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Social Technologies, Informal Knowledge Practices, and the Enterprise

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ABSTRACT

This paper focuses on the ways in which social technologies facilitate informal knowledge sharing in the workplace. Social technologies include both common technologies such as email, phone and instant messenger and emerging social networking technologies, often known as social media or Web 2.0, such as blogs, wikis, public social networking sites (i.e., Facebook, Twitter, and LinkedIn), enterprise social networking technologies, etc. We know social technologies support informal interactions over digital systems and influence informal social connections among people within and across organizational boundaries. To understand the role of social technologies in informal knowledge practices, we pursue a field study of knowledge workers in consulting firms to investigate the role of social technologies in their informal knowledge sharing practices. Our theorizing from the data is guided by the conceptual premises of sociomateriality to better understand the ways social technologies are integrated with common knowledge practices. Findings highlight five knowledge practices supported by the use of social technologies. Building from these findings we offer conceptual insights regarding the material performance of different social technologies as an assemblage.

KEYWORDS: social technologies, social media, sociomateriality, informal knowledge sharing, knowledge practices

1. INTRODUCTION

“Hey Everett, have you seen Andrew’s blog post on online project portfolio management portals?”

“No I have not, but Rob did and tweeted the top two changes. I will also put the word out to the Project Portfolio Management User Group on LinkedIn. I believe many people will appreciate it. By the way Brian just IM’d me to say that he had already commented on his blog.”

“Yes I know. That blog post sparked a lot of discussion—oh sorry! Jason just IM’d that the teleconference is about to start.”

This scenario represents a common situation playing out in many contemporary organizations:

knowledge workers employ multiple social technologies to communicate and share knowledge with one another. These organizations may vary by size and industry, but they are similar in that knowledge work increasingly manifests itself as a salient component of their processes and practices (Drucker 1999) .

Knowledge work is work that: 1) produces and transmits knowledge, 2) involves intellectual skills such as manipulation of abstractions, 3) is primarily non-routine problem solving that involves creativity, and 4) requires theoretical and technical knowledge (and formal education) (Schultze 2000).

We know knowledge work is driven in large part by workers interacting with one another and that these workers account for as much as 70% of the U.S. workforce (Aral, Brynjolfsson, and Van Alstyne 2007). Nearly 15 years ago, Komito (1998) theorized knowledge workers would spend much of their time looking (foraging) for information. This is borne out in fact: knowledge workers spend 15-30% of their time seeking specific information, though these efforts prove successful less than half of the time but account for 10% of labor costs (Mayfield 2009).

Substantial prior research indicates knowledge sharing practices in the workplace are primarily informal (e.g., Wenger and Snyder 2000; Cross, Nohria, and Parker 2002; Powell and Grodal 2005). Deloitte’s chief learning officer recently posited that 90% of all corporate learning is done informally, including information gleaned through social networks (Carr 2011). More broadly, we know a significant component of people’s social context consists of interpersonal ties they use for various information and collaboration needs. People typically rely on their social relationships to help deal with the complexity of

their jobs (Powell, Koput, and Smith-Doerr 1996). Through these informal relationships people incorporate different sets of expertise, perspectives and problem-solving capabilities into their work practices (Cross, Borgatti, and Parker 2002).

With the profusion of information and communication technologies (ICTs) in the workplace, knowledge sharing practices are increasingly digital: largely mediated and supported by an ever-widening array of “social technologies.” Organizations have long benefited from traditional, and now commonplace, social technologies such as phone and email, so it follows that they are likely to benefit from newer social technologies. Certainly, social media (which we characterize as a subset of social technologies) have encouraged new possibilities for organizational knowledge sharing. Social media uses offer opportunities for collaboration and social exchange, and are well positioned (in fact, designed) to augment and extend interpersonal social ties (Skeels and Grudin 2009; McAfee 2006).

We also know the uses of social media are both increasing and ever-more pervasive. A recent Pew Research Center report notes the number of adults using social media increased from 8% in 2005 to 65% in 2011 (Madden and Zickuhr 2011). Since the mid-2000s, social media uses have become a commonplace, if not daily, part of the social lives of millions of people. This is being seen at workplaces, as a recent study of US knowledge workers found 29% of them currently use one or more social technologies on a regular basis (Keitt, Brown, and Dang 2011).

While the evidence is clear that (1) social media have permeated most organizational settings, (2) most workers value its presence and use, and (3) most organizations realize their potential value (Bughin, Byers, and Chui 2011), our knowledge of these tools and their possible roles in these contexts is remarkably limited (Richter and Riemer 2009; Skeels and Grudin 2009). The literature on organizational impacts of social media uses to date has been primarily speculation in the professional business literature. One possible explanation for this is the growth in social media usage has largely originated outside of formal organizations, with much of the early use of these platforms by young people and students. As a result, most research on social media uses focuses on non-organizational or explicitly social contexts, and

particularly on teens' and students' uses (e.g., boyd 2008; Hewitt and Forte 2006; Lampe, Ellison, and Steinfield 2006).

What we do know about social media uses in workplaces is based on studies of organizational uses of social media which have primarily focused on a single social technology, often in isolation. These include studies of wikis (e.g., DeLuca, Gasson, and Kock 2006; Majchrzak, Wagner, and Yates 2006), blogging (e.g., Efimova and Grudin 2007), micro-blogging (e.g., Zhao and Rosson 2009; Riemer, Richter, and Bohringer 2010), corporate social networking sites (e.g., Steinfield et al. 2009; Wu, DiMicco, and Millen 2010) and public social networking platforms such as LinkedIn and Facebook (e.g., Skeels and Grudin 2009).

Such studies offer useful insights into some organizational implications of their use. But, they do not account for how these technologies are used in combination, how they are used in relation to traditional social technologies, or how workers approach using multiple social technologies. While we know most people interact with multiple ICTs (Bélanger and Watson-Manheim 2006; Kane and Alavi 2008; Lyytinen and Yoo 2002), we are unable to theorize on the potential value or implications of suites of social technologies.

We also know people often use combinations of ICTs such as email, smartphones, instant messengers, and more recently social media, to pursue goals. This suggests we should be focusing scholarly attention towards how people combine multiple ICTs to meet their goals, moving beyond studying the adoption of a single ICT in isolation. Doing so is the primary objective of the research reported here: to better understand and theorize how social technologies are used for informal knowledge sharing in organizational contexts, addressing the following research questions:

- RQ1: How do the uses of social technologies by various knowledge workers facilitate informal knowledge practices within and across organizational boundaries?
- RQ1.1: How do knowledge workers use social technologies as a whole (or in combination) to support their informal knowledge practices?

- RQ1.2: What are the affordances of social media in relation to each other and to more traditional social technologies such as email, telephone and instant messengers?

2. CONCEPTUAL BASIS

Three reasons draw us to sociomateriality as the conceptual foundation for this study. First, sociomateriality provides conceptual mechanisms to explain the way informal knowledge practices are enabled by the uses of multiple social technologies. Rooted in the sociology of science, sociomateriality posits social practices as intrinsically conjoined with the technologies in use. That is, the material (the roles played by technology) and human agency (what humans can achieve) arise and are mutually and emergently productive of one another (Orlikowski and Scott 2008).

