THE RELATIONSHIP BETWEEN LANDSCAPE PREFERENCE AND
LOOKING TIME: A METHODOLOGICAL INVESTIGATION

by

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Chapter 1

INTRODUCTION

Through the ages, the relationship between man and nature has been varied. The physical aspect of nature has been something to be resisted or endured, to be adjusted to, to be exploited. The recent concern for environmental quality has implied, among other things, that this physical aspect is also something to be appreciated, for pleasure or displeasure in an aesthetic way (Calvin, Dearing, & Curtin, 1972). Evidence of preferences for quality landscapes has been recorded throughout history by artisans of all types: poets, painters, playwrights, motion picture directors, song writers, and authors. In addition, landscape architects have manipulated scenery ever since King Nebuchadnezzar's Hanging Gardens of Babylon in order to make it more appealing to potential viewers and/or users. Quality landscapes have meant many things to many people: developers have schemed for them, conservationists have agonized over them, politicians have argued over them, philosophers have justified them, and tourists have travelled great distances for them.

All over America vacationers and weekenders are exploring their natural environment and are garnering natural features in memory and on film as never before. As a result, outdoor recreation resource planners and managers are seeking better ways of measuring people's perceptions of natural environments and of understanding the importance of the different senses involved in perception. Such information can provide a better basis for planning, developing, and managing natural environments

which are needed to meet the demands and preferences of outdoor recreationists (Shafer, 1969).

Although landscape assessment as a specialized field of activity is primarily a function of planning (Greenbie, 1975), both the planners and managers of parks, forests, and other recreation areas have preferences for landscapes which are formed according to their previous experience and education, and unfortunately they assume visitors to these sites will share their views. Whether or not these managers adopt specific aesthetic management plans, they should recognize and respect the preferences of the recreationist. Since he or she is the one for whom the recreation area was established, it is only reasonable that the recreationist should have considerable influence on its appearance (Cook, 1972). The more managers learn about how laymen perceive landscape scenes and their attitude toward certain recreation area practices, the more effective their management will be (Willhite & Sise, 1974).

However, a consensus of opinion as to what is a beautiful scene or landscape has been extremely difficult to obtain. It could be said that if beauty is in the eye of the beholder, then preference for it is in the mind of the beholder. Given objectively equivalent stimulus conditions, two individuals may manifest markedly different degrees of response versatility because of personal characteristics (Bieri, 1961). A wide range of variables influences individuals' choices for certain landscape preferences. Scenic beauty is so individualized--the interplay of all the learned values, experiences, emotions, and contemporary influences--that measurements of it can never be accurately generalized over the entire population. "In general, the public response to such

studies that evaluate scenery has been that judgment of natural beauty is so personal and subjective that it is difficult to predict" (Morisawa, 1970, p. 97).

Landscape's aesthetic quality is now recognized as a valuable resource on par with other traditional resources, such as timber, water, or wildlife. Moreover, landscape preference measurement is recognized as a legitimate area of scientific inquiry and is especially important at a time in which natural beauty values clash with technological development (Shafer & Tooby, 1973). Scenic beauty, however, is an extremely difficult resource to measure objectively. This measurement problem is a result of scenic beauty being defined not only in terms of environmental characteristics but, more importantly, in terms of human judgment and preference.

There have been many studies involving physical assessments of scenic landscapes, their individual component's attributes as well as their holistic effects. It may also be useful to describe these landscapes along psychological dimensions. According to Shafer and Mietz (1969), the aesthetic and emotional experiences stimulated by natural environments were ranked as more important than physical, educational, or social ones by hikers. Calvin and others (1972) claimed that while it does not necessarily follow that the psychological qualities of the natural environment are more important than physical qualities for each individual, it does seem reasonable to expect that utilization of psychological variables might provide an interesting and practical way of describing natural landscape preference.

Although this field of investigation is still relatively new, it seems clear that personal reactions to physical environment are determined by at least two sets of factors: variables in the environment itself and personality differences among people experiencing or reacting to the environment. (p. 449)

Many disciplines have contributed to the pool of knowledge encompassing scenic beauty preference procedures. Landscape architects, psychologists, engineers, geographers, economists, and recreation specialists have developed and tested a variety of methods and techniques. In general, these research tools may be classified two ways, descriptive inventories and perceptual preference evaluations. Neither of these two has been generally accepted (Propst, 1977).

The on-site landscape inventory methods traditionally used for the description, analysis, and evaluation of the visual attributes and qualities of relatively discreet parcels of land are exceedingly demanding of time and are exceedingly expensive when dealing with larger sections of the landscape continuum. Therefore, new data sources and new modes of inventory are being sought (Zube, 1974).

Only recently have scientists become sufficiently aroused by deterioration of environmental quality to attempt evaluations of scenic beauty. We are beginning to realize that the true values of life come from ties with the natural world, that recourse to natural beauty is related to our health and well being. Escape from society is needed as society presses more and more upon us. It is necessary to save sanctuaries for the

spirit now; the problem of choosing such sanctuaries is here.

(Morisawa, 1970, p. 91)

Developing an efficient methodology for landscape preference will be helpful in determining such sanctuaries for enhancing the recreation experience and the quality of life.

STATEMENT OF THE PROBLEM

There is no research which has thus far developed a conceptual and methodological framework for analyzing subjective response to the appearance of simulated recreation landscapes through the use of a behavioral measurement of visual preference, looking time.

HYPOTHESIS

It was hypothesized that differences would be found in preferences for landscapes in direct proportion to the time spent looking at visual representations of those landscapes.

SIGNIFICANCE OF THE STUDY

The information obtained from this study will contribute to the growing bodies of knowledge in the areas of landscape preference and looking time. This study represents an initial attempt to compare landscape preference with time spent looking at photographic simulations of landscapes.

In this study a methodology not heretofore utilized for determining the preferences of potential users for landscape alternatives which could be found in a park, campsite, or other recreation setting will be

explored. Therefore, the study might be beneficial to the planners and managers of these recreation sites. "Human satisfaction is becoming increasingly common as a goal of planning in many different contexts" (Mercer, 1967, p. 261).

In addition to providing an appropriate level of management and development to make . . . recreational services available, the manager must design, plan, and develop the resources in such a way that the user's experience or his satisfaction from the engagement will be enhanced. (Driver, 1971, p. 17)

Because the appearance of the environment influences the subjective benefits derived from the recreation experience, it is valid to examine how people respond to the visual recreation environment so that it may be designed and managed more effectively. (Peterson & Neumann, 1969, p. 219)

The procedure and analysis utilized in this study for landscape preference may serve as a demonstration for user preference in other areas of recreation, such as facility design and placement, cueing, and optimal crowding at sites.

Chapter 2

REVIEW OF LITERATURE

This chapter is comprised of a survey of the research relating to landscape preference and looking time. During the last decade and a half, many studies have been completed--particularly in the fields of psychology, landscape architecture, and forestry--related to the various aspects of landscape preference, forming the basis for this study.

For the sake of efficacy, this chapter is divided according to human response to landscapes as was distinguished by Craik (1972a):

1. descriptive assessments, which simply seek to depict, rate, measure, etc., the attributes of specific landscapes;
2. evaluative appraisals, which judge the relative quality of specific landscapes against some implicit or explicit standard of comparison; and
3. preferential judgments, which express a wholly personal, subjective appreciation of (or repugnance for) specific landscapes. (p. 292)

In addition, the literature reviewed is encapsulated in a brief summary section.

DESCRIPTIVE ASSESSMENTS

Descriptive assessments are based on the observer's or the inventory designer's reaction to the visual qualities of the physical content of landscapes in the field, that is, observations based on the quality of individual landscape components or features. Specific methods vary.

Some are very subjective and provide only lists of vaguely defined landscape features--such as warmth, variety, and harmony--that can barely be related to scenic beauty. However, more sophisticated inventory methods have been developed recently, which are less subjective and provide structured lists of relatively well-defined and sometimes numerically scaled landscape features that are formally related to scenic beauty (Daniel & Boster, 1976).

One such inventory approach requiring the identification of landscape features which constitute scenic beauty was developed by Leopold (1969). She utilized uniqueness ratios for aesthetic factors in which numerical values were assigned to landscape features of a variety of sites having aesthetic, biologic, or human interest connotation. The features were ranked and the number of sites that shared a particular rank on each feature was recorded: the fewer sites sharing a rank on a particular feature, the higher the uniqueness score. A summation of these values yielded a comparison of the overall uniqueness of the sites.

Arthur, Daniel, and Boster (1976) stated that the interrelationship of scenic beauty and scenic preferences is consistent with the view that both kinds of judgments rely on viewers' perceptions and preferences or aesthetic standards. Most descriptive inventories have not tried to evaluate public perceptions and preferences. Rather, inventories often depend heavily upon the intuitive judgments of individual authors and users. As Arthur and others pointed out,

To the extent that "beauty is in the eye of the beholder,"
there is no guarantee that evaluations made by individual
professionals bear a good relationship to public perceptions

and preferences; to the extent that procedures allow for subjective judgments, inventories provide indications of the professional's perception of beauty but may not reflect the aesthetic tastes of the non professional public. (p. 9)

Litton has done much to give impetus to the descriptive inventory methods. For example, in 1972 Litton attempted to provide some assistance for better relationships between resource use and natural landscape management by studying the ways of recognizing and evaluating the landscape as something that is seen as a visual experience and that can provide a better framework for resource-use activities. He divided generalized attributes of the landscape into factors of recognition and compositional types. From these means of recognition and their combinations, Litton identified compositions and suggested several compositional units or landscape types.

Craik (1972b) has maintained that descriptive assessment of settings and scenes increase our understanding of factors that influence landscape quality. Comprehensive assessments that cover all possible descriptive attributes aid in gauging the strength of the relationship of each attribute to appraised landscape quality. "The aim is not low costs but complete description, which may require extensive description as well as evaluative field surveys" (pp. 262-263).

EVALUATIVE APPRAISALS

The methods and techniques which can be categorized as evaluative appraisals of landscapes employ quantifications of surrogate landscape components or holistic landscapes. The results of these kinds of studies

do not reveal people's preferences for given landscapes but rather their reactions to, attitudes about, judgments of, or feelings toward those landscapes. Peters (1942) stated, "The judgmental methods employed in experiments on aesthetics consist of three basic ones: rank order, paired comparison, absolute judgment, and numerous modifications of each" (p. 273).

In a study directed by Craik (1972b), the full paradigm of landscape appraisal involved two separate processes: a direct field inventory of landscape quality and a descriptive assessment of attributes of settings, whose relationship to the appraised qualities of the landscape must be calculated. He said that the assessment process may reduce the costs of landscape appraisal by eliminating the need for full field inventories of landscape quality and that it aids in identifying those attributes of settings which are least costly to assess and which afford the strongest predictive relationship to appraised landscape quality. In addition, Craik claimed that if the predictive variables could be validated through field inventories in some contexts, they could subsequently be used alone for making landscape quality decisions in other contexts, avoiding the expense of further field inventories.

