Appropriate Combinations of Technology for Solving Landscape Management Problems— Session K: Water Resource Development

Landscape Preference Assessment of Louisiana River Landscapes: A Methodological Study[1]

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Abstract: The study pertains to the development of an assessment system for the analysis of visual preference attributed to Louisiana river landscapes. The assessment system was utilized in the evaluation of 20 Louisiana river scenes. Individuals were tested for their free choice preference for the same scenes. A statistical analysis was conducted to examine the relationship between the assessment model and the individual's preference for the scenes. The test results indicated that the logic followed in the evaluative model may be of value in the prediction of visual preference for Louisiana river landscapes.

INTRODUCTION

Objectives

The major study objectives were the following:

1. Develop and test a model for the evaluation of visual preference for Louisiana river scenes.

2. Determine if the evaluative model is correlated to individual preference for Louisiana river scenes.

Assumptions

The following assumptions were made in the study:

1. There are identifiable criteria that are important to individual perception of the environment.

2. Values can be assessed by evaluating the physical factors of river sites that are important to visual preference.

3. There is a degree of commonality in human perception of the environment.

4. Individual reactions to 35-millimeter slides are strongly related to preference for the actual river scenes.

Literature Review

Information relating to the general problem of identification of scenic values inherent in the landscape and the specific problem of the identification and evaluation of scenic attributes of water-related landscapes is quite recent. Recognizing this fact, a review of literature on the topic was done from a categorical rather than a historical perspective. The research reviewed aided in the identification of principles indicated as having a significant influence upon visual preference. The next step was to structure these principles into a logical evaluative format.

DEVELOPMENT OF THE PREFERENTIAL MODEL

A theory proposed by Stephen and Rachael Kaplan appeared to provide a basis for the structuring of a preferential model. The theory attempted to explain the perceptual process in terms of informational processing, suggesting that examination of the information an environment provides can be used to isolate components relevant to individual preference.

The Kaplans identified two general variables aiding in the identification of factors important to visual preference. One variable concerns the order and structure apparent in a scene. The second variable relates to individual involvement or interest in a visual display. A preferred environment is, there-

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fore, one that people can organize perceptually and also become involved with. (S. Kaplan 1975).

Four factors are identified as being important to visual preference in the environment, two informational variables and two involvement variables. Legibility and spatial definition are important informational variables; complexity and mystery are described as the two involvement variables.

Levin (1977) attempted to test the validity of these concepts in application to analysis of riverscape preference. It was found that the four variables - legibility, spatial definition, complexity and mystery appeared to be of value in the prediction of preference for river landscapes.

This theory seemed to provide a logical basis or structure for an evaluative model. The next step was to relate these principles to the primary landscape components - land, water and vegetation.

Two important levels of evaluation are identified. The first level of analysis involves the identification of perceptual influences. The topics of legibility, complexity, spatial definition and mystery serve as the primary factors used in this level of the analysis. The second level of the analysis involves the identification of focal elements in the landscape. These elements attract attention and can exist as positive or negative influences upon visual preference for river corridors.

The evaluative process used in this study is illustrated in table 1. Each major topic is further divided into a major variable or variables. The right hand portion of the table indicates the landscape dimension evaluated in the rating process. The 'X' indicates the dimensions rated under each of the variables. A rating may, therefore, involve the analysis of vegetation, water, land or the total scene (composite factors) according to a specific rating variable. A total of 17 factors are analyzed per landscape scene. By combining numerical values obtained in the evaluation, an "assessment ratio" is determined. This factor is hypothesised as indicating the relative visual preference value for the river scene.

