Group Judgment Processes and Outcomes in Video-Conferencing vs. Face-to-Face Groups

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Abstract

Groups of size three completed an estimation task by interacting either face-to-face or via a video-conferencing system. Results show significant differences were found in the confidence attached by groups to their decisions. Compared to face-to-face groups, video-conferencing groups showed smaller increases in confidence in their decisions, especially if they were instructed to discuss their beliefs and assumptions underlying their estimates and not the estimates themselves. However, this confidence was more appropriate than that of the face-to-face groups. Further, video-conferencing groups reported modifying more of their beliefs during discussion. However, there were no significant differences between the two interaction media on the following outcome dimensions: accuracy; over-confidence; size of credible intervals; or improvement over average initial individual estimates. Implications for the design and application of advanced systems for decision-making support and research are discussed.

1. Introduction

Recent advances in systems sciences have produced a wide assortment of cognitive tools to support interactions among the parties engaged in decision-making. Technology-mediated decision-making may represent more and more the reality of decision making in a variety of settings, be they social, organizational, or military in nature.

A subset of these collaborative technologies that have been developed and studied allow real-time interactions with audio and video communication among decision-makers. These new approaches to decision support are especially valuable where important decisions involve multiple geographically-distributed persons. Collaborative technologies for synchronous communication allow the dispersed decision makers to “meet” without the time, effort, and financial costs of a face-to-face meeting.

Yet, as with any new technology, questions arise about the advantages and limitations of these tools for collaborative decision-making among non-proximate group members. This report describes a laboratory experiment comparing decision making in traditional face-to-face groups and groups interacting via collaborative technology consisting of a video-conferencing system with audio as well as video communication capabilities. The decision task is designed represent real-world problems where members have asymmetric information and substantial uncertainty, but incentives to make the best or “correct” decision. Hence the focus is on group members’ subjective uncertainty or confidence regarding the decision as well as actual decision quality.

The paper begins with a brief overview of research on group judgment and decision-making, and then proceeds to discuss group decision technology and behavioral research with technology-mediated interactions. Next, we use current theories of group performance and decision making to identify the criteria by which group decision making can be evaluated, and report a laboratory study comparing face-to-face and collaborative technology groups on these criteria. Finally, we discuss the implications of these findings for the design and implementation of collaborative technologies.
1.1. Group Decision-Making Research

The importance of effective decision-making in organizations, particularly in the face of incomplete and uncertain information, leads many organizations to assign the task of decision-making to groups. Groups typically have access to a greater range of information than individuals and should thus be able to produce decisions that are higher in quality than those of individuals. It is also common for groups to show more confidence in their decisions than persons working alone [22], which is often desirable for implementation of the decision. Decisions made in groups may also be more likely to be accepted by group members than had they been made by one person simply because the members were involved in the process of making the decision.

One task for which interacting groups have demonstrated impressive gains over individuals is that of group judgment. A fundamental part of the task of many decision-making (and other) groups is the estimation of unknown quantities. That is, in the course of planning, choosing, or problem solving, it becomes necessary for the group to arrive at some consensus about the value of some variable, e.g., completion time, cost, number persons affected, and amount of available resources. For some groups, such as those charged with producing forecasts, their primary task is to form a group judgment under uncertainty. Not only have groups been found to be more accurate than their average individual, a non-trivial number of them are better than their best member [23], [24].

Unfortunately, the literature also shows that groups can exhibit many of the potentially problematic decision outcomes and processes commonly found among individuals (e.g. overconfidence [23]; and over-reliance on the availability heuristic [15]. Further, groups may fail to live up to their promise by not making good use of their members’ unique knowledge and information [20], [25]. Even worse, groups may engage in additional behaviors that can reduce decision quality (e.g. groupthink, [12], [17]). Thus, groups are a widespread means of making decisions in organizations, but the quality of their decisions is not guaranteed, even if members are confident in and committed to their group decisions.

