There is a growing mountain of research. But there is increased evidence that we are being bogged down today as specialization extends. The investigator is staggered by the findings and conclusions of thousands of other workers—conclusions which he cannot find time to grasp, much less to remember, as they appear. Yet specialization becomes increasingly necessary for progress, and the effort to bridge between disciplines is correspondingly superficial.

Vannevar Bush (1945)

Introduction

Across the domains of scholarship, expectations are high for development of “new forms of scientific discovery and scholarly research” previously considered impossible (Arms and Larsen 2007, 3). In contrast to such expectations, recent empirical research on scholarly communication suggests low rates of adoption of the technologies that underpin the vision of an e-infrastructure. Instead, there is continued preference for publishing research in traditional, high-ranked journals and book-length monographs (Harley et al. 2010). At the same time, publishers are providing digital versions of articles and books, and open access journals are increasing in number. Nevertheless, the format and structure of formal scholarly communication remains largely unchanged.

In less formal communication settings, researchers are inclined to adopt a variety of the freely available Internet products and services. Without overt concerns for the academic reward system in the informal setting, scholars are experimenting with new practices. These innovations occur differently across disciplinary contexts, degrees of collaboration, and stages in career (Procter et al. 2010a). Analysis of technologically-facilitated scholarly communication is complicated by differences in situated practice. Common among these new informal venues and practices is an environment of openness,
less compatible with the role of formal scholarly communication, particularly regarding the academic reward system.

In light of these challenges, we propose an analytical framework of openness to better understand scholarly communication in the digital era. The chapter begins with a brief panorama of developments underway. This is followed by elaboration of the conceptual framework of openness afforded by digital media and the proliferation of user-generated content associated with Web 2.0 (O'Reilly 2005, Vossen, and Hagemann 2007). Further, we situate these changing practices within the rubric of e-research. The chapter introduces this perspective, followed by a review of scholarly communication more generally. We then focus on the dynamics of openness in formal and informal communication. This serves as a means to examine emerging practices and the ways in which such practices help understand challenges and opportunities in scholarly communication. With this conceptual backdrop, we offer illustrations of both formal and informal communicative forms, focusing on emerging practices in the informal realm and recent digital publishing initiatives by academic publishers. These illustrations serve as a basis for examination of the tension and flux in scholarly communication associated with dimensions of openness, and for proposing avenues for further empirical exploration.

**Panorama of Developments**

For decades scholarly communication has been confronted by crises and challenges. This period was also witness to the emergence of electronic networks, digitalization and tools for authoring, processing, and distributing scholarship. These developments have contributed to exceptional institutional challenges while at the same time presenting opportunities for new communication practices among scholars. In the 1980s and 1990s university libraries struggled to meet the rising costs of periodicals, particularly in the fields of science and medicine, when financial resources for library acquisitions were dwindling. The challenges in part clarify the proliferation of journal titles and specialized publishing houses, often operating exclusively within an online environment. This seeming wealth of outlets and voices has raised concerns about the quality of scholarship and suitability of traditional assessment procedures (e.g., Roberts 1999; Fitzpatrick forthcoming 2010). In contrast, the growth of informal scholarly communication using Web 2.0 platforms (e.g., blogs, social networks, wikis), has contributed to a situation in which communication practices are changing rapidly, thereby further expanding opportunities for scholarly communication. On Facebook, for example, the Dynamic City Foundation¹ (DCF), a Beijing-based urban research and design institute, hosts a group page with over 1300 members. The group page serves to share relevant information among an extended, international audience. In another example, the UsefulChem² Project provides a URL to a laboratory notebook that is freely available on the Web and is indexed on search engines (Bradley 2006). In both of these examples, research ideas, events, and information are published and discussed openly and in real-time.

Formal and informal communication practices have evolved in different ways in the face of digital media. Journal publications and books have frequently changed very little beyond creating digital versions with near identical structure. The growing body of work on open access sheds some light on scholarly communication and digital media, but again with a focus primarily on formally published work. This is not to suggest a misplaced focus; however, it does point to limitations for understanding evolving modes
of informal communication, particularly regarding the use of digital media and the new possibilities of openness that reach beyond open access.

Open access publishing on the Internet “is demonstrating dramatic and striking gains in the circulation of knowledge” (Willinsky 2006, 29). Openness in informal communication is increasingly intertwined in research practice. Access to research as it happens and the ability to participate in communication about research and research practice in situ are some of the indicators of openness in scholarship. As discussed in more detail below, we frame a view of openness with both interface and infrastructure dimensions. Our argument in abbreviated form is that research focused on free availability of academic literature on the Internet, e.g., open access (e.g., BOAI 2002), misses a larger range of open practices emerging in informal venues. Two additional factors are participation in the content of scholarly communication and the visibility of the procedures, processes, and organizational structures related to a particular communication venue. We identify inclusivity and transparency, in addition to access, as dimensions at the interface of openness in a communication medium. Similarly, the selection of a specific communication technology or platform, and decisions made during its installation, influence the possibility of openness. Here we identify standards, content interoperability, and levels of customization as dimensions at the infrastructure of openness.

e-Research and Scholarly Communication

Innovative new practices are emerging in informal, Web-based communication spaces, outpacing development of new practices within the formal modes of academic journal and book publishing. While informality facilitates opportunities for open exchange, presenting new ideas, and testing new claims, the lack of boundaries expands what counts as scholarly discourse, both in terms of content and contributors. Common among these informal modes of communication is the ethic and practice of openness, which on the surface is consistent with the principles of open science. Openness in science is most visible in the ethos of “communism” that prescribes “open communication of findings,” a practice that benefited tremendously from early advances in printing technologies (Merton 1979, 474). Printing technologies facilitated improvements in the accuracy of knowledge communicated, a more secure system for protecting intellectual property rights, and vastly increased dissemination.

Paradoxically, it appears that use of digital communication media in scholarship increases openness in such a way to challenge these long-held principles of open science. For example, the notion of ‘radical transparency’ is the practice of providing access to not only the content produced by contributors, but also to information about the organization of the collaboration, and crucially to the stakes, or interests, in the collaboration. Moreover, radical transparency makes these resources visible to collaborators and stakeholders alike – as well as to competitors and often the public at large – instead of the traditional practice of only providing open access to the final publication. That cooperation coexists with competition for intellectual priority points to an inherent tension within the normative structure of science. This tension is attenuated to some degree by, disinterestedness, another institutional norm of science, which is a distancing of personal interests or ideologies from scientific inquiry. Disinterestedness, together with communism of intellectual property, organized skepticism, and universalism “comprise the ethos of modern science” (Merton 1979, 270). The radical transparency example is
used here to illustrate an increase in the intensity of tensions facilitated by the possibilities of both openness and closeness. And further, the notion of communal sharing of intellectual resources is often contingent upon academic rewards having already been extracted from resources to be shared. In other words, having formally published new knowledge, which is only new once, makes it shareable.

