Knowledge Sourcing and Knowledge Consumption in Computer-Mediated Complex Decision Making

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Abstract

Individuals are turning increasingly toward web-based information sources as input for complex decisions. Gathering and evaluating decision criteria in an online context is enticing because of information availability and increased control over the process, but how do these factors impact performance? This study shows how an interaction effect between Social Comparison and Social Facilitation predicts and explains how decision making performance is influenced differently by an information consumption-only approach versus a consume-and-contribute approach. Results from an empirical evaluation indicate that publishing decision criteria and reasoning (e.g. in a forum, blog, or knowledge base) plays an important role in improving complex decision making performance.

1. Introduction

Complex decision making is a staple of life. Almost daily, individuals rely on peer knowledge published in electronic sources such as forums, specialized blogs, or knowledge bases to inform difficult problems.

Many decisions are simple, in that they involve few options and the outcomes of each option are relatively certain. Other decisions may involve many options or input combinations, and uncertainty, subjectivity, and ambiguity may be high. When decisions display these aspects of complexity, decision makers often desire external input. This input may be gathered from formal group interactions, informal interpersonal communications, books or periodicals, or from electronic sources such as online community forums, specialized blogs, or knowledge bases. The common belief is that more input tends to generate better results, or in other words, “two heads are better than one.”

More and more input for decision making is being obtained via web sources, probably because they are relatively easy to access, are searchable, and because the social norms of face-to-face communication are not present. A decision maker also has greater control over the information he or she chooses to consume, whereas in a face-to-face approach social norms or meeting structure require consideration of certain ideas.

Of course, because knowledge can be obtained from many sources, methods of sourcing (i.e. contributing) knowledge are equally varied, and there are cost and benefits to each method [11]. Notably, when decision making involves online interactions, contributing knowledge back to an online community, forum, or similar source is optional, whereas in a face-to-face environment, interaction is expected.

On its face, it may seem obvious that having so much information to access would improve accuracy. At the same time, publishing decision making criteria on a web forum or knowledge base may seem irrelevant to the accuracy of a decision. But these suppositions have not as yet been examined from a theoretical standpoint, or tested empirically. As such, this study addresses the following research question:

How do knowledge sourcing and consumption in a web environment influence complex decision making performance?

2. Knowledge sourcing in a web environment

Knowledge sourcing is the act of contributing information for others to consume. This may come in the form of verbal discussion or lecture, or the information may be published in a physical document or in a knowledge database, forum, blog, or other electronic medium. The motivations for knowledge sourcing include self-interest, personal gain, relationship nurturing, reciprocal behaviors, and organizational gain [3]. There is clear value in
capturing information for the benefit of others, and extensive research continues to explore this important domain. However, the benefits of knowledge sourcing have generally been viewed from the standpoint of eventual consumers. Less consideration has been given to the effects of knowledge sourcing on the individuals who source. Specifically, this research seeks to understand the impact of knowledge sourcing on the contributor’s performance.

The proposition that sourcing may affect the contributor’s performance stems from Social Facilitation Theory (SFT). SFT posits that the prospect of being evaluated by peers impacts performance [22]. SFT evolved from many empirical observations of altered performance when a person is in the presence of others as opposed to being alone [20]. In some cases performance was improved by the presence of others, and in other cases performance was impaired [22]. This altered performance is posited to stem from increased arousal resulting from apprehension of negative evaluation [21], which arousal then increases cognitive effort [22]. Within a given domain, these effects of evaluation apprehension serve to increase performance for skilled persons, but decrease performance for unskilled persons. For instance, the presence of an audience would serve to improve a skilled actor’s performance, while making a poor actor perform even worse.

The actual presence of others is not necessary for social facilitation. Since the driving factor is evaluation apprehension, merely the expectation of peer evaluation is enough to create this effect [1, 5]. In particular, people have been shown to react to computer mediated social phenomena as they would to real people in real proximity [16].

When web users post their decision process in a blog, forum, or other web interface, they recognize that their performance is available to be evaluated by others. SFT explains that this arousal will increase cognitive effort [22], resulting in better thought-out and more accurate decisions, when the decision maker has skill in the subject matter in question. Conversely, SFT explains that when the decision maker is unskilled in the subject matter, decreased accuracy should result. Hence, we predict,

H1a. Knowledge sourcing will increase complex decision making accuracy when the domain skill of the decision maker is high.

H1b. Knowledge sourcing will decrease complex decision making accuracy when the domain skill of the decision maker is low.

