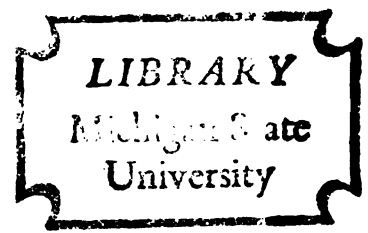


THE INFLUENCE OF ENVIRONMENTAL
DISCONTINUITIES ON AESTHETIC EXPERIENCE

Thesis for the Degree of M. S.
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ABSTRACT

THE INFLUENCE OF ENVIRONMENTAL DISCONTINUITIES ON AESTHETIC EXPERIENCE

By

Larry D. Gustke

A study designed to investigate and measure the arousal of an aesthetic response to a nature trail environment was conducted on a portion of an interpretive trail in the Nature Sanctuary of Kensington Metropolitan Park, Milford, Michigan. The section of trail selected as the research area contained a well defined discontinuity between an open meadow and a forest. The section of trail was divided into four equal segments, two in each direction of the discontinuity. Thirty subjects were observed while they hiked the trail.

Aesthetic response to the environment was measured by the amount of time a hiker spent in each of the trail segments. If the discontinuity had no effect on aesthetic experience, habituation would predict that the rate of travel would increase from segment to segment or would be constant. If the discontinuity had an effect, the rate of travel would increase from the first to the second segment of the meadow then decrease from the second segment of the meadow to the first segment of forest, and finally the rate would increase

from the first segment of the forest to the second segment of the forest.

The observed changes in the rate of travel between the various segments of the trail were statistically significant and in the directions predicted. Therefore, the null hypothesis is rejected in favor of the hypothesis that a discontinuity will elicit an aesthetic affect greater than an aesthetic affect for a specific aesthetic event.

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ON AESTHETIC EXPERIENCE

By

Larry Douglas Gustke

A THESIS

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CHAPTER I

INTRODUCTION

The Problem

In recent years concern about the quality of the environment has resulted in the activation and creation of numerous interest groups. These groups have played a significant role in lobbying both political and public opinion toward a realization of the magnitude and scope of contemporary environmental problems. The major thrust of these groups has been in the preservation and conservation of natural resources to insure a quality life for present and future generations. It should also be recognized that the emphasis on the preservation and restoration of our natural resources is in part an attempt at restoring and preserving the aesthetic qualities of the environment.

The aesthetics of the natural environment are important components of a quality environment. Aesthetics play a significant role in the enjoyment of outdoor leisure and recreation activities. Recreational activities including hiking, backpacking, camping, skiing, water sports, and many others are pursued in natural environmental settings. Evidence of aesthetic interest and participation in related

recreational activities exist in a number of natural resource publications exemplified by Sierra Club magazines, bulletins, and manuals.

Interest in the aesthetics of the environment has generated research conducted by resource agencies such as the United States Forest Service (USFS). Under the sponsorship of the USFS, Shafer¹ conducted two studies of camper preference for specific natural environments. Even though a few researchers have followed Shafer's lead, there exists very little understanding or empirical evidence of the relationship between environmental variables and aesthetics. Research and investigations into this relationship is needed if natural resource managers are to improve, maintain, and develop the quality of the environment for which they are responsible. The research reported in this paper is an investigation of one possible determinate of an aesthetic experience in a natural environment with direct management applications.

¹E. L. Shafer, Jr. and John F. Hamilton and Elizabeth A. Schmidt, "Natural Landscape Preferences: A Predictive Model," Journal of Leisure Research, Vol. 1, (Winter, 1969), pp. 1-19.

William Rutherford, Jr. and Elwood L. Shafer, "Selection Cuts Increased the Beauty In Two Adirondack Forest Stands," Journal of Forestry, June, 1969.

The Research Question

Most of the research in the area of environmental aesthetics has sought a determination of the aesthetics of a scene from the affect arousal quality of that scene. The physical characteristics and arousal potential of the scene are considered as important components of a scene's aesthetic quality. Evidence by Lynch² and Cherum³ suggests that affect arousal is more a function of the exposure or experience that precedes encountering an affect arousing event rather than the event itself.

The research question, therefore, is: "Is the aesthetic affect aroused in experiencing an environmental discontinuity greater than that aroused within a specific scene or environment?"

Hypothesis

The hypothesis tested in this paper is that: An environmental discontinuity will elicit an aesthetic affect (arousal affect) greater than the arousal affect for a specific aesthetic event.

²Kevin Lynch, The Image of the City, Cambridge: the M.I.T. Press, 1960.

³Gabriel J. Cherum, "Visitor Responsiveness to a Natural Trail Environment," Unpublished Ph.D. Dissertation, (University of Michigan, 1972), p. 14.

Methods

A 1,000 foot section of trail in the Nature Sanctuary of Kensington Metropolitan Park, Milford, Michigan, was chosen as the research area. The trail section was divided into four equal sections. Hikers were observed and timed as they hiked through all four sections. Hiking the trail consisted of hiking through a semi-rolling meadow, encountering the edge of a forest, and continuing through the forest. Thirty hikers were observed and timed. Data analysis consisted of a comparison of the difference direction and difference magnitude of hiking rates through the four segments of the trail by application of the Wilcoxin Sign Test.

Limitations

There are three factors which should be considered as possible limitations in the design, operationalization, and implementation of this study.

1. An Alternate Hypothesis. An alternate hypothesis to the arousal affect of a natural discontinuity may be possible. Arousal affect may be the result of a preference for a specific environment or natural scene contained in a preferred environment. A decrease in hiking rate may be the result of a steep hill or of the maintenance of heightened attention resulting from an environmental preference for forests over meadows.

2. A Second Alternate Hypothesis. Observed differences in the rate of hiking may be the result of the variable terrain of the trail. The experimental section of the trail was flat with the exception of one stretch of hill fifty feet long. A correction coefficient was calculated and applied to data from the section of trail containing the hill. The application of the correction coefficient removed the effect of the hill. Corrected rates are as they would be had the trail been of uniform slope.

3. Aesthetic Affect. The measurement used as representative of arousal of aesthetic affect may be questioned. It is assumed because physical and kinesthetic movements or orientations are an important component of attention that the rate of hiking is a valid index of affect arousal.

4. Natural Discontinuity. The natural discontinuity used in this study was easily observed and readily distinguishable. A photographic record of the discontinuity supports that fact. However, measurement of the physical and environmental characteristics of the discontinuity would have resulted in a more exact description of the natural discontinuity.

Organization Of The Thesis

Chapter Two begins with an introduction and background of research on the aesthetics of scenes. Suggestions

and evidence of the dynamics of aesthetics follow. A discussion of the concepts of habituation and adaptation and the role they play relative to the discontinuity and aesthetic affect conclude the chapter.

A statement of the conceptual hypothesis followed by a discussion of the operationalization of discontinuity and aesthetic affect make up the first two sections of Chapter Three. A statement and an explanation of the operational hypothesis is next. The remaining section is a comprehensive description of methods including selection of the experimental environment, pre-test, and data collection.

Analysis, results, and discussion are the major headings of Chapter Four. Under analysis, a statement of the statistical hypothesis and a description of the test statistic is offered. A description of the results follows and the chapter is concluded with a discussion of an alternative hypothesis to the discontinuity hypothesis.

The final chapter summarizes the entire study and contains conclusions derived from the results. Recommendations for the application of the results and for further research on the arousal affect of a natural discontinuity complete the thesis.

CHAPTER II

ENVIRONMENTAL AESTHETICS: LITERATURE REVIEW

Organization of the Literature Review

Most of the literature in the area of environmental aesthetics and environmental preference emphasizes the importance of specific environmental characteristics or qualities in determining the aesthetics of a scene or environment. Contrary to this emphasis, two researchers suggest that experience plays a significant role in influencing what is considered as aesthetic. The literature review contains a discussion of both of these emphases. This study focuses on the role that experience plays in influencing aesthetic appreciation. Therefore, a major portion of the literature review is devoted to a description of the two studies that suggest experience is a determinant of aesthetic preferences. Representative research dealing with aesthetic characteristics of scenes is also reviewed.

Background

Literature from landscape design, urban perception, experimental psychology, and leisure and recreation behavior was surveyed to gain an awareness of the historical background relevant to environmental perception and aesthetics.

The interaction and overlap between these areas became quite obvious as the literature was reviewed. As the importance of maintaining and preserving our environment has increased, a small number of researchers sharing an interest in environmental aesthetics have directed their efforts toward investigating preferences for specific environments and the aesthetic characteristics of those environments. Two unique research efforts by Cherum¹ and Lynch² have provided a clue about the dynamics of environmental aesthetics. Combining these dynamics with perceptual and learning concepts may make the meaning of aesthetics and the role of a discontinuity in environmental aesthetics clearer.

Exemplifying the research interest in environmental aesthetics, Craik³ in "The Environmental Dispositions of Environmental Decision Makers" suggests that a new field of research has recently become prominent. Its emphasis is on studying how persons comprehend, use, shape, and are shaped by their physical environment. Craik proposes the hypothesis that environmental decision makers differ from their clients

¹Cherum, "Visitor Responsiveness to a Nature Trail Environment."

²Lynch, The Image of the City.

³Kenneth H. Craik, "The Environmental Disposition of Environmental Decision Makers," Annals of the American Academy of Political and Social Science, 1970 (May, Vol. 389, pp. 87-94.

in the perception, interpretation, and evaluation of the environment. To bridge the gap between clients and decision makers, Craik suggests that research is needed to gain an understanding of environmental decision maker's comprehension and perception of the environment. Psychological techniques should be developed that comprehensively describe an individual's orientation to his environment.

Interested in an individual's orientation to the environment, Petersen and Neuman⁴ conducted a study in which they determined beach preferences. Using free response and semantic differential techniques, Chicago-Evanston beach users indicated their preferences among 8 photographs of public beaches. Responses indicated two major types of beach preferences: scenic uncrowded beaches and urban beaches with high quality sand and attractive buildings. An implied conclusion of these results was that a person can be characterized by his response to a setting or environment.

