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The authors investigated the impact of perceived danger on judged likelihood of restoration. Participants imagined that they were in a state of directed attention fatigue and then that they were taking a walk in a potentially restorative setting. The authors varied two properties of the setting in a factorial design. The setting was either a nature trail or a busy urban street, and it contained either no obvious source of danger or an ominous stalker. Measures of perceived danger and of judged likelihood of restoration were obtained. For both types of measures, in the low-danger condition the two setting categories differed, with the natural setting seen as less dangerous and more likely to be restorative. In the high-danger condition, the difference between the setting categories was eliminated. The authors conclude that the presence of a serious and potentially uncontrollable source of danger can damage the perceived restorative potential of a setting.

Keywords: *restoration; danger; mental fatigue; nature; reflection*

The purpose of the study reported in this article was to assess the impact of perceived danger on judged likelihood of restoration. Restoration generally refers to returning to an original state and often carries the connotation that the state returned from is negative. In environmental psychology, the negative state that requires restoration is typically either stress (Ulrich, 1983; Ulrich et al., 1991) or directed attention fatigue (Kaplan & Kaplan, 1989; S. Kaplan, 1995, 2001). Settings that promote restoration from either of these negative states are known as restorative settings. Danger generally refers to situations that carry the risk of serious harm. On intuitive grounds, it seems likely that danger would interfere with the process of restoration, and that is what we expected in this study. We dealt with perceived danger and judged likelihood of restoration rather than their actual counterparts, but the intuition still seems sound.

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Is there any other reason besides intuition to expect a negative impact of perceived danger on judged likelihood of restoration? Two lines of thought, one empirically based and one theoretical, support such a view. The empirically based support comes from an extensive literature investigating the relation between danger and preference. For a review, see Herzog and Kirk (2005). The danger–preference relation is typically negative but varies in magnitude and on the average is not strong enough to consider the two variables as opposite ends of a single dimension. The salient finding is the negative relation, which supports the view that danger can interfere with a positive reaction such as preference. When we add to this picture the finding that preference and judged likelihood of restoration are positively related (e.g., Korpella, Hartig, Kaiser, & Fuhrer, 2001; van den Berg, Koole, & van der Wulp, 2003), one can infer the likelihood of a negative relation between danger and judged likelihood of restoration.

Theoretical support for a negative impact of danger on perceived restoration comes from both the major theories of restoration. In the psychoevolutionary theory (PET) of Ulrich and colleagues (Ulrich, 1983; Ulrich et al., 1991), the body's physiological defenses are weakened by stressful settings. Restoration requires a pleasant and calm setting that can reduce stress and replace negative affect with positive affect. It follows that danger usually (thrill seekers may be an exception) would disrupt such a process. In the attention restoration theory (ART) of the Kaplans (Kaplan & Kaplan, 1989; S. Kaplan, 1995, 2001), directed attention, the kind that requires effort, can become fatigued from prolonged use, leading to the inability to focus attention voluntarily. Restoration requires a setting that is different from the ones that led to fatigue (being away), has sufficient scope and organization to occupy one's mind (extent), holds attention without requiring an effort (fascination), and supports one's inclinations or purposes (compatibility). The converse of the last requirement is that an incompatible setting will require the use of directed attention to cope with the incompatibility and will thus disrupt the process of restoration. S. Kaplan (2001) specifies danger as one of six categories of incompatibility (the others are deficit of information, distraction, duty, deception, and difficulty). He is referring specifically to dangerous situations where there is reason to doubt that one has the ability or competence to cope with the danger. In such situations, a great deal of effortful attention will be expended on tasks such as vigilance and trying to figure out what to do. It follows that the restorative potential of such a setting will be substantially impaired.

Although both major restoration theories predict that danger would interfere with actual restoration, would the same be true for judged likelihood of

restoration? As noted below, for very strong independent variables such as setting type (natural vs. urban), parallel results have been obtained for both actual restoration and judged likelihood of restoration. It was our feeling that danger also represents a very strong independent variable. We develop this point below. Thus, we expected that danger would impact judged likelihood of restoration in much the same way as it would impact actual restoration. However, it is clear from this line of thought that we were not directly testing the restoration theories because of our use of judged likelihood of restoration as our dependent variable. Instead, we were testing a prediction inspired by the restoration theories. We return to the issue of actual versus judged likelihood of restoration in the Discussion section.

