Open Access and Libraries

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What Is Open Access?

Conventional fee-based publishing models fragment worldwide scholarly journal literature into numerous digital enclaves protected by various security systems that limit access to licensed users. What would global scholarship be like if its journal literature were freely available to all, regardless of whether the researcher worked at Harvard or a small liberal arts college, or he/she was in the United States or Zambia? What would it be like if, rather than being entangled in restrictive licenses that limited its use, journal literature was under a license that permitted any use as long as certain common-sense conditions were met? This is the promise of open access (OA). Needless to say, there are many challenges in involved in trying to achieve this bold vision, and it is not embraced, or even viewed as being feasible, by all parties in the scholarly communication system. Without question, open access has significant implications for libraries, especially academic libraries.

For electronic resources librarians, "open access" raises a variety of questions. What is OA? Is it different from free access, or is it the same? What is a Creative Commons License, which some OA providers use? What's an "e-print"? Are there different types of e-prints? What is "self-archiving"? What are the different ways that e-prints are made publicly available? What's an open access journal? Are there different types of OA journals? How can OA journals be made available at no cost? How do you search for OA materials? Why is OA desirable? Will OA flourish or fail? How will OA affect library collections and services? What can libraries do to support OA and to integrate OA materials into their collections? How will OA affect library budgets, especially collection budgets? How will OA affect electronic resources librarians' jobs?

Open Access Definitions

Budapest Open Access Initiative

Although there are important historical precedents that noted open access advocate Peter Suber outlines in his "Timeline of the Open Access Movement,"[1] the open access movement's "constitutional convention" was in December 2001 at a meeting in Budapest convened by the Open Society Institute. The resulting statement of this meeting, the "Budapest Open Access Initiative," was made public in February 2002. It still stands as the most important definition of open access. The key passage from the BOAI is:

> The literature that should be freely accessible online is that which scholars give to the world without expectation of payment. Primarily, this category encompasses their peer-reviewed journal articles, but it also includes any unreviewed preprints that they might wish to put online for comment or to alert colleagues to important research findings. There are many degrees and kinds of wider and easier access to this literature. By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited. . . .
>
> To achieve open access to scholarly journal literature, we recommend two complementary strategies.
>
> I. Self-Archiving: First, scholars need the tools and assistance to deposit their refereed journal articles in open electronic archives, a practice commonly called, self-archiving. When these archives conform to standards created by the Open Archives Initiative, then search engines and other tools can treat the separate archives as one. Users then need not know which archives exist or where they are located in order to find and make use of their contents.

> II. Open-access Journals: Second, scholars need the means to launch a new generation of journals committed to open access, and to help existing journals that elect to make the transition to open access. Because journal articles should be disseminated as widely as possible, these new journals will no longer invoke copyright to restrict access to and use of the material they publish. Instead they will use copyright and other tools to ensure permanent open access to all the articles they publish. Because price is a barrier to access, these new journals will not charge subscription or access fees, and will turn to other methods for covering their expenses.[2]

The Bethesda Statement on Open Access Publishing

In April 2003, a second influential meeting was held at the Howard Hughes Medical Institute in Chevy Chase, Maryland. This meeting resulted in the "Bethesda Statement on Open Access Publishing," which further refined the definition of open access. Since the BOAI definition was in place, the Bethesda Statement did not recap all the characteristics of open access literature. Rather, it stated that an open access work meets two criteria:

> 1. The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual 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, 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 a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving (for the biomedical sciences, PubMed Central is such a repository).[3]

Note that, in contrast to the BOAI, the Bethesda Statement introduces the use of a license, specifies the creation of derivative works, and requires the deposit of open access works in digital repositories run by "well-established" organizations. The specification of "small numbers of printed copies" for personal use is also new.

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

The Berlin Declaration, which written as a result of the Conference on Open Access to Knowledge in the Sciences and Humanities in October 2003, is very similar to the Bethesda Statement, with only minor additions and word changes in its definition.

> 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.[4]

Analysis of Open Access Definitions

Suber refers to the BOAI, Bethesda Statement, and Berlin Declaration, which he considers to be the "major public definitions of 'open access'" as the "BBB definition of open access." [5]

Let's examine key aspects of the BBB definition in more detail.

Open Access Literature Is Freely Available

While open access advocates may dispute some other aspects of the essential characteristics of an open access work, they are fully unified in believing that free availability is a mandatory characteristic. Suber states that "this is the element that catalyzed the open-access movement." [6] He indicates that providing free access removes "price barriers."[7]

Open Access Literature is Online

Open access literature is "online."[8] The unique economics of digital publication, which entail minimal distribution costs after first copy production costs are met, are necessary for open access to be feasible. The Internet, the Web, and related digital publishing developments have made open access possible. However, as we shall see, for-fee print publications may be used to supplement online open access publications.

Open Access Literature Is Scholarly and Royalty Free

Open access only deals with unpaid, scholarly works (Suber calls this "royalty-free literature"[9]). Typically, scholars are not paid to write journal articles. They do so to for both selfless (contribute to the growing body of knowledge) and self-interested (career advancement) reasons. Open access literature includes journal articles that are published and unpublished (i.e., preprints).

While the BBB definition excludes textbooks, scholarly monographs, or other works that scholars are paid for, Suber has suggested that providing open access to "royalty-producing literature" may be possible as part of a potential future three-phase development of the open access concept:

> Phase 1: Provide OA to royalty-free literature and to all other content for which there is already permission. This includes public domain content and content for which the copyright holder already consents to OA or would consent after a little education. . . .
>
> Phase 2: Provide OA to royalty-producing literature and to content for which copyright holders are not yet consenting to OA. Since OA to copyrighted content must be consensual, this will require persuasion. . . .

