KNOWLEDGE RETRIEVAL IN WORK GROUPS: WHAT KNOWLEDGE IS CRITICAL?

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Abstract

This paper addresses the knowledge criticality question: what knowledge is critical to the focal task and therefore, needs to be retrieved. It argues that knowledge criticality is not an objective construct and that people's prior task knowledge which consists of two dimensions: knowledge domain and expertise level, as well as social knowledge has an effect on what knowledge they perceive as critical to the focal task and thus, needs to be retrieved. Task uncertainty is likely to aggravate this effect. The role of communication in members' agreement on knowledge criticality judgment is also discussed. Communication strength and the two dimensions of communication diversity - structural dimension and content dimension – are expected to have positive effects on the extent to which group members agree on knowledge criticality assessment; and this effect is stronger in groups where members have highly diverse task knowledge and social knowledge, The implications of this analysis are discussed in the context of knowledge sharing.

Keywords: knowledge criticality task knowledge, social knowledge, task uncertainty, communication.

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Suggested track: Knowledge sharing

1 Introduction

The present project is designed to study knowledge retrieval behavior in work groups. Before we engage in detailed discussions on specifics, it would be helpful to explain how knowledge retrieval differs from information seeking, a term more broadly used in communication and management literature. The differences, in my view, exist along three dimensions. First, information seeking implicitly involves a search process, either a random search (i.e., the information seeker has little clue about where the needed information resides, and therefore engages in an unplanned, spontaneous search for the source of the information) or a targeted search (i.e., the information seeker has some clues about possible information holders). Moreover, when people are involved in information seeking activities, the quality of the information often is not one of the primary determinants of their choices of the information source because any information is potentially helpful. This is why much literature on information seeking

does not take into account the effect of information quality on individual's information seeking behavior (e.g., Morrison, 1993). Knowledge retrieval, on the other hand, implies that the person who needs the knowledge knows where to locate that knowledge and has a positive evaluation of the quality of the knowledge. The absence of the search process and the awareness of the value of the knowledge in knowledge retrieval would lead to a somewhat different estimate of the cost (either physical or psychological) of retrieval than in information seeking.

Second, knowledge retrieval examined in this paper is restricted to retrieval of task-related knowledge while information seeking encompasses a much broader scope including seeking referent information, performance and social feedback information, and normative information, for example, among new hires (Morrison, 1993). Third, there are two modes for information seeking, passively observing and actively inquiring. The obtaining of task-related knowledge, however, occurs most effectively through explicit inquiry (Comer, 1991; Morrison, 1993) because the reason why a high performer chooses to carry out a task in a particular manner may not be directly observable to or comprehended by a bystander. These differences lead to different mechanisms through which people retrieve knowledge vs. seek information.

The exchange of task knowledge has been found to have a strong positive effect on organizational performance (Snyder & Morris, 1984). Knowledge retrieval is a key process in knowledge exchange, and therefore has significant performance effects. Whether a person is capable of obtaining task knowledge he or she needs to complete a task has a direct impact on the performance outcome. Research on knowledge retrieval is expected to address two questions: (1) what knowledge is critical and therefore, needs to be retrieved; and (2) from where to retrieve that knowledge. These two questions are closely related to Tsoukas's (1996) analysis of the two senses of knowledge distribution: (1) the *decision* of what knowledge is critical is distributed in different minds (i.e., different people make different judgments of what knowledge is critical to the focal task); and (2) the *knowledge* itself is distributed in different minds (i.e., different people have expertise in different knowledge domains). The current study deals with the first question.

