C E O

**Center for
Effective
Organizations**

**FROM KNOWLEDGE ACCUMULATION
TO ACCOMMODATION:
CYCLES OF COLLECTIVE COGNITION
IN WORK GROUPS**

CRISTINA B. GIBSON

*Center for Effective Organizations
Marshall School of Business
University of Southern California*

January 2003

FROM KNOWLEDGE ACCUMULATION TO ACCOMMODATION:

CYCLES OF COLLECTIVE COGNITION IN WORK GROUPS

CRISTINA B. GIBSON
Center for Effective Organizations
Marshall School of Business
University of Southern California
3670 Trousdale Parkway - BRI 204
Los Angeles, CA 90089-0806
(213) 740-7057
cgibson@marshall.usc.edu

FROM KNOWLEDGE ACCUMULATION TO ACCOMMODATION:

CYCLES OF COLLECTIVE COGNITION IN WORK GROUPS

ABSTRACT

A framework for collective cognition in the workplace is developed to provide guidance to groups, their leaders, and researchers interested in understanding and improving cognitive processes. First, phases of the process and elements essential at each phase are identified based on prior research. Next, a series of catalysts are proposed which help bring about potential movement through the phases. Propositions regarding these catalysts are suggested to demonstrate the verifiability of the framework and guide future research and practice.

Conventional wisdom suggests that group-level cognitive processes are analogous to those that occur at the individual level (Corner, Kinicki & Keats, 1994; Hinsz, Tindale & Vollrath, 1997; Lindsley, Brass, & Thomas, 1995; Sandelands & Stablein, 1987). However, research over the last decade indicates an inconsistency between empirical observations and this conventional wisdom (Gibson, 1999; Hutchins, 1991; Parker, 1994; Prussia & Kinicki, 1996; Walsh, Henderson, & Deighton, 1988; Weick & Roberts, 1993). For example, using a multi-method approach, Gibson (1999) investigated simulated top management teams in Hong Kong and the U.S. and nursing teams in Indonesia and the U.S. She found that the typical positive relationships between efficacy-related cognitions and performance were less consistent at the group level than at the individual level, with the impact of group-level cognitions moderated by characteristics of the task and cultural context. These factors were related to the nature of the information exchange in groups. When task uncertainty was high, team members worked independently, and collectivism was low, group-efficacy was not related to group effectiveness. In contrast, when groups knew what was required to perform a task, worked interdependently, and valued collectivism, the relationship between group-efficacy and group effectiveness was positive. Reviewing this research domain, it is clear that in order to develop better theories that capture, predict, and guide work behavior in groups, we must understand both the process of collective cognition and the impact of collective cognition on work behavior.

In terms of applications, the focus on collective cognition is important for three reasons. First, there is increasing recognition that effective collaboration in the use of information is a principal source of organizational rents and competitive advantage (Schendel, 1996; Spender & Grant, 1996). Second, greater and greater numbers of employees are employed in the domain of knowledge work in general, as opposed to manufacturing or service (Nonaka, 1994). Third,

organizations increasingly utilize collective strategies such as team-based designs for accomplishing this work, rather than individual "job based" approaches (Mohrman, Cohen, & Mohrman, 1995). Research has demonstrated that collective strategies are efficient ways of creating and disseminating knowledge, leading some to speculate that teams are the fundamental learning unit in modern organizations (Nonaka & Takeuchi, 1995). Thus, understanding collective cognitive processes has important implications for organizational knowledge management and learning. In the longer term, a framework for collective cognition can help to increase the effectiveness of work organizations.

In this paper, I first review previous theories of collective cognition and research investigating these theories in order to identify phases of the cognitive process and elements essential at each phase. Next, I delineate a set of catalysts that help move a group through the phases. Together, the phases and catalysts comprise a framework for collective cognition that integrates previous research and provides guidance for future research and practice. In the third section of this paper, I suggest a series of propositions that capture potential relationships among the phases over time as the catalysts are introduced. I conclude by delineating what is gained by understanding collective cognition, and what would be lost if the focus were only on individual-level cognition.

THE PROCESS OF COLLECTIVE COGNITION

Assumptions, Definitions, and Theoretical Foundations

The most basic assumption underlying this framework for collective cognition is that human thought plays an important role in human behavior. We behave in a certain way based on the thought patterns which preceded that behavior, and these thought patterns mediate the direct impact of many environmental cues on our behavior. The set of thought process that proceed

organizational behavior are often referred to as "cognition" (Hutchins, 1991; Wyer & Srull, 1984). This is a common assumption that underlies all cognitive theories, dating back to Durkheim (for a review, see Hjelle & Ziegler, 1981).

A second assumption is that a group is an entity with psychological significance. The framework developed here adopts a definition for a group based on those provided in the social psychology literature (McGrath, 1984; Shaw, 1976). Specifically, a group is a social aggregation, recognized as a meaningful unit by its members, in which a limited number of people interact on a regular basis to accomplish a set of shared objectives for which they have mutual accountability. This definition excludes social aggregations such as crowds, in which people come together by chance and do not recognize themselves as a unit. The definition also excludes sets of people, such as a collection of friends, that may not have a sense of accountability for fulfilling an objective. Finally, this definition excludes extremely large social aggregates, such as an entire department in an organization, which may have common objectives and accountability, but which do not conceive of themselves as a group and thus members may not interact on a regular basis.

