

reading recent research findings which would otherwise allow them to improve their own research efforts. This limitation principally affected academics at small institutions (in many countries) and independent scholars^{2,3} with no academic affiliation. Such restrictions on journal readership limited the use of published research findings, the citation of that work, and, generally, the spread of knowledge.

Ultimately the rising *price of journal subscriptions* reached the point that many large academic institutions rebelled and looked to the alternative: open access (OA) publishing (e.g. see chapter 2 in Suber, 2012). Basically, the cost of maintaining academic libraries had become unsustainable and contributed to the changes we are now seeing.

Open access (OA) was a relatively new, rapidly growing, phenomenon within academic publishing circles. Open access strives to make published works available to a wider readership by removing the cost of access to journal articles... by making articles free to read. Examples of respected *early OA journals* are Ecology and Society online since 1997⁴, and the seven journals published by the Public Library of Science (PLOS)⁵, online since 2003, among others. These and other pioneering OA journals helped establish the *credibility of OA as a platform* (Figure 2).

Although the rapid expansion of OA was relatively new, *early OA archives* had existed for some time, a fact that also helped establish the *credibility of OA as a platform* (Figure 2). ArXiv⁶, still in use today, first went online in 1991 to improve scholarly communication within certain fields of mathematics and physics (Ginsparg, 1994). Other early OA archives are PubMed Central⁷ launched in 2000, and Project Euclid⁸ online since 2003. In reality, using the internet to exchange information in formalized serial format started even earlier (e.g. see Bailey, 1990, 1991).⁹

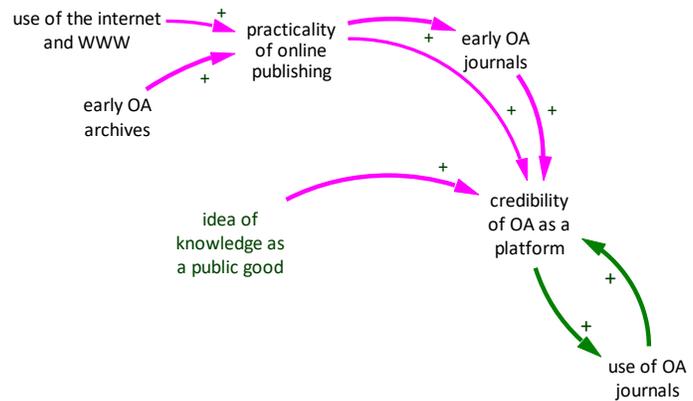


Figure 2. Early years of OA were stimulated by success of previous experimentation and the established idea of knowledge as a public good.

Laakso et al. (2011) provide a detailed review of the growth of OA publishing from 1993 to 2009. They found that annual growth in OA journals from 2000 to 2009 was 18% and annual growth in the number of OA articles during the same period was 30%. However, by 2009 OA articles still made up only 7.7% of peer reviewed articles.

² The term “academic nomad” is sometimes used but that usually refers to people who move among temporary academic positions, including those who must move for political reasons (Vatansever, 2018). The term “peripheral scholar” is used but that could be interpreted as “not important” which is not what is meant here.

³ See, for example, comments by Björk (2017) about specialists working outside academia.

⁴ <http://www.ecologyandsociety.org/> Originally published under the title Conservation Ecology.

⁵ <https://www.plos.org/>

⁶ <http://arXiv.org>

⁷ <http://www.ncbi.nlm.nih.gov/pmc/>. An archive of scholarly articles in biomedical and life sciences.

⁸ <https://projecteuclid.org/>.

⁹ The open access directory (http://oad.simmons.edu/oadwiki/Main_Page) provides additional information about early OA and online journals.

University libraries, fighting ever rising subscription costs, were early promoters of OA. As the open access movement grew it gained the support of government and other funding agencies, and many of those began to require results from research they funded to be readily accessible to other researchers and to the public (Figure 3). Since 2008 research funding agencies of the US government require that resulting research findings be made available on OA platforms (Varmus, 2008). More recently, since September 2018, a major campaign, Plan S, has been underway, backed by an influential international consortium of research funders¹⁰ (Rabesandratana, 2018; Schiltz, 2018). Such widespread *funding agency support for OA* has reinforced the *credibility of OA as a platform* and, as of 2018 more than half of all published academic articles were freely available (Science-Metrix Inc., 2018).

