



Interdisciplinary scholarly collaboration in data-intensive, public-funded, international digital humanities project work

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ABSTRACT

The information practices of collaborative interdisciplinary researchers, especially in distributed environments, remain understudied. Embracing the naturalistic paradigm, this qualitative case study relies upon semi-structured interviews, snowball sampling, and grounded analysis. Based on interviews with 53 participants from 11 Digging Into Data 3 (DID3, 2014–2016) projects, this study examines the working practices of scholars (library and information science professionals, humanists, and computer scientists) engaging in collaborative, international, data-intensive, publicly-funded interdisciplinary research. Benefits of such work include avoiding redundancy, exploding disciplinary silos, and more ambitious, larger-scale outputs. Challenges and lessons learned center on innovation, flexibility, and failure, translation, intermediaries, divisions of labor and delegation of responsibilities and tasks, conflict resolution, technology, outputs and publication, and timeframe, sustainability, and infrastructure.

1. Introduction

The field of digital humanities (DH) straddles computing, arts and humanities, cultural and communication studies, education, and library and information science (LIS) (Klein, 2015). It leverages computational media to represent, manipulate, analyze, and interpret humanistic data (Davidson, 2017) and is almost invariably collaborative (Borgman, 2009; Burdick et al., 2012; Chan et al., 2017; McCarty, 2012). Inextricable from the future of the humanities writ large, it encourages innovative, even visionary and transformative, intellectual exploration (Svensson & Goldberg, 2015).

Some of the most transformative DH work falls under the aegis of the Digging into Data Challenges. The first Digging into Data Challenge (DID1, 2010–2012) brought together humanities scholars, computer scientists, and information professionals, fusing e-science and the humanities into “one culture” (Williford & Henry, 2012). Funded by four public agencies from three nations (the United States, United Kingdom, and Canada), the eight projects introduced a paradigm shift embracing new forms of scholarly data, tools, and publications (Williford & Henry, 2012).

In Digging into Data's third round (DID3, 2014–2016), 10 agencies from four countries (the Netherlands joined the previous three nations) sponsored 14 international teams of scholars pursuing innovative, collaborative, interdisciplinary, and data-driven research in digital humanities (Garwood & Poole, 2018; Poole & Garwood, 2018). DID3 permits an examination of the working practices of digital humanities scholars in project environments, specifically the benefits and

challenges of and lessons learned from such activity.

2. Problem statement

Researchers increasingly work across established disciplinary frameworks as they exchange information, tools, and methods and address research questions and problems (Palmer, 1996; Palmer, 1999). But the behaviors and practices of collaborative interdisciplinary researchers, especially in distributed environments, remain understudied—even though they constitute an area of great interest in LIS research (Bates, 1996; Borgman, 2007; Palmer, 1996; Palmer & Cragin, 2008; Palmer & Neumann, 2002). Given the impact of DH upon traditional scholarship and its frequent reliance on public funds, the need for research on interdisciplinary research (IDR) in DH is as urgent as in the sciences (American Council of Learned Societies, 2006). Further, examining such collaborative IDR practices represents a fruitful way to explore scholarly information exchange (Palmer, 2017). Finally, in order to improve future collaboration with researchers, information professionals need first to understand the information work involved in researchers' practices (Palmer, 1996). Analysis of DID3 offers a useful first step toward this understanding.

3. Literature review

In theory and practice alike, DH imbricates interdisciplinarity, collaborative work methods, and communities of practice.

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3.1. Interdisciplinary research

Palmer and Crag (2008) contend, “The term ‘discipline’ is commonly used to describe and differentiate knowledge, institutional structures, researchers, and resources in the working world of scholarship and science” (p. 172). A discipline socializes its researchers through common epistemologies, phenomena of study, concepts, problems, theories, tools, and methods (Klein, 2015; Lyall et al., 2011; Repko & Szostak, 2016).

Despite the longstanding grip of disciplines on the academy’s organization and operation, inter-disciplinarity is unprecedentedly visible (Lyall et al., 2011; Palmer, 2001; Palmer & Neumann, 2002). “A complex and contradictory set of practices located along shifting coordinates,” interdisciplinary research “exposes the inadequacies of the existing organization of knowledge to accomplish given tasks” ((Klein, 1996), pp. 4, 14).

Interdisciplinary research integrates information, language and terminology, techniques, processes, data, methods, tools, perspectives, worldviews, concepts, theories, and results from two or more disciplines to achieve a more holistic understanding of a research question or problem (Klein, 2003; Klein, 2015; National Academy of Sciences, 2004; Palmer, 2017). IDR enables its participants to explore new intellectual terrain, learn the lexicon of other fields, and author works for new audiences (Palmer & Neumann, 2002).

Supporting IDR, boundary work entails bridging separate social worlds to pursue tasks cooperatively (Palmer, 1999). Whether abstract or concrete, boundary objects such as words and people facilitate boundary work. As “nodes” and “conduits,” people—intermediaries—constitute essential boundary objects (Palmer, 1996). Intermediaries liaise between labs, between academia and industry, and between experimentation and theory (Palmer, 1996). They produce brokered knowledge, knowledge “made more robust, more accountable, more usable; knowledge that ‘serves locally’ at a given time; knowledge that has been de- and reassembled” (Meyer, 2010, p. 123). At the same time, juggling numerous liminal memberships can prove vexing for intermediaries (Star & Griesemer, 1989). Palmer, 1999

Boundary objects occupy and satisfy the information needs of multiple communities of practice at once (Bowker & Star, 1999). As vehicles for translation, moreover, these objects are sufficiently malleable to fulfil local needs, but sufficiently robust to bestride different sites (Star & Griesemer, 1989).

Enabled by boundary objects, translation involves words, vocabularies, research conventions, and cultures that span disciplines (Palmer, 1996; Palmer, 2017). A practical and intellectual challenge, translation depends upon a hybrid lingua franca that anneals specialized and general terms from multiple disciplines (Klein, 1996; Klein, 2003; Palmer, 1999; Palmer & Neumann, 2002). Not only does translation offer new interpretations, it also involves directing individuals (Latour, 1987).

Joint authorship entails another round of sedulous translation work. Demanding resources and practice, IDR writing remains especially difficult. It requires aligning interests, contextualizing and re-configuring ideas, and developing audience-appropriate language, formats, and citations (Klein, 1996; Palmer, 1996; Palmer, 2017; Palmer & Cragin, 2008; Palmer & Neumann, 2002). Even under optimal conditions, however, scholarly information resists full translation across disciplines; interdisciplinary knowledge remains partial knowledge (Borgman, 2007; Klein, 1996).

Obstacles to successful IDR are non-trivial and uncertainty is endemic (Sonnenwald, 2007). Temporal and financial resources, immanent complexity, shortfalls in or even failures of integration or systems thinking—all constrain IDR (Klein, 1996). IDR challenges entrenched disciplinary-based practices of data collection, analysis, and interpretation; thus tacit disciplinary knowledge can militate against such collaborations (Haythornwaite et al., 2006; Polanyi, 1966).

