RELATIONSHIPS BETWEEN MOTIVATION AND PSYCHOLOGICAL DISTANCE IN A FOREST RECREATION ENVIRONMENT

by

Alexander Rockwood Hoar

Thesis submitted to the Graduate Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Forestry and Forest Products

APPROVED:

Gregory J. Buhyoff, Chairman

Thomas A. More

Terry L. Sharik

J. Douglas Wellman

August, 1977

Blacksburg, Virginia 24061

TO MY SISTERS

Stephanie and Amy

ACKNOWLEDGEMENTS

There are several people who should be acknowledged for the logistical support that they provided in the completion of this study. Thomas Ligon was invaluable in solving the technical communication problems that constantly arose during the sampling period. Susan Sands, Janet Town, and Cheryl Weston volunteered many hours as research assistants at the Cascades. It was a pleasure to work with such dependable and enthusiastic individuals.

I am grateful to the members of my graduate committee. I would like to thank Dr. Thomas A. More for his interest and enthusiasm, Dr. Terry L. Sharik for his friendship and guidance, as well as Dr. J. Douglas Wellman for his constructive comments and objective review of this thesis. I would like to express my appreciation to my committe chairman, Dr. Gregory J. Buhyoff, for the many hours that he spent critically reviewing this paper. He was always available and willing to discuss any aspect of this research; his comments were clear, concise, and very helpful. I would like to especially thank him for the understanding that he exhibited throughout my graduate career.

Mr. William Jolly served as a confidant and ad hoc advisor for which I will always be grateful. Many heartfelt thanks to Dr. Anne LaBastille who's energy and determination inspired me to enter the field of Natural Resources.

Finally, I will always be indebted to both my step-father and my mother for their kindness during my tenure in graduate school. Without them, none of this would have been possible.

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Objective of the Study

The objective of this study was to field test a portion of the recreation quality theory: the inverse relationship between force of motivation and the psychological distance to a goal in a forested recreation environment.

Background Information

During the last ten to fifteen years, the number of people who have chosen to spend their vacation in wilderness areas has soared dramatically (Stankey et al. 1976); the magnitude of the problems associated with managing these areas has increased proportionally.

As more and more people venture into the "wilds" to spend their leisure time, certain areas may become overcrowded or overused, and those environmental attributes which are attractive may become degraded. Not only can the physical character of the environment deteriorate as a result of excessive use (Ohmann 1974), but also the psychological conditions necessary for a pleasurable recreation experience can be impaired (Lime and Stankey 1971). Today there is a need to examine, through research, certain of the variables which may affect the quality of outdoor recreation on public lands. By discovering more about the behavior and expectations of recreationists, existing management activities may be modified to protect the integrity of the area, accommodate the user, and enhance the quality of the experience (Driver 1976).

The basic objective of recreation management is to provide the public with an opportunity to experience recreation of the highest quality. Correspondingly, the primary purpose of outdoor recreation research is to provide information that defines and/or explains some aspect of the complex set of variables which, when integrated, determines the quality of recreation. How is "quality" determined? How are the "benefits" of recreation to be measured? Recreation experiences are inherently difficult to analyze and measure. To date, these experiences cannot be precisely defined, since they are a state of mind that occur when the environmental and psychological conditions mesh in such a fashion that the stressful elements of day to day living are absent. Hence it is pleasurable for those who experience it. This brief interlude provides an opportunity for the individual to regain the resilience necessary to remain bouyant: to successfully surmount the challenges of living in a complex society (Knopf 1972). The phenomenon is not an exclusive attribute of the "outdoors"; it can be achieved through any one of a myriad of leisure activities. Nevertheless, every year millions of Americans roam over the Nation's public lands in search of pleasurable recreation experiences.

A Behavioral Approach to Planning

There have been a number of authors who have discussed many of the potential social benefits of outdoor recreation behavior (Buhyoff and Brown 1975; Catton 1969; Clark et al. 1971; Driver 1972, 1976; Driver and Tocher 1970; Grubb 1975; Knopf 1972; Knopf et al. 1973; Knopp 1972). Many of these authors have emphasized the need to develop management techniques that will focus on maximizing the social benefits of outdoor recreation activities. It has been suggested that recreation behavior can be influenced in ways that the expectations of users might be met. However, research is needed that shows how human behavior may be specifically directed and changed in an outdoor recreation environment.

Changing Visitor Behavior

Brown et al. (1969) found that strategically situated information signing may effectively alter visitor use patterns of roadside facilities. By providing highway information signs in Utah's Logan Canyon Recreation Complex, visitors were distributed more evenly among the reststops. Facilities with high visitation decreased in use, while those which had had low visitation increased in use. Oxenfeldt (1966) found that information may influence the direction of behavior most efficiently when it meets people's needs. Therefore, information dissemination might be an overlooked management tool to control the distribution of visitor use.

Stankey et al. (1974) reviewed a host of management techniques which might aid in the redistribution of use from congested areas within and among wilderness areas. These techniques ranged from the outright regulation of behavior (e.g., when, where, and for how long a person may use an area), to subtly influencing behavior by providing information which alters perceptions of the physical environment. The main objective of these management tools would be to maintain, or create, low-density use patterns and thus increase the opportunity for solitude that wilderness users anticipate (Stankey 1973).

Burgess et al. (1971) experimented with various techniques to reduce littering in two movie theaters. The methods they used to modify behavior were: extra trash cans, an anti-litter film, litterbags, litterbags with instructions, litterbags plus a monetary reward, and litterbags plus a free ticket to another movie. Only the last two methods had a significant effect on reducing litter. They concluded that the immediate personal benefit of littering, that is, not having to carry the trash about, may be the most influencial determinant of littering behavior. The environmental degradation that may result from littering was not considered to be an influential determinant of behavior.

These studies,of behavior modification in a recreation environment, represent only a beginning of the research that will be necessary before management techniques may be developed to improve recreation quality. There is an overriding need either to use formal psychological theories or to develop explanatory models for research into human behavior in recreation settings in order that the change process can be attempted systematically.

Psychology of Choice and Motivation

A framework for some aspects of outdoor recreation behavior research might be provided in the psychological Field Theory proposed by Lewin (1951). Inspired by the works of others (Tolman 1925a, 1925b, 1926; Hull 1930a, 1930b, 1931) who were attempting to describe and predict molar animal behavior, Lewin realized that many of the paradigms that dominated the majority of psychological thought during the 1920's were not satisfactory explanations of human behavior. He also recognized that the integration of new ideas from various psychological disciplines would be necessary to facilitate the conceptualization of sound ideas on human motivation.

Lewin began theorizing about human motivation by describing the concepts of topological space (Lewin 1936) and hodological space (Lewin 1938). These semi-quantitative geometries characterized the "field" in which a person interacts with the psychological environment. Once the "life space" in which behavior occurs had been described, he then defined the force of motivation as a psychological tendency to locomote from one topological region (goal) to another within the field (Lewin 1938). The determinants of this motivational force were hypothesized to be the valence (Va) of the goal (G), and the psychological distance (e) separating the person (p) from the goal (g). The mathematical relationships between these variables were:

$$F = Va\ (G) \times \frac{1}{e_{p,g}} \quad \text{(Lewin 1938).}$$

The essence of Field Theory is contained in Lewin's (1938) principal of contemporaniety which states that any behavior (B) is a product of interaction between a person (P) and the psychological environment (E) as perceived by the person at that point in time. Thus, B = f (P, E).

Tolman's (1926) conceptual clarification of molar behavior, Murray's (1938) analysis of human personality, and the investigation of achievement motivation (McClelland and Atkinson 1948; McClelland et al. 1949; Mead 1949; Lowell 1950; McClelland et al. 1953; Veroff 1953; French 1955; Martire 1956; Atkinson 1958; McClelland 1961; Lesser et al. 1963), provided experimental support for the concept of B = f (P, E) and therefore for Lewin's principal of contemporaniety.

Other theoretical modifications were made to Lewin's initial theoretical statement. Expectancy x Value theory evolved and gained credibility as a viable alternative to the traditional Drive x Habit theory (Atkinson 1964). This revolutionary concept emphasized the determinant role of expectation (i.e., the cognitive process of anticipating the consequences of behavior) on motivation (Atkinson 1964). The mathematical statement: T = M x I x E was developed to describe the tendency (T) to approach a goal through action, where M (motive) is a stable personality factor, I (incentive) is the attractiveness of a goal, and E (expectancy) is the expectation that a certain goal can be attained. These conceptual variables were developed into the Dynamics of Action Theory (Atkinson and Birch 1970).

Theoretical Applications to Recreation Behavior

An example of a conceptual framework which seeks to provide insight into the behavior of outdoor recreationists is presented by More and Buhyoff (1977). Their reasoning can be applied to a broad array of recreation activities, but is most easily understood when used to explain the emotions of people traveling to a specific goal. A goal is interpreted to mean any physical place or thing in an outdoor environment that attracts people. A mountain top, a trail shelter, or a visitor center are all potential goals. Any area may offer a variety of goals; some will be more attractive than others. Whether one goal is chosen over another is determined by the amount of positive emotion that a person feels toward it. For example: an individual may prefer to travel on a less demanding trail to a scenic overlook, rather than undertake and arduous climb to a cave, even though the distances are equal.

The concept has management implications which are hinged on two assumptions. First, the quality of a recreation experience may be enhanced if the amount of positive emotion felt by the user is increased (i.e., the two are directly proportional). Second, the amount of emotion felt is determined by the strength of the force which motivates the user toward the goal. Thus the quality of the experience is influenced by the strength of the motivating force.

Specifically the theoretical framework proposed by More and Buhyoff is based on Lewin's (1951) work in psychological Field Theory. A mathematical statement of the theory is given below:

$$F = \frac{Va(G)}{e_{p,g}}$$

where: F = the strength of the motivating force

$Va(G)$ = the valence of a goal

$e_{p,g}$ = the psychological distance between a person (p) and the goal (g).

Force can be equated with the speed at which an organism moves (Atkinson and Birch 1970). For example, an animal that has been deprived of food for several days will eat with more intensity than one which has been fed regularly. Therefore, it is assumed in this research that a recreation user who is plodding along is less motivated than one who is walking at a brisk pace, or even running.

Valence is the attractiveness of the goal object and can be equated to the concept of utility in human choice models and economics (Atkinson 1964). Force is directly proportional to the valence of a goal ($F \propto Va(G)$), and is an indirect measure of the intensity of motivation. Thus, by making a recreational goal more attractive to a user (i.e., increasing its valence), the motivating force will increase, providing that the psychological distance remains constant. It is assumed that this would enhance the quality of the experience since emotion levels would increase. Also, such a change would be likely to increase the number of visits that the area received.

Psychological distance is related to physical distance but is more completely described as an estimate of the time required to reach a goal (Atkinson 1964). As an example, a handicapped person would very likely perceive a greater psychological distance between two points on a trail than a non-handicapped user would. Force is hypothesized to be inversely proportional to the psychological distance $(F \frac{1}{\alpha} e_{p,g})$.

The mathematical statement of this model is similar to those advanced by geographers and economists who generally refer to them as gravity-potential models. Rather than predicting gross visitation to recreation areas, the focus of this "psychological-gravity" model is to predict on-site movement and satisfaction by evaluating changing emotion levels as a result of fluctuations in valence and psychological distances.

If two people independently walked the same trail, and one was intimately familiar with the trail while the other was not, the person who was familiar with his surroundings would take less time to reach the goal. As he recognized landmarks along the trail, he would be able to gauge the physical distance remaining to the goal and adjust his estimate of the psychological distance. The first-time-user would have no frame of reference with which to determine his proximity to the goal. Because the veteran would be able to systematically decrease the psychological distance, his motivating force would increase faster than that of the first-time-user. Hence, he would walk at a faster pace and arrive at the goal first.

According to More and Buhyoff's (1977) recreation quality theory, the stronger the motivating force, the higher will be the quality of the recreation experience because emotion levels have systematically increased. Therefore, users who are able to orient themselves in relation to their goal will benefit more from their experience. In areas that attract a high percentage of first-time-users, management could probably enhance the quality of the recreation by providing maps or mileposts along the trails.

The Research Problem

The theory presented by More and Buhyoff (1977) explores a provocative aspect of outdoor recreation behavior which to date has remained uncharted. Before the theory may be applied to the development of management techniques, its logic and predictive ability must be thoroughly tested. Since no experimental attempts have yet been made to test this theory in recreation controls, it was the purpose of this research to test a portion of the theory. Specifically, the inverse relationship between force (F) and psychological distance ($e_{p,g}$) was examined.

It was assumed that valence (Va(G)) remained constant during the study period. Time spent was considered a function of force, and physical distance was a function of the psychological distance to the goal. Thus, by experimentally decreasing visitors' estimates of the psychological distance to the goal, the motivating force should increase, the users should have walked at a faster pace, and arrived at the goal in less time.

This research was not intended to be a definitive analysis of the relationship between force and psychological distance, since the variables are undoubtedly multi-dimensional and can be measured in a variety of ways.

