Doctoral Thesis

Mind over network: individual agency, cognition, and organizational networks

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MIND OVER NETWORK:
INDIVIDUAL AGENCY, COGNITION, AND ORGANIZATIONAL NETWORKS

A thesis submitted to attain the degree of

DOCTOR OF SCIENCES of ETH ZURICH
(Dr. sc. ETH Zurich)

presented by

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2016
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I thank my parents and my brother, both for supporting me in tough times and for celebrating the successes together.

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A vast amount of research in the field of organizational social networks has demonstrated that the structure of relations surrounding individuals can greatly impact various aspects of their work, such as their performance, innovativeness, and mobility. However, the emphasis on network structure at the expense of individual agency has recently attracted much criticism. These critics have pointed out that this “structuralist” perspective has gone hand-in-hand with a disregard for micro-level factors related to individual cognition and agency. They argue that this exclusion is unwarranted, as a growing number of studies demonstrate the influence of individual-level differences.

This dissertation contributes to the emerging stream of literature on the role of individual agency and cognition in organizational networks. The broader framework of the cumulative dissertation is provided by a process model of network cognition in organizations. The model explicates the mediating role of cognition in the process ranging from network formation and position to social network outcomes. All three papers in the dissertation fit closely into this model, focusing on different stages of the process. Further, they highlight the role of certain individual-level cognitive attributes in affecting the sub-processes in question. Specifically, Paper 1 deals with the way in which individuals’ mobilized networks serve as a source of innovation, focusing on the role of cognitive style. Paper 2 then examines an earlier stage in the process, accentuating the relationship between the perceived and the cognitively activated network, with an emphasis on differences in self-monitoring. Finally, Paper 3 connects the two preceding papers by linking activation to mobilization, shedding light on the role of cognitive flexibility.

As a whole, the research presented in this dissertation serves to enrich the stream of literature on the micro-level foundations of social networks. Approaching relevant theoretical questions from multiple angles, these studies show that inter-individual differences related to cognition and personality play a crucial role in how individuals access resources in their networks. As the focus is on the least well-understood elements of the process of organizational network use, the research presented here may inspire future studies taking a similarly in-depth look at the role of individual agency in organizational social networks.
ZUSAMMENFASSUNG

Wesentliche Forschung auf dem Gebiet der sozialen Netzwerke in Organisationen hat gezeigt, dass sich die Netzwerkstruktur von Individuen (i.e. die Anzahl, Art und Menge von persönlichen Beziehungen) stark auf verschiedene Aspekte ihrer Arbeit auswirkt, wie zum Beispiel auf ihre Leistung, Innovationskraft und Mobilität. Dieser Fokus auf die strukturellen Aspekte der sozialen Netzwerkforschung hat jedoch in jüngster Zeit Kritik geerntet, da dieser weitgehend die Handlungsfähigkeit des Individuums nicht vollends einbezieht. Im Speziellen haben Kritiker darauf hingewiesen, dass diese "strukturelle" Perspektive die kognitive Wahrnehmung und Fähigkeit des Individuums das Netzwerk effektiv zu nutzen ignoriert. Sie argumentieren, dass die fehlende Einbeziehung individueller Faktoren nicht gerechtfertigt sei, da eine wachsende Zahl von Studien den Einfluss ebendieser demonstriert.


Zusammengefasst trägt die vorgelegte Forschungsarbeit zu der Literatur über individuelle Grundlagen sozialer Netzwerke bei. Diese wird aus verschiedenen Blickwinkeln erörtert, und zeigt, dass inter-individuelle Unterschiede in der kognitiven Wahrnehmung und Persönlichkeit eine entscheidende Rolle spielen, wie Individuen Zugriff auf Ressourcen in ihrem Netzwerk haben und diese effektiv nutzen können. Da sich der Fokus dieser Arbeit auf einen der am wenigsten untersuchten Bereiche der sozialen Netzwerkforschung bezieht, wird sie hoffentlich weitere Forschung auf dem Gebiet der sozialen Netzwerkforschung in Organisationen inspirieren.
INTRODUCTION

This doctoral dissertation presents various approaches to answering the question: how do interindvidual differences in cognition and personality affect the way in which individuals use their social networks? It consists of three scholarly papers that utilize different theoretical and empirical approaches, in an attempt to tackle the central question of the dissertation from three different angles. The subject of all three papers pertains to elements of a general process model of network cognition in organizations.

The current doctoral thesis is organized as follows. First, in the next section of the introductory chapter, I outline the process model that serves as the backbone of the dissertation, various parts of which are addressed by the three scholarly papers. I then summarize all three papers, and provide detail on their publication status, as well as on my personal contribution to each. This is followed by a discussion of the dissertation’s contributions to management research and practice. I then present all three papers, in the following order:


THEORETICAL BACKGROUND: A PROCESS MODEL OF NETWORK COGNITION IN ORGANIZATIONS

Since the seminal Hawthorn studies (Roethlisberger & Dickson, 1939), the network of social relations within organizations has grown to become a topic of considerable interest for organizational scholars (Borgatti & Foster, 2003; Moliterno & Mahoney, 2011), as it has been shown to impact several aspects of organizational behavior, such as job satisfaction, leadership, power, turnover, perceived organizational support, and innovation (Brass, Galaskiewicz, Greve, & Tsai, 2004; Hayton, Carnabuci & Eisenberger, 2012; Kilduff & Brass, 2010; Kilduff & Krackhardt 2008; Nelson, 1989). Traditionally, many social network studies have taken a macrosociological approach (Wellman & Berkowitz, 1988). Following a general trend in the social sciences towards more psychologically informed theories of macrophenomena (Baron, 2004; Hodgkinson, & Healey, 2008; Laureiro-Martínez et al., 2015; Lord & Emrich, 2000), however, a young but thriving stream of research has recognized that to deepen our understanding of how social networks impact organizational behavior, it is essential to examine the micro-level mechanisms underpinning network effects. Kilduff and Krackhardt (2008: 4), in particular, urged scholars to “bring the individual back into” the analysis of organizational networks, arguing that while many network studies assume network effects to directly derive from “objective” features of the network structure around an individual, recent research has shown that individuals vary widely in their ability to cognitively map (Kilduff & Krackhardt, 2008) and use (Carnabuci & Diószegi, 2015; Casciaro & Lobo, 2014) their network of relations. Such interindividual differences may significantly affect various network outcomes (Krackhardt, 1990). Kilduff and Krackhardt (2008) also direct our attention to the important role of personality differences, which have been found to affect both the way in which individuals relate to each other (Klein, Lim, Saltz, & Mayer, 2004; Mehra, Kilduff, & Brass, 2001) and to their ability to take stock of the resources inherent in social networks (Anderson, 2008).

Inspired by these recent developments, the current aim is to integrate the many but thus far disparate contributions which have emerged from within this literature, in an attempt to develop a general process model which explicates the intraindividual factors through which social networks affect organizational behavior. Extending and further elaborating the work of Menon and Smith (2014), the model proposed here posits that social networks do not directly “cause” organizational consequences. Rather, the mechanisms responsible for the effects of social networks are best viewed as being part of a sequence of logical phases, which in the current model range from network formation to network outcomes. The underlying contention is that individual traits and cognition exert a specifically strong and empirically observable role in each
phase, and in the transition from one phase to another. As summarized in Figure 1, six major logical phases are identified: 1. network formation; 2. network position; 3. network perception; 4. network activation; 5. network mobilization; 6. network outcomes.

The majority of existing network studies have taken what has been called a structuralist perspective (Emirbayer & Goodwin, 1994; Wellman & Berkowitz, 1988), whereby an individual's network position (Phase 2) is postulated to directly impact outcomes (Phase 6) such as creativity (Burt, 2004, 2005), role performance (Sparrowe, Liden, Wayne, & Kraimer, 2001) and entrepreneurship (Aldrich & Zimmer, 1986). By contrast, the model described in this dissertation identifies four additional logical steps, which emphasize the role of the individual as an active agent guided (and bound) by cognition. This model thus aims to bridge micro and macro perspectives on organizational networks, with the goal of linking insights from the social networks literature with the rich body of psychologically informed theory developed in the field of organizational behavior.

The first logical phase in the model is *network formation*. Although studies taking the more traditional “structuralist” approach do provide important insights pertaining to network
dynamics (Rivera, Soderstrom, & Uzzi, 2010; Snyders, 2001; Tomasello et al., 2014), they tend to focus on network members as mere occupants of certain structural positions, instead of as active cognitive agents (Kilduff & Tsai, 2003). Conversely, recent works have shown that, structural positions aside, individuals do differ in the way they form ties and construct their social networks. For example, differences in the personality trait Self-Monitoring (Snyder, 1974) have been shown to affect the degree to which individuals build brokering networks (Mehra, Kilduff, & Brass, 2001; Sasovova, Mehra, Borgatti, & Schippers, 2010), as do differences entrepreneurial personality (Burt, Jannotta, & Mahoney, 1998), neuroticism (Klein, Lim, Saltz, & Mayer, 2004) and locus of control (Kalish & Robins, 2006).

The second phase is network position (typically defined as individuals’ set of social relationships and the relationships existing among these contacts). In the vast majority of social network studies, this position has been treated as the direct determinant of various network outcomes (Kilduff & Tsai, 2003). The present model extends this view of social networks by adding three additional, intermediate steps, all of which are heavily affected by interindividual cognitive differences.

The third phase is that of network perception. Network perception pertains to the learning and cognitive accuracy of individuals’ network position, that is, to their cognitive map of the social network within which they are embedded (e.g., Janicik & Larrick, 2005; Krackhardt, 1987). Such a mental map comes about through individuals’ attention to the state and evolution of social relations around them. However, since cognition is bounded, we can only attend to a finite set of stimuli at any given time (Kahneman, 1973), thus restricting the breadth of network attention. The social relations that individuals devote more attention to are likely to depend on the amount and quality of potential resources perceived to be accessible through these relations, as evidenced for example by entrepreneurs’ higher valuation of network ties (i.e. relations) anticipated to provide more resources (Grossman, Yli-Renko, & Janakiraman, 2012). The role of attention in perceiving the surrounding set of relations is complemented by the ability to learn certain kinds of network structures, an ability which varies among individuals (Janicik & Larrick, 2005). Furthermore, network perception is distorted by reliance on cognitive schemas or heuristics (Janicik & Larrick 2005; Emery, Carnabuci, & Brinberg, 2011) and by biases in network perception (Brewer, 2011; Kumbasar, Romney, & Batchelder, 1994). As a result, we often find a considerable disconnect between one’s actual network, and one’s perception of it (Killworth & Bernard, 1976, 1979; Bernard & Killworth, 1977). Such variations in the accuracy of network perception have been the subject of a number of works (e.g., Casciaro, 1998; Freeman & Romney, 1987; Krackhardt, 1990; Simpson, Markovsky, & Steketee, 2011). Moreover, network perception has been found to be influenced by various intraindividual characteristics and personality traits (Casciaro, 1998; Casciaro, Carley, & Krackhardt, 1999). Taken together, these studies suggest that
individuals define their relational strategies based on their own perception of the organizational network (Janicik & Larrick, 2005), and that such perceptions vary greatly in accuracy (Krackhardt, 1987). Building on these findings, this model suggests that to understand how social networks impact organizational behavior, it is pivotal to examine the sources and consequences of intraindividual variation in network perception.

The network, as perceived by the individual, provides the basis for the fourth logical step in the model: network activation. While the term has been used with reference to the use of network ties in general (Elliott, Hainey, & Sams-Abiodun, 2010; Hurlbert, Haines, & Beggs, 2000; Tortoriello & Krackhardt, 2010), the current model follows the work of Smith, Menon, & Thompson (2012) to differentiate between cognitive network activation and network mobilization. Cognitive network activation pertains to the act of calling to mind a subset of one’s network for the purpose of mobilizing support (Menon & Smith, 2014). While the way in which individuals recall knowledge or social contacts from memory has been dealt with in the realm of psychology (e.g. Förster & Liberman, 2007; Higgins, 1996) and studies dealing with learning and memory (e.g. Brashears & Quintane, 2015; Hills & Pachur, 2012), applying the concept to social networks has provided a valuable contribution to our understanding of differences in network resource access (Tasselli, Kilduff, & Menges, 2015). This is because cognitive network activation is argued to be an important antecedent to mobilizing network resources, which implies that differences in the former will affect success in the latter (Menon & Smith, 2014). Though research on cognitive network activation is still in its early stages, important interindividual differences have already been identified. One such difference pertains to perceived social status: the contacts an individual mentally activates during the emotionally laden experience of job threat has been shown to depend on perceived social status, with higher status individuals activating broader networks (Smith, Menon, & Thompson, 2012). Building on this work, a later study has found that power leads to broad network activation only if this sense of power is in line with one’s identity (Menon & Smith, 2014). Finally, emotional states were also shown to influence cognitive action, in that individuals experiencing positive affect tend to activate larger networks with more structural holes (Shea, Menon, Smith, & Emich, 2015).

The fifth phase in the model pertains to network mobilization: the public, social activity of seeking out others in one’s network with the purpose of securing various resources (Menon & Smith, 2014). In the narrow sense, the mobilized network refers only to the subset of the cognitively activated network that is subsequently mobilized (Smith, Menon, & Thompson, 2012). In the broader sense, we may consider it to refer to goal-oriented networking in general, irrespective of the degree of forethought involved (Kmec & Trimble, 2009; Maurer, Bartsch, & Ebers, 2011; Vissa, 2010). Again, this phase is ripe with interindividual differences, pertaining to the subjective valuation of network ties (Grossman, Yli-Renko, & Janakiraman, 2012), networking style (Vissa,
2010), social status (Elliott, Haney, & Sams-Abiodun, 2010), conformity value (Zhou et al., 2009) and interpersonal affect (Casciaro & Lobo, 2008).

The sixth and final phase in the process is that of network outcomes which, as previously discussed, include a wide range of phenomena of pivotal importance to organizational behavior (e.g., creativity, work performance, leadership). As the model presented here shows, network outcomes can rarely be directly explained by an individual’s network position alone. By shedding light on the intervening intraindividual cognitive mechanisms, research taking a micro-level, agentic approach to social networks has the potential to deepen our understanding of how social networks affect organizational outcomes.
SUMMARY OF PAPERS COMPRISING THE DISSERTATION

The three papers that comprise this dissertation all fit closely into the framework of the process model outlined above, focusing on different elements of the model, and examining the role of interindividual cognitive differences with respect to these elements. The first paper sheds light on the link between network mobilization and network outcomes, to understand why individuals with different cognitive traits (cognitive style) profit differentially from the mobilization of similar networks. The focus of the second paper is on cognitive network activation, highlighting its important with respect to a specific kind of potentially valuable connection: dormant ties. In doing so, it also draws attention to the role of Self-monitoring, and to the way this personality trait affects network activation. Finally, the third paper addressed the link between activation and mobilization, highlighting the importance of cognitive flexibility (see Figure 1).

Summary of Paper 1

The first paper in this dissertation ("Social networks, cognitive style and innovative performance: A contingency perspective"), deals with the link between network mobilization and network outcomes. It highlights the role of inter-individual differences, namely in cognitive style (Kirton, 1976, 1989), to show that individuals mobilizing very similar networks for the purpose of seeking advice may end up with very different outcomes. Drawing from the literature on social networks and innovation (Burt, 2005; Obstfeld, 2005), as well as on cognitive style (Kirton & De Ciantis, 1986; Pounds & Bailey, 2001), this study shows that knowing the structure of individuals’ mobilized networks is not enough to predict innovative performance; in fact, it may be outright misleading. This is because interindividual differences, such as those in cognitive style, may strongly affect how individuals deal with the information they acquire from their networks. The same kind of information may be extremely useful to some, and of little value to others.

The work demonstrates the importance of the interaction between mobilized network structure (the advice network) and individual cognition (cognitive style) in the context of organizational innovation. The need for examining interindividual differences is made apparent by the presence of what has been termed the “innovation paradox” (Miron-Spektor, Erez, & Naveh, 2011). The innovation paradox is used to refer to the antagonistic relationship between the predictors of the two main components of innovation: idea creation and idea implementation. With respect to social networks, research has found that while brokering networks present opportunities for knowledge recombination, and thereby aid idea creation, the coordination difficulties brought about by such networks tend to hinder idea implementation (Burt, 2000; Obstfeld, 2005).
Conversely, closed networks provide the coordination benefits needed for idea implementation, but lack the recombination opportunities necessary for idea creation (Aral & Alstyne, 2011; Flap & Völker, 2001). Resolving this paradox is difficult when relying only on network structure. As closure and brokerage are in opposition, an individual cannot reap the benefits of both worlds simultaneously (Burt, 2005).

We propose a solution to the innovation paradox by complementing extant literature on social networks and innovation (Kijkuit & Van Den Ende, 2007; Obstfeld, 2005) with that on Adaptive-Innovative Cognitive Style (Kirton, 1976, 1989). The relevance of cognitive style to the innovation paradox lies in its differentiation between two problem-solving styles that provide similar advantages (and disadvantages) to those of brokerage and closure. Namely, Innovators are characterized by “out-of-the-box” thinking and the tendency to combine diverse piece of information, making them highly adept at idea creation (Kirton & De Ciantis, 1986). However, the downside of their originality and departure from shared frames of thought is that they find it especially difficult to have their ideas implemented (Kirton, 1984). Conversely, the latter aspect is where Adaptors face much less difficulty. Their “by-the-book” way of dealing with problems makes them more skilled at implementation – but also inhibits their creativity (Basadur, 1995; Kaufmann, 2004). We therefore theorize, and empirically demonstrate, the presence of a complementary fit between mobilized network structure and cognitive style. Using a small manufacturing firm as our empirical context, we demonstrate that the effects of network structure on innovative performance are contingent on individuals’ cognitive style. That is, while Innovators perform better when embedded in the closed networks that make up for their weakness in implementation, Adaptors are at an advantage in brokering networks, as these provide them with much-needed creative inspiration.

The insights gained from this study provide multiple contributions to extant literature. Firstly, they add to the emerging stream of literature on the micro-level foundations of social networks (Kilduff & Krackhardt, 2008; Simpson, Markovsky, & Steketee, 2011), demonstrating that examining inter-individual differences is crucial to understanding the effects of intraorganizational network structure on individual performance. Second, they complement the contingency view of social networks (Anderson, 2008; Hansen, 1999) by demonstrating how the effect of network structure on innovative performance is contingent on cognitive style. Finally, our study advances the literature on intraorganizational social networks (Adler & Kwon, 2002; Burt, 2005), by accounting for both the closure and brokerage views of social capital in a unified theoretical framework.
Summary of Paper 2

The second paper in this dissertation (“Awakening the undead: The cognitive activation of dormant ties”) focuses on the link between earlier elements of the process model: on that between network perception and cognitive network activation. Here, we explore how the way in which individuals perceive their networks impacts the set of network ties they active. The theoretical framework of the paper builds upon insights from a diverse set of literature streams. These include the literature on social networks and dormant ties (McCarthy & Levin, 2014; Walter, Levin, & Murnighan, 2015), cognitive network activation (Menon & Smith, 2014; Smith, Menon, & Thompson, 2012), as well as that on memory and social recall (Hills & Pachur, 2012). Drawing from the insights gained by work in this field, we accentuate the importance of network activation with respect to its role in recalling dormant ties. Dormant ties – ties to former contacts with whom we have not interacted with for an extended period of time – present an underutilized, yet potentially valuable form of social capital (Levin, Walter, & Murnighan, 2011). They also present a conundrum: their potential value notwithstanding, they are difficult to recall, making it difficult to reach the resources they could provide access to.

We begin by demonstrating why a well-understood aspect of memory recall – the recency effect – hinders the cognitive activation of dormant ties. The recency effect pertains to a general tendency to recall recent information easily, and non-recent information much less so (Murdock, 1962). When applied to the cognitive activation of dormant ties, the result is that dormant ties, which are characterized by large temporal distances, are rarely activated.

In an attempt to understand how certain individuals may nonetheless successfully recall dormant ties when needed, we turn to extant theory on a personality trait closely linked to social network research: Self-monitoring (Snyder, 1974, 1979). Considered the personality analogue to network brokerage (Burt, Kilduff, & Tasselli, 2013), Self-monitoring has become especially relevant to organizational research, as the respective theory deals with the way in which people are able to adapt their behavior to that expected in a diverse set of social environments (Kilduff and Day, 1994). However, instead of focusing on the behavioral aspects of Self-monitoring, we concentrate on the cognitive dimensions. The reason is that high self-monitors’ cognitive characteristics make them more likely to recall dormant ties when needed, that is, when searching for novel information. Firstly, they invest substantial effort into collecting information about members of their network (Snyder and Cantor, 1980). Second, they are able to recall such information more readily (Berscheid, Graziano, Monson, & Dermer, 1976). Third, high self-monitors are strongly goal-oriented (Danheiser and Graziano, 1982), which makes them more likely to utilize this information when necessary. As dormant ties may potentially lead to novel and useful information, we theorize that high self-monitors will, by way of their resource-
oriented network perception, recall them more readily when searching for novel information. We provide empirical evidence to support our theoretical arguments, using a large and diverse sample of individuals from the United States. Our results show that high self-monitors indeed tend to recall more dormant ties if and only if their task involves a search for novel information.

The study presented in this paper may prove valuable to the burgeoning literature on the micro-level foundations of social networks (Casciaro & Lobo, 2008; Mehra, Kilduff, & Brass, 2001), especially to emerging research on cognitive network activation (Shea, Menon, Smith, & Emich, 2015). By emphasizing the importance of network activation with respect to the use of resources accessible through dormant ties, we call attention to the need for more research on the cognitive antecedents of networking behavior. In addition, this study also provides a micro-level, cognitive backdrop to the literature on dormant ties (Walter, Levin, & Murnighan, 2015), and may thus inspire future research on individuals’ differential ability to recall dormant ties.

**Summary of Paper 3**

The third paper of this dissertation (“Networking with forethought: The role of cognitive flexibility”) focuses on the link between network activation and network mobilization. As such, it partly addresses the limitations of the second paper, which did not directly observe how cognitively activated networks lead up to actual networking actions.

The aim of the third paper is not to confirm the presence of a link between activation and mobilization, with respect to the narrow definition of the latter (Smith, Menon, & Thompson, 2012). The narrow definition used by these authors treats the mobilized network as a subset of the activated one. In this sense, making the claim that some activated contacts are subsequently mobilized becomes rather straightforward, as any form of planned, purposeful mobilization presents such a link. Rather, we conceptualize mobilization in the broader sense, to comprise all forms of networking behavior (Uehara, 1990; Vissa, 2010). As such, mobilization that is both purposeful and planned (i.e. preceded by forethought, and therefore presenting a link between activation and mobilization), is only one of three types of mobilization actions we distinguish. The other two are alter-initiated and serendipitous interactions.

We continue by arguing that what is truly important and consequential for networking success is the degree to which mobilization (i.e. networking) is preceded by forethought, as opposed to being guided by alter-initiated or serendipitous processes. It is in these cases that the individual is truly the initiating agent of his/her networking behavior. We argue that, when the individual has at least some knowledge of the attributes of his/her search target and of members of his/her network, then forethought-driven networking may be expected to lead to superior outcomes.
Conversely, we posit that alter-initiated and serendipitous interactions are less likely to provide valuable information, due the highly skewed distribution of connections and resources within the network (Adamic & Adar, 2005; Watts & Strogatz, 1998). We therefore hypothesize that individuals whose networking comprises a larger share of forethought-precended mobilization should be at an advantage: they should gain access to information that is more relevant and valuable, and consequentially should be more likely to succeed in their search.

Moving further, we expect that interindividual differences in cognitive flexibility (Martin & Rubin, 1995) should, in part, predict the degree of forethought in individuals’ network mobilization. Cognitive flexibility pertains to the ability to identify key aspects of the problem and reflect on the appropriateness of various strategies (Raes, Heijltjes, Glunk, & Roe, 2011). We therefore hypothesize cognitive flexibility to be positively related to the degree to which individuals’ networking is guided by forethought.

We tested our hypotheses using an experimental approach, which involved an interactive networking task completed by a set of co-located participants. Although in its current stage, this study should be considered preliminary, it nonetheless produced several intriguing results. Firstly, we find that when the link between activation and mobilization is stronger (i.e. when a larger share of networking actions is driven by forethought), it results in access to more valuable information. Subsequently, such individuals were more likely to succeed in reaching their target. Second, cognitive flexibility appears to play a role in the degree to which forethought pervades into individuals’ networking behavior.

This study further underscores the importance of understanding how cognitive network activation affects mobilization, and thereby network outcomes. Our results show that the stronger the role of activation in networking behavior, the better the outcomes. Furthermore, we begin to explore the cognitive underpinnings of the activation-mobilization link, with a focus on cognitive flexibility. More broadly, our study contributes to the literature on organization networks (Adler & Kwon, 2002; Kilduff & Krackhardt, 2008), by showing that instead of attempting to separate the individual from the structure, a more promising approach would be to examine how inter-individual differences affect their entangled relationship.
Publication Status

For a summary of the publication statuses and my personal contributions to the three papers comprising this dissertation, see Table 1.

In addition, the thesis introduction profited from an unpublished short working paper, of which I am the first author, and which was written in collaboration with Stefano Brusoni and Gianluca Carnabuci.

Table 1 Summary of Papers, Highlighting Publication Status and my Personal Contributions

<table>
<thead>
<tr>
<th>Paper #</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tr>
<td><strong>Title</strong></td>
<td>Social networks, cognitive style, and innovative performance: A contingency perspective</td>
<td>Awakening the undead: The cognitive activation of dormant ties</td>
<td>Networking with forethought: The role of cognitive flexibility</td>
</tr>
<tr>
<td><strong>Authors</strong></td>
<td>Gianluca Carnabuci, Bálint Diószegi</td>
<td>Bálint Diószegi, Daniella Laureiro-Martínez, Stefano Brusoni</td>
<td>Bálint Diószegi, Daniella Laureiro-Martínez, Stefano Brusoni</td>
</tr>
<tr>
<td><strong>Theoretical background</strong></td>
<td>Social networks and innovation; cognitive style</td>
<td>Social capital of dormant ties; cognitive network activation; Self-monitoring</td>
<td>Cognitive network activation; networking; network search; cognitive flexibility</td>
</tr>
<tr>
<td><strong>Empirical context</strong></td>
<td>Small manufacturing firm (n=68)</td>
<td>United States online sample (n=193)</td>
<td>University students (n=43)</td>
</tr>
<tr>
<td><strong>Contribution by B. Diószegi</strong></td>
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<td>First author</td>
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<td></td>
<td>Theoretical development (in part)</td>
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CONTRIBUTIONS TO ORGANIZATIONAL RESEARCH AND PRACTICE

Research Contributions

The current dissertation addresses a theoretical gap in the literature on organizational social networks. Research in this field has made significant progress in uncovering how organizational members’ network position affects important outcomes, such as performance (Sparrowe, Liden, Wayne, & Kraimer, 2001), creativity (Burt, 2004), and job satisfaction (Flap & Völker, 2001). However, as multiple scholars have pointed out, relatively little is known of the role of individual agency in influencing these outcomes (Anderson 2008; Kilduff & Krackhardt, 2008). Our knowledge is therefore lacking with respect to the cognitive processes taking place between network position and network outcomes (Kilduff & Krackhardt, 1994). Shedding light on these intermediate processes is crucial, as recent studies have shown that individuals occupying similar network positions may well reach very different outcomes, depending on a number of individual-level attributes (Anderson, 2008; Simpson, Markovsky, & Steketee, 2011). Therefore, this dissertation focuses on the process leading from network position to network outcomes, as it is this part of network-related mechanisms that is the least well understood.

