Dynamics of Social Capital: Effects of Performance Feedback on Network Change

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We present a theory of social capital dynamics. In particular, we examine how individuals in an organization respond to events such as performance evaluations by changing the way they interact with their contacts. We argue that positive performance feedback from supervisors increases levels of self-efficacy and results in increased utilization of new and existing social capital (i.e., forming new ties and increasing interactions with existing ties) while negative feedback decreases self-efficacy resulting in an individual reallocating their social capital utilization to concentrate on a small number of existing frequently accessed ties (i.e., decreasing interactions with some contacts while increasing interactions with others). Our arguments clarify the role of individual agency in social capital dynamics as well as highlighting the part that individual performance evaluations can play in the evolving structure of social networks. To test our hypotheses, we use a longitudinal-social network data set collected over a six-year period in the IT department of a global engineering firm. Using fixed effects panel regression models, we find support for our hypotheses, suggesting that performance feedback is a determinant factor in social capital dynamics.

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Introduction

In organizations, interactions are vital for getting things done. In what Wellman (2002) calls "networked individualism," work is increasingly self-organized and implemented in a collaborative and negotiated fashion with colleagues rather than through formal task relationships. Through social relationships, individuals access and coordinate the resources needed to accomplish work. Persons with strong access to resources -- in short, social capital -- are able to successfully complete the tasks they are set, and are likely to collect rewards as a result. Research taking this social capital perspective has typically focused on differences in social capital across individuals, and how these differences relate to differences in outcomes (*cf.* Lin, Cook & Burt, 2001). However, social capital also varies within individuals across time. Individuals may arrive at an organization knowing almost no one, and within a few months develop a number of relationships that provide the individual with key information and aid that enable the person to do their job. But these social capital dynamics are not simply a process of accumulation of relationships. First of all, social capital dynamics are as much about selective utilization of social capital as about simply forming relationships. Social capital can be pro-active, as in the case of family and friends looking out for someone, but in general it requires active effort to mobilize, including making decisions about which contacts to use for what problem. Second, as Sasovova, Mehra, Borgatti and Schippers (2010) point out, there is relational churn -- contacts come in and out of a person's work life as a function of numerous factors, including new employees being hired, job changes, location changes and so on. Much of this churn may be outside a person's control, but it is also clear -- especially in settings like the one we study -- that individuals continually make decisions about who to interact with in order get things done and achieve their goals.

Note that changes in a person's utilization of social capital need not occur only when their goals change. As has been well studied, individuals monitor their progress toward achieving their goals and make changes accordingly (Lord, Diefendorff, Schmidt & Hall, 2010). In organizations where realizing the benefits of social capital is part and parcel of accomplishing goals, this sets up a fundamental mechanism for social capital dynamics. In particular, feedback about performance is likely to be viewed as especially relevant. Thus, the fundamental dynamic we explore is how the feedback an individual receives with respect to their performance in the organization affects the choices they then make in constructing -- and then utilizing -- their social worlds.

Performance evaluations are intended to reinforce behavior that is in line with organizational goals and extinguish behavior that is misaligned (*cf*. Kluger & DeNisi, 1996). Goal-setting theory (Locke & Latham, 1990), control theory (Carver & Scheier, 1981), and feedback intervention theory (Kluger & DeNisi, 1996) all suggest that individuals are motivated to change their behavior as a result of performance feedback. However, theories of self-efficacy (Baron, 1988; Gist & Mitchell, 1992) suggest that an individual's belief in their own capabilities is malleable and receiving a high versus low performance evaluation will influence their confidence, which will have an impact on their goal-oriented decision-making process. We suggest that in knowledge-intensive organizations where flows of information are key to performance (Cross & Cummings, 2004; Sparrowe, Liden, Wayne & Kraimer, 2001), the behaviors that individuals are motivated to change include networking behaviors -- who they rely on for information and how much effort to allocate to each potential source. We develop a theory of social capital dynamics that explains how performance feedback and its impact on self-

efficacy can result in shifting social capital utilization, such as increasing reliance on certain existing ties, decreasing utilization of others, and risking reliance on new ties.

We characterize our work in three ways. First, our interest is in the role of individual agency and how an individual makes network changes in response to external events. This focus on agency is consistent with recent theorizing on network dynamics. For example, Ahuja, Soda, and Zaheer (2012) highlight the role of agency as a microfoundation of network change. Likewise, Gulati and Srivastava (2014) focus on the role that constrained agency plays in network dynamics. We examine relatively long term changes that may reflect elements of deliberate goal-oriented agency (a la Emirbayer & Mische, 1998), as opposed to, say, short-term emotional and perhaps unconscious reactions such as threat rigidity (Staw, Sandelands, & Dutton, 1981). We also note that the kind of agency we examine consists not of differences across individuals, as in personality or demographic differences, but within individuals over time, similar to the work of Lord and colleagues (2010) on self-regulatory processes.

Second, our work might appear to spring from a long tradition of research relating networks to performance. However, most work in that tradition sees performance as an outcome of network ties or position (Brass, 1981, 1984; Burt, 1992, 2005; Lin, 1999, 2001). This is not our aim. If anything, we examine how performance affects network ties. But in fact, it is not performance per se that we are interested in, but rather performance feedback. In this respect, our work is again more consonant with the self-regulatory literature than the social capital literature.

Third, while the network dynamics literature (*cf.* Snijders, Van de Bunt & Steglich, 2010) tends to focus exclusively on the formation and dissolution of ties, we add another dimension. Our subject is social capital, a concept that emphasizes the benefits that an actor might wring from his or her ties as much as the simple existence of ties. As such, the network dynamics we

study include changes in the utilization of existing ties. Specifically, we examine how individuals react to performance evaluations by adjusting their utilization of different elements of their social portfolio.

To test our ideas, we conduct a longitudinal analysis of a dataset containing social network and performance measures collected annually in the information technology (IT) department of a global engineering firm over a six-year period. Using fixed-effects regression models, we examine within-individual changes in tie utilization over time.

