"Who are you going to call?"

Network activation in creative idea generation and elaboration

Pier Vittorio Mannucci
London Business School
pmannucci@london.edu

Jill E. Perry-Smith
Goizueta Business School
Emory University
jill.perry-smith@emory.edu

forthcoming on *Academy of Management Journal*

Acknowledgments

The authors extend their gratitude to associate editor Jason Shaw and three anonymous reviewers for their invaluable feedback throughout the review process. We thank Raina Brands for her feedback on an earlier version of the paper. We are also grateful to the participants at seminars at Cambridge, Georgetown, NYU, UCL School of Management, University of Wisconsin Madison, as well as at the ION Social Networks Conference, Society & Organizations Research Day, Association for Psychological Science, and Academy of Management Conference for their helpful comments and suggestions on previous drafts. We also thank members of GRV Italia for participating to this study. Finally, the authors would like to thank Gledis Cinque for her precious help with data collection.

"WHO ARE YOU GOING TO CALL?"

NETWORK ACTIVATION IN CREATIVE IDEA GENERATION AND ELABORATION

ABSTRACT

Considering creativity as a journey beyond idea generation, scholars have theorized that different ties are beneficial in different phases. As individuals usually possess different types of ties, selecting the optimal ties in each phase and changing ties as needed are central activities for creative success. We identify the types of ties (weak or strong) that are helpful in idea generation and idea elaboration, and given this understanding, whether individuals activate ties in each phase accordingly. In an experimental study of individuals conversing with their ties, we provide evidence of the causal effects of weak and strong ties on idea generation and idea elaboration. We also find that individuals do not always activate ties optimally and identify network size and risk as barriers. Our results in a series of studies reveal that individuals with large networks, despite providing more opportunity to activate both strong and weak ties, activate fewer weak ties and are less likely to switch ties across phases than individuals with smaller networks, particularly when creativity is perceived as a high-risk endeavor. Finally, we find that activating the wrong ties leads to either dropping creative ideas or pursuing uncreative ones.

What type of social relationship is more conducive to creativity? One tenet of creativity research is that weak ties are more beneficial, because they grant access to non-redundant knowledge and foster cognitive flexibility (e.g., Baer, 2010; Perry-Smith, 2006; Zhou, Shin, Brass, Choi & Zhang, 2009). Another tenet, in contrast, is that strong ties are better, because they provide support and motivation (e.g., Chua, Morris, & Mor, 2012; McFadyen & Cannella, 2004; Sosa, 2011). Recently, however, scholars have started to consider how social relationships affect the idea journey in its entirety, rather than just idea generation, suggesting that different types of ties might be beneficial for different phases. In particular, they have theorized that weak ties are

more conducive for idea generation (i.e., the process of generating a novel and useful idea), when cognitive flexibility is needed. In contrast, strong ties are more beneficial for idea elaboration (i.e., the process of evaluating a novel idea's potential and further clarifying and developing it), when creators need constructive feedback and support (Perry-Smith & Mannucci, 2017; Rouse, 2020).

If individuals need different ties in each phase, successfully moving forward in the idea journey requires interacting with either weak or strong ties across phases as needed. What matters for creative success may thus not only be the availability of different ties but also whom individuals call to mind in each phase. Social networks, in fact, are not only fixed, objective social structures, but also cognitive representations in the mind (Carley, 1986; Krackhardt, 1987, 1990). Individuals generate mental maps of their network contacts and who is connected to whom, and activate different parts of their networks at different times (Bridwell-Mitchell & Lant, 2013; Shea et al., 2015; Smith et al., 2012). In contrast to available networks, activated networks – the set of ties an individual calls to mind in a given situation – are fluid and dynamic, as they are continuously reconstructed depending on the situation (Carley, 1986; Casciaro, 1998; Perry-Smith & Mannucci, 2017). Given availability, individuals should thus be able to accommodate different tie demands across phases by activating the appropriate tie in one phase and activating another in the next phase.

Yet, there is reason to believe that the mere availability of both strong and weak ties is not enough to ensure that people will activate ties optimally across phases. First, individuals are often unable to recognize the value of their contacts, fail to remember them, or actively decide not to activate them for factors unrelated to their usefulness (e.g., Casciaro & Lobo, 2008; Flynn et al., 2010; Janicik & Larrick, 2005). Second, research on decision making (e.g., Hall, Ariss, &

Todorov, 2007; Iyengar & Lepper, 2000) suggests that large amounts of alternatives may engender biases that result in suboptimal choices for some. If networks are cognitive representations, they also may reflect information or alternatives available in the mind. This raises the question: do large networks, despite providing correspondingly large tie choices, present a barrier to optimal tie activation? Extant research on the effect of the number of direct ties on creativity provides an equivocal answer (see Phelps, Heidl, & Whadwa, 2012, for a review). Finally, research suggests individual limits on the capacity to adequately process social information is particularly strong when risk is present (Smith, Menon, & Thompson, 2012). This amplifies questions about optimal tie activation during creative tasks, as creativity is perceived as a risky endeavor (Criscuolo, Salter, & Ter-Wal, 2013; Mueller, Melwani, & Goncalo, 2012).

Given that creators often go through a series of iterations between phases (Harrison & Rouse, 2015; Perry-Smith & Mannucci, 2017; Rahman & Barley, 2017), failing to activate the appropriate ties across different phases has far-reaching implications and may help explain difficulties in idea journey success. The activation of the "wrong" ties in one phase may explain why highly creative ideas get stuck between phases or are discarded prematurely. Conversely, mediocre ideas may move forward in the idea journey for development and elaboration and be subsequently presented to gatekeepers. An idea moving forward in the idea journey may thus be more a reflection of activation inadequacy than of the quality of the idea. Quite surprisingly, research on network activation has been silent on activation stickiness, overlooking how early network activation choices could anchor or imprint later ones.

The objective of this research is to understand the types of ties (weak or strong) that are helpful in different phases of product creation and, given this understanding, what helps or hinders individuals' ability to activate ties in each phase accordingly. Our theoretical premise

requires an explicit emphasis on multiple phases and on the movement between them. We thus adopt a multi-study approach and use each study to explore different aspects of our theorizing. First, we establish the causal effects of weak and strong ties on generation and elaboration phases through an experimental study of individuals conversing with network alters. While the optimal ties for each phase have been theorized (Perry-Smith & Mannucci, 2017), in fact, their direct causal effects and underlying mechanisms have yet to be tested empirically. Next, in a field and laboratory experiment we identify two barriers to optimal activation patterns in network size and risk. We theorize that large networks, which provide more opportunities to activate both strong and weak ties, may hinder optimal activation in contrast to smaller networks which provide fewer opportunities. Finally, in a lab experiment we test two types of downstream consequences of suboptimal activation patterns: false positives (i.e., pursuing uncreative ideas for further implementation), or false negatives (i.e., dropping relatively creative ideas rather than elaborating upon them). In so doing, we highlight how sticking to the same ties across the idea journey can impair creators' ability to pursue highly creative ideas.

IDEA GENERATION AND IDEA ELABORATION

The idea journey represents the path followed by a novel idea from its conception to its successful dissemination (Perry-Smith & Mannucci, 2017). While the idea journey consists of multiple phases, the first two – idea generation and elaboration – are those where the role of the individual creator is more central, whereas the following phases (i.e., championing and implementation) are characterized by an increased involvement of the collective.

Idea Generation

Idea generation begins with a problem or challenge that the creator seeks to address (Campbell, 1960). The challenge may be implicit, such as in the case of a product developer

continuously interested in new designs, or explicit, such as in the case of a developer with a specific design problem in need of a solution. At the individual level, this phase entails the conception of many different ideas in the mind (Campbell, 1960; Simonton, 2003). Individuals serendipitously generate "crowds" of ideas (Poincaré, 1913: p. 387), with notions and concepts colliding with each other and being recombined through an associative variation process (Campbell, 1960; Mannucci & Yong, 2018; Mednick, 1962; Simonton, 2003). This process is characterized by uncertainty and risk, as creators have to decide whether an idea is worth pursuing or if it should be dropped in favor of another one (Berg, 2016; Campbell, 1960; Perry-Smith & Mannucci, 2020; Simonton, 2003). This phase ends when the creator "stumbles" on a single idea that is novel and fits the problem (Amabile, 1983): this is the "A-ah", "Eureka" moment that "marks the successful termination of the process" (Campbell, 1960: p. 384). Importantly, the selected idea is merely a vague idea or core concept to be elaborated upon in future phases. The complexity of the challenge determines the length of idea generation: trivial problems may correspond to a short generation phase, whereas multifaceted issues might require more time with a correspondingly longer generation process.

Interacting with others helps with the generation of ideas, as it can trigger those subconscious associative processes that are at the heart of this phase. For example, David Byrne, the former lead singer of the revolutionary band Talking Heads, gets his best ideas by just listening and paying attention to people around him – random encounters that change the way he sees things and automatically expand his mind (Lehrer, 2012: p. 178). While these interactions can fuel the process, idea generation still happens within the individual's mind (Amabile, 1983; Campbell, 1960; Cronin & Weingart, 2007; Mueller & Kamdar, 2011; Simonton, 1984). Studies of collective creative processes corroborate this notion. For example, the realization of the Pixar

movie *Monsters, Inc.* required the synthesis of the ideas of hundreds of individuals, but its seed lies in Pete Docter wanting to make a movie about one of his childhood fears (Harvey, 2014; Snetiker, 2016).

Idea Elaboration

Once the idea has been selected, it enters the elaboration phase (Perry-Smith & Mannucci, 2017). At this point the creator has identified an idea that he/she believes is worthy of further development, re-evaluates the idea's potential, and further clarifies and develops it (Mainemelis, 2010; Rahman & Barley, 2017; Staw, 1990). Through this process, the idea moves from being a vague concept to a more elaborated form. The creator refines the idea by checking for inconsistencies, making improvements (Csikszentmihalyi, 1997; Mainemelis, 2010; Perry-Smith & Mannucci, 2017), and continuously re-assesses whether it is worth the time and effort needed to develop it further. As a consequence, the duration of this phase varies considerably: while some ideas are developed very quickly, others can even take years, with creators going through multiple iterations of elaboration before deeming the idea "ready" for securing resources and implementing it (i.e., the next phases of the idea journey – Perry-Smith & Mannucci, 2017). For example, while it took Quentin Tarantino three years to transform the initial concept of *Pulp Fiction* into a script, it took him only three weeks to do the same with *Reservoir Dogs* (Biskind, 2004; Dawson, 1993).

Since the creator's elaboration efforts focus on improving on a promising idea, interacting with others during the elaboration phase may involve the creator sharing the idea (Hargadon & Bechky, 2006; Rouse, 2020). This includes informal exchanges that begin with expressions like "let me run something by you" or "I had this idea, tell me what you think about it." As creators invest time and energy in one idea, they feel increasing psychological ownership,

seeing the idea as an extension of themselves (Pierce, Kostova, & Dirks, 2001). Consequently, sharing an idea is perceived as an extremely vulnerable and risky experience because it is like sharing one's self (Brown & Baer, 2015; Grimes, 2018; Rouse, 2020). Those with whom the creator shares the idea can become co-creators (Rouse, 2020), but most of the time they keep the role of feedback providers and "creative confidants" (Harrison & Rouse, 2015; Perry-Smith & Mannucci, 2017). For example, architects get feedback and suggestions from other people, such as engineers and constructors, but they are in charge of deciding whether and how to change their designs as a consequence of these interactions (Rahman & Barley, 2017).

NETWORK TIES AND IDEA GENERATION AND ELABORATION NEEDS

Because of their inherent differences, the generation and elaboration phases are characterized by different needs (Perry-Smith & Mannucci, 2017). During idea generation, creators require cognitive flexibility in order to be able to make the connections and associations that lead to the generation of novel and useful ideas (Campbell, 1960; Mednick, 1962; Simonton, 2003). During idea elaboration, the higher risk associated with a novel idea engenders a need for support in the form of (a) constructive feedback that builds on the idea and (b) encouragement to present it to gatekeepers and decision-makers (Bangle, 2001; Catmull & Wallace, 2014; Rouse, 2020; Zhou, 1998, 2003). This has led networks scholars to theorize that weak ties should be more beneficial for idea generation, and strong ties for idea elaboration (Perry-Smith & Mannucci, 2017).

Weak ties have long been argued to foster creativity because they expose individuals to diverse perspectives (Baer, 2010; Perry-Smith, 2006, 2014; Zhou et al., 2009). In other words, weak ties increase the chance of "creative accidents" (Campbell, 1960; Simonton, 2003) by providing diverse notions that collide in the brain and thus foster the recombinatory process that

is at the heart of idea generation. In addition, research suggests that individuals process novel insights and perspectives more thoroughly and integrate them more in their thinking when these insights come from weak ties or strangers compared to when they come from strong ties or close friends (Perry-Smith, 2014; Savitsky, Keysar, Epley, Carter & Swanson, 2011). On the contrary, strong ties expose individuals to homogeneous knowledge and similar paradigms and perspectives (Granovetter, 1973). Instead of gaining new insights, individuals exposed to strong ties end up building upon their existing knowledge base or solidifying assumptions. This, in turn, is expected to enhance cognitive rigidity rather than flexibility, and thus stifles divergent thinking.

