New Media & Society
Theme Issue: "Scholarly Communication: Changes, Challenges & Initiatives"

Credit, time, and personality: The human challenges to sharing scholarly work using Web 2.0

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Abstract

Funding bodies, the economics of publishing, and the affordances of Web 2.0 platforms have spurred learned societies, publishers, and scholars to experiment with new media venues for scholarly communication. Why, then, have we seen few wide-spread changes in how scholars disseminate research in most disciplines? Drawing on qualitative interview data from the Mellon-funded Future of Scholarly Communication Project (2005-2011), we describe how scholars share their work-in-progress and the disciplinary values driving these practices. We then discuss credit, time, and personality as significant barriers to change across disciplines, and we explore these obstacles through an examination of two new paradigms for sharing: open peer review and data sharing. By situating larger discussions about the future of scholarly communication in the everyday lives of scholars, we argue that integration with disciplinary cultures will be key to the success of new media initiatives.

Key words
scholarly communication, Web 2.0, data sharing, higher education, social media, peer review, tenure and promotion, epistemic culture, sociology of science

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INTRODUCTION

Much has been written about how new digital technologies and Web 2.0 platforms afford innovative and more economically sustainable ways of conducting research, collaborating, and disseminating research ideas and products within and outside the Academy. These predictions describe a brave new world where traditional barriers and dissemination channels are replaced by a more democratic and open universe of ideas. In this world, the peer review of scholarly manuscripts needs no longer to be blind or conducted behind closed doors by select gatekeepers, and a scholar's data and other research materials will be made openly accessible, regardless of their source or complexity. Put simply, we will be able to do more, more easily, than ever before throughout the entire scholarly communication lifecycle.

In this paper, we reference our empirical policy-oriented work on the future of scholarly communication (Harley et al., 2007, 2010; Harley and Acord, 2011) to examine how the potential affordances of new digital technologies as described above intersect with the deeply seated conventions, values, and social processes that have shaped contemporary disciplines. Our interpretation of some of these conventions (which are explored in detail by many sociologists of science such as Becher and Trowler, 2001; Camic et al., 2011; Knorr-Cetina, 1999; Latour and Woolgar, 1979; Zuckerman and Merton, 1971) emphasize the modern context of everyday lives of individual researchers in highly competitive institutional contexts.

Other recent surveys, of varying rigor and scope, examine the uptake of 'social media' tools among university faculty. Most results mirror our own work and report a variety of barriers to the adoption of new tools, including awareness, user skills, perceived utility, and quality control (cf. Moran et al., 2011; Ponte and Simon, 2011; Procter et al., 2010; Rowlands et al., 2004, 2008). In addition to our own, a recent series of disciplinary case studies published by the UK's Research Information Network (Bulger, et al., 2011; Meyer, et al., 2011; RIN and British Library, 2009) and US research firm Ithaka (Dawson and Rascoff, 2006; Griffiths, et al., 2006; Quinn and Kim, 2007) describe technology use driven by habitual behaviours and disciplinary needs and cultures. Taken together, these studies demonstrate a widespread, if gradual, uptake of 'new media' technologies by scholars to locate and access scholarly resources and collaborate, but much less use is found of new media technologies to share and disseminate one's own scholarship.

The question remains: What factors actually condition the use of new media venues for sharing and openness in scholarly communication? Our answers to this question here stress the cultural drivers of academic conventions, and the personal values of credit, time, and personality. With regards to faculty at research-intensive universities, we posit four crucial ingredients necessary to understanding and predicting potential changes in scholarly communication behaviour. First, there is extraordinary variance in communication needs, forms, and practices across the disciplines. Second, scholars negotiate diverse and sometimes countervailing forces that impinge upon their communication choices. These include practical issues (time, budgets, access to resources, and receiving due credit), as well as personal issues (privacy, trust, and ego). Third, any discussion of the future of scholarly communication *writ large* inevitably becomes a discussion of peer review, as peer review (in all its forms) is the primary value system supporting perceived quality in research. And, fourth, there is an important distinction between experimentation with forms of what we termed 'in-progress communication' versus archival

publication (e.g., books and articles); conventions around the latter have seen slow if any change. In what follows, we build on these ingredients to explore current scholarly sharing practices and the impact of faculty needs and values on the adoption of new digital tools for sharing in the disciplines.

