PUTTING THE NETWORK INTO TEAMWORK

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ABSTRACT

This paper explores how ties within and across teams shape both the internal processes of a team and a team’s access to critical outside resources. We then apply these ideas in a field setting, testing the hypotheses that prior ties among teammates (internal social capital) help teams overcome the free-rider and coordination problems that often bedevil teams, and that ties to the outside social system (external social capital) provide a team with additional resources to draw on.

We find that at the team level of analysis, density of intra- and extra-team ties are poor predictors of team functioning or team performance. At the individual level, however, the picture is more complex. The connectedness of an individual to his/her team is strongly and positively related to that individual's perception of team functioning *when the rest of the members of the team are not connected to one another*. However, the connectedness of an individual to his/her team is strongly and *negatively* related to that individual's perception of team functioning *when the rest of the members of the team are highly connected to one another*. Similarly, the degree to which the rest of the members of the team are highly connected to one another is positively related to an individual's perception of team functioning when said individual is not well connected to the team, and negatively when s/he is well connected. This suggests a “too many chefs” problem in intra-team networks: everyone sees the need for some ties to coordinate team action; everyone feels the team functions best if they themselves fill this function exclusively (that is, if they are the hub and the other members of the team are mere spokes); and the worst possible scenario is to have too many people fill this function (everyone is trying to be the hub).

Organizations are increasingly using teams rather than individuals to accomplish key tasks. A large body of research examines the factors – both internal and external to the team – that influence team effectiveness. Relatively little research, however, has focused on how the network ties – both internal and external to the team – influence team effectiveness.

This paper bridges this gap by bringing together two largely separate streams of research, on team functioning and social networks, to examine how the ties within a team, and a team's embedded position in the larger social structure of the organization, affect team performance. Individuals on a team may or may not know each other ahead of time, they may or may not have chosen to work together, and they may or may not have useful allies outside of the team that will aid team objectives. These 'network' dimensions of teamwork, while often acknowledged to be critical, have not, to this point, been deeply explored. This paper explores how ties within and across teams shape both the internal processes of a team and a team's access to critical outside resources. We then apply these ideas in a field setting, testing the hypotheses that prior ties among teammates help a team overcome the free-rider and coordination problems that often bedevil teams, and that ties to the outside social system provide a team with additional resources to draw on.

Below we briefly review the reasons why we would expect network structure to affect team processes and outcomes, deriving a series of hypotheses regarding the impact of network structure on teamwork. We then outline the data we have collected to test these hypotheses and the variables constructed from these data. We report the results of statistical analysis of these data, and in the conclusion we discuss the broader implications both for designing teams and for research on teams.

PUTTING THE "NETWORK" IN TEAMWORK

There is ample evidence that networks affect solidarity, collective action, reputation, information flow—all of which are central to the functioning of teams (e.g. Thompson & Valley, 1997). For example, consider Figure 1, which is a characterization of an organization that is made up of four teams—A, B, C, and D—and the linkages among the 19 team members prior to the creation of those teams.

[Insert Figure 1 about here]

The question we would ask is how those prior linkages among individuals affect how the subsequently formed four teams function. There is substantial variation in the internal and external networks of those four teams. A's members are not at all connected to each other, while D's members are all connected to each other, and C has a "hub and spoke" structure—all members of the team communicating to just one central individual. Do these variations affect how the teams function? Regarding ties internal to the team, we might expect the team's internal ties to affect their ability to deal with coordination and free-rider problems. Thus, for example, we might expect A to have acute free rider and coordination problems. Regarding external ties, externally, B has six connections—two connections to each of the 3 other teams, as compared to C, at the other extreme, which only has two connections—both to B. We might expect that B's centrality offers it some advantage over the 3 other teams, such as greater access to information and resources. Similarly, we might expect C's peripherality and thereby reduced access to information and resources to represent a handicap.

Teams, we assert, thus differ in the internal and external "social capital" (Coleman, 1990; Putnam, 1993; Nahapiet & Ghoshal, 1998) they possess. The internal structure (i.e., the ties among teammates) of some teams allows them to avoid conflicts and free riding, while facilitating coordination. Similarly, the structure of the external ties (i.e., links to people outside the team) of some teams allow them to call on substantial external resources, while other teams do not. Below we discuss the types of internal and external social capital that the network literature suggests might be relevant to the functioning and performance of teams.

