PSYCHOLOGICAL RESTORATION IN NATURE AS A POSITIVE MOTIVATION FOR ECOLOGICAL BEHAVIOR

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ABSTRACT: Shifting the focus from fear, guilt, and indignation related to deteriorating environmental quality, the authors hypothesized that people who see greater potential for restorative experiences in natural environments also do more to protect them by behaving ecologically, as with recycling or reduced driving. University students ($N = 488$) rated a familiar freshwater marsh in terms of being away, fascination, coherence, and compatibility, qualities of restorative person-environment transactions described in attention restoration theory. They also reported on their performance of various ecological behaviors. The authors tested a structural equation model with data from a randomly drawn subset of participants and then confirmed it with the data from a second subset. For the combined subsets, perceptions of the restorative qualities predicted 23% of the variance in general ecological behavior. As the only direct predictor, fascination mediated the influences of coherence, being away, and compatibility.

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Will people drive less or recycle more only when they feel that they must do so to ward off the threat of ecological collapse? We see in environment-behavior research an emphasis on risks, damages, and moral obligations as the driving forces of ecological behavior (i.e., behaviors that contribute to environmental preservation and conservation) (Axelrod & Lehman, 1993). Although research on negative determinants such as personal threat (e.g., Baldassare & Katz, 1992), harm (e.g., Manzo & Weinstein, 1987), and guilt feelings (e.g., Kaiser & Shimoda, 1999) may help to ameliorate environmental problems, it represents a limited perspective on the motivational basis of ecological behavior. In this article, we apply a complementary perspective that encompasses positive motivations for ecological behavior.

There are solid conceptual grounds for attending to positive as well as negative motivations for ecological behavior. Ecological behavior is commonly understood as a consequence of attitudes and concerns related to habitat destruction, global climate change, and other ecological effects of human activity (e.g., Fransson & Gärling, 1999; McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995; Schahn & Holzer, 1990; Stern, Dietz, & Kalof, 1993). Environmental concern implies a distinction between more and less desired conditions. Accordingly, ecological behavior can be seen not only as a way to avoid undesired conditions (e.g., obliterated habitats) but also as a way to maintain or achieve desired conditions (e.g., intact habitats). More generally, attitudes as cognitive-affective structures that underlie ecological behavior can be positively as well as negatively valenced (e.g., Bogner & Wiseman, 1999; Staats, in press). Positive attitudes toward ecological behavior may involve positive evaluations of the behaviors themselves (e.g., as means to develop competence) (De Young, 1996) or of the consequences of the behaviors (e.g., intact habitats). With respect to the consequences of the behaviors, a positive attitude will often if not always be implicit in statements of negative attitudes toward ecologically harmful human effects, as with environmental concern.

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There are also solid evidential grounds for making more explicit reference to positive motivations for ecological behavior. Abundant anecdotal evidence points to conjoint positive and negative motivations for ecological behavior. Certainly, leaders of the American environmental movement have railed against environmental destruction, but their range of expression has hardly been limited to outrage, bitterness, and disappointment. Appreciation of nature and outdoor life runs through the ecological and activist writings of Aldo Leopold (1949), Rachel Carson (1962), David Brower (1990), and many others (see Fox, 1985). Environmental activists have often stoked people's fears about ecological catastrophe in the effort to sway public opinion, but they have also frequently remarked on psychological values of environments in need of protection.

The simultaneous expression of positive and negative motivations is clearly manifest in efforts to prevent the loss of psychological values of natural environments. Solitude, aesthetic experience, and psychological health have long been major themes in the rhetoric of park proponents in the United States and abroad. People such as Frederick Law Olmsted (1865/1952) and John Muir (1912) articulated prospects for enjoyment of scenery and public recreation in tandem with warnings about flagrant commercialism and ecological destruction on American public lands. Rhetoric such as theirs has frequently been effective, judging from the passage of the National Park Service Act of 1916, the Wilderness Act of 1964, the National Wild and Scenic Rivers Act of 1968, and similar pieces of legislation. Such measures have slowed the erosion of psychological values by physical resource–focused land use practices that are also ecologically unsustainable.