> Phase 3. Enlarge and protect the public domain by rolling back copyright term extensions and assuring that federal copyright law preempts state contract or licensing law. Make permission-seeking less often necessary by establishing the first-sale doctrine for digital content and restoring fair-use rights denied by copy-protection technologies. If Phase 2 persuades copyright holders to reevaluate their interests, then Phase 3 persuades legislators to revise copyright law. Successes at Phases 1 and 2 would make Phase 3 largely unnecessary, and vice versa. . . .[10]

Open Access Literature Can Be Used With Minimal Restrictions

Open access goes well beyond simply making journal literature freely available: it must also be able to be used for any purpose as long as there is correct attribution and the integrity of the work is maintained.[11] Consequently, scholars, students, and other users do not need to seek permission to utilize open access works as they choose. Nor do they make payments to do so. This is a radical departure from conventional publishing, where use rights are constrained by hard-to-determine fair-use copyright provisions, restrictive publisher license agreements, and permissions fees.

Suber characterizes this aspect of open access as removing "permission barriers," and he states:

> Permission barriers are more difficult to discuss than price barriers. First, there are many kinds of them, some arising from statute (copyright law), some from contracts (licenses), and some from hardware and software (DRM). They are not like prices, which differ only in magnitude. Second, their details are harder to discover and understand. Third, different users in different times, places, institutions, and situations can face very different permission barriers for the same work. Fourth, authors who deposit their articles in open-access archives bypass permission barriers even if they also publish the same articles in conventional journals protected by copyright, licenses, and DRM. Finally, some rights may be retained by authors without interfering with open access, such as the right to block distribution of a mangled or misattributed copy of the work. So permission barriers do not arise from retaining rights as such but only from retaining some rights rather than others. For all these reasons, the literature on open access is rarely as clear and careful on permission barriers as it is on price barriers.[12]

The Creative Commons offers six main licenses that could be used to operationalize the minimal use restrictions envisioned in the BBB definition.[13] Aside from legal jurisdiction and format considerations, there are two key factors that differentiate these licenses: (1) whether commercial use is allowed, and (2) whether derivative works are allowed, and, if so, whether these derivative works must be under the same license as the primary work. For example, the Attribution License allows users to "copy, distribute, display, and perform the work"; "to make derivative works"; and "to make commercial use of the work" as long as they "attribute the work in the manner specified by the author or licensor" and "for any reuse or distribution" the user "must make clear to others the license terms" of the work.[14] By contrast, the Attribution-NonCommercial License has all of the Attribution License's provisions, but forbids commercial use without permission, and the Attribution-NoDerivs License has all of the Attribution License's provisions, but forbids derivative works.

There are a variety of other licenses, such as the GNU Free Documentation License, that might be also used to provide open access.[15]

It should be noted that this removal of permission barriers through Creative Commons or similar licenses is not the same thing as putting the work in the public domain. In the former, the author or publisher retains copyright then, through a license, grants users specific rights. In the latter, the author or publisher relinquishes the copyright to the work completely, and there are no restrictions of any kind on its use.

Suber has underlined the importance of removing permission barriers in the BBB definition:

> All three tributaries of the mainstream BBB definition agree that OA removes both price and permission barriers. Free online access isn't enough. "Fair use" ("fair dealing" in the UK) isn't enough.[16]

Nonetheless, removing permission barriers is a controversial requirement within the open access movement. Prominent open access spokesman Stevan Harnad has debated this requirement at length in the American Scientist Open Access Forum mailing list and in other venues, asserting that open access simply requires: "free, immediate, permanent access to refereed-article full-texts online."[17] In one message, he notes that his definition has been criticized because it omits reuse and redistribution criteria and does not make reference to the Creative Commons Attribution License, and then he states:

> And what is meant by "redistribute" when the text is already distributed all over the planet on the web, and freely available to anyone who may wish to find, search, read, download, process computationally online or offline, and print off anywhere in the world, any time?
>
> Could this "reuse" and "redistribute" right perhaps be a spurious holdover from another medium—the Gutenberg medium, print-on-paper—where "re-use" of a printed text meant re-use in *another* printed text (i.e., republication), and "redistribution" meant the distribution of that other printed text? But why on earth would anyone want to bother doing that in the PostGutenberg era, when *everyone* already has access to the text, and each can print it off directly for himself?
>
> Collected works? That's just a list of URLs in the PostGutenberg era.
>
> And that's where it stops. My text is not like data or software, to be modified, built upon, and then redistributed (perhaps as your own). You may use its content, but you may not alter it and then distribute the altered version, online or on-paper.[18]

Open Access Strategies: Self-Archiving and Open Access Journals

Open access can be accomplished through two complementary strategies: self-archiving and open access journals.

Self-Archiving of E-Prints

"Self-archiving" refers to making "e-prints" available on the Web. An e-print is either a digital preprint or a postprint.

The typical preprint is an article that has been (or is intended to be) submitted to a scholarly journal for peer review and editorial acceptance and editing. However, the term is also commonly used to refer to articles submitted to serials that do not conduct peer review and to articles that will never be submitted to any serial.

A postprint is the final version of an article, which reflects changes made during the peer review and editorial process. It can either be the publishers' digital version or a preprint that the author has modified to mirror the publisher's changes. The author may, for legal reasons, chose to append a list of changes (errata) to the original preprint rather than incorporating those changes in the body of the document.