Second, sociomateriality stands apart from socially and technologically deterministic conceptualizations. Central to sociomateriality is premise of technological affordances: what technologies achieve in practice can only be understood by focusing on their material performances, which are always enacted by humans. Performativity of technologies are not given *a priori*, but emerge through social practices (Orlikowski and Scott 2008). While technology set of material features influences the way people make sense of it and put it into use (Leonardi and Barley 2008), technological affordances – represented through technological performances – are subject to human interpretation and contextual influences. As Orlikowski contends: “human agency is always materially performed, just as material performances are always enacted by human agency” (Orlikowski 2005, p.185).

Third, sociomateriality conceptualizes knowledge as enacted in people’s practices. Practice here is defined as a “recurrent, materially bounded and situated action engaged in by members of a community”(Orlikowski 2002, 256). Sociomateriality also conceptualizes knowledge and practice as mutually constitutive. As such, knowing is inseparable from knowledge practices and is constituted through those actions. Following this focus on social practices, the unit of analysis for this study is knowledge practices, with a particular interest in scaffolding role of social technologies. This focus enables us to explore the “effective loop of insight, problem identification, leaning, and knowledge

production” (Brown and Duguid 2001, p. 202), and to examine how knowledge workers engage with different social technologies when sharing knowledge with work colleagues and other social contacts.

Of particular interest is the concept of *scaffolding*. Sociomaterial scholars see scaffolding as providing a lens for studying how ICTs can shape social practices (Woerner, Orlikowski, and Yates 2004). Just like scaffolds that support physical construction, performativity of technology scaffolds the enactment of particular social practices. Scaffolds are, in practice, diverse, heterogeneous, emergent, flexible, and exist only within of the practices they support. For example, the role of email in organizational contexts cannot be defined and explored outside the organizational practices it enables and constrains. This scaffolding can be described as diverse and flexible because organizational members use email in many different ways. According to Orlikowski (2006), the performance of scaffolds may shape practices by :

- *Extending human agency*: Scaffolding extends human agency across space (different geographic locations) and time.
- *Complementing human agency*: Scaffolding complements human agency by performing work that is difficult or tedious for humans to do.
- *Linking humans*: Scaffolding connects human agency through linking humans to each other as well as humans to artifacts.
- *Stabilizing*: Scaffolding stabilizes the dynamic interaction of humans (with each other and with artifacts).
- *Aligning relationships*: Scaffolding facilitates an alignment or realignment of relationships.
- *Transforming human agency*: Scaffolding transforms human agency, in the sense that the supported human agency is different from what can be performed without the scaffolding.

3. RESEARCH DESIGN AND METHODOLOGY

We pursued this theory-building effort with a field-based study focusing on the ways in which knowledge workers use social technologies to advance their work. The sociomateriality perspective guided our data collection and analysis. To do this we designed an interview protocol to generate narratives about how people engage in various knowledge practices, using multiple social technologies in order to acquire and share knowledge. In data analysis, the concept of scaffolding aided comparison of the role of various social technologies relative to different knowledge practices.

We began with a pilot study to help refine our understanding of social technologies in organizations, improve the data collection plans, and make sure the sampling plan would provide what we would need. We interviewed 16 individuals from five large management consulting firms. These people were selected based on purposive sampling of people who hold knowledge-intensive roles in formal work organizations. The pilot study interview protocol took about 45 minutes to complete and included both closed-ended and open-ended questions about how people obtained knowledge for accomplishing their work and how they used different technologies for sharing knowledge, communicating and collaborating with others.

The protocol was refined based on emergent themes from the pilot study and generated more targeted questions, emphasizing certain group of technologies and knowledge practices. Based on feedback from several pilot study participants, we shifted from narrative approaches to a more focused elicitation structure drawing on the critical incident technique (CIT) (Flanagan 1954). The CIT approach helped informants better focus on knowledge-intensive practices in which they needed to seek out knowledge from other people. The final interview protocol had four sets of questions (see Appendix 1): (1) about interviewees' professional background, (2) about the nature and structure of work and context of knowledge sharing, (3) specifically based on the critical incident technique (CIT), and (4) about the role of different ICTs including social technologies in work practices.

As in the pilot study, informants for the main study were identified through purposive sampling of possible contacts developed through targeted solicitation of volunteers in the work-related social networks of a wide range of doctoral students, faculty, and other professionals. This strategy generated a pool of possible study participants that is not random and therefore may not be representative of some larger population (something that future work can more directly assess). To provide some basis for comparison, informants were selected based on the similarity of their work context, the comparability of the work roles they performed and their ability and willingness to provide key information.

Participants in the main study held knowledge-intensive roles in consulting firms. The focus on consulting firms reflects guidance from literature on these archetypal knowledge intensive environments and therefore excellent places to study informal knowledge sharing (e.g., Werr and Stjernberg 2003; Empson 2001; Morris 2001; Anand, Gardner, and Morris 2007; Dunford 2000). Hansen, Nohria and Tierney (1999) note that consulting firms were among the first organizations to pay attention to knowledge management and ICTs because knowledge is pivotal to their organizational processes. More specifically, Pettigrew (1990) argues it makes sense to choose cases in which the process of interest is “transparently observable.” These contexts allow a better understanding of the use of social technologies in informal knowledge sharing and are better positioned for theory building than those in which specific effects may be more difficult to tease apart. This is a form of theoretical sampling in which cases are selected to replicate or extend the emergent theory (Eisenhardt 1989).

The goals of this research make purposive sampling an acceptable mechanism to advance formative insights from the data collected. Randomized sampling’s underlying goal (to create a representative pool of possible variations and then to generalize the results of the sample to a population) is incompatible with the research questions since it is not clear which possible variations matter. In contrast, purposive sampling is designed to help researchers gain a deeper understanding of a complex problem (such as relating to human behavior like knowledge sharing) (Marshall 1996).

The sampling approach focused on recruiting informants with maximum variations across age, gender, level in the organization (managers vs. non-managers), and adoption behaviors (adopter and non-adopter of social media). This allowed us to create a diverse group of knowledge workers to share attitudes and experiences in using social technologies for informal knowledge sharing.

Over the course of this study, we contacted 76 people whose names we obtained through our personal and professional networks. A handful of intermediaries – managers in large consulting companies and official liaisons between their organizations and universities – were instrumental in providing access to the majority of our research participants. The intermediaries took our selection criteria into account in recommending participants. Data were collected between April and September, 2011, with most interviews held by telephone.

Of the initial 76 leads, we interviewed 54 people. After the first 30 interviews we reached theoretical saturation relative to our research questions pursued in this paper. That is, we observed that new data no longer brought additional insights to the research questions and emerging themes. 30 interviews, from people in 17 different organizations, were used for this stage of data analysis. However, the additional interviews were marginally useful in that all interviews contain interesting secondary and tertiary data, and confirmed convergence. Table 1 outlines the distribution of our informants along different sampling dimensions.

Table1 Distribution of informants

Gender	Male	34
	Female	20
Level in organization	Non-managerial	32
	Managerial	22
Age	Under 30 (Min: 21)	23
	30 and above (Max: 54)	31
Adoption behavior	Users of most social media	38
	Non-users	16
Total	54	

The other 24 interviews were focused on different research topics (e.g., personal differences in using social technologies for knowledge sharing and the impact of organizational norms policies and structure on the adoption of social technologies for knowledge practices.) So, the second set of interviews was excluded from this stage of analysis, because they were only indirectly related to the research questions.