Thus, this dissertation makes three important contributions to the extant literature on organizational social networks. Firstly, it sheds light on the role of individual agency, cognition, and personality in the way organizational members use their social networks to achieve various outcomes. The need for such research is pressing, as most work on organizational networks provides little insight into how individuals in certain network positions make use of their network, and why they differ in their ability to leverage network resources (Stevenson & Greenberg, 2000; Tasselli, Kilduff, & Menges, 2015). Therefore, this dissertation contributes to the literature on organizational social networks by uncovering and examining the cognitive processes that link network positions to network outcomes.

Second, the research presented in this dissertation takes important steps towards bridging the gap between micro and macro levels of analyses; between the individual and the organizational network. As network structural research tends to disregard individual agency and cognition (Kilduff & Krackhardt, 1994), the two perspectives remain largely disconnected (Goldspink & Ray, 2004). By examining how individual-level cognitive processes affect outcomes at the level of the organizational network, the research presented here sheds light on the “missing link” between individual cognition and network structure, that is, between micro and macro levels of analyses. Specifically, we contribute to such theoretical bridge building by linking micro-level attributes, such as cognitive flexibility and cognitive style, to macro-level outcomes, such as innovative performance and the efficiency of organizational advice seeking.
Third, this dissertation contributes to organizational network research taking a contingency perspective (Anderson, 2008; Burt, 1997). The key argument underlying this stream of research is that the effects of network structure on outcomes are contingent on a variety of inter-individual (Kilduff & Krackhardt, 2008) and contextual differences (Kijkuit & Van Den Ende, 2007). Works in this stream of literature have shown that two individuals may occupy very similar network positions, yet end up with very different outcomes (Simpson, Markovsky, & Steketee, 2011). Consequently, knowledge of network position alone is insufficient to understand how social networks affect individuals. Complementing this literature, we demonstrate that individuals differ in how they use their networks, depending on factors such as cognitive flexibility, cognitive style, and personality.

In addition, the work presented in this dissertation may serve to inspire future research on the relationship between cognition and social networks. One such avenue for potential research relates to network perception. Most work on how individuals perceive the network around them has focused on relational schemata and learning (De Soto, 1960; Emery, Carnabuci, & Brinberg, 2011; Janicik & Larrick, 2005), perceptual accuracy (Casciano, Carley, & Krackhardt, 1999; Killworth & Bernard, 1976; Kumbasar, Romney, & Batchelder, 1994), and on cognitive social structure (Brands, 2013; Kilduff, Crossland, Tsai, & Krackhardt, 2008). Complementing this work, the papers in this dissertation (Paper 2 and Paper 3) add another angle. They suggest that network perceptual differences may apply not only to the way individuals perceive the social structure around them, but to the way in which they categorize their contacts (Bodenhausen, Kang, & Peary, 2012; Simon, 1993). Specifically, it is argued that while individuals may categorize others based on emotional attachments (Crisp & Hewstone, 2006; Tajfel, 1982), they may also do so based on perceived resource access. In other words, the extent to which individuals can think of their network as a means to an end may affect their ability to access the resources therein.

Relatedly, the ability to switch our perceptual lens from one based on affect to another based on resources may be related to cognitive flexibility, due to the latter’s relationship with “mental set shifting” (Goel & Vartanian, 2005). Paper 2 suggests that high self-monitors (Snyder, 1974, 1979), by harvesting information about their networks, and by making use of this information in their search efforts, are both willing and able to make such a switch. Paper 3 then explores the role of cognitive flexibility in following through on one’s forethought-driven networking strategy. Though the two approaches are different, self-monitoring and cognitive flexibility are related (Martin & Rubin, 1994). Disentangling their effects on our ability to exploit network resources may prove to be a promising avenue for future research.
Leadership research may also find work on network cognition to be useful in understanding the origins and effectiveness of informal leadership. Instead of focusing solely on leaders' characteristics, conceptualizing leadership as a process in context is becoming an important avenue for contemporary research in this area (Wood, 2005). As noted by Mehra, Dixon, Brass, & Robertson (2006: 64), "Leaders do not lead in a social vacuum", and they can be seen as arising out of social construction through a reliance on relational schemas (Emery, Carnabuci, & Brinberg, 2011). Understanding such processes is crucial given the scholarly attention devoted to researching the role of leadership in team and organizational settings (Bienefeld & Grote, 2014; Mehra, Smith, Dixon, & Robertson, 2006; Morgeson, DeRue, & Karam, 2010). Reliance on relational schemas affects network perception, and thereby coalition choices (Janicik & Larrick, 2005), which in the case of leaders may determine whether they are able to create the right balance of people when appointing task forces or committees (Balkundi & Kilduff, 2005).

Finally, research on social neuroscience might also benefit from the differentiation of network processes into micro-level cognitive subprocesses, as these may prove to be more accessible to neuroscientific research methods. Creating bridges between neuroscience and organizational behavior may lead to valuable insights about work in organizations (Becker, Cropanzano, & Sanfey, 2011; Laureiro-Martínez, Brusoni, & Zollo, 2010; Lee, Senior, & Butler, 2012).

Managerial Implications

Although only one of the papers comprising this dissertation deals specifically with (intra)organizational networks, all may provide potentially valuable implications relevant to organizations. One of these implications is that managers’ or employees’ potentially accessible knowledge resources may be greatly constrained by cognitive heuristics. In other words, network contacts from within or outside of the organization may become cognitively inaccessible if they have not been activated for a long time. However, knowledge of this phenomenon may push managers toward utilizing more comprehensive and easily searchable “skill databases” (Hiermann & Höfferer, 2005). Although existing services (Birkinshaw & Sheehan, 2002) and online social networks such as LinkedIn already provide certain information about contacts’ backgrounds, a more comprehensive tool may include information about other, informal resources and social circles. Relatedly, and as suggested by the third paper in this dissertation, an increased use of such tools by organizational members may help counteract tendencies to network in less premeditated ways, i.e. leaving interactions to chance, or to the initiatives of others. While such a strategy may work well when one is not clear about his/her search target, or if that target is sufficiently easy to find, it seems to work less efficiently when searching for
more distant, or more complex, information. In such cases, a more conscious, software-enhanced
networking strategy could allow organizational members to engage in more fruitful search
efforts. Doing so would allow the organization to make more efficient use of its existing
knowledge base and human capital.

More generally, this dissertation shows that, when it comes to networking, there are no “one-
size-fits-all” solutions. A large part of network-related benefits are dependent on who we are,
and how we think. The moral of the fable attributed to Aesop, that “that which is one man’s
meat, is another man’s poison” (Croxall, 1843: 243), is certainly true when it comes to networks.
The same network that is extremely valuable to one person may be a hindrance to another. Thus,
practitioners aiming to leverage the resources in their networks should adapt their networking
strategy to the kind of information they most need. For example, as one study in this dissertation
shows, if one is skilled at coming up with creative ideas, but not so adept at putting them into
practice, then his/her best bet is to mobilize a tight-knit group of supporters. Conversely, for
those whose weakness is in coming up with creative ideas, the opposite is best: mobilizing a
diverse set of contacts from very different social circles. Furthermore, the choice of the best
strategy also depends on what one is searching for. If it is something new and hard to find, then
one may do well to get back in touch with old friends and acquaintances, as these people may
surprise us with new perspectives (Levin, Walter, & Murnighan, 2011). If, however, what we seek
is abundant, then we should not waste time strategizing, but should simply turn to the people
who first enter our mind.

An additional important implication of this work is that, contrary to popular misconception (e.g.
Darling, 2003; Nierenberg, 2002), it is not always best to grow one’s network and constantly strive
to meet new people (McFadyen and Cannella, 2004). Many of the most valuable resources
reachable through networks already exist in the networks we possess (Burt, 2004; Walter, Levin,
& Murnighan, 2015). We would therefore do well to leverage the relationships into which we’ve
already invested much time and effort. For example, instead of striving to meet new people for
the sake of gaining creative insights, we might be better off reconnecting with old acquaintances
(Levin, Walter, & Murnighan, 2011). However, as this research shows, this is not so easy. Often,
it is our very minds that come between us and the resources we seek. We might forget our most
valuable contacts, due simply to the way in which our minds work. Still, there is hope. Being
aware of one’s limitations is the first step toward overcoming them.
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Social Networks, Cognitive Style, and Innovative Performance: A Contingency Perspective

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Abstract: Integrating insights from cognitive psychology into current network theory on the social capital of brokering and closed networks, we argue that cognitive style is a critical contingency explaining the relation between social network position and innovative performance. Based on a “complementary fit” argument, we posit that a social network rich in structural holes enhances the innovative performance of employees with an Adaptive cognitive style; however, individuals with an Innovative cognitive style are most innovative when embedded in a closed network of densely interconnected contacts. Using data on the individual cognitive style and complete workplace social network of all employees within a small design and manufacturing firm (n = 68), we show that our theorized contingency mechanism accounts for a large share of empirical variation in employee innovative performance over and above existing social network explanations.

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INTRODUCTION

Extant research has shown that the workplace social network within which an employee is embedded deeply affects his or her ability to produce useful organizational innovations (Brass, Galaskiewicz, Greve, & Tsai, 2004; Sparrowe, Liden, & Wayne, 2001). A well-established line of inquiry, in particular, argues that occupying a brokering network position that spans across structural holes expands the inventiveness of individuals (Burt, 2000). By tapping information from mutually unconnected colleagues (Aral & Alstyne, 2011; Burt, 2004), employees in such positions are more likely to come across and combine diverse and apparently unrelated information, which is critical for conceiving novel approaches and creative solutions (Amabile, 1996a; Burt, 2005). Supporting this argument, prior research found that employees with a workplace network rich in structural holes generate more numerous and more original ideas than comparable individuals embedded within a closed web of interconnected contacts (Burt, 2004).

While research into the benefits of structural holes significantly advanced our understanding of how workplace social networks affect employee innovation, recent discussions highlighted an unresolved theoretical tension in this line of argument. As innovation scholars pointed out, successful innovation requires both creating and implementing novel ideas; however, the same conditions favoring the creation of novel ideas often impede the idea-implementation process (Hargadon & Douglas, 2001; Laureiro-Martinez, Brusoni, Canessa, & Zollo, 2015), leading to an “innovation paradox” (Miron-Spektor, Erez, & Naveh, 2011). Recent network studies noticed a similar paradox, arguing that although having a network rich in structural holes helps employees come up with novel ideas, it is an impediment during idea implementation because converting a creative idea into an actual innovation requires internal support, alignment, and coordinated action (Kijkuit & Van Den Ende, 2007). Thus, as Obstfeld eloquently put it (2005: 101), social networks rich in structural holes “present both an opportunity structure for generating new ideas and an action problem ... because the dispersed, unconnected people found around structural holes are inherently more difficult to mobilize or coordinate, especially around novel ideas.”

One way in which recent network scholarship has addressed this “innovation paradox” is by pointing out that brokering and closed social networks confer different kinds of social capital, each of which is useful at different stages in the innovation process. During the initial phase, when coming up with a wide range of creative, out-of-the box ideas is of critical importance, employees embedded in a brokering network have an advantage (Rodan & Galunic, 2004). When it comes to championing a novel idea and integrating it into the existing technologies, processes, and structures of an organization, however, employees who can leverage a closed web of contacts may be in a better position (Flap & Völker, 2001). This line of argument clarified how
the social capital of brokering versus closed social networks facilitates the innovation process at different points in the “organizational life of an idea” (Kijkuit & Van Den Ende, 2007). However, since each employee is structurally embedded within a single network position, he or she will generally be able to mobilize only one kind of social capital, irrespective of which phase of the innovation process he or she is dealing with. Therefore, recognizing that brokering networks are beneficial during early phases of the innovation process, while closed networks become critical during idea implementation, is not enough to produce a conclusive answer to a question of both practical and theoretical relevance: which network structure is most conducive to innovative performance at the level of the individual employee?

In an attempt to address this question, the present study develops a “complementary fit” argument (Cable & Edwards, 2004; Ostroff, 2012) that integrates an individual-level, cognitive perspective into current network theory of social capital. Departing from the widespread assumption that workplace social networks affect all employees in the same way, we draw insights from Adaption-Innovation theory (Kirton, 1976, 1989) to argue that whether a brokering or a closed network will enhance an employee’s innovative performance is contingent on that employee’s idiosyncratic cognitive style. We put our argument to an empirical test using unusually rich data on the cognitive style and complete intra-organizational network of all employees within a design and manufacturing company. Our empirical analyses lend support to our theoretical claim, showing that our theorized mechanism accounts for a substantial share of empirical variation in employee innovative performance that is not captured by existing network theory. By demonstrating that individual cognitive style is a key factor influencing whether closed or brokering social networks enhance employees’ innovative performance, this study makes three main contributions to the extant literature.

First, we address the innovation paradox at the level of the individual employee. Responding to recent calls for micro-founded, psychologically informed conceptualizations of social networks (Kilduff & Krackhardt, 2008; Barsade, Casciaro, Edmondson, Gibson, Krackhardt, & Labianca, 2012), we illuminate the conditions under which a brokering or a closed network structure is most conducive to individual innovation. Second, our study advances the stream of literature that studies social networks from a contingency perspective (Anderson, 2008; Burt, 1997). This line of inquiry argues that network effects vary depending on characteristics of the context around the network (Kijkuit & Van Den Ende, 2007), of the information flowing through the network (Aral & Alstyne, 2011; Hansen, 1999), or of the actors themselves (Kilduff & Krackhardt, 2008). We contribute to this emerging research field by showing that cognitive style is a key contingency variable in explaining the link between social networks and employee innovation. Third, we develop a novel theoretical argument that accounts for both the closure and brokerage
views of social capital within a unitary explanation. Incorporating the role of cognitive style into existing network-structural models of social capital is straightforward because the latter explain which kind of information accrues to individuals, while the former explains which kind of information individuals need most. Despite its underlying simplicity, our theoretical integration reconciles apparent discrepancies between the closure and brokerage views within a more general theory of social capital, and yields consequential implications for both scholars and managers.

**Network Brokerage and Individual Innovation**

The extant literature widely concurs that developing a workplace network spanning across structural holes enhances individuals’ innovative performance by making them more likely to come up with new and original ideas (Burt, 2000). Since much organizational information flows through networks of interpersonal relations (Cross & Cummings, 2004), tapping information from mutually unconnected contacts exposes individuals to a diverse range of views, opinions, and ideas that are hardly accessible to employees embedded within closely connected networks (Granovetter, 1973). This heterogeneous information environment is key to the social capital inherent in brokering networks because, by stimulating individuals to envision novel combinations of seemingly unrelated ideas, it fosters the idea generation process (Aral & Alstyne, 2011; Burt, 2004; Hemphala & Magnusson, 2012; Kijkuit & Van Den Ende, 2007; Rodan & Galunic, 2004). Although closed social networks are more conducive to idea implementation than brokering ones (Obstfeld, 2005), there is broad consensus in the literature that occupying a brokering network position has an overall positive effect on individuals’ innovative performance (Burt 2005). The reason is that although both idea creation and idea implementation play a role in innovation dynamics, implementation cannot occur unless creative ideas have been generated (Baer, 2012: 1104). Conversely, the ability to come up with original, out-of-the-box ideas represents a salient and intrinsically valuable aspect of an employee’s innovative performance because such ideas are the buds from which organizational innovations can develop (Baer, Oldham, & Cummings, 2003). Extant research from a variety of empirical settings supports the view that individuals embedded in brokering networks tend to be more innovative than equally skilled colleagues occupying closed network positions. For example, Burt (2004) studied a large sample of managers running the supply chain of a multinational electronics company and found that those embedded in brokering workplace networks systematically come up with more numerous and more valuable ideas than those in closed network positions. Similarly, Fleming (2002) examined innovative dynamics within Hewlett-Packard and found that brokering social networks that cut across projects help engineers develop innovative technologies. Lastly, Rodan
and Galunic (2004) showed that having a workplace network rich in structural holes improved the innovative performance of senior managers in a Scandinavian telecommunications company. In line with prior literature, we therefore advance the following baseline hypothesis.

_Hypothesis 1. The more brokering (closed) an employee’s workplace social network, the higher (lower) his or her innovative performance._

The hypothesis presented above is “structuralist” in the sense that it focuses solely on characteristics of the network within which employees are embedded, not on characteristics of the employees themselves (Emirbayer & Goodwin, 1994). Interestingly, though, a long-established line of research in the psychology of problem solving literature offers evidence that individuals with different cognitive styles use information differently, suggesting that employees might differ in the extent to which they profit from the social capital inherent in closed versus brokering networks. Before we can explicitly integrate the structuralist and psychological perspectives into a unified theoretical argument, a discussion of existing literature on cognitive styles is in order.

**Adaptive-Innovative Cognitive Style**

Cognitive style refers to “consistent individual differences in the ways people organize and process information” (Martinsen, Kaufmann, & Furham, 2011: 214), which influence how individuals conceive of and deal with problems. Theories of cognitive style have become increasingly relevant in organizational research, as evidence shows that cognitive styles are “a fundamental factor determining both individual and organizational behavior” (Kozhevnikov, 2007: 464). One prominent example is Kirton’s Adaption-Innovation Theory (Kirton, 1976, 1989), which has received much attention as an approach to both conceptualizing and measuring cognitive style (Shalley, Zhou & Oldham, 2004), and has influenced research in a broad range of fields including entrepreneurship, leadership, team dynamics (Stum, 2009). Adaption-Innovation Theory posits that individuals differ starkly in how they make decisions, solve problems, and construe change (Tullett & Davies, 1997). Such differences in cognitive style develop early in life, and determine how the individual deals with all stages of the problem solving process, including the view of the nature of problem, the scope of possible solutions, and the implementation of chosen solutions (Chan, 1996; Kirton, 1989).

Adaption and Innovation are two ends of a continuum, having a normal distribution around the theoretical mean (Goldsmith & Kerr, 1991). Descriptions of individuals on the two extremes of the continuum are in stark opposition. Adaptors use the information available to them to find
solutions that fit within established frameworks (Kaufmann, 2004). As such, they are more apt at “doing things better” than they are at “doing things differently” (Kirton, 1976: 622). While they are meticulous and thorough in their approach to problem solving, their focus on established frameworks inhibits them from venturing far from current ways of thinking, winnowing the range of ideas and information they consider (Talbot, 1997). Adaptors’ solutions generally fit well with those of others and with the commonly accepted way of doing things. However, it is often difficult for them to recognize when existing solutions are no longer effective (Pounds & Bailey, 2001). In addition, Adaptors tend to analyze problems logically and methodically instead of turning to free idea generation (Basadur, 1995). While this approach helps them solve “problems by proceeding at a disciplined pace in a predictable direction” (Kirton, 1994: 13), it also makes divergent thinking unlikely, reducing their likelihood of generating truly novel and creative ideas. Innovators process information in a very different fashion, as their cognitive focus is on finding new ways to conceptualize and frame the problem (Kirton, 1976), and not on immediate solutions. Being less inclined to adjust their ideas to the expectations of others, Innovators typically approach problems from original and unusual perspectives (Singer, 1990), “breaking the customary starting point” for their solution (Kirton & De Ciantis, 1986: 141). Furthermore, they solve problems by systematically turning around the information accruing to them through repeated cognitive re-framings, allowing them to see new ways of linking apparently unrelated ideas (Hayes & Allinson, 1998). This approach helps them come up with creative ideas and initiatives that often break away from established practice, facilitating the idea generation process (Kirton, 1976).

In sum, Innovators find it relatively easy to generate original ideas by recombining seemingly unrelated perspectives and information, although it is quite difficult for them to convert creative ideas into implemented innovations. Conversely, Adaptors come up with fewer and less original ideas, but their focus on finding solutions that fit well within the organization’s established way of doing things aids them during the idea implementation process. Such differences in cognitive style describe an individual’s preferred way of processing and organizing information, and are thus conceptually different from cognitive level or ability (Goldsmith, 1985). Nevertheless, extant research suggests that Innovators are likely to achieve higher performance in tasks where the relative importance of idea creation is greater than that of idea implementation, while the opposite is true for Adaptors (Pounds and Bailey 2001).

We mentioned before that although both idea creation and idea implementation constitute important facets of innovation, the former represents a highly salient aspect of an employee’s innovative performance that most contemporary workplaces regard as intrinsically valuable (Baer, Oldham, & Cummings, 2003). In line with this view, prior literature indicates that the
tendency to shift mental models and combine seemingly unrelated information, which is characteristic of Innovators but not Adaptors, is a critical antecedent of individual innovative performance (Holyoak and Thagard, 1995, Simonton, 1999). For example, Rostan (1994) showed that the most innovative scientists and artists spend significantly more time framing problems from alternative perspectives than their less innovative peers. Furthermore, research found that combining concepts in unconventional ways is a main driver of employees’ innovative performance in such diverse areas as engineering and advertising (Mumford, Baughman, Maher, Costanza, and Supinski, 1997; Owens, 1969). Building on this prior literature, we advance a second baseline hypothesis.

*Hypothesis 2. The more Innovative (Adaptive) an employee’s cognitive style the higher (lower) his or her innovative performance.*

**Social Network Position and Cognitive Style: A Contingency Perspective**

The two baseline hypotheses presented above descend from the well-established premise that, within the contemporary workplace, the ability to generate original, out-of-the-box ideas is a defining aspect of individual creativity that has a direct positive impact on the innovative performance of employees (Baer et al., 2003). While being innovative undoubtedly requires one to come up with creative ideas, extant research also suggests that the extent to which the process of idea creation converts into an employee’s overall innovative performance depends on his or her efficacy in turning novel ideas into implemented innovations (Amabile, 1996b; Baer, 2012). In the present section, we elaborate on this insight, which is at the core of the innovation paradox, to advance extant theory on the network structures most conducive to an employee’s innovative performance. Specifically, we argue that the effect of social network position on individual innovative performance varies depending on employees’ cognitive style. The logical principle underpinning our hypothesis is that of “complementary fit” (Ostroff, 2012), which suggests that an individual’s performance will be highest when “the weaknesses or needs of the environment are offset by the strength of the individual, and vice-versa” (Muchinsky & Monahan, 1987: 271). Following this logic, we posit that a closed network of densely connected contacts will effectively complement the weaknesses of Innovators, while a network rich in structural holes will best complement those of Adaptors. Table 1 summarizes the arguments we will detail in the following paragraphs, presenting a schematic description of how, according to our theory, complementarity between cognitive style and social network position affects individuals’ innovative performance.
Let us begin by explaining why we expect Innovators to exhibit lower innovative performance when embedded in a brokering network than when embedded in a closed one. As argued above, individuals with an Innovative cognitive style tend to come up with more numerous and more creative ideas, which is a critical factor in producing successful innovations. The extent to which creative ideas get implemented into actual innovations, however, depends on whether those ideas can be integrated within the organization’s existing processes and aligned with “the set of existing understandings and actions” predominant within the organization (Hargadon & Douglas, 2001: 476). Prior research has found that Innovators frequently fail to gain the consensus needed

### Table 1

**Summary of the combined effects of network structure and cognitive style on innovative performance**

<table>
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<th>Type of social capital</th>
<th>Adaptive-innovative cognitive style</th>
<th>Innovative cognitive style</th>
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<td><strong>Innovators</strong></td>
<td>• more likely to reframe problems, recombine information and generate novel ideas</td>
<td>• ideas more acceptable to others and in line with existing frames, making implementation easier</td>
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<td>• inept at gaining support for ideas and making them acceptable to others, thus hindering their implementation</td>
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#### Brokering network structure
- heterogeneous information environment aids idea creation and information recombination
- unconnected contacts make coordination and implementation difficult

#### Closed network structure
- homogenous information environment simplifies coordination and makes network more supportive, aiding idea implementation
- information redundancy and normative pressure hinders novel idea generation

#### Innovators in brokering position
- The opportunity to recombine disparate pieces of information, which is inherent in a brokering position, is redundant with Innovators’ inborn ability to reframe problems and generate novel ideas. At the same time, Innovators’ main weakness (idea implementation) is made worse by the difficulty of coordinating a disconnected network.

#### Innovators in closed position
- Innovators’ inborn ability to reframe problems and generate novel solutions is complemented by a supportive social milieu where coordination is less difficult, making ideas more likely to be implemented.

#### Adaptors in brokering position
- Diversity of perspectives in a brokering network stimulates Adaptors to discover novel connections among them. This vision advantage is complemented by Adaptors’ innate ability to frame solutions in acceptable ways, allowing them to garner support for the implementation of new ideas.

#### Adaptors in closed position
- Coordination advantages of a closed network are largely unnecessary, as Adaptors’ ideas are already framed in a way that is more acceptable to others, while the strong normative pressure in a closed network amplifies their reluctance to break from established practice.
to implement their ideas within the organization because their cognitive style funnels their thought processes and efforts towards idea creation, rather than towards idea implementation. As a consequence, Innovators’ creative output often does not accommodate the needs, constraints, or interests of organizational decision makers (Kirton, 1988), with the result that a fair share of their ideas never become implemented into successful innovations. Since gaining the support and coordinated action needed for idea implementation is especially difficult for individuals embedded in brokering networks (Gargiulo, Ertug, & Galunic, 2009; Obstfeld, 2005), Innovators whose workplace ties span many structural holes may come up with many novel ideas, but the share of those ideas that become implemented into actual innovations is likely to be especially low.

Based on a complementary fit argument (Ostroff, 2012), conversely, we argue that Innovators will benefit from a closed social network of densely interconnected colleagues. By facilitating cooperation and “coordinated action,” closed networks convey a form of social capital conducive to idea implementation (Obstfeld, 2005: 101). Corroborating this view, prior research found that employees embedded in closed networks have an edge when seeking the sponsorship and resources needed to realize their initiatives (Flap & Völker, 2001) and that this is especially true when such initiatives are based on unconventional, creative ideas (Baer, 2012). Furthermore, closed networks facilitate consensus formation (Lott & Lott, 1961), which is critical when trying to put novel ideas into effect within the organizational context (Baer, 2012; Kijkuit & Van Den Ende, 2007). As Innovators frequently come up with creative ideas, but often fail to implement them, they should benefit most from a social milieu that supports them throughout the process of idea implementation. Consistent with the notion of complementarity fit, these arguments suggest that a closed workplace network will confer the kind of social capital necessary to take full stock of Innovators’ characteristic inclination to focus on idea creation, while concurrently compensating for their main weakness – their limited focus on idea implementation.

