A NETWORK PERSPECTIVE ON INDIVIDUAL LEVEL AMBIDEXTERITY IN ORGANIZATIONS [*]

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Abstract

Addressing the call for a deeper understanding of ambidexterity at the individual level, we propose that managers' networks are an important yet understudied factor in the ability to balance the trade-off between exploring for new business and exploiting existing business. Analyses of 1449 ties in the internal and external networks of 79 senior managers in a management consulting firm revealed significant differences in the density, contact heterogeneity and informality of ties in the networks of senior managers who engaged in both exploration and exploitation compared to managers that predominately explored or exploited. The findings suggest that managers' networks are important levers for their ability to behave ambidextrously and offer insights into the microfoundations of organizational ambidexterity.

How do senior managers balance the trade-off between exploration and exploitation in organizations? A well-known solution for achieving balance is structural ambidexterity in which exploration and exploitation activities are separated into different units in the firm (e.g. Adler, Goldoftas and Levine 1999, Duncan 1976, Tushman and O'Reilly 1997). A critical part of the solution is the senior manager who allocates resources across the units and serves as a point of integration between them (Benner and Tushman 2003, Jansen et al. 2009, Tushman et al., 2010). Yet, given the inherent trade-off between exploration and exploitation, senior managers' resource allocation decisions are challenging. Because the returns from exploration are less certain and more remote in time than the returns from exploitation, senior managers have a tendency to prioritize exploitation over exploration (March 1991). Managers that do allocate resources evenly between exploration and exploitation are considered to be acting ambidextrously, or in other words to be "ambidextrous managers" (O'Reilly and Tushman 2004: 81).

To date, prior research into the role senior managers play in ambidextrous organizations has focused primarily on managerial cognition. For example, Smith and Tushman (2005) propose that managing the contradictions between exploration and exploitation is associated with two processes – differentiating (i.e., articulating distinctions between the new business and the old) and integrating (i.e., identifying potential linkages between the new and old). Yet, as Eisenhardt and colleagues (2010: 1265) point out, although prior arguments acknowledge the contradictions inherent in the exploration-exploitation tradeoff, they do not address how these are managed except to say that it is necessary for managers to hold dual conflicting solutions simultaneously. As a consequence, our understanding of the microfoundations of ambidexterity – the individual managerial behaviors that underlie the ability to both explore and exploit - remains underdeveloped.

In this study, we depart from the traditional emphasis on managerial cognition and consider the potential for structural separation and integration of exploration and exploitation at the individual level (Lavie, Stettner and Tushman 2010). To do this, we propose a network perspective on individual level ambidexterity. The idea of applying network theory to questions of ambidexterity is not new (e.g.,

Atuahene-Gima and Murray 2007, Lavie and Rosenkopf 2006, Lazer and Friedman 2007, Tiwana 2008). Yet, thus far applications at the individual level have been limited (cf. Mom et al. 2009). Although buffering via structural separation is commonly invoked when discussing organizational ambidexterity, at the individual level cognitive explanations dominate. In prior research, senior managers as individual actors have typically been conceptualized as singular, indivisible units. This has likely led to a focus on cognitive processes as a solution to managing the trade-off between exploration and exploitation at the individual level. As a consequence separation at the level of the individual has not been entertained as an option. Indeed, building from a similar conception of the individual as a singular unit, Gupta, Smith and Shalley (2006) concluded that ambidexterity may not be possible at the individual level. We contend that this view is unnecessarily limiting. By re-conceptualizing senior managers as actors within networks, the potential to develop arguments for networks as a means to buffer and integrate exploration and exploitation activities at the individual level arises.

Hence, a network perspective of individual level ambidexterity starts with a different conceptualization of the individual. Rather than viewing the individual as a single, indivisible unit, individuals are viewed as organizational actors embedded in networks that can be decomposed into sets of different ties. A central insight of network theory is that the actions of individuals are shaped by the networks in which they are embedded (e.g. Burt 1992, Granovetter 1985; see Brass et al. 2004 for a review). An individual's network of ties affects with whom the individual interacts, the information the individual receives, and the development of norms that constrain the individual's behavior. Thus, to the extent that exploration and exploitation behaviors are the result of interactions, information flows, and normative constraints on behavior, the ties in the network that drive each of these processes support exploration and exploitation behaviors. We propose that part of the reason individual managers are able to behave ambidextrously is that they hold networks of ties that help buffer exploration and exploitation activities and facilitate their integration. To be sure, managers may engage in cognitive processes that aid in managing the tradeoff. Yet, their networks also play a critical and under-researched role in shaping individual level ambidexterity.

To build our arguments, we first review prior research into the ambidexterity of organizations to develop a theoretical framework of ambidexterity at the individual level (e.g., O'Reilly and Tushman 2004, Taylor and Helfat 2009, Tushman and O'Reilly 1997). Prior research suggests that the ambidextrous behavior of senior managers includes four dimensions: resource allocation, cross-fertilization of knowledge, resource mobilization and new opportunity identification. Applying arguments from network theory (e.g., Burt 1992, Coleman 1988, Reagans and McEvily 2003, Rodan and Galunic 2004), we consider how three characteristics of networks – network cohesion, contact heterogeneity and the informality of relationships in the network - relate to the ambidextrous behavior of senior managers. Thus, our focus is on what these managers do rather than what they think and how the characteristics of their networks relate to these behaviors.

We test our arguments on a sample of 79 senior managers in a management consulting firm. The ability to exploit existing business while exploring for new business is essential to the long-term performance of professional service firms (Anand, Gardner and Morris 2007, Groysberg and Lee 2009). In many professional service firms and in this firm in particular, the senior managers (i.e., partners) were expected to oversee both the firm's current business with its clients and the firm's activities for bringing in new business, or in other words to act ambidextrously (Lorsch and Tierney 2002). Nevertheless, acting ambidextrously was difficult given the inherent trade-off in the allocation of the firm's resources (e.g. staff, time, budget) to serving existing work versus searching for new work. Our empirical analysis provides evidence of significant relationships between characteristics of senior managers' networks and their ambidexterity, consistent with the idea that the networks of senior managers enable buffering and integration of exploration and exploitation activities at the individual level. Accordingly, this study offers further insight into how ambidexterity occurs at the individual level and in so doing sheds light on its microfoundations (Eisenhardt, Furr and Bingham 2010).

INDIVIDUAL LEVEL AMBIDEXTERITY AND MANAGERS' NETWORKS

Existing empirical studies of individual level ambidexterity within strategy and organizations research, though few in number, provide a useful starting point for further investigation.[1] A review of prior research suggests that the ambidextrous behavior of senior managers is comprised of four main dimensions. First, as noted by Tushman and O'Reilly (1997), a primary function of senior managers is the allocation of resources between new and existing businesses of the firm. Yet, the tendency towards exploitation common to firms means that managers are more likely to prioritize existing business over new business (March 1991). For a senior manager to allocate resources in a balanced fashion, the manager needs a degree of autonomy in decision-making. Second, ambidextrous behavior of managers involves the selective cross-fertilization of knowledge between the new and existing businesses of the firm (O'Reilly and Tushman 2004, Taylor and Helfat 2009). This involves the identification and translation of relevant knowledge from one business to another. In addition, ambidextrous behavior by definition includes elements of exploitation and exploration behavior. Thus, like managers focused on exploitation, ambidextrous managers also mobilize resources for the efficient implementation of existing business. Similar to exploration, ambidexterity involves identifying opportunities that can be converted into new business for the firm. Therefore, while resource allocation and cross-fertilization of knowledge between new and existing business are unique to ambidexterity, ambidexterity also includes resource mobilization and opportunity identification as associated with exploitation and exploration respectively. Decomposing ambidexterity into these four areas of behavior is an important step in the development of our arguments. In the arguments below, we relate existing network theory to these behaviors to develop a network perspective on individual level ambidexterity.

