
Institutional Repositories

Their Emergence and Impact on Scholarly Publishing

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Institutional Repositories

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Institutional Repositories: An Overview

Visitors to the Smithsonian National Museums in Washington D.C. are often overwhelmed by the sheer number of objects that are on display there. And yet, the Smithsonian exhibits to the public less than 2% of the 142 million items that are in its collections.¹ The rest of the institution's holdings are stored in vast warehouses and other facilities, accessible to staff and selected researchers but invisible, for all intents and purposes, to everyone else.

The same is true at most other large museums and also, to a lesser extent, at universities, government agencies, corporations, and other types of institutions. These organizations often possess treasures that have been squirreled away in back rooms and basement archives and which are largely inaccessible to the organization's own staff and to the larger public. These assets include not only physical objects but also the intellectual output of the organization, which may reside in printed documents or other formats that cannot easily be distributed and shared.

Dissatisfied that so much of this knowledge should be available to so few, institutions have begun creating repositories to preserve and provide access to these assets electronically over the Internet. Librarians have taken the lead developing these institutional repositories (IRs), in keeping with their traditional interests in maintaining and managing the use of documents and digital information.

While any type of institution can create a digital repository, most of the activity in this area is taking place at universities. University repositories have emerged from a growing grassroots practice of posting faculty research online, or "self-archiving," on personal web sites, departmental sites or in subject-specific repositories. This trend has special significance for scholarly publishers, as university faculty are the core author pool for most scholarly

journals, and university libraries are the primary institutional market for scholarly journal subscriptions. As more and more research papers are posted on freely accessible repositories, publishers naturally have begun to raise questions about the practice and what it means for their subscription business models. Concerns have risen further as a core of librarian "activists" vocally articulate a vision in which repositories will usurp the role of traditional publishers and help realize a dream of unlimited free and open access to the scholarly literature.

Institutional repositories today house just a tiny fraction of the scholarly literature, and it is far too early to predict with any certainty what effects they may ultimately have on scholarly publishing. Still, it is not too soon for publishers to begin exploring this phenomenon and formulating appropriate policies in response. In this white paper we take an in-depth look at institutional repositories and the challenges that they pose to scholarly publishers. We will explore the origins and rationale for repositories, and will provide a snapshot of their current state of development. We will focus special attention on the various ways publishers are reacting to repositories, with emphasis on copyright issues and policies regarding pre- and post-print posting. Finally, we will look at some of the potential long-term implications of repositories and how publishers are positioning themselves in preparation.

What Are Institutional Repositories?

Richard (Rick) Johnson, former Enterprise Director at the United Kingdom's Scholarly Publishing and Academic Resources Coalition (SPARC), defines a digital IR as "any collection of digital material hosted, owned or controlled, or disseminated by a college or university, irrespective of purpose or provenance."² Although this broad definition allows for many different types of repositories, here we will focus on a specific type of repository that exists at academic institutions and which, according to

Johnson, serves as “a digital archive of the intellectual product created by the faculty, research staff, and students of an institution; accessible to end users both within and outside of the institution, with few if any barriers to access.”

Benefits of Repositories

Advocates such as Johnson cite many reasons why institutions should develop repositories. The primary rationale is that repositories make it easier for faculty to obtain previously scattered or restricted-access materials in a single centralized location. Repositories also make sense for universities from a competitive business standpoint, advocates say. When researchers publish their findings in academic journals, a substantial portion of the prestige value of the research goes to the journal instead of to the sponsoring institution. When scholarship is posted on the institution’s own servers, however, the institution can gain increased recognition for its academic quality. In this way, so the argument goes, institutions with superior output can distinguish themselves not only in the academic community but also to potential funding bodies. Repositories can therefore be justified based on the increased grant support that they may be able to help generate for the institution.

Researchers and faculty are also expected to benefit from the increased visibility associated with repositories. Since repositories are typically defined as open access systems, the content that resides there should, in theory, receive more use from the academic community because it is free. This may translate into higher citation rates than comparable material published in subscription-only journals. Moreover, repositories remove what many academics consider the artificial space limitations of printed journals, allowing for more and different kinds of information to be published. As these constraints are lifted, researchers can expect more of their own work and that of colleagues to become available for review. This, in turn, should assist in the

creation of knowledge and help advance the field of study.

Another driver behind the repository movement is its potential to wrest leverage away from scholarly publishers, whom many librarians view as an impediment to the free flow of information. Concerned about rising subscription prices and unconvinced that publishers provide much in the way of value added services, some librarians champion repositories as a means of radically reshaping the industry and diminishing the role of traditional scholarly publishers. We discuss this aspect of the repository movement and its implications in more detail starting on page 3.

To be sure, many of the proposed benefits of repositories remain hypothetical at best. For one thing, most publishers vigorously dispute the notion that subscription-based journals impede access to research in any significant way. As publishers affiliated with the *Washington DC Principles for Free Access to Science* have noted, the full text of many scholarly journals is already freely available to everyone worldwide either immediately or within months of publication.³

In addition, recent studies have cast doubt on the assertion widely touted by open access (OA) advocates that open access articles have higher citation rates compared to traditionally published journal articles. In their analysis of articles posted in the arXiv, a repository of math and physics papers, for example, researchers at Cornell University found that authors tended to post their most highly cited papers in the online repository while electing not to post their less frequently cited papers.⁴ The researchers concluded that arXiv articles were more highly cited than traditionally published papers not because they were open access, but because they represented a selection of better quality papers. Speculating on the possible reasons for this phenomenon, the investigators noted the potential for a “trophy effect” associated with repositories, wherein researchers post their

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papers mainly to self-promote and display their own accomplishments.