Linton (1968) maintained that systematic landscape appraisals are complicated and costly undertakings. He presented a method that substitutes map analysis for field reconnaissance: to identify the features that contribute most fundamentally to landscape quality, to assign appropriate weights to these attributes according to their importance, to combine scores for each location, and to map them. This process

resulted in a quantitative cartographic inventory of the scenic resources of a given area.

Among other types of evaluative appraisals, there are those which have been classified as psychometric. According to Arthur and others (1976), the primary methods employed within this classification are Likert-type rating scales, paired comparisons, and sorting and ranking techniques. Winkel, Malek, and Thiel (1969) tried to determine the relationship between personality factors and roadside evaluation by the use of personality questionnaires. The items on the personality scale were intercorrelated and subjected to factor analysis. Of the 97 items, three factors (generally negative orientation to the urban roadside; belief in conservation, preservation, and maintenance of order; and desire for an action-oriented environment) accounted for the majority of the reliable variance.

An often-used research technique included in the psychometric classification is the semantic differential method (Acking & Sorte, 1973; Shafer & Richards, 1974; Daniel & Boster, 1976), a bipolar adjectival scale. This technique involved showing environmental or other representations via pictures, photographs, or slides to people and then having them rate them on scales comprised of descriptive antonyms. Results of the data analyses revealed the feelings of the people toward the contents of the representation they were shown.

Craik (1972a) employed Litton's (1972) landscape rating scales of primary and secondary recognition factors, embodying the principal elements of his system of landscape dimensions. In addition, Craik gave his panels of subjects a copy of the graphic landscape typology. They

were first to decide which of the 10 graphic types each photographic slide best exemplified, and then for the same scene, to work down the landscape rating scales, encircling numbers to record their ratings of the scene on each landscape dimension. Furthermore, the subjects were presented with a landscape adjective checklist when there were studies involving the assessment of diverse landscape scenery.

PREFERENTIAL JUDGMENTS

The literature search revealed that preferential judgments have encompassed those experimental studies which seek out people's preferences toward any number of entities. The judgments have been derived through a variety of studies utilizing direct observation or viewing landscape representations via 35mm slides or photographs as experimental stimuli. For this literature review these studies were subdivided into four general categories: (a) landscape preference reaction to management strategies, (b) landscape preference models, (c) landscape preference methodology, and (d) looking time.

Landscape Preference Reaction to Management Strategies

Managers of parks, forests, and other recreation areas have been perplexed as to what decisions to make regarding landscape alternatives for the users. A number of studies measuring landscape preference reaction to such management decisions have been completed.

Morisawa (1970) compared two approaches being used to determine which physical features of riverscapes are preferred: an expert's evaluation of vista, color, vegetation, spaciousness, serenity,

naturalness, riffles, turbidity, and pollution and an analysis of ratings by viewers of riverscape slides. She indicated that ratings of viewers and experts are similar, that preferences are general, and that evidence of man's interference lowers the beauty value.

Whether people could tell the aesthetic difference between cut and uncut stands of trees was researched by Rutherford and Shafer (1969). Employing 16 sets of slides showing cut and uncut areas for both softwood and hardwood timber types, the researchers showed them to five different groups of subjects. Afterwards, the subjects were asked which forest stand they found more attractive. Rutherford and Shafer examined preferences within each group and then for all groups combined, and they found that cut stands were preferred to uncut stands in softwoods (63% of the time) but that both were equally attractive in hardwoods.

An attempt was made by Cook (1972) to determine the type or form of trees preferred by recreationists and to gain insight about the underlying physical characteristics most responsible for stated preferences. Twelve pairs of trees, 12 inches or more in diameter at 45 feet above the ground, were selected for their varying timber quality at three different recreation sites. Each pair of trees was clearly visible from a single marked point on a trail. At this vantage point visitors indicated on a ballot which of the two trees in each set they considered more attractive. Cook learned that the results generally indicated a positive relationship between aesthetic quality and timber quality and that the greater the difference in timber quality within the pairs, the stronger the preference for the better quality tree. He concluded that participants were attracted by variety, not the uniform mixture of the

classic all-aged, mixed hardwood stand but a heterogeneous and natural mixture.

A study was undertaken by Hess (1966) in which he experimented with autonomic physical response as a means of determining preference. He ascertained that pupillary dilation, or increase in pupil size above the normal size for a given amount of light, is associated with interesting or pleasant stimuli while pupillary constriction, or decrease in pupil size, is associated with stimuli which a person might find distasteful or unappealing. Wenger and Videbeck (1969) explored the potential use of eye pupillary measurement as an index of aesthetic experience in forest settings. Subjects with and without camping experience viewed 52 visual experimental stimuli and were compared. The researchers concluded that (a) prior camping experience is related to mean difference in pupillary responses associated with landscape photographs, (b) sex is not related to pupillary responses in landscape photographs; although, it is related to responses to social stimuli, (c) women with prior wildland recreation experience did not dilate more to landscapes than did other subjects, and (d) although a reliable pattern of differences occurred between campers and non-campers to landscapes, the results were contrary to those hypothesized (that persons with much wildland recreation experience dilate more to landscape photographs than do persons with little or no experience).

Landscape Preference Models

Mathematical models have been developed to predict people's preferences for landscapes by correlating landscape areal physical attributes to viewer preference. One such model was developed in 1969 (Shafer, Hamilton, & Schmidt). It was the purpose of that study to identify the qualitative variables in a natural landscape which are significantly related to public preference for that landscape. One hundred 8 X 10-inch, black and white photographs of trees in foliage in half eastern and half western scenes which included mountains, meadows, water, and various combinations of each were shown to Adirondack campers who ranked them according to preference. The landscapes were divided into 10 zones; although, every zone did not occur in each photograph:

1. Sky
2. Immediate vegetation
3. Intermediate vegetation
4. Distant vegetation
5. Immediate nonvegetation
6. Intermediate nonvegetation
7. Distant nonvegetation
8. Stream
9. Waterfall
10. Lake

A plastic grid overlay was used to divide each photograph into 1/4-inch squares, thus allowing each separate zone to be quantified. Each zone was comprised of four variables: (a) perimeter squares, (b) interior squares, (c) total area squares, and (d) horizontal end-squares. In

addition, three variables used to describe a landscape were tonal variation of sky, land, and water. These variables were calculated by the use of a 1/2-inch grid overlay. The data were statistically treated by factor analysis and linear regression techniques from which the findings indicated that preference for landscape depends on the area or perimeter measurements of six items within a photograph 66% of the time.

Basically, the same model was repeated by Shafer and Mietz (1970) for recreation areas on the Wasatch National Forest near Salt Lake City, Utah, and by Shafer and Tooby (1973) in Scotland. The studies yielded generally the same results as the original study (Shafer, Hamilton, & Schmidt, 1969), establishing its reliability.

Carls' study (1972) concentrated on preference factors associated with the more heavily used and highly developed outdoor recreation areas. He hypothesized whether landscape scenes containing higher levels of people, development, or a combination of these would be less preferred than those with lower levels. The methodology was primarily based on that of Shafer, Hamilton, and Schmidt (1969) with some modifications to include numbers of people and levels of development. Carls learned that as levels of people and development increase, preference decreases.

A semantic differential model was developed by Calvin, Dearing, and Curtin (1972). There were 15 and 21 scales employed for the data collection. Between-scale correlation coefficients were calculated, and a factor analysis was used on a correlation matrix. The researchers discovered that only two semantic differential factors (natural scenic

beauty and natural force) accounted for 85% of the variations in the landscape scenery in their study.

Landscape Preference Methodology

Some preference research has dealt with designs that are methodological in nature. Some representative efforts ensue.

Dunn (1976) discussed techniques for assessing public preference for landscapes. The feasibility of using landscape photographs to assess such preferences was also discussed.

A major problem in the advancement of measurement techniques is that however diligent the search for an exhaustive set of "relevant" factors may be, there will inevitably remain a proportion of variation in landscape quality which cannot be predicted or explained by the assembled factors. This proportion will consist of the subtleties of landscape, such as interaction between elements and the properties of the landscape, such as colour, form, shape, and lighting. The crucial point is that whilst measurement techniques cannot develop sufficiently to embrace such subtleties, the preference approach concerned with the evaluation of the total landscape rather than with elements of it--inevitably includes them. (p. 16)

Zuk (1973) presented a systematic methodology for rationally determining the aesthetic appeal of bridge designs by the use of paired line drawings for which one visual factor at a time is varied. He said that if the difference between two bridges relates to one particular feature, that feature can be isolated (relative to the whole) and

evaluated on its effect on appearance. Zuk also said that in this way, preferences for different features of bridges [or natural landscapes] can be systematically evaluated, always in a set of two.

Another methodological study was offered by S. Kaplan (1975). He stated that only the variables that can be used by experts should be studied. Kaplan looked at a function approach to perception. "A great deal of knowledge, experience, and interpretation enters into what may seem to be the straightforward process of looking" (p. 93).

Kaplan further stated that like other perceptual processes, the perception of space is very inferential.

This inferential process takes a two-dimensional pattern of light falling on the retina and interprets it in three dimensions. (Thus, the spatial interpretations that participants make of two-dimensional photographs in our research and in other studies is hardly surprising. The perceptual apparatus is highly biased toward spatial interpretations, and people in our society have extensive experience with photographs as representations of the three-dimensional world. To criticize photographs as artificial and inadequate in landscape research is to fail to appreciate the nature of human perceptual mechanisms.) (p. 93)

Six variables that seem to have some role in the prediction of preference: (a) complexity, (b) mystery, (c) identifiability, (d) coherence, (e) texture, and (f) spaciousness were identified by S. Kaplan (1975). He proposed a framework of implications for preference:

1. Quest for information, both in terms of the two-dimensional configurations that meet the eye and the three-dimensional world that is inferred;
2. Sensitivity to depth or spaciousness; and
3. Concern for individual differences.

However, the most fruitful approach to this problem, according to Kaplan, seemed to be not one of determining how different such group preferences are but of identifying what the pattern of variables is that underlies preference for these various groups. He claimed that the difference between groups can be explained in terms of differing emphasis among the same set of variables. R. Kaplan (1975) said that although preference is undeniably subjective, the subjectivity is often shared to a great degree.

Colored photographs were used by Zube, Pitt, and Anderson (1975) to elicit evaluative responses to landscapes. They investigated 23 landscape characteristics for which quantitative values were individually obtained for each of the 56 view stations by using topographic maps and land-use data from current aerial photography. The top six dimensions explained 61.4% of the variance in the regression analysis.

