KNOWLEDGE DIVERSITY AND SIMMELIAN TIE IN GENERATING CREATIVE IDEAS: THE IMPORTANCE OF MEDIA MULTIPLEXITY

Research-in-Progress

Yi Wu
National University of Singapore
Kent Ridge, Singapore, 117418
wuyi@nus.edu.sg

Xiqing Sha
National University of Singapore
Kent Ridge, Singapore, 117418
xiqing@nus.edu.sg

Klarissa Chang
National University of Singapore
Kent Ridge, Singapore, 117418
changtt@comp.nus.edu.sg

Abstract

Why are some technology-mediated interactions between pairs of individuals more successful than others in generating creative ideas? To seek the answers to this question, we study the generation of creative ideas from a dyadic perspective. We examine the attributes of dyadic ties that influence the generation of creative ideas, and how the strength of influence changes contingently on the usage of multiple media. Our study augments previous research by examining the impacts of knowledge diversity, Simmelian tie and media multiplexity on generating creative ideas. We conducted a survey among students in a knowledge-intensive academic institution. The results show that knowledge diversity, Simmelian tie and media multiplexity can trigger the generation of creative ideas. However, the influence of knowledge diversity and Simmelian tie on creative idea generation is weakened by media multiplexity. We discuss the findings and propose future plan for this research-in-progress study.

Keywords: Generating creative ideas, knowledge diversity, Simmelian tie, media multiplexity
Introduction

Creativity refers to the generation of ideas that are novel and useful (Amabile 1996). It is important to study creativity in order to effectively manage the innovation process in organizations. It is even more important to understand how to generate creative ideas because idea-generation is the prerequisite for idea evaluation and selection (Fleming et al. 2007). Generating creative ideas has been studied from different perspectives, including organizational (e.g., Monge et al. 1992) and individual (e.g., Perry-Smith 2006) levels. However, little attention has been devoted to studying creativity at the dyadic level, i.e., generating creative ideas between each pair of individuals. Understanding why some technology-mediated interactions are more likely than others to generate novel and useful ideas is important because creativity is usually the outcome of the social interactions between two individuals (Sosa 2011). Dyadic exchanges are not only conduits of knowledge but also transmit various levels of social support reflected by the time, energy, and engagement associated with them. Therefore, dyads constitute an ideal unit of analysis to precisely disentangle the factors that help in the generation of creative ideas. In this study, we emphasize the generation of novel and useful ideas between pairs of individuals through the perspectives of knowledge diversity and Simmelian tie.

One way to generate creative ideas between dyads is through knowledge diversity. Knowledge diversity refers to the extent to which the content exchanged between pairs of individuals in the interactions includes knowledge across distinct domains (Sosa 2011). From a knowledge viewpoint, sources with greater knowledge diversity are more likely to act as cognitive catalysts that ignite the generation of creative ideas between the source and recipient. This consideration is important because generating creative ideas is the result of novel combination of useful knowledge, i.e., a convergent process whereby a pair of individuals is more likely to generate creative ideas when they are able to access to diverse knowledge from each other (Fleming et al. 2007).

Other research studies have shown that it is easier to generate creative ideas when the source and recipient share a common knowledge base (Ahuja 2000). The common knowledge base can be represented by the presence of Simmelian tie, a significant factor that enhances generation of creative ideas (Obstfeld 2005; Tortoriello and Krackhardt 2010). A Simmelian tie refers to the extent to which the focal dyad is surrounded by at least one common third party (Krackhardt 1998). It facilitates the formation of common knowledge and shared understanding, reduces friction and takes advantage of shared sources of knowledge (Tortoriello and Krackhardt 2010). Therefore, it is important to have common third parties for generating creative ideas, i.e., a divergent process whereby a pair of individuals is more likely to generate creative ideas when they are able to access to diverse knowledge from each other.

