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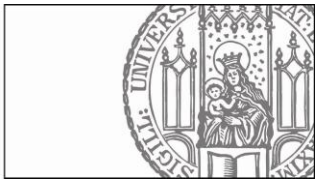

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Group Decision-Making under Conditions of Distributed Knowledge: The Information Asymmetries Model

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ABSTRACT

We present a theoretical model that synthesizes and expands current explanations for the failure of decision- making groups to effectively use information that is distributed among their members. It is proposed that groups can outperform individual decision makers and voting schemes, if certain asymmetries in information distribution are present and certain asymmetries in information processing are absent. How to achieve this is deduced from a review of the relevant literature. Directions for future research and practical implications are discussed.

Group Decision-Making under Conditions of Distributed Knowledge: The Information Asymmetries Model

The effectiveness of group decision-making is an increasingly vital concern for organizations. When important economical, technical, medical, or political issues are to be resolved, groups rather than individuals are employed to accomplish high-quality decisions (Hollenbeck et al., 1995; Vroom & Jago, 1988). They may take the form of committees, expert boards, commissions, project groups, advice teams, think tanks (cf. Hackman, 1990; Sundstrom, De Meuse, & Futrell, 1990), or multi-disciplinary and multi- functional teams (Jackson, 1992), as for example, in medical diagnostics and treatment (Larson, Christensen, Abbott, & Franz, 1996). Obviously, group decision-making is more costly than individual decision- making or an opinion poll. It necessitates the co-presence of several individuals and it is more time-consuming due to information exchange and discussion. Considering the higher costs, it seems justified to ask: what are the alleged advantages provided by group decision-making as compared with individual decision-making?

There are essentially two prospects. On the one hand, groups can be perceived as a vehicle for identifying and integrating individual viewpoints. This representative and integrative function permits participation in decision-making which mainly has the beneficial results of higher acceptance and better implementation of a decision. Research has shown that participation in group decision- making increases perceptions of fairness, the acceptance of the decisions made, allows for higher identification with the decision, and results in stronger commitment to the decisional implications (see for reviews, e.g., Moscovici & Doise, 1994; Vroom & Jago, 1988). With regard to this perspective, groups seem to meet expectations.

On the other hand, groups can be viewed as a vehicle for combining and integrating different knowledge, ideas and perspectives into high-quality decisions. Compared to individual decision makers, groups have access to more and a broader range of information due to the unique knowledge distributed among group members (e.g., Clark & Stephenson,

1989; Hollenbeck et al., 1995; Maier, 1963). Therefore, groups are often expected to make high-quality decisions and to foster creativity and innovation (cf. Stasser & Birchmeier, 2003).

The present paper is focused on the latter perspective, because more and more groups of employees make decisions under conditions of distributed knowledge but the common expectation that they effectively use their superior knowledge base when necessary seems empirically not justified.

Based on a randomized sample from the entire population of US organizations, Devine, Clayton, Philips, Dunford, and Melner (1999) found that group work is more prevalent in organizations with multiple departments and divisions, suggesting that many teams are cross-functional and cross-disciplinary in nature. Alongside a sustained trend towards an increasingly diverse work force (e.g., Williams & O'Reilly, 1998), organizations have redesigned jobs in ways that increase task interdependency and team work (e.g., Jackson, 1992, 1996). The objective is to stimulate the exchange of information among employees with dissimilar knowledge and expertise in order to promote cross- fertilization, innovation, and high-quality group decisions.

A widely shared expectation in organizations is that decisions made by groups of employees with diverse knowledge and expertise will be higher in quality than those made by employees with more homogenous backgrounds or by a single employee such as a manager (e.g., Jackson, 1992). However, research about group decision-making suggests that groups often fail to effectively use their full informational potential (see for reviews, e.g., Hinsz, Tindale, & Vollrath, 1997; Kerr & Tindale, 2004). This represents a considerable threat to the effectiveness of groups of individuals in organizations that aim to make high-quality decisions by learning from each others' unique knowledge through interaction.

In the present paper, we undertake a comprehensive theoretical analysis of how this

threat comes about and how it can be counteracted. The theoretical model we suggest (for an overview, see Figure 1) focuses on how asymmetries in the distribution of information *prior to* group decision- making and asymmetries in the processing of information *during* group decision-making interact to influence group decision quality and related variables.

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Insert Figure 1 about here
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One central prediction that can be derived from the model is that groups can indeed outperform individual decision makers and social combinations of individual votes. This will be the case if a) a specific type of asymmetry in information distribution is *present* in the group and b) specific types of asymmetries in information processing are *absent* in the group (see Figure 2).

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Insert Figure 2 about here
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ASYMMETRYIN THE DISTRIBUTION OF INFORMATION PRIOR TO GROUP DECISION-MAKING

The pre-discussion distribution of information determines whether group discussion can result in superior decision quality. For an illustration, consider a simplified example of a top management team in which members discuss whether to acquire company A or company B. Prior to discussion, the board members possess individual sets of information about the decision problem which they have gathered from their respective knowledge sources. The individual sets contain some overlapping (*shared*) and some unique (*unshared*) information about each company. The shared and unshared information of all group members constitute the total information available to the group. In our example, let us suppose that the objectively assessed best acquisition is company A, that is, in the group's full information set company A is supported by more attributes that matter to the decision than is company B. We now

consider two different ways – symmetric and asymmetric - in which the sets of information can be distributed among the board members.

In symmetric information distributions, the group members' individual information sets, on the one hand, and the group's full information set, on the other hand, have the same decisional implication. Prior to discussion, all members hold individual information sets implying that company A is the best choice and, as mentioned above, company A really is the best choice given the full information set held by the whole group. In this case, a *manifest profile* exists (Lavery, Franz, Winquist, & Larson, 1999). Under the condition of a manifest profile the discussion of unshared information can promote cross- fertilization and learning of new information, thereby broadening the group members' individual knowledge, but it is not critical to the group 's decision quality. No matter how (biased) the group members exchange their information (or not), the distribution of their individual preferences suffices to derive the correct (i.e. best informed) decision. Hence, in this type of knowledge distribution a laborious exchange of information can not "pay off" with regard to decision quality.

The situation changes when we consider an asymmetric information distribution in which the group members' individual information sets and the group's full information set have different decisional implications. In our example, this would mean that, whereas company A is the best choice (given all information available to the group) each group member individually possesses information that implies company B to be the best choice. In their seminal study Stasser and Titus (1985) introduced this asymmetric information distribution to the literature, and Stasser (1988) labeled it *hidden profile*. The name arises out of the fact that the best informed decision alternative is hidden from individual group members prior to discussion. Logically, hidden profiles can only occur if shared and unshared information have different decisional implications, and if the unshared information points at the best choice. In our example, a hidden profile would result in a three-person group if there were six arguments in favor of company A and three arguments in favor of company B

(supposed they are all equally strong) and, whereas all arguments in favor of company B are shared, all arguments in favor of company A were unshared. As a consequence, each group member would only know two arguments in favor of company A and, hence, had the impression that company B was the better choice. As becomes evident here, in the case of a hidden profile, group members enter the discussion preferring a suboptimal alternative and can only arrive at a correct decision by pooling and integrating the unshared information during discussion.

