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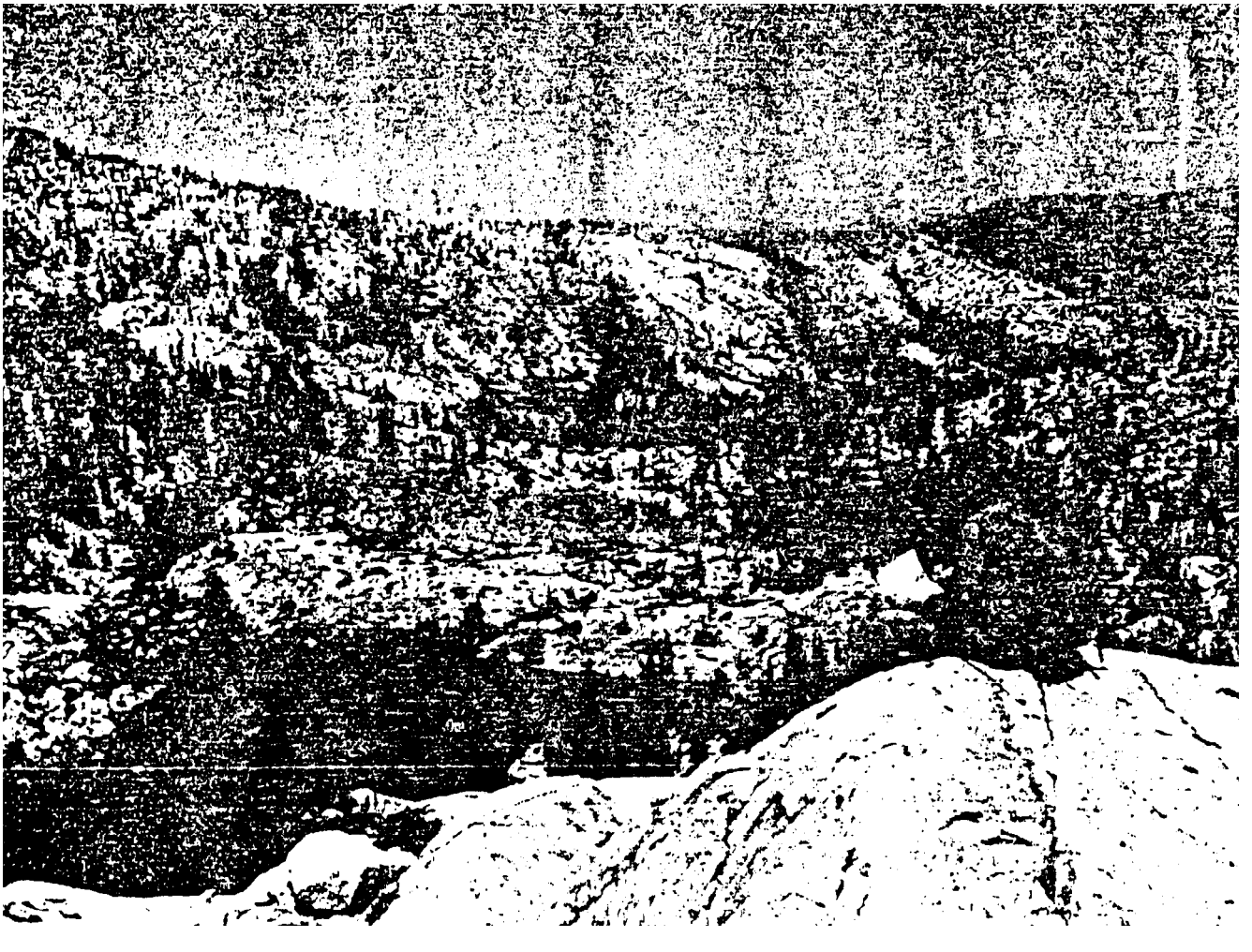

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Compilers:

