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Nature with a Human Touch: Human-Induced Alteration Negatively Impacts Perceived  
Naturalness and Preferences for Natural Environments

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### Abstract

Natural environments vary in the degree to which humans have altered them; some environments, like wilderness areas, are relatively untouched, while others, like urban green spaces, are heavily manicured. The current research examined the effect of human-induced alteration to natural environments on perceived naturalness and environmental preferences in a student sample (Study 1) and a sample of non-student adults (Study 2). It was predicted that a human-altered natural environment would be viewed as less natural than a non-altered natural environment. It was also predicted that a human-altered natural environment would be viewed more negatively than a non-altered natural environment. Results largely supported these predictions. Human-altered natural environments were viewed as less natural than non-altered natural environments, and across several indicators of environmental preference, participants responded more negatively to human-altered natural environments than non-altered natural environments. Perceived naturalness mediated the effect of human-induced alteration on each environmental preference variable, suggesting that non-altered environments are preferred because they are viewed as more natural than their human-altered counterparts. These findings are consistent with an evolutionary account of non-altered natural environments offering more benefits and entailing fewer costs than human-altered natural environments.

*Keywords:* nature, naturalness, environmental preferences, human impact, conservation

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Natural environments are highly valued and often preferred over urban and built environments (see Hartig & Evans, 1993; van den Berg, Hartig, & Staats, 2007). A common attribute of natural environments is that they contain elements of living systems, including flora and fauna. However, natural environments are a broad and heterogeneous class of environments that can differ in several important respects. In particular, natural environments can vary in their degree of human contact, influence, and management (Bratman, Hamilton, & Daily, 2012). For example, wilderness areas are natural environments that have been subjected to relatively little human-induced alteration, whereas urban greenspaces are natural environments that are influenced heavily by humans. The current investigation examines whether knowledge of human contact and alteration impacts individuals' assessment of the naturalness of natural environments and in turn the value they place on these environments. It was predicted that, all else being equal, a human-altered natural environment would be perceived as less natural and viewed more negatively than a non-altered natural environment.

**The Natural Preference**

Across many domains, natural entities are viewed more positively than their corresponding non-natural, artificial, processed, or built counterparts. For example, natural foods are generally considered more valuable, healthier, and more desirable than processed food or, more generally, food that has been produced with human intervention (e.g., genetically modified foods; Li & Chapman, 2012; Rozin, 2006). Similarly, natural medicines (e.g., ones involving a substance extracted from a plant) are preferred over medicines that have been synthesized in a laboratory (Rozin et al., 2004). Further, this preference for the natural seems to hold for aversive

events, as potential injuries from natural hazards are viewed as less dangerous and less scary than identical injuries from human-created hazards (e.g., an electrical burn from lightning versus a downed power line; Rudski, Osei, Jacobson, & Lynch, 2011).

The natural preference is suggested to be rooted in a biologically-based desire to be in contact with natural entities that contributed to the reproductive success of our ancestors over human evolutionary history (e.g., fresh water; see Kellert & Wilson, 1993; Wilson, 1984); accordingly, the natural preference may be universal (Rozin, 2005, 2006). Initial support for this proposition comes from research indicating that across several Western industrialized countries, free associations to the term “natural” are almost all positive (Rozin, Fischler, & Shields-Argeles, 2012). Rozin and colleagues (Rozin, 2005; Rozin et al., 2004) suggest two distinct bases for the natural preference. First, individuals may prefer natural entities for instrumental reasons. For example, a natural entity may be preferred over a non-natural counterpart because it is assumed to be healthier, safer, or more effective. Second, individuals may prefer natural entities for ideological reasons, such as believing that natural entities are inherently better or morally superior to non-natural entities. Existing research supports the distinction between instrumental and ideological bases of the natural preference, finding that both types of factors predict preferences for natural over non-natural entities (e.g., Rozin et al., 2004; but see Li & Chapman, 2012).