METHODS

This article is based upon the qualitative interview, observational, workshop, and textual data collected during the seven-year Future of Scholarly Communication Project (2005-2011), funded by the Andrew W. Mellon Foundation. The goal of this project was to map the current and evolving needs and perceptions of scholars as both users and producers of research. One- to two-hour semi-structured interviews were conducted with over 160 faculty, administrators, librarians, and publishers across more than 45 'elite' research institutions largely in North America (and some in Western Europe) in over 12 disciplines.[1] These interviews covered a variety of topics including tenure and promotion, sharing and publication, collaboration, data and resource use, and public engagement. Individuals were chosen through convenience sampling and a quota-informed system of snowball sampling to ensure that the informant pool represented a diversity of career stage and experience.

The project resulted in multiple publications (Harley 2008, Harley et al., 2007, Harley et al., 2010, Harley and Acord, 2011). These publications offer comprehensive descriptions and analyses across much of the scholarly communication spectrum, including an in-depth investigation of peer review. For the present paper, we analyzed our larger database and general findings with regards to the uptake of Web 2.0 technologies in various disciplines for sharing scholarly work and pulled quotes as appropriate from Harley et al. (2007, 2010). We refer readers to the 'thick descriptions' of disciplinary case studies and more extensive literature reviews in previous publications.

SHARING IN A DIGITAL AGE: WHO, WHAT, WHEN, WITH WHOM, AND WHY?

If the predictions of Web 2.0 pundits are to hold true in academic contexts, why are we not seeing more widespread change in some of the most basic and early-stage forms of scholarly communication across the disciplines? We have argued that an understanding of sharing practices should be put in the context of the primary drivers of scholarly communication behaviour, which, in competitive institutions, are career self-interest, advancing the field, and receiving credit and attribution. Even though the tenure and promotion process allows for disciplinary differences in type of scholarly product (e.g., books, articles, musical scores, computer code, etc.), a stellar record of high-impact publications continues to be the most important criterion for judging a successful scholar in the institutional peer-review process (Bell et al., 2007*;* Estabrook and Warner, 2003; Harley et al., 2007, 2010).[2] This may be because, as Borgman (2007: 63) observes, it is easier for institutions to measure a scholar's outputs (in publications), than to measure inputs (e.g., in research time). Consequently, most scholars concentrate their energies and activities on developing, refining, and producing archival publications through a complex and continual process of peer review (Harley and Acord, 2011).[3]

As with everyday communication practices more generally (cf. Goodwin, 2000), individuals design scholarly communication practices to maximize impact with a select 'target' audience. As scholars formulate, develop, edit, and fact-check their work-in-progress, they gradually share

their work with wider and wider circles of trusted, targeted individuals. As we describe below, while the web has extended the reach of these types of sharing, the functions they serve developmentally have not changed radically. As one historian noted, 'It's really not substantially different than what's been in practice for several hundred years…[except] it's faster and it's more global'.

Personal communications

As first described by Price (1963), personal communications and informal exchange practices among geographically-disparate scholars in an 'invisible college' (academic discipline or area of study) are at the root of scholarly communication. Sharing of early thoughts and ideas most often occurs first as personal exchanges with colleagues, collaborators, or students in real time (e.g., 'hallway conversations') or through email. As work is refined through informal exchange, a scholar may invite a larger network of trusted colleagues to comment upon the work, most commonly by emailing a Word file or PDF. Indeed, as an economist notes below, this stage of sharing may involve several mini-stages as work is circulated to different target groups:

> I have a working draft of a paper…first I'll send it by email to four or five people whom I know relatively well, who I went to grad school with or I'm friends with, for feedback…And I'll reincorporate that feedback and send it out to a wider range of people…who are going to be reviewing it in the editorial process…And then after *those* comments, I'll submit to a journal…The way I view it is: who you know means that you'll get higher-quality comments…and you'll be able to get rid of the obvious criticisms *before* you get into the referee process.

In addition to engaging one's informal scholarly networks, this iterative process of sharing alerts others to one's upcoming work, keeps one on their radar, and is done as a courtesy to scholars who have been cited or have worked in the field.

Group sharing: conferences and seminars

When scholars feel that their work is well developed and far enough along that it cannot be 'scooped,' they begin to share it in more open (but still targeted) environments. Across disciplines, small seminars and conferences are reported to function best for early stage results, particularly when composed of highly specialized groups of scholars willing to share their current ongoing work in depth. Larger conferences remain important occasions for scholars to present work, meet face-to-face with colleagues, and build their informal networks.

