Virtual symposia: an investigation into scholarly communities online

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Abstract:
This paper reports on the pilot study for a survey regarding the use of the Internet by academic staff at Curtin University of Technology for the purposes of informal scholarly communication. The survey included questions regarding the respondents' current and evolving research practices and their use of various services provided by the University Library. The paper reports on the relevant data, and suggests ways in which this might reflect on library services, in particular the development of institutional repositories as a means of supporting the emerging types of scholarly community.

Introduction

Research into academic use of information and communication technologies (ICTs) has generally focused on the potential impacts on teaching and scholarly publication, producing important work on technologically-mediated learning communities and 'communities of practice'. The resultant impact on traditional practices within scholarly publishing and information provision has also received significant attention. Few studies to date, however, have investigated the impact of the Internet on the more 'idealised' notion of a 'community of scholars' – which is 'more about the ongoing conversation within a group of scholars than it is about the production and consumption of scholarly "information" or knowledge' (Lally 2001, 82).

The term 'scholarly communication' is used in this paper to refer to both the communication practices of academics and researchers in the production and consumption of information, and also the more informal collaborations, and fostering of scholarly communities. The paper reports on the interim results of a study of the impact of the Internet on scholarly community and communication by academics at Curtin University of Technology. In particular it looks at those results that have implications for the University's library.

The study of scholarly communication flourished in the late 1960s and early 1970s. The rapid expansion of tertiary education and research driven publication in the wake of the Second World War demanded an understanding of the manner in which academic disciplines gather, exchange, use and disseminate information. This first generation of research resulted in the classic studies of scholarly communication in the sciences (Meadows 1974) and the social sciences (INFROSS 1971), and an awareness of the importance of informal communication channels in the transfer of scholarly information (Crane 1972).

Interest in scholarly communication waned substantially for a period thereafter. It was assumed that a 'steady state' existed and therefore the findings of the initial research still applied. Since the mid-1990s, however, there has been a resurgence of interest in scholarly communication. This has largely been driven by the rapid and transformative adoption of various forms of ICTs, including the Internet, which have enabled the digital storage and transfer of information. In turn, the widespread use of ICTs for both formal and informal communication has resulted in recognition of the need to re-examine the *changing patterns* of scholarly communication.

At the same time, the work of academic and research libraries has been revolutionised by these technologies. As an outcome of the sudden shifts in scholarly publishing librarians and information scientists have become involved in debates regarding the need to bring about changes in the formal patterns of scholarly communication. In particular, these debates have focused on the 'crisis in scholarly communication' induced by the rapidly rising price of scholarly information coupled with the advent of electronic periodicals and the publisher led practices of licensing and 'bundling' of electronic datasets. Librarians have become leaders in the formation of groups such as the Centre for Scholarly Information in the United States, and the Coalition for Innovation in Scholarly Communication in Australia, and Australian librarians have also been influential in the deliberations of the National Scholarly Communication Forum. Other librarians who were engaged in the first generation of scholarly communication research, such as Maurice Line and Jack Meadows, have lately re-entered the field in order to assess the extent of the changes (Line 1999; Costa & Meadows 2000)

While this recent activity has largely focused on the study of changes to formal means of scholarly communication, there is also, however, a need to understand the changing patterns of informal scholarly communication and the effect that these may have on academic and research libraries. The so-called 'invisible college' is no more visible in the digital age, but it may now impact on scholars' use of academic libraries more profoundly than was the case in the pre-digital era.

Previous Research

By far the most common area of research into the impact of ICTs on academic activity is the use of the Internet for teaching and learning, and in particular the development of online services for the delivery of higher education. The research that has been conducted on the use of the Internet for scholarly communication has been focused on formal rather than informal communication practices. Indeed, it could be suggested that this has been due to the increasingly informal nature of the communication encouraged by the Internet, which has in turn created difficulty in evaluating those changes and their impact. It should also be noted that, although the impact of ICTs on scholarly communication practice has been comparatively rapid, its nonetheless incremental nature has also meant that, for more than a decade, academic practice has been in a state of transition, with different generations of scholarly communication practice running in parallel. This in turn has created difficulties for researchers wishing to assess the emerging paradigm.