A third basic assumption of the framework results when the concept of "cognition" is fused with the concept of "group." Drawing on the research in small group and interpersonal relations literature in which intragroup communication is viewed as a form of information processing, collective cognition can be defined as the group processes involved in the acquisition, storage, transmission, manipulation, and use of information (e.g., Hinsz et al., 1997; von Cranach, Ochsebein & Valach, 1986; Wegner, 1987).

Many theorists have suggested that groups and/or organizations function as information processing systems (Anand, Manz & Glick, 1998; Argyris & Schon, 1978; Gioia & Poole, 1984;

Hinsz et al., 1997; Hutchins, 1991; Lord & Foti, 1985; Walsh & Ungson, 1991; Wegner, 1987).

The notion that a group might have cognitive properties similar to those that occur at the

individual level has actually been around since the turn of the century (cf. Durkheim, 1893/1933;

McDougall, 1938). More recent developments in the notion of collective cognition suggest that

the earlier conceptualizations of the group mind were too simplistic. For example, Sandelands

and Stablein (1987) pointed out that "mind" is not so much a substance with intellective power as

it is *a process of forming ideas*. Along these same lines, Weick and Roberts (1993) suggested

that the key to understanding collective cognition is recognizing that "mind" is "located" in

patterns of connections between individuals and the weights put on them, rather than in entities

or elements, and to understand group mind is to be attentive to *process*. Thus collective cognition

does not reside in the individuals taken separately, though each individual contributes to it. Nor

does it reside outside them. It is present in the interrelations between the activities of group

members. This argument highlights the need for a framework that specifies not only elements

involved in collective thought, but also the processes that bring about change in the basic

elements, and the levers or techniques that might encourage or inhibit this change. Making this

transition requires a triadic focus on: (1) elements, (2) the process by which one element is

related to another, and (3) the catalysts that might bring about changes in the process.

In previous models of collective cognition, individual-level social information processing

frameworks have served as a useful source for understanding how the process of collective

cognition might occur (Corner et al., 1994; Ginsberg, 1990; Hinsz et al., 1997). For example,

Corner et al. (1994) review information processing theory at the individual level and propose

organizational-level analogues to the sequence of steps that typically comprise these models;

however, their focus is on the organization as a whole, and they place relatively little emphasis

on understanding how subunits (i.e., groups) function as information processors within the organizational context. In contrast, Hinsz et al. (1997) recently published a review of research that specifically focuses on the emerging view of groups as information processors. They review numerous studies, which provide evidence for analogous structures for information processing at the individual and group level. Knowing something about these structures is very useful for understanding collective cognition. However, Hinsz et al. did not delineate a process by which these structures might function at the group level. Similarly, they opted to leave the task of developing propositions regarding collective cognition to other researchers. Nonetheless, the Hinsz et al. review serves as a useful point of departure for the current discussion.

Also important, is that many previous models have lacked implications for the dynamics of organizational practice. Once we understand the basic process of collective cognition, a natural question that arises is, can the cycle be altered? Group members themselves, or managers that lead work groups, who are concerned with improving group effectiveness need insight regarding the factors that impact collective cognition. The framework developed here proposes some specific factors that serve as catalysts for moving the group through the cognitive process. These catalysts can also be used as techniques for guiding a group that finds itself "stuck" on a given process phase, unable to move forward and complete the collaborative thinking process that often must proceed effective collective action.

Research from information processing, group development, and communication indicates that collective cognition can be conceptualized by at least four process phases: accumulation, interaction, examination, and accommodation (Argyris and Schon, 1978; Goodman, Ravlin, & Schminke, 1990; Jewell & Reitz, 1988; Kolb, 1984; Levine & Moreland, 1991; Tuckman & Jensen, 1977; von Cranach, Ochsenbein & Valach, 1986). In turn, each of these phases appears

to be comprised of several key elements and sub-processes (Hinsz, Tindale & Vollrath, 1997;

Sniezek & Henry, 1990; Stasser & Davis, 1981). Although research suggests that most groups

partake in each of the major process phases to some degree, the extent to which each sub-process

is undertaken seems to vary among groups, as does the time spent on any given phase (Corner,

Kinicki & Keats, 1994; Gersick, 1988; Hutchins, 1991). Furthermore, movement from one

major process phase to another is sometimes linear and sequential, but there can also be

reciprocal relationships among the phases, and a reversal of the cycle may also occur (Aldag &

Fuller, 1993; Argyris, 1976; Hinsz, Tindale & Vollrath, 1997; Mohrman, Gibson & Mohrman,

2000). Indeed, the framework becomes most interesting when we view the possible

permutations of the sequence, and the potential relationships between the processes brought

about by certain catalysts. Together, these form a cycle of collective cognition. Below, I define

each phase in terms of key sub-processes and elements and review the empirical research that

supports this conceptualization. This information is summarized in Table 1.

Insert Table 1 About Here

Accumulation: Perceiving, Filtering, and Storing

During accumulation groups acquire knowledge and information. Groups can be said to

"perceive" when members become aware of new information. Members "filter" knowledge,

such that only certain information will be operated upon within the group interaction process;

other information is edited out (Wyer & Srull, 1984). The first permutation of individual

knowledge are collectively derived labels. When information enters group interaction, labels are

linked to it through group conversation based on members' perceptions of the group's objectives,

positioning within the larger organization, and their own role in the group (Thomas & McDaniel,

1990). For example, a new product development team describes an initiative as "creative interaction technology" or a merger integration team tags the effort with the nomenclature of a marriage (e.g., a union, a partnership, the honeymoon, etc). These labels tend to color what is subsequently perceived and stored by the group. The label applied first, perhaps arbitrarily, becomes the catchword for the concept. Afterward, the group members are more inclined to recall information as discussed rather than as perceived (Wegner, 1987).