In this article, we start from the possibility that positive experiences in natural environments underlie the formation, maintenance, and modification of positive attitudes regarding ecological behavior and its consequences. We focus on restorative experience as one kind of positive experience frequently sought in natural settings. Restorative experiences involve the renewal of depleted psychological resources. A focus on restorative experience is appropriate; since the time of the Outdoor Recreation Resources Review Commission (1962) report, surveys have consistently identified stress reduction and escape from stressors as important motivations for outdoor recreation (cf. Bultena & Taves, 1961; Driver & Knopf, 1976; see reviews by Hartig, 1993; Knopf, 1987; Schreyer, 1989).

We frame restorative experience here in terms of attention restoration theory (S. Kaplan, 1995). Restoration is seen taking place in situations that involve psychological distance from aspects of one's usual routines and demands on directed attention (being away), effortless attention engaged by

objects in the environment or the process of making sense of the environment (fascination), immersion in a coherent physical or conceptual environment that is of sufficient scope to sustain exploration (extent), and congruence between personal inclinations and purposes, environmental supports for intended activities, and environmental demands for action (compatibility). These constructs can be used to characterize experiences in any environment; however, they were developed through research on the psychological values of natural environments (also see R. Kaplan & Kaplan, 1989; S. Kaplan & Talbot, 1983).

Being away, fascination, extent, and compatibility are qualities of person-environment transactions; they do not exist in the environment or in the person in isolation. We assume that a person's perceptions regarding these restorative qualities provide useful information about the potential for him or her to experience restoration in the given environment. We also assume that the person's perceptions are based on experiences with natural and other environments that varied in the extent to which such perceptions were enabled. Thus, when we refer to psychological restoration in nature as a positive motivation here, we are referring simultaneously to a person's history of restorative nature experiences and to the potential for restorative experiences that the person sees in a given natural environment. Finally, we assume that people who perceive relatively high restorative quality in an unspectacular natural environment are more likely to perceive restorative potential in natural environments more generally.

In sum, we hypothesized that perceptions of being away, fascination, extent, and compatibility in an unspectacular natural environment would be associated with ecological behavior. Toward testing this hypothesis, we asked a sample of university students to rate the restorative qualities of a familiar, unspectacular freshwater marsh and to then complete a measure of general ecological behavior.

METHOD

PARTICIPANTS

The sample consisted of 488 students who were either biology or social ecology majors at the University of California, Irvine. Their median age was 21.0 years (M = 21.4, range = 17 to 50), and 44.4% were male. The students were recruited from various environmental courses.

STUDY SITE

The San Joaquin Marsh Reserve is a 202-acre unit of the University of California's Natural Reserve System. A remnant of a vast freshwater marsh system, the reserve is surrounded by roads and development. Because flood control measures now prevent the passage of San Diego Creek through the marsh, vegetation is no longer flushed out on a regular basis and areas that had been open water have filled with cattails and reeds. The marsh is also bisected by a berm on top of which a major road is situated; this reduces the flow of water within the marsh and so also promotes vegetation buildup. Trails and single-track dirt roads provide access to some areas of the marsh.

The marsh was familiar to all of the subjects. All had visited the marsh as part of ongoing course activity, and the location of the marsh near to the university campus also ensured familiarity with its appearance and extent.

We had several reasons to expect that the marsh would receive low evaluations of restorative potential relative to other natural environments to which the students ordinarily had access, such as local beach, forest, and mountain areas. Among those reasons were the density and uniformity of the vegetation, the extent to which the vegetation limits views within the marsh, the extent to which commercial buildings are present in the longer views available from the marsh, and the audibility of automobile traffic and overflights into a nearby airport. Some representative views from within more accessible areas of the marsh are given in Figure 1.

MEASURES

The Perceived Restorativeness Scale described by Hartig, Korpela, Evans, and Gärling (1997) consisted of 16 items designed to measure being away, fascination, coherence, and compatibility. To strengthen the representation of those constructs, in the present study the earlier items, some slightly revised, were joined with 10 new items. Of the 26 items, 5 represented being away (e.g., "Spending time here gives me a break from my day-to-day routine"), 8 tapped fascination (e.g., "This place has fascinating qualities"), 4 measured the coherence aspect of extent (e.g., "It is chaotic here "), and 9 measured compatibility (e.g., "I can do things I like here"). Respondents used a 7-point scale to indicate the extent to which the given statement described their experience in the given setting (0 = *not at all*, 6 = *completely*). Confirmation of the four-factor structure of the measurement model was for this sample reported by Hartig, Kaiser, and Bowler (1997).

