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The Process of Information Sharing in Small Groups: Application of a Local Model

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Members of small groups do not always mention available information, and this leads to inferior decision making. A local model of participation was applied to information sharing discussions to evaluate the extent to which task-relevant judgments are related to comments that contain unique (i.e., data that only one member knows) and shared (i.e., known to all members) information. In addition, the model was applied to only "incorrect" groups, ones that did not choose the optimal solution. Findings revealed that the local model applied to incorrect groups in the sense that shared information figured prominently in the development and maintenance of judgments. Unique comments, however, played a limited role in the process. Other findings showed that shared contributions were not associated within groups, indicating somewhat skewed rates of participation. Discussion focuses on the distribution of variance related to judgments.

Keywords: Information Sharing; Hidden Profiles; Decision Making; Participation; Social Relations Analysis

Members of small groups do not always mention the information in their possession during discussion, and the failure to mention information often results in suboptimal decision making. Scholars have invested considerable effort investigating antecedents to information exchange (see the reviews in Stasser & Titus, 2003; Wittenbaum, Hollingshead, & Botero, 2004) but have not explored the process in any detail. Evidence exists that discussion processes influence decisions to participate (Bonito, 2006). Explicating the role of process adds to our understanding of how, when, and why participants contribute information during discussion (Bonito, 2007).

The "local" model of participation is applied to the process of information sharing in small groups. The model has two primary features. First, the model is recursive in

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the sense that judgments of task-related ability influence the decision to contribute information, and the act of contributing information bolsters or enhances the perceived abilities of the contributor (Bonito, 2006, 2007). Second, the local model is developmental in the sense that distributions of judgments at the beginning of discussion are assumed to be relatively homogeneous but that discussion processes allow participants to identify more able and competent contributors. The developmental and process-based features of the model require the measurement of the type of information each participant mentions and judgments about each members' performance at multiple points during discussion (e.g., Bonito, 2006). Such a study is presented below.

In subsuming information sharing as a special case of participation, several theoretical issues become relevant. First, the local model assumes that all substantive (i.e., task-based) comments are positively related to task-related judgments. This assumption may not be true, however, of the two main substantive contributions of interest to researchers of information sharing—those that contain shared information (i.e., data given to all members) and those that contain unique or hidden information (i.e., data that only one member knows). These two types of information appear to have different effects on relevant task-related judgments (Larson, Sargis, Elstein, & Schwartz, 2002; Wittenbaum, Hubbell, & Zuckerman, 1999). Second, it is not clear if the relationship between the two types of contributions and task judgments evolves similarly over time. Third, the local model does not account for different types of "rationality" during discussion. As Winquist and Larson (1998) noted, there are at least two distinct processes that link initial information distributions (which are assumed to influence prediscussion preferences) with group outcomes. The first process privileges initial preferences over any changes to them that discussion might affect, and is characteristic of groups that fail to select the correct or most appropriate answer. The second process emphasizes the role of discussion in affecting preference shift and is common to groups that adopt the best decision. Thus, it is not certain if the model covers only processes attributable to "correct" groups. Finally, as Kenny (1994) discussed, interpersonal judgments have several different features, and it is not known how such features translate to the process of information sharing in small groups.

In what follows, the main issues underlying information sharing research are described, followed by a discussion of the local model, focusing on how the model might apply to the problem of information exchange in groups. Study methods are then presented, and in the analysis section the model as described in Bonito (2006) is applied to the discussion and judgment data collected for the current study. Finally, implications of the findings on the local model in general, and on the problem of information sharing in groups specifically, are discussed.

Information Sharing and Participation

The substantive problem is that shared information is typically discussed more frequently during discussion than unique information, and that group outcomes

suffer as a result. Stasser and Titus (1985) identified the problem, somewhat serendipitously, via a study to isolate informational and normative influences on group outcomes. To this end, they developed what has come to be known as the *hidden profile* design (for a review, see Stasser & Titus, 2003). Borrowing from persuasive arguments theory (e.g., Vinokur & Burnstein, 1978; Vinokur, Trope, & Burnstein, 1975), Stasser and Titus assumed that participants are influenced by information they do not know or have not been exposed to. The general form of the design is that (a) some information is given to all members, (b) some members are given additional information that is not given to others, and (c) the shared information points to a suboptimal decision whereas unique information usually is linked to the optimal choice. Ideally, participants begin discussion by favoring the suboptimal choice (or choices), and the mentioning of unique or hidden information moves the group toward the favored or optimal solution.

Research, however, has demonstrated that groups tend to perform poorly, largely because (a) members do not always contribute unique information, and (b) when unique information is contributed, it often fails to influence the group (Stasser & Birchmeier, 2003; Stasser & Titus, 2003). Regarding participation, Larson (1997) noted that shared information is discussed more frequently and earlier than unique information. Larson's explanation is based, to a certain extent, on the prediscussion distributions which favor shared information—all things equal, shared information is more likely to be "sampled" among all group members and contributed to discussion than unique information. Regarding unique information's inability to persuade, Wittenbaum et al. (1999) discovered that the presentation of shared information during discussion generated higher assessments of competence, knowledge, and credibility compared to the mentioning of unique information. Because all three factors are associated with persuasion (O'Keefe, 2002), it is not surprising that unique information is less persuasive. Wittenbaum et al.'s explanation highlights the notion of common ground (Clark, 1996); shared information, because it can be verified by group members as accurate and important, leads to positive assessments of competence for those who mention it. Unique information, in contrast, cannot be verified in the same way, and those who mention it do not reap the same social rewards as those frequently mentioning shared information.

