An Empirical Analysis of Strategies and Efficiencies in Social Networks

Nathaniel Bulkley
University of Illinois, Urbana-Champaign
nbulkley@uiuc.edu

Marshall Van Alstyne
Boston University & MIT
mva@bu.edu

Abstract: This research examines hypotheses about the efficient and strategic uses of social networks by a specific group of white collar workers. We examine two existing theories relating network structure and tie strength to performance and put forward a new hypothesis. The new hypothesis is based on a life-cycle interpretation of investment, returns and flows associated with social capital. It proposes that optimal network characteristics evolve over the course of a career from those favoring exploration to those favoring exploitation of knowledge and relationships. Using a unique data set containing email patterns and accounting records for several dozen executive recruiters, we find statistically significant differences related to network (1) structure (2) flow and (3) age. Consistent with existing theory, more central position is associated with higher output. The positional advantage is broadly true for weak ties, while strong ties among project team members confer an additional advantage. Applying our proposed theory, we find exploration strategies among early career recruiters and exploitation strategies among senior recruiters are both positively associated with performance. Results of this research have the potential to create a more complete understanding of different types of efficiency associated with social networks.

An earlier version of this paper received the International Network for Social Network Analysis/Visible Path award for the best graduate student paper on social networks and organizational performance (Sunbelt 2006). For helpful comments and suggestions, the authors thank Wayne Baker, Michael Cohen, Jerry Davis and Jun Zhang. The authors also gratefully acknowledge support for data gathering under NSF Career Award 9876233 and sponsorship from Intel Corporation.
The modern milieu of “anytime, anywhere” communication conducted over media such as email, instant messaging, cell phones and Blackberries has precipitated significant changes in how professionals do their work (e.g. Castells 2000; Friedman 2005). At the same time, social network research continues to grow at an exponential rate (Borgatti and Foster 2003).

Given these trends, it seems surprising that they seldom intersect in the form of research relating the strategic use of information communication technologies (ICTs) to individual performance. One reason is that intra-organizational network studies that measure individual performance are still fairly rare. Castilla (2005) uses direct measures; Brass (1981; 1984; 1985); Burt (1992; 1997; 2004; Forthcoming); Cross and Cummings (2004); Mehra, Kilduff et. al. (2001); Podolny and Baron (1997); Seibert, Kraimer et. al. (2001); Sparrowe, Liden et. al. (2001) use promotions or supervisor ratings. Rice (1994), which relates email communication of R&D interns to supervisor evaluations, may be the only network study to combine individual performance measures with direct measures of communication based on electronic archival data.

In this paper, we use direct measures of both communication and individual performance to test hypotheses about the efficient and strategic uses of social networks by a specific group of white collar workers. We use existing theoretical constructs, structural holes and the search-transfer problem, to explore implications of network position and tie-strength within an organizational email network (Burt 1992; Hansen 1999). We also test hypotheses from a proposed theory based on a life-cycle interpretation of social capital. We do this in a setting, executive recruiting, in which we were able to directly measure output in the form of individual revenue.
Our results are consistent with predictions of the two existing theories. While relationships between structural holes and performance have been established across multiple contexts, we do so using email to directly measure the information flows specified by the theory. In applying the search transfer hypothesis, we find that information flows, as well as position, are related to performance. Consistent with our new theory, we find exploration strategies among early career recruiters and exploitation strategies among senior recruiters are both positively associated with performance.

**Background**

We selected executive search as a setting for three reasons: (1) theory suggests strong relationships between social networks and individual performance; (2) we were able to directly measure a significant component of internal communication through records of email traffic; and most importantly (3) we were able to obtain direct measures of performance at the individual level.

Executive recruiters, colloquially known as headhunters, find people to fill jobs (Byrne 1986; Finlay and Coverdill 2002; Khurana 2002). Recruiters generate value through brokerage, filling the structural hole between clients and candidates. In return for a fee, typically around one-third of a candidate’s expected first year salary, recruiters lead a matchmaking process that involves selling candidates to employers and employers to candidates. Rangan (2000) suggests that the economic consequences of social networks are greatest in contexts involving search and deliberation, an apt description of what recruiters do.

Recruiters act as agents of employers. In retained search, the type we studied, a firm acts as an exclusive agent. Retained search generally focuses on more senior level positions and follows a team-based approach. Team-based brokerage requires extensive internal
communication, a portion of which we observed directly by measuring email traffic. Our interest centers on relationships between these internal information flows and individual performance. We focus broadly on three questions: (1) does position in the internal email network matter?; (2) do information flows matter?; and (3) does the nature of the value recruiters derive from internal communications change over the course of their careers?

**Research setting**

We conducted our study in a mid-sized firm that has a national focus. Like many professional services organizations, it is organized as a hierarchy. Partners have primary responsibility for landing contracts, a client-side activity we refer to as booking in accordance with industry jargon. Consultants focus more on executing contracts, finding the right candidate for the job, referred to as billing. The role distinctions are relative; all recruiters received some credit for billing and 96 percent received some credit for booking. For each search, the firm assigns credit as shares of revenue based on a task level formula. Access to accounting data at the level of search contracts allowed us to measure individual performance directly as billing and booking revenue.

Our focus on consultants and partners, the revenue generating members of the firm, follows from our interest in relationships with direct measures of performance. The firm also employs researchers and staff who provide support.

Selling people is a relatively complex form of informational arbitrage. The complexity of a recruiter’s role as intermediary generally increases with the job level of the position being filled (Khurana 2002). Task complexity creates opportunities for efficiency gains through specialization and teamwork. The modal team is composed of a partner and a consultant. No recruiter operated solely as a lone wolf and teams frequently reconfigured
around the demands of a new assignment. Two person teams conducted sixty percent of the searches, slightly under a third were solo searches and three or more person teams conducted the remainder.

The recruiting process can be divided into four stages in rough chronological order: (1) landing contracts; (2) identifying and screening candidates; (3) coordinating client interviews with “short list” candidates; and (4) closing the deal. The natural place for the division of labor within a search team occurs between the client (buyer) and candidate (seller) sides of the market. Internal information flows among recruiters can be thought of as market making activity. Recruiters generally prefer the richer media of phone and face-to-face for landing contracts and closing the deal (stages 1 and 4). They use email heavily in the information intensive process of dynamically matching characteristics of candidates with those sought by clients (stages 2 and 3).

*Using email to measure internal communication*

To investigate the networking strategies recruiters used within the organization we sought a way to measure fine-grained characteristics of communication, such as proportional information flows and response patterns. Studies of informant inaccuracy in surveys provide ample evidence of problems with subject reactivity and recall errors (Webb, Campbell et al. 1981; Bernard, Killworth et al. 1984; Marsden 1990). Although network surveys can provide reasonable measures of general communication tendencies, particularly when reciprocated reports are used, studies of informant inaccuracy have demonstrated that self-reports become increasingly unreliable for capturing finer grained details of interaction patterns. Using email
traffic as opposed to a network survey provided us with a way to accurately measure finer grained characteristics of communication.

At the same time, this choice meant we had to learn a great deal about how this particular group of recruiters used email. We focus this discussion around assessing the extent to which their email behaviors were likely to be consistent with more general communication behaviors across media. The alternative is that some behaviors could be specific to the use of email as technology leading to a strong methods bias. Since existing literature suggests email usage in organizations is context specific, we had to address this problem of interpretation through analyses based on the use of secondary data (Webb, Campbell et al. 1981; Rice 1994). Data we used for these analyses included survey self-reports of communication by medium (average number of people communicated with per day, proportion of time spent, proportion of value received), records of project assignments and records of the office locations of individual recruiters.