The extant research on knowledge management has failed to systematically examine the underlying mechanisms that cause the members in work groups to disagree on what knowledge they consider critical to the performance of a task. The disagreement on knowledge criticality judgment increases with the uncertainty of the task environment where task performers have to constantly redefine the task and decide on what knowledge needs to be retrieved for task performance purposes. The

concept of absorptive capacity highlights the importance of prior knowledge to digesting new knowledge (Cohen & Levinthal, 1990), but it does not explain how and why people differ in their perceptions of the criticality of new knowledge before they decide to assimilate that knowledge. This question is an important one. The decision making literature suggests that the more critical information is used in the decision making process, the better decision people will make (see e.g., Blanchard, 1966; Porat & Haas, 1969). O'Reilly (1980) cited Troutman & Shanteau's (1977) work on judge's decision making to provide compelling empirical evidence that irrelevant information often misled judges to erroneous decision.

This project is designed to address the knowledge criticality question. It argues that knowledge criticality is not an objective construct and that people's prior task knowledge which consists of two dimensions: knowledge domain and expertise level, as well as social knowledge has an effect on what knowledge they perceive as critical to the focal task and thus, needs to be retrieved. Task uncertainty is likely to aggravate this effect. As Carley (1986) succinctly summarized, "the task becomes a social task in which the task formulation, the set of requisite knowledge, is negotiated by those performing the task" (p. 432).

The arguments in this paper are outlined against the backdrop of a broader theoretical framework constituting such sociological theories as Stryker's (1980) structural symbolic interactionism, Blau's (1977) social differentiation theory, and more recently Carley's (1991) constructuralism, all of which argue that the knowledge a person has determines his or her behavior. In the context of knowledge retrieval, a person's task knowledge and social knowledge determines what knowledge he or she deems relevant to the task and from where he or she chooses to retrieve that knowledge.

2 Theory/Issues

Hayek (1945) reminded us more than half a century ago that the use of knowledge in society is a social process – that is, both scientific knowledge and the knowledge of the social context are critical to understanding knowledge use. In organizations, both task knowledge and social knowledge affect the exploitation of existing knowledge and the assimilation of new knowledge, which ultimately affects a firm's absorptive capacity (Cohen & Levinthal, 1990). However, prior research has focused primarily on the effect of task knowledge on knowledge use and overlooked the effect of social knowledge (Levine & Moreland, 1991). This section aims to uncover the underlying mechanisms through which task knowledge and social knowledge

influence people's judgment of what knowledge is critical to the focal task. This is a step before absorbing new knowledge – focus of the absorptive capacity – because people have to appreciate the value and the criticality of the knowledge before they are motivated to learn (i.e., "absorb") it. The arguments are made by drawing literatures in multiple disciplines such as cognitive psychology, sociology, communication, and management.

2.1 Task Knowledge and Knowledge Criticality Judgment

The proposition that different task knowledge leads to different judgments of what knowledge is critical and valuable to the focal task is rooted in Bruner's (1957) analysis of "perceptual readiness," a concept referring to "the relative accessibility of categories to afferent stimulus inputs" (p. 148). Category accessibility differs among individuals with diverse task knowledge. Task knowledge diversity can be classified into two categories: domain diversity and expertise level diversity. Domain diversity refers to the degree to which the members in a collective system possess knowledge in different domains. The differential accessibility of various categories among individuals with specialized knowledge in different domains may prime certain stimuli over others and lead to different perceptions by different people. Expertise level diversity refers to the extent to which the expertise levels of knowledge holders vary in the same domain. The prior knowledge of experts and non-experts varies in both content and structure, which subsequently influences their judgments of what knowledge is critical. The diversity in the knowledge and skills among task performers is not as noticeable as the diversity in "readily detectable" attributes such as gender or race, yet yields substantial performance consequence nonetheless (Sessa & Jackson, 1995).

People's perception of the criticality of knowledge varies especially in complex task environments (Halpin, Streufert, Steffey, & Lanham, 1971). Hayek (1945) argued that how salient a knowledge item is in a person's knowledge system is a primary determinant of his or her judgment of how critical it is to the task at hand. Among individuals with knowledge in a specialized domain, the knowledge items related to that domain are most salient in their minds, which may lead them to assigning more weight to those items. In the same knowledge area, domain-specific items are more salient in an expert's memory than in a non-expert's memory. This may lead experts and non-experts to different judgments of what knowledge is critical and the degree of its criticality.