3. Knowledge consumption in a web environment

When it comes to complex decisions, knowledge consumption is generally considered to be the important factor influencing performance. More information is expected to provide more alternatives and perhaps even synergy as thoughts are combined. However, the availability of information does not guarantee the thorough and proper use of that information [8]. Sometimes, useful peer knowledge is utilized and sometimes it is ignored [8].

We propose that Social Comparison Theory (SCT) can help explain the manner in which peer knowledge is likely to be consumed when decision makers seek external input (e.g. access a knowledge base or electronic forum). SCT explains that individuals evaluate their own opinions and abilities by comparing them with others [10]. SCT has been widely applied, finding interest in fields as diverse as sport performance [2], emotional health [6], and cultural measurement [13]. In organizational settings, effects of social comparison have been posited to affect leadership, performance appraisals, and virtual team interactions, to name a few [12]. Even technology acceptance may be partially driven by a need to compare oneself to others [14]. Though SCT was originally developed for face-to-face contexts, the same effects have been discovered in computer-mediated contexts [17, 18]. Thus, it appears that the motives that drive social comparison behavior are also present in virtual interactions.

SCT makes the following three propositions that are relevant to the present study:

Prop. 1: Humans have an intrinsic desire to establish that their opinions are correct.

Prop. 2: To the extent that objective, non-social information is unavailable, people will evaluate their opinions and abilities by comparing them to the opinions and abilities of others.

Prop. 3: Given a choice, individuals will intentionally compare themselves to those they perceives to be most similar to themselves in ability or opinion. The less similar one is with
another person, the less likely one will compare oneself with the other person.

The intrinsic motives for social comparison include a desire to gauge relative standing and build or maintain a positive self-image [19]. To the extent that complex decision makers already have a formed opinion when they seek outside input, SCT posits that they will compare their opinion to only a specific subset of available information: that which tends to match their own preconceived notions. This is because in computer-mediated knowledge consumption, objective points of comparison may be difficult to identify, causing opinions to become the main point of comparison and evaluation. In addition, in an online environment, users can “block out” opinions that are dissimilar to their own because in online environments, as opposed to face-to-face contexts, users have a great deal of control of what information is presented. This means that even though there may be many alternative ideas and approaches to consider, knowledge consumers will tend to narrow their attention to focus only on information that most closely matches their own ideas.

In a scenario where a decision maker is seeking input for a complex decision via electronic meeting systems, web forums, or knowledge bases, we therefore expect that the availability of peer knowledge should have little effect on performance. To put it simply, there is a tendency to get external input only to confirm one’s own ideas. In such cases, outside input that offers an alternative view is more likely to be ignored.

When considering complex decision making from a social comparison standpoint, simply having more information is by itself not necessarily a good thing. More information increases the likelihood that some of the available commentary will closely match the user’s opinion, thereby making a narrow focus easier, not allowing proper consideration for alternative ideas.

Based on SCT, we hypothesize that knowledge consumption will only increase complex decision performance when it is accompanied by knowledge sourcing. Knowledge sourcing can overcome the problem of narrow comparison focus by giving a user motivation to consider information that contradicts his or her own opinion. As mentioned previously, the act of publishing decision-making criteria will increase apprehension of negative criticism. A decision maker experiencing this apprehension will have increased motivation to review alternative opinions, so as to identify and address potential criticism prior to publishing. Thus, increased information availability should increase the performance of the decision maker, if the decision maker is expecting to source his or her decision making process. SCT explains this exception by stating that considering divergent opinions “will produce tendencies to change one’s evaluation of the opinion or ability in question” [10] (p. 12).

This interaction of social facilitation and social comparison effects should only serve to improve accuracy if the decision maker has some level of skill in the subject domain. Increasing the amount of consideration given to alternatives is only useful if the decision maker has at least some ability to determine the value of proposed alternative ideas. If such ability is lacking, no amount of extra consideration of alternatives can improve the result.

Hence, a decision maker who is skilled in the subject domain should improve their performance beyond what knowledge sourcing alone would provide, because their skill allows them to better recognize the more valuable alternative viewpoints. In summary, H2. Combining knowledge sourcing with knowledge consumption will further increase complex decision making accuracy.

4. Credibility assessments as complex decisions

The field of deception detection is an ideal example of complex decision making, and ideal for testing the proposed hypotheses. Those who make credibility assessments at border stations, interrogation rooms, in hiring committees, or in various other environments rely on many inputs, each with varying levels of reliability and contextual constraints. Because of the number, the constraints, and the complexity of possible inputs, reliable information in an operational environment is difficult to find and identify. Because of the difficulty of accurately assessing an individual’s credibility, novices and professionals alike consistently perform poorly, and yet display overconfidence in their abilities. Actual unaided accuracy in this arena consistently hovers just above chance levels [4] regardless of novice or professional status. Yet
confidence is consistently higher than actual ability [9].