Theory and Hypotheses

Existing research on network utilization suggests that when people feel threatened or stressed, they tend to go to their close ties. For example, in work investigating the effects of firm performance on the social networks of firm leadership, McDonald and Westphal (2003) use threat rigidity theory (Staw et al., 1981) as an explanation of the networking behavior of CEOs. They show that CEOs of low-performing firms tend to seek guidance from executives in similar industries or who they are friends with. However, much of the individual level research that underlies threat rigidity is based upon short-term reactions as a result of stress, anxiety, and disasters, where people instinctively follow well-learned responses as opposed to making goal-driven decisions. While performance evaluations, especially negative ones, can result in stress and anxiety we suggest that threat-rigidity type reactions only influence behaviors a short-time after the negative stimuli. Our focus is on long-term change to peoples' networks that are likely to be more goal-driven and so we turn to other explanations of what underlies the relationship between external events and subsequent utilization of social capital.

Another potential explanation of how environmental events may influence network utilization is network activation theory (Menon & Smith, 2014; Smith, Menon, & Thompson, 2012). The theory is based upon a nested conception of networks in which there is (a) a potential network that consists of an individual's entire network, (b) an activated network that refers to just those people that come to mind at a specific point in time, and (c) a mobilized network consisting of people that an individual actually draws upon for resources. A test of the theory by Smith et al. (2012) indicated that under a condition of job threat, high status people will activate a larger subsection of their network compared to low status people. Presumably, this would then have implications for which contacts they would mobilize. This is an important finding that complements our present work, which is concerned with how individuals dynamically make changes in their mobilized network in response to varying job conditions.

A person's willingness to mobilize their network -- i.e., exploit their social capital -- is also likely a function of their perceived self-efficacy in this regard. Self-efficacy is an individual's perception of their ability to complete a specific task (Gist & Mitchell, 1992). The concept was developed by Bandura (1977; 1982) and has been shown to be an important factor in performance and learning outcomes (Taylor, Locke, Lee, & Gist, 1984; Stajkovic & Luthans, 1998; Wood & Locke, 1987). Bandura (2001:10) suggests that "efficacy beliefs are the foundation of human agency. Unless people believe they can produce desired results and forestall detrimental ones by their actions, they have little incentive to act or to persevere in the face of difficulties." Self-efficacy is thought to determine the amount of effort that people will put into a task and how long they will persist in doing it (Bandura, 1982). It is also thought to be a dynamic property of individuals that can change as a result of life events (Gist & Mitchell, 1992), as opposed to personality traits.

In the following section we develop hypotheses regarding the relationship between performance feedback, the resultant change in self-efficacy and social capital utilization. We consider three distinct ways of changing one's network to utilize social capital: (1) Adding new ties, (2) decreasing reliance on select existing ties, and (3) increasing reliance on others.

Performance feedback and utilization of new ties

Following Baron (1988), we suggest that a positive evaluation results in an increase in an individual's self-efficacy. That is to say, a positive evaluation increases an individual's belief in his or her "capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands" (Wood & Bandura, 1989: 408). In contrast, a negative evaluation leads an individual to have a decreased belief in their own capabilities. It is important to note that we are not examining the differences in self-efficacy across different persons (controlled for in our fixed effects models). In addition, our view is that the performance evaluations provoke goal-oriented decisions over the months that follow, as opposed to mindless, habitual decisions that can occur shortly after an environmental event. This claim contrasts with the threat rigidity perspective (Staw et al., 1981), which emphasizes habitual, well-learned responses to events. However, as Bandura (1982; 2001) indicates, people with lowered self-efficacy tend to avoid decisions that lead them into behaviors that exceed their coping strategies. In addition, individuals will only expend effort in situations that they perceive they are competent in (Wood & Bandura, 1989). This suggests that individuals with lowered self-efficacy may know the appropriate action to take to achieve a specific goal but in some cases are reluctant to take it (Bandura, 1982).

We believe that in a work context where the ability to use others as resources is key, performance evaluations will have a direct effect on a person's assessment of their ability to network. Consider, for example, the case of forming new ties. New ties carry a certain amount of risk. First, there is uncertainty about the value of the information that the new contact controls as well as how easily and quickly this knowledge can be transferred (Reagans & McEvily, 2003). An individual needs a certain level of confidence to overcome this uncertainty. Second, in organizations there is competition for people's attention, especially those who have resources (Davenport & Beck, 2001; Simon, 1971). Spending time and effort courting an individual who is already highly committed to many others requires confidence that the time and effort will be well spent. While some requests for information may result in a minimal effort required by the person sought out, other requests in the knowledge-intensive environment of our study require considerably more effort.

When an individual has an increased belief in their capabilities, we posit that they will be more likely to see the benefits involved in creating new ties as outweighing the risks. In addition, individuals are more willing to exert effort in situations where they believe they have the requisite capabilities (Wood & Bandura, 1989). This willingness to put in additional effort is important in the creation of new ties. Furthermore, we suggest that the feeling of competence an individual gets from a positive evaluation can give them the confidence to admit to others that they don't know something, an often necessary step when seeking information from others. Increased self-efficacy reflects that an individual has the confidence that they will have resources such as information to offer in return when seeking out new instrumental ties (Gouldner, 1960). Thus, we expect that the reception of positive performance feedback results in a decision to

increase the utilization of their social capital, making an individual more willing to take the risks involved in working with new contacts.

In contrast, when the same individual receives negative feedback, they will have lowered self-efficacy and we expect them to adapt their networks in a different way. In this situation there will be less inclination to utilize social capital in the form of new ties as the individual will have less confidence in themselves and will be less motivated to put in the necessary effort due to their perception that the risks outweigh the benefits. Note that the comparison is not between generally high-performing individuals and low-performing individuals (who may differ on a number of grounds), but between the same individuals responding to high or low performance evaluations.

Hypothesis 1: The more positive the performance feedback that an individual receives, the more likely they are to add new sources of information.

Changes in utilization of existing informational sources

In the knowledge-intensive setting that we consider here, employees know the importance of workplace relationships (Cross & Parker, 2004). As we have suggested above, when individuals receive positive feedback, their perceptions of self-efficacy are heightened and they become more willing to take the risks associated with developing and utilizing new social capital. Conversely, when they receive negative performance feedback, they avoid situations in which they perceive they feel they will have a low ability to cope (Bandura, 1977), hence they make decisions consistent with a preference to minimize both effort and risk. Specifically, they are less likely to utilize new unproven information sources. In line with this thinking, we posit

that high versus low performance feedback, will also lead individuals to make different goal-directed decisions about ways to manage their existing relationships.

