

Running head: A NATURE RELATEDNESS INTERVENTION

A Nature Relatedness Intervention to Promote Happiness and Environmental Concern

by

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Abstract

Disconnection from nature may lead to environmentally destructive behaviour whereas connectedness may foster sustainable behaviour. Nature relatedness is associated with greater happiness, thus, improving human-nature relationships may promote ecological behaviour and human psychological health. In a randomized controlled trial, I attempted to manipulate nature relatedness and test the causal relationship between connectedness and psychological well-being, comparing a nature relatedness writing intervention to a control one. Student and community participants ($N = 207$) completed biweekly online surveys about well-being and nature contact, as well as eight nature or control writing exercises over a month. The nature intervention did not increase nature relatedness, but at the individual difference level, greater connectedness led to more nature contact during the study, which in turn led to greater happiness, environmental concern, and behaviour. Results suggest nature relatedness is fairly resistant to change, but may be enhanced with increased nature contact. This study was the first to manipulate nature contact and connectedness with writing. The experience sampling methodology uniquely demonstrated how trait connectedness is linked with nature contact over time, and how this is beneficial for subjective well-being. This research bridges personality, environmental, and positive psychology, adds to the literature on connectedness, and lends further support to the notion that nature can be a source of happiness. Results are discussed in terms of the potential for refining interventions as well as the theoretical and practical implications for researchers, educators, policy makers, and all concerned with sustainability and human health.

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A Nature Relatedness Intervention to Promote Happiness and Environmental Concern

The natural environment is changing in ways that influence human health and well-being. Ecological problems such as smog, floods, and drought are increasingly becoming a threat to human health. Human behaviour can be damaging to the environment (Winter, 2000), but environmental problems also influence the quality of human health (Boyd & Genius, 2008). Climate change, pollution, and habitat destruction affect human physical health (World Health Organization, 2008), but may also have negative implications for human psychological well-being. A disconnection from the natural environment may be contributing to poor psychological health as well as environmentally destructive behaviour (Conn, 1998; Kellert, 1997). By restoring connections to nature we may be able to foster greater ecological concern and sustainable behaviour (Howard, 1997; Schultz, 2000), as well as promote psychological well-being. The fact that human behaviour contributes to many environmental issues means that, potentially, these problems may be lessened or reversed by human intervention and behaviour change (Howard, 2000). We may be able to promote both human well-being and sustainable behaviour by increasing connectedness to nature, and this behaviour may become intrinsically rewarding and self-sustaining if it contributes to human happiness.

This study tested the potential benefits of an online intervention designed to increase connectedness with nature. Drawing on the positive psychology and environmental psychology literature, I developed a series of writing exercises to promote connection to the natural environment, happiness and environmental concern. To test the intervention's unique potential for increasing connectedness to nature, I compared it to a

control intervention with exercises containing no explicit nature content, in a randomized, controlled trial.

This study expands on research and theory linking human health to the natural environment and investigates the psychological health benefits of strengthening the human-nature bond. Much of the research linking connection to nature and happiness is correlational (e.g., Mayer & Frantz, 2004; Nisbet, 2005; Nisbet, Zelenski, & Murphy, 2011). The goal of the present study was to demonstrate a causal relationship between nature and happiness. I attempted to manipulate happiness and environmental concern by increasing connectedness to nature.

Psychology and Environmental Behaviour

Psychologists have been studying the causes and consequences of environmental behaviour for several decades (Gifford, 2002, 2008; Vlek & Steg, 2007), and have identified a number of the determinants of environmental behaviour (see Bamberg & Möser, 2007, for a recent meta-analysis). There are structural barriers that prevent people from acting sustainably such as socio-economic circumstances, inaccessible public transit, or lack of curbside recycling (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995). There are also psychological barriers such as feelings of helplessness, confusion, or denial. Environmental problems such as climate change are often slow processes, undetectable by human senses (Thomashow, 1998, Winter, 2000). People may not consider the impact of their behaviour on the environment or may not feel problems are personally relevant (Kortenkamp & Moore, 2001). For example, unless people suffer the direct and immediate consequences of pollution or climate change they may not be convinced they are contributing to the problem, or even that there is a problem.

People experience amotivation and are unmotivated to act sustainably if they feel the situation is hopeless or if they do not feel confident to perform and integrate environmental behaviours into their lifestyles (Pelletier, Dion, Tuson, & Green-Demers, 1999). Global environmental problems such as climate change may seem insurmountable and people may not believe they are able to contribute to solutions. The amount of information about environmental problems may overwhelm people and create feelings of helplessness (Kaplan, 2000) rather than inspire behaviour change. For example, people may hear conflicting messages about the causes of climate change, or about which are the most environmental products or practices. If people feel overwhelmed with complex or contradictory scientific information, they may feel there is little point in attempting solutions.

Those who do act environmentally do so for a number of reasons. Dissatisfaction with local environmental conditions can prompt pro-environmental action (Pelletier, Legault, & Tuson, 1996). Concerns about water quality or local air pollution may inspire action, for example. Long-term thinking is associated with pro-environmental choices (Lindsay & Strathman, 1997). For instance, those who think more about the future impact of driving and the potentially harmful environmental consequences are more likely to prefer public transportation (Joireman, Van Lange, & Van Vugt, 2004).

Altruism may motivate some sustainable behaviours (Allen & Ferrand, 1999; Schultz, Shriver, Tabanico, & Khazian, 2004; Stern, Dietz, Kalof, & Guagnano, 1995), although Kaplan (2000) argues that the altruistic approach needlessly relies on a model of self-sacrifice and only contributes to helplessness, denial, and inaction. Indeed, people may be more likely to continue behaving sustainably if they feel it is personally important,

rather than if they feel guilty (Koestner, Houlihan, Paquet, & Knight, 2001). Some people may feel nature has intrinsic value or is worth protecting for its benefit to humans (Kortenkamp & Moore, 2001). If people enjoy their experiences in nature it may also motivate sustainable behaviour (Hartig, Kaiser, & Bowler, 2001; Pooley & O'Connor, 2000).

While many people seem concerned about the environment, there is a discrepancy between these attitudes and environmental behaviour (Dunlap, Van Liere, Mertig, & Jones, 2000; Kaplan, 2000; Kortenkamp & Moore, 2001; Pooley & O'Connor, 2000). As an illustrative example, many Canadians say they believe individual actions are most important for solving environmental problems (Ipsos, 2007), yet even in warm weather, three quarters of Canadians commute by car and over half travel alone (Environment Canada, 2007). Similarly, water conservation is important to Canadians, however only one in four own a rain barrel, and only 6% believe individual consumers are a threat to the country's supply of fresh water (Ipsos, 2008). We need to better understand how to overcome the disconnection between people's feelings about the environment and their own actions, and find ways to more consistently translate people's concern for the environment into behaviour.

Despite the fact that we understand a great deal about the motivation, amotivation, and precursors of environmental activities (e.g., McKenzie-Mohr, 2000; Pelletier et al., 1999), public service messages and other persuasion efforts are not always effective in changing behaviour. Promoting sustainable behaviour is likely to benefit human physical and psychological health, yet environmental issues have not always been framed in terms of the human health consequences (Nisbet & Glick, 2008). Despite the fact that

psychologists have insight into human motivation and behaviour, environmental issues have not often been addressed by mainstream psychology and most environmental studies programs do not include psychology (Koger & Scott, 2007). Psychologists have a responsibility to promote and improve human well-being (American Psychological Association, 2008). One way psychologists can simultaneously contribute to human and environmental health is to develop empirically tested interventions that encourage sustainable behaviour. Promoting behaviour that is good for the environment has human health benefits. Finding ways to improve human-nature relationships may contribute to both of these endeavours by increasing human happiness and environmental behaviour.

Connectedness to Nature

As environmental problems worsen, researchers are directing their attention toward human-nature relationships and their influence on sustainable behaviour (e.g., Allen & Ferrand, 1999; Iwata, 2001; Pooley & O'Connor, 2000). One possible reason for the attitude-behaviour discrepancy is the fragmented nature of human-environment relationships. The biophilia hypothesis (Kellert & Wilson, 1993) helps explain our connection (and the consequences of disconnection) with the natural world. Wilson (1984) proposed the concept of biophilia to describe humans' innate need to connect with other living things, as a result of our evolutionary history in the natural environment. Given that humans began living in cities, separate from nature, relatively recently in terms of our evolutionary development, Kellert and Wilson argue that we cannot erase the learning and appreciation of biodiversity embedded in our biology.

The biophilia hypothesis has spawned important questions and inspired a wide variety of research (for example, the work on landscape preference and phobias, e.g.,

Heerwagen & Orians, 1993; Kaplan & Kaplan, 1989; Ulrich, 1993). The popularity of outdoor wilderness activities, gardening, our relationship with animals, and our fondness for natural scenery are evidence of biophilia. Further support comes from research demonstrating that nature scenes are consistently preferred over urban images (Hartig, Böök, Garvill, Olsson, & Gärling, 1996; Kaplan, 1995; Ulrich, Simons, Losito, Fiorito, Miles, & Zelson, 1991; see also Kahn, 1999, for a review of the empirical support for biophilia).

