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Evaluating Visual Impacts of Near-View Rock Climbing Scenes

Christopher D. Jones

EXECUTIVE SUMMARY: In light of recent management proposals to increase bans of fixed-climbing anchors, this study examines visual impacts of rock climbing in Rock Canyon Park of Provo, Utah. Visitor responses to photo-based measures of visual preference were obtained during on-site interviews. Undergraduate research assistants distributed a series of questionnaires during the summer of 2001. Questionnaires corresponded to digital photos taken systematically across the cliffs. One hundred forty-three respondents rated a series of 16 photos for visual preference on 5-point Likert-type scales. Three *a priori* hypotheses were tested to evaluate visual impacts of rock climbing: (1) Preference for photos containing evidence of fixed-anchors would not be significantly higher than preference for photos without evidence of fixed-anchors; (2) Photos containing evidence of climbing chalk would not be significantly less preferred than photos containing little or no evidence of chalk; and (3) Being a climber or nonclimber would not significantly determine whether visual preference of scenes containing evidence of rock climbing was significantly higher than visual preference of scenes containing no evidence of rock climbing. Results suggested that proposed park and forest area regulations to eliminate fixed-anchors on the basis of visual impact might be unfounded as evidenced by the finding of no significant differences between an anchors only factor and an anchors and chalk excluded factor. In addition, gymnastic chalk was found to have no significant visual impact upon ratings of cliff environments in Rock Canyon. Climbers' ratings of visual preference for photos containing evidence of rock climbing were not significantly different from non-climbers. Overall, the results suggest that rock climbing has little significant visual impact upon cliff environments in Rock Canyon. Thus, climbing management plans, stating that fixed-anchors create a significant visual impact, appear to be unfounded.

KEYWORDS: Fixed-anchors, visual preference, visual impacts, climbing management plans.

AUTHORS: Christopher D. Jones is with the Department of Physical Education and Recreation, Utah Valley State College, Orem, UT, 84058-5999. Email: jonescd@uvsc.edu. The author would like to thank Cody Watkins, Undergraduate Research Assistant, for data collection and photo editing.

Introduction

The importance of understanding visual impacts is evident in recent controversies related to determining land management practices and regulations aimed at improving the quality of recreational scenery. In the past decade, federal and state land managers interested in conserving

recreational scenery have frequently banned fixed rock climbing anchors citing a visual impact of their presence on the resource. Fixed-anchors have been defined among state and federal agencies to be any temporary or permanent hardware (i.e., bolts or pitons) or nylon slings remaining on cliff or cave environments (Jones & Hollenhorst, 2002). The ban of fixed-anchors has been most frequently imposed by Forest Service officials who have argued that they are opposed to the visual and possible biophysical impacts caused by climbing anchors (Baker, 1999). Despite the lack of empirical investigation to justify the claims of land managers, an increasing number of climbing management plans, including a recent Draft Plan and Environmental Assessment conducted in the Obed Wild and Scenic River System (2002), have stated that fixed-anchors are a visual impact.

A number of approaches have been used in the peer-reviewed literature to address visual impacts to recreational scenery. Theoretical approaches to evaluating scenic quality have often been developed through studies of distant landscape scenes. However, predominant visual preference approaches are less suited to examining visual impacts within near-view scenes, which often have more defined characteristics or site-specific impacts (i.e., climbing anchors). Thus, there is little empirical support for understanding climbing impacts within near-view scenes.

Further examination of the literature reveals alternative theoretical approaches that have more relevance to near-view scenes (i.e., addressing the functional quality of the specific scenery itself rather than the broader visual elements of the scene). However, the relevance of these alternative approaches for examining visual impacts of rock climbing is again lacking. Given the lack of applicability of visual perception approaches for explaining visual impacts of climbing anchors, the primary purpose of this study is to determine whether rock climbing has a visual impact upon near-view cliff scenes. The implications of this study will further the development of the visual perception construct through assessment of impacts within near-view scenes.

The concept of visual preference was originally defined as the extent to which one likes a particular scene or set of scenes. The predominant approaches to understanding visual perception of landscapes have been the psychological and psychophysical which have examined visual perception through estimations of visual preference. Studies that have adopted these approaches have found that human beings always prefer certain types of landscapes to others (Daniel & Vining, 1983; Kaplan, 1987).

