

The Future of the Electronic Journal

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Abstract

The character of the electronic academic journal is changing rapidly as new technologies, reader habits, and patterns of communication evolve and the Internet is increasingly adopted as a common medium. The obvious changes involve new methods of delivery and subscription, but the underlying structures of academic communication are also changing, presenting a host of new possibilities.

Key Words: electronic publication, open access, academic communication

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*"I used to think that it was just the biggest thing since Gutenberg,
but now I think you have to go back farther."*

John Perry Barlow,
Electronic Frontier Foundation co-founder, on the Internet

John Barlow's comments on the profundity of the Internet may have sounded ridiculous in the wake of the subsequent dot-com crash, but as the Internet continues to grow in both the scope and depth of impact it has had on traditional institutions, the rosy image he presents is hard to dismiss outright.

Academic journals are undergoing rapid transformation due to the emergence of the Internet as a major force in communication. The superficial changes, which are apparent to outsiders such as readers and authors, are not difficult to guess: new methods of distribution, new patterns of readership, and new means of access. As the published journal becomes a collection of data instead of a tangible object, however, the same transformative pressures

are causing more fundamental changes to the nature of academic communication.

The common linear process of publishing an academic journal was established by logistics and tradition. Before electronic publication began its spread, and long before the World Wide Web became the medium of choice, journals moved at the speed of the postal service. Submissions to the journal were vetted by an editor and assigned to reviewers according to a double-blind review process. Eventually the completed reviews could be collected and mailed back to the author; if the article was judged worthy, the author could send back a revised version for publication. Then the accepted submissions were gathered into an issue, laid out for print publication, and printed and distributed.

These activities would take place in a number of different locations, traditionally linked by mail, making it unsurprising that the time between submission and publication

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could take most of a year. The low speed and relatively high cost of communication placed limitations on the physical route that a submission could take on its way to publication. Each mile traveled by a submission involved time and costs, pitting distance against the best interests of both the author and the journal that timely research be published quickly.

Apart from its slow speed, the physical nature of print publication adds further limitations. Photocopies are relatively cheap, but physical documents are expensive to manage, obviously for completed issues of the journal, but also for submissions in the publication pipeline. A copy of an in-process submission, such as a revision with reviewer annotations, cannot be in two places at once; it cannot be easily compared with another copy; it may not be convenient to edit, such as to remove author identification before sending to reviewers.

Finally, the entire process, from submission to publication, is unidirectional. Once a submission is laid out for printing, it can be cumbersome to take new feedback into account, e.g. an author's last-minute discovery of a flaw. Once an article is printed and distributed, it is for all intents and purposes immutable – corrections, if they are deemed fundamental enough, must be distributed separately as errata. Once the journal is in the hands of a reader (at the end of the long trip that began with the author's pen) the opportunity for participation in the publishing process for that article has ended. Related correspondence can be published in later issues of the journal, but while this correspondence can refer back to the original publication, the original publication can never refer forward to related discussion.

None of these restrictions – the high cost and low speed of communication, the limitations of managing physical documents, and the unidirectionality of the process – need apply to an electronic publication such as an academic journal. Copies are essentially free, distribution is no longer a major expense and logistical problem, and because most web-based electronic publishing structures involve “delivering” the article electronically from a single, authoritative

source anytime it's requested, control over the document and thus the power to change it at any time remains with the publisher – even after the date of publication.

These changes are typically discussed with respect to distribution, which is the aspect that undergoes the most visible change when a publication goes digital – but distribution is only the tip of the iceberg. For a truly “born-electronic” publication, these pressures also operate on each step of the publishing process, from submission, through peer review, copyediting, layout, and so on. The currently accepted set of processes for each step involves media-related restrictions that are no longer at play for an electronic publication; these restrictions are so familiar that they are difficult to perceive, and thus it can be difficult to imagine the impact their removal will have on established processes like double-blind peer review.

Of course, discarding models of publishing that were based in part on the limitations of physical media would be foolhardy, as these models are thorough, well-understood, and established. John Buschmann, for example, provides a valuably pessimistic (if somewhat dated) overview of some of the negative potentials of electronic publishing, particularly with regard to preservation, economics, and fundamental differences between print and electronic media (Buschman, 1997). A careful reexamination of the current structure with the positive and negative effects of technological change in mind presents a number of exciting potential directions for the future while building on long-standing traditions. Several journals – popular academic journals with a long history of rigour, whose names command respect – are experimenting with these possibilities.

