Information Seeking in Social Context: Structural Influences and Receipt of Information Benefits

Rob Cross, Ronald E. Rice, and Andrew Parker

***Abstract*—Research in the information processing, situated learning, and social network traditions has consistently demonstrated the importance of social networks for acquiring information. However, we know little about how organizational relationships established by a relative position in a formal structure or social relationships established by interpersonal processes influence whom is sought out for various kinds of information. Prior research suggests that people often receive some combination of five benefits when seeking information from other people: 1) solutions; 2) meta-knowledge (pointers to databases or people); 3) problem reformulation; 4) validation of plans or solutions; and 5) legitimation from contact with a respected person. This research builds on that work by assessing the influence of organizational and social structures (such as similarity of job function, hierarchy, task interdependence, physical proximity, influence, trust, friendship, and gender) on receipt of these benefits from other people in a physically distributed organization. Task interdependence is the strongest and most consistent predictor of information seeking. However, social relations also affect the receipt of informational benefits, especially as they become more representational and affective. Implications are suggested for the study of social capital, computer-mediated communication, and organizational learning.**

***Index Terms*—Information, networks, relationships.**

I. Introduction

With the evolution of knowledge management (KM), we have seen increased emphasis placed on understanding and supporting processes of knowledge creation and sharing within and across groups in organizations [16], [21], [26], [35], [99], [106]. However, outside of work on communities of practice (CoP) there has been little research on knowledge creation and sharing within informal networks of employees. Given the centrality of social interaction as a vehicle for knowledge creation and learning, it is important to better understand these processes from a social network perspective. While research is placing increased emphasis on the social context of knowledge creation and sharing, there is much yet to learn in terms of both the kinds of information that people seek out from other people and the characteristics of relationships that dictate who is sought. The purpose of this paper is to identify and analyze the influence of two categories of relationships—organizational and social—that might facilitate or constrain the flow of various kinds of information within a group.

We will begin by briefly reviewing research establishing the importance of the social context of organizational knowledge creation and sharing. We then identify five categories of informational benefits typically derived when seeking information from other people as well as review relevant research regarding potential structural influences on receipt of these information benefits. This review serves to motivate a general research question concerning the relationship between organizational and social structural influences and receipt of information. The methods section describes the sample and site, the overall procedures, and the measures used in assessing these relationships. The results section presents bivariate and multivariate relationships among these variables, highlighting the separate roles of organizational and social structural influences. Finally, the discussion section considers implications for future research and practice involving social capital, computer-mediated communication, and organizational learning.

Manuscript received October 21, 2001; revised November 2, 2001.

R. Cross is with the University of Virginia, Charlottesville, VA 22903 USA, and also with IBM's Institute for Knowledge Management, Cambridge, MA 02142 USA (e-mail: robcross@virginia.edu).

R. E. Rice is with the School of Communication, Information and Library Studies, Rutgers University, New Brunswick, NJ 08901-1071 USA (e-mail: rrice@scils.rutgers.edu).

A. Parker is with the IBM's Institute for Knowledge Management, Cambridge, MA 02142 USA (e-mail: andparke@us.ibm.com).

Publisher Item Identifier S 1094-6977(01)11256-3.

II. Background

A. Social Context of Organizational Knowledge Creation and Sharing

Many early KM initiatives involved the implementation of distributed databases and organizational processes to ensure capture and sharing of lessons and reusable work products [32], [33], [73], [85], [93]. These so-called knowledge repositories bridge boundaries of time and space, allow for reuse of work products, and provide one form of memory with which an organization can learn over time. However, many of these approaches have conceptualized knowledge as something that exists outside of social interactions. Such perspectives overlook the fact that the creation and interpretation of knowledge is inherently a social process [7], [67], [107], [100], [101]. Evidence accumulating over the past 30 years has consistently demonstrated the importance of social relationships for acquiring information [3], [16], [32], [69], learning how to do one's work [15], [60], [75], [97], and collectively solving cognitively complex tasks [48], [70], [105].

While we know social networks significantly effect how people find and assimilate information to do their work, research has less thoroughly explored two aspects of information seeking in social networks. First, we know relatively little about the specific ways in which people benefit when they obtain information from other people. The situated learning literature has richly demonstrated the importance of relationships for learning at work [15], [60], [75], [106], but these

ethnographic accounts have not provided sufficient specificity regarding the kinds of information received to model learning in social networks (for an exception, see [98]). While social network analysis provides the means with which to model these processes in groups, a review of that literature reveals limitations to the way in which researchers have traditionally assessed "advice" or "information" seeking networks [68]. Social network research has typically emphasized the role of weak or bridging ties in the acquisition of nonredundant information [18], [44], [84], [88], [89], (for an exception, see [45]). As a result, information-seeking networks have often been considered uni-dimensional, a bias that has slowed our understanding of how individuals and groups create and share knowledge in organizations.

Second, we also know little about how formal and interpersonal characteristics of relationships predict whom is sought out for various kinds of information. Knowledge does not flow freely or uniformly in organizations. Sociologists have poignantly demonstrated how correct information can have little or no impact on critical decision processes as groups can limit and reinforce shared information [51], [77], [98]. Organizational theorists have shown that a person's knowledge can be constrained by one's role [64], [76] or not acted upon due to motivational or cognitive impediments resulting from introducing knowledge into diverse social contexts [10], [36], [40], [95]. For shared knowledge to be meaningfully used, it must be coupled with mechanisms for acquisition, retention, retrieval, evaluation, and application of the information [5], [34], [90]. A critical component of this context lies with the network of relationships among members of a given collective; however, we currently have little empirical understanding of the way in which organizational and social aspects of relationships influence which people are sought for information. Again, this lack of awareness of relational attributes that lead people to seek specific others in the face of new problems or opportunities has slowed our understanding of how individuals and groups create and share knowledge in organizations.

B. Benefits From Seeking Information From People

How might a person benefit when seeking information from another? Clearly people can provide information that directly solves a problem or answers a question. Alternatively they might not be able to answer a given question yet still play a critical brokering function by pointing people to others that might know the answer [3], [18]. However, in addition to simply transferring information, people can engage each other in interactions shaping the dimensions of a problem space that an information seeker considers important [37], [60], [87], [102]–[104]. Such interactions are particularly salient early in problem solving and quite often dramatically affect the trajectory of information seeking and solution development over time.

People can also receive psychological and/or social benefits when seeking information from another person. For example, outside of any objectively correct information that might be obtained, people can also derive confidence or assurance when seeking information from another person. According to Blau [9, p. 32], people "are anxious to receive social approval for their decisions and actions, for their opinions and suggestions. The approving agreement of others helps to confirm their judgments, justify their conduct and validate their beliefs." Such approval can be highly instrumental in terms of efficiency by helping information seekers determine when to terminate a search [65]. Further, confidence can be built in these interactions, thereby improving the effectiveness with which a person advances their knowledge in new and often diverse social contexts [37].

