Global Access to Science – Meeting the Revolution

IATUL Keynote Paper

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"Global Access to Science – a Time of Change": International, National and Institutional Trends to Open Access"

Topics B and D

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Abstract

This paper considers the large changes occurring in the way science is done, and the global significance of such changes. It reviews the mission of librarianship in promoting access to science and then surveys developments in recent years specifically in improving open access to scientific publications, covering a range of issues including significant shifts in the public policy debate about access, as well as some of the arguments about the best means of achieving outcomes. It concludes with a review of fresh challenges in terms of access to scientific data (eResearch, eScience), and gives a view that while libraries cannot act unilaterally to improve open access to quality certified research, library leadership can do more to promote clear minded strategic thinking about the future of access to science. Suggestions about what such leadership roles demand are made.

While the paper covers these trends globally, the institutional perspective is that of one of the few universities worldwide that has mandated the deposit of research outputs in an institutional repository. The national perspective also reflects some recent changes in Australia, as well as elsewhere.

Introduction

In "Towards 2020 Science", the widely publicised report produced by Microsoft in 2006, the editors assert that

> "A scientific revolution is just beginning. It has the potential to create an era of science-based innovation that could completely eclipse the last half-century of technology-based innovation; and with that, a new wave of global social, technological and economic growth" [1]

Nothing that has happened over the last year would contradict the view that we are in a scientific revolution. Many of us however might put a less expansive (i.e. growth oriented) view about the results of such a revolution. For there is a rising and global urgency about solving the problems of our times that is detectable everywhere we look.

Before the last century was half over, the reality of World War meant that humankind was facing the spectre of global catastrophe never before encountered. It was not that the imagination or the image of global catastrophe was new (after all you could say it was as old as the Ark), but rather that the notion of a man-made possibility caused it to seem all the more pressing, and all the more something that should be remedied.

No sooner was the Second World War concluded than the technological possibilities based on, at that time, recent atomic science, dominated the development of the Cold War. In the most benign interpretation the mutual unleashing of terror on an unprecedented scale actually helped to ensure that the world did avoid the possible catastrophe. But on some careful reading of relevant history it was a close run thing.

Now, in the 21st century, we have new incarnations of the same spectre. Most commonly discussed now is global warming and climate change, but crises induced by sudden depletions of energy sources, and indeed by the underlying problem of our times, population pressure of an unprecedented kind, are also firmly in the frame.

The optimists among us, and many optimists do work in scientific and technological universities, will hold that we can prevail in overcoming these problems -- "Big Science For Big Problems" may well become a global mantra in the developed world.

Against this backdrop, questions of access to science on a global and therefore highly collaborative scale have assumed greater urgency. In the context of this greater urgency I would like to trace developments in addressing the challenge of removing obstacles to the science we need.

In doing so I propose to review the way that debates about open access have developed, internationally and nationally (with examples from the Australian setting) locally, referring to various achievements since the scholarly community first started to understand what the Internet might mean in terms of research communication; examine some of the debates' main themes including issues about what constitutes repositories, the gold versus green approach, discipline versus institutional approaches, economic metrics, the relationship of the public interest to specific open

access proposals, the importance of explicit mandating processes, and the constraints on science and scientific communication posed by some publishing practices.

In addition to well known, and for some, unendurably lengthy debates on open access, the theme of "Global Access to Science" requires us, in 2007, to address the rising issue of access to the data of science, and the role that our university libraries and their leadership must play in the world of eResearch, or eScience.

Finally, in the context of these debates, the role of libraries and the leadership of libraries has a mixed report card. I would like to suggest remedies for this.

Mission, Vision and Librarianship

It was over 70 years ago, that the Spanish philosopher and writer Jose Ortega Y Gasset exhorted librarians to take on an interventionist or activist role in what they do. And although that is a long time ago, I think that figuring out whether to take a leadership position in debates about the best way to communicate research output, to increase access to science is critical. But it has been very difficult for some in responsible library positions in our universities and research institutions either to recognise the need or once seen to effectively respond.

