The Open Access Initiative: A New Paradigm for Scholarly Communications

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This paper gives an account of the origin and development of the Open Access Initiative (OAI) and the digital technology that enables its existence. The researcher explains the crisis in scholarly communications and how open access (OA) can reform the present system. OA has evolved two systems for delivering research articles: OA archives or repositories and OA journals. They differ in that OA journals conduct peer review and OA archives do not. Discussion focuses on how these two delivery systems work, including such topics as OAI, local institutional repositories, Eprints self-archiving software, cross-archives searching, metadata harvesting, and the individuals who invented OA and organizations that support it.

The scholarly communications crisis has become a major concern in the academic and research community. Libraries across the board are undergoing significant budget shortfalls caused by increases in the numbers and costs of peer-reviewed journals. At issue is commercial publishers' policy of turning scholarly research into a commodity and raising subscription rates to levels that cannot be absorbed by library budgets. This has the effect of keeping professional publications out of the reach of users. A worldwide effort is underway to address this scholarly communications crisis. A new paradigm has emerged that will realign scholarly journals to their traditional role of free information created for the public good. This paper explores the origins and development of the Open Access Initiative (OAI), which enables a more socially responsible and equitable way of disseminating scholarly communications.

Scholarly communications as a system

The process of scholarship depends on the free exchange of information, from disseminating the latest research findings to preserving them for future use. Built into this system are standards for evaluating research by way of editorial boards of scholarly journals made up of scholars who determine who and what gets published based on merit alone. Also built into this system is the willingness of the creators of this research to submit their articles free of charge and the willingness of editors and referees to peer-review the articles also without a fee. Costs are incurred in printing and publishing the journals, rather than in the payment of royalties or fees to the writers or editors.[1] Scholars publish their research in peer-reviewed journals not for financial, but for professional, gain. The more work one publishes in these venues, the greater one's opportunities for tenured faculty positions and research grants. Publishing potentially exposes one's ideas to a wide audience and can yield impact and professional recognition.

The system of scholarly communications that has existed for hundreds of years consists of research and other scholarly writings created free of charge, edited or peer-reviewed also free of charge, printed and published at cost, and sold to libraries and research institutions for dissemination.[2] Functionally, the system can be viewed as having six parts: creation, quality control, production, distribution, consumption, and support.[3] Creation, the key function of the model, is the domain of scholars. Quality control, the editorial process through rigorous peer review, is also the responsibility of scholars. Production is the job of the publishers. Distribution is handled by both libraries and publishers, with libraries disseminating the finished publication to most readers. Consumption is also the domain of scholars along with students and nonscholars. Underlying the system is the support provided by institutions, such as universities, governments, granting institutions, and taxpayers.[4]

More scholarly research published

An explosion in scholarly research and information began in the 1960s and 1970s, brought about by increased federal spending in support of higher education, and resulting in great advances in science and technology.[5] A bonanza of federal research dollars flowed into educational institutions during the Cold War and its aftermath, and university faculties grew because of expanded enrollments. Many universities aspired to and won research status. The pressure intensified on faculty to publish and to obtain research support through grants. As a result, the quantity of research grew beyond the capacity of the scholarly publication system, which was then still dominated by scholarly societies.

Enterprising commercial publishers became interested in the potential profits to be made from publishing in the context of a well-established creative source and an equally well-established pattern of consumption. Scholarly societies offloaded journals to commercial

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publishers. Existing journals expanded and new journals were formed until a majority of the market was in the hands of commercial publishers. Eventually, scholarly communication became a multibillion dollar international business. By the end of the twentieth century, "ownership of information—ownership of content created by scholars and then given away by them—had become the linchpin of a huge and profitable industry."[6] Initially faculty benefited by "hav[ing] an increasing pool of publications that enhanced their chances to win tenure and promotion both through publication and through other opportunities, such as appointment to editorial boards."[7]

By the mid-1980s, commercial publishers began a process of consolidation and mergers that enabled them to gain monopolies on all publishing in their designated fields, particularly the journals in science, technology, and medicine (STM). Along with these monopolies came subscription hikes beyond inflation and cost of living increases. Profit margins grew by 20 to 40 percent per year, pacing the levels of luxury market goods such as fine jewelry, yachts, and expensive cars. The Association of Research Libraries' (ARL) 1999 data show the Science Publishing Division of Reed Elsevier, operating with a 35 to 40 percent profit margin.[8] "During the period 1990–2000, the average journal subscription price increased by more than 10 percent per year for a ten-year total increase of nearly 170 percent."[9]