A descriptive approach is used in the analysis of the 17 criteria relating each evaluation to a descriptive 5 point rating scale. Preceding each rating scale is a brief review of literature applicable to the rating topic, attempting to justify and clarify each procedure. The study is written as a "cookbook" approach, explaining rating procedures and providing descriptive rating scales with the thought that by thoroughly studying the procedures and concepts, any interested individual could apply the proposed system. The specific rating criteria and numerical scales cannot be discussed in detail in this paper, only the general framework and model applications will be addressed.[3/]

Table 1 -- The Evaluative Process for Visual Preference

LEVEL 1: PERCEPTUAL INFLUENCES

MAJOR TOPIC	MAJOR VARIABLE	DIMENSION EVALUATED			
		VEG.	LAND	WATER	TOTAL SCENE
LEGIBILITY	DEFINITION	X	X	X	
	EDGE CONTRAST	X	X	X	
COMPLEXITY	DIVERSITY	X	X	X	
	EDGE COMPLEXITY				X
SPATIAL DEFINITION	ENCLOSURE				X
	DEPTH				X
MYSTERY	MYSTERY				X

LEVEL 2: FOCAL ELEMENTS

MAJOR TOPIC	MAJOR VARIABLE	VEG.	LAND	WATER	TOTAL SCENE
DISTINCTIVE ELEMENTS	VISUAL DISTINCTION				X
DISTURBANCE FACTORS	HUMAN INFLUENCED SHORELINE DISTURBANCE				X
	VISUAL POLLUTION				X

PERCEPTUAL INFLUENCES

Visual perception involves the reception and processing of information obtained from a

[3/] A detailed discussion of all of the rating criteria, processes and weightings can be found in the authors thesis, referenced in the bibliography.

visual display (Zube et al. 1975). Historically, perception has been essential to survival. Information from the landscape provided visual clues to aid in the location of prey and protection from potential enemies. Survival depended, to a great extent, on the ability to process and interpret the information from the visual environment. (S. Kaplan 1975). The process of human visual perception involves the organization of information received from the visual array. Incoming light rays evoke perception of intensity, color and texture. Individuals attempt to organize these outlines and textural groupings into identifiable objects (Appleyard, Lynch, Meyer 1965).

Legibility

Legibility of the visual environment is related to the perceptual establishment of relationships within and among elements of the visual display (Proshanskey, et al. 1964). Legibility is related to the ability of an individual to make sense of or to recognize relationships among parts. The viewer must be able to recognize connections and see distinction between elements.

This concept can be directly applied to the landscape components of vegetation, landform and water. Vegetation is legible when internal limb structure and connections are visible. Studies show that people demonstrated visual preference for a "parklike" situation, (Rabanowitz and Coughlin 1970) and a dislike for "unkempt" or illegible vegetation (Levin 1977, R. Kaplan 1977, 1976). Legibility or distinction of landform relates to topographic change. As slopes steepen, the viewer is able to see the slope surface and its component parts. Similarly, water gains distinction as clarity and reflectivity increase the ability to see the characteristic forms produced in water surface variation.

Contrast

Contrast is an important factor contributing to the legibility of elements in the landscape, particularly the strong contrasts produced by edge relationships. Newby (1971) states: "landscape elements are organized and identified by virtue of what designers call edges."

An edge is defined when dissimilar landscape elements merge. Sharp edges are defined as the junction between significantly contrasting (primarily height contrast) form types, typified by evoking a strong visual image. (Litton et al., 1974). Various degrees of of contrast may exist depending upon the strength or degree of height contrast exhibited by the dominant landscape elements. Litton describes this relationship between landform contrast and visual impression:

> Junctions involving general form such as a meeting between a mountain range and hill range are apt to be a subtle or inconspicuous joining rather than a positive delineation. A junction of maximum impression would be that of a mountain range against plain

Maximum landform contrast would occur where a tall cliff or bluff joined a water surface. Little contrast would exist in the combination of adjoining height classes. If water or flat land is seen in combination with low undulating landform types, lesser edge distinction would result, indicating a weaker edge relationship. A similar approach is used in the analysis of vegetation and water form contrast.