The context within which scholarly communication functions is changing concurrent with the proliferation of digital versions of materials and Web-based dissemination. Scholarship in such an environment goes by different labels, but it is increasingly prevalent in the context of e-research, which is defined as “a form of scholarship conducted in a network environment utilizing Internet-based tools and involving collaboration among scholars separated by distance, often on a global scale” (Jankowski 2009, 7). Delineating the components of e-research in the form of a model is useful here as it enables illustration of the relationships of informal and formal modes of communication, which are made visible in a technologically enabled research collaboration environment. Jankowski (2009) proposes such a model, suggesting three clusters of research activities within a networked environment; see Figure 1.

![Figure 1: Components of e-Research (adapted version of Jankowski, 2009, 8)](image)

The dash and curved line at the edge of this figure suggests the networked environment within which e-research functions. As stated, three interrelated clusters of research activities are identified: research organization, research process, and scholarly communication. The first, research organization, involves the functions typically associated with project management. The second refers to those tasks associated with problem formulation, data collection and analysis, and data preservation. The third
concerns communication in both the formal sense (e.g., publication of research reports, conference papers, journal articles, and monographs) and the more informal mode.

This chapter concentrates on the third cluster of research activities noted in the figure, scholarly communication. Like constructions of the notion ‘science communication’ (e.g., Garvey, Lin, Nelson, and Tomita 1972), two overlapping activities are identified, both oriented towards audiences external to the research project: informal and formal. Whereas formal modes of communication are concerned with academic reward, informal modes are central to academic practice. Formal scholarly communication is often seen as synonymous with academic publishing and involves the well-known end products of academia: conference papers and proceedings, journal articles, chapters in edited books, and single-authored monographs. Such forms of formal scholarly communication frequently transpire in a networked environment through placement of manuscripts on personal Web home pages and submission of this work to institutional or disciplinary repositories. Informal scholarly communication includes conference presentations, workshops, email exchange, and the variety of ad-hoc professional conversations that occur among scholars in less structured institutional and social settings. Although less studied than formal communication, informal modes are increasingly becoming visible with the use of digital technologies, as reflected in blog postings, exchanges via microblogging platforms such as Twitter, contributions to discussion lists, and uploading of material to specialized repositories. Traditionally, emphasis rested with, and importance was attributed to, formal communication as reflected in ISI-ranked journal articles and monographs released by established scholarly publishers. Such tradition is prominent across the social sciences and humanities, particularly in North America and Western Europe, and has an impact on institutional criteria for hiring, tenure and promotion. This arrangement, however, has come under pressure as institutions struggle to evaluate the proliferation of academic contributions produced in an e-research context (ACLS 2006).

It is important to note that changes in communication practices vary across disciplinary settings. In his historical account of science and the formation of disciplinary work, Whitley (2000) identifies two key dimensions, mutual dependence and task uncertainty, as significant in understanding variations in how knowledge is produced. These dimensions are also useful in understanding variations in scholarly use of information and communication technologies (Fry 2006; Fry and Talja 2007). By tracing social and intellectual influences of scientific practice over the past two centuries, Whitley develops an analytical framework that locates scientific work (broadly construed to include the humanities and social sciences) as primarily a craft that evolved in different ways associated with the particularities of cognitive objects and contextual factors. Practices clustered in relation to mutual dependence (e.g., standardized methods) and in relation to task uncertainty (e.g., the particularity of cognitive objects) have implications for how scientific fields are organized and for their respective use of formal communication venues.

For example, Whitley claims that scientific fields with high task uncertainty often rely on social networks to interpret research findings once they are published. In a field where ethnographic methods are used, findings are often descriptive and the data set, or field site, is of little use without accounting for social context. Empirically based knowledge claims in such fields are necessarily localized in a particular social context. Integral to the argument are the research approach and interpretive framework as adapted
to particular circumstances. In fields with high task uncertainty, meaning and significance of published research results are often ambiguous without an argument supporting a particular interpretation. By contrast, in fields with a high degree of standardized research methods, for example with routine laboratory practices and standard raw materials, publication of research results are understood on the basis of the specific standards used. New knowledge produced is contingent upon compliance with a known set of standards.

In other words, a high degree of variability in the way research is conducted limits the potential to standardize research practices, a characteristic that influences the role of scholarly communication. According to Whitley’s (2000) account, while the format of journal publication remains very similar across disciplines, the role of publication serves different strategic ends. In a field where mutual dependence is dominant, published research is often used to establish the priority of common goals and problems, and thus facilitate coordination of a research agenda within a field or among related fields (Whitley 2000, 269). Use of formal communication venues to address issues of strategic importance relies in part on a stable meaning of the results of research.

This is less the case if task uncertainty is dominant, where publication of research would not be readily understood on the basis of standardized practices. Where the object of research is situated in a social context, for example, formulation of problems and goals would unlikely find common ground on the basis of published research. Researchers in fields with uncertain, and usually unstable research agendas, correspondingly have more individual autonomy in facilitating a localized research strategy. Addressing issues of strategic importance would involve frequent negotiation and conflict (Whitley 2000, 122-7). As such, coordination of goals, problems and research priorities is facilitated through informal social networks rather than through formal publication (Whitley 2000, 122-7). These differences in the role of formal communication suggest differences in informal communication. In their explorative case study, Fry and Talja (2007) use Whitely’s theory to examine disciplinary uses of digital communication media. In fields with high task uncertainty and low mutual dependence, they find that scholars use informal modes of communication, such as email lists, for coordination of research goals, problems and priorities (Fry and Talja 2007, 123-4).

That the role of scholarly communication varies across different fields has implications for how we understand new communication practices emerging through digital media. It is important here again to make clear a distinction between informal and formal modes of scholarly communication. Harley et al. (2010), show very little movement among scholars toward publication of scholarly work in online venues. In spite of increasing use of e-research practices, scholars interviewed across a variety of disciplines overwhelmingly prioritize traditional publication venues as important for career advancement. From this study, it is apparent that the academic reward system, particularly in the United States, shows little sign of deviation from the traditional structure. Although there is much development in the area of informal scholarly communication, most visibly within e-research environments, there is little research that identifies it as the primary object of inquiry. Although the Harley et al. (2010) study does explore the place of social media in the overall pattern of academic publishing, that study concentrates on formal publications. Moreover, delineating informal from formal is complicated by its relaxed demeanor as a scholarly activity and by its ubiquity among virtually all modes of scholarship. To address these issues we begin by framing scholarly communication through identifying the roles of informal with respect to formal practices.
Changes in the Role of Scholarly Communication

Informal scholarly communication manifests in a variety of structures, from organized conferences to ad-hoc discussions. In the traditional sense very few, if any, informal modes of scholarly communication count as formal knowledge and thus have not substantially contributed to the academic reward system. At the same time, it is difficult to imagine science and research functioning without informal communication practices.

