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Small Group Research 2007; 38; 437
DOI: 10.1177/1046496407301974

The online version of this article can be found at:
http://sgr.sagepub.com/cgi/content/abstract/38/3/437

Published by:
SAGE Publications
http://www.sagepublications.com

Small Group Research
Volume 38 Number 3
June 2007 437-468

10.1177/1046496407301974
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How to Improve Decision Making in Small Groups

Effects of Dissent and Training Interventions

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Decision-making groups are often biased in favor of shared information (sharedness bias) and in favor of its members' initial preferences (preference bias). The present experiment aimed at analyzing both biases at the group level (communication of information and preferences) and at the individual level (evaluation of information) simultaneously. Two interventions were evaluated, each focusing on one of the two biases and illustrating it with a group exercise. The interventions enhanced the amount of discussed information and reduced the preference bias but had no effects on decision quality. Dissent (diversity in members' initial preferences) enhanced the preference bias in information exchange but reduced both biases in information evaluation and improved decision quality when no intervention was applied. Decision quality correlated with individual-level processes but not with group-level processes.

Keywords: *biased information sampling; dissent; group decision making; hidden profile; preference consistency*

Decision making in small groups is especially useful under two circumstances: (a) Each group member has relevant unshared (i.e., unique) information, and (b) the optimal decision can only be identified

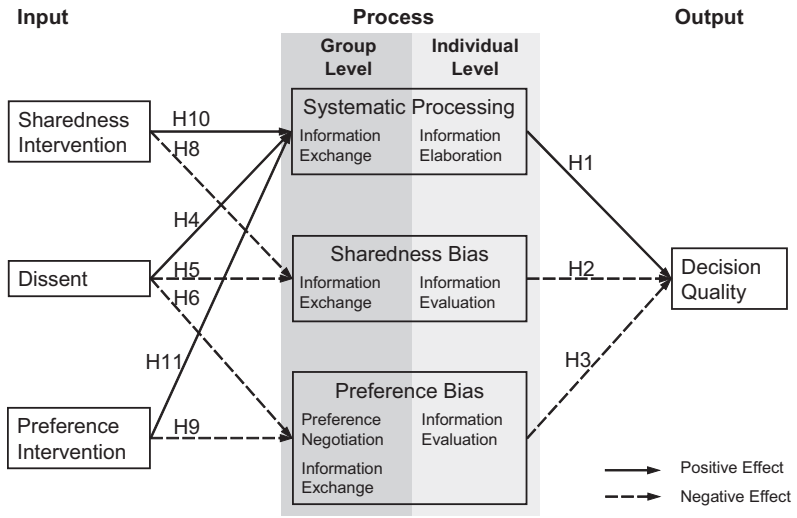
Author's Note: An earlier version of this article was presented on July 28, 2006, at the First Annual Conference of the Interdisciplinary Network for Group Research (INGRoup), Pittsburgh, PA. This study would not have been possible without the help of Cathleen Bache, Daniela Hausstein, Franziska Jentsch, Juliane Lindner, and Katharina Pilz. They provided and implemented valuable ideas for the design and the development of the material, and they acquired research participants and performed the experiments. I am very grateful to them for their commitment and support. Thanks are also due to Wolfgang Scholl, Katja Corcoran, Alena Erke, Joann Keyton, and Gwen Wittenbaum who helped to improve this article by providing valuable feedback. Please address correspondence to Ulrich Klocke, Institute of Psychology, Humboldt University of Berlin, Rudower Chaussee 18, D–10099, Berlin.

by an integration of this information. Under these circumstances, groups have the potential to produce a better outcome than if one simply aggregates individual predecisions. Groups can produce this better outcome by exchanging the unshared information of each group member and making the decision on the basis of all information (shared and initially unshared). In an organizational context, a common example of this situation is a project team of different experts who are supposed to find a solution on a complex and distinctive problem (e.g., to develop a new product line or to introduce new software). In the laboratory, this is called a hidden profile task. Here, groups often do not go beyond a simple aggregation of their initial preferences (Stasser & Titus, 1985). The article analyzes some processes which might be responsible for this deficit. Whereas previous studies focused either on processes at the group level or on processes at the individual level, this study analyzes both levels simultaneously. In addition, the way in which decision making in groups might be improved is investigated: Can dissent (i.e., diverse initial preferences) help groups to reduce defective decision processes and find the best solution? Is it also possible to improve decision making by informing group members about the defective processes and instructing them to avoid these processes? In comparable interventions of previous studies, group members often only received information passively. In the interventions here, group members were also actively engaged in a group exercise aimed at demonstrating the effectiveness or ineffectiveness of specific processes.

Reasons for Defective Decision Making in Groups

There are several reasons why groups often do not make the best decision even if they have enough information (see Figure 1; for reviews see Brodbeck, Kerschreiter, Mojzisch, & Schulz-Hardt, in press; Mojzisch & Schulz-Hardt, 2006; Wittenbaum, Hollingshead, & Botero, 2004). First, groups might fail to process the available information systematically. Second, groups might be prone to two processing biases: (a) a bias in favor of shared information and (b) a bias in favor of members' initial preferences. Systematic processing and both biases do not only occur at the group level (i.e., during discussion of information and preferred solutions). They are also relevant at the individual level (i.e., in the information processing of each single group member).

Figure 1
Theoretical Model of Group Decision Making



Failure of Systematic Processing

The higher the amount of relevant information that groups process, the higher the quality of their decisions. In an analysis of historical cases of decision making, Peterson, Owens, Tetlock, Fan, and Martorana (1998) showed that top management teams who were more open to external information (intellectual flexibility) made higher quality decisions. Tasa and Whyte (2005) studied business students who worked together on a business simulation task. They found a positive relationship between vigilant problem solving and group performance. Vigilant problem solving was measured by external observers of group interaction and included identification of goals, generation of alternatives, accuracy of information processing, and consideration of benefits and risks. Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, and Frey (2006) demonstrated that groups who introduced and repeated more information in the discussion had a higher likelihood of discovering the correct solution in a hidden profile task. Thus, there is evidence at the group level that more systematic processing of information results in higher quality decisions. However, to integrate discussed information into the decision, this information has to be perceived, understood,

and recalled at a later time by the individual group members. Thus, the following hypothesis could be derived:

Hypothesis 1: Decision quality in hidden profile situations is enhanced by systematic processing of information with regard to (a) information exchange in the group and (b) information elaboration of individual members (see Figure 1).

Sharedness Bias

The proportion of group members who have specific information before discussion is related to the impact of this information on the subsequent group decision (Gigone & Hastie, 1993, 1997; Stasser & Titus, 1985). Often, this is explained at the group level by a sharedness bias in information exchange: Groups communicate predominantly about information, which all or most group members share before entering the discussion, and neglect unshared information, which only one or few members have initially (Larson, Christensen, Franz, & Abbott, 1998; Stasser, Taylor, & Hanna, 1989; Wittenbaum, 1998). This relative neglect of unshared information in group discussion is predominantly a probabilistic phenomenon and was first discussed by Stasser and Titus in their biased sampling model of discussion (Stasser et al., 1989; Stasser & Titus, 1985, 1987): If the individual likelihood of remembering and introducing one piece of information is equal for unshared and shared information, shared information has a higher probability of being mentioned in group discussion because it can be remembered by more members. However, in hidden profile tasks, only the integration of unshared information ensures higher quality decisions by groups compared to individuals. Thus, some studies have shown that decision quality is unrelated to the introduction of shared information (Devine, 1999; Galinsky & Kray, 2004; Larson, Christensen et al., 1998) but positively related to the introduction of unshared information (Galinsky & Kray, 2004; Larson, Christensen et al., 1998; Winquist & Larson, 1998).

