Introduction

Networked Work and Network Research: New Forms of Teamwork in the Triple Revolution

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Abstract
There has been more hype than evidence about networked work. The researchers in the two parts of this double issue use survey, interview, and sensor data to present systematic evidence about how networked work actually works. The first part of the issue (April) presents four articles about how professionals network. The second part of the issue (May) focuses on a particular kind of networked work—scholarly networks—including studies of how such networks change over time. Taken together, these articles show that workers tend to network with similar others. Although they integrate digital media into their work lives, they nevertheless tend to work with nearby colleagues.

Keywords
networked work, networked scholarship, proximity, diversity, teamwork

The Triple Revolution Fosters a Networked Operating System at Work
For centuries, the dominant modes of work have been lone workers—shopkeepers such as Brent LeRoy at Corner Gas, artisans such as Silas Marner at his spinning wheel, or taxi drivers (hopefully not like Travis Bickle)—small groups—such as family farms, retail shops, or artisans—and large factories, offices, or plantations—be they satanic mills in developing countries producing mobile phones, trendy Silicon Valley complexes designing these phones, or Madison Avenue men advertising them.

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Post–World War II, bureaucratic organizations have been the dominant form of North American work. In the book *The Organization Man* (Whyte, 1956), or the TV show *Mad Men* (Weiner, 2007) set in the 1960s, multitasking involved a cigarette in one hand and a notepad in the other. In-person communication was the dominant way information spread.

Compare this with today’s organizational milieus. Many people still work in bureaucratic organizations, small groups, or alone. But technology has fostered their hyperconnectivity, enabling workers to communicate by digital media as well as in-person—sometimes simultaneously (Quan-Haase & Wellman, 2006). These are more than technological changes as they affect how workers operate. Today, the cigarette has become a smartphone, the notepad a laptop, and organizations strive to include women within their structure in a more representative manner.

Such changes are part of the new social operating system Rainie and Wellman (2012) call “the triple revolution.”

1. The *Social Network Revolution*, starting at least as far back as the 1960s, has seen people change from being embedded in groups—family and community as well as work—to involvement in multiple, partial networks. There are fewer Derek Jeters, dedicating an entire career to the *New York Yankees*.

2. The *Internet Revolution* has provided communication and information-gathering capacities that dwarf those of the past. While neither Frances Cairncross’ (1997) hyperbolic *The Death of Distance* nor Thomas Friedman’s (2005) *The World Is Flat* has come to pass, networked computers easily afford connectivity that leaps large distances at a single keystroke. These computers are *personal* means; the individual, and not the work group, has become the point of contact. However, it took a while for these phenomena to be recognized as revolutionary for the organization of work. Up until the 1990s, computer scientists kept designing “groupware” to help small solidary sets of spatially dispersed workers collaborate (e.g., Mantei et al., 1992). It took the proliferation of the Internet and the normalization of its use for workers and organizations to move to more networked modes of connectivity. Now, workers seek out information and lore throughout an organization and beyond; while artisanal shops learn new tricks online and sell their products through such sites as *Etsy* and *eBay*.

3. The *Mobile Revolution* has allowed digital media to become bodily appendages, affording handy access to coworkers and information. Coworkers’ physical separation by time and space can be less important than days of yore. This is not just a white-collar phenomenon. Taxi drivers no longer brood alone, as they chatter with their friends and family on mobile phones, assembly line workers check in with family and friends during biobreaks, and mobile technology keeps long-distance truckers under constant surveillance.

Together, these three revolutions have made possible “networked individualism” where people function more as connected individuals and less as embedded group
members or lone workers (Rainie & Wellman, 2012). While many workers are no longer enmeshed in solidary groups, they are rarely alone. They become “networked workers” moving among multiple sets of coworkers, using their ties to get their jobs done, and often relying on digital media to connect to nearby and distant network members. The triple revolution makes it possible for such networked workers to move among multiple sets of relations doing different jobs. Many are also spatially dispersed “distributed workers,” communicating by digital media and using planes and cars for in-person contact.

