

Interim Report

Assessing the Future Landscape of Scholarly Communication: An In-depth Study of Faculty Needs and Ways of Meeting Them

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ABSTRACT: The Center for Studies in Higher Education, with generous funding from the Andrew W. Mellon Foundation, is conducting research to understand the needs and desires of faculty for in-progress scholarly communication (i.e., forms of communication employed as research is being executed) as well as archival publication. In the interest of developing a deeper understanding of how and why scholars do what they do to advance their fields, as well as their careers, our approach focuses on fine-grained analyses of faculty values and behaviors throughout the scholarly communication lifecycle, including sharing, collaborating, publishing, and engaging with the public. Well into our second year, we have posted a draft interim report describing some of our early results and impressions based on the responses of more than 150 interviewees in the fields of astrophysics, archaeology, biology, economics, history, music, and political science.

Our work to date has confirmed the important impact of disciplinary culture and tradition on many scholarly communication habits. These traditions may override the perceived “opportunities” afforded by new technologies, including those falling into the Web 2.0 category. As we have listened to our diverse informants, as well as followed closely the prognostications about the likely future of scholarly communication, we note that it is absolutely imperative to be precise about terms. That includes being clear about what is meant by “open access” publishing (i.e., using preprint or postprint servers for scholarship published in prestigious outlets versus publishing in new, untested open access journals, or the more casual individual posting of working papers, blogs, and other non-peer-reviewed work). Our research suggests that enthusiasm for technology development and adoption should not be conflated with the hard reality of tenure and promotion requirements (including the needs and goals of final archival publication) in highly competitive professional environments.

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Introduction and Background

There have been studies around such specific issues as the costs of starting journals and the finances of university presses,¹ but there has not yet been a bigger-picture, comprehensive analysis from the point of view of the university and how its various stakeholders, most notably faculty, value traditional and emerging forms of scholarly communication. The A.W. Mellon Foundation awarded The Center for Studies in Higher Education (CSHE) a two-year grant in January 2007 to conduct research that explores the emergence of alternative scholarly communication models in relation to faculty values in a select number of academic disciplines. This report provides a preliminary review of our work to date.

Our research focus is on understanding faculty needs and desires for *in-progress* scholarly communication *as well as* archival publication. Among our goals is providing a broader understanding of the full array of activities related to the scholarly communication lifecycle in order to assess with any accuracy the future communication and publication landscape in universities.

The following are among the questions driving our work:

- What will scholars want to do in their research and with their research results, and what new forms of communication do or do not support those desires?
- How will scholars want to disseminate and receive input on their work at various lifecycle stages?
- What are the emerging trends?
- What are the scope and depth of pent-up demand for new models by various sectors/disciplines?
- How do institutions and other stakeholders support these faculty needs, if at all?

We suggest that more innovation does and will occur first during in-progress communication than in final archival publication. One can foresee a scenario where useful and effective innovations in in-progress communication may eventually serve as drivers for improvements in final archival publication. It is therefore worthwhile to gain deeper insight into the needs, motives, and new capabilities within in-progress communication as well as for final archival publication. The significant work leading up to the current research, including the planning project report, the five associated disciplinary case studies, and the most recent proposal can be found at: <http://cshe.berkeley.edu/research/scholarlycommunication/>

Overview of the Project

Research Design: Goals, Research Questions, and Methods

The goals of this project are to map and assess systematically:

- the current and evolving scholarly communication needs of researchers in seven selected representative academic fields. Our focus is on assessing scholars' attitudes and needs as both authors and users of research results,
- the capabilities of various traditional and emerging models of scholarly communication and publication for meeting those needs, and
- the likely future scenarios for scholarly communication (by field), and how those scenarios might be best supported by institutional organizations and units (e.g., departments, libraries, commercial publishers, societies, etc.).