Despite the importance of individual level ambidexterity to the achievement of ambidexterity at the organizational level, studies of individual level ambidexterity are rare (Raisch et al. 2009). The

[1] Although individual level ambidexterity remains underdeveloped in strategy and organizations research, a more developed research stream in neuroscience confirms that individuals do vary in the ability to simultaneously engage in exploration and exploitation activities (e.g. Cohen, McClure and Yu 2007, Daw et al. 2006, Laureiro-Martinez, Brusoni and Zollo 2010). In comparison, our study is most relevant to research considering the ambidextrous behavior of managers within organizations.

relative scarcity of individual level studies may be a function of two key challenges associated with this type of investigation – one empirical and the other theoretical. First, although scholars acknowledge that the adaptive processes that drive firm level capabilities for ambidexterity occur at the level of individual behavior; empirically observing these processes is difficult. Thus, much prior empirical research has used organization or unit level data to make inferences about individual level behavior (e.g., Gibson and Birkinshaw 2004) or qualitative or small sample data with limited generalizability (e.g., Taylor and Helfat 2009, Tushman and O'Reilly 1996). The second challenge is theoretical. In Gupta and colleagues' (2006) review of research on the exploration-exploitation tradeoff, they propose that the co-existence of exploration and exploitation within a single domain such as an individual person may not be possible; and that only in a loosely coupled system, such as a team, unit or firm, is ambidexterity possible. As a result, studies of ambidextrous behavior of managers have largely been limited to cognitive processes as a means of balancing exploration and exploitation (e.g., Smith and Tushman 2005).

A network approach to the investigation of individual level ambidexterity provides a means to overcome these challenges. First, network analysis offers an opportunity to empirically investigate ambidexterity at the individual level without relying on organization-level data or only qualitative or small sample data. A large body of knowledge regarding the observation and measurement of networks has been developed (e.g. Borgatti, Everett and Freeman 2002, Marsden 2004), and thus a network approach lessens the measurement difficulties encountered in other approaches. Second, a network approach also helps to overcome the theoretical challenge discussed above. In contrast to a conceptualization of the individual manager as a unitary actor that is a tightly coupled unit by definition (Gupta et al. 2006), a network approach conceptualizes the individual manager as an actor embedded in a network of relationships which varies on multiple dimensions and can be loosely coupled. Specifically, different attributes of the manager's network may be associated with performing different tasks, and thus, it may be possible for an individual manager to both explore and exploit, i.e. to act ambidextrously, as different parts of the network are activated.

While a network approach to the exploration-exploration trade-off has only recently been developed, evidence that the networks of organizational actors affect their abilities to balance exploration and exploitation has accumulated. To date, the majority of this prior research has focused on interorganizational networks (Im and Rai 2008, Lavie and Rosenkopf 2006, Rothermael and Deeds 2004, Tiwana 2008); yet a few studies have begun to investigate the implications of managerial networks for ambidexterity. In conceptual work, Kleinbaum and Tushman (2007) emphasize the role of the social networks of managers in cross unit innovation. These networks are hybrid social structures that consist of cross-divisional information brokerage, needed to identify possible collaborations, and cross-divisional cohesion, needed to implement them, which together underlie ambidexterity in firms. Similarly, Taylor and Helfat (2009) offer a conceptual framework for technology transitions in established firms in which middle management plays a key role in creating and maintaining linkages across exploratory and exploitative units in the firm. In empirical work, Mom and colleagues (2009) highlight the role of personal coordination mechanisms, measured as connectedness, to achieving ambidexterity. A network approach to individual level ambidexterity builds on and extends this work. We consider not only the role of managerial networks inside the firm for achieving ambidexterity but also the effect of their external networks, which have been shown to be important in research at the organizational level (e.g. Lavie and Rosenkopf 2006). Furthermore, our theory and analyses are developed at a more fine-grained level than prior work (cf. Mom et al. 2009), allowing for further insights into the microfoundations of ambidextrous behavior among managers.

The central insight of network theory is that the networks in which an actor is embedded shape the actor's behavior, and the theory has been applied extensively in research on strategy and organizations. Rather than studying only the characteristics of the actors themselves (i.e., nodes in the network), network scholars propose that gains in our understanding of behavior can be made by examining the relationships that connect the actors. These relationships can vary in terms of structure, for example, how densely or sparsely connected the ties within an actor's network are (Burt 1992, Coleman 1988). And they can vary in terms of content, for example, how heterogeneous the knowledge flowing

across the ties is (Rodan and Galunic 2004, Mors 2010). The two are often correlated. Sparsely connected networks tend to provide less redundant knowledge relative to densely connected ones.

Because an aim of this study is to shed light on the microfoundations of ambidexterity, two additional network attributes require attention. As noted by Barney and Felin (2013), research into microfoundations requires examination not only of individual level factors but also these individual level factors in light of the organizational context. Therefore, we also consider, first, whether the ties within the network are formal, i.e., associated with the manager's formal role in the firm, or informal, i.e., independent of the manager's role (Krackhardt and Hanson 1993, Lin 2001) and whether the ties in the network are internal or external to the boundary of the firm. In summary, we focus on three attributes of networks that prior theory suggests are relevant for ambidexterity: (i) the density of the network, (ii) the heterogeneity of contacts providing knowledge in the network, (iii) the informality of ties in the network; and how the effects of these may differ depending on whether the tie is with a contact internal or external to the firm.

Network structure: Density

Extant research on networks shows that the structure of a manager's network affects both a manager's access to novel information as well as the ability to mobilize resources. Sparsely connected networks, as opposed to densely connected ones, have been found to provide managers with new knowledge and information (Burt 1992, Reagans and McEvily 2003). The more interconnected a manager's network is, the more similar the information that the members of the network hold, which in turn leads to greater redundancy in the information provided by each contact. Thus, by maintaining sparsely connected networks, managers can improve their access to novel information (Burt 1992). Exploration for new opportunities requires a flow of novel ideas and knowledge from outside the firm. To this point, in a simulation study, Lazer and Friedman (2007) illustrate how a sparsely connected network maintains greater diversity and consequently is better for exploration than a densely connected network. A key dimension of ambidexterity common to exploration is the identification of new opportunities, which requires access to novel ideas from outside the firm. In contrast, exploitation of existing business

does not. For these reasons, low density in the external networks of managers should be associated with a higher likelihood of ambidexterity than exploitation, and there should be no difference in the likelihoods of ambidexterity and exploration.

Nevertheless, as described above, like managers focused on exploitation, managers that act ambidextrously must also mobilize resources within the firm to exploit current business opportunities. The cohesion that characterizes dense networks aids in the formation of cooperative norms (Granovetter 1985). In networks in which members are themselves connected, information diffuses rapidly and efficiently aiding the coordination necessary for implementation of existing business activities (Coleman 1988; Lazer and Friedman 2007). Thus, although the external networks of these managers are likely to resemble those of exploration-focused managers, we expect their internal networks to differ significantly. As described above, whereas the association of redundant information with dense networks means that they are less helpful for exploration efforts, density in internal networks is important for exploitation activities, as they require the efficient mobilization of the firm's resources. Specifically, the internal network density of networks of managers that act ambidextrously should be lower than managers focused on exploitation and no different from managers focused on exploration. These arguments lead to the following hypotheses:

Hypothesis 1: External network density in a manager's network is associated with a lower likelihood of ambidexterity than exploitation.

Hypothesis 2: Internal network density in a manager's network is associated with a higher likelihood of ambidexterity than exploration.

Network content: Contact heterogeneity

While most prior network studies point to the importance of the structure of individual managers' networks, the qualitative nature of the ties in the network, referred to as the content of the network, has also been shown to affect behavior and performance outcomes. Rodan and Galunic (2004) in their study of middle managers in a telecommunications company show that the heterogeneity of knowledge provided by contacts in the network was as important as the structure of the network for access to novel

information, and furthermore that access to a broader range of knowledge experts and resources also aided managers' implementation of innovations. Applied to this investigation, these arguments suggest that the heterogeneity of contacts in managers' networks, and therefore the knowledge available via the network, also will affect their tendencies towards exploitation, exploration or ambidexterity.

Greater heterogeneity of contacts in manager's network affects ambidexterity in at least two ways. First, and consistent with Rodan and Galunic's (2004) arguments about access to knowledge, contact heterogeneity aids in the discovery of novel recombinations of resources required for exploration. By synthesizing knowledge and information across knowledge areas, managers are more likely to make associations that lead to new business ideas. To this point, Atuahene-Gima and Murray (2007) argue that whereas intra-industry ties in a top management team's network are associated with exploitation, inter-industry ties are associated with exploration. Thus, the heterogeneity of contacts, and therefore the knowledge available via ties to these contacts in the external network of a senior manager aids in new opportunity identification. We expect that greater external contact heterogeneity of networks of senior managers will be more positively associated with ambidexterity than exploitation.

