

OPEN ACCESS IN THE NATURAL AND SOCIAL SCIENCES: THE CORRESPONDENCE OF
INNOVATIVE MOVES TO ENHANCE ACCESS, INCLUSION AND IMPACT IN SCHOLARLY
COMMUNICATION

Chris Armbruster
Research Associate, Max Planck Digital Library,
Max Planck Society
Invalidenstrasse 35, D 10115 Berlin
www.mpdl.mpg.de

Executive Director, Research Network 1989
www.cee-socialscience.net/1989

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Abstract

Online, open access is the superior model for scholarly communication. A variety of scientific communities in physics, the life sciences and economics have gone furthest in innovating their scholarly communication through open access, enhancing accessibility for scientists, students and the interested public. Open access enjoys a comparative advantage across the science and humanities and it is therefore only logical that functional innovation and structural improvements should be similar in the natural and social sciences. A variety of innovative moves in the natural and social sciences are portrayed and analysed, demonstrating correspondence of the innovative logic across the disciplines even as solutions vary.

Open access is technologically feasible and economically efficient. Moreover, open access has become vital to secure the continued advancement of knowledge. It may be expected that public and philanthropic funding will flow in the future only if public visibility and academic impact of the research results can be demonstrated.

Keywords

Scholarly communication, electronic publishing, STM publishing, publishing economics, open access, digital repositories, peer review, literature awareness tools

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URLs of surveyed innovative moves

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1. Introduction: Scholarly communication and open access

Scholarly communication serves the elaboration, refutation and creation of knowledge claims. Scholarly communication may be informal and oral, but knowledge claims are advanced in writing. Written knowledge claims may be circulated informally among colleagues, or they may be advanced more formally in and through a variety of media such as conferences, working papers, journals and monographs. The rapid worldwide expansion of higher education and university research in the 20th century was, however, not accompanied by the rise of globally inclusive scholarly communication, but by increasing restrictions in the access to knowledge. Worldwide, the faculty and students are 'switched off' as libraries are not able to afford the increasingly expensive subscriptions and site licences.¹

Formal, written scholarly communication entails the registration, certification and dissemination of knowledge claims. Scholarship entails a commitment to (e)valuating knowledge claims irrespective of their location. Only the authors of popular textbooks, timely essays and some legal matters may be said to be making money. Yet even these authors are not writing for a living. Indeed, when submitting to a journal, we divulge our knowledge for free. When presenting at a conference, we pay to have an audience. Our first motivation for writing is not 'money', but impact.

To the increasingly restricted access to published knowledge scientists and scholars have responded with a call for Open Access. The Budapest Open Access Initiative (2001) states:

An old tradition and a new technology have converged to make possible an unprecedented public good. The old tradition is the willingness of scientists and scholars to publish the fruits of their research in scholarly journals without payment, for the sake of inquiry and knowledge. The new technology is the Internet. The public good they make possible is the worldwide electronic distribution of the peer-reviewed journal literature and completely free and unrestricted access to it by all scientists, scholars, teachers, students, and other curious minds. Removing access barriers to this literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge.

2. Open Access is feasible and likely

Open Access (OA) is technologically and economically feasible. The OA movement has been well organized, encompassing universities, public research organisations, funding agencies, philanthropic foundations and research libraries. In fact, the support is so numerous and consistent that it is in the hands of the OA coalition whether Open Access is the future standard of

scholarly publishing and communication. Unless strategic blunders are committed, the big commercial publishing houses are not in a position to stop OA, because the OA coalition is committed to establishing national, institutional and disciplinary e-print repositories. Thus authors will obtain control over the copyright. Moreover, philanthropic sponsors and research funding agencies not only back OA journal publishing by covering publication charges, but are also beginning to mandate OA publication for research they fund. This is the lever, by which commercial, profit-maximizing publishers could be forced out of business. Yet that is not necessarily the point of the OA coalition, which merely seeks to establish OA to research data and results, of which journal articles are a crucial component. All publishers have the option to restructure.

Learned societies and publishers that have tied themselves to the commercialisation of scholarly communication may resist OA. Some publishers will miss the boat, but subscription-based journals may be converted to OA. Moreover, OA allows for the development of a whole new range of e-authoring tools and services for accessing and transmitting scholarly e-publications. OA enhances the flow of knowledge and makes scholarly communication more transparent and inclusive. Moreover, for comparative, trans-national and global research agendas, crucial to the advancement of social and cultural science, OA facilitates participation and exchange.

Comparative advantage, functional innovations and structural improvements

Open Access runs against a publishing model that turns the article into a commodity as scientists and scholars sign away the copyright. Publishers that become the 'content owner' may use exclusive copyright to levy subscription fees, site licences and pay-per-view charges. In contrast, the 'Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities' (2003) stipulates that

Open access contributions must satisfy two conditions:

1. The author(s) and right holder(s) of such contributions grant(s) to all users a free, irrevocable, worldwide, right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship (community standards will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now), as well as the right to make small numbers of printed copies for their personal use.
2. A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in an appropriate standard electronic format is deposited (and thus published) in at least one online repository using suitable technical standards (such as the Open Archive definitions) that is supported and maintained by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, inter operability, and long-term archiving.

Vis-à-vis the commodity publishing model the open access publishing model enjoys a comparative advantage because it

- Facilitates the registration of knowledge claims and their distribution because authors retain the copyright and so distribution may serve to maximise circulation;
- Enhances academic impact and enables public visibility as online access is unrestricted world-wide;
- Reduces overall costs and better protects authors' rights as online only automated processing reduces the cost of the additional copy to zero while facilitating the uncovering of theft-of-authorship (plagiarism);
- Garneres additional resources from supportive foundations and research funding agencies that as sponsors will always endeavour to maximise usefulness and usage.

