Creative Performance in Mediated Communication: The Contextual Effects of Communication Media

Full Papers

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Abstract
Acknowledging that cognitive limit may constrain creativity, researchers have begun identifying social networks as sources of diverse knowledge. According to previous literature, weak ties result in infrequent interactions, low level of knowledge redundant, thus ease the access to diverse knowledge and improve creative performance. As technology advances, organizations bring appropriate employees to work on a project regardless of their locations, employees are working geographically distributed and communicate with communication media. Thus this taken-for-granted relationship between weak ties and creativity has to be contextualized in the context of mediated communication where employees nowadays rely heavily on various communication media. In this study we build on literature on social networks on creativity and communication media research to hypothesize that network ties will create opportunities for diverse information, and extend this stream of research by investigating untested contextual effects of communication media on moderating the relationship between network ties and creativity.

Keyword: Creativity, mediated communication, communication media, dyads, social network analysis
**Introduction**

As work becomes increasingly dynamic, uncertain and knowledge-based, organizations depend on creative ideas from employees to distinguish their products and services from competitors (Oldham and Cummings 1996). Creativity is defined as the production of original and useful ideas (Amabile et al. 1996). There has been a burgeoning interest to understand the factors that facilitate or constrain creativity in a working environment (e.g., Elsbach and Hargadon 2006; Gong et al. 2009; Grant and Berry 2011; Lam et al. 2007; Shalley et al. 2004). Among these factors, social network factors attract tremendous attention in recent years. As the generation of creative ideas involves synthesis and combination of different perspectives, network ties are viewed as important vectors that exchange these different perspectives (e.g., Baer 2010; Perry-Smith and Shalley 2003; Perry-Smith 2006; Zhou et al. 2009). Based on a widely cited work "strength-of-weak-tie" theory (Granovetter 1983; Granovetter 1973), it is well documented that weak strength of social network ties favor creativity because of the structural proper ties that affect individuals' ability of obtaining diverse ideas.

In a working context, social network ties serve informational purposes in communication process and usually include both knowledge seeking and knowledge contributing ties (Borgatti and Cross 2003; Levin and Cross 2004). *Knowledge seeking* refers to the frequency of seeking work-related information from others (Borgatti and Cross 2003). *Knowledge contributing* is the frequency of contributing work-related information to others (Wasko and Faraj 2005). According to previous literature, weak strength of knowledge seeking and knowledge contributing ties result in a low level of knowledge redundant, thus ease the access to diverse knowledge and improve creative performance (Perry-Smith and Shalley 2003). However, as technology advances organizations are able to bring appropriate employees to work on a project regardless of their locations, employees work geographically distributed and communicate depending on communication media. The capacities of communication media in terms of presenting and transferring rich information cues greatly impact the content and effectiveness in communication process (e.g., Burkhardt and Lubart 2010; Haythornthwaite and Wellman 1998; Haythornthwaite 2002). Thus this taken-for-granted relationship between weak ties and creativity has to be contextualized in the context of mediated communication where employees nowadays rely heavily on various communication media.

Communication media have tremendously changed the way of knowledge exchange in organizations (Burkhardt and Lubart 2010). For example, instead of delivering tutorial face to face, employees prefer posting instructional blogs and videos on organizational knowledge sharing platforms to obtain wide audience. Each communication media have different levels of functional advantages in presenting and transferring rich information cues. As the number of communication media available to employees constantly increases, employees reap the benefits of multiple communication media to easy the communication based on the functional advantages of each communication media in terms of presenting and transferring information (Haythornthwaite and Wellman 1998; Yuan et al. 2010). As a result, multiple communication media complement each other to enrich the content of knowledge exchange and increase the amount of diverse information that employees received from others. Although it is highlighted that communication media greatly increase the diversity when presenting and transferring information, few empirical analysis have been done to statistically explain the impact of communication media on generating creative ideas. **Do multiple communication media help employees perform better on creative tasks?** In this study we build on literature on social networks on creativity and communication media research to hypothesize that network ties create opportunities for diverse information, and extend this stream of research by investigating an untested relation between network ties, communication media and creativity.

