Repositories, research and reporting: the conflict between institutional and disciplinary needs

Danny Kingsley
PhD Scholar
Centre for the Public Awareness of Science
Australian National University
danny.kingsley@anu.edu.au

Abstract:
In Australia, research reporting is considered a way to increase awareness of and support for opening up accessibility to research outputs. This paper explores the fundamental differences between disciplines, which extend beyond publishing outputs. Most crucially, the information-seeking behaviour of a disciplinary cohort will determine the likelihood of individuals voluntarily embracing repositories. There is an inherent conflict between the needs of the institution and those of academics' 'invisible colleges', as institutional repositories exist to serve the institution and funding bodies, rather than the individual.

Introduction

This paper addresses the problem of encouraging academic staff to use an institutional repository. While institutional repositories are becoming more prevalent in academic life in Australia, the disappointingly small number of items in them reflects worldwide trends. Voluntary use of institutional repositories has stagnated at about 15% of total scholarly output. Institutions mandating repository use, such as the Queensland University of Technology (QUT) and the Computer Science Department of the University of Tasmania, have had higher but not complete rates. The recently abandoned Research Quality Framework (RQF) had been the motivation for many universities to develop their repository, and it was generally hoped this would increase awareness of and support for opening up accessibility to research in Australia. At the time of writing, the newly elected Federal Government had not specified a new scheme for assessing research, so it is too early to say if repositories will be part of that plan (Carr, 2007).

Most academics are members of research communities and these are often discrete from their institutional colleagues. There is a myriad of social and scholarly expectations within these 'invisible colleges,' to which the members must conform in order to maintain their standing within their community. Broadly, the reporting requirements imposed upon academics at an institutional level (for example: promotion committees) and at a governmental level (for example: grant applications and research reporting) do not always concur with the expectations of the invisible college. This is the difficulty facing repository managers across the world. Unless the repository can offer some mirroring of the expectations of the academic's invisible college, it is unlikely that academics will voluntarily use their repository for anything other than the required amount of reporting.

Before embarking on any research project an important question is: has anyone else looked at this area? When considering the problem of the barriers to the uptake of open access publishing, there have been several studies asking similar questions (Bjork, 2004) (Prosser, 2003) (Hess et al., 2007) (Davis and Connolly, 2007). There has also been a considerable amount of work looking at academic's attitudes to open access and their willingness to use open access publishing options (Rowlands et al., 2004) (Swan et al., 2004) (Pelizzari, 2003) (Allen, 2005). Many of these studies have been conducted as internet surveys, with a few exceptions, for example (Schroter et al., 2005) (Watson, 2007) (Pitts and Stanley, 2007). A more substantial study has looked at academic values (King et al., 2006).

A study of particular interest in this work is Foster & Gibbons (2005) who spent time interviewing academics in depth about how a repository could be adapted to better serve their needs. Their approach of determining academics' work practices (rather than their attitudes) is almost unique in this debate. The study's title, "Understanding Faculty to Improve Content Recruitment for Institutional Repositories", is very telling and the word 'understanding' is the key to the approach this research has taken.

There is a real need in the open access debate to consider current work practices in scholarly communication, as any attempt to change these practices will be more

successful if they are designed in consideration of, and incorporate aspects of, what is currently the norm. This research hopes to address these issues and inform the open access debate in an area that has, to date, been somewhat neglected.

Research Design

This paper incorporates early findings from the empirical component of a PhD looking into the research and publishing practices of Australian researchers in different disciplines. This has consisted of a series of 43 in-depth interviews with members of two Australian universities, the University of New South Wales (UNSW), and the Australian National University (ANU). Three disciplines were chosen: Chemistry, Computer Science and Sociology. The three disciplines represent three of the four areas described by Becher (1994): hard pure/abstract reflective, hard applied/abstract active and soft pure/concrete reflective respectively (p152).

The interviews were conducted between October 2006 to April 2007, each lasting approximately one hour. The broad question being addressed is: *What are the barriers to the uptake of open access publications options in Australia?* The interviews were semi-structured and based on the same set of questions. The questions centred on the interviewee's interaction with the literature, from the perspective of a researcher, an author and a referee. The interview ended with questions about their awareness of, and activities in, open access publishing methods. The sub-question detailed here was: "*How do you keep up with the literature?"* A fuller description of the methodology used is attached as an appendix.

