

Digital Scholarly Communication: A Snapshot of Current Trends

Nancy L. Maron and K. Kirby Smith, Strategic Services Analysts, Ithaka

Introduction

While society journals, university press publications, and conference proceedings still form the backbone of scholarly publishing, many new digital scholarly resources have emerged that make use of the space, speed, and interactivity of the Internet. The university library still plays a central role in distributing many resources, but the networked digital environment has enabled the creation of new works that are accessible to end users directly. The decentralized distribution of these new digital resources can make it difficult to fully appreciate their range and number, even for academic librarians tasked with being familiar with valuable resources across the disciplines. In spring 2008, the Association of Research Libraries (ARL) engaged Ithaka to help survey the broader landscape of online resources currently in use by the scholarly community, to understand more about the resources that exist, and to highlight particular examples of innovation. This report describes some of the ways in which scholarly communication is occurring in a digital world.¹

Methodology

ARL's objective was not to conduct an exhaustive survey of the resources in use across all disciplines, but rather to highlight interesting examples of digital scholarly resources, their contribution to the scholarly process, and the organizational and business models that help them survive and thrive. To that end, Ithaka's Strategic Services group helped coordinate and evaluate the results of interviews with faculty members about the digital scholarly

resources they use, in the hope that the findings would be of interest to faculty and students looking for digital sources for their research or new models for their publishing, as well as to the librarians who support faculty and students in these endeavors.

Identifying Digital Scholarly Resources

A field team of 301 librarians at 46 ARL member institutions in the United States and Canada interviewed faculty members on their campuses about the digital

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scholarly resources they find useful in their work. When the library field team participants conducted their interviews, they asked faculty members to identify the “online works you rely on to keep up with current research,” and, specifically, those

that could be described as containing original scholarly work. They were asked not to focus on search engines or sites that only provide collections of links.

ARL’s goal was to investigate Web sites with original scholarly content designed for scholarly audiences, based on the expectation that these resources are central to scholarly communication, and are often created by faculty who regularly ask the library for advice on developing digital projects. “Original” resources were defined as born-digital materials (including digitized primary source materials, if the resource enabled born-digital annotation). Though digitized versions of print publications and search tools may be extremely useful to scholars, they were outside the scope of this study. “Scholarly” resources were defined as those authored by and for the scholarly community, including a wide variety of formal resources—like e-only journals—and informal resources—like scholarly blogs. Although it would be fascinating to study the way that popular-interest resources like YouTube and Wikipedia are becoming both the subject of and resources for scholarly work, they were considered outside the scope of this study.

The Data-Gathering Process

Field-team interviews yielded 358 responses. The Ithaka team found that about two-thirds of those—240 resources—contained original scholarly content.² Many resources were named by multiple respondents; in all, 206 unique resources emerged from the collection. Ithaka staff assessed and categorized each resource, then conducted in-depth interviews with project leaders of 11 representative

projects to gain a deeper understanding of how they think about strategies for creating and developing site content over time, metrics for understanding the site's users, experimentation with technical innovations, and sustainability. By integrating these sources of information, this project offers a snapshot of what innovation in digital scholarly resources looks like today.

Types of Digital Scholarly Resources

For purposes of analysis, the 206 unique resources were categorized by type. In instances where a resource contained multiple content types—for example, an e-only journal that also had a blog—it was categorized based on the element of the site the scholar reported using, or the content type that appeared to be predominant. Some resources included extensive aggregated content in several of these categories; these are described here as “hubs.” Below are summaries of findings about the eight types of digital scholarly resources in the sample, examining how scholars said they are using the resources, the methods of editorial selection in evidence, the disciplinary patterns that emerge, and the revenue-generating strategies most often used. Along the way, representative or exceptionally innovative cases provide further detail to the profiles of each model.