Formal scholarly communication has four distinct functions with respect to academic reward: (1) registering intellectual priority, (2) certifying quality/validity of research, (3) disseminating new research, and (4) preserving scholarly record for future use (Roosendaal and Geurts 1997; Johnson 2004). As will be discussed, digital media features are being incorporated into formal communication, but these changes are incremental and often without leveraging the social aspects commonly associated with Web 2.0 applications. Discounting some notable exceptions, academic journals and scholarly book formats have remained largely unchanged, in contrast to modes of informal communication where practices are more readily influenced by innovations in popular use. With a limited role in the academic reward system, advances in informal scholarly communication are more closely aligned with advances in popular uses of digital media, and thus provide a site for examination of change in scholarly communication practices.

Discussion of informal scholarly communication has appeared within studies addressing other aspects of the academic system. This is evident, for example, in the context of science communication research (Garvey 1979) and in an historical account of science and the emergence of academic disciplines (Whitley 2000), both of which have utility in examining the rapid growth and adoption of Web-based informal communication practices. Garvey characterizes formal communication as highly structured, primarily concerned with the dissemination of knowledge, which is often ‘old’ by the time it is available in scholarly journals. In contrast, he characterizes informal communication as fluid, adaptive, and often ephemeral modes of communication where preliminary research results and new ideas are presented for feedback.

While informal communication operates much in this same way today, adoption of Web-based communication media renders these practices more visible, and in so doing it provides a basis from which to identify both existing and new practices. As an example, Garvey’s (1979) account of expected audiences points to a tension in the utilization of digital media for formal and informal scholarly communication. In academic tradition, new knowledge is first made public when it appears in academic journals. In Garvey’s account scientific communication finds its large potential audience in journal distribution, and informal communion is noted by a small audience, intentionally limited to public presentations, face-to-face interaction, and distribution of printed-on-paper drafts (Garvey 1979,154). In comparison, publishing text on an academic blog or uploading a video to YouTube, is instantly accessible with the potential to reach a much larger audience. Whereas academic journals, even when published online, are often restricted through pay-for-access systems, content published openly on the Web is immediately accessible. One of the most consulted examples of an academic employing social media is the YouTube video by Michael Welsh on the meaning of Web 2.0. The video “Web 2.0 ... The Machine is Us/ing Us” (Wesch 2007) has been viewed nearly 11 million times with over 21,000
ratings and 8,000 comments. In another example, where informal publications by academics have achieved very large audiences, the online version of Fitzpatrick’s scholarly monograph (Fitzpatrick, forthcoming 2010), scheduled for release by New York University Press, has been consulted more than 20,000 times by almost 8000 site visitors who posted nearly 300 comments.3

These examples are not meant to suggest that blogs or videos create a competitive threat to journal publishers, but they do suggest radical change in potential audiences. With the aid of digital media, modes of informal scholarly communication are encountering much larger audiences, even when considering open access to journal articles and books.

Changes in relative audience size have implications regarding the respective roles of scholarly communication. As Garvey notes, informal scholarly communication is where new findings and ideas are first presented. Sharing insights and information on an academic blog makes it instantly accessible to the online public, and in so doing provides some degree of intellectual priority, albeit without formal assessment by peer review. However, because informal communication is both central to scholarship and still not very well defined in the literature, it is difficult to isolate. In addition to the overlapping contributions in establishing intellectual priority and to the extent that informal scholarly communication is distributed and maintained on the Web, it can also provide an archival role, thus overlapping another primary function of formal scholarly communication. Content repositories in particular serve an archive function.

The popularity of uploading of draft articles to the Social Science Research Network4 (SSRN) or uploading presentation slides to SlideShare5 are examples of how scholars are leveraging digital media to distribute informal scholarship. In their multi-disciplinary study, Procter et al., find a majority of scholars in the UK occasionally (45%) or frequently (13%) “use Web 2.0 in novel forms of scholarly communication (Procter, et al. 2010a, 4043). These results are based on an expanded definition of scholarly communication, one that combines the informal and formal modes. The Research Information Network (RIN) report of the same study concludes that a significant minority of scholars “express considerable enthusiasm for change” and an understanding that “benefits may come from relatively unconstrained early dissemination and discussion of their ideas and their findings.” However, their enthusiasm is muted by concerns about disrupting academic reward system and by jeopardizing formal publication opportunities (Procter, et al. 2010b, 49).

This conflict can be understood as a tension between the benefits of establishing intellectual priority through the use of digital media and the risk of loosing intellectual priority by waiting for the process of formal publication. At stake in the move to increased openness are the rewards upon which academic careers are based. Academic journals have traditionally provided the ‘date stamp’ that establishes when new knowledge is produced. This establishes when and by whom research results, ideas, theoretical claims, and discoveries are considered new and original. Amidst the transformation of scholarly communication and the rush to build new technology infrastructures, also within the academic publishing sector, the role of formal modes of scholarly communication are complicated by increasing openness in informal modes. While technology infrastructures provide significant benefits for open communication across barriers of space and time, the tension between open scholarly communication and the management of intellectual rewards points to a lack of understanding.
In the next two sections we review technological advances in both formal and informal modes of scholarly communication. Journal and book publishers continue to experiment with new ways of leveraging the capabilities of digital media, but with careful consideration of their role in facilitating the academic reward system described above. In spite of some rather innovative features, the structure of journal articles and books remains very much unchanged. While access has improved and readership has increased, the benefits provided are limited to a specific text. On the other hand, there is significant change taking place among informal modes of communication where there is some overlap in establishing intellectual priority and the archival role of formal publication. More importantly, the increase of potential audience, the diversity of interconnected communication channels, and the creation of networked content through informal communication practices seem to expand the utility and function of scholarly communication in interesting ways. In the illustrations that follow, we show advanced features added to digital versions of academic journals and books. For informal communication examples, we select typical uses of stable technologies to illustrate the ways in which increased openness facilitates interconnecting of communication content between and among communication venues.

Formal Scholarly Communication

As mentioned earlier, the two main forms of formal scholarly communication are book monographs and journal articles. Here we illustrate how these forms are adapting to the Internet environment. Regarding books, three examples are presented: an initiative of the University of Michigan Press, an overview of Web sites complementing scholarly titles, and a new variant to peer review of book manuscripts. Similarly with journals, three examples are presented: illustrations from a few open access journals, initiatives by commercial publishers in the social sciences and humanities, and a far-reaching transformation of the journal article by a major publisher in the natural and biological sciences.

Book Publishing

Book publishers have experimented with a range of marketing strategies involving digital media and Web-based distribution, and sometimes in hybrid fashion. MIT Press, for example, released Mitchell’s (1996) *City of Bits* online and in print, with some degree of financial success, according to Thompson (2005, 330-331). Other MIT Press books have since been released in a similar fashion: the revised version of Rheingold’s (2000) *Virtual Community*, Willinsky’s (2006) *The Access Principle*, and a series of reports prepared in collaboration with the MacArthur Foundation on digital media and learning. In 2007 the University of Michigan Press established a series entitled ‘digitalculturebooks’ as an experimental publishing strategy and makes titles available both as files that can be read online (and not printed) and as conventionally bound and printed versions for purchase (see, e.g., Turow and Tsui 2008). Another strategy involves construction of complementary Web sites that complement print-based books. Thompson (2005) suggests several reasons publishers consider this approach and constructs a list of ‘added values’ similar to that compiled for other media, such as for electronic newspapers (e.g., Jankowski and Van Selm 2000).