The two schools of thought present a dilemma as to whether creativity is influenced by diverse knowledge or common knowledge through common third parties in dyads. Some studies have addressed the waxing and waning effects of diverse and common knowledge by exploring how media multiplexity impacts dyads to generate creative ideas. Media multiplexity refers to the extent to which the same communication media are used among dyads (Haythornthwaite 2002). Technology advances have brought together pairs of individuals to work on a plethora of tasks regardless of spatial and temporal boundaries (Thatcher and Brown 2010). Besides traditional face-to-face meetings in groups, the increased use of technology presents interesting opportunities and challenges in generation of creative ideas. However, there is little research on the role of media multiplexity in generating creative ideas. Media multiplexity enables individuals to exchange diverse knowledge in corresponding channels endowed with technology accessibility (Yuan et al. 2010). It also deepens the common understanding of problems by enriching communication opportunities that help in overcoming interpretive barriers in the generation of creative ideas (Carlile 2004). Different media may complement one another to provide individuals with better access to information embedded in rich formats of, and hence facilitate the fulfillment of various communication needs (Haythornthwaite and Wellman 1998). Therefore, examining media multiplexity provides insights into the socio-technical mechanisms through which a creative idea is generated in dyadic relationships.

Due to the knowledge gaps identified above, we address the following research questions in this study:

RQ1. What are the impacts of knowledge diversity and Simmelian tie on generating creative ideas among dyads?
RQ2. How are the impacts of knowledge diversity and Simmelian tie on generating creative ideas contingent on media multiplexity?

This research has significant theoretical contributions. It helps in understanding how creative ideas are generated between individuals by the integration of different theoretical perspectives (i.e., theories of knowledge diversity, Simmelian tie and media multiplexity). By examining the direct and moderating effects of media multiplexity, the research opens a black box to show how media multiplexity influences the relationships between social ties and generation of creative ideas. More importantly, it calls for significant theoretical attention on dyadic perspectives in studies that investigate the nuances of social networks in work teams. The study also provides significant practical contributions. Organizational managers are often encouraged to form creative teams by recruiting employees with diverse expertise domains. The research findings can assist in providing insights on the configuration of team members with an appropriate level of diverse and common knowledge. In addition, technology designers would benefit by introducing both verbal and non-verbal features into organizational systems, hence making the single system function as if it was equipped with a combination of multiplex media tools.

Theoretical Background

Generating Creative Ideas

Generating creative ideas is often the result of novel combinations of different perspectives that individuals are exposed to via social interactions (Allen 1977). Social interaction is defined as the transfer of information between the source which is sending information and the recipient who is receiving information (Sosa 2011). Such interaction between two individuals includes the following basic stages: the recipient’s acquiring of knowledge from the source and processing that knowledge, and then realizing the potential value of the interaction outcome (Reagans and McEvily 2003). Processing knowledge that yields creative ideas has been the subject of studies that adopt a cognitive psychology perspective in studying creativity (Simonton 1988). Within this context, creative ideas are associated with the occurrence of two distinct sets of cognitive processes: generation of creative ideas and evaluation of the generated ideas to select the ones for further pursuit. This model is consistent with the “blind-variation and selection-retention” model of creative thought by Simonton (1988).

We rely on the recipient to assess the novelty and usefulness of his/her ideas because we focus on the generative aspect of ideas before the ideas are exposed for further evaluation and selection. It is important to recognize that what the recipient considers as potentially creative may not necessarily be considered as creative by others. Generating creative ideas is enhanced through both the convergent process (defined as an approach bringing diverse points of views together (Amabile et al. 1996), as well as the divergent process (defined as a process whereby one analyzes situations from a new perspective (Ford 1996). These processes complement each other in generation of creative ideas (Scheidel 1986).