**Part I: Networked Work**

Changing social norms have resonated with new ways of organizing that, in turn, affect how people work with colleagues; use information technology; find information, advice, and guidance; and where they set up shop. Organizations with extensive use of computer networks and mobile technologies have become “networked,” with salient changes in communications and group dynamics (Olson & Olson, 2003; Sproull & Kiesler, 1991). Over time, the triple revolution has fostered changes in the broader social context that have affected organizations’ formal structure, authority relations, and information flows.

What happens when social networks meet bureaucracy, while both social networks and bureaucracies are changing? Since the 1980s, consultants and academics proposed new post-bureaucratic forms that were the polar opposite of bureaucracies, including horizontal exchanges, permeable boundaries, flat nonhierarchical structures, and flexible autonomous workers (Drucker, 1988; Heckscher, 1994; Kanter, 1988; Nohria & Eccles, 1992). What gave the new organizational form a distinctive character was the understanding that some post-bureaucracies are “network organizations,” coordinated by social networks and better suited than bureaucracies for information exchanges (Podolny & Page, 1998; Powell, 1990). While the link between networked and network organizations, new technologies and emerging organizational forms require further research (Symon, 2000), the new organizational forms gained traction as developed countries have moved from “atom work”—growing, mining, making, and transporting things—to “bit work”—selling, describing, and analyzing things (Florida, 2002; Negroponte, 1995; Rainie & Wellman, 2012).

Buttressed by the triple revolution, spurred by the shift to a knowledge-based economy, and facilitated by technological innovations, networked work and organizations can reshape the way people and organizations function. Early evidence-free celebrations of networked work and organizations are now being replaced by more complex descriptions in which informal networks nestle within formal hierarchies in helix-like structures (Hecksher, 1994; Krebs, 2007; Stephenson, 2008); interactions are inevitably constrained (Krackhardt, 1994); communication is hierarchical (Ahuja & Carley, 1999); and exchanges are both virtual and local (Quan-Haase & Wellman, 2006). As Sproull and Kiesler (1991) predicted, many workers are no longer defined by their membership to a single work group, but by the multitude of intersecting networks to which they belong. They function as connected individuals juggling multiple projects.
and teams, some locally and others across distance (Rainie & Wellman, 2012). While we have always known that organizational networks are crucial for individual and group performance (Burt, 1992; Cross & Borgatti, 2004; Lin, 2001), participation in such networks is do or die for networked workers and organizations.

The proliferation of networked work and organizations, as well as the accumulation of relevant theory and research in several fields can now be integrated to create more systematic knowledge that builds on our understanding of post-bureaucracies, relational organizations, social capital, digital media, and innovation and knowledge exchange. Taken together, the articles in this issue present a diverse set of studies on how networked workers—and the networks in which they are embedded—operate.

Networked Work: The Articles in This Issue

Four articles in this issue examine networked work in private industry. They analyze both the antecedents and consequences of networked work, in milieus ranging from software development to manufacturing to online entrepreneurship. The authors’ data collection and analytic methods include surveys, interviews, and a pioneering use of sensor-equipped badges.

Halgin, Gopalakrishnan, and Borgatti examine a globally distributed team in a knowledge-intensive software company. They address an issue crucial for networked work: “Who can succeed in networked work?” More than in bureaucratic organizations, networked workers need to actively develop and maintain their ties with colleagues. To make matters more difficult, their success depends on connecting with multiple shifting coworkers, clients, and partners, yet they often work in temporary, spatially distributed projects where colleagues change and face-to-face interaction may be impossible. Developing the winning mix of strong and weak ties is simultaneously necessary and demanding.

Their research shows that people’s engagement in their work helps them manage their networks, thereby improving their performance. The authors use both survey and interview data to show that highly engaged individuals develop more strong ties with both local and distant colleagues, and are global brokers who coordinate work among spatially dispersed colleagues. Notably, while all employees appreciate the need to connect with distant colleagues, only highly engaged employees invest the time and effort. While the concept of networked individualism suggests that networked workers are apt to be self-driven autonomous employees, this study demonstrates how individual motivation functions in the new workplace. Although commitment has previously been shown to increase reciprocity and mutual assistance among coworkers (Frenkel & Sanders, 2007), this study makes contributions to two distinct fields: organizational behavior, regarding how motivation can lead to increased performance, and social network analysis, concerning the means by which motivation can facilitate the creation and maintenance of relationships.