Observers like Thompson (2005) argue that the most substantial change in publishing is occurring in the production and marketing divisions of the enterprise.
Readers are generally unable to see such changes, but the changes cover the range of activities in publishing, from receipt of a manuscript through publication in print or electronic form, including establishment of a point of sale on the publisher’s Web site.

The scope and intensity of the transformation of the publishing industry suggests that much is in flux. At the same time, the essence of what scholarship entails – the contribution to understanding and to new knowledge, to scientific breakthroughs – remains a craft entailing much time and intellectual investment that is less influenced by digital innovations.

**Academic Journals**

Scholarly journals by and large reflect the publishing traditions developed within specific academic disciplines, and in the social sciences and humanities these traditions generally place emphasis on text-based argumentation, attention usually devoted to both theoretical issues and empirical evidence. Journal articles rely on and are prepared according to an accepted template, with limited attention to visualization and dynamic presentation of data, little opportunity for reader-author exchange, few internal or external hyperlinks, and no accessibility to research instruments and datasets. This sketch, albeit sweeping, reflects the dominant profile of social science and humanities journal article publishing. It is also prominent among online-only open access periodicals in many disciplines in the humanities and social sciences. One illustration of the application of this template can be found in the *International Journal of Internet Science* (see Figure 2), which is essentially a mirror-image of the style and content found in the high-status print-based periodicals in the same area of scholarship.

Figure 2: Screen shot of Article in Online-Only Journal

Source: [http://www.ijis.net/ijis4_1/ijis4_1_egermann_pre.html](http://www.ijis.net/ijis4_1/ijis4_1_egermann_pre.html) (accessed 25 May 2010)

Although online journal publishing products closely resemble those of traditional print publishing, there are signs of change. One important development involves migration to an online environment by the major publishers of academic periodicals. While these publishers continue to print journal titles, they also have developed electronic databases containing the titles owned or distributed by a publishing house. The titles in these
databases are packaged in a form suitable for subscription or individual article purchase. Institutional subscriptions to scholarly journals made available in electronic form by publishers, are frequently packaged with related titles owned by a publisher, and this constitutes an increasingly important source of revenue for publishers. SAGE Online is illustrative of this relatively recent change where the publisher provides, since 2008, a Web-based version of its print-based journals. Most major publishers have developed such online variants of their print journals by 2010, although the details of the business models differ. Some, like SAGE Publications, make the full article content available to persons affiliated to subscribing institutions, although the search function and article abstracts are fully accessible to all site visitors. SAGE, as do other publishers, allows individuals to purchase single articles; some publishers provide the option to purchase a ‘day pass’, and a few give full free access to articles for which the authors have paid a fee prior to publication. Marketing objectives often determine when a publisher extends journal content free of charge, and usually for a specific promotional period.

Many publishers are also experimenting with initial publication of journal articles on the publishers’ Web sites of journals, which have accepted manuscripts for publication. This approach reduces the delay between manuscript acceptance and publication in the print version of the journal, a process that can consume several months required for preparation of the printed issue. SAGE calls its version of this publication form ‘OnlineFirst’ and as of 2010 the system has been implemented for a large number of the 500-plus periodicals owned by this house; see Figure 3.

**New Media & Society**

New Media & Society offers OnlineFirst when forthcoming articles are published online before they are scheduled to appear in print. More details, including how to cite OnlineFirst articles, are found on the OnlineFirst Fact Sheet.

**To see an article, click its [PDF] link. To add articles to your marked citations, check the boxes to the left of the titles you want, and click the Add to Marked Citations button. To see one abstract at a time, click its [Abstract] link.**

**May 18, 2010**

- Michael Chan
  *The Impact of E-mail on Collective Action: A Field application of the SIDE Model*
  New Media Society first published on May 19, 2010 as doi:10.1177/1461444810383351
  [Abstract] [OnlineFirstPDF]

- Nikos Kourt fc, Emmanuel Mott, and Frank Rebagg
  *Does the Long Tail Apply to Online News? A Quantitative Study of French-Speaking News Websites*
  New Media Society first published on May 19, 2010 as doi:10.1177/1461444810383350
  [Abstract] [OnlineFirstPDF]

- John Drinnick, John Christian Rauscher, and Gregory J. Kallmizian
  *News in the Interstices: The Notices of Mobile Media in Space and Time*
  New Media Society first published on May 19, 2010 as doi:10.1177/1461444810383352
  [Abstract] [OnlineFirstPDF]

- Noah Aranhaup, and Amy Shinnitz Weiss
  *Seems Stupid Until You Try It: Press Coverage of Twitter, 2006–09*
  New Media Society first published on May 19, 2010 as doi:10.1177/1461444810383373
  [Abstract] [OnlineFirstPDF]

**Figure 3:** Screen shot of OnlineFirst articles published in New Media & Society

These incremental changes are minor, however, when compared to an initiative by Elsevier and its subsidiary Cell Press, termed the ‘Article of the Future’. Announced in 2009, the initiative was billed at launch to “take full advantage of online capabilities, allowing readers individualized entry points and routes through the content, while using the latest advances in visualization techniques” (Elsevier press release, 20 July 2009, consulted 25 May 2010 at: http://www.elsevier.com/wps/find/authored_newsitem.cws_home/companynews05_01279 ). The journal serving as a testing ground for the initiative, Cell, published its first issue with this format in January 2010 and an article of that issue remains accessible without subscription; see Figures 4 and 5. The new format for articles in this journal facilitates reader attention to specific components of an article rather than an all-encompassing presentation or argument. It emphasizes visualizations and multimedia components. Internal and external hyperlinks are included and audio interviews with article authors. References with citation rankings are dynamically updated and an analysis of references is provided indicating frequency of citation. Overall, the ‘Article of the Future’ initiative suggests movement away from the traditional linear structure of the scholarly journal article to an almost postmodern conception of the article. Emphasis is on visual, multiple modes of presentation, and online dynamic updating.

There is nothing comparable to Elsevier’s ‘Article of the Future’ initiative in the social sciences or humanities, although there are some titles exploring incorporation of multimedia. The International Journal of Learning and Media (IJLM) launched in 2009 by MIT Press and supported by the MacArthur Foundation, includes a contribution based on YouTube videos (Juhasz 2009), and in January 2010 IJLM organized a Web-based forum discussion involving the journal editor, two authors and a respondent (available at: http://ijlm.net/forum/13-forum-civic-engagement-media-and-learning). Several periodicals
(e.g., *Journalism Studies*, *Television & New Media, Information, Communication & Society*) have been experimenting since 2009 with podcasts and videos as supplements to journal issues, but these initiatives reflect only a small handful of the thousands of periodicals being published in the humanities and social sciences.