While recent research has emphasised changes in the formal patterns of communication, some changes have also been detected in attitudes to, and practices of, informal communication. Costa and Meadows reported, from research based in Brazil and the United Kingdom, that the use of the Internet widened the boundaries of scholarly communities, with 86.9% of economists and 77.8% of sociologists reporting an expectation of 'increase(d) informal communication' in a networked environment, and 60.6% of economists and 56.1% of sociologists indicating that they expected such an environment to 'lead to new scholarly communities' (Costa & Meadows 1999, p. 258).

Other research has isolated various forms of computer mediated informal scholarly communication for close study. Walsh, Kuker & Maloney (2000) measured the email activity of scientists and its impact on their 'professional tasks' and 'research tasks' and concluded that 'E-mail's main function in scientific communities is to facilitate scientific communication, providing the glue for the virtual college' (p.1304). Koku, Nazer & Wellman (2001) also examined the use of email and its potential to overcome barriers of distance in forging scholarly relations. Although it was determined that email can facilitate long distance informal communication, the strongest predictors of email communication continued to be those associated with more traditional forms of informal communications, including friendship, geographic proximity and established face-to-face contact.

Hert (1997) used discourse analysis to examine the scholarly use of an electronic discussion list. He reported that such lists are valued as an 'equal and more democratic discussion space' and therefore ideal for informal scholarly communication. In practice, however, Hert concluded that 'rhetorical abilities', 'academic affiliations' and established power relationships intrude in ways that diminish the benefits of discussion lists and reinforce hierarchies and practices characteristic of more formal communication channels.

Several Australian studies of academic use of the Internet have also been conducted, although they have not shed any significant light on the question of informal scholarly communication. The first Australian study was conducted by Harry Bruce in 1994 and 1995. This broad-ranging survey did address, *inter alia*, the issue of the impact of the Internet on the scholarly communication practices of the thirty participants. Some 73% reported using the Internet for collaborative research in the previous twelve months (Bruce 1996, p.32), and 63% believed that the Internet had enhanced their visibility within their research community (p. 33).

Another Australian study conducted in the mid-90s by Applebee, Clayton & Pascoe did not directly raise the issue of informal professional networking or scholarly communication. The survey did find, however, that of 243 respondents approximately 48% reported frequent or regular use of discussion lists, an activity that could be thought of as being primarily an informal means of scholarly communication. It should be noted that this survey made no distinction between those who posted to these groups and those who simply read them. The importance of distinguishing between the two types of participation is indicated by Hert (discussed above), who noted that although discussion lists seemingly offer a democratic and accessible space for communicating, some potential participants felt excluded and that the 'hierarchical and power-driven context is still present' (Hert 1997, p. 343).

Australia has recently provided a third major study on the impact of ICTs on research and scholarly communication practices. Houghton, Steele & Henty (2003) conducted detailed interviews with forty senior researchers from a range of disciplines. Taking as a starting point the influential identification by Gibbons et al (1994) of Mode 2 knowledge production (characterised by increasing interdisciplinary, transdisciplinary and multidisciplinary activity; increased use of collaborative teams; a focus on problem solving; an emphasis a diverse communication methods, and an increasing use of informal communication), they explored the research and communication habits of the current generation of Australian scholars. Although Houghton, Steele & Henty did not consider the concept of the scholarly community in detail, they did assess the importance of 'wider networks of scholarship' (p. 81) and examine the extent to which ICTs have been adopted for collaborative research and communication. Their results recorded the well-established distinction between practice in the sciences and the social sciences and humanities. They also established the extent to which all scholars in their population had been influenced by the uptake of ICTs in their gathering of research data, forming teams, communicating with fellow researchers, and disseminating results.

When librarians and information scientists have researched the role of digital libraries in supporting the scholarly communication process they have often focused on the extent to which academics use established artifacts of scholarly communication, in particular journals, in their digital form (Tenopir & King, 2002; Robb & Janes, 2003). Driven by their concern about the rapidly rising price of periodicals, and keen to explore the advent of electronic publication as a means of addressing this 'crisis', librarians have been most interested in formal channels of scholarly communication. Or perhaps it might be said they are interested in scholarly publishing rather than scholarly communication. This is not surprising, given that it is the published artifact that has hitherto constituted the interface between the library and the research process.

Much of the librarian-driven investigation of the interface between digital libraries and scholarly communication has, however, been speculative rather than research based. This

speculation has focused on the manner in which digital libraries can support scholars' needs, by providing easy or enhanced access to the end products of scholarly communication, in particular journal articles, monographs, conference proceedings, and the various reference tools which provide intellectual access to these publications (Harrison & Stephen 1995; Lesk, 1999; Borgman 2000, McKnight et al. 2000).