Unlike the corporate organization that Halgin and associates study, Yetis-Larsson, Teigland, and Dovbysh examine entrepreneurs in networks of open-source developers—an extreme case of complexity. In this milieu, traditional structures are missing
and networks heavily determine business success. Entrepreneurs must manage involvement in multiple online networks of like-minded individuals as they move between different sets of collaborators, clients, and members of their open-source networks. This is a particularly suitable setting for the study of agency and complexity of behavior because initiative, motivation, and individual drive are especially important without the guidance of traditional organizational structures.

Yetis-Larsson and her colleagues show that these entrepreneurs embed themselves in multiple geographically distributed networks to uncover new business opportunities and access a variety of resources: information, services, and influence. Many become mediators, diffusing tensions between different groups and keeping the overall network healthy. They build their reputation and legitimacy by sharing resources and assisting network members, relying on technology for their social networking, achieving their business goals, and using digital media interactions to maintain and leverage their in-person networks. Thus, these open-source entrepreneurs are the ultimate networked workers.

Unlike the Halgin et al. article that focuses on antecedents, and the Yetis-Larsson et al. article that focuses on behavior, Chen and McDonald’s article focuses on the consequences of networked work. The authors examine a wide range of workplace arrangements and behavior: teamwork, telework, digital media use, and social capital. They demonstrate that multiple team memberships contribute to more autonomy and greater opportunities for skill development, but they find no evidence about the benefits of telework despite the extensive hype about its advantages (e.g., Nilles, 1998; Vega, 2003). The authors do not find significant differences between onsite, mixed, and home workers, informing us that “teamwork, rather than telework, is more relevant to job quality.” They conclude that networked workplaces are better for workers than traditional ones, affording more decision autonomy and better skill utilization and development.

In the last article of Part I, Orbach, Demko, Doyle, Waber, and Pentland pioneer the combination of sensor and digital data to construct a picture of informal work networks. Instead of asking people about whom they connect with, their sensors report it directly. Their study of the sales division of a global manufacturing company shows that actual communication patterns are messier than interview and survey data report, and that interactions outside of teams are only loosely guided by formal procedures. Similar to studies of housing (Festinger & Back, 1963; Michelson, 1976) and schools (Coleman 1961; Moreno, 1934), this research shows that spatial proximity within an office encourages communication—and especially enhances contact between members of different work teams.

Part II: Networked Scholarship

Part II of the double issue (May) focuses on a particular kind of networked work: networked scholarship. Why include it in an issue devoted to networked work? In fact, the editors asked this question in reverse. We started by wanting to situate our own studies of networked scholarship within the broader context of the field (see the articles in this issue by Hayat & Mo; Dimitrova, et al.).
The more we thought about it, the more we realized that networked scholarship fit into the broader context of networked work. (Indeed, scholars used to be called “knowledge workers” in Communist Eastern Europe.) Scholarly life is rarely as silent, lonely, and contemplative as popular myth has it (e.g., Lonely Scholar Salon, 2012). Effective scholars never talk only to themselves. They lecture, mentor, present papers, schmooze at conferences, gossip over coffee, blog, tweet, Facebook—and eventually publish articles and books. If scholars have a message to get out, they cannot keep it moldering in a desk drawer or on a hard drive.

Scholarly communication has mostly been in-person since Socrates strolled the agora with his disciples (Levinson, 2012). In addition to such gathering places, travel and letter writing provided longer distance contact. By 1662, English scholars had coalesced into the Royal Society, soon to be followed by French and Irish academies (Beaver & Rosen, 1978; De Sola Price, 1961).

Late in the 19th century the zeitgeist of the Industrial Revolution fostered a turn away from broadly based scholarly networks toward hierarchical bureaucratic organizations built around specializations contained in departments, faculties, and universities. The growth and specialization of the scholarly world means that researchers doing similar work usually live elsewhere, yet spatial proximity has remained a key basis of scholarly communication.