While smaller conferences provide a more protected layer of interaction, the degree to which a scholar will share sensitive information among disciplinary colleagues is related to the sense of community and collaboration in an academic subfield.[4] One molecular biologist described 'the game,' in which scientists 'know to a nicety exactly how to both ask the questions designed to uncover commercially relevant information in an academic context, and also how to answer such questions without giving anything away'. Scholars compensate for these risks by guarding what and how they share at conferences (e.g., by declining to circulate a full paper, or presenting work already submitted for publication).

Public sharing: websites and repositories

In some high-paradigm fields with low commercial value and/or growing lag times to publication (e.g., physics/astrophysics, economics, and quantitative social sciences), scholars post drafts to personal websites, preprint servers, and working paper repositories (e.g., arXiv, SSRN, Cogprints, and RePEc) to stake a public claim to their work and solicit further informal feedback. For most scholars, a certain level of excellence must be achieved before this public exposure of ideas — in what is called a 'penultimate draft' — and frequently scholars will post an unpublished paper simultaneously with submitting it to an academic journal. Work shared in such ways can receive 'reputation credit as a contribution to the field' and 'speed up the citation count process' if a discipline's relative 'culture of sharing' is high.[5] Importantly, this is only possible when certain outlets have been institutionalized as essential to keeping up to date in the field (e.g., via receiving daily email alerts to new content). The arXiv, for example, is successful because it allows scholars to quickly get their work before their main audience. An astrophysicist reflects:

> It [arXiv] has changed the sociology. We used to have various things that we tried to get our graduate students to do over coffee in the morning with the faculty, and one of the things that's clicked all over the country is having a morning coffee periodically, whether it's once a week or once a day, which discusses three hot arXiv papers. So that has really made quite a difference in the culture, as well as how you actually proceed when you're trying to do research…

The irony is that even though such formalized practices have entered the culture of some scholarly communities, the opportunities provided by rapid dissemination through preprint outlets do not replace the overriding influence of formal archival publication because they are not yet recognized as, and were not necessarily intended to be, equivalent currency in tenure and promotion evaluations (Ginsparg, 1994; Harley et al., 2010; Kling and Spector, 2004: 98).[6] Moreover, working papers are unheard of in highly-competitive fields like chemistry or molecular biology that are characterized by large grant funding, commercial potential, an extant quick turnaround time to publication (and a surfeit of publications and outlets), and an overload of (or risks associated with relying upon) unvetted material. Openly sharing pre-publication work is also avoided by many scholars in the humanities or qualitative social sciences, who are wary of sharing 'unfinished' drafts that are ultimately and ideally destined for a long, careful, interpretive argument in the form of a monograph published by a prestigious press.

Taken together, guarded prepublication sharing practices function as a safety net for scholars to not only improve the work and avoid 'making fools of themselves', but also to stake a claim on ideas and maintain a visibility in their research areas. Our work suggests that scholars seek out informal peer review in a highly strategic manner based on social variables and disciplinary values. That is, in deciding when and where to share their work-in-progress, scholars make decisions based upon their discipline's culture and degree of trust (of the interlocutor), comfort (how well they feel their work is developed), and audience (who needs to be aware of their work and how are they best reached).

FACULTY VALUES AND BARRIERS TO CHANGE

Web 2.0 tools are of course used by some scholars, in some disciplines, for sharing scholarship in particular ways. Witness the uptake of blogs by some well-known economists and the growth

of Twitter in the digital humanities community as just a few examples. We describe in more detail below how the values of credit, time, and personality, however, can impede broader adoption of such tools and practices.

Securing prestige, credit, and attribution

As is well documented by sociologists of science in explorations of epistemic cultures, the formal process of converting research findings into academic discourse through publishing is the concrete way in which research enters into scholarly canons that record contributions to and progress in a field (Knorr-Cetina, 1999; Latour and Woolgar, 1979; Lynch, 1985; Myers, 1990). Moreover, the institutional reward structure in higher education makes faculty responsible to dual, intertwined entities: their universities and their scholarly disciplines. Universities give scholars professional *credit* for (a certain number and quality of) publications in particular prestige outlets. Disciplinary colleagues, however, decide how ideas and work are *attributed* to a scholar by governing what makes it to into print (through peer review) to be cited by others (Crane, 1972). Norms for both credit and attribution are part of the established sharing and publication system in a scholarly discipline.