Domain Diversity and Knowledge Relevance Judgment. Domain diversity may originate from diversity in functions, occupations, educational backgrounds, and

so on. Although diversity in work group's knowledge composition has been reported to contribute to group performance (Pelled, Eisenhardt, & Xin, 1999), especially in the area of innovation (Damanpour, 1991), through increasing communication with experts both within and outside the group (Ancona and Caldwell, 1992), it brings about challenges groups have to deal with as well. Milliken and Martins (1996) did a comprehensive review of the literature on group diversity and a thorough analysis on the complex effects diversity has on group functioning. They argued that subtle differences in knowledge structure and content are likely to cause substantial coordination problems. For instance, people with different functional training may develop different beliefs about how various components in organizational life are connected to one another. Pelled, Eisenhardt, and Xin (1999) reported that functional diversity was one of the major sources of task conflicts because people with different functional backgrounds tended to build different mental models and had different opinions about work-related issues. Murray (1989) found that functional diversity contributed to efficiency in a short run, but obstructed adaptation in a long run.

Moreover, individuals with specialized knowledge in different domains may have developed different "habits of thoughts" (Hayek, 1989) that may lead to different evaluations of the relevance of the same knowledge item. For instance, hard-core economists assume human beings are perfectly rational, and therefore completely ignore the role emotion plays in human decision making. The decision models developed by these scientists purposefully exclude the relevance of the irrational aspect of human beings. Many decision scientists trained in the areas of psychology and sociology, on the other hand, hold a more realistic (i.e., softer) view of human beings and regard emotion as extremely relevant to explaining human decision making behavior because, in their views, no one can escape the influence of emotion no matter how rational they claim themselves to be.

Medin, Lynch, and Coley (1997) studied categorization and reasoning among different types of tree experts such as taxonomists, landscape workers, parks maintenance personnel and found that they used different reasoning strategies and placed different weights on the same features. This result may be generalized to other areas. Thus,

Hypothesis 1: Domain diversity will be positively related to disagreement on knowledge criticality judgment.

Expertise Level Diversity and Knowledge Criticality Judgment. Besides domain diversity, the other dimension of task knowledge diversity is expertise level diversity. In this paper, I use experts versus non-experts to differentiate individuals with

high levels of expertise from those with low levels of expertise. This distinction enjoys greater validity than that between experts and novices because research has found that length of experience is not invariably correlated with the amount of declarative knowledge, or knowledge structures, or performance (Sonnentag, 1998), the three components of expertise (Ford & Kraiger, 1995; Schvaneveldt, Durso, Goldsmith, Breen, & Cooke, 1985). The judgment of what knowledge is critical is dependent on both the content and the structure of one's prior knowledge.

First, differences in the content of the knowledge system among experts and non-experts may lead to different knowledge criticality judgments. Chase and Simon's (1973) study of chess players suggests that compared with less skilled chess players, chess masters have their expert knowledge stored in larger chunks in their memories, have more chunks, and all the chunks can be retrieved relatively easily. Lindsay and Norman's (1977) study of memory development provides further empirical support for Chase and Simon's (1973) findings on retrieval. They explained that the reason why experts are capable of retrieving a knowledge item from their memories with less effort than non-experts is that experts spend more time processing it in the stage of encoding. Kirschenbaum (1992) found that experts also processed task-related knowledge items in more depth than non-experts. The greater amount of knowledge stored in experts' memories and its ease for retrieval enhances expert's ability to recognize critical knowledge. In addition, the larger knowledge bases possessed by experts allow for easier connections between a knowledge item in their knowledge bases and new knowledge (Carley, 1986). This feature of an expert's knowledge system also helps experts detect the criticality of a particular knowledge item.