In an attempt to determine scene preferences, Shafer⁵ et. al. investigated the research questions: Why

⁴George L. Peterson and Edward S. Neuman, "Modeling and Predicting Human Response to the Visual Environment," Journal of Leisure Research, Vol. 1, No. 3, (Summer, 1969), pp. 219-239.

⁵Shafer, Hamilton and Schmidt, "Natural Landscape Preferences: A Predictive Model," Journal of Leisure Research.

is one landscape preferred more than another? What quantitative variables in a natural landscape are significantly related to public preference for that landscape? One hundred black and white photographs of typical wildlands in the United States were randomly assigned to 20 packets of 5 each. Campers were interviewed and asked to rank the 5 scenes. The rank values for each photograph were added to obtain a preference score. The contents of the photographs were also quantified in terms of the area or volume of a physical characteristic (sky, vegetation, path, water) in the photograph. Rank scores and physical characteristics were analyzed. Factor and multiple regression analysis led to the development of an equation that used six variables and accounted for 66% of the variation in preference scores for the photos of landscape scenes. These results indicate that preference for a landscape depends upon the area or perimeter measurements of six variables or items of the scene. These items are:

1. Perimeter of immediate vegetation
2. Perimeter of intermediate vegetation
3. Perimeter of distant vegetation
4. Area of intermediate vegetation
5. Area of any kind of water
6. Area of distant non-vegetation

Shafer concludes that this method of quantifying preferences and physical characteristics is applicable in many areas of natural resources management and planning,

both in wilderness aesthetics and scenic road design. By determining the quantitative features in a landscape that affect aesthetic appeal, natural resource planners and administrators will have some factual information upon which they can base decisions about purchasing, developing, and preserving natural resources.

Later the same year, Rutherford and Shafer⁶ measured and quantified preferences for undisturbed and selected cutting areas in Adirondack hardwood and softwood stands using color slides and an interview technique. Cut areas were reported as equally attractive by respondents. Cut areas were preferred to uncut areas in softwoods. From these results Shafer concludes that a mixture of uncut and cut conditions may satisfy most aesthetic interests. Shafer also suggests that additional research is needed so that general principles of aesthetic appreciation can be established and applied to resource management.

Natural scenes were preferred over urban scenes in a study reported by Kaplan and Wendt⁷ employing a rating

⁶Rutherford and Shafer, "Selection Cuts Increased the Beauty in Two Adirondack Forest Stands," Journal of Forestry.

⁷Stephen Kaplan and John S. Wendt, "Preferences and the Visual Environment: Complexity and Some Alternatives," EDRA Three, Proceedings of the Third Environmental Design Research Association Conference, Los Angeles, Ca., January, 1972.

task of color slides of urban and natural scenes. Subjects were instructed to rate each slide according to preference, complexity, and excitement intrigue. The preference for natural scenes is explained as a function of three components of the scene:

1. "Legibility" - The identifiability of the scene.
2. "Predicted Information" - The complexity and mystery of the scene.
3. "Primary Landscape Features" - Landscape features such as vegetation, water, pathways.

A mixture of these components determine or contribute to the aesthetics of the preferred natural scenes.

Also using photographs, Calvin⁸ et. al. investigated college student preferences for natural scenes. Students responded to 15 natural scene photographs on 21 semantic differential scales. The preference for natural scenes is explained as resulting from students evaluating each photograph on two major factors: "natural scenic beauty" and "natural force-natural tranquility." Preferred scenes were rated higher on the natural scenic beauty factor.

Studies of the type reviewed above share a common element. Each seeks a determination or characterization of the aesthetics of a scene within the physical attributes

⁸James S. Calvin, John A. Dearing, and Mary Ellen Curtin, "An Attempt at Assessing Preferences for Natural Landscapes," Environment and Behavior, Vol. 1, No. 4, December, 1972, pp. 447-470.

of the scene, itself. On this point a qualification is warranted. An aesthetic experience is dependent upon and characteristic of a human being perceiving the scene and not the scene itself. This suggests that the prior knowledge or previous experiences of individuals perceiving a scene may be equally or more important than the innate characteristics of a scene in determining aesthetic affect.

The results of two studies in particular suggest that an aesthetic experience may be the result of a dynamic interaction between previous experience and the ability of an individual to experience aesthetic affect from a specific environment. The first of these studies is by Kevin Lynch,⁹ an urban planner. The second and more recent is by Gariel Cherum¹⁰ an environmental interpreter. Both studies provide a perspective on the dynamics of environmental aesthetics and aesthetic affect.

Dynamics of Environmental Aesthetics

Kevin Lynch¹¹ conducted a study in an urban environment that emphasized the dynamics of environmental aesthetics. His interest was in understanding the mental image

⁹Lynch, The Image of the City.

¹⁰Cherum, "Visitor Responsiveness to a Natural Trail Environment."

¹¹Lynch, The Image of the City.

citizens hold of their cities. Lynch's concept of importance is imageability: that quality in a physical object which gives it a high probability of evoking a strong image when it is observed.¹² For Lynch the physical characteristics of shape, color, and/or arrangement which facilitate the making of vividly identified, powerfully structured, highly useful mental images are important in the development of the image of the environment. Lynch's thesis is that individuals are able to develop an image of the environment by operating on the external physical characteristics of the environment as well as modifying their internal learning process.

Interviews of small samples of citizens, and a systematic examination of environmental images by trained observers, produced data from which Lynch concluded that "images of a city exist in people's minds that enable them to maintain a pragmatic orientation toward the urban environment: People organize and use sensory clues (stimuli) from the environment to facilitate their living and working in that environment."¹³

¹²Ibid., p. 9.

¹³Ibid.

Lynch classified the physical characteristics discussed in interviews and reported by observers into 5 types of elements: paths, edges, districts, nodes, and landmarks. He suggests that the combination of these physical units affects the perception and formulation of shared public images.

In a modified replication of Lynch's study, Lowenthal¹⁴ investigated human responses to urban landscapes. The results supported the importance of Lynch's public held images. A second replication having an international flavor was conducted by John Gulick¹⁵ in Tripoli and Lebanon. Behavior exhibited by Tripolitan and Lebanese residents led to the conclusion that the urban image is the product of visual clues and sociological associations.

The Lynch study and its replications are important to this paper because they present the idea of shared images, and that these images are the result of the interaction and interdependence between many environmental stimuli. The shared images described by Lynch's respondents may represent images of discontinuities in the urban environment. The concept of shared images is also an integral part

¹⁴David Lowenthal and Marquita Riel, Publication in Environmental Perception, No. 6, Structures of Environmental Association, New York, The American Geographical Society, 1972.

¹⁵John Gulick, "Images of an Arab City," The Urban Image and Anthropology, August.

of a more contemporary study that produced evidence of the dynamics of aesthetics in a natural environment.

Evidence of Dynamics of Natural Aesthetics

The most recent study associated with environmental preferences and aesthetics was conducted in a natural environment by Gabriel J. Cherum.¹⁶ The study was designed to learn more about the recreational experience of hiking a nature trail. Hiker's responses to a nature trail environment; characteristics of scenes that make them appealing; characteristics that make some scenes more appealing than other; and stimuli that influence hikers, were variables investigated.

A visitor-employed photographic method was used to record hikers' responses to a nature trail environment. It consisted of issuing Kodak Instamatic Cameras (X-25) to hikers visiting the nature sanctuary at a large metropolitan park. Hikers were free to use the cameras as they wished and were instructed by the experimenter to photograph anything of interest during their hike. They were also requested to record on a tally sheet their comments about the objects or events that they photographed.

¹⁶Cherum, "Visitor Responsiveness to a Nature Trail Environment."

Many of the hikers pursued their hiking activity in a group. Because the visitor-employed photographic method required only one individual to operate a camera, it was necessary to select one individual in each group to serve as the group photographer. The group photographer took all of the photographs and was responsible for recording on the tally sheet his or the group's comments about the objects or events photographed.

A content analysis of the photographs resulted in the designation of two categories of photographs; a thematic category and a universal category.

The thematic category of photographs consisted of specific subject matter photographed during the hike (flowers, birds, etc.). The universal category photographs were scenes frequently recorded by a large percentage of hikers. They were exact records of views photographed by a number of hikers.

A major portion of the Cherum study consisted of an analysis of the universal photographs. Much of the discussion in this paper is directly related to these universal photographs; therefore, a discussion of Cherum's analysis of the universal photographs follows.

Universal Photographs

Universal photographs were defined as photographs taken of a specific scene. Thematic photographs were those

taken of a particular subject or object. Cherum's analysis suggests that thematic and universal photographs differ along one major dimension: complexity of the tally sheet descriptions. Universal photographs are more complex than those of thematic photographs.

Cherum states that ". . . contrary to the monothematic nature of the thematic photos, tally descriptions for any individual universal photo contained a variety of themes. In addition to thematic comments, universal photograph descriptions often contained two other types of comments, one general such as 'pretty scene' and one more specifically related to types of contrast such as 'geese honking'. As an example of a tally sheet description containing all three of these types of comments, one respondent's description of the universal photo 'marsh scene' read: 'marsh area (thematic comment)--interesting, scenic area (general comment)--noise of insects (contrast comment)."

All universal photograph tally sheets were content analyzed. This analysis led to a categorization of comments into three types referred to above: thematic, contrast, and general. The following examples illustrate the differences.

Universal Photograph Tally (Comment) Categories

Thematic - Subject's tally description or comments considered to be a description of the subject of the photograph or object described as important or prominent in the

photograph. Example: Description of a dead tree, flower, or a bird.