Larson et al. (2002) provide a bridge to the current problem. They examined the relation between information distributions (one in which the majority of information was shared among all three members, the other where two of three members shared information and the other had only unique information), participation, and task-related judgments (including perceived influence, preparation, knowledge, and aptitude). The findings indicated that the "target" person (the one who was given only unique information) in the unique condition was rated as more influential than the target person (randomly assigned to that role, as all three members possessed equal proportions of shared and unique information) in the shared condition. More relevantly for current purposes, Larson et al. evaluated the correspondence between participation and task judgments (again, for only the targets), although they examined only the second half of discussion, as they assumed that members would

know by then the extent to which they shared information. Target members' participation (no matter how measured, e.g., in time or turns) did not significantly correlate with any of the judgments. Essentially, the only issue that mattered for task-relevant judgments across the conditions was identifying, via contributions to discussion, the extent of information sharing; actual participation had no bearing on the judgments.

There are several relevant issues in the Larson et al. (2002) study. The first is their reliance on assessments of "targets" when, in fact, participation and the assignment of task-related judgments are both interdependent. One's participation is relative to that of others (Bonito, 2002), and judgments made about one's colleagues are often related to the judgments made by other members. These issues are theoretically important and have analytical consequences, as will be noted below. Second, although perceptions of influence differed by experimental condition, Larson et al. did not evaluate contributions by information type. This is reasonable given that the target in the unique condition could only provide unique contributions, but it does not tell us how judgments are related to comments that contain shared and unique information. Third, Larson et al. did not consider the recursive and developmental relationship between judgments and participation (cf. Fisek, Berger, & Norman, 1991). Although it is reasonable to focus only on the second half of discussion, early participation may be associated with judgments. As Fisek and Ofshe (1970) and Shelly and Troyer (2001) discovered, participation becomes differentiated quickly, frequently within the first minute of discussion, and by that time is associated with judgments (Bonito, 2006).

In sum, participants mentioning shared information reap social benefits, in the form of higher task judgments, than do members mentioning unique information, but unique information does realize greater assessments of influence when it (unique information) distinguishes a participant from those with only shared information. Several theoretical, methodological, and analytical difficulties in the study, however, lend alternative interpretations to the findings. In what follows, the local model of participation is described, with focus on addressing these difficulties.

Local Management Model of Participation

Bonito (2007) argued that information sharing constitutes a special problem in participation. Drawing on several sources, including expectation states theory (Knottnerus, 1997) and O'Keefe and Lambert's (1995) model of the relation between thought and language during interaction, Bonito posited that decisions to participate are made locally, at each point where speaker exchange becomes relevant. Two processes are assumed to work serially. The first is the activation of relevant thoughts (including information), which become the basis for contributions to interaction, and the second is the decision to contribute information to discussion. Such decisions potentially are based on a variety of factors, including global ones such a status (e.g., Fisek, Berger, & Norman, 1995), but the local model is concerned with those decisions that develop over the course of discussion and that are directly the

result of interaction. The model assumes that contributions to discussion differentially affect perceptions of ability (generally in terms of moving the group to a desired outcome), and that such judgments influence both the distribution of speaking opportunities within the group, as well as the likelihood that a speaking opportunity will be taken by a given member.

The local model treats participation as an interdependent and multilevel phenomenon. The first level is at the group, such that group dynamics influence members to participate more or less in relation to the participation of their colleagues (Bonito, 2002). This dynamic is true of overall participation, as well as types of contributions, including both substantive (i.e., task-based) and nonsubstantive (e.g., procedural moves) comments. Second, at the contribution level, one's comment at any given point influences both who speaks next (Dabbs & Ruback, 1987; Parker, 1988) and the substance, at semantic or functional levels of analysis, of what is said (Bonito, 2007). Thus, one must model both an individual's participation and its relation to others' participation within the group. The third level is dyadic in the sense that contributions to discussion often occur among pairs of members (Parker, 1988), and that the patterns of participation are not isomorphic across dyads within groups.

If participation is interdependent, and judgments are related to participation, then the judgments become interdependent. Interdependence explicated in models of status-based accounts of participation (e.g., Fisek et al., 1991) is largely assumed rather than measured. The local model borrows from Kenny's (1994) model of social perception. Briefly, Kenny decomposed perception into three main components (cf. Cook & Kenny, 2004). The first is the *target effect*, which is the extent to which a set of perceivers judges a target similarly. The second is the *perceiver effect*, which describes the consistency with which one judges or evaluates a set of targets. Finally, the *relationship effect* is the unique judgments each pair of participants form of each other, above and beyond the target and perceiver effects. Crucially, the relationship effect operates as a dyad-level construct, whereas the perceiver and target effects operate at the individual level. Each component is conceptualized as a variance, and researchers are often concerned with the amount of variance accounted for by each component of the total variance in the judgments. A significant perceiver effect indicates variation across perceivers in ratings of targets—some people uniformly rate others positively, while other perceivers have poorer overall assessments of colleagues. A significant target effect indicates that some people elicit uniformly high ratings from their colleagues, whereas other targets garner lower ratings. And the relationship effect signifies that the perceptions particular to a given dyad within the group differ from those of the other possible dyads.

Reciprocity is not uncommon in social perceptions; the ratings one generates often reflect the ratings received. Reciprocity is also a multilevel phenomenon. Generalized reciprocity is an individual-level construct composed of the correlation between target and perceiver effects. Dyadic reciprocity refers to the association among ratings within the group and is analogous to the intraclass correlation of the ratings (Kenny, Kashy, & Cook, 2006).

Research Questions and Hypotheses

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The preceding leads to a set of research questions and hypotheses. The first set concerns the distribution of the variance components associated with task judgments. Kenny's (2004) review of the social relations literature suggests that perceiver and relationship variance account for the majority of variance in social perceptions. The distribution of variance components is not without consequence, as stability in perceiver variance indicates that characteristics of the perceiver influence judgments (e.g., Swann, Kwan, Polzer, & Milton, 2003), and a stable relationship effect shows that pairs of members form unique judgments of each other (Bonito, 2003).

