Gatersleben, B & Andrews, M (2013). When walking in nature is not restorative—The role of prospect and refuge. *Health & Place*, 20, 91–101.

When walking in nature is not restorative – the role of prospect and refuge

Abstract

People tend to recover more quickly from stress and mental fatigue in natural than in urban environments. But, natural environments may not always be restorative. They can be full of dangers or factors that demand attention, for instance, to avoid tripping over or getting lost. We know relatively little about the restorative potential of different types of natural environments. Two experiments were conducted to examine restoration in natural environments with different levels of accessibility, prospect (clear field of vision) and refuge (places to hide). An on-line survey examined perceived restoration of environments presented in a slide show. A second study examined actual restoration in response to the slide show (in a laboratory) and in response to walks in a real outdoor setting. The findings demonstrate that exposure to natural environments with high levels of prospect and low levels of refuge, is indeed restorative. However, exposure to environments low in prospect and high in refuge is not and may even further increase levels of stress and attention fatigue. These findings demonstrate that natural places may not always be restorative places.

Exposure to natural environments can improve mood, reduce blood pressure and heart activity and improve people's ability to concentrate. There is much evidence that natural environments can be more restorative than built environments (for reviews see Bowler, Buyung-Ali, Knight & Pullin, 2010 and Health Council of The Netherlands, 2004). However, not all natural environments may be restorative. Dense wooded areas, for instance, may not be restorative as they can evoke a sense of fear of getting lost or being attacked and they may require concentration to find ones way around. This paper uses Prospect-Refuge Theory (Appleton, 1975) to examine how the physical structure of a natural environment may enhance or reduce actual and perceived restoration.

In Environmental Psychology two theories have been devised to try and explain what makes an environment restorative and to help explain why natural environments typically provide greater restorative benefits than urban environments. Ulrich's (1983) Stress Recovery Theory (SRT) claims that restoration is derived from the reduction of stress and the corresponding negative emotion through interacting with a physical environment that is a source of reprieve rather than stress. Non-threatening natural environments provide a restorative setting where solace and refuge can be taken from the everyday pressures of life and environmental stressors such as noise, overcrowding and the invasion of personal space. In support of SRT, it has been shown that viewing natural environments fosters faster and greater recovery from physiological stress than viewing urban environments, for instance, by lowering blood pressure and heart rate (Hartig, Evans, Jamner, Davis & Gärling, 2003; Laumann, Gärling & Stormark, 2003; Ulrich, Simons, Losito, Fiorito, Mailes, & Zelson, 1991) or reducing hand sweating and muscle tension (Ulrich et al., 1991). Moreover, positive changes in self-reported mood tend to be greater during and after exposure to natural environments than non-natural environments (Cackowski & Nasar, 2003; Hartig et al., 2003; Ulrich et al., 1991).

Kaplan's (1995; Kaplan & Kaplan's, 1989) Attention Restoration Theory (ART) adopts a cognitive framework to explain the restorative process. Two main types of attention are distinguished; directed and involuntary. Directed attention forces the mind to actively engage and focus attention (for instance on a difficult task) even in the presence of more exciting stimuli (Kaplan & Kaplan, 1989). Like a battery, our directed attention capacity is limited and can be depleted by completing an intense task. ART

proposes that our directed attention is best recharged through exposure to a source of involuntary attention. Attention Restoration theory attributes particular value to natural settings as settings for directed attention restoration. This has been supported by several studies (Hartig et al., 2003; Tennessen & Cimprich, 1995; Berto, 2005).

Both theories suggest that not all natural environments may be restorative. SRT suggests that a restorative environment is one that provides a source of solace and reprieve and is devoid of every day stressors. For ART restoration comes from the recovery of directed attention fatigue. An environment that demands directed attention to negotiate or to keep a look out for threats is unlikely to be restorative (Kaplan, 1995). But we know relatively little about the environmental properties that affect restoration.

The vast majority of research on restorative environments compares prototypical examples of non-threatening natural environments with stressful build environments (e.g. Berto, 2005; Hartig et al., 2003; Parsons, Tassinary, Ulrich, Hebl & Grossman-Alexander, 1998; Roe & Aspinall, 2010). Moreover, much of this research takes place in laboratory settings (e.g. Hartig et al., 1996; Staats & Hartig, 2004; Ulrich et al., 1991 – see Hartig et al., 1991; Hartig et al., 2003; Kaplan & Kaplan, 1989, for exceptions). But many natural environments are not like this and not all experiences in nature are positive (Van den Berg & Ter Heijne, 2005). Yet, very few studies examine the features of restorative environments (Bowler, et al., 2010).

Nature contains many different sources of stress, danger and threat that may or may not evoke negative reactions, including natural threats such as predators, venomous animals and lightning (Tooby & Cosmides, 1990) as well as social threats such as the threat of being attacked by another individual (Burgess, 1998; Coble, Selin & Erickson, 2003). Indeed enclosed, dark and dense wooded areas may prove intimidating rather than therapeutic (Milligan & Bingley, 2007). Safety can be a real concern in natural places (Krenichyn, 2006).

The few studies that examine threat in nature demonstrate that the two variables are not necessarily negatively related. Some people have positive emotional and physiological experiences by overcoming sources of physical danger in awe-inspiring nature (e.g. Kaplan & Talbot, 1983). Positive responses to wilderness include increased energy, self-confidence and feelings of awe that may lead to deeper thought and

reflection on life (Ewert, 1986; Kaplan & Kaplan, 1989; Kaplan & Talbot, 1983). Even fearful encounters in more everyday nature are not always negative (Van den Berg & Ter Heijne, 2005).

Density may be one important factor that affects people's experiences in a natural environment and therefore the restorative potential of that environment. Prospect-refuge theory (Appleton, 1975) provides a theoretical framework that is particularly relevant here. The theory postulates that humans prefer environments high in prospect (clear field of vision) and refuge (places to hide) because they afford survival from living hazards by offering early observation and a chance to attain shelter. Appleton (1975) claims that perceived levels of prospect and refuge are determined by various physical or symbolic attributes of the surrounding environment: "Any feature or situation which directly facilitates observation or indirectly suggests an opportunity to extend the field of vision fits into the category of prospect; any which affords, or symbolically suggests an opportunity to hide or attain shelter fits into the category of a refuge" (Appleton, 1975, p.85). Features of both prospect and refuge have been linked to perceptions of danger in urban (Nasar & Fisher, 1993; Nasar & Jones, 1997) and natural environments (Andrews & Gatersleben, 2010; Chapin, 1991; Herzog & Kirk, 2005; Herzog & Kutzli, 2002); although Stamps (2008a and b) found little consistent evidence of the role of prospect-refuge on preferences. This research, however, focused mostly on simulated environments and did not study restoration. Grahn and Stigsdotter (2010) suggested that refuge is one of the most significant variables in restorative environments for stressed individuals.

