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Information Flow and Influence during Collective Search, Discussion, and Choice

Susanne Abele*
and Sandra I. Vaughan-Parsons**
and Garold Stasser***

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*Miami University, Department of Psychology, email: abeles@muohio.edu

**Howard Community College, Columbia, email:

***Miami University, Department of Psychology, email: stassegl@muohio.edu

Universität Mannheim
L 13,15
68131 Mannheim

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Susanne Abele

Miami University, Department of Psychology, Oxford, Ohio, e-mail: abeles@muohio.edu,

Sandra I. Vaughan-Parsons

Howard Community College, Columbia,

Garold Stasser

Miami University, Department of Psychology, Oxford, Ohio, U.S.A.

Abstract

If decision-relevant information is distributed among team members, the group is inclined to focus on shared information and to neglect unshared information, resulting often in suboptimal decisions. This classical finding is robust in experimental settings, in which the distribution of information is created artificially by an experimenter. The current paper looks at information sharing effects when access to information is not restricted, and decision makers are very familiar with the decision task. We analyzed archival search and discussion data obtained from business executives completing a personnel selection exercise. Information popularity in the population from which groups were composed predicted number of group members accessing items during information searches and whether the group discussed the items. The number of group members who accessed an item predicted whether information was repeated during discussion, and repetition predicted which items were included on an executive summary. Moreover, cognitively central group members were more influential than cognitively peripheral members. One implication is that collective decision making amplifies what is commonly known at the expense of disseminating what is not.

Keywords: Information Sharing, Cognitive Centrality, Group Decision Making, Collective Choice, Archival Data

The reasons for delegating decisions to groups are varied but they often are related to one of two goals (Stasser & Birchmeier, 2003). One goal is identify what is commonly believed or preferred among a set of stakeholders. Serving this goal requires zooming in on shared perspectives and knowledge. Another goal is to collate members' diverse perspectives and information. In pursuit of this latter goal, group discussion is often used as a mechanism for combining members' unique contributions in an attempt to construct a more complete and balanced account of the decision options. Serving this goal requires zooming out to encompass the unique bits of information that each member can add to the collective account. For example, consider a group of fund managers constructing collectively an investment portfolio. On the one hand, they could discuss what they know in common and, based on this common ground, allocate funds based on the popularity of the investment options among the fund managers. On the other hand, they could discuss extensively the investment options, combining their unique knowledge in an attempt to identify which options offer the greatest potential for financial growth. Based on this pooled knowledge, each manager may revise her assessments of the options leading to group selections that none of the managers favoured initially. Zooming in on the common information and zooming out to encompass unique information are quite different processes and may often lead to different collective decisions (Hinsz, Tindale, & Vollrath, 1997; Larsen & Christensen, 1993; Stasser, 1999). In this paper, we report the analysis of archival data obtained from teams of executives completing a collective personnel selection task. We explored whether collective decision making zoomed in or out by tracking what information individual members accessed during searches of the candidate databases and what information they discussed en route to a collective decision and to constructing an executive summary. Moreover, we examined whether members at the intersection of others' knowledge (cognitively central) were more or less influential than members who possessed unique information (cognitively peripheral). Zooming in on the core of common knowledge would promote the influence of cognitively central members whereas zooming out to encompass unique information would promote the influence of peripheral members.

In the following section we discuss Persuasive Arguments Theory, a classic theory of group influence based on ideas of how information is distributed among decision makers and the types of information that they exchange. Although the theory has not been the focus of recent empirical work, it nevertheless postulates that novel information exchanged within a group will have the greater influence than commonly known information. Subsequently, we will review a more recent model that is based on a collective sampling metaphor and proposes that common information will be more likely to be mentioned and more influential than unique information. The empirical evidence for this model stems primarily from situations where information distributions were experimentally controlled rather than arising naturally.

Persuasive Arguments and Assembly Bonuses

Burnstein and Vinokur (1973, 1977) argued that the information content of group discussions affects members' opinions and hence their collective decisions and judgments. Group members are rational information processors, who in a group discussion respond to new information and arguments. They originally advanced their theory to account for the typical finding that discussions polarize, rather than moderate, judgments. At the core of the theory is the proposition that judgments change because members of the group contribute unique arguments and information that others in the group did not know or had forgotten. That is, unique arguments and information are persuasive; common information and arguments do not change minds. A large body of empirical evidence supports their theory, showing for example that changes in risk preference are related to the proportion of risky to cautious arguments in a discussion and that novel arguments produce larger judgmental shifts than common ones (Burnstein & Vinokur, 1973; Vinokur and Burnstein, 1974: see also, Myers & Lamm, 1976, for a review of group polarization).

The idea that diversity can improve the quality of decisions also rests on the idea that unique perspectives and information are potentially persuasive. Diverse perspectives and information often produce dissent during the decision process, and dissent improves decision quality as long as it does not compromise loyalty to the group and commitment to the decision (Dooley & Fryxell, 1999).

Both persuasive arguments theory and the proposition that cognitive diversity improves decision quality assume that old information is already integrated into members' judgments and preferences and that new information produces shifts of judgment and changes of preference. Additionally, the "diversity produces quality decisions" argument presumes that there is an *assembly bonus effect* (Collins & Guetzkow, 1964). By contributing their unique knowledge, members can assemble a more complete picture of the decision options and thereby increase the prospect of identifying a better decision option than the majority would favor given incomplete knowledge.

In general, an information processing function of group discussion implicitly assumes that groups can in theory make better decisions than their individual members acting alone. Groups have the potential to make better decisions than individuals, if (1) *n* heads know more than one, (2) individuals exchange critical, new information with one another, (3) others accept this information as valid, and (4) the group uses their pooled information to make an informed decision (Hastie, 1986; Stasser, 1992). From an information pooling perspective, information that is known to only one group member is an important commodity that an individual brings to the group decision-making table. Indeed, expertise is often defined by uniquely held information. As such, experts are perceived to have specialized, unique knowledge of a topic, process, or task, and they are often ascribed high status as a testament to the value of holding unique information (e.g., Bottger, 1984).

Thus, the diversity leads to quality argument is compelling both theoretically and intuitively. Nonetheless, there is considerable empirical evidence that groups frequently do not consider the diversity of information available to them and that they risk making suboptimal decisions, particularly when unique information is critical to a good decision (Gruenfeld, Mannix, Williams, & Neale, 1996; Hollingshead, 1996; Stasser & Titus, 1985).