### **Preferences for Natural Environments**

The natural preference is also evident in individuals’ preferences for certain types of environments, with natural environments being preferred over built and urban environments (see Hartig & Evans, 1993; Kaplan & Kaplan, 1989; Ulrich, 1983; van den Berg, Hartig, & Staats, 2007; van den Berg, Koole, & van der Wulp, 2003). For example, photographs of natural scenes

receive higher ratings of pleasantness, liking, and scenic beauty than photographs of urban scenes (Purcell, Lamb, Peron, & Falchero, 1994). Additional theory and research concerns the specific elements within natural environments that lead to positive responses. For example, research based on prospect-refuge theory (Appleton, 1975) has found that natural environments that include prospects (i.e., views outward), refuge (i.e., places to hide or take shelter), and few hazards are preferred over natural environments that do not have these attributes (e.g., Fischer & Shrout, 2006). Similarly, the environmental preference theory of Kaplan and Kaplan (1989) uses a feature-based approach to understanding environmental preferences, and states that natural environments will be preferred to the extent that they are perceived to be coherent and amenable to exploration and way finding.

Research examining preferences between different natural environments has focused primarily on how observable features of the environments impact these preferences. However, less research has examined whether non-observable factors, such as previous knowledge about an environment, might influence environmental preferences. This is a notable limitation because, as suggested by Kaplan (1987), the operative factor in determining how people respond to environments is their knowledge and not merely the sensory information on which some of that knowledge is based. Observable features of environments are a rich source of information, but ultimately it is knowledge generated from both observation and other sources that determines cognitive, affective, and behavioral responses to environments. Additional research examining the effects of environmental knowledge is thus critical for a comprehensive understanding of environmental preferences.

### **Human-Induced Alteration and Perceived Naturalness**

We submit that one key piece of information that impacts responses to natural environments is knowledge of human contact and alteration of the environment. Empirical evidence suggests that a lack of human contact and intervention is a central component of the folk concept of natural (Rozin, 2005; Rozin et al., 2012); that is, entities are believed to be natural to the extent that they have not been created, altered, or changed through human agency. Given this, a natural environment that has been altered through human activity is likely to be viewed as less natural than a non-altered counterpart. Additionally, because natural entities tend to be viewed more positively than non-natural entities, non-altered natural environments should be viewed more positively and preferred over human-altered natural environments. To date, no previous research has investigated the effects of knowledge of human-induced alteration on responses to natural environments. However, initial support for the above predictions comes from research examining the effects of human-induced alteration on perceived naturalness and preferences within the domain of food, where it has been found that foods that have been created or altered by humans are rated as less natural and less acceptable than non-altered foods, even when the foods are stated to be identical in healthfulness, taste, chemical composition, and are otherwise perceptually identical (e.g., Rozin, 2006).

Unlike foods, however, where differences between natural and non-natural entities are often not obvious unless explicitly identified, the naturalness of an environment can in many cases be inferred through perceptual cues that indicate a presence (or lack) of human contact or alteration (e.g., power lines spanning the length of an otherwise empty mountain meadow are a directly observable indication of human alteration). Yet, there also exist many instances of non-obvious human-alterations to natural environments. For example, many outdoor recreational areas, such as national parks, are manicured in subtle ways to be more hospitable to visitors

(National Park Service, 2006). In addition, differences between lakes and reservoirs are not often apparent unless a dam is directly within view. Further, many natural areas are, to varying degrees, a product of land reclamation, whereby active efforts have been made to return a given environment to a more natural state following years of human use (e.g., mining, forestry, etc.; see Environmental Protection and Enhancement Act, 2014). In cases where human impact is not obvious, such as those above, knowledge that humans have in some way altered the environment may nevertheless influence assessments of the naturalness of the environment and, in turn, the value of that environment.

### **The Current Research**

Based on the rationale presented above, across two studies we examined whether knowledge of human-induced alteration impacts the perceived naturalness of ostensibly natural environments and, correspondingly, preferences among these environments. Participants viewed photographs and descriptions of two natural environments that differed only in degree of human-induced alteration (a non-altered and a human-altered natural environment). To isolate the effects human-induced alteration, perceptual differences between natural environments were minimized and then experimentally controlled. Perceived naturalness and environmental preference were measured via responses to several self-report items created specifically for the current research. In general, it was hypothesized that knowledge of human alteration of natural environments would influence perceived naturalness and environmental preferences, such that a human-altered natural environment would be rated lower on perceived naturalness and preference when compared to a non-altered natural environment.

### **Study 1**



In Study 1, participants read a short vignette describing two natural environments and viewed photographs corresponding to both natural environments. Participants then responded to several items assessing the relative naturalness of each environment and their environmental preferences.