The General Ecological Behavior Scale (Kaiser, 1998; Kaiser & Wilson, 2000) consists of 51 items that represent different types of ecological

Figure 1: Views From Within the San Joaquin Freshwater Marsh Reserve

behavior (e.g., "I bring empty bottles to a recycling bin") and some nonenvironmental prosocial behaviors (e.g., "Sometimes I give change to panhandlers"). Responses were made with a 5-point Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*).[1] Missing values (0.33% of all general ecological behavior item responses) were treated as if participants tended to answer in a neutral way (i.e., they were coded to the middle category indicating neither agreement nor disagreement).

The general ecological behavior measure has been calibrated as a unidimensional scale based on a partial credit model within item response theory (see Wright & Masters, 1982). Despite acceptable indications of reliability and validity, poor general ecological behavior estimates were obtained for 175 of the 488 participants, as indicated by person-related fit indices based on item response theory. Plausible reasons for the problematic scores include an overly differential response format and a restricted range of scores (see Kaiser & Wilson, 2000). The overly differential response format (i.e., Likert-type vs. yes/no) allowed for more arbitrary answers, whereas the narrow distribution of general ecological behavior scores made the whole estimation procedure more problematic given the influence of even small random differences on the estimates. The range restriction presumably is due to the homogeneity of the student sample. Because poor general ecological behavior estimates may affect the remaining results, the analyses to be reported are first carried out with the data from those 313 participants for whom the general ecological behavior estimate is more trustworthy; use of the subsample is assumed by us to be a conservative approach to analysis. This exclusion is a precautionary measure, and the model test is replicated using the whole sample.

The Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960) enabled a check on social desirability response bias. The Marlowe-Crowne scale has also been treated as a measure of a tendency to avoid disapproval (see Paulhus, 1991); however, the conventional reference will be retained here. The scale consists of 33 items. Eighteen of the items must be answered affirmatively to contribute to the social desirability summary score. For example, an affirmative answer to the item "I have never intensely disliked someone" is taken as a socially desirable response and added to the summary score. The remaining 15 items have to be answered negatively to contribute to the summary score (e.g., "I like to gossip at times"). To be consistent with the response options for the ecological behavior items, the original true/false format was changed to a Likert-type scale (1 = *strongly disagree*, 5 = *strongly agree*). Missing values (0.16% of all social desirability item responses) were treated as if participants tended to

answer in a neutral way (i.e., they were coded to the middle category indicating neither agreement nor disagreement).

In addition to the general ecological behavior, perceived restorativeness, and social desirability measures, the study instrument included a set of environmental attitude measures. For further details and the results based on those measures, see Kaiser, Ranney, Hartig, and Bowler (1999).

PROCEDURES

All participants filled out their questionnaires during a single class period either on location in the San Joaquin marsh or in a lecture hall. For those students who completed the questionnaire in the lecture hall, evaluation of the marsh with the Perceived Restorativeness Scale was aided by projecting a color slide of the marsh onto a large screen.[2] The questionnaire required about 35 minutes to complete.

RESULTS

We first checked whether perceptions of restorative quality and reports of ecological behavior were susceptible to a social desirability response bias. A composite score for each restorative quality subscale (mean of all item ratings) was correlated weakly but significantly with the sum of the social desirability item scores: r (social desirability–being away) = .13, r (social desirability–fascination) = .21, r (social desirability–coherence) = .16, and r (social desirability–compatibility) = .22 (all ps $< .01$).[3] The correlation between social desirability and general ecological behavior was more substantial, $r = .29$, $p < .001$ ($N = 488$). Accordingly, we took social desirability into account in the structural equation modeling process.

The next step in the analysis involved establishing and confirming a structural equation model that used students' perceptions of the restorative qualities in the marsh as predictors of their orientation to behave ecologically. Two composite scores apiece were calculated for the Being Away, Fascination, Coherence, and Compatibility subscales for use in the analyses. Each composite score was the average of two or more items from the given subscale.[4]

As a conservative approach to analysis, the initial model test and confirmation of the model were based on the data from that subsample of participants for whom general ecological behavior estimates were relatively more trustworthy ($n = 313$). The results were then checked against the whole sample ($N = 488$). The proposed model corrects attenuation of relationships due

to unreliability in the general ecological behavior measure by setting its reliability to .73, a value previously established for this sample by Kaiser and Wilson (2000). The correlation matrix was used as the input matrix.