In North America, more people go to zoos each year than attend all major sporting events combined, which Wilson (1984) claims is further evidence of biophilia and our need to connect with animals - agents of nature. Lawrence (1993) suggests our biophilic affiliation with animals is evident in both direct contact with animals and the pervasive use of animal words and symbolism in language. People frequently use nature words to represent thoughts and emotions (Kellert, 1997), including animal words to describe other humans, their personality, and behaviour (e.g., blind as a bat, smart as a fox, a chauvinist pig). Our use of animal symbolism is an expression of what Lawrence (1993) terms “cognitive biophilia” or the method by which nature fosters human communication. Animal symbolism represents a merging of humans and nature and can be exhibited through both positive (busy as a bee) and negative (filthy pig) representations in language. Nature imagery and symbolism is universal, prevalent across cultures and throughout human history, and is indicative of our emotional, spiritual, physical, and evolutionary ties to the natural world (Lawrence, 1993). Humans appear to have an innate understanding of the threatening or harmful aspects of nature (e.g., spiders, snakes), but these fears (biophobia) do not necessarily preclude

connectedness. In fact, individual differences in implicit connectedness are observed for negative or unpleasant aspects of nature, such as fungus, germs, maggots, and insects (Bruni, Chance, Schultz, & Nolan, in press). To survive, early human would have needed to understand both nature's benefits and hazards. Biophilia and biophobia would have been important adaptive advantages for humans dependent on the natural environment; perhaps they still are given current environmental threats (e.g., climate change, pollution).

The fact that our biophilic tendencies have not resulted in more widespread environmental behaviour suggests a need to further study individual differences in levels of connectedness. Some people may be very connected to the ecosystem in which they live, while others may view themselves as completely separate from the natural environment. Urban-dwelling people, in particular, may have little or no contact with nature (Maller, Townsend, Pryor, Brown, & St. Leger, 2005).¹ People likely find it difficult to value and care for the environment if they feel separated from nature and it is not part of their experience. Individual differences in how connected people are to nature may reflect how aware they are of biophilia or how much their biophilic tendencies are supported or suppressed. Many people may have lost their connection to the natural world (Conn, 1998) and these damaged human-nature relationships may be contributing to environmentally destructive behaviour. Schultz (2000) argues that environmental concerns are directly related to the degree with which people see themselves as part of

¹ I use the term nature to refer to elements of the natural or physical environment such as flowers, trees, rocks, soil, plants, animals, and to refer to places such as landscaped areas, parks, green spaces, forests, fields, rivers, lakes, and oceans (c.f., Kaplan, 1984). For assessment purposes, I allow a subjective interpretation of the word, given that there are many interpretations of what constitutes nature (e.g., wild versus cultivated nature; Regan & Horn, 2005) and the benefits of nature for human well-being do not appear to depend on establishing objective terminology or a limited definition.

nature. In other words, if people do not value nature or care about the environment they are not likely to protect it (Howard, 1997). With continuing environmental destruction, loss of biodiversity, and species extinction, we may be losing many of the elements necessary to trigger and nurture our biophilia (Thomashow, 1998). A damaged environment is unlikely to extinguish our need to connect with nature, however it may diminish our appreciation for the role of natural diversity in healthy physical and psychological development, and reduce the opportunity for future generations to benefit from nature (Kellert, 1997).

Another way to describe a sense of connection to nature and one's understanding of the interconnectedness with the earth is ecological identity or 'ecological self', a term coined by Arne Naess (1973). An ecological sense of self is a self-concept that includes the entire earth. Those who identify with nature feel empathy for other living things, and see themselves as part of, rather than separate from, the natural environment. Those with a strong ecological self are less likely to behave destructively since damaging nature will be seen as damaging one's self (Conn, 1998; Feral, 1998). Ecological identity theory suggests that restoring damaged person-nature relationships may promote environmental concern and behaviour (Clayton, 2003). The more connected people are to nature, the more they will be aware of their own actions and concerned for all living things (Schultz, 2000). This type of "biospheric" attitude reflects a strong human-nature connection, whereas exclusive concerns for one's self ("egoistic" concerns) indicate a damaged relationship. Connectedness to nature and biospheric concern are associated with less self-interest and more consideration of the larger environment, in other words, more environmental concern (Dutcher, Finley, Luloff, & Buttolph Johnson, 2007; Mayer &

Frantz, 2004; Schultz, 2000) and self-reported environmental behaviour (Clayton, 2003; Nisbet, 2005; Nisbet, Zelenski, & Murphy, 2009; Schultz, 2001, 2002).

Nature Relatedness

Ecological identity is an important aspect of the human-nature relationship, but not the only one. Human-nature relationships encompass cognitions and beliefs such as a sense of oneness or identification with the natural world (ecological identity), but also include emotions and experiences in nature. To fully capture the complexity of the human-nature bond, it is important to examine both affective and cognitive elements, as well as people's interest in, fascination with, and desire for nature contact. The construct of "nature relatedness" (NR; Nisbet et al., 2009) captures these three facets of human-nature relationships - cognitions, affect, and experience. Based on theory and research on restorative environments, and the biophilia hypothesis, nature relatedness is similar to the notion of an ecological identity, but is a broader concept encompassing emotions, experiences, and an understanding of human interconnectedness with all other living things.

Nature relatedness is comprised of the feelings and thoughts people have about their relationship with nature. Nature relatedness is not simply a love for nature, or enjoyment of only the superficially pleasing facets of nature, but rather an awareness and understanding of all aspects of the natural world, even those that are not aesthetically appealing or useful to humans. Nature relatedness can be regarded as an indicator of whether our innate need to connect with nature has either been supported or suppressed. A strong connection with nature should inspire protective behaviour, however, acting sustainably is not contingent upon love for nature, an interest in the environment, or any

specific set of attitudes, beliefs or values (a person might act based upon self-interest – protesting a toxic waste site because it detracts from property values or threatens one’s own health, for example). The connectedness and concern for nature that is consistent with biophilia does not imply that all environmentalists are biophilic, or that all those who are biophilic must be environmental activists. Those highly related to nature may not be activists for a variety of reasons, but strong feelings of connectedness should motivate people to gain a deeper understanding of each organism’s place in the complex functioning of ecosystems and a respect for the system as a whole.

The Nature Relatedness Scale (Nisbet et al., 2009) assesses internalized identification with nature as well as nature-related worldviews, people’s familiarity, comfort with, and desire to be in nature. Nature relatedness is comprised of three sub-dimensions which contribute to one’s relationship with the natural environment.² The first dimension, nature related-self, represents an internalized identification with nature, reflecting feelings and thoughts about one’s personal connection to nature. A person scoring high on this dimension would consider herself to be a part of nature and live life in ways that reflect this.

² The three nature relatedness dimensions share some similarities with the three elements mentioned above (cognitions, emotions, experiences). We view cognitions, emotions, and experiences as important but potentially overlapping features of human-nature relationships. For example, cognitions, emotions, and one’s past and present experiences may all contribute to one’s environmental self-concept. Similarly, one’s perspective or environmental worldview may involve judgements, cognitions or beliefs about human treatment of the environment, as well as emotions about animals and pollution, and may be influenced by experiences in degraded habitats or nearby nature. Thus, while cognitions, emotions, and experiences are captured by the broader nature relatedness construct, the three dimensions may not always distinguish between these three elements. To assume that the thoughts, feelings, and experiences people have with nature do not overlap or interact would oversimplify the human-nature relationship. As Beringer (2003) points out, “in lived experience, cognition, affect and behaviour are intertwined and feedback on each other; thus, they cannot be separated for purposes of psychological research” (p. 150). See Nisbet et al. (2009) for development and validation of the scale and a discussion of the multidimensionality of the three nature relatedness factors.

The second dimension, nature related-perspective, represents an external, nature-related world view about how humans interact with other living things. This component of nature relatedness would be reflected in a person's views about the treatment of animals and use of natural resources, for example, and may be apparent in pro-environmental attitudes. This aspect of nature relatedness would also be demonstrated by a sense of agency concerning individual actions and their impact on all living things.

The third dimension, nature related-experience, reflects a physical familiarity with the natural world, a level of comfort with and desire for nature contact. The physical aspect of human-nature relationships is a key element of people's sense of connectedness (Chawla, 1998, 1999; Chawla & Cushing, 2007; Kahn & Kellert, 2002; Sebba, 1991). Both past and present nature experiences are also predictive of nature-protective behaviour (Kals, Schumacher, & Montada, 1999). This aspect of nature relatedness would be most evident in someone who seeks out nature, is drawn to the wilderness, and who is aware of and fascinated with nature everywhere in daily life.

Nature related people are more likely to be vegetarian, love animals, engage in environmental activism, think long-term, and report more pro-environmental behaviours (Nisbet et al., 2009). Nature relatedness is also a better predictor of environmental attitudes and self-reported behaviour than other environmental scales such as the New Ecological Paradigm scale (Nisbet et al., 2009).