Repository Contents and Management

What do repositories contain? In theory, a repository can house a virtually unlimited variety of materials that enhance scholarly communication and support the educational goals of the institution. At academic institutions, this may include preprints (an article manuscript posted by the author prior to journal acceptance) and postprints (the author's final edited manuscript, though typically not the publisher's formatted PDF), monographs, classroom teaching materials, data sets and other ancillary research material, conference papers, electronic theses and dissertations, technical reports, white papers, and important print and image collections.

The decision to develop and then maintain such a comprehensive storehouse of information is not one that institutions can make lightly. Although technology and digital storage costs have become much less daunting in recent years, institutions still face numerous challenges to the successful roll-out of an IR. In addition to technological considerations and costs, IR managers must craft and implement strategies to address:

- **Content accession:** Who is allowed to deposit materials in the repository, what type of content is allowed, and in what formats?
- **Metadata:** Which metadata tags will the repository support? Institutions must try to maximize richness and searchability while not overburdening repository depositors by requesting too much information.
- **Licensing and permissions:** Just as publishers require copyright transfer or permission to distribute an author's work, repositories must obtain the necessary

authority to host the author's work in the repository in perpetuity.

- **Training:** Staff and authors must be trained to use the software and to submit content.
- **Marketing and PR:** Successful implementation requires support from major stakeholders such as administrators, academic faculty, and information technology personnel. In addition, repository managers must actively solicit materials from authors to populate the system with useful data.

Repository Projects

As many publishers will no doubt observe, the challenges faced by repository managers bear a striking resemblance to those faced by publishers implementing electronic manuscript submission and tracking systems. This is no coincidence, as both types of systems are designed to do what is in effect the same task: Take research papers from a diverse pool of authors and, through an online interface, prepare them for distribution to readers. Of course there are many differences between the two paradigms, but in both types of systems, a successful launch requires a mix of technical expertise and infrastructure, as well as promotional savvy to assure acceptance and participation by authors.

The similarities between these systems don't end there: Just as service providers have emerged to help publishers plan and execute the transition from paper to an electronic manuscript environment, a community of support has also coalesced to assist in the development of repositories in academia. This support comes in the form of entities, often based at universities or representing coalitions of universities, which wish to disseminate the knowledge gleaned from their own repository development projects. Some notable IR projects, many of which have served as models and incubators for new IRs at other institutions, are listed in Table 1.

Table 1. Notable Institutional Repository Projects

Repository Project	Managing Institution/ Entity	Description
DSpace dspace.mit.edu	MIT	DSpace is both the repository for MIT research output and the name of the open source software engine used to run it. Developed with funding from Hewlett Packard, the DSpace project involves not only MIT but also a federation of institutions, including Cambridge, Columbia, and Cornell, who are implementing DSpace software to run their own institutional repositories.
Eprints.org	University of Southampton, UK	Eprints.org encompasses a number of open access and repository projects headquartered at Southampton. Eprints is probably best known as the most popular repository software engine currently in use, which is freely available and has been implemented by some 200 repositories. Eprints.org also offers fee-based consulting and support, and manages the CiteBase OAI search service.
Digital Academic Repositories (DARE) www.darenet.nl	SURF (Dutch higher education and research partnership organization)	DARE is a national collaboration by all Dutch universities, the National Library of The Netherlands, The Royal Netherlands Academy of Arts and Sciences and The Netherlands Organisation for Scientific Research. Its goal is to archive all Dutch research results in open access repositories that are locally managed by the institutions, but which are networked and have adopted the same standards.
Focus on Access to Institutional Resources (FAIR) www.jisc.ac.uk/index.cfm?name=programme_fair	Joint Information Systems Committee, UK	The FAIR program involves a number of projects designed to help institutions build and manage repositories. Notable initiatives include RoMeO, which surveys and reports on the copyright provisions of academic publishers to clarify what uses are/are not allowed with respect to repositories. Another key project is SHERPA (Securing a Hybrid Environment for Research Preservation and Access), whose goals including the development of thirteen institutional open access e-print repositories in the UK.
Caltech Collection of Digital Archives (CODA) library.caltech.edu/digital/	Caltech	Launched in 2000, CODA provides access to 17 Caltech repositories that include electronic theses, technical reports, books, conference papers, and oral histories from the Caltech archives.
CARL Institutional Repository Project www.carl-abrc.ca/projects/institutional_repositories/institutional_repositories-e.html	Canadian Association of Research Libraries	Launched in 2002, the CARL project aims to develop institutional repositories at a number of Canadian research libraries. There are currently 14 libraries participating.

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One of the most important and tangible contributions made by these groups is the development of software to manage IRs. Some of these software packages are freely available under open source licenses, eliminating a key cost/infrastructure barrier to the spread of IRs. According to the Scholarly Publishing and Academic Resources Coalition (SPARC), some of the most widely used off-the-shelf repository engines are DSPACE, developed by MIT; GNU Eprints from Southampton University, UK; and CDSware from CERN, Switzerland.⁵ In addition to providing software, some IR support entities offer fee-based consulting services to help manage both the technical and operational aspects of managing an IR.

Institutional vs. Other Types of Repositories

Institutional repositories, which remain fledgling enterprises in most cases, should be differentiated from other types of repositories that in some cases are already very firmly established. The most notable examples are subject-specific digital repositories that first developed in mathematics and the physical sciences (Table 2).

Table 2. Subject-Based Repositories

Academic Field	Subject-Based Repository
Physics and Mathematics	arXiv xxx.arXiv.org
Economics	RePEc (Research Papers in Economics) www.repec.org
Cognitive Science	CogPrints www.cogprints.org
Astronomy, astrophysics, geophysics	NASA Technical Report Server ntrs.nasa.gov
Computer Science	Networked Computer Science Technical Reference Library www.ncstrl.org

In these research communities, the practice of self-archiving developed as an extension and expansion of informal communications among researchers. By posting their manuscripts online, investigators in these fast-moving fields could make their latest findings available to a

worldwide audience long before the peer-reviewed article would appear in print. arXiv, the first-ever preprint repository launched at Los Alamos National Laboratories in 1991, now provides open access to 363,552 papers in physics, mathematics, computer science and quantitative biology.