In addition, we also know that information seeking is a symbolic act with social significance. For example, the need to legitimate decisions to various stakeholders has been identified as a reason why organizational members search for more information than necessary to solve a specific problem [47], [74]. While scholars have focused on the process of information seeking, it is also reasonable to believe that the status of people sought out carries symbolic value. Particularly in ambiguous, knowledge-intensive settings, it is possible that whom is sought out can be as important as what is found [39].

In short, research has fingered unique ways that people benefit when seeking information from other people. However, we have no holistic view of these informational benefits and concurrently how we might model information seeking in social contexts. Recently, a series of studies by Cross *et al.* have begun to more systematically assess ways that people benefit when seeking information from other people. In an initial qualitative effort, Cross [24] interviewed 40 managers in a consulting organization from a wide cross section of offices throughout the U.S. about a sample of 120 relations (40 people $\times$ 3 critical relationships each). Leveraging results from prior related research as sensitizing concepts [94], [108], five categories of information benefits were identified:

1) solutions (know what and know how);
2) meta-knowledge (pointers to databases or other people);
3) problem reformulation;
4) validation of plans or solutions;
5) legitimation from contact with a respected person.[1]

Table I provides the conceptual definition and a sample transcript quote for each of the five information benefits.

Each of these information benefits was found to perform a unique function in helping interviewees to solve problems, thus providing granularity to what has typically been considered an uni-dimensional advice or information seeking network [18], [44], [84]. A follow-on quantitative study of 118 managers within a different consulting organization known for its KM technology demonstrated that all five of these informational benefits were more effectively derived from each respondent's network than from alternative impersonal sources within the organization [25]. Consistent with Allen's [3] findings, this work further underscored the critical informational role an individual's network plays even in the face of sophisticated, accessible, and well-populated KM databases. Finally, a recent study of research scientists employed a Guttman scaling technique and found a graded structure of these benefits suggesting that receipt of these informational benefits are uniquely affected by organizational and social structures [28].

However, to date this research has done little to specify the role of organizational and social structures on receipt of

[1]Final inter-rater reliability of the coding for these categories was 94%.

TABLE I
INFORMATION BENEFITS DERIVED FROM SEEKING INFORMATION FROM PEOPLE [24]

Information Benefit	Representative Quote
Solutions: People can turn to other people and get specific information or answers that address questions or problems. Such information tends to be either declarative (know what) or procedural (know how) and allows seekers to solve a given problem.	"At [Company X] we had access to background information and you know lots of case studies and approaches that were really well written up. So what was useful was to talk with Terry who knew what we were trying to achieve to help me work some of this accessible content into a workable approach. What I needed to know was: How might we apply this given that we have not done it before."
Meta-knowledge: In addition to obtaining solutions, people often turn to others and learn about the location of relevant information. Such information might be housed in inanimate sources or held by other people, but learning of the location of relevant information increases the efficiency of problem solving.	"It was critical that Naomi was also able to bring to bear some work she had done in other projects. You know, she was able to say we could tap into this person who did something just like this over here or I can steal the code he wrote for this client and use it here. She had a lot of ideas of how to pull in her existing network to much more quickly get our stuff up and running."
Problem Reformulation: Often people turn to others for information and engage in interactions that lead them to think differently about their problem. Such interactions help seekers of information consider important dimensions of a problem or future consequences of a plan.	"I often miss the dynamics in a situation that will affect people. I don't know why, but it has bitten me before and so is something I am increasingly cognizant of... [that's why] I continue to go back to her for advice..."
Validation: Sometimes people turn to other people and receive no additional information but value the interaction because their own solutions or plans have been validated. Such interactions allow seekers of information to more confidently and effectively introduce their solutions to others.	"...the other times I tended to turn to him for help was when I had a problem that I had a solution for and I just wanted him to validate it. You just want someone important to say yeah, you are thinking along the right lines."
Legitimation: Sometimes people turn to other people for information and benefit by virtue of being able to tell others that they consulted that person. The ability to cite a respected source as having reviewed a solution can increase credibility outside of the objective quality of one's ideas.	"in conversations with the two heads of the E-Commerce initiative the fact that I had covered my plan with [the CIO] and [the CIO] bought into it they were like "Oh Great. We have the buy-in of IT, we don't need to worry about that and you know, [the CIO] understands the web so we are sure that there are some good ideas there...Despite the importance of the topic to their company and their own jobs they never really paid attention to the ideas once they knew [the CIO] had looked at the plan."

these informational benefits. Outside of the construct of tie strength [44], there is little evidence regarding the way in which kinds of relationships constrain or facilitate information flow in networks. For example, for which information benefits is trust likely to play a greater role? Does hierarchy or informal authority have a greater influence on whom is sought out for various information benefits? Gaining clarity on how social context affects information seeking will allow us to model with greater precision processes of knowledge creation, sharing, and learning in organizations.

C. Structural Influences on Receiving Information Benefits

Seeking information from another person inherently involves more than just individual attributes of the information seeker or person sought out. It involves various structures, or ongoing patterns of relations that constrain or facilitate action. We can summarize these into two categories of structural influences likely to contextualize information seeking [79]: Organizational (functional similarity, hierarchical proximity, task interdependency, and spatial proximity), and social (influence, trust, friendship, and gender). Organizational structures are those more or less defined by process flows, formal reporting relations, and physical locations. Social structures are those more or less defined by the nature of the interpersonal relationship between members of a social system.

1) Organizational Influences: Unit proximity refers to occupying positions within the same functional department [80]. There are at least two reasons why helping relationships should develop within a work unit. First, workgroup members tend to be peers, and employees rely on peers for job-related information because they are less likely to lose face by admitting ignorance to an individual of equal status [20], [56], [71]. The second reason that information sharing should develop among workgroup members is because such people belong to the same *functional* sub-culture and *hierarchical* position, and thus, are likely to share similar perceptions and have similar needs and information resources. For example, Stevenson and Gilly's study [91] of problem-solving networks found that medical employees were more likely to seek assistance within their own functional sub-culture (of doctors, nurses, or administrators) than outside of their division. In both Lang *et al.*'s [59] study of two university departments, and Lee's [61] study of 12 private and public sector organizations, users cited departmental colleagues as their primary source of computing advice.

Related to unit proximity is *task interdependency* which is especially relevant to the present study for two reasons. First, task interdependence should facilitate knowledge of, and access to, those who might have useful information. Second, interdependent jobs necessarily involve some similar task information, technical processes, and both covert and overt knowledge. For example, Eveland *et al.* [38] found that IT helper/helpee dyads shared at least five similar information work tasks, and Rice *et al.* [81] reported a significant effect of task interdependency on an employee's being sought as an information provider.

Spatial proximity refers to the degree that individuals work physically close to one another. Physical proximity, while not much studied, has been shown to play a significant role in influencing how frequently organizational members interact, what

kinds of knowledge are shared spontaneously, and how information and social norms are made more or less accessible [3], [4], [69]. The frequency of informal conversations decreases dramatically between employees who are located on different floors, and of course in different buildings [57]. Employees in two studies [11], [58] cite nearness or availability as one of the most important reasons for choosing a particular source of help concerning a new information system. However, spatial proximity (in one of two offices in different states) was one of the weakest predictors of seeking or providing help in Rice *et al.*'s [81] study, and played no role in fostering similar attitudes toward a new information system in Rice and Aydin's [80] study.

