



Scholarly publishing for the network generation

The increasing momentum towards opening up various dimensions of society is discussed in this article, and the authors consider whether 'open' is now an unstoppable force for change in the world. Various topics within research communication, such as open access (OA) and post-publication peer review (PPPR), are considered from the perspective of the authors as participants in the scholarly communication community of more than 20 years' standing, with both for- and non-profit credentials.

The authors explore how harnessing the wisdom of the crowd in rating everyday services manifests itself by improving our ability to make choices in our daily lives. They explain how this network effect can be applied to scholarly communication and how it provided some of the inspiration behind the launch of ScienceOpen, the research and OA publishing network, in May 2014. This publishing platform is then described as an example of democratizing publishing. The increasing importance of software development in publishing and the need for stand-alone expertise in this space (as opposed to a publisher-centric approach) is also discussed.

Finally, the authors consider the role that the impact factor and the promotion/tenure system play in holding back progress in scholarly communication and they highlight the efforts of early career researchers to break the stalemate by taking 'open' pledges.

The internet has fundamentally changed the way we communicate and interact with the world. We find the right vacation rental with Airbnb, ride to the airport with Uber, find new places to eat on TripAdvisor or Yelp and we rate our experiences as we go so that others can learn from our mistakes or share our positive outcomes. So why do we continue to expect that science and the output of scholarly publishing should function differently?

'Web 2.0' showed that users are willing to share their experiences online and this realization has shaped the successful start-ups of the last decade. Everywhere we depend on the wisdom of the crowd to make informed decisions on what to buy, where to vacation or what music or movies we might like. An open internet which understands commerce as inextricably tied to communication and creates space for dialogue has been able to give voice to the many as opposed to the few. The network structure of the internet makes it possible to find and process those experiences for our own decisions. Scholarly communication still lags behind the consumer market, but recent years have seen the rise of professional networks such as Academia.edu, Mendeley and ResearchGate, as well as communities on Twitter and Facebook, where academics are increasingly communicating about their work (although frequently not with the support of the traditional publishers that produce the articles). That these networks have thrived none the less is a telling sign that times are changing.

The internet is synonymous with the concept of 'open'. As it becomes easier to find, share, rate and discuss academic output online, researchers and the public still frequently encounter paywalls blocking their access to copyrighted material. One of the big motivating forces behind the open access movement is to free up the flow of information. The network can only work efficiently if everyone has immediate and free access to information. Open access (OA) democratizes knowledge by making the results of research, funded largely through public taxes, immediately and freely accessible for all to read and reuse online. This open principle now extends to many other topics where sharing is key to transparency and progress, such as data, peer review, annotation, health, society and government.



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'The internet is synonymous with the concept of "open"'

58 The desire for 'open' has been followed by a growing number of OA publishers experimenting with new publishing forms and business models. Most, beginning with trailblazers such as PLOS and BioMed Central (BMC) and carrying on to newer organizations such as F1000 Research, PeerJ and ScienceOpen, depend on article processing charges (APCs) and capital funding of various kinds to support their mainly for-profit publishing operations (PLOS being the notable exception).

These publishers have fuelled a global rise in OA articles as indicated by the *BMC Medicine* journal article entitled 'Anatomy of open access publishing: a study of longitudinal development and internal structure'¹. Of the 1.66 million articles indexed by Scopus in 2011, 11% were published in fully OA journals (where content is immediately available under a CC BY licence). When combined with hybrid and articles with delayed OA, these account for almost 17% of the total article volume in the whole index and these percentages have grown by approximately 1% per year from 2008-2011. With the growth of this market, we see encouraging trends to lower APCs based on the costs of services provided and rewards for the services provided by researchers (in the form of discounts for timely peer review, etc.), which is good for taxpayers and the scientific community in general.

Now, seemingly, open is an unstoppable force that challenges us to reconsider practices that we previously begrudgingly accepted. For example, librarians begin to question the desirability and even legality of restrictive and secretive contracts worth multiple millions ('big deals') that they have previously signed with large traditional publishers to gain subscription access for their universities to journals that they may not even want (so-called bundling). This practice continues even now although there are many OA alternatives of high quality that are free for library users (and everyone) to read.

'open is an unstoppable force'

The opportunity and promise of open access nevertheless carries with it a challenge for the scholarly community. Given that it is now possible to make any and all information freely available on the internet through blogs, websites and networks, how can audiences know which information is worthy (or not worthy) of their valuable time? Before the digitalization of the scientific enterprise, qualification of scholarly output was provided by anonymous peer review and editorial approval. It therefore seems reasonable to ask, if we depend on user-networks and crowd wisdom to inform our decisions in nearly every consumer field, could not these same tools be adapted to support discovery and evaluation of research results?

In the effort to improve research communication, there is, as ever, a great deal of talk from all sectors of the community about next steps. For example, Pat Brown, co-founder of PLOS who, in a rousing speech at OpenCon2014, the Early Career Researcher Conference held in Washington DC during November 2014, said, 'Now that OA is being won, pre-publication peer review is now the most backward and destructive system in scientific publishing.'

When we designed ScienceOpen, we wanted to bring the efficiency and openness inherent in the internet to bear upon the field of scholarly publishing. We wanted to rethink scientific publishing in terms of communication between academics. The platform offers four main services to researchers:

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- aggregation of OA content to provide researchers with broad access to information beyond what a single publisher can offer
- networking opportunities, including researcher profiles, discussion groups and news feeds, etc., to encourage community building and conversation
- rapid publishing services – we provide a platform to both consume and produce scholarly documents
- a facility for open discussion of research results via transparent and network-based peer review after publication.