However, other studies did not find a positive relationship between the introduction of unshared information and decision quality (Devine, 1999; Lavery, Franz, Winquist, & Larson, 1999). This might indicate that group-level processing can not sufficiently explain the failures of groups to uncover hidden profile situations. And indeed, Wittenbaum, Hubbell, and Zuckerman (1999) found evidence that group members individually judge shared information as more important, relevant, accurate, and influential than unshared information (see also Greitemeyer & Schulz-Hardt, 2003; Greitemeyer, Schulz-Hardt, & Frey, 2003). This bias seems to have two

reasons: First, shared information can be confirmed by more than one group member (social validation; Greitemeyer & Schulz-Hardt, 2003). Second, individuals evaluate their own information as more valid than information from other members (ownership bias; Van Swol, Savadori, & Sniezek, 2003). Thus, unshared information, even if mentioned in the discussion, is not seriously considered by other group members and therefore has less impact on the final decision than shared information. Taken together, the following hypothesis could be derived:

Hypothesis 2: Decision quality in hidden profile situations is reduced by the sharedness bias with regard to (a) information exchange in the group and (b) information evaluation of individual members (see Figure 1).

Preference Bias

Even when all information necessary to identify the correct solution is exchanged during discussion, individual group members often stick to their initially preferred wrong solution (Greitemeyer & Schulz-Hardt, 2003). People bias their information processing to favor an initially preferred alternative (Brownstein, 2003). Other studies show the same phenomenon at the group level: Group decisions can often be predicted by the initial preferences of its members (e.g., Gigone & Hastie, 1997; Lavery et al., 1999; Stasser & Titus, 1985). If a majority favors a certain alternative before the discussion, the group seldom decides to chose another alternative (Gigone & Hastie, 1997). Thus, frequently, group discussions are superfluous, and groups would be better off using a decision shortcut like an immediate vote or an averaging procedure. This strong effect of initial preferences, even when they are wrong, on the final group decision might be because of three different subprocesses. Two are at the group level: (a) a direct negotiation about members' preferences and (b) a bias in information exchange favoring initial preferences. The third is (c) a related bias in information evaluation at the individual level.

With regard to subprocess (a), Gigone and Hastie (1993) analyzed discussions about the grades of fictitious students. Nearly always, members expressed their individual preferences early in the decision process. When the member preferences were in agreement, often no information was exchanged. Mojzisch and Schulz-Hardt (2005) showed that preference negotiation is detrimental for decision quality: A feedback of the preferences of the other group members was sufficient to reduce decision quality in a hidden profile task.

Preference consistent information exchange—subprocess (b)—is a tendency to bias communication of information in favor of the initially preferred alternative. Dennis (1996) demonstrated this tendency in that members of decision groups introduced more unique information that supported their initial preference than neutral or opposing information. In addition, Wittenbaum, Bowman, and Hollingshead (2003) showed that group members spin up (i.e., make appear more positive) information about their favored decision alternative and spin down (i.e., make appear less positive) information about nonpreferred alternatives.

The preference bias occurs at the individual level as well—subprocess (c): New information that supports an initial preference is rated as more relevant and credible than information that undermines an initial preference (Edwards & Smith, 1996; Greitemeyer & Schulz-Hardt, 2003; Lord, Ross, & Lepper, 1979). This evaluation bias mediates the effect of the initial individual preference on the final individual decision after a group discussion and is sufficient to impair a person's ability to solve a hidden profile task (Greitemeyer & Schulz-Hardt, 2003).

Hypothesis 3: Decision quality in hidden profile situations is reduced by the preference bias with regard to (a) preference negotiation, (b) information exchange in the group, and (c) information evaluation by individual members (see Figure 1).

Effects of Dissent on Decision Making

There is evidence at the group level and at the individual level that dissent—a confrontation with opinions that deviate from one's own opinion—can have promotional effects on decision making. At the group level, early field studies analyzed the effects of groupthink, a tendency for concurrence seeking that effectively suppresses the expression of dissent (Janis, 1982). They found evidence that groupthink can have detrimental effects on group decisions (Janis, 1982; Peterson et al., 1998; Tetlock, Peterson, McGuire, & Chang, 1992). Correspondingly, laboratory and field experiments demonstrated that encouraging group members to express divergent opinions openly before reaching an agreement promotes information exchange and problem-solving performance (see Johnson & Johnson, 1989). In recent group laboratory experiments with hidden profile tasks, the composition of groups, in terms of its members' initial preferences, was directly manipulated. These experiments showed that dissent (compared to consent) enhances decision-making quality (Brodbeck, Kerschreiter, Mojzisch, Frey,

& Schulz-Hardt, 2002), even when no group member favors the correct solution before the discussion (Schulz-Hardt et al., 2006). This effect was mediated predominantly by more systematic processing of information but also by less biased processing of information (Schulz-Hardt et al., 2006). Specifically, dissent led to the introduction and repetition of more information (see also Parks & Nelson, 1999) and to a more balanced discussion of shared and unshared and preference-consistent and inconsistent information. Not analyzed but also possible is an additional mediation of the effect of dissent by reduced preference negotiation. If the group members recognize divergent preferences of other members, they might be less prone to an early direct expression of their own preference than if they agree with the other members.

In addition to these group-level effects, it is likely that the positive effect of dissent on group decision quality is mediated by more systematic and less biased processing at the individual level. There is evidence for more systematic processing by individuals after being exposed to divergent opinions (see Johnson & Johnson, 1989). One factor that mobilizes systematic processing is surprise or a deviation from expectancy (Fiske, 1995; Petty, Fleming, Priester, & Feinstein, 2001; Petty & Wegener, 1999). Usually, divergent opinions are unexpected and therefore cause surprise and mobilize cognitive resources to explain the unexpected event (for exceptions, see David & Turner, 2001). In addition, it has been demonstrated that dissent, especially when articulated by a consistent minority, promotes divergent thinking, a variable related to unbiased processing (see Nemeth & Nemeth-Brown, 2003).

Thus, in this study, the following regarding dissent was hypothesized:

Hypothesis 4: Enhances systematic processing with regard to information exchange in the group and information elaboration of individual members.

Hypothesis 5: Reduces the sharedness bias with regard to information exchange in the group and information evaluation of individual members.

Hypothesis 6: Reduces the preference bias with regard to preference negotiation and information exchange in the group and information evaluation by individual members.

Hypothesis 7: Enhances decision quality in hidden profile situations (see Figure 1).

However, in an organizational context, it is not always possible to realize authentic dissent in decision-making groups. Therefore, it might be necessary to design interventions as a substitute for dissent when group members' preferences are homogeneous.