There has, however, been at least some consideration of the extent to which the services provided by digital libraries are infiltrating the informal communication channels of researchers. For example David Robins has highlighted the need for enhanced partnership between digital libraries and 'information communities', arguing that:

> …digital libraries are open systems that allow themselves to freely exchange resources in an environment charged with information. By fostering collaboration among information community members, and by participating in the research of community members, digital libraries become involved in the invisible colleges associated with their clientele. (Robins 2002, pp. 69-70)

Robins's view has also been supported by the testimony of members of scholarly communities who have highlighted the extent to which they now expect libraries to create digital services that enhance the process of informal scholarly communication. As Australian humanities researcher Elaine Lally noted:

> Bringing together the diverse kinds of information which researchers draw in during the process of doing and disseminating research, including things that were never found in the library in the traditional sense, clearly make sense in the electronic environment. This would include such things as conference announcements and calls for papers, job advertisements, e-mail discussions or bulletin boards and preprint servers, as well as scholarly publications such as journals and monographs in electronic form. (Lally 2001, p. 84)

Many libraries have accepted this challenge by building web based subject portals incorporating at least some of the features referred to by Lally. The need remains, however, to try and understand the process of informal scholarly communication as it is being shaped by the possibilities offered through the Internet, in order that the investment in library based digital services can be as relevant as possible to the changing needs of scholars.

The Study

The study reported in this paper was the pilot phase of a much larger and more broadly-based survey of academic staff and post-graduate researchers working across the full range of academic disciplines. The pilot was conducted using the staff and research students from the Faculty of Media, Society and Culture from Curtin University of Technology. The Faculty is comprised of three departments; Communication and Cultural Studies, Media and Information, and Social Sciences. It therefore encompasses a range of academic teaching areas spanning the social sciences and humanities.

One hundred and twenty eight copies of the survey were distributed, with the intention that they should be received by all of the Faculty's academic staff and research students. Distribution was by hard copy, except for some students (for example, those studying remotely) who were sent copies as an email attachment. Forty-six responses (35.9%) were returned. Thirty-two of the returned surveys came from academic staff, and fourteen from postgraduate research students. Given the small number and the preliminary nature of this

survey, it has been decided not to separate staff from research students in the report of the results which follows.

The survey consisted of two parts. Part A collected demographic information and asked respondents about their current use of the Internet for scholarly communication purposes. Part B was to be completed by only those respondents who had participated in scholarly communication prior to the introduction of the Internet, in order that they could make assessments of the impact of the Internet on their scholarly communication practice. It is worth noting with regard to the questions asked in Part B that one researcher who recently undertook similar comparisons concluded that:

> As time passes, it will become increasingly difficult for researchers to compile data from respondents on communication, cooperation, and collaboration prior to the Internet… respondents had a genuinely difficult time remembering their communication patterns and levels of cooperation prior to the use of e-mail and electronic discussion groups because these mechanisms had become so integrated within their day-to-day tasks. (Roselle 2001, p. 167)

The following section considers preliminary results from the survey concerning the use of the net for informal scholarly communication, before focusing more specifically on how ICTs might impact on libraries contribution to both formal and informal scholarly communication practices.

Overall, It should be noted that respondents are – as expected – a generally 'Internet savvy' group who reported a high level of daily usage for communication functions such as 'personal email' (80.4%) and reading discussion lists (84.8%). In other regards, however, there may have been lower levels of usage of Internet features than anticipated. For example while 11 (23.9%) reported reading bulletin boards on a daily or weekly basis, 18 (39.1%) reported never reading these boards; and 29 (63%) reported that they never post to bulletin boards. Similarly, only 4 (8.7%) reported posting to discussion lists on a daily basis, while 16 (34.8%) reported that they never post to discussion lists.

Responses to questions focused on the impact of ICTs on research and scholarly communication indicated, *inter alia*, that the Internet had impacted upon both formal and informal communication.

Table 1 How has the Internet impacted on your contributing to professional literature?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more	9	19.6	33.3	33.3
	the same	17	37.0	63.0	96.3
	less	1	2.2	3.7	100.0
	Total	27	58.7	100.0	
Missing	System	19	41.3		
Total		46	100.0		

One third of respondents indicated that the Internet had enhanced their prospects of contributing to the professional literature. It is not possible to conclude if this is due to

enhanced research productivity or to the new range of online publishing opportunities provided by the Internet, but this result indicates a powerful motivation for some scholars to use the Internet in order to maximise their contribution to formal scholarly communication.