However, in idea elaboration individuals do not need cognitive flexibility, but support and constructive feedback. Consequently, during this phase strong ties, rather than weak ones, can help creators elaborate on a novel idea. Strong ties are more likely to provide creators with support in the form of developmental feedback – i.e., useful idea extensions, validation, and encouragement (Madjar, Oldham, & Pratt, 2002; Sosa, 2011; Tortoriello, Reagans, & McEvily, 2012). This support should enhance the creators' confidence in the worthiness of refining the idea. For example, Copernicus was persuaded to publish his groundbreaking work by the feedback and support he received from his pupil, Rheticus; and Galileus finally resorted to publish his *Messenger from the stars* thanks to the feedback and suggestions he received from Kepler, a colleague that he trusted and admired (Koestler, 1964). On the contrary, weak ties lack the shared frames of understanding that characterize strong ties (Granovetter, 1973). Thus, when presented with a novel "early stage" idea, weakly tied contacts are more likely to "fail to see its potential or lack the patience to let it evolve" (Catmull & Wallace, 2014: p. 132). We expect that

their lack of interest in better understanding the idea will lead them to ignore or reject its novel elements (Mueller et al., 2012).

Hypothesis 1 (a/b): Interacting with weak (strong) ties during idea generation (elaboration) will lead to higher creativity than interacting with strong (weak) ties.

BARRIERS TO OPTIMAL TIE ACTIVATION AND TIE SWITCHING

A potential solution to the need for different ties across phases is for individuals to maintain a network comprised of both weak and strong ties and activate different ties in each phase. The question then becomes: do creators activate optimally and dynamically – weak ties in generation and switching to strong ties in elaboration? Research suggests the baseline answer is not simply yes or no. In the sections that follow, we identify two barriers in network size and perceived risk that may hamper optimal activation. We theorize that individuals' network size engenders activation biases, increasing the likelihood that individuals activate ties and switch activated ties in contrast to what is needed – a tendency exacerbated by perceived risk.

Network Size

Individuals generate mental maps of their network contacts and who is connected to whom (Carley, 1986; Krackhardt, 1987, 1990). As a result, every person and tie in the network can be seen as information stored in memory (Brands, 2013; Dunbar, 2008). This information and its cognitive organization represent a fundamental activity in human sociality (Hill & Dunbar, 2003) and influence whom individuals call to mind, or tie activation (Krackhardt, 1987). The number of ties and nodes, or network size, reflects the amount of social information that is cognitively available to creators when they have to make activation choices (Flynn et al., 2006; Krackhardt, 1990; Parkinson, Kleinbaum, & Wheatley, 2017). Having many direct ties means having to cognitively encode and process a corresponding amount of social information: the

larger the network, the larger the amount of information (Dahlander & McFarland, 2013; DeSoto, 1960; Sparrow, 1999).

Individuals' mental capacity for information, however, is limited (Simon, 1950). A wealth of social information can create "a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that might consume it" (Simon, 1971: 41). Choice and decision-making research reveals that individuals have a tendency to cope with high volumes of information and alternatives by focusing on a small percentage of the information available and neglecting the rest (Hauser & Wernerfelt, 1990; Sparrow, 1999; Timmermanns, 1993). Specifically, some individuals construct their decisions by focusing on the alternatives that are mentally more readily available to them (e.g., Hall, Ariss, & Todorov, 2007; Iyengar & Lepper, 2000; Tversky & Kahneman, 1974 – see Roetzel, 2019 for a review). Instead of thinking more expansively, they think more narrowly as information increases. In essence, abundant information engenders a paradox: individuals cope with the availability of high levels of information by narrowing cognitively.[1]

Similar to decision making choice sets, research on human sociality indicates that the human brain has a limited capacity to store and actively manage relationships (e.g., Dunbar, 1998; Dunbar & Spoors, 1995). Emotionally close ties are cognitively more salient and are stored in mental maps as core social information leading individuals on average to disproportionately emphasize closer ties (Binder, Roberts, & Sutcliffe, 2012; Dunbar, 1998; Dunbar & Spoors, 1995; Hill & Dunbar, 2003). Just as individuals have limited time and energy to maintain many relationships, which may undermine the ability to focus on and perform

[1] Note that the emphasis is on voluminous information. Two choices may lead to better decisions than just one, and this may be why individuals say they prefer more choice. Yet, individuals "seem to ignore possible side effects of information overload up to a very high level" (Roetzel, 2019: p. 508), and thus continue to look for more choices, worsening the effect.

creative tasks (Baer, 2010; Dahlander & Fredrisken, 2011; McFadyen & Cannella, 2004), individuals have limited cognitive capacities. We suggest a cognitive narrowing effect associated with large networks that hampers ties activated in the first place rather than affecting task focus.

In sum, when engaged in a creative endeavor with its associated risk and uncertainty, we expect individuals with large networks will cope with cognitive overload by activating more easily accessible portions of their networks compared to individuals with smaller networks, with fewer available options. Specifically, individuals with large networks will call to mind those ties that are more mentally salient and "core" in mental maps, and that thus require less cognitive effort – i.e., strong ties, in contrast to what is optimal for generation in particular.

In order to successfully progress in the idea journey, during the elaboration phase individuals do not "simply" need to activate strong ties, but they also need to switch from weak to strong ties. In contrast to this need, research in decision-making suggests individuals tend to anchor to their past choices and stick to them, particularly when the previous choice has worked well (Bornstein, Khaw, Shohamy, Daw, 2017; Samuelson & Zeckhauser, 1988). Large networks, which provide a correspondingly large set of choices, may exacerbate the tendency to limit choice space and pick the fast, easy option. When repeated choices are involved, the "easy option" is to anchor to first decisions in order to reduce the cognitive load and minimize cognitive fatigue (Blankenship et al., 2008; Tversky & Kahnemann, 1974). When they have already made a choice across multiple options in the form of many available network ties, creators with a large network are more likely to activate during idea elaboration the same ties that they have previously activated during idea generation, because the large choice set induces cognitive narrowing in the form of anchoring.

An examination of existing empirical evidence of the relationship between network size and creativity is consistent with the logic that large networks may impose barriers on optimal tie activation in some cases. Among studies that consider network size as the number of direct ties within informal networks (rather than formal ties such as affiliation ties), the effect of network size on creativity is in fact mixed. While some have found a positive relationship between network size and creativity (e.g., Chua et al., 2012; Dokko, Kane, & Tortoriello, 2013), other scholars have found the effect to be curvilinear (e.g., Baer, 2010), whereas others have found no effect (e.g., Moran, 2005; Rodan & Galunic, 2004) or even a negative effect (e.g., Tortoriello, 2015). Possible explanations for the mixed results may be due to not accounting for movement across phases, but may also be due to risk perceptions, a possibility we explicate in the next section.

Hypothesis 2: Network size negatively affects the proportion of weak ties individuals activate in idea generation and idea elaboration.

Hypothesis 3: Network size negatively affects the likelihood of switching ties from idea generation to idea elaboration.

Perceived Risk

One overarching assumption of our theorizing is that creativity, and idea elaboration in particular, is a risky activity (Criscuolo et al., 2013; Grimes, 2018; Mueller et al., 2012; Rouse, 2020; Staw, 1990). Importantly, research suggests that the cognitive narrowing and fixation induced by information overload is likely when risk and uncertainty are high (see Chernev, Böckenholt, & Goodman, 2015 for a meta-analysis). First, in these situations, individuals do not have adequate mental models to rationally process information, and thus rely even more on cognitive shortcuts and on the information that is more readily available to them (Kahneman,

Slovic, & Tversky, 1982; Tversky & Kahneman, 1982). Consistent with this reasoning, Smith and colleagues (2012) found that when individuals perceive the situation as threatening, they exhibit a winnowing response, activating densely interconnected subsections of their network. Second, perceiving the situation as risky and uncertain induces individuals to think that there is no "correct" choice, thus reducing the incentive to systematically process information and increasing the likelihood of sticking to one's previous choices (Samuelson & Zeckhauser, 1988; Tversky & Kahneman, 1974). Thus, we expect the cognitive narrowing and anchoring effects associated with large networks to be present when perceived risk is high.

When the uncertainty and perceived risk are low, we instead expect the aforementioned biases to be less likely. Decision-making research has in fact shown that the negative effects of having a large choice set are less likely when the task is simple, structured, and clear, compared to when it is complex, unstructured, and characterized by high uncertainty (Chernev et al., 2015). Although creativity is generally perceived as complex and risky, some companies manage to reduce this risk perception by creating a work environment that encourages the embracement of risk and complexity (Catmull & Wallace, 2014; Parke & Seo, 2017; Vera & Crossan, 2005). Consistent with our reasoning, these companies are characterized by fluid relationships among their members, who ask for help and suggestions both to individuals with whom they have frequent interactions and to individuals with whom they have only sporadic exchanges (Fisher, Pillemer, & Amabile, 2018). Overall, these arguments lead to the following predictions:

Hypothesis 4: The effect of network size on the likelihood of activating weak ties is negative when perceived risk is high, and this effect is weaker when perceived risk is low.

Hypothesis 5: The effect of network size on the likelihood of switching ties is negative when perceived risk is high, and this effect is weaker when perceived risk is low.

THE NEGATIVE CONSEQUENCES OF SUBOPTIMAL ACTIVATION

Considering in conjunction our theorizing on network tie needs across phases and the potential barriers to optimal activation reveals two likely suboptimal network activation patterns that entail *not* switching ties across phases. First, individuals may stick to strong ties in both phases. Over-relying on strong ties, they activate strong ties in generation and then anchor on their tie choice, sticking with strong ties also in elaboration. Second, individuals may stick to weak ties in both phases: they pick the "right" ties in generation and activate weak ties, but they anchor on their choice and stick with weak ties also in elaboration. Building on extant work in creativity and innovation (Berg, 2016; Giarratana, Mariani, & Weller, 2018), we frame these negative consequences as two types of errors: false positives – i.e., generating relatively bad ideas and selecting them for further elaboration, and false negatives – i.e., generating relatively creative ideas but dropping them rather than elaborating upon them.

The overreliance on strong ties and sticking with them across generation and elaboration (suboptimal activation pattern 1) will make individuals more susceptible to false positives. Despite generating low-quality ideas, by sticking to strong ties during idea elaboration individuals will receive more validation compared to what they would receive from weak ties. Strong ties will likely share constructive suggestions to improve even low-quality ideas, thus encouraging creators and providing them with (falsely) positive cues regarding the idea's creativity. On the contrary, weak ties are less likely to provide encouragement and may dismiss the idea, thus providing less positive cues about its creativity. Therefore, creators that interact with strong ties across the two phases will be more likely to (a) generate uncreative ideas and (b) to pursue, rather than drop, these uncreative ideas compared to individuals who switch to weak ties in idea elaboration.

Hypothesis 6: For creators who interact with strong ties during idea generation, sticking to strong ties during idea elaboration will increase the likelihood of false positives compared to creators who switch to weak ties.

Activating weak ties in generation and sticking to them during idea elaboration (suboptimal activation pattern 2) will make individuals more susceptible to false negatives. While by interacting with weak ties during idea generation, creators are likely to generate highly creative ideas, sticking to weak ties during idea elaboration will decrease the likelihood of receiving developmental feedback and validation. Compared to strong ties, weak ties are less likely to invest effort to see the idea's potential or to fully engage with it, and thus fail to provide positive cues that reassure creators. Given the high uncertainty associated with creativity, this will result in creators abandoning creative ideas. On the contrary, strong ties provide constructive suggestions and encouragement, thus fostering the creators' confidence in the creativity of the idea during elaboration. Consequently, we expect creators that always interact with weak ties across the two phases to (a) generate highly creative ideas, but (b) be more likely to drop, rather than pursue, these ideas compared to creators who switch to strong ties during idea elaboration. Thus, we predict:

Hypothesis 7: For creators who interact with weak ties during idea generation, sticking to weak ties during idea elaboration will increase the likelihood of false negatives compared to creators who switch to strong ties.

OVERVIEW OF STUDIES

We tested our hypotheses in three experimental studies. While rarely applied in networks-creativity research (see Perry-Smith, 2014, for a relevant exception), experimental studies are best suited to isolate the effect of network ties, as well as to explore the underlying

mechanisms (Phelps, Heidl, & Whadwa, 2012; Perry-Smith & Mannucci, 2015, 2017). In Study 1, we test our Hypothesis 1 in order to empirically establish which tie type is more conducive to creativity in each phase. We also explore the mechanisms underlying these relationships. In Study 2, we test our hypotheses on the effects of network size on activation and switching. Finally, in Study 3 we test our hypotheses on the negative consequences of not switching tie type across phases.

STUDY 1

To establish which ties are optimal in each phase, we investigated the causal effects of tie strength (strong vs. weak) on creativity in the idea generation and elaboration phases of the idea journey. We implemented a 2 (weak vs. strong ties) by 2 (interaction during idea generation vs. idea elaboration) + 1 (control – no interaction condition) between-subjects experimental design to establish the influence of weak and strong ties on overall creativity.

Methods

Participants. We recruited 93 individuals (M_{age}= 27.27, SD= 9.89; 70% female) from an active participant pool at the behavioral lab in a European business school and randomly assigned them to one of the five experimental conditions. In return for their participation in this 60-minute study, participants received compensation equivalent to roughly $12.50 per hour.