¹ See, for example, studies cited in background documents at the Future of Scholarly Communication project website: <http://cshe.berkeley.edu/research/scholarlycommunication>

Disciplines

In consultation with our steering committee and others, we proceeded to explore approximately 12-14 disciplines for inclusion in the study. In the first three months of the study, we conducted a large number (~20) of what we call “lay of the land” interviews with UC colleagues and those with whom we had been put in contact by various sources. Based on those interviews, interviews from the planning grant,² and background research activities, we have chosen seven broad disciplinary areas to be the subject of our case studies:

- Archaeology (including classics and Mediterranean, overlap with history and art history)
- Astrophysics
- Biology/Molecular and Cell Biology (including sampling faculty participating in large interdisciplinary projects)
- Economics
- History (the entire field plus sampling collaborative, interdisciplinary centers and projects)
- Music (special emphasis on electronic composition/performance)
- Political Science (initially the entire field, but subsequently focusing on quantitative subfields)

Interviews and Focus Groups

Our primary methodology relies upon in-depth interviews with faculty, supplemented by interviews with persons responsible for implementing innovative scholarly publishing initiatives, including librarians and IT professionals. The interviews form the primary basis for the case studies. All but a few of the interviews have been audio recorded. Detailed notes are taken during all interviews. Each recorded interview is transcribed, cleaned, summarized, and tagged. Interviews are stored on a secure, password protected file-sharing system provided by UC Berkeley, called CalShare. We have conducted nine focus groups as well.

We are combining the results of interviews and focus groups with (1) our knowledge from the planning study, (2) our ongoing background research on individuals and initiatives, and (3) the results of associated surveys and other activities,³ to identify the current and evolving scholarly communication needs of researchers in selected disciplinary areas. Additionally, in November 2007, we hosted a meeting on the topic of [The University as Publisher](#), which brought together scholars, publishers, administrators, and librarians, among others.⁴ Our steering committee and expanding network of scholars and practitioners continue to be a source of information and guidance.

It should be noted that our interviewees are independent souls with copious experience, opinions, and ideas. Many are well-regarded leaders and even stars in their fields. Although we try to adhere to a “structured” interview, it is not unusual for our interviewees to lead us on some merry and enlightening chases. We willingly comply because it surfaces issues that we may not have otherwise anticipated.

Interview Protocols

We have developed an interview protocol that explores: how faculty use and value in-progress communication; how in-progress communication relates to needs and values for archival publication; what needs faculty envision for types, timing, and means of in-progress communication and archival publication; and the extent to which in-progress communication influences reputations *vis-à-vis* final archival publication.

² The planning grant disciplines were anthropology, biostatistics, chemical engineering, English-language literature, and the combined field of law and economics.

³ We have reviewed a variety of relevant reports from diverse sources including Ithaka, the Scholarly Communication Institute, the Association of Research Libraries, CLIR, and the California Digital Library, among others.

⁴ A report from the meeting is available at: <http://cshe.berkeley.edu/publications/publications.php?id=295>.

We distinguish between perceptions of new forms of communication (e.g., blogs, wikis, online conferences, etc.) and the need for databases and other intensive resource development. The short protocol, which we send to interviewees prior to speaking with them, is below.

Short Protocol

Our overall goal is to understand what you and your colleagues want or need to support your research over the entire scholarly communication "lifecycle." This includes making a name for yourself, and requirements for tenure and promotion.

We are interested in both final archival publication (journals, books, etc.) as well as your needs in the earlier stages of your research (what we call "in-progress" communication).

- 1) What is required in your field for tenure and promotion? Making a name?
- 2) What criteria do you use when choosing a medium for publishing your research results or sharing your research ideas?
- 3) How has technology affected your scholarly communication practices, if at all? Including:
 - How do you share your work with other scholars and keep up to date in a field? When? How? Why or why not?
 - How do you collaborate with other scholars? Why or why not? At what stage of research?
 - What types of data/resources do you use for your own scholarship? (e.g., the value of data archives, data sets, bibliographic, news sources, etc.) What do you need that you don't have?
- 4) To what degree do you or your colleagues engage with the public? How? Why or why not?
- 5) What new, transformational developments in your field are on the horizon?

Sampling

Interviews and Focus Groups

We are limiting our investigation to research universities. Our sample of informants to date was derived through a combination of convenience and snowball sampling. Convenience sampling is typically used in exploratory research, and we have employed it since the beginning of the study. As the name implies, the sample is selected because it is convenient for the researcher. Snowball sampling is often used when it is difficult or cost prohibitive to locate respondents in a more randomized way. Snowball sampling relies on referrals from initial informants to generate additional informants, and can be particularly effective in gaining access to elite populations. We are aware that both methods introduce bias because they reduce the likelihood of sampling a cross-section representative of the entire possible population. In spite of these drawbacks, however, we are convinced that these methods are especially useful when conducting qualitative research as we are reporting here.