Zube (1974) examined whether (a) there is agreement on the use of evaluative and descriptive terms for the landscape, (b) there are common patterns of usage of these terms across professions, and (c) the results of landscape surveys using aerial data sources differ from those using ground reconnaissance. In addition, to what extent and for what purposes data from remote sources can substitute for the in-person, on-site inventory were studied by Zube. The two study groups, one

participating in field reconnaissance and the other in office study using aerial photographs and topographic maps, performed the same tasks in the following order:

1. Description and evaluation of four sections of the landscape utilizing a set of 25 semantic-differential scales;
2. Writing a free or instructional description of a segment of the landscape; and
3. Rank ordering by scenic quality a set of six aerial photographs of the given landscape.

A factor analysis on the semantic differential scales indicated at least for two groups of participants in resource planning studies that there is a reasonable level of agreement on a set of evaluative and descriptive terminology relating to scenic resources. It was further indicated that there is considerable utility in the use of aerial photographs and topographic maps as major information sources for regional scenic resource studies.

Daniel, Wheeler, Boster, and Best (1973) declared that when a person makes an evaluative judgment about a quality or characteristic of some specific stimulus display, such as a landscape, two elements influence the judgment behavior: the person's sensory experience relevant to the perceptual dimension that defines the judged characteristic and the person's willingness to make discriminations at each point on the given sensitivity and his criterion state. They stated that each of these elements may vary from moment to moment, day to day, or trial to trial, both within one observer and among different observers. The researcher claimed that many psychophysical methods, rating

techniques, and scaling systems failed to discern adequately between the distinct sources of variability represented in sensitivity and in the criterion state.

Therefore, in order to try to rectify that deficiency, a measurement technique--the Theory of Signal Detectability (TSD), which is a psychophysical measurement model that explicitly distinguishes the two components of a perceptual judgment--was developed (Green & Swets, 1966). According to Daniel and others (1973), TSD methods have indicated great potential when applied to complex stimulus situations. The researchers experimented with the TSD model in relation to perceptual evaluations of forest landscapes. One of the aims of the experiment was to identify those landscape characteristics that are significant determinants of aesthetic responses. Slides of six ponderosa pine forest areas, each representing a different vegetative treatment, were used as visual stimuli. The slides were presented at intervals of 5 seconds to two separate groups of subjects. The one group of viewers were to judge whether the area in which the slide was taken had been treated (cut, logged, etc.), while the other group were to report whether or not they liked the area represented by each slide. The groups' degree of confidence in their responses were recorded on respective 10-point scales. The nature of the differences in the subjects' judgments of the various areas was depicted by several characteristics of cumulative frequency functions. The researchers indicated that a subject's judgments in either of the group experiments may be viewed as a combined product of his perception of the represented area and a more general component, his or her judgmental criteria, which had been established

independently of the specific characteristics of the forest areas being evaluated. The conclusions were that both the treatment and the aesthetic preference experiments gave systematic and reliable indices of observers' reactions to different forest landscapes. In each case, the resultant differences were consistently related to the physical characteristics of the represented environments. The signal detection methods of analysis ensured that quantitative estimates of perceived differences in the environments were unbiased by the subjects' judgmental criteria.

Kaplan, Kaplan, and Wendt (1972) studied the relationship between complexity preference for slides of the physical environment and tested the hypothesis that the content of the slides (in particular, whether nature or urban) would influence preference, independent of complexity rated on a 5-point scale. They found that (a) nature scenes were preferred to urban scenes, (b) complexity predicted preference within the nature domain, and (c) complexity did not account for the preference for nature over urban slides.

Looking Time

The hypothesis that the behavior of looking at a picture is reinforced by what is seen, the times spent looking varying from one picture to another, was investigated by Bullock (1959). Two male and two female subjects looked at slides of 36 individual female nudes, then 36 landscapes, and finally 28 of the original nudes. For each subject the times spent looking were recorded in values of seconds and then plotted on a graph with dots for each set of slides. It was discovered

that all four subjects spent about the same amount of time looking at the landscape slides but that the male subjects spent more time looking at the slides of the female nudes in both trials than the female subjects did.

Berlyne's 1960 theoretical treatise on conflict, arousal, and curiosity and subsequent article (1966) on curiosity and exploration served as the groundwork for many ensuing studies involving those basic psychological aspects of human behavior. Looking time and visual images were the basis of experimentation by Berlyne and Lawrence (1964). They found that human subjects spend more time fixating on the more irregular (complex or incongruous) member of a simultaneously displayed pair of visual figures, whether the exposure time be 10 seconds or 2 minutes.

Berlyne (1971) advocated that visual patterns which are extremely simple or high in redundancy are pleasing but uninteresting and that patterns which are found both pleasing and interesting are ones that possess not only a great deal of complexity but also a great deal of internal organization so that perceptual effort can make something of them. He concluded that complexity increases interest to a point and then the complex patterns begin to look simple and uniform.

Berlyne's research was the basis for his statement (1971) that when polygons are shown, both looking time and interestingness rise as complexity increases, with hints of a flattening out or slight reversal as the upper extreme of complexity is approached. He also stated that "maximal pleasingness or preference coincides with intermediate complexity" (p. 220).

The effect of different rates of pre-tested stimulus presentation on the measures of free looking time was explored by Leckart, Keeling, and Bakan (1966). The results showed that high rates of presentation (every 3 seconds) reduced natural looking times and that low fixed rates of presentation (every 15 or 60 seconds) increased natural looking times.

Watman (1967) investigated the judgments of complex photographs and looking time. The subjects looked at pictures of high, medium, and low complexity, with mean looking times of 8.3, 7.4, and 6.5 seconds, respectively. These findings showed that subjectively judged complexity of stimuli was positively related to looking time. An analysis of variance indicated that complexity and looking time were not independent.

Interrelations of verbal and nonverbal measures used in experimental aesthetics were studied by Berlyne (1973). His study was divided into two parts. Experiment I dealt with 40 miscellaneous visual patterns which the subjects rated on 12 semantic differential scales. Experiment II measured looking time, utilizing the same 40 patterns as stimuli. Galvanic skin response and electrocardiogram techniques were also employed in the data collection while the subject was looking at each picture for as long as he or she wished. The findings showed the same tendency for more complex material to be inspected for a longer time.

Walker (1973) substantiated Berlyne's (1971) findings:

All preference functions are to be derived from optimal complexity level. Preference is perfectly correlated with the probability of the occurrence of an event. In a completely free

responding situation, whichever event is closest to optimal complexity level will occur. When there are constraints and the organism may choose only between two or more alternatives which are somewhat removed from optimum, the choice will be that event which is closest to optimum regardless of whether it is more or less complex than the optimum. (p. 68)

Walker (1973) said that there are at least three very different appearing functions obtained when an evaluative variable, such as preference, is plotted against a structural variable, such as psychological complexity: (a) a monotonically increasing function, (b) an inverted U-shaped function, and (c) a double inverted U-shaped function. When experimenting with children's responses to meaningful pictures varying in diversity, Wohlwill (1975) also found that looking time increases with complexity and that preference in regards to the level of complexity forms an inverted U on the graphs.

The interrelations among response frequency, looking time, and rated interest with visual stimuli (slides) were examined by Russell (1975). The 16 subjects of the looking-time experiment viewed four practice slides and 21 experimental slides, varying from simple black and white geometric patterns to complex colored scenes and representations that covered a wide range on the subjective dimensions on novelty, complexity, and pleasantness. The subjects viewed the slides for as long as they liked; the time spent looking was recorded for each slide. In addition, the subjects rated each slide for how ambiguous, complex, novel, interesting, and pleasant they thought it was. Another group of 16 subjects looked at the same slides for periods of .5 second for as many

times as they wanted; the response frequency for each slide viewed was recorded. The main result showed that looking time, viewing response frequency, and rated visual interest in a set of stimuli were correlated at .73 and above. This finding concurred with Berlyne's (1973) finding showing a high correlation between looking time and rated interest.

Marcus and Hakmiller (1975) claimed that the basic problem with all experiments which have manipulated exposure duration and frequency of exposure concurrently is that noted effects are subject to other explanations. The investigators hoped that their study could point to a basis for resolving divergent results of various experiments on frequency of exposure and duration of exposure. Six males and 14 females were used as subjects for each of three experimental conditions: duration constant, frequency constant, and duration of study trial constant. The subjects were shown 10 slides of college-aged nude females for varying time intervals. They also rated the attractiveness of the slides on a scale of 0 to 100 (the more they liked a slide, the higher it was rated). The data for females showed that since no effect was found when total duration or frequency was held constant, one of these variables or an interaction of the two must be the crucial variables. The data for males indicated that duration of study trial and/or total duration are the factors which lead to changes in ratings or attractiveness for slides of female nudes. The researchers concluded that the factor of total duration of exposure was common to both these findings and that if total duration is held constant although duration of study trial and frequency vary, no changes in attractiveness ratings occur but if total duration increases and duration of study trial or

frequency increases simultaneously, a mere exposure effect (an enhancement of affective judgments of formerly neutral or positive stimuli by virtue of mere re-presentation of the stimuli) will occur.

Measurement of the relative attractiveness of different landscapes to recreationists and the kinds of activity or behavior they exhibited within a given recreation environment was attempted by Buhyoff (1975). Viewing was the primary activity at the scenic sites used in the study. Buhyoff evaluated the attractiveness of similar activities in different environments by observing the on-site time people spent engaging in them. He found that landscapes with a wide variety of elements were visually more attractive as measured by viewing time and that environments with a wider assortment of alternative activities and complex landscape patterns were preferred. He also found that an assessment of visual attractiveness alone does not serve as an efficient way of evaluating the overall preference for a landscape.

SUMMARY

Within the past decade and a half many methods and techniques have been developed which propose to evaluate or measure landscape preference or which have implications for landscape preference. These evaluations and measurements range from simple inventory of the physical components of sites to psychometric scaling of landscape preferences or assessments. However, few methodologies have been tested for validity and/or reliability (Harvey, 1977), and the review of literature suggested that less have practical application, especially ones which can be utilized by lay people or even non research-oriented professionals and ones which are not so narrow in scope. There is a real need for an inexpensive and practical as well as an accurate and efficient methodology for assessing scenic landscapes for park, recreational, or other purposes.

Chapter 3

METHODS AND MATERIALS

This chapter contains the limitations and the terms peculiar to this study as well as the methods and materials used for the selection of natural park and recreation landscapes simulated by the 35mm slides presented to the subjects as experimental stimuli. The use of photographic representations of these slides is discussed. In addition, this chapter includes the criteria for choosing the experimental subjects and the steps taken to elicit responses for data collection from all subjects in an Original Experiment (OE) and from a randomly selected sample of original subjects in a Follow-up Experiment (FE). Furthermore, the experimental instrumentation and laboratory used for the study are described.

Procedures for the data analysis are stated and include summary statistics, frequency distributions, and correlations for expressing the relationship between looking time and preference rank in the OE. Average looking times for the slides in the OE were tested to show their interrelationships. Also included in the analysis are comparisons of the preference rankings by each sample subject in the OE and FE and of the frequency distributions of these rankings across all sample subjects in both experiments. Further, the average preference ranks for each slide across all sample subjects in the OE and FE were established. A measurement of the reliability of the sample subjects' preference rankings in the two experiments was determined.

