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Information Exchange in Decision-Making Groups Using Group Support Systems

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Abstract

One important factor that can give decision making groups an edge over individual decision makers is the amount and diversity of decision-relevant information held by group members. Prior to group discussion, some of such information may be held uniquely by one or more members (unshared information) while other may be common among all members (shared information). How efficiently groups exchange shared as well as unshared information can influence decision quality. Past research suggests that face-to-face group discussions are frequently biased in favor of shared information: groups discuss more of their shared than unshared information, and unshared information is often introduced late in discussion. In this paper we examine these information sharing biases in the context of computer-mediated group communication. We describe a model of information sampling and use the model to predict sampling behavior. Model predictions are then compared with data obtained through a pilot study that used a Group Support System (GSS) for group communication. Findings of the pilot study are reported.

Keywords: Information exchange, information sampling, group support systems, GSS

Introduction

Major organizational decisions are routinely made by groups. Committees, task forces, project teams, panels, and boards are among the many labels for organizational subunits responsible for tasks ranging from planning, coordinating, and monitoring to problem solving and collective judgment. Groups are formed for many reasons, such as improved decision quality, sharing workloads, building social networks, and gaining support for the decision among stakeholders (Dennis 1996). New product development teams reduce costs and time to market, develop better quality products, and make more effective decisions than those made by individuals (Schmidt et al. 2001).

Perhaps no other factor plays a role as important to a group's accomplishments as communication among its members. Although group decision is affected by a number of factors, many researchers believe that group communication quality may be the single most important influence on the decision making success or failure of a group (e.g., Hirokawa and Poole 1996). Despite its significance, however, few studies have examined the communication process by which individuals access information from others (Hollingshead 1998). In particular, research in the efficiency of information exchange in groups using communication media other than verbal, face-to-face discussions is limited.

Due to differing roles, responsibilities, training, and experiences, members of decision-making groups often possess different sets of decision-relevant information. Information that every member of a work group holds prior to discussion is referred to here as *shared information* and information that is held uniquely by individual members as *unshared information.* Both shared and unshared information play important roles in group decision making processes and outcomes. For example, shared or redundant knowledge may help establish a common understanding among group members and help consensus building and better problem solving (Clark et al. 2002). From the information resource perspective, however, the differential advantage of groups over individual decision makers lies essentially in the unshared information.

The generally accepted information resource superiority of groups is based on the presumption that groups *pool* their unshared information which enables them to make more informed choices than would be possible if decision were made by individuals

alone. Group discussion serves as the primary mechanism for information pooling. A growing body of research suggests that groups engaged in face-to-face discussions have difficulty pooling their information - both shared and unshared (e.g., Stasser and Titus 1987). The pooling process is particularly inefficient with respect to unshared information. Information exchange inefficiencies in groups using computer-mediated communication, however, have received little research attention. This paper highlights the need for further examination of this important issue. Specifically, we discuss information sharing in GSS-supported groups and present the results of a pilot study.

In the next section we discuss information sampling and pooling and describe a model of information sampling. This section also contains research propositions. The section that follows describes research methodology. Next we present preliminary findings based on data generated using the model as well as that obtained through a pilot study of groups using a GSS. The paper concludes with a brief summary and suggestions for future research.

Sampling and Pooling of Information

Many scholars view discussions in decision making and problem solving groups as mechanisms for *collective information processing* (CIP). CIP may be defined as the degree to which information, ideas, or cognitive processes are shared and how this sharing affects both individual and group outcomes (Hinsz et al. 1997). In order for groups to succeed in achieving their goals, individual members need to share their knowledge, expertise, and opinions with the group, and the group as a collective unit must effectively synthesize, evaluate, and use the individual informational resources. From the *functional theory* perspective on group communication, forming an information base or a collective pool of information is a requisite for effective CIP and group problem solving. Communication plays a central role in establishing such a collective pool through search, storage, retrieval, weighting, and use of information. From the perspective of *social cognition*, groups need to ensure that individual cognitions are shared, evaluated, and incorporated to become part of collective cognition.