Second, differences in the structure of the knowledge system among experts and non-experts may lead to different knowledge criticality judgments. Day and Gettman (2001) reported that expert's knowledge structure differed from that of a non-expert. The various knowledge items in an expert's knowledge system are organized in a more coherent fashion than that in a non-expert's knowledge system (Wisniewski, 1995). The more systematic organization of an expert's knowledge enables experts to see better the interconnectedness among knowledge items (Sujan, Sujan, & Bettman, 1988) and relate and integrate critical knowledge items into the existing system more easily. Non-experts, however, often place much weight on spurious associations and ignore the real associations among various pieces of knowledge (McKeithen, Reitman, Rueter, & Hirtle, 1981). This is probably another reason why experts are capable of recalling more critical knowledge while non-experts often get distracted by irrelevant knowledge and delay the problem solving process (Kirschenbaum, 1992).

The above discussion on knowledge structure has focused on patterns of associations among knowledge items. Another dimension of knowledge structure is the strength of association. Schvaneveldt, Durso, Goldsmith, Breen, and Cooke (1985) reported that the items in an expert's knowledge system were connected with substantial key links while the organization of a non-expert's knowledge system was fragmented and characterized by spurious links. People's decision on what knowledge is critical is contingent on the nature and strength of associations between knowledge pieces (Krippendorff, 1975). The lack of critical links and the existence of inaccurate linkages among non-experts will inevitably impair their judgment of what knowledge is indispensable to the task at hand.

In addition to differences in the content and structure of knowledge systems, differences in other issues such as problem comprehension and task representation may also lead experts and non-experts to different judgments on what knowledge is critical to the completion of the task. Sonnentag (1998) found that expert software designers were better at grasping the gist of the problem very early in the problem solving stage while non-expert designers improved their problem comprehension over time. Chi, Feltovich, and Glaser (1982) also found that experts had better representations of tasks than non-experts. Experts are more likely to detect the underlying similarities shared by a cluster of problems while non-experts focus on the ostensible dissimilarities on the surface (Chi, Feltovich, & Glaser, 1981). Expert's superior ability in problem comprehension and task representation explains why experts, compared with non-experts, have better intuitions that enable them to respond to a problem solving situation more rapidly and more accurately (Simon, 1986) and engage in task-related knowledge search (Bouman, 1980) in a more efficient manner. This suggests that experts and non-experts may not only disagree on what knowledge is critical to the focal task, but also disagree on when that knowledge should be sought for and utilized. Besides, experts engage in more planning activities than non-experts (Klemp & McClelland, 1986). Thus, experts and non-experts may regard the same knowledge item as critical at different points in time due to differences in their plans.

Experts are also more likely to have access to diverse knowledge than non-experts. Morse and Gordon (1974) studied scientists working in industry settings and found that high performing, innovative scientists tended to go outside the organizational boundary for new knowledge while less innovative scientists tended to limit their knowledge search within the organization. Due to differences in exposure, the critical knowledge brought in by innovative scientists from outside sources may appear novel

to inward-focused scientists and may be dismissed as tangential by less innovative scientists.

Hypothesis 2: Expertise level diversity will be positively related to disagreement on knowledge criticality judgment.

2.2 Social Knowledge and Knowledge Criticality Judgment

Social knowledge as well as task knowledge plays a critical role in determining how knowledge is utilized in organizations (Levine & Moreland, 1991). Social knowledge refers to "knowledge about the group's structure; its culture, norms, methods of coordination; and task performance strategies" (Argote, Insko, Yovetich, & Romero, 1995, p. 525). For instance, role expectation is one type of social knowledge. Role expectations are often dynamic and multidimensional, especially in complex tasks (Brown, Ganesan, & Challagalla, 2001). Members in an organization must continually make sense of the constantly changing task environment and figure out what they are expected to do given their respective roles. Members with the same role functions may have different understandings about the task due to differences in sense making. Members with different role functions may harbor different priorities. These differences will lead them to different judgments of the criticality of the same knowledge item.