Table 2: How often do you undertake collaborative work impossible without the Internet?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	3	6.5	6.8	6.8
	weekly	8	17.4	18.2	25.0
	occasionally	12	26.1	27.3	52.3
	never	21	45.7	47.7	100.0
	Total	44	95.7	100.0	
Missing	System	2	4.3		
Total		46	100.0		

A quarter of respondents indicated that the Internet provided them with collaborative opportunities not facilitated otherwise on at least a weekly basis, and in excess of half of respondents (52.3%) reported that they did so occasionally. This result suggests that there now exist modes of research which are unique to the Internet and which influence the nature or speed of research based knowledge production.

Table 3: Has the Internet changed the likelihood of you contacting an unknown person?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more likely	22	47.8	81.5	81.5
	no change	5	10.9	18.5	100.0
	Total	27	58.7	100.0	
Missing	System	19	41.3		
Total		46	100.0		

Table 4 Has the Internet changed the likelihood of you being contacted by unknown person?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more likely	22	47.8	81.5	81.5
	no change	5	10.9	18.5	100.0
	Total	27	58.7	100.0	
Missing	System	19	41.3		
Total		46	100.0		

Tables 3 and 4 report that the Internet substantially facilitates the ease of contact between colleagues. The same percentage of respondents (81.5%) indicated that they were both more likely to be contacted by, and more likely to make contact with, someone previously unknown to them. In response to other questions 80.4% indicated that they had been contacted in this way by persons unknown to them at least occasionally, and 82.6% reported that they initiated such contact on at least an occasional basis. Perhaps even more importantly

55.6% of respondents indicated that they were 'more likely' to respond to this contact than they were previously. These figures seemingly provide witness to the ease and speed of email as a means of communication. To further support this conclusion, in response to additional questions, 81.5% of respondents also indicated that since the inception of the Internet they engaged in more 'informal communication with colleagues', 89.5% agreed that the Internet had made it 'easier to find other scholars or peers', and 62.1% agreed that it had made it 'easier to approach senior scholars'.

These results pointing to the ease of email communication do not seem to have reduced the need for more personal forms of scholarly contact. Some 44.4% of respondents indicated that they now attended more conferences than before they had Internet access, and 48.1% indicated no change in this regard. Only two respondents (7.4%) indicated that the Internet had reduced their need for conference attendance. This would suggest that although the Internet and email are valuable means by which scholars communicate, that there are some forms of informal contact which they cannot replicate.

The responses to other questions indicate that at least some of this use of the Internet to contact peers is directed outside established disciplines.

Table 5 The internet has extended scholarly networks beyond disciplinary areas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	19	41.3	65.5	65.5
	neither	10	21.7	34.5	100.0
	Total	29	63.0	100.0	
Missing	System	17	37.0		
Total		46	100.0		

Table 6 The Internet has increased the flow of cross disciplinary information

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	agree	22	47.8	75.9	75.9
	neither	7	15.2	24.1	100.0
	Total	29	63.0	100.0	
Missing	System	17	37.0		
Total		46	100.0		

Tables 5 and 6, both of which required a response from experienced researchers only, indicate the growth in cross-disciplinary and interdisciplinary activity. This is true of both collaboration (65.5% agreeing that the Internet facilitated 'scholarly networks beyond disciplinary areas), and information flow (75.9% agreeing that the Internet has 'increased the flow of cross-disciplinary information').

Finally, experienced researchers were asked to assess the extent to which they agreed that the use of the Internet for research has altered the concept of 'scholarly communities'.

Table 7 Communication and research possibilities via the Internet have altered the concept of scholarly communities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	8	17.4	27.6	27.6
	agree	14	30.4	48.3	75.9
	neither	4	8.7	13.8	89.7
	disagree	2	4.3	6.9	96.6
	strongly disagree	1	2.2	3.4	100.0
	Total	29	63.0	100.0	
Missing	System	17	37.0		
Total		46	100.0		

With 75.9% either strongly agreeing or agreeing that the Internet had altered the concept of the scholarly community, it appears that its impact on the invisible college has been quite profound. Coupled with the response to other questions, the survey results strongly suggest that these communities and their scholarly communication practices have been fundamentally and permanently altered.