2) Social Influences: Relational proximity is the degree to which individuals directly interact. This informal, or emergent, network of relations may overlap, subsume, or avoid connections created by organizational structures [79]. Employees tend to seek help from organizational members who are relationally proximate whether they are located in the same organizational unit [56], [92], or in different units [20]. Employees may seek help from members that they interact with frequently because they have developed a trusting relationship which allows them to expose their information needs, or share innovative information [1], [2], [27], [29], [30]. For example, studies find a positive relationship between relational proximity and similarity of attitudes and behavior toward a particular information technology [17], [23], [42], [79]–[82], [86]. For the purposes of this study, we suggest that relational proximity can be thought of along three dimensions of relationships:

1) influence;
2) trust;
3) friendship.

Participants' *gender* may also influence the sharing of information. People tend to seek information from members of the same gender since they may share similar perspectives, similar communication styles, or belong to the same communication networks [49], [50]. However, Ibarra notes that women are more likely to go to men for task-oriented support, but to other women for social support. Females tend to be socialized to exhibit more cooperative behaviors than males, and to be less concerned with presenting themselves as independent and autonomous [43], [96], so may be more likely to seek validation and problem reformulation.

D. Research Question

Effectively modeling knowledge creation and sharing in organizational settings requires an understanding of the structural contexts experienced by the seeker. Thus, the question motivating this research is: *What organizational (unit, functional, hierarchical, task interdependency, and spatial proximity) and social structures (relations of relative power, trust, friendship, and gender) influence the receipt of various kinds information seeking benefits (solutions, meta-knowledge, problem reformulation, legitimacy, and validation) in an organizational setting?* This general research question presumes a causal model whereby organizational and social structures, which are independent variables, influence the receipt of benefits from information seeking, which are the dependent variables.

III. Methods

A. Sample and Site

We collected relevant organizational (function, hierarchical level, task interdependency, location), and social (influence, trust, friendship, gender) structural data from a group of 34 information scientists within a global pharmaceutical organization. These people supported the research and development function within the organization and so often dealt with complex requests for information that required them to rely on each other's expertise in various domains. Members of this department were highly trained (over 75% held doctorates) and were expected to conduct extensive reviews of ambiguous topics with little or no guidance from the research scientists. Typically, they were also expected to consolidate and package the results of their searches into oral presentations and written documentation for the scientists. As a result, they were required to demonstrate an advanced understanding of the specific compound under study and were expected to apply their intuition (and their colleagues') in shaping the materials delivered to the research scientists. This was a challenge as the group was distributed over four sites throughout the U.S. and also crossed four hierarchical levels. Each site had roughly the same number of people; however, the hierarchical levels were not equal, as three people occupied the most senior position, five the next level (the management team), five more as supervisors, and the remaining 21 as researchers.

B. Measures

Table II provides the wording and the descriptive statistics of the survey items. Wherever possible, we used question items employed in previous research, including indicators of friendship [53], [54], influence [13], [14], trust [55] and task interdependency [12]. Remaining items were constructed to tap the above components of the information network. Several steps were taken in this process to ensure reliability [66]. First, questions were constructed to be specific and provide detail as to the construct of interest. Second, we sought to elicit typical patterns of interaction as prior research indicates that recall of specific interactions that occurred in specific time intervals has lower reliability than more general measures of typical interactions [8], [41]. Third, we pre-tested the instruments on a group of 17 human resource executives in the same organization. A focus group debriefing of these respondents suggested that people were interpreting items correctly based on both general understanding of the items and their ability to recount specific instances where they received the five information benefits.

Finally, following survey administration, we randomly chose and interviewed ten of the 34 respondents to the network survey. These interviews assessed the participants' general understanding of network questions and required them to recount critical incidents with a person they had named in the network survey. In only three out of the 50 scenarios explored (i.e., 10 respondents $\times$ 5 information benefits) did people make a mistake. Two of these scenarios were where people reported receiving solutions that we would have coded as meta-knowledge and one was a report of legitimation that we would have coded as validation. This process provided further support for reliability of the social network question items employed.

TABLE II
ITEM WORDING AND DESCRIPTIVE STATISTICS FOR INFORMATION BENEFITS, AND STRUCTURAL INFLUENCES (ORGANIZATIONAL AND SOCIAL)

	Question		
Variable	**Information Benefits**	**Mean**	**S.D.**
Solution	Sometimes when we turn to people for information we benefit from their ability to provide specific answers to our question or solutions to our problems. Please indicate whether you typically turn to each of the following people for information and receive answers to your questions or solutions to your problems. ["1" if yes, "0" if no]	0.16	0.36
Meta-Knowledge	Sometimes when we turn to other people for information we benefit from their ability to point us to relevant sources of information such as other people, paper archives or databases. Please indicate whether you typically turn to each of the following people for information and receive knowledge of other sources of information. ["1" if yes, "0" if no]	0.09	0.29
Problem Reformulation	Sometimes when we turn to other people for information we benefit from their helping us think through a problem (even when they may not have specific information that solves our original problem). These interactions may help us consider important dimensions of a problem and/or anticipate issues likely to appear in the future. Please indicate whether you typically turn to each of the following people for information and engage in such problem solving. ["1" if yes, "0" if no]	0.08	0.27
Validation	Sometimes when we turn to other people for information we benefit from their validation of our plans or solutions. These interactions bolster confidence in a plan or solution and improve our willingness and ability to express ideas persuasively to others. Please indicate whether you typically turn to each of the following people for information and receive such validation of your plans or solutions. ["1" if yes, "0" if no]	0.06	0.24
Legitimation	Sometimes when we turn to other people for information we benefit from the ability to say we have spoken with that person about our plans or solutions. The individual may be in a position of formal authority or an expert and so indicating that we have consulted them for information lends credence to our plans or solutions. Please indicate whether you typically turn to each of the following people for information and benefit from being able to associate the person with your plans or solutions. ["1" if yes, "0" if no]	0.05	0.22
	Structural Influences: Organizational	**Mean**	**S.D.**
Function	"1" if same function, "0" if not.	0.29	0.45
Hierarchy	"0" if at same level in the organization, "-1" if at a lower hierarchical level and "1" if at a higher hierarchical level.	0.46	0.50
Task Interdependence	Please indicate the extent to which people listed below provide you with inputs necessary to do your job AND/OR to whom you distribute outputs from your work. ["1" yes, "0" no]	0.16	0.36
Co-Location	"1" if work in same office "0" if not.	0.44	0.50
	Structural Influences: Social		
Influence	Please indicate the extent to which you consider each person listed below to be influential at [the name of the organization]. That is, people who seem to have pull, weight or clout in this company. ["1" if yes, "0" if no]	0.25	0.43
Trust	Please indicate whether you would trust each person listed below to keep in confidence your concerns about a work-related issue. ["1" if yes, "0" if no"]	0.23	0.42
Friendship	Please indicate whether you consider each person below to be a personal friend. ["1" if yes, "0" if no]	0.11	0.31
Gender	"1" if same gender, "0" if not.	0.51	0.50

Note: N = 34

C. Nature of Network Measures and Analysis

It is important to note that all of these variables either are initially dyadic, as the unit of observation is an ordered *pair* of persons, or are converted into dyadic format. That is, the primary form of the data is a 34×34 (respondent $\times$ respondent) matrix for each kind of information benefit and each kind of network relationship. For each ordered pair (i, j) we asked whether i's relationship with j could be characterized by organizational or social structures (the independent variables), and we asked whether or not person i typically received solutions, meta-knowledge, problem reformulation, validation, and legitimation from person j (the dependent variables).

