The Scholarly Workflow in the Digital Age: What Do We Know? What Should We Do?

Steven Weiland
Michigan State University, weiland@msu.edu

Follow this and additional works at: <https://docs.lib.purdue.edu/charleston>

An indexed, print copy of the Proceedings is also available for purchase at:

<http://www.thepress.purdue.edu/series/charleston>.

You may also be interested in the new series, Charleston Insights in Library, Archival, and Information Sciences. Find out more at: <http://www.thepress.purdue.edu/series/charleston-insights-library-archival-and-information-sciences>.

Steven Weiland, "The Scholarly Workflow in the Digital Age: What Do We Know? What Should We Do?" (2017). *Proceedings of the Charleston Library Conference*.
<http://dx.doi.org/10.5703/1288284316687>

This document has been made available through Purdue e-Pubs, a service of the Purdue University Libraries. Please contact epubs@purdue.edu for additional information.

The Scholarly Workflow in the Digital Age: What Do We Know? What Should We Do?

Steven Weiland, Michigan State University

Abstract

The figure of the scholarly workflow is common in studies of scholarly communications. Accounts and images of the workflow, based on surveys, interviews, ethnography, and scholarly autobiography, have identified the sequence of steps in research. This paper explains what is common to such work, how configurations of information behavior differ in representing the newest technologies, and thus how the workflow is being freshly interpreted and made part of library practices. Altogether, the workflow, as it has been understood and as it is being remade, is a format for understanding how scholarly communications reflect the individual, disciplinary, and institutional conditions of faculty work.

Introduction

“Workflow” can refer to the deliberate or rational organization of any purposeful activity, typically specifying its steps in the form of a process directed at a particular result. Of course, it is often applied to work, particularly in manufacturing systems. Indeed, in the Taylorism of industrializing America the workflow became the location for imposing standardization and efficiency as the essence of work. But no one would mistake a biology laboratory or a historian’s office as a place of strict professional order. Indeed, in the late 1990s when the *University of Chicago Magazine* sent a photographer to faculty offices they found “chaos” in the random, and often floor-obscuring, array of books, papers, and other research materials (Yoe, 2001).

What makes the scholarly workflow worth attention? It contributes to the authority of inquiry by displaying the conventions that produce knowledge across the disciplines. It is an essential resource for understanding and managing research careers, and thus for professional socialization and periodic renewal. It registers the impact of libraries and technology on scholarship. And it indicates how the conditions of academic work can be improved, productivity strengthened, and satisfaction in scholarly careers sustained.

The figure of the workflow is common in studies of scholarly communications, specifying the essential activities in research, writing, publishing, and, most recently, participation in digital professional networks. Accounts and images of the workflow, based on surveys, interviews, ethnography, and scholarly autobiography, have represented it in different

forms, though the figure of a circle of steps, repeating itself from project to project, dominates representational styles (e.g., Antonijevic, 2016; Bosman & Kramer, 2015; Cahoy, 2012; Sack, 2017). Paradoxically, perhaps, the workflow is typically seen as representing circular progress (so to speak) or work that gains from habit, a flow whose procedural vitality reflects the variations that individual scholars bring to the essentials of search, annotation, analysis, writing, and publishing. And today we can add to the workflow uses of the newest technologies from discovery to citation management to recognition (via social media) beyond the traditional academic reward system. So too does a competing metaphor, the scholarly “ecosystem,” identify the elements of science and scholarship, if with less focus on their sequence and more on their interaction (Meyer & Schroeder, 2009; Nardi & O’Day, 1999). The research “life cycle” is another synonym for workflow, sometimes close to conventional uses of the term (Favaro & Hoadley, 2014; Gessner, Eldermire, Tang, & Tancheva, 2017) but also applied more narrowly to scientific project development (Vaughn et al., 2013).

Altogether, the workflow is a format for understanding how scholarly communications reflect the individual, disciplinary, and institutional conditions of faculty work. Steady innovation (e.g., in citation management software) has not impressed John Sack (2017), the influential founder of Stanford’s digital publishing platform, the HighWire Press, who has asserted that a “piecemeal” approach will provide “fixes but no lasting and feasible rearrangement of the system.” Indeed, for Sack, removing the “friction” from today’s workflow will take nothing less than “discontinuous and disruptive change” (p. 22).

