Scholarly Communication & Libraries Unbound: The Opportunity of the Commons

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The world in which ideas and information are created, shared, and documented – the world of scholarly communication – is undergoing some of the most phenomenal transformation in the history of recorded knowledge. One can point to past pivotal events in these centuries-old traditions (whether it is the invention of the printing press, or the establishment of scientific societies), but more recent technologies and concurrently changing norms have prompted a sea change of unusual scale and impact. While technology has enabled new venues and models for communication, it has also motivated the various stakeholders in the scholarly communication arena in both subtle and not-too-subtle ways.

The thesis presented here is that the trends of distributed computing and open paradigms for scholarly exchange have relaxed the boundaries between stakeholders, allowing more permeable and overlapping roles. Content once fettered by physical constraints has been loosened. The conventions of scholarly communication have been stretched and opened to a wider audience. The products of publication have become more process-like. The roles of libraries have also changed to embrace new opportunities for facilitating and shaping content, communication, and collaboration. This paper explores the changes underway and in particular the new ways in which the research library's role as *archive* or *steward* of information goods is being transformed as a *collaborator* and potentially a *catalyst* within interest-based communities.

While the discussion here will not focus on the concept of a commons per se, a central premise of this analysis involves the interplay of stakeholder roles within the scholarly information commons. The intent is to provide a review of key themes and a practical exploration of roles, culminating with potential opportunities for libraries in the future.

Hess and Ostrom's (2004) organizing framework for this workshop notes the convergence of forces within the commons, citing the *hyperchange* brought about by "linear, exponential, discontinuous, and chaotic change." The exploration here includes instances of linear change (extrapolation from past models) as well as discontinuous change (innovation) and will suggest that the fundamental social norms and constraints of discipline communities explain a good deal of the variability in the adoption of new scholarly communication models. Further, while research libraries have potential to affect change, sensitivity to context – to the prevailing norms – will be absolutely key. This focus also poses significant challenge and potentially significant cost for the library.

To understand the contemporary environment, we will first address the traditional conventions of scholarly communication and the traditional archival role of libraries in that environment. Then, to set the stage for an analysis of new, more engaged and collaborative roles for libraries, the transformations underway in content and communication processes will be pursued. With this investigation as backdrop, we can then explore library engagement within discipline communities and in shaping scholarly communication processes.

Communication Conventions in the Commons

Borgman (1990) has provided a useful definition of scholarly communication and the critical social aspects of the processes:

> By *scholarly communication* we mean the study of how scholars in any field (e.g., physical, biological, social, and behavioural sciences, humanities, technology) use and disseminate information through formal and informal channels. The study of scholarly communication includes the growth of scholarly information, the relationships among research areas and disciplines, the information needs and uses of individual user groups, and the relationships among formal and informal methods of communication. [pp. 13-14]

While we can point to generic stages in the communication process (e.g., idea, documentation, dissemination) and types of communication venues that exist in the majority of disciplines (e.g., conferences, books, journals, or reviews), there are also significant domain-specific practices and expectations that have developed. Hyland's (2000) analysis of discourse within disciplines differentiates the common practices (such as acknowledging sources, testing, intellectual honesty), from those activities that evolve as the result of community-specific consensus:

> The ways that writers chose to represent themselves, their readers and their world, how they seek to advance knowledge, how they maintain the authority of their discipline and the processes whereby they establish what is to be accepted as substantiated truth, a useful contribution and a valid argument are all culturally-influenced practical actions and matters for community agreement… [D]isciplinary communicative practices involve a system of appropriate social engagement with one's material and one's colleagues. The writing that disciplines produce, support and authorise [sic] … are representations of legitimate discourses which help to define and maintain particular epistemologies and academic boundaries. [p.11]

"Appropriate social engagement with one's material and one's colleagues." This phrase captures the core dynamic that has fueled scholarship. The interaction of ideas, typically represented in some tangible form, and individuals within bounded disciplines and subdisciplines has been the primary context for advancing knowledge. These interactions occur through both formal and informal means. The so-called "invisible college," informal

groups and networks of interested parties, has played a critical role in advancing knowledge within disciplines.

In her pre-Internet analysis of invisible colleges, Crane (1972) captures the defining characteristics of informal networks. The exact boundaries are difficult to define. Members are geographically separated and each is aware of some, but not all members. Interaction rarely involves the entire group in a physical context, but typically is indirect or mediated through intervening parties. Central figures, rather than leaders, are evident.

Crane's analysis raises a number of interesting possibilities for revolution within disciplines. For example, if we only focus on groups as well-bounded abstract entities, we may miss the influences of individual action and opinion leaders. She notes that central figures and some of their associates are "closely linked by direct ties and develop a kind of solidarity that is useful in building morale and maintaining motivation among members" [p. 139]. In addition, the multiple affiliations of individuals enable communication and potentially innovation to move between groups, potentially advancing new ideas, paradigms, or methods.