Biased Information Sampling

Recent experimental evidence documents that widely-shared information tends to dominate discussions and uniquely-held information is often omitted from discussion (see, Stasser & Titus, 2003, for a recent review). Two reasons for this discussion bias favoring common information are advocacy and information sampling dynamics.

In advocacy, members bias their contributions to discussion to support their initial preferences (Schulz-Hardt, Frey, Luthgens, and Moscovici, 2000**;** Stasser and Titus, 1985; Stasser, 1988). This bias may arise for several reasons. First, information that is consistent with one's preference may be more salient when searching for items to contribute to discussion. Second, members may be prone to defend their initial choices. Because common information affects everyone's initial preference (the common knowledge effect; Gigone and Hastie, 1993, 1997), defending initial preferences will tend to promote the discussion of common information.

The structural effects of collective information sampling also favor common information over unique information. Even in the absence of advocacy, groups are more likely to mention an item of common information than an equally salient item of unique information. Stasser and Titus's (1987) collective information sampling (CIS) model suggests that one reason why common information is discussed more often is due to sampling probabilities. Their model states that the probability that a piece of information will be mentioned is a function of how many people could potentially mention it and the likelihood that any one of those members will mention it. According to this model, common information has a greater probability of being discussed than unique information because of the greater number of people who know common information and can mention it (see Stasser, Taylor, & Hanna, 1989, for a direct empirical test of the CIS).

Studies have identified a number of factors that reduce, but do not eliminate, the bias in discussion favoring common information. For example, making members publicly aware of who is likely to know more in domain or category of information increases the amount of unique information mentioned but does not eliminate the advantage to common information (Stasser, Vaughan, & Stewart, 2000). Increasing the amount of information discussed (e.g., by requiring or promoting longer discussions) sometimes facilitates the discussion of unique information (Larson et al, 1996), but also often increases the amount of common information discussed (Stasser, et al, 1989). Thus, the dominance of common information remains even in long discussions that air extensive amounts of information.

What is Influential?

The advantage to common information extends beyond what is mentioned during discussion. Contrary to a central tenet of persuasive arguments theory, common information seems to draw more attention than unique information when mentioned during discussion. This extended advantage to common information has been documented in several ways. Groups are more likely to repeat common, than unique, information later in discussion (Stasser, et al., 1989; Larson et al., 1996). After discussion, members are more likely to correctly remember common, than unique, information that was mentioned during discussion (Stewart and Stasser, 1995). Also, in written summaries of their discussions, groups are more likely to include the common, than the unique, items (Stewart and Stasser, 1995).

This increased attention and retention of common, as compared to the unique, information that emerges in discussion may be due to people giving more weight to information that they have already considered before discussion. For example, Greitemeyer and Schulz-Hardt (2003) gave individuals information favoring a suboptimal choice and then let them read a group discussion protocol containing full information exchange, which, if fully analyzed, would have favored the optimal option. Still individuals tended to decide for the alternative based on the initial information that they were given. Greitemeyer and Schulz-Hardt argued that this reliance on pre-discussion information is due to a preference-consistent evaluation of information. At the level of the group, this reliance on already known information by individuals means that common information is viewed as more important than unique information. When everybody pays more attention to the information they initially have, unique information gained during discussion is less likely to influence their judgments. However, in all the experimental studies on the effects of information sharing in decision making groups the distribution of information was controlled. What was shared and unshared prior to discussion was determined by the experimenter, and did not arise from individual information searches as is the case in the archival data analyzed for this paper.

Who is Influential?: Cognitive Centrality

The conceptualization of cognitive centrality derived from a view of decision-making groups as sociocognitive networks. Kameda, Ohtsubo, & Takezawa (1997) drew a parallel between social and cognitive networks and suggested that just as people share social links in a group, they also share cognitive links. Cognitive connections among group members are measured in terms of how much information they hold in common. A cognitively central member is someone whose knowledge is predominately shared with other members (i.e., has many information links to others) whereas a cognitively peripheral member knows mostly unique items (i.e., has few information links to others). Kameda et al. extended the idea of the greater influence of common information over unique information to the level of the member: they proposed that a member, who shares more information than another has greater influence in group discussion. Indeed, Kameda et al. (1997) showed that cognitively central members were more influential and participated more during the discussion. They showed this effect in a correlational study, as well in an experiment in which they controlled the distribution of information. The authors suggested that widely shared information is viewed reliable and credible and, as a result, cognitively central members come to be viewed as reliable and valid sources and are more influential in groups than cognitively peripheral members.

Hypotheses

Source of Data: Center for Creative Leadership

For the results presented in this paper we analyzed archival data, obtained from the Center for Creative Leadership (CCL). CCL offers top-level executives a course on leadership and decision-making styles. As part of the seminar, executives participated in the Peak Selection

Simulation (PSS). One of the featured components in the PSS exercise was a small group decision-making task.

Participants individually reviewed information about four candidates for presidency of a division of a hypothetical company. Although the company was hypothetical, the participants in the PSS exercise had already received extensive information about the company in general and the position in particular. The day after they reviewed the candidates' computer files, participants met in small groups. During the group meetings, they discussed the candidates, ranked ordered the candidates and then recorded the strengths and weaknesses of each of the four candidates. Individuals had access to all of the available information about the candidates during their pre-discussion computer searches; their information searches were only limited by the amount of time to search. All of the participants in the PSS decision-making groups were top level executives. Most were probably familiar with making personnel decisions for top-level positions in their companies.

There are two features of the CCL exercise that are different from the typical study of information pooling in decision making teams. First and important for our purposes, the experimenters control who gets what information in the typical study (all studies to our knowledge) of information pooling. Participants in these studies received information passively and the experimenter determined what information was common and unique. In the CCL data, within any team, what was unique and common depended on what information members selected during their computer search. Unique information was information that only one member of the team accessed during the computer search. Common information was information that all members of the team independently accessed. This feature of the CCL task produces a process that resembles closely the dynamics that Burnstein and Vinokur (1973, 1977) envisioned in their

Persuasive Arguments Theory. They presumed that common information arose because it was widely accessible and known in the population from which groups were composed but that unique information would be particularly influential when it arose in discussions.

Second, the participants in the typical study of information pooling probably do not have significant experience with the decision task (see, Larson et al., 1996, for a notable exception). The participants in the CCL Leadership at the Peak (LAP) program had considerable experience and familiarity with decision tasks similar to the personnel selection exercise.

