Predictive validity of editorial decisions at an open access journal: A case study on *Atmospheric Chemistry and Physics*

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Abstract

In this study we investigate the quality of the selection process of an open access (OA) journal, taking as an example the journal *Atmospheric Chemistry and Physics* (ACP). ACP is working with a new system of public peer review. We examined the predictive validity of the ACP peer review system – namely, whether the process selects the best of the manuscripts submitted. We have data for 1111 manuscripts that went through the complete ACP selection process in the years 2001 to 2006. The predictive validity was investigated on the basis of citation counts for the later published manuscripts. The results of the citation analysis confirm the predictive validity of the editorial decisions at ACP: They covary with citation counts for the published manuscripts.

Keywords: public peer review, open access, predictive validity

1. Introduction

More than 4500 open access (OA) journals have now become established in science that either still use the traditional peer review system or have introduced the 'new' system of public peer review (see http://www.doaj.org/). "The difference compared to traditional. . .journals is that OA journals let authors retain the copyright, and that they have a different business strategy: they are free of charge at the point of use. . .Many – but not all – of the OA publishers adopt the 'author/institution pays' policy, that is, paying once and in advance and grant free access for everyone, worldwide" [1]. The greatest reservation about OA journals is whether they achieve adequate quality control [2]. "In the open-access business model, it is widely accepted that authors (or their funding agencies or universities) pay. This means that the journals' revenues depend directly on the number of articles published. Only fools would believe that editors wouldn't then tend to accept a manuscript in the many borderline cases" [3].

Taking as an example the journal *Atmospheric Chemistry and Physics* (ACP), we present the – according to our literature search – first results of an evaluation study on the quality of the selection process of an electronic OA journal. The study examines whether the ACP peer review system actually does select the 'best' manuscripts among those submitted. For that, the citation impact of papers is compared which, after a positive evaluation either in ACP or if rejected after a negative evaluation, were submitted and published elsewhere. As the number of citations of a publication reflects the international impact of the reported research and in the absence of other operationalizable indicators, it is a common approach in peer review research to evaluate the success of a peer review process on the basis of the citation count of the reviewed manuscripts [4]. According to Jennings [5] "the most important question is how accurately the peer review system predicts the longer-term

judgements of the scientific community." Scientific judgements on manuscripts are said to show predictive validity in peer review research if the citation counts of manuscripts receiving different decisions differ to a statistically significant degree.

2. Methodology

ACP was launched in September 2001. It is produced and published by the European Geosciences Union (EGU) (www.copernicus.org/EGU/EGU.html) and the Copernicus Society (www.copernicus.org). ACP is freely accessible via the Internet (www.atmos-chem-phys.org). ACP has a two-stage publication process, with a 'new' peer review process consisting of a public peer review and interactive discussion [6, 7]. In the first stage, manuscripts that pass a rapid pre-screening process (access review) are immediately published as 'discussion papers' on the journal's Web site (as a result, they are published in Atmospheric Chemistry and Physics Discussions, ACPD). After the end of the discussion phase, based on the revised manuscript and in the light of the access peer review and interactive public discussion, the editor accepts or rejects the revised manuscript for publication in ACP.

For the investigation of peer review at ACP we had data for 1111 manuscripts that went through the complete ACP selection process in the years 2001 to 2006. These manuscripts reached one of the following final statuses: 958 (86%) were published in ACPD and ACP, 74 (7%) were published in ACPD but not in ACP (here, the editor rejected the revised manuscript), and 79 (7%) were not published in either ACPD or ACP (these manuscripts were rejected during the access review). Some of the manuscripts submitted to ACP but not published there (because they were rejected during the access review, for example) were submitted by the authors, as described in the following, to another journal and published there. According to Schultz [8], there are two reasons for the high publication rate of submissions to ACP [see also 9]: By using the public peer review and interactive discussion, (1) ACP can expect a high average quality of submitted manuscripts, and (2) ACP works harder than journals working with the traditional peer review to keep and improve the submissions.

For manuscripts published in ACP, ACPD or elsewhere, we determined the number of citations for a fixed time window of three years including the publication year. The citation analyses were based on the Science Citation Index (SCI, Thomson Reuters, Philadelphia, PA, USA), Chemical Abstracts (CA, Chemical Abstracts Services, Columbus, Ohio, USA) and Scopus (Elsevier, Amsterdam, The Netherlands).

3. Results

The search for the fate of the manuscripts that were not published in ACP (n=153) was conducted using two research literature databases, Web of Science (WoS, Thomson Reuters) and CA. Two Ph.D. environmental research scientists carried out the search. The results of the investigation revealed that of the 153 manuscripts, 38 (25%) were published in other journals. No publication information was found for 115 (75%) manuscripts, whereby 70 of the 115 manuscripts (61%) were published in ACPD. Other studies on the fate of manuscripts that were rejected by a journal reported percentages ranging from 28% to nearly 85% for manuscripts later published elsewhere [10], whereby the journals examined do not work with a two-stage publication process as does ACP. For manuscripts rejected by AC-IE at the beginning of the year 2000, Bornmann and Daniel [11] determined a percentage of 95%.