Inspired by these successful projects, subject-based repositories in other disciplines have begun to emerge. In the biomedical arena, for example, the National Library of Medicine launched PubMed Central, a free digital archive of life sciences literature. Since its inception in 2000, PubMed Central has recruited 232 participating journals that have deposited several hundred thousand articles in the repository.

The emergence of several distinct repository models (i.e. institutional vs. subject-based repositories) is viewed by some as redundant and by others as necessary to fully catalog the literature. In the former camp, critics note that subject-based repositories draw from a much wider base of contributors than institutional repositories, which by definition are restricted to the output of a single institution. More broadly based subject repositories may therefore be more likely to attract a critical mass of papers, which in turn will lead to greater usage. In support of this viewpoint, it has been noted that subject-based repositories, unlike their institutional counterparts, developed organically from the ground up, a sure sign of researcher interest and support. Moreover, the subject-based repository is the only model so far proven to be self-sustaining over a relatively long timeframe (although, admittedly, most repositories are not old enough to have developed a track record that could be considered “long-term.”)

Proponents of institutionally based repositories argue that these systems are a necessary complement to discipline-specific archives. They note that self-sustaining subject-based repositories have emerged in only a few scientific fields and that uptake in the social

sciences and humanities has lagged considerably. Institutional repositories can not only provide some much needed infrastructure for author self-archiving in these fields, proponents say, but they may also help stimulate increased participation by authors. Since institutions have a vested interest in having their repositories succeed, they may create an incentive for faculty to deposit their papers in fields, such as the social sciences, where there is not yet an established self-archiving culture.

Another point frequently made by IR supporters is that users – i.e., those searching and accessing repository content – are likely to notice little if any difference between the two types of repositories. Most users will search for repository content not on the repository site itself but on a search engine that harvests metadata from numerous repositories (both institutional and subject-based repositories). Since open access is a core component of the repository movement, most systems comply with the Open Archive Initiative – Metadata Harvesting Protocol, a standard that assures interoperability between repositories and allows search engines to gather data from participating sites. Searches can be performed on sites known as OAI service providers, a popular example of which is the University of Michigan’s OAIster (pronounced “oyster”). Repository data is also accessible on commercial search services such as Google Scholar and Elsevier’s Scirus scientific search service.

Impact on Scholarly Publishing

Open Access Component

For their advocates, institutional repositories represent a tool for promoting free and open access to the scholarly literature. Implicit is the view that as research becomes more openly available, the subscription-based model of scholarly publishing will change, and with it, the role and influence of traditional publishers.

Stevan Harnad, a cognitive scientist who is among the most prolific supporters of open access and institutional repositories, describes how the industry may evolve as scholarly literature becomes increasingly available through institutional repositories.⁶ “When the refereed literature is accessible online for free,” he speculates, “users will prefer the free version (as so many physicists already do). Journal revenues will then shrink and institutional savings grow, until journals eventually have to scale down to providing only the essentials (the quality-control service), with the rest (paper version, online PDF version, other 'added values') sold as options.” To Harnad and other proclaimed “archivangelists,” the scholarly publishing industry has maintained inflated subscription prices due to its control over each individual task in the publishing chain, from editorial processing, to production, to distribution. They argue that the vertical integration of these functions has meant that efficiencies realized in different areas of the publishing chain have not translated into reduced subscription prices.

Concurring with Harnad’s analysis, Raym Crow, a senior consultant at SPARC, describes what he sees as an example of this vertical integration stifling market efficiency.⁷ “With the evolution of digital publishing and networked distribution technologies, the relative value of print production and distribution has declined,” he writes. “Yet most publishers are unwilling to accept the commensurate decline in revenues and profits that their reduced participation in the chain would yield. Therefore, many publishers have responded with real or artificial added-value programs, such as bundled print-and-digital offerings or cross-subject aggregations, to support prices.” Harnad’s and Crow’s comments are representative of a strong urge within the repository community to reform the scholarly publishing model. Many repository advocates seek to unbundle the tasks currently managed by publishers, which they believe would allow market forces to dictate how and by whom these functions are performed. Some repository advocates regard management of the

peer-review process as perhaps the only function in the scholarly publishing chain that rightfully belongs with journal publishers.

It should be noted, however, that while most repository advocates seem to support this reform agenda, the community is by no means monolithic in this regard. Clifford Lynch, the director of the Coalition for Networked Information, has written that the “institutional repository is a complement and a supplement, rather than a substitute, for traditional scholarly publication venues.”⁸ In his view, “it dramatically underestimates the importance of institutional repositories to characterise them as instruments for restructuring the current economics of scholarly publishing.” Instead of trying to replicate what publishers are already doing, Lynch advances the notion the repositories should serve as “vehicles to advance, support, and legitimise a much broader spectrum of new scholarly communications.”

Current State of Development

Despite the threat that many IR advocates claim their agenda poses to traditional publishers, the scholarly publishing community so far appears largely unfazed. In a survey of publisher attitudes toward institutional repositories, 74% of 69 respondents thought that institutional repositories would either have a neutral impact on publishing (negatives balanced by positives) or there would be no significant impact.⁹ Only 19% expected an adverse impact, while 8% thought the net impact would be positive for publishers. There was an even split between respondents who were taking a “wait-and-see” approach toward repositories (40%) and those trying to actively collaborate/experiment with repositories (42%).

Can publishers afford to be this relaxed about developments that may threaten to displace them? An objective look at the data suggests that they probably can, at least for now. For, while enthusiasm for repositories remains high among librarians, participation by university faculty appears to be lagging far behind.