Other *active promotion of OA* also occurs. The Scholarly Publishing and Academic Resources Coalition SPARC (<http://sparc.arl.org/about>), is “an international alliance of academic and research libraries working to create a more open system of scholarly communication.” The Directory of Open Access Journals DOAJ (<https://doaj.org/>), and the Open Access Scholarly Publishers Association OASPA (<http://oaspa.org/>) work with authors to find suitable OA outlets for their publications (Figure 3). These organizations also help authors avoid *predatory journals* (see below).

Benefits of Open Access

The benefits of open access publishing in terms of increased visibility of research findings has been documented for some years (Antelman, 2004), as has evidence for increased citation of open access articles (Eysenbach, 2006). More recent studies have confirmed these findings (Breugelmanns et al., 2018; Piwowar et al., 2018; Science-Metrix Inc., 2018). Although Davis (2010) found only a slight increase in *citation* of OA articles he found a 100% plus increase in *downloads* of OA articles, compared to non-OA articles. He hypothesized that writers of academic articles typically worked at institutions where they can access pay-to-view journals while a large proportion of readers did not. This suggests that OA publishing helps authors reach a wider audience (Figure 3).

The wider availability of scholarly articles via OA also helps remove certain non-financial barriers faced by ‘peripheral’ scholars such as the likelihood that they have current references, an assumption that they should adhere to a particular writing style, and an expectation that they adhere to internationally accepted framing of discussion (Canagarajah, 1996, 2010). As access to a wide range of journals becomes more common, authors, reviewers, and editors will develop an improved understanding of different academic traditions.

Ultimately the *idea of knowledge as a public good* is fundamental and an early

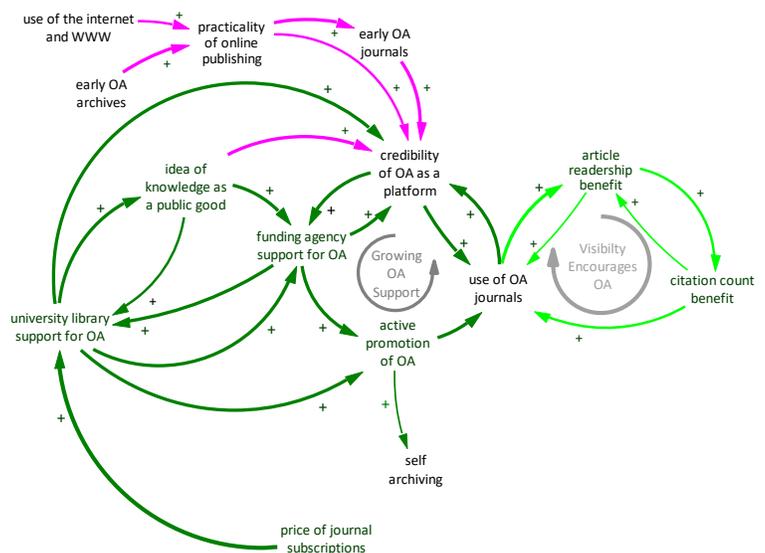


Figure 3. Influences on early growth of the OA movement. As journal prices grew, libraries rebelled, and funding agencies started to support OA, reinforcing the idea of knowledge as a public good (dark green). As use of OA grew authors realized that OA provided improved article readership reinforcing that growth (light green).

¹⁰ See: Plan S Website at <https://www.coalition-s.org>.

make an article OA.¹¹ Most pure OA journal publishers also use the APC approach to fund their operations but, in that case, all articles are OA... there are no subscription charges. This fact coupled with the hybrid approach has created a system where the APC has become a de facto standard within the OA landscape (Figure 4). Most major academic institutions have now created specific funding mechanisms to help their authors pay for APCs thereby reinforcing the use of the APC model. Although APCs can be as low as a few hundred dollars, most range in the thousands, and some are well above USD5000. This seems to have more than compensated publishers for possible loss of revenue from subscriptions and major publishing houses have been accused of double dipping: charging for both subscriptions and for APCs (Pinfield et al., 2016).

While one ideal of the open access movement has been equal access to scholarly knowledge, the increasing use of APCs has placed significant financial barriers in the path of independent scholars, those at smaller institutions, and academics in much of the developing world who would like, or need, to publish their work (Gadagkar, 2008). Consequently, the growing legitimacy of the pay-to-publish model has given rise to sub-standard, predatory and fake journals (Figure 4).

Incentivizing Predators?

As the pay-to-publish model became more acceptable, increasing numbers of journals have allowed OA through this approach. This permits authors to continue publishing in their favorite/normal journals, and the OA requirements of research funders can also be met, if the APC is paid. This new self-reinforcing OA system provides additional income to publishers and also enhances the wider availability of OA articles (Figure 4).