Task and procedures. The study was divided in two parts. In the first part, we asked participants to indicate up to eight people with whom they discuss important matters, and to provide information on the strength of their relationship with each of them. All participants responded to the following name generator question: “From time to time, people informally discuss any range of matters. Who are the people with whom you discuss these matters? Please think broadly. These individuals may span a number of different dimensions (e.g., colleagues,

old or new friends, family members)." After they had selected names, respondents were asked to "please look over your responses to the above question and add below anyone else that is an appropriate answer to the question, even though you may interact with the person less frequently than those previously named." They were given the chance to indicate up to five additional names[2]. After they listed the names, we asked participants to indicate how emotionally close they were to each contact (1=distant, 4=very close), and whether their contacts knew each other (1=yes, 0=no). Finally, we asked participants to indicate who among the contacts they listed would be willing to take part in the second part of the study, and we asked them to provide us with the contact details of the people they listed. At this stage, participants were told that by participating in the second part of the study, they and their contacts (if invited) would be entered in a lottery awarding nine individual prizes of the total value of the equivalent of $1,200.

The second part of the study occurred approximately one week after the first part. Given that our hypotheses focused on the benefits of strong vs. weak ties across phases, we wanted these interactions to be real, rather than based on a scenario. Thus, we had participants and their contacts come to the lab and have real interactions[3]. This also presented the advantage of directly observing what actually happens in the interactions. To this end, we videotaped all conversations, which allowed us to conduct exploratory analyses on the content of each type of interaction[4].

[2] We decided to add this question, consistent with prior research (e.g., Perry-Smith, 2006), in order to prime the respondents to include their weak contacts as well.
[3] We pre-tested this design with 21 participants from the same subject pool, who did not take part in the actual study. In this pre-test, we tried to have participants and their contacts interact remotely, rather than bringing both participants and contacts to the Lab. However, this system generated too many uncontrolled differences across interactions, and we thus opted to have both participants and contacts in the lab for the main study.
[4] We informed the participants and their contacts that their interaction was going to be videotaped and they agreed to this provision.

We randomly assigned participants to interact with either two strong or two weak ties, or to no interaction at all. Upon arriving at the Lab, the participants and each of their contacts were placed in separate rooms. They did not interact until the task started. Participants were presented with the creativity task and told they would have the chance to interact with their contacts at some point. The creativity task was adapted from Gino and colleagues (Gino, Argote, Miron-Spektor, & Todorova, 2010), and consisted of generating ideas for a decorative object that could be sold in the university shop. Participants were invited to generate creative ideas, defined as ideas that are both novel and useful, and elaborate upon them. All participants, (except those in the control – no tie condition), interacted separately with each contact, thus each participant engaged in two conversations. Participants and contacts interacted via Skype, calling each other from their cubicles. Each interaction lasted for a maximum of five minutes. At the conclusion of the experiment, participants completed a manipulation check and rated the usefulness of each interaction.

Manipulations. Before coming to the Lab for the second part of the study, participants assigned to the *strong tie* condition were asked to get in touch with two of their strong ties, and were given the chance to choose a timeslot. We classified as strong all those contacts whom the participants reported being a close or very close alter (i.e., received a score of 3 or 4). Participants assigned to the *weak tie* condition interacted instead with two people randomly chosen from the Lab subject pool and who agreed to participate in the second part of the study.

The phase manipulation (generation, elaboration) altered whether participants interacted with contacts before generation or elaboration. The precise manipulation is reported in the Appendix. After reading the task description, participants randomly assigned to the *generation* condition interacted with two contacts. After both interactions, they proceeded to generate ideas,

and selected the one they deemed to be the most creative for further elaboration. They engaged in a filler task (a word-finding puzzle) before proceeding to elaborate on the idea. Participants randomly assigned to the *elaboration* condition followed the same procedure, but with two key differences: they completed the filler task before generating ideas, and they interacted with two contacts after having selected their most creative idea and before elaborating it. Participants in the control condition completed two filler tasks before each phase and did not interact with anyone.

Measurement of creativity. We focused on the final elaborated idea to assess creativity for all conditions. Creativity was assessed using the consensual assessment technique (Amabile, 1982). Two raters highly familiar with the university shop and blind to the experimental conditions served as the expert judges. The judges rated the overall creativity of the decorative objects ideas on a scale from 1 to 7. Following the consensual assessment technique protocol, they also rated each idea on likelihood to use, likelihood to buy, and novelty. We assessed interrater reliability using Cohen's weighted kappa (1960), which is more appropriate in the presence of ordinal variables (Bakeman & Gottman, 1997). The average k for the overall reliability of creativity ratings was 0.69 ($Z < 0.001$), which is above the accepted threshold of 0.61 generally accepted as a good level of overall agreement (Kvalseth, 1989) and consistent with extant creativity research (Taylor & Greve, 2006)[5]. We used the average of the two ratings as the measure of creativity.

Results

[5] We recognize the use of r_{wg} as an alternative measure of interrater agreement more widely used by scholars employing the consensual assessment technique. We also calculated r_{wg}=0.86, which also suggests strong agreement.

Manipulation check. The manipulation check consisted of asking participants how close they were to the two contacts they interacted with. As expected, participants assigned to the strong tie condition reported high levels of emotional closeness with their contacts, whereas participants assigned to the weak ties condition reported low levels of closeness (M_{strong} = 3.45, SD= 0.10; M_{weak}= 1.45, SD= 0.10; t(60)=14.23, p < .001). 92% of the participants within the strong tie condition reported a closeness score of 3 or 4 (i.e., close or very close) for their contacts, while this percentage fell to 8% among participants in the weak tie condition.

Hypotheses tests. The five conditions were first converted to a one-way ANOVA design (no contacts, weak tie-generation, weak tie-elaboration, strong tie-generation, strong tie-elaboration). This approach was appropriate given that idea phase and type of tie only apply when participants consulted contacts. Given that the "no contacts" condition did not interact with anyone, a fully crossed ANOVA (e.g., 3x2 factorial) could not be used here.

The hypotheses were tested using planned contrasts, consistent with the fact that we had specific hypotheses based on a priori predictions (Winer, Brown & Michels, 1991; see Brands & Mehra, 2019, and Perry-Smith, 2014, for a similar approach). Hypothesis 1(a) predicted that during idea generation interacting with weak ties leads to higher creativity than interacting with strong ties. Planned contrasts revealed that participants who interacted with weak ties during idea generation were more creative than participants who interacted with strong ties (M_{weak}=3.87, SD_{weak}=0.95; M_{strong}=2.62, SD_{strong}=0.99; t(88)=3.15, p=0.022) and participants in the control condition who did not interact with anyone ($M_{control}$=2.87, $SD_{control}$=1.15; t(88)=2.89, p=0.048). Thus, Hypothesis 1(a) was supported. Hypothesis 1(b) predicted that in the elaboration condition participants who interacted with strong ties will display higher creativity than participants who interacted with weak ties. While the difference was in the expected direction, with strong ties

having more positive effects than weak ties in idea elaboration, this difference was not statistically significant (M_{weak}=2.72, SD_{weak}=1.22; M_{strong}=3.27, SD_{strong}=1.08; t(88)=- 1.39, p=0.841). Thus, Hypothesis 1(b) was not supported.

Robustness checks. We ran supplementary analyses to ensure the robustness of our findings. First, we controlled for openness to experience using Goldberg's (1999) IPIP scale (α=0.75), and creative self-efficacy using Tierney and Farmer's (2002) scale (α=0.84). Both variables are widely studied individual factors that affect the likelihood of exposure to diverse ideas and influence creativity. There was no difference in openness to experience (F(4,88)=1.90, p=0.12) nor in creative self-efficacy (F(4,88)=1.74, p=0.15) across experimental conditions.

Second, we controlled for participants' pre-existing network structure. This control was warranted because network structure has been shown to affect both individual creativity (Perry-Smith & Mannucci, 2015) and individuals' likelihood to engage with weak or strong ties (Burt, 1992). We used the information provided in the name generator questions to compute each participant's network size and network density score using UCINET software (Borgatti, Everett, & Freeman, 2002). There was no difference in network density (F(2,90)=0.31, p=0.74) or in network size (F(2,90)=0.84, p=0.44) across the idea generation and idea elaboration conditions. The same was true across the weak tie and strong tie conditions for both density (F(2,90)=0.55, p=0.58) and size (F(2,90)=0.92, p=0.40). We also re-ran our main analysis, once controlling for participants' network size and once controlling for participants' network density. Size did not have a significant effect on creativity (p=0.36), and adding it to the model did not alter our findings. Network density had instead a negative and significant effect on creativity (p=0.02), but its inclusion in the model also did not alter our results.[6]

[6] We obtained the same non-significant results even when excluding the "no tie" condition from the analysis.

We also explored whether there were significant differences in the perceived usefulness of the tie across the four conditions, and whether these differences affected our results. There was no difference across idea generation and idea elaboration in the reported usefulness of the ties participants interacted with ($F(3,62)=2.53$, $p=0.12$). However, we found a significant difference between strong and weak ties ($F(3,62)=11.80$, $p=0.001$), with participants perceiving strong ties as more useful ($M_{strong}=6.24$, $SD_{strong}=0.71$; $M_{weak}=5.54$, $SD_{weak}=0.86$). The coefficient of the interaction term between idea phase and tie type was not significant ($F(3,62)=0.04$, $p=0.83$). We re-ran our main analyses controlling for the perceived usefulness of the conversation, finding results to be identical with those reported in the main analyses.

Conversation content exploratory analyses. We ran exploratory analyses on the content of the interactions. Our theorized effects of strong and weak ties hinge on two ideas: (a) that interacting with weak ties is more beneficial during idea generation because weak ties are more likely to share new perspectives and ideas; and (b) that interacting with strong ties is more beneficial during idea elaboration because strong ties are more likely to provide constructive criticism and encouragement. The authors first separately coded four interactions (two with strong ties, two with weak ties) to develop a coding protocol. We identified *sharing ideas* (the degree contacts shared new ideas with the participants) and *building on ideas* (the degree contacts built on the participants' ideas) as two behaviors that were theoretically relevant for our focal relationships.

Sharing ideas mirrored our theorized mechanism for the benefits of weak ties in terms of sharing new ideas and perspectives. Building on ideas mirrored our theorized mechanism for the benefits of strong ties in terms of providing support in the form of developmental feedback that expands on and validates the creator's idea. We then provided this coding protocol to two raters

blind to the conditions and objectives of the study. These raters used the protocol to code all the interactions, counting the occurrences of sharing and building. We described sharing ideas as "introducing a new idea to the conversation," whereas building was described as "engaging with and expanding on an idea, tweaking or altering it." As an illustration, consider an exchange where the participant said "I was thinking of a mug." If the contact replied with "Or a water bottle. That could be good," the contact's reply would be classified as *sharing an idea*; if the contact replied with "Oh, cool. It could be one of those mugs that changes color when hot liquid is poured into them," her/his reply would be classified as *building on the idea*. The interrater agreement for the two dimensions (ICC) was equal to 0.92 for sharing, and 0.77 for building – both indicating excellent agreement under conventional standards (Cicchetti, 1994). We thus used the average of the two raters' assessment as our measures of sharing and building. Please see the Appendix for other details on the coding procedure.

We investigated whether the effect of tie type on creativity is mediated by idea sharing or building and if this mediation effect varies by phase. We used Hayes's (2013) PROCESS macro (Model 8) to test these moderated mediation models. First, we tested the mechanism of sharing ideas. In the generation phase, based on a bootstrap sample of 10000, zero fell inside the 95% confidence interval for the indirect effect of tie type via sharing on creativity (B= 0.08, (SE=0.14), 95% confidence interval [-0.159, 0.413]). This indicates that *sharing* does not mediate the relationship between tie type and creativity during this phase. In contrast, zero fell outside the 95% confidence interval for the indirect effect of tie type via sharing during idea elaboration (B=-0.18 (SE=0.11), 95% CI [-0.495, -0.028]). This indicates that *sharing* mediates the tie type-creativity relationship during idea elaboration. Compared to strong ties, weak ties share new ideas during idea elaboration, and this continued sharing undermines creativity during

this phase. Further, the index of moderated mediation was significant (B=0.26 (SE=0.17), 95% confidence interval [0.001, 0.687]) supporting the overall moderated mediation model; sharing differentially mediates the effect of tie strength and creativity for idea elaboration compared to idea generation.

We conducted the same analysis with building as the mediator. In the generation phase, based on a bootstrap sample of 10000 zero fell inside the 95% confidence interval for the indirect effect of tie type via building on creativity (B=- 0.16 (SE=0.14), 95% CI [-0.504, 0.067]), indicating that *building* does not mediate the relationship between tie type and creativity during this phase. In contrast, zero fell outside the 95% confidence interval for the indirect effect of tie type via building during elaboration (B= -0.60 (SE=0.23), 95% CI [-1.135, -0.224]). This indicates that *building* mediates the tie type-creativity relationship during idea elaboration. Weak ties build less on participants' ideas during idea elaboration compared to strong ties, and this lack of building reduces creativity during the idea elaboration phase. Put differently, the higher level of building displayed by strong ties during idea elaboration fosters creativity. The index of moderated mediation was significant (B=0.44 (SE=0.26), 95% confidence interval [0.006, 1.030]), supporting the overall moderated mediation model; building differentially mediates the effect of tie strength on creativity in idea elaboration compared to idea generation.

Discussion of Study 1

Our main analysis provides partial support for Hypothesis 1: weak ties are more beneficial for creativity during idea generation than during idea elaboration, but strong ties do not lead to significantly higher creativity during idea elaboration. The lack of a main effect of strong ties on elaboration could be due to our small sample size. However, our supplementary analyses reveal two indirect effects through which strong ties, compared to weak ties, foster

creativity during idea elaboration: strong ties (1) stop sharing their own ideas and (2) engage with the creator's idea, providing developmental feedback for improving it and ameliorating it. On the contrary, weak ties are detrimental during idea elaboration because they keep sharing new ideas instead of building on the creator's idea. Both these effects are consistent with our theorizing on the reasons why strong ties should be more beneficial than weak ties during idea elaboration. Another interesting insight from our findings is that participants perceived strong ties to be more useful despite their lower effectiveness in fostering creativity in idea generation. This result suggests that people might not be able to assess the true importance of their ties, leading to the theorized overreliance on strong ties[7].