Open access publishing has led to three major innovations. Functionally differentiated, these are

- E-print repositories – to which pre-prints and post-prints are streamed or uploaded and which may be viewed and downloaded free of charge (like arXiv, the Social Science Research Network and Research Papers in Economics);
- Knowledge exchanges – which feature area reviews that delimit knowledge and method, contain extensive bibliographies and are suitable for teaching and learning (like OpenCourseWare at MIT and Living Reviews);
- E-journal platforms – for migrating and new journals with automated procedures for submission, review and publication (publishers like the Public Library of Science, BioMed Central and Berkeley Electronic Press).

Structurally, Open Access publishing has accomplished

- An accelerated and more transparent peer review process, often featuring innovations like open, multiple and/or signed reviews (like the journal Atmospheric Chemistry and Physics (ACP) and the Journal of Interactive Media in Education (JIME) as well as publishers like BioMed Central and Berkeley Electronic Press);
- New literature awareness tools that guide readers through the literature by indicating significance and quality (like Faculty of 1000, Living Reviews and some services at RePEc).

Copyright and authors' rights: Economics and ethics

Copyright is a bundle of rights that forbid or permit uses such as distribution, performance and display. The Statute of Anne passed by the English parliament in 1710 granted publishers a limited exclusive right for works that were published. The House of Lords confirmed in 1774 that copyrighted work falls into the public domain after 20 years. The Constitution of the United States (1776) legitimated the granting of exclusive rights insofar as they 'promote the

progress of Science and the useful Arts' (Rose 1993, Lessig 2002).

While copyright and authors' rights were a 'quid pro quo', the prevailing conception is currently one of innovation, incentives and property rights. It is suggested that broader, longer and stronger protection of intellectual property rights provides the right incentives for continuous innovation. Because owners' rights are exclusive, publishers have found it possible to rapidly and steeply raise subscription, license and pay-per-view prices. Annual subscriptions to STM journals, depending on prestige, may cost more than \$10,000. Social science and the humanities are equally affected, as the logic of the situation is the same: A non-substitutable good with inelastic demand is subject to corporate exploitation because of the exclusivity of the copyright (McCabe 2002 and 2004). Particularly troubling is the emergence of code, known as Digital Rights Management, which by digital watermarking and enhanced encryption is able to restrict viewing, reading, borrowing and printing.

Monopoly rights, however, are at odds with the ethos of science (Gibbons/Wittrock 1985). Already R.K. Merton (1942) found that:

"The substantive findings of science are a product of social collaboration and are assigned to the community. They constitute a common heritage in which the equity of the individual producer is severely limited. An eponymous law or theory does not enter into the exclusive possession of the discoverer and heirs, nor do the mores bestow upon them special rights of use and disposition. Property rights in science are whittled down to the bare minimum by the rationale of the scientific ethic. Scientists' claim to "their" intellectual "property" are limited to those of recognition and esteem which, if the institution functions with a modicum of efficiency, are roughly commensurate with the significance of the increments brought to the common fund of knowledge".

By implication, it is equally a violation of the ethos of science if publishers exercise monopoly rights. Yet the scholars themselves sign away their rights, even if the contract stipulating the transfer of copyright is imposed unilaterally by the publisher. Increasingly scholars are not free to distribute, copy and transform the articles they wrote without the explicit permission of the new 'content owner'. Moreover, the new content owner sells back their work to university libraries, colleagues and students at monopoly prices.

The OA coalition has countered this trend by asserting the moral rights of the author and developing attribution licences that make copyright non-exclusive. Authors want protection against plagiarism, but they do want others to have access to their ideas and use their work. This implies an interest in distributing and sharing publications as widely as possible. OA copyright has been formalised by Creative Commons in an Attribution License that enables non-exclusively:

- Copying, distribution, display, and performance;
- Derivative works;
- Commercial use of the work.

With the Attribution License the OA coalition has succeeded in implementing an alternative legal mechanism for protecting authors' rights while offering a copyright rule by which distribution may be maximised, thus reinforcing and highlighting the comparative advantage of OA publishing.

3. Looking back: the commercialisation of scholarly communication and the rise of the Internet

In creating the Philosophical Transactions of the Royal Society of London in 1665, Henry Oldenburg very much had 'impact' in mind, both academic and public. Phil Trans was a procedure to establish knowledge claims, have them (e)valuated and recognized by peers and then utilized by the public. Well into the 20th century, editors and publishers of scholarly journals recuperated costs only. However, in the 1960s the Institute of Scientific Information's (ISI) Science Citation Index (SCI) began defining 'core journals' from citation counts. Ever since, corporate publishers have been seeking to gain control over these lucrative titles, whilst learned societies in possession of such a title could capitalize on it (Guedon 2001).

The journal article: Recovering cost or maximising rent?

Journal prices in the social sciences and humanities have not risen as rapidly as in STM. Yet the logic of the situation is the same (Nentwich 2001b, David 2003, McCabe 2004, Nelson 2004). The commercialisation of scholarly communication has become problematic to the extent that the elaboration, refutation and creation of knowledge claims is increasingly restricted and distorted. Does this justify speaking of a crisis?