The peer review process, central to academic communication, can be broadened now that the metrics of distribution have been transformed. Rather than an editor choosing a small number of reviewers, the Internet makes a new process possible whereby any reader is able to anonymously comment on a pre-publication submission. Variants of this process are used by a number of journals and organizations:

- * Philica (<http://www.philica.com>), an electronic journal
- * Naboj (<http://www.naboj.com>), a service allowing open commentary on arXiv.org preprints
- * Living Reviews (<http://www.livingreviews.org>), a process and collection of journals allowing authors of review articles to incorporate ongoing research developments

These new processes are made possible by broad, rapid public access to the Internet, which provides global access to pre-prints in a way that has not been possible before, and the ability to respond quickly without incurring the overhead a traditional process would require. While these and other recastings of the review process are experimental and results have so far been uneven, they are being considered seriously by established high-profile journals such as Nature (<http://www.nature.com>) and the British Medical Journal (<http://www.bmj.com>). Nature has published the results of their high-profile (if not particularly successful) experiment with Open Reviews at <http://www.nature.com/nature/peerreview/debate/nature05535.html>.

From a reader's perspective, the transition from print to electronic has had its own drawbacks. Assuming both are on hand, a computer has never been as portable, durable, or immediate as a printed publication, and computer screens and e-book displays are only just becoming as eyeball-friendly as the printed page. Initially, electronic publications were simple reproductions of existing print journals, in a less familiar and reader-friendly format – but those days are over. Readers are increasingly being offered power and resources that print publications simply cannot match.

An obvious benefit to electronic publication is the availability of full-text searches, something broadly taken for granted by anyone who is accustomed to the speed and immediacy of the world wide web. Google's well-known plain search interface (<http://www.google.com>) is a great example of a lowest-common-denominator search engine; it indexes tremendous amounts of content indiscriminately, which results in a tangle of high- and low-quality results for a given search, with the consolation that the desired result will likely be in there

somewhere. Google Scholar (<http://scholar.google.com>) is an attempt to address the indiscriminate nature of traditional search engines by including a limited set of data but ensuring that it is better indexed and of meets certain standards; while it is not comprehensive, any results it does find are quite likely to be relevant, and because of the high quality of indexing information, Google Scholar is able to mine the set of papers it includes for references, author information, etc. There are many other databases of high-quality content available, often domain-specific, such as the Public Library of Science (<http://www.plos.org>) and PubMed Central (<http://www.pubmedcentral.nih.gov>).

Online journals are also instituting additional mechanisms for author feedback. The British Medical Journal, Open Medicine (<http://www.openmedicine.ca>), and others have implemented Rapid Responses, which attach a forum for public discussion to each article. Article authors are encouraged to use the same mechanism to address questions or criticism. As online publications are never “complete” in the way that a print publication is – warts and all – these continuations of the discussion can be viewed as part of the article itself in a way that was not possible with print publication.

Articles can be corrected directly rather than via a subsequent distribution of errata, raising a host of ethical and editorial policy questions: under what conditions can previously published content be removed? What level of correction, on a scale from typos and grammar problems all the way to major revisions, is permissible? With the stability of paper gone, citations become a moving target. Several organizations have published publishing guidelines for managing these issues.

A pivotal real-world example can be found online in the New England Journal of Medicine's handling of the Vioxx® study scandal. The original article, the legitimacy of which was later called into question, is still published online; however, an annotation has been added notifying the reader that they should be aware of some of the subsequent discussion and providing links to those

resources. There are three major approaches NEJM could have taken: a published notice of retraction in place of the original document, a notice presented alongside the original document, or (least likely) outright removal of the original document. These are very different political approaches to retraction, but technically they are all as easy – in stark contrast to the literal paper trail left by a print publication.

This lack of permanence will be familiar to any frequent user of the web in the form of broken links. Documents frequently do disappear and move in an online environment for a variety of reasons, leading to scores of solutions and technologies, including Permalinks (a general term for a permanent link, but most commonly used in blogs); DOI (<http://www.doi.org>), which provides a framework for persistent identification; LOCKSS (<http://www.lockss.org>), which is amply explained by its full name, “Lots Of Copies Keep Stuff Safe”; Dataverse (<http://www.thedata.org>), an open archive of research data; OpenURL and link resolvers; and many others.

The overwhelmingly dynamic nature of an electronically-published article need not be entirely a liability. Many online publishers are making positive use of this flexibility, such as by tracking and publishing a list of citations to a particular article as part of its metadata. While traditional bibliographies make it possible to review the research that an article is based upon, this allows readers (and authors) to see what further research was influenced by an article. Citation counts are tremendously important in assessing the importance of a work.

Furthermore, when bidirectional citation information is available for works that are also published online, the ability of a researcher to explore the lineage of a domain of research becomes tremendous. These citation links can be built automatically as part of an indexing process, as seen in Google Scholar (<http://scholar.google.com>). In this way, collections of electronic publications accumulate “synergistically” – as more are published online, the network of interrelations can grow exponentially,

particularly for indexing tools that are vendor-neutral (as opposed to indexes that only relate works owned by the same publisher).

Last but not least are two major developments that have been largely made possible by electronic publishing: the Open Access movement, and a revolution in academic publishing in the developing world.

The Open Access movement simply makes research available for free to all readers, recognizing that traditional subscription-based publishing hampers access to research. There are many reasons for Open Access – it increases access to information (good for readers) and the number of citations to a published article (good for authors) (Willinsky, 2006). Furthermore, since research is often funded via government grants, Open Access often returns the finished product to those who paid for it – taxpayers.