The survey also investigated academic use of ICTs specifically provided by, or linked to, library services. All respondents were asked in Part A to indicate how frequently they accessed the Curtin University Library services via the Internet.

Table 8 How often do you use the services offered by the University Library?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	10	21.7	22.2	22.2
	weekly	23	50.0	51.1	73.3
	occasionally	11	23.9	24.4	97.8
	never	1	2.2	2.2	100.0
	Total	45	97.8	100.0	
Missing	System	1	2.2		
Total		46	100.0		

It is apparent most respondents can be categorised as regular users of the Internet for the purpose of accessing the Library's services, with 33 (73.3%) reporting daily or weekly use, and only one respondent reporting no such use at all.

The survey then proceeded to ask a series of questions related to the use of particular library services.

Table 9 How often do you use the Library's web catalogue?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	10	21.7	21.7	21.7
	weekly	24	52.2	52.2	73.9
	occasionally	12	26.1	26.1	100.0
	Total	46	100.0	100.0	

Respondents reported a 100% use of the Library's web based catalogue on at least an occasional basis – a result that calls into question the one outlying response reported in Table 8.

Table 10 How often do you use the Library's online reference service?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	1	2.2	2.2	2.2
	weekly	15	32.6	33.3	35.6
	occasionally	13	28.3	28.9	64.4
	never	16	34.8	35.6	100.0
	Total	45	97.8	100.0	
Missing	System	1	2.2		
Total		46	100.0		

The Curtin Library offers an email reference service through a form which can be completed and submitted via the Library webpage. It was this service that was intended to be the focus of this question. Given, however, that one respondent reported the unlikely outcome of daily usage and a high number of others (32.6%) reported weekly usage, it is probable that some respondents did not differentiate between the intended email reference service and other reference-related services which are delivered via the web (i.e. subject-based portals, access to scholarly electronic databases). Nevertheless the results indicate a high degree of awareness and usage of the various web- based 'reference' services, with 29 (64.4%) of respondents indicating at least occasional usage of these services.

Table 11 How often do you use bibliographic databases provided by the Library?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	3	6.5	6.5	6.5
	weekly	24	52.2	52.2	58.7
	occasionally	12	26.1	26.1	84.8
	never	7	15.2	15.2	100.0
	Total	46	100.0	100.0	

These results again indicate a high degree of awareness and usage of the bibliographic databases, with 27 (58.7%) reporting at least weekly usage, and a further 12 (26.1%)

reporting less frequent but still occasional usage. It should, however, be noted that there remain 7 (15.2%) respondents who have never had need of this service even when it is delivered to their desk-top.

Table 12 How often do you use full text electronic journals provided by the Library?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	2	4.3	4.3	4.3
	weekly	25	54.3	54.3	58.7
	occasionally	15	32.6	32.6	91.3
	never	4	8.7	8.7	100.0
	Total	46	100.0	100.0	

The results relating to 'full text electronic journals' are very similar to those for 'bibliographic databases' reported in Table 4. This is to be expected, given that the two share a common point of access (the Library's 'Gecko' service), and in many cases the bibliographic databases interface with the full text of journals.

It is noteworthy that a lower number of respondents (8.7%) reported that they 'never' used the full text electronic journals than reported the same response for the bibliographic databases (15.2%). Given the linked nature of these services, this would suggest that at least some of the non-usage of databases is due to a lack of perceived usefulness, rather than a lack of awareness of their existence.

Table 13 How often do you use the Library's electronic reserve?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	daily	1	2.2	2.2	2.2
	weekly	10	21.7	21.7	23.9
	occasionally	24	52.2	52.2	76.1
	never	11	23.9	23.9	100.0
	Total	46	100.0	100.0	

The Curtin Library has been offering an electronic closed reserve service since 2000. Again, use of the system is reported as high, with 35 (76.1%) of users reporting at least occasional use.

Table 14 How has the Internet impacted on your reading of research journals?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more	14	30.4	51.9	51.9
	the same	12	26.1	44.4	96.3
	less	1	2.2	3.7	100.0
	Total	27	58.7	100.0	
Missing	System	19	41.3		
Total		46	100.0		

A majority of respondents (51.9%) indicated that their reading of research journals had increased since the inception of the Internet. This could in part be explained by the access to free web-based journals. Given, however, the responses reported in Table 12, which indicated that 27 (58.7%) of respondents read full text journals sourced from the Library on at least a weekly basis, with a further 15 (32.6%) reading such journals at least occasionally, it would seem that the likely explanation for this increase in readership is found in the availability of these journals from the Library.