The complementary fit argument also suggests that the innovative performance of Adaptors will be lower when they are embedded within a closed network than when they are embedded in a brokering one. The social capital generated by closed workplace networks is valuable insofar as it facilitates the idea implementation process, but offers little support in generating creative ideas, which is precisely where Adaptors are lacking. Therefore, although closed networks may aid Adaptors in implementing their ideas, these ideas will most likely not be novel. Extant research found that closed networks often cut individuals off from novel ideas flowing outside of their immediate social environment (Uzzi, 1997), which may amplify Adaptors’ inherent preference for well-established ideas over novel ones, as well as their reluctance to consider solutions that break away from current practice. Similarly, Adaptors’ inclination to address problems through commonly accepted frameworks is likely to intensify, since closed networks
often present a “well-defined and consistent normative framework” that disciplines social action (Gargiulo et al., 2009) and curtails individual creativity (Gargiulo & Benassi 1999: 305). As a result, Adaptors embedded within a closed workplace network can be expected to exhibit a very low innovative performance.

Adaptors’ innovative performance should instead benefit from the kind of social capital generated by brokering social networks. As Adaptors’ information processing style discourages cognitive reframing, Adaptors generally find it hard to envision creative idea combinations, which reduces both the number and the novelty of the ideas they generate (Basadur, 1995; Talbot, 1997). A workplace network spanning structural holes would provide the kind of social capital needed to offset this weakness. By broadening the diversity of views and opinions individuals must discuss and try to reconcile while carrying out their tasks, a brokering network would make it necessary for Adaptors to frame and reframe problems from multiple and possibly discrepant perspectives, stimulating them to envision connections between previously unrelated ideas. Furthermore, by embedding employees within a heterogeneous information environment, brokering social networks would serve to counteract Adaptors’ tendency to focus on well-established and commonly accepted solutions, pushing them to process novel information and combine ideas in unusual ways. At the same time, the close attention Adaptors pay to converting creative ideas into implemented solutions would allow them to take full stock of the ideageneration benefits inherent in brokering network positions. As a result, we expect that a workplace network rich in structural holes will confer the kind of social capital necessary to compensate for Adaptors’ main weakness – their tendency to generate few creative ideas – while concurrently helping them to fully profit from their strength in implementing creative ideas. These arguments lead to our central hypothesis.

Hypothesis 3. The more Innovative (Adaptive) an individual’s cognitive style, the more a closed (brokering) workplace social network will enhance his or her innovative performance.

**SETTING, DATA, AND MEASURES**

We drew the empirical data to test our theory from a small Italian design and manufacturing firm, which we dub ItalianSofa to preserve anonymity. ItalianSofa has been a leading designer and producer of sofas for over 40 years, with a presence both in Italy and abroad. This empirical setting is strategic to test the theoretical integration postulated in this study for multiple reasons. Interviews with the CEO and upper management suggest that both idea creation and idea implementation are of utmost importance to the organization. While some combination of idea creation and idea implementation is essential in all organizations and jobs (Amabile, 1996b)
finding evidence of complementarity effects is not necessarily easy in many empirical settings. Creativity is certainly pivotal in a fashion-driven market where design is a key element of success; nevertheless, ItalianSofa is also a manufacturing firm and, as such, it values operational and organizational efficiency. Furthermore, most of our interviewees stressed that ItalianSofa has a collaborative culture that emphasizes the role of informal, interpersonal relations within the workplace, as both a value in itself and as a means of increasing employee performance. Such emphasis on cooperation and social networks may partly reflect the fact that ItalianSofa is a family-owned business, as well as the broader national culture within which the company is embedded (Hofstede, 1976), and confirms us in our opinion that ItalianSofa is a suitable site to test how workplace social networks affect employees’ innovative performance.

The sample we use comprises the entire organization, including first line managers and the CEO, amounting to 68 persons in total. A sample of this size is appropriate for complete-network studies using survey data. Smaller samples may be too low on statistical power, while larger ones may generate poor quality network data due to the cognitive effort required by complete-network surveys. For that reason, prior survey-based research using complete-network data has used samples of comparable size (Hayton, Carnabuci, & Eisenberger, 2012; Mehra et al., 2001). We collected the data through personal distribution of two questionnaires: one to all members of the organization, and one only to managers. As the organization is located in Italy, we administered the questionnaires in Italian. Participation was voluntary, and participants were assured that the results would only be used for research purposes and that their identities would not be revealed. The first questionnaire consisted of two parts, the first collecting demographic information and questions related to cognitive style, and the second collecting relational data. We obtained a 100% response rate, which is of key importance as incomplete data create serious methodological problems in social network analysis (Wasserman & Faust, 1994). We stress that network data were collected through a “roster method”. That is, we did not ask employees to freely recall their contacts; rather, we presented them with a complete list of all other employees and asked them to tick their contacts. The roster method is superior to the less time-consuming free-recall approach for two reasons. First, free recalls tend to provide less accurate information (Hammer, 1984). Second, research has shown that respondents have systematic biases when asked to recall their contacts’ contacts (Kumbasar, Romney & Batchelder, 1994). This is a problem for studies of brokerage since individuals tend to recall fewer structural holes than there actually are, and such recall errors vary systematically with individuals’ previous experiences and personality traits (Casciaro, 1998; Janicik & Larrick, 2005). As the roster approach reconstructs the complete network by consolidating information from respondents’ direct contacts, it eliminates this problem. The second questionnaire asks questions related to employee performance, and was distributed only to those in a supervisory position (25 people).
We collected relational data about intraorganizational advice relations. These relations are key conduits of information within organizations (Lomi, Lusher, Pattison & Robins, 2013), and have been found to influence performance (Sparrowe et al., 2001). Following a consolidated practice (Sparrowe et al., 2001), we phrased the network question as follows: “Which of your colleagues do you turn to for advice in professional, technical or work-related matters?” This question was followed by a list containing (in alphabetical order) the names of all employees. Respondents were asked to tick next to the names of their colleagues, indicating their sources of advice. They were also asked about how often they turn to each colleague for advice. Possible answers were: at least once a week; at least once a month; less than once a month (Burt, 1984). We did not limit the number of nominated contacts, in order to reduce measurement error (Holland & Leinhardt, 1973). Answers were recoded to indicate tie strengths, resulting in a directed, weighted network of interpersonal advice ties. We entered the data in a 68x68 square matrix and used UCINET 6.381 (Borgatti, Everett, & Freeman, 2002) to compute all network measures.

Respondents reported an average of 10.2 colleagues as contacts they consult for advice. Of these advice relations, 14.3 percent represent strong ties (“at least once a week”), 37 percent represent moderately strong ties (“at least once a month”) and the remaining 48.7 percent represent weak ties (“less than once a month”). The distribution of network ties suggests that lateral relations are of key importance. For example, 65 percent of advice relations by lower ranked employees are directed at their own hierarchical level, and inter-departmental ties abound, with as much as 69 percent of advice relations among lower ranked employees cutting across departmental borders. These statistics align well with the company descriptions that emerged during the interviews, which emphasized the role of interpersonal ties and collaboration as a key part of ItalianSofa’s culture.

Measures

**Cognitive style.** We measured cognitive style using Kirton’s (1976) Adaption-Innovation Inventory (KAI)². The KAI inventory was developed by Kirton to measure his Adaption-Innovation construct (Kirton, 1976, 1989). It is a measure of cognitive style and not of level, meaning that it is independent of cognitive ability, cognitive complexity and creative capability (Goldsmith, 1985; Kirton, 1978, 1987). Several studies found the scale’s internal consistency to be high (Foxall & Haskins, 1986; Goldsmith & Kerr, 1991). Significant correlations between adaptive-innovative cognitive style and sensation seeking (Goldsmith, 1984), openness to change (Kwang, Ang, Ooi, ________________

² The instrument is protected by copyright and was used with permission from the copyright owner.
Shin, Oei, & Leng, 2005), and other theoretically relevant personality dimensions (e.g., Basadur, 1995; Houtz, Selby, Esquivel, Okoye, Peters, & Treffinger, 2003) provide evidence of convergent validity. Discriminant validity is evidenced by statistical independence between cognitive style and measures of cognitive ability (Chan, 1996; Kirton, 1978, 1992). Cognitive style has been found to be stable over time (Taylor, 1994). Evidence for the scale’s reliability is provided by a large number of studies conducted with different populations and in different countries (e.g., Bagozzi & Foxall, 1995; Shiomi & Loo, 1999). The instrument comprises 32 questions. Each question asks respondents how difficult it would be for them to behave in the way described, that is, to present a certain image of themselves for an extended period of time. Example items include “Never acts without proper authority” and “Likes to vary set routines at a moment’s notice”. Respondents select their answers from a scale of 1 to 5 (“very hard” to “very easy”). Answers are coded in such a way that Innovators score high, while Adaptors score low. As we use absolute scores (Pounds & Bailey, 2001), theoretical values range from 32 to 160, while the observed range in our sample is between 68 and 108. Consistent with theory and prior research (e.g., Kirton 1976, 1992), the observed distribution is normal according to both the Shapiro-Wilk Test (1965) and the Jarque-Bera Skewness-Kurtosis Test (1987), with a mean of 87.40 and a standard deviation of 7.72. The Cronbach’s alpha for our sample is acceptable but rather low (0.64), an issue that we will address in the additional analysis section. Finally, interdepartmental differences in average KAI scores were observed, in accordance with prior research (Kirton & McCarthy, 1988). ‘Marketing and Communication’ and ‘Research and Development’ were found to be the most Innovator-oriented departments (with average KAI scores of, respectively, 101.2 and 92.8), while ‘Production’ (85.3), ‘Quality, Safety and Environment’ (84.8), and ‘Administration, Finance and Controlling’ (82.5) are geared more towards Adaptors.

**Network Brokerage.** We calculated network brokerage using the “Structural Holes” routine in UCINET 6.381 (Borgatti, Everett, & Freeman, 2002), which we specified as (the additive inverse of) Burt’s original constraint measure (Burt, 1992: 55). This specification allows us to measure brokerage and closure as two polar opposites, that is, a high level of brokerage implies a low level of closure, and vice-versa. This is consistent with our theory, with Burt’s original formulation, and with extant literature on the brokerage-closure debate (Adler & Kwon, 2000; Burt, 1992, 2005). The measure of network brokerage pertains to the weighted, directed advice network, and ranges within the [0, 1) interval, 0 indicating maximal closure and 1 maximal brokerage.

**Innovator-Brokerage Interaction.** To test our interaction hypothesis (Hypothesis 3), we first mean-centered and then multiplied Innovator and Network Brokerage to create a new variable, labeled Innovator-Brokerage Interaction.
Innovative Performance. We measured employees’ innovative performance using the Role-Based Performance Scale (RBPS), a theory-based and widely validated measure of role performance (Welbourne, Johnson, & Erez, 1998). The RBPS is a generalizable (i.e., not context-specific) measure of employee performance, consisting of the following five components: Job, Career, Team, Organization, and Innovation. For the purposes of this study, we used only the Innovation subsection, as it directly captures the *explanandum* of our theory. The Innovation subsection measures both idea creation and idea implementation, and comprises the following four items: “Coming up with new ideas”; “Working to implement new ideas”; “Finding improved ways to do things”; “Creating better processes and routines”. The response format was a Likert scale ranging from 1 = "needs much improvement," to 5 = "excellent.” Following Welbourne and colleagues, our dependent variable was created using the sum of all responses, ranging from theoretical a minimum of 4 to a theoretical maximum of 20. We relied on supervisory ratings, asking supervisors to compile the Innovation subscale of the RBPS for each employee reporting directly to them, resulting in a single performance value for each employee, based solely on the evaluations provided by his or her supervisor without discussing the evaluations with others. Supervisory ratings are the most commonly used proxy for measuring performance in organizations (Arvey & Murphy, 1998). The employee innovative performance data pertain to 67 employees instead of 68, as the CEO reports to no supervisor and hence was not evaluated.

Control variables. We controlled for a number of demographic, organizational, and psychological variables that might unduly affect our estimates of interest. Demographic variables include gender, age and level of education. Controlling for gender is important because it may affect employee cognitive style (Sim & Wright, 2002), and because supervisory biases may lead to differential performance evaluations based on subordinates’ gender (Shore & Thornton, 1986). Age was included because older individuals tend to have a more Adaptive cognitive style (Kirton, 1976) and may receive lower performance ratings than their younger peers (Ferris, Yates, Gilmore, & Rowland, 1985). Education was included mainly due to its theorized connection with innovative behavior (Scott & Bruce, 1994). Reflecting the Italian higher education system, level of education variable ranged from 1 to 4, where 1 = High School Diploma, 2 = Bachelor’s Degree (3 years), 3 = Laurea (four-year post-secondary academic degree), and 4 = Bachelor’s plus Master’s Degree. We included a control for job tenure, measured as the number of years in the job, as tenure may affect both employees’ performance (Sturman, 2003) and their ability to occupy brokering positions (Mehra et al., 2001). We also controlled for hierarchical position (ranging from the lowest level of 1 to the highest level of 3, with level 4 as a reference category including only the CEO). We included this variable as prior work found it to relate to both advice

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3 The instrument was used with written permission from Theresa M. Welbourne.
network brokerage and innovative performance (Ibarra & Andrews, 1993). We also added two variables characterizing individual traits that might confound our effects of interest. We controlled for employees’ level of self-monitoring, using a revised version of the Self-Monitoring Scale (O’Cass, 2000). Prior research found high self-monitors to be more likely to gain brokering network positions and to be better able to reap the benefits inherent in these positions (Mehra et al., 2001). Furthermore, high self-monitors are more likely to have an Innovative cognitive style (Hutchinson & Skinner, 2007). We also measured employees’ individualistic-collectivistic value orientation (collectivism) by using the Individualism-Collectivism Scale (Wagner & Moch, 1986). Evidence exists that individuals engaging in brokering behaviors may come across as being oriented towards individualistic values, which may hamper their performance in contexts where collectivistic values are predominant (Xiao & Tsui, 2007). In addition, the connection between individualism and creativity (Goncalo & Staw, 2006) might suggest that individualistic-collectivistic value orientations may relate to cognitive style and innovative performance.

Extant research suggests that an employee’s web of friendship relations within the workplace is an important source of both instrumental and emotional support that may enhance employees’ performance (Brass, 1984; Hayton et al., 2012). To account for this, we collected data on each employee’s friendship ties using a roster method and constructed a variable called Number of Friends. Because people are not always accurate in their perceptions of who sees them as a friend (Crockett, 1982), we followed past research and considered a friendship tie to exist between two actors only if both actors report it (Balkundi, Kilduff, Barsness, & Michael, 2007). The question for the friendship network was phrased as follows: “Please indicate the colleagues you regard as your friends”. Employees were also asked to indicate the strengths of their friendship relations, which we recoded to indicate tie strengths ranging from weak to strong as follows: weak (tie strength = 1); strong (tie strength = 2); very strong (tie strength = 3). As supervisors’ ratings might be affected by their relations with the employees they are rating (Lefkowitz, 2000), we introduced two further control variables to account for this possibility. Friendship from supervisor controls for whether or not the supervisor rating the focal employee indicated a friendship relation to the employee, and if so, the strength of this tie (ranging from 1 to 3). A tie strength of zero (0) indicates the absence of a tie. Collaboration from supervisor accounts for whether the supervisor indicated a collaborative relation with the focal employee. Tie strengths were based on indications of collaboration frequency, phrased as follows: a few times over the whole year (weak tie); a few times a month (medium tie); daily or almost daily (strong tie).
EMPIRICAL ANALYSIS AND RESULTS

As we estimated our model through OLS, we ran an extensive set of diagnostic tests to ensure that all assumptions underpinning linear regression models are met in the context of our data. Both graphical and formal analyses showed that the residuals are normally distributed (Shapiro-Wilk W test for normality, p = 0.14), which is important for hypothesis testing. We found no evidence of influential observations. Studentized residuals are all below 2.5, and below 2 in all but 4 cases. These four cases are employees who have all been recently hired. Removing or keeping these observations left unaltered the direction and significance of our estimates of interest. The data show no sign of heteroskedasticity, as is confirmed by Cameron and Trivedi’s (1990) decomposition test (p-value = 0.44) and appear to be linear in the parameters.

Table 2 presents means, standard deviations and pairwise correlations among the variables. We notice that zero-order correlations provide prima facie evidence for two of our three hypotheses, indicating a positive relation between Brokerage and Innovative Performance (r = 0.36, p < 0.01), as well as a positive relation between Innovator and Innovative Performance (r = 0.24, p < 0.05). Pairwise correlations among our independent variables are relatively low. The triad of variables Age, Job Tenure and Hierarchical Position represents a mild exception, showing moderately high correlation coefficients and individual variance inflation factors ranging from 3.03 to 3.75. We are not concerned about multicollinearity, though, as the mean variance inflation factor (VIF) for our model is 1.85, and the highest value is 3.75. Furthermore, removing the triad of variables from our regression equation does not have any noteworthy effect on the significance and effect size of our variables of interest. It may also be interesting to notice the significant positive correlation between the dependent variable and several of the control variables, namely job tenure and hierarchical level (p < 0.01), as well as age, self-monitoring, collectivism, and collaboration from supervisor (p < 0.05). Of the organizational control variables, job tenure is the most strongly correlated with innovative performance (r = 0.41, p < 0.01), which suggests that accumulated work-related experience also plays a role in innovation success. Further, the fact that brokerage is positively correlated to hierarchical position (r = 0.27, p < 0.05) underscores the importance of controlling for hierarchy in our analysis.
**TABLE 2**

**Descriptive Statistics and Correlations**

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<th>Variable</th>
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**Table continues below -0.24 and above 0.24 are significant at the 0.05 level.**

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Table 3 presents the results of our OLS estimations. In all subsequent models, we mean-centered self-monitoring, collectivism, brokerage, and innovator to facilitate interpretation. Models 1 through 3 are nested: Model 1 estimates a specification including only control variables; Model 2 adds the effects of Innovator and Brokerage; Model 3 adds the interaction term – our core variable of interest. Model 1 shows that, of all the control variables, only Collectivism has an effect on our dependent variable. However, the effect is barely significant (p = 0.097) and loses significance completely with the addition of Innovator. Model 2 introduces the Innovator and Brokerage variables. Their inclusion significantly improves the overall fit of the model, as the

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Model 5&lt;sup&gt;c&lt;/sup&gt;</th>
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<td><strong>Interaction</strong></td>
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<sup>a</sup> Figures in parentheses are the standard errors of the coefficients.

<sup>b</sup> Robust standard errors at the department level.

<sup>c</sup> Robust standard errors at the supervisor level.

<sup>*</sup> p < .10

<sup>**</sup> p < .05

<sup>***</sup> p < .01 (two-tailed tests)
difference in F-tests between Models 2 and 1 is significant at the 0.01 level ($F(2, 54) = 5.17$). While Collectivism is no longer significant, we do observe a weak positive effect of self-monitoring ($p < 0.1$), a result which might reflect the importance of interpersonal dynamics within ItalianSofa. In line with prior studies (Burt, 1992; Mehra et al., 2001), we find that being embedded in a brokering network positively influences employees’ performance ($p < 0.05$), providing support for Hypothesis 1. With regard to cognitive style, we observe that Innovators in our sample reach significantly higher performance levels than Adaptors ($p < 0.05$), in line with Hypothesis 2. Model 3 introduces our core variable of interest, Innovator-Brokerage Interaction. The coefficient for this variable is negative and statistically significant ($p < 0.01$). Importantly, introducing Innovator-Brokerage Interaction substantially improves model fit, as indicated by the fact that the difference in F-tests between Models 3 and 2 is significant at the 0.01 level ($F(1, 53) = 13.46$). These results corroborate Hypothesis 3.

Due to the nested nature of our data, we added a model to account for possible unobserved differences in performance ratings across departments. If not accounted for, these differences might generate clusters in the error structure, potentially affecting standard errors and significance statistics. We therefore augmented Model 3 by specifying cluster-robust standard errors at the department level (White, 1984) (see Model 4). Our three hypothesized effects became somewhat weaker but continued to hold (Innovator: $b = 0.17$, $p < 0.05$; Brokerage: $b = 5.67$, $p = 0.05$; Innovator-Brokerage Interaction: $b = -1.78$, $p = 0.02$). The highest VIF value in this model was 3.75, and the average value was 1.85. Furthermore, since our dependent variable is based on supervisory ratings, and supervisors may systematically differ in their rating of employees, we added an additional model to account for this possibility. In Model 5, we augmented Model 3 by specifying cluster-robust standard errors at the supervisor level. The significance of our main estimates of interest remained unchanged (Innovator: $b = 0.17$, $p < 0.05$; Brokerage: 5.67, $p = 0.06$; Innovator-Brokerage Interaction: $p < 0.01$) (highest VIF = 3.75, mean VIF = 1.85).
Figure 1 allows us to gain more insights into the interaction effect that is the focal point of this study. The figure shows a two-dimensional interaction plot modeling the predictive margins from Model 3. The two intersecting lines show the expected innovative performance values of Adaptors and Innovators (defined, respectively, as one standard deviation below and above the mean Innovator values observed in our sample), with all other variables held constant. Performance values are shown for one and two standard deviations above and below the mean Brokerage value observed in our sample, with the mean observed Brokerage value represented by the middle dot. Standard errors, represented by vertical lines, are shown at 95% confidence levels. The picture shows that the effect of network structure on employee innovative performance is opposite for Adaptors and Innovators. Namely, brokering more structural holes steeply increases the innovative performance of Adaptors but decreases that of Innovators. An analysis of the margins indicates that the size of these effects is large. Compare two hypothetical employees, Ashley and Judith. Both Ashley and Judith have an Innovative style, defined as one standard deviation above the mean value observed in our sample. Furthermore, they have identical characteristics (i.e., age, gender, hierarchy, tenure, etc.) on all but the following aspect.
Judith is embedded in a closed network (defined as a value of Network Brokerage one standard deviation below the mean observed in our sample), while Ashley is embedded in a brokering one (defined as a value of Network Brokerage one standard deviation above the observed mean). Corroborating the claim that closed social networks improve the innovative performance of Innovators, our fitted parameters from Model 3 imply that Judith’s expected innovative performance is 15% higher than Ashley’s. Let us now take the hypothetical case of two employees, Mary and Jane, with an Adaptive style, defined as one standard deviation below the mean Innovator value observed in our sample. As before, the only difference between them is that Mary is embedded within a closed network, while Jane’s network is brokering (closed and brokering networks are defined as above). Our predicted values imply that Mary’s innovative performance score is well below average and roughly 34% below Jane’s. These examples demonstrate at least two important things. First, our contingency argument explains a large share of variance in employees’ innovative performance. Second, supporting our theory, there is a clear reversal effect whereby brokering networks boost the performance of Adaptors, but hinder that of Innovators (and vice-versa for closed networks).

**Robustness Checks**

We ran several additional analyses to examine the robustness of our results. First, as previously mentioned, we found the Cronbach’s alpha value for our sample to be acceptable (Flynn, Schroeder, & Sakakibara, 1994) but rather low (0.64). The reason for this is that four of the thirty-two items in our measure of cognitive style are weakly or negatively correlated to the rest of the items. When these four items are omitted, the value of Cronbach’s alpha rises to 0.72, a commonly accepted, moderate level of reliability (Nunnally & Bernstein, 1994). Since the questionnaires were administered in Italian, the wording of these items may have had a different connotation for some of the respondents. This was the case in a recent study administering the KAI inventory in Thailand, where reliability was also found to be low due to inadequate inter-item correlations, two of which were the same as our problematic items (Clapp, De Ciantis, Ruchthum, & Cornelius, 2010). As a robustness check, we also ran our analyses with these four items omitted. Direction and significance of our estimates of interest remained almost identical. We therefore chose to use the full, 32-item measure, for comparability with other studies (Im & Hu, 2005).

Second, in addition to the analysis presented in Model 4, we conducted further analyses to account for possible unobserved differences across departments. We began by modelling departments’ fixed effects, including a set of dummy variables. As there are 11 departments
within ItalianSofa, and our n = 67, including 10 (cross-correlated) dummies in our regression model exceedingly reduced the model’s degrees of freedom while simultaneously generating huge multicollinearity (highest VIF = 18.52, mean VIF = 6.83). We therefore chose to run further analyses to pinpoint which departments systematically affected our results. We found consistently higher performance ratings in “Marketing and Communications” and “Information Systems,” and consistently lower performance ratings in “Logistics.” We then ran our regression tests augmenting Model 3 with dummies for these departments (see Model 3 in the Appendix). The main effect of Innovator lost significance (b = 0.01, p = 0.77), while that of Brokerage remained largely unchanged (b = 4.30, p < 0.05), as did the Innovator-Brokerage Interaction (b = -1.30, p < 0.01). Additional analyses revealed that the effect of Innovator tends to be washed away by that of “Marketing and Communication.” As it turns out, this department has both a high average innovative performance and a strong concentration of Innovators. As we discuss later, these results may suggest that the main effect of cognitive style on innovation may in part depend on how creative the context is within which employees operate.

Third, although network constraint is a widely used measure of network brokerage (Gargiulo & Benassi, 1999; Xiao & Tsui, 2007), we also ran our analysis using the alternative measure of ego network density. We found all three hypotheses to hold. The effect of Innovator weakened slightly but remained significant (b = 0.15, p < 0.01), while that of Brokerage became stronger and more significant (b = 0.08, p < 0.01). The interaction of cognitive style and network structure was slightly weakened but remained significant at the p < 0.05 level (b = -0.01).

We also ran additional analyses to ensure that our results hold when including further control variables. We began by investigating the role of formal hierarchy. We created three dummy variables to separately model each hierarchical level, as opposed to estimating a single parameter as in our main model. None of these dummies had a significant effect, and including them did not affect our variables of interest. In an attempt to control for supervisors’ span of control, we also constructed a variable called Number of subordinates, capturing the number of direct reports of each supervisor (people in non-supervisory roles were assigned a value of zero). This variable did not have a significant effect on innovative performance, nor did its inclusion change our results. Finally, we added a variable for Status, since a sizeable body of work has shown that employees’ informal status position within the workplace is an important predictor of performance (Brass et al., 2004; Sparrowe et al., 2001). We constructed this variable from data on advice relations. Asking for advice is a signal of deference from the advice seeker to the source of advice, and the extent to which such signals confer status depends on the status of the advice seeker (Ibarra & Andrews, 1993). Bonacich formalized this argument and proposed a network index, known as the Bonacich centrality index (Bonacich, 1987), which has become a standard measure of status among organizational network scholars (Friedkin, 1991). Therefore, we
constructed our *Status* variable using this measure. We set the beta parameter to slightly less than the reciprocal of the eigenvalue (beta = 0.017), as suggested by Bonacich (1987). Including this variable left our variables of interest unaffected (Innovator: b = 0.17, p < 0.01; Brokerage: b = 6.29, p = 0.07; Innovator-Brokerage Interaction: b = -1.76, p < 0.01). The effect of *Status* itself was not significant (b = -0.42, p = 0.77). We present additional analyses with robust standard errors, random intercepts, and random coefficients at the department- and supervisor-level in the Appendix.