GEORGE H. STANKEY, Research Social Scientist, Intermountain Research Station, Missoula, Montana

STEPHEN F. McCOOL, Professor, School of Forestry, University of Montana, Missoula, Montana

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APPROXIMATING RECREATION SITE CHOICE: THE PREDICTIVE CAPABILITY OF A LEXICOGRAPHIC SEMI-ORDER MODEL

Alan E. Watson and Joseph W. Roggenbuck

ABSTRACT : The relevancy of a lexicographic semi-order model, as a basis for development of a microcomputer-based decision aid for backcountry hikers, was investigated. In an interactive microcomputer exercise, it was found that a decision aid based upon this model may assist recreationists in reduction of an alternative set to a cognitively manageable number.

INTRODUCTION

In the eastern United States, many Forest Service managers of wilderness areas are reporting heavy and increasing use levels (Roggenbuck and Watson 1981). Managers generally believe that techniques to disperse users within an area or across areas could help reduce congestion. overuse, and perhaps physica1 impacts (Hendee and others l978; Roggenbuck and Watson 1981).

Not all Forest Service wilderness area managers in the East report overuse, however. Indeed, reports show several areas have very little use or use at such low levels that impact is negligible (Roggenbuck and Watson 1981).

Alternatives to visiting a National Forest wilderness area often exist. Within a given region, wilderness managed by the National Park Service, Fish and Wildlife Service, some states (for example, Tennessee Pocket Wilderness), and some privately owned and managed backcountry (for example, Grandfather Mountain in North Carolina), and many National Forest, National Park, and State-managed backcountry opportunities are of ten available. The question becomes: How do we encourage people looking for a primitive outdoor recreation experience to avoid the areas that are currently overused?

Often, decisions are made to visit a geographic region without an actual decision concerning a specific recreation activity site. This is evidenced by the number of visitors entering Forest Service visitor centers and District Ranger offices daily to obtain information on primitive recreation opportunities in the immediate area. If information about the full spectrum of opportunities available in a particular area could be presented, recreationists may be able to choose sites that meet their needs outside heavily used wilderness.

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Alan E. Watson is Assistant Professor, Recreation and Leisure Services, Georgia Southern College, Statesboro, GA. Joseph W. Roggenbuck is Associate Professor of Forestry, Virginia Polytechnic Institute and State University, Blacksburg. VA. Support for thin research was provided by the Intermountain Forest and Range Experiment Station, USDA Forest Service.

DECISION AIDS

Our interest in the research reported here was in providing a framework for development of decision aids for backcountry recreation site selection. These decision aids would most likely be used in a Forest Service district office or visitor center or in a corresponding contact situation of other land management agencies. Currently, brochures and some verbal message from an attendant in a visitor center are typically provided. The same written information is presented to all visitors regardless of reasons for visiting. This often leads to the visitor searching through these materials for personally relevant information. One improvement over the brochure presentation system within the Forest Service is the Recreation Opportunity Guide (ROG) (USDA Forest Service 1979). The ROG is available for the recreationist's use at the visitor center or for use by a receptionist in helping the recreationist decide upon a site for a chosen activity. The ROG for the Pisgah District of the Pisgah National Forest in North Carolina is divided into two loose-leaf notebooks: (1) trails; and (2) all other recreation resources in the district. Within the trails section of the ROG, names of trails are listed alphabetically. Various information is listed for each trail such as length, a mapped location, access points, attractions and considerations, recommended season, amount of use received, difficulty, and change in elevation by distance.

The ROG for trails on the Pisgah district is indexed in four ways. Trails are listed by activity (for example, hiking, skiing, horseback riding); by name (alphabetically); by length (In miles) ; and by area (planning unit within the district). Using this index, some alternatives can be eliminated based upon location, length of trail, and activity interest. The recreationist must, however, search through an alphabetical listing to obtain additional information on the remaining alternatives.

