Cross Understanding in Decision Groups: Analysis and Support

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Abstract

A fundamental concept that underlies the phenomena dealt with by decision scientists and Group Decision Support System designers is that of "mental model" — the decision maker's beliefs about how the world is, how it works, and how it should be. This paper examines this concept, and also that of "cross understanding" — the understanding that individual group members have about the mental models of other individual group members. Our analysis indicates that cross understanding has important consequences for the quality of group decisions. The paper concludes with suggestions for improving decision group performance by using information technology to exploit cross understanding.

Keywords

Group decision making, mental model, cross understanding, Group Decision Support Systems.

1. INTRODUCTION

By a person's "mental model," we mean that person's mind-resident set of beliefs about how the world is, how it works, and how it should be. Nearly always, and certainly after they have interacted, members of decision-making groups have some understanding of the mental models of the other group members. For convenience, let us refer to such understanding as "cross understanding," as in "understanding across group members of the mental models of the other group members." Such understanding means "insight into," rather than "agreement with," the mental models of others. As we expect to make clear, high levels of cross understanding are, except in unusual instances, beneficial to groups engaged in decision making (or closely related tasks such as product design or recommendation making), groups that we hereafter refer to as "decision groups."

Take, for example, decision groups that are purposefully designed to leverage the diversity of members' knowledge and perspectives. Cross understanding can help such groups both overcome some of the process disadvantages of this diversity and capitalize on the advantages that knowledge variation offers. Information exchange during members' attempts to arrive at a collective interpretation of a decision situation would be more efficient when members have an understanding of each other's mental models, as members could word their communications in ways that would make them more understandable and acceptable to their listeners. As a result, interpretation processes would be faster and more effective, and the consequent decision process would be more fully informed. Cross understanding of the assumptions and values incorporated in other members' mental models would also result in more appropriate decision implementation assignments, which would help decision implementations to progress more smoothly and expeditiously.

The purpose of this paper is to analyze and predict how cross understanding influences decision processes and outcomes. We begin with a description of mental models, followed by an analysis of cross understanding and its effects. We conclude with recommendations for how organizations can facilitate cross understanding and exploit its advantages.

1.1 Mental Models

When they are made explicit, mental models can help decision makers overcome their cognitive limitations. For example, in the fields of operational research and decision analysis, much is gained by making explicit the mental models that an organization's decision makers wish to use when attempting to make rational decisions on behalf of their organization. In particular, much is gained by developing objective functions and decision trees for use in communication and analysis by decision makers or their staffs. Further, of course, a central element in what is generally meant by "Decision Support System" is a collection of software that helps the

decision maker articulate and bring to bear on the decision situation the subset of knowledge, beliefs, and values that he or she sees as relevant to the decision situation.

An individual's mental model is partly a composite of other decision-relevant belief systems. Examples of other belief systems, at one extreme, are the very general models that capture the belief system of a society or a culture (such as Western Civilization). Other somewhat more specific but still general belief systems are "political ideologies" (Tetlock, 2000), "industry mindsets" (Phillips, 1994), "dominant logics" (Prahalad and Bettis, 1986), and "organizational cultures" (Martin, 2002). Systems of such generality, which we will refer to as "social-belief models," tend not to be associated with individuals and the differences in individuals' belief structures, but rather are associated with large groups of individuals and the beliefs they hold in common.

In contrast, the mental models used by decision makers in organizations are, at least in the limit, idiosyncratic to the individual. They are idiosyncratic because they are developed as a unique aggregate of (1) the particular mix of social-belief models to which the individual has been exposed and has uniquely interpreted over his or her lifetime, (2) the particular beliefs that the individual has adopted as a result of exposure to the beliefs of others, especially associates and high-status persons in various workplaces, and (3) the particular beliefs that the individual has adopted as a result of his or her personal experiences – especially experiences in workplaces. The resulting synthesis of beliefs is incorporated in the individual's global mental model and in the subsets of this model that the individual uses to make judgments in his or her life and organizational workplace.