The manifest and hidden profiles described here are simple in nature for illustrative purposes. Yet they provide us with the basis for reasoning about much more complex and realistic situations, for example, with interdependent information (Fraidin, 2004), partially shared information (Schittekatte & Van Hiel, 1996), repeated group decision-making (e.g., Gigone & Hastie, 1993), with four or more group members (e.g., Stasser & Stewart, 1992), with three and more decision alternatives and diverse group member preferences (e.g., Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2005) or diverse areas of expertise (e.g., Stasser, Vaughan, & Stewart, 2000).

With regard to decision quality, hidden profiles are particularly important because they represent the prototype of situations in which groups have the potential to outperform individual decision makers and social combinations of individual preferences (e.g. by voting). Remarkably, research of the past two decades has consistently shown that most decision-making groups fail to detect the best informed decision alternative in hidden profile situations (e.g., Brodbeck, Kerschreiter, Mojzisch, Frey, & Schulz-Hardt, 2002; Gruenfeld, Mannix, Williams, & Neale, 1996; Lam & Schaubroeck, 2000; Lavery et al., 1999; Stasser & Stewart, 1992; Stasser & Titus, 1985; Winquist & Larson, 1998). The reported solution rates of unsupported decision- making groups across various tasks domains (e.g., economic, personnel, medical diagnostic s, and criminal investigation) and groups of participants (students, junior and senior level practitioners) mainly range between 0% and 30%.

We have argued that an asymmetric information distribution in the form of a hidden profile is a necessary precondition for decision-making groups to outperform individual decisions and voting schemes. However, the empirical research shows that it does not seem to be a sufficient condition for this quality surplus to actually occur. As we will argue in the following section, for this group surplus to occur, asymmetries in information distribution have to be offset by the absence of asymmetries in information processing (see Figure 2, upper right quadrant).

ASYMMETRIES IN INFORMATION PROCESSING DURING GROUP DECISION-MAKING

From a review of the (mainly) experimental literature about group decision-making and our own research, a number of asymmetries were noted in the processing of information during group decision-making. We have classified them into three categories: *negotiation focus*, *discussion bias*, and *evaluation bias*. The first two categories address the group level of collective information processing and the third category addresses the individual level of information processing during group discussion. The reasons why we focus on these asymmetries are that a) they influence the degree of cross- fertilization and individual learning via group interaction when information is distributed - under manifest *and* hidden profile conditions, b) they impair decision quality if information is asymmetrically distributed in the form of a hidden profile, and c) they build upon and extend already known group and individual bias phenomena in the domain of decision-making. In Figure 3 the mechanisms we identified are listed per category (left-hand side) together with the impact each of them has on the collective and individual processing of information (right-hand side).

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Insert Figure 3 about here
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Negotiation Focus

In the group decision-making literature, a basic distinction is made regarding how groups exert *social influence* on their members (i.e. a change in the judgments and opinions of an individual as a result of being exposed to the views of others): normative versus informational influence (Deutsch & Gerard, 1955). Under normative influence, individuals who dissent from the dominant position held in the group tend to conform because they are motivated by the desire to please others, to gain social approval or to avoid others' rejection. We suggest that on the group level of information processing, there is an observable pattern of social interaction which serves the exertion of normative influence. We term it *negotiation focus*, that is, group members focus on exchanging and negotiating opinions and preferences so that the dominant or majority position can be identified and settled within the group (e.g., by voting). In contrast, under informational influence, an individual's opinion changes result from learning new information and re-evaluating the preferred decision alternative in the light of the fresh information. On the group level, the observable pattern of social interaction that serves the exertion of informational influence is termed *information pooling*, that is, the communication, combination and integration of decision relevant information.

Hastie, Penrod and Pennington (1983) provide evidence that whole groups can indeed focus on certain discussion styles. About a third of the juries they studied displayed a *verdict-driven* deliberation style, that is, early and frequent voting behavior. Another third displayed an *evidence-driven* deliberation style, that is, information is reviewed and combined into a plausible narrative on the basis of which the most appropriate verdict option is chosen (see also Pennington & Hastie, 1992). No clear deliberation style was discernible for the remaining third of the juries. The verdict-driven deliberation style is similar to what is termed negotiation focus, while the evidence driven deliberation style is similar to what is termed information pooling focus. However, our concept of a group negotiation focus applies to group decision-making more generally than jury deliberation styles do. It is neither limited to a particular decisional frame (e.g., vote for a verdict by using evidence from the court trial

only), nor to a fixed number of alternatives (e.g., guilty versus not guilty), and it is applicable to conditions of distributed information, which are not investigated in jury deliberation studies.

Often groups have several decisions to make in the same meeting, which fosters the dominance of negotiation over information pooling. Gigone and Hastie (1993) asked groups to make a series of decisions similar in content (on average, 36 decisions in 56 minutes). They concluded that "group members exchanged and combined their opinions but paid little attention to anything else." (Gigone & Hastie, 1997, p. 132). A group's negotiation focus is also fostered by framing group decision- making as a judgmental task rather than a problem solving task (Stasser & Stewart, 1992). Consent among individual decision preferences, apparent at the beginning of a group discussion, also fosters a group's negotiation focus. It promotes swift agreement on a group decision by reducing the time and effort that is devoted to exchanging the full range of information and it reduces the learning of unshared information (Brodbeck et al., 2002).

A group's predominant focus on negotiation reduces the total amount of information exchanged during group decision-making (including unshared information) thereby obstructing the impact of the potentially available information on the group decision outcome. It also hampers cross-fertilization between group members, and thus, individual learning of new information. However, as long as the members' individual preferences are not misleading, negotiating the group decision on the basis of these initial preferences is not harmful to decision quality. Thus, under manifest conditions of knowledge distribution, a negotiation focus hinders individual learning of new information, but it is unlikely to reduce group decision quality. In contrast, in the case of a hidden profile, the group members are predisposed to enter the group discussion with suboptimal individual preferences and a group's negotiation focus hampers a shift towards discussing unshared information that can lead to a group decision that differs from the one that would be made when only the

preferences were negotiated. Thus, the overall likelihood of detecting the correct solution is reduced.

Proposition 1: A group's negotiation focus hinders individual learning of new information.

Proposition 2: A group's negotiation focus has negative effects on group decision quality, if decision-relevant knowledge is distributed in the form of a hidden profile.

Group Level Discussion Bias

Even if a group's negotiation focus is counteracted so that more information pooling is practiced, this need not necessarily lead to improvements in group decision quality. There are further biases which characterize the exchange of information during group discussion favoring either shared information (over unshared) or preference-consistent (i.e. information that supports the group members' individual decision preference) over preference inconsistent information.