Being clear about the role that libraries might play has been a matter which has occupied many in the profession in our universities for at least a decade and a half, with the focus developing as the digital age has matured beyond what many could imagine in the early 1990s. I was interested in preparing this paper to look at something that I had written in 1992:

> "so libraries, on whom a good number of scholarly publishers are dependent for their livelihood, have a significant role to play, particularly if they are highly organised through peak bodies... If scholarly communication is going to radically shift its container base, libraries will be as profoundly affected as publishers. In a sense it is the authors, the scholars themselves, who have the most to gain by major paradigms shift in the containers for the literature (for want of a better phrase). But to say this assumes rather a lot:
>
> -- it assumes the publishers are not themselves thinking deeply about the future actions which they might take to steer in directions which would preserve publishers interests, and remember some publishing is very narrowly controlled by very wealthy people;
>
> -- it assumes that authors and scholars will act in some kind of concerted way;
>
> -- it assumes that the myriad of problems associated with copyright and intellectual ownership issues will be sorted out. [2]

Looking back on this it is clear that indeed some publishers were engaged in long-term strategy to exploit the digital medium and move the basis of their business to that medium. In doing so, they received extensive cooperation from their primary market, academic and research libraries. Indeed, in the ensuing years (since 1992), the productivity and convenience that was delivered to students and staff through the advent of the electronic journal bundles, has been one of the striking improvements in the quality of University life. Indeed it has been arguably the standout improvement fostered by the digital era so far, but it has come at a price. This was especially the

case in Australia, as distance disadvantage (at least in speed of scholarly communication) disappeared.

While it has been developing, so too has the radical and common sense alternative, the corpus of the refereed research literature freely available online. Those who have played a role in this, have included librarians, administrators, but most importantly, researchers and academics who have indeed recognized what there is to gain, analysed the problem of access for what it is, and campaigned accordingly.

From the Ejournal to Green Mandates

This paper takes as a given, the basic distinction between the give-away and the non-give-away refereed research literature. The time since the first mention of the prospect of having the bulk of the world's refereed research available freely online is going on for more than a decade and a half.

Over that time, it is useful to review the main themes and developments which have occurred.

The "repository" – discipline or institution?

When the idea of depositing one's research publication in a repository for freely available access first developed, it seemed too many who thought about it that such a process would have to be driven by one's discipline that is one's field of study. After all, a longstanding precedent for a discipline driven process existed in the form of the Los Alamos based physics archive. Furthermore, it seemed initially logical that those responsible for certification of quality in a particular subject area would need to develop some consensual approach to such a mechanism. One of the early areas of confusion in the debate about open access, (and there have been many, as I will record), involved mixing up the idea of self publishing with the idea of open access to quality research. Of course the latter takes as a given the fundamental role of peer review. The links between peer review and a discipline-based approach to repositories seemed to be a compelling argument for the development of such discipline-based approaches.

But from about 2001, institutions also developed a particular perspective on the possible purposes to be served by repositories. Universities certainly in most developed countries operate in competitive environments in which success is measured by one's ability to increase one's research income i.e. the kind of money that is available through public and private competitive research schemes. Government policy in countries such as the UK caused universities to respond to activity which was intended to measure research achievement, and research quality.

In this context, having better control and knowledge of the research output of academic staff working in one's University, led to a natural linkage between the tasks of research management, and the idea of capturing research output as a profile of institutional productivity, year by year.

I had a striking lesson in this regard myself. When the link between the UK research assessment exercise (RAE), and the role of an institutional repository of research output was made in an article in The Times Higher Education Supplement, I sent it to my Vice-Chancellor (President), who responded with immediate curiosity. Until that time he had not himself shown any evident interest in the general question of developing repositories for research output.

As institutional approaches developed in the early part of this decade, the evidence built that these would be a faster path to the true opening up of access than any other.

The institutional mandate

Indeed, at my own institution the possibility of developing an institutional and mandated approach became an implemented policy by 2003. It is worth quoting the institution's formal policy, in part:

> " QUT staff and post-graduate students produce research and scholarly output as a contribution to their discipline and/or as part of scholarly discourse. A significant proportion of this is intended for publication for the general purpose of recognition and impact. The following policy applies to this process, only where such output is not intended for commercialisation or individual royalty payment or revenue for the author or QUT. In effect it applies to the corpus of refereed research literature, conference proceedings, and other non-refereed output, as contributed by QUT to the outside world." [3]

The means by which this policy came to be approved, and how it was used once approved to accelerate the level of activity in depositing papers, has been documented elsewhere. [4] It is fair to say that it has also attracted the attention and approval of the Australian government at a policy level. Nevertheless, QUT remains in a minority of institutions that have yet gone down this path. It is clear to me that leadership and clear-headedness are needed to succeed. This is best provided by those that not only understand the issues but commit to action in their institutions to address them.