Many scholars and librarians perceive the current situation as a crisis because to their mind the commercialization of journals has led to an impasse of rising prices and restricted access – as libraries cancel journal subscriptions and reduce book acquisitions. It is circumstantial that price rises led to restricted access because the patrons of libraries have been unable to cover the increasing costs. However, analysts concur that the journals market is characterized by inelastic demand, which hands the advantage to the seller. They observe that the mix of prestige and specialization makes many academic journals a non-substitutable good. By mergers and acquisitions a select few corporate publishers control large segments. Flagship high-impact journals are bundled with the publishers' remaining titles and sold to libraries. Libraries may refuse these bundled packages only at great cost, because publishers may offer only all-or-nothing and individual subscriptions to journals which are pricier to subscribe to and more expensive to administer. Big deals push out the smaller, independent and not-for-profit publisher because libraries that have subscribed to the 'big deal' will run out of funds to acquire additional titles. This further reduces competition. If libraries form consortia to negotiate discounted deals they reinforce the 'big deal'. Independent publishers may opt to

collaborate to offer 'smaller big deals', but again this only reinforces the logic of mergers and acquisitions, further strengthening the position of the seller.

The OA coalition has been countering this trend by launching new journals that compete with some of the most expensive corporate titles. New OA titles at the Public Library of Science are capable of matching the impact factors of corporate titles. It is known that the mere threat of a rival journal with significantly lower subscription rates has moved publishers to freeze and reduce subscription rates. Is there any hope that a competitive market might emerge? The OA coalition, because it can potentially control copyright, may force OA if either scientists and scholars widely adopt a non-exclusive attribution license for their work or, else, funding agencies mandate OA publishing. However, what the OA coalition cannot achieve is the creation of a competitive market. Even if a new journal with a lower subscription rate (or none) is successful, it simply becomes part of the 'core collection' that the library must have at any price, making it a target for a corporate acquisition.

The rise of the Internet: de-commodification of scholarly publishing?

In the Gutenberg Galaxy all authors and their editors required the services of a publishing house. It performed valuable services such as advertising, distribution and dissemination. Yet the copyright is the mechanism whereby corporate publishers seek to transform the Internet into a platform for site licenses and a channel for pay-per-view charges. From intellectual property that they did not create, corporate publishers seek to maximize their rents.

The Internet enables Open Access with a few keystrokes (Nentwich 2001a, Harnard 2004, Krichel/Zimmermann 2005, Nentwich 2006). Any academic author may already deposit all her research articles in national, disciplinary or institutional repositories. Indeed, repositories have become so pervasive that they have global scope and principally cover all the sciences and humanities. Once an author has understood the procedure, it takes only a few minutes to make research articles available to a worldwide audience. If coupled with a non-exclusive attribution license, this would lead to the de-commodification of scholarly publishing, restoring its original function: to share knowledge.

The World Wide Web was made available by the physicist Tim Berners-Lee at CERN in 1990. arXiv, the physicists' pre-print server, the first major electronic innovation in scholarly communication, was launched in 1991. Research fields that have cyber entrepreneurs, a faster pace, a uniform method, an active pre-print culture and a cumulative tradition find the Internet a readily congenial environment (Nentwich 2001a). Nevertheless the Internet is being appropriated across countries, languages and disciplines. It is the 'impact logic' of scholarly communication that pulls publishing towards OA. Impact is extended considerably by OA around the world: among scholars, in higher education and in society.

4. Innovative moves in scholarly communication and publishing to broaden access and enhance impact

The rise of the Internet has been seized upon by academic cyber entrepreneurs, who have created a host of innovative services for scholarly communication. We portray and analyse in some detail six innovative moves in the natural and social sciences. Comparison reveals that the innovative logic is the same across disciplines and fields while the publishing solutions vary in detail.

Disciplinary repository and electronic distribution: arXiv in physics and computing and the Social Science Research Network (SSRN) in economics and law

arXiv and SSRN present two alternative models of open access distribution and dissemination. arXiv prioritizes moderated scholarly communication in organized research fields with an identifiable research community and, hence, seeks to facilitate the distribution of new results. SSRN is concerned with disseminating scholarly papers in broadly defined fields and enhances the chances for authors to be known and cited.

arXiv is a fully automated e-print service and distribution system for pre-prints in physics and related disciplines such as mathematics, computing and quantitative biology. The service is hosted by Cornell University Library and is funded by Cornell University and the National Science Foundation. Its server was donated by Sun Microsystems. Server content is mirrored by sites on all continents for ease of access. In 2006 and 2007 an average of more than 4,000 submissions were processed each month, with peak months above 5,000 submissions. Since its foundation in 1991 more than 440,000 papers have been deposited. arXiv accepts only full papers from registered authors.

Authors need an endorsement (from an active author with a number of submissions) for a first submission or for a first submission to a new field. arXiv seeks to ensure the appropriateness of any submission, but it does not seek to ascertain the quality by peer review or to establish the truth-value. Broad research fields in physics and related disciplines are organised into subject categories that have named moderators (from academic institutions all over the world). The subject categories evolve with community interest and demand. Deposited articles may be replaced with a later version (but the previous version remains archived). The withdrawal of an article is only possible with a public explanation.

The concept of arXiv is 'an openly accessible, moderated repository for scholarly papers in specific scientific disciplines. Material submitted to arXiv is expected to be of interest, relevance, and value to those disciplines. Endorsement is a necessary but not sufficient condition to have papers accepted in arXiv; arXiv reserves the right to reject or reclassify any submission'.

SSRN features papers and abstracts in economics and law as well as related disciplines such as accounting, finance, negotiations, marketing, social insurance and management. Networks for political science and humanities were set up in 2007. Registered authors may upload their papers free of charge to these broadly defined research networks. SSRN also streams abstracts for papers in commercially published journals and working paper series of known academic and public institutions, most of which are located and published in the United States. All downloads are free unless the publisher requires SSRN to charge, in which case SSRN requires that the price must be equal to or lower than the lowest price available elsewhere.

