Social Media and Shared Cognition:

Exploring the Effects of Network Expansion, Content Integration, and Triggered Recalling

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Abstract

This study is organized around two goals. The first goal is to determine whether employees who have access to social media are more likely than employees who do not to develop shared cognition – similar perceptions of what and whom people in the organization know. The second goal is to explore what behaviors associated with social media use allow employees to develop such shared cognition about their coworkers' knowledge and social structures. Given the distinct, yet complementary nature of these goals, I conducted a multi-methodological, longitudinal field study of the use of one type of social media – a social networking site – by employees at a large financial services organization. This study takes advantage of a comparative analysis in which only one of two matched-sample groups within the same organization was given access to the social networking site for six months; the other group was not. The findings show that users of the social networking site developed their cognition through three interrelated processes – network expansion, content integration, and triggered recalling. Because all members of the organization enacted this process with data from the same common pool (content on the social networking site), their cognitions became shared. A difference-in-differences estimation showed that shared cognition developed much more strongly over six months in the group that used the social networking site than the group that did not use it.

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Peyton is a senior marketing manager at a large financial services firm in the mid-western United States. She prides herself on being "easy to get along with" in the workplace. But she constantly battles with her boss over which employees should be assigned to various marketing projects. As Peyton recounted:

> My boss and I get into it all the time... He asked me who we should put on this project. I told him we should put Luke on it. He said Luke doesn't have the expertise the project requires. I said he did. Then he said to put Chloe on it. I said that Chloe didn't have enough connections to people in Finance to get the right input. He said she did. So we ended up compromising. We chose Rhea. She wasn't as good as either Luke or Chloe probably, but we could both agree on what she could bring. I don't know why we can't see eye-to-eye. In the end, we both agreed the project wasn't as good as it could have been with Rhea on it. She just wasn't the right choice. It made me mad.

A significant body of research suggests that Peyton and her boss do not see "eye-to-eye" because they lack shared cognition. Shared cognition is often defined as "the knowledge that team members hold, which enables them to form accurate explanations and expectations for the task and in turn to coordinate their actions and adapt their behavior to demands of the task and other team members" (Razzouk and Johnson 2012: 3056). The case of Peyton and her boss showcases two important attributes of shared cognition. The first attribute is a common perception of who within the organization has certain kinds of knowledge. This type of cognition about who knows what in the organization is often referred to as a cognitive knowledge structure (Contractor and Monge 2002). The second attribute is a common perception of who within the organization has relationships with whom. This type of cognition is called a cognitive social structure (Krackhardt 1987). As her description makes clear, Peyton and her boss hold different cognitive knowledge and social structures; they do not have common perceptions about who at the organization knows what and whom. Research shows that shared cognition of knowledge and social structures by team members can result in a variety of positive organizational outcomes, including increased team performance (Moreland, Argote and Krishnan 1996), enhanced leadership skills (Burke, Fiore and Salas 2003), improved task efficiency, (Park 2008), heightened sense of shared identity (Swaab, Postmes, van Beest and Spears 2007), faster time to market of new products (Ensley and Pearce 2001) and improved job satisfaction (Bonito 2004). Studies find that without shared cognition, members of teams, departments, and sometimes entire organizations, end up mired in debate and make sub-optimal decisions - much like Peyton and her boss (Cannon- Bowers and Salas 2001).

How do employees develop shared cognition? Research on groups and teams has shown that people tend to develop shared cognition when they have shared experiences with others (Resnick 1991; Thompson and Fine 1999). Training sessions are one example of such shared experience. When people are trained together they are exposed to similar stimuli at the same time and encode those stimuli together (Moreland 1999). Working together on joint projects is another example of a shared experience. When people work together on a project they can observe the competencies their coworkers have and see them enact their knowledge in practice (Reagans, Argote and Brooks 2005). They also learn through discussions with them about others with whom they have worked in the past and those with whom they are friends (Monge and Contractor 2003). Proximity also places people in similar situations where they share experiences. When people work in close physical proximity to others they see each other completing tasks (Knoben and Oerlemans 2006), see who their coworkers talk with (Perlow and Weeks 2002) and engage in many informal water cooler-type discussions where they share information about what they know and with whom they communicate (Palazzolo, Serb, She, Su and Contractor 2006). Together, such evidence suggests that shared experience is one of the primary antecedents of shared cognition in the workplace.

But in today's organizations, it is difficult to have shared experiences with a wide range of people. Employees in the same organization often work in different offices or in different parts of the world, a facet of organizational life that reduces the amount of time in which people can come into physical contact with each other to share experiences (Saunders and Ahuja 2006). Also, when communication occurs at a distance, it tends to happen over technologies that do not foster shared experience. Studies of teleconference and videoconference use in meetings show a decidedly small amount of informal communication amongst participants and a lack of co-orientation and mutual understanding (Kraut, Rice, Cool and Fish 1998). Studies of dyadic exchanges via email and instant messaging also show quick interactions, often wrought with misunderstandings and misattributions that act as roadblocks to shared experience (Cameron and Webster 2005). As a result, employees have increasingly smaller circles of coworkers with whom they have shared experiences and they learn more about what and whom fewer people know in the workplace (Hinds and Bailey 2003). When employees do find themselves on cross-functional teams, they do not have a common set of experiences on which to draw to develop shared cognition and thus often

end up employing boundary objects to allow themselves to work together productively *without* the need to share experiences (Leonardi 2011).

Given that the distributed nature of work is unlikely to decline, and that the opportunity to engage in shared experiences in the workplace is unlikely to improve, how might employees in contemporary organizational settings develop shared cognition with more than a very small subset of their coworkers? Recent research on the use of social media in organizations suggests that these new technologies may provide certain capabilities uncommon to more traditional communication technologies that can enable shared cognition. By providing a common virtual platform on which members of the organization can interact with each other regardless of their location by sending messages, posting pictures and other documents, chatting, and commenting on each other's content, social media can create a collective space for the enactment of shared experience (Majchrzak, Faraj, Kane and Azad 2013). But in addition to helping employees engage in shared experiences directly, regardless of their locale, social media provide the opportunity for employees to observe the experiences that are occurring amongst others. Such third-party observation of what content coworkers communicate to others and to whom they communicate that content can allow individuals to participate vicariously in the experience and interactions of others (Leonardi, Huysman and Steinfield 2013). Thus it seems possible that through the combination of both experiential and vicarious interaction with coworkers via social media, employees may be able to engage in the kinds of shared experiences with a broad range of coworkers that aid in the development of their own cognitive knowledge and social structures. And, importantly, if multiple employees from around the organization are drawing on the same interactions occurring on social media to form their cognitive knowledge and social structures, those employees may develop shared cognition about who knows what and whom in the organization.

This study is organized around two goals. The first goal is to determine whether employees who have access to social media are more likely than employees who do not to develop shared cognition – similar perceptions of what and whom people in the organization know. The second goal is to explore what behaviors associated with social media use allow employees to develop such shared cognition about their coworkers' knowledge and social structures. Given the distinct, yet complementary nature of these goals, I conducted a multi-methodological, longitudinal field study of the use of one type of social media – a social networking site – by employees at a large

financial services organization. This study takes advantage of a comparative analysis in which only one of two matched-sample groups within the same organization was given access to the social networking site for six months; the other group was not. Interviews with and surveys of members of both groups before the implementation of the social networking site and six months after its introduction provided a comparative basis for understanding what role the technology played in the development of shared cognition across the organization.

Shared Experience, Shared Cognition, and Social Media Use

The boundaries of shared cognition typically appear around small task-based teams (Thompson, Levine and Messick 1999). It is no surprise that members of small teams are able to develop shared cognition because they engage in many shared experiences, which research shows is the predominant antecedent of shared cognition (Thompson and Fine 1999). Members of small groups typically attend meetings together (Jackson and Klobas 2008), rotate through projects together (Pinto, Pinto and Prescott 1993) and their ego networks tend to be dense and are characterized by communication and interaction that reinforces particular ways of thinking and acting (Katz, Lazer, Arrow and Contractor 2004). Members of small teams are often co-located such that these shared experiences can happen frequently without the hindrance of traditional communication technologies, and if they are not co-located their small numbers make it easy to travel frequently and visit with one another, producing more occasions in which shared experiences can occur (Hinds and Cramton 2013). But as several scholars have suggested, shared cognition beyond small teams - at the scale of the department or division within the organization - is equally important for organizational performance (Jarvenpaa and Majchrzak 2008; Ren and Argote 2011). In fact Ren, Carley and Argote (2006) showed that the positive effects of shared cognition on efficiency and productivity actually increase with the size of the group.

As attractive as the idea of shared cognition at units greater in size than small teams might be, Ren and Argote (2011) suggest four reasons why shared cognition is difficult to achieve at scale. First, the practices that occur across the organization are more varied than those that occur within small groups. Consequently, employees often have more trouble "identifying who knows what in the organization than in small work groups" (p. 218). Second, organizational departments and divisions consist of multiple subgroups with less communication and knowledge sharing occurring across them than is typical within subgroup boundaries. Consequently, people have less likelihood

of engaging in shared experiences with others outside of their small work groups. Third, organizations are increasingly geographically distributed and rely upon communication technologies to locate and share information that do not facilitate shared experiences. Fourth, knowledge sharing is easier in small groups because trust and familiarity encourage interaction and communication in ways that enable people to develop shared cognition. As these drawbacks suggest, developing shared cognition on a departmental or divisional scale is much more difficult to achieve than the development of shared cognition at the scale of a small team where shared experiences are common.

Typically, interaction that occurs through communication technologies has been considered much less capable of facilitating shared experiences than face-to-face, in person interaction (Rice 1992). But recently, a number of studies have shown that social media, such as social networking sites, blogs, micro-blogs, and wikis provide a number of features through which people can share in experiences together (Hampton, Lee and Her 2011; Kane, Alavi, Labianca and Borgatti 2014). Social media have begun to enter the workplace at tremendous speed. Chui and colleagues (2012) estimates that 72% of companies deploy some form of social media. According to Leonardi, Huysman, and Steinfield (2013: 2), social media allow workers to: (1) communicate messages with specific coworkers or broadcast messages to everyone in the organization; (2) explicitly indicate or implicitly reveal particular coworkers as communication partners; (3) post, edit, and sort text and files linked to themselves or others; and (4) view the messages, connections, text, and files communicated, posted, edited and sorted by anyone else in the organization at any time of their choosing. Importantly, social media sites also provide a forum for public communication among employees (DiMicco et al. 2008). When two people share messages with one another, those messages appear on the communicators' personal profile pages, or "news feeds." On many social media sold specifically for enterprise use, or enterprise applications that are built in-house, the interactions that occur between two people in the organization can be seen by all of those peoples' contacts, and, if the appropriate settings are applied, by everyone in the organization. These characteristics of social media suggest two possible avenues through which employees may develop shared cognition.