Our analyses provided significant evidence supporting the interpretation of a number of email measures as proxies for more general internal communication patterns. Some results help illustrate this claim. Recruiters were quite responsive to colleagues over email, using the medium as if it were instant messaging. When we divided response times into 30 minute intervals, we found the modal response time to colleagues for all recruiters except one was 0-30 minutes. E-mail was used extensively in the coordination of searches; more than 60 percent of the messages exchanged between revenue generating recruiters occurred while they had one or more active searches in common.\(^1\) We did not find any consistent evidence that

\(^1\) Results from a model that predicts the number of emails sent between any two recruiters further support this claim. Variables related to the number of weeks recruiters worked together on searches are the most significant predictors of the number of messages exchanged. In addition, all recruiters who worked together on searches exchanged some email.
recruiters who were collocated exchanged either more or fewer messages. The most prolific
communicators over email were the most prolific communications across all media; measured
email activity was correlated with self-reported estimates of the number of people
communicated with per day across all media (p < 0.01).

In this setting, email is not a good proxy for external communication. In addition, our
analyses led us to believe that five senior partners exhibited a preference for media other than
email in communicating with colleagues. But the results of these analyses suggested that
email could provide reasonably valid measures of the colleagues recruiters interact with
(network position) and frequencies of interaction (tie strength). Proportional flows of
messages across different types of colleagues also suggested characteristics of how individual
recruiters did their work. Dimensions of email activity we considered useful for testing
hypotheses included allocations of communication, timing and size, as well as topology.

Theory

We use theory to explain why we would expect to find relationships between the email
patterns of individual recruiters and their performance. We did not observe the larger
networks of clients or candidates. Instead, our data consists of information flows that occur
within a market making context of recruiters dynamically matching characteristics of
candidates with those sought by clients. Our theorizing reflects this internal focus.

---

2 More specifically, we examined email exchanges between all pairs of recruiters who worked together on a
search for more than half the study period. This distinction provides a common context. Within this group, we
examined dyads with the lowest levels of email activity (bottom 20 percent based on the expected number of
messages exchanged given the number of weeks of search activity). Some cases could be attributed to factors
such as recruiters who left the firm during the study period (in which case the time spent together on the search
was probably overstated). The remaining cases all involved at least one of five senior partners. The effects were
typically bi-directional, suggesting that not only did these individuals prefer other media, their teammates had
some level of awareness that made them less likely to initiate communication through email. Residual plots with
these partners highlighted did not reveal any evidence of unusual effects. Reported results include these partners.

3 The derivation of specific measures involved analyzing the distributional properties of the data in light of
theories to be tested. Details can be found in Bulkley (2006).
Drawing on our initial questions and observations of what we can measure using email data, we pursued three lines of interpretation. The first is to interpret email patterns as a representation of the informal communication network within the firm. Some positions in the communication network may provide better access to or control over information, which could be associated with higher levels of performance. The second is to interpret email patterns as indicators of the likely strength of dyadic relationships. Tie strength has implications for the movement and application of information, suggesting theoretical reasons why certain patterns of information flow could be associated with higher levels of performance. Finally, allocations of communication may be interpreted as realizations of strategies. In light of relevant tradeoffs, some strategies for interacting with colleagues may be associated with higher levels of performance. In particular, we considered the possibility of job level differences in associations between strategies and performance. We now turn to the theoretical development of these three interpretations.

**Network position and performance**

Brokerage is the mechanism through which recruiters create value. Explanations for how network positions facilitate brokerage developed in the theory of structural holes suggest why position in the internal email network could be associated with higher levels of performance (Burt 1992; Burt 2005). Benefits of structural holes include better access to and greater over information. Both are relevant in recruiting. However, we believe benefits related to information access are likely to better explain why position in the internal email network could be related to performance. The primary situation in which control over information becomes important involves negotiations between clients and candidates. As self-interested third parties filling a structural hole, recruiters know more than the client about
the specifics of the candidate and more than the candidate about specifics of the client. They are well aware of strategic advantages inherent in the *teritus* position and use this to frame expectations in ways they believe are most likely to lead to a successful match. However, much of this framing is most effectively done over the richer media of the phone and face-to-face, which we did not observe.

It is still true that better access to specific information on clients and candidates is likely to lead to more effective framing of client-candidate negotiations. In addition, better access to information leads to more options (e.g. more candidates, timely recognition of opportunities, referrals and scripts that facilitate sales). Not all of these options will be useful in any given search, but some valuable options that would otherwise lie undiscovered are likely to be created through better internal access to information.

While we have developed the argument that informational benefits associated with structural holes in the internal communication network may lead to higher performance, there is an argument for causality running in the opposite direction. Recruiters who are more effective performers, particularly those that have more productive relationships with clients, may be more sought after by their peers. We return to this question of causal direction in the context of our life-cycle theory of social capital.

Another possibility is that a relationship between structural holes in the email network and performance could simply reflect the effects of position in the formal network. We assess this through separate tests of relationships between performance and position in both the email network and the formal network defined by recruiters who worked together on search contracts during the study period.
Information flows and performance

It is important to recognize the role of opportunity costs in constraining the development of a recruiter’s internal communication network. Time spent communicating with colleagues represents time away from cultivating relationships with clients and candidates. The theory of structural holes suggests one route to optimizing a network, pruning and developing links to maximize sources of non-redundant information. In practice, efficient use of internal email is likely to involve maintaining some relationships with colleagues as weak ties and others as strong ties.

In investigating the optimal balance of strong and weak ties in the context of relationships between inter-unit communication and cycle time in new product development, Hansen (1999) focuses on the relationship with knowledge complexity. He hypothesizes that weak ties are optimal when the information conveyed is independent and codified, while strong ties are optimal for conveying dependent non-codified information. The explanation lies in balancing the relative costs of developing and maintaining ties at different strengths and their corresponding effectiveness with respect to two problems: searching for new information and transferring it within the context of a specific opportunity. Weak ties are less costly to maintain and usually sufficient for searching for information regarding new opportunities or ideas. However, when information is complex, meaning interdependent or non-codified, transferring it from one context to another often becomes problematic unless strong ties exist to support interpretation across contexts.

In executive search, the problem of matching clients and candidates involves the application of interdependent and non-codified information. Finding the right person for the job means establishing a match in the dimensions of specs, hot buttons and chemistry (Finlay
and Coverdill 2002). While initial screening of candidates occurs on the basis of independent
codifiable information, such as that found in resumes and stored in candidate databases
(specs), candidates that make the short list are more likely to be those who can differentiate
themselves in ways that correspond with a client’s specific desires (hot buttons). A good
short list candidate has attributes recruiters perceive as likely to represent solutions to the
problem(s) the client is trying to solve through a new hire. The right candidate is one who
also matches on the intangible dimension of interpersonal chemistry. In contrast to assessing
matches on the basis of specs, assessing matches at the level of hot buttons and chemistry
involves the transfer of complex information within the context of a specific search. This
leads to the argument that internal strong ties are likely to be positively related to performance
when they exist between recruiters working together on an active search.