For triangulation, a case study of Queensland University of Technology (QUT) was undertaken. QUT is unique in Australia in that it has a mandate requiring all academics to place a copy of the final version of their peer reviewed and corrected papers into QUT ePrints (QUT, 2004). Interviews were sought and granted with Professor Tom Cochrane, Deputy Vice Chancellor (Technology Information and Learning Support) and Paula Callan, eResearch Access Coordinator from QUT. These interviews were structured very differently to those conducted with the academic participants, as the purpose of these interviews was to determine if the general conclusions that seemed to be coming out of the interviews conducted so far were reflected in the experiences at QUT when rolling out their repository. These interviews explored the reasoning behind the policy and about specific issues faced with populating their repository. Some elements of this case study are detailed here.

The interviews proved to be a rich source of information, and analysis has elicited several themes. The most striking issue, of information seeking behaviour within the context of disciplinary differences, is the first theme to be explored in this paper. Other themes to emerge include the effectiveness of the master/apprentice system in academia, with the related theme of the institutional/disciplinary divide. The second part of this paper will look at this conflict between institutional and disciplinary needs and include a case study of the QUT repository. This will demonstrate how recognising and addressing the different needs of disciplines can result in a higher likelihood of repository use amongst academics.

Part 1: Disciplinary differences

The three disciplines of Chemistry, Computer Science and Sociology have distinct publishing practices, with Chemistry almost exclusively publishing in journals, Computer Science publishing in conference proceedings and some journals, and Sociology publishing a mixture of books and journal papers. Having separate communication systems is one of the conditions for establishing scientific fields as distinct systems of work, the others being: "a) scientific reputations need to be socially prestigious and to control access to critical rewards, [and] b) each fields (sic) has to be able to set particular standards of research competence and craft skills" (Whitley, 1984) (p29).

In 1965, JP Snow described the problem of 'two cultures' of literary intellectuals and scientists and between them, "a gulf of mutual incomprehension – sometimes…hostility and dislike, but most of all lack of understanding" (Snow, 1965) (p36). This gulf of understanding yawns not just between science and the arts, it can be seen between disciplines that broadly constitute 'science'. One example is the lack of understanding within disciplines of the value of other discipline's publication outputs; while humanities disciplines value books as a publication forum, the lab sciences typically devalue book and book chapter publication (Kling and McKim, 1999). The differences are particularly marked in computer science where conference articles are treated as: "significant forms of publication, and computer science journals are more likely to republish amplified versions of a conference article. In contrast, natural scientists insist that journal articles are the primary form of significant publication, and their best journals do not publish amplified versions of articles that have previously been published in very obscure journals" (Kling and McKim, 1999) (p890).

Academics who move from one discipline into another can find it difficult to adjust to different publication expectations:

> *The majority of what I published before I joined [the computer science department]– was chemistry and chemistry and computing literature. It's different, in chemistry it's heavily oriented towards formal publication…In computer science the majority of publications are conference proceedings. I came to the community somewhat sceptical of conference publications. Now I'm not quite so sceptical…It is quite hard to get a paper in the [top] conference*. (Computer Science)

Evidently, publication is one manifestation of an entire subculture of a discipline, and any discussion that involves changing publication behaviour (such as making work available in an open access format) must allow for disciplinary differences. The remainder of the paper will explore this concept.

A series of sub-disciplines

This section will begin by taking a brief look at the disciplinary differences in the three chosen fields of this study. Each of these disciplines can in turn be broken into many sub-disciplines. Chemistry is a heterogenous discipline with several major, distinct subfields, each with different work modes (Walsh and Bayma, 1996). Chemistry is

mainly a bench science, meaning that the chemists were the only group interviewed whose work involves the use of sharing some costly component of basic apparatus.

The discipline of Computer Science is complicated by the way the faculty or department is defined within the institutions I attended. At UNSW, the School of Computer Science and Engineering is housed in the Faculty of Engineering, the Computer Sciences Laboratory at ANU is housed under the College of Engineering and Computer Science, and the Department of Computer Sciences is within the Faculty of Engineering and Information Technology. Therefore, both engineers and scientists are employed under the banner of 'computer sciences'. It is important to recognise the clear distinction between engineers and scientists. In very general terms, engineers use knowledge to produce end-items and there is often monetary reward, which is outside the social system of technology. Scientists, however contribute to their field with new knowledge, under a reward system of collegial recognition through publication (Pinelli, 1991).