The price hikes impacted library budgets. For libraries to keep a constant level of serial subscriptions while prices are rising, they have to cut back in other areas. ARL statistics show an annual average increase in serial costs ranging from 8 to 10 percent from 1994 to 1998.[10] While the average ARL library managed to keep constant the level of serial subscriptions, reductions had to be made elsewhere in the collections, mostly in the purchase of monographs. By 2000 and beyond, libraries could no longer maintain the constant level of serials subscriptions and began a steady cutback in subscriptions in addition to paying more for the journals to which they continued to subscribe.

▌ The subversive proposed

Scientists, scholars, and librarians began fighting back. The idea of a new paradigm emerging in a post-Gutenberg era began to form, enabled by Internet technology, with the aim of shifting the control of knowledge resources away from commercial publishers and back to scholars, who are now reclaiming ownership and copyright of their work.

In 1994, Stevan Harnad posted "A Subversive Proposal" to the discussion list VPIEJ-L based at Virginia Poly-technic Institute, a list devoted to "electronic journals."[11] Harnad, Professor of Cognitive Science at Princeton University and the University of Southampton, United Kingdom, was for many years a researcher and editor of *Behavioral and Brain Sciences*, a journal published by Cambridge University Press. In 1990, he introduced *Psycoloquy*, the first peer-reviewed scientific journal on the Internet, and in 1997, the Cognitive Sciences Eprints Archive.[12] In 1998, he started the American Scientist Open Access Forum, a high-volume discussion list concerned with open access (OA) and open archives.[13]

Harnad's proposal was the inspiration for OAI.[14] He suggested that scholars publish their preprints of unpublished, unrefereed, original work on a globally accessible archive, freely available to scholars with network access anywhere in the world. When a work is formally published, scholars will substitute the published work for the preprint. Harnad made the point that scholars need not withdraw preprints from public viewing after refereed versions are accepted for paper publication. Once this process becomes common, journal publishers will then be forced to restructure their costs for the electronic-only versions to be truer to actual costs, which he estimated to be 25 percent less than the paper page costs.[15] Harnad also suggested that the cost for local archiving be built into the cost of research and be paid in advance by the author or the funding agency rather than by the end user. If the current publishers did not restructure, a new generation of electronic-only publishers would take over the market.

The intention of "A Subversive Proposal" was to bypass restrictive copyright legally. Publishing unrefereed preprints by self-archiving before submitting the paper to a journal enables the author to negotiate to hold, rather than transfer, copyright. If the author holds copyright, the author would self-archive the refereed postprint. If the author loses copyright, the author would self-archive the corrigenda, the differences between the preprint and the postprint.[16] Either way, the article would be freely available and the author's research impact would continue unfettered. In Harnad's "post-Gutenberg galaxy," permission is not a barrier.[17]

The discussion that followed Harnad's proposal is recorded on a file transfer protocol (FTP) directory and in a book, published by ARL, titled *Scholarly Journals at the Crossroads: A Subversive Proposal for Electronic Publishing, An Internet Discussion about Scientific and Scholarly Journals and Their Future*.[18] Several benefits would accrue from electronic publishing. Researchers would benefit by increasing impact. The scholarly community would benefit by enabling free, unrestricted access to communications. Finally, libraries would benefit by redirecting the 10 to 30 percent savings on the serials subscriptions budget to quality control and certification activities such as peer review, editing services, and consortial support for institutional archives.[19]

◼ OAI repositories

By 1994, the scientific community had already used electronic files for archiving scientific literature. The first centralized archive, begun in 1991, was arXiv.org, a physics archive out of Los Alamos, New Mexico, now owned and operated by Cornell University.[20] With self-archiving, a digital document is deposited on a publicly accessible, institutional Web site. Until standards emerged that allowed for cross-archive searching, institutional repositories were not interoperable; hence, self-archiving did not guarantee research impact, a major reason scholars publish their findings.[21] Interoperability guarantees that any user anywhere in the world can search archives in repositories also located anywhere.[22] The technical breakthrough that makes this possible is Extensible Markup Language (XML).[23]