Although some observers (e.g., Hendler 2007; Whitworth and Friedman 2009) speak in terms of a ‘revolution’ ongoing in academic journal publishing, change of that magnitude is limited to very few scholarly periodicals. Instead, change seems small, incremental, and cautious, at least in disciplines in the humanities and social sciences. Change also seems most prominent in those areas that facilitate organizational efficiency (e.g., in ‘back office’ manuscript processing) and in areas of marketing and promotion where social media seem to have more prominence. While some scholars may incorporate social media into their informal communication practices, this is seldom evident in the journal articles prepared and published by these same academics.

![Figure 5: Screen shot of Dynamic References included in 'Article of the Future' published in *Cell*, January 2010](http://www.cell.com/abstract/S0092-8674(09)01439-1#References (accessed 25 May 2010))

**Informal Scholarly Communication**

Informal modes of scholarly communication are increasingly made visible with the use of digital media. In this section we show typical examples of how informal communication practices are adapting through the use of freely available products and services on the Web. In selecting commonly used applications for illustrations we foreground emergent
practices that are compatible with open Web standards. Excluded from this selection are
the kinds of custom-designed platforms that limit interoperability either intentionally, for
example, for economic purposes, or unintentionally, as a result of specific functional
needs. As will be discussed below, compliance with open Web standards, facilitates the
possibility of making explicit intertextual references through hyperlinking (Mitra 2006)
from one text to another across different communication platforms.

Illustrative examples include an email list used by the Association of Internet
Researchers (AoIR), the incorporation of individual blogs in the Oxford Internet Institute
(OII) and Humanities, Arts, Science, and Technology Advanced Collaboratory
(HASTAC) Web sites, syndication of article updates, and the use of a keyword tagcloud
by the Science Studies Network (SSNet). Although contemporary communication
platforms can and do include all of these functions, bundled in a single Web site,
examination of these practices individually sheds light on the role of digital tools and
resources in the co-construction of scholarly discourse.

**Email**

The Association of Internet Researchers administers an email list (Air-L), presently with
over 2000 subscribers. Scientists, scholars, researchers, activists, and technologists engage
in communication about societal aspects of the Internet. Although there are guidelines to
direct discussion topics and communication etiquette, in practice they are typically flexible
and enforced by the group itself. Participation is open but requires registration.
Contributions to the Air-L discussion cannot be made anonymously, but the list is not
moderated so when a registered user sends an email to the list, it will be instantaneously
distributed to all other users.

Email discussion in most contemporary email lists is archived and, in the case of
Air-L, the archive spans almost a decade of active engagement. Archived content is open
on the Web and searchable. The archive consists of html-coded Web pages with an
ordered list links, each corresponding to an individual email. Emails are sortable by
subject, date, author, or discussion thread. The resulting link structure is internally robust,
providing easy navigation throughout the archive with connections to external content
through active links embedded in the original email correspondence. As each email has a
unique URL, email content can be linked-to as a resource and the archive itself is open to
indexing by public search engine robots. As an archive, however, the content is
completely static. Other than the internal link structure, its contribution to intertextuality
occurs passively, if and when content is linked. Even so, linked content is likely findable,
and in some cases more findable, because of the influence of links in search engine
ranking (Tatum 2005).

Scholarly communication using email lists is perhaps the least dynamic contribution
to structuring scholarly discourse. Nevertheless, simplicity and ubiquity of use along with
low economic and administrative barriers contribute to the popularity of email lists. In
addition, email lists have been shown to encourage inclusivity and equality (Kavada
2010). Common in many fields and disciplines, email lists leverage asynchronous
communication in ways that enable an increase in the diversity of topics, scale of
participation, and continuity of discourse across time. However, it should be noted that
reliance on email lists to ensure an informed group of participants can also facilitate
exclusion when combined with face-to-face meetings. Inevitably, not all participants can
attend all face-to-face meetings, thus potentially creating inequalities of information access (Kavada 2010).

With the international reach of AoIR, asymmetric attendance at annual face-to-face conferences is the norm. This being the case, the Air-L email list is more likely to facilitate inclusion and equality among geographically dispersed membership who would otherwise be less informed. In summary, Air-L email list provides an open communication venue, where registered users have equal access to contribute and receive information, ideas, and opinions, and where all communication is archived for future reference. The full archive is accessible to non-participants as well. The link structure of the archive is internally robust, providing a precise historical record of communication.

**Academic Blogs**

Academic blogs come in many forms, spanning a range of approaches that includes publication of scientific results, discussion of new ideas, or reflections of scholarly life and culture. Configurations are similarly diverse, ranging from individual blogs to a variety of network structures, such as those loosely connected around a broad topic or a highly selective set of blogs aggregated and present in a single place. Blogs serve many purposes and anyone with Internet access and a normal browser can, in principle, read and comment on academic blogs. The blog format typically includes published texts presented in reverse chronological order, a place for readers to comment, a display of links to other blogs relevant to topic, and a variety of options for navigating and consuming content. In comparison to email lists, discourse is nonlinear and unbounded, and participation is typically open to the public.

Through hyperlinking, a common practice in blogging, documents, collections of documents, and related audio and visual resources are structured across the Web (Halavais 2008, 43). This “textured connectivity” of scholarly discourse is created by hyperlinking from both human and machine (such as databases) actors (Beaulieu and Simakova 2006). Unlike traditional citations in printed text, the immediacy of hyperlinks facilitates the construction of intertextual discourses, which are dynamic in both production and consumption. A text published on a blog can be commented on by others, updated at a later time, and reacted to in another blog that links back to the text. The potential for response is both immediate and enduring, something Gray et al., (2008, 114) refer to as the anticipation of “intertextual orders of meaning” that can be created by future “reader/writer contributors.” The suggestion is that meaning is more fluid in the co-construction of hyperlinked discourses when the potential for new contributions can occur over time (Gray et al. 2008). Consumption of hyperlinked discourses is also influenced by this dynamic, in the opportunities to follow unique paths of hyperlinks in a particular text and in the potential for additions and changes over time.

**RSS - Really Simple Syndication**

RSS or Atom syndication protocols enable users to subscribe to content from a variety of sources, thereby creating a customized aggregation of content readable in a single location (usually an RSS reader). Through aggregation techniques, a short announcement of the most recent content, often a blog post, is automatically compiled, thus enabling readers to follow the progress of multiple Web venues in a single place. These same aggregation techniques are used to present content from multiple individual voices on, for example, a single institutional Web site. The Oxford Internet Institute (OII) and Humanities, Arts, Science, and Technology Advanced Collaboratory (HASTAC) Web sites are examples
of institutionally Web sites that aggregate and publish member blog posts prominently on their respective home pages.

Being the first person to present findings or make particular claims on a blog does not formally register intellectual priority as would be the case in a journal publication, but it does provide a sounding board among peers. And in some cases, it signals interest in a particular intellectual territory. The implications of this suggest more about role of informal communication in preparing the groundwork for submission of manuscripts intended for publication. Ideas and findings communicated on a blog prior to publication in a journal establish a registration of intellectual priority, insofar as blog content on the Web has a date stamp as to when published. While there are a large variety of uses for blogs that range from private, password-protected blogs open only to a select group of individuals to publicly accessible blogs, key attributes of blogs generally are the ways in which content is contextualized.

