Harvesting for Disseminating.

Open Archives and Role of Academic Libraries

Abstract

The Scholarly communication system is in a critical stage, due to a number of factors.

The Open Access movement is perhaps the most interesting response that the scientific community has tried to give to this problem.

The paper examines strengths and weaknesses of the Open Access strategy in general and, more specifically, of the Open Archives Initiative, discussing experiences, criticisms and barriers.

All authors that have faced the problems of implementing an OAI compliant e-print server agree that technical and practical problems are not the most difficult to overcome and that the real problem is the change in cultural attitude required.

In this scenario the university library is possibly the standard bearer for the advent and implementation of e-prints archives and Open Archives services. To ensure the successful implementation of this service the Library has a number of distinct roles to play.

Key words

Self-archiving, Open Access archives, Open Archives Initiative.

Introduction

The "anomalous picture" described in an important paper (Harnad, "For Whom") is a fine example of the critical point in which scholarly communication lies.

The ever increasing journal prices, perceptions of inadequacies in the journal system, along with a consistent reduction in library resources and the advent of new technologies thus creating new opportunities have all contributed to a ferment of innovative ideas and projects for enhancing or replacing the present scholarly communication system.

The crisis has a paradoxical aspect: scientists and researchers who produce this specialist literature, mainly with the aid of external public investments, grant their articles to the publishers without seeking any revenues. Later on, when trying to maximize the uptake of their own work, they and their would-be users face serious problems of access. The first response to this crisis has come from the LIS community. After an initial reactive phase, characterized by subscription cancellations and increasingly intensive adoption of the "just in time" strategy, it has resulted in a number of initiatives with the goal of modifying the scholarly communication process, "freeing" scientific literature from the usage-barriers created by access-tolls.

The Open Access initiatives are perhaps the most interesting response that the scientific community has tried to make to this problem.

Opening the Access to the Scholarly Communication

What does the word "open" mean in the context of digital libraries? At least two different interpretations are possible and both of them work towards the enhancement of scholarly communication, though from different points of view.

From one point of view, "open" means "free accessibility through the Web to the contents of refereed articles, now, for everyone, forever", its most enthusiastic supporter being Stevan Harnad.

In his criticism of the traditional scholarly communication system, Harnad has been resetting his initial intuition of an electronic-only model of scholarly publications (Duranceu 111). Since his first proposal (Harnad, "Scholarly Skywriting"), new topics have been examined, presented and discussed internationally (such as costs, archiving, preservation, quality control and the role of commercial publishers) and new solutions offered. Perhaps the most complete view of his model is outlined in the paper in which he presents his idea and contrasts supporters of opposing views (Harnad, "For Whom").

Through Harnad's vision the model (extended from the pre-peer-review pre-prints world) applies now only to the pre- and post-peer-review journal article literature, not to other types of scholarly communication such as books, best-sellers etc. The first essential distinction he poses is between "non-give-away" literature and "give-away" literature. In the latter, authors do not seek royalties or fees for their work; they only seek research "impact" (usage, uptake, application, citation) on the scientific community (for both scientific and career reasons). Until now dissemination has been guaranteed by publishers who recover costs but restricting access to those who can pay (academic and research libraries). Harnad claims that in an electronic-only environment, the costs can be drastically reduced to peer-review alone and covered by charging authors' institutions (or research funders) for their outgoing papers rather than subscribers institutions for their incoming papers, so that users can access scientific literature free of charge on the Internet.

Harnad recommends that online public self-archiving of refereed journals can and should be introduced without delay and he sees it as "optimal and inevitable" in all fields within a very short time.

However Harnad himself recognizes that his "original 1994 'subversive proposal' of freeing the refereed literature through self-archiving fell largely on deaf ears because self-archiving in an anonymous FTP archive or a Web home page would be unsearchable, unnavigable, irretrievable,

and hence unusable. Nor has centralized archiving, even when made available to other disciplines, been catching on fast enough either" (Harnad, "Self-Archiving").

At this point the second approach to the term "open" as it is intended – and declared - by the Open Archives Initiative (OAI; http://www.openarchives.org/) is raised: "Our intention is 'open' from the architectural perspective – defining and promoting machine interfaces that facilitate the availability of content from a variety of providers. Openness does not necessarily mean "free" or "unlimited" access to the information repositories that conform to the OAI-PMH" (OAI–Protocol for Metadada Harvesting; http://www.openarchives.org/documents/FAQ.html).