Internal team ties should reduce free riding, enhance coordination

Coordination and free riding (aka social loafing) are two key issues that any team must deal with. Free riding can be an acute problem in a team, especially when team members are working on a product on which they are jointly rewarded (or punished) for its success (e.g. Williams, Harkins, & Latane, 1981; Harkins & Jackson, 1985; Shepperd, 1993). This was the case in the data set we examine below. There is a potential incentive for individuals to underinvest in the team effort, since they derive only a fraction of the return on the time they put into the team project, as compared to purely "private" investments of time. Free riding by one or two team members can set into motion a vicious cycle by which all team members come to underinvest in the team effort, so as not to be taken advantage of by their free riding teammates (Harkins, 1987).

Coordination—the extent to which team members pull together in the same direction—is also critical to a team's success (Hackman & Morris, 1975; Hackman, 1987). Without coordination, team members might duplicate efforts, not perform all the necessary components of a project, not properly time the production of different parts of the project, etc. Avoiding free riding is necessary to produce efficient levels of effort from all team members; coordination is necessary to combine those individual efforts into the best possible task performance.

We propose that there are clear links between intra-team network ties and the extent of free-riding and coordination. As the number of ties (defined here as communication between two individuals)[1] among members of a team increases, free riding should be reduced, for several reasons. Members of the group have an ongoing relationship with other group members that they do not want to jeopardize (Axelrod, 1984). That is, even from a purely selfish point of view, an individual may not free ride because of the loss of the potential product of a continued (healthy) relationship. Even if two individuals do not have an ongoing relationship, if they have common ties with third

[1] This is an admittedly crude definition of a nuanced concept. In fact, there are many kinds of network ties and many dimensions along which ties can vary: their content, their affect, their frequency, etc.

parties (within or outside of the team)—i.e., they are embedded together within a social structure—there may be a substantial incentive not to free ride for reputational reasons (Uzzi, 1999; Hoyt, 1994). Furthermore, as the number of within-team ties increases, a sense of group identity is likely to develop, and that sense of group identity also reduces the extent of free riding (Kramer & Brewer, 1984; van de Kragt et al., 1986). Also, high levels of communication may increase the identifiability of each team member's contributions, which in turn will reduce free riding (Williams, Harkins, & Latane, 1981).

Pre-existing network ties among teammates are also likely to enhance coordination. More network ties mean more intra-team communication, and communication is essential for coordination. If team members are aware of what each other are doing, there is a reduced likelihood of duplicated efforts, etc. (Bohnet, 1997). Intra-team network ties are also likely to enhance effective coordination by reducing the likelihood of dysfunctional conflict and increasing liking and cohesiveness among teammates. Pre-existing network ties among team members may provide the "grease" to prevent too much friction within teams (e.g., Nelson, 1989). In the absence of such ties, an incipient conflict may be more likely to spin out of control (for an organizational example, see Burt & Ronchi, 1990). Furthermore, the "mere exposure effect" suggests that familiarity breeds liking (Bornstein, 1989; Zajonc, 1970); therefore, pre-existing ties are likely to be associated with greater positive affect and cohesiveness among teammates. That cohesiveness will enhance intrateam coordination (Mullen & Copper, 1994).

It is also likely that not just the volume of intra-team ties but the pattern of ties matters as well. Padgett & Ansell (1993) offer a fascinating study of the rise of the Medici in Venice in the 1400's. Their analysis suggests that the network structure of the Medici alliance offered it a decisive advantage over the anti-Medici alliance. The key difference in the structure of the two networks was the centralization of the Medici alliance. The members of the Medici alliance were far better able to marshal their resources effectively because communication was centralized, and because there were no other families situated within their alliance to contest their leadership.

The Medici example also highlights the fact that even though everyone in a group may be riding in the same vehicle, they may be riding in different positions in that vehicle, and their capacity to affect its direction depends on that position. Centrality is a recurrent theme with respect to power and network position (e.g., see Brass and Burkhardt, 1992; Kameda et al., 1997; Mizruchi & Potts, 1998).