There are, of course, obvious parallels to be drawn and understood between the notion of invisible colleges and the asynchronous communications and links among interested parties in today’s world of electronic communication, although electronic media may provide for broader participation in various communication venues.

The evolution of twentieth century scholarship shows evidence of increasing specialization within disciplines, growth of informal networks, and also growth of another stakeholder group—namely, professional societies and associations. These organizations began publications, and concurrently universities initiated subsidized systems of publishing

through institutional presses. Articulated systems of peer review took hold within these communities as a primary mechanism for designating quality. As these organizations took shape, the research library also matured, its role focusing primarily on collecting the *valued* publications of the community. Driven largely by demand for specific types of publications, the library operated relatively independently from the informal circles of communication. Collecting tangible, recorded knowledge -- primary and secondary sources -- was the library's focus.

The profession of librarianship also took shape, developing systems of access (through cataloging and classification) and services that mediated between individual and content to serve *expressed* information needs. These access systems generally were undifferentiating and unintrusive –that is, all materials were treated with the same descriptive systems, and the library's actions had little effect on the functionality or the structure of the published works. In general, the library emerges in the twentieth century as an organization serving all disciplines with similar tools, providing broad and generalized access to its collections. Stewardship of resources is paramount and this responsibility is manifest in roles that acquired, organized, preserved, and mediated the products of scholarship. The 20th century library exists largely as an institution separate from the creative or communication processes of other stakeholder groups.

Distributed, Open Trends

If we fast-forward to the late 20th century, we see several emerging trends that provided a significant catalyst for changing relationships among the stakeholders.[1] The

[1] See Lougee (2002) for an exploration of the impact of distributed computing and open models on classic functions of libraries: collection development, access, and service.

growth of distributed technologies and the Web brought democratic access. The capability to disseminate ("publish") and collect information (build "libraries") was now possible on the individual desktop. As standards emerged for creating, structuring, and disseminating digital content, libraries and other content-rich organizations were able to move away from proprietary methods of information access and management. The standards and tools offered libraries new opportunities for more robust services: e.g., to add functionality to content or to deliver content differently for different audiences, or to sustain digital collections over time. Intelligent tools and systems also enabled information inquiry and analysis that were heretofore impossible.

A second critical trend is evident in the emergence of "open" paradigms that brought models of open and collaborative exchange. Programs to adopt these models took shape, sometimes with both a practical and poliltical agenda. Efforts such as the Open Knowledge Initiative to share learning technologies offered an alternative to more formal or commercial means of sharing resources. The Open Archives Initiative was launched in response to community concerns about the constraints of commercial journal publishing. The intent was to offer an alternative to the "gift economy" whereby intellectual property is ceded to the for-profit sector and then re-purchased for community use. The resulting protocols for information exchange and initiatives to implement these protocols created new conventions for distributing content, such as e-print archives.

As control and access to information become more distributed and open models of exchange become more common, another critical trend is taking shape. There is in these open trends evidence of a shift from publication as *product* to publication as *process*. Computer scientist Hal Berghel (2001) has forecast that this shift will become increasingly prominent:

> By 2100, our current view of electronic publications as copyright-able artifacts will be viewed primarily as a historical allegiance to a pre-participatory, non-interactive, essentially dull and lifeless era of publishing – an era in which one thought of digital libraries…as a collection of linked "things" rather than articulated processes and procedures. The current digital publication will be a relic, an obscure by-product from the horse and buggy age of digital networks. [p. 18]

This notion of "articulated processes and procedures" provides a quite different context in which to think about scholarly communication. The potential for dynamic and cumulating exchange not only affects the scholarly community, but other stakeholders as well. The library's historic focus on tangible products (with associated rights) is significantly affected by this new paradigm.

In this new context, libraries are challenged not only to harness the potential offered by distributed and open models, but to sustain and possibly enhance the library's longstanding traditions of bringing order, access, permanence, and trust to the information commons. The question remains, however: can these traits be translated to an environment where process, not product, is king? Is control and management possible in this context or will some new role for libraries emerge?

Transformation: Content & Publication

Evidence of change in the products of scholarship reflects considerable variability. In some cases we have examples that merely replicate traditional structures. In other instances, we see new models that "push the envelope" in experimenting with new constructs. At one end of a continuum we have digital equivalents of print publications. Except for additional search capability, these e-versions are otherwise as fixed and "conventional" as their print counterparts. At the other end of the continuum, we have new forms that are more organic, more dynamic, and more a process than product.