The first avenue through which use of social media in the workplace may lead to the development of shared cognition is through the creation of shared experiences with people from across the organization. In contrast to most contemporary communication technologies used in organizations that are *channels* through which people simple

communicate, social media are *platforms* on which people interact (Leonardi et al. 2013). Platforms are sites of interaction. Conference rooms in office buildings are platforms, so are employee offices and corporate research laboratories. On these platforms, people discuss, debate, negotiate, present artifacts, co-orient to objects, provide instantaneous feedback, and build off one another's comments in real-time. Channels like email, instant messaging, and the telephone do not provide opportunities for these kinds of interactional achievements, but social media do (Treem and Leonardi 2012). The threaded nature of communication allows multiple parties to engage together in discussion in real time and to build on their interactions cumulatively through feedback and joint sensemaking (Ellison, Gibbs and Weber 2015). Individuals can also quickly learn about their communication partners by perusing their profiles and online repositories during interaction. Also, people can post work artifacts such as documents, code, or pictures of hardware and link those posts to their discussion threads (Jarrahi and Sawyer 2013).

Several authors suggest that an important characteristic of social media as platforms that extend even the capabilities of traditional face-to-face platforms is the persistent nature of contact they afford (Gibbs, Rozaidi and Eisenberg 2013; Hampton et al. 2011). Unlike other communication technologies, which enable people to communicate from person-to-person, social media afford people with the ability to communicate from person-to-network. The low-cost, broadcast nature of person-to-network communication affords persistence of interaction because people are able to maintain contact with each other without having to spend valuable time and resources to maintain relationships as they would through other forms of communication (Kane et al. 2014). In other words, on social media platforms it is easy to engage in numerous "lightweight" shared experiences with *many* others that help people to see the world in similar ways than it is to engage in "deep" shared experiences with *few* others (Nardi 2010). Consequently, the number of people with whom an individual can have shared experiences that can result in shared cognition is likely much greater on social media than it is in face-to-face contexts or through other communication technologies (Oh, Eom and Rao 2015).

The second avenue through which use of social media may enable the development of shared cognition is through vicarious involvement in other people's shared experiences. Due to the open nature of the platform, people's conversations, posts, documents, commentaries, and articulated networks (e.g., who people indicate are their friends or co-workers) are visible to all other members of the organization. Consequently, an employee can easily act as a

voyeur, eavesdropping on the conversations of others (on social networking sites such people are typically referred to as "lurkers"). As Hampton (2016: 111) explains, this type of voyeurism is easily accomplished via social media and is often quite unintentional because information on these technologies cascades quickly and visibly across social ties:

> [T]he articulation of relations through social media often allows people to navigate social ties through second and third degrees of visibility. In this way, contacts from an organization or other foci of activity not directly articulated are accessible through friends-of-friends. You may never truly lose contact with friends, including those who are "unfriended" through social media and those who are never directly articulated, because awareness continues through mutual acquaintances and shared and persistent content.

In this way, users of social media are constantly involved in and are observers of the experiences of others. In the context of the workplace, this means that employees who use social media not only have the opportunity to share experiences with others directly, but they also have opportunities to participate, vicariously, in the shared experiences that others - who are located either near or far, or who work in their same division or in another division - are having on the platform.

Numerous lines of organizational inquiry, including situated learning (Lave and Wenger 1991), managerial cognition (Gioia and Manz 1985), and strategy (Baum, Lu and Usher 2000) have shown that vicarious participation in the behaviors and interactions of others is a reliable way to learn and develop individual or organizational level cognition. Given the reliability of vicarious observation, as individuals partake in experiences that are shared with others across the organization, they will likely develop accurate perceptions of what people do and who they know (Huber 1991). Importantly, if many employees in the organization are participating vicariously in the same interactions occurring on the company's social media platform, it would stand to reason that their cognitive knowledge and social structures would develop similar profiles. For example, if employee A and B had a shared experience on the company's social networking site that was observed by employees C, D, and E, those three voyeuristic employees would be observing the same shared experiences to construct their perceptions of who knows what and whom. Because social media provide a common platform for interaction, those employees do not have to draw on separate observations of or experiences with employees A and B to develop their perceptions of what and whom they know, which could lead to differences in the formation of their cognitive knowledge and social structures and, hence, divergent cognition. But when those employees participate vicariously in the same experiences, their cognition is more likely to be shared because it is built upon the same foundation (Manz and Sims 1981).

Although the foregoing discussion suggests that employees may be able to use social media to develop shared cognition, success is by no means assured. Research has shown that many users of social media in organizations tend to communicate with and observe those whom they regularly communicate with offline (Brzozowksi 2009). That is, people's communication partners on social media are often the same people they talk to through other channels. If employees' social networks are duplicated in this way, the use of social media would not likely allow people to expand their direct or vicarious experiences and develop cognition that is more shared than if they were not using the technology. Also, no matter whether employees are interacting with each other directly on social media to created shared experiences, or whether they are participating, vicariously, in the shared experiences of others, research on social media use suggests that the content of those interactions is likely to be different than interaction would be in face-to-face settings or over traditional communication technologies like email (Gibbs et al. 2013). Many messages that are posted and most interactions that occur on social media platforms tend to be staccato-like. That is, they provide brief bits of information in an episodic manner (Carr and Walther 2014). As Hampton (2016: 111) describes, users of social media platforms outside of organizations tend to communication in "short, asynchronous exchanges of text or photos… The content of messages that contribute to pervasive awareness includes those that, on face, might appear trivial, for example, a photograph of a meal, as well as those that are more likely to be described as important matters, including political, health, financial, or relationship content." If employees ignore this seemingly trivial information or fail to stitch it together into a coherent whole, use of social media will not likely lead to the development of shared cognition.

Given that social media may provide important avenues through which to develop shared cognition that is broader than the level of a small work group, but that the ways existing evidence shows that people use these new organizational technologies might undermine this possibility, I ask the following research questions:

1) Do employees who use social media at work tend to have higher levels of shared cognition with their colleagues than employees who do not use social media?

2) How do direct and vicarious interactions with others on social media enable employees to develop shared cognition?

To answer these two questions, I turn to a quasi-natural field experiment conducted in two matched-sample groups in a large financial services firm located in the mid-western United States.

Methods

Field Site and Research Design

The organization, called American Financial (a pseudonym), specialized in direct baking and payment

services and was one of the largest credit card issuers in the U.S. The credit card issuing side of the company had

receivables of more than $46 billion in 2012 (the year this study was conducted) and the deposits side had $18 billion

in consumer deposits and originated more than $5 billion in personal and student loans. At the time of this study,

American Financial employed more than 15,000 employees who worked across eight different countries.

In the final months of 2011, company executives decided to implement a social media platform - an internal

social networking site - to improve knowledge sharing across the company. The hope, as one executive commented,

was that the social networking site would "get people talking across departments within their divisions and across

divisions of the company and share knowledge. We find that traditional databases don't work well and communities

of practice are only so good. So, we hope being more social will lead to knowledge sharing." The company began

working with an external software vendor to customize their social networking site for American Financial. The new

technology, branded "A-Life" (short for American Financial Life) was strikingly similar in appearance and

functionality to Facebook. Each user had a profile page on which he or she could list a job title and department

affiliation, and to which he or she could post pictures or documents. The profiles pages were public so that anyone in

the company could access them. In addition to the profile page, users also had a newsfeed (what users called a

"wall") to which they could post thoughts, ideas, descriptions of work, or simply communicate with co-workers.

Users could also specify a list of "colleagues," similar to "friends" on Facebook. Unlike on Facebook, where users

can limit the visibility of their profile page and newsfeed to people who are not on the "friends" list, users at

American Financial could still visit the profile and newsfeed pages of anyone in the company even if they did not

choose each other as "colleagues." But, choosing someone as a colleague did have a consequence in that the posts

that a colleague made and communications a contact had with others would appear on the newsfeed of any user who

claimed that person as a contact. Also, unlike Facebook, there was no capability for users to send private messages to

coworkers, regardless of whether that coworker was a contact or not. All messages sent and received were posted on

the dyads' respective newsfeeds and those newsfeeds could be seen by anyone at the company who was not a contact

of one of those individuals in the dyad simply by going to one of those individuals' newsfeeds directly. Employees typically left the A-Life application open on their desktops all day.

Company executives decided to first roll out A-Life to employees in their leadership rotation program for high potential employees. New hires that were accepted into the program spent two years rotating through three departments within one of the organization's divisions. American Financial created the leadership rotation program to expose future leaders to the work conducted in multiple departments and to create a community of practice. During and after their rotations, program members were given unprecedented access to company executives, participated in extensive professional development classes, and attended regularly scheduled workshops and speaker events designed specifically for the program Through these practices, individuals interacted with all current and alumni members of the program across its ten cohorts within a specific division. As one executive explained, "because the leadership programs were already communities of practice, we thought A-Life would do the most good there because people generally know each other across departments even thought they don't always know what other people do. So they would be willing to use A-Life and hopefully gain some initial benefits."

One of the first leadership rotation programs to receive A-Life would be in the Marketing division. The leadership program in Marketing was an ideal context for this study. The group was small enough such that one could reasonably expect that anyone in it could know what and whom a large number of others in the group knew. But the group members were distributed across 12 different departments within Marketing, so they did not necessarily know each other very well. Further, at 44 members, the leadership program group's size was consistent with the size of groups reported in the literature on which successful analyses of cognitive knowledge structures (Yuan, Fulk, Monge and Contractor 2010) and cognitive social structures (Casciaro 1998; Krackhardt 1990) have been performed. Finally, because the group had been selected as a user community for the A-Life pilot study, but had not yet seen or begun to use the technology, a pre-/post-implementation research design could be employed to examine changes in the level of shared cognition among employees associated with implementation and use of the social networking site.

In order to attribute changes in the shared cognition to A-Life, however, required more than just a pre/post research design. It was also necessary to compare whatever changes may have occurred in Marketing with whatever

changes might have occurred in another group that did not use A-Life so as to demonstrate that an increase in shared cognition attributable to the use of A-Life was not attributable simply to the passage of time. Fortunately, another leadership rotation program in the Operations Division served as a strong comparison. The Marketing and Operations groups represented a matched sample in that the two leadership program groups had nearly identical demographic profiles in regards to age (Marketing, M = 26.2, SD = 3.4; Operations (M = 26.9, SD = 3.2), gender (Marketing = 53% female; Operations = 48% female), ethnicity (Marketing, 68% White, 14% Asian, 10% Hispanic, 8% Other; Operations = 71% White, 18% Asian, 7% Hispanic, 4% Other) tenure at the company (Marketing, M = 4.3 years, SD = 4.1; Operations (M = 4.8 years, SD = 3.9), hierarchical level (Marketing, M = 4.9, SD = 1.9; Operations (M = 4.2, SD = 1.3), and job performance ratings (Marketing, M = 8.8/10, SD = 0.9; Operations (M = 8.6/10, SD = 0.7). The Operations groups had 50 employees spread across one more department than in the Marketing division. Directors of the two leadership programs agreed that the level of work complexity was also similar across both divisions. Importantly, the Operations group would not receive A-Life during the same period that the Marketing group would. And, preliminary interviews indicated that employees in the Operations group did not talk with or know informants from the Marketing group, which reduced the possibility that changes that occurred in one of these groups would somehow be dependent upon or affected by changes occurring in the other. Most importantly, the Operations group would not receive A-Life during the time of this study.

