal does not say very much about the quality or originality of a paper but it may still distinguish it from pseudoscience or egregiously bad work, and this is the way in which groups like Sense About Science believe it can help the public. The other problem is that peer review has been shown not to be particularly effective as a quality control tool, or at detecting errors or outright fraud. (These problems are discussed in more detail below, see *Critiques of peer review.*)

The second way in which peer review can provide a filter for readers is much more important for working academics: it provides the basis for the stratification of journals by perceived quality (where quality is frequently taken to be indicated by the impact factor, a measure of how often on average articles in the journal in question are cited). Peer review thus supports the system that routes the better papers to the better journals and this allows academics to focus their reading on a manageable number of core journals in their field. Publishers in particular see this kind of filtering as one of the major benefits of peer review and the journals system.

Respondents to our survey have a lot of confidence in the peer review system to support these filtering functions (see Figure 7). As well as very strongly supporting the notion that peer review improves the quality of published papers (as discussed above), there was also strong support for the idea that it determines the importance of the findings and the originality of the manuscript. There was somewhat less support (though still a net majority) for believing peer review was effective at detecting plagiarism and academic fraud.

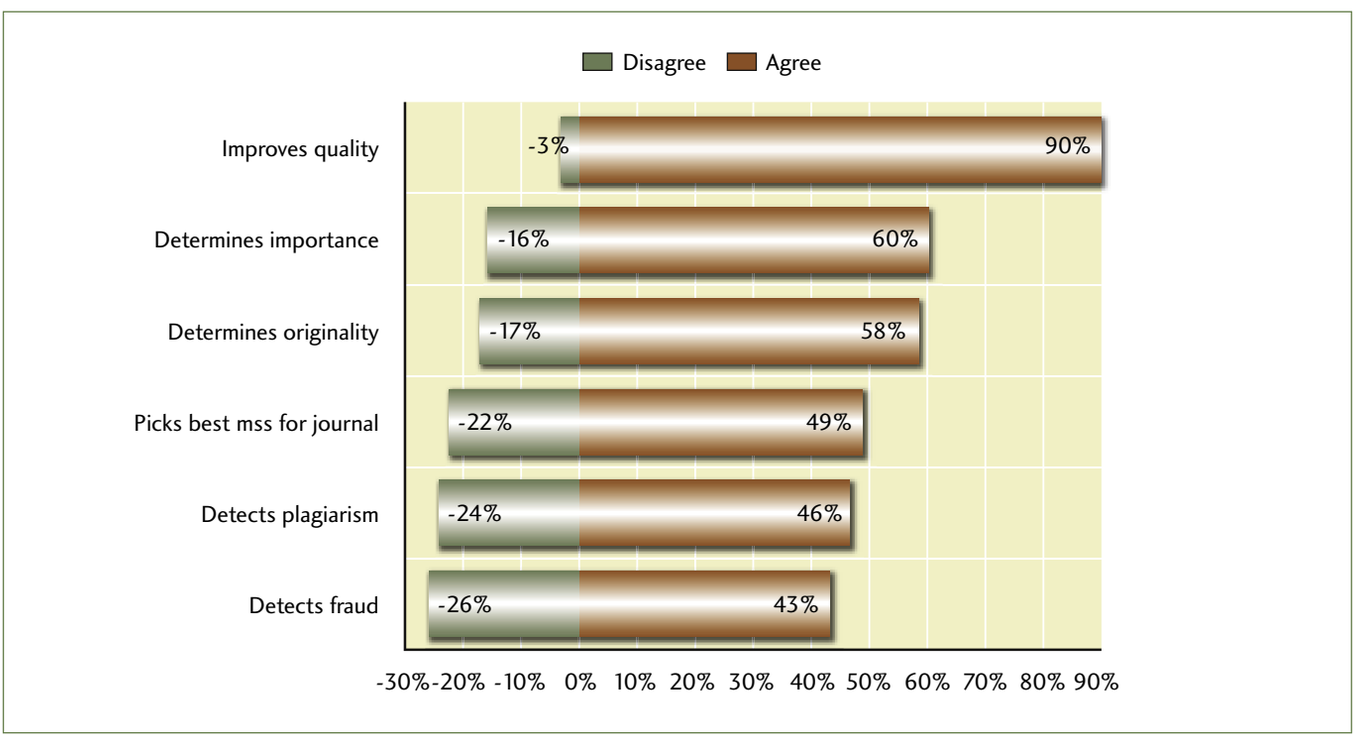


Figure 7
Views on the effectiveness of peer review in different areas

Views of survey respondents

Overall satisfaction with peer review

The majority (64%) of academics declared themselves satisfied with the current system of peer review used by journals, with just 12% saying they were dissatisfied (Figure 8). There was very little variation amongst the sample in these figures; for instance there were no differences by age, gender or position (seniority).

Respondents' attitudes were also tested by asking for their degree of agreement or disagreement towards a number of statements about peer review, as shown in Figure 9.

On the positive side, the large majority (85%) agreed with the proposition that scientific communication is greatly helped by peer review. There was a similarly high level of support (83%) for the idea that peer review provides control in scientific communication.

Given the generally low level of overall dissatisfaction with peer review, though, it is perhaps surprising that a strong statement like 'peer review in journals needs a

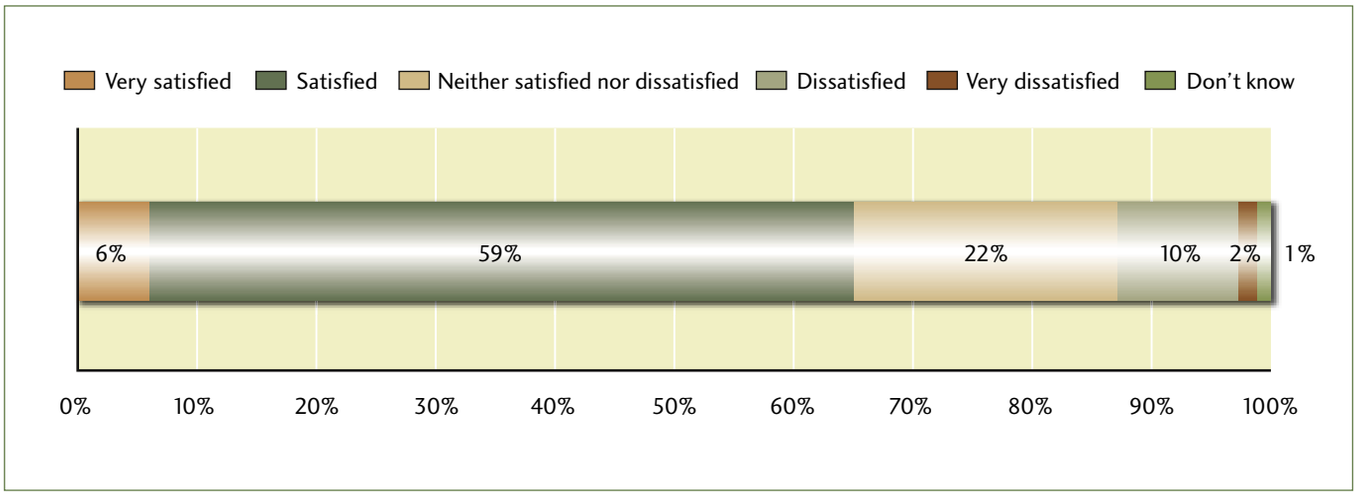


Figure 8
Overall satisfaction with the peer review system used by scholarly journals