## **Method**

**Participants.** Study 1 participants were 57 students (40 female,  $M_{\text{age}} = 26.74$ ,  $SD_{\text{age}} = 10.27$ ) sampled from the undergraduate population of a mid-sized university in the northwestern United States. The majority of the sample was Caucasian (72%). Participants were remunerated with partial course credit for participation.

**Materials and procedure.** The experimental protocol was administered via the online survey administration program, Qualtrics. Participants were allowed to complete the study at the location of their choosing. All materials included in the current study are described below.

Participants were presented with two photographs of mountain landscapes and a short descriptive vignette. The vignette described two ostensibly real locations, labeled Site A and Site B, which were explicitly stated to be similar in most ways yet differing in their degree of human-induced alteration. Site A was specified as the non-altered environment. Site B was specified as the human-altered environment. The term “natural” was not used at any point in the vignette. In addition, care was taken to create objective descriptions of each location and to avoid emotive language that could bias participant responses. The full vignette is provided below:

Site A and Site B are both located in the same general region of Western Colorado. Both sites are approximately the same size (about 66 square miles), and are featured with mountains, foothills, and a centrally located mountain stream. Both sites are very similar in terms of wildlife, vegetation, and topography, but the sites differ in one important way.

The stream in Site A is fed by a large spring located several miles up in the mountains. The stream in Site B was created approximately 75 years ago when a large dam was constructed, many miles outside of Site B, and construction of the dam redirected water flow into this mountain valley. Both streams include similar-sized populations of fish and other aquatic wildlife that are common in Western Colorado. The aquatic wildlife in Site B was introduced following creation of the stream. The aquatic wildlife in Site A is native to the stream.

To minimize observable differences between the two landscapes, the photographs depicting Site A and Site B were selected from an earlier pilot study in which participants rated the aesthetic quality of 22 different photographed landscapes. Based on the results of this pilot study, several similarly-rated photographs were identified and then reviewed by members of the research team for similarity in topography, flora, seasonal cues, and dominant physical features (e.g., rock formations). Following this review, two photographs depicting mountain landscapes with small streams in the foreground were selected. To further ensure that any effects related to perceptual differences between the two photographs were controlled for, the photographs were counterbalanced, such that each photograph was presented as Site A (i.e., the non-altered natural environment) to approximately half of the participants and as Site B (i.e., the human-altered natural environment) to the remaining participants.

After viewing the photographs and reading the vignette, participants responded to six items that directly compared Site A to Site B. Relative naturalness of Site A and Site B was assessed with the item, “Environments differ in terms of how natural they are. Which of these do you believe is a more natural environment?” Participants responded to this item on a 7-point scale ranging from -3 = *Site A is much more natural* to 0 = *They are equally natural* to 3 = *Site B*

*is much more natural.* Visit preference was assessed using the item, “Of these two locations, which would you like to visit more?” Participants responded to this item on a 7-point scale ranging from -3 = *Visit Site A much more* to 0 = *I want to visit both equally* to 3 = *Visit Site B much more*. Predicted enjoyment was assessed with the item, “If you were to visit both of these locations, which would you enjoy visiting more?” Participants responded to this item on a 7-point scale ranging from -3 = *Enjoy Site A much more* to 0 = *I would enjoy them both equally* to 3 = *Enjoy Site B much more*. Support for conservation was assessed using the item, “People and organizations often engage in active conservation of certain environments. If you had to choose, which of these locations would be more appropriate for active conservation efforts?” Participants responded to this item on a 7-point scale ranging from -3 = *Conserve Site A much more* to 0 = *Both should be conserved equally* to 3 = *Conserve Site B much more*. Support for designation as a protected area was assessed using the item, “If you had to choose between these two locations, which do you think should be designated as a protected area (for example, as a National Park)?” Participants responded to this item on a 7-point scale ranging from -3 = *Protect Site A much more* to 0 = *Both should be protected equally* to 3 = *Protect Site B much more*. Relative aesthetic quality was assessed using the item, “Among the two locations, which is more aesthetically pleasing (visually appealing)?” Participants responded to this item on a 7-point scale ranging from -3 = *Site A is much more pleasing* to 0 = *They are equally aesthetically pleasing* to 3 = *Site B is much more pleasing*. The order of the above questions was randomized across all participants.