Often, initial labels evolve into jargon (words, phrases or gestures that are significant to group members but mean nothing to outsiders) or categories (sets of like information that organize knowledge, and are similar to schema at the individual level of analysis) that are used on an ongoing basis (Levine & Moreland, 1991; Wyer & Srull, 1984). Jargon and categories convey appropriate attributes or behaviors and groups draw upon them in order to define experiences and develop meaning of those experiences (Klimoski & Mohammed, 1994).

Interaction: Retrieving, Exchanging, and Structuring

To utilize knowledge, groups must be able to recall information shared in previous interactions. A transactive memory system -- the set of individual memory systems in combination with the communication that takes place between them -- facilitates this process (Wegner, 1987). One person has access to information in another's memory by virtue of knowing that the other person is a location for an item with a certain label. This interdependence produces a knowledge-holding system that is larger and more complex than any one individuals' own memory system. Using a computer simulation model, Hutchins (1991) demonstrated that even when holding constant the cognitive characteristics of individual knowledge, such as specificity of knowledge or breadth of knowledge categories, groups as a whole may display different cognitive characteristics, depending on how communication is organized within the group over

time. Furthermore, given that transactive memory is not traceable to any one individual, but rather is a property of the group, it may be impervious to changes in the composition of the group, and retrieval might occur despite these changes (Sniezek & Henry, 1990).

The process of retrieving knowledge from transactive memory likely depends on the patterns of interconnectivity among members, often referred to as the group structure (Hutchins, 1991). For example, in a team with a cross-functional structure, if the member from organization development learns that the member from engineering has knowledge of the manufacturing safety records, she is likely to ask him to contribute this when a question arises pertaining to maintenance. If this interaction is repeated, an interdependence and a pattern results. Sometimes the patterns are consciously orchestrated, at other times they occur unprompted, as group members enact routines that have become "second nature" or in other words, more automatic (Gersick & Hackman, 1990). In either case, a group will be more or less able to utilize knowledge, recalling and retrieving it to a greater or lesser extent, depending upon the communication patterns in the group.

Examination: Negotiating, Interpreting, and Evaluating

As group members work together to examine information, they share subjective and alternative impressions of what has occurred or what may occur and the interpretation of these impressions are what will be used to arrive at evaluations of various courses of action (Zander & Medow, 1963). By highlighting certain items of information, drawing attention to faulty logic, and presenting arguments in support of particular conclusions, group members can affect one another's perceptions, judgments, and opinions (Stasser & Davis, 1981).

During this process, member roles and status are important because they serve a "weighting" function. For example, information and experiences contributed to group

interactions by individuals with higher status (e.g., a leader or facilitator) may be weighted more heavily than information contributed by other individuals, thus biasing cognitions in the direction determined by the member with the highest status (Bandura, 1997; Bartunek, 1984). Indeed, preliminary evidence suggests that discussion is often dominated by the high status member(s) (Walsh et al., 1988; Earley, 1999). Walsh et al. captured "potential collective beliefs" in groups (a linear combination of the members' individual schemata prior to interaction) and "negotiated collective beliefs" (computed by weighting the members' schemata according to the level of participation in the group discussion). Results indicated that the negotiated beliefs were better predictors of performance than the unweighted beliefs.

Accommodation: Integrating, Deciding, and Acting

Examination then enables a fourth important phase of collective cognition: accommodation. During this phase, group members' perceptions, judgments and opinions are integrated to a greater or lesser degree and then generate decisions and actions. Cognitive integration among a collective first requires mutual perspective-taking. This is similar to empathy in dyadic exchanges, but involves the exchange of a multiplicity of views. It requires making preconceptions, assumptions, and meaning systems visible and open to oneself and to others, apprehending each other's process of interpretation, and opening up one's own interpretive schemes to mutual scrutiny (Habermas, 1979; Mohrman, Gibson and Mohrman, 2000). Furthermore, in their comprehensive investigation of the use of knowledge by practitioner communities, Mohrman et al. (2000) found that knowledge was construed as more useful when mutual perspective taking had occurred.

Beyond this first step in accommodation, the use of information for decisions and actions may also depend on integration. This process of cognitive integration likely varies across groups

(Corner et al., 1994). Some groups can be characterized by emergent knowledge (resulting from automatic processing) and others may be characterized by integrated knowledge (resulting from controlled processing) (Ginsberg, 1990; Weick & Bougon, 1986). Once emergent knowledge has been constructed there is substantial inertial and process efficiency value in retaining it to interpret future issues (Weick, 1979). The knowledge becomes so entrenched over time that the construction portion of the process occurs more quickly as group members apply a repeatedly used structure to new data. Processing then becomes more automatic and less controlled.

When integration is moderate, group members are likely to attend to a variety of information, and this can facilitate innovative responses. For example, top management teams with many highly integrated cognitive structures used less variety of information for environmental analysis than did top management teams with less integration (Thomas and McDaniel, 1990) and case study observations suggest that optimal group situation awareness is achieved when enough overlap occurs to maintain group coordination while allowing enough division to maximize coverage of the environment (Wellens, 1993). In both studies, groups who used environmental analysis or who were less situationally award (due to higher integration) were less apt to diversity holdings or incorporate behavior beyond the status quo. This makes sense given that innovation requires diversity or differentiation, two forces which run contrary to integration in groups. I turn now to a discussion of other forces for change in the next section.