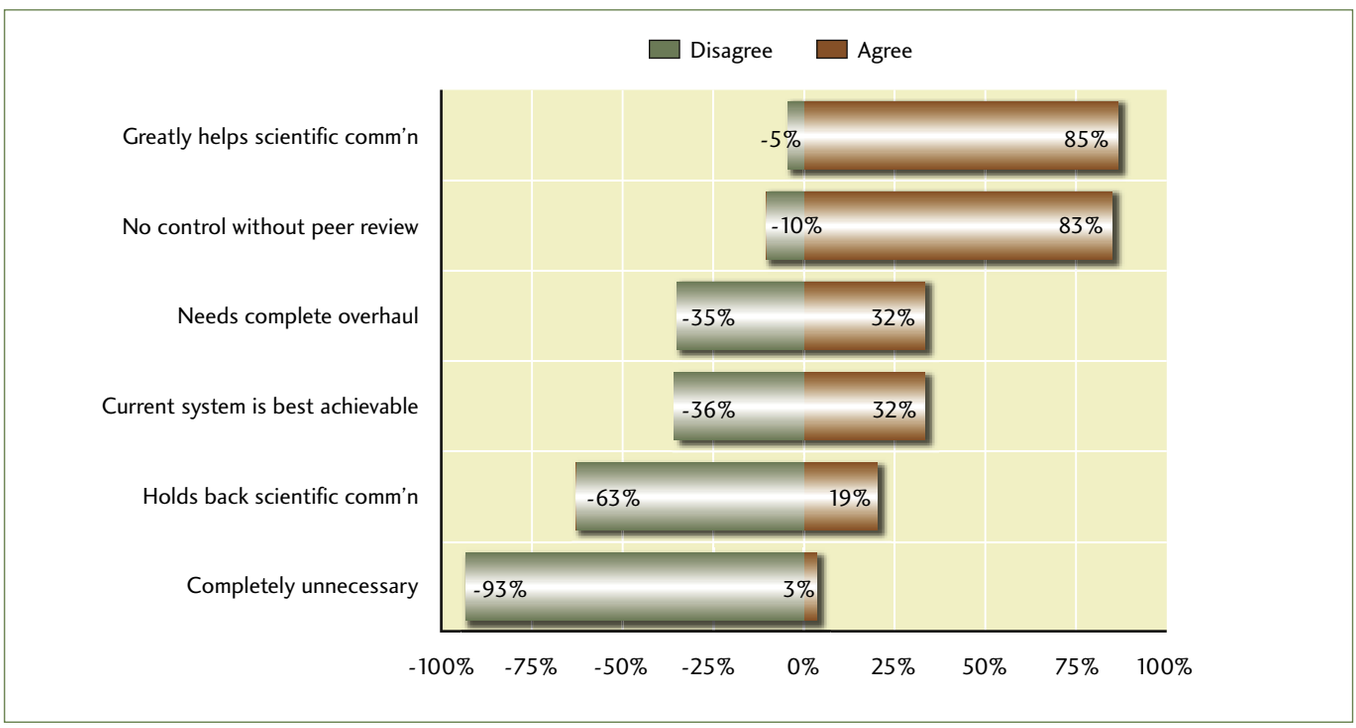


Figure 9
Views on peer review

complete overhaul' did not receive more disagreement – in fact respondents were divided, with 35% disagreeing versus 32% agreeing. Similarly, respondents were divided on whether the current peer review system is the best we can achieve, with 32% agreeing versus 36% disagreeing.

There was, however, virtually no support for the radical proposition that peer review was completely unnecessary.

Only a minority overall (19%) agreed that peer review was holding back scientific communication. Those with poor/very poor access to the journals literature tended to agree more (23%) than those with excellent access (16%).

The dissatisfied group

While the large majority of respondents expressed themselves satisfied with the peer review system used by scholarly journals, a minority (12%) said they were dissatisfied or very dissatisfied. It is interesting to ask what we can say about this group.

In terms of demographics, there are relatively few differences from the average. There were no significant differences by age, gender, type of organization or position (seniority). By region, they were more somewhat likely to be in the Anglophone regions, and less likely to be in Asia or the Rest of world. Looking at field of research, they were most likely to be in humanities and social sciences, and least likely in physical sciences/engineering.