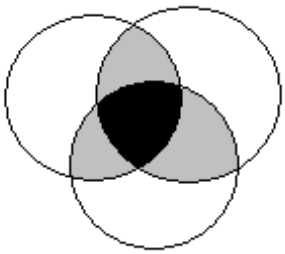

Figure 1. Prediscussion Decision-Relevant Information in a Three-Person Group Shared (Black), Partially-Shared (Gray), and Unshared (White)

Consider Figure 1, which is a conceptual depiction of the informational resources of a three-member group. Prediscussion, shared information (shown in black) is an important potential resource. This redundant information promotes shared understanding, discussion, and mutual consultation and advice, leading to better problem solving (Nonaka 1994). On the other hand, too large a size of prediscussion shared knowledge can also be counterproductive, especially if it leads to prediscussion consensus among members' preferences about a solution or decision. Members may perceive that they have similar knowledge and interpretations, and consequently may feel that there is less need to share information (Propp 1997). Irrespective of the amount and diversity of initial team member knowledge, benefits of group decision can only be realized if that knowledge is effectively communicated and assimilated in the collective memory.

In one of the earliest attempts to explain the information pooling bias in group discussion, Stasser and Titus (1987) proposed a collective information sampling model (CIS) of the following form:

$$p(\mathrm{D}) = 1 - [\ 1 - p(\mathrm{M})\ ]^n \qquad (1)$$

The probability that the group will discuss an item, p(D), is a function of the number of members who hold that item of information, n, and the likelihood that any one of these members will mention it, p(M). An implication of this formulation is that as the number of members who have access to an item before discussion increases, the likelihood of that item's being discussed increases as well. Although subsequent research provided general support for the model, it rests on several assumptions that often do not hold in actual groups settings. The model assumes, for example, that shared and unshared items are equally memorable, and all members have equal rates of recall and information communication - regardless of whether some are more talkative or cognitively alert than others. Other researchers have extended the model to allow for, for example, different recall rates.

The information-sampling models have received empirical support under specific conditions such as when equal-status members have comparable information loads, shared and unshared items are similar in task-relevance, and there are no cues in the discussion environment to help members to distinguish shared from unshared items (Wittenbaum and Stasser 1996). These models, however, do not account for various psychological and social variables that characterize discussions in "real-life" decision-making groups. They are best regarded as *baseline* models that can be informative in understanding the effects of information distribution on dissemination of information (Wittenbaum and Stasser 1996).

The precise role of computer-mediated communication (CMC) environments such as GSS in the recall and exchange of shared versus unshared information is currently unclear. Research in GSS supported group communication has so far yielded inconsistent results. Communication media can exert inhibitive as well as promotive influences on the exchange of information and formation of a group's collective information base. By limiting social context cues, most CMC environments help decrease awareness of members' social status and behavioral barriers to communication. Parallel communication reduces "production blocking" and allows group members to participate equally. These media effects, as a whole, should help remove any information sharing biases or inequalities. However, researchers have also found negative impacts of CMC on collective information processing. For instance, as Hollingshead (1996) determined, CMC can actually suppress information exchange by reducing the influence of all group members – including those that are "information rich".

The above discussion is stated formally in the following set of propositions:

Proposition 1: *The proportions of shared and unshared information actually discussed by GSS groups will resemble closely to those predicted by the model.*

Proposition 2: *Information sampling behavior in GSS groups will also resemble closely to that predicted by the model.*

Research Methodology

Our focus was to examine information sampling and pooling behavior in GSS supported groups. Specifically, the study looked at the exchange of decision-relevant information that was either completely shared or uniquely held by group members prior to discussion. Dependent measures were also generated using the information sampling model. Distribution of shared and unshared items of information was uniform across all groups.

The two dependent measures of interest were *percentage of information items pooled* during discussion, and *serial (temporal) order* of shared and unshared items discussed. The percentages were calculated using the number of shared and, separately, unshared items mentioned at least once, divided by their counts in the case (six and four, respectively), times 100. Item serial positions (e.g., first, second, third) were noted considering when an item of information was first brought into discussion. Mean serial position of shared and unshared items in each group was then calculated. Means for all GSS groups were derived from individual group means.

Participants were 39 undergraduate business students enrolled in a systems analysis and design course at a large US university. As part of the course, the students had received instruction in requirements elicitation through interviewing. Overall, 9 four-person and one 3-person group were randomly formed prior to the experiment.