One of the issues with Appleton's theory is that environmental features that afford refuge for a potential victim also act as a potential hiding place for offenders (Warr, 1990; Hassinger, 1985; Fisher & Nasar, 1992). Fisher and Nasar (1992) created a typology for evaluating an individual's perception of safety including both affordances for victims as well as offenders because. Both field research and experimental studies have demonstrated that environments low in prospect and escape for potential victims but high in refuge for potential offenders are perceived as less safe than environments high in prospect and escape for the potential victim but low in refuge for the potential

offender (Fisher & Nasar, 1992; Nasar & Jones, 1997; Petherick, 2000/2001; Wang & Taylor, 2006).

Although the typology is yet to be tested within natural environments, there appears no reason why it would not form an applicable framework to understand perceptions and restoration in such environments. The threat of being attacked by another person is still a realistic possibility within a natural environment (particularly for women; e.g. Coble et al., 2003; Henderson & Bialeschki, 1993) as is the fear of becoming lost (Bixler, Carlisle, Hammitt & Floyd, 1994; Coble et al., 2003; Kaplan & Talbot, 1983) or to step on a snake, trip over a tree, get chased by a swarm of bees or get caught in a thunderstorm (Bixler & Floyd, 1997; Van den Berg & ter Heijne, 2005). High levels of prospect and escape combined with low levels of refuge would help an individual identify and avoid such dangers. One would therefore expect such an environment to be perceived as more safe than a similar one with little prospect and escape and high levels of vegetation concealing possible dangers. And this may affect the perceived and actual restorative potential of such environments. However, this has not yet been studied in detail. The closest existing research has got to examining how specific physical features of the natural environment impact on perceived restoration is from Staats, Gatersleben and Hartig (1997) who studied the effects of density and accessibility on mood change with a simulated forest hike. They found that low levels of accessibility (manipulated by a path or no path) resulted in the lowest reported levels of pleasure. Given that restoration is not confined to emotion, further investigation into the area is required. From an SRT (Ulrich, 1983) perspective, the perception of danger is more likely to create stress than dispel it. This would disrupt the restoration process because restoration requires a calming environment devoid of stress. In ART (Kaplan, 1995; Kaplan & Kaplan, 1989), the recovery of attentional fatigue requires a setting that is compatible to restoration. If it is not, the individual has to direct attention to overcome the incompatibility (for instance to find one's way around), thus disrupting the restoration process.

Natural environments may not always be restorative environments. The levels of prospect (clear field of vision) and refuge (number of hiding places) may be particularly important when studying experiences in nature. This paper presents two studies which

examine the role of prospect and refuge on perceived (study 1) and actual (study 2) restoration in natural environments. Both studies focused on a country park in the UK. Such parks incorporate a range of different types of natural landscapes. There are over 270 of them in England, covering over 38,000 hectares and the majority are located on the rural-urban fringe collectively receiving an estimated 73 million visitors per year (Countryside Agency, 2004). The identification of physical features that enhance or reduce restoration in natural settings can be valuable for the design and management of such parks to ensure they remain restorative and valuable to visitors.

STUDY 1

Study 1 examines whether natural environments with high levels of accessibility and prospect and few hiding places (high prospect-low refuge) are perceived as less dangerous, evoke less fear and are perceived as more restorative than less accessible environments with low levels of prospect and many hiding places (low prospect-high refuge). It also examines whether prospect-refuge affects perceived restoration by affecting perceptions of danger and fear. This first study was conducted in an economic way (a large sample on-line experiment) to provide an initial insight into the relationship between environmental restoration and prospect-refuge.

Respondents and design

Two hundred and sixty nine respondents consisting of students and alumni of a University in the South-East of England were recruited using a snowball sampling technique through social networking websites (198 female; $M = 22.48$ years, $SD = 7.84$ years; 18-27 years). Respondents were randomly assigned to one of three simulated environmental conditions that differed in levels of prospect-refuge according to Fisher and Nasar's (1992) typology: low (poor field of vision, many hiding places and poor accessible), $n = 90$; medium, $n = 89$; high (clear field of vision, few hiding places and highly accessible), $n = 90$). Participation in the study was voluntary and no compensation was given.

Environmental simulations

The three environmental conditions were represented using a series of photographs that had been taken for this study in a country park in the south of England. An initial set of 124 photographs were taken, all on a summer afternoon under sunny and clear weather conditions. Photographs did not contain human beings or animals.

A small pre-test was conducted with 7 respondents (4 female; $M = 32.15$ years, $SD = 8.16$ years; 20-56 years). They were asked to sort the 124 photographs into one of three piles representing low, medium or high agreement in response to three independent questions measuring prospect ('The extent to which your view is unobstructed to allow your field of vision to extend deep into the scene'), accessibility ('The ease in which you can move through the scene') and the number of hiding places ('The number of potential hiding places and opportunities for concealment').

For the low prospect-high refuge condition, the photographs that were ranked in both the bottom 20% for prospect and accessibility and the top 20% for hiding places were selected. For the medium prospect-refuge condition, the photographs that were all ranked in the middle 20% for prospect, accessibility and hiding places were selected. For the high prospect-low refuge condition, the photographs ranked in both the top 20% for prospect and accessibility and the bottom 20% for hiding places were selected. This resulted in 36 photographs equally divided between the three conditions. The 12 photographs that were chosen for each condition were arranged into a believable sequence with respect to landscape and light to depict a short walk through the environment (see Figure 1). To help emphasise the physical structure of the environment, each condition was preceded by a short description of the walk that respondents were about to see in the photographs (see Staats et al., 1997). For instance, respondents in the low prospect-high refuge condition read the following description: *'You are taking a short walk alone through a country park. You have entered a dense forest-like area that is becoming wilder and less well kept. The tall trees block out the sun making it darker. The undergrowth and overhanging branches from the trees are blocking your views further into the forest. There is no obvious trail and you really have*

to find your way past fallen branches and other obstructions that make the area difficult to walk through. It is hard to see clearly ahead and back where you have come from'.

Figure 1

Measures

Perceived danger was measured using 3 items (e.g., How likely do you think it is that you could come to harm during your walk through this environment?; 1 = *not at all*, 7 = *very much so*). The scale had a respectable level of internal consistency (Cronbach's $\alpha = .73$).

Fear was measured using 3 items: "How frightened/scared/uneasy would you be taking a walk through this environment? (1 = *not at all*, 7 = *very much so*). The scale had high internal consistency (Cronbach's $\alpha = .93$).

Perceived restoration was measured using Han's (2003) self-rating restoration scale (SRRS) which consists of 8 items spread equally across four dimensions; emotion (I feel anxious - relaxed), cognition (I feel attentive to the present scene), physiology (my breathing is become faster) and behaviour (I would like to stay here longer). Respondents were asked to indicate how much they agreed with each statement (1 = not at all, 9 = very much so). The overall perceived restoration score was calculated by taking the mean average of the four dimensions, with higher ratings indicating greater perceived restoration. The scale had high internal consistency (Cronbach's $\alpha = .93$).