**DISCUSSION**

Although idea creation and idea implementation are both critical aspects of the innovation process, several previous studies pointed out that the conditions favoring idea creation are often in contrast with those favoring idea implementation, resulting in what has been termed an “innovation paradox” (Miron-Spektor, Erez, & Naveh, 2011). Reflecting this paradox, research into the role of workplace social networks found that employees embedded in brokering positions have an advantage during the idea creation phase, while closed networks of mutually tied contacts favor idea implementation. Since producing successful innovations requires both the creation and the implementation of novel ideas, this research did not offer conclusive answers to a question of both theoretical and practical relevance: which type of network structure is most conducive to employee innovation? We offered one answer to this question by developing a “complementary fit” argument that integrates an individual level, cognitive perspective into existing network theory. Since workplace social networks influence the innovation process by shaping the information accruing to employees (Burt, 2004, 2005), we argued that understanding which kind of network position is more likely to heighten an employee’s innovative performance requires examination of that employee’s idiosyncratic information-processing style. Drawing from Adaption-Innovation Theory (Kirton, 1976, 1989), in particular, we argued that workplace networks rich in structural holes maximize the innovative performance of employees with an Adaptive cognitive style. Conversely, closed networks boost the innovative performance of individuals with an Innovative cognitive style. Using data on the individual cognitive style and complete workplace social network of all employees within a design and manufacturing firm, we found that our theorized complementary fit argument accounts for a large share of empirical variation in employee innovative performance over and above currently existing social network explanations.

By demonstrating that cognitive style moderates the effect of social networks on innovative performance, the present study contributes to the contingency view of social networks (Anderson, 2008; Burt, 1997). This line of inquiry significantly advanced our understanding of
workplace social networks by unraveling how network effects vary depending on various critical contingencies, including the complexity of the information circulating through the network (Hansen, 1999), the speed at which such information changes (Aral & Alstyne, 2011), and the competence area of the actors receiving it (Carnabuci & Operti, 2013). Recently, multiple studies adopting a contingency perspective focused on the role of individual cognition, showing that the same network structure may lead to very different outcomes depending on individuals’ need for cognition (Anderson, 2008), self-monitoring abilities (Mehra et al., 2001), and cognitive activation strategies (Smith et al., 2012). The present study contributes to this growing area of research by showing that individual cognitive style is a key contingency explaining how social networks affect employee innovation. Specifically, we posit that because Adaptors and Innovators have opposite strengths and weaknesses, they are likely to benefit from different network positions. Consistent with the notion of “complementary fit,” we argued that a network rich in structural holes would supplement Adaptors’ shortcoming in the creation of original ideas, while at the same time providing them with more opportunities to exploit their distinctive strength in implementing such ideas. Conversely, a closed social network of mutually interconnected colleagues would help Innovators compensate for their main weakness – a difficulty in implementing ideas – while aiding them to fully profit from their distinctive strength in coming up with novel and creative ideas.

Perhaps the most counterintuitive insight of our contingency argument is that being entrenched within a clique of densely interconnected colleagues may boost, rather than dampen, innovative performance for a non-negligible portion of an organization’s workforce. While this finding challenges the widely established tenet that individual innovation requires networks rich in structural holes, it is important to emphasize that the theoretical argument that explains this finding builds on and extends current social network theory. In line with extant network literature, we theorized and showed that employees with a brokering social network generally exhibit a higher innovative performance relative to comparable individuals occupying a closed network position. This finding corroborates the structuralist claim that networks affect employees’ performance by shaping the information environment around them. Responding to recent calls for psychologically informed conceptualizations of social networks (Kilduff & Krackhardt, 2008; Barsade et al., 2012), our contingency argument advanced a straightforward yet consequential extension of the structuralist argument. While retaining the assumption that social networks affect the kind of information accruing to individuals, we drew from research on cognitive style to argue that individuals differ systematically in how they process the information accruing to them through the network. Allowing for such individual-level differences suggests that not all individuals benefit equally from the same network position. Consistent with this view, we combined insights from psychological and network research to argue that the heterogeneous
information environment characteristic of brokering social networks is especially beneficial for individuals with an Adaptive cognitive style. Departing from previous studies that found structural holes to benefit innovation in general, however, we argued further that a closed network of interconnected contacts boosts the innovative performance of employees with an Innovative cognitive style. Thus, our theorized mechanism enriches existing network-structural explanations by articulating how cognitive style generates a reversal effect in the relationship between social networks and innovative performance.

In addition to contributing to the contingency view of social networks, the present study adds to the extant literature by explicitly integrating both the brokerage and the closure views of social capital within a unitary explanation. While the brokerage view builds on the premise that being innovative requires employees to generate creative ideas (Hemphala & Magnusson, 2012), the extent to which this ability converts into an employee’s overall innovative performance may vary depending on his or her efficacy in implementing those ideas. Building on this insight, the closure view of social capital posits that because closed social networks facilitate idea implementation, while the presence of structural holes hinders it, under some conditions network closure may enhance innovation. Multiple scholars pointed out that reconciling the brokerage and closure views of social capital is essential to deepening our understanding of how workplace networks affect performance (Adler & Kwon, 2002; Lin, Cook, & Burt, 2001). Towards this end, for example, Burt (2005) proposed that one way to resolve the discrepancies separating the closure and brokerage views is to apply the two arguments to different levels of analysis. Accordingly, he suggested that the most innovative organizations are those whose employees build brokering connections outside their teams, but network closure within them. Other attempts at integrating the closure and brokerage views have built on the notion that innovation is a two-stage process, involving the creation of ideas and their subsequent implementation (Anderson, Potocnik & Zhou, 2014). In this vein, for example, Obstfeld (2005) suggested that while brokering networks facilitate the generation of good ideas, as required by the first stage of innovation, success in the implementation stage necessitates the mobilization of closed networks.

Contributing to these integrative attempts, we reconciled the brokerage and closure views by incorporating the role of cognitive style within existing network-structural models of social capital. In line with the notion that social capital resides in the relations connecting individuals, received social capital research examined in detail the networks within which individuals are embedded (Brass et al., 2004), while it typically treated individual level differences as nuisances that may be safely assumed away (Kilduff & Tsai, 2003). Departing from this approach, we proposed that individual cognition is an integral part of how social networks confer social capital to individuals. Accordingly, accounting for heterogeneity in individual cognitive style is critical to
push further current theories of social capital. Augmenting existing network-structural models of social capital with insights from Adaptive-Innovative Theory (Kirton, 1976, 1989), we illuminated the conditions under which brokering and closed networks enhance individual innovative performance, thereby explicitly incorporating both views within a unitary explanation.

Limitations and Future Research

This study has several limitations, which in turn point to opportunities for future research. While the research site chosen for our analyses allowed us to capture unusually rich information on employees’ workplace social networks, a key limitation is that our data is cross sectional. This makes it difficult to exclude the possibility of endogeneity, as well as to rule out possible alternative explanations for our findings. Because sizeable research has demonstrated that cognitive styles are stable individual traits that do not change over time (Taylor, 1994), endogeneity is unlikely to represent an issue with regard to this variable. Nevertheless, it is possible that cognitive style and innovative performance will concurrently affect which kind of social network individuals develop within the workplace. While conclusively ruling out endogeneity concerns is impossible in the absence of appropriate data, we carried out a set of additional analyses to ensure that the risk of endogeneity is limited. We begin by noticing that network position is uncorrelated with cognitive style (beta = -0.05, p = n.s.). Further, in a set of analyses not reported here, we used Exponential Random Graph Models (ERGMs) to examine further the relation between the aforementioned variables. A key strength of these models is that they enable direct parameterizing of the network structure at the dyadic and extra-dyadic level, as opposed to aggregating network information at the individual level. This allows for estimating the probability that individuals with a higher innovative performance, or with a more Innovative cognitive style, form a brokering tie. The ERGMs analyses suggest that neither individuals’ cognitive style nor their innovative performance affect the probability of developing a brokering network.

While these analyses alleviate our concerns of endogeneity, future research should put our theorized causal mechanisms to a more conclusive test. Ideally, this would require a research design leveraging panel data within a quasi-experimental setting. While collecting complete social network data about various aspects of people’s workplace network, as we have done, would probably make this task too daunting, a more realistic possibility would be to use archival network data in a way akin to Rider (2011). In order to tease out the causal effect of US lawyers’ social (professional) networks on their ability to find a prestigious job, Rider used archival data on each lawyer’s history of prior organizational affiliations to trace their network contacts.
Further, he exploited a quasi-experimental setting generated by the sudden and unexpected dissolution of six U.S. law firms. Treating these dissolution events as an exogenous shock causing mobility, the author was able to identify and gauge the causal effect of individuals’ networks on structuring job opportunities net of possible endogenous factors. To provide more conclusive evidence in support of our arguments, as well as to rule out possible alternative explanations of our findings, future research could use a similar a quasi-experimental design and test our theorized causal effects within a setting where the workplace social network gets shaken up by an exogenous shock.

A straightforward extension of our study would be to expand consideration to the interpersonal ties employees create across organizations. While we focused exclusively on intraorganizational networks, prior research has shown that ties reaching out to other organizations are often an important conduit of information that may affect innovation (Mors, 2010). Indeed, one of the earliest studies on the relation between social networks and innovation identified the “gatekeeper” – an individual who draws information from the organization’s external environment and spreads it internally through his or her workplace social network – as an especially critical figure within innovative organizations. While many studies exist that examine the role of gatekeepers from a social network perspective, the theory developed in this paper suggests that it may be important to consider their cognitive style, too. Our theory suggests that Adaptors are likely to be more effective gatekeepers than Innovators, for two reasons. First, gatekeepers’ role is not to generate new ideas; it is to draw ideas from the external information and “translate” them so that they become useful and usable within the organization (Tushman & Katz, 1980). Second, a distinguishing characteristic of gatekeepers is that both their internal and external network is rich in structural holes, as this is essential for them to be able to both tap and disseminate information efficiently (Allen & Cohen, 1969; Tushman, 1977). While testing this presumption empirically should be relatively straightforward, we believe that the results of such test might shed new light on an important line of inquiry for scholars of networks and innovation.

The central hypothesis advanced and tested in the present study emphasizes the importance of complementary fit. Future research should extend our arguments by addressing a related question that we have left unanswered: what is the role of “similarity fit” in the link between cognitive style and social networks? Our conjecture is that, while complementary fit is important to understand how cognitive style and social networks combine to affect individual performance, similarity fit may play a role in explaining with whom individuals prefer to form a tie. As Cable and Edwards (2004: 823) put it, similarity fit occurs when individuals experience value congruence and, as such, it “should affect employees’ attitudes and behaviors because people are more attracted to and trusting of others who are similar to them”. In line with the concept of
network homophily (McPherson, Smith-Lovin & Cook, 2001), therefore, the notion of similarity fit suggests that employees should generally prefer to form a tie with contacts who are similar to them on some relevant dimension. Because people find it easier to trust and understand those similar to them, the similarity fit logic suggests further that similarity-based ties are also more likely to survive over time than ties between dissimilar persons. Taken together, these arguments lead to the conjecture that employees’ social networks will generally comprise contacts with a similar cognitive style as the focal employee. By shifting the focus of analysis to the composition of social networks, rather than its structure, this line of argument highlights an interesting tension between the complementary fit and the similarity fit logics. On the one hand, people may preferentially form interpersonal ties with colleagues whose cognitive style is similar to theirs. On the other hand, the complementarity logic suggests that forming ties with contacts whose cognitive style is similar to one’s own might stifle one’s innovative performance.

We began to explore this pair of conjectures using our study population. To examine whether employees are more likely to have ties with colleagues with a similar cognitive style, we ran a Geary autocorrelation test (Geary, 1954). The results of the test suggest that people do tend to have more ties with contacts whose cognitive style is similar to their own (pseudo p-value < .05). To investigate whether this tendency depresses individuals’ innovative performance, we first constructed a variable, called Cognitive misfit. This variable captures the extent to which an individual’s contacts have a cognitive style that differs from his or her own. Specifically, it measures the (absolute value of the) difference between the focal individual’s KAI score and each of his/her contacts, weighed by the strength of each tie. We then included this variable as an additional covariate to our main statistical model. The results show a positive and significant result of Cognitive misfit on individuals’ innovative performance (beta = 0.12, p < 0.05). Taken together, our analyses provide initial evidence that people tend to form ties with others whose cognitive style is similar to theirs (reflecting a similarity fit logic), but doing so hampers their innovative performance (in line with the complementarity fit logic). While we regard this evidence as merely suggestive, we are hopeful that future studies will further explore these interesting results empirically as well as theoretically.⁴

Future research could extend the arguments presented in this paper in several directions. One direction that seems especially promising links our results to the recent stream of research on social network activation. For example, Smith and colleagues (2012) found that high status persons respond to job threats by seeking support from a relatively large share of their contacts, and the contacts they activate are often separated by structural holes. Conversely, low status

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⁴ We thank an anonymous reviewer for pointing us in this fruitful direction.
individuals respond to the same kind of threat by activating a smaller and more densely connected portion of their network. As mentioned above, we found that cognitive style does not influence individuals’ social network position within our empirical setting. However, it is possible that Adaptors and Innovators differ in how they use their social network. Since Adaptors and Innovators differ systematically in how they seek information when trying to solve a problem, they might also differ in how they navigate their network when seeking information. While we think that delving into these questions would help us gain a better understanding of the link between cognitive style and social networks, the scope and research design of our study did not allow us to explore them. Similarly, we used a single organization for our empirical analyses. Testing our hypotheses across multiple organizations and sectors would be important in order to understand the scope conditions of our arguments. Most notably, the setting of our study places a premium on creativity. While this trait is typical of most innovation and brokerage studies, it would be important to examine whether our results hold in less creative settings. Interestingly, the theoretical arguments we developed suggest that, while the main effect of social networks and cognitive style may vary depending on how much emphasis the context places on creativity, the contingent effect that is at the core of our theory should not. The reason is that we predicted Brokerage and Innovator to have a main effect on Innovative performance because they increase the likelihood that employees will come up with new ideas. Since idea creation (unlike idea implementation) is a defining aspect of innovative performance in most contemporary organizations, one might speculate that the smaller the premium placed on creativity within a given context, the smaller the main effect of Brokerage and Innovator will be. Alternatively, one might conjecture that contexts that place a premium on creativity may attract Innovators while repelling Adaptors (Kirton & McCarthy, 1988), thereby generating a differential selection process. In line with this conjecture, we found a remarkable concentration of Innovators within ItalianSofa’s Marketing and Communication department, and additional analyses (see Appendix) provide initial evidence that a selection process may be at work. Whatever the specific mechanism, it seems likely that the effects of Brokerage and Innovator vary in intensity depending on context. Conversely, the complementarity benefit derived from combining idea creation with idea implementation, which is at the basis of our contingency hypothesis, should be robust across creative and non-creative sectors. We hope that future research will test the veridicality of these arguments.
Managerial Implications

This study also bears straightforward implications for managers and practitioners. The advances made over the past years in our understanding of workplace social networks have not only deeply influenced current management scholarship; it also changed the curriculum of management courses in executive education, as well the services offered by consulting firms in HR and organization-related areas (Burt & Ronchi, 2007; Cross & Parker, 2004). Similarly, we think that the insights generated by our study have direct and actionable implications that might enhance current managerial practice. On a general level, our findings demonstrate that if managers want to enhance the innovative performance of their employees, they need to develop a keen understanding not only of their employees’ social network, but also of their cognitive style. Collecting social network data has become a well-established practice among many managers trying to increase the social capital of their employees (Cross & Parker, 2004). Our findings suggest that collecting data on employees’ individual cognitive style would provide managers with the additional information needed to understand which type of social capital their employees need. Recognizing that employees have different cognitive styles would also help managers escape easy solutions that may have unexpectedly negative consequences. Let us imagine, for example, that a manager needs to foster out-of-the-box thinking to refresh the company’s existing product line, and therefore hires a highly innovative person. This manager may have learned from executive education, or through managerial books, that fostering novelty and creative thinking requires embedding the newly hired person within a brokering social network that spans across structural holes. Our results suggest that by nurturing such a network around the newly hired employee, the manager would inadvertently but severely hamper the new employee’s performance. Knowing that Innovators perform best within closed networks, while structural holes benefit Adaptors, will avoid these kinds of misjudgments and help managers maximize their firm’s innovativeness.

Similarly, the theory and findings presented in this paper provide guidance to employees seeking to boost their own innovative performance. Because different cognitive styles benefit from different kinds of social networks, gaining awareness of one’s idiosyncratic cognitive style is a necessary first step towards developing an effective networking strategy. Our study suggests that employees should aim at developing a brokering or a closed social network depending on whether they have an Adaptive or an Innovative cognitive style, respectively. While the results we documented show that doing so would enhance employees’ innovativeness, they also suggest that it may be a difficult goal to achieve. Within the research site analyzed by the present paper, for example, people’s cognitive style had no discernible influence on the structure of their social network. This might reflect different causes. People may not be aware of their own cognitive
style; they may not be aware of the benefits deriving from developing a social network matching their cognitive style; or, they may not be able to map and manipulate the structure of their network. Countering these causes likely requires specialized training. While research found that people often fail to identify structural holes among their contacts (Janicik & Larrick, 2005), for example, Burt and Ronchi (2007) showed that training employees about the advantages of structural holes leads them to develop a more brokering social network. In addition to training, building a social network that matches one’s cognitive style likely requires different socializing strategies. For example, company party mixers have become an established way by which individuals try to develop bridging connections with colleagues who are far from their own existing network (Ingram & Morris, 2007). Our results suggest that these kinds of events are likely to be especially beneficial for Adaptors, as they may aid them in expanding the range of structural holes they broker. Conversely, Innovators should benefit from investing in team building activities and tertius iungens tactics aimed at creating cohesion between one’s contacts (Obstfeld, 2005), as these may help them build closure within their social network.

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APPENDIX

We conducted several analyses to account for possible unobserved differences across departments, as well as across supervisors. The results of these analyses are reported below. First, we ran models with robust standard errors using the Huber–White Sandwich estimator, assuming error clustering at (a) the department level (Model 1) and (b) the supervisor level (Model 2). Second, we constructed three dummy variables for the three departments with significantly different performance ratings (Model 3). Third, we examined random-intercept and random-coefficient models with department as the higher level (Models 4 and 5). Fourth, we fitted both random-intercept (Model 6) and random-coefficients (Model 7) models at the supervisor level in addition to introducing the three department-level dummies.

We notice that the results of these analyses should be treated with caution, as multiple scholars warn against running multilevel analyses when the number of higher level groups and/or the size of these groups is relatively small (e.g., Maas & Hox, 2005). This is certainly the case with our data; the number of groups is small (with a total of 25 supervisors and 11 departments), as is the size of these groups (on average, there are only 2.7 subordinates per supervisor, and 6.1 employees per department). With this caveat in mind, the results indicate that both our central hypothesis (H3) and H1 are supported in all models, while there is weak or no support for H2. These results align with a conjecture discussed in the paper: certain departments may attract and select individuals with a specific cognitive style, leading to a differential selection process. This appears to be the case within ItalianSofa’s Marketing and Communication department, where we observed a concentration of individuals with an Innovative cognitive style (average KAI score: 101.2). Insofar as controlling for the effect of “Marketing and Communication” washes away the main effect of Innovator, these results suggest that the benefits of an Innovative cognitive style are limited in contexts where most peers have that same cognitive style.
## Results of Robustness Checks Accounting for Nested Data

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*a Figures in parentheses are the standard errors of the coefficients.
*b Figures in parentheses are robust standard errors at the department level.
*c Figures in parentheses are robust standard errors at the supervisor level.
*d Random-intercept model with department as the higher level.
*e Random-coefficient model with department as the higher level.
*f Random-intercept model with supervisor as the higher level.
*g Random-coefficient model with supervisor as the higher level.
† p < 0.10; * p < 0.05; ** p < 0.01; two-tailed tests.
Awakening the Undead: The Cognitive Activation of Dormant Ties

Bálint Diószegi
ETH Zürich

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ETH Zürich

Stefano Brusoni
ETH Zürich

Abstract: Despite their value, making use of dormant ties is made difficult by our frequent inaptitude in recalling them. One of the main obstacles is the pervasiveness of the recency heuristic. We depart from the question: if dormant ties have such high potential value but are largely inaccessible to our minds, how can some individuals, but not others, realize the value of these network ties? To provide an answer, we implement a novel multistep methodology. We analyze the cognitive network activation patterns of 193 individuals to identify and understand differences in the ability to recall dormant ties. Our focus is on Self-monitoring, which is characterized by attentiveness and adaptability to the current social context. We argue that high self-monitors are able to both collect resource-related information about their network, as well as to overcome cognitive heuristics by focusing more strongly on this information. As a result, dormant ties relevant to their task are less likely to elude them. Through these insights, we contribute to the recent stream of literature on the micro-foundations of social networks.
INTRODUCTION

When mentally searching for resources that are beyond our reach – such as information or connections – we sometimes remember contacts with whom we have not spoken in years. Despite the lengthy period that has passed without any form of personal communication, we nonetheless remember that a certain contact may have what we are looking for. Thus, by picking up the phone and re-establishing contact, we gain access to the knowledge, experiences and new connections that these contacts have accumulated over the years. Unfortunately, however, a much more likely scenario is that, when searching for resources, we mentally constrain ourselves to our immediate temporal environment: the people we frequently interact with. However valuable and relevant they may be, people with whom we’ve lost touch are unlikely to even come to our mind. It is as though these acquaintances have been relegated to the deepest recesses of our minds, from where they seldom return. How we may raise them from the depths of our memory and tap the resources they possess is the focus of our study.

Such slumbering relationships have been termed “dormant ties”: “relationship[s] between two individuals who have not communicated with each other for a long time” (Levin, Walter, and Murnighan, 2011a: 923). Such connections are dormant in the sense that, although they are not currently active, they may potentially be reactivated. Doing so has been argued to provide important advantages. This is because, although these connections are inactive from the perspective of the individual, they in fact continue to form new connections and access distant information, which means that reactivating them can provide the individual with novel, non-redundant and useful information (Levin, Walter, and Murnighan, 2011b).

However, their potential value notwithstanding, reactivating dormant ties is likely to be challenging. The reason for this lies in the way our mind works. As demonstrated by research on memory and recall, recent information is much more cognitively accessible than non-recent information (Riegel, 1973; Higgins, 1996; Schooler and Hertwig, 2005). This “recency heuristic” or “recency effect” (Murdock, 1962; Richter, 2003) has significant implications for the utilization of dormant ties. As dormant ties are temporally very distant, their salience in our minds is likely to be very low. Thus, cognitively activating (calling to mind) (Smith, Menon, and Thompson, 2012) such contacts when needed is far from straightforward.

Cognitive network activation (henceforth: CNA) has been argued to be an important predictor of the set of ties the individual subsequently turns to (Menon and Smith, 2014). Hence, due to our strong cognitive bias toward recent ties, temporally distant ties become very hard to access (Baddeley, 1997; Förster and Liberman, 2007). Simply put, no matter how useful such ties may be, we are very likely to forget about them when searching our networks for
information. This presents us with a theoretical conundrum: if dormant ties have such high potential value, but are at the same time largely inaccessible to our minds, then how can the value of these network ties be realized?

The current study attempts to answer this question by utilizing a novel multistep methodology to provide an in-depth view of CNA. We examine the implications of patterns in CNA with respect to dormant ties in two stages. First, we provide clear evidence as to the ubiquity of the recency heuristic in CNA. In doing so, we also show that this cognitive heuristic may provide advantages with respect to efficient resource access, as it allows for quick solutions with little invested effort. However, when novelty is a key aspect of the resource to be accessed, the bias resulting from the recency heuristic can become a serious impediment. Thus, in the second stage, we examine the extent to which individuals are able to activate dormant ties when searching for novel, non-redundant information. As our results show, certain individuals are more able than others to override this cognitive heuristic when doing so is likely to be beneficial. Specifically, we provide empirical evidence that individuals characterized by high Self-monitoring (Snyder, 1979; Gangestad and Snyder, 2000) are more apt at selectively abstaining from the recency heuristic when searching for novel information, resulting in the cognitive activation of dormant ties. Self-monitoring is a personality trait that has been studied extensively with regard to social networks (Mehra, Kilduff, and Brass, 2001; Flynn et al., 2006; Kleinbaum, Jordan, and Audia, 2015), and relates to the way individuals attend and adapt to their current social context. Our theorized mechanism, which underlies this phenomenon, is that such individuals employ a different cognitive approach to network search, one which makes dormant ties more cognitively accessible. We argue that by collecting more resource-related information about their social contacts, and by using this information effectively when searching their minds, high self-monitors are more likely to mentally “stumble upon”, and subsequently awaken, dormant ties.

The questions raised and the insights gained from this study have the potential to advance our understanding of social networks and their effects on individuals in two important ways. Firstly, we complement recent work on dormant ties (Levin, Walter, and Murnighan, 2011a; Shea et al., 2015) by highlighting the inherent difficulty of unlocking their potential. At the same time, we also provide a potential solution, showing that certain individuals may overcome their temporal biases by changing the way in which they cognitively search their networks for resources. Second, our work contributes to a growing stream of research which emphasizes the role of inter-individual differences in making use of network resources (Anderson, 2008; Kilduff and Krackhardt, 2008; Mehra, Kilduff, and Brass, 2001). Here, we show that differences in the way individuals cognitively activate their networks (Smith, Menon, and Thompson, 2012) can affect outcomes in hitherto unexplored ways.
THEORY AND HYPOTHESES

Dormant Ties’ Value

An abundance of research in the field of social capital has shown that social networks (the web of interactions surrounding an individual) are an important source of potential advantages (Adler and Kwon, 2002), leading to economically relevant outcomes such as workplace mobility (Brass, 1984; Podolny and Baron, 1997), creativity (Ibarra, 1993; Obstfeld, 2005), and performance (Mehra, Kilduff, and Brass, 2001; Sparrowe et al., 2001). However, with few exceptions (e.g. Soda, Usai, and Zaheer, 2004), the focus of this research has traditionally been on ties that are currently active, or have been active in the recent past (McCarthy and Levin, 2014). Ties to others with whom the individual has not interacted with for a prolonged period have usually been considered to be decayed (Burt, 2000; 2002; Jonczyk et al., 2015) and devoid of value (Levin, Walter, and Murnighan, 2011a). Thus, without active maintenance, ties were considered to disappear, in the sense that they no longer form a part of the individual’s social capital (Burt, 2002).