**Literature Review**

**Network Perspective of Creativity**

In a reflection of the insight that the generation of creative ideas is a result of novel combinations of different perspectives and approaches individuals are exposed to via social interactions (Perry-Smith and Shalley 2003), recent scholars have identified social network parameters that shape creativity at work. Based on a well-developed strength-of-weak-tie theory (Granovetter 1983; Granovetter 1973), the concept...
of weak ties has illuminated the effects of social network ties on creativity research (e.g., Baer 2010; Perry-Smith 2006; Zhou et al. 2009). With respect to individual creativity, previous studies suggest that through infrequent social interactions, individuals who are exposed to different perspectives and approaches are less likely to share redundant knowledge, thus ease the access to diverse knowledge and have better performance of generating creative ideas (Sosa 2011; Zhou et al. 2009). Social network scholars posit social network ties as conduits of information flow, and emphasize that accessing diverse information is an important source of creativity. Weak network ties enable individuals to access information that is likely to be novel, thus have potential of inspiring novel combination and synthesis (Burt 2004).

The positive influence of weak ties on creativity is grounded in the role of cognitive variation in generation of creative ideas. The number of cognitive elements that is used for knowledge creation is essential to generate creative ideas, for the reason that they can be combined into new variations depending on the exiting knowledge elements in the mind of knowledge creators (Simonton 1999). Knowledge creators have a large pool of novel and useful ideas to choose when the source has greater variance in their cognitive idea generation. Hence weak ties that transfer diverse knowledge are supposed to increase cognitive variation of creators and are more likely to facilitate the generation of creative ideas.

**Contextual Effects of Communication Media**

Scholars on communication studies have found that communication media have contextual effects on moderating the relationships between social network ties and the process of information exchange (Burkhardt and Lubart 2010; Haythornthwaite and Wellman 1998; Haythornthwaite 2002). For example, theories on communication media indicate that the usage of communication media strengthens the positive effects of personal closeness on information content (e.g., Haythornthwaite and Wellman 1998). Communication media also moderates the positive relationship between intensity of network ties and interpersonal relationship development (e.g., Watson-Manheim and Bélanger 2007).

As individuals are likely to maintain various social ties at the same time, they intend to use multiple communication media to enhance connectedness with others. Employees in modern organizations also often use various communication media to perform daily tasks and collaborate with colleagues. As technology advances, the number of these communication media available to employees constantly increases. As a result, employees reap the benefits of multiple communication media in an integrated way to exchange knowledge. The benefits of using multiple media include firstly expanding the communication channels to access diverse knowledge. According to media richness theory (Dennis and Kinney 1998; Dennis et al. 2008), different media vary based on their capabilities of presenting and transferring rich information cues. Multiple media offers employees with benefits of each communication media to obtain different expertise from others to accomplish a task (Yuan et al. 2010). Second, multiple media complement each other to present rich information cues in various formats based on their own functional capabilities, which increase the diversity of information by presenting it from different angles. As a result, employees are more likely to generate creative ideas facilitated by multiple communication media, which due to expanded channels and diverse information formats through multiple media. Therefore this study investigates the contextual effects of media multiplexity on facilitating creative ideas generation, which refers to the extent to which individuals use multiple communication media to interact with others.

**Research Model**

**The Effects of Weak Ties on Creativity**

Knowledge seeking and knowledge contributing are two activities that are commonly happened in working places. As indicated in previous studies, the generation of creative ideas sources from the combination of different perspectives (Hansen 1999; Reagans and McEvily 2003). The more frequent interaction individuals have, the more likely they share redundant information (Perry-Smith 2006). Knowledge seeking happens when individuals seek work-related information and wish to solve their problems with perspectives from others. As the frequency of seeking knowledge from the same person increase, the amount of diverse information between them will decrease due to source’s limited knowledge amount. The increasing amount of redundant information is likely to reduce the level of creativity.

*Twenty-first Americas Conference on Information Systems, Puerto Rico, 2015*
H1: Frequency of knowledge seeking ties is negatively associated with creativity.

Similarly, infrequent communication makes the recipients of knowledge contributors feel that the contributors' knowledge pool is distinct from theirs. However, as the communication frequency increase, knowledge contributors' limited knowledge base as well as the mismatch between update of their knowledge pool and the seekers' information need, are very likely to decrease the diversity of information, reduce the possibility of inspiring creative ideas.

H2: Frequency of knowledge contributing ties is negatively associated with creativity.