In terms of their own experience of peer review, this group reported that the peer review of their last published paper took significantly longer than average (about 110 compared to 80 days), and they were more likely to be dissatisfied with the length of time involved. The dissatisfied group tended to be somewhat less likely to report that peer review had improved their last published paper, and likely to give lower scores to the improvements they did report. We cannot from the data say if there is a causal relationship; that is, is this group dissatisfied with peer review because they have experienced longer times and less personal benefit on their own papers, or does their dissatisfaction arise from other causes and then lead them to give less positive scores?

In terms of alternative approaches to peer review, this dissatisfied group was more likely to agree that open and post-publication review were effective. As a small minority, however, they did not form the main constituency for these alternative approaches.

Critiques of peer review

Peer review is not without its critics.

Perhaps the strongest criticism is that there is a lack of real evidence that peer review actually works: for instance, a 2002 study published in the *Journal of the American Medical Association*[7] concluded that 'Editorial peer review, although widely used, is largely untested and its effects are uncertain'. Similarly, the Cochrane Collaboration (a UK-based international healthcare analysis group) first published its own review in 2003, which concluded that there was 'little empirical evidence to support the use of editorial peer review as a mechanism to ensure quality of biomedical research, despite its widespread use and costs'. The latest update (2007) of the Cochrane review confirms this conclusion[8], though it is important to understand that it is saying that the evidence to support peer review has not yet been produced, not that there is evidence that peer review does not work.

Some have shown that peer review can be unreliable. For instance one study[9] showed that the chances of two reviewers agreeing about a particular paper were only slightly better than chance; in order to produce a reliable result, editors would need to use six reviewers for each paper. (In practice, they typically use two or three – the average reported in this survey was 2.3.)

Other studies have shown that peer review can be not very good at detecting errors. Godlee and colleagues at the *BMJ* took a paper about to be published, inserted eight deliberate errors, and sent the paper to 420 potential reviewers: 221 (53%) responded. The average number of errors spotted was two, nobody spotted

[7]Jefferson, T., Alderson, P., Wager, E. and Davidoff, F. (2002) Effects of Editorial Peer Review: A Systematic Review. *Journal of the American Medical Association* 287: 2784-2786.

[8]Jefferson, T., Rudin, M., Brodney Folse, S. and Davidoff, F. (2007) Editorial peer review for improving the quality of reports of biomedical studies. *Cochrane Database of Sytematic Reviews* 2007, Issue 2. Art. No.: MR000016. DOI: 10.1002/14651858.MR000016.pub3

[9]Rothwell, P.M. and Martyn, C.N. (2000) Reproducibility of peer review in clinical neuroscience: is agreement between reviewers any greater than would be expected by chance alone? *Brain* 123: 1964-1969.

more than five, and 16% didn't spot any[10].

It is also said that peer review, particularly in its single-blind form, offers too much scope for bias on the part of the reviewer or editor. For instance, papers published in an issue of the *Journal of the American Medical Association*[11] devoted to peer review presented evidence for nationality bias, language bias, specialty bias, and perhaps even gender bias, as well as the recognised bias toward the publication of positive results.

One response to the problems of reviewer bias has been to move to double-blind rather than single-blind review. However, the secrecy involved in 'blinding' the reviewer's identity has itself been criticised on two main grounds. From a pragmatic viewpoint, most studies that have investigated reviewer blinding have failed to measure improvements in the quality of the review and, conversely, other studies have shown that making the reviewer's identity known to authors had no effect on quality.[12] There is also a strong ethical argument against secrecy, namely that it is seen to be unfair for somebody making an important judgement on the work of others to do so in secret.

Another argument against double-blinding is that it is very difficult in practice to disguise the identity of the author of an academic manuscript from a skilled reviewer; by definition the reviewer is an expert in the field who will frequently know the previous work of authors in the field.