As illustration of the dimensions upon which new communications may vary, consider these examples. Working papers and e-print services now abound, allowing access to early instances of publication, sometimes outside of the peer review process. While widely used in some disciplines (e.g., physics), they have been less successful in others (e.g., RePEc in economics).[2] In some domains, large-scale services such as the Social Science Research Network combine working papers and published articles, bringing together diverse publication types for a community of disciplines.

Examples are emerging that introduce the concept of dynamic publication. For example, *Living Reviews* is an online-only model created by the Max Planck Institute, incorporating peer review and tools to support ongoing revision of each article by the author. *Living Reviews* articles are truly "living" in their cumulating presentation. Related models exist whereby fixed articles might be complimented by ongoing commentary and dialogue. And, of course, the concept of blogs has introduced a whole new genre of cumulating commentary.

AAAS's Signal Transduction Knowledge Environment (STKE) challenges the boundaries of a publication. Rather than a singular product, STKE incorporates the functions of journal, current awareness, community dialogue, and analytic tools in a compound and interrelated environment of different media.[3]

The point of this highly selective set of examples is that models are diverse and may vary along dimensions of peer review, stability or "fixity," incorporation of associated data or media, and tools and capabilities for analysis. Publication is no longer of singular form nor are publications necessarily the final product in the communication process. Rather, technology

[2] Information about RePEc can be found at: http://www.repec.org/
[3] Additional information and analysis of STKE can be found at: http://stke.sciencemag.org/

has increased access, added functionality, and enabled interaction. These are significant steps in unbinding or unbundling traditional modes of scholarly communication.

Transformation: Disciplines

The themes of distributed technologies and open paradigms have had a transforming effect on the products and processes of communication within disciplines. Since disciplines have evolved with different practices and expectations about scholarly communication, it is no surprise that the impact of new technologies has played out differentially within each community. Kling and McKim (2000) remind us of the misguided, deterministic assumption that "sooner or later everyone will catch on" and that disciplines will converge on a stable set of electronic vehicles such as e-prints, e-lists, and e-journals. Rather, the unique characteristics of disciplines will prevail in shaping the future of scholarly discourse and communication within each disciplinary culture. The role of scholarly/professional societies, the degree of collaboration and co-authorship, established norms for informal communication, methods for conveying recognition, and the existence of near-monopolies of publishers are factors that come into play when understanding the differences between communities.

The field of physics has been the focus of study from a variety of perspectives to understand the culture and to analyze the success of the arXiv e-print environment. Anthropologist Traweek's (1988) analysis of the high energy physics community paints a picture of a well-bounded group, characterized by large research projects, focus on shared instrumentation, and a critical distinction between the roles of informal and formal communication:

> Acquiring the capacity to gossip and to gain access to gossip about physicists, data, detectors, and ideas is the final and necessary stage in the training of a high

> energy physicist. Losing access to that gossip as punishment for violating certain moral codes effectively prevents the physicist from practicing physics…
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> If gossip is a means of producing physics, physicists, and their culture, then written materials, articles and preprints, are the commodities the physicists produce in their turn. Articles represent the consensus, the "facts," data with the noise removed. The authors of these written accounts own the information in the account. Any subsequent users of that new information must pay royalties to the authors in the form of homage or credit, thereby increasing the accumulating reputations of the authors. In talk physicists rarely give credit to others. Scientific writing keeps track of the results of these debates. It is a record-keeping device, a spare ledger of credits and debits. [p.122]

This dichotomy that existed in the pre-Internet culture of physicists (i.e., informal sharing within well-bounded groups and the highly valued "ledger" role of the published literature) sheds significant light on what has transpired with the phenomenal success of the arXiv e-print service.

Physics offers an interesting case study of change. Crane's suggestion that central figures can make a difference played out here in a relatively short period of time through the work of Paul Ginsparg. Interestingly, however, the high-volume, high-use, and rapid dissemination of e-prints has not diminished the role of traditional journals in physics. The need for the "ledger of credits and debits" remains. At least one recent analysis (Brown 2001), for example, suggests that the citation of top tier physics journals has not decreased despite the concurrent rise in citation of e-print literature. In the world of physics, the prevailing cultural norms have been sustained while exploiting the tools of the digital age.

Other disciplines offer similar examples of culture shaping the adoption of new modes of communication. The seminal work of Garvey and Griffith (1971), for example, depicts a well-established sequence of scholarly communication in psychology that embraces distinct roles for conferences, preprints, journal articles, citation, and review articles. They also identify the critical role of the highly structured professional societies. They note that "the

most crucial point in the process of dissemination of *scientific* information is the transfer of information from the informal to the formal domain." [p. 358] Garvey and Griffith's commissioned analysis concluded with concern about the emerging emphasis on speeding up the flow of informal scientific information: "such mechanisms would change the norms governing these processes and confuse the mechanisms concerned with evaluating and integrating knowledge." [p. 360] Not surprisingly, the American Psychological Association journals have exhibited similar caution in initially prohibiting publication of manuscripts previously posted on the Web.[4]

Chemistry is another discipline where the strong role of the primary society publisher, the American Chemical Society, has constrained widespread adoption of e-print technologies through policy restrictions on self-archiving or pre-publication distribution. In contrast, the Association for Computer Machinery had been more open about pre-posting and has been liberal in policies with respect to the retention of author rights, suggesting a more enabling role of the professional organization.