Sampling bias and repetition bias favoring shared information. When information is distributed among their members, groups tend to discuss proportionally more shared than unshared information. This discussion bias consists of two components. First, as compared to unshared information, shared information is proportionally more often brought up first during discussion (*sampling bias*). A model that explains the sampling bias favoring shared information was introduced in Stasser and Titus' (1985, 1987) seminal studies. Accordingly, shared information has a probabilistic sampling advantage over unshared information, because more group members can mention it. Second, once it was brought up, shared information is proportionally more often repeated during discussion than unshared information (*repetition bias*, e.g., Larson et al., 1996; Savadori, Van Swol, & Sniezek, 2001).

Larson, Foster-Fishman and Keys (1994) presented a dynamic extens ion of the probabilistic sampling model from Stasser and Titus. As the group discussion proceeds, the probability of sampling additional "not-yet" mentioned shared items systematically decreases

whereas the probability of sampling additional "not- yet" mentioned unshared items increases. Thus, theoretically, a sufficiently long group discussion should shift the balance of sampling opportunities towards unshared items (for empirical support of this, cf. Larson et al., 1996). Consequently, if groups tend to prematurely terminate discussion by agreement-seeking or voting (negotiation focus), they will not benefit from the increased sampling opportunities for unshared information in later stages of the discussion. This effect is illustrated in Figure 2 by a downward arrow from negotiation focus to mentioning and repetition of information.

Sampling bias and repetition bias favoring preference-consistent information. Previous research has primarily focused on the distinction between shared and unshared information. Recently, theoretical developments have been made that shed some light on the relationship between the decision preferences group members hold and the information they contribute to discussion (Dennis, 1996; Kerschreiter, Schulz- Hardt, Faulmüller, Mojzisch, & Frey, 2005; Schulz-Hardt et al., 2005). The implications of these studies are incorporated in our theoretical model. Group members tend to discuss information that supports their initial decision preferences (preference-consistent information) more often than information that speaks against their decision preferences (preference- inconsistent information). This tendency is evident for both the sampling and the repetition of information during group discussion. Therefore, it can be seen as a group level phenomenon.

One possible explanation is that group members want to appear competent and consistent and thus, for strategic reasons, are holding back information that would compromise their own position (e.g., Wittenbaum, Hollingshead, & Botero, 2004). Another plausible explanation is that group members act upon a conversation norm implying that they serve as advocates for their individual preference or, at least, explain why they have this preference (cf. Stasser & Titus, 1985). Finally, group members might simply prefer to discuss preference-consistent information because they judge it to be more credible and important than preference- inconsistent information (cf. Greitemeyer & Schulz-Hardt, 2003).

Individual Level Evaluation Bias

Even if the described group level biases (negotiation focus, sampling bias, repetition bias) can be controlled, there are still asymmetries evident on the individual level of information processing during group discussion that can hamper group decision-making. They are important for at least two reasons: first, they can explain why groups sometimes fail to solve hidden profiles even if all relevant information is exchanged during discussion and second, they contribute to the group level discussion biases described above.

Evaluation bias favoring shared information. Shared information is judged to be more credible and more important than unshared information (Greitemeyer, Schulz-Hardt, & Frey, 2003; Kerschreiter et al., 2005). This evaluation bias is founded on two characteristics of shared information: a) it is "owned" by several group members whereas unshared information is owned by only one group member, b) shared information can be socially validated, which is more difficult to achieve for unshared information.

There is increasing evidence suggesting that decision makers treat the contributions of others less favorably than their own (e.g., Harvey & Fischer, 1997; Yaniv & Kleinberger, 2000). In the context of group decision-making, Van Swol, Savadori, and Sniezek (2003) showed that group members perceive their own information as more valid than information held by other group members (*ownership bias,* see also Chernyshenko, Miner, Baumann, & Sniezek, 2003). Because unshared information is predominantly encountered for the first time during group discussion, the ownership bias works in favor of shared information. Shared information can be socially validated (e.g., Parks & Cowlin, 1996; Postmes, Spears, & Cihangir, 2001; Wittenbaum, Hubbell, & Zuckerman, 1999). When a group member contributes a shared item of information to the discussion, other members can confirm its veracity. In contrast, unshared items cannot be corroborated by other members (unless the information contains its own evidence as with courtroom evidence or boardroom charts) and hence are treated with more skepticism. In support of the social validation hypothesis,

Mojzisch, Schulz- Hardt, Kerschreiter, Brodbeck, and Frey (2005) demonstrated that items that could be corroborated by other group members were perceived as more favorable, independently of whether those items were owned before the group discussion or presented by another group member during the discussion. Thus, social validation and ownership bias seem to be two independent mechanisms by which group members evaluate shared information more favorably than unshared information.

Evaluation bias favoring preference-consistent information. From research on individual decision- making, it is known that people evaluate information in relation to preferences they have developed (e.g., Edwards & Smith, 1996). Information (one's own and others), which is inconsistent with one's own preference is critically evaluated and accurately perceived with regard to its strengths and weaknesses. By contrast, preference-consistent information is quickly accepted at face value, leading the decision- maker to neglect possible flaws in the argumentation. Within the context of group decision-making, the same holds true: Preference-consistent information is judged to be more credible and important than preference- inconsistent information (*preference consistency effect*, Greitemeyer & Schulz-Hardt, 2003) and therefore it is more likely to be mentioned during group discussion than preference- inconsistent information (Kerschreiter et al., 2005). This cross- level effect is illustrated in Figure 2 by an upward arrow from individual level evaluation bias to mentioning and repetition of information during group discussion.

How Discussion Biases and Evaluation Biases Interact with Pre-discussion Distributions of Information

For the sake of conceptual clarity, we discuss interactions between the information processing asymmetries in favor of shared and preference-consistent information and the distribution of information (manifest versus hidden profile) independent of whether they occur on the group level of information processing (discussion biases) or on the individual level of information processing (evaluation biases). We draw the line between the two

relevant characteristics of asymmetric information processing: a) bias in favor of shared information and b) bias in favor of preference-consistent information. This division represents the current state of research: most group decision- making research addresses the processing of shared versus unshared information, whereas the processing of preference-consistent versus preference- inconsistent information provides a new perspective.

Discussion bias and evaluation bias favoring shared information. A dominance of shared over unshared information during group discussion and in the group members' individual judgments does not necessarily lead to suboptimal group decisions. The imbalance can also serve as an advantage, for example, when shared information is used to establish a "common ground", which enables group members to better understand each other (Clark & Brennan, 1991; Baba, Gluesing, Ratner, & Wagner, 2004) or by providing retrieval cues to each other (e.g. Liang, Moreland, & Argote, 1995). However, when decision relevant information is distributed among group members (no matter whether in a manifest or a hidden profile) discussion bias and evaluation bias favoring shared information hinder cross-fertilization. The less frequently unshared information is brought up and repeated during group discussion and the less it is evaluated in an unbiased way the less learning of new information can take place.

