SOCIAL NETWORK TIES BEYOND NON-REDUNDANCY:

AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF KNOWLEDGE CONTENT AND TIE STRENGTH ON

CREATIVITY

JILL E. PERRY-SMITH

Emory University

Goizueta Business School

Atlanta, GA 30322-2710

404-727-4820

jill.perry-smith@emory.edu

ABSTRACT

Social network research emphasizes the access to non-redundant knowledge content that network ties provide. I suggest that some content is more beneficial than others and that tie strength may affect creativity for reasons other than the associated structure. That is, tie strength may affect how individuals process non-redundant knowledge. I investigate two types of knowledge content—information (i.e., facts or data) and frames (i.e., interpretations or impressions)—and explore whether tie strength influences their effect on creativity. Drawing on creativity theory, I employ an experimental design to provide greater theoretical clarity and to isolate causality. According to the results from two studies, distinct frames received from contacts facilitate creativity, but the effect of distinct information is more complex. When individuals receive distinct information from strong ties, it constrains creativity compared to distinct frames. Content from weak ties appears to facilitate creativity across all scenarios. The results of mediated moderation analysis indicate the effect of framing versus information for strong ties is driven by decision-making time, as an indicator of cognitive expansion.

Keywords: creativity; social networks; tie strength; knowledge content

Designing organizations for creativity is a highly complex undertaking. An emerging line of research suggests that organizations aiming to inspire creativity among their employees must carefully consider a variety of factors. The evaluative context, resources, and rewards (e.g. Byron, Khazanchi & Nazarian, 2010; Eisenberger & Armeli, 1997; Madjar, Greenberg & Chen, 2011) all play a role in creating an environment that encourages creative solutions (see Shalley, Zhou & Oldham, 2004 for a review). Social interactions, even informal ones, also may help leverage creativity among employees. A variety of scholars have used a social network lens to view those interactions in terms of ties and structures that facilitate creativity (e.g., Baer, 2010; Brass, 1995; Perry-Smith & Shalley, 2003; Zhou, Shin, Brass, Choi & Zhang, 2009). Those scholars emphasize, for example, networks that reach diverse social circles, bridge disconnected individuals, or balance centrality with ties outside of the organization. Based on seminal network theories (Burt, 1992; Granovetter, 1973), the general premise driving much of this research is that these structures affect creativity because they provide access to non-redundant (i.e., distinct and non-overlapping) knowledge content. The particulars of the content and their effects on creativity, however, are rarely clearly explicated or tested. In this article, I intend to address that omission by examining the influence on creativity of particular *types* of content and the extent to which the effect depends on tie strength.

In general, scholars of networks and creativity describe knowledge content in broad terms. They tend to approach content in one of two ways. The dominant approach emphasizes non-redundant *information* (e.g., Perry-Smith, 2006; Baer, 2010; Zhou et al., 2009; Rodan & Galunic, 2004). A second, less common approach highlights non-redundant thought worlds or perspectives (e.g., Fleming, Mingo & Chen, 2007; Baer, 2010; Cattani & Ferriani, 2008), which I will conceptualize as problem *frames*. A close read of the literature reveals these two approaches, as well as a tendency to leave underdeveloped actual conceptualizations of the nature of the content driving creativity. Granted, from a structuralist's perspective, the particulars of content are less important than the question of whether it is non-

redundant (e.g., Burt, 2004). Creativity theorists suggest, however, the effects of knowledge on creativity are complex (Amabile, 1983; Dane, 2010). It is not simply the uniqueness of knowledge or the accumulation of non-redundant knowledge. Rather, it is how the knowledge is organized in the mind. Does the accumulation of knowledge allow for flexibility and new cognitive pathways, or does it merely reinforce existing modes of thinking? That means there is reason to believe that the *type* of knowledge content (i.e, information versus frames) may indeed matter, although few if any direct tests exist of their effect on creativity. Understanding this effect could add a significant facet to the social network lens. I take it as given that non-redundant content actually flows from non-redundant ties. I do not directly test this assumption. Rather, I isolate content and focus on evaluating what type of non-redundant knowledge content facilitates creativity.

The premise of network research, however, is that knowledge content is not divorced from its social context. It is reasonable to ask, then, whether the nature of the relationship through which knowledge is received matters. Strong ties are relationships that are more emotionally close, reciprocal, and frequent than weak ties (Granovetter, 1973). In a predominant interpretation of Granovetter's (1973) "strength of weak ties" theory, the more proximate and relevant mechanism of the "weak tie effect" is the related structure (Borgatti & Halgin, 2011; Burt, 1992). This makes sense, given that Granovetter himself emphasizes that weak ties are more likely than strong ones to reach distinct social circles, and as a result, distinct pockets of content. There is reason to believe, however, that tie strength may be important not only for structure. Empirical researchers controlling for structural non-redundancy still find effects of strength (Baer, 2010; Perry-Smith, 2006; Zhou et al., 2009). In addition, balance theory (Heider, 1958; Newcomb, 1961; Phillips, 2003) posits that whether an individual is friends with another affects how she interprets objects such as possessions, opinions, and information— or people associated with the friend. It is thus important to understand both the nature of the relationship—its strength—and the content of the exchange. Accordingly, then, in addition to asking

about the effects of content type, I also ask: does tie strength affect the relationship between non-redundant content and creativity? If so, strength is not simply a proxy for non-redundant content. That is, "the strength of weak ties" may lie not only in the associated structure, but in how strength affects the interpretation of content, as well.

Although early social network research employed laboratory methodologies (see Borgatti, Mehra, Brass & Labianca, 2009 for a history of network research), recent work has relied primarily on field and archival approaches. These methods certainly have been important to the literature. They limit researchers' ability, however, to clarify and explicitly test assumptions, fully understand the relationship between networks and individual outcomes, and design further studies accordingly. To address this shortcoming, I isolate non-redundancy, holding it constant, and test the effects of content type (i.e., information versus framing) in an experimental setting. While it may be difficult to measure content objectively using survey methodologies, an experimental design provides a unique opportunity, because content can be manipulated and its impact clearly assessed. By isolating structure, I can test whether or not the psychological effects of tie strength inform creativity. That is, do individuals process content differently depending on whether it is received from a strong or weak tie?

The purpose of this research, then, is to investigate the effect of tie strength on the relationship between non-redundant knowledge content and creativity in an experimental setting. Interestingly, although knowledge is a central component of Amabile's (1983) influential componential theory, it has been less emphasized in subsequent creativity research compared to other theoretical drivers of creativity, such as intrinsic motivation (Shalley et al., 2004). In the first of two studies, I test the interaction between tie strength and knowledge type on creativity, which I explain via cognitive expansion and cognitive flexibility. To provide evidence of cognitive processing, in the second study I test the mediating role of decision-making time as a proxy of cognitive expansion. Cognition also has been underemphasized in the creativity literature, although some have argued it is at the heart of how

social context affects creativity (Ward, Smith & Finke, 1999). To begin, I provide relevant theoretical

background. Then, I develop and test hypotheses in the two studies.

THEORETICAL FRAMEWORK

Creativity scholars have defined creativity as novel and useful ideas, solutions, or processes

(Amabile, 1996; Shalley, 1991), and like others (e.g., Shalley, Gilson, & Blum, 2000), I assume that

creativity is important in a variety of jobs and professions, particularly those that involve complex

problems. Empirical evidence shows that individuals with ties to individuals who otherwise are

disconnected (i.e., non-redundant ties) are more creative (Baer, 2010; Burt, 2004; Perry-Smith & Shalley,

2003; Zhou et al., 2009; Cattani & Ferriani, 2008; Fleming et al., 2007). The primary rationale is

grounded in the assumption that non-redundant ties provide access to non-redundant knowledge

content. My principal interest, however, lies in understanding how non-redundant content *type* affects

creativity. I use assumptions about what non-redundant ties provide to articulate the kinds of content of

interest. Below, I highlight two approaches that have not previously been clearly distinguished. I then

use creativity theory to predict the effect of the two types of content on creativity, and finally use

balance theory to predict that the effects are contingent on tie strength.

Assumptions about the kind of non-redundant knowledge content that is beneficial to creativity

can be categorized into two perspectives. The "transfer perspective" assumes individuals obtain

actionable knowledge from others that will lead to the "right" answer (Cross & Sproull, 2004). In this

case, individuals receive content that either can be directly applied to the problem at hand or that will

lead to a correct solution. This can include explicit or procedural types of knowledge as well as codifiable

information (e.g. Cross, Borgatti & Parker, 2001; Hansen, 1999). An alternative perspective, the

"constructivist perspective," assumes that answers are not obtained from contacts, but contacts help

individuals make sense of, or "frame," a problem (Cross & Sproull, 2004). This framing may include a

different assumption or perspective on key aspects of the problem. The new perspective may help

individuals reformulate the problem (Cross, Borgatti & Parker, 2001; Hargadon & Bechky, 2006), or interpret and translate key issues and constraints (Burt, 2008; Reagans & McEvily, 2003). Consistent with the constructivist view, Burt (2008) posits that exposure to non-redundant contacts enhances cognitive and emotional skills. He states (p.963, 2008), "brokerage is not valuable for the information it provides so much as it is valuable as a forcing function for the cognitive and emotional skills required to communicate divergent views. It is the cognitive and emotional skills produced as a by-product of bridging structural holes that are the proximate source of competitive advantage."