Methods for reducing non-optimal decision-making in groups have long been of interest. Also of interest are group practices aimed solely at achieving efficiency goals. The plethora of groupware, electronic meeting systems, group decision support systems, group communication support, etc. have been designed to do both, improve group efficiency and decision quality [5], [26]. It is important that success in one area is not negated by failure in the other. The goal is for technologies to support groups help overcome the problems groups face without creating new, more serious problems.

Though the data showing their effectiveness are not in, collaborative technologies are being used, largely because they provide benefits to efficiency such as decreased time and money for transportation of group members to meetings. Ideally, collaborative technologies help, or at least, do not hurt the quality of decision making. Whether any given technology has beneficial, negative, or insignificant effects depends on many factors, notably the purpose of the technology, the type of task, group characteristics and member attributes, work context [11] and the evaluation criteria used. Our objective is to evaluate a particular form of collaborative technology—video-conferencing that supporting real-time audio and video communication—for a fundamental decision making task. In the next section, we review relevant literature concerning the use of video-conferencing technology for decision making by groups.

1.2. Video-Conferencing Technology

Decision-making processes in organizations are incorporating technology to an ever-greater degree. For example, consider the increasing use of video-conferencing that allows individuals separated by large geographical distances to interact in an approximation of face-to-face interaction. Decision making via video-conferencing may lead to both a reduction in transportation costs and a commensurate improvement in the time taken to make decisions.

Although it has benefits in terms of efficiency, collaborative technology to support group communications provides organizations and managers with a number of new challenges such as ensuring that miscommunication is minimized; roles, expertise, and trust are established; organizational policy and process is adhered to; fear of technology is overcome; and that all group members participate in the video-mediated decision-making process [6].

The growing use of collaborative technologies makes it important to learn whether technology-mediated decision-making differs significantly from the traditional face-to-face form of decision-making. Yet another important reason for comparative research has not been argued: to determine the generalizability of data from groups interacting via collaborative technology for the purpose of using
such technology to do research on basic group processes. That is, computer media, and particularly the video-conferencing technology discussed in this report, have several methodological advantages over group decision-making research with face-to-face or even traditional computer-mediated interactions [2]. Video-conferencing allows the manipulation of various independent variables and recording of dependent variables that are not possible otherwise. As such, greater knowledge can be derived from laboratory research into group decision-making processes.

Although researchers over the last decade have addressed the question of the advantages and disadvantages of computer-mediated communications, the precise impact of these technologies on group decision making remains unclear given the lack of consistent findings. Methodologies have been varied, but previous research on computer-mediated decision-making was restricted by technological limitations [8], and hence mainly considered keyboard-based interactions. Nevertheless, these findings have some relevance to the development and use of advanced collaborative technologies for interactions that include audio and video communications.

A number of comparisons of computer-mediated and face-to-face group decision-making suggest that computer-mediated decision-making is characterized by a number of deficiencies. Again, we note that the actual benefits and disadvantages depend on many variables, making generalization difficult. Nevertheless, it is informative to learn that many studies (e.g., [3]; [27] and [13]) have found that computer-mediated groups require more time than face-to-face groups to come to an agreement. (Also see [11]).

Computer-mediation has also been shown to lead to relatively lower levels of opinion change [1] and riskier decisions [13]. In addition, it has been reported [19] that computerized decision support systems improved the organization of the decision-making process but may lead to less thorough and critical discussion. In an experimental comparison, [11], reported that teams in a face-to-face condition were better informed and made recommendations that were more predictive of the correct team decision than did teams communicating via computers.

Computer-mediated communication does eliminate social information that is available in face-to-face interactions, though this is not always a disadvantage, and does not necessarily prevent personal interactions [28]. Nevertheless, it is possible that decision-making deficiencies under computer-mediated conditions are linked to the lack of visual feedback from interaction partners. Some research [3] for instance, showed better decision-making in the face-to-face condition than in the computer-mediated (non-visual) condition for women, who were predicted to be more sensitive to non-verbal communication than men. Yet, some authors [21] report women to be more satisfied with computer-mediated discussion than men, while others [18] reports more complex findings.