LIMITATIONS

This study was limited for data collection to any person who was an undergraduate or graduate student or a faculty or staff member at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, regardless of his or her demographic variables. There were 100 subjects for the convenient sample in the OE and 25 subjects for the randomized sample in the FE. The original data were collected over a 2-week period, while the follow-up data collection took approximately 1 week.

The pictorial representations of the natural landscapes used in this study were 35mm slides, the film for which was exposed during the fall season of the year. The slides were taken along the Blue Ridge Parkway within 50 miles north and south of Roanoke, Virginia; along Rt. 52 in southwest Virginia; along I-81 approximately five miles south of Ironto, Virginia; at Valley Forge Park in Valley Forge, Pennsylvania; and along the Northeast Extension of the Pennsylvania Turnpike near Mahoning Valley. The photographed landscape scenes were natural and had no man-made structures therein. However, some landscapes had turf consisting of mowed grass.

DEFINITIONS

For the purposes of this study, the following were defined by the investigator:

Landscape--the natural environment, excluding all man-made structures.

Landscape preference--the natural environment which is desired by a person as a scenic vista.

Looking time--the free time spent viewing a photographic simulation of a landscape.

SELECTION OF SLIDES

Slides were taken by the investigator with a Voigtlander Prominent II, 24 X 36 • 35mm camera. Seven slides were taken of scenic landscapes in Valley Forge Park, Valley Forge, Pennsylvania, and four of scenery along the Northeast Extension of the Pennsylvania Turnpike near Mahoning Valley during mid-September, 1977. Slides were taken at two different times along the Blue Ridge Parkway in southwest Virginia. During the first part of October, 1977, 43 slides were taken which pictured landscapes north of Roanoke, Virginia, and one slide, of an area five miles south of Irons, Virginia. In mid-October 29 slides were taken which captured natural scenery south of Roanoke. In addition, in mid-October two slides were taken of scenes along Rt. 52 in southwest Virginia.

Of the total number of 85 slides taken, a panel of six, five faculty members and the investigator from Virginia Polytechnic Institute and State University, selected 13 for the data collection phase of this study. Ten of them, lettered A through J on their backs, were for actual data collection, while three of them--numbered 1, 2, and 3--were used for a warm-up period to familiarize the subjects with the ensuing stimuli as well as the procedure for viewing them. The slides were natural scenic landscapes with varied composition: both evergreen and deciduous trees and shrubbery, mountains, sky, rocks, clouds, water,

and turf, which was mostly covered by grass. In addition, the grass was sometimes mowed. Furthermore, the panel chose the 10 experimental slides which probably would more readily lend themselves to the subject's discrimination of looking times so that a more discerning analysis of the collected data might be possible. The warm-up slides were chosen to reflect dissimilarity but not incongruity with the experimental slides.

PHOTOGRAPHS

Color 5 X 7-inch photographic representations of the 10 slides used in the looking-time phase of the data collection in the OE were utilized for a rank-ordering phase immediately following the completion of the looking-time phase and for the rank-ordering data collection in a later FE. These 10 photographs were glued onto posterboard for support due to the anticipated handling and were lettered A through J on their backs; each letter corresponded with the one marked on the slide which it represented. The three slides used for the warm-up period as well as the 10 slides which were used for actual data collection and which were reproduced as color 5 X 7-inch photographs are shown in Figures 1 through 13 as 3 X 5-inch color photographs.

Figure 1

Photographic Representation of Slide 1

Figure 2

Photographic Representation of Slide 2

Figure 3

Photographic Representation of Slide 3

Figure 4

Photographic Representation of Slide A

Figure 5

Photographic Representation of Slide B

Figure 6

Photographic Representation of Slide C

Figure 7

Photographic Representation of Slide D

Figure 8

Photographic Representation of Slide E

Figure 9

Photographic Representation of Slide F

Figure 10

Photographic Representation of Slide G

Figure 11

Photographic Representation of Slide H

Figure 12

Photographic Representation of Slide I

Figure 13

Photographic Representation of Slide J

SELECTION OF SUBJECTS

Potential subjects were any of the undergraduate or graduate students, the faculty, or the staff at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, with no regard for any demographic variables. A total of 100 subjects were chosen by the investigator in a nonrandom manner on a voluntary basis. They had been informed that the study involved looking at a few slides of scenic landscapes, and they were asked whether they were color blind or had any other visual handicap which might bias the results. Those who answered affirmatively were rejected as subjects by the investigator. The names, addresses, and telephone numbers of the subjects were recorded in the event that they would be among those selected for the FE in the study (see Table A).

The 25 subjects for the FE were randomly selected from the original 100 subjects through the use of an electronic random number generator. The follow-up subjects were chosen from the original roster of subjects, enumerated from 1 to 100 in order of their appearance for the initial data collection.

EXPERIMENTAL INSTRUMENTATION AND LABORATORY

The data were collected in the initial phase of the OE by the investigator with the employment of a Hewlett Packard Digital Recorder, Model Number 560A, adapted to and synchronized with a Kodak Ektagaphic Carousel Slide Projector, Model B-2. Micro-switches were attached to the projector to feed the devices for the timing mechanism. The

recorder printed on a paper tape the frame number of the slide viewed and the time spent looking at it with a range of .001 second to 999 seconds.

A room was set up to be utilized for the data collection during the OE and FE. The equipment therein included a projection screen with a desk-top chair for the subject nine feet from the front of the screen; a desk-top chair for the investigator; a table on which was a Kodak Carousel Projector; a Hewlett Packard Digital Recorder on a shelf behind a screened section out of the view of the subject; and a table on which were 10 randomly scattered colored 5 X 7-inch photographs of the landscapes pictured in the data collection slides, with a chair in front for the subject.

COLLECTION OF DATA

Original Data Collection

The bulk of the subjects were scheduled individually 20 minutes apart for the original collection of the data during the winter of 1978. The collection period involved two phases.

First Phase

For the initial phase of the OE, each subject individually looked at 13 slides of scenic landscapes. The order of the first 3 slides and the next 10 slides was randomly selected and was likewise maintained for each of the first 49 subjects. The order of the last 10 slides was reversed for the next 51 subjects in order to avoid an ordering-effect bias. After seating the subject in front of the projection screen, the investigator told the subject to read the following instructions,

which had been typed on a 5 X 8-inch card and glued onto posterboard for support and placed on the subject's desk-top chair:

Please relax and make yourself comfortable. You will look at a series of slides of various scenic landscapes. You may look at each slide as long as you like (Berlyne, 1971, 1973; Leckart et al., 1966; Russell, 1975). You will operate the slide projector yourself by pressing only the forward button on the remote control, which you find on the desk top in front of you. The first three slides will familiarize you with the type of slides at which you will be looking during this presentation. You will not have to remember any of the pictures or anything about them. When you finish looking at these slides, you will receive further instructions. All right, you may begin at your own pace (Leckart et al., 1966).

The investigator did not instruct the subjects to look at the slides within landscape dimensions as related to either physical or psychological variables--for example, aesthetics, attractiveness, and beauty--so as not to influence their perceptions of the landscape stimuli. Without the subject's knowing, the time spent looking at each slide was recorded by a hidden recorder adapted to operate in synchronization with the slide projector. Only the last 10 slides for each subject were used for the data collection and analysis. The investigator recorded the number of each subject on the appropriate data segment of the digital recorder paper tape. The number (1 to 100) was given to a subject in the order of his or her appearance for the experiment.

Second Phase

The second phase of the OE was a rank ordering of color 5 X 7-inch photographs of the 10 slides used for data collection in the first phase. The following instructions, typed on a 5 X 8-inch card and glued onto posterboard, were handed to the subject by the investigator upon his or her completion of the slide viewing:

Now that you have finished looking at the projected slides, please have a seat at the table. Here you will find color photographs of the last 10 slides that you have just seen. Please rank them in the order that you prefer them as scenic vistas, placing the most preferred landscape at the far left on the table and the second most preferred to the immediate right of it, and so forth, so that the least preferred one will be at the far right of the same row. If you have any landscapes which you find equally preferred for a certain rank, place them on a pile in the row and continue the ranking procedure, and be sure to inform the investigator as to which ones they are.

The investigator recorded each subject's ranking of the landscapes on a typed form.

Upon leaving, the subjects were told by the investigator that they might be notified in approximately one month's time to participate in a follow-up part of the study. The subjects were not told about their being surreptitiously timed during the slide presentation in the first phase of the OE.

Follow-up Data Collection

A random sample of 25 of the original 100 subjects were selected by an electronic random number generator to participate in a FE to establish reliability. This part of the investigation took place approximately one month after the first data collection period in order to allow the subjects to forget the stimuli (the 35mm slides and their photographic representations of scenic landscapes) viewed in the OE

The FE included only the second phase of the OE, and the procedures for the FE were similar to that phase of the OE's procedures. The subject was handed the following instructions by the investigator via a 5 X 8-inch typed card glued onto posterboard:

Please have a seat at the table. Here you will find 10 color photographs of scenic landscapes. Please rank them in the order that you prefer them as scenic vistas, placing the most preferred landscape at the far left on the table and the second most preferred to the immediate right of it, and so forth, so that the least preferred one will be at the far right of the same row. If you have any landscapes which you find equally preferred for a certain rank, place them on a pile in the row and continue the ranking procedure, and be sure to inform the investigator as to which ones they are.

The investigator recorded each subject's ranking of the landscapes.

ANALYSIS OF DATA

The analysis of data was divided into two main aspects. One of these aspects involved various calculations concerning the relationship between looking time and preference rank in the OE: summary statistics, frequency distributions, and correlations. In addition, a test to point out the relationship among the average looking times for the slides was computed. The second main aspect was an investigation of the agreement between the rankings in the OE and FE for the purpose of determining the reliability of the sample subjects' preferences for the landscapes used as visual stimuli in this study. The data were processed by the use of an IBM 370 computer at the Virginia Polytechnic Institute and State University. The program used for the computations was SAS (Statistical Analysis System) software.

Looking-Time and Preference-Rank Averages for Each Slide Across All Subjects

The average time spent looking and the average preference rank in the OE were ascertained for each slide across all subjects in order to measure overall landscape preference. Furthermore, a least squares regression equation was calculated to estimate the relationship of these averages.

Average Looking Times for All Slides Across All Subjects

The frequency distribution of the average looking times was tabulated for all slides across all subjects in the OE. In addition, a comparison of these average looking times was made by using Duncan's New Multiple Range Test.

Looking Times and Preference Ranks for Each Subject, Slides A Through J

Frequency distributions were computed for each subject's time spent looking at individual slides, A through J, in the OE. Each subject's preference ranks for the slides were also computed in the OE.

