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Abstract

This paper examines the use of the Analytic Hierarchy Process (AHP) in individual and group decision making. Group AHP without individual AHP resulted in the exchange of the most common information while the combination of both group and individual AHP resulted in the least. The use of AHP in group decision making took longer, but did not result in better decisions. Subjects reported that they processed less information when using AHP and felt there was less credibility in the information discussed.

Introduction

Group Support Systems (GSS) have been the focus of research for almost a decade. One important potential contribution of GSS is the ability to structure the decision making process (Nunamaker, et al., 1991; Sambamurthy and Poole, 1992). One commonly used form of structured decision making is the Analytic Hierarchy Process (AHP) (Saaty, 1980).

We examined the effects of AHP use by both individuals and groups. In this study, participants were given a decision making task to solve. They first worked as individuals to reach an individual decision, and then met as a group to reach a group decision on the same task. We used a 2x2 design in which individuals either used or did not use the AHP to make their individual decision and then either used or did not use the AHP to make their group decision.

Research Framework

In most decision making situations, some information is common -- known to all participants. Other information is unique, in that it is known to only one person. Group discussion enables participants to share information so that the group as a whole can access a larger pool of information than any one person acting alone, and presumably make better decisions because of this more complete use of unique information.

However, information exchange is often done poorly, with much unique information known to some participants never shared with the group (Stasser, 1992). This unique information can be important, and poor decisions can result when it is not considered (Gigone and Hastie, 1993). While GSS can improve the exchange of both common and unique information, there is some evidence to suggest that participants tend to ignore unique information received during group discussions, whether verbal or GSS (Dennis, in

press; Gigone and Hastie, 1993). A more structured decision making process may reduce this (Dennis, in press).

AHP is a structured multicriteria decision making procedure (Saaty, 1980). In the AHP, decision makers break the criteria of the decision problem into a hierarchy of subcriteria, and use pairwise comparisons to evaluate the criteria and the decision alternatives. Ultimately, ratings are computed that reflect the overall attractiveness of each alternative.

For example, criteria contributing to the overall goal of selecting the most qualified student for admission to a university could be related to academic performance and extracurricular activities. In turn, the academic performance criterion can be divided further into subcriteria such as GPA and SAT scores. The decision alternatives, such as a list of applicants to the university, form the lowest level of the hierarchy. The importance of the criteria is evaluated by pairwise comparisons, in a top-down fashion from the highest to the lowest criterion level, after which the alternatives are compared pairwise with respect to each of the lowest criteria. Finally, the preference information is synthesized to arrive at the final ratings of the alternatives.

In general, the AHP (or any formal modeling technique) affects individual problem solving in two ways. First, it forces the decision maker to explicitly consider criteria, before rushing to choose an alternative. The AHP forces decision makers to explicitly trade-off the importance of different criteria and help ensure that no criteria are overlooked.

Second, when using informal decision making processes, decision makers may overlook key pieces of information or value them differently among alternatives (i.e., alternatives with essentially similar characteristics may be valued differently because one is more memorable than another). The AHP encourages decision makers to explicitly evaluate each alternative on each criterion. This may make information less likely to be overlooked and may provide greater consistency across alternatives.

These two factors should make three important contributions to the group decision making that follows from individual decision making. First, participants who have used the AHP should be more familiar with the information and be less prone to forget or overlook it. Second, the use of the AHP will indicate information that the individual lacks, encouraging them to seek the information from the groups. Third, the AHP should have helped the individuals give more explicit consideration to the relative importance of the criteria simplifying the resolution of different opinions within the group.

In many ways, group decision making mirrors individual decision making. We would expect a group using the AHP to exchange more information and to perform a more thorough consideration of it, making the group less likely to overlook information.

In many cases, individuals in groups do not seek the best decision, but seek to influence the group to adopt their solution. The AHP should help the group focus on the facts and criteria, not on the individual preferences of its members. In other words, it should

promote the use of information influence over normative influence (Dennis, in press). However, it is commonly known that GSS will increase the amount of time to complete a task (Dennis, Haley, Vandenberg, 1996).

From the above analysis, the following hypotheses were developed.

H1: AHP use during individual or group decision making will result in the exchange of more information during group discussion.

H2: AHP use during individual or group decision making will result in better consideration of information during group discussion.

H3: AHP use during individual or group decision making will result in better group decisions.

H4: AHP use during individual or group decision making will require more time.

Research Methodology

A 2X2 factorial design was used, crossing AHP use during individual decision making (AHP or not) with AHP use during group decision making (AHP or not). Thirty-one 6-member groups of undergraduate students from a core business course served as subjects and were randomly assigned to one of the four experimental treatments.

