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An Experimental Investigation of the Effect of Expert Decision Analyses and Explanations Support onConsensus and Decision Accuracy in Small Groups

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Introduction

An Expert Support System (ESS) provides expert advice to complement the knowledge of the decision maker, and is intended to *support* , rather than replace, the decision maker. The ESS technology provides two fundamental functions:

(1) the ability to perform *analyses* and draw *conclusions* by providing users with expert opinions, judgments, evaluations and advice;

(2) the ability to *explain* its reasoning and conclusions.

The usefulness of expert support technology has been evaluated in a number of empirical studies. However these studies either examined the organizational impact of the technology [e.g., 1] or the use of the technology by single individuals [e.g., 2]. No empirical study has yet examined the use of expert systems technology for supporting group decision. *The aim of this research is to advance knowledge in this direction by investigating the usefulness of ESS for group decision support.*

Theoretical Foundation

The features of the expert support technology can be viewed in terms of the lens model framework, which is based on Brunswik's [3] theory of perception or the so-called cue theory. According to the theory, an individual does not have direct access to information about the objects in the environment. Instead, perception is an indirect process, mediated by a set of proximal cues. In accordance with this view, judgment is a process which involves the integration of information from a set of cues into a judgment about some distal state of affairs.

The lens model, as illustrated in Figure 1, defines the unit for psychological analysis as a system consisting of two subsystems. These subsystems have a common interface which consists of the proximal cues in perception. The two subsystems in the model are the *task system* and the *cognitive (or judgmental) system*. The task system is defined in terms of the relations between the cues (Xi) and the distal variable (Ye) of interest to the person, as well as the relations among the cues (Xi). The cognitive system is defined in terms of the relations between the cues (Xi) and the judgment (Ys).

The literature on "multiple-cue probability learning", which refers to learning to make valid inferences from several cues that are only probabilistically related to a criterion, has shown that cognitive feedback (CFB) is more effective than outcome feedback (OFB) in improving the accuracy of judgments [4]. OFB, or the knowledge of results, does not appear to be appropriate for learning probabilistic relations because it yields information which is restricted to a comparison of end results -- the comparison of the response with the correct answer.

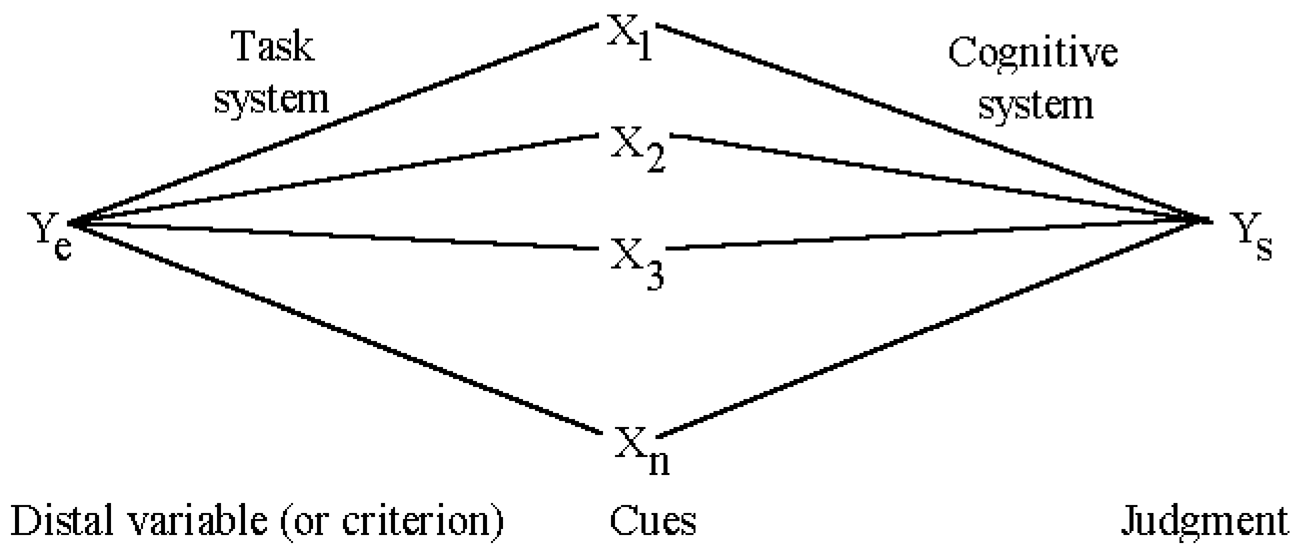

Figure 1: Brunswik's Standard Lens Model

The CFB paradigm, on the other hand, refers to information about relations rather than outcomes. A review of the literature in CFB [5] indicates that *task* information (i.e., information about the relations in the task environment), rather than *cognitive* information (i.e., relations perceived by the decision maker) is the aspect of CFB that influences performance. Specifically, task information refers to relations between the cues and the criterion, and information about the criterion or the cues themselves, or both, whereas cognitive information largely mirrors task information and refers to information about the cognitive system.