An unintended consequence of the growing use and acceptance of the pay-to-publish model has been the creation of many new OA journals with minimal or no publishing standards (Butler, 2013; Shen and Björk, 2015). These publishers may deliberately seek out authors needing to publish their work by offering somewhat lower APCs and less stringent, or no real, peer review. Some of these, termed “predatory journals” (Beall, 2012) lack any academic credibility, and publishing in such journals carries a risk for authors who are attempting to build an academic reputation. In some cases, such journals merely seek out unsuspecting authors who can be charged fees, their papers perhaps never published at all (Figure 4).

The pay to publish approach is particularly problematic for independent/peripheral scholars and those at smaller institutions or departments where charges to publish academic work cannot be met. For those with limited, or no funds, the cheaper OA journals may seem an attractive alternative (Figure 4). Originally OA seemed to provide substantial benefits to such scholars, but the rise of pay-to-publish OA has created new barriers. The following section looks at these questions in more detail.

¹¹ A pay to view (subscription) journal that includes OA articles paid for with APCs is referred to as a hybrid OA journal.

Current Situation - More Details

Big Publishers Persist

Although the rise of predatory publishing may diminish the reputation of OA, particularly the pay to publish model, pay-to-publish OA has, nevertheless, become the dominant component of the OA landscape. This is largely due to the *reputation of established publishers* and their subscription journals which now offer OA via the APC option (Figure 5). These established publishers seem important in maintaining journal quality via an established peer review process, well established editorial procedures, support for some professional societies, and a well-established web presence, with archives, which is growing in sophistication. Another major attraction these journals have appears to be the fact that they are already well established as the expected place for academics, in a given field, to publish. Academics, to a large extent, feel obligated to publish in these primary journals if possible. As these journals' reputations grow, author reputation can be enhanced by publishing in them. This feedback mechanism continues to enhance the attractiveness of established journals even as OA publishing expands. This also allows publishers to charge high APCs to maintain or improve their income stream.

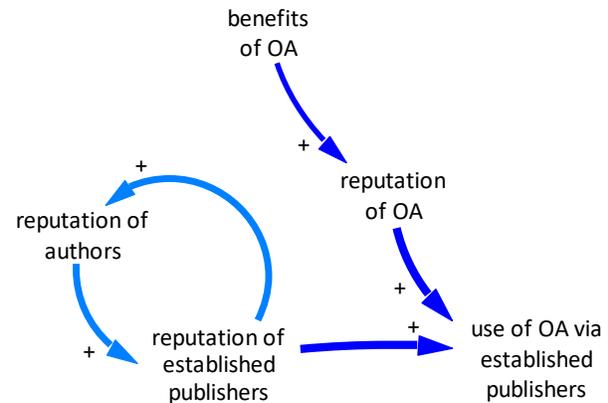


Figure 5. Closer details. Growth of Pay to Publish OA 1: Authors tend to stick with known publishers with a good reputation (light blue).

Journal reputation has come to be measured by journal impact factors that track citations of a journal's articles (Garfield, 1999, 2006). These impact factors have come under increasing criticism and alternatives have been proposed (Anon., 2012; Brembs et al., 2013). Nevertheless, at least in general, journals with higher impact factors tend to charge higher APCs (Solomon and Björk, 2012). That is, authors can pay more for higher impact¹². According to ECAC (2018) the current hybrid open access system has actually increased the total cost of scholarly communication directly undermining an original OA goal of lowering costs. This has led to a renewed criticism of traditional publishers' high profits.

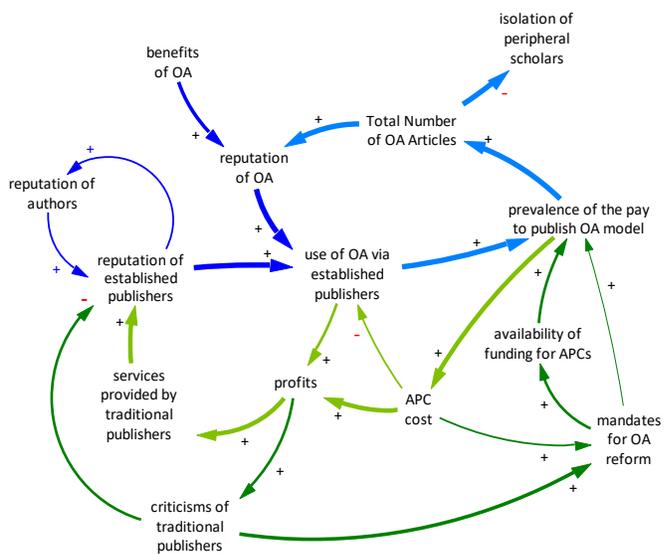


Figure 6. Demands for OA have reinforced use of APCs which fund further development of traditional publishers (light green). Growing criticisms (dark green) tended also to reinforce pay to publish by providing funding for APCs.