RQ1: What is the distribution of the social relations variance components for task-related judgments?
RQ2: What is the degree of reciprocity in task-related judgments?

The second set of questions concerns the association (i.e., the intraclass correlation) of participation types within groups. As noted, the local model assumes, and research has demonstrated, that participation in general, and substantive comments specifically, are associated within groups. Research suggests that shared comments are positively associated, but it is unclear if unique comments are. For example, Wittenbaum et al. (1999) noted that shared comments beget positive judgments and that positive judgments lead to the contribution of more shared information. Unique information does not involve the same process; in fact, it often elicits lower judgments, which seem to reduce the number of unique contributions members make during discussion. This leads to the following hypothesis and research question.

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H1: Shared contributions are positively associated within groups.
RQ3: Are unique contributions associated within groups?

The third set of issues is the relation between task-related judgments and participation. Again drawing on Wittenbaum et al. (1999), the process of participation during information-sharing discussions is based largely on the relation between shared contributions and task-related judgments. It is not clear, however, what role (if any) unique contributions play in the process. In addition, it is not known how the relationships develop and change over the course of interaction. Finally, it is not known if the associations described above hold across correct and incorrect groups. As noted above, Winquist and Larson (1998) argued that shared information influences prediscussion preferences but that unique information, especially when participants persist in presenting it, influences participants during discussion. Groups are successful when the processes associated with the mentioning of unique information override those associated with the development of suboptimal, initial preferences. Turning this around a bit, the influence of unique information affects groups that successfully solve problems, whereas shared information likely plays a larger role in groups that fail to select the best or optimum choice. Thus, a local model that emphasizes the relation between shared information and task-related judgments should fit low-performing groups, and a model that emphasizes the

association between unique information and judgments should apply to high-performing teams.

H2: Task judgments are positively associated with shared contributions during discussion.
RQ4: Are task judgments and unique contributions associated during discussion?
RQ5: Do the associations between task judgments and participation types change over time?
H3: Task judgments and shared contributions are positively associated for groups that reach an incorrect answer.

Method

Overview

Participants interacted in homogeneous (with respect to gender) groups, with the interactions recorded. Prior to discussion, participants familiarized themselves with task information. Using techniques adapted from Waldron's (1997; Waldron & Cegala, 1992) discussions of stimulated recall, participants privately viewed the recording of the first minute of discussion and then rated themselves and colleagues on four survey items. Following that, participants watched the remainder of the video, and then filled out the same set of survey items.

Participants

Eighty women, mean age = 20.01 (SD = 1.35) and 40 men, mean age = 20.78 (SD = 2.38), participated in the study. Because groups were composed to be homogeneous with respect to gender, the study used 20 all-female and 10 all-male groups. Participants were recruited from an introductory communication course at a large southwestern public university. In exchange for participation, they were awarded extra course credit at their instructors' discretion.

Materials

Discussion task. Prior to interacting in groups, participants were asked to read a list of 42 character traits for three "finalists" for a hypothetical faculty position in a communication department (adapted from Larson, Foster-Fishman, & Keys, 1994; see Table 1). Included with the list was a set of characteristics of an "ideal" candidate (e.g., active researcher, strong teaching record). The candidates were named "Smith," "Martin," and "Jones." When pooled, the items as a whole were designed to point to the optimal choice, which in this case was the candidate named "Martin." The items were tested by asking 26 participants from another sample to view the whole set of information and then indicate the best choice. Twenty-three of the participants (88%) correctly identified "Martin" as the best candidate, $\chi^2(2, N = 23) = 15.38$, $p < .01$. All participants were given the same six characteristics for each candidate—these were the shared items. In addition, each participant was given six items about the candidates that were not given to the other participants (unique items). After being

Table 1 The 42 Information Items from the "Choose the Best Candidate" Task

	Trait
1	Allows 2 to 3 absences without penalty
2	Class lectures are not always helpful
3	Curves the grades
4	Does not assign term papers
5	Does not curve the grades
6	Does not offer extra credit
7	Does not show films
8	Gives a final only
9	Gives interesting lectures
10	Has experience practicing communication in the real world
11	Has good command of the English language
12	Has never taught this class before
13	Has no experience practicing communication in the real world
14	Has taught this class before
15	Is a fair teacher
16	Is always on time for class
17	Is always well-prepared for class
18	Is an easy A
19	Is an effective communicator
20	Is available to meet with students after class
21	Is between 30 and 40 years old
22	Is between 40 and 50 years old
23	Is close-minded
24	Is currently researching a new area in communication
25	Is famous in communication
26	Is not available to meet with students outside of class
27	Is not currently doing research in communication
28	Is often late to class
29	Is often not well-prepared for class
30	Is very knowledgeable about the course topic
31	Is well-organized
32	Never brings outside speakers to lecture
33	Offers extra credit
34	Provides opportunities for in-class discussion
35	Requires class attendance
36	Seldom provides opportunities for in-class discussion
37	Shows films during class time
38	Shows interest in student progress
39	Takes time to answer student questions
40	Uses essay tests
41	Uses multiple choice tests only
42	Usually assigns term papers

given time to review the list, participants were then asked to identify the most qualified candidate.

Survey instrument. The survey instrument used in this study contained the items for the dyadic variables, where participants were asked to rate themselves and their colleagues on each item. Dyadic variables form the basis for analysis within Kenny's (1994) social relations model. Four items derived from Gouran's (2003) discussion of

small group discussion skills were contained in the instrument. The items were "[Target] contributed a fair amount of useful information," "[Target] seemed to understand the problem very well," "[Target] could tell a lot about the problem from the information given" and "[Target] summarized the arguments to help the group reach a decision." All items were presented as seven-point Likert-statements, with "strongly disagree" and "strongly agree" as the poles.