Interoperability involves a single Web interface where the depositor enters XML metadata tags for date, author name, title, and journal name, and then attaches the full-text document.[24] Full-text documents can be in different formats and locations, but the XML metadata tags make them interoperable. The interoperable interface was developed by the international OAI. The software that supports cross-archive interoperability is GNU Eprints developed at Massachusetts Institute of Technology (MIT) and the University of Southampton.[25] GNU (pronounced "guh-noo"), developed by the GNU Project at MIT in 1985, is a free operating system that is compatible with UNIX.[26] Free software means the user is free to run, study, distribute, and improve the program. Eprints software unifies the open archives system.

In 1999, OAI convened in Santa Fe, New Mexico, to work out "a technical and organizational framework to support basic interoperability among Eprints archives."[27] The framework instituted OAI compliance, enabling interoperability among Eprints archives so that all can be harvested, integrated, navigated, and searched seamlessly as if they were all in one global archive.[28] Standardized protocols for metadata harvesting enable users to search a virtual archive through such cross-archive search engines as ARC Cross Archives Search Service and OAIster, and to retrieve documents from university or institutional archives distributed throughout the world, eliminating the need for a single, searchable centralized archive.[29]

OAI established a registry for OAI-compliant, distributed archives using Eprints software.[30] To participate in this network, any individual or institution running a UNIX operating system can download Eprints software for free, set up a self-archiving repository, and register with OAI. Their local archives then become searchable worldwide.[31] Using this system, universities set up electronic theses and dissertations repositories on which students and faculty publish theses and dissertations, such as the Electronic Theses and Dissertations Archive at Virginia Polytechnic Institute and State University.[32] Each institutional repository becomes its own open archive within a worldwide OAI resource of refereed research literature.[33]

◼ Libraries support OA journals

As Harnad predicted, a new form of peer-reviewed, research publication emerged as OA, electronic-only journals. In 1998, ARL launched the Scholarly Publishing and Academic Resources Coalition (SPARC), an alliance of university research libraries and organizations. SPARC addresses the high cost of scholarly journals by supporting competitive and OA repositories. SPARC's goal is to expand information dissemination using a networked digital environment by helping existing journals adopt an OA format and by forming partnerships with new journals to get them started.[34]

SPARC's agenda focuses on three strategic pursuits: incubation, advocacy, and education, for which it has developed an arsenal of resources.[35] The Publisher Partners programs set up partnerships for incubating new journals and converting existing ones to OA. Alternative Partnerships set up competitive alternatives to existing high-priced titles, especially the STM trio. Scientific Community Partnerships develop nonprofit information portals that serve specific scientific communities, such as the Directory of Open Access Journals.[36] Leading-edge Partnerships create new, peer-reviewed, electronic journals that compete with traditional STM proprietary journals; *Public Library of Science* (*PLoS*), *New Journal of Physics*, and *BioMed Central* are examples.[37] *PLoS* now publishes three journals that "compete head-to-head with the leading existing publications in biology and medical research publishing the best peer-reviewed original research articles": *PLoS Biology*, *PLoS Medicine*, *PLoS Computational Biology*, with *PLoS Genetics* and *PLoS Pathogens* commencing in 2005.[38]

In 1999, SPARC launched the Create Change campaign as its advocacy and education arm. Create Change works with university faculty and librarians to build momentum to further the cause of OA by providing information and resources on its Web site. Designed for librarians and scholars, the site features resources pertaining to the scholarly communications crisis, including graphs that show rising costs for journals, information about intellectual property rights, and alternative models for scholarly communications. The site provides librarians with an advocacy kit that includes PowerPoint presentations and brochures that summarize the issues; scholars are provided sample letters of resignation from board membership and refusal-to-referee letters in protest of publishers' pricing policies.[39]

OA gains momentum

The Budapest Open Access Initiative (BOAI) of 2002 was a milestone in the OA movement in that it unified, in a single statement and under a common name and purpose, the different terms that the many groups used for the same idea, some of which are the following: Free Online Scholarship (FOS), Scholarly Communication Initiative, Immediate Free Web Access, Refereed Literature Liberation Movement, Intellectual Property Conservancy. BOAI advocates OA for scholarly journal articles and elicits signatures from individuals and institutions at its Web site.[40] Its parent organization, the Open Society Institute, was founded with a $3 million donation by the Hungarian financier George Soros, and is active in persuading foundations and other organizations to donate resources.[41] BOAI endorses two strategies for achieving the goal of OA to scholarly journal literature: institutional repositories that use the metadata tagging standards created by OAI, and the creation and nurturing of OA journals.[42]