**Social Tagging**
Tagging is a collaborative form of indexing, often referred to as folksonomy, in which user generated keywords and associations contribute to a co-produced organization of content. Common sites of tagging include social bookmarking, (e.g., Delicious), photo sharing (e.g., Flickr) and among blog posts. Keyword tags have a dual role; first, a tag communicates meaning and, second, it contributes to content structure. Like adding keywords to a journal article, producers as well as consumers of digital content add keyword tags to content. User-generated tagging in aggregate results in a bottom-up structuring, or taxonomy, of content. Thus, tagging serves to imbue meaning in individual content objects and to establish association among content irrespective of formal hierarchy, type, or kind that would otherwise be imposed. For example, tags such as ‘1950s,’ ‘musician,’ and ‘Jacques Brel’ can be attributed to a blog post, a video, an image, a music collection, and a top-level Web site. Implications of social indexing include the ability to add description to individual content objects, to contextualize content locally and globally, and, in doing so, to categorize these objects among other Web-based content related to each descriptor tag.

![Figure 6: Science Studies Network – Tagcloud application on Facebook](Source: http://apps.facebook.com/sciencestudies/ - accessed 27 May 2010)

Figure 6 is an illustration of tags aggregated into a tag cloud with size of individual tags associated with frequency of use. Users enter keywords describing research interests and can click keywords to locate researchers with similar interests.
Openness in Scholarly Communication

Open access publishing is an acknowledged development, readily apparent through the increasing numbers of established journals publishing their contents online, and through the growing number of new journals emerging as online-only publications. With few exceptions, research on openness with respect to formal scholarly communication is primarily concerned with this access dimension. Examination of informal communication practices in the digital environment reveals a more complex and productive relationship with openness. Since the invention of academic literature, in the form of letters exchanged among scholars, the practice of science has operated on the basis of open collaboration and a communal sharing of scientific resources (Merton 1979). Scholars regularly share insights, techniques, and data associated with knowledge production, in addition to the results of research through publication in an academic journal. That open science operates differently among the variety of disciplinary priorities and situated research contexts, does not in itself undermine the normative role of openness in science practice. However, as scholars increasingly adopt popular communication technologies in the service of professional practice, new practices of openness are challenging the ideals upon which open science is based. This clash of ideals necessitates a better understanding of openness. In what follows we propose an expanded view of openness as the basis for inquiry of scholarly communication in the digital era.

In contrast to the YouTube video example cited above, the structure of academic publishing limits potential audience size and delays distribution during the normal course of facilitating its role in the academic reward system. Although science is understood as open, the peer review system that underpins publication in academic journals is often perceived as “secretive” (Lamont 2009, 2) and contrary to the basic principles of scholarship (Fitzpatrick, in press). As a consequence, several innovative experiments have been initiated to create a more open form of review. In spite of such innovations, the most prevalent peer review procedure followed by most major publishers is double-blind and restricted to those persons immediately involved: authors, reviewers, and editors.

As the academic publishing industry experiments with new ways of employing digital media, the prospect of openness presents a complicated terrain not only with regard to the industry’s need for economic return but also in terms of maintaining the functions of formal publication of new knowledge. Concern for openness has evolved beyond category-defining types, such as open access, to the extent that there is limited analytical power in using these terms to frame the context and conditions of scholarly communication. Individually, research on open access, open source, open standards, and open innovation, among others, contribute to a larger awareness of the potential of openness facilitated by Internet technologies. Collectively, the perspectives and insights from each of these specific domains of research facilitate an analytical framing for openness of scholarly communication. In what follows, we outline elements of research on specific kinds of openness that are useful in framing the dynamics of scholarly communication.

As noted above, open access is an established movement aimed at increasing the circulation of and free access to new knowledge, especially with regard to online publication of academic journals. There are various open access models that strive to make
content freely available while still retaining the necessary quality and validity expected from print publications. Online journals, institutional repositories, and even author-paid journals are typical approaches (see, e.g., Willinsky 2006). As a dimension of openness in scholarly communication, access to content is essential, but the basic topology of one-to-many is limited to a simple broadcast orientation. In this way, distribution of knowledge is increased. However, contribution to the content is unsupported in the open access model.

The open source software movement has also been a significant influence within the open phenomenon (see, e.g., Raymond 2001). In this model software developers use the Internet in voluntarily collaborative development of software applications. Von Hippel and von Krogh (2003) find that incentive for participation in open source projects is neither completely for the sake of public good nor completely for private gain. Rather, they identify a hybrid ‘private-collective’ combination of both objectives. According to the authors, software developers are typically motivated by satisfying their own needs while also contributing to the solution of shared technical problems (von Hippel and von Krogh 2003, 217).

Like the open access model, the collaborative output of open source software is provided freely on the Web. However, unlike open access, the collaborative development effort is also open. In addition to free access to the final product, participation in its development is also open. Understanding of the participatory dimension in open source environments contributes to our thinking about openness in scholarly communication. For example, the tension between normative values of openness in science and the notion of intellectual priority is somewhat analogous to the private-collective incentives identified in open source.

Because collaboration is managed with heavy dependence on Internet communication resources, there is increased visibility to the overall collaborative process: “[T]he way these projects operate, detailed and time-stamped logs of most interactions among community members and of project outputs are automatically generated.” (von Hippel and von Krogh 2003, 212). Transparency of this practice and how it is managed would also be important for the balance of public good of open collaboration and the private gains expected from the academic reward system. From a technology perspective, transparency and the possibility of distributed contributions are dependent on interoperability across different platforms. The Web is inter-operable world wide because of open standards.

Standards create a shared technical language that governs how individual software and hardware components communicate with each other (Simcoe 2006, 161). Two international standards bodies, the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF), work closely together and with others to create and perpetuate open standards that establish “a formal set of obligations that promote fairness, responsiveness, and progress” on the Internet (W3C 2010). There are many uses of the term ‘open standards’ but it is generally understood as a process in developing technical specifications that meet the conditions established by the W3C (www.w3.org, accessed 24 March 2010), including: transparency in decision making, openness to participation, impartiality in procedures, and availability across phases of development. Although there is a wide diversity of openness employed within different standards by organizations and open source development projects, dimensions of participation and transparency are fundamental to their construction. There is, however, a relationship between public good
and private benefit that is not so often considered in the sort of openness attributed to the ideal of open science.

Open innovation, a growing body of research in business management, provides useful cross-linking between the knowledge products of science and the profit imperatives of technological development. “Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, et al. 2006, 1). The open innovation paradigm represents recognition that the traditional structure of closed research and development is no longer a viable mode for firms to innovate. The Internet generally, and in particular the kinds of social media associated with Web 2.0, has escalated an open exchange to such an extent that companies are faced with the need to open their innovation efforts to remain competitive.

The systematic opening of innovation strategies under the guise of open innovation is useful for our examination of scholarly communication. First, the development of the scholarly communication infrastructures are linked to the logic of balancing interests of public good and private benefit. While there is an increasing diversity of publishing models, due in part to the open access movement, the top academic journals are typically published by for-profit publishing corporations. Second, informal scholarly communication practices are emerging with the use of a diversity of open source and commercial products and services.