Procedure

Participants signed up for time slots via the internet. Group assignments were restricted by same-sex conditions; males could sign up for some time slots, females for others. Openings were filled on a "first come, first served" basis and e-mail reminders of the meeting dates were sent 24 hours in advance.

A research assistant greeted participants as they arrived at the laboratory. As soon as the four people arrived, the research assistant asked them to move to a room that contained four computer stations arranged such that participants could not see one another's computer screens. Each of the four participants sat at a computer station; all instructions, survey items, and digital video of the interaction (see below) were presented via computer. Participants were told they would be reading a list of character traits for potential job candidates and would be expected to discuss those traits in the group.

Respondents then read the descriptions of the three job candidates and privately chose their preferred candidate. If a participant completed this task before the others, he or she was asked to wait quietly for the others to finish. Upon completion of the prediscussion instrument, participants were taken as a group into a second room. This room had a circular table with four individual cameras (each containing its own microphone) mounted at the center of the table. Name cards identifying each participant by his or her first name were placed in front of the corresponding person.

Participants were told they "might" have received different information regarding the candidates. They were asked to discuss the information and come to a consensus as to which job candidate would be the best for the faculty position. They were told that once the group reached a consensus they should call the research assistant back into the room.

The researcher began recording the group and left the room. Once the recording was started, participants were asked to begin the discussion. After the group reached consensus, the recording was stopped and the participants were escorted back into the second room with the separate computer stations. They were asked to return to their original seats and to continue on with a set of survey instruments (results from which were not reported in this paper).

Once the survey instruments had been completed, participants were presented with another set of instructions that informed them they were about to watch a video of the discussion in which they had just participated. The participants were told that they would be shown only the first minute of the video and that they should try to remember what they thought of the interaction and of their colleagues during that first minute. Upon the conclusion of that part of the video, participants were

presented with the items, described above, and asked to rate each of the colleagues, as well as themselves, on those items. To aid in identification of each participant, the video was split into four quadrants, one for each of the participants. Because of the placement of the cameras, each participant was able to see the faces of all four participants, with the participants' names captioned at the bottom of each quadrant. After completing the survey items, participants were asked to watch the remainder of the interaction, and to try to remember what they thought of the interaction and the participants at discussion's end. When the video finished playing, participants were presented with the same set of items as that presented after the first minute of the video. After completing the items, participants were debriefed, thanked for their participation in the study, encouraged to ask questions, and then dismissed.

3 surveys: pre, post 1 (short), post 2 (full)

Variables

Time. For the purpose of this study, time was analyzed at two points: after the first minute of the interaction and at the end of the discussion. The choice to take a measurement at the first minute of discussion was based on a set of studies (Bonito, 2006; Fisek & Ofshe, 1970; Shelly & Troyer, 2001) that showed participation hierarchies develop quickly, often within the first minute, in putatively homogeneous discussion groups. As described above, after the discussion was completed, participants were asked to view the first minute of the discussion and then evaluate the other members of the group (Time 1). They then viewed the remainder of the discussion, after which they evaluated their colleagues (Time 2).

Task-related judgments. The responses from the postinteraction survey items, in which participants rated themselves and colleagues on four separate questions at two different time periods, were used to form the variables. Traditional means of establishing scale reliability are problematic because of the correlated nature of the responses within groups, as well as the multilevel nature of the variance components. Furthermore, instead of a single reliability estimate as is typical for traditional designs, a social relations model has multiple estimates, as each of the variance components has a separate covariance matrix for the set of scale items. Bonito and Kenny (2007) have developed a means of estimating reliability for social relations designs. A thorough description of the logic and the presentation of the formulas are beyond the scope of this paper. However, each reliability estimate may be thought of as the ratio of the covariance among the items to variance of the items (which, of course, is true of traditional reliability estimates), with the caveat that in some cases the denominator contains not only random error, but also systematic variance attributable to unique relationships within the group and reciprocity (all of which is weighted by group size).[1]

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reliability diff. w/ grps

Using the formulas presented in Bonito and Kenny (2007), reliabilities for the scale at Time 1 were .713, .663, and .836 for the perceiver, target, and relationship effects, respectively. At Time 2, the estimates for the perceiver, target, and relationship effects were .694, .561, and .796, respectively. The estimate for the target effect at Time 2 is of some concern. However, it is important to note that group size directly affects reliability, but that the number of groups does not, at least not directly. This is, in

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part, a consequence of round-robin designs on reliability estimates for small groups. The means for our measure of task judgments were 5.25 ($SD = .93$) and 5.72 ($SD = .75$) at T1 and T2, respectively.

There is some concern regarding the validity of the measure. Two issues are relevant, the first of which concerns the relatively short interval of discussion between the measurements ($M = 6.49$ minutes, $SD = 2.45$). Kenny (2004) has observed that personality judgments begin to stabilize fairly quickly, often after the target performs 10 acts, and level off at approximately 30 acts. Our data reveal that the mean number of contributions per person is 7.92 ($SD = 9.25$) and 30.76 ($SD = 23.18$) at Time 1 and Time 2, respectively. Moreover, a multilevel analysis (nesting participants within groups and with a random intercept) of the perceiver effect reveals that the ratings do differ at the two time periods, $t(210) = 4.09$, $p < .01$. Taken together, it is plausible that the relatively short interval between measurement points is sufficient for participants to distinguish themselves via their contributions, and that this manifests itself as changes in the perceiver effect for task judgments.