Decision makers bring parts of their mental model to the decision situations they face. In particular they bring to decision situations (1) their beliefs or suppositions about cause-effect linkages (and other associations among the variables characterizing the decision situation) and (2) their beliefs about the value or utility (on either individual or multiple dimensions) of the various current conditions or imaginable outcomes associated with the decision situation. In decision groups, cross understanding of members' mental models can influence how these beliefs come to bear on the group's decisions.

1.2 Objectives and Motivations

Studies where mental models were clearly the independent or dependent variable of interest, or where they can be inferred as having played an important albeit not explicated role, are plentiful. In this paper, we draw particularly (but not exclusively) on our knowledge of the literature on (1) interpersonal learning and transactive memory, (2) group diversity and conflict, (3) bargaining and negotiation, and (4) organizational politics, and apply what is applicable in these literatures – along with what we intend to be sound reasoning – to create a set of assertions about cross understanding and its effects.

We examine the possible effects of cross understanding by focusing primarily on two likely consequences: (1) the ease and speed with which the decision group develops and executes its decision processes, and (2) the quality of the group's decisions. Further, we are sympathetic to Hackman's (1990: 6-7) emphasis concerning the importance of two additional group process outcomes: (1) "the degree to which the process . . . enhances the capability of members to work together interdependently in the future" and (2) "the degree to which the group experience contributes to the growth . . . of the members." It is worth calling attention to the fact that the development of cross understanding is clearly congruent with and instrumental to both of these latter group process outcomes. Each of these four outcomes is of interest to decision managers in organizations. Each can be supported, to varying degrees, with information technology.

The motivations for this paper are four. One is to call the attention of decision managers, decision scientists, and Group Decision Support System designers to the concept of cross understanding of mental models in decision groups. A second motivation is to identify some likely benefits of cross understanding, and some approaches that managers, consultants, and decision group members can use to ensure and support cross understanding in decision groups. The third motivation for the paper is to codify as formal assertions empirically well substantiated relationships where the independent variable is cross understanding or agreement and the dependent variable is one of the four consequences noted in the above paragraph, and so serve the communities of decision scientists and consultants who have a need to know what is known. The fourth and final motivation is to propose for investigation and for use as working hypotheses other relationships (among these same variables) that are neither well substantiated nor contradicted by evidence, but rather that are of a more speculative but still plausible nature, and thereby prompt decision science researchers to test these relationships and consequently expand our knowledge about the effects of mental models, particularly the effects of cross understanding. (To ease the load on ear and eye, below we use the term "assertions" in place of the phrase "empirically well substantiated assertions and plausible proposed working hypotheses.")

The paper has as its focus decisions made by groups on behalf of an organization. Thus its assertions are limited to contexts of groups whose members are attentive to the organization's goal set (although the members may differ about the relative importance of the goals or about the most appropriate means for attaining the

goals, and may individually possess goals other than those in the organization's goal set). Further, the assertions are limited to contexts where members' intrinsic or extrinsic rewards are tied to the quality and speed of the group's decision and where the group decision cannot be obtained except through some degree of within-group cooperation. To minimize the complexity of the analysis, let us assume that the group members have roughly equal amounts of knowledge relevant to the decision situation, but that the nature of this knowledge may vary.

Let us turn to an analysis of how cross understanding of mental models affects decision processes and decision outcomes. Afterwards we will examine managerial actions and decision support system features that can be used to support decision groups by increasing cross understanding and hence influencing the effectiveness of decision processes and the quality and speed of the decisions themselves.

2. CROSS UNDERSTANDING: ANALYSES

We portray the results of our analysis as linked clusters of related assertions, each assertion linking a construct (cross understanding or agreement) to one of four outcome constructs (development and execution of group processes, decision quality, future group viability, and group member growth and learning, including increases in cross understanding).

We begin our analysis in a region where certainty is highest and then progress toward the less certain, more speculative region described above. We begin in this more certain region because it is familiar to us and to the reader; it is a base-level condition about which much is known. As used in science, our assertions regarding the effects of cross understanding and agreement in this well-explored region could properly be regarded as "propositions." This will not be the case as we progress toward less certain regions. Because we move from more certain predictions to those that are more speculative, the order in which the assertions are presented is not uniform across different clusters.