Other pragmatic criticisms of peer review include the delay it causes to publication and the view that it does not scale efficiently with the growth of science. The survey showed some basis for each of these. Although the average delay reported by authors for peer review was only about 80 days, 39% reported times of greater than 3 months, and 10% of greater than 6 months. Editors reported that the average time from submission to acceptance on their journals was about 130 days, with 22% reporting times of more than 6 months. There was a correlation between those reporting longer review times and lower overall satisfaction with peer review. The survey also showed that the large majority of reviews were undertaken by a core group of active reviewers who appear to be overloaded.

[10] Godlee, F., Gale, C. R. and Martyn, C. N. (1998) *Journal of the American Medical Association* 280: 237-240.

[11] *Journal of the American Medical Association* (1998) 280: issue 3.

[12] E.g. Goldbeck-Wood, S. (1999) Evidence on peer review: scientific quality control or smokescreen? *British Medical Journal* 318: 44-45.

Views of survey respondents

How did survey respondents deal with these criticisms? In the most part, as we have already seen, respondents had positive views about peer review and its effectiveness at improving the quality of published papers. Their views on alternative systems of peer review, which have been proposed at least in part as responses to criticisms of conventional peer review, are explored in the next section.

Different types of peer review

Most respondents in most fields experience single-blind review as the norm. When asked which options they thought were effective, however, respondents expressed a clear preference for double-blind review, as shown in Figure 10 . The level of support for the effectiveness of post-publication review is surprisingly high.