Other social knowledge includes knowledge concerning "local norms, values, language schemes, and subcultures," which has been proposed to affect how a problem is defined and what is the appropriate solution (Katz & Tushman, 1979, p. 145). According to Katz and Tushman (1979), a problem is not definable only in common (i.e., shared) terms; a "local orientation" is critical to problem definition as well (p. 145). Cramton (2001) found that the lack of situational and contextual cues was one of the major obstacles to coordinating geographically dispersed work groups. She argued that groups distributed at different locations might be evaluated according to different criteria and allocated different amounts of time to finish the task. These differences may affect their definition of the task and consequently what knowledge is critical to accomplishing the task and when.

Hypothesis 3: Diversity of social knowledge will be positively related to disagreement on knowledge criticality judgment.

2.3 The Moderating Effects of Task Uncertainty

As tasks become more uncertain and complex, expert knowledge is no longer concentrated in those who are high in the hierarchy, but rather critical task-related expertise is more evenly distributed across different levels in the hierarchy (Katz &

Tushman, 1979). This increases the differentiation in task knowledge as well as social knowledge among task performers, and hence the amount of disagreement on knowledge criticality judgment. When the features of new knowledge are ambiguous (as in many uncertain task environments), people tend to interpret new knowledge as congruent to their prior knowledge, a phenomenon addressed by distortion theory (Heit, 1994). Since different individuals possess different prior knowledge either due to differences in their functional training, levels of expertise, or understandings of the social environment, they are more likely make biased interpretations of new knowledge in uncertain tasks, which may lead to different assessments of the criticality of the new knowledge to the focal task.

> *Hypothesis 4*: Task uncertainty moderates the strength of the association between the diversity in member's task knowledge and social knowledge and their disagreement on knowledge criticality judgment with stronger associations expected in more uncertain task environments.

2.4 The Role of Communication

Although expertise diversity in a group or a firm increases its innovative capacity (Cohen & Levinthal, 1990), its information search efficiency (Ginsberg, 1990), and the number of choices available in organizational decision making (Brunnson, 1982), it creates communication and coordination problems and may not produce the optimal outcome as expected. As Ancona and Caldwell (1992) have pointed out, the diverse knowledge composition in a team does not have a uniformly positive effect on performance; rather, its effects are contingent on the degree to which group processes successfully maximize the positive effects (i.e., enhanced creativity) and minimize the negative effects (i.e., difficulty in coordination). Communication is clearly a key process component mediating the relationship between expertise diversity and the collective performance.

The connection between knowledge diversity and communication received some attention in past research. Glick, Miller, and Huber (1993) reported that functional diversity had a negative effect on the amount of person-to-person communication among group members because of increasing conflicts encountered by members with different functional backgrounds. Triandis (1960) found that shared mentality contributed to communication effectiveness. Sykes, Larntz, and Cox (1976) discovered that people tended to interact with similar others even if they were physically far apart.

Ashby's (1956) "law of requisite variety" provides an alternative view of the link between knowledge diversity and communication. The law of requisite variety stipulates that a match between the diversity of a system and the diversity of the environment is a crucial condition for its positive performance. When applied to the discussion here, the diversity of communication among members should match the diversity of the knowledge composition of the collective to ensure its survival. That is, when the members in a collective system, be it a group or a firm, have knowledge tapping a large number of domains and/or highly differentiated expertise levels, there should be a high degree of communication diversity for the system to survive and function smoothly.

In this paper, I analyze two dimensions of communication diversity: structural dimension and content dimension. The structural dimension of communication diversity refers to the extent to which individuals communicate with others who have task knowledge in other domains, different levels of expert knowledge in the same domain, and different understandings of the social environment. The content dimension of communication diversity refers to the diversity of the knowledge content exchanged through each communication link, be it task knowledge in various areas or social knowledge tapping various dimensions of organizational life.