Group Interventions to Improve Decision Making

Because of the identification of the difficulties groups have with sharing distributed information and integrating it into their decisions, many group researchers have tried to find interventions that enable groups to effectively handle hidden profile situations (see Brodbeck et al., in press; Wittenbaum & Stasser, 1996). However, a lot of interventions have not been successful in enhancing group decision quality (Greitemeyer, Schulz-Hardt, Brodbeck, & Frey, 2006; Mennecke, 1997; Stewart, Billings, & Stasser, 1998). Decision quality has been successfully enhanced by the following interventions: (a) inducing critical norms by having groups discuss a policy proposal that virtually all participants disapproved (Postmes, Spears, & Cihangir, 2001), (b) priming counterfactual mind-sets (Galinsky & Kray, 2004), (c) implementing a transactive memory system by an explicit expert role assignment (Stasser, Stewart, & Wittenbaum, 1995), and (d) instructing the groups to create a rank order of all decision alternatives (enhanced decision quality in face-to-face groups but not in virtual groups; Hollingshead, 1996).

In this study, two interventions that directly inform participants about the defective processes in group decision making were investigated. One intervention was labeled *sharedness intervention* and provided a comprehensive explanation of the sharedness bias. The other intervention was labeled *preference intervention* and provided a comprehensive explanation of the preference bias. Both interventions were aimed at enhancing systematic processing.

There are similar interventions aimed at preventing defective processes by means of direct instruction. Some authors instructed group members to avoid mentioning their preferences in the first part of the discussion and concentrate instead on recalling and pooling all relevant information (Larson, Christensen et al., 1998; Mennecke, 1997; Stasser et al., 1989). The results of these interventions were mixed. The exchange of shared and unshared information was enhanced in all three studies. Decision quality could only be improved in the study by Larson, Christensen, et al. (1998) but not in Mennecke's (1997) study, and it was not analyzed in the study by Stasser et al. (1989). Larson, Foster-Fishman, and Keys (1994) developed a group decision training program: Group members were requested to first plan a strategy on how to proceed in the decision process. They were informed about three frequent mistakes in group decisions: adoption of the first discussed solution, an uncritical adoption of new solutions, and the neglect of important information. Afterwards, strategies were suggested to overcome

these mistakes, which were illustrated in a 4-min videotape of an optimal group decision process. This training enhanced the discussion of shared and unshared information. Decision quality could not be analyzed because there was no one best solution.

The mixed results of previous interventions suggest that a mere instruction to participants to prevent defective processes is not always enough to improve quality of group decisions. An instructional sequence should always provide learners with opportunities to be active by practicing the material being learned (Smith & Ragan, 1999). It might be useful to let people experience the defective processes by themselves before explaining the importance of preventing them. Therefore, in this study, the instructions were enriched with a group exercise to demonstrate the possible defective processes in group decision making. In addition, each of the processes was illustrated with a real-life example of a joint decision with friends. Finally, although previous interventions focused on group-level processes such as the discussion of information and preferences, there is evidence that individual-level processes such as biased information evaluation also interfere with group decision making (see above). Thus, the intervention used in this study demonstrated individual-level processes as well.

It was assumed that the sharedness intervention reduces the sharedness bias (Hypothesis 8) and that the preference intervention reduces the preference bias (Hypothesis 9), both at group and individual level (see Figure 1). Furthermore, it was assumed that both interventions enhance systematic processing at group and individual level (Hypothesis 10 and Hypothesis 11). All of these favorable effects of the new interventions on decision processes together can be supposed to promote decision quality as well (Hypothesis 12).

Aims of This Study

The aim of this study was to simultaneously analyze the effects of dissent and the two group interventions on processes and quality of group decision making in hidden profile situations. It was supposed to replicate the favorable effects of dissent (Hypothesis 4 to Hypothesis 7) from recent studies (Brodbeck et al., 2002; Schulz-Hardt et al., 2006) and to investigate whether the created group interventions have similarly favorable effects as dissent (Hypothesis 8 to Hypothesis 12). In addition, the study should explore which of the supposed processes are most important in explaining the quality of group decisions (Hypothesis 1 to Hypothesis 3). Until now, most research focused on group-level explanations of group decision quality.

The effects of individual-level processes have been analyzed only for individual decisions in a fictitious group context (Greitemeyer & Schulz-Hardt, 2003). So one general aim of this study was to compare the effects of the different individual-level and group-level processes on group decision quality in real interacting groups.

Method

Participants and Design

The study analyzed 90 participants divided into 30 groups of three members. All members within a group knew each other in advance. All participants had at least a high school degree (German, *Realschulabschluss*). Ninety-three percent of participants were university students (41% of them with a psychology major, and the others with very different subjects of study). Forty-nine percent were female, and 51% male. The mean age was 24.0 years (SD = 2.8 years). The experiment was advertised as an assessment center exercise. Participants were told that the best groups would enter a draw for 100 €. Eighteen percent participated as a requirement of being an undergraduate psychology student.

Two independent variables were manipulated between groups in a 2 × 3 design with five groups in each cell: (a) dissent versus consent (i.e., heterogeneous vs. homogeneous decision preferences) and (b) two interventions aimed at reducing the defective processes and a control condition.

Procedure

Each experimental session was led by one of five female experimenters. The groups were assigned to the experimental conditions in a random way with the exception of controlling for sex composition and experimenter. After a short introduction, the participants were asked to go to separate places and answer the prequestionnaire. Following this, the intervention manipulation was administered. Subsequently, the groups performed a hidden profile decision-making task and then answered the postquestionnaire. The postquestionnaire included an unexpected free recall task of all information given in the hidden profile task. Finally, they were thanked for their participation and received some information about assessment centers and given an e-mail address where they could ask for information about the purpose and the results of the experiment. In total, the experiment lasted for approximately 2 hrs.

Group task. The decision-making task from Schulz-Hardt et al. (2006) was used with some modifications (see below). The participants played the role of members of a personnel selection committee of an airline company. Together in the group, they had to select a pilot for long-distance flights from four different candidates named A, B, C and D. Each candidate was described by 10 attributes; thus, together there were 40 attributes. Eighteen attributes were positive, 21 were negative, and 1 was neutral. Schulz-Hardt et al. had pretested the attributes and selected the ones that were unambiguously positive or negative (they had no neutral attribute) and of comparable importance and strength. Given the full information set (see Table 1), usually candidate C was identified as the best candidate because he or she had the most positive and the least negative attributes. However, the total information was distributed over the three group members in such a way that usually C could not be identified by means of the information of one individual member. The task was a hidden profile task because negative information about C was shared between all members and each piece of positive information about C was unshared (i.e., owned by only one member).

Before the task, the experimenter emphasized that there was one best solution. To motivate participants, it was stressed that the detection of the correct solution is an indicator of the ability to work in teams, which is valued highly in assessment centers, and they were reminded of the drawing for 100 € among the successful groups. Then, the instructions for the task were read aloud and afterwards also given to participants. The participants were informed that all information came from reliable sources and was randomly assigned to group members. They were told that some information was shared and some unshared without specifying further. After the instruction, the participants were given 10 mins to read their individual information sheets about the candidates and evaluate them. Following this, they had 10 mins to memorize the information because they were not allowed to take the sheets into the group discussion. Subsequently, they were asked to sit at the same table and decide within 30 mins as a group which candidate to select. They were allowed to use paper and pencil.