It is reasonable to ask how strong ties might be identified using email data? In the
social network literature, tie strength is defined along dimensions of both frequency and affect
(Granovetter 1973; 1983; Krackhardt 1992). Without network survey data, we are unable to
directly compare properties of email measures with more familiar survey measures.
However, we have already mentioned that recruiters were generally very responsive to their
colleagues over email. Research in other professional settings where email is extensively
used suggests messages frequently occur in combination with phone or face-to-face activity, a
phenomenon Markus (1994) refers to as “channel-switching.” Common applications include
messages sent to schedule meetings, provide critical bits of timely information that make
sense in the context of identifying and defining problems or opportunities, etc. Markus’ work
suggests professionals often make the most of email, then meet face-to-face or use the phone
to address the remaining transfer problem. Her multi-method study of professionals in a risk
management firm provides an example of a context where email patterns are likely to be correlated with in-depth exchanges, suggesting an application as proxies. More frequent interactions are more likely to represent stronger ties in the sense that through these interactions team members develop the shared context or common ground that facilitates their ability to identify likely matches along dimensions such as hot buttons and chemistry (Weick 1979; Clark and Brennan 1991; Weick 1995).

Based on this argument, the primary measure we used to assess tie strength within teams was response time, defined in terms of gaps between messages and the percentage of messages returned within specific time intervals. We used message size as a secondary measure to investigate a related hypothesis that shorter more frequent email communication would outperform longer less frequent communication in the context of team based work. 4 We would not expect to find relationships between the frequency of communication with team members and booking revenue, since the coordination demands of booking are typically lower.

**The life-cycle of social capital**

The third application of email patterns we suggest involves interpreting allocations of communication across types of individuals as strategies. Strategies help define communication pattern; communication patterns can be used to make inferences about broad differences in strategies. We use this approach to test hypotheses regarding job level differences in relationships between information flows and performance. We develop these

---

4 This idea was motivated by a human analogy with a queuing theory problem involving the division of a volume of information into messages. One strategy for using email involves batching communication, resulting in longer messages and less frequent interactions. We hypothesized that the alternative strategy, more frequent interactions and shorter messages within search teams would be positively related to performance in executing search contracts. Load balancing models of queuing and network flow imply that short jobs can be swapped in and attended to more quickly than long jobs of the same priority. A natural analog for email might be a tendency of people to postpone or defer long messages until they have free time.
hypotheses by using a life-cycle framework to conceptualize social capital in terms of patterns of investment, consumption and flows.

A precedent for using life-cycle frameworks can be found in economics, where they provide a standard way of thinking about the intertemporal allocation of time, effort and money (Browning and Crossley 2001). Economists use these frameworks, which are collections of stylized facts, in developing theories that explain how people split their income between spending and saving, and how they borrow. For example, young people generally invest heavily (e.g. in education, building a family, buying a home), often through borrowing. As people get older, incomes generally rise; saving and investment increase sharply. In retirement, people spend most of their income and often more by selling off assets.

We suggest a similar conceptualization of social capital in terms of patterns of investment, consumption and flows. Young people generally begin their careers with little occupational social capital. They invest by establishing relationships with others they perceive may help them in their careers. As careers progress, opportunities for leveraging social capital begin to accumulate. Relationships and positions of influence can be tapped. People direct activity towards deepening productive relationships and begin to actively realize returns from social capital. Particularly within organizations, these include opportunities to delegate lower valued work to others. The flow of resources associated with social capital often peaks in mid-late career. In retirement, quality of life is influenced by flows representing returns on reputational assets. This may be simply good will associated with friendships, although it can also take the form of opportunities associated with honorary titles or even assets that can be sold, such as the name of successful business or client lists.
We use the broad outlines of this framework to interpret proportional allocations of internal email in terms of opportunities for accumulating or exercising social capital within the firm. Broadly speaking, we expect that optimal characteristics will evolve over the course of a career from an emphasis on accumulating to exercising social capital. This can also be thought of as a tradeoff between exploration and exploitation of knowledge and relationships (March 1991). This fundamental tension between exploring new possibilities and exploiting old certainties has been widely applied in organizational and inter-organizational studies to examine tradeoffs in organizational learning (Siggelkow and Levinthal 2003; He and Wong 2004; Homqvist 2004). We suggest that parallels between exploration involving activities such as learning and search and exploitation as refinement that promotes efficiency are relevant in the recruiting context. However, the explanatory power of the life-cycle framework lies in relationships between investment, realizing returns and flows, while the explanatory power of explore-exploit is based on tradeoffs between low and high variance strategies.

In applying the life-cycle framework to characteristics of email information flows within the firm, we focus on relationships with booking revenue. This reflects a somewhat cynical view of internal social capital as a means to an end. Economically, the most valuable form of social capital for recruiters involves client relationships. Approximately 80 percent of revenues come from contracts with existing clients. The importance of client relationships is reflected in the allocation formula for revenues associated with landing contracts. Individual recruiters are granted “ownership” rights over the clients they develop.  

Recruiters receive 50 percent of the booking credit for searches involving one of their clients; the remaining 50 percent is allocated according to tasks performed, such as fielding leads and managing the client relationship associated with specific contract.
Recruiters typically enter the firm as consultants with few, if any, client relationships. By actively developing their internal network, consultants can learn the ropes. The implication for testing theory is that we expect internal investment strategies will be positively associated with booking revenue at the consultant, but not partner level. Some allocations of email, such as the proportion of messages sent to colleagues a recruiter has never worked with formally on projects, can be reasonably interpreted as investment. This does not mean that partners cannot gain from investing in internal relationships, they can and do, but at the partner level we expect relationships with performance to run in the direction of allocations of communication that can be interpreted as leveraging social capital assets. For example, the proportion of internal email sent to consultants, interpreted as an indicator of the ability to delegate lower valued work to others. Our argument is that the life-cycle timing of the investment is important to consider (e.g. with respect to human capital, consider the implications for earnings relative to an age-based cohort of finishing a college degree at age 20 vs. 40).

We also find this framework useful for suggesting situations in which relationships between information behavioral factors and internal network position may vary by job level. One example involves the distinction between sharing procedural (e.g. “how to”) and declarative (e.g. facts, status updates) information with colleagues. A second involves relationships between information sharing behavior and network position. We develop these ideas further in outlining our hypotheses.
Hypotheses

We specify hypotheses that follow from our previous discussion to consider effects related to position in an email network, information flows and job level differences.

Network position

To investigate the role of a recruiter’s position in the network, we considered relationships between the effective size of structural holes and performance in the email network and the formal network. We define the latter in terms of recruiters who worked together on search contracts during the study period. Visualizations of the two networks can be found in figures 1 and 2 in the Appendix.

If relationships involving structural holes in the two networks were found to be similar, it could be argued that performance differences attributed to position in the email network might be misplaced; the email network might merely reflect the effects of formal organizational structure. On the other hand, studies of email networks in other contexts suggest they often contain many weak ties not present in the formal network, particularly geographically dispersed ties (Feldman 1986; Finholt and Sproull 1990). Research on communication networks suggests informal networks may be better predictors of performance, since the resources individuals rely on to do their jobs are often found outside the formal chain of command (Krackhardt and Hanson 1993; Monge and Contractor 1999). This leads to the following hypotheses:

Hypothesis 1a: The effective size of structural holes in a recruiter’s internal email network will be positively related to revenue.

Hypothesis 1b: The relationship between the effective size of structural holes and revenue will be stronger with respect to the email network than the contract network.

While we believe Burt’s theory of structural holes provides the best theoretical explanation for a relationship between position and performance in the recruiting context, we test two additional measures of position in a network, betweenness and indegree, to assess
whether the hypothesized effect is specific to structural holes or might be better characterized as a general notion of centrality.