Sequence and Segments

Sack himself conducted a study at Stanford (Newman & Sack, 2013), where the library is the home of HighWire, of what he names as the scholarly workflow. It featured primarily the transition to electronic journals and how scholars find, store, and retrieve articles. The interview questions only occasionally prompted attention to other scholarly activities. In more wide-ranging interviews researchers and librarians at Penn State and Cornell have demonstrated why it is hard to identify a common pattern of “information practices,” much less “best practices” as they are called in many professional domains. In fact, accounts of information practices among scholars and scientists show that most do *not* have systematic strategies for keeping up-to-date, capitalizing on all opportunities for discovery, and for organizing and managing their resources (e.g., Bussert, Chiang, & Tancheva, 2011).

As in all areas of life and work, theoretical studies, or those aimed at generalizing about behavior among groups, can be fruitfully complemented by attention to what scholars and scientists do, or how they account for their day-to-day work in their own words. Smiljana Antonijevic (2016; see also Antonijevic & Cahoy, 2014) offers an actual model of the research workflow (see Figure 1; Newman & Sack don’t get quite that far). It reflects ethnographic

work based at Penn State but also with scholars at other institutions, particularly in the digital humanities (see <https://scholarlyworkflow.org> about the Mellon-funded projects). But the results are not as specialized as that phrase sounds. Thus, as Antonijevic says, she is after a *heuristic*, or a way of understanding a phenomenon.

While Antonijevic recognizes that “knowledge in practice can be hard to articulate or recall,” she discovers a great deal from her interview subjects and observations. Of course, the parts of the workflow are not limited to the borders represented in the figure. An example would be what is said of “reflection,” presented by Antonijevic as a feature of reading, associated with “annotating” texts. Reading itself does not actually appear in the scheme, though there are several places in which it is the foundation of the task that is named. In any case, most scholars are reflecting, in one form or another, at all stages of their work. So, while workflow sounds directional it is also recursive, as different elements appear and reappear as needed in the life of a research project. We don’t do all of our “searching” at the start but continue to discover useful work as we go along.

Inevitably, an important lesson Antonijevic (2016) learns is that each phase of research influences the

Figure 1. Research workflow.

other phases in ways that are not always predictable. That prompts her to say: "Digital research tools should be designed to support a continuous research workflow, enabling scholars to navigate among separate, yet interconnected activities" (p. 53). Others have registered the role of serendipity (Makri & Blandford, 2012).

Similarly, questions of navigation among the segments of the scholarly workflow were also addressed in a study at Cornell organized in "A Day in the Life" format (Tancheva et al., 2016; see also Eldermire & Tang, 2016, and Gessner et al., 2017). But a circle or sequence is only implicit in this work. Instead the librarian researchers favor segments of the "research lifecycle" presented in ratios of attention they get from scholars. To a degree, the vocabulary overlaps with Antonijevic's, as in "Seeking Information" and "Academic Activities" such as annotating, writing, and archiving. But it includes broad categories of scholarly behavior like "Self-Discipline" and "Brainwork," each an activity that cannot be represented as an isolated segment of a workflow sequence. The "life cycle" also recognizes "Obstacles" to steady research and the meanings of "Space," or the impact of the work environment.

The Cornell team interviewed 21 scholars across the disciplines after they had each kept a detailed record of their workflow over the course of a typical workday (if there is one at a research university). The study was based on these records and follow-up interviews where subjects addressed questions of scholarship, particularly the impact on it of digital innovation and the roles of libraries in the work of scholars. The focus throughout was on going beyond library-based studies of "information behavior," or seeing it and allied pursuits "in the context of other components that [librarians] normally do not see or know about" (Tancheva et al., 2016, p. 35). Still, in its design the study plainly represented what the Cornell librarians had been observing in their interactions with the faculty and graduate students. Thus, "technological innovation has increased the extent to which individuals can adjust available tools to suit their personal preferences" (p. 39).

It is surely no surprise that the Stanford, Penn State, and Cornell studies of the scholarly workflow found that individual differences matter more than anything else. They can reflect disciplinary conventions, personal histories and preferences, and a configuration of opportunities and resistances, or even refusals in encounters with digital innovations.