The sociologists interviewed are in some ways more homogenous, although each person interviewed had a discrete area of research from their colleagues. To further complicate the situation, due to small Sociology department numbers, several Anthropologists were also interviewed. Anthropology is a separate discipline altogether, despite sharing some publication behaviours with Sociology.

Broadly, a discipline is 'a particular branch of knowledge'. Most researchers work within a 'research network', described as a relatively intensive concentration of interest ties, with no defined boundary (Woolgar, 1976). With some of the interviewees, these networks consisted of only one or two people. The way academics within these networks search for information has considerable bearing on the success of a repository, and it is this that will be explored next.

Information seeking behaviours within disciplines

Broadly, most academics will engage in two types of information seeking, one is directed searching for specific information, the second is undirected searching in a wider field, and can unearth results which link into other fields (Menzel, 1962), (Back, 1962). The academics interviewed reflected this pattern.

Chemists, of the three disciplines interviewed, had the most systematic approach to 'keeping on top of the literature'. Several chemists interviewed indicated that general browsing of the literature was still part of their routine, although many of them mentioned how different things are today to ten years ago, when putting aside a period of time each week to sit in the library with the new display of journals was a regular habit:

> *For the first 2 years of my PhD I spent every Friday morning looking at journals in the library. I have not picked up a journal in the last 3 years. I just remember the last bastion of paper. I remember the reading area in the library*. (Chemistry)

This behavioural change is due to the proliferation of electronically available information, and represents a shift from attitudes in 1995 when chemists were one group surveyed as part of an Honours thesis at UNSW (Kingsley, 1995). This attitudinal change was also demonstrated in a 2004 survey of geochemists and chemists: “a comparison of the present results with similar unpublished data from a 1998 study illustrates the rapid evolution and acceptance of electronic journals” (Hallmark, 2004).

The second type of information search involves specifically searching for work that relates to a research project being planned, currently in process or being written up. Chemists use a variety of databases for this purpose, with the American Chemical Society Abstracts, the Web of Science and PubMed all mentioned. The search tool used by almost every chemist interviewed was SciFinder:

> *Periodically I would do a SciFinder search – it has really revolutionised the way we work with the literature. When I have an idea I like to test it out and work out what has been done in the area – keyword/author or substructure search.* (Chemistry)

A study of over 1000 researchers (Swan and Brown, 2005) found that 72% of the respondents used Google as their first-choice tool for finding information on a topic. That said, in the group I interviewed, Chemists were far less likely than the other two disciplines interviewed to use Google, and those that did admitted it somewhat reluctantly:

> *I use the Web of Knowledge. I have Googled – generally for clarification about a topic - I am sorry to say.* (Chemistry)

Sociologists rely on a combination of journal articles and books for their information. There appears to be considerably less emphasis on regular browsing of particular journals, possibly because a concept of ‘the literature’ is far broader in this discipline than Chemistry. Other research has found that browsing and following citation chains are often more effective techniques for humanities scholars, to identify relevant literature than directed (descriptor-based searching) ((Green, 2000) discussed in (Talja et al., 2004)). While Sociology is a social science rather than a humanities subject, the sociologists interviewed supported this finding and described a broad range of information seeking techniques, such as PubMed Central, Project Muse, the library’s own electronic resource portal, and government websites. More than the other two disciplines, the sociologists placed greater emphasis on serendipitous browsing of the literature:

> *I am a bit of a generalist in my approach. What it gets down to is largely a matter of accident…I still do a fair bit of browsing, I might go to the library to look for a book - take it off the shelf and have a read. And I browse on the internet for things.* (Sociology)

> *I am a great believer in non-systematic searching. I follow footnotes, references in articles, leads given by people I know…I use websites from government agencies.* (Sociology)

Despite having a higher reliance on books as a source of information, many of the sociologists interviewed also used search engines, although some expressed frustration at the broad brush Google takes. Even a self-confessed 'book person' had undertaken some online searches. There was no sense of resistance to using new tools:

> *Some material lives only on the internet. Future academic research won't involve literature because of the alternatives, it's what people want. I am using Google or AltaVista or Yahoo.* (Sociology)