Unlike other measures of connectedness (c.f., Clayton, 2003; Frantz & Mayer, 2004; Schultz, 2001), which assess environmental self-concept or emotion separately, the nature relatedness construct and self-report scale capture thoughts, emotions, and experiences related to nature, together, as part of a broader construct. We contend that

these components of human-nature relationships are often interrelated, so have created a measure that captures multiple elements, potentially even within items. That is, thoughts, feelings, and experiences concerning the environment are inextricably linked, and this is reflected in items that draw on multiple factors. For example, belief statements have affective components, and for this reason, some scale items tap into both of these elements of nature-relatedness. Environmental self-concept is an essential component of nature relatedness, however emotions such as sympathy and caring for nature motivate people to adopt and sustain pro-environmental behaviours (Allen & Ferrand, 1999; Pooley & O'Connor, 2000) and so are a key element of nature relatedness. Self-identification or ecological identity (e.g., Clayton, 2003), while key to the nature relatedness construct, may not capture the influence of daily life experiences or the emotional connection people have with nature.

Kahn (1999) suggests that we need to build on and empirically test the biophilia hypothesis. Measuring individual differences in nature relatedness may be one way to do this. From a biophilia perspective, individual differences in nature relatedness indicate how much our innate need to connect with the natural world has been supported or suppressed.

Nature and Happiness

Kellert (1997) expands on the biophilia hypothesis and suggests that our biophilic tendencies drawing us to nature are essential for optimal emotional and psychological development. In other words, we need nature and becoming more connected to nature may make us healthier and happier. This also implies that a disconnection from the natural world has negative consequences for human psychological well-being.

Defining and Measuring Happiness

Happiness or subjective well-being is conceptualized in a variety of ways and has spawned a vast amount of research and varying methodological approaches, particularly in the last decade, due to the interest in positive psychology. Some, but not all of the constructs that are thought to be indicative of happiness are: positive emotions (and fewer negative emotions), satisfaction with one's life, relatedness and self-acceptance, as well as having a sense of autonomy and purpose in life, or meaning (Diener, Suh, Lucas, & Smith, 1999; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Schmutte & Ryff, 1997).

One method of defining subjective well-being - a hedonic approach - is to focus on the quantity of positive and negative emotions, and satisfaction with one's life (Diener, 2000). Not only do positive emotions contribute to positive physical and mental conditions such as healthy immune functioning (Davidson et al., 2003) and resilience (Fredrickson, Tugade, Waugh, & Larken, 2003), but positive moods may also promote other types of happiness such as the feeling that life is meaningful (King, Hicks, Krull, & Del Gaiso, 2006). Joy, interest, contentment, and other positive emotions may help counteract the influence of negative emotions (e.g., cardiac reactivity; Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000). Fredrickson (2000) suggests contentment - a feeling frequently reported during nature or wilderness experiences - broadens a person's self and world views, allowing for the building of personal resources. Cultivating positive emotions may help people to escape negative mindsets and find meaning in adverse circumstances, as well as contributing to well-being. Because this type of hedonic well-being includes subjective experiences of

pleasure (or the absence of it), as well as subjective judgements about one's life, it is sometimes referred to as subjective well-being (Ryan & Deci, 2001).

Another approach, from a humanistic perspective, uses the term psychological well-being, and refers to a sense of purpose and meaning in life (Ryff & Keyes, 1995). This eudaimonic approach is characterized by self-development and personal engagement (Ryff, Singer, & Love, 2004). Ryff's (1989) model of psychological well-being is comprised of six dimensions: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Ryan and Frederick (1997) contend that vitality - feeling alive and energetic - is a characteristic of fully functioning and psychologically healthy people. Nix, Ryan, Manly, and Deci (1999) suggest that vitality is a central indicant of eudaimonic well-being. Vitality is positively related to other happiness indicators such as self-actualization, autonomy and self-esteem, and negatively related to depression, anxiety, and physical pain (Nix et al. 1999). Eudaimonia is also associated with biological markers of well-being such as reduced cardiovascular risk and healthy immune functioning (Ryff et al., 2004).

Seligman (2002) suggests there are three types of happiness: positive hedonic balance (i.e., more positive and less negative emotions), sense of satisfaction (i.e., a more cognitive evaluation that things are going well), and a sense of meaning (i.e., that one's life has an important purpose). Ryan and Deci (2001) argue that despite the distinctions between various types, well-being is most likely a multidimensional phenomenon that includes both hedonic and eudaimonic components. They suggest that because these aspects of well-being can be distinct but sometimes overlap, well-being is best understood by using a variety of measurement methods. Ideally, research on happiness

combines these perspectives and measures both hedonic and eudaimonic well-being simultaneously (Spangler & Palrecha, 2004). In this study, I incorporated a variety of subjective well-being indicators to capture the hedonic and eudaimonic aspects of happiness that may be associated with nature.³

Connection to Nature, Health, and Happiness

It follows from the biophilia hypothesis that nurturing biophilic tendencies and connecting with nature will be good for human health. Indeed, a vast amount of research conducted prior to, and since the publishing of the biophilia hypothesis, indicates that nature images and scenery and natural settings have well-documented benefits for human physical and psychological health (see Frumkin, 2001 for a thorough review of the health benefits of nature). Most of the research in this area has investigated nature as a corrective or remedial measure to reduce stress, relieve anxiety, or to recover from illness (Herzog, Black, Fountaine, & Knotts, 1997; Herzog, Maguire, & Nebel, 2003; Laumann, Gärling, & Stormark, 2003; Ulrich, 1993). For example, pre-surgical patients had lower systolic blood pressure when looking at nature scenes (Ulrich, 1993), and blood donors were more relaxed when viewing images of nature versus built environments (Ulrich, Simons, & Miles, 2003). Even dental surgery patients reported less stress on days with a nature mural displayed than on days without it (Heerwagen, 1990).

There is some evidence that nature has health benefits beyond just recovery or stress reduction. Nature may facilitate executive functioning and self-regulation, by helping to restore depleted attentional resources (Kaplan & Berman, 2010). Nature has

³ Happiness and subjective well-being are used here to refer to the same broad concept and the various indicators measured here, including hedonic and eudaimonic well-being. Ryff's (1989) dimensions are also considered as happiness indicators in the present study, and are referred to with the term psychological well-being.

positive effects on psychological well-being, even when viewed through a window. Having a view of nature predicts feelings of peacefulness, satisfaction with the neighbourhood (Kaplan, 2001), and better functioning at work (Kaplan, 1993; Leather, Pyrgas, Beale, & Lawrence, 1998). People often engage in unhealthy activities during breaks from work such as smoking or drinking large amounts of coffee (Taylor, 2005). The work on restorative environments suggests there are opportunities for encouraging healthier options by incorporating nature into workplace stress reduction programs (Hartig, 2006). For example, Kaplan's (1993) work shows that the microrestorative breaks involved with having a view of trees from an office window have psychological health benefits. Empirical research is needed, however, to test whether improving connectedness to nature has equivalent or greater psychological benefits than those associated with nature views.

Nature contact is associated with a variety of positive emotions. "Green exercise" (e.g., in a city park, green space, or wilderness) appears to have psychological health benefits that indoor fitness environments do not (Pretty, Peacock, Hines, Sellen, South, & Griffin, 2005; Seymour, 2003). Those who exercise outdoors, in natural settings (a "green gym") are less depressed and have better psychological well-being compared to people who exercise indoors (Bodin & Hartig, 2003). Being in nature engages our interest, curiosity, and imagination (Kellert, 1997). Research on people's experiences in forest environments indicates these places evoke fascination, relaxation, and other indicators of well-being (Williams & Harvey, 2001).

Nature's benefits are not limited to remote or wilderness experiences, however. Urban landscapes provide opportunities to observe plants and animals which have

evolved in cities and thrive in the midst of human activities (Nareshwar & Pandya, 2006; Ryan, 2005). It may be possible to experience some of the benefits of nearby nature without venturing far from home or work. Indeed, people may be more motivated to connect with nearby nature if they are aware of the potential for improving their happiness. This may be particularly useful for those who are poor, disabled, or otherwise marginalized and who may benefit the most but have difficulty accessing more remote nature areas (Frumkin & Louv, 2007). Outdoor activities such as walking through a park helps people to feel more vital, positive, focused, effective, and alert (Kaplan, 2001; Nisbet & Zelenski, in press). Everyday nature provides aesthetically pleasing, positive, and meaningful experiences for people (Chenoweth & Gobster, 1990).

We recently tested how built and natural environments influence subjective well-being in a study of nearby nature's mood benefits. University students who walked for 15 minutes along a path bordered by campus buildings and a river reported significantly greater levels of positive affect and vitality, compared to those who walked indoors (Nisbet & Zelenski, in press). These effects held when controlling for weather and pre-walk (trait) levels of subjective well-being. We also observed nature's happiness benefits in an experience sampling study. Middle managers across Canada reported on their emotional experiences at home and work, as well as time outdoors and in nature. Those who spent more time in nature reported experiencing more positive emotions in both their home and work lives. By removing personality differences in our analyses and looking at within-person changes in emotions over time, we also discovered that when people are outdoors and in nature they tend to be happier (Nisbet et al., 2011).