The psychophysical approach evaluates the association between landscape content and psychological experiences by determining the relationship between values of specific landscape attributes and ratings of scenic beauty (Daniel & Vining, 1983). For example, in some studies attributes are identified, such as the number of ridges, rolling plateau, and running water, and the objective values of these attributes are compared to subjective responses of scenic beauty measured on Likert-type response scales (Noe & Hammitt, 1988). Generally, studies have shown that

running water has the highest correlation with scenic beauty (McAndrew, 1993). Other physical attributes such as the number of ridges and the size of trees greatly influence the level of aesthetic response to forest scenes (Daniel & Vining, 1983).

The psychophysical approach is rooted in psychophysics, a psychological discipline that examines the relationship between environmental stimuli and human sensations, perceptions, and judgments (Hull, Buhyoff, & Daniel, 1984). This approach assumes a direct stimulus-response relationship between the effect of environment and the individual and assumes a similar response framework between individuals. This approach helps identify landscape features that individuals respond to in a predictable manner. For example, the model identifies some natural features such as waterfalls and ridgelines that tend to increase the attractiveness of landscapes (McAndrew, 1993). The application of the psychophysical approach to near-view cliff scenes is troublesome because of its stimulus-response assumptions. For example, when regressing a number of attributes of the setting (i.e., evidence of chalk, rock color, anchor type, and rock texture) on visual preference responses, the likelihood of finding that certain content would tend to increase the attractiveness of the scene (i.e., the removal of an anchor, the removal of chalk) is very unlikely. This assertion is based on the difficulty of discerning these features from typical trailside viewing distances.

The psychophysical approach has been applied to resource management to demonstrate changes in the site characteristics that impact scenic quality. This approach enables managers to suggest future management practices that may increase the level of scenic beauty, such as selective forest harvesting treatments. One weakness of the psychophysical model is that it adopts a utilitarian approach that emphasizes measures that quantify attributes such as timber and fiber production in order to predict the number of trees to be harvested. Little attention is given to understanding the social-psychological relationship between these physical attributes and scenic beauty (Hull & Buhyoff, 1983). Adopting this approach is problematic because preference for scenery is strongly influenced by a number of social-psychological factors. For example, if one were to apply the psychophysical approach to the study of climbing impacts, scenic beauty could be correlated with the percentage of the cliff face covered by the impacts (i.e., anchors, chalk, etc.). However, these, often difficult to distinguish impacts, may have little negative social meaning to park visitors. For example, in established climbing areas, visitors are often conditioned to viewing chalk stains that have been there for years.

The psychological perspective, proposed by Kaplan and Kaplan (1982), assumes that visual preference is a function of an "evolutionarily determined capacity to evaluate and organize visual information" (Jones, Patterson, & Hammitt, 2000, p. 385; Kaplan, 1973; Kaplan, 1987). The Kaplan's determined that visual preference of a scene is influenced by its organizational properties, including (1) legibility—can be easily read

allowing one to explore without becoming lost; (2) mystery - contains more possibilities than can presently be seen; (3) coherence - comes together as a whole; and (4) complexity—may be overly complex and result in a lesser degree of liking. Visual preference ratings are generally higher with scenes that contain legibility, coherence, and mystery absent of danger (Kaplan & Kaplan, 1982).

The psychological approach also assumes that individuals select scenes that allow them to focus attention on the important content within the scene. Scenes with high visual preference ratings should contain collative properties which facilitate orderly perception including the following: (1) enframement - the setting's appearance as a geometrical picture frame; (2) convergence - point of two lines merging which draw attention to some point on the horizon; and (3) contrast differences between elements of a setting in form, color, or texture that allow one to distinguish between foreground and background (McAndrew, 1993). An example of a scene containing these properties would be a trail with cliffs disappearing into the distance.

While the psychological approach has a strong theoretical framework, from the perspective of managers, it often does not lead to understandings that are easily applicable to predicting aesthetic impacts. For example, although organizational properties often explain much of the variance in forest or overlook scenes, it would be theoretically unfounded to conclude that fixed-anchors, chalk, and other near-view impacts of climbing significantly affect the legibility, mystery, coherence, or complexity of a scene. Thus, because of the abstract nature of these properties, managers may have difficulty applying the results of this approach to decision-making.