Manipulation of dissent versus consent. In the consent condition, the information was distributed in such a way that all three members were likely to prefer the same suboptimal candidate (A) on the basis of their individual information (see Table 1). In the dissent condition, the information was distributed in such a way that all three members were likely to prefer a different suboptimal candidate (A, B, or D). To improve this manipulation of decision preferences by means of the individual information, 5 of the 40

Table 1
Distribution of Information in the Hidden Profile Task

	Candidates							
	A		B		C		D	
	Shared	Unshared	Shared	Unshared	Shared	Unshared	Shared	Unshared
Consent condition (full information available to the group)								
Positive	4	0	1	3	0[a]	6[a]	1	3
Neutral	0	0	0	0	1[a]	0[a]	0	0
Negative	0	6	3	3	3[a]	0[a]	3	3
Consent condition (information available to each individual → preference for A)								
Positive	4[a]	0[a]	1	1	0	2	1	1
Neutral	0[a]	0[a]	0	0	1	0	0	0
Negative	0[a]	2[a]	3	1	3	0	3	1
Dissent condition (full information available to the group)								
Positive	2	2	2	2	0[a]	6[a]	2	2
Neutral	0	0	0	0	1[a]	0[a]	0	0
Negative	2	4	2	4	3[a]	0[a]	2	4
Dissent condition (information available to member X → preference for D)								
Positive	2	0	2	0	0	2	2[a]	2[a]
Neutral	0	0	0	0	1	0	0[a]	0[a]
Negative	2	2	2	2	3	0	2[a]	0[a]
Dissent condition (information available to member Y → preference for A)								
Positive	2[a]	2[a]	2	0	0	2	2	0
Neutral	0[a]	0[a]	0	0	1	0	0	0
Negative	2[a]	0[a]	2	2	3	0	2	2
Dissent condition (information available to member Z → Preference for B)								
Positive	2	0	2[a]	2[a]	0	2	2	0
Neutral	0	0	0[a]	0[a]	1	0	0	0
Negative	2	2	2[a]	0[a]	3	0	2	2

Note: In each condition, the full information included four positive and six negative attributes for candidate A, B and D, and six positive, one neutral, and three negative attributes for candidate C.
[a]The candidate who was supposed to be preferred by the information distribution.

attributes (Schulz-Hardt et al., 2006) were reallocated to another candidate, and 5 were exchanged with new attributes.

Manipulation of the interventions. Two different interventions were compared with a control condition. In both interventions, the procedure was

the same but with a different content. First, participants were requested to solve a jigsaw puzzle together in the group. To complete the puzzle, 21 pieces were needed from which a red house could be constructed (12 pieces) on a blue background (9 pieces) with the help of a draft. The aim of the puzzle was to demonstrate the effectiveness or ineffectiveness of certain strategies that were comparable to strategies in group decision making (see below). Second, individual participants were provided with a written explanation that was read aloud to the group by the experimenter. In this explanation, the analogy of the puzzle with group decision making was made. Afterwards, a familiar example of a group decision was presented: the decision of where to spend one's next vacation together with two friends. The defective processes in group decision making were illustrated with this example. Participants were requested to prevent these processes in the subsequent decision task and to focus on appropriate strategies. Finally, they were asked to read the explanation again individually at separate places and to recall comparable situations from their own experience to ensure the internalization of the acquired knowledge.

In the sharedness intervention, group members had racks in front of them which contained pieces of the puzzle and could not be seen by the other members. Ten of the pieces were available on more than one rack (shared pieces), and 11 were available only on one rack (unshared pieces). Participants were requested to keep their pieces on their rack when they were not using them in the group puzzle. The pieces were labeled according to ownership. The aim of the puzzle was to demonstrate the higher importance of the unshared pieces. In the following explanation, the importance of the unshared pieces was highlighted, and the analogy to unshared information in decision making was made. The reasons for neglecting unshared information in group decisions were explained using the vacation example: For example, the group was asked to imagine that every member knows that Gran Canaria has long sandy beaches, but only one member knows that it is also suitable for hiking. It was proposed to be more likely that the group talks about the beaches and that this information seems more credible and important than the hiking information. The intervention finished with an explicit request to focus on introducing new information in the following group decision.

In the preference intervention, at first, each participant had to solve the jigsaw puzzle individually at a separate place. The individual puzzles were identical with the exception that the house puzzle had a different color for each member (red, green, or yellow). Afterwards, group members were requested to solve the same puzzle in the group. They were provided with

the 9 pieces of the blue background and 72 pieces in six different colors, the three colors of the individual puzzles (12 red, 12 green, and 12 yellow) and three new ones (12 pink, 12 white, and 12 orange). They were informed that the house should be in one color but not which color the successful solution had. The only color by which the puzzle could be completed successfully was a new one (pink). The aim of the puzzle was to demonstrate the impact of an initially preferred solution on problem solving. In the following explanation, the importance to deviate sometimes from one's initially preferred solution was highlighted and the analogy to an initial preference in a group decision was made. The different consequences of initial preferences for group decisions were illustrated using the vacation example: Participants were asked to imagine that they preferred La Gomera over Gran Canaria. Then, for example, it was proposed to be more likely that they judge new positive information with regard to La Gomera (nice beaches) as credible and important than new positive information with regard to Gran Canaria (suitable for hiking). The intervention finished with a request not to introduce preferences but focus instead on pooling information without a preference bias.

In the control condition, the same jigsaw puzzle was to be solved in the group. It was introduced as a training session for group problem solving. Everybody had access to all pieces. There were no shared versus unshared or superfluous pieces. No subsequent clarifications were given.

Measures

Group-level processes were assessed by two psychology students who observed the group communication on videotapes. Before the analysis, both observers were trained by test observations and clarifications of contradicting codings. Each group discussion was coded by one observer with the exception of nine group discussions. On the basis of the double-coded discussions, unadjusted intraclass correlations (ICC_u) were calculated as measures for interrater reliabilities (see below). The six experimental conditions were equally distributed over the observers who were blind to conditions and hypotheses. The expression of a certain piece of information was coded if a specific attribute was correctly assigned to a certain candidate or when another member indicated that he or she has the same information just mentioned by the last speaker. The assignment had to be explicit or by context (because the candidate was the last one mentioned in discussion). The first expression of a piece of information was coded as introduction; all further expressions were coded as repetitions. The expression of the same piece of

information twice was only coded again when expressed by another member or when another expression was coded in between. Incorrectly assigned attributes were coded as confusion, separately for each candidate and for positive versus negative attributes.

Individual-level processes were assessed by a questionnaire after the group decision, which included a request to recall as much information as possible about the four candidates. On the basis of the individually recalled information from 24 participants, unadjusted intraclass correlations (ICC_u) were calculated as measures for interrater reliabilities (see below). All analyses except for the reliability analyses were carried out at the group level to cope with the problem of nonindependence within groups (Kenny, Kashy, & Bolger, 1998; Kenny, Mannetti, Pierro, Livi, & Kashy, 2002). This means that individual-level scores were averaged within groups.

Possible covariates and confounding variables. In a prequestionnaire, participants were asked about their familiarity with the two other group members (two 5-point Likert-type scales), about their expectation of the quality of teamwork with each other member (two 5-point Likert-type scales), about their sex, age, average grade in their university entrance exam (German, *Abitur*), major subject of study, and semester. After the participants read their individual information for the group decision, they were requested to evaluate the aptitude of the four candidates on 7-point scales and to select their favorite candidate.