## **Results**

For ease of interpretation, scores on the six items assessing the dependent variables of interest were reverse-coded such that positive scores indicate greater perceived naturalness and

preference for the non-altered environment (i.e., Site A), scores around 0 indicate no preference between the environments, and negative scores indicate greater perceived naturalness and preference for the human-altered environment (i.e., Site B). Following this, several single-sample *t*-tests with reference value set to 0 (i.e., testing the null hypothesis of no preference between the sites) were conducted to address whether participants preferred Site A or Site B across the assessed variables.

The results of these analyses are displayed in Table 1. As shown, participants rated Site A as more natural than Site B. In addition, participants indicated that they would prefer to visit Site A over Site B, that they would enjoy visiting Site A more than Site B, that they would prefer active conservation of Site A over Site B, and that Site A should be designated as protected area over Site B. Contrary to hypotheses, participants did not indicate a preference concerning the aesthetic quality of Site A versus Site B.

## **Discussion**

The results of Study 1 provide strong initial support for the hypothesis that human alteration of natural environments influences the perceived naturalness of and preferences for these environments. Importantly, effects were observed after counterbalancing and experimentally controlling for observable differences between the two environments, thus ruling out the possibility that the current findings are the result of perceptual differences between the two landscapes. This suggests that even in the absence of observable evidence of human contact, simply knowing that humans have impacted the environment is sufficient in reducing perceived naturalness and preference for that environment. Interestingly, participants did not indicate a preference concerning the aesthetic qualities of Site A and Site B. Perhaps aesthetic preferences, relative to other types of preference, are influenced more by the observable characteristics of

environments, and experimentally controlling for observable differences between the two environments may have effectively eliminated any aesthetic preference between the two sites.

While the above findings provide evidence that human-induced alteration negatively impacts perceived naturalness and preferences for natural environments, Study 1 included only undergraduate student participants, thus limiting the generalizability of the findings. To address this limitation, a non-student sample was selected for Study 2. Additionally, in Study 2 we examined the process by which knowledge of human-induced alteration influences environmental preferences. As stated previously, it is likely that knowledge of human-induced alteration to a natural environment impacts individuals' beliefs about the naturalness of that environment which then in turn impacts environmental preferences. This suggests a mediational model, whereby knowledge of human-induced alteration influences environmental preferences indirectly via perceived naturalness. Accordingly, Study 2 investigated whether perceived naturalness mediates associations between knowledge of human-induced alteration and each indicator of environmental preference.

### **Study 2**

The primary objectives of Study 2 were to (1) conduct a conceptual replication of Study 1 using a non-student sample and (2) examine whether perceived naturalness mediates the effect of human-induced alteration on each indicator of environmental preference. The same photo stimuli and vignettes that were used in Study 1 were again used in Study 2. However, to permit mediational analyses, the response format for the items assessing naturalness and environmental preference were altered such that both environments were rated independently.

### **Method**

**Participants.** Study 2 participants were 100 individuals (50 female,  $M_{\text{age}} = 33.03$ ,  $SD_{\text{age}} = 11.91$ ) sampled via Amazon's Mechanical Turk. The majority of the sample was Caucasian (80%). Participants were remunerated monetarily for participation.

**Materials and procedure.** The experimental protocol was again administered via the online survey administration program, Qualtrics. The photographic stimuli and vignettes in Study 2 were identical to those used in Study 1. As before, the photographs were counterbalanced to control for any perceptual differences between the two environments.

Naturalness and environmental preference were assessed using the same six items described in Study 1. However, the response format for these items was altered to allow participants to rate the non-altered and human-altered environments independently using a scale of 0 to 100. The wording for each item was altered to accommodate this new response format. For example, the item measuring perceived naturalness was reworded to state, "Environments differ in terms of how natural they are. Please rate how natural you think Site A and Site B are on a scale of '0' to '100', with a score of '0' meaning *not natural at all* and a score of '100' meaning *completely natural*." Each participant thus provided a rating for both the non-altered and human-altered environments for each of the six items. The order of items was randomized across participants.

## Results

**Effects of human-induced alteration.** We first examined the effects of human-induced alteration (coded: 0 = non-altered, 1 = human-altered) on each outcome variable using paired-sample *t*-tests. Results of these analyses are displayed in Table 2. As shown, there was a significant effect of human-induced alteration on perceived naturalness, where participants rated the human-altered environment lower in naturalness than the non-altered environment. In

addition, participants rated the human-altered environment lower on visit preference, active conservation, protected area, and aesthetic quality. Although not statistically significant, a marginally significant effect of human-induced alteration in the predicted direction was observed for predicted enjoyment.