RESEARCH DESIGN AND METHODOLOGY

Site Desrciption

The experiment was conducted on U.S. Forest Service property in Giles County, Virginia, approximately 30 miles west of the VPI & SU campus. The area, known as the Cascades, offers to the recreationist a two mile hike which parallels a tumbling mountain stream and terminates at the base of a picturesque, 60' waterfall. The falls served as the "goal" in this experiment as it is the main attraction for the majority of visitors. The elevation ranges from 2500' at the parking lot to 3200' at the falls.

Two routes of equal length are available to the goal. They begin at identical locations and wind along opposite sides of Little Stony Creek, through cove hardwood and northern deciduous forest types. One is a service road which is neither as strenuous nor as scenic as the alternative foot trail. The foot trail wanders through rhododendron groves, around boulders, between trees, and is never out of earshot of the Creek. Most hikers use the foot trail when ascending to the falls, but are attracted to the less demanding service road when returning to the parking lot. This general use pattern results in a one-way traffic flow which was utilized in the design of this research.

Experimental Design

A static group comparison was used for this experiment (Runkle and McGrath, 1972). The walking times for user groups (O_1) were measured while being exposed to treatment (X), and compared to those of other groups (O_2) that were measured without the treatment influence. Both test conditions were never implemented on the same day. The groups all received the same treatment on a given day to reduce suspicion and preserve the unobtrusive nature of the experiment. Thus, possible confounding biases were avoided that may have decreased both the reliability and validity of the experiment. Because the number of groups that use the Cascades fluxuates from day to day, test conditions were assigned to sampling days so that similar sample sizes could be maintained under each condition. This procedure constituted a convenience sampling method.

$$C \left\langle \begin{array}{l} X\ O_1 \\ \quad O_2 \end{array} \right.$$

where: C = convenient assignment of test conditions to sampling days

X = treatment

O = groups.

The treatment effect was created by supplying the experimental groups with an orientation map of the foot trail (Figure 1). The map identified various landmarks along the two mile hike and indicated their physical distance from the parking lot. It was assumed that the

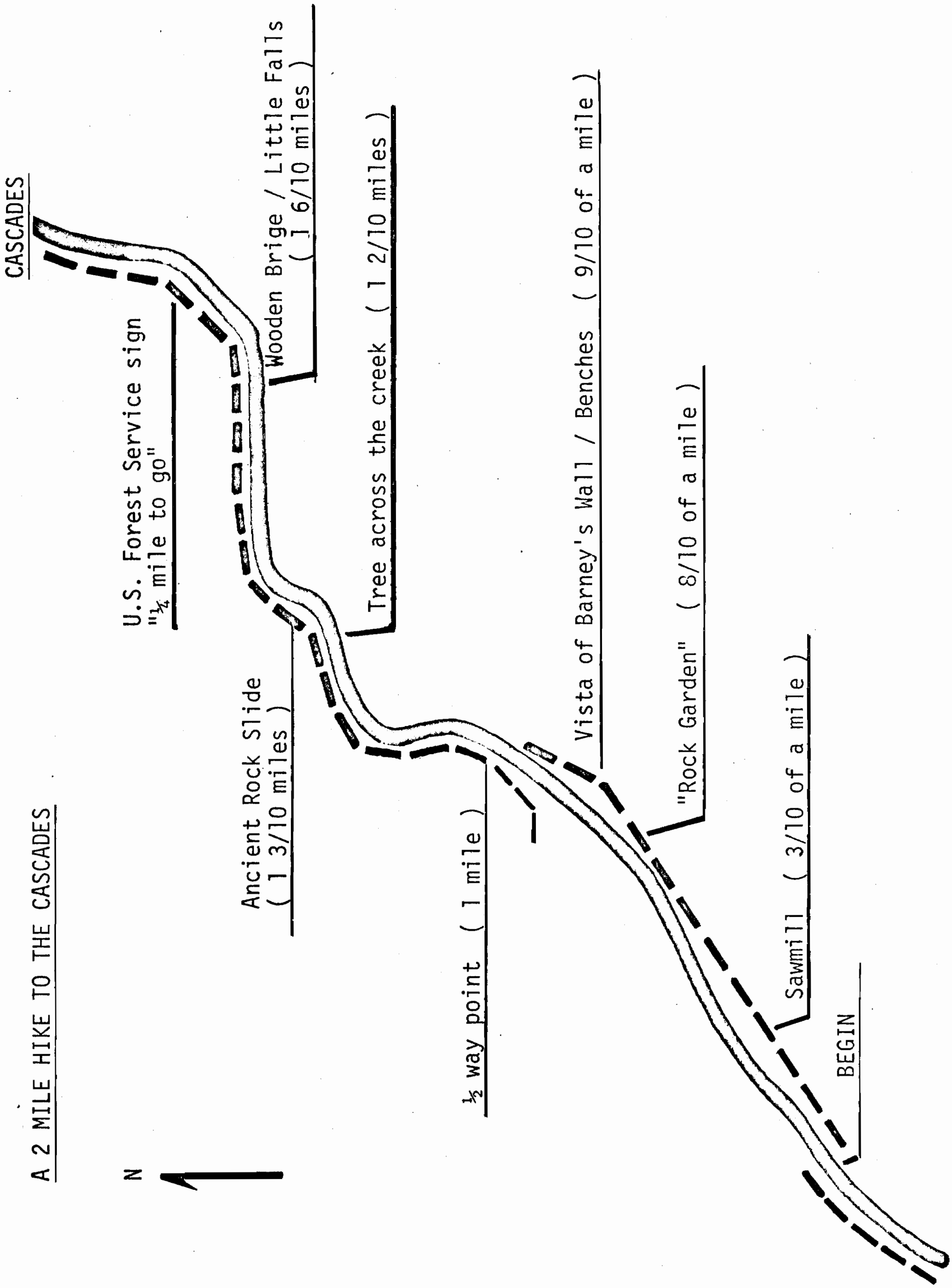

Figure 1. Map of the Cascades

experimental groups were consistently able to decrease their estimate of the psychological distance remaining to the goal from the information provided by the map.

Due to the unobtrusive nature of this experiment, many potential biases were avoided (Webb et al. 1966). People were not aware that they were being observed, so there was not a response bias. Any maturation that occurred was independent of the treatment and had an equal probability of affecting any of the groups. Likewise, mortality could not be attributed to the treatment, since those who did not reach the falls were not considered part of the sample. The oneway use pattern on the trails should have reduced the probability of interaction between groups. It was not expected that the real function of the map would be second guessed, so a Hawthorne Effect was only a remote possibility.[1]

The majority of visitors ranged in age from late teens through the late twenties and many were students form several surrounding colleges. During the sampling period there were no attempts made to influence the normal recreation selection process (Driver 1976). Those who were sampled were part of the general population of Cascade users.

---

[1]When the maps were collected at the end of the trail, only one group indicated that they thought they had participated in an experiment. Because they had been given a map, they thought that they had been involved in an experiment about littering.

Sampling Procedures

Preliminary observations of the visitor-use patterns at the Cascades indicated that the area receives very light use during the working week. The heaviest use occurs between the hours of 11:00 a.m. and 4:30 p.m. on Saturday and Sunday. Therefore, sampling took place only on weekends.

Under the controlled conditions every user group was greeted at the beginning of the trail by the researcher: "Hello, have all of you been to the falls before?" After noting their reply, the number of first-time-users was added to a tally-wacker (this cosmetic jesture was visible to the users). If, however, all were veteran users of the Cascades, they were politely dismissed and not considered part of the experiment. When the question was raised as to why the information was being gathered, the group was told that the Department of Forestry at VPI & SU was interested in determining how many people were using the Cascades for the first time. The exact nature of the experiment was not divulged.

After the group departed, the number of first-time-users was recorded, along with the total number in the group, and a physical description of one or more in the party, e.g., female with long red hair, blue napsack, green shorts. The information was then relayed via two-way radio to the observer at the falls. The radio equipment was concealed from view at all points. As the user groups filed past the researcher at the end point, they were matched with the relayed information. The appropriate time of arrival was recorded for each group. At the end of the day the walking time for each group was calculated and recorded.

Under the experimental conditions, every group of visitors was greeted in the same manner as described for the controlled conditions. The number of first-time-users was added to the tally-wacker, and prior to their departure a first-time-user in the group was handed an experimental map. They were told that the map pinpointed various landmarks of interest along the trail as well as the distance to each. This was the crux of the experiment and the researcher made sure that he had the group's attention. As a parting jesture, mention was made that there was a person at the falls to collect the maps (so that they would not litter the trail). As the group departed, the time, identification number of the map, total number of users in the group, and the number of first-time-users was carefully recorded.

At the other end of the trail, each party was intercepted and asked if they had a map. After it was collected, the time of the group's arrival was recorded on the map next to its identification number. Then, at the end of the day, the walking time for each group was determined and recorded as before. No further contact with the visitors was necessary.

Data Analysis

The absence of confounding biases and the nature of this experiment allowed the statistical analysis to be straight forward (Figure 2). Stephen's (1974) modification of the Kolmogorov-Smirnov goodness-of-fit test was utilized to determine if the data was normally distributed. Because the assumption of normality could not be satisfied, non-parametric techniques were used to analyze the data. To test for the effects of possible environmental biases on the validity of the method, comparable analyses were performed on the data for each test condition, across the sampling period. The Kruskal-Wallis test for multiple comparisons was used to detect differences between the data, which was collected on three separate occasions under the experimental conditions. The Wilcoxon rank sum test (which is equivalent to the Kruskal Wallis where $k = 2$) was utilized to detect differences between the data collected on two occassions under controlled conditions. Tests of the hypothesis were accomplished by employing the Wilcoxon rank sum test, the Ansari-Bradley disperson test, as well as the Moses dispersion test. (The results of the Wilcoxon rank sum test were used to satisfy the assumptions of the dispersion tests.)

Preliminary Analyses

Stephen's Modification of the

Kolmogorov-Smirnov Goodness-of-fit Test

(null hypothesis: $F(x) = N(\mu, \sigma^2)$)

↓

Kruskal-Wallis Multiple Comparisons

(null hypothesis: $\tau_1 = \tau_2 = \tau_3$)

or

↓

Wilcoxon Rank Sum

(null hypothesis: $\Delta = 0$)

Tests of Hypothesis

↓

Wilcoxon Rank Sum

(null hypothesis: $\Delta = 0$)

reject

↓

Moses Test for Dispersion

(null hypothesis: $\gamma = 1$)

fail to reject

Ansari-Bradley Dispersion Test

(null hypothesis: $\gamma = 1$)

Figure 2. Flow Chart of Statistical Tests

RESULTS

Description of Observed Groups

A total of 109 visitor groups at the Cascades Nature Trail in Jefferson National Forest was sampled on five days between September 26 and November 7, 1976. Forty-nine of the groups were not given a map (control) and 60 groups were handed the prepared trail map (experimental condition). The number of Multiple-User (MU)[1] and First-Time-User (FTU)[2] groups sampled under each test condition were as follows:

	Test Condition	
User Groups	Controlled	Experimental
Multiple-User	32	38
First-Time-User	17	22
	49	60

Total = 109 groups

The size of both the Multiple and First-Time-User groups showed considerable variation (Table 1). The MU groups averaged approximately four people of which the majority were usually veteran users. There were very few groups which contained more than five people. Most of the

[1]A MU group was either composed of both veteran and first-time-users, or only veterans. Veterans had visited the Cascades on a prior occasion and, therefore, were familiar with the trail.

[2]A FTU group was composed of only first-time-users, those who had never been to the Cascades and had no personal knowledge of the area.

Table 1

DESCRIPTIVE STATISTICS FOR MULTIPLE AND FIRST-TIME-USER GROUPS SAMPLED

UNDER CONTROLLED AND EXPERIMENTAL CONDITIONS

Test Condition/User Group	Number of Groups	Total People/Group			FTU[a]/Groups			Veterans/Group		
		mean	min.	max.	mean	min.	max.	mean	min.	max.
Multiple-User Groups										
Controlled Conditions	32	3.7	2	8	1.4	0	5	2.3	1	6
Experimental Conditions	38	3.6	2	8	1.7	1	6	1.9	1	5
First-Time-User Groups										
Controlled Conditions	17	2.1	1	4	2.1	1	4	n.a.	n.a.	n.a.
Experimental Conditions	22	2.5	1	4	2.5	1	4	n.a.	n.a.	n.a.

[a]FTU = First-Time-User

family units sampled were multiple-users. Many groups contained only one person; these single-user groups appeared to be evenly composed of veterans and first-time-users. First-time-user groups were smaller than the MU groups, and often consisted of two or three people. The majority of group members were college students, and there seemed to be a proportionate number of male and female users. No records were kept on the sex or estimated age of group members.

Statistical Tests

Tests were made on the data to determine if they were normally distributed. The null hypothesis for each test was: the data for a similar user group, sampled under the same condition, were normally distributed. Stephen's (Stephen, 1974) modification of the Kolmogorov-Smirnov goodness-of-fit test (Hollander and Wolfe, 1973) was used to test the null hypothesis against its natural alternative at an alpha level of .05. These goodness-of-fit tests strongly suggested that the data for controlled MU groups and experimental FTU groups were not normally distributed. The attained critical levels were .001 and .01, respectively (Table 2). The data for experimental MU groups, as well as for the controlled FTU groups, were found to be normally distributed. The critical levels for the latter two tests were both > .15 (Table 2).