The Cornell study demonstrated that "research begins everywhere" (Gessner et al., 2017, p. 542), that it is "interrupted and yet continuous," and that it is "simultaneously linear, in its overarching goal from idea to manuscript, and chaotic," as researchers constantly negotiate tasks and move from one activity to another (p. 535). As Antonijevic found at Penn State, practices are highly "idiosyncratic." The Cornell study names "task negotiation" as the frequent stance of scholars looking for ways in and out of segments of the workflow, adapting as they go to opportunities and to variable intensity in one or another segment as demands (as in publication and grant proposal deadlines) and mood require. Accordingly, interviews are coded for "Self-Discipline" and "Brainwork," or orientations to research that shape how it is done without specifying a step in the process. Inevitably, scholarly practices can belie the structure conveyed by any orderly looking image of the workflow. Segments count more than sequence, and scholarly personality plays as big a role as commitment to the process (see also Acord & Harley, 2012).

Saved by Software?

The Penn State and Cornell studies also reveal surprising ambivalence about the uses of technology in the research workflow. Virtually all scholars (and those in the Stanford study) welcome digital access to journal and articles, while many remain ambivalent (at best) about e-books. Beyond that the record of adoption of technology is uneven.

Many scholars are diffident about the constant stream of new apps and cling to the most familiar forms of digital and professional communications. The Cornell group reports that "e-mail is used by everyone, everywhere" (Tancheva et al., 2016, p. 24). For Antonijevic (2016) "e-mail is a killer app" (p. 61). But everyone who studies the scholarly workflow encounters pockets of indifference. There are those who still rely on printing anything worth storing or on making a digital file on a flash drive. And a historian told Antonijevic: "I am a dinosaur. Everybody at the library has their laptop and they go 'click, click, click.' I have reams of paper and lots of pencils" (p. 56; see Hillesund [2010] for an inventive account of how every scholar's workspace, in the relations of analog and digital resources, is an ecosystem of its own).

What will prompt more and better uses of technology, presumably resources for improving the workflow? Since research on the workflow features libraries, and librarians themselves conduct some of

the best studies, it inevitably addresses new professional and institutional roles. According to ITHAKA's Roger Schonfeld (2015): "Libraries need to develop a completely different approach to acquiring and licensing digital content, platforms and services. They simply must move beyond the false choice that sees only the solutions currently available and instead push for a vision that is *right for their researchers*" (p. 13; emphasis added).

For some scholars, problems of "friction" (as Sack [2017] calls them), or the lack of integration among segments of the workflow, can be addressed with individual solutions, including, of course, adoption of new software. A sociologist told Antonijevic (2016): "I use Dropbox for everything. It has saved my life, it has changed my life" (p. 51). There is testimony in all studies of the workflow about recognition of one affordance or another. But, surprisingly, there is considerable indifference to well-known programs for citation management, this before they began to incorporate features of social media.

The Cornell group is candid about institutional limits, recognizing individual preferences and the proliferation of software. Thus, according to Nancy Foster (in her "Introduction" to "A Day in the Life"), librarians may be wise not to "urge use of library technologies in the prescribed ways but rather [to accept the] imperfect practices of researchers as reasonable, individual work habits" (Tancheva et al., 2016, p. 10). The report itself adds, "Often the very technology that is meant to make users productive can distract them from focused work" (p. 33). In any case, Antonijevic (with Cahoy, 2014) reports that only about half (sometimes fewer) of the scholars they studied "felt the library should have a role in instructional support relative to the research workflow." Instead, researchers claimed that adopting technology was the "responsibility" of the scholar" (p. 300; see also Koltay & Spiranec, 2017).

Sack (2017) has a more militant view: "friction is escalating, and piecemeal innovation brings temporary relief only." He believes that "Our consumer experiences shape our expectations with regard to the possibilities for online work" (p. 21). Scholars will want to be fully active on an integrated platform. "Today's metaphor of the scholarly web is that it is like a library: full of documents to read and to write." But a different metaphor lies ahead: "Consumers already see the web as a place to *do* things, not just read about them. Even libraries at universities are changing to places where you do things, not just

borrow and read documents. The scholarly web will evolve this same way, as workflow goes beyond engagement with the literature and integrates literature into the overall work of the researcher to discover and communicate" (p. 22).