The second issue concerns whether participants are able to make accurate judgments one minute into discussion given the relatively low number of contributions made during that time. There is evidence that people make, under certain conditions, accurate interpersonal judgments at zero acquaintance (Levesque & Kenny, 1993). Participants can make accurate or useful judgments one minute into discussion based on scant behavioral evidence. In addition, previous research (Bonito, 2006; Fisek & Ofshe, 1970; Shelly & Troyer, 2001) has indicated that members of homogeneous groups do develop differentiated rates of participation early in discussion. This finding is generally taken to indicate the rapid development of perceptions relative to participation, at least in some cases and for some groups.

Discussion variables. The discussion data were transcribed by an undergraduate research assistant, and then checked for accuracy by the second author. The data were first segmented into thought units (Folger, Hewes, & Poole, 1984). Two graduate student coders were given a set of data from a prior study (that used the same task) on which to train. Following that, the coders segmented approximately 10% of the study data with acceptable reliability, with U (Guetzkow, 1950) = .002 (where lower numbers, those approaching zero, are indicative of reliable unitization). Disagreement was resolved through discussion. The discussion data were then divided equally between the two coders for them to segment independently.

Discussion content was coded into three categories. Shared comments contained information that was provided to all participants in the prediscussion task, whereas unique comments contained information that was given to only one participant in the prediscussion task. Finally, the remainder was coded as nonsubstantive (Weiner & Goodenough, 1977). The two coders first trained on data from a previous study (in which the same task was used) then coded independently a set of unitized data (approximately 10% of the study data) that resulted from the segmentation process. The outcome from this first pass at coding proved unsuccessful. The coders and the lead author met to discuss the disagreements, and the coders were given another set of unitized data to categorize. This resulted in acceptable reliability, with Cohen's

kappa = .83. Finally, the coders categorized the remaining discussion independently, each working on approximately half of the data.

Analysis and Results

Group Performance

The hidden profile worked largely as intended, as 27 of the groups started discussion with members disagreeing on which candidate was best suited for the position. Oddly, three of the groups began discussion unanimously favoring the "correct" candidate, but none of the three chose the candidate at discussion's end. Overall, groups in this study performed poorly, with only seven identifying the "best" candidate.

Research Questions 1 and 2

The first two research questions address the distribution of the variances components for the task judgments. Kenny's (1994) SOREMO program was used to estimate the variance components. Although the absolute variances were tested, it is common practice to report the relative variance components. As is evident in Table 2, all of the variances across all of the groups are significant at $p < .05$, one-tailed—variances technically cannot be negative (although it is possible with some estimation methods, most notably maximum likelihood). In all, the distribution of the variances looks very much like those in Kenny's (2004) survey of social relations research—perceiver variance was large relative to target and relationship variance. In addition, the variance components across incorrect and correct groups are significant, all but one with $ps < .05$, the remaining estimate with $p < .10$.

Correlations

Correlations among the discussion variables and the social relations estimates of the task judgments are presented in Table 3. We used group mean deviated data to estimate the correlations; as a result, degrees of freedom are $N - g - 1$ for the test of

Table 2 Variance Components from the Social Relations Analysis of the Task Judgments

	Perceiver	Target	Relationship	Stable construct variance
All groups ($N = 30$)				
T1	.298***	.176***	.189***	0.663
T2	.317***	.123***	.201***	0.641
Correct groups ($N = 7$)				
T1	.250**	.143*	.254**	0.647
T2	.293**	.099**	.159***	0.552
Incorrect groups ($N = 23$)				
T1	.313***	.187***	.169***	0.668
T2	.323**	.129***	.211***	0.663

Note: $df = g - 1$.
*$p < .10$, **$p < .05$, ***$p < .01$.

Table 3 Correlations for the Group Mean Deviated Variables

	1	2	3	4	5	6	7	8
All groups ($N=120$)								
1. Perceiver effect (T1)	—	.24**	.02	.00	.75***	.11	.06	-.03
2. Target effect (T1)		—	.48***	.39***	.21**	.71***	.21**	.16
3. Shared comments (T1)			—	.40***	.11	.23**	.05	.08
4. Unique comments (T1)				—	.09	.22**	-.03	-.02
5. Perceiver effect (T2)					—	.25**	.12	.06
6. Target effect (T2)						—	.39***	.32***
7. Shared comments (T2)							—	.28***
8. Unique comments (T2)								—
Correct groups ($N=28$)								
1. Perceiver effect (T1)	—	.31	.20	.35	.64***	-.03	-.07	-.16
2. Target effect (T1)		—	.53**	.31	.24	.58***	.06	.12
3. Shared comments (T1)			—	.33	.08	-.04	.01	-.37*
4. Unique comments (T1)				—	.10	.06	-.04	-.39*
5. Perceiver effect (T2)					—	.22	.15	-.03
6. Target effect (T2)						—	.41*	.23
7. Shared comments (T2)							—	.30
8. Unique comments (T2)								—
Incorrect groups ($N=92$)								
1. Perceiver effect (T1)	—	.22*	-.03	-.12	.78***	.15	.10	.01
2. Target effect (T1)		—	.46***	.41***	.21*	.74***	.25*	.17
3. Shared comments (T1)			—	.42	.11	.29**	.06	.20*
4. Unique comments (T1)				—	.09	.27**	-.03	.10
5. Perceiver effect (T2)					—	.26**	.12	.09
6. Target effect (T2)						—	.38	.35
7. Shared comments (T2)							—	.28
8. Unique comments (T2)								—

Note: Data are group mean deviated. $df=N-g-1$.
*$p<.10$, **$p<.05$, ***$p<.01$.

significance, where g is the number of groups. As is evident for all groups, the target effect at Time 1 was positively associated with both shared and unique comments at that time; the same pattern was true of the variables measured at Time 2. Thus, this pattern of correlations is consistent with the local model. The pattern, however, does not directly address the recursive nature of the model; that issue is examined below.