Because the null hypothesis of normality was strongly rejected on two occasions, the data generated during this experiment was analyzed using nonparametric statistics. "More often than not, the non-paramatric procedures are only slightly less efficient than their

Table 2

RESULTS OF K-S GOODNESS-OF-FIT TESTS

Condition/User Groups	N	Fixed alpha level	Attained alpha level	Results
Multiple-User Groups				
Controlled Conditions	32	0.050	< 0.001	non-normal data
Experimental Conditions	53	0.050	> 0.150	normal data
First-Time-Users				
Controlled Conditions	17	0.050	> 0.150	normal data
Experimental Conditions	22	0.050	$= 0.010$	non-normal data

normal theory competitors when the underlying populations are normal (the home court of normal theory methods), and they can be mildly and wildly more efficient than these competitors when the underlying populations are not normal" (Hollander and Wolfe, 1973, p. 1).

Two different types of non-parametric tests were used to analyze the data: both location and dispersion tests. The basic hypothesis of the location test is that the samples came from the same population and may be considered homogeneous. The alternative is that the experimental population has a different location (median) than the control population. The location shift is attributed to the treatment received by the experimental population. This is illustrated by Figure 3a where delta-hat ($\hat{\Delta}$) represents the estimated change in location. ($\hat{\Delta}$ may not be equal to the classical estimator $\bar{\Delta} = \bar{Y} - \bar{X}$). The location test assumes that all observations in the experimental population are equally affected by the treatment ($\pm$ random variation). Therefore, the location shift should be evenly distributed over the entire population, i.e., the change for each observation of the population is equal to the change for the median observation. The validity of a location test is not preserved if the dispersions[1] of the populations differ as a result of the treatment (Hollander and Wolfe, 1973, p. 71). Figure 3b illustrates a hypothetical case where the dispersion of the experimental population differs from that of the control

---

[1]Dispersion refers to the distance between the observations and the median of the population.

Figure 3a: Location Shift

Figure 3b: Dispersion Change with Equal Medians

Figure 3c: Dispersion Change with Unequal Medians

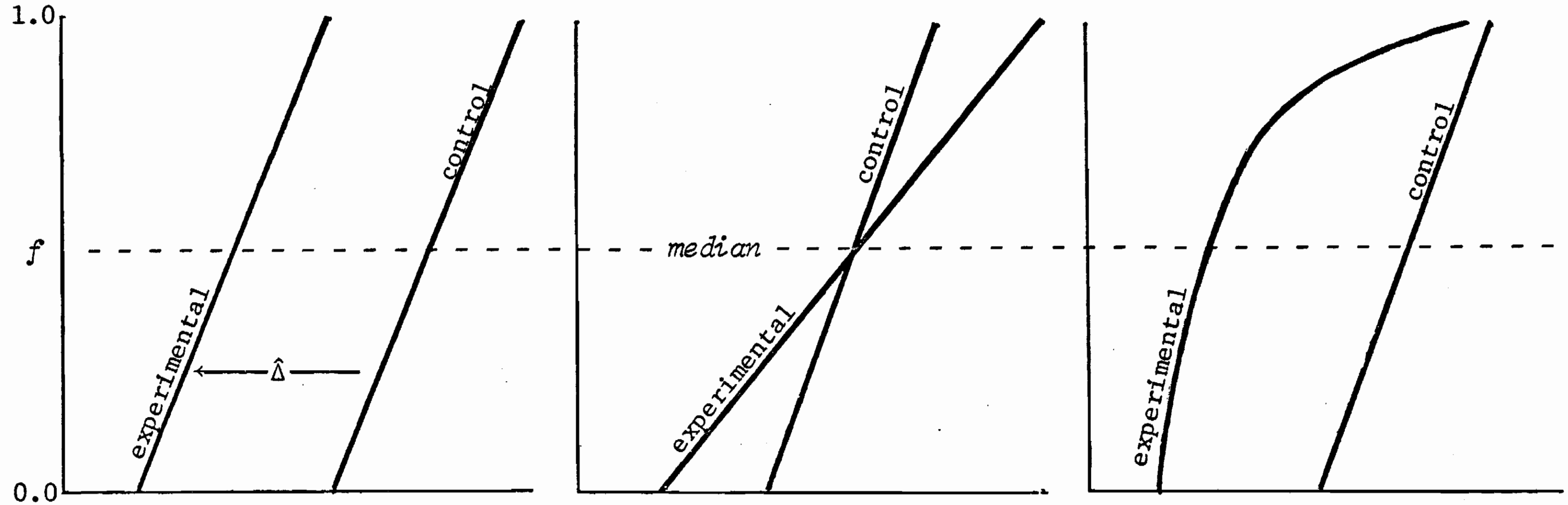

Figure 3: Three Distribution Functions for Comparing the Effects of Location Shifts and Changes in Dispersion

population, but the median values are equal. For a hypothetical case where both the median and dispersion of the experimental population were changed, refer to Figure 3c. Treatment effects, such as those represented in Figures 3b and 3c, are detected by dispersion tests. The null hypothesis for a dispersion test is the same as for a location test, but the alternatives of interest compare the relative dispersions of the two populations. In summary, the treatment can cause a change in the location of the data. Ideally, all observations in the experimental population are "shifted" an equal distance in the same direction. The dispersion of the observations is not changed in this instance. Thus by definition, it is impossible to have a location shift without affecting the "value" of the median observation. The treatment can also cause a dispersion change by altering the shape of the experimental group's distribution, which may not affect the median observation. (Hollander and Wolfe, 1973).

Preliminary statistical tests were performed to investigate the effects of environmental condition differences on time spent (Table 3). It was desirable to have a relatively consistent interaction between the users and their physical environment during all of the sampling period; otherwise, the validity of statistical comparisons to detect the experimental effects of controlling psychological distance would be seriously impaired. For example, groups were sampled under experimental conditions on October 16. The weather was overcast and warm at mid-day but began drizzling during the afternoon; also, the

Table 3

COMPREHENSIVE LISTING: DATE, SAMPLING CONDITIONS, NUMBERS, GROUPS, AND WEATHER CONDITIONS DURING THE SAMPLING PERIOD

Day of the week	Date	Sample conditions	Median	N	Number of MU groups	Number of FTU groups	Weather conditions
Sunday	9/26	Controlled	71.5 minutes	12	11	1	overcast/drizzle
Saturday	10/16	Experimental	65.0 minutes	33	21	12	overcast/drizzle
Saturday	10/23	Controlled	72.0 minutes	37	21	16	clear/cool[a]
Sunday	10/24	Experimental	58.0 minutes	7	6	1	overcast/cool
Sunday	11/7	Experimental	65.0 minutes	20	11	9	partly sunny/cool

[a]Cool means that the temperature was in the low 50^{o}F range.

brilliant colors of the fall foliage, that had attracted many users to the Cascades, were at a peak. On October 24, sampling was again done under experimental conditions. The weather was overcast and cool--around 50°F, and the leaves were dropping from the trees. It was desirable to know if there was a statistically significant difference between the experimental groups (medians = 65 and 58 minutes, respectively) as a result of differences in the weather.

The walking times for all groups (MU as well as FTU) sampled under the same test conditions were compared so that any location shifts could be detected, due to changing weather conditions. The test hypothesis was: walking times for groups sampled on a particular day were not different from those sampled on any other day(s) under the same test conditions.

First, the Kruskal Wallis test for multiple comparisons was used to compare groups sampled on three different days under the experimental conditions (Hollander and Wolfe, 1973). The null hypothesis that all the populations were equal was tested at an alpha level of 0.05, against three possible variations of the alternative hypothesis (i.e., $H_a: \tau_u \neq \tau_v$, where $u < v$). In all cases the alternative failed to reject the null hypothesis. The procedure used to compare unequal sample sizes (7, 20, and 33 groups per sampling day) provided a conservative test that may not have been sensitive to small differences between the taus. However, because all of the assumptions of the test were satisfied, the null hypothesis was accepted.

Second, the Wilcoxon Rank Sum Test[1] was used to compare groups on two different days under controlled conditions. The null hypothesis was tested against its alternative that the walking times for groups sampled on October 16 were greater than those on October 24. The null was accepted at $p \leq 0.05$. Therefore, it was assumed that there were no differences between these two groups due to changing weather conditions. Finally, the Kruskal Wallis Test for multiple comparisons and the Wilcoxon Rank Sum Test failed to detect any differences between groups sampled on different days, under the same test conditions. Due to these results, it was assumed that the fluctuations of environmental conditions during this experiment, such as weather, temperature, and fall foliage color, were not of sufficient magnitude to cause a significant shift in the time spent distributions of hikers.

Tests of Formal Hypothesis

Hypothesis I. People who are able to accurately determine the distance remaining to the goal, in an outdoor recreation environment, will spend less time walking to that goal than people who are not able to accurately determine the distance remaining to the same goal.

---

[1]The Wilcoxon Rank Sum Test is equivalent to the Kruskall Wallis Test when only two independent samples are compared ($k = 2$).

Location Tests

In order that this hypothesis could be investigated the assumption was made that the goal valences were constant within similar user groups (i.e., FTU or MU) during the entire sampling period. Wilcoxon's Rank Sum Test (WRST) was used to test the hypothesis, at an alpha level of 0.05, under six different combinations of user groups and sampling conditions (Hollander and Wolfe, 1973). This test for two independent samples detects shifts, in the location (median) of the experimental population, attributed to some treatment effect. The treatment effect was created by the map which was given to users during the experiment. For those tests that rejected the null, both a distribution-free estimation of the shift (delta-hat = $\hat{\Delta}$) and a distribution-free confidence interval for the delta (Δ) were given, (Hollander and Wolfe, 1973, pp. 75-79).

Test 1. The populations of control and experiment FTU groups were compared. The null hypothesis that the walking times under both conditions were the same, was tested by the alternative that the experimental groups took less time to reach the goal than the control groups did. Neither of the groups had a priori knowledge of the trail. It was assumed, because of the one-way use pattern on the trails, that there was no meaningful interaction between user groups. The control groups should not have been able to accurately estimate the distance remaining to the goal, but the experimental groups should have been able to systematically estimate the distance from their map.

The WRST strongly rejected the null hypothesis that there were no differences between the groups. The attained critical level (0.0060) strongly supports a conclusion that the experimental FTU groups spent less time reaching the falls than the controlled groups. Based on these results the distribution-free estimation of the shift was that the experimental groups arrived at the falls 17 minutes[1] earlier than the control groups. A distribution-free 95% confidence interval of (-4, -30) minutes was set for the point estimator (Δ) (Table 4). Conclusions drawn from the results (Table 5) of this test provide strong positive support for Hypothesis 1.

Test 2. The populations of both the control and experimental MU subjects were compared. A null hypothesis was tested against its alternative that the walking times for the experimental groups were less than those for the control group. All (MU) groups contained veterans who could presumably determine the approximate distance remaining to the goal. Therefore, any differences could be attributed to the effect of the map.

The results of the WRST failed to reject the null hypothesis that there were no differences between the walking times of the two populations at $p = 0.2378$ (Table 5). This supports a conclusion that the map did not significantly change the location of the median walking time for the experimental groups. Because of this result, it

---

[1]For a discussion of this estimate see Dispersion Test 1, p. 41.

Table 4

RESULTS OF AN ESTIMATOR ASSOCIATED WITH THE WILCOXON RANK SUM STATISTIC FOR EXPERIMENTAL AND CONTROL FIRST-TIME-USER GROUPS[a]

X_i \ Y_j	37	46	49	62	66	69	72	73	74	76	88	89	92	95	102	114	147
43	6	-3	-6	-19	-23	-26	-29	$\boxed{-30}$	-31	-33	-45	-46	-49	-52	-59	-71	-104
46	9	0	-3	-16	-20	-23	-26	-27	-28	-30	-42	-43	-46	-49	-56	-68	-101
46	9	0	-3	-16	-20	-23	-26	-27	-28	-30	-42	-43	-46	-49	-56	-68	-101
48	11	2	-1	-14	-18	-21	-24	-25	-26	-28	-40	-41	-44	-47	-54	-66	-99
48	11	2	-1	-14	-18	-21	-24	-25	-26	-28	-40	-41	-44	-47	-54	-66	-99
52	15	6	3	-10	-14	-17	-20	-21	-22	-24	-36	-37	-40	-43	-50	-62	-95
55	18	9	6	-7	-11	-14	-17	-18	-19	-21	-33	-34	-37	-40	-47	-59	-92
55	18	9	6	-7	-11	-14	-17	-18	-19	-21	-33	-34	-37	-40	-47	-59	-92
56	19	10	7	-6	-10	-13	-16	-17	-18	-20	-32	-33	-36	-39	-46	-58	-91
57	20	11	8	-5	-9	-12	-15	-16	-17	-19	-31	-32	-35	-38	-45	-57	-90
58	21	12	9	-4	-8	-11	-14	-15	-16	-18	-30	-31	-34	-37	-44	-56	-89
58	21	12	9	-4	-8	-11	-14	-15	-16	-18	-30	-31	-34	-37	-44	-56	-89
58	21	12	9	-4	-8	-11	-14	-15	-16	-18	-30	-31	-34	-37	-44	-56	-89
63	26	17	14	1	-3	-6	-9	-10	-11	-13	-25	-26	-29	-32	-39	-51	-84
63	26	17	14	1	-3	-6	-9	-10	-11	-13	-25	-26	-29	-32	-39	-51	-84
65	28	19	16	3	-1	-4	-7	-8	-9	-11	-23	-24	-27	-30	-37	-49	-82
66	29	20	17	4	0	-3	-6	-7	-8	-10	-22	-23	-26	-29	-36	-48	-81
66	29	20	17	4	0	-3	-6	-7	-8	-10	-22	-23	-26	-29	-36	-48	-81
70	33	24	21	8	4	1	-2	-3	-4	-6	-18	-19	-22	-25	-32	-44	-77
83	46	37	34	21	17	14	11	10	9	7	-5	-6	-9	-12	-19	-31	-64
102	65	56	53	40	36	33	30	29	28	26	14	13	10	7	0	-12	-45
110	73	64	61	48	44	41	38	37	36	34	22	21	18	15	8	$\boxed{-4}$	-37

[a] $U_{ij} = X_i - Y_j$, where i = 1, . . ., 22 experimental groups and j = 1, . . ., 17 control groups; delta-hat ($\hat{\Delta}$) = $(U^{(k)} + U^{(k+1)}) / 2 = 17$, where $k = (mn) / 2$, and $U^{(k)}$ = the k^{th} largest U_{ij}; a 95% confidence interval for delta (Δ) is (-4,-30) when $U^{(C\alpha)} \geq \Delta \geq U^{(mn + 1 - C\alpha)}$, where $C\alpha = ((mn) / 2) - Z_{(\alpha/2)} [(mn (m + n + 1)) / 12]^{1/2} = 118$, and $U^{(C\alpha)}$ = the $C\alpha^{th}$ largest U_{ij} (Hollander and Wolfe, 1973, pp. 75-79).