E-prints are typically made available in one of primary four ways: (1) the author's personal Website; (2) a disciplinary archive that includes works by authors worldwide about one or more subjects; (3) an institutional e-print archive that includes e-prints by authors in a single academic unit, such as a department, or the entire institution; or (4) an institutional repository that includes diverse types of digital works (e.g., data sets, electronic theses and dissertations, presentations, and technical reports), including e-prints, by authors at a single institution.[19] Of course, given the flexibility of digital archiving tools and the inventive imagination of their users, there are other variations on the theme. For example, there are academic unit archives that include diverse types of works. A wide variety of free open source software is available to support digital archives and institutional repositories, and commercial vendors have begun to offer turnkey systems to support the latter.

Open access to e-prints rests on the foundation of copyright law. The copyright owner of the article, whether it is the author or the publisher, must permit open access to it. It should be noted that open access does not require that current copyright laws be changed.[20]

Historically, publishers have required that authors assign all rights to journal articles to them. However, authors still owned the rights to preprints that were created prior to the copyright transfer for the final, edited work, and this allowed them to make these preprints publicly available. Recognizing this, some journals have refused to publish articles if digital preprints of them were available; however, this practice appears to be dying out.

Primarily as a result of the open access movement, publishers are gradually becoming more open to letting authors retain copyright, with authors granting specific rights to publishers. Although many publishers still require a copyright transfer, most of them now have explicit policies that grant authors' specific rights to distribute their articles and to make other uses of them.

While these policies could hardly be characterized as uniform, they are often grouped by open access advocates in four broad classes in a taxonomy created by Stevan Harnad: "gold (provides OA to its research articles, without delay), green (permits postprint archiving by authors), pale green (permits, i.e. doesn't oppose, preprint archiving by authors), gray (none of the above)."[21] The SHERPA Project provides a very useful database of publishers' self-archiving policies.[22]

There is no uniformity in e-print copyright or license practices. E-Prints may have: (1) no copyright statement (under US law they are under copyright by default); (2) a conventional copyright statement; (3) a copyright statement that is modified by specific use provisions (e.g., liberal use permitted for noncommercial purposes); (4) a Creative Commons or other license, which may or may not permit commercial use or derivative works; or (5) another variation.

Consequently, the removal of permission barriers in e-prints is extremely variable, and, from a conventional BBB open access definition point of view, not as common as might be desired. To some extent, this is because the copyright statement is that of a non-OA publisher; however, author indifference or resistance to the permissions barrier issue are other common causes. In practical terms, open access to e-prints currently means *free* access.

Open Access Journals

Open access journals are e-journals that are freely available (some open access journals have supplementary fee-based print versions as well). They mirror the quality assurance practices of conventional journals, such as editorial oversight, peer review, and copy editing. The extent to which they have an organizational infrastructure similar to that of traditional publishers varies according to whether they are revenue generating (this includes both commercial and nonprofit publishers) or what I term "no profit," meaning they literally make no money from their publishing endeavors. The existence of fee-based add-on products, such as supplemental print versions, is another factor. As noted earlier, electronic-only publication offers some meaningful cost savings, since physical reproduction, storage, distribution, and claiming costs are eliminated.

Open access advocates recognize that it costs money to produce journals and that viable business models are required to accomplish this, even though they may be unconventional.[23]

There are a small number of young commercial (e.g., BioMed Central[24]) and nonprofit (e.g., Public Library of Science[25]) publishers, whose only function is to publish journals and who only use the open access business model (I will call these "Born-OA journal publishers"). These publishers use a variety of strategies to fund open access journals, but the key ones are author publication fees (grant agencies may pay such fees), library membership fees that subsidize author fees in whole or in part for authors affiliated with the library's institution, grants, and supplemental products (such as print versions). Author fees are usually waived in cases of financial hardship, leveling the playing field for less affluent authors, and author fees do not influence publication decisions.

Born-OA journal publishers typically let authors retain the copyright to their articles and use the Creative Commons Attribution License or a very similar license.

Biomedical journals from these publishers are usually archived in PubMed Central,[26] a digital archival run by U.S. National Institutes of Health, in addition to being archived at the publisher's site, ensuring perpetual access regardless of the financial health of the publisher. Given the Creative Commons Attribution License, any digital repository or archive that wanted to could also preserve these publications without asking permission.

Increasingly, conventional publishers are experimenting with publishing some open access journals or using a mix of traditional and open access models in their business. An example of this is the Oxford Open initiative of Oxford University Press, which uses full open access for some journals and "optional open access" for others (i.e., authors decide if they want to pay fees to make their articles open access, leading to journal issues that have a mix of restricted and OA content). [27] Author fees are reduced if the author's institution subscribes to the journal and/or if the author is from a developing country (for some developing countries, authors pay no fees). The license agreement is similar to a Creative Commons Attribution-NonCommercial License.

The precursors to today's open access journals were scholar-produced e-journals established in the late 1980s and early 1990s whose business model was to use volunteer labor and institutional resources to offer "no-profit journals." Examples of such journals are *EJournal*,[28] *New Horizons in Adult Education*,[29] *Psycoloquy*,[30] *PostModern Culture*,[31] and *The Public-Access Computer Systems Review*.[32] These journals typically also had very liberal copyright policies (e.g., allowed authors to retain their copyright and allowed noncommercial use).

Given the relatively informal publishing arrangements that "no profit" journals can operate under, a significant issue can be their sustainability. They may have no formal business plans or funding base, and their continued existence may be contingent on the ongoing enthusiasm and involvement of their founders.