Just as there are two possible explanatory paths through which network ties can facilitate creativity, there are also two relevant perspectives on knowledge content. In the first, individuals receive bits of information directly applicable to the problem at hand. In the second, individuals receive content that shapes and changes the way they think about and interpret the problem. The former I conceptualize as *information* and the later I conceptualize as *frames*.

Information

Social network research has emphasized the flow of new information (Borgatti & Halgin, 2011). The central premise relies on a probabilistic, importation logic. In other words, the greater the quantity of unique (non-redundant) bits of information transferred through network ties, the greater the likelihood that these bits can be recombined to create something new. Creative or innovative ideas rely on old concepts or ideas recombined in new ways (Mumford & Gustafson, 1988; Ward et al., 1999). Therefore, network ties that provide access to a larger number of distinct—or non-redundant—pieces of information (Baer, 2010; Rodan & Galunic, 2004; Zhou et al., 2009), are thought to provide more opportunities for recombination (Fleming et al, 2007). The emphasis here is on quantity of non-redundant inputs, consistent with the knowledge transfer perspective of networks (e.g., Aral & Van Alstyne, 2011). As a result, the more unique —as opposed to redundant or overlapping—bits of information one receives from disconnected contacts, the greater chance one will have to be creative.

Thus, *information*, which I define as facts or data relevant to the problem at hand, is one type of

network content expected to facilitate creativity. For example, in a consumer marketing problem,

"information" might be the size of the target population and the product's time line.

Framing

Frames are lenses through which individuals view a situation or problem, a way for individuals

to make sense of a problem (Goffman, 1974; Snow, Rochford, Worden & Benford, 1986). A frame

reflects an individual's impression of what is happening—how the observed behaviors and outcomes are

interconnected. In the consumer marketing problem, for example, "frames" might be interpretations of

the root cause of the problem—for instance, the belief that the limited sales are due to flaws in

advertisements or incorrect consumer data. In addition to information, an undercurrent of the

theoretical narrative is that non-redundant ties affect creativity by providing exposure to diverse frames,

described loosely as different "ways of thinking," for example (Fleming et al., 2007; Baer, 2010; Cattani

& Ferriani, 2008; Perry-Smith, 2006). Contacts also may help reformulate or "reframe" a problem by

redefining the question (Cross & Sproull, 2004; Hargadon & Bechky, 2006). Though they are not

referenced specifically in network studies, frames provide one systematic way of conceptualizing

different perspectives. Framing, then, is another type of content assumed to flow from non-redundant

ties.

A person's ability to generate novel solutions depends on her interpretation of the situation

(Drazin, Glynn & Kazanjian, 1999; Madjar et al., 2011), or more specifically on her ability to reframe

problems (Getzels, 1975). Broad categorization, or the ability to think beyond narrow categories, is

important for creativity (Guilford, 1967; Ward et al., 1999; Shalley & Perry-Smith, 2008). In many cases,

possible solutions to a problem are constrained by how a problem is categorized. Narrow

categorizations result in individuals "running out" of ideas rather quickly and settling on standard ones.

If individuals categorize inputs in broad terms, they are more likely to make connections across inputs

than they would if the inputs are narrowly categorized and disconnected. Exposure to different frames can broaden one's thinking about a problem, pushing one to go from a narrow conceptualization to a broader one. Otherwise, individuals anchor on one interpretation (Reiter-Palmon, Mumford, O'Conner, Boes & Runco, 1997). That is, they cannot move away from their initial, often standard, way of conceiving a problem. Framing, then, is another type of content expected to facilitate creativity.

Tie Strength

Balance theory posits that individuals desire psychological balance in their representation of concepts in the mind (Heider, 1958; Newcomb, 1961). These concepts can include the perceiver, others, their "objects," and the connections among them. A balanced state is one in which an individual's sentiments about concepts are congruent. Individuals are uncomfortable with imbalance, and are motivated to restore balance either by altering relationships or altering cognition (Heider, 1958). Typically, when balance theory is applied in the network literature, scholars emphasize social ties among the triad of perceiver (P) and two others (O_1 and O_2) (e.g., Krackhardt & Kilduff, 1999; Kilduff & Krackhardt, 1994; Labianca, Brass & Gray, 1998). For example, in a balanced triad, an individual (P) likes his or her friend's (O_1) friend (O_2) resulting in a closed triad of positive sentiment—strong ties—or, alternatively, an individual (P) dislikes others (O_2) whom his or her friend (O_1) dislikes. Interestingly, individuals also expect balance among indirect ties as well (Krackhardt & Kilduff, 1999). This line of reasoning suggests that psychological balance exists when an individual's (P's) friends (O_1, O_2, and O_3) are also friends with each other.

In an extension of balance theory, Phillips and colleagues (Phillips, 2003; Phillips, Mannix, Neale & Gruenfield, 2004; Phillips & Loyd, 2006) emphasize individuals and their "objects" (i.e., knowledge) and posit that individuals expect psychological balance or congruence between knowledge ties and social ties. Balance is achieved when individuals with positive associations agree or have similar knowledge (Heider, 1958). In particular, an individual expects friends to have similar views or information and

reflect the same knowledge pool (Phillips & Loyd, 2006). Conversely, an individual will not have similar expectations of acquaintances and is comfortable if they disagree and reflect different knowledge pools (Phillips et al., 2004). This suggests that given a triad of friends (i.e, three positive ties among individual nodes), individuals expect a similar pattern among the friend's knowledge ties (i.e, three positive ties among the knowledge nodes). Psychological balance or congruence thus involves not only individuals expecting their friends to be friends but also involves the friends having the same knowledge.

Social and knowledge balance (or imbalance) influences the way an individual uses and processes content. When friends (O) present knowledge (X) that differs from the perceiver's information, the perceiver (P) will alter cognition by discounting the friend's association with X or its importance as a way of maintaining perceptions of balance (Heider, 1958). She will, therefore, disregard or diminish the information in this case (Phillips, 2003). Conversely, when expectations for cognitive balance are met, she is better able to process and integrate the associated content. For example, individuals in congruent groups (e.g., familiars with the same information and acquaintances with unique information) repeated and validated, information mentioned by their teammates compared to individuals in incongruent groups (e.g., familiars with unique information and acquaintances with the same information). These groups also were more likely to move individuals from incorrect decisions to correct ones (Phillips, Mannix, Neale & Gruenfield, 2004). In another study (Phillips & Loyd, 2006), members of incongruent groups (e.g., surface level similar groups with a dissenting member) spent less time discussing task relevant information, and made poorer decisions than congruent groups (surface level different groups with a dissenting member). In a related study, individuals generated more positive thoughts about unique content that was assumed to come from distinct knowledge pools (Harkins & Petty, 1987). Thus, congruence between knowledge and tie strength may facilitate better use and integration of the full breadth of non-redundant content received from others than incongruence.

HYPOTHESES

First, I develop the argument that framing will have a more significant effect on creativity compared to information. Individuals tend to anchor on one particular frame and have difficulty envisioning alternative frames, so exposure to different frames helps to alter the way the focal individual sees the problem by opening him or her up to the possibility that other frames may exist (Reiter-Palmon et al., 1997). Similarly, problem reformulation signals that the problem's premise should be questioned (Cross, Borgatti, & Parker, 2001), which suggests possibilities beyond the initial frame. Thus, individuals exposed to a different interpretation of a problem have a greater capacity to reformulate the problem themselves (Fiske & Taylor, 1991; Hargadon & Bechky, 2006), even beyond the frames to which they were exposed, and reconcile less obvious alternatives. In this way, I predict that non-redundant frames will expand cognitive pathways by prompting an individual to think more broadly about a problem and less rigidly within one particular category of solution.

While non-redundant information offers the potential for recombination and an important knowledge base, Amabile (1983) suggests in her componential theory of creativity that the accumulation of knowledge facilitates creativity only if the accumulated knowledge affects the organization of content in the mind. In particular, knowledge in the form of additional expertise can constrain creativity, as individuals become more cognitively entrenched rather than flexible (e.g., Dane, 2010). That is, information prompts more rigid connections between ideas and concepts, perhaps strengthening existing pathways and categorizations instead of broadening them by freeing and loosening connections. In particular more specific and less abstract content, such as information, is more likely to constrain the generation of pre-inventive ideas than less specific and more abstract content, such as frames (Amabile, 1983; Ward et al., 1999). Whereas frames serve as examples of possibilities that enhance creative cognition, then, information serves as markers of facts that must be incorporated. For example, given five different facts about a consumer segment, a brand manager

considering a failed marketing campaign may be compelled to generate a solution that addresses those

five facts—or at a minimum, evaluate the relevance of each fact and use or discard each accordingly.