The rising volume of public policy discussion

I have just mentioned the interest of the Australian government. This comes at a time when more public policy comments have been made in support of the general principle of open access than ever before. In Australia, the examples include published funding rules (commencing 2008), from the Australian Research Council and the National Health and Medical Research Council, and more recently (March 2007) the release of the Australian Productivity Commission's report on Public Support for Science and Innovation. It is useful to refer to one point in particular in the case of the latter report:

> However, the pursuit of commercialisation for financial gain by universities, while important in its own right, should not be to the detriment of maximising the broader returns from the productive use of university research. [5]

There is a swing of the pendulum occurring here, as the mantra of pursuing "commercialisation" at all costs has been dominant for some time. But in general public policy has clearly moved to the position that public investment in research should lead to publicly accessible outcomes. Putting this in business language, the return on investment (ROI) by government includes the Australian community having access to research outcomes with a minimum of obstacles.

And developments involving the Scientific Council of the European Research Commission (ERC), a variety of initiatives within the national jurisdictions within Europe, the well-documented policy changes involving the NIH in United States, are all part of an increasing level of public discourse. Indeed, Peter Suber, in his newsletter (i.e. the SPARC Open Access Newsletter, January 2007), characterised 2006 as "the year of the OA mandate". In doing so he made reference to developments in the UK, Germany, Austria, China, France, Sweden, and the US. [6]

To these we should add individual University and institutional responses, including some that are coordinated, such as in Belgium last year.

Publisher responses

It has always been assumed that any significant move to greater open access would meet with publisher opposition. And to some extent, a somewhat uneasy co-existence to date, may be replaced by more specific opposition to specific access initiatives. There is also some evidence that open access as a concept is being misleadingly portrayed as having one main form, namely the one that goes by the description "gold". (See below for further discussion of green and gold).

Thus we have seen earlier this year, the so called "Brussels Declaration", a ten point declaration of principles opposing open access drafted by 35 publishers and eight publisher associations. [7]

In the long-term there will surely be significant re-adjustment by publishers to a situation where one way or the other, open access to science, and indeed all fields of knowledge, becomes the norm. One form that such a readjustment might take, would be to move business to the publishing of the "non-giveaway" and away from the publishing of the "giveaway" literature. After all, if a library budget of $10 million is committed 60% to the purchase of the journal literature, and that content becomes available without the need to pay toll, then that 60% could well be directed to the purchase of the non-giveaway literature. Of course the world is not that simple, and the largest publishers of the journal literature are not necessarily the same as the publishers of other material.

As these arguments heat up, (and I think it is fair to expect such heating), we can expect more pressure to be applied to bodies that might be considering policy on the mandating of open access. But as Stevan Harnad tirelessly points out, we should not lose sight of the fact that the total investment in R&D and in our universities and research institutes far outweighs the outlays of the journal publishing industry. This publishing industry is a service industry which will need to adapt and reconfigure its business, or inevitably diminish.

Metrics and impact

Numerous attempts have been made to attempt to quantify the benefits of open access. Perhaps one of the most significant contributions here has been the study by John Houghton and Peter Sheehan, released in mid-2006, with significant data attempting to measure the problems and therefore the inefficiencies in the subscription model of scholarly communication. It is probable that their general finding that there "may be substantial benefits to be gained from increased access to research findings" was influential in the later report of the Productivity Commission in Australia. A dominant theme in the report is the self reported obstacles that research workers experience in the subscription-based model of scholarly communication. In a world where an ever greater sense of urgency will be felt in tackling some of the largest challenges in science, the tolerance for inefficiencies in access will reduce.