To answer both research questions necessitated collection of two different kinds of data. For the first research question, which asked whether employees who used A-Life would have greater degrees of shared cognition with their colleagues than employees who did not use social media, required numerical data. Consequently, I employed a survey aimed a tracking shared cognition over time within the two groups. The second research question, which asked what kinds of behaviors or practices employees conducted when using social media to develop cognitive knowledge and social structures, required data that could uncover employees' behaviors and practices. To this end, I collected and analyzed data obtained from 68 interviews of 34 employees (each employee was interviewed twice) in both the Marketing and Operations groups during a six-month period. Below, I explain the collection and analysis of the survey and interview data separately.

Collection and Analysis of Survey Data

Data Collection. In December of 2011, a survey was administered to each member of Marketing and Operations. In addition to demographic information, data were collected on what respondents believed to be areas in which they were most knowledgeable, what areas they believed each of their coworkers in their respective leadership program were knowledgeable about, who they considered to be a friend at work, who they believed were their coworkers' work-related friends, who they sought advice from about work-related matters, who they believed their coworkers' sought advice from, and with whom they had worked on a project team at some point at American Financial. The survey had a very high response and completion rate of 93% (41/44) in Marketing and 90% (45/50) in Operations. A-Life was implemented in Marketing only in early January 2012.

At the end of June 2012, six months after A-Life was implemented in Marketing, but before Operations began to use the technology, a second survey was conducted with both groups. Questions from the first survey were repeated verbatim. Several additional questions about A-Life use that emerged from the second round of interviews were asked of Marketing. Due to the longitudinal design of the study, only individuals who completed the first survey were invited to respond to the second survey. 85% (35/41) of respondents in Marketing and 91% (41/45) of respondents in Operations returned a completed survey in the second round. To avoid approximating for missing data, which can affect the validity of the accuracy scores used as dependent variables in this study, only respondents who completed both survey 1 and 2 were included in the analyses presented in this paper.[1]

Shared cognition is the overarching dependent construct in this study. In line with the theory outlined above, shared cognition was operationalized as the similarity in cognitive knowledge structure and cognitive social structure amongst employees in a particular organizational division.

Similarity of Cognitive Knowledge Structure. The first dependent variable is the degree of similarity in cognitive knowledge structure between individuals within both the Marketing and Operations groups. Each respondent was asked to write in three self-generated pieces of task-related knowledge about which he or she considered him or herself to be an expert. Respondents were then given a list of each other person who worked in their division (Marketing or Operations) and asked to write in, for each of those people, three pieces of task-related knowledge about which those people had expertise.

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[1] Consequently, the remainder of individuals in Marketing (*n*=9) and Operations (*n*=9) were excluded as option choices for respondents when calculating the dependent variables described below.

A dyadic approach was used to calculate similarity among informants in their perceptions of whom within their group was an expert on which topics. There were 595 possible dyads among the 35 respondents from Marketing and 820 possible dyads among the 41 respondents in Operations, for a total of 1,415 total of possible dyads in the study population. Two independent raters who were graduate students took the answers provided by each respondent in a given dyad about what types of task-related knowledge others in his or her division possessed and compared these answers to the answers to each other. For example, if one respondent in the dyad said that person X was an expert in search engine optimization and the second respondent in the dyad said that person X was also an expert in search engine optimization, a score of 1 was assigned. If both members of the dyad were in agreement on all three pieces of knowledge held by person X the overall score for the dyad was a 3. If they were only in agreement about two pieces of knowledge held by person X, the overall score for the dyad was a 2, and so on (e.g., possible scores were 0-3). This process was repeated to determine the dyads' similarity of perception of every other person's knowledge in their division. The similarity between the numbers of correctly identified pieces of knowledge for all members of the division was calculated for each dyad by obtaining a Person's correlation coefficient. This coefficient represents the degree of similarity in cognitive knowledge structure between each dyad in each division. This coding was completed at Time 1, before A-Life was implemented, and at Time 2, six months after A-Life was implemented.

Similarity of Cognitive Social Structure. The second dependent variable is the degree of similarity in cognitive social structure between individuals within both the Marketing and Operations groups. Following prior studies, the advice network was chosen for this analysis because as the instrumental, workflow-based network of the organization, the advice network serves as the primary conduit linking people who can provide help in accomplishing key work tasks (Blau 1955; Constant, Sproull and Kiesler 1996). To perform this analysis, I adopted a cognitive social structure approach (Krackhardt 1987, 1990). Following the work of Casciaro (1998), the individual cognition of work-related advice networks was measured through a questionnaire in matrix format. In the advice network, each person k was asked whether he or she thought that person i in his or her division (Marketing or Operations) sought task-related advice from person j who was also in the same division. When the answer was positive, person k placed a check in the cell of the advice network matrix that corresponded to a relation going from i

to *j*. This process was repeated such that each respondent in Marketing evaluated his own advice seeking relations, as well as those of his 34 coworkers, while each respondent in Operations evaluated the advice seeking relations of his 40 coworkers in addition to his own. The result was the creation of a network of the perception of advice relations in each division for each respondent. In short, there were 35 cognitive social structures in Marketing and 41 cognitive social structures in Operations.

For each dyad in Marketing and each dyad in Operations, a Pearson's correlation coefficient was calculated, which represented the similarity between the two individuals' cognitive social structures. To produce this correlation coefficient, I employed the Quadratic Assignment Procedure (QAP: Hubert and Schultz 1976). QAP calculates a Pearson's correlation coefficient between corresponding cells of two data matrices, in this case, the cognitive social structures held by *i* and *j*. Because network data are relational, the values in each cell of an adjacency matrix are not independent of one another, so estimation procedures designed for independent observations will calculate incorrect standard errors. QAP is a resampling-based method, similar to the bootstrap, for calculating the correct standard errors. QAP calculates Pearson's correlation coefficient between corresponding cells of two data matrices. The procedure repeats these calculations multiple times by holding the structure of one matrix constant and randomly permuting the rows and columns of the other, thus testing if the association between the two networks is statistically significant. The result is a correlation coefficient, which is the measure of similarity in cognitive social structure for each of the 595 dyads in Marketing and each of the 820 dyads in Operations.

Explanatory Variables. A number of additional possible explanatory variables were included in the analysis. These explanatory variables were determined based on responses from the interviews at American Financial and from studies published in the literature that discussed the ways the typical ways (absent use of a social networking site) in which employees develop shared cognition. People who have been in the organization for some time may have more accurate metaknowledge through simple exposure to others (Blau, 1955). Tenure was measured by the number of months of employment at American Financial. The variable *Tenure Dissimilarity* was measured as the difference in tenure between a respondent and a contact. Also, people who are higher-up in the hierarchy may have a broader view of who has worked on what and with whom, and consequently more accurate metaknowledge (Heald et al., 1998). Hierarchical Level was demarcated by one of eight possible hierarchical levels within American

Financial that respondents in Marketing or Operations could attain. *Hierarchical Dissimilarity* was measured as the difference in hierarchical level between a respondent and a contact. The company's human resource department provided data about tenure and hierarchical level.

People who sit in close proximity to others may learn "who knows what" and "who knows whom" through chance hallway encounters or by overhearing or seeing coworkers in conversation with others (Palazzolo et al., 2006). Using a scaled seating chart diagram provided by the company, I was able to calculate the number of meters between the desks of each respondent in the study, *Proximity* is the distance, in meters, between the desks of a respondent and a contact.

Individuals may also learn who and what others know if they have worked together with them on teams (Ren and Argote, 2011). The term "project team" was a specific term used at American Financial that referred to a departmental team assignment. To determine who had worked with whom on a team, respondents were presented with a roster of everyone in their division and asked to indicate those individuals with whom they were currently working or had worked on a project team in the past. Each respondent's response was compared to the responses of the people they selected and only those who selected each other were considered to have worked together on a team. *Common Team Membership* is a dummy variable, where a 1 indicates that a respondent and a contact worked together on at least one team and a 0 indicates that they had not.

Individuals may learn what and whom others know because they are friends at work and, consequently, share information or gossip about coworkers and the tasks they conduct (Krackhardt, 1990). *Friendship relations were* assessed by asking respondents to look down a list of coworkers from their division and place checks next to the names of people they considered to be personal friends. *Friendship Relationship* is a dummy variable, where a 1 indicates that a respondent and a contact indicated that they consider each other friends and a 0 indicates that there is no mutual agreement about friendship in the dyad. Another way in which people may learn what and who others know is by being sought often for advice about work related issues (Blau, 1955). *Advice Relationship* is a dummy variable where a 1 indicates that, between a respondent and contact, at least one of the two communication partners has sought advice from the other and a 0 indicates that neither has sought advice from the other.

Data Analysis. A difference-in-differences estimation was used to test the effect of social networking site use on change in shared cognition from Time 1 (before A-Life was implemented) to Time 2 (six months after A-Life was implemented) (Cameron and Trivedi 2005).The estimation was conducted on the observations of 1,415 dyads. Change in *Similarity of Cognitive Knowledge Structure* and *Similarity of Cognitive Social Structure* were calculated by subtracting the values obtained for each variable at Time 1 from the values obtained at Time 2. A difference-in-differences evaluation tests the impact of a program or treatment on an outcome *Y* over a population of individuals *T* who have either received a treatment (*T*=1) or who have not (*T*=0; the control group). Observations are made in two time periods, $t = 0,1$ where 0 indicates a time period before the treatment group receives treatment, i.e. pre-treatment, and 1 indicates a time period after the treatment group receives treatment (i.e. post-treatment). Every observation is indexed by the letter $i = 1, ..., N$, such that individuals will have two observations each, one pre-treatment and one post-treatment. Thus the outcome Y_i is modeled by the following equation,

$$Y_i = \alpha + \beta T_i + \gamma t_i + \delta\ (T_i \cdot t_i) + \varepsilon_i$$

where α = constant term, β = treatment group specific effect (to account for average permanent differences between treatment and control), γ = time trend common to control and treatment groups, δ = true effect of treatment, and ε_i is a random, unobserved "error" term that contains all determinants of Y_i the model omits. The specific difference-in-differences estimator is defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment,

$$\delta_{DD} = Y_1^T - Y_0^T - (Y_1^C - Y_0^C)$$

where all subscripts correspond to time period (1,0) and superscripts to treatment status (T=treatment, C=Control).