Brief experiences in nearby nature are linked to positive emotions and vitality (e.g., Kaplan, 2001; Nisbet & Zelenski, in press), but these findings, and those on nature views, are mostly correlational, cross-sectional, and do not involve individual differences in connectedness. Some studies assessing restorative environments randomly assign participants to either a nature or non-nature condition (i.e., built versus natural environment; e.g., Hartig, Evans, Jamner, Davis, & Gärling, 2003), however the focus is often on recovery from unpleasant or stressful experiences and involves images or views of nature rather than actual experiences or nature contact (e.g., Hartig et al., 1996; Staats, Kieviet, & Hartig, 2003). Participants may be asked to report on state emotions but are rarely assessed later to determine the lasting effects of nature's happiness benefits (c.f., Hartig, Mang, & Evans, 1991). That is, the research on restorative environments and the links between nature experiences and positive emotions suggests connection to nature will promote happiness, but there is a gap in the research regarding trait levels (versus momentary or short-term experiences) of connectedness and how malleable individual differences in connection to nature may be. Similarly, no empirical research has demonstrated that increases in connectedness to nature will improve happiness.

Nature Relatedness, Happiness, and Environmental Concern

Researchers have only recently begun to explore the links between individual or trait-level differences in connectedness to nature and happiness (as opposed to the research on temporary or "state" nature affiliations and well-being reviewed above). The idea that connectedness with nature may promote sustainable behaviour (and happiness) is relatively new. Mayer and Frantz (2004) found a weak but positive correlation between emotional (trait) connectedness to nature and life satisfaction, when controlling

for the effects of ecological worldview. We explored how connectedness was related to a variety of subjective well-being and environmental variables. Controlling for environmental attitude measures, nature relatedness predicts happiness indicators such as positive affect, autonomy, personal growth, purpose in life, and life satisfaction (Nisbet et al., 2011). These results are mostly correlational, however trait level differences in connection to nature seem to be associated with both hedonic as well as eudaimonic well-being in ways that environmental attitude measures are not.

There are a number of possible explanations for this unique relationship between nature relatedness and happiness. People high in nature relatedness spend more time in nature (Nisbet et al., 2009) and so may benefit more from nature's restorative, mood enhancing, and energizing properties. It may be that highly nature related people deal with stress and daily hassles through nature contact and have developed a healthy coping mechanism to reduce stress and promote positive emotions. Further research is needed, however, to test the causal relationship between nature relatedness and happiness.

The specific happiness indicators associated with being connected with nature may also help explain why nature related people engage in more pro-environmental behaviour. People who are autonomous are independent thinkers and may be better able to withstand the social and other pressures that condone environmentally destructive behaviours. Indeed, autonomy is linked with more stable and pervasive environmentally responsible behaviour (Villacorta, Koestner, & Lekes, 2003). Nature related people also report more personal growth, are open to new experiences, and able to think long-term (Nisbet, 2005, Nisbet et al., 2011) – all qualities that may encourage responsible ecological behaviour. Nature relatedness is also associated with having a sense of

purpose in life (Nisbet et al., 2011). This may be expressed as a sense of meaning, or working toward future plans and goals. Nature related people may act more sustainably because they feel a sense of responsibility to solve environmental problems and are more likely to consider the future consequences of their actions. Since people who are more nature related also have more biospheric (versus egoistic) concerns for the environment, this sense of connection with the larger ecosystem may be expressed through a sense of purpose and personal goals for the future that include a healthy environment.

The research linking sustainability to happiness is relatively new (e.g., Brown & Kasser, 2005; Kasser & Sheldon, 2000; Mayer & Frantz, 2004; O'Brien, 2005), however, there appear to be links worth exploring between ecological values or behaviour and subjective well-being. A number of studies now suggest that happiness is related to self-reported pro-environmental behaviour (Brown & Kasser, 2005), while materialistic values are linked to lower levels of happiness and vitality, increased anxiety (Kasser & Ahuvia, 2002; Kasser & Ryan, 1993), and less sustainable behaviour.

The relationship between happiness and environmental behaviour may be partly explained by the fact that positive moods are associated with broad-minded coping and the building of resources that promote future positive emotions (Fredrickson & Joiner, 2002). If contact with nature promotes positive affect, then people may be more motivated to protect places they feel happy in. The research reviewed above indicates that nature contact and strong human-nature connections are associated with more positive emotions and fewer negative emotions. It may be that the narrowing of focus and avoidance that accompanies negative moods may help to explain environmentally destructive behaviour. Trait and state positive emotions broaden perspective to help

people see the forest and not just the trees (Fredrickson, 1998; Gasper & Clore, 2002). If people are very disconnected from nature and are missing out on the mood enhancing benefits of contact with nature, they may experience more negative emotions and the narrow focus that prevents more global and long-term thinking and consideration of how to contribute to environmental solutions. In contrast, positive emotions promote interest, curiosity, exploration, and more accurate knowledge than negative feelings (Fredrickson & Branigan, 2005). Thus, the positive feelings that accompany nature relatedness may promote more environmental knowledge, concern, and behaviour.

It is possible that as people become more aware of environmental problems, they may feel some negative emotions. Particularly for people who have a strong connection with nature, concerns about the degradation of the environment may lead to negative emotions. People who are unsatisfied with local environmental conditions and government policy, for example, are likely to be frustrated and discouraged (Pelletier et al., 1996). The association with environmental concern and happiness, however, suggests that nature related people are able to feel concern for the state of the environment, but also, simultaneously, feel positive about their individual relationship with nature.

O'Brien (2005) suggests we can achieve happiness in ways that are not only healthy but ecologically friendly. Sustainable happiness is a concept developed by O'Brien to describe happiness pursuits that do not exploit other people or the environment. She points out that sustainable, ecologically friendly transportation methods like walking and cycling also contribute to human well-being. We can think of nature relatedness as a personality characteristic conducive to sustainable happiness, or an individual difference that predisposes people to think, feel, and act in ways that are

ecologically and psychologically healthy. The nature relatedness links to subjective well-being and environmental concern (Nisbet et al., 2009, 2011), as well as O'Brien's concept of sustainable happiness, suggest that acting sustainably may promote happiness (cf., Brown & Kasser, 2005), producing a positive feedback loop whereby nature-protective behaviour becomes reinforcing for the good feelings and personal happiness it produces. Finding ways to promote connectedness with the environment and nurture intrinsic motivation for environmental actions may help prevent environmentally destructive behaviour, and at the same time increase human psychological health.

Promoting Nature-Relatedness

Although there is considerable evidence that nature has benefits for human physical and mental health, few studies have attempted to increase environmental concern or happiness by increasing connectedness to nature. Although nature relatedness is somewhat trait-like (i.e., relatively stable overtime), there is evidence to suggest that it is possible to change people's levels of connectedness to nature. Role play, art therapy, and perspective taking exercises have been used to foster relatedness.

Feral (1998) developed an intervention for children who were disconnected from nature and deprived of green spaces. In her "Eco-psych-4-Kids" program, ten at-risk children in grades four through eight participated in summer sessions including role-play, art therapy, and visualization exercises designed to increase connection with nature. Participation in the sessions significantly improved the children's emotional well-being and increased their empathy for nature (compared to a matched control group of students who were not emotionally at risk and were not in the eco-psych program).

Bragg (1996) describes “The Council of all Beings” workshops, aimed at expanding people’s self-concepts to include all living things. Adult participants create masks, sounds, and movement to role-play and portray a nonhuman being (e.g., a rock, the sun, a plant or animal). Bragg observed changes in the ecological self-concept of participants following these workshops, however most participants were environmental activists. Thus, further study is needed on how to influence people who may be less motivated to change and whether changes in self-concept are associated with any improvements in happiness.

Schultz (2000) has studied how perspective taking exercises involving animals influence environmental concern. Participants looked at photographs depicting various nature scenes, some including animals being harmed by pollution (e.g., an otter in an oil spill, an eagle on a factory smokestack), and were told to either look at the images objectively, or to take on the perspective of the subject, imagining how they feel. The perspective-taking condition involving animals was the most successful in eliciting biospheric environmental concern (concern for all living things, as opposed to concern for the self, or for close others), suggesting that feelings of interconnectedness (or at least biospheric concern) may be malleable.

The research on outdoor adventure programs also suggests that environmental education or nature experiences may increase connectedness (e.g., Kaplan, 1995, Kaplan & Kaplan, 1989; Kaplan & Talbot, 1983). Extended wilderness adventures can evoke feelings of closeness with the earth as well as a sense of awe and wonder (Talbot & Kaplan, 1986). Outdoor adventure programs and nature therapy may be time-intensive

and costly ways of attempting to shift perspective and feelings about the human nature relationship, however, and are not widely accessible.