One alternative approach that is more appropriate for explaining preferences in near-view scenes is Gibson's Theory of Affordance (1979). This approach assumes that the functional quality of the specific scenery itself, rather than the broader visual elements of the scene, influence visual perceptions and that the individual may prefer scenes that contain information which promotes well-being. Gibson's theory was developed primarily in the study of visual perception, and his affordances generally refer to environmental objects such as substances, media, layouts, and events.

Gibson's (1979) theory assumes that humans perceive in order to operate within the environment. In other words, positive perception of scenery is related to affordances, which are the possibilities for action in the setting. Human beings are presumed to perceive affordance properties in an immediate and direct way such that decision making is determined through visualization. For example, Gibson states that individuals perceive possibilities for action such as hammers for hitting, holds for climbing, ropes for swinging, and hardware for manipulating. Somewhat similar to affective models of visual perception, this theory implies that human beings have evolved with a propensity to perceiving useful opportunities for action.

Although Gibson (1977, 1979) suggests that meanings and values for objects in the environment are external to the individual perceiving them, he states that affordance is not solely the property of the environment, but is jointly determined by the environment and the organism. Thus, the environment furnishes affordances in an ecologically constructive manner. This relationship is best demonstrated by examining Gibson's five types of affordances: (1) biological (i.e., fresh water affords living); (2) physical (i.e., a trail affords locomotion to a destination); (3) perceptual (i.e., a trail sign figure matches the trail angling at the same gradient and in the same direction as the actual trail affording one to navigate the trail with more success); (4) cognitive (i.e., a black diamond on a ski trail sign affords the meaning of a steep slope ahead and danger); and (5) mixed (any combination of the above affordances). Upon first examination, these affordance types would appear to be effective in explaining near-view impacts of rock climbing. However, while bolt hangers may promote safety they rarely promote absolute survival and some ethically sensitive climbers purposely avoid them. Furthermore, although fixed-anchors and chalk promote the affordance of ascending a specific vertical trail, there are often many nearby substitutes to ascend the same cliff face (i.e., a crack that accepts natural protection). Perceptually, climbing anchors provide no apparent affordances. Cognitively, to a sport climber (who primarily relies on fixed-protection), while anchors represent a path of least resistance, they represent little cognitive meaning to the majority of park visitors. Thus, while affordance theory has applications for assessing visual impacts in near-view scenes (i.e., vandalism of park restrooms and trail signs) that are more functional in nature, it has less relevance for understanding visual impacts that are more social in nature (i.e., uncamoflauged anchors violating principles of Leave No Trace).

A second alternative model appropriate to understanding preferences within near-view scenes is Ulrich's (1991) physiological model. This model states that emotional and neurophysiological arousal occur when a visitor views a scene. This type of arousal may affect the preference for specific setting attributes that enhance the well being of the individual. Ruddell et al. (1989) support Ulrich's model by stating that people tend to behave in ways that improve their well being as a result of impulses that are influenced by the level of arousal. This adaptive approach assumes that behavioral responses that can enhance well being are dependent upon the content and configuration of scenes. Thus, the physiological model proposes that natural scenes are often preferred over urban scenes because of their restorative properties (i.e., fresh water lakes, streams, and waterfall scenes) that can potentially alleviate stress. Ulrich states that preference for natural settings is influenced by humans lacking a biological preparedness for urban environments. For example, people have evolved to survive successfully in certain types of natural environments (e.g., savannah-type settings), while the introduction of urban environments is a relatively recent phenomena in terms of biological evolution.

Unfortunately, it is difficult to apply the above theory to visual impacts of rock climbing. For example, does the evidence of chalk on a rock face or the presence of a shiny anchor create a negative stimulus-response? Do cliff scenes with climbing impacts produce a greater level of stress and provide less restoration than cliff scenes without climbing impacts? While the physiological model is appropriate for understanding near-view visual impacts, such as litter and crowds of people that contribute to stressful encounters, the model provides less understanding of visual impacts with a stronger underlying social meaning.