To date we have conducted approximately 150 interviews that are informing this draft report. We began exploration from our base at UC Berkeley; therefore the early sample was heavily UC-centered. We have not limited ourselves to any one institution, however. Our method is to ask each interviewee for recommendations of colleagues. We then follow up with these individuals selectively. We have made a concerted effort to talk with a small sample of graduate students [N = 12 (plus an additional 3 postdoctoral scholars)]. As of April 30, 2008, we conducted 152 interviews, with an average of approximately 20 per

discipline, for this report. Of these, 123 were individual interviews; the remaining 28 participants met in nine focus groups. In this sample, we have also included 16 planning grant interviews representing archaeology, economics, history, political science, the humanities in general, academic computing, publishing, and librarians.

Roughly one-third of our sample represents full professors, one-sixth of our sample represents associate or untenured faculty, and another one-seventh of our sample represents faculty currently in high-level administrative positions (provosts, deans, vice chancellors, etc.). The remaining approximately one-third of our sample is composed of graduate students, postdoctoral scholars, librarians, publishers, research scientists, and ITS/academic computing professionals. Within the entire sample, 29 faculty participants also hold active editorial positions and 22 of the professor-level participants have current or past experience as high-level administrators (e.g., dean, department chair, director of a research center, vice chancellor, provost, president, etc.). While we have conducted a large number of semi-structured interviews, including 15 with scholarly publishers, librarians, and consultants working in our chosen academic disciplines (and noted in the table below), we have also had innumerable conversations and interactions with the broader perspectives of other scholars, librarians, and publishers through regular attendance at a variety of formal and informal gatherings, and one-on-one conversations.

Interviews by Discipline	
Disciplines	Completed
Archaeology *	22
Astrophysics*	25
Biology*	18
Economics	13
History*	22
Music/Performance*	21
Political Science	15
Publishers, Librarians & Consultants	15
Totals	152

*Includes focus group participants.

Challenges of Assessing New Models: Organizational and Structural Means of Implementation

One of our proposed goals is to assess what types of institutions, whether universities or other entities, are implementing new models of scholarly communication with more or less success, be it at the single- or multi-discipline level. We continue to identify candidate organizational structures for more in-depth collection and analysis of data through interviews and basic web research.

We have found that answering these questions may be easier when focusing on disciplines such as astrophysics, biology, and new music composition, which are fields that often have a dedicated group of scholars sharing limited resources at one institution (e.g., telescopes, labs, and centers respectively). Site visits to some of these venues have provided us with a sense of organization and support that other means of inquiry may not. For history, archaeology, economics, musicology, and political science, scholars tend to operate in a more solitary fashion relative to their own institution's resources. In these cases, we are targeting innovators, as well as specific centers and projects (if they exist). We also ask our interviewees about where they go for support and what their opinions are about the quality of that support. We have taken numerous opportunities to participate as observers in meetings, symposia, and workshops that bring together a large number of scholars around themes and topics relevant to the present study. These include [George Mason University \(GMU\) Center for History and New Media](#), [the Pacific Neighborhood Consortium \(PNC\)](#), [The Scholarly Communications Institute \(SCI\)](#), The UCB Digital Humanities focus group, [UC Irvine Humanities Research Institute \(UCIHRI\)/HASTAC](#) MacArthur Foundation Future of Learning, and [Bamboo](#).

Results and Early Impressions

We present our early impressions here; they are very brief thoughts relative to the overarching questions we posed to our more than 150 interviewees. Following the planning grant model, we are developing seven descriptive disciplinary case studies to be published with the final report. These detailed cases will allow the ability to tease out common themes as well as draw contrasts among disciplinary traditions and behaviors. The cases themselves represent the tip of an exceptionally large data iceberg; we have thousands of pages of transcripts yet to systematically analyze. In the interest of developing a deeper understanding of how and why scholars do what they do to advance their fields, as well as their careers, our approach is to focus on fine-grained analyses of faculty values and behaviors such as sharing, collaborating, publishing, and engaging with the public.