Contrast - Subject's tally description or comments about stimuli considered to be in contrast to the environment of the universal photograph. Example: Comment about a gnarled and twisted trunk of a tree, the broadness or openness of a view, or the pungent odor of a field of flowers.¹⁷

General - Subjects comments or descriptions considered to be non-specific (or general) with respect to the universal scenes. These comments were more value-oriented or philosophical as if to represent a judgment of the scenes by the subjects. These were divided into the following four categories:¹⁸

1. Pretty, scenic, picturesque
2. Peaceful or serene
3. Intersting, different, or unusual
4. Negative, philosophical or personal commentary

It is the category of contrast, or difference, exemplified by photographic images such as a gnarled tree trunk or the prominence of dead trees among healthy species that is significant. Cherum discussed the concept of contrast from a landscape architect's and aesthetic philosopher's

¹⁷Cherum, "Visitor Responsiveness to a Nature Trail Environment," p. 49.

¹⁸Ibid., p. 50.

viewpoint. He suggests that contrast was any extreme in the landscape that was noticed or recorded by trail hikers.¹⁹

The hikers' descriptions of contrast in universal scenes appear to be an explanation of why they photographed the scenes. The explanations often refer to natural features, characteristics, or aspects of the trail environment that were discontinuous.

Summary Of The Literature On Environmental Aesthetics

Most research has attempted to explain an aesthetic scene. The physical and environmental components of the scene have been considered as the major factors which determine or arouse an aesthetic affect. Contrary to this orientation, Lynch and Cherum suggest that an aesthetic experience may be as much a function of experience that precedes an aesthetic event as of the characteristic of the actual scene. An aesthetic experience may be influenced or even determined by experience prior to encountering an aesthetic event. These observations have led to formulation of an hypothesis that explains the arousal of aesthetic affect.²⁰ as a function of stimulus discontinuity.

¹⁹Ibid., p. 49.

²⁰Aesthetic affect - Throughout this paper, aesthetic affect refers to the arousal of pleasure or enjoyment elicited when aesthetic stimuli are perceived. Such feelings will result in a change in attention and a modification in behavior.

Habituation and Adaptation

Concepts relevant to discontinuity can be found in the research and theory of perception, motivation, and learning. Basic to a concept of discontinuity is the pleasure principle. As described by many philosophers, pleasure is the ultimate goal of life and various activities are pursued to obtain pleasure and enjoyment.²¹ Freud was a major proponent of the philosophy that pleasure was important in motivation.²² This principle has been discussed more contemporarily in the areas of learning theory and motivation. Munn²³ suggests that when our acts produce pleasurable results, there develops a tendency to repeat these or comparable acts, the aim being to gain a repetition of the pleasure associated with them. The motivation to display these acts is a result of the pleasure or enjoyment resulting from the actions.

Even though many researchers have observed behavior that supports the pleasure principle, it should be noted that it is still an assumption that individuals will engage

²¹Norman L. Munn, Psychology - The Fundamentals of Human Adjustment, Houghton Mifflin Company, Boston, Mass., 1956, pp. 196-197.

²²Ibid.

²³Ibid.

in or pursue behavior that is enjoyable or pleasurable when given a choice between pleasurable and non-pleasurable behavior. For this study it is also an assumption that individuals engage in or pursue recreational activity because it is enjoyable or pleasurable.

The second concept from experimental psychology that is of significance to discontinuity is "habituation." Habituation is an established concept in perception and learning theory. Woodworth²⁴ and Munn²⁵ have defined it as a process of adapting or becoming accustomed to a situation. Habituation is often confused with adaptation. It may be considered as a form of negative adaptation, during which repeated response to stimuli results in a decrease of the responses of the organism to the stimuli, and a decrease in behavior associated with the stimulus.

Anticipation may be considered as a motivational component of habituation. As an individual habituates, his anticipation level heightens. The individual looks for (anticipates) a new or novel stimulus to which he can attend. The pleasure or enjoyment received from eliminating the monotony and repetition of the previous stimulus and the

²⁴Robert S. Woodworth, Experimental Psychology, Henry Holt and Company, New York, 1938, p. 156.

²⁵Munn, Psychology - The Fundamentals of Human Adjustment.

perception of the new stimulus, motivate the individual to anticipate.

Adaptation is referred to as an adjustment or decline in sensitivity to continual or repeated stimulation. It is also defined as a "change in the direction of normal perception."²⁶ Adaptation may be considered as the sensory component of habituation.

The following examples will illustrate the difference between adaptation and habituation.

Dark adaptation is when an individual's visual sense organs adjust to a darkened room, which results in an individual seeing more clearly in a darkened room.²⁷

The elicitation of fewer responses or the less frequent display of conditioned or learned behavior associated with a darkened room exemplify habituation. Adaptation is basically a sensory response and habituation a behavioral response.

Every individual is bombarded by thousands of diverse stimuli every second of every day. An individual does not consciously perceive or interact with each and every one of

²⁶Irvin Rock, The Nature of Perceptual Adaptation, Basic Books, Inc., New York and London, 1966.

Eleanor J. Gibson, Principles of Perceptual Learning and Development, Appleton-Century-Crofts, Educational Division, Meredith Corporation, New York, 1967.

²⁷Clifford T. Morgan and Richard A. King, Introduction to Psychology, McGraw-Hill Book Company, New York, 1966, p. 468.

these stimuli. By the processes of sensory adaptation and selective perception our senses respond automatically to such stimuli. Individual attention to some stimuli are the result of their innate uniqueness or novelty. Novel stimuli may elicit a conscious or unconscious, positive or negative, response. The importance of the novel stimulus in eliciting responses and behavior in habituation and adaptation experiments has been reported by Dallet,²⁸ Day²⁹ and others. The role of stimulus change and the introduction of (novel) stimuli in aiding an organism to adjust to his environment is extremely important.

Novel stimuli, adaptation, and habituation are inter-related phenomenon or concepts. It is difficult to describe adaptation or habituation to a stimulus or environment without the perception of that stimulus. It is also difficult for an organism to be in a habituated or adapted state and yet ignore a novel stimulus that might facilitate awakening or removal from that state and result in a more pleasant or enjoyable existence.

²⁸Kent Dallet, Problems of Psychology, John Wiley & Sons, Inc., New York, 1969, pp. 166-167.

²⁹R. H. Day, Human Perception, John Wiley & Sons, Inc., New York, 1969, pp. 8-9.

Having laid a theoretical foundation, a hypothetical explanation of the responses exhibited by hikers using the "visitor-employed photographic" method is warranted.

The author would suggest that most of the photographs taken by hikers, especially those categorized as universal photos, were taken because of the novelty, uniqueness, or restorative characteristics of the stimuli recorded in the photograph. While hiking the trail, anticipation of hiking and of what will be observed arouse attention. Sensory adaptation occurs, followed by habituation which is manifested in a change (increase) in hiking rate. Habituation parallels a decrease in attention and the restoration or arousal of attention is the result of encountering new or novel stimuli. The photographs taken by hikers are a record of these stimuli.

Discontinuity: An Example

Consider a hiker proceeding on a trail through a semi-rolling meadow, perceiving its lack of foliage, vegetation and wildlife. Continuing, the hiker encounters a moderately rolling terrain with a climax forest containing natural hardwoods, shrubs, and associated wildlife. An analysis of this situation with respect to the concept of discontinuity would read as follows:

"As the hiker proceeded through the meadow, he attended to the stimuli associated with the natural characteristics of the meadow environment. Continuing to hike

through the field a sensory adaptation occurs in which all of the hiker's senses become acclimated or accustomed to the natural characteristics of the field environment. Concomitantly, habituation begins and is manifested in an increased rate of hiking by the hiker."

"As the hiker becomes more habituated, his rate of travel increases until he reaches a point on the trail where he encounters the edge of the forest. The forest is a new, novel stimulus which elicits an attentive response within the hiker. This response results in a return to a decreased hiking rate to facilitate the hiker's orientation and attention toward the natural characteristics of the forest."

CHAPTER III

HYPOTHESIS AND METHODS

Conceptual Hypothesis

The conceptual hypothesis is that: Aesthetic affect is the result of an environmental discontinuity.

The aesthetic affect elicited by an environmental discontinuity is due to the attention arousal characteristics of a novel discontinuous stimulus. The novelty or discontinuity of this stimulus is dependent upon adaptation and habituation to the environment of which that stimulus is a part. Experience in the environment prior to encountering an aesthetic event will result in habituation and adaptation which will facilitate the eliciting of an attentive, pleasurable response (aesthetic affect) to an aesthetic stimulus or event.

Operations

In the process of developing a research design, the variables presented in the conceptual hypothesis must be defined and operationalized. The definition and operationalization of discontinuity and aesthetic affect follow.

Discontinuity - A discontinuity is theoretically defined as any novel stimulus or physical characteristic of the environment that elicits an attentive response. Novel refers to unique, new, or different. The important aspects of a discontinuity are the perceptual adaptation and behaviorial habituation that occur prior to the perception and recognition of novel stimuli.

A naturally occurring environmental difference served as the operationalization of discontinuity in this study. A section of the Deer Run Trail in the Nature Sanctuary at Kensington Metropolitan Park exhibited a natural discontinuity adequate for the study. The section of trail was 1,000 feet long. The environment consisted of a semi-rolling open field, followed by a semi-climax forest. The point at which the edge of the forest was encountered was the environmental discontinuity. Photographic and graphic representations of this discontinuity are in Figures 1 and 2.

The semi-rolling field had moderate vegetation, very little tree cover, and few visible species of wildlife. Birds were singing but were not readily visible. On a hot summer or fall day the heat was noticeable. The semi-climax forest contained softwoods and hardwoods of moderate size, an abundance of birds and small wildlife, and a dense canopy that reduced the temperature in the forest area on a

Figure 1.--Graphic Representation of Experimental Section
of Deer Run Trail, Nature Sanctuary - Kensington
Metropolitan Park. TM #1 to TM #5 = 1000 ft.