The first model we analyze is a base-level model characterized by both cross understanding of members' mental models and high member agreement about cause-effect relationships and the value of foreseeable decision outcomes. Following the analysis of this base-level model, we analyze two departures from the model: 1) no or little agreement about cause-effect relationships or the value of foreseeable decision outcomes, and 2) no or little cross understanding of members' mental models.

3. BASE-LEVEL MODEL: CROSS UNDERSTANDING AND MENTAL MODEL AGREEMENT

Consider the case where cross understanding in the group is perfect and where there is no disagreement among members concerning either the relative importance of the goals in the goal set or the most appropriate means for attaining the goals, i.e., members have common beliefs about both the value of recognized decision outcomes and the nature of cause-effect relationships. Although never totally realized, this condition is approximated in mature groups where deviant thinkers have chosen to leave or been forced out, where members have had many common experiences and have developed common interpretations of those experiences, and where the group has often undertaken the same frequently encountered decision-related tasks and developed agreed-upon efficient and efficacious routines for accomplishing these tasks. An example of such a group would be a top management group whose members were all among the founders of a long-established successful company.

3.1 Development of processes for addressing the decision situation

As a result of having common beliefs about cause-effect relationships and the identity and value of recognized outcomes, it seems reasonable to conclude that agreement about the *identity* of the information and the nature of the decision rules needed to make the decision would be readily achieved. Thus:

> *Assertion 3.1: Agreement on the process used to address a particular decision situation tends to be reached more quickly in base-level-model groups than in other groups.*

3.2 Execution of process for addressing the decision situation

Because they have common interpretations of the *meaning* of the information acquired, base-level-model groups will come to agreement about its implications more quickly than will other groups. It follows that:

> *Assertion 3.2: Execution of the process used to address a particular decision situation tends to be culminated more quickly in base-level-model groups than in other groups.*

The exception to Assertion 3.2 occurs when the decision group is forced to recognize that it is incapable of finding a satisfactory resolution to the decision situation. We know of no authoritative commentary on decision group actions in this circumstance. Here it seems true rather than trite to claim that "more research is needed."

3.3 Decision quality and related outcomes

In their attempt to carry out due diligence, members of decision groups search for and evaluate information and options that they recognize as relevant to the decision situation. However, because in base-level-model groups the scope of search and evaluation-directing knowledge is essentially no greater than that of the one member whose mental model is greatest in scope, such search and evaluation tends to be more limited than in non-base-level-model groups. Further, when the decision situation is unlike those encountered in the past, its non-routine features are less likely to be recognized and, even if recognized, are less likely to be appropriately accounted for than they would be in base-level-model groups. As a result:

> *Assertion 3.3a: In base-level-model groups, the decision chosen is generally of lower quality than that which would be chosen by other groups.*

Other outcomes that seem to follow from the above are:

> *Assertion 3.3b: When a base-level-model group makes a decision, the quality of the decision chosen is only marginally greater than that which would be chosen by any one member.*

> *Assertion 3.3c: When a base-level-model group makes a decision, the decision chosen is similar to those chosen in the past.*

> *Assertion 3.3d: Base-level-model decision groups are more likely than are other groups to delegate decision-making authority to individual members.*

3.4 Process-related outcomes

As a result of having common mental models and encountering ready agreement about the appropriate decision process, it seems reasonable to conclude that:

> *Assertion 3.4a: Members of base-level-model groups are apt to experience negligible growth in factual knowledge, process skills, and cross understanding.*

As a result of having their mental models affirmed by the other group members:

> *Assertion 3.4b: Base-level-model group members are more likely than are members of other groups to be well satisfied with the decision process and outcome and therefore to be attracted to working together interdependently in the future.*

4. DEPARTURES FROM BASE-LEVEL CONDITIONS: MENTAL MODEL DISAGREEMENT

Conditions that create departures from the base-level model include those where members' cross-understanding of others' mental models is low, and those where the mental models of decision group members are not in perfect agreement, but are instead rather heterogeneous. We discuss the conditions characterized by heterogeneous mental models first, and the conditions characterized by low cross understanding second.