Although we are cautious about proposing sweeping conclusions at this relatively early stage (and before our analyses are complete), some clear patterns have emerged. Our research to date has confirmed the important impact of disciplinary culture and tradition on many scholarly communication habits. These traditions may override the perceived “opportunities” afforded by new technologies, including those falling into the Web 2.0 category. Additionally, as we have listened to our diverse informants, and followed closely the prognostications about the likely future of scholarly communication, we note that it is absolutely imperative to be precise about terms. That includes being clear about what is meant by “open access” publishing (i.e., using preprint or postprint servers for scholarship published in prestigious outlets, versus publishing in new, untested open access journals, or the more casual individual posting of working papers, blogs, and other non-peer-reviewed work). “Electronic publishing” should not be used as a proxy for open access publishing, as many commercial journals are accessed predominantly online. Additionally, Web 2.0 technologies and vague terms like “social scholarship” (blogging, tagging, social networks) should not be conflated with the hard reality of tenure and promotion requirements (including the needs and goals of final archival publication) in highly competitive professional environments.

Furthermore, the impressions laid out here should be placed in the context of our sampling a variety of scholars in research universities who range from those who do not use technology in sophisticated ways (beyond the ubiquitous search, retrieval, and sharing of information) to those whose scholarship is intimately tied up with the use of technology. It is clear from our interviews so far that many scholars, young and old, can be innovative in their fields without the need or desire to use cutting-edge technologies. Moreover, some disciplinary subfields appear to have low technology requirements, while others—in the sciences, for example—are highly dependent on the use of sophisticated technology in research practice (and those technologies are evolving at a torrid pace). More than a few scholars have suggested that technology used indiscriminately and for its own sake can limit the scope of questions asked and therefore lead to detrimental effects on the quality of scholarship. We suggest at this stage of our work that it is reasonable to presume that there may be no one vision for technology-enabled scholarship in a field. Ultimately, the personality of individuals combined with disciplinary tradition, the needs of the field, and affiliation with type of higher education institution will determine how widespread public sharing of non-peer-reviewed incipient ideas and data will be and what forms final archival publications will take.

1) What is required in your field for tenure and promotion?

There are virtually no surprises here. As we found in our planning study, peer-reviewed prestige publications are the “coin of the realm” in tenure and promotion decisions. Monographs and books, and secondarily journal articles, are important in history, traditional musicology (including theory and history), and archaeology. Journal articles are important in astrophysics, biology, economics, and increasingly in the quantitative subfields of political science (and we hear acceptable, in some cases, in musicology and classics). Music composition and performance, as with the arts in general, have other products (performances,

commissions, prizes, etc.) that are judged. Securing grants in astrophysics and biology (as in many, if not most, sciences) is exceptionally important for advancement.

In addition to publication, there are other criteria such as service and teaching that are judged in a tenure and promotion case. But as we heard again and again, these criteria hold no weight without a stellar publication record and evidence that a scholar's work is widely read, is judged to be of high quality by internal and external reviewers, and advances the field. "Groundbreaking, creative, original, transformational, high impact on the field, indicative of sustainable scholarship, lauded by the larger community of scholars," are just some of the descriptive criteria that are used to judge the quality of a scholar's work in every discipline we have examined. The common practice of soliciting external letters as part of a tenure/promotion review means that what a scholar needs to do to make a name in the field is often closely linked to tenure/promotion requirements. As one economist commented, "you may not know these external reviewers directly, so they are only aware of you through your high-visibility publication record."

We noted a fair amount of flexibility with regard to how a scholar coming up for tenure and promotion is judged; "quality over quantity" was a common refrain. Exceptions to the unwritten "rules" (e.g., N journal articles per year, N books, rigid adherence to citation indices, etc.) are regularly made if a scholar meets the criteria described above. Each tenure and promotion case receives a prodigious amount of scrutiny and analysis (although a few interviewees mentioned cases where the final review committees might not be well equipped to make an informed decision given their distance from the subject matter). Another observation is that every institution and department can have different traditions and standards. It was suggested by some that standards at second-tier institutions vary significantly from those in the top tier (less selective journals and presses, fewer publications, more emphasis on teaching, etc.), but that anxiety about getting published in what is described as a "competitive" market can be much higher. It should also be noted that, at many of the institutions we surveyed, much of the vetting takes place before a scholar is hired. That is, the determination of a "good fit" to a department's goals and aspirations is made well before the tenure case is presented.