Given that there is good reason for expecting a negative impact of danger on judged likelihood of restoration, how great will that impact be? If we consider the sudden or unexpected appearance of a potentially uncontrollable source of danger, then our feeling was that the impact would be very great. In fact, we predicted that such a danger source would either greatly reduce or even eliminate the judged restorative potential of a setting that would typically have an advantage in that regard when no danger was present. In our view, a sudden and uncontrollable danger source overrides all other ongoing cognitive processes and produces a serious and attention-dominating effort to cope. The effect on judged likelihood of restoration should be dramatic. Herzog and Kirk (2005) have proposed that on evolutionary grounds danger should be more salient for humans than preference. They argue that preference is less urgent in that it can be deferred, but generally danger must be given a high priority or survival is threatened. We make precisely the same argument for danger and either actual or judged likelihood of restoration. Serious danger takes center stage and nullifies other concerns.

Although the case for a substantial negative impact of perceived danger on judged likelihood of restoration seems well-founded, we are not aware that the obvious prediction has been directly tested. Even though both restoration theories lead to the same prediction, it is worthwhile to provide empirical confirmation for such a prediction. History provides dramatic examples of widely held beliefs that proved false. Hence, we tested these ideas by comparing two kinds of settings, one of which is known to have an advantage in restorative potential. The two setting categories were a busy urban street and a nature trail. Both PET and ART specify that ordinary natural settings should be very good for restorative purposes because they tend to be generously endowed with the required properties of a restorative setting. A host of studies has supported the advantage of natural over urban settings for measures of actual restoration (e.g., Berto, 2005;

R. Kaplan, 2001; S. Kaplan, 1995; Kuo, 2001; Kuo & Sullivan, 2001; Taylor, Kuo, & Sullivan, 2001, 2002; Wells, 2000) or judged likelihood of restoration (Staats & Hartig, 2004; Staats, Kieviet, & Hartig, 2003). We asked participants to imagine walking in one of the two setting categories after experiencing a serious case of directed-attention fatigue. We crossed the setting categories with the presence or absence of a danger source within the setting in a factorial design. The danger source was an ominous stranger who appeared to be tailing the walker. It was important to us that the danger source was integral to the setting and not simply a manipulation of the participant's emotional state detached from the setting.

We predicted an interaction of setting category and danger condition. In the low-danger condition, judged likelihood of restoration should be greater for the nature setting than for the urban setting. In the high-danger condition, that difference should be reduced or even eliminated. In addition, we examined two measures of judged likelihood of restoration: recovery of directed attention and opportunity for reflection. These two kinds of restorative benefits were first distinguished empirically by Herzog, Black, Fountaine, and Knotts (1997) and later investigated further by Staats and Hartig (2004) and Staats et al. (2003). We used an updated version of the scales used by Staats. We had no prior reason to expect any difference in the impact of danger on these two kinds of restorative benefits. Indeed, if danger is as dominant as we expected, any difference in its impact on the two measures would be surprising.

Method

Participants

The sample consisted of 308 undergraduate students at a university in the Midwestern United States. Participation fulfilled a course requirement for introductory psychology. A total of 10 sessions were run, with the number of participants per session ranging from 26 to 35. The participants were young (91% less than 20 years old), single (98%), and predominantly female (79%).

Stimuli and Measures

Each participant read two scenarios. The first, which all participants saw in exactly the same version, was an attempt to get them to imagine a state

of directed-attention fatigue. Written instructions directed them to imagine that they were the person in the following account:

> This semester you have studied intensely. Now, at the end of the week of exams, you really have had it. You have difficulty concentrating and are very irritable.

The scenario was borrowed from Staats et al. (2003) who provided evidence of its effectiveness as a manipulation.