Each Slide Across All Subjects

To determine consistency from slide to slide, a correlation between looking time and rank preference was computed for each slide individually, using all subjects in the OE. These data were statistically treated by the Pearson Product-Moment Correlation.

All Slides Across All Subjects

The time spent looking at 10 slides and the rank ordering of those slides across all subjects were also statistically treated by the Pearson Product-Moment Correlation. An overall estimate of correlation between looking time and preference rank for all subjects in the OE was obtained.

All Slides by Each Subject

To determine consistency among the subjects, an estimate of correlation between looking time and preference rank for all slides for each subject in the OE was calculated. The Pearson Product-Moment Correlation was the statistic utilized. In addition, the frequency distribution of these correlations was determined.

Comparison of Preference Rankings Across Sample Subjects

Kendall's Tau was applied to the data collected in the second phase of the OE and in the FE. The amount of agreement between the two

separate rankings of landscape simulations by each sample subject was measured. Furthermore, the frequency distributions of these two rankings were compared.

Average Preference Ranks for Each Slide Across Sample Subjects

The average preference ranks for each slide across all sample subjects were ascertained. These average preference ranks were calculated for both the OE and FE.

Estimate of Reliability of Preference Ranks

Kendall's Tau was employed to compute correlation estimates between the preference ranks for all slides by each of the sample subjects in the OE and FE in order to determine reliability. Moreover, the overall estimate of reliability between the preference ranks for all slides across all sample subjects was also computed by using Kendall's Taus.

Chapter 4

RESULTS

The data collected for this study and its analysis is presented in this chapter. The analysis has been divided into two major sections. The first section, Original Experiment (OE), is subdivided into looking-time and preference-rank averages and their relationship, a comparison of average looking times and of complexity levels, frequency distributions of looking times as well as preference ranks and their frequency distributions. The second section, Follow-up Experiment (FE), involves a sample of subjects from the OE and includes comparisons of their preference-rank distributions and average preference ranks in the OE and FE as well as a measure of the reliability of the subjects' preferences for the landscape stimuli presented in this study.

ORIGINAL EXPERIMENT

During the OE the time spent looking at the 10 slides of natural landscapes by 100 subjects was recorded to the thousandth of a second. However, to eliminate possible error due to variability in subject reaction time, looking-times were rounded to the nearest hundredth of a second.

MANOVA Test for Overall Order Effect

A MANOVA test was performed on the looking times of the slides presented in the OE as visual stimuli in two orders, A through J for 49 subjects and J through A for 51 subjects. There were no significant

differences between corresponding slides' looking times in the two orders; hence, no overall order effect.

Looking-Time and Preference-Rank Averages
for Each Slide Across All Subjects

The overall measure of landscape preference by all subjects in the OE was determined by calculating the average time spent looking and the average preference rank for each slide (see Table 1). The range of average looking times varied over a little more than 1 second (from 6.58 seconds for Slide F to 7.75 seconds for Slide J). The average time spent looking for all slides was 7.02 seconds. Table 1 shows that the average preference ranks for the slides ranged from 7.47 (Slide D) to 3.27 (Slide J). The average ranking for Slide J showed a strong relationship with its associated average looking times. Slide J was generally the most preferred slide and had the greatest average looking time (7.75 seconds). While Slide C was next to last on the average preference rankings (9th), its looking-time average, however, was near the middle of the range (6th).

Average looking times were plotted against corresponding preference-rank values for Slides A through J (see Figure 14). The points appear to be somewhat clustered, indicating that the subjects' average looking times and rankings of the same slides may be correlated.

Relationship Between Looking-Time and Preference-Rank
Averages for Each Slide Across All Subjects

To estimate the relationship between the average looking time and the average preference rank for each slide across all subjects in the

Table 1

Comparison of Complexity, Average Looking Time, and Average Preference Rank for Each Slide Across All Subjects in Original Experiment

Slide	Complexity Level ^a	Avg. Looking Time (sec.)	Comparative Ranking By Time	Avg. Pref. Rank ^b	Comparative Ranking By Rank
A	L	7.00	5	6.46	7
B	M	6.73	9	3.86	3
C	H	7.15	3	4.17	4
D	H	6.91	6	7.47	9
E	H	7.23	2	5.40	5
F	L	6.58	10	6.58	8
G	M	7.12	4	3.74	2
H	L	6.88	7	5.88	6
I	H	6.82	8	8.14	10
J	M	7.75	1	3.27	1

Note. Average looking time for all slides is 7.02.

^aL = Low; M = Moderate; H = High

^bMost preferred = 1; least preferred = 10

Figure 14

Average Looking Time and Average Preference Rank for Each
Slide Across All Subjects in Original Experiment

^a Rounded to nearest 10th.

OE, a least squares regression equation ($y = b_0 + b_1x$, where b_0 and b_1 are least squares estimates of the intercept and the slope, respectively) was calculated. A linear relationship resulted (see Figure 15). The regression line reveals that as preference for the landscapes increases, time spent looking at them tends to decrease. Stated in another way, if the subjects did not prefer certain landscape simulations, then they generally spent longer periods of time looking at them. This relationship is the antithesis of the hypothesized relationship between those two variables in this study.

Frequency Distribution of Average Looking Times for All Slides Across All Subjects

Average looking times for the slides were divided into 1-second intervals, and a frequency distribution was tabulated for all slides across all subjects in the OE. By comparing the data in Figure 16 with those in Table 2, it can be seen that approximately three-fourths of the subjects (77) had an average looking time of 5.81 seconds. The range was from 1.93 seconds to 27.27 seconds.

Comparison of Average Looking Times for All Slides Across All Subjects

The average looking times for all slides across all subjects in the OE were compared using Duncan's New Multiple Range Test (see Table 3). Slide E was the only one whose average looking time was significantly different from those of all the other slides at $p \leq .05$. Generally, the average looking times of the slides were significantly different from one another with a few noted exceptions.

Figure 15

Relationship Between Average Looking Time and Average Preference Rank
for Each Slide Across All Subjects in Original Experiment

^aRounded to nearest 10th.

Figure 16

Frequency Distribution of Average Looking Time for All
Slides Across All Subjects in Original Experiment

Table 2

Average Looking Times of All Subjects for 1-Second
Intervals in Original Experiment

<u>Time Intervals</u>	<u>Avg. Looking Time (sec)^a</u>
1 - 2	1.93
2 - 3	2.49
3 - 4	3.52
4 - 5	4.49
5 - 6	5.56
6 - 7	6.52
7 - 8	7.48
8 - 9	8.45
9 - 10	9.59
10 - 11	10.54
12 - 13	12.41
13 - 14	13.98
15 - 16	15.99
27 - 28	27.27

^a Average looking times rounded to nearest hundredth of a second.

Table 3
Comparison of Average Looking Times for All Slides
Across All Subjects in Original Experiment

<u>Slides</u>	<u>Difference (sec.)</u>	<u>Conclusion ($\leq .05$)^a</u>
I - J	4.865	S
I - B	4.275	S
I - C	3.965	S
I - E	2.740	S
I - A	1.670	S
I - F	1.550	S
I - H	1.254	S
I - G	1.017	S
I - D	.665	NS
D - J	4.200	S
D - B	3.610	S
D - C	3.300	S
D - E	2.075	S
D - A	1.005	S
D - F	.885	S
D - H	.589	NS
D - G	.352	NS
G - J	3.848	S
G - B	3.258	S
G - C	2.948	S
G - E	1.723	S
G - A	.653	S

Table 3 (cont.)

<u>Slides</u>	<u>Difference (sec.)</u>	<u>Conclusion ($\leq .05$)^a</u>
G - F	.533	S
G - H	.237	NS
H - J	3.611	S
H - B	3.021	S
H - C	2.711	S
H - E	1.486	S
H - A	.416	NS
H - F	.296	NS
F - J	3.315	S
F - B	2.725	S
F - C	2.415	S
F - E	1.190	S
F - A	.120	NS
A - J	3.195	S
A - B	2.605	S
A - C	2.295	S
A - E	1.070	S
E - J	2.125	S
E - B	1.535	S
E - C	1.225	S
C - J	.900	S
C - B	.310	NS
B - J	.590	NS

^aSignificant = S; not significant = NS

Frequency Distributions of Looking Times for Each Subject,

Slides A Through J

Looking times in the OE were divided into 1-second intervals, and each subject's time spent looking at individual slides, A through J, was computed (see odd-numbered Figures 17 through 33). Looking-time frequencies varied greatly over the 1-second intervals with the majority of the 100 subjects looking at each slide for approximately 2 to 11 seconds. Only nine and eight subjects looked at Slides C and D, respectively, over 11 seconds (see Figures 21 and 23). Figure 23 indicates that almost four-fifths of the subjects' looking times (79) for Slide D were concentrated between 2 and 9 seconds. Furthermore, approximately six-tenths of the subjects (59) spent from 3 to 8 seconds looking at Slide I (see Figure 33). The frequency of looking times for the subjects viewing Slide J, however, was somewhat more evenly distributed than for the other slides (see Figure 35).

Frequency Distributions of Preference Ranks for Each Subject,

Slides A Through J

The frequency of preference ranks for each slide, A through J, for each subject in the OE was determined (see even-numbered Figures 18 through 34). To simplify the resulting frequency distributions, ranks of the form $K + .5$ ($K =$ any integer value 2 through 9) were randomly assigned to either rank K or rank $K + 1$. Preference rank varied widely for each slide with few exceptions. Only Slides I and J were not ranked by at least one subject for every ranking value (see Figures 34 and 36). The higher frequencies for the preferred rankings for Slide C were not

Figure 17

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide A

Figure 18

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide A

^aTied ranks were randomly assigned integer value ranks.

Figure 19

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide B

Figure 20

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide B

^aTied ranks were randomly assigned integer value ranks.

Figure 21

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide C

Figure 22

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide C

^aTied ranks were randomly assigned integer value ranks.

Figure 23

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide D

Figure 24

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide D

^aTied ranks were randomly assigned integer value ranks.

Figure 25

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide E

Figure 26

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide E

^aTied ranks were randomly assigned integer value ranks.

Figure 27

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide F

Figure 28

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide F

^aTied ranks were randomly assigned integer value ranks.

Figure 29

Frequency Distribution of Looking Time for Each
Subject in Original Experiment: Slide G

Figure 30

Frequency Distribution of Preference Ranks for Each

Subject in Original Experiment: Slide G

^aTied Ranks were randomly assigned integer value ranks.

Figure 31

Frequency Distribution of Looking Time for Each
Subject in Original Experiment: Slide H

Figure 32

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide H

^aTied ranks were randomly assigned integer value ranks.

Figure 33

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide I

Figure 34

Frequency Distribution of Preference Rank for Each

Subject in Original Experiment: Slide I

^aTied ranks were randomly assigned to integer value ranks.