The support provided by the expert support technology corresponds to information about the task environment [2]. As mentioned earlier, the expert support technology is capable of providing two fundamental types of task support -- the ability to give advice and draw conclusions, and the ability to explain its reasoning and conclusions. Put into the framework of the lens model, the two types of expert support complement each other in providing a more complete set of information about the task environment (see Figure 2). When no decision support is available, the decision maker will have to make judgments solely from cues available in the environment, as illustrated by the leftmost lens model in Figure 2. The lens model in the middle of Figure 2 illustrates the situation where the decision maker is supported by ESS analyses without any ESS explanations support. In this case, only advice about the criterion (Ye) is provided. The rightmost lens model in Figure 2 depicts the context where the decision maker is supported by both ESS analyses and explanations support. In this case, in addition to advice about the criterion, explanations about how the criterion (Ye) is related to the cues (Xi), as well as how the cues are related to one another, are also provided.

Expert Support for Groups

The lens model, which typically refers to the case of one individual and one task, has been extended by a number of researchers to the social context (see [6, 7]). In multiple-individual settings, two variables are of interest: (1) agreement or consensus (i.e., difference between Ysi variables), and (2) achievement or decision accuracy (i.e., difference between Ye and Ysi). Agreement and achievement are standard terms used in the lens model literature, whereas consensus and decision accuracy are their corresponding terms used in the MIS literature. Figure 2 also illustrates these two concepts in the context of providing the different levels of expert support to groups.

In the case of groups, multiple judgments (Ysi) are made by the members of the group. When ESS provides analyses or advice about the criterion (Ye), achievement or decision accuracy is expected to increase. Agreement or consensus is also expected to increase as the group members are likely to trust the analyses and advice given by the ESS, thus helping them in their conflict resolution process.