Study Purpose

The purpose of the present study was to assess the near-view visual impacts of rock climbing on cliff environments and to provide empirical data for managers to make informed decisions when proposing rock climbing regulations. Three *a priori* hypotheses were tested to evaluate visual impacts of rock climbing: (H_1) Preference for photos containing evidence of fixed-anchors is not significantly higher than preference for photos without evidence of fixed-anchors. (H_2) Photos containing evidence of climbing chalk is not significantly less preferred than photos containing little or no evidence of chalk. (H_3) Being a climber or nonclimber does not significantly determine whether visual preference of scenes containing evidence of rock climbing is higher than visual preference of scenes containing no evidence of rock climbing.

Methods

The Research Setting

The study was conducted on-site over six days in September 2002 in Rock Canyon Park managed by the City of Provo, Utah. Rock Canyon Park was chosen because it has a high visitation frequency of both climbers and nonclimbers and a central hiking trail that is within a few feet of many popular climbs. Rock Canyon is a relatively long canyon (4 miles) and has over 300 established technical sport and traditional climbs ranging from 5.4 (beginner) to 5.13 (expert).

Sampling

A number of studies have demonstrated that on-site photo-based measures are a valid method of assessing visual preference. In one near-view study, Shelby and Harris (1985) reported that when examining visitor evaluations of ecological impacts at campsites, responses to color prints were similar to on-site evaluations when photos accurately portray what respondents view in the field. Furthermore, in their study of campsite preferences, Brown et al. (1988) reported that ratings and rankings of scenic beauty were higher for on-site judgments when compared to off-site photographic judgments. Hull and Stewart (1992) also suggest on-site photo-based measures are more ecologically valid since they provide a more realistic context than off-site photo assessments (Daniel & Ittelson, 1981; Winkel, 1987). They state that the context in which subjects' responses are

elicited is important because responses (i.e., behaviors, attitudes, emotions, scenic beauty evaluations) are conditional based on the physical, social, and cultural contexts in which they occur.

In the current study, visitors were approached at the trailhead as they returned from their visit and were asked to volunteer for a study of their perception of scenery in Rock Canyon. Approximately 25 respondents over the age of 15 were surveyed from 10:00 a.m. to 6:00 p.m. on each of six days, two days each on consecutive weekends. Research assistants were instructed to sample one visitor per group every 15 minutes. The total sample size was 143 visitors.

A questionnaire was administered that asked visitors to rate 16 photographs of near-view cliff scenes that contained climbing impacts. These photos were taken systematically one week before sampling began from typical viewing distances (three paces from base of climbs) using a 35mm camera. Respondents were asked to view all photos first and then rate them individually. Sampling schedules were selected to ensure visitation from both climbers and nonclimbers.

Two of the original photos were edited to remove climbing impacts. The subsequent photos were systematically ordered in the questionnaire as follows: (1) all impacts present, (2) anchor removed / chalk present, (3) chalk removed / anchor present, and (4) all impacts removed. Respondents rated each photograph for how much they liked it using a 5-point Likert-type scale (1 = not at all to 5 = very much).

Analyses

To establish the homo / heterogeneity of the sample, descriptive statistics were calculated for the variables of gender, age, and years of climbing experience. Next, principal components analysis (PCA) was used to group the photo ratings. Using an unrotated factor matrix, an extraction of factors was determined by eigenvalues > 1. Variables were assigned to a specific factor if they displayed a factor loading > .30. This procedure yielded four factors: anchors only, anchors and chalk excluded, chalk only, and anchors and chalk included (untouched photos). Subject factor scores were then computed for each factor.

The first two hypotheses were assessed with paired t-tests between photo factors to determine the visual impacts of fixed-anchors and chalk. The third hypothesis was assessed with a series of repeated measures ANOVAs to determine differences between pairs of each of the photo factors, while controlling for whether a visitor was a climber or non-climber. Climbers were those respondents who gave a positive response to the question of "Have you ever participated in technical-roped rock climbing?" Results of these analyses were interpreted to be significant at the $p < 0.05$ level.