The picture in the humanities is, not surprisingly, quite different. Stone (1982) depicts the humanist:

> …he works differently in terms of time-scale, approach to his material, the age and form of material required, and the extent of immediate contact with other researchers. He is rather disadvantaged in terms of the development of secondary services and is very dependent on a well-stocked library with open access. The literature he uses tends not to become obsolete, though frequency of use of some important items may be low. The importance in humanities of criticism and analysis—including personal observation and opinion—marks a fundamental difference from the literature of science, and the subjective interaction between the humanist and his material is a unique feature. [p. 303-304]

[4] Currently, the decision on pre-publication posting is left to the discretion of individual APA journal editors.

Here we see the prominence of the "lone scholar" and the intimate interaction between scholar and his/her targeted materials. While initially the publications of scholarly associations served to create a distinctive identity for humanistic disciplines and to define practice, over time these publications became the disseminators of stable (and archive-able) authoritative scholarship as well (Tomlins 1998).

Learned societies play a unique role in the humanities, since they help establish connections between scholars that might otherwise remain separate due to the fragmented and solitary nature of their work. Some have argued that societies such as the American Council of Learned Societies, should help validate and organize scholarly resources, and there is evidence they have indeed played such a role through pilot efforts to incorporate digital technologies in publication and dissemination (Bennett 1997). The challenge in creating responsive digital environments for humanists may well lie in bringing highly functional tools to the individual scholar to use in accessing scholarly works (e.g., searchable text, or tools for analysis) rather than attempting to create a more collaborative culture of communication. While the traditional vehicles for disseminating scholarship have resisted change, there is evidence of new arenas for dialogue (e.g., H-Net in History) and for coalescing resources of interest. Unsworth (2003) perhaps best captures the tension experienced by the humanities in a digital era, tension between the reward structures, the technology, and the desire for connection:

> What matters, in the humanities, is brilliance usually measured in citation – that is, reputation—not (frankly) efficacy, or proof, or any other outcome. These network discussion groups – which are really communities of interest – make it possible for people to break out of their underfunded, undercapitalized, under-recognized institutional contexts, and become recognized for their own contributions to the community. This provides a kind of access and even mobility that formal publication would not, precisely because of the weakness of the peer review system in the humanities….

The distinction between formal and informal venues for communication may remain distinct for humanities disciplines for the foreseeable future.

Transformation: Libraries

A shared assumption of many of the papers within this workshop has been the imperative of a more ecological analysis of the information commons – i.e., an understanding of the stakeholders, the dynamics between and among them, the norms of behavior, and the structure of incentives and disincentives that advance knowledge. The analysis thus far has focused on the context within communities of common interest, within disciplines. The changes that are evident, fueled by distributed technologies and open models of exchange, have been played out uniquely within each discipline's context. The selected examples reflect constraints that obtain in some disciplines as well as the natural progressions to new media in others. In some cases, new venues, new types of publication have been more readily adopted and valued within a community. In other cases, true innovation is at the margins. As the library seeks to adapt and transform itself in this emerging environment, sensitivity to context, to these prevailing forces within each discipline context will be critical.

There are numerous examples of library experimentation and investment in new roles in the scholarly communication environment. The majority of research libraries have assumed responsibilities for digital content that modestly extend existing core functions (e.g., creation of metadata for intellectual access or digital reformatting for preservation). A much smaller number of libraries have become significant players in advancing new systems and tools that fundamentally change scholarly communication practices. Rather than inventory

here the many projects underway, the overview that follows will highlight three models of library activity, each reflecting different characteristics and degrees of library engagement within the scholarly communication process.

The Library as Control Zone

…Libraries lack the strategic position in the distribution chain that publishers, commercial or non-commercial have. …And although they are often an important part of the chain, their role is not exclusive…
Brian Kahin (1995)

The traditional focus of libraries as archive of the products of scholarship places the library in a relatively fixed role within the commons. Authors and publishers also hold distinct and separate roles and responsibilities within the traditional, linear sequence of scholarly communication. Libraries typically serve as agent, as intermediary between publisher and user, acquiring and managing content that had been conceived by the author and produced by the publisher. We see evidence in early digital libraries of this role continuing, with e-content being brought into the library environment either by locally managing the bits or through a sustained access relationship (license) with the publisher. Libraries acquire, manage, describe, and preserve the digital content much as they handle traditional media.