STUDY 2

Our aims in Study 2 were to test our hypotheses on (a) the negative effects of network size on the activation of weak ties and on tie switching, and on (b) the underlying assumption that these effects occur when risk is high (Hypotheses 2, 3, 4, and 5). To this end, we first implemented a field experiment as a preliminary study to observe the "baseline" patterns of network activation in the two phases relevant to our theorizing. We then run our main study in a randomized laboratory experiment where we manipulated network size and the risk associated with creativity. This methodology allowed us to cleanly establish causality, isolate size and activation, while controlling for alternative explanations due to unmeasured contextual conditions that may affect network recall.

Preliminary Study: Baseline Activation Patterns

[7] Another explanation could reside in the nature of the strong ties considered. Specifically, it might be that what is needed for creativity in idea elaboration is not a generic strong tie, but a particularly strong one, such as the creator's most trusted confidante – i.e., a tie from their "inner circle." For example, Alfred Hitchcock used to present all his ideas for new movies to his wife, Alma Reville, before pitching them to other friends and collaborators (O'Connell & Bouzerau, 2004). Unfortunately, our interest in observing the effects of real interactions, rather than imaginary ones reduced our pool of "inner circle" strong ties. We explore this idea in the pilot for Study 2.

Preliminary Study 2 was a field experiment where we manipulated the idea phase (idea generation vs. idea elaboration), which allowed us to test our assumptions on baseline activation and switching patterns. Our design secondarily allowed us also to run an exploratory analysis to test Hypothesis 2 on the effect of network size on activation.

We conducted this study on 74 members (M_{age}=31.53, SD=5.85, 34% female) of a non-profit organizing historical re-enactments and live-action role-playing events (LARP). The largest and longest-lived LARP organization in Italy, GRV Italia, granted us the permission to contact and recruit their participants and to randomly assign them to our two conditions. LARPs are immersive narrative games in which players assume the roles of fictional characters in a choral story enacted within a physical space (Tychsen, Hitchens, Brolund, & Kavakli, 2006). LARP players have to develop their characters, writing a fictional biography (called "background") that includes all the key elements of the character, such as its psychology, motives, relationships, and worldviews. Players' status and reputation within the group largely depends on their ability to create a novel, engaging character. LARP players' communities have in fact high standards for background creation, and are always striving for novelty. Consequently, creating a shallow, uncreative background would result in a loss of reputation and credibility (Orazi & Cruz, 2018).

We first collected information about participants' available network, using a "roster method" that included a complete list of members who participated in the most recent LARP event. For each contact listed, we asked participants to indicate: (a) how emotionally close they were to the contact (1=distant, 4= very close); and (b) how frequently they interacted with the contact (1=less that once a month, 5=everyday). Two weeks later, we manipulated the creativity phase in which they would engage (generation vs. elaboration) and randomly assigned them to

one of two conditions[8]. Depending on the condition, their task was to either generate or elaborate ideas for the background of the character they will play in an upcoming LARP event organized by GRV Italia. We chose the upcoming event in order to add realism and stakes to the task, as creating their character's background was already part of the requirement for participating to the event.

After viewing the phase manipulation, participants were asked a name generator question to capture tie activation. We calculated the *strength of the activated network* as the average strength of all ties activated. We computed two measures to distinguish activation patterns across phases: the *proportion of activated strong ties*, calculated after classifying all the ties listed by each participant as either strong (above average – $M_{strength}$=2.09, SD=0.49) or weak (below average); and *activated inner circle ties* (see footnote 5 above), with the objective to capture the degree to which individuals activated their strongest ties. More details on the phase manipulation and on the composition of measures can be found in the Appendix.

Results. To check our expectation that individuals activate stronger ties when involved in a creative task, we compared the average tie strength of the activated network with the average strength of the available network. Results show support for our expectation: the tie strength of the activated network is significantly higher than the strength of the available network ($M_{activated}$=3.31, $SD_{activated}$=0.73; M_{full}=2.09, SD_{full}=0.49; t(73)=13.59, p=0.000). This was true in both phases, with individuals activating stronger ties of their network both in idea generation ($M_{activated}$=3.16, $SD_{activated}$=0.73; M_{full}=2.05, SD_{full}=0.52; t(36)=9.07, p=0.000) and in idea elaboration ($M_{activated}$=3.46, $SD_{activated}$=0.72; M_{full}=2.12, SD_{full}=0.47; t(36)=10.21, p=0.000).

[8] 74 participants completed both the first and the second phase of the study ($M_{network\ size}$=42.89, SD=29.59). We found no significant difference in terms of network size ($M_{first\ part\ only}$=45.88, SD=34.02; t(89)=0.37, p=0.72), tie strength ($M_{first\ part\ only}$=2.10, SD=0.36; $M_{both\ parts}$=2.09, SD=0.49; t(89)=- 0.09, p=0.93) and demographic composition between subjects who participated only to the first phase and subjects who participated to both phases.

However, we found this effect to be particularly true for idea elaboration, with individuals activating a lower proportion of weak ties in the elaboration phase than in the generation phase ($M_{elaboration}$=0.14, $SD_{elaboration}$=0.19; $M_{generation}$=0.27, $SD_{generation}$=0.28; t(72)=-2.18, p=0.032, d=-0.51); and a higher number of ties belonging to their inner circle – i.e., their strongest ties ($M_{elaboration}$=3.26; $SD_{elaboration}$=0.93; $M_{generation}$=2.78, $SD_{generation}$=1.13; t(72)=2.00 , p=0.049, d=0.47).

Exploratory analysis on network size. We utilized the collected data on the actual available network of all participants and ran an exploratory analysis of the effect of having a large network on the activation of weak ties (Hypothesis 2). Network size was measured as degree centrality in participants' actual available network. We first run a Poisson regression predicting the number of weak ties in the available network, using network size as a predictor and participants' age, gender (0=female, 1=male), number of years spent in the field, self-rated experience (1 item, 1-7 scale) and ties' experience (1 item, 1-7 scale) as control variables. Not surprisingly, and consistent with extant research (e.g., Brass, 1984) we found participants with larger networks to have a larger number of weak ties (p=0.000). We then ran a series of OLS regressions with participants' network size as the predictor and proportion of activated weak ties and our measure of inner circle ties as the dependent variables. We controlled for manipulation condition (0=generation, 1=elaboration) and for the same controls listed above. Network size has a negative effect on the proportion of activated weak ties (p=0.002), and a positive effect on the proportion of activated inner circle ties (p=0.003). The full results, as well as analyses with alternative specifications of network size, such as effective size (Burt, 1992), are summarized in the Appendix. Overall, these analyses provide preliminary support for Hypothesis 2.

Main Study: The Effect of Network Size on Activation and Switching

To test our Hypotheses on the effect of network size on activation and switching and on the moderating role of risk, we implemented a 2 (small vs. large available network size) by 2 (low vs. high perceived risk) between-subjects experiment.

Participants. We recruited 221 individuals (M_{age}=33.48, SD=13.35; 67% female) from an active participant pool at the behavioral lab in a European business school to participate in our study. Participants were randomly assigned to one of the four experimental conditions. In return for their participation in this 60-minute study, participants received compensation at the US equivalent of roughly $12.50 per hour. Participants were sent an electronic invitation to our study in which they could then sign up for different time sessions.

Task & Procedures. Participants were asked to imagine that they were working as Personnel Director for a company called *I love Italy,* which specializes in selling Italian products to non-Italian markets. Participants were presented with their social network of relationships within *I love Italy,* the size of which varied depending on the size condition, followed by the manipulation of perceived risk (see manipulations below). The creative task was one problem from Shalley's (1991) complex-heuristic in-basket exercise. This task has been used in a variety of creativity experiments to assess individual creativity (e.g., Perry-Smith, 2014; Zhou, 1998). Participants were asked to respond to an e-mail addressed to them as Personnel Director, containing a problem that they needed to solve. The email was sent by a hypothetical manager named Sue. It described a situation where employees were asking for a more flexible working schedule (see Appendix for the full text of the e-mail). Participants were asked to provide ideas to solve Sue's problem. Before both generating ideas and elaborating, they were presented with the following question: "Before you get started with generating (elaborating on) ideas, imagine that you have the chance to ask some of your contacts within the company for advice. Among the

people listed in the network you saw earlier, who would you go to for advice? Please list below only the people you believe you would consult in a similar situation." After listing as many of the contacts as they wanted prior to each phase, all participants went on to complete the idea generation and idea elaboration task. Finally, we asked them to complete a questionnaire, which included manipulation checks, and we debriefed them.

Manipulations. Participants in the *large network* condition were shown an ego network diagram with eight contacts, whereas participants in the *small network* condition were shown an ego network with four contacts (see Figure 1). They were told that individuals connected through thick lines were friends (i.e., strong ties), while individuals connected through thin lines were acquaintances (i.e., weak ties). Both conditions presented a 50% of strong ties and a 50% of weak ties. Building on extant research on network memory (e.g., De Soto & Bosley, 1962; De Soto, Henley, & London, 1968; Janicik & Larrick, 2005) we developed a procedure to ensure that participants remembered the network. This procedure was pre-tested (see Appendix) to ensure effectiveness. The pre-test confirmed the validity of our network memory procedure, with participants remembering the network, in terms of both names and attributes, with a 98% accuracy. We thus followed this same procedure for the main study.

Perceived risk was manipulated through a scenario describing the attitudes towards creativity and the sharing of ideas at *I love Italy*. Participants in the *high risk* condition read about a company where creativity and idea sharing are discouraged, whereas participants in the *low risk* condition read about a company where creativity and idea sharing are encouraged. This scenario-based approach was consistent with extant research that has manipulated risk and threat in experimental settings (e.g., Moon & Conlon, 2002; Niessen & Jimmieson, 2016; Smith et al., 2012). The full manipulation and pre-test are reproduced in the Appendix.

Insert Figure 1 about here

Measures. The *proportion of weak ties* activated in each phase was calculated as the ratio between number of activated weak ties and total ties activated, in order to account for the fact that participants had different available network sizes dependent on the condition. For the same reason, *tie switching* was computed as the ratio between the number of new ties (i.e., not activated before idea generation) activated before idea elaboration, and the total number of ties activated before idea elaboration. We also tried a more conservative measure of tie switching, where we did not look at new ties in general (e.g., A vs. B), but at the strength of the activated tie compared to the previous phase. For this measure, we operationalized tie switching as the number of activated ties that were both new and of different strength. Analyses using this second measure yielded results identical to those presented in the manuscript, and are available from the authors upon request.

Results. Our results ruled out the possibility of memory loss: consistent with the pre-test procedure, participants exhibited 98% accuracy in remembering the network. We developed a six-item scale to assess the effectiveness of our risk manipulation (α=0.84). The full scale is presented in the Appendix. Exemplary items include "I feel uncertain about how my ideas will be received" and "I may jeopardize my personal reputation by sharing my ideas" (1=strongly disagree, 7=strongly agree). Results confirmed the effectiveness of the manipulation: participants in the high risk condition reported a higher perceived risk associated with creativity than those in the low risk condition ($M_{high\ risk}$=4.50; $SD_{high\ risk}$=1.12; $M_{low\ risk}$=3.23; $SD_{low\ risk}$=0.98: $t(52)=8.95$, $p=0.00$, $d=1.20$).

Our design allowed us to test once more our baseline assumption that individuals activate stronger ties in both phases, this time in a controlled condition since the proportion of strong and weak ties in the available network was identical for each subject and equal to 0.5. A test on the equality of proportions (Acock, 2016) revealed that the proportion of activated weak ties was significantly lower than the expected level of 0.5 both for idea generation (M=0.13; SD=0.25: z=-10.88, p=0.00) and idea elaboration (M=0.17; SD= 0.27: z=- 9.86, p=0.00).

Given our design, we measured tie activation for each phase and thus report the two phases separately. According to Hypothesis 2, network size negatively affects the proportion of weak ties individuals activate. Participants with larger available networks activated a lower proportion of weak ties both during idea generation (M_{small}=0.17; SD_{small}=0.28; M_{large}=0.10; SD_{large}=0.21: t(219)=-2.26, p=0.02, d= -0.30) and idea elaboration (M_{small}=0.20; SD_{small}=0.28; M_{large}=0.13; SD_{large}=0.24: t(219)=-2.03, p=0.04, d= -0.27). Hypothesis 2 was thus supported. According to Hypothesis 4, the effect of network size on the activation of weak ties is negative when perceived risk is high, and is weaker when perceived risk is low. In the *High Risk* condition, the effect of network size was significant and in the expected direction prior to both generation (M_{small}=0.13; SD_{small}=0.21; M_{large}=0.05; SD_{large}=0.15: t(111)=-2.23, p=0.03, d=- 0.42) and elaboration (M_{small}=0.18; SD_{small}=0.26; M_{large}=0.06; SD_{large}=0.15: t(111)=-2.83, p=0.01, d=-0.53). In the *Low Risk* condition, there was no significant effect of network size on activation prior to generation (M_{small}=0.22; SD_{small}=0.33; M_{large}=0.14; SD_{large}=0.26: t(106)=-1.30, p=0.20) or elaboration (M_{small}=0.23; SD_{small}=0.30; M_{large}=0.20; SD_{large}=0.30: t(106)=-0.48, p=0.63). Notably, the effect of network size on activation between the two risk conditions was not significantly different, for generation (F(1, 217)=0.00, p=0.96) or elaboration (F(1, 217)=1.56, p=0.21). Hypothesis 4 was thus partially supported.