Knowledge Diversity

The convergent process requires individuals to bring diverse knowledge together to build personal thinking and solutions. The cognitive resource theory suggests that knowledge diversity will improve creative performance, since individuals will then have opportunities to a wide array of views, skills, and information (Perry-Smith and Shalley 2003). The divergent process requires individuals to analyze situations from a new perspective. The diverse knowledge obtained by individuals helps to derive new understanding of problems and think of the problems from new perspectives. Hence, knowledge diversity could enhance both the convergent and divergent processes during generation of creative ideas. Therefore Exposure to a wide range of perspectives is especially important when one is interested in the development of creative products and ideas (Garfield et al. 2001).

Previous research on creativity has suggested that accessing diverse pools of knowledge to establish novel linkages among them is an important condition to generate creative outcomes (Fleming et al. 2007; Simonton 1999). Individual-level analyses have emphasized the value of accessing diverse knowledge through ties with diverse groups of people, which overlooks the possibility that ties that convey diverse knowledge may also themselves facilitate generation of creative ideas (Sosa 2011). Hence, an individual
with a portfolio of dyadic interactions that convey diverse knowledge are expected to be highly proficient at generating creative ideas.

**Simmelian Tie**

The concept of Simmelian tie stresses that the context in which relationships are embedded has the potential to affect the character and quality of relationships (Tortoriello and Krackhardt 2010). Specifically, Simmelian tie indicates the presence of common third parties (Krackhardt 1998); and it bears loose resemblance to a clique (Dekker 2006), which is defined on a graph as a maximal set of three or more nodes, all of which are directly and reciprocally connected to one other (Krackhardt 1998). Simmelian tie facilitates the formation of common knowledge and shared understanding between individuals; and such knowledge and understanding toward particular problem is helpful in triggering new thinking and solutions of problems, regard of the divergent process. Meanwhile, Simmelian tie intensifies individuals to access and bring diverse knowledge together by promoting open communication opportunities. Therefore, knowledge diversity benefits both the convergent and divergent processes during generation of creative ideas.

Simmelian tie facilitates the formation of shared understanding and the pursuit of common goals by mitigating competition and self-interest. This is important, because informational advantages can be quite limited if the parties involved, acting opportunistically, avoid sharing sensitive knowledge and information with each other (Tortoriello and Krackhardt 2010). Simmelian tie instead limits selfish behaviors and promotes open and complete knowledge sharing among the parties involved. In a Simmelian structure, common third parties increase the stability of dyadic relationships by reducing dissension and facilitating conflict resolution. The increased stability promotes the formation of common knowledge and shared understanding among the parties involved. Common knowledge and shared understanding is critical in overcoming interpretive barriers and achieving the successful integration of different perspectives to generate creative ideas.

**Media Multiplexity**

Theoretically speaking, we contend that media multiplexity provides individuals with technology access to diverse and common knowledge as well as shared understanding among dyads for generating creative ideas. The media multiplexity theory assumes that information exchanged through communication media among individuals is a social phenomenon, hence it is important to understand how “social relationships affect what is communicated between whom, and via which media” (Haythornthwaite and Wellman 1998). Individuals learn and retain information both through verbal and nonverbal systems (Clark and Paivio 1991).

Media multiplexity complementarily enables users to provide rich cues to ease the sharing of knowledge for generating creative ideas, especially when the sources encounter the difficulties regarding knowledge codification and verbalization (Yuan et al. 2010) and when the knowledge is new to the recipient. Media multiplexity improves both accuracy and efficiency in knowledge sharing, and deepens the understanding of problems for generating creative ideas. Another advantage of media multiplexity is that it offers individuals with the benefits of each communication media in an integrated manner to obtain diverse types of knowledge and to understand problems from interactions with different sources (Yuan et al. 2010). Receiving information through multiple media not only influences how one receives information but affects how one perceives information and influences the amount of time one engages in communication-related activities (Thatcher and Brown 2010). Finally, we maintain that media multiplexity extends the communication channels for individuals to access diverse knowledge and improve common knowledge and shared understanding among dyads.