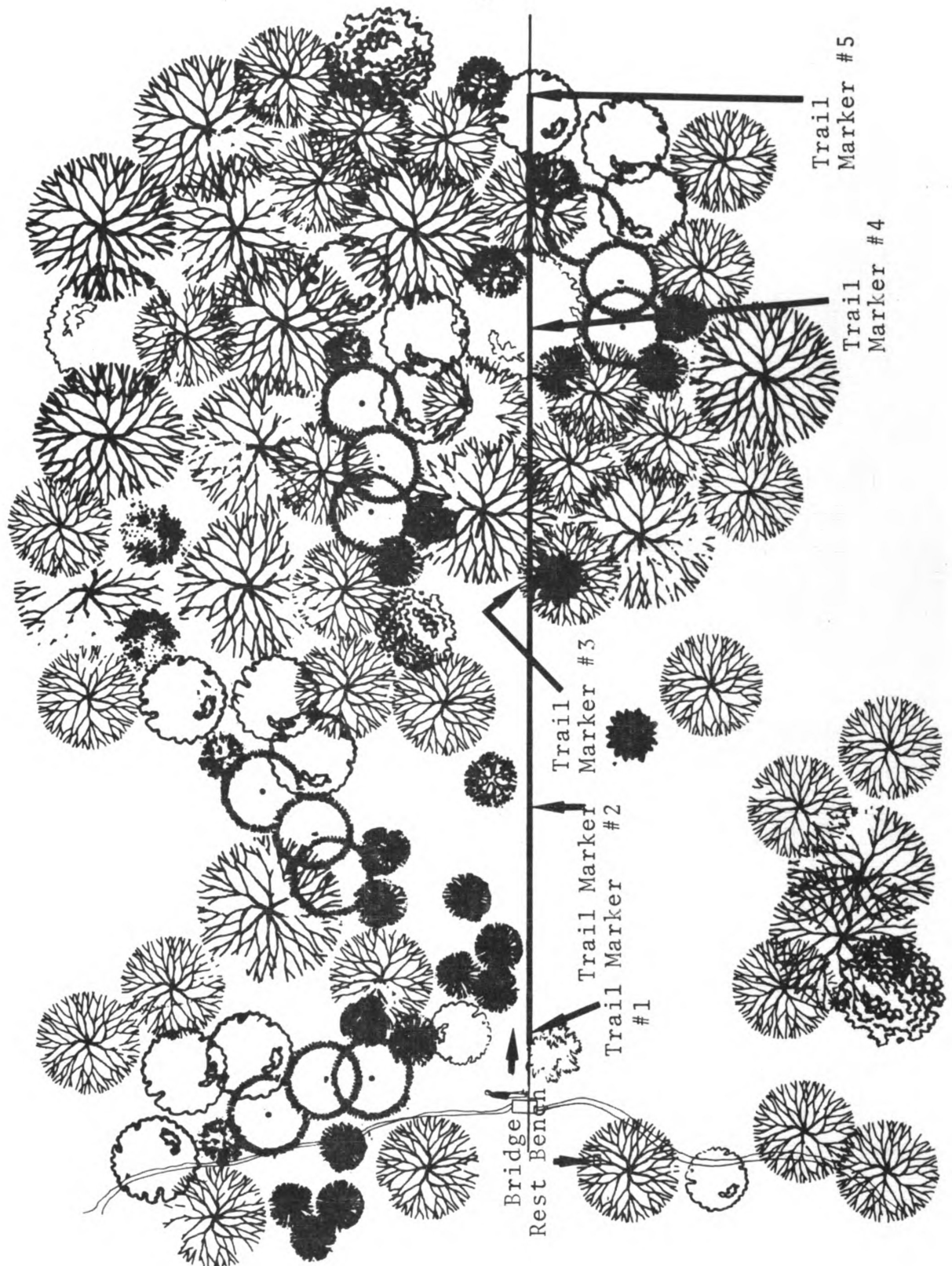


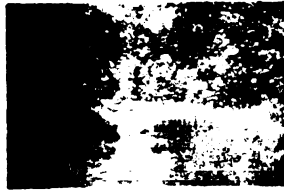
Figure 1

Figure 2.--Photographic Record of 1,000 ft. experimental section of Deer Run Trail - Nature Sanctuary, Kensington Metropolitan Park. Photographs were taken at 100 ft. intervals beginning at trail marker number one and concluding at the trail end.

Beginning of Trail
(0 ft.)



(100 ft.)



(200 ft.)



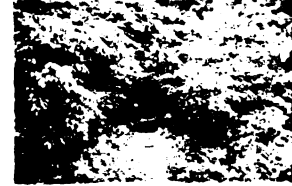
(300 ft.)



Approaching Discontinuity
(400 ft.)



Discontinuity
(500 ft.)



Leaving Discontinuity
(600 ft.)



(700 ft.)



(800 ft.)



(900 ft.)



End of Trail
(1000 ft.)



Figure 2

hot day. The difference between the two environments was visible and quite distinguishable.

A limited budget, time constraints, and a limited availability of equipment to measure physical characteristic differences (noise levels, illumination, earth texture and composition) between the physical characteristics of these two environments, resulted in the researcher relying on his perception of the differences in environmental characteristics to designate the discontinuity. Reinforcing this perception was the interpretive signing on the trail. Prior to beginning the study all interpretive signing was removed from the experiment section of the trail. One of the signs that was removed had been located at the edge of the forest. It pointed out the difference between the forest and field environment and specifically discussed the cooling effect of the forest canopy.

Aesthetic Affect - Rate of travel was chosen as the operationalization of Aesthetic Affect. This choice was based upon the assumption that most behavior is motivated toward the pursuit of pleasurable or pleasant activities. It is also assumed that trail hiking is engaged in because it is a pleasurable or pleasant recreational activity. In order for an individual to attend to stimuli in a nature trail environment, some physical response such as stopping or decreasing hiking rate would be necessary. The change in the rate of travel over the 1,000 foot experiment section

of the trail represents attentive responses to various stimuli encountered on the trail. Rate is an indication of attention and the perception of environmental stimuli.

Operational Hypothesis - From the previous discussion of the conceptual hypothesis and the operationalization of variables the following operational hypothesis was developed: A natural discontinuity has a negative (rate decreasing) effect upon trail hikers rate of travel.

If discontinuity has no effect the rate of hiking for the entire trail will be relatively equal or slowly increasing as a result of adaptation, habituation, and fatigue. If discontinuity has an effect, the rate of travel following the discontinuity will be less than the rate preceeding it. Graphically this is represented in Figures 3 and 4.

Beginning at point X and continuing through segment A, an increase in the rate of hiking is anticipated as a result of adaptation. The rate of hiking through segment B will be greater than that of segment A due to adaptation and habituation. At point Z the discontinuity is encountered. The discontinuity will elicit an attentive response and be manifested in a decrease in hiking rate through segment C. Continuing, the rate will again increase in segment D as a result of adaptation and habituation to the new environment. The hiking rate for segment D will be greater than segment C and possibly greater than segment B as a

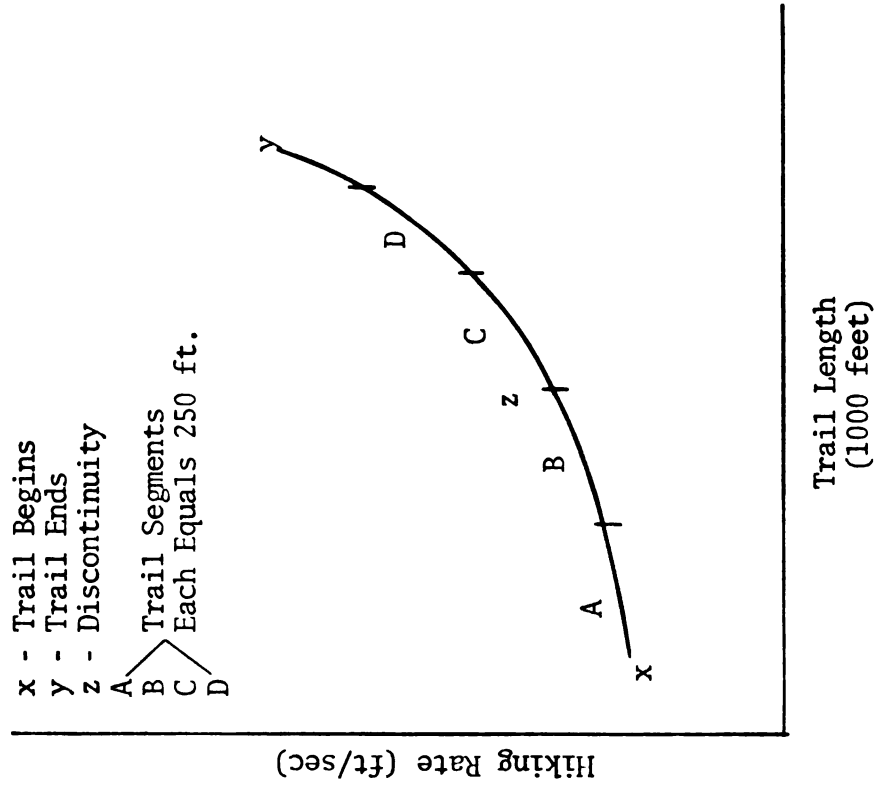


Figure 3.--No Discontinuity Effect.
(Adaptation - Habituation Curve)

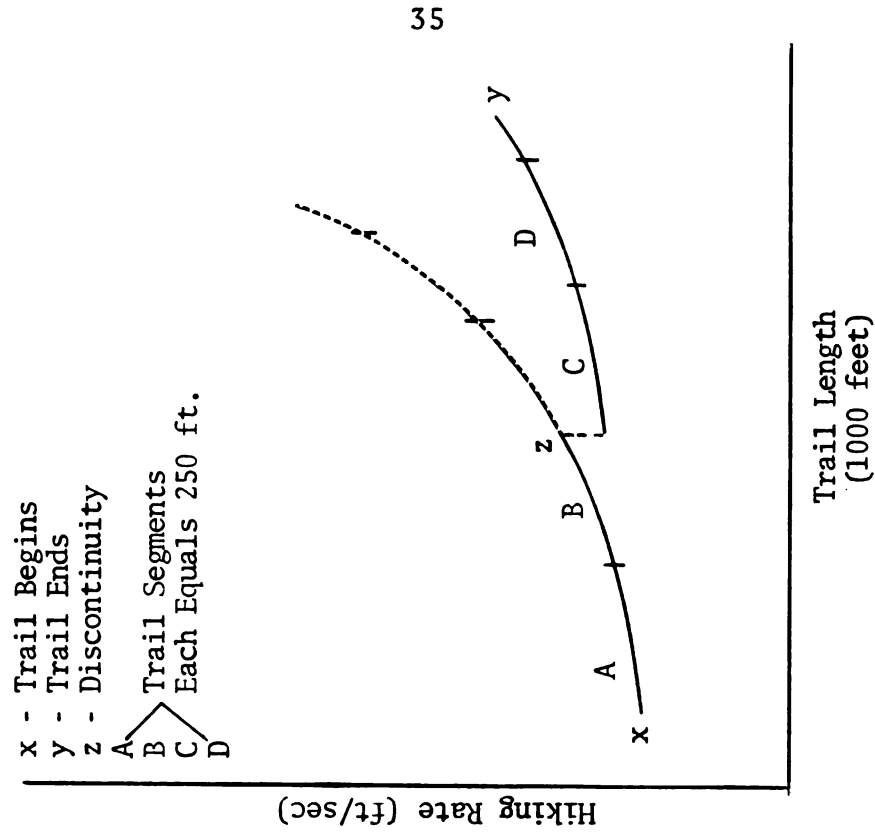


Figure 4.--Discontinuity Effect.

result of cumulative adaptation, habituation, and fatigue. The differences between the hiking rates for B and C will be determined by the magnitude of the discontinuity.