External team ties enhance access to information and resources

Ties between teams are also important, as they allow a team to access valuable information in the broader organizational social structure. If one team finds some data that is useful for an assignment, individuals on other teams that have relationships with individuals on that team might gain use of those data as well. Teams that have many external relationships might be more likely to succeed because they are able to gather more of those "tidbits" of information from other teams. There is an enormous and varied literature that documents how ties facilitate the flow of information across a network. Examples include Coleman's (1966) classic study of diffusion of the use of penicillin among doctors, the spread of corporate behaviors through corporate communication networks (e.g., see Haunschild, 1993; Davis, 1991; Mizruchi, 1989); political voting decisions (e.g., Huckfeldt et al., 1995). In fact, much of the network literature can be viewed as a study of optimal placement within the network. Granovetter (1973) finds weak ties are more useful in gathering information about employment opportunities because they are less likely to provide redundant information than strong ties; similarly, Burt (1992) asserts that it is useful for there to be "structural holes" between people with whom you communicate. Centrality in network position, unsurprisingly, plays an especially important role in determining how much information an individual receives (e.g. Ibarra, 1993).

DATA AND RESEARCH DESIGN

This paper is based on network data collected February, 1999 from the entire cohort of first year masters students at the Kennedy School of Government, and team data collected in the Spring of 1999 at the conclusion of the students' "Spring Exercise" team projects. The data regarding the communication network and the team exercises are described below.

Network Data

There were three kinds of network data collected from first year masters students: recognition, academic, and friendship (we use only the latter two below). Students were presented with a complete list of the names of first year masters students, and asked to check off who they (a) recognized, (b) got together with outside of class to study, and (c) got together with informally for non-academic reasons. The response rate to this questionnaire was 81%.

It is important to note that the teams were formed, via random assignment, later in the semester, after the students completed the network survey. Thus the network data describe the ties that pre-existed among teammates - and between students on different teams - before the students were assigned to teams and teams were actually formed

For the analyses below, we constructed at both the individual-level and the group-level two variables: density of intra-team ties and density of extra-team ties, where density is defined as the ratio of reported ties over the number of potential ties. For the analyses below, we averaged the variables constructed from the academic and non-academic networks (which were correlated at r=.74). The average intra-team density was .43, and average extra-team density was 16.[2]

At the individual level we also constructed a measure of the density of intra-team ties for <u>other</u> members of the team (in contrast to the density of the target person's ties with his/her teammates). We label the density of an individual's ties to his/her team "density-self" and the average density-self scores of other members of his/her team "density-other." Figure 2 and Table 1 will illustrate how the two intra-team variables were constructed. Figure 2 is a graph representation of the communication structure of a particular team.

[Insert Figure 2 about here.]

[2] Intra-group density is higher than extra-group, despite the random selection process, because groups were all drawn intra-cohort. Density of communication was much higher intra-cohort than extra-cohort.

Note that an arrow from A to B does not indicate direction (the sociometric questions did not ask which direction communication went, just whether there was communication). Rather, it means that A reports that s/he interacts with B.[3] Thus, for example, Betty has 2 out of 4 possible ties, and thus has an intra-group density of .5. The other 4 individuals have an average intra-group density of .437 (see Table 1 for the computation of this variable for all 5 members of the team in figure 2). Finally, the team overall has a density of .45.[4]

[Insert Table 1 about here.]

Team Data

Spring exercise at the Kennedy School of Government is the public policy equivalent of moot court, where students take two weeks off from their core required classes to work on a policy related project. In this case, in the first week, students had to sift through over 1,000 pages of dense policy materials and individually produce two-page policy memos regarding the reform of Medicare. In the second week, students were randomly grouped into teams of 5 members each, and had to produce a 20 page "briefing book" for Health and Human Services Secretary Donna Shalala to aid her in the testimony before Congress, as well as a mock briefing of Shalala. For both the briefing book and the mock briefing, one grade was given to the entire group. Table 2 summarizes the key features of the group part of spring exercise.

[Insert Table 2 about here.]

[3] Each dyad typically but not always agreed about whether they interacted or not. The rationale for using what j, k, etc., say about i to generate i's density numbers rather than i's own reports is that this should reduce biases from individual-level variations in interpreting the network questions. That is, some people may systematically be more likely to report interactions, and some systematically less likely. High reporters would tend to have greater densities than low reporters. While biases may exist in reporting interactions with particular individuals (e.g., interactions with high prestige individuals may be more memorable), our guess is that these biases should be systematically lower than respondent biases.

[4] If there are missing network data in the team, the individual-level data are generated without the missing responses entering into either the numerator or the denominator of the individual-level variable. For example, if Betty had not responded to the network questionnaire, Casey's density drops from .5 to .33, Edith's from .25 to 0, and David and Alfred's densities remain unchanged.

After spring exercise we circulated questionnaires regarding students' experiences with their teams (see Appendix A). These questionnaires included 26 closed-ended questions regarding their spring exercise team experiences. The response rate to this questionnaire was 57%.