Information Sampling

From the perspective of information sampling models such as CIS, there are two possible mechanisms, one local and one global, underlying the proposed effect that common information will be more likely to be mentioned than unique information. Locally, such an effect could be due to the collective sampling dynamics within a group. As predicted by the CIS model (Stasser & Titus, 1987; Stasser, Taylor, & Hanna, 1989), common information has a higher chance of being mentioned as more group members know it and can mention it. With the archival data we can test whether for the biased information sampling effect to occur, the information distribution needs to be controlled. Because information access was not restricted, there is a possible second mechanism, operating more globally at the level of the population. Because participants were familiar with the task and were experienced at making personnel decisions, there was likely some degree of normative agreement about what kinds of information are relevant and important. Thus, participants probably searched for types of information that were generally regarded as important. Moreover, groups probably discussed the types of information that were commonly seen as important for the task. That is, shared perceptions of what was important information for making the decision may have guided information searches and subsequently shaped the content of discussions. Thus, we expected that these executive teams produced information sampling patterns like those observed in the typical experimental, laboratory study of collective decision making, although the underlying mechanisms should differ.

Hypothesis 1: *CCL teams mentioned more common information than unique information during discussion.*

We also investigated whether the popularity of information in the population of participants affected the likelihood that information was discussed in teams and whether the number of members of a team who viewed items could account for such normative effects.

***Research Question 1*:** To what degree did the content of group discussions reflect the overall popularity of information in individual computer searches, and did the number of members who examined items within each team mediate the relationship between overall popularity and discussion content. Stated differently, do the local information sampling dynamics within teams (as suggested by the CIS model) account for a global relationship between the information searched by PSS participants and the content of group discussions?

Information Repetition

Whereas we expected that the content of discussion would favor information that was accessed by all or most of a group's members in their computer searches, we are also interested in how the sharedness of information affects group members' repetition of items once they were mentioned. Stasser et al. (1989) and Larson, et al (1996) found that common items were repeated more than unique items, once they were mentioned. This repetition effect has been explained in terms of social validation: the accuracy of unique information can not be validated by others in the group. Moreover, beyond socially validating the accuracy of information, discussion may have served to signal what information was viewed as relevant and important. That is, the number of members accessing a item during their searches may have signaled its importance. Access by all or most in a group suggests an item is widely viewed as important and relevant. Information accessed by only one member (unique information) may be viewed as consensually unimportant and dropped from further consideration.

However, there is an important countervailing process in the CCL teams that is consistent with the implications of Persuasive Argument Theory and its assertion that novel information is influential. Individuals actively acquired information in the PSS exercise, and they may have felt a sense of ownership for their unique items (Chernyshenko, Miner, Baumann, & Sniezek, 2003; Van Swol, Savadori, & Sniezek, 2003). Thus, having mentioned an item that was new to others, they may have promoted its consideration by repeating it. Also, Larson and his colleagues (Larson et al., 1996; Larson et al., 1998) have shown that status and leadership roles promote the repetition of unique information. Similarly, Stewart and Stasser (1995), as well as Stasser, Vaughan & Stewart (2000) observed that mutually recognized expertise also promoted the repetition of unique items. Hence we considered two competing hypotheses regarding the repetition of information.

Hypothesis 2a*: CCL teams repeated more common than unique information.*

Hypothesis 2b*: CCL teams repeated more unique than common information.*

Information Retention

The executive teams listed strengths and weaknesses for each candidate at the end of their discussions. Stewart and Stasser (1995) found that groups were less likely to record unique information than common information on their written summaries, again, presumably because other members could not verify the accuracy of unique information or because it was considered as less important. However, for the same reasons that CCL teams may not have replicated the typical experimental finding of repeating more common than unique information during discussions, they may not have been so prone to omitting unique items from their strengths and weakness lists. For example, Stewart and Stasser (1995) also found that, when group members were explicitly assigned expertise for particular domains of information, unique information that emerged during discussions was as likely as common information to be retained on the group's written protocol. Again, in the data set we analyze for the present investigation, all participants were CEOs and hence could be reasonably regarded as experts in tasks like the PSS. Moreover, if CCL teams repeated more unique than common items as predicted in the Hypothesis 2b, this repetition may have increased the likelihood that unique information would be salient and thus promoted its inclusion on the written protocols. Thus, as with repetition of information, we considered two competing hypotheses.

***Hypothesis 3a**: Groups will retain a larger proportion of common than unique information from their discussions on their written strengths and weaknesses sheets.*

***Hypothesis 3b**: Groups will retain a larger proportion of unique than common information from their discussions on their written strengths and weaknesses sheets.*

Who exerts the Influence?

Investigating the mentioning, repeating and listing of information tells what groups discuss and emphasize in their discussion. However, analyzing the content of discussions and executive summaries does not tell us what kinds of information facilitate influence within the group. Is a person more influential if she holds a lot of unique knowledge which will be new to others or if she shares a lot of knowledge with a lot of group members and is thus able to reinforce what they already know?

We examined how team member's centrality in the cognitive network of their team affected the degree to which they were successful in influencing the group to adopt their initial ranking of the job candidates. Participants gave their private and individual rankings of the alternatives before meeting as a group, and a comparison between these rankings and the group's ranking was used to derive a measure of influence.

Persuasive Arguments Theory suggests that a person who has information that the other team members do not have should be more influential (Vinokur & Burnstein, 1973). However, the concept of cognitive centrality implies that a person who shares a lot of information with other group members will exert more influence (Kameda et al., 1997). Considering both of these established theoretical concepts, we have two competing predictions concerning the influence.

Hypothesis 4a*: Cognitively central members were more influential than cognitively peripheral members.*

Hypothesis 4b*: Cognitively peripheral members were more influential than cognitively central members.*

Kameda et al. (1997) also found that cognitively central members talked more during group discussions than did cognitively peripheral members. This raises the possibility that the influence attributed to cognitive centrality may be due in part to higher participation rates in discussions.

***Research Question 2*:** In the CCL discussions, was centrality related to participation rates and, if so, does participation mediate in whole or partly the relationship of cognitive centrality and influence?

Method

Participants in CCL Executive Training

All of the participants took part in the PSS exercise as part of a CCL seminar in Colorado Springs, Colorado. A subset of 25 groups was selected from the first 80 groups who completed the PSS program. In order to examine groups of comparable size, we eliminated groups smaller than four and larger than six. Moreover, for our analyses we were forced to eliminate groups whose members' search data were incomplete.