While some of these journals have ceased publication or morphed into commercial journals, they demonstrated the viability of electronic journals at a time when it was in serious question and they offered a model for others to follow. And follow they did: scholars and nonprofit organizations have continued to establish and publish journals of this type to this day, and this task has been made progressively easier by the Web, declining hardware/software costs, increased hardware/software power, and the availability of open source e-journal publishing systems that provide editorial management and journal production functions. While all of these journals are freely available, their copyright and licensing practices vary widely, ranging from conventional (or no) copyright statements to using Creative Commons or similar licenses.

One size does not fit all when it comes to open access journal business models. There can be significant differences between STM journals and humanities/social science journals in terms of number of articles published per year, article submission and acceptance rates, the necessity for inclusion of high-end production features (such as high-resolution color graphics), and the impact of publication errors, and these factors influence production complexity and cost. Disciplinary differences can also affect scholars' receptiveness to open access options.

Sparked by Harnad, there is a lively debate in the open access movement about the relative merits of e-prints ("Green Road") versus open access journals ("Gold Road") as the best way to advance the cause: Harnad strong favors the "Green Road."[33]

Open Access Literature Metadata Can Be Harvested

Since open access literature is not hidden behind technical access barriers (such as IP restriction) its full text can be indexed and made accessible by conventional search engines; however, while very powerful, these search engines do not offer precise field-based searching of particular bibliographic elements, such as author. The e-prints in a digital archive or institutional repository are described by metadata records (typically in Dublin Core format) that provide such information and, using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH),[34] external search systems can retrieve this metadata using a standard protocol, combine it with metadata from other archives and repositories, and create composite databases that allow users to retrieve information about e-prints from diverse archives and repositories as well as retrieve the full text of e-prints of interest from those systems. Unfortunately, conventional author home pages on the Web do not have this capability, and this is a limitation of self-archiving e-prints in this way.

Why Open Access?

To a large degree, open access is a reaction to dysfunctions in the conventional scholarly communication system. Since many of its leaders have been scholars, it strongly reflects their concerns and perceptions. As such, it is not focused on dealing with the underlying causes of serials crisis and the scholarly publishing "knowledge explosion" (e.g., the proliferation of ever more specialized journals publishing an increasing number of articles), but rather on developing new scholarly communication strategies that will function effectively in that environment. Of course, there are also prominent open access advocates who are librarians, and they bring to the table strong concerns with fundamental scholarly publishing issues. While this has resulted in differences of perception, it has not caused any meaningful schisms in the movement.

For scholarship to advance, its global knowledgebase must be accessible so that it can be built upon. Although it is highly competitive, scholarship is, paradoxically, also highly cooperative. Scholars must compete with each other for jobs, publishing and presentation opportunities, grants, tenure, and other career opportunities. However, they must also be able to easily access and utilize other scholars work and to ensure that their own work is equally available for use by other scholars.

For scholars' careers to progress, other scholars must read, value, use, and cite their works. To be read, their articles must be visible to the scholarly community. If an article is published in a journal whose articles are highly cited, it is more likely to be visible. Consequently, a journal's "impact factor," as measured by bibliometric formulas (the key one being the Thomson ISI formula created by Eugene Garfield) is important, and the importance of scholars' articles are often judged by promotion and grant committees by the impact factors of the journals they were published in. [35]

However, under the conventional system, not even scholars at the most affluent research institutions in the world can be assured of having the access that they need, much less be assured that their peers worldwide will have such access.

Suber has characterized the its inadequacies of the conventional scholarly communication system and the resulting need for open access this way:

> It doesn't matter whether we blame unaffordable journals on excessive publisher prices or inadequate library budgets. If we focus on publishers, it doesn't matter whether we blame greed or innocent market forces (rising costs and new services). Blame is irrelevant and distracting. The volume of published knowledge is growing exponentially and will always grow faster than library budgets. In that sense, OA scales with the growth of knowledge and toll access does not. We've already (long since) reached the point at which even affluent research institutions cannot afford access to the full range of research literature. Priced access to journal articles would not scale with the continuing, explosive growth of knowledge even if prices were low today and guaranteed to remain low forever.[36]

While the focus of open access on journal articles is likely the result of the serials crisis making journals increasingly inaccessible, it also reflects the STM and social science background of some key open access advocates (the crisis is worse for STM faculty since they are heavily dependent on journal literature and their journals are very expensive) and the unique characteristics of journal literature itself that simplify transition issues: its royalty-free nature and its structural features (i.e., articles are short, discrete works and can be easily downloaded and printed). If humanists had mainly led the charge, there might be more emphasis on scholarly monographs, given their limited sales and the increasing difficulty in getting such works published, but the end-game problem of a pile of hundreds of unbound book pages would have remained—that problem is not easily solved without affordable, ubiquitous print-on-demand solutions that pop out books at low or no (due to being part of subsidized infrastructure) cost to the user.

With its current orientation, open access is designed to remedy the perceived failings of the traditional scholarly communication system. Open access always topples price barriers. Anyone anywhere in the world can freely access open access literature as long as they have Internet access (such network access is one of several barriers that open access can't remedy). Permission barriers also fall if the open access work is under an appropriate Creative Commons or similar license (or if the copyright holders' statement permits it).