Complexity

Wohlwill describes the legibility of the outdoor environment in terms of an individual's ability to adapt to a visual experience. Each individual has an adaption level to environmental stimuli which is based upon the environment experienced in daily activity. Individuals derive pleasure in variations from this typical display; this concept is illustrated in figure 1. Any variation in the amount of stimulation will initiate a positive perceptual response. A point is reached where the response is no longer positive. The environment becomes either exceedingly complex or monotonous.

This indicates a strong relationship between legibility and complexity. A scene

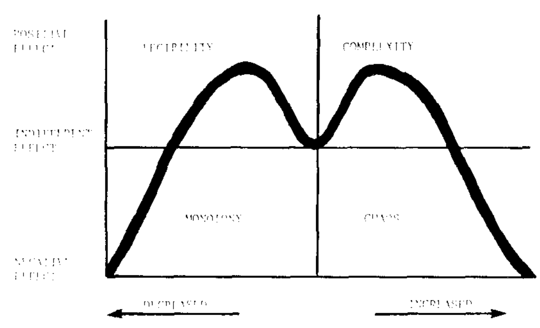

Figure 1--Discrepancy from adaption level. Adapted from Wohlwill (1966).

must be legible and individual landscape components should be identifiable, but if a visual display does not possess a degree of complexity it may become monotonous. Similarly a scene may become overly complex to the point that it is chaotic or no longer legible.

Newby defines complexity as: "relating to the intricacy of relationships which affect the rate at which information can be perceived ...complexity increases with the number of elements which can be identified." (Newby 1971). Newby identifies "elements" as being space defining components of the landscape, specifically vegetation, topography, and water. This study equates complexity with the number of legible vegetation, landform and waterform types present in a landscape scene.

Edge Complexity

Edge complexity is directly related to the irregularity of an edge; thus, visual quality is also related to this degree of irregularity. An edge may be strongly defined, yet a straight or uniform edge would provide less perceptual information than a complex or highly irregular edge. (Smardon 1972). As stated by Litton: "To the degree that an irregular shape represents a form of variety, higher quality should normally accrue to the more complex form" (Litton et al. (1974). This concept is applied to river landscapes through the analysis of the complexity or irregularity of the shoreline and skyline edges (created by the junction of landform, or structure with the atmosphere). The visual preference model utilizes a descriptive scale analyzing the complexity or irregularity of the shoreline and skyline edges.

Spatial Definition

In the environment, space is defined by physical elements. The primary space defining elements in the landscape are vegetation, land and water. Primarily, all spaces acquire their specific character from the elements that contain them. Vertical elements, more than any other elements in the landscape, develop the character of a given volume or space. The elements of landform and vegetation are the primary space definers in the natural environment. These elements are important in framing views, directing interest and creating enclosure (Simonds 1961).

Enclosure is related to visual contrast and orientation in the natural landscape. For river zones, the characteristic relationship of a water body as a flat surface indicates the potential of maximum contrast being developed as the bordering landscape elements become taller creating heightened enclosure adjacent to the water surface. Litton et al. 1974).

In this study spatial factors are analyzed in two modes. First, a descriptive numerical evaluation is conducted identifying the presence or absence of significant space defining elements (landforms, vegetation or structures). Finally, an evaluation is conducted analyzing the degree of depth (presence of a perceivable foreground, middleground or background) present in a scene. While the presence of enclosing elements appears to be strongly related to preference, (Rabanowitz and Coughlin 1970, Dearinger et al. 1973, Morisawa 1971 and Levin 1977) depth also is indicated as influencing visual preference in the landscape. (R. Kaplan 1974).

Mystery

Mystery is related to an individual's desire to enter an environment in order to obtain further information. This anticipation variable suggests to the viewer that additional information exists, and is partially hidden from view. The individual is tempted or attracted to move further into the scene.