As important, friction surrounding the perceived hierarchies of

disciplines, power and gender, language, accents and cultures, and the ambitions of participants may arise; patience, understanding, reflexivity, humility, and respect are at a premium (Bracken & Oughton, 2006; Easterby-Smith & Malina, 1999; Klein, 1996; Klein, 2003; Klein, 2015; Lawrence, 2006; Poole & Zhang, 2005; Siemens, 2010; Williford & Henry, 2012). “The traditions, cliques, publishing quirks, heroes, artifacts and in-jokes that combine to make a discipline,” Terras (Terras, 2012) concludes, “are not easily and quickly learned or understood” (p. 216). Becoming a discursive “insider” numbers among the most difficult of IDR challenges; translation among stakeholders is essential (Palmer, 2001; Palmer & Neumann, 2002).

3.2. Collaborative research

Sonnenwald, Lassi, Olson, and Ponti (Sonnenwald et al., 2009) posit, “Increasingly collaboration across disciplines, organizations, geographical distances and political boundaries is needed in order to create new knowledge, solve complex problems, enhance work practices, design new services and products, and educate students and lifelong learners” (p. 191). The crux of IDR, collaboration is a highly adaptable strategy central to project-based work (Klein, 2003; Palmer, 1996; Palmer, 2001). It involves social interaction among two or more individuals in a research setting that concentrates on a common higher-order goal such as meaning-making or task completion (Gunawardena et al., 2010; Sonnenwald, 2007).

Successful collaboration demands common ground regarding definitions, theories, languages, value systems, methodologies, and research style ((Borgman, 2009; Bracken & Oughton, 2006; Lawrence, 2006); Siemens, Cunningham, Duff, & Warwick, 2012). Such projects depend, too, on human factors such as dignity, respect, trust, and understanding (Siemens, 2009). Collaborations that build on previous collaborations are more likely to achieve their goals (Lawrence, 2006; Siemens, 2009; Siemens, 2010).

More complex, uncertain, and resource-intensive than individual research, collaboration demands trade-offs between autonomy and synergy, individual and collective responsibility (Flanders, 2012; Klein, 2015; Sonnenwald, 2007). No panacea, it may fail to increase productivity even while increasing workload, at least in the short-term (Palmer, 1999; Palmer, 2001). Scholarly and disciplinary cultures, time zones and geographical distance, technological readiness and maturity, definition of research problem, methodology, interdependence and trust among team members, work and communication patterns, inertia or resistance to innovation, equal contributions from team members, seeing the larger picture, power and status, management and decision-making, authorship and publication, and dissemination priorities—all potentially complicate, undercut, and even vitiate collaborative work (Cummings & Kiesler, 2005; Klein, 1996; Lawrence, 2006; Olson et al., 2008; Olson et al., 2009; Siemens, 2009; Siemens et al., 2011; Siemens et al., 2012).

Adding still another challenge, collaborative research often involves teams whose members interact mostly if not exclusively through distributed information technology. Such technology itself poses challenges, namely the expense and quality of equipment, the need to schedule its use, its sound or video quality, and its ease of use (Lawrence, 2006; Siemens, 2010).

Usually larger than collocated work groups, virtual teams grapple with geographical, organizational, and cultural issues. These may include dispersion and isolation, logistics and communication, membership integration and stability, task coordination, content sharing, consensus-building, differing authority structures, and the development of relationships and trust (Lawrence, 2006; Murphy, 2004; Poole & Zhang, 2005). Geographical distance undercuts the likelihood of planned meetings and extemporaneous conversations alike (Cummings & Kiesler, 2005; Olson et al., 2009). Virtual teams may learn to communicate effectively, but it takes considerable time and effort (Poole & Zhang, 2005).

Given the differing worldviews participants bring to collaborative IDR work, conflict is inevitable. Virtual conflicts may take longer than face to face conflicts to emerge, which can impede their resolution (Poole & Zhang, 2005). Suffice to say, conflict must be recognized and used productively (Klein, 2003; Lawrence, 2006). In collaborative work, in short, acculturation barriers abound (Lawrence, 2006; Palmer, 2001; Poole, 2017a).

3.3. Communities of practice

Digital humanities constitutes a community of practice (COP) (Burdick et al., 2012; Ross, 2012). According to Davenport and Hall (Davenport & Hall, 2002), Davies (Davies, 2009), Wenger (Wenger, 1999; Wenger, 2004; Wenger, 2006), and Wenger and Snyder (Wenger & Snyder, 2000), COPs represent self-selecting, self-organizing, and self-sustaining sites for domain-specific mutual engagement and informal learning. Through common work practices, regular contact, and a shared body of language, concepts, tools, and stories, members cultivate expertise, build trusting relationships and foster belonging, and develop, manage, and exchange knowledge.

Bound together by a commitment to and an identification with the group's expertise and enterprise, COPs imbricate tacit and explicit knowledge. Members learn collectively through the immersive social practices characterizing a common domain. Wenger (Wenger, 2004) sums up, "Domain provides a common focus; community builds relationships that enable collective learning; and practice anchors the learning in what people do."

COPs constitute "a living curriculum for the apprentice" (Wenger, 2006). Apprentices become insiders or master practitioners by acquiring a community's subjective viewpoint and both its language and its skills: they are "enculturated" through "legitimate peripheral participation" comprising authentic prosaic activities (Brown & Adler, 2008; Brown & Duguid, 1991; Brown et al., 1989; Lave, 1991). Such activities include developing collective problem-solving strategies and collaborative work skills, assuming multiple roles, and both addressing misconceptions and redressing ineffective approaches (Brown, Collins, & Duguid, 1989). Ultimately, legitimate peripheral participation not only helps cultivate skills and a sense of identity, but also the (re)production of communities of practice (Lave, 1991).

4. Methods

This study focuses on the information work practices of DH collaborations. User-centered, it hinges on view-point-driven questions (Benardou et al., 2010; Benardou et al., 2013). Anchored in the naturalistic paradigm, it employs qualitative methods, a case study approach, purposive sampling, and inductive, grounded data analysis (Lincoln & Guba, 1985; Pickard, 2013).

Concentrating on exploration, description, and comparison, qualitative research integrates and contextualizes multiple perspectives by interpolating inquiry, data collection, and analysis (Bernard & Ryan, 2010; Denzin & Lincoln, 2007; Meloy, 2002; Saldana, 2013; Taylor & Bogdan, 1998). This method harmonizes with a case study approach (Choemprayong & Wildemuth, 2009; Yin, 2009); as Sholtz and Tietje (Sholtz & Tietje, 2002) assert, "The more complex and contextualized the objects of research, the more valuable the case study approach is regarded to be" (p. 4).

Semi-structured interviews facilitate the integration of multiple perspectives and the development of holistic descriptions (Rubin & Rubin, 2005; Weiss, 1994). Guiding participant recruitment for these interviews, snowball sampling allows a researcher to locate participants where they are few in number or difficult to locate or when higher levels of trust are needed to initiate participation (Atkinson & Flint, 2004; Biernacki & Waldorf, 1981; Morgan, 2008).

Finally, this study embraces grounded analysis. In explaining as well as describing, grounded analysis helps capture the dynamism and

contextual relationships inherent in interviewer/participant interactions. As germane, it lends itself to iterative data collection, coding, and analysis (Charmaz, 2014; Corbin & Strauss, 1990; Saldana, 2013). Documentary evidence complements empirical evidence (Charmaz, 2014; Hodder, 2000; Lincoln & Guba, 1985; Wildemuth, 2009).