The short version of the open access vision of a transformed scholarly communication system follows. It is certainly far more complex than this, and the reader is referred to the *Open Access Bibliography: Liberating Scholarly Literature with E-Prints and Open Access Journals* (especially sections 1.1 and 1.2) for more in-depth treatments.[37]

When both barriers fall, scholarly communication is transformed: the global knowledgebase is fully accessible on the Internet to users in both the developed and developing countries; scholarly works are fully visible to discovery tools such as search engines and OAI-PMH harvesters and are available for linking, increasing their likelihood of being found and being used by scholars; ease of discovery increases the probability that the OA works will have greater impact[38]; the creation of derivative works (as well as other new knowledge) is greatly facilitated; the use of scholarly works for instructional purposes is easy, convenient, and free of permission fees; the return on investment for scholarly research sponsored by governments, foundations, universities, and other funding agencies is maximized; and knowledge preservation is greatly enhanced because there are no legal obstacles that prevent it.[39]

Open access has a number of potential benefits for libraries, which will be discussed later.

Although open access is primarily aimed at solving key problems in the traditional scholarly communication system, its benefits are not confined to scholars and librarians because, despite it specialized nature, scholarly literature can be of potentially great utility to other users as well.

For example, Sharon Terry recounts her struggle to gain access to medical literature that might help her two children who suffer from pseudoxanthoma elasticum (PXE):

> We spent hours copying articles from bound journals. But fees gate the research libraries of private medical schools. These fees became too costly for us to manage, and we needed to gain access to the material without paying for entry into the library each time. We learned that by volunteering at a hospital associated with a research library, we could enter the library for free. After several months of this, policies changed and we resorted to masking our outdated volunteer badge and following a legitimate student (who would distract the guard) into the library.[40]

Although she and her husband had to teach themselves medical terminology to even read needed literature and faced major barriers to accessing it, they went on to establish a nonprofit organization devoted to PXE, and they discovered a key gene related to the disease and created a test to detect it. Admittedly, few people would be able to duplicate this feat; however, one does not need to look far to encounter average citizens who, when faced with a major medical crisis, try to conduct research that will help them overcome it.

The Difficulty of Assessing Open Access Impacts

As we saw in the earlier analysis of open access definitions, there is disagreement about whether the removal of price barriers is sufficient to achieve open access or whether, as is more commonly believed, the removal of permission barriers is also required. In the self-archiving and open access journal discussions, we saw that, in reality, digital works commonly characterized as "open access" could be under a wide range of copyright and licensing arrangements. For example, many journals listed in the *Directory of Open Access Journals*[41] (a widely recognized and used finding tool) do not remove permission barriers and neither do many e-print authors.

Looking solely at journals for a moment, the information environment is even more complex because there is a further distinction between free access to the entire contents of a journal and some subset of those contents. With this in mind, I have suggested the following taxonomy for journals, reserving the term "open access" for those journals that meet the highest level criteria:

> 1. **Open Access journals** (OA journals, color code: green): These journals provide free access to all articles and utilize a form of licensing that puts minimal restrictions on the use of articles, such as the Creative Commons Attribution License. Example: *Biomedical Digital Libraries*.

2. **Free Access journals** (FA journals, color code: cyan): These journals provide free access to all articles and utilize a variety of copyright statements (e.g., the journal copyright statement may grant liberal educational copying provisions), but they do not use a Creative Commons Attribution License or similar license. Example: *The Public-Access Computer Systems Review*.

3. **Embargoed Access journals** (EA journals, color code: yellow): These journals provide free access to all articles after a specified embargo period and typically utilize conventional copyright statements. Example: *Learned Publishing*.

4. **Partial Access journals** (PA journals, color code: orange): These journals provide free access to selected articles and typically utilize conventional copyright statements. Example: *College & Research Libraries*.

5. **Restricted Access journals** (RA journals, color code: red): These journals provide no free access to articles and typically utilize conventional copyright statements. Example: *Library Administration and Management*. (Available in electronic form from *Library Literature & Information Science Full Text* and other databases.)[42]

So, once all types of free access are considered, the overall access picture becomes more complex. While no major open access advocate endorses embargoed or partial access as a substitute for complete free/open access, the "Washington DC Principles for Free Access to Science,"[43] a significant statement from important not-for-profit STM publishers, does.

These factors make it somewhat difficult to discuss the impact of open access in simple black-and-white terms. As noted earlier, a pragmatic assessment of the current state of open access suggests that OA materials are always free of price barriers and they may be free of permission barriers as well, depending on whether the copyright holder has authorized this through a license or copyright statement.

The Impact of Open Access on Libraries

Schmidt, Sennyey, and Carstens have outlined three scenarios that would affect how open access impacts libraries: (1) the open access movement collapses, (2) the open access movement triumphs, and (3) the open access movement partially succeeds, resulting in a mixed scholarly communication system that has elements of both traditional and open access publishing.[44] The third scenario is the one that the authors feel is most likely, and their subsequent analysis is based on this scenario. Of course, the third scenario is also the one that libraries find themselves operating under today.

From my perspective, a complete failure of the open access movement seems unlikely. It appears to me that, at this point, the primary factors that will determine its degree of success are: (1) legislative, funding agency, employer and other mandates that require open access (and may provide author-fee subsidies or provide other types of financial support for open access efforts); (2) sustainable business models for open access journals, including nonprofit and "no profit" journals; (3) a commitment by universities and other organizations to establish, adequately fund, staff, and operate *permanent* digital repositories and archives; and (4) a successful campaign to win the hearts and minds of scholars so that they will support (e.g., serve as editors and editorial board members) and publish in those journals, deposit e-prints in digital archives and repositories, and recognize the validity of open access publications in promotion and tenure proceedings.

Major Open Access Impacts on Libraries

Suber has identified a number of key ways that full open access transforms library policies, procedures, and services when it removes both price and permission barriers:

- You would own, not merely license, your own copies of electronic journals.

- You would have the right to archive them forever without special permission or periodic payments. Long-term preservation and access would not be limited to the actions taken by publishers, with future market potential in mind, but could be supplemented by independent library actions.