Table 5

RESULTS OF WILCOXON RANK SUM TESTS FOR GROUP COMPARISONS FOR MEDIAN LOCATION SHIFTS

Comparison	N	Median walking time (minutes)	Alpha level	Sig. Level attained
Experimental FTU[a] Groups	22	58.0	0.05	0.006
Control FTU Groups	17	74.0		
Experimental MU[b] Groups	38	65.5	0.05	0.238
Control MU Groups	32	70.5		
Control MU Groups	32	70.5	0.05	0.298
Control FTU Groups	17	74.0		
Experimental MU Groups	38	65.5	0.05	0.062
Control FTU Groups	17	74.0		
Experimental FTU Groups	22	58.0	0.05	0.017
Control MU Groups	32	70.5		
Experimental FTU Groups	22	58.0	0.05	0.406
Experimental MU Groups	38	65.5		

[a]FTU = first-time-user.

[b]MU = multiple-user.

is hypothesized that the veterans in each control MU group may have possessed knowledge of the trail that was equal to the information provided by the experimental map. This test provides some insight into the "strength" of the map, relative to the knowledge of the trail that the veterans had attained from previous learning.

Test 3. The population of FTU control groups was compared with that of MU control groups. A null hypothesis was tested against an alternative that the walking times for the MU control groups were less than those for the FTU control groups. The later subjects had no information available from which the remaining distance to the falls could be determined, while the MU groups contained veteran users who could estimate the distance based on their prior knowledge of the area.

The WRST, however, indicated that there were no significant differences between the median hiking times for the two populations ($p = 0.290$) (Table 5). The results may provide some evidence that the valences for the FTU and MU groups may not have been equivalent. If the valences had been comparable for both groups, the MU groups should have arrived at the falls faster, because veteran users would have had the opportunity to "perceptually map" the trail on previous visits.

Test 4. The population of FTU control groups was compared with that of experimental MU groups. The WRST tested the null against the alternate hypothesis that the walking times for MU groups were less than those for FTU groups. This statistical test was similar to Test 3; the only difference was that the experimental MU groups had the added benefit of referring to their map.

A location shift was not detected, which might be attributed to the superior knowledge of distances possessed by the experimental MU subjects. The WRST barely failed to reject the null hypothesis, as the attained critical level was 0.0618 (using an a priori alpha of 0.05) (Table 5).

Since critical levels indicate the strength of a particular test's results, they also serve as useful tools for comparing the results of similar tests. By comparing the attained critical levels in this test ($p = 0.0618$) to those of Test 2 ($p = 0.2378$) and Test 3 ($p = 0.2946$), support is generated for the tentative conclusion that the FTU control subjects were more similar in their hiking times to the MU control groups, than they were to the experimental MU groups.

Test 5. The population of experimental FTU subjects was compared with that of control MU subjects. The WRST rejected the null in favor of the alternative that the walking times for FTU groups were less than those for MU groups (Table 5). The attained critical level ($p = 0.0166$) indicated a rejection of the null. The distribution-free estimation of the location shift separating the two populations was nine minutes. The distribution-free 95% confidence interval for the point estimator (Δ) was set at (-1,-24) (Table 6) (Hollander and Wolfe, 1973). It was concluded in Test 2 that the MU groups' knowledge

Table 6

RESULTS OF AN ESTIMATOR ASSOCIATED WITH THE WILCOXON RANK SUM STATISTIC

FOR EXPERIMENTAL FIRST-TIME-USER AND CONTROL MULTIPLE-USER GROUPS[a]

X_i \ Y_j	43	46	46	48	48	52	55	55	56	57	58	58	58	63	63	65	66	66	70	83	102	110
49	-6	-3	-3	-1	-1	3	6	6	7	8	9	9	9	14	14	16	17	17	21	34	55	61
50	-7	-4	-4	-2	-2	2	5	5	6	7	8	8	8	13	13	15	16	16	20	33	52	60
50	-7	-4	-4	-2	-2	2	5	5	6	7	8	8	8	13	13	15	16	16	20	33	52	60
51	-8	-5	-5	-3	-3	1	4	4	5	6	7	7	7	12	12	14	15	15	19	32	51	59
52	-9	-6	-6	-4	-4	0	3	3	4	5	6	6	6	11	11	13	14	14	18	31	50	58
52	-9	-6	-6	-4	-4	0	3	3	4	5	6	6	6	11	11	13	14	14	17	30	50	58
53	-10	-7	-7	-5	-5	$\boxed{-1}$	2	2	3	4	5	5	5	10	10	12	13	13	16	29	49	57
55	=12	-9	-9	-7	-7	-3	0	0	1	2	3	3	3	8	8	10	11	11	14	27	47	55
55	-12	-9	-9	-7	-7	-3	0	0	1	2	3	3	3	8	8	10	11	11	14	27	47	55
55	-12	-9	-9	-7	-7	-3	0	0	1	2	3	3	3	8	8	10	11	11	14	27	47	55
57	-14	-11	-11	-9	-9	-5	-2	-2	-1	0	1	1	1	6	6	8	9	9	12	25	45	53
64	-21	-18	-18	-16	-16	-12	-9	-9	-8	-7	-6	-6	-6	-1	-1	1	2	2	6	19	38	46
64	-21	-18	-18	-16	-16	-12	-9	-9	-8	-7	-6	-6	-6	-1	-1	1	2	2	6	19	38	46
66	-23	-20	-20	-18	-18	-14	-11	-11	-10	-9	-8	-8	-8	-3	-3	-1	0	0	4	17	36	44
66	-23	-20	-20	-18	-18	-14	-11	-11	-10	-9	-8	-8	-8	-3	-3	-1	0	0	4	17	36	44
70	-27	-24	-24	-22	-22	-18	-15	-15	-14	-13	-12	-12	-12	-7	-7	-5	-4	-4	0	13	32	40
71	-28	-25	-25	-23	-23	-19	-16	-16	-15	-14	-13	-13	-13	-8	-8	-6	-5	-5	-1	12	31	39
73	-30	-27	-27	-25	-25	-21	-18	-18	-17	-16	-15	-15	-15	-10	-10	-8	-7	-7	-3	10	29	37
73	-30	-27	-27	-25	-25	-21	-18	-18	-17	-16	-15	-15	-15	-10	-10	-8	-7	-7	-3	10	29	37
75	-32	-29	-29	-27	-27	-23	-20	-20	-19	-18	-17	-17	-17	-12	-12	-10	-9	-9	-8	8	27	35
79	-36	-33	-33	-31	-31	-29	-29	-24	-23	-22	-21	-21	-21	-16	-16	-14	-13	-13	-9	4	23	31
85	-42	-39	-39	-37	-37	-33	-30	-30	-29	-28	-27	-27	-27	-22	-22	-20	-19	-19	-15	-2	17	25
89	-46	-43	-43	-41	-41	-37	-34	-34	-33	-32	-31	-31	-31	-26	-26	$\boxed{-24}$	-23	-23	-19	-6	13	24
91	-48	-45	-45	-43	-43	-39	-36	-36	-35	-34	-33	-33	-33	-28	-28	-26	-25	-25	-21	-8	11	19
95	-52	-49	-49	-47	-47	-43	-40	-40	-39	-38	-37	-37	-37	-32	-32	-30	-29	-29	-25	-12	7	15
96	-53	-50	-50	-48	-48	-44	-41	-41	-40	-39	-38	-38	-38	-33	-33	-31	-30	-30	-26	-13	6	14
97	-59	-51	-51	-49	-49	-45	-42	-42	-41	-40	-39	-39	-39	-34	-34	-32	-31	-31	-27	-14	5	13
106	-63	-60	-60	-58	-58	-54	-51	-51	-50	-49	-48	-48	-48	-43	-43	-41	-40	-40	-36	-23	-4	4
108	-65	-62	-62	-60	-60	-56	-53	-53	-52	-51	-50	-50	-50	-45	-45	-43	-42	-42	-38	-25	-6	2
115	-72	-69	-69	-67	-67	-63	-60	-60	-59	-58	-57	-57	-57	-52	-52	-50	-49	-49	-45	-32	-13	-5
135	-92	-89	-89	-87	-87	-83	-80	-80	-79	-78	-77	-77	-77	-72	-72	-70	-69	-69	-65	-52	-33	-28
137	-99	-91	-91	-89	-89	-85	-82	-82	-81	-80	-79	-79	-79	-74	-74	-72	-71	-71	-67	-54	-35	-27

[a] $U_{ij} = Y_j - X_i$, where $i = 1, \ldots, 32$ control groups and $j = 1, \ldots, 22$ experimental groups; delta-hat ($\hat{\Delta}$) = $(U^{(k)} + U^{(k+1)}) / 2 = -9$, where $k = (mn) / 2$, and $U^{(k)}$ = the k^{th} largest U_{ij}; a 95% confidence interval for delta (Δ) is (-1, -24) when $U^{(C\alpha)} \geq \Delta \geq U^{(mn + 1 - C\alpha)}$, where $C\alpha = ((mn) / 2) - Z_{(\alpha/2)} [(mn (m + n + 1)) / 12]^{\frac{1}{2}} = 241$, and $U^{(C\alpha)}$ = the $C\alpha^{th}$ largest U_{ij} (Hollander and Wolfe, 1973, pp. 75-79).

of the trail, based on previous visits, may have been comparable to the information provided by the experimental map. Therefore, the cause of the shift in this test cannot be ascertained from the data. However, the experimental FTU subjects did hike faster than the controlled MU subjects. Therefore, these results may provide further support for the conjecture that the valences for the FTU and MU groups were not comparable. If this was the case, the assumption that the valence was held constant within similar groups was not violated.

Test 6. The population of experimental FTU groups was compared with that of the experimental MU groups. The WRST tested the null against the alternate hypothesis that the walking times for the FTU groups were less than those for the MU groups. The null was accepted, and of all the Rank Sum Tests performed on the data, this test attained the largest critical level ($p = 0.4063$) (Table 5). Both control groups were found to be very similar in Test 3, and both experimental groups were significantly similar here. This test did not provide any further evidence to support the suggestion, from other results, that the valences may have been different for dissimilar groups. However, the results do support Hypothesis I, since both groups had equivalent information about the trail.

Dispersion Tests

Under the assumption that the valences were constant for similar groups (i.e., FTU or MU) during the entire sampling period, dispersion tests were performed on the six combinations of control and experimental populations (in the same order as was done for the location tests). The Ansari-Bradley Test for dispersion differences assumes that the medians, of the two populations being compared, are known or equal (Hollander and Wolfe, 1973). The results of the corresponding Wilcoxon Rank Sum Tests were used to satisfy this assumption, when the null had been accepted. All of the Ansari-Bradley tests were done at a fixed alpha level of 0.05. The Moses test for dispersion, however, assumes that the medians of the two populations are unknown or not equal (Hollander and Wolfe, 1973). Therefore, this test was performed on the data when the WRST had rejected the null hypothesis. Because the assumptions for this test are not as specific as those for the Ansari-Bradley, it is not as powerful a test. Therefore, a fixed alpha level of 0.10 was used for the two Moses tests. A Cumulative Distribution Function (CDF) for both populations in each test is included so that the differences between populations may be visually compared.