Interviews for the main study took 40 minutes on average and were transcribed verbatim. To supplement the interview data, we connected to the informants on LinkedIn and Twitter (provided that the informant gave consent and participated on these sites). This system level analysis allowed us to further observe the way informants employed Twitter and LinkedIn in their knowledge practices. During interviews, we also asked for relevant documents, such as the organization's social media policy, to better understand how consulting firms regulate the use of social technologies, and relevant rules and policies.

As is recommended for this type of research, data collection and analysis proceeded concurrently (Miles and Huberman 1994). Data analysis was inductive and iterative to identify emergent ideas, leads, and issues (Glaser 1978). This noted, data analysis was also framed by concepts of sociomateriality, as previously discussed. Doing so allowed us to produce an emergent theory regarding the use of multiple social technologies in informal knowledge practices. We used an iterative data collection process to identify and successively refine themes emerging from the interviews (Maxwell 2005, p. 63–66).

The analysis involved numerous iterations between data collection and the emerging theory. Analysis of transcripts from early interviews generated a set of recurrent themes regarding the way knowledge workers seek out knowledge. These themes were refined during the interview process to reflect both the data from the interviews and findings of the extant research (Miles and Huberman 1994). In this process, interviews transcripts were coded, and codes were organized using the qualitative research software package NVIVO 9. In analyzing the transcripts, we followed Orlikowski's (2002) process to examine how informants described and made sense of different "activities they engaged in" to obtain knowledge required for their work. This yielded a list of recurrent knowledge practices and enabling

social technologies that were characterized by their repeated presence across the data and apparent salience to how people accomplish work.

4. FINDINGS

Analysis highlights five knowledge practices which enable knowledge sharing (see Table 2). Each practice was identified based on an underlying knowledge problem, which leads knowledge workers to seek out advice or input.

Three considerations affect the analysis and interpretation presented here; 1) Informants used many different types of social technologies. Given this breadth of use, we chose to focus on technologies most commonly used by most informants to limit the analytical scope of this study, as we sought to emphasize common patterns of uses. 2) We describe these practices and respective social technologies in relation to a composite representing a typical or average knowledge worker (patterning). We recognize “typical” is, in some sense, mythical as there are evident variations in terms of the way each knowledge practice is conducted and how social technologies are used. 3) The identified practices are neither exhaustive nor exclusive. Data include examples of other practices (often singular and possibly unique) and practices identified in this discussion are not independent of each other: they typically overlap and interact both simultaneously and over time (Orlikowski 2002). For convenience we present them individually in Table 2.

Table2 Knowledge practices scaffolded by social technologies

Knowledge practice	Knowledge Objectives	Resultant knowing	Technologies commonly used
Expertise locating	Finding a relevant piece of information	Knowing how to accomplish certain tasks: <ul style="list-style-type: none"> • Codified knowledge • Directly related to work 	<ul style="list-style-type: none"> • Knowledge repositories • Wikis
Expert locating	Findings a person with relevant expertise	Knowing who holds the relevant expertise: <ul style="list-style-type: none"> • Often non-codified knowledge • Directly related to work 	<ul style="list-style-type: none"> • Email • Forums • Yammer • Twitter • LinkedIn • Corporate portals or internal social networking platforms

Reaching out	Finding the answer to a knowledge problem	Knowing how to accomplish certain tasks: <ul style="list-style-type: none"> • Often non-codified knowledge • Directly related to work 	<ul style="list-style-type: none"> • Phone • Email • Instant messenger • Twitter
Socializing	Generating, learning about, and maintaining social ties	Knowing about colleagues and other social contacts	<ul style="list-style-type: none"> • Blogs • Facebook • Twitter • LinkedIn
Horizon broadening	Finding broader perspectives on work and professional interests	Knowing how broader business and technology trends unfold	<ul style="list-style-type: none"> • Twitter • LinkedIn • Facebook • Blogs

4.1. Expertise Locating

This knowledge practice is motivated by the worker’s lack of critical knowledge to complete or advance a task-at-hand. This approach allows knowledge workers to search for and retrieve codified knowledge without having to contact the person who originally developed it. The type of knowledge shared is often codified and can be inscribed into knowledge artifacts such as templates and checklists.

When practicing expertise locating, knowledge workers may not initially draw on their personal networks for several reasons: (1) they do not want to reach out to people without having basic background knowledge, (2) they know what to search for, (3) the answer to the knowledge problem is considered explicit and requires little explanations, or (4) they may not want to incur social costs. Expertise locating builds on the concept of “knowledge reuse”-- situations in which a knowledge asset developed by one actor can be used by others in the organization (Hansen et al. 1999). The practice of expertise locating is often supported by the use of formal knowledge repositories and wikis. By most accounts, knowledge repositories are not considered social technologies (e.g., McAfee 2009); however, they appear to be the most critical ICT supporting expertise locating.

4.1.1. Formal knowledge repositories. Like most knowledge-centric firms, and more aggressively than many, consulting firms have developed knowledge repositories which offer some communicative and content-sharing capabilities for their workers. These knowledge repositories (also

known as portals or knowledge exchange systems) often rely on commodity applications such as Microsoft SharePoint. Many people do not contribute to these repositories; they are used as an information source. However, some knowledge workers contribute to the content by placing deliverable or other documents generated over the course of ongoing projects. In many projects, a common practice is to write a summary of the project work, and deposit it to a shared repository so other consultants can draw from it. In these situations, the performativity of knowledge repositories complement or extend people's capabilities with access to new sources of expertise. This approach is mediated and has little influence on interpersonal interactions. Due to their focus on content, knowledge repositories rarely advance social relationships among human actors.

4.1.2. Wikis. Wikis are typically internal-to-the-firm websites that employees could contribute to or edit without needing permission or HTML skills. Wikis are employed in consulting firms in ways very similar to the ways in which knowledge repositories scaffold expert locating practices. Wikis differ from repositories in that they allow all project members to modify content. Similar to knowledge repositories, the use of wikis scaffolds expertise locating practices by providing a shared point of reference, facilitating the storage and retrieval of expertise generated in various projects. Specifically, when people need to respond to proposals and are looking for certain knowledge elements, wikis can be used to handle projects information and documents. Our findings suggest, however, wikis are not used as social software in most consulting firms, even though the public wikis, with Wikipedia the most well-known, tend to involve meaningful social interactions.

Knowledge repositories and wikis often serve as an organization's memory, embodying past experiences and engagements (Ackerman 1998). Many workers find it useful to consult these knowledge sources before going through other knowledge practices. This suggests the practice of expertise locating may be one of the first steps in the process of knowledge sharing.

4.2. Expert Locating

Due to the special requirements of certain organizational positions within consulting firms, expertise locating was more central to the work of some individuals and less critical for others. For knowledge workers with more standardized tasks, expertise locating tended to be a larger portion of their daily work. For example, knowledge workers from tax and assurance practices often find these repositories a useful reference point regarding accounting standards. In contrast, people with non-routine work for which little codified knowledge exists tend to rely more on other knowledge practices such as expert locating or reaching out.