As discussed before, individuals with different task knowledge and social knowledge are more likely to disagree on what knowledge is critcial to the focal task, the degree of criticality, and when it is critical. Communication with high structural diversity and content diversity allows the members in a collective system to be exposed to different judgments by different members on what knowledge is needed to complete the task and helps to reach a sufficient degree of consensus – a precondition for smooth coordination in the process of performing the task. The first step to consensus building is to make everyone aware of the variety of divergent views present in the system. According to Carley (1991), a broad knowledge distribution will make consensus building much easier. The greater exposure brought by high communication structural diversity and content diversity increases the amount of shared knowledge among the members in a collective system. When people share much of their knowledge, it takes less time to reach consensus. Even if the members of the system still disagree on certain issues after communication, at least they are aware of the source of the disagreement and why. This will reduce the difficulty in coordinating individual performance of the task.

Hypothesis 5a: Communication structural diversity has a positive effect on the extent to which group members agree on knowledge criticality

judgment; and this effect is stronger in groups where members have highly diverse task knowledge and social knowledge,

Hypothesis 5b: Communication content diversity has a positive effect on the extent to which group members agree on knowledge criticality judgment; and this effect is stronger in groups where members have highly diverse task knowledge and social knowledge,

Another method that will increase consensus and improve coordination is to have group members engage in intense communication, a feature I term "communication strength." Communication reduces the amount of disagreement among a collection of people. As discussed earlier, interaction facilitates the accumulation of shared knowledge. Shared knowledge is critical to achieving consensus because people can only agree on a perspective if it is directly related to the knowledge they have (Carley, 1986). C. West Churchman stated in his foreword to Mitroff's (1983) book *The Subjective Side of Science* that "truth is as much psychological as it is logical" (p. xii). He argued that people had to be psychologically prepared to accept a new way of thinking. Frequent and deep communication will help to achieve mutual understanding and remove the psychological barrier to acquiring a new perspective.

Hypothesis 6: Communication strength has a positive effect on the extent to which group members agree on knowledge criticality judgment; and this effect is stronger in groups where members have highly diverse task knowledge and social knowledge,

3 Methods, Results, and Discussion to be Determined

Survey data are being collected to evaluate these hypotheses. The knowledge criticality question is worth exploring because if group members are not aware of the criticality of a knowledge item to the focal task, they won't make an effort to retrieve that knowledge item from a relevant expert. Presumably, the lack of critical knowledge in the process of performing the task will lead to inferior performance outcome. Since different people with different prior task knowledge and social knowledge often have different opinions as to what knowledge item is critical to the task at hand, communication, especially communication with people who have expert knowledge in another domain, or who differ on the level of expertise, or who have different social knowledge, is proposed as a useful mechanism that helps to bring to light a greater number of critical knowledge items needed for an optimal performance outcome.

4 References

Ancona, D. G., & Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. Organization Science, 3 (3), 321-341.

Argote, L. (1993). Group and organizational learning curves: Individual, system and environmental components. British Journal of Social Psychology, 32, 31-51.

Argote, L., Insko, C. A., Yovetich, N., & Romeo, A. A. (1995). Group learning curves: The effects of turnover and task complexity on group performance. Journal of Applied Social Psychology, 25 (6), 512-529.

Ashby, W. R. (1956). An introduction to cybernetics. London: Chapman & Hall.

Blanchard, W. (1966). Relevance of information and accuracy of interpersonal prediction: A methodological note. Psychological Reports, 18, 379-382.

Bouman, M. J. (1980). Application of information-processing and decision-making research. In G. R. Ungson & D. N. Braunstein (Eds.), Decision making: An interdisciplinary inquiry (pp. 129-167). Boston: Kent.

Brown, S. P., Ganesan, S., & Challagalla, G. (2001). Self-efficacy as a moderator of information-seeking effectiveness. Journal of Applied Psychology, 86 (5), 1043-1051.