Collection and Analysis of Interview Data

Data Collection. In December of 2011, semi-structured interviews were conducted with 16 employees from Marketing and 18 employees from the Operations leadership program groups (hereafter, simply Marketing and Operations) to learn about their normal patterns of communication and the various technologies they used to share knowledge. Each interview lasted between 40 and 70 minutes, with an average length of 50 minutes. The interviews followed the same semi-standard protocol that was comprised of four major sections. In the first section, informants were asked general information about their background and past work experience. Questions such as "What do you

do in your job?" and "What does it take to be successful in your current role?" were aimed at soliciting from informants their opinions of the skills necessary to do their work. In the second section, we asked specific questions about information and data they use at work. Questions like, "What type of information or data do you think is most important for being a good _____ (insert job title)?" and "Are some people at American Financial more knowledgeable in certain areas than others?" were meant to encourage informants to discuss their needs for information and data to complete their work. The third section asked them about the kinds of people they interacted with on daily basis, how they interacted with them, and how they knew to interact with them. Questions like "How do you decide who you will talk with when you're working on a project?" "What kinds of technologies do you use to interact with others?" and "What kinds of technologies do you use to learn about the interactions occurring among your coworkers?" were intended to capture informant's strategies for communication, interaction, and learning. Finally, the fourth section asked them specific questions about various technologies they used at home and at work, their perceptions about social media technologies generally, and their perceptions about the role of technology in successfully executing their work tasks.

Six months after Marketing began using A-Life, a second round of interviews was conducted with the same 16 employees from Marketing and 18 employees from Operations. Both Marketing and Operations employees were administered the exact same interview protocol as in round one with additional questions asking them to explicitly consider similarities and differences in communication and knowledge sharing since the last interview. Employees in Marketing were also asked specific questions about how they used A-Life over the previous six months. In total, across the two rounds of interviews with both Marketing and Operations, 68 interviews were conducted. With the consent of the informants, all of theses interviews were audio-recorded and later transcribed verbatim to aid in analysis. In total, 473 pages of single-spaced interview transcripts were produced, which served as the raw data used for analysis in this study

Data Analysis. The logic of this research design was to be able to isolate the effects of the development of cognitive knowledge and social structures enabled by social media use within Marketing through a two-way comparison (e.g., Miles and Huberman 1994). The diachronic comparison (comparison over time) facilitated understanding of what changes to work occurred in Marketing after the implementation of the social networking site.

The synchronic comparison (comparison with another group at the same time) between Marketing and Operations both before the implementation of the technology and after six months of use facilitated an understanding of what changes in Marketing resulted from social networking site use as opposed to simply broader organizational changes or changes due to natural increases in learning amongst coworkers due to six additional months spent working together. In other words, comparing the experience of people in Marketing and Operations at two points in time helped to bring into focus the nature of changes that occurred in Marketing, the only group to use the social networking site. A-Life was implemented in the Marketing Division only in January of 2012. Data analysis proceeded through three sequential phases, which are outlined in Table 1.

INSERT TABLE 1 ABOUT HERE

The goal of the first phase of data analysis was to uncover the mechanisms by which use of the social networking site enabled people to participate in shared experiences with co-workers directly, or to observe a shared experience occurring amongst others and thus participate vicariously in that shared experience. I began the analysis with the process of theoretical coding. Glaser (1978), suggests that theoretical coding is a useful strategy when the analyst has a concept he or she is looking to learn about by examining the data. I began by examining the interview transcripts in Marketing only from the interviews that were conducted six months after A-Life was implemented. I identified each instance in which employees talked about their participation (direct of vicarious) in shared experiences on A-Life and I applied codes to each of these instances that indicated what was the theme or topic of the experience, the way that experience was carried out on A-Life, whether their participation in that experience was direct or vicarious, and what they learned about the actor(s) involved in that experience. In total, 27 distinct codes were produced in these various categories. The next step of analysis - axial coding - involved putting the coded data back together in new ways by grouping codes that were conceptually similar (Strauss and Corbin 1998). Axial coding resulted in a reclassification into two main codes indicating whether or not informants recognized that they had perceptions of what and who people across the organization knew that were similar to the perceptions held by their co-workers (recognition of shared cognition, lack of recognition of shared cognition), and five main codes indicating how informants developed shared cognition due to direct and vicarious participation in shared experience on A-Life. This round of coding revealed no discernible differences in whether differences in direct or vicarious

participation in shared experience was related in anyway to these three codes. To be sure, I conducted one more around of open and axial coding and again found no discernible difference in the data.

The goal of the second phase of data analysis was to confirm that the codes described above about the shared experiences that employees generated on a A-Life as well as the codes describing the processes they went through to develop that shared cognition were indeed specific to Marketing at Time 2. Following the process of analytical induction (Glaser 1965), I examined all the other transcripts (Marketing before implementation of A-Life and Operations at both time periods) to ascertain whether the practices that individuals in Marketing conducted after using A-Life were similar or different to the practices they conducted before A-Life and that their counterparts in Operations performed at either time. To verify that the five practices employees in Marketing conducted were confined, specifically, to the period of use following the implementation of the social networking site, I followed the same process outlined earlier by comparing these codes to codes generated in the other interview transcripts. I used a conservative estimate to determine whether changes uncovered through this process of coding were specific to the Marketing group. Specifically, I sought to determine if discussions of these five practices were present in fewer than 25 percent of the interviews conducted in Marketing before implementation of the social networking tool, or in Operations at either point in time. If they were, they would be excluded from further analysis. Following procedures outlined by Patton (2002) I chose this 25 percent threshold because, given the trends uncovered in the first phase, any practice discussed by fewer than one quarter of the informants did not appear to be widely spread and thus not likely to be employed regularly. In short, given the trends in this dataset, it was not a consistent finding. Two of the five practices were mentioned in just 12 percent of interviews in Operations at time 2, so they were excluded as findings - leaving only three main practices linked to the use of the new technology in the development of shared cognition in Marketing (network expansion, content integration, and triggered recalling).

Atlas.ti software was used to create and manage all the theoretical and axial codes in each round of coding described above. To verify the accuracy of these codes, two research assistants repeated the coding procedure undertaken by the first author using the detailed codebook (descriptions of each code) that was created in the Atlas.ti software. To ensure consistency, the author initially reviewed the codes applied by the two researchers after they had completed coding five randomly assigned transcripts. These discussions were held to help the researchers to come to

agreement on the proper interpretation and application of each code. The researchers then recoded the five initial transcripts and all subsequent transcripts. At the end of this process, a Cohen's Kappa was calculated to determine the extent of agreement amongst the three coders (the author and the two researchers). The final Cohen's Kappa was a very acceptable .83 (Fleiss 1971).

Effects of Social Networking Site Use on the Development of Shared Cognition

The first research question asked if social networking site users would tend to have higher levels of shared cognition with their colleagues than employees who did not use social media. One reason to suspect that use of social networking sites would enable employees to improve their shared cognition was that the technology's features can help employees to engage in shared experiences – both directly and vicariously. Through such shared experiences, and the observation of the shared experiences of others, users may be able to develop a sense of what types of knowledge their coworkers had. In other words, the social networking site can provide a common platform for shared experiences that can be accessed by every user – in this case, employees in the marketing division. As a senior marketing manger observed, this important point separated A-Life from other communication tools:

> If someone sends a message to someone else over email, who knows it? Only they do. I can't see it. So they have this experience and it's theirs. If they send that same message on A-Life I can see it. So can everyone else. We can all be in on that experience. A-Life is unique like that. It's like everyone has the same window into what is going on at the company. There aren't any closed doors.

Another user expressed a similar sentiment:

> With A-Life it's like we're all drinking from the same pond. It's a common gathering ground and you know if you saw something on there, everyone else did too. And if you did something on there, everyone else saw it. So I think it just makes us all be more on the same page.

Of course, A-Life was not the only medium for communication at American Financial. Employees still interacted with their teammates regularly via phone, IM, email, in conference rooms, and in trips to each other's desks. But if as these two informants suggest, A-Life provided the ability or employees at American Financial to draw from the same pool of resources when forming their cognitive knowledge and social structures, it would stand to reason that there would be some degree of convergence in users' views of what and whom other users knew that would not have been possible before A-Life was implemented nor would it be possible for groups not using A-Life.

Correlations among the variables used to explore whether use of the social networking site would lead to similarity in peoples' social cognition are presented in Table 2. Table 3 summarizes the results of the difference-in-

differences estimation, which tested whether the treatment condition (social networking site use) predicted change in the similarity of employees' cognitive knowledge and social structures. As the results show, the only predictor of change in similarity from Time 1 to Time 2 was the treatment condition. In other words, the analysis indicates that the mean value of shared cognition (measured as similarity in cognitive knowledge structure and cognitive social structure) within Marketing at Time 2 differed significantly from the expected mean value at Time 2 based on the trend in Operations across the two time periods.

<div align="center">INSERT TABLES 2 AND 3 ABOUT HERE</div>

These results suggest that employees in Marketing drew from their common access to shared experiences on A-Life when developing their individual perceptions of who within the organization knew what and whom. Consequently, the data show that social networking site use was the only variable to predict a significant increase in similarity of cognitive and knowledge structures during the six month period immediately following the implementation of A-Life.

As a partial empirical check on this conclusion, consider the following comments made by members of the Operations group about how they developed their own individual cognition about other people's knowledge and social structures. As one operations manager noted,

> I mean I really just know the people on my team. I've been on a few other teams over the years so if you asked me to find an expert, I would probably know really well what those 10 or 15 people do but the rest would be me mostly just guessing or going off of something I've heard.

Another manager concurred with this assessment:

> I'd really like to be able to just to find the right people I need to talk to. And it would be great if I could get people to introduce me to them. But I don't always know who they are. That's a problem around here. You're re-inventing the wheel a lot I guess.

Employees in the operations group also commented that they had trouble agreeing with their colleagues about where certain expertise lies within the organization. As one of the operations managers noted at the end of this study:

> The people on my team and me don't always agree on who we should ask to do certain jobs. I think someone is more of the expert in that area and they think I'm wrong. They think someone else is more of the expert. But I don't thinking they're right. So we just have trouble finding the right people because no one agrees on where they are or how to find them. The other day I said this guy Ray was the one we should go to. One of my team members said we should go to Dave. I said, "Why do you think it's Dave." She said she worked on a project with Dave in the past. I said I hadn't worked on a project with him but I heard about him. So it was like we were drawing on two different experiences and they conflicted with each other. Which one was right?

This comment directly reflects the comments made by Peyton, the senior marketing manager who we met at the beginning of this article well before she tried A-Life for the first time. Without a common pool of knowledge from which to draw when forming their cognition, that cognition about who knew what and whom was often different across a group. But, as a manager in the marketing group commented, use of A-Life had made the situation quite different:

> There was this weird experience where we basically got to pick a new person for the project. So the four of us sat down to decide who to give it to. We all said Karen. We laughed because we almost never agree on that kind of thing. Tina [one of the team members who was in on the decision] said, "I like Karen because she really seems to get the computational aspect of what we're trying to do." I said I agreed because she was always posting documentation about that kind of stuff on A-Life.

