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Aesthetic and Affective Response to Natural Environment

ROGER S. ULRICH

INTRODUCTION

Affect is central to conscious experience and behavior in any environment, whether natural or built, crowded or unpopulated. Because virtually no meaningful thoughts, actions, or environmental encounters occur without affect (Ittelson, 1973, p. 16; Izard, 1977; Zajonc, 1980), an affective state is an important indicator of the nature and significance of a person's ongoing interaction with an environment (Lazarus, Kanner, & Folkman, 1980, p. 190). Research concerning affective and aesthetic response, therefore, may have a central role in advancing our understanding of human interactions with the natural environment and could prove pivotal in the development of comprehensive theories. Further, this area of research relates to important questions in environmental planning and design, including, for instance, visual landscape assessment, the provision of vegetation and parks in cities, and issues of wilderness management and recreation. Concerning the latter, it appears that aesthetic and emotional experiences are the most important benefits realized by many recreationists in the natural environment (Rossman & Ulehla, 1977; Shafer & Mietz, 1969).

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This chapter is restricted to aesthetic and affective reactions associated with visual perception of natural environments. This is somewhat artificial because environmental perception is obviously multimodal and is not restricted to vision. Although vision is by far our most important sense, many sounds and smells in natural settings surely also influence our feelings. Unfortunately, empirical studies of affective and aesthetic response to auditory and olfactory components of natural environments are virtually nonexistent. Despite the restriction to the visual environment, the topic remains broad and relevant work is found in numerous disciplines, reflecting approaches as diverse as phenomenology and psychophysiology. There can be no attempt here to achieve a comprehensive review of all related studies, and the intuitive literature is largely omitted. One principal purpose is to summarize selectively studies that derive conclusions from empirical observation structured by a research design. A second major objective is to advance a theoretical framework that provides an organized perspective for interpreting and integrating findings. This framework, which is set out in some detail in the initial sections of the chapter, draws heavily on recent emotions theory and research. It proposes an explanation of how affects arise in the natural environment, postulates their functions, and explicitly links them to cognition, activity in physiological systems, and behavior. To ignore associations between affects, actions, and other systems would be to imply that humans are creatures who, despite a very long period of evolution in the natural environment, are saturated with feelings somehow having neither adaptive value nor links with thought or behavior. The position of this chapter is that aesthetic and affective responses cannot be understood in any depth as isolated phenomena.

DEFINING AFFECTIVE AND AESTHETIC RESPONSE

Most of the theory advanced in environmental aesthetics has consisted of quite general statements lacking in-depth development and unaccompanied by definitions of key concepts. To preclude confusion, certain terms central to this chapter should be defined at the outset. *Affect* is used here synonymously with emotion, although in a strict sense the concepts are different. Many psychologists construe affect as a broader term that encompasses not only emotions, but also feelings in terms of drive states such as thirst and hunger (Izard, 1977). Affect is used here in the narrower sense of emotion, and drives are not discussed. Consistent with many contemporary theories of emotion, no

sharp distinction is made between emotions and moods. A mood can be considered an emotional state that, compared to an episode of strong feeling, is less intense and often more diffuse. *Aesthetic response* is defined as preference or like–dislike affect (Zajonc, 1980) in association with pleasurable feelings and neurophysiological activity (Berlyne, 1971) elicited by visual encounter with a natural setting. These variables can be measured separately, although investigations using factor analysis indicate that aesthetic preference and pleasurable feelings, or liking and semantic pleasantness evaluations having a strong affective character (Osgood, 1962), typically load on the same dimension (e.g., Calvin, Dearinger, & Curtin, 1972; Küller, 1972; Zube, 1974). This supports an interpretation of aesthetic preference as affect within the broad pleasantness dimension of emotion that has been prominent in theory and research since Wundt's work in the last century.

Affects or emotions are defined as innate, cross-cultural phenomena, each having characteristic experiential, facial, and neurophysiological components (Izard, 1977). One does not learn to feel afraid or to cry any more than one learns to feel pain or to gasp for air (Tomkins, 1962, 1963). Five emotions can be elicited at birth, and the onset of others may occur in association with age-related maturational processes (Izard, 1971; Izard & Buechler, 1980, p. 1973). The innateness of affects is clearly evident from investigations showing, for instance, that congenitally blind children express emotions facially in the same way as children who can see (Eibl-Eibesfeldt, 1972, p. 22). The empirical case for the cross-cultural nature of fundamental or primary emotions is extremely strong. Numerous studies indicate that emotions have the same experiential qualities and facial expressions across widely different cultures, including isolated preliterate groups having had virtually no contact with Western cultures (Ekman, Friesen, & Ellsworth, 1972; Izard, 1971). Whereas affects are universal, the cognitive accompaniments of a given emotion can vary greatly with factors such as age, experience, and culture; therefore, the quality and complexity of conscious experience change throughout an individual's life as affects become associated with cognition, or as affective-cognitive structures are formed (Izard & Buechler, 1980, p. 176). Thus, if a natural scene elicits pleasantness in two observers, one an adult and the other a child, the position here is that the view has similar influences on the quality or type of the persons' affects. However, the conscious experience of the individuals might vary considerably because of differences in cognition. Presumably, the adult's conscious experience would be more complex than the child's because of a greater number of learned associations and possibly a more elaborated cognitive appraisal of the scene.

TOWARD A THEORY OF AFFECTIVE RESPONSE TO NATURAL ENVIRONMENT

During the last two decades, very substantial progress has been made in the area of emotions theory and research, primarily as the result of efforts by clinically trained research psychologists. This work is potentially a rich resource for environment–behavior researchers, and much of it is relevant to an understanding of affective and aesthetic reactions in the natural environment. One clear theoretical trend is toward viewing affects as adaptive. Different authors have construed the adaptive functions of emotions in terms of evolutionary survival requirements, the fostering of well-being defined broadly, or both. An important implication of this extensive literature is that in order to understand why a given natural view elicits certain feelings, it is necessary to consider adaptive functions of preference and other affects in the situation. In the area of landscape aesthetics, Appleton, a geographer, has advanced a rather extreme, ethologically based adaptive position, postulating that aesthetic pleasantness is a response to elements having either real or symbolic significance for survival (1975).

Both the experimental and intuitive schools in landscape aesthetics have failed to incorporate advances from the emotions literature. This may partly explain why theoretical statements in landscape aesthetics have not addressed in any depth fundamental issues such as the link between affects and adaptive behavior, or what internal processes are involved in generating feelings. By venturing briefly into the recent emotions literature, it is possible to shed light on these and other critical issues and to establish a much firmer foundation for a theoretical conception of affective response to the natural environment. These issues must be addressed; as will become evident, they are central to an understanding of why different natural stimuli or configurations can elicit quite different aesthetic reactions.

Generating Affects: Feelings Precede Thoughts

With the rise of cognitive psychology in the 1960s, feelings came to be viewed as products of thought. If applied to explain aesthetic and affective responses to the natural environment, this general perspective would hold that an observer's affects are postcognitive phenomena resulting from a process of cognitive evaluation or appraisal of a scene. This interpretation is also echoed explicitly or implicitly in most intuitive work and in some of the experimental literature on landscape aesthetics. For instance, Tuan asserts that attractive visual landscapes elicit positive

affects "because the mind finds repose or excitement in the comeliness of place and setting" (1978, p. 133).

Given the prominence of such cognitive explanations of affect, it is important to emphasize that there is no evidence that feelings are necessarily preceded by a cognitive process (Zajonc, 1980). To the contrary, there is mounting empirical support for the position of Zajonc, Ittelson (1973), Izard (1977), and others that many affects are essentially precognitive and constitute the initial level of response to environment. Drawing on evidence from several studies, Zajonc cogently argues that affective reactions need not depend on cognition and that the first stage of response to stimuli consists of global, generalized affects related to preferences (e.g., liking, fear) and approach–avoidance behavior. The onset of such reactions occurs quickly and is based on very little information. Indeed, there is evidence that like–dislike emotion in relation to a stimulus can be *independent of recognition* (Moreland & Zajonc, 1977; Wilson, 1979). Zajonc asserts that "we can like something or be afraid of it before we know precisely what it is and perhaps even without knowing what it is" (1980, p. 145). This initial affective response then structures and significantly influences the ensuing cognitive process (Zajonc, 1980; Izard, 1977). Zajonc argues convincingly that initial reactions in many instances speed recognition and sharply increase the efficiency of information processing. From the standpoint of survival requirements in evolution, quick-onset responses motivating approach–avoidance behaviors would have had great adaptive value.

Zajonc speculates that affects can occur with little information and without precise recognition because of a class of features and stimulus characteristics he calls "preferenda" (1980). These are gross, often vague, configural aspects that may be insufficient as a basis for cognitive judgments but can be highly effective in eliciting affect. In a similar vein, Ittelson says that initial affect is a general response to the "ambiance" of an environment (1973, p. 16). The quality and intensity of affect reactions elicited by preferenda can be influenced by internal states or conditions of the individual such as previous experience with stimuli of the same general class, immediately preceding exposures that may produce contrast or similarity, and the person's affective state immediately prior to the encounter (Zajonc, 1980).