At the same time computer-mediated decision-making has been shown to hold significant advantages over face-to-face interactions [8] [9] report that teams in the computer-mediated condition were better able to differentiate group members in terms of the quality of their decision. Further, computer-mediation appears to have a significant impact on the group process, reducing the tendency for various behaviors that threaten quality decision making. The reported advantages of computer mediation include: more discussion among members and lower persuasiveness of individual arguments [8], a greater expression of opinions by group members [13], [16] lower conformity [1], the development and consideration of more solution alternatives [27], more unconventional decisions and greater equality of participation [13], and higher satisfaction with the process [27]. Yet, other studies (cf. [11]) find no differences in important group process and outcome variables.

All of the studies reviewed above, however, focused on keyboard interactions only. That is, there was no visual contact or audio communication between group members. Consequently, past findings may not generalize to groups using advanced collaborative technologies, such as video-conferencing.

At the same time it is possible that many of the advantages shown to exist for computer-mediated decision making under keyboard base conditions will extend to video-conferencing interactions. It may be that the advantages of computer-mediated interactions illustrated above are the result of a lower pressure to conform due to the physical separation of group members. Video-conferencing retains the physical separation of members found under keyboard based interactions; yet it is not known whether being able to see and speak with other group members might reduce this advantage. However, given that a lack of visual feedback from members may retard decision-making speed [3], [13], [27], the fact that visual feedback is present with video-conferencing interactions means that the time taken for may approximate those of face-to-face interactions.
Recently, technological developments have allowed the use of video-conferencing in decision-making research. The increased ease of use of this technology in comparison to keyboard-based interactions is likely to result in higher levels of satisfaction with the process [18], and a process that approximates that of face-to-face groups. A comparison of face-to-face and video-mediated interactions has shown that there are no significant differences in the number or duration of spoken turns, and the interpersonal interaction processes.

These video-conferencing studies however considered only differences in group decision-making process and have not examined potential differences in the decision outcomes between groups utilizing face-to-face and video-mediated interaction. For most organizations, differences in process will be of interest only inasmuch as they result in outcome differences. The quality of decisions resulting from group interaction is very important to organizations, and ultimately decision quality will be a major factor determining whether video-mediated interactions can be substituted for the traditional form of face-to-face interactions.

The investigation outlined in this paper allows a direct comparison of group decision making with video-conferencing technology and face-to-face interactions on a number of outcome and process variables. We proceed to describe these variables, and their role in determining the efficacy of the group interaction.

1.3. Decision Quality

The quality of individual and especially group decisions may be measured in a variety of ways. Normative models of group effectiveness include various outcome variables, e.g., the acceptability of the output to individual group members; whether the capability of group members to work together in the future is maintained or strengthened; and whether or not group members’ needs are more satisfied than strengthened by the group decision-making experience.

While such factors are important, another attribute is essential in comparisons regarding decision quality: the objective quality of the decision itself. Of course, objective measures of quality are unobtainable in the contexts of many if not most group decisions. If they can be made available in controlled research, it becomes possible to obtain crucial information that may generalize to these other contexts.

To allow for the evaluation of decision quality, the present research used a judgment task where the true value of the quantity being estimated could be obtained by the researchers. This means that decision quality could be assessed objectively in terms of estimation error. Note that although it has not been used in studies of the relative effects of various technologies on group performance, this task is representative of decision problems involving judgment and delayed feedback, such as occur when the future values of key variables must be estimated.

Estimation task have another special significance. As pointed out earlier, there is strong evidence that groups perform much better than individuals working alone. Thus the question is not whether the collaborative technology can overcome deficiencies in group process, but whether it can offer practical advantages without eliminating the special ability of groups to make more accurate judgments than individuals.