To be sure, there is no question that the infrastructure to support repositories is growing at a rapid rate. A survey conducted in 2005 found that about 40% of US doctoral-granting institutions have deployed some type of IR.¹⁰ In addition, 88% of institutions that did not yet have a repository either planned to unveil one or to participate in a consortial repository system.

These figures are broadly consistent with data showing rapid expansion in the number of repositories launched with the Eprints.org software. Released in 2001, the Eprints software was being used by 125 repositories in January 2004. Today, according to the site’s statistics, that number has grown to about 200. Moreover, the number of OAI repositories covered by the OAIster site has nearly tripled since December 2003, from 243 to 617. Although OAIster collects metadata from both subject-based repositories and institutional repositories, clearly much of the recent growth has come from the IR segment.

Impressive as this expansion may seem, it has not generally been paralleled by significant growth in the number of researchers who self-archive journal papers. The Registry of Open Access Repositories¹¹ shows the total number of records in 332 institutional research repositories is now approaching 1 million. However, most of this content is concentrated in a small number of the largest repositories. Half of these repositories contain fewer than 500 records, and the bottom 100 contain fewer than 100 records each. These data suggest that a significant number of repositories are little more than empty shells waiting for faculty to populate them with papers.

Whether this will eventually happen remains an open question. Many anecdotal reports attest to the difficulty of convincing university faculty to post their papers on IRs. Thus far, researchers have been more willing to do so in areas, such as physics and mathematics, where there is already a culture of posting on subject-based repositories. By contrast, in areas where there is no self-archiving culture, such as the social

sciences and humanities, the volume of posting generally remains low.

So, IRs to date have not yet fulfilled what was supposed to be one of their primary objectives: expanding the self-archiving culture to disciplines where it had not taken root organically. Furthermore, even in repositories that *are* being populated with records, the material being deposited is not a viable substitute for traditional scholarly journal content. In an analysis of 45 IRs containing some 42,000 documents, Ware determined that pre- and post-prints together constituted only about 22% of the content on these repositories.⁹ The rest was a mix of theses, dissertations, images, and other types of documents. Poynder, in anecdotal interviews with institutional librarians, confirms that “efforts to persuade faculty to self-archive have consistently fallen on deaf ears.”¹² At the University of Oregon, he notes, the repository that was initially commissioned to house the faculty’s research output instead has become a hodgepodge of departmental newsletters, student class projects, campus administrative records, and other miscellany. Only about 18% of the 1,900 documents housed in the repository were authored by University of Oregon faculty.

There are many possible reasons why faculty participation in repositories has fallen short of expectations. It may be that it will simply take some time for the self-archiving habit to take hold, and that faculty involvement will increase once repositories become more established and integrated into the institutional infrastructure. Another possibility is that the benefits of open access repositories, so apparent to their champions, do not seem as compelling to authors. High journal subscription prices, which are clearly an impetus for the development of repositories, may be of greater concern to librarians than they are to the average faculty member. Moreover, many faculty members depend upon the current system of publishing in scholarly journals for their career advancement; accordingly, they may have little interest in

helping to dismantle a system that benefits them personally.

This is not to say that publishers see no cause for concern in the repository movement. However, the larger threat at the moment seems to come from subject-based repositories, not institutionally based systems. This fact was underscored recently by the finding that manuscripts posted on the arXiv math and physics repository received, on average, 23% fewer full text downloads from the publisher’s site compared to articles that were not posted on arXiv.⁴ Although the society whose journals were studied – the London Mathematical Society – allows only preprints and not proofs or postprints to be posted publicly, the data suggest that this distinction means little to readers in this field. As the authors of the study observed, “For the purposes of the mathematician, a final peer-reviewed preprint including correctly formatted formulae may be nearly as good as a final published copy.”

The arXiv repository has existed side by side with math and physics journals for over a decade, and as of yet there is no evidence that arXiv is causing erosion in journal subscriptions. However, if users continue to favor the arXiv version of articles over the final published version, it seems reasonable to conclude that this will ultimately have a negative impact on subscription renewal rates.

Another looming threat is the specter of mandated self-archiving, which, if implemented, would kick start faculty participation and rapidly turn repositories into a viable substitute to scholarly journals. A handful of institutions are mandating that postgraduate students post their dissertations online in the institution’s repository, but few have extended this policy to include research output from faculty. There is no sign that mandatory self-archiving is likely to be implemented soon by institutions.

If self-archiving mandates *are* to be put in place, they are likely to come from research funding bodies and not the institutions themselves. Up

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until recently, the NIH was leading the charge by funding bodies to mandate open access to the literature. After a contentious debate in Washington, however, the NIH's proposed mandate to self-archive became merely a "request" that NIH-funded investigators deposit their papers in the PubMed Central repository. Not surprisingly, a recent NIH report concludes that a mere 3.8% of eligible papers have been archived in PubMed Central since the adoption of this voluntary self-archiving policy.¹³

Now the focus is shifting to the UK, where the Wellcome Trust, the largest private funder of research in that country, has recently mandated that recipients of its grant awards archive their research reports in PubMed Central or its soon-to-be-developed UK Counterpart, UK PubMed Central. In addition, the UK government has taken steps to encourage open access as well. A recent statement from Research Councils UK (RCUK), the major public funding body, proposes that "funded researchers should, where required to do so, deposit the outputs from research councils funded research in an acceptable repository."¹⁴ Professional societies, notably the Royal Society, had vigorously opposed an earlier draft RCUK proposal that would have mandated self-archiving regardless of publisher copyright restrictions.¹⁵ In response to this outcry and in what appears to be a significant concession to publishers, the final RCUK policy on self-archiving makes it clear that "Full implementation of these requirements must be undertaken such that current copyright and licensing policies, for example embargo periods or provisions limiting the use of deposited content to non-commercial purposes, are respected by authors." The RCUK has described plans for a joint study with several publishers and societies on the effects of open access on research publishing. The project will run through 2008, at which time the RCUK "will review its position... in light of the findings from this research."