The Contextual Effects of Media Multiplexity

Multiple media have different advantages in presenting and transferring information based on its capabilities of transferring different formats of information cues. Using multiple media is effective to enrich the diversity of communication content. For knowledge seekers, they have more choices to present their information enquiries with the help of multiple media. For instance, compared to emails, wikis and blogs are more suitable to present complex knowledge with formats of non-verbal cues, such as images and videos. Knowledge seekers' information enquiries presented by multiple media include diverse information cues in various formats, thus are more likely to obtain diverse feedbacks which are responded by the sources in corresponding formats via different communication media. Thus knowledge seekers are likely to receive more diverse information from the contributors.

H3a: The negative relationship between knowledge seeking ties and creativity is weakened when using multiple communication media.

In a similar vein, multiple media help knowledge contributors present their sharing in multiple formats by making use of the functional capabilities of each media. For instance, contributors use E-mail to elaborate their basic ideas for a new product, with a video to deliver a demonstration virtually. Therefore, it is more likely for the recipients to feel that they obtain diverse responses in different formats from the contributors.

H3b: The negative relationship between knowledge contributing ties and creativity is weakened when using multiple communication media.

Research Context and Methodology

Research Context

We did a test on our research model in a research institute in the electronics technology industry in Asia. The primary function of the research institute was to promote technology innovation and provide technical solutions for electronics devices, with a focus on addressing technological difficult problems. Generating creative ideas was critical for the overall success that improved work efficiency and provided solutions to customers. The tasks for the research institute required the ability of exchanging information across products, research ideas, geographies, and required the ability of building and maintaining coordinated and shared understanding of information and group activities. Employees also had access to a variety of communication media, including emails, telephone, instant messaging, collaborative tools and other social media tools based on their communication needs.

Research Methodology

The unit of analysis in this study is dyads with each dyad include a pair of employees. As an output of combination and synthesis of knowledge exchanged between individuals, dyads constitute an ideal unit of analysis to explain that what differences in dyadic ties result in different levels of creative performance. An important advantage of examining creativity at a dyadic level includes it assumes that dyadic relationships are not equally good catalyst in the generation of creative ideas. It helps uncover the differences of dyads that contribute to creative performance and answer the question that why some dyads are more creative than others.

Following the convention of social network studies (Scott 2000; Wasserman and Faust 1994),we collected data for most of the variables using onsite survey with a method of name generation. All employees in the
division were invited to participate in the study. Participants were asked to complete the survey during their working days to obtain highest possible response rate. The survey took an average of 40 minutes to complete and was filled out by 56 of 72 employees in the research institute, which included 146 pairs of dyads. Each participant was provided with a fixed roster of employees and was asked to list the name of employees who they know in the research institute. After participants identified their contacts, they were asked to answer the questions about the relationships with each of their contacts. On average, participants listed 4 contacts they knew in the research institute. In addition, demographic data was obtained from company records.

Collecting complete social network data involves asking a respondent to answer the same question over and over again about each of his or her contacts. As the intensive work involved in this process, most social network scholars rely on single-item measurement to measure relationships due to the concern for participants’ level of fatigue (Borgatti and Cross 2003; Labianca et al. 1998). Consistent with social network research, and to ensure a high and reliable response, each variable was measured by a single network question (Carrington et al. 2005; Marsden 1990).

**Measurements**

**Creativity** The dependent variable, *creativity*, was measured by one item, adapting from previous studies (Sosa 2011; Zhou and George 2001). On a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), respondents were required to rate the extent to which they agree or disagree with the statement related to creative performance. This type of measure had been widely used in creativity research (Oldham and Cummings 1996; Perry-Smith 2006; Zhou and George 2001; Zhou et al. 2009) and provided a broad assessment of creative performance. The item was “I often develop new ideas with this person when solving the problems in project tasks”. A one-mode matrix was constructed to map the mutual evaluation of creative performance.

**Network ties** Knowledge seeking measured the frequency of seeking information from an identified contact on project-related issues during the past three months (Borgatti and Cross 2003). Knowledge contributing measured the frequency of contributing information to an identified contact on project-related issues during the past three months (Wasko and Faraj 2005). The scale was 1 = never, 2 = less than once a week, 3 = once a week, 4 = several times a week, 5 = at least once a day.