Figure 35

Frequency Distribution of Looking Time for Each

Subject in Original Experiment: Slide J

Figure 36

Frequency Distribution of Preference Rank for Each
Subject in Original Experiment: Slide J

^aTied ranks were randomly assigned integer value ranks.

clustered but were interspersed among most of the ranks, differing somewhat from the frequency-distribution patterns of the other slides (see Figure 22). The subjects' preferences for Slide D varied greatly (see Figure 24). However, Slide G was ranked relatively high by almost six-tenths of the subjects (59) in the top 3 ranks (see Figure 30). Conversely, Slide H was ranked low by six-tenths of the subjects (60), ranging through Ranks 6 to 9 (see Figure 32). Slide I was preferred the least by half the subjects (50), while the other 50 subjects' rankings were fairly well distributed over the remaining ranks with the exception of Rank 1. In contrast, Slide J was preferred the most by more subjects (28) than any other slide (see Figure 36). It was ranked high (2nd or 3rd) by 32 subjects. Furthermore, this landscape was the only one not to be ranked the least preferred by any subject.

Estimates of Correlation Between Looking Time and Preference Rank
for Each Slide Across All Subjects

Correlation estimates between looking time and preference rank for each landscape slide, A through J, across all subjects in the OE were calculated by employing the Pearson Product-Moment Correlation (see Table 4). Only Slide A had a positive correlation with looking time, but the correlation was not significantly different from zero. Slide D had the only correlation significantly different from zero at $p \leq .05$.

Estimates of Correlation Between Looking Time and Preference Rank
for All Slides Across All Subjects

The overall estimate of correlation between looking time and preference rank for all slides across all subjects in the OE was determined

Table 4

Estimates of Correlation Between Looking Time and Preference Rank
for Each Slide Across All Subjects in Original Experiment

	Slide									
	A	B	C	D	E	F	G	H	I	J
	.006	-.084	-.096	-.199 ^a	-.163	-.081	-.002	-.072	-.146	-.088

Note. The overall estimate of correlation = $-.073$

^a_p $\leq .05$

to be $-.073$ by use of the Pearson Product-Moment Correlation but was not significantly different from zero ($p \leq .05$). Therefore, there was no linear relationship between looking time and preference rankings for the landscape stimuli presented in this experiment.

Estimates of Correlation Between Looking Time and Preference Rank
for All Slides by Each Subject

Estimates of correlations between looking times and preference ranks for all slides by each subject in the OE were computed using the Pearson Product-Moment Correlation (see Table 5). Of the 100 subjects 71 exhibited negative correlations with only 6 correlations significantly different from zero at $p \leq .05$. Only one subject (number 2) had a significant ($p \leq .05$) positive correlation ($r = .723$).

Frequency Distribution of Individual Subject's Estimate of Correlation
Between Looking Time and Preference Rank for All Slides

The frequency distribution of correlations (10% intervals) between looking time and preference rank for the individual subjects in the OE is displayed in Figure 37. Over half of the subjects' correlations fell between 0 and $-.50$. There were 29 positive correlations, 21 of them occurring between the range of 0 and $.30$. Only 2 subjects had correlations over $.60$.

Table 5

Estimates of Correlation Between Looking Time and Preference Rank
for All Slides by Each Subject in Original Experiment

Subject	Estimate of Correlation for Slides A - J
1	-.388
2	.723 ^a
3	-.348
4	-.679 ^a
5	-.073
6	-.154
7	.507
8	-.486
9	.253
10	-.326
11	-.224
12	.034
13	-.392
14	-.406
15	-.098
16	-.019
17	-.655 ^a
18	-.112

Table 5 (cont.)

Subject	Estimate of Correlation for Slides A - J
19	-.306
20	-.528
21	-.479
22	-.294
23	-.182
24	-.195
25	.176
26	.095
27	-.625
28	-.557
29	.114
30	.514
31	-.259
32	-.223
33	-.229
34	.035
35	.060
36	-.002
37	-.486
38	-.494

Table 5 (cont.)

Subject	Estimate of Correlation for Slides A - J
39	-.465
40	.364
41	-.364
42	-.245
43	-.779 ^b
44	-.019
45	.142
46	-.042
47	.123
48	.229
49	.458
50	-.247
51	-.566
52	.121
53	-.336
54	-.061
55	-.518
56	-.353
57	-.620
58	.093

Table 5 (cont.)

Subject	Estimate of Correlation for Slides A - J
59	.631
60	.534
61	-.224
62	-.018
63	-.435
64	-.020
65	.204
66	-.177
67	-.147
68	-.055
69	-.391
70	.146
71	.080
72	-.350
73	.172
74	-.342
75	.186
76	-.033
77	-.521
78	-.437

Table 5 (cont.)

Subject	Estimate of Correlation for Slides A - J
79	-.281
80	-.430
81	-.519
82	.315
83	-.537
84	-.442
85	-.095
86	-.218
87	-.167
88	-.191
89	-.692 ^a
90	.235
91	.094
92	-.017
93	.250
94	.156
95	-.151
96	-.790 ^b
97	-.145
98	-.664 ^a

Table 5 (cont.)

Subject	Estimate of Correlation for Slides A - J
99	-.261
100	-.447

^a
 $p \leq .05$ ^b
 $p \leq .01$

Figure 37

Frequency Distributions of Individual Subject's Estimate
of Correlation Between Looking Time and Preference Rank
for All Slides in Original Experiment

FOLLOW-UP EXPERIMENT

Comparison of Preference Ranks for Each Slide by Each Sample Subject
in Original and Follow-up Experiments

The preference ranks for each slide by each sample subject in the OE and FE were paired (see Table 6). Of the 25 sample subjects only 2 (number 23 with 5 and number 35 with 6) ranked at least half of the slides (5) in the FE exactly the same as they did in the OE. The other subjects had less agreement between their individual slide rankings. Nevertheless, despite this apparent lack of agreement, the dissimilar rankings for each slide were generally not too many rank values apart.

Comparison of Frequency Distributions of Preference Ranks Across Sample
Subjects in Original and Follow-up Experiments, Slides A Through J

All sample subjects' rankings for the 10 slides, A through J, in both the OE and FE were computed and compared in Figures 38 through 47. There were many discrepancies between the frequency distributions of the preference ranks in the OE and FE but were minor in relation to rank order movement. Typical examples of these minor differences were apparent in the subjects' selection of Slide A as 6th in the OE, 3 times as much as in the FE (see Figure 38). While no one picked this slide as the 3rd most preferred landscape in the FE, three subjects did in the OE (see Figure 38). In addition, the greatest discrepancy between the OE and FE rankings for Slide B occurred with the integer value rank of 1, four more subjects ranking it thusly in the FE than in the OE (see Figure 39). In the FE Slide F was ranked 10th five times as compared to not times in the OE, contributing to a slight decrease in

Table 6

Comparison of Preference Ranks for Each Slide Across Sample

Subjects in Original and Follow-up Experiments

Sub- ject		A	B	C	Slide						J	No. of Slides in Perfect Agreement
					D	E	F	G	H	I		
6	Original Rank	5	2	7	9	4	8	3	6	10	1	1
	Follow-up Rank	8	4	3	10	5	9	6	2	7	1	
12	Original Rank	7	2	3	8	5	9	4	6	10	1	2
	Follow-up Rank	5	1	7	6	9	8	4	3	10	2	
14	Original Rank	1	8	6	7	5	4	9	3	10	2	1
	Follow-up Rank	3	8	7	5	4	2	9.5	1	9.5	6	
16	Original Rank	5	3	1	10	6	9	2	8	4	7	1
	Follow-up Rank	7	1	2	8	6	10	3	9	5	4	
22	Original Rank	6	2	3	10	5	8	4	7	9	1	1
	Follow-up Rank	8	4	2	9	3	7	5	6	10	1	
23	Original Rank	4	9	6	2	3	7	10	5	8	1	5
	Follow-up Rank	5	10	4	2	3	7	9	6	8	1	
29	Original Rank	10	1	6	9	3	4	2	5	7	8	4
	Follow-up Rank	10	1	3	8	4	6	2	5	9	7	
30	Original Rank	1	4	2	9	3	7	5	8	10	6	4
	Follow-up Rank	1	3	6	9	4	8	5	7	10	2	

Table 6 (cont.)

Sub- ject		A	B	C	Slide						J	No. of Slides in Perfect Agreement
					D	E	F	G	H	I		
34	Original Rank	5.5	8	1	7	2	5.5	10	4	9	3	1
	Follow-up Rank	9	5	1	4	6	10	8	7	3	2	
35	Original Rank	6	4	5	10	3	9	1	7	8	2	6
	Follow-up Rank	6	3	5	10	4	8	1	7	9	2	
40	Original Rank	4	3	2	8	6	9	5	7	10	1	2
	Follow-up Rank	3	5	9	10	6	7.5	4	7.5	2	1	
41	Original Rank	5	4	6	7	10	8	2	9	3	1	1
	Follow-up Rank	4	1.5	5	7.5	10	9	3	7.5	6	1.5	
49	Original Rank	8	5	3	9	7	4	2	1	10	6	3
	Follow-up Rank	8	2	1	9	6	7	3	4	10	5	
50	Original Rank	4	5	2	9	7	6	8	3	10	1	3
	Follow-up Rank	7	8	2	6	4	3	9	5	10	1	
60	Original Rank	6	8.5	8.5	4	6	1.5	3	1.5	10	6	1
	Follow-up Rank	3.5	9	7	3.5	7	3.5	1	3.5	10	7	
62	Original Rank	6	1	4	10	8	7	3	5	9	2	3
	Follow-up Rank	9	3	4	5	8	7	2	6	10	1	
69	Original Rank	9	2	3	4	6	7.5	1	7.5	10	5	1
	Follow-up Rank	8	1	3	10	5	6.5	4	6.5	9	4	

Table 6 (cont.)

Sub- ject		A	B	C	Slide						J	No. of Slides in Perfect Agreement
					D	E	F	G	H	I		
77	Original Rank	9	5	2	4	6	7.5	1	7.5	10	3	4
	Follow-up Rank	9	4	1	6	5	7.5	3	7.5	10	2	
79	Original Rank	5	7	8	2	9	6	3	1	10	4	2
	Follow-up Rank	9	6	3	2	7	8	5	4	10	1	
81	Original Rank	10	5	2	9	4	8	6	7	3	1	2
	Follow-up Rank	7.5	3.5	2	6	3.5	9.5	7.5	9.5	5	1	
85	Original Rank	4	6	1	9	7.5	7.5	2	5	10	3	1
	Follow-up Rank	5	2	6	8	9	7	1	3	10	4	
87	Original Rank	9	3	6	10	5	7	2	8	4	1	4
	Follow-up Rank	10	3	6	9	8	7	4	5	2	1	
88	Original Rank	5	8	1	9	10	7	2	6	3	4	1
	Follow-up Rank	7	4	1	10	6	9	5	8	2	3	
95	Original Rank	6	2	3	10	4	7	1	8	9	5	3
	Follow-up Rank	6.5	1	3	10	5	8	2	6.5	9	4	
96	Original Rank	8	3	2	5	7	9.5	1	9.5	6	4	2
	Follow-up Rank	6.5	2	3	6.5	5	10	1	9	8	4	

Note. Most preferred = 1; least preferred = 10.