Table 15 How has the Internet impacted on your use of the Library and its services?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more use	17	37.0	60.7	60.7
	no change	8	17.4	28.6	89.3
	less use	3	6.5	10.7	100.0
	Total	28	60.9	100.0	
Missing	System	18	39.1		
Total		46	100.0		

A majority of respondents (60.7%) reported that their use of the Library and its services had increased since the inception of the Internet. This compares with 3 (10.7%) of users who reported less use.

Table 16 How has the Internet impacted on your attending the Library in person?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	more	4	8.7	14.8	14.8
	the same	9		33.3	48.1
	less	14	30.4	51.9	100.0
	Total	27	58.7	100.0	
Missing	System	19	41.3		
Total		46	100.0		

Although Table 15 reported an increase in Library service usage for a majority of respondents since the inception of the Internet, it might have been expected that the increase was due to

the ease of desk-top access which removed the necessity to attend the Library in person. Although 14 (51.9%) of respondents reported that it was the case that they now needed to visit the Library less frequently, nearly half indicated that there had been either no change (9 = 33.3%) or that in some cases (4 = 14.8%) their personal library attendance is now more frequent. It is difficult to know what would explain this latter response, although it may well be that the additional 'reach' of the Library's web-based services acts as a form of marketing which attracts users to services and collections of which they were not previously aware.

Discussion

The results reported above, concerning the adoption of ICTs for scholarly communication and library use by Curtin University academic staff and research students, are at best indicative. As this was a pilot survey and distributed to a comparatively small and homogenous (in terms of discipline background) population, it is difficult to know to what extent the results might be extrapolated. Further information will be forthcoming when the survey is distributed to a wider group.

The results, however, indicate the extent to which Internet-based scholarly practice has penetrated the academic community at Curtin University. There is a high level of usage of all of the web based services investigated in this survey, and it could in turn be assumed that other such library services (book recalls, book ordering and document delivery requests) might record similar levels of use. Indeed it is hardly surprising that staff and research students will avail themselves of the opportunity to use desk-top services which prior to the Internet would have required them to leave their office and attend the library in person.

The implications of these results for academic library services, in so far as they record both library activity and associated research and communication practices, may be best understood in the context of the wider goals of this research project. That is, the extent to which research and scholarly communication practices and, in turn, scholarly communities are being modified by the use of the Internet. It is important that all of the recent shifts in formal and informal scholarly communication have been facilitated by the technology which resides in the one 'box' on the researcher's desk, and it is the same box which is used to access the various library services as reported above. Many of these are services which would still be characterised as being part of the formal apparatus of scholarly communication – access to journals, bibliographic resources and library catalogues. One of the Internet's major attractions for researchers, however, is that it unites the two aspects of the scholarly communication process - the formal and the informal - into a single point of access (the PC) and an increasingly seamless mode of publishing and communication. Access to journal literature, conference proceedings, library catalogues, bibliographic databases, local and international colleagues, professional organisations, affiliations of researchers, library reference services, and numerous other forms of contact with the scholarly enterprise are enabled by the Internet.

In this environment it is highly likely that there will be a continuing erosion of the formal/informal scholarly communication dichotomy. The responses gathered to this survey in no way indicate that libraries are being marginalised by this process, but the challenge remains to find ways to maximise their contribution to scholarly communities by tapping in to changes in the way scholars communicate.

The means by which libraries can expand their role in a way that acknowledges the changing nature of scholarly communication and scholarly communities may well be available in the form of institutional repositories. Libraries have taken a leading role in promoting the concept of institutional repositories as a means of addressing aspects of the crisis in scholarly publishing, but because their concern has been with problems associated with the formal aspects of scholarly communication, they may not have realised the full potential of such repositories. That is, the institutional repository should not be configured simply as a surrogate form of distribution for formal (i.e. peer reviewed) scholarship, but rather it has the potential to develop into a hybrid form, to be used for the dissemination of both formal and informal communication. This is not to argue that the established formal scholarly communication channels, grounded in a model of peer review and the scholarly journal, are redundant, but that to reproduce them in the institutional repository will be to duplicate a system that was designed to comply with the limitations of previous technologies and with now dated concepts of research practice and scholarly community. Indeed, examples already exist of new approaches to peer review and publication which take advantage of the communicative possibilities of ICTs, such as the *Journal of Interactive Media in Education* which uses an open peer review system employing 'Computer-Supported Collaborative Argumentation' (CSCA), and the Australian research forum, *Fibreculture* (Sumner & Buckingham Shum 1996; Fibreculture 2001).