It is clear that science and scholarly communication are not completely open, in spite of long held normative values. The diversity of academic practice further suggests that the configuration of openness and closeness would be context dependant. Open innovation suggests strategic, localized configurations of openness that balance sharing of intellectual content with the academic reward system.

**Openness Framework**

Taking this evolution of openness into account, we propose a framework based on the interfaces and infrastructures of openness; see Figure 7. Specifically, we define the interface of openness as the point of interaction between user and communication medium. The interface dimensions include accessibility, inclusivity, and transparency, which collectively provide a basis for examining the practice of openness. Analysis at the interface provides a view of openness in the ways in which digital media are used with respect to their intended functions. In this framework, the infrastructure of openness is embedded in the construction and operation of the communication venues, each of which utilizes an enabling platform. The infrastructure of openness is defined here as the possibilities enabled or constrained by the interaction between technical standards, modes of interoperability, and levels of adaptability. Although it is not universally the case, we identify scholars as the primary actors at the interface openness while technical experts and administrators are the primary actors involved with the infrastructure of openness. In the remainder of this section we describe each of the interface and infrastructure dimensions introduced and in the next section we use the framework to examine openness through examples of recent innovations in scholarly communication.
In this framework, the interface of openness is conceived as the place where users act upon digital media to communicate with others. Correspondingly, the possibility for openness is conceived as a technological infrastructure, which is the result of social agents selecting, configuring, and implementing associated communication resources. As such, analytical focus is aimed at individual acts of openness framed as the result of interaction between human agency, social structure in the form of situated practices, and material structure in the form of digital media. Following Orlikowski, we view technology as “both an enabler of, and a constraint on, human action” (Orlikowski 1992, 25). The conceptual framing of openness as interface and infrastructure is recognition of the dual role of technology in facilitating both agency and structure (Wouters, et al. 2008). In creating a dichotomy between front end (interface) and back end (infrastructure) we foreground the ways in which openness can be enabled and constrained differently at different stages of technology development and implementation. In other words, the interface and infrastructure of openness are conceived as structural manifestations of human action involved with creating and using digital communication media.

Taking the previously discussed Wesch (2007) YouTube video as an example, the interface for uploading the video offers a range of user-selected parameters that both enable and constrain how the video can be viewed, rated, commented upon, and distributed. Similarly, the viewing interface enables and constrains how the video can be consumed in conjunction with the content producer’s settings. Over time, common usage patterns begin to form expected use of the medium while at the same time informing developers about future enhancements. In this way, human interaction with the YouTube interface can influence decisions made about future iterations of the infrastructure. In this example, we are interested in changes in the YouTube platform that result in changes to its interface. Orlikowski describes this cycle as “ongoing interaction of technology with organizations [that] must be understood dialectically, as involving reciprocal causation, where the specific institutional context and the actions of knowledgeable, reflexive humans always mediate the relationship" of the interaction (Orlikowski 1992, 34). To be clear, the possibility of openness exists among many other features of a particular interface and among many other attributes of a particular technology. It is therefore necessary to operationalize the concepts of interface and infrastructure of openness.

**The Interface of Openness**

Operationally, the interface of openness is defined to include the dimensions of access, inclusion, and transparency. For our analysis, accessibility is indicated when and to what
degree content is available for distribution and consumption. Inclusivity, on the other hand, would depend on the extent to which a communication venue allows others to participate. Indications of inclusivity would include aspects such as when users are able to add comments to published content, edit published content, upload new content, and delete existing content. The transparency dimension is defined as visibility of people associated with the medium, relevant processes, and organizational issues associated with operation of the platform. Most digital resources include information about the site and its owners, organizers, and sometimes its participants. The ‘About’ page is a common identifier for this sort of information. Information regarding processes, codes of conduct, limitations and liabilities are also found in a ‘Terms of Service’ or ‘Rules’ page. Indicators of interest are more complicated, and may be impossible to know from information provided in any communication medium. However, examination of the structure and organization of the technology reveals information that, when combined with published information, allows inference regarding the degree of transparency. Indicators of this sort include identification of the domain name registration holder and the location of Web servers. For example, this is identification of who ‘owns’ the domain name and where the Web site is hosted; whether it is hosted independently, by a related or parent institution, or by a commercial service provider. Something as seemingly innocuous as domain registration or Web site host points to additional stakeholders in the configuration of openness facilitated by digital media.

The Infrastructure of Openness

Like the interface of a communication medium, the proposed interface of openness would be influenced through the design and configuration of the chosen technology. For example, while enabling inclusivity is a prerequisite to participation, it does not automatically cause participation. Thus, identification of inclusivity as a dimension of openness is a matter of both the way it is used and the technical parameters that enable it, or by both interface and infrastructure. The infrastructure of openness is operationalized as the development of system-level conditions and features that shape the possibilities of openness. Informed by concepts in open innovation research we define the infrastructure of openness as dimensions of standardization, interoperability, and adaptability. At a system level, the standards employed have a significant role in shaping the possibilities of openness. We are not so much concerned with which standards are employed. Rather, the selection and utilization of standard protocols and interfaces have a direct bearing on the communication between communication systems. Proprietary software, for example, is an inwardly focused ecology of standards, concerned with control of internal (to the system) operations, often for the purpose of exacting economic gain from the software.

Proprietary software leaves little room for deviation from a top-down defined set of use scenarios. Proprietary standardization is indicated by the use of a commercial product, such as Microsoft’s SharePoint, a platform for collaboration designed primarily for the business market. While SharePoint offers a vast range of communication and content management features, use of this platform is defined by particular interface logic and adaptation is constrained by proprietary technical standards. At the other extreme, open standard interfaces are established as an environment of bottom-up compilation of technical protocols and interfaces oriented toward particular needs. A platform utilizing open standards could be built upon digital resources and customized to fit the needs of a specific community of practice. In this scenario, a platform could be assembled from an ad hoc set of open source software applications or the unique deployment of freely available institutional resources. Between these two orientations of standards we define a managed
environment of open standards. An example at the platform level is the deployment of an open source content management system (CMS), such as Drupal, which has a large community of developers who develop plugins for this platform. The software code is open to the user to modify or adapt, and the ecology of themes and plugins, also based on open standards, provide plug-and-play adaptability of features. However, the degree of adaptability is managed locally. In other words, the features of the platform are comprised from resources interconnected through open standards. However, once defined and installed, future possibilities are limited by the constraints of the system.

We define the next two infrastructure dimensions, interoperability and adaptability, first by establishing relevant technical standards; however, their respective orientations have a bearing on openness. Issues of interoperability are typically a concern about intercompatibility of technological components. Here we use the same logic, but applied to content rather than technology per se. Apart from whether a communication platform is in compliance with open Web standards, and thus accessible by anyone with Internet access and an active account, we measure content interoperability in terms of intertextuality among internal as well as external resources—specifically the ways in which digital content is compatible with tagging, hyperlinking, and syndication. Concepts of content interoperability go back to Vannevar Bush’s (1945) “mesh of associative trails” and Ted Nelson’s (1965) pioneering formulation of hypertext; see Figure 8. The capacity of intertextuality is fundamental to the structure of content across the Web, but these capabilities are not always similarly employed.