The term "interoperability" is not a new concept. In June 2000 Paul Miller discussed that almost all-pervasive term, interoperability, and distinguished six possible types of interoperability: technical, semantic, political/human, inter-community, legal and international. He discussed what it really means to be interoperable, concluding that: "A truly interoperable organization is able to maximise the value and reuse potential of information under its control. It is also able to exchange this information effectively with other equally interoperable bodies, allowing new knowledge to be generated from the identification of relationship between previously unrelated sets of data. Changing internal systems and practice to make them interoperable is a far from simple task. The benefits for the organization and those making use of information it publishes are potentially incalculable" (Miller, "Interoperability").

The Open Archives Initiative has now provided the metadata tagging standards that enable the content of distributed archives to be interoperable.

In this sense the Self-Archiving Initiative (http://www.eprints.org) is devoted to opening access to the refereed research literature online, providing free software for institutions to create OAI-compliant archives, interoperable with all other open archives through the OAI-Protocol for Metadata Harvesting (http://www.openarchives.org/OAI/openarchivesprotocol.html).

The concept behind this initiative is: free full-text accessibility.

Attention has also been focused on the importance of open archiving for scientists in poorly-resourced countries (Chan and Kirsop, "Open Archiving").

The Open Archives Initiative

In its original form, the UPS (Universal Preprint Service), a type of self-archiving which focused on unrefereed pre-prints, was quickly dropped and the Open Archives Initiative has since vastly outgrown those limited original objectives (Van de Sompel and Lagoze, "The Santa Fe").

The OAI has hence become (despite its original core aim) a much broader initiative than the Self-Archiving Initiative. OAI is now providing shared interoperability standards for the entire on-line digital literature world, whether self-archived or not, free or for a fee, be it a journal, a book or other, full text or not, centralised or distributed. The concept behind this initiative is: interoperability.

Although OAI is still in its early phases, "it is gaining significant momentum and it is predicted to become a key piece of the future digital library landscape" (Breeding, "Emergence").

The roots of OAI lie in the e-print community; it arose from a meeting held in Santa Fe in 1999 (Van de Sompel and Lagoze, "The Santa Fe") to discuss mechanisms to encourage the development of e-print archives and solutions. ArXiv (http://arxiv.org/), the physics e-print archive, run by Paul Ginsparg, had already changed the communication paradigm in its field (Ginsparg, "Creating"). The group attending this meeting were investigating the possibility of extending these changes to other domains. The outcome of this meeting was the development of the technical and organizational agreement known as the Santa Fe Convention and the adoption of an interoperability solution known as "metadata harvesting" (Lagoze and Van de Sompel, "The Open Archives").

During the numerous workshops held following the Santa Fe meeting, it emerged that many other groups had very similar problems to those faced by the e-print community: "the metadata that

each community wanted to make available had unique features, but the underlying mechanism of making metadata available for harvest was widely needed" (Shearer, "Open Archives").

With the above criteria in mind an international steering committee was set up to develop the initiative. Its goal was to support the harvesting of all kinds of metadata and to explore other technical problems related to metadata harvesting and other potentially valuable application.

In September 2000 OAI extended its interoperability framework beyond e-prints to facilitate the dissemination of the contents. This framework was named "OAI Protocol for Metadata Harvesting".

The OAI Protocol for Metadata Harvesting (OAI-PMH)

The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), was released in January 2001, substituting an initial protocol that resulted from the Santa Fe meeting (Warner, "Exposing"). The protocol "is simply an interface that a networked server (not necessarily an e-print server) can employ to make metadata describing objects housed at that server available to external applications that wish to collect this metadata" (Lynch, "Metadata Harvesting"). In July 2001 the protocol was updated to incorporate XML-related standards.

Version 1.x of OAI-PMH was experimental, and the results over the following sixteen months seemed to indicate that its underlying technical scope was properly defined. On June 1st 2002, version 2.0 was officially released.