Institutional repositories offer librarians the opportunity to shift from being end players in the scholarly communication process to being participants in scholarly publishing, because it may well fall to them to set the parameters for inclusion in institutional repositories. Clifford Lynch has recently emphasised the need for an open mind on the material to be included in repositories, arguing that they need to be understood and developed as a new form of scholarly publishing. He has called for libraries to use the development of repositories as an opportunity to 'digitally capture and preserve many of the events of campus life – symposia, performances, lectures' (Lynch 2003). To Lynch's list one might add field and laboratory notes, papers under review, papers not intended for formal publication, correspondence with colleagues, significant postings to discussion lists or bulletin boards, weblogs, successful grant proposals and interim reports on project outcomes. By making this material accessible on institutional repositories, libraries will not only be using the power of the Internet to help break down the often artificial barriers between formal and informal scholarly communication, but also reinforcing their role in the process of scholarship.

Houghton, Steele & Henty concluded their recent report on changing research practices in Australia by advocating the development of institutional repositories, noting that to date 'there have only been piecemeal approaches through a variety of institutional and institutionally hosted departmental and personal websites' (2003, p. 141). They argue for the potential for repositories to 'more effectively disseminate the research of the institution, raising its visibility and providing an avenue for increasing its impact' (142), and they also draw attention to their capacity to support 'new research practices which emphasise data, related software and other analytical objects as an integral part of the record and discourse of scholarship' (142).

Houghton, Steele & Henty remain somewhat coy, however, about suggesting exactly what content should be included in institutional repositories. Their report considers issues of peer review at some length, and while collecting evidence from some respondents that peer review no longer has the core role that it once did, they still acknowledge its continuing importance

to the formal processes of scholarly communication. This leads them to the following conclusion when discussing the content of digital repositories:

> Perhaps the most important feature, given the strong adherence to peer review and widespread concerns about quality control, will be quality control of the material populating repositories and clear standardised means for identifying the level of quality control that each item meets. (143)

The need to apply such rigorous control is clearly outside the skills currently available to libraries, and in any case almost certainly unnecessary. The 'concerns about quality control' noted by Houghton, Steele & Henty refer to frequently expressed concerns about the quality of information found on the Internet, much of which comes without institutional or academic authority. The fundamental policing of quality of material loaded to institutional repositories should come from those who are most vulnerable, the academic staff who elect to add material to those repositories. To insist on peer review of this material, or some other form of regulated quality control, will simply be to risk these repositories becoming an extension of formal scholarly communication practice, rather than a tool which reflects the new technological and research environments in which scholars now function. In the terms used by Gibbons et al (1994), institutional repositories need to be developed in support of Mode 2 knowledge production.

Conclusion

The Internet has undoubtedly impacted upon – and continues to affect -- the scholarly communication practices and expectations of academic communities. Such possibilities and changed practices provide an opportunity for libraries to re-evaluate their role and position within scholarly communities. Many university libraries in Australia, including the Library of Curtin University of Technology, are currently in the early stages of developing institutional repositories. The implementation of these repositories provides universities with an opportunity to develop a resource for the storage and distribution of scholarly information in a manner that recognises the reality of modern forms of scholarly discourse. Part of this 'reality' derives from the digital *form* in which the information is stored, but it should also be related to the *content* of the information and knowledge made available in these repositories. That is, the content should encompass not only the formal products of scholarly communication, but also the informal by-products.

The institutional repository offers an opportunity for creating a marriage between formal and informal communication, in a way that allows libraries to use their existing skills in the organisation and distribution of knowledge in order to create new and exciting synergies between the previously separate arms of scholarly communication. By doing so, university libraries will transform themselves into increasingly active participants in the scholarly communication process.

References

Borgman, C. L. 2000. 'Digital libraries and the continuum of scholarly research', *Journal of Documentation*, vol. 56, no. 4, pp. 412-430.