As these data suggest, when cognition is formed based on a common pool of information, that cognition may be shared amongst all employees who dip their toes into the pool. Within American Financial's marketing group the social networking site provided the pool. But simply having a common pool of information at hand is no guarantee that people will be able to access it. To explore the practices through which employees used the common information produced on the social networking site to develop shared cognition, I turn to a comparative analysis of the interview data.

Practices of Shared Cognition Development on the Social Networking Site

The second research question posed in this study asked what kinds of practices users of a social networking site would have to conduct in order to use it in ways that allowed them to build their cognitive knowledge and social structures. The findings, in response to this first research question, are depicted in Figure 1. Employees in American Financial's Marketing group who used A-life to develop their cognitive knowledge and social structures followed a process whereby they (1) expanded their social networks on the site from the social networks they maintained offline, (2) kept track of various bits of content shared by coworkers, and (3) they developed a capacity to let circumstantial events trigger their recall of those bits of content and then integrate them into a uniform picture of that person's knowledge base and social capital. As the figure demonstrates, network expansion proceeded content integration and triggered recalling. But content integration and triggered recalling were both recursive and interactive. The data suggest that partial integration of content often began in advance of an event that triggered recall of some of that content, but it was not until such recall was triggered that the

integration into a coherent picture occurred. Thus, although I present content integration and triggered recalling practices as separate below, such a presentation is for analytic convenience only.

INSERT FIGURE 1 ABOUT HERE

Table 4 provides examples from the data of each of these three practices from each of the sixteen A-Life users, where evidence of those practices existed. The table indicates where evidence was not found. The sixteen individuals in this table are arranged in descending order based on how similar their cognitive knowledge and social structures were to the cognitions of each of the other members of the marketing division: Of the 16 A-Life users interviewed, User 1's cognition was shared with the most other members in Marketing (of the 44 individuals surveyed) and User 16's cognition was shared with the fewest other members in Marketing. As the table indicates, the data show that the nine users (1-9) with the highest degree of cognition shared with other members of Marketing conducted all three of practices, while the next three (10-12) conducted two practices each, the next three (13-15) conducted one practice each, and the final user (16) conducted none of them. Although clearly not a statistical test, the data in the table suggest a powerful association between the conduct of these practices and the development of shared cognition. Namely, the more employees expanded their networks, integrated content, and allowed events to trigger recall of the content they experienced directly or vicariously on A-Life, the more likely the were to share the cognitive knowledge and social structures of their coworkers. Users who did fewer of these practices had lower levels of shared cognition. Below, I describe this process of shared cognitive development by explaining each of these practices in detail.

INSERT TABLE 4 ABOUT HERE

Network Expansion

Employees at American Financial, like employees at most other companies prided themselves on cultivating and maintaining extensive social networks. As one marketing specialist commented, "One of the key ways you make yourself successful at work is having a big rolodex. You have to know lots of people." An employee in operations noted that those social networks tended to be quite large: "I know people from lots of divisions, us [Operations], Marketing, Finance. I'd say most people normally keep up with 50 or 60 people here – and that number's the same no matter what division they're in." Employees considered most of these

communication partners weak ties. They were coworkers with whom they had worked on a project once in the past, or that they knew from their orientation at the company but did not talk with regularly. The core group of people with whom American Financial employees regularly maintained relations were those with whom they actively worked on specific projects, or those to whom they sat in close proximity. These strong ties numbered typically numbered between 10-15 people.

On A-Life, employees had the option of indicating "colleagues" (the equivalent of "friends" on Facebook) who were coworkers with which they wished to signal that they had an affiliation. Colleague had to be jointly verified such that John could not say Susie was his "colleague" if Susie did not agree. Indicating that someone was a "colleague" did nothing more than place that person's picture and link to their A-Life wall in that person's "colleagues" list on A-Life. "Colleagues" did not have any special access to a person's content, messages or documents; those materials were available to anyone at American Financial who navigated to the users' wall. But if people were "colleagues" they did share one added feature, posts that the other person made or conversations that the other person had with another coworkers would occasionally (depending on the whims of the algorithm) appear on each other's walls. In practice, this meant that when John viewed his own wall, he could see a conversation that Susie had with Terry, even if Terry was not John's "colleague." On average, A-Life users had 29 "colleagues," roughly half the number of people they indicated were in their social networks in general. But those 29 "colleagues" gave an employee access to conversations of many more people at American Financial because if those 29 "colleagues" had colleagues of their own that were not shared by the focal individual, that individual would see postings of conversations their 29 "colleagues" had with their own "colleagues."

The data revealed three practices of articulation between people's "offline" communication partners and those with whom they communicated or had as "colleagues" on A-Life: Replication, deliberate expansion and delayed expansion. Table 5 provides a summary of and additional data on these practices. The first practice was replication. Some users chose to replicate their offline social networks on A-Life. As one employee who used this replication practice, commented, it reduced cognitive complexity:

> I communicate with the same people on A-Life that I do through every other window we've got. You know, in person or on the phone or over email. I mean I don't get these people who like to talk to these people on the phone and these people online and these people wherever. It's like, I've got too many other things to keep straight what I said where. So I don't want the situation to be that if I told people that I was

changing our rate assignment threshold I'd have to remember, oh, did I tell the people on my email distribution list, or did I tell the people in the meeting, or did I tell the people on A-Life. I just want to announce the threshold in one place and know that everyone I talk to got it… So, I just make sure that if I'm connecting with people on A-Life, it's the same people I talk to normally anyway.

Although replication made it easy to manage one's portfolio of contacts because it assured that their social networks on A-Life were tightly coupled with their social networks offline, replication practices could mean that individuals missed out on important information. An e-commerce marketing manager described this situation in which her replication practice led to a problem on her team:

Well one day I come back from some committee meeting and I've got like 20 texts on my phone and five voice mails. They're all from people on my team asking where I am and what's going on. One of the voice mails explained that there was a hack into one of the databases and the whole team had gone to one of our other sites to work with the security team to make sure we hadn't lost any data. I drove there myself and got there like two hours late… When I asked how they all knew about it they told me that they were discussing it on A-Life and thought I saw it. But I never check A-Life because it's just the people on there that I talk with in other places anyway.

As the manager later discovered, her teammates all used A-Life frequently and most of their "colleagues" were people who were not direct team members but other people that they knew at American Financial. One of the teammates was "colleagues" with a coworker from the datacenter who posted a message about the brief. The teammate saw the note and quickly posted it to all of his teammates on A-Life. The other teammates who checked A-Life regularly because, as one of them said "I usually just have connections with people on there that I don't talk to regularly" saw the message and all convened to head to the datacenter together.

INSERT TABLE 3 ABOUT HERE

These teammates engaged in the second of three practices identified in regards to the articulation of online and offline networks: Deliberate expansion. Individuals who deliberately expanded their offline social networks from their social networks on A-Life made a conscious choice to cultivate and maintain a different group of contacts on A-Life than those contacts with whom they regularly communicated daily as part of their job. A manager in the credit card marketing division discussed how such expansion was a deliberate strategy:

When you get a tool like A-life you try to think how can it be useful. We're a company of, what, 15,000 people? In a day, I get to interact with maybe seven of those people and in a week maybe four of five more. And I only work with four of them on my team. So A-Life is an opportunity to get to know other people and interact with them and have experiences with them. So I don't want to waste my time being friends with people on there that I talk with anyway.

As this manager was aware, use of A-Life had the potential to put him into contact with people at the company

that he would otherwise have little occasion to meet and with whom he would have few opportunities to build and

maintain a relationship. The nature of these relationships on A-Life were casual; they were not often strong. But

the cultivation of strong ties was not what most informants had in mind. Instead, employees who deliberately

expanded their offline and A-Life networks recognized that weak relationships that took little effort to maintain

were quite desirable. As an accounts specialist observed:

> The great thing about A-Life is you can have relationships with people without having to do a lot. You
> watch what they say to their teammates, you offer a comment every once in a while and you just sort of
> get to know about them and what they do. But you don't have to take them to coffee or buy their kids a
> present. It's easy. And really all I want when I'm on there is to get a sense for what people are doing; I'm
> not looking for a new best friend. So it's easy and it makes it easy to just have different people to talk to
> on A-Life than I talk with in my normal day.

Employees who chose to deliberately expand their networks sometimes found that it was a bit awkward when

their A-Life and offline social networks came into contact. As one branding specialist observed:

> There are times when I say to one of my teammates 'oh, I saw this on A-Life' and then there will be this
> kind of awkward silence like, 'why aren't we connected on A-Life. That's always a little weird but
> whatever. I mean maybe I'll just connect with him on A-Life, but then I won't ever pay attention to what
> he's doing on there because I already know. I'll just keep following other people I don't know as well.

The advantages of deliberate expansion of networks seemed, for most employees, to outweigh their social costs.

Access to people with whom they otherwise would have little occasion to interact meant that an employee could

expand his or her network and share experiences with people outside his or her own work team.

The third practice uncovered in regards to the articulation of online and offline networks was delayed

expansion. Delayed expansion took two forms. The first form was active and the second form was passive.

Employees who initially indicated their teammates and managers as "colleages" and talked with them online often

decided, after some time, that their energy would be better spent interacting and sharing experiences with other

people that they did not know as well. As a specialist in the promotions department recalled:

> When I first got on A-Life of course I friended[2] all of my teammates and all the people I hang out
> socially. But after a while it kind of hit me that when I looked at my wall I was just seeing them post
> about projects and stuff that I already knew about and it was kind of just repetitive. And it also was kind
> of crowding out space for me to see what other people on there were doing 'cause the first like 10 posts

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[2] Informants often used the word "friend" (the name given to connections on Facebook) in place of "colleague" which is how A-Life officially named user's connections. And, as in this quote, they often used the verb "to friend" (also a term associated with Facebook) to describe that they had indicated someone as a "colleague" on A-Life.

on my wall were all filled up with my teammates stuff. So, I eventually just started de-selecting them as colleagues so I could focus on what other people were saying and talk to them – people I didn't know that well.

This choice to change his practice of tie maintenance and shift the contours of his social network on A-life reflected an active decision to diversify the number of people he interacted with and observed across the company. Other employees took a more passive route to delayed expansion. One account manager in the student loan marketing department discussed how rather than actively shifting his strategy of connection on A-Life, his interests and attention gradually shifted over time:

I was always talking and joking and sharing things with my team on A-Life. But after a while I kind of just stopped doing that because I was more interested in what other people were doing. It was cool to see two people sharing information about, like, search engine optimization techniques and you could read through their posts and follow their conversation. That stuff just became more interesting and the people I already talk to on my team just kind of faded to the side. I don't even bother to go to their pages usually anymore.