Recently, however, scholars have begun to challenge the assumption that ties which have been neglected for a prolonged period (i.e. dormant ties) are devoid of value (Levin, Walter, and Murnighan, 2011a; Vissa, 2011; Mariotti and Delbridge, 2012). These authors argue, firstly, that individuals who were once in contact will retain memory of previous interaction and attained common understanding (Granovetter, 1992; Levin, Walter, and Murnighan, 2011a). Second, although rare, reconnecting dormant ties remains a possibility (Zettel and Rook, 2004; Burt, 2005). Third, and most importantly, reconnecting dormant ties may provide a value that surpasses that of currently active ties in terms of efficiency and novelty (Vissa, 2011).

Before discussing the potential advantages of reconnecting dormant ties, it is important to clarify the difference between dormant and weak ties. Firstly, while weak and strong ties differ, most importantly, in their degree of emotional intensity (Granovetter, 1973; Marsden and Campbell, 1984), dormant ties may be either weak or strong. Instead they are distinguished from their recent counterparts by the duration of their inactivity. Second, reconnected dormant ties may provide novelty irrespective of tie strength. That is, dormant strong ties can provide novelty, while at the same time retaining their light level of trust, while dormant weak ties provide even more novel information than current weak ties (Levin, Walter, and Murnighan, 2011a).

Previous research has already established that dormant ties are indeed valuable, as well as different from weak ties (Levin, Walter, and Murnighan, 2011a; Vissa, 2011; McCarthy and Levin, 2014), making a detailed reiteration of these arguments unnecessary. Instead, much
more central to our inquiry is exploring the richness of novel information that dormant ties carry. As Granovetter (1974: 82) observed, “it is a remarkable fact that one may receive crucial information from individuals whose existence one has nearly forgotten”. This is because these contacts are only dormant from the point of view of the focal individual. In reality, they continue to gather experiences and information, and to form ties with others; ties which the focal individual is unlikely to share (Levin, Walter, and Murnighan, 2011b). Thus, awakening such ties opens up a broad spectrum of information unbeknownst to the focal individual, as well allowing access to distant network contacts. In addition, reconnecting dormant ties is considered to be efficient, as they retain memories of part interaction, shared language and emotional content, and thereby require much less time and effort to reach a working level of communication (Levin, Walter, and Murnighan, 2011a). In other words, not only do they carry the promise of novel, non-redundant information and new contacts, but they are also able to efficiently transmit these resources to the focal individual.

**Dormant Ties’ Elusiveness**

Why, then, does the potential value of dormant ties so often remain unexploited? This question is of both theoretical and practical importance. Theoretical, because the high value of dormant ties contradicts the conceptualization of social capital that considers such ties dead and devoid of value (Levin, Walter, and Murnighan, 2011a). Practical, because the ability to gain access to non-redundant information in such an efficient way can be a key advantage to entrepreneurs, managers, and employees alike.

Clearly, the reason for their neglect is not their scarcity. Throughout their lifetime, individuals form social connections with thousands of people. Due to factors such as geographical mobility and selection of contacts, however, the vast majority of current ties will no longer be active in a few years (Burt, 2000). This leads to the accumulation of dormant ties (Levin, Walter, Murnighan, 2011b). A quick look at one’s list of Facebook friends (or LinkedIn connections) will reveal that the majority of these contacts are in fact dormant.

There may be other reasons for why dormant ties are seldom reconnected, such as a lack of interest in the given person (Burt, 2000), or even outright dislike (Casciaro and Lobo, 2008). However, the ties that are of theoretical importance to us are not those that have been intentionally severed, but the multitude of connections with whom we have simply lost touch. In such cases, we argue that the main obstacle to reconnection is simply that, when thinking of whom to contact for a certain purpose, these contacts never even enter our awareness.

Without calling network contacts to mind in the first place, we are unlikely to turn to them for support, advice, or information (Menon and Smith, 2014). The mental process of recalling
network contacts – cognitive network activation – is the focus of a recent stream of research on social networks (Smith, Menon, and Thompson, 2012; Brands, 2013; Shea et al., 2015). Research on the topic challenges the assumption that all individuals use their network equally, and has uncovered substantial inter-individual differences in how people mentally activate their networks (Smith, Menon, and Thompson, 2012; Menon and Smith, 2014; Shea et al., 2015).

The role of CNA may be especially prominent when it comes to the reactivation of dormant ties. This is because one of the defining characteristics of dormant ties is their temporal distance from the individual. Insofar as temporally distant – i.e. dormant – ties are less likely to be cognitively activated, the resources accessible through these ties will not be exploited. While the subject of cognitive network activation per se remains, as of yet, largely unexplored, insights gained from research on memory, social recall and cognitive heuristics may provide clear and valuable contributions to our understanding of this cognitive process.

Of special importance to the cognitive activation of dormant ties is what studies of memory and learning call the “recency heuristic” (also called the “recency effect”) (Murdock, 1962; Richter, 2003). Extensive research on the subject has found that, while recently stored information is highly accessible, its level of accessibility drops steeply over time, making retrieval increasingly difficult (Baddeley, 1997; Förster and Liberman, 2007). The reason for this lies in the limitations of the human mind with regard to information processing (Brashears, 2013). To counteract these limitations, our memory is organized in such a way that recently activated information is more easily retrievable than that which has not been used for some time. In essence, the mind “bets” that this information is more likely to be needed in the future, and therefore makes it more accessible, at the expense of potentially obsolete and less relevant information (Baddeley, 1997; Schooler and Hertwig, 2005: 611; Pachur, Schooler, and Stevens, 2013). Thus, while “forgetting is usually viewed as a regrettable loss of information” (Schooler and Hertwig, 2005: 610), it serves a clear purpose by focusing our cognitive processing on potentially more pertinent information.

This same mechanism also applies to the social realm. Remembering all the people we interact with, and maintaining relationships with them, is well beyond our cognitive limitations (McFadyen and Cannella, 2004; Dunbar, 2008; Brashears, 2013). Thus, in selecting the set of ties which are cognitively accessible, the same metaphor of “betting” can be argued to apply. For any given purpose, individuals with whom we have recently interacted are likely to be a better bet, as they are more likely to be physically accessible (Zahn, 1991; Borgatti and Cross, 2003). Accordingly, the recency heuristic has been observed with respect to CNA as well (Riegel, 1973; Hammer, 1984), alongside recall of non-social information (Förster and Liberman, 2007). The results of this research show that people we have recently interacted
with are more cognitively accessible, and those with whom we have not interacted for an extended period are much less so.

A broad range of cognitive heuristics, or “mental shortcuts” (Gilovich and Griffin, 2002) have been shown to affect the way in which individuals navigate complex social worlds (De Soto, 1960; Kilduff et al., 2008; Brewer, 2011). These heuristics have evolved for the sake of evolutionary fitness, allowing us to make decisions quickly and effortlessly (Gigerenzer and Brighton, 2009). As such, the recency heuristic also provides clear advantages. While it is unlikely to lead to the cognitive activation of network ties that provide highly novel information, it does allow for quick and easy solutions. Thus, the cognitive exclusion of dormant ties may be faster and require less cognitive effort. Building on these arguments, we posit the following baseline hypothesis with respect to the activation of dormant ties.

**Hypothesis 1.** Individuals will be faster in cognitively activating recent ties than when activating dormant ties.

**The Recency Heuristic as a Double-Edged Sword**

As discussed above, the recency heuristic in CNA provides the advantage of speed, as this method of cognitive search requires less cognitive effort (Higgins, 1996). Furthermore, the set of ties available in recent memory are likely to be the same ties with whom the individual has recently interacted (Hammer, 1984). In most situations, such ties are more likely to provide necessary information than dormant ties, for multiple reasons. Firstly, they are likely to be physically proximate (Burt, 2000). The tendency to retain geographically homophilous – i.e. co-located – ties as opposed to more distant ones implies that, at any given moment, our recent network will contain more geographically proximate ties (McPherson, Smith-Lovin, and Cook, 2001). For purposes of information-seeking, proximate ties are useful, simply because it “takes more energy to connect to those who are far away than those who are readily available” (McPherson, Smith-Lovin, and Cook, 2001: 429). Second, recent interaction with others serves to update our knowledge of the information or resources they have access to (Borgatti and Cross, 2003). It is thus more likely that recent ties will, in fact, have the resources we seek, and which we attribute to them, than those of whom we have less up-to-date knowledge. Third, approaching contacts with whom we have recently interacted spares us the possible discomfort of reconnecting with people after longer periods of time (Levin, Walter, and Murnighan, 2011b).

While recent ties provide clear advantages with respect to accessibility, they are also less likely to provide truly novel information. In most everyday situations, this shortcoming is unlikely to be a serious impediment. Take, for example, an employee seeking a quick solution to a
relatively simple problem. In such a case, quick and effortless access to a solution is much more important than the novelty of that solution. Thus, asking one of the first colleagues that come to mind is likely to suffice. In other cases, however, we may require information that is very different from our own, or provides a different perspective. The importance of such endeavors lies in the fact that access to novel and non-redundant information is a core antecedent of creativity and innovation (Perry-Smith and Shalley, 2003; Obstfeld, 2005). Therefore, the success of these search efforts is of key importance to organizations (Anderson, Potocnik, and Zhou, 2014).

It is precisely in these critical situations that the temporal bias produced by the recency heuristic becomes a major impediment. Take, for example, the case an entrepreneur looking for a fresh perspective on a business idea, or a manager searching for information leading to a creative solution. In such cases, consulting contacts with whom he/she has recently interacted will likely result in redundant information (McFadyen and Cannella, 2004). This is because these people are likely to be the same ones with whom he/she frequently interacts (Pachur, Schooler, and Stevens, 2013), or is emotionally closer to (Hill and Dunbar, 2003). Conversely, dormant ties are likely to provide the non-redundant information (Levin, Walter, and Murnighan, 2011a) that is required for creative solutions (Perry-Smith and Shalley, 2003).

In retrieving information from memory, a balance must be struck between speed and quality (Schooler and Hertwig, 2005). If speed is more important, then the exclusion of dormant ties from the scope of cognitive search is likely beneficial. However, when characteristics of the target resource raise the value of non-redundant information, solution quality – its degree of novelty – becomes more important than search speed. Thus, investing extra cognitive effort into activating dormant ties is likely to pay off, as the value of the potentially novel and non-redundant information they provide outweighs the difficulty of recalling them.

However, the fact that activating dormant ties may be beneficial for certain purposes does not imply that individuals will readily do so. Accordingly, recent research has shown that individuals vary in the extent to which they are able to exploit their potential social capital (Anderson, 2008, Elliott, Haney, and Sams-Abiodun, 2010; Smith, Menon, and Thompson, 2012; Carnabuci and Dióslezgi, 2015). This suggests that we may also observe significant inter-individual differences in the extent to which individuals cognitively activate dormant ties in situations where this would be appropriate.
Wielding the Sword

An especially promising direction in which to search for inter-individual differences pertaining to dormant tie activation is the personality trait Self-monitoring (Snyder, 1974). This trait is related to individual differences in the ability to control expressive behavior and self-presentation (Snyder, 1974; 1979). Since individuals characterized as high self-monitors pay more attention to the social context around them, they are better able to adapt their behavior to it (Berscheid et al., 1976; Kilduff and Day, 1994). The topic has become highly relevant to research on social networks (Mehra, Kilduff, and Brass, 2001; Sasovova et al., 2010; Kleinbaum, Jordan, and Audi 2015). Due to their ability to interact with a diverse set of contacts, Self-monitoring has been considered analogous to network brokerage (Burt, Kilduff, and Tasselli, 2013). Accordingly, high self-monitors’ superior networking skills have been linked, among others, to higher job performance (Day and Schleicher, 2006) workplace mobility (Kilduff and Day, 1994), and leadership (Ellis et al., 1988).

High self-monitors are of theoretical interest to us because their behavioral and cognitive characteristics suggest that they should be more likely to cognitively activate dormant ties when needed. Firstly, high self-monitors are more likely to gain knowledge of the resources held by their network contacts. Second, they are also more likely to access that knowledge when needed. Before moving on to the construction of our key hypotheses, we will discuss in more detail the reason why dormant ties are less likely to elude high self-monitors.

High self-monitors invest significant cognitive effort into gathering information about their social contacts (Snyder and Cantor, 1980; Casciaro, 1998). By paying closer attention to their contacts’ social behavior, they are better able to discern the structure of relations around them (Flynn et al., 2006). Also, not only do they collect more information about members of their personal network, but they also augment this information with the way in which they cognitively organize their networks. The mental representations of high self-monitors are compartmentalized; they organize their relationships according to personal attributes, such as skills or knowledge (Leone, 2006). This is in contrast with low self-monitors, who do so based on emotional intimacy (Leone and Hawkins, 2006). As expressed in their behavior, this results in high self-monitors having different friends for different activities, while low self-monitors prefer to take part in most activities with the same, emotionally close set of people (Snyder, Gangestad and Simpson, 1983). Furthermore, high self-monitors are also able to recall information about others more readily than low self-monitors (Berscheid et al., 1976; Hosch and Platz, 1984). This ability is augmented by the fact that high self-monitors tend to form more extreme impressions of others (Berscheid et al., 1976), which may increase the salience and distinctiveness of certain people in their minds. Due to these reasons, when searching their networks for resources, high self-monitors can rely on a broad repository of person-related knowledge, which they have accumulated through observing those around
them. In other words, the people in their network are already cognitively mapped to their respective resources.

Possessing this knowledge, however, does not necessarily imply its timely use. Herein lies the importance of high self-monitors’ other characteristics. Such individuals have been described as being highly goal-oriented (Danheiser and Graziano, 1982; Hauck and Loughead, 1985), striving to be the “right person at the right place and the right time” (Leone, 2006: 636). They are strongly focused on maximizing their own outcomes during social interactions, and subsequently engage in more strategic, instrumental behavior (Danheiser and Graziano, 1982) and networking (Casciaro, Gino, and Kouchaki, 2014). Further, their friendships tend to be utilitarian in nature (Leone and Hawkins, 2006). In terms of cognitively activating network contacts for the purpose of acquiring resources, these characteristics may imply that they put more effort into locating the people who best fit their current needs. As their attitudes have little influence on their behavior (Snyder and Swann 1976), they may more easily overcome the impulse to concentrate on recent ties.

As explained above, the recency heuristic may be considered a double-edged sword, in that it aids networking in most situations, but hinders it in others. Thus, wielding the sword skillfully requires one to use it only when this constitutes an advantage, and to lay it down when it becomes a liability. The characteristics of high self-monitors suggest that such individuals are more likely to have mastered this art. Thus, when their objective does not involve a search for non-redundant information, they can be expected to rely on the recency heuristic as much as their low self-monitoring counterparts. In contrast, when seeking novel and hard-to-access resources, their cognitive and behavioral characteristics will aid them in abstaining from said heuristic. First, they will have accumulated a wealth of knowledge about the resources their contacts have access to. Second, their goal-oriented focus will increase the cognitive salience of the resources they seek, allowing them to fully utilize the knowledge they have accumulated.

We expect this approach to result in the activation of dormant ties when high self-monitors’ objectives require non-redundant information. To clarify, we do not expect high self-monitors to deliberately search their minds for dormant ties, as most individuals are unaware of the potential benefits (Levin, Walter, and Murnighan, 2011b). Instead, dormant ties, along with their unique value in terms of novelty, should be activated as a by-product of high self-monitors’ efforts to utilize their knowledge of network resources. This leads us to our two central hypotheses: we expect high self-monitors to cognitively activate more dormant ties if – and only if – their objective involves a search for novelty.
Hypothesis 2a. When novelty is a crucial aspect of the target resource, high self-monitors will cognitively activate more dormant ties than low self-monitors.

Hypothesis 2b. When novelty is not a crucial aspect of the target resource, there will be no difference in the number of dormant ties cognitively activated by high and low self-monitors.

METHODS

Sample

We collected data using an online, United States sample of 193 individuals. The sample was drawn from Amazon’s Mechanical Turk (www.mturk.com) (henceforth MTurk) (Buhrmester, Kwang, and Gosling, 2011; Mason and Suri, 2012). MTurk is increasingly being used for research purposes in the field of management, and has proven to be a reliable source of representative data (e.g. Kovács, Carroll, and Lehman, 2013; Casciaro, Gino, and Kouchaki, 2014).

Procedure

We collected our data in two sessions (for an overview of measurement order, see Appendix A). The first session was aimed mainly at screening out inattentive respondents (see Appendix B for a list of screening procedures), while the second session involved collecting the key variables of the study. Respondents were paid at the end of each session (for a description of further incentives, see Appendix C).

Our methodology was designed in such a way as to address our three hypotheses, while at the same time controlling for a number of alternative explanations. We developed a three-step methodology to address each prediction separately. All three tasks followed the same structure: before the task began, respondents were informed that they will be asked to name a certain number of items, in the order in which they come to their mind. As they proceeded, we measured the time they took to produce their answers. Afterwards, we asked respondents a number of questions pertaining to the items – or persons – they listed.

Our aim with the first task was to control for differences in the ability to recall non-social (semantic) information from memory, as this may also affect social recall (Hills and Pachur, 2012). We therefore asked respondents to name any 30 cities, in the order in which they came to their mind (Gronlund and Schiffrin, 1986).
The second task involved asking respondents to recall information about their social contacts, in such a way that novelty was unimportant, and only accessibility mattered. We selected a target resource that is fairly abundant, and likely to be independent from the structure and content of respondents’ networks. This latter aspect is important, as it allows us to empirically separate the cognitively activated network from the full set of network contacts. Doing so would be difficult with the frequently used name generator (Burt, 1984) or resource generator (Van Der Gaag and Snijders, 2005) approaches. Thus, we asked respondents to “write the first names or nicknames of 20 people [they] know personally that wear glasses, either always or only sometimes. Regular glasses only, not contacts or sunglasses.” This way, respondents’ only objective was to recall names as quickly as possible without regard to their uniqueness.

The third task maintained the objective of network recall but added the element of novelty. We asked respondents to indicate the city from which they know the most people, as well as a favorite performer. Next, we asked them to think of all their social contacts, and to list those who might be able to grant them access to a backstage pass to their chosen performance, or might know others who could. We also specified that tickets are not available for purchase, and can only be accessed through personal contacts. A minimum of three responses was required to complete the task, and a maximum of 30 responses was possible. The task was designed in such a way that novelty — access to information outside the individual’s reach — was more important than the cognitive accessibility of contacts. Since dormant ties may provide exceptionally novel information (Levin, Walter, and Murnighan, 2011a), activating such contacts during this task is likely to be advantageous.

**Dependent Variables**

We measured *Cognitive activation speed* in the novelty-independent CNA task as the average amount of time a respondent spent thinking before writing down a name. That is, we first subtracted the time respondents spent typing from the total time spent on the task, and then divided this number by the number of names listed (20). This way, our measure is not affected by differences in typing speed.

We measured the *Number of activated dormant ties* as the total number of dormant ties the respondent activated in the given CNA task. This data was collected following completion of the respective CNA task. To assess whether or not a given tie is dormant, we relied on two criteria. First, following Levin and colleagues (2011a), we asked respondents whether they had any face-to-face interaction with the given person within the last three years. Second, we asked respondents whether this person had been on their mind, in any way, within the last seven days. We included this second criterion to better match our underlying theory, as recently thinking of a dormant tie may temporarily increase that person’s cognitive salience.
in our minds. Thus, we considered a tie to be dormant if respondents provided a negative response to both questions.

**Independent Variables**

We used the *Number of activated dormant ties* as an independent variable in testing our Hypothesis 1. Our measure of *Self-monitoring* relied on the 25-item Self-monitoring Scale (Snyder, 1974). The instrument was found to have good test-retest reliability (Snyder, 1974; 1987), and sufficiently high inter-item correlations (Day, Schleicher, and Unckless, 2002). Studies examining its relation to other, theoretically relevant variables have found evidence of discriminant validity (Snyder, 1979). We asked respondents to indicate whether a statement is true or false about them (e.g. “When I am uncertain how to act in a social situation, I look to the behavior of others for cues.”). Possible values for the measure ranged between 0 and 25, where higher values (13-25) indicated high Self-monitoring and low values (0-12) indicated low Self-monitoring.

**Controls**

We included an extensive set of controls to rule out possible alternative explanations of our results (see Appendix D for a detailed description of our control variables). To account for differences in the ability to recall social contacts or information in general, we controlled for *Semantic recall speed*, *Cognitive activation speed* in the novelty-independent and novelty-dependent tasks, as well as for working memory (Kirchner, 1958). To rule out explanations related to differences in mental state, we added controls for *Mental alertness*, as well as for anxiety (Spielberger, 1983). With the aim of addressing differences in networking behavior, we controlled for *Need for cognition* (Cacioppo, Petty, and Kao, 1984), *Sociability* (Cheek and Buss, 1981) and *Network size*. In addition, we included two variables to account for the cognitive salience of certain ties: *Daily Facebook use* and *Wearing glasses*. Finally, we added the demographic controls of *Age*, *Gender*, and *Education*.

**Analyses**

To test Hypothesis 1, we used an ordinary least squares regression model, with the natural logarithm of Cognitive activation speed in the novelty-independent CNA task as our dependent variable. Alongside inclusion of our key independent variable – the number of
activated dormant ties —, we included several control variables to account for differences in, among others, working memory, semantic recall speed, and level of anxiety. An extensive set of tests showed that our data meet the assumptions of an OLS regression model. For a detailed description of robustness checks for our three reported models, see Appendix E.

Testing Hypothesis 2 required a different approach. The number of activated dormant ties in the novelty-dependent CNA task was a count variable, taking integer values from zero upwards. The most commonly used procedure for analyzing such data is a Poisson regression (Reuer and Ragozzino, 2006; Cameron and Trivedi, 2013). We tested the data for overdispersion and found no indication of this being the case. We obtained robust standard errors for our parameter estimates, to account for mild violations of the equidispersion assumption (Cameron and Trivedi, 2009). We found the data to meet the requirements of Poisson regression, and to fit the data reasonably well (deviance goodness-of-fit: $p = 0.27$).

In addition to a number of other control variables, we included the number of activated dormant ties in the novelty-independent task, in order to empirically separate the activation of dormant ties for instrumental purposes from any other inter-individual differences in the tendency to activate such ties. Furthermore, we controlled for activation speed in the current task, to account for differences in the amount of effort respondents invested in solving the task.

When constructing our model to test Hypothesis 3, we found that the number of activated dormant ties presents a case of overdispersion. Since this violates the assumption of the Poisson model that the variance equals the mean, we instead used a negative binomial regression model (Tortoriello and Krackhardt, 2010). This model adds a stochastic component to the Poisson model, allowing it to handle overdispersion. Consequently, the negative binomial model produced a better fit than the more restrictive Poisson model.

**RESULTS**

**Descriptive Statistics**

In support for our methods, it is worth mentioning that the mean activation speeds in our three tasks provide clear evidence as to their ordering in terms of increasing cognitive complexity. In the semantic recall task, the average speed was 20.9 cities per one minute of thinking time. In the novelty-independent CNA task, average speed was lower: 14.6 names per minute. Finally, in the novelty-dependent CNA task, this value was as low as 7.0.
Table 1

Descriptive Statistics and Correlations
Means, standard deviations and correlations are presented in Table 1. We begin by noticing that the number of activated dormant ties in the novelty-independent CNA task is negatively correlated with activation speed in the same task (beta = -0.24, p<0.01). This provides prima facie evidence to our Hypothesis 1. We also observe a lack of correlation between Self-monitoring and the number of activated dormant ties in the novelty-dependent task (beta = 0.11, p = n.s.). The reason for this is that age is negatively correlated with Self-monitoring (b = -0.20, p < 0.01) (Reifman, Klein, and Murphy, 1989), but positively with the number of activated dormant ties (b = 0.15, p < 0.05). These results highlight the importance of controlling for age. Finally, and in line with our Hypothesis 2b, we do not observe any correlation between Self-monitoring and the number of activated dormant ties in the novelty-independent task (beta = -0.06, p = n.s.).

Empirical Analyses and Results

Activation speed (Hypothesis 1). The results of our OLS regression analysis are presented in the first column of Table 2. As expected, the number of activated dormant ties has a significant, negative effect on activation speed (b = -0.05, p < 0.05). In other words, activating more dormant ties will slow down activation, and vice versa; activating less (or none at all) will contribute to speed. This result provides support for Hypothesis 1. In addition, we uncovered positive effects of working memory (3-back) and semantic recall speed, and negative effects of anxiety.

Dormant tie activation in the novelty-dependent CNA task (Hypothesis 2a). The second column of Table 2 shows the results of our Poisson regression model, with the number of ties activated in the novelty-dependent task as our dependent variable. These results provide support for Hypothesis 2a: Self-monitoring has a significant, positive effect on the number of activated dormant ties (b = 0.07, p < 0.05). Interestingly, semantic recall speed also has a positive effect, suggesting that semantic information recall may play a role in the retrieval of resource-related information.

Dormant tie activation in the novelty-independent CNA task (Hypothesis 2b). The results of our negative binomial model are presented in the third column of Table 2. We see that Self-monitoring has no discernible effect on the number of dormant ties activation in the novelty-independent task (b = -0.00, p = 0.80). This result supports our arguments formulated in Hypothesis 2b, in that Self-monitoring only affects dormant tie activation when the current objective calls for locating novel information.
<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Variable</th>
<th>H1 Cognitive activation speed (Novelty-independent CNA task)</th>
<th>H2a Number of activated dormant ties (Novelty-dependent CNA task)</th>
<th>H2b Number of activated dormant ties (Novelty-independent CNA task)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td></td>
<td>OLS(^a)</td>
<td>Poisson(^b)</td>
<td>Negative binomial(^a)</td>
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<td>Regression model</td>
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<td>Variable</td>
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<td>Constant 1.47 (0.85)</td>
<td>Self-monitoring 0.07* (0.03)</td>
<td>Number of activated dormant ties(^c) -0.05* (0.02)</td>
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<td>(0.03)</td>
<td>0.20*** (0.03)</td>
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<td>Network size(^d)</td>
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<td>Semantic recall speed 0.02*** (0.00)</td>
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<td>Cognitive activation speed(^c) -0.02* (0.01)</td>
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<td>Cognitive activation speed(^d) -0.07* (0.03)</td>
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<td>Working memory (3-back) 0.94** (0.29)</td>
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<td>Daily Facebook use 0.23* (0.11)</td>
<td>Sociability -0.02 (0.01)</td>
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<td>Education -0.02 -0.12(^d) (0.04)</td>
<td>Age 0.00 (0.00)</td>
<td>Gender -0.15 -0.12 (0.11)</td>
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<td>(0.07)</td>
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<td>Wearing glasses -0.13 (0.11)</td>
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<td>(0.11)</td>
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<td>R(^2)</td>
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<td>0.01(^f)</td>
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<td>Likelihood-ratio</td>
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<td>Wald chi-square statistic 171.63***</td>
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\(^a\) Figures in parentheses are the standard errors of the coefficients.  
\(^b\) Figures in parentheses are the robust standard errors of the coefficients.  
\(^c\) Novelty-independent CNA task  
\(^d\) Novelty-dependent CNA task  
\(^e\) p < 0.10; \(^f\) p < 0.05; \(^g\) p < 0.01; \(^h\) p < 0.001  
\(^i\) McFadden's pseudo R-squared  
\(^j\) McFadden's adjusted pseudo R-squared
Additional Analyses

To further probe the nature of these effects, we conducted a set of additional analyses. We began by examining the way in which the activation of dormant ties acts to slow activation speed. To do this, we calculated the ratio of all respondents who activated a certain kind of tie for each of the 20 people listed in the novelty-independent CNA task. Here, we separated ties depending on whether they were recent and/or dormant. Figure 1 provides an illustration of how the cognitive salience of these ties changed as the task progressed. When activating the first person, 88 percent of respondents listed a recent (and non-dormant) tie, while only three percent listed a dormant (and non-recent) tie. This difference provides additional evidence as to the low cognitive salience of dormant ties, as opposed to those more recent in memory. As the task progressed, respondents began activating less salient ties more often. This may be because their set of recent contacts was being exhausted, and/or because their streams of thought gradually carried them farther into their network. Finally, it is interesting to note that the ratio of dormant ties which have been on respondents’ mind recently continued to stay at a very low, constant level. In this case, the high salience of recent ties may counteract dormant ties’ low accessibility. Nonetheless, the scarcity of such ties shows that, even with the advent of online communication, the salience of dormant ties continues to remain very low.