In addition to the questionnaire data, we also have complete data on the grades that students received on both the individual and team parts of spring exercise. Grades varied from 78 (C+) to 95 (A).

Based on the results of a principal components analyses as well as a priori theory, we selected ten items from the questionnaire that loaded heavily onto one primary factor and which tapped into students' *p*erception of the quality of *t*eam *f*unctioning (PTF). These items are marked with asterisks in appendix A.[5] We derived a normalized scale using a factor analysis of these items. We emphasize both the P and the TF of the PTF scale—individuals on the same team may (and, in fact, do) have systematically different perceptions of how well the team functioned.

Research Design

These data have important strengths in terms of generalizability. Team participants had a substantial motivation to perform well on the team efforts. The team projects (briefing book and mock briefing) were both significant endeavors. Finally, while a Kennedy School masters student may not be representative of the average member of the average organization, most of these students will join larger organizations, and be in the types of positions in which they might participate in teamwork. That is, the modal masters student is a future organization man/woman, and a future potential team member. (In the conclusion section of this paper we discuss how the Kennedy School, as

[5] The PTF is an admittedly gross measure of overall team functioning—a team might function well in some ways and not in others. In fact, we had designed different sets of questions to tap into different dimensions of team function—e.g., was there team solidarity; was there free riding; did everyone manage to coordinate their efforts well, etc. However, the items that we assigned to each of these categories on a priori expectations did not obviously correlate more strongly with each other than with other items, and the scales for each of these constructs with separate factor analyses were highly correlated (despite the lack of overlapping items). Further, when we ran the regressions summarized below with these disaggregated scales, each scale yielded substantively identical results as the PTF scale.

an "organizational setting," is distinctive in many ways and discuss how this may have affected our findings.)

The data, though, also have potential weaknesses for drawing causal inferences. In particular, since we did not have control over the key independent variable—the structure of the network—we need to be appropriately cautious in deriving causal inferences from the relationships we find in the data.

A second research design concern has to do with the order of data collection, and how this might affect causal inferences. The network data were collected the second week of the semester. Spring exercise was held during weeks 6 and 7. Feedback on spring exercise occurred, in part, immediately after completion, and in part the week after spring exercise. Finally, the team functioning questionnaire was circulated during week 14.

The concern one needs to have is that the feedback students received might contaminate the data we collected in week 14. One might expect, for example, that after receiving positive evaluations students will rate the quality of team functioning higher than they would have before receiving those evaluations (Staw, 1975). While this does not render the questionnaire data useless, it does suggest, again, that it should be interpreted with caution.

Hypotheses

We will divide our hypotheses into team-level and individual-level. At the team level, we hypothesize that a high density of intra-team ties will yield higher levels of team functioning (less free riding, better coordination, etc.), and that a higher level of team functioning will be strongly associated with better performance (operationalized by grade).

Hypothesis 1: *Density of intra-team ties will be positively related to team functioning.*

Hypothesis 2: *Team functioning will be positively related to team performance.*

Finally, teams with more external ties should be better positioned to receive information that might affect performance.

Hypothesis 3*: Density of external ties will be positively related to team performance.*

At the individual level, we expect that the density of an individual's ties with his/her teammates should improve the functioning of the team, especially if that team is not well tied together already.

Hypothesis 4*: Density of an individual's ties to his/her team will be positively related to PTF, especially when teammates are not densely tied together.*

Conversely, an individual's assessment of the functioning of the team should be positively related to how well the other members of the team are integrated into the team, especially if that individual is not already tying the pieces of the team together through his/her own links to teammates.

Hypothesis 5*: Density of other member's ties to a team will be positively related to PTF, especially when an individual is not densely tied to the team.*

Finally, we anticipate that if an individual, by virtue of his network position, plays a disproportionate role in the functioning of the team, that individual will have a systematically more positive assessment of how that team functioned than the other members of the team. Team functioning is necessarily, in part, in the eye of the beholder. An everyday corrollary would be: everyone may agree that a car is being driven well or poorly, but the actual drivers probably have a systematically more positive assessment of how well it is being driven than passengers do. The more central members of the team, we assert, are more likely to make positive evaluations of how the team functioned.

Hypothesis 6*: An individual's own ties will be more important in determining his/her PTF than other members' ties.*

RESULTS

First we examine the role that internal social capital plays in team function and performance (hypotheses 1, 2, 4, 5, and 6), and then we examine the impact of external social capital on team performance (hypothesis 3).