On the other hand, considering five different interpretations of the cause of the marketing problem may

give the brand manager some cognitive expansion—new flexibility to play around with different

solutions within any one frame or to consider alternative frames.

> *Hypothesis 1: Individuals exposed to non-redundant <u>framing</u> from informal contacts will*
>
> *produce more creative responses than individuals exposed to non-redundant <u>information</u>*
>
> *from informal contacts.*

Framing versus Information from Strong Ties

In this and the following section, I develop the argument that the effect of content depends on

the strength of the tie through which it is received. Receiving non-redundant content from strong ties is

a psychologically or cognitively unbalanced situation. I expect this to exacerbate the difference between

the effects of non-redundant information and non-redundant frames. Just as individuals may not

similarly take advantage of their capacity to think creatively (Amabile, 1986; Ward et al., 1999), fully

taking advantage of the capacity for recombination provided by different bits of information is difficult

without full consideration and integration. In the case of information, prior research suggests that

individuals in incongruent groups do not use information effectively. These groups spent less time

discussing information and tended not to convert incorrect choices to correct ones (Phillips, Mannix,

Neale & Gruenfield, 2004; Phillips & Loyd, 2006). Similarly, I expect individuals receiving non-redundant

information from strong ties to be hampered by the cognitive imbalance and not integrate the

information to form creative solutions.

The possibility that an individual will form positive associations about her strong tie's content as a

way of restoring balance is untenable in the case of ties beyond dyads. In the case of a triad of friends,

for example, if an individual receiving advice from members of a triad accepts or adopts one friend's

content, she is still left with the imbalance created by the other two friends' distinct content. The

general logic is that it is the lack of balance at the level of the social system (e.g. triad of social ties) that

drives the discomfort associated with imbalance and the resulting minimization of the content. If an

individual receives unique information from two different strong ties, that individual will likely dismiss or

minimize the importance of the information and fail to integrate it. This does not mean the information

will be totally ignored. Again, information can restrict an individual's thinking about a problem so that he

or she offers extensions rather than novel ideas (Ward et al., 1999). Information from strong ties may

thus prompt mere extensions of initial opinions and perhaps enhance appropriateness, rather than

prompt integration and recombination needed for creative solutions.

By contrast, the effects of framing are expected to operate at the latent level. Exposure to non-

redundant framing frees up cognitive pathways in a less direct process and affects how content is

organized in the mind. Exposures to stimuli that "break perceptual sets" and "break scripts" can

enhance creativity (Amabile, 1983) even if the individual claims to reject the stimulus. Again, non-

redundant frames can suggest alternate ways of thinking about the problem, prompting the individual

to think broadly and identify new frames rather than simply adopt the non-redundant frames presented.

This logic is consistent with minority influence research. Minority opinion holders within groups

influence others at the latent level by prompting others to consider a variety of alternatives, even if they

potentially reject the minority's opinion (Nemeth, 1986). As a result of their more extensive processing,

teams with minority opinion holders or newcomers make higher quality decisions (Nemeth, 1986).

Interestingly, however, team members do not necessarily attribute their change to the minority opinion

holder and may even reject her and her ideas (e.g., Gruenfeld, Marturana & Fan, 2000). Exposure to

frames similarly alters cognitive structures and relies less on direct integration at the manifest level. So

even when received from strong ties, non-redundant framing should be helpful. Although the social

imbalance may dampen the effect, this anticipated positive outcome will offset that dampening.

Framing versus Information from Weak Ties

Non-redundant content among weak ties is consistent with a cognitively balanced situation. Individuals are comfortable if acquaintances disagree, provide unique information, and appear to represent different knowledge pools (Phillips et al., 2004). As a result, individuals receiving non-redundant information distributed across weak ties should be more open to processing it, and thus spend the time and attention required to fully integrate and apply it. Novel combinations are more likely, given greater integration and the development of less rigid cognitive pathways or connections between ideas in the mind, in contrast to a more simple consideration of information involving extending existing thoughts and solidifying cognitive pathways. In the case of framing, cognitive balance eases the broader categorization of concepts and the identification of different frames and solutions. Thus, when individuals receive either diverse information or frames from weak ties, the cognitive balance between social ties and content enhances the possibility of cognitive flexibility.

To summarize: I expect the effect of framing versus information content on creativity to depend on the strength of tie through which the content is received. I expect strong ties to exacerbate the difference between non-redundant information and framing, due to the effect of social and knowledge imbalance on the full utilization and integration of information. In contrast, when individuals receive content from weak ties, I expect the difference between framing and information to be less pronounced. In this case, non-redundant information reflects a social-knowledge balance, so information is fully integrated to form a creative solution.

Hypothesis 2: There will be an interaction between tie strength and content received such that the difference between non-redundant framing and non-redundant information will be greater when received from strongly tied contacts in comparison to when received from weakly tied contacts.

STUDY 1

Method

Design & Participants. I tested the hypotheses in a laboratory setting. Ninety-three undergraduate student participants were randomly assigned to a 2 (non-redundant information, non-redundant framing) x 2 (strong tie contacts, weak tie contacts) + 1 (control – no content) between subjects factorial design. Participants' average age was 20 years old, and 49% were men.

Task & Procedures. Participants were told that they would be participating in a study involving management problem solving. Each participant worked individually and received pre-recorded instructions via headphone. The task was one problem from Shalley's (1991) complex-heuristic "in basket exercise." This task is appropriate for assessing creativity and has been used in a variety of creativity experiments (e.g., Shalley & Perry-Smith, 2001; Zhou, 1998). Participants were asked to respond to an e-mail that contained a problem that must be solved. The e-mail was sent to the human resource director of a steel company, and participants were asked to assume the role of the HR director. Via web interface, participants received information about their role, the e-mail problem requiring their response, and a brief description of the company. The e-mail, sent by a hypothetical manager (Stan), described a female worker who was dressing inappropriately (see Appendix for the full text of the e-mail). Participants were told that the researcher is interested in creative solutions and were asked to do their best to generate creative solutions. After reading the background material and listening to instructions, participants received the manipulation instruction (described below). Finally, participants were asked to complete a questionnaire and were debriefed.

Manipulations. All participants, except those assigned to the control condition, were told that they consulted three contacts about the problem. The contacts were either described as friends or acquaintances, depending on the condition assigned to the respondent. The participants viewed responses that reflected either three different pieces of information—one from each contact—or three

different frames—one from each contact, depending on the content condition. Prior to viewing the

responses, participants were asked to note their initial reaction to the problem presented in the e-mail

to force participants to engage with the problem prior to receiving input from contacts. The control

condition participants did not consult three contacts.

Strength. The tie strength manipulation was designed to capture the relevant dimensions of

strength suggested by Granovetter (1973): frequency, duration, and closeness. For example, the

description of contacts in the strong tie condition emphasized closeness, frequent conversations, and

knowing the contact for a long time. Participants in the strong tie condition saw the following:

> *You decide to consult three of your very close friends within KAI Steel. The individuals are among your closest contacts. You talk to them frequently and have known them for a long time relative to your other contacts. In separate conversations with each friend, you describe the problem and following is the essence of each person's reaction.*

Participants in the weak tie condition saw the following:

> *You decide to consult three acquaintances within KAI Steel. The individuals are among your more distant contacts. You talk to them occasionally at work, although you have known them for a short time relative to your other contacts. In separate conversations with each acquaintance, you describe the problem and the following is the essence of each person's reaction.*

In addition, each contact was labeled "friend/acquaintance."

Information. The non-redundant information manipulation was designed so that each contact's

content reflected distinct, non-overlapping facts or data about the problem or context. As Cross &

Sproull (2004) describe, declarative knowledge represents one component of information consistent

with the knowledge transfer perspective. Similarly, Levin and Cross (2004) emphasize explicit or

codifiable knowledge in their exploration of knowledge transfer among weak and strong ties. I

therefore operationalized information to be consistent with these approaches as specific facts or data

relevant to the problem. Participants assigned to the information conditions received the following:

Friend/acquaintance 1 says:

"Let me give you a little background information on Stan[1]. I've served on a number of committees with him over the years. He is well respected within the company. He worked his way up – impressing and making friends with many high level managers along the way. He is very well connected here."

Friend/acquaintance 2 says:
"The heat transfer department engages in a very unique type of work in comparison to the rest of KAI Steel. I worked there when I first started with the company. The work requires intense concentration. Everyone is very isolated and has little interaction with others."

Friend/acquaintance 3 says:
"It is true that we don't have a dress code now, but there was one about 20 years ago. I had to research this a few years ago. It was very extensive and covered things from the proper length of hair to the types of shirts that were allowed."