A Psychoevolutionary Framework

The notion of preferenda, and the position that affect precedes cognition, are important features of the conceptual framework described here, which is intended as a step toward an integrated theory of aesthet-

ic and affective response to the natural environment. It draws on a cross-section of emotions theory and research, including work by Lazarus (1968), Tomkins (1962, 1963), Plutchik (1970), McDougall (1908) and especially Zajonc and Izard. The result is a theoretical synthesis that (1) describes internal processes generating affects, (2) postulates a number of adaptive functions of affects in natural environment, and (3) explicitly relates affects to behavior. Although developed for natural environment, many notions in the framework would apply to urban visual settings as well.

The framework is summarized in Figure 1. For the sake of clarity, many feedback loops have been omitted from the diagram; as a result, the generation of an affective reaction appears more linear than it is in reality. A general feature of the framework is the conceptualization of affect and cognition as occurring in separate though interrelated systems (Izard, 1977; Zajonc, 1980). In this regard it should be noted that feeling and thought are linked with different parts of the brain. The limbic system, which appeared early in evolution, has a central role in emotions, whereas cognition takes place in the neocortex.

As Figure 1 indicates, the first variable of importance in influencing the eventual feeling/behavior outcome is the observer's affective state immediately prior to the visual encounter. This state is derived from a combination of the person's present and past history, including cognitions. The initial affective state directs and sustains attention (Izard, 1977), thereby influencing selection of the feature or scene that is perceived. When perception of natural environment occurs that reaches consciousness, the framework postulates, with Zajonc and Ittelson, that the first level of the reaction is generalized affect (e.g., liking, interest, fear) motivating approach-avoidance impulses or behavior. The initial affect reaction is based on little information, but it is nonetheless elicited quickly by certain general properties or preferenda of the view. In the event the environmental interaction entails risk or pronounced threat (e.g., a hiker suddenly encountering the edge of a precipice), the initial affect reaction (fear, dislike) can very quickly motivate adaptive avoidance behavior on the basis of only a minimum of cognitive activity. Although Figure 1 portrays initial affect in association with visual perception of the natural environment, a feeling response could also be elicited by imagination or a vivid memory of a natural setting (Singer, 1966).

The framework assumes that in natural environments preferenda for the most part are (1) gross configurational or structural aspects of settings, (2) gross depth properties that require little inference, and (3) general classes of environmental content. It argues that various gross

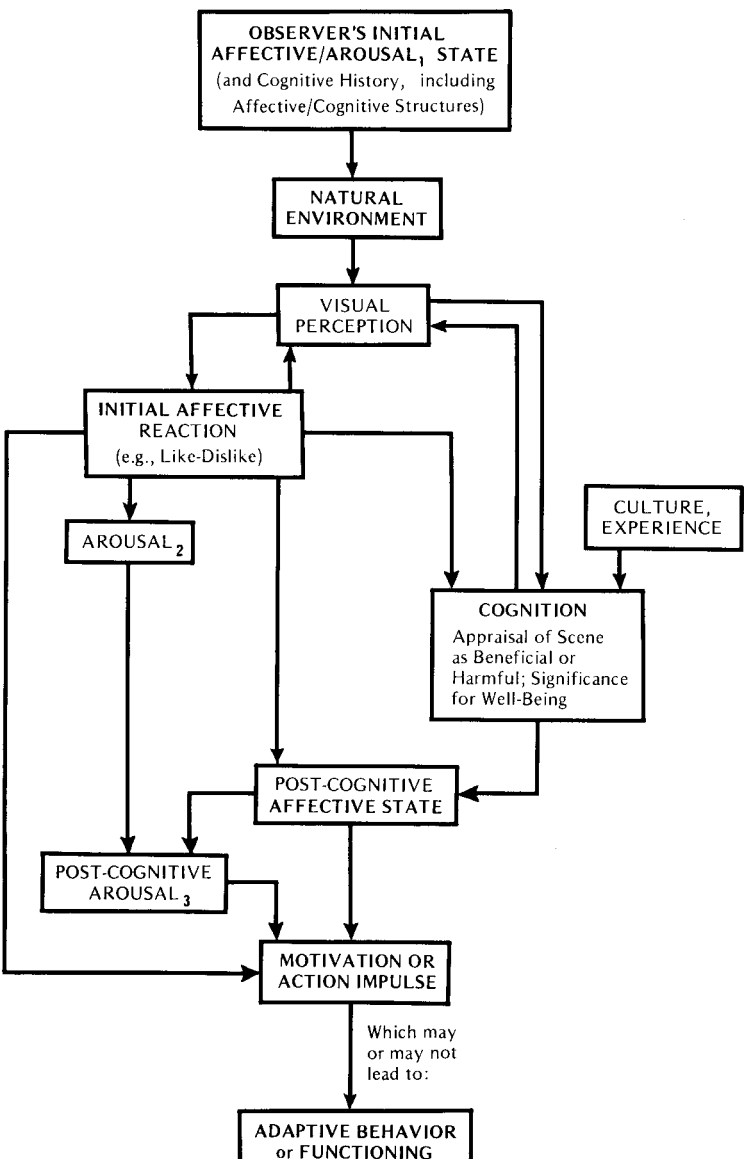

Figure 1. Model of affective/arousal response to a natural scene.

structural properties (e.g., the presence of a focal area and patterning) combine with biases in human perception to convey quickly, and with very little processing, salient general characteristics of a setting that elicit affect. The framework further assumes that certain broad classes of content (e.g., water, vegetation) can produce visual ambiances that quickly elicit affective reactions prior to identification or extensive processing. These assumptions are central in the formulation; later sections discuss them in greater detail and cite some empirical evidence in their support.

The initial affect reaction produces arousal in the electrocortical and autonomic systems, thereby mobilizing the individual for sustaining or undertaking behavior (see $Arousal_2$ in Figure 1). The framework holds that the initial affect reaction then influences an ensuing process of cognitive evaluation of the scene. If the feeling response is strong, it may dominate the cognitive process and be salient in the observer's conscious experience. Further, if the initial affect is strong, the ensuing cognition may be more efficient in the sense that elements will be more quickly recognized and identified, and the view will be remembered better than a comparatively neutral scene (Zajonc, 1980). Thus, remembered views will in most instances be those that elicit reactions such as strong initial liking or dislike. If the initial reaction is weak, it does not significantly influence the subsequent cognition, and, in any case, extensive cognition is quite unlikely if the scene does not elicit the emotion of interest (Izard, 1977).

After onset of the initial affect reaction, the ensuing cognition evaluates the setting in terms of its significance for well-being, broadly defined (Arnold, 1960; Lazarus *et al.*, 1980, p. 193). This process entails recognition, identification, and much more extensive processing of the information. Processing and evaluation will be faster and more efficient when there are present organizational properties and depth cues that facilitate comprehension of the scene in all three dimensions (Ulrich, 1977). In line with traditional cognitive theories of emotion, the framework assumes at this point that the observer's feeling state is affected by the cognitive evaluation of the actual or anticipated outcome of the encounter (e.g., Lazarus *et al.*, 1980, p. 195). The viewer's evaluation, which is influenced by learned associations and expectations, refines and more sharply focuses the comparatively general affect of the initial reaction and may generate other emotions. To the extent that cognition modifies emotion, this will produce changes in physiological arousal as well as in subjective feelings (see $Arousal_3$ and Postcognitive Affect boxes in Figure 1). Evaluation may be accompanied by memories and associations which, along with emerging emotions, add to the complexity of the observer's conscious experience. Emerging affects may in turn

influence perceptual activity and cognition, and therefore some encounters will entail a complex, ongoing interplay of feelings and thoughts (Izard, 1977; Lazarus, 1968). As an extreme example, an aesthetically spectacular vista would likely elicit an initial affective reaction of strong preference and interest that could sustain a lengthy and elaborated cognitive process, involving detailed perception and processing of the visual information and thoughts as diverse as memories from a childhood vacation or an idea recalled from a poem. This would be an exception, however, as the vast majority of encounters are with unspectacular natural environments eliciting comparatively weak affective responses that are probably dominated by the initial general affective reaction and involve only elementary cognition.

Affects and Behavior in Natural Environments

To understand more fully why different natural scenes can elicit quite different affective reactions, it is essential to consider the functions and consequences of affects in natural enviornments. This implies the assumption that affective reactions to natural scenes are adaptive in terms of the total behavior of the individual. The framework now converges with some theoretical conceptions in environmental psychology (Ittelson, Franck, & O'Hanlon, 1976, p. 192; Mehrabian and Russell, 1974), as well as many emotion theories, by premising that feelings are inseparably linked to actions. More specifically, it is assumed that an individual's affective reaction motivates, or serves as an action impulse for, adaptive behavior or functioning (Izard, 1977; Tomkins, 1962). The individual is physiologically mobilized to undertake or sustain adaptive actions because affects in relation to the scene have produced appropriate changes in arousal (see $Arousal_3$ in Figure 1). *Adaptive* refers here to a wide array of actions and functioning which are appropriate in terms of fostering well-being. The term *action impulse* reflects the notion that an action motivated internally by affect and expressed in neurophysiological arousal need not be carried out and can be suppressed or denied (Lazarus *et al.*, 1980, p. 198). For instance, a person viewing an attractive natural setting might feel strong preference and interest, and an impulse to explore the area on foot, but could suppress the behavior and simply continue looking from the same vantage point.