Peter Suber, one of the original BOAI signatories, has become an OA spokesperson through his positions as senior researcher with SPARC and OA project director for Public Knowledge, a Washington, D.C.–based advocacy group concerned with digital policy issues.[43] Suber was recently on a panel of speakers presenting "Open Access: Evaluating Quality and Participation," at the 2005 Special Library Association Annual Conference in Toronto, where discussion centered on citation analysis in OA journals, self-archiving, and engaging faculty in OA publishing.[44] Now editor of the *SPARC Open Access Newsletter (SOAN)*, Suber, also professor of philosophy at Earlham College, Indiana, founded the *Free Online Scholarship (FOS) Newsletter* in 2001. In 2003, Suber brought *FOS* under the SPARC umbrella and added a daily OA news weblog to which others can contribute.[45] The newsletter Web site has virtually unlimited pages, an excellent frequently asked questions (FAQ) section, a glossary of terms, a timeline of the history of the OA movement, articles on where the movement stands today, the *FOS* and *SOAN* archives, and links to conferences and other sites involved in the movement.[46] One of Suber's contributions has been introducing OA to scholars and librarians from the humanities, social sciences, and the arts.

In a 2003 article titled "Removing Barriers to Research," Suber argues the major thesis of OAI: both the serials pricing and permission crises can be solved by OA, first because "it is free of charge to [users, and] second [because] copyright holder[s] consent in advance to unrestricted reading, downloading, copying, sharing, storing, printing, searching, linking and crawling" of OA articles.[47] Suber argues if scholars retain copyright to their work, then they consent to give users OA to research articles for which they expect no payment. If scholars transfer the copyright to the traditional publisher, then the publisher will erect price and permission barriers to prevent OA.[48] Suber asserts that OA is ideal for this unique form of literature—refereed, scholarly articles—and works because scholars retain copyright.[49] Scholars seek impact and exposure, which unrestricted publishing provides. They therefore benefit by consenting in advance to unrestricted copying of their work. The motive for publishers is profit, whereby access restrictions and costs are intertwined.

Suber's 2003 article was followed by a white paper published by Association of College and Research Libraries (ACRL), "Principles and Strategies for the Reform of Scholarly Communication," which spearheaded ACRL's Scholarly Communication Initiative.[50] This initiative became the central focus of the ACRL Issues and Advocacy Forum and remains so today, evidenced by "Scholarly Communications 101," ACRL's preconference workshop at the 2004 American Library Association Annual Conference.[51] The initiative works in partnership with other library and higher education organizations to encourage reform of the system and broaden involvement by academic libraries.[52]

Another major player is the World Summit on the Information Society (WSIS), a United Nations–sponsored working group concerned with closing the gap in scientific information between have and have-not nations.[53] OA is one concern of WSIS. WSIS advocates OA as a move toward removing access barriers comparable to removing political and economic boundaries, such as the European Union. The WSIS Web site is probably the definitive site on OA, combining all other sites into a clearinghouse of information on all aspects of the OA movement: technology, legal issues, worldwide conferences, projects, journals, statistics, current news, and archives of articles about OA from all over the world.[54]

Conclusion

OA signifies the democratization of knowledge and supports a socially responsible way to distribute knowledge. OA makes the same knowledge and information available to scholars in wealthy, first-world nations, in developing ex-communist, second-world nations, and in underdeveloped third-world nations. OAI and the existence of open archives repositories are evidence of growing desires, worldwide, for an equitable and democratic distribution of information resources between have and have-not nations, and here within the United States, for a more sensible allocation of limited tax dollars, so that those who fund the research get the benefits of the research freely and without additional payment. OA

archives and journals are evidence that the world is moving in the direction of democratization of information and knowledge by removing access restrictions in the form of copyright protection or fee-based dissemination policies. Individual scholars must decide when and how to maintain copyright of their articles and where to publish their research.

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