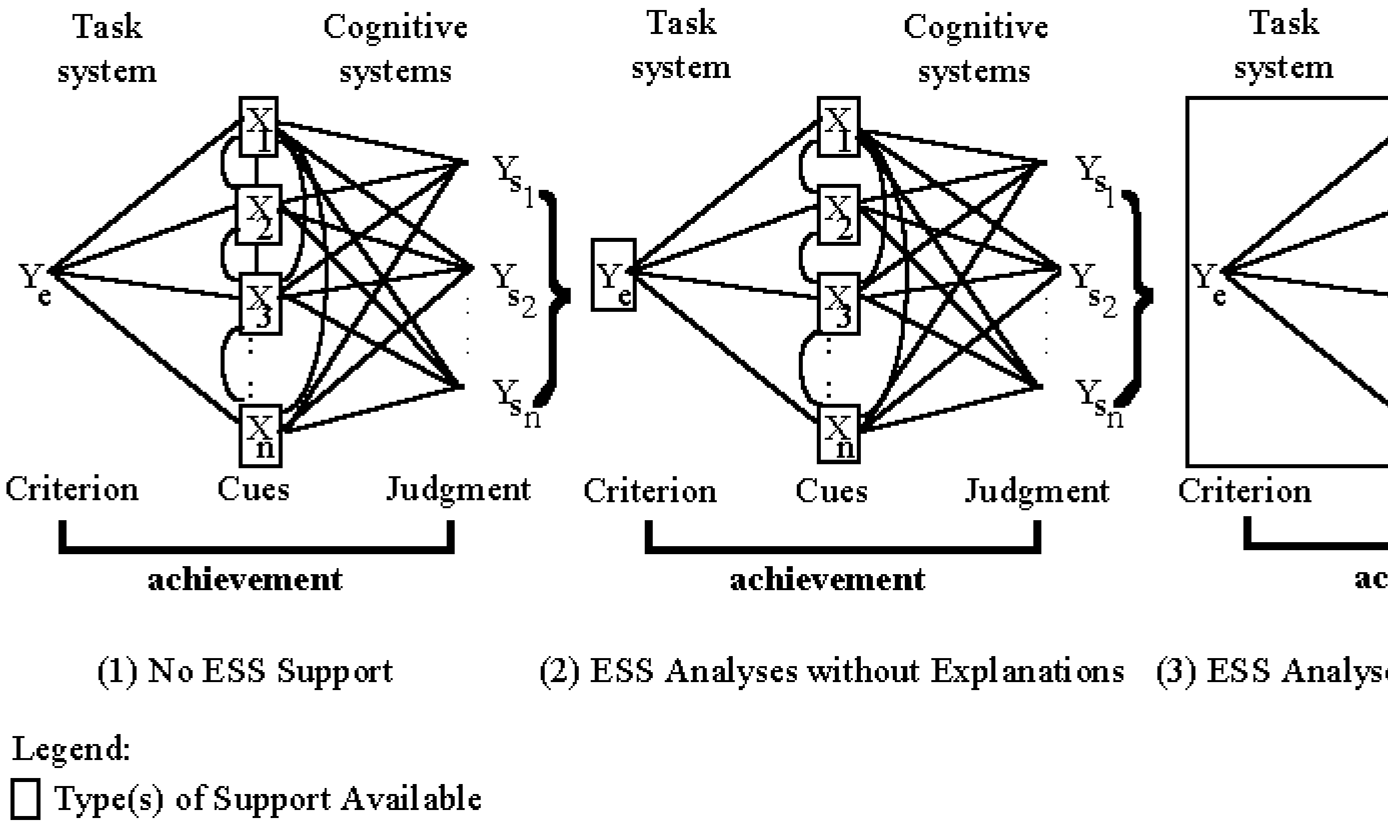

Figure 2: ESS Support for Groups presented in the Framework of Lens M

When ESS provides explanations, the agreement among group members are likely to increase even more because the set of reasons provided by the ESS for its actions not only increases the group members' joint understanding of the outcome, but also serves as a common frame of reference for reconciling the differences between the multiple judgments of the individual group members.

Research Methodology and Task

An experimental design will be employed and a commercial loan decision task will be used in this study. All subjects will be given the financial statements of a company and related information, and asked to evaluate the financial position, performance, and potential of the company and to determine an appropriate loan amount. The subjects will first perform the task individually and without any form of ESS support. They will then be randomly assigned to groups of three and asked to make a decision as a group. A third of these groups will make the decision without any form of ESS support; one-third will be provided with the ESS without the explanations support; and the rest with the complete ESS support, which includes the explanations support. Subjects will work in their groups until a consensus is reached. Finally, subjects will be asked to make an individual decision again.

The ESS to be used was developed based on the knowledge of five experts in financial analysis and validated in a number of pilots (see [2]). It provides seven aspects of financial analysis -- balance sheet analysis, income statement analysis, funds flow analysis, liquidity analysis, capital structure analysis, profitability analysis, and market value analysis, as well as an overall analysis. Analyses and explanations on these areas will be available to users upon request.

Hypotheses

In this research, we examine how increasing levels of expert support (no support, ESS analyses support, ESS analyses and explanations support) would affect agreement and achievement in the group context (see Figure 2). Consistent with the multiple-cue probability learning literature which suggests that it is the task information component of CFB that is responsible for improvement in performance, we hypothesize that the greater the level of expert support provided to groups:

H1: the greater the increase in agreement (or consensus) of individual decisions made subsequent to group discussion over individual decisions made prior to group discussion.

H2: the greater the perceived agreement (or consensus) of group decision.

H3: the greater the increase in achievement (or decision accuracy) of individual decisions made subsequent to group discussion over individual decisions made prior to group discussion.

H4: the greater the increase in achievement (or decision accuracy) of group decision made subsequent to group discussion over individual decisions made prior to group discussion.

The conflict reduction potential of expert support is tested by hypotheses H1 and H2. The perceived consensus of group decision will be assessed using the instrument developed by Knutson, Lee and Danes [8]. Decision accuracy in hypotheses H3 and H4 will be assessed with respect to the judgment obtained from a consensus of a group of experts [2].

Conclusion

As this research is the first to examine the impact of ESS for group decision making, it promises to make significant contribution to the group decision making literature. Not only will the findings be of interest to researchers in group decision making, they will also be valuable to professionals in the financial sector and companies that are considering the use of expert systems to complement their group decision making processes.

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