Our theory of social capital dynamics proposes that utilizing existing ties also has costs and benefits. On the benefits side, existing ties provide individuals with information of known quality and reliability (Cross, Parker, Prusak, & Borgatti, 2001). However, there are also costs such as the time and effort required to maintain the relationship (Hansen, 1999; Hansen, Podolny, & Pfeffer, 2001), and the probable need to reciprocate the help at a later time (Grant, 2013). Individuals with lowered perceptions of self-efficacy are more likely to doubt their ability to pay these costs and hence will carefully evaluate the value of all their existing social ties. We suggest that in some cases they will decide to decrease the frequency of interaction. However, this does not mean that individuals with lowered self-efficacy will completely cease contact with all those in their network, as they are aware of the benefits of the ties. But they will try to balance the benefits of information with their reluctance to frequently put themselves in situations they are not comfortable with. As a result, we expect to see an overall reduction in the utilization of existing social capital. We formalize this as follows:

Hypothesis 2a: Lower performance feedback will result in decreased utilization of existing social capital.

Individuals get varying tangible benefits from their instrumental ties -- some are more useful than others. Although we propose a general tendency for individuals with low performance evaluations to react by decreasing their utilization of existing ties, this doesn't mean they will do this equally with all contacts. Rather, we suggest that they will be selective about it. Information-getting is rarely a one-way street, particularly in the knowledge-intensive settings

we consider here (Grant, 2013). At the very least, frequent interactions provide opportunities for trust, affection, shared identity and other aspects of relationship to evolve (Uzzi, 1997). There is likely to be a greater bond between individuals who interact more frequently. When an individual has reduced self-efficacy and wishes to only put in effort in situations where they feel most competent they will choose to interact with those they have the greatest bond with. Therefore, one approach to minimizing the risks and costs of accessing resources is to prune the ties with those they have had less interaction. Thus,

Hypothesis 2b: Lower performance feedback will reduce utilization of rarely-tapped ties more than frequently used ties.

Individuals with whom one interacts frequently are likely to have a similar understanding of the work environment and have shared experiences (Krackhardt, 1992; Mizruchi & Stearns, 2001). While there is less gain from existing ties with regard to novel information there is also less risk, which as we argue is a driver of the subsequent network changes of individuals after receiving low performance feedback. Thus, a negative performance evaluation leads one to redirect their efforts to better utilize known sources of information. The case of high evaluations or positive feedback is different. A positive performance evaluation confirms for the employee that they are relying on the right sources of information, and an individual would tend to learn from and replicate that behavior (Levitt & March, 1988; March 1999). In addition, elevated levels of self-efficacy associated with a positive performance evaluation increase an individual's subsequent level of effort (Wood & Bandura, 1989), likely resulting in increased interaction with existing ties. When an individual receives a mid-range performance evaluation, they have neither the same need to balance risks and benefits as recipients of low performance feedback nor the

same affirmation regarding their social capital utilization as recipients of positive performance feedback. We formalize these ideas as follows:

> ***Hypothesis 3: Both exceptionally high and low performance evaluations will lead individuals to increase reliance on the contacts they already utilize most heavily.***

Methods

Data

The data for the paper come from a six-year study of the global IT department of one of the world's largest engineering consulting firms with over 7000 specialists worldwide. The firm was originally founded in the nineteenth century and has grown through numerous mergers. While the global headquarters is based in the U.S. there are also regional offices throughout the Americas; Europe, Middle East and Africa (EMEA); and Asia/Pacific. Employees of the IT department were dispersed across 11 offices in various countries such as India, New Zealand, United Kingdom, and the United States. The number of people in each location varied from one to 41. The work conducted by members of the IT department was internal to the firm and involved supporting the IT infrastructure of the organization, e.g., maintaining the networks and servers. Members of the IT department also supported the day-to-day needs of the business through managing a technical help desk, and maintaining and upgrading the enterprise resource planning (ERP) system across geographic regions. Thus, the IT department members did not have required workflow relationships other than formally assigned reporting relationships (which, we account for in our analyses). In an interview, the head of the IT department indicated that there was the expectation that department members would reach across their locations for information to help them solve the IT challenges that they faced on a daily basis. This view is

also reflected in the IT department's mission statement to "*create strategic solutions to connect people and knowledge for firm and our global client community.*"

Access to information from across the IT department had notable performance implications for members. For example, the work tasks drove department members to develop global IT standards as well as to connect across geographic regions in order deal with virus attacks or global network reliability. The more they were able to access information, the better their performance would be as knowledge exchange was crucial to ensuring acceptable work products and effective rollouts of upgrades and new IT platforms. Overall, accessing knowledge from other department members was key to performance in the IT department.

During the six-year period (2004-09) of the study, one of the authors conducted an annual social network analysis survey of the IT department. In the last two weeks of October of each year the entire population of the IT department was surveyed. The number of people surveyed annually year ranged from 161 in 2009 to 176 in 2004. In all years except one, the survey response rate was over 88%, which is consistent with other network studies (e.g., Sparrowe et al., 2001). In 2007 there was only a 65% response rate. While this is not ideal, we have kept the 2007 data in our analysis for the sake of continuity.

The data in 2004 were collected through surveys emailed as documents to each member of the IT department. Respondents added their responses to the documents and emailed them back to the researcher. In subsequent years, data were collected through an online survey tool. The same questions were asked each year. Respondents were asked to indicate their relationships with all other members of the IT department using the roster method (Marsden, 2005). The roster consisted of all names in the IT department listed alphabetically. Respondents were also asked to provide their gender, tenure, location and hierarchical level. Individual performance was

evaluated by supervisors in late October and revealed to the employees during interviews conducted during the first two weeks of November. The performance data was given to us in early December of each year.

All network metrics were calculated using UCINET (Borgatti, Everett, & Freeman, 2002). Most of these metrics were based on individuals' outgoing sociometric choices, since our interest is in agency and outgoing choices are to a large extent under the person's control. However, metrics based on incoming ties were also used as controls.