Computer scientists differ from the other disciplines interviewed in several ways. They were chosen as a group because their publication output is predominantly peer-reviewed conference papers with some journal articles. While some computer scientists do systematic searches of conference papers similar to the chemists, this was not standard practice. It is part of the social norm of Computer Science for researchers to have their own website which at the very least lists (and usually links to) all of their publications. These websites are often the first port of call for researchers trying to locate a particular paper. In addition, searches conducted by computer scientists are often primarily looking for the author:

> *I hit the web first – web pages of most academics have pretty near to full record…I look up a particular person to see what they are up to. Looking from people's point of view – is better that looking at individual articles.* (Computer Science)

Computer scientists, not surprisingly, were keen users of general search engines (as opposed to specific databases). Almost without exception, they stated they used Google:

> *If work is by a computer scientist there are copies on their webpage. I Google them and go to their webpage.* (Computer Science)

> *Google is the solution to everything.* (Computer Science)

> *I tend to use Google – can't live without it.* (Computer Science)

Google however, is not the only way the people interviewed looked for information. Like Chemistry, the main publication outlets are fairly well defined in Computer Science. Each sub-discipline has its own set of conferences that are applicable, and within that set there is a ranking (CORE Rankings Subcommittee, 2007). Many interviewees referred to the proceedings from IEEE[i] and ACM[ii], and some mentioned DLBP (Database of Logic Programming) and CiteSeer, although CiteSeer appears to have some credibility issues in terms of how up-to-date it is.

Generally, the three disciplines all used search engines, but the degree to which they relied on them and whether they were using a general search engine or undertaking a database search tended to relate to their discipline.

'Knowing people'

Research is a social activity and social factors within a research area affect the dissemination of information (Crane, 1972). Sub-specialities are very small, and it is not uncommon for scientists to be working in a number of different specialties (Hagstrom, 1970). This means that often all the members in a speciality are known to one another and are in close communication. This was most obvious in the interviews with the computer scientists and sociologists, where personal communication was given as one of the ways information is distributed in their networks.

Sociology fits within the description of a field whose members are: "loosely organised, non-hierarchical, intellectually pluralistic with local variation in work organization, are particularly likely to rely heavily upon face-to-face informal communication for co-ordinating collaborative work" (Fry, 2006) (p312). But this type of informal communication is not restricted to the social sciences; a large study of 780 UK research academics across a broad spectrum of disciplines found that for less formal research and information resources: "by far the most popular methods across all groups were 'asking a colleague face to face on the telephone' and 'emailing a colleague or peer'" (Sparks, 2005) (p25). Certainly 'knowing people' was described by many sociologists interviewed as a way of finding out about their field:

> *I follow…leads given by people I know. I rely on personal networks.* (Sociology)

> *I have a social network, I know people.* (Sociology)

The computer scientists, too, showed a high level of interaction with one another. The methods they used to interact are two-fold – possibly due to the nature of their research, computer scientists displayed the highest level of use of Web 2.0 systems, such as wikis, blogs, Skype, list serves and other informal communication channels over the internet. In addition, due to the emphasis in the field on conferences as a form of disseminating information, computer scientists also tend to consider communicating in person at conferences an important part of their information-seeking:

> *[I keep up by] attending conferences – talking to people…Gossip at conferences is very important for finding out who is working out what.* (Computer Science)

> *[I keep up by] networking at PC meeting and conferences. Such a vital part of my publishing regime is talking to peers.* (Computer Science)

Even chemists, who tend to work with an in-house team, will collaborate with a small number of colleagues elsewhere. It is possible for academics to maintain these close

relationships because the numbers of people in their immediate field are often very small. This finite size of the groups was mentioned by members of all disciplines interviewed:

> *The number of people in my absolute finite area is in the 10's in the general area it is in the 1000's. I keep an eye on about 20 people and there is 10-15 with a broader interest I keep an eye on*. (Chemistry)

> *I know most of the people active in my field, they send me their work. About 12-20 people.* (Computer Science)

> *It's a very small pool in Australia. There are only 5-6 people at the top.* (Sociology)

It is the intimacy of these groups that works against institutional goals. Because of the requirements of teaching undergraduate programs, subject groups must have team members between them that can teach across the discipline, and "this generally means that appointments are made to fill gaps in specialisms, rather than to reinforce existing research expertise: so colleagues who teach together are unlikely to be readily able to combine their research interests" (Becher, 1981)(p118). The nature of a teaching university means that research undertaken at that university is more likely to be conducted in collaboration with researchers elsewhere than with those housed in the same building.