CATALYSTS FOR MOVEMENT FROM PHASE TO PHASE

Having described the general nature of the four process phases of collective cognition, it is next important to address the relationships among them. These phases may sometimes occur in a linear sequence, from accumulation to interaction, and from there to examination and to accommodation. However, I also argue that the relationship between the processes can be

reciprocal and movement may not be linear. In fact, somewhere in the midst of each process phase is a critical juncture. Many events, influences, and factors will determine which path a group takes at this juncture. These factors serve as catalysts, moving the group from one phase to another. In the next section, I outline a few of these catalysts, which can also serve as leverage points for interventions to move groups onward to a next phase of cognition (see Figure 1).

Insert Figure 1 About Here

Equilibrium Between Task Uncertainty and Routines

Following the accumulation of information and knowledge, a group is likely to either enter into an interaction phase or into the accommodation phase. As shown in Figure 1, based on research conducted to date, I argue that task uncertainty in groups encourages movement from accumulation to interaction; routines encourage movement from accumulation to accommodation. Task uncertainty has also been referred to as manageability (Mohr, 1971) or task predictability (Comstock & Scott, 1977), but the underlying logic is the same. It is the degree to which it is known that if "x" is performed then a given outcome will result (Gist & Mitchell, 1992).

In a group context, "x" might represent task strategies for effective performance. Task strategies are clear under conditions of low task uncertainty and the group can be confident that certain strategies lead to effectiveness. Under conditions of high task uncertainty, strategies are not known, and thus must be established through a lengthy process of interaction and examination in the group in which assumptions are checked, educated guesses are made and tested, and additional information is gathered and exchanged.

On the other hand, when tasks are predictable and certain, groups are able to develop decision scripts. Based on the recall of these scripts, groups have structured expectations about the appropriate processes to be used to accomplish work and about the likely subsequent events that will result from their actions (Gioia & Poole, 1984; Gioia & Manz, 1985). This is true because when carried out under the guidance of a recalled script, behavior is enacted with minimal cognitive strain, prior knowledge and feedback substitute for an explicit and detailed analysis of each part of a complex task, and the task is performed more efficiently (Lord & Foti, 1985). Indeed, the response to the new incoming information is itself a routine. Routines occur regularly and are often taken for granted by members of the work group, although they might appear odd to outsiders (Gersick, 1988; Waller, Zellmer-Bruhn, & Giambatistia, In Press; Zellmer-Bruhn & Gibson, 1998). Thus the presence of routines established in prior performance are an important antecedent to the sequence of collective cognition (Bandura, 1986; Hackman, 1990; Lindsley et al., 1995). When routines exist, less interaction and examination are necessary and the group can bypass a lengthy exploration of potential task characteristics. The following propositions captures the impact of task uncertainty and routines on collective cognition:

Proposition 1a: The higher the task uncertainty in groups, the more time spent on accumulation activities (perceiving, filtering, and storing) and interactional activities (retrieving, exchanging, and structuring knowledge) and the less time spent on accommodation activities (integrating, deciding, acting).

Proposition 1b: Establishing strong routines in groups increases the effectiveness of accommodation activities (integrating, deciding, acting).

Equilibrium Between Leadership and Role Ambiguity

Following interaction, a group is likely to either begin examination or go back through a second iteration of accumulation. Based on the research reviewed, I argue that the presence of leadership and facilitation will encourage movement from interaction to examination; role

ambiguity is likely to lead to pressure for more accumulation of knowledge (see Figure 1).

Leaders, or members engaging in leadership behavior if the leader role is shared, may perform

the function of structuring or organizing information, thus acting as catalysts that guide the

group from accumulation of group knowledge to active consideration of that knowledge. These

individuals are often engaged in assigning information gathering activities among group

members, interpreting information, resolving disagreements and/or directing individual group

members into action, thus facilitating examination of information.

Without leadership and facilitation, roles are often ambiguous. Role ambiguity is a

condition in which members lack a basic understanding of either the function they play in the

group, the activities they are responsible for, or potentially how the group fits into the larger

organizational context (Rizzo, House, & Lirtzman, 1970). Member roles serve an essential

guiding function that enables members to make more efficient use of each other's personal store

of problem-relevant information. Preliminary evidence suggests that when members know

which other members of the group have expertise in which specific knowledge domains, the

amount of unshared information they actually discuss increases significantly (Stasser, 1991).

Clearly defined roles enable this sharing. Furthermore, in the video-taped interactions of the

teams in her series of studies, Gibson (1995; 1999; 2000) found preliminary evidence that in the

simulated top management teams with assigned leaders, these individuals helped to overcome

the initial role ambiguity that plagued the newly formed teams. Those teams without an assigned

leader did not have such role clarity, and as a consequence, had less well formed collective

cognitions such as group-efficacy beliefs. The following propositions summarize this idea:

> *Proposition 2a: The greater the role ambiguity in groups, the more time spent on interaction activities (retrieving, exchanging and structuring knowledge) and accumulation activities (perceiving, filtering and storing knowledge) the less time spent on examination activities (negotiating, interpreting, and evaluating).*

Proposition 2b: The presence of a clearly defined leader in a group increases the effectiveness of examination activities (negotiating, interpreting, and evaluating).