E-Only Journals (51 resources)

E-only journals were the most frequently named type of resource in this study and represented a wide range of disciplines. Most e-only journals examined in this study strongly resembled traditional print journals in terms of editorial guidelines, peer review, and a well-defined scholarly mission, while also incorporating a variety of innovations made possible by the digital environment, primarily regarding speed of publication and the relative lack of space restrictions. Where some journal editors were offering more fundamental changes—*Atmospheric Chemistry and Physics* experiments with open peer review, while *Ecology and Society* solicits articles that demonstrate innovative use of digital technologies—these efforts were sometimes met with hesitation on the part of contributing scholars, perhaps because of concerns about the credibility or prestige of new digital publication models.

Some innovations relate to novel features like annotation or public commenting, as in Public Library of Science (PLOS) journals and *Industrial and Organizational Psychology: Perspectives on Science and Practice*. Other innovations take advantage of the digital environment to accelerate the speed of publication

and the peer-review process and explore the possibilities of multimedia formats. While most e-only journals in this study incorporate multimedia elements to illustrate text-based articles, others, such as the *Journal of Visualized Experiments (JoVE)*, notably make video the central medium for their content.

Most of the e-only journals that emerged through this study use an open-access model; the few examples of subscription-based support were for e-only journals published by commercial publishers or scholarly societies. Many of the open access e-only journals support costs such as Web hosting and copyediting through in-kind support from their host institution (in the form of server space, technical support, or contributed staff time of programmers or copy editors), through soliciting donations from readers, from advertising, and—particularly in scientific/technical/medical fields—from author fees.

Reviews (10 resources)

Reviews of scholarly works meet a real need in the scholarly community for rapid notification about and evaluation of new work. The process of writing, editing, and publishing a review in a traditional print journal can take so long that one of the major benefits of the review—to help scholars identify the best new scholarship—can be greatly diminished. Digital reviews help respond to this problem. Many of the resources in this study review works in the humanities, reflecting the long-standing importance of the monograph in that scholarly community. Several sites were mentioned by multiple scholars, including the *Bryn Mawr Classical Review* in the humanities, and *UptoDate* and *Faculty of 1000* in medicine and biology.

Digital reviews innovate through the speed of publication and through the lack of space restrictions that the online environment makes possible. *H-France Review's* Editor-in-Chief was pleased not to have to restrict authors to a short word limit, allowing space to include a detailed review of the literature in the book review. Digital publication enables reviews to be published as soon as they are prepared, without a wait for a new print cycle—a major benefit both for authors and readers. The *Bryn Mawr Classical Review* strives to deliver “a review a day, every day,” to the nearly 10,000 subscribers to its e-mail list. The greater volume of digital reviews (and the fact that faculty are often able to receive updates about new reviews via e-mail) may contribute to the fact that many of the scholars who use reviews reported relying on them daily or weekly. Still, while the book reviews may benefit from the economics of online space, they must still confront the high cost of mailing

printed monographs to an international body of reviewers. The director of one review site told us that his single greatest expense each year is the approximately \$10,000 needed to mail books to reviewers around the world.

Preprints and Working Papers (10 resources)

Preprint and working-paper servers provide scholars with access to new research and permit them to share their own work without the delay a journal's lengthy peer-review and publication process can cause. The study results suggest that today the landscape for these servers is dominated by the oldest, largest preprint servers like Social Science Research Network (SSRN) and arXiv, although the study surfaced smaller working-paper exchanges in some niche fields as well. The scholars who suggested preprint servers tend to use them very frequently, both to share their own work and discover the work of others.

Disciplinary culture seems to play a role in influencing the extent to which preprint sites are adopted. In economics, where the National Bureau of Economic Research had distributed printed and bound working papers for decades before use of the Internet was widespread, this tradition of sharing early work seems to have easily translated to the Internet in the form of an abundance of preprint and working paper resources. While large preprint resources are expanding into new disciplines—SSRN recently branched into the humanities, for example—others deliver a service to a well-defined niche audience. PhilSci Archive, for example, focuses on the philosophy of science; the discipline has many overlaps with theoretical physics, and was in fact inspired by arXiv. It has no plans to expand into other fields, but instead hopes to continue establishing its importance in a tightly knit community.