Lynch (1960) talks about mystery related to urban landscapes:

> It must be granted that there is some value in mystification, labyrinth or surprise in the environment. Many of us enjoy the house of mirrors and there is certain charm in the crooked street of Boston. This is so, however, only under two conditions. First there must be no danger of losing basic form or orientation or never coming out. The surprise must occur in an overall framework; the confusions must be small regions in a visible whole. Furthermore, the labyrinth or mystery must in itself have some form that can be explored and in time apprehended. Complete chaos without hint of connection is never pleasurable.

Three situations are used in the evaluation of the mystery or anticipation variable. Two situations involve the placement and structure of vegetation, while one situation depends upon the relative shoreline configuration. Mystery is created by vegetation directly or indirectly.

Vegetation can partially obscure a view to the surrounding river environment. Vegetation may also indirectly create a sense of anticipation, by limiting and modifying the amount of light entering a visual display. Alteration of light intensity by vegetation can obscure vision by producing darkness or by modifying light patterns.

Shoreline configuration is also directly related to the mystery dimension. In this situation, mystery results from the inability to see what lies beyond. A broad, sweeping curve totally obscures what lies ahead. This configuration creates anticipation and induces individual movement further into a space. (S. Kaplan 1974, Levin 1977). This concept is applicable to the basic river structure, or the configuration of any circulation corridor where movement provides the participant with a sequential viewing experience.

FOCAL ELEMENTS

The second level of evaluation is difficult to explain in terms of the visual preference model. These factors are identified as elements that attract attention in the landscape, often producing a significant influence upon individual preference. The effect of focal elements on preference is related to the perceptual influences of legibility, complexity, spatial influence and mystery. These factors obviously affect the distinction of a focal element, but there is another influencing factor, purely personal, highly emotional and regional in nature but of importance to individual preference in the landscape.

Distinctive Elements

Distinctive elements in a visual array may be simply defined as: "elements in the visual display that are differentiated from associated landscape elements " (Litton *et al* 1964). Litton divides elements in the distinctive category into two groups: feature elements and point elements.

Feature elements are distinguished from point elements primarily due to rarity in the landscape. A feature element in the Louisiana landscape may he included in any of the three general categories:

(1) Distinctive landform features: such features may include visually dominant bluffs, cliffs or escarpments.

(2) Distinctive vegetative features: such features may include vegetation distinguished by (a) age distinction and (b) rarity of species type.

(3) Distinctive water features: Such features may include waterfalls or turbulent rapids.

Point elements occur commonly in the river environment. Typical examples of point elements would include distinctive vegetation, specimen trees, logs or snags, rocks or rock outcroppings, and sand bars. Despite the fact that point elements often lack the emotional impact indicated by the presence of feature elements, point elements may serve as important elements to attract the eye and provide striking contrast or focal reference. The visual distinction of a feature or point element is evaluated according to the rarity, contrast and relative placement of the element in a visual display.

Disturbance Factors

Feature elements possess the ability to evoke a positive emotional response related to visual quality in the river environment. Similarly, factors exist which can produce highly emotional negative impacts upon viewers. These elements are identified and analyzed as disturbance factors. Disturbance of the natural environment occurs when human influence initiates destruction or alteration of the natural interface between water and land (shoreline).

The shoreline is extremely fragile and is subject to destruction by direct human influence. Alteration of this native shoreline character may produce a negative influence upon the visual quality of the natural river environment. An analysis is conducted and a numerical rating is assigned through an analysis of visual contrasts produced by human activities on the shoreline environment.[4/]

ADJUSTING THE VISUAL ASSESSMENT RATING

The evaluation for each scene is recorded on a sheet similar to that presented in table 2. Each of the 17 specific rating factors is analyzed and given a numerical rating from 1 to S based upon the detailed rating criteria presented in the original study. The rating dimensions evaluated in each scene are only

[4/] Refer to the Bureau of Land Management, USDI, Visual Contrast Rating System, Manual B431 those that can he thoroughly analyzed according to the information presented in the evaluative model. If a dimension is not clearly visible, it can obviously not be thoroughly evaluated. Once the analysis is complete the numerical ratings are added and totaled. This total is divided by the total possible points producing a ratio that indicates a relative preference value for each scene.