In a quasi-experimental study of connectedness, I compared students enrolled in biology, geography, and environmental studies courses with a control group of students not enrolled in any type of environmental education classes. I measured participants' nature relatedness, environmental attitudes and behaviour, and well being at the start and end of fall term classes. Changes in nature relatedness mediated the effects of education on vitality as well as self-reported environmental behaviour (Nisbet, 2005). In other words, learning about the environment enhances subjective well-being, but because of the felt connectedness with nature. The courses I studied had no pre-planned nature relatedness content and I could not randomly assign participants to condition. These findings, along with the studies on connectedness reviewed above, suggest that an intervention designed specifically to increase nature relatedness could have stronger effects on both happiness and environmental concern.

Creating A Nature Relatedness Intervention

Based on the biophilia hypothesis, the research on connectedness to nature, and the literature demonstrating nature's health benefits, I developed a series of exercises to foster nature relatedness, which I also expected would promote happiness, environmental concern and behaviour. The nature relatedness intervention consisted of eight online writing exercises involving reflection about human-nature connections or experiences in nature (see Appendix F for the eight intervention instructions). Since nature contact is associated with subjective well-being and is a key element of human-nature relationships (Chawla, 1998, 1999; Chawla & Cushing, 2007; Kahn & Kellert, 2002; Sebba, 1991) the

writing intervention was designed to tap into the psychological benefits of nature experiences. One of the ways I did this was to ask people to reflect on past, present, and future experiences in nature; another was to encourage people to spend time in nearby nature.

The first intervention activity asked participants to consider a familiar, comfortable, and accessible place in nature (e.g., a park, recreation area, garden, or backyard). They were instructed to commit to spending some time in this place during the next week, and were asked to be aware of their surroundings for future intervention activities. Given the association between time in nature and well being (e.g., Nisbet et al., 2009; 2011; Nisbet & Zelenski, in press), I expected that even brief experiences in nearby nature would promote happiness. Because nature relatedness correlates with time spent in nature, I also expected that nature contact would promote greater connectedness.

The second intervention activity built upon the first by asking participants to reflect on recent time in nature and to document their experiences in writing, detailing their thoughts, and re-experiencing their emotions. Following from the well-established health benefits of the expressive writing paradigm (e.g., Pennebaker, 2004; Pennebaker & Seagal, 1999), a writing task was incorporated into this and subsequent intervention activities.

Pennebaker and colleagues have extensively studied expressive writing and the health benefits are well-established across diverse cultures and age groups (Smyth & Pennebaker, 2008). Writing for only a few minutes a day for fewer than five days can produce improvements in well-being (Pennebaker & Seagal, 1999). For example, students have written about their thoughts and feelings related to college, unemployed

engineers have written about being laid off, and Latino, Jewish people, and lesbians have written about social stigmatization. Writing is associated with a variety of physical and mental health benefits, including lower levels of depression, better immune functioning, and higher self-esteem (Pennebaker & Seagal, 1999).

The variability in language people use suggests that the way we use words reflects our emotions (Mehl & Pennebaker, 2004; Pennebaker, Mehl, & Niederhoffer, 2003). Writing about emotional experiences provides structure and meaning, and thus makes events more manageable (Pennebaker & Seagal, 1999). Although these studies involved writing about trauma, the psychological and health benefits of writing are not necessarily limited to the disclosure of negative emotions or traumatic experiences (Smyth & Pennebaker, 2008). Writing about positive events can also significantly increase positive mood (Burton & King, 2004) and those who benefit most from writing seem to use more positive emotion words (Pennebaker & Seagal, 1999).

Writing may shift people's perspective and allow them to better understand the events they are writing about (Pennebaker & King, 1999). Therefore, it follows that manipulating people's use of language or directing their writing (to focus on nature, for example) might influence their cognitive and emotional relationship with the natural environment. Writing about nature, natural things such as animals, or experiences in nature could change how people's thoughts and feelings about their relationship with nature are organized. Writing in a way that makes connectedness with the natural environment more salient could change how people see themselves and their place in nature, making them feel a part of, and less disconnected from their environment. In

other words, the process of nature relatedness writing might lead to cognitive restructuring and shifts in the perception of human-nature relationships.

People who write about trauma or negative events likely feel better as a result of the disclosure achieved by expressing emotions and restructuring the events in their minds (Pennebaker, 2004). Writing about nature and one's connection to the environment was expected to produce similar positive effects (although by a different process) in both hedonic as well as eudaimonic well-being. While expressive writing about negative events may promote well-being due to a reframing or better understanding and acceptance of past events, I anticipated nature relatedness writing would tap into biophilic tendencies, increasing connectedness and triggering the positive feelings associated with nature such as vitality, awe, fascination, contentment, restoration, and relaxation. I also expected nature relatedness writing would promote environmental concern, if writing about nature highlighted the ways humans and the environment are interconnected. Writing interventions do not need to be lengthy or occur repeatedly; even a few minutes may produce positive effects (Burton & King, 2008), however increasing nature relatedness in a lasting way was not something I expected to occur in one session of a few minutes of writing and reflection about nature. Likely, several sessions of nature relatedness writing would be required to produce the greatest and most lasting increases in connectedness, happiness, and environmental concern. Thus, to facilitate opportunities for reflection and nature contact, the research design allowed for time in between each of the writing intervention exercises.

In creating writing exercises to promote nature relatedness, I considered the work on nature-guided therapy (Burns, 1998, 1999), Schultz's (2000) perspective-taking study

involving animal photographs, Wilson and Kellert's (1993) notions of biophilia, and Lawrence's (1993) cognitive biophilia and animal symbolism. Of the eight nature relatedness intervention activities, I designed two specifically to tap into the biophilic properties of human-animal relationships, and I included animal elements in two others. In activity 5, for example, participants were guided to think about an interesting animal (either domestic or wild). A series of questions prompted them to consider the animal's characteristics, habitat, and any emotions associated with this experience. In activity 7, participants considered the words, phrases and sayings in the English language that are related to animals. They were then provided with examples of phrases involving animals (e.g., people *howl* with laughter) and prompted to write their own phrases related to animals and animal words or phrases used to describe human personality.

In activity 6, participants took on the perspective of some natural element, such as the sun, a tree, or an animal. They were then guided to reflect on what they saw and felt from this new perspective. I expected that some participants would choose an animal for their perspective-taking experience. In activities 4 and 8 participants were guided to consider animals in their visualization of an outdoor place and in their reflections of their recent experiences in nature.

For many people, symbolic representation of animals may have replaced contact with their living counterparts (Lawrence, 1993). Participants could choose to write about any type of animal or animal experience within the intervention design. The nature relatedness intervention was designed to make people aware of their interconnection with all living things, including non-human animals, but was not designed to correct irrational beliefs about animals or to overcome any negative associations. Attempting to correct

misconceptions or change cultural or religious concepts about animals was beyond the scope of this study, but a potentially useful endeavour for future researchers. Shepard (1993) and Lawrence (1993) point out that biophilic tendencies can be manifest in both positive and negative associations with animals, so I allowed participants freedom in this regard, although I expected most people to write about an animal they felt positive or at least curious about.

Wilson (1993) believes that our use of animal symbolism encourages us to explore our relationship with other living things and contemplate our place in a shared ecosystem. Animal symbolism connects us with nature and is an expression of our cognitive biophilia (Lawrence, 1993). Thus, I considered contemplation of animal words and imagery in language and reflecting on experiences and interactions with animals a plausible method for evoking biophilic tendencies and increasing nature relatedness.

The instructions for activity 3 guided participants to consider their food and its origins. Participants thought about a food item recently consumed, and then wrote about where the item came from, the landscape, climate, ecosystem, and culture where it was produced. Pollan (2006) insists that the food we consume and how we eat links us to the earth. Thinking about what we eat and where it comes from - the food chain, whether industrial or organic - helps us to understand our connection to the environment. As Pollan suggests, from this perspective, even a “Twinkie” is interconnected. I hoped that by guiding participants to be fully conscious of where their food came from it might evoke contemplation of how all life is interrelated.

The benefit of the writing intervention exercises to increase nature relatedness is that they did not require special access to nature, or even a window view. While I am not

advocating writing as a replacement for time spent connecting with the natural world, it could be a cost-effective, accessible, and practical alternative for people who are unable to get outdoors on a regular basis. Not only could writing about nature complement other nature activities, but it could motivate those who might not otherwise be inclined to go outside and spend time connecting with their natural environment.

Purpose and Hypotheses

Increasing connectedness to nature may promote human happiness as well as conservation behaviours. The present study used cross-sectional, longitudinal, and experience sampling methodology (ESM), in a randomized controlled trial, to test whether an online writing intervention would enhance individual levels of connection to nature, and whether these increases might mediate potential increases in psychological well-being and environmental concern. I developed an intervention to increase nature relatedness through exercises involving reflection, writing about, and spending time in nature. The control condition intervention consisted of similar writing exercises (see Appendix F), but focused on reflections about activities in built rather than natural environments (e.g., writing about one's bedroom or living room). Trait levels of connection to nature and happiness were assessed at the start of the study. Then, over the next month, participants completed reports on short-term subjective well-being and time use twice weekly (ESM), and received instructions for intervention activities specific to their experimental condition. ESM has the advantage of minimizing retrospective (memory) biases. Frequent, repeated assessments diminish the need for mental aggregation over time, and this makes self-reports more indicative of actual experience or behaviour (see Scollon, Kim-Prieto, & Diener 2003).