Methods

Field Procedure - During the fall of 1972 a trail study was conducted in Kensington Metropolitan Park, Milford, Michigan. This location was chosen because of the park's proximity to Michigan State University. Of secondary importance was the fact that Cherum's research had been conducted in the Kensington Nature Sanctuary.

A number of visits to the nature sanctuary were required of the author and a colleague for site selection and data collection. The researchers hiked the sanctuary trail system that had been used in Cherum's study. A 1,000 foot section of the Deer Run Trail that seemed appropriate for the purpose of testing the effects of discontinuity was selected as a research area. The researchers mapped the 1,000 foot section of the trail to obtain a record of verticle variability, direction, and the unique physical characteristics of the trail. A record of vegetative types and vegetative landmarks on the trail was also kept. A graphic representation and a photographic record of the trail are contained in Figures 1 and 2.

The 1,000 foot section of the trail was divided into four equal segments; two equal segments in each direction

from the edge of the forest (discontinuity). The rate of travel of hikers through the four segments was determined by timing how long it took them to hike each segment (250 feet) of the trail.

Pre-Test - During a pre-test of the data collection procedures it was discovered that because of terrain and foilage there was very little cover from which to take unobtrusive timings of the hikers' rate of travel. Telemetry equipment was too expensive and would require contact with the hikers; therefore, two techniques were tried.

Technique One: The researchers hiked behind the subjects at a safe distance, recording the time it took them to travel the four segments of the trail. This procedure proved awkward and not as unobtrusive as was anticipated.

Technique Two: The researchers proceeded in front of the hikers, recording the time it took them to travel the four segments of the trail. The researchers maintained enough distance between themselves and the hikers so that they could not be observed. This consisted of a minimum distance of approximately 100 feet to a maximum of 250 feet. Because the trail was winding, proceeding ahead of the subjects provided a vegetative blind from which the researchers could observe the subjects without being seen.

The four segments of the trail were marked as unobtrusively as possible with small orange strip flags attached

to the backs of trees. The flags were easily seen by the researchers but not by the subjects. During the data collection, only one subject detected a flag.

The researchers suspected hiking in front of the subjects may have had an effect upon subjects' rates of hiking. To see if this was the case, one-half of the subjects were questioned at the end of the trail. They were asked if they had noticed the researchers? All of the subjects questioned responded that they had not noticed the researchers and did not realize they had been observed or were subjects in an experiment. It should be noted that the Huron Clinton Metropolitan Authority preferred that the researchers not interrupt the park visitors pursuit of recreational activities with detailed questioning about their experiences, thus a questionnaire seeking verbal confirmation of affect arousal was not possible.

Data Collection

The data was collected on three weekends in the fall of 1972. Subjects were observed and timings taken from noon until 6:00 p.m. on Saturday and Sunday afternoons. The procedure for collecting data consisted of the researchers observing a hiker or group of hikers as they left a rest bench that was located near the beginning of the 1,000 foot section of the trail. If a group of hikers was observed, one of the adults in the group was designated as the subject.

No children were designated as subjects because of inconsistencies in hiking behavior observed during the pre-test.

As the subject stepped off of a little wooden foot bridge and committed his party to travel the experimental section of the trail, the researchers proceeded to hike the trail ahead of the subject, constantly observing the subject from a safe distance. One of the researchers started a stop watch as the subject passed the first trail marker. Continuing ahead of the subject the researchers remained as unobtrusive as possible. As the subject passed trail marker number two, the first watch was stopped and the second started. The second researcher then recorded the time lapse for the segment of trail just traversed. The procedure was followed for 30 subjects through all four segments of the trail. The subjects were randomly selected. As soon as the timing and hiking of one subject on the trail was completed, the researchers returned to the beginning of the trail section and picked up the next subject.

Subjects: Group Composition

Group composition ranged from a single individual to a six member family. All groups were not exclusively made up of adults. During the data collection approximately fifteen groups hiked the trail untimed. They were the groups that traversed the trail while the researchers were returning to the beginning of the trail to pick up the next subject.

CHAPTER IV

ANALYSIS, RESULTS, AND DISCUSSION

Analysis

Statistical Hypothesis: The following statistical hypotheses are derived from the preceding theoretical and conceptual foundations. (See Figure 3, page 35 for graphic interpretation of the hypotheses.)

Sub Hypothesis 1

Null Hypothesis - $H_{OA}: R_A = R_B$

Alternate Hypothesis - $H_{1A}: R_A < R_B$

When: R_A = Hiking Rate for Segment A of the trail,
 R_B = Hiking Rate for Segment B of the trail.

Sub Hypothesis 2

Null Hypothesis - $H_{OB}: R_B = R_C$

Alternate Hypothesis - $H_{1B}: R_B > R_C$

When: R_B = Hiking Rate for Segment B of the trail,
 R_C = Hiking Rate for Segment C of the trail.

Sub Hypothesis 3

Null Hypothesis - $H_{OC}: R_C = R_D$

Alternate Hypothesis - $H_{1C}: R_C < R_D$

When: R_C = Hiking Rate for Segment C of the trail,
 R_D = Hiking Rate for Segment D of the trail.

Wilcoxin Sign Test - The direction of difference of rate of hiking and the magnitude of differences of rate of hiking may be equally important in this study. Therefore, a statistical test was needed that could take both of these factors into account. The Wilcoxin Sign Test does this. The Wilcoxin Sign Test is a non-parametric, high power efficiency statistical test that accounts for difference direction and difference magnitude.

The Wilcoxin Test compares favorably with the t statistic and may be superior when the assumptions for t are not met. The Wilcoxin test statistic is T ; and when the number of subjects or observations increase (a large N), the sampling distribution is approximately normal and the test statistic approximates z .

The Wilcoxin Test tests the hypothesis that the relative difference magnitude and difference direction between two groups of paired scores are equal. The test also refers to the hypothesis that two population distributions of unspecified parameters are exactly alike.

Corrections For Possible Bias

At this point it should be noted that hiking rates for two of the subjects were not included in the calculation of average hiking rates and application of the Wilcoxin

Sign Test. Inclusion of the hiking rates for these two subjects would have biased the results in support of the conceptual hypothesis - the research hypothesis.

One of the hiking rates that was thrown out was that of a female subject who was a member of a group of three senior citizens. An elderly gentlemen in the group used two canes to walk and required assistance of group members to get around. The female subject's rate may have been slower than normal because she was needed to assist the less agile member of the group. The second hiking rate that was not included was that of a female subject who was part of a family group. The family hiked the trail pushing a baby stroller. Pushing the stroller over difficult terrain and soil types required a great deal of effort and time. This may have resulted in a reduction in her normal rate of hiking. This effort and time would be reflected in the time it took the subject and her group to hike the trail. Inclusion of these two slower rates would have biased the results in favor of the research hypothesis.

A second point of interest was that the vertical variability of the 1,000 foot section of trail was minimal. The trail was relatively flat and easily negotiated by all subjects.

A slight hill of 50 foot length existed in one segment of the trail. Regrettably, the hill was located in the segment of trail following the environmental discontinuity.

(Segment C of the trail.) Conceptually, the hill could be justified or rationalized as a part of the discontinuity. But, some consideration must be given to the physical effort required to climb the hill and the psychological effect the hill might have on the hikers. As a physical obstacle the hill may have reduced hiking rates.

In order to compensate for the possible decreased hiking rate resulting from the hill, a correction coefficient (k) was calculated to correct the rate of hiking in the segment of the trail containing the hill. (See appendix A.2)

Correction Coefficient

Two trail sections similar in all respects to the experimental hill segment were located in the Kensington Nature Sanctuary. One trail section was flat and the second was equal in grade to the experimental hill. Each section was 150 feet long and had the physical and environmental characteristics of the experimental hill segment. The flat and hill sections were mapped and physical characteristics noted. Timings were taken for 30 subjects, 15 hiking the flat and 15 hiking the hill sections.

Timing of the subjects hiking the flat and hill sections did not require the researchers to hike the trail in front of the subjects. The terrain and length of the trail sections made it possible to use observation points.

Calculation of the correction coefficient was based upon a ratio between the time it took subjects to hike the flat and hill sections. (See Appendix A.2 and A.3)

The correction coefficient was used to calculate a flat equivalent distance for the hill in the experimental trail. The flat equivalent distance was used to calculate a corrected rate of hiking for segment C (forest) of the experimental trail. (See Appendix A.1 and A.2)

Results

The results of the Wilcoxin Sign Test indicate a rejection of the Null Hypothesis and support for the Alternate Hypothesis. The statistical tests were all significant at $p < .05$.