Bruner, J. S (1957). On perceptual readiness. Psychological Review, 64 (2), 123-152.

Brunsson, N. (1982). The irrationality of action and action rationality: Decisions, ideologies and organizational actions. Journal of Management Studies, 19, 29-44.

Carley, K. (1986). Knowledge acquisition as a social phenomenon. Instructional Science, 14, 381-438.

Carley, K. (1991). A theory of group stability. American Sociological Review, 56 (3), 331-354.

Chase, W. C., & Simon, H. A. (1973). Perception in chess. Cognitive Psychology, 4, 55-81.

Chi, M., Feltovich, P., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. Cognitive Science, 5, 121-152.

Chi, M., Feltovich, P., & Glaser, R. (1982). Categorization in experts and novices. In R. Sternberg (Ed.), The handbook of intelligence (pp. 66-84). Hillsdale, NJ: Erlbaum.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35, 128-152.

Comer, D. R. (1991). Organizational newcomers' acquisition of information from peers. Management Communication Quarterly, 5 (1), 64-89.

Cramton, C. D. (2001). The mutual knowledge problem and its consequence for dispersed collaboration. Organization Science, 12 (3), 346-371.

Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of Management Journal, 34, 555-590.

Day, E. A., Arthur, W. Jr., & Gettman, D. (2001). Knowledge structures and the acquisition of a complex skill. Journal of Applied Psychology, 86 (5), 1022-1033.

Ford, J. K., & Kraiger, K. (1995). The application of cognitive constructs and principles to the instructional systems model of training: Implications for needs assessment, design, and transfer. In C. L. Cooper & I. T. Robertson (Ed.), International review of industrial and organizational psychology (pp. 1-48). Chichester, England: Wiley.

Gerstberger, P. G., & Allen, T. J. (1968). Criteria used by research and development engineers in the selection of an information source. Journal of Applied Psychology, 52 (4), 272-279.

Ginsberg, A. (1990). Connecting diversification to performance: A sociocognitive approach. Academy of Management Review, 15 (3), 514-543.

Glick, W. H., Miller, C. C., & Huber, G. P. (1993). The impact of upper-echelon diversity on organizational performance. In G. P. Huber & W. H. Glick (Eds.), Organizational change and redesign: Ideas and insights for improving performance (pp. 176-214). New York, NY: Oxford University Press.

Halpin, S. M., Streufert, S., Steffey, J., & Lanham, N. (1971). Information load, proportion of relevance, and relevance perception. Psychonomic Science, 23 (6), 404-406.

Hayek, F. A. (1945). The use of knowledge in society. American Economic Review, 35 (4), 519-530.

Hayek, F. A. (1989). The pretence of knowledge. American Economic Review, 79 (6), 3-7.

Heit, E. (1994). Models of the effects of prior knowledge on category learning. Journal of Experimental Psychology: Learning, Memory, and Cognition, 20 (6), 1264-1282.

Katz, R., & Tushman, M. (1979). Communication patterns, project performance, and task characteristics: An empirical evaluation and integration in an R & D setting. Organizational Behavior and Human Performance, 23, 139-162.

Kirschenbaum, S. (1992). Influence of experience on information-gathering strategies. Journal of Applied Psychology, 77 (3), 343-352.

Klemp, G. O., & McClelland, D. C. (1986). What characterizes intelligent functioning among senior managers? In R. J. Sternberg & R. K. Wagner (Eds.), Practical intelligence: Nature and origin of competence in the everyday world (pp. 31-50). Cambridge, England: Cambridge University Press.

Krippendorff, K. (1975). Some principles of information storage and retrieval in society. General Systems, 20, 15-35.

Levine, J. M., & Moreland, R. L. (1991). Culture and socialization in work groups. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), Perspectives on socially shared cognition (pp. 257-279). Washington DC: American Psychological Association.

Lindsay, P. H., & Norman, D. A. (1972). Human information processing: An introduction to psychology. New York, NY: Academic Press.