**Research Model and Hypotheses**

Based on theoretical analysis, this study proposes a research model (Figure 1) for investigating the generation of creative ideas between dyads. The model suggests that knowledge diversity, Simmelian tie and media multiplexity are predictors of generation of creative ideas. And media multiplexity is a moderator as well.
The effect of knowledge diversity is grounded in the role of cognitive variations in generating creative ideas (Simonton 1988). As cognitive variation depends on the existence of knowledge elements that can be combined into new feasible variations in the mind of the recipient, the number and breadth of cognitive elements acquired by the recipient from the source are essential factors in the generation of creative ideas (Simonton 1999). Furthermore, diverse knowledge acquired by a recipient usually introduces ambiguity and misunderstandings to that recipient, due to the limited capacity of that recipient. Creative ideas to problems have sometimes developed as the results of accidents or misunderstandings (Thatcher and Brown 2010). Therefore, we hypothesize:

**H1:** Knowledge diversity is positively associated with the generation of creative ideas between dyads.

The increased stability resulting from Simmelian tie promotes the formation of common knowledge and shared understanding among the individuals involved (Tortoriello and Krackhardt 2010); and such common knowledge and understanding is critical in overcoming interpretive barriers and achieving the successful integration of different perspectives for generating creative ideas (Carlile 2004). Simmelian tie exhibits high levels of cooperation observed within the dyads (Tortoriello and Krackhardt 2010), as ties embedded in a clique are characterized by the reduction of dissension and the resolution of conflict, thus facilitating the knowledge exchange for the generating of creative ideas (Reagans and McEvily 2003). When a dyad shares common third parties that strengthen their collaborative environment, it assists in generating creative ideas (Obstfeld 2005). Therefore, we hypothesize:

**H2:** The presence of Simmelian tie is positively associated with the generation of creative ideas between dyads.

Faraj and Spoull (2000) demonstrated that work performance was a function of access to knowledge rather than the mere presence of expertise, indicating that awareness of expertise by itself might not adequately explain performance. Awareness of “who knows what” needs to be supported by technology accessibility and strong relationships to obtain actual access to expertise. Media multiplexity provides dyads with the benefits of each communication medium in an integrated way, and provides more choices for individuals in media selection (Yuan et al. 2010). Thus media multiplexity is effective in enriching the communication content and deepening the understanding of problems important for generating thought-through solutions. Therefore, we hypothesize:

**H3:** The level of media multiplexity is positively associated with the generation of creative ideas between dyads.

A recipient, who communicates with a source via multiple communication media, will find it easy to access and understand knowledge given by the source; such a condition results in increasing of knowledge overlap and similarity between the recipient and the source. In fact, knowledge overlap obstructs the generating of creative ideas (Sosa 2011). Furthermore, considering the limited attention and capability of individuals, it is much better for them to focus on specific media with high level of cues, because it is important to be able to see visual cues when explaining diverse knowledge (Thatcher and Brown 2010). And there is overhead associated with using multiple media, and complex communications of diverse knowledge would be best supported by a single medium. Thus media multiplexity would be less influential as knowledge diversity increases. Therefore, we hypothesize:

**H4:** The impact of knowledge diversity on the generation of creative ideas will be weakened by the level of media multiplexity between dyads.

Media multiplexity increases the mutual responsiveness process for shared understanding between recipient and source, which is critical for generating creative ideas. It facilitates the formation of common knowledge and shared understanding between recipient and source regarding problems (Carlile 2004). Media multiplexity provides multiple communication channels for individuals in Simmelian tie to enrich communication opportunities and accessibility; thus leading them to spend more time together to

Therefore, we hypothesize:

**H5:** The impact of Simmelian tie on the generation of creative ideas will be strengthened by the level of media multiplexity between dyads.
Methodology

Research Setting

The study was conducted in a course from an academic institution. Preliminary interviews with the course instructors confirmed that teamwork in this setting would suffer from a lack of creative ideas. Since students were not constantly together, but frequently communicated with each other, it was important for them to have access to multiple communication tools e.g., e-mail, shared documentation systems (e.g., Google Doc) and other social media tools (e.g., Facebook).