The Internet’s ability to span continents in a single keystroke has potentially minimized the constraints of time and distance, so much so that Lee Rainie and Barry Wellman (2012) proclaimed, “The new media is the new neighborhood” (p. 13), and enthusiast William Mitchell (1995) revealed that “the keyboard is my café” (p. 7). Indeed, the Internet first took off in the 1980s as a means of scholarly communication (Abbate, 1999; Hiltz & Turoff, 1993) and only opened to the public in 1992. Digital collaborative tools have fostered a continued increase in the number of papers coauthored within and across disciplines and geographic areas (Cummings & Kiesler, 2005; Olson, Zimmerman, & Bos, 2008; Rhoten, 2003). Government and foundation funders claim that the complexity of many scholarly problems can no longer be solved by a single discipline or by the specialized expertise of a single institution. They assert that they are looking for more innovative solutions, better utilization of infrastructure, and more efficient training to further promote collaboration (Hoekman, Frenken, & Tijssen, 2010; Olson & Olson, 2003). Hence, they have fostered large and complex research networks—sometimes even insisting on them. And, of course, research networks spanning continents make for splashier media coverage and enable funders to say they are tackling big, world-changing projects, all the while saving money through large-scale coordination.

Like the Crusaders of yore, scholars flock to research networks to seek adventure, discover wider worlds, gain material and intellectual benefits, and respond to their masters’ entreaties or coercion. But like the gap between the hype and reality of networked work, has the reality of networked scholarship lived up to the hope of scholars and their sponsors? Disciplines—and even subdisciplines—continue to talk different languages, have different cultures, garner different levels of funding, and produce different outputs—whereas reward structures remain within old-line departments and universities.
Scholarly Networks: The Articles in This Issue

Five articles in this issue present the latest research into the nature of scholarly networks. We start with coauthorship patterns, the tangible manifestations of scholarly collaborations. We caution that the final coauthors of scholarly papers may not be the initial collaborators in the project, and in several fields, collaborators in a project get to be coauthors without doing any actual writing.

Two articles examine coauthorship patterns in molecular and cellular biology, as well as in oncofertility. The article by Binz-Scharf, Kalish, and Paik wonders if online databases can create a more open science by fostering widespread access to data that increases opportunities for collaboration across geographic and organizational boundaries. The authors look at the implications for collaboration ranging from geographic location, interactions at conferences, institutional reputation, to scholarly prestige. Their results show that digital media has not fundamentally changed the production and dissemination of knowledge, nor has it eliminated geographic and institutional boundaries. The traditional social organization of academic institutions still affects coauthorship patterns. The authors find that distance and in-person interactions still matter. Preferential attachment to prominent scientists continues to be strong and even surpasses the reputation of their institutions. Collaboration might have become virtual, but it is not yet distance-free nor encumbered by social constraints.

Lungeanu and Contractor search for the drivers of scientific innovation in oncofertility. They compare the impact two different dimensions of diversity—distance and discipline—on collaboration. Their analysis nicely distinguishes between the impact of cognitive and geographic diversity on publications, resolving the dilemma of diversity versus similarity in innovative work. On the one hand, generating innovative ideas requires diverse ideas; on the other hand, collaboration requires the trust, ease of communication, and lack of conflict more easily found in similar people. Diversity in knowledge backgrounds fosters a recombinant range of information useful for innovation. However, the cultural similarity of working in the same country or working with prior collaborators reduces uncertainty in interactions. Cognitive diversity and national similarity both facilitate coauthorship and innovation.

Lungeanu and Contractor find that innovation is collective, based on coauthored publications. One fifth of the researchers participate in more than one team. Nevertheless, collaborative ties remain sparse in the overall network: a finding consistent with the results of Dimitrova et al. in this issue on the difficulties of starting collaboration. Similar to Binz-Scharf and her colleagues, Lungeanu and Contractor find preferential attachment: newcomers enter the field by coauthoring with existing researchers.

The final three articles in Part II are set in the more structured settings of large multidisciplinary research networks. Funded by the Canadian government, these networks have a somewhat formal structure focused on a set of substantive research questions. They function more as post-bureaucratic networked organizations than as informal research networks (see also Dimitrova et al., 2013).
Quan-Haase, Suarez, and Brown focus on an international network of researchers in the humanities studying the Hispanic Baroque period. Compared with natural scientists, researchers in the humanities neither have collaborative traditions and the need to coordinate the use of expensive equipment or data sets, nor the funding to form networks or go to many specialized conferences. The lone scholar model has remained powerful among both scholars and funders. Hence, the humanists’ shift to collaborative work and research networks has been slow.