Frame. The non-redundant framing mechanism was designed to reflect the contacts' interpretations of the problem. Interpretations can vary along several dimensions, however. The social movement literature is highly relevant here because it emphasizes various interpretations of events and actions (e.g., Snow, Rochford, Worden & Benford, 1986). Examples of those dimensions include beliefs about the seriousness of the problem, beliefs about the locus of causality, and beliefs about the probability of change. I was careful to make sure that the frames received from each of the contacts varied within one dimension, rather than mixing multiple dimensions. Given the nature of the problem, I selected to vary the locus of causality frame. In other words, the responses were designed to reflect different, non-overlapping interpretations of who is to blame for the problem presented in the e-mail. Participants in the different framing condition saw the following responses from their contacts:

Friend/acquaintance 1 says:
"I am surprised that the workers have time to stand around staring. This is time away from doing their actual work and productivity is so important. I have not spent time in this group, but my interpretation is that the workers are the problem."

Friend/acquaintance 2 says:
"My take on this is that if she really were a good worker, she wouldn't be detracting from the team by getting individual attention. My reaction is that she is the problem, and if she really were a great worker and nice person, she would make other choices that help the department versus hurt it."

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[1] Stan is the name of the manager sending the e-mail.

Friend/acquaintance 3 says:
"It sounds like Stan[2] needs to re-evaluate his leadership style and management practices. What kind of environment has he created where this can occur? I am not sure of the answer to this question, but my belief about the cause of this situation is consistent with the saying 'all problems start at the top.' "

   Pre-test. The responses from contacts were pre-tested to rule out unintended alternative explanations for the results. Directly after viewing the contact's responses, pre-test participants were asked a series of questions about the responses. Participants were asked to assess three qualities in each response: distinction, novelty, and importance. I focused on these three qualities because each can affect creativity in their own right. Prior research suggests that concepts that are more distinctive provide the potential for higher creativity than concepts that are conceptually closer together (Ward et al., 1999). In addition, creativity can vary as a function of the creativity of examples or models that individuals are exposed to before problem solving (Shalley & Perry-Smith, 2001). Last, individuals may be more likely to defer to responses that they think provide more important input. It was thus desirable to confirm in the pre-test that there were no significant differences between information and framing manipulations on any of the three qualities.

   The pre-test revealed a significant difference between the framing and information conditions in the reported importance of contact responses ($F(1,14)=6.72$, $p<.05$). It also showed a significant difference in the rated distinction between the two conditions ($F(1,14)=20.69$, $p<.001$). There was no significant difference, however, in the novelty of the responses ($F(1,14)=.71,p>.05$). Participants rated importance with a three-item scale that measured the extent to which each contact's response provided important insights (e.g., "Response 1 provided important insights"). Distinction was measured with a question asking about the extent to which each pair of responses "differed from the other." To assess novelty, respondents were asked whether "Response 1 reflected a novel way of looking at the events stated in the problem" for each of the three contact responses.

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[2] Stan is the manager sending the e-mail.

Based on the pre-test results, I modified the content manipulations to minimize those differences in importance and distinction. Given that importance and distinction were based on questions about all pairs of responses (that is, one question per pair), I was able to identify one particular response in each condition that explained the undesirable difference. I therefore modified one of the three framing responses and one of the three information responses. The manipulations reported in the study herein reflect those modifications. To test the modified manipulations, I asked a separate sample of participants the same series of questions about importance, novelty, and distinction. The results revealed no significant difference in the distinctiveness ($F(1,14)=2.86$, $p>.05$), importance ($F(1,14)=.01$, $p>.05$), or novelty ($F(1,14)=1.21$, $p>.05$) between the two conditions.

Measures.

Manipulation checks. The post-survey questionnaire contained questions to assess the effectiveness of the content and strength manipulations. The questions were designed to check whether participants within the information and framing conditions paid attention to the distinct pieces of input. Three questions related to information received were averaged ($\alpha = .86$): "I learned from the people with whom I consulted that…KAI Steel had a dress code in the past," "Stan is well respected within KAI Steel," and "the work requires concentration." Three questions were averaged to provide an index of framing received ($\alpha = .88$): "The people with whom I consulted…. suggested that the workers caused the problem," "the women referred to in the e-mail may have caused the problem," "the leadership style is the problem." Finally, the survey contained two questions to confirm the tie strength manipulation ($r=.82$): "The people with whom I consulted were my close friends" and "I did not know the people with whom I consulted very well" (reverse coded).

Creativity. The participants' responses to the e-mail were assessed using the consensual assessment technique (Amabile, 1983) widely used in creativity research (e.g., Shalley, 1995; Shalley & Perry-Smith, 2001; Zhou, 1998). A graduate student with relevant work experience and the author

served as expert judges. The responses were randomized, and the judges were blind to experimental condition. As a result, it was not apparent to which condition each response corresponded. The judges independently rated the overall creativity of each solution by answering two questions (1=not at all creative to 7=highly creative). Judges were asked to rate the "creativity of solutions (or suggestions for improvement) to problems/issues" and "overall quality of content (e.g., extent solutions will effectively resolve issues identified)." Effectiveness was included to more closely mirror the importance of appropriateness and usefulness emphasized in conceptualizations of creativity (Amabile, 1983; Shalley et al., 2004). The final measure is the square root of the product of creativity and effectiveness, following Rodan and Galunic (2004). With this approach, highly creative solutions that were ineffective and thus inappropriate were assigned a low score, creative solutions that were moderately effective were assigned a midrange score, and creative solutions that were highly effective were assigned high scores. The measure thus reflects the extent to which solutions are creative and potentially effective.[3] The interrater reliability for the judges' ratings of creativity (mean r_{wg} = .82 and median r_{wg} = .93) suggests a reasonable level of agreement.[4] The appendix contains an example of a creative and non-creative response.

Results

    Manipulation checks. As expected, participants receiving non-redundant information reported higher information scores (M=6.11) than those in the framing condition (M=2.31), ($F_{(1,74)}$=250.88, p<.001). Similarly, those receiving non-redundant frames reported higher framing scores (M=5.74) than those in the information condition (M=3.01), ($F_{(1,74)}$=76.02, p<.001). The friendship and acquaintance

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[3] This approach is consistent with creativity as a composite of novelty and effectiveness where novelty and effectiveness are formative indicators. With formative indicators, unlike reflective indicators, items are not interchangeable nor is a positive high correlation necessarily expected (Bollen & Lennox, 1991; Diamantopoulos & Winklhofer, 2001). For example, high levels of effectiveness are not necessarily expected when high levels of creativity exist. A solution may be creative, but may be considered less effective than a standard solution. Nevertheless, creativity and effectiveness were positively correlated in this sample (r=.54, p<.05).

[4] Following James, Demaree and Wolf (1984), three negative r_{wg} values were set equal to 0.

manipulation checks also were as expected. Respondents in the friendship condition reported higher

closeness scores (M=6.24) than those in the acquaintance condition (M=2.17), (F(1,74)=145.68, p<.001).

Other questionnaire measures. There was no significant difference in personality across the

conditions (F(4,88)=1.50,p>.05), as measured by openness to experience (IPIP, Goldberg, 1999, α = .74),

from the five-factor model of personality (Costa & McCrae, 1992). This suggests that the results cannot

be explained by certain conditions differentially containing creative participants. In addition,

participants reported no difference in the extent to which the contact responses differed from their

initial thoughts about the problem (F(3,72)=1.27,p>.05). This suggests that the participants did not

differentially perceive that the manipulations were distinct relative to their initial thoughts, and the

results cannot be explained by some manipulations being more different than others.

Hypotheses Tests

As a baseline inferred by all hypotheses, I tested whether consulting contacts and receiving non-

redundant content facilitated creativity compared to not consulting contacts and independently forming

a solution. Although the literature often assumes the former is superior, I wanted to establish a baseline

test of this idea. As Mueller and Kamdar (2011) describe, there are disadvantages to seeking advice. I

tested this by converting the five conditions (control, strong tie-information, strong tie-frame, weak tie-

information, weak tie-frame) to a one-way ANOVA design, and then testing the contrast (-4 1 1 1 1). The

contrast coefficient was significant (t(88)=2.33, p< .05).

I tested the hypotheses using a strength X content analysis of covariance (ANCOVA). Table 1

summarizes the hypothesized results, and figure 1 presents the means. The displayed significance levels

reflect one-tailed tests given that all hypotheses were directional and theory driven (Jones, 1954;

Kimmel, 1957). Hypothesis 1 compares the framing condition to the information condition and predicted

that respondents exposed to different framing will produce more creative responses than respondents

exposed to different information. There was no significant main effect for content (F(1,72)=2.44, p> .05). Hypothesis 1 was thus not supported.

According to Hypothesis 2, strength and content will interact such that the difference between framing and information content will be greater for strong ties than for weak ties. The interaction between strength and content was significant (F(1,72)=3.77, p<.05). In addition, the mean difference between framing and information was significantly different for strong ties (t(72)=2.48, p<.01) but was not significantly different for weak ties (t(72)=-.27, p>.05). Hypothesis 2 was thus supported.