This reliance on a small network of people as both a source of information and as an 'invisible college' underlies the problem that institutions face when trying to impose a centralised system of communication. Academics face divided loyalties, both to their employing institution (more so if their work involves the use of expensive equipment), and to their international network of colleagues. This division sits at the heart of the problem of attempting to engage all academics into the use of institutional repositories, and this issue will be explored next.

Part 2: The conflict between institutional and disciplinary needs

Repositories have been taken up by a large number of Australian universities for several reasons. One was a response to the centralised approach of the previous Australian Government requiring them for the reporting process of the (now defunct) RQF. Repositories also fulfil another role for universities, as they potentially provide a convenient way to collate reporting data not simply for reporting processes but also for internal promotion purposes and for grant applications. In 1994, Becher observed: "there is a tendency – which a proper attention to disciplinary cultures can help to check – for administrators to lay down uniform specifications to be observed across the whole range of departments, even where these are clearly inappropriate" (Becher, 1994) (p157).

Unfortunately for those who argue that repositories should be being used voluntarily by academics to make Australian research output freely available, there is an inherent

conflict between the reporting requirements by the academic to the university and those to their colleagues. This is an issue in all aspects of trying to run an institution: “disciplinary cultures, in virtually all fields, transcend the institutional boundaries within any given system,” (Becher, 1994). This section of the paper will expand on the difficulties that repositories face in the quest to increase deposit levels.

In diffusion theory, innovations are more likely to be adopted quickly if, within the group adopting them, they have higher perceived levels of: relative advantage, compatibility, trialability and observability and with less complexity (Rogers, 1983). Note the issue is ‘perceptions’ not absolutes, and given the differences between disciplines, these perceptions will differ accordingly. The earliest, and to-date, most successful repository is arXiv (http://arxiv.org) which caters to high-energy physics, astrophysics and some mathematics disciplines. The disciplines in question in this case had a previous culture of sharing preprints and, because arXiv automates this pre-existing culture, there are fewer problems with the appropriateness of this medium (Walsh and Bayma, 1996). The repository offers a high level of compatibility and advantage to the previous system of posting paper copies or sending electronic copies to individuals using ftp. Given the nature of the disciplines involved, the concept of using a computer-based system would not have provided a high level of complexity to the users involved. ArXiv users represent ‘innovators’ in diffusion theory.

It is not simply a discipline’s culture of communicating information that needs to be considered in this context. The social systems and reward values of a discipline play heavily into the debate. Research reporting is an example of an external structure being imposed onto academic endeavour. However, disciplinary expectations extend beyond the processes of undertaking research, to the social rewards within the community: “external status tends to be more important than immediate employment status for many scientists and, indeed, often determines it in the public sciences” (Whitley, 1984) (p16). Academics have a greater loyalty to their research ‘community’ than to their institution. When this institution (or the broader institution of the federal government) imposes publication practices upon them at odds with the practices that are considered acceptable by their own community, there is evidently conflict.

One example is the conservatism shown by many chemists interviewed towards the idea of institutional repositories. The aversion by the natural sciences to pre-publication mentioned in Part 1 extends to the American Chemical Society’s “Editors Policy on Papers on Preprint Server” which states:

> A preprint will be considered as an electronic publication and, according to positions taken by most editors of ACS journals, will not be considered for publication. If a submitted paper is later found to have been posted on a preprint server, it will be withdrawn from consideration by the journal. (American Chemical Society, 2004).

Not every Chemistry journal adheres to this policy, and in the absence of directly asking interviewees if they knew of this policy, there is no data on what percentage of chemists interviewed were aware of it. However, the mere existence of this policy indicates a

culture that is wary of non-traditional forms of publishing. To achieve a successful uptake of a repository these cultural issues must be taken into consideration.

The case of the Economists

An attempt to resolve this conflict can be illustrated with an example from QUT ePrints. Generally, economists worldwide use an archive called RePEc (Research Papers in Economics - http://RePEc.org/) as a system for sharing papers. The archive contains: information on individuals, on institutions, software programs, working papers and bibliographic information for papers and books. In total, over 500,000 items are in the archive, with over 375,000 research items that can be downloaded as full text. To give some perspective on the level of use of the RePEc service, there were 472,050 File Downloads and 1,674,553 Abstract Views in August 2007, according to the website.