Early in the evolution of digital libraries Cornell's Ross Atkinson (1996), in fact, proposed that a critical task for libraries was the creation of a "control zone" which would be "technically and conceptually separate from the open zone" (the "open zone" representing the unfettered and free arena on the Internet). His proposal adds a critical aspect of creating the zone – namely the *explicit* movement of content into a context in which the library would guarantee the quality and accessibility of that object indefinitely. Further, this "modest

proposal" suggests that the academy could seize the opportunity of the control zone to assume responsibility for publications intended for a scholarly audience, leaving higher-use information within the commercial sector. His assertion maintains that the enclosed or bounded library remains the "ultimate and quintessential research instrument."

The emergence of institutional repositories is, in some respect, consistent with this notion of the control zone, with the important distinction that institutional repositories currently can embody a range of information types, from informal to more formal. As libraries become engaged in such services (e.g., D-Space), the potential exists for involvement earlier in the communication and dissemination process. We see, for example, the possibility of libraries working actively with a community to ensure the creation of content employing standards-based methods, or perhaps educating stakeholders about options with respect to rights and dissemination. While the shift is perhaps subtle, the library's archival or stewardship role has expanded to embrace a broader arena of content and to work with a community to ensure the sustainability of the archive.

There are also instances where libraries have created roles further "upstream" in the scholarly communication process, serving as formal distributors of publications. These cases exhibit variations on a theme. For example, Stanford's HighWire Press works in cooperation with major society publishers to fulfill a distribution role. The University of Michigan's Scholarly Publishing Office and Cornell's Digital Consulting and Production Services offer examples where expertise and tools are brought to the table for creators and authors in a service-bureau environment.[5] Michigan's services for the ACLS History E-Book project, for example, demonstrate a focused production role, while the Cornell library's Project Euclid

reflects more of a partnership with publishers in order to co-develop an interoperable environment for theoretical and applied statistics.

In these examples, the library's role is still largely as steward and archive, but is now involved in direct interaction with the authors and content providers. The content management, archival and dissemination functions co-exist in the "library."

A reasonable question to be raised about these services is "why the library?" Surely other entities have expertise in structuring content for dissemination or technology services to provide access? However, the library may be uniquely or strongly positioned to uphold principles of cost-effective or low-barrier access. Also, libraries bring other important characteristics associated with integrity, authenticity, and trust. Each of these characteristics has been evident in the library's traditional roles, but take on new importance and dimensions in the digital context. Cliff Lynch (2000 and 2001) has explored the fundamental values represented by these characteristics –e.g., the determination of provenance of an object, assurance that the digital object is what it purports to be, and the codification of the version or instance of an object. These functions which may have been largely handled through description (e.g., cataloging of fixed objects) in the print arena, now take on new proportions in the more dynamic digital context. While capabilities exist to capture information about these basic characteristics, more robust systems will be essential in the future. And, as Lynch (2001) suggests, the development of a technology framework to establish trust within a community may actually pose dangers of censorship and control.

Equally important will be the codification of responsibilities in sustaining an archive. Cornell's Mann Library has expressed these issues in the context of the Language Acquisition

[5] In these examples, the library's expertise with respect to content, technology, and users is brought to bear in designing new products and distribution systems. The library role is largely in service to the production of

Laboratory partnership. A "Living Trust" has been proposed as an experimental model and organizational framework for the acquisition, management, preservation, and storage of digital data sets collected by Cornell faculty and researchers.[6]

In the models described here as "control zone," the library role remains relatively well-bounded – i.e., typically acting on behalf of or in response to the needs of the client group. While new forms or methods of scholarly communication may result, the motivating forces remain largely within the discipline community and its associated publishing organizations.

The Library as Systems and Services

As digital libraries have evolved, there have been concurrent developments in technology applications, the structure and functionality of content, the depth of intelligence in systems of description and retrieval, and in interoperable architectures to enable federation of distributed resources. Libraries have made considerable investment in these developments, often in partnership with technology or research organizations.[7] As these investments mature, libraries have shifted emphasis from management of digital products of scholarship to understanding content, its use, and associated users in order to develop more robust and useful digital environments. These explorations reflect a second model for library roles –i.e., more engaged in adding value, in harnessing the potential of content and systems for particular user communities, and in creating tools for more complex exploitation of content by individual scholars and communities of scholars.

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products conceived or developed by other stakeholders.