Table 1 contains several examples of adaptive behaviors motivated by different affective/arousal reactions to natural scenes. While the list is by no means comprehensive, it does set out what may be some of the most important and frequent behaviors in the natural environment. Common to the different motivating states are feelings of like–dislike

TABLE 1
ADAPTIVE BEHAVIORS MOTIVATED BY AFFECT/AROUSAL REACTIONS TO VISUAL NATURAL ENVIRONMENT

Motivating state		
Feelings	Arousal[a] change	Behavior or functioning
Interest, anticipation accompanied by preference/pleasantness	Increase	Approach or exploration
Interest and strong preference/pleasantness (elation, exhilaration, joy)	Maintained if initial level is moderately high Increased if initial level is low	Ongoing activity or performance is sustained; challenging activity undertaken
Mild-moderate interest accompanied by preference/pleasantness, including calm, peacefulness	Maintained if initial level is moderate Decreased if initial level is high	Psychophysiological restoration; nonvigilant attention with little scanning
Interest, dislike, accompanied by fear or anxiety	Sharp increase	Deal with threat—e.g., avoidance or flight
Interest and dislike accompanied by one or more of following: fear, caution, uncertainty	Increase	Vigilant attention with scanning

[a]Arousal may be electrocortical, autonomic, or both.

and interest, and most of the states are linked to approach–avoidance behaviors or impulses. Approach behaviors motivated by preference include seeking out, exploring, staying in, and not avoiding a situation (Mehrabian and Russell, 1974, p. 157). Some states motivate overt actions having obvious adaptive functions, such as acquiring environmental information (exploration) or dealing with a survival-related threat (e.g., Appleton, 1975; Berlyne, 1960; Plutchik, 1970, p. 11). It is proposed that an important adaptive function of strongly positive affects can be to sustain ongoing activity (Izard, 1977; Lazarus *et al.*, 1980, p. 209). For instance, a wilderness backpacker who is fatigued might feel exhilaration or elation upon viewing an aesthetically spectacular setting, and these affects would produce physiological arousal and help to sustain his journey. Many aesthetic and affective reactions to natural environments are assumed to motivate behaviors that are not necessarily expressed as observable actions, but which nonetheless qualify as adap-

tive functioning. For example, if an observer's state prior to a visual encounter is one of stress and excessive arousal, an attractive natural view might elicit feelings of pleasantness, hold interest and block or reduce stressful thoughts, and therefore foster psychophysiological restoration (Ulrich, 1979a). In this instance, adaptive approach behavior might consist simply of staying in and continuing to view the setting, rather than engaging in actions such as exploration. Even the passive intellectual contemplation of a natural setting can be quite adaptive if it provides a breather from stress (Lazarus *et al.*, 1980, p. 208), or gives the observer a sense of competence in terms of mental prowess or efficacy, thereby contributing to a sense of identity (White, 1959). The framework therefore construes adaptive behavior motivated by affects as encompassing a wide range of observable actions and nonmotor (e.g., perceptual) activity.

The following section discusses visual properties that influence affective reactions, and surveys related empirical findings. It will be evident that very few studies have directly addressed behaviors motivated by aesthetic and affective responses to natural scenes. The overwhelming majority of investigations of outdoor environments has been concerned exclusively with aesthetic preference or pleasantness and in some cases with other emotions, such as interest. Some of the literature gives the impression that affects are isolated phenomena having no explicit associations with behavior or even with other systems and processes. In contrast, the framework here stresses that an affective reaction is closely linked to the preceding affective state, to thought, neurophysiological activity, and action. In this light, the following discussion tends to dwell on specific slices of the larger process whereby people interact with natural environment to foster well-being.

VISUAL PROPERTIES INFLUENCING AESTHETIC PREFERENCE AND INTEREST

Complexity

Complexity refers generally to the number of independently perceived elements in a scene. High complexity is associated with large numbers of elements and with dissimilarity among elements (Berlyne, 1971). Complexity has long been a featured variable in experimental aesthetics, and findings from numerous laboratory studies using randomly generated, unstructured arrays have rather consistently indicated that aesthetic preference or pleasantness are related to complexity in an inverted-U-shaped manner (for a survey of studies, see Berlyne, 1971).

That is, high preference tends to be associated with moderate levels of complexity, whereas low preference is linked with the extremes of either low or high complexity. Additionally, in several investigations using art works and a variety of more artificial stimuli such as random polygons, Berlyne and his colleagues identified generally linear positive relationships between the complexity of an array and judged interestingness, attention (viewing time), and exploratory activity (e.g., Berlyne, 1963; Day, 1967). It can be inferred from these studies that most high-complexity natural scenes should elicit considerable interest/attention, but only low levels of preference. On the other hand, high-preference views will not necessarily elicit strong interest. Consistent with Berlyne's results for nonlandscape stimuli, Wohlwill found that subjects' number of voluntary exposures of landscape slides correlated with judged complexity (1968).

Several investigations have tested complexity as a predictor of preference for natural and urban scenes (e.g., Kaplan, Kaplan, & Wendt, 1972; Ulrich, 1977; Wohlwill, 1968, 1976). Although nearly all studies have found significant associations with preference, in some cases the relationships are inverted-U-shaped, while in others they are linear positive. These conflicting results are probably attributable to the difficulty of assembling samples of natural scenes depicting broad ranges of complexity (Wohlwill, 1976, p. 46). Many studies of natural settings likely sample only low to moderate complexity ranges, and therefore identify a linear positive association between complexity and preference representing the left side of an inverted-U curve.

Complexity is incorporated in an implicit fashion in many scenic-quality assessment procedures. For instance, the successful models developed by Daniel and his colleagues for assessing forest landscapes include variables such as amount of downed wood, slash, and species diversity (Daniel & Schroeder, 1979). It can be argued that these variables are surrogates for complexity, offering in this particular context the considerable advantage of their direct relevance to forest-management practices.

In view of the inverted-U-shaped relation that has emerged in many complexity studies, it should be stressed that the theoretical framework also suggests that high levels of random, unstructured complexity should elicit low aesthetic preference. This position derives from the basic premise that affective reactions are motivators of adaptive behavior. The explanation can be illustrated using the example of a hiker's feelings and actions as he travels through a large-scale natural environment. The individual's journey can be construed as consisting of a large number of approach behaviors of varying durations and distances,

punctuated by some avoidance actions and periods of restoration (Table 1). In most instances, an approach or avoidance segment of the trip is motivated by the hiker's affective reaction to the area of landscape immediately in view. If a setting is encountered that is characterized by unstructured high complexity (e.g., a thicket), the individual cannot quickly grasp the salient global aspects of the setting, and has to engage in detailed processing in order to achieve even a modicum of comprehension. Also, this situation warrants a comparatively elaborated process of cognitive appraisal of the anticipated outcome of the encounter. If approach movement continues under these circumstances, important information might be missed, and in some cases the situation could prove dangerous. Therefore, a quick-onset reaction of low preference or dislike is clearly adaptive because such affects generate avoidance impulses, thereby leading to a slowing or cessation of approach movement. Further, the affect reaction should also include interest, because this feeling motivates attention and processing and sustains a process of cognitive appraisal. These affects, dislike and interest, are the major components of the initial level of response, emerging with minimal cognition and before recognition or identification has occurred. This argument implies that disordered high complexity constitutes one type of gross environmental ambiance that very quickly elicits initial affect.

At the other extreme, the theoretical framework suggests that low complexity scenes should elicit low interest and moderately low preference. A flat, featureless open field, for instance, could be processed rather quickly by the hiker, and little additional information would be gained by exploring it. Interest therefore should be low because sustained attention and detailed processing are unnecessary or would yield little in return; weak preference would motivate neither strong approach/exploration nor avoidance impulses. The hiker might move on, avoiding the area, or might walk through it at a faster pace than when traversing a pleasurable, interesting segment (Gustke & Hodgson, 1980). These arguments are in clear accord with findings of the many laboratory studies, and provide a plausible explanation of preference and interest responses in relation to low and high complexity. Preference and interest are largely independent dimensions of emotion, and in some instances can be influenced in different directions by the same combination of visual properties.

Structural Properties

The framework assumes that gross structural or configurational properties are preferenda that elicit initial affective reactions with mini-

mal cognition. If disorder is an environmental ambiance that produces dislike and interest/attention, then gross structure is considered another ambiance that should tend to elicit liking and approach. Considerable research has shown that perception in both humans and animals is characterized by a strong orientation to information that is structured or patterned. Further, it has been demonstrated that affective reactions can occur largely on the basis of the configuration in a visual array, as opposed to individual features. For instance, affective reactions to faces, and facial recognition, appear to be more related to configurations of facial features than to individual features (e.g., Patterson & Baddeley, 1977). A bias towards gross configurations in natural settings would be highly adaptive because large numbers of environmental elements could be grasped as smaller numbers of element groupings or chunks (Ulrich, 1977). This would expedite appropriate affective reactions and would speed up recognition and identification. It follows that even high-complexity natural scenes can be efficiently processed, provided that the complexity is structured. Structuring of natural stimuli can be achieved in a number of ways, such as through the presence of homogeneous textures, redundant elements, groupings of elements, and properties that provide continuity among separated or dissimilar elements. Of particular importance can be patterning that establishes a focal point in the scene.