Herbert Van de Sompel and Carl Lagoze state that during the period from the first to the second release the protocol has emerged as a practical foundation for digital libraries interoperability. The reasons for OAI-PMH's vast approval by the scientific community can be seen in the light of a number of factors: it is low barrier, exploiting widely deployed Web technologies; it builds on metadata practice, leveraging the development of a lingua franca metadata vocabulary in the Dublin Core Metadata initiative (http://dublincore.org); it accommodates different communities

and domain-specific extensions (Van de Sompel and Lagoze, "Notes", 144). The initiative is seen by other authors as the right framework to build Open Digital Libraries (Suleman and Fox, "Framework").

From a technical point of view the protocol is http-based and uses the "Get or Post" mechanism. "Repositories" are defined as networked accessible systems that contain metadata that can be harvested. The metadata is returned encoded in XML (Needleman 156).

Two types of participants are defined: data providers and service providers. Following the OAI definitions: "A data provider maintains one or more repositories (Web servers) that support the OAI-PMH as a means of exposing metadata", while "a service provider issues OAI-PMH requests to data providers and uses the metadata as a basis for building value-added services" (http://www.openarchives.org/documents/FAQ.html). In fact "While resource discovery is often mentioned as the exemplar service, other service possibilities include longevity and risk management, personalization and current awareness" (Van de Sompel and Lagoze, "Notes" 144).

Open Archives Initiative: a Work in Progress

The – relative – simplicity of the OAI-PMH Protocol has attracted a large number of "repositories" (or "archives"). The list of registered repositories as of today (03/10/2003) stands at sixty-five, including e-print servers, digital library collections, electronic theses and dissertations archives and so on, with contents offered in a variety of media (http://OAIsrv.nsdl.cornell.edu/Register/BrowseSites.pl), while at the same date there are twelve registered service providers that provide services based on metadata that is harvested using the OAI Metadata Harvesting Protocol (http://www.openarchives.org/service/listproviders.html). Registration is voluntary for both OAI compliant data and service providers and it is also possible that not all repositories or service providers have registered with the OAI (http://oaister.umdl.umich.edu/o/oaister/ already harvests from 189 OAI Archives).

Peter Suber wrote: "Institutional eprint archiving is currently undergoing an unprecedented surge of acceptance and support. Eprint archiving has three components:

1. the software for building the archives, Eprints for large institutional or disciplinary archives and Kepler for smaller individual "archivelets" (Maly, Zubair and Liu, "Kepler");

2. the Open Archives Initiative metadata harvesting protocol, the standard for making the archives interoperable, and

3. the decision by universities and laboratories to launch archives and fill them with the research output of their faculty" (Suber, "Momentum").

On the Free On-Line Scholarship Newsletter in February 2003 (FOS; http://www.earlham.edu/~peters/fos/, (now called the Open Access Newsletter) referring to the previous six months, he listed the major developments on these three fronts stating that: "If you've been following the progress of the FOS movement for any number of years, you'll agree that no other single idea or technology in the movement has enjoyed this density of endorsement and adoption in a six month period" (Suber, "Momentum").

In theory this should be true but, on the other hand, according to the number of data and service providers registered, and the slow rate as which the e-print archives are being filled we can argue that this new paradigm is not yet completely understood and accepted by the scientific community. Practical implementation of open archives can perhaps help us to understand the barriers that are hindering the full development of their potentialities.

Open Archives: Experiences, Criticisms and Barriers

While there has been a lot of publicity about the Open Archives Initiative as an idea, there has been much less on the actual implementation of OAI archives and the problems it faces.

Criticisms have arisen concerning both the technical and the more general cultural aspects.

Technical Concerns

Kathleen Shearer observes that "the key debate about the value of the protocol is regarding the granularity of its metadata" (Shearer, "Open Archives"). The Open Citation Project (OpCit; http://opcit.eprints.org/) promoters, for example, believe that "it does not provide a rich enough infrastructure on which to build services, such as a reference linking" and have proposed "extending the current OAI framework to include access to full text content of archived data, rather than simply the location of a document". The objection is that "expanding minimum metadata standard will discourage participation by data providers, thus limiting the scope and ultimately the power of the OAI Protocol for Metadata Harvesting". Furthermore, according to Lynch, any implementation of the OAI-PMH at an institutional level should be done by consulting with other institutions, along with a careful consideration as to what metadata will be exposed and its particular level of granularity, regarding the future use of this metadata (Lynch, "Metadata Harvesting").