Second, ambidextrous behavior involves not only the generation of new business ideas, but also the cross-fertilization of knowledge and ideas between the new business and existing business of the firm. Managers with contacts across different units of the firm are well positioned to share ideas across units (Kleinbaum and Tushman 2007). At the same time, the higher cost of maintaining ties in other organizational units is likely to outweigh the benefits of these for exploitation or exploration activities alone (Hansen, Podolny and Pfeffer 2001), and so greater contact heterogeneity is a relatively 'expensive' means for supporting exploration or exploitation only. Senior managers who behave ambidextrously are more likely to benefit from greater contact heterogeneity of ties in their internal networks than managers focused on exploitation or exploration given the benefits to cross-fertilization of ideas, a unique dimension of ambidextrous behavior. Thus, we expect the internal contact heterogeneity of networks of managers who act ambidextrously to be greater than managers focused on exploitation or exploration. We propose the following two hypotheses:

Hypothesis 3: External contact heterogeneity in a manager's network is associated with a higher likelihood of ambidexterity than exploitation.

Hypothesis 4: Internal contact heterogeneity in a manager's network is associated with a higher likelihood of ambidexterity than (a) exploitation or (b) exploration.

Formal v. informal relationships in the network

Within organizations, both managers' formal ties, those associated with their formal positions in the firm, and their informal ties, those that are independent of their roles, affect managerial behavior (Krackhardt and Hanson 1993, Lin 2001, Sorenson and Rogan 2014). A manager's formal ties "evoke not only the resources embedded in positions in an organization, but also the power, wealth and reputation of the organization itself" (Lin 2001: 44-5), and are most critical to the implementation of existing activities. In contrast, informal ties are the result of non-prescribed social interaction processes and have been found to be more critical than formal ties when managers need to go outside existing boundaries (within or outside the firm) to accomplish tasks (Ibarra 1993, Tushman and Romanelli 1983).

As noted above, an important dimension of ambidextrous behavior is the allocation of the firm's resources towards new versus existing activities. Given that firms generally tend towards exploitation at the expense of exploration, this involves resisting pressures to invest resources mainly in existing business activities (March 1991). To do so, managers require autonomy in decision making as this allows them to allocate resources and attention towards exploration regardless of the pressures for exploitation (Burgelman 1994, McGrath 2001). For example, when managers occupy more senior roles in the firm, which are characterized by greater autonomy and discretion over resources, they are more likely to behave ambidextrously (Mom et al. 2009). Regarding the importance of informal structure, a link between informal ties and autonomy has been proposed by Kleinbaum and Tushman (2007) in their a conceptual model of corporate innovation in which individuals autonomously initiate cross-line-of-business projects not through the formal structure of the firm, but by using contacts from their own informal networks.

Informal structures affect senior managers' tendencies towards ambidexterity via both their external and internal networks. Informal ties to contacts outside the firm can increase a manager's autonomy within the firm. A manager's external network is a key driver of the manager's performance, for example by providing information about new business opportunities or facilitating access to needed resources outside the firm. When a manager engages in activities that are not aligned with the firm's existing business or that have uncertain outcomes, one means the firm has to sanction the manager's behavior is to threaten to remove the manager from her formal position. Removal entails the loss of benefits associated with the position, including access to the external formal network tied to that position (i.e. customers, suppliers, industry experts). In contrast, removal would not affect the continuity of a manager's informal ties to contacts outside the firm (e.g. Bendapudi and Leone 2002, Groysberg and Lee 2009), and the manager's performance (either at the current firm or in another firm should the manager leave) will be affected less by the firm's sanctions (cf. Rogan and Mors 2009). Therefore, given the tendency of firms to sanction unconventional, riskier activities, informal ties in the external network can increase managers' autonomy regarding the allocation of resources to new business, and both ambidexterity and exploration would be supported by having more informal ties in the external network. At the same time, ambidexterity also involves exploitation activities for which managers are likely to need formal ties. Managers have finite time to build and maintain their network ties, and the costs of maintaining informal ties are greater than the costs of maintaining formal ties, as they require a greater investment of personal time and resources. Maintaining a high number of external informal ties limits the number of internal, exploitation-related ties a manager can maintain. Therefore, we expect that greater informality of ties in a senior manager's external network will be more strongly associated with ambidexterity than exploitation but less strongly associated with ambidexterity than exploration.

When informal ties are internal, they play an important role in resource mobilization outside the existing hierarchy (Ibarra 1993, Krackhardt and Hanson 1993, Tortoriello and Krackhardt 2010). For example, Gulati and Puranam (2009) argue that informal structures enable coordination in addition to that provided by the formal structure of the firm, which allows managers to mobilize resources more

effectively. Informal relationships help managers avoid bureaucracy that hampers access to resources and slows down implementation (Løvås and Sorenson 2008). Thus, informal internal ties are associated with resource mobilization, a key dimension of ambidextrous behavior. In addition, internal informal ties aid in the cross-fertilization of knowledge between new and existing businesses (Kleinbaum and Tushman 2007, Tsai and Ghoshal 1998). By increasing the goodwill between the businesses and the motivation to provide and receive knowledge, informal ties improve knowledge sharing above and beyond the links provided by formal reporting relationships in the firm. Illustrating the importance of informal ties in cross-fertilization of ideas, Martin and Eisenhardt (2010) described how formal, corporate-driven collaborations between business units performed worse than collaborations originating via informal interactions between the units. Accordingly, informal internal ties of senior managers should be more effective than formal ties for the selective facilitation of these interactions. Given the importance of cross-fertilization of knowledge to ambidexterity, internal informal ties are more likely to be associated with ambidexterity than either exploration or exploitation.

Although informal internal ties can aid existing business, exploitation of existing business activities can be well served by the existing formal reporting relationships of the firm. Given that informal ties are more costly than formal ties to maintain, without the added benefit to cross-fertilization of knowledge, the net benefits of internal informal ties to managers focused purely on exploitation are lower than the costs of maintaining them. In addition, the usefulness of internal informal ties for managers focused only on exploration is limited given that the primary benefits are for resource mobilization and cross-fertilization of knowledge across units. Therefore, we expect that the informality of internal networks of managers who act ambidextrously will be greater than that of managers focused on exploitation or exploration. These arguments lead to the following hypotheses:

Hypothesis 5: External tie informality in a manager's network is associated with (a) a higher likelihood of ambidexterity than exploitation and (b) a lower likelihood of ambidexterity than exploration.

Hypothesis 6: Internal tie informality in a manager's network is associated with a higher likelihood of ambidexterity than (a) exploitation or (b) exploration.

Table 1 summarizes our argument and the resulting predictions.

Insert Table 1 about Here

METHODS

Empirical setting

The empirical setting is a professional services firm offering management consulting services to its clients (hereafter referred to as 'the firm'). We test our hypotheses on sample data of the professional networks of partners in the firm. At the time of data collection, the firm had annual sales of more than US$500 million, employed more than 55,000 professionals worldwide, and operated in more than 100 countries.[2] It had a partnership structure including analysts, consultants, project managers, senior project managers, associate partners, and senior partners. The firm was organized in global industry groups with functional specialty and geography as secondary dimensions. Our investigation focuses on the ambidexterity of senior managers, or in the study context, the partners of the firm. By studying senior managers at the same hierarchical level within the firm and at the same job grade, we are able to examine the relationship of their network attributes to ambidexterity over and above the effects of organizational and role related factors identified in previous work (Mom et al. 2009). The partners in the consulting firm in our sample perform roles similar to those performed by business unit leaders in firms outside of professional services. They are responsible for overseeing new and existing business activities for the firm and can oversee anywhere from a few hundred to a thousand consultants. Accordingly, they are tasked with allocating resources across the new and existing businesses and cross fertilizing knowledge between the new and existing businesses, while also mobilizing resources for efficient implementation of existing business and identifying opportunities for new business for the firm.

[2] For more information about the empirical setting, data set and data collection process, see Mors (2010).