Test 1. The populations of the control and experimental FTU groups were compared. The Moses test for dispersion tested the null against the alternative that the walking times for the experimental population were less dispersed than those for the control population. The null was rejected and the attained critical level was $p = 0.056$ (Table 7). A comparison of the CDFs for both populations (Figure 4) indicates that the slope of the experimental CDF may be steeper than

Table 7

RESULTS OF ANSARI-BRADLEY AND MOSES TESTS FOR GROUP COMPARISONS FOR DISPERSION DIFFERENCES

Comparison	N	Test	Alpha level	Sig. level attained
Experimental FTU[a] Groups	22	Moses	0.10	0.0560
Control FTU Groups	17			
Experimental MU[b] Groups	38	Ansari-Bradley	0.05	0.0094
Control MU Groups				
Control MU Groups	32	Ansari-Bradley	0.05	0.4135
Control FTU Groups	17			
Experimental MU Groups	38	Ansari-Bradley	0.05	0.1024
Control FTU Groups	17			
Experimental FTU Groups	22	Moses	0.10	0.1110[c]
Control MU Groups	32			
Experimental FTU Groups	22	Ansari-Bradley	0.05	0.0793
Experimental MU Groups	38			

[a]FTU = first-time-user. [b]MU = multiple-user

[c]See p. 46 for a discussion of this statistic's validity.

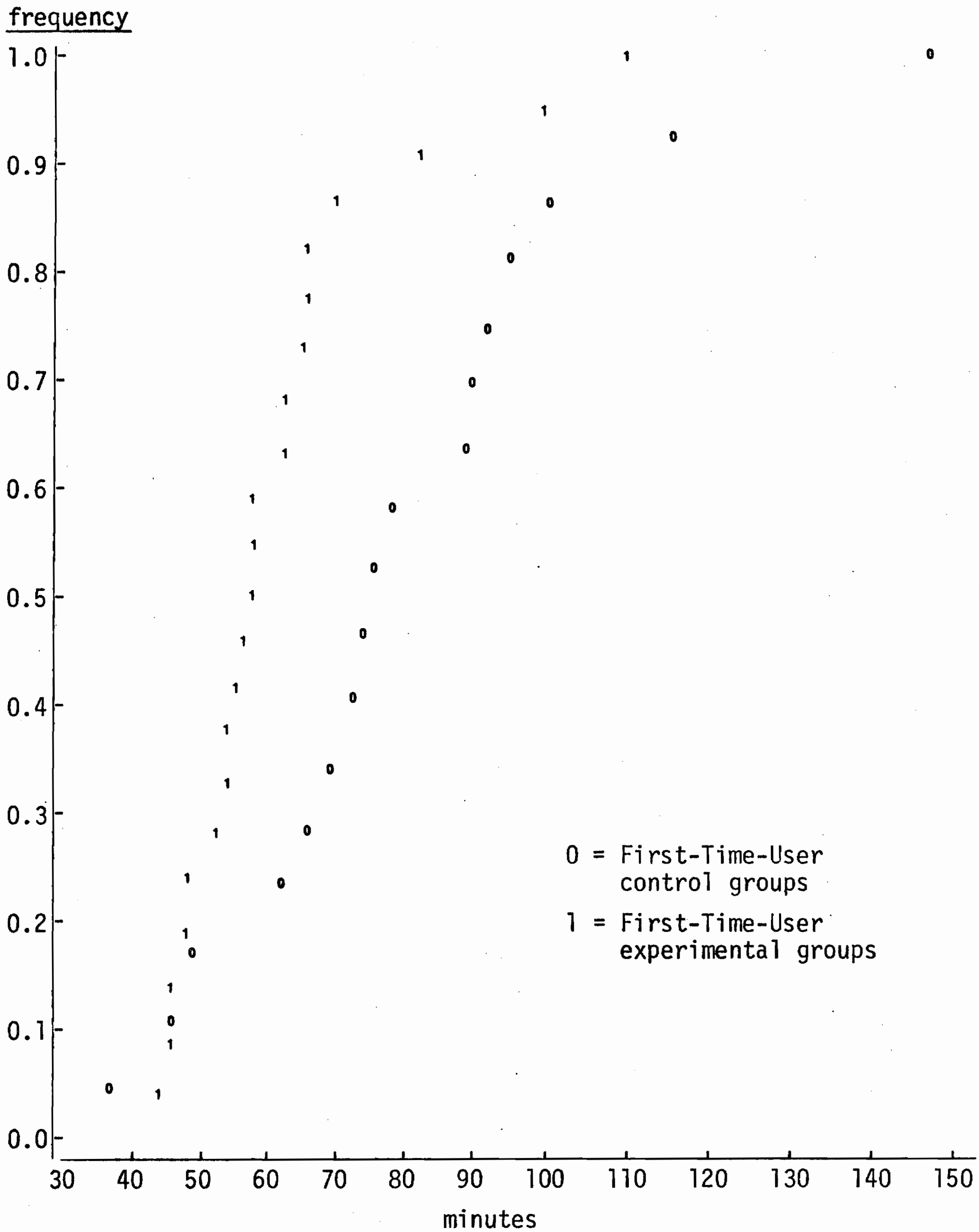

Figure 4. Cumulative distribution functions comparing First-Time-User control and experimental groups

that of the control CDF. Based on this observation, it was hypothesized that the map may have affected the walking speed of the all experimental groups for the entire duration of the hike (rather than just the last half, for example). (The last three experimental as well as the last two control observations are considered outliers whose valence for the goal may have been distinct from the other groups.) Because the location tests assumed that the treatment did not affect the dispersion of the experimental population, the results of this test suggest that the first location test (attained critical level $p = 0.0060$) may not have been as valid as had been previously thought. Figure 4 illustrates that the location shift was not evenly distributed over the entire experimental population.

Test 2. The populations of control and experimental MU subjects were compared. A null hypothesis was tested by the Ansari-Bradley test against the alternative that the walking times for the experimental groups were less dispersed than those of the control groups. The null was rejected; the attained critical level ($p = 0.0094$) (Table 7) provides support for the conclusion that the map did affect the walking times of the experimental groups. The CDFs represented in Figure 5 indicate that the map may have affected the time-spent of approximately 30% of the experimental MU groups. There appeared to be no significant differences between the experimental and control groups that arrived at the falls in less than 75 minutes. This may imply that they did not "need" the map to determine distances.

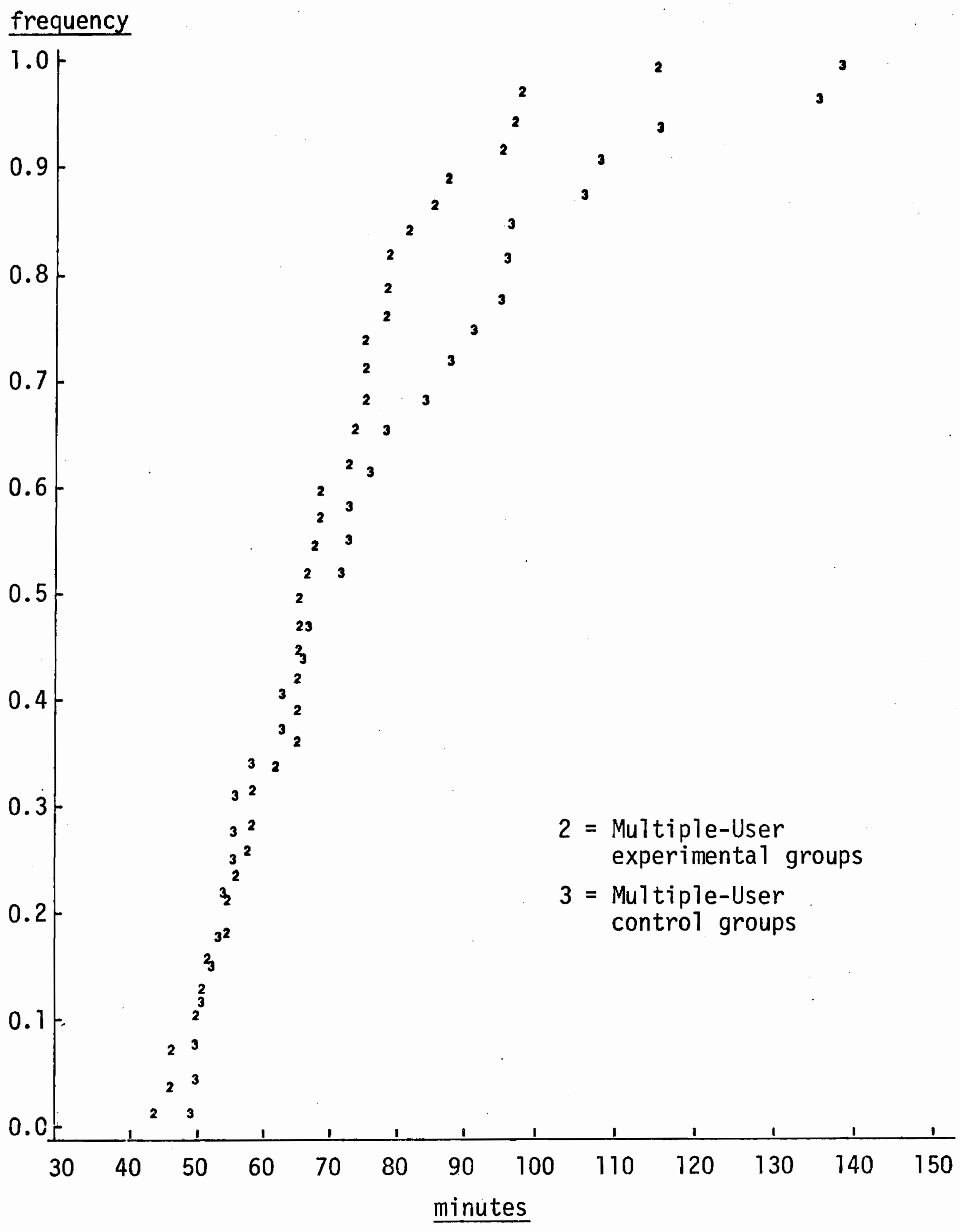

Figure 5. Cumulative distribution functions comparing Multiple-User control and experimental groups

Test 3. The FTU control population was compared with the MU control population. The alternate hypothesis was that the walking-times of the MU control groups were less dispersed than those of the FTU control groups. The results of the Ansari-Bradley test failed to reject the null hypothesis that the groups were equally dispersed (Figure 6). Both the test result and the attained critical level ($p = 0.4135$) (Table 7) provide further evidence (see the third location test) implying that the valences for MU and FTU groups may not have been equivalent.

Test 4. The population of FTU control subjects was compared with the population of MU experimental subjects. The null was tested against the alternative that the time-spent walking for the MU experimental groups were less dispersed than for the FTU control groups. The Ansari-Bradley test failed to detect any differences between the populations and the null hypothesis was accepted that the populations were equally dispersed (Figure 7). The attained critical level was 0.1024 for this test (Table 7).

Test 5. The population of FTU experimental groups was compared to that of the MU control groups. The Moses test for dispersion was utilized to test the null hypothesis against the alternative that the FTUs' walking-times were less dispersed than those for the MU subjects. The results failed to reject the null at a fixed alpha level of 0.10. The attained critical level, however, was only 0.1110 (Table

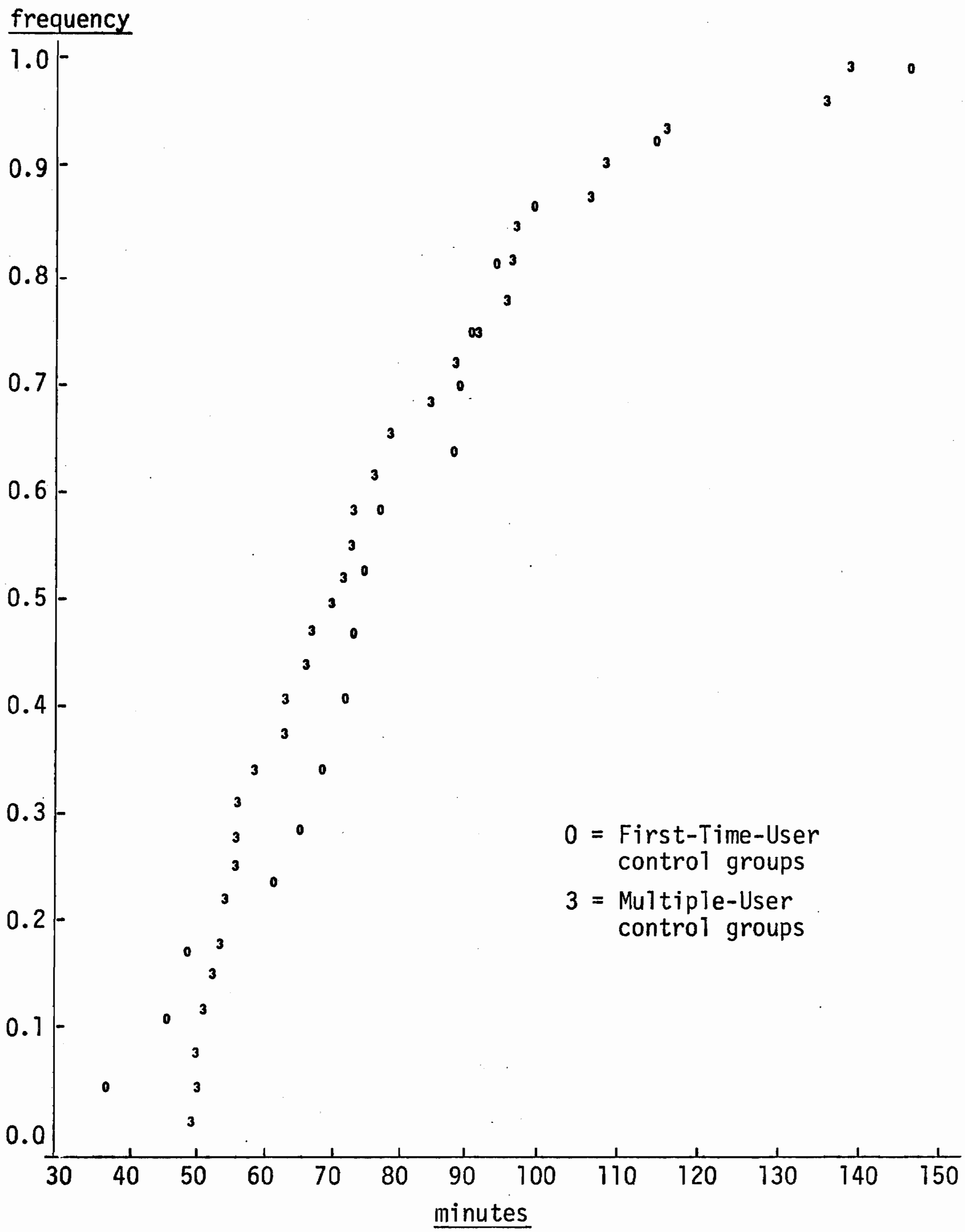

Figure 6. Cumulative distribution functions comparing First-Time-User and Multiple-User control groups