How scholars receive attribution for their ideas varies by field. In smaller fields with low internal competition, informal mechanisms for reputation management enforce attribution because their academic communities are centrally organized and maintained through face-to-face interaction (via conferences and workshops). This 'sharing culture' can change, however, with funding and other exigencies of a field. For example, although economics is commonly described as a 'big sharing group' where 'we're very open about ideas', the subfield of neuroeconomics is rapidly moving towards less sharing. As one scholar notes:

> There's a huge time element because people are really at the point where they're stealing other people's ideas. Social scientists in particular tend to share ideas…This has ceased to happen in neuroeconomics...It's much more like the natural sciences, because we have huge low-hanging fruit that's quite valuable. Getting a paper in *Science* and *Nature* is career changing, and grants open up. There's a lot of money and prestige and potentially a Nobel Prize sitting there, so turnaround is important.

Once a field begins to take shape, and funding becomes a large driver of research success, the stakes for formalizing 'credit' can be raised and scholars take no chances of being 'scooped' in attribution. As one molecular biologist observes, 'At a meeting you can raise an important question, but if you don't publish it and three other people do, they get the credit and everyone forgets about you. So, you can be brilliant and forgotten, but what's the point?' The need to secure absolute attribution and credit through a traditional publication outlet is thus one of the strongest barriers to sharing early ideas openly in many fields.

Managing finite time and limited resources

Higher education is an increasingly bureaucratic environment where more and more demands are being placed upon scholars. At the same time, higher education is growing exponentially, on a global basis, and new communication tools are quickly increasing the number of peers, students, and other individuals with whom scholars correspond and keep up to date on a regular basis. While there is widespread agreement among faculty that new digital technologies have made

scholarly communication much faster, faculty also accuse them of enabling a proliferation of junk and noise online; publication has become an 'inflationary currency' in the words of one department chair. In a profession where individuals habitually cite being overworked (Jacobs and Winslow, 2004), and are increasingly required by their institutions to 'do more of everything' (Tuchman, 2009: 158), time in a scholar's day is at an absolute premium.

It is ironic perhaps, given the predictions about unlimited possibilities afforded by new Web 2.0 tools, the importance placed by tenure and promotion committees, grant review committees, and scholars themselves, on archival publication in the top peer-reviewed outlets is growing, not decreasing, in competitive research universities (Van Dalen and Henkens, 2012). This is reflected in the remarkably consistent advice given to pre-tenure scholars across fields: focus on publishing in the right venues and avoid spending too much time on competing activities such as public engagement, committee work, writing op-ed pieces, developing websites, blogging, data curation, developing courseware, or other activities. Consequently, young scholars in search of tenure-track positions exhibit a unique form of professional 'anxiety' (Archer, 2008: 18) or 'sterility of professionalization' (Lamont, 2009: 197). Importantly, such professional drivers are not 'objective,' but are products of intense socialization into an increasingly competitive working environment.[7] As one astrophysicist lamented:

> I find myself always playing catch up…And, one of the things I tell younger faculty when they first arrive is the most important skill to learn is how to do a barely passable job on 80 percent of the things that you're asked to do, so that you can do a good job on the other 20 percent.

The resulting publication pressure on young scholars, and scholars at less competitive institutions globally where this singular focus 'trickles down,' translates into a growing glut of low-quality publications and publication outlets (Bell et al., 2007; Harley and Acord 2011; Holmgren and Schnitzer, 2004; Ware and Mabe, 2010). This proliferation of outlets has placed a premium on separating prestige outlets (with their imprimatur as proxy for quality) from those that are viewed as less stringently refereed. Consequently, most scholars choose outlets to publish their work based on three factors: (1) prestige (perceptions of rigor in peer review, selectivity, and 'reputation'), (2) speed to publication, and (3) highest visibility within a target audience (Harley et al., 2010: 10).

The proliferation of publication outlets, combined with the professional anxiety of scholars, has a corollary in scholarly consumption practices. As scholars prioritize their core research activities, they struggle to keep up to date and look for more filters, not fewer, in determining what to read. Time, and the related need for filters, is cited as one of the most influential variables in scholar's decision whether to adopt 'new' scholarly communication practices (Harley et al., 2007, 2010).[8] Most scholars turn to the familiar filters of peer review, perceived selectivity, 'reputation', and personal networks to filter what they pay attention to, and that often includes browsing flagship journals to keep up with advances from across the discipline.