The relevance of the RePEc archive to an institutional repository in Australia is the way metadata is collected by a related service called IDEAS (Internet Documents in Economics Access Service – http://ideas.RePEc.org/), which provides information about working papers and published research to the Economics profession. This system collects download statistics and sends out a monthly mailing to registered individuals about the popularity of their works, their ranking and new citations found. These download statistics are important 'currency' for economists. While economists evidently already have a culture of sharing working papers online, the difficulty with them placing material into their institutional repository as well is that any download from that repository will dilute their statistics collated by IDEAS.

Paula Callan, eResearch Access Coordinator from QUT, has approached Thomas Krichel, the person who wrote the software for RePEc, about the possibility of having QUT economists deposit their working papers into QUT ePrints and have RePEc harvest the metadata to create a RePEc record. The eprint record would point visitors to RePEc so that downloads would all be initiated (and counted) via RePEc. This is a neat solution that addresses the requirements of the QUT repository and the Economists using it. Krichel has agreed to work with QUT to trial this option:

> *That is an example of a disciplinary difference. You have got to find a way to work with that group – you are not going to persuade them to change their practice.* (Paula Callan)

This one example demonstrates that despite outward appearances of 'innovative' behaviour by a group towards a new system, an internal social reward system may work counter to that group embracing a new technology. Considering diffusion theory in the case of the economists' embracing institutional repositories, exposure to RePEc has demonstrated that archives are not complex, and has provided an opportunity to trial the system and observe the benefits. However, there is a clear relative disadvantage in using an alternative repository unless that repository becomes compatible with the "existing values, past experiences, and needs of [the] potential adopters" (Rogers, 1983) (p15), as was the situation in this QUT case.

Adapting the repository

Software developers creating the technical base for repositories have built a system that will work technically but does not necessarily suit all disciplines; the 'form' of the technology has been predetermined. In a study that looked at how different disciplines were using the (then) new technologies of computer networks, Walsh & Bayma (1996) concluded that the "form of technology introduced is highly dependent on the context into which the new technology is embedded" (p693). When there is input from a discipline, the final form of an innovation will emerge from an interaction between structural and institutional factors. However, in order for this interaction to occur, the institution needs to observe and incorporate the structure of the disciplines.

Fry (2006) makes the point that with fields that are 'loosely organised' (such as Sociology, see above), the lack of centralised coordination and control make it difficult for this community to systematically appropriate and develop digital infrastructures and resources in response to specific cultural needs. This also means that a repository manager will find it very challenging to create tools for fields such as Sociology. Certainly imposing norms from other disciplines will be unsuccessful. To give an example, one interviewee mentioned that they had been asked to identify the top four journals in their field, which they described as 'a nonsense' in the area of Sociology:

> *Internally within the department we are doing deals with each other. There will be no congruence, they probably won't find any repeats. (*Sociology)

Institutional repositories exist to serve the institution and funding bodies, rather than the individual. This disconnect between the needs of the institution and those of academics' 'invisible colleges' means that unless repositories adapt to reflect the social norms of different disciplines it is unlikely they will be voluntarily taken up on a large scale. If repositories are to be the solution for widespread open access, they must mirror the information-seeking behaviour of the communities they serve.

To conclude, this paper will look at how reporting systems have the potential to counter to the open access hopes for repositories in Australian institutions.

Conclusion

Repositories offer a potential method for opening up access to Australian research outputs, but there are several important barriers to their general uptake in the academic community. The area of most relevance to the issue of repository use is the information-seeking behaviour of academics from different areas. Disciplines with a culture of searching specific databases for the literature will not obviously benefit from having articles freely available in a repository.

Academics will have no choice but to comply with requirements for any reporting system created by the government. The RQF had stipulated the publisher's version of papers needed to be uploaded for reporting. As these are protected by copyright, the papers would have had to be in repositories as 'closed access'. It would be unlikely academics would also voluntarily track down and deposit their post-print version of the same paper.

This apparently trivial requirement demonstrated that any reporting system must be designed with great care if it is to have the added benefit of increased access to the literature.

Providing a mandate has shown to be helpful to the awareness and use of a repository, but disciplinary differences in publishing outputs and information seeking behaviour must be taken into consideration for a repository implementation program to have any success. In addition, the social and status norms existing in academe's invisible colleges should ideally be recognised and nurtured with repository features for the best possible outcome.