Internal Social Capital

Individual level analysis. First , we will test hypotheses 4, 5, and 6. Table 3 summarizes an OLS regression of PTF on each individual's density of ties to his/her team (density-self); density of other member's ties to his/her team (density-other); and an interaction between the two. Our expectations based on hypotheses 4 and 5 are that density-self and density-other will be positively related to PTF, and that the interaction term should be negative. Further, based on hypothesis 6, we expect that the impact of density-self should be disproportionately large relative to the total number of ties a single individual can have within the group.[6]

[Insert Table 3 about here.]

The results summarized in table 3 offer strong support for hypotheses 1-3. The coefficients on density-self and density-other are positive, and interaction between the two is negative, and all coefficients are large and statistically significant ($p < .01$). The coefficient on density-other is not only not much larger than density-self, it is actually smaller (hypothesis 6). Because of the interaction term, it is a little difficult to interpret the relationship between PTF and density-self and density-other. Figure 3 plots the relationship between PTF and density-self for 4 values of density-other: 0, .25, .5, and .75. Figure 4 does the same for density-other with respect to density-self.

[6] Note a single tie has a greater impact on density-self than density-other. Looking at figure 2, one more tie for Betty increases density-self from .5 to .75. One more tie among other members increases density-other from .4375 to just .5. Thus, if other member's ties were just as important as an individual's ties in determining that individual's PTF, the coefficient on density-other should be much larger than density-self.

[Figure 3 about here]

[Figure 4 about here]

In interpreting Figure 3, note that density-other has a mean of .44 and a standard deviation of .13; almost all of the data are between .25 and .65. Figure 3 illustrates that density-self has a large positive impact on perception of team function when density-other is low. Thus, for example, when density-other is .25, going from the minimum possible (and observed) values of density-self, 0, to the maximum, 1, results in a massive 2.8 point change in an individual's perception of team function. When density-other is at its average value, however, density-self has essentially no impact on perception of team function. Finally, and strikingly, *when density-other is at a very high value, density-self has a significant negative impact on perception of team function*. Thus, for example, when density-other is .65 (at the upper end of its range), going from the minimum value to the maximum value of density-self results in a 2.1 point change in an individual's perception of team function.

A similar pattern may be observed with the impact of density-other on PTF (note that density-self has the same mean but a larger variance than density-other—its standard deviation is .22). If density-self is very low—PTF increases dramatically with density-other. If density-self is 0, a .2 increase in density-other would result in a 1.2 increase of PTF. This relationship is attenuated as density-self increases—so that when density-self is at its mean, density-other has no impact on PTF. Finally, the impact of density-other is negative for larger values of density-self. For example, when density-self is .75, a .2 increase in density-other results in a .8 decrease in PTF.

We are thus left with a somewhat paradoxical pattern in the data. A team member's ideal world (with respect to his perception of team function) is one in which he does all of the talking (note that this is, at best, a mediocre world from the perspective of his team-mates). A close second is a world in which he does none of the talking, and everyone else talks a lot. In contrast, the worst of worlds is one in which he talks a lot, but everyone else on the team does as well. In short: everyone is happy with the soup if they're the only chef, but too many chefs spoils the broth—if you are one of the chefs.

Team level: At the team level, we predict that density of intra-team ties should be be positively related to performance. Below we regress average perception of teamfunction of a team on internal ties (table 4). We also regress team performance on average perception of team function, intra-team ties, and extra-team ties (table 5a). We also include a regression with just intra-team and extra-team density as independent variables (table 5b).

[Tables 4a and 4b about here]

[Table 5 about here]

In fact, we find that in all of the regressions, the coefficient for intra-team density is tiny and does not differ significantly from 0. We do find that average team PTF is strongly related to team performance ($p < .05$). However, as we noted earlier, this relationship is contaminated by the fact that students received feedback on their group project before we circulated our questionnaire—it is therefore impossible to state with certainty the direction of causation in this relationship.