Scholars who produce data sets, cell lines, edited volumes, critical editions, software, etc., will get credit for that work, but usually it will not be the only criterion upon which their scholarship is judged. Without high impact publications, such activities are not counted for much. Instrument builders in astrophysics, bioinformatics specialists in biology, and various technical support personnel in archaeology are crucial to the overall scholarly productivity of any one faculty member in those fields, but they produce non-text "scholarship" that can be difficult to assess by traditional means. This challenge will only grow as large collaborative projects, especially in the sciences, depend on ever-expanding cadres of technical experts.

Established scholars seem to exercise significantly more freedom in the choice of publication outlet than their untenured colleagues, although in the sciences, high impact publications are important for garnering research grants throughout a career. There has been a suggestion that faculty in younger and less established departments in the humanities and social sciences might be more amenable to risk-taking in publication practices because the particular institution supports it.

Some conference attendance (but not too much) is seen as important for newer scholars to make a name for themselves (it's good to "make senior friends"). Older faculty may spend less time at large conferences than their younger colleagues, with the exception of several charismatic professors in various fields (biology, musicology/music theory) who firmly believed that attending conferences and keeping in touch with young scholars stimulates research in an important way.

There is evidence that some individuals/departments in humanistic disciplines are discussing or implementing amendments to tenure/promotion criteria in order to draw analogies between existing forms of scholarly publication and new, multimedia, dynamic forms of publication. Indeed, as mentioned above, the institution already has experience in judging such non-text productivity in the arts. The fact remains, however, that (1) new forms must be perceived as having undergone rigorous peer review, (2) few untenured scholars are

presenting such publications as part of their tenure cases, and (3) the mechanisms for evaluating new genres (e.g., nonlinear narratives and multimedia publications) may be prohibitive for reviewers in terms of time and inclination. Associate professors may well be the class that will exercise more freedom in the type of publication submitted for promotion to full professor (e.g., an encyclopedia or electronic resource instead of the second book). Finally, the advice given to pre-tenure scholars was quite consistent across all fields: focus on publishing in the right venues and avoid spending too much time on public engagement, committee work, writing op-ed pieces, developing websites, blogging, and other non-traditional forms of electronic dissemination (including courses).

2) What criteria do you use when choosing a medium for publishing your research results or sharing your research ideas?

Time is one of the most important limiting factors for everyone in the production and consumption of scholarship. There is a lot of “noise” and low quality work on the internet, and the perception is that “junk” is increasing at a rapid pace. Peer review, perceived selectivity, and other less formal mechanisms such as “reputation,” function to filter that noise for the time-pressed in keeping up to date and determining what to read.

Speed to publication is essential for astrophysics, biology, economics, and political science. Archaeologists and historians are not generally concerned with speed for its own sake, nor do music scholars appear to be, although some ethnomusicologists and musicologists lament the extensive time lag to publication. Working papers and preprints in astrophysics, economics, and political science are ways in which scholars can get well-developed articles in the public domain quickly. Working papers seem to be nonexistent (and even disparaged) in molecular and cell biology. Conferences and seminars, of course, function to get early ideas “out there,” but the degree to which conference papers are circulated and/or published can vary by discipline and also by individual conference (or an individual’s preference).

As noted above, when choosing where to publish, the stature and selectivity of the publication organ, as well as its appropriateness for targeted audiences, are of importance to all disciplines. We suspect that the desire for “wide readership” is an outgrowth of these criteria and not the primary motivation for selecting a publication venue (i.e., an open-access online publication without a prestigious imprimatur will not usually be chosen over a prestigious commercial publisher). When selecting a publication, scholars choose an outlet that will garner the highest visibility with the specific audience they want to reach, even if that targeted audience is small.