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Appendix 1: Research Design

The broad research question of this research is attempting to uncover the nature of academics' experiences with scholarly publication. This research is a good example of the type of phenomena "that are difficult to convey with quantitative methods" (Strauss and Corbin, 1990)(p19), but whose intricate details can be uncovered by the use of qualitative methods. Qualitative methods can be used to gain novel and fresh slants on areas of research that have already been studied in other ways.

The project was focused on trying to understand the process of a move to open access publishing which is, by definition, about change and process. These studies usually begin with questions about what is happening in a given situation and are often grounded theory studies (Morse and Richards, 2002)(p55). Due to the wide scope of the research question, the analysis drew on several theoretical frameworks, including disciplinary differences research, information seeking research and diffusion of innovations theory.

In grounded theory, the research process needs a research question or questions that give the flexibility and freedom to explore a phenomenon in depth (Strauss and Corbin, 1990) (p37). The question "What is preventing academics in Australia from embracing open access publishing options?" is deceptively simple, masking the complexity of the topic. This research took the form of a semi-structured interview with each of the academics in their own offices. The purpose of the interviews was to gain a deeper understanding of the academic's motivations behind their publishing and researching decisions than would be possible by a simple written survey.

Some of the background knowledge informing this research design was not obtained from previously published research, but instead was a mixture of informal interviews and personal experiences. Because the topic of this thesis encompasses the writing, publishing and reviewing of academic literature, it would have been remiss not to have attempted to take part in this process. Several papers (including this one) have been published concurrently with researching for and writing the PhD. This attempt to 'immerse' myself in the topic at hand by various means was a deliberate research tactic. This technique, of using personal experiences, general knowledge and the stories of others is described as 'anecdotal comparison' by Glaser & Strauss (Glaser and Strauss, 1967).

One way of establishing if the procedures in place at an institution affected scholar's publishing behaviour was to compare the publishing and research behaviours of scholars at two Australian higher education institutions, reflecting the transferability of the research (Marshall and Rossman, 1995). The two institutions, the Australian National University (ANU) and the University of New South Wales (UNSW) were chosen partly because of the disparate status of their institutional repositories.

In order to attempt to address the issue of whether research funding in Australia was affecting researcher's publication decisions, Emeritus (retired) Fellows and Professors, and Visiting Fellows were excluded, as these groups are not funded as academic staff

members of the university. For the same reason, and because generally PhD students are unlikely to have a publishing record, they were also deliberately excluded from the sample.

The most logical way of determining if a potential influence on academics behaviour was their discipline was to compare disciplines. Differences in publication behaviour between disciplines is well documented (Kling and McKim, 1999) (p896). In order to allow for the differences in publication protocols for different disciplines, three specific disciplines, each with their own publication emphasis were chosen to be approached at both institutions, Chemistry, Computer Science and Sociology.

The research design was approved by a Human Research Ethics Committee, and given the protocol number 2006/164 on 30 June 2006. In total, 43 people were interviewed, 20 from UNSW and 23 from ANU. All of the interviews with participants were audio recorded with a minidisk and comprehensive handwritten notes during the interviews were taken. These interview notes have been typed up, with reference to the recording when the notes were unclear. The transcripts have been broken into smaller amounts of data, allowing independent consideration.

In order to identify themes within and across the universities and disciplines, each interview was first hand-coded using content analysis and coding (Higginbotham et al., 2001, p248). First stage coding involves labelling data, unstructured coding, looking for categories and simple descriptive coding. For the second stage coding, which is structured and conceptual, NVivo, a qualitative analysis software program was used. This coding involves moving information into natural groups, looking for patterns/relationships in the code. This is finished with third stage coding where the bigger patterns emerge in the data and the different groups are labelled. In keeping with the grounded theory approach, the analytical codes were self-generated rather than derived from the literature.

This research has followed the general mode of operation in the grounded theory style of analysis described in qualitative study texts (Strauss and Corbin, 1990) (p30). There are several limiting factors to this study design, not least the fact that those people who chose to participate in the study are, in effect, self-selecting. These people may not be a general reflection of their colleagues awareness of, or attitudes to the issues discussed. Unfortunately, this limitation is one that is not easily addressed, and any further study will be affected by the same problem.

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[ii] Association for Computing Machinery – www.acm.org