The second scenario consisted of four versions that manipulated the independent variables of setting category and danger level. Written instructions directed the participants to think of the account that followed as a continuation of the previous account (the fatigue scenario) and again to try to imagine that they were the person involved. The basic kernel of the scenario was as follows: "You decide to take a walk along [description of setting here]. After walking for awhile, [description of danger level here]. . . . and leave the area." The setting description for the busy urban street was as follows: ". . . a city street. There are few people on the sidewalk, but traffic in the street is very heavy. The noise from the traffic is loud." The setting description for the nature trail was as follows: " . . . a nature trail in the woods. It is very quiet on the trail, but you can hear leaves rustling in the breeze and birds chirping." The low-danger description was as follows: " . . . , you decide that you've had enough and leave the area." The high-danger description was more elaborate:

> You suddenly have the unmistakable feeling that eyes are boring into the back of your head. You glance back and notice a stranger several yards behind you. He is wearing a long dark coat and a hat, and he seems to be looking at you. You stop walking and so does he. When you resume walking, he does too. You try this ploy a few more times, and every time you stop, so does he. The whole experience is beginning to creep you out, so you walk quickly to the end of the (block, trail) and leave the area.

The two words in brackets represent the sole difference between the urban and natural versions of the high-danger description.

Five variables were measured via Likert scales. All items used a 7-point step scale for responding that ranged from "strongly agree" through "neutral" to "strongly disagree." The first two items followed the attention-fatigue scenario and were intended to measure its effectiveness. The items were "I am familiar with the state of mind described above" and "I can easily imagine being in the state of mind described above." Immediately

following the walking scenario was the stem "I find this situation:" and a list of eight adjectives intended to measure perceived danger and preference, presented in a randomized order. The adjectives were pleasant, scary, positive, frightening, dangerous, attractive, agreeable, and threatening. The four positive adjectives were borrowed from Staats et al. (2003) Factor analysis of standard scores obtained separately within each of the four experimental conditions confirmed that the eight adjectives were measuring two constructs corresponding to perceived danger and preference.[1] Our primary interest was in using the perceived danger scale as a manipulation check on the danger manipulation.

Immediately following the adjectives was a set of items to measure judged likelihood of restoration preceded by the stem "After this walk, I think I would be likely to:" We used all the recovery and reflection items (7 and 6 items, respectively) from Staats et al. (2003) and supplemented them with additional items of our own devising so that we had a total of 10 items each intended to measure recovery and reflection. The entire set of items is reproduced in the Appendix. Factor analysis of standard scores obtained separately within each of the four experimental conditions confirmed that the 20 items were measuring two constructs corresponding to recovery and reflection. Only two items intended to measure recovery failed to load adequately on either factor. Those items were "come to rest" and "put everything aside." The findings of the experiment were the same with or without those items included in the recovery scale. The results below are for the scale without the two items.

The restoration items were followed by five items assessing personal information and then two sets of self-report items that were not used in the analysis. The total number of self-report items in the booklet was 62.

Procedure

After obtaining informed consent and going over instructions for how to fill out the survey, the researcher passed out booklets containing the scenarios and scales and allowed participants in each session to work at their own pace. Responses were entered on computer forms for scanning into a data file. Within each session, the booklets containing the four versions of the walking scenario were passed out in a randomized order with the constraint that each sequence of four booklets constituted one replication of the 2×2 factorial design. The purpose was to insure that a roughly equal number of each version was used within each session. Final sample sizes were 78 and 79 for the urban low- and high-danger conditions and 76 and 75 for the

nature low- and high-danger conditions. Most participants required from 20 to 30 min to complete the survey.

Results

Reliability and Manipulation Checks

Internal consistency for the five measured variables was assessed by computing coefficient alpha. For the two-item attentional-fatigue familiarity scale, coefficient α based on the entire sample of 308 was .70. The remaining measures came after the walking-scenario manipulation, and thus coefficient alpha was computed separately within each of the four experimental conditions. The coefficients ranged from .73 to .86 for preference, .78 to .88 for perceived danger, .86 to .89 for judged recovery, and .85 to .87 for judged reflection.