- If publishers did not migrate older content, such as the back runs of journals, to new media and formats to keep them readable as technology changed, then libraries would have the right to do it on their own.

- Access and usage would not be limited by password, IP address, usage hours, institutional affiliation, physical location, a cap on simultaneous users, or ability to pay. You would not have to authenticate users or administer proxy servers.

- You would have the right to lend and copy digital articles on any terms you liked to any users you liked. You could offer the same services to users affiliated with your institution, walk-in patrons, users at home, visiting faculty, and ILL users.

- Faculty and others could donate digital literature and software without violating their licenses, and you could accept them without limiting their usability.

- All use would be non-infringing use, and all use allowed by law would also be allowed by technology. There would be no need for fair-use judgment calls and their accompanying risk of liability. There would be no need to err on the side of non-use. Faculty could reproduce full-text for students without the delays, costs, or uncertainties of seeking permission.

- You would not have to negotiate, either as individual institutions or consortia, for prices or licensing terms. You would not have to remember, consult, or even retain, complex licensing agreements that differ from publisher to publisher and year to year.

- Users who object to cookies or registration would have the same access privileges as other users. Anonymous inquiry would be possible again for every user.

- You would never have to cancel a subscription due to a tight budget or unacceptable licensing terms. Researchers would not encounter gaps in the collection corresponding to journals with unacceptable prices or licensing terms.[45]

The Role of Libraries in Open Access

Open access does not *require* that libraries do anything for it to exist. It has not been designed with libraries as its foundation. From this perspective, open access is all benefit, and no cost. For example, if a traditional journal becomes fully open access or a new open access journal fully substitutes for a conventional one, that is one less journal the library has to buy, and it can deploy those collection development funds elsewhere. If it was a double-digit-cost STM journal, all the better.

However, the probability that libraries, especially academic libraries, will simply ignore open access materials is quite low, if not zero. The lesson of other freely available Internet resources is that, regardless of what libraries think, many users (especially undergraduates) love them and may well use them to the exclusion of conventional, vetted materials. Graduate students and faculty find riches in the Internet as well, and may be engaged in creating valuable new authoritative digital resources in that setting. Of course, they can distinguish between the real and the glass diamonds; less sophisticated users can't. So whether it was out of enthusiasm for new digital resources or out of a sense of obligation to steer users towards useful materials (or both), libraries have increasingly considered that vast sea of Internet materials to be a source of materials that are a potential part of a redefined collection, one that primarily includes purchased and licensed materials, but also, through inclusion in digital finding tools and instruction, free Internet materials.

Libraries Can Provide Enhanced Access to OA Works

Providing access to open access materials has inherent challenges similar to those of other freely available digital works on the Internet. Schmidt et al. identify a number of these challenges: the effort required to effectively select and catalog (or otherwise create metadata for) high-quality OA materials from a pool of candidates that is not restricted by materials cost considerations; difficulties in tracking changes in dynamic OA materials and monitoring their availability when the library has no special relationship with the publisher or other supplier; lack of adequate coverage of OA materials in indexes, aggregator databases, and other conventional finding tools; the necessity of using search engines and specialized finding tools to identify relevant materials; and the broadened scope of information literacy programs to account for the peculiarities of these materials.[46]

They also point out a unique challenge involved with open access in the mixed scenario:

> The hybrid character of the MOA environment presents other serial maintenance challenges for the library. A library might contain parts of the same journal in print and microform, provide access to a part of the journal's back file through an open-access archive, and provide access to issues through an aggregator. Access for a particular resource may undergo constant change as license agreements are renegotiated, embargoes are put into effect, and publication strategies evolve. Keeping up with this constant change, while making all these variations in access transparent to the patron, is an additional maintenance challenge for the library.[47]

Consequently, the integration of open access materials into normal ongoing library operations requires, as other Internet resources do, additional staff time and effort, even though the materials themselves are free.

Libraries Can Be Digital Publishers of OA Works

Libraries are no longer simply consumers of scholarly information. A growing number of libraries have become digital publishers, primarily offering free/open access journals and institutional repositories.

High quality free open source software is available to support digital publishing.[48] Hardware requirements will vary according to the scope of the project; however, they may be more modest than you would image, and hardware cost/performance characteristics continue to regularly improve.

Free/Open Access Journals and Books

Libraries have been publishing free electronic journals for at least 16 years: in 1989, the University of Houston Libraries established one of the first free scholarly e-journals published on the Internet, *The Public-Access Computer Systems Review*, and, in 1996, began publishing a freely available electronic book, the *Scholarly Electronic Publishing Bibliography*,[49] which has been regularly updated. Starting in the early 1990s, the Scholarly Communications Project of the Virginia Polytechnic Institute & State University Libraries[50] published a variety of e-journals, including the *Journal of the International Academy of Hospitality Research*.[51]

More recent examples of libraries as digital publishers of free/open access works include Cornell University Library's Internet-First University Press,[52] the University of Wisconsin Libraries' *The Journal of Insect Science*,[53] and the University of Idaho Library's *Electronic Green Journal*.[54] *The Journal of Insect Science* uses the Creative Commons Attribution License, and it is a full open access journal.

The staffing requirements for free/open access journals is proportional to the level of editorial and journal production support services that the library provides. Given the sophistication of contemporary open source e-journal production systems, it is possible to have faculty editors shoulder more responsibility for key functions and to limit the library's role; however, this is a decision that must account for specific local factors.