**Naturalness as a mediator of human-induced alteration and environmental preference.** We then examined whether perceived naturalness mediated the effect of human-induced alteration on environmental preference. Because each of the variables of interest was a repeated response-level variable nested within participants, we conducted lower level mediational analyses within a multilevel modeling framework (see Bauer, Preacher, & Gil, 2006; Kenny, Korchmaros, & Bolger, 2003). The product of coefficients method was used to test for mediation (see MacKinnon & Fairchild, 2009; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). This method involves (1) estimating the association between the putative causal variable and the mediator, (2) estimating the association between the mediator and the outcome variable, (3) calculating the product of the above coefficients to obtain an estimate of the indirect effect, and (4) dividing the estimate of the indirect effect by its standard error. The resulting value is then compared to a standard normal distribution to determine if mediation is present. Using the above procedures, we conducted independent mediational analyses for each indicator of environmental preference.

Results of this set of analyses are summarized in Figure 1. For brevity, we report only the results for the indirect effects here, as they directly address whether mediation is present. Consistent with predictions, the indirect effect of human-induced alteration on visit preference via perceived naturalness was significant,  $\gamma = -.43$ ,  $SE = .12$ , 95%  $CI = [-.66, -.21]$ ,  $z = -3.73$ ,  $p < .001$ . The indirect effect of human-induced alteration on predicted enjoyment via perceived

naturalness was significant,  $\gamma = -.44$ ,  $SE = .11$ ,  $95\% CI = [-.65, -.23]$ ,  $z = -4.12$ ,  $p < .001$ . The indirect effect of human-induced alteration on support for conservation via perceived naturalness was significant,  $\gamma = -.31$ ,  $SE = .09$ ,  $95\% CI = [-.49, -.13]$ ,  $z = -3.63$ ,  $p < .001$ . The indirect effect of human-induced alteration on support for protection via perceived naturalness was significant,  $\gamma = -.38$ ,  $SE = .11$ ,  $95\% CI = [-.59, -.17]$ ,  $z = -3.55$ ,  $p < .001$ . Finally, the indirect effect of human-induced alteration on aesthetic quality via perceived naturalness was significant,  $\gamma = -.41$ ,  $SE = .13$ ,  $95\% CI = [-.67, -.15]$ ,  $z = -3.29$ ,  $p < .001$ . The above findings thus indicate that perceived naturalness mediated the effects of human-induced alteration on each environmental preference variable.

## **Discussion**

Study 2 provides additional support for the prediction that knowledge of human-induced alteration impacts perceived naturalness and preferences for natural environments. Importantly, these findings were obtained using a non-student sample, thus replicating the findings of Study 1 and providing evidence of generalizability. In addition, the results supported the prediction that perceived naturalness mediates the effect of human-induced alteration on environmental preferences, thus clarifying the process by which knowledge of human-induced alteration is associated with more negative responses to ostensibly natural environments by illuminating the central role that perceived naturalness plays in this process.

### **General discussion**

Across two studies, results generally supported the predictions of the current research. First, human-altered natural environments were rated as less natural than non-altered natural environments, suggesting that alteration of natural environments by humans is associated with decreased perceived naturalness. Second, in both Study 1 and Study 2, participants indicated that



they would prefer to visit and support the active conservation and protection of the non-altered natural environment over the human-altered natural environment. Mixed findings were observed for the predicted enjoyment and aesthetic preference variables. Specifically, participants indicated greater predicted enjoyment of the non-altered environment in Study 1 only, and the non-altered environment was rated as more aesthetically pleasing than the human altered environment in Study 2 only. Despite the seeming instability of the findings regarding predicted enjoyment and environmental preference, it should be noted that for each variable, the nonsignificant findings were in the predicted direction. Third, the results of Study 2 indicated that perceived naturalness mediated associations between human-induced alteration and environmental preference, supporting the prediction that knowledge of human-induced alteration of natural environments impacts environmental preferences indirectly via perceived naturalness.

The current findings raise the question of why people prefer non-altered natural environments to those in which evidence of human alteration is present. In line with research concerning the evolutionary origins of the natural preference in general (Rozin, 2005, 2006) and landscape preferences in particular (Appleton, 1975; Fischer & Shrouf, 2006; Kaplan & Kaplan, 1989; Orians & Heerwagen, 1992), we submit that a preference for non-altered natural environments was selected over the course of human evolutionary history because such environments offered greater benefits and/or entailed fewer costs (on average) than human-altered natural environments.