Information flows

As explained in the previous section, we use response times to colleagues as our primary measure of tie strength. Following the logic of the search transfer problem, we hypothesize that relationships between strong ties and performance are likely to appear as a positive association between strong ties among team members and billing revenue. To test whether strong ties provide an additional benefit (theoretically attributed to the transfer of complex information) over search benefits associated with weak ties, we control for the latter. We also test for similar effects of email size to investigate a secondary hypothesis based on a queuing theory model of information flow that suggests shorter more frequent email communication may outperform longer less frequent communication in the context of team based work.

Hypothesis 2a: Controlling for network position, longer average response times to teammates will be negatively related to billing revenue.

Hypothesis 2b: Controlling for network position, sending longer average emails to teammates will be negatively related to billing revenue.

To test discriminant validity, we investigate similar relationships involving non-team email and booking revenue, contexts in which we do not expect that effects related to the transfer of complex information would significantly influence performance (Cook and Campbell 1979).

The life-cycle of social capital

We investigate relationships with performance predicted on the basis of our life cycle interpretation of social capital by formulating hypotheses as tests of whether theoretically relevant allocations of email communication are related to booking revenue at one job level and not the other. Among consultants, our framework suggests that email activity reflecting
investment in social capital will be positively associated with booking revenue. A higher proportion of e-mail messages sent to colleagues with whom they have not worked on projects is likely to correspond with a strategy focused on learning and developing relationships through exploration (March 1991). Research on the role of social capital in career success has found that individuals with multiple mentors and more contacts at high organizational levels enjoy greater career benefits (Seibert, Kraimer et al. 2001). This can be expressed in terms of a more diverse message share of communications with senior colleagues, namely partners in the recruiting context.\(^6\) We summarize these conjectures as:

**Hypothesis 3a:** For consultants, but not partners, the proportion of messages sent to colleagues with whom they have not worked on projects will be positively related to bookings revenue.

**Hypothesis 3b:** For consultants, but not partners, the diversity of email message share sent to partners will be positively related to bookings revenue.

Among partners, our framework suggests that email activity associated with the deployment of social capital assets will be positively related to booking revenue. Delegation of lower valued work to others represents one such opportunity. Partners can potentially delegate to consultants, researchers or staff. In this context, consultants can be thought of as middle management, so this represents the most efficient option when available. To reflect this, we use all internal email, including email sent to researchers and staff, as the denominator in the following hypothesis:

**H3c:** For partners, but not consultants, the proportion of messages sent to consultants will be positively related to bookings revenue.

Finally, we apply the life cycle framework to investigate potential job level differences in relationships between information behaviors and structural holes. Individuals that engage

\(^6\) We operationalize message share diversity of email communication through a Herfindahl index. This is explained under measures.
in certain behaviors may be more likely to achieve a favorable position in an internal communication network. The type of information exchanged with others, viewed on a spectrum ranging from procedural (e.g., “how to”) represents to declarative (e.g., facts, status updates) represents one such behavior. Among consultants, the exchange of procedural information is consistent with the investment motivation. Among partners, a position rich in structural holes may represent an information filter for obtaining the best facts that can be used as inputs into existing routines. This is consistent with models of organizational information processing in which orders flow down and information flows up the hierarchy (Galbraith 1973; Radner 1992; Bolton and Dewatripont 1994). Perceptions regarding the extent to which information shared with others was primarily declarative or procedural were elicited through a survey. Stated as a hypothesis:

\[H4a: \text{For consultants, procedural information sharing will be positively related to structural holes; for partners, declarative information sharing will be positively related to structural holes.}\]

Relationships between structural holes and attitudes towards information sharing may also differ by job level. We previously observed that network positions may be obtained by seeking out others or being sought after by others. We suggest that the former is more likely to be associated with performance among consultants and the latter among partners. For partners, we hypothesize that a self-professed willing to share information with others will be associated with structural holes. For consultants, our measure of seeking out others is self-reported personal rolodex size (i.e. typically the electronic equivalent).

\[H4b: \text{Partner structural holes will be positively related to information sharing; consultant structural holes will be positively related to the self-reported number of contacts privately held in personal rolodexes.}\]

\footnote{We observe that procedural information typically has value in repeated use, while the value of declarative information is contingent on the specifics of a decision problem (Blackwell 1953; Van Alstyne 1999). The distinction between procedural and declarative information frequently corresponds with a difference in the time horizon for realizing returns on the investment required to acquire the information. This suggests another parallel involving job level differences that is consistent with a life cycle framework.}
METHOD

Data

We based our analysis on a three-part dataset consisting of an online survey, accounting data on search contracts and six months of e-mail traffic. Participation rates for each of the three parts were over 80 percent. A total of 29 consultants, 27 partners, 13 researchers and 2 information technology staffers participated in at least one of the parts. Models used in testing hypotheses 1-3 are based on a population of 47 recruiters (22 partners and 25 consultants). As a result of survey non-response, the population for models used in testing hypothesis 4 is smaller (n = 39). Recruiters who left the firm during the study or worked part-time were not included in any of the models, although records of their email activity were used in computing measures.

The online survey consisted of 52 questions covering aspects of information management including attitudes towards information sharing, types of information shared (e.g. procedural vs. declarative), database use, compensation practices and proportions of time spent and value gained from both information sources and modes of information gathering. We used perceptual data from the survey to inform the interpretation of email measures through triangulation.

Output measures include booking revenue (associated with landing contracts) and billing revenue (associated with executing contracts). Since more than one recruiter is typically involved in executing and sometime landing a contract, total contract revenue is apportioned based on shares that were calculated by the firm on the basis of tasks each recruiter performed on the specific assignment. Contracts also identify the industry sector and level of placed candidates, information we used to control for search quality. Of the more
than 500 search contracts we examined in this study, 30 percent were conducted as solo searches, 60 percent were two person searches and the remaining 10 percent were predominately three person searches.

Although we have full e-mail logs for a period of six months, participation was voluntary on an opt-out basis, and we implemented several mechanisms to protect individual privacy, ensure consistency of data, and retain both firm and individual consent. Briefly, we encrypted e-mail header and body information using one-way hash functions that permit comparisons of similar tokens but not semantic interpretation of content (Zhang and Alstyne 2003). We provided incentive payments of $100 in Amazon gift certificates per person for consent. This and CIO encouragement helped boost e-mail participation above 85 percent.

Because there was extensive communication between offices (approximately 50 percent of the messages were exchanged among co-located colleagues), we selected the firm as the relevant network. In this paper, we focused solely on email communication among consultants and partners to compute measures with one exception: the proportion of internal email sent to consultants also includes messages to researchers and staff in the denominator. In this case, we use proportions of email as a proxy for interactions with individuals at different job levels and it was important to consider all of the alternatives within the firm.

Email communication involving external sources was also gathered and could be analyzed in future work.

Measures

We provide descriptions of all measures used in testing hypotheses in the Appendix.
Research Model and Hypothesis

We tested the hypotheses outlined in the theory section using the following linear regression model:

\[ Q_i = \alpha + \beta H_i + \gamma X_i + \delta Y_i + e_i \]

The determinants of output or network structure \((Q_i)\) in the equation above include: \((H_i)\) controls for the type of searches recruiters performed (two industry sector dummy variables and separate percentages of CEO-level and solo searches); \((X_i)\) human capital and organizational position controls (years of experience and a dummy variable for whether a recruiter had made partner); information behavioral treatments \((Y_i)\), constant \((\alpha)\) and error terms.