Data collection

Testing the predictions required data on the managerial behaviors of partners and the attributes of their networks, which are available only via primary data collection. Therefore, we conducted two separate surveys: one survey of the supervisors of the partners to collect the managerial behavior and performance data and another of the partners to collect their network data. Furthermore, because access to senior managers, such as the partners in this study, is very difficult to obtain and limited, we took additional measures to validate the design of the surveys before administering them. In the first phase of data collection, in-depth interviews were conducted with 32 partners across five Western European countries. The interviews explored the role of professional networks in the work and performance of these partners and provided input to the survey designs. The interviews revealed the importance of ambidexterity to the performance of the firm. Explained a partner in the London office of the firm: *"We need to address the long-term now, both in terms of our external network and in terms of our internal networks…. So, the balance between long-term and short-term… is absolutely crucial."* The conflicting agendas of exploitation of existing business with clients and exploration for new clients were described by a partner in the Madrid office: *"Building new clients is not so easy, and most of our success is based on long term clients…But old clients learn a lot in working with you, and they always take the first [opportunity]…to negotiate lower prices. …You get [to the existing client] and you want to develop new opportunities with that client. [Also] you need to look for other clients and this is something that everybody clearly has on their minds."*

In the second phase, quantitative data were collected via two surveys over three stages. In the first stage, the survey was piloted with six partners to eliminate potential biases arising from the sequencing or wording of items. The results of the pilot indicated that an in-person interview format would generate the highest response rate and provide more accurate and complete data than a written questionnaire, and therefore, the survey was adapted for use in a face-to-face interview format (Schober and Conrad 1997). In the second stage of data collection, a sample of 147 partners was randomly selected from offices located in New York, Chicago, San Francisco, London, Paris, Milan, Madrid, Frankfurt, Tokyo, and

Sydney. A total of 133 survey interviews were scheduled, and of these 102 survey interviews were completed.[3]

The survey design used in the second stage adhered to the standard network methodology for egocentric designs (e.g., Burt 1984, 1992). It was organized in three main sections: (i) demographic data (ii) identification and description of contact networks of each partner, i.e., name generator questions (iii) characteristics of each of the contacts in the partner's network, i.e., name interpreter questions. The name generator questions were adapted to the empirical context. Thus, to generate the list of contact names in their networks, the partners were asked on whom they relied to identify new business opportunities, to negotiate and close deals, to provide new knowledge and expertise, to develop their skills, to provide operational support, and sponsor their projects. A partner could identify a maximum of 24 different network contacts. Partners also indicated the existence of relationships among the contacts they named so that structural measures of the ego networks could be constructed. The network surveys were administered during 90-minute face-to-face meetings with individual partners between November 1999 and January 2000.

The third stage of data collection involved the collection of managerial behaviour and performance measures for each of the partners surveyed. Via a separate survey, the lead investigator interviewed the supervisors of each partner in the sample to gather performance data. Due to legality and confidentiality issues, human resources would not provide performance data directly. Therefore, we adopted an approach consistent with related research on the performance of managers which confidentiality issues did not allow access to actual performance data (e.g., Cross and Cummings 2004, Moran 2005), and asked the supervisors to provide an assessment of each partner's performance. These data were collected via approximately 30-minute phone interviews with the supervisors, shortly after the official annual reviews of the partners were completed. The evaluation survey was designed to ensure that

[3] To rule out systematic bias between the partners sampled and those interviewed, we tested for differences in the mean values of the main organizational units of the firm (Levene 1960). There were no significant differences across industry group and functional specialization and only slight differences in geographic location. However these differences were a function of the availability of the interviewers in different geographic locations, not the partners' propensity to participate.

the questions were closely related to those in the actual internal annual review. In total, complete data on 79 of the 102 partners surveyed were collected, yielding a final sample size of 79 (1449 ties).[4]

Dependent variables

Managerial behavior. Managers vary in the extent to which they engage primarily in exploitation activities, exploration activities or both exploitation and exploration. Prior empirical studies have treated the exploration-exploitation trade-off either as a continuum (e.g., Lavie and Rosenkopf 2006, Lin, Yang and Demirkan 2007, Uotila et al. 2009) or as separate orthogonal dimensions (e.g., He and Wong 2004, Jansen et al. 2009). As argued by Lavie, Stettner and Tushman (2010) in their review of exploration-exploitation research, the use of a continuum is preferable because it is most consistent with March's (1991) foundational conceptualization of the exploration-exploitation trade-off, and it does not conflate the underlying trade-off with efforts to reconcile the trade-off. A useful guideline provided by Gupta and colleagues (2006) is that the relationship between exploration and exploitation depends on whether the two activities compete for scarce resources. In this study, the resources allocated by each partner to pursue new or existing businesses are primarily their own time and human capital or those of other members of the firm, which are by definition scarce. Therefore, we measured each partner's exploration-exploitation behavior on a continuum.

In the firm, exploration was represented by new business activities, for example, projects with new clients or projects involving new services, which had less certain outcomes for the firm. In contrast, exploitation was represented by existing business, such as the implementation of an existing client project, which does not introduce new uncertainty and instead brings closer in time the returns on the work. Therefore, we used a partner's tendency to engage in new business, existing business or both as indicators of exploration, exploitation or ambidexterity, consistent with prior ambidexterity work that focuses on the distinction between new business and existing business activities in the firm (e.g., Tushman and O'Reilly 1996, 1997). The supervisors rated each partner in the sample on a five-point

[4] We compared means from the final sample of 79 partners with the sample for which we had collected network data along a number of demographic variables and found no evidence of bias.

Likert scale: from one: 'much better at implementing existing business' to five: 'much better at new business development' with a midpoint of 'equally good at both.'[5] 'New' in this context refers to activity in which the firm has not yet engaged, as opposed to 'existing' which refers to an expansion or renewal based on existing practices with existing clients. From this measure we constructed the dependent variable comprised of three categories. Partners who received a score of one or two were categorized as 'exploitation-focused.' Those receiving a three were categorized as 'ambidextrous.' Those who received a score of four or five were categorized as 'exploration-focused.'[6]

Independent variables

Network density. Network density is the extent to which a partner's contacts interact with one another. We measured network density according to the method proposed by Borgatti, Everett and Freeman (2002) for ego-centric network data, which is as follows:

$$\textit{Network density} = \textit{ties} / [\ (\textit{size}*(\textit{size}-1)) / 2\ ]$$

Ties are the number of actual relationships among the contacts in the partner's network rated by the partner as being close or especially close to one another. *Size* is the total number of contacts in the partner's network where the denominator represents the number of possible ties among the contacts in the network. A high score on network density indicates that the partner's contacts are highly interconnected. Separate network density scores were calculated for the external and internal networks.

Contact heterogeneity. When reporting their network contacts, partners were asked to give the main industry within which each contact worked. Thus, contact heterogeneity is measured as the count of

[5] We took several steps to ensure that the supervisors correctly interpreted exploration, exploitation and ambidexterity when assessing the managerial behaviors of the partners in the sample. First, we consulted representatives of the firm to generate the wording for the measures that best reflected the firm's view of exploration and exploitation. Second, we piloted the question with two lead partners in the firm to verify that the question was being interpreted consistently. And third, we collected the data via telephone interviews with the supervising partners to ensure that we could adequately explain the question and answer questions regarding interpretation to improve the validity of the measure (Schober and Conrad 1997).

[6] We explored alternative methods for coding of the dependent variable. We recoded the variable such that categories 2, 3 and 4 were indicators of ambidextrous behavior, 1 indicated exploitative behavior and 5 indicated explorative behavior. However, with the recoded dependent variable, 91% of the partners are classified as ambidextrous; and the regression models did not converge. This distribution of responses for the dependent variable is not surprising and is consistent with the idea that respondents tend to avoid the ends of scales (ends aversion bias) and avoid extremes when given a range of options (Simonson and Tversky 1992).

different industries represented in each partner's network. Although contact heterogeneity is not a direct measure of the knowledge that is shared in the ties, it is a good indicator of the potential for heterogeneous knowledge flows in the ties in the network. Separate contact heterogeneity scores were calculated for the external and internal networks.

Informal ties. The informality of relationships was measured by asking the partners which resources they used to build and maintain each relationship with their contacts. On the written questionnaire item, the partners were reminded that they invested resources to build and maintain their network ties, and that some of these resources were independent of their formal role in the firm (e.g., personal knowledge, expertise, reputation, or friendship) and some were made available to them through their formal position in the firm (e.g., the firm's knowledge, reputation, or delivery capacity). The partners were asked to indicate on a five-point Likert scale the combination of resources they used to build and maintain each relationship with five indicating 'independent of formal' and one indicating 'formal.' We then calculated the average score for all ties in the partner's internal and external networks respectively. Thus, higher values indicate greater informality of ties in the partners' networks.

Control variables

We included standard human capital controls that could affect the relationship between our explanatory variables and dependent variable, including age and education.[7] Time to partner, or the number of years a manager was employed by the firm before promotion to partner, and tenure, total years with the firm, were included to capture the socialization of managers into the firm's routines, which could bias a manager towards exploitation. We also included the average growth rate in the partner's industry over the five years prior to the study year gathered from *Value Line* to control for industry driven differences in managerial growth performance.[8] We included a measure of each partner's revenue generation capability gathered during the interviews with the supervising partners (five-point Likert scale

[7] Including gender as a control variable does not affect the findings and gender is not significant. Therefore, we do not report the models including gender as a control variable.
[8] The Value Line data were compiled and made available to us by Professor Aswath Damadoran at NYU (http://pages.stern.nyu.edu/~adamodar/).

with five indicating highest level of revenue generation capability) as a control for performance differences across partners.