Expert locating is an informal and largely social process through which workers seek advice and input from other people. The situations driving this practice involve questions or problems that are often seen as too complex or nuanced to be articulated for searching in knowledge repositories. In these situations, the appraisal of the knowledge problem often also reveals that the immediate social contacts of a knowledge worker (strong ties) are less likely to have the required knowledge. This combination of need and lack drives the worker to reach out to other people in their extended social network. That is, and in the words of social network theorist Mark Granovetter (1973), they activate their weak ties, people they interact with less often.

A key resource for locating relevant experts is the seeker's personal social network. Networking was seen as relatively effective for finding the right person in the organization in many situations. The starting points are people whom the knowledge worker has come to know. And, while these contacts may not be able to help, they often point out others in the broader social network who may possess the relevant knowledge. Particular forms and features of social technologies can boost traditional social networking for locating expertise. By supporting the mechanisms underlying the social practices of expert locating, social technologies serve as a platform for supporting informal networks within and across enterprises. In this regard, multiple social technologies prove useful.

4.2.1. Email. Email use for expert locating is very common. In addition, email often acts as an introductory means to connect people. Informant 7 argued:

“I’ll get emails all the time from somebody that’s referenced from somebody else saying, you know, John mentioned your name, I should come talk to you about this type of thing; we’re looking for somebody to help us build something. Can you give us some assistance?”

Email distribution lists also play a distinct role in bridging the gap among knowledge workers who may not know each other. Informant 4 described his use of listservs for finding experts:

“Sometimes it’s based upon our problem, we can send out broadcast emails, asking people for advice, and then people can chime in.”

People also come up with improvisational uses of email for extending weak ties. For example, they can learn about new people with similar professional interests and areas of expertise when the name keeps showing up in email distribution list threads. The performativity of email links people and allow them to align their relationships. These material performances allow knowledge workers to locate experts in certain areas and exchange knowledge directly related to their work.

4.2.2. Forums. Many consulting firms have deployed internal forums. In some of these companies, these forums are integrated with an internal social networking platform or knowledge repository. In all of these cases the forum’s basic use begins with a worker posting their questions so other workers, who may or may not know the asker, can respond. Questions and answers threads are normally categorized based on common topics. With this basic structure, knowledge workers are enabled to tap into a large pool of expertise and find expert regarding a knowledge problem. Forums also provide a record of questions and respective answers. This permits people to search through the history of discussions. In this way, the use of forums can also support expertise locating practices. Users’ activities on forums can also reveal subject matter experts. Informant 26 asserted:

“Occasionally I will see someone for instance that has responded to multiple forum posts that I’m kind of guessing is an expert on the topic and if I needed more information I might e-mail that person.”

The performativity of forums therefore complements human agency by identifying experts and linking people.

4.2.3. Yammer. Yammer¹ is an enterprise social networking tool provided as a third-party service with features such as user profiles and enterprise microblogging. Yammer is used for private communication within organizations or between organizational members in pre-designated groups. Access to a Yammer network is based on a user's Internet domain, so only people with email addresses from the same company can join the networks.

Although its technological infrastructure originates outside the organization, the uses of Yammer are focused on information directly related to work. Much like forums, Yammer is considered effective for posting questions in a high visibility venue. Answers may be very short, but this use supports the practice of expert locating. As an example, informant 9, a young business analyst, needed to find a contact within a specific industry, so he posted his question on Yammer, received responses within five minutes, and was given multiple names that he could contact. This example demonstrates how the use of Yammer scaffolds the expert locating practice by extending human agency, enabling knowledge worker to locate and connect with new people in their organization.

4.2.4. Twitter. Informants who used Twitter reported that it could help find experts in their field through the process of following people who they may not necessarily have met in person but who broadcast interesting insights. Sometimes tweets addressed to a general inter-organizational audience from the same industry can result in identification of experts. Informant 15 described the way Twitter helped him find new experts on different work-related topics:

“Unless what I’m working on is confidential, or too private, I have no hesitation in just tweeting out... hey, I’m having this problem, has anybody else had this? And just, I’m always shocked, because sometimes a person that I’ve never talked to before will respond, other times like 4 or 5 people will respond from my network saying, oh, I had that same problem recently; here’s how I fixed it.”

The use of Yammer and forums are typically tied to one organization. However, as opposed to those of forums and Yammer, the performativity of Twitter provides access to an inter-organizational network of social contacts. This noted, our data shows that the older generations of knowledge workers

¹ <https://www.yammer.com/>

are not yet comfortable with work-related postings on Twitter due to concerns over confidentiality and sensitivity of corporate information.

4.2.5. LinkedIn. LinkedIn supports expert locating practices through its communities and profile search. In particular, for people with technical roles, LinkedIn communities offer forum-like capabilities where a question can be brought to the attention of members of a large community who share interests in and expertise about the same topic. Informant 16 highlighted this:

“LinkedIn has actually been very helpful, especially for commercial products [that] have communities on LinkedIn... We post to the groups in LinkedIn and get direct responses from people who are also having a problem or using a software and have to work around.”

Using LinkedIn also allows people to search or browse through profiles, even the profiles of people to whom a knowledge worker is not currently connected. Many profiles on LinkedIn present detailed and up-to-date information about people’s area of expertise and previous experiences. This creates opportunities for finding experts on a topic.

LinkedIn’s performativity relative to expert locating practices opens the possibility of extending individuals’ capabilities in finding expert on different topics and also the possibility of connecting to people who can provide valuable inputs on work-related problems from a different perspective.

4.2.6. Corporate portals and internal social networking platforms. As noted, corporate portals were often merged with knowledge repositories or social networking sites in several organizations. A defining feature of most portals and internal social networking tools is the profiles that people create and maintain over time. These profiles are mostly used by project managers in formal processes of staffing and preparing proposals, since one of their primary tasks is finding employees with expertise relevant to projects. This practice of managers is not necessarily motivated by a question or problem that can be answered by these experts, but it seeks to identify relevant people within the organization for staffing purposes. Informant 17, a senior manager, stated:

“In our recent project...the resources that we typically put on these proposals were already engaged in other opportunities, so I had to reach out these tools to find out did we have anyone with the expertise that we were looking for? Eventually we found the resources and potential candidates for the job.”

By outlining standard details such as people expertise and their certifications, profiles on these internal websites provide the search capability through which relevant experts are identified and can be contacted. A few informants conceded that they may periodically receive questions because of the information listed in their profiles on either corporate portal or an internal social networking tool.

In all of these scenarios, different social technologies scaffold the practice of expert locating through linking people and extending and complementing human agency by letting them draw on the wisdom of crowd. Through the practice of expert locating, knowledge workers could connect with others who had relevant expertise to exchange tacit and non-codified knowing that is mostly directed to their daily basis practices.

4.3. Reaching-out

The knowledge problems which motivate reaching-out practices overlap with those involved in expert locating. However, here the knowledge seekers' immediate social contacts (strong ties) possess the required knowledge. Based on previous interactions, this practice reflects a level of social awareness about the members in their social network. Knowledge workers get to know their contacts through previous projects and may stay in touch with them beyond a project. In most consulting firms, people work on numerous projects, and in doing so have the opportunity to work with new teams. Organizational members develop network ties from the first day of employment – and many consulting organizations have procedures to support such network development. Therefore, people who have been with the company for a longer time develop sizable social networks and consequently more resources. These network-driven resources provide people with confidence that there is an expert around who can be consulted for many work-related issues.