Since the data are dyadic, the observations do not satisfy the assumptions of ordinary procedures for statistical inference (that is, rows and columns in the dataset are not necessarily independent as they refer to the same people). Consequently, the quadratic assignment procedure (QAP) [6], [52] is used to compute Pearson correlations and multiple regressions, and the associated nonparametric significance tests (using a permutation technique to create a distribution of possible correlations so as to identify the significance of the observed correlation) among the variables. A side benefit of this procedure is that we can compute network correlations (and regressions) even when all variables are dichotomous.

Table III summarizes the various stages and procedures in this study.

IV. RESULTS

Table IV shows bivariate correlations among the variables. The correlations are fairly high among the five information ben-

TABLE III
SUMMARY OF PROCEDURES—SURVEY DEVELOPMENT, NETWORK MEASURES, CREATION AND ANALYSIS OF NETWORK MATRICES

- Identify five categories of benefits from seeking information from people (developed and validated by Cross and colleagues [24]-[30]).
- Surveyed 34 information scientists in a global pharmaceutical organization, distributed across four U.S. locations and four hierarchical levels.
- Survey contained measures of organizational structural influences: one's similarity of job function, level in the organizational hierarchy, task interdependency, physical location with each other information scientist.
- Survey contained measures of social structural influences: similarity of gender, and the extent of influence, trust, and friendship, with each other information scientist.
- Survey contained measures of the five information benefits receives from each other information scientist.
- All the survey measures were directly measured as network relations. That is, each survey listed all 34 people, and each respondent was asked to indicate the extent or similarity of function, hierarchical level, task interdependency, location, influence, trust, friendship, gender, and each of the five information benefits sought from, each of the other 33 people.
- The survey was pre-tested on 17 human resources executives in the organization.
- After the survey was completed, we randomly selected 10 of the 34 respondents and interviewed them to assess how well they understood the survey and to see if they could remember a critical incident with each person they had named in the survey.
- The survey data was used to create separate 34x34 network matrices for each of the variables.
- Each of these matrices was first correlated with each other matrix, similar to the familiar bivariate correlations of case-based variables (Table Four).
- Finally, to control for interdependencies among the influence matrices, each of the five information benefit matrices was regressed on the full set of organizational and social influence matrices (Table Five). Again, this procedure is similar to the more familiar multiple regression, except the variables are matrices instead of case-based variables.

efits; however, our follow-on interviews with the respondents make it clear that participants conceptualize these dimensions as distinct. Thus, we attribute the strong inter-correlations to the tendency for people to obtain more than one kind of information benefit from any one individual. Further, a review of Table IV shows correlations among the independent variables (the structural influences) to be within acceptable ranges [72], though task structures are moderately correlated with trust and friendship structures. Nonetheless, to control for these inter-relationships, and to identify the unique relationships of the task and social structural influences with the five information benefits, we ran a series of QAP multiple regressions, as shown in Table V. As with traditional multiple regression, the final coefficients represent the unique, partial correlations of each structural influence on each information benefit, independent of the other structural influences. Again, though, we note that the five information benefits are not themselves completely independent, so that the final variances explained and significance levels of the five multiple regressions are overestimates.

Of particular interest is that both organizational and social structural influences yield robust models. Variance accounted for in the information benefit variables ranges from a high of 44% for receipt of solutions to 25% for receipt of legitimation.

A. Organizational Structural Influences

As indicated by the beta coefficients, the structural influence of task interdependence is a consistent and strong predictor of receipt of all five information benefits (with standardized betas from 0.24 to 0.54). Of the other organizational influences, one's location in the functional structure had no influence on receiving information benefits, except that being in a different job function did slightly influence receipt of validation. This implies, somewhat in agreement with the weak ties [44], [54] and structural holes arguments [12], that support for the "rightness" of a decision must come from outside of one's cohesive network or strong ties. Reinforcement from one's close relations may serve other purposes, but seemingly does not provide the external or "objective" perspective necessary for validation. Similarity or difference in hierarchical levels had no influence on receipt of information benefits. It may be that in scientific or R&D organizations such as this one, formal hierarchical status is peripheral to expertise, as represented in the task interdependence network. Interestingly, co-location did not seem to play a significant role in receipt of the five information benefits. This was unexpected given some prior findings on the importance of physical propinquity and interaction [3], [69]; but not all studies have found significant effects of co-location [80]. More than likely, this is a product of our study focusing on intentional search and not the more serendipitous kinds of interactions that might result from physical propinquity [57], [81].

B. Social Structural Influences

Aside from friendship, social aspects of relationships play a smaller role in determining whether a pair of respondents reported exchanging a given information benefit. Power (here, in the form of influence) plays a role in framing dimensions of problems that are attended to (problem reformulation) and the way in which solutions become more broadly accepted (legitimation). Trust influenced whom was sought for meta-knowledge, problem reformulation and validation. However, trust did

TABLE IV
CORRELATIONS AMONG INFORMATION BENEFIT AND STRUCTURAL INFLUENCE MATRICES

	Information Benefits					Structural Influences: Organizational				Social		
	Solu	Meta	Prob	Valid	Legit	Funct	Hier	Task	Loc	Infl	Trust	Friend
Information Benefits												
Solution	--											
Meta	0.63***	--										
Problem	0.63***	0.60***	--									
Validation	0.54***	0.58***	0.71***	--								
Legitimation	0.41***	0.48***	0.57***	0.56***	--							
Organizational Structural Influences												
Function	0.20***	0.14***	0.18***	0.13**	0.09*	--						
Hierarchy	0.04	0.02	0.05	0.07	-0.02	0.25***	--					
Task Inter-dependency	0.65***	0.53***	0.55***	0.46***	0.45***	0.27***	0.09*	--				
Location	0.15**	0.12*	0.13**	0.10*	-.09	0.22**	-0.08	0.14*	--			
Social Structural Influences												
Influence	0.27***	0.24***	0.29***	0.21***	0.31***	0.11**	-0.17	0.29***	0.15*	--		
Trust	0.39***	0.38***	0.42***	0.41***	0.32***	0.30***	0.05	0.46***	0.15**	0.37***	--	
Friend	0.42***	0.44***	0.46***	0.46***	0.32***	0.21***	0.12**	0.50***	0.08	0.18***	0.47***	--
Gender	0.08*	0.08*	0.09*	0.11**	0.02	0.02	-0.01	0.05	-0.05	0.06	0.06	0.10*

N=34 people.
* = p <.05; ** = p <.01; *** = p <.001
Correlations are non-parametric bivariate correlations between each 34x34 matrix.
The shaded area highlights the correlations between the independent matrices (information benefits) and the dependent matric (Organizational and Social Structural Influences).