Personnel Selection Task

Before participants met at CCL, they received a packet of information about PSS. The packet contained information about a hypothetical company, Looking Glass, Incorporated, and abbreviated resumes for four candidates for the presidency of the Advanced Products Division of the company. During PSS, participants individually searched for and read information contained in a computer database about the job candidates. The information was presented through a series of menus representing different types of information available about each candidate. The major categories were interview questions and answers, resume, solicited and unsolicited opinions, and a personnel search report. Three of the four candidates were internal to the company and their information also included human resource files.

The task was designed so that the available information closely resembled the types of information that executives would expect to have in a real hiring situation. Additionally, CCL asked consultants to review the entire profiles and rank the candidates. This procedure yielded a "school solution" that we will subsequently refer to as the correct solution. Each candidate had roughly the same number of screens of information. There was no systematic attempt to balance strengths and weaknesses for each candidate across the various sources of information.

Procedure

Participants viewed a brief videotaped message from an actor portraying the CEO of Looking Glass, Inc., outlining the group's task. Subsequently, individuals began their computer searches of the candidate information. After 60 minutes of searching and reviewing the information, participants ranked the four candidates. Then, the computer displayed a message that advised participants that they had completed the computer search portion of the PSS. They were instructed not to speak to anyone about their computer search until the small group discussions.

During the search task, a record of what screens of information were accessed, in what order, and how long was kept for each participant. Additionally, the participant's name, gender, and private ranking of the candidates were recorded.

Participants met with their groups in a small room with a round table. The rooms had a large tablet of paper on one wall, a video camera in one corner on the ceiling, and a one-way mirror along one wall. All of the participants were aware that they were being videotaped as well as observed from a one-way mirror along one side of the room. A facilitator instructed each group to discuss the candidates, rank them, and record their strengths and weaknesses.

Coding Scheme

Both the video-tapes of group discussions and the written summaries were coded for content. The coding scheme is divided into two categories: action codes and information codes. The action codes were developed to capture the nature of the discussants' communications throughout the discussion. Codes represent actions such as stating a preference for a candidate, agreeing with another discussant, etc. The information codes were designed to code for the actual pieces of information that individuals mentioned about the candidates.

In order to construct the information codes, numerical codes were assigned to the roughly 400 pieces of information developed by CCL. The codes were constructed to capture the hierarchical nature of the way in which the information was presented to the subjects via a computer menu. The information was available to subjects through a menu that contained large categories of information (e.g., Resume, Interview, etc.). Within each of those larger categories were sub-categories of information (e.g., Work history, Education). Finally, each computer screen under a sub-category presented specific pieces of information (e.g., BA in business communication). The information codes were designed to retain as much information as participants might provide about the exact source and content of the information that s/he mentioned from the menu. Each tape was viewed by one of six trained coders who created a sequential record of discussion content. Nine of the 25 discussions were viewed by a second coder in order to estimate coder reliability. The two independent coders agreed 92% of the time on the presence and absence specific items of information in these nine discussion tapes.

The same set of coders also read and recorded the content of the written executive summaries that the groups produced at the end of their discussions. Six of the lists were coded independently by two people. The two coders agreed 98% of the time on the presence and absence items of information in these six written protocols.

Measures

Individual and Group Rankings

After individuals completed their information search of the computer data base, they were prompted to rank the four candidates. In addition, each group ranked the four candidates at the end of their discussion. The individual rankings were compared to the group rankings and to the expert solution to assess members' influence and correctness, respectively.

Information Pooling

The videotapes were coded for information that was mentioned during the group discussion. The coding system allowed us to record where the information was accessed (i.e., from which information source) as well as the actual content of the information. The information pooling analyses were conducted using the most specific level expressed by the information codes (e.g., "Cooper worked in Hungary"). Information was coded for the number of times each piece of information was mentioned and by whom. To capture the sharedness of information prior to discussion, information was coded as unique, partially shared, or common. Information accessed during the computer search by only one member of a group was categorized as unique, information accessed by more than one but not all members was designated as partially shared; and information accessed by all members was designated as common.

Cognitive Centrality

Each individual received a cognitive centrality score. This score was calculated as in Kameda et al. (1997). The centrality score for each Member i, C_i, is given by:

$$C_i = \sum_{j=1}^{n} BB'_{ij} \, ,$$

where j ≠ i, n is group size, and B is a member (row) by information item (column) matrix. Each row of this matrix corresponds to a member and each column to an information item. If member *i* looked at item *j* the entry $c_{ij} = 1$; otherwise, $c_{ij} = 0$. To construct this matrix, we determined which screens each individual member of the group accessed to determine which members viewed each item of information. The centrality score captures both the number of information links one shares with others in the group and the number of people with whom one shares these information links. In short, a high cognitive centrality score indicates multiple information links with other members whereas a low centrality score indicates that much of a member's information is not known by others.

Participation Rates

In order to assess the relationships among centrality, influence and participation, we also computed the total number of codable utterances each person made during the discussion.

Results

Information Sampling

Information was categorized, for each group separately, as unique (one member viewed it), partially shared (two or more, but not all, members viewed it), and common (all members viewed it). On average, a group's members collectively accessed a total of 316 items in their information search. Most of those items (187) were accessed by two or more, but not all, group members (partially shared). On average, 44 items were accessed by only one member (unique), and 85 items were accessed by all group members (common). The analyses of discussion content were based on the proportions of items that at least one member in a group had accessed. That is, a group could only discuss an item if at least one member accessed it. Across all levels of sharedness, participants mentioned only 8.7% of information that was looked at by at least one member of the group prior to discussion. That is, groups discussed, on average, about 27 items of information.

A one-way ANOVA using level of information sharedness as a repeated measure factor was conducted on the proportions of unique, partially shared, and common information mentioned during discussion. There was a significant main effect for the level of sharedness, $F(2, 48)= 41.19$, $p<.000l$. A Tukey test revealed that an item of information was significantly more likely to be mentioned during discussion if it was common ($M=.127$, $SD=.058$) than if it was partially shared ($M=.083$, $SD=.032$), $p<.05$. Moreover, partially shared information was mentioned significantly more often than unique information, ($M=.037$, $SD=.034$), $p<.05$.