Responses were received from 72 of 79 undergraduates resulting in a 91.14% response rate more than the minimum 80% participation rate needed for network studies (Scott 2000). Demographic data was collected from their class rosters. The sample included a heterogeneous mix of educational backgrounds, and included students from computer science (20%), information systems (35%), social science (10%), business (20%) and engineering (15%) departments 53% of them were males.

Data Collection and Measurement

This study adopted an on-site paper-based survey method. Following the accepted norms of social network studies (e.g., Shah 1998), network data was collected using the combination of roster methodology and single-item measurement (Marsden 1990). Freeman et al. (1987) found network questions to be highly reliable when respondents are inquiring about typical interaction patterns. Therefore, considering the risk of respondents dropping out of our survey if there were an excessive number of relational questions, we chose to use a single item to measure each variable.

Ease of generating creative ideas captures the extent to the recipient generate creative ideas associated with interactions with source (Sosa 2011). We focused on the source's ease of generating creative ideas with the recipient, and this measurement is consistent with previous studies (Reagans and McEvily 2003). The ease of generating creative ideas was captured by asking each respondent to rate, on a four-point Likert scale (“strongly disagree”, “disagree”, “agree” and “strongly agree”), his/her level of agreement with statements such as “When I interact with this person, it is easy for me to generate novel and useful ideas.” (Tortoriello 2005).

Knowledge diversity is the extent to which the dyads share different types knowledge across distinct domains (Sosa 2011). It was measured: “I think the knowledge received from this person is different to me,” on a four-point Likert scale (“strongly disagree”, “disagree”, “agree” and “strongly agree”).

Simmelian tie captures the extent to which each dyad is surrounded by common third parties (Krackhardt 1998). Respondents were asked to indicate the average frequency of knowledge exchange on work-related issues, with each individual indicating their responses on a four-point scale (“never”, “less than once a week”, “once a week”, and “more than once a week”) (Umphress et al. 2003). We first constructed the interaction network (C), where \( C_{ij} \) was set as “1” if individual \( i \) exchanged knowledge with individual \( j \) at least once a week; otherwise, it was set as “0”. This operationalization is theoretically consistent with previous studies (e.g., Sykes et al. 2009; Yuan et al. 2010). We then constructed the reciprocal interaction matrix (\( C^{R} \)) where a reciprocated tie existed only if individual \( i \) was connected to individual \( j \), i.e., \( C_{i,j} = 1 \).
and vice versa. The Simmelian matrix $C$ (Krackhardt and Kilduff 2002) was derived from the reciprocal interaction matrix, such that $C_{ij} = 1$ if each dyad was connected with at least one common third party, and $C_{ij} = 0$ if each dyad was not connected with any common third party.

**Media multiplexity** measures the extent to which the same communication media are used between dyads. Respondents were asked to indicate the frequency at which each medium was used to communicate with each individual on a four-point scale (“never”, “less than once a week”, “once a week”, and “more than once a week”). The media included face-to-face meetings, e-mails, shared documentation systems (e.g., Google Doc) and other social media tools (e.g., Facebook). For each medium usage matrix ($M_i$, $M_{ij}$ was set as “1” if individual $i$ used the medium to communicate with individual $j$ at least once a week, otherwise, it was set as “0" (Sykes et al. 2009). Following Haythornthwaite and Wellman (1998), media multiplexity was measured by adding these matrices to create a single matrix with cell values ranging from 0 (no media used at least once a week) to 4 (all media used at least once a week).