Research Question 2

The second research question asked if task judgments were reciprocal within groups. Reciprocity of task-related judgments is, as noted, a multilevel construct. Generalized reciprocity (which is at the individual level) is assessed as the correlation between perceiver and target effects. As is evident in Table 3, the correlations for all groups were significant at both time periods. Thus, the ratings one provided were associated with those he or she received from the rest of the group. For correct groups, the correlations were not significant at either time period, but they were significant at both time periods for the incorrect groups. (Differences in statistical power, however,

can account for these findings.) Dyadic reciprocity is a covariance, and is provided in SOREMO's output. In short, none of the dyadic correlations was significant across all of the groups, or within the incorrect and correct groups. Thus, reciprocity for these groups was at the individual level of analysis, and was not different across dyads within groups.

Hypothesis 1 and Research Question 3

The first hypothesis predicted that shared contributions are associated within groups, whereas the third research question asked if unique contributions were associated within groups. We computed the intraclass correlations for the discussion data with the so-called "unconditional model" (i.e., which is similar to a one-way ANOVA with group as the predictor and a random intercept) in SAS Proc Mixed (Singer, 1998; cf. Gonzalez & Griffin, 2002, and Young & Bhandary, 1998). Kashy and Kenny (2000) recommend a relatively liberal significance criterion of .20 for the assessment of intraclass correlations because such tests are typically underpowered. None of the interclass correlations, all of which were less than .06, was significant at Time 1 for any of the groups (i.e., all groups, correct, and incorrect groups). At Time 2, however, the intraclass correlation for unique comments for all groups ($\rho_I = .21$, $p < .05$), correct groups ($\rho_I = .33$, $p < .10$), and incorrect groups ($\rho_I = .18$, $p < .10$) were significant. In contrast, shared contributions were associated within all groups ($\rho_I = .18$, $p < .10$) and correct groups ($\rho_I = .38$, $p < .10$), but not incorrect groups ($\rho_I = .07$, $p > .20$). Thus, it appears that members of correct groups mirror each other's participation, whereas this is generally not true of incorrect groups.

Hypotheses 2 and 3, and Research Questions 4 and 5

The remaining research questions and hypotheses are concerned with the relation between task judgments and participation, and they were evaluated by fitting the local model to the discussion data. The local model is depicted graphically in Figure 1 (see Bonito, 2006); the model also includes the autoregressions from the variables at T1 to their respective counterparts at T2. In addition, the direct effects of the participation variables at T1 on judgments at T1 were evaluated. The model was used to assess its fit on the data from incorrect groups—there were not enough correct

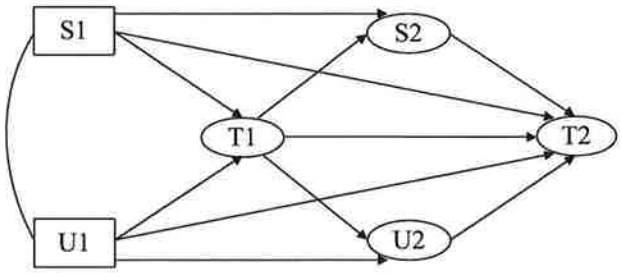

Figure 1 Full model for the path analyses. S = shared contributions, U = unique contributions, and T = the target effect. The numbers refer to the time when the measurements were taken.

groups to warrant a similar analysis for them. SAS Proc Calis was used on group mean deviated data, with degrees of freedom again $= N - g - 1$. For the analyses only the target component for the task judgments was included, which corresponds to the adjusted ratings one receives from a set of raters.

The analysis strategy was to begin by comparing the theoretical model to all groups in the study. Following that, the model was applied separately to the incorrect groups. The test for all groups revealed that the model did not fit the data well, $\chi^2(3, N = 120) = 9.61$, $p < .05$. Several residuals were near 3, and the NNFI (.80) was below acceptable limits. None of the autoregression paths for the participation variables was significant, and neither were the paths from the participation variables at T1 to task judgments at T2. Although the beta matrix indicated the model could be improved by adding a path from unique comments at T2 to shared comments at T2, the modification process was started by removing the nonsignificant paths (see Hatcher, 1994). That model too did not fit the data well, as the model chi-square, $\chi^2(7, N = 120) = 14.42$, $p < .05$ was significant, and the largest residual (for shared and unique comments at T2) was near 3. For the final modification, a path was added from unique to shared comments at T2. The third model fit the data well, with the model chi-square, $\chi^2(5, N = 120) = 7.68$, $p > .17$. The CFI, NNFI, and NFI were .98, .95, and .96, respectively, and all residuals were less than 2. The path from task judgments at time one to shared comments at Time 2, however, was not significant in the final model. The test of the difference between the two model chi-squares was significant, with $\chi^2(2, N = 120) = 6.73$, $p < .05$. The final model for all groups is presented in Figure 2 (only the significant paths are included in the figure).

As with the analysis of all groups, the analysis of the incorrect groups began with the full model (Figure 1). The full model did not fit the data well, with model chi-square, $\chi^2(3, N = 92) = 9.92$, $p < .05$, CFI = .95, NNFI = .75, and NFI = .94, and the largest standardized residual = 2.43. Of the autoregressions, only that for the task-judgments was significant. More importantly, although the two contribution types predicted judgments at T1, those judgments predicted subsequent shared, but not unique comments. The model was reevaluated by dropping the nonsignificant paths. Although $\chi^2(6, N = 92) = 11.05$ was not significant, $p < .09$, the model was not an improvement over the full model—in fact, the chi-square for the restricted model

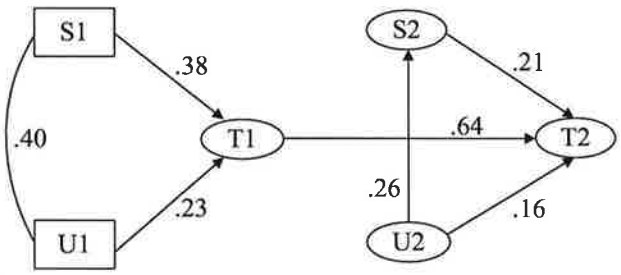

Figure 2 Final model across both conditions, significant paths only. S = shared contributions, U = unique contributions, and T = the target effect. The numbers refer to the time when the measurements were taken.