The rationale for a positive relationship between liking and structure emerges directly from the premise that affective reactions motivate adaptive functioning. If the hiker in the earlier example encountered a setting characterized by moderate complexity and extensive gross structure, he could rapidly grasp global aspects relevant to behavior with very little cognition and perhaps even without identification. The scene should elicit quick-onset liking, since this would expeditiously motivate adaptive approach behavior (exploring, staying in, or not avoiding). The initial reaction would not necessarily include strong interest, however, because lengthy processing motivated by interest would not be required. In some instances, encounters with highly structured scenes should generate both liking and strong interest. An expansive vista of ordered high complexity should elicit comparatively strong interest and liking, because the view would contain a great deal of information about the surrounding area relevant to adaptive functioning. Initial feelings of strong liking/pleasantness would generate approach impulses and would produce physiological arousal to sustain the observer's subsequent actions (see Table 1).

The notion that structural or organizational properties influence aesthetic preference is also prominent in Gestalt theory and in the litera-

ture of intuitive design and art where concepts such as "harmony" and "composition" have long been emphasized. In experimental contexts, several authors have proposed structural variables or dimensions. A notable example is Küller's semantic factor—unity—which has been consistently identified in a series of studies, including cross-cultural replications, and emerges for built as well as rural scenes (e.g., Küller, 1972; Kwok, 1979). Concepts such as unity, order, and coherence are extremely general, which suggests they can be broken down into more specific component variables. Wohlwill (1980) has called attention to the neglect by investigators of several related issues, such as pattern perception and unit chunking, that would lead to a deeper understanding of the role of structure.

Focality

The author has identified a "focality" variable that is considerably less general than the above notions, and appears to tap an important gross structural property (Ulrich, 1977). Focality refers to the degree to which a scene contains a focal point, or an area that attracts the observer's attention. It is present when textures, landform contours, and other patterns direct the observer's attention to a part of the scene. Focality is also produced when a prominent feature, or grouping of features, creates a point or subarea of dominance that attracts the viewer's eye. Compared to other structural variables, a major advantage of focality is that it can be unambiguously applied to scenes ranging from very low to very high levels of complexity. Empirical support for a link between focality and preference comes from a study using rural roadside scenes (Ulrich, 1977). The views were scaled for focality using ratings by trained judges and then were shown to two groups (American suburbanites and Swedish university students) who rated the scenes for aesthetic preference. The rank correlation coefficients between focality and preference were .46 for the Americans, and .54 for the Swedes.

It is contended that focality is one type of gross configurational property that is important in eliciting initial affect and which retains a central role in subsequent stages of processing and appraisal. Support for this position is provided by Janssens's pioneering investigation of eye movements in relation to outdoor scenes (1976). Although buildings were prominent in all the views that Janssens analyzed, his major findings may also hold for natural settings. His recordings of eye-fixation sequences strongly suggest that immediately after onset of a view, subjects sought a salient feature or pattern (i.e., a focal area), which nearly all individuals located within about 1.25 seconds. Importantly, Jan-

ssens's results support the interpretation that individuals tended to use the focal area as a reference point or "home base" for subsequent perception. For example, a person might follow a major contour out from the focal area for three or four fixations, then return to the focal area and fixate, move away in a new direction for a few fixations, return again, and so on. The critical importance of focality was clearly evident in the finding that a distinct subarea of each scene attracted a disproportionate percentage of all fixations, *especially the earliest fixations.* The Janssens study vividly demonstrates the incompleteness of human visual perception of environments and the central role of structure in grasping a subset of the information in an outdoor scene.

Depth

Several investigations have identified significant positive relationships between depth and aesthetic preference for natural or rural scenes (Craik, 1970; Ulrich, 1973, 1977; Wohlwill, 1973). Similarly, studies of forest landscape aesthetics have consistently found that preference levels are higher for tree stands having some visual depth or openness, as opposed to those with restricted depth (e.g., Brush, 1978; Daniel & Boster, 1976). On the basis of data originating in Ulrich's 1973 roadside research, S. Kaplan incorporated depth as a central variable in his evolutionary preference model (1975, p. 97). Küller has identified a spatial semantic factor, "enclosedness," that has emerged in several studies encompassing rural and built visual landscapes (1972).

The framework proposes that depth/spaciousness influences both the initial affective reaction to a scene and the ensuing process of cognitive appraisal. This differs from the usual position that depth is exclusively an inferred property contingent on considerable cognition. It is hypothesized that lack of depth (e.g., a visually impenetrable foreground immediately ahead of the observer) can be a gross ambiance that quickly elicits dislike and uncertainty with minimal cognition. An adaptive perspective suggests that spatial restriction should elicit reaction almost immediately, certainly before a complex, extended inference process that comprehends distances or relationships among elements in three dimensions. The reaction should be based on a very coarse interpretation that depth is absent or highly restricted. A moving, exploring person would be promptly motivated by this initial response to avoid a setting that could contain hidden dangers or constrain opportunities to escape (Appleton, 1975). These arguments are consonant with the finding that scenes having sharply restricted levels of depth are accorded low preference (Brush, 1978; Craik, 1970; Ulrich, 1973, 1977).

Conversely, a gross ambiance of some spaciousness should not elicit dislike and avoidance, because immediate risk or threat would be negligible (Appleton, 1975).

Following the initial affective reaction, specific depth properties will be critical in the process of cognitive appraisal. Evaluation of a setting in terms of its significance for well-being is contingent on accurately inferring distances and relationships among elements in three dimensions (Ulrich, 1977). If depth in the natural environment could not be perceived, features would stand ambiguously in two dimensions and appraisal would be essentially impossible. The observer's cognitive history is of central importance both in the process to infer distances and in appraisal. Settings having numerous depth cues and clear spatial definition facilitate cognitive evaluation, tend to yield more environmental information, and therefore should be liked.[1]

Ground Surface Texture

Textures characterizing ground surfaces in the natural environment are very important in defining depth, and they may strongly influence cognitive appraisal following the initial affective reaction. Gibson's research has clearly shown that ground textural gradients can play a major role in depth perception and that the character of a textural surface profoundly affects the accuracy of depth estimates (1958, p. 420). There is ample basis for concluding that surface textures influence both the inferred depth or space in a setting and the ease of comprehending element relationships in three dimensions (Ulrich, 1977). Importantly, cognitive appraisal following the initial affective reaction to a scene should be facilitated by the presence of uniform, even-length ground textures, as opposed to rough, uneven surfaces. Even textures preserve the sense of a continuous "sheet" or surface between the observer and the environmental elements that Gibson has shown is necessary if distance is to be perceived accurately (1958, p. 421). Therefore, if ground textures tend to be even in a setting, more information can be extracted, and the observer's appraisal should be more definite and positive. Uni-

[1]A few individuals may have phobic reactions of extreme dislike, fear, or even panic when they encounter vast expanses (Balint, 1955). However, such agoraphobic disorders much more commonly involve fear of being in spaces that contain people (American Psychiatric Association, 1980) and therefore are strongly tied to social as well as physical aspects of environment. By contrast, claustrophobia (fear of restricted or closed spaces) does not involve the presence of people and is almost exclusively related to spatial conditions (American Psychiatric Association, 1980).

form, relatively smooth textures should also be evaluated positively, generating liking, because an observer knows from previous experience they are conducive to movement or exploration. On the other hand, rough, uneven textures may disrupt the sense of a continuous depth sheet or surface, thereby producing spatial ambiguities, difficulties in grasping a setting, uncertainty, and reduced preference. Further, rough textures are often produced by coarse scrub or brush that are obstacles to movement, and appraisals accordingly should be negative, generating dislike.

In addition to influences on depth perception and appraisals of movement opportunities, ground surface textures affect the complexity and structure of the two-dimensional visual array. Scenes having scruffy, irregular textures present the observer with unordered high complexity that works against preference. Surfaces having even textures, or areas of textural homogeneity, should tend to be preferred because the complexity is ordered. Several arguments, therefore, can be given for a link between uniform ground textures and liking; it is not surprising that the few studies explicitly addressing ground texture have identified strong associations with preference. Rabinowitz and Coughlin (1970) and Ulrich (1973) found consistent patterns of low preference for scenes having rough, scruffy ground surfaces. In the cross-cultural roadside study mentioned earlier, the sample of scenes was rated by trained judges using scales that assessed surface textural unevenness–evenness and coarseness–fineness (Ulrich, 1977). The rank correlation coefficient between ground texture judgments and the American group's aesthetic preference ratings was .66; it was .55 for the Swedish subjects, indicating a clear pattern that groups from both countries prefer settings having even ground textures. Additionally, several studies of forest landscapes have found positive relationships between aesthetic preference and comparatively even-length grass ground covers and negative preference effects of rough ground covers (e.g., Daniel & Boster, 1976; Arthur, 1977).