We have heard little about a crisis in scholarly communication from our interviewees, with a few exceptions. For example, some biologists exhibit a pro-open access journal bias, are well aware of the serials “crisis,” and may refuse to publish in commercial journals (especially Elsevier). Other biologists are adamant that the solution lies in supporting the non-profit journals published by scholarly societies. Among humanists, we have heard quite a few rejections of the idea that there is a publishing crisis (with the exception of faculty working in art history, a number of fields outside of American history, and perhaps at institutions whose faculty and graduate students are not as “competitive”). Good scholars doing good work at top-tier institutions seem to be able to get their books published with premier publishers. There was some (but not universal) consternation expressed about (1) the two-book requirement for tenure in history and classics, (2) the glut of lower quality publications that can result, and (3) young scholars wasting time developing the dissertation into a first book instead of moving on to the second book (and showing the ability to sustain more than “one good idea”).

We heard a fair amount of griping about the editorial and peer review process in general for both journals and books, which included long lag times and editorial quality issues. Although there were complaints and recommendations for improving it, peer review was generally seen as the best available system. Complaints about peer review included too many reviewers and/or reviewers who may lack the specific knowledge or

background to judge scholarship effectively. We heard a number of comments about “too powerful” and/or “uninformed” editors arbitrating who does and does not get published in some of the most prestigious journal imprints and presses. In some new and/or small fields, finding an unbiased reviewer can be difficult; a critical mass of potential reviewers able to give unvarnished opinions may not yet exist. In addition, some scholars felt overloaded by the number of requests to review work (including being asked to review the same paper that was moving down the journal “food chain” after serial rejections). This overload factor was cited by some as an important cause of the general decline in the quality of peer review.

New publishing models were mentioned as being needed for shorter “monographs” in some humanistic disciplines and longer articles in the sciences. In biology, criticism was levied against constraining word limits to achieve “the smallest publishable unit” (*Science* and *Nature* being the extreme examples), which often eliminates detailed discussions of methods and room for deeper arguments. In history and archaeology, similar complaints about eliminating methods, plus constraints on including high quality images and other supporting materials, were expressed. Some humanists in music, art history, and history lamented the prohibitively high costs of permissions for publishing image and sound archival excerpts when authoring their work. Scholars in music, archaeology, classics, history, biology, astrophysics, political science, and economics embraced the potential of linking from final publications directly to data sets and/or primary source material.

Such concerns about the limitations of the current publication system are linked to the positive potential of electronic publication to extend the usefulness and depth of final publications (multimedia books, CD-ROMs, linked data, footnotes, embedded media, software, etc.). Those innovators who use a lot of hyperlinking, graphics, and/or audio want publications that can accommodate high quality media. No one we talked to, however, could point to the existence of easy-to-use tools (and sufficient institutional support and expertise) for publishing multimedia monographs and articles. Lacking such tools, the perceived difficulty of evaluating such publications, and the prohibitive costs in time and money to produce truly multimedia monographs, experiments in such genres will likely be few and far between.

3) How has technology affected your scholarly communication practices, if at all? Including:

- ***How do you share your work with other scholars and keep up to date in a field?***

Sharing scholarly work at multiple stages of development is universal. Most scholars are inherently “social” in this regard, although it is clear that personality is a key determinant of who shares what, with whom, and at what stage of research. Sharing is most often done first and foremost using informal email exchanges within a circle of trusted colleagues (“personal communication”). As a piece of work becomes refined through this informal exchange, and before it is made public and/or submitted for publication, an ever-widening circle of colleagues may be enlisted for critiques (including via presentation at conferences).

Astrophysicists, political scientists, and economists, and perhaps performers/composers, are clearly the groups that have the lowest threshold for sharing scholarship prior to formal publication; astrophysicists use the [arXiv](#) and economists (and some political scientists) use preprint servers and/or personal webpages for posting in-progress work. It is important to note, however, that no one we talked to in these fields shares their in-progress work widely until s/he feels the work has reached a certain level of excellence. Indeed it may not be posted as a working paper until it is deemed “good enough” for submission to a journal. One scholar described this well developed and vetted version as the “penultimate draft.”

Historians and archaeologists, with some notable exceptions, play very close to the chest until their ideas are well developed, which can take many years. As far as we can determine, molecular and cell biologists in top-tier universities do not share early findings or preprints until a paper has been accepted for publication. This group may be at the extreme among biologists; biomedical scientists and chemists may be in this camp as well. This is certainly due to the hyper-competitive atmosphere of those fields, the need for exceptionally

rapid dissemination of results, the large size of the subfields, the speed with which experiments can be conducted, the imperative to receive due credit for work, and the commercial potential of some of the research in these fields. As one biochemist said, “Why publish early ideas? Just get the publication out there... Without formal publication, all of your brilliant ideas do not matter.” We have heard from other limited interviewees, however, that the sharing of early work may be more relaxed in fields such as neurobiology, evolutionary biology, certain communities in the plant sciences, and ecology.