Costa, S., and Meadows, J., 2000. 'The impact of computer usage on scholarly communication among social scientists', *Journal of Information Science*, vol. 26, no. 4, pp. 255-262.

Crane, D. 1972, *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*, University of Chicago Press, Chicago.

Fibreculture 2001, 'Introduction: Listing Media in Transition: An Introduction to Fibreculture' 2001, in *Politics of a Digital Present: An Inventory of Australian Net Culture, Criticism and Theory*, eds H. Brown, G. Lovink, H. Merrick, N. Rossiter, D.Teh, & M. Willson, Fibreculture Publications, Melbourne. Available at: <http://www.fibreculture.org/reader2001.html> [10 September 2003]

Gibbons, M., Nowotny, H., Limoges, C., Schwartzman, S., Scott, P. and Trow, M. 1994, *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*, Sage, London.

Harrison, T. and Stephen, T. 1995, 'The electronic journal as the heart of an online scholarly community (networked scholarly publishing)', *Library Trends*, vol. 43, no. 4, pp. 592-608.

Hert, P. 1997, 'Social dynamics of an on-line scholarly debate', *The Information Society*, vol. 13, no. 4, pp. 329-360.

Houghton, J. W., Steele, C., and Henty, M. 2003, *Changing Research Practices in the Digital Information and Communication Environment*, Department of Education, Science and Training, Canberra.

INFROSS [Investigation into the Information Requirements of Social Sciences] 1971, *Information Requirements of Researchers in the Social Sciences*, Bath University Library, Bath.

Koku, E., Nazer, N., and Wellman, B. 2001, 'Netting scholars: online and offline', *American Behavioral Scientist*, vol. 44, no. 10, pp. 1752-1774.

Lally, E. 2001, 'A researcher's perspective on electronic scholarly communication', *Online Information Review*, vol. 25, no. 2, pp. 80-87.

Lesk, M. 1999, 'Digital libraries: a unifying or distributing force?', in *Technology and Scholarly Communication*, eds R. Ekman & R. E. Quandt, University of California Press, Berkley, pp. 354-365.

Line, M. 1999, 'Social science information – the poor relation', *INSPEL*, vol. 33, no. 3, pp. 131-136.

Lynch, C. A. 2003, 'Institutional repositories: essential infrastructure for scholarship in the digital age', *ARL Bimonthly Report*, 226. Available from: <http://www.arl.org/newsltr/226/ir.html> [5 September 2003].

McKnight, C., Yu, L., Harker, S. and Phillips, K. (2000). 'Librarians in the delivery of journals: roles revisited', *Journal of Librarianship and Information Science*, vol. 32, no. 3, pp. 117-134.

Meadows, A. J. 1974, *Communicating in Science*, Butterworth, London.

Robb, M. and Janes, M. 2003, 'Research on the research support needs of social scientists', paper presented at *World Library and Information Congress: 69th IFLA General Conference and Council, 1-9 August 2003, Berlin*. Available from: <http://www.ifla.org/IV/ifla69/papers/083e-Robb_Janes.pdf> [2 September 2003].

Robins, D. 2002, 'From virtual libraries to digital libraries: the role of digital libraries in information communities', in *Libraries, the Internet and Scholarship: Tool and Trends Converging*, ed C. F. Thomas, New York: Marcel Dekker Inc., New York, pp. 45-76.

Roselle, A. 2001, 'The effects of electronic communication and the World Wide Web on US academic documents librarians' relationships', *Journal of Government Information*, vol. 28, pp. 149-169.

Sumner, T and Buckingham Shum, S. 1996, 'Open Peer Review & Argumentation: Loosening the Paper Chains on Journals', *Ariadne*, issue 5, Sep. 1996. available from: <http://www.ariadne.ac.uk/issue5/jime/> [29 August 2003]

Tenopir, C. and King, D. 2002, 'Reading behaviour and electronic journals', *Learned Publishing*, vol. 15, no. 4, pp. 259-264.

Walsh, J. P. and Bayma, T. 1996, 'The virtual college: computer-mediated communication and scientific work', *The Information Society*, vol. 12, no. 4, pp. 343-364.

Walsh, J. P., Kucker, S., and Maloney, N. 2000, 'Connecting minds: computer-mediated communication and scientific work', *Journal of the American Society for Information Science*, vol. 51, no. 14, pp. 1295-1305.