As Table 4 indicates, six months after they had begun using A-Life 13 out of the 16 A users interviewed for this study eventually expanded their networks – they either decided to do so deliberately at the start, or eventually ended up expansion after some delay. By contrast, only three users never expanded their networks and, instead, replicated their offline contacts and relationships on A-Life.

Content Integration

Employees who expanded their offline and A-Life networks had access to a broader number of employees across the company than those who either did not use A-Life or who did use it but chose to replicate their offline network on the site. Attention followed access. Individuals who expanded their networks found themselves engaged in experiences directly with coworkers who they did not know well and also engaging in experiences between other employees vicariously. Direct engagement typically took the form of a conversation occurring in a threaded format, often with employees providing links and posting documents to relevant content. A senior branding manager recalled one memorable experience he had engaging directly with a coworker from another department.

I was doing some prep work for an earnings call and we were at this meeting and I met a guy from the consumer brand department. He was in marketing like me, but that's a different department so I didn't know him. We chatted for a minute and it turns out we graduate from the same school. So he friended me on A-Life. Well I had a consumer question – because I do corporate work – and I didn't know who to go to so I just asked him. So we was saying this and I was responding that I didn't get it and we had this

> conversation that went on for a couple days. The cool thing was it was all right there on the wall so I could see it easily and go back to see how he responded to the question. Then one of his team members, I guess, chimed in to. I didn't know that guy, but what he said was really helpful. So then we just made some jokes on there too and I actually learned a lot.

In other occasions employees did not interact with each other directly, but participated in an interaction vicariously as an observer. The visible nature of the communication occurring on the social networking site along with the fact that all of the interactions were recorded made it easy for voyeuristic employees to watch others interacting and learn from it. One senior marketing analyst recounted his experience participating vicariously:

> I was on A-Life and I went to this guy's page in another department. I saw on his wall that he had gone through this whole discussion of how they calculated the SAM for a certain market. It was really useful and so I was just reading along and cause it's like a threaded discussion on there, you know, I could see who said what and when they said it and it was like I was having the conversation with them. That's happened a lot on A-Life. I just kind of like to watch what other people are doing and learn from it. You can't do that on e-mail 'cause email is private.

Through such direct and vicarious interactions with others, A-life users were sharing experiences with colleagues they often did not interact with regularly in their workday (because their networks were expanded) and observing shared experiences among others. But the information that they encountered on A-Life was typically brief and was often devoid of context clues that would help the reader interpret its meaning or origin. This information typically took two forms: Information about what tasks people conduct and information about the relationships people have. (Table 6 provides a summary of and additional data on these forms). As one employee described, content about the tasks coworkers conducted was often "scattered" across A-life was often scattered:

> I'd say my experience on A-life is scattered. It's like you're on there one day and you talk with someone about a topic like consumer spending habits. Then you're on there a few days later and you see that person talking to someone else about consumer debt. There's just lots of little pieces out there and you only see bits of everything.

In discussing this diffuse access to information about the tasks coworkers conducted, another employee made the analogy to food pictures on Facebook:

> You know how people on Facebook are always posting pictures of their food or saying that they just had the best sushi ever. Well you see those things and you kind of are thinking, 'whatever, I don't even know what I'm supposed to do with that.' But you see them over and over again and then finally you just say, 'I guess that guy is really into Japanese food.' It's kind of like that on A-Life. You just see little pieces of people's work and what they do. You never really get the full picture.

INSERT TABLE 6 ABOUT HERE

Content about people's relationships on A-Life was equally as diffuse as content about their tasks. Relational content came in one of two forms. The first form was from the list of people that a user indicated was his or her "colleague." Employees could choose to signal a relationship with anyone in the organization, but given that only several dozen "colleagues" were chosen by most (not the full 15,000 employees at American Financial) the one's list of "colleagues" was an important marker. As a marketing manager noted:

> I scroll through people's "colleagues." It's interesting to see who they put on there. Sometimes you find things you didn't know or expect, like two people are friends. And sometimes it's just interesting to see that this person knows someone in another department. Then sometimes you're on another person's page doing the same thing and you see that two people both are connected to someone and you kind of start to see a whole network.

The second form of relational content was from observation of actual conversations and document exchanges among employees on A-Life. Because people's conversations were displayed in text for any other user of the technology to see, users could observe the intensity, duration, and frequency of other people's interactions with each other. A senior marketing team lead recalled his surprise at one particular set of interactions:

> There were these two women from different departments – departments you wouldn't think would have much to do with each other. But one of them was my "colleague" on A-Life so I saw her conversations with this other woman who wasn't my colleague. It was interesting that they were getting really technical and they kept asking questions of each other about this and that. I could see that their conversations had been going on for like four or five weeks so it was clear that they really had knowledge that the other person needed. Then a while later I saw their names both on a report so I remember thinking that these two really had a strong connection.

As the foregoing examples illustrate, the information that A-life users gleaned about their coworkers' tasks and relations through direct interaction with them and/or vicarious involvement in the experiences they shared with others was sparse. Content was scattered across various places on the site – in conversations, documents, posted links – and it was episodic – something appeared one day and not then again for several weeks. All sixteen of the A-Life users who were interviewed commented that it was hard to really learn about their coworkers and what they did because on A-Life, the content that people posted or contributed was but a snapshot of their work and relationships taken out of context. Yet as Table 4 indicates, there was evidence that three quarters of A-Life users were able to pull these diverse threads together to make them cohere. As one such users described:

> You see all these things and they don't mean anything alone. You've got to step back and just sort of think about how it all fits together and most of the time you start to get an idea of what a person is all

about on A-Life. You get to start to see what kinds of knowledge they have and you get to sort of realize who are the people in their universe that they go to for information and help.

Another users made a similar comment:

It seems like there is a lot of stuff out there on A-Life that is useless. But I've learned that you can't go in expecting to see the big picture. You just see parts of it and it's up to you to put the big picture together. If you want a big picture from the start, you have to go talk to the person directly or ask for their resume or go watch them do their work I guess.

This act of integrating separate pieces of information so that they coalesce to form a complete substance or picture took patience and practice and represented a different way of processing information than most informants said they were used to.

Triggered Recalling

What drives content integration? Put differently, what compels users to begin to put together all the diverse pieces of content they have collected into a unified whole from which they can make inferences about who knows what and whom? The data suggest that most social networking site users did not simply aggregate content. That is, they did not build the bigger picture cumulatively and linearly. Instead, the data suggest that some exogenous event typically triggered recall of one or two pieces of content and the memory of that specific content catalyzed the recollection of more memories of similar content until the bigger picture was revealed. In effect, content integration and triggered recalling with recursive and interrelated practices. There were numerous examples of triggers in the data: Someone lamenting about not being able to solve a problem, being assigned a particular task, reading a report, listening to an earnings call, receiving an email with a difficult question, or being sought for advice. Any of these events could trigger the recollection of a piece of content observed on A-Life. The data revealed two types of triggers: Rapid triggers and slow triggers. (Table 7 provides a summary of and additional data on these forms).

INSERT TABLE 7 ABOUT HERE

A rapid trigger was an exogenous event that quickly triggered the integration of content gleaned from A-Life. As one example, a marketing specialist from the branding department noted that he was working with an outside graphic designer for one of his projects. The graphic designer asked him if it was possible to reproduce a

logo from one of American Financial's brochures. The marketing specialist did not know the answer. But the consultant's question triggered the recall of memory of a post that one of his "colleagues" had made on A-life.

> When he [the consultant] brought that up I suddenly remembered that I'd seen Jim having a discussion with someone on A-Life about some legal issue. When I remembered that it was like all of a sudden there was a waterfall. All these other memories started coming back too. Like I remember a document I saw Jim post on A-Life about legal regulations and I remember a joke I made with him on his wall about lawyers and it call came together and I realized Jim knows a lot about legal issues – I should talk to him about this.

Interestingly, this marketing specialist's reflection highlights the point that it had not occurred to him that Jim was knowledgeable about legal issues before the consultant's question triggered his recall of that first piece of information about Jim. The "waterfall" effect of that trigger prompted him to integrate several different small bits of information that, at the time they were seen, appeared insignificant on their own. But when they were brought together, those individual pieces of content formed a broad picture of someone who had knowledge about legal issues.

Events could also rapidly trigger the integration of content that led A-Life users to build an impression of someone's social network. As one example, a marketing promotional manager wanted to run a query on data in one of the company's large databases. The manager tried unsuccessful to do a SQL query to extract the data she needed. In a staff meeting, she asked if her teammates new of anyone who could help her. One of them gave her the name of a man named Ted in the IT department who was a pro at writing scripts to query the database. The manager looked Ted up on the company's people finder where she saw his picture and found his email and phone number. Over the course of a week she sent several emails and phone calls to him to ask for help and he did not respond. Then, one day she saw a picture that one of her "colleagues" from another department posted on A-life. The picture, taken at a company gathering, depicted her "colleague" standing next to Ted (whose picture she remembered from the People Finder. As she recounted:

> I saw that picture and then it like all hit me. I remember I'd seen her [the "colleague"] exchanging messages with someone named Ted on her wall awhile back. Then I remembered that I had actually been involved in a conversation thread that she [the "colleague"] was in with some guy named Ted and we actually exchanged some messages. Then I remembered that the reason I got on that thread was because she [the "colleague"] and Ted had produced a document together that I saw on A-life and was commenting on. So it all just came together and I was like, "she knows Ted pretty well."

After integrating this diverse content into coherent vision of relationship between the "colleague" and Ted, the manager called the "colleague" and asked her if she knew Ted and if she would mind asking Ted to call her back. The "colleague" answered affirmatively to both questions and by the end of the day Ted called the manager back and apologized for taking so long to do so.

Other events triggered the recall of content needed for integration very slowly. Unlike the waterfall metaphor used by the marketing specialist above, another marketing manager recounted that events normally triggered content integration very slowly, like water filling up a bucket:

> I've noticed something weird that happens since I've been using A-Life. I started off thinking it was useless because no one really says anything on there. They just post this and that. But what's been happening is I'm like reading a report and it raises some issue. That kind of triggers me to remember a post someone made on A-Life about something related. Then, like a couple of days later thinking of that post reminds me of a conversation I saw that person have with someone, and then maybe a few days later something else happens and then I suddenly have this thought, "wait, I think he would know how to fix that problem." It's like it all comes together finally – really slowly. Like each think I remember is like a drop that fills up the bucket and when that last drop hits all the water rushes out over the top.

Whether the trigger was rapid or slow, the important point was that it served as a catalyst for content integration. When asked what they learned about people on A-Life, users routinely responded by saying things like "it's not really very useful," "the content isn't detailed enough" and "people post random stuff on there that doesn't make sense." But as Table 4 shows, 11 out of 16 informants could come up with a time when an exogenous event triggered their memory of a particular piece of content (that upon first inspection seemed useless) that led them to integrate it with others to form a big picture. This finding suggests that the value of participating directly and vicariously with others on the social networking site may not be accrued immediately, but only after some time when individuals encounter an event that brings everything they have seen into relief.