[6] Additional information about the Lab can be found at: http://www.clal.cornell.edu/

The Digital Library Federation's proposed Distributed Open Digital Library (DODL) reflects this next level of engagement.[8] With more structured content and protocols for dissemination, the potential exists to share richer digital masters of content and thereby enable local manipulation, analysis, and new capabilities for research. A key element in the DODL plan is the essential re-purposing of content for multiple uses and users with a goal of nurturing new scholarship and new forms of scholarship. Through the DODL project, libraries will be developing the protocols for this deeper sharing and establishing the inter-library and inter-institutional rules of re-purposing content.

Other examples of libraries attending to the use dimensions of digital content include instances where socially-based cues (e.g., collaborative or social filtering mechanisms) or semantic structures are incorporated in information systems. Here we see the library taking on a more overt role in shaping the discovery environment through complex associative and interpretive structures. These structures, in turn, enable associations between digital objects and potentially between resources of different disciplines. The semantic web, as proposed, would bring together metadata and a framework of relationships between digital terms and objects. W3C's Semantic Web lead Eric Miller (2003) notes that a semantic framework will enable collaboration by creating the structure to document the flow of data, information, and knowledge: "the steps, social and automatic, by which the associated information evolved." This articulation of relationships is an important step for libraries to address issues associated with communication processes (vs. products).

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[7] While the initial NSF Digital Library Initiatives had modest library involvement, over time library presence has been increasingly evident and the research projects have moved from testbeds to more operational settings.

[8] The rationale and intended focus of the proposed Distributed Open Digital Library project is described in: Seaman, David. "Deep Sharing: A Case for the Federated Digital Library," *Educause Review,* July/August 2003.

In a recent analysis of ontologies and their potential for new forms of library service Atkinson (2003) describes capabilities for specifying the relationship among multiple metadata descriptions through an articulation of the *events* (including transitions and transformations) in a resource's lifecycle. This would enable interoperability among different metadata schema that serve different disciplines and purposes – in other words, would allow inter-discipline communication to occur. Events, as specified in the ontology, might include actions on content such as modification, compilation, extraction, or derivation. This framework allows tracking a work to its origins, but also tracking variations in the history of the work. Such a framework should also allow a user to trace the evolution of a concept over time. Atkinson further explores two types of library service that might be created, an analytic service (to essentially identify the origin and integrity of a work) and a synthetic service (to allow the user to combine the contents of different objects and create new contexts for them):

> The synthetic service is therefore in some ways the exact opposite of the analytical one. The analytical service is more observational, seeking not to disturb objects, but to observe them, so to speak, in their natural habitat – rather like a delicate archaeological dig. The synthetic service, on the other hand, has the potential to pull objects to pieces, recombining parts of them into new forms, disregarding in some cases even the intentions of their original creators. In the synthetic service, the purpose of objects is to serve as building blocks for new user creations.
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> A certain amount of "damage" to a personal database could be done in the course of the kind of recontextualization made possible by such a synthetic service. One role the library plays, therefore, is the same as that for the analytical service – to serve as the protected space to which the user can always return to find the original intact. [p. 169]

This description captures a significant and complex role (which, it should be noted is proposed rather than operational) wherein the library provides the capacity to document processes of scholarly communication *and* enable the re-purposing and transformation of

scholarship over time. In this case, the library role in explicating and enabling scholarly communication proceeds in tandem with the communication itself.

The model reflected in these examples presents the library as facilitator of scholarship and potentially of new forms of scholarship. Often acting in partnership with disciplines, the goal is adding value or utility to the content and, in the future, the processes. An important characteristic that emerges in the event-based example is the library's role to *capture* the communication process and, in so doing, play a much more integrated role in that process.

Library as Catalyst

Collaboration technologies are taking shape as content becomes more interactive and as communities explore new methods for both formal and informal exchange. Examples of digital libraries conceived as domain-specific environments are also emerging. The University of Virginia has advanced the concept of *information communities* as part of the library's overall strategic planning framework. Each information community project brings together distributed content, distributed content providers and organizations, and relevant communication and analytic tools to serve a particular discipline community. The community may include students, faculty, researchers, librarians, information specialists, and citizens with a common interest in a particular thematic area. So, for example, the American Studies information Community is being undertaken collaboratively with other institutions (e.g., Thomas Jefferson Foundation, Virginia Tech University, and the Smithsonian Museum of American Art). The Tibetan and Himalayan community includes the Tibet Heritage Foundation, the Himalayan Health Exchange, and the Center for Research on Tibet.

In the Information Community, the "library" includes content resources built by UVa faculty and the UVa Library based on local and remote collections; online finding aids for physical UVa Library collections; and digital objects licensed for UVa use. Tools might include concordance software, translation capabilities, or geographic resources, depending on the community need. "Features" promote research themes, events, and activities involving or of interest to the Community's members. An email list and an online discussion forum are incorporated to stimulate dialogue and collaboration. The capability exists to allow participants to register their own digital projects and tools, as well as contribute to a collaborative bibliography.