Manipulation items were included to check that the manipulation of prospect-refuge was successful. Three items asked respondents "How clear is your view allowing your field of vision to extend deep into the scene?" (prospect), "How easily do you think you could move through the scene?" (accessibility) and "How many potential hiding places and opportunities for concealment are there for another person?" (refuge). The response options all ranged from 1 (*not at all clear/ not at all easily/ very few hiding places*) to 7 (*very clear/ very easily/ many hiding places*). Respondents were also asked how often they visit country parks (1 = *not at all often*, 7 = *very often*) and how

representative they believed the slide show was of a typical country park in the United Kingdom (1 = *not at all*, 7 = *very much so*).

Procedure

An online questionnaire was developed for the study. Respondents were e-mailed a link to the study that instructed them to complete it at the end of a fatiguing working day in a quiet environment without any distractions. This was done in an attempt to put respondents in a higher and more consistent state of need for restoration and to avoid distractions during the experiment. Following a brief explanation of the study, respondents were randomly assigned to one of the three conditions by means of a computer program which was embedded in the on-line survey. They were given the short walk description and instructed to imagine they were taking the walk for real before viewing the twelve photographs. The photographs were presented as a slideshow, with each photograph displayed for 3 seconds before merging into the next one. Because the questionnaire was quite long it was split into three blocks (two blocks included aesthetics and safety questions which are not relevant for this paper). Respondents saw the same slide show three times after each time they were given one block of questions. The order of the blocks of questions was randomised. After completing the dependent measures, respondents were asked to complete the manipulation check items and indicate their age and gender.

Results

Manipulation checks

Given that differences in environmental preference ratings have been shown to be a function of age, gender and landscape exposure (e.g. Lyons, 1983), it made sense to ensure that between-group differences were minimised and the groups were as homogenous as possible. No significant differences in age ($\chi^2(2) = 0.22, p = .89$), gender ($\chi^2(2) = 0.22, p = .90$) or experience of visiting country park environments ($F(2, 266) = 2.48, p = .09$) were found between the three conditions.

The respondents indicated that they considered the slides to be largely representative of a walk through a country park in the United Kingdom ($M = 5.24, SD = 1.26$) and these

ratings were not significantly different between the three conditions ($F(2, 266) = 0.62, p = .54$). The manipulation of prospect-refuge appeared successful, with the mean ratings of prospect, accessibility and number of hiding places found to differ significantly (see Table 1).

Table 1 here

Effect of prospect-refuge

To test the effects of prospect-refuge on perceptions of fear, danger and restoration, a series of one-way between-subjects analyses of variances each with 3 planned contrasts were conducted. This analysis was chosen as we did not have specific hypotheses about the type of relationship between prospect-refuge and perceived restoration in terms of linearity.

Table 2 here

Significant differences in perceived danger were found between the three prospect-refuge conditions ($F(2, 266) = 11.88, p < .001, \eta_p^2 = .08$, see Table 2). Planned contrasts revealed that perceived danger ratings from the low prospect-high refuge condition were significantly greater than for those from both the medium prospect-refuge condition ($t(266) = 2.69, p < .01, d = .33$) and the high prospect-low refuge condition ($t(266) = 4.87, p < .001, d = .60$). The difference in perceived danger ratings between the medium and high prospect-low refuge conditions was also found to be significant but statistically weaker than the other two comparisons ($t(266) = 2.16, p < .03, d = .26$).

Significant differences in fear were also found between the three prospect-refuge conditions ($F(2, 175.13) = 21.64, p < .001, \eta_p^2 = .15$). Fear ratings from the low prospect-high refuge condition were significantly greater than for those from both the medium prospect-refuge condition ($t(172.02) = 4.31, p < .001, d = .66$) and the high prospect-low refuge condition ($t(165.21) = 6.58, p < .001, d = .67$). The difference in fear ratings between the medium and high prospect-low refuge conditions was also found to be

significant but slightly statistically weaker than the other two comparisons ($t(174.75) = 2.32, p < .03, d = .35$).

Significant differences in perceived restoration were found between the three prospect-refuge conditions ($F(2, 266) = 36.35, p < .001, \eta_p^2 = .22$). Perceived restoration ratings were significantly lower in the low prospect-high refuge condition than in the medium prospect-refuge condition ($t(266) = 5.67, p < .001, d = .70$) and the high prospect-low refuge condition ($t(266) = 8.24, p < .001, d = 1.24$). Perceived restoration ratings from the high prospect-low refuge condition were also significantly greater than those from the medium prospect-refuge condition ($t(266) = 2.65, p < .01, d = .32$).

To test whether the link between prospect-refuge and restoration was mediated by perceptions of danger and feelings of fear we conducted two separate mediation tests for each of these variables. Of course, danger and fear are likely to be related and so it would be possible to test other models as well. However, as it is beyond the scope of this paper to test different models of fear and danger analysing the two variables separately was deemed most appropriate.

Overall prospect-refuge was significantly related to perceived restoration ($B = 1.04, \text{error } B = .13, p < .001, \text{adj } R^2 = .20, F(1, 267) = 69.13, p < .001$). Simple regression analyses also revealed that prospect-refuge was a significant predictor of perceived danger ($B = -.48, \text{error } B = .099, p < .001$) and that perceptions of danger significantly explained perceived restoration ($B = -.90, \text{error } B = .06, p < .001$). The extent to which prospect-refuge predicted perceived restoration was significantly reduced when controlled for the mediating effect of perceived danger ($B = .66, \text{error } B = .10, \text{Sobel } z = 4.55, p < .01$).

For fear similar results were found. Prospect-refuge significantly predicted fear ($B = -1.09, \text{error } B = .16, p < .001$) and fear significantly explained perceived restoration ($B = -.68, \text{error } B = .03, p < .001$). As indicated, prospect-refuge significantly explained perceived restoration ($B = 1.04, \text{error } B = .13, p < .001$) but again this relationship was significantly reduced when controlled for the mediating effect of fear ($B = .34, \text{error } B = .08, \text{Sobel } z = 6.56, p < .001$).

The findings of this study demonstrate that accessible natural environments with clear lines of vision (high prospect) and few hiding places (refuge) are perceived as more restorative and less dangerous and evoke less fear than inaccessible environments with no clear lines of vision (low prospect) and many hiding places (refuge). Moreover, the mediation analyses suggested that the effect of prospect-refuge on perceived restoration may be partially mediated by perceptions of danger and fear. Perceptions of fear and danger may therefore help explain why some natural environments may not be perceived as restorative. Study 1, did not examine actual restoration. Moreover, the study was conducted as a large scale on-line experiment and does not give specific insight into experiences in real natural environments. These issues we addressed in Study 2.

STUDY 2

Study 2 examined whether people who are exposed to natural environments with high levels of prospect-and low levels of refuge are more likely to recover (more quickly) from stress and mental fatigue than respondents exposed to an environment with low levels of prospect-and high levels of refuge. In this study we opted for a smaller scale more intensive study adopting a range of measures of actual restoration. In addition we examined restoration in a laboratory setting as well as in a real environment. This allowed us to compare restoration in a simulated setting with a real outdoor setting. This type of comparison is relatively rare as most research in the field has been conducted in a laboratory (see Kjellgren & Buhrkall, 2010, for an exception).