Dependent variables

All of the dependent variables were based on one kind of network tie, which was information-getting. The tie was measured using the following sociometric survey question (Cross & Parker, 2004): "*Often we rely on the people we work with to provide us with information to get our work done. For example, people might provide us with simple or routine administrative or technical information that we need to do our work. Alternatively people might provide us with complex information or engage in problem solving with us to help us solve novel problems. Please indicate the extent to which the people listed below provide you with information you use to accomplish your work.*" The respondents could indicate a value from 0 to 6, where 0 = do not know this person, 1= very infrequently, and 6 = very frequently. A separate matrix was created for each data collection year, yielding six information-getting matrices. If a tie between two people in a particular year was impossible, such as when one of them was not part of the IT department, the tie was coded as a missing value. These data matrices then served as the basis for the network measures that served as our dependent variables.

New information-getting ties: To identify new ties, we first dichotomized each information-getting matrix at one or greater, meaning that any value greater than zero in an original data

matrix was recoded to one. Then, to get the number of new ties for a given person in a given year, we used the egonet change routine within UCINET (Borgatti et al., 2002), which simply counts the number of 1s in that person's row that were not present in the previous year's matrix. As noted in the results section, dichotomizing at different cutoff values had little effect on our results. We disregarded new ties that were the result of required workflow by excluding ties to each respondent's supervisor and subordinates.

Decreasing utilization of existing ties: To measure decreasing utilization of all types of ties, we counted the number of contacts with whom a given individual reduced their frequency of information getting.

Decreasing utilization of rarely-utilized ties: We use the term "rarely-utilized tie" to refer to information-getting frequencies of three ("somewhat infrequently") or below, as three ("somewhat infrequently") was the highest response on the "infrequently" part of the response scale. To measure decreasing reliance on rarely-utilized ties, we counted the number of such contacts with whom a given individual reduced their frequency of information getting (e.g., from a 3 to a 2, 3 to a 1, and from 2 to a 1). This was done for each pair of adjacent years.

Increasing utilization of already heavily-utilized ties: We use the term "heavily-utilized tie" to refer to information-getting frequencies of four ("somewhat frequently") or above, as four was the lowest response on the "frequently" part of the response scale. To measure increasing reliance on such ties, we counted the number of frequent-tie contacts with whom a given individual increased their frequency of information-getting (as in going from a 4 to a 5, a 5 to a 6, or a 4 to a 6). This was done for each pair of adjacent years.

Independent variable

The principal independent variable for this study was a person's performance as rated by their supervisor. Various measures of supervisor-rated performance were collected annually by the Human Resources department. These included separate measures for knowledge and skills, business development, client services management, project management, general management, employee leadership, and decision making. Each of these was measured on a 1 to 5 scale, and the overall average score across the seven measures was calculated. A factor analysis of the eight items using the principal components routine was conducted in SPSS indicated that they load as one factor. The factor analysis was conducted for each year that we have performance data. The scores for each year were then transformed into z-scores, so that in each year a score of zero represented average performance. In order to test for a curvilinear relationship between performance evaluation and reliance on heavily-utilized ties, we centered and squared the performance feedback variable.

Control variables

In this longitudinal study, we used two kinds of control variables: those dependent on both time and the individual (which we term person controls), and those dependent only on time (termed global controls). We selected variables to account for established mechanisms of network change and thus better investigate the influence of performance feedback on social capital utilization. Note that, with our fixed-effects models, time-invariant controls such as gender were not used.

Person controls

New incoming information-getting ties in prior period: To account for individuals who receive a great number of incoming ties in the prior period potentially having more opportunities to form

subsequent outgoing ties, we controlled for incoming ties. This control can be considered a popularity effect and accounts for Merton's (1968) Matthew effect or the effect of preferential attachment (Barabási & Albert, 1999).

Existing information-getting ties: Having a large number of existing ties may make it easier for a person to make new ties in the next period, and may provide a greater appreciation of the value in doing so. This control can be considered an activity effect (Snijders, et al., 2010).

Number of structural holes: We define a structural hole as the lack of a tie between two people who are both contacts of a given individual. Hence, the number of structural holes an individual has is the number of pairs of contacts who are not connected to each other. The direction of ties between the contacts was ignored. Structural holes are sources of social capital (Burt, 2000), thus it is possible that the number of holes that an individual has will influence subsequent network choices. This measure was calculated using the *brokerage elasticity* routine of UCINET (Borgatti et al., 2002).

Outgoing unreciprocated ties: An outgoing unreciprocated tie occurs when an individual receives information from a contact, but that contact does not report receiving information from the individual. Given norms of reciprocity (Gouldner, 1960), it is possible that an individual who seeks information from someone who does not seek it from the individual could feel slighted, and this would provide an impetus for network change. Hence, we controlled for this factor.

Transitivity tendency: To account for the transitive processes that are known to influence network change (Heider, 1946; Festinger, 1957), we controlled for an individual's tendency to form new ties with those who are connected to his current alters. This measure was calculated using the *egonet change* routine of UCINET (Borgatti et al., 2002).

Increasing/decreasing utilization of existing ties: In models predicting increases/decreases in utilization of certain kinds of ties (e.g., rarely-utilized ties, heavily-utilized ties), we controlled for increases/decreases in ties of all kinds.

Lost ties due to exit: The number of people in our sample was not static over time as some people left the organization and others moved to departments outside of our study. Since people might be motivated to replace contacts lost in this way, we controlled for this variable.

Hierarchical level: In our sample, several employees received promotions and demotions during the study period. Changes in role can have strong effects on a person's instrumental ties (Kleinbaum, 2012) as certain ties "come with" the job. We controlled for this in order to focus on network changes due directly to individual agency.

Global controls

Number of co-located people: Prior research (Festinger, Schachter, & Back, 1950) indicates individuals are more likely to make new ties with people that are co-located. Therefore, the more people who are located in a particular location, the greater the likelihood that individuals will form new ties based on propinquity alone.

Average performance by location: Average levels of performance can differ between teams, work groups or between people in different locations. This potentially can have an impact on the likelihood of individuals forming new information-getting ties.