Threat/Tension

An obvious implication of the position that affects motivate adaptive behavior is that natural settings characterized by threat or risk should elicit dislike and often fear, thereby generating adaptive avoidance (Table 1). If dangerous or threatening features are near the observer and are visually salient, they should elicit a reaction almost immediately. The traditional view that emotions result exclusively from a process of cognitive evaluation makes little sense in this context. If an individual is

to escape from an immediately dangerous situation, the action must be undertaken long before completion of even a very simple cognitive process (Zajonc, 1980). In this light it is understandable why affective judgments are made faster and with much more confidence than recognition judgments (Kunst-Wilson & Zajonc, 1980; Zajonc, 1980). If a threat is comparatively hidden, fear will not be part of the initial response, but will be generated by the cognitive appraisal process in later stages of the encounter. A threat inference following the initial response obviously results from learned associations and expectations (Zuckerman, 1976).

Surprisingly little empirical work has either addressed the relationship between threat and preference in the case of visual natural landscapes or evaluated different natural phenomena in terms of threat or tension. A recent study explored some of these questions using a collection of 52 slides of natural landscape paintings (Ulrich & Zuckerman, 1981). The collection included works by several European and American artists and depicted a broad range of natural features and geographical settings. The paintings also varied markedly in terms of calm–tension properties, as scored by trained judges using a semantic differential procedure. Nearly all the high-tension paintings contained phenomena that would be extremely dangerous in real encounters, such as stormy seas, an avalanche, the edge of a steep cliff, and a violent thunderstorm and flash flood. Among the landscapes lowest in tension were those containing calm water surfaces. The collection was shown to more than 200 university students, who rated each scene for liking. Results revealed a highly significant inverse relationship between the liking ratings and tension scores. Since the paintings simulated environmental tension or threat, and real danger was absent, it can be expected that real exposures to threat in the natural environment are characterized by an even stronger tension/preference association.

Deflected Vistas

Authors from different fields have pointed out that preference and curiosity are elicited when the line of sight in a natural or urban setting is deflected or curved, signaling that new landscape information is just beyond the visual bounds defined by the observer's position. This property is highly cognitive, and therefore is probably not a major factor in the initial affective reaction. Cullen called attention to this notion in his analysis of townscapes, referring to it as "anticipation" (1961). Using views of curving city streets as his principal examples, he argues that such settings "clearly arouse one's curiosity as to what scene will meet our eyes upon reaching the end of the street" (p. 49). Analogous config-

urations in the natural environment have been termed "deflected vistas" by Appleton, who lists as examples curving sight lines associated with paths, rivers, and valleys (1975). Essentially the same property has been called "mystery" by S. and R. Kaplan, who define it as a "promise of information" associated with a projected change in vantage point (R. Kaplan, 1973; S. Kaplan, 1975, p. 94). S. Kaplan describes mystery as an inferred property of the three-dimensional array, and he has advanced theoretical arguments for a link between mystery or deflected vista configurations and preference. He asserts that evolution has left its mark on contemporary humans in the form of an innate predilection for exploring and acquiring landscape information. It follows that we should prefer scenes that explicitly convey to the observer a sense that additional information could be gained by moving deeper into the area. The framework in this chapter, however, implies that deflected sight lines or mystery will be positively related to preference only when the observer judges that new information can be gained at low risk—a position consistent with the well-established point that there is a very close and unstable equilibrium between curiosity and fear (McDougall, 1908; Tomkins, 1962).

Importantly, studies using samples of nonthreatening natural scenes have found that views having mystery consistently receive high preference ratings (R. Kaplan, 1973; Ulrich, 1977). This property, by whatever name, may eventually prove to be one of the most efficacious predictors of liking for visual landscapes. Future investigations that also examine interest (curiosity) in relation to this property are needed.

Water

Water has been described in a large body of intuitive literature as a landscape element that evokes interest, aesthetic pleasantness, and positive feelings, such as tranquility (e.g., Hubbard & Kimball, 1967). Although negative affective reactions can be elicited by some water phenomena (e.g., a stormy sea or a lake dotted with chemical foam pollution), a consistent finding in the experimental literature is that scenes with water features usually are accorded especially high levels of preference or pleasantness (e.g., Brush & Shafer, 1975; Civco, 1979; Palmer, 1978; Penning-Rowsell, 1979; Shafer, Hamilton, & Schmidt, 1969; Ulrich, 1981; Zube, Pitt, & Anderson, 1975). There is considerable evidence to support the conclusion of Zube and his colleagues that water is a dominant visual landscape property that nearly always enhances scenic quality (Zube *et al.*, 1975, p. 152).

The framework assumes that water is a class or dimension of en-

vironmental content that produces ambiances that are effective in quickly eliciting affective reactions. This implies that the preference effects of a water feature stem more from content *per se* than from such informational properties as complexity. Perhaps part of the appeal of water is biologically based and largely independent of informational characteristics and learned associations. In terms of the properties discussed above, water may also enhance preference by serving as a focal element and possibly by increasing subjective depth (Hubbard & Kimball, 1967).

Summary of Visual Properties Influencing Preference

The earlier theoretical discussion argued that feelings of like–dislike arise very early in visual encounters with natural environment as part of the initial generalized affective reaction and subsequently can be refined or modified by the process of cognitive appraisal. The framework postulated that initial affective reactions to natural scenes are elicited by general ambiances or preferenda that for the most part are (1) the presence or absence of gross structural or configurational aspects, (2) gross depth properties, and (3) general classes of environmental content, such as water. The influences of water on affects are further discussed in a later section addressing the issue of differential responsiveness to natural versus man-made content.

The preceding sections discussed several properties that influence liking for *unspectacular* natural scenes. In terms of these properties, a view should be preferred if:

1. Complexity is moderate to high.
2. The complexity has structural properties that establish a focal point and other order or patterning is also present.
3. There is a moderate to high level of depth that can be perceived unambiguously.
4. The ground surface texture tends to be homogeneous and even and is appraised as conducive to movement.
5. A deflected vista is present.
6. Appraised threat is negligible or absent.

Although the above properties in concert will elicit liking, preference will be even greater if a water feature is present.

By contrast, low preference scenes will be marked by

1. either low complexity, or unstructured high complexity with no focal area;
2. restricted depth;

3. rough, uneven ground surface textures that are obstacles to movement;
4. absence of both a deflected vista and water feature; and
5. high appraised threat. (In contrast to the preceding attributes, which are thought to function in an interdependent, or possibly additive fashion, the presence of moderate to high appraised threat can be expected by itself to produce dislike.)

The efficacy of these properties when used in combination to predict preference can be illustrated with data from the roadside study using American and Swedish subjects (Ulrich, 1977). Since none of the 53 unspectacular rural scenes in the study conveyed a sense of threat or contained water, these properties did not influence the results. The patterns of preference ratings for both the Americans and the Swedes were clearly consistent with this model. Both groups accorded moderately high to high preference to views having at least midrange values for complexity, focality, depth, and ground textural evenness. Also, all scenes in the sample containing a deflected vista received high ratings. For individuals from both countries, the most-liked scenes tended to be parklike in appearance. These typically contained scattered trees or groupings of trees, and all had even ground textures. Complexity in the parklike views consisted primarily of vertical elements, such as trees and bushes, which stood out as depth cues against the unambiguous depth sheet of the even ground surface. Complexity therefore was structured and comprehensible, spaces were well-defined, and the settings could be readily grasped in three dimensions. The finding that parklike scenes were highly preferred is consistent with results from other investigations (Rabinowitz & Coughlin, 1970; Ulrich, 1973).

The results for the American and Swedish groups with respect to the low-preference scenes were also in clear agreement with the model. Several views contained unordered high complexity and rough, uneven ground textures and therefore could not be grasped efficiently or unambiguously. Focality was low or absent, and none of the scenes contained a deflected vista. Scenes that were lowest in preference tended to have restricted levels of depth. Views of flat, featureless fields received below-average ratings, probably because of excessively low complexity. These findings, together with other results surveyed earlier, strongly suggest that the properties featured here are major determinants of preference for visual natural environment.

Extent of Agreement among Observers for Preference

Several studies have reported high levels of agreement among individuals in their aesthetic preferences for natural environments (e.g.,

Clamp, 1976; Coughlin & Goldstein, 1970; Daniel & Boster, 1976; Penning-Roswell, 1979; Shafer *et al.*, 1969; Zube *et al.*, 1975, p. 157). Although some of these investigations measured preference (like–dislike), and others used affect-saturated scales such as beautiful-ugly, ratings from these different measures are highly intercorrelated (Zube *et al.*, 1975, p. 162). Therefore, despite somewhat different measures, the studies support the same general picture of agreement. There is absolutely nothing in this substantial body of findings to suggest that aesthetic preferences for natural environment are random or idiosyncratic. To the contrary, the strong implication is that aesthetic preference can be analyzed in terms of underlying principles that are quite general from individual to individual. To the extent that some differences exist between groups of individuals, such variations may often be greater between the public and certain professions (Brush, 1976, p. 54) than among groups defined on the basis of such traditional variables as income or rural versus urban background. In this regard a number of studies have found that preferences of professionals such as architects, landscape architects, and range managers can vary significantly from those of the public (e.g., Buhyoff, Wellman, Harvey, & Fraser, 1978; Daniel & Boster, 1976; R. Kaplan, 1973; Küller, 1972).