Fifty-three persons representing 11 projects were interviewed by phone, Skype, or Google Hangout. Participants include principal investigators (PIs), project managers (PMs), and project team members ranging from faculty members to postdoctoral researchers to PhD students. These individuals hail from a remarkable diversity of disciplines, fields, and departments, as do their projects more broadly (Appendices A, B, C, and D). Nonetheless, computer science and linguistics were especially important disciplinary foci. Interviews were transcribed and open coded by hand and with NVivo.

5. Findings

5.1. Benefits of collaborative IDR

Fourteen participants from seven teams comment on the specific benefits of collaborative IDR work in DH. P46-10 calls IDR "a great source of inspiration."¹ The payoff of collaborative IDR is "huge" (P26-11), even "fantastic" (P5-10).

5.1.1. Avoid redundancy

Two participants representing two teams applaud the ways in which DID3 permitted them to avoid redundant research. Computer scientist P29-05 reflects, "I've seen projects where people have reinvented the wheel so many times. They're presenting something as new and innovative, where it's been done in another field maybe ten years before, but because those fields don't communicate, they just don't realize [it]." Trained in a quite different field (organizational and industrial psychology), P51-08 similarly maintains, "What was late and great going on in another field...could help propel our thinking." She elaborates, "We don't want to reinvent the wheel; we want to go from the best wheel that's out there and add it to the car."

5.1.2. Explode disciplinary silos

Three participants from three teams embrace DID3 to explode disciplinary silos. LIS-trained PM P28-08 notes, "Everyone [who] is such an expert in their field just deals with the experts in their field and they don't think about people who may be able to provide some insight or actually develop a different way." PI P36-09, trained in literature, reflects, "If you are working in one national or linguistic or historical space you are almost never talking to people outside of that space. As much as people pay lip service of 'compared to this/compared to that,' it's such a minority of research on a national basis." By contrast, research initiatives such as DID3 promote intellectual bridge-building. Computer scientist PI P5-10 insists, "The whole point of methods of technology is to be able to reach different domains."

5.1.3. Enable more ambitious work

IDR collaborations such as DID3 permit scholars to tackle more ambitious and impactful projects, as nine participants representing six teams aver. PI P18-05, a computer scientist, insists, "There's no way these three labs could have done [DID3] independently" and PM P4-09 explains, "If we were all just independent people across campus, across the globe...at the very least the project would take exponentially longer."

Other participants emphasize their fruitful research outcomes. Historian and PI P32-03 embraces "constant discussion and a lot of co-

¹ Fifty-three DID3 participants were interviewed. The first number (e.g. 46) denotes the participant herself, whereas the second (e.g. 10) denotes the project on which she worked.

authoring, co-writing, and [the] kinds of things that I don't really do"; she claims, "[DID3] was an incredibly rich project. It made us think about things in a very different way." Though trained not in history like P32-03, but in computer science, P46-10 discerns a similar payoff: "the impact [of projects such as DID3] is going to be much more interesting than just working on your own." Still other participants underscore the unprecedented rewards of collaborative IDR. PM P19-08 marvels, "We're doing something that has never even been done before."

5.2. Challenges

Participants representing 10 of the 11 international teams grapple with eight challenges stemming from IDR work. Only one team reports no such challenges: linguist PI P16-06 notes, "There were challenging aspects to the project, but interdisciplinarity was not really one of them because we were both working in very similar fields."

5.2.1. Flexibility and failure

More widely across the case study, 14 participants on seven teams discuss challenges related to conducting innovative research, namely the need to remain flexible and learn from apparent failure. LIS-trained P41-10 admits, "At the beginning you don't quite understand what you are trying to do and where these things are going to end up." In the same vein, PI P24-01, trained in critical studies, suggests, "We got to the end goal, but...there were things that were in the work plan that we said, 'we're going to do it this way,' and then once we started doing it that way, we realized this is a really bad way to do it" and P19-08 recalls "some teething problems" and "a phase of learning" in her project. This adversity could prove fruitful, however. Computer science postdoctoral researcher P18-05 relates of one project challenge, "That was both a delay and an unanticipated risk, but it was also exciting, because we were doing something new and interesting, and, 'Wow. There is way more in this data than we thought.'"

5.2.2. Translation

Twenty-five participants representing 10 teams discuss the challenges of translation among disciplines. PI P6-04, a linguist, expounds:

We did have database experts, but they were not linguists, so they didn't know what type of database we would need. We would tell them what we thought we needed, and they would give us the best recommendations for what we thought we needed, but they didn't know that we didn't know what to tell them. When do you stop telling someone something? You don't know what they don't know and what they know.

Similarly, PI P53-07, a historian, states, "that's the trickiest thing about negotiating [inter disciplinary]: sometimes you use the same terminology, but they're false friends...because you're not actually meaning the same thing at all." Likewise, literature scholar P3-09 admits, "It's difficult when you have groups of people that have different questions around the same set of objects," and management-trained PI P12-08 concedes, "We have so many different terms that refer to the same thing." Perhaps most insidious, as P31-09, trained in journalism, observes of her tri-national team, "it might take...a long time before we even understand that there has been a misunderstanding."

Eleven participants on seven teams discuss good practices for and lessons learned with respect to translation. Postdoctoral researcher P42-01 states, "The skill set of a humanist is really valuable...because you're clued in to the different words and the different kind of frameworks and understanding that different groups can have." To enable translation among her team's members, P29-05 develops a glossary of domain terms.

Highlighting emphatic listening skills, P20-08 comments, "Everybody comes with their own expertise to add to the mixture, and you have to up the level of communication to make sure that you're not using shortcuts and assumptions that other people don't know about." In just this way, P53-07 observes, "Somebody very early on said 'it's

Table 1
DID3 intermediaries (by team)

Team	Intermediaries
01	P24-01 P25-01 P38-01 P42-01 P45-01
03	P34-03
04	P6-04 P17-04
05	P29-05 P39-05
07	P8-07 P9-07 P10-07 P14-07 P23-07 P53-07
08	P47-08
09	P2-09 P3-09 P31-09
10	P15-10
11	P21-11 P33-11

really important to remember that there's no such thing as a stupid question,' and...getting that out there very early on freed people up to say, 'Hold on. I'm not sure what that acronym is. Do you mean the same thing by that as I mean?'" P46-10 even insists, "I'm not sure there is any such strategy other than keep talking and trying to make sure that we are all on the same page."

5.2.3. Intermediaries

Intermediaries effect translation among and within groups. Nine teams feature 23 participants who exemplify intermediaries (Table 1).

For example, PhD student P25-01 notes, "A lot of the emphasis on interdisciplinarity within this specific project...is on individuals trying to bridge two different areas themselves." Straddling history and computer science, postdoctoral researcher P10-07 labels herself "a piggy in the middle." P3-09 in like fashion suggests, "I can translate the concerns of one group into the language of another group in a more straightforward way than some of my colleagues." Calling herself an "ambassador" able to speak across disciplines, P25-01 reflects, "One of the key positions that I took on was...translating how we could use quantitative methods for questions that we normally ask of qualitative methods." Boasting a background in computer science, linguistics, and philosophy as well as a PhD in history, P34-03 jokes, "Back in the day, no one knew what to do with me." As a result, "I practiced computer science without a license." Most expansive, computer scientist P23-07 recalls, "Pretty much everybody on the project was an inter-disciplinarian in one way or another."