Nearly all of the preprint resources examined in this study are open access. Even SSRN, a commercial site, makes any paper uploaded voluntarily by a researcher freely available, though it generates revenue through institutional subscriptions to curated networks of content and through its Partners in Publishing program. Most of the other preprint sites examined make their content available for free and had few apparent strategies to generate revenue outside of grants and support from host institutions. While some niche preprint servers like PhilSci Archive model themselves after existing sources, other sites experiment with newer models for exchanging work. The Online Feminist Philosophy Draft Exchange, for example, utilizes a Google Group to exchange working papers.

Encyclopedias, Dictionaries, and Annotated Content (24 resources)

This category of new digital publication includes resources in all disciplines attempting to provide comprehensive, authoritative reference for a topic as well as resources that layer primary source material with definitive scholarly commentary. Most of the resources found through this field study are completely open access, although a few require some minimal level of registration for visitors.

Perhaps the most innovative aspect is the use of user-generated content to populate some of these resources. Some, like the Stanford Encyclopedia of Philosophy, function as scholarly peer-reviewed sources, with articles written and reviewed by credentialed scholars in the field, finding online benefits largely in facilitating the editorial process, and speeding the revision of articles. Others are innovating by making use of the general public to develop data and other content that is then made available to scholars. Encyclopedia of Life describes itself as an “online reference and database” of information about Earth’s 1.8 million known species. It encourages contributions from the lay public but has a team of experts to authenticate and select the material that will ultimately appear in each entry.

The digital environment also enables scholars to publish commentary and annotations around primary source content, making them richer forms of publication than simple libraries of digital images. Roman de la Rose Digital Library is a collection of digital surrogates of versions of that medieval illuminated text, whose originals are dispersed in special collections around the world. The project allows side-by-side comparisons of digitized manuscripts that would be impossible otherwise. In addition, scholars contributed to the development of metadata for these digital surrogates, based on different critical interpretations of this work. The digitized texts are therefore searchable based on criteria reflecting scholarly output—and the research enabled by these searches will lead to new scholarly conclusions not possible in an analog world.

Data Resources (41 resources)

The sciences were among the first fields to use technology to aggregate and share the results of research. There are several types of examples reported in this study: sites hosting the data output of a particular scientific endeavor for

others to use and analyze; active databases that allow scientists to deposit the output of their individual work; and community data initiatives, which harness efforts of the general public to create data for researchers. An example of a community data initiative is eBird, which, by collecting the recorded observations made by amateur bird-watchers, has been able to develop a large set of data regarding bird sightings that is valuable both to the scientific research community and to nonacademic parties interested in avian migration patterns.

Many of the data projects in this sample are supported by grants from foundations or government sources. For example, the Protein Data Bank has been able to sustain itself through a series of grants, in large part due to the prominence and importance of the resource to the scientific community. One of the founders noted, "Last time we counted, we had 16 different grants worldwide to fund this thing; 8–9 in the US from different agencies." Because of the unpredictability of the revenue stream and the labor involved in monitoring and applying for so many grants, project leadership feels this model is not ideal, and has begun discussions about other sustainability options to pursue.³

Many data projects also receive some kind of support from their home institutions and some, though not many, have tried advertising or corporate sponsorship. Chemspider offers ads on its home page, as well as "compound-based advertising," which allows advertisers to display ads in proximity to materials relevant to the products being advertised. Similarly, eBird has a corporate sponsor in Zeiss, a manufacturer of the optic devices that birders use.