Information Repetition

The proportions of information repeated at least once after being mentioned were also analyzed in a one-way ANOVA using level of information sharedness as a repeated measure factor. This analysis showed the same pattern as above. There was a significant main effect for the level of sharedness, $F(2, 48)= 20.03$, $p<.0001$. A Tukey test showed that an item was significantly more likely to be discussed more than once, if it was common ($M=.044$, $SD=.033$) than if it was partially shared ($M=.023$ $SD=.016$), $p<.05$. Additionally, partially shared information was repeated significantly more often than unique information, ($M=.008$, $SD=.012$), $p<.05$.

Information Listing

The proportions of information accessed by the group that were included on the written strengths and weakness protocols were analyzed in a one-way ANOVA using information sharedness as a repeated measure factor. Once again, there was a significant main effect for the level of sharedness, $F(2, 48)=22.74$, $p<.0001$. A Tukey test showed that an item was significantly more likely to be included on the list if it was common ($M=.025$, $SD=.014$) than if it was partially shared (M=.014, SD=.013), $p<.05$. Furthermore, partially shared information was significantly more likely to be included on the list than unique information (M= .004, SD=.009), $p<.05$.

Summary. These results support our Hypothesis 1: the likelihood that individuals would mention an item increased when more people knew it prior to discussion. These results are consistent with much of the previous research in the information sampling literature (e.g., Stasser et al, 1989; Larson, et al., 1996). There was also support for the Hypothesis 2a in that common information was more likely to be repeated once it was mentioned than was unique and partially shared information. Additionally, Hypothesis 3a was supported in that common information was more likely to be included on the strength and weaknesses lists than were unique and partially shared information.

Normative Value of Information

Due to the nature of the participant pool and their familiarity with the type of task, we suspected that a collective information sampling process due to the numbers of members accessing items might not be the only factor affecting discussion content. Both the likelihood that group members accessed an item and then later discussed it might be due to the perceived relevance or importance of the item to the decision task. To test the idea that members may have a shared script or a mental model guiding their selections, we examined the computer search data for 576 CCL participants whose group results data were not included because of missing data or identifiers that linked them to a specific group. For each item, we computed the proportion of these participants who accessed the item during their computer search. This proportion was used as an indicator of the normative understanding about an item's perceived relevance or usefulness in the population of participants from which groups were composed. We computed the average normativeness of common, partially shared, and unique information for each group. A one-way ANOVA using information sharedness as a repeated measure was conducted on these normativeness values, and a significant main effect for information sharedness emerged, $F(2, 48)=1291.93$, $p<.0001$. A Tukey test showed that common information was significantly more normative ($M=.85$, $SD=.029$) than partially shared information ($M=.60$, $SD=.028$), $p<.05$. Likewise, partially shared information was more normative than unique information ($M=.30$, $SD=.054$), $p<.05$. Thus, not surprisingly, normativeness was strongly related to whether information was viewed by one, two or more, or all group members during their information search. This raises the possibility that the number of a group's members accessing an item is a proxy for the normativeness and normativeness of information determines the likelihood that it will be discussed. Note that this complexity could not be discovered in laboratory studies because members are given information rather than allowed to search a database.

In order to further investigate the role of information normativeness, we conducted a series of multilevel regressions (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002) to predict whether items were mentioned, repeated and included on the strengths and weakness lists[1]. In these analyses, information items were treated as nested in the group. To predict whether an item was mentioned, we restricted the set of items with each group to those that accessed by at least one member of the group during the information search. (If not member accessed an item, it is structurally impossible for the group to discuss it.) For each item, we used the following predictors: the proportion of group members who accessed the item (sharedness) and the proportion of other CCL participants who also accessed the item (normativeness). For group level predictors, we computed the mean sharedness and mean normativeness of all items in the set accessed by at least one group member. In the regression including the item level predictor of sharedness and the group level predictor of average sharedness of items, sharedness was a significant predictor of mentioning, $F(1, 7878) = 99.81$, $p < .0001$. Similarly, in the regression using normativeness as the item level predictor and average normativeness of all items accessed by the group, normativeness was a significant predictor of mentioning, $F(1, 7878) = 144.42$, $p < .0001$. When both item sharedness and normativeness (and their corresponding group level predictors) were entered in the regression simultaneously, only normativeness significantly predicted mentioning, $F(1, 7877) = 44.84$, $p < .0001$. In the presence of normativeness, sharedness was not significantly predictive, $F(1, 7877) = 0.79$, ns. Thus, the answer to Research Question 1 is that discussion content did reflect the popularity of information in the larger population from which groups were composed and that local information sampling dynamics arising from the number of a group's members who accessed an item only partially mediated this relationship.

A similar series of multilevel regressions were conducted to predict whether mentioned items were repeated. However, in these analyses, only the set of items mentioned at least once during the discussion were included, not the entire set accessed during the computer search by a group's members. This restriction on the set of items considered is due to the fact that an item could not be repeated if it was not mentioned. In the regression including the item level predictor of sharedness and the group level predictor of average sharedness of items, sharedness was a significant predictor of whether an item was repeated once mentioned, $F(1, 668) = 8.79$, $p < .004$. Similarly, in the regression using normativeness as the item level predictor and average normativeness of all items accessed by the group, normativeness was a marginally significant predictor of repetition, $F(1, 667) = 3.66$, $p < .06$. When both item sharedness and normativeness (and their corresponding group level predictors) were entered in the regression simultaneously, only sharedness significantly predicted mentioning, $F(1, 665) = 5.36$, $p < .03$. In the presence of sharedness, normativeness was not a significant predictor of repetition, $\underline{F}(1, 664)= 0.26$, ns.. Whereas global normativeness was the best predictor of whether an item would be mentioned, local sharedness within the group predicted whether it would be repeated once mentioned. The more members who had accessed an item during their computer search, the more likely it would be repeated once it was mentioned. Thus consistent with Hypothesis 2a and the ANOVA's examining the effects of sharedness on repetition: degree of sharedness promoted the repetition of items once they are introduced into discussion.

We also conducted a series of multilevel regressions to predict whether a discussed item would be included on the strengths and weaknesses lists. We also considered repetition as a potential predictor because preliminary analyses showed that a higher proportion (.29) of items that were repeated during discussion were included in the lists than items that were mentioned but not repeated (.14), χ^2 (1, N=694) = 22.4, $\underline{p} < .0001$. Both sharedness and normativeness (in the presence of their respective group level averages) by themselves were significant predictors, $\underline{F}(1, 670)= 2.15$, $\underline{p}<.04$, and $\underline{F}(1, 670)= 2.25$, $\underline{p}<.03$, respectively. However, when repetition was included as a predictor, neither sharedness nor normativeness were significant predictors, $\underline{F}(1, 668)= 0.07$, ns., and $\underline{F}(1, 668)= 1.12$, ns., respectively. In this regression including all predictors, repetition during discussion remained highly predictive of inclusion of an item on the final list, $\underline{F}(1, 665)= 22.47$, $\underline{p}<.0001$.