Figure 1

![Proportion of tie types by order of activation](image-url)
We also calculated, in the novelty-independent task, the mean amount of time respondents needed to activate certain ties. Our t-tests indicated that the mean activation time for recent (and non-dormant) and for dormant (and non-recent) ties are significantly \( p < 0.01 \) different. Mean activation time for the former was 6.05 seconds, as compared to 10.28 seconds for the latter. These results further confirm our Hypothesis 1, in that dormant ties are indeed more difficult to activate than recent ones.

Next, we turned to a deeper examination of our Hypothesis 2a. As our argument specifically concerns dormant ties, irrespective of their tie strength, we ran an additional analysis controlling for tie strength. Tie strength was conceptualized in terms of emotional intensity, which has been shown to be its strongest predictor (Marsden and Campbell, 1984, 2012). We used a five-point Likert scale to measure tie strength, where higher values indicated emotionally closer ties (Kogovšek et al., 2002). We then averaged all tie strengths to create our \textit{Mean tie strength} variable. This variable was included as a control in our regression analysis of the number of activated dormant ties in the novelty-dependent task. The effect of Self-monitoring weakened slightly, but remained significant \( b = 0.6, p < 0.05 \). This confirms our argument that the higher number of dormant ties in high self-monitors’ activated networks is not simply an artifact of more weak ties.

\section*{DISCUSSION}

The point of departure of this study was the question of how the value of dormant ties may be realized, given that our cognitive heuristics inhibit their activation. In providing an answer, we emphasized that whether or not the recency heuristic supports or impedes networking is contingent on the nature of one’s objective; specifically, on the relative importance of non-redundant information. When the non-redundancy of information is less critical than the speed with which it is accessed, the recency heuristic acts in our interest. However, when seeking non-redundant information, this same heuristic becomes a hindrance. In such cases, individuals must strive to circumvent this automatic process, if they are to harness the potential of dormant ties.

How this may be achieved, however, is far from straightforward. Most people are unaware of the potential value of dormant ties (Levin, Walter, and Murnighan, 2011b), and thus cannot be expected to search for them purposefully. Instead, what is needed is a dual approach. First, individuals must acquire information pertaining to their contacts’ resources, in order to draw upon this knowledge when needed. Second, they must focus their cognitive processes on the resource they seek, and not on their relationships with their contacts. In this way, members
of their networks who may have access to this resource become more salient, irrespective of whether or not these ties are dormant.

Here, we provided evidence to our argument by way of the personality trait Self-monitoring. However, it should be noted that we do not claim Self-monitoring to directly influence dormant tie activation. Rather, having the cognitive and behavioral characteristics associated with high Self-monitoring makes individuals more likely to both acquire and organize resource-relevant information about their contacts, as well as to center their cognitive search efforts around this information. This, in turn, implies that there may well be other cognitive or personality traits which, by way of these same mechanisms, make dormant tie activation more likely. While Self-monitoring is considered to be a stable trait (Kilduff and Day, 1994), future research might identify other relevant ones, some of which may be more malleable and responsive to conscious training.

Our research provides two main contributions to extant work on social networks. First, we advance our understanding of the social capital of dormant ties (Levin, Walter, and Murnighan, 2011a; Vissa, 2012; McCarthy and Levin, 2014). While previous studies have shed light on the potential value of such connections, our study adds a different perspective, accentuating the role played by cognition in realizing the latent value of dormant ties. Incorporating a cognitive perspective into research on dormant ties is critical, as the greatest obstacle to unlocking dormant ties’ potential appears to be of cognitive nature.

Second, we complement extant work on the cognitive and psychological foundations of social networks (Mehra, Kilduff, and Brass, 2001; Anderson, 2008, Kilduff and Krackhardt, 2008). This emerging stream of inquiry departs from the “structuralist” perspective most often utilized in social network research (Emirbayer and Goodwin, 1994), focusing instead on inter-individual psychological differences in the ability to make use of social networks. Recent work in this area has begun to explore the process of CNA, uncovering substantial differences in how individuals call their networks to mind (Smith, Menon, and Thompson, 2012; Menon and Smith, 2014; Shea et al., 2015). Our work contributes to this research by connecting it with insights on dormant ties. Our results show that we are largely “blind” to dormant ties, due to consistent patterns in CNA. Given the high potential value of such ties (Vissa, 2011; Mariotti and Delbridge, 2012), we expect research into the cognitive activation of dormant ties to be especially promising.

More broadly, our work may also inspire research on local versus distant search (Levinthal, 1997; Gavetti and Levinthal, 2000), in that positioning these search strategies within a temporal setting may require alterations to how the two approaches are conceptualized. That is, while local search is usually related to learning from the past – going backwards in time –, and distant search to experimenting with new possibilities – going forward in time – (Gavetti
and Levinthal, 2000), the case we present is quite different. Here, both approaches are related to the past; recent ties to the recent past, and dormant ties to the distant past. The former approach is faster and safer, but does not provide the novelty potential of the latter, which, conversely, requires more effort and entails more uncertainty. It therefore appears to be the case that, with respect to search in a temporal dimension, conceptualizations of local and distal search may be in need of reappraisal.

Going further, this study may also prove valuable to research dealing with exploration-exploitation (Levinthal and March, 1993; O’Reilly and Tushman, 2013). Scholars in this field have often attempted to resolve this dilemma by way of contingency arguments, in that whether exploration or exploitation is a superior option is contingent on a variety of contextual factors (Lavie, Stettner, and Tushman, 2010). However, insofar as the effortless reliance on recent ties, as opposed to the more energy-intensive exploration of temporally distant ties is akin to, respectively, exploitation and exploration, our research may provide an interesting insight. This is because the cognitive activation of dormant ties, as opposed to recent ones, raises two questions. First, and thus far in line with contingency arguments dealing with exploration-exploitation, we argue that the superiority of one or the other is contingent on the nature of the objective. However, the dominating presence of the recency heuristic raises an additional question: to what extent are decision-makers aware of, and able to utilize, an exploratory approach? Thus, our research may contribute to the exploration-exploitation literature by emphasizing that it is not enough to determine which approach is better in a given situation, since the two options may not be equally available to all individuals.

Although not explicitly explored in this study, our findings may also inform research on cognitive flexibility (Martin and Rubin, 1995; Diamond, 2013). Cognitive flexibility is key to the ability to switch between modes of cognition; switching at the right time may result in better performance (Laureiro-Martínez, Brusoni, and Zollo, 2010; Laureiro-Martínez et al., 2013). More specifically, it allows one to deautomatize cognitive processes when current objectives so require (Moore and Malinowski, 2009), that is, when awakening dormant ties may be beneficial. For this reason, cognitive flexibility may well play a role in individuals’ ability to dynamically switch from more to less automatic search. This possibility is not incompatible with our results. Self-monitoring has been associated with cognitive flexibility (Martin and Rubin, 1995), as the ability to adapt to very different social contexts makes it necessary to deal with, and dynamically switch between, multiple perspectives (Nohria, 1992) and role sets (Granovetter, 1983). However, as our data does not allow for an examination of this theoretical link, more research would be necessary to better understand the relationship between cognitive flexibility and network activation.

Finally, an important limitation of our study is that we did not examine the extent to which CNA translates into actual networking behavior. Although network activation has been
theorized to be an antecedent to networking behavior (Menon and Smith, 2014), this relationship remains to be empirically confirmed. Doing so may require an experimental study. For example, researchers could ask respondents first to cognitively activate contacts for a given purpose, and to then use their networks to find the resource they seek. We hope that future studies using such experimental designs will further our understanding of the link between cognition and networking behavior.

Managerial Implications

This research may also prove valuable to management practitioners who are heavily reliant on their network resources. As our study shows, our own mental processes may prohibit us from making full use of our networks’ value. Until we gain more clarity with regard to how these processes may be used strategically and to our advantage, a viable first step is for practitioners to become aware of their existence. Thus, when thinking of who to turn to for novel insights or information, we may already partly overcome our cognitive limitations by consciously attempting to remember those with whom we’ve lost contact.

Entrepreneurs are a prime example, since the success of their search efforts play an important role in startup performance (Nohria, 1992). Not surprisingly, dormant ties have been shown to be very useful to entrepreneurs, as these contacts may become valuable exchange partners (Vissa, 2011). Therefore, by expanding their horizons beyond their immediate temporal environment, entrepreneurs may gain access to vital resources. Managers present another example. Research has shown that the ability to access diverse and relevant information is key to managers’ success, allowing them to notice new trends and achieve higher performance (Anderson, 2008). However, continually growing their networks to increase diversity may be counterproductive, and may actually result in less new knowledge (Mariotti and Delbridge, 2012; McFadyen and Cannella, 2004). Instead, managers may do well to make use of their existing networks (Menon and Smith, 2014). Reconnecting dormant ties may thus provide novelty without the need to form new contacts (Levin, Walter, and Murnighan, 2011b). In doing so, however, managers should be aware of their own temporal biases, and consciously attempt to overcome them, in order to realize the full potential of their networks.
REFERENCES


Cameron, A. C., and P.K Trivedi. 2009. Microeconometrics using STATA. College Station, Texas: StataCorp LP.


APPENDIX A

Data collection order

<table>
<thead>
<tr>
<th>session</th>
<th>order</th>
<th>data collected</th>
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<tr>
<td>1</td>
<td>1</td>
<td>Nationality</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>English comprehension</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>Working memory</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>Frequency of Facebook use</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>Software test</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Willingness to participate in second wave</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Age</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Gender</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>State-Trait Anxiety Inventory</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Mental alertness</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Semantic recall task</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Novelty-independent CNA task</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>Wearing glasses</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>Novelty-dependent CNA task</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>Task strategy (qualitative)</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>Sociability</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
<td>Need for cognition</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>Self-monitoring</td>
</tr>
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## APPENDIX B

### Summary of screening procedures used

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<tr>
<th>Stage</th>
<th>Screening criteria</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification for Session 1</td>
<td>Mturk registered location is not United States</td>
<td>May not properly understand English instructions</td>
</tr>
<tr>
<td>Qualification for Session 1</td>
<td>Mturk approval rate (% of work that was accepted) less than 95%</td>
<td>Likely to be inattentive and careless</td>
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<tr>
<td>Qualification for Session 1</td>
<td>Less than 100 Mturk jobs completed.</td>
<td>May be inexperienced with basic platform functionality</td>
</tr>
<tr>
<td>Qualified for Session 1</td>
<td>Participated in pilot studies</td>
<td>Familiarity with survey items</td>
</tr>
<tr>
<td>Screened after Session 1</td>
<td>Failed attention check (O’Reilly et al., 2014)</td>
<td>Inattentive to instructions and/or questions</td>
</tr>
<tr>
<td>Screened after Session 1</td>
<td>Implausibly fast survey completion</td>
<td></td>
</tr>
<tr>
<td>Screened after Session 1</td>
<td>Completely oppositional answers to near-identical survey items</td>
<td></td>
</tr>
<tr>
<td>Screened after Session 1</td>
<td>Unusually high number of invalid responses in working memory task</td>
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</tr>
<tr>
<td>Screened after Session 1</td>
<td>English comprehension level (reading, writing, speaking) indicated to be low</td>
<td>May not properly understand English instructions</td>
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<td>Screened after Session 1</td>
<td>IP-based location is not United States</td>
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</tr>
<tr>
<td>Screened after Session 1</td>
<td>Nationality is not United States</td>
<td>Large part of network may be inaccessible</td>
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<tr>
<td>Screened after Session 1</td>
<td>Did not indicate willingness to participate in Session 2</td>
<td>Unwilling to complete study</td>
</tr>
<tr>
<td>Screened after Session 1</td>
<td>Error in software test for upcoming cognitive tasks</td>
<td>Software errors may prevent proper data recording</td>
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<tr>
<td>Screened after Session 1</td>
<td>Error in software for working memory task</td>
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<tr>
<td>Qualification for Session 2</td>
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<td>Did not indicate very good understanding of English instructions</td>
<td>May not properly understand English instructions</td>
</tr>
<tr>
<td>Qualification for Session 2</td>
<td>Uses unsupported device or browser</td>
<td>Software errors may prevent proper data recording</td>
</tr>
<tr>
<td>Screened after Session 2</td>
<td>Data not recorded properly</td>
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</tr>
<tr>
<td>Screened after Session 2</td>
<td>IP-based location is not United States</td>
<td>May not properly understand English instructions</td>
</tr>
<tr>
<td>Screened after Session 2</td>
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<td>Inattentive to instructions and/or questions</td>
</tr>
<tr>
<td>Screened after Session 2</td>
<td>Failed instructional manipulation test (Oppenheimer, Meyvis, and Davidenko, 2009)</td>
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</tr>
<tr>
<td>Screened after Session 2</td>
<td>Verbal explanations of task strategy indicate erroneous task interpretation or completion</td>
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<tr>
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<td>Failed to understand instructions, as indicated by pre-task checks</td>
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<tr>
<td>Screened after Session 2</td>
<td>Invalid responses in cognitive tasks</td>
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</tr>
<tr>
<td>Screened after Session 2</td>
<td>Indicated being interrupted during cognitive tasks</td>
<td>Measurement imprecision</td>
</tr>
</tbody>
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APPENDIX C

Performance incentives

<table>
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<tr>
<th>incentive</th>
<th>affected performance aspect</th>
<th>source</th>
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</thead>
<tbody>
<tr>
<td>cordial and detailed information about importance of study</td>
<td>commitment</td>
<td>additional</td>
</tr>
<tr>
<td>possibility of future work if current work found acceptable</td>
<td>work quality</td>
<td>additional</td>
</tr>
<tr>
<td>possibility of providing comments</td>
<td>commitment</td>
<td>additional</td>
</tr>
<tr>
<td>promise that work will be thoroughly checked for quality</td>
<td>work quality</td>
<td>additional</td>
</tr>
<tr>
<td>monetary compensation</td>
<td>participation</td>
<td>built-in</td>
</tr>
<tr>
<td>piece rate payment</td>
<td>work speed</td>
<td>built-in</td>
</tr>
<tr>
<td>possibility of access to additional work from same employer</td>
<td>work quality</td>
<td>built-in</td>
</tr>
<tr>
<td>possibility of non-payment for subpar work</td>
<td>work quality</td>
<td>built-in</td>
</tr>
<tr>
<td>single account (based on proof of identity)</td>
<td>work quality</td>
<td>built-in</td>
</tr>
<tr>
<td>work qualification based on rejection rate</td>
<td>work quality</td>
<td>built-in</td>
</tr>
</tbody>
</table>

APPENDIX D

Description of Control Variables

We measured recall speed in the semantic recall task (Semantic recall speed), as well as in the novelty-dependent and novelty-dependent CNA tasks (Cognitive activation speed), by dividing the total thinking time (i.e. excluding time spent typing) by the number of items (cities or network contacts) the respondent activated.

We controlled for respondents’ mental state in two ways. First, we controlled for Mental alertness, to account for the fact that mental exhaustion may affect cognitive performance. We created this variable by averaging responses to two questions: “How tired are you at the moment?; How sleepy do you feel right now?”. Both items used a five-point Likert scale. Second, we added two variables to account for anxiety levels, using the State and Trait Anxiety Inventory (STAI) (Spielberger, 1983). The measure consists of two scales, one for current level of anxiety (State Anxiety) and one for long term anxiety (Trait Anxiety). Both scales comprise 20 items, and use a four-point Likert scale to indicate how respondents feel right now and generally. Accounting for anxiety is important because high levels of stress tend to hinder the ability to recall social contacts (Takahashi et al., 2004).

We assessed working memory using the N-back task (Kirchner, 1958), which required respondents to indicate, while viewing a quickly changing string of letters, whether or not the letter appearing on the screen is the same as the one they saw two (and later, three) positions before. The N-back is the most widely used measure for working memory (Conway et al., 2005). We used the mean reaction time for correct answers as our measure (Honey et al., 2000), both for the 2-back (Working memory (2-back)) and the more difficult 3-back (Working memory (3-back)).
memory (3-back)) tasks. Working memory was included because it may affect individuals’ ability to recall their social contacts (Hills and Pachur, 2012).

We measured Need for cognition using the Need for Cognition Scale (Cacioppo, Petty, and Kao, 1984). The instrument comprises 18 questions, and uses a nine-point Likert scale. We added this variable due to its effects on networking behavior (Anderson, 2008).

Our measure of Sociability used the Sociability subscale of the Cheek and Buss Shyness and Sociability scale (Cheek and Buss, 1981). The inventory consists of five items, and uses a five-point Likert scale. We included this variable to account for differences in social interaction (Asendorpf and Wilpers, 1998).

Activated network size for the novelty-dependent CNA task indicates the number of contacts the respondent listed, ranging from a minimum of 3 to a maximum of 30.

We included the variable Wearing glasses as a dummy variable to show whether the respondent wears glasses, either all the time or occasionally. We included this control as people who wear glasses may be more attentive to glasses on others, and may thus find recalling them easier.

We measured Daily Facebook use as a dummy variable, indicating whether or not the respondent uses Facebook on a daily basis. We included this variable as frequent Facebook use may increase the cognitive salience of certain ties (Menon and Smith, 2014).

Finally, we controlled for a number of demographic differences. We included Age to account for the fact that older respondents may find recall more difficult (Hills et al., 2013), and Gender to account for possible differences in networking behavior (Burt, 1998). We measured Education as an eight-point ordinal scale pertaining to respondents’ highest completed level of education. We included this variable because those with higher education may have accumulated more dormant ties from their previous studies.

APPENDIX E

Robustness checks

Hypothesis 1. We utilized a set of diagnostics to ensure that our data meets all the assumptions of OLS regression analysis. Graphical and formal analyses indicated that the residuals are normally distributed (Shapiro-Wilk test for normality: p=0.51). (Shapiro and Wilk, 1965) We found no indication of heteroskedasticity (Cameron and Trivedi’s decomposition test: p = 0.52), multicollinearity (highest VIF = 2.51), model specification error, or non-linearity of parameters (Cameron and Trivedi, 1990). Studentized residuals were below two in all but
ten cases. Two of these were above 2.5, and one was above three. We did not observe any unusual characteristics in these respondents’ data, with the exception of the highest residual. This respondent indicated extremely high levels of anxiety. However, the number of high residuals (10) approximates the number of respondents (9.65) that could be expected to lie outside of two standard deviations in a normally distributed sample of 193 individuals. We therefore did not exclude these respondents from our analysis. Additional analyses showed that doing so does not alter the direction, nor the significance level, of our variable of interest.

Hypothesis 2a. The distribution of the number of activated dormant ties in the novelty-dependent CNA task did not allow for the use of OLS regression, as the assumptions of the linear model were violated. Residuals were not normally distributed (Shapiro-Wilk test for normality: p=0.00), heteroskedasticity was apparent (Cameron and Trivedi’s decomposition test: p = 0.00), and the distribution was highly (positively) skewed. We therefore utilized a Poisson regression model, which is standard procedure when analyzing count variables taking only non-negative integer values (Reuer and Ragozzino, 2006; Cameron and Trivedi, 2013). This approach, however, relies on the assumption that the variance is equal to the mean. We therefore compared our model with a negative binomial model (which allows for overdispersion). A Likelihood-ratio test of alpha=0 indicated that overdispersion is not high enough to necessitate such a model (p = 0.50). Nonetheless, we estimated our coefficients using robust standard errors, in order to account for mild violations of the equidispersion assumption (Cameron and Trivedi, 2009). We did not specify an exposure variable. Although network size limits the range of the dependent variable, its relationship with the logarithm of the latter is non-linear. Setting such an exposure variable would violate the assumptions of the Poisson model. Therefore, we instead included network size as a control. Furthermore, we did not specify a zero-inflated model. This would be necessary if a certain variable categorically determined whether or not respondents could activate dormant ties at all. For example, examining the predictors of the number of cigarettes smoked per day would require such a model, to account for whether or not a given respondent smokes at all. As it does not seem theoretically plausible in our case that any respondents would be categorically barred from activating dormant ties, using a zero-inflated model was not necessary. We did not find any indication of omitted variables, nor of multicollinearity (highest VIF = 2.63). A Wald chi-square test result of 171.63 (p < 0.00) indicated that at least one of the coefficients in the model was different from zero. Furthermore, as the deviance goodness-of-fit chi-squared test was not significant (p = 0.27), we concluded that our model fits the data reasonably well.

Hypothesis 3. For the same reasons as described above, analyzing the predictors of the number of activated dormant ties in the novelty-independent CNA task was not possible using OLS regression, but instead required a Poisson model. In this case, however, we did find an indication of overdispersion (Likelihood-ratio test of alpha=0, p = 0.00). We therefore used a
negative binomial model (Tortoriello and Krackhardt, 2010). This model adds a stochastic component to the Poisson model, allowing it to accommodate for overdispersion. We did not consider specifying an exposure variable, as all respondents named exactly 20 contacts. Also, for the same reason as above, using a zero-inflated model was not necessary. There was no indication of omitted variables or of multicollinearity (highest VIF = 2.54). Finally, we compared our negative binomial model to a Poisson model, examining the Akaike information criterion (AIC) value (Akaike, 1974). We found a lower value for the negative binomial model, indicating a better fit.
Abstract: Individuals differ in the degree of agency they exhibit in their networking behavior, that is, in the extent to which their networking is driven by forethought. We argue that, given a minimum level of awareness of one’s network and search target, networking that is more agentic (i.e. forethought-driven) will be more effective. Results of an interactive networking experiment (n=43) suggest that individuals who, in their observed networking, follow through on their task-related forethought, find more relevant information, and are more likely to succeed in their search efforts. In addition, we find that such individuals are characterized by higher levels of cognitive flexibility. As our work links micro-level cognitive characteristics to network outcomes, it may inspire future research on the role of individual agency in social networks.
"In life, as in chess, forethought wins."
Charles Buxton (1823-1871)
English brewer, philanthropist, writer and member of Parliament.

INTRODUCTION

Individuals’ social networks constitute a reservoir of resources which the individual may potentially draw upon (Lai, Lin, & Leung, 1998). To explain differences in the extent to which they are able to do so, most research in the field of social networks has taken a “structuralist” approach (Emirbayer & Goodwin, 1994), arguing that the structure of networks surrounding individuals determine the amount of social capital, and therefore resource access, that they possess (Tsai & Ghoshal, 1998). While this approach to understanding network-related benefits has greatly advanced our understanding of how social structures affect the individuals embedded within them (Burt, 2000), it has also been criticized for downplaying the role of the individual in making use of these networks (Gulati & Srivastava, 2014; Kilduff & Krackhardt, 1994; 2008; Stevenson & Greenberg, 2000).

Conversely, use of the term “networking” (Vissa, 2010) emphasizes the agency of the individual striving to gain access to network resources, and actively engaging in strategic efforts to secure these resources, as opposed to a view of the individual as passive recipient of network benefits dependent on the individual’s position in the network. The key insight on which this approach is based is that individuals differ substantially in the degree to which they are able to benefit from the potential resources within their networks (Anderson, 2008; Carnabuci & Diószegi, 2015). They differ in how they build their networks (Klein, Lim, Saltz, & Mayer, 2004; Mehra, Kilduff, & Brass, 2001), in how they perceive them (Casciaro, 1998; Casciaro & Krackhardt, 1999), in how they mentally evoke them for certain purposes (Menon & Smith, 2014; Smith, Menon, & Thompson, 2012), and in how they differentially approach contacts (Casciaro & Lobo, 2008).

In examining the role of individual agency in networking behavior, it is useful to differentiate between what has been termed cognitive network activation and network mobilization (Smith, Menon, & Thompson, 2012; Menon & Smith, 2014). With the goal of accessing a certain resource, the individual begins by calling to mind a set of potential contacts (network activation), and then selectively approaching some of these contacts in an attempt to secure this resource (network mobilization). Neither step is straightforward. Individuals vary in the kind of contacts they recall for a certain purpose (Fitzsimons & Shah, 2008; Janicik & Larrick, 2005), and also in the kinds of contacts they are willing to approach (Casciaro & Lobo, 2014).
Yet there is a key difference between the two in terms of the individual’s level of agency. Albeit the individual may be biased in multiple ways (Menon & Smith, 2014), the kind of network that he/she activates, along with the degree to which this network may be expected to provide value, is essentially up to the individual. The same cannot be said of network mobilization. Once the individual enacts his/her cognitive activation and begins interacting with others, he/she is no longer the sole agent in the process, in that whether or not these attempts at resource access succeed or fail also depends on the actions of others (Leider, Möbius, & Rosenblat, 2009; Murphy, Rapoport, & Parco, 2006), as well as on social structural dynamics (Coleman, 1988; Obstfeld, 2005).

The degree to which the individual acts as the agent in his/her networking behavior, or in other words, the extent to which his/her networking is driven by forethought, is at the focus of our study. We move beyond a narrow conceptualization of network mobilization, in which the mobilized network is a subset of the activated one (Menon & Smith, 2014). By considering network mobilization to include all kinds of networking activity (Vissa, 2010), that which is preceded by forethought becomes a subset of all networking actions. Other than being initiated by ego, and driven by his/her forethought, interactions may be initiated by others (Leider, Möbius, & Rosenblat, 2009), or may be the result of serendipitous social processes (Nahapiet & Ghoshal, 1998). In attempting to understand how much control individuals have over network outcomes, the extent to which networking is comprised of conscious, goal-oriented and forethought-driven actions is of key theoretical interest to our study. We argue that forethought-driven networking is, under certain conditions, superior to alter-initiated or serendipitous interactions in terms of information access.