A lack of intermediaries may hamstring projects. P6-04 observes, "There's a lot of research projects that fail at the beginning just because they don't have these types of people [like P17-04] to get it started, or these people join the project too late."

5.2.4. Division of labor and delegation of responsibilities and tasks

Six participants from five teams broach division of labor as a necessary part of collaboration. Notes P36-09, "When you are dealing with a project with this many researchers on it, it's very, very challenging to arrive at shared work." In this sense, P35-01 says, "I see the tips of many icebergs, but I don't know the overall flow of the project."

Yet not seeing the larger project context did not necessarily hinder project work. As political scientist and PI P14-07 recalls, "I didn't see the whole big picture coming together as I was doing my part, but once everybody's parts came in, it was very obvious that the whole big

picture had come perfectly together.”

Four participants representing three teams recommend delegation. PI P40-10 claims, “Not everybody has to know everything.” In similar spirit, P34-03 suggests, “If you can find a way of saying, ‘I’ll do this, and you’ll do that, and then we’ll meet back and forth and discuss’...it works better.” PI P53-07 also favors allowing project team members to pursue their interests: “If...somebody really became interested in a particular aspect of the data...let them follow that through so long as the main work of the project didn’t suffer, so that everybody had a stake in it and you’re not...being too controlling and rigid.”

5.2.5. Conflict resolution

Seven participants hailing from four teams discuss conflict resolution. Of unsuccessful collaborations, PI and computer scientist P13-03 remarks, “A lot is due to the personality level of conflicts. It’s someone misunderstanding; sometimes people fear there’s a level of competition.” Even minor disagreements could fester, especially given the distributed nature of DID3. PM P9-07 remembers ambiguity about which schema her project would use. “That might seem a small thing,” she admits, “but it was quite a heated discussion in the project, so it loomed a little bit large psychologically.” In the same vein, P16-06 recalls of her project, “We had a few things...where we just couldn’t agree...We thought they were trivial things, so we’ll just agree to disagree and will carry on doing it in our own different ways.”

By contrast, conflict could prove intellectually productive. PI P32-03 ruminates, “There was a kind of tension within the team as to what we were actually trying to do.” But over time, “The two sides more or less merged” and thus this tension proved “quite fruitful.” Meanwhile PI P47-08, trained in psychology, notes, “Even if you share the overall vision, you can even have differences of what to do next or where to spend a dollar on the level of development.” Her co-PI P12-08 expatiates, “We haven’t been without our rough spots. We’ve had disagreements in the past. We’ve managed to get over them just fine, but...conflict resolution is probably very important on a long-term project like this.” P47-08 underlines the need “to resolve those conflicts, which constantly come again and again and again, until it becomes normal.” The team has been successful in this regard: P12-08 jests, “The collaboration has lasted probably longer than most marriages.”

5.2.6. Technology

Members of nine teams encounter challenges related to technology. Both P9-07 and postdoctoral researcher and historian P8-07 struggle with hardware problems. P9-07 recalls, “[The institution’s computers] just don’t do the kind of stuff we need. They’re kind of stock-standard for administrative tasks, not digital humanities wrangling.” Thus she resorts to her personal laptop. P8-07 remembers, “There was a very good server at the [university] computer science department, but it took me some time to find out how it works.” As a result, she works a good deal on an outdated laptop.

Team 8 also encounters technological challenges, albeit of a different sort. P27-08, who succeeded P19-08 as the project’s PM, stresses both software versions and compatibility issues. Software proves challenging for Team 9 as well. “It’s about platforms, like what platform you create the data in, where you store it, how it is stored,” P4-09 comments. “We’re using Google Docs because we’re sharing these documents, but Google Docs is the worst data storage side of things.”

Team 9 further reports that mediated communication constitutes “an exercise in patience and tolerance” (P31-09), due to inadequate technology. “In some cases we had 15 people in a room, and it was difficult to hear, and sometimes it was difficult for them to hear us, and maybe the visual wasn’t working.” Put another way, as P41-10 maintains, “When you’re not looking at somebody’s face...and you’re just listening to the voice, it makes it more challenging to understand what they’re saying.” PI P40-10 suggests that funders add a budgetary line item to address just such issues.

Technological barriers also beset collaborative relationships on five

teams, exacerbated at times by poor or even non-existent communication and sharing platforms. P18-05 stresses, “There were definitely times where I was frustrated by not really knowing what [other international team] was doing.” Of her project team’s communication, anthropologist P26-11 confesses, “We got bogged down...and then we didn’t keep talking during the work.”

Cultural differences also contribute to distributed communication problems. P14-07 recalls “some tension between the [international partner institution] group and one of the computer scientists on the [other international partner institution] side. It was obvious right from the get-go and I don’t know what that was about.” Perhaps more problematic, as P9-07 observes, is failure of communication: “When the [international partner institution] took things, they kind of disappeared.” Adding still another complication, the partner institution’s communication style differs from that of Team 7. P9-07 elaborates, “They were very definite about what they wanted back from us, and I think it’s partly a cultural thing that the [persons of this nationality] are quite blunt, but they would quite often just say that what we’d produced was unacceptable and they couldn’t use it.”

Team 9 struggles in much the same way with one of their international partners. Laments P3-09, “We literally got nothing at any point from [partner institution]...It was no data sharing and that was a problem. Part of that problem was I don’t think we effectively communicated—this was early on in the grant—what we needed and what they should be giving us. By the time we got to do that, they had already received the data they needed and so were less incentivized to provide what we needed.” Rather more bluntly, PI P49-09, a literature scholar, says, “The results that [P43-09] sent us were unusable.” “We weren’t cutting [P43-09] out or anything like that,” she stipulates, “we just didn’t get any results.”

5.2.7. Outputs and publication

Seven participants from five projects relate collaboration to project outputs. Advises P13-03, “what’s really important for collaboration is to complement each other...And once you have the complement scale, once you know how to utilize each other...find a way...where both can contribute and both benefit.” P53-07 suggests, “Openness to appreciating that someone else may not have the same interests as you...and...that what counts as a valuable research outcome is going to be different for people working in different disciplines...we have to make sure that everybody is getting the research outcomes that they need.” Communication is crucial: P3-09 asserts, “Communication needs to be more clear [sic] at the beginning, and clear not in terms of speculative goals of the project but in terms of...deliverables.”

Five participants on four teams discuss three challenges relating to publication and authorship. First, P30-10 confesses, “We are at that stage where there is nothing to publish out of the Digging Into Data project; it’s all development work.” Surmising that this dilemma confronted all DID3 project stakeholders, P30-10 wonders, “Do we create the next generation of digital-savvy people who will go on and build the systems in their next life, or do we extract the research that we do and just focus on developing a system, but then do a disservice to the students if they work on this because they won’t get a thesis out of it?”

Second, something as seemingly basic as the field-specific expectations for the frequency and number of publications could also prove challenging. “As a computer scientist you’re expected to write a lot of short papers,” P8-07 notes. “As a historian you’re expected to write one good paper a year.”

Tailoring one’s work to the audience(s) represented a third challenge. P29-05 underlines, “There is a risk when you come to publication, particularly when you’re working with computer science and archaeology and these more philosophy- and arts-based subjects versus science-based subjects. They write very differently in journals, and understanding the journal that you’re going for at the time, and trying to make it accessible to both people...can be a challenge.”