Publisher Policies

Publishers have had to carefully calibrate their response to the emergence of open access repositories. The institutional faculties who read, edit, and contribute to scholarly journals are by and large supportive of the concept of open access, regardless of whether or not they themselves self-archive their papers. In the case of scholarly societies, moreover, these faculty are also a core member group whose annual dues help finance society operations. So, while the natural publisher reaction to IRs is often one of wariness, publishers certainly do not want to be seen as "against" repositories or open access – a position that would alienate important constituencies. At the same time, publishers cannot afford to be too effusive in their support of open access, either. This is partly out of self-interest but also for the good of the scientific community. Institutional repositories operate on a largely untested business model that may not be self-sustaining. Adopting this untested model could drive subscription journals out of business without a workable alternative, stifling instead of advancing scholarly communication. Moreover, it has yet to be established whether, when all the costs are tallied, the open access model is indeed more cost-effective than the traditional publishing model.

How have publishers managed this careful balancing act between the interests of their organizations and the desires of the academic community? Many seem to have calculated that they should be more accommodating to authors and open access advocates, and have liberalized policies regarding copyright transfer, permissions, and redistribution of journal content. The traditional rights model for publishing, where the author transfers copyright and almost all interest in their work as a precondition of publication, is rapidly changing. Many journals have relaxed restrictions on how authors can use their own work, offering more leeway for authors to post their articles online, share them with colleagues, and republish figures and tables. Others have dropped

permission requirements and fees for the non-profit academic use of published works, while maintaining restrictions on commercial use or republication. A number of publishers have gone so far as to allow authors to retain copyright to their work, replacing traditional copyright transfer with a licensing arrangement. The terms of such licenses can vary greatly, with some allowing for virtually unlimited re-use of journal articles with proper citation, while others preserve most of the privileges associated with traditional copyright transfer – including the exclusive rights to publish and distribute the material, or to permit others to do so – for the publisher.

At the same time that they have loosened many restrictions, publishers have remained concerned about maintaining priority of publication and controlling distribution of the final published version of articles. Publishers make the case that they add value to the publishing process through peer review, copyediting, and formatting of papers. Accordingly, while many publishers currently have no prohibition on authors posting their final corrected drafts of an article online, many do not allow authors to post the formatted publisher’s PDF on open archives. (Having said that, a significant number of publishers *require* authors to use the publisher’s final version, presumably for the additional exposure or so that the work is seen as professionally produced.) In addition, many publishers require that authors wait until the printed version is released before depositing a postprint online; others impose a 6- or 12-month embargo before allowing postprints to be deposited.

Survey of Self-Archiving Policies

The RoMEO (Rights METadata for Open Archiving) project currently tracks the self-archiving policies of 147 scholarly journal publishers.¹⁶ Reflecting the trend toward authors maintaining more rights over their work, statistics from the site show that 78% of publishers allow some form of online self-archiving. Nearly half of these publishers allow

both pre- and postprint archiving, making them “green” in the eyes of the open access movement. Twenty-two percent of publishers allow only postprint archiving, and 11% allow only preprints to be archived. Less than a quarter of publishers on the RoMEO list prohibit all forms of author self-archiving (Table 3).

Table 3. Publishers that Allow Various Forms of Self-Archiving

Publisher Archiving Policy	%
Allow archiving of pre- and postprint (“green”)	45%
Allow archiving of postprint only	22%
Allow archiving of preprint only	11%
No archiving formally allowed	22%

In addition to offering overview statistics, the RoMEO site provides links to publisher policies on self-archiving when available and lists any conditions that must be met before articles can be archived. As noted earlier, these conditions can vary greatly from publisher to publisher, an indication that publishers are still experimenting with and fine-tuning their policies in this area. Some conditions that are commonly imposed by publishers include the following:

- Eprint cannot appear before the printed version, or articles are embargoed for 6 or 12 months before posting
- Publisher’s final PDF must/must not be used for self-archiving purposes
- Posting allowed only on non-profit sites
- Unrefereed preprints must be removed and replaced with postprint after publication
- Link to publisher site must be included with article
- Publisher statement regarding copyright must be included with article

It appears that publishers can afford to allow self-archiving in part because so few authors take advantage of the privilege. Being “green”

earns goodwill with the scholarly community but at present carries little risk of hurting subscription revenues. While the arXiv example suggests that repositories and journals can coexist even with a relatively high rate of self-archiving, this premise has not been tested over the long term. Should self-archiving rates in other academic fields increase substantially, publishers may receive a more thorough test of their commitment to “green” principles.

Survey of Copyright Transfer Policies

The increasing clout of authors is also evident in the shrinking number of publishers who require copyright transfer as a prerequisite to publication. In a study of open access publishing for the Association of Learned and Professional Society Publishers (ALPSP), the Kaufman-Wills Group surveyed nearly 500 journals, including journals published by members of ALPSP; journals published by members of the American Association of Medical Colleges (AAMC); a subset of journals hosted by HighWire Press (HW) which make their content freely available sometime after publication; and journals listed on the Directory of Open Access Journals (DOAJ).¹⁷ The study found that while 88% of AAMC journals still required transfer of copyright as a prerequisite to publication, only 67% of the HighWire-hosted journals maintained this requirement. Even fewer (40%) ALPSP journals, and only 14% of DOAJ journals, still required copyright transfer (Table 4).