The University of Virginia describes these information communities as "learning and teaching environments" developed around a particular subject domain, with the expressed goal of fostering interdisciplinary and collaborative research and publication. Perhaps most significant, the system and services are explicitly designed to serve a social role as catalyst for an interdisciplinary community. This is a far more intrusive role for the library.

This integration of content, services, data, and tools begins to mirror the construct of a *collaboratory* for focused research communities. Collaboratories have been defined as "tool-oriented computing and communication systems to support scientific collaboration." [9] For example, the Space Physics and Aeronomy Research Collaboratory (SPARC) provides an online knowledge environment for atmospheric scientists worldwide. SPARC incorporates the ability to control remote instrumentation, to review and collaboratively analyze observational data of atmospheric events, to create and archive vast amounts of research data, and to use

[9] National Research Council Committee on a National Collaboratory. *National Collaboratories.* Washington, D.C.: National Academy Press, 1993.

tools to manipulate the data. These types of robust information environments are also envisioned in the recent NSF Cyberinfrastructure report.

While libraries have not been players in research collaboratory development, the Virginia concept suggests a potential role. In this capacity, the library is called upon to comprehend and engage the needs of a community, knitting together content, technology, tools, and people. This is a critical *social* role and offers potential to motivate change within a community. One could also imagine these online environments incorporating the interpretive and semantic functions described above to enhance the utility of content and to document processes over time.

This model of "library as catalyst" reflects two key elements. The library works in collaboration with other stakeholders (scholars, publishers, organizations) and potentially serves as an agent of change in the context of the newly created scholarly communication environment. Library functions are fully part of the overall process of scholarly activity within the environment; in fact, it is difficult to define what is "library" within the online community context. The imperative, however, is gauging and engaging the discipline and its norms for communication and interaction. The outcome of such engagement is a library that is a useful and purposeful player within the discipline.

Concluding Remarks

The exploration of library roles in the scholarly information commons suggests there is no one model that will emerge in the foreseeable future. Since disciplines vary in terms of the degree of *openness to change*, the potential for libraries to engage within these communities will vary as well. Characteristics of each discipline, including norms of

communication and publication, may inhibit adoption of new models within a community or may enable a willing response to new opportunities. Existing control of communication processes by scholarly/professional organizations and publishers also carry significant weight.

We have discussed the forces that are prompting change, including technology and social forces that are enabling traditional products and processes to be unbound, to be enabled for change. This exploration of three archetypal models for library engagement – a focus on "control," on systems and services, or as a catalyst for change – also suggests several core challenges for the future.

The library community has already invested in significant experimentation, and partnerships with the research community have yielded important new capabilities to further development. However, one area for attention that has been largely absent from research agendas is further exploration of discipline cultures. As described, this is a critical element in the comprehension, design, and catalyzing of new models of scholarly communication. Analyses similar to the anthropological work of Traweek could advance progress toward more agile and community-sensitive information environments. The Mellon-sponsored Scholarly Communication Institutes at Dartmouth and (forthcoming) at the University of Virginia (focused on Bioethics) offer the potential to explore the redesign of scholarly communication through a focused assessment of a specific discipline's existing resources and emergent needs.

A second obvious arena for research and investment involves the development of the semantic and interpretive structures and tools that will enable libraries and scholarly communities to develop the systems to document and potentially manage scholarly

communication processes. As the emphasis on process takes greater shape, existing schema and tools will prove inadequate.

A third area for focused investment is the necessary structure(s) to coalesce library resources and expertise. Organizations such as the Digital Library Federation have brought attention to the variability and distribution of library capacity – i.e., technology infrastructure, expertise, and potential for expanded effort. Coordinating resources and leveraging investments require a new framework for federated governance of multiple library partners. These challenges are magnified further as groups of libraries pursue collaboration with communities and associated organizations.

Understanding communities, developing new interpretive systems, and framing inter-organizational models for collaboration are three critical areas where collective attention could make a difference in facilitating collaboration in the commons.

In closing, consider the following question from OCLC's annual environmental scan:

> ***What if libraries…and all the other players in the world of structured access to information erased the organizational charts, the artificial separations of content, the visible taxonomies, and the other edifices real or otherwise built to bring order and rationality to what we perceive as a chaotic universe? What if we built an infosphere rich in content and context that was easy to use, ubiquitous and integrated, designed to become woven into the fabric of people's lives; people looking for answers, meaning and authoritative, trustable results?***

This question underscores the key themes explored here. The overarching challenge is to create the ubiquitous and integrated information communities that will serve scholars of today *and at the same time* enable the products and processes of scholarly communication for tomorrow. Libraries have a critical role to play in exercising control, in adding value, and – increasingly – in catalyzing change.