To check our assumption that individuals on average will tend not to switch ties, we computed the average proportion of switched ties and compared it with the one that would be predicted if switching happened at random (i.e, 0.5, as there are two alternatives: switching vs. not switching). A test on the equality of proportions (Acock, 2016) revealed that the proportion of tie switched was significantly different from the expected level of 0.5 (M=0.13; SD=0.26: z=-10.99, p=0.00). Hypothesis 3 predicts that network size negatively affects the likelihood of switching ties from idea generation to idea elaboration. The difference in tie switching between participants in the small versus large network condition was not significant (M_{small}=0.15; SD_{small}=0.27; M_{large}=0.11; SD_{large}=0.24: t(219)=-1.05, p=0.30). Hypothesis 3 was thus not supported. According to Hypothesis 5, the negative effect of network size on tie switching is stronger when perceived risk is high, and weaker when perceived risk is low. In the *High Risk* condition, the effect of network size was significant and in the expected direction (M_{small}=0.11; SD_{small}=0.19; M_{large}=0.04; SD_{large}=0.13: t(111)=-2.33, p<0.02, d=-0.44); within the *Low Risk* condition, there was no significant difference in tie switching across the two network size conditions (M_{small}=0.19; SD_{small}=0.33; M_{large}=0.19; SD_{large}=0.31: t(106)=0.04, p=0.99). However, the effect of size on switching did not differ across the two conditions (F(1, 217)=1.14, p=0.29). Hypothesis 5 was thus partially supported.

Post-hoc analyses. Since the role of risk in the idea journey is a key assumption throughout our theorizing, we conducted post-hoc analyses also to explore the direct effect of risk on network activation. We tested the effect of risk running a 2x2 ANOVA, which revealed a significant main negative effect of perceived risk on weak tie activation while controlling for the main effect of network size, both during idea generation (F(2, 218)=7.02, p=0.01, η^2=0.03) and idea elaboration (F(2, 218)=7.32, p=0.01, η^2=0.03). We also found a significant main effect of

risk on tie switching ($F(2, 218)=11.63$, $p=0.00$, $\eta^2=0.05$). Tie switching was higher for participants in the *Low Risk* condition, who switched ties more (M=0.19; SD=0.32) than participants in the *High Risk* condition (M=0.07; SD=0.17).

Discussion of Study 2

The aim of Study 2 was to understand how the structure of an actor's network affects her/his likelihood to activate strong ties and to switch tie activation from one phase to another. Our preliminary study corroborated the baseline assumption that individuals activate stronger ties when involved in a creative endeavor. The preliminary study also provided evidence in support of Hypothesis 2 in a field setting.

We replicated and extended this finding in our main Study, where we manipulated network size to provide stronger evidence of causality and manipulated risk to pinpoint a potential boundary condition. Our main analyses are consistent with our proposed paradoxical effect of network size on tie activation. Network size increases the likelihood of activating strong ties (rather than weak) during both the idea generation and the idea elaboration phase. As expected, this effect is present only when perceived creativity risk is high. Network size also reduces the likelihood of switching ties when moving from generation to elaboration, particularly when perceived risk is high.

Analyses from Study 2 also provide insights into the effect of risk, consistent with its theorized importance in shaping network activation. The results from the post-hoc analyses suggest that risk has consistent independent effects on both tie activation and tie switching. More importantly, while the effect of network size on tie switching is contingent on risk, the effect of risk on switching is not dependent on size. The results suggest that, while size may add to its effect, perceived risk is a dominant underlying factor that most strongly undermines network

activation switching. Our findings also imply two suboptimal activation patterns that could result in individuals getting stuck in the idea journey: a general tendency to pick strong ties both in idea generation and idea elaboration – i.e., the overreliance on strong ties; and a tendency to activate the same ties in elaboration as generation, or not switch activated ties.

STUDY 3

Our aim in Study 3 was to test our hypotheses (Hypothesis 6 and Hypothesis 7) on the negative consequences of not switching ties between phases. We argued that sticking to strong ties in both idea generation and elaboration (i.e., suboptimal activation pattern 1) would lead to an increased risk of pursuing non-creative ideas, while sticking to weak ties in both phases (i.e., suboptimal activation pattern 2) would lead to an increased risk of abandoning creative ideas. Essentially, not switching leads to abandoning creative ideas or pursuing uncreative ones. To test these ideas, we implemented a 2 (weak vs. strong ties in idea generation) by 2 (switching vs. not switching ties in elaboration) between-subjects design. Given that the focus of this study was less on participant's creativity in generation or elaboration and more on whether creators pursue an idea, we used a scenario study. We built on the insights of Study 1 to control the novelty of the generated idea and to design the strong and weak alters' responses during idea elaboration. Thus, our design allowed us to isolate the causal effect of not switching ties (i.e., weak ties in both phases, strong ties in both phases) on decisions to pursue a creative or uncreative idea.

Methods

Participants. Participants consisted of 217 individuals (M_{age}=33.20, SD=12.90; 59% female) from an active participant pool at the behavioral lab in a European business school. We randomly assigned participants to one of the four experimental conditions. We compensated

them for their participation in this 30-minutes study with the equivalent of roughly $12.50 per hour.

Task and procedures. We first presented participants with the description of a fictional design company, *Idea Peach*. The description informed participants that creativity is important at *Idea Peach*, and that designers' reputation depends on their creativity, for better or for worse (see Appendix for the full description). The objective of this description was to recreate the experience of creative idea generation at work and of the associated reputational risks (see e.g., Harrison & Rouse, 2014; Mannucci & Yong, 2018). We did not manipulate risk as in Study 2, given that we found that the switching effects exist only when creativity is perceived as risky.

After reading the description, participants were presented with the task. The task was an adaptation of Gino and colleagues' (2010). Participants were asked to assume the role of a product designer at *Idea Peach*, and that they have been assigned to a project where the client was a local university, looking to revamp the offer of its shop. Their job was to put forward creative ideas for a new décor object that could be sold in the university shop. Participants were told that they consulted two contacts, either weak or strong ties depending on condition, before generating ideas (see tie strength manipulation below). They were presented with five ideas that their character generated and were asked to pick one to further elaborate on it. Before delving into elaboration, they received feedback from two contacts, whose tie strength was either the same or different from the strength of the contacts presented in generation (see tie switching manipulation below). Finally, they completed a short survey containing the dependent variable of interest, the decision to drop or pursue the elaborated idea, as well as manipulation checks and demographics.

Manipulations. To manipulate tie strength in generation, participants were told that they consulted two contacts before generating ideas. We described these contacts either as acquaintances (in the *weak tie* condition) or friends (in the *strong tie* condition) using the same manipulation procedure as Perry-Smith (2014). Using Study 1 findings, participants in the weak tie condition received five highly creative ideas, while participants in the strong tie condition received five non-creative ideas. These ideas were those that were judged as the most creative (average rating=5.20) and least creative (average rating=1.00) by raters in Study 1 (see Zhou, Wang, Song, & Wu, 2017, for a similar approach). This ensured that participants within the same tie type condition during idea generation entered elaboration with an idea of similar creativity. We described each idea consistent with the level of detail provided by participants during idea generation in Study 1 (see Appendix).

After having picked the idea, participants were told that, before elaborating further on the idea, they consulted two contacts. Participants in the *no switching* condition were told that they interacted with contacts who were described as having tie strength that was the same as in the generation phase, while participants in the *switching* conditions were told that they interacted with contacts who were described as having a different tie strength compared to generation. The description of weak and strong ties mirrored the procedure used to manipulate tie strength in idea generation (i.e., friend or acquaintance). We designed alters' reactions based on the content analysis conducted in Study 1. We consulted with the two research assistants who coded the content interactions for Study 1 to identify the most common forms of feedback.

Participants who interacted with strong ties received two pieces of feedback (one for each tie) that built on their idea. The feedback was the following: (a) "Nice, and you could have…"; and (b) "Good, and it could be…", followed by customized suggestions depending on the idea

selected in generation, adding specifics, details, and extra features (see Appendix for the complete feedback received depending on the idea). These suggestions were based on the full description of the idea provided by participants in Study 1 at the end of the idea elaboration phase. Participants who interacted with weak ties received feedback that, instead of building on their idea, shared alternative new ideas. The feedback received was: (a) "I see. Or you could go with a glass water bottle that can be clipped onto bikes" and (b) "Mmm... Or you could do something different, like a portable phone power bank."[9] The newly shared ideas were ideas of similarly high creativity as the ideas presented in the weak ties-generation condition based on the ratings from Study 1.

Measures. We measured the likelihood of dropping the idea using a self-developed three-item scale (1=strongly disagree, 7=strongly agree; α=0.90). The items were: "I would likely drop this idea", "I don't think I should continue working on this idea", and "I should keep working on this idea going forward" (reverse coded).

Results

Manipulation checks. We checked whether the tie strength manipulation during idea elaboration worked in two different ways. First, we used two items used by Perry-Smith (2014). The items, measured on a 1-7 Likert scale (1=strongly disagree, 7=strongly agree), were "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; α = 0.84). As expected, participants in the strong tie condition reported higher closeness scores than participants in the weak tie condition (M_{strong}=5.29;

[9] While we identified two forms that were far more prevalent for building, there were four equally frequent forms for sharing. To select the two used in the study for sharing, we run a pretest on 194 participants recruited on Prolific, an online participant recruitment service. The full procedure of the pretest is reported in the Appendix. Results showed no significance difference across the four forms in terms of how positive/negative the feedback was perceived to be (positive: F(3, 194)=1.12, p>0.10; negative: F(3, 194)=1.27, p>0.10). We thus used the two most frequent forms ("I see. Or…" and "Mmm… Or") for the study.

SD_{strong}=1.33; M_{weak}=3.31; SD_{weak}=1.38: t(215)=10.81, p=0.00). Second, we used two sets of two items each (1-7 Likert scale) to measure whether participants perceived receiving "sharing" feedback or a "building" feedback during idea elaboration. The two items for sharing (α=0.70) were: "The people whom I consulted shared new ideas with me" and "The people whom I consulted came up with different ideas". The two questions for building (α=0.87) were: "The people whom I consulted gave me suggestions on how to improve my idea" and "The people whom I consulted built on my idea". As expected, participants in the strong tie condition reported lower levels of sharing (M_{strong}= 4.16; SD_{strong}=1.38; M_{weak}=5.86; SD_{weak}=1.14: t(215)=-9.92, p=0.00) and higher levels of building (M_{strong}=5.48; SD_{strong}=1.27; M_{weak}=2.33; SD_{weak}=1.38: t(215)=17.48, p=0.00) than participants in the weak tie condition.

Hypothesis testing. We tested our hypotheses using planned contrasts. According to Hypothesis 6, not switching ties (i.e., sticking to strong ties in both phases) will result in a higher likelihood of not dropping (and thus pursuing) an uncreative idea (false positive). Participants who started with strong ties and did not switch, interacting with strong ties in both phases, were significantly less likely to drop their uncreative idea than participants who switched to weak ties ($M_{not\ switch}$=2.05; $SD_{not\ switch}$=0.74; M_{switch}=2.86; SD_{switch}=1.41: t(108)=- 3.92, p=0.00, d=0.72). Hypothesis 6 was thus supported.

According to Hypothesis 7, not switching from weak to strong ties when moving from generation to elaboration will result in a higher likelihood of dropping the idea, despite the fact that the idea is creative (false negative). Participants who did not switch and interacted with weak ties during generation and elaboration were significantly more likely to drop their creative idea than participants who interacted with weak ties in generation and switched to strong ties in

idea elaboration ($M_{not\ switch}$=2.59; $SD_{not\ switch}$=1.16; M_{switch}=2.01; SD_{switch}=0.91: t(105)=- 2.72, p=0.04, d=-0.55). Hypothesis 7 was thus supported.

Discussion of Study 3

The aim of Study 3 was to understand the negative consequences of not switching ties. Specifically, we identified two suboptimal activation patterns that shape decisions to pursue or abandon ideas: when one starts with strong ties and sticks to them also during idea elaboration and when one starts with weak ties and sticks to them during idea generation. Our results provided support for our hypotheses. Holding the creativity of the idea constant, sticking to strong ties across phases (overreliance on strong ties) decreases the chances of dropping an idea, whereas sticking to weak ties across phases increases the chances. Considering results from both this study and Study 1 suggests that sticking to strong ties increases the risk of false negatives, with individuals more likely to generate an uncreative idea and to pursue it despite its lack of creativity. Sticking to weak ties across phases increases instead the chances of false positives: individuals are more likely to generate a highly creative idea, but are also more likely to drop it in spite of its qualities. This supports Study 1's findings that weak ties may negatively affect elaboration success. These results imply that the ability to switch ties is paramount for avoiding getting stuck with a bad idea or for avoiding dropping a highly novel idea.