A suggestive step toward easing workflow friction with software is the work done in the final phase (2014–2016) of the Penn State project (Cahoy, 2017). Thus, enhancements were added to Zotero to integrate discovery and self-archiving into the citation management tool. A limited usability study in 2016 with 10 participants showed first "continual frustration and unmet desires across multiple phases of the scholarly workflow." But, at least as far as discovery was concerned, scholars were open to embedded services with citation management software. Elyssa Cahoy concluded that if they could manage, as a majority of study participants did, the "high learning barrier" for using the "enhanced" software, then "the idea of adding on additional services seemed natural and realistic." Still, there remains a "challenge" for libraries "to begin embedding content where our users are rather than where we want them to go (library websites, publisher websites, subscription databases)" (p. 17).

Conclusions: In and Out of Starbucks

The workflow organizes time, or the best ways to move through the tasks of scholarship. Removing "friction" and gaining efficiency saves time within projects of inquiry and captures time for new ones. But there are also the spaces of scholarship, where the workflow, with its movement or momentum, subsidizes on behalf of an individually determined pace of research and writing. We can recognize resistance where we find it, even beyond celebrations of the "slow professor" (Berg & Seeber, 2017).

Technology writer Kevin Kelly (2016) named his most recent book *The Inevitable*. At just about the same time scholarly communications expert Joseph Esposito (2015) proposed that the question of how much of the scholarly workflow will end up on smartphones is worth attention. Still, the Cornell study reminds us of "the various ways and means by which scholars adapt and adjust their own skill, preferences and habits to work with technology, and the ways they locate and/or adapt spaces (physical or virtual) that allow them to maximize their productivity" (Tancheva et al., 2016, p. 35).

Just as scholars mix and match old and new tools, they position themselves for work according to

both new opportunities and (fruitful) habits. Thus, for some a mobile research life is best: “I can bring my entire library’s worth of video to Starbucks and be working on it. . . . I’ve been able to do my work anywhere” (cited in Antonijevic, 2016, p. 42). But the library itself, well equipped for research with technology, still meets desires that cannot be digitized. Here is how historian Anthony Grafton (2009), adept as he is with new technologies, registers what he believes is essential to understanding what is durable and analog in academic work:

Sit in your local coffee shop and your laptop can tell you a lot, especially if you wield your search terms adeptly. But if you want deeper, more local knowledge, you will have to take the narrower path that leads [to the research library]. . . . You will use all the new sources, all the time. . . . But these streams of data, rich as they are, will illuminate rather than eliminate the unique books and prints and manuscripts that only the library can put in front of you. For now, and

for the foreseeable future, if you want to piece together the richest possible mosaic of documents and texts and images, you will have to do it . . . where sunlight gleams on varnished tables, as it has for more than a century, and knowledge is still embodied in millions of dusty, crumbly, smelly irreplaceable manuscripts and books. (pp. 323–324)

Some may see more nostalgia than professional savvy in Grafton’s account. But his scholarly productivity demonstrates that he knows how to get things done. The workflow, he reminds us, should always be as personal as is necessary. Grafton complements his antiquarian tastes with a lively Twitter account. He might welcome a comprehensive integrated digital platform. But, in the vocabulary of the Cornell study, he finds what he has “good enough” at the border of the analog and the digital. “People who do the work,” ITHAKA’s Nancy Foster (a collaborator in planning the Cornell study) insists, “know best how to do it” (Tancheva et al., 2016, p. 4).