Additionally, several control variables were included in the model to eliminate alternative explanations. First, we examined culture differences as cultural issues had been shown to influence the communication process (Cummings 2004). This was measured by the differences in nationality, where “1” indicated that each dyad came from different countries and “0” indicated that they were from the same country. Second, we treated pre-existing networks as a control variable, through a self-reported item, namely: “How many projects have you worked on with this person. Third, media experience differences was treated as another control variable by measuring differences in media experience between each dyad, respondents were asked to indicate their frequency usage of each communication medium prior to the study. We then calculated the differences between the responses of each dyad by averaging the differences of each medium. Finally, we controlled the effect of the communication costs. It was measured by asking the respondents the extent to which they agreed that exchanging information with each individual was costly, on a four-point Likert scale (“strongly disagree”, “disagree”, “agree” and “strongly agree”).

**Analysis and Results**

Traditional methods of regression analysis are inappropriate because dyads do not constitute independent observations, and would result in high levels of autocorrelation in the regression results (Carley and Krackhardt 1996). For this reason we applied the multinominal logistic regression quadratic assignment procedure (MRQAP) (Baker and Hubert 1981) provided in UCINET 6 (Borgatti et al. 2002) to analyze the data. MRQAP regression has been shown to yield unbiased parameter estimates regardless of the degree of autocorrelation(Krackhardt 1998).

Table 1 provides the correlation statistics for all variables used in our study. It can be seen from Table 1 that correlation results show significant correlations of the dependent variable with the key independent variables. The high significant levels of correlations between the variables are due to the variable interdependence, resulting from non-independent network observations (Umphress et al. 2003).

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>S.D</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>0</td>
<td>1</td>
<td>0.63</td>
<td>0.48</td>
<td>586</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PN</td>
<td>0</td>
<td>3</td>
<td>0.73</td>
<td>1.06</td>
<td>586</td>
<td>0.05</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>0</td>
<td>4</td>
<td>0.94</td>
<td>0.75</td>
<td>586</td>
<td>-0.02</td>
<td>-0.07</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>1</td>
<td>4</td>
<td>1.58</td>
<td>0.83</td>
<td>586</td>
<td>-0.01</td>
<td>0.05</td>
<td>-0.02</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KD</td>
<td>1</td>
<td>4</td>
<td>2.20</td>
<td>0.66</td>
<td>586</td>
<td>-0.02</td>
<td>0.18</td>
<td>-0.01</td>
<td>0.09</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>0</td>
<td>1</td>
<td>0.19</td>
<td>0.39</td>
<td>586</td>
<td>0.03</td>
<td>0.30*</td>
<td>-0.05</td>
<td>-0.08</td>
<td>0.12</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>0</td>
<td>4</td>
<td>1.04</td>
<td>1.21</td>
<td>586</td>
<td>0.02</td>
<td>0.29*</td>
<td>-0.24</td>
<td>-0.13</td>
<td>0.18</td>
<td>0.51**</td>
<td>-</td>
</tr>
<tr>
<td>EI</td>
<td>1</td>
<td>4</td>
<td>2.74</td>
<td>0.76</td>
<td>586</td>
<td>0.02</td>
<td>0.37**</td>
<td>-0.05</td>
<td>-0.06</td>
<td>0.24*</td>
<td>0.33**</td>
<td>0.42**</td>
</tr>
</tbody>
</table>

Note: CD: culture differences, PN: pre-existing networks, MD: media experience differences, CC: communication costs, KD: knowledge diversity, ST: Simmelian tie, MM: media multiplexity, EI: ease of generating creative ideas, *=p<0.05, **=p<0.01
With the preliminary data, the results of the MRQAP are displayed in Table 2. The hypothesized model provides an acceptable fit to the data with an R-square of 0.33 (Model 3). It can be seen from Model 2 that knowledge diversity \( b=0.11, p<0.01 \), presence of Simmelian tie \( b=0.17, p<0.01 \) and media multiplexity \( b=0.30, p<0.01 \) positively affect ease of generating creative ideas. Therefore, H1, H2 and H3 are supported.