The subjective assessment of decision quality by the group members is also an important outcome variable. The group members’ beliefs about their decision quality are reflected in their expressed confidence in the accuracy of their estimates. As noted by [22], although acceptance of and confidence in a decision is important to ensure the effective implementation of a given decision, such confidence should not be unrealistic or too high. This is particularly so given that new information may emerge in the process of decision implementation which should lead to an amendment or correction of the initial group decision. Such an amendment may however become unlikely if the initial decision was made with an inappropriate degree of over-confidence.

The individual’s commitment to the group’s decision can also be measured by the degree to which the individual’s judgment after group discussion diverges from the group consensus judgment. The larger the difference the lower the commitment of the individual to the group decision.

In addition to the two main types of quality criteria for judgment tasks—those relating to objective estimation accuracy and those relating to the group’s beliefs about their estimation accuracy, another outcome of interest is the amount of time taken to reach the group decision.

In summary, the specific outcome measures used to assess quality include: estimation error as given by the difference between the correct answer and estimated answer (the mean signed deviation or mean absolute error), the level of confidence members place in their group estimate, the appropriateness of the confidence levels (i.e. correspondence between confidence and estimation accuracy), and the length of time taken to reach decision.
2. Method

The experiment consisted of three parts, an initial individual task, a consensus group estimation task, and a final individual estimation task. Monetary rewards were used for each part to promote efforts at accurate estimation and responding of true individual beliefs.

2.1. Participants

Participants were 189 undergraduate students at a large public university who completed the task for credit for a class. Participants in each session were not previously acquainted and were randomly placed into groups of three and engaged in an estimation task. Participants were informed that the top performing group in each experimental condition would be rewarded with $30 i.e. $10 for each group member.

2.2. Task

Participants were asked to estimate an unknown quantity, specifically the number of parking tickets issued per annum at the University of Illinois at Urbana-Champaign. Participants were not provided with any prior information. This task was chosen because participants were likely to possess some, but not all, of the knowledge relevant to the correct estimation of the quantity. Each individual can therefore be thought to hold a number of beliefs or assumptions regarding the value of unknown quantity. Because group members were able to draw on their own unique knowledge pertinent to the problem, there was the information asymmetry evident in decision-making groups in the field [4].

Pre-testing with individuals showed that there existed a systematic bias in the direction of underestimation of the quantity. This task provided groups with the challenge to de-bias their individual estimates through the process of group discussion.

2.3. Design

The primary design was 2 x 3 factorial with two between-subjects independent variables: Medium for interaction (face-to-face or video-conference) and Estimation Process. The three conditions of Estimation Process varied with respect to the on the elicitation and discussion of individual estimates and beliefs.

Instructions were used to vary what individuals produced initially, and what they shared with other members in the group discussion. More precisely, the initial task asked individual to independently provide either their estimates or statements of their beliefs pertaining to the variable to be estimated, or both.

Condition labels for this individual pre-group step show a capital letter, with I representing initial independent individual estimates and B representing initial independent individual beliefs. Labels for the procedure for group discussion include lower case letters i or b to indicate which members’ independently-produced information, individual estimates or beliefs, respectively, was to be discussed within the group.

The Estimation Process conditions were:

Condition 1: Ii – each group member made an independent individual judgment regarding the number of parking tickets and then was instructed to discuss these initial individual estimates in their groups and arriving at a group estimate.

Condition 2: IBb: each group member made an independent individual judgments regarding the number of parking tickets and then listed their beliefs and assumptions before joining the group and being instructed to discuss both the independent individual estimates and beliefs.

Condition 3: Bb - group members did not make any explicit independent individual judgments regarding the number of parking tickets but did list their beliefs and assumptions and then were instructed to discuss these during their group discussion.

The design included a within-persons factor for elements of the task that were completed more than once. This includes estimations and credible intervals made in the initial individual phase that were repeated in groups and again as individuals following the group task.

Participants were randomly assigned to groups and the groups were, in turn, randomly assigned to the three interaction conditions. Assignment to Medium condition was determined by the date of participation.