Credibility assessment performance can be dichotomized in two categories—truth detection accuracy and deception detection accuracy. Truth detection accuracy refers to the decision maker’s accuracy when the target of interest is in fact truthful. Conversely, deception detection accuracy refers to the decision maker’s accuracy when the target of interest is in fact being untruthful. Though overall accuracy is around 54% [4], truth detection accuracy consistently outperforms deception detection accuracy, at least among novices. Novices are relatively good at detecting truth-tellers, while detecting liars has proven much more difficult. This observation has been termed the “veracity effect” [15].

There are at least two possible explanations for the veracity effect, both of which rely on the premise that humans are more familiar with truthful communication than deceptive communication. Because overall deception detection accuracy hovers consistently around chance levels, the veracity effect may be simply a product of a “truth bias,” or the tendency to assume truthfulness simply because that is what is most familiar. The alternative explanation is that the veracity effect is reflective of actual skill—that people really are better at detecting truth than they are at detecting accuracy. In other words, because people are most familiar with truthful communication, it is easier for them to identify it. While we tend to believe the latter explanation, in that humans have at least some skill, the exact cause of the veracity effect has not yet been determined.

To the extent the veracity effect reflects an actual difference in skill, it provides a useful mechanism for testing our hypotheses in a computer-mediated decision-making environment. This study’s proposed hypotheses make separate predictions regarding high-skill versus low-skill domains. Deception detection accuracy generally falls below chance levels, while truth detection accuracy is consistently above chance levels. Thus, for this study, we operationalize high-skill domain performance as truth detection accuracy, and low-skill domain performance as deception detection accuracy.

5. Method

Participants for an experiment designed to test the hypotheses were recruited from several locations in the Midwest and Western United States. Because credibility assessment performance has been shown to be relatively standard across all demographic groups [4], no attempt was made to target specific sub-populations.

Credibility assessment interviews were conducted by professionals as part of a separate experiment. Interviewees in the separate experiment were instructed to be truthful or deceptive in their responses, and self-reported their truthfulness for each question on an 11-point scale. These interviews were semi-structured such that specific questions were asked of each interviewee, and ad-hoc follow-up questions by the interviewer were allowed. The interviewees were motivated monetarily to convince the interviewer that they were being truthful.

For the current study, we selected a subset of these responses. The interaction from one standard question was singled out, and 20 total interviewee responses were selected. The singled-out question read as follows: “Please tell me what you did today from the time you woke up until arriving at this interview.” This question was chosen because it is a question regularly used by professional interviewers in various settings. Also, for simplification and to guard against the inherent weaknesses of self-report measures, only responses that were self-reported as very truthful or very deceptive were retained.

Participants in the current study (N=54) read transcripts of a portion of each interview and made truthfulness judgments regarding the interviewee via a web interface. The web interface allowed participants to read the 20 transcripts where the interviewee was either lying (9 cases) or telling the truth (11 cases). After reading the transcripts, participants were asked to rate how truthful they perceived the interviewee to be on a 0 to 10 scale, 10 being completely truthful. Half of the participants were required to provide justification for their decisions, with the understanding that future participants would review their reasoning. Efforts were made to encourage participants in the justification requirement condition to give thoughtful justification. In addition to careful instructions, monetary awards were offered for the decision criteria that received the highest evaluations by the research team. Participants were allowed to give as many reasons as they desired, but tended to limit their justification to about two reasons.

A 2x2 factorial design with 20 repeated measures per participant was used.
treatments were 1) the justification requirement explained above, and 2) peer knowledge access. Those who had peer knowledge access were shown decision criteria provided by other participants prior to making their own decision. The justification condition was designed as an operationalization of knowledge sourcing, while the peer knowledge access condition allowed for manipulation of knowledge consumption.

In a real-world environment, not all users of a system see the same number of comments. Over time the number of and variety among comments grow. We wished to retain this dynamic nature in the experimental setting, thus, we did not place limits on the number of comments that were visible to each participant.

5.1. Measures

Participant performance was determined using the traditional method for this type of deception detection experiment, which is to calculate the absolute difference between the interviewee self-report and the participant’s judgment [7]. For instance, if an interviewee reported a “10: completely truthful,” and the participant selected a “0: completely deceptive,” the participant would have an error of 10 points. Relatively higher values indicate a larger error, which is equivalent to lower accuracy, and thus poorer performance.