Perceived dissent. To check the success of the dissent manipulation, after the group decision, participants were asked which candidate the other members initially preferred. On the basis of these perceived preferences and each participant's own preference, the amount of perceived preference heterogeneity was determined (no heterogeneity, minority dissent, full heterogeneity). In addition, participants were asked about their perception of disagreement in the group on two items with 5-point Likert-type scales: "During discussion, different opinions emerged" and "During discussion, we quickly agreed" (reversed). Perceived dissent was calculated as the average of perceived preference heterogeneity and two questions regarding perceived disagreement (Cronbach's $\alpha = .69$).

Systematic processing. At the group level, the amount of different pieces of information introduced in the discussion ($ICC_u = .85$) was taken as a measure for systematic processing. Only information which actually was contained in the information set given to the groups was counted. At the

individual level, the amount of information recalled after discussion (ICC_u = .99) was measured individually. For each piece of information that was incorrectly recalled, one point was subtracted from the score.

Sharedness bias. Because of the correlational pattern between the three indicators of the sharedness bias, this bias was not split into group-level and individual-level indicators but rather into actual sharedness bias and motive for sharedness bias. The actual sharedness bias was calculated as an average of two *z*-standardized indicators: the repetition bias in favor of shared information (ICC_u = .84) and the recall bias in favor of shared information (ICC_u = .98) as both indicators correlated at r = .57, (p < .001). The repetition bias in favor of shared information was calculated using the same procedure as Schulz-Hardt et al. (2006) used: The repetition rate of shared information was divided by the sum of the repetition rate of shared information and the repetition rate of unshared information. An introduction bias in favor of shared information was not calculated because participants did not know before the discussion whether a piece of information was shared or unshared. The recall bias in favor of shared information was calculated as the proportion of recalled shared information to all recalled information. The motive for sharedness bias was measured with three items in the postquestionnaire on 5-point Likert-type scales (Cronbach α = .60). The items started with "during discussion" and ended with "it was important to me to confirm arguments mentioned by other members," "I felt validated by the information of the others," and "I tried to back up the majority opinion in the group with arguments."

Preference bias. At the group level, preference negotiation and preference-consistent information exchange were assessed. Preference negotiation (ICC_u = .88) was measured as the average of two *z*-standardized indicators. The first was the proportion of explicit evaluations of the candidates to all expressions (evaluations and information). An explicit evaluation was coded when participants expressed a general preference for or rejection of a certain candidate. The second indicator measured how early in the discussion preferences were negotiated: For all members, the number of information pieces mentioned in the group was counted before they expressed their first evaluation. This indicator was reversed because high scores indicated low preference negotiation, and its logarithm was used because its skewness was 1.87. Both indicators correlated at r = .35 (p < .10). Preference-consistent information exchange (ICC_u = .89) was measured as the proportion of mentioned preference-consistent information to all

mentioned evaluative (i.e., positive or negative) information (including confusions). Preference-consistent information contained positive attributes of the preferred candidate or negative attributes of the nonpreferred candidates. At the individual level, preference-consistent information evaluation was measured as the average of two *z*-standardized scores: the proportion of recalled preference-consistent information to all recalled evaluative information ($ICC_u = .98$) and the motive for preference bias; both indicators correlated at $r = .62$ ($p < .001$). The motive for preference bias was measured using four items from the postquestionnaire on 5-point Likert-type scales (Cronbach $\alpha = .62$). The items started with "during discussion" and ended with "I was convinced of my initial choice to be correct," "I considered it superfluous to continue gathering information after we preferred the same candidate," "I considered information against my favorite candidate to be convincing," (reversed), and "I changed my opinion in the face of new arguments" (reversed).

Decision quality. After the groups jointly selected a candidate, they were asked also to rank the three remaining candidates according to their aptitude. Decision quality was assessed as the reversed rank position of the correct candidate (i.e., first position = 3, second position = 2, third position = 1, fourth position = 0). Because this variable had a very skewed distribution (skewness = –1.58), it was transformed using the formula suggested by Tabachnik and Fidell (1989). After transformation, skewness was an acceptable –0.42.

Results

Covariates

Nine percent of the participants initially preferred the correct candidate C. Therefore, the relative initial preference for the correct candidate was included in the analyses as a covariate or partialled out in the correlation analyses. This variable was calculated as the evaluation of candidate C minus the average evaluations of the other candidates. To reduce error variance, the following variables were also included as covariates or partialled out: age, average grade of university entrance exam, proportion of female group members, proportion of undergraduate psychology members, and expected quality of teamwork. However, these variables were only included if their effects on the dependent variable were at least of medium size ($\eta^2 > .06$ or $r \geq .30$).

Preliminary Analyses

Distributions. All variables except decision quality (see above) were normally distributed (all p values in the Kolmogorov-Smirnov tests > .613), not skewed (skewness < 0.40) and had no outliers ($M \pm -3\ SD$). In the analyses of covariance, there were no multivariate outliers (all Cook's distances < .50).

Manipulation checks. The manipulation of the initial preference for a certain candidate was successful for 88% of the participants. To check if the manipulation of preferences also influenced the perception of disagreement by the participants, a univariate analysis of covariance was performed with perceived dissent as dependent variable and dissent versus consent and intervention as independent variables. As expected, in the dissent condition, much more dissent was perceived than in the consent condition, $F(1, 21) = 73.81$, $\eta^2 = .78$, $p < .001$. In addition, both interventions lead to more perceived dissent than the control condition, $F(2, 21) = 4.56$, $\eta^2 = .30$, $p < .05$; contrast between sharedness intervention and control condition: $F(1, 13) = 7.15$, $\eta^2 = .36$, $p < .05$, contrast between preference intervention and control condition: $F(1, 13) = 6.77$, $\eta^2 = .34$, $p < .05$. Thus, it seems that independent of preference heterogeneity, a sensitization for defective group processes stimulated the expression and/or awareness of different opinions. The interaction between dissent and intervention was not significant, $F(2, 21) = 1.26$, $\eta^2 = .11$, $p > .30$.

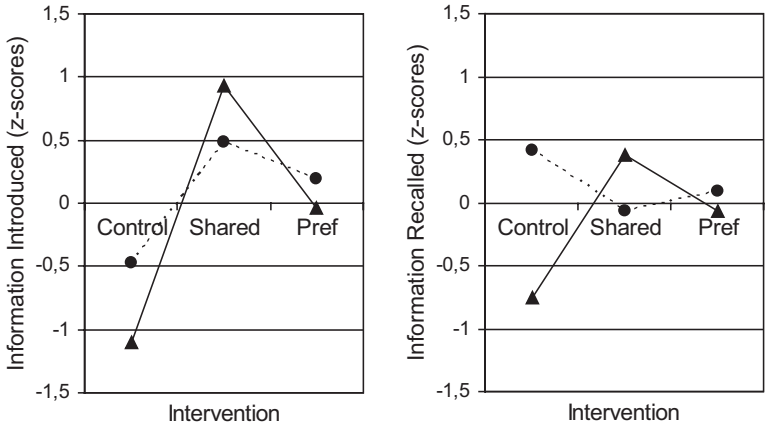
Confounding variables. The independent variables were not confounded ($p > .10$) with average grade of university entrance exam, age, proportion of undergraduate psychology students, familiarity of group members, proportion of proponents for the correct candidate C, sex composition, or experimenter.