We offer the following functional explanations to account for the preference for non-altered over human-altered natural environments. First, non-altered natural environments are, by definition, less likely to be inhabited by rival, human groups than those in which evidence of human alteration is present. Over human evolutionary history (and in contemporary hunter-

gatherer societies) trespassers into out-group territories were met with violence, injury, or death (Bowles, 2009). Thus, a preference for non-altered natural environments may be the output of evolved psychological mechanisms that function to prevent intergroup conflict when the costs of such conflict exceed the benefits of the resources that might be gained. Second, non-altered natural environments may also pose less risk of contamination by human-transmitted diseases, a statistical regularity that may have been incorporated into the human behavioral immune system (a suite of psychological processes that promote the avoidance of potentially harmful pathogens; Schaller & Park, 2011). A third possibility is that non-altered natural environments may have a greater prevalence of resources given the absence of rival groups to consume those resources. Taken together, the above suggests that individuals may prefer non-altered natural environments because they are believed to be less dangerous, cleaner, and more plentiful than their human-altered counterparts.

The preference for natural entities over artificial, human-altered entities demonstrated in previous research (e.g., McDaniel & Malone, 2007; Rudski et al., 2011) has typically been explained with reference to the instrumental and/or ideational reasons underlying this preference. The functional perspective described above dovetails nicely with the notion that individuals may prefer natural entities for instrumental reasons (i.e., they provide greater benefits and/or entail fewer costs). The current research, however, does not speak to potential ideational reasons for preferring non-altered natural environments. Researchers have categorized a natural preference as ideational when (1) participants demonstrate a preference for natural entities over their non-natural counterparts despite both options having been described as perceptually and functionally identical, or (2) participants cannot articulate a reason for their preference (e.g., Rozin et al., 2004). Although we do not rule out the possibility that ideational factors may play a role in the

natural preference, we caution against using the above criteria to infer an ideational basis for participants' preferences. For one, research shows that participants may not believe that natural and non-natural alternatives can be identical (Li & Chapman, 2012). In addition, participants may not be consciously aware of the function(s) their preferences evolved to serve (Nisbett & Wilson, 1977; Tooby & Cosmides, 1992;) and may therefore be unable to articulate the instrumental rationale that underlies their preferences. Finally, the ideational perspective lacks heuristic value. It fails to explain why natural entities are considered morally superior, rather than the reverse.

A major goal of environmental psychology in general, and conservation psychology in particular is to investigate and elucidate the psychological factors that impact human engagement in the conservation or preservation of natural environments and resources (Clayton & Saunders, 2012; Gifford, 2008; Oskamp, 2000). The current findings both directly and indirectly concern this goal. First, the current findings indicate that human-altered natural environments are viewed as less natural than non-altered natural environments, and therefore individuals may believe that human-altered natural environments are not natural enough to warrant protection or conservation. The current study provides evidence of this, indicating that participants were less inclined to support actions aimed at the conservation and protection of the human-altered environment than the non-altered environment. Thus, it would seem that when individuals know that a natural environment has been substantially impacted by human actions, they are less likely to support additional action aimed at the responsible management of that environment. This is somewhat ironic, as it suggests that natural environments with the greatest need for responsible management (i.e., those that have been most impacted by humans) may be the least likely to receive it.

Second, the current findings suggest that, all else being equal, individuals are less likely to visit and less likely to enjoy visiting a human-altered natural environment when compared to a non-altered natural environment. Research conducted using the theoretical framework of place attachment (see Lewicka, 2011) has found that mere exposure to natural environments increases attachment to those environments and, in turn, positive environmental attitudes and an increased likelihood of engaging environmentally-responsible behavior (see Korpela, 2012). Thus, if individuals are less likely to visit an environment because it has been altered or impacted by humans in some way, they may then be less likely to support responsible management of that environment. Said differently, human-induced alteration of a natural environment may negatively impact engagement in environmentally-responsible behaviors indirectly via decreased visitation and connection to the environment.

### **Limitations and Conclusion**

The current study is not without limitations. First, participants self-selected to participate in each of the studies, increasing the probability of sampling bias. Future research should therefore address the generalizability of the current results using, for example, probability sampling techniques. In addition, although the current research included both an undergraduate student sample (Study 1) and a non-student sample selected from the general population (Study 2), both samples were from a single Western industrialized nation, and it is unclear whether the results of the current study will generalize to other populations.