And on the other side of the same coin, is the increasing body of evidence about the enhanced citation rates and evidence of impact associated with research articles freely available online. Considerable work on this was reported on The American Scientist Forum during 2005 with data on increased citation rates for self-archived articles also being used to deduce greater Return On Investment (ROI) from a national funding program, in this case in the United Kingdom. I am pleased to remark that Professor Ray Frost, a chemist from my own University was reported in the Australian press last October, as saying that the QUT ePrints repository gave him a new global readership, with his papers being downloaded on average, 2080 times per month. [8]

Gold or Green?

The terms "gold" and "green" to describe the two main routes for the refereed research literature to open access (0A), have been in use for some years. For some time both were seen by the OA advocacy community as equally viable possibilities. But recently there is evidence of rising concern about "gold" access. Canadian research director John Harnad, describes this as follows:

> " Gold OA means that a journal charges nothing for reader access to electronic versions of articles published in it, while Green OA means just that it explicitly allows simultaneous deposit of peer reviewed published papers in publicly accessible, linked institutional repositories, or central repositories...
>
> It is unfortunate that the same expression "open access" is used to refer to both these policies, since they have very different implications. Confounding them may lead to misunderstandings and possibly even a hijacking of objectives". [9]

The hijacking that is referred to here is the possibility, suggested by some recent interactions with publishers that the notion of open access will be automatically taken to mean open access through the gold model. The problem with the gold model is that it assumes the payment of significant author fees. Whether indeed such fees are paid by the author, the authors research grant, the author's institution, does not affect the fact that many researchers find the notion of such payment repugnant, and are likely to react to it. For the advocates of green open access, a significant concern lies

in the possibility that forced into this new world of open access, publishers will see their best chance commercially as a transition from toll gated access to gold access, and will accordingly push harder against green access which by its very nature shows no possibility of a complete economic accommodation with their interests.

In my own institution we have had green access mandated for over three years, and have been considering the possibility of supporting researchers in science and health disciplines with gold access fees. However, we will be monitoring the present developments and treating gold access with a new caution.

Some confusables (repositories; librarians and publishers; research quality and impact; copyright and fear).

As with many issues that are new and dynamic, and where new ways of thinking are involved, there is seemingly endless potential for confusion and ambiguity. And of course where confusion and ambiguity reign, a routine outcome is to take no action. Some of my "favourite" confusables involve
> -- the role and content of repositories
> -- the role of publishers in supporting research quality
> -- measuring quality in research, and
> -- copyright and fear.

Institutions approach the development of repositories from a number of angles. From the beginning of the QUT ePrint repository, it had to be clear that its principal aim, indeed its sole aim, was to increase the communication of quality research outputs. The notion that it might also house learning objects and content relevant to the institution's teaching activities, had to be resisted. Evidence abounded from around the sector that policy intended to drive changes in access to research could be confounded by muddy objectives relating to the principal mechanism for sharing outputs. And I'm afraid to say that this has probably been made worse by the fact that the principal advocates of repository approaches in institutions (usually from the library and/or IT world) would too often lose sight of the core objectives of establishing such a mechanism. In other words they would be preoccupied with process and imprecise objectives relating to the management of content defined generically.

The ability of publishers to link their activity to the concept of quality has been significant during the time that open access has developed. Once again, insufficient knowledge of the publishing process by advocates of the use of the Web for example has not helped the clear understanding of the publisher role. Researchers themselves are quite clear that quality certification for the most part is based on peer review organised within disciplines and generally provided gratis.

But they are also driven, sometimes by national policy, to support a view of a hierarchy of prestige in journals. In Australia, a new national Research Quality Framework (similar to the UK RAE and New Zealand Research Assessment exercises), is in the process of being implemented. Here the university sector faces an interesting and contradictory challenge. For on the one hand, the notion of quality of research output and journal prestige is clearly linked, and can only serve the purpose

of shoring up the notion that the journal is a deeply embedded and permanent part of our research environment. On the other hand, the federal agency (DEST) responsible for implementing the framework has a clear intention that access to research output should be open, and aspires to the view that the framework agenda will cause institutions to instigate repository arrangements, particularly since the second characteristic being measured after quality, is the much discussed "impact".

But nothing has been as durable an area of confusion as the question of copyright.

Copyright as a solution (not an obstacle)

There seem to be few areas in the University that people avoid coming to terms with as much as copyright. As the trend towards open access has developed, so too has awareness by authors of the need to be careful of the rights that they previously habitually assigned to publishers. Indeed part of the development of Green OA has been an increasingly sophisticated appreciation of the bundle of rights that may transfer or be shared between an author, a publisher, and an institution.