Sub Hypothesis 1

$H_{0A}: R_A = R_B$ Rejected

$H_{1A}: R_A < R_B$ Supported

$T = +111.5$ $N = 28$

$z = -2.08$

$p = \text{approximately } .02$

Sub Hypothesis 2

$H_{0B}: R_B = R_C$ Rejected

$H_{1B}: R_B > R_C$ Supported

$T = -40.0$ $N = 28$

$z = -3.71$

$p = \text{approximately } .0001$

Sub Hypothesis 3

$H_{0C}: R_C = R_D$ Rejected

$H_{1C}: R_C < R_D$ Supported

$T = +50.0$ $N = 28$

$z = -3.5$

$p = \text{approximately } .0002$

Subjects exhibited hiking rates as predicted. The hiking rate through segment A of the meadow was less than that through segment B. The hiking rate through segment C of the forest was less than that for segment D. The hiking rate for segment B was significantly greater than that for segment C. Hiking rates increased following exposure to the same environment and decreased after encountering an environmental discontinuity.

Table 1.--Average Hiking Rates For Each Trail Segment

	Trail Segment			
	A	B	C (corrected rate)	D
Average Hiking Rate (ft./sec.)	3.34	3.64	3.40	3.74

Discussion

An Alternate Hypothesis - An alternate hypothesis to the discontinuity hypothesis is possible. Subjects may prefer certain environments over others. A preference for a

forest or meadow environment would be manifested in a change in the rate of hiking through the preferred environment. A subject's preference for one environment will be reflected in a slower (as compared with the non-preferred environment) more constant rate of hiking through the preferred environment. The rate of hiking will decrease and be maintained at a fairly constant rate because the subject's preference for a specific environment will help maintain his attention level as long as he/she is in that environment. Adaptation and habituation will not occur as rapidly when a subject is hiking through a preferred environment. The subject's rate of hiking may increase slightly but not significantly. A preference for an environment is represented graphically as in Figures 5 and 6.

The following analysis will clarify the effect of environmental preference on hiking rates.

Preference for Meadow - If there is a preference for the meadow it would be reflected in the slower hiking rate for the meadow as compared with the hiking rate for the forest.

Case 1 - The hiking rate through segment A will be less than or equal to that for segment B. $R_A = R_B$: The data indicate that this is possible, but R_A very seldom equals R_B .

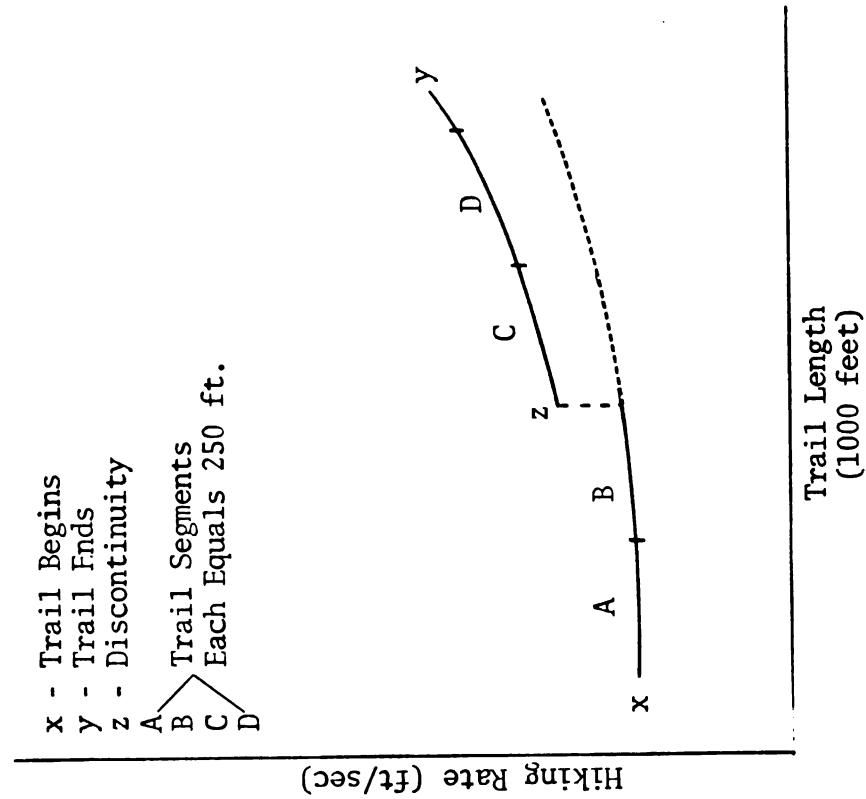


Figure 5.--Meadow Preference Curve.

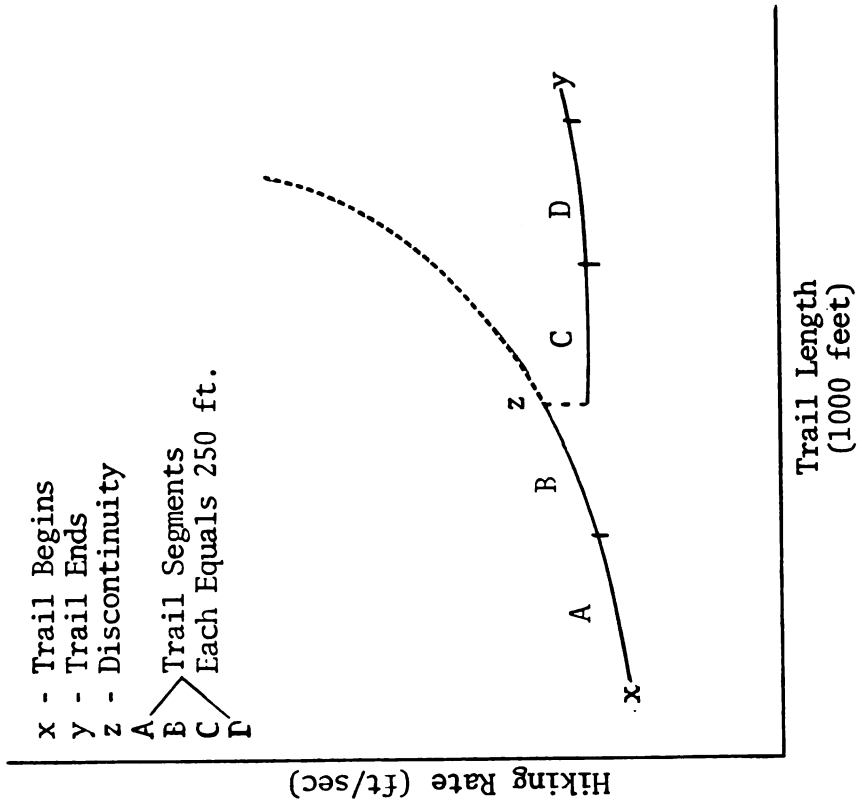


Figure 6.--Forest Preference Curve.

Case 2 - The hiking rate through segment B will be less than that for segment C. $R_B < R_C$: The data indicate that this does not occur. (Table 1)

Preference for Forest - If there is a preference for the forest it would be reflected in a slower hiking rate for the forest compared to the hiking rate for the meadow.

Case 1 - The hiking rate through segment B should be greater than that for segment C. $R_B > R_C$: The data indicate that this does occur.

Case 2 - The hiking rate through segment C is less than or equal to that for segment D. $R_C < R_D$: The data indicate that $R_C < R_D$ but not equal to R_D .

When one environment is preferred over another, that preference will be reflected in a constant or relatively constant rate of hiking through the preferred environment. The hiking rates through the segments of the preferred environment should be relatively equal and reflect no significant difference.

From this analysis, inspection of the data, and the Wilcoxin Sign Test, the alternate hypothesis that "Changes in hiking rate are the result of an environmental preference" is rejected.

Two Way Test - A second method of checking this alternate hypothesis and the general results of the study

would consist of allowing subjects to hike the trail in both directions. The discontinuity should have an effect in either direction. If a subject has a preference for one environment over another, that preference will effect the hiking rate prior to and following the discontinuity, depending upon the direction of hiking. While hiking the trail in the meadow-forest direction, a preference for meadows would result in a slower hiking rate through the meadow (segments A and B) than through the forest (segments C and D). Hiking the trail in the meadow-forest direction and having a preference for forests would result in a decreased hiking rate through the forest (segments C and D) as compared with the hiking rate for the meadow (segments A and B).

While hiking the trail in the forest-meadow direction a preference for forests would result in a slower rate of hiking through the forest (C and B) than through the meadow (A and B). Hiking the trail in the forest-meadow direction and having a preference for meadows would result in a decreased hiking rate for the meadow (A and B) as compared to the forest (C and D). The slower hiking rates through all preferred environments are the result of a higher attention level associated with preferred stimuli or environments. The higher attention level overrides or combats increased hiking rates due to adaptation and habituation.

A two direction discontinuity test was not conducted in this study because of administrative constraints imposed

by the agency managing the area. A duplication of this study or use of its methodology should include a two-direction discontinuity test. If a change in hiking rate is observed following the discontinuity while hiking in one direction and not the other, the rate change may be the result of an environmental preference. A thorough inspection of the data and the application of appropriate statistical analysis will be required to determine if the hiking rate change is the result of an environmental discontinuity or environmental preference.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In the last decade an increased interest in participating in recreational activities associated with aesthetic environments has led to a marked increase in the preservation of those environments. A few researchers have directed their efforts toward discovering the specific qualities or characteristics of an environment or scene that make it aesthetically pleasing. Such research has been motivated by a need for a tool or guideline that resource planners and managers can apply when making decisions about the preservation, development, and use of natural resources. The importance of aesthetic qualities within a scene cannot be denied. But, two researchers, Lynch¹ and Cherum,² suggest that previous experience or exposure to an environment influences aesthetic experience. Research and theory in experimental psychology suggest that continued exposure to

¹Lynch, The Image of the City.