Figure 38

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide A

Note. Original Experiment = _____

Follow-up Experiment = - - - -

^aTied ranks were randomly assigned integer value ranks.

Figure 39

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide B

Note. Original Experiment = _____

Follow-up Experiment = _ _ _ _ _

^aTied ranks were randomly assigned integer value ranks.

Figure 40

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide C

Note. Original Experiment = _____

Follow-up Experiment = _ _ _ _ _

^aTied ranks were randomly assigned integer values.

Figure 41

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide D

Note. Original Experiment = _____

Follow-up Experiment = _ _ _ _ _

^aTied ranks were randomly assigned integer value ranks.

Figure 42

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide E

Note. Original Experiment = _____

Follow-up Experiment = - - - - -

^aTied ranks were randomly assigned integer value ranks.

Figure 43

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide F

Note. Original Experiment = _____

Follow-up Experiment = _ _ _ _ _

^aTied ranks were randomly assigned integer value ranks.

Figure 44

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide G

Note. Original Experiment = _____

Follow-up Experiment = - - - - -

^aTied ranks were randomly assigned integer value ranks.

Figure 45

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide H

Note. Original Experiment = _____

Follow-up Experiment = _____

^aTied ranks were randomly assigned integer value ranks.

Figure 46

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide I

Note. Original Experiment = _____

Follow-up Experiment = _____

^aTied ranks were randomly assigned integer value ranks.

Figure 47

Comparison of Frequency Distributions of Preference Rank by All Sample Subjects in Original and Follow-up Experiments: Slide J

Note. Original Experiment = _____

Follow-up Experiment = _ _ _ _ _

^aTied ranks were randomly assigned integer value ranks.

preference in the overall ranking of this slide. A very strong concurrence by the sample subjects between their choices in the OE and FE happened with Ranks 6 through 10 for the landscape representation in Slide I (see Figure 46). However, there was practically no agreement in their selections for Ranks 2 through 5. Figure 47 illustrates that there was no exact agreement on any of the rankings for Slide J by the sample subjects between the OE and FE. The greatest concurrence occurred for their choices of this slide as the most preferred of the landscapes. Slide J was chosen by 9 subjects in the OE and by 10 subjects in the FE as Number 1. However, there were discrepancies in the frequencies in all other ranks receiving choices.

Average Preference Ranks for Each Slide Across Sample Subjects
in Original and Follow-up Experiments

The average preference ranks for each slide across all sample subjects in the OE and FE were plotted (see Figure 48). The 45° line upon which all points would fall if there had been perfect agreement for the rankings between the OE and FE is depicted in Figure 48. The rankings of Slides E and H were the most consistent, while the rankings of Slide G were the most discrepant between the OE and FE samples. In general, the average rankings of each slide in the two experiments were in fairly close agreement.

Figure 48

Average Preference Rank for Each Slide Across All Sample

Subjects in Original and Follow-up Experiments

Note. Average ranks rounded to nearest 100th.

Reliability of Preference Ranks

Estimates of Correlation Between Preference Ranks for All Slides by Each Sample Subject in Original and Follow-up Experiments

Correlation estimates between the preference ranks for all slides by each of the sample subjects in the OE and FE were derived by using Kendall's Tau (see Table 7). Of the 25 sample subjects all had positive correlation, and 21 of them were significant, 9 of them at $p \leq .05$ and 12 of them at $p \leq .01$.

Overall Estimate of Correlation Between Preference Ranks for All Slides Across All Sample Subjects in Original and Follow-up Experiments

The overall estimate of correlation between preference ranks for all slides across all sample subjects in the two experiments was calculated by Kendall's Tau to be .606, which was significant at $p \leq .0001$. This figure indicates that the rankings by the sample subjects in the OE and FE were extremely consistent.

Table 7

Estimates of Correlation Between Preference Ranks for All Slides by
Each Sample Subject in Original and Follow-up Experiments

Subject	Estimate of Correlation for Slides A - J
6	.467
12	.556 ^a
14	.674 ^b
16	.644 ^b
22	.733 ^b
23	.867 ^b
29	.733 ^b
30	.600 ^a
34	.225
35	.911 ^b
40	.225
41	.750 ^b
49	.644 ^b
50	.600 ^a
60	.764 ^b
62	.600 ^a
69	.545 ^a
77	.818 ^b

Table 7 (cont.)

Subject	Estimate of Correlation for Slides A - J
79	.378
81	.644 ^a
85	.494 ^a
87	.600 ^a
88	.556 ^a
95	.854 ^b
96	.795 ^b

^a $p \leq .05$ ^b $p \leq .01$

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

Time spent looking at slides of natural landscapes was hypothesized to be an indirect measure of preference for those landscapes. In the Original Experiment (OE) subjects were surreptitiously timed while looking at slides of varying natural landscapes. They then ranked photographic representations of those slides according to their preference of the landscapes as scenic vistas. A Follow-up Experiment (FE) was conducted, utilizing a random sample of subjects from the OE. The sample subjects again ranked the same photographs but were not timed.

The data analysis was aimed at revealing any relationships between looking time and the preference ranks of landscapes as well as the reliability of the subjects' preferences for landscape stimuli presented in this study. The major concern of the investigator was to assess these gross relationships and not to explore the specific physical or psychological variables affecting preference of landscapes or time spent looking at landscapes.

SUMMARY

In order to facilitate comparisons of the slides employed for data collection in this study, brief descriptions of the landscapes in the slides follow.

Slide A: Grassy slopes in foreground with a winding, eroded gully; even stand of trees in background.

Slide B: Pond at base of single mountain peak.

Slide C: Elevated view of rocky stream bordered by trees on slopes.

Slide D: Brown weeds and grass fronting sparse, low stand of trees.

Slide E: Flat grassy area with solitary tree on foreside of river and with multicolored trees covering the opposite highly sloped bank.

Slide F: Spacious, flat expanse of grass with conical-shaped tree at middle distance and row of ovate-shaped trees in background.

Slide G: Top view of trees in foreground with hazy mountains in the distance.

Slide H: Spacious grasslands with old, sparsely leaved tree in foreground, partial row of trees at middle distance, and trees in background at a great distance.

Slide I: Brown fragmented rocks in foreground with low, hazy mountains on horizon.

Slide J: Stream with small rapids and with trees bordering the far side; one tree with barren limbs on the near side.

A summary of the results follows.

Original Experiment

Overall Landscape Preference: Looking Time and Preference Rank

Each slide across all subjects. The average time spent looking at each slide across the 100 subjects in the OE ranged between 6.58 seconds for Slide F to 7.75 seconds for Slide J (see Table 1). The difference between the shortest and longest looking times was only 1.17 seconds. Thus, there was not a very substantial discrepancy of looking times between the different landscapes. Slide J had not only the longest average looking time (7.75 seconds) but also the highest average

preference rank (3.27). However, this type relationship did not sustain itself for any of the other slides.

Investigators (Berlyne & Lawrence, 1964; Watman, 1967; Berlyne, 1971; Kaplan, Kaplan, & Wendt, 1972; Berlyne, 1973; Walker, 1973; S. Kaplan, 1975; Russell, 1975; Buhyoff, 1975) have researched the relationship among complexity, looking time, and/or preference of stimuli. The experimental stimuli in this study were categorized a posteriori by a panel of three judges on a complexity dimension; even though, complexity of the composition of natural landscapes was not an initial concern in this investigation. Specifically, the final categories were low, moderate, and high complexity. Slides A, F, and H were categorized as being low in complexity; Slides B, E, G, and J, as being moderately complex; and Slides C, D, and I, as being high in complexity. No effort was made to formulate complexity indices for the slides by quantitatively merging measures of complexity along several dimensions. An inspection of the slides' looking times disclosed that Slides E, G, and J of moderate complexity had three of the four highest average looking times (see Table 1).

It should be noted that the dimension of complexity in landscape stimuli is relative with the given array of stimuli. Preferences for landscapes appear to correspond with their related complexity levels within that array; the intermediately complex ones generally received the longest looking times.

According to Berlyne and Lawrence (1964), subjects spent more time looking at complex or incongruous visual figures. Furthermore, Berlyne (1973) measured looking time at 40 miscellaneous visual patterns by

means of galvanic skin response and electrocardiogram and found that the more complex material tended to be viewed for a longer time. However, as a point of interest, if these findings were applied to the figures in the Comparative-Ranking-by-Time column and the complexity levels in Table 1, the comparison would seem to indicate that this theory did not hold true for this investigation of landscape preference since the complex slide representations received ranks of 3, 6, and 8 for average looking times. In addition, the landscape representations of moderate complexity generally had the longest average looking times: Slide J, 1st; Slide E, 2nd; Slide G, 4th; and Slide B, 9th.

Buhyoff (1975) found that landscapes with a wide variety of elements were viewed longer and were visually more attractive and that environments with a wider assortment of alternative activities and complex landscape patterns were preferred. The results of this study supported his findings up to a point, as in the cases of Berlyne and Lawrence (1964) and Berlyne (1973): the moderately complex landscapes were the most preferred, not the most complex ones.

Berlyne's (1971) conclusions that interest increases along with complexity to an optimum point of complexity and then complex patterns begin to look simple and uniform; that both looking time and interest-iness rise monotonically as complexity increases, with hints of flattening out or slight reversal as the upper extreme of complexity is approached; and that "maximal pleasingness or preference coincides with intermediate complexity" (p. 220) appear to correspond, for the most part, with the findings of this investigation (see Table 1). In addition, Walker (1973) contended that "all preference functions are to be

derived from optimal complexity level" (p. 68). His claims that preference in relationship to complexity increases monotonically and when plotted forms an inverted U or double U supported Berlyne's (1971) findings.

In an investigation by Watman (1967), he discovered that subjectively judged complexity of stimuli was positively related to looking time: pictures of high, medium, and low complexity sustained mean looking times of 8.3, 7.4, and 6.5 seconds, respectively. However, the data in Table 1 would apparently point out different findings. Generally, the slides of landscapes which were judged moderately complex in this study had the highest average looking times. To support further the disagreement between the findings of Watman's study and this study, by matching the complexity levels for the slides in Table 1 with the estimates of correlation for the corresponding slides in Table 4, it can be seen that there is no consistent relationship among the slides' correlation estimates between looking time and landscape preference rank and their adjudged complexity levels.

Moreover, through investigation of the looking times for all slides across all subjects in the OE, it was determined that these data tended to show rhythmic patterns for a majority of the subjects. For example, a typical subject's looking times ranged from 3.28 seconds to 3.94 seconds for all 10 slides except the 4th (D) in the series (4.40 seconds). Another subject's looking time at the first slide (A) in the series was 4.85 seconds, and the nine succeeding looking times ranged between 5.13 seconds and 5.89 seconds.