SSRN is a corporate entity. Partly it finances itself through 'Partners in Publishing' that advertise their journals and working paper series. SSRN also charges a fee for access to the research networks. Institutions and individuals may subscribe to these networks that give access to journal papers, conference proceedings and announcements. SSRN does not seek government grants or capital investment from outsiders. Genuine open access SSRN is able to provide to those papers (pre- and post-print) that authors have uploaded to their own personal repository on SSRN.

Accumulated since 1994, the SSRN repository features over 160,000 documents, of which over 130,000 are full-text documents from over 80,000 authors. SSRN has counted more than 16 million downloads; averaging in 2006 and 2007 at more than 350,000 per month. SSRN services count downloads per paper and per author, both overall and for recent submissions. The top author may boast nearly 300,000 downloads, while No 10 still has more than 70,000 downloads and No 50 has more than 28,000 downloads. Over 1000 scholars contribute their services to SSRN, free of charge. There is no pay to academic principals and no dividend to shareholders. SSRN channels all revenue back into its service and spends about \$800,000 yearly on system development and user support.

SSRN has a focus on dissemination and reputation. SSRN is keen to include working paper series of institutions such as the World Bank and Harvard Business School. It provides download counters and ranks authors and papers. SSRN has the support of reputable scholars from highly ranked institutions, to whom it serves as a dissemination platform from which their work is made more widely accessible. arXiv, by contrast, provides neither rankings nor counters. Instead it has a very detailed classification scheme that closely reflects ongoing research. Its focus, consequently, is on making new results available to the community as soon as possible.

[Online literature awareness tools: Living Reviews in physics and political science and Faculty of 1000 in biology and medicine](#)

Living Reviews and the Faculty of 1000 present two possible ways of evaluating knowledge claims and organizing information, thereby facilitating scholarly

communication. Living Reviews offers solicited, compact surveys of the state of knowledge and method in a research field. The Faculty of 1000 highlights important contributions to knowledge and outlines their relevance.

Living Reviews provides solicited online-only refereed review articles that guide active researchers at any stage of their career to the relevant literature. 'Living' review articles are updated regularly to incorporate the latest developments, seeking to advance the research programme. Articles are solicited by an international advisory board and are subjected to peer review. Authors update published articles regularly and the full history of any article (revisions, updates and errata) is viewable online.

All review articles 'are readable online in HTML, integrated in a highly functional hypertext viewing environment. Sophisticated navigation support is offered for equations, figures, footnotes and references. Additionally, all references cited in Living Reviews articles are collated in online searchable literature databases, with the database entries linked back to and put into context by the annotation within the respective review articles'.

'Living Reviews in Relativity' (over 70 review articles published, over 40 upcoming) is sponsored by the Max Planck Institute for Gravitational Physics and 'Living Reviews in Solar Physics' (16 published, over 40 upcoming) is sponsored by the Max Planck Institute for Solar System Research. 'Living Reviews in European Governance' (4 published, 15 upcoming) is sponsored by CONNEX (Connecting Excellence on European Governance) and NEWGOV (New Modes of Governance), research networks funded under the European Union's Sixth Framework Programme of Research. Living Reviews is an Open Access service. For private, educational and scientific purposes up to 7 copies of each article may be downloaded and distributed by the user. Living Reviews encourages the adoption of its concept. The software is available under a GNU Public Licence.

Faculty of 1000 at BioMed Central functions as an online literature awareness tool. Biology, for example, is systematically covered in 18 faculties (from biochemistry to structural biology), which in turn comprise between 5 to 14 sections. Over 2300 internationally known faculty members have commented on tens of thousands articles. Continuously they provide readers with a rapidly evolving insider's evaluation of new research. The merit of the individual paper counts. A sister service in Medicine was launched in 2006, with over 2400 faculty members evaluating published research.

Faculty of 1000 is an institutional and individual subscription service. Individual subscriptions are priced at \$116. Subscribed users may browse and search all papers by faculty and by section and sort them by various criteria such as date of publication, type of paper (novel finding, technical advance, interesting hypothesis, important confirmation, controversial finding) and number and strength of recommendations (recommended, must read, exceptional). Subscribers also have access to a Hidden Jewels list of papers published in

less known journals as well as alerting and rating services.

The service is freely available in countries with a GNI per capita below \$1000 and at reduced rates in other developing countries. Moreover, faculty members may sponsor institutions for free access, so that, for example, Tsinghua University and the University of Madras enjoy free access. In effect, Faculty of 1000 must recover its costs from institutional and individual subscriptions made in the developed world.

Living Reviews and Faculty of 1000 are both forms of public and documented peer review after publication. They serve as a literature awareness tool that for its users helps to organise information effectively and efficiently with respect to ongoing research programmes. Living Review is primarily concerned with advancing research programmes in a coherent manner (rather than praising authors) whereas Faculty of 1000 recognises primarily the contribution of the author(s) (rather than setting an agenda).

Peer review as inclusive scholarly communication: Atmospheric Chemistry and Physics (ACP) and the Journal of Interactive Media in Education (JIME)

Open, signed and/or documented peer review has enabled OA journals to be a less of a gatekeeper and more of a facilitator of scholarly communication. Atmospheric Chemistry and Physics (ACP) and the Journal of Interactive Media in Education (JIME) have pioneered review environments that enable their respective communities to participate more fully, including public credits for reviewers and discussants.