2.4. Procedure

Participants read and signed informed consent forms explaining the study and the manner in which the reward would be allocated. In the video-conferencing conditions all tasks were done on the computer whereas in the face-to-face condition all
tasks were done with paper-and-pencil. After the group arrived at a consensus group estimate, the group also attached a confidence level to the estimate and arrived at a 90% credible interval for the group estimate.

Group members were then separated and told they had a final opportunity to win money for accurate estimation as an individual. Each member gave an individual estimate as well as a confidence level for this individual estimate. These provided the measure of member commitment to the group estimate.

Finally, all participants completed a post-task questionnaire designed to assess their perceptions of their group and the process that they followed and demographic information. In addition, the post-task questionnaire asked participants to list the beliefs and assumptions that were modified, learned from others, and created during the group discussion.

The nature of the estimation task resulted in a distribution of estimates that was not normal given that estimates were bounded by zero and infinity. Estimates were thus log-transformed to achieve a normal distribution and all subsequent calculations used these log-transformations. The log transformation resulted in a reduction in the skewness from 4.083 to -0.437.

Data from seven participants whose estimates were more than three standard deviations from the mean estimates were eliminated.

3. Results

The results of this study suggest that computer-mediated decision-making is not significantly different from face-to-face interactions in terms of several criteria assessing the quality of the group decision. Significant differences did however exist between computer-mediated and face-to-face interactions in terms of the group confidence in the decision made by the group. Face-to-face groups were more confident, and their confidence was less valid, compared to video-conferencing groups. Nevertheless, video-conferencing groups were still overconfident.

Another important difference to emerge was the greater tendency of video-conferencing groups to report more changes in their beliefs regarding the variable being estimated. The manipulation of Estimation Process changed group members’ reports of learning and modifying their beliefs—but so did the communication medium used by the groups.

Furthermore, this study was replicated some of the findings regarding group and individual confidence made by other researchers in the field of judgment and decision-making for groups, such as evidence of overconfidence at both the group and individual level [23], [24]. More importantly these phenomena existed for both the computer-mediated and face-to-face conditions, illustrating that some of the traditional biases of decision-making of decision making by individuals and by groups are observed for groups interacting under computer-mediated conditions.

3.1. Quality of Group Judgments

No significant main effect for Medium on the quality of the group estimate (defined as the log of the absolute difference between the group estimate and correct answer) was found (F=.406, p=.524). Similarly, there was no significant main effect for the Estimation Process condition on group decision-quality (F=2.052, p=.130).

3.1.1. Improvement of Group Judgment over Average Individual Judgment. There was no significant main effect for either the Medium (F=.762, p=.386) or the Estimation Process (F=.004, p=.944) on the mean improvement of group judgment over average individual judgment.

Similarly, non-significant effects are found for Medium (F=.453, p=.504) and Estimation Process (F=2.123, p=.151) when the improvement of group judgment over average individual judgment is treated as a categorical variable (improvement versus no-improvement). It should be noted that this analysis involved comparisons with only the II and IBb conditions, as there were no initial estimates in condition Bb.

3.1.2. Improvement of Group Judgment over Best Individual Judgment. There was no significant main effect for Medium (F=1.78, p=.187), whereas a significant effect did exist for Estimation Process (F=5.199, p=.026). Groups that did discuss their beliefs (condition IBb) were, on average closer to the best individual judgment in their group (mean difference=-3287) than groups that were not instructed to discuss their beliefs (mean difference=-14651).

3.1.3. Confidence in Group Judgment. While Estimation Process appeared to have no significant effect on the confidence of groups in their judgment (F=.543, p=.582), a highly significant main effect for communication Medium was evident (F=16.853, p<.001). Overall, face-to-face groups had higher confidence in their group judgments than did video-
conferencing groups. Groups that interacted face-to-face had significantly higher confidence levels (mean=6.53) than those that interacted via a video link (mean=5.87).