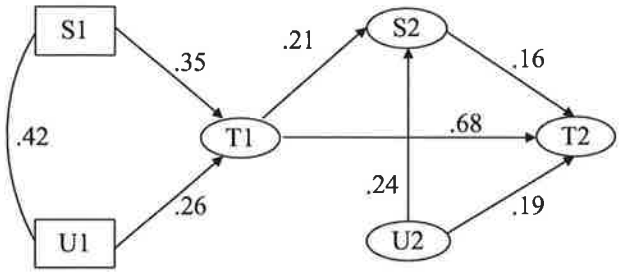

Figure 3 Final model for incorrect groups, significant paths only. S = shared contributions, U = unique contributions, and T = the target effect. The numbers refer to the time when the measurements were taken.

increased and the largest standardized residual = 2.45. The modifier indices indicated that model fit might be substantially improved by adding a path from unique comments at Time 2 to shared comments at that time. This resulted in $\chi^2(5, N = 92) = 5.23$, $p > .38$, and fit indices of CFI = .98, NNFI = .99, and NFI = .97, all well within acceptable limits. Furthermore, the largest standardized residual was −1.50, also within limits. Finally, the test of the difference between the two models was significant, $\chi^2(2, N = 92) = 5.92$, $p < .05$. The final model for the incorrect groups, with standardized path coefficients, is presented in Figure 3. The model does reveal that shared contributions and task judgments are related as expected for incorrect groups, but the magnitude of the relationships is small compared to that for task judgments at the two measurement times.

so incorrect & correct grp.s are different

Discussion

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This paper applied the "local" model of participation to the problem of information sharing in small groups. The local management model assumes that the issue or topic under discussion, the possession (or not) of relevant information about that topic, and calculations about the fitness of one's contribution in relation to others' potential inputs, provide the bases for participation. The local model is recursive; contributions to discussion influence and are influenced by the decision to contribute that information.

local model

The concerns in this study were twofold. First, the local model was evaluated for the extent it applies to information sharing discussion, in which two types of contributions—those containing shared and those containing unique information—are of interest and, as research has shown, have differential affects on task-relevant judgments. Second, the model was applied to groups that arrive at a suboptimal or inappropriate decision. Winquist and Larson (1998) noted that the process of information sharing in "incorrect" groups is largely a function of shared information, in terms of the development and maintenance of initial, suboptimal preferences. The local mode was hypothesized to fit data from incorrect groups, especially in terms of the relation between task-related judgments and comments that contained shared information.

In the end, the model applies satisfactorily to discussion in which groups arrived at the suboptimal decision. The data provide evidence for the recursive relationship between comments containing shared information and task-related judgments. The data suggest, however, that the greatest influence on task judgments at discussion's end was judgments made early in discussion. Thus, the data support Winquist and Larson's (1998) contention that shared information helps to develop and maintain initial, suboptimal preferences. If initial preferences are made evident during early parts of discussion, and if there is general consensus regarding the group's choice, then those preferences, and their corresponding assessments, seem to govern participation, task judgments, and the group's output.

Although there were not enough "correct" groups on which to test a path-model version of the local model, the data do provide some intriguing findings and raise several important questions. The first finding of note is the negative correspondence between participation during the first minute and mentioning of unique comments during the remainder of discussion. Thus, the less one participates early in discussion, the more he or she provides unique comments later. Decreased participation early increases the difficulty of ascertaining initial preferences. Following Winquist and Larson's (1998) dual-process model, initial preferences have less hold or sway on discussion, which increases the likelihood that participants will contribute unique comments more frequently, and that such comments will impact discussion.

Another finding of potential interest is that the mentioning of shared information was not correlated within incorrect groups during the majority of discussion, but was associated within correct groups. This finding indicates that the mentioning of shared information was more similar across members of correct groups than among those in incorrect groups. It is not clear how differentiated information sharing might lead to the adoption of suboptimal decisions, but several explanations are possible. The first explanation is that inequality of participation leads to the opinions of some members dominating those of others (Bottger, 1984; Sorrentino & Boutillier, 1975). The second explanation is that members were not closely monitoring the contributions of their colleagues, and were perhaps taking for granted the content and veracity of shared contributions rather than exploring them.

This study provides a partial replication of Larson et al. (2002) and Wittenbaum et al. (1999), both of which noted a correspondence among task-related judgments and the two types of contributions. Those studies, however, did not employ social relations designs, and were unable to partial out target effects from other elements of social perception (Kenny, 1994). The current study, using just the target effect in the analysis, did find significant relationships between unique contributions and task judgments. The target effect, however, constituted approximately 18% and 12% of the variance in perceived competence at T1 and T2, respectively, for all groups. The perceiver effect (i.e., the tendency of an individual to evaluate a set of targets similarly) accounted for 30% of the variance at both time periods. In addition, the relationship effect (i.e., that part of judgment unique to a pair of participants within a group) accounted for approximately 20% of the variance at both time periods. Thus, a relatively large percentage of the variance was accounted for by aspects of social

perception not related to target effects. This finding has substantive implications for studies of information sharing. For example, Swann et al. (2003) conceptualized the perceiver effect as the tendency to homogenize potential diversity in groups, and Bonito (2003) has defined the relationship effect as the outcome of differential assessments of communicative behavior. Clearly, these effects in the context of information sharing require further examination.