The lack of impact of team connectedness on average team PTF seems to be a puzzle given the strong individual-level results. However, this apparent contradiction disappears upon closer inspection of the individual-level results. First, the negative interaction term indicates that more interactions are not an unalloyed good, from the individual perspective. Substantial interactions are only good from the individual perspective if it is just greater for that individual or for the rest of the team—not both. In fact, if density-self were set equal to density-other, the relationship between average team PTF and intra-group ties would be curvilinear, with a single maximum at .45 (team PTF = .03), a global minimum at 1 (team PTF = -3.75), and a local minimum at 0 (team PTF = -2.5). A curvilinear specification is no more successful than the linear specification summarized in table 4. This second null finding is also unsurprising, because all of the team data are in the neighborhood of the maximum, where the slope of the curve is small. Thus, the predicted team PTF for a team whose uniform internal density was at the mean plus or minus one standard deviation would be .2 or .3 below the maximum, respectively; and for two standard deviations the drop would be .7 or .8. There is, in short, very little variation predicted for the range of the intra-group density variable that is observed—less than one standard deviation. Given the small n and the noise inherent in the data it is therefore unsurprising that we do not find a relationship between intra-group density and team PTF.

External social capital

The team-level regressions in tables 4 and 5 also included external ties as an independent variable. As with density of internal ties, external ties are not a significant predictor of either team function or team performance. We also examined the relationship between individual connectedness and performance on the individual component of spring exercise.

Table 6 summarizes an OLS regression of memo grade on number of ties an individual reported (note: the mean of ties was 21, and the standard deviation 9; the mean grade was 89, with a standard deviation of 4).

[Table 6 here]

The impact of ties on memo grade is substantial, both statistically ($p < .001$) and substantively. An increase of 20 ties (slightly more than two standard deviations) is associated with an increased grade of 2.6—quite large given the level of compression of the grades.

There is therefore a sharp contrast between the role of individual ties in affecting individual memo grades and a team's external ties in affecting team grades. In retrospect, it is unsurprising that the former would be more important than the latter, due to the difference in individual and team tasks, and in how useful network ties might prove in achieving those tasks. The individual task for the memo was to sift through 1000+ pages of dense reading materials on Medicare they were given at the beginning of the week, sit through many hours of lectures during that week, and produce by the end of the week a two page memo distilling the most important facts in those materials. This was, in terms of information processing, a monumental task—the students were given more material than they could realistically process. The actual item they needed to produce—the memo—was not such a difficult task. An individual's network could prove useful in information processing—because people could talk to their associates over what they found in the material, informally dividing the materials up, etc. That is, given this overload of material, people created "teams without boundaries" to process it. After this material was processed, they could then each—individually—produce their memos. The role of the network in providing information was potentially enormously valuable for students—and isolated students were, effectively, playing a team sport without a team.

In contrast, the team exercise the following week required students to go through the same materials, produce a 20 page briefing book, and, at the end of the week, to brief a fake HHS Secretary. Students were, in essence, being given materials they had just intensively reviewed, to re-process with 4 other students on their team. In this case, the informational task was a fraction of the magnitude compared to the prior week's exercise, but the actual product (which individuals outside the team could only be of limited assistance) was far larger.

The other contrast between the two parts of spring exercise was that there was far greater variance in individual ties than team ties (unsurprisingly). The most isolated individuals had just a handful of ties. The most isolated teams, were, in fact, not terribly isolated. Thus, in short: the team exercise was not that informationally demanding, and the most isolated teams were not that informationally needy. This is, of course, largely an artifact of the structure of the task the teams had to do, and of how these teams were constructed. In other settings, teams may be more isolated in the network, and be confronting more informationally demanding tasks.

The final point about the null finding of the impact of external ties on team performance is that our measure of external ties may not be capturing how much information teams are receiving through their external ties. It may be that on some teams individuals have a similar array of external ties, and other teams members have different external ties. Informationally, it would be advantageous for teams if their members had non-redundant ties.

CONCLUSION

This paper aims to conjoin two research streams—that on networks and that on teamwork. We argue that there are many reasons to expect the social structure of a system to affect the process and the success of teams within that system. We develop six hypotheses about the relationship between the network structure and team process and success, and test these hypotheses on team exercise among students at the Kennedy School of Government. Our initial tests of the data support a subset of these hypotheses. In particular, we find that an individual's ties to his teammates is positively related to his perception of team function if those teammates are not tied to each other, and negatively related to his perception of team function if they are connected to each other. Similarly, we find that an individual's perception of team function is positively related to his teammates connectedness if his own connectedness is low, and negatively if his own connectedness is high. In short, everyone feels there is a need for the team to be connected, and feels that the team functions best if they play the role of holding the team together. However, *the worst of possible worlds (from the individual's point of view) is to be connected to the team and for his teammates to also be connected together*—that is, too many chefs spoil the broth.