The tested model is presented in Figure 2. General ecological behavior is predicted by being away, fascination, coherence, and compatibility, which in turn are free to correlate with one another. Initially, 156 participants were randomly drawn from the subsample of 313; their data were used to test the proposed model. With the exception of general ecological behavior's reliability and measurement error, in this initial test all parameters were left free to vary for estimation by the program (i.e., LISREL 8) (Jöreskog & Sörbom, 1993). The fit indices were excellent: $\chi^2 = 15.36$, $df = 18$, $p = .64$, non-normed fit index (NNFI) = 1.00, root mean square error of approximation (RMSEA) = 0.00. The findings were then confirmed using the data from the remaining participants ($n = 157$) in the subsample of 313: $\chi^2 = 21.60$, $df = 19$, $p = .30$, NNFI = .99, RMSEA = .030. Only one minor modification was required; the error variance of one of the two coherence indicators had to be fixed at 0 so as to not allow it to be negative. Figure 2 represents the model and all the estimates for the reduced sample as a whole ($n = 313$: $\chi^2 = 23.71$, $df = 18$, $p = .16$, NNFI = .99, RMSEA = .032). The fit statistics of the proposed model were acceptable even when the participants with less trustworthy ecological behavior estimates were included ($N = 488$: $\chi^2 = 28.78$, $df = 18$, $p = .05$, NNFI = .99, RMSEA = .035).

The structural model we tested accounted for a substantial amount of general ecological behavior's variance. Twenty-three percent of the variance in general ecological behavior could be explained by the four hypothesized determinants (see Figure 2): coherence ($\beta = .01$), fascination ($\beta = .36$), being away ($\beta = -.11$), and compatibility ($\beta = .23$). However, only the causal path from fascination to general ecological behavior was statistically significant. Significant correlations were found among the predictors of general ecological behavior: r (coherence-fascination) = .20, r (coherence–being away) = .24, r (fascination–being away) = .75, r (fascination–compatibility) = .79, r (being away–compatibility) = .74. Only the correlation between coherence and compatibility was not significant, $r = .04$. Thus, coherence, compatibility, and being away were only indirectly associated with ecological behavior, through their association with fascination.

Descriptive statistics and the correlation matrix that was analyzed ($n = 313$) are provided in Table 1. Note that the means for the various restorative quality scores lie in the midrange of the scale, in line with our expectation that the marsh would receive low evaluations of restorative potential relative to other outdoor natural environments available to the students (cf. Hartig, Korpela, et al., 1997).

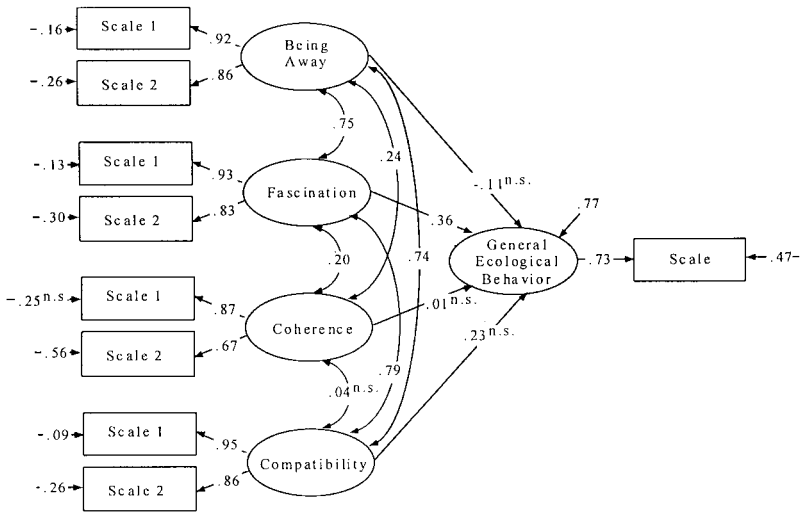

Figure 2: Perceived Restorativeness and Ecological Behavior
NOTE: General ecological behavior is predicted by being away, fascination, coherence, and compatibility ($n = 313$). For being away, fascination, coherence, and compatibility, the two indicators (e.g., Scale 1 and Scale 2) are composed of two to five items each. Because the relations between constructs are directed, arrows indicate such relations. β coefficients (i.e., standardized multiple regression coefficients) represent their strength. Two-sided arrows indicate Pearson correlation coefficients. Arrows without origin indicate proportions of error and unexplained variances. The item response theory-based reliability of the General Ecological Behavior Scale (β = .73), and accordingly the error variance ($\sigma^2_e = .47$), is not estimated by the structural equation approach; rather, it is provided by the partial credit model within item response theory (see Kaiser & Wilson, 2000).