Descriptive and Experimental Results

Separate univariate analyses of covariance were calculated with dissent versus consent and intervention as independent variables and the process variables as well as decision quality as dependent variables.

Systematic processing. With regard to systematic processing at the group level, groups introduced 25.3 ($SD = 4.5$) of the 40 available pieces of information on average into the discussion. A large main effect of intervention emerged (see Figure 2). In agreement with H10 and H11, planned contrasts showed that both interventions enhanced the number of different information pieces

Figure 2
Systematic Processing as a Function of Dissent and Intervention



	Information Introduced			Information Recalled		
Source of Variance	***df***	***F***	**η²**	***df***	***F***	**η²**
Dissent ▲ vs. Consent ●	1, 22	0.19	.01	1, 22	0.82	.04
Intervention	2, 22	6.71	*** .38	2, 22	0.34	.03
Dissent x Intervention	2, 22	0.88	.07	2, 22	2.06	.16

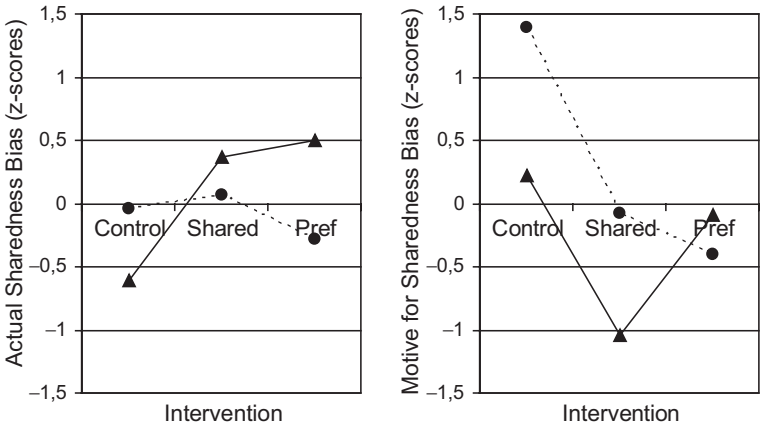
***$p < .01$.

compared to the control condition, $F(1, 14) = 17.57$, $\eta^2 = .56$, $p < .001$ for the sharedness intervention and $F(1, 14) = 4.44$, $\eta^2 = .24$, one-tailed $p < .05$ for the preference intervention. Contrary to Hypothesis 4, there was no significant main effect of dissent versus consent and also no interaction effect of dissent and intervention.

With regard to systematic processing at the individual level, on average each group member correctly recalled 11.5 ($SD = 4.2$) of 40 available information pieces after the discussion. Contrary to Hypothesis 4, Hypothesis 10, and Hypothesis 11, in the ANCOVA, no significant effects emerged.

Sharedness bias. It could be demonstrated that shared information was preferred on the group level and on the individual level. Both indicators of

Figure 3
Sharedness Bias as a Function of Dissent and Intervention



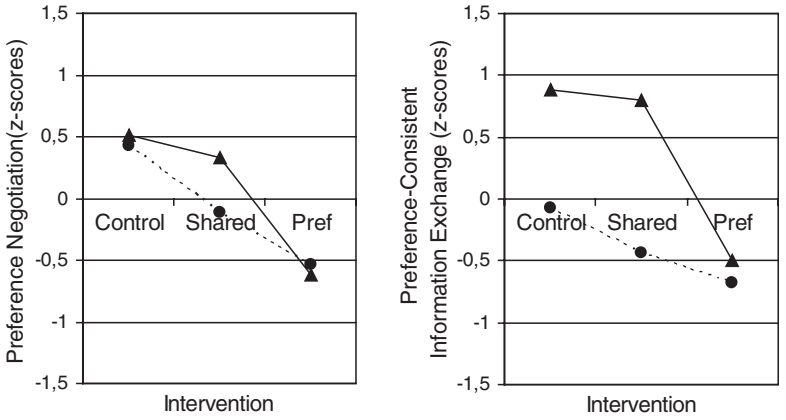
	Actual Sharedness Bias			Motive for Sharedness Bias		
Source of Variance	***df***	***F***	**η̂**	***df***	***F***	**η̂**
Dissent ▲ vs. Consent ●	1, 22	0.30	.01	1, 21	5.01	** .19
Intervention	2, 22	1.04	.09	2, 21	7.91	*** .43
Dissent x Intervention	2, 22	1.55	.12	2, 21	2.93	* .22

*$p < .10$. **$p < .05$. ***$p < .01$.

actual sharedness bias were clearly different from a balanced score: The average repetition bias in favor of shared information was .63 (SD = .08), which was significantly different from .50, $t(29) = 9.09$, $p < .001$. The average proportion of recalled information that was shared was 61% (SD = 8%), which was significantly different from 40%, $t(29) = 13.52$, $p < .001$. Contrary to Hypothesis 5 and Hypothesis 8, there were no significant experimental effects on the actual sharedness bias (see Figure 3).

On average, participants agreed on the items measuring the motive for sharedness bias to a medium extent ($M = 3.2$, $SD = 0.5$). A huge main effect of intervention emerged. In support of Hypothesis 8, planned contrasts showed that both interventions reduced the motive for sharedness bias compared to the control condition, $F(1, 13) = 12.17$, $\eta^2 = .48$, $p < .01$ for the

Figure 4
Preference Bias at Group Level as a Function of Dissent and Intervention



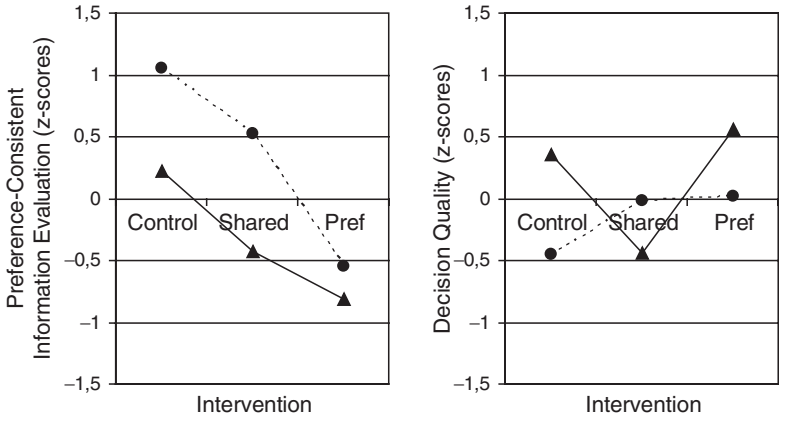
	Preference Negotiation			Preference-Consistent Information Exchange		
Source of Variance	***df***	***F***	**η²**	***df***	***F***	**η²**
Dissent ▲ vs. Consent ●	1, 23	0.21	.01	1, 21	7.74	** .27
Intervention	2, 23	2.76	* .23	2, 21	4.62	** .31
Dissent x Intervention	2, 23	0.22	.02	2, 21	1.22	.10

Note: *$p < .10$. **$p < .05$.

sharedness intervention and $F(1, 13) = 9.68$, $\eta^2 = .43$, $p < .01$ for the preference intervention. In line with Hypothesis 5, dissent also reduced the motive for sharedness bias. The effect of dissent was qualified by a marginally significant interaction with the intervention condition: It only emerged in the control and the sharedness intervention condition.