We began by fitting the base model composed of control variables, \((H_i)\) and \((X_i)\). We then added behavioral treatment(s). Significant effects are indicated by statistically significant changes in the F-statistic of the model. An overview of models as they relate to specific hypotheses is given in the table below:

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Controls</th>
<th>Treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Revenue</td>
<td>Revenue base model + Network structure</td>
<td>+ Network structure</td>
</tr>
<tr>
<td>H2: Revenue</td>
<td>Revenue base model + Network structure</td>
<td>+ Email behaviors</td>
</tr>
<tr>
<td>H3: Revenue</td>
<td>Revenue base model</td>
<td>+ Email proportions</td>
</tr>
<tr>
<td>H4: Network structure</td>
<td>Network base model</td>
<td>+ Information sharing</td>
</tr>
</tbody>
</table>

In testing hypothesis 2, we added the best fitting measure of network position to the base model. This enabled us to test whether characteristics of ties with team members (response times and message size) influenced performance while controlling for an individual’s position in the network. To test hypotheses 3 and 4, which predict differences between partners and consultants, we first ran the base model using the treatment of interest and then ran it using both the treatment and an interaction between the treatment and a consultant or partner dummy variable.
### Summary Table of Results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Supported?</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1a: Centrality in a recruiter’s internal email network will be positively related to revenue.</td>
<td>Yes</td>
<td>More central network positions in the email network are associated with higher revenues for both consultants and partners.</td>
</tr>
<tr>
<td>H1b: The relationship between network centrality and revenue will be stronger with respect to the email network than contract network.</td>
<td>Yes</td>
<td>A statistically stronger relationship with respect to email network centrality suggests that the email network is not merely mirroring the contract network.</td>
</tr>
<tr>
<td>H2a: Controlling for network structure, longer than average response times to colleagues will be negatively related to billing revenue.</td>
<td>Yes</td>
<td>Longer than average response times to teammates were negatively related to performance executing searches.</td>
</tr>
<tr>
<td>H2b: Controlling for network structure, sending longer than average emails will be negatively related to billing revenue.</td>
<td>Yes</td>
<td>For H2, size and frequency effects of communication matter in addition to topology. For H2b, sending longer than average emails was negatively related to performance executing searches.</td>
</tr>
<tr>
<td>H3a: For consultants, but not partners, the proportion of messages sent to colleagues with whom they have not worked on projects will be positively related to bookings revenue.</td>
<td>Yes</td>
<td>For H3, proportions and directions of information flows matter as well as network topology. For H3a, network search behaviors are positively related to consultant revenues, but not related to partner revenues.</td>
</tr>
<tr>
<td>H3b: For consultants, but not partners, the diversity of message share sent to partners will be positively related to bookings revenue.</td>
<td>Partially (1)</td>
<td>The diversity of message share sent to partners was found to be significantly related to performance among both consultants and partners.</td>
</tr>
<tr>
<td>H3c: For partners, but not consultants, the proportion of messages sent to consultants will be positively related to bookings revenue.</td>
<td>Partially (2)</td>
<td>For partners, focusing communications towards consultants may free up time to focus on rainmaking. For consultants, active participation in the peer-to-peer network may promote better performance through learning.</td>
</tr>
<tr>
<td>H4a: For consultants, procedural information sharing will be positively related to structural holes; for partners, declarative information sharing will be positively related to structural holes.</td>
<td>Yes</td>
<td>For H4 information sharing behaviors may differ across job levels with implications for social network development. For H4a, larger partner networks are associated with more declarative information sharing, while larger consultant networks are associated with more procedural information sharing.</td>
</tr>
<tr>
<td>H4b: Partner structural holes will be positively related to information sharing; consultant structural holes will be positively related to the number of contacts privately held in personal rolodexes.</td>
<td>Partially (3)</td>
<td>Relationships between information sharing and network size differ by job level. Partner information sharing is positively related to network size, while consultant information sharing is unrelated to network size at statistically significant levels.</td>
</tr>
</tbody>
</table>

(1) This hypothesis was supported with respect to consultant communication. The diversity of message share sent to partners was also found to be related to partner performance.
(2) The hypothesis was supported with respect to partner communication. Peer-to-peer communication was unexpectedly found to be positively related to consultant performance.
(3) The hypothesis was supported with respect to partner communication. Results were inconclusive with respect to consultant communication.
Results

Network structure

Hypothesis 1a: The effective size of structural holes in a recruiter’s internal email network will be positively related to revenue.

Hypothesis 1b: The relationship between the effective size of structural holes and revenue will be stronger with respect to the email network than contract network.

Table 1 - Relationships between network structure and performance

<table>
<thead>
<tr>
<th>Variables</th>
<th>Booking Revenue</th>
<th>Billings Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B   S.E. Adj. R² Sig. F Change</td>
<td>B   S.E. Adj. R² Sig. F Change</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>91,768 54,555 0.49</td>
<td>526,026 68,114</td>
</tr>
<tr>
<td>Yrs. of Experience</td>
<td>-3,465 3,145 0.48</td>
<td>-8,323 ** 3,514</td>
</tr>
<tr>
<td>Partner (Dummy)</td>
<td>222,596 *** 54,864</td>
<td>34,598 59,629</td>
</tr>
<tr>
<td>% Solo Searches</td>
<td>-270 93,836 0.47</td>
<td>289,259 ** 115,488</td>
</tr>
<tr>
<td>% CEO Searches</td>
<td>337,583 *** 129,338</td>
<td>181,485 113,758</td>
</tr>
<tr>
<td>Sector A (Dummy)</td>
<td>37,171 59,683 0.48</td>
<td>-88,139 70,045</td>
</tr>
<tr>
<td>Sector B (Dummy)</td>
<td>155,991 * 84,331</td>
<td>48,309 95,147</td>
</tr>
<tr>
<td>Base Model Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothesis 1a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email Network Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural holes (ge1)</td>
<td>7,066 ** 3,386 0.53 0.04</td>
<td>9,262 ** 3,906 0.24 0.02</td>
</tr>
<tr>
<td>Betweenness centrality (ge1)</td>
<td>17,528 24,837 0.48 0.50</td>
<td>55,876 * 27,872 0.22 0.05</td>
</tr>
<tr>
<td>Internal indegree (ge1)</td>
<td>7,226 ** 3,529 0.52 0.05</td>
<td>11,632 *** 3,918 0.29 0.01</td>
</tr>
<tr>
<td>Structural holes (ge5)</td>
<td>5,203 4,077 0.49 0.21</td>
<td>15,854 *** 4,173 0.37 0.00</td>
</tr>
<tr>
<td>Betweenness centrality (ge5)</td>
<td>9,771 12,658 0.48 0.44</td>
<td>35,743 ** 13,930 0.26 0.01</td>
</tr>
<tr>
<td>Internal indegree (ge5)</td>
<td>5,187 4,355 0.49 0.24</td>
<td>13,217 *** 4,789 0.28 0.01</td>
</tr>
<tr>
<td>Hypothesis 1b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract Network Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural holes</td>
<td>10,191 9,197 0.49 0.27</td>
<td>19,208 * 9,750 0.21 0.06</td>
</tr>
<tr>
<td>Betweenness centrality</td>
<td>13,840 18,463 0.48 0.46</td>
<td>33,403 19,978 0.19 0.10</td>
</tr>
<tr>
<td>Degree</td>
<td>10,287 8,204 0.49 0.22</td>
<td>19,265 ** 8,818 0.23 0.03</td>
</tr>
</tbody>
</table>

N = 47 recruiters, *** p < 0.01, ** p < 0.05, * p < 0.10

The positive relationship between structural holes in the email network and performance measured in terms of both booking revenue and billing revenue predicted by hypothesis 1a was statistically significant. For landing contracts, statistical significance depended on the cutoff point above which the number of email messages was interpreted as a link. Relationships were significant when measured over all possible ties, but this often did not hold when the weakest ties were excluded. For executing contracts, the relationship was
far less sensitive to the choice of cutoff point. Among the three centrality metrics, the
weakest relationships were usually observed with respect to betweenness centrality.
Structural holes and indegree exhibited similar relationships. On the basis of the best fit, we
chose structural holes at cutoffs of above one and five messages as the network structure
controls we needed to test hypothesis 2.