CULTURAL INFLUENCES ON AESTHETIC PREFERENCE

Culture unquestionably has important influences on innumerable aspects of persons' relations with the physical environment, from constructing homes, to achieving privacy, to developing world views (Altman & Chemers, 1980). In recent decades considerable work on landscape aesthetics, especially in geography, landscape architecture, and, to a lesser extent, psychology, has stressed culture as a preeminent determinant of preference (e.g., Lowenthal, 1968; Tuan, 1973). A writer of this genre might conclude, for instance, that a given natural setting elicits preference and other positive feelings because landscape painters have taught us that it is beautiful, or because our society has conditioned us to revere wilderness and dislike cities. This literature is characterized by a tendency to emphasize the differences, rather than similarities, in the visual landscape preferences of different groups. Indeed, much of the work explicitly or implicitly suggests that the influences of culture and such factors as adaptation to a given landscape are so great as to preclude major similarities in aesthetic preferences across societies.

Unfortunately, relatively few experimental studies have tested this widely held position that aesthetic preferences are determined largely by culture and therefore vary fundamentally between societies. Because

many more comparative investigations are needed, especially of non-Western groups, the conclusions of studies to date should be interpreted with caution. Nonetheless, it is noteworthy that findings to date unanimously suggest the possibility of similarity between the preferences of different cultures for visual natural environments. For instance, Shafer and Tooby (1973) showed 100 photographs of diverse rural and wilderness landscapes to 250 campers of several different nationalities in Scotland. The campers' preference ratings correlated very highly (.91) with ratings obtained from American subjects in a previous study using the same scenes (Shafer *et al.*, 1969). Indeed, the *r* value is so high that it indicates that the ranked order of scenes in terms of liking was nearly the same for both groups. In the roadside study previously mentioned, the rank-order correlation between the Swedish and American ratings was .88 (Ulrich, 1977). Agreement across groups was nearly perfect in terms of scenes falling in the extremes of either high or low preference. Even more impressive was the finding that the factor structures of the groups' ratings were nearly the same. Factor analysis identified groupings of interrelated scenes that could be easily categorized in terms of differences in ground surface texture, depth, and complexity, suggesting strongly that individuals from both countries responded sensitively to these properties.

Additionally, broad consistencies across cultures in responsiveness to visual environments are suggested by findings from semantic evaluation procedures. Kwok (1979) used Küller's semantic scales and sample of architectural and landscape slides to obtain data from Chinese students in Singapore and from middle-income British professionals in London. Semantic factors identified for both groups were nearly the same as Küller's factors for Swedish subjects (Küller, 1972), which indicates striking similarity across different cultures in terms of the ways in which the various evaluative judgments were related to one another. Likewise, Berlyne and his colleagues found similar factor structures for broad semantic evaluations of abstract visual arrays by (1) Canadian university students and (2) a diverse sample of 300 Banganda farmers and urban dwellers in Uganda (Berlyne, Robbins, & Thompson, 1974). While noting differences among individuals and ethnic groups, the investigators concluded there were "impressive similarities in the ways in which people with markedly different cultural backgrounds respond to the same visual material" (p. 277). Berlyne subsequently (1975) extended this study to include samples of university students and illiterate villagers in India. He found that the tendency to look longer at high-complexity patterns was somewhat greater for the students. However, the groups' factor structures for semantic evaluations (including pleas-

antness) were virtually the same, and they closely matched the factors obtained for the Ugandans and Canadians in the earlier study. These similarities are especially striking in view of the fact that some variance must have been introduced by translation of the scales into the Luganda (Ugandan) and Hindu languages, and because the scales were administered by oral interview to the illiterate groups.

Although far from conclusive, these findings nonetheless cast some doubt on the position that preferences vary fundamentally as a function of culture. One interpretation is that learning experiences may be much more ubiquitous than the descriptive cultural literature suggests. Alternatively, as Berlyne has posited (1971, 1975, p. 328), it may be that preference responses are influenced by characteristics of the nervous system that are universal in our species. Likewise, the psychoevolutionary framework outlined earlier gives rise to theoretical arguments for expecting some similarity to characterize the preferences of different cultures for natural scenes. It will be recalled that emotions are universal and have the same qualities across different cultures. A plausible assumption is that, irrespective of culture, liking motivates the approach class of behaviors and dislike motivates avoidance. In this light, scenes characterized by, for instance, disordered high complexity and restricted depth should tend to elicit initial reactions of dislike in different societies because avoidance is initially adaptive regardless of culture. It would be surprising if one culture liked such views, and individuals accordingly engaged in approach actions that would be maladaptive because observers could not have grasped a setting or completed an appraisal process. Therefore, some correspondence in preference should be evident, since the general approach or avoidance behavior appropriate in a given setting should be more or less similar across cultures.

Another major argument for similarity derives from the fact that there is no evidence that fundamental perceptual and cognitive processes vary between cultures (Cole & Scribner, 1974; Kennedy, 1974). The similarities across cultures in terms of perception and cognition are much more impressive than the differences. Thus, it would be quite unexpected if, for instance, one culture liked views having focality and other structural properties, while another culture liked unordered scenes. Such an outcome would imply nothing less than major differences between the groups in terms of information processing, chunking, and other aspects of cognition. This finding would also conflict with a vast body of intuitive literature, produced over centuries by many cultures, that stresses the importance of structure and composition in landscape design and art, and which implies a measure of cross-cultural agreement in aesthetic preferences (Ulrich, 1977).

These arguments, together with the findings surveyed earlier, imply that much previous work on preferences for visual landscapes has perhaps overstated the role of culture. This in no way suggests that culture is unimportant; indeed, an ideal or complete preference theory should include culture as a component. The conceptual framework assumes that culture is especially important as a factor that can in some instances produce wide variations in cognitive appraisals of natural settings subsequent to initial affective reactions (see Figure 1). In this regard the descriptive cultural literature is particularly valuable for shedding light on learned associations and meanings in relation to landscapes (e.g., Lowenthal & Prince, 1965). The view here is that culture can be a significant variable influencing aesthetic and affective reactions, but that it should not be emphasized to the exclusion of other factors that the experimental literature clearly shows have major—often dominant—effects on preference.

AESTHETIC RESPONSE TO NATURAL VERSUS BUILT ENVIRONMENTS

One of the most clear-cut findings in the experimental literature on environmental aesthetics is the consistent tendency for North American and European groups to prefer natural scenes over built views, especially when the latter lack vegetation or water features. Several studies have been unanimous in showing that even unspectacular or subpar natural views elicit higher aesthetic preference or pleasantness than do all but a very small percentage of urban views (e.g., Bernaldez & Parra, 1979; Kaplan *et al.*, 1972; Palmer, 1978; Wohlwill, 1976, p. 72; Zube *et al.*, 1975, p. 155). Preference levels for the natural scenes are usually so much higher than for the urban views that the distributions of scores for the two domains hardly overlap. This pattern emerged even in an investigation comparing aesthetic preferences for everyday rural scenes and picturesque Scandinavian townscapes (Ulrich, 1981). Also, levels of agreement among individuals' preferences or scenic evaluations tend to be greater for natural than for urban scenes (Coughlin & Goldstein, 1970; Zube, Pitt, & Anderson, 1974). Importantly, the gap in liking or pleasantness between natural and urban views cannot be explained by differences in properties such as complexity and the others discussed above. Rather, individuals appear to respond in fundamentally different ways to natural and man-made material, irrespective of levels of complexity and other variables. One result is a strong tendency for settings containing natural content such as vegetation and water to be preferred.

As mentioned earlier, the presence of water tends to elicit especially high levels of preference or pleasantness. It is also noteworthy that when natural elements are added to urban scenes, preference levels usually rise significantly (Brush & Palmer, 1979; Thayer & Atwood, 1978).

Findings from these studies provide insights into properties that influence whether a visual setting is responded to as natural or man-made (see Chapter 1). Investigations employing factor or cluster analysis have consistently identified groupings or factors of interrelated scenes, where individual factors can be unambiguously categorized as natural or built in character (e.g., Kaplan *et al.*, 1972; Palmer, 1978). Interpretation of scenes comprising such factors indicates that the domain of natural visual environment is by no means restricted to wilderness; it also encompasses man-made settings such as wheat fields, wooded parks, and golf courses. These results suggest the inappropriateness of proposing narrow definitions of what constitutes a natural or a man-made visual environment. In general, American groups appear to respond to a scene as natural if (1) it contains extensive vegetation or water, and (2) if buildings, cars, and other built features are absent or not prominent. To the extent that there is a common general quality to views responded to as natural, it might be characterized as a general ambiance of vegetation and/or water content. These findings support the position that water and vegetation can be considered preferenda that are highly effective in eliciting affective reactions. There is ample empirical justification for including these general classes of content in the list of visual properties that influence aesthetic response.

