

THE EFFECTS OF THE NATURAL ENVIRONMENT ON ATTENTION RESTORATION

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by
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Abstract

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In modern society, it is not uncommon for individuals to go days at a time without interacting with nature. Because natural environments have previously been found to promote both positive moods and cognitive restoration, interacting with nature may help support an individual's cognitive and emotional well being. The purpose of this study was to determine if an indoor environment with natural elements facilitates a more relaxing and restorative experience than an indoor environment without natural elements. The restorative qualities of the environments were assessed through the framework of Attention Restoration Theory (ART). ART suggests that there are four qualities that must be present in an environment to facilitate a restorative experience: being away, fascination, extent, and compatibility. Undergraduate students at Appalachian State University completed measures aimed to induce directed attention fatigue (DAF) and were randomly assigned to spend 10 minutes in either the Solarium ("natural environment") or Whitewater Café ("built environment"). A pilot study indicated that these locations differ significantly in their perceived restorative qualities. Following their allotted 10 minutes in either the Solarium or

Whitewater Café, participants completed the same perceived restorative qualities questionnaire in the experimental study as in the pilot study. Participants then completed post-measures to assess for attention restoration in each location. Contrary to the pilot study, results indicated that there was no difference in levels of perceived restoration between the two locations, and there was no difference between levels of attention restoration as measured by several cognitive tasks. Though location did not matter, participants in both conditions experienced a marginal decrease of negative affect following their restorative experience.

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Foreword

This thesis is written in accordance with the style of the *Publication Manual of the American Psychological Association (6th Edition)* as required by the Department of Psychology at Appalachian State University

Introduction and Literature Review

The Effects of the Natural Environment on Attention Restoration

Western culture is often described as “fast-paced,” “non-stop,” and “caffeine-charged.” It is not uncommon for individuals to go throughout their days without taking time to relax and to rest their bodies and minds. In fact, the United States Department of Labor (2010) reports that Americans typically spend on average only 15 minutes a day “thinking and relaxing.” The fast-paced and interconnected nature of the modern world can cause stress in both the workplace and home (Harris, Marett, & Harris, 2011). Although the home should be viewed as a place of relaxation and a place to “unwind,” there is often competition between the actual act of de-stressing and other evening activities (e.g., chores, cooking dinner, taking care of a pet, homework; Saxbe, Repetti, & Graesch, 2011). It is also common for adults to exhibit physiological and mental stress outside of work (de Bloom et al., 2010), which may at least partly be caused by rumination about past and potential future stressors. These stressors not only impact one’s emotional and physiological experience, but also have the potential to drain one’s cognitive resources (e.g., the mental processes necessary to focus on tasks for a prolonged period of time). Overall, it is important for adults in these times to understand how to handle stress effectively, as high levels of stress can evolve into larger, more maladaptive problems such as an increased risk for health complications and a lower quality of life (Geurts & Sonnetag, 2006).

While the college experience is meant to prepare students for their adult lives, not much attention is paid to teaching individuals how to manage their stress levels effectively. Stress is common for college students, whose busy lives include academics and other activities (e.g., part-time jobs, sports). Despite the fact that college students engage in more

leisure activities and sleep than working adults who have children (U.S. Department of Labor, 2010), students still report high levels of stress and anxiety, which can negatively impact school performance. For example, the American College Health Association (ACHA) administered the National College Health Assessment II (NCHA-II) to 105,781 respondents in the spring of 2011, and found that 19.1% felt that anxiety affected their academic performance. The study also revealed that 27.5% of the sample felt that stress affected their academic performance (ACHA, 2011). These results are consistent with the belief that college students are susceptible to heightened levels of stress and anxiety, which may impair their performance on cognitive tasks.

While the U.S. Department of Labor reported that college students spend a relatively large amount of time engaging in leisure activities, the ACHA reported that college students experience heightened stress. These conflicting results may be due to the fact that college students are often faced with novel situations and have not yet developed effective coping strategies necessary to combat the associated stress. What follows is a review of several explanations as to why college students may be stressed and this circumstance's relationship to attention depletion, as well as both effective and ineffective ways that individuals might experience restored attention, with a specific focus on the benefits of nature as proposed by Attention Restoration Theory.

College Student Stress and Directed Attention

There are many situations that can increase stress levels in college students that may put the results found in the NCHA-II into context. For many students, moving from home to college comes with new freedoms and experiences yet necessitates adjustment to a new social environment (e.g., making new friends and creating a strong social support group). In

addition, the pressure put on students to earn good grades and to complete their degree is high, which also leads to increased stress levels (Hamaideh, 2011); however, Romano (1992) suggests that it is not the stressors alone that impact an individual, but the reaction of the individual towards the stressor that causes the negative feelings and affect. The ability of college students to be able to manage reactions towards stressors is an integral piece of overall functioning.

College students consistently expend effort to complete homework, synthesize new information, and maintain good grades in order to earn a degree. Academic workload is cited as a common stressor among students, in fact, as is role ambiguity (Ragsdale, Beehr, Grebner, & Han, 2011). Academic workload is the volume of work a student is given, and role ambiguity is the uncertainty of expectations (i.e., how to fulfill required tasks such as homework or major selection). As the workload and pressure to succeed in multiple roles (e.g., student, son/daughter, leader) increases, heightened levels of stress are common. Inevitably, these tasks involve the use of *directed attention*. Directed attention can be described as a finite resource that is used when one focuses attention on a task by inhibiting distractions in the environment that are not pertinent (Kaplan, 2001).

The more effort that individuals spend on a particular task, the more their directed attention is depleted. This can be especially true for those individuals whose work or school responsibilities often translate to their home lives. When this occurs, it is difficult to get a sufficient enough break to relax and restore directed attention. In such a situation, one must keep running on depleted cognitive resources, is more likely to fatigue faster, and may notice a decline in physical health. Such negative outcomes of attention depletion are signs of Directed Attention Fatigue (DAF; Hartig & Evans, 1993).

The Relationship Between DAF and Stress

Lazarus (1966) defines stress as “demands made by the internal or external environment that upset balance, thus influencing physical and psychological well being and requiring actions to restore balance” (p. 19). Kaplan and Kaplan (1989) state that stress and DAF are interrelated in that DAF can both cause and be caused by stress. DAF can *cause* stress in two ways. First, DAF can lead to an earlier onset of stress by reducing the cognitive resources needed to employ effective coping techniques. Second, Kaplan (1995) also suggests that as one’s cognitive resources begin to decline and DAF begins, it is likely for this depletion to itself cause a stress response. Finally, DAF can *be caused by* stress as a result of the anticipation of and preparation for a situation appraised as threatening.

Often, individuals who are stressed experience similar psychological and physiological effects as individuals who are experiencing DAF, such as irritability, difficulty concentrating, and difficulty sleeping. Like stress, the consequences of DAF can be serious; it can cause an individual to be impulsive, inaccurate, and irritable (Herzog, Maguire, & Nebel, 2003). After a prolonged amount of time attending to a particular task, subsequent attempts to attend to the task are less likely to be successful. The failure to attend to the intended task is also often a cause of stress in individuals, thereby continuing to deplete cognitive resources even further, creating a negative cycle. Overall, this body of research suggests a strong relationship between attention depletion and stress (Muraven & Baumeister, 2000).

Though similar in many aspects, stress and DAF can differ in that attentional fatigue can result in situations where anticipation, negative valuations, and threat of harm are absent. Conversely, some stressful situations may not induce DAF (e.g., watching the final moments

of a tied sporting event; Hartig, Book, Garvill, Olsson & Garling, 1996). In sum, it appears that the relationship between stress and DAF is situationally determined. Because DAF and stress are related but not identical, some terminology clarification may be useful. For the purposes of this thesis, the term *relaxing* will be used to refer to activities that either reduce or are perceived to *reduce stress*. The term *restorative* will be used to refer to tasks aimed at reducing DAF and *restoring attention*.

Efforts to Relax and Restore

Since many college students experience stress due to coursework, transitions into adulthood, and the pressure to succeed, they often engage in leisure activities to wind down; however, many such activities that are perceived as relaxing might actually prolong feelings of stress and induce DAF as a byproduct. For example, many students watch television as a primary leisure activity. According to the U.S. Department of Labor (2010), watching television accounted for half of all leisure activity for individuals ages 15 and older, which equates to about 2.7 hours per day. Unfortunately, watching television (especially violent programs) tends to lead to less effective processing of information, impaired cognitive performance, and inattention (Maass, Klöpper, Michel, & Lohaus, 2011). In addition, individuals across the age span who are heavy television watchers report greater levels of dissatisfaction in life than those who watch less (Frey, Benesch, & Stutzer, 2007).

Along with watching television, many college students attempt to self-medicate by smoking cigarettes to relax (Nichter, Nichter, & Carkoglu, 2007). Ikard, Green, and Horn (1969) found that many smokers report that smoking calms them down and that it positively affects their mood; however, when individuals are not smoking, they report adverse moods and higher levels of stress. In order to cease the negative symptoms (e.g., adverse mood and

heightened stress), it is common for individuals to begin smoking once more to stop the withdrawal symptoms, which leads to a sense of calm. These results have been replicated by other researchers, often noting that the calming effect of smoking is actually misattributed withdrawal relief (Hajek, Taylor, & McRobbie, 2010). While smoking may appear to have immediate positive effects, it tends to impact an individual in the long-term and inhibits the ability of an individual to have a relaxing and restorative experience.

Further, many college students engage in online computing to relax, which also has its maladaptive side. It is not uncommon for college students to spend a great deal of time on the Internet, which can lead to distress or impairment such as social isolation, loss of educational productivity, and dysfunction in romantic relationships (Greenfield, 2000). It is possible that individuals who overuse the Internet may begin to have feelings of hopelessness due to decreased social interaction. In fact, Velezmoro, Lacefield, and Roberti (2010) found that perceived hopelessness and stress significantly predicted the likelihood that an individual would abuse the Internet. The authors also suggest that individuals who abuse the Internet may be suffering from other minor psychological problems. It appears that these interactions between stress and computer use for relaxation may be cyclical in nature and have negative effects, if unrecognized.

Although there are many maladaptive activities an individual may misguidedly choose for relaxation and restoration, there are also many others that are likely to be more effective. One way an individual may choose to relax is by eating. A classic example is the consumption of chocolate. Parker, Parker, and Brotchie (2006) describe how eating chocolate may be a form of self-medication in some individuals and may actually have an impact on brain neurotransmitters which could have antidepressant benefits. The neurotransmitter

affected by chocolate is serotonin, which influences sleep, appetite, impulse control, and mood elevation. Consuming chocolate may not just have an impact on stress levels, but it may reduce DAF as well. For example, Field, Williams, and Butler (2011) found that adults who consumed a high dosage of cocoa flavonols found in chocolate experienced a significant improvement in visual-spatial working memory performance, whereas there was no significant improvement in individuals who consumed a lower dosage. The consumption of chocolate may help restore depleted levels of serotonin and positively impact working memory and may help one have a truly restorative experience. Additionally, Gailliot et al. (2007) suggest that one's self-control (the ability to have control over one's thoughts, behaviors, and emotions) is driven by glucose (e.g., sugar). For example, low levels of blood glucose have been linked to poor cognitive performance on many different tasks such as the Stroop (1935), driving simulation, and other tasks demanding the use of executive functioning. Similarly, Gailliot et al. (2007) found that individuals who consume beverages with glucose after engaging in depleting tasks were less likely to make errors on a post-depletion Stroop task than individuals who consumed a beverage without glucose.

Another effective activity for relaxation and restoration is exercise. Studies have shown that bouts of exercise are related to reductions in anxiety, stress, depression, negative mood, and increases one's positive mood and psychological well being (Giacobbi, Hausenblas, & Frye, 2005). Some individuals find enjoyment in the social aspect of exercise; some find it a pleasant time to spend alone and reflect on meaningful topics; and others find enjoyment in the physical exertion itself. In contrast, individuals who are not physically active are twice as likely to report high stress levels (Aldana, Sutton, Jacobson, & Quirk, 1996). Along with being a stress-reliever, exercise also has positive cognitive benefits that

aid the restorative process. O’Leary, Pontifex, Scudder, Brown, and Hillman (2011) noted that following exercise, individuals are better able to identify task-irrelevant information from the environment, which aids in the inhibition of distractions; therefore, individuals are able to focus more on their specified tasks.

Finally, some individuals choose to spend time outdoors as a way to help relax, which may lead to restored directed attention. For example, Gulwadi (2006) found that elementary school teachers most frequently chose the outdoors as a spontaneous place to implement coping and reflection strategies. Korpela and Kinnunen (2011) found that exercise and being outdoors during one’s free time was rated as the most effective way to recover from work stress. Being in a natural environment is not only accessible to most individuals, whether it is a walk or a drive away, but is also a cost-effective and healthy way to reduce stress. Nature facilitates a range of relaxing experiences, from escaping from everyday activities, to the pleasant feeling of observing a beautiful landscape. In addition to retreating to the outdoor environment as a way to escape from daily hassles, actually living in areas with more green space has positive impacts on one’s overall well-being. Specifically, White, Alcock, Wheeler, and Depledge (2012) conducted a longitudinal study that examined the relationship between living near green urban areas (e.g., parks, gardens, fresh water) and well-being as well as overall psychological distress. The authors found that those who lived in areas with more urban green space when compared to their counterparts reported lower psychological distress and higher well-being.

Additionally, being outdoors may be combined with exercise to be particularly effective. For example, studies have shown that individuals who exercise outside have a decline in negative affect versus individuals who stay inside to exercise (Harte & Eifert,

1995). Korpela and Kinnunen (2011) found that exercise along with being outdoors during free time was rated as the most effective activity for recovery from work stress.

As shown by previous examples, there are many positive ways in which individuals choose to relax such as being in nature, eating food, and exercising. How might we know which activities an individual will find relaxing and restorative at the same time?