Institutional Repositories

While the trend for libraries to assume the role of a formal scholarly publisher has evolved fairly slowly, the trend for academic libraries to establish institutional repositories has evolved more quickly and with more vigor (e.g., see the list of DSpace users[55]).

Although supporting open access may not be the only motivation for such endeavors (especially for institutional repositories), they are highly congruent with it. As was noted earlier, the establishment and operation of permanent institutional repositories is likely to be a critical factor in the success of open access. Other institutional units, such as the information technology unit, could theoretically provide institutional repositories without library involvement; however, this is unlikely at many institutions (especially academic ones) and, if it occurs, may not be as successful as it would be with library involvement.

There is a remarkable harmony between the skill set needed to successfully support institutional repositories and those possessed by librarians. The experience of early adopters of institutional repositories suggests that the technical challenges involved with them are far less daunting than the author attitude change, information organization and metadata, intellectual property, policy and procedure, public relations, and training challenges.[56]

While institutional repositories and the relationship of libraries to them is a complicated topic, the following list provides insight into how one group of librarians (reference librarians) could effectively support institutional repositories.

1. Helping to create sensible IR policies and procedures and to provide feedback about how they work in practice.

2. Assisting in designing the IR user interface so that it is clear, easy to use, and effective.

3. Helping to identify current self-archiving activity on campus to aid the content recruitment effort.

4. Acting as change agents by promoting the IR to faculty and graduate students in their subject areas.

5. Informing faculty and graduate students about Creative Commons licensing options and publisher e-print policies.

6. Depositing digital materials for faculty in their subject areas if such assistance is desired.

7. Participating in the creation of IR metadata, such as local controlled vocabularies (e.g., subject categories for IR documents).

8. Preparing Web-based and paper documents that explain and promote the IR and advocate scholarly publishing reform.

9. Training users in IR deposit and searching procedures.

10. Assisting local and remote users with IR utilization, answering questions about IR policies and procedures, and using the IR to answer reference questions.[57]

As this list of potential reference librarian responsibilities suggests, staff involvement in institutional repositories is likely to extend beyond technical staff. If the library has collection development specialists other than reference librarians, they may also play some or all of the above roles. Depending on local decisions about how to handle metadata issues, IRs could require significant involvement by cataloging/metadata staff, and require increased staffing in this area. Electronic resources librarians and special collections librarians/archivists may also be involved, depending on local factors.

Libraries Can Build Specialized OA Systems

Since the dawn of the computer age, libraries have built specialized computer systems to meet their unique needs. Single-function library automation systems (e.g., a punched-card circulation system at the University of Texas at Austin in the 1930s[58]), were followed by integrated library automation systems (e.g., Northwestern University Libraries' NOTIS system in the 1970s[59]), and, in recent years, open-source institutional repository software (e.g., MIT Libraries/Hewlett Packard's DSpace[60] and the University of Virginia Libraries' Fedora[61]) and OAI-PMH search services (e.g., University of Michigan Library's OAIster[62]).

Obviously, there is an extremely strong connection between some recent system development activities and open access support, although libraries may have additional motives for creating such systems. Consequently, libraries have been an important source of innovative system tools for the open access movement, and there is every indication that libraries will continue to play this crucial role in the future. Needless to say, such system development projects can be expensive and labor-intensive, and they can have significant budgetary impacts on the libraries that engage in them; however, they are also excellent candidates for grant support and for computer industry partnerships.

Libraries Can Digitize OA Versions of Out-of-Copyright Works

Library digitization efforts also harmonize with the open access movement, since the resulting digital materials are typically made freely available in whole or in part. While many digitization projects have focused on rare materials housed in special collections, there has been a recent spate of partnership projects aimed at digitizing standard scholarly library books, including Google Library,[63] the Million Books Project,[64] and the Open Content Alliance.[65] While price barriers may be eliminated by such projects, permission barriers may not always be (e.g., some digitized works are not in the public domain).

For libraries engaged digitization projects, a key question is this: should the digitized works created from out-of-copyright works remain in the public domain (or be put under a Creative Commons license) versus being put under a standard copyright statement with the digitizing library as the owner? To do the former, is to remove both price and permission barriers to these works. Even if both are removed, technological barriers to usability can remain if long works, such as e-books, are only offered through one-page-at-a-time access.

Libraries Can Preserve OA Materials

Another area of traditional library responsibility is preservation, and libraries have already begun to tackle the difficult task of digital preservation of e-journals, notably through the LOCKSS project.[66] While the preservation of biomedical open access journals is ensured by PubMed Central, other types of open access journals do not have a similar digital archive. The most pressing need is the preservation of a significant number of "no profit" open access journals, which can be in real danger of ceasing to be available. Open access journals from conventional publishers have similar preservation needs as their traditional counterparts. While "dark" open access journal archives are unquestionably better than no archives, their contents need to come to light when the journals within them cease to be available on the Internet from their publishers.

As was noted earlier, libraries are likely to view institutional repositories as permanent entities, and, consequently, to have assumed the digital preservation burdens associated with their contents. Other digital archives may be in long-term danger (e.g., disciplinary archives that house digital materials about one or more disciplines created by authors worldwide). The preservation of e-prints has been a controversial topic in the open access movement, with the thought being that the publisher's copy is the archival copy.[67] However, some e-prints may never be published. Moreover, there can be other types of digital objects in non-institutional digital archives, such as technical reports and digital presentations. Should these materials be preserved? If the answer is yes, then libraries may consider doing so.