Atmospheric Chemistry and Physics (ACP) is a not-for-profit e-journal published since 2001 by the European Geosciences Union (which has launched three more journals following the same interactive OA concept and converted one). Submissions to the editor are rejected or accepted immediately, possibly with the help of peer review according to published criteria of significance, quality and presentation. Subject to technical corrections, access-reviewed papers are published as discussion papers. This stage is designated as ACP with Discussion [with D]. Discussion papers are citable and available for public discussion. Referee comments, author comments and further comments from the community are interactive and viewable. After 8 weeks the public discussion closes and the authors are requested to revise the manuscript (if warranted) for a final decision on acceptance or rejection, possibly again with the help of peer review. For well-prepared manuscripts ACP charges authors €23-25.- per Internet page, plus VAT (a manuscript with 10 pages in the original would be calculated at 30 internet pages, giving a minimum of €690.- plus VAT, plus any additional charges for converting files and copy-editing). ACP deploys a Creative Commons Attribution – NonCommercial –ShareAlike License, which means that non-commercial copying and distribution is permitted while any alterations or transformations may only be undertaken if the subsequent work carries an identical license.

The editors of ACP [with D] insist that the initial check is rigorous, but that the open discussion would reveal any erroneous decision. Yet the main function of the open discussion is to improve the quality of the paper while enabling the rapid dissemination of ideas and results. Moreover, contributions to the discussion themselves are archived and citable. ACP thereby gains the character of a logbook that records the advancement of knowledge claims, with due credit to reviewers and discussants.

The Journal of Interactive Media in Education (JIME) is published by the Open University (UK). With the first issue out in 1996, it is older than ACP, but it is a stand-alone journal. JIME employs a similar interactive OA publishing concept, distinguishing between 'private open peer review' and 'public open peer review'.

When an author submits, the editor will verify if the article is relevant and substantive. This is followed by a 'private open peer review' involving the reviewer, editor and author. Subject to acceptance, broadly defined, the article progresses to a 'public open peer review' that involves the relevant community. Articles are tightly integrated with reviews and discussion in a web interface. Subject to final revision, the editor publishes the article with the discussion threads, enabling further commentary.

In this sense JIME is an early example of interactive OA publishing by making available for comment the pre-print and the post-print. The particular strength of JIME and APD is to combine interactive OA publishing with raising the bar as regards peer review. Open and interactive peer review is (Pöschl 2004)

- More effective because of the more inclusive selection of referees and the provision of more information;
- More efficient because of the faster publication time and the more comprehensive evaluation of results;
- An improvement in quality assurance because of the greater likelihood of exposing the duplication and splitting of papers, tracking tuned results and detecting plagiarism.

Reducing barriers and costs while accelerating and increasing publication rates: The Public Library of Science (PLoS) in biology and medicine and Berkeley Electronic Press (bepress) in economics and law

The Public Library of Science (PLoS) and Berkeley Electronic Press (bepress) are scholar-led innovations that seek to facilitate and accelerate publication while reducing both access barriers and costs.

PLoS was founded after 34,000 scientists from 180 countries had signed an initiative asking 'scientific publishers to make the archival scientific research literature available for distribution through free online public libraries of science'. PLoS was not satisfied with the response of the publishers. Upon receiving a \$9 million grant from the Gordon and Betty Moore Foundation, PLoS first launched PLoS Biology (10/2003) and PLoS Medicine (10/2004), followed by 6 more journals including PLoS ONE, a high volume journal for the sciences and

medicine that has rapidly published over 1000 articles in over 50 different subjects. PLoS ONE publishes all papers that are rigorous and technically sound within weeks, with judgement of the importance of the article reserved until after publication. Readers are invited to comment and rate.

PLoS expects reviewers to respond within 7 days. Reviews are confidential (the referee may not discuss the submitted paper with anyone else) and the reviewers remain anonymous unless they request that their name is passed on to the author. Accepted papers are published online as soon as possible. PLoS publishes under the Creative Commons Attribution Licence, which enables unrestricted use, distribution and reproduction subject to proper attribution. PLoS sees itself committed to 'the highest standard of excellence', which means securing above average scientific impact for what it publishes as well as public impact by reproductions and use in education.

PLoS charges a publication fee of \$1250-\$2750 for each article, but accepts submissions without regard for the financial circumstances of the author. PLoS expects that research funding agencies will increasingly underwrite publishing costs for research projects they finance (which some are already doing and others are considering). Authors without the necessary financial resources will have the publication fee waived. Thus revenue generated is considered sufficient to sustain a not-for-profit Open Access publishing house.

Bepress was founded by legal and economic scholars from UC Berkeley. Bepress journals are subscription based. However, bepress contends that 'journals are priced significantly below both the discipline's average and the rates typical of large commercial publishers. For example, in 2004, the average price to libraries for business and economics titles was \$614... while the average for bepress titles was \$297 - less than half as much... Even more important are trends: the price of the average economics title has soared 49% between 2000-2004, while the average price of bepress economics titles has fallen by 29% (we kept each journal's price constant and added new, less expensive titles). On a price per page basis, looking across all disciplines, between 2001 and 2004, our prices fell by over 25% per year'.

At the heart of bepress is a new editorial management software, an authors and reviewers' credit bank and a new quality sorting mechanism. The EdiKit software automates every step from submission to final publication – all online. The A&R Bank formalizes the review process by creating a debt upon submission that may be redeemed by undertaking two timely reviews (or else by paying a fee) as well as creating a credit upon the completion of two timely reviews for one submission. A bepress journal title may house four distinct titles – designated as Frontiers, Advances, Contributions and Topics in a research field – which enable reviewers to simultaneously consider an article for publication in a tiered system. The result is reduced rejection rates and time saved for the authors (faster publication) and reviewers (less re-reviewing).