However, a significant effect was observed for the interaction between Medium and Estimation Process (F=6.186, p=.002). The difference in group confidence between the two media conditions became even more pronounced for those conditions where beliefs were discussed (conditions IBb and Bb combined). Under these conditions the mean confidence for groups interacting face-to-face was 6.74 whereas for groups that interacted via the video link the mean confidence dropped to 5.76. The difference between the Medium conditions was significant for both the IBb and Bb Estimation Process conditions even when using a Bonferroni correction for post-hoc test (t(94)=4.724, p<.01; and t(83)=2.822, p<.01, respectively).

3.1.5. Size of Credible Intervals. The size of the credible interval can be considered to be an indication of the uncertainty of the group in the group judgment; the larger the size the greater the degree of uncertainty. There were no significant effects for either Medium (F=1.252, p=.288) or Estimation Process (F=2.177, p=.141) on the size of the credible interval (defined as the log of the difference between the upper and lower bound of the credible interval).

3.1.6. Overconfidence. Both computer-mediated and face-to-face groups were highly overconfident in that their credible intervals were narrower than implied by confidence levels. Only 12.5% for the face-to-face groups and 12.17% of the groups in the video-mediated condition had a 90% confidence interval that contained the true answer as opposed to the 90% of groups whose confidence intervals would be expected to contain the correct answer if overconfidence did not exist. These “hit rate” percentages are not significantly different (z(obt)=.04, p>.1).

3.1.7. Validity of Confidence. The correlation between the group confidence and the group error can be interpreted as an indication of the validity of a confidence rating; a negative correlation would indicate that confidence increased as the group error decreased. For face-to-face group the correlation was .296 (p=.003) whereas for video-mediated groups the correlation was -.052 (p=.520). Face-to-face groups thus got more confident as their error increased. This was not the case for groups that communicated via the video-link.

3.1.8. Beliefs Modified, Learned, and Discussed. As expected, Estimation Process had a significant main effect on the number of beliefs that the group modified and learned in the group discussion. Those groups that were instructed to discuss their beliefs (i.e. condition IBb and Bb) reported modifying and learning significantly more beliefs than those groups that were not instructed to discuss their beliefs (t(85)=3.181, p<.01; and t(80)=3.351, p<.01). No significant differences existed for the number of beliefs that emerged (t(72)=1.741, p=.083) although groups that were instructed to discuss beliefs did report more beliefs emerging (mean=1.31) than groups that were not instructed to do so (mean=1.04).
A main effect was also noted for the Medium for the number of beliefs modified (F= 14.333, p<.001) with groups that communicated via a video link reporting significantly more beliefs that were modified (mean=3.04) than groups that interacted face-to-face (mean=2.19).

Table 1. The effects of Communication Medium and Estimation Process on reported number of beliefs modified, learned from other members, or emerging from group discussion.

<table>
<thead>
<tr>
<th>Beliefs</th>
<th>Estimation Process</th>
<th>Video-mediated</th>
<th>Face-to-Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified</td>
<td>Li</td>
<td>2.500</td>
<td>1.862</td>
</tr>
<tr>
<td></td>
<td>IBb</td>
<td>3.211</td>
<td>2.391</td>
</tr>
<tr>
<td></td>
<td>Bb</td>
<td>3.207</td>
<td>2.323</td>
</tr>
<tr>
<td>Learned</td>
<td>Li</td>
<td>1.237</td>
<td>1.385</td>
</tr>
<tr>
<td></td>
<td>IBb</td>
<td>1.765</td>
<td>1.846</td>
</tr>
<tr>
<td></td>
<td>Bb</td>
<td>1.962</td>
<td>1.656</td>
</tr>
<tr>
<td>Emerged</td>
<td>Li</td>
<td>.921</td>
<td>1.3125</td>
</tr>
<tr>
<td></td>
<td>IBb</td>
<td>1.254</td>
<td>1.421</td>
</tr>
<tr>
<td></td>
<td>Bb</td>
<td>1.302</td>
<td>1.417</td>
</tr>
</tbody>
</table>

4. Discussion

The results of this study suggest that there exist no important differences between face-to-face and computer-mediated decision making at the level of the decision quality. Decision making that was mediated by a video link did not produce group estimates that were significantly larger, more accurate, or a greater improvement on the average initial individual estimates than was the case for face-to-face interactions.