²Cherum, "Visitor Responsiveness to a Nature Trail Environment."

an environment or stimulus results in adaptation and habituation to that environment or stimulus. Only by encountering or perceiving a novel (new, or different) stimulus does an organism again exhibit a response. Combining these psychological concepts and the conclusions of Lynch and Cherum, the important role that prior experience plays in affecting the perception of the aesthetic clues and the arousal of aesthetic affect becomes more obvious. This study was an attempt to investigate the arousal of aesthetic effect as a function of environmental discontinuity.

The methodology consisted of recording the time it took hikers to traverse a section of nature trail. The trail section was 1000 feet long and divided into four equal segments. Encountering the edge of a forest at the beginning of the third segment of trail after having hiked through two segments of meadow environment served as the operationalization of an environmental discontinuity. Hiking rates for all subjects for all segments of the trail were calculated.

The rate data were analyzed by the Wilcoxin Sign Test. The rate of hiking following a environmental discontinuity was significantly less than that preceding the discontinuity; other differences were in the directions predicted and were significant. Therefore, it was concluded that an environmental discontinuity does significantly influence the arousal of aesthetic affect.

Conclusions

Aesthetic affect arousal is a function of stimulus discontinuity. This conclusion is contingent upon the validity of rate of hiking as an index of attention and aesthetic affect. Prior experience or exposure to an environment influences aesthetic affect through the process of habituation to the environment and novelty effect when a discontinuity is encountered. A number of scenes and environments considered to have characteristics or qualities capable of eliciting aesthetic affect will need to be looked at from an interaction or transactional point of view. This is a point of view that suggests a number of factors may elicit an aesthetic affect. Two of the prominent factors are experience in the environment and perception of an environmental discontinuity.

Recommendations and Applications

The implications of the concept of discontinuity in the interpretation, design, and management of park and recreation areas and resources are many. Discontinuity is a concept or tool that can be used by recreation resource managers, designers, and interpreters to understand the relationships among environmental characteristics that influence aesthetic experiences in natural environments.

In the area of interpretation a discontinuity can serve as a focal point from which environmental concepts

can be communicated. The communication of environmental messages, information, concepts, and attitudes can be coordinated with the occurrence of a natural discontinuity. The following examples illustrates two methods of incorporating and environmental discontinuity into an interpretive program.

Example 1 - During a guided trail hike an interpreter could build his/her interpretation of the environment around a discontinuity. In the case of a forest discontinuity the interpreter could point out the significance of the discontinuity and lead into a discussion of forest succession, flora, fauna, and environmental or ecological relationships. The importance of the discontinuity for the interpreter is that it facilitates the maintenance of the audience's attention. The interpreter should use this to communicate messages or concepts. The interpreter can also point out obscured or unobtrusive discontinuities that will attract attention.

Example 2 - Descriptive signing or environmental messages might be located (at or immediately) following a discontinuity. Again referring to the forest discontinuity: all messages relevant to the cooling effect of the forest canopy should be displayed at the point at which the forest discontinuity is encountered. To present the message further along the trail would be less effective. After an individual has hiked a short distance on the trail he/she will have adapted to the temperature difference between the

forest and meadow environments. As in the first example, it is important that a hiker's heightened attention resulting from the discontinuity be used to facilitate the perception of environmental and interpretive messages.

The major application of a discontinuity in interpretation is the exploitation of the heightened attention level that results from perceiving a discontinuity. Looking at discontinuity from a pure communication perspective, it can be thought of as the equivalent of an inanimate "opinion" leader. Its physical and stimulus characteristics of eliciting an attentive response can aid substantially in the dissemination and diffusion of environmental information and concepts.

Application of the concept of discontinuity in the design of recreational areas and facilities would be diverse. It might consist of insuring that a recreational facility or area was not constructed or developed in natural areas where an environmental discontinuity contributed to the aesthetics of the environment. It might also consist of supplementing a natural discontinuity with an appropriately designed area or structure.

In the design of access or transportation systems a discontinuity can play a significant role. Incorporating discontinuities into transportation systems and access routes will facilitate visitor appreciation of the natural environment. By the appropriate location of a nature trail to incorporate natural discontinuities the recreational

and educational experience of hiking a nature trail can be heightened. Through the application of a discontinuity and design concepts the length of nature trails and the size of recreational areas could be reduced. The constraints of this decrease in size would be the psychological and physical aspects of carrying capacity.

The application of a discontinuity to the design of recreational areas and facilities will require answers to specific questions such as: What are the maximum number of discontinuities within any given area that will elicit an attentive response? What is the maximum or minimum distance between each discontinuity that facilitates a response to the next discontinuity? What magnitude of discontinuity will elicit an attentive response or aesthetic affect? What are the physical characteristics that form a discontinuity? Recreation designers will need to translate the answers to these questions into applicable design concepts.

The basic responsibility of a manager or administrator in the application of discontinuity will be the skillful direction of his staff in the identification, designation, preservation, maintenance, development, and use of resource and recreational areas that contain natural environmental discontinuities. They will need to be aware of the potential application of the concept of discontinuity in providing opportunities for recreation in an aesthetically pleasing environment.

Specific actions that a manager or administrator can take to provide a quality recreational experience is to insure that recreational service and facilities operated in an area containing a natural discontinuity do not detract or compete with the discontinuity. They can require that areas and facilities be maintained to both complement and supplement the aesthetic experience associated with the discontinuity. In the area of policy formulation and the development of new facilities and services, the opportunity to participate in activities in a pleasing environment is paramount. The management of park and recreation areas and facilities are responsible for generating and maintaining an awareness of the importance of the role that natural environmental discontinuities play in an aesthetic recreational experience.

Suggested Research

There is a need for research on the parameters of a discontinuity. This is supported by the previous discussion about the application of a discontinuity in the design and an understanding of recreation areas and facilities. An understanding of minimum and maximum magnitudes, distance between discontinuities, and optimum number of discontinuities in a given area, would facilitate the application of the discontinuity concept. The construction of new and the modification of old trail systems by applying the concept

of discontinuity would follow a parameter study. Such experimental trails would be monitored and evaluated by trail user responses and behaviors. Paramount to either parameter or experimental trail studies would be a two-way discontinuity test.

Research in communications employing the discontinuity concept is the next area that needs study. The effectiveness of using a natural discontinuity as a focal point for the dissemination and diffusion of messages and information needs to be tested. Methods of presentation, message design, information diffusion, signing techniques, and trail design are all aspects of interpretation and communication that may be directly or indirectly influenced by a natural discontinuity.

In the literature review the importance of Lynch's shared public images was discussed. These shared public images may be the result of shared perceptions of specific environmental discontinuities. Research on the generalizability of the results of this study to an urban environment is needed. The operationalization of the variables will present some unique challenges for an ingenious researcher. The results may offer some clue to an understanding of the perception of the aesthetics of an urban environment.

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LITERATURE CITED

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APPENDIX A

DATA - TIME REQUIRED TO HIKE
EACH SEGMENT OF THE TRAIL

Time Required To Hike
Each Segment Of The Trail
(Seconds)

Subject Number	T _A	T _B	T _C	T _D
1	74.1	73.5	95.8	88.9
2	100.9	72.6	83.3	66.1
3	70.5	75.3	90.1	76.0
4	112.4	93.4	99.5	80.8
5	111.3	54.5	64.3	50.7
6	79.9	78.2	93.9	83.4
7	119.8	121.3	295.7	140.6
8	85.4	84.7	92.5	81.1
9	52.2	53.1	60.9	53.1
10	75.7	71.6	86.2	70.7
11	74.7	75.7	89.0	75.5
12	73.6	69.9	73.1	70.1
13	78.5	77.0	95.2	74.7
14	117.1	56.8	69.7	53.2
15	83.4	80.4	84.1	68.3
16	52.9	54.1	58.6	51.0
17	64.5	63.4	69.6	67.6
18	91.0	129.3	155.5	121.6
19	104.2	52.5	58.9	55.5
20	73.4	78.0	78.7	76.7
21	84.1	68.7	72.9	84.5
22	90.8	101.8	95.2	66.7
23	89.0	57.1	65.3	61.9
24	43.8	45.4	50.7	45.8
25	104.0	125.7	110.1	104.4
26	45.9	51.2	54.5	55.7
27	76.8	88.2	343.4	84.4
28	64.0	65.0	67.2	64.8
29	65.7	70.7	75.0	91.8
30	66.6	62.7	61.3	41.3

APPENDIX A.1

HIKING RATE FOR EACH SEGMENT OF THE TRAIL

Hiking Rate For Each Segment Of The Trail

Subject Number	R_A	R_B	R_C	R_D
	(Corrected)			
1	3.37	3.40	2.69	2.81
2	2.47	3.44	3.10	3.78
3	3.54	3.32	2.87	3.28
4	2.22	2.67	2.59	3.09
5	2.24	4.58	4.01	4.93
6	3.12	3.19	2.75	2.99
*7	2.08	2.06	0.87	1.77
8	2.92	2.95	2.79	3.08
9	4.78	4.70	4.24	4.70
10	3.30	3.49	3.00	3.53
11	3.34	3.30	2.90	3.31
12	3.39	3.57	3.53	3.56
13	3.18	3.24	2.71	3.34
14	2.13	4.40	3.70	4.69
15	2.99	3.10	3.07	3.66
16	4.72	4.62	4.41	4.90
17	3.87	3.94	3.71	3.69
18	2.74	1.93	1.66	2.05
19	2.39	4.76	4.39	4.50
20	3.40	3.20	3.28	3.25
21	2.97	3.63	3.54	2.95
22	2.75	2.45	2.91	3.74
23	2.80	4.37	3.96	4.03
24	5.70	5.50	5.10	5.45
25	2.40	1.98	2.35	2.39
26	5.44	4.88	4.74	4.48
*27	3.25	2.83	0.75	2.96
28	3.90	3.84	3.85	3.85
29	3.80	3.53	3.45	2.72
30	3.75	3.98	4.22	6.05
Total	93.62	101.96	95.32	104.80
Average Rate For All Subjects	3.34	3.64	3.40	3.74

*These two subjects rate of hiking were not included in the calculations because of extraneous variables that may have influenced their hiking behavior. (See Chapter 4, page 41: Correction For Bias, for an explanation.)