All editors focus on publishing high-impact journals, yet all also experiment with

the peer review process. It seems plausible that a shift to a more transparent and open review process will benefit the impact of the journal because submissions will be of a higher quality to avoid public embarrassment; reviewers must be more judicious and constructive to avoid public embarrassment; and multiple public reviews will enhance the quality of the final submission.

New modes of scholarly publishing: BioMed Central as a platform for open access journals and JSTOR as an electronic journal archive for the social and cultural sciences

BioMed Central is the most successful Open Access publishing house with over 180 journals on a shared platform, of which over 100 journals are new. BioMed Central continuously invites scholars to migrate existing journals to Open Access and to launch more new journals. JSTOR is the most successful not-for-profit electronic archive. It provides a complete run of 457 journals in the social and cultural sciences (from the date of the launch of the journal, even if in the 19th century). JSTOR is available to higher education institutions, which are charged a one-off joining fee to finance the conversion of journals into a digital format and an annual fee to finance system development and user services. JSTOR offers access at reduced cost for institutions in low-income countries.

BioMed Central offers free and immediate access to peer-reviewed biomedical research. BMC is a publisher as well as an electronic platform based on OAI compliant software. Migrating and new journals on the BMC platform need to conform to the usual academic standards and implement a peer review process. Some journals have opted for an open, signed and documented peer review process. BMC realises an accelerated electronic peer review, aiming for a first decision in 6-8 weeks. BMC guarantees the permanency of published articles.

BioMed Central has a processing charge of \$515 to \$2460 for published articles, but authors retain the copyright. Authors situated at one of the more than 500 institutional subscribers do not pay the article processing charge (or are at least entitled to a significant discount). Moreover, Norway and Denmark are the first countries to have a nationwide institutional commitment. Further still, authors will have the charge waived if they reside in a poor income country or can make a plausible claim for hardship. In effect, acceptance for publication is 'resource-blind'.

JSTOR is a site that offers access to the back issues of academic journals based on the concept of a 'moving wall'. Journal publishers release material 3 to 5 years after publication and JSTOR provides access to all back issues. Access to JSTOR is available to participating institutions (which may be HE or FE but can also be public or corporate institutions) for a cost-covering fee. For a research university full access to JSTOR is available at about \$25,000 annually. Institutions that subscribe to JSTOR could, in principle, terminate most paper subscriptions and free up space by disposing of all paper copies. Insofar as

publishers now provide online access to their content and JSTOR functions as an archive, libraries are in a position to achieve substantial savings.

JSTOR coupled with online subscriptions may therefore be said to provide a solution to the problem of rising subscription costs at a time of tighter library budgets. Moreover, the online service (in combination with, for example Ingenta or Web of Science) is arguably more effective and efficient because of the facilities to search, mark, download and print. JSTOR data is backed up at several mirror sites (fully independent and complete copies) and in collaboration with university libraries two so-called 'dim libraries' with complete sets of paper copies have been established – in case the data ever needed to be retrieved. JSTOR data may be downloaded and used on the understanding that it is for personal and non-commercial use.

From Open Access to Open Digital Libraries: Research Papers in Economics (RePEc) and Dspace@MIT with OpenCourseWare

RePEc is the most successful digital research library. It is an international library for economics. This sets it apart from institutional repositories. Indeed, RePEc is an overlay service that links repositories through a common access point. DSpace is an open source software for digital archives, used by more than 100 universities. DSpace@MIT is the digital archive of MIT Libraries. Its content is overwhelmingly OA. OpenCourseWare is the digital teaching library of MIT, which comprehensively makes available syllabi and course materials.

RePEc has been designed as an Open Library. Content and services are provided by a multitude of institutions, including economics departments, national research institutes, international organisations and publishers. It is an add-on library to which new content and new services may be joined by linking servers. RePEc is not premised on a central server (like arXiv is), but links a multitude of interfaces that users navigate to retrieve information. Economics has a lively institutional working paper culture, which means that pre-prints are widely available. But since RePEc is also fed by publishers, some links lead to the toll-gates of subscription and pay-per-view. However, RePEc offers a search function to check if the paper is available in Open Access somewhere else.

RePEc tracking of impact factors reveals that working paper series outpace the commercial journals. In economics working papers define the frontier of research. With and through RePEc authors advertise and disseminate their work. Once scholars as readers and authors begin using the open digital library, others follow, because if not their work would remain invisible. Open libraries invite third parties to link services and contents rather than build a rival network.

Open Access Courseware (OCW) at MIT is an open digital publication of teaching materials that hosts MIT's undergraduate and postgraduate syllabi, lectures and course materials for open perusal and use. Course materials published on the OCW website are used by educators and self-learners around

the world and have been translated into Chinese, Spanish and Portuguese. OCW was inspired by the open source software movement and operates on the basis of the Creative Commons Attribution License. MIT was an early sponsor of Creative Commons. MIT had initially considered a commercial distance-learning venture, but found this not to be a viable option given the commitment of faculty to the residential learning experience.

OCW has become a concept for the benefit of education. It makes the most advanced teaching and materials available for worldwide use, but it does so without seeking to substitute local educators and educational institutions elsewhere. OCW reinforces the public character of education, since commercial use of its materials is prohibited. MIT develops metadata that make OCW searchable. The adaptation of OCW by other universities is encouraged and supported (the whole process is documented online).

However, whereas with RePEc the incentives are to collaborate, OCW is more competitive. OCW challenges other universities to demonstrate the value of their curriculum, syllabi and supporting materials by open digital publication.