Opinions varied on sharing and publishing data sets. Generally most scholars are agreeable to sharing as long as they have finished their analyses and/or publication of said data. Sharing can ultimately depend on who is doing the asking and what they want to do with the data; scholars need to ensure that they are properly credited. Journals in the sciences, economics, and political science increasingly require that data sets be published. There is also a move for funding bodies to promote the publication of data; whether this policy is mandatory differs among agencies. Some scholars publish supplementary data sets on their websites, including codebooks and so on, after they complete and publish analyses. Some say that such practices allow for the reuse of data and provide transparency to facilitate better scholarship, although institutional support for hosting and managing such data is not generally provided (with the exception of some facilities for social science data and, of course, large-scale science). There were more than a few remarks that transparency may not be welcomed by those who fear that their work practices will come under too much scrutiny.

Personal websites are ubiquitous, even if they only post a short bio or CV, course list, working papers, and links to published papers. Blogs, RSS feeds, wikis, etc., are less common ways in which scholars broadcast and receive information. Listservs, seminars, and conferences were cited as important for finding out about new developments in a field and for seeking feedback on new ideas. Graduate students were mentioned by tenured scholars as essential sources of new information (see below).

Among most of our interviewees, blogs were simply off the radar as a source of scholarship and are generally viewed as a waste of time because they are not peer reviewed. “You have to have some standards! How in the hell are you going to judge the quality of what’s on a blog?” “...who has the time! There have to be some filters!...” There was, however, limited mention of “good” blogs in economics, astrophysics, political science, and history (that often serve simply as more sophisticated versions of the subject listserv and are used in much the same way: for finding out about new developments in a field and for making general announcements). But again, our particular interviewees generally said they do not spend time following them (even those who maintain their own blog). A number of faculty mentioned reading blogs related to a topic of their research (e.g., a historian of science consulting a blog about a particular branch of mathematics).

There may be a trend among young scholars in all fields, and particularly graduate students, to be especially leery of putting ideas and data out too soon for fear of theft and/or misinterpretation. Given these findings, we caution against assumptions that “millennials” will change the landscape of scholarship by virtue of their facility with technology. There is ample evidence that, once initiated into the profession, newer scholars, be they graduate students or assistant professors, adopt the behaviors and norms of their mentors to advance their careers. Moreover, given the complex motivations around sharing scholarly work we are finding, and the importance of peer review as a quality and noise filter, we think it premature to assume that Web 2.0 platforms geared toward early public exposure of ideas or data are going to spread among scholars in the most competitive institutions. These platforms may, however, become populated with material developed by scholars in less competitive institutions, including internationally, and who may have more difficulty finding a high stature publisher for their work. Time will tell.

- ***How do you collaborate with other scholars? At what stage of research?***

Scholars in new music, archaeology, astrophysics, and biology are highly collaborative and rely on large teams of individuals that have varied expertise. Many fields are changing in ways that mean “one group of experts can’t do everything.” This is particularly dramatic in those fields that integrate significant

computational analysis. Collaborations are not uncommon, although on a smaller relative scale, in history, economics, and political science as well. Collaborations are usually multi-disciplinary by nature. Scholars collaborate for several reasons and, similar to the comfort level with sharing, the desire for collaborating can very much depend on personality. Many scholars are motivated to collaborate because it is “fun.” Collaboration “makes you think harder” and provides opportunities to “bounce ideas around” with people who have different backgrounds and interests. When a scholar has an idea that requires different skills and expertise, finding the right people—the best people—to collaborate with is essential for some.

Collaborations arise in many ways. They may grow out of relationships forged in graduate school with peers or mentors or in chance encounters at conferences and seminars. Scholars may identify collaborators through reading their publications (including when blind reviewing articles). In many cases, funding agencies require large-scale interdisciplinary collaborations; these increasingly include armies of technical support staff. In cases in which data sets or equipment (e.g., telescopes, supercomputers, or fMRI) are shared or funding is awarded across institutions, collaboration can be essential. More than a few senior scholars mentioned the importance of collaborations and co-authorship with younger scholars to give them a leg up in their pre-tenure years.