Overall network density: The information network changes its overall level of connectedness over the six-year period. In years in which the network is becoming more connected there will be more new ties created. To control for this we included *overall network density* measured as the actual number of ties divided by the possible number of ties.

Models

To assess the relationship between performance feedback and subsequent network change we use negative binomial panel regression models, as our dependent variables (e.g., number of new information-getting ties) are counts. In all cases, we used fixed effects models to examine changes over time within individuals, effectively controlling for individual differences that could influence network change, including demographics such as gender, tenure, location, education, and stable personality characteristics such as extraversion (Klein, Lim, Saltz, & Mayer, 2004), neuroticism (Kalish & Robins, 2006), self-monitoring (Mehra, Kilduff, & Brass, 2001), and charisma (Balkundi, Kilduff, & Harrison, 2011). The fixed effects models allowed us to focus on how individuals react over time to important events such as positive or negative performance evaluations. In general, the independent variables in each model were measured at time t, whereas the dependent variable was measured at time $t + 1$.

Results

Table 1 provides descriptive statistics for all variables across the six time periods. The overall number of employees within the IT group was relatively constant throughout the six-year time period, ranging from 161 in 2005 to 176 in 2004. There was continual change in personnel over the period, with an average of 33 people exiting and 30 people joining the group each year. The average number of ties per respondent was lowest in 2004 (63 ties) rising to 82 in 2005 and up to 92 in 2009. We detail aggregated changes in performance evaluations in Table 2 in the form of a transition matrix of performance feedback quartiles. Although close to 60% of individuals who received an evaluation in the top quartile received a subsequent rating in this

same upper quartile, there was quite a bit of up and down movement in the bottom three quartiles.

<Tables 1 and 2 about here>

Overall descriptive statistics and Pearson correlations for the cases and variables used in the analysis are detailed in Table 3[1]. On average, each person in the analysis had 75.31 contacts from whom they sought information. The high value reflects the knowledge-intensive setting, and also includes contacts a person might reach out to very infrequently. The average number of outgoing new ties per person across the time periods was 17.91. The average number of contacts with whom the respondent increased interaction frequency (18.19) was similar to the average number with whom they decreased frequency (16.54). The average number of heavily-utilized ties that respondents increased interactions with (1.26) was similar to the number of rarely-utilized ties they decreased interactions with (1.98). We also controlled for the number of ties lost due to people leaving the network (average of 12.02).

<Table 3 about here>

In Model 1 of Table 4 we detail the effects of a variety of control variables on new tie formation. We found that individuals with more existing information-getting ties were less likely to seek out new information-getting partners (b = -0.033, p < .001), which suggests that there is a cost to maintaining multiple relationships. We also found that increasing utilization of existing ties is positive and significant (b = 0.016, p < 0.01), suggesting that, in general, when people increased their utilization of existing ties, they also sought out new ties. Finally, we found a positive and significant relationship between hierarchical level (a time-variant variable in this study) and number of new ties (b = 0.299, p < 0.01). Model 2 shows that the more positive the

[1] We used the maximum number of appropriate cases for each analysis, so the n slightly varies across models (i.e., fixed-effects models do not include cases with all zero outcomes across panels).

performance feedback that an individual receives, the more new ties they form ($b = 0.152$, $p < 0.05$), providing support for Hypothesis 1. In results not presented, our findings were consistent when using a higher threshold for what counted as a tie (i.e., greater than or equal to 2). We also conducted additional multi-level analyses to rule out the possibility that clustering at the level of location or manager was biasing our results. Results (available from the authors) from likelihood ratio tests indicate that adding an additional level of clustering (i.e., location or manager) did not significantly improve the fit over our presented model.

<Table 4 about here>

Hypothesis 2a and 2b predicted that a person would reduce their utilization of ties, and especially rarely-accessed ties, after receiving a low performance evaluation. Model 1 of Table 5 shows the effects of just the control variables on decreased utilization of ties of all types. Model 2 includes the performance feedback variable, and indicates a negative and significant relationship between individual performance feedback and the number of total ties with reduced utilization ($b = -0.093$, $p < 0.01$). Model 4 presents the significant relationship between performance feedback and the number of rarely-utilized ties with decreased interaction ($b = -0.179$, $p < 0.01$). These results provide support for Hypotheses 2a and 2b.

<Table 5 about here>

In Table 6 we present results predicting increasing utilization of specific ties. Hypothesis 3 predicted that both exceptionally high and low performance evaluations will lead individuals to increase reliance on contacts that they already utilize most heavily. In Model 1 we specify the control variables predicting increased reliance on heavily-utilized ties. We found that individuals higher in the hierarchy increased their reliance on a greater number of such ties than other IT department members ($b = 0.295$, $p < 0.05$). Results in Model 2 include our hypothesized

variables and indicate a curvilinear relationship between performance feedback valence and further reliance on already heavily-utilized ties ($b = 0.080$, $p < 0.05$) providing support for Hypothesis 3. See Figure 1 for a plot of this relationship. As an aside, additional analyses did not find any significant relationship between performance feedback and increased reliance on rarely-utilized ties, making it clear that it was only already heavily-utilized ties that were being further utilized.

<Table 6 and Figure 1 about here>

Alternative mechanisms

In this paper we explain network changes as a result of individual decisions induced by unfolding events. However, we recognize the possibility of alternative mechanisms that could also explain our pattern of findings. For instance, it is possible that -- through gossip and other processes -- an individual who received a positive performance evaluation could subsequently become more visible in the workplace and be seen as a more desirable interaction partner by others. This in turn could make their attempts to form ties with others more likely to succeed and therefore result in more new ties (our Hypothesis 1). Likewise, an individual who received a negative performance evaluation might become stigmatized and less attractive to others in the network, making their attempts to make new ties more difficult and leading their existing ties to shy away from them (Hypothesis 2a and 2b). This mechanism of attraction could lead to a similar pattern of findings of network evolution as we actually observed, and yet would not involve motivational differences in agency on the part of the focal actor, as we have theorized. However, an implication of this alternative mechanism is that individuals receiving positive performance evaluations would become attractive partners to others and therefore receive more incoming ties. But, as shown in Table 7, there was no significant relationship between valence of

performance evaluation and the subsequent number of new incoming information-getting ties (b = 0.002, p ns). This suggests that it was not changes in the attractiveness of the focal individual as a result of a performance evaluation that was driving network evolution.