Respondents and Design

Two different walks were designed: one through a low prospect-high refuge environment and one through a high prospect-low refuge environment. Seventeen students participated in the field study (10 female; $M = 23.18$ years, $SD = 8.23$ years; 18-43 years). Another group of 17 students participated in the laboratory study where they viewed video recordings of the same walks as in the field study (laboratory condition; 10 female; $M = 20.88$ years, $SD = 5.02$ years; 18-38 years). In each setting (lab and field)

participants made two separate walks (in random order) one high prospect-low refuge and one low prospect-high refuge. Respondents participated in the study in exchange for course credits. The study formed a mixed model design with one within-subject factor (low vs. high prospect-refuge walk) and one between-subject factor (field vs. simulation). Participants in the field and lab study did not differ significantly in age ($U = 133.50, p = .91$), gender ($U = 133.00, p = .91$) or previous experience of visiting country parks ($U = 488.50, p = .45$).

Fatigue task

To ensure participants were in a state conducive to restoration, they were asked to complete a computer-based fatigue task. The task was an amended Stroop task created using E-Prime 2.0 which used both colours and shapes. The task requires that a person inhibits a response, which is assumed to require directed attention.

Participants took a seat in front of a PC with a 19 inch monitor and were presented with individual trials where a coloured shape appeared in the centre of the screen with a word describing either a colour or shape at the top of the screen. Participants indicated whether or not the word was related to the coloured shape. After each response, a new shape was shown. This continued for five minutes. Participants were instructed that they would be scored on how quickly and how accurately they responded. During the task, participants were also given a set of headphones playing building construction sounds in an attempt to distract them from the task, thus placing an even higher demand on attentional capacity.

A pilot test with a small group of students ($n = 12$; 7 female; $M = 21$ years) revealed that the task was a successful manipulation. Attention (measured with the NCPCT, see below) was significantly lower immediately after completing the fatigue task ($M = 6.12, SD = 1.44$) than before starting it ($M = 4.21, SD = 1.79$; $t(11) = -2.88, p < .01$). Positive affect was significantly lower after completing the fatigue task ($M = 1.94, SD = 0.53$) than before ($M = 3.75, SD = 0.67$; $t(11) = -7.71, p < .001$) and heart rate significantly increased from 72.30 ($SD = 10.63$) to 87.60 bpm ($SD = 11.24$; $t(11) = -3.43, p < .01$).

Study environments

The study focused on the same country park as Study 1. Following extensive exploration of the park, two walks were developed that differed according to Fisher and Nasar's (1992) typology of prospect-refuge. Both walks were actual walks that followed paths through the environment. Coloured discs with arrows were placed on the paths where the walk's direction changed or was uncertain. At the end of the walk participants were asked if they lost their way or encountered any other people. Nobody lost their way. Two participants encountered other people (one in each condition).

The walks shown in the laboratory were the same as those taken in the field and were filmed two days prior to the field condition being completed. They were recorded from a first person perspective using a Samsung DV381 video camera. The recordings also included an audio recording from the background sound from the walk. The walks were recorded in one minute segments consisting of a 45 second walking element followed by a 15 second pause and 360 degree panoramic scan before continuing into the next segment. Both videos lasted for a total of ten minutes and no people were visible or audible in either of the videos. In the lab respondents saw the videos of the two walks projected onto a white-washed laboratory wall using a Sony VPL-EPX5+ digital projector. The projections were fairly immersive and were projected to a size of 307cm x 230cm whilst the audio recordings were played using integrated speakers. Before viewing each video of the walk, participants in the laboratory condition read the same short descriptions of the walks that were used in Study 1. Figure 2 shows scenes of each of the walks.

Participants in both the field and the laboratory condition were told that they could take the walk at their own speed. In the laboratory a system was developed which allowed participants to alter the speed of the walk they were shown using a handheld switch. The average duration of the walks did not vary significantly between the laboratory (9 mins and 5 sec) and the field (10 mins) conditions.

Figure 2 about here

Measures

Affective states were measured using Zuckerman's (1977) Inventory of Personal Reactions (ZIPERS). The ZIPERS is a 12 item measure that consists of five factors: positive affect, attentiveness, fear arousal (fear), sadness, and anger/aggression (anger). Respondents were asked to indicate the extent to which statements describe how they felt at the start and end of the (simulated) walks on a five-point likert scale (e.g. I feel elated or pleased; 1 = not at all; 5 = very much). The scores used in the analyses are the mean ratings for each of the five ZIPERS factors. The ZIPERS has been a sensitive measure of emotional restoration in a number of previous restorative environment studies (e.g. Hartig et al., 1991, 1996, 2003; Ulrich et al., 1991). Higher emotional restoration is characterised by more positive mood states (high positive affect but low fear arousal, sadness and anger).

Attention was measured using the Necker Cube Pattern Control task (NCPCT). The NCPCT has been a sensitive measure of attention in previous restoration literature (e.g. Hartig et al., 2003; Tennessen & Cimprich, 1995). Respondents are shown a sheet of paper with a line drawing of a three-dimensional cube. They are told that people's perspective on the cube tends to shift when they look at it for a while, with the front and back faces of the cube reversing their relative positions. They are then instructed to focus on (hold) one pattern for as long as they can and to tap audibly on the desk every time they do see the pattern shift. Reversals that occur despite the effort to hold a pattern are a result of attentional fatigue (Kaplan, 1995). The average number of reversals occurring across two 30 second 'hold' periods, were taken as the dependent variable (cf. Tennessen & Cimprich, 1995).

Physiology was measured with heart rate (pulse) represented in beats per minute. The measurement of heart rate has become a common measure of physiologically restoration (e.g. De Kort, Meijnders, Sponselee, & Ijsselsteijn, 2006; Laumann, et al., 2003; Ulrich et al., 1991). Heart rate was measured using an A&D UA-767 digital blood pressure and heart rate monitor. *Although the monitor also measures blood pressure, only heart rate was used in the analyses. Initial analyses showed no significant findings in expected directions. Further examination of the data revealed a significant number of outliers and values outside an acceptable range (perhaps because exogenous variables such as time of day, recent caffeine intake and hormone levels).* The blood pressure data

were therefore deemed unreliable. The cuff was wrapped around the participant's upper left arm on bare skin, around 2-3cm above the elbow. Each time a measurement was taken, participants were seated with their arm resting upon a table in front of them. They were instructed to remain still and quiet during the measurement.

One item was used to ensure there were no significant differences in previous experience of visiting country parks between the laboratory and field conditions: "How often do you visit country parks?" The response options ranged from 1 (*not at all often*) to 7 (*very often*).