Attention Restoration Theory

As previously mentioned, there are many positive activities in which an individual may engage that are perceived to be relaxing and simultaneously restore directed attention. One explanation for how individuals experience restoration through certain activities is described by Attention Restoration Theory (ART; Kaplan, 1995). ART posits that there must be certain qualities present in an environment in order for it to provide a restorative experience. ART states that restorative activities and environments have four particular qualities: being away, fascination, extent, and compatibility (Kaplan, 2001).

Being Away. The first aspect of ART is the sense of “being away from everyday thoughts and concerns” (Herzog et al., 2003). The concept of “being away” does not necessarily require the individual to be physically away from their environment. Scopelliti and Giuliani (2004) note that it is often more restorative to have a conceptual change instead of a physical change. For example, a sense of “being away” could be induced by reading a fiction novel; while one is reading about another environment that includes people who are not in their physical lives, it is easy to feel as if one is taking part in the story. Being away is also similar to psychological detachment, which is outlined in Psychological Recovery Theory (PRT). Ragsdale et al. (2011) described psychological detachment as “psychological experience of mentally disengaging from demands during free time, and it involves

distraction from task-related thoughts” (p.159). One way to overcome resource-depletion is by engaging in activities that are different from one’s regular schedule or demands. While it is not necessary for an individual to be in a new or novel environment to experience the effects of being away, it is necessary for the individual to be away from the environment that is causing the attention depletion (either physically or mentally). The aspect of a different environment that helps facilitate restoration is the change in one’s thoughts away from the stressors and obligations of everyday activity.

Fascination. The fascination aspect of ART involves engaging in activities that are inherently interesting and that hold one’s attention effortlessly. Engaging in fascinating activities does not require effort or inhibition of competing stimuli and allows directed attention to rest. Kaplan (1995) suggests that there are two types of fascination: hard fascination and soft fascination. Hard fascination is typically embodied in an activity that has high stimulation, and those activities often rivet’s one’s attention without one having the opportunity to reflect. Soft fascination is an activity that usually consists of viewing pleasing stimuli (such as nature) and allows for an opportunity to reflect, which promotes the most attention restoration.

Although situations that involve hard fascination and soft fascination share the aspect of captured attention, they may have different restorative effects. Because hard fascination tends to allow little time for reflection, it may be beneficial by entertaining an individual and reducing boredom. In contrast, soft fascination allows individuals to think more freely, make sense of prior experiences, and think through current situations. According to Kaplan (2001), it is important for an individual to recognize and seek out supportive environments that can be conducive to their own personal cognitive restoration. In many studies, natural

environments (e.g., gardens, forests, beaches) have been shown to be the simplest way to invoke fascination. This suggests that these environments have good potential for reflection and restoration (Herzog et al., 2003).

Extent. Extent refers to environments that have a scope and coherence that allows one to feel immersed and engaged with the environment (Kaplan, 2001). In a coherent environment, things happen in a relatively simple, orderly, and predictable way. This means that an individual must be familiar with the environment and not be presented with new or unusual scenarios. One example could be going to one's favorite hiking trail. In this particular situation, an individual knows the lay of the land, the difficulty level, the direction, and all other important aspects that are relative to the environment.

Kaplan (2001) proposes that the extent of an environment can be conceptualized through cognitive maps, which are mental structures that are built from concepts or objects that one has experienced at some point in their lifetime. Cognitive maps help individuals to anticipate things before they happen and to be better prepared for novel situations. Because many environments and concepts have overlapping features, it is typical to have more than one cognitive map "running" at once. In order to focus, a person must be able to inhibit mental maps that are not relevant to the current situation. This inhibition requires directed attention and therefore can lead to DAF.

Environments and situations that evoke "extent" allow the use of fewer cognitive maps. In this case, inhibition is not required, attention is effortless, and restoration is more likely. Familiar environments may be particularly successful at evoking extent. Once an individual is presented with some type of unfamiliar stimuli or experience, it is necessary to

make use of another cognitive map, which takes away from the restorative properties in the environment.

Compatibility. The final quality of ART is compatibility, which means that the individual is doing an activity that is fitting with and supporting what one desires to do or what one is inclined to do (Kaplan, 2001). In seeking compatibility, there are a few key factors that individuals tend to avoid. First of all, many people avoid places that are unfamiliar and that consequently require running multiple cognitive maps at once, expending more energy to understand the new environment. Inappropriate motivation (or extrinsic motivation) may also increase the incompatibility of an environment. Inappropriate motivation may make the activity less meaningful for the individual, thus reducing restorative effects. Finally, engaging in a task that is completely new to an individual may not be restorative due to the struggle involved with acquiring a novel skill. If an individual is doing a task that they intended to do, then they have adequately prepared for the task at hand; however, if an individual is presented with a task or an activity that is not exactly what was intended, this also results in incompatibility.

In addition to the aforementioned “incompatibility factors,” Kaplan (2001) mentions that there are 6 additional sources of incompatibility: distraction, deficit of information, danger, duty, deception, and difficulty. A distracting environment is typically characterized by stimuli that are fascinating but irrelevant to one’s ultimate goal. A highly distracting environment makes obtaining information a highly effortful activity, thus increasing the likelihood of DAF. If an individual lacks adequate information about an environment (e.g., how to behave, how to achieve goals), the individual is experiencing a deficit of information. Deficits of information require an individual to increase attention to search for useful cues to

facilitate task achievement. While a modest amount of danger (e.g., mountain climbing, snowboarding) can be fascinating, chronic and uncontrollable danger can be exhausting. A chronically dangerous environment evokes high levels of vigilance, therefore requiring great use of sustained attention (e.g., a soldier in a warzone). Finally, a sense of danger can be characterized by a fear of acting inappropriately or appearing foolish. While this is a different type of perceived danger than being faced with an actual dangerous activity, it nonetheless evokes a sense of incompatibility in an individual, thus hindering a restorative experience. Duty is similar to extrinsic motivation in that one is engaging in a task that is required or expected, however is different from what one prefers to do. Similarly, deception is the discrepancy between the task one is completing and their thoughts towards it. For example, one can act politely towards an individual yet still be thinking about how much one dislikes him or her. Finally, difficulty is a key factor to incompatibility in that the lack of preparation or anticipation of a difficult situation evokes the use of multiple cognitive maps and therefore, like the rest of the factors, results in incompatibility. These types of situations are best avoided when an individual needs to restore depleted cognitive resources.

Research on ART

There have been several studies to date that have examined the applied utility of ART; however, the findings have been conflicting in regards to how much nature provides restoration of attention. Studies have varied on the type of “nature” intervention used (e.g., viewing pictures vs. actually being immersed in an environment), as well as the type of cognitive task used, the type of mood measure used, and whether the manipulations were between- or within- subjects.

For example, Hartig et al. (1996) conducted a between-subjects study to determine how viewing pictures of nature, an urban setting, or viewing no pictures affected levels of attention restoration. The researchers used the Stroop Task (Stroop, 1935) to induce DAF, the Search and Memory Task (SMT; Smith & Miles, 1987) as an outcome measure to determine attentional restoration, and Zuckerman's (1977) Inventory of Personal Reactions (ZIPERS) to measure mood. After completing the Stroop Task, participants were shown their assigned type of pictures on a projection screen (or none at all, in the control group). Participants spent roughly 13.5 minutes looking at pictures prior to completing the SMT. The researchers found evidence in favor of higher rates of attention restoration with exposure to the nature pictures versus the no-picture control; however, they did not find any significant differences when comparing the effects of natural versus urban scenes. Regarding mood, the researchers found that those who viewed pictures of nature reported higher positive affect than the controls; contrary to that which was expected, however, participants also showed an increase in negative affectivity as well.

Berman, Jonides, and Kaplan (2008) conducted a similar study and found different results through using a within-subjects design. Participants completed the Positive and Negative Affect Schedule (PANAS) to assess mood, and the backwards digit-span (BDS) task and Attention Network Task (ANT) both to induce DAF and to test attention restoration. After participants completed the measures, they walked in an urban or naturalistic environment (Experiment 1) or viewed pictures of either an urban or naturalistic environment (Experiment 2). After exposure to the environment, participants completed each measure once more. Interestingly, participants who walked in a naturalistic environment experienced an increase in mood in comparison with those who walked in an urban environment; though

those who simply viewed pictures of natural or urban environments did not experience any differences in reported mood. Although data were slightly different across studies, it seems that exposure to nature resulted in more attention restoration on both the ANT and BDS.

Finally, Hartig, Evans, Jamner, Davis, and Garling (2003) conducted a study similar to that of Berman et al. (2008), though a between-subjects design was used. Specifically, prior to a restorative experience, participants completed self-report measures on mood and attentiveness via the ZIPERS, the SMT, and the Necker Cue Pattern Control task (NCPCT) to induce DAF. Participants were then randomly assigned to either sit in a room with a view of nature then take a nature walk, or to sit in a room without a view then take a walk through an urban environment. The researchers found that environment had a statistically significant effect on the post-measures of cognitive performance, where those who were exposed to a natural environment showed improvement in comparison to individuals exposed to an urban environment. In addition, the researchers found a significant interaction between assigned environment and task condition such that participants who took a nature walk without completing a DAF-inducing task reported higher levels of overall happiness as measured by the ZIPERS (Zuckerman, 1977) than those who walked in an urban environment without completing DAF-inducing measures. Nonetheless, there were no differences in reported happiness between natural or urban groups when participants completed DAF-inducing measures.

It is important to note the ambiguity of the preexisting literature regarding ART. Specifically, two studies found a positive impact on one's attention following *physical exercise in an outdoor environment* (e.g., Berman et al., 2008; Hartig et al., 2003). On the other hand, another study (e.g., Hartig et al., 1989) did not find any difference in attention

restoration after simply *sitting and looking* at pictures of outdoor environments. It is unclear whether the variation between studies is because of differences in movement, immersion in the environment, or in being outdoors vs. indoors. This suggests that more research is needed to determine the boundary conditions for ART. Therefore, the current study aims to determine if immersion in an indoor environment with natural elements (“natural environment”) will be more beneficial to cognitive restoration than immersion in an environment with no naturalistic elements (“built environment”).

Clinical Applications of ART

While there have been several studies regarding the conceptual and applied framework of ART in non-clinical populations, research is limited on the utility of ART on clinical populations. One study focused on the relationship between exposure to nature and reports of Attention-Deficit /Hyperactivity Disorder (ADHD; Kuo & Taylor, 2004). Participants in this study were those who volunteered to participate via the website of Children and Adults with Attention-Deficit/Hyperactivity Disorder. Individuals whose responses indicated that they were a parent of a child diagnosed with ADHD by a professional were included in the study. The survey included 4 symptoms selected from the Diagnostic and Statistical Manual of Mental Disorders criteria of ADHD that are “easily observable” by parents (DSM; 4th ed., text revision, American Psychiatric Association, 2000; Kuo & Taylor, 2004, p.1582). The survey investigated the effects of common after-school and weekend activities on their child’s ADHD symptoms. The findings indicated that outdoor activities in natural environments significantly reduced ADHD symptoms in comparison to indoor activities or outdoor activities in built environments.

There are several limitations to this study. First of all, the respondents may have had different perceptions of symptom severity or perceptions of change. Also, the activities reported by the respondents may have been interpreted differently than they were intended in the survey (e.g., playing outside for one person may include throwing a baseball, whereas someone else may interpret playing outside as sitting in the grass). Canu and Gordon (2005) stated that another limitation of this study is that the reports of the positive effects of nature on ADHD symptoms were reported retrospectively, and were not directly measured following interaction with nature. Additionally, there is no evidence from this study concluding the duration of the positive effects of nature last for an extended period of time. Canu and Gordon (2005) also point out that Kuo and Taylor's (2004) conclusion that nature is a beneficial intervention for the alleviation of ADHD symptoms is based on statistical significance and not on actual clinical impact.

Kuo and Taylor (2004) note that that they would not expect for the advantage of completing activities in a natural setting to disappear if they were to use objective performance measures after carefully matched activities. Taylor and Kuo (2009) conducted a separate study involving reduction of ADHD symptoms in relation to the natural environment. Children in this study were recruited through newspaper advertisements and were required to be diagnosed by a professional who has experience in ADHD assessment. Prior to having each of the children walk for 20 minutes in either an urban, natural, or neighborhood environment, they were required to participate in tasks aimed at inducing DAF. Each child visited each location on different days as a method to counterbalance order effects. The researchers found that children performed better on tasks of concentration after walking in nature rather than walking in urban or neighborhood settings.

A recent study examined the relationship between interacting with nature and improvements in short-term and/or working memory for individuals with Major Depressive Disorder (MDD; Berman et al., 2012). They hypothesized that people with MDD are more likely to be mentally fatigued than people without MDD, so they may experience more benefits from interacting with nature. Participants included in this study met criteria for MDD as determined by the Structured Clinical Interview for DSM Disorders (SCID). The researchers first assessed mood with the PANAS. Afterwards, participants completed a backward digit span task. Finally, participants were primed to ruminate by instructing them to analyze their feelings surrounding an intense, unresolved negative autobiographical experience. They were then taken on a 2.8-mile walk through either an outdoor arboretum or a downtown walk in an urban area. When they returned to the lab, they completed the PANAS and backwards digit span once more. The researchers discovered that individuals who were diagnosed with MDD exhibited cognitive and affective improvements after walking in a nature setting. The effects were observed even though participants were instructed to ruminate about a negative experience, which has been shown to disrupt working memory.

While the current study is not focusing on a clinical population, it may shed light on the utility of using aspects of nature as a therapeutic intervention. Many times, an individual will engage in therapy because they are stressed or feel overworked. If a clinician can familiarize themselves with different ways and perspectives that could constitute a restorative experience, clients can be given a broader range of options to help with relaxation along with other techniques (such as guided imagery, breathing exercises, and muscle relaxation). If the results of the current study substantially support the hypotheses (see below), it may suggest

that interacting with nature lends itself to a cost-effective and relatively accessible type of intervention.