Sometimes people in a worker's social network work outside their organization (e.g., people who used to work for the same organization but have left). In this case, the links with outsiders are independent of the organization's formal structure. Informant 30 explained how he reached out to a person outside his organization for a work-related issue:

“Recently I was tasked with trying to find a vendor who could provide software that would provide statistics about our website, and I have a friend I know in my personal network who is a full time web analyst, so I reached out to her for some advice about what the best types of software products would be.”

For reaching out practices, traditional social technologies, such as phone or email, prove more useful, discussed next.

4.3.1. Phone. People often find it easy to pick up the phone and reach out to a colleague for a question. The performance of phone in most scenarios scaffolds conversations among people that know each other relatively well. It is useful in situations where the knowledge problem needs to be discussed in details. Since phone calls are synchronous, the conversation can move quickly. The performativity of the phone in this scenario allows knowledge workers to overcome space boundaries, and to extend their human agency. In particular, it is an ideal medium for conducting “verbal discussion” and interactively elaborating on complex knowledge problems that require clarifications. Informant 19 highlighted this affordance of phone conversations:

“If I’m running into an issue at work and I need some guidance from another colleague I normally just pick up the phone and dial the person and just kind of have him explain what the situation is...try to get some solid input from the person based on his or her experiences.”

Workers often draw upon the synchronous nature of interactions over the phone to deal with urgent situations and problems. Informant 24 noted:

“If it’s something that I need to get a response right now I’m going to give the person a call and say hey I’d like to talk about this, you got a few minutes to talk, so it’s mostly driven by the urgency. If you send something in an e-mail there’s a little expectation that it’s going to be not necessarily answered.”

4.3.2. Email. Email plays a critical role in buttressing reaching out practices. When a record of the exchange is desired, email proves more useful. In addition, sometimes this asynchronous communication enables the receiver to conduct extensive research before replying back. The performativity of email in reaching out practices spans both temporal and spatial boundaries. This performativity extends the human agency of sender and receiver so that they can communicate and share knowledge across different geographies and time zones. Data make it clear the informants tended to reach out to their coworkers

located in a different office via email. Unlike the phone, email creates a logbook of discussions, permitting knowledge workers keep record of the communication. In future, they can address similar knowledge problems without having to reach out to others.

4.3.3. Instant messaging. The use of instant messaging (IM) enables person A to reach out to person B for a “small question.” The use of IM supports timely, unstructured discussions around critical business issues. One informant noted that he would reach out to person B via email only if he had a more articulated idea or question, while he could “flesh out” ideas using instant messengers.

For the most part, IM allow quick communications and avoids numerous iterations through emails or other communication means. The performativity of IM in reaching out practices also extend human agency by scaffolding instantaneous, simultaneous communications. It also complements and transforms human agency because the scaffold erected using IM allows person a person to communicate with multiple people at the same time, something almost impossible without it because of the bounded capabilities of humans such as their cognitive limitations. Informant 14 delineated the affordance of IM for multitasking: “on a given day, I have like 20 chat windows open.” Although both phone and IM offer synchronous communication, enabling multitasking is considered an advantage of IM over phone conversations for practice of reaching out, as informant 24 noted:

“It’s a little easier to multitask through instant messenger, you know, just to be able to pull up a window and just hitting them. You can just still get a quick response but not without having that need for a wired connection to be sitting somewhere at a desk answering a phone.”

4.3.4. Twitter. The data make clear that younger knowledge workers are more likely to employ public social media for reaching out to their strong ties. As these platforms are public, older knowledge workers may not see them as relevant. An explanation for this difference lies in how people define friendship (Backstrom et al. 2011). This perception can lead them to assume that they can reach out to their friends on public social media, even though they have never met them. No matter where these social links are geographically located, younger knowledge workers may develop close relationships they rely upon for work-related or non-work related advice.

In addition, younger people are more likely to perceive public social media as a fruitful venue for sharing advice. An informant, who was just starting at the current company, reflected this mindset:

“I actually have a strong group of Twitter friends that, some of them, I hadn’t met until recently. My primary friendship with them is online. But we have a tight group of interests that we have in common, and we’re able to support each other in decisions we make...so, I’d say, outside of work, I use Twitter quite heavily, especially for getting advice, or if I’m thinking about something I’m wondering what other people think.”

Here, the performativity of Twitter, combined with expectations of interactivity, links younger knowledge workers with similar professional and personal interests, allowing them to collaborate even without knowing each other outside the virtual world. Therefore the social structures emerging from the younger people’s practice of “reaching out” may differ from that of prior generations of knowledge workers. Their perception of strong ties influences the way they make sense of Twitter as a useful social technology for scaffolding their practice of “reaching out.”

4.4. Instrumental Socializing

This practice is motivated by the natural need of individuals to generate, learn about, and maintain social contacts rather than resolve an immediate work problem. Through this practice, people extend or augment their personal network, making it more useful for more directed and targeted knowledge sharing in future. These social ties serve as infrastructure for most other knowledge practices that underlie knowledge sharing within and across organizations. Socializing practices often involve three types of activities:

- Generating new ties: learning about and connecting with new people both from within and outside the organization.
- Solidifying social ties: maintaining relationships with existing social ties. Through these social interactions, new and weak social ties can be transformed into strong ties over time.
- Community building: a combination of the above activities. This activity produces a deeper sense of community that provides emotional support and identity.

The primary knowing implicated in socializing practices is a heightened awareness about social contacts. This social awareness indirectly supports:

1. Expert locating practices by raising the knowledge worker's understanding of weak ties and their expertise and interests.
2. Reaching out practices by helping knowledge workers transform their weak ties into strong ties to bolster future collaborations.

Social technologies offer affordances which extend the reach of socializing practices, permitting knowledge workers to cultivate and harness social ties:

4.4.1. Blogs. In our data, the use of blogs within consulting firms is not as common as other social technologies. In most firms technological infrastructures do not offer blogging capabilities. Even within those that provide a blogging feature, employees see little value in writing and reading blog posts. This noted, 5 of the 17 firms in our sample exhibit distinct blog adoption pathways. One informant underscored the value of blogs for generating social ties:

“Most teams have <like> a blog and they’ll post regularly about things they’re working on or kind of general questions. So I follow those and will participate in cases where mine is strategically relevant, and I found that that’s a good way to make contact.”

The use of blogs in these firms also fuels a sense of community. In one case where people were generally frustrated with the existing IT infrastructure, the CIO invoked blog posts to clarify the IT strategy:

“The CIO does a really great job of blogging.... He can alleviate a lot of concerns... Everyone was clamoring for iPhones, but our CIO said I know you guys have been clamoring for the iPhone, and I can understand why. Let me tell you some of the reasons why we haven’t been doing it. There’s the security, there’s been this, and there’s been that. And I get it. (Laughs)”

These examples demonstrate the performativity of blogs in nurturing social ties within the organization. The informal nature of blog postings and resulting interactions such as people's commenting activities can create and foster informal links between different groups of knowledge workers, helping individuals with their socializing practices.

4.4.2. Facebook. Facebook is embedded into the social life of so many people across the world, many of whom are members of organizations. Unsurprisingly, we found knowledge workers tended to connect with family and friends on Facebook. Their network on Facebook may or may not include

coworkers. Connecting to coworkers on Facebook was a function of disparate strategies that individuals adopted for managing the fine line between personal and professional lives. All of our informants maintained that relationships on Facebook are largely personal, and Facebook has little relevance to their work and work-related knowledge.