Table 1 and Figure 1 about here

Discussion

The purpose of study 1 was to illuminate the effect of knowledge content type and tie strength on creativity. Although there was no significant main effect of framing versus information, the difference between framing and information was dependent on tie strength. When participants were exposed to content via a strong tie, the effect of non-redundant information was significantly lower than the effect of non-redundant framing. These results indicate that the effect of knowledge is more complex than previously thought and that framing is a highly relevant explanation for the effects of non-redundancy. The effect of information dipped for strong ties, suggesting a complex association between information and creativity and a relatively more straightforward association between framing and creativity. In addition, the results suggest that tie strength matters not just because of the associated structural properties. Tie strength may also matter because of diffuse psychological processes.

Although the results of study 1 are interesting and informative, they did not provide evidence to support the theorized explanation for why non-redundant content facilitates creativity. In study 2, I sought to replicate the effects found in study 1 and test an intervening variable. In addition, the result may not be generalizable beyond students. If the effects of content and strength reflect basic

psychological processes, however, the working status or age of participants should not matter. Nevertheless, I address this potential limitation in study 2 by including working adults.

STUDY 2

A summary of the theory from study 1, informed by the results, is presented in Figure 2. The difference between non-redundant frames and non-redundant information depends on the strength of tie through with the content is received. When individuals receive content from weak ties, they are in a socially and cognitively balanced situation. They tend to consider each piece of non-redundant information, given that expectations for similarity do not exist among acquaintances. As a result, individuals may realize their capacity for cognitive expansion in the form of more flexible thinking. Similarly, when non-redundant frames are received from weak ties, the cognitive effects (i.e., cognitive flexibility and broad categorization) may flourish. Non-redundant content from weak ties will thus facilitate creativity, and the effect of information and framing is not expected to differ. In contrast, non-redundant content from strong ties is a socially imbalanced situation, exacerbating the difference between information and frames. Strong ties constrain the cognitive expansion generally thought to be possible with non-redundant content. Instead, individuals discount the information or at a minimum use the content at a surface level to extend initial thoughts, resulting in greater cognitive rigidity and less cognitive flexibility. Framing on the other hand, works at the latent level to broaden one's mind and loosen schemas indirectly—even if individuals reject the non-redundant frames to which they were exposed. These psychological processes mean that the distinction between framing and information is primarily relevant for strong ties rather than weak ties. As a result, study 2 seeks to understand why the effects of knowledge content type differ among strong ties in particular.

Figure 2 about here

In this study, I formalize the intervening processes and investigate the mechanism implied by the proceeding logic. I investigate cognitive expansion by measuring decision-making time as a proxy for the extent to which individuals think broadly beyond initial ideas to consider different ideas and combinations of ideas before settling on one. Cognitive expansion via framing in the form of cognitive flexibility, which involves thinking expansively about different alternatives and possibilities, is expected to take more time than simple extensions of existing anchors via non-redundant information. In this case, individuals are expected to spend more time thinking about a solution. In contrast, in a more automatic processing of content, individuals are more cognitively rigid and settle on the first available option, and thus solve problems more quickly. Figure 3 summarizes the hypotheses tested in study 2.

Figure 3 about here

Decision-Making Time

Non-redundant frames provide the modifications to cognition expected to facilitate creativity compared to non-redundant information, as discussed previously. Decision-making time provides one indication of cognitive expansion. In group studies, incongruent groups spent less time discussing a problem than congruent groups. This difference was explained by the surprise associated with imbalance, undermining the team member's ability to make use of unique opinions and information (Phillips & Loyd, 2006). Similarly, at the individual level, time spent making a decision can indicate the extent to which an individual considers non-redundant content. There is some suggestion that more automatic processing is associated with faster completion and response times (Srivastava & Banaji, 2011; Bilalic, McLeod & Gobet, 2008). Solutions based on initial anchors tend to be faster than those that break existing frames (Bilalic et al., 2008). In contrast, more complex processing that requires individuals to move away from existing anchors takes more time (Bilalic et al., 2008; Tamir & Mitchell, 2013). Non-redundant frames raise alternative possibilities, serve to expand the scope of possibilities,

and prompt individuals to employ greater cognitive flexibility—to play around with different ideas before settling on a solution. Non-redundant information from strong ties, on the other hand, may prompt individuals to ignore the content, discount it, or use it to simply extend initial anchors. For those reasons, I expect individuals who receive non-redundant frames from strong tie contacts to have longer response times than individuals who receive non-redundant information from strong tie contacts.

Hypothesis 3: When receiving content from strong ties, individuals exposed to non-redundant frames will spend more time thinking about their decision than individuals exposed to non-redundant information.

Again, cognitive flexibility and broad thinking are expected to facilitate creativity (Guilford, 1967; Ward et al., 1999; Shalley & Perry-Smith, 2008). Individuals need time to generate alternatives, make new connections, and select the best idea rather than quickly settling on the first or most obvious idea. Notably, one exception may be creative insight problems. For example, eminent creatives asked to solve divergent thinking tasks (e.g., unusual uses for a break) may solve these problems quickly (Vartanian, Martindale & Matthews, 2009). For tasks with greater ambiguity and complexity, however, highly creative people are thought to be slower due to their tendency to broaden their thinking and less quickly focus on one particular solution (Dorfman, Martindale, Gassimova & Vartanian, 2008; Martindale, 1999). Thus, if higher creativity results from non-redundant framing versus non-redundant information, that is partly because individuals receiving non-redundant framing take more time to decide on a solution.

Hypothesis 4: When receiving content from strong ties, the effect of non-redundant framing versus non-redundant information on creativity will be mediated by decision-making time.

Method

Design & Participants. Participants were drawn from two populations: undergraduate students and working adults. The sample included 116 undergraduate students and 110 working adults randomly

assigned to a 2 (non-redundant information, non-redundant framing) x 2 (strong tie contacts, weak tie contacts) between subjects factorial design. The first sample, the undergraduates, were recruited from a university research pool and participated in the study in a laboratory setting. Each participant received credit that partially fulfilled a degree requirement. The second sample, the working adults, was recruited from a Qualtrics panel of working adults interested in participating in web-based research. These participants received a nominal payment. The average age of the student sample participant was 20.19 years old and 45% were men; the participants in the working adult sample had an average age of 47.87 and 69% were men.

Task & Procedures. The task and procedures were similar to study 1. Participants were told that they would be participating in a study about management problem solving. The task involved the same problem and in-role instructions as study 1. Instructions were standardized and embedded in a web interface. In both cases, participants could move themselves through the study and interface, listening to and reading instructions as they progressed. In the adult sample, however, participants completed the study asynchronously and at their individual locations rather than in the behavioral lab. In this study, like the first, participants were told that the researchers were interested in creative solutions and were asked to accept a creativity goal. The last part of the study involved answering a brief survey, which included manipulation checks, and mediators (and attention filters in the case of the adult sample).

Manipulations. The manipulations were identical to study 1. The contacts were either described as friends or acquaintances, and participants viewed responses that reflected either three different pieces of information, one from each contact, or three different frames, one from each contact.

Measures.

Manipulation checks. The same manipulation check questions were used as in study one. The information index was composed of the average of three questions (α = .73, working adult; α = .88, students), and the framing index included the average of three questions (α = .90, working adult; α =

.82, students). The same two tie-strength manipulation questions were used as in study 1 and were

averaged (r=.42, p<.001 working adults; r=.69, p<.001 students).

Creativity. As with study 1, participant responses were assessed using the consensual

assessment technique (Amabile, 2983), widely used in creativity research (e.g., Shalley, 1995; Shalley &

Perry-Smith, 2001; Zhou, 1998). In the case of the working adult sample, a graduate student with

relevant work experience and the author served as expert judges. The responses were randomized, and

the judges were blind to experimental condition when rating each solution. In the case of the student

sample, two graduate students and one undergraduate student independently rated the solutions. In

both samples, none of the student raters were aware of the study's purpose or hypotheses prior to

rating the solutions. Judges were asked to rate the "creativity of solutions (or suggestions for

improvement) to problems/issues" and "overall quality of content (e.g., extent solutions will effectively

resolve issues identified)" on a seven-point scale. Like study 1, the creativity measure was the square

root of the product of creativity and effectiveness following Rodan and Galunic (2004). The interrater

reliability for the judges' ratings of the student sample (mean r_{wg} = .81 and median r_{wg} = .88) and the

working adult sample (mean r_{wg} = .76 and median r_{wg} = .86) suggested a reasonable level of agreement.[5]

Decision time. I measured decision-making time by capturing time between clicks in the web

interface. After viewing the content from contacts, participants were asked to click to the next page

(first click). At this point, participants were told that they were now ready to develop their solution to

the problem and reply. They were given a space to enter their reply and told to click next when finished

(second click). Decision time was measured as the time between clicks in seconds.