Insert Figure 1here

Figure 1 summarizes the results of these regressions and includes the significant standardized regression weights and their standard errors. As the figure illustrates, normativeness predicted whether an item would be mentioned during discussion but the number of group members who accessed the item predicted whether it would be repeated once it was mentioned. Neither sharedness nor normativeness had a direct influence on the retention of an item on the strength and weakness list compiled at the end of discussion. However, repeated items were much more likely to be included than items that were not repeated during discussion. This pattern of findings suggests that the apparent influence of sharedness on the inclusion of an item on a list was mediated by repetition.

Cognitive Centrality

Hypotheses 4a and b addressed the relationship between cognitive centrality and influence in the group. Cognitive centrality scores were calculated for each group member based on the formula given in Kameda et al. (1997) and described earlier. The mean cognitive centrality score for an individual in this sample is 654, SD=137. One can think of this index as representing the number of information links between a member and the rest of his/her group.

In order to assess the relationship between cognitive centrality and influence during discussion, an influence score was computed based on the distance between individuals' pre-discussion ranking and their group's final ranking of the candidates. This influence could take on values from '0' to '10.' A score of '10' indicates no difference between the individual and the group ranking, and a '0' indicates that the group's ranking was the inverse of the individual's original ranking. The mean influence score for an individual in this sample is 7.5, SD=2.23, indicating that group rankings were, not surprisingly, similar but not identical to the typical member's ranking.

Group rankings were closer to the expert solution ($M = 8.38$, $SD=1.93$) than were the members' initial rankings ($M = 7.31$, $SD=1.19$), $F(1, 23) = 7.92$, $p < .01$. As a result, members whose initial ranking was close to the expert solution would appear to be influential. Indeed, being correct may have enhanced one's influence but we wanted to control for correctness in evaluating the relationship of cognitive centrality and influence. Thus, we also computed a correctness index for each member. The index was computed like the influence index except it was based on the ranking contained in the expert solution, rather than the group's ranking. As with the influence score, the correctness score could vary from '0' to '10.' A '10' indicates that an individual's ranking was identical to the expert solution and a '0' indicates that the individual's ranking was the inverse of the expert solution.

In order to investigate the effect of cognitive centrality on influence, we conducted a series of multilevel regressions. In these analyses, members were nested within groups. For each member, we used the following predictors: cognitive centrality and closeness of the member's initial ranking to the expert solution (correctness). For group level predictors, we computed the mean centrality and mean correctness for other members of the group. In the regression including member centrality and the group level predictor of average centrality of others, member centrality was positively related to influence, $F(1, 107) = 25.80$, $p < .0001$. Additionally, the average centrality of others in the group was negatively related to influence, $F(1, 98.8) = 13.34$, $p < .001$. That is, a member was influential to the degree that s/he was cognitively central and the remaining members of the group were not. In the regression using correctness as the member level predictor and average correctness of the others in the group as the group level predictor, only correctness was a significant predictor of influence, $F(1, 123) = 32.13$, $p < .0001$. When both cognitive centrality and correctness (and their corresponding group level predictors) were entered in the regression simultaneously, both remained significant predictors of influence, $F(1, 104) = 13.16$, $p < .001$ and $F(1, 121) = 18.78$, $p < .0001$. Additionally, the average centrality of the other members was also still negatively related to influence, $F(1, 106) = 4.67$, $p < .04$. The implication is that cognitively central members were more influential in moving the group toward their initial solution than were their more cognitively peripheral peers. It also helped if the member's initial solution was close to the expert solution and other members of the group were relatively cognitively peripheral. We considered the possibility that the individuals who accessed more information had higher centrality scores (i.e., more informational overlap with other simply by virtue of having more information) and were more influential. However, when the total amount of information accessed was added to the regression model for predicting influence, it was not a significant predictor, $F(1, 106)= 0.76$, ns, and member centrality, average group centrality and member correctness remained significant predictors. Figure 2 summarizes these findings and includes the significant standardized regression weights and their standard errors.

To answer Research Question 2 regarding the role of participation rates in influence, we measured participation by counting the total number of utterances for each individual. We correlated member influence (the distance between an individuals' ranking and the group ranking) and participation within each group. The mean correlation between participation and group influence across all groups ($M = -.01$; $SD = .35$) was not significantly different from 0, $t(22)=-.20$, $p = .84$. Thus, influence was not due to high participation. The mean correlations across groups between participation and correctness ($M =-.04$, $SD=.35$) and participation and centrality ($M=.03$, $SD=.30$) were likewise not significantly different from 0, $t(23)=-.57$, $p=.58$ and $t(23)=.46$, $p=.64$, respectively.

Insert Figure 2 here

Thus, Hypothesis 4a received strong support. Consistent with the hypothesis, cognitively central members were more influential than peripheral members. Cognitively central members did not, however, participate more than cognitively peripheral members did and thus did not mediate the effect of centrality on influence.

Discussion

At the onset, we identified two broadly defined goals that underlie many of the reasons for delegating decisions to groups. One goal treats the group as a representative body of a larger population of stakeholders and is aimed at extracting common information, perspectives, and sentiments - a process of zooming in on common ground. The other goal treats the group as a mechanism for disseminating information that is not commonly known and airing diverse perspectives – a process of zooming out to encompass all that is collectively known. We examined information flow and influence in decision making teams to assess whether emergent processes in face-to-face decision making groups tended to realize one of these goals at the expense of the other. The decision making teams had completed a hiring simulation that had been designed to emulate many decisions that organizations face. Most notably, participants had first reviewed information about candidates for a top-level management position in preparation for a group meeting and formed tentative preferences. Then they had met and discussed the candidates with the objective of producing a collective ranking and creating an executive summary of the strengths and weaknesses of each candidate. The information processing and influence patterns in these groups were more suited to highlighting shared perspectives than to identifying and integrating diverse perspectives. We first summarize these findings. Then, we address the implications of these findings for collective decisions in organizational contexts.