As with any revolutionary idea, Open Access has met with a variety of reactions, from enthusiasm to uncertainty. In the years since the “birth” of Open Access at the Budapest Open Access Initiative conference in 2001, the movement has gained incredible momentum and an increasing number of Open Access resources are launching, including innumerable individual journals (Neuroquantology among them), many of which are listed in the Directory of Open Access Journals (<http://www.doaj.org>), and comprehensive, cutting-edge collections like the previously-mentioned Public Library of Science and PubMed Central.

The most disruptive aspect of Open Access publishing, and the one that is still the most controversial, is funding. Many journals earn their operating revenues with subscriptions, particularly those owned by commercial publishers, and moving to an Open Access model would require a new means of support. There are many possible solutions that individual journals are employing with success, such as author fees, advertising, and cost cutting, but so far there is no “silver bullet” to replace a subscription-based business model.

Open Access publishing is largely dependent on electronic publishing. It is

simply too expensive for most publishers to print and distribute paper copies without resorting to subscriptions. As free, open-source tools for electronic publishing mature, not only tools for delivering publications but also the tools for creating them and supporting processes like peer review, it becomes possible to run an Open Access journal efficiently and without requiring revenue streams like high author fees or advertisements. This is a promising way forward for the Open Access movement.

Electronic publishing, particularly in combination with Open Access, has immense benefits to offer the developing world. It is prohibitively expensive for many institutions to subscribe to and maintain collections of print publications (particularly with recent changes in subscription prices and the attendant "serials crisis"), but with Internet infrastructure exploding both within institutions and for use by the greater public, Internet-based electronic delivery is clearly poised for success. Because much of the world's scholarly communication happens in academic journals, this growing first-rate access to publications means that scholars in the developing world are able for the first time to participate as peers in the global academic communications network. INASP (International Network for the Availability of Scientific Publications), for example, is spearheading a number of projects to expand academic publication in Asia, in Nepal (<http://www.nepjol.info>), Bangladesh (<http://www.banglajol.info>), and Vietnam (<http://www.vjol.info>), and in Africa (<http://www.ajol.info>).

Some aspects of the future of academic publication are clear – electronic delivery and born-electronic publications will increase in popularity and the Internet will continue to grow as a means for accessing and reading research. The enormous generational changes in research habits have already secured the Internet as an invaluable research tool. Behind the scenes, however, the transformation has only just begun. The nature of the Internet will provide faster and more flexible ways of working on papers and articles through each step of the process, from submission, through peer review and

various editorial processes, leading to new processes that are currently embryonic but will co-evolve rapidly with the tools to support them.

During the early stages of development of electronic publishing, it was not clear that the Internet was the medium of choice. Many types of works were distributed on CD-ROM, for example. With the Internet's position in electronic publishing secure, an interesting immediacy results from bringing the enormous set of publications and their processes onto a common medium. Authorship, research, peer review, editing, and reading are for the first time taking place, in effect, in the same room. Laymen, professionals, and academics are able to participate in more ways, and for the first time, their geographical location is no impediment. Thanks to the non-discriminating nature of publishing on the Internet (Lemley, 2000), small journals may publish alongside large ones without incurring the enormous cost of entry associated with print publication.

Born-digital journals have a unique opportunity to embrace the potentials offered by electronic publication without being encumbered by the constraints of print publication. They face several unknowns, however: first, as described above, traditional publishing processes were designed with print in mind and may not apply perfectly to electronic publications. Second, the tools to support electronic processes are developing rapidly, but since the processes they support are moving targets, it can be difficult to incorporate these processes using off-the-shelf software. Fortunately, another kind of openness offers a solution for journals that are able to push the envelope: Open Source.

Broadly speaking, Open Source is to software what Open Access is to research. If an application is Open Source, its source code, which by contrast is closely-held intellectual property in the commercial software world, can be used, modified and reviewed by anyone (with certain restrictions imposed by the specific Open Source license in question).

There are innumerable Open Source tools available for electronic publishing. In

the field of academic journal publishing, for example, there are DPubS, ePublishing Toolkit, GAPworks, Hyperjournal, OpenACS, Open Journal Systems (OJS), SOPS, and TOPAZ (see http://pkp.sfu.ca/ojs_faq for links). Many of these are perfectly capable of managing a “typical” electronic journal without modifications – but because they are open source, the community is free to add whatever journal-specific or cutting-edge features they like.

For the present, however, electronic publishing's most exciting and proven potential is greater participation. Few would argue, putting aside such complications as funding models and technological and process-related growing pains, against removing barriers in access to scholarly research. If this simple promise continues to be fulfilled by the gradual shift of academic communication to electronic media, Barlow can be forgiven his enthusiasm. While some familiar aspects of publication may cease to exist, the benefit to the global community is clear: easy, immediate, non-discriminatory access to cutting-edge research.

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