Overview of the Current Study

There are several reasons why it is important to examine restoration as described by ART. Although many college students engage in activities that they believe are relaxing (and possibly restorative), it is important to understand the ways in which they can adaptively use campus resources to help with the restorative process. Since college is such an important step in one's life, it is also one that can be heavily laden with stress. Accordingly, it is important to help students understand the characteristics of a fully restorative experience and how to incorporate them into their daily routine. Far too often, individuals do not engage in restorative experiences (or do not reach levels of optimal restoration), which may have negative consequences on cognitive performance and physiological state.

From a research perspective, it is important to study the different aspects of ART because there is a dearth of literature regarding the potential restorativeness of nature in general, and there are conflicting results in the few studies that have been published. This makes it difficult to understand the extent and mechanisms of actual restorative processes taking place in vivo. Because individuals differ in environmental preferences (e.g., some individuals may not enjoy being in nature), further investigation of the strengths and weaknesses of ART will help tailor restorative experiences on an individual level.

The proposed hypotheses of this study are as follows:

1. A more naturalistic environment will have higher levels of perceived restorativeness than a less naturalistic environment.

2. After inducing directed attention fatigue, individuals will experience more attention restoration in the naturalistic environment than the less naturalistic environment and will perform better on post-measures of attention.
3. After engaging in their restorative experience, individuals in the naturalistic environment will report better mood than individuals in the less naturalistic environment.

Pilot Study

The purpose of the pilot study was to determine whether participants viewed the chosen naturalistic environment as more restorative than the less naturalistic (“built”) environment. The naturalistic environment chosen for the pilot study was the Solarium, housed in the Student Union located on the campus of Appalachian State University. The Solarium is an indoor space including living plants, trees, and running water that reminds one of waterfalls. The Solarium also has large windows, which allow individuals to be able to have a view of the outdoors, which also includes trees, naturally occurring open space, the Appalachian Mountains, and the current weather. According to Hartig et al. (1989), restorative responses are evoked by naturalistic characteristics including the presence of vegetation or water, which are both present in the Solarium. The built environment chosen for the pilot study is called Whitewater Café, which is also in the Student Union on campus. This environment does not have any views of nature nor does it have any type of foliage or plant life. Whitewater Café consists of an assortment of chairs scattered throughout the room along with computers, televisions, and artwork. Representative photos of the two environments may be found in Figure 1 on page 59.

The rationale for choosing the Solarium and Whitewater Café is supported by a study conducted by Felsten (2009) that investigated which locations on campus elicited higher levels of perceived restoration. The researchers found that individuals who looked at pictures of a study lounge that included a window view of nature had higher rates of perceived restoration than individuals who viewed a study lounge that only had views of built environments. The researchers also found that individuals who had a picture of a lounge that included a mural of running water (such as a waterfall or ocean view) received the highest level of restoration. This is another reason why the Solarium was chosen to be the naturalistic environment: participants will actually experience being around running water. One advantage that this pilot study has over much of the existing research on ART is that individuals were actually seated in the specified location and did not simply look at pictures. This method of research may allow for a better examination of the restorative qualities of a natural environment.

Method

Prior to the beginning of the study, the researcher submitted a request for approval to the Institutional Review Board (IRB). The pilot study was considered exempt by the IRB under Exemption Category 2 on 2/21/2012 (see Appendix A).

Participants. Participants were 51 undergraduates from Appalachian State University who agreed to participate in the study. Participants signed up for the study via the research database (SONA) available to undergraduates in the psychology department. Participants were at least 18 years of age, and the overall academic status of the participants ranged from freshmen to seniors, including 41 women and 10 men.

Measures. Participants completed two measures. The first measure was the Restorative Qualities of the Environment, which is a 5-item scale used to assess the restorative components of an environment through the framework of ART (Herzog et al., 2003). Each response to this questionnaire was on a 10-point Likert scale, with higher scores indicating higher levels of perceived restorativeness. Each question assessed one of the four components of ART: being away, fascination, compatibility, and extent, with an additional quality called preference. Only the four main qualities of ART were included in the analyses. The second measure that was distributed to the participants is called the Restorative Preferences Questionnaire, which was created by the investigator (see Appendix C). This measure was included for exploratory purposes, in particular to assess the students' general environmental preferences for relaxation and to determine whether there were differences in how familiar students were with the selected locations.

Procedure

The researcher adhered to all ethical principles pertaining to human subjects as outlined by the Collaborative Institutional Training Initiative (CITI). Once participants signed up for the study they were randomly assigned to meet the experimenter at either the Solarium or Whitewater Café. Upon arrival at the research site, participants first completed an informed consent document (see Appendix B). After consent was obtained, participants filled out the Restorative Qualities of the Environment Questionnaire and the Restorative Preferences Questionnaire.

Results

Differences in the perceived restorativeness of the two environments were tested using a multivariate analysis of variance (MANOVA), with the four facets of ART (e.g.,

being away, extent, fascination, and compatibility- as measured by the Restorative Qualities of the Environment Questionnaire) as dependent variables and location (Solarium vs. Whitewater Café) as the independent variable. Consistent with Hypothesis 1, the naturalistic environment (i.e., Solarium) was perceived to be more restorative than the built environment (i.e., Whitewater Café), $\lambda = .78$, $F(4, 47) = 3.25$, $p = .02$ (see Figure 2, Top). Specifically, individuals who completed their measures in the Solarium indicated higher levels of extent than individuals who completed their measures in Whitewater Café, $F(1, 49) = 6.53$, $p = .014$, $d = .71$. Individuals in the Solarium also perceived higher levels of fascination than individuals in Whitewater Café, $F(1, 49) = 6.57$, $p = .014$, $d = .72$. Finally, individuals located in the Solarium perceived higher levels of compatibility than individuals in Whitewater Café, $F(1, 49) = 4.84$, $p = .033$, $d = .33$. There were no significant differences, however, between the Solarium and Whitewater Café on perceived levels of being away $F(1, 49) = .222$, $p = .640$, $d = .07$.

The results of the Restorative Preferences Questionnaire indicated that significantly more people in the Solarium condition had been in that location before (22 of 25), compared to the Whitewater Café condition (15 of 26), $\chi^2(1) = 5.88$, $p = .02$. Additionally, among the participants who had previously been in their assigned location, those in the Solarium condition reported visiting that location more frequently than the participants in the Whitewater Café condition, $\chi^2(1) = 5.88$, $p = .02$; see Table 1 on page 57.

To examine the potential effects of location familiarity on perceived restorativeness, two additional MANOVAs were conducted on the data from the Restorative Qualities of the Environment Questionnaire. In each MANOVA, Location Familiarity (Previously Been in Location vs. Not Been in Location) was used as an independent variable. The first

MANOVA was on the full sample, collapsing over location. Because almost all of the participants in the Solarium condition had previously been in the Solarium, the second MANOVA examined the impact of location familiarity only for participants in the Whitewater Café condition. In neither analysis did prior location familiarity make a difference in perceived restorativeness; $\lambda = .92$, $F(4, 46) = 1.02$, $p = .41$, for the full sample; $\lambda = .92$, $F(4, 21) = 0.85$, $p = .51$, for Whitewater Café.

Discussion

The purpose of this pilot study was to determine whether a more naturalistic environment would elicit higher reports of restorative properties than the less naturalistic environment. Hypothesis 1, that the Solarium would evoke higher levels of perceived restorativeness than Whitewater Café, was supported regarding extent, fascination, and compatibility elements of restoration. Because individuals perceived the Solarium as more restorative than Whitewater Café, it is hypothesized that the Solarium will elicit higher levels of attention restoration in the experimental study.

Because people were more familiar with the Solarium than Whitewater Café, however, this introduces a potential confound. That is, it may be that being in a familiar location, rather than being in a natural environment, was more restorative. It is important to note that participants who had previously been in Whitewater Café did not rate the environment significantly differently than those who had not previously been there. Moreover, participants' greater familiarity with the Solarium may be a *result* rather than the *cause* of their perceptions of its restorative nature. Question #2 of the restorative preferences questionnaire asked participants to choose a place to relax from among several campus

locations. The solarium was chosen by the largest number of participants ($N = 20$); no one selected Whitewater Café.

Experimental Study

The purpose of the experimental study was to determine whether the naturalistic environment would improve attention and improve mood as suggested by the results of the pilot study. Based on the results of the pilot study, the Solarium was used as the natural environment and Whitewater Café as the built environment. Prior to the beginning of the study, the researcher submitted a request for approval to the Institutional Review Board (IRB). The experimental study was approved on 9/4/2012 by the IRB (see Appendix D).

Method

Participants. Participants were 58 college students (44 women, 14 men; 29 in each condition) between the ages of 18 and 37 ($M = 19.26$, $SD = 2.53$) who participated in return for course credit. The sample was primarily Caucasian (90%), with 5% of participants identifying as Hispanic and 1 each identifying as Asian, Korean, and Armenian (5%). Students reported having completed between 0 and 14 semesters of college ($M = 1.85$, $SD = 2.08$).

Previous research examining the impact of the environment on measures of cognitive performance in college students has found effect sizes between $\eta_p^2 = .04$ and $\eta_p^2 = .14$. Using the current sample size and a correlation of .60 between the repeated measures, the statistical software G*Power indicates power of .93 to detect the critical Condition x Time Point interaction with the smaller effect size ($\eta_p^2 = .04$).

Materials and Measures

Cognitive Measures. Participants completed two cognitive tests designed to induce and measure directed attention that have been used in previous research on ART.

Search and Memory Test. The Search and Memory Test (SMT) was used as a means of inducing DAF by searching for target letters in random strings of letters that may or may not have had the original targets present (Hartig et al., 1996; Smith & Miles, 1987; see Appendix E). The purpose of this task was for the participants to deplete their cognitive resources by searching for a letter that will not be present. Each line contained 59 letters, of which 0-4 were targets. Lines were arranged in sets of six, with 11-14 target letters distributed through each set. Two pieces of paper were given to each participant along with a cover sheet that provided instructions and prevented individuals from searching the lines before given the start command. Participants were allowed 10 minutes for performance, and after 5 minutes participants were instructed to circle the letter they were looking at the moment. Two scores were used to determine SMT performance: the percentage of correctly identified targets (accuracy) and the number of lines scanned in 5 minutes (speed).

Backwards Digit Span Task. The backwards digit span task was modeled after the Backwards Digit Span (BDS) subtest in the Wechsler Adult Intelligence Scales—Fourth Edition (WAIS-IV; Wechsler, 2008; see Appendix F). In BDS, participants listen to a string of numbers and then are asked to report the numbers in reverse order. While participants in this study did not use the same number sequences as in the WAIS-IV, the structure was similar. Each sequence had different numbers; and as the sequence became more difficult, it became longer. Participants recited each sequence until they either incorrectly recited two sequences in a row or completed all of the items on the measure. The BDS was used in

this study because it depended heavily on directed-attention abilities in that participants moved items in and out of their attentional focus (Cowan, 2001). The BDS was administered pre-restorative experience as a way to induce DAF and was also administered post-restorative experience as a measure of attention restoration. Scores indicate the total number of sequences recalled correctly. Alternate forms were used for both the BDS and the SMT pre- and post-restoration.

Mood & Restoration Measures.

Positive and Negative Affect Schedule. Participants completed the Positive and Negative Affect Schedule (PANAS) before and after their restorative experience. The PANAS is a 10-item self-report measure that is aimed at measuring Positive Affect (PA) and Negative Affect (NA; Watson, Clark, & Tellegen, 1988). Specifically, individuals who report high PA are in a state of high energy, full concentration, and pleasurable engagement, while low PA is characterized by sadness or lethargy (Watson et al., 1988). Additionally, high NA is characterized by subjective distress and aversive mood states, including anger, contempt fear, disgust, and nervousness. Low NA is considered a state of calmness and serenity (Watson et al., 1988). Participants were instructed to rate their different feelings and emotions for the present moment, with responses ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). The PANAS has strong internal consistency, including $\alpha = .89$ for the PA scale and $\alpha = .85$ for the NA scale. The purpose of including the PANAS was to determine if the location had an impact on one's reported mood after inducing DAF by comparing scores pre- and post-restorative experience.

Restorative Qualities of the Environment. As in the pilot, participants completed the Restorative Qualities of the Environment Questionnaire (Herzog et al., 2003) following ten

minutes of quiet sitting in their randomly assigned location as a manipulation check. For the experimental study, additional information was obtained regarding familiarity of both Whitewater Café and the Solarium as part of this questionnaire rather than filling out a separate measure (e.g., Restorative Preferences Questionnaire as in the pilot study). Specifically, participants indicated “yes” or “no” if they had previously been in both Whitewater Café and/or the Solarium as well as how many times they had been in each location. In the current study, participants answered in a continuous nature rather than categorical, as in the pilot study.

Research Assistant Survey. Research assistants filled out a survey that included information about the number of people in each location, the noise level of the location, and the time of day. When appropriate, the descriptive information obtained from each location was used to determine if attention restoration covaries with additional factors (see Appendix G).

Other Measures.

Depression Anxiety Stress Scales. The DASS-21 is a 21-item self-report measure aimed at measuring the severity of a range of symptoms common to depression, anxiety, and stress (Henry & Crawford, 2005). The DASS-21 has been shown to have strong internal consistency, including $\alpha = .88$ for the depression subscale, $\alpha = .82$ for the anxiety scale, and $\alpha = .90$ for the stress scale. The DASS-21 has internal consistency of $\alpha = .93$ for the total scale (Henry & Crawford, 2005). Scores on this scale were obtained by summing item responses. Once scores were summed, they were assigned a severity rating of “normal, mild, moderate, severe, or extremely severe” for each subscale. It is important to note that severity ratings of the DASS-21 are not intended for diagnostic purposes or clinical cutoffs, as it is normed on

the whole population in comparison to a clinical population. Rather, the scores were used for descriptive purposes to understand the subjects' symptomology in comparison to the rest of the population. One advantage to using this scale was that it is short in length, thus making it more acceptable for participants who might have limited concentration after DAF-inducing tasks to complete. Another advantage was that this scale has strong psychometric properties, and has shown to be valid for both clinical and non-clinical populations (Henry & Crawford, 2005). Participants completed the DASS-21 after their restorative experience and after completing the SMT and BDS tasks.