The mean rating for the attentional-fatigue familiarity scale was 5.98 (out of a possible 7), indicating that the participants were very familiar with the state of directed attention fatigue and could easily imagine being in that state. The mean ratings for the perceived danger scale are presented in Table 1. Analysis of variance revealed that the interaction of setting category and danger level was significant, $F(1, 304) = 18.20$, $p < .001$, as were both main effects, $F(1, 304) = 28.24$, $p < .001$ for setting category and $F(1, 304) = 860.57$, $p < .001$ for danger level. As indicated by the subscripts within the table, tests of the simple main effect of setting category for each danger level showed that the two setting categories differed significantly in the low-danger condition but not in the high-danger condition. Tests of the simple main effect of danger level for each setting category showed that the two danger levels differed significantly in both setting categories Thus, although the urban setting was seen as more dangerous when there were no obvious danger cues, the high-danger manipulation raised perceived danger in both setting categories to the same high level.

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The major findings of the experiment are presented in Tables 2 and 3, which contain the mean ratings for judged recovery and reflection, respectively. A slightly different pattern of results was obtained for the two measures. For both measures, the interaction of setting category and danger

Table 1
Means for Perceived Danger as a Function of Setting Category and Danger Level

	Setting Category		
Danger Level	Urban	Natural	Mean
Low			
M	3.38_a	2.22_b	2.78
SD	1.30	1.11	
High			
M	6.27_c	6.14_c	6.21
SD	0.83	0.78	
Mean	4.81	4.17	

Note: Means with different subscripts within rows or columns differ significantly at $p < .025$ in tests of simple main effects.

level was significant, $F(1, 304) = 15.92$, $p < .001$ for recovery and $F(1, 304) = 5.29$, $p = .022$ for reflection, as was the main effect of setting category, $F(1, 304) = 14.43$, $p < .001$ for recovery and $F(1, 304) = 10.31$, $p < .005$ for reflection. The main effect of danger level was significant for recovery, $F(1, 304) = 57.24$, $p < .001$, but not for reflection, $F(1, 304) = 3.18$, $p = .076$, although the trend was in the predicted direction. Tests of the simple main effect of setting category for each danger level showed that for both measures the two setting categories differed significantly in the low-danger condition but not in the high-danger condition. Tests of the simple main effect of danger level for each setting category showed that for both measures the two danger levels differed significantly in the nature category. However, in the urban category, the two danger levels differed significantly for recovery but not for reflection. Thus, the nature setting category was seen as more conducive to recovery when there were no obvious danger cues, but both setting categories were reduced to the same level of judged likelihood of recovery in the high-danger condition. The pattern was slightly different for reflection. Although the setting category effects were similar to those for recovery, high danger reduced judged likelihood of reflection only for the nature category.

Preference and Relations Among Measured Variables

The results for the preference scale are presented in Table 4. Although preference was not our primary focus, it is clear that the preference results

Table 2
Means for Perceived Recovery as a Function of Setting Category and Danger Level

	Setting Category		
Danger Level	Urban	Natural	Mean
Low			
M	4.18_{a}	5.13_{b}	4.65
SD	1.01	.91	
High			
M	3.74_{c}	3.72_{c}	3.73
SD	1.14	1.22	
Mean	3.96	4.43	

Note: Means with different subscripts within rows or columns differ significantly at $p < .025$ in tests of simple main effects.

Table 3
Means for Perceived Reflection as a Function of Setting Category and Danger Level

	Setting Category		
Danger Level	Urban	Natural	Mean
Low			
M	4.13_{a}	4.74_{b}	4.43
SD	.98	.96	
High			
M	4.18_{a}	4.28_{a}	4.23
SD	1.06	.92	
Mean	4.15	4.52	

Note: Means with different subscripts within rows or columns differ significantly at $p < .025$ in tests of simple main effects.