Equilibrium Between Conflict and Consensus

As shown in Figure 1, following examination, a group either engages in more interaction or moves forward toward accommodation of the knowledge. Based on research conducted to date, I argue that when conflict and debate occur, the group is likely to need additional interaction; consensus building encourages accommodation of knowledge. Neither path is necessarily good nor bad. In fact, iterative movement between the phases of interaction and examination is probably healthy.

Groups that have consensus have reached common expectations of the task and group, allowing them to predict the behavior and resource needs of group members more accurately, thus facilitating performance (Cannon-Bowers & Salas, 1990). Walsh et al. (1988) refer to this component as "realized consensus," Corner et al., (1994) refer to it as "consensus frame" and Klimoski and Mohammed (1994) refer to it as "sharedness." However, when all group members agree on nearly all pieces of knowledge and information, the group may gradually suffer from biases associated with groupthink (Janis, 1982).

There is some preliminary empirical support for this effect. Walsh et al. (1988) investigated the schema employed by strategic decision-making groups participating in a simulated business environment and found that groups marked by low consensus actually performed better than decision-making groups marked by high consensus. Likewise, based on their case study observations, Cannon-Bowers, Salas and Converse (1993) argue that knowledge of group members may overlap to the point where shared cognitions become a liability, and the potential for individual contribution is lost. Finally, based on her case study of a fire brigade,

Langfield-Smith (1992) argues that it is not necessary for members of a group to have complete consensus. She suggests that the repeated cycles of interaction in response to changing circumstances leads to the best performance.

In the business world, this plays out in numerous contexts, but it is perhaps most evident in the new product development arena. Anecdotal accounts of groups in organizations that rely on quick time to market for competitive advantage abound in the literature (e.g., Brown & Eisenhardt, 1998; Mohrman, Cohen, & Mohrman, 1995). A common theme is that successful groups in this domain have worked through the delicate balance of deliberation versus decision. Taken together, this preliminary evidence indicates that agreement and integration are important factors in collective cognition; however, conflict and debate may also serve a necessary role in prompting the group to act outside routines and controlled processing of information. The following propositions capture these ideas:

> *Proposition 3a: The greater the amount of conflict in groups, the more time spent on examination activities (negotiating, interpreting, and evaluating knowledge) and interaction activities (retrieving, exchanging, structuring knowledge) and the less time spent on accommodation activities (integrating, deciding, and acting).*

> *Proposition 3b: Establishing consensus in groups increases the effectiveness of accommodation activities (integrating, deciding, acting).*

Equilibrium Between Feedback and Social Comparison

Following accommodation, a group is likely to either move toward accumulation of new knowledge or to conduct a re-examination of previous knowledge. As shown in Figure 1, based on research conducted to date, I argue that positive feedback about group outcomes is likely to encourage accumulation of additional knowledge and repetition of the cognitive cycle for the next iteration of behavior; negative social comparison is likely to encourage internal re-examination.

When a group acts and feedback is available about performance, this information is likely to generate a feedback loop. Feedback is first perceived, then filtered and stored. Once again, group members share subjective impressions of what has occurred or what may occur and these impressions are utilized to form future cognitions. This is a critical issue because these collective interpretations are eventually stored in the group's memory and can form the basis for future performance throughout the life of the group. When the information is positive, this may encourage accumulation of more knowledge, and repetition of the cycle. When the feedback is negative, it will likely encourage re-examination. Preliminary evidence offers support for the relationship between feedback and accumulation of knowledge. In a laboratory study of 81 four-person groups that performed a series of brainstorming tasks, Prussia and Kinicki (1996) found that performance feedback was related to both group affect and performance expectations.

On the other hand, accommodation (i.e., integration, decisions and actions) might react with another catalyst--social comparison--in which behavior is compared to some other group. That comparison may then form the basis for a re-examination of the groups' knowledge stores (Bandura, 1997, 1995; Lindsley et al., 1995). In other words, groups may look outward to "referent others" following the accommodation process. These referent others serve as models or standards that guide re-examination. If there are large discrepancies between the group and other groups, this is likely to encourages re-examination of the group's actions. However, few discrepancies are likely to encourage a new cycle of collective cognition. The following propositions capture this effect:

> *Proposition 4a: The greater the discrepancies between the group and other groups in the social comparisons process, the more time spent on examination activities (negotiating, interpreting, and evaluating knowledge) and accommodation activities (integrating, deciding and acting), and the less time spent on accumulation activities (perceiving, filtering, storing new knowledge).*

Proposition 4b: Receiving objective feedback about group outcomes increases the effectiveness of accumulation activities (perceiving, filtering, storing).

Having delineated the key factors which impact the process of collective cognition and proposed several important relationships regarding their role, I now turn to a summary of the framework and recommendations for future research designed to investigate the propositions.

SUMMARY AND CONCLUSION

Thus, in summary, this framework has highlighted the role of several key elements or compounds which become critical for future research. To better understand accumulation of knowledge, the operation of labels, jargon, and categories of knowledge in groups must be specified. To delineate processes of interaction, transactive memory, group structure, and communication patterns become the focus. To explain collective examination, the operation of negotiated interpretations, status, and roles must be delineated. A better understanding of knowledge accommodation in groups is arrived at by focusing on mutual perspective taking, cognitive integration, and innovations.

To examine the dynamics of collective cognition, the framework highlights several catalysts for movement among the phases. These catalysts are dual forces that must be balanced in a group, including task uncertainty versus routines, leadership versus role ambiguity, consensus versus conflict, and feedback versus social comparison. As depicted in Figure 1, routines, leadership, consensus, and feedback move the group forward through the cycle of accumulation, interaction examination and accommodation. In contrast, task uncertainty, role ambiguity, conflict, and social comparison slow the progression toward accommodation and encourage additional accumulation, interaction or examination. These catalysts may serve as levers that can be managed in order to move groups forward through the cognitive cycle.