Demographic Questionnaire. Participants completed a demographic questionnaire after completing the DASS-21. The items on the questionnaire include age, ethnicity, college status, medical problems, psychological diagnoses, psychological treatments, and medication use.

Adult ADHD Self-Report Scale. Participants completed the Adult ADHD Self-Report Scale after completing the Demographic Questionnaire (ASRS-v1.1; Kessler et al., 2005). The ASRS-v1.1 is a symptom checklist consisting of the 18 DSM-IV-TR (American Psychiatric Association, 2000) criteria for ADHD. The purpose of including the ASRS-v1.1 was to identify any participants who might meet criteria for ADHD, as this study pertains to attentional mechanisms. While ASRS-v1.1 and the demographic questionnaire are not used as diagnostic tools, they might shed light on the effects of attention restoration on any participants who meet criteria for ADHD or any other psychological disorder. Since there is a deficit of literature on ART in clinical populations, additional information might shed light on the potential positive benefits of attention restoration as provided by nature.

Procedure

Based on activity levels in the Solarium and Whitewater Café that were observed during the pilot study, it appeared that times during the early morning or early evening were the least busy and appeared to have less distraction in each location. Therefore, participant times were scheduled during these hours. In addition, research assistants did not test participants during times when there were formal events scheduled in each location. All research assistants were trained by the author of the study and ran several practice participants to bolster intervention fidelity.

Once participants signed up for the study, they were randomly assigned to engage in their restorative experience in either the Solarium or Whitewater Café. After each participant was randomly assigned, the participant met an undergraduate research assistant in a specific room located in Plemmons' Student Union. Though the same room was not used for the entire duration of the study due to availability, each room was similar in its aesthetic qualities and set-up. Specifically, each room was set-up with one table and two chairs and the rooms were located in low-traffic areas of the Student Union.

After informed consent was obtained, participants completed the first administration of the SMT and BDS; the order of these two tasks was counterbalanced across participants. They then filled out the first administration of the PANAS. They were then led to their predetermined location (either the Solarium or Whitewater Café) to engage in their restorative experience. Prior to the restorative experience, the experimenter provided the participants with the prompt, "Please sit quietly for the next ten minutes. You are free to think about whatever you wish, but please do not go to sleep, use any electronic device, or engage in any other activity." Following ten minutes of quiet sitting, participants filled out

the Restorative Qualities of the Natural Environment Measure (Herzog et al., 2003). After filling out the measure, the researcher led the participants back to the previous location, and had them fill out the PANAS once more. They then completed the second version of the BDS and SMT in the same counterbalanced order. After completion of the cognitive tasks, participants completed the demographic questionnaire, the DASS-21 and the ASRS-v1.1.

Results

Preliminary Analyses

Because this was a naturalistic study, there were several aspects of the two environments that could not be experimentally controlled, but that had potential implications for the restorative experience. Therefore, before investigating the hypothesized differences in perceived and actual restoration, I first examined whether the two environments differed in noise level, music playing, presence of other people, and participants' familiarity with the locations.

When specifically examining the Research Assistant Questionnaire, there are several differences between environments worth noting. For one, it appears that the Solarium ($M = 30.28$, $SD = 14.14$) had significantly more people present during the restorative experience than Whitewater Café ($M = 6.38$, $SD = 4.91$), $t(55) = 8.59$, $p < .001$. Additionally, music was playing more frequently in Whitewater Café (27 participants) than in the Solarium (20 participants), $X^2(1, N = 57) = 4.63$, $p = .03$. The two environments did not differ in perceived noise level, $X^2(3, N = 57) = 2.65$, $p = .45$, with the majority of the ratings in both conditions being either "Quiet" ($N = 28$) or "Somewhat Loud:" ($N = 24$).

Unlike the findings in the pilot study, analyses of familiarity indicated that there were no significant differences between the locations in participants' familiarity with the locations.

Specifically, 23 out of 29 participants in the Solarium condition indicated that they had visited the Solarium prior to the study, and 18 out of 29 individuals in the Whitewater Café condition had visited Whitewater Café prior to the study, $\chi^2(1, N = 58) = 2.08, p = .15$. In addition, among the participants who had previously been to their assigned location, there were not significant differences in the number of times people had been to the Solarium ($M = 7.36, SD = 9.95$) or Whitewater Café ($M = 3.78, SD = 3.92$), $t(38) = 1.44, p = .16$.

Because the locations differed in the number of people present and the playing of music, these variables were included as covariates in the following analyses. Because responses on the research assistant questionnaire were missing for one Solarium participant, the total number of participants in any of the ANCOVAs below is 57 (28 in the Solarium, 29 in Whitewater Café).

Hypothesis 1

To determine whether the naturalistic environment elicited higher levels of perceived restorativeness than the less naturalistic environment, a MANCOVA was conducted to compare the scores of perceived restorativeness for each of the environments, as in the pilot study. The four facets of ART as measured by the Restorative Qualities of the Environment Questionnaire (Herzog et al., 2003) were dependent variables and location (Solarium vs. Whitewater Café) was the independent variable. Overall, results were not consistent with Hypothesis 1, such that there was no significant difference in perceived levels of restoration between locations, $F(4, 50) = .84, \lambda = .94, p = .51$ (see Figure 2, bottom). It is important to note that a bivariate correlation indicated the larger amount of individuals present in the restorative location, the less compatible they felt with their environment, $r(55) = -.31, p = .02$.

To examine the potential effects of location familiarity on perceived restorativeness, two additional MANCOVAs were conducted using the data from the Restorative Qualities of the Environment Questionnaire. In each MANCOVA, Location Familiarity (previously been in location vs. not having been in location before) was used as an independent variable. The first MANCOVA was on the full sample, collapsing over location. Overall, there was no effect of familiarity on perceived restorativeness across both groups, $\lambda = .043$, $F(4, 50) = .58$, $p = .68$. This MANCOVA was then repeated in each group, but again location familiarity had no significant effect on restoration (all p 's $> .20$).

Because the results for perceived restorativeness in the Experimental study were so different from that of the Pilot study, another analysis was conducted to investigate the nature of this difference. Inspection of the means in Figure 2 suggested that the participants in the Solarium rated the environment as less restorative in the Experimental study than in the Pilot study, and that participants in Whitewater Café rated the environment as more restorative in the Experimental than in the Pilot study. To determine if the difference between Studies was significant, another MANOVA was conducted on perceived restorativeness with Location (Solarium vs. Whitewater) as one independent variable and Study (Experimental vs. Pilot) as the second independent variable (covariates were excluded on this analysis because they were not collected for the pilot study). Results indicated that there was no main effect of Condition, $F(4, 102) = .86$, $\lambda = .97$, $p = .49$ or Study, $F(4, 102) = .60$, $\lambda = .98$, $p = .66$. There was, however, a highly significant interaction between Condition and Study, $F(4, 102) = 4.17$, $\lambda = .86$, $p = .14$. Follow-up MANOVAs comparing the pilot to the experimental studies for each location, however, indicated that the difference between studies was only statistically significant for the Solarium condition, $F(4, 49) = 3.52$, $p = .013$. This suggests

that pilot participants in the Solarium may have overestimated the perceived restorativeness of their location. It may also be possible that participants in the Solarium condition in the experimental study underestimated its perceived restorativeness, suggesting variability in the perception of restoration across studies.

Hypothesis 2

To test the hypothesis that the natural environment would reduce attention fatigue more than the less-naturalistic environment, separate analyses of covariance (ANCOVAs) were conducted on the speed and accuracy on the SMT, and the total BDS scores, before and after the restorative experience. For each dependent variable, a 2x2 mixed ANCOVA was conducted, with location as a between-subject variable, and timepoint (pre vs. post) as a within-subjects variable. As noted above, number of people present and the playing of music were included as covariates.

SMT Correct Responses. The ANCOVA on SMT correct responses did not indicate a significant main effect of timepoint, $F(1, 53) = .21, p = .65, \eta_p^2 = .004$ or condition, $F(1, 53) = .63, p = .43, \eta_p^2 = .01$. Critically for hypothesis 2, the interaction between condition and timepoint was not significant, $F(1, 53) = .34, p = .55, \eta_p^2 = .006$. This suggests that spending time in the Solarium did not result in more attention restoration than spending time in Whitewater Café.

SMT Speed. Regarding the dependent variable of speed, it is important to note that some participants completed the SMT prior to the five-minute check-point; therefore, participants who finished early were excluded from this analysis. Further investigation indicated that more individuals in the Whitewater Café condition completed their SMT prior to the five-minute check-point than those in the Solarium, both pre- and post-restorativeness

experience (25 participants in the Solarium condition both pre- and post- did not finish before five minutes as compared to 21 participants in the Whitewater Café condition), although this difference was not statistically significant, $\chi^2(1, N = 58) = 2.81, p = .09$. After excluding these participants, there was no main effect of timepoint, $F(1, 42) = .09, p = .76, \eta_p^2 = .002$, or condition, $F(1, 42) = 2.28, p = .14, \eta_p^2 = .05$. Specific to hypothesis 2, the interaction between timepoint and condition was not statistically significant, $F(4, 42) = 3.11, p = .08, \eta_p^2 = .07$ (see Figure 3).

BDS Scores. Regarding BDS scores, there were no significant main effects for timepoint, $F(1, 53) = .02, p = .89, \eta_p^2 = .002$, or condition, $F(1, 53) = 1.18, p = .28, \eta_p^2 = .02$. Critical to hypothesis 2, there was not a significant interaction between timepoint and condition, $F(1, 53) = .53, p = .47, \eta_p^2 = .01$. Consistent with results of SMT correct responses, spending time in the Solarium did not elicit more attention restoration than those who spent time in Whitewater Café (see Figure 4).

When taking the sum of information into account, individuals who had their restorativeness experience in the Solarium did not experience significantly more attention restoration than those who spent time in Whitewater Café as measured by several instruments, which is contrary to hypothesis 2. It is important to note that the effect sizes found in this study were relatively smaller than those found in previous studies (e.g., Berman et al., 2008), so the lack of significant findings is not simply due to low power. In fact, the effect sizes found in the current study were nearly zero for several of the critical interactions (e.g., BDS scores and SMT correct responses). Potential explanations for this will be explored below in the discussion section. For SMT speed, there was a trend towards the people in the Solarium getting faster after their restorative experience, whereas the people in

Whitewater did not. Given that more people in the Whitewater condition were excluded from this analysis, some caution in interpretation is warranted.

Hypothesis 3

To test the hypothesis that spending time in the natural environment would improve mood more than spending time in the built environment, separate 2x2 mixed ANCOVAs were conducted on the Positive and Negative PANAS scores, with location as a between-subject variable, and timepoint (pre vs. post) as a within-subjects variable. For positive affect, the ANCOVA did not indicate a significant main effect of timepoint, $F(1, 53) = 0.81$, $p = .37$, $\eta_p^2 = .015$ or condition, $F(1, 53) = 1.36$, $p = .25$, $\eta_p^2 = .025$. Critically for hypothesis 3, the interaction between condition and timepoint was not statistically significant, $F(1, 53) = .001$, $p = .97$, $\eta_p^2 < .001$ (see Figure 5). For negative affect, the ANCOVA indicated a marginal main effect of timepoint, $F(1, 53) = 3.71$, $p = .06$, $\eta_p^2 = .065$, and significant effect of condition, $F(1, 53) = 4.27$, $p = .04$, $\eta_p^2 = .075$ but no interaction between condition and timepoint, $F(1, 53) = .77$, $p = .38$, $\eta_p^2 = .014$. As may be seen in Figure 5, participants in both conditions were lower in negative affect after the restorative experience, and participants in the Solarium condition showed slightly less overall negative affect than participants in the Whitewater condition.

Overall, results did not support hypothesis 3, such that individuals who had their restorativeness experience in the Solarium did not experience a significant increase in positive affect. Participants did report lower levels of negative affect post the restorativeness experience, regardless of condition.

Exploratory Analyses

As previously mentioned, the research conducted on the clinical implications of ART is scant. As such, several exploratory analyses were conducted to investigate the impact of spending time in a natural environment on those whose self-report measures were suggestive of psychological disorders. The first set of analyses examined whether having been previously diagnosed with a psychological disorder moderated the results for Hypotheses 2 and 3. To do this, the ANCOVAs reported above were re-run with the inclusion of Prior Mental Health Diagnosis (Yes or No) as a second independent variable. Of particular interest for this exploratory question, diagnostic status interacted with Time Point and Condition for two of the five dependent variables: Negative Affect, $F(1,51) = 4.01, p = .05, \eta_p^2 = .07$, and SMT correct responses, $F(1,51) = 4.83, p = .03, \eta_p^2 = .09$. As may be seen in Figure 6, in general the pattern of results suggests that participants who had prior mental health diagnoses may have been more strongly affected by the experimental manipulation. Specifically, over half of the population with previous diagnoses reported sole diagnoses of ADHD ($N = 8$); additionally, some participants endorsed comorbid conditions such as ADHD and some type of affective disorder ($N = 4$). Four participants endorsed diagnoses other than ADHD. Interestingly, the majority of participants in the Whitewater Café condition (6 out of 7) endorsed a diagnosis of ADHD, whereas only 2 out of 5 participants in the Solarium reported a diagnosis of ADHD. Because of the very small number of participants with prior diagnoses ($N = 5$ in the Solarium condition; $N = 7$ in the Whitewater condition), caution is warranted in this interpretation. Nevertheless, it does suggest ground for future research.