Procedure

Participants in both the laboratory and field conditions first had the heart rate monitor attached to their arm before a reading was taken to ensure the monitor was working correctly. Participants were then asked to complete the PC-administered fatigue task. Upon completion of the task, another reading was taken from the heart rate monitor before participants were asked to complete the ZIPERS and NCPCT. Those in the laboratory condition were then given the short description of the walk to read before taking a seat that was positioned 4 m from and directly facing the laboratory wall on which the video was projected. During the video of the walks, the laboratory lights were switched off to aid the clarity of the projection. Immediately after the video had finished a reading from the heart rate monitor was taken again. Participants then completed the NCPCT, ZIPERS and manipulation check item. The order in which these items were completed was randomised to prevent order effects. Participants were then taken to a nearby common room and given ten minutes to relax, read magazines and have a hot drink. They were then asked back into the laboratory to complete the whole process for a second time with the other video. The order in which the videos were shown was randomised.

For those in the field condition, a park office served as a laboratory for the task. Following the fatigue task, initial heart rate monitor check, ZIPERS and NCPCT, participants were given instructions regarding the two walks. A reading from the heart rate monitor was then taken immediately before participants started the walk. Both walks started and finished within 25 metres of the park office that was used to

administer the fatigue task. The researcher waited for participants at the end of the walk where a final reading from the heart rate monitor was taken. Participants were then led back into the park office where they completed the NCPCT, ZIPERS and manipulation check item. Once again, the order in which these were completed was randomised to prevent order effects. Participants were then taken to the nearby park visitor centre and given ten minutes to relax, read magazines and have a hot drink. They were then taken back to the park office to complete the whole process again but taking the other walk. The order in which participants took the walks was alternated. For both laboratory and field conditions, the whole process took around 50 minutes.

Results

Affective states

Change scores were computed for each of the variables (subtracting scores at the start of the walks from those at the end of the walks) and analyses of variance were conducted to examine whether the amount of change differed significantly between lab and field walks and between prospect-refuge conditions. Analyses of variance with Tukey post hoc tests were conducted to test whether mood change varied significantly between conductions.

Restoration of positive affect was significantly greater following the walks through the high prospect-low refuge environments ($M = 2.50$) than the low prospect-high refuge environments ($M = 1.36$; $F(1, 66) = 47.78, p < .001, d = 1.72$). On average, the field walks ($M = 1.53$) were significantly less restorative than the simulated laboratory walks ($M = 2.33$; $F(1, 66) = 7.76, p < .01, d = 0.68$). But no significant interaction effect was found between prospect-refuge and walk type ($F(1, 66) = 1.58, p = .21$).

Figure 3 here

Overall feelings of sadness did not differ between the field walk ($M = 0.37$) and simulated laboratory walk ($M = 0.62$; $F(1, 66) = 1.35, p = .25, d = 0.28$). They did differ significantly between environmental conditions ($F(1, 66) = 26.84, p < .001, d = 1.27$). In high prospect-low refuge environments sadness slightly decreased ($M = -0.03$) but in the low prospect-high refuge environments it increased ($M = 1.04$). A significant interaction effect was found between walk type and environment ($F(1, 66) = 10.66, p < .001$). Figure 3 shows that the reduction of sadness was particularly strong in the high prospect-low refuge field walk. A significant pre to post-walk reduction in sadness ratings was found for those in the high prospect-low refuge field walk. The increase in sadness ratings for those exposed to the low prospect-high refuge environments were also found to be significant for both field and laboratory conditions (all p 's $< .03$).

Restoration of attentiveness was significantly greater following the walk through the high prospect-low refuge environments ($M = 1.00$) than the low prospect-high refuge environments which actually recorded a reduction in attentiveness ratings ($M = -0.22$; $F(1, 66) = 59.22, p < .001, d = 1.92$). It did not differ between field walks ($M = 0.46$) and the simulated laboratory walks ($M = 0.33$; $F(1, 66) = 0.72, p = .40, d = 0.21$). However a significant interaction effect was found ($F(1, 66) = 12.07, p < .001$). Figure 3 shows that the increase in attentiveness in the high prospect-low refuge conditions and the decrease in attentiveness in the low prospect-high refuge conditions was particularly strong in the field conditions. Attentiveness ratings increased significantly for those taking the high prospect-low refuge walks (p 's $< .01$), but not for those taking the low prospect-high refuge walks (p 's $> .05$).

Fear arousal went down among participants exposed to the high prospect-low refuge walks ($M = -0.52$) but it went up in the low prospect-high refuge walks ($M = 0.25$; $F(1, 66) = 23.72, p < .001, d = 1.18$). No difference was found between field walks ($M = -0.74$) and simulated laboratory walks ($M = -0.67$; $F(1, 66) = 0.66, p = .22, d = 0.11$). However, the interaction between prospect-refuge and walk type was found to be significant ($F(1, 66) = 5.97, p < .03$). A significant decrease in fear arousal ratings was found for both high prospect-low refuge walks (p 's $< .001$) and a significant increase in fear arousal in the low prospect-high refuge field walk ($p < .001$) but not in the low prospect-high refuge lab walk.

Finally anger/aggression ratings reduced for those exposed to the high prospect-low refuge walks ($M = -1.16$) while it increased for those who took the low prospect-high refuge walks ($M = 0.25$; $F(1, 66) = 56.72, p < .001, d = 1.94$). Moreover, the field walks resulted in a reduction in anger/aggression ($M = -1.27$) but not the laboratory walks ($M = 0.25$; $F(1, 66) = 19.32, p < .001, d = 1.07$). Once again a significant interaction effect was found ($F(1, 66) = 4.88, p < .03$). Restoration appeared greatest in the high prospect-low refuge field walk (see Figure 3). Anger/aggression decreased significantly in both high prospect-low refuge walks (p 's $< .001$) but increases in the low prospect-high refuge walks were not significant (p 's $> .05$).

Attention

NCPCT scores reduced following the walks through the high prospect-low refuge environments ($M = -0.42$) but increased after walks through the low prospect-high refuge environments ($M = 0.61$; $F(1, 66) = 8.74, p < .01, d = 4.79$, see Figure 4). This means that respondents could concentrate better after exposure to the high prospect – low refuge environments (could ‘hold’ the cube pattern for longer or saw less pattern changes) whereas in the low prospect- high refuge environment ability to concentrate got worse (respondents saw the cube pattern shift more often). Cognitive restoration was also greater in the field walks ($M = -0.10$) than in the simulated laboratory walks ($M = 0.28$; $F(1, 66) = 5.85, p < .001, d = 1.77$). Moreover, environment and walk type were found to significantly interact ($F(1, 66) = 9.15, p < .01$). Tukey HSD post-hocs showed that improvements in ability to ‘hold’ the cube patterns were significantly greater in the high prospect-low refuge field condition than the other three conditions (all p 's $< .01$).