<Table 7 about here>

Post-hoc dyadic analysis

We also investigated dyadic factors that might influence changes in social capital investment in our sample. Using the multiple regression quadratic assignment procedure (Dekker, Krackhardt & Snijders 2007; Krackhardt 1987) we analyzed the formation of new ties in a subset of our data using UCINET (Borgatti et al., 2002) (results not presented in this manuscript). We found a general tendency for new ties to form between individuals located in the same geographic region and function consistent with the laws of propinquity (Allen, 1977; Festinger et al., 1950) and homophily (McPherson, Smith-Lovin, & Cook, 2001). However, the propinquity effect was negatively moderated with sender performance, such that recipients of positive performance feedback were more likely than others to form new ties reaching across geographic regions. In addition, we found a general tendency for top performers to form more new ties than others. These results are consistent with our actor-level fixed effect models.

Discussion

In our six-year study of a global engineering firm, we found evidence that annual performance evaluations -- an environmental event that triggers individual decisions related to goal-setting behaviors -- affects how individuals utilize social capital within the organization. In general, when an individual receives positive feedback, they expand and deepen their utilization of social capital. One way they do this is by forming new ties to information sources. Another

way is by increasing the frequency of interaction with existing sources, which serves a double purpose of strengthening their relationship and extracting additional benefit from it. In contrast, when an individual receives negative performance feedback they make fewer new ties, reduce their interactions with existing ties and increase their interactions with heavily used ties.

The pattern of results is consistent with a conceptualization of positive and negative performance feedback affecting a person's sense of self-efficacy. When an individual receives positive feedback, it is as if their confidence grows and they are more expansive in the way they utilize their social capital. When an individual receives negative feedback, they increase their reliance on a limited set of valuable sources, while cutting back on interactions with most others, as if they have less confidence in managing their overall network of contacts. In other words, they appear to take defensive action and reallocate their social capital away from the risks of new and weak ties toward the familiarity of well-worn strong ties. The assumption here is that new ties require effort to form, and rarely-used ties contain some uncertainty about the quality of information obtained from them. This is perhaps not surprising but is rarely stated in the social capital literature, where the implicit assumption is often that more is always better.

More broadly, we see performance feedback as only one of the environmental stimuli that can explain network change. Existing research already tells us the many factors that determine who an individual will view as an eligible or attractive network contact (e.g., Barabási & Albert, 1999; Festinger, 1957; Festinger et al., 1950; Gouldner, 1960; McPherson et al., 2001). But these factors are "always on" so to speak, exerting a constant pull like gravity on a boulder at the top of a mountain. What is missing from much of the existing research on network antecedents is the event or stimulus that gets the boulder moving. In this paper we study in some detail how an event like a performance appraisal triggers dynamics of social capital utilization.

A popular call in the network literature for many years now has been that we must inject more agency into network theorizing (Brass, Galaskiewicz, Greve, Tsai, 2004; Kilduff & Brass, 2010). Network thinking, according to its critics, assumes unchanging networks of ties among identical actors who passively receive the benefits (and constraints) of their perpetual position (Borgatti, Brass & Halgin, 2014). Whatever one thinks about the accuracy of these claims in general, the present paper is about agency and network dynamics. But to be very clear, there are many different concepts of agency (Emirbayer & Mische, 1998). Whereas for some, agency implies willful action, for others the existence of individual differences is sufficient, even if these differences are unchanging demographic or personality characteristics. In our study, the conceptualization of agency occupies a kind of middle ground; we ignore (and specifically control for) differences across individuals and look at the changes individuals make over time in how they utilize their social capital, but at the same time the trigger for these changes is in some part exogenous to the individual -- an environmental event to which the individual then actively responds. We note also that the term dynamics typically connotes simple formation and dissolution of ties. To that conception we add an additional dimension, which is varying utilization of existing ties. We feel that in many organizational and small groups contexts, where each individual is at least aware of most others, it is changes in the amounts of interaction and flow that is the most relevant network dynamic.

Limitations

Collecting data annually over a six-year period allowed us to answer various calls in the literature for examining network change using longitudinal data (Brass et al., 2004; Kilduff & Brass, 2010). We recognize, however, there are certain limitations in this work. First, we have only looked at one department in one organization. This limits our ability to make general

statements based on the findings, and begs replication in a different setting. Second, we were not able to account for the ties that people had to other departments within the organization or to individuals outside the organization. This introduces noise into our models because an individual who responds to feedback by, say, adding new ties outside the organization would not be coded as such in our data, reducing our apparent predictive accuracy. Third, the data were collected through surveys, which does bring in an element of subjectivity to the measures. Fourth, we have only examined the impact of performance evaluations on one type of network relationship -- information ties. There are other types of relationships that could be examined such as friendship ties or multiplex relations. Finally, we have only studied one environmental change -- annual performance evaluations. There are many potential events that a person is likely to respond to by making changes in their networks, such as changes in their health, in the well-being of their family and friends, as well as positive and negative swings in their firm's performance or that of the overall economy. Our findings may not be generalizable to these varied other external shocks, and this would be an area for future research. Finally, we assume that positive performance evaluations result in high self-efficacy, but a fuller test of our theory would entail an independent measure of self-efficacy. Indeed this provides an opportunity for developing a self-efficacy scale that is specifically designed to capture perceived self-efficacy in the arena of networking behaviors, such as creating ties and negotiating requests for help and information.

Conclusion

A large body of work has identified the benefits of social capital. Whether through serendipity or design, individuals form and maintain relationships which prove useful later, as when an individual is able to call on another's knowledge to get things done. Most work in the social capital area has focused broadly on the relationship between having social capital and

subsequent performance, without examining the specifics of how the individual goes about extracting the benefits from the capital. The present study looks at not only new tie formation but also year to year changes in which ties an individual chooses to tap at any given point in time. We view this as the result of an ongoing decision-making process in which individuals respond to feedback about their performance in the organization by making adjustments in their patterns of utilization of socially-accessed resources. We hope others will continue this line of work, particularly with regard to examining additional triggers for social capital dynamics.