The sizes of the partners' internal and external networks were included as controls to rule out the possibility that network size rather than the hypothesized network indicators were responsible for differences in ambidexterity. We also controlled for the effect of tie strength to distinguish the effect of the informality of ties from the strength of ties in the network. Consistent with prior studies (Marsden and Campbell 1984, Tsai and Ghoshal 1998) we measure tie strength as the closeness to each contact measured on a five-point Likert scale from one indicating "distant" to five indicating "especially close." We then calculated the average closeness across the partner's contacts in the external and internal networks.

The partners in the sample were at the same level in the firm's hierarchy ruling out differences in ambidexterity due to differences in formal role. Because our sample is drawn from a single firm, we also can rule out organization-level variance in ambidexterity. However, although the partners were at the same level of hierarchy in the firm, they were members of different units in the firm. To be certain that the variance in managerial ambidexterity in our sample is not a function of unit-level ambidexterity, we control for unit-level ambidexterity by including the average managerial behavior score given to partners in the same organizational unit in the firm (17 unique units in the sample).

Analysis

The dependent variable, managerial behavior, is categorical. Therefore we estimated the models using a multinomial logistic regression (Long 1997). The variable coefficients in the models indicate the effect of a one unit change in the variable on the log of the ratio of the probability of being ambidextrous over the probability of being exploitation or exploration focused. Thus, a positive (negative) sign on a coefficient corresponds to an increase (decrease) in the probability of being ambidextrous rather than exploitation or exploration focused. All models were generated using STATA's (version 11.0) *mlogit* command with robust standard errors, and clustered by the raters (i.e. the supervising partners providing the performance data).

RESULTS

Descriptive statistics and correlations for the full sample are given in Table 2. Means and standard deviations for the explanatory variables are given by managerial behavioral type in Table 3. Of the 79 partners in the sample, 34 were categorized as 'ambidextrous managers' (43%), 21 as 'exploitation managers' (27%) and 24 as 'exploration managers' (30%). The high incidence of ambidexterity in the sample differs from prior work, which suggests that ambidexterity should be rare given the strong pressures for exploitation assumed to exist in firms. However, this could be explained by the fact that our study subjects were all senior managers in the firm, consistent with Mom and colleagues (2009) finding that ambidexterity was positively associated with formal decision-making authority.

Insert Tables 2, 3 and 4 about Here

Results from the multinomial logistic regression analyses are given in Table 4. Model 1 reports the results for the tests of Hypotheses 1 and 2. The negative significant coefficient on external network density in the baseline exploit model indicates that the likelihood of ambidexterity rather than exploitation decreases with external network density supporting Hypothesis 1. Hypothesis 2, predicting that internal network density would be more positively associated with ambidexterity than exploration was not supported. Model 2 reports the results for the tests of contact heterogeneity effects, Hypotheses 3 and 4. Hypothesis 3, predicting that external contact heterogeneity is associated with a higher likelihood of ambidexterity than exploitation was not supported. Hypothesis 4, predicting that internal contact heterogeneity would be associated with a higher likelihood of ambidexterity than either exploitation or exploration received partial support. Although the likelihood of ambidexterity was greater than the likelihood of exploitation, it is lower than the likelihood of exploration -- the opposite of the prediction. Model 3 reports the results for the final two hypotheses. Hypothesis 5 predicting that the informality of ties in the external network would be associated with a higher likelihood of ambidexterity than exploitation and a lower likelihood of ambidexterity than exploration received strong support. Hypothesis 6, predicting that the informality of ties in the internal network would be associated with a higher

likelihood of ambidexterity than exploitation and exploration, received partial support. In summary four of six hypotheses received support.

Interpretation

To interpret the coefficients, we followed the procedures recommended by Hoetker (2007) and plotted the conditional probability of being ambidextrous, exploitation-focused or exploration-focused for each significant explanatory variable holding the other covariates at their means using the estimates from Model 4 in Table 4 in Figure 1. As illustrated in Figure 1a, a one standard deviation increase in external network density decreases the probability of being ambidextrous by 29 percent, consistent with the arguments in Hypothesis 1. In Figure 1b, increasing internal contact heterogeneity from one standard deviation below the mean to the mean increases the probability of being ambidextrous by 4 percent, consistent with Hypothesis 4a. However, the graph also shows evidence of a curvilinear effect. Increases from the mean to one standard deviation above decreased the probability of being ambidextrous by 21 percent. Tests for a curvilinear effect by including the squared term of internal contact heterogeneity in the full model showed evidence of a weak effect ($p<0.10$), indicating that moderate levels of internal contact heterogeneity were associated with ambidexterity. Figure 1c illustrates the relationship between the informality of external ties and ambidexterity. Again, the graph provides evidence of a curvilinear effect. Increasing informality of external ties increases the probability of being ambidextrous up to a point and then decreases the probability. To confirm this we again tested for a curvilinear effect by including the squared term of informal external ties and found significant evidence of a curvilinear effect ($p=0.001$), indicating that moderate levels of informal external ties were associated with ambidexterity. Lastly, Figure 1d illustrates the relationship between internal informality of networks and ambidexterity. The probability of being ambidextrous increases by 71 percent when informality increases from one standard deviation below to the mean and by 19 percent when it increases from the mean to one standard deviation above.

Insert Figure 2 about Here

Robustness checks and further analysis

A test of the independence of irrelevant alternatives (IIA) assumption was not significant (Hausmann and McFadden 1984). Nevertheless, we also estimated the models using multinomial probit analysis, which is appropriate if the IIA assumption is violated, and the results are consistent with those reported here. Multinomial logistic regression can produce incorrect results if the sample size is too small relative to the number of explanatory variables in the models. Therefore we also estimated a reduced form model including only the significant variables in Models 5 and 6 in Table 4. The results are consistent with those reported here.

In the main analysis, we aggregated all ties generated by the different categories of the name generators in the network survey into an internal network and an external network for each of the partners. This aggregation assumed that the effect of network ties on behaviors is consistent across each of the categories of the name generator. As a check of the aggregation, we re-aggregated the ties into four internal networks and four external networks based on the following categories: one category for identifying and negotiating access to business opportunities, a second category for accessing knowledge and developing skills, a third category for getting sponsorship for projects, and a fourth for the operational support and talent relied upon to implement projects. The pattern of results for the explanatory variables was consistent with the reported findings using the fully aggregated measures in Table 4.

As with many studies of network effects, a potential for endogeneity exists. An unobserved variable could affect both the networks that a partner forms and the partner's tendency towards ambidexterity or the type of networks formed could be endogenous to the partner's exploration-exploitation behavior. To address this concern, first, as noted in the description of control variables, we included a set of measures of partner characteristics that could affect both networks and ambidexterity. Second, in an additional analyses, we attempted to estimate models using a two-stage least squares technique with an instrumental variable for the explanatory network variable in each of the models (Davidson and MacKinnon 1993). However, due to data limitations the available instruments did not meet the criteria for inclusion. Because weak instruments can introduce bias that is greater than

endogeneity bias they are intended to correct (Murray 2006), the instrumental variables regression could not be implemented with the available data; and we cannot rule out endogeneity bias entirely. We address the implications of endogeneity for the interpretation of our findings in the discussion section.

Lastly, although we did not hypothesize interaction effects among the network variables, given the differing effects of many of the network variables in the internal and external networks, one might be interested to know if significant interaction effects exist.[9] For example, if internal network density is associated with resource mobilization and external network density is associated with opportunity identification, how does the effect of external network density on the likelihood of ambidexterity change when internal network density is also high? To test for the possibility of interaction effects, we centered each of the network variables before creating the set of three interaction terms for internal and external density, internal and external contact heterogeneity and internal and external informal ties (Aiken and West 1999). Results of the estimations of the models including the interaction terms shows evidence of a significant, positive interaction effect of internal and external density and a significant, positive interaction effect of internal and external informal ties on the likelihood of ambidexterity relative to exploitation and ambidexterity relative to exploration.[10] The interaction of internal contact heterogeneity and external contact heterogeneity was not significant. Examination of the marginal effect of internal network density at high and low values of external network density indicates that internal network density does increase the likelihood of ambidexterity but only when external network density is above 0.38 (mean is .32). Below this level, the effect is insignificant (95% confidence intervals). Thus, the result of the estimation provides conditional support for Hypothesis 2. As predicted, internal network density is more positively associated with the likelihood of acting ambidextrously than acting exploratively, but only when external network density is high. A similar pattern of results was found for the effect of the interaction of internal informal ties and external informal ties. We had predicted in Hypothesis 6a that informal ties in the internal network would be associated with a higher likelihood of ambidexterity than

[9] We thank an anonymous reviewer for this suggestion.
[10] Results are available upon request.

exploitation but did not find support in the main analysis. Examination of the marginal effect of internal informal ties shows that internal informal ties are positively associated with ambidexterity but only when external informal ties are above 3 (mean is 2.78), and below this level the effect is insignificant (95% confidence intervals). Thus Hypothesis 6a receives conditional support.