5. Into the future: a robust strategy to meeting the concerns of readers and authors

Open Access has come a long way, but particularly in the social sciences and humanities there is a need for more publishers and editors. Technology platforms, software, business models and start-up funds are available for OA journals. Scholars will want reassurance that OA will deliver (Rowlands 2004, Swan 2004):

- Superior literature awareness tools;
- Reduced and defrayed costs;
- Enhanced registration of knowledge claims.

Literature awareness tools

Impact factor rankings and citation counts are crude impact measures. When paradigms are settled, research programmes clarified and results are being accumulated, then this crude measure may serve as a proxy for influence. Yet in the social sciences and humanities this scenario is not a frequent occurrence. Therefore one would be much more cautious to infer influence or even quality from citation counts. All that can be said reliably is, that ISI with its impact factor ranking has created a framework for a winner-takes-all contest. The result is self-reinforcing as a hierarchical stratification of journals emerges, in which one would expect the impact factor of the journal to correlate with the prestige of authors' institution.

OA publishers and services offer better alternatives. Already when it comes to impact measures, OA offers a more differentiated picture by being able to distinguish between views, downloads and citations, the difference between

which may also constitute valuable feedback for the author. Furthermore, RePEc has developed a recursive impact factor that includes working paper series (WPS). In economics, academic WPS outrank the corporate journals.

More opportunities for the development of literature awareness tools are offered by open, documented and/or signed peer reviews. Literature awareness here is premised on the active participation of the scholarly community, but if this happens, readers have access to a live and ongoing literature review in a way that (double-)blind peer review will never offer.

Yet OA truly comes into its own with advanced literature awareness tools such as those pioneered by Living Reviews and Faculty of 1000. Consider how a Living Reviews article with active hyperlinks to publications and data in OA is superior to the corporate model in terms of efficiency, inclusiveness and the quality of information conveyed. Faculty of 1000 offers the same gains. But the two services differ substantially in the added value they offer. Faculty of 1000 provides ongoing commentary and guidance on a weekly basis, while Living Reviews offers medium-term appraisals of research fields.

As Open Access becomes the standard academic publishing model a level and competitive field of innovation emerges for all kinds of new tools that will aid scholars in retrieving, evaluating and utilising publications and data.

Reducing and defraying costs

If subscribers are not paying the costs of publishing, someone else must. A first option is to charge for publishing. In STM the costs of publishing are charged to research grants, institutions and governments. Nominally, the costs are charged to the authors. Yet the social sciences and humanities suffer from a relative paucity of research grants. Moreover, authors frequently are not members of academic institutions. Further still, single-authored papers are the standard. Therefore, in the social sciences author charges would not go such a long way towards covering the costs. However, Denmark and Norway have signed countrywide agreements with BioMed Central. In return for 'national' membership all publication charges for authors from these countries are waived. This is the first possible solution: countries agree to pool resources to fund the costs of publishing on the condition that the publisher disseminates articles in OA mode.

A second option would be to exploit technology and e-publishing innovations to reduce costs as much as possible while aiming for economies of scale. This would entail centralising functions and running e-print repositories, knowledge exchanges and e-journals as efficiently as possible, including automation whenever possible (as OA services already routinely do). Structurally this would leave open a space of innovation in the competition between platforms to provide services to readers and authors.

A third option would be to defray costs by raising an endowment to guarantee that publication charges may be waived in case of institutional and individual hardship. OA publishers that charge for publication (like PLoS and BioMed Central) have a policy to waive charges for low-income countries and for independent scholars.

A fourth option would be to ask library associations, national e-grids and universities to host as much data as possible and to take over the archiving in full. Important in this context is that RePEc demonstrates the feasibility of an 'overlay' service. RePEc has no central server, only one designated server to which authors who do not have access to an institutional repository may submit. A combination of an endowment to cover the publishing process while the actual publication is hosted and stored in an institutional repository would minimise the costs to authors – somewhere close to zero.

Essential to OA is the reduction and defraying of costs. Costs may be reduced in a digital and automated publishing process. Costs may be defrayed by spreading them between scholarly institutions and funding agencies, authors and libraries. Circumstances will vary, but publishers have shown the way, like

- SSRN, which channels revenues towards system development and user services and does not pay dividends to shareholders;
- JSTOR, which charges libraries a one-off joining fee to fund the digitalization of paper journals and then asks for contributions from libraries to cover its operating costs;
- BioMed Central, a commercial publishing house, nominally charges the author, but effectively is funded by the authors' institutions and patrons, while fees are waived for authors from low-income countries and those without sufficient funds.

Enhanced registration of knowledge claims

In the social sciences and humanities a concern for certification and quality standards is often observable. It is interesting to note, that neither arXiv nor SSRN fuss over quality. They ascertain that submissions meet academic standards and reserve the right to refuse a paper. But they leave the more detailed evaluation of a paper's significance and quality to scholarly communication. ACP [with D] has formalised this approach with a quick first check of every submission for relevance and quality, followed by systematic exposure in an open review process.

OA repositories that date submissions are the best way to publicly establish a claim to knowledge and to priority. Scholars seek protection against plagiarism. Online OA repositories facilitate the tracking down of theft-of-authorship. But scholars do hope that colleagues, students and practitioners will 'steal' their ideas – that is to read, cite and use their work. Scholars are not interested in preventing anyone from downloading the text or making a photocopy. That is the promise of Open Access: To maximise distribution and impact.