6. Results

An important assumption of this experiment is that in general, individuals are better at detecting truthful communications than they are at detecting deception. This veracity effect has been discovered in previous work, and we rely on it here to serve as an operationalization of domain skill, an important factor in SFT. To verify this trend for the current context, performance scores for the 11 truth cases and 9 deception cases were compared in a paired t-test. Deception accuracy was significantly lower than truth accuracy, (t = 2.25, df = 53, p = .029). Truth mean error was 3.60; deception mean error was 4.43.

A multiple regression model examined the effects of the two manipulations--knowledge sourcing requirement and knowledge consumption--on overall complex decision accuracy. Total time spent by participants was initially included as a covariate, but it was not significant and did not significantly add to the amount of explained variance; thus it was dropped from the final model. In this analysis, neither manipulation displayed independent significant effects on accuracy. However, the interaction of knowledge sourcing and knowledge consumption was significant (p < .01). The model produced via the regression analysis was also significant (p < .05, R² = .18).

Figure 1 displays the truth detection and deception detection accuracy rates of each condition.
Deception detection accuracy appeared to be relatively unaffected by experimental manipulations. Thus, the performance improvement among the participants that both consumed and contributed information reflects an increase in truth detection accuracy.

7. Discussion

As expected, knowledge consumption alone did not improve complex decision making performance. Simply accessing and processing available information did not have a noticeable effect on accuracy. Knowledge sourcing alone also had a near-significant effect on truth accuracy but not deception detection accuracy, providing tentative or suggestive support for hypothesis 1a but not for 1b. In other words, knowledge sourcing alone may have improved performance in the high-skill domain, but no evidence was found that it decreased performance in the low-skill domain, contrary to SFT.

In support of hypothesis 2, performance did increase when decision makers both consumed and contributed decision criteria. Based on SFT, we would predict that any increase in performance would only occur when the decision maker was skilled, and the results support this proposition: performance only increased when the interviewee being judged was not lying. This supports the idea that when decision makers experience evaluation apprehension, they are more likely to put more cognitive effort into considering information that may contradict their own view.

SFT would also predict that deception detection performance should decrease, and this effect was not seen. The reason or reasons that SFT’s predictions were only partially supported are unclear. Perhaps there is a lower limit to how much social facilitation can decrease performance, or perhaps the computer-mediated complex decision making domain has unique qualities that somehow moderate this effect. Future research can seek to better understand this phenomenon.

The knowledge sourcing and knowledge consumption interaction produced a performance increase of approximately 5% compared to the other three conditions. Though somewhat small, a 5% performance increase in screening accuracy or forecasting can have very profitable results.

The results of this study impact both theory and practice. Though decision makers have long been posting their knowledge to blogs, forums, knowledge bases, and so forth, this study is among the first to theoretically and empirically investigate the performance value of this practice. The effects of social facilitation have been shown to play a role in computer-mediated task performance. Prior to this study, the concept of social facilitation in a virtual, asynchronous decision making setting has not received much attention or explanation in information systems research.

On the practical side, this study provides counterintuitive explanations of the value of online knowledge gathering. Decision makers who use intranets and the internet for input often have a consumer-only attitude, tacitly thinking that knowledge sourcing has little or no effect on their own performance. The results of this study suggest that at least in the case of complex decision making, a consumer-only attitude may not improve results. For complex decisions, individuals and organizations may improve their performance by integrating knowledge sourcing into their decision processes.

In spite of their complexity, complex decisions are often made in relatively short amounts of time. Time is often not available for an exhaustive search and analysis phase. Credibility assessments are good examples of complex decision making under time constraints. Screening agents, police officers, investigators, and others usually have only minutes to make a decision. But even when professionals of any sort are short on time, spending a little of that time on knowledge sourcing may be more effective than only seeking and consuming input. The increase in performance in this study was seen after only a small amount of deliberation time per decision. Thus, even quick decisions may benefit from combining knowledge seeking with knowledge sourcing.

8. Conclusion

The rise of easily accessible online information stores is shifting the preferred method of gathering input for decision making. Individuals are turning increasingly toward virtual information sources as input for making complex decisions. Gathering and evaluating decision criteria in an online context is enticing because of information availability and increased control over the process, but there are implications for decision making performance. Decision makers often consume information they
deem relevant, but only some also contribute their own domain knowledge for others to consume. This study provided evidence that complex decision making may not be improved by a consumption-only attitude. Complex decision performance improved only among decision makers who both consumed and contributed knowledge. Contrary to popular belief, posting one’s decision criteria and reasoning in a forum, blog, or knowledge base likely plays an important role in improving complex decision making performance.

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10. References