GENERAL DISCUSSION

The objective of this paper was to shed light on the role of network activation during idea generation and elaboration. More specifically, we sought to understand the types of ties that are helpful in different phases of the idea journey, whether individuals activate ties in each phase accordingly, and the consequences of these activation patterns. In the first study, we found that during idea generation interacting with weak ties leads to higher creativity than interacting with

strong ties. We also found an indirect effect of strong ties in elaboration. Strong ties, in contrast to weak ties, enhance creativity in elaboration because they build on the creator's initial idea, thus encouraging its development. We then integrated decision-making and network theory to examine two potential barriers to optimal network activation – i.e., network size and perceived risk. In the second study we found that having a large network, compared to smaller networks, paradoxically reduces the likelihood of activating weak ties. Moreover, our results show that a large network reduces the likelihood of network activation switching. We also confirm the underlying assumption that the risk associated with creative endeavors is a key driver of the cognitive biases associated with a large network. Finally, in our last study we confirm the negative downstream consequences associated with suboptimal activation patterns. Individuals who fail to switch activated ties across phases either move forward with uncreative ideas or fail to move forward with creative ideas.

Theoretical Contributions

Our findings contribute to existing theoretical perspectives on social networks and creativity by developing and testing a theory of network activation across different phases of the idea journey. Instead of focusing on the presence of one type of tie over the other, we adopt a more realistic approach that acknowledges that individuals on average possess both strong and weak ties. Thus, understanding which ties are more conducive to creativity requires shifting the focus from the actual configuration of ties (e.g., Baer, 2010; Perry-Smith, 2006) to the cognitive map of activated ties (e.g., Brands, 2013; Smith et al., 2012). If any given creator has a mix of strong and weak ties, the creative advantage will come from the ability to activate the correct type of tie during idea generation and elaboration, as well from the ability to switch from one tie to the other when moving across phases. In particular, switching ties in idea elaboration can help

creators discern which ideas are worth pursuing. Since the quality of early-stage might be difficult to assess, switching ties represents a very relevant activity within the idea journey.

Our research provides a critical empirical test of the causal effects of weak versus strong ties in different phases of the idea journey. While different paradigms exist where scholars assert either weak or strong ties benefit creativity (see Perry-Smith & Mannucci, 2015, for a review), a conclusive empirical test of the impact of conversations with weakly tied contacts versus strongly tied ones does not exist. Building on recent theoretical frameworks (Perry-Smith & Mannucci, 2017), we constructed a randomized experiment where participants interacted with either weak or strong contacts to identify the causal role of tie strength for idea generation and elaboration. Our results provide evidence of the benefits of conversing with weak ties during idea generation, clearly distinguishing it from other theorized mechanisms such as structure.

Further, our methodology allowed for an inner look at the conversation dynamics with strong and weak ties that may influence creative outcomes, which provided insights into previously untested conceptual mechanisms. Our finding that strong ties build on the creator's original idea, which facilitates the idea's ultimate creativity, is consistent with the notion of "yes-anding" used to foster improvisational creativity (Vera & Crossan, 2005). Yes-anding means that improvisers are required to build on others' ideas, accepting, supporting, and enhancing them, while blocking or dismissing these ideas is considered a form of aggression. Consistently, successful creative companies promote similar behaviors: for example, Pixar has established the practice of "plussing", which is consistent with the idea of building and of developmental feedback more broadly (Burkus, 2013; Catmull & Wallace, 2014). In contrast, our finding that weak ties share new ideas in elaboration suggests the dampening effect of weak ties in elaboration may be more subtle than initially theorized. Instead of dismissing or harshly

criticizing ideas directly, merely offering new ideas may serve to discourage the creator's original idea.

Although we found an indirect effect of strong ties via building, one explanation for the lack of a main effect of strong ties may be that the conceptualization and operationalization of strong ties requires more specificity, particularly where micro dynamics are at play. For instance, in a supplemental analysis we found "inner circle" ties to be more frequently activated during idea elaboration: these ties could actually be not only what is actually used by creators, but also what is needed at this stage, rather than generic strong ties. Extant research on human sociality has shown that our minds clearly differentiate between inner circle and other types of strong ties (e.g., Dunbar, 1998; Hill & Dunbar, 2003). It may thus be that the *type* of strong tie matters, such that strongest, "inner circle" ties may be necessary. Anecdotal evidence also points in this direction, with many eminent creatives who had very close "creative confidants" that belonged to their inner circle of ties: Alfred Hitchcock relied on Alma Raville, his wife, to have feedback on his ideas for movies (Anderson, 2012: AR16); Virginia Woolf relied on the Bloomsbury Group, a group of fellow artists characterized by extremely close relationships that pre-dated their fame as writers, artists, and thinkers (Moyers, 2009); and J.R.R. Tolkien first presented his idea for *The Lord of the Rings* to the Inklings, a literary group he formed with very close friends and associates (Duriez, 2003).

We also pinpoint the cognitive biases – which we call activation biases – that lead to activating the "wrong" ties, either because of improper activation or lack of activation switching. Our findings on the over-reliance on strong ties provide a potential explanation as to why many individuals fail to generate novel ideas and fall instead prey to conformity and push forward incremental, uncreative ideas (i.e., false positives). At the same time, our findings on failure to

switch activated ties when creativity is perceived as risky provides an explanation as to why individuals fail to progress in the idea journey even if they activate weak ties in idea generation: the tendency not to switch ties leads creators to stick to weak ties (i.e., the "wrong ties") also during idea elaboration. The result, in this case, is failing to pursue promising highly creative ideas (i.e., false negatives). In this sense, sharing an early-stage idea with a weak tie is no different than sharing it prematurely with the field, and comes with similar negative consequences in terms of novelty reduction and abandonment (Bangle, 2001). Ideas during elaboration are like "ugly babies" (Catmull & Wallace, 2014): they are not fully formed, and thus they are fragile and it is difficult to maintain confidence in them. The continued exposure to alternative ideas may undermine the creator's confidence in her/his original idea, leading to abandonment.

In addition to contributing to creativity-networks research, our research has implications for theoretical perspectives of cognitive networks more broadly (e.g., Brands, 2013; Krackhardt, 1990; Smith et al., 2012). Our finding that the larger the network, the more individuals activate strong ties suggests that while weaker ties may be easy to accumulate through various means (e.g., social media, networking events), they are less likely to be utilized, because individuals are less likely to think of them even when needed. This finding is counter to the simple premise that having more ties leads to greater choice and availability; however, it is highly consistent with findings in research on human sociality (Dunbar, 1998; Dunbar & Spoors, 1995) that suggest that the human brain has a limited capacity in terms of how many ties it can actively remember and manage. Even when available networks have many weak ties, individuals may be cognitively limited in their ability to recall them. Moreover, our findings corroborate and extend extant research which has shown that individuals fail to effectively activate and use their networks

when they perceive the situation as risky and threatening (e.g., Brands & Mehra, 2019; Smith et al., 2012). We show that this notion is particularly relevant to creative endeavors because of the high risk associated with them (Berg, 2016; Mueller et al., 2012) and with idea elaboration specifically. Exploring other contextual factors that can hinder network activation represents in our view a promising avenue for future research.

We also inform networks research by showing how network structure influences network activation and network activation switching. While the relationship between structural and relational features of one's network has been thoroughly explored (e.g., Borgatti & Halgin, 2011; Tortoriello & Krackhardt, 2010), to our knowledge ours is the first attempt to show how structure can affect the type of ties individuals call to mind in a given situation. All in all, our studies provide a potential explanation to the inconsistent findings on the effects of network size on creativity observed in extant research. Scholars who have argued for the creative downsides of network size have mostly focused on the fact that maintaining too many ties requires time and effort, thus distracting from creative tasks (e.g., Baer, 2010; McFadyen & Cannella, 2004; Moran, 2005; Perry-Smith & Shalley, 2003). We bring this notion of the downsides of size a step further by illuminating one mechanism at play. Instead of focusing on tie maintenance time as something that drains mental energy and attention from the creative task, our empirical results reveal that size interferes with the optimal selection of the people one approaches. This evidence of size, as a representation of more information in the mind, impeding flexibility is consistent with extant research on expert cognition, which has shown that experts – who presumably have large volumes of information stored in the mind – tend to have rigid cognitive pathways condemning them to repeat previously tried patterns rather than exploring new ones (Dane, 2010). We also identify in perceived risk a potential boundary condition that could explain when

the positive or negative effects of size are likely to be predominant: an environment that supports and encourages creative efforts, thus lowering perceived risk, or a personal disposition to embrace risk and novelty (see Baer, 2010), could be necessary preconditions in order for these benefits to be accrued. For example, network size might lead to the recall of more ties in less risky situations and provide advantages during idea elaboration, when stronger ties are needed.

Finally, our research has implications for core premises of creativity theory. First, we focus on an underexplored phase: idea elaboration. Historically, idea generation has received much of the attention from creativity scholars (see Anderson, Potočnik, & Zhou, 2014, and Shalley, Zhou, & Oldham, 2004, for reviews), relegating idea elaboration to the backstage. While idea generation is of course highly important because it is the first step in the idea journey, elaboration also plays a central role in the idea journey (Grimes, 2018; Mainemelis, 2010; Perry-Smith & Mannucci, 2017; Staw, 1990). As a rich body of research reveals, numerous contextual and individual barriers exist that limit generation (e.g., Shalley et al., 2004). Yet, numerous phases exist beyond generation that reveal possible points where the idea may be abandoned and never reach the intended audience (Perry-Smith & Mannucci, 2017). Idea elaboration is one of these steps, and probably the most important one in determining idea abandonment. It is during idea elaboration that the creator decides whether to pursue the idea further or abandon it, and sharing the idea with the right person can make the difference between successful progression in the idea journey or creative failure. Our paper shines a spotlight on the transition between idea generation and idea elaboration. In so doing, we bring to life the notion of journey or movement across phases. We underscore that an unsuccessful idea journey may occur not only because of the impediments in coming up with a novel idea (e.g., Shalley et al., 2004), but also because of

the difficulties in switching ties across phases, which can engender the abandonment of creative ideas and the pursuing of uncreative ones.

Limitations and Directions for Future Research

Although our research contributes to the literature in important ways, it does not come without limitations. The first set of limitations is related to our research methodology. The experimental design allowed us to isolate causality and rule out alternative explanations. At the same time, we are not able to fully replicate the complexity and duration of creative tasks that can be found in an organizational context. Creative projects within organizations may span months in contrast to our experimental tasks. For instance, idea complexity may expand or contract throughout the idea journey, and duration may influence the exposure to network ties. Ideas can potentially undergo more radical elaboration, to the point of being considered totally new, re-generated ideas – something we did not observe in our studies (see Appendix). Moreover, social network dynamics are also likely to be more articulated within organizations. While our methods allow us to precisely pinpoint the causal effects of our manipulated variables (i.e., tie strength, idea journey phase, perceived risk, and network structure), they do not speak to the effects of contacts' network, indirect ties or personal characteristics that may inform creativity across the idea journey (e.g., Grosser et al., 2017; Venkataramani, Richter, & Clarke, 2014; see Perry-Smith & Mannucci, 2020, for a review). For example, alter's status could play a role in the decision to activate them. Recent research reveals that actors may not approach highly-ranked contacts because these contacts could be difficult to approach (Brennecke, 2020). We encourage future researchers to investigate individual, project, and alter characteristics that may affect the influence of network characteristics.

Another limitation lies in the fact that we observed just a "one shot," clear-cut transition from generation to elaboration. However, creators go through multiple iterations of this transition, both within the same idea and across different ones (Harrison & Rouse, 2015; Lingo & O'Mahony, 2010; Perry-Smith & Mannucci, 2017; Rahman & Barley, 2017). It might thus be that activation and switching play out differently when one considers repeated iterations. In particular, the importance of switching could become even more central, as sticking to the same contacts across multiple transitions could be even more harmful than across a single one. Alternatively, the tendency to activate strong ties even in idea generation might become weaker as a consequence of the low success of previous attempts. Moreover, sometimes the boundaries between the two phases are blurred, such as when creators engage in brainstorming sessions (Harvey & Kou, 2013). It might be that a mix of strong and weak ties is ideal when the two phases are not clearly distinguishable from each other. Future research could further explore these issues either by adopting longitudinal designs that allow exploring repeated iterations between different phases, or by looking at situations where the distinction between the two phases is less evident and at the time spent in each phase.

Lastly, we recognize three limitations related to our sample and design. We did not directly capture the cognitive mechanisms at the heart of our theorizing. In other words, while we capture a behavior consistent with our theorizing (tie activation choice), we did not directly measure the underlying cognitive process. This issue is shared with experiments on information and choice overload and could be solved by adopting a neuroimaging approach (Woo et al., 2017), which allows for capturing the precise cognitive processes underlying decisions such as tie activation. Moreover, our decision to use multiple studies to test different hypotheses does not provide strong replication evidence. Given the dynamic nature of the phenomenon, we

decided that capturing the breadth of phenomenon should be our primary objective. That said, future studies could focus more precisely on pieces of our theoretical model to provide stronger evidence of replication and explore other micro-dynamics that we were not able to capture. Finally, our subject pools were characterized by a predominance of women. Given that gender shapes networking behaviors and how these behaviors are perceived (Brands & Mehra, 2019), it could be that these results play out differently in settings that are predominantly male. Both are very interesting and worthwhile avenues for future researchers to explore conceptually and isolate empirically.