A second set of analyses then investigated whether depressive symptomatology moderated the results for hypotheses 2 and 3. In this case, the ANCOVAs for hypotheses 2

and 3 were repeated with total DASS-21 depression scores included as a covariate. The only relevant effect was a marginally significant interaction between depression scores and Time Point for negative affect, $F(1,52) = 3.74, p = .06, \eta_p^2 = .07$. Participants with higher depression scores showed a greater decline in negative affect after their restorative experience than those with lower depression scores. This effect, however, did not vary by condition.

Finally, individuals who endorse four out of six critical ASRS-v1.1 items have symptoms highly consistent with ADHD in adults (Kessler et al., 2005). As such, we investigated whether those who met this threshold responded differently to the intervention than those who did not. As before, the ANCOVAs for hypotheses 2 and 3 were repeated with those who endorsed four or more symptoms on the first six items of the ASRS-v1.1 included as a second independent variable. None of the results involving the ASRS-v1.1 scores were statistically significant.

Discussion

The purpose of this study was to examine whether different qualities of an environment (as suggested by ART) helped to facilitate the restoration of one's cognitive resources after completing tasks aimed to induce DAF. Overall, the results suggest that indoor environments with natural elements are no more restorative than indoor environments without these elements.

Perceived Restoration

For Hypothesis 1, it was expected that results of the pilot study would be replicated, such that participants would perceive the Solarium to be more restorative than Whitewater Café. In the experimental study, however, there were no overall differences in perceived

restoration between environments. Moreover, an exploratory analysis directly comparing the pilot and experimental studies found that people in the pilot study rated the Solarium as more restorative than did people in the experimental study.

There are several factors that might have contributed to the differences in perceived restoration between the pilot study and the experimental study. For one, participants completed two very different activities. In the pilot study, participants were only told to complete the Restorative Qualities of the Environment Questionnaire and *imagine* how restorative that location might be (Herzog et al., 2003). In contrast, participants in the experimental study had to complete two rounds of difficult and cognitively draining tasks before and after their restorative experience and actually spent time in their assigned environment prior to completing the Restorative Qualities of the Environment Questionnaire. As such, it is possible that the tasks that an individual engages in *prior* to attempting to restore cognitive resources have an impact on how a person perceives the restorativeness of the environment. Similarly, participants in the pilot study did not have to sit in their assigned environment for several minutes before completing the Restorative Qualities of the Environment Questionnaire as in the experimental study. Therefore, impulsively completing the questionnaire may not have given as accurate a picture of perceived restorativeness as experiencing the environment itself did.

Another reason why there were such stark differences between levels of perceived restorativeness between the pilot study and the experimental study might be affective forecasting (Wilson & Gilbert, 2003). Affective forecasting research suggests that people's predictions about how something will make them feel are often distorted, and they tend to *overestimate* the impact of experiences on their feelings. In particular, when participants

make quick judgments about environments (as in the pilot study), they often focus on one aspect of the environment (e.g., the lighting, the plants) and ignore other relevant information (e.g., the size, the noise). This is known as “focalism” (Wilson & Gilbert, 2003) and has previously been shown to cause inaccurate predictions of how different living environments impact life satisfaction (Schkade & Kahneman, 1998). Besides focusing, other biases may have been present in the pilot participants. For example, more pilot participants in the Solarium condition had visited the Solarium prior to the study. It is possible that they were basing their predictions of restorativeness on their past experiences of the Solarium (e.g., “I’ve been here many times before, so it must be restorative”).

Though it is more common for individuals to overestimate the emotional impact of certain events, it is also possible for individuals to *underestimate* that same impact (Nisbet & Zelenski, 2011). In fact, Nisbet and Zelenski (2011) conducted a study in which participants were randomly assigned to walk indoors via underground tunnels or outdoors in an environmental urban area and were either emotional forecasters or emotional experiencers (i.e., forecasters were told to predict how the walk would make them feel and experiencers rated their feelings following the walk). Results suggested that the forecasters underestimated the positive impact of walking outdoors when compared to the experiencers and that forecasters overestimated the positive experience of walking indoors when compared to the experiencers (2011). While the results of this study are opposite of ours (i.e., participants in the pilot study overestimated the effects of the Solarium on attention restoration), it does suggest that affective forecasting errors can influence people’s judgments of natural and built environments.

Another factor that may have impacted perceived restorativeness is the time of year in which data were collected. Data collected for the pilot study occurred during the late Spring 2012 semester during a time in which participants were able to view the budding of flora after winter while sitting in the Solarium. In contrast, data were collected for the experimental study in October and November 2012 and then from January, February, September, and October 2013. As such, there were times in which participants in the Solarium condition may not have had the same type of view of the outdoors or perhaps degree of natural light as those in the pilot study. Future research should consider investigating whether seasonality influences people's perceptions of the restoration of the environment.

Attention Restoration

Regarding Hypothesis 2, it was expected that participants who sat quietly for ten minutes in the Solarium following DAF-inducing tasks would experience more attention restoration than those who sat quietly in Whitewater Café. Contrary to our predictions, results indicated that there were no differences in measured attention restoration between conditions. One contributing factor to the lack of restoration may simply be that there were no differences in perceived restoration to begin with. It may be that one's perception of how restorative an environment is may be directly related to the amount of restoration one is able to experience (see Hypothesis 1 above). It is also important to note that the majority of the previous research conducted on ART measured attention restoration through means of comparing pre-restoration and post-restoration scores on cognitive measures and did not include the Restorative Qualities of the Environment Questionnaire as a manipulation check (Herzog et al., 2013).

Though there was not a statistically significant difference regarding perceived restorativeness between locations, examining the different components of the environment that are predictive of actual restoration can allow for a more in-depth analysis as to what actually aids the process. In fact, according to Berto, Baroni, Zainaghi, and Bettella (2010), fascination appears to be the most predictive element of ART that aids in actual attention restoration. In their study, participants performed better on cognitive tasks after viewing highly fascinating photos than those who viewed low fascination photos, which included photographs of both natural environments and built environments. Related to the current study, it may be possible that the Solarium was not fascinating enough to capture one's involuntary attention, especially when considering the item measuring fascination on the Restorative Qualities of the Environment Questionnaire asks, "How much does the setting draw your attention without any effort on your part? How much does it easily and effortlessly engage your interest?" (Herzog et al., 2003).

Additionally, it might be that the Solarium was not immersive enough to elicit attention restoration. Previous research on ART typically involved participants simply viewing pictures of nature while being in a neutral setting (e.g., Hartig et al., 1989) or actually being immersed in a natural environment by means of going on a "nature walk" (e.g., Berman et al., 2008 and Hartig et al., 2003). The current study attempted to incorporate both aspects of previous literature by having subjects simply sit in an environment that has living natural components (live foliage and running water). Unfortunately, it does not seem that simply sitting in a manmade environment with natural features was enough to evoke attention restoration. In addition to being not immersive enough, it might be that there were other, unmeasured factors that influenced the restorativeness of the environment. Though this

study is high in ecological validity, the inability to control external factors may have impacted results. It is important to note, however, that this concern is equally valid for prior experiments in which participants walked outdoors.

Regarding the cognitive measures used in this study, there is no single test that is more effective than another at inducing or measuring DAF. In fact, many activities and tasks induce DAF, with varying difficulties and time lengths. Although the NCPT is commonly used to measure one's directed attention capacity, it would not serve the same purpose of measuring DAF or even actual restoration. As such, the SMT and the BDS were used to both induce and measure DAF, as they had been used for these purposes in previous research. Similarly, though there were alternate forms of both the SMT and BDS pre- and post-restoration, it is also possible that participants might have experienced some type of practice effect. Specifically, regarding the SMT, participants may have noticed that some lines do not have all or perhaps any of the target letters present; therefore, participants may have exhibited less effort searching each line, thus taking away some of the difficulty. Though it may be ideal to use the same measures both pre- post- for a more accurate comparison of restoration, future studies might consider using different tasks that tap the same resource pool (e.g., different tests of executive functioning from the Delis-Kaplan Executive Function System; Delis, Kaplan, & Kramer, 2001).

Finally, it is important to note that the effect sizes found for Hypothesis 2 were very small, especially compared with similar studies (e.g., Berman et al., 2012; Hartig et al., 1996, Hartig et al., 2003). There were also notable differences in the interventions when compared to previous studies. Specifically, Berman et al. (2012) had participants walk outdoors in either an urban or natural location. Hartig et al. (1996) utilized a "nature simulation" as the

experimental condition and an “urban simulation” as the control condition. Participants in either condition simply viewed a slideshow of pictures showing a progression along walkways of their predetermined location. Hartig et al. (2003) utilized a hybrid approach including both a seated phase and a walking phase, both indoors and outdoors in either an urban area or natural area. Obviously each of these studies is different from the current study as the current study had both a view of the outdoors as well as *indoor* natural elements, and participants were not required to walk for an extended period of time. Taking the sum of information to account, it may still be that the environments used in the current study may not have been immersive enough to elicit large effect sizes.

Mood Changes

Contrary to Hypothesis 3, that spending time in the natural environment would improve mood more than spending time in the built environment, there were no group differences in reported positive or negative affect as measured by the PANAS (Watson et al. 1988). Though this contradicts the original hypotheses, it still is consistent with some of the previous literature. Specifically, Berman et al. (2008) found that participants who engaged in a nature walk experienced an increase in positive mood as measured by the PANAS as well (Watson et al., 1988); however, participants who simply viewed pictures of natural or urban environments did not. Similarly, Hartig et al. (2003) found that participants only experienced affective improvement as measured by the ZIPERS (Zuckerman, 1977) if they walked in a natural environment without completing DAF-inducing measures. As such, it appears that positive mood is most affected when being in a natural environment is accompanied by physical exercise, the latter of which may play an important role in positive mood induction itself. It may also be that participants who struggle with mood disorders (e.g., depression;

Berman et al., 2012) experienced affective improvements from the simple intervention of behavioral activation, which is an integral component of psychotherapy for mood disorders. It is important to note that previous literature seemed to focus on the impact of nature on positive mood rather than considering its effect on negative mood. In the context of the current study, participants actually experienced a decrease in negative affect following the intervention. Though condition did not appear to play a role in this change of reported negative affect, this finding suggests the importance of taking time from one's day to sit quietly to mitigate negative emotions and stress.

Clinical Findings

In the exploratory analyses, there were some differences in response to the intervention in people who had been previously diagnosed with a mental illness. Specifically, people with a prior mental illness diagnosis had improvements in negative affect and performance on the SMT after spending time in the Solarium. Although there were only a small number of people with mental illness diagnoses in the study, this is consistent with prior research (Berman et al., 2012), which found improvements in mood and cognitive performance in patients with major depressive disorder after walking in nature. Moreover, Berman and colleagues (2008; 2012) found that the effect sizes for nature interventions were larger in the depressed patients than in a sample of college students. This suggests that although our intervention was not restorative enough overall, it may be more effective for those with chronic lower mood or attention resources.

The results of the DASS-21 and ASRS-v1.1 analyses are less supportive of this interpretation. People who scored in the at-risk-for-ADHD range on the ASRS-v1.1 did not show greater restoration in the Solarium than in Whitewater Café. Similarly, elevated scores

on the DASS-21 did not predict restoration across the two conditions. There was a small effect of DASS-21 scores on change in negative mood after sitting for 10 minutes.

Specifically, those who reported higher levels of depressive symptoms experienced a larger decrease in negative affect than those who did not report high levels of depressive symptoms after ten minutes of quiet sitting in either environment.

Strengths, Limitations, and Future Directions

When considering the results of the pilot study, the results of the experimental study, and the overall pre-existing literature base for ART, there are several important points to be addressed. First, the majority of the existing research on ART has suggested that spending time in nature by means of walking outdoors or looking at photographs of natural scenery typically improves attention resources following DAF-inducing tasks. As such, it seems that one of the strengths of the current study is that our naturalistic intervention did not include the confound of exercise as in the previous research on ART. In fact, the majority of studies did include a rather large component of exercise (e.g., 2.8 miles of walking, Berman et al., 2008; Berman et al., 2012; 50 minutes of walking, Hartig et al., 2003). Though Hartig et al. (2003) examined how walking in nature affected blood pressure and overall stress recovery, the researchers in that study nor any of the other existing studies did not seem to consider the fact that the attention restoration and affective improvements may have been moderated by the component of exercise. Of particular interest, the current study found that participants who do indeed suffer from psychological disorders actually experienced affective improvements as well as attention restoration. Such findings might suggest that those of a non-clinical population might necessitate exercise or physical activity to experience the restorative effects of nature or other environments, while those with psychological disorders

may benefit from simply engaging in behavioral activation and presence of natural elements. In addition, participants did not simply look at pictures of the natural environment; rather, they were sitting in a room with living trees, running water, and views of the outdoors (including trees, mountains, and plants). Another strength of this study is that it was high in ecological validity in comparison to previous research, which allowed for a more accurate depiction of attention restoration and affective impact.

Regarding limitations, although the study was high in ecological validity, the inability to control for extraneous variables (e.g., observable weather, amount of people present, maintenance) may have affected the data. Additionally, the walk back to the testing room following the restorative experience may have been enough to neutralize any increase in positive affect that may have occurred. Specifically, in the time between leaving the restorative area and measuring mood once again, participants may have begun thinking about engaging in the difficult cognitive tasks once more or may have even negatively forecasted the latter part of the study. In relation to the significant difference in perceived restoration in the pilot when compared to the experimental study, we were unable to include the number of individuals present in either location as a covariate in the pilot study, as it was not measured in a dimensional manner. As such, it is unknown whether amount of people present in either location played a role in the affective forecasting discussion.