Despite the manifest challenges of writing for different audiences,

however, doctoral student P25-01 insists, “The writing process actually helped us refine a lot of ideas and figure out what it was that we were actually doing, and what the implications were...so it wasn’t just this cynical ‘oh, we’ve got to make this count.’”

5.2.8. Timeframe, sustainability, and infrastructure

Eighteen participants from eight teams address DID3’s short timeframe. P29-05 jokes, “I don’t think anybody would ever in their hearts say, ‘Yes, we had plenty of time. It was great. We finished at 3 every afternoon and watched a little TV. No, there’s never enough time.’” In this regard, cultural studies scholar and PI P1-01 calls the DID3 timeframe “shockingly short” and P5-10 calls it “basically a short pilot.” P26-11 enjoins DID funders to extend the timeframe to three years. Supporting these arguments, teams from five projects (1, 7, 9, 10, and 11) exploit no-cost extensions.

Despite DID3’s timeframe, twelve participants from six teams relate their DID3 work to long-term sustainability, specifically to advancing the broader state of DH through data, infrastructure, and further collaboration. P16-06 points to DID3 output “as a way forward for other people who may be in the earlier stages of creating their corpora.” P6-04 contributes, “The short-term goals were not as important to me as the long-term goals of having some influence on the way linguists store data, the security in which that data is stored, and the ease with which that data is shared.”

Also providing for the future of the field, P25-01 reports, “Even though they’re not always recognized as scholarship within our field... [projects such as DID3] provide infrastructural support to people doing historical work in actually expanding the capacity of the field.” P47-08 also emphasizes her team’s aim of promoting “the future of science” through “a scientific infrastructure.” “Instead of building a Ferrari by hand, we want to build a factory that builds Ferraris,” she concludes. Computer scientist P43-09 made the same point, albeit using different imagery: she frames her project “As a continuous facility that is there and where people can do experiments, as physicists would go hire some time on a particle accelerator and also come back after a few months, or as astronomers who hire time on an observatory.”

DID3 work also encouraged further collaboration among team members. For instance, P10-07 joined another international and collaborative IDR project that involves P53-07 and P8-07. “It’s contagious,” she maintains. P5-10 sums up: DID3 is “living research.”

6. Discussion

Collaborative and distributed IDR projects such as DID3 enable scholars to avoid redundancy, break out of disciplinary silos, and engage in larger-scale, more ambitious work than in traditional humanities. Realizing these benefits, however, depends upon welcoming an open-ended problem-solving environment. Flexibility and a tolerance for disruption and even failure proves crucial to DID3 participants as they negotiate eight challenges: flexibility and failure, translation, intermediaries, division of labor and delegation of responsibility, conflict resolution, technology, outputs and publication, and timeframe, sustainability, and infrastructure.

First, the ACLS (2006) encourages researchers to document and disseminate lessons learned through innovation. Innovative projects should encourage productive failure and embrace ignorance (Chan et al., 2017; Kapur, 2008; Unsworth, 1997). DID3 participants affirm these assertions: though inherently risky, innovation inspires them and often leads to unanticipated breakthroughs.

Second, this study shows that translation remains challenging and effortful in DH as in other IDR work (Klein, 1996; Klein, 2003; Latour, 1987; Palmer, 1999; Palmer, 2017; Palmer & Neumann, 2002). Terms are extraordinarily important boundary objects in digital humanities work such as DID3, just as Palmer (Palmer, 1996) finds in the sciences and as Palmer and Neumann (Palmer & Neumann, 2002) find in the humanities. Like Palmer’s (Palmer, 2001) scientists, moreover, DID3

participants favor open, patient, and empathetic communication in service of translation and intermediation. Communication in DID3 could be facilitated by previous collaborative IDR experiences (Lawrence, 2006; Siemens, 2009; Siemens, 2010).

Third, as intermediaries, students and postdoctoral researchers play pivotal translation roles in DH, just as in the sciences (Palmer, 1996). Paradoxically given their vital importance, intermediaries may be among the most vulnerable of project members—perennially at the mercy of short-term funding and, if graduate students or postdoctoral researchers, the academic calendar or the job market as well. Digital humanities and its practitioners remain in an institutionally precarious state overall (Poole, 2017b).

Fourth, even in deeply collaborative environments such as DID3, a division of labor is nonetheless necessary (Strauss, 1985). Judicious delegation can further encourage exploration and innovation—the hallmarks of DH work (Svensson & Goldberg, 2015). More pragmatically, wanting proper delegation, project bottlenecks may occur (Lawrence, 2006). Project management skills are central in planning, negotiating, and coordinating tasks; they help mitigate conflict as well (Garwood & Poole, 2018).

Fifth, conflicts arise. Teams 3 and 8 work through and even profit from conflict, in line with Klein’s (Klein, 2003) recommendation. Communication and culture prove a volatile mixture in collaborative, data-intensive work. Harmony and conflict in these projects invariably remain in tension (Lawrence, 2006).

Sixth, some teams grapple with technological barriers. But technology is less a challenge than interpersonal dynamics, as is the case with digital humanities scholars pursuing Office of Digital Humanities start-up grants (SUGs) in Poole (Poole, 2017a).

Seventh, participants strive to align IDR knowledge production with discipline-specific publication and authorship conventions. Digital humanities outputs often resist traditional scholarly metrics linked to promotion and tenure. As such, DID3’s avowed emphasis on collaboration aside, team members need sufficient independence to capitalize on their respective intellectual strengths and professional needs (Poole, 2017b).

Eighth, DID3 researchers considered the grant window of two years scarcely sufficient. Working within these temporal constraints, most teams folded DID3 into other overarching collaborative projects and research agendas. In this sense, sustainability remains a chronic problem in the field (Brown et al., 2009; Maron & Loy, 2011; Maron & Pickle, 2014; Maron et al., 2009; Maron et al., 2013; McGann, 2010; Williford & Henry, 2012). Most funders provide resources only for tool development, with minimal if any of those resources earmarked for subsequent support (Waltzer, 2012). This concern foremost in their minds, numerous participants underscore the importance of their projects in developing infrastructure for future work. Cyberinfrastructure thus continues to develop in the humanities as in the sciences (Atkins et al., 2003; Jackson et al., 2007; National Science Foundation, 2007; National Science Foundation Advisory Committee for Cyberinfrastructure Task Force on Grand Challenges, 2011).

Digital humanities scholarship hints at revelatory new knowledge. Four areas for robust future research emerge from this study. First, researchers might profitably explore how best to train and retain intermediaries, who often represent linchpins of DH projects such as DID3. Second, best practices for conflict resolution across geographic distances, technology, and cultures merit further scrutiny. Third, how to ensure scholarly outputs that will satisfy each project member’s needs bears more attention, given the importance of deliverables that align with various institutional standards for promotion and tenure. This issue ramifies into delegation, namely attaining a balance between control and autonomy in project work. Fourth and most capacious, researchers might further juxtapose the information practices of scholars in digital humanities projects such as DID3 with those of researchers in other fields such as basic sciences. The number and nature of the disciplines involved, the number of institutions and nations

involved, the number of persons on each team and their professional position—considering these variables would enrich our understanding of international, collaborative, interdisciplinary work. In applying computational techniques to humanities data and topics, as P36-09 puts it, “We are at the very, very beginning, at the tip of the iceberg.”