Figure 8: Nelson’s Notion of Evolutionary List File (ELF) Applied to Historiography. Source: Nelson (1965, 12)

Technological infrastructure at universities, often vertically constructed, provides an illustrative view of the dynamics of content interoperability. A university installation may utilize proprietary or open source software, or a combination of both, but the
concerns for interoperability are typically prioritized with respect to the complete set of resources. This might include everything from access to the Internet, to office automation, to the latest installation of e-research infrastructures. The need to keep these resources safe and secure, for example, often requires significant and on-going engagement. Such an effort would necessitate security standards across the campus-wide collection of resources while maintaining interoperability among them, but often at the expense of compatibility with resources outside of the collection. In a university setting, infrastructure is often the dominant consideration in enabling and constraining content interoperability. As an alternative to institutional level of focus on interoperability, we identify a modular approach whereby individual components, such as an institutional repository, could be changed or replaced without interfering with the operations of related resources.

The ways in which an infrastructure can be adapted for a particular context is shaped by technical standards employed and the interoperability designed into a platform. But the potential for user interventions also contribute to how a communication medium can be adapted for particular uses. We define the adaptability dimension as the level at which customization can occur. Adaptability is conceived here as the possibility of changes at three levels: (1) user customization, (2) the ability to facilitate community-driven process improvements and refinements, and (3) at the institutional level customization.

**Summary of Openness Framework**

In Figure 7 we diagram the components of our openness framework. We use this framework to examine openness associated with technological innovations in both formal and informal scholarly communication. We then evaluate the implications of openness with respect to the functions of scholarly communication noted above. Of particular interest are the areas where informal communication practices overlap with the traditional role of formal communication and the intertextual structures that are co-created through the collaborative use of digital media in informal communication. The results of this analysis enable us to make explicit the emergence of new academic practices facilitated by digital media and provide a framework for examining new features introduced into formal modes of scholarly communication. Identification of the interface and infrastructural dimensions of openness provides a comparative basis for what a particular socio-technical installation enables and how it is used.

**Conclusions**

Facilitated by the use of digital media, formal and informal modes of scholarly communication are changing, but in different ways. We illustrated advanced features added to digital versions of academic journals and books, and the ways in which increased openness facilitates interconnecting communication content between and among informal communication venues. Formal modes of scholarly communication, not surprisingly, are slow to adopt aspects of openness beyond open access. Journals that engage digital media tend to rely on pdf versions that are compliant with Web standards but reduce content compatibility to the document-level of intertextuality. In other words, a pdf document can only be linked as a downloadable document. As such, the content within a pdf document is excluded from intertextual hyperlinking, a form of networked discourse that creates more precise associations and at the same time contributes to a structuring of domain-specific content. Experiments with online forms of academic book authorship and peer review
have much broader adoption of openness, but at the expense of certification of validity. The book projects reviewed sought open peer review as comments to the book text published on a blog. The review activity is inclusive and both the text and the comments are interoperable with linking and tagging techniques. However, it is unclear what role the open comments play in the actual text that will eventually be printed. If included in the final version, it is unclear what sort of academic certification the publisher can grant.

Informal modes of communication exhibit openness in a variety of configurations. In some cases informal communication practice also contribute to functions of formal communication. In comparison to traditional accounts of informal communication, having smaller audiences and limited distribution, it is now common to register intellectual priority first on a blog or in a video posted online, while a journal article would still be locked in a typically months-long blind peer review procedure. Numerous Internet venues are being employed to help disseminate new research beyond the formal publication of the article itself. And to some extent, informal communication platforms, content repositories, and networked discourse preserve the scholarly record, both through the automatic date stamping of contributions and the intertextual associations created over time. Something as unsophisticated as the published archive of an email list provides a chronological account of discipline specific debates, events, and controversies.

We do not interpret the overlap of roles as a competitive threat to the journal publishing industry. Nor do we see the diversity of open practices as somehow disrupting the normative structure of science. Rather, the openness framework stimulates interesting questions about perceptions of open science versus how scholarship is actually practiced. Scholarly communication in a digital context makes these informal practices more visible and at the same time gives users and developers the capacity to fine-tune the configuration of openness for each new platform installation. This seems particularly salient in the humanities and social sciences where situated practice precludes some of the more over-arching visions of standardized e-science infrastructure (Wouters and Beaulieu 2006). Further empirical research is needed to determine the ways in which informal communication media are being adapted in the humanities and social sciences.

The openness framework developed in this chapter provides a lens for increasing understanding of informal communication practice. The framework is a step toward developing of theory of openness in scholarly communication and, as such, points to a variety of contemporary issues that warrant further research. For example, can the concept of openness provide useful insights in the deployment and utilization of e-science infrastructural resources for humanities and social science research? How is or how might openness be configured where situatedness of research in social contexts and methodological reflexivity are heightened? What is or should be the role of content interoperability standards in relation to e-research? In light of the dynamics discussed in this chapter, how might structure and agency with regard to technology be mobilized to explain the role of openness? Which theoretical resources can be mobilized to strengthen knowledge of openness in academic research? If we understand the system of scholarly communication as discursive, there is significant potential in the kinds of intertextual practices indentified here as primarily in the purview of informal communication and as primarily facilitated through the construction of interfaces and infrastructures of openness. These questions, albeit general, provide direction for exploring the potential of Web 2.0 and the Semantic Web in relation to scholarly publishing as conceived through a theory of openness.
The technological capacity envisioned by Vannevar Bush in his 1945 essay, *As We May Think*, is today quite common and taken for granted. Scholars often “store books, records, and communications” which can be “consulted with exceeding speed and flexibility” and can be selected based on association rather than only by indexing (Bush 1945). However, the challenge noted by Bush in the introduction to this text still exists. Aided by digital media, the mountain of research produced continues to grow and efforts to sufficiently structure this content between and among disciplines still seem correspondingly superficial.

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Notes

3 Detailed in Fitzpatrick’s presentation at the University of Michigan in February 2010 and archived at: [http://deepblue.lib.umich.edu/handle/2027.42/65019](http://deepblue.lib.umich.edu/handle/2027.42/65019)
6 This section of the chapter draws from a presentation made at a research meeting of the Virtual Knowledge Studio for the Humanities and Social Sciences on 15 January 2009; the Powerpoint slides of this presentation are available at SlideShare. [http://www.slideshare.net/](http://www.slideshare.net/)
7 As of 2010, MIT Press has published in collaboration with and support from the Macarthur Foundation 10 book-length titles in the series Digital Media and Learning. These publications are available for sale in printed form or may be downloaded free of charge from MIT Press; see (consulted 21 May 2010): [http://mitpress.mit.edu/catalog/browse/browse.asp?btype=6&serid=178](http://mitpress.mit.edu/catalog/browse/browse.asp?btype=6&serid=178).
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