Notwithstanding these limitations, our approach has many strengths. The experimental design allowed us to isolate causal effects, provided empirical support for the different mechanisms at play across different phases, and emphasized transitions across phases. We see this as a useful addition to the impactful survey and archival approaches more typical in the social network field. In particular, in Study 1, where participants interacted with their existing ties in the lab, we also provided a more realistic situation compared to the scenario designs used in the limited network research that has adopted an experimental approach (e.g., Brands & Mehra, 2019; Perry-Smith, 2014; Smith et al., 2012). This approach also allowed us to adopt a more fine-grained approach to understanding the content of these interactions – something that is usually missing in experimental and archival studies and is more the domain of qualitative research (e.g., Lingo & O'Mahony, 2010; Rahman & Barley, 2017). We expect that the socio-psychological processes that underlie our effects, such as perception of risk and conversation dynamics, will replicate across a variety of settings. Future researchers should adopt other methodologies such as qualitative methods to further understand the social drivers of the

different phases of the idea journey, and could further expand on the content analysis that we have explored in this study to gain more precise insights.

Conclusions

Our work provides a much-needed focus on network activation and creativity across different phases of the idea journey. A critical part of fully understanding creativity and the social context is to distinguish phases and study the different network drivers. Our findings reveal that activating the optimal ties in each phase is not an activity that can be taken for granted, and that it can be hampered both by the size of the creators' networks and the inherent risk associated with creativity itself. Suboptimal activation patterns are dangerous because they can lead to the abandonment of creative ideas and the pursuit of uncreative ones. We hope that our paper will stimulate research on the topic of network activation, furthering our understanding of the cognitive dynamics of tie activation and tie switching and their effects on creativity across the idea journey.

REFERENCES

Acock, A. C. 2016. ***A Gentle Introduction to Stata***. 5th ed. College Station, TX: Stata Press.

Amabile, T. M. 1982. Social psychology of creativity: A consensual assessment technique. ***Journal of Personality and Social Psychology***, 43: 997.

Amabile, T. M. 1983. The social psychology of creativity: A componential conceptualization. ***Journal of Personality and Social Psychology***, 45: 357.

Amabile, T., Fisher, C. M., & Pillemer, J. 2014. IDEO's Culture of Helping. ***Harvard Business Review***, 92: 54-61.

Amabile, T. M., & Pratt, M. G. 2016. The dynamic componential model of creativity and innovation in organizations: Making progress, making meaning. ***Research in Organizational Behavior***, 36, 157-183.

Anderson, J. 2012. ***Alfred Hitchcock's secret weapon becomes a star***. New York Times, November 16: http://www.nytimes.com/2012/11/18/movies/hitchcock-and-the-girlremember-alma-reville.html?_r50.

Anderson, N., Potočnik, K., & Zhou, J. 2014. Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. ***Journal of Management***, 40: 1297-1333.

Baer, M. 2010. The strength-of-weak-ties perspective on creativity: A comprehensive examination and extension. ***Journal of Applied Psychology***, 95: 592-601.

Baer, M., & Brown, G. 2012. Blind in one eye: How psychological ownership of ideas affects the types of suggestions people adopt. ***Organizational Behavior and Human Decision Processes***, 118: 60-71.

Bakeman R., Gottman J.M. 1997. ***Observing interaction: An introduction to sequential analysis*** (2nd ed.). Cambridge, UK: Cambridge University Press.

Bangle, C. 2001. The ultimate creativity machine: How BMW turns art into profit. ***Harvard Business Review***, 79(1): 47–55.

Berg, J. M. 2016. Balancing on the creative highwire: Forecasting the success of novel ideas in organizations. ***Administrative Science Quarterly***, 61: 433-468.

Binder, J., Roberts, S., & Sutcliffe, A. G. 2012. Closeness, loneliness, support: Core ties and significant ties in personal communities. ***Social Networks***, 34: 206-214.

Biskind, P. 2004. ***Down and Dirty Pictures: Miramax, Sundance, and the Rise of Independent Film***. New York: Simon & Schuster.

Borgatti, S.P., Everett, M.G., & Freeman, L. C. 2002. ***Ucinet for Windows: Software for social network analysis***.

Bornstein, A. M., Khaw, M. W., Shohamy, D., & Daw, N. D. 2017. Reminders of past choices bias decisions for reward in humans. ***Nature Communications***, 8: 15958.

Blankenship, K. L., Wegener, D. T., Petty, R. E., Detweiler-Bedell, B., & Macy, C. L. 2008. Elaboration and consequences of anchored estimates: An attitudinal perspective on numerical anchoring. ***Journal of Experimental Social Psychology***, 44: 1465–1476.

Borgatti, S. P., & Halgin, D. S. 2011. On network theory. ***Organization Science***, 22: 1168-1181.

Brands, R. A. 2013. Cognitive social structures in social network research: A review. ***Journal of Organizational Behavior***, 34: S82-S103.

Brands, R., & Mehra, A. 2019. Gender, brokerage and performance: A construal approach. ***Academy of Management Journal***, 62: 196-219.

Brass, D. J. 1984. Being in the right place: A structural analysis of individual influence in an organization. ***Administrative Science Quarterly***, 29: 518-539.

Brass, D. J. 1995. Creativity: It's all in your social network. In C. M. Ford & D. A. Gioia (Eds.), ***Creative action in organizations***: 94-99. Thousand Oaks, CA: Sage.

Brennecke, J. 2020. Dissonant ties in intraorganizational networks: Why individuals seek problem-solving assistance from difficult colleagues. ***Academy of Management Journal***, 63: 743-778.

Bridwell-Mitchell, E.N., & Lant, T.K. 2013. Be careful what you wish for: The effects of issue interpretation on social choices in professional networks. ***Organization Science***, 25: 401-419.

Brown, G., & Baer, M. 2015. Protecting the turf: The effect of territorial marking on others' creativity. ***Journal of Applied Psychology***, 100: 1785.

Burkus, D. 2013. How criticism creates innovative teams. ***Harvard Business Review***, July 22. https://hbr.org/2013/07/how-criticism-creates-innovati

Burt, R. S. 1982. ***Toward a structural theory of action: Network models of social structure, perception, and action***. New York: Academic Press.

Burt, R.S. 1984. Network items and the general social survey. ***Social Networks***, 6: 293-339.

Burt, R.S. 1992. ***Structural Holes: The social structure of competition***. Cambridge, MA: Harvard University Press.

Burt, R.S. 2004. Structural holes and good ideas. ***American Journal of Sociology***, 110: 349-399.

Campbell, D. T. 1960. Blind variation and selective retentions in creative thought as in other knowledge processes. ***Psychological Review***, 67: 380-400.

Carley, K. 1986. An approach for relating social structure to cognitive structure. ***Journal of Mathematical Sociology***, 12: 137-189.

Casciaro, T. 1998. Seeing things clearly: Social structure, personality, and accuracy in social network perception. ***Social Networks***, 20: 331-351.

Casciaro, T., & Lobo, M. S. 2008. When competence is irrelevant: The role of interpersonal affect in task-related ties. ***Administrative Science Quarterly***, 53: 655-684.

Catmull, E., & Wallace, A. 2014. ***Creativity Inc.: Overcoming the unseen forces that stand in the way of true inspiration***. New York: Random House.

Chernev, A., Böckenholt, U., & Goodman, J. 2015. Choice overload: A conceptual review and meta-analysis. ***Journal of Consumer Psychology***, 25: 333-358.Cicchetti, D.V. 1994. Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. ***Psychological Assessment***, 6: 284.

Cohen, J. 1960. A coefficient of agreement for nominal scales. ***Education and Psychology Measurement***, 20: 37-46.

Chua, R. Y., Morris, M. W., & Mor, S. 2012. Collaborating across cultures: Cultural metacognition and affect-based trust in creative collaboration. ***Organizational Behavior and Human Decision Processes***, 118: 116-131.

Côté, S., Moskowitz, D. S., & Zuroff, D. C. 2012. Social relationships and intraindividual variability in interpersonal behavior: Correlates of interpersonal spin. ***Journal of Personality and Social Psychology***, 102: 646-659.

Criscuolo, P., Salter, A., & Ter Wal, A. L. 2013. Going underground: Bootlegging and individual innovative performance. ***Organization Science***, 25: 1287-1305.

Cronin, M. A., & Weingart, L. R. 2007. Representational gaps, information processing, and conflict in functionally diverse teams. ***Academy of Management Review***, 32: 761-773.

Cross, R., & Sproull, L. 2004. More than an answer: Information relationships for actionable knowledge. ***Organization Science***, 15: 446-462.

Csikszentmihályi, M. 1997. ***Flow and the psychology of discovery and invention***. New York: HarperPerennial.

Dahlander, L., & McFarland, D.A. 2013. Ties that last: Tie formation and persistence in research collaborations over time. ***Administrative Science Quarterly***, 58: 69-110.

Dane, E. 2010. Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective. ***Academy of Management Review***, 35: 579-603.

Dawson, J. 1993. The Making Of Reservoir Dogs. ***Empire***, 44.

De Soto, C.B. 1960. Learning a social structure. ***Journal of Abnormal and Social Psychology***, 60: 417-421.

De Soto, C. B., & Bosley, J. J. 1962. The cognitive structure of a social structure. ***Journal of Abnormal and Social Psychology***, 64: 303-307.

De Soto, C. B., Henley, N. M., & London, M. 1968. Balance and the grouping schema. ***Journal of Personality and Social Psychology***, 8: 1-7.

Dunbar, R.I.M. 1998. The social brain hypothesis. ***Evolutionary Anthropology***, 6: 178–190.

Dunbar, R.I.M. 2008. Cognitive constraints on the structure and dynamics of social networks. ***Group Dynamics: Theory, Research, and Practice***, 12: 7–16

Dunbar, R.I.M., & Spoors, M. 1995. Social networks, support cliques, and kinship. ***Human Nature***, 6: 273-290.

Duriez, C. 2003. ***Tolkien and CS Lewis: The Gift of Friendship***. St Paul (MI): Paulist Press International.

Fisher, C.M., Pillemer, J., & Amabile, T.M. 2018. Deep help in complex project work: Guiding and path-clearing across difficult terrain. ***Academy of Management Journal***, 61: 1524-1553.

Flynn, F. J., Reagans, R. E., Amanatullah, E. T., & Ames, D. R. 2006. Helping one's way to the top: Self-monitors achieve status by helping others and knowing who helps whom. ***Journal of Personality and Social Psychology***, 91: 1123–1137.

Flynn, F. J., Reagans, R. E., & Guillory, L. 2010. Do you two know each other? Transitivity, homophily, and the need for (network) closure. ***Journal of Personality and Social Psychology***, 99: 855-869.

Giarratana, M. S., Mariani, M., & Weller, I. 2018. Rewards for patents and inventor behaviors in industrial research and development. ***Academy of Management Journal***, 61: 264-292.

Gino, F., Argote, L., Miron-Spektor, E., & Todorova, G. 2010. First, get your feet wet: The effects of learning from direct and indirect experience on team creativity. ***Organizational Behavior and Human Decision Processes***, 111: 102-115.

Goldberg, L. R. 1999. ***The International Personality Item Pool (IPIP)***.

Granovetter, M. 1973. The strength of weak ties. ***American Journal of Sociology***, 78: 1360-1380.

Grimes, M. 2018. The pivot: How founders respond to feedback through idea and identity work. ***Academy of Management Journal***, 61: 1692-1717.

Grosser, T. J., Venkataramani, V., & Labianca, G. J. 2017. An alter-centric perspective on employee innovation: The importance of alters' creative self-efficacy and network structure. ***Journal of Applied Psychology***, 102: 1360.

Hall, C.C., Ariss, L. & Todorov, A. 2007. The illusion of knowledge: When more information reduces accuracy and increases confidence. ***Organizational Behavior and Human Decision Processes***, 103: 277-290.

Hargadon, A. B., & Bechky, B. A. 2006. When collections of creatives become creative collectives: A field study of problem solving at work. ***Organization Science***, 17: 484-500.

Harrison, S. H., & Rouse, E. D. 2014. Let's dance! Elastic coordination in creative group work: A qualitative study of modern dancers. ***Academy of Management Journal***, 57: 1256-1283.

Harrison, S. H., & Rouse, E.D. 2015. An inductive study of feedback interactions over the course of creative projects. ***Academy of Management Journal***, 58: 375-404.

Harvey, S. 2014. Creative synthesis: Exploring the process of extraordinary group creativity. ***Academy of Management Review***, 39: 324-343.

Harvey, S., & Kou, C. Y. 2013. Collective engagement in creative tasks: The role of evaluation in the creative process in groups. ***Administrative Science Quarterly***, 58: 346-386.

Hauser, J. R., & Wernerfelt, B. 1990. An evaluation cost model of consideration sets. ***Journal of Consumer Research***, 16: 393-408.

Hill, R. A., & Dunbar, R. I. 2003. Social network size in humans. ***Human Nature***, 14: 53-72.

Ibarra, H. 1999. Provisional selves: Experimenting with image and identity in professional adaptation. ***Administrative Science Quarterly***, 44: 764-791.

Iyengar, S. S., & Lepper, M. R. 2000. When choice is demotivating: Can one desire too much of a good thing?. ***Journal of Personality and Social Psychology***, 79: 995-1006.

Janicik, G. A., & Larrick, R. P. 2005. Social network schemas and the learning of incomplete networks. ***Journal of Personality and Social Psychology***, 88: 348-364.

Kahneman, D. 2011. ***Thinking, fast and slow***. New York: Farrar, Straus and Giroux.

Kahneman, D., Slovic, P., & Tversky, A. 1982. ***Judgment under uncertainty: Heuristics and biases***. New York: Cambridge University Press.

Koestler, A. 1964. ***The sleepwalkers: A history of man's changing vision of the universe***. London: Penguin.