Control variables. Sample (student versus working adult) was an important control, given that

unobserved differences could stem from sample type (see hypotheses test section below for tests of the

differences across sample). Motivation was also controlled. Due to the possibility that some in the adult

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[5] Following James, Demaree and Wolf (1984), three negative r_{wg} values were set equal to 0.

sample, in particular, may be more engaged by the task than others depending on factors in the

environment in which they participated, I controlled for overall level of motivation. In addition, intrinsic

motivation is critical for creativity (e.g., Amabile, 1983). I averaged two questions: "In completing the

survey, I felt involved," and "I was very engaged while completing the survey." (r = .51, p<.001 working

adult). In the student sample, I used three questions consistent with how intrinsic motivation has been

measured with student samples (e.g., Shalley & Perry-Smith, 2001). Three questions were averaged: "I

was very engaged while responding to the e-mails," "working on the task was fun," and "in general, I

enjoyed working on the types of problems presented in the e-mails" (α = .79).

Results

      Manipulation checks. As expected, participants receiving non-redundant information reported

higher information scores than those in the framing condition in the working adult (F(1,108)= 173.34,

p<.001) and student sample (F(1,116)=519.95, p<.001). The mean rating for the participants in the

information condition was 6.40 compared to 4.04 for those in the framing condition for the working

adult sample. In the student sample, those ratings were 6.42 and 2.47, respectively. Similarly, those

receiving non-redundant frames reported higher framing scores than those in the information condition

in the working adult (F(1,108)=56.49, p<.001) and student sample (F(1,116)=77.42, p<.001). The mean

for participants in the framing condition was 5.29, compared to 2.92 for those in the information

condition for the working adult sample. The student sample means were 5.69 and 3.26, respectively.

Respondents in the friendship condition reported higher closeness scores than those in the

acquaintance condition for the adult (F(1,108)=44.67, p<.001) and student (F(1,116)=119.52, p<.001)

samples. The mean rating for participants in the strong tie and weak tie conditions were 5.26 versus

3.52, respectively, for the working adults and 5.69 and 2.62, respectively, for the student sample.

      Other questionnaire measures. In the working adult sample, one concern was that participants

would be distracted and simply not fully read the instructions. This was less of a concern in the case of

the student sample, since an administrator was on hand to make sure participants were not distracted by personal materials or items. As a result, I included three attention filter questions at the end of the study designed to check whether the working adult participants read the study instructions and questions. Participants who failed the attention filters were excluded from the data. One attention filter question, administered by Qualtrics, was simply, "please select answer choice 2" (correct answer=2). Participants who selected a response other than 2 were excluded by Qualtrics and replaced. The second question was, "while working on this task, I was asked to be … (creative, diplomatic, funny, kind)." The correct answer (creative) was emphasized in the instructions, and the other options were never mentioned. A total of 20 participants failed this question and were excluded. Last, after reading instructions describing the creativity goal, participants were asked if they were willing to try to be creative. Two participants answered no and were excluded from the data.

Hypotheses Tests. The data from both samples were combined for all analyses. To determine whether the differences in samples affected the results, I conducted a series of sample by treatment ANOVAs on the dependent variable and mediators. Neither the main effect of sample type nor the interaction of sample type with either content or strength was significantly related to creativity ($p > .05$). None of the main effects or interactions were significantly related to either mediator with the exception of the main effect of sample type on decision making time, which was significant ($p < .01$) (the undergraduate students took more time than the working adults). I therefore controlled for sample type in all analyses.

The direct effect (Hypothesis 3) was tested using analysis of co-variance (ANCOVA). To test the indirect effect (Hypothesis 4), I followed the procedure outlined by Edwards and Lambert (2007) to test a mediated moderation model, involving moderation of the first stage (See Figure 3). I obtained coefficients from regression models testing the effect of the content by strength interaction on the mediator and the effect of the mediator on the dependent variable controlling for the interaction. I then

tested the conditional indirect effect using non-parametric bootstrapping and 95% confidence intervals (e.g., Shrout & Bolger, 2002). All displayed results reflect two-tailed tests.

First, I replicated Hypothesis 1 in study 1. Consistent with this Hypothesis, participants exposed to different frames were more creative than participants exposed to different information. The main effect of content type was significant ($F(1,220)=3.84$, $p<.05$). Thus, Hypothesis 1 was supported. Next, I tested the effects hypothesized in study 2.[6] Hypothesis 3 predicted participants in the strong tie, framing condition would take longer to reply than participants in the strong tie, information condition. The interaction of strength and content type was significant ($F(1,220)=3.76$, $p<.05$). The mean difference in decision time between framing and information for strong ties was significantly different ($t(220)=2.42, p<.05$) but was not significantly different for weak ties ($t(220)=-.31, p>.05$). Thus, Hypothesis 3 was supported. Table 2 reports the ANCOVA results for decision-making time, and Figure 4 displays the means.

Table 2 and Figure 4 about here

The OLS regression models used to obtain coefficients for the mediated moderation procedure (Edwards & Lambert, 2007) are reported in Table 3. The mediator model (top of Table 3) examines the effect of the interaction between content and strength. The results reveal a significant interaction between content and strength on decision time ($p<.05$). This is consistent with the ANCOVA results reported in the prior paragraph. Next, the dependent variable model (bottom of Table 3) examines the effect of the mediator controlling for the interaction of content and strength. The results reveal a significant effect of decision time ($p<.05$) on creativity.[7]

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[6] The interaction between strength and content (Hypothesis 2) predicted in study 1 was tested via the indirect effect, mediated moderation analysis (Hypothesis 4).

[7] Examining indirect effects does not require examining the direct effect of the independent variable on the dependent variable, although the causal step approach to mediation (e.g. Baron & Kenny, 1986) requires this. For example, a direct effect may not be significant if low power exists or if the independent variable affects the

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Table 3 about here

Finally, I used bias-corrected 95% confidence intervals based on 1,000 bootstrap samples to test the indirect effects of each mediator for strong ties (Edwards & Lambert, 2007). I also examined whether the indirect effects for weak and strong ties were significantly different from each other (Edwards & Lambert, 2007). The results are reported in Table 4. Hypothesis 4 predicted an indirect effect of content on creativity as indicated via decision-making time for strong ties. The results revealed a significant conditional indirect effect of content on creativity via decision time; the indirect effect was significant for strong ties (95% CI = [.04,.41]) but not for weak ties (95% CI = [-.20,.10]). In addition, the indirect effect of decision time for strong ties was significantly different than the indirect effect for weak ties (95% CI = [-.54,-.04]). Hypothesis 4 was thus supported.

Table 4 about here

Supplemental analysis. My arguments suggest that due to cognitive balance individuals will find non-redundant information and framing content received from strong ties to be similarly less useful, given that distinct pieces of content from strong ties will be rejected or at least discounted to maintain balance. I have argued that although non-redundant framing from strong ties facilitates greater creativity than non-redundant information from strong ties, the effects of non-redundant framing operate at the latent level. In particular, frames can alter cognitive pathways and broad thinking, even if the individuals reject the frames to which they are exposed. Because information is concrete and factual, however, individuals may consider this content to be more useful than frames—more abstract interpretations of the problem's cause. In addition, although they may discount the assortment of

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dependent variable through intervening variables with opposite signs (MacKinnon, Krull & Lockwood, 2000; MacKinnon, Lockwood, Hoffman, West & Sheets, 2002). In either case, an indirect effect can exist and is meaningful.

information to maintain balance, it is possible that they may use some of it that allows them to extend initial thoughts, although that does not facilitate creativity. Further, there is some evidence that individuals generally perceive content from strong ties to be highly credible (Levin & Cross, 2004). All of this suggests that the effect of content type from strong ties on perceptions of usefulness is unclear.

To assess usefulness, I asked participants to indicate the extent to which they considered the content useful. I measured their responses with two items: "I ignored the input from my contacts when coming up with a solution" (reversed), and, "the input from my contacts was informative" (1=strongly disagree, 7=strongly agree). The items were averaged in both samples (r = .51, p<.001 working adult sample; r = .53, p<.001 student sample). Results of an ANCOVA revealed a marginally significant interaction between content and strength (F(1,220)=2.78,p<.10). Participants receiving information from strong ties considered the content to be more useful than participants receiving framing from strong ties (t(220)=3.51,p<.001). There was no difference in usefulness between information and framing received from weak ties (t(220)=1.16,p>.05). This is consistent with the idea that framing operates at a more latent level. While non-redundant frames facilitate their creativity, individuals may not consciously identify the importance of distinct frames compared to more concrete and factual information.

Discussion

The results of study 2 further inform the effect of content type and tie strength on creativity in a sample of students and working adults. The results support the effect of framing versus the effect of information hypothesized in study 1. They also provide evidence of the intervening variable theorized to explain why non-redundant content (i.e., framing and information), moderated by tie strength, affects creativity. The results suggest that framing facilitates longer decision-making time, as a proxy for cognitive expansion, which facilitates creativity in the case of strong ties.