The 38 manuscripts that were published as contributions in other journals were published in 25 different journals within a time period of five years (that is, between 2005 and 2009). Six manuscripts were published in

the *Journal of Geophysical Research*; three manuscripts were published in *Geophysical Research Letters*. The other 23 journals each published one or two manuscripts.

Table 1 shows the mean number of citations found in CA, SCI and Scopus for manuscripts published in ACP and ACPD (group 1), published in ACPD only or in ACPD and elsewhere (group 2), or published neither in ACP nor in ACPD, but elsewhere (group 3). The medians are printed in bold in the table since the median – unlike the arithmetic mean – is not affected by outliers. The high standard deviations indicate that the distributions of the citation counts are characterized by a multitude of outliers.

Table 1: Descriptive statistics about citation counts for manuscripts published in ACP and ACPD (group 1), published in ACPD only or in ACPD and elsewhere (group 2), or published neither in ACP nor in ACPD, but elsewhere (group 3).

Group	Statistic	CA	SCI	Scopus
Group 1	n	958.00	958.00	951.00
	mean	8.49	9.72	11.87
	sd	11.32	12.99	15.68
	median	6.00*	6.00$	7.00§
Group 2	n	74.00	74.00	51.00
	mean	1.76	2.04	3.82
	sd	2.69	2.83	4.47
	median	1.00*	1.00$	2.00§
Group 3	n	17.00	17.00	15.00
	mean	1.29	1.71	2.73
	sd	2.20	2.37	2.74
	median	0.00*	1.00$	2.00§

Notes: The citation counts were searched in the databases Chemical Abstracts (CA), Science Citation Index (SCI) and Scopus for a fixed three-year citation window. Since citation counts could not be searched for all manuscripts in the databases, the number of manuscripts in the table differs from the number of manuscripts stated in the methodology section.*

* $\chi^2 = 99.6$, $P < .001$; $ $\chi^2 = 108.2$, $P < .001$; § $\chi^2 = 56.7$, $P < .001$.

As the results in Table 1 show, independently of the literature database in which the citation search was conducted, manuscripts in group 1 are cited more frequently on average than those in group 3. For example, manuscripts that were published in ACP and ACPD (group 1) were cited, according to the SCI, on average 6 times (median); manuscripts that were published neither in ACP nor in ACPD, but elsewhere (group 3) were cited on average once (median). It is also evident that manuscripts in group 1 are cited much more frequently than those published only in ACPD or in ACPD and elsewhere (group 2). In contrast, hardly any differences are detectable between the median citation counts of group 2 and group 3 manuscripts. Regardless of the citation database, the differences between the three groups in Table 1 are statistically significant.

4. Discussion

Many OA journals come into being in recent years. It is hoped that unrestricted access to scientific publications will have a positive effect on scientific progress: According to Borgman [12], “scholarship is a cumulative process, and its success depends on wide and rapid dissemination of new knowledge so that findings can be discarded if they are unreliable or built on if they are confirmed. Society overall benefits from the open exchange of ideas within the scholarly community” (p. 35). Some of the OA journals are using public or open

peer review, for one, in the interest of higher quality submissions: "Open review has the advantage of speeding and democratizing reviewing, and could result in better manuscripts being submitted" [13]. Furthermore, "reviewers would be more tactful and constructive" [14]. And for another, "there is a widely held suspicion (certainly amongst commercial publishers and to a lesser extent amongst authors) that articles in … OA journals are less well peer-reviewed than their counterparts in toll-access journals. This perception has two roots; firstly, as … OA journals are new, they have not yet had a chance to attain high status, and secondly, there is a feeling that because income depends on the number of accepted articles, the editors will be under pressure to accept poor quality manuscripts to keep the income stream up" [15].

Contrary to those fears, the results of this study show – in agreement with the results on various closed peer review systems of traditional journals [see an overview in 4] – that in the journal examined here, public peer review is able to assess the quality of manuscripts 'validly' and to select the 'best' manuscripts among the manuscripts submitted. The results of the citation analysis confirm the predictive validity of the editorial decisions: They correlate statistically significantly with citation counts. When interpreting these results, however, it should be taken into consideration that the ACP peer review system, through the high acceptance rate among submissions, in many cases exercises a different function that the peer review system at many traditional journals, such as at AC-IE: It is more about improving manuscripts prior to publication than about selecting among submissions. In the words of Shashock [16], journals like *Science*, *Nature*, or the AC-IE skim off the cream and discard everything else among the submissions. ACP, in contrast, in the first review step screens out unsuitable manuscripts only and eliminates them from the further selection process. Through the use of public peer review in the second review step, a large part of the manuscripts that in the access review were deemed potentially suitable for publication in ACP are published after varying degrees of revision.

5. Conclusions

For Anderson [17], open and closed peer review systems are each suitable for different publication environments: "Closed peer review works best in scarce environments, where many papers fight for a few coveted journal slots. Open peer review works best in an abundant environment of online journals with unlimited space. In the scarce world of limited pages in top journals, prestige is earned through those journals' high standard and exclusivity. That comes, in part, from the process, which involves impressing the very discriminating combination of an editor and a few respected researchers." Since the number of OA journals can be expected to increase in coming years, future studies on predictive validity should examine in particular their peer review systems. Here, studies are needed that investigate not only the selection function, as in this study, but also the improvement function of peer review.

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