The beliefs of decision group members can vary from the base-level conditions for mental model agreement in at least two ways. One way is with respect to the specific variables they contain or the believed cause-effect relationships among these variables. The other is where the members' mental models vary in the values or utilities that are associated with the various current or imaginable conditions or outcomes associated with the decision situation. An example of a decision situation where members' mental models would likely vary with regard both to beliefs about cause-effect relationships and to beliefs about values of decision outcomes would be one where a multidisciplinary and multi-constituency group was created and directed to plan the revitalization of an urban waterfront. For the sake of analysis, and perhaps for the future design of decision groups and support systems for such groups, we discuss separately the situations where disagreement concerns beliefs about cause-effect relationships and where it concerns beliefs about the values of different decision outcomes.

4.1 High cross understanding, agreement about values, and disagreement about cause-effect relationships

An example of such a decision situation would be a weekly meeting convened by specialists from different disciplines to determine treatment modalities that would be most effective for each patient case and diagnosis.

Another example would be where a variety of technology experts were brought together to define the features of an IT infrastructure that would meet a client's strategic goals. As these examples illustrate, agreement about values and disagreement about cause-effect relationships are most likely in decision situations where the decision relies on expertise-based judgments.

4.1.1 Development of processes for addressing the decision situation

The group's decision processes are shaped by all or several members, some of whom may try to influence the decision situation, process, or outcome. Perhaps because of their need to feel superior, or at least to be recognized for the knowledge they possess, or perhaps because of their need to help set the world right, when encountering others who hold to beliefs about facts different from their own, people are disposed to teach these others the correct beliefs. More generously, perhaps they are disposed to correct what they see as the mistaken beliefs of others because they are concerned these mistaken beliefs could lead to non-optimal decisions. In any case:

> *Assertion 4.1a: When disagreement about cause-effect relationships is recognized, group members attempt to persuade others to their beliefs by searching for and bringing to bear supporting evidence or reasoning.*

4.1.2 Decision quality and other process-related outcomes

The results of a great many studies can be interpreted as indicating that veridical cause-effect relationships and correct information are surfaced through the searches and exchanges noted in Assertion 4.1a. As a consequence, and considering the behaviors noted in Assertion 4.1a, it seems reasonable to believe that:

> *Assertion 4.1b: When group members persuade others to their beliefs about cause-effect relationships by searching for and bringing to bear supporting evidence or reasoning, (1) decision quality tends to be greater and cross understanding increases, (2) future decision processes proceed more smoothly in similar decision situations, and (3) the satisfaction of individual learners varies and depends on their ego involvement with their prior beliefs and the social skills of their teachers.*

More speculative is the following:

> *Assertion 4.1c: When disagreement about cause-effect relationships is blocking the decision process, recognition of the disagreement generally has a net beneficial effect on progress, but if the disagreement was not blocking the process, then the time spent on the search and teaching effort extends the duration of the process.*

It seems worth noting that, in Machiavellian situations, when disagreement about cause-effect relationships is recognized, some or all of the evidence or reasoning used to change the beliefs of others may be known by its user to be invalid.

> *Assertion 4.1d: In Machiavellian situations, when disagreement about cause-effect relationships is recognized, decision quality tends to be less.*

4.2 High cross understanding, agreement about cause-effect relationships, and disagreement about the value of various decision outcomes

In general, because a member's value perceptions are associated with ideologies or with other deeply-held beliefs about what is morally correct, disagreements about the value of different decision options are more difficult to resolve than disagreement about cause-effect relationships,. An example of a decision situation where there is agreement about cause-effect relationships and disagreement about the value of various decision outcomes would be one where legislators from different political parties were members of a group charged with redrawing the boundaries of voting districts. A less clear example might be where a group of gerontologists, pediatricians, and emergency room personnel were brought together to make recommendations concerning how to allocate funds within a hospital.

4.2.1 Development of processes for addressing the decision situation

When encountering others who hold beliefs about values different from their own, people are disposed to challenge others' beliefs and vigorously defend their own. Perhaps because they perceive different beliefs as threats to their self-concept or identity, or because they are concerned that these beliefs will lead to decisions that are morally inferior, people will try to exert influence over the decision process to produce outcomes that are closely aligned with their own beliefs.