At this point one might argue that, at certain times, some cultures, including our own, have feared and avoided wilderness environments (e.g., Tuan, 1979). There is no solid evidence, however, that negatively toned affects are elicited by water or vegetation content *per se*. A reaction of strong dislike or fear typically occurs when the context or disposition of natural elements comprising a setting is evaluated as threatening. If an individual responds with fear or uncertainty to a dense forest, this reaction is probably attributable to aggregate properties of the setting and to inferences such as the presence of wild animals, rather than to vegetation *per se*. Therefore, the notion that natural settings sometimes engender fear and dislike is consistent with the conceptual framework and with the preference findings concerning water and vegetation content.

Very little research has addressed behavior motivated by preferences for natural versus urban visual environment. In one study, shoppers in Ann Arbor, Michigan, had a choice between driving on an inter-

state highway or on a parkway to a large shopping center (Ulrich, 1973). The highway was several minutes faster, but its roadside environment was nonscenic, containing several obtrusive man-made structures. In contrast, the longer parkway route provided a continuous sequence of wooded, undeveloped scenes, and at one point motorists could view a riverscape. Despite the longer driving time, slightly more than half the shoppers' trips used the parkway. Results from a questionnaire procedure strongly suggested that the most important reason for choosing the parkway was to experience its natural scenery. This is noteworthy because in applications of cost–benefit analysis to highway planning, dollar benefits are calculated largely on the basis of time savings for motorists. In this manner, benefits that often total millions of dollars annually are attributed to an expressway or other high-speed design that reduces travel time for users. Following the same logic, the visual encounters with natural settings provided by the parkway must be worth a great deal, since drivers consciously gave up substantial amounts of time in order to have these experiences.

Man-Made Features in Natural Settings

The findings summarized in the previous section imply that the presence of prominent man-made features in natural settings will usually depress aesthetic preferences. Some studies have in fact identified strong inverse relationships between liking or rated attractiveness and the presence of built features in natural environments. For instance, Evans and Wood (1980) found that the introduction of even compatible or sympathetic development along a scenic highway in California sharply reduced perceived aesthetic quality. An investigation of English rural landscapes by Clamp (1976) revealed a pronounced negative association between attractiveness evaluations and extent of visible road surfaces. Findings by Brush and Palmer (1979) suggest that certain man-made elements, such as utility poles and wires, can have a more negative influence on aesthetic evaluations than other types of built features.

The design of man-made structures that are visually congruent with natural settings is an important concern of architects, landscape architects, and wilderness managers. In a series of experiments, Wohlwill has shed light on variables influencing the degree of fittingness or congruity between man-made elements in scenes and their natural surroundings (e.g., Wohlwill, 1979; Wohlwill & Harris, 1980). He defines fittingness as the sense of harmony or clashing between a man-made feature and its natural background. Several properties appear to influence whether a feature is evaluated as fitting. Low fittingness (obtrusiveness) correlates

highly with: high color contrast between the feature and its surroundings, high textural contrast, size of the feature, and low congruity of shape (Wohlwill & Harris, 1980). Working in Scandinavia, Sorte (1971) has shown that fittingness and unity are usually greater when the feature is appraised as permanent rather than temporary. Examples of permanent features are most buildings, whereas elements such as billboards and cars are temporary (Sorte, 1971). Although Wohlwill's findings strongly suggest that fittingness can be quite important in influencing liking, this property does not correlate with the judged interestingness of a setting, or with curiosity as measured by number of voluntary exposures to a scene (Wohlwill & Harris, 1980). These results are consistent with the point made earlier that aesthetic preference and interest (curiosity) are largely independent dimensions of affect and can in some instances be influenced in different directions by the same combination of visual properties. Wohlwill's research clearly shows there is no simple general relationship between aesthetic preference and the presence or extent of man-made features in natural settings. Rather, preference can vary widely as a function of the degree of integration of the feature into its surroundings. Interestingly, it appears that in certain instances preference may be greater when there is some degree of contrast or obtrusiveness, which suggests the hazardousness of applying a contrast-minimizing approach to design problems in natural environments (Wohlwill, 1979). Because of their relevance to the design of harmonious blends of the man-made and the natural, more studies are needed to confirm and extend these findings.

OTHER AFFECTIVE-AROUSAL RESPONSES TO NATURAL VERSUS URBAN VISUAL ENVIRONMENT

Apart from the issue of aesthetic preference, a widely held notion in urbanized countries is that experiences with the natural environment can be psychologically healthful (Driver & Greene, 1977; Ulrich, 1979a). The intuitively based idea that people benefit emotionally in some broad sense from contacts with nature often forms part of the rationale for actions preserving wilderness or establishing city parks and urban landscaping programs (Driver, Rosenthal, & Petersen, 1978). Because of the importance of this assumption for many planning and political decisions, research is necessary to evaluate its validity and to increase understanding of the benefits in terms of positively toned emotional states that exposures to nature may provide.

Two recent studies have compared influences of exposures to large samples of natural and urban scenes using broad measures of affec-

tive/arousal states (Ulrich, 1979a, 1981). The first study addressed the restoration hypothesis (see Table 1)—that is, the notion that stressed or anxious individuals tend to feel better after exposure to natural rather than urban views (Ulrich, 1979a). University students who were experiencing anxiety because of a course examination viewed color-slide presentations of either (1) everyday natural scenes dominated by green vegetation, or (2) unblighted urban views lacking vegetation or water. The individuals' feelings were measured both immediately before and after the slide exposures using the Zuckerman Inventory of Personal Reactions (Zuckerman, 1977). Results showed a clear pattern of restoration for the natural scenes, whereas exposure to the urban views actually tended to be detrimental to emotional well-being on some dimensions. The principal differences between the influences of the natural and urban scenes were for factors of Sadness and Positive Affect. Also, exposure to the natural scenes significantly reduced anxiety in terms of a Fear Arousal factor, although the reduction did not differ significantly from a Fear Arousal decline associated with the collection of urban views. The two categories of environment produced quite different changes in emotional states despite the fact that the complexity levels of the slide samples were equivalent. Since complexity has received considerable emphasis as a variable influencing emotional activation, the findings imply that other visual properties, related to natural versus man-made content, were primarily responsible for the differences.

The second experiment, which was performed in Sweden, measured certain physiological as well as emotional responses to natural and urban scenes (Ulrich, 1981). Physiological influences were evaluated in part through recordings of alpha wave amplitude. Alpha is a valid indicator of cortical arousal and is associated with feelings of wakeful relaxation. Unstressed individuals in normal arousal states viewed lengthy color-slide presentations of either (1) nature dominated by vegetation, (2) nature with water, or (3) Scandinavian urban environments without water or vegetation. The three slide samples were equivalent in terms of complexity and information rate. Results revealed a clear-cut pattern for the two categories of natural scenes—especially water—to have more positive influences on affective states. A major finding was that settings with water, and to a lesser extent vegetation views, sustained attention and interest much more effectively than the urban scenes. Importantly, alpha was significantly higher when subjects viewed vegetation as opposed to urban slides and was higher on average during the water than during the urban exposures. Apart from indicating that the scenes had different effects on arousal as a function of environment, the alpha findings strongly suggest that individuals felt more wakefully relaxed while viewing the natural settings. These results, together with those of

the first study, clearly suggest that the significance of visual encounters with natural environment is by no means limited to aesthetic response, but can also include important influences on other emotions and arousal. Although this pattern of evidence favoring natural environments is impressive, it was apparent in these studies that exposure to nature did not have a global, or comprehensively, restorative influence relative to the urban views (Ulrich, 1981). Also, it is likely that the differences between the effects of the environmental categories would have been less if the urban settings had contained prominent amounts of natural content such as vegetation.

Explanatory perspectives stressing either cultural conditioning or adaptation are only weakly consistent with the findings from these two studies. The results were similar for individuals who had grown up in either rural or urban environments. Also, despite the fact the studies were performed in different countries, there was considerable accord in terms of the different emotional influences of natural versus urban content. Cultural traditions and attitudes with respect to nature are quite different in America and Sweden—as expressed, for instance, in folklore, holidays, and common law. The possibility remains, however, that people in both countries tended to associate certain positive experiences, such as vacations, to a greater extent with natural settings, and this may have been a factor in the results.

An alternative explanation for these differential reactions to natural and urban material is implied by the work of authors who contend that response to environment is affected by unlearned factors of evolutionary origin. They assume that because humans evolved over a long period in natural environments, we are to some extent biologically adapted to natural as opposed to built content (e.g., Driver & Greene, 1977; Iltis, Loucks, & Andrews, 1970; Stainbrook, 1968). A theme common to this perspective is that individuals are innately predisposed to respond positively to many natural settings. Such evolutionary notions are not new. For instance, William McDougall argued more than 70 years ago that instinctive or unlearned factors are important in the elicitation of emotional responses (1908). McDougall's views should not be lightly dismissed, because he originated a number of other, remarkably prescient ideas about emotions that have been adopted by contemporary theorists, and which in some instances have been empirically substantiated. McDougall defined an instinct as

> an inherited or innate psycho-physical disposition which determines its possessor to perceive, and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object, and to act in regard to it . . . or at least to experience an impulse to such action. (1908, p. 29, as quoted in Izard, 1977)

Although behavioral scientists no longer use the term instinct in relation to humans, parts of McDougall's statement are quite consonant with the empirical record concerning aesthetic and affective reactions to natural as opposed to man-made environments. Faced with such findings as the strong attention-holding properties of water relative to urban content—irrespective of complexity—or the pattern for individuals from different countries to prefer scenes with water or vegetation, an evolutionary position such as McDougall's may seem as plausible to many researchers as a more traditional explanatory perspective stressing learning or conditioning. McDougall would probably have no quarrel with the concept of preferenda that is a central feature of the psychoevolutionary framework in this chapter. However, the framework also stresses that learned as well as unlearned factors play a critical role in aesthetic and affective response to natural environment.