On the other hand, corresponding metrics computed on the basis of shared search
contracts alone were insignificant with respect to booking revenue and less significant than
email metrics with respect to billings revenue. This provides evidence that the email network
is not merely serving as a reflection of the formal contract network, despite considerable
overlap.

Information flows

Hypothesis 2a: Controlling for network structure, longer than average response times to
colleagues will be negatively related to billing revenue.

Hypothesis 2b: Controlling for network structure, sending longer than average emails will be
negatively related to billing revenue.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Booking Revenue</th>
<th>Billing Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>S.E.</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue Base Model</td>
<td>-5,306</td>
<td>44,463</td>
</tr>
<tr>
<td>Structural holes (ge1)</td>
<td>11,293</td>
<td>38,880</td>
</tr>
<tr>
<td>Structural holes (ge5)</td>
<td>-12,355</td>
<td>44,523</td>
</tr>
<tr>
<td>Email Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sent</td>
<td>12,864</td>
<td>24,908</td>
</tr>
<tr>
<td>Sent-team</td>
<td>2,976</td>
<td>23,213</td>
</tr>
<tr>
<td>Sent-non-team</td>
<td>25,744</td>
<td>23,688</td>
</tr>
</tbody>
</table>

N = 47 recruiters, *** p < 0.01, ** p < 0.05, * p < 0.10
Strongest structural predictor is effective size of structural holes at ge1 for booking revenue and ge5 for billing revenue.
As shown in table 2, sending longer emails and taking a longer time to respond to teammates on average was negatively related to performance executing contracts (billings revenue) at statistically significant levels. The results shown include the best fitting measure of network structure associated with the two types of revenue added as controls. We also obtained statistically significant results without these controls. Relationships with booking revenue were insignificant and relationships based on team email measures were stronger than those based on non-team email measures.

Although these results are consistent with our hypotheses, limitations of our existing data precluded a number of other potentially important controls that would be useful for differentiating between plausible competing hypotheses. For example, since only measures of the replies that came over email are included, a pattern of replying to email using other media, such as phone or face-to-face could appear as a longer response time. Appropriate size is likely to depend significantly on the context of both messages and the relationship between correspondents. Without better controls, any prescriptive interpretation of these results needs to be couched in very tentative terms. We return to this subject, bringing additional evidence to bear on the problem of interpretation in the discussion.

**Proportions of email**

**Hypothesis 3a:** For consultants, but not partners, the proportion of messages exchanged with colleagues with whom they have not worked on projects will be positively related to bookings revenue.

**Hypothesis 3b:** For consultants, but not partners, the diversity of message share sent to partners will be positively related to bookings revenue.

**Hypothesis 3c:** For partners, but not consultants, the proportion of messages sent to consultants will be positively related to bookings revenue.
Hypotheses 3a-c predict differences in relationships between proportions of email activity and performance at the consultant and partner levels. We tested each of these hypotheses by comparing two models. The first model included the base model and treatment with no distinction made between job level; the second model (below the dashed line) included the base model, treatment and an interaction between the treatment and a job level dummy variable. Shading indicates the relevant model for interpreting results.

For hypothesis 3a, both the treatment and the interaction term are significant when estimated together. For consultants, exchanging a greater proportion of emails with
colleagues they have never formally worked with on contracts is positively related to booking revenue (p < 0.01); for partners, it is negatively related.

For hypotheses 3b and 3c, the treatments are significant, but the interactions are insignificant. This is interpreted as a significant effect, but not one that differs by job level, indicating partial support for the respective hypotheses. A negative Herfindahl indicates a more diverse message share, so the interpretation of the hypotheses 3b result is that a more diffuse pattern of email communication to partners is positively related to booking revenue.

Taken together, the hypothesized positive relationships between proportions of email activity and performance of consultants and partners were all found to be at least weakly significant. However, both the diversity of message share sent to partners and the proportion of email sent to consultants were found to be significant predictors for both groups. The latter result can be interpreted as a job level difference between recruiters in that higher performing consultants are communicating proportionally more with their peers over email, while higher performing partners are communicating more with subordinates.

*Information sharing*

**Hypothesis 4a:** For consultants, procedural information sharing will be positively related to structural holes; for partners, declarative information sharing will be positively related to structural holes.

**Hypothesis 4b:** Partner structural holes will be positively related to information sharing; consultant structural holes will be positively related to the number of privately held contacts stored in personal rolodexes.
Table 4 - Relationships between structural holes and information sharing

<table>
<thead>
<tr>
<th>Variables</th>
<th>Structural Holes (ge5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>19.54</td>
</tr>
<tr>
<td>Yrs. of Experience</td>
<td>-0.43 ***</td>
</tr>
<tr>
<td>Partner (Dummy)</td>
<td>5.14 **</td>
</tr>
<tr>
<td>Sector A (Dummy)</td>
<td>-7.11 ***</td>
</tr>
<tr>
<td>Sector B (Dummy)</td>
<td>-6.84 **</td>
</tr>
<tr>
<td>Base Model Total</td>
<td></td>
</tr>
</tbody>
</table>

**Hypothesis 4a**

Type of information exchanged

(Procedural vs. Declarative)

|                     | B     | S.E. | SB  | T     | Sig. | Adj. R² | Sig. F Change |
|---------------------|-------|------|-----|-------|------|---------|               |
| " "                 | 0.45  | 0.62 | 0.11| 0.72  | 0.48 | 0.31    | 0.48          |
| " " * partner (dummy)| 2.44 ***| 0.86 | 0.59| 2.84  | 0.01 |         |               |

**Hypothesis 4b**

I volunteer all relevant information to colleagues

|                     | B     | S.E. | SB  | T     | Sig. | Adj. R² | Sig. F Change |
|---------------------|-------|------|-----|-------|------|---------|               |
| " "                 | -0.57 | 0.85 | -0.10| -0.67 | 0.51 | 0.31    | 0.51          |
| " " * partner (dummy)| -1.48 | 0.98 | -0.25| -1.50 | 0.14 |         |               |

**Hypothesis 4b**

Self-reported contacts in private Rolodex

|                     | B     | S.E. | SB  | T     | Sig. | Adj. R² | Sig. F Change |
|---------------------|-------|------|-----|-------|------|---------|               |
| " "                 | 0.001 | 0.002| 0.08| 0.48  | 0.64 | 0.28    | 0.64          |
| " " * consultant (dummy)| 0.001 | 0.003| 0.08| 0.26  | 0.79 |         |               |

N = 39 recruiters, *** p < 0.01, ** p < 0.05, * p < 0.10

Relationships between the type of information shared and structural holes were significant for both groups with opposite signs. For consultants, exchanging a greater proportion of procedural information was positively associated with structural holes, while for partners exchanging a greater proportion of declarative information was positively associated with structural holes, supporting hypothesis 4a at statistically significant levels.
The first half of hypothesis 4b, predicting that for partners the perception that they were more willing to share information would be positively related to structural holes, was weakly supported (just above $p = 0.10$), while self-reported information sharing was insignificant for consultants. Since structural holes were strongly correlated with the number of colleagues in a recruiter’s email network (degree measures), this suggests that sharing information is positively related to the size of partner networks while the relationship with consultant network size is inconclusive. The second half of hypothesis 4b, predicting that for consultants, more contacts in their private rolodexes would be associated with structural holes was not supported.