Powell, discussing the openness of the Protocol, states that the use of the existing mechanism can be adopted (for example by publishers) to restrict access to the contents (Powell, "An OAI Approach"). However this could possibly be considered one of the protocol's strengths, whose degree of accessibility can be freely decided by those implementing it.

More General Concerns

Stephen Pinfield, in two important articles, examines how eprint archives are used (Pinfield, "How Do Physicists") and the implications in setting up an institutional OAI compliant e-print archive (Pinfield, Gardner and MacColl, "Setting Up").

The following are some of his concerns:

o The format of papers: careful consideration must be given to what formats will be accepted from authors, what formats they will allow on the e-print server and whether they can, if necessary, convert from one format to another.

- o Metadata format and quality: this is crucial to the OAI Service Providers who are harvesting it and creating search facilities. The creators of the ARC service (an experimental service provider), for example, report a number of problems associated with metadata diversity (Liu, Maly and Zubair, "Arc").

- o The need to standardize metadata so as to enable more consistent retrieval of results from cross-collection searches has been confirmed in a paper describing a recent work carried out by the University of Illinois Library, recipient of one of seven OAI-related grants from the Andrew W. Mellon Foundation (Cole et al., "Now That").

- o One more possible weakness of the OAI protocol related to metadata is the fact that the OAI metadata is not picked up by conventional search engines. This possibility is being discussed in the "OAI-general" discussion list (http://oaisrv.nsdl.cornell.edu/pipermail/oai-general/) and in the September 1998 American Scientist Forum (http://amsci-forum.amsci.org/archives/september98-forum.html). New software tools such as DP9, which can translate OAI compliant metadata into search engine-friendly data, may be important (http://arc.cs.odu.edu:8080/dp9/index.jsp).

- o Subject scheme seems to be a very important issue. Nixon states that while a local scheme may be very useful for local use there is the need to use an established subject scheme which would provide some degree of consistency for future cross-searching (Nixon, "Evolution").

- o Authentication and long-term preservation of documents: this aspect is of particular importance to the "open archives" community. These problems have not been looked into by the Open Archives Initiative. Data providers remain responsible for the preservation and accuracy of their records.[1]

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[1] This is not a problem for the self-archiving community, which is merely trying to provide open access versions of their peer-reviewed publications.

- o The self-submission process: the self-submission process (that eprint.org software allows) may create some problems. Pinfield argues that some potential contributors may lack the know-how or the patience to submit their documents themselves. In the initial stages of the implementation of institutional archives, it may be best if the archive administrator inserts papers on behalf of users (Pinfield, Gardner and MacColl, 2002). Not all users, in fact, will wish to self-archive their material for a variety of reasons - from time constraints to technical ability - but it is seen as vital to provide this as an option (Nixon, 2002). It could be objected that this is not the reason why archives are not spreading and filling fast enough and that the real problem, concerning this, is the lack of an institutional and national policy of mandatory research self-archiving to maximize research impact (Harnad et al., "Mandated online").

- o "Look and feel": Pinfield states that institutional design polices have an impact on the "look and feel" of the archives, suggesting that they have the same consistent look and feel of other existing resources such as catalogues. Cole and his colleagues suggest identifying likely users of the system as distinctly separate groups adopting consequently different end-user search interface design strategies (Cole et al., "Now That").

- o Another question raised is how a directory of OAI compliant repositories will be maintained. The method currently in use provides a list of self-registered archives that can work with few repositories but will not be sufficient as the number of repositories increase (Shearer, "Open Archives").

- o From a practical implementation point of view, William Nixon states that, in his experience with the institutional e-prints archive at the University of Glasgow, the technical expertise which computing services provided was essential in getting the archive up and running (Nixon, "Evolution").