In the interests of parsimony, we tested a model that excluded all three nonsignificant predictors of general ecological behavior (i.e., coherence, compatibility, and being away). This exploratory model yielded sufficient and statistically acceptable fit characteristics: $n = 313$: $\chi^2 = 26.01$, $df = 21$, $p = .21$, NNFI = .99, RMSEA = .028. This finding was also approximately replicated with the whole sample: $N = 488$: $\chi^2 = 42.35$, $df = 21$, $p = .004$, NNFI = .99, RMSEA = .046.

This parsimonious model holds even when we control for social desirability's influence on behavior. Two social desirability indicators were constructed, with one including the positively formulated items of the Marlowe-Crowne scale and the other including the negatively formulated items. When social desirability was included as an additional predictor of ecological behavior, the tests with the subsample of 313 and the total sample

TABLE 1
Correlation Matrix, Variable Means, and Standard Deviations of the Variables Used in the Main Structural Equation Model

				Correlation Matrix							
Scale	n	M	SD	*BA1*	*BA2*	*FA1*	*FA2*	*CO1*	*CO2*	*CM1*	*CM2*
BA1	313	3.93	1.30								
BA2	313	3.89	1.30	.79							
FA1	313	4.48	1.08	.65	.60						
FA2	313	4.66	0.97	.56	.51	.78					
CO1	313	3.99	1.28	.20	.17	.17	.13				
CO2	313	3.88	1.39	.14	.12	.12	.11	.58			
CM1	313	3.69	1.12	.65	.63	.70	.62	.04	.00		
CM2	313	3.77	1.01	.58	.55	.63	.62	.05	.08	.82	
GEB	313	0.05	0.25	.22	.21	.30	.32	.04	.04	.30	.28

NOTE: BA = being away; FA = fascination; CO = coherence; CM = compatibility. Means for these indicators fall on a 0 to 6 scale, with larger values indicating greater presence of the particular restorative quality. The participants' general ecological behavior (GEB) scores ranged between –0.61 (indicative of a weaker orientation to behave ecologically) and 0.92 logits (indicative of a stronger orientation to behave ecologically), which represents a fairly restricted range of scores (see Kaiser & Wilson, 2000). Logits are the basic units of scales based on item response theory (cf. Wright & Masters, 1982).

still yielded acceptable fit statistics: for $n = 313$, $\chi^2 = 47.67$, $df = 33$, $p = .05$, NNFI = .99, RMSEA = .038; for $N = 488$, $\chi^2 = 62.03$, $df = 33$, $p = .002$, NNFI = .98, RMSEA = .042. In both tests of this model, fascination's association with behavior remained significant and appeared to be little affected by the inclusion of social desirability ($\beta = .39$ and $\beta = .35$, respectively) (cf. Figure 2). However, when the 175 participants with poorly fitting general ecological behavior scores were included, social desirability's contribution to the prediction of ecological behavior became more pronounced, as indicated by an increase in the proportion of explained variance from 30% ($n = 313$) to 46% ($N = 488$).

DISCUSSION

We have reported evidence that ecological behavior is associated with a perceived potential for restorative experience in a natural environment. Among the people in our sample, those who found more of interest in a freshwater marsh also engaged in more ecological behavior. This result complements a large and rich body of anecdotal literature that reveals both positive

and negative motivations of park proponents and other environmental activists.

Fascination mediated the associations of the remaining qualities of restorative experience as described in attention restoration theory. Thus, fascination appears in the structural equation model as the sole direct predictor of ecological behavior and at the same time the mediator through which perceptions of being away, coherence, and compatibility exert their influences on ecological behavior. Control for socially desirable responding did not nullify fascination's influence on ecological behavior; however, social desirability was a significant independent predictor of the students' ecological behavior.