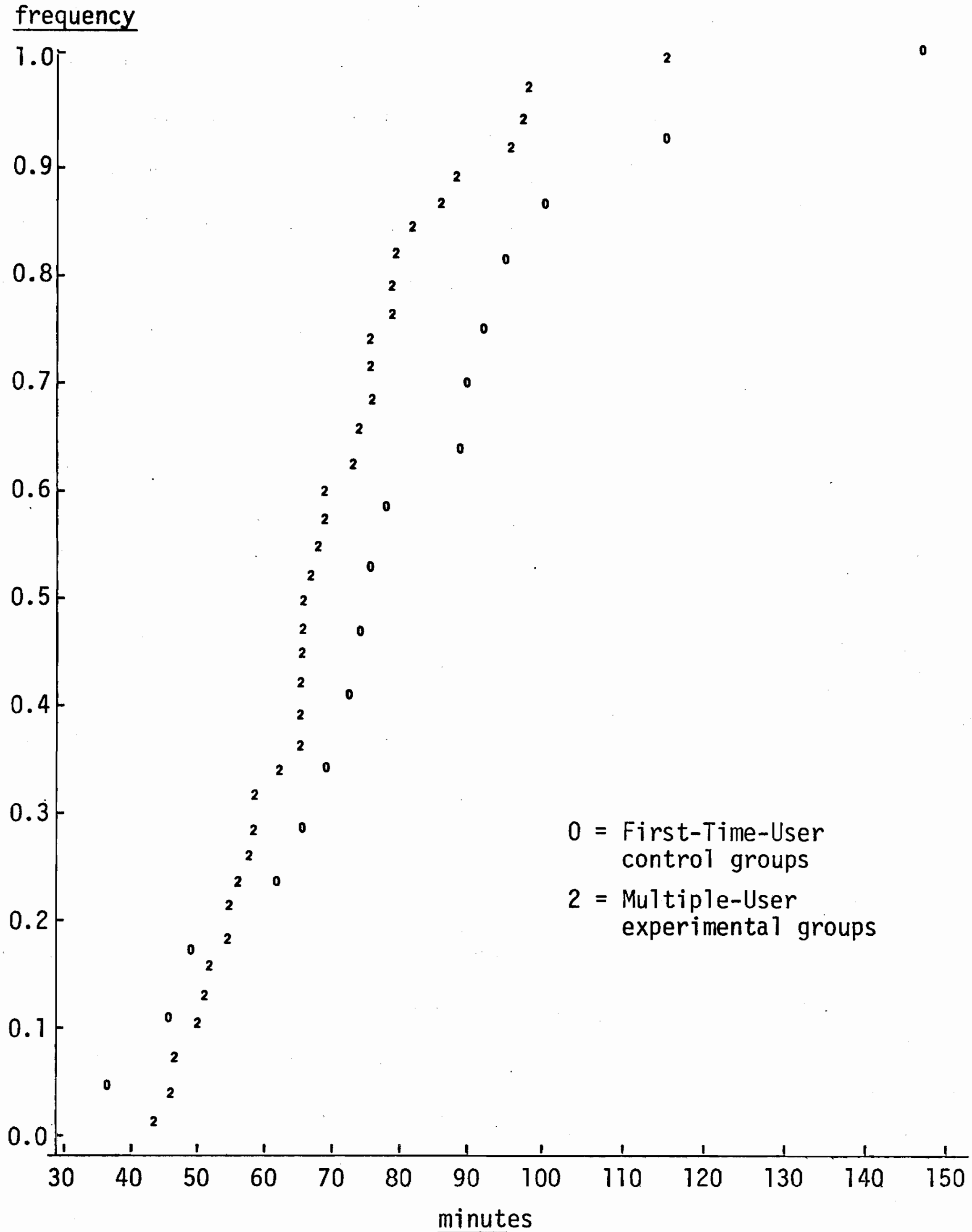

Figure 7. Cumulative distribution functions comparing First-Time-User control and Multiple-User experimental groups

7) which suggest the possibility that a slight dispersion difference may exist between the populations, that was not detectable by the Moses test. (The Moses test is not very powerful.) Visual comparison of the CDFs for both populations (Figure 8) indicates that the location shift that was supposed to separate the populations (see discussion in the fifth location test) is not evenly distributed over all the experimental groups. Due to the tentative acceptance of the null in this Moses test, and the evidence presented by Figure 8, it was concluded that the validity of the fifth location test may be questionable. An Ansari-Bradley test was performed on the data for comparative purposes and rejected the null hypothesis with $p = 0.0154$. If there was a change in the dispersion between the populations, Figure 8 may provide evidence that the change affected only about 40% of the experimental groups.

Test 6. The populations of experimental FTU and MU groups were compared. The Ansari-Bradley test accepted the null hypothesis that the groups were equally dispersed ($p = 0.0793$) (Table 7). The attained critical level supports the conclusion that there was not enough evidence to indicate that the time-spent hiking by experimental FTU groups was less dispersed than that of the MU groups. The results provide further evidence in support of Hypothesis 1: both groups had equivalent information about the trail and their walking times were evenly dispersed (Figure 9). This test does not, however, provide further insight into whether the MU and FTU groups had the same valence for the goal.

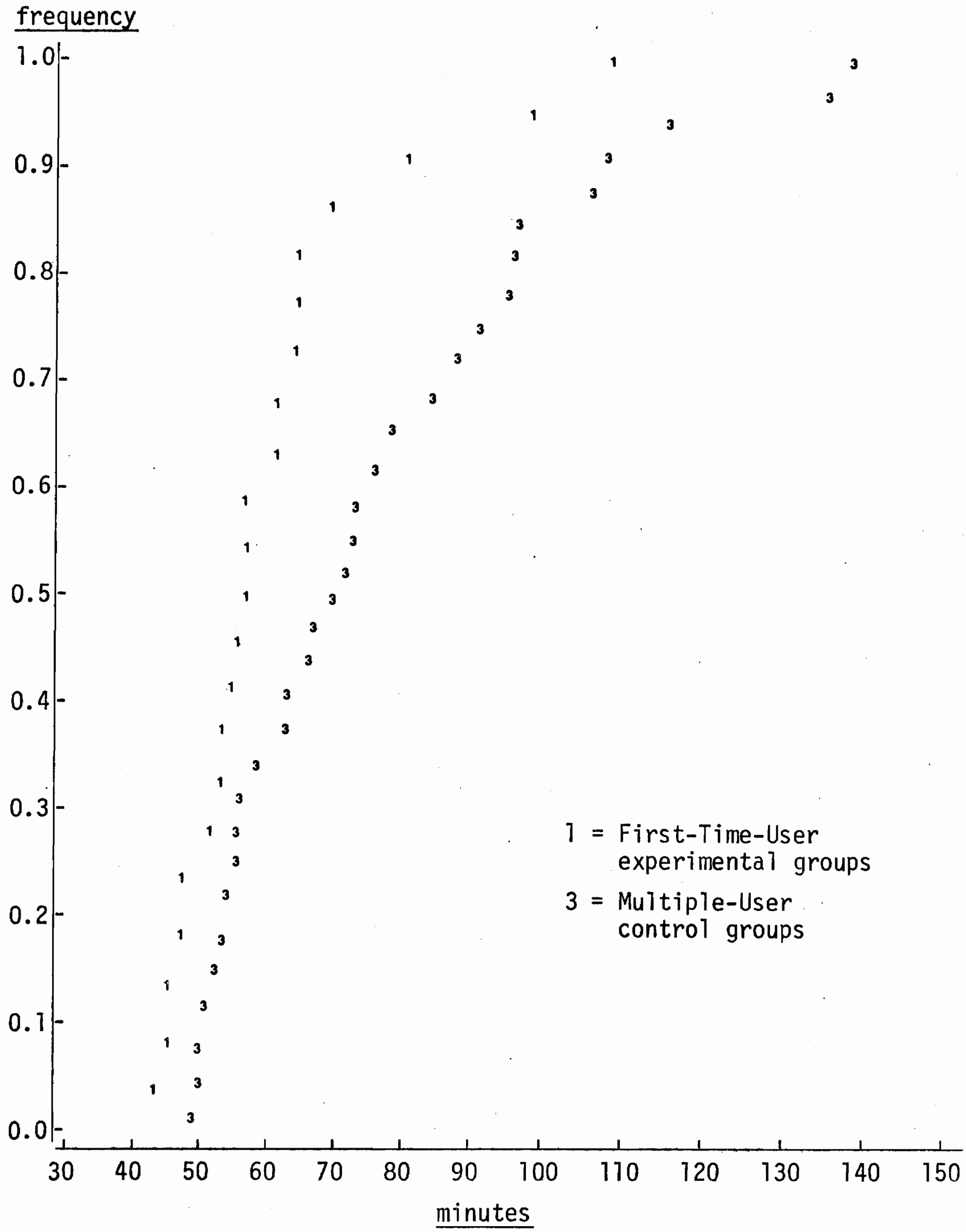

Figure 8. Cumulative distribution functions comparing Fist-Time-User experimental and Multiple-User control groups

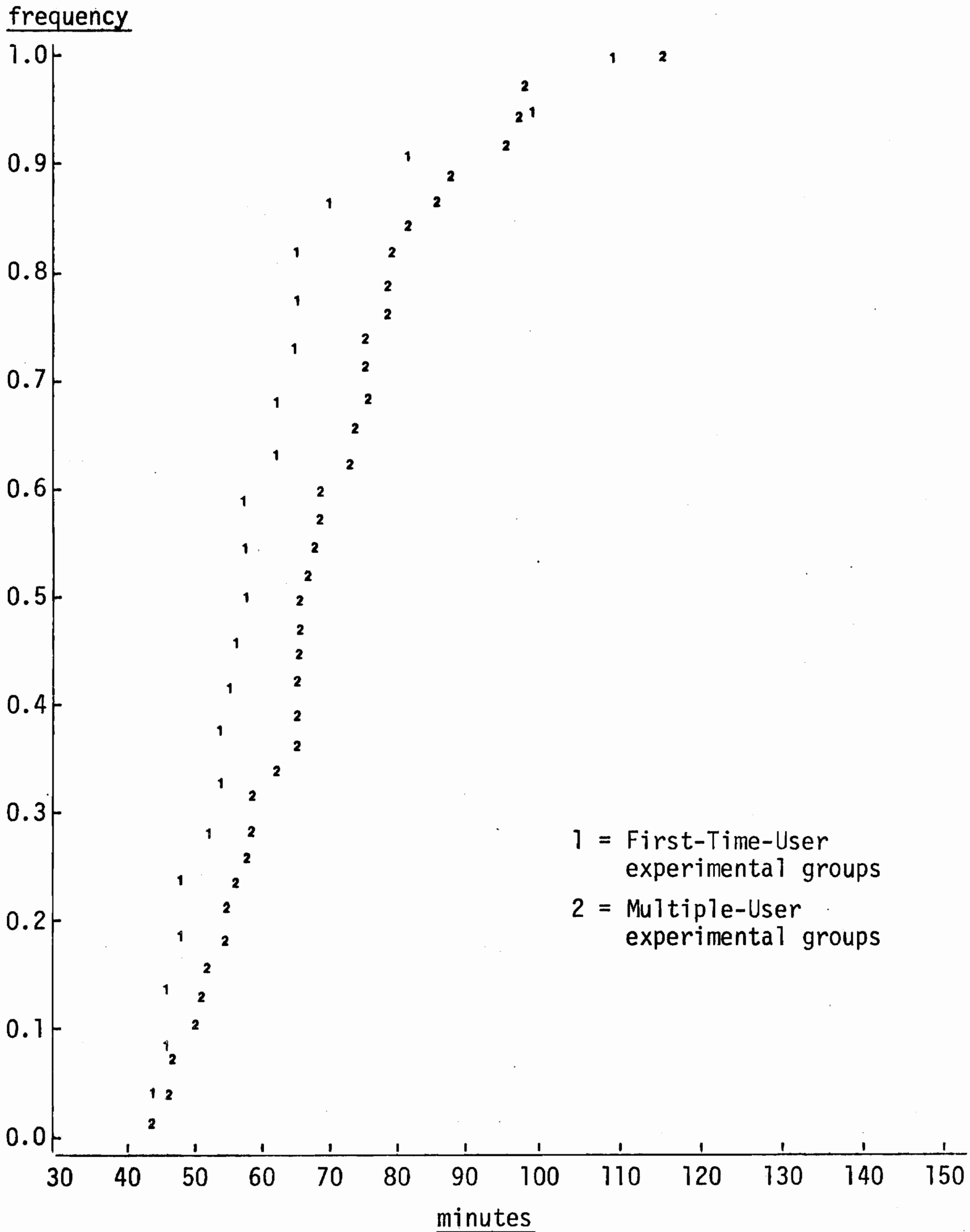

Figure 9. Cumulative distribution functions comparing First-Time-User and Multiple-User experimental groups

DISCUSSION AND CONCLUSION

Summary of the Results

The results of this study provide support for the hypothesis that recreationists who are able to accurately determine the distance remaining to a goal, in an outdoor recreation environment, will spend less time walking to that goal than people who are not able to accurately determine the distance remaining to the same goal. The hiking times of both the First-Time-User and the Multiple-User groups were significantly affected by providing them with information about distances. The information, which was supplied by the experimental map, allowed the groups to systematically determine the distance remaining to the falls as they proceeded along the trail.