Proposition 3: The discussion bias and evaluation bias in favor of shared information hinder individual learning of new information.

As outlined above, under the more specific conditions of a hidden profile, the decisional implications of shared information are suboptimal. Thus, the discussion bias and the evaluation bias favoring shared over unshared information steer the group discussion and the group members' individual judgments away from the optimal decision alternative, thereby reducing group decision quality.

Proposition 4: The discussion bias and evaluation bias in favor of shared information have negative effects on group decision quality, if decision-relevant knowledge is distributed in the form of a hidden profile.

Discussion bias and evaluation bias favoring preference-consistent information. The dominance of preference-consistent over preference- inconsistent information during group discussion and in the group members' individual judgments does also not necessarily lead to suboptimal group decisions. It can serve as an advantage in situations which require rapid decision-making, where a thorough evaluation of alternatives would hinder advancement (Beckmann & Kuhl, 1984). Nevertheless, the dominance of preference consistent information always steers the group discussion toward the common sentiment of the group members' opinions. When information is distributed (in a manifest or hidden profile) the discussion bias in favor of preference consistent information affects cross-fertilization, such that, there is proportionally more preference-consistent new information to learn during group discussion than preference- inconsistent new information. The effects of the evaluation bias on the group members' learning of new information are more complex. On the one hand, preference- inconsistent information (once brought to an individual's attention) is more intensively elaborated, and thus, should be at least memorized better than preference-consistent information. On the other hand, because preference-inconsistent information is perceived to be less credible and less important than preference-consistent information, it is more likely to be disregarded for individual decision- making than the preference-consistent information. We therefore propose that when information is distributed (in a manifest or hidden profile) new information that is preference-consistent is overall more readily learned (in the sense of being integrated in the cognitive representation of the decisional problem at hand) than new information that is preference-inconsistent.

Proposition 5: The discussion bias and evaluation bias in favor of preference-consistent information hinder individual learning of preference- inconsistent new information.

Under the more specific conditions of a hidden profile, groups and individual group members are steered away from the optimal decision alternative because the information that is critical to making the correct decision is likely to be inconsistent with most of the group members' initial (suboptimal) preferences. Preference-consistent information processing also fosters the group members' tendency to hold their initial suboptimal preference – despite contradictory evidence (Greitemeyer & Schulz-Hardt, 2003). As a consequence, even in the absence of asymmetric group level information processing, groups may fail to solve hidden profiles because preference-consistent evaluation of information on the individual level fosters the maintenance of an initial (suboptimal) preference.

Proposition 6: The discussion bias and evaluation bias in favor of preference-consistent information have negative effects on group decision quality, if decision relevant knowledge is distributed in the form of a hidden profile.

How Asymmetries in Information Processing Interact with Each Other

Each of the above described asymmetries in information processing has negative effects on group decision quality under hidden profile conditions. In the case that several or all asymmetries are working simultaneously, stronger effects are to be expected. Our model predicts that their detrimental effects accumulate and even aggravate each other. The latter is due to specific interrelations between certain information processing asymmetries. For example, as was described above, a group's negotiation focus reduces the sum total of information exchanged and increases the likelihood that group discussion is prematurely terminated. This aggravates the information sampling bias in favor of shared information, because this bias tends to be particularly strong in early stages of group discussion. The evaluation bias and discussion bias are also interrelated. Specifically, because preference-

consistent information is judged to be more credible and important than preference-inconsistent information (evaluation bias), it is also more likely to be mentioned during group discussion than preference- inconsistent information (discussion bias). Further interrelations can be derived from our model but they have not yet been empirically investigated, for example, a positive interrelation between a group's negotiation focus and evaluation bias in favor of preference-consistent information.

A central message of our model is that groups can outperform individuals and voting schemes in decision quality if the distribution of information is asymmetric (e.g., in the form of a hidden profile) and the processing of information is symmetric. Without having empirically investigated all possible interrelations between the types of asymmetric information processing postulated in this paper, we feel justified to propose, that those groups who succeed to overcome these asymmetries in information processing will benefit more from their superior information potential in group decision-making.

THEORETICAL IMPLICATIONS AND QUESTIONS FOR FUTURE RESEARCH

The information asymmetries model explains why group decision quality is suboptimal under certain conditions of distributed knowledge. Its predictions about the conditions under which group decision-making can be improved align with recent research about diversity in the distribution of the group members' preferences, on the one hand, and the effects of transactive memory systems in multi-expert groups, on the other hand. These are discussed in this section together with questions for future research and theory development. Some further theoretical implications we discuss highlight the model's overlap and distinctiveness with respect to theories about well-known group decision-making phenomena such as "group polarization" and "groupthink ". Finally, we address the model's boundary conditions and questions for applied research.

Diversity in Decisional Preferences

In prior theorizing and research, the essence of group decision- making is often seen in the reduction of initial opinion differences among group members (Hogg, 1995). This perspective finds a theoretical interpretation in social combination models (Hinsz et al., 1997; Stasser, Kerr, & Davis, 1989), which address the way in which group members combine their resources into a group decision. For example, the renowned *social decision schemes* (SDS) approach (cf. Davis, 1973; Hastie & Kameda, 2005; Parks & Kerr, 1999) predicts group decisions with high degree of certainty on the basis of the distribution of individual pre-discussion preferences and a small set of decision-making rules (e.g., "truth wins" or "truth supported wins" for intellective tasks).

Now, imagine the case of a hidden profile, where the objectively best informed decision alternative finds no support among group members because of the way information is distributed among group members. In this case, SDS models predict that this decision alternative will not be taken into account, and indeed, this is what most studies about group decision-making demonstrate (for a review, see Hinsz et al., 1997; see also Hollingshead, 1996a). To be more precise, finding a position or a solution to a problem, which none of the group members has anticipated, by using the full potential of distributed information, is outside the domain of the SDS approach. For predicting a group decision outcome, SDS approaches consider whether and how many group members favor the correct decision alternative prior to discussion. Thus, from an SDS perspective, it does not matter whether pre-discussion preferences are diverse or not, if no group member promotes the correct decision.