- o Difference in fields: a shared opinion is that there are basic differences among the scientific fields that influence the acceptance of the open archives philosophy and their

use (Relman 1828). Some authors state that the variety of practices seem to be related to specific fields, based on particular work products, and that "communicative heterogeneity" will persist (Kling and McKim, "Not Just"). In mathematics, for example, the use of Tex language facilitated the diffusion of free accessible documents, while this has not occurred in other fields. As De Robbio affirms, behaviour can also be different inside the same particular field, as with mathematicians, where communications are sometime shared by e-mails and not deposited in archives. Moreover in the IT field, researchers are used to putting their works on personal sites and Web pages rather than in archives: this fragmentation hinders the establishment of a common strategy towards open archives (De Robbio, "Open Archive").

On the other hand it is said that institutional repository policies, practices, and expectations must also accommodate the differences in publishing practices between academic disciplines (Crow, "Case").With regard to this aspect, the reality may be that discipline differences can explain why self.archiving started in physics but it seems arduous to assert that enhancing research impact and open access to research literature does not benefit all disciplines.

Cultural Barriers

All authors that have faced the problems of implementing an OAI compliant e-print server agree that technical and practical problems are not the most difficult to overcome and that the real problem is the change in cultural attitude required by professors and researchers. The problem seems to be an informational one: researchers still don't see the connection between self-archiving, research access and research impact (http://www.ecs.soton.ac.uk/~harnad/Temp/self-archiving.htm).

William Nixon confirms this idea: "the challenge, ultimately will not be the technical implementation of an e-prints service but rather the cultural change necessary for it to become embedded and commonplace in the activities of the institution". Also for this reason he claims that

change should be assisted by national programmes and international declarations such as that of the

Budapest Open Access Initiative (BOAI; http://www.soros.org/openaccess/; Harnad et al.,

"Mandated online").

Suzie Allard stresses the need to develop structures like OAI, to understand the human and

social dimensions as well as the technology. The psychological aspect, in terms of finding

procedures that are comfortable for individuals with different approaches to the information

environment, has to be carefully considered as well, stating that "humanities scholars approach

research in an entirely different fashion than researchers in the hard sciences. Each group would be

very uncomfortable with the other's technique, yet each group can generally conduct a satisfactory

search" (Allard, "Erasing").

Jeffrey R. Young, investigating barriers to the implementation of open archives, found that

the biggest obstacle may be inertia. He reports the opinion of Mrs. MacKenzie Smith, Associate

Director of Technology for MIT's libraries, on the super archive which has been developed at the

Massachusetts Institute of Technology, called Dspace (http://www.dspace.org/): "Professors are

busy, and they may not use the repository if they perceive it as more work, even if they like it in

principle. Setting up the framework for an archive was the easy part, however. Getting professors to

contribute is proving more difficult". "It's a slow process," confirms Eric F. Van de Velde, Director

of Library Information Technology at Caltech. "We talk to people all the time" to try to get them to

include material, he adds. "This is not foremost on the mind of any faculty member, and changing

the work flow kind of takes time" (Young, "Superarchives").

The same concept is expressed by Raym Crow, SPARC Senior Consultant: "The greatest

obstacle to any change in the fundamental structure of scholarly communication lies in the inertia of

the traditional publishing paradigm (Crow, "Case"). In the self-archiving strategy, however, the

inertia is not seen in the publishing paradigm, but in researchers' habitual practices

(http://www.eprints.org/self-faq/#1.Preservation).

These assumptions have been confirmed by two surveys.

The Information World Review reports about a survey conducted with their scientific panellists (not an academic environment) where they were asked if they saw self-archiving by authors as a means of solving some of the problems in scientific journal publishing.

Overall, sixty percent of respondents saw self-archiving as an idea worthy of consideration. However within this group, less than a third were wholehearted supporters, while the rest felt it was too soon to be able to predict how successful self-archiving might be. Forty per cent expressed real reservations.

The most common objections raised were: that authors preferred to be published in recognised channels for the sake of their careers (but it is to be remembered here that self-archiving is the self-archiving of papers that have been published in the recognised channells!),that they could not be relied upon to be consistent in their approach, or find the time for self-archiving ("Jury is Still Out").

However, most panellists' doubts were cultural, the two most often cited being career progression and the problem of overturning established practices ("Panellists Have Doubts").

More interesting though is a survey on attitudes and perceptions regarding self-archiving carried out among academic staff of the three universities participating in the ARNO Project (http://cf.uba.uva.nl/en/projects/arno/).