Individual characteristics and personality

In combination with receiving credit and time management, personality can trump the conventions in a field. Defining what is 'good enough' to share is often a subjective decision that

has its roots in the context of an individual scholar's specific academic training and research habits. There are economists and astrophysicists who do not share working papers or preprints, and there are molecular biologists (like the one quoted below) who have no qualms about sharing unpublished work openly:

> …there are very strong individual differences. Extremely strong. And it's just another example of the impact of training. Jerks come from jerks, and nice people come from nice people…I always talk about stuff we just did…I think people appreciate that…I grew up with the notion that a way to get credit for something is to talk about it right away…and other people say you've got to hide it until it's in print…[The former] is something we try to pass along in the culture in our lab.

Although 'socialization' in graduate training can have an impact on sharing practices, confidence about sharing is also a personal consideration linked to one's comfort level, research process, and sense that sharing early 'matters' in developing an idea. As one archaeologist noted:

> There's this research group in my area and…they want to do a lot of discussions on [social media]…but I just can't…There needs to be a little bit of space where I can actually think about something. ...I have to be a little bit more deliberate and think about things a little bit more…I need some time to reason...

In addition to the personal desire for privacy and reflective time described above, some scholars fear that once a comment or draft is put 'out there' online, they lose control of how ideas therein will be used by interlocutors. For example, one political scientist reveals a fear that 'there will be some graduate student [half way around the world] who will get a hold of your preprint where you said some things that were really stupid or not quite right, and he'll quote you until the day you die on this half-baked version of your ideas'. In the case of this social scientist, as with many others we encountered, the growing working paper sharing culture in the field conflicts with a deeply-seated personal relationship to one's work and belief in the integrity of the formal peer-review process, a collision of values that we will explore below.

FACULTY VALUES AND EXPERIMENTS IN OPEN PEER REVIEW AND OPEN DATA

Above, we posit that the values of credit, time, and personality play deterministic roles in how scholars embrace new media for scholarly communication purposes. We now turn to open peer review experiments and new models of data sharing to explore how these values are influencing new scholarly sharing experiments on the ground.

Open peer review

As reviewed in Harley and Acord (2011: 45-48), there have been a variety of experiments across disciplines with the online peer review of manuscripts submitted for publication, where commentary is openly solicited and shared by random readers, colleagues, and sometimes editor-invited reviewers, rather than exclusively organized by editors. The results of these experiments indicate that open peer review may have the potential to add value to the traditional closed peer-review process, but that it's wide spread adoption is unlikely for a number of reasons related particularly to time and credit. For example, in *Nature*'s 2006 experiment, the editors concluded

that there was a marked reluctance by readers to offer comments, and the comments offered were not more helpful than the conventional blind reviews (Greaves et al., 2006). One of the few successful open peer review models is in the journal *Atmospheric Chemistry and Physics*, although the number of comments per article is quite low. *PLoS ONE*, an interdisciplinary science journal, also has a vanishingly small number of comments per article in its post-publication discussion model. We argue that scientists, particularly in very competitive fields, generally avoid *en masse* such experiments because many do not have the time to sort through existing vetted material, let alone additional 'unvetted' material or material 'vetted' by unknown individuals.[9] As one molecular biologist stated, 'It comes down to a matter of time. I would probably sacrifice missing something that's buried in the big heap and instead hope that I pick it up in another way or wait until it goes through the peer-review process'.

In the humanities, Media Commons (a community network for media studies scholars) has experimented with a variety of publications with varying success, including various book manuscripts (e.g., Fitzpatrick, 2011; Wardrip-Fruin, 2009) and the journal *Shakespeare Quarterly*. These experiments were described as a success, and comments were described as productive by the readers and authors involved. Recruiting reviewers to take part in a thoughtful manner was noted as challenging and exacting, and put large demands on editorial time (Howard, 2010; Rowe and Fitzpatrick, 2010).

Based on our work and observations of open peer review experiments (including the one for this *New Media & Society* special issue), we posit open peer review will not gain widespread traction across disciplines because scholars, particularly senior scholars, already spend an enormous amount of their time conducting peer review in its myriad forms, and established publishers have an exceptionally difficult time recruiting competent reviewers (Harley et al. 2010; Harley and Acord, 2011: 24-25). The fact is most scholars do not have the time to conduct invited reviews, let alone engage in 'optional' volunteer and open reviews. Scholars generally read something one time, and, given a choice, the version they will want to read will be the final one.