We had significant evidences to support H4 \( b=-0.12, p<0.01 \) from Model 3. The marginal effect of knowledge diversity on ease of generating creative ideas will be stronger when the level of media multiplexity is low than when the level of media multiplexity is high. Contrary to our theoretical prediction of H5 \( b=-0.20, p<0.01 \), we found a significant negative moderating effect in Model 3. The marginal effect of Simmelian tie on ease of generating creative ideas will be stronger when in the low level of media multiplexity than in the high level of media multiplexity. H5 is not supported.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercepts</td>
<td>2.42</td>
<td>2.07</td>
<td>2.131</td>
</tr>
<tr>
<td>Culture differences</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>Pre-existing networks</td>
<td>0.27**</td>
<td>0.10**</td>
<td>0.18**</td>
</tr>
<tr>
<td>Media experience differences</td>
<td>-0.02</td>
<td>0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>Communication costs</td>
<td>-0.07*</td>
<td>-0.03*</td>
<td>-0.03*</td>
</tr>
<tr>
<td>Knowledge diversity</td>
<td>0.11**</td>
<td>0.09**</td>
<td></td>
</tr>
<tr>
<td>Simmelian tie</td>
<td>0.17**</td>
<td>0.54**</td>
<td></td>
</tr>
<tr>
<td>Media multiplexity</td>
<td>0.30**</td>
<td>0.47**</td>
<td></td>
</tr>
<tr>
<td>KD*MM</td>
<td></td>
<td>-0.12**</td>
<td></td>
</tr>
<tr>
<td>ST*MM</td>
<td></td>
<td>-0.20**</td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.14</td>
<td>0.28</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Note: KD: knowledge diversity, ST: Simmelian ties, MM: media multiplexity, *=p<0.05, **=p<0.01

**Concluding Remarks**

Our results show that knowledge diversity assists in the generation of creative ideas at the dyadic level. Having a diverse knowledge base acquired by engaging in distinct interactions with different sources does increase the generation of creative ideas (Fleming et al. 2007). The formation of common knowledge and shared understanding is promoted by the third party presence among the parties involved (Tortoriello and Krackhardt 2010). Common knowledge is critical in overcoming interpretive barriers and achieving the successful integration of different perspectives to ease generation of creative ideas (Carlile 2004). Our empirical results confirm the benefits of media multiplexity in generating creative ideas. However, media multiplexity actually decreases knowledge diversity between dyads. Interestingly, impacts of media multiplexity and Simmelian tie on ease of generating creative ideas are complementary. Furthermore, strongly connected individuals prefer to focus on a specific communication tool to interact with each other, due to the high maintenance costs for multiple media and limited availability of individual attention.

Regard of theoretical implications, our paper studies the micro-processes involved in creativity research, by focusing on idea generation rather than on idea evaluation. This study emphasizes the importance of studying social network phenomenons in organizations from the fundamental unit of networks (i.e., dyads), because social interactions within dyads are different in terms of ties and media multiplexity. By introducing theories from knowledge diversity, Simmelian tie and media multiplexity, we theoretically verified that generating creative ideas is a combination of convergent process, divergent process and technology support. Practically speaking, organizational managers are encouraged to recruit employees with diverse knowledge backgrounds, especially for the R&D departments. Second, practitioners are provided with guidelines on how to structure a team with a Simmelian tie in the work environment to form collaborative environments for problem-solving. Finally, technology designers would benefit by introducing both verbal and non-verbal features into organizational systems, making the single system function as if it was equipped with a combination of multiplex media tools.
As a research in progress, model and findings need further validation. First, regarding to the sample bias, it is proposed to collect data in an R&D department from a business organization. Second, besides subjective measurement of network variables, we should collect objective data (e.g., logs of email exchange) to construct employees' network in future. Third, due to the difficulty in data collection, we did not measure the quality of generated ideas; and we suggest that content analysis could be applied to assess the "ideas" in future work.

References