Table 2 -- Sample Evaluative Rating Sheet

DATE ______________ SLIDE # ______________

RIVER ______________ EVALUATOR ______________

VARIABLE	DIMENSION	RATING DIMENSION	RATING SCALE 1	2	3	4	5	RATING
LEGIBILITY	DEFINITION	VEGETATION						
		WATER				X		4
		LANDFORM	X					1
	CONTRAST	VEGETATION					X	5
		WATER		X				2
		LANDFORM	X					1
COMPLEXITY	DIVERSITY	VEGETATION		X				2
		WATER		X				2
		LANDFORM		X				2
	EDGE COMPLEXITY	SKYLINE			X			3
		SHORELINE			X			3
SPATIAL DEFINITION		ENCLOSURE			X			3
		DEPTH					X	5
MYSTERY		MYSTERY		X				2
DISTINCTIVE ELEMENTS		DISTINCTION		X				2
DISTURBANCE FACTORS	SHORELINE DISTURBANCE	HUMAN (INF.)					X	5
		POLLUTION					X	5

* (1) Total Points 50

* (2) Total Possible Points 85

ASSESSMENT RATIO .588

* Total possible = number of factors rated X 5

* Assessment ratio = (1) divided by (2)

TESTING THE PREFERENTIAL MODEL

The evaluative system was used in the analysis of 20 Louisiana river scenes. A form similar to that presented in Table 2 was utilized in the evaluation of the scenes. A ratio indicating the relative preference value of each scene was determined.

One hundred landscape architecture students evaluated each of the 20 scenes. The students indicated their free choice preference evaluating each scene on a 1 - 7 rating scale which was based upon the relative beauty or unattractiveness of the scene.

The results of the evaluations were totaled and a hierarchy (1-20) based upon visual preference was produced for the model-based evaluation and the respondent evaluation. The rankings for the two evaluation procedures were then compared statistically to determine if a significant correlation existed between the two procedures. The Kendall rank correlation coefficient was utilized in the analysis results (Siegel 1956). The statistical analysis indicated a strong relationship existed between the model ranking and the respondent analysis of the 20 river scenes. An analysis of the scenes was then conducted speculating on factors contributing to preference for the Louisiana river landscape.

DISCUSSION OF THE RESULTS

All of the high scoring river scenes rated strongly in terms of legibility of vegetation. Legible vegetation allows for visual examination of individual plant forms and limb structure, resulting in more clearly defined perceptual information being conveyed to the viewer, thus producing a positive preferential response. Tangled vegetation limits the ability to process the visual stimuli and results in confusion for an observer.

The lack of topographic change in Louisiana decreases the significance of landform and increases the impact of vegetation upon visual preference. The visual preference for the Louisiana river landscape appears to be highly dependent upon the legibility, contrast, and complexity of vegetation. In regions of low relief, vegetation becomes the primary formative element in visual display. In regions of significant topographic change, the landform legibility, contrast and complexity dimensions would gain importance relating to individual preference for the river environment, while the importance of vegetation would be diminished.

It appears that all of the variables used in the study are interdependent. Analysis of complexity involves the identification of form variations of land, water or vegetation, which are highly dependent upon the legibility of a scene. Separate form types would be difficult to distinguish if the scene were not legible. Mystery also appears to be strongly related to spatial definition and configuration.

The study indicates that recreation preference or "intended use" has a significant impact upon visual perception. For example, a canoeist may place high visual preference on factors which would affect use or recreational desires. This concept could apply to the

the legibility of vegetation or the legibility of water dimensions. Illegible vegetation does not allow for visual penetration or physical penetration into the shoreline environment, while illegible water (muddy turbid water) would discourage swimming and other related water activities. This discussion indicates that specific rating criteria will influence individual perceptions differently. This influence appears to be related to recreation desires, regional and social factors. The influence of these factors on the model criteria should be analyzed in greater detail.