Kvalseth, T.O. 1989. Note on Cohen's kappa. ***Psychological Reports***, 65: 223–226.

Krackhardt, D. 1987. Cognitive social structures. ***Social Networks***, 9: 109-134.

Krackhardt, D. 1990. Assessing the political landscape: Structure, cognition, and power in organizations. ***Administrative Science Quarterly***, 35: 342-369.

Laumann, E.O. 1966. ***Prestige and association in an urban community: An analysis of an urban stratification system***. New York: Bobbs-Merrill Company.

Lehrer, J. 2012. ***Imagine: How creativity works***. Houghton Mifflin Harcourt.

Lingo, E. L., & O'Mahony, S. 2010. Nexus work: Brokerage on creative projects. ***Administrative Science Quarterly***, 55: 47-81.

Madjar, N., Oldham, G. R., & Pratt, M. G. 2002. There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance. ***Academy of Management Journal***, 45: 757-767.

Mainemelis, C. 2010. Stealing fire: Creative deviance in the evolution of new ideas. ***Academy of Management Review***, 35: 558-578.

Mannucci, P.V., & Yong, K. 2018. The differential impact of knowledge depth and knowledge breadth on creativity over individual careers. ***Academy of Management Journal***, 61: 1741-1763.

Marsden, P.V. 1990. Network data and measurement. ***Annual Review of Sociology***, 16: 435-463.

McEvily, B., Perrone, V., & Zaheer, A. 2003. Trust as an organizing principle. ***Organization Science***, 14: 91-103.

Mednick, S. 1962. The associative basis of the creative process. ***Psychological Review***,69: 220-232.

McFadyen, M.A., & Cannella Jr, A.A. 2004. Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. ***Academy of Management Journal***, 47: 735-746.

Moon, H., & Conlon, D. E. 2002. From acclaim to blame: Evidence of a person sensitivity decision bias. ***Journal of Applied Psychology***, 87: 33.

Moyers, S. 2009. British Modernism's Many Manners. ***Humanities***, 30 (2).

Mueller, J.S., & Kamdar, D. 2011. Why seeking help from teammates is a blessing and a curse: A theory of help seeking and individual creativity in team contexts. ***Journal of Applied Psychology***, 96: 263.

Mueller, J. S., Melwani, S., & Goncalo, J. A. 2012. The bias against creativity: Why people desire but reject creative ideas. ***Psychological Science***, 23: 13-17.

Niessen, C., & Jimmieson, N.L. 2016. Threat of resource loss: The role of self-regulation in adaptive task performance. ***Journal of Applied Psychology***, 101: 450.

O'Connell, P. H., & Bouzereau, L. 2004. ***Alma Hitchcock: The woman behind the man***. New York: Berkley Trade.

Orazi, D.C., & Cruz, A.G.B. 2018. LARPnography: an embodied embedded cognition method to probe the future. ***European Journal of Marketing***.

Parke, M. R., & Seo, M. G. 2017. The role of affect climate in organizational effectiveness. ***Academy of Management Review***, 42: 334-360.

Parkinson, C., Kleinbaum, A. M., & Wheatley, T. 2017. Spontaneous neural encoding of social network position. ***Nature Human Behaviour***, 1: 0072.

Perry-Smith, J.E. 2006. Social yet creative: The role of social relationships in facilitating individual creativity. ***Academy of Management Journal***, 49: 85-101.

Perry-Smith, J.E. 2014. Social network ties beyond nonredundancy: An experimental investigation of the effect of knowledge content and tie strength on creativity. ***Journal of Applied Psychology***, 99: 831.

Perry-Smith, J.E., & Mannucci, P.V. 2015. Social networks, creativity, and entrepreneurship. In C. E. Shalley, M. A. Hitt, & J. Zhou (Eds.) ***The Oxford handbook of creativity, innovation, and entrepreneurship***: 205–224. New York: Oxford University Press.

Perry-Smith, J.E., & Mannucci, P.V. 2017. From creativity to innovation: The social network drivers of the four phases of the idea journey. ***Academy of Management Review***, 42: 53-79.

Perry-Smith, J.E., & Mannucci, P.V. 2020. From ugly duckling to swan: A social networks perspective on novelty recognition and creativity. In D.J. Brass, S. Borgatti (Eds), ***Social networks at work***. London: Routledge.

Perry-Smith, J. E., & Shalley, C. E. 2003. The social side of creativity: A static and dynamic social network perspective. ***Academy of Management Review***, 28: 89-106.

Phelps, C., Heidl, R., & Wadhwa, A. 2012. Knowledge, networks, and knowledge networks: A review and research agenda. ***Journal of Management***, 38: 1115-1166.

Pierce, J. L., Kostova, T., & Dirks, K. T. 2001. Toward a theory of psychological ownership in organizations. ***Academy of Management Review***, 26: 298-310.

Poincarè, H. 1921. ***The foundations of science***. New York: Science Press.

Rahman, H. A., & Barley, S. R. 2017. Situated redesign in creative occupations–An ethnography of architects. ***Academy of Management Discoveries***, 3: 404-424.

Roetzel, P. G. 2019. Information overload in the information age: a review of the literature from business administration, business psychology, and related disciplines with a bibliometric approach and framework development. ***Business Research***, 12: 479-522.

Rouse, E. D. 2020. Where you end and I begin: Understanding intimate co-creation. ***Academy of Management Review***, 45: 181-204.

Samuelson, W., & Zeckhauser, R. 1988. Status quo bias in decision making. ***Journal of Risk and Uncertainty***, 1: 7-59.

Sasovova, Z., Mehra, A., Borgatti, S.P., & Schippers, M.C. 2010. Network churn: The effects of self-monitoring personality on brokerage dynamics. ***Administrative Science Quarterly***, 55: 639-670.

Savistsky, K., Keysar, B., Epley, N., Carter, T. & Swanson, A. 2011. The closeness-communication bias: Increased egocentrism among friends versus strangers. ***Journal of Experimental Social Psychology***, 47: 269-273.

Shafir, E., & Tversky, A. 1992. Thinking through uncertainty: Nonconsequential reasoning and choice. ***Preference, belief, and similarity***, 703.

Shalley, C. E. 1991. Effects of productivity goals, creativity goals, and personal discretion on individual creativity. ***Journal of Applied Psychology***, 76: 179.

Shalley, C. E., Zhou, J., & Oldham, G. R. 2004. The effects of personal and contextual characteristics on creativity: Where should we go from here?. ***Journal of Management***, 30: 933-958.

Shea, C. T., Menon, T., Smith, E. B., & Emich, K. 2015. The affective antecedents of cognitive social network activation. ***Social Networks***, 43: 91-99.

Simon, H.A. 1955. A behavioral model of rational choice. ***Quarterly Journal of Economics***, 69: 99-118.

Simon, H. A. 1971. Designing organizations for an information-rich world. In M. Greenberger, ***Computers, Communication, and the Public Interest***. Baltimore: The Johns Hopkins Press.

Simonton, D. K. 1984. Artistic creativity and interpersonal relationships across and within generations. ***Journal of Personality and Social Psychology***, 46: 1273.

Simonton, D.K. 2003. Scientific creativity as constrained stochastic behavior: the integration of product, person, and process perspectives. ***Psychological Bulletin***, 129: 475-494.

Smith, E. B., Menon, T., & Thompson, L. 2012. Status differences in the cognitive activation of social networks. ***Organization Science***, 23: 67-82.

Snetiker, M. 2016. Monsters Inc: Pete Docter dives deep into movie's legacy and creation, 15 years later. ***Entertainment Weekly***, November 2nd. https://ew.com/article/2016/11/02/monsters-inc-anniversary-pete-docter/

Sosa, M. E. 2011. Where do creative interactions come from? The role of tie content and social networks. ***Organization Science***, 22: 1-21.

Sparrow, P. 1999. Strategy and cognition: Understanding the role of management knowledge structures, organizational memory and information overload. ***Creativity and Innovation Management***, 8: 140-148.

Staw, B. M. 1990. ***An evolutionary approach to creativity and innovation***.

Taylor, A., & Greve, H. R. 2006. Superman or the fantastic four? Knowledge combination and experience in innovative teams. ***Academy of Management Journal***, 49: 723-740.

Tierney, P., & Farmer, S.M. 2002. Creative self-efficacy: Its potential antecedents and relationship to creative performance. ***Academy of Management Journal***, 45: 1137-1148.

Timmermans, D. 1993. The impact of task complexity on information use in multi-attribute decision making. ***Journal of Behavioral Decision Making***, 6: 95-111.

Tortoriello, M., & Krackhardt, D. 2010. Activating cross-boundary knowledge: The role of Simmelian ties in the generation of innovations. ***Academy of Management Journal***, 53: 167-181.

Tortoriello, M., Reagans, R., & McEvily, B. 2012. Bridging the knowledge gap: The influence of strong ties, network cohesion, and network range on the transfer of knowledge between organizational units. ***Organization Science***, 23: 1024-1039.

Tversky, A., & Kahneman, D. 1973. Availability: A heuristic for judging frequency and probability. ***Cognitive Psychology***, 5: 207-232.

Tversky, A., & Kahneman, D. 1974. Judgment under uncertainty: Heuristics and biases. ***Science***, 185: 1124-1131.

Tversky A, & Kahneman, D. 1982. ***Judgment Under Uncertainty: Heuristics and Biases***. Cambridge, MA: Cambridge University Press.

Tychsen, A., Hitchens, M., Brolund, T., & Kavakli, M. 2006. Live action role-playing games: Control, communication, storytelling, and MMORPG similarities. ***Games and Culture***, 1: 252-275.

Venkataramani, V., Richter, A. W., & Clarke, R. 2014. Creative benefits from well-connected leaders: Leader social network ties as facilitators of employee radical creativity. ***Journal of Applied Psychology***, 99: 966.

Vera, D., & Crossan, M. 2005. Improvisation and innovative performance in teams. ***Organization Science***, 16: 203-224.

Winer, B. J., Brown, D. R., & Michels, K. M. 1991. ***Statistical principles in empirical design***. New York: McGraw.

Zhou, J. 1998. Feedback valence, feedback style, task autonomy, and achievement orientation: Interactive effects on creative performance. ***Journal of Applied Psychology***, 83: 261.

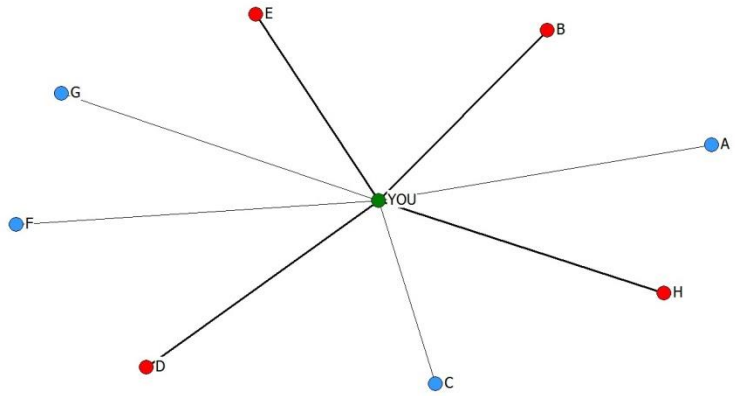
Zhou, J. 2003. When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback, and creative personality. ***Journal of Applied Psychology***, 88: 413.

Zhou, J., Shin, S.J., Brass, D.J., Choi, J., & Zhang, Z.X. 2009. Social networks, personal values, and creativity: evidence for curvilinear and interaction effects. ***Journal of Applied Psychology***, 94: 1544.

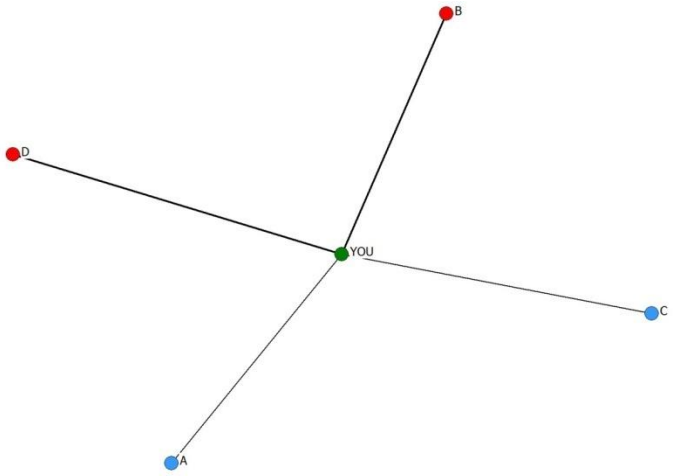
Zhou, J., Wang, X. M., Song, L. J., & Wu, J. 2017. Is it new? Personal and contextual influences on perceptions of novelty and creativity. ***Journal of Applied Psychology***, 102: 180-202.

FIGURE 1
Network Size Manipulations from Study 3

Large network condition



Small network condition



Authors' Biographies

Pier Vittorio Mannucci (pmannucci@london.edu) is an assistant professor of Organizational Behavior at London Business School. He received his Ph.D. in management from HEC Paris. His research focuses on creativity and its dynamics.

Jill E. Perry-Smith (jill.perry-smith@emory.edu) is Goizueta Foundation Term Char and professor of organization and management at Emory University's Goizueta Business School. She received her Ph.D. in organizational behavior from Georgia Institute of Technology. Her research focuses on creativity as a social process, particularly on how social network theories and ideas inform the study of individual and team creativity. In addition, her research explores the interface between the work and nonwork domains and the effect on individual and organizational outcomes.