Assertion 4.2a: When disagreement about the value of various decision outcomes is recognized, group members challenge the values of others by using moral reasoning, by instilling guilt feelings, or by otherwise arguing for the appropriateness of their own values in the decision situation at hand.

Assertion 4.2b: When group members challenge the values of others by arguing for the appropriateness of their own values in the decision situation at hand, and when this exchange of views results in the members developing more uniform perceptions of the values appropriate to the decision situation, (1) cross understanding increases, (2) future decision processes proceed more smoothly in similar decision situations, and (3) the satisfaction of individual learners varies and depends on their ego involvement with their prior beliefs and the social skills of their teachers.

However, values tend to be robust. As a consequence:

Assertion 4.2c: When the approaches of Assertion 4.2a fail, members either (1) seek to negotiate win-win decisions both by trading off decision outcomes with low value in their belief system in return for obtaining outcomes of higher value and by offering decision outcomes of high value in the belief systems of others but low value in their own belief systems or (2) seek to impose processes such as voting or filibustering (fatiguing the opposition).

Assertion 4.2d: When the approaches of Assertion 4.2c fail, members either (1) appeal to sources of power to influence the group decision in ways that satisfy their own values – power sources such as higher authorities, pressure groups, and other powerful extra-group entities thought to possess the same values as the manipulating group member, (2) engage in personal attacks in an attempt to discredit values in conflict with their own, or (3) use bribes, favors, or other side payments to persuade others to go along with decisions that satisfy the member's value system.

4.2.2 Decision speed and other process-related outcomes

Assertion 4.2e: When the approaches of Assertions 4.2c or 4.2d are employed, the decision process tends to be long, members tend to develop negative feelings about one another, satisfaction with the decision process tends to be low, and members tend not to be attracted to working together interdependently in the future.

We expect that any issues impeding efficient and effective group processes will be even more difficult to resolve when members do not understand the mental models of others (low cross-understanding). Below we analyze the effects of low cross understanding in more detail.

5. DEPARTURES FROM BASE-LEVEL CONDITIONS: LOW CROSS UNDERSTANDING

Another way that decision-making situations can depart from base-level conditions is the situation where cross understanding among group members is initially low. Cross understanding is an emergent property of a group, developing as a consequence of group members' accumulated experience together. To varying degrees, members of ad hoc groups lack cross understanding of each other's mental models; they do not know whether the mental models of the other members (and particularly the value systems of these members) are in agreement with their own, although they may have beliefs about the nature of these models. An example of such a situation might be one where the decision group was composed of members previously unacquainted with each other and drawn from different organizations and units within these organizations, as would be a group designed and directed to plan the transfer of a technology or other complex asset from one firm to another. Here, until they have interacted for some time and learned about other members' mental models, cross understanding will remain low.

5.1 Accurate perceptions of members' mental models

When there is little evidence of members' actual beliefs, members will attempt to "fill in the blanks" in their hypothesized representations of others' mental models. Conceptualizations of others' mental models may be formed from demographic cues, early information and interactions, or inferred from the nature of the group's task even before the group interacts.

If the mental models that members attribute to other members are accurate but incomplete, that is if the elements attributed to others' mental models are accurate but not encompassing of all of the elements in others' mental models, then subsequent interactions will quickly confirm members' suppositions and encourage them to make further extrapolations concerning the remaining elements of others' mental models. These too, will tend to be confirmed. It follows that:

> *Assertion 5.1a: When members' initial perceptions of others' mental models are accurate but incomplete, decision related interactions among the members lead to rapid increases in cross understanding.*

Members' perceptions about other members' mental models will be more accurate if members have information about each other before they interact. For instance, in some situations, members of ad hoc decision groups are not personally acquainted but they do have some knowledge of the backgrounds of the other members, as when the resumes of the ad hoc group's members are distributed before the first meeting.