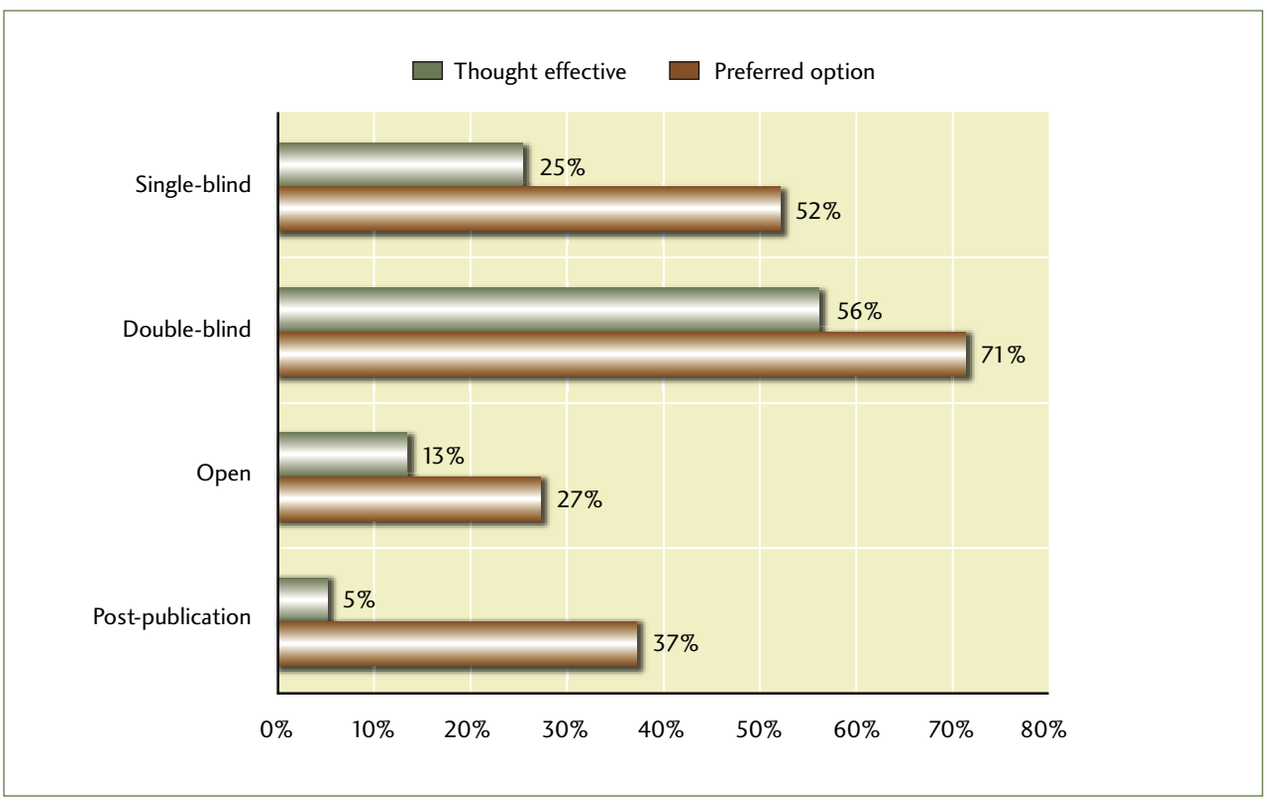


Figure 10
Types of peer review thought to be effective (multiple responses allowed), and respondents' preferred choice (single response)

Respondents did not have personal experience of all types of review. Those with experience of double-blind review were substantially less likely to rate single-blind review as effective compared to others. Similarly, those who had experience of open peer review and post-publication review as an author were considerably more likely to rate them as effective. It is notable, though, that although 37% of respondents said that post-publication review was effective, only 8% had had experience of it as authors – this support is therefore somewhat hypothetical.

Asked which of the four peer review types was their preferred option, there was a clear preference for double-blind review, with 56% selecting this, followed by 25% for single-blind, 13% for open and 5% for post-publication review. Post-publication review gets much less support here compared to the perceptions of its effectiveness: this is not inconsistent because respondents clearly saw it as a useful supplement to current peer review methods rather than a replacement for them.

It was clear from the verbatim comments that the preference for double-blind review was largely a response to the potential for bias in single-blind review: the reasons given for this preference were primarily its objectivity and fairness.