There have indeed been many constructive engagements between publishers and authors/institutions. In many cases publishers acknowledge the right of an author to self archive a copy of their article, while still requiring an assignment of copyright, or seeking to limit the form of such self archiving to at least protect the publisher's version. The use of authors' addenda has grown as authors have accepted advice to protect their own rights more carefully.

Within the open access "community" there has been a sometimes spirited debate about the treatment of Copyright. It seems that not only authors and institutions experience confusion, but also OA advocates.

To put it simply, it is not feasible to self archive, or make available an article through a gold access process, without considering the disposition of the copyright in the article; or perhaps more correctly – it *may* be possible for the individual researcher not to consider copyright, but the issue nevertheless exists. It is possible that some of the advice to think as little as possible about this problem is motivated by a fear that it will hinder the much-needed acceleration in the provision of open access, and that is a fair concern.

However, the recent development of new forms of licensing designed to encourage the sharing of intellectual property, particularly for non-commercial use and with due observance of rights of integrity and attribution, should help allay such a concern. Indeed significant legal work is proceeding in some places to assist to define the terms and conditions under which authors make their research output freely available. Perhaps the best known of these is the Creative Commons initiative, but there are also examples of similar licences, particularly within education sector settings. The Open Access to Knowledge (OAK Law) project funded at my own institution by the Australian government is designed to diminish the extent to which legal obstruction to better access might occur.

Science and the adequacy of publishing formats

One of the contributors to the "2020 Science" report, Timo Hannay, focused on the theme of scientific communication. In doing so he declared:

> "The effects of the Web on scientific publishing as of 2005 have focused heavily on the issue of *open access.* At its core, this is a debate about whether it is more effective for the publication of scientific papers to be paid for by authors or by readers (and their respective institutions or funding agencies) [sic]. We believe this debate is almost insignificant compared to the changes that the Web will eventually have on scientific communication. Those who focus on open access, far from being radical, are not being nearly radical enough."

He goes on:

> "the grand challenge for scientific communication is not merely to adjust the economics of publishing to reflect new realities (though that is certainly happening), but rather to redefine the very concept of a scientific publication. Only in this way will scientific publishing remain relevant and fulfil its duty to help accelerate the pace of scientific discovery now that we are unconstrained by many of the restrictions imposed by print." [10]

While Hannay either misunderstands or misrepresents the debate about OA as an argument about who pays for publication, and apparently misses the fundamental point about self archiving, he draws our attention to a complex area with which I think it is essential for university libraries to deal, especially those whose role is to mediate scientific communication. Thus, new ways of adding value to traditional publication through interactivity, dynamic and personalised delivery, links between the underlying data and its writing up in an article, the reader as active participant, and more sophisticated digital discovery techniques; these are all changes which are already underway.

For a more detailed exposition of this I recommend the work of UK (Cambridge) chemist Peter Murray-Rust who sees current publishing processes and even data expression crumbling in the face of the semantic revolution. Murray-Rust, whose research group is exploring the next generation of Informatics and its impact on knowledge-driven scientific research in chemistry, sees the uptake of new techniques such as Chemical Mark-up Language being strongest in bioscience, materials, chemical publishing, and "among librarians".

It is essential that these developments be well understood by library directors as well as their more talented research support staff.

eResearch and Access to Science – A Truly Global Challenge

The science revolution brings local and world wide access challenges. Indeed, one of these access challenges is the challenge of understanding itself. There is evidence in our research communities of widely differing levels of comprehension about both the impact and relevance of the changes being produced by the widespread deployment of more sophisticated computing and computation techniques, massive production of

data, and greater speed of communication and exploitation of tools to improve the derivation of meaning (visualisation etc).