References

- Acord, S., & Harley, D. (2012). Credit, time, and personality: The human challenges to sharing scholarly work. *New Media and Society*, 15(3): 379–397.
- Antonijevic, S. (2016). *Amongst digital humanists: An ethnographic study of digital knowledge production*. New York: Palgrave Macmillan.
- Antonijevic, S., & Cahoy, E. (2014). Personal library curation: An ethnographic study of scholars’ information practices. *portal: Libraries and the Academy*, 14(2), 287–306.
- Berg, M., & Seeber, B. (2017). *The slow professor: Challenging the culture of speed in the academy*. Toronto: University of Toronto Press.
- Bosman, J., & Kramer, B. (2015). 101 Innovations in scholarly communication: How researchers are getting a grip with the myriad new tools. <http://blogs.lse.ac.uk/impactofsocialsciences/2015/11/11/101-innovations-in-scholarly-communication/>
- Bussert, K., Chiang, K., & Tancheva, K. (2011). Personal management of scholarly information. In N. Foster, K. Clark, K. Tancheva, and R. Kilzer (Eds.), *Scholarly practice, participatory design and the extensible catalog* (pp. 123–150). Chicago: Association of College and Research Libraries.
- Cahoy, E. (2012) at *Penn State News*. <http://news.psu.edu/story/418547/2016/07/25/academics/penn-state-librarian-leads-exploration-scholarly-research>
- Cahoy, E. (2017). Leave the browser behind: Placing discovery within the user’s workflow. <https://scholarlyworkflow.files.wordpress.com/2017/08/cahoy-leave-the-browser-behind-submission-317.pdf>
- Eldermire, E., & Tang, N. (2016). So everyday: Interviews with academic researchers to understand their day-to-day. *Proceedings of the 2016 Library Assessment Conference* (pp. 414–418). Washington, DC: Association of Research Libraries.

- Esposito, J. (2015). The elephant in the room is a phone. *Scholarly Kitchen*, February 12. Access: <https://scholarlykitchen.sspnet.org/2015/02/12/the-elephant-in-the-room-is-a-phone/>
- Favaro, S., & Hoadley, C. (2014). The changing role of digital tools and academic libraries in scholarly workflows: A review. *Nordic Journal of Information Literacy in Higher Education*, 6(1), 23–38.
- Gessner, G., Eldermire, E., Tang, N., & Tancheva, K. (2017). The research lifecycle and the future of research libraries: A library of apps. *Proceedings of the 2017 Conference of the Association of College and Research Libraries* (pp. 533–543).
- Grafton, A. (2009). *Worlds made by words: Scholarship and community in the modern West*. Cambridge, MA: Harvard University Press.
- Hillesund, T. (2010). Digital reading spaces: How expert readers handle books, the Web, and electronic paper. *First Monday*, 15(4).
- Kelly, K. (2016). *The inevitable: Understanding the 12 technological forces that will shape our future*. New York: Viking.
- Koltay, T., & Spiranec, S. (2017). Libraries meet research 2.0: Literacies and services. In A. Esposito (Ed.), *Research 2.0 and the impact of digital technologies on scholarly inquiry* (pp. 32–52). Hershey, PA: IGI Global.
- Makri, S., & Blandford, A. (2012). Coming across information serendipitously—Part 1: A process model. *Journal of Documentation*, 65(5), 684–705.
- Meyer, E., & Schroeder, R. (2009). The world wide web of research and access to knowledge. *Knowledge Management Research & Practice*, 7(3), 218–233.
- Nardi, B., & O'Day, L. (1999). *Information ecologies: Using technology with heart*. Cambridge, MA: MIT Press.
- Newman, M., & Sack, J. (2013). Information workflow of academic researchers in the evolving information environment: An interview study. *Learned Publishing*, 26(2), 123–131.
- Sack, J. (2017). Friction in the scholarly workflow: Obstacles and opportunities. *Information Services and Use*, 37, 17–22.
- Schonfeld, R. (2015). *Meeting researchers where they start: Streamlining access to scholarly resources*. New York: ITHAKA S+R.
- Tancheva, K., Gessner, G., Tang, N., Eldermire, E., Furnas, H., Branchini, D., & Steinhart, G. (2016). *A day in the life of a (serious) researcher: Envisioning the future of the research library*. New York: ITHAKA S+R.
- Vaughn, K., Hayes, B., Lerner, R., McElfresh, K., Pavlech, L., Romito, D., . . . Morris, E. (2013). Development of the research lifecycle model for library services. *Journal of the Medical Library Association*, 10(4), 310–314.
- Yoe, R. (2001). Kings of chaos. *University of Chicago Magazine*, 93(5).