References
(Online resources checked March 15, 2004)

The 2003 OCLC Environmental Scan: Pattern Recognition. 2003. Dublin, Ohio: OCLC Online Computer Library Center. http://www.oclc.org/membership/escan/default.htm

Atkinson, Ross. 1996. Library Functions, Scholarly Communication, and the Foundation of the Digital Library: Laying Claim to the Control Zone. *The Library Quarterly*, 66:3 (July): 239-265.

Atkinson, Ross. 2003. Toward a Rationale for Future Event-Based Information Services. *In* Patricia Hodges, Maria Bonn, Mark Sandler and John Price Wilkin (Eds.) *Digital Libraries: A Vision for the 21st Century*, Ann Arbor, MI: University of Michigan Library Scholarly Publishing Office, pp. 154-175. http://name.umdl.umich.edu/bbv9812

Bennett, Douglas C. 1997. New Connections for Scholars: The Changing Missions of a Learned Society in an Era of Digital Networks. *American Council of Learned Societies Occasional Paper No. 36.* http://www.acls.org/op36.htm

Berghel, Hal. 2001. Digital Village: A Cyberpublishing Manifesto. *Communications of the ACM*, 44:3 (March): 17-20.

Borgman, Christine.L. 1990. In: Borgman, C.L., ed. *Scholarly Communication and Bibliometrics*. Newbury Park, CA: Sage, pp. 10-27.

Brown, Cecelia. 2001. The E-volution of Preprints in the Scholarly Communication of Physicists and Astronomers. *Journal of the American Society for Information Science and Technology,* 52(3): 187-200.

Crane, Diana. 1972. *Invisible Colleges*. Chicago: University of Chicago Press.

Garvey, William D. and Belver C. Griffith. 1971. Scientific Communication: Its Role in the Conduct of Research and the Creation of Knowledge. *American Psychologist,* 26: 349-362.

Hess, Charlotte and Elinor Ostrom. 2004. A Framework for Analyzing Scholarly Communication as a Commons. Workshop on Scholarly Communication as an Information Commons, Bloomington, IN, March/April.

Hyland, Ken. 2000. *Disciplinary Discourses: Social Interactions in Academic Writing*. New York: Longman.

Kahin, Brian. 1995.Insittutional and Policy Issues in the Development of the Digital Library. *Journal of Electronic Publishing,* January.
http://www.press.umich.edu/jep/works/kahin.dl.html

Kling, Rob and Geoffrey McKim. 2000. Not Just a Matter of Time: Field Differences and the Shaping of Electronic Media in Supporting Scientific Communication, *Journal of the American Society for Information Science*, 51(14): 1306-1320.

Lougee, Wendy Pradt. 2002. *Diffuse Libraries: Emergent Roles for the Research Library in the Digital Age.* Washington, D.C.: Council on Library and Information Resources.

Lynch, Clifford. 2000. Authenticity and Integrity in the Digital Environment: An Exploratory Analysis of the Central Role of Trust. *Council on Library and Information Resources Report* 92. http://www.clir.org/pubs/abstract/pub92abst.html

Lynch, Clifford. 2001. When Documents Deceive: Trust and Provenance as New Factors for Retrieval in a Tangled Web. *Journal of the American Society for Information Science and Technology*. 52(1): 12-17.

Miller, Eric. 2003. Enabling the Semantic Web for Scientific Research and Collaboration. NSF Post Digital Library Futures Workshop. Chatham, MA, June. http://www.sis.pitt.edu/~dlwkshop/paper_miller.html

National Research Council Committee on a National Collaboratory. 1993. *National Collaboratories: Applying Information Technology for Scientific Research.* Washington, D.C.: National Academy Press.

Seaman, David. 2003. Deep Sharing: A Case for the Federated Digital Library. *Educause Review,* July/August. http://www.educause.edu/ir/library/pdf/erm0348.pdf

Stone, Sue. 1982. Humanities Scholars: Information Needs and Uses. *Journal of Documentation*, 38(4): 292-313.

Tomlins, Christopher L. 1998. Wave of the Present: The Scholarly Journal on the Edge of the Internet. *American Council of Learned Societies Occasional Paper No. 43.* http://www.acls.org/op43.htm

Traweek, Sharon. 1988. *Beamtimes and Lifetimes: The World of High Energy Physicists.* Cambridge, MA: Harvard University Press.

Unsworth, John. 2003. The Humanist: "Dances with Wolves" or "Bowls Alone"? *Scholarly Tribes and Tribulations: How Tradition and Technology are Driving Disciplinary Change*. Association of Research Libraries, Washington, D.C. October 17, 2003. http://www.arl.org/scomm/disciplines_program.html

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