Quan-Haase et al. found substantial variation within a network of Hispanic Baroque scholars. While most scholars had ties with a number of thematic groups, the preponderance of interactions were within teams. The most connected team was the only one that had met in a focused conference before the Hispanic Baroque network started, while the others only began to forge links between thematic groups once the network started. Proximity to researchers in the same university and city also helped connectivity. Yet, like scientists, they benefited from the expansion of knowledge that the network’s diverse ties provided. While it is too early to compare the working patterns of scientists and humanists, this study is a first step in an important line of inquiry that could foster more comparative understanding of how humanists operate as they become networked.

Hayat and Mo examine the structural constraints of advice giving and receiving. The analysis advances our understanding of the interplay between formal and informal structures, an issue that is becoming increasingly important with the shift to networked forms of organization. The authors examine advice exchanges in the Canada-wide Graphics, Animation and New Media (GRAND) research network of computer scientists, social scientists, and a few humanists. Advice exchanges are a critical aspect of collaboration among researchers—and all knowledge workers. The authors integrate two kinds of evidence—social status and network holes (Burt, 1992)—to examine advice giving and receiving among researchers.

Hayat and Mo’s results demonstrate that researchers’ advice networks are associated with their social status, although the association is contingent on the kinds of media the researchers use. Their findings capture an interaction effect between network structure and formal organizational structure, showing that status in the research network moderates the effect of e-mail communication on centrality in both giving and receiving advice. Researchers with less redundant communications give and receive more advice from diverse colleagues. However, even though giving and receiving advice are correlated, these two advice networks have distinct patterns, with giving advice more strongly related to formal status.

Finally, Dimitrova, Mok, and Wellman provide one of the few studies investigating change in network relationships over time. Analyzing the same network that Hayat and Mo study, they delve deeply into four types of interpersonal relations: acquaintance-ship, friendship, advice in relationships, and collaboration in research. They examine the personal and tie characteristics associated with changes, and the practices and experiences of GRAND researchers explaining the changes. The study distinguishes between the members’ social and professional ties, and shows different implications of
disciplinary, institutional, and geographic diversity. The tie patterns the authors reveal are complemented by the network members’ descriptions of their own relationships.

Behind the relatively static picture of the network, the authors find that ties are constantly being added or dropped. Most studies of networked research have emphasized long-term relationships among researchers and repeat collaborations. While confirming such findings, Dimitrova et al. also reveal that volatile and short-lived ties are an important part of research networks. Congruent with the findings of other articles in this issue, these scholars are more apt to weaken contact with acquaintances and friends who are distant and come from another discipline or institution. Yet, in their professional ties, researchers often look for cognitive diversity.

Conclusion

Networked work—embedded in multiple networks and reliant on Internet and mobile technology—is flourishing in the Western world, although many do not seem to be self-consciously aware that they are networked workers. While we do not have prevalence studies in this issue, the authors make it clear that the networked workers they have studied are part of a broad transformation of work and organizations. Major social trends, rooted in technological advances, organizational changes, and the turn to a networked society, are fostering its growth.

When we started editing this issue, we expected to see major differences between networked research and networked work in organizations. We were wrong. Everything we have found shows that networked scholars behave like networked workers in general. Perhaps this is because the people studied here are knowledge workers—bit workers—whether they work in universities, other kinds of organizations, or by themselves. With the shift to a knowledge-based economy in the developed world, knowledge exchanges are crucial in a wide range of social settings. The findings are thus applicable for scholarly collaborations, knowledge-intensive organizations, or more complex alliances.