The groups in the pilot study worked on a requirements elicitation task for the design of an information system for a restaurant chain. In four-member groups, two members assumed the role of a client and the other two that of a systems analyst. The case narrative contained ten information items that were considered essential for design of the system. Six of the items were shared among all four members in a group and two items each were uniquely held by two members representing clients. In order to

generate model data, we used a computer program that implements the information sampling model. An equal rate of recall and equal contribution of members were assumed.

Group members used the electronic brainstorming tool of *GroupSystems*, a popular GSS software. They were given 45 minutes to deliberate. Computer-generated records of *GroupSystems* discussions were printed out for coding.

Findings of the Study

Results concerning information exchange are shown in Table 1. The results indicate that Proposition 1 was not supported, suggesting that GSS groups may be able to avert the information sharing bias observed by researchers in face-to-face discussions. In particular, GSS groups shared considerably higher percentage of unshared information than predicted by the model. Figure 2 compares sampling behavior of the experimental GSS groups with that predicted by the model. As depicted in Figure 2, information sampling observed in GSS groups approximately matches that predicted by the model. Proposition 2 thus received a cautious support. Since the model has generally predicted well in face-to-face groups in the past, these results suggest that the sampling behavior of GSS groups was not much different from that observed in past face-to-face discussions. In other words, GSS supported group discussions may also exhibit temporal bias in favor of shared information. These findings, however, are based on a limited set of data and are exploratory in nature. A complete and accurate picture will emerge only after data obtained from a larger and more comprehensive study are analyzed.

Table 1. Mean Percentage of Information Exchanged

	Shared	Unshared
Model	85.4	48.5
GSS	87.2	75.0

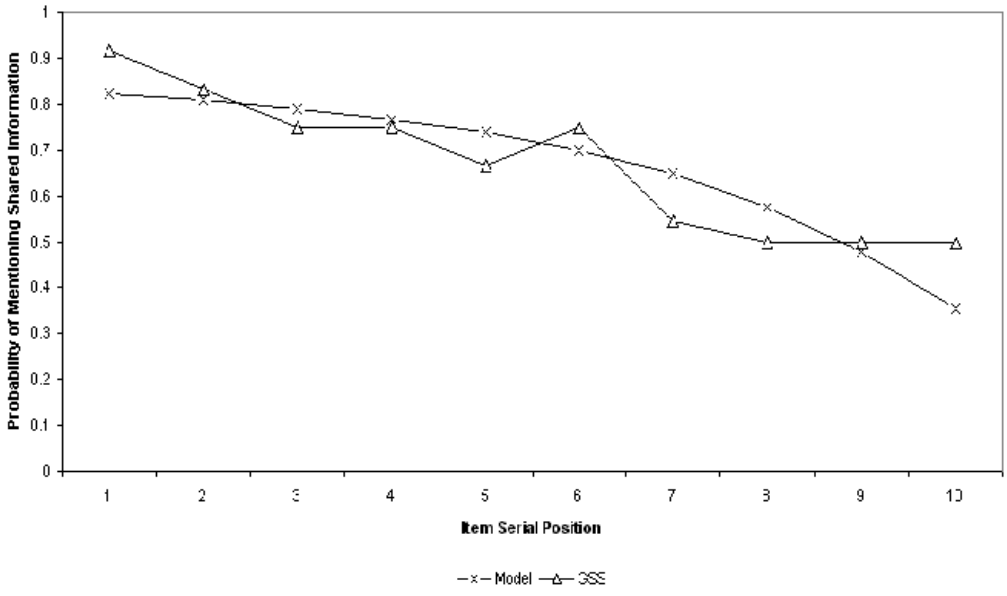

Figure 2. Probability of Mentioning Shared Information in Each Item Serial Position

Conclusion

In this paper we described how various decision-making environments might be susceptible to information sharing biases. In particular, previous research has found that unshared information is discussed disproportionately less and is introduced late in

discussions. We also described an information sampling model that attempts to explain some of the information sharing biases in groups. This research is expected to advance the current knowledge through enhancing our understanding of how shared and unshared information is exchanged in GSS-based group discussions.

The present research was also intended to serve as an exploratory study to learn the direction and approximate magnitude of information sharing biases, if any, in the GSS environment. Future research will examine these issues in more detail. More importantly, however, future research should attempt to answer why these biases occur and what role various factors related to task, technology, and discussion processes play in the information sharing inequities. Addressing these issues could lead to better information sharing environments and processes.

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