In contrast, from the perspective of the information asymmetries model, diversity in pre-discussion preferences matters for group decision outcome to the extent that it affects the asymmetries in information processing. Diversity in pre-discussion preferences (be it a minority- majority distribution or a full diversity in opinions) should reduce a group's negotiation focus and increase information pooling activities (Parks & Nelson, 1999). Dissent in group members' preferences should also have positive effects with regard to discussion

bias and evaluation bias (cf. Schulz-Hardt, Frey, Lüthgens, & Moscovici, 2000). Being exposed to diverging minority opinions instigates a process where group members try to critically test the validity of their own as well as the minority's position by intensively checking the available evidence (cf. Moscovici, 1980). Thus, in groups with a minority and a majority faction, at least the majority members should be more receptive to information that is new to them and that contradicts their individual preferences, which counteracts the discussion bias (in particular the repetition bias) favoring both shared and preference-consistent information. Minority influence and dissent should also reduce individual level evaluation bias because it stimulates divergent thinking (cf. Nemeth, 1986). Results from two hidden profile experiments (Brodbeck et al., 2002; Schulz-Hardt et al., 2005) are in support of these predictions. In the first study, groups with minority and diversity dissent (compared to groups with consensual pre-discussion preferences) continued discussions for longer (less negotiation focus) and their members showed more learning of new information. The design of the second study provides for a simultaneous test of the predictions from SDS and the information asymmetries model. Improvements in information sampling, individual learning of new information and group decision quality were evident for minority/majority and diversity groups (as compared to groups with no dissent among individual preferences) - no matter whether the dissenting members' preferences were right or wrong (i.e. none of the group members had an individual preference for the correct alternative).

The current empirical evidence rests upon only two studies. Thus, it is important to conduct further studies about the consequences of diversity and dissent for information processing under conditions of distributed knowledge. Also of relevance is the question of why simulated dissent (e.g., "devil's advocacy") as compared to authentic dissent, does not seem to alter asymmetries in information processing sufficiently to warrant improved group decision quality (Greitemeyer, Schulz- Hardt, Brodbeck, & Frey, in press). Finally, not very much is known yet about how other types of group member diversity (e.g., in domain of

expertise, cultural background, or functional background) affect information processing and group decision-making.

Diversity in Expertise: The Role of Transactive Memory Systems

Considering the above findings, one could argue that similar effects are to be expected when group members differ in expertise. However, providing for heterogeneity in group members' areas of expertise is not sufficient for solving the problems imposed by distributed knowledge in group decision- making. As long as individual group members do not know about each others' areas of expertise and how to benefit from this meta-knowledge through social interaction, the group's superior knowledge base is likely to remain underused (cf. Rulke & Galaskiewicz, 2000).

The meta-knowledge held within the group about its members' differential knowledge, skills and roles has been empirically investigated under the label *transactive memory systems* (Moreland, 1999; Wegner, 1987). In the light of our theoretical model, a transactive memory system should reduce a group's negotiation focus because it enables group members to more confidently contribute their individual information and to more actively retrieve information from each other. Well developed transactive knowledge systems should also reduce group discussion bias by promoting more frequent discussion of unshared information because each member is likely to focus on his or her areas of expertise where he or she can access and contribute more information than others (cf. Stasser, Stewart, & Wittenbaum, 1995). Finally, transactive memory systems allow for the validation of unshared information on the basis of knowledge about the expertise of the source of information (cf. Stewart & Stasser, 1995), which reduces individual level evaluation bias favoring shared information. Furthermore, groups in which members know about each others' area of expertise, tend to discuss more unshared information (Stasser et al., 1995; Stasser et al., 2000; Stewart & Stasser, 1995) and solve hidden profiles more often (Stasser et al., 1995) than groups in which no transactive memory system exists.

There are limits to the multiple-experts approach for improving group decision quality and innovation. Experts tend to go out of the limits of their expertise and bring up other information, which tends to be shared information due to its sampling advantage (cf. Stasser & Birchmeier, 2003). Usually, there are no strong normative injunctions against this behavior, which can severely compromise the potential benefits of expert-driven discussion for pooling unique information. Further research should therefore investigate which norms are feasible and practicable in promoting expert-driven sampling of unshared information.

Group Polarization: Persuasive Arguments Theory

Group polarization is the tendency of groups to lean toward decisions that are more extreme than the average of members' initial positions (e.g., more risky or more conservative), in the direction already favored. Persuasive arguments theory explains the group polarization phenomenon by informational influence (Burnstein & Vinokur, 1977), that is, novel (i.e., unshared) information has more influence on judgments resulting from group discussion than known (i.e. shared) information. This claim is in opposition to the findings of the literature on unshared information under conditions of distributed knowledge. According to the information asymmetries model, further factors need to be taken into account, for example, a group's negotiation focus, which counteracts the potentially stronger effect unshared information could have on group decisions, if the group discussion were long enough to reveal a meaningful amount of unshared information.

Moreover, persuasive arguments theory builds on the assumption that the group discussion of information is unbiased. However, this assumption seems to be unrealistic from the scope of our theoretical model, which identifies a whole range of mechanisms which result in the dominance of shared over unshared and preference-consistent over preference-inconsistent information. Additional research is certainly needed to clarify the boundary conditions of these mechanisms.

Persuasive arguments theory and other theories explaining group polarization (e.g. Isenberg, 1986) predict under which conditions social interaction in groups results in more or less polarization of the group members' initial sentiment in opinions – no matter whether the underlying sentiment is right or wrong. Our theoretical model also attempts to explain why, when and how group decision quality becomes suboptimal or optimal respectively in relation to a group's potential level of performance defined by the sum total of knowledge distributed among group members. This should make it particularly useful for the management sciences because a major motivation for using groups as decision-making agents under conditions of distributed knowledge is the hope for higher group decision quality.

Groupthink: Motivational versus Cognitive Processes in Group Decision-Making

According to Janis (1982), groupthink describes a dysfunctional pattern of interaction and thought during group decision- making, which is characterized by pressures toward uniformity, closed- mindedness, overestimation of the group, and defective information processing, and which can lead to group decision fiascos. Groupthink is proposed to occur only under limited conditions, like high cohesiveness of the group, structural faults (e.g., directive leadership, homogeneity of members' social background and ideology, lack of methodological procedures) and a provocative situational context (high stress and low group members' self esteem).

The predominant psychological explanations for the groupthink phenomenon address motivational processes: for example, the creation or maintenance of solidarity and harmony within the group prevails over the goal of finding the best possible decision (Esser, 1998). Although there is evidence that groupthink conditions may aggravate the biases favoring shared and preference-consistent information (Schulz-Hardt et al., 2000), the research presented in this review and elsewhere (e.g., Stewart, Billings, & Stasser, 1998) demonstrates that the failure of groups to effectively use information in group decision25 making occurs

even when the (motivational) conditions favoring groupthink are absent (for a similar argument, see Stasser & Birchmeier, 2003, p. 105).

Certainly, the extent to which groups use their full information potential can also have motivational causes. Apart from groupthink, social loafing of individual group members may be a relevant motivational factor. Furthermore, some group members may pursue their own (often hidden) goals in order to maintain or increase their power in general or to implement specific decisions to their own benefit. Therefore, future research should address the complementary and interactive effects motivational and cognitive processes have on group decision-making. For example, the tendency of group members to discuss preference-consistent rather than preference- inconsistent information may have motivational causes (group members want to appear competent and therefore hold back information that could compromise their position, cf. Wittenbaum et al., 2004), or cognitive causes (preference-consistent information is judged to be more credible and important than preference-inconsistent information, cf. Edwards & Smith, 1996), or both in combination.