¹² Publishers of selective journals claim higher APCs are justified due to high selectivity requiring more articles to be rejected thus higher costs (e.g. see comments in Else, 2019b).

Plan S Problems

The current (2018-19) controversies regarding hybrid OA and Plan S are related to both journal and scholar reputation. One unusual aspect of Plan S is the insistence that scholarly papers not be published in hybrid OA journals -- journals that publish both OA and non-OA papers. This requirement was meant to force all papers to be OA (even though most would be pay-to-publish). Plan S has met with significant resistance both from publishers, who wish to continue with subscription based as well as OA options, and from scientists and other scholars. Scholarly resistance is based on the concern that forcing everyone to use OA will: likely lock in place high APCs, may prevent scholars from publishing in their preferred journals, may place severe limitations on journals published by professional societies, and may cause a loss of income for professional societies (Brainard, 2019b; Clarke, 2018; Kamerlin et al., 2018; Research Community, 2018; Several authors, 2019).¹³

The opposition to Plan S is a new phase in the continuing push for OA reform (Figure 7). In this case reformers seem to be requesting a step backward... to the continuation of subscription-based journals. Pending a better resolution of how OA publishing will be funded, many are concerned about weakening the original goal of the OA movement: open access to both read and publish.

The significant progress toward OA has certainly helped peripheral scholars as intended, by providing access to newly available, and archived, knowledge. However, the form that OA has now taken again increases *isolation of peripheral scholars* (Figure 7 brown arrows). They will be less able to publish their work because, typically, they have no funds to pay APCs. OA, as it is being implemented is increasing the likelihood that these scholars will publish in sub-standard journals. This same outcome might also appear in academic fields that have less research funding but nevertheless have scholars who are expected to publish (Alizon, 2018; Edwards, 2015).

Efforts to establish platinum¹⁴, no-pay, OA are still limited due to the lack of well-organized funding options (Figure 7). The dominance of big publishers and the acceptance of the pay-to-publish model have also hurt platinum OA efforts. While some early efforts at platinum OA have succeeded, overall these successes form a rather small part of the OA publishing landscape. To some extent this is due to the time needed to build a new journal's reputation, but certainly the solid reputation of existing journals and the acceptance of the pay to publish model limit progress toward platinum OA. The near term future journal publishing landscape appear to favor pay-to-publish OA with a possible transitioning from hybrid to pure pay-to-publish OA (e.g. see Schimmer et al., 2015).

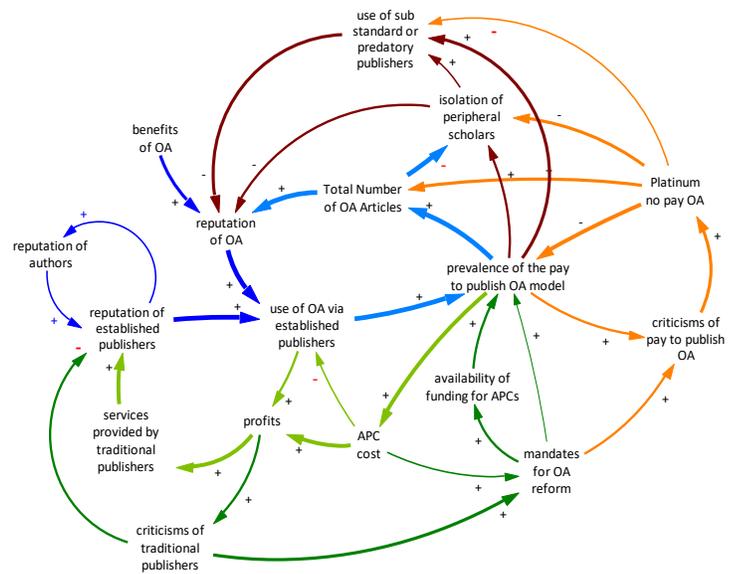


Figure 7. Current situation. The dominance of pay to publish OA (blue) and its reinforcing factors (light green) led to mandates for OA reform (dark green) which continued to focus on promoting OA via pay to publish which also incentivized sub-standard and predatory journals. Efforts at platinum OA remain weak (orange).

¹³ In May 2019 it was announced that implementation of plan S was to be delayed (Else, 2019a).