Results

The mean age of the sample population was 28 years (SD = 13.2). Thirty-six percent (n = 45) of the sample were males and 64% (n = 80) were

females. The mean number of years of climbing experience indicated that the overall sample population was fairly experienced in the activity of rock climbing was (M = 5.6 years, SD = 12.8).

Results of paired t-tests confirmed the first two hypotheses (Table 1). As predicted there were no significant differences between the anchors only factor and the anchors and chalk excluded factor (H_1), the chalk only factor and the anchors and chalk present factor (H_2). Thus, the visual representation of various climbing impacts in the photos did not have a significant effect on the visual preference among Rock Canyon visitors.

Table 1
Mean Differences of Visual Preference Between Photo Factors, Rock Canyon Park, 2001

Variables	Mean	*t*-value	2-tail Sig.
Anchors Only	-.0003		
		-.30	.763
Anchors & Chalk Excluded	.0172		
Chalk Only	-.0056		
		-.13	.893
Anchors & Chalk Excluded	-.0029		
Anchors Only	-.0147		
		.19	.849
Chalk Only	.0000		
Anchors & Chalk Present	-.0001		
		.17	.865
Anchors & Chalk Excluded	-.0143		

The third hypothesis was confirmed by the results of a repeated measures ANOVA. When controlling for whether a visitor was a technical climber, there was no significant within- subjects effect, thus, revealing a lack of differences between photo factor scores. Repeated measures ANOVA revealed that, for visual preference, there was no statistically significant difference [$F(1, 203) = 0.06$, $p > .814$] in test time photo factor scores, for the Anchors and Chalk Excluded and the Anchors and Chalk Present factors, between climbers and non-climbers. Similar analyses were conducted to determine differences among each of the photo factors. Results of ANOVAs also revealed that for visual preference, there were no significant differences between climbers and nonclimbers when examining differences among the remaining pairs of each of the photo factors (Anchors Only, Chalk Only, Anchors and Chalk Excluded, and Anchors and Chalk Present).

Conclusions

The results of hypothesis testing confirmed each of the three hypotheses, indicating that the sampled park visitors do not perceive significant visual impacts of fixed-anchors and chalk. Thus, while park and forest managers claim that fixed-anchors have a visual impact, studies have yet to support these claims. The current findings reveal that visual impacts of climbing are perceived to be much less of a problem than implied by their inclusion as justification for action in a number of climbing management plans. The dichotomy between scientific evidence and managerial attitudes towards visual impacts of climbing is consistent with the findings of Schuster, Thompson, and Hammitt (2001) who found that traditional, sport, and hybrid climbers perceived that managers had little understanding of climbing as an activity and that resources were often micromanaged as a result. Thus, future studies should focus on determining differences between managerial and public attitudes towards the presence of anchors.

In order to more effectively manage fixed-anchor use and avoid unfounded bans based on visual impacts to the resource, there is a need to develop a national dataset on the impacts of climbing. With this data, managers and educators can promote education and appropriate stewardship of practices to avoid future impacts and public misperceptions. To further reduce impacts, educational efforts should focus on the development of a climbing management guide which describes: (1) camouflaging fixed-anchors; (2) placing the first fixed-anchor out of sight from hikers (i.e., 15 ft or more); (3) properly using a hand drill, e.g., placing fixed-anchors during off-peak hours when hikers are less likely to hear the hammer driving the bit; (4) placing fixed-anchors when gear protection is unreasonable; (5) placing fixed-anchors at least 30 feet away from existing routes to deter grid bolting; (6) placing fixed-anchors on quality routes with little vegetation to be climbed over; (7) placing fixed-anchors at intervals necessary to maintain a sense of adventure; and (8) informing climbers to place no fixed-anchors unless absolutely necessary to ascend quality climbs. Future research studies should investigate whether educating about, and practicing of, these low-impact practices decreases managerial and visitor perceptions of visual and resource impacts.

Despite the growing scientific evidence that anchors are not perceived as an impact on the resource, management perceptions may be more guided by the simple knowledge that these “installations” exist on managed lands. Thus, because traditional visual preference approaches provide less understanding of how to measure impacts of climbing, future studies should investigate the social construction of the concept of “visual impacts” to determine how management decisions are influenced by different social preconceptions toward this resource dependent activity.

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