7. Limitations

This study evinces two limitations. First, snowball sampling militates against generalizability (internal validity). This study relies not upon statistical verification, but upon triangulation to yield “‘holistic work’ or ‘thick description’” (Jick, 1979, p. 609). Second, the investigator can generalize from case studies only theoretically (external validity): transferability needs to be reassessed in each case (Lincoln & Guba, 1985). More than one person from each project was interviewed whenever possible. Similarly, multiple document types about each

project were consulted and interviewees were asked about the same project but in different ways. Nonetheless, in case study research, generalizability is not relevant: the goal is to understand the phenomenon, not to control it (Westbrook, 1994).

8. Conclusion

This study is among the first to analyze the information practices of digital humanities scholars. Digging into Data 3 generated new and fruitful knowledge. In developing “one culture,” these scholars capitalize upon work practices previously exploited by scientists. More LIS research will focus on IDR as the latter’s importance and prevalence continues to increase (Palmer, 2017). IDR “has delivered much already and promises more” (National Academy of Sciences, 2004, p. 16). Nonetheless, we have much to learn about how lessons from other IDR projects and DH work such as DID3 can inform one another.

Appendix A. Number of collaborating institutions and funders

Project number	Number of collaborating institutions	Number of funders
01	2	2
02	5	3
03	2	2
04	3	2
05	3	3
06	2	2
07	5	3
08	2	2
09	4	3
10	4	3
11	2	2

Appendix B. Projects and participants

Project number	PIs per project interviewed	Other project personnel interviewed	Total number of participants interviewed
01	2	5	7
02	1	2	3
03	2	1	3
04	2	1	3
05	1	2	3
06	1	0	1
07	2	6	8
08	2	5	7
09	3	4	7
10	2	6	8
11	1	2	3
Total	19	34	53

Appendix C. Disciplines and fields represented in projects (from DID3 applications)

Discipline or field	Number of participants	Teams represented
Computational linguistics	3	04, 06, 07
Computer science	3	01, 03, 04
History	3	01, 03, 07
Text mining	3	02, 05, 10
Image processing	2	05, 09
Linguistics	2	06, 11
Literature, literary cultures	2	03, 09
Visualization	2	03, 10
Archaeology	1	05

Biodiversity	1	10
Chinese history and literature	1	02
Communication	1	01
Corpus linguistics	1	06
Deaf communication	1	06
Digital humanities	1	02
Film and media studies	1	01
Geography	1	11
Historical demography	1	11
Human-computer interaction	1	05
Image search	1	05
Language documentation	1	04
Library and information science	1	01
Management	1	08
Natural language processing	1	02
Network science	1	09
Political science	1	07
Psychology	1	08
Sign languages	1	06
Social media	1	10
Theoretical linguistics	1	04
Total	42	

Appendix D. Participants: disciplines and fields in which highest degree earned

Discipline or field	Project and participant(s)
Computer science, electrical engineering (13)	Project 1: P35-01, P38-01 Project 3: P13-03 Project 5: P18-05, P29-05 Project 7: P48-07 Project 10: P5-10, P7-10, P30-10, P46-10
History (6)	Project 1: P11-02 Project 3: P34-03 Project 7: P53-07
Languages, literatures (6)	Project 2: P52-02 Project 3: P3-09, P33-11 Project 9: P3-09, P36-09
Linguistics, lexicography (6)	Project 4: P6-04, P17-04, P37-04 Project 6: P16-06 Project 11: P21-11
Library and information science (4)	Project 8: P20-08, P28-08 Project 10: P15-10, P41-10
Psychology (4)	Project 8: P27-08, P47-08, P51-08 Project 9: P43-09
Cultural, critical, or media studies (3)	Project 1: P1-01, P24-01, P25-01
Cultural anthropology, geography (2)	Project 9: P4-09 Project 11: P26-11
Management (2)	Project 8: P12-08, P19-08
Art history (1)	Project 10: P41-10
Biology (1)	Project 10: P22-10
Communication arts (1)	Project 1: P45-01
Folklore (1)	Project 1: P42-01
Journalism (1)	Project 9: P31-09
Music (1)	Project 9: P2-09
Oriental studies (1)	Project 2: P50-02
Political science (1)	Project 7: P14-07
Total	11 projects, 53 participants, 54 degrees

References

- American Council of Learned Societies (2006). *Our cultural commonwealth: The report of the American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences*. New York, NY: American Council of Learned Societies and Andrew W. Mellon Foundation.
- Atkins, D., Droegemeier, K. K., Feldman, S. I., Garcia-Molina, H., Klein, M. L., Messerschmitt, D. G., & Wright, M. H. (2003). *Report of the National Science Foundation Blue Ribbon Panel on Cyberinfrastructure*. Arlington, VA: National Science Foundation.