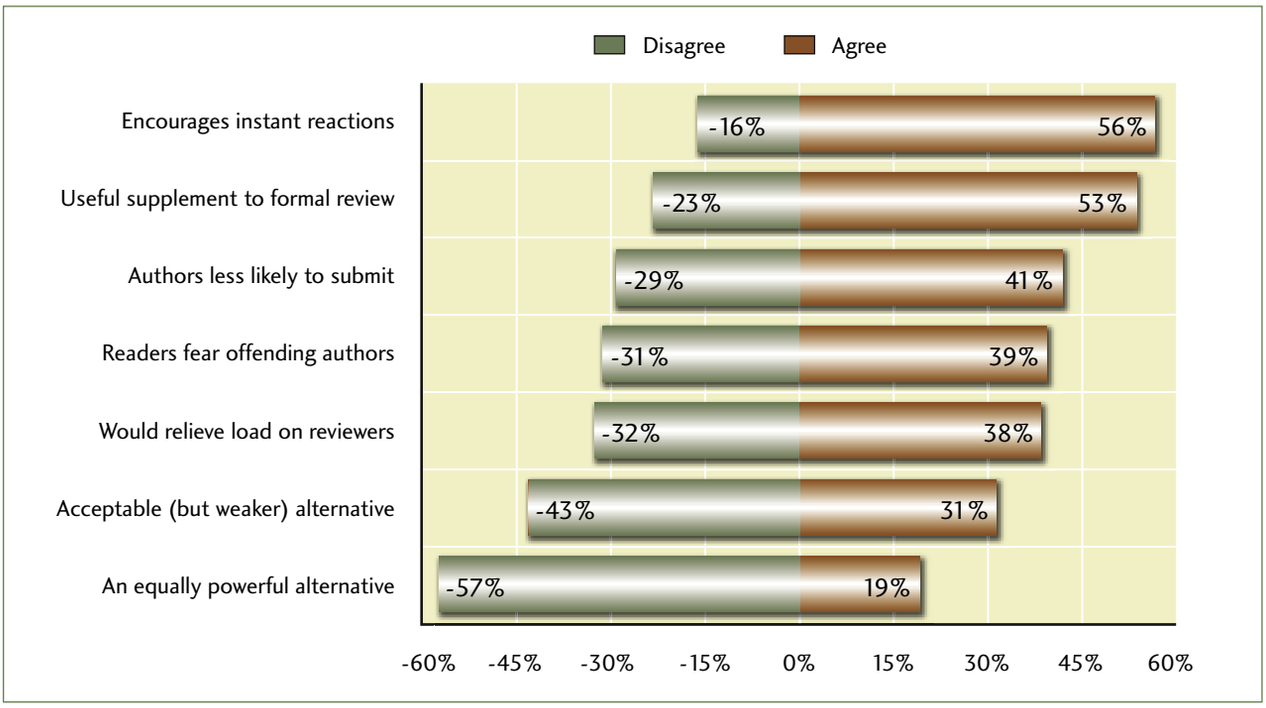


Figure 11
Views on post-publication review

Post-publication review

Looking in more detail at post-publication review (Figure 11), researchers saw it as a useful supplement to formal peer review in quite large numbers (53% agreed compared to 23% disagreeing with this statement). They see this usefulness despite a clear perception that it tends to encourage instant reactions and discourage thoughtful review. There is less support for the idea that it could be a less good but still acceptable alternative (31% supported versus 43% opposed) and fairly strong opposition to the idea that it could be an equally powerful alternative to formal peer review (57% opposed versus 19% supported). There was even stronger opposition to replacing peer review with post-publication ratings or usage or citation statistics to identify good papers.

Open peer review

Support for open peer review started to grow during the mid-1990s. The BMJ was one of the first major journals to adopt open peer review, basing its decision partly on the ethical case against secrecy and partly on the evidence mentioned above that blinding did not improve review outcomes. Open review, however, remains far from being the norm. The main argument against it is that reviewers will be reluctant to criticise the work of more senior researchers on whom they may be dependent for career advancement or grant awards. During 2006, the journal Nature conducted a trial of open peer review[13]; it was not a success – despite interest in the trial, only a small proportion of authors chose to participate, and only a few comments were received, many of which were not substantive. Feedback suggested 'that there is a marked reluctance among researchers to offer open comments'.

In the survey, the numbers of respondents preferring open peer review were smaller than for single- or double-blind peer review (about 13%). The main reasons given for preferring it were: reviewer accountability, leading to better reports and less likelihood of bias, and the view that open review made reviewers more civil, made the process more of a dialogue with the author and generally improved author/reviewer communication.

[13]Nature editors/publishers. (2006) Overview: Nature's peer review trial. *Nature* doi:10.1038/nature05535.

Proponents of open peer review will also have to overcome the fact that 47% of reviewers said that publishing their signed report would make them less likely to review for a journal and that a similar proportion, 49%, would see disclosure of their name to the author as a disincentive (see Figure 3 above).

Reviewing authors' data

As science utilizes more automated experimental equipment and otherwise moves towards a more data-centric 'e-science' model, the amount of data that supports (and could potentially be linked to) the average scientific paper increases. The question arises as to whether this data should itself be subject to peer review. There are clearly a number of practical issues: do reviewers have the time to do this? Is the data sufficiently standardized, and do the software tools exist to handle it? Are authors even prepared to share their data with reviewers?

A majority of reviewers (63%) and editors (68%) said that it was desirable in principle to review authors' data. Perhaps surprisingly, a majority of reviewers (albeit a small one, 51%) said that they would be prepared to review authors' data themselves, compared to only 19% who disagreed. This was despite 40% of reviewers (and 45% of editors) saying that it was unrealistic to expect peer reviewers to review authors' data.

Conclusions

The survey thus paints a picture of academics committed to peer review, with the vast majority believing that it helps scientific communication and in particular that it improves the quality of published papers. They are willing to play their part in carrying out review, though it is worrying that the most productive reviewers appear to be overloaded. Many of them in fact say they are willing to go further than at present and take on responsibility for reviewing authors' data.

Within this picture of overall satisfaction there are, however, some sizeable pockets of discontent. This discontent does not always translate into support for alternative methods of peer review; for example some of those most positive about the benefits of peer review were also the most supportive of post-publication review.

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