The differences between the groups may be visually compared in Fig. 10. The Cumulative Distribution Functions (CDF) for the MU control and experimental groups appear to be "sandwiched" between those of the FTU groups, although this relationship is not consistent at the extremes of the distributions. The results of all the statistical tests indicated that the FTU experimental groups were most similar to the MU experimental groups, since significant differences in the hiking times were found between the FTU experimental groups and both the FTU and the MU control groups. It was not concluded that these experimental groups were homogeneous, however, since the MU groups had knowledge of the trail from previous visits. Also, because this was the first

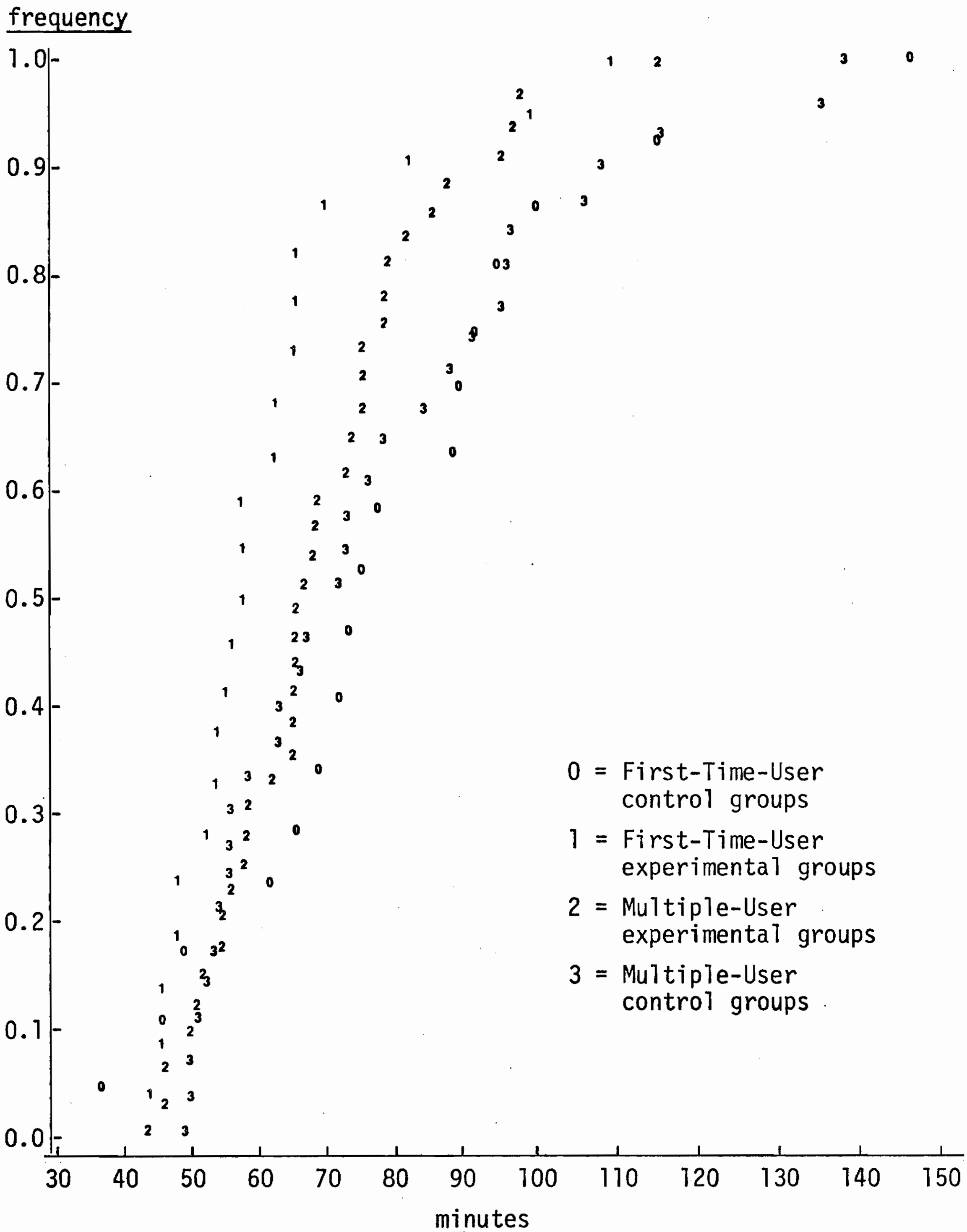

Figure 10. Cumulative distribution functions comparing all groups

visit to the Cascades for the FTU groups, the novelty of the occasion may have significantly increased their valence for the falls, relative to that possessed by the MU groups. Finally, the FTU control groups were found to be more similar to the MU control groups than they were to the MU experimental groups, although no significant differences in the hiking times were detected by the tests.

Discussion of the Results

Several questions arise when considering how the experimental map may have affected the behavior of those who participated in this research. Was the map used? When was it first used to determine the group's proximity to the goal? Was the map used at regular intervals? Did the group stop at every point of interest that was suggested by the map? The subjects were not interviewed after they had reached the falls, so these questions cannot be answered conclusively. However, when the researcher at the falls attempted to collect the map, many of the subjects were reluctant to surrender it and requested that they be allowed to keep it for future reference. Although this anecdotal information offers insight only with respect to the question of the map's use or non-use, it may suggest that the map did provide a service to many of the hikers. The results of this study indicate that the map affected the FTU groups more than MU groups.

Any discussion of how the map may have modified the behavior of the hikers must be based upon the theoretical works on the psychology of motivation that were discussed in the Introduction of this thesis.

Specifically, Lewin's (1936) concept of topological space and his principal of contemporaniety (Lewin 1938) may help to explain how the map affected the psychological environment of the hikers. The recreation quality theory may explain why those with the map may have experienced higher quality recreation than those without the map.

The Cascades may be equated to Lewin's "psychological field" in which the observed behavior occurred. The principal of contemporaniety states that human behavior is a product of the interaction between a person and the psychological environment, as it is perceived by the person at a particular point in time (B = f (P,E)). The only independent variable of this relationship that is believed to have been experimentally modified is the psychological environment.

Since the force of motivation is defined as the tendency to locomote from one topological region (goal) to another within the field, it is assumed that there were only two potential goals for the users under the control conditions: the parking lot and the falls (a goal may have a negative attraction). It is also assumed that the psychological field, perceived by the control groups, contained only two topological regions: the parking lot and the falls. The distance between the two goals was 2.0 miles.

Under the experimental conditions, the effect of the map may have been to divide the psychological field into nine topological regions: beginning at the point where the users received the map and ending at the falls. This may have occurred as a result of the fact that the map defined eight secondary goals in addition to the falls. Because each region contained only one goal by definition, the average distance between goals was approximately 0.2 miles.

It was hypothesized that force is inversely proportional to psychological distance, but proportional to valence (Lewin 1938). For this research, the assumption was made that the valence was held constant during the sampling period and was not considered to be a determinant of behavior for this study. An experimental group's average maximum perceived distance to their next goal, at any point along the trail, may not have exceeded 0.2 miles. On the other hand, the maximum perceived distance for the control group was 2.0 miles. It is not possible to determine how accurate the control groups may have been at estimating the distance traveled or the distance remaining to the goal. However, based on the results of the study, it is concluded that the experimental group's estimate of the distance to their next goal may have been consistently lower than the control group's estimate of the distance remaining to the falls. Conversely, the force of motivation acting upon the experimental groups may have been consistently stronger than that acting upon the control groups. As a consequence, the experimental groups walked at a faster pace and required less time to reach their primary goal.

This reasoning, as to the map's effect on the user's psychological environment, may be more appropriate for First-Time-Users than for Multiple-Users at the Cascades Nature Trail. The results provide evidence that the Multiple-User groups may not have had as strong a need for the information that the map provided. Either the Multiple-Users were already familiar with the trail, or the falls was not as attractive to them as it was for the First-Time-Users. This would seem to be in agreement with Oxenfeldt's (1966) suggestion that information may influence behavior most efficiently when it meets the needs of the people. Burgess et al. (1971) implied that the most influential determinant of a particular behavior may be the immediate personal benefit of the behavior. Therefore, if the Multiple-User groups were more familiar with the trail, then they needed the map less than the First-Time-User groups did to determine distances. If the falls was not the main attraction for the Multiple-Users, then there was nothing for them to gain by moving more quickly along the trail.

According to the recreation quality theory, those who exhibit a stronger force of motivation will have a higher positive emotion level. From this it is assumed that hikers who have a higher emotion level will experience recreation of a higher quality, relative to those with a lower emotion level. Since the FTU experimental groups did exhibit a stronger motivational force than the FTU control groups, it is concluded that the emotional benefits received by the experimental groups were greater than those received by the control groups. In other words, the the quality of the recreation experienced by the experimental FTU groups was significantly higher than it was for the control groups.

The determinants of valence should be investigated to identify which are consistantly the most influencial (i.e. novelty). Is valence independent of the user's estimate of the psychological distance? The hypothesized proportional relationship between valence and force seems intuitively correct. However, this should be tested under recreation controlled conditions. Also, the role of trail length (as represented on large visitor orientation maps) in determining recreation trail preferences may reveal information that would be invaluable to managers of parks and recreation areas in order to influences the amount and distribution of trail use.

Management Implications

The basic objective of managing an outdoor recreation area is to provide an opportunity for people to enjoy quality experiences without disrupting the physical or psychological environment.
This study suggests that the psychological distance to a goal may be a factor in determining the quality of a recreation experience, and that information about distances may be an underestimated influence of human behavior.

The qualtty of recreation may be improved if the psychological distance to a primary goal is reduced, This may be accomplished by creating several secondary goals along the trail. For example, at the Cascades there are signs along the trail that point out an old sawmill and a view of Barney's Wall. But these areas cannot serve as secondary goals if a visitor is not aware of their existence ahead of time. This could be remedied by placing a sign at the old sawmill that says, "Vista of Barney's Wall, 0.2 of a mile." The user would be alerted that a secondary goal exists and how far away it is. The force motivating the user onward would then be influenced by the shorter distance to the vista, and not necessarily by the longer distance to the falls. Therefore, as the distance to the next goal decreases both the level of positive emotion and the quality of the experience may increase.

Most areas that have one primary goal, such as a mountain top, offer several trails which the recreationist may use. A large map of the trail system is usually displayed at the base of the mountain. Assuming that the user's primary objective is to reach the summit, the relative length of a trail as it appears on the map, may be an under-estimated determinant of visitor trail preference. Often the trail that appears to be the most direct route to the goal will receive the most use and be environmentally impacted. Mount Monadnock[1], in Jaffery, New Hampshire, may provide a good example of this situation. The most direct route to its summit has been seriously damaged by over-use, and excessive washing. As a result, it has become one of the least attractive trails on the mountain; yet it remains the most heavily used.

To reduce the attractiveness of the shorter trail and create an evenly distributed use-pattern over the entire trail system, the recreationists must be informed about the positive attributes (increase the valence) of the alternative trails. This could be accomplished by color coding the trails on the orientation map and defining each color in the legend. Since the color that represents each trail on the map may also influence a visitor's trail preference, the shortest trail could be represented by a displeasing color that is defined in the legend in such a way to discourage people from using the trail, i.e. over-used, eroded, steep, environmentally damaged, no vistas. The longer trails, however, could be represented by more pleasing colors and described by more appealing phrases.

[1]This mountain is climbed by more people every year than any other mountain in the country.