Following the month-long intervention, respondents again completed trait measures of connectedness to nature, happiness, and time use, as well as measures of environmental concern, and behaviour. A follow up assessment of trait happiness, time use, environmental concern and behaviour was completed six months later to investigate whether any effects of the intervention were sustained.

Nature relatedness was expected to increase through contact with the natural environment and from frequently spending time outdoors. For many people, however, this may not always be possible, given time constraints or limited access to parks and other urban or wilderness nature settings. Unseasonable or inclement weather may reduce opportunities for contact with nature and contribute to depression (Hartig, Catalano, & Ong, 2007). The nature relatedness intervention involved some activities that encouraged people to spend time in nature. Because nature contact is not always possible, many of the exercises provided alternate ways to experience the positive emotions associated with being more nature related, and were designed to foster connectedness, even if people were not able to physically connect with the natural environment. The method that follows describes the randomized controlled trial designed to test the causal relationships between connection to nature, happiness, and environmental concern. Hypotheses were as follows:

- 1) Participants in the nature intervention group were expected to report higher levels of nature relatedness than the control group at the end of the study. The nature intervention was designed, primarily, to increase connectedness with nature and participants completing these exercises were expected to exhibit significant differences from the control group.

2) Following from the well-documented mental health benefits of nature, I expected those in the nature intervention group would report greater happiness than the control group, specifically more positive affect, and a greater sense of vitality, personal growth, and purpose in life, at the end of the study. The nature activities were expected to inspire contact with nature and the resultant benefits to psychological well-being.

3) Nature relatedness is associated with environmental attitude as well as self-reported environmental behaviour. Thus, I expected those who completed the nature intervention activities would feel more concerned about nature and want to protect it. Those in the nature group were expected to report more environmental concern and environmental behaviours than the control group, at the end of the interventions.

4) Theory reviewed above and past findings suggest that nature relatedness mediates the relationship between environmental education and subjective well-being. I expected that an intervention designed specifically to increase connectedness would result in significant nature relatedness increases, and that these increases would mediate any benefits of the nature intervention on subjective well-being and environmental concern.

5) Participants who reported spending more time connecting with nature (an aggregated score reflecting average time spent in nature during the study) were expected to report more nature relatedness and greater levels of happiness than those investing less time in nature related activities.

6) Participants who reported spending more time connecting with nature (aggregated scores) were expected to increase in nature relatedness and report greater

concern and more environmental behaviours at the end of the study, compared to those investing less time in nature.

7) Given that nature relatedness is correlated with time spent in nature and subjective well-being, increased nature contact could promote both nature relatedness and happiness. In other words, nature relatedness was considered as a potential mediator of the nature time-happiness relationship. I also considered the possibility that increases in nature relatedness would inspire more nature contact and subjective well-being (i.e., that nature time would mediate the nature relatedness-happiness relationship), so both of these pathways were examined.

8) Given that the intervention involved multiple writing sessions, over several weeks, I expected lasting changes in connectedness and happiness for the nature intervention group. I anticipated that any improvements in happiness, environmental concern, and behaviour would be sustained by the nature condition participants over time (assessed at the 6-month follow up).

My goal was to establish causal links between nature relatedness and happiness, as well as between nature relatedness and sustainable behaviour. By doing so, I also hoped to lend empirical support to the biophilia hypothesis and the construct of nature relatedness.

Method

Participants

Two hundred and seven student and community participants voluntarily completed a series of nine surveys as part of an online study about happiness. Fifty three of these participants completed a follow up survey six months later. Student participants

($n = 123$) were recruited through the Psychology Department's online sign up system and received course credit for their participation (4% maximum; prorated to proportion of surveys completed). Community participants ($n = 84$) were recruited with advertisements on Facebook, Google, Craigslist, and websites that list web-based experiments. Community participants received one chance at a draw for \$500.00 U.S. for each survey they completed (to a maximum of 9). Both student and community participants who completed a follow-up survey six months later were entered into a draw for \$200.00 U.S. Draws were conducted in August 2009 and February 2010. Winners received a cheque by mail.

Interested participants enrolled on the study website and agreed to receive email notices about web-based activities designed to increase awareness of their surroundings, and to potentially improve their happiness. Participants were randomly assigned to either a nature relatedness ($n = 104$) or control ($n = 103$) condition, as a function of the survey website program. The website program generated automated emails twice weekly, and a follow up email six months later, with a link and secure password for each participant to complete the appropriate online survey.

Seven hundred and forty-eight people began the study by completing the first survey - an initial baseline questionnaire (survey 1). To allow for attrition, recruitment continued until at least 100 participants in each condition had completed the intervention phase of the study (surveys 1-9). One student who did not complete any of the intervention exercises was excluded from further analyses. Approximately one quarter ($N = 207$) of people who began the study continued on and completed the intervention

exercises; of those, 53 people (23 nature, 30 control) completed a six month follow up questionnaire (survey 10).

Participants ranged in age from 16 to 72 ($M = 27.81$, $SD = 13.37$) and the majority were women (77.8%, $n = 161$; men: $n = 46$). Most participants were Caucasian ($n = 151$, 72.9%); 9.2% were Asian, 5.8% identified as having mixed ethnicity, 3.4% were Black, and the remaining participants were East Indian, Hispanic, Iranian, Lebanese, Pakistani, Tamil, or Egyptian. Five people did not report their ethnicity. Most participants were from Canada ($n = 143$, 69.1%), but New Zealanders (14.5%), Americans (11.1%), and people from Australia, the United Kingdom, Ireland, Poland, and Bangladesh (5.3%) took part in the study.

Most participants had acquired at least high school education: 19.8% finished high school, 7.2% had a college degree, 48.3% had some university education, 13.0% held an undergraduate degree, 5.8% had post-graduate education, 2.9% had trade education, and 2.9% had some high school. Approximately half (54.6%) were employed. The majority of participants were urban dwellers, residing in the centre (33.3%) or suburbs (49.3%) of a city. Some participants were from a small town (9.7%) or lived in a rural area or on a farm (6.3%). Most participants had grown up in the centre (16.4%) or suburbs (45.4%) of a city, but a few had been raised in a small town (25.6%) or rural area (11.6%). Most people were living in a detached house (47.8%); 20.3% were apartment dwellers, 19.3% lived in a townhouse, 10.6% were in university residences, and the remainder (2.0%) lived in semi-detached housing, cottages, or hostels.

People who completed the six month follow up questionnaire were of similar age as the full sample ($M = 26.76$, $SD = 10.77$, range: 17-60), and were, again, mostly female

($n = 40$, 75.5%, male: $n = 13$). The nationality of these participants was also similar to the overall sample: 73.6% Canadian, 15.1% New Zealander, 5.7% American.

Materials

Participants in the two conditions completed the same baseline questionnaires measuring trait happiness, connection to nature, and mindfulness, the same bi-weekly experience sampling (ESM) surveys, with measures of short-term happiness and time use, and the same post-intervention and follow-up assessments of trait happiness, connectedness to nature, time use, environmental concern, and behaviour. When people signed up for the study on the website they were directed to a baseline questionnaire with demographic information such as age, gender, education, occupation, and geographic location (see Appendix C, General Information). This initial survey (survey 1) assessed hedonic and eudaimonic well-being, connectedness to nature, and mindfulness (see Appendix D), providing baseline data on these variables for later comparison with endpoint measurements.

The *Nature Relatedness (NR) Scale* (Nisbet et al., 2009) assessed individual connection with nature. Respondents rated 21 statements on how well each item describes them, using a five-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*), such that higher scores are indicative of a stronger connection to nature. The items in the nature relatedness scale combine to provide a reliable measure of cognitive, affective, and experiential connection with the natural environment (α in prior research ranges from .87 to .88). A three-factor structure provides an opportunity to examine specific dimensions of NR that contribute to one's connection to nature. The first dimension, NR-self, includes eight items such as "I feel very connected to all living

things and the earth”, “My relationship to nature is an important part of who I am”, and “I am not separate from nature, but a part of nature”. The second dimension is NR-perspective and includes seven items such as “Humans have the right to use natural resources any way we want”, and “Nothing I do will change problems in other places on the planet”. The third dimension, NR-experience, includes six items such as “I don’t often go out in nature” (reversed item), “I enjoy being outdoors, even in unpleasant weather”, and “I take notice of wildlife wherever I am”.

The initial baseline questionnaire included six items selected from the Nature Relatedness scale, inserted amongst personality items (the Big Five Factor Inventory; John & Srivastava, 1999), to unobtrusively gather baseline data about connection to nature, while avoiding demand characteristics⁴. The full 21-item nature relatedness scale was administered as part of the post-intervention questionnaires.

To select items that best represent the construct of nature relatedness, as well as those believed to be most sensitive to the nature intervention exercises, I examined data from over 1,200 participants, both students and business people. I studied frequency distributions to find items that discriminate low from highly nature related people and that had a relatively normal distribution in various participant samples. I selected items based on theoretical foundations consistent with the nature relatedness construct as well as aspects of it that I believed would be more sensitive to manipulation as a result of the interventions.