DISCUSSION AND CONCLUSIONS

Benner and Tushman (2003: 248) observed that to achieve ambidexterity, "senior [managers] must develop techniques that permit them to be consistently inconsistent [and] …focused both on the short term and long term simultaneously." Yet, our understanding of how senior managers achieve this balance has been limited. In this study, we extended prior work on the ambidexterity of senior managers by offering arguments for how senior managers' networks help them balance the tradeoff between exploration and exploitation. Our analysis provides evidence that the networks of managers who act ambidextrously differ significantly from other managers and underlines the important role that networks play in shaping ambidexterity.

Ambidexterity involves balancing exploration and exploitation, and therefore it is associated with elements of each. Thus it is not surprising that our analyses showed that certain characteristics of networks associated with exploration are also associated with ambidexterity, and that other characteristics associated with exploitation are also associated with ambidexterity. For example, because the identification of new opportunities is important not only to exploration but also to ambidexterity, in our analysis, we found evidence of a significant positive association between sparse external networks and ambidexterity. Likewise, one dimension of ambidexterity that is also part of exploitation is resource mobilization. Thus, greater informality of ties inside the firm, which aids the mobilization of human capital and resources, was significantly and positively associated with ambidexterity.

More importantly, our analysis provides insight into the way in which senior managers separate and integrate exploration and exploitation activities and the role their networks play in aiding this separation and integration. Two dimensions of ambidextrous behavior of senior managers are unique to

ambidexterity: resource allocation and cross-fertilization of knowledge between exploration and exploitation activities (Benner and Tushman 2003, O'Reilly and Tushman 2004). The separation of exploration and exploitation is explicit in the allocation of resources to each of these activities. However resource allocation is challenging because, in organizations, the pressure for near-term, certain rewards associated with exploitation is generally stronger than the promise of long-term, uncertain returns to exploration (March 1991). Managers with decision-making autonomy are better able to reduce pressures for exploitation and ensure adequate resources are allocated to exploration (Burgelman 1994). Our analysis showed a positive association between informal external ties and ambidextrous behavior, supporting the argument that informal external ties in a manager's network improve the outside options available to the manager, which in turn increases the manager's autonomy when allocating resources. Ambidexterity also involves integration of exploration and exploitation via the cross-fertilization of knowledge between new and existing units (O'Reilly and Tushman 2004, Taylor and Helfat 2009). We found evidence consistent with the argument that informal internal ties and internal contact heterogeneity in networks of senior managers aid the selective cross-fertilization of ideas. This is also in line with the predictions of the conceptual model of cross-unit innovation proposed by Kleinbaum and Tushman (2007).

In further analyses, we found evidence of significant interaction effects of network characteristics on ambidexterity that warrant further discussion. As described in the results section, the effect of internal network density on the likelihood of ambidexterity was significant only when external network density was high. That is, the probability of ambidexterity was high either when a manager had sparse external networks or when the manager had a combination of dense external networks and dense internal networks. These seemingly contradictory findings are reconciled if one considers ambidexterity as representing a range of behaviors that combine exploration and exploitation to varying degrees. Some ambidextrous behavior may include more exploitation related behaviors. Other ambidextrous behavior may include more exploration related behaviors. Whereas dense internal and external networks would support the first, sparse external networks would better support the second. An implication of these

findings is that while ambidexterity is clearly represented by the mid point on a continuum between exploration and exploitation, it also includes a range of points of balance on the continuum. This interpretation is consistent with the idea put forward by Lavie and colleagues that "the distinction between exploration and exploitation is often a matter of degree rather than kind" (2010: 114). Although our measure of managerial behavior included a range of points between exploration and exploitation, actual responses were clustered in the middle three points, which limited our ability to probe further. Future research would benefit from further investigation of the set of behaviors that combine to support ambidexterity.

The study also highlights the important role informal networks play in ambidexterity (Kleinbaum and Tushman 2007, Mom et al. 2009). In the main analysis, the association of external informal ties and ambidexterity was positive at low levels and negative at high levels. Having more informal ties in their external networks affords senior managers more autonomy in decision making, which is needed to engage in riskier, exploration-related activities. Yet, efforts to maintain more informal ties in the external network may have limited managers' abilities to maintain other ties needed for exploitation-related activities, and so a moderate level of external informal ties best supported ambidexterity in the main analysis. Informal ties in the internal network had a consistently positive relationship to ambidexterity. These were likely important for the cross-fertilization of knowledge between units of the firm as well as the ability to mobilize resources quickly as these activities require knowledge and resource flows outside of the formal structures of the firm. However, a test of the interaction of internal and external informal ties indicated that informal internal ties were significantly associated with ambidexterity only when external informal ties were also high. One explanation for this finding is that informal ties in the external network, in addition to increasing a senior manager's autonomy, are also likely to be associated with the pursuit of business opportunities outside of the usual clients, services and industries of the firm. The implementation of these new opportunities and the linking of these to the firm's existing business would be aided by informal ties inside the firm because formal structures linking these new activities do not yet exist. This

interpretation connects to recent work on the performance effects of the interplay of the formal and informal structures of firms (e.g., Soda and Zaheer 2012).

Limitations

Generalizability. We tested our predictions in the context of a professional service firm. An asset of the study setting is that partners in the firm were expected to both implement existing business and generate new business. Thus, ambidextrous behavior occurred sufficiently often in our sample to conduct the empirical analysis. Furthermore it is interesting that even though the partners in the sample were expected to do both, we still observed significant variance in behaviors across the partners in the sample. A potential liability is that ambidexterity may be more common in this setting than in other settings. Exploration and exploitation relative and therefore must be defined from the viewpoint of a given organization (Lavie et al. 2010). We operationalized exploration and exploitation in the way that was most meaningful to the senior managers and the firm we studied – as new business versus existing business - which could limit the generalizability of our findings. Given that this study is one of the first to investigate the association between networks and individual level ambidexterity, this is not overly concerning. At the same time, it is important to recognize that the study setting does limit the generalizability of our findings. The partners (i.e., senior managers) in our sample were responsible for overseeing new and existing business activities for the firm and could manage anywhere from a few hundred to a thousand consultants similar to business unit leaders in firms in other industries, and so the locus of ambidexterity in this study was at the level of the individual partner. Consequently, the application of our findings to other organizations where the locus of ambidexterity is at a higher or lower level in the organization could require some translation. Nevertheless, we expect that networks are important to ambidexterity for members of organizations at all levels. Furthermore, our findings would apply not only to senior managers of professional service firms but also to business unit leaders, and so the research should be valuable to many managers and their firms.

Endogeneity. A network perspective on individual level ambidexterity implies that the networks of managers affect their behaviors. Nevertheless, we recognize that our study, like other studies of

networks and performance, is subject to bias from endogeneity (cf. Soda and Zaheer 2012, Tortoriello, Reagans and McEvily 2012). One might worry that an unobserved characteristic of managers affects both their networks and their behaviors or that networks and behaviors affect each other simultaneously. We took several steps to alleviate endogeneity concerns including the addition of control variables, and we attempted to conduct additional analyses using an instrumental variable regression. Nevertheless, the idea that networks drive behavior is well established in the theory, and recently empirical studies accounting for endogeneity provide evidence of network effects on behavior. For example, Kleinbaum (2012) argues and finds that the positive effect of an atypical career pattern on brokerage opportunities is fully mediated by direct prior ties and indirect ties in actors' networks, and his findings are robust to correcting for endogeneity. Thus, it is likely that networks drive a large part of the variance in ambidextrous behavior. At the same time, because in network theory an actor's networks are determined in part by the previous network structure, by definition networks are endogenous (Rosenkopf and Padula 2008). Thus, although we have attempted to reduce the concern regarding endogeneity, as in other network studies, a potential for bias still remains. An important task for future research is the identification of exogenous shocks or stronger instruments to better address endogeneity concerns.