- Foundation.
- Atkinson, R., & Flint, J. (2004). Snowball sampling. In M. Lewis-Beck, A. Bryman, & T. Liao (Eds.). *Encyclopedia of social science research methods* (pp. 1044–1045). Thousand Oaks, CA: SAGE.
- Bates, M. (1996). Learning about the information seeking of interdisciplinary scholars. *Library Trends*, 22, 155–164.
- Benardou, A., Constantopoulos, P., Dallas, C., & Gavrili, D. (2010). Understanding the information requirements of arts and humanities scholars. *International Journal of Digital Curation*, 5(1), 18–33.
- Benardou, A., Constantopoulos, P., & Dallas, C. (2013). An approach to analyzing working practices of research communities in the digital humanities. *International Journal of Humanities and Arts Computing*, 7(1–2), 105–127.
- Bernard, H. R., & Ryan, G. W. (2010). *Analyzing qualitative research*. Thousand Oaks, CA: SAGE.
- Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, 10(2), 141–163.
- Borgman, C. (2007). *Scholarship in the digital age*. Cambridge, MA: MIT Press.
- Borgman, C. (2009). The digital future is now: A call to action for the humanities. *Digital Humanities Quarterly*, 3(4). Retrieved from <http://www.digitalhumanities.org/dhq/vol/3/4/000077/000077.html>.
- Bowker, G. C., & Star, S. L. (1999). *Sorting things out: Classification and its consequences*. Cambridge, MA: MIT Press.
- Bracken, L., & Oughton, E. (2006). What do you mean? The importance of language in developing interdisciplinary research. *Transactions of the Institute of British Geographers. New Series*, 31(3), 371–382.
- Brown, J. S., & Adler, R. (2008). Minds on fire: Open education, the long tail, and learning 2.0. *Education Review*, 43(1), 17–32.
- Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, 2(1), 40–57.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Research*, 18(1), 32–42.
- Brown, S., Clements, P., Grundy, I., Ruecker, S., Antoniuk, J., & Balazs, S. (2009). Published yet never done: The tension between projection and completion in digital humanities research. *Digital Humanities Quarterly*, 3(2). Retrieved August 1, 2018, from <http://www.digitalhumanities.org/dhq/vol/3/2/000040/000040.html>.
- Burdick, A., Drucker, J., Lunenfeld, P., Presner, T., & Schnapp, J. (2012). *Digital humanities*. Cambridge, MA: MIT Press. Retrieved from http://mitpress.mit.edu/sites/default/files/titles/content/9780262018470_Open_Access_Edition.pdf.
- Chan, A., Chenhall, R., Kohn, T., & Stevens, C. (2017). Interdisciplinary collaboration and brokerage in the digital Humanities. *Digital Humanities Quarterly*, 11(3). Retrieved August 1, 2018, from <http://www.digitalhumanities.org/dhq/vol/11/3/000336/000336.html>.
- Charmaz, K. (2014). *Constructing grounded theory*. Thousand Oaks, CA: SAGE.
- Chomprayong, S., & Wildemuth, B. (2009). Case studies. In B. Wildemuth (Ed.). *Applications of social research methods to questions in information and library science* (pp. 51–61). Westport, CT: Libraries Unlimited.
- Corbin, J., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13, 3–21.
- Cummings, J. N., & Kiesler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science*, 35(5), 703–722.
- Davenport, E., & Hall, H. (2002). Organizational knowledge and communities of practice. *Annual Review of Information Science and Technology*, 171–227.
- Davidson, C. N. (2017). Humanities and technology in the information age. In R. Frodeman, J. T. Klein, & R. C. S. Pacheco (Eds.). *The Oxford handbook of interdisciplinarity* (pp. 206–219). New York, NY: Oxford University Press.
- Davies, E. (2009). Communities of practice. In K. E. Fisher, S. Erdelez, L. McKechnie, & L.E.F. (Eds.). *Theories of information behavior* (pp. 104–107). Medford, NJ: Information Today.
- Denzin, N. K., & Lincoln, Y. S. (2007). The discipline and practice of qualitative research. In N. K. Denzin, & Y. S. Lincoln (Eds.). *Strategies of qualitative inquiry* (pp. 1–19). Thousand Oaks, CA: SAGE.
- Easterby-Smith, M., & Malina, D. (1999). Cross-cultural collaborative research: Toward reflexivity. *The Academy of Management Journal*, 42(1), 76–86.
- Flanders, J. (2012). Collaboration and dissent: Challenges of collaborative standards for the digital humanities. In M. Deegan, & W. McCarty (Eds.). *Collaborative research in the digital humanities* (pp. 67–80). Burlington, VT: Ashgate.
- Garwood, D. A., & Poole, A. H. (2018). Project management as information management in interdisciplinary research: “Lots of different pieces working together”. *International Journal of Information Management*, 41, 14–22.
- Gunawardena, S., Weber, R., & Agosto, D. E. (2010). Finding that special someone: Interdisciplinary collaboration in an academic context. *Journal of Education for Library and Information Science*, 51(4), 210–221.
- Haythornwaite, C., Lunsford, K. J., Bowker, G. C., & Bruce, B. C. (2006). Challenges for research and practice in distributed, interdisciplinary collaboration. In C. M. Hine (Ed.). *New infrastructures for knowledge production: Understanding e-science* (pp. 143–166). Hershey, PA: Information Science Publishing.
- Hodder, I. (2000). The interpretation of documents and material culture. In N. K. Lincoln, N. Denzin, & Y. Lincoln (Eds.). *Handbook of qualitative research* (pp. 703–715). Thousand Oaks, CA: SAGE.
- Jackson, S. J., Edwards, P. N., Bowker, G. C., & Knobel, C. P. (2007). Understanding cyberinfrastructure: History, heuristics, and cyberinfrastructure policy. *First Monday*, 6(12). <https://doi.org/10.5210/fm.v12i6.1904>.
- Jick, T. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly*, 24(4), 602–611.
- Kapur, M. (2008). Productive failure. *Cognition and Instruction*, 26(3), 379–425.
- Klein, J. T. (1996). *Crossing boundaries: Knowledge, disciplines, and interdisciplinarity*. Charlottesville, VA: University Press of Virginia.
- Klein, J. T. (2003). Thinking about interdisciplinarity: A primer for practice. *Colorado School of Mines Quarterly*, 103(1), 101–114.
- Klein, J. T. (2015). *Interdisciplining digital humanities*. Ann Arbor, MI: University of Michigan Press.
- Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge, MA: Harvard University Press.
- Lave, J. (1991). Situated learning in communities of practice. In L. Resnick, J. Levine, & S. Teasley (Eds.). *Perspectives on socially shared cognition* (pp. 63–82). Washington, DC: American Psychological Association.
- Lawrence, K. A. (2006). Walking the tightrope: The balancing acts of a large e-research project. *Computer Supported Cooperative Work*, 15(4), 385–411.
- Lincoln, Y. S., & Guba, E. (1985). *Naturalistic inquiry*. Newbury Park, CA: SAGE.
- Lyall, C., Bruce, A., & Tait, J. (2011). Signposts for interdisciplinary travellers. In C. Lyall, A. Bruce, J. Tait, & L. Meagher (Eds.). *Interdisciplinary research journeys: Practical strategies for capturing creativity* (pp. 1–6). London, England: Bloomsbury Academic.
- Maron, N. L., & Loy, M. (2011). *Funding for sustainability: How funders' practices influence the future of digital resources*. New York, NY: ITHAKA S + R.
- Maron, N. L., & Pickle, S. (2014). *Sustaining the digital humanities: Host institution support beyond the start-up phase*. New York, NY: ITHAKA S + R. Retrieved from http://www.sr.ithaka.org/sites/default/files/SR_Supporting_Digital_Humanities_20140618f.pdf.
- Maron, N. L., Smith, K. K., & Loy, M. (2009). *Sustaining digital resources: An on-the-ground view of projects today*. New York, NY: ITHAKA S + R. Retrieved from <http://www.sr.ithaka.org/wp-content/mig/reports/4.17.2.pdf>.
- Maron, N. L., Yun, J., & Pickle, S. (2013). *Sustaining our digital future: Institutional strategies for digital content*. New York, NY: ITHAKA S + R.
- McCarty, W. (2012). Collaborative research in the digital humanities. In M. Deegan, & W. McCarty (Eds.). *Collaborative research in the digital humanities* (pp. 1–10). Burlington, VT: Ashgate.
- McGann, J. (2010). *Online humanities scholarship: The shape of things to come*. Houston, TX: Rice University Press. Retrieved from <http://cnx.org/contents/PVdH0-ID@1.3:kfH0uNB@2/Introduction>.
- Meloy, J. (2002). *Writing the qualitative dissertation*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Meyer, M. (2010). The rise of the knowledge broker. *Science Communication*, 32(1), 118–127.
- Morgan, D. L. (2008). Snowball sampling. In L. M. Given (Ed.). *The SAGE encyclopedia of qualitative research methods* (pp. 816–817). Thousand Oaks, CA: SAGE.
- Murphy, P. (2004). Trust, rationality and the virtual team. In D. Pauleen (Ed.). *Virtual teams: Projects, protocols and processes* (pp. 317–343). Hershey, PA: Idea Group.
- National Academy of Sciences (2004). *Facilitating interdisciplinary research*. Washington, DC: National Academic Press.
- National Science Foundation (2007). *Cyberinfrastructure vision for 21st century discovery*. Arlington, VA: National Science Foundation. Retrieved from <http://www.nsf.gov/pubs/2007/nsf0728/nsf0728.pdf>.
- National Science Foundation Advisory Committee for Cyberinfrastructure Task Force on Grand Challenges (2011). *A report of the National Science Foundation Advisory Committee for Cyberinfrastructure Task Force on Grand Challenges*. Arlington, VA: National Science Foundation.
- Olson, G. M., Bos, N., & Zimmerman, A. (2008). Introduction. In G. M. Olson, A. Zimmerman, & N. Bos (Eds.). *Scientific collaboration on the Internet* (pp. 1–12). Cambridge, MA: MIT Press.
- Olson, G. M., Olson, J. S., & Venolia, G. (2009). What still matters about distance? In *Proceedings of the Human-Computer Interaction Consortium 2009*. Retrieved from <https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/Olson9370.pdf>.
- Palmer, C. L. (1996). Information work at the boundaries of science: Linking library services to research practices. *Library Trends*, 44, 165–191.
- Palmer, C. L. (1999). Structures and strategies of interdisciplinary science. *Journal of the American Society for Information Science and Technology*, 50, 242–253.
- Palmer, C. L. (2001). *Work at the boundaries of science: Information and the interdisciplinary research process*. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Palmer, C. L. (2017). Information research on interdisciplinarity. In R. Frodeman, J. T. Klein, & R. C. S. Pacheco (Eds.). *The Oxford handbook of interdisciplinarity* (pp. 174–188). New York, NY: Oxford University Press.
- Palmer, C. L., & Cragin, M. H. (2008). Scholarship and disciplinary practices. *Annual Review of Information Science and Technology*, 42, 165–212.
- Palmer, C. L., & Neumann, L. J. (2002). *The information work of interdisciplinary humanities scholars: Exploration and translation*. *The Library Quarterly*, 72, 85–117.
- Pickard, A. (2013). *Research methods in information*. Chicago, IL: Neal-Schumann.
- Polanyi, M. (1966). *The tacit dimension*. Garden City, NY: Anchor Books.
- Poole, A. H. (2017a). A greatly unexplored area: Digital curation and innovation in the digital humanities. *Journal of the Association for Information Science and Technology*, 68, 1772–1781. <https://doi.org/10.1002/asi.23743>.
- Poole, A. H. (2017b). The conceptual ecology of digital humanities. *Journal of Documentation*, 73(1), 91–122.
- Poole, A. H., & Garwood, D. A. (2018). ‘Natural allies’: Librarians, archivists, and big data in international digital humanities project work. *Journal of Documentation*, 74, 804–826.
- Poole, M. S., & Zhang, H. (2005). Virtual teams. In S. A. Wheelan (Ed.). *The handbook of group research and practice* (pp. 363–384). Thousand Oaks, CA: SAGE.
- Repko, A., & Szostak, R. (2016). *Interdisciplinary research: Process and theory*. Los Angeles, CA: SAGE.
- Ross, C. (2012). Social media for digital humanities and community engagement. In C. Warwick, M. Terras, & J. Nyhan (Eds.). *Digital humanities in practice* (pp. 23–45).