The results also raised several questions worth investigating in future research. Specifically, when considering the possible interplay between affective forecasting and restoration, future studies might consider conducting a study examining the impact of “forecasting” and “experiencing” when comparing the two locations on campus. It may also

be useful to take various pictures on ASU's campus and have them rated for fascination, as that appears to be one of the biggest predictors of attention restoration.

Though positive affect did not increase for either condition in the current study, negative affect actually decreased, and possibly decreased more for participants with depressive symptomatology. As such, future investigation of the components at play during the quiet sitting part of the intervention might be fruitful. Specifically, perhaps using a prompt including components of mindfulness as the participants begin their quiet sitting exercise might have a different effect on their approach to quiet sitting. Additionally, including measures that examine trait mindfulness could shed light on this process. Related to the quiet sitting process, future studies might consider using individuals diagnosed with major depressive disorder (or even another affective disorder such as generalized anxiety disorder) to examine how the quiet sitting impacts one's internal processes (e.g., rumination, worrying) and their capacity of attention restoration.

Finally, future researchers might consider creating a measure specifically aimed at inducing DAF as well as a way to objectively measure attention restoration. In the current study (as well as previous research), cognitive tasks that were deemed cognitively difficult were used as a means to induce and measure DAF. Unfortunately, it is difficult to discern whether the tasks were taxing enough to actually induce DAF. Therefore, future studies might consider using some kind of manipulation check to affirm attention depletion. Additionally, creating a task specifically aimed at measuring attention restoration would be advantageous.

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Table 1

Number of Times Participants Visited either the Solarium or Whitewater Café in Pilot Study

Times Visited	Solarium	Whitewater Café	Total
Once or twice a month	6	4	10
About once a week	9	1	10
A few times a week	3	0	3
At least once a day	0	1	1

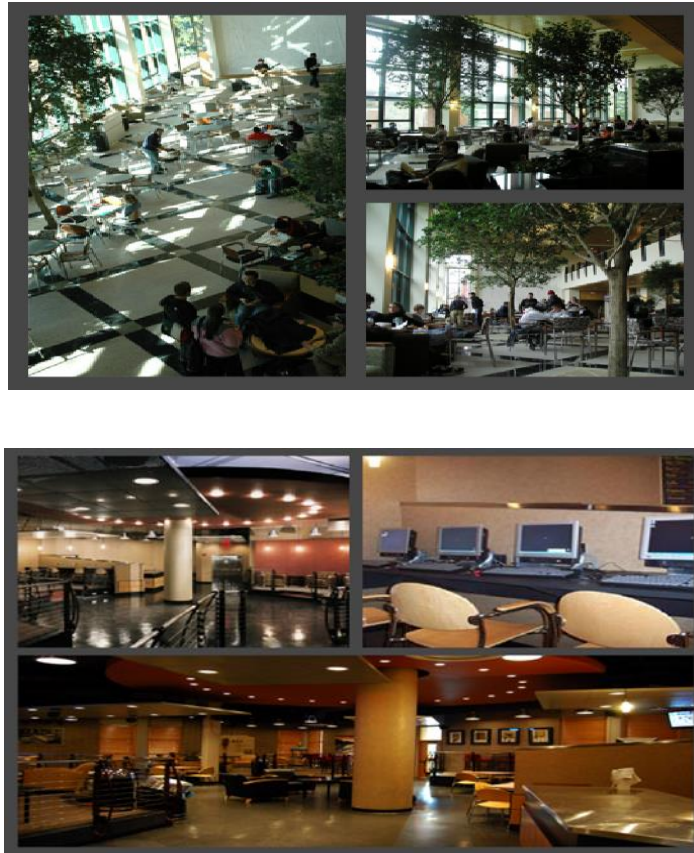


Figure 1. Various views of the experimental condition, the Solarium (Top) and Whitewater Café (Bottom).

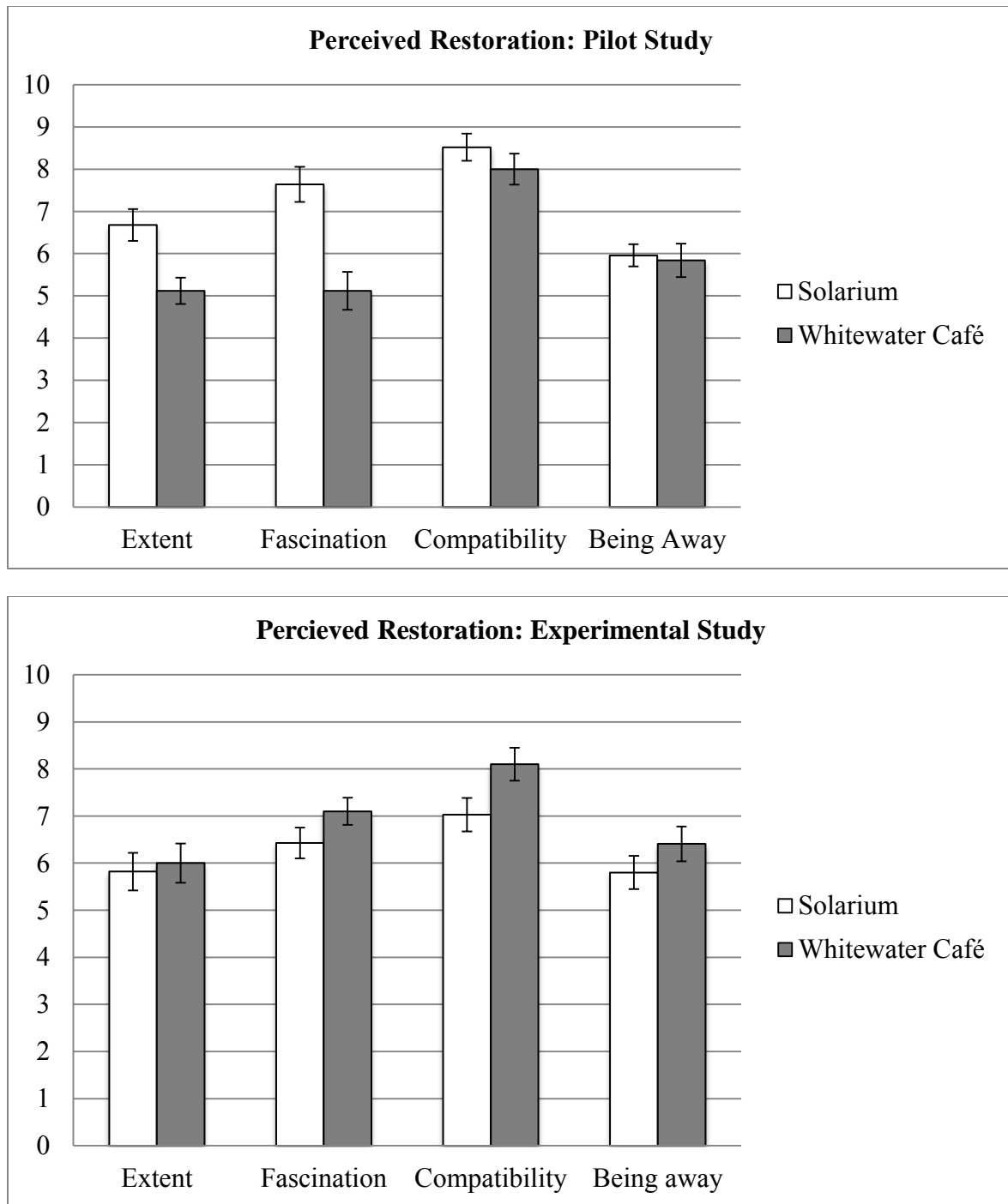


Figure 2. Levels of perceived restoration for both the Solarium and Whitewater Café. The top graph depicts perceived restoration for the Pilot Study and the bottom graph depicts perceived restoration for the Experimental Study. Error bars are standard errors.

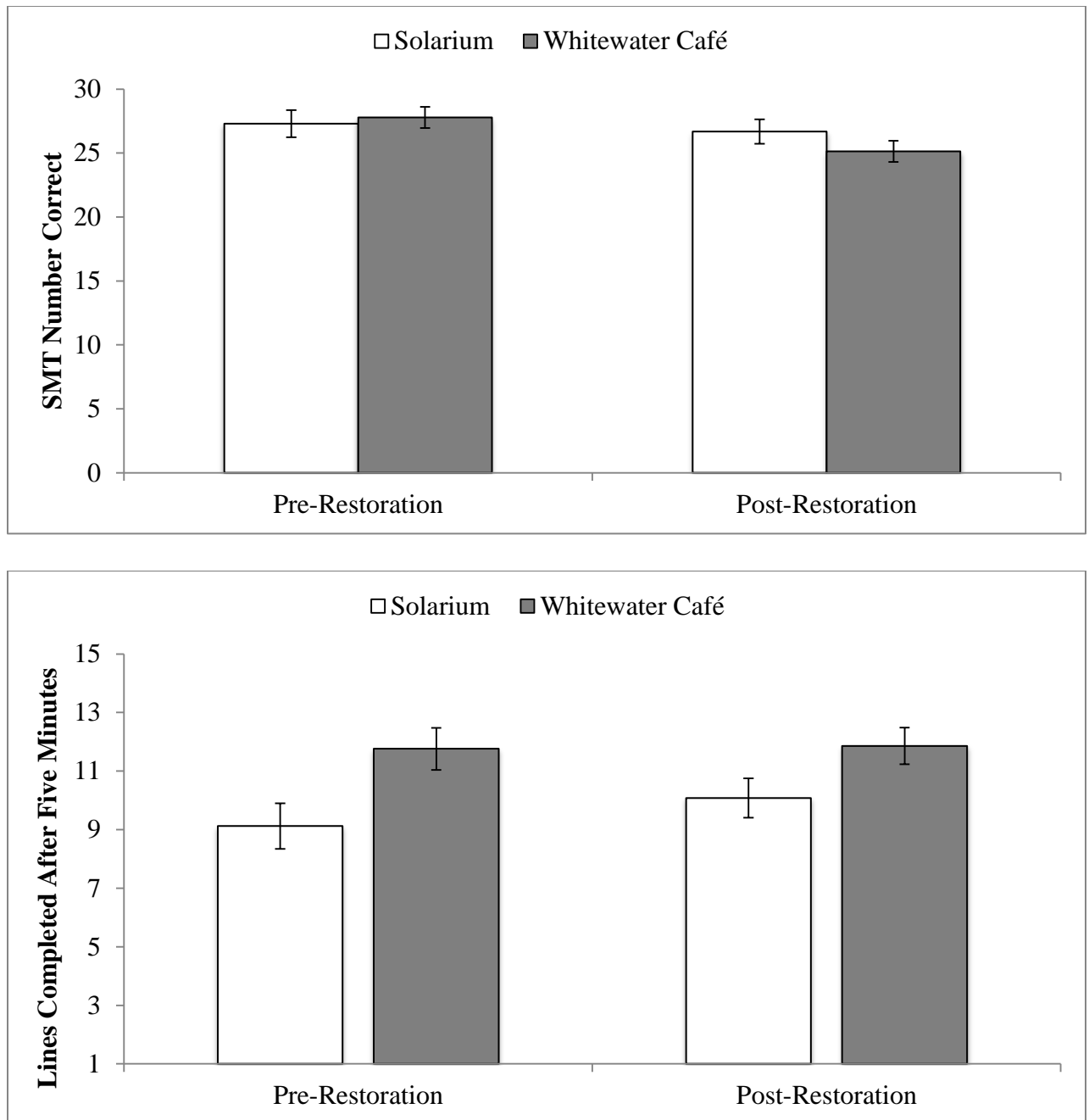


Figure 3. SMT scores pre- and post- restorativeness experience for the Solarium and Whitewater Café are depicted in the top graph. Speed of SMT responses both pre- and post- restorativeness experience are depicted in the bottom graph for both conditions. Error bars are standard errors.

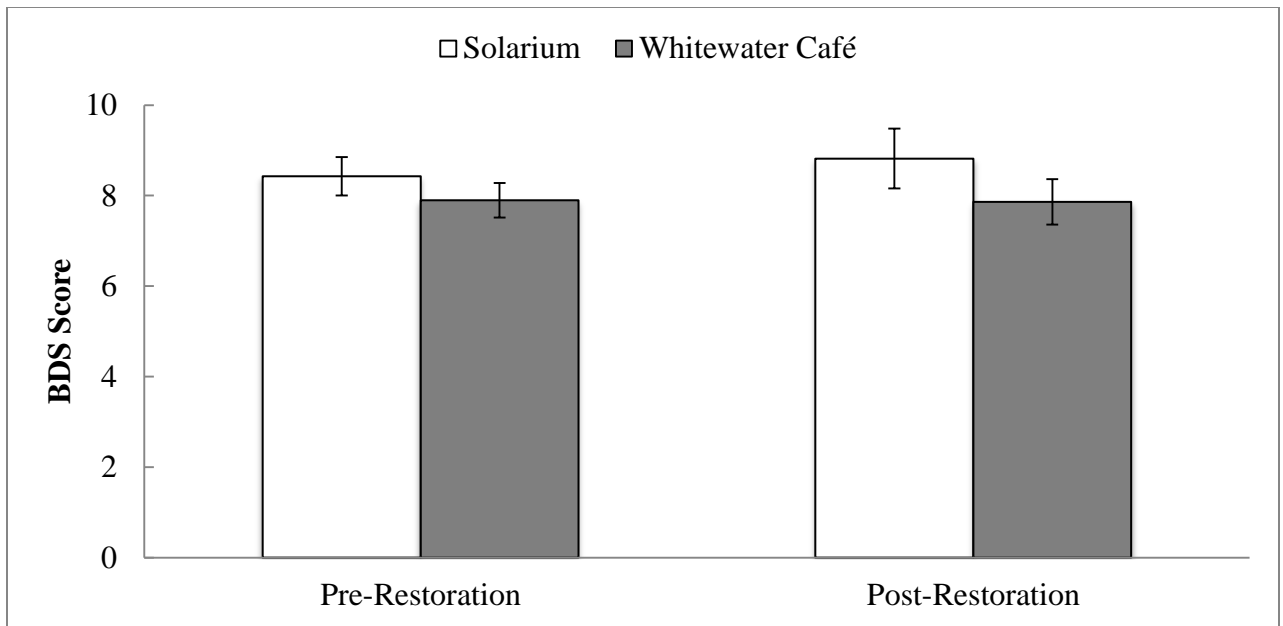


Figure 4. Comparison of BDS scores both pre- and post- restorativeness experience for the Solarium and Whitewater Café. Error bars are standard errors.