Figure 4 about here

Physiology

Reductions in heart rate were significantly greater following the walk through the high prospect-low refuge environments ($M = 8.33$) than the low prospect-high refuge environments ($M = 3.43$; $F(1, 66) = 12.83, p < .001, d = 0.88$). The change in heart rate in the field walks ($M = 3.00$) was significantly smaller than the change in heart rate in

the laboratory walks ($M = 8.26$; $F(1, 66) = 15.02$, $p < .001$, $d = 0.94$), suggesting that the laboratory walk was more restorative. Finally, a significant interaction effect was found ($F(1, 66) = 4.14$, $p < .05$). Post-hoc tests showed that reductions in heart rate in the high prospect-low refuge laboratory condition are significantly greater than in the other three conditions (all p 's $< .01$).

Figure 5 here

The findings of Study 2 demonstrate that accessible natural environments with clear lines of vision (high prospect) and few hiding places (low refuge) are more likely to improve positive and reduce negative mood, to recover attention depletion and to reduce physiological arousal than environments with no clear lines of vision (low prospect) and many hiding places (high refuge). Although positive affect improved in both conditions, low prospect-refuge environments increased sadness and fear ratings and did not alter anger aggression ratings. Changes in affect did not vary significantly between field walks and simulated lab walks, although some effects were stronger in the field walks. But changes in attention and heart rate did. In the field attention appeared to recover, but not in the lab (where attention depletion appeared to increase slightly). Physiological arousal reduced only when people saw a slide show of an open environment with high levels of prospect and low levels of refuge in the lab. It may well be that the field walk did not demonstrate a significant reduction in heart rate as walking is a physical activity that increases heart rate and sitting still in a lab is not.

Taken together the findings demonstrate that restoration is more likely in environments with high prospect and low refuge but the findings do vary for types of restoration and between lab and field conditions.

DISCUSSION

Spending time in nature is generally perceived to be good for health and wellbeing. There is plenty of evidence to support this (for reviews see Bowler, 2010 and

Health Council of The Netherlands, 2004). Although, theories of environmental restoration suggest that not all natural environments may be restorative (Ulrich, 1983; Kaplan & Kaplan, 1989) there is little research that examines the environmental features that promote or negate restoration. The two studies presented in this paper examined whether the concepts of prospect and refuge may be useful in our understanding of the types of natural environments which are more or less restorative (Appleton, 1975). The studies showed that more accessible environments with clear fields of vision (prospect) and few hiding places (refuge) are indeed (perceived to be) more restorative than environments with poor accessibility and prospect and many hiding places (low prospect-high refuge). This supports the hypothesis that not all natural environments promote restoration. In fact Study 2 suggests that exposure to environments with low levels of prospect-and high levels of refuge may actually increase attention depletion and negative mood.

Restoration in study 2 varied between lab and field conditions. Although the direction of findings were generally similar (more prospect and less refuge led to more restoration both in lab and field) there were also some differences. Restoration of attention anger/aggression and sadness was greater in the field walk than in the lab walk. Perhaps this is because simulations are not as realistic and do not contain as much sensory information as their real-life counterparts (Mayer, McPherson Frantz, Bruehlman-Senecal & Dolliver, 2009). However, the field walk did not demonstrate a significant reduction in heart rate probably because heart rate was affected by the physical activity of walking.

Our study did not only measure heart rate to provide insight into changes in physiological arousal but also blood pressure. However, the blood pressure data was deemed unreliable. In our study we only took one measure at each stage of the process, perhaps more frequent measurement may have revealed more robust results. Future research may also want to include other measures of physiological arousal such as blood pressure or stress hormones (Hartig et al., 1991; Ulrich et al., 1991) to verify the findings.

Environments with low levels of prospect-refuge may be more restorative because they demand less attention and because they harbour less threats. Walking in a

half-open, non-threatening environment requires little attention to find ones way or to avoid tripping. Moreover, such an environment is associated with less threat and fear. Study 1 and Study 2 showed that fear and fear arousal were significantly lower for the high prospect-low refuge walks than the high prospect-low refuge environments. Study 1 suggested that the link between type of environment and perceived restoration could be partially explained by the link between environment type and perceptions of danger and feelings of fear. This is in line with research conducted by Herzog and Kirk, 2005 (see also Andrews & Gatersleben, 2010). The mediation, however, was partial so feelings of fear and perceptions of danger could not fully explain the link between environment and restoration. Further research may want to explore the link between prospect-refuge and restoration in more detail in order to understand the process which may underlie this link. We know relatively little about the role of prospect-refuge on perceptions, preferences and restoration. Existing evidence, for instance on the role of refuge appears to be conflicting (see Stamps, 2008a and 2008b) and operationalization of variables is inconsistent (Grahn & Stigsdotter, 2010). It will be worth further exploring the role of potentially mediating variables such as fear or mystery. Mystery, for instance, has been positively associated with restoration but also with fear. A dense environment may be perceived as more dangerous as well as more mysterious (Herzog & Miller, 1998).

This research did not allow us to separate effects for prospect and refuge. Moreover, this study did not include examples of very open environments with very high levels of prospect and no refuge as such environments do not exist in the places we chose to study. In light of the theory it may be well worth exploring these different aspects separately. For instance, although our findings appear to suggest a linear relationship between prospect-refuge and restoration it may well be that such a relationship is in fact curvilinear. A very open landscape will provide no refuge at all; neither to potential offenders nor to potential victims. And although social dangers may be lurking in the bushes a thunderstorm will not. Further research is needed to explore the role of both prospect and refuge separately on specific types of dangers and restoration.

As most studies, this research had some limitations. The studies were entirely based on student samples. Some previous studies investigating landscape preference have suggested that preferences vary with age and gender (e.g. Lyons, 1983; Balling & Falk, 1982; Van den Berg & Koole, 2006). However, an extensive meta-analysis of landscape preference assessments by Stamps (1999) found a strong positive correlation ($r = .83$) between student and non-student samples. Arguably, the experimental nature of Study 2 somewhat limits the need for a representative sample. However, future work may need to replicate these findings with different populations to verify their generalisability.

Bowler et al. (2010) commented that most existing research on restorative environments examines only relatively short term effects. This was also the case in this paper. Respondents walked only for a short period of time, we do not know what the effect is of longer exposure to environments with different levels of prospect-refuge. Moreover, our manipulation of cognitive depletion in Study 2 was relatively short. Although the pre-test suggested that such a short manipulation was effective we do not know for certain that it was sufficient in the main study. Taken together the study can only shed light on relatively short term effects and does not allow us to draw generalisable conclusions on the effect of longer exposure to both stressors and restorative environments which will need to be examined in further research.

In real life most people tend to visit natural environments with others. Our studies did not examine the role of company in nature experiences. Of the limited research that has explored the role of company in restoration, Staats and Hartig (2004) found that company enhanced restoration when safety was a concern, whilst solitude enhanced restoration when safety was controlled for. This seems particularly relevant for our studies. Further research may want to explore how company affects the link between type of environment and (perceived) restoration. A recent study suggests that company may have a positive effect on restoration when walking through an urban environment whereas a walk through a natural environment may be more restorative when walking alone (Johansson, Hartig & Staats, 2011). Walking with a family member or friend is therefore likely to diminish the negative impact of any danger threat that may be associated with low prospect-high refuge environments.