Preference bias. With regard to the preference bias at group level, preference negotiation and preference-consistent information exchange were analyzed. Two indicators of preference negotiation were assessed: The average proportion of explicit evaluations of the candidates to all expressions was 16% (SD = 8%). The average number of information pieces

Figure 5
Preference Bias at Individual Level and Decision Quality as a Function of Dissent and Intervention

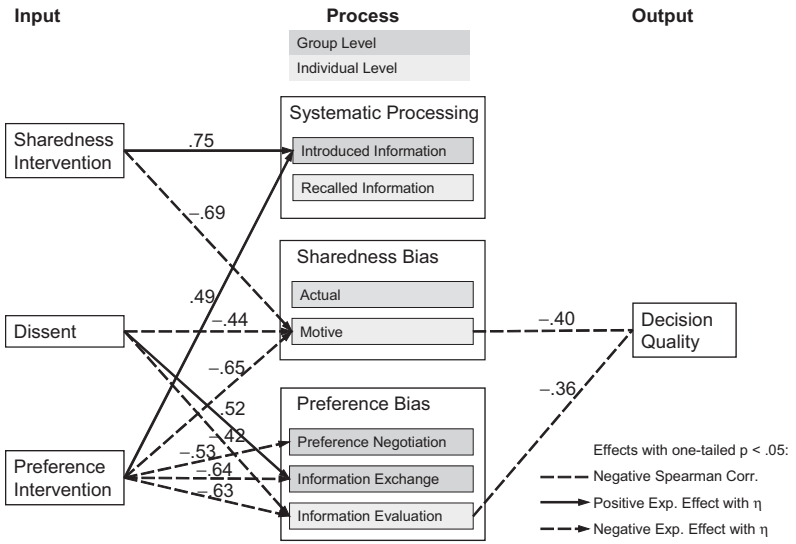


	Preference-Consistent Information Evaluation			Decision Quality		
Source of Variance	***df***	***F***	**η²**	***df***	***F***	**η²**
Dissent —▲— vs. Consent --●--	1, 23	5.01	** .18	1, 21	0.81	.04
Intervention	2, 23	6.32	*** .36	2, 21	0.82	.07
Dissent x Intervention	2, 23	0.50	.04	2, 21	1.04	.09

**$p < .05$. ***$p < .01$.

mentioned in the group before the members expressed their first evaluation was 27.1 (SD = 39.5). Preference negotiation was influenced ($p < .10$) by the intervention applied before the group discussion (see Figure 4). In support of Hypothesis 9, it was reduced only by the preference intervention, which differed significantly from the control condition in a planned contrast, $F(1, 15) = 6.02$, $\eta^2 = .29$, $p < .05$. Contrary to Hypothesis 6, neither dissent nor the interaction of dissent and intervention had an impact on preference negotiation. Sixty percent (SD = 4.2) of total evaluative information mentioned was preference consistent. Also supporting Hypothesis 9, preference-consistent information exchange was clearly reduced by the preference intervention, $F(1, 13) = 8.86$, $\eta^2 = .41$, $p < .05$ for contrast to the control condition and $F(1, 13) = 2.26$, $\eta^2 = .15$, one-tailed $p < .10$ for contrast to the sharedness intervention. Contrary to Hypothesis 6, dissent enhanced

Figure 6
Correlational and Experimental Results



preference-consistent information exchange. No significant interaction effect emerged.

With regard to the preference bias at the individual level, two indicators were aggregated to assess preference-consistent information evaluation. The average proportion of recalled evaluative information that was preference consistent was 54% (*SD* = 6%). On average, participants endorsed the items measuring the motive for preference bias to a less than medium extent ($M = 2.6$, $SD = 0.6$). Supporting Hypothesis 9, also preference-consistent information evaluation was strongly reduced by the preference intervention (see Figure 5), $F(1, 15) = 9.82$, $\eta^2 = .40$, $p < .01$ for contrast to the control condition and $F(1, 15) = 5.40$, $\eta^2 = .27$, $p < .05$ for contrast to the sharedness intervention. In agreement with Hypothesis 6, the assumed reduction of preference-consistent information evaluation by dissent also emerged. No interaction effect was found.

Decision quality. The best candidate (C) was identified by 57% of the groups. The average rank position was 1.5 ($SD = 0.7$). In the analysis of

covariance, no significant general effects were found (see Figure 5). However, to have an adequate comparison with the analysis of Schulz-Hardt et al. (2006), a planned contrast between dissent and consent was analyzed within the control condition. This contrast showed that in the dissent condition, decision quality was higher, one-tailed $p < .10$, $F(1, 6) = 3.64$, $\eta^2 = .38$. Thus, Hypothesis 7, but not Hypothesis 12, could partially be supported.

Correlational Analyses

Spearman correlations were calculated between decision quality and the seven process variables. As expected, the motive for sharedness bias and the preference bias in information evaluation correlated negatively with decision quality (see Figure 6). All other correlations were below .10. Thus, Hypothesis 2 and Hypothesis 3, but not Hypothesis 1, could partially be supported.

Discussion

When people are supposed to make a decision in a group, they are prone to two biases: They favor information that is shared among its members over information that is unique to one member (sharedness bias), and their communication and evaluation of information are influenced by their initial preferences (preference bias). Therefore, it is of high interest for the design of teamwork in organizations to identify strategies that reduce these biases to improve the quality of group decisions. This study tested the effectiveness of diverse initial preferences (dissent) and of two interventions that are aimed at directly reducing each of the two biases and enhancing systematic processing of information. Whereas other studies focused either on group-level processes (communication) or on individual-level processes (recall or evaluation), this study analyzed both biases and systematic processing at the group level and at the individual level. Its results are summarized in Figure 6.

Effects of Dissent

An interesting finding is that dissent had opposite effects on the preference bias at the individual level and at the group level: On the one hand, and as expected, it reduced the preference bias in individual information evaluation. On the other hand, and unexpectedly, it enhanced the preference bias

in information exchange during discussion. This contradicts the result of Schulz-Hardt et al. (2006) who found that dissent reduced the repetition bias in favor of preference-consistent information. However, it is in line with a study by Kerschreiter, Schulz-Hardt, and Frey (2005) who informed their participants about the preferences of a fictitious discussion partner. Participants who were informed about a deviating preference (dissent) were more biased in their information exchange than participants who were informed about a corresponding preference (consent). Possibly, these inconclusive results can be explained by different dissent intensities. In the study by Schulz-Hardt et al. (2006), the information distribution was the same in the consent and in the dissent conditions. Different preferences did not emerge on the basis of a different distribution of positive and negative attributes over the four candidates (like in this study) but on the basis of idiosyncratic evaluations of the attributes. Thus, it is likely that the preference of one candidate over the others was comparatively small. When people do not have a strong commitment to their preference, dissent might lead to a more balanced exchange of information because it reduces the confidence in the individual predecision (Schulz-Hardt, Frey, Lüthgens, & Moscovici, 2000). But when people are more convinced of their initial preference, dissent might enhance discussion bias: Group members selectively mention preference-consistent information to convince the other group members that their own predecision is correct (for motivated information sharing; see also Wittenbaum et al., 2004). However, even when each individual member focuses on preference-consistent information and withholds preference-inconsistent information, dissent leads to more balanced information sampling for the group as a whole. Because more decision alternatives have a proponent in the group, it is more likely that the communicated information pro and contra each alternative is representative of the information present in the group. Therefore, each member is also confronted with preference-inconsistent information by the other members. This promotes a more balanced consideration of different information so that the preference bias in individual information evaluation is reduced by dissent in this study.