Implications for Applied Research

From earlier reviews (e.g., Mojzisch & Schulz-Hardt, in press; Stasser & Birchmeier, 2003) and from the present one, it is evident that most of the research about group decision-making under conditions of distributed knowledge is reported in social psychological journals devoted to laboratory-based research (for exceptions see, Baba et al., 2004; Rulke & Galaskiewicz, 2000). To develop a better theoretical understanding of the underlying mechanisms, laboratory research is indeed essential. However, there is a lack of field research on the basis of which managers and participants in decision-making groups can be informed about what to do to improve their use of distributed knowledge.

Transferring the findings from laboratory based research into practical settings via applied research is impeded by a current lack of measures for identifying manifest and hidden

profiles *in situ*. Future applied research should therefore concentrate on identifying conditions under which unfavorable patterns of knowledge distribution are most likely.

The laboratory studies also tell us that there seems to be a general tendency among decision makers (students and practitioners) to disregard the implications of unfavorable distributional patterns of information distributions, even when the possibility of their existence is pointed out to them in various ways (e.g., Christensen et al., 2000; Stasser et al., 1995). Furthermore, it seems that the professional skills to transform distributed knowledge into high-quality decisions are not automatically developed by repeatedly performing group decision- making tasks, whether it is in the domain of medical diagnostics (cf. Christensen et al., 2000; Larson et al., 1996; Larson, Christensen, Franz, & Abbott, 1998a) or of information systems audits (e.g., O'Donnell, Arnold, & Sutton, 2000). Thus, more applied research is necessary to determine whether these quite discouraging results from laboratory studies hold up in natural groups, and where this is the case, how they can be counteracted.

The information asymmetries model of group decision-making provides a framework for the identification of factors which can de-bias individual and group level information processing. Applied researchers who want to identify and test such factors should consider variables that are embedded in natural decision-making groups and their organizational environments: For example, the degree of familiarity between group members, which has been shown to relate to information exchange and decision quality in groups (Gruenfeld et al. 1996; Phillips, Mannix, Neale, & Gruenfeld, 2004), as well as team climate (e.g., psychological safety, Edmondson, 1999), group composition (e.g., diversity in preferences, e.g., Brodbeck et al., 2002), informational centrality of group members (Sargis & Larson, 2002), cognitive load (Tindale & Sheffey, 2002; Fraidin, 2004), group decision support systems (Lam & Schaubroeck, 2000), and information management behaviors shown by group leaders (Larson, Foster-Fishman, & Franz, 1998b). The latter stream of research has

reached a level of maturity which makes it a promising area for the development of effective interventions via applied research.

Information management. Information management is a central function in group decision- making, which is often performed by a leader whose task is to keep the group focused on the problem at hand, to facilitate communication, stimulate decision relevant contributions, and to keep them alive during discussion (e.g., Fleishman et al., 1991; Maier, 1967). Evidence from research on leadership styles converged in the notion that groups under directive leadership outperform groups under participative leadership only when their leaders possess sufficient information to favor the best decision alternative. However, when the directive leaders prefer a suboptimal alternative (as other group members do) group decision quality deteriorates severely and drops significantly below the level of groups headed by participative leaders (Cruz, Henningsen, & Smith, 1999; Larson et al., 1998b). Considering that in situations of a hidden profile most or all group members (including the leader) are likely to hold information that does no t imply the best possible decision alternative, a directive leadership style seems less functional for high-quality decision-making than a participative leadership style. Edmondson, Roberto, and Watkins (2003) draw on similar considerations in their theoretical model about leadership and top management team (TMT) effectiveness. They concluded that power centralization increases negative effects of situation-specific information asymmetry on TMT effectiveness.

From our model's perspective, future research should concentrate on identifying information management behaviors that can help to de-bias the various information processing asymmetries proposed. With respect to the dominance of shared over unshared information, Larson et al. (1996, 1998a) report encouraging results. Experienced leaders of medical diagnostic groups tend to repeat unshared information at a steadily increasing rate over time and raise more questions concerning concrete factual information than other group members do, which correlates positively with decision quality. The information asymmetries

model can serve to develop further research questions for information management and leadership. For instance, how can a group's negotiation focus be transformed into an information pooling focus? How can group discussion bias be changed toward a more balanced account of preference- inconsistent information? And, last but not least, how can several information processing asymmetries be simultaneously balanced?

Interventions with multiple effects. From the failed attempts to improve group decision-making under conditions of distributed information we can learn about potentially more promising avenues for future applied research. One observation from the literature we reviewed was that interventions which failed or delivered mixed results altered only one or few of the information asymmetries specified in our model while successful interventions addressed several asymmetries simultaneously. As described above, the information asymmetries model predicts that the detrimental effects of negotiation focus, discussion biases, and evaluation biases accumulate and even aggravate each other. Therefore, it seems to be a promising strategy to search for interventions that alter several information processing asymmetries at once. Providing for diversity in group member's preferences (described in detail above) is one example of such an intervention.

PRACTICAL IMPLICATIONS

By focusing on decision quality, our theoretical model is meant to re-establish the quality of the final group decision as an important "bottom- line" criterion for the study of group discussion under conditions of distributed knowledge. From a practitioner point of view, when costs are involved for improving the decision-making process, it actually matters whether respective upgrading investments result in higher decision quality or not. Our model's propositions two, four and six predict this "bottom- line" criterion.

Solving a hidden profile can also be seen as a model for how paradigm shifts and innovations are stimulated. A paradigm shift or an innovation is by definition unfamiliar to most or all group members. If there is a new option or a new position that is supported by

preference-inconsistent and unshared information which the group holds collectively, an unbiased sharing and evaluation of information can foster a discussion process by which disjoint and counter intuitive facts do not remain scattered or unduly rejected. Our model's propositions one, three and five predict the cross- fertilization and individual learning of new information that is necessary for this type of innovation. Both sets of propositions underline the model's more general value to the domain of group-based knowledge management in organizations.

Our review has approached the problem of knowledge integration and high-quality group decision-making from the perspective of the behavioral scientist. From an applied perspective, the interest is in designing effective information processing and group decision-making units. Therefore, the remainder of this chapter summarizes what we know about group decision-making under conditions of distributed knowledge that helps to inform the practitioner about how to improve the quality of group decisions. Many of the recommendations described also apply to the domain of group creativity and innovation which has been reviewed by Stasser and Birchmeier (2003).

How to Improve Decision-Making in Groups

Obviously, not every decision in organizations calls for cost intensive and laborious group decision-making (e.g. routine decisions where a single person holds all information necessary to make a proper decision) and not every decision that requires group decision-making needs to draw on distributed knowledge (e.g. when all group members hold the same information and interpret it in a similar way). In the case of fully-shared information, a simple voting procedure or a single person's decision can be sufficient to maintain high decision quality from an information sampling perspective - unless there are other reasons that require the use of group discussion, for example, the necessity of high commitment to the decisions made or high acceptance of the decisional consequences, as well as legal requirements (e.g.,

in jury decision-making) or organizational cultural preferences for participation, empowerment, and fair representation of different stakeholders.