Medin, D. L., Lynch, E. B., Coley, J. D., & Atran, S. (1997). Categorization and reasoning among tree experts: Do all roads lead to Rome? Cognitive Psychology, 32, 49-96.

Milliken, F. J., & Martins, L. L. (1996). Searching for common threads: Understanding the multiple effects of diversity in organizational groups. Academy of Management Review, 21 (2), 402-433.

Mitroff, I. I. (1983). The subjective side of science: A philosophical inquiry into the psychology of the Appolo Moon scientists. Seaside, CA: Intersystems Publications.

Morrison, E. W. (1993). Newcomer information seeking: Exploring types, modes, sources, and outcomes. Academy of Management Journal, 36 (3), 557-589.

Morse, E. V., & Gordon, G. (1974). Cognitive skills: A determinant of scientists' local-cosmopolitan orientation. Academy of Management Journal, 17 (4), 709-723.

Murphy, G. L., & Wright, J. C. (1984). Changes in conceptual structure with expertise: Differences between real-world experts and novices. Journal of Experimental Psychology: Learning, Memory, and Cognition, 10 (1), 144-155.

Murray, A. I. (1989). Top management group heterogeneity and firm performance. Strategic Management Journal, Summer, 125-141.

O'Reilly, C. A. (1980). Individuals and information overload in organizations: Is more necessarily better? Academy of Management Journal, 23 (4), 684-694.

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. (1999). Exploring the black box: An analysis of work group diversity, conflict, and performance. Administrative Science Quarterly, 44 (1), 1-28.

Porat, A., & Hass, J. (1969). Information effects on decision making. Behavioral Science, 14, 98-104.

Schvaneveld, R. W., Durso, F. T., Goldsmith, T. E., Breen, T. J., Cooke, N. M., Tucker, R. G., & De Maio, J. C. (1985). International Journal of Man-Machine Studies, 23, 699-728.

Sessa, V. I., & Jackson, S. (1995). Diversity in decision-making teams: All differences are not created equal. In M. M. Chemers, S. Oskamp, & M. A. Costanzo (Eds.), Diversity in organizations: New perspectives for a changing workplace (pp. 133-156). Thousand Oaks, CA: Sage.

Simon, H. A. (1986). What we know about the creative process. In .R L. Kuhn (Ed.), Frontiers in creative and innovative management (pp. 3-20). Cambridge, MA: Ballinger.

Snyder, R. A., & Morris, J. H. (1984). Organizational communication and performance. Journal of Applied Psychology, 69 (3), 461-465.

Sonnentag, S. (1998). Expertise in professional software design: A process study. Journal of Applied Psychology, 83 (5), 703-715.

Stryker, S. (1980). Symbolic interactionism. Menlo Park: Benjamin Cummings.

Sujan, H., Sujan, M., & Bettman, J. R. (1988). Knowledge structure differences between more effective and less effective salespeople. Journal of Marketing Research, 25, 81-86.

Sykes, R. E., Larntz, K., & Cox, J. C. (1976). Proximity and similarity effects on frequency of interaction in a class of naval recruits. Sociometry, 39 (3), 263-269.

Triandis, H. C. (1960). Cognitive similarity and communication in a dyad. Human Relations, 13, 175-183.

Troutman, C. M., & Shanteau, J. (1977). Inferences based on nondiagnostic information. Organizational Behavior and Human Performance, 19, 43-55.

Tsoukas, H. (1996). The firm as a distributed knowledge system: A constructionist approach. Strategic Management Journal, 17 (Winter Special Issue), 11-25.

Walsh, J. P. (1995). Managerial and organizational cognition: Notes from a trip down memory lane. Organization Science, 6 (3), 280-321.

Wisnieski, E. J. (1995). Prior knowledge and functionally relevant features in concept learning. Journal of Experimental Psychology: Learning, Memory, and Cognition, 21 (2), 449-468.