TABLE V
PREDICTING INFORMATION BENEFITS FROM STRUCTURAL INFLUENCES

	Information Benefits				
Structural Influences	**Solution**	**Meta**	**Problem**	**Validation**	**Legitimation**
Organizational					
Function	0.00	-0.04	-0.01	-0.07*	-0.05
Hierarchy	-0.01	-0.02	0.01	0.03	-0.02
Task Interdependence	0.54***	0.38***	0.37***	0.24***	0.33***
Co-Location	0.05	0.03	0.04	0.04	0.00
Social					
Influence	0.06	0.05	0.10*	0.03	0.17***
Trust	0.07	0.11*	0.12**	0.17***	0.08
Friendship	0.10*	0.20***	0.19***	0.25***	0.10*
Gender	0.04	0.03	0.04	0.07*	-0.02
Adj. R-Squared	0.44	0.34	0.37	0.31	0.25

not predict whom was sought for solutions or legitimation. It seems that if a problem domain is well-defined, then it is likely not so important that one trust the person they turn to for informational purposes.

The friendship relationship predicted whom was sought for all five information benefits (with betas ranging from 0.10 to 0.25). It is particularly interesting to note the stronger importance of the friendship relationship for meta-knowledge, problem reformulation, and validation, as this introduces a potential bias in early stages of problem reformulation. That is, if people tend to overemphasize their friends when conceptualizing and validating problems and solutions, they will be limited by the fact that the same information and perspectives are already shared and well known among friends. As a result, problem resolution will not benefit from the different perspectives, novel knowledge, or remote expertise that might come from others not so well known (as argued in the weak ties/structural holes research). Finally, gender similarity had no

influence, in this network of information scientists anyway, on receipt of information benefits, except that people of similar gender were more likely to receive validation from each other. Clearly, if validation is an important basis for creating a shared interpretation of information that becomes organizational knowledge, and validation is greater between members of the same gender, we can see one of the manifestations of the social context of knowledge.

C. Relative Influences of Organizational and Social Structure Influence on Different Information Benefits

In aggregate, the trends in the beta coefficients demonstrate the relative importance of task and social relationships in predicting whom is sought for each of the five information benefits. As Fig. 1 shows, a parsimonious view of the five information benefits might be that in moving from solution and legitimation (what might be considered more instrumental information benefits) to meta-knowledge, problem-solving, and validation (what might be considered more representational and affective information benefits), knowledge can be seen as increasingly resident in the social context of a group. As one moves from solution to validation, the beta coefficients indicating the influence of the task interdependence relationship on those information benefits decline, while the influence of social relations, though playing different roles, generally increases in importance. In all cases except the influence of friendship on validation, however, task interdependency is the strongest influence.

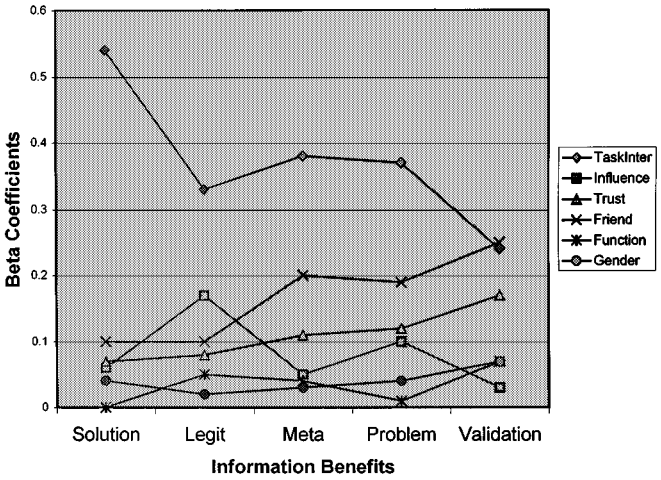

Fig. 1. Extent to which each selected structural influence predicts each information benefit.

V. Discussion

A. Limitations

Of course this study has several limitations. First, the study was conducted within one organization, which limits generalizability of findings. This was a conscious decision as we felt the limitation was mitigated by the depth of analysis afforded and the increased prevalence of similar cognitive and social characteristics in knowledge intensive work. However, it is likely that different national, occupational, or organizational cultures would provide different patterns as to the importance of any given social relationship.

A second limitation of this study is its primary focus on social context. This study did not address the way in which impersonal sources of information such as computer or online databases or paper archives facilitate the creation of meaning in a given organizational context. Future work will hopefully consider this challenge and help create a more robust theory regarding the creation of knowledge as a product of affordances (both personal and impersonal) in one's environment. This is accomplished by including additional sources and channels as network choices [83], [90].

Nevertheless, we feel this research makes a contribution to the KM, information processing and social network literatures. In contrast to the information processing and KM literature's focus on transfer and assimilation of objective information or data, the present results show that when information is sought from people, benefits accrue that are important to both generating a solution and introducing the solution into diverse social contexts through adaptive, symbolic and affective processes. As a contribution to the social network literature, results show that there are several dimensions to the advice or information seeking network that contribute to knowledge creation and use, and that are differentially influenced by organizational and social structures.

B. Social Capital

This work may extend theorizing on social capital in knowledge-intensive settings. By adding further granularity to traditional lines of inquiry that have focused on tie strength [44], [45] or structural holes [18], our perspective offers evidence of social capital in knowledge-intensive settings based on a functional view of relationships. Time and energy constraints restrict one's ability to develop and maintain a set of task and social relationships that provide various information benefits [78]. For example, legitimation likely accrues within a given collective as a product of authority or expertise. Such people are likely highly sought out, and so are costly and time consuming relationships to develop and maintain. Similarly, problem reformulation seems to occur in trusting relationships, again ones that might require significant effort and history to develop and maintain. It is feasible that individual effectiveness is derived from expending one's finite relational energy in developing and maintaining those relationships that provide an appropriate balance of the five information benefits (as Burt [18], [19] argues).

C. Computer-Mediated Communication

Our research also suggests implications for studies of computer-mediated communication. Information processing studies tend to focus on knowledge sharing that is mediated by distributed technologies [22], [31], [46], [62]. In relation to the five information benefits discussed above, we suggest that understanding what is both lost and gained through computer mediated communication among people offers important insight into the way in which technology might be effectively deployed. Specifically, one might anticipate that e-mail and collaborative virtual environments facilitate the receipt of solutions and meta-knowledge by extending a person's reach across boundaries of

time and space. However, it is likely that information benefits of problem reformulation or validation do not move across mediated networks as readily.