Using images is common in research on restorative environments, but it does raise questions about ecological validity. Photos can only show parts of an environment and exclude sensory experiences such as smell and touch. The use of sequential slides or photographs to depict a walk also prevents movement (e.g. Heft & Nasar, 2000). Some steps were taken to mitigate these issues. Similarly to existing research (e.g. Staats et al., 1997) descriptions of the walk were included to help respondents imagine taking the walk for real. Moreover, in Study 2 respondents were exposed to large projections of the walks (De Kort et al., 2006). In addition the study was conducted in the lab as well as in the field, allowing us to compare these different experiences and forms of data collection and findings were generally consistent in terms of the effect of prospect-refuge on restoration.

Research that compares field and lab experiences is relatively rare. Most existing research suggests that viewing as well walking through certain types of natural environments can be restorative. Kjellgren and Buhrkall (2010) demonstrated that whereas both natural and simulated natural environments can aid restoration natural environments can also bring increased energy and altered states of consciousness thereby further promoting restoration. This study supports these findings in that it was shown that a walk through a real environment resulted in more recovery of attention depletion. Findings for emotional restoration were more mixed. According to Attention Restoration Theory recovery of directed attention can come from a range of sources and although environments that provide soft fascination may have added advantages environments that have hard fascination can also aid restoration of directed attention by drawing attention involuntary (Kaplan, 1995). Our study suggest that whereas attention fatigue recovers in open environments and may further deplete in dense environments this difference is stronger in a real than a simulated environment.

Conclusion

The results of these studies clearly indicate that a walk through a natural environment that contains a high degree of prospect and accessibility but low levels of refuge is (perceived to be) more restorative than a walk through a natural environment low on prospect and accessibility combined with a high level of refuge. These results

suggest that adopting Fisher and Nasar's (1992) typology of prospect-refuge to design and manage country parks so that they contain a high level of prospect and accessibility but a low number of hiding places could be one way of maximising the restorative benefits of contact with such environments.

In England there are over 270 designated country parks and they cover over 38,000 hectares of land. The majority of these country parks are located on the rural-urban fringe and collectively receive an estimated 73 million visitors per year (The Countryside Agency, 2004). Ensuring that country parks contain walks, that offer a high degree of prospect and ease of movement but a low number of hiding places, maximises perceived and actual restoration. In the absence of any specific danger or threat, the typology appears extremely useful. Given that we live in a time of escalating health care costs, increasing mental health problems amongst the population and declining environmental quality (Hartig et al., 2003), it is imperative that the benefits of contact with natural environments such as country parks are made the most of to help ensure that the public health strategies that incorporate them are successful. Environmental planners and designers may therefore like to consider Fisher and Nasar's (1992) typology of prospect-refuge when designing and maintaining natural environments such as wooded areas in country parks.

REFERENCES

- Andrews, M. & Gatersleben, B. (2010). Variations in perceptions of danger, fear and preferences in a simulated natural environment. *Journal of Environmental Psychology*, 30, 473-481.
- Appleton, J. (1975). *The experience of place*. London: Wiley.
- Balling, J. D. & Falk, J. H. (1982). Development of visual preference for natural environments. *Environmental Behavior*, 14, 5-28.
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology*, 25, 249-259.

- Bixler, R. D., Carlisle, C. L., Hammitt, W. E. & Floyd, M. F. (1994). Observed fears and discomforts among urban students on school field trips to wildland areas. *Journal of Environmental Education*, 26, 24-33.
- Bixler, R. D. & Floyd, M. F. (1997). Nature is scary, disgusting and uncomfortable. *Environment and Behavior*, 29, 443-467.
- Bowler, D.E., Buyung-Ali, L.M., Knight, T.M. & Pullin, A.S. (2010). A systematic review of evidence for the added benefits to health of exposure to natural environments. *BMC Public Health*, 10, 456-466.
<http://www.biomedcentral.com/1471-2458/10/456>
- Burgess, J. (1998). 'But is it worth taking the risk?' How women negotiate access to urban woodland: a case study. In Ainley, R. (Ed.) *New frontiers of space, bodies and gender* (pp. 115-128). London: Routledge.
- Cackowski, J. M. & Nasar, J. L. (2003). The restorative effects of roadside vegetation. *Environment and Behavior*, 35, 736-751.
- Chapin, D. (1991). Making green places safer places: Experiences in New York City. *Landscape Architecture Review*, 12, 16-18.
- Coble, T. G., Selin, S. W. & Erickson, B. B. (2003). Hiking alone: Understanding fear, negotiation strategies and leisure experience. *Journal of Leisure Research*, 35, 1-22.
- Countryside Agency (2004). Towards a country parks renaissance. *CRN* 35.
- De Kort, Y. A.W., Meijnders, A. L., Sponselee, A. A. G. & Ijsselstein, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology*, 26, 309-320.
- Ewert, A. (1986). Fear and anxiety in environmental education programs. *Journal of Environmental Education*, 18, 33-39.
- Fisher, B. S. & Nasar, J. L. (1992). Fear of crime in relation to three exterior site features: Prospect, refuge, and escape. *Environment and Behavior*, 24, 35-65.
- Grahn, P. & Stigsdotter, U. (2010). The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning*, 94, 3-4, 264-275.

- Han, K. (2003). A reliable and valid self-rating measure of the restorative quality of natural environments. *Landscape and Urban Planning*, 64, 209-232.
- Hartig, T., Böök, A., Garvill, J., Olsson, T. & Gärling, T. (1996). Environmental influences on psychological restoration. *Scandinavian Journal of Psychology*, 37, 378-393.
- Hartig T., Evans, G. W., Jamner, L. D., Davis, D. S. & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23, 109–123.
- Hartig, T., Mang, M. & Evans, G. W. (1991). Restorative effects of natural environment experience. *Environment and Behavior*, 23, 3-26.
- Hassinger, J. (1985). Fear of crime in public environments. *Journal of Architectural and Planning Research*, 2, 289-300.
- Health Council of The Netherlands (2004). *Nature and Health. The influence of nature on social, psychological and physical well-being*. Publication No 2004/09E, RMNO publication No A02ae. The Hague: Health council of the Netherlands and RMNO. Available at ww.healthcouncil.nl.
- Heft, H. & Nasar, J. L. (2000). Evaluating environmental scenes using dynamic versus static displays. *Environment and Behavior*, 32, 301-322.
- Henderson, K. A. & Bialeschki, M. D. (1993). Fear as a constraint to active lifestyles for females. *Journal of Physical Education, Recreation and Dance*, 64, 1, 44-47.
- Herzog, T. R. & Kirk, K. M. (2005). Pathway curvature and border visibility as predictors of preference and danger in forest settings. *Environment and Behavior*, 37, 620-639.
- Herzog, T. R. & Kutzli, G. E. (2002). Preference and Perceived Danger in Field/Forest Settings. *Environment and Behavior*, 34, 819-835.
- Herzog, T. R. & Miller, E. J. (1998). The role of mystery in perceived danger and environmental preference. *Environment and Behavior*, 30, 429-449.
- Johansson, M., Hartig, T., & Staats, H. (2011). Psychological Benefits of Walking: Moderation by Company and Outdoor Environment. *Applied Psychology: Health and Well-Being*, 3, 3, 261–280.