When only the control condition is considered, this study also replicates the result reported by Brodbeck et al. (2002) and Schulz-Hardt et al. (2006) that dissent promotes decision quality. Because of small sample size, this effect was only significant at a one-tailed alpha level of 10%. However, there was no general dissent effect on decision quality. Obviously, at least the sharedness intervention seems to interfere with the beneficial effects of dissent. It is possible that a strong focus on introducing new information,

which under dissent is often unshared or preference-inconsistent for the other members, is detrimental for intragroup trust. Unshared and preference-inconsistent information is perceived as less credible and less relevant (Greitemeyer et al., 2003; Greitemeyer & Schulz-Hardt, 2003), and its communicators as less competent (Wittenbaum & Bowman, 2004; Wittenbaum et al., 1999) and also may be considered less trustworthy. In field studies, however, intragroup trust was shown to be a precondition of the beneficial effects of dissent on decision quality (Dooley & Fryxell, 1999).

Effects of the Interventions

Although participants in previous interventions received instructions passively, in the present interventions, participants were actively involved in a group exercise to demonstrate each of the two biases. After the exercise, the analogy was clarified, the bias was explained in detail using a common decision example, and the participants were requested to show alternative behaviors in the following group decision.

Like previous interventions (Larson, Christensen et al., 1998; Mennecke, 1997; Stasser et al., 1989), both interventions were successful in stimulating systematic processing at the group level: Groups discussed much more different information compared to the control condition. The preference intervention especially was effective in reducing the preference bias at the group level and at the individual level: Groups focused less on negotiating about their members' preferences and more on discussing preference-inconsistent information, which was also more highly appreciated individually. The sharedness intervention was also able to reduce the individual motive to confirm other members' information and be confirmed by other members (sharedness bias). However, it was not able to reduce the actual bias to favor shared information in discussion and individual elaboration. Neither the preference nor the sharedness intervention successfully enhanced the quality of the final decision. Possible improvements of the interventions will be discussed below.

Important Processes to Improve Decision Quality

This study shows evidence for the importance of individual-level processes for group-level decisions. The decision quality only correlates negatively with the motive for sharedness bias and the preference bias in information evaluation. Predominantly, groups whose members individually

appreciated their own and others' unique information and preference-inconsistent information were able to identify the correct candidate. These results support the results of Greitemeyer and Schulz-Hardt (2003) who showed that the evaluation bias in favor of preference-consistent information is sufficient to impair people's ability to solve hidden profile tasks. However, although the study of Greitemeyer and Schulz-Hardt was limited to individual decision making in a simulated group context, this study demonstrated the detrimental effects of the individual evaluation bias on group decision making. In addition, it showed that biased evaluation of information is not a stable phenomenon but that individual differences in these biases explain differences between groups in their ability to solve hidden profile tasks. All group-level variables correlated with decision quality nonsignificantly and lower than .10. This result is in line with results from Devine (1999), Lavery et al. (1999), and Mennecke (1997) who also did not find correlations between information exchange and decision quality.

Limitations

Because of the missing correlations between the group level variables and decision quality, the question arises as to whether communication really is less important or whether crucial aspects of communication were simply not measured. Maybe the amount or proportion of certain kinds of information is less important than the strategy on how information is sampled. For example, it might be beneficial for decision quality when information is discussed in a well-ordered way, one alternative after the other, or when it is visualized for everybody. These assumptions should be analyzed in future studies about the relationships between group decision processes and decision quality. In addition, because of the small sample size, the power of the statistical analyses might have been too low to identify all existing effects in the population. Thus, it is not justified to conclude that group communication has no effect on decision quality.

Because of time restrictions for the experimental sessions, the evaluation of information was not measured separately for each piece of information. Instead, it was measured on 5-point items that summarize the evaluation of information of a certain kind (e.g., shared or preference-consistent information). In addition, biased information recall was assessed as an indirect measure of the preference bias in information evaluation. The aggregation of this indirect measure with the motive measure can be justified by a correlation of $r = .62$ between both measures.

Applications and Future Research

The interventions were clearly shown to improve decision processes in groups. It is possible that they will also improve decision quality when both interventions are combined so that the sharedness bias and the preference bias are reduced. The interventions should have a stronger emphasis on the individual appreciation of unique and preference-inconsistent information because individual-level processes are crucial for high decision quality.

In the present laboratory experiment, it was not possible to take another hidden profile task as an intervention to let the participants experience the defective processes by themselves. A positive effect of such an intervention on decision quality in the following hidden profile task could be interpreted as simple familiarity with the structure of the group task. However, in real organizational teams, the jigsaw puzzle used in this experiment could be exchanged with a real hidden profile task. The hidden profile task should have as much similarity as possible with the typical decision tasks of the teams to be trained. After the group decision, the teams should be encouraged to reflect on their decision processes. Detailed feedback about strengths and failures could be provided and combined with the clarifications and common example given in the present experiment. The evaluation of such a team training session with regard to decision quality in real organizational tasks would be an important aim for future research. However, it is difficult to identify appropriate criteria for decision quality in the field. An immediate evaluation by external observers (e.g., supervisors) is inappropriate because it is likely that suboptimal decisions in hidden profile situations can only be recognized with a temporal delay.

As alternative to a training intervention, decision-making teams could be composed of members with diverse opinions to secure a more balanced evaluation of information and thereby improve decision quality. If the relevant opinions of potential team members are unknown, then diversity with respect to functional or educational background can enhance the likelihood of diverse opinions in a decision process (Jehn, Northcraft, & Neale, 1999; Lovelace, Shapiro, & Weingart, 2001) and the range and depth of information use (Dahlin, Weingart, & Hinds, 2005). Thus, especially in teams who have to decide about issues with a high impact on the well-being of the organization or society, divergent opinions of different experts should be viewed as a valuable resource. It has to be ensured that these diverse opinions are really expressed openly, but in an objective way that is not face threatening for other members. This might be obtained by a participative leadership style (Larson, Foster-Fishman, & Franz, 1998), which can be implemented by an impartial facilitator who is only responsible for the process quality.

Conclusion

Decision making in the context of complex problems often requires the integration of knowledge from different experts. When decision quality is of high importance, the decision-making team should be composed of members with a diversity of opinions. It is true that the resulting dissent can stimulate members to bias their information exchange on the basis of their initial opinions. However, it leads to a more balanced individual evaluation of information and thereby improves decision quality. Although other studies focused on either group-level or individual-level processes of group decision making, this study analyzed both levels simultaneously. In doing so, the importance of individual-level processes was demonstrated. The individual overvaluing of shared and preference-consistent information is responsible for the failure to identify the correct decision in the group. If no dissent is present, this evaluation bias can also be reduced by two training interventions with a group exercise to demonstrate defective decision processes. However, as no intervention alone was able to enhance group decision quality, a combination of both interventions and a stronger focus on individual-level processes is recommended.

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