The results showed that perceptions regarding institutional open archives as a parallel publication channel vary a lot among the different fields, suggesting that programs and projects for encouraging their use should be tailored to accommodate these differences.

Concerns about copyright were confirmed, along with the importance of a "quality label for academic output" (Bentum et al., "Reclaiming"; http://www.eprints.org/self-faq/#10.Copyright; http://www.eprints.org/self-faq/#7.Peer).

Discussion

All the opinions set out in the literature seem to confirm that "setting an archive up is one thing, getting users to participate in its ongoing development is quite another" (Pinfield, Gardner and MacColl, "Setting Up").

The problems seem to be related more to cultural aspects rather than to technological or developmental issues.

The participation of users is required through the contribution to contents, and experience reveals that what is self-archived is widely used. The objection that authors will not use the institutional archive until there is a sufficient content but they won't contribute content until they use it, seems to be unsuitable: authors, in fact, don't use their "own" institutional archive, but they use everyone else's (Harnad, "Self-Archive").

An important step is seen in talking to academics and scholars more generally about scholarly communication issues. An OAI-compliant e-print archive should not be seen as an isolated development but as a response to a number of structural problems in the academic publishing field.

It is quite probable that scholars are not as interested as librarians are in the "serials crisis" problem. Rising costs can easily be seen as a "librarians' problem". Possibly, it is more effective to emphasize the arguments more related to researcher activities: among them lowering impact barriers, ease of access, rapid dissemination, OAI functionality and valued added services.

Previous experience suggests a better chance of success when positioning the repository as a complement to, rather than as a replacement for, traditional publishing.

There are a number of major concerns that academics seem to raise on a regular basis:

- Intellectual property rights (and particularly copyright: http://www.eprints.org/self-faq/#10.Copyright)

- Quality control (and particularly peer review: http://www.eprints.org/self-faq/#7.Peer)

- Workload (their own: http://www.eprints.org/self-faq/#libraries-do)

- Undermining the 'tried and tested' publishing status quo (on which academic reputations and promotions lie: http://www.eprints.org/self-faq/#7.Peer).

In this sense, organizing special promotional events for university staff might be very important.

As a paradox: Elsevier does allow its authors to publish their papers in institutional repositories or in other non-commercial archives, provided that the authors first ask permission. Arie Jongejan, chief executive officer of Elsevier Science and Technology, a division of Reed Elsevier, says that fewer than 5 percent of authors ask.

Harnad explains that the reason is that disciplines fields are not the right agent for change: "The right entity for all of this is the university" (Young, "Superarchives") because researchers and their institutions (and research funders) all share a common interest in maximising the impact of their research output, the very same interest their share in publish-or-perish.

The Role of Libraries

The university library is possibly the standard bearer for the advent and implementation of e-prints archives and Open Archives services (http://www.eprints.org/self-faq/#libraries-do). To ensure the successful implementation of this service the library has a number of distinct roles beyond its technical know-how and maintenance. These have been identified as the following (Nixon, "Evolution"):

o Encouraging authors of the University to deposit material in the e-prints archives;

o Providing advice to authors about copyright and journal embargo policies for material which they would like to deposit in the archive, and liasing where required directly with the journal;

- o Converting material to a suitable format such as HTML or PDF to import into the archive and ensuring that HTML which is submitted is properly formatted and cross-browser compatible;

- o Depositing material directly on behalf of members of the University who do not, or cannot self-archive their scientific publications.

In this new scenario the role of the library changes, as affirmed by the SPARC Position Paper: "Establishing an institutional repository program indicates that a Library seeks to move beyond a custodial role to contribute actively to the evolution of scholarly communication" (Crow, "Case").

Peter Suber states: "The Internet has given scholars and librarians an unprecedented opportunity to save money and advance their interests at the same time. We should simply seize it. What are waiting for?" (Suber, "Removing").

More sensationally Barbara Quint declares: "This is the best chance librarians will ever have to break the chains that have bound them and their budgets….Who will step up and help to create a better process of scholarly communication? Who will do the hard work and take the risks?… If academic librarians do not step up to pay that price and right now, they could find themselves blocked out of that future and perhaps any future at all… ACT. Now or never." (Quint, "Now or Never").

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