D. Organizational Learning

Finally, at the network level of analysis, the five information benefits can further our understanding of social processes and performance implications of organizational learning. Specifically, March [63] identifies a fundamental contextual influence in his distinction between *exploration* and *exploitation*. In relation to the five information benefits it is likely that social systems engaged in exploitative tasks benefit from relations providing better instrumental access to nonredundant information. Thus, we would expect the content of such networks to be more heavily weighted to solutions and meta-knowledge as there likely exists some collective agreement on relevant problem dimensions. In short, if we do truly know what we need to know and/or speed matters, solidarity of the group on who is either influential or an expert in a given domain is likely important.

However, often tasks of importance in organizations are not characterized by exploitation so much as by exploration, whose essence "is experimentation with new alternatives" (March [63, p. 85]). Meaning in such equivocal endeavors is likely heavily reliant on expressive social interaction. Thus in exploratory settings characterized by ambiguity or equivocality (as opposed to settings ripe for exploiting available knowledge) we might see a greater weighting on the importance of relationships for the provision of problem reformulation, validation and legitimation. As developing and maintaining these relationships likely entails trust (in the case of problem reformulation and validation) or coping with status differentials (in the case of legitimation) then we might also expect to see fewer relationships than in exploitative task domains characterized by greater uncertainty and less equivocality. Further, in contrast to the exploitation contingency, it is likely that performance of a group in an exploratory setting is benefited by considering competing alternatives, and then validating those alternatives. In this context, excessive agreement on who provides legitimation might stunt learning and knowledge creation, as what is "legitimate" is typically what is already acceptable and formalized.

VI. Conclusion

This research was undertaken to illuminate ways that social context (in the form of organizational and social structural factors) might influence the receipt of the five information benefits. We sought to offer findings relevant to two gaps in the literature—informational benefits that people receive from other people and the characteristics of relationships that dictate whom is sought for these benefits. We found that while receipt of the five information benefits was most significantly related to task interdependence, social features of relationships take on added significance as one moves from receipt of a solution to validation of decisions in organizational settings. We hope that future research will explore the performance implications of our findings in relation to social capital, computer-mediated communication and organizational learning.

Acknowledgment

The authors thank P. Adler for his comments on an earlier version of this work.

References

[1] T. L. Albrecht and B. Hall, "Relational and content differences between elite and outsiders in innovation networks," *Hum. Commun. Res.*, vol. 17, pp. 535–561, 1991.
[2] ——, "Facilitating talk about new ideas: The role of personal relationships in organizational innovation," *Commun. Monogr.*, vol. 58, pp. 273–288, 1991.
[3] T. Allen, *Managing the Flow of Technology*. Cambridge, MA: MIT Press, 1977.
[4] J. Archea, "The place of architectural factors in behavioral theories of privacy," *J. Social Issues*, vol. 33, no. 3, pp. 116–137, 1977.
[5] S. Ba, K. R. Lang, and A. B. Whinston, "Enterprise decision support using the Intranet technology," *Decision Support Syst.*, vol. 20, no. 2, pp. 99–134, 1997.
[6] F. Baker and L. Hubert, "The analysis of social interaction data," *Sociol. Meth. Res.*, vol. 9, pp. 339–361, 1981.
[7] P. Berger and T. Luckman, *The Social Construction of Reality*. New York: Anchor Books, 1966.
[8] R. Bernard, P. Killworth, and L. Sailer, "Informant accuracy in social network data V: An experimental attempt to predict actual communication from recall data," *Social Sci. Res.*, vol. 11, pp. 30–60, 1982.
[9] P. Blau, *Exchange and Power in Social Life*. New Brunswick, NJ: Transactions Books, 1986.
[10] R. Boland and V. Ramkirshnan, "Perspective making and perspective taking in communities of knowing," *Organiz. Sci.*, vol. 6, no. 4, pp. 350–372, 1995.
[11] B. Bowman, F. H. Grupe, D. Lund, and W. Moore, "An examination of sources of support preferred by end-user computing personnel," *J. End User Comput.*, pp. 4–11, 1993.
[12] D. Brass, "Being in the right place: A structural analysis of individual influence in an organization," *Adm. Sci. Quart.*, vol. 29, pp. 518–539, 1984.
[13] ——, "Technology and the structuring of jobs: Employee satisfaction, performance and influence," *Organiz. Beh. Human Decision Process.*, vol. 35, pp. 216–240, 1985.
[14] D. Brass and M. Burkhardt, "Centrality and power in organizations," in *Networks and Organizations: Structure, Form and Action*, N. Nohria and R. Eccles, Eds. Cambridge, MA: Harvard Business School Press, 1992, pp. 191–215.
[15] J. S. Brown and P. Duguid, "Organizational learning and communities-of-practice: Toward a unified view of working, learning and innovation," *Organiz. Sci.*, vol. 2, no. 1, pp. 40–57, 1991.
[16] ——, *The Social Life of Information*. Cambridge, MA: Harvard Business School Press, 2000.
[17] M. E. Burkhardt, "Social interaction effects following a technological change: A longitudinal investigation," *Acad. Manage. J.*, vol. 4, pp. 869–898, 1994.
[18] R. Burt, *Structural Holes*. Cambridge, MA: Harvard Univ. Press, 1992.
[19] ——, "The contingent value of social capital," *Adm. Sci. Quart.*, vol. 42, pp. 339–365, 1997.
[20] A. S. Chitgopekar and E. Mabry, "Communicating supportiveness in on-line mentoring and peer helping relationships," in *Proc. Ann. Meet. Speech Commun. Assoc.*, San Diego, CA, 1996.
[21] D. Cohen and L. Prusak, *In Good Company*. Cambridge, MA: Harvard Business School Press, 2000.
[22] D. Constant, L. Sproull, and S. Kiesler, "The kindness of strangers: The usefulness of electronic weak ties for technical advice," *Organiz. Sci.*, vol. 7, no. 2, pp. 119–135, 1996.
[23] N. S. Contractor, D. Seibold, and M. Heller, "Interactional influence in the structuring of media use in groups: Influence in members' perceptions of group decision support system use," *Hum. Commun. Res.*, vol. 22, no. 4, pp. 451–481, 1996.
[24] R. Cross, "More than an answer: How seeking information through people facilitates knowledge creation and use," in *Proc. Toronto Acad. Manage. Conf.*, Toronto, ON, Canada, Aug. 2000.
[25] ——, "A relational view of information seeking: Tapping people and impersonal sources in intentional search," in *Proc. Washington Acad. Manage. Conf.*, Aug. 2001.

[26] R. Cross and L. Baird, "Technology is not enough: Improving performance by building organizational memory," *Sloan Manage. Rev.*, vol. 41, no. 3, pp. 41–54, 2000.

[27] R. Cross and S. Borgatti, "A social network view of organizational learning," in *Proc. Acad. Manage.*, 2001.

[28] R. Cross, S. Borgatti, and A. Parker, "Beyond information: Relational content of the advice network," *Social Networks*, vol. 23, no. 3, 2001.

[29] R. Cross, A. Parker, L. Prusak, and S. Borgatti, "Knowing what we know: Supporting knowledge creation and transfer in social networks," *Organiz. Dyn.*, 2002.