**Discussion and Interpretation**

Stepping outside the specific boundaries of the formal model, we provide gloss, caveats, and interpretation for our main findings. Based on our goal of understanding the benefits of networks within organizations, we find support for three sets of hypotheses regarding their various efficiencies. These predicted that structural holes relate positively to performance, more frequent communication among team members provides an additional advantage and communication strategies differ for accumulating social capital early in a career versus exercising it later on. Elaborating these findings below, we discuss context, applicability and limitations.

In relating social networks to performance in the context of knowledge sharing among structurally diverse work groups performing complex, non-routine tasks, Cummings (2004) found innovation to be negatively associated with structural holes in the networks of group leaders. In the context of executive search, we found structural holes to be positively associated with individual performance. Such differences may well hinge on questions of
context. More closed networks, in which the size of structural holes is smaller, are often associated with establishing trust and the ability to elicit specific capabilities from individuals in a complex, non-routine setting. On the other hand, more open networks may be advantageous in the recruiting context because deliverables are better understood, teams are smaller with a modal size of two, and network breadth facilitates finding the right person quickly. Correlations with other social network measures in our results also confirm centrality is important, while suggesting distinctions regarding the level at which networks are open or closed may be less important in this context.

While our results were consistent with Hansen’s (1999) search transfer hypothesis, we observe that complex information, defined as non-codifiable or interdependent, can take a variety of forms. In professional services, temporal interdependencies are common (e.g. a stream of updates that only make sense in the context of an evolving problem or opportunity (Thompson 1967). The construct validity of response times as a proxy for the frequency of interactions involving the exchange of complex information may well hinge on a confluence of factors including temporal interdependencies and “channel switching” (Markus 1994). When information is complex in other ways, as was likely to be the case in the R&D context in which Hansen (1999) conducted his research, this interpretation becomes increasingly questionable. It would benefit from tests using both survey and electronic archival data in other professional services contexts, suggesting opportunities for future research.

Our results are also consistent with our related hypothesis that shorter, more frequent email communication is likely to be more effective in the context of team based work. Studies of email use from social psychological, sociological, organizational and business perspectives provide a sense of “conventional wisdom” regarding more or less effective
practices for using email as a communications medium (Cavanaugh 2003; Kraut, et. al. 1998; Pickering and King 1995; Sproull and Kiesler 1995; Owens and Neale 2000). Our empirical results align with many of these notions. This literature also suggests response times and size are not the only relevant factors.  

Correlates of response time and email size measures provide some additional contexts for interpreting results. Among partners, we found correlations between sending smaller emails to consultants and both self-reported tendencies to mentor others (0.43, p < 0.10) and less time reported on email (0.48, p < 0.05). Preferences of executives for shorter email have been found in other settings (Owens and Neale 2000). One possibility is that, through mentoring, partners teach junior colleagues to better “fill in the holes” in email, enabling more efficient communication (Clark and Brennan 1991). It is worth considering what role is played by unobserved behaviors that permit shorter emails to be effective. Among consultants, self-reported information overload was correlated with longer emails (0.39, p < 0.10) and longer response times (0.49, p < 0.05) from teammates. The ability to juggle more simultaneous projects is positively related to consultant, but not partner performance and we speculate that the asynchronous nature of email communication may play a role.

While our findings support existing theories relating specific aspects of network topology and tie strength to performance, we find evidence that the underlying story is richer still. We introduced a life cycle framework of social capital to suggest that the role of a social network may change over time. Early in a career, when a professional is “learning the ropes,”

---

8 As an example of the importance of context, which we bounded by formulating hypotheses in terms of activity between search team members, we found email exchanges outside active searches and relationships with booking revenue did not typically exhibit statistically significant associations between shorter more frequent communication and performance. For example, the percentage of responses received from non search team members within one week is negatively associated with booking revenue at statistically significant levels. Gaps of more than one week are more likely to be associated with the initiation of new threads. This suggests recruiters do exhibit a tendency to seek out more successful colleagues over email.
the social network may serve as a source of procedural know-how, socialization, and new opportunities. There is relatively more emphasis on information pull. Late in a career, the social network appears to facilitate the dissemination of directives and the exchange of status updates. There is relatively more information push. These observations must be reconciled with measures of the send/receive ratio in this data set that suggest it declines with status. This appears consistent, however, with receiving more frequent status updates with no response required. In terms of explore vs. exploit more generally, we do not suppose that these two functions are mutually exclusive but rather that the relative emphasis changes over time. Our results support the idea that initiating contacts with others plays an important role in network building. At the same time, they also suggest a balance between initiating and deepening relationships that may evolve over the course of a career. In the recruiting context, a senior partner who is still directing a significant proportion of communications effort towards initiating new relationships may be one who hasn’t learned to use existing contacts effectively.

The positive relationship between junior consultant performance and the proportion of email sent to peers initially came as a surprise. However, this result makes sense when considered along with the positive relationship between exchanging procedural information and consultant performance. It suggests in seeking answers to questions, consultants are more likely to turn to their peers rather than admit ignorance to their superiors, an explanation that was supported by anecdotal evidence from interviews. The partner emphasis on declarative information corresponds with a prototypical executive decision maker, who needs the best facts to make decisions following established routines, while the consultant emphasis on procedural information sharing is consistent with the use of social networks for learning.
Our finding that information sharing was related to structural holes for partners, but not consultants has potential implications for the development of strategies to promote information sharing within organizations. These results suggest sharing information as strategy for network building may be more effective at senior levels, while exchanging information that promotes learning among peers may be of greater relative importance earlier in a career. They also suggest more value might be associated with information that is shared down the hierarchy from partners to consultants. Interviews confirmed that partners would never ask consultants how to perform a task. Status differences, accompanied by an unwillingness to risk embarrassment by admitting ignorance, may limit organizational learning across job levels in both directions.

While not stated in the hypotheses, we looked for and did not find a relationship between self-reported information sharing and revenues at statistically significant levels. This suggests a potential issue similar to that found in the economic literature on the private provision of public goods: sharing may benefit the organization as a whole, but unless it is related to the performance metrics on which compensation is based individuals may miss direct benefits from sharing.

A basic tension underlies a number of our results. Partners who focused a greater proportion of internal email activity on relationships with consultants performed better, but the relationship did not run in the opposite direction. Instead, consultant performance was related to communication with peers and the diversity of communication with partners. In other words, behaviors that were most strongly related to the performance of junior employees were not the same as those that appear to provide the greatest benefits to their superiors. We are intrigued by potential interpretations in light of new research on the effects
of second hand brokerage (Burt Forthcoming). With respect to consultants, the evidence suggests that establishing strong relationships to high performing partners may initially help socialization. But a misplaced belief in the efficacy of second hand brokerage could have negative consequences for subsequent career development.9

We speculate that results of this study are most likely to be applicable to professional service organizations, which have similar incentive structures and rely on similar skills, such as interviewing, negotiating, research, project management and the care and feeding of client relationships. Private sector examples include law, consulting, and accounting. Public sector examples include political action groups and university development offices. Since recruiters play the role of intermediaries, parallels with other types of professionals that play this role, such as investment bankers (Eccles and Crane 1988), venture capitalists (Stross 2000) and securities analysts (Zuckerman 1999) may be particularly relevant. However, a lack of existing social network research relating electronic archival data to performance limits our ability to assess external validity.