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Table 1
Number of actors and descriptive statistics by year

Year	# Employees	# Respondents	# of Same Employees as Previous Year	New Employees	Exited Employees	# Ties	Average Ties per Respondent
2004	176	161				10128	63
2005	161	142	133	28	43	11604	82
2006	164	160	127	37	34	12791	80
2007	170	111	138	32	26	9079	82
2008	169	163	140	29	30	13891	85
2009	161	157	139	22	30	14406	92
Average	167	149	135	30	33	11983	81

Note: N = 323 (76 employees in all years)

Table 2
Transition matrix of performance evaluations by quartiles
(4th represents highest performance)

	1st	2nd	3rd	4th	Total
1st	49	24	16	4	93
	(52.69%)	(25.81%)	(17.20%)	(4.30%)	(100%)
2nd	23	24	21	9	77
	(29.87%)	(31.17%)	(27.27%)	(11.69%)	(100%)
3rd	7	18	28	21	74
	(9.46%)	(24.32%)	(37.84%)	(28.38%)	(100%)
4th	4	7	23	47	81
	(4.94%)	(8.64%)	(28.40%)	(58.02%)	(100 %)
Total	83	73	88	81	325
	(25.54%)	(22.46%)	(27.08%)	(24.92%)	(100%)

Table 3
Descriptive statistics and correlations of actors and network characteristics (2004-2009)

	Variable	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9
1	New information-getting ties	17.91	16	0	102	1								
2	New information-getting ties in prior period	.	.	.	.	-0.09	1							
3	New incoming information-getting ties in prior period	16.19	15.82	0	102	-0.08	1	1						
4	Increasing utilization of existing ties	18.19	14.68	0	94	-0.04	0.15***	0.14**	1					
5	Increasing utilization of ties in prior period	.	.	.	.	-0.20***	-0.04	-0.03	0.08	1				
6	Increasing utilization of heavy-utilized ties	1.26	3.11	0	34	0.08*	0.13**	0.12**	0.50***	0.13**	1			
7	Decreasing utilization of existing ties	16.54	14.04	0	90	-0.19***	0.01	0.01	-0.13***	0.59***	-0.03	1		
8	Decreasing utilization of ties in prior period	.	.	.	.	-0.10*	-0.19***	-0.19***	0.43***	-0.13***	0.14***	0.05	1	
9	Decreasing utilization of rarely-utilized ties	1.98	4.73	0	49	-0.19*	0.03	0.03	-0.07	0.38***	0.32***	0.77***	0.08	1
10	Number of structural holes	704.11	812.46	0	4451	-0.21	0.15**	0.13***	0.41***	0.49***	0.28***	0.51***	0.31***	0.44***
11	Existing information-getting ties	75.31	38.26	1	174	-0.31***	0.34***	0.33***	0.55***	0.55***	0.30***	0.55***	0.42***	0.44***
12	Outgoing unreciprocated ties	0.22	0.14	0	1	-0.13**	0.24***	0.22***	0.15***	-0.01	0.05	0.04	0.07	0.02
13	Transitivity tendency	0.97	0.16	0	1	0.18***	-0.32***	-0.26***	0.02	-0.05	0.03	-0.06	0.001	-0.02
14	Hierarchical level	1.51	0.83	1	4	0.02	0.01	0.04	0.21***	0.22***	0.24***	0.23***	0.22***	0.21***
15	Number of co-located people	22.53	11.02	1	41	0.04	0.03	0.07***	0.22***	0.17***	0.13***	0.22***	0.17***	0.16
16	Average performance by location	3.62	0.16	3.16	3.94	-0.14**	0.09	0.10*	0.03	0.14***	0.06	0.03	-0.08	0.10
17	Overall network density	0.46	0.09	0.3	0.57	-0.24***	-0.06	-0.05	0.29*****	0.29***	0.06	0.21***	0.14***	0.12
18	Lost ties due to exit	12.02	7.23	0	43	-0.28***	0.43***	0.38***	0.50***	0.38***	0.30***	0.41***	0.30***	0.36***
19	Supervisor performance evaluation	0	1	-4.44	2.94	-0.04	0.02	0.05	0.08	0.06	0.07	0.05	0.001	0.12
20	Supervisor performance evaluation squared	0.99	1.61	0	19.68	-0.05	-0.01	0.001	-0.03	-0.07	0.02	-0.06	0.001	-0.01

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3 continued

		10	11	12	13	14	15	16	17	18	19
10	Number of structural holes	1									
11	Existing information-getting ties	0.79***	1								
12	Outgoing unreciprocated ties	-0.15***	0.22***	1							
13	Transitivity tendency	-0.07	-0.24***	-0.25***	1						
14	Hierarchical level	0.52***	0.4***	-0.01	-0.02	1					
15	Number of co-located people	0.28***	0.31***	0.02	0.05	0.15***	1				
16	Average performance by location	0.14**	0.13**	-0.32***	0.02	0.07	0.07	1			
17	Overall network density	0.26***	0.38***	-0.14***	0.07	-0.05	0.07*	0.20***	1		
18	Lost ties due to exit	0.69***	0.90***	0.29***	-0.32***	0.39***	0.27***	0.13**	0.24***	1	
19	Supervisor performance evaluation	0.17***	0.20***	-0.10*	0.001	0.06	0.04	0.28***	0.001	0.16***	1
20	Supervisor performance evaluation squared	-0.05	-0.11	-0.04	-0.01	-0.11	-0.01	-0.01	0.001	-0.10	-0.05

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 4
Fixed-effects negative binomial regression models predicting new information-getting ties

	Model 1	Model 2
Performance		
Supervisor performance evaluation		0.152**
		(0.055)
Person controls		
New information-getting ties added in prior period	0.0001	0.0001
	(0.004)	(0.004)
New incoming information-getting ties in prior period	-0.004	-0.004
	(0.006)	(0.006)
Increasing utilization of existing ties	0.016**	0.016**
	(0.005)	(0.005)
Decreasing utilization of existing ties	0.008	0.008
	(0.006)	(0.005)
Lost ties due to exit	0.018	0.020
	(0.018)	(0.018)
Existing information-getting ties	-0.033***	-0.035***
	(0.006)	(0.006)
Number of structural holes	0.0001	0.0001
	(0.0001)	(0.0001)
Outgoing unreciprocated ties	0.598	0.530
	(0.482)	(0.483)
Transitivity tendency	15.738	15.846
	(1007.82)	(1110.43)
Hierarchical level	0.299**	0.295***
	(0.103)	(0.103)
Global controls		
Number of co-located people	0.017	0.016
	(0.011)	(0.011)
Average performance by location	-0.775**	-0.948*
	(0.411)	(0.413)
Overall network density	8.582*	8.666*
	(4.107)	(4.123)
Constant	-14.481	-13.883
	(1077.827)	(1110.43)
Log likelihood	-529.10	-525.31
Wald chi2	113.43	129.61
N	274	274

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
Note: Entries represent parameter estimates; standard errors are in parentheses.