- London, England: Facet.
- Rubin, H. J., & Rubin, I. S. (2005). *Qualitative interviewing: The art of hearing data*. Thousand Oaks, CA: SAGE.
- Saldana, J. (2013). *Coding manual for qualitative research*. Thousand Oaks, CA: SAGE.
- Sholtz, R. W., & Tietje, O. (2002). *Embedded case study methods*. Thousand Oaks, CA: SAGE.
- Siemens, L. (2009). It's a team if you use reply all': An exploration of research teams in digital humanities environments. *Literary and Linguistic Computing*, 24(2), 225–233.
- Siemens, L. (2010). Time, place, and cyberspace: Foundations for successful e-research collaboration. In M. Anandarajan, & A. Anandarajan (Eds.). *e-Research collaboration: Theory, techniques and challenges* (pp. 35–48). Berlin, Germany: Springer-Verlag.
- Siemens, L., Cunningham, R., Duff, W., & Warwick, C. (2011). A tale of two cities: Implications of the similarities and differences in collaborative approaches within the digital libraries and digital humanities communities. *Literary and Linguistic Computing*, 26(3), 335–348.
- Siemens, R., Dobson, T., Ruecker, S., Cunningham, R., Galey, A., Warwick, C., & Siemens, L. (2012). Human-computer interface/interaction and the book: A consultation-derived perspective on foundational e-book research. In M. Deegan, & W. McCarty (Eds.). *Collaborative research in the digital humanities* (pp. 163–189). Burlington, VT: Ashgate.
- Sonnenwald, D. H. (2007). Scientific collaboration. *Annual Review of Information Science and Technology*, 41, 643–681.
- Sonnenwald, D. H., Lassi, M., Olson, N., & Ponti, M. (2009). Exploring new ways of working using virtual research environments in library and information science. *Library Hi Tech*, 27(2), 191–204.
- Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, “translations,” and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939. *Social Studies of Science*, 19(3), 387–420.
- Strauss, A. (1985). Work and the division of labor. *The Sociological Quarterly*, 26(1), 1–19.
- Svensson, P., & Goldberg, D. T. (2015). Introduction. In P. Svensson, & D. T. Goldberg (Eds.). *Between humanities and the digital* (pp. 1–8). Cambridge, MA: MIT Press.
- Taylor, S. J., & Bogdan, R. (1998). *Introduction to qualitative methods: A guidebook and resource*. New York, NY: John Wiley & Sons.
- Terras, M. (2012). Being the other: Interdisciplinary work in computational science and the humanities. In M. Deegan, & W. McCarty (Eds.). *Collaborative research in the digital humanities* (pp. 213–230). Burlington, VT: Ashgate.
- Unsworth, J. (1997). Documenting the reinvention of text: The importance of failure. *Journal of Electronic Publishing*, 3(2). Retrieved from <https://quod.lib.umich.edu/j/jep/3336451.0003.201?view=text;rgn=main>
- Waltzer, L. (2012). Digital humanities and the “ugly stepchildren” of American higher education. In M. K. Gold (Ed.). *Debates in the digital humanities* (pp. 335–349). Minneapolis, MN: University of Minnesota.
- Weiss, R. (1994). *Learning from strangers: The art and method of qualitative interviewing*. New York, NY: Free Press.
- Wenger, E. C. (1999). *Communities of practice: Learning, meaning, and identity*. Cambridge, England: Cambridge University Press.
- Wenger, E. C. (2004). Knowledge management as a donut: Shaping your knowledge strategy through communities of practice. *Ivey Business Journal*, 1–8. January–February. Retrieved from <https://iveybusinessjournal.com/publication/knowledge-management-as-a-doughnut/>.
- Wenger, E. C. (2006). Communities of practice: A brief introduction. Retrieved from <https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/11736/A%20brief%20introduction%20to%20CoP.pdf?sequence=1>.
- Wenger, E. C., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review*, 78(1), 139–145.
- Westbrook, L. (1994). Qualitative research methods: A review of major stages, data analysis techniques, and quality controls. *Library and Information Science Research*, 16, 241–254.
- Wildemuth, B. (2009). Existing documents and artifacts as data. In B. Wildemuth (Ed.). *Applications of social research methods to questions in information and library science* (pp. 158–165). Westport, CT: Libraries Unlimited.
- Williford, C., & Henry, C. (2012). *One culture: Computationally intensive research in the humanities and social sciences, a report on the experiences of first respondents to the Digging into Data challenge*. Washington, DC: Council on Library and Information Resources. Retrieved from <http://www.clir.org/pubs/reports/pub151/pub151.pdf>.
- Yin, R. (2009). *Case study research: Design and methods*. Los Angeles, CA: Sage.

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