APPENDIX A.2

CALCULATION OF CORRECTION COEFFICIENT

CALCULATION OF FLAT EQUIVALENT FOR HILL IN SEGMENT C

Calculation of Correction Coefficients and Flat Equivalent for Hill in Segment C.

Definitions

D_H = Length of hill on test trail.

D_F = Length of flat in test trail.

T_H = Time required to travel

T_F = Time required to travel D_F .

R_H = Rate of hiking hill = $\frac{D_H}{T_H}$

R_F = Rate of hiking flat = $\frac{D_F}{T_F}$.

Steps in Calculation of Coefficient

Reason

- | | |
|--|--------------------------------------|
| 1. $D_H = D_F$ | Experimental Manipulation |
| 2. $T_H > T_F$ | Observed in Data |
| 3. $\frac{D_H}{T_H} < \frac{D_F}{T_F}$ | Mathematics |
| 4. $R_H = K R_F$ | K is a number to restore
equality |
| 5. $\frac{D_H}{T_H} = K \frac{D_F}{T_F}$ | Substitution |
| 6. $T_F D_H = K D_F T_H$ | Algebra |
| 7. $\frac{T_F D_H}{D_F T_H} = K$ | Algebra |
| 8. $\frac{T_F}{T_H} = K$ | $D_H = D_F$; Step #1 |

Steps in Calculation
of Coefficient

Reason

- | | | |
|-----|---|-----------------------|
| 9. | $T_F = 29.17$
$T_H = 34.09$ | Observed |
| 10. | $K = .856$ | |
| 11. | Assume rate of travel are equal.
$R_H = R_F$ | |
| 12. | $\frac{D_H}{T_H} = \frac{D_F}{T_F}$ | Substitution |
| 13. | $D_H = D_F \frac{T_H}{T_F}$ | Algebra |
| 14. | $D_H = D_F K$ | Substitution; Step #8 |
| 15. | $D_F = 1/K D_H$ | Algebra |
| 16. | $D_F = 1.168 D_H$ | |

On the experimental trail, the hill section was 50' long. The flat equivalent of 50' is given by

$$D_F = (1.168) 50'$$

$$D_F \text{ (Flat Equivalent)} = 58.4'$$

Therefore the flat equivalent length of trail segment C is = 200' + 58.4'

$$\text{Flat Equivalent of C} = 258.4'$$

Therefore the corrected rates for segment C can be calculated by

$$R_C = \frac{258.4'}{T_C}$$

APPENDIX A.3

DATA USED TO CALCULATE CORRECTION COEFFICIENT

Time Required to Hike
Hill and Flat Trail Sections
(Correction Coefficient)

Subject Number	T _{Hill}	T _{Level}
	(T in Seconds)	
1	26.6	31.1
2	36.0	27.6
3	32.7	31.4
4	27.8	38.5
5	40.8	25.2
6	36.7	48.6
7	36.6	24.3
8	25.5	31.1
9	29.0	23.2
10	28.7	25.9
11	20.6	25.9
12	28.8	20.5
13	29.2	26.4
14	52.4	27.7
15	60.0	30.2
Total Seconds	511.4	437.6
Mean Seconds	34.09	29.17

APPENDIX A.4

PROCEDURE FOR CALCULATING WILCOXIN SIGN TEST

Calculation of the Wilcoxin Sign Test

1. The signed difference between each pair of observations is found.
2. The differences are ranked in terms of their absolute size.
3. The sign of the difference is attached to the rank for that difference.
4. The test statistic is T, which is the sum of the ranks with the less frequent sign.

The Wilcoxin tests the hypothesis that there is a significant difference between two observations. The test statistic is T and for a large sample (large N) the sampling distribution is approximately normal. When this is the case:

$$E(T) = \frac{N(N+1)}{4}$$

$$\text{and } \lambda_T^2 = \frac{N(N+1)(2N+1)}{24}$$

The large sample test is then given by:

$$z = \frac{T - E(T)}{\lambda_T}$$

APPENDIX A.5

DATA USED TO CALCULATE THE WILCOXIN SIGN TEST

Data Used To Calculate
The Wilcoxin Sign Test
For Sub Hypothesis 1; H_{OA}

Subject Number	R_A	R_B	$R_A - R_B$	Rank
1	3.37	3.40	- .03	+ 1.5
2	2.47	3.44	+ .03	+ 1.5
3	3.54	3.32	+ .22	+11.0
4	2.22	2.67	- .45	-15.0
5	2.24	4.58	-2.34	-22.0
6	3.12	3.19	- .07	- 4.5
*7	2.08	2.06	-	-
8	2.92	2.95	- .03	- 1.5
9	4.78	4.70	+ .08	+ 5.5
10	3.30	3.49	- .19	- 9.0
11	3.34	3.30	+ .04	+ 2.0
12	3.39	3.57	- .18	- 8.0
13	3.18	3.24	- .06	- 3.5
14	2.13	4.40	-2.27	-21.0
15	2.99	3.10	- .11	- 7.0
16	4.72	4.62	+ .10	+ 6.0
17	3.87	3.94	- .07	- 4.5
18	2.74	1.93	+ .81	+18.0
19	2.39	4.76	-2.37	-23.0
20	3.40	3.20	+ .20	+10.5
21	2.97	3.63	- .66	-17.0
22	2.75	2.45	+ .30	+13.0
23	2.80	4.37	-1.57	-19.0
24	5.70	5.50	+ .20	+10.5
25	2.40	1.98	+ .42	+14.0
26	5.44	4.88	+ .56	+16.0
*27	3.25	2.83	-	-
28	3.90	3.84	+ .06	+ 3.5
29	3.80	5.53	-1.73	-20.0
30	3.75	3.98	- .23	-12.0

Total (-) Ranks = 118.5

Total (+) Ranks = 111.5

$T = 111.5$

*These two subjects rate of hiking were not included in the calculation because of extraneous variables that may have affected their hiking behavior. (See Chapter 4, page 41: Correction for Bias, for an explanation)

$Z = -2.08$

$P(Z) = .018 = .02$

Data Used To Calculate
The Wilcoxin Sign Test
For Sub Hypothesis 2; H_{OB}

Subject Number	R_B	R_C	$R_B - R_C$	Rank
1	3.40	2.69	+.71	+24.0
2	3.44	3.10	+.34	+13.0
3	3.32	2.37	+.45	+18.0
4	2.67	2.59	+.08	+ 4.5
5	4.54	4.01	+.57	+22.0
6	3.19	2.75	+.44	+17.0
*7	2.06	0.87	-	-
8	2.95	2.72	+.16	+ 7.0
9	4.70	4.24	+.46	+19.0
10	3.49	3.00	+.49	+20.0
11	3.30	2.90	+.40	+15.5
12	3.57	3.53	+.04	+ 3.0
13	3.24	2.71	+.53	+21.0
14	4.40	3.70	+.70	+23.0
15	3.10	3.07	+.03	+ 2.0
16	4.62	4.41	+.21	+ 8.0
17	3.94	3.71	+.27	+12.5
18	1.93	1.66	+.27	+12.5
19	4.76	4.39	+.37	+14.5
20	3.20	3.28	-.08	- 4.5
21	3.63	3.54	+.09	+ 5.0
22	2.45	2.71	-.26	-11.0
23	4.37	3.96	+.41	+16.0
24	5.50	5.10	+.40	+15.5
25	1.98	2.35	-.37	-14.5
26	4.38	4.74	+.14	+ 6.0
*27	2.83	0.75	-	-
28	3.84	3.35	+.01	+ 1.0
29	3.53	3.45	+.08	+ 4.5
30	3.98	4.22	-.24	-10.0

Total (-) Ranks = 40.0

Total (+) Ranks = 300.5

$T = 40.0$

*These two subjects rate of hiking were not included in the calculation because of extraneous variables that may have affected their hiking behavior. (See Chapter 4, page 41: Correction for Bias, for an explanation.)

$$Z = -3.71 = 3.7$$

$$P(Z) = .0001$$

Data Used To Calculate
The Wilcoxin Sign Test
For Sub Hypothesis 3; H_{OC}

Subject Number	R_C	R_D	$R_C - R_D$	Rank
1	2.69	2.89	- .12	- 6.0
2	3.10	3.78	- .68	-19.0
3	2.87	3.28	- .41	-12.5
4	2.59	3.04	- .50	-15.0
5	4.01	4.93	- .92	-21.0
6	2.75	2.99	- .16	- 7.0
*7	0.47	1.77	-	-
8	2.79	3.08	- .29	- 8.0
9	4.24	4.70	- .46	-13.0
10	3.00	3.53	- .53	-16.0
11	2.90	3.31	- .41	-12.5
12	3.53	3.56	- .02	- 2.5
13	2.71	3.34	- .63	-18.0
14	3.70	4.69	- .99	-22.0
15	3.07	3.66	- .59	-17.5
16	4.41	4.90	- .49	-14.0
17	3.71	3.62	+ .03	+ 1.0
18	1.66	2.05	- .39	-11.0
19	4.39	4.50	- .11	- 5.0
20	3.28	3.25	+ .03	+ 2.5
21	3.54	2.95	+ .59	+17.5
22	2.71	3.74	-1.03	-23.0
23	3.96	4.03	- .07	- 4.0
24	5.10	5.45	- .35	-10.0
25	2.35	2.39	- .04	- 3.0
26	4.74	4.48	+ .30	+ 9.0
*27	0.75	2.96	-	-
28	3.85	3.85	.0	+ 1.0
29	3.45	2.72	+ .73	+20.0
30	4.22	6.05	-1.83	-24.0

Total (-) Ranks = 284.0

Total (+) Ranks = 50.0

T = 50

*These two subjects rate of hiking were not included in the calculation because of extraneous variables that may have affected their hiking behavior. (See Chapter 4, page 41: Correction for Bias, for an explanation.)

$Z = 3.45 = 3.5$

$P(Z) = .0002$

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