The current study is not without limitations. The task might lack ecological validity (e.g., Frey, 2003). The task permits the distribution of information in theoretically meaningful ways and with a degree of control, whereas existing groups offer no real means for assessing informational differences. On the other hand, it is not clear if the task has any relation to the uses of information in nonexperimental groups. For example, Wittenbaum et al. (2004) noted a set of problems that confronts research on information sharing, and argued for a model that highlights the strategic management of information. Clearly, the task as used here offers no comparable motive for such strategies. Still, the current study does suggest that information differences (in terms of the information presented during discussion) affect subsequent participation. The issue of how the relation between information, discussion, and judgments translates to contexts in which other, more strategic issues are operative is an open question.

The current study provides several avenues for future research. The first area concerns the effect of the accuracy of participants' informational contributions on discussion. Examination of the transcripts revealed that participants sometimes attributed information to the wrong candidate. Such inaccuracies occur in discussions of groups of all types. Both perceptions of competence and group outcomes are affected by misinformation. Future work with this model should evaluate potentially confounding information cues from the candidates' profiles to assess their effect on perceptions and outcomes. In fact, little is known about the many possible connections among the data points and their relevance for discussion and decision making (Bonito, 2007). This is a complex problem that would benefit from research on the relations among information units as participants might organize and think about them.

Analysis showed that the effect of participant's unique contributions on group member ratings increased over time, across all conditions. Distribution of information within the group has been shown to increase participant persuasiveness ratings when one participant is given only unique information. Future research should examine different distributions of shared and unique information and how those distributions affect participant ratings, participation, and group outcomes. Presumably, those members who have more unique information relative to other group members would contribute more unique and less shared information than would group members who were given relatively more shared information. Thus, unequally distributing shared and unique information in groups could affect the frequency with which both types of information are shared and, subsequently, affect the quality of the group's decisions.

Absent from this study was any consideration of the valence of the information offered. Skowronski, Carlston, Mae, and Crawford (1998) outlined how communicators can take on the qualities they describe in others. If a group member offers unique information about a candidate that is negatively valenced (e.g., "Is often not well-prepared for class") or positively valenced (e.g., "Gives interesting lectures"), would peer evaluations of the group member reflect these differences? Additionally, the intensity of positive or negative candidate information was ignored herein. The decision task presented a mix of good, neutral, and bad candidate characteristics, for example, "Is very knowledgeable about the course topic," "Is between 30 and 40 years old," and "Is close-minded." Future research could explore how the introduction of valenced information prompts or inhibits the contribution of complementary or contrasting information.

Finally, the use of stimulated recall might affect the findings. Clearly, stimulated recall might lead to different types of processing that affect ratings on task-related judgments. These include post hoc rationalizing, in which participants might generate assessments of their colleagues that did not exist during actual discussion, and social desirability, in which participants' assessments reflect positive stereotypes rather actual performance. Still, the method is widely used, even in group research (e.g., Stockton, Morran, & Clark, 2004), and has proven to be a useful and valid technique for assessing cognitions and attitudes during communication episodes (Waldron & Cegala, 1992).

One last issue is the representational validity of our task-judgment measure (Folger & Poole, 1982). Representational validity assumes that participants' evaluations of message features are consistent with those of the researcher. If representations are not consistent, then there are potentially other explanations for the findings. In the current study, participants were asked to make judgments, for example, regarding if participants contributed useful information or understood the problem as presented in the task. Clearly, there is some latitude in what constitutes "useful" information, as well as the extent to which a given person's behavior exemplifies understanding. For example, participants sometimes use frequency of participation as a heuristic for quality of participation (Sorrentino & Boutillier, 1975), in which case it is possible that the relationship between task judgments and information-based contributions is actually the covariance between frequency of participation and ratings. Future studies then should evaluate the representative validity of task-based judgments, especially in round-robin designs of the type used here.

In conclusion, understanding the process of information sharing, relative to its relation with task judgments, provides a benchmark for evaluating the effect of exogenous (to discussion) factors. If the development and maintenance of task judgments in incorrect groups is a function of the mentioning of shared information, the researchers need to identify factors that reduce the effect of shared on information on task judgments, or increase the effect of unique comments. Doing so should lead to a better understanding of the relation between inputs and processes that, hopefully, lead to improved group outcomes.

Note

[1] The formula for the target effect is

$$\frac{S^2_{S\beta}}{S^2_{S\beta} + S^2_{U\beta}/r + \frac{n-1}{n(n-2)}(S^2_{S\gamma} + S^2_{U\gamma}/r) + \frac{1}{n(n-2)}(S_{S\gamma\gamma} + S_{U\gamma\gamma}/r)}$$

where $S^2_{S\beta}$ is the estimated stable construct variance for the target effect, $S^2_{U\beta}$ is the unstable variance for the target effect, $S^2_{S\gamma}$ and $S^2_{U\gamma}$ are the stable and unstable construct variances for the relationship effect, respectively, $S_{S\gamma\gamma}$ and $S_{U\gamma\gamma}$ the stable and unstable reciprocity covariances, respectively, r is the number of items, and n group size (assuming equal groups). To obtain reliability for the perceiver effect, the stable and unstable construct variances for the perceiver effect are substituted into the formula in place of those for the target effect. The other terms remain the same. Finally, the reliability formula for the relationship effect is

$$\frac{S^2_{S\gamma}}{S^2_{S\gamma} + S^2_{U\gamma}/r}$$

with the terms as described above.

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