CONCLUSIONS

The analysis indicates that the logic used in the establishment of the preferential model may he of value in the prediction of preference for Louisiana river landscapes. The basis for the evaluation is derived from previous attempts to explain human preference in terms of informational processing theory. This approach appears to be of value in the explanation of human preference for river landscapes.

In this study the general concepts proposed in the informational theory were expanded, applying them to the landscape components of land, vegetation and water, attempting to create a model that could predict human preference for Louisiana river landscapes. In this analysis the importance of the interdependence between the evaluative factors becomes readily apparent. The strong interdependence among factors indicates that a scene will not possess exceptional preferential value with one or two of the characteristics (legibility, complexity, spatial definition, mystery, distinction or disturbance) dominating, while placing the other factors in a subordinate position. A very high ranking scene in terms of visual preference, in most instances, will possess qualities relating to each of the factors. Thus, the mixing and combination of the factors and the resultant effect upon visual preference appear to be more significant than the effect of a single factor. To what extent each of the factors influence perception could not be concluded in this study. This concept indicates potential areas for future research.

UTILIZATION OF THE STUDY

The study is founded upon the assumption that a visual experience on a river consists of a series of views or sequential glimpses down a river corridor. If a system were developed to evaluate the visual preference for these views, a significant tool will be available for the evaluation and subsequent land use planning in river corridors or any water related landscape. The model could be used as the basis for the establishment of an inventory system for the analysis of rivers in Louisiana. Coupled with a photographic inventory, the model could he used to evaluate river systems eventually resulting in the establishment of a hierarchy of rivers or river sections based upon predicted preferential value.

A numerical value described in the study as an "assessment ratio" is determined following the format discussed in this paper, for each of the photographs or slides. A photographic inventory could he conducted on all rivers or river sections indicated for designation in a scenic river system. By evaluating each photograph numerically according to the 17 rating criteria and totaling these values, a hierarchy could he established based solely upon visual preference. Rivers or river stretches rating the highest might be preserved while other use designations would be given according to the numerical results of the evaluation.

At a site scale of evaluation, the model could be used to identify key river stretches and distinctive river sections. Zones could be located relating to a hierarchy of uses based upon visual preference. For example, a recreational activity might he located in a zone of low visual quality, while viewing or observation points may he established in key visual zones which have been set aside for protection. The detail of the photographic inventory indicates the detail of the analysis.

The model could also be used to locate key areas for recreation sites, bridges or powerline crossings. An evaluation could be made on the impacts of proposed or existing activities on visual quality. A more detailed analysis of the inventory data would yield information on individual rating factors such as complexity, spatial enclosure, legibility, shoreline disturbance, etc.

FUTURE RESEARCH

It is important to stress the need for extensive testing of the concepts discussed in this study. Testing should take place further analyzing each of the rating dimensions utilized in the model evaluation. Each of these dimensions should he tested examining the influence of the dimension upon visual perception. Once the significance of each of the rating dimensions has been evaluated, the relationships among these dimensions should also be examined. Statistical tests should be run on the relative significance and behavior of all of the dimensions, as well as the relationships between dimensions. Limitations in the scope of this study did not allow for extensive statistical analysis of the evaluative model. The preliminary indications are that the model has value in the assessment of visual preference for Louisiana river landscapes, but the use of the system for practical purposes should not be conducted until the model has been adequately tested and revised for utility, clarity and accuracy.

Additional analysis should be conducted testing the concepts proposed to determine the correlation between landscape preference and visual quality evaluation in the landscape. Such an analysis is needed in the development of visual assessment systems. Such systems would be of significant value in the land use decision making process.

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