Another innovative decision aid, tented in a dispersed recreation setting, is the Backcountry Trail Selector (Krumpe and Brown 1982). The Backcountry Trail Selector leads a decision maker

through a series of intermediate choices (for example, a trail along a stream vs. a trail over high passes) to a final choice between alternatives. This decision aid is described as a decision net, usually depicted as a branching tree of successive decision steps. The decision nodes, or branches. represent the individual, intermediate choices, where attributes of possible alternative sites are considered. The branch taken at a node depends on whether or not the level of the attribute under consideration is satisfactory or unsatisfactory.

The need is to examine these two innovations to determine strengths and weaknesses. Decision models evolving from psychology and consumer behavior research offer some insight into how we might build upon these two decision aids. Additionally, microcomputer-visitor interaction systems potentially open new possibilities in construction and application of decision aids. If a theoretically sound method of information presentation were provided, an individual could work interactively with the microcomputer to gain personally relevant information efficiently.

DECISION MODELS

A large quantity of decision-related research in recreation is based upon the compensatory approach of the expectancy X valence theory framework (Haas and others 1981; Manfredo 1979; Cockrell 1981). This framework suggests that decisions might be best predicted by combining Information on attributes (specifically, information on the value of specific outcomes related to the attributes and probability of achieving the specific outcomes) to derive a single evaluative score for each alternative behavior (for example, visits to alternative recreation sites) being considered. Applications of the Fishbein model of expectancy X valence theory also often include a normative component as a further determinant of behavioral intentions (Cockrell 1981).

On the basis of their research, Cockrell (1981) and Krumpe (1979) believe that noncompensatory models may be better at predicting choice in the recreation context (for whatever reason) than previously tested compensatory models. Tversky (1972, p. 298), one noncompensatory theorist, supports this belief by stating that the lexicographic noncompensatory model may be a “good approximation to much more complicated compensatory models” and, in fact, may be “a useful simplification procedure.” Compensatory models may be good predictors of choice, but in the recreation context a more simply operationalized approximation may provide better results than past efforts at a very complex task. Normative factors, weightings of importance of attributes, and calculations of value and expectancies are not involved in a noncompensatory model, though their effects may be approximated in a simplified manner.

The noncompensatory models of choice look for alternatives in a decision situation that are satisfactory for all attributes or a particular set of attributes. Alternatives are usually compared on an attribute-by-attribute basis, rather than by comparing an evaluative score as in the compensatory models. In this type of decision model one attribute does not compensate for the lack of another. Rather, if the attribute is not present in sufficient quantity, the alternative is excluded from further consideration.

The lexicographic model calls for a finite ordering of elements (Fishburn 1974). Most notably, the lexicographic semi-order choice model (Luce 1956; Coombs 1964; Tversky 1969; Fishburn 1974) assumes an ordering of the relevant attributes a priori. This ordering is based on importance of the attribute to the decision maker when choosing among alternatives. In this model all alternatives are first compared on the most important attribute. The alternatives judged not satisfactory for this most important attribute are deleted from further consideration. This process continues with those attributes judged to be second, third, fourth, etc., in importance until only one acceptable alternative is left.

Notice use of the term “not satisfactory” in determining which alternative to drop from further consideration. Fishburn (1974) has recognized that in many cases it is not possible to discover a feasible alternative that is “acceptable” or “best” for all criteria or wants. With a lexicographic order in mind, Georgescu-Roegen (1954, p. 518) asserts that “choice aims at satisfying the greatest number of wants starting with the most important and going down the hierarchy. Therefore, choice is determined by the least important want that could be reached.”

Fishburn (1974) refers to this process as “satisficing-plus.” In this case, one achieves a satisfactory level on as many of the most important criteria as possible, then uses the next most important criteria (for which only one of the remaining alternatives is “satisfactory”) to differentiate among the alternatives that are satisfactory for all preceding criteria.