Given this ambivalent relationship between team connectedness and team function, it is unsurprisingthenthat we find no clear relationship at the team level between intra-team connectedness and team function or performance.

We also find little connection between external connectedness and team performance. This may have to do with the nature of the task and how the teams were constructed. External informational ties, for example, would be only marginally useful given what the teams needed to produce. As a check on this, we examined the relationship between the individual component of spring exercise, which was informationally a far more challenging task—one where ties would come in especially useful—and we found that the number of ties each individual had powerfully predicted performance.

Overall, these findings suggest internal and external team social capital are complex and nuanced constructs. In particular, with respect to internal social capital, these findings clearly indicate that internal social capital is not an objective, team-wide variable. What constitutes capital depends on where you sit in the team. Second, with respect to external social capital, these findings highlight the role of task definition in determining whether external social capital is valuable.

More generally, these particular findings point to our broader agenda to highlight the necessity to bring network ideas into understanding team function. There are a myriad of potential relationships to explore. We conclude with three research questions in this vein that we are currently studying:

- *What is the role of external relationships on the internal functioning of a team?* Individuals may choose not to free-ride not only to preserve their relationships with members of their team, but also to avoid sanctions from the broader social system. For example, if an individual gets a reputation as a free rider, it will be difficult to form productive relationships with other members of the social system. This type of effect is likely to be greater the greater the overlap in external ties an individual has with the external ties of his teammates. If team-mates Joe and Mark both know non-teammate Anne, they may be more likely to behave well with each other in order to maintain that relationship with Anne. More generally, the more similar the position (the more "structurally equivalent") of teammates in the broader social structure, the greater the pressure not to free ride.

- *What is the long run impact of a team on network structure?* One rationale for forming teams within a larger organization is that in doing so, the organization creates an informal network over which useful information might flow after the team has officially disbanded. That is, organizing cross-functional teams creates social capital for the organization. We plan to examine this empirically with the masters students through a follow-up network survey. We expect to find that if two individuals were on a spring exercise team together, they are more likely to report a network tie 12 months after the team was disbanded.

- *What is the interaction between organizational variables and the role the network plays in team functioning?* In our data set, many interesting dimensions did not vary. The students were largely homogeneous in their talents, there was relatively little need for information outside of the team, teams were doing similar or even identical tasks, and the particular way that teams were put together was largely arbitrary (that is, one did not need one engineer, one lawyer, one marketing person, etc.). In contrast, in large organizational settings, the team needs to be structured in a particular way so as to represent particular skill sets and organizational interests. Typically, there is an essential need to draw on organizational information/resources that are not contained within the team, and only one team is entrusted with a given task. What are the implications of our findings for the latter setting? Our findings point to an important trade-off faced by larger organizations: creating cohesive teams on the one hand, versus cross-functional teams that are less cohesive but better able to draw upon resources from the broader social network.

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TABLE 1

Constructing Individual-level Intra-Group Density Measures

	Density of Individual to Team Ties (density-self)	**Average Density of Other Team Members (density-other)**
Alfred	1	.3125
Betty	.5	.4375
Cathy	.5	.4375
David	.25	.5
Edith	0	.5625

TABLE 2

Key Features of Spring Exercise

Time span of exercise	1 week
Number of team members	5
Intensity	High—requiring working full time + for a week
Team selection	Randomly allocated
Similarity of team tasks	Very high.
Description of team assignment	To produce briefing book and provide mock briefing for Secretary "Shalala" regarding upcoming Medicare testimony.

TABLE 3

Perceived Quality of Team Functioning Regressed on
My Ties to My Teammates, My Teammates' Ties to Team, and the Interaction

Dependent Variable: Perceived Quality of Team Functioning (PTF)

Variable	Coefficients	SE	T	Sig.
(Constant)	-2.484	.815	-3.048	.003
DENSITY-SELF	5.867	1.890	3.104	.003
DENSITY-OTHER	5.231	1.872	2.794	.007
DENSITY-SELF X DENSITY-OTHER	-12.250	4.355	-2.813	.006

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.369	.136	.097	.9752385

N=70

TABLE 4

Perceived Quality of Team Functioning Regressed on Density of Internal Ties

Dependent Variable: Perceived Quality of Team Functioning (PTF), averaged over the team

	Coeffs	SE	T	Sig.
(Constant)	-.0534	.498	-.107	.915
INTERNAL TIES	.216	1.164	.186	.854