Results from an interactive experiment involving networking provide empirical confirmation to our theoretical arguments. We find individuals exercising a higher degree of agency in their networking to outperform others, in terms of search success, and in terms of the quality of information they gain access to. We then move one step forward in exploring the relationship between forethought and networking, by identifying the individuals who exercise more of the former. Building on extant theory on cognitive flexibility (Diamond, 2013; Furr, 2010; Laureiro-Martínez, Brusoni, & Zollo, 2010), we argue, and empirically demonstrate, that individuals characterized by higher levels of cognitive flexibility are more likely to act as the agent in their interactions.

This study contributes to the emerging stream of research on the cognitive foundations of social networks (Fang et al., 2015; Kilduff & Krackhardt, 1994; Mehra, Kilduff, & Brass, 2001). Scholars in this field have shown that individual-level differences may substantially impact the degree to which individuals are able to secure network resources (Anderson, 2008; Carnabuci & Diószegi, 2015; Elliott, Haney, & Sams-Abiodun, 2010). Adding to this work, we show that individuals differ in the amount of agency they exercise in their networking. These differences
may be especially relevant to prior work on the role of cognition in social networks. This is because agency is what protects an individual from structural determination (Barnes, 2000). Consequently, the importance of the cognitive characteristics studied by these scholars may depend on the degree to which they exercise agency, or in other words, on the extent to which their networking is a manifestation of forethought.

**NETWORKING, FORETHOUGHT, AND COGNITIVE FLEXIBILITY**

Social network research has traditionally followed the “structuralist” (Emirbayer & Goodwin 1994) perspective prevalent in sociology, by emphasizing the role of social structures in explaining micro and macro-level outcomes (e.g. Burt, 2005; Coleman, 1988; McPherson, Smith-Lovin, & Cook, 2001). Recently, this feature of the field has been subject to extensive criticism (Kilduff & Krackhardt, 2008), in that the role of individual agency is all but ignored (Gulati & Srivastava, 2014). These critics have pointed out that individuals are not uniformly affected by the same network structure, but differ widely in how they form, manage, and use their networks (Anderson, 2008; Sasovova, Mehra, Borgatti, & Schippers, 2010).

The study by Smith and colleagues (2012) is an especially prominent contribution to this emerging stream of research. The work distinguishes between cognitive network activation and network mobilization. While the former pertains to the set of contacts that come to the individual’s mind when searching for a specific resource, the latter is concerned with the physical act of turning to others for the purpose of resource attainment (Menon & Smith, 2014). Between these two lies the frontier between individual agency and network structure. As network activation happens solely in the mind of the individual, the role of individual agency is apparent. Conversely, when network activation is acted upon in the form of network mobilization, the individual is no longer the sole agent, as structural factors begin to affect outcomes. While activation, even if biased (Smith, Menon, & Thompson, 2012), is under the control of the individual, the success of network mobilization efforts depends on factors such as the willingness of others to help (Leider, Möbius, & Rosenblat, 2009), which in turn are influenced by network structure (Hanaki, Peterhansl, Dodds, & Watts, 2007).

While Smith and colleagues (2012) refer to mobilization as a subset of activation, we instead rely on a broader conceptualization of the former, as encompassing all networking activity (Vissa, 2010). Doing so allows us to examine how activation affects the success of networking activities. The latter includes not only mobilization that is preceded by conscious forethought (i.e. previously activated), but alter-initiated and serendipitous processes as well. Thus, examining the extent to which forethought pervades and affects networking is crucial to understanding the role and importance of cognitive network activation.
Exploring such questions may help to reconcile individual agency with network structure. If the amount of forethought that individuals exercise in their networking efforts affects the likelihood of their success, then it may be worthwhile to examine which individuals are better able to follow through on their network activation. Those that are able to retain a higher degree of individual agency in their networking may be more successful at securing resources from their networks. If confirmed, such differences would present important implications, both practical and theoretical. Practical, as the success of networking behavior is of key importance to entrepreneurs (Vissa, 2010), managers (Anderson, 2008, Luthans, 1988), and employees (Burt, 2005). Theoretical, as it may lead to more clarity on how the agent and the network jointly affect outcomes.

The link between activation and networking is far from straightforward. While forethought is likely to play a role in networking (Menon & Smith, 2014), the degree to which it guides mobilization may vary among individuals. Even once certain contacts have been activated, the individual may not follow through, for reasons related to affect (Casciaro & Lobo, 2008) and attitudes toward instrumental networking (Casciaro, Gino, & Kouchaki, 2014).

Often, networking is not driven by forethought and conscious planning, but by various structural factors. To better understand the nature of the link between activation and mobilization, we propose categorizing networking behaviors into one of three types, based on who the agent is in the interaction. Type 1 represents networking which was priorly planned by the individual (ego); forethought-driven networking. As such behavior follows from ego’s prior intentions, such an act represents a case where ego exercises agency. (Bandura, 2001). An example may be that of an employee who plans to ask a certain colleague for advice, and subsequently does so. Conversely, Type 2 pertains to the same kind of premeditated, deliberate networking action, but one which was initiated not by ego, but by another individual (one of ego’s alters). We call this alter-initiated networking. Such a case occurs when one’s colleague asks one for advice. Finally, Type 3 refers to any form of serendipitous social interaction which was not priorly planned by either party. This may happen when two colleagues bump into each other on the hallway, and subsequently engage in interaction. In such a case, we cannot speak of any specific agent, but more of a dynamic and emergent assignment of such a role.

In this categorization, Type 1 differs from Type 2 and Type 3 in that it represents a clear link from the cognitively activated network to that mobilized by the individual. Here, networking is preceded by forethought, and is guided by the instrumental actions of the individual. As a consequence, the individual exercises a higher degree of agency, and has a greater influence on possible outcomes than he/she does in the other two cases. When interaction is planned and initiated by the other party, or when it is serendipitous, ego has significantly less control of outcomes. Due to ego’s heightened level of agency in Type 1 interactions, inter-individual
differences, such as those in personality and cognition, are likely to play a more salient role in affecting outcomes. Conversely, when ego is not the initiator, and thus not the agent of the interaction, then we may expect network structural factors to be more influential than individual attributes.

It follows that, when searching for a specific target resource, any knowledge the individual possesses with respect to both the target itself and to the resources embedded within the individuals network will significantly affect the kind of network that he/she mobilizes if the individual is the initiator of the interaction (Type 1 interaction). Conversely, this knowledge may be expected to play a lesser role in Type 2 and Type 3 interactions, in which the individual does not act as the agent. Thus, assuming that the individual possesses at least some knowledge of network and target, Type 1 interactions should be more likely to provide useful information as to the location of the resource that is sought. In other words, the more interactions are governed by the agency of the individual (i.e. the more they are behavioral manifestations of forethought), the more useful the received information, and consequently the higher the likelihood that the search effort will succeed.

Before continuing, it is important to mention that we expect this proposition to hold only if all of three conditions are satisfied. First, the resource to be sought should not be too abundant within the network. If it is, then alter-initiated or serendipitous interactions should not fare much worse than ego-initiated interactions in their value for resource attainment. Second, ego should have some knowledge of the target resource. Without this, he/she has no frame of reference as to which contacts may be useful, decreasing the relative value of ego-initiated interaction. Third, ego should possess some awareness of the resources embedded within his/her network (such as contacts’ knowledge, skills, personal attributes, and network structure). Lacking such awareness (e.g. in the case of a newly hired employee without any intraorganizational connections) means that the individual would not be able to make informed decisions as to which contacts are worth approaching. If all three conditions are satisfied, we may expect individuals whose networking is driven to a greater extent by forethought to gain access to information that is both valuable and relevant. Consequently, the search efforts of such individuals are more likely to succeed.

Put simply, the interactions that satisfy these conditions are those in which the individual has some idea of what he/she is searching for and at least a vague understanding of who may provide relevant information. These limitations, therefore, are not overly restrictive. However, they do exclude one important type of networking: that which is aimed at meeting new people, and establishing knowledge about them (Vissa, 2010). In such cases, the individual lacks knowledge of alters and does not have clear instrumental goals, and can therefore exercise less agency and planning.
In most other cases of purposeful information search, we expect our propositions to hold, for two main reasons. The first pertains to the relative efficiency of various search strategies in small world networks. Human social networks tend to possess a small world structure, characterized by high clustering and small path lengths (Davidson, Ebel, & Bornholdt, 2002; Watts & Strogatz, 1998). Searching such networks for resources is more efficient using certain strategies as opposed to others. One of these is to mobilize contacts who have a high degree centrality, i.e. are well connected (Adamic, Lukose, Puniyani, & Huberman, 2001). Of course, this requires a certain degree of knowledge of alters; specifically, their degree of connectedness. However, the success likelihood of using this strategy is dwarfed by that of strategies relying on attributes of the target (Adamic & Adar, 2005; Dodds, Muhamad, & Watts, 2003). If ego mobilizes contacts whose attributes are similar to that of the target (e.g. similar interests, expertise, hierarchical level, or physical location), then the target resource is likely to be reached much more quickly (Adamic & Adar, 2005).

Using any such strategy, however, requires that the individual exercise forethought in selecting interaction partners. When such forethought is less clearly present (i.e. a large portion of interactions are not the result of ego’s agency), then many of the mobilized contacts will not be in line with either strategy. With respect to the strategy of mobilizing well-connected people, serendipitous or alter-initiated interactions are unlike to be of use, as social networks tend to be highly skewed in terms of connectedness (Marsden, 2002; Sparrowe, Liden, Wayne, & Kraimer, 2001). That is, only a minority will be highly connected, while most will have only few connections (Adamic, Lukose, Puniyani, & Huberman, 2001). Without individual agency and strategic choice, “randomly” selected interactions will involve alters with few connections.

With respect to the attribute-based strategy, leaving interactions to chance (i.e. unguided by forethought) is unlikely to result in the mobilization of target-relevant contacts. This is because such a strategy relies on homophily: individuals are more likely to be connected to similar others (McPherson, Smith-Lovin, & Cook, 2001). By using this strategy, the individual is guided by the assumption that contacts with attributes similar to that of the target are more likely to be closer to the target (Adamic & Adar, 2005). However, if mobilization is left to others, or to serendipitous processes, then interactions will involve (by virtue of the same homophily mechanism) people who are similar to ego, and not the target. These arguments lead us to the central hypothesis of this paper:

**Hypothesis 1.** When searching for resources within their networks, individuals who exercise a higher degree of agency in their networking will gain access to more useful information.

In searching for resources within their networks, it is a straightforward assumption to claim that those who find more useful information are more likely to reach their target. Due to the
intuitive nature of this claim, we do not present it as a hypothesis, but nonetheless examine
whether it holds with respect to our data.

Moving forward, to understand why certain individuals are more agentic in their networking,
an important first step is to identify which individuals exercise more forethought before
interacting with others. To do so, we turn to extant theory on cognitive flexibility (Diamond,
2013; Furr, 2010), as it has been associated with cognitive characteristics that may be
conceptually linked to the extent of forethought individuals employ in networking.

Various authors have studied that social exchange necessitate mental abilities to inhibit
immediate responses and deal with situations that require forethought (Cosmides & Tooby,
1992). “In essence, social exchange requires a sort of mental spreadsheet that calculates
temporal sequences of exchange for which the executive system seems ideally designed.”
(Barkley, 2001: 18) Among the different executive functions, cognitive flexibility is essential
for interacting in social space.

Cognitive flexibility lies at the core of human adaptation, and is the hallmark of human
cognition and intelligent behavior (Deák, 2004; Evers, Van der Veen, Fekkes, & Jolles, 2007).
Specific definitions of the term vary, ranging from an “ability to generate broad or narrow
categorizations of stimuli depending on appropriateness” (Murray, Sujan, Hirt, & Sujan, 1990:
413), to the plasticity required to adjust to new environmental demands (Furr, 2010; Salisbury,
2003).

One aspect of cognitive flexibility is being able to change perspectives interpersonally
(Diamond, 2013). In addition, “cognitive flexibility involves changing how we think about
something (thinking outside the box). For example, if one way of solving a problem isn’t
working, can we come up with a new way of attacking this or conceiving of this that hadn’t
been considered before? Cognitive flexibility also involves being flexible enough to adjust to
changed demands or priorities, to admit you were wrong, and to take advantage of sudden,
unexpected opportunities” (Diamond, 2013: 14).

Cognitive flexibility allows individuals to better adapt to their environments by identifying the
key aspects of the problems they face by detecting different elements and their discontinuities
and by reflecting upon the different elements connections and therefore untangling cause-
and-effect relationships (Raes, Heijltjes, Glunk, & Roe, 2011). In particular, Raes and colleagues
(2011) consider cognitive flexibility in the context of the interactions between top and middle
managers to find that more cognitively flexible individuals develop a broader variety of
interpretations and perspectives. In turn, this breadth leads them to superior performance.
Furr and colleagues (2012) explore the concept of cognitive flexibility at the level of the
individual decision-maker, defining it as the characteristics and processes that allow
individuals to collect and integrate new information, reflect upon it, and modify their
perspectives. In addition, cognitive flexibility has been associated with creativity and idea generation (Bledow, Rosing & Frese, 2013), due to its facilitative effect on “mental set shifting” (Goel & Vartanian, 2005).

The characteristics associated with cognitive flexibility suggest that it may strengthen the role of forethought in individuals’ networking behavior, for three reasons. First, in the case of instrumental networking, creativity and adaptability may allow individuals to change the way they think of their networks. That is, they may be more likely to think of these networks as resource pools. Second, the reflectivity associated with cognitive flexibility may aid them in their effort to rank possible strategies according to their expected outcomes. Third, a higher level of cognitive flexibility may allow individuals to more readily realize when the “strategy” of random networking is not producing the desired results, and therefore push them to change their strategy. In summary, we expect cognitive flexibility to play a role both in the extent to which individuals exercise forethought, as well as the extent to which they follow through on this forethought in their actual networking.

**Hypothesis 2. Cognitive flexibility will have a positive effect on the extent to which individuals’ networking behavior is driven by forethought.**

**METHODS**

**Overview**

The goal of our empirical design was to observe a social environment which contains the critical aspects of an organizational environment: there exists a social network among many of the participants, and the majority of the participants are indirectly linked to other members. Without such an initial level of connectivity, i.e. with a sample of complete strangers, we would be unable to observe how individuals use their networks, and their knowledge of their alters, to reach a certain target.

**Recruitment and Participant Pool**

We therefore recruited participants for our study from a pool of masters students taking classes at the Management department of a major European university. Most of these students partake in the same university courses and see each other on a weekly basis. Recruitment was done online (via a call for participants), as well as in person at a highly attended university class. The rationale behind using students taking the same classes, as opposed to a random sample, was to ensure a certain degree of network connectivity. While
it is was not necessary that all participants know each other, some connectivity is necessary for networking strategies to become relevant.

Potential participants were told that they would participate in a two-part study, consisting of an online part (to be done from any location) and an interactive part (to be done in a fixed location). Upon completion of both parts, participants were promised payment. This payment included both a fixed amount (similar to the amount offered for participation in other university studies), as well as a varying one, the latter of which was indicated to depend on their performance, the performance of others, or random chance mechanisms. Finally, before registering, participants were asked whether they agree to have their university profile picture and name shown to other participants as part of the study.

43 participants completed both parts of the study. They were predominantly Master’s level students of Management, at varying levels of completion of their studies. As they were recruited from a highly internationalized university, there was substantial heterogeneity in terms of country of origin, mother tongue, and ethnicity. However, all participants spoke English, which was the language in which the study was conducted.

Task Description

The study consisted of two parts: an online part, and an interactive part. The online part consisted of a battery of personality, demographic, and cognition-related measures, as well as various network-related questions aimed at understanding the network structure among participants. The interactive part took place in a fixed location, and involved a networking task, where participants’ aim was to interact with others, and use the information they receive to identify a certain target person. All participants were paid for their time and effort, but those that succeeded in reaching their target were paid a premium.

Procedure: Online Phase

The first part of the study consisted of an online questionnaire, which took approximately 30 minutes to complete. Participants were assured of confidential treatment of their data, as well of the fact that the study involves no psychological or physical risks. The questionnaire began with a battery of self-reported measures pertaining to demographics, personality, and cognition. The following measures were administered: Age, Gender, Nationality, Sociability; Need for Cognition; Self-monitoring; Reflectivity; the Temperament and Character Inventory; Cognitive Flexibility. As the traits we measured are not susceptible to short-term changes
(Cacioppo & Petty, 1982; Georgsdottir & Getz, 2004; Snyder, 1974), we did not randomize their order.

Next, we asked participants to look through the names and profile pictures of their fellow participants, and select those whom they recognize. The purpose of this step was threefold. First, it allowed us to limit the number of people we subsequently ask questions about to the set of people the participants are familiar with. Second, it allowed us ensure that the interactive part of the study would involve participants who have a certain degree of familiarity with each other. Third, this question allowed for the calculation of various network structural measures.

Following this filtering step, we asked participants several questions about their relationship with the people they selected. First, we asked them to indicate how close they feel to each of these individuals. Second, we asked about when they last talked to these people personally (i.e. face-to-face). Finally, we asked participants to indicate their level of awareness of these others’ past or current workplaces.

**Procedure: Interactive Phase**

The second part of the study took place in a large university auditorium (338 seats). Participants were asked to take seats in pre-assigned, randomly distributed locations, in order to avoid preferential seating. Their task began online, with all participants reading the following text: “We will soon ask you to walk around and talk to other participants, in order to identify a person with a certain work background. For you, we ask that you search for a specific person that:”. This was followed by a target description, randomly selected from four possible options: “Currently works in a company that specializes in developing [major mobile platform] apps”; “Worked as an intern at [major IT firm] (within the last two years)”; “Worked as an intern at [well-known automobile firm] (within the last year)”; “Is part of the Executive Committee of the [university] entrepreneur club”.

We pre-selected four target persons, all of whom were contacted prior to the study. By having multiple targets, we could avoid the target being overly visible, and could also examine search strategies irrespective of the specific nature of their target. Possible targets were identified using their publicly available LinkedIn profiles. We selected targets with (past or current) work experience that may be of interest to others, in that the target person may be able to provide them with information, advice, or relevant contacts. Our goal was thus to emulate, as closely as possible, the kind of information that a manager, employee, or entrepreneur may be searching for. In addition, we selected targets with a work experience of at least 6 months. The purpose of this latter criterion was to increase the chances that certain other participants
may have heard of the targets’ work experience prior to the study. Finally, target persons were promised additional payment, and asked not to disclose their additional role to anyone else prior to the study.

Once participants were presented with a short description of their target, they were asked to look at a complete list of participants, and select those that they believe may be the target person, or might point them in the right direction. The set of alters they selected at this stage was considered their cognitively activated network. It should be noted that this roster-based method of eliciting activated ties is different from the free recall approach (e.g. Fitzsimons & Shah, 2008; Smith, Menon, & Thompson, 2012), in that the set of potential ties is limited to an artificial group. In such a way, our approach may also be considered a form of planning (in terms of creating a pool of potential network routes). While the roster-based approach is less “natural” than the free recall approach, it allows for comparing individuals’ cognitively activated networks with their pre-existing network structures.

Having finished the preceding task, participants were given instructions for the upcoming interactive task, as follows. Once told to begin, their goal was to identify the person – a single person, and one that was present in the room – described to them previously. They were asked do so by asking others in the room about whether or not they know such a person, or perhaps are such a person, moving from person to person until they find their target, or until time runs out (after 24 minutes). In doing so, they were asked to complete a predesigned “mobilization form” to keep track of all conversations (see Appendix A). Those who succeeded were asked to return to their seats and indicate completion on the online platform, but nonetheless remain available to answer others’ questions. For a detailed description of the interactive experiment, along with a list of all rules to which participants adhered to, see Appendix B.

Once the interactive phase was complete, respondents returned to their desks, and to the online survey, and selected all individuals with whom they have talked, in the order in which they did so. We then asked participants questions about their conversations with these people. The first pertained to their reasoning for approaching certain targets. Participants could, for each person they talked to, select any number of the following reason: “Closeness: You know this person well, so it was easy to turn to him/her”; Recently talked to: You've recently talked to this person, so it was easy to turn to him/her”; “Connections: This person knows a lot of people, so he/she may point you to the right person”; Relevance: This person’s background (education, interests, employment, etc.) seemed relevant to what you were searching for”; Available: No special reason, the person was simply available to talk to at the moment”; “They came to me: You talked to this person because he/she came to you first”; “Other: None of the above”. Then, we asked about the perceived usefulness of the information they received from each person.
We next asked participants to indicate, for the people they cognitively activated beforehand but did not then approach, why they did not do so. The possible options were phrased oppositely to the options above: Not close; Haven’t talked to recently; Lack of connections; Not relevant; Unavailable; Other. Finally, we asked participants about how difficult they perceived the interactive task to be. The study was then concluded after a total of approximately one hour. All participants were paid the agreed amount for both parts of the study (45 CHF), and those that succeeded in the interactive task received their additional payment (5 CHF). Also, the four target persons received the agreed extra payment (30 CHF).

**Measures**

**Succeeded** was measured as a binary variable indicated whether (1) or not (0) the participant succeeded in identifying his/her target.

**Size of cognitively activated network** was used to indicate the number of people the participant cognitively activated prior to interaction (i.e. the people that he/she selected as possible being able to provide crucial information).

**Size of mobilized network** indicates the number of people the participant approached and asked for information, including the target person (where applicable). Instances when only the participant was asked questions (and not vice versa) do not count towards the amount.

**Degree of forethought** refers to the degree to which the participant’s mobilized network constitutes individuals who were previously cognitively activated. In other words, it is the ratio of all observed networking actions that have been preceded by forethought. The value was calculated by dividing the number of people both activated and later mobilized by the total number of people mobilized. We chose to formulate the variable in this way, as opposed to examining the extent to which activated individuals were mobilized, for the following reasons. First, activation in this context constitutes a form of planning – drawing up a list of potential alters. If, for instance, person A activates only 3 people, while person B activates a broader range of 6 people, and then both mobilize a total of 3 people (all of whom have been activated), then both may be said to be behaving according to plan. Second, if a participant find his/her target following the mobilization of only a handful of previously activated contacts, leaving other activated contacts unmobilized, it would then be implausible to claim that he/she has not been networking according to plan. Third, the aim of our study is not to understand why certain activated contacts are mobilized, and others not. Instead, our interest lies in examining the extent to which individuals’ networking is forethought-driven. Therefore, the way in which we construct this variable is in line with our broader conceptualization of network mobilization.
Information value pertains to the mean perceived usefulness of the information received from all mobilized others. It was derived from a binary variable (0: “less useful”; 1: “more useful”). We relied on a self-reported measure of information usefulness (Constant, Sproull, Kiesler, 1996; Nebus, 2006).

Task-related knowledge refers to participants’ mean degree of awareness of the current or past work background of those they recognize. Including this variable in our analyses is important, as knowledge of others is likely to affect who individuals turn to (Borgatti & Cross, 2003). This data was collected following selection of recognized others. For each recognized person, possible answers were “Not at all” (1); “Somewhat” (2); “Quite well” (3).

Target dummy variables were created to account for possible differences in the ease of reaching different kinds of targets. There were four targets in total, therefore we included three dummy variables in our models (with the remaining one being omitted). Target 1 (auto) worked at a major automobile company. Target 2 (app) currently works in a company specializing in developing mobile apps. Target 3 (entrep. club) is a leader of the university’s entrepreneur club. Finally, Target 4 (IT) worked at a major IT firm.

Sociability was measured using the five-item Sociability subscale of the Cheek and Buss Shyness and Sociability scale (Cheek and Buss, 1981). We controlled for this variable as it may have an effect on individuals’ proclivity to interact with others (Asendorpf and Wilpers, 1998).

Cognitive flexibility was measured using the Cognitive Flexibility Scale (Martin & Rubin, 1995). The scale comprises 12 questions, and uses a Likert-type format.

Additional measures used in screening for potential control variables, but not reported in our analyses, are reported in Appendix C.

EMPIRICAL ANALYSES AND RESULTS

Descriptives

The total sample used for this study consisted of 43 students. While this sample size is relatively small in comparison to other network studies (e.g. Mehra, Kilduff, & Brass, 2001; Sparrowe, Liden, Wayne, & Kraimer, 2001), it should be noted that, given our research focus, the number of participants is less relevant than the number of interactions taking place. Both our dependent variables relate to interaction measures; to their average usefulness, as well as to the extent to which they were preceded by forethought. Thus, while our study is certainly limited with respect to the number of participants (n=43), it is nonetheless based on a large number of interactions (n=249).
Almost all were Master’s level students of the university’s management & technology department. Most (60%) were enrolled in the first semester of their studies (although many have also completed their BSc at the same university. 66% of students in our sample were male, which reflect the gender distribution of the department. All were in their 20s, with the median age being 24.

Our study required a sample of individuals who are socially interconnected, such that network-related strategies could become relevant. Network analyses of our sample confirmed that this was indeed the case (see Figure 1 below). On average, participants recognized 11 others, and were in closer-than-average friendship relations with 4.9 others. They were also somewhat aware of others’ current and past work experience (mean of mean awareness scores: 1.6, on a scale ranging from 1 to 3).

Figure 1  Symmetrized recognition network among participants. Nodes represent participants, with edges present when both parties recognized each other.

The majority (81%) of participants successfully identified their target within the allotted 24-minute timeframe. During this time, a total of 249 network mobilizations occurred (i.e. a minimum of 125 conversations). 40% of these were considered to be useful. With respect to the reason for mobilization, as claimed by those seeking advice, we found the following distribution (note that one instance of network mobilization may involve multiple underlying reasons): 18% involved relevance, 11% involved perceived connectedness of the alter, 13% was due to emotional closeness, and 6% to recency. In addition, due to the elements of close
physical proximity and the similarity in goals, 37% of mobilizations were claimed to involve the alter simply being available, while 21% was initiated following alters’ advice seeking.

With respect to both the cognitive and behavioral aspect of networking, we found the size of both the cognitively activated and mobilized networks to be approximately normally distributed, following the exclusion of two individuals. One of these did not activate anyone at all, while another appeared to have misunderstood the question, activating 84% of all participants. Disregarding these two participants, we found an average activated network size of 4.58 alters (s.d. = 3.0). The mean number of alters mobilized was somewhat higher, at 5.7 individuals (s.d. = 2.2). Finally, in terms of the degree of forethought in networking, we found the mean value to be rather low (mean = 0.24, s.d. = 0.24), likely due to the fact that participants were in close proximity and were thus more prone to serendipitous interaction. The distribution of this variable resembled a normal curve.

**Analyses and Results**

Means, standard deviations, and pairwise correlations among our reported variables are presented in Table 1.