<div align="center">**Discussion**</div>

Shared cognition is important for organizational performance. But until recently, most scholars have identified the existence of shared cognition only at the level of the small work group (Bonito 2004; Moreland et al. 1996; Park 2008). I began this paper by suggesting that perhaps part of the reason for such a finding was that the literature suggests that shared cognition is formed when people engage in shared experiences with one another. Given the temporal and spatial constraints placed on shared experience in the modern workplace, it is not surprising

that employees have difficulty building shared cognition with those outside their immediate work groups, even if such broader departmental or divisional-level shared cognition would be advantageous.

Social media technologies, like the social networking site used by informants in this study, provide unique opportunities for the production of shared experience. They create a virtual platform for interaction upon which people from far-flung parts of the organization (or people who are proximate to one another but have no opportunities to interact) can share experiences directly through conversations, documents, posts, links, pictures, and video. In addition to providing these increased virtual opportunities for participation in shared experiences, social media also make it possible for employees to participate vicariously in the shared experiences of others. Thus social media enable users to move past only one traditionally limiting route to developing shared experience (co-presence in physical contexts) by creating two new avenues (co-presence on virtual platforms and visibility into the communications and behaviors of others) that can expand people's range of interactions with others across the organization. But because social media users tend to replicate their offline social networks on the sites and because they are exposed only to cryptic and erratic content, it was not clear what kinds of practices would enable users to take advantages of the features of these new technologies and use them to engage in the kinds of shared experiences that would lead to the development of shared cognition.

The findings from this study show that employees at American Financial engaged in three practices – network expansion, content integration, and triggered recalling that allowed them to overcome these two potential barriers. The data show how these practices led users to draw on the interactions occurring on the social networking site as material with which to construct cognition of what employees had what knowledge and with whom those employees communicated. Because users were drawing from the same common pool of interactions, their cognitions developed similarly. The result was that use of the social networking site increased the congruence in users' cognition (making it shared) over time. A comparison with a group of similar workers who did not use the social networking site confirmed that the effects of increasingly shared cognition were attributable to use of the technology and the qualitative comparative analysis presented in this paper demonstrated how people used the tool in ways that produced these effects. I discuss the theoretical contributions suggest by these findings below.

Broadening the Base for Shared Cognition: The Importance of Network Expansion

A central concern motivating this study was how shared cognition might be expanded in organizations beyond the small team. This study provides support for Ren and Argote's (2011: 219) speculation that social media may "have 'affordances' that enable the development of transactive memory systems without members being in the same location." The data show that it is not only through direct engagement in shared experiences with others on social media that people develop shared cognition. They also developed shared cognition by participating vicariously in the shared experiences occurring amongst other people on the site. Developing cognition through vicarious exposure is not a new finding. One of the major insights from situated learning theory (Lave and Wenger 1991), for example, is that people often learn on the periphery of a social system not by participating experientially in work and communication events, but by observing from the sidelines and learning vicariously. In her study of the development of situated cognition Lave (1996) showed how apprentice tailors in West Africa learned who among their potential teachers were knowledgeable about particular tasks and which teachers knew other teachers by listening in on conversations teachers had with other apprentices and learning vicariously through their observation of this ongoing communication occurring around them. Brown and Duguid (2000: 136) have characterized such vicarious learning from third-party exposure to the communications and behaviors occurring among others as "stolen knowledge." They argue that in the workplace, learners can, when they need, steal their knowledge from the social periphery made up of other workers and ongoing, socially shared practice. This study shows that despite the fact that (or, perhaps, because) communication and interaction happens in a mediated context like social media, vicarious exposure can be a powerful way of developing cognition.

Yet the findings also show that regardless of whether individuals develop cognition through direct engagement in shared experience or through vicarious observation of that experience, network expansion is an important pre-requisite for the expansion of shared cognition across the organization. Shared cognition often fails to extend outside the boundaries of small work groups because it takes considerable time and effort to build and maintain relationships with people. For the entire team to build relationships with the same set of external individuals would be too costly to team performance (Ancona and Caldwell 1992). Social media provide a partial solution to this problem because the lightweight nature of interaction on them make it easy to form and maintain relationships with little investment of time and effort (Nardi, 2010). Despite this possibility of easily extended relationships, most

empirical research conducted in organizations shows that social media users tend to replicate their offline communication partners online (Brzozowksi 2009). In short, they tightly couple their social networks across the physical and digital realms. Network expansion provided a way for individuals to reach others in the organization outside of their primary work teams. By making either the deliberate decision to connect with new people who they did not talk with offline, or by making a delayed decision, informants in this study were able to expand their networks so that they direct and vicarious engagement they had with others would yield diverse information. And, it was with this information that they could begin to develop cognition of who knew what and whom.

Without network expansion its seems unlikely that use of social media would have enabled an expansion of shared cognition outside the immediate work team. Perhaps one reason that expansion seemed less daunting was that the barriers to initiating new relationships on social media are quite low. For example, in their study of social networking site use at a large telecommunications company, Leonardi and Meyer (2015) showed that by participating with and observing people engaging in work practices on the site, users began to pick up important contextual information about the work people were conducting and the people themselves. For example, users learned work-related information about what other solutions had been tried in the past as well as non work-related information about people's personal lives that occurred through routine threaded discussions in practice during the conduct of work-related tasks. The authors showed how being exposed to this contextual knowledge allowed workers to use this knowledge to initiate future social interactions with colleagues. Thus, social media provide features that, if used in certain ways, can enable the creation of new ties with minimal effort (Kane et al. 2014) and also allow people to keep latent ties with whom they rarely interact, but occasionally observe communicating on the site (Ellison, Steinfield and Lampe 2011). Together, these findings add to our understanding of how organizations can increase shared cognition at levels higher than the small team. Network expansion is likely to be a key process in whether such expansion is successful and the features of social media may make that network expansion less daunting as task to undertake than it would so appear through other communication channels.

Cognitive Dexterity: The Recursive Relationship Between Content Integration and Triggered Recalling

One of the most surprising findings in this study was the recursive relationship between content integration and triggered recalling. As other studies have shown, content on the social networking site was diffuse and sporadic

(Carr and Walther 2014). It was hard for users to learn anything of value simply by reading one post or one document because the contents of those communications were thin and they lacked context cues with which to interpret their importance. But, when taken together, the many threads of content that individuals shared on the site could be woven together to form a rich tapestry of understanding about what and whom people knew. Surprisingly, the data suggest that there were few cases in which users of the technology wove those threads together endogenously. In other words, people did not assemble one piece of information, then another, then another and finally determine that they added up to something important. Instead, it took some exogenous event to trigger the memory of one piece of content and that initial memory set the stage for adding the remaining pieces to it to show the larger view. Hence, the practices of content integration and triggered recalling were interactively and recursively related.

The typical way in which people deal with problems they encounter in their work is to reactively search for knowledge that can help to solve them (Gavetti and Levinthal 2000). The process is characterized as reactive because people did not typically think about acquiring new knowledge that will help them to solve a problem until the problem arises (Cyert and March 1963). But when they do, they engage in search processes whereby they actively look in a focused and directed way for some specific type of knowledge (Norman 1982).

But A-Life users in this study who navigated the dance between content integration and triggered recalling did not reactively search for knowledge when they ran into a particular problem. Instead, they let the problem trigger the recollection of a stored piece of content and then proceeded through a complex cognitive process of linking that content to other pieces of content to arrive at a unified vision of a solution. In other words, they typically stumbled into content that provided clues about what and who a coworker new and they did not have a particular use for that content. Rather than discard it, they held it in passive memory along with other pieces of content for use at a possible later time.

To produce these integrated pictures of what and whom people knew required a good deal of cognitive dexterity. Collection, abstraction, and attenuation were all core cognitive processes needed to integrate content (Norman 1983). What these findings suggest is that if social media are to be useful for organizations to promote wide reaching shared cognition, employees may have to develop the kinds of cognitive skills that allow them to

engage in the abstract thinking and interrelating necessary to allow events to trigger integration of content. Such cognitive dexterity would also seem to require an appreciation for the banal. Although the quantitative findings reported in this paper suggest that respondents were capable of integration quotidian content into useful tapestries of information indicating what people knew and who they knew, the qualitative data indicate that they did not seem to appreciate their own ability to do so. When asked directly whether use of the social networking site helped them to learn what or whom their colleagues knew each of the 16 respondents in Marketing who were interviewed said, "No." As one respondent elaborated, "There's a lot of dumb chit-chat on A-Life. If I need to find out who knows something I'll ask around until I find the right person. A-Life isn't really useful for that because no one is really messaging other people to say 'Hey I know this and I know that.'" This belief that only unimportant "chit-chat" occurs on social networking technologies is echoed by respondents interviewed about their use of public sites like Facebook and MySpace (Tufecki 2008). This dissonance between the empirical findings about the effectiveness of social networking site use for developing cognition about other people's knowledge and social structures, and respondents' own self-reports that the technology was not very helpful in their ability to do so demonstrates just how passive this process was.

But this passivity also illuminates an important problem: If individuals spend time on social media and do not feel they are gaining value from exposure to coworkers' communications, they may discontinue use of the site and stymie their ability expand ambient awareness and learn vicariously. Similarly, if management examines the content of communications occurring through these technologies and sees what appears to be aimless discussion or inchoate ideas, they may decide to pull the plug on the technology thus eliminating any hope for the more subtle long term benefits of ambient awareness that accrue slowly over time. Yet as Gioa and Mehra (1996: 1228-1229) have argued, there is an important place in organizations for the seemingly banal, it simply requires, however, the right kind of cognitive approach to move it from banality to utility:

> Much of organizational life consists of situations that are neither novel nor surprising, that is, situations that are routine and situations that do not demand our full attention, but which we make sense of nonetheless. Such slices of our organizational existence are in fact meaningful because they involve episodes of schema matching and schema adjustment, much of which occurs out of awareness. Schemas obviously can be modified when discrepancies above a certain threshold trigger active reconsideration of prior sense making, but they can also be modified in intricate ways out of awareness via assimilation of subtle cues over time.

If social media are to be useful for developing shared cognition in organizations, employees may have to exercise a good deal of cognitive dexterity to make it so. This implies, perhaps training for employees, and, importantly, allowing content that seems at first glance irrelevant or useless to persist on a social media so they can be used at a future time for content integration when the appropriate event triggers that activity.

Conclusion

This study has shown that social media can be useful for the development of shared cognition within organizations if users expand their networks and use exogenous events to trigger the integration of diverse content they have seen produced by others into a coherent whole. When multiple employees within the same organization conduct these practices on the same set of content, which social media allow them to do, their cognitive and social structures can become more similar to each other over time. And, as existing literature shows, there are many benefits to such shared cognition.