Moreover, some scholars are concerned about having their unpublished work posted online, where it is exposed to wide scrutiny, what Cronin (2010) terms 'fear review'. Other scholars are concerned about writing comments online (and therefore reacting prematurely to research) because there is a risk of 'getting it wrong' in the absence of reflection and then having these 'wrong' conclusions become part of the permanent record.[10] Finally, regarding credit, although peer reviewing is considered to be an important part of service (and all scholars include such activities in their promotion dossiers and receive credit for that work), there are currently few additional means to credit people who make important public 'comments' on preprints or published work.

We note, however, two factors that may predict acceptance of open peer-review models. One is discipline and another is the size of the field, with smaller fields that have fewer publications overall being perhaps the ripest for success. For example, the monograph open peer-review experiments run by MediaCommons have been conducted specifically in the media studies domain, and comprise relatively small specialized communities that may already have an 'elective affinity' (Weber, 1930) to new technologies based upon their topic of study.[11] Here, the issues of trust (attribution) and motivation are resolved. If such experiments proliferate, it will be

important to assess who is offering comments (i.e., what portion of such open comments come from 'friends') in these venues, and whether the overall impact and costs exceed the normal levels of traditional informal and formal peer review.

Data sharing

A variety of forces are challenging traditional data sharing practices. They include calls (and sometimes mandates) from some journals and funding bodies to publish data sets, particularly in the sciences and quantitative social sciences.[12] These calls are motivated by the desire for more transparency in research practice, greater returns on funders' investments, as well as claims that this growing availability of digital primary source material is creating novel opportunities for computational research that is significantly different than traditional forms of scholarship (Arms and Larsen, 2007; Nature, 2008; Waters, 2009). Despite these opportunities and mandates, however, data sharing is idiosyncratic and may not occur at all in many fields (Borgman, 2012; Harley et al., 2010; Nelson, 2009; Noor et al., 2006; Schofield et al., 2009).

Data sets, exhibitions, tools/instruments, and other 'subsidiary' products are awarded far less credit in tenure and promotion decisions than standard publications unless they are themselves 'discussed' in a peer-reviewed publication (Harley et al., 2010: 18). Although some have suggested that enabling citation of data would equalize the currency of data outputs with formal publications (cf: Australian National Data Service, 2011), our findings suggest that the solution is not so simple. While making data citable may satisfy 'attribution,' it would not solve the problem of *credit*, which requires that data be stringently peer-reviewed. It is not clear how or when data will be formally peer reviewed in the same way that journals and books are currently. Who has the time? Indeed, *The Journal of Neuroscience* (Maunsell, 2010) and the *Journal of Experimental Medicine* (Borowski, 2011) recently announced their decisions to cease the publication of supplementary data because reviewers cannot realistically spend the time necessary to review that material closely, and critical information on data or methods needed by readers can be lost in a giant, time-consuming 'data dump.'

Of course, many scholars already have *ad hoc* systems for sharing data and other scholarly materials upon request, or by publishing supplementary data sets on personal websites following article publication. As with decisions to share one's in-progress narrative work, the decision to share data is frequently related to individual personality, stage of research, who is doing the asking, and what an individual plans to do with the data (Harley et al., 2010: 14; Savage and Vickers, 2009). Scholars may wish, for example, to 'squeeze' future publications out of the data, and are subsequently concerned that making the data available will result in a loss of ownership and 'first rights.' In the sciences, this can take the form of holding onto data to secure proof of principle for one's next grant application; 'You don't dare publish the results until you've got the NIH grant that you're using those results to get'.[13] Additionally, some scholars are reluctant to share their data for fear that it is 'messy' or that their work practices will come under too much scrutiny.

Data sharing is also greatly impeded by scholars' lack of personal time to prepare the data and necessary metadata for deposit and reuse (which includes the sometimes Herculean efforts of converting analog data to digital formats, or migrating old digital formats to new ones). For scholars focused on credit, narrowly defined, there is no advantage to spending time (and grant

funding) curating data, when that same time can be applied to the next research project and/or publishing books and articles. While data sharing may be facilitated by development of new tools and instruments that ensure standardization (such as in gene sequencing), the idiosyncratic ways in which scholars work, and the extreme heterogeneity of data types in most non-computational fields, do not lend themselves to one-size-fits-all models of data sharing. The escalation of funder requirements (e.g., NSF, NIH) for sharing data management plans points to an important space to track.[14] We predict that faculty will not be doing the work, but rather a new professional class and academic track (perhaps akin to museum curators, specialist librarians, or tool-builders) may emerge to take on these new scholarly roles (cf: Borgman, 2007; Nature, 2008; Science, 2011; Waters, 2004). In sum, until issues of time and peer review are worked out, we predict an uneven adoption of sharing and publishing data openly.