This semi-order model is characterized by Luce (1956) as having a just noticeable difference structure imposed on a lexicographic ordering. Inclusion of the semi-order factor results from research findings which indicate that preference for some values of some attributes is not always transitive (Tversky 1969). Those supporting a compensatory approach seem to believe that values of other attributes might compensate for low values of an important factor. Semi-order lexicographic proponents, however, believe that several values of one attribute may not be “noticeably different,” thus are intransitive. Selection may therefore be based on lass important attributes though the alternatives differ, but not to a noticeable degree, on a very important one.

Tversky (1969) used the lexicographic semi-order model to study intransitivities In preference. In a laboratory experiment he studied the decision process of subjects who were choosing from college applicants the one they thought should be accepted. Subjects also were asked to indicate preference between simple gambles. Tversky found that the semi-order choice model predicted subject choice better than a model assuming weak stochastic transitivity (the most general probabilistic version of transitivity). Tversky (1969) concluded that when faced with complex multidimensional alternatives, it is extremely difficult to utilize properly all of the available information. Instead, it appears that people may employ various approximation methods that enable them to process the relevant information in making a decision. The lexicographic semi-order choice model may be just such an approximation. It is easy to apply, without complex mathematical computations, and is fairly easily understandable by researchers and those who apply research findings.

As for many decision models that have been proposed in the fields of economics and psychology, there have been relatively few empirical studies of the lexicographic semi-order model of choice (Azumi 1981). Tversky (1972) pointed out that the primary reasons for the lack of such model testing are the difficulties involved in controlling the experiment appropriately and obtaining adequate estimates of choice probabilities.

Selection of the lexicographic semi-order choice model seems, however, justified through a series of smaller, individual research and theory building accomplishments. Evidence supporting use of such a model deals with a subject's ability to make decisions from information presented sequentially. In many cases, subjects have shown a tendency to seek and process information in that manner. The relationship between subject-expressed preferences for attributes and choices made: between alternatives has also been explored in a variety of contexts.

Studies that have successfully presented information in a sequential manner to decision makers, or found the subject to use available information in this manner, are varied in purpose and discipline (Olshavsky 1979; Powell 1979; Crow and others 1980; Englander and Tyszka 1980; Herstein 1981; Lowery 1981; Busemeyer 1982). Taken together, although not specifically testing the lexicographic semi-order choice model, they do present data that support the concept of sequential information processing.

The noncompensatory approach, and the lexicographic semi-order model in particular, appears to be a viable alternative to previously used compensatory models in predicting recreationist choice. In developing a decision aid for recreation site selection it is desirable to use a presentation format known to approximate the actual decision process and could, therefore, provide such a format for presentation of information. For these reasons, we selected this model for testing in our research.

METHODS

Our methodology Included a laboratory exercise In which subjects interacted with a microcomputer to collect data. Overnight backpackers, as one of the most common user groups of backcountry, were chosen as the subject population. Fifty members of the local community were selected from response to local appeals for volunteers. Subjects selected had backpacking experience ranging from several years to none (those planning their first trip).

In Task 1, subjects were asked to select from 15 hypothetical backcountry areas (fig. 1) a first, second, and third choice as a place to visit. The purpose of this choice task was to provide a criterion variable on which to evaluate the predictive ability of the lexicographic semi-order choice model. Hypothetical areas were assigned numbers rather than names to avoid preference effects due to the attractiveness of the name. The 15 attributes listed in the same order for each area were those found to be most relevant to participants in a pilot study. The order of presentation of attribute information was randomly generated and assumed to have no significance. Values for the attributes were determined with concern for assuring some conflict. We sought to avoid making any area so attractive that every subject would choose it. Also, the 15 areas needed to be different enough for a single choice to emerge.