Reverse causality. A related concern is reverse causality. The data are cross-sectional, which necessarily limits the interpretation of the findings. The networks we observed existed well before the behaviors of the partners were assessed (i.e., average tie duration was five years), implying that the networks were driving behaviors and not the other way around. Yet, even without making claims of causality, evidence of a positive association between networks and ambidexterity at the individual level is novel and valuable. Ambidexterity has largely been examined at the organizational level despite the fact that the theory highlights the importance of individuals to achieving it. Hence the theory leaves open questions about the level at which exploration and exploitation behaviors are integrated. Our study shows that integration does occur at the individual level and that the networks built and maintained by individuals play an important role in integration. This association helps explain how "ambidextrous managers" in models of structural ambidexterity are able to balance the tension between exploration and

exploitation that exists at all levels of an organization. These managers act both as buffers and integration points between new and existing activities or units of the firm. Part of their ability to do so may arise from cognitive skills (Smith and Tushman 2005), and as we have argued here, part may arise from the characteristics of their networks.

Implications and contributions

An implication of our theory and findings is that network characteristics at the individual level can affect organization level outcomes including performance and survival. For example, we found a positive relationship between informal ties and ambidexterity (and exploration). If the managers in a firm maintain primarily formal ties, they are likely to tend more toward exploitation rather than either ambidexterity or exploration, which in aggregate lowers the organization's survival chances. Such aggregation processes are fundamental to the development of a complete theory of microfoundations (Barney and Felin 2013, Felin and Foss 2005). Although we were not able to observe the aggregation process, interviews indicated that the partners were conscious of the effect their individual performance had on the firm's survival. One partner we interviewed remarked that if collectively the partners did not sell new work to clients for as little as six months, the firm would be out of business. Further examination of this aggregation process, and the role of networks within it, represents a necessary next step for research into the microfoundations of ambidexterity.

In closing, our study makes three contributions. First, our research adds to a stream of papers applying network theory to better understand ambidexterity (e.g. Im and Rai 2008, Lavie and Rosenkopf 2006, Tiwana 2008). Whereas past studies have explored either ambidexterity within relationships such as alliances or the effect of networks on organization level ambidexterity, we offer arguments for how differences in networks affect ambidexterity at the individual level. In particular, the evidence provided by our analysis that different network attributes are associated with different managerial behaviors should be of interest to both network scholars and ambidexterity scholars. To the extent that the exploration and exploitation behaviors that characterize ambidexterity are the result of interactions, information flows,

and normative constraints on behavior, the ties in the network that drive each of these processes support ambidextrous behavior.

Second, our study contributes to research on structural ambidexterity by providing insight into how senior managers separate and integrate exploration and exploitation activities in firms. As O'Reilly and Tushman (2004: 81) noted, "…ambidextrous organizations need ambidextrous senior teams and managers." While structural ambidexterity provides a solution to managing the trade-off at the organizational level, existing arguments provide little basis for understanding how the senior managers that serve as points of integration in structurally ambidextrous organizations manage the tradeoff at the individual level. A network approach to individual level ambidexterity complements prior work on managerial cognition as a means for managing the trade-off (e.g., Smith and Tushman 2005) by focusing on what senior managers do rather than what they think and how the characteristics of their networks relate to these behaviors. We found strong support for the argument that networks of "ambidextrous managers" differ from networks of other managers in ways that help these managers reconcile the trade-off between exploration and exploitation. For example, the dense internal networks and sparse external networks associated with ambidexterity support resource mobilization in existing business and identification of new business opportunities respectively, complementing the cognitive process of differentiating; and internal informal ties support cross-fertilization of ideas and resources, complementing the cognitive process of integrating.

Lastly, our study furthers our understanding of the microfoundations of ambidexterity. A recent stream of work has begun exploring the underlying individual level mechanisms that explain outcomes at the level of organization and in so doing contribute to our understanding of strategy and organizational performance (e.g. Corredoira and Rosenkopf 2010, Cui, Ding and Yanadori 2011, Eisenhardt et al. 2010, Kleinbaum and Stuart 2013). Like these recent studies, our paper addresses the call for ambidexterity research at different levels of analysis. By outlining how networks affect the ability of managers to act ambidextrously, this study not only advances our understanding of individual level ambidexterity, but

also lays more of the groundwork for understanding the implications of ambidexterity for organizational performance at higher levels of analysis.

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Table 1. Summary of predictions

Network characteristic	**Relationship to individual level ambidexterity**	
	External network	**Internal network**
Density	H1: Lower likelihood of ambidexterity than exploitation	H2: Higher likelihood of ambidexterity than exploration
Contact heterogeneity	H3: Higher likelihood of ambidexterity than exploitation	H4: Higher likelihood of ambidexterity than (a) exploitation or (b) exploration
Informality of ties	H5: (a) Higher likelihood of ambidexterity than exploitation and (b) lower likelihood of ambidexterity than exploration	H6: Higher likelihood of ambidexterity than (a) exploitation or (b) exploration

Table 2: Descriptive statistics and correlations[a]

	Variable	Mean	S.D.	Min	Max	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	Managerial Behavior	2.04	.76	1	3										
2.	External Network Density	.33	.32	0	1	-.17									
3.	Internal Network Density	.62	.20	.20	1	.06	.06								
4.	Ext. Contact Heterogeneity	1.13	.71	0	5	.13	-.02	.11							
5.	Int. Contact Heterogeneity	1.75	.95	0	5	.16	-.03	-.11	.35*						
6.	External Informal Ties	2.78	.94	1	5	.24*	.17	.09	.01	.02					
7.	Internal Informal Ties	3.30	.95	1	5	-.08	.23*	.13	-.14	.01	.31*				
8.	Revenue Generation	3.43	1.06	1	5	.22	.13	.08	-.02	-.17	-.03	.16			
9.	Age	43.72	4.46	37	55	-.11	-.09	-.07	-.05	.21	.03	-.01	-.13		
10.	Education Level	3.72	.55	3	5	.09	-.00	.07	.19	.01	.13	-.04	.12	.22*	
11.	Tenure	15.73	5.11	2	29	-.26*	-.02	.01	-.07	.23*	-.12	.02	-.05	.31*	-.25*
12.	Industry Avg. Growth Rate	.07	.03	.03	.11	.15	-.07	.11	.14	.03	.03	-.02	.04	-.01	.19
13.	Years Before Partner	9.61	3.58	0	15	-.27*	.11	.10	-.11	.02	-.09	.02	-.03	-.30*	-.29*
14.	Unit Level Ambidexterity	2.04	.31	1	2.80	.41*	-.19	.16	.09	-.05	-.01	-.13	.10	-.08	.04
15.	External Network Size	4.62	2.51	0	12	-.01	.15	.14	.34*	-.00	.03	.01	.14	.10	.16
16.	Internal Network Size	11.59	3.44	4	18	-.01	.01	-.35*	-.14	.24*	-.01	-.17	-.16	-.05	-.21
17.	External Tie Strength	3.44	.76	1.50	5	.08	.15	.15	.04	.10	.50*	.13	-.06	.11	.24*
18.	Internal Tie Strength	3.97	.50	2.62	5	.08	.07	.59*	.18	-.12	.08	.17	.23*	.10	.22

	Variable	11.	12.	13.	14.	15.	16.	17.
12.	Industry Avg. Growth Rate	-.10						
13.	Years Before Partner	.65	-.07					
14.	Unit Level Ambidexterity	-.20	.38*	-.11				
15.	External Network Size	.18	-.05	.10	.01			
16.	Internal Network Size	-.01	-.12	-.04	-.17	-.29*		
17.	External Tie Strength	-.05	.10	-.12	.06	.10	-.14	
18.	Internal Tie Strength	.10	.11	.05	.02	.44*	-.43*	.36*

[a]N=79

*p<0.05

Table 3: Descriptive statistics by managerial behavior type

	Exploitative *n=21*	**Ambidextrous** *n=34*	**Exploratory** *n=24*
Variable	Mean (sd)	Mean (sd)	Mean (sd)
External Network Density	0.43 (0.38)	0.30 (0.30)	0.29 (0.28)
Internal Network Density	0.57 (0.17)	0.66 (0.21)	0.61 (0.22)
External Contact Heterogeneity	0.90 (0.30)	1.24 (0.65)	1.17 (0.96)
Internal Contact Heterogeneity	1.57 (0.68)	1.71 (1.03)	1.96 (1.04)
External Informal Ties	2.49 (0.68)	2.74 (0.87)	3.09 (1.14)
Internal Informal Ties	3.30 (0.88)	3.43 (0.96)	3.10 (1.01)