Some organizational members “friend” close coworkers with whom they have already developed rapport outside the virtual world. The use of Facebook allows people to strengthen these social ties while people are kept updated regarding each other’s personal lives. Informant 19 pointed out:

“What’s great about Facebook is the fact that someone can put all their pictures of their kids up, and I can meet them in the airport and be like, Oh, I saw the pictures of your kids. And the conversation at the airport can be 2 minutes. That conversation in the airport before was perhaps an hour, right? And so that’s very good for casual connections, and for the connections that you really wanna maintain.”

The performativity of Facebook allows knowledge workers to keep abreast of what’s happening in their personal networks. Even though it may not be directly related to their work, it still helped them when they need to reach out to these social ties for work-related knowledge problem. More understanding about people’s personal interests always help informal discussions, supporting social ties that serve expert locating and reaching out social practices.

4.4.3. LinkedIn. Unlike Facebook, LinkedIn is primarily used for maintaining (and sometimes generating) professional ties. Organizational members connect with colleagues, clients, and others outside the organization with whom they meet or with whom they share professional interests. Relative to generating professional ties, LinkedIn has a feature which suggests adding people with similar professional interests. For example, Informant 23 explained:

“I logged on to update my LinkedIn page, it pops up that you might know any number of these people... I actually connected with another lady here who’s with the University and we started to get to know each other and see if there were any business opportunities between the two of us. So it has helped me meet some new people that it has presented me, but I haven’t gone and searched necessarily.”

LinkedIn is useful for keeping organizational members updated about colleagues’ current positions and engagements as they move among jobs and companies, which is quite common in the US job market.

In addition to these uses, some people also employ LinkedIn as a networking and community building tools. Some informants noted that active participation in the LinkedIn communities may lead to professional face-to-face meetings, consequently bringing about more networking opportunities.

The performativity of LinkedIn is directed towards professional networking and professional links. These performances scaffold socializing practices by extending people capabilities in forging, maintaining, and augmenting professional ties.

4.4.4. Twitter. Since connections on Twitter revolve primarily around shared interests, people are presented with the opportunity to open up relationship with like-interested individuals through replies or “retweets.” One technical informant (informant 15) characterized the way a common interest in a database technology enabled him generate an important social tie:

“Hadoop is a database technology, and I saw someone on Twitter talk about how he just implemented his first usage of Hadoop. And because of that, I was able to connect with him and reach out, and we were sharing contacts, and information about that.”

For younger workers, the use of Twitter scaffolds their community building. For example, one informant noted the use of Twitter for keeping in touch with peers who work for the same company:

“So I was in training with these people for a month. There are people from India, China and all around the world, and social media has allowed us to keep in contact and keep up to date with each other’s lives, so that it feels like we’re all working together still. ... They work with us all on a day to day basis, and you don’t notice the fact that they’re actually around the world.”

Although internal social networking technologies are designed and intended to support socializing practices and informal knowledge sharing among employees, our data showed little success in this regard. On the contrary, public social media are more promising and instrumental for supporting socializing practices. The performativity of these tools enable people to overcome the limits of traditional networking mechanisms and strategically extend their social network.

4.5. Horizon Broadening

Horizon broadening practices are rarely motivated by an immediate knowledge problem. More often, this practice reflects a personal desire to learn about things beyond the immediate demands of

work-at-hand. What comes from this practice may be directly related to work, though it is rarely immediately applicable. Because market, technological and business landscapes keep shifting, knowledge workers feel the need to keep updated and social channels serve as a valuable means for doing this.

Informant 18 noted:

“There’s actually a specific goal that’s gathering data from outside of our company. The goal isn’t necessarily about relationships but it’s about having a really clear understanding of what’s happening in the broader marketplace and that usually happens because of good relationships.”

The following social technologies serve as conduits and scaffold horizon broadening practices.

4.5.1. Twitter. For many people, Twitter serves as a news aggregator. Twitter’s interactivity allows users to contribute to discussions, “retweet” others’ posts, and learn about new ideas and new people. We found knowledge workers often use Twitter for keeping up with technology and business trends. Many perceive the content they share on Twitter as much more professional and topic-centric than what they exchange on Facebook. Via Twitter, they are constantly updated about both industry-centric information and specific developments about technologies. One informant noted:

“Rather than having to go to trade journals and resources of news of professional or otherwise, I have the news come to me by selecting who to follow.”

Using Twitter allows workers to follow interesting topics and interesting people. An instrumental mechanism to learn about interesting people is the retweet feature which enables people to re-broadcast tweets. Retweets contain the information of the originator, helping people learn about thought leaders on certain topics.

4.5.2. LinkedIn. Professional communities on LinkedIn provide people with a sense of what other knowledge workers with similar positions or in similar organizations engaged in, allowing them to maintain their awareness of current trends and innovative ideas. Profiles of people working in other organizations can be equally illuminating. Informant 27 discussed how she was inspired by reviewing other people’s profiles:

“[By reviewing profiles] you get to know if someone, very good or at a very high level, what certifications he’s doing, but there are some certifications that you even won’t know, and that you’ve come to know from the other people’s profiles on LinkedIn.”

LinkedIn communities as well as profile information create avenues for monitoring and learning about broader trends happening outside the organization.

4.5.3. Facebook. While most uses of Facebook were personal, a few informants share or receive information indirectly related to their work. One senior manager explained how he shared work-related publications with a broader audience on Facebook:

“Sometimes when I have new publications, new white papers, we normally publish that also on Facebook, so the people who know me they get to know this and I have also some colleagues and professional ties that benefit from that.”

Another respondent noted his consulting firm encouraged people to post news from regular emails from the company on their Facebook pages or on Twitter. So, the performativity of Facebook emerges as a vehicle for supporting horizon broadening knowledge practices.

4.5.4. Blogs. Blogs were a particularly useful social technology for horizon broadening. In the companies from which our informants were selected, internal blogs were not considered a primary source: most used external blogs to receive updates about these trends as this enabled them to prepare for future knowledge problem:

“So it’s good to know just a little back pocket information. ... to understand that in the IT space the new buzz word is cloud computing and to monitor the conversation around it, so that if we do get a project that’s related to cloud computing or something of that nature you’re not just totally in the dark; you’re a little bit more proactive to the research before it actually lands on your desk for a project.” (Informant 24)

The performativity of public social media such as Twitter, LinkedIn and Blogs creates an infrastructure through which knowledge workers *pull* information, extending their ability for staying in touch with trends that in long term influence their work. In addition, a broadened horizon influences professional development of individuals, creating the opportunity for them to reinvent themselves. In this way, the broad type of knowing deriving from knowledge practice of horizon broadening could transform human agency.

5. DISCUSSION

In Table 3, we summarize the affordances of each social technology based on its material performance in different knowledge practices, and describe types of social contacts and respective knowing mediated by the use of these technologies.