**Media multiplexity** The measure for media multiplexity was derived from media-usage matrices. It was measured by asking respondents to indicate the frequency (1 = never, 2 = less than once a week, 3 = once a week, 4 = several times a week, 5 = at least once a day) of each media they use to communicate with each identified contact. The listed communication media included face-to-face meeting, ad-hoc meeting, email, phone, instant messaging, social media and collaborative tools. Following previous studies (Sykes et al. 2009), media multiplexity captured the number of tools used at least once a week in the dyads. The responses were put into matrices such that a cell value of 1 in each matrix indicated that a participant (in the column) had used that media to communicate with a specific contact (in the row) at least weekly, otherwise 0. Following Haythornthwaite and Wellman (1998)’s study, media multiplexity was measured by summing these matrices to create a single matrix with cell values ranging from 0 (no media used per week) to 6 (all medium used per week).

In addition to the primary variables, several control variables were included in the analysis. **Background heterogeneity** was the heterogeneity of functional background (Williams and O’Reilly 1998), which were obtained from participants’ resumes. Functional background was each person’s highest academic degree. We calculated background similarity to assess the extent to which a participant’s background is similar to his/her contacts, and reversed it as the measure of background heterogeneity. Background heterogeneity was included for it may influence the diversity of information transferred between the dyads (Perry-Smith 2006). **Prior working ties** measured whether respondents had shared working experience on research projects before. Respondents were asked to indicate how many projects they had worked on in the last year, using one question “How many common projects have you worked with this person previously”. **Work duration** was the number of years the dyad knows each other. Prior working ties and work duration were included for its high correlation with the strength of network ties (Sosa 2011; Zhou et al. 2009). We controlled **knowledge seeking cost** and **knowledge contributing cost** for they may have an impact knowledge seeking and contributing ties (Borgatti and Cross 2003). In addition, we also controlled **task type** for it may influence the diversity of information exchanged between dyads.
Preliminary Analysis

To test the model statistically, network correlation and regression were performed. The observations of network data are not independent and do not satisfy assumptions of statistical inference in classical regression. Consequently, special procedures known as quadratic assignment procedure (QAP) and multiple regression quadratic assignment procedure (MRQAP) (Krackhardt 1988) were used to run the correlations and multiple regressions respectively. QAP and MRQAP were identical to their non-network counterparts with respect to parameter estimates, but used a randomization permutation technique (Edgington 1969) to construct significance tests. Significance levels for correlations and regressions were based on distributions generated from 10,000 random permutations. In the first step of MRQAP, Pearson correlations between the dependent and the independent network matrices were calculated. In the second step, the significances of the association between the matrices were determined by using a random permutation method (Labianca et al. 1998). To test our hypotheses, we used MRQAP that was implemented in the software package UCINET (Borgatti et al. 1999).

We first calculated the Pearson correlations between variables. Means, standard deviations and correlation coefficient for all measures are in Table 1. To test the hypotheses, we conducted a hierarchical regression using MRQAP. We regressed creativity on control variables, independent variables and moderating variables step by step. To minimize any potential problems of multicollinearity and to better interpret the results, we centred the predictor variables before calculating the cross-product terms and examining the interaction effects before doing regression analysis (Enders and Tofighi 2007). The results of the regression models are shown in Table 2.

Model 1 in Table 2 shows the regression results of creativity on control variables. Background heterogeneity (b=0.042, p > .05) and work duration (b=0.044, p < .05) were positively related creativity. Prior working ties (b=0.086, p < .01), contributing cost (b=0.109, p < .01), seeking cost (b=0.241, p < .05) and task type (b=0.053, p < .01) were negatively related creativity. As predicted in H1 and H2, knowledge seeking ties (b=0.082, p < .01) and knowledge contributing ties (b=0.047, p < .01) were negatively associated with creativity. Both hypotheses were fully supported. H3a was supported (b=0.146, p < .01), which indicates that when the dyads use multiple media to communicate, the negative relationships between knowledge seeking ties and creativity would be weakened. H3b was not supported (b=-0.158, p < .01), with the path coefficient of the opposite direction significant, indicating that as knowledge contributing happens increasingly between dyads, the usage of multiple media to communicate may reduce the level of creativity.