URLs of surveyed innovative moves

arXiv

<http://arXiv.org/>

Atmospheric Chemistry and Physics

<http://www.copernicus.org/EGU/acp/acp.html>

Berkeley Electronic Press

<http://www.bepress.com/>

Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities

<http://oa.mpg.de/openaccess-berlin/berlindeclaration.html>

Biomed Central

<http://www.biomedcentral.com/>

Budapest Open Access Initiative

<http://www.soros.org/openaccess/>

Creative Commons

<http://creativecommons.org/>

Directory of Open Access Journals:

<http://www.doaj.org>

DSpace@MIT

<https://dspace.mit.edu/index.jsp>

Faculty of 1000

<http://www.facultyof1000.com/>

Journal of Interactive Media in Education (JIME)

<http://www-jime.open.ac.uk/>

JSTOR

<http://www.jstor.org/>

Living Reviews

<http://www.livingreviews.org/>

Open Access News

<http://www.earlham.edu/~peters/fos/>

OpenCourseWare at MIT

<http://web.mit.edu/ocw/>

Public Library of Science (PLoS)

<http://www.plos.org/>

Research Papers in Economics (RePEc)

<http://repec.org/>

Scholarly Publishing and Academic Resources Coalition (SPARC)

<http://www.arl.org/sparc/>

Social Science Research Network (SSRN)

<http://www.ssrn.com/>

References

- Bachrach, S. et al. (1998) Who should own scientific papers?' *Science* 281, 1459-1460
- Bailey, C.W. (2005) Open Access Bibliography. Liberating Scholarly Literature with E-Prints and Open Access Journals. Association of Research Libraries - <http://www.escholarlypub.com/oab/oab.pdf>
- Bergstrom, T.C. (2001) Free Labor for Costly Journals? *Journal of Economic Perspectives* 15(4), 183-198
- David, P. (2004) Can 'Open Science' Be Protected from the Evolving Regime of IPR Protections? *Journal of Institutional and Theoretical Economics JITE*, 160(1), 9-34
- Edlin, A. and Rubinfeld, D. (2004) Exclusion Or Efficient Pricing? The "Big Deal" Bundling Of Academic Journals. *Antitrust Law Journal* 72(1), 119-157
- Gibbons, M. and B. Wittrock eds. (1985) *Science as a Commodity. Threats to the open community of scholars.* Harlow: Longman
- Ginsparg, Paul (2003) Can Peer Review be better focused? Working paper - <http://arXiv.org/blurb/pg02pr.html>
- (2004) Scholarly Information Architecture, 1989-2015. *Data Science Journal* 3(4), 29-37
- Guedon, J.-C. (2001) In Oldenburg's Long Shadow: Librarians, Research Scientists, Publishers, and the Control of Scientific Libraries. *American Research Libraries Proceedings* 138
- Houghton, J. (2002) The crisis in scholarly communication: an economic analysis. Working paper - <http://www.vala.org.au/vala2002/2002pdf/16Houton.pdf>
- Kling, R. (2003) The Internet and Unrefereed Scholarly Publishing. In: B. Cronin (ed.) *Annual Review of Information Science and Technology* 38, 591-631
- and Spector, L. and McKim, G. (2002) Locally Controlled Scholarly publishing via the Internet: The Guild Model. *The Journal of Electronic Publishing* 8(1) - <http://www.press.umich.edu/jep/08-01/kling.html>
- Krichel, T. and Zimmermann, C. (2005) The Economics of Open Bibliographic Data Provision. Working Paper - <http://eprints.rclis.org/archive/00003117/>
- Lessig, L. (2002) *The future of ideas: the fate of the commons in a connected world.* New York: Vintage Books
- McCabe, M. (2002) Journal pricing and mergers. a portfolio approach. *American Economic Review* 92, 259-269
- (2004) Information goods and endogenous pricing strategies: the case of academic journals. *Economics Bulletin* 12(10), 1-11
- Merton, R.K. (1942) *The Ethos of Science*, republished in: *On Social Structure and Science*, ed. P. Szotompa (1986) Chicago: University of Chicago Press
- Mruck, K. and Gersmann, G. (eds.) (2004) *New Media in the Humanities. Electronic Publishing and Open Access: Current State and Future Perspectives.* Historical

- Social Research 29(1)
- Nelson, R.R. (2004) The market economy, and the scientific commons. *Research Policy* 33, 455-471
- Nentwich, M. (2001a) (Re-)De-Commodification in Academic Knowledge Distribution? *Science Studies* 14(2), 21-42
- (2001b) How online communication may affect academic knowledge production. Some preliminary hypotheses. *Trans* 10
 - (2006) Cyberscience. Modelling ICT-induced changes of the scholarly communication system. *Information, Communication & Society* 8(4), 542-560
- Pöschl, U. (2004) Interactive journal concept for improved scientific publishing and quality assurance. *Learned Publishing* 17(2), 105-113
- Rose, M. (1993) *Authors and owners: the invention of copyright*. Cambridge, MA: Harvard University Press
- Rowlands, I. et al. (2004) *Scholarly Communication in the Digital Environment: What Do Authors Want? Findings of an International Survey of Author Opinion: Project Report*. London (City University): Centre for Information Behaviour and the Evaluation of Research
- Smith, A.P. (2000) The Journal as an Overlay on Preprint Databases. *Learned Publishing* 13(1), 43-48
- Swan, A. and Brown, S. (2004) *JISC/OSI Journal Authors Survey Report*. Truro: Key Perspectives Ltd - http://www.jisc.ac.uk/uploaded_documents/JISCOAreport1.pdf
- Stephen, T. and Harrison, T.M. (2002) Building Systems Responsive to Intellectual Tradition and Scholarly Culture. *Journal of Electronic Publishing* 8(1) - <http://www.press.umich.edu/jep/08-01/stephen.html>

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