The type of group or nature of the group's task can also reveal information about the mental models of members. For example, product development groups and task forces are usually composed of members from different but complementary functional backgrounds. A reasonable assumption about members of such groups would be that members identified with different functional areas represent the values and interests of those functions. Perceptions based on this assumption are likely to be somewhat accurate, and because they seem reliable, will guide members' initial interactions. In these situations, members would have "moderate certainty" about the mental models of others. Following Assertion 5.1a and the reasoning set forth above, it follows that:

> *Assertion 5.1b: In groups whose members initially have moderate cross understanding, increases in cross understanding that follow from decision-related interactions are more rapid than in groups whose members initially have low cross understanding.*

In situations involving members with initially low or moderate cross understanding, developing higher levels of cross understanding requires that members learn about one another's knowledge and beliefs. This learning may be more rapid when members' initial assumptions about elements in others' mental models are accurate, but this learning nevertheless takes time. Thus, compared to the decision-making process of groups with initially high cross understanding, the decision-making processes of groups with initially low or moderate levels of cross understanding will evolve and be executed more slowly.

> *Assertion 5.1c: Groups whose members have initially low or moderate cross understanding are slower to agree upon and execute a decision making process, and are consequently slower to produce a decision than are their high-cross-understanding counterparts.*

Because cross understanding develops rapidly when members initially have accurate perceptions of others' mental models (Assertion 5.1a), in groups with initially low or moderate cross understanding, overall decision quality and member satisfaction with the decision outcome and process are likely to approach the decision quality and member satisfaction of high cross-understanding groups (given similar levels of mental model agreement or disagreement).

> *Assertion 5.1d: For groups with initially low or moderate cross understanding, the quality of decisions and members' satisfaction with those decisions approach that of comparable groups with initially high cross-understanding.*

5.2 Inaccurate perceptions of members' mental models

Decision group members may hold inaccurate perceptions about the mental models of other members with whom they are unfamiliar. Members' perceptions about other members' mental models are likely to be inaccurate if, for example, these perceptions rely on erroneous or unfounded assumptions of similarity or dissimilarity based on demographic cues. When members' perceptions of others' beliefs are inaccurate, members must not only learn what is accurate, but also unlearn what is not. Even if members quickly determine that their hypothesized representations of others' mental models are not confirmed, repeated interactions are necessary before those hypotheses can be accurately revised and refined. Therefore, it seems reasonable to conclude that:

> *Assertion 5.2a: In groups whose members initially have inaccurate perceptions of other members' mental models, cross understanding will be slow to develop.*

As a consequence of the time it takes to unlearn inaccuracies and learn about members' actual mental models, groups whose members have low initial cross understanding and inaccurate perceptions of others' mental

models are likely to be confused about how to proceed. Members will need to backtrack to correct and clarify incorrect assumptions, making their group slow to define and execute a decision process.

> *Assertion 5.2b: Compared to groups with accurate perceptions, groups whose members have inaccurate perceptions of others' mental models and will be slow to agree on and execute a decision process.*

The confusion and delays that result from incongruence prohibit group members from developing tacit coordination mechanisms that facilitate quick and efficient decision processes. This, combined with the effects described in Assertion 5.2b, suggests that:

> *Assertion 5.2c: Decisions are made more slowly in groups whose members hold initially inaccurate perceptions of other members' mental models.*

When members' mental models are not well understood by others, member roles and task responsibilities may be assigned based on inappropriate perceptions, causing decision quality to suffer.

> *Assertion 5.2d: Decisions made by groups whose members have initially low cross understanding and inaccurate perceptions of other members' mental models are of lower quality.*

Furthermore, their recognition of the group's slow progress combined with their recognition of the need to produce a decision causes some members to dominate the discussion in order to force yielding and acquiescence on the part of others. The outcome is a decision arrived at by finding a solution to which no (or only a few, weak) members object. At best, this is a form of satisficing on social criteria rather than on technical criteria. It follows that, as a result of the inefficient decision process and the thwarted contribution of some members, members' satisfaction with the decision process and the outcome will be low.