Table 4. Copyright and Self-Archiving Policies of Publishers

	ALPSP	AAMC	HW	DOAJ
Require copyright transfer as condition of publication	40%	88%	67%	14%
Require copyright transfer but will grant a license if requested	12%	6%	5%	1%
Grant a license to publish	43%	3%	28%	34%
No formal agreement required	3%			18%

The journals that do not require copyright transfer generally operate under a licensing agreement with the author. Such licenses can be structured to allow the publisher exclusive publishing rights in print and electronic formats, as well as the right to handle permissions requests. Most explicitly allow the author to post their work online on their own website or in a repository. The ALPSP has developed a sample publisher/author licensing agreement that is available for download from its website, www.alpsp.org/2005pdfs/grantli.pdf.

Case Studies

To supplement the findings of our research and literature review regarding publisher policies toward repositories, we interviewed publishers to explore their personal perspectives on the issue. Although we found them supportive of open access principles and all allowed some form of author self-archiving, they each expressed concern about maintaining revenues and receiving fair compensation for the value-added services publishers provide. All indicated that they would continue to monitor the situation closely and adjust policies as necessary to protect their interests.

BMJ Publishing Group

According to Market Intelligence Manager Michael Butterfield, BMJ Publishing has a strong commitment to making its content freely accessible to readers. However, the publisher recognizes the need to receive fair compensation for the value that it adds and has already moved to rein in some of its more generous policies.

For its flagship *British Medical Journal*, BMJ Publishing Group makes all original research free upon publication and simultaneously posts the paper on the PubMed Central repository. For its line of 19 specialty titles, BMJ Publishing Group makes all online content free after 12 months. Authors are free to archive preprints and the author's version of the peer-reviewed, corrected postprint. However, BMJ recently moved to prohibit authors from posting the publisher's PDF in online repositories.

Butterfield says that this decision was made reluctantly to assure that BMJ Publishing Group would receive an adequate return for its contribution to the publishing process. "BMJ Group pays quite a lot to add value in making this clean PDF version of the manuscript," Butterfield comments, "and we feel as if we add a lot of value to the online version in terms of functionality through HighWire. We want to differentiate the version on our website from any other versions that are in institutional repositories."

In addition, says Butterfield, the publisher felt that its policies were too far ahead of the curve for accessibility and risked putting it at a competitive disadvantage. "We had quite a shock, really, because we had this generous policy of allowing authors to post the final PDF, but then we suddenly found that no other publisher is doing this. Especially when you've got things like this OAIster out there capable of making virtual journals with your content, you suddenly feel a bit vulnerable." He adds, "We want to be as author-friendly as possible without

putting ourselves out of business." (*Note: OAIster is a project to create a collection of freely available, academically-oriented digital resources, harvested from Open Archives Initiative (OAI)-compliant Institutional Repositories.*)

Surveying the repository landscape broadly, Butterfield says that things are in a state of flux and that it is difficult to determine how much of an impact repositories will ultimately have on the publisher's subscription business model. Under current circumstances, he notes, institutional repositories do not appear very threatening because "it is clear that many authors don't seem to be that interested in institutional repositories, as rates of deposit are quite low at the moment." However, what he finds "slightly alarming" are attempts by funding bodies, such as the NIH and the Royal Councils UK, to mandate archiving by their investigators. "They've put these policies in place without any real understanding of what the effects might be," he says. Although arXiv is often cited as a model for coexistence between active repositories and publishers, Butterfield says that publishers shouldn't take too much comfort in this, as the situation in physics may not translate to other fields. "They've got more of a sharing culture in physics, and it's not clear what the situation will be like in other areas such as clinical medicine."

Publishers aren't the only ones who stand to lose out if traditional journals are displaced, Butterfield contends. "There could be less quality control, with masses and masses of paper of low quality sitting on these institutional repositories," he says. "Or we may well find that library budgets are slashed because libraries won't be needed anymore. You could also be at risk for government censorship, because when everything is on one repository it is easier to censor. We saw that recently in the U.S. where there were attempts to control publication for security reasons."

With important new developments in this area taking place all the time, Butterfield says that today's policies are sure to evolve and that publishers must remain vigilant. "We're keeping a watchful eye on this and we'll revisit it again as part of the 2007 pricing discussions that we're having in-house," he notes.

MIT Press

Although the Massachusetts Institute of Technology is in many ways at the heart of the institutional repository movement, Rebecca McLeod, Journals Manager at the MIT Press, says that so far repositories have not had much of an impact—positive or negative—on the Press's operations or its business model. "There is some talk of creating an area in the DSpace repository to serve as an archive for MIT Press materials, but other than that we haven't really been affected by it," McLeod notes.

The MIT Press policy is to ask authors for its 33 journals to wait one year before posting published articles to a repository or on their own websites. But in practice, says McLeod, the Press usually grants requests to post articles before the embargo is up. The Press is currently reviewing its archiving policy and may consider revising its Copyright Transfer Agreements to allow authors to post with no embargo period or one that is less than one year. McLeod notes that while MIT is often associated with "hard" scientific disciplines such as physics and mathematics, the majority of the Press's journals cover social sciences, current affairs, art, and other "softer" subject areas where self-archiving is not as prevalent. Accordingly, the Press has not been as affected as some publishers by the development of arXiv, Pubmed Central, and other subject-based repositories.

McLeod says that while it is difficult to make predictions, she does not anticipate repositories making much of a difference in the MIT Press Journals' day-to-day operations for the foreseeable future. McLeod sees little evidence that readers are seeking out the sites where

archived articles may be obtained. That said, McLeod cautions, the situation could change quickly if the published material were to become more easily accessed for free in a central location. "The concept of 'open access,' where the articles would be available for free right on our own site, is something that we are studying very closely," she notes.

London Mathematical Society

The London Mathematical Society (LMS), which publishes four journals together with Cambridge University Press, allows unrestricted self-archiving of article preprints prior to acceptance by the journal. Once an article is accepted, however, the society prohibits any further posting of the manuscript or making changes to it.