CONCLUSIONS: ORDER AND DISORDER IN THE FUTURE OF SCHOLARLY SHARING

Ten years ago, Nentwich (2003) spoke of the Academy as being in the middle of forceful changes ushered in by new information and communication technologies. Our research shows that we are still in these changing times, most recently compounded by the economic ramifications rocking the publishing industry (Cronin, 2010). What is clear is that different scholarly communities and subfields are creating and adopting tools that facilitate the specific needs and practices that they themselves delineate collectively.[15] As disciplines become more and more specialized, it is increasingly unlikely that wide-scale adoptions of the same models for scholarly communication will occur. In summarizing our findings on the future of online sharing of academic research, we conclude with an identification of the larger theoretical issues at play and suggestions for further empirical study.

In his article in this issue examining the consequences of new media for the publishing industry, Phil Pochada (2012) coins the term ‘digital soup’ to describe this brave new world of online scholarly communication and its mix of comments, preprints, publications, tweets, data sets and all manner of scholarly material. This term also has great relevance for our findings, if we see scholarly communication as a symbolic system, something common to any society. As described by anthropologist Mary Douglas (1966), societies function by maintaining classifications between different social categories and excluding (as ‘dirt’ or ‘matter out of place’) the activities that do not fit into these categories. In scholarly communication, these categories could be seen as the different conventions for sharing work described above. In this light, the chief danger of publicly-open social media tools and venues is that they mix the conventions of different levels of sharing in the disciplines. Social media enable a more informal, immediate engagement with ideas, which is more common to small conferences or ‘hallway conversations’ with trusted colleagues, but combine this embryonic discussion with an open permanence that is more common to the final archival publication of record. Following Douglas, who wrote about other social contexts, the blurring of these traditionally separate spheres of activity can result in ‘disorder.’ We have found that, for many scholars, this ‘disorder’ results in avoidance of social media technologies (as producing ‘matter out of place’).

Interestingly, new technologies for in-progress communication have always been instrumental in fostering discussions excluded from the mainstream, either consciously (e.g., by editorial

'cabals') or of nascent fields without established publication outlets. As a biologist described the 1970s *C. elegans* (roundworm) community:

> Nascent fields, as they emerge, fairly often have these community blackboards, and I remember the times when the Drosophila community had stuff flying around on faxes. *C. elegans* has a Worm Breeder's Gazette…on the Web…People put up negative results as well as positive results, everything…these things seem to work well as the field is struggling to establish itself and people realize that nobody's got a breadth of expertise or tools…

Similarly to the *C. elegans* community, we predict that new social media will continue to be valuable in incubating new fields and topics of discussion.[16] But, as a field grows, gels, and establishes a research trajectory, walls may be erected that preclude the facile sharing of early ideas. In this analogy, the formal publication system can be seen as a 'ritual of purity' acting to restore order (and enforce credit) by directing the multitude of voices and conversations involved in pre-publication sharing into a record of progress in a field.

Scholarly conventions have such remarkable staying power because of their role to maintain order in academic communities, but they do not preclude change. Douglas notes that societies evolve by finding ways to include 'matter out of place' in classification systems by giving these substances or activities an interpretation that better fits into the established social order. We can use this framework to predict that new tools for in-progress scholarly communication are adopted (to maintain 'order') when they address distinct needs in a specific discipline by: (a) complementing, rather than interfering with, conventional practices for attribution and crediting; (b) building on established circles of trust and audience within discrete scholarly communities and; (c) not requiring additional resources, i.e., time and money.[17]

Moving forward, although individual scholarly communities are likely to maintain order in scholarly communication as described above, the adoption of different digital tools and resources by different fields and subfields may perpetuate disorder on a larger scale, across the Academy. We speak, in particular, of the fear of spawning digital echo chambers in an online research universe. As Abbott (2011: 72-73) describes, in the 1940s and 50s, an explosion of new research positions and subdisciplinary areas, and the resulting 'flood of material,' drove scholars away from standardized indexes and abstracting journals produced by librarians to specialty scholarly literature and article reference lists as finding aids. Adding to this phenomenon, the early days of virtual communities (Katz et al., 2004: 326; Wellman et al., 1996: 232) saw the beginning of online social networking creating a powerful multiplication and fragmentation of traditional social networks. In scholarly disciplines, these shifts - multiplication of knowledge areas and social networking - could actually impede cross-pollination and focused disciplinary conversation by encouraging scholars to only communicate with (and cite) like-minded individuals. We suggest that it will be important going forward to study how some entity – scholarly societies, editors, curated crowdsourced resources, and so on – works to ensure deep, wide-ranging conversation among scholars so that all members of a community can reap the rewards of each other's work.