The task asked subjects to select one student from a set of four students for admission to the university. The complete information set included positive, negative, or neutral information on 18 criteria for each alternative for a total of 72 pieces of information. Five pieces of information for all four alternatives (verbal SAT, math SAT, GPA, sex, major) were "common" -- i.e., given to all subjects. The remaining information was "unique." Each subject was given a task description containing the set of common information and a different set of unique information.

This task was designed with the assistance of the university Admissions Office. The complete information version of the task was independently validated by three admissions officers (the director of admissions and two associate directors) to ensure that the alternative designed to be optimal was indeed the preferred candidate.

Decision making was done either using AHP or unstructured interaction. The AHP treatments were implemented using the Expert Choice software (Expert Choice, Inc.). Subjects used the AHP on individual computers to make their individual decisions, but only one computer with one copy of Expert Choice was provided for group decision making (i.e., a chauffeured process). Prior to the experiment, subjects had a one hour in-class training session on decision making, AHP, and Expert Choice and had to complete an assignment, similar to the experimental task.

The experiment began with each subject working individually to make a decision based on the information they had (either using the AHP or not). The subjects then worked as a group to reach a group decision (either using the AHP or not). They then completed a post-session questionnaire.

There were seven measures. The amount of common and unique information exchanged was measured by analyzing the audio tapes and counting the number of items discussed. Decision quality was measured by counting the number of groups making the optimal decision in each treatment. Decision time was measured by counting the number of minutes groups required to reach their decision. The post-session questionnaire had three measures: perceived use of information (5 items, =.83), credibility of information (4 items, =.81), and overall satisfaction (5 items, =.74)

Results

Table 1 presents the means and standard deviations. Table 2 presents the statistical results. Participants who did not use the AHP exchanged more unique information during group discussion. Group AHP without individual AHP use resulted in the exchange of the most common information while the combination of both group and individual AHP resulted in the least. The use of AHP in group decision making took longer, but did not result in better decisions. Subjects reported that they processed less information when using the AHP, either individually or in groups. In these situations, the AHP may have helped the subjects focus on the important information. Subjects using group AHP reported that they felt there was less credibility in the information discussed.

Discussion

These findings suggest that the AHP may provide few benefits to group decision making. While AHP has long been used in organizational decision making and perceived to be useful, we were unable to find any controlled empirical research on group use of the AHP. Virtually all research studies are case studies. Thus, it may be that the AHP's benefits are an illusion.

There may also be something unusual about the task used in this study that is inappropriate for AHP use. It may be that our task was too simple and concrete to benefit from using the AHP (Saaty, 1994), having only four alternatives and 18 criteria. However, similar university admission tasks have been used in prior AHP studies (Saaty, France, & Valentine, 1991).

It may be that our subjects lacked sufficient experience with AHP to use it properly. However, they received one hour of training and used it in one prior task, which is often more experience than groups in organizations have when they first use AHP. AHP is also better suited to decision makers experienced with the task (Saaty & Ramanujam, 1983). Our subjects might have been unfamiliar with the task, although we explicitly choose this task because we believed that subjects were familiar with the item under discussion.

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Table 1: Means and Standard Deviations

	Individual with AHP		**Individual w/out AHP**					
	Group (w/ AHP)		**Group (w/out AHP)**		**Group (w/ AHP)**		**Group (w/out AHP)**	
Group Measures	**mean**	**std**	**mean**	**std**	**mean**	**std**	**mean**	**std**
Common information exchanged	10.75	1.98	12.43	2.07	14.00	2.18	12.43	1.51
Unique information exchanged	16.75	7.07	13.71	7.06	22.33	6.67	20.71	1.50
Time	22.75	4.83	8.43	8.85	30.78	5.83	10.43	4.24
Decision quality	0.38	0.52	0.43	0.53	0.33	0.50	0.57	0.53
Satisfaction	4.71	1.12	5.52	0.94	5.45	0.91	5.51	0.68
Information processed	5.29	1.13	5.79	1.14	5.83	0.97	5.93	0.68
Information credibility	5.15	1.37	5.73	0.99	5.56	1.18	5.81	0.96

Table 2: Statistical Results

		Indiv. Model (with AHP)		**Group Model (with AHP)**		**Indiv. x Group (with AHP)**	
Group Measures	**df**	**F**	**p**	**F**	**p**	**F**	**p**
Common information exchanged	27	5.21	.031	0.01	ns	5.21	.031
Unique information exchanged	27	8.05	.009	1.10	ns	0.10	ns
Time	27	5.14	.032	61.43	.001	1.86	ns
Decision quality	27	0.07	ns	0.60	ns	0.24	ns
Satisfaction	157	8.94	.003	13.2	.001	8.97	.003
Information processed	155	7.68	.006	6.19	.014	1.97	ns
Information credibility	157	2.71	ns	6.81	.010	1.19	ns