¹⁴ Platinum OA articles are free to publish and free to read.

Discussion

Ideally, true open access should remove financial barriers to publish articles as well as to read them—so-called platinum open access. In this way financial barriers would be removed, and articles could, in theory, be judged solely on merit. Few primary journals follow the platinum OA model.

Nevertheless, DOAJ lists over 9,000 platinum OA journals, some 400 of which are based in the USA. Many of those appear to be specialized journals catering to limited readerships. However, several different funding models are apparent for some better-quality platinum OA journals.

Some such as Fishery Bulletin¹⁵ are published by government agencies, in this case the US National Oceanic and Atmospheric Administration. Others such as Cultural Anthropology¹⁶ are published by scholarly societies, in this case the American Anthropological Association. A third platinum OA funding model draws on universities, in some cases on behalf of academic organizations. Three examples are: The Journal of World-Systems Research¹⁷ published by the U of Pittsburg library system on behalf of the American Sociological Association, the Journal of Political Ecology¹⁸ published by the University of Arizona since 1994, and a non US example Revista de Biología Tropical¹⁹ published by the University of Costa Rica. A fourth platinum OA funding model, private foundation funding, supports for example Conservation and Society funded by the Ashoka Trust for Research in Ecology and the Environment (ATREE)²⁰, and The Journal of Open Source Software (JOSS) sponsored by a non-profit umbrella organization NumFOCUS^{21 22}.

These examples illustrate free-to-read / free-to-publish OA funding approaches have persisted for many years indicating that platinum OA can be a viable publishing approach. One might wonder, if platinum OA is a viable option why isn't it more common? To a certain extent the answers to this question lie in the reinforcing causal relationships illustrated in this paper.

OA has reached a critical mass and OA articles are read and cited more often than non-OA causing more authors to prefer, and more publishers/journals to offer an open access option. We might imagine that competition for good papers would push APCs down making quality journals more widely accessible to both readers and writers. Unfortunately, the opposite seems to have happened. Data indicate that, in general, more prestigious journals charge higher APCs. Scholars continue to favor prestigious journals over less expensive alternatives making the emergence of new, cheaper key journals less likely.

¹⁵ Fishery Bulletin: <https://spo.nmfs.noaa.gov/fb.htm>

¹⁶ Cultural Anthropology: <https://journal.culanth.org/index.php/ca/about>

¹⁷ Journal of World-Systems Research: <https://jwsr.pitt.edu/ojs/index.php/jwsr>

¹⁸ Journal of Political Ecology: <https://journals.uair.arizona.edu/index.php/JPE>

¹⁹ Revista de Biología Tropical: <https://revistas.ucr.ac.cr/index.php/rbt/about>

²⁰ Conservation and Society: <http://www.conservationandsociety.org/>, ATREE: <https://atree.org/about>

²¹ JOSS: <http://joss.theoj.org/about#about>, NumFOCUS: <https://numfocus.org/community>

²² Note that some journals listed on the DOAJ as platinum seem to be pay-to-publish journals that waive APCs for the first few years of the journal's existence, apparently using the no fee approach to gain authors. The publisher AIMS Press <http://www.aimspress.com/index.html> seems to fall in the category.

Initially, the increased availability of OA, within a field, increased the use of those publications perhaps at the expense of traditional publications. The increasing OA readership stimulated further growth of OA. Sensing a possible loss of revenue from subscription journals publishers initiated open access options using the author pays model. They were able to do this because of 1) the established reputation of key journals, and 2) the growing acceptance of the idea that research projects would budget funds for APCs.

APCs posed a significant problem for the new funding model. With the previous, subscription, model, journal funding was quite removed from research funding... researchers at large institutions had very little knowledge of the total journal cost. It was not their concern. On the other hand, APC funding often comes straight from the research budget, a fact that researchers cannot ignore. Subsequent efforts on behalf of researchers resulted in changes that reinforced the author-pays-model: Special accounts were set up, by universities and funding agencies, to pay the APCs on behalf the authors. This reinforced the dominance of the APC approach to funding which was already in use by the pure OA (non-hybrid) publishers.

Unfortunately, the APC approach hurts peripheral scholars who, otherwise, have greatly benefited from the growth of OA publishing. They cannot afford the APCs. These financial (and other) barriers to publishing their work creates a demand for “sub-standard journals”. Publishing in those, to a large extent, diminishes the reputation of work carried out. This reinforces the existing dichotomy between scholars in wealthier and those in relatively poorer research situations, and also diminishes the idea of knowledge as a common good, equally shared by all.

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