A longitudinal research design that follows a set of groups through the cognitive process as various catalysts are introduced would usefully test the power of these forces for movement through the cycle of collective cognition, as they progress toward effective decisions and actions. To adequately capture the subtle nature of many of the cognitive sub-processes proposed here, a multi-method approach is advised, including observations, interviews, individual member journals, survey indicators of perceptions, and objective indicators of performance (e.g., records of decisions made, goal achievement, productivity, and relative performance indicators to compare effectiveness across groups). Examples of promising approaches include the work of Earley (e.g., Earley, 1999; Earley & Mosakowski, 2000), Weick (e.g., Weick, 1990; Weick & Robert, 1993) and Manz (e.g., Manz & Sims, 1982; 1987; Anand, Manz, & Glick, 1998).

In conclusion, the framework for collective cognition developed here holds great promise. Although we seem to know a great deal about individual level motivational processes, the more timely issue of how to initiate, direct, and maintain group behavior toward organizational objectives remains somewhat of a mystery. If we can understand groups' cognitive processes, then we can better manage these processes. In doing so, we will have taken one more step toward helping them to formulate what is required to perform effectively. Perhaps even more importantly, for managers attempting to maximize knowledge sharing and transfer, collective cognition may help to unlock some of the secrets to better collaborative thought. Given the current trend toward incorporation of teams into knowledge management operations, this understanding may go a long way toward increasing the effectiveness of twenty-first century organizations.

REFERENCES

Aldag, R.J. & Fuller, S.R. 1993. Beyond fiasco: A reappraisal of the groupthink phenomenon and a new model of group decision processes. *Psychological Bulletin*, 113(3): 533-552.

Anand, V., Manz, C.C., & Glick, W.H. 1998. An organizational memory approach to information management. *Academy of Management Review*, 23(4): 796-809.

Argyris, C. 1976. Single-loop and double-loop models in research on decision making. *Administrative Science Quarterly,* 21(3): 363-376.

Argyris, C., & Schon, D. 1978. *Organizational learning*. London: Addison-Wesley.

Bandura, A. 1986. *The social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. 1997. *Self efficacy*. NJ: Prentice Hall.

Bartunek, J.M. 1984. Changing interpretive schemes and organizational restructuring: The example of a religious order. *Administrative Science Quarterly*, 29: 355-373.

Brown, S. L., & Eisenhardt, K. M. 1998. *Competing on the edge: Strategy as structured chaos*. Boston, MA: Harvard Business School Press.

Cannon-Bowers, J.A. & Salas, E. 1990. Cognitive psychology and team training: Shared mental models in complex systems. Paper presented at the annual meeting of the Society for Industrial and Organizational Psychology, Miami, Florida.

Cannon-Bowers, J.A., Salas, E., & Converse, S.A. 1993. Shared mental models in expert team decision-making In N.J. Castellan (Ed.), *Individual and group decision making*: 221-246. Hillsdale, NJ: Lawrence Erlbaum Associates.

Comstock, D.E., & Scott, W.R. 1977. Technology and the structure of subunits: Distinguishing individual and workgroup effects. *Administrative Science Quarterly*, 22: 177-202.

Corner, P.D., Kinicki, A.J., & Keats, B.W. 1994. Integrating organizational and individual information processing perspectives on choice. *Organization Science*, 5(3): 294-308.

Durkheim, E. 1893/1933. *The division of labor in society* (G. Simpson, Translation). New York: MacMillan.

Earley, P. C. 1999. Playing follow the leader: Status-determining traits in relation to collective efficacy across cultures. *Organizational Behavior and Human Decision Processes*, 80: 1-21.

Earley, P. C. & Mosakowski, E. M. 2000. Creating hybrid team cultures: An empirical test of transnational team functioning. *Academy of Management Journal.* 1: 26-49.

Gersick, C.G. 1988. Time and transition in work teams: Toward a new model of group development. *Academy of Management Journal*, 31: 9-41.

Gersick, C. J. G. and Hackman, J. R. 1990. Habitual routines in task-performing groups. *Organizational Behavior and Human Decision Processes*, 47: 65-97.

Gibson, C.B. 1995. Determinants and consequences of group-efficacy beliefs in the work organizations in the U.S., Hong Kong, and Indonesia. Unpublished doctoral dissertation, University of California, Irvine.

Gibson, C.B. 1999. Do they do what they believe they can? Group-efficacy beliefs and group performance across tasks and cultures. *Academy of Management Journal*, 41: 1-15.

Gibson, C.B. 2000. The efficacy advantage: Factors influencing the formation of group-efficacy across cultures. Working Paper, University of southern California.

Gibson, C.B., Randel, A. & Earley, P.C. 2000. Understanding Group-efficacy: An empirical test of multiple assessment methods. *Group and Organization Management*, 25(1): 67-97.

Ginsberg, A. 1990. Connecting diversification to performance: A sociocognitive perspective. *Academy of Management Review,* 15(3).

Gioia, D.A. & Manz, C.C. 1985. Linking cognition and behavior: A script processing interpretation of vicarious learning. *Academy of Management Review*, 10(3): 527-539.