Astrophysicists and musicians/composers appear to use the most sophisticated technologies for collaborations ([Skype](#), password-protected wikis, high-speed networks). It seems to be second nature for many of them. Wiki-like sites are often used in biology labs as well. Emailing documents back and forth is still an old standby for collaborating. Except for astrophysics and many large-scale projects in the sciences, most collaboration and co-authoring occur through the exchange of documents by email and FTP, using tracked changes. The importance of face-to-face contact has been emphasized as allowing much more creative exchanges among collaborators than are enabled by electronic means alone. We heard the sentiment that the handshake and eye-contact provide the foundation of good personal relationships that make for productive collaborations. These elements cannot be replaced by tools (even if tools can enhance collaborations).

Graduate students (and postdoctoral scholars in some fields) are essential to collaborations and are often relied upon for technical support. A theme we are exploring is one of “intergenerational models” for scholarly publication and communication, i.e., in what ways faculty and graduate students interact to create opportunities for new scholarly communication modes. There is evidence that intergenerational models often serve as building blocks for technology and project innovation in the field; young scholars, often assuming the role of technical expert, may work with senior scholars on multimedia projects, archival repositories, computational and visualization problems, and the development of complex databases.

A common theme regarding collaborations involving technology (e.g., informatics, GIS, etc.) is that they complicate judging individual contributions to multiple-authored papers or projects. This will continue to be a growing challenge in most fields.

- ***What types of data/resources do you use for your own scholarship? (e.g., the value of data archives, data sets, bibliographic, news sources, etc.) What do you need that you don't have?***

The variety of “tools” at the disposal of scholars for their research is quite dazzling and growing in sophistication by the day. GIS, visualization tools, virtual reality, and natural-language processing, are just a few being used by researchers now. This is to say nothing of the sophisticated instruments that allow scientists to investigate micro and macroscopic processes. As an example, the exponential growth of data generated by observations associated with various instruments, including telescopes and surveys, has led to numerous online archives in astrophysics containing both raw and processed data (such as the [Sloan Digital Sky Survey](#) and the [Chandra X-Ray Observatory](#).) What is used and by whom is highly variable by discipline and will be described in the individual case studies at the conclusion of our study.

There appears to be a universal enthusiastic embrace of the sheer amount of research material that is now online. Too numerous to list in this summary, it includes electronic journals (including JSTOR), digitized books, data sets, archives, governmental data, and international newspapers. It is a vast treasure trove for researchers. Quite a few scholars lamented the loss of browsing and serendipity in discovery that electronic search and selective digitization create, however. This may be particularly acute in fields such as history that depend on archives, although we heard the same from a few biologists as well. We also heard from some scientists that “if it wasn’t online, it didn’t exist, and wasn’t important.” (Although one biologist pointed out that not everything made it into [PubMed](#) when it was creating its digital archives). Similar criticisms have surfaced around [Google Books](#); the selectivity and bias of digitization will serve to cripple its utility as a definitive scholarly resource.

The preservation and storage of a researcher’s own data is a thorny issue. The degree to which support structures and organizations are available is uneven at best, and, given the enormity of the challenges, most institutions seem to be approaching it in a piecemeal manner, if at all.

4) To what degree do you or your colleagues engage with the public? How? Why or why not?

Engagement with the public is valued and occurs in all fields under investigation. It is considered to be an important part of service and is judged by tenure and promotion committees as such. But, and it is a big “but,” public engagement is something that almost everyone said is only appropriate on any appreciable scale once a scholar has been promoted and has made a name for her/himself in the field.

As we did not define the term “public” for our interviewees, they interpreted the question to refer to a wide spectrum of activities and described their own personal “publics” for us. One biologist interpreted public engagement as embodied in expanding private industry partnerships. Political scientists and economists mentioned consulting work with the government and NGOs. Teaching, public lectures, op-ed pieces, K-12 outreach, performances, websites, TV and radio interviews, concerts, and festivals were also cited. Blogs were not reported as being used for public engagement very often.

5) What new, transformational, developments in your field are on the horizon?

This is highly variable by discipline and will be presented in the final analysis.

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