Six nature relatedness items had high inter-item correlations in all data samples and, together, have good reliability (α ranged from .81 to .86 in three data samples) and a

⁴ The wording of nature relatedness items was slightly adjusted to be consistent with the format of the Big Five Factor Inventory. Several foils were added to the measure as distractors.

similar pattern of correlations with subjective well-being and environmental variables as the full 21-item scale. Four of the items assess self-identification with nature, a sense of connectedness that may be reflected in spirituality, awareness or subjective knowledge about the environment, and feelings of oneness with nature: “I always think about how my actions affect the environment”, “My connection to nature and the environment is a part of my spirituality”, “My relationship to nature is an important part of who I am”, and “I feel very connected to all living things and the earth”. Two additional items capture individual differences in the need for nature and comfort with wilderness, as well as awareness of local wildlife or nearby nature: “My ideal vacation spot would be a remote, wilderness area” and “I take notice of wildlife wherever I am”.

Items not selected were mostly from the NR-perspective dimension, and indicative of environmental attitude or reflecting an external perspective about human-nature interactions. While these items are important elements of nature relatedness, the focus of this study was on increasing connectedness, which was best captured with NR-self and experience items (other reliable measures of environmental attitude were included in the study). In addition, the high face validity of some of the omitted items would have made them more difficult to use without compromising the cover story and potentially inviting demand characteristics. Participants completed the full 21-item nature relatedness scale following the intervention ($\alpha = .90$), allowing for comparison between groups on the comprehensive measure as well as changes captured by the 6-item subscale.

In sum, taken together, these 6 nature relatedness items provide a brief assessment of individual differences in nature relatedness, maintaining statistical and conceptual

reliability without compromising the construct (Nisbet & Zelenski, 2011). Although selecting a few items for a brief baseline measure of nature relatedness was a difficult task, the items selected were those expected to be most useful in capturing potential changes in connectedness over the course of the study. The 6-item measure demonstrated acceptable internal consistency at all stages of the study (baseline $\alpha = .87$, survey 9 $\alpha = .87$, six-month follow up $\alpha = .88$). The short form of the nature relatedness scale was highly correlated with the full scale, had high test-retest correlations, and predicted happiness and environmental variables similarly to the full scale (these details are described in the results section; see also Appendix I, Table 22).⁵

The *Inclusion of Nature In Self* (Schultz, 2002) scale assessed participants' feelings of closeness in their relationship with the natural world. This single-item measure was an adaptation of Aron, Aron and Smollan's work (1992) on closeness in interpersonal relationships. Seven images were presented which represent varying levels of inclusion of self with nature. Each image consisted of two circles, each circle containing either the word "self" or "nature". Participants were asked to select the image that best describes their relationship with nature. The least inclusive was represented by the self and nature circles side-by-side, while the most inclusive was an image of the two circles merged into one with both the words self and nature together inside. A number of other versions of the scale were included such as: me/my country, me/my culture, me/my family, me/music, me/my home, me/my friends, me/my partner, me/my environment, to distract participants from the true nature of the study.

⁵ All the post-intervention nature variables were positively correlated. The 6-item nature relatedness measure correlated .92 with the 21-item NR scale, .74 with inclusion in nature, and .28 with aggregated nature contact.

Happiness Indicators

A revised version of the *PANAS* (Watson, Clark, & Tellegen, 1988) was used to measure positive and negative affect. I added five additional words that are markers of subjective well-being (joyous, anxious, sad, happy, content), as well as three emotion words (in awe, fascinated, curious) particularly relevant to nature experiences (Fredrickson, 2000; Kellert, 1997; Keltner & Haidt, 2003; Williams & Harvey, 2001). Participants indicated how much, in general, they felt each of the 28 emotions, using a 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Responses to the 16 positive and 12 negative emotion words were averaged, separately, to create positive and negative affect scores at baseline (PA: $\alpha = .93$, NA: $\alpha = .90$), post-intervention (PA: $\alpha = .95$, NA: $\alpha = .92$), and six months later (PA: $\alpha = .93$, NA: $\alpha = .88$). A nature-specific PA variable was calculated by averaging scores on the three emotion words (in awe, fascinated, curious) intended to capture the restorative ‘soft fascination’ evoked by nature, (described by Kaplan, 1995). This 3-item *fascination* scale had acceptable reliability at baseline ($\alpha = .74$), post-intervention ($\alpha = .80$), and six months later ($\alpha = .83$).

Vitality was assessed with the *Vitality Scale* (individual difference level version, Ryan & Frederick, 1997). The scale is a reliable measure of how much participants feel alive and energetic (Bostic, Rubio, & Hood, 2000). Items include “I feel alive and vital” and “I have energy and spirit”. Respondents indicated how true each statement was for them, using a Likert scale ranging from 1 (*not at all true*) to 7 (*very true*). Items were averaged to produce an overall vitality score (baseline $\alpha = .92$, post-intervention: $\alpha = .95$, six-month follow up: $\alpha = .94$).

In addition, aggregate scores for positive and negative affect, fascination, and vitality were calculated from the bi-weekly (ESM) reports for every participant, averaging across the five weeks of reporting. By collapsing over the entire rating period, I obtained individual average ratings for each variable.

The *Psychological Well-Being Inventory* (Ryff, 1989) assessed three dimensions of psychological well-being previously linked with nature relatedness: autonomy, purpose in life, and personal growth. Respondents were asked about 27 statements pertaining to various aspects of their lives, using a Likert scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Each dimension contains nine items. The autonomy sub-scale measures ability to think independently and resist social pressures, and includes items such as “My decisions are not usually influenced by what everyone else is doing” and “Being happy with myself is more important to me than having others approve of me”. Personal growth assesses openness to new experiences and feelings of continued development. Items include “I have the sense that I have developed a lot as a person over time” and “For me, life is a continuous process of learning, changing, and growth”. Purpose in life measures one’s goals in life and a sense of directedness and meaning. Items include “Some people wander aimlessly through life, but I am not one of them” and “I enjoy making plans for the future and working to make them a reality”. Items for each dimension were averaged to create scores for autonomy (baseline $\alpha = .80$, post-intervention: $\alpha = .83$, six-month follow up: $\alpha = .84$), purpose in life (baseline $\alpha = .82$, post-intervention: $\alpha = .81$, six-month follow up: $\alpha = .75$), and personal growth (baseline $\alpha = .79$, post-intervention: $\alpha = .83$, six-month follow up: $\alpha = .82$).

The *Subjective Happiness Scale* (Lyubomirsky & Lepper, 1999) assessed general happiness levels with four statements or questions. Sample items included: “In general, I consider myself...1 (*not a very happy person*) 7 (*a very happy person*)” and “Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?” Response options ranged from 1 (*not at all*) to 7 (*a great deal*). Items were averaged with higher scores indicating greater happiness (baseline $\alpha = .88$, post-intervention: $\alpha = .90$, six-month follow up: $\alpha = .87$).

The *Satisfaction With Life Scale* (Diener, Emmons, Larsen, & Griffin, 1985) asked participants to respond to five statements concerning their life satisfaction on a Likert scale ranging from 1 (*strong disagreement*) to 6 (*strong agreement*). Statements included “In most ways my life is close to my ideal” and “So far, I have gotten the important things I want in life”. Items were averaged to produce a life satisfaction score (baseline $\alpha = .89$, post-intervention: $\alpha = .92$, six-month follow up: $\alpha = .87$).

Happiness was also measured by asking participants to estimate how much of the time (by percentage) they felt happy, unhappy, and neutral (Fordyce, 1988).

Depression symptoms were assessed using the *Centre for Epidemiological Studies Depression Scale* (Radloff, 1977). This scale is designed to measure depressive symptoms in the general population and consists of 20 items such as “I did not feel like eating; my appetite was poor”, and “I felt that everything I did was an effort”. Participants rated how much of the time they felt each item during the prior week using a 4-point Likert scale ranging from 0 (*rarely*) to 3 (*most*). Scores were calculated by summing the items such that a higher overall score (maximum possible is 80) indicates

greater depression (baseline $\alpha = .75$, post-intervention: $\alpha = .76$, six-month follow up: $\alpha = .77$).

Mindfulness was assessed with the *Mindful Attention Awareness Scale* (Brown & Ryan, 2003). The scale measures dispositional awareness and attention to the present. Participants were asked to indicate how much 15 statements reflect their every day experience, using a 6-point Likert scale ranging from 1 (*almost always*) to 6 (*almost never*). Items include “I find it difficult to stay focused on what’s happening in the present” and “I find myself doing things without paying attention”. Scores were calculated by averaging the items such that a higher overall score indicates greater mindfulness (baseline $\alpha = .86$, post-intervention: $\alpha = .87$, six-month follow up: $\alpha = .89$).

Bi-Weekly ESM Assessments

Participants completed the modified PANAS (PA α ranged from .93 to .95, NA α ranged from .89 to .92, fascination α ranged from .76 to .82), and Vitality scales (α ranged from .94 to .95) twice per week. Instructions were modified, asking participants to respond according to how they felt “recently”, over the preceding three days.