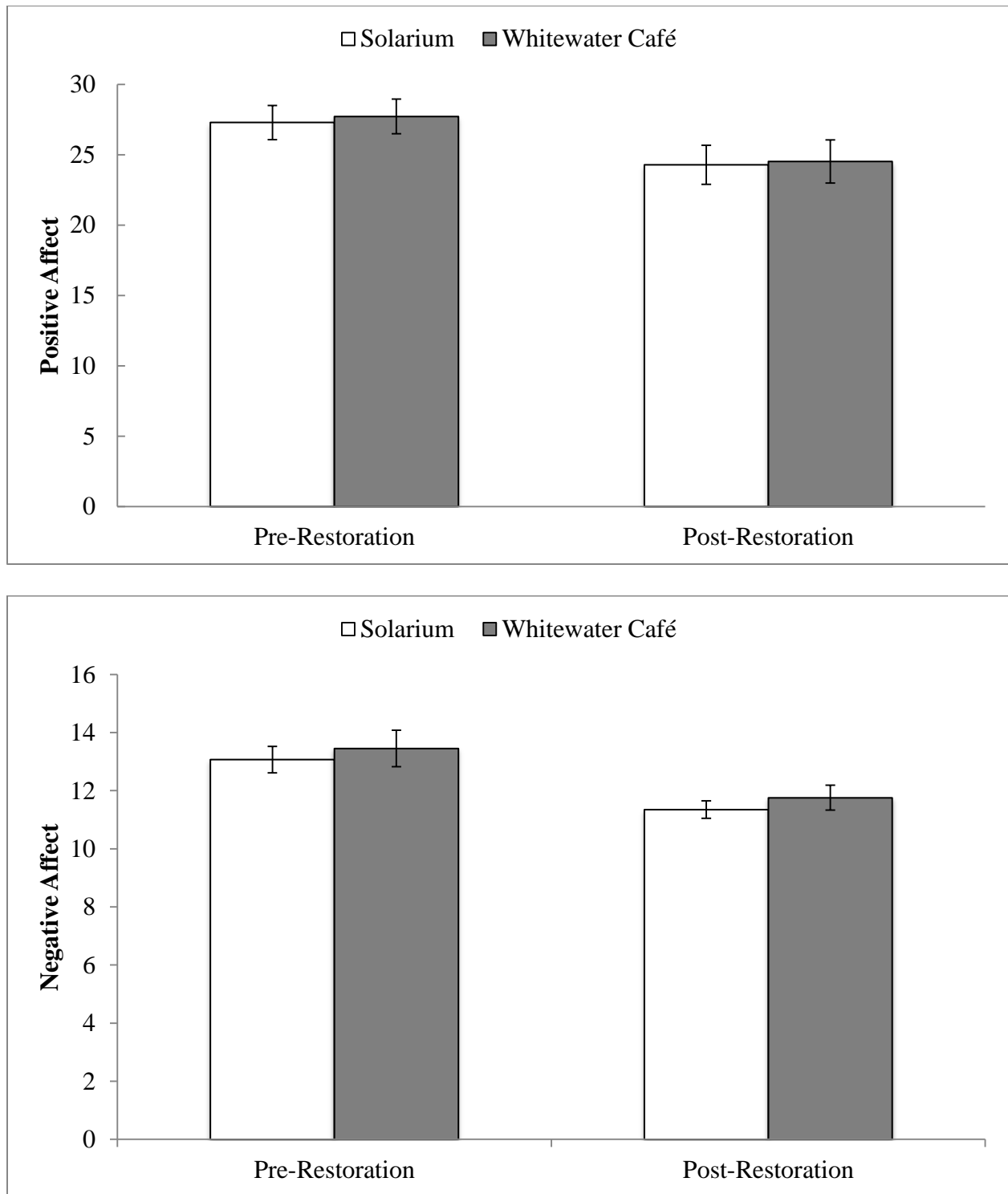


Figure 5. Ratings of positive affect for both the Solarium and Whitewater Café pre- and post-restorativity experience are depicted on the top graph with ratings of negative affect pre- and post-restorativity depicted on the bottom. Error bars are standard errors.

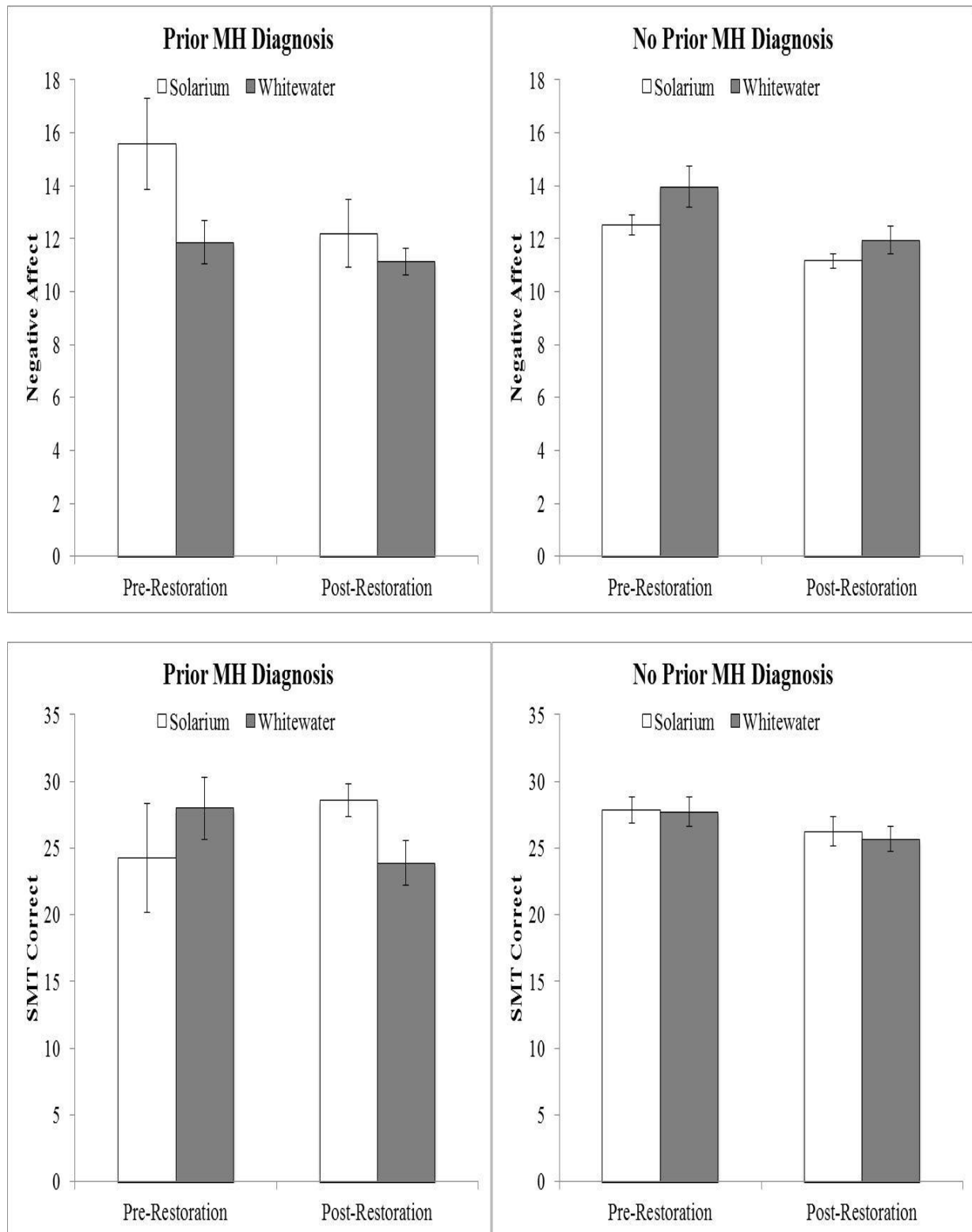


Figure 6. Negative Affect (Top) and SMT Correct Scores (Bottom) by prior mental health diagnosis. Error bars are standard errors.

Appendix A

Date: 2/21/2012

RE: Notice of IRB Exemption

Study #: 12-0191

Study Title: What Makes an Environment Restorative? The Effects of the Natural Environment on Attention Restoration

Exemption Category: (2) Anonymous Educational Tests; Surveys, Interviews or Observations

This submission has been reviewed by the IRB Office and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b). Should you change any aspect of the proposal, you must contact the IRB before implementing the changes to make sure the exempt status continues to apply. Otherwise, you do not need to request an annual renewal of IRB approval. Please notify the IRB Office when you have completed the study.

Best wishes with your research!

Appendix B

What Makes an Environment Restorative?

Principal Investigator: Rebecca Daniel

Department: Psychology

Contact Information: 222 Joyce Lawrence Lane, P.O. box 32109, Boone, NC, 28607. 828-262-2272. Faculty Contact: Dr. Lisa Emery.

What is the purpose of this research?

You are being invited to take part in a research study about people's impressions of different environments. If you take part in this study, you will be one of about 50 people to do so. By doing this study we hope to learn which environments are the most conducive to restoration in order to educate individuals on different methods of regaining attention.

What will I be asked to do?

The research procedure will be conducted in Plemmons' Student Union. This visit will take about 15 minutes. The total amount of time you will be asked to volunteer for this study is 15 minutes.

You will be asked to answer questions about your general experience in a selected location in Plemmons' Student Union and your specific food preferences. You should not volunteer for this study if are under 18 years of age.

What are possible harms or discomforts that I might experience during the research?

To the best of our knowledge, the risk of harm for participating in this research study is no more than you would experience in everyday life.

What are the possible benefits of this research?

There may be no personal benefit from your participation but the information gained by doing this research may help others in the future.

This study should help us learn about why individuals choose certain destinations to relax. This will also help us find out the types of food that individuals choose to consume while relaxing. Finally, this study will help explain some of the underlying themes beneath relaxation on personal preference.

Will I be paid for taking part in the research?

We will not pay you for the time you volunteer while being in this study.

How will you keep my private information confidential?

Your information will be combined with information from other people taking part in the study. When we write up the study to share it with other researchers, we will write about the combined information. You will not be identified in any published or presented materials.

The research team will be taking extra precaution to maintain confidentiality by locking all information gathered from the session in a file cabinet. Instead of obtaining names, all participants will only be identified by a number. The research team will also use this information for educational purposes.

The data obtained from this session will be kept for 5 years. In the future, results from this study may be used in future research or in publications. In this case, any identifying information will be eliminated, and data will only be mentioned as a whole.

Who can I contact if I have questions?

The people conducting this study will be available to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at 828-262-2272. If you have questions about your rights as someone taking part in research, contact the Appalachian Institutional Review Board Administrator at 828-262-2130 (days), through email at irb@appstate.edu or at Appalachian State University, Office of Research and Sponsored Programs, IRB Administrator, Boone, NC 28608.

Do I have to participate? What else should I know?

Your participation in this research is completely voluntary. If you choose not to volunteer, there will be no penalty and you will not lose any benefits or rights you would normally have. If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. There will be no penalty and no loss of benefits or rights if you decide at any time to stop participating in the study.

This research project has been determined to be exempt from further review by the Institutional Review Board of Appalachian State University

I have decided I want to take part in this research. What should I do now?

The person obtaining informed consent will ask you to read the following and if you agree, you should indicate your agreement:

I have read (or had read to me) all of the above information.

I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.

I understand that I can stop taking part in this study at any time.

I understand I am not giving up any of my rights.

I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT)

Signature

Date

Appendix C

Restorative Preferences

Read each statement and choose the best answer.

Date and Current Time:

Please describe what you were doing before coming to this study:

Part I

1) Imagine that you have had classes all day, and that you have an exam immediately following this break. Where would be your optimal location to prepare for your exam? (Please circle one)

- a) The Solarium
- b) The Library
- c) Your Room
- d) Crossroads Coffee Shop
- e) Other (please explain _____)

2) If you had to choose a favorite place on campus to relax, where would that location be? (Please circle one)

- a) The Library
- b) Sanford Mall
- c) The Solarium
- d) Whitewater Café
- e) Other (please explain _____)

3) What do you usually do to relax in general? (Please circle one)

- a) Read
- b) Listen to music
- c) Go outside
- d) Sit in silence
- e) Take a nap
- f) Other (please explain _____)

Part II

4) Out of the choices listed, which word best describes this location? (Please circle one)

- a) Noisy

- b) Stressful
- c) Relaxing
- d) Quiet
- e) Pretty

5) Have you ever visited the location before? (Please circle one)

- 1. YES
- 2. NO

IF you answered “Yes” to question 5, answer the following questions:

6) How often do you typically visit this location?

- a) Once or twice a year
- b) Once or twice a month
- c) About once a week
- d) A few times a week
- e) At least once a day

7) When you visit this location, what activities do you typically engage in (circle all that apply)?

- a. Eating/Drinking
- b. Studying
- c. Socializing
- d. Reading
- e. Using the computer
- f. Sleeping
- g. Other (Please describe : _____)

Appendix D

From: Dr. Stan Aeschleman, Institutional Review Board Chairperson

Date: 9/04/2012

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)

Study #: 13-0026

Study Title: The Effects of the Natural Environment on Attention Restoration—Part 2

Submission Type: Initial

Expedited Category: (7) Research on Group Characteristics or Behavior, or Surveys, Interviews, etc.