The key difference between video-mediated and face-to-face interactions appears to be that face-to-face interactions result in a significantly higher confidence by the group in the group decision than is the case of video-mediated interaction when the group explicitly discusses the beliefs and assumption underlying their individually arrived at estimates. The reasons for this interaction effect are not clear but it may be that a discussion of beliefs and assumptions is seen to be helpful by group members only when they are in close physical proximity to each other. It may be that social presence [cf. [28]] and the availability of cues about the social context [Sproull & Kiesler, 1986] play a role in the increase in confidence so prevalent in face-to-face groups.

It is also possible that face-to-face interactions promote a greater degree of group ownership of the arrived at solution. Jointly writing down beliefs and assumptions on a shared and tangible document may lead to greater confidence and escalation of commitment than the more intangible sharing of ideas and assumptions via a video link.

This difference in terms of group confidence between face-to-face and video-mediated interactions is important in that it raises questions about the validity of modeling face-to-face interactions using computer-mediated interactions. Yet, neither the size of credible intervals nor commitment to the group estimate varied with communication medium despite the supposed high correlation between these different manifestations of confidence and uncertainty in a decision. This suggests that the manner in which confidence assessments are arrived at merits further investigation.

The repeatedly established tendency for both individuals and groups to be highly overconfident when making judgments and decisions has already been discussed and has also been replicated in this study. The implications of such overconfidence for any organizations, business, government or military in nature, are profound. Groups that are too confident about the veracity of their decisions are unlikely to be open to new or contradictory information, are likely to over commit resources to their chosen path of action and are thus, in general, likely to engage in many of the dysfunctional decision-making heuristics that have been extensively discussed in the decision-making literature (e.g. escalation of commitment, groupthink).

The finding that video-mediated interaction results in lower levels of confidence, particularly when beliefs are explicitly discussed at the same time is thus encouraging. The physical separation of individual group members may act to reduce group pressures to consider only one solution, reduce the
tendency for one individual to dominate the discussion, e.g. [14], or reduce the tendency for individuals to reinforce each other’s level of confidence.

Similarly, the explicit discussion of beliefs may reduce confidence by allowing group members to realize a large range of factors that may impact on the solution (i.e., increasing uncertainty). As such computer-mediated technology may, in fact, lead to a greater focus on facts rather than personal factors such as confidence or perceived expertise which can, in turn lead to overconfidence and lower decision quality. The result is that video-mediated discussion may result in confidence levels that are lower but at the same time more appropriate (i.e. well-calibrated). This is reflected in the fact that face-to-face groups were more confident the more incorrect their answer was.

Both the review of literature and the findings of this study suggest that there are significant process differences between video-conferencing mediated and face-to-face decision-making. Which form is more desirable is likely to be context dependent. The more rapid decision making which seems to occur for face-to-face groups may be key in certain decisions while the more appropriate confidence level and greater status equality under video-conferencing may be important in other conditions.

These findings suggest that video-mediated decision-making may be ideal for creative decision-making in organizations and environments that are characterized by high status differences and norms and expectations of conformity to authority; while having lesser applicability in situations that require that decisions are made rapidly and are implemented by all individuals with confidence.

It may however be possible to design group processes that overcome some of these limitations of video-mediated decision-making while retaining the advantages. A context dependent normative model of video-mediated decision-making may provide general guidance for the application of video-conferencing technology to the applied decision-making field.

The overall implications of these findings are that computer-mediated group decision-making closely approximates face-to-face interactions—at least for most outcome variables considered in this study. This, in turn, suggests that, for estimation tasks at least, computer-mediated decision-making can be substituted for face-to-face interactions. Further, there is reason to be optimistic about being able to use video-conferencing technology in basic research on group decision making processes and performance—as long as the impact of this technology on subjective evaluations of decision quality by group members, i.e., confidence assessments, are taken into account.

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