> *Assertion 5.2e: Member satisfaction with the decision process and outcome are lower in groups with initially low cross understanding and inaccurate perceptions of members' mental models.*

Compared to groups with low cross understanding, groups whose members understand each other's mental models enjoy reliable, predictable interactions that result in smooth and efficient decision processes. Our analyses indicate that cross understanding leads to faster decision-making processes and higher quality decisions and, further, it contributes to greater member satisfaction with decision processes and outcomes and therefore an enhanced capability for working together interdependently in the future. Cross understanding provides advantages even when members' beliefs differ, but especially when members' beliefs about cause-effect relationships disagree, because cross understanding promotes efficient searches for information and efficient and effective utilization of all members' unique perspectives. By explicating some of the barriers to cross understanding, the above analyses also suggest ways to overcome these impediments and foster cross understanding in decision groups. These are discussed next.

6. ENHANCING EFFECTIVENESS OF DECISION GROUPS BY SUPPORTING CROSS UNDERSTANDING

Organizations can help cross understanding develop and mature in decision groups by influencing group composition, the information available to group members, and the group's early interactions. Organizations can exploit cross understanding and leverage member diversity by influencing how members interpret decision situations and how they define and execute decision processes.

6.1 Influencing decision group composition and membership

Individuals that have worked together before are more likely to understand each other's mental models. Diversity in knowledge or expertise is necessary for most decision group tasks, but unless the group members possess or achieve cross understanding, such diversity cannot be fully exploited and indeed can be dysfunctional. As Assertions 4.1a and b, 4.2b, and 5.1a, b, and d suggest, it is the combination of (1) a high level of knowledge diversity and (2) a high level of initial or achieved cross understanding that is maximally effective in enabling decision groups to produce high quality decisions. Organizations can use information technology to ensure that the staffing of decision groups is attentive to both of these group attributes. For example, while Human Resource Information Systems (HRISs) often provide key information about employee skills and experience, many do not provide information about individuals' previous experience with other potential decision group members. Alone or in combination with the organization's HRIS, the organization's intranet could be used to search for potential group members who not only satisfy the knowledge-diversity criterion, but who satisfy the cross understanding criterion, possibly by identifying personnel who have worked

together in the past. These thoughts, building on our earlier analysis, suggest that information indicating potentially high levels of cross understanding among potential decision group members would be a valuable addition to Human Resource Information Systems.

6.2 Influencing early information and interactions

Managers can influence the initial level of cross understanding, and the accuracy of members' perceptions about other members' mental models. Something as simple as informing members about others can dramatically affect cross understanding and early interactions. Providing accurate information about other group members helps ensure the positive decision outcomes described in Assertions 5.1a, b, and d and avoid the relatively negative outcomes resulting from inaccurate initial perceptions of members' mental models (Assertions 5.2a-e). Managers might email members' biographies, resumes, and capabilities inventories to all group members before they meet. Providing contact information to all members (for example, email addresses, personal Web pages) may also encourage members to meet each other before their task begins. Managers may also arrange for face-to-face meetings among members prior to any formal task meetings to allow members to become better acquainted. Face-to-face interactions provide important verbal and non-verbal information that helps form the basic structure of members' initial hypotheses about other members' mental models. Combined with objective data about members' skills, knowledge, and experience, providing face-to-face meetings can help ensure that members' initial hypotheses are somewhat accurate.

6.3 Influencing the interpretation of decision situations

Drawing on early work by Daft & Weick (1984) and Dutton & Jackson (1987), we see that "[I]nterpretation of events (e.g., decision situations) is often a social process. . . . As part of their interpretation, events are categorized. The particular categorization of an event brings into effect corresponding organizational routines, including particular decision processes. . . . For example, whether a loss in market share is categorized as a marketing problem, as a cost problem, or as a product design problem will greatly influence (1) who will participate in making the decision about what to do, (2) which criteria and constraints will be considered, and (3) which information and information sources will be accessed" (Huber, 2004: 47-48). As we see from comparing Assertions 3.1 and 3.2 about base-level groups and Assertions 4.1a-d and 4.2a-e concerning the effects of disagreement in mental models, there are important behavioral and attitudinal consequences of dissimilar interpretations, and these affect decision outcomes. What can be done to increase the likelihood of appropriate and shared interpretations of decision situations? Here we are on unfamiliar ground, as what appears to be a matter of some consequence seems to have received little attention from decision scientists. The exception to this statement might be work in the area of "case based reasoning" (Kolodner, 1993; Riesbek & Schank, 1989). For decision environments where decision situations tend to be similar to previous decision situations, a Decision Support System with many well-indexed cases would often be of considerable use in making appropriate interpretations and therefore increasing the likelihood of employing appropriate decision criteria and constraints and seeking and using appropriate information.