When there is uncertainty about whether a hidden profile may exist or not, a further factor needs to be taken into account: the expected impact of the group decisional consequences. The failure to notice and account for situations in which information is distributed in a manner that steers individuals and groups away from the best informed decision can be costly or even fatal, for example, when the decisional consequences impact significantly on the health and well being of people (e.g. in medical diagnostics and treatment) or have far-reaching economic or societal implications (e.g. in military intelligence, business, research & development, politics, law, or ethics). Thus, whenever group decisions are to be made on the basis of distributed knowledge, low-cost interventions should be considered. If high decision quality is imperative, it is recommended to also consider high-cost interventions, which tend to have an overall higher impact on group decision quality than the low-cost interventions.

Low-Cost Interventions

This set of interventions aims to directly shape the individual and collective information processing during group discussion. Most of them address only one or two of the mechanisms specified in the information asymmetries model. This means that an individual factor may not result in visible effects, and thus, several factors may need to be combined. We classify them as "low cost" interventions because the knowledge, skills and attitudes which group leaders and group members should possess in order to show the respective behaviors can be communicated as part of ongoing HRM programs. For example, decision- making groups in organizations can be instructed or supervised accordingly by appropriately trained group leaders or facilitators.

Through *information vigilance instruction* (Larson et al., 1994; Larson et al., 1998a) group members are asked to refrain from mentioning their decisional preferences until

everyone in the group feels that all of the information has been discussed. Group members should be clear that their job is not to convince the group that they are right. Their job is to educate the group about the meaning and importance of the information they hold. Furthermore, allowing for *sufficient time* helps to sample more of the unshared information, because it is likely to be mentioned more frequently in later phases of group discussion. These factors reduce a group's negotiation focus and discussion bias in favor of shared information. The same two asymmetries are addressed by *information management* (e.g., Larson et al., 1996), which is usually performed by a group leader. Information management involves continual encouragement of decision relevant contributions and keeping them alive throughout group discussion by increasingly asking questions about factual information and deliberately repeating obviously unshared information. When leaders do not hold the full set of information or are as competent (in their area of expertise) as are other group members in their areas of expertise, *participative leadership* (Vroom & Jago, 1988) is more bene ficial to high-quality decision-making than directive leadership (Larson et al., 1998b). The use of *memory aids* by individual group members for verifying their information or the use of *group documentation* alongside discussions help to structure the decision-making task thereby facilitating information management (Sawyer, 2004). Through *rank ordering* of all available alternatives it is ensured that none of the decisional options is overlooked during group discussion (Hollingshead, 1996a). *Critical norms* (opposed to *consensus norms*, Postmes et al., 2001) reduce a group's negotiation focus and diminish the group members' tendency to unduly rely on social validation on the cost of factual validity when evaluating information individually. Furthermore, critical norms reduce a group's negotiation focus and they direct group discussions toward fact finding by promoting independence and critical thought (cf. *counterfactual mind sets*, Galinsky & Kray, 2004). A group's negotiation focus and discussion bias can also be reduced by *dual task structuring*, that is, the decision task is divided into two subtasks and groups are instructed to gather all information as accurately and

completely as possible *and* to make a group decision (Brodbeck, Kerschreiter, Mojzisch, & Schulz-Hardt, 2003).

High-Cost Interventions

High-cost interventions mainly target characteristics of the group and organizational context of group decision-making, by group composition, by developing cross-disciplinary units or multi-expert teams, by division of the decision task across different sub-units, or by implementing group decision support systems (GDSS). Although this renders them more costly than the interventions described above, they should have a higher individual impact on group decision quality because each of them addresses a larger proportion of the mechanisms specified in our model than low-cost interventions.

The multiple effects authentic *dissent* (Brodbeck et al., 2002; Schulz- Hardt et al., 2005) has on information processing asymmetries have been described above. Establishing authentic dissent requires knowledge of the distribution of individual preferences about the decisional matter and respective group composition prior to discussion. Once established, it is also likely to result in prolonged group discussion, lower cohesiveness and conflict in natural groups (cf. Jehn, Northcraft, & Neale, 1999; Williams & O'Reilly, 1998) which increases the propensity of disengagement from the task, the group, or both. Such negative effects of diversity can be counteracted by either loyalty among team members (Dooley & Fryxell, 1999) or by a shared identity (van Knippenberg & Haslam, 2003), which promotes the understanding that the team is a team because its diversity (e.g., in perspectives, opinions, backgrounds, knowledge) allows it to perform well. Authentic dissent also requires social competencies of individual group members (e.g., for the constructive resolution of conflict) and stress resistance (e.g., to effective ly cope with the negative emotions involved when a minority position is consistently upheld against a majority).

In the case of multidisciplinary or cross- functional groups, it is necessary to invest in the development of *transactive memory systems* which require working together on a regular

basis over a longer period of time (Stasser et al., 1995). This allows group members to develop meta-knowledge about each others` expertise, strengths and weaknesses and their skill to arouse and retrieve the other group members' expertise and knowledge effectively during group decision-making. Recently, measures for evaluating the extent to which natural groups in organizations possess effective transactive memory systems have been developed and were found to relate positively to measures of performance (Austin, 2003; Lewis, 2003). For the process of multi-expert group discussion, Stasser and Birchmeier (2003) have argued that the best results in terms of decision quality are obtained when each group member focuses on the domain of his or her expertise while contributing information. *Task structuring* (Brodbeck et al., 2003) requires a sub-unit to sample and document the decision relevant information and then relay it to another agent for decision-making (an individual or a group). For regular or very important decisions in organizations, such divisional structures are already established. This requires administrative and organizational investments, and from the perspective of the model presented here, still requires each member of the decision-making sub- unit to study the sum total of information. Finally, the use of *group decision support systems* (GDSS) seems to improve group decision quality only when substantial training in group decision-making in general and in the use of the GDSS in particular is provided (Lam & Schaubroeck, 2000). This seems to ensure that several of the mechanisms identified in our model are indeed addressed by the support functions GDSS offers. Other studies of GDSS, which for a variety of reasons addressed only one or two of the mechanisms described in our model, report no positive effects of GDSS on group decision quality (Dennis, 1996; Hollingshead, 1996b; McLeod, Baron, Wieghner Marti, & Yoon, 1997).

No evidence has been published so far which shows that when information is fully shared or a manifest profile exists, interventions that protect against hidden profiles actually reduce group decision quality. However, we concur with Galinsky and Kray (2004), who posit that additional research is necessary to ascertain that negative effects of particular

interventions on decision quality under conditions other than hidden profiles can be identified and avoided.