Despite these optimistic findings, I end this article with words of caution. As Howard Becker (1996) has argued, observation of people's actions is often a reliable indicator of their knowledge because it is difficult to convincingly try to be something you are not. But communication platforms like social media make it easier to accomplish self-editing and self-presentation behaviors than when individuals are together in face-to-face contexts (Toma, Hancock and Ellison 2008). Research has also shown that, due to the increased visibility of behavior on social platforms, individuals may feel increased pressures to present themselves favorably and, thus, might not always communicate in ways that are completely accurate or forthcoming (Leonardi and Treem 2012). Consequently, scholars and managers should exercise caution when hoping to implement social media to encourage more open and transparent communication. It may be the case that users of these sites will form cognition about the knowledge and social of others based on content that is not representative. If this were the case, and if multiple users drew from the same content to form such cognitions, those cognitions would be shared, but not accurate portrayals of what and whom those under watch really do know. The data in this study were checked to assure that the shared cognition that was developed was also accurate. Each marketing respondent's election of another person's areas of knowledge at Time 2 was checked against that other person's own self-report of their knowledge. This preliminary analysis showed that, on average, respondents correctly identified all three pieces

of knowledge held by other people in 79% of instances, at least two pieces of knowledge in 86% of instances and at least one piece of knowledge in 94% of instances. These data do not seem to be affected by self-presentation. Yet it is worth keeping in mind that self-presentation pressures could arise in contexts of social media use and that shared cognition that muddles the facts is likely to be worse than scattered cognition.

Too much shared cognition may also be a bad thing for organizations. If everyone knows what and whom others know, there may be few opportunities for brokerage of ideas and insights across non-redundant groups. Worse, however, would be pressures toward groupthink. If everyone agreed that Roger was knowledgeable about a particular idea, no one would question if someone else, say Audrey, might be a better choice to place on a project. Thus, organizational scholars and managers should be careful that they encourage the right amount of similarity in cognition to make work flow smoothly and stem disagreements, but not too much that it stamps out variation in thought and action.

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Figure 1: Process of Shared Cognition Development Via Social Media

Table 1: Phases and Procedures of Data Analysis

Phase	Goal	Data	Coding Procedures		Comparison Procedures		Finding
			Theoretical	Axial	Analytic Induction	25% Threshold Analysis	
1	To uncover mechanisms by which social networking site enabled people to participate in shared experiences with co-workers directly, or to observe a shared experience occurring amongst others and thus participate vicariously in that shared experience	- 16 interviews with employees in Marketing after 6 months of tech use	- 27 codes describing the theme or topic of the experience, the way that experience was carried out on A-Life, whether their participation in that experience was direct or vicarious, and what they learned about the actor(s) involved in that experience	-2 codes indicating whether or not informants recognized that they had perceptions of what and who people across the organization knew that were similar to the perceptions held by their co-workers - 5 codes indicating how informants developed shared cognition due to direct and vicarious participation in shared experience on A-Life	N.A.	N.A.	- Low and high levels of recognition about shared cognition of what and whom people know - Network expansion, rapid response, follow-up questioning, content integration, and triggered recalling
2	To confirm that findings from Phase 1 (that people were aware of shared cognition and what practices they conducted to achieve it) were limited to people who used new technology	- 32 interviews with employees in Marketing (16 before and 16 after implementation) - 36 interviews with employees in Operations (18 before and 18 after implementation)	N.A.	N.A.	-Compared placement and frequency of codes given to Marketing and Operations from interviews before tech implementation	-Examined 5 codes indicating how informants developed shared cognition from Marketing in Time 2 and compared to appearance in all other transcripts	- Only network expansion, content integration, and triggered recalling remain

Table 2

Descriptive Statistics and Correlations (*N*=1,415)*										
Variable	Mean	S.D.	1	2	3	4	5	6	7
1. Tenure Dissimilarity	32.34	30.65							
2. Hierarchical Dissimilarity	1.66	1.44	.29						
3. Proximity	3.58	2.24	.01	.10					
4. Common Team Assignment	.50	.50	.02	-.01	-.03				
5. Friendship Relationship	.51	.04	-.03	.01	-.01	.02			
6. Advice Relationship	.48	.50	-.01	.00	.01	.01	-.04		
7. Change in Accuracy of Cognitive Knowledge Structure	.11	.05	.01	.11	.24	-.00	-.02	-.01	
8. Change in Accuracy of Cognitive Social Structure	.12	.06	.01	.13	.33	.00	-.01	-.01	.34

*Correlations ≥ .06 are significant at $p<.05$

Table 3

Differences-in-Differences Estimation of Effects of Treatment (Social Networking Site Use) on Change in Similarity of Metaknowledge from Time 1 to Time 2 (*N*=1,415)

Dependent Variable	Change in Similarity of Cognitive Knowledge Structure (Knowing "Who Knows What")	Change in Similarity of Cognitive Social Structure (Knowing "Who Knows Whom")
Treatment Condition	.110* (.053)	.208 *** (.059)
Tenure Dissimilarity	.001 (.001)	.021 (.002)
Hierarchical Dissimilarity	-.001 (.001)	-.002 (.001)
Proximity	-.012 (.001)	.001 (.001)
Common Team Assignment	-.002 (.003)	-.001 (.003)
Friendship Relationship	-.002 (.003)	-0.001 (.003)
Advice Relationship	-.002 (.003)	-0.004 (.003)
R^2	.263	.377
Adjusted R^2	.218	.339
F	5.810***	9.849***

Note: Coefficients of dyad dummy variables are omitted to conserve space
*p < .05; **p < .01; ***p < .001
Standard errors are in parentheses.

Table 4: Evidence and Examples of Practices Leading to Shared Cognition From A-Life User Interviews

User	Activities Leading to Shared Cognition					
	Network Expansion		Content Integration		Triggered Recalling	
	Evidence	*Example*	*Evidence*	*Example*	*Evidence*	*Example*
1	Yes	"I keep track of different people on A-Life than I normally do."	Yes	"It's like you see something and then something else and you put it together."	Yes	"It wasn't till I needed to know about it that I suddenly remembered he knew this."
2	Yes	"The people I follow on A-Life are different than the people I follow offline."	Yes	"I saw him post about data mining three times and kind of put the pieces together."	Yes	"I was wracking my brain about it then I remembered I saw all those messages."
3	Yes	"I'm seeing things from people on A-Life I wouldn't normally talk to in my job."	Yes	"Over like two months he had like 10 messages about it so that's how I knew he had the info."	Yes	I had a problem with the forecast and it popped in my head that I'd seen him talk about it a lot."
4	Yes	"I didn't get how different the people I follow are be on A-Life than who I normally talk to."	Yes	"I kept seeing messages he sent about paying consultants. That's how I knew to go to him."	Yes	"A-Life stuff doesn't stick with me. But twice now I've run into something and it comes back."
5	Yes	"I didn't even know most of the people on A-Life. I don't follow my friends."	Yes	"It didn't hit me till like the tenth time I saw him send a message about it. Then I was like, 'Oh, he's got skills in that area.'"	Yes	"When my manager said that I was like, 'wait, I know someone who sends messages about it on A-Life.'"
6	Yes	"I'm always checking out people I don't know on A-Life. I ignore my friends."	Yes	"There's lots of bits and bytes of information on A-Life. You eventually piece it all together."	Yes	"I piece it all together much later. It's all a blur till I need it, then it comes into focus."
7	Yes	"When I'm on A-Life it's like I have a different set of people to watch."	Yes	"I read lots of messages she sent. Over time you just saw what it added up to."	Yes	"I find myself putting things together that I learned on A-Life after the fact."
8	Yes	"A-Life exposes you to people outside your normal group."	Yes	"I'm seeing this and seeing that and after a while I'm like, "Oh, I get her now."	Yes	"When the negotiations were falling apart I remembered that I'd seen her post about this."
9	Yes	"My world is different on A-Life than the people around my desk or on my team."	Yes	"I feel like I'm a detective on A-Life. I put evidence together about people – very slowly."	Yes	"I was doing the calculation when I remembered he posted about it a bunch."
10	Yes	"A-Life is really different. It's a different set of people – at least who I follow."	Yes	"She was talking with people lots of times about something and I picked up on it after a while."	No	
11	Yes	"I see people on A-Life that I don't talk to in my regular day."	Yes	"It's like you see a little bit of this and a little bit of that and you put it all together."	No	
12	Yes	"I'm like, 'Why don't I ever see these people in real life?' They're just on A-Life."	Yes	"They had conversations multiple times. They were intense. So they were clearly experts."	No	
13	Yes	"I'm not going to waste time talking to people on A-Life I can talk to in person. It's better to talk to different people."	No		No	
14	No		No		Yes	"It's weird how I never remember anything from A-Life till there is some problem."
15	No		No		Yes	"A-Life seems like a waste of time. But when you hit a bump you remember things from it."
16	No		No		No	

Table 5: Varieties of Network Expansion

Activity	Practice	Data
Network Expansion (*The decision to build social networks differently on social networking sites from one's offline social network*)	Replication	"There's not difference between being online and being offline. It's all one thing. I talk to people their desk and I talk to them on A-Life too. I like having multiple ways to access them… If I wanted to be friends with someone I wouldn't just do that on A-Life, I'd make sure I talk to them in person too."
	Deliberate Expansion	"When I first started on A-Life I was like 'this is my opportunity to interact with different people who I don't talk to in my regular day. So I want to have experiences with different people and see different things on there than I do in a meeting, let's say."
	Delayed Expansion	"For the first few weeks I was just sending messages to all the people on my team. You know, all my friends. But after awhile I started thinking that they were taking up too much of my attention so I just unfriended them all so I could start reaching out to other people I'd met once or twice but I didn't talk to normally."

Table 6: Varieties of Content Integration

Activity	Form	Data
Content Integration (*Bringing diverse and separate pieces of content together to create a unified whole*)	Information about tasks	"Someone posts this, then posts that, then you see them have a conversation about something with someone. There are all these pieces of information out there about what people did, but none of them are adjacent. So you have to weave it all together to learn what someone actually knows about."
	Information about relations	"I see people say that someone is their 'colleague' and then I see them exchange some messages with each other. Then both of their names end up as editors on a file. All of that starts to tell me that these people know each other pretty well."

Table 7: Varieties of Triggered Recalling

Activity	Type	Data
Triggered Recalling (*Events that trigger the recollection of a piece of content from the social networking site that start content integration*)	Rapid Trigger	"When he told me about that problem I suddenly remembered I'd seen someone post about that on A-Life. Then it all started piling on. I remembered other posts too and some PowerPoints he posted about that and I really quickly realized that that person on A-Life knew how to solve that problem. I never realized it before that moment."
	Slow Trigger	"It bugged me when it happened. My first thought was that I'd seen Kim post about that on A-Life. But that didn't really seem relevant. But over the next couple days I remembered that Kim had also written this briefing that she linked to on her wall. Then a few days later I thought of something else Kim had posted and it started to be like a puzzle coming together showing that Kim was kind of an expert on that."