Approval Date: 9/04/2012

Expiration Date of Approval: 9/03/2013

This submission has been approved by the Institutional Review Board for the period indicated. It has been determined that the risk involved in this research is no more than minimal.

Investigator's Responsibilities:

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to request renewal of approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval.

Any adverse event or unanticipated problem involving risks to subjects must be reported immediately to the IRB. You are required to obtain IRB approval for changes to any aspect of this study before they can be implemented except to eliminate apparent immediate hazards. Best wishes with your research!

Appendix E

Search and Memory Test (Pre-Restorative Experience)

****The target letters are bolded and underlined as a scoring template for the research assistants. They will not be bolded and underlined for the participants.**** Each line of letters will contain some or all of the target letters presented below. Memorize the target letters and search through each line **only once**. Draw a line through each target letter. You will be allowed 10 minutes to complete the task, and after 5 minutes, **circle** the letter that you are looking at.

1. **a u i t o**

w f e n p h z o f r r n q m l h z b j j l m w v r c j l l e c g w s q n h c m n s y r m n j w n j d x m
l g q **t** b c p

2. **s c h o b**

k m d m **h** v y p v **s** y n p t d j g l w f u t g y m w z k n w l n j q y z y r k y w w r y j v y d y q
w m d g g m k m **b**

3. **q d x z v**

k m r e n o h m f a s g t e y e a a l s c l k r g p e y u g f r o e t w t c m r m n p w w m r a c a f
p m j l y u m h

4. **m h f k e**

h d c j j x y g a q q d p r g **m** t p b x c c r s s z d x x v g x x r s t n b a l b v **e** d q n l d q x **k** z y
y o b b l **f**

5. **p w n l y**

p t b q q a x k u g o x v b q f f l s l r g e r u h h **w y** x c k x d t l d s z s s h o v u r d k e q h v f
s f s s e **l**

6. **b n r i a**

z c j z y t f z o u g o w p j w x z p q x o g z x s **i** j l u u d c y y k q j p y f h o x p q o d u f d e e
v s s p w q

7. **t e z p q**

l o k l w l s h u u s l w x f n d r k b w **q** m s g l j l m x g j o d g b j c k d v l m m m n u **t** g v h
a c y u o f m r

8. v t y o x

ohqnfgnkjhmsduzpkadv yfpbnupcjadlqsprpusbbegtbglnzdzmnfpscg x

9. r q i n a

pzx xvukou ztkdvtssunzuhhozwmovvojopmfsflgstjwpzjcucbjpszjlsw

10. s v p u g

cmltlffqeraktwarblzxjxaanfrfqmxcdoimjxlxchkmkjlbnoanrlxwIkl

11. m x c d o

d olpwabjjpqehiltahpfllkljmybnbhrlisutv yajinsawprezrtcuelvrx

12. g t h b e

qlajficmommmdmqvvpdrwnocqyyyqkrvxnofmaxfozlinepcleojqejuzurw

13. d r w c m

xkevdqleaubnqaaflynvsftlnexgstbrfokaozfIvblleaovkkeqpv saxxe

14. o p t l s

ytrmedijcwgwceimiqivxkjikxjvydcmejiujxnevdaajigwfvhvhzgrbcu

15. b q a x i

alpgjvpumdddwsfcfpthgmzjq xfhyldvcknpcdtzdothhugucvbhpgkjou

16. z n k f c

rmgajegrllggtrdejutqbiudtysggisvapvuqddmsmwmtiijouvlywuduxqs

17. w t a g v

aj e p p c f y j m q f o b p s o d c o r c z p q f b m c d r **g** q y n p u r z b j i i o x e h f f i e o n j
d **w** y r o

18. y r b g o

b r v l v x i p v q x u z s c n l s i c h z w z k k d v s w **o** v q a d j j d k x p u p d j m z h l p s a
h h k z n q

Search and Memory Test (Post-Restorative Experience)

****The target letters are bolded and underlined as a scoring template for the research assistants. They will not be bolded and underlined for the participants.**** Each line of letters will contain some or all of the target letters presented below. Memorize the target letters and search through each line **only once**. Draw a line through each target letter. You will be allowed 10 minutes to complete the task, and after 5 minutes, **circle** the letter that you are looking at.

1. **p l q i v**

c b m k x t **p** x d j y g z o u f y s t g z m w g d g o u y s b **y** k m y u x x e j h g n r a d f u x r w
y d f b j m j c

2. **b h q u w**

n e f n t f g g z n o a s z y p p o i j j d j z f p k i f i p k m x o x d e k n n a x d g j a p x g d d t l
p g g d r

3. **c x z m s**

a k h n k t j j e l **z** u u k o u y w a u v a v q b h **c** k w f u v k k h v t j t d b v a f l i q d g i n **m x**
f t f f i i

4. **y e k o u**

o a p p c l w i v l s g i p m w p f i l g t b c **k** a q a w l c m d p h l v i b l a a i a w a h q m z j l c
l n s x p f

5. **c w e o t**

q m y h y **w** d r h p v s m s p m h s q k q y h u x x p y **c** b r s p m l b g v k r v u q d i **t e** r j m
p q a p m j x s **o**

6. **o v l c j**

z b r w b t w a e y b p i n w y z z k a d k z s k k t a f s y z t x k k i w x s g k k w q w s k n r q e
n g d x u x z

7. **b g a z q**

i d r h s c k h s v k h l r t d o u h v l k n o **b** e h j u w w c k u l y l f i e l l r k n j o y c f v i **q** x i
k j o u

8. r e o u v

mn i f e q w q h y s n y t h n t f t y b h y u w x t z d b p i f l p c f t c t o y f g j z z m s n s z s
i d s x r

9. d x h c n

w g l w a o m b o r l b f q k u a l p q z m b y g j y j l r x y m o l b z i u w q k y y p j p b t l j w
s e e s j v r

10. p q j x t

p o n i e v i z g l r b f k d h w v d b z z d c r v v h s b y m h f f z z l v h f f h v w r e e w f l v l
l m v w d u

11. u v a w i

c s o c j k k q l g t d b s z k h c p h c l t n a p n p s t h k h y h k r r r d j s f n e z z h k z m y j j
p g p f r

12. v j y d s

t g g x g c a n z n w i y e l k e n r w q h e e c r i k r o w a r q i e b c k i i g r c k i t i u w k u r o
p a r k a

13. m w f b n

w k c y y p x c i a a y k s i y z q c t u e f r j m s u j h i e l a u g y i t s l d u h q y j d t u n t k o r
b i l k

14. w t p s b

q d l z d m z l i m q j v k q o c c f y z r u n a m q l c y l x f e f j m h l d h i u v g e i a i d y f k
d y h e e m

15. d s m r t

o l e n a p c i w i v y a n n h g u f a w t h j j x j z g y c f l n o c e f a z f a g v i i u g p g y q x e
z q i q k

16. h y k j w

i o o l l e v m i t o a w f f i e o p o x b r t z c i z v p m f q l o c q u d q k h e d f l g t t z t z s s q
z f p c

17. **y k w o a**

ctzuqetebreiusqumexslclvurzcusmxmtiduzuivtdjedzjnhijlt
qcf d

18. **w e j d z**

zsyqqalkgcxptpiphtusldmribmkpubinpamckxbhkqvshwulqb
bfgbcbe

Appendix F

Backwards Digit Span (Pre-Restorative Experience)

Say: "I am going to say some numbers. Repeat the numbers back to me in reverse order. Let's practice. If I say 1 – 2, what should you say?" [participant should say '2 – 1']. If the participant gets the sample item correct, move on to item one. If they get it incorrect, say "Let's try again. If I say, '1 – 2', you should say 2 – 1". After the participant understands the directions, move to item one. The numbers that you should say are in the left column, and the right answer is in the right column. Say the numbers at a rate of ONE LETTER PER SECOND. Write their responses on the right column next to the sequence. Each correct SEQUENCE gets 1 point. Anything that is incorrect is a 0. Discontinue after they get both trials of an item incorrect (one trial = two number sequences)

Sample item:	1 – 2	2 – 1
Item 1:	3 – 4	4 – 3
	7 – 1	1 – 7
Item 2:	2 – 5 – 9	9 – 5 – 2
	7 – 1 – 8	8 – 1 – 7
Item 3:	5 – 0 – 1 – 2	2 – 1 – 0 – 5
	1 – 3 – 9 – 6	6 – 9 – 3 – 1
Item 4:	1 – 8 – 1 – 7 – 2	2 – 7 – 1 – 8 – 1
	4 – 0 – 6 – 5 – 3	3 – 5 – 6 – 0 – 4
Item 5:	2 – 1 – 3 – 0 – 7 – 6	6 – 7 – 0 – 3 – 1 – 2
	8 – 9 – 3 – 1 – 3 – 2	2 – 3 – 1 – 3 – 9 – 8
Item 6:	5 – 0 – 9 – 1 – 7 – 2 – 8	8 – 2 – 7 – 1 – 9 – 0 – 5
	3 – 8 – 1 – 0 – 2 – 6 – 7	7 – 6 – 2 – 0 – 1 – 8 – 3
Item 7:	4 – 4 – 3 – 8 – 2 – 6 – 1 – 9	9 – 1 – 6 – 2 – 8 – 3 – 4 – 4
	6 – 0 – 7 – 3 – 9 – 5 – 8 – 2	2 – 8 – 5 – 9 – 3 – 7 – 0 – 6
Item 8:	3 – 7 – 9 – 1 – 8 – 2 – 6 – 4 – 5	5 – 4 – 6 – 2 – 8 – 1 – 9 – 7 – 3
	0 – 0 – 7 – 5 – 1 – 9 – 5 – 3 – 2	2 – 3 – 5 – 9 – 1 – 5 – 7 – 0 – 0

Backwards Digit Span (Post-Restorative Experience)

Say: "I am going to say some numbers. Repeat the numbers back to me in reverse order. Let's practice. If I say 1 – 2, what should you say?" [participant should say '2 – 1']. If the participant gets the sample item correct, move on to item one. If they get it incorrect, say "Let's try again. If I say, '1 – 2', you should say 2 – 1". After the participant understands the directions, move to item one. The numbers that you should say are in the left column, and the right answer is in the right column. Say the numbers at a rate of ONE LETTER PER SECOND. Write their responses on the right column next to the sequence. Each correct SEQUENCE gets 1 point. Anything that is incorrect is a 0. Discontinue after they get both trials of an item incorrect (one trial = two number sequences)

Sample item:	4 – 5	5 – 4
Item 1:	9 – 1	1 – 9
	7 – 8	8 – 7
Item 2:	3 – 5 – 1	1 – 5 – 3
	8 – 4 – 2	2 – 4 – 8
Item 3:	5 – 6 – 0 – 1	1 – 0 – 6 – 5
	7 – 8 – 4 – 0	0 – 4 – 8 – 7
Item 4:	6 – 3 – 2 – 5 – 9	9 – 5 – 2 – 3 – 6
	1 – 7 – 5 – 9 – 8	8 – 9 – 5 – 7 – 1
Item 5:	7 – 0 – 3 – 9 – 1 – 6	6 – 1 – 9 – 3 – 0 – 7
	8 – 2 – 1 – 6 – 3 – 5	5 – 3 – 6 – 1 – 2 – 8
Item 6:	5 – 4 – 9 – 2 – 0 – 7 – 8	8 – 7 – 0 – 2 – 9 – 4 – 5
	9 – 4 – 1 – 2 – 7 – 3 – 6	6 – 3 – 7 – 2 – 1 – 4 – 9
Item 7:	2 – 0 – 3 – 5 – 1 – 9 – 6 – 8	8 – 6 – 9 – 1 – 5 – 3 – 0 – 2
	3 – 5 – 1 – 6 – 7 – 0 – 2 – 9	9 – 2 – 0 – 7 – 6 – 1 – 5 – 3
Item 8:	2 – 4 – 0 – 5 – 6 – 9 – 1 – 8 – 7	7 – 8 – 1 – 9 – 6 – 5 – 0 – 4 – 2
	9 – 5 – 6 – 7 – 2 – 8 – 1 – 4 – 0	0 – 4 – 1 – 8 – 2 – 7 – 6 – 5 – 9

Appendix G

Research Assistant Questionnaire

Name:

Date:

Time:

Location:

Please answer each question to the best of your ability.

1. How many other people are in the location?
2. Describe the noise level:
 - a. Quiet
 - b. Somewhat Loud
 - c. Moderately Loud
 - d. Extremely Loud
 - e. Other: _____
3. Are there any events occurring in that location?
 - a. Yes
 - b. No
4. Are there any unusual events or people in the location? If so, please describe.
 - a. Yes
 - b. No
5. Is there music playing? If so, what type of music?
 - a. No music is playing
 - b. Classical music
 - c. Adult contemporary
 - d. Pop/rock
 - e. Hip hop/R&B
 - f. Country
 - g. Other: _____
6. Does the participant interact with anyone not involved with the study?
 - a. Yes (please explain): _____
 - b. No

Vita

Rebecca Marie Daniel was born in Long Beach, California, on November 10, 1989, to Jeffery and Bonnie Daniel. She has one younger sibling, Timothy Daniel. She graduated from West Stokes High School in May 2007. The following January of 2008, she began her undergraduate studies at Appalachian State University, graduating with a Bachelor of Arts degree in Psychology with a minor in Spanish in May 2011. In the fall of 2011, she enrolled in the Master of Arts in Clinical Health Psychology Program at Appalachian State University. She received her Master of Arts in Clinical Health Psychology in May 2014 and will be moving to Wilmington, NC, to work in a private practice. This investigation is Ms. Daniel's Master's thesis and was supervised by Lisa J. Emery, Ph.D., Appalachian State University.