More generally, though, decision groups are not supported with such a Decision Support System. More generally the analogous "cases" or decision situations that the group must draw upon to construct an appropriate interpretation are resident only in the members' minds. What seems to be needed then, to ensure that the group's interpretation is appropriate, is not so much a diversity of technical knowledge or beliefs about cause-effect relationships or beliefs about values, but rather a diversity of prior experiences with similar or otherwise analogous situations. In addition, and drawing on our earlier analysis, it seems that the decision group's task of constructing an interpretation by drawing on the diverse and somewhat "sticky" mind-resident experiences of the various group members would be more effectively accomplished if the level of cross understanding in the group was high. Here, again, we draw on the idea of combining the use of an HRIS and an intranet to identify as potential decision group members personnel (1) who have a wide variety of experiences in decision situations, so as to increase the probability that appropriate analogies will be available, and (2) who also are likely to have at least moderate levels of cross understanding, so that they will be able to comprehend and communicate about the decision situations described by other members as they attempt to collectively arrive at an appropriate interpretation.

6.4 Influencing the development and execution of the decision process

We alluded earlier to the fact that the explication of decision makers' beliefs about the precise process through which decision-relevant information should be transformed into a choice is often captured in the form of decision rules or objective functions, such as maximizing expected value, and in the form of cognitive aids, such as decision trees. As is well known but not widely practiced, construction of these models could be supported and greatly facilitated with information technology. For example, managers could use electronic

communication media to distribute information about the decision task ahead of time, and use a Delphi-like technique to obtain the decision group members' ideas about the information needed to make the decision. The process could be iterated to create and narrow the decision set to a "short list" of task-critical information. For less well structured situations, the approach might include asking members to come up with decision options, decision criteria, and possible outcomes, and to agree on a rough decision calculus (how would we know a good decision if we saw it?). Whether done remotely with electronic communication media or in a face-to-face setting using electronic "white boards" with memories and image transmission capabilities and other features of Group Decision Support Systems, our earlier analysis concerning how decision group members attempt to sway the beliefs of other members makes clear that arriving at a consensus about the decision calculus to be used is a process that can be much more readily achieved if cross understanding is present.

Execution of the overall decision process can be greatly facilitated by treating it as a project in which the decision group members interactively create a PERT network or CPM chart that plans out the integration of information, expertise, knowledge, processes, and authorizations and permissions needed to arrive at the decision. Here too, agreement about cause-effect relationships, priorities, and resources needed for the project's component tasks, is arrived at much more easily if the group members understand who has what expertise, i.e., understand each other's mental models. Finally, and of considerable importance in the world of organizational action taking, initial assignments and responsibilities for carrying out the decision implementation activities are best made with a solid understanding of members' capabilities and inclinations, i.e., their mental models.

7. SUMMARY AND CONCLUSIONS

Decision scientists studying group decision making have focused greatly on member diversity and diversity consequences such as conflict, decision quality, and scope of information and expertise available to and utilized by the group. Designers of Group Decision Support Systems have focused greatly on technologies that support the sharing and exchange of information, expertise, and judgment. A fundamental (but seldom articulated) concept underlying the work in both communities of practice is that of "mental model," a person's mind-resident set of beliefs about how the world is, how it works, and how it should be. In this paper we examined the concept of "cross understanding," the understanding that individual decision group members have about the mental models of the other individual group members. More specifically, we analyzed the effects of different levels of cross understanding and different levels of agreement in beliefs (about cause and effect relationships and about the value of different decision outcomes) on four consequences of group decision making endeavors: (1) the ease and speed with which the decision group develops and executes its decision processes, (2) the quality of the group's decisions, (3) the degree to which the process enhances the capability of members to work together interdependently in the future, and (4) the degree to which the group experience contributes to the growth of the members. Our analysis indicated that cross understanding has important consequences for all of these outcomes. The paper concluded with suggestions for improving decision group performance by using information technology to develop and exploit cross understanding.

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