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NOTES

[1] More detailed information on our sample population and research design can be found in Harley et al. (2010: 3-7) and Harley and Acord (2011: 12-13).

[2] Monographs and books are important in history, traditional musicology, and archaeology. Journal articles are important in astrophysics, biology, and the quantitative social sciences (and sometimes 'acceptable' in music theory and classics). The performing arts have other products (performances, commissions, software, etc.). Securing grants in laboratory sciences is exceptionally important. Although conference presentations, working papers, (some) edited volumes, blogs, and other non-peer-reviewed work may influence the evaluations of external reviewers, they do not substitute for peer-reviewed publications in institutional review. (Exceptions to this include computer science, where conference papers are penultimate publications.)

[3] Harley and Acord (2011) summarizes a workshop, funded by the A. W. Mellon Foundation, which brought together leading scholars, publishers, librarians, and administrators to discuss the relationship of institutional peer review (tenure and promotion) to publication-based peer review (book and journal editors). These proceedings examine in depth the wide breadth of peer review activities and where (and at what cost) they are carried out.

[4] In biology, for example, the *C. elegans*, *Arabidopsis*, and Maize communities were noted as well-integrated (Harley et. al, 2010: 255-256). Papyrology was similarly described as a more sharing community than epigraphy.

[5] This sharing culture is maintained through an enforcement of reputation and citation. As an economist observed, 'People who are viewed as stealing other people's ideas and publishing them as their own would be ostracized very rapidly. It almost never happens. We treat it like plagiarism. As a result we're very open about ideas' (Harley et al., 2010: 357).

[6] In the absence of the traditional publication filters, factors like the 'reputation' of the scholar become important in determining whether or not his/her shared work merits reading and citation. In economics, for example, these outlets may function well for top-ranking authors (Ellison, 2011), but are less viable for younger scholars who must build their reputations on published work before their working papers are consulted by other scholars (Harley and Acord, 2011: 50).

[7] As described by the 'new institutionalism' in organizational sociology (Powell and DiMaggio, 1991), professional norms and conventions permeate the scholarly community as participants are motivated by common carrots (or sticks) and share conceptions of appropriate behaviour.

[8] This includes listservs (Harley et al., 2010: 95), blogs and blogging (Rodrik, 2007), and pre-circulated conference papers (Grant, 2011).

[9] Another consequence of this 'inflationary currency' is a growing reliance on bibliometrics, such as the impact factor, and an increasing 'arms race' among scholars to publish in the highest impact outlets. As detailed by Harley and Acord (2011: 48-53), there is widespread concern that, taken alone, alternative (quantitative) metrics for judging scholarly work are much more susceptible to gaming and popularity contests than traditional peer-review processes.

[10] On a different note, some scientists ban young scholars in their labs from too much public commentary for fear that they will say too much in their comments and risk being scooped (Harley et al., 2010: 283).

[11] The same might be said of the recent crowdsourced blog discussion of Deolalikar's 'proof' in computer science (Rehmeyer, 2010).

[12] For example, NASA and other agencies require that observatories archive all observational data stemming from projects they support.

[13] Ironically, there was a linked fear in biology that *too much* preliminary data cannot be included on grant applications, because of the risk that someone on the review panel will see the data and scoop the applicant (Harley et al., 2010: 279).

[14] Note, for example, the Board of Research Data and Information at the National Academies: http://sites.nationalacademies.org/PGA/brdi/.

[15] As described by Crotty (2011), grassroots discussions are unlikely to crop up in fora socially engineered by corporate entities for 'scholarly social networking'. Consequently, as suggested by Procter et al. (2010: 52), technical and staff support for scholars interested in building new communication for their fields may become increasingly important.

[16] Witness, for example, the role of blogs in fostering the new philosophical subfield of speculative realism (Thrift, 2011).
[17] More information on the pragmatic aspects of tool development to ensure more widespread adoption (e.g., intuitive functioning, support staff, free at the point of use) is discussed in Procter et al. (2010: 47-53).

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