Information Sampling

Unique information was less likely to be mentioned than common information. Several reasons that have been advanced to explain such a finding: collective information sampling (Larson et al., Stasser & Titus, 1987; Stasser, et al, 1989), advocacy of initial preferences (e.g., Gigone and Hastie, 1993, 1996; Stasser, 1988), and attributing more importance to information encountered before discussion (Schulz-Hardt, et al., 2000). However, these explanations cannot readily explain the finding that the popularity of items among the broader sample of CCL participants was a better predictor of which items were mentioned than the number of team members who accessed the items. We had thought that, to the degree that discussion content reflected the popularity of information in general, this reflection would occur for three reasons. First, CLL members shared a norm regarding what types of information were more important or relevant in making the hiring decisions (Tindale & Kameda, 2000). Second, because of this shared norm, the popularity of information among CCL participants would predict what items a team's members would access. Third, the frequency of access at the team level would determine what items were likely to be discussed. To explain the direct impact of popularity (normativeness) on discussion requires a fourth reason (see Figure 1): team members contributions to discussion were also filtered by normative concerns. Hence normative concerns exerted their influence twice in the process -- once during the individuals' information searches and second during the teams' discussions.

Repetition of Information

Common information was more likely to be repeated than was unique and partially shared information. Whereas normativeness predicted which items were mentioned, the number of group members who accessed the item before discussion (team sharedness) predicted whether an item was repeated after it was mentioned. Once a piece of information was mentioned, it was more likely to receive additional consideration if all members knew it before discussion.

Retention of Information on Written Summary

Common information had a higher chance to end up on a written protocol than unique and partially shared information. However, the effect of sharedness on the retention of information on the written summaries is indirect. Repetition of information during discussion directly predicted whether an item was retained on the written record. Normativeness had a distal, indirect effect in that it predicted what was mentioned during discussion. Team sharedness had a more proximal, but still indirect, effect in that it predicted what items were repeated. This pattern suggests that information that was repeated was salient to the group members at the time that they constructed the executive summaries. Moreover, it is possible that the sheer repetition made the information seem more credible and important.

In sum, an implicit normative understanding about what types of information are relevant for a task seemingly guided what information was brought up during group discussion. But beyond shaping the initial content of discussion, normativeness did not have a direct impact. What information was repeated during group discussion was related to how many members accessed it before discussion. What kind of information ended up on the summary list, presumably reflecting what was deemed important and supportive of the final decision, was shaped by the things that were repeated. Thus, indirectly, how many members of a group accessed an item during their individual information searches affected the likelihood that the item would be retained on the final written record. One noteworthy implication is that each step of this process acts in the direction of extracting what is most commonly known and works against the introduction of novel information. In the end, group discussion and collectively written executive summaries are more a distillation of what is commonly known than an integration of common with novel or unique knowledge.

Who Was Influential?

Persuasive argument theory suggests it is unique information is persuasive and hence shapes team decisions, whereas cognitive centrality suggests the opposite. The idea of cognitive centrality assumes that people can be linked to one another in a cognitive network of common knowledge. Kameda et al. (1997) found evidence that cognitively central people were more influential and participated more in their groups. In the current data, we also found that member centrality was positively related to influence. The influence of central members was not due to their being more correct, having more information than others or their participating more during group discussion. There was virtually no correlation between participation and cognitive centrality or between participation and correctness. Further, participation was not correlated with group influence. Although this is a null finding, it is interesting in its own right. It counters the somewhat cynical view that one can be influential by simply talking a lot. Moreover, it suggests that what was said was more important than how much was said in these executive teams. This finding is inconsistent with other research that has shown that people use participation rates as an indication of correctness or degree of expertise (e.g., Littlepage, Schmidt, Whisler, & Frost, 1995). Perhaps, the CCL participants have learned to focus more on the quality than the quantity of contributions to judge competence and expertise. As participation was not related to correctness in the current data, the executives were well served to ignore talkativeness as a heuristic cue for competence.

It is also important to note that the current data used participation rates that were based on an objective measure derived from coding video tapes of discussion. Often research on participation uses group members' estimates of participation as an index of participation (e.g., Kameda et al., 1997; Littlepage & Silbiger, 1992). It is possible that people who were influential in the current groups were also perceived by other in the team as high participators, when in fact they were not. If participants had ranked each another's participation, as they did in Kameda et al.'s study (1997), they may have ranked central and correct members as high relative to others regardless of their actual participation rates.

Managing Decision-Making Teams

Our findings imply that common information signals something, just because it is common, meaning that all group members were searching for that information. Moreover, what is commonly known before group discussion is amplified in the contents of discussion, and the choice supported by what is commonly known will likely be the group's choice. In short, our results suggest that group discussions amplify common information and do not effectively disseminate unique information.

The finding that cognitively central members were more influential adds another layer of evidence that group choice is an effective mechanism for identifying options that are supported by common information. Stated simply, the influence of a member is enhanced if she shares a lot of information with other members. Members who bring diverse information to the group will be cognitively peripheral, and their influence will be compromised. That is, having different information than others in a group decreased the ability to persuade others to adopt one's solution. Thus, unique information was not a valued commodity but was a liability in the influence process.

If the goal is to articulate widely shared information and to decide an issue based on what is commonly known, then group discussion and decision making is a useful vehicle for doing so.

We found that the groups' solutions were closer to the correct solution than were individuals' initially proposed solutions. Given that there is a normative solution approach to a decision problem, and that approach is indeed correct, then groups are better in making a decision than individuals. In contrast, if the normative perspective does not lead to the best choice and consideration of unique information would, then the goal should be to foster the impact of novel information on the group's collective decision.

If the goal is integrate diverse knowledge and to identify decision options that are supported by combining unique knowledge, then it is dangerous to assume that group discussions -- particularly unstructured, face-to-face discussions – will realize such a goal. One obvious implication is that the reasons for delegating decisions to groups need to be considered carefully. Moreover, it is important to recognize that group decisions are more likely to be supported by common than by collective knowledge. Collective knowledge is the sum of what is known by a group members and includes both common and unique information. In order to ascertain whether a decision is supported by collective knowledge, it is essential that unique information be fully explored and considered in the decision-making process.

If the goal is to construct an account of collective knowledge, then groups must be composed and their interactions structured with that goal in mind. One way to enhance the consideration of unique information is to assign members expert roles (Stasser et al., 1995, 2000; Stewart and Stasser, 1995). We analyzed archival data from an executive training session and hence were subject to many constraints in our investigation. However, in our data set, the role and within group variation of expertise maps much better on real world decision making groups, than is often the case for experimental studies. In experimental studies, members are assigned expert roles and, when such assignments are made salient, experts were more likely to repeat unique information. Most groups in organizational contexts would be more similar to the CCL team than to laboratory groups in this respect. That is, members' expertise is often not apparent or salient.