Task 2 entailed collection of data via a microcomputer. In an interactive microcomputer exercise developed specifically for this study, each subject ranked the 15 attributes from Task 1 in terms of importance to choosing among alternative backcountry recreation sites. Each subject was next asked to indicate a preference for the values of the attributes in the following manner: "2," category that was most desirable; "1," categories that were acceptable; or "0," categories that were definitely unacceptable. Minimum thresholds of acceptance were established for attributes with at least one value rated "0." Indications of preference of values were obtained for attributes containing a "2" designation. From this information alternatives were eliminated in a sequential application of the lexicographic semi-order model and a final choice predicted.

In the elimination process the experimenter started with each subject's most important attribute and proceeded through the attributes one at a time (fig. 2). All alternatives that exhibited unacceptable values for the most important attribute were eliminated. This process continued with the second, third, etc. , most important attributes with the goal of reaching only one alternative. If more than one alternative remained, we then selected as the predicted choice the alternative that possessed the preferred category of the highest ranked attribute, for which no other alternative possessed the preferred category.

ATTRIBUTES \ AREAS	763	321	457	827	532	886	421	356	439	562	465	633	512	703	644
Number of miles of trail between springs (*=no springs)	3	3	7	7	10	4	10	*	5	20	4	12	6	1	13
Probability of finding an isolated campsite	0%	75%	80%	95%	35%	95%	90%	65%	65%	90%	0%	20%	95%	25%	90%
Miles of trail in the area	19	27	36	43	57	4	10	88	95	110	72	10	84	92	40
Permits required to enter the area	Yes	No	No	No	Yes	No	Yes	Yes	No	No	Yes	No	No	No	No
Campfires allowed in the area	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Number of wildlife species you would likely see in the area	6	8	6	3	1	22	30	11	8	3	23	4	29	13	3
Number of people who enter each trailhead per day	100+	35	17	11	3	51	62	17	12	2	76	26	27	11	4
Trail configuration (see page 3 for explanation)	1	3	3	1	3	2	1	2	1	2	1	2	3	3	2
Number of people likely to encounter per day	95	45	21	15	3	35	40	16	3	4	100+	50	30	7	0
Campfires assigned in the area	No	No	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
Number of bears seen in the area during last visitor season	5	None	1	4	3	17	6	4	1	None	3	5	1	1	10
Size of area, in acres	1,750	3,000	12,000	6,000	3,500	1,100	750	3,750	4,000	10000	4,400	4,500	10000	13000	5000
Camping at designated sites only in the area	No	No	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	No	Yes	No
Number of overlooks along trails in the area	5	9	15	None	1	1	9	12	None	1	2	29	11	4	3
Probability of vandalism to your vehicle parked at the trailhead	5%	15%	20%	35%	45%	55%	0%	5%	25%	25%	40%	50%	20%	0%	5%

First Choice _____ Second Choice _____ Third Choice _____

Figure 1:--Hypothetical choice situation data presented to a group of backpackers.

	PROCEDURE	PREDICTED CHOICE
Step 1:	Eliminate all alternatives which do not possess an acceptable level of the most important attribute. Does only one alternative remain?	---- Yes
	' NO	
Step 2:	Of the remaining alternatives, eliminate all which do not possess an acceptable level of the second most important attribute. Does only one alternative remain?	---- Yes
	' No	
Step 3:	Proceed through the list of attributes in decreasing order of importance, eliminating alternatives as in Steps 1 and 2. Does only one alternative remain after consideration of any one attribute?	---- Yes
	' No	
Step 4:	Eliminate all remaining alternatives which do not possess the preferred value of the most important attribute. Does only one alternative remain?	---- Yes
	' No	
Step 5:	Eliminate all alternatives which do not possess the preferred value of the second most important attribute. Does only one alternative remain?	---- Yes
	' No	
Step 6:	Proceed through the list of attributes in decreasing order of importance, eliminating alternatives as in Steps 4 and 5 until a final choice can be predicted.	

Figure 2.--Flow chart of the lexicographic semiorder choice model tested in a study with 50 backpackers.