GENERAL DISCUSSION

The results of both studies suggest that non-redundant framing facilitates creativity more effectively than non-redundant information. In particular, when participants received content from strong ties, participants receiving non-redundant information were significantly less creative compared to participants receiving non-redundant framing. In general, the results suggest that content from weak ties facilitates creativity, but strong ties facilitate creativity only when different frames are received. The mediated moderation results support the mechanism of cognitive expansion I theorized. I found a significant indirect effect of framing versus information via decision-making time in the context of strong ties. Consistent with my initial aims, the results isolate non-redundant content type and tie strength and provide evidence for the intervening mechanism.

By disentangling the structures assumed to facilitate creativity from the actual content exchanged in those structures, the series of studies presented in this paper provides critical insight into which content is important given non-redundancy. On the one hand, network ties may provide content that can be recombined to lead to a solution, and in other cases, network ties may provide content that informs the way individuals make sense of a problem (Burt, 2008; Cross & Spruill, 2004). By clarifying and making explicit assumptions embedded in network theories that had not previously been tested, the findings can help guide the kinds of ties, structures, and alter characteristics that future researchers should explore. For example, given the consistent effect of framing, the level of an alter's expertise may be less relevant than previously assumed. I do not intend to imply that information is not beneficial; rather, the effects are more complex than previously assumed, and other types of content should be explored as well. For creativity, the level of actionable knowledge that alters provide should not be the only factor considered. Exposure to different perspectives, in the form of alternative ways of framing a problem, may be as important, if not more important, than information. Future researchers should continue to explore the relevance of alternative contents.

These results do not only clarify what type of content facilitates creativity. They also suggest that a psychological effect is associated with the strength of ties through which a person receives content. The pattern of results is consistent with the reasoning that tie strength affects processing content, as suggested by desires for knowledge and social balance (e.g., Phillips et al., 2004). Apparently, individuals attend to and process input from weaker ties in a more complex way: content received from weak ties facilitates creativity, regardless of content type. Recombining information is not easy. With strong ties, the cognitive imbalance undermines cognitive flexibility, which limits the integration and recombination of content. This is an important insight for network research: strong ties are not only problematic because they are less likely to provide access to non-redundant content, but rather because strong ties affect individual psychological processes—particularly how an individual interprets content.

The supplemental finding that information from strong ties is perceived as highly useful while it simultaneously undermines creativity is interesting. Frames were considered significantly less useful, but they still facilitated creative expansion, as evidenced by a longer decision-making time. Other instances exist in the literature of individuals considering interactions unimportant or even harmful, even as they expand processing and ultimately creativity. Take, for example, the minority opinion holder in a team. Team members report that the minority opinion holder is inaccurate, often rejecting his or her opinion; yet the presence of minority opinion holders pushes the other team members to more carefully consider their opinions, consider other alternatives, and ultimately be more creative (Nemeth & Wachtler, 1983). The implication here is that reliance on individual accounts of which contacts are most important should be considered very carefully. For example, Levin & Cross (2004) found that although content from strong ties was generally perceived to be useful, knowledge from weak ties was perceived to be useful when trust and competence were controlled. One interpretation of this result is that certain

halo effects associated with likability and other factors might be driving perceptions of usefulness. When these factors are held constant, perceptions of usefulness may change.

The results also inform creativity theory. First, the effects of framing support the role of cognition in the creative process. Historically, creativity scholars have focused on personality and other individual factors (see Barron & Harrington, 1981 for a review). Organizational scholars have focused more on context and intervening mechanisms such as affect and intrinsic motivation (see Shalley et al., 2004 for a review). Cognition deserves more attention as an intervening variable. Although measuring cognition is difficult, other approaches should be explored. One option is to document decision-making strategies (e.g., Elsbach & Barr, 1999). This approach also has limitations, however, such as being obtrusive and altering the way individuals approach the problem. Nevertheless, theorizing and measuring cognition could be very informative. Second, knowledge has long been a central theoretical construct in social psychological theories of creativity (Amabile, 1983). Understanding different facets of knowledge and its potentially constraining aspect helps to clarify the effect of knowledge—and clarify how and when context facilitates rather than constrains creativity. One implication of the results is that conveying knowledge through weaker ties is one way of enhancing knowledge without undermining creativity. This approach may reduce the kind of cognitive entrenchment associated with high levels of knowledge (see Dane, 2010).

While this research makes several important contributions, there are a number of limitations that must be noted. First, although an experimental design has the advantages of control and isolating causality, the experimental context may not reflect the complexity found in organizations. For example, it may be that in organizations, individuals with different knowledge areas also approach problems with different frames (Cronin & Weingart, 2007). Perhaps individuals who supply both different frames and information may provide the optimal combination of content for creativity. Alternatively, non-redundant information or frames may exist in organizations in ways that were not reflected by my

operationalizations. For example, different dimensions of frames that reflect different degrees of

disagreement, such as the level of seriousness of the problem, may have different effects. As another

example, individuals in organizations may actively seek or receive certain kinds of content from either

strong or weak ties. These possibilities suggest very interesting extensions of the present research.

Future researchers should explore their implications and how they inform the results obtained herein.

Second, greater attention to relevant focal actor characteristics—expertise or personality—may

be helpful. For example, it may be that certain personality characteristics interact with framing and

information, meaning that certain personality types are better able to work with information and

successfully recombine it without being cognitively constrained. Finally, the participants in the two

studies did not actually interact with contacts but instead read scenarios. As a result, these results likely

represent a conservative test of the effects. Nevertheless, future researchers could explore different

laboratory designs that involve interacting with friends or acquaintances.

Despite these limitations, the results suggest practical implications that should continue to be

explored. For organizational leaders interested in building creative organizations, these results give

insight into how the social context should be designed to achieve the goal of enhanced creativity. For

example, if information is thought to be the primary and only relevant mechanism, the focus should

then be on creating opportunities for information exchange. This might involve seminars or lectures

featuring experts within a given field to deepen workers' knowledge base. If framing is an important

mechanism, however, then exposing workers to individuals or groups who would question prevailing

assumptions with a different way of framing the problem may be most helpful. This may include

"interpretation sharing" sessions, in which a group of workers brainstorms interpretations of a problem

before discussing solutions. Alternatively, a manager may opt to have an "outsider" join team meetings

to question prevailing frames. Although speculative, these ideas suggest a variety of levers that can be

used to design more creative organizations based on the results of this research.

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Table 1

Analysis of Variance of Content and Strength on Creativity
Study 1 (Hypothesis 1 and 2)

Source	F Value	Partial eta squared
Content (framing, information)	2.44	0.03
Strength (weak, strong)	2.00	0.03
Content X strength	3.77 *	0.05

Note. The model is based on one-tailed tests; df = 1, 72

* $p < 0.05$

Table 2

Analysis of CoVariance of Content and Strength on Decision Time
Study 2 (Hypothesis 3)

Source	F Value		Partial eta squared
Content (framing, information)	2.21		0.01
Strength (weak, strong)	0.00		0.00
Content X strength	3.76	*	0.02

Note. The model is based on two-tailed tests; df = 1, 220

* $p < 0.05$

Table 3

Regression Results for Estimated Coefficients of the Mediation Moderation (Study 2)

Variable	B		SE	R^2	
Model: Decision time				0.16	***
constant	-0.461		0.089		
sample	0.089	***	0.015		
motivation	0.004		0.006		
content	0.107	*	0.046		
strength	0.086		0.046		
content x strength	-0.057	*	0.029		
Model: Creativity				0.19	***
constant	3.628		0.87		
sample	-0.312	*	0.149		
motivation	0.071		0.06		
content	0.347		0.434		
strength	0.33		0.428		
content x strength	-0.096		0.273		
decision time	3.922	***	0.622		

* p < .05, ** p < .01, ** p < .001, two tailed

N=226

Table 4

Conditional Indirect Effect of X on Y at Values of the Moderator (Study 2)

Hypothesis	Mediator	Tie Strength	Effect [a]	Bootstrap 95% CI
4	Decision time	Strong Tie	**0.196** *	[.04,.41]
	Decision time	Weak Tie	**-0.039**	[-.20,.10]