This set of articles contributes a deeper understanding of power relations and the interplay of formal and informal structures to the literature on organizational behavior and organizational design. To an appreciable extent, networked work operates within the context of more traditional bureaucratic organizations. As expected, hierarchy and authority did not disappear with the rise of networked work and organizations (Ahuja & Carley, 1999; Sproull & Kiesler, 1991). Even scholars, used to connecting freely with collaborators everywhere, must work within the traditional reward and discipline structures of universities, as well as having to consider power and status differences. The Matthew effect, repeatedly uncovered in scholarly networks, suggests cumulative advantages in social capital, prestige, or performance: people like to work with those who have higher status and more network connections (Binz-Scharf et al; Lungeanu & Contractor; see also Perc, 2014). Yet power relations do not go unchallenged: in corporate settings networked workers have more autonomy—at least as measured in job decision latitude (Chen & McDonald).
Equally exciting is finding an interaction effect between social status and network structure, with giving advice more strongly related to formal status (Hayat & Mo). Social network analysts have long ago assumed the linkages between formal and informal organizational structures (Krackhardt & Hanson, 1993), yet studies rarely examined them simultaneously (Burt, 1997). If current organizations have a helix-like structure, and if performance depends more than ever on the creation and management of informal networks, understanding the interplay between formal and informal structures becomes critical. Where formal organizational structure is missing—as is the case for open-source entrepreneurs (Yetis-Larsson et al.)—networked workers take on the responsibility for maintaining the health of the broader network.

This set of articles firmly locates scholarly networks and research collaboration within the framework of networked work and organizations. Researchers collaborate with different sets of colleagues to gain information, advice, or access to equipment, which in turn enable them to do their work. Consistent with past research, studies in this issue find continuing effects of proximity, status, or country and disciplinary similarity. Unpacking the distinctive impact of cognitive diversity, as well as geographic and cultural similarity, is a key step forward in understanding this complex set of social constraints (Lungeanu & Contractor).

Taken together, these articles suggest a delicate balance between similarity and diversity. Although the virtues of diverse networks have been extensively hyped, similarity is needed as much as diversity for collaboration, coauthorship, and innovation (Lungeanu & Contractor). That is why networked workers more readily weaken ties with acquaintances and friends who are geographically distant and come from other departments and organizations (Dimitrova et al.). Too much diversity may be counterproductive by introducing too much uncertainty.

Similarly, the research presented here advances our understanding of the role of short-lived, often weaker, ties. Such ties can bring diverse ideas to networked workers (Granovetter, 1973), and they are especially important when people move between different organizations, or link different teams within organizations. Yet because they tend to operate more independently from the bureaucratic constraints that bind workers together, they are easier to let go.

The strong pattern of the Matthew effect and preferential attachment observed in these articles resonates with previous findings on hierarchy in network structure (Ahuja & Carley, 1999). That these studies uncover the existence of both structural constraints for scholars and discretion for organizational employees is more than a delightful paradox. As networked work spreads in once-bureaucratic organizations, and large networks increasingly structure once-lonely academic researchers, the working arrangements of organizational and academic workers are moving in opposite directions but becoming increasingly similar to each other.

Networked work is sometimes associated with distributed work—where coworkers are not physically collocated. Although networked workers can inhabit the same spaces, most of the studies we present show people working at a distance. Yet distance is not dead. As three articles in this issue show—Binz-Scharf et al., Dimitrova et al., and Orbach et al.—proximity continues to matter for social and work relations. Rather
than digital media eliminating distance, it is used more often to facilitate collaborations with team members who work nearby. Despite Thomas Friedman’s proclamation in 2005 that the world is flat, in fact, it is lumpy (see also Mok, Wellman, & Carrasco, 2010).

Networked workers tend to work with those who are physically nearby, have frequent in-person contact, and are in the same professions. Their similar locations and professions are important for establishing relationships and maintaining them. Yet the authors in this issue show that diversity—especially cognitive diversity—provides innovative ideas. But getting that diversity paradoxically requires trust, ease of communication, and the lack of conflict that similarity generates more easily.

The nine articles provide an important conceptual link between networked work and the even broader transformation of work that many organizations are experiencing. Networked work is part of the current changes in social reality. It is not happening in isolation, but is an integral part of the turn to a network society.

The research in this issue shows that networked work is firmly embedded in the developed world, and that it functions quite well for both networked workers and their organizational milieus. However, the research provides guidelines for the future. While traditional performance measures often discourage collaboration, institutions and funding agencies can create alternative outputs that encourage working in partially committed teams. Similarity and diversity must be balanced. People seek out similar others and trust them more. At the same time, diversity increases the range of their ideas. In-person contact seems to be a key factor: when networked workers see each other, they tend to develop stronger bonds. Contact by digital media fills in the gaps, but the more opportunities for get-togethers, the more and the better the team work. “Travel to trust,” as management guru Charlie Grantham advised in 1993.

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