According to Publisher Susan Hezlet, the policy is designed to differentiate between the author's original work and work to which the Society has contributed through peer review, copyediting, academic editing, and formatting. "We consider that added value brought by the Society and we don't allow them to post that for free," she explains. Especially in the area of peer review, she notes, "The referee reports for mathematicians are very detailed. And although we don't pay for that, we manage it very carefully, and that adds value."

Despite the LMS's prohibition against self-archiving of postprints, Hezlet admits that "there are a huge number of authors who simply stick the stuff up there anyway, and we haven't sued anybody yet." She adds, "Although there is a difference between what we say people may do and what we would go to court about; if an author refused to sign a copyright form or wished to negotiate a change, we would not publish the article."

Hezlet says that institutional repositories currently represent just a tiny slice of the self-archiving pie and are not considered a threat to LMS subscription revenue. The majority of LMS authors will self-archive on the arXiv

math repository or the author's own homepage—not on their institution's repository. In fact, says Hezlet, institutional repositories in her view are “a bit like reinventing the wheel.” She notes that particularly in fields where there is already a functioning subject-based repository, “I can't see that there's any added benefit to it, and I certainly don't think it benefits the authors unless they come from a very large institution where perhaps the name of the institution will add some gloss to their reputation.”

While preprints are currently posted online for only 23% of papers that are published in LMS journals, over the long-term, Hezlet says, “We recognize that we are in danger of losing income to our journals if all of this stuff is available for free. And this is an argument that we will make publicly, because in the end, we'll be putting that money, the income we receive from the journals, back into mathematics.” Underscoring the threat posed by freely available journal content, Hezlet points to the recent Cornell University study which shows a reduced number of downloads from the LMS journal sites for articles that were also posted on the arXiv. “This suggests that people are using the arXiv as a place to read the papers instead of coming to our journal sites,” she says. Hezlet worries that LMS journals are especially vulnerable to being undercut by free papers from repositories. For unlike fields such as clinical medicine, where the focus is almost exclusively on the most recent findings, research in math tends to endure much longer. “People should still be reading and wanting to read the articles in our journals ten to twenty years down the line, and as such, if you end up with these ‘almost-as-good’ articles in repositories, that will be a real problem for us,” Hezlet notes.

Like other publishers, Hezlet is monitoring the development of repositories very closely and says that the LMS will change its policies on self-archiving as necessary. “We may adapt the policy as time goes by and make it more or less

strict according to what we consider the threats are,” she says.

Elsevier

Elsevier believes that any discussion of repositories should start not with policy but with terminology. According to the company, differing definitions of “postprint” have served to muddy the debate over repositories and have left authors confused about what they can and cannot do to distribute their work. Elsevier encourages standardization of this terminology to prevent confusion among authors and to increase compliance with publisher policies.

Nick Fowler, Elsevier's Director of Strategy, explained the company's concerns by noting that the term “postprint” is frequently used to mean both the author's accepted manuscript and the final published journal article. But in Elsevier's view, he notes, these are two very different documents. To preserve important distinctions that accompany each phase of development of a journal article, Elsevier encourages the adoption of a common terminology across the scholarly publishing community. The *preprint*, in Elsevier's definition, is the author's original manuscript prior to acceptance, which has not received any input from the publisher. The *accepted manuscript*, by contrast, is essentially the author's work, but may incorporate comments made during editing or the publisher-managed peer review process. These in turn are different from the *published journal article*, which, according to Elsevier, is the version that incorporates all changes made by the publisher, including typesetting, the issue date, the journal brand name and logo, etc. Elsevier notes that it is confusing to refer to the published journal article as a “PDF,” as is commonly done, because PDF is essentially a document format, and preprints can exist as PDFs.

These distinctions are important because they underpin the logic of Elsevier's approach to self-archiving. Elsevier places no restriction on

self-archiving of preprints, which it considers to be the author's own work and not subject to control by the publisher. However, Elsevier does place limitations on the redistribution of the accepted manuscript and the published journal article, both of which are documents to which the publisher has added value. Elsevier's policy allows accepted manuscripts to be posted on the author's own website and on his or her institution's repository. However, accepted manuscripts may not be posted for commercial purposes or for purposes of "systematic distribution," including posting in subject-based repositories. In addition, under no circumstances can the author or any other party post the published journal article to a repository or other site where it will be publicly available.

The policy seeks to ensure authors the ability to distribute their accepted manuscript of their own volition and for their own professional purposes. However, Elsevier does not sanction posting to sites that aggregate content across a field and are in effect seeking to create a parallel distribution system for journal content. Moreover, the policy prohibits any posting of the final published article, the primary reason being that the publisher serves as ultimate guarantor of the integrity of the final published article. Accordingly, that article has to reside on a website that the publisher controls—not a site that others control and where it can be altered. Elsevier's Fowler elaborated on the company's approach with an example: "If you see 50 years from now that something was published in *Cell*, for that to mean something, you have to be able to guard that content, you have to be able to say this is the definitive version and we will stand by that."

What about institution or funder-mandated deposit of articles in repositories? According to Elsevier, this is tantamount to systematic distribution and is prohibited, except in cases where the publisher has worked out an agreement with the funder in question. In the case where NIH requested voluntary deposit of manuscripts in PubMed Central within 12 months of publication, for example, Elsevier

met with NIH to understand their objectives, and because the content was almost exclusively life science articles, they viewed 12 months as a timeline that the company would be willing to test. The resulting policy is that NIH-funded authors can e-mail Elsevier and request that their articles be posted on PubMed Central, and Elsevier will then send the article on the author's behalf. Arrangements with other funders will be worked out on a case by case basis, and might include quite different provisions depending upon the field. Math and social science content tends to be used over a longer period than life sciences content, and so a 12-month timeframe for posting in those fields might not be sustainable.