Blogs (15 resources)

The study turned up blogs across many disciplines. Faculty reported reading them daily or weekly to learn about new works and events in their field. Some blogs, like RealClimate, alert readers to new and interesting research and events in their community and field while adding a layer of commentary on top of the news. Blogs can add value to resources focused on other sources of content, like e-only journals or encyclopedias; at least 29 other resources from the sample include blogs as a supplemental form of content. Some blogs provide a vehicle for conversation among scholars in a particular field or specialty. The scholars who created PEA Soup, a blog focused on philosophy and ethics, were eager to create a space to work through ideas informally with colleagues, "the electronic equivalent of walking down the hall to talk to your colleague, but with people all over the country and world," said one of PEA Soup's founders.

Though blogs are clearly an informal method of scholarly communication, restrictions on who can post allow them to maintain a degree of quality control and content vetting. This is not to say that blogs are closed endeavors—PEA Soup, for example, has 46 contributors, and frequently invites new ones to join. However, unlike discussion lists where all readers of the list are also potential contributors to the list, blogs tend to be a more “controlled” form of informal scholarly communication, allowing a limited number of authors to post work to a much wider audience. Concerns that informal, unpolished ideas posted on blogs would be mistaken for formal scholarly output may have made some scholars reluctant to post on blogs early on, but the general scholarly community appears to be increasingly coming to understand that, while blogs may be an interesting (and citable) record of the development of scholarly thought, they represent interim stages, not a final product.

Although some larger resources, like the ScienceBlogs network of 74 science-related blogs, have begun to experiment with advertising, most of the blogs that emerged through this study operate without advertising or other forms of earned revenue. Many are built on free blogging software like Blogspot, LiveJournal, or WordPress. For many blogs, extremely low costs mean this lack of revenue may not be a problem.

Discussion Forums (21 resources)

Message boards, e-mail lists, and other sites to which individuals can post comments and respond to others’ thoughts have long been used by scholars, and they are still important and heavily used today, particularly in the humanities and social sciences. Their continued popularity is likely due both to their long-established presence in certain communities, and to the fact that their relatively basic technology is well suited to facilitating a simple form of communication, whether offering news or engaging in a conversation. Scholars reported that discussion lists allow them to keep in touch with their broader community, keep abreast of new research trends, and post queries to a large group of peers. Fewer, however, seem to use these e-mail lists to deeply work through nascent scholarly ideas or share working papers.⁴ Most of the scholars who nominated these discussion forums also author posts or contribute commentary to them.

Because e-mail list technology is inexpensive, many of these resources do not require independent sources of support. Five discussion lists in this sample

use either free software like that provided by Google Groups, or were created with mailing-list capability provided by a scholar's institution, and others were supported with mailing-list tools provided by a scholarly society or association. H-France, for example, spends a few hundred dollars per year on Web site hosting, and is able to cover these costs from small grants and member donations. One notable exception to this among the discussion lists is H-Net; it combines university support, grant support, donations, and some revenue from click-through book sales to support the organizational structure that houses many lists.

Some innovative discussion forums are starting to take advantage of social networking technology. Emerging Scholars Interdisciplinary Network includes a "Scholars Only Lounge" where members can discuss issues, share information, and read news alerts. The resource also allows members to create personal profiles, and to develop their own mini-networks around topics of interest. While resources like this suggest that Web 2.0 technology will enable new forms of scholarly exchange and interaction in the future, this study indicates that there is still a place for more traditional e-mail lists and discussion forums in the academy today.

Professional and Academic Hubs (34 resources)

While the majority of resources faculty mentioned focused on delivering one type of content, such as journal articles or data, a group of resources stood out for combining a wide range of content types in a single site. These "hubs," which are often the digital portal for a scholarly society or professional organization, may offer e-only journals, reviews, access to preprints and conference papers, gray literature, blogs or newsletters that disseminate timely content, and functionality for networking with other scholars. Faculty find them useful as portals, or "one-stop shops" for information. Large sites such as these require many resources to build and update regularly. Because many of these sites are built as the portal or Web-presence for a scholarly society, that society's membership fees help to finance the sites. Perhaps because these large sites likely attract large audiences, they frequently support themselves in part with advertising or corporate sponsorships, as well.

Summary of Findings

Digital innovations are taking place in all disciplines.