[30] R. Cross and L. Prusak, "The political economy of knowledge markets in organizations," Handbook of Organizational Learning, 2002, to be published.

[31] R. Daft, R. Lengel, and L. Trevino, "Message equivocality, media selection and manager performance: Implications for information systems," *MIS Quart.*, pp. 355–366, Sept. 1987.

[32] T. Davenport, D. Delong, and M. Beers, "Successful knowledge management projects," *Sloan Manage. Rev.*, pp. 43–57, Winter 1998.

[33] T. Davenport and L. Prusak, *Working Knowledge*. Boston, MA: Harvard Business School Press, 1998.

[34] A. R. Dennis, "Information exchange and use in group decision making: You can lead a group to information, but you can't make it think," *MIS Quart.*, vol. 20, no. 4, pp. 433–458, 1996.

[35] N. Dixon, *Common Knowledge: How Companies Thrive by Sharing What They Know*. Boston, MA: Harvard Business School Press, 2000.

[36] D. Dougherty, "Interpretive barriers to successful product innovation in large firms," *Organiz. Sci.*, vol. 3, no. 2, pp. 179–202, 1992.

[37] B. Erickson, "The relational basis of attitudes," in *Social Structures: A Network Approach*, B. Wellman and S. Berkowitz, Eds. Cambridge, U.K.: Cambridge Univ. Press, 1988, pp. 99–121.

[38] J. D. Eveland, A. Blanchard, W. Brown, and J. Mattocks, "The role of 'help networks' in facilitating use of CSCW tools," *Inform. Soc.*, vol. 11, pp. 113–129, 1995.

[39] M. Feldman and J. March, "Information in organizations as signal and symbol," *Adm. Sci. Quart.*, vol. 26, pp. 171–186, 1981.

[40] C. M. Fiol, "Consensus, diversity and learning in organizations," *Organiz. Sci.*, vol. 5, no. 3, pp. 18–29, 1994.

[41] L. C. Freeman, A. K. Romney, and S. Freeman, "Cognitive structure and informant accuracy," *Amer. Anthropologist*, vol. 89, pp. 310–325, 1987.

[42] J. Fulk, "Social construction of communication technology," *Acad. Manage. J.*, vol. 36, pp. 921–950, 1993.

[43] W. L. Gardner, III, J. V. Peluchette, and Clinebell, "Valuing women in management: An impression management perspective on gender diversity," *Manage. Commun. Quart.*, vol. 8, pp. 115–164, 1994.

[44] M. Granovetter, "The strength of weak ties," *Amer. J. Sociol.*, vol. 78, pp. 1360–1380, 1973.

[45] M. Hansen, "The search-transfer problem: The role of weak ties in sharing knowledge across organization sub-units," *Admin. Sci. Quart.*, vol. 44, pp. 82–111, 1999.

[46] P. Hinds and S. Kiesler, "Communication across boundaries: Work, structure, and use of communication technologies in a large organization," *Organiz. Sci.*, vol. 6, no. 4, pp. 373–393, 1995.

[47] G. Huber and R. Daft, "Information environments of organizations," in *Handbook of Organizational Communication*, F. Jablin, L. Putnam, K. Roberts, and L. Porter, Eds. Newbury Park, CA: Sage, 1987, pp. 130–164.

[48] E. Hutchins, *Cognition in the Wild*. Cambridge, MA: MIT Press, 1995.

[49] H. Ibarra, "Homophily and differential returns: Sex differences in network structure and access in an advertising firm," *Adm. Sci. Quart.*, vol. 37, pp. 422–447, 1992.

[50] ——, "Personal networks of women and minorities in management: A conceptual framework," *Acad. Manage. Rev.*, vol. 18, pp. 56–87, 1993.

[51] I. Janis, *Victims of Groupthink*. Boston, MA: Houghton-Mifflin, 1972.

[52] D. Krackhardt, "Predicting with social networks: Nonparametric multiple regression analysis of dyadic data," *Social Networks*, vol. 10, pp. 359–382, 1988.

[53] ——, "Assessing the political landscape: Structure, cognition, and power in organizational settings," *Adm. Sci. Quart.*, vol. 35, pp. 342–369, 1990.

[54] ——, "The strength of strong ties: The importance of *philos* in organizations," in *Networks and Organizations: Structure, Form, and Action*, N. Nohria and R. Eccles, Eds. Cambridge, MA: Harvard Business School Press, 1992, pp. 216–239.

[55] *Informal Networks: The Company Behind the Chart*, vol. 71, pp. 104–111, 1993.

[56] M. W. Kramer, "A longitudinal study of peer communication during job transfers: The impact of frequency, quality, and network multiplexity on adjustment," *Hum. Commun. Res.*, vol. 23, pp. 59–86, 1996.

[57] R. Kraut, R. Fish, R. Root, and B. Chalfonte, "Informal communication in organizations: Form, function, and technology," in *Human Reaction to Technology: Claremont Symposium on Applied Social Psychology*, S. Oskamp and S. Spacapan, Eds. Newbury Park, CA: Sage, 1990.

[58] K. N. Lang, R. Auld, R. Lang, and T. Lang, "The goals and methods of computer users," *Int. J. Man–Mach. Stud.*, vol. 17, pp. 375–399, 1982.

[59] T. Lang, K. N. Lang, and R. Auld, "Support for users of operating systems and applications software," *Int. J. Man–Mach. Stud.*, vol. 14, pp. 269–282, 1981.

[60] J. Lave and E. Wenger, *Situated Learning: Legitimate Peripheral Participation*. Cambridge, U.K.: Cambridge Univ. Press, 1991.

[61] D. M. S. Lee, "Usage pattern and sources of assistance for personal computer users," *MIS Quart.*, pp. 313–325, 1986.

[62] A. Majchrzak, R. E. Rice, A. Malhotra, N. King, and S. Ba, "Technology adaptation: The case of a computer-supported inter-organizational virtual team," *MIS Quart.*, vol. 24, no. 4, pp. 569–600, 2000.

[63] J. March, "Exploration and exploitation in organizational learning," *Organiz. Sci.*, vol. 2, no. 1, pp. 71–879, 1991.

[64] J. March and J. Olsen, "The uncertainty of the past: Organizational learning under ambiguity," *Eur. J. Politic. Res.*, vol. 3, pp. 147–171, 1975.

[65] J. March and H. Simon, *Organizations*. New York: Wiley, 1958.

[66] P. Marsden, "Network data and measurement," *Annu. Rev. Sociol.*, vol. 16, pp. 435–463, 1990.

[67] M. Mead, *Mind, Self and Society*. Chicago, IL: Univ.of Chicago Press, 1934.

[68] P. Monge and N. Contractor, "Emergence of communication networks," in *Handbook of Organizational Communication*, 2nd ed, F. Jablin and L. Putnam, Eds. Newbury Park, CA: Sage, 2000.

[69] P. Monge, L. Rothman, E. Eisenberg, K. Miller, and K. Kirste, "The dynamics of organizational proximity," *Manage. Sci.*, vol. 31, pp. 1129–1141, 1985.