RESULTS

In 48 of the 50 cases, a clear choice was predicted from information collected through the microcomputer exercise. In only two cases could no clear "winner" be predicted. In 27 cases (54 percent), the predicted choice matched the subject's actual choice. The predictive success of this noncompensatory mode1 is difficult to compare directly with past tests of compensatory approaches in the recreation context. In one of the most recent applications of the Fishbein model, however, Cockrell (1981) reported nonsignificant R-squares in five of six regression equations used for prediction. Elements of the regression equations included attitudes and norms toward various alternative areas. The lack of significant R-squares was interpreted by Cockrell to be an indication of little predictive success. He concluded that a river runner's intentions to participate in a river trip are not determined by the person's attitudes toward the trip and his social norms about the trip.

Although the choice prediction capability of the lexicographic semi-order model is substantial, the model's ability to predict elimination of alternatives is even more noteworthy. In 72 percent of the cases in our study, the prediction process successfully eliminated twelve of the 15 alternatives, leaving a set of three alternatives, one of which was the subject's first choice. This figure increased to 86 percent for deriving a set of five areas that contained the subject's first choice.

The area selected as the first choice by the : subject in Task 1 and which served as the criterion measure for evaluating the predictive capability of the lexicographic semi-order choice model may not have been the individual's "best" choice. Recall that Task 1 was a written exercise that required the subject to name a first, second, and third choice among 15 hypothetical backcountry areas. Information on 15 attributes for each of these 15 areas was presented to the subject in tabular form. This task, designed as it was to assure some conflict in decision making, may have been so difficult that the "best" decision was not made. If this occurred, then the predictive capability of the model may be underestimated. The predictive capability may have been better had fewer areas, fewer attributes, or a different method of presenting the attribute information been used in determining the criterion measure.

It is possible. however, that the procedure used to identify the criterion measure may have increased the likelihood of a valid selection of a "best" choice. The researcher communicated instructions to the subjects orally, only one subject at a time was processed, and the subject was aware that the general goal of the study was to find out how people make decisions about where to go on recreation visits. A subject making a decision in this context may have attempted to very carefully process every item of information available. Such processing may, in fact, be more complete than in a real situation without oral Instructions and knowledge of the purpose to which responses were to be applied.

CONCLUSIONS

The lexicographic semi-order choice model used in this study did not approximate the backcountry site selection decision process closely enough to select a final choice for all users. Our findings do, however, suggest that a decision aid based upon this model could assist a recreationist in reducing a set of alternative site choices co a manageable number. Efforts to develop such an aid, which would assist the user in determining a viable alternative set containing three to five alternatives, would provide a great service to the user and be justified.

One possible immediate application of these findings would be to develop a microcomputer-based decision aid built upon the principles of the lexicographic semi-order model for use on a Forest Service District to supplement current information and education efforts. This decision aid could improve Information dissemination programs while It collected some very useful information for the manager. Information that could be recorded would include what attributes must meet minimum thresholds for acceptance, what these threshold levels are, and finally, given this information, what specific areas decision aid users decide to visit.

Needed additional research would include the opportunity to compare the site chosen from the decision aid exercise to the actual site visited. These data could be collected observationally and would be a desirable follow-up test on the usefulness of such a decision aid. Another research need is to manipulate data considered in the decision process to test for resultant changes in choice behavior. Both of these suggestions arise from the need to demonstrate that recreationists can and will use such a decision aid, and that the content and manner of presentation of the information supplied produces enough confidence in the decision that the chosen area is actually visited.

The empirical support of the lexicographic semi-order choice model provides a basis for analysis of the Recreation Opportunity Guide and the Backcountry Trail Selector as decision aids. An obvious weakness of the ROG is the lack of adaptability to the Individual. The lack of desirability of a few fixed indexing items is reinforced by examination of the variations in the rankings of attributes in this study. Many different attributes and areas were indicated as top choices by study participants. It therefore seems erroneous to assume that miles of trail, name of area, and planning unit location are relevant or important attributes for every user of the ROG. Without Indexing by relevant variables, the individual user of a ROG must leaf through every page to search out a destination. This is exactly the type of overwhelming information (often leading to unsatisfactory choices) that any decision aid should be trying to minimize.