[a] Indirect effects in bold are significantly different from each other

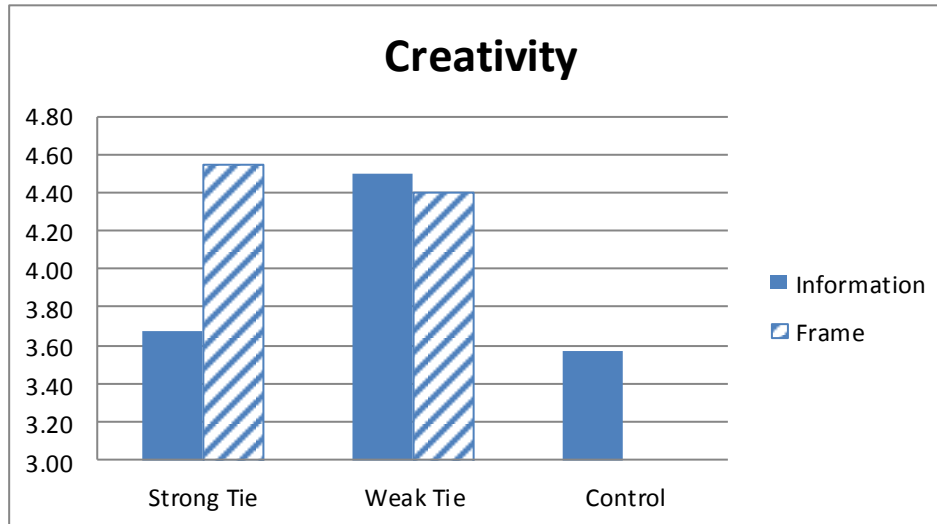bootstrap sample = 1,000; SE= standard error; CI = confidence interval

Figure 1

Means for Creativity (Study 1)

Figure 2

Summary of Weak versus Strong tie Rationale [1,2]

	Weak tie	**Strong tie**
Frame	Cognitive expansion **+++** (e.g.,cognitive flexibility) ↑ Balance +	Cognitive expansion **+** (e.g., cognitive flexibility) ↑ Imbalance -
Information	Cognitive expansion **++** (e.g., cognitive flexibility) ↑ Balance ++	Cognitive expansion **--** (e.g., cognitive flexibility) ↑ Imbalance --

[1] The signs represent the direction of the effect on creativity. The number of signs
represents the expected strengh of the effect relative to other cells. The bold signs
reflect the net effect after balance/imbalance is considered.

[2] I define cognitive expansion as broad categorization of concepts in the mind via the loosening
of cognitive pathways or connections between narrow categories.This also has been refered to
as flexibility in cognitive organization or cognitive flexibility (Isen, 1987; Murray, Sujan, Hirt & Sujan, 1990).
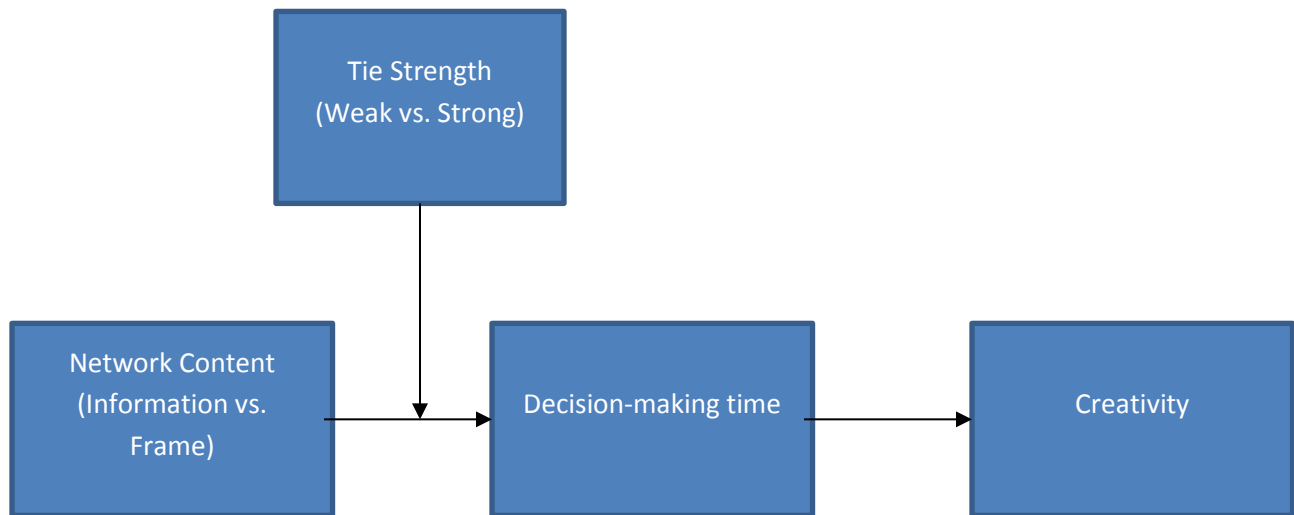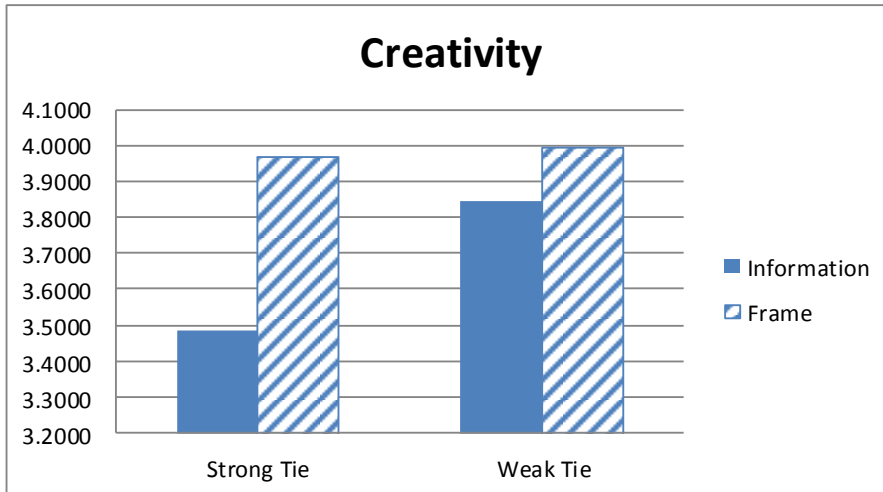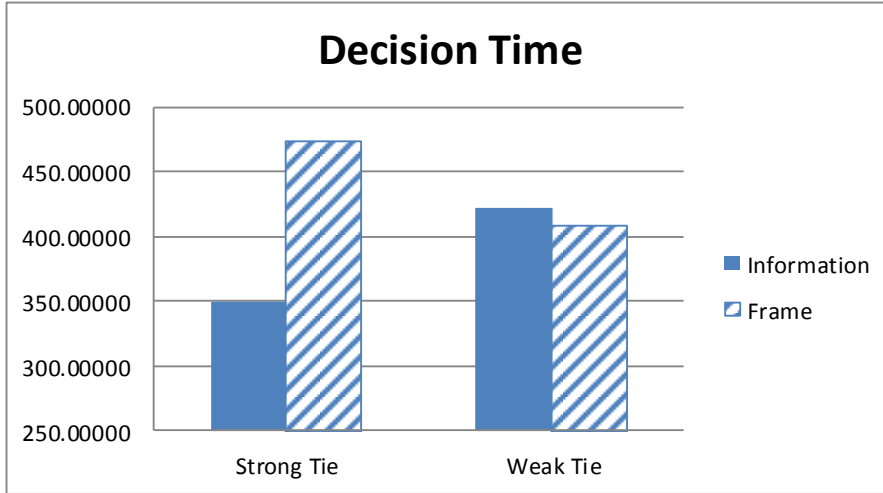
Figure 3

Hypothesized Model

Figure 4

Means for Mediators and Creativity (Study 2).

APPENDIX

E-mail problem

Pat,

I need your advice on how to deal with one of my female employees. She is a nice person and a very good worker. However, she always comes to work dressed very seductively. For example, she wears clingy, low-cut dresses, tight skirts, and see-through blouses. Her appearance is distracting my male employees. They spend too much time ogling her, and not enough time doing their work. I know the company does not have a dress code, so how do I handle the situation? Please respond ASAP, the situation is affecting my department's performance!

Stan

Example standard solution

Honestly Stan if her attire is affecting your work performance then you should talk to her about it. I haven't had any complaints from any other coworkers and think you should be able to handle this matter on your own. We did have a dress code in the past but it didn't work out and was dismissed. If you truly don't feel comfortable talking to her then let me know and I will take care of it, but I think you should be able to say something.

Example creative solution

Stan, It seems like all of your employees, male and female, share some of the blame. If individual attention is a problem maybe you should consider some creative solutions. First, consider a casual dress day, maybe with costumes. Give each employee a chance to stand out on their own. Maybe this will remove attention from your female employee and show her that she doesn't need to wear seductive clothes to stand out to be respected. Additionally, it may change the way other employees consider her. They may realize that she has more to offer than seduction, when she is dressed differently. Second, try getting some input from other female employees. Have they noticed the problem? Maybe a group meeting or exercise with the female workers could change the way your employee thinks about her image. She may realize that other females can create attention in ways other than attire. Perhaps let the female and male employees set up a dress code convention, something that is fun and that allows each person to offer input on their personal style. This could be a fun event, like a run-way event, that changes the way people think about dress code.