[70] R. Moreland, L. Argote, and R. Krishnan, "Socially shared cognition at work: Transactive memory and group performance," in *What's Social About Social Cognition?*, J. Nye and A. Brower, Eds. Newbury Park, CA: Sage, 1996, pp. 57–85.

[71] E. W. Morrison, "Newcomer information seeking: Exploring types, modes, sources, and outcomes," *Acad. Manage. J.*, vol. 36, pp. 557–589, 1993.

[72] J. Nunnally, *Psychometric Theory*, 2nd ed. New York: McGraw-Hill, 1978.

[73] C. O'Dell and C. J. Grayson, *If Only We Knew What We Know*. New York: Free, 1998.

[74] C. O'Reilly, "Variations in decision makers use of information sources: The impact of quality and accessibility of information," *Acad. Manage. J.*, vol. 25, pp. 756–771, 1982.

[75] J. E. Orr, *Talking About Machines: An Ethnography of a Modern Job*. Ithaca, NY: Cornell Univ. Press, 1996.

[76] B. T. Pentland, "Organizing moves in software support hot lines," *Adm. Sci. Quart.*, vol. 37, no. 4, pp. 527–548, 1992.

[77] C. Perrow, *Complex Organizations: A Critical Essay*. New York: McGraw-Hill, 1986, pp. 119–156.

[78] R. E. Rice, "Communication networking in computer-conferencing systems: A longitudinal study of group roles and system structure," in *Communication Yearbook*, M. Burgoon, Ed. Newbury Park, CA: Sage, 1982, vol. 6, pp. 925–944.

[79] ——, "Using network concepts to clarify sources and mechanisms of social influence," in *Progress in Communication Sciences, XII*, W. D. Richards and G. Barnett, Eds. Norwood, NJ: Ablex, 1993, pp. 43–62.

[80] R. E. Rice and C. Aydin, "Attitudes toward new organizational technology: Network proximity as a mechanism for social information processing," *Adm. Sci. Quart.*, vol. 36, pp. 219–244, 1991.

[81] R. E. Rice, L. Collins-Jarvis, and S. Zydney-Walker, "Individual and structural influences on information technology helping relationships," *J. Appl. Commun. Res.*, vol. 27, no. 4, pp. 285–303, 1999.

[82] R. E. Rice, A. Grant, J. Schmitz, and J. Torobin, "Individual and network influences on the adoption and perceived outcomes of electronic messaging," *Social Networks*, vol. 12, pp. 27–55, 1990.

[83] R. E. Rice, M. McCreadie, and S.-J. Chang, *Accessing and Browsing Information and Communication*. Cambridge, MA: MIT, 2001.

[84] E. Rogers, *Diffusion of Innovations*, 4th ed. New York: Free, 1995.

[85] R. Ruggles, "The state of the notion: Knowledge management in practice," *Calif. Manage. Rev.*, vol. 40, no. 3, pp. 80–89, 1998.

[86] J. Schmitz and J. Fulk, "Organizational colleagues, information richness, and electronic mail: A test of the social influence model of technology use," *Commun. Res.*, vol. 18, pp. 487–523, 1991.
[87] D. A. Schon, "Generative metaphor: A perspective on problem-setting in social policy," in *Metaphor and Thought*, 2nd ed, A. Ortony, Ed. New York: Cambridge Univ. Press, 1993.
[88] P. Shah, "Who are employees' social referents? Using a network perspective to determine referent others," *Acad. Manage. J.*, vol. 41, no. 3, pp. 249–268, 1998.
[89] G. Simmel, *The Sociology of Georg Simmel*. New York: Free, 1950.
[90] E. W. Stein and V. Zwass, "Actualizing organizational memory with information systems," *Inform. Syst. Res.*, vol. 6, no. 2, pp. 85–113, 1995.
[91] W. B. Stevenson and M. Gilly, "Information processing and problem-solving: The migration of problems through formal positions and networks of ties," *Acad. Manage. J.*, vol. 34, pp. 918–928, 1991.
[92] ——, "Problem-solving networks in organizations: Intentional design and emergent structure," *Social Sci. Networks*, vol. 22, pp. 92–113, 1993.
[93] T. Stewart, *Intellectual Capital: The New Wealth of Organizations*. New York: Doubleday, 1997.
[94] A. Strauss and J. Corbin, *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage, 1990.
[95] G. Szulanski, "Exploring internal stickiness: Impediments to the transfer of best practice within the firm," *Strategic Manage. J.*, vol. 17, pp. 27–43, 1996.
[96] D. Tannen, *Talking From 9 to 5: How Women's and Men's Conversational Styles Affect Who Gets Heard, Who Gets Credit, and What Gets Done at Work*. New York: William Morrow, 1994.
[97] M. Tyre and E. von Hippel, "The situated nature of adaptive learning in organizations," *Organization Sci.*, vol. 8, no. 1, pp. 71–83, 1997.
[98] D. Vaughn, *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA*. Chicago, IL: Univ. of Chicago Press, 1996.
[99] G. Von Krogh, K. Ichijo, and I. Nonaka, *Enabling Knowledge Creation*. London, U.K.: Oxford Univ. Press, 2000.
[100] L. Vygotsky, *Thought and Language*. Cambridge, MA: MIT Press, 1962.
[101] ——, *Mind in Society: The Development of Higher Psychological Processes*, M. Cole, V. John-Steiner, S. Scribner, and E. Souberman, Eds. Cambridge, MA: Harvard Univ. Press, 1978.
[102] J. P. Walsh, "Managerial and organizational cognition: Notes from a trip down memory lane," *Organiz. Sci.*, vol. 6, no. 3, pp. 280–321, 1995.
[103] K. Weick, *The Social Psychology of Organizing*. New York: McGraw-Hill, 1979.
[104] ——, *Sensemaking in Organizations*. Newbury Park, CA: Sage, 1995.
[105] K. Weick and K. Roberts, "Collective mind in organizations: Heedful interrelating on flight decks," *Adm. Sci. Quart.*, vol. 38, pp. 357–381, 1993.
[106] E. Wenger, *Communities of Practice*. London, U.K.: Oxford Univ. Press, 1998.
[107] L. Wittgenstein, *Philosophical Investigations*. New York: McMillan, 1953.
[108] R. K. Yin, *Case Study Research: Design and Methods*, 2nd ed. Newbury Park, CA: Sage, 1994.

Rob Cross he is a Research Manager with the IBM Institute for Knowledge Management, Cambridge, MA, where he directs the social network research program. He is also on faculty at the University of Virginia, Charlottesville, as a Professor in the Management Department. To date, he has worked with over 40 companies in applying social network analysis to such organizational issues as merger integration, large-scale change, organizational alignment, initiation of CoP, and leadership development/integration. His current research projects include a series of studies on the role of social networks in knowledge creation and sharing, assessment of the role of trust in knowledge exchange, modeling cultural consensus as a product of social network position, and emerging work on the role of energy in social networks.

Ronald E. Rice, photograph and biography not available at the time of publication.

Andrew Parker, photograph and biography not available at the time of publication.