59 ScienceOpen funds its publishing operation from an APC of US\$800, which is significantly less than many other OA publishers. This revenue is used to offset expenses such as staff, limited office space, article production, online hosting, archiving and outreach. Many, but by no means all, authors receive support for OA fees from institutional, library, government agencies or research funders. Those from lower- and middle-income countries, less well-funded disciplines, or those simply without access to OA publishing resources, may apply to receive a full or partial fee waiver from us, so that cost is never a barrier to publishing at ScienceOpen.

Underlying these services is a belief system, and underlying our beliefs is technology. We believe:

'underlying our beliefs is technology'

- in immediate publication in order to speed up research. We publish the author's PDF in 'Preview' with digital object identifier (DOI) within about a week of submission
- that siloing OA content on publishers' websites does not lend itself to creative reuse; a good reason to aggregate 1.4 million articles (currently from PubMed Central and arXiv) on our platform
- that journals, whether 'mega-', highly specialized or super selective, are becoming outmoded. We need channels to serve OA content that meet community needs
- in giving the power for content creation, curation and review fully back to the research community who have the required discipline-specific expertise
- that whether content is 'worthy' is a matter for the community to decide, which is why we only offer post-publication peer review (PPPR)² (non-anonymous) for our ScienceOpen journals
- in expert review, and therefore insist that those participating must have five publications linked to their ORCID to maintain the level of scientific discourse on the site
- that the conversation about research is never over, which is why we don't put a hard line under content and call it 'approved' and why we offer versioning³.

The ScienceOpen team combines publishing expertise (backgrounds and experience with De Gruyter, Wiley, Springer, Nature Publishing Group, American Association for the Advancement of Science [AAAS] and *The Scientist*) with a software company. Often publishers cannot easily adapt to the changing needs of the communities they serve because they are not software developers and, increasingly, this is the key ingredient needed for success in the digital world. This means that although they may want to change their offering, they simply can't do so as quickly as they might like because their legacy systems hold them back.

The reason that we combine publishing and software expertise is that we think it is this combination that will make it possible for us to rapidly adapt to the changing needs of researchers. For example, the conversation about the future of research communication now includes the openness of data, the evaluation of impact (both article and author) plus the reproducibility of research. All these topics are hotly debated on blogs, Twitter and in the mainstream press which places them before the public for their consideration. This only seems right and proper since taxpayer funding is a core component of research.

Heading down this open path is easier for nimble and technology-empowered organizations such as ScienceOpen because there is truth in the old adage that 'one thing leads to another'. Establishing non-anonymous PPPR in and of itself increases the transparency of the research process and makes it ideally suited to tackle issues of reproducibility such as reminding reviewers to ask for more clarity in methods, or suggesting more experiments or even ways to collaborate.

'Heading down this open path is easier for nimble and technology-empowered organizations'

60 Another example of the 'open' domino effect is the possibility of greater inclusivity in the communication process, with roles for researchers at different career levels. Peer review (which has always been done by the research community) after publication gives more individuals the valuable experience of critiquing the work of others, which raises their professional profile. The fact that these reviews receive a DOI at ScienceOpen means they can be found and cited. However, more recognition is required for PPPR to gain traction and we are advocating for PPPR to be recognized in altmetrics as a priority.

We would also like to expand the role of editor to embrace a much more flexible idea of content curation than is currently represented by a journal and so we have developed a new role: 'Community Editor'⁴. These are also empowered to ask others at all career levels to assist them. We have also created a 'collections' tool to help Community Editors draw together articles from multiple leading OA publishers from over 1.4 million aggregated on our platform into mini-journals in topics of their choosing. These individuals can decide which existing content they want to feature in their collection and if they wish, which articles need to be written in order to fill content gaps and call for more. It also seems likely that societies, organizations, biotech companies and other groups will be interested in customized channels, and they are equally welcome to get involved.

Despite the numerous benefits of 'open', establishing credibility for it in research communication is difficult because conservatism and resistance to change are fuelled by the environment in which academics work, with its complex system of funding, promotion and tenure where reputation has traditionally depended on publishing output.

One of the key factors slowing down this process is the impact factor that attempts to measure the reputation of a journal based on its average citations. But, increasingly, users are searching for specific information and coming to single articles from search engines such as Google, PubMed and Web of Science. These users are interested in article-level rather than journal-level metrics: How often was *this* article cited? Downloaded? Tweeted? Thankfully, many organizations exist that provide new measures of reputation that will help to dismantle the status quo that has long rewarded a static and closed system. ScienceOpen, for example, partners with Altmetric to offer digital measurement of article impact for all content on the platform.

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Naturally, in every growing movement there are, thankfully, a few individuals who embrace a new approach, and every OA publisher is extremely grateful on a daily basis for their support. It is also encouraging to see early career researchers like Erin McKiernan, a researcher working primarily in experimental and theoretical neuroscience, taking open pledges⁵ in which they promise to foster open by only choosing this path throughout their careers.

With ScienceOpen, we have tried to embrace the internet and the networking opportunities that it affords to forward the most important agenda of all: that of improving the way research is carried out and communicated, for the betterment of society.

Competing interests: The authors have declared their affiliations – Liz Allen is VP of Marketing for ScienceOpen, research + Open Access publishing network and Stephanie Dawson is CEO of ScienceOpen

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