It is in some ways a peculiar problem and one with which many national jurisdictions are wrestling. At the level of policy-making and research and education funding, governments in Europe, North America, Asia and in my own small part of the world are concerned to make the appropriate investments and decisions, but in our institutions we have a necessary level of concern with our ability to leverage these investments to produce change in the capabilities of our researchers and therefore their ability to exploit the new tools and techniques. As remarked in the first two years of the UK programme, you can build the infrastructure, but you cannot force its use

In the UK the investments were made under the national programme that came to be known as eScience; in the United States the preferred term is Cyber-infrastructure; and in Australia we have apparently settled for the word eResearch. (These terms are notoriously hard to translate across languages). Just two months ago, the component of the Australian National Collaborative Research Infrastructure strategy (NCRIS), known as "Platforms for Collaboration" presented its plan for national investment to enhance Australian research infrastructure. [11]

It's interesting to look at its several components. Thus, investment in computational capacity; investment in interoperation and collaborative infrastructure (grid capabilities); funding for new more co-ordinated approach is to data and its management; extensive discipline-based development of new tools and services together with the expertise to bring these to bear; and the underpinning requirements for a robust and powerful national high bandwidth network in support of research; and access among institutions and services (The Australian Access Federation), comprise the six essential features of this investment programme.

As this report was being prepared, it has been interesting to see the increased attention being paid by some universities to the question of developing a specific and explicit eResearch strategy, and to figure out what roles are required to improve this kind of research support, including the library role in data management, curation, access and exploitation. Seized by a sense of urgency, some universities have moved to appoint eResearch Directors to proselytize and develop action plans in their University research communities.

The report was prepared with the assistance of a reference (or advisory) group, drawn from universities around the country, of which I was a member. It was somewhat amusing to me personally, to notice the way that those with backgrounds in scientific computing were evidently extremely surprised that library directors (or ex library directors!) were turning up at this particular table.

Conclusion - the Challenge of the Activist Mission

What then has to happen? How can the community of interests represented by IATUL respond?

First it is necessary to understand as fully as possible the revolutionary changes happening in science. These changes are occurring locally in our institutions, as well as regionally, nationally, and globally.

Second it is necessary to develop strategy and plans for action involving coalitions of researchers; IT services management and technical specialists, and library managers and specialists.

This is not an exhortation to act for fear of being made irrelevant if no action is taken -- we have all heard that before: but more crucially, a view that we must intercede, in some cases boldly, to support changes with which our institutions may well be struggling. What is required is strong upward management, whether to advance the relatively simply expressed goal of better access to the refereed research literature, or more complex goals in developing the science research capability and direction in our universities

In both cases more active and central roles, which some may not be comfortable to adopt, must be played. These roles demand

> -an informed understanding of the rapidly changing dynamics of scholarly publishing
> - a readiness to lead in enhancing accessibility to the research of our own institutions
> -crystal clarity about the role and strategic deployment of repositories and their use
> - a repudiation of the view that the "problems" are too big for those with service and enabling roles
> - better knowledge of significant changes in the way Science is done and the way it is communicated
> - a disposition to lead, or at least share the lead, in dealing with the data deluge.

For now, more than ever, the mission of the librarian first conceived by Jose Ortega Y Gasset over 70 years ago, will be critical in providing the level of global access to Science that may well be required to mutually and collaboratively assure our future.

Ends

[1] *Towards 2020 Science,* *http://research.microsoft.com/towards2020science/* :p 10

[2] Cochrane, Tom "The Economics of Scholarly Information: a Dissolving Triangle?" *Australian and New Zealand Journal of Serials Librarianship,* 3 (2), 1992: pp 27-28

[3] *QUT Manual of Policy and Procedures,* *http://www.mopp.qut.edu.au/F/*

[4] Callan,Paula A "The Development and Implementation of a University-wide Self-Archiving Policy at Queensland University of Technology (QUT):Insights from the Frontline" in *Proceedings, Institutional Repositories:The Next Stage.* Workshop presented by SPARC and SPARC EUROPE, November 18-19, 2004,Washington DC.

[5] *http://www.pc.gov.au/study/science/finalreport/keypoints.html*

[6] *SPARC Open Access Newsletter,* 1/2/07, HTTP://www.earlham.edu/~peters/fos/newsletter/01-02-07.htm

[7] *http://www.stm-assoc.org/brussels-declaration/*

[8] *The Australian, Higher Education Supplement,*18/10/06;p21

[9] Letter to *Physics World,* supplied by the author

[10] *op cit;* p 18

[11] At time of writing this is about to be made publicly available, but no URL is yet available