Both the Perceived Restorativeness Scale and the General Ecological Behavior Scale are self-report measures. Yet shared methods variance does not provide a plausible account for the relationships we have uncovered. As a check on construct validity, we factor analyzed the combined item sets from the two scales (principal-axis extraction followed by varimax rotation). That the ecological behavior and restorativeness measures do not simply represent the same construct was clearly indicated by the pattern of item loadings. None of the 51 items used to represent general ecological behavior had its largest loading on any factor defined by items meant to represent perceived restorative qualities. Indeed, no ecological behavior item had a loading greater than .31 on the factors defined by restorativeness items. Conversely, none of the 26 restorativeness items had its largest loading on a factor defined by ecological behavior items. None of the restorativeness items had a loading greater than .30 on any of the factors defined by ecological behavior items.[5]

The findings are in a sense conservative. All of the measures had fairly narrow distributions. This suggests that our sample was in relevant respects more homogenous than the encompassing population to which we want to refer our findings. This homogeneity is also apparent in characteristics such as the participants' median age (21 years) and marital status (94.5% single). Their similar life circumstances may have significantly restricted the range of variability in the measures and so attenuated correlations among variables (cf. Fabrigar, Wegener, MacCallum, & Strahan, 1999). Thus, the proportion of explained variance (i.e., 23%) might be more substantial given a more heterogeneous sample. With a more representative sample of adults, we may find a more pronounced relationship between fascination and ecological behavior. At the same time, such a sample should also be less sensitive to a social desirability response bias (cf. Kaiser et al., 1999).

A limit to interpretation of the findings is imposed by the study design. We collected only cross-sectional data, which do not provide conclusive evidence about whether it is ecological behavior or restorative experiences in

natural environments that initiate possible cycles of reciprocal influence (cf. Hartig, Bowler, & Wolf, 1994). Another limitation to interpretation owes to our not having used both negative and positive predictors in our model. We have thus not estimated the extent to which reference to restoration in nature augments the prediction of ecological behavior by variables such as personal threat.

Questions also remain about the process through which restorative experiences in natural environments translate into general ecological behavior. Some elements of an explanation can be found in research on the role of restorative experiences in the formation of place attachments. Restorative experiences occur in ongoing processes of emotion and self-regulation. People often develop emotional attachments to places that reliably support emotion and self-regulation (Korpela, 1992; Korpela & Hartig, 1996). Some evidence indicates that natural settings are disproportionately represented among places that support restorative experiences and to which an attachment has formed (Korpela, Hartig, Kaiser, & Fuhrer, 2001 [this issue]). An emotional attachment to a place may engender protective behavior (cf. Kals, Schumacher, & Montada, 1999). Following this line of thought further, it is appropriate to ask how specific behaviors that are protective of a particular place might generalize to a broader category of behaviors that are protective of a category of places that includes the place for which a specific attachment had formed.

A link between emotional attachment and protective behavior can be described for people's homes as well as for natural environments. The parallels are illuminating. Similar to many natural environments, the home is commonly viewed as a place for restorative experiences (e.g., Després, 1991) and as a locus for attachments (Altman & Low, 1992). Similar to threats to natural environments, threats to the home motivate activism (cf. B. B. Brown & Perkins, 1992). One example of this protective orientation is commonly referred to as the NIMBY (Not In My Back Yard) syndrome (e.g., Benford, Moore, & Williams, 1993; P. Brown & Masterson-Allen, 1994; Takahashi & Dear, 1997). Just as a protective stance toward some favorite natural area may generalize into a range of ecological behaviors, efforts to protect one's own home may also generalize, as suggested by the development of the NIABY (Not In Anyone's BackYard) perspective (Freudenberg & Steinsapir, 1991).

Our findings contribute to the empirical basis for efforts to promote ecological behavior by enabling positive experiences in natural environments. Attention to direct and mediated effects of fascination, being away, coherence, and compatibility may help in prioritizing measures for promoting ecological behavior. In particular, the findings encourage a focus on fascination. Other evidence also encourages such a focus. For example, people who

engage in appreciative rather than consumptive or motor-based outdoor recreation are more likely to behave proenvironmentally (Nord, Luloff, & Bridger, 1998). Presumably, their outdoor recreation is more closely tied to interests related to the environment itself.