Looking ahead, Elsevier is not overly concerned about the specter of repositories eroding the subscription journal business. Authors at present do not seem to be very interested in posting to repositories, as indicated by the 3-4% posting rate in the PubMed Central Repository. And unless something significant happens to increase that posting rate, it seems unlikely that repositories will ever represent viable alternative to traditional journals. "Publishers aren't the barrier," comments Elsevier's Fowler, "it's the authors themselves who don't appear to want to post. They don't perceive that access to their research is in any way an issue; they see that it's time-consuming to post on repositories; they're worried about what version of their content people are going to see; and they don't use repositories themselves in their research." So, "If you've got repositories that have less than 5% of the content of journals and that content isn't the definitively published version, it's a very poor research substitute compared to what they already have access to and which is free at the point of access for them." He adds, "Whereas in theory you could see repositories as a possible substitute [to journals], the reality is quite different."

Looking Ahead

Interest in IRs remains very high, and most institutions of any size have either implemented a repository or are considering it. However, if these repositories are to serve a valuable function within the academic community, they will have to evolve beyond their current status. As originally envisioned, IRs at universities were to serve primarily as storehouses of the institutional faculty's published literature. But given the reluctance of most faculty members to self-archive, this objective may well prove difficult or impossible to attain. Without more widespread self-archiving, it is unclear whether IRs will survive at all, much less transform the economics of scholarly publishing. Repository supporters, therefore, are left with some difficult questions: Should self-archiving of published papers continue to be the primary purpose of the IR, or should the IR instead focus on encouraging new and innovative forms of scholarly communication? If the former, IR advocates will have to implement new strategies to encourage participation; a different approach clearly is needed if a critical mass of content is to be deposited. If the latter, advocates will need to determine what forms of new content will be collected in repositories, and how. In Lynch's vision, the repository serves not just as an archive of journal articles, but as a place that houses experimental and observational data; research and teaching materials; and documentation of events, performances, and other elements of the intellectual life of the institution.⁸ There can be little doubt that a resource containing these items would prove useful to many in the scholarly community, but the obstacles to realizing this vision seem at least as daunting – if not more so—than those that have so far prevented mainstream participation in self-archiving.

IRs of course are still at a very early stage of development, and it is easy to lose sight of the considerable progress they have already made in such a short period. Moreover, a trend toward funder-mandated open access, which is still a

real possibility, could easily lead to much greater rates of self-archiving, thereby eliminating the key shortcoming of IRs to date.

Publishers are keen to avoid such a development, for this might force the hard decisions that they have so far been able to sidestep with respect to repositories. Faced with demands for more liberal copyright terms from some authors, many publishers have eased their restrictions and sanctioned the posting of research papers online for free downloading. They have not had to confront the potential downside of such policies, however, because most authors have not exercised the privileges that publishers have given in this regard.

The “wait and see” attitude that seems prevalent among publishers appears justified, considering that repositories are very much works in progress and do not yet offer a viable alternative to traditional journals. But over the longer-term, free availability of papers could place additional pressure on the subscription-based business model of traditional publishing. If and when that occurs, publishers may choose to tighten their author agreements so as to prevent posting of free versions of published papers. However, resistance to such a move would probably be strong in the author community, considering that it would reverse the open access precedents that many publishers have set in recent years.

The publisher/IR relationship need not always be antagonistic. One way that publishers are cooperating with IRs is by exposing their metadata via the OAI-MHP protocol. This allows OAI service providers to harvest the data and make it searchable to users on their sites. Once the user links to the article, the publisher can institute the same access controls (e.g. subscription or pay-per-view) that they would for any other user. Inderscience, a commercial publisher in engineering, technology, and business/management, has reported excellent results making its metadata available in this fashion to OAI repositories such as RePEc.¹⁸

While most observers foresee competition, not collaboration, as the driving force in publisher/IR relations for the foreseeable future, nobody knows precisely how events will play out. For every claim that IRs represent the demise of traditional publishing, there is an alternate plausible argument that the IR is a white elephant soon to be abandoned by the academic community.

One thing that everyone can agree upon is that developments in this area bear close monitoring. Here are some selected resources for keeping up with the latest news:

- JISC Repositories Discussion List (www.jiscmail.ac.uk/archives/jisc-repositories.html)
- SPARC Institutional Repositories Discussion List (<https://arl.org/Lists/SPARC-IR/List.html>)
- Open Access News Blog (www.earlham.edu/~peters/fos/fosblog.html)

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13. NIH Report on Public Access Policy, Available at: http://publicaccess.nih.gov/Final_Report_20060201.pdf

14. Research Councils UK Updated Position Statement on Access to Research Outputs, Available at: <http://www.rcuk.ac.uk/access/2006statement.pdf>

15. Royal Society response to Research Councils UK's consultation on access to research outputs, Available at: <http://www.royalsoc.ac.uk/displaypagedoc.asp?id=17329>

16. <http://www.sherpa.ac.uk/romeo.php?stats=yes>

17. Kaufman Wills Group, The Facts About Open Access, Available at: <http://www.alpsp.org/publications/pub11.htm>

18. Marketing with Metadata, Available at: <http://www.icbl.hw.ac.uk/perx/advocacy/exposingmetadata.htm>

About the Authors

Cara Kaufman and Alma Wills co-founded the Kaufman-Wills Group, LLC (www.kaufmanwills.com) in 2000. Kaufman-Wills is a consultancy offering the scholarly publishing community a broad spectrum of services including strategic planning, publications development, process improvement, and market research. Recent clients include the National Academy of Sciences, the American Academy of Ophthalmology, The Endocrine Society, Society for Neuroscience, the American Society of Clinical Oncology, Health Affairs/Project Hope, AAAS/Science Online, and the *New England Journal of Medicine*. In addition to his consulting work with the Kaufman-Wills Group, Kevin Lomangino writes for a number of magazines and health science newsletters.

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Member Recruitment April 2003

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Digital Art May 2002

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