The method of presentation of information using the Backcountry Trail Selector has the same weakness--lack of adaptability to the needs of the individual user. By forcing every individual to consider the same attribute first, we are assuming that the attribute is not only a relevant one, but the most important one for all users.

REFERENCES

Azumi, K. Preference regions on preference scales. Japanese Psychological Research. 23(3): 131-139; 1981.

Busemeyer. J. R. Choice behavior in a sequential decision making task. Organizational Behavior and Human Performance. 29: 175-207; 1982.

Cockrell, D. Motivation, satisfaction, and social influence in wild river recreation. Unpubl. Doctoral dissertation. U. of Idaho; 1981.

Coombs, C. H. A theory of data. New York, NY: John Wiley & Sons; 1964.

Crow, L. E.; Olshavsky, R. W.; Summers, J. 0. industrial buyers' choice strategies: a protocol analysis. Journal of Marketing Research. 17(l): 34-44; 1980.

Englander, T.; Tyszka, T. Information seeking in open decision strategies. Acta Psychologica. 45(1-3): 169-176; 1980.

Fishburn, P. 0. Utility theory. Management Science. 13: 435-453; 1974.

Georgescu-Roegen, N. Choice, expectations, and measurability. Quarterly Journal of Economics. 68: 503-534; 1954.

Haas, G. User preferences for recreation experience opportunities and physical resource attributes in three Colorado wilderness areas. Unpubl. Doctoral dissertation. Colorado State U.; 1979.

Haas, G. E; Driver, B. L.; Brown. P. J. Measuring wilderness recreation experiences. Paper presented at the Wilderness Psychology Conference, Durham, NH, August 14-15, 1980.

Hendee. J. C.; Stankey. G. H.; Lucas, R. C. Wilderness Management. USDA, Forest Service Misc. Publication 1365, Superintendent of Documents, Govt. printing office, Washington, DC; 1978.

Herstein, J. A. Keeping the voter's limits in mind; a cognitive process analysis of decision making in voting. Journal of Personality and Social Psych. 40(5): 843-861; 1981.

Krumpe, E. E. Redistributing backcountry 'use by a behaviorally based communications device. Unpubl. Doctoral dissertation, Colorado State U.; 1979.

Krumpe, E. E.; Brown, P.J. Redistributing backcountry use through information related to recreation experiences. Journal of For. 80(6); 360-362, 364 ; 1982.

Lowery, C. R. Child custody decisions in divorce proceedings: a survey of judges. Professional Psych. 12(4): 492-497; 1981.

Luce, R. D. Semiorders and a theory of utility discrimination. Econometrica. 24: 178-191; 1956.

Manfredo, M. J. Wilderness experiences opportunities and management preferences for three Wyoming wilderness areas. Unpubl. Doctoral dissertation. Colorado State U. ; 1979.

Olshavsky, R. W. Task complexity and contingent processing in decision making: a replication and extension. Organizational Behavior and Human Perf. 24: 300-316; 1979.

Powell, L. W. A Baynesian approach to a sequential three-dimension problem: voting and the uses of information in electoral choice. Journal of Mathematical Soc. 6(2): 177-198; 1979.

Roggenbuck, J. W.; Watson, A. E. Technology transfer planning for strengthening wilderness management in the East. Phase I baseline information for technology transfer planning. Project report to the Pinchot Institute for Conservation Studies and the Southeastern Forest Experiment Station, USDA, Forest Service; 1981.

Tversky, A. Intransitivity of preferences. Psychological Rev. 76(l): 31-48; 1969.

Tversky, A. Elimination by aspects: a theory of choice. Psychological Rev. 79(4) 281-298; 1972.

USDA Forest Service. Recreation opportunity guide manual. U.S. Government Printing Office: 796-058/32; 1979.