Conclusion

This study has provided support for the hypothesis proposed by More and Buhyoff (1977) in the recreation quality theory, that an inverse relationship exists between the force of motivation and the psychological distance to a goal in a forest recreation environment. The results indicated that people who are able to accurately determine the distance remianing to their goal, as they are walking along a trail, will arrive at the goal in less time than those who are not able to accurately estimate the distance. People who were visiting the Cascades for the first time seemed to utilize the information about distances provided by the map more than those who had prior knowledge of the trail. It was hypothesized that the valence of the falls was greater for the First-Time-Users than it was for the Multiple-Users, possibly due to the novelty of the experience for the First-Time-Users.

The unobtrusive method of observation eliminated may of the confounding biases that were anticipated, and as a consequence the statistical analysis of the data was simplified. However, because of the limited contact with the observed subjects, no information was gathered on how the groups related to the map. It was proposed that the map altered the psychological environment by dividing the trail into topological regions, i.e. one region for every point of interest suggested on the map.

The force that motivated the experimental groups along the trail could have been a function of the perceived distance to the next secondary goal. The force that motivated the control groups is assumed to have been a function of the perceived distance to the primary goal. Therefore, the distance separating the experimental groups from their next secondary goal was consistently less than that between the control groups and the falls. The results support the conclusion that a stronger motivating force caused the experimental groups to walk faster and arrive at the falls in less time, because the distance to their next goal was consistently less than it was for the control groups. Since the experimental groups seem to have had a stronger motivating force, they may have also had a higher positive emotion level. It has been hypothesized that the level of positive emotion is an indicator of recreation quality. Thus the experimental groups of this study may have experienced recreation of a higher quality, relative to that which was experienced by the control groups.

REFERENCES CITED

Atkinson, J. W. 1958. Motives in Fantasy, Action, and Society. Princeton: D. Van Nostrand Company, Inc.

________ and Birch, D. 1970. The Dynamics of Action. New York: John Wiley & Sons, Inc.

Brown, P. J. and Hunt, J. D. 1969. "The Influence of Information Signs on Visitor Distribution and Use." J. of Leisure Research 1(1):79-83.

Buhyoff, G. J. and Brown, P. J. 1975. "Social and Individual Learning Benefits from Recreational Engagements." A paper presented at the EDRA 6 Workshop, Lawrence, Kansas, April 21, 1975.

Burgess, R. L, Clark, R. C. and Hendee, J. C. 1971. "An Experimental Analysis of Anti-Litter Procedures." J. of Applied Behavior Analysis 4(2):71-75.

Campbell, D. T. and Stankey, J. C. 1963. "Experimental and Quasi-Experimental Designs for Research on Teaching" In Handbook on Teaching, pp. 171-246. H. L. Gage (Ed.). Chicago: Rand McNally. Reprinted separately as Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally, 1966.

Catton, W. R., Jr. 1969. "Motivations of Wilderness Users" Pulp and Paper Magazine of Canada (Woodlands Section) (December 19), pp. 121-126.

Clark, R. N., Hendee, J. C., and Frederick, F. L. 1971. "Values Behavior, and Conflict in Modern Camping Culture." J. of Leisure Research 3(3):143-159.

Driver, B. L. 1972. "Potential Contributions of Psychology to Recreation Resource Management." In Environment and the Social Sciences: Perspectives and Applications, pp. 233-244. J. Wohlwill and D. H. Carson (Eds.) Washington, D. C.: American Psychological Association.

Lewin, K. 1936. Principles of Topological Psychology. New York: McGraw-Hill Book Company.

_______. 1938. The Conceptual Representation and the Measurement of Psychological Forces. Durham, North Carolina: Duke University Press.

_______. 1951. Field Theory in the Social Sciences. D. Cartwright (Ed.). New York: Harper and Row.

Lime, D. W. and Stankey, G. H. 1971. "Carrying Capacity: Maintaining Outdoor Recreation Quality," pp. 174-184. In The Forest Recreation Symposium, N.Y. Coll. For., Syracuse, October 12-14, 1971, 211 p. Northeast For. Exp. Stn., Upper Darby, Pa.

Lowell, E. L. 1950. "A Methodological Study of Projectivity Measured Achievement Motivation." Master's thesis, Wesleyan University.

Martirz, J. G. 1956. "Relationships Between the Self Concept and Differences in the Strength and Generality of Achievement Motivation." J. Pers., 24, pp. 364-375.

McClelland, D. C. 1961. The Achieving Society. Princeton: D. Van Nostrand Company, Inc.

_______ and Atkinson, J. W. 1948. "The Projective Expression of Needs. I. The Effects of Different Intensities of the Hunger Drive on Perception." J. Psychol., 25, pp. 205-222.

_______; Atkinson, J. W.; Clark, R. N.; and Lowell, E. L. 1953. The Achievement Motive. New York: Appleton-Century-Crofts.

_______; Clark, R. A.; Roby, T. B.; and Atkinson, J. W. 1949. "The Projective Expression of Needs. IV. The Effect of the Need for Achievement on Thematic Apperception." J. Exp. Psychol., 39, pp. 242-255.

Mead, M. 1949. Male and Female. New York: William Morrow.

More, T. A. and Buhyoff, G. J. 1977. "On-Site Behavior in Recreation Areas: A Theory of Recreation Quality." unpublished manuscript, U.S.D.A. For. Serv., Northeast For. Serv. Exp. Sta., Amherst, Ma.

Murray, H. A. 1938. Explorations in Personality. New York: Oxford University Press.

Driver, B. L. 1976. "Toward a Better Understanding of the Social Benefits of Outdoor Recreation Participation," p. 163-189. In Proceedings of the Southern States Recreation Research Applications Workshop, Asheville, September 15-18, 1975. Southeast For. Exp. Stn., Asheville, N.C. 302 p. (USDA For. Serv. Gen. Tech. Rep. SE-9, June 1976).

________ and Tocher, S. R. 1970. "Toward a Behavioral Interpretation of Recreation, with Implications for Planning." pp. 9-31. In _Elements of Outdoor Recreation Planning_. B. L. Driver (Ed.). Ann Arbor: The University of Michigan Press.

French, E. G. 1955. "Some Characteristics of Achievement Motivation." _J. Exp. Psychol_. 50, pp. 232-236.

Grubb, E. A. 1975. "Assembly Line Bordom and Individual Differences in Recreation Participation." _J. of Leisure Res_. 7(4):256-269.

Hull, C. L. 1930a. "Knowledge and Purpose as Habit Mechanisms." _Psychol. Review_ 37, pp. 511-525.

________. 1930b. "Simple Trial and Error Learning: A Study in Psychological Theory." _Psychol. Review_ 37, pp. 241-256.

________. 1931. "Goal Attraction and Directing Ideas Conceived as Habit Phenomena." _Psychol. Review_ 38, 487-506.

Knopf, R. C. 1972. "Motivational Determinants of Recreation Behavior." Master's thesis, The University of Michigan. (Univ. Microfilms, No. N-4244, 268 pp.).

________. 1976. "Relationships Between Recreation Demand and Selected Conditions in Home Neighborhood Environments." Ph.D. dissertation, The University of Michigan.

________; Driver, B. L.; and Bassett, J. R. 1973. "Motivations for Fishing." In _Human Dimensions in Wildlife Programs_, pp. 28-41. J. C. Hendee and C. Schoenfeld (Eds.). Seattle, Washington: The People/Natural Resources Research Council.

Knopp, T. B. 1972. "Environmental Determinants of Recreation Behavior." _J. of Leisure Research_ 4(2):129-38.

Lesser, G. S.; Krawitz, R. N.; and Packard, R. 1963. "Experimental Arousal of Achievement Motivation in Adolescent Girls." _J. Abnorm. Soc. Psychol_. 66, pp. 59-66.

Ohmann, L. F. 1974. "Ecological Carrying Capacity," pp. 24-28. In <u>Outdoor Recreation Research: Applying the Results</u>." Papers from a workshop held by the USDA For. Serv. at Marquette, Michigan, June 19-21, 1973. North Cent. For. Exp. Stn., St. Paul, Minn., 113 p., illus. (USDA For. Serv. Gen. Tech. Rep. NC-9).

Oxenfeldt, A. R. 1966. <u>Executive Action in Marketing</u>. Belmont, California: Wadsworth Pub. Co., Inc., p. 799.

Runkle, P. J. and McGrath, J. E. 1972. <u>Research on Human Behavior: A Systematic Guide to Method</u>. New York: Holt, Rinehart and Winston, Inc.

Stankey, G. H. 1973. "Visitor Perception of Wilderness Recreation Carrying Capacity." USDA For. Ser. Res. Paper, INT-142. Int. For. and Range Exp. Sta., Ogden, Utah. pp. 61.

________; Lucas, R. L.; and Lime, D. W. 1974. "Patterns of Wilderness Use as Related to Congestion and Solitude." A paper presented at the Annual Meeting of the Association of American Geographers, Seattle, Washington, April 29, 1974.

________; Lucas, R. C.; and Lime, D. W. 1976. "Crowding in Parks and Wilderness." <u>Design and Environment</u>. Fall 1976.

Tolman, E. C. 1925a. "Behaviorism and Purpose." <u>J. Phil</u>., 22, pp. 36-41.

________. 1925b. "Purpose and Cognition: The Determinants of Animal Learning." <u>Psychol. Review</u> 32, pp. 285-297.

________. 1926. "A Behavioral Theory of Ideas." <u>Psychol. Rev</u>. 33, pp. 352-369.

Veroff, J.; Wilcox, S.; and Atkinson, J. W. "The Achievement Motive in High School and College Age Women." <u>J. Abnorm. Soc. Psychol</u>. 48, pp. 108-119.

Webb, E. J.; Campbell, D. T.; Schwartz, R. D.; and Sechrest, L. 1966. <u>Unobtrusive Measures: Nonreactive Research in the Social Sciences</u>. Chicago: Rand McNally College Publishing Co.

APPENDIX A

DATA COLLECTED AT THE CASCADES FROM SEPTEMBER 26 THROUGH NOVEMBER 7, 1977

Time Spent (minutes) Hiking by Multiple-User Groups

Experimental	Control
43	49
46	50
46	50
50	51
51	52
52	52
54	53
54	55
55	55
57	55
58	57
58	64
61	64
65	66
65	66
65	70
65	71
65	73
65	73
66	75
67	79
68	85
68	89
73	91
74	95
75	96
75	97
75	106
78	108
78	115
79	135
81	137
85	N = 32
88	
95	
96	
98	
115	
N = 38	

Time Spent (minutes) Hiking by First-Time-User Groups

Experimental	Control
43	37
46	46
46	49
48	62
48	66
52	69
55	72
55	73
56	74
57	76
58	88
58	89
58	92
63	95
63	102
65	114
66	147
66	N = 17
70	
83	
102	
110	
N = 22	

VITA

The author of this paper was born Boston, Massachusetts on September 21,1949. He was raised in Concord, Massachusetts, as well as in Paso Robles, Claifornia and Old Saybrook, Connecticut. He attended Sterling School in Craftsbury Common, Vermont where he was a member of the varsity hockey team. He also attended Paso Robles High and graduated from Old Saybrook High School in the spring of 1968. While at Old Saybrook High, he was a member of the track team. He matriculated at Quinnipiac College in Hamden, Connecticut during the fall of 1968, and received the B.A. degree in History in June of 1972. While in college, he was a student member of the College Board of Trustees, editor of the College Annual, co-founder of the College Cooperative Bookstore, and recieved an award for outstanding contributions to the College in 1972. He was employed by the Smithsonian Institution of Washington, D.C. in 1973. At the Smithsonian, he worked for the Office of International and Environmental Affairs as a research assistant, and later for the Museum of Natural History as a museum technician. He became a candidate for the Master's Degree in Forestry and Forest Products at Virginia Polytechnic Institute and State University in September of 1975. He is a member of the Xi Sigma Pi honorary forestry society.

Alexander Rockwood Hoar

Alexander Rockwood Hoar

RELATIONSHIPS BETWEEN MOTIVATION AND PSYCHOLOGICAL DISTANCES IN A FOREST RECREATION ENVIRONMENT

by

Alexander Rockwood Hoar

(ABSTRACT)

The purpose of this study was to field test a portion of the recreation quality theory: a conceptual framework which seeks to provide insight into the behavior of outdoor recreationists. Specifically, the inverse relationship of two variables which may affect the quality of outdoor recreation was examined. These were the force of motivation and the psychological distance to the user's destination in a recreation environment. Time spent hiking to the destination was considered a function of force, and physical distance was considered a function of the psychological distance to the destination.

It was hypothesized that people who were able to accurately determine the distance remaining to the destination, as they were hiking along the trail, would arrive sooner than those who could not accurately determine the distance remaining to the destination. A map was used to provide users with information about distances. The hiking times for 109 visitor groups at the Cascades Nature Trail in the Jefferson National Forest, Virginia were unobtrusively recorded between September 26 and November 7,1976.

Differences between the hiking times of groups were analyzed by

means of Wilcoxon's Rank Sum Test, the Ansari-Bradley Dispersion Test, and the Moses Dispersion Test. The effects of changing environmental conditions were assessed by means of the Kruskal-Wallis Test for Multiple Comparisons, as well as by Wilcoxon's Rank Sum Test.

This study provided evidence that supports the hypothesis proposed in the recreation quality theory, that an inverse relationship exists between the force of motivation and the psychological distance to a goal in a forested recreation environment.