Moreover, in decision making groups in real life, it is unlikely that they would consist of experts and non-experts making a decision about issues that fall within the area of expertise of one or more of the group members. The most important decision making groups in real life consist of experts only. Think of the board of a company, the Federal Open Market Committee of the Federal Reserve Bank, the Governing Council of the European Central Bank, all small groups consisting of experts of equally high status, who make decisions that vastly influence our economy and consequently to a great deal our economic well-being. For this sort of real life decision making groups, the CCL results have relevant implications. Because members of the executive teams were all high status, leaders who were experienced at group decision-making and consequently they were more or less equal to one another. In order to benefit from the potential of such a high powered group in situations which demand novel solutions, we should differentiate the team member's roles and make salient their complementary domains of expertise (Stasser, et al., 1995). Although a great part of the expertise and knowledge will overlap, we should make the smaller part that each of them carries uniquely highly salient. The bits of unique expertise that each can offer need to be mutually recognized. Finally, to successfully air and integrate their unique knowledge, they need to be motivated to do so. That is, there needs to be an expectation that collective knowledge will likely support different decisions than common knowledge.

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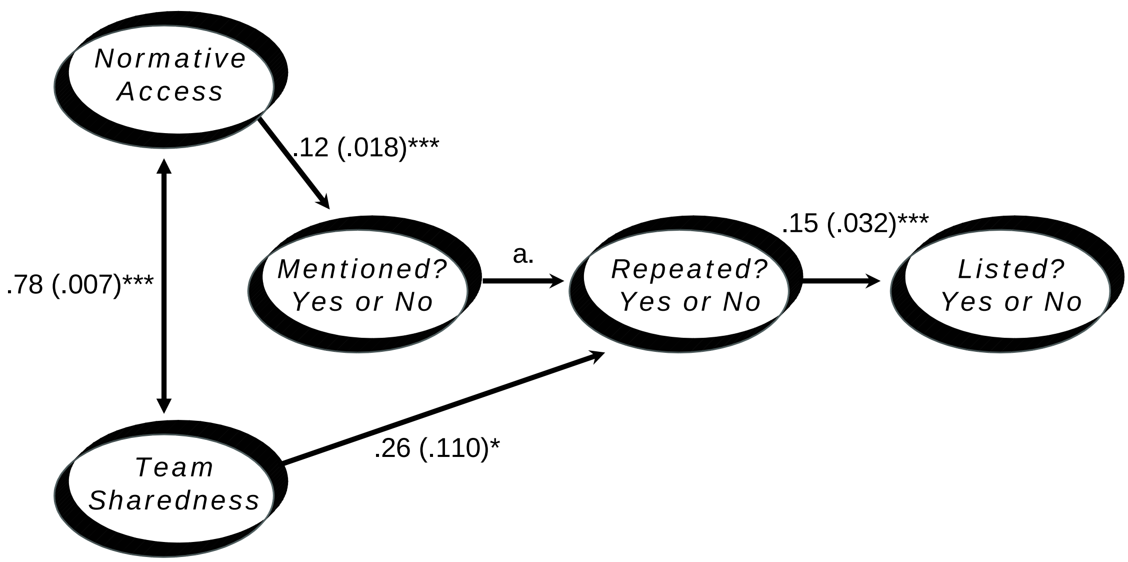
[1]. The current reported as well as subsequent multilevel regressions follow the accepted method proposed by Kenny and colleagues for the analysis of groups' data. Readers who are not familiar with that form of analysis are referred to Kenny et al (2002).

Figure Captions

Figure 1. Predicting whether an item will be mentioned, repeated and listed; standardized partial regression included for significant links with estimated standard errors in parentheses.

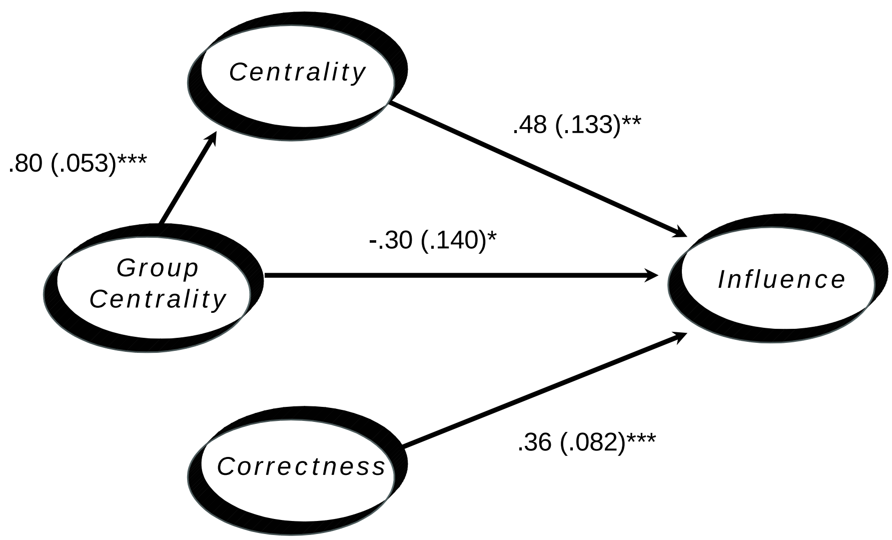
Figure 2. Predicting member influence from member centrality, average group centrality, and correctness of member's initial solution; partial regression coefficients included for significant links with estimated standard errors in parentheses.



a. Structural Link: Information could only be repeated if it was already mentioned.

*** p<.0001; * p<.05

Figure 1. Predicting whether an item will be mentioned, repeated and listed; standardized partial regression included for significant links with estimated standard errors in parentheses.



*** p<.0001; ** p < .001; * p<.05

Figure 2. Predicting member influence from member centrality, average group centrality, and correctness of member's initial solution; partial regression coefficients included for significant links with estimated standard errors in parentheses.

Nr.	Author	Title
08-40	Florian Kutzner Tobias Vogel Peter Freytag Klaus Fiedler	Pseudocontingencies in stereotype formation: extending illusory correlations
08-39	Wendelin Schnedler Adam Dominiak	Uncertainty Aversion and Preference for Randomization
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