- Kaplan, S. (1995). The restorative benefits of nature: Towards an integrative framework. *Journal of Environmental Psychology*, 15, 169-182.
- Kaplan, R. & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge: Cambridge University Press.
- Kaplan, S. & Talbot, J. F. (1983). Psychological benefits of a wilderness experience. In I. Altman & J. Wohlwill (Eds.), *Human behavior and environment: Advances in theory and research*, Vol. 6 (pp. 163-203). New York: Plenum Press.
- Kjellgren, A & Buhrkall, H. (2010). A comparison of the restorative effect of a natural environment with that of a simulated natural environment. *Journal of Environmental Psychology*, 30, 4, 464-472.
- Krenichyn, K (2006). The only place to go and be in the city: Women talk about exercise, being outdoors and the meaning of a large urban park. *Health and Place*, 12, 631-643.
- Laumann, K., Gärling, T. & Stormark, K. M. (2003). Selective attention and heart rate responses to natural and urban environments. *Journal of Environmental Psychology*, 23, 125-134.
- Lyons, E. (1983). Demographic correlates of landscape preference. *Environment and Behavior*, 15, 487-511.
- Mayer, S.F., McPherson Frantz, C., Bruehlman-Senecal, E. & Dolliver, K (2009). Why Is Nature Beneficial? The Role of Connectedness to Nature. *Environment and Behavior*, 41, 5, 607-643.
- Milligan, C. & Bingley, A. (2007). Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults. *Health & Place*, 13, 799-811.
- Nasar, J. L. & Fisher, B. (1993). 'Hot spots' of fear and crime: A multi-method investigation. *Journal of Environmental Psychology*, 13, 187-206.
- Nasar, J. & Jones, K. (1997). Landscapes of fear and stress, *Environment and Behavior*, 29, 291-323.

- Parsons, R., Tassinary, L. G., Ulrich, R. S., Hebl, M. R. & Grossman-Alexander, M. (1998). The view from the road: Implications for stress recovery and immunization. *Journal of Environmental Psychology*, 14, 195-209.
- Petherick, N. (2000/2001). Environmental Design and Fear: The Prospect-Refuge Model and the University College of the Cariboo Campus. *Western Geography*, 10/11, 89-112.
- Roe, J & Aspinal, P. (2010). The restorative benefits of walking in urban and rural settings in adults with good and poor mental health. *Health and Place*, 17, 103-113.
- Staats, H., Gatersleben, B. & Hartig, T. (1997). Change in mood as a function of environmental design: Arousal and pleasure on a simulated forest hike. *Journal of Environmental Psychology*, 17, 288-300.
- Staats, H. & Hartig, T. (2004). Alone or with a friend: A social context for psychological restoration and environmental preferences. *Journal of Environmental Psychology*, 24, 199-211.
- Stamps, A.E 3rd (2008a). Some findings on prospect and refuge: I. *Perceptual and Motor Skills*, 106, 1, 147-62.
- Stamps, A.E. 3rd (2008b). Some findings on prospect and refuge theory: II. *Perceptual and Motor Skills*, 107, 1, 14-158.
- Stamps, A.E. 3rd (1999). Mystery, complexity, legibility and coherence: A meta-analysis. *Journal of Environmental Psychology*, 24, 1, 1-16.
- Tennessen, C. M. & Cimprich, B. (1995). Views to nature: Effects on attention. *Journal of Environmental Psychology*, 15, 77-85.
- Tooby, J. & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environment. *Ethology and Sociobiology*, 11, 375-424.
- Ulrich, R. S. (1983). Aesthetic and affective responses to natural environment. In I. Altman & J. F. Wohlwill (Eds.), *Behavior and the natural environment* (pp. 85-125). New York: Plenum Press.
- Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, 224, 420-421.

- Ulrich, R. S., Simons, R., Losito, B. D., Fiorito, E., Mailes, M. A. & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11, 201-230.
- Van den Berg, A. E. & Koole, S. L. (2006). New wilderness in the Netherlands: An investigation of visual preferences for nature development landscapes. *Landscape and Urban Planning*, 78, 362-372.
- Van den Berg, A. E. & Ter Heijne, M. (2005). Fear versus fascination: An exploration of emotional responses to natural threats. *Journal of Environmental Psychology*, 25, 261-272.
- Wang, K. & Taylor, R. B. (2006). Simulated walks through dangerous alleys: Impacts of features and progress on fear. *Journal of Environmental Psychology*, 26, 269-283.
- Warr, M. (1990). Dangerous situations: Social context and fear of victimization. *Social Forces*, 65, 891-907.
- Zuckerman, M. (1977). Development of a situation-specific trait-state test for the prediction and measurement of affective responses. *Journal of Consulting and Clinical Psychology*, 45, 513-523.

Example scene from low prospect-refuge condition

Example scene from medium prospect-refuge condition

Example scene from high prospect-refuge condition

Figure 1. Example scenes from three different walks

Example of scene from the low prospect-refuge walk.

Example of scene from the high prospect-refuge walk.

Figure 2. Examples scenes from the lab and field walks

Figure 3. Changes in positive affect, sadness, anger/aggression, fear arousal and attentiveness ratings as a function of prospect-refuge and walk type.

Figure 4. Change in NCPT scores as a function of prospect-refuge and walk type (higher scores reflect less concentration).

Figure 5. Change in heart rate as a function of prospect-refuge and walk type.

Table 1. Mean ratings (standard deviation) and ANOVA for prospect, accessibility and hiding places across the three prospect-refuge conditions.

	Low	Medium	High	Test of difference
Prospect	4.83 _a (1.26)	4.07 _b (1.02)	3.43 _c (1.34)	$F(2, 254.83) = 30.05, p < .001$
Accessibility	3.59 _a (1.51)	5.25 _b (1.36)	5.86 _c (1.35)	$F(2, 266) = 64.43, p < .001$
Hiding places	6.03 _a (1.16)	5.35 _b (1.38)	4.81 _c (1.60)	$F(2, 249.51) = 17.45, p < .001$

Note: means with similar subscripts do not differ significantly ($p > .05$).

Table 2. Mean danger, fear and restoration ratings (standard deviation) for the three prospect-refuge conditions.

	Low	Medium	High
Perceived danger	3.53 _a (1.45)	3.00 _b (1.27)	2.57 _c (1.25)
Fear	4.87 _a (2.52)	3.38 _b (2.10)	2.69 _c (1.89)
Perceived restoration	4.58 _a (1.74)	5.99 _b (1.62)	6.65 _c (1.63)

Note: means with similar subscripts do not differ significantly ($p > .05$).