Gioia, D.A. & Poole, P.P. 1984. Scripts in organizational behavior. *Academy of Management Review*, 9(3): 449-459

Gist, M.E., & Mitchell, T.R. 1992. Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review*, 17(2), 183-211.

Goodman, P.S., Ravlin, E.C., & Schminke, M. 1990. Understanding groups in organizations. In L.L. Cummings and B.M. Staw (Eds.) *Leadership, participation, and group behavior*: 323-385. Greenwich, CT: JAI Press.

Habermas, J. 1979. *Communication and the evolution of society.* Boston: Beacon Press.

Hackman, J.R. 1990. *Groups that work (and those that don't)*. San Francisco: Jossey Bass.

Hinsz, V.B., Tindale, R.S., & Vollrath, D.A. 1997. The emerging conceptualization of groups as information processors. *Psychological Bulletin*, 121: 43-64.

Hjelle, L.A., & Ziegler, D.J. 1981. *Personality theories: Basic assumptions, research, and applications*. New York: McGraw-Hill.

Hutchins, E. 1991. The social organization of distributed cognition. In L.B. Resnick, J.M. Levine, and S.D. Teasley (Eds.). *Perspectives on socially shared cognition:* 283-307. Washington, D.C.: American Psychological Association.

Janis, I. 1982. *Groupthink* (2nd ed.). Boston: Houghton-Mifflin.

Jewell, L. and Reitz, J. 1988. Group decision making. In Katz, R. (Ed), et al. *Managing professionals in innovative organizations: A collection of readings.* Cambridge, MA; Ballinger Publishing Co/Harper & Row Publishers, pp. 247-261.

Klimoski, R., & Mohammed, S. 1994. Team mental model: Construct or metaphor? *Journal of Management*, 20: 403-437.

Kolb, D.A. 1984. *Experiential learning.* Prentice-Hall: Englewood Cliffs, N.J.

Langfield-Smith, K. 1992. Exploring the need for a shared cognitive map. *Journal of Management Studies*, 29(3): 349-368.

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

Lindsley, D.H., Brass, D.J., & Thomas, J.B. 1995. Efficacy-performance spirals: A multilevel perspective. *Academy of Management Review*, 20(3): 645 - 678.

Lord, R.G. & Foti, R.J . 1985. Schema theories, information processing, and organizational behavior. In H.P. Sims & D.A. Gioia (Eds.), *The thinking organization*: 21-48. San Francisco: Jossey Bass.

Manz, C.C. & Sims, H.P . 1982. The potential for "groupthink" in autonomous work groups. *Human Relations*, 35(9): 773-784.

Manz, C. C. and Sims, H.P. 1987. Leading workers to lead themselves: The external leadership of self-managing work teams. *Administrative Science Quarterly*, 32: 106-128.

McDougall, W. 1938. *The group mind* (2nd ed.). Cambridge: Cambridge University Press.

McGrath, J.E . 1984. *Groups: Interaction and performance*. Englewood Cliffs, N.J.: Prentice-Hall.

Mezias, S.J. & Glyn, M.A . 1993. The three faces of corporate renewal: Institution, revolution, and evolution. *Strategic Management Journal*, 14: 77-101.

Mohr, L. 1971. Organizational technology and organization structure. *Administrative Science Quarterly*, 16: 444-459.

Mohrman, S.A., Cohen, S.G., and Mohrman, A.M. 1995. *Designing team-based organizations: New forms for knowledge work*. San Francisco: Jossey-Bass.

Mohrman, S.A., Gibson, C.B., & Mohrman, A.M. 2000. Doing research that is useful to practice: An exploration of the impact of interpretive spaces, mutual perspective-taking, and sense-making. Forthcoming, *Academy of Management Journal.*

Mone, M.A. & Baker, D.D. 1992. A social-cognitive, attribution model of personal goals: An empirical evaluation. Paper presented at the National Academy of Management Meeting, Las Vegas, NV.

Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*. 5: 1: 14-37.

Nonaka, I, & Takeuchi, H. 1995. *The knowledge creating company*. New York: Oxford University Press.

Parker, L.E . 1994. Working together: Perceived self- and collective-efficacy at the workplace. *Journal of Applied Social Psychology*, 24(1): 43-59.

Prussia, G.E. & Kinicki, A.J . 1996. A motivational investigation of group effectiveness using social-cognitive theory. *Journal of Applied Psychology*, 81(2): 187-198.

Rizzo, J.R., House, R.J., & Lirtzman, S.I. (1970). Role conflict and ambiguity in complex organizations. *Administrative Science Quarterly*, 15: 435-454.

Roberts, J . 1964. The self-management of cultures. In W. Goodenough (Ed.), *Explorations in cultural anthropology: Essays in honor of George Peter Murdock*: 433-454. New York: McGraw-Hill.

Sandelands, L.E. & Stablein, R.E . 1987. The concept of organization mind. In S. Bacharach and N. DiTomaso (Eds.), *Research in the Sociology of Organizations*, 5: 135-161.

Schendel, D. 1996. Knowledge and the firm. *Strategic Management Journal*. Winter: 17: 1-4.

Shaw, M.E . 1976. *Group dynamics: The psychology of small group behavio*r (2nd ed.). New York: McGraw-Hill.

Sniezek, J.A., & Henry, R.A . 1990. Revision, weighting, and commitment in consensus group judgment. *Organizational Behavior and Human Decision Processes*, 45: 66-84.

Spender, J.C. & Grant, R. 1996. Knowledge and the firm: An overview. *Strategic Management Journal*. Winter: 17: 5-9.