While some disciplines seem to lend themselves to certain formats of digital resource more than others, examples of innovative resources can be found across the humanities, social sciences, and scientific/technical/medical subject areas.

Digital publishing is shaped powerfully by the traditions of scholarly culture.

Traditions of scholarly culture relating to establishing scholarly legitimacy through credentialing, peer review, and citation metrics exert a powerful force on these innovative online projects. Almost every resource suggested by the interviewed scholars incorporates peer review or editorial oversight. Though some born-digital journals are beginning to experiment with open peer review, the examples observed in this study were still in early stages.

Some of the largest resources with greatest impact have been in existence a long while.

Given the importance of longevity in establishing scholarly reputation, the necessity of building an audience to attract high-quality content, and the time it takes to fine-tune a digital resource, even excellent new digital publications may need years to establish their place in their scholarly community.

Many digital publications are small, niche resources.

Many digital publications are directed at small, niche audiences. There appears to be a very long tail in the field of digital scholarly resources with many tightly focused publications directed at narrow audiences and capable of running on relatively small budgets.

Although many of the digital scholarly resources are primarily text-based, there are also examples that incorporate multimedia technology and networking tools to create new and innovative works.

"Video articles," peer-reviewed reader commentary, and medieval illuminated texts coded as data are all evidence of the creative format mash-ups that challenge us to re-think the definitions of traditional content categories. Many of the resources in this sample that incorporate these sorts of innovations—data sites, annotated primary source content, and the newest forums to facilitate exchanges between scholars—have no print corollary.

Establishing credibility is not easy, but is of critical importance.

Maintaining quality control, whether by peer review or moderation of submissions, is a critical issue for nearly all digital publications. A large majority of informal resources engages in some form of editorial selection or moderation to monitor and control the content that appears on the site. Particularly for “born-digital” publications with no print-based reputation for quality, quickly establishing credibility is necessary to attract and impact scholars in the field.

Achieving sustainability—especially for those resources with an open-access mandate—is a universal challenge.

Projects of all sizes are still seeking paths to sustainability. For open-access sites—the vast majority of the resources studied here—the challenges can be great, since subscription fees are not an option. Nearly all of the publications that emerged in this survey are experimenting to find economic models that will support their work.

¹ This article is derived from “Current Models of Digital Scholarly Communication: Results of an Investigation Conducted by Ithaka Strategic Services for the Association of Research Libraries,” *Journal of Electronic Publishing* 12, no. 1 (February 2009), <http://dx.doi.org/10.3998/3336451.0012.105>.

² While 240 of the entries faculty and librarians submitted to the study database met the criteria set out by ARL as “scholarly and original,” 115 did not. (Three entries were from respondents who said they do not use digital scholarly resources.) These resources, though often of high quality, were excluded from analysis for this report. They included aggregations of links to other sites, software and digital tools, digital copies of print content, industry newsletters, commercial and/or mass-audience sites, and teaching-focused resources. Faculty reported using these resources daily far more often than they did the resources that include works of original scholarship. This suggests that scholars’ priority is to find relevant content, regardless of where it is hosted. Among the additional reasons faculty cited for using these resources were quick access, easy searching, and useful overviews.

³ For a discussion of the range of sustainability options for digital resources, see Kevin Guthrie, Rebecca Griffiths, and Nancy Maron, *Sustainability and Revenue Models for Online Academic Resources: An Ithaka Report* (Ithaka, May 2008), http://www.ithaka.org/strategic-services/sca_ithaka_sustainability_report-final.pdf. Also see the Ithaka Case Studies in Sustainability project, forthcoming June 2009, <http://www.ithaka.org/>.

⁴ For further information on the use of discussion lists among history scholars, see Ithaka’s report by Rebecca Griffiths, Michael Dawson, and Matthew Rascoff, “Scholarly Communications in the History Discipline,” 2006, http://www.ithaka.org/publications/pdfs/ISTOR_History_Study_Report_Public_final1031.pdf.

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