Another limitation concerns how we assessed environmental preference and responses to each environment. For many of the preference variables included in the current research, we assessed only participants' beliefs or expectations about how they would respond to each environment and did not assess actual affective or behavioral responses. This is problematic in

that individuals' predictions about how they will feel and/or behave in certain situations (i.e., affective and behavioral forecasts) often do not correspond to how they actually feel and/or behave when those situations manifest (e.g., Diekmann, Tenbrunsel, & Galinsky, 2003; Griffin, Dunning, & Ross, 1990; Wilson & Gilbert, 2005). Moreover, individuals tend to overestimate the degree to which they will engage in socially desirable behavior (Epley & Dunning, 2000), such as those entailed in environmental conservation. Thus, individuals' predictions concerning how they would respond to an altered versus a non-altered environment may not correspond to how they would actually respond to these environments, and future research should examine the effects of human alteration to natural environments on experienced affect and actual behavior.

It should also be noted that we used only one type of environment in our experimental stimuli (i.e., a mountain environment with a central riparian zone), and it is unclear whether similar effects of human-induced alteration would be observed for other types of natural environments. Specific responses to natural environments depend in part on the type of natural environment in question, with certain environments (e.g., savannahs) eliciting more positive responses than others (e.g., deserts; Falk & Balling, 2010). Given this, it is possible that individuals' responses to human alteration of natural environments may depend on the type of environment being altered. An additional question concerns how degree of human alteration impacts environmental preferences. For example, is a natural environment that has been altered only once viewed more positively than a natural environment that has been altered on multiple occasions? Existing empirical research suggests that perceptions of naturalness depend heavily on the process-history of the entity in question, with increased alteration associated with corresponding decreases in naturalness and acceptability (Rozin, 2006). Responses to human-altered environments may therefore depend on the degree (e.g., minor versus extensive) of

alteration. Future research addressing this possibility and the above-listed limitations will provide additional and more nuanced information about the nature of individuals' responses to human-impacted versus non-impacted natural environments.

The natural world has been altered substantially through human behavior, and all evidence suggests that humans will continue to significantly, if not destructively, impact the environment for many years to come (see Intergovernmental Panel on Climate Change, 2014). Given this, one of the most pressing challenges facing human populations in the upcoming decades will be the development of effective strategies aimed at the mitigation of human impact on the environment. The current findings suggest that one potential strategy to promoting positive human-environment interaction and environmentally-responsible behavior may be to emphasize the pristine, wild, and untouched quality of natural environments. Through this, people may view such environments as more natural, more valuable, and more worthy of protection.

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Table 1

*Study 1: Descriptive and Test Statistics (n = 57)*

	<i>M</i>	<i>SD</i>	95% CI [LL, UL]	<i>t</i>	<i>d</i>
Perceived naturalness	1.26	1.52	[.86, 1.67]	6.28***	.83
Visit preference	.65	1.76	[.18, 1.12]	2.79**	.37
Predicted enjoyment	.46	1.39	[.09, .82]	2.48*	.33
Active conservation	.74	1.58	[.32, 1.15]	3.53**	.47
Protected Area	.95	1.49	[.55, 1.34]	4.79***	.64
Aesthetically pleasing	.18	1.70	[-.28, .63]	.78	.11

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 2

*Study 2: Paired-sample t tests of the effects of human-induced alteration on perceived naturalness, visit preference, predicted enjoyment, appropriateness of conservation, designation as protected area, and aesthetic quality of natural environments (n = 100)*

	$M_{\text{non-}}_{\text{altered}}$	$M_{\text{altered}}$	$M_{\text{difference}}$	$SD$	95% CI [LL, UL]	$t$	$d$
Perceived naturalness	93.79	73.42	-20.37	22.79	[-15.85, -24.89]	-8.94***	.89
Visit preference	88.16	81.15	-7.01	21.47	[-2.75, -11.27]	-3.27**	.33
Predicted enjoyment	89.24	85.90	-3.34	18.33	[.30, -6.98]	-1.82†	.18
Active conservation	87.65	82.61	-5.04	15.38	[-1.99, -8.09]	-3.28**	.33
Protected Area	89.89	83.28	-6.61	19.33	[-2.78, -10.45]	-3.42**	.34
Aesthetically pleasing	91.19	87.38	-3.81	16.86	[-.46, -7.16]	-2.26*	.23