Visual Landscapes and Psychophysiological Restoration: A Tentative Perspective

On the basis of the admittedly limited evidence from two studies (Ulrich, 1979a, 1981), the proposition suggests itself that restorative influences of unspectacular natural scenes, compared to urban views, may be most pronounced when the observer's initial state is one of stress and excessive arousal. For individuals experiencing stress or anxiety, most unthreatening natural views may be more arousal reducing and tend to elicit more positively toned emotional reactions than the vast majority of urban scenes, and hence are more restorative in a psychophysiological sense. For unstressed individuals in normal arousal states, visual exposures to everyday nature may be more effective in holding interest and maintaining arousal in the comparatively optimal middle ranges. There are as yet no findings comparing natural and urban views for the case of observers experiencing boredom or excessively low arousal. However, it is entirely possible that, for instance, a window view of a lively urban setting would be more stimulating and restorative for a chronically understimulated person (e.g., a nursing home resident or a long-term fracture patient) than the vast majority of unspectacular natural settings.

This general perspective has a number of implications for environmental planning and design. Perhaps location and design decisions for some facilities and institutions, such as hospitals and high-stress workplaces, should place considerable importance on providing visual contacts with nature. Does a preoperative hospital patient experience less anxiety if his window overlooks a wooded park rather than an urban

freeway or parking lot? Do most people recuperate more quickly after a stressful workday if, for instance, their homes allow views of a lake or a forest? Findings from future investigations may indicate the need to evaluate alternative design or planning proposals in light of the potential of different visual environments to influence emotional/arousal states in very different ways.

SUMMARY AND DIRECTIONS FOR RESEARCH

Participants in the developing area of environmental aesthetics and landscape assessment have been considerably more active in generating findings than in formulating theory. Consequently, the rapidly expanding empirical record concerning aesthetic and affective response to natural environments has lacked both the structure and explanatory foundation that could be provided by a well-developed theory. In an attempt to address this weakness, this chapter's coverage has been a balance between findings and theoretical discussion; a principal objective has been to advance an integrated conceptual framework. As its starting point, the framework questions the widely held view that feelings result exclusively from a process of cognition. The cognitive primacy perspective is implicit in many experimental articles, and it dominates the intuitive literature on landscape aesthetics. There is simply no evidence that cognition necessarily precedes affect, and in fact recent findings support the notion that the initial level of response to environment is affective. The theoretical position here is that feelings, not thoughts, come first in environmental encounters, and the observer's initial feeling reaction shapes subsequent cognitive events. The relative sequence of feeling and thinking in environmental encounters represents a fundamental issue that should be addressed in future research. Study designs developed by Zajonc and others for affect/cognition experiments might be adapted for this purpose (for a survey, see Zajonc, 1980).

Aesthetic and affective reactions to the natural environment cannot be understood in any depth if they are treated as isolated phenomena. The framework premises that affective responses are adaptive in terms of the total behavior of the individual and are closely linked not only to cognition, but also to the preceding affective state, neurophysiological activity, and behavior. Since the vast majority of studies to date has been concerned exclusively with aesthetic reactions, the conceptual framework clearly implies a research agenda with a broader array of concerns. This emphasizes the need for studies that include systems and behavior which are inseparably linked to affects. If a thorough understanding of

affective response to natural environment is ever to be achieved, it will be necessary to investigate influences of antecedent states ranging from boredom through both positively and negatively toned states of excitement. Other research needs include the measurement of neurophysiological concomitants of feeling responses to natural scenes and the recording of behaviors or functioning motivated by affects. By integrating such findings with data on aesthetic and emotional reactions, a much more complete and in-depth picture of responsiveness to visual natural environment would emerge. The list contained in Table 1 of arousal changes and behaviors associated with different feeling reactions to nature can be viewed as a set of hypotheses for future research. It should also be mentioned that if more investigators undertake studies that combine measurements of affective responses with recordings of neurophysiological activity or behavior, the field of environmental aesthetics would begin to move away from its excessive reliance on verbal measures. Although physiological activity (e.g., brain waves, cardiac response) is comparatively difficult and time-consuming to record, physiological procedures provide a means for validating results obtained from more subjective measures and have a number of other important strengths in the context of landscape aesthetics research (Ulrich, 1979b).

In addition to these research needs, a number of other important questions remain unresolved. One issue that has received virtually no attention is responsiveness to natural settings containing prominent ephemeral phenomena. The intuitive literature is replete with accounts of emotional reactions to, for instance, sunsets, cloud formations, and freshly fallen snow. Although such occurrences may be infrequent in a given natural environment, some ephemeral conditions probably elicit strong affective reactions and therefore are important factors in many memorable experiences in the natural environment. This topic has been so neglected that even responses to common ephemeral conditions associated with seasonal changes, such as the absence of foliage on deciduous vegetation in winter, have not been empirically evaluated.

Another topic requiring study is variation between individuals in reactions to visual natural environments. The relative lack of emphasis in environmental aesthetics on individual variability is perhaps understandable in light of the high levels of agreement among observers reported by many investigators. Future studies should systematically evaluate individual differences along environmentally relevant dimensions of personality, rather than exclusively in terms of traditional demographic variables such as age, sex, and occupation (Wohlwill, 1976, p. 76–77). One personality dimension that will very likely prove important

is *sensation-seeking*, which can underlie variability in curiosity, risk appraisals, and preferences for complexity and novelty (Ulrich & Zuckerman, 1981; Zuckerman, 1979). From the standpoint of applied concerns such as wilderness preservation and environmental planning, a critical question in need of research is individual or group variability in relation to the perceived importance or utility of natural scenery. Rather paradoxically, there is evidence that despite high agreement in aesthetic preferences, different individuals may vary markedly with respect to the importance or value they place on visual encounters with natural environments (Ulrich, 1973). Perhaps gross differences in this regard will also be found across cultures.

Another important direction of future research concerns the role of environmental adaptation or familiarity in aesthetic preferences for natural scenes. In some instances, high levels of experience or familiarity with a given setting doubtless give rise to attachments or symbolic associations, and possibly adjustment to particular levels of stimulation, which affect the observer's aesthetic and emotional reaction. The question emerges whether most preference variations attributable to adaptation are of wide magnitude, or whether they are more a matter of degree. A further adaptation issue is the extent to which a visual setting can sustain the intensity and quality of an affective response following repeated exposure. Findings from experiments using abstract stimuli suggest the possibility that habituation will tend to occur more rapidly when settings are low in complexity (e.g., Berlyne, 1970). In view of the substantial body of findings showing gross differences in reactions to natural versus urban environments, the question arises: Do observers habituate significantly less or more slowly to natural than to urban content, irrespective of levels of complexity?

Despite these and other research gaps that remain to be filled, considerable progress has already been made in identifying visual properties of natural environments that strongly influence aesthetic response. Investigators have consistently shown it is possible to account for most of the variance in observers' aesthetic judgments. As noted above, an important related finding is the pattern of widespread agreement among individuals and groups in their aesthetic preferences for natural environments. This picture of agreement, coupled with the success in identifying highly efficacious predictors of preference, contradicts strongly the traditional notion that aesthetic response to environment is an inherently subjective phenomenon, impervious to empirical investigation and devoid of underlying principles that hold for different individuals.

One of the most clear-cut and potentially important findings to date

is the consistent tendency for North American and European groups to prefer even unspectacular natural scenes over the vast majority of urban views. This pattern of differential responsiveness appears to extend well beyond aesthetic preference to include other emotions such as interest, and it is probably also expressed in differences in neurophysiological activity. The theoretical view here is that both unlearned and learned factors are responsible for these differences. Debate among investigators will probably intensify over these related questions of responsiveness to natural versus urban scenes and the relative importance of learning as opposed to evolutionary/biological factors. For further elucidation of these issues, one obvious need is a greater volume of cross-cultural studies. However, more convincing conclusions might be obtained from experiments using young children or infants. Psychologists have developed a battery of measures (e.g., eye-movement recording, classification of facial expressions, phasic cardiac response) for assessing attention/interest, and in some cases other responses in children and infants. If very young subjects are shown slides of natural and built settings equivalent in information rate, do the children evidence significantly greater interest in one of the categories of content? If findings from such studies, as well as from additional cross-cultural investigations, were to corroborate the results of studies to date, this would have considerable significance for the environment–behavior field in general. It would imply the need to recognize explicitly the role of natural versus built material in attempts to develop realistic and accurate conceptions of responsiveness to the physical environment.

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