All slides across all subjects. A frequency distribution of the average looking time for all slides across all subjects in the OE illustrated that the subjects looked at the slides for relatively short periods of time (see Figure 16). The highest frequency of subjects (18), for example, averaged only 4 to 5 seconds per slide.

Each slide by each subject. The frequency distributions of looking times and preference ranks of each slide by each subject in the OE generally showed that the greatest frequencies for looking times were between 2 and 10 seconds with only nominal frequencies occurring outside that range (see odd-numbered Figures 17 through 33). Of the 100 subjects participating in the OE, the highest number of them included in a 1-second interval was 19 for two slides, A (4 to 5 seconds) and I (3 to 4 seconds). The looking-time interval of 3 to 4 seconds received the highest frequencies most often: Slides B (18), F (17), G (17), and I (19). The frequency distributions of preference ranks for each slide indicated that there was much disagreement among the subjects concerning their preferences for landscapes (see even-numbered Figures 18 through 34). The slides with the greatest number of subjects placing them in a specific rank were: I, 50 subjects for Rank 10; J, 28 subjects for Rank 1; D, 27 subjects for Rank 9; and B, C, and G, 21 subjects for Ranks 2, 2, and 3, respectively. However, these relatively high frequencies for certain ranks were not usually enough to dominate the overall ranking for the given slides since the remaining subjects for each slide's rank selection were spread out among most of the other ranks, thus diluting the overall ranking value.

Estimates of Correlation Between Looking Time and Preference Rank

All slides across all subjects. The overall estimate of correlation for all slides across all subjects in the OE was $-.073$. This slightly negative correlation showed that, in general, there is no relationship between looking time and preference rank for landscapes.

Each slide across all subjects. The correlation estimates between looking time and preference rank for each slide across all subjects in the OE were all slightly negative except the one for Slide A, which was barely positive ($.006$) (see Table 3). Slide D was the only one that was significant at $p \leq .05$ ($-.199$). Generally, when considered on an individual slide basis, there seemed to be very little evidence of correlation between looking time and preference rank of landscapes.

All slides by each subject. Correlation estimates between looking time and preference rank for all slides by each subject in the OE disclosed that almost three-fourths of the subjects' estimates of correlation (71) were negative: 6 significantly different from zero, 4 at $p \leq .05$ and 2 at $p \leq .01$ (see Table 4). The 29 positive estimates of correlation included only 1 which was significant at $p \leq .05$, but this significance did not necessarily indicate any real relationship since it could be expected that approximately 5% of these sample correlations would exceed the 5% significance solely on the basis of chance fluctuations.

Russell's (1975) experiment agreed with Berlyne's (1973) finding that a high correlation between looking time and rated visual interest existed. Although interest was not rated in this study, the investigator learned through conversing with the subjects after the data had been

collected that some of them had looked longer at a slide because they were more interested in or curious about the landscape than in actually showing preference for it. Furthermore, some subjects related to the investigator that those landscapes which they preferred the most they looked at the shortest periods of time because they were the most familiar with them. This phenomenon would tend to indicate that these subjects were timed for interest in landscapes rather than for preference for them.

S. Kaplan identified six variables that appear to have some influence in the prediction of preference: (a) complexity, (b) mystery, (c) identifiability, (d) coherence, (e) texture, and (f) spaciousness. Comments by the subjects to the investigator during and after ranking the slides would seem to support some of those variables. Several subjects related that they looked at some of the slides wondering what might be hidden therein (mystery). Other subjects ranked some slides high because they reminded them of their home environment (identifiability). Two slides, D and I, were generally ranked very low (9th and 10th, respectively) (see Table 1). Nevertheless, a few subjects ranked them fairly high because of the contrast they presented in color and texture (texture). Some slides (F and H, specifically) were ranked low because the landscapes had too much open area (spaciousness).

Follow-up Experiment

Comparison of Preference Ranks by Sample Subjects

Each slide by each subject. A comparison of the rankings compiled by each of the 25 sample subjects used in the FE revealed that few of

the subjects agreed perfectly with the ranks which they had assigned in the OE (see Table 6). However, there does appear to be a general overall agreement between the ranks assigned in both experiments.

Each slide across all subjects. A comparison of the frequency distributions of preference ranks for each slide across all sample subjects in the OE and FE disclosed that for the most part there was some variability in the frequencies of most of the rankings for each slide (see Figures 38 through 47). However, the variations were generally not so great, and the frequency fluctuations which occurred among the rank values counterbalanced one another fairly well so that the overall ranking for each slide in the OE appeared to remain rather stable when compared to the rankings in the FE.

The average preference rank for each of the slides across all subjects illustrated that most of the preference rank coordinates for the slides in the two experiments were fairly close to concurrence (see Figure 48). Only one slide's coordinates (G) seemed relatively distant from perfect agreement.

Reliability of Preference Ranking

All slides by each subject. The estimates of correlation between preference ranks for all slides by each sample subject in the OE and FE indicated that most of the 25 subjects (21) had significant positive correlations at least at $p \leq .05$ (see Table 7). The preference rankings in the two experiments by sample subjects, therefore, had a strong positive relationship.

All slides across all subjects. The correlation estimates between preference ranks for all slides across all sample subjects in the OE and FE showed that the relationship between the two rankings was extremely strong (.606). The probability that this relationship would occur by chance was a mere .01%, indicating a high reliability of the subjects' preference for the landscape stimuli presented in the OE and FE.

CONCLUSIONS

Based on the results of this study, with recognition of the limitations states in Chapter 3, the following are conclusions regarding the relationship between looking time and preference rank for natural landscapes:

1. There appears to be no relationship between looking time and preference rank for natural landscapes: the antithesis to the hypothesis proposed by the investigator.
2. There was very little variability among the average looking times for the slides by all the subjects, a range of 6.58 seconds to 7.75 seconds.
3. The subjects' preference rankings generally ranged across all the integer value ranks for each slide.
4. For all the slides except one (I), no integer value for preference rank had a dominant frequency.
5. Preference ranking, as was determined by comparing sample subjects' rankings in the OE and FE, is a reliable direct method for determining landscape preference.

6. Landscape complexity may be a major indicator for determining variation in looking time.

7. Subjects may unconsciously lapse into a rhythmic time-sequence pattern when operating a slide projector.

RECOMMENDATIONS FOR FURTHER STUDY

Inasmuch as this study dealt with a methodological investigation of the basic hypothesis that there is a relationship between looking time and landscape preference, recommendations for both methodology and hypotheses are suggested.

Methodology

Modifications of the looking-time technique might include:

1. The investigator's supplying the subjects with specific parameters for the slides to be viewed so they know what to react to in the slides and do not spend their time looking for nonexistent variables which they have conjured up; e.g., telling them that they are to view slides dealing with picnic areas for a state park.

2. Using replicas of the slides rather than photographic representations for the rankings since some of the subjects remarked about the difference in the quality of the photographs compared to the slides.

3. A comparison of the results of subjects who had been informed that their looking times were being recorded and the results of subjects who had not been informed.

4. Mixing the slides for data collection with other irrelevant slides to discourage a rhythmic pattern in the time spent looking.

5. Obtain measures of complexity in natural landscapes in a quantitative way.

Further Studies

Based upon the results and the pertinent questions and ideas which emanated throughout the course of this investigation, the recommendations for further research are made:

1. An investigation could be undertaken in which landscapes would be selected specifically for their levels of complexity; then the relationship of looking time and complexity of landscapes could be studied by utilizing a series of individual slides of varying complexity or by the technique of paired slides, varying the levels of complexity within the pairs.

2. Interest versus preference in landscapes could be researched through the looking-time method and the use of follow-up questionnaires or through the correlation of looking times and pupillary measurements for the same stimuli since pupil size has been found to indicate degree of interest.

3. Looking time could be used while presenting slides of exactly the same landscapes for the four seasons as well as during the four seasons to determine variabilities of preference among the seasons and within the given sites for those seasons.

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VITA

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Glenn's professional experience commenced during mid-summer of 1967 while still a student at Penn State. His training in recreation and park planning was put to use in the Prince William County (Virginia) Recreation and Parks Department as he assisted in the establishment of a county recreation and park system there. Later that year he was hired as a planner in the Educational, Recreational, and Health Facilities Planning Section of the Middlesex County Planning Board, New Brunswick, New Jersey. During the summer of 1973, he filled the position of Mobile Recreation Unit Supervisor in the Orange (Texas) Park and Recreation Department. The following summer in 1974 he was a Playground Leader for the Recreation and Parks Department of Dallas, Texas. That same

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Glenn Wade

THE RELATIONSHIP BETWEEN LANDSCAPE PREFERENCE AND LOOKING TIME:

A METHODOLOGICAL INVESTIGATION

by

Glenn Robert Wade

(ABSTRACT)

This study was an investigation of the relationship between landscape preference and looking time. In the Original Experiment 100 subjects were unknowingly timed while looking at 10 slides of natural landscapes. They then ranked photographic representations of those slides for their preference of them as scenic vistas. A random sample of 25 of the original subjects participated in a Follow-up Experiment about one month later in which they ranked the same landscape simulations as in the first experiment. The analysis of data was divided into two main aspects. In the first aspect the relationship between looking time and preference rank in the Original Experiment was analyzed through summary statistics, frequency distributions, and correlations. In addition, a test to point out the relationship among the average looking times for the slides computed. The second main aspect was an investigation of the agreement between the rankings in the Original and Follow-up Experiments for the purpose of determining the reliability of the sample subjects' preferences for the landscapes used as visual stimuli. The major results of this investigation included: (a) the average time spent looking for all the slides was 7.02 seconds, (b) looking-time frequencies varied greatly with the majority of the

100 subjects looking at each slide for approximately 2 to 11 seconds, (c) the overall estimate of correlation between looking time and landscape preference was $r = -.073$, and (d) of the 25 sample subjects only 2 ranked at least half of the slides (5) in the Follow-up Experiment exactly the same as they did in the Original Experiment; however, the overall estimate of correlation between the two rankings was calculated to be $r = .606$ (significant at $p \leq .0001$). The investigator concluded that (a) there appears to be no relationship between looking time and preference rank for natural landscapes, (b) there was very little variability among the average looking times for the slides by all the subjects, a range of 6.58 seconds to 7.75 seconds, (c) the subjects' preference rankings generally ranged across all the integer value ranks for each slide, (d) for all slides except one (I) no integer value for preference rank had a dominate frequency, (e) preference ranking, as was determined by comparing sample subjects' rankings in the Original and Follow-up Experiments, is a reliable direct method for determining landscape preference, (f) landscape complexity may be a major indicator for determining variation in looking time, and (g) subjects may unconsciously lapse into a rhythmic time-sequence pattern when operating a slide projector.