**Limitations**

This study also has important limitations. Our methodology does not establish the direction of causality. A simultaneous equation approach to model estimation would generally be preferred, pending enumeration of suitable instruments; a panel would be even better. We would have preferred a multi-method approach combining network surveys and electronic archival data. Our reliance on email alone was by necessity. This research also relies heavily on quantitative measures and would benefit from a deeper qualitative exploration of the patterns uncovered so far. For instance, while we have relied on interviews

---

9 Relationships between the proportion of email exchanged with colleagues weighted by their booking revenue and an individual’s booking revenue are negative and significant across job levels. In other words, in the performance dimension of bookings, higher performers tend to associate with lower performers and visa versa.
with individual recruiters in shaping our interpretations of findings to date, it would be interesting to learn more about recruiters’ intentional networking strategies, what these strategies mean to the individuals involved, whether these strategies are borrowed from previous careers, and how they evolve.

**Conclusion**

A major strength of this research lies in the data itself. Accounting data obtained for this research permits direct economic comparisons of performance at the individual level. Email data provides a direct measure of communication, as distinct from self-report. It also provides measures of information flow and behaviors. Linking information flows and behaviors as well as network structure to performance is a major contribution of this work.

More specifically, we find evidence of three distinct and statistically significant relationships. First, our results support existing theories that network centrality and structural holes provide information benefits. Recruiters scoring higher on these social network indices have higher levels of output measured in terms of revenue. This supports intuitive arguments for efficiencies of structure.

Second, our results suggest that flow efficiencies matter in addition to topologies. Controlling for network structure, smaller emails and shorter response times on average were positively related to performance. It should not be surprising that success might be related not just to whom you know but also to how you communicate with them.

Third, social networks may follow general patterns as they evolve over time. We find that early career professionals exhibit information seeking patterns consistent with building their networks. Late career professionals exhibit patterns consistent with deploying their networks. This appears almost directly as seeking diversity and learning versus seeking focus.
and clarity. Junior consultant performance is associated with the development of a peer network and procedural information sharing. In contrast, senior consultant performance is associated with a focus strategy exhibiting email patterns consistent with delegating work to others and the use of networks for exchanging declarative information. Consultants who initiated the most contacts with others were the most successful in developing networks, while information sharing was more important for partners.

This research also illustrates the value of intra-organizational networks in supporting externally directed activities. In the early days of executive recruiting, the recruiters with the largest individual rolodexes may have been the most successful. That no longer appears to be true. Indeed, statistically significant relationships between internal network activity and performance highlight the importance of internal communication in leveraging externally focused networks.

Finally, we are intrigued by the role electronic archival data sources are likely to play in the future development of social analysis. Using surveys and records of association researchers have focused on establishing that relationships matter; electronic archival data lends itself to analysis at the level of interactions. In the history of science, instrumentation that enables research at new levels of analyses, accompanied by careful observation and theorizing, has precipitated profound discoveries. We wonder what lies in store for the future of social science research.
Appendix

Description of Measures

Independent variables (treatments)

Social Network measures

All social network measures were calculated using UCINET VI software. The relevant network for this calculation was the partner and consultant network within the firm. For precise mathematical definitions, the reader is referred to Burt (1992) for structural holes and to Wasserman and Faust (1994) for betweenness centrality and indegree.

1.1 Effective size of structural holes
   A count of the number of links in an individual ego-network with a discount applied to links with nodes that are linked to each other.

1.2 Betweenness centrality
   A count of the number of times an individual lies on the shortest path between two others. When more than one shortest path exists, a fraction is allocated to all individuals on the shortest path in equal proportions summing to 1.

1.3 Internal indegree
   A count of the number of people from whom an individual receives communication. Each of these measures were calculated at two levels above which the number of emails was represented as a link. The cutoffs were greater than or equal to one (ge1) and greater than or equal to five (ge5) emails.

Information Flow measures

2.1 Proportion of messages exchanged with recruiters with no previous contracts in common
   Using 5 years of contract data, individual emails were classified into three groups: (1) those between recruiters working together on an active search; (2) those between recruiters not currently engaged together in a search, but who had worked together on a search previously; (3) and those who had never worked on a search together. The measure reflects (3) / ((1) + (2) + (3)).

2.2 Share of email communication sent to partners (Herfindahl)
   A Herfindahl index was calculated by using the total number of e-mails each recruiter sent to partners as the denominator and the number sent to each individual partner as the numerator. These values were then squared and summed. A Herfindahl index of 1 indicates a network concentrated solely on 1 individual, as the index approaches 0 it indicates an increasingly diffuse network.
2.3 Proportion of internal email sent to consultants

The number of messages sent to consultants was used for the numerator. The denominator is a sum of all internal messages, which includes those sent to partners, consultants, researchers and administrative staff.

Information sharing variables

All information sharing variables reflect self-reports given in an online survey. For 3.1 – 3.3 respondents used a slider to indicate their position on a spectrum. 470 distinct values were possible, values were normed to a 0-7 scale for use in regressions. For 3.4, respondents were asked to enter a number.

3.1 The question asked: the information content I share with others is typically:
declarative…procedural. This was explained with the further clarification: Declarative means factual data such as “Bob has 1995 MBA from Wharton.” Procedural means a know-how tip such as how to let a candidate down gracefully when he/she did not get the job.

3.2 Agreement with the statement: I volunteer all relevant information to colleagues.

3.3 Agreement with the statement: I have provided extensive mentoring to others within the company.

3.4 Self-reported size of the private rolodex.

Email network efficiency variables

4.1 Average size of internal e-mail sent
The measure used in this paper was the natural log of the email size distribution.

Forwarded messages were excluded because the time required to forward a message is unrelated to size.

4.2 Average response time
The measure used in this paper was the natural log of the response time distribution.

Daily periodicity was removed by scaling time to reflect a ten hour workday (8 am – 6 pm). A time based measure as opposed to “Re:” header was used because analysis of the data suggested individual specific differences in the use of “Re:”
**Independent variables (controls)**

5.1 Industry sector dummies

Dummy variables for industry sectors such as finance, health, education, etc. The firm used in this study conducted searches in three sectors labeled A, B and C. These sectors are not specifically identified and do not necessarily correspond to the examples given above because this information could help identify the firm.

5.2 Job level of searches (percentage)

Percentage of searches conducted at the (1) CEO level, (2) VP level and (3) All other levels. This three level distinction was suggested by recruiters as the most relevant.

5.3 Years of experience

5.4 Gender

5.5 Years of education

**Dependent variables**

When more than one recruiter was active in the process of landing (booking) or executing (billing) a search, revenues were apportioned on the basis of shares using an internal formula that assigns credit for particular tasks. These share calculations were provided by the firm.

6.1 Booking revenue

Revenue generated by the search credited to the recruiter(s) that landed the contract. Booking revenue was measured over the six month period that overlaps the email data.

6.2 Billing revenue

Revenue generated by the search credited to recruiter(s) who fulfilled the contract. Because searches take approximately 180 days on average to complete, a one year time window was used for calculating billing revenue and only searches that were completed within that year were counted.
Appendix

The Contract Network

Fig. 1. The network in which recruiters are linked by formal search contracts. Node colors indicate regional affiliations.
Fig. 2  The network of email communication between revenue generating recruiters (consultants and partners). Red lines indicate recruiters linked by email activity and active contracts. Green indicates recruiters linked by email and contracts before the study period. Light blue indicates recruiters who exchange email, but have never worked together on contracts.
Bibliography