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.038	.001	-.040	.7484

N=26

TABLE 5a

Team Performance Regressed on Internal Team Ties, External Team Ties, and Average Perceived Team Functioning

Dependent Variable: Team Performance (Group project grade)

	Coeffs.	SE	T	Sig.
(Constant)	84.7	5.04	16.82	.000
INTERNAL TIES	4.39	6.90	.64	.53
EXTERNAL TIES	21.50	31.90	.68	.51
PERCEIVED TEAM FUNCTIONING	2.86	1.26	2.34	.029

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.53	.28	.19	4.25

N=26

TABLE 5B

Team Performance Regressed on Internal Team Ties and External Team Ties

Dependent Variable: Team Performance (Group project grade)

	Coeffs.	SE	T	Sig.
(Constant)	81.38	5.27	15.42	.000
INTERNAL TIES	3.43	7.53	.45	.65
EXTERNAL TIES	45.87	32.90	1.39	.17

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.33	.11	.03	4.64

N=26

TABLE 6

Individual Performance Regressed on Density of Ties

Dependent Variable: Individual Memo Grade

	Coefficients	SE	T	Sig.
(Constant)	86.133	.829	103.930	.000
TIES	.131	.037	3.578	.000

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.300	.090	.083	3.6458

N=130

FIGURE 1

(see hard copy)

FIGURE 2

Sample Sociogram of Team

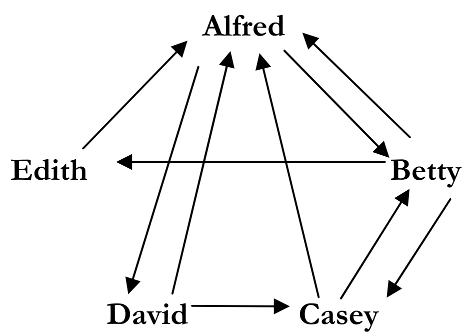

FIGURE 3

Impact of Density-self on Perception of Team Function

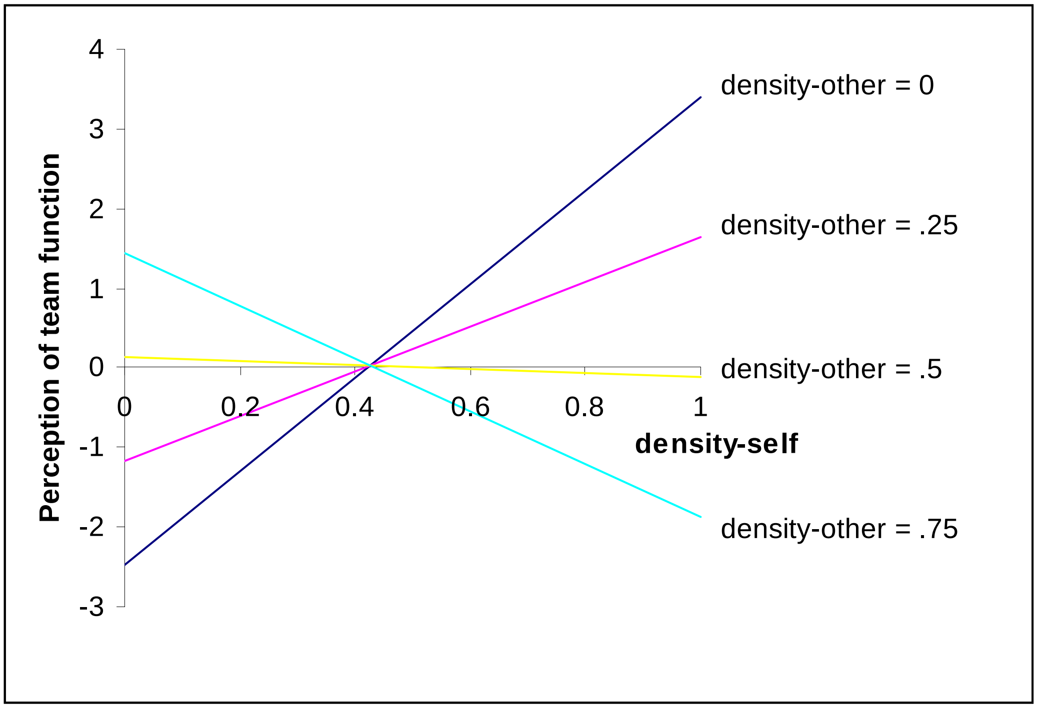

FIGURE 4

Impact of Density-other on Perception of Team Function