†  $p < .10$ . \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

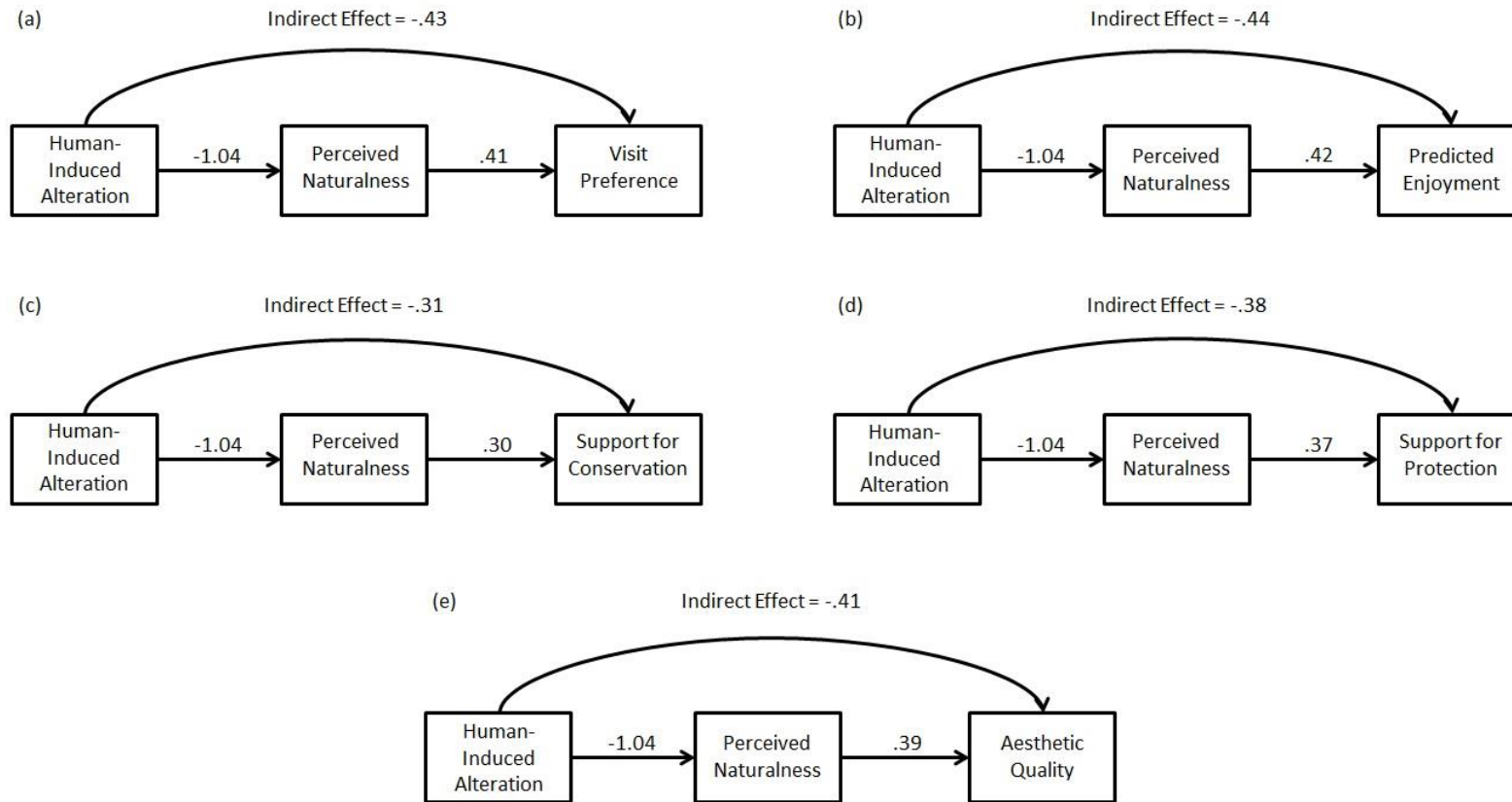


Figure 1. Mediational models with human-induced alteration predicting (a) visit preference, (b) predicted enjoyment, (c) support for active conservation, (d) support for designation as a protected area, and (e) aesthetic quality via naturalness beliefs.

Note. All coefficients are significant at  $p < .001$ .