We began by examining whether those participants that received, on average, more useful information, were more likely to succeed in reaching their target. Here, we excluded any interactions with target persons, as these were clearly considered useful. We used a t-test to compare the mean usefulness of information received by those that succeeded (0.34), and those that did not (0.2). The difference is significant (p = 0.07) but not very salient, likely because of our small sample size, and because the majority did manage to succeed. Nonetheless, although we did not construct a related hypothesis, our expectation that finding useful information should make target identification more likely has been confirmed.
Table 1

| Variable | Min | Max | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----------|-----|-----|------|------|---|---|---|---|---|---|---|---|---|---|---|---|---|
|          |     |     |      |      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Descriptive statistics and correlations.
We next turned our attention to examining whether a higher degree of forethought appears to lead to the acquisition of information that is more useful (i.e. relevant). For these analyses, we excluded a total of three observations. Two were excluded for irregularities in their activated network size (described as above), and one for reasons of missing data. We noted a positive, significant correlation between degree of forethought and mean information usefulness ($r = 0.46$, $p < 0.01$). Next, we ran an OLS regression analysis, with mean information usefulness as the dependent variable, and degree of forethought as the independent variable (see Table 2). Due to limitations arising from our small sample size, we aimed to keep the number of control variables at a manageable level. Therefore, we only added controls that were either significantly correlated with both the dependent and the independent variable, or which were necessary due to the design of our study. Thus, we included controls for the sizes of the activated and mobilized networks, as both can affect our measure of the degree of forethought. We also included a dummy variable for whether or not the individual succeeded, as this would mean that the information received from the last person (the target) was considered useful. We chose to include such a control variable, as opposed to deleting usefulness data for the target, in order not to penalize those who, by virtue of activation or mobilization strategy, mobilized their target. Also, we included a control for their mean level of awareness of others’ work background, as this may be expected to lead to the acquisition of more relevant information. Finally, dummy variables were included to account for possible differences in the difficulty level of reaching different targets. Our model explains 56% of the variance of information usefulness ($F(8, 31) = 4.88$, $p < 0.01$). Multicollinearity among the variables was not a concern (highest VIF = 2.08). We find degree of forethought to be positively related to information usefulness ($b = 0.42$, $p < 0.05$), explaining 7% of variance. This confirms our Hypothesis 1. In addition, a higher degree of awareness of others’ work background also lead to the acquisition of more useful information ($b = 0.43$, $p < 0.01$). Finally, we found the effect of the dummy variable for success to be mild ($b = 0.16$, $p < 0.1$).
We continued by examining whether cognitive flexibility has an effect on participants’ degree of forethought in networking. Following initial analyses using OLS regression (and excluding the two participants with irregular activation sizes, as above), we found a small number of outliers. These included people who acted as target persons. As they were frequently approached by others, their mobilization strategy is likely to have been unduly disturbed. Additionally, one participant managed to find his/her target (whom he/she previously activated) on the first attempt. Also, although seating was randomized, this participant’s target was in his/her close proximity. Thus, the strategic underpinnings of a high degree of forethought would be difficult to observe in this case. Finally, one participant’s cognitive flexibility score was unusually low, almost 3 standard deviations lower than the average. We thus excluded these observations from our analyses, as all represent anomalous cases which, in a small sample, can distract us from observing underlying mechanism.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.37</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
</tr>
<tr>
<td>Forethought-driven networking</td>
<td>0.42*</td>
</tr>
<tr>
<td></td>
<td>(0.19)</td>
</tr>
<tr>
<td>Succeeded</td>
<td>0.16†</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
</tr>
<tr>
<td>Size of cognitively activated network</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Size of mobilized network</td>
<td>-0.00</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
<td>Knowledge of alters</td>
<td>0.34**</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
</tr>
<tr>
<td>Target 1 (auto)</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
</tr>
<tr>
<td>Target 2 (app)</td>
<td>-0.15</td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
</tr>
<tr>
<td>Target 3 (entrep. club)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
</tr>
<tr>
<td>R²</td>
<td>0.56</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.44</td>
</tr>
<tr>
<td>F</td>
<td>4.88**</td>
</tr>
<tr>
<td>N</td>
<td>40</td>
</tr>
</tbody>
</table>

* Figures in parentheses are the standard errors of the coefficients.
† p < 0.10; * p < 0.05; ** p < 0.01
We then ran OLS regression analyses on this subsample (n = 36), with degree of forethought being the dependent variable and cognitive flexibility the independent variable (see Table 3). Apart from including controls for the size of participants’ activated and mobilized networks, as well as for their targets, we also added a control for sociability. The latter was added as individuals that are more sociable may find it less difficult to approach those they plan to, irrespective of how close they feel to these people (Cheek & Buss, 1981). We found that our model accounts for 71% of total variance in degree of forethought (F(7, 28) = 9.78, p < 0.01). Again, multicollinearity was not high (highest VIF = 1.62). Confirming our Hypothesis 2, we find a positive effect of cognitive flexibility on degree of forethought (b = 0.02, p < 0.01), accounting

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.78</td>
</tr>
<tr>
<td></td>
<td>(0.26)</td>
</tr>
<tr>
<td>Cognitive flexibility</td>
<td>0.02**</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
</tr>
<tr>
<td>Sociability</td>
<td>0.01†</td>
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<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Size of cognitively activated network</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Size of mobilized network</td>
<td>-0.04**</td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Target 1 (auto)</td>
<td>0.13*</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
</tr>
<tr>
<td>Target 2 (app)</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
</tr>
<tr>
<td>Target 3 (entrep. club)</td>
<td>0.09†</td>
</tr>
<tr>
<td></td>
<td>(0.04)</td>
</tr>
<tr>
<td>R²</td>
<td>0.71</td>
</tr>
<tr>
<td>Adj. R²</td>
<td>0.64</td>
</tr>
<tr>
<td>F</td>
<td>9.78**</td>
</tr>
<tr>
<td>N</td>
<td>36</td>
</tr>
</tbody>
</table>

a Figures in parentheses are the standard errors of the coefficients.
† p < 0.10; * p < 0.05; ** p < 0.01
for 19% of variance in degree of forethought. In addition, sociability also had a positive effect (b = 0.01), though significant only at the p < 0.1 level.

Additional Analyses

We ran a number of additional analyses to further understand our results. We began by bootstrapping our reported regression analyses. A method of resampling with replacement, bootstrapping is useful when analysing small samples which may violate normality assumptions (McWilliams & Siegel, 1997). Bootstrapping the model (1000 repetitions) used for testing Hypothesis 1 yielded a significant effect (degree of forethought b = 0.42, bootstrap standard error = 0.19, p < 0.05). Using the same technique (1000 repetitions) for our model testing Hypothesis 2 also provided satisfactory results (cognitive flexibility b = 0.02, bootstrap standard error = 0.004, p < 0.01).

Next, we ran Wald tests (Lu & Beamish, 2004; Tsang & Yip, 2007) to see whether including our key explanatory variable in our reported models significantly increases model fit. We found that they did. When explaining Information value, the model with Degree of forethought is a significant improvement over the model without (F(1, 31) = 4.84, p < 0.05). Similarly, adding Cognitive Flexibility to our model explaining Degree of forethought also improves model fit (F(1, 28) = 18.28, p < 0.01).

We then ran our analyses examining the effects of degree of forethought on information usefulness using a modified dataset. Here, we excluded participants’ target persons from their activated and mobilized networks. This lead to values of degree of forethought and information usefulness that exclude interaction with the target. As information received from the target is in all likelihood useful, this additional analysis was intended to examine the extent to which degree of forethought affects information usefulness in mobilization leading up to, but not including, the target. We ran a model identical to the one reported for Hypothesis 1, and found similar results. The effect of degree of forethought on information usefulness was positive and significant, though weaker than in the full model (b = 0.33, p = 0.061). The effect of awareness was left unchanged (b = 0.33, p < 0.01).

We then took a different approach to Hypothesis 1, in that we analyzed the effect of serendipitous interactions on information usefulness. Our theoretical argument underlying this hypothesis is that a higher degree of agency in networking (i.e. higher degree of forethought) is more likely to result in the mobilization of contacts who are similar in their attributes to those of the target person, and also better connected. In turn, this would also mean that serendipitous interactions (with people mobilized for the reason that they were simply available to talk to at the moment) will result in less useful information. Our OLS model
for this analysis was identical to that used for testing Hypothesis 1 (including the dependent variable: information usefulness), with one exception. Instead of having degree of forethought as the independent variable, we constructed a variable called *Ratio of serendipitous interaction*. This measure represent the proportion of all mobilized ties that were mobilized for the reason that they were available to talk to (ranging from 0.00 to 1.00). The mean value was 0.33 (s.d. = 0.31). In this model, the effect of Ratio of serendipitous interaction was significant and negative (b = -0.34, p < 0.01). This result confirmed our expectation that the strategy of mobilization relying on serendipitous interactions is a suboptimal one.

Finally, to better understand why cognitive flexibility affects the tendency to retain a higher degree of agency in one’s networking behavior, we examined the correlation coefficients of each of the 12 cognitive flexibility items with degree of forethought, using the subsample on which our model testing Hypothesis 2 was based. We found four items to be significantly correlated with degree of forethought: “I can find workable solutions to seemingly unsolvable problems.” (r = 0.36, p < 0.05); “I am willing to work at creative solutions to problems.” (r = 0.38, p < 0.05); “I seldom have choices when deciding how to behave.” (r = -0.28, p < 0.01); “I have difficulty using my knowledge on a given topic in real life situations.” (r = -0.31, p < 0.1). It thus appears that creativity, along with the willingness to invest effort in problem solving are related to highly agentic networking.

**DISCUSSION**

**Limitations**

The purpose of this study was to gain insight into a hitherto largely unaddressed question: to what extent do interindividual differences in the degree of agency in networking influence the success of such endeavors, and to what mechanisms can such performance variations be attributed? As the phenomenon is poorly understood, ours was an exploratory study, aimed at discovering potentially fruitful avenues for future research. In many ways, our empirical design, along with our results, should be considered preliminary and open to extension. Firstly, characteristics of our research design, including purposeful choices and unanticipated weaknesses, leave many questions. Second, as our aim was to uncover basic mechanisms, the exact way in which these mechanisms exert their influence is yet to be better understood. Thus, in the next paragraphs, we discuss the weaknesses of this study, along with possible ways in which future research on the topic might address them.

One important limitation of our study pertains to its sample size. Our sample consisted of 43 individuals, a sample size that was further restricted by the need to drop unreliable observations from certain analyses. The reason for this restriction lay in the difficulty of
coordinating a time when a large number of participants could all be present. Repeating this study using a substantially larger sample size would provide advantages that extend beyond an increase in statistical power. On advantage would be the possibility of adding more explanatory variables and controls, in order to gain further clarity not only with respect to the precise nature of the underlying mechanisms, but also to how these mechanisms may interact with each other. Further, if using a larger sample, the cost of engaging in serendipitous (as opposed to deliberate) interaction would be higher, as a random stranger would be even less likely to provide valuable information. Finally, the role of individuals most central in the network would be less salient with a larger sample size. In our case, the presence of certain highly central individuals acquainted with one of the targets led multiple participants to identify their target within a short timeframe. This increased the visibility of the target and thereby reduced the importance of strategic decisions.

Another, more complex limitation is related to the tradeoff between control and emergence. By adding more rules and more closely controlling interactions, we may gain precision and clarity, but at the cost of increased artificiality, and thereby less generalizability. Conversely, a much less controlled social environment provides more space for natural, emergent social behavior, but makes interpretation of underlying mechanisms more difficult. While we strove to maintain a certain degree of control, our design prioritized emergence over control. As such, our choice of design led to a number of irregularities. Some participants were louder than expected, and needed to be reminded to keep their tone down. Also, as multiple participants were looking for the same target, once they identified this individual, they began to congregate near him/her, which may have been noticed by other participants. In addition, some of these participants, though aware of their probable target, engaged in further interactions which served no instrumental purpose. Although the majority of such irrelevant interactions could later be screened out (by way of verbal or written comments attached to their notes), those that remain may add further noise to our data. In addition, all participants shared common knowledge of the task, which substantially reduced the psychological cost of engaging strangers. As a result, of all others that participants interacted with, an average of 68% were strangers (i.e. individuals they did not previously claim to recognize). Given the inherent psychological costs of asking for advice (Borgatti & Cross, 2003; Hofmann, Lei, & Grant, 2009), this ratio is likely to much lower in a real-life organizational context.

Overall, these issues were the byproducts of our choice of a less controlled design, leading to an “informal” social setting, with all its advantages and disadvantages. Future research on the topic could, therefore, alter the research design in multiple ways to address these issues. For example, one possibility would be to limit the number of interactions that participants could engage in. Combined with a clear monetary incentive to reach their target, an upper limit to mobilized network size would make interactions more closely, and thus elevate the
importance of non-serendipitous interaction. By doing so, future researchers could gain more insight into the kinds of networking strategies that individuals employ, along with their predictors and relative value.

Another possibility would be to replace face-to-face interaction with phone conversations. Such a design would involve sharing the names, profile pictures, and phone numbers (using experimenter-provided phones). Participants would need to select others from the list and call them to request information. My monitoring the time, direction, and content of calls, researchers could better understand not only the precise structure of interaction, but also the kind of accessed information that certain strategies result in. In addition, serendipitous interactions would be less common, since participants need to actively choose their conversation partners.

Yet another approach to more closely delineating different strategies would involve a very different empirical design. Instead of having all participants co-located within the same area, activation and subsequent mobilization could be traced in an organizational setting, by asking selected members to seek out colleagues in search of specific information. Such an approach would more closely resemble intraorganizational advice-seeking in two important ways. First, approached colleagues would not be aware of the purpose of the study, and second, approaching less well-known colleagues would entail the degree of discomfort that often accompanies advice seeking in such cases (Borgatti & Cross, 2003). While such research would most likely involve even smaller samples, it could allow a more in-depth and realistic view into the mechanisms underlying advice seeking.

Finally, another limitation of our research is that we do not examine exactly why certain individuals activate certain kinds of networks, and then selectively mobilize some of these individuals. This question could better be examined using more in-depth verbal protocol analysis (VPA) (Bainbridge & Sanderson, 1995). By having participants continually voice their thoughts as they activate networks, and then make decisions as to their selective mobilization, we could gain a better understanding of the underlying psychological mechanisms. For example, prior research in memory and recall has found that working memory aids the recall of social contacts (Hills & Pachur, 2012). However, the extent to which this advantage carries over to network mobilization is unclear; an important question, as network activation is only important insofar as it translates to actual behavior. Furthermore, prior research has suggested that the way in which individuals mentally categorize their social contacts may affect which ones they activate (Diószegi, Laureiro-Martínez, & Brusoni, 2015; Fitzsimons & Shah, 2008). Utilizing VPA techniques in combination with cognitive measures (such as working memory) would allow us to disentangle the effects of recall ability, network categorization, and the rationale used to filter contacts for subsequent mobilization.
Future Research

In recent years, much criticism has befallen proponents of the “structuralist” perspective on social networks, for the reason that this approach tends to imply ignoring the role individual agency (Kilduff & Krackhardt, 1994). However, researchers should not go from one extreme to the other by overemphasizing individual agency at the expense of structural factors (Mayhew, 1980). In fact, the individual and the network are deeply, if not inextricably, entangled (Giddens, 1984; Mead, 1934). Their entanglement permeates even those processes which take place in the individual’s mind, such as cognitive network activation. External structural factors, such as status relations (Smith, Menon, & Thompson, 2012) or past networking experience (Janicik & Larrick, 2005) may exert an influence on the kind of networks that individuals bring to mind. Thus, instead of aiming to clearly separate individual and structure, it may be more worthwhile to think of their relationship as that between the blind man and his dog. Although the blind man relies on the dog to lead him, the dog does not know where they are going. Thus, their relationship is not one of unchanging agency, but of dynamic switching of roles (Naderi, Miklósi, Dóka, & Csányi, 2001). Similarly, the individual and the network are in the process of continually “switching” the role of the agent. At times, the individual may exercise agency, such as when mentally activating, then deliberately mobilizing, contacts for instrumental purposes. At other times, the individual may relinquish agency, allowing him/herself to be swayed by social structural forces, and by the agency of others.

Examining how, and why, the degree of agency varies between individuals, and at different points in time, may provide more clarity as to the role of agency in social networks (Gulati & Srivastava, 2014). As deliberately engaging in serendipitous interaction, such as by meeting new people, can also entail benefits (Vissa, 2010), it may be worth examining how different individuals manage the balance between maintaining and relinquishing agency. Similarly to the advantageousness of switching between explorative and exploitative mindsets (Laureiro-Martínez, 2014), those that make more timely switches between agency and “passivity” may be more apt at reaping the rewards of their networks.

Further analyses are also possible using the current dataset, or with similar studies in the future. One of these involves a different unit of analyses. Instead of the individual, it may be worthwhile to focus on interactions. We could thereby gain clarity into what makes a certain interaction more or less likely to be valuable. Extant research provides considerable insight, for example, into the relative value of strong, weak, or dormant ties (Granovetter, 1973; Levin, Walter, & Murnighan, 2011). Instead of focusing on network structure, however, one could compare different cognitive strategies, such as those based on forethought, on perceptions of connectedness (Casciaro, 1998), or on the amount of awareness individuals have or others’ knowledge (Borgatti & Cross, 2003).
Another possibility would be to examine the extent to which the structure of individuals’ cognitively activated networks impact their mobilized networks, and the resources they are able to access. Building on network brokerage arguments (Burt, 2000, 2004), extant work on network activation emphasizes the value of activating sparse networks (Smith, Menon, & Thompson, 2012). It is, however, not clear whether those who activate sparse networks are more likely to mobilize similarly sparse ones.

Further, as our study suggests, cognitive flexibility plays a role in the degree to which individuals are able to exercise agency in their networking behavior. Exactly why this may be so, and which aspects of cognitive flexibility are most strongly involved, however, remains unclear. Nonetheless, past research suggests that one’s willingness to construct mental strategies, and follow through in spite of distractions, may play a key role. Following extant theory, we note that cognitive flexibility has been associated with self-insight, assertiveness, interpersonal communication competence, and the willingness to explore new options (Konig & Crawford, 2004; Laureiro-Martínez, Brusoni, Canessa, & Zollo, 2015; Martin & Anderson, 1998). Furthermore, our own additional analyses suggest that it is strongly correlated (r = 0.66, p < 0.01) with a conceptually related aspect of personality: self-directedness (Cloninger, 1994).

Self-directedness is one of seven facets of personality that are distinguished in the Temperament and Character Inventory (Cloninger, Svrakic, & Przybeck, 1993; Cloninger, 1994). It is characterized by “responsibility and resourcefulness in initiating and organizing steps to achieve personal goals” (Cloninger, 1994: 270), and is, together with forethought, an integral part of human agency (Bandura, 2001). In addition, it is related to “willpower”, in that it describes “the extent to which a person identifies the imaginal self as an integrated, purposeful whole individual, rather than a disorganized set of reactive impulses” (Cloninger, Svrakic, & Przybeck, 1993: 979). Thus, given the relevance of self-directedness to agentic behavior, as well as its conceptual similarity to cognitive flexibility, future research may do well to probe deeper into the extent to which it plays a role in networking behavior.

Finally, the fact that cognitive flexibility seems to be related to networking success may also inspire future studies because the underlying mental abilities are somewhat malleable (Heeren, Van Broeck, & Philippot, 2009). Past research has found that cognitive flexibility can be improved (Diamond, Barnett, Thomas, & Munro, 2007), for example, by meditation (Moore & Malinowski, 2009) or physical exercise (Themanson, Pontifex, & Hillman, 2008). Further, another related trait, self-directedness, is not considered to be genetically predetermined (Cloninger, 1994). For these reasons, once we gain a clearer understanding of the exact nature of the cognitive mechanisms that drive networking, we may also gain insight into how these abilities can be improved.
REFERENCES


APPENDIX A

Example of a Mobilization Form (Participant Names Withheld)

<table>
<thead>
<tr>
<th></th>
<th>Participant's name: [name of conversation partner]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What do you think the greatest invention has been?</td>
</tr>
<tr>
<td></td>
<td>What is your home city? When have you last been there?</td>
</tr>
<tr>
<td></td>
<td>What's the furthest you've ever been on holiday?</td>
</tr>
<tr>
<td></td>
<td>What is one sport you do, or did?</td>
</tr>
<tr>
<td>2</td>
<td>What's your favorite type of tree?</td>
</tr>
<tr>
<td></td>
<td>Name a food you really like.</td>
</tr>
<tr>
<td></td>
<td>If you were born again, what animal would you be?</td>
</tr>
<tr>
<td></td>
<td>What is your favorite color?</td>
</tr>
<tr>
<td>3</td>
<td>What is your favorite movie? When did you last see it?</td>
</tr>
<tr>
<td></td>
<td>Which is your favorite season? Why?</td>
</tr>
<tr>
<td></td>
<td>Do you prefer sunriser or sunsets?</td>
</tr>
<tr>
<td></td>
<td>What's your lucky number?</td>
</tr>
<tr>
<td>4</td>
<td>Have you ever been to Africa? If not, would you like to?</td>
</tr>
<tr>
<td></td>
<td>Do you have any pets? If yes, what?</td>
</tr>
<tr>
<td></td>
<td>What's the longest you've gone without sleep?</td>
</tr>
<tr>
<td></td>
<td>Are you a good cook?</td>
</tr>
<tr>
<td>5</td>
<td>Are you a good swimmer? Do you like swimming?</td>
</tr>
</tbody>
</table>
## APPENDIX B

### Summary of Rules for Interactive Phase of Experiment

<table>
<thead>
<tr>
<th>Rule</th>
<th>Details</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talk only in pairs.</td>
<td>If the person they wish to approach is talking to someone else, they should either wait at a distance or approach someone else.</td>
<td>1) To avoid participants basing their search strategy on information that is overheard—an artifact of our confined networking environment. 2) Allows us to trace the paths they took through their networks.</td>
</tr>
<tr>
<td>Only talk in designated locations.</td>
<td>Talk only at the assigned seat of either party.</td>
<td>To avoid congregation in the middle of the room, along with unavoidable overhearing of conversations.</td>
</tr>
<tr>
<td>Limited time.</td>
<td>Time available for completing the task is limited (though unspecified).</td>
<td>To ensure that only some participants succeed, as required to analyze our success variable.</td>
</tr>
<tr>
<td>Begin each conversation by asking a random set of four unrelated questions.</td>
<td>Each participant was given a large sheet of paper, on which they were asked to write the names of all their conversation partners (in order), along with their answers to four unrelated questions. These questions were randomly ordered for each participant and conversation. All involved &quot;small talk&quot; questions, such as &quot;What was the last film you saw? Did you like it?&quot;.</td>
<td>1) To emulate natural conversations during advice-seeking, by not having participants approach others directly with a question. 2) Given limited time, this makes conversations more costly, and their conscious selection more important.</td>
</tr>
<tr>
<td>Ask and answer each question naturally.</td>
<td>Participants asked not to attempt to read out questions, but ask them as they would in a normal conversation.</td>
<td>To emulate natural conversations during advice-seeking.</td>
</tr>
<tr>
<td>Talk quietly.</td>
<td>Do not let others overhear conversations.</td>
<td>To allow us to trace the source of information, all of which originates from interpersonal communication.</td>
</tr>
<tr>
<td>Only fill in mobilization form when asking questions.</td>
<td>If one does not reciprocate advice-seeking (i.e. is asked for information, but himself/herself does not ask the partner for the same), then he/she need not note the partner's name.</td>
<td>To avoid including irrelevant conversation in our data.</td>
</tr>
<tr>
<td>Do not inform others of task completion.</td>
<td>If the target has been identified, the participant was asked not to make this visible to others, but quietly return to their seat.</td>
<td>To decrease the visibility of target persons.</td>
</tr>
<tr>
<td>No phones or computers during interaction.</td>
<td>-</td>
<td>To avoid drawing upon information other than that received through interpersonal communication.</td>
</tr>
</tbody>
</table>
## APPENDIX C

### Summary of Additional Measures Not Reported in Paper

<table>
<thead>
<tr>
<th>variable</th>
<th>measuring instrument</th>
<th>theoretical range</th>
<th>observed range</th>
<th>observed median</th>
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<tbody>
<tr>
<td>Age</td>
<td>-</td>
<td>-</td>
<td>21 to 29</td>
<td>24</td>
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<tr>
<td>Cooperativeness</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Cooperativeness subscale</td>
<td>8 to 40</td>
<td>14 to 39</td>
<td>28</td>
</tr>
<tr>
<td>Gender</td>
<td>-</td>
<td>0 to 1 (1 is male)</td>
<td>0 to 1</td>
<td>(mean: 0.65)</td>
</tr>
<tr>
<td>Harm Avoidance</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Harm Avoidance subscale</td>
<td>8 to 40</td>
<td>8 to 32</td>
<td>23</td>
</tr>
<tr>
<td>Nationality</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(14% local)</td>
</tr>
<tr>
<td>Need for Cognition</td>
<td>Need for Cognition Scale (Cacioppo, Petty, and Kao, 1984)</td>
<td>-72 to 72</td>
<td>-22 to 56</td>
<td>27</td>
</tr>
<tr>
<td>Network Density</td>
<td>Symmetrized recognition network: (number of ties among alters) / (number of possible ties among alter)</td>
<td>0 to 1</td>
<td>0 to 1</td>
<td>0.55</td>
</tr>
<tr>
<td>Network Size</td>
<td>Symmetrized recognition network: number of alters</td>
<td>0 to 42</td>
<td>0 to 21</td>
<td>6</td>
</tr>
<tr>
<td>Novelty Seeking</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Novelty Seeking subscale</td>
<td>8 to 40</td>
<td>14 to 34</td>
<td>21</td>
</tr>
<tr>
<td>Persistence</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Persistence subscale</td>
<td>8 to 40</td>
<td>17 to 39</td>
<td>30</td>
</tr>
<tr>
<td>Reflectivity</td>
<td>Cognitive Reflection Test (Frederick, 2005)</td>
<td>0 to 3</td>
<td>0 to 3</td>
<td>3 (mean: 2.4)</td>
</tr>
<tr>
<td>Reward Dependence</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Reward Dependence subscale</td>
<td>8 to 40</td>
<td>15 to 36</td>
<td>27</td>
</tr>
<tr>
<td>Self-Directedness</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Self-Directedness subscale</td>
<td>8 to 40</td>
<td>17 to 39</td>
<td>31</td>
</tr>
<tr>
<td>Self-Monitoring</td>
<td>Self-monitoring Scale (Snyder, 1974)</td>
<td>0 to 25</td>
<td>3 to 20</td>
<td>12</td>
</tr>
<tr>
<td>Self-Transcendence</td>
<td>Reduced Temperament and Character Inventory (TCI-56) (Adan et al., 2009): Self-Transcendence subscale</td>
<td>8 to 40</td>
<td>8 to 34</td>
<td>20</td>
</tr>
<tr>
<td>Semester</td>
<td>(semester of study at university)</td>
<td>-</td>
<td>1 to 5</td>
<td>1 (mean: 1.95)</td>
</tr>
</tbody>
</table>