Libraries Can Subsidize Author Fees

Libraries can subsidize open access journal fees through institutional memberships with publishers, which either eliminate or reduce such fees for affiliated authors. There are several factors to keep in mind when thinking about these memberships. Open access institutional memberships are voluntary, not mandatory. They are not universal in the very diverse open access journal publishing world (only 47% charge such fees[68]). Since the publishers that offer institutional memberships are specialized, it only makes economic sense to consider them if the publisher's journals are highly likely targets for a significant number of institutional authors' submissions and if the majority of those authors will need assistance in paying fees (as has been noted, there are other potential sources for such payment). Moreover, institutional memberships are part of a broader number of funding strategies that some open access journal publishers are experimenting with: it is difficult to predict their future.

If every journal in the world would suddenly (and magically) become open access, it would not mean that libraries would have to substitute open access institutional membership fees for subscription fees for all journals that were crucial to them unless: (1) every open access journal publisher had such membership fees, and (2) no other significant sources of support for open access journal publishers existed, and, consequently, the journal publishing system would fail if they were not paid.

Open access institutional membership fees can also be looked at another way: by supporting open access journals, they make their benefits available to all, and this is a collective good.

Funding for Open Access Efforts

As we consider library roles in support of open access, the natural question is: where will the money come from to support such efforts? While there are no easy answers to this question, it is important to realize that open access can potentially reduce certain costs, leaving these funds to be redeployed elsewhere.

Since libraries may not view preprints as the full equivalent of published articles, incremental cost reductions as a result of open access are primarily proportional to the prevalence of open access journals and postprints.

The primary potential impact is on collection development costs as a result of having free access to a growing number of open access journals. These savings will be realized if libraries cut journal subscriptions because competing open access journals are viewed as being an adequate substitutes for conventional ones; if journals that previously required subscriptions fully convert to the open access model, eliminating their subscription costs; or if publishers reduce the cost of mixed-model journals (those that include both open access articles subsidized by author fees and traditional articles) in proportion to the number of open access articles published annually (e.g., Springer Open Choice).[69]

Aside from collection development budget savings, other potential savings as a result of open access for libraries may be in acquisitions and serials functions (fewer journals to buy and control), licensing management (fewer licenses to negotiate and track), restricted access enforcement (fewer journals to restrict), interlibrary loan (no need to loan articles that are freely available), and reserves (no need to assess fair use or pay permission fees).

Will OA Transform Electronic Resources Librarians' Jobs?

Will OA *change* electronic resources librarians' jobs? Yes, if their libraries want to provide access to open access materials.

To do so, electronic resources librarians must understand OA concepts and systems, including search systems such as the *Directory of Open Access Journals*, the Institutional Archives Registry, OAIster, and Google Scholar.[70] They will need to establish (or help establish) collection development policies for OA materials, devise strategies for incorporating selected materials into appropriate electronic resource finding tools, track OA resource URL changes and maintain links, and facilitate user access to selected external finding tools. The identification of desirable OA materials is more challenging than the identification of conventional electronic materials because there are a large number of potential suppliers, not a limited number of commercial vendors, and these suppliers typically have no special relationship to the library. Electronic resources librarians will not need to license OA materials or restrict access to them.

Electronic resources librarians will play a major role in helping their libraries to determine whether to go further than mere access and to support OA through institutional memberships that subsidize author fees or through other mechanisms. If such support is desired, they will help deal with the collection development implications of this decision and handle the arrangements for such support.

The extent to which OA flourishes will determine the extent to which electronic resources librarians' shift their work focus from licensing commercial materials to facilitating and fostering access to OA materials. Given prior experience with other types of free Internet materials, this shift will not result in a radical change of duties, except that licensing and access restriction tasks will diminish.

Will OA *transform* electronic resources librarians' jobs? That depends on two things: (1) will their libraries engage in transformational OA activities, such as operating institutional repositories and acting as formal electronic publishers, and (2) will electronic resources librarians be directly involved in such activities. If the answer to both questions is "yes," then their jobs are likely to be transformed to some degree. However, both factors are library-specific, and, at this early stage, the crystal ball is cloudy regarding the general outcome.

Conclusion

The open access movement has gained considerable traction in the last six years. It has become the most successful scholarly publishing reform movement in modern times, and it has begun to transform the scholarly communication system.

Understandably, it has been met by hostility and skepticism by traditional publishers; however, a growing number of them are overcoming their initial reactions, and they are testing whether open access offers them a viable business model.

Open access has struck a sympathetic cord in the library community, which has long suffered the debilitating effects of the serials crisis; however, libraries have been somewhat cautious in their embrace of open access, uncertain about its destabilizing effects on the scholarly publishing system and its ultimate impact on their budget and operations.

A growing number of scholars, especially in STM disciplines that have been hard hit by high serials prices, have either become open access advocates or have been swayed by its arguments; however, disciplines that are less dependent on journal literature have shown less enthusiasm and many scholars still have concerns about credibility issues associated with new digital publishing efforts and have not yet seen that the benefits outweigh the risks and costs in terms of time and effort (e.g., to create and deposit e-prints).

Primarily as a result of the open access movement, there is now a rare opportunity to truly transform the scholarly communication system. There has not been such an opportunity in living memory, and, if it is not seized, it is unclear if there will be another one in our lifetimes. If you want change, now is the time to act. Action does not require total agreement with the open access movement's beliefs and proposals, but it requires an active engagement with them. The movement is not monolithic, but diverse. Not closed, but participatory. Not dogmatic, but argumentative as it vigorously debates its future. It can be influenced by new voices and perspectives.

The open access movement is not the only potential solution to the serious problems that libraries face in the conventional scholarly communication system, but it is a very important one, and it does not require that other strategies be abandoned. The voice of libraries needs to be heard more strongly in it.

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