Finally, our model also reminds practitioners to stay realistic in their expectations regarding the potential benefits of group decision-making for decision quality. Although nothing is known yet about how widespread hidden profiles are in various decision contexts, it is highly plausible that manifest profiles occur more often than hidden profiles, because for a hidden profile all group members' information subsets have to be a rather untypical sample of the whole group's information set. Thus, for most decision problems groups should not even have a theoretical chance to systematically outperform individuals or social voting schemes. Furthermore, if the situation allows for such systematic gains in decision quality, the "normal" asymmetries in how information is processed during group discussion work against realizing this potential. Hence, it is rather the exception than the rule for groups to really outperform their individual counterparts – and our model offers some instruments for making such exceptions more frequent.

Since its introduction into the literature about 20 years ago, the acknowledgement of information distribution in the form of manifest and hidden profiles has stimulated a lot of experimental research and theorizing in the domain of group decision-making. We think that it is now time to encourage the practical application of these ideas via applied research about knowledge sharing, decision-making and innovation. They appear fruitful for the development of tools to improve group discussion and decision quality under conditions of distributed knowledge. Our review of empirical studies and the information asymmetries model of group decision-making, together with its implications for research and practice, are intended to provide a framework on which future research can build on.

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FIGURE 1

The Information Asymmetries Model of Group Decision Making

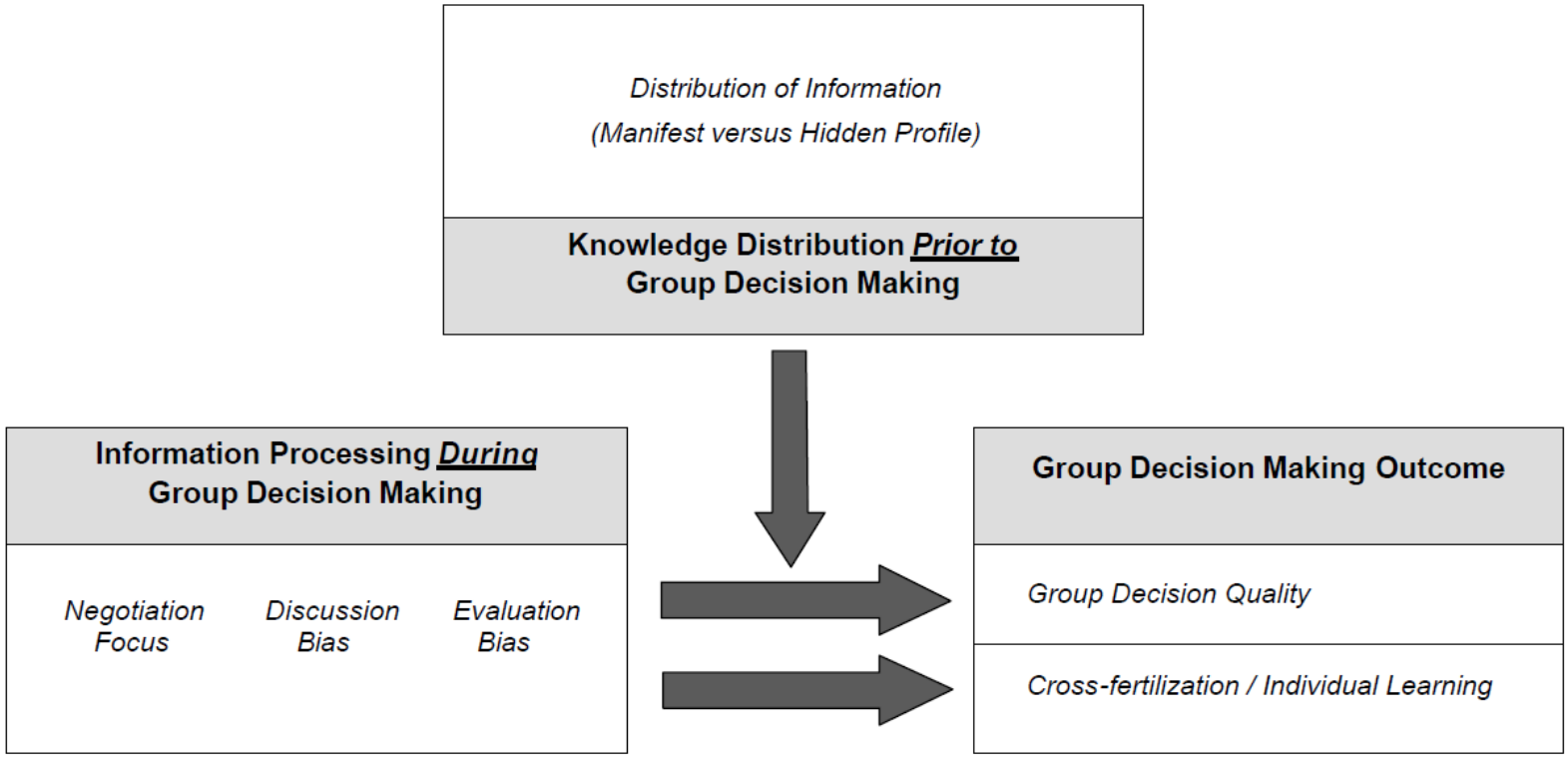

FIGURE 2

Likelihood of Groups Outperforming Individuals and Social Voting Schemes on Decision Quality

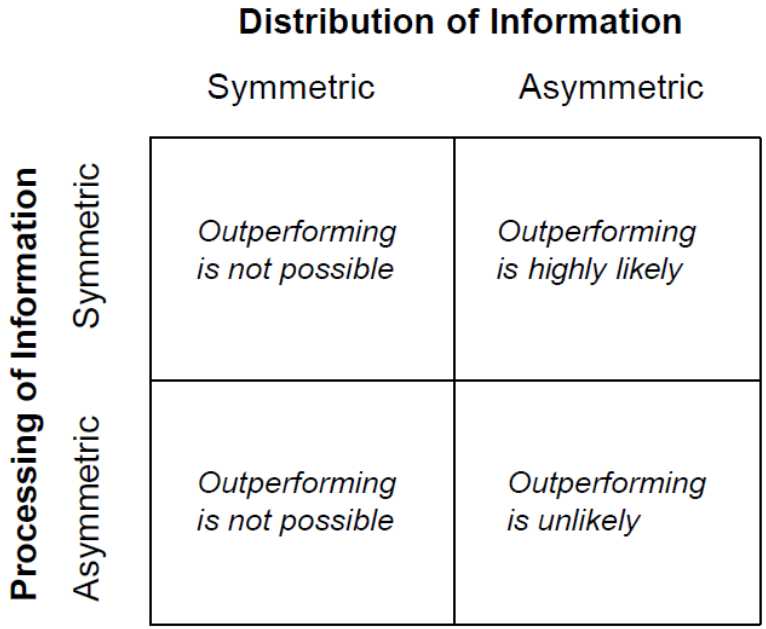

FIGURE 3

Asymmetries in Information Processing During Group Decision Making