Multicollinearity could distort the statistical results because the unique contribution of each independent variable cannot be determined due to the largely overlapping information between the independent variables (Hair et al. 1995). As a result, the variance of regression is inflated leading to rejection of the hypotheses. We calculated the value of variance inflation factor (VIF) to measure multicollinearity. A common cut-off threshold is the VIF value of 2. All the VIF values of our independent variables were all below the thresholds (VIF of knowledge seeking = 1.389, VIF of knowledge contributing = 1.769; VIF of media multiplexity = 1.237), indicating no evidences were found for the existence of multicollinearity.

An important limitation of organizational studies investigating relationship outcomes is the lack of independent sources to measure the dependent relational variable. This may make results artificially inflated due to common method bias. We conducted the Harmon one-factor test to mitigate the threat of common methods bias (Podsakoff and Organ 1986). Harmon’s one-factor test was conducted by entering all independent variables and dependent variables in an exploratory factor analysis. The data would have a common methods bias problem if a single factor emerged that accounted for a large percentage of the variance in the resulting factors. We first averaged the dyadic measures into measurements at individual level of measurements. After that, we constrained the number of factors extracted in the EFA to be just one (rather than extracting via eigenvalues). Then we examined the un-rotated solution. However, a single factor did not emerge in our analyses. This provides assurance that our results are not due to common methods variance.
This research was an effort to understand the contextual effects of communication media in moderating the relationships between network ties and creativity. Our results indicate a consistent finding that weak knowledge seeking and knowledge contributing ties result in diverse information and improve creative performance. However, this association is contextualized on the usage of multiple media. The usage of multiple communication media mitigates the negative relationships between knowledge seeking ties and creativity. It suggests that for knowledge seekers, it is beneficial for them to use multiple media to present their information enquires and access the diverse information source to satisfy their seeking needs. However, our results suggest that when individuals engage in high frequency of knowledge contributing activities, the usage of multiple media reduce the level of creativity. It may due to knowledge contributors'...
limited knowledge base and maintenance cost of multiple communication media. As the frequency of knowledge contributing activities increase, knowledge contributors are highly likely to share the same knowledge across different media. Therefore it burdens the recipients with much more redundant information. Second, the usage of multiple media definitely take extra amount of time to maintain across multiple communication media, making them feel cost in communication process, and reduce the intrinsic motivation of providing diverse responses.

Theoretical and Practical Implications

Theoretical Implications

The present research makes two theoretical contributions to the extant network analysis of creativity literature and communication media literature. First, it differentiates the context that media multiplexity can play a positive role in improving creative performance. Specifically, our study supports that multiple media enrich knowledge seeking activities with diverse information, but burden knowledge contributing activities with maintenance cost and the possibility of sharing redundant information. Second, built on other communication media theories, our study provides integrated theoretical support to explain how communication media increase diversity of knowledge exchange among employees.

Practical Implications

Team leaders may consider implement multiple communication media to facilitate the creative communication. Our study suggests that making usage of multiple media is not beneficial for the generation of creative ideas except that it is used for employees to seek knowledge from others. Therefore, when requesting ideas from external sources, the usage of multiple media that have different abilities of presenting rich information cues would make the presentation of problems be more complete and accuracy, especially for tacit and complex knowledge.

Limitations and Future Improvement

Although this sociometric study provides important empirical evidence supporting the hypothesized effects outlined in the theoretical framework, a limitation stems from our inability to validate the existence of the reported relationships. However, previous research suggests that although people may not be able to recall certain interactions in a limited period of time, they are able to accurately report typical social relationships (Hansen 1999; Marsden and Campbell 1984). Hence, threats to reliability of the name generator method validity may not be of great concern in this study.

In this study our reliance upon survey and the self-assessment of creative performance may introduce bias when evaluating dyadic creative performance. The success of past interaction with certain colleagues may overvalue the contribution of these dyadic relationships. Although we controlled shared working experience in the past (e.g., prior working ties), it may not eliminate the concern of evaluation bias. Given that the bias that is introduced by self-assessment of creativity, we plan to collect objective measures of creativity in the future analysis. Our future analysis will conduct dyadic analysis of creativity with objective measures. For instance, for software development teams, the dyadic creativity will be measures by the numbers of bugs they debugged together, or the solutions they provided for customers.

Reference