Table 4: Multinomial Regression of Ambidexterity

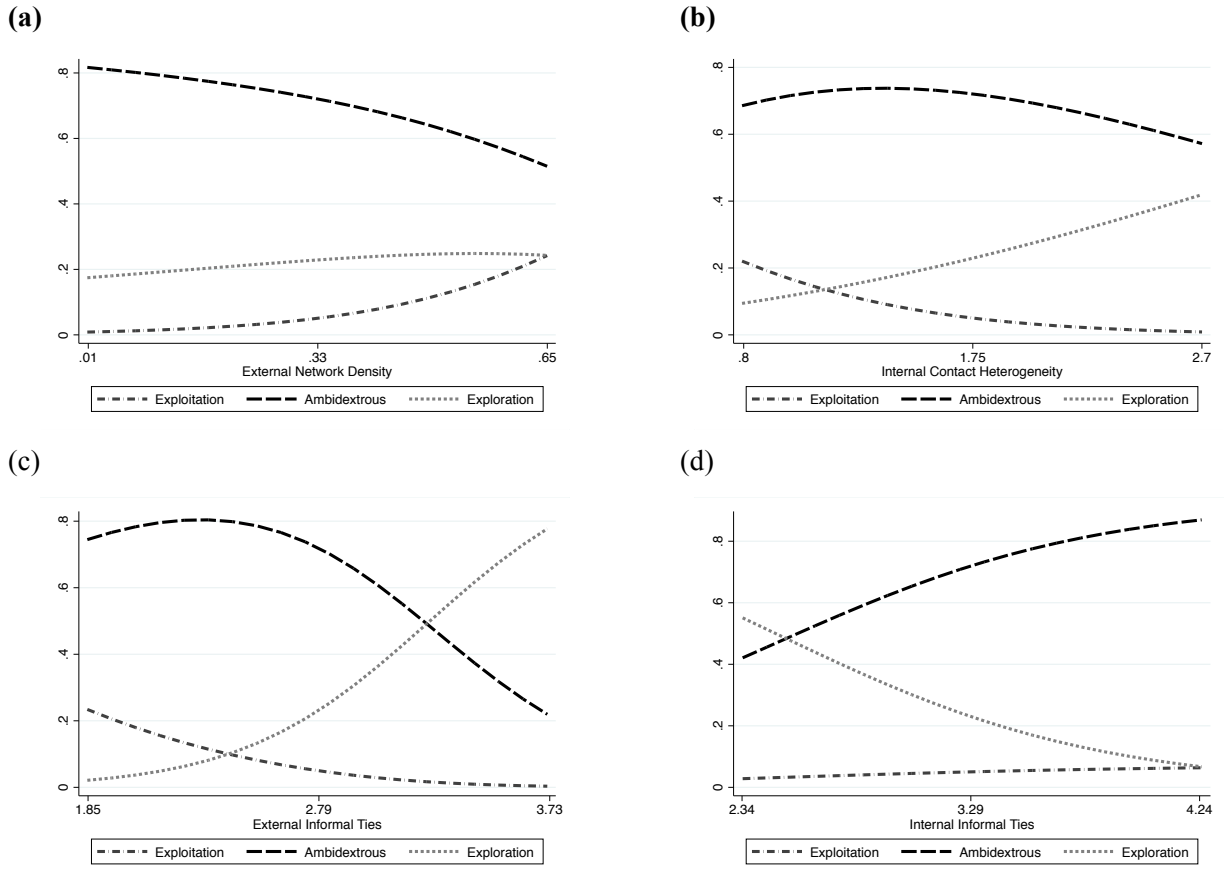
	Model 1		Model 2		Model 3		Model 4	
	Baseline Exploit	*Baseline Explore*	*Baseline Exploit*	*Baseline Explore*	*Baseline Exploit*	*Baseline Explore*	*Baseline Exploit*	*Baseline Explore*
External Network Density	**-3.46****	-1.31					**-5.94*****	-1.24
	(1.10)	(1.32)					**(1.54)**	(1.35)
Internal Network Density	2.32	**1.87**					1.53	**4.07**
	(2.40)	**(2.38)**					(3.41)	**(2.69)**
Ext. Contact Heterogeneity			**-0.05**	0.08			**-0.86**	0.67
			(0.45)	(0.78)			**(0.84)**	(0.80)
Int. Contact Heterogeneity			**0.90+**	**-0.19**			**1.60***	**-0.88***
			(0.50)	**(0.31)**			**(0.76)**	**(0.40)**
External Informal Ties					**0.64***	**-1.42****	**1.61*****	**-2.58****
					(0.33)	**(0.54)**	**(0.37)**	**(0.88)**
Internal Informal Ties					**-0.23**	**0.98***	**-0.05**	**1.49****
					(0.42)	**(0.45)**	**(0.59)**	**(0.50)**
Revenue Generation	1.07**	0.11	0.63	-0.03	0.68	-0.21	1.94*	-0.10
	(0.39)	(0.33)	(0.50)	(0.29)	(0.49)	(0.31)	(0.78)	(0.40)
Age	-0.18	0.10	-0.16	0.08	-0.19	0.14	-0.43*	0.18
	(0.12)	(0.14)	(0.11)	(0.14)	(0.14)	(0.15)	(0.20)	(0.21)
Education Level	0.85	0.74	0.55	0.72	0.73	0.92	0.69	0.86
	(0.90)	(0.58)	(1.04)	(0.65)	(1.01)	(0.75)	(1.42)	(0.76)
Tenure	-0.01	-0.22	-0.05	-0.16	0.06	-0.24	-0.05	-0.22
	(0.15)	(0.14)	(0.14)	(0.12)	(0.13)	(0.15)	(0.21)	(0.20)
Industry Avg. Growth Rate	-22.62*	-7.72	-18.26*	-6.19	-16.57	-9.04	-34.32*	-12.19
	(11.13)	(11.32)	(7.94)	(11.94)	(10.71)	(13.85)	(14.92)	(20.79)
Years Before Partner	0.05	0.47*	-0.04	0.38*	-0.06	0.53*	-0.05	0.65*
	(0.19)	(0.18)	(0.16)	(0.16)	(0.17)	(0.22)	(0.25)	(0.31)
Unit Level Ambidexterity	5.63*	-2.05	7.02***	-1.47	5.92***	-1.36	11.21**	-2.29+
	(2.47)	(1.31)	(2.02)	(1.20)	(1.63)	(1.25)	(4.02)	(1.37)
External Network Size	0.19	0.21	0.12	0.15	0.09	0.29	0.40	0.48+
	(0.20)	(0.21)	(0.24)	(0.18)	(0.20)	(0.19)	(0.30)	(0.25)
Internal Network Size	-0.06	-0.11	-0.10	-0.11	-0.09	-0.10	-0.18	-0.01
	(0.11)	(0.10)	(0.11)	(0.10)	(0.12)	(0.10)	(0.12)	(0.11)
External Tie Strength	0.62	0.11	-0.09	-0.04	0.05	1.12	-0.45	2.78**

	(0.61)	(0.49)	(0.68)	(0.48)	(0.77)	(0.78)	(0.81)	(1.04)
Internal Tie Strength	-0.40	-0.66	1.09	-0.11	0.49	-0.85	0.46	-2.91+
	(1.37)	(1.49)	(0.93)	(1.14)	(1.07)	(1.25)	(1.70)	(1.52)
Constant	-9.06	-1.57	-12.84+	-1.73	-9.47	-5.63	-12.32	-6.25
	(9.49)	(8.23)	(7.46)	(7.16)	(7.34)	(7.01)	(10.20)	(11.17)
Log pseudolikelihood	-60.06		-60.48		-57.09		-44.65	
Pseudo R2	0.29		0.29		0.33		0.48	
Degrees of freedom	13		13		13		17	

[a] N=79 (1449 ties); Dependent variable has three categories: Exploitation, ambidextrous and exploration. The baseline outcome is either exploitation or exploration as indicated for each Model. Robust standard errors clustered by supervisor are in parentheses. The relevant coefficients for the hypotheses tests are given in bold.

+ $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 1: Probability of ambidexterity, exploration and exploitation[a]



[a] The graphs are plots of conditional probabilities calculated using estimates from Model 4 in Table 4 for the range of values from one standard deviation below the mean to one standard deviation above the mean for each variable indicated. All other covariates are set at their means.