were similar to those for judged likelihood of recovery. The interaction of setting category and danger level was significant, $F(1, 304) = 148.88$, $p < .001$, as were both main effects, $F(1, 304) = 128.85$, $p < .001$ for setting category and $F(1, 304) = 770.08$, $p < .001$ for danger level. Tests of the simple main effect of setting category for each danger level showed that the two setting categories differed significantly in the low-danger condition but not in the high-danger condition. Tests of the simple main effect of danger level for each setting category showed that the two danger levels differed significantly

Table 4
Means for Preference as a Function of Setting Category and Danger Level

	Setting Category		
Danger Level	Urban	Natural	Mean
Low			
M	3.17_{a}	5.60_{b}	4.37
SD	1.05	1.11	
High			
M	1.54_{c}	1.47_{c}	1.51
SD	.72	.68	
Mean	2.35	3.55	

Note: Means with different subscripts within rows or columns differ significantly at $p < .025$ in tests of simple main effects.

in both setting categories. The nature category was higher in preference when there were no obvious danger cues, but both categories were reduced to the same low level of preference in the high-danger condition.

Correlations among the preference, danger, recovery, and reflection measures were based on standard scores obtained separately within each of the setting-by-danger conditions.[2] The correlations are presented in Table 5. As is evident, preference was negatively correlated with perceived danger and positively correlated with judged likelihood of recovery. In addition, the two judged likelihood of restoration measures were positively correlated with each other.

Discussion

The results indicate that the perception of a serious and potentially uncontrollable source of danger has a damaging effect on the judged prospects for restoration. The results were obtained with an experimental procedure featuring random assignment to conditions and including a manipulation check, which showed that perceived danger had an opposite pattern of results from those for perceived restoration. This gives us a high degree of confidence that it was the perception of danger that did the damage to judged likelihood of restoration. The opposing pattern of results was perfect for the measure of recovery, but there was a slight departure for the measure of reflection. Instead of reducing judged reflection in both setting categories, as was the case for

Table 5
Correlations Among Measures of Preference, Perceived Danger, Judged Likelihood of Recovery, and Judged Likelihood of Reflection

	1	2	3	4
1. Preference	—			
2. Danger	−.32*	—		
3. Recovery	.27*	−.07	—	
4. Reflection	.08	.06	.40*	—

Note: Correlations are based on standard scores obtained separately within each setting-by-danger condition. $N = 308$.
*$p < .001$.

recovery, high danger reduced judged reflection only in the nature category. We are disinclined to make much of this anomaly until it is replicated. We are far more impressed by the fact that high danger eliminated the traditional advantage of an ordinary natural setting over an urban setting for both judged restoration measures. Thus, people see little promise of restoration from a walk in the woods unless they feel safe.

The practical implications seem clear but are worth making explicit. People are unlikely to reap the restorative benefits of natural settings if they avoid them. People will avoid such settings if they feel that serious danger is likely for two reasons. First and foremost, there is the threat. Second is the perception that no restoration can be achieved in such a setting. In fact, ART implies that one's cognitive state may get even worse if one enters a dangerous setting because such a setting is not neutral with respect to the use of directed attention. Rather, the incompatibility of having to deal with a potentially uncontrollable danger imposes a further drain on directed attention, exacerbating its fatigue. Thus, for restorative purposes, it is paramount that people feel safe in such settings. Perceived safety is a goal that can be addressed at several levels. At the level of design, much has been written about how design features (e.g., good lighting and visibility, lack of hiding places, limbed-up trees) can contribute (e.g., Herzog & Kutzli, 2002; Herzog & Leverich, 2003; Herzog & Miller, 1998; Kuo, Bacaicoa, & Sullivan, 1998; Nasar & Jones, 1997). At the social and political levels, one can support policies and programs that encourage vigilance and a sense of ownership of natural settings as well as those that tend to eliminate negative images of such settings by making them unsafe for social predators.