Table 3 The affordances of technologies regarding different knowledge practices

Technology	Knowledge practices	Performativity	Types of social contacts	Primary type of knowing
Telephone	Reaching out	Extending human agencies	Coworkers and other social contacts known relatively well	Expertise and advice directly related to a knowledge problem
Email	Expert locating Reaching out	Extending human agencies Linking humans	Coworkers Personal and professional contacts outside the organization	Expertise and advice directly related to a knowledge problem Confidential information Information about social contacts
IM	Reaching out	Extending and complementing human agencies Transforming human agency	Coworkers known relatively well	Quick questions and answers
Forum	Expert locating	Linking humans	Colleagues from the same organization	Quick pieces of advice More awareness about weak ties within the organization
Knowledge repositories and portals	Expertise locating	Extending and complementing human agencies	Lack social mechanisms for connecting people Formal and project-centric ties	Relatively static information on people areas of expertise Information on staffing and current and past engagements
Internal social networking platforms	Expert locating	Linking humans	Coworkers	Awareness about coworkers' interests and areas of expertise
Facebook	Socializing Horizon broadening	Linking humans Aligning relationships	Family and friends Close colleagues	Updates about personal life Information indirectly influencing people's work
Twitter	Expert locating Reaching out Socializing	Aligning relationships Linking humans Extending human agency Transforming human agency	Like-interested individuals	Innovative and groundbreaking information, indirectly influencing people's work Awareness about thought leaders on certain topics or within certain industries
LinkedIn	Expert locating Horizon broadening Socializing	Aligning relationships Linking humans Transforming human agency	Professional contacts from multiple organizations	Updates about professional contacts Topics discussed on professional communities Information on job opportunities
Yammer	Expert locating	Linking humans	Interpersonal contacts within the same organization	Quick pieces of advice More awareness about weak ties within the organization

Blogs	Socializing Horizon broadening	Aligning relationships Linking humans Transforming human agency	Like-interested individuals	Technology and business trends Awareness about like- interested individuals
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Studying the uses of social technologies provides us with the opportunity to understand how they are related in practice. We call the relationships among these the “relational affordances” of social technologies. Our analysis of the relational affordances of multiple social technologies and the ways they are used in combination highlights two important dimensions of these relationships: competition and interoperability among social technologies. These two dimensions help us understand how relative affordances of social tools are enacted in practice.

5.1. Competition among Social Technologies

Our analysis leads us to conclude that social technologies “compete” with one another for the attention of the worker. That is, knowledge workers constantly compare the functional capabilities of available social technologies and perceive one more effective than others in supporting knowledge practices. A social technology “wins” the competition (is used) only if its inscribed material properties prove more relevant to certain knowledge practices. It is noteworthy that these properties do not determine social practices but prove useful only when they translate into effective material scaffoldings in practice.

This study is motivated in large part by the dearth of insight on relative affordances of social media in knowledge sharing practices. Based on our findings, the following patterns outline the relative affordances of social media, cast as the competitive advantage of these technologies. While recognizing the competition among social technologies, we use the following patterns to explicate the affordance of social media in comparison to more traditional social technologies.

5.1.1. Social media provide advantages for expert locating and socializing. Presently, email is considered the single most common social technology in organizations (Dabbish et al. 2005). Several researchers argue that notwithstanding the pervasive use of email in organizations, social media may provide distinct affordances for certain knowledge sharing practices (e.g., McAfee 2009; Zhao and

Rosson 2009). Consistent with this premise, our findings highlight that a primary advantage of social media over email is creating an information platform for expert locating. Informant 1 noted:

“It’s gotten easier to get in touch with other with these tools. I don’t like telephone and email; that used to be the main way. Now I have a wealth of tools. I am tired of telephone and email. Because they are one way; I want it to be a community of ideas. ... I like more community conversation.”

5.1.2. Social media provide advantages for creating social awareness. A primary contribution of both public and corporate social networking platforms is heightened awareness about groups of social contact and colleagues. This is an important function because people have limited social and cognitive capabilities for maintaining a large number of social ties and keeping themselves constantly updated about social contacts (Dunbar 1998) The use of social media can result in more knowledge about people who are adjacent to knowledge workers’ personal network. Informant 8 indicated how the awareness about professional contacts directly impacted his work:

“So for example, we were interested in pursuing business with the National Energy Resource labs, and so in that particular case, I was able to leverage LinkedIn, and found some former co-workers of mine that are currently working there. This is an external person, he did not work for my current company; so somebody I’d worked with previously.”

One dimension which distinguishes social technology from another is the type of social relationships that they support or leverage. For instance, social relationships affiliated with LinkedIn are dominantly professional, whereas social interactions enabled by Facebook are primarily related to personal ties. Between these two poles, emerging social technologies such as Google+ are designed to relate to both personal and professional social relationships. Although we observed very little use of Google+, our speculation is that it will likely enable the further erosion of the line between these two spheres.

5.1.3. Social media provide advantages for infusion of innovative ideas. The uses of social media contribute to the transfer of innovative idea through scaffolding horizon-broadening practices, primarily by helping people grow the number of weak ties and also leverage this network to get one’s ideas circulating. This is consistent with what is already known about weak ties (Obstfeld 2005). In

many instances, social media are useful for nurturing weak ties, and therefore they facilitate the transfer of innovative knowledge. While workers draw on strong ties for work-related advice that directly influences their work in reaching out practices, they also benefit from creative and innovative ideas shared through weak ties enabled by social media. Informant 1 explained:

“Sometimes during the day at work, you are busy with your work and project, but you need time to sit back and envision and focus on where you want to grow as a person and as an employee. I use my external channels to get that type of information. The social tools offer the ability to have this global perspective when you talk to different people from different countries, different cultural backgrounds. You get a whole different view of the world.”

5.2. Interoperability and Convergence across Social Technologies

Different social technologies may be independent and discrete. But, their interoperability in day-to-day use makes such distinctions less meaningful in practice. In practice, interoperability among multiple social technologies serves as *combinatory material scaffolding*. For many knowledge-sharing problems, people take advantage of the differing capacities and capabilities of various social technologies. In other words, the scaffolding constructed by a single social technology is not likely viable enough to support knowledge practices. In this type of situation, one tool cannot simply win over others, so must forge alliances with other tools, creating combinatory material scaffolding.

This combinatory scaffolding can be concurrent or sequential. That is, knowledge workers may opt to pair technologies simultaneously or sequentially. In simultaneous pairing, people engage in communication with “nearly synchronous” social technologies of different types (Reinsch, Turner, and Tinsley 2008). A common example of concurrent pairing is using IM to share screens while the two people are on the phone at the same time discussing the document. Here the performativity of phone in this reaching out practice is not sufficient; therefore, it is paired with the performance of the instant messenger to effectively scaffold the entire practice.

In sequential pairing, people choose a social technology for communication at time one, then follow with a second technology, on the same issue, at a later time (Leonardi et al. 2011). Our data reveal informants often drew upon different social tools sequentially to conduct their communication and

knowledge sharing practices. For example, they found contact names on internal social networking platform or on LinkedIn, but contacted them via email. The first social technology allows them to locate new individuals in the organization or elsewhere, while email provided a private, dyadic channel to convey a specific message or request. In another example of sequential uses, person A emailed a Powerpoint deck to person B for feedback. Then A called B and the two discussed what should be changed. In this common scenario, the material scaffolding was constituted of both artifacts and the performativity of each tool complements what is offered by the other. The use of email initially helped them discuss the problem, transfer the file, and schedule the phone call. The phone call helped the two individuals discuss their problem simultaneously. These emergent combinatory scaffolds help extend human agencies.