Stasser, G . 1991. Facilitating the use of unshared information in decision making groups. Paper presented at the 63rd meeting of the Midwest Psychological Association, Chicago, IL.

Stasser, G., & Davis, J.J . 1981. Group decision making and social influence: A social interaction model. *Psychological Review*, 88: 523-551.

Thomas, J., & McDaniel, R . 1990. Interpreting strategic issues: Effects of strategy and the information –processing structure of top management teams. *Academy of Management Journal*, 33: 286.

Tuckman, B. W. & Jensen, M. C. 1977. Stages of small group development revisited. *Group and Organizational Studies*, 2: 419-429.

von Cranach, M., Ochsenbein, G., & Valach, L . 1986. The group as a self-active system: Outline of a theory of group action. *European Journal of Social Psychology*, 16: 193-229.

Waller, M.J., Zellmer-Bruhn, M., & Giambatista, R.C. In press. The effects of individual time urgency on group polychronicity. *Journal of Managerial Psychology*.

Walsh, J.P., Henderson, C.M., & Deighton, J . 1988. Negotiated belief structures and decision performance: An empirical investigation. *Organizational Behavior and Human Decision Processes*, 42: 194-216.

Walsh, J.P. & Ungson, G.R . 1991. Organizational memory. *Academy of Management Review*, 16: 57-91.

Wegner, D.M . 1987. Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G.R. Goethals (Eds.) *Theories of group behavior*: 185-208. New York: Springer-Verlag.

Weick, K. 1979. *The social psychology of organizing*. Reading, MA: Addison-Wesley Publishing.

Weick, K.E. 1990. Cognitive processes in organizations. In L.L. Cummings & B.M. Staw (Eds.), *Information and cognition in organizations.* 185-210. Greenwich, CT: JAI Press.

Weick, K.E. & Roberts, K . 1993. Collective minds in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly*, 38: 357-381.

Weick, K.E., & Bougon, M . 1986. Organizations as cognitive maps in H.P. Sims and D. Gioia (Eds.) *Thinking Organizations*: 102-135.

Wellens, A.R. 1993. Group situation awareness and distributed decision making: From military to civilian applications. In N.J. Castellan (Ed.) *Individual and group decision making*: 267-291. Hillsdale, NJ: Lawrence Erlbaum Associates.

Wyer, R.S. & T.K. Srull, T.K. 1984. *Handbook of social cognition*. Hillsdale, NJ: Erlbaum.

Zander, A.W. & Medow, H . 1963. Individual and group aspiration. *Human Relations*, 16: 89-105.

Zellmer-Bruhn, M., & Gibson, C.B . 1998. Inter-team transfer of knowledge: An exploratory study of the facilitators and impediments to sharing practices between teams. Paper presented at the Academy of Management Meeting, San Diego, CA.

TABLE 1
Phases, Sub-Processes, and Elements That Comprise Collective Cognition

PHASE	PROCESSES	ELEMENTS	SUPPORTING LITERATURE	KEY IDEAS OR FINDINGS
Accumulation	• Perceiving • Filtering • Storing	♦ Labels ♦ Jargon ♦ Categories	➢ Wyer & Srull (1984) ➢ Wegner (1987) ➢ Thomas & McDaniel (1990) ➢ Klimoski & Mohammed (1994)	➢ Filtering processes occur in individual information processing ➢ Groups collectively derive labels for knowledge ➢ Labels impact what is subsequently perceived by groups ➢ Labels evolve into jargon and categories
Interaction	• Retrieving • Exchanging • Structuring	♦ Transactive Memory ♦ Group Structure ♦ Communication Patterns	➢ Wegner (1987) ➢ Hutchins (1991) ➢ Sniezek & Henry (1990) ➢ Gersick & Hackman (1990)	➢ Transactive memory is the set of communication connections between individual memories ➢ Groups memories are more than the sum of their parts (i.e., sum of individual memories) ➢ Group memory can withstand changes in group composition ➢ Groups enact routines for some processes; others are consciously orchestrated based on structure
Examination	• Negotiating • Interpreting • Evaluating	♦ Negotiated Interpretations ♦ Status ♦ Roles	➢ Zander & Medow (1963) ➢ Stasser & Davis (1981) ➢ Bandura (1997); Bartunek (1984) ➢ Walsh, Henderson & Deighton (1988); Earley (1999)	➢ Collectively negotiated impressions guide evaluations and subsequent action ➢ Group members affect one another's perceptions, judgments, and opinions ➢ Group discussion is often dominated by high status members ➢ Information contributed to groups by high status members is more heavily weighted
Accommodation	• Integrating • Deciding • Acting	♦ Mutual Perspective Taking ♦ Cognitive Integration ♦ Innovations	➢ Habermas (1979) ➢ Mohrman, Gibson & Mohrman (2000) ➢ Corner, Knicki, & Keats (1994) ➢ Ginsberg (1990); Weick & Bougon (1986) ➢ Weick (1979) ➢ Thomas & McDaniel (1990) ➢ Wellens (1993)	➢ Mutual perspective-taking involves sharing meaning systems and interpretive schemes ➢ Knowledge is often construed as more useful when mutual perspective taking occurs ➢ Cognitive integration varies across groups ➢ Some groups have more emergent knowledge others have more integrated knowledge ➢ There is inertial pressure to retain knowledge once constructed ➢ Teams with high integration used less variety of information ➢ Optimal group situation awareness occurs when with moderate integration

FIGURE 1

Catalysts for Movement from Phase to Phase