Several issues of generality are raised by the results of this study. First, there are the issues of whether results for college students apply to other

demographic groups and whether scenario manipulations tell us anything about the real world. The generalizability of results from college students is best settled by future research, but there are meta-analytic data that provide grounds for optimism (Stamps, 1999). Carefully crafted scenario manipulations in environment–behavior research have been shown to be effective and to have some validity beyond the laboratory setting (Leff & Gordon, 1979). Use of images rather than scenarios would raise the possibility that peculiarities of the sampled images might limit generalizability of results. That problem could be overcome only by broad sampling of images, which would make the procedure far more cumbersome. Given that we seek reactions to generic danger situations, effective scenario manipulation can avoid such problems. Staged danger manipulation would likely be precluded on ethical grounds.

Another issue is whether results for judged likelihood of restoration tell us anything about actual restoration based on performance measures such as the sustained attention measure used by Berto (2005). We have already noted that perceived restoration is important in its own right because expectations can influence behaviors that bear on actual restoration. Here, we would reiterate that for potent independent variables such as setting type (nature vs. urban), judged and actual restorations have shown similar results. As we argued earlier, the right kind of danger (the ominous stalker) would also seem to be a potent independent variable. Our results for danger were consistent with that impression. Thus, we have some grounds for believing that our results would be replicated with performance measures of restoration. However, the only way to be sure is to replicate our study with such measures.

Some of the most interesting issues of generality involve the independent variables of this study, setting category and danger. As regards settings category, we pursued the by now traditional comparison of ordinary nature with a busy urban setting. Some research has begun to investigate other possibilities for restorative settings such as museums (Kaplan, Bardwell, & Slakter, 1993), monasteries (Oullette, Kaplan, & Kaplan, 2005), and favorite places (Korpella et al., 2001), and we are aware of ongoing work involving urban parks, cafes, shopping malls, and churches. Comparison of the impact of danger on judged or actual restoration across a variety of such settings would surely be informative. Some of these settings raise other pertinent issues. Does the presence of others who could aid in dealing with danger blunt the impact of danger? Even if one is alone, do the spiritual resources associated with a religious setting help counteract the impact of danger?

A final direction for further exploration has to do with danger itself. The danger source in our scenario had four key properties. It was sudden, serious,

potentially uncontrollable, and social in nature. All of these properties are worthy of investigation. Does the impact of a danger source change when its onset or the perception of its presence occurs more gradually? What if the danger source is physical (a sudden electrical storm or the growling of a wild animal) rather than social (a stalker)? Herzog and Smith (1988) found differences between social and physical danger as they relate to environmental preferences. Might there be similar differences in their relation to restoration? We suspect that the most potent of the four properties are seriousness and uncontrollability. What if the stalker is not so relentlessly ominous as in our scenario? What changes will begin to lower the perceived menace? What if the stalker smiles or is female? Finally, what if the walker has an ace in the hole, an equalizer, say a can of mace or a miniature tazer or even a cell phone? It seems clear that there is a rich agenda for future research on perceived danger and restoration.

Appendix

Perceived Restoration Items Used in the Experiment

Come to rest
Reevaluate my beliefs and values (–)
Think about myself in relation to other people (–)
Be able to finish things I have started (+)
Think about my place in the larger scheme of things (–)
Be able to order my thoughts (+)
Renew my energy (+)
See things in a new perspective (–)
Be able to get really absorbed in a task (+)
Lose all tension (+)
Examine my goals for the future (–)
Digest my daily experiences (–)
Make plans for the future (–)
Think about my relationships with other people (–)
Be able to concentrate again (+)
Become myself again (+)
Think of new approaches for dealing with problems in my life (–)
Put everything aside
Think over what is really important in my life (–)
Keep my mind on what I am doing (+)

Note: (+) indicates recovery items and (—) indicates reflection items.

Notes

1. The two factor analyses described in this article used principal-axis factoring and a varimax rotation. They were performed on standard scores obtained separately within each setting-by-danger condition to avoid any distortions in the correlations attributable to the effects of the manipulated variables. To determine factor composition, we defined a pure loader as an item with a rotated factor loading of |.40| or greater on one factor only. Factor-based scores were obtained by averaging the item scores for pure-loading items.

2. Here again the purpose of obtaining standard scores separately within each condition was to avoid distortion of the correlations attributable to effects of the manipulated variables.

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