Concurrent or sequential uses of social technologies also showcase a trend to technical convergence: multi-communicating or mediamorphosis (see Fidler (1997)) is to be engaging in two or more overlapping synchronous conversations with multiple people using different technologies. And, we know convergence uses are becoming increasingly common at work (Reinsch et al. 2008). Convergence takes places when multiple technologies come together and form a combinatory technological platform with the advantages of all of them.

Convergence makes distinguishing among social technologies even more difficult and blurry. However, it is important to note that, even though we juxtaposed several social technologies, they should not be viewed as entirely separate and mutually exclusive. Email communication or forum-like-types of social interactions as means of communication are offered by many social technologies. For example, most social networking sites such as LinkedIn and Facebook now offer private messaging capabilities (similar to email) or features that can be effectively viewed as micro blogging capabilities. These social networking sites offer multiple means of communication beside their core technological affordances outlined above. These new technologies serve as nexus of multiple social technologies convergences. This all suggests that integrated technological platforms which offer multiple modes of social

communication (i.e., Facebook and Goolge+) for differing types of knowledge practices will likely appeal to more knowledge workers compared to standalone and separate technological platforms.

6. CONCLUSION

This study makes clear the information ecology around knowledge workers is constituted of several social technologies. These social technologies both mediate social interactions with other people and facilitate knowledge sharing practices within and across organizational boundaries. Data also make clear that social technologies are often used in conjunction with both other social technologies and existing organizational communication and information infrastructures. This suggests we should conceptualize social technologies as an assemblage – an evolving collection of specific tools – which embodies interactions among technologies themselves. Table 4 compares our research approach (study of technologies in combination) with common studies of single technologies.

Table 4 Two approaches to the study of technologies in organizations:

Approach to the study of technologies in organization	Conceptualization of technologies	Problematization	Research focus	Organizational Setting
Examination of technologies in combination	Technologies as assemblages	Competition and interoperability among technologies	Simultaneous or sequential use of multiple technologies	Ubiquity of technological artifacts
Examination of individual technologies	Singular technological artifact	Freestanding technology	The selection and use of only one technology at a time	Dominated by one technology

The contribution this research makes to theory lies in its conceptualization of social technologies as assemblages in knowledge practices in organizations. By examining the uses of a single technology, we lose the bigger picture regarding the knowledge workers' intentional uses of multiple social technologies in knowledge practices. And, in focusing on the combined uses, we learn social technologies are used in

concert to scaffold organizational practices. Studies of technologies in the workplace traditionally center on the use of a handful of technologies.

This insight stands in contrast with much of the published research on workers' relationships with freestanding social technologies (e.g., Efimova and Grudin 2007; Wu et al. 2010; Zhao and Rosson 2009). The study of social technologies seems less amenable to the isolated analyses that have permeated the organization and technology research for decades. In this paper, by building from sociomateriality, we proposed an alternate, holistic conceptualization of how multiple social technologies are used in combination, and how their relational affordances are enacted in knowledge practices in the workplace.

The findings reported here give rise to an emergent theory about the potential roles of social technologies in knowledge practices of consulting firms. This emergent theory requires additional elaboration and testing. A second limitation of this approach is its exclusive focus on the affordances of social technologies for knowledge practices in organizations. Further research is needed to examine the implicit and explicit costs of social technologies adoption in organizations (Skeels and Grudin 2009). An examination of both costs and benefits of social technologies will provide us with a more holistic understanding about the pros and cons of these technologies in the workplace. Finally, another limitation of this study is the difficulty to disentangle enduring social practices from current temporary technologies without a longitudinal study. We acknowledge the fact that the nature of technologies may change; therefore, our research focus is on enduring social practices and mechanisms by which transient technologies can support these practices.

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APPENDIX 1: INTERVIEW GUIDE

General questions about the interviewee's (your) background and work:

1. To start, could you please tell about your professional and educational background, and your current position
 - <Probes>
 - <Questions on education (majors)>
 - how you got into your current position
 - How long have you worked for this organization?
 - What positions have you had in this organization?
 - What about age, gender, race (which all matter in ICT uses)?
2. What kinds of work do you do? Is it done in groups or mostly alone?
 - <Probes>
 - Are the groups stable or project oriented? Are you on more than one project/task/group at a time?
 - Do you spend time at client sites?
3. Do you have people reporting to you, do you have one or more bosses?
4. How willing are you to try out new technologies?
5. Do you consider yourself an introverted or extroverted person?

Context of knowledge sharing

6. That is, for some of the questions I want to explore, it is easier for you to ground your responses in a particular situation or scenario. So, can you give me an example of the time when you need to seek out advice or inputs from another person to do your work?
 - In responding to this need, how did you use your personal network?
 - For obtaining work-related information, what type of people would you often go to?
 - Are these interactions primarily face-to-face?
 - When are face-to-face interactions not effective for getting advice?
 - In that type of situation, what are the primary digital technologies that you would use to reach out to others and share knowledge?
 - Do other people get in touch with you for getting advice?
7. Do you use specific social networking mechanism to expand your social network? (e.g. networking events)

8. Would you turn to your connections outside the organization to solve any work-related issue? Do social media help with this?

Question about the adoption of social technologies

9. What tools do you use to interact with others?

10. Could you tell me which Web 2.0 tools your organization is currently using internally?

Now I list the tool you just mentioned and a few others; and then I ask similar questions regarding each technology:

General questions (the same for all the tools)

11. Do you use this tool? How do you use it?

- How frequently you use the tool?

12. Who are you connected with on this tool / who do you interact with using this tool/media?

13. What type of information do you send or receive via this tool/media?

14. Does this information influence your work?

- a) Directly b) indirectly c) not at all? In what ways?

15. What are your primary reasons for using (or not using) this tool?

- <probe> How it compares with other communication media such as telephone, email and face to face interaction?

Technology /Medium	General questions	Specific probes
Telephone Video conferencing	Question 11-15	Do you use your office telephone differently from your cell phone while at work?
Email or list serves?	Question 11-15	Is the company email different from the personal email? Do you check both on your smart phone
Instant messengers / Skype?	Question 11-15	
Knowledge exchange systems (portals)	Question 11-15	Do you use the interactive features like forum
Internal social networking platforms	Question 11-15	Do you participate in communities enabled by these tools? Does it help you find and connect with new people?
Facebook	Question 11-15	Do you friend your coworkers on Facebook? How many friends on Facebook?
LinkedIn	Question 11-15	Do you connect with coworkers on LinkedIn? Do you participate in LinkedIn

		communities? How does it help you connect with new people?
Twitter	Question 11-15	
Yammer	Question 11-15	Are you a member of Yammer communities?
Blog within and outside the organization	Question 11-15	
Wikis within the organization	Question 11-15	wiki use related to work

16. Do you use any of the above applications on your smartphone?

17. Do you use these tools in combination? (e.g., reusing your communication on one media on another one)?

Now, I'd like to specifically focus on the use of social media or Web 2.0 (i.e. blogs, wikis, Facebook, Twitter)

18. When and how did you encounter social media?

19. How have these tools changed the way you keep in touch and interact with others?

20. Optional follow-up probes:

- Do social media help you find new people in your organization?
- In general, what are your primary reasons for using or not using social media

21. What do you think is important about the use of social media at work that we have not talked about?

22. Who else in the organization do you think might be willing to talk to me about this topic?

23. How can I get a copy of the social media policy?