Table 5
Fixed-effects negative binomial regression models predicting decreasing utilization of existing ties

	Model 1 (All)	Model 2 (All)	Model 3 (Rarely-utilized)	Model 4 (Rarely-utilized)
Performance				
Supervisor performance evaluation		-0.093**		-0.179**
		(0.002)		(0.066)
Person controls				
Decreasing utilization of ties in prior period	-0.008**	-0.008**	0.0001	-0.0001
	(0.002)	(0.002)	(0.004)	(0.004)
New incoming information-getting ties in prior period	0.0001	-0.001	-0.009	-0.011
	(0.004)	(0.004)	(0.006)	(0.006)
Increasing utilization of existing ties	-0.035***	-0.034***	-0.004	-0.004
	(0.002)	(0.002)	(0.005)	(0.004)
Decreasing utilization of existing ties	.	.	0.033***	0.035***
			(0.005)	(0.005)
New information-getting ties	0.005	-0.001	-0.003	-0.002
	(0.003)	(0.004)	(0.005)	(0.005)
Lost ties due to exit	-0.037**	-0.034**	-0.011	-0.011
	(0.011)	(0.012)	(0.018)	(0.018)
Existing information-getting ties	0.005***	0.005***	0.010	0.010
	(0.003)	(0.003)	(0.007)	(0.007)
Number of structural holes	0.0001	-0.0001	-0.0001	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)
Outgoing unreciprocated ties	0.057	-0.068	-1.150*	-1.039
	(0.376)	(0.394)	(0.578)	(0.551)
Transitivity tendency	0.667**	0.599*	0.150	0.014
	(0.230)	(0.234)	(0.366)	(0.355)
Hierarchical level	0.120	0.128	0.022	0.028
	(0.074)	(0.074)	(0.107)	(0.105)
Global controls				
Number of co-located people	-0.009	-0.008	-0.020	-0.021
	(0.008)	(0.008)	(0.012)	(0.012)
Average performance by location	-0.252	-0.027	0.466	0.646
	(0.268)	(0.281)	(0.420)	(0.409)
Overall network density	-0.673	-0.727	-4.521	-4.229
	(2.96)	(3.03)	(4.456)	(4.308)
Constant	1.990	1.298	1.778	1.259
	(1.885)	(1.963)	(2.787)	(2.703)
Log likelihood	-534.33	-495.86	-390.49	-387.02
Wald chi2	499.83	464.40	242.71	259.00
N	263	263	245	245

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
Note: Entries represent parameter estimates; standard errors are in parentheses.

Table 6
Fixed-effects negative binomial regression models predicting increasing utilization of heavily-utilized ties

	Model 1	Model 2
Performance		
Supervisor performance evaluation		-0.082
		(0.074)
Supervisor performance evaluation squared		0.080*
		(0.037)
Person controls		
Increasing utilization of ties in prior period	0.003	0.004
	(0.004)	(0.004)
New incoming information-getting ties in prior period	-0.003	-0.030
	(0.006)	(0.004)
Increasing utilization of existing ties	0.019**	0.018**
	(0.006)	(0.006)
Decreasing utilization of existing ties	-0.012	-0.013
	(0.008)	(0.007)
New information-getting ties	0.006	0.008
	(0.006)	(0.005)
Lost ties due to exit	-0.031	-0.030
	(0.022)	(0.023)
Existing information-getting ties	0.009	0.008
	(0.007)	(0.006)
Number of structural holes	-0.0001	-0.0001
	(0.0001)	(0.0001)
Outgoing unreciprocated ties	-0.743	-0.940
	(0.703)	(0.703)
Transitivity tendency	-0.006	-0.043
	(0.463)	(0.458)
Hierarchical level	0.295*	0.335*
	(0.135)	(0.135)
Global controls		
Number of co-located people	-0.028	-0.029
	(0.015)	(0.016)
Average performance by location	-0.028	-0.306
	(0.521)	(0.522)
Overall network density	3.223	2.256
	(5.446)	(5.365)
Constant	0.608	1.485
	(3.398)	(3.418)
Log likelihood	-313.94	-311.40
Wald chi2	85.34	93.09
N	243	243

Note: Entries represent parameter estimates; standard errors are in parentheses
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 7
Fixed-effects negative binomial regression models predicting new incoming information-getting ties

	Model 1
Performance	
Supervisor performance evaluation	0.002
	(0.035)
Person controls	
New information-getting ties in prior period	0.001
	(0.003)
New incoming information-getting ties in prior period	-0.023***
	(0.004)
Increasing utilization of existing ties	0.006*
	(0.003)
Decreasing utilization of existing ties	0.006*
	(0.003)
Lost ties due to exit	0.008
	(0.010)
Existing information-getting ties	-0.001
	(0.003)
Number of structural holes	-0.0001***
	(0.0001)
Outgoing unreciprocated ties	0.882
	(0.306)
Transitivity tendency	0.582
	(0.237)
Hierarchical level	0.021
	(0.065)
Global controls	
Number of co-located people	-0.002
	(0.007)
Average performance by location	0.221)
	(0.228)
Overall network density	30.380***
	(2.385)
Constant	-0.772**
	(551.33)
Log likelihood	-424.01
Wald chi2	283.93
N	274

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
Note: Entries represent parameter estimates; standard errors are in parentheses.

Figure 1
Relationship between supervisor performance evaluation and increasing utilization of heavily-utilized ties