Environmental instruction is one way to promote greater interest in natural environments and ecological processes (cf. Bowler, Kaiser, & Hartig, 1999). Increased interest is certainly a goal of the outings that various environmental organizations have used to engage people in efforts to protect particular environments (e.g., Brower, 1990; Farquhar, 1965). As fear and threat can in some instances result in the denial of an environmental hazard, such as when it is perceived to be beyond personal control (cf. Gardner & Stern, 1996), attempting to instill such negative feelings could actually work against involvement in environmentally protective activities. Attention to fascination, restoration, and other positive motivations might be better suited to promoting ecological behavior.

NOTES

1. A yes/no response format has previously been used for the General Ecological Behavior Scale and would seem to be more fitting than a Likert-type scale. However, to be consistent with the response options for environmental attitude items also included in the study instrument (cf. Kaiser, Ranney, Hartig, & Bowler, 1999), the 5-point Likert-type scale was used uniformly. The change in response format did not affect the overall model fit of the General Ecological Behavior Scale except for the person fit (cf. Kaiser & Wilson, 2000). Midpoint responses ranged between 4% and 51% of all answers to the General Ecological Behavior Scale items.

2. That the one group of students completed their forms in the classroom should not be an issue because they had visited the study site previously. Hartig, Korpela, Evans, and Gärling (1997) found that mean Perceived Restorativeness Scale evaluations of other environments did not significantly differ when made on-site or with the aid of slide or video simulations even when participants were not familiar with the appearance of the given site.

3. For some participants, a composite score for one or another of the restorative quality subscales could not be calculated because of a missing value for one or more of the constituent items; for these cases, the mean based on the remaining participants' scores was imputed. For any given composite score, the number of such cases never exceeded 2.5% of the sample.

4. The division in terms of the number of items contributing to each composite score was as even as possible. Again, for some participants the composite score could not be calculated because of a missing value for one or more of the constituent items; for these cases, the mean based on the remaining participants' scores was imputed. For any given composite score, the number of such cases never exceeded 1.2% of the sample. With the exception of the coherence items, the use of different combinations of items for the two composite scores did not substantially change the results. The partition used with coherence items was that which yielded the highest average reliability for the two subsets of items.

5. Note that we refer to multiple ecological behavior factors. Checking shared methods variance as a threat to the construct validities of the outcome and predictors discussed here is complicated by the fact that the outcome variable was derived using an approach to measurement (item response theory) that is different from the measurement approach that underlies the perceived restorativeness variables (classical test theory).

Aggregated measures of ecological behavior based on classical test theory do not consider situational influences on such behaviors. Thus, they do not systematically consider the differential probabilities of endorsement of different behaviors. For this reason, they are commonly multidimensional rather than unidimensional measures (Kaiser, 1998). However, the multidimensional findings (e.g., Leonard-Barton, 1981) are likely to be grounded in difficulty factors or similar statistical artifacts (see Ferguson, 1941). This is because situational influences make some behaviors easier to perform than others (e.g., Guagnano, Stern, & Dietz, 1995). For example, recycling is easier to carry out when recycling bins are readily accessible, and refraining from using a car is more difficult when a well-functioning mass transit system does not exist. As a result, when conventional factor-analytic procedures are used to develop a (multidimensional) measure, the scores subsequently obtained suggest that a person's ecological behavior does not generalize across different behavior domains; if someone recycles paper, he or she may not also refrain from using a car.

To systematically take behavior difficulties into account in the measurement of ecological behavior necessitates the use of an item response theory model, such as the partial credit model (e.g., Wright & Masters, 1982). A person's general ecological behavior level is then measured by the difficulties that he or she actually overcomes (see Kaiser, 1998). Such an ecological behavior measure represents an achievement test of a person's performance. The more numerous the difficulties overcome, the higher the level of general ecological behavior.

Derivation of such an ecological behavior measure does not involve conventional factor-analytic procedures. Thus, when entering the ecological behavior items into a conventional factor analysis as a test of the distinctness of predictors and outcome, we did not expect a single ecological behavior factor but rather a set of factors that in part reflected differences among the behaviors in terms of their performance difficulty (cf. Ferguson, 1941). In line with expectations, when a conventional extraction criterion (eigenvalues > 1) was applied, 21 factors were extracted from the 77-item set. The first factor is clearly defined by perceived restorativeness items. Most of the remaining factors are defined by ecological behavior items. The same basic pattern holds whether one uses the data from the subsample of 313 or the total sample.

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