Time Use was evaluated with questions asking about daily activities and life settings (the list of activities was adapted from Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004, but the present study used different methodology). I assessed how many hours people spent: “shopping”, “out at a restaurant”, “listening to music”, “at a gym or fitness facility”, “on a walk, hike, or activity in nature”, “visiting friends”, “watching television”, “doing housework”, “commuting to work/school”, “talking on the phone”, “taking care of children”, “sending e-mail/surfing the internet”, “eating”, “relaxing”, and “sleeping” during the previous three days (covering the period since the last ESM

survey and intervention instruction). A number of these were distractor items, inserted to reduce demand characteristics. The time use questions provided a measure of nature contact, time engaged in nature-related activities, and an indication of whether participants followed the intervention instructions directing them to spend time in nature. Aggregated scores for nature time were calculated by averaging participants' nature time use over the month-long intervention period.

Writing Interventions

Nature relatedness intervention. The nature intervention included instructions and exercises designed to increase awareness of people's interconnection with the natural world (see Appendix F). Participants reflected on past experiences in nature, visualized themselves in outdoor settings, and planned time in nature. Exercises 1 and 2 involved planning and spending time in nature and reflecting on the thoughts and feelings associated with those experiences. Exercise 3 guided participants to consider where their food came from and the interconnectedness between people and what we eat.

Exercises 4, 5, 7, 8 (and potentially 6) provided opportunities for participants to reflect on their experiences with wildlife, pets, or animals in general, and encouraged people to be more aware of and notice wildlife in their environment. Many of the exercises (activity 3 in particular, and to a lesser extent activity 6) encouraged participants to consider how their own actions influence the environment and to think about their interconnectedness with the ecosystems in which they live. All the exercises were designed to help people internalize their sense of connection to the environment.

Control Intervention. Intervention exercises in the control condition (see Appendix F) were not designed to decrease or increase connectedness, happiness, or

environmental concern. These exercises were not expected to cause people any physical or psychological discomfort, but they also were not designed to produce significant increases in happiness. Participants in the control condition also reflected on their own experiences, but focused on indoor or built environments. The control intervention was similar to the nature one, but focused on indoor elements, places, and perspective taking.

Post-Intervention Assessments

At the end of the four-week intervention, all participants completed measures of connectedness with nature, including the 21-item nature relatedness scale, the Inclusion of Nature in Self scale, environmental concern and behaviour scales. Participants also completed the same measures of affect, vitality, psychological well-being, and happiness from the beginning of the study, and the same Time Use survey from the ESM portion of the study. For all variables that were measured at baseline and post-intervention, standardized residuals, derived from regression analyses, were used as change scores.

The *Ecology Scale, Short-Form* (Maloney, Ward, & Braucht, 1975) assessed both feelings about ecological issues and willingness to commit to behaviour change in a “true” or “false” response format⁶. I included the two 10-item subscales that assess *verbal* and *actual commitment* towards ecological issues concerning transportation, monetary donations, consumer purchases, pollution, political activism, and general awareness. The verbal commitment subscale measured what participants were willing to do in regard to environmental issues. Items included “I’d be willing to ride a bicycle or take the bus to school or work in order to reduce air pollution” and “I would be willing to stop buying products from companies guilty of polluting the environment, even though it

⁶ I made minor adjustments to the scale’s original wording to remove place-specific and dated terminology.

might be inconvenient”. The actual commitment sub-scale measured what participants have actually done for the environment (self-reported behaviour) and included items such as “I have switched products for ecological reasons” and “I subscribe to ecological publications/newsgroups/listservs”. The respective items were summed to create overall scores for verbal commitment (post-intervention $\alpha = .63$, six month follow up $\alpha = .68$) and actual commitment (post-intervention $\alpha = .74$, six month follow up $\alpha = .71$).

The *Environmental Concern* scale (Schultz, 2000) evaluated the structure of participants’ concern for the environment. The scale differentiates between three types of motivation or concern: egoistic, which is based on how the environment affects one’s own well-being; social-altruistic, which is concern based on the environmental conditions that affect other humans; and biospheric, concern for the impact of environmental problems on all other living things. Using a 7-point Likert scale ranging from 1 (*not important*) to 7 (*supreme importance*), people indicated their concern for the environment due to the consequences to: “animals”, “plants”, “marine life”, “birds” (these four items reflect biospheric concern), “me”, “my future”, “my lifestyle”, “my health” (reflecting egoistic concern), “all people”, “children”, “people in my community”, and “my children” (reflecting social-altruistic concern). Responses on the respective dimensional items were averaged to create scores for biospheric (post-intervention $\alpha = .90$, six month follow up $\alpha = .86$), altruistic (post-intervention $\alpha = .91$, six month follow up $\alpha = .87$), and egoistic (post-intervention $\alpha = .94$, six month follow up $\alpha = .94$) concern.

A survey inquiring about environmentally sustainable behaviours (*Sustainability Survey*) was also included to assess self-reported environmental actions. Participants reported on whether or not they performed 14 different environmental behaviours related

to transportation, recycling, activism, and purchasing patterns. The number of activities reported by each participant was summed to create a sustainable behaviour score (post-intervention $\alpha = .72$, six month follow up $\alpha = .77$).

Six Month Follow-Up Assessments

Six months after the end of the intervention phase, participants were contacted by email and directed to an online follow-up survey. This assessment included the same measures of connectedness, mindfulness, psychological well-being, environmental concern and behaviour, and time use, to determine if the benefits of the intervention were maintained. Participants were also asked about whether they still engaged in any of the activities that were part of the intervention exercises, and whether they found them useful or beneficial to their personal happiness.

Procedure

The study was advertised as being about mindful awareness of one's daily surroundings and happiness. The study webpage briefly described the procedure and people who chose to sign-up received a link with study information, including informed consent. Participants were randomly assigned to either the nature intervention or the control intervention as a function of the survey website program. All survey instruments were completed on the study website. Participants initially completed a baseline questionnaire with demographics, measures of connectedness with nature, mindfulness, and psychological well-being. Then, for the next four weeks, participants received two emails per week, with a link to the online ESM questionnaire and intervention activity instructions.

The writing interventions for the nature relatedness condition were designed to promote a sense of connectedness with nature by guiding participants to be aware of the natural environment and their own nature experiences, past and present. The exercises were designed to tap into various aspects of ecological awareness, using human senses associated with nature experiences, and encouraged participants to reflect on the emotions and thoughts they had during those experiences. The method and content for the exercises was drawn from environmental and positive psychology research, writing intervention studies, and the work on nature experiences and happiness. The control condition exercises involved similar writing tasks about participants' environments but focused on the built or indoor environment. Participants completed the writing portion of the intervention exercises by typing into a dialogue box on the online survey screen. The text provided by each participant was saved along with their other data, allowing for verification of whether the participants did indeed complete each writing task.

One week after the last intervention exercise, participants completed measures of subjective well-being, connection to nature, time use, environmental concern and behaviour. All participants received an interim debriefing and were given the opportunity to complete the exercises in the alternate intervention condition if they wished. Students received course credit for their participation, pro-rated according to the number of surveys completed. Community participants were entered into a draw to win a prize of \$500 U.S. and received one entry for each survey they completed. The draw took place in August 2009 and a cheque was mailed to the winner.

Six months after participants completed the post-intervention survey, they were contacted and invited to complete a follow-up survey comprised of the same subjective

well-being and environmental measures. All participants who completed this final survey were entered into a draw to win \$200 U.S. The draw for this prize took place in February 2010 and the winner received a cheque by mail.

Results

Missing Data and Outliers

Data were examined for missing values and outliers. There was no indication that missing data were not random. Prior to analyses, all variables were examined for normality, using a histogram of frequencies as well as skewness and kurtosis features of the distributions. To detect univariate outliers, standardized (z) scores were created for each variable. Participant scores greater than $|3.29|$ were considered to be outliers, however none were adjusted to within 3 standard deviations of the mean as the number of outliers was less than one percent, below an acceptable limit (Tabachnick & Fidell, 2001).

Preliminary Analyses - Nature and Control Group Characteristics

The nature and control groups were compared on demographic and baseline variables to detect any initial group differences and to confirm successful random assignment. The age range of the groups was similar (control: $M = 27.18$, $SD = 13.00$, nature: $M = 28.43$, $SD = 13.76$), $t(205) = 0.67$, $p = .50$. The groups were also similar on demographic characteristics such as ethnicity, where they grew up and live now, dwelling type, education, and employment (see Appendix H, Table 21 for percentages by group and Mann-Whitney U test results). Gender was not evenly distributed across the groups. Fewer men than women men participated in the study, overall, but there was a significantly smaller proportion of men in the nature condition ($n = 17$, 16.3%),

compared to the control condition ($n = 29, 28.2\%$), $\chi^2(1, N = 207) = 4.18, p = .04$. There were no significant differences between the groups on the baseline connectedness with nature variables, or on the subjective well-being variables, with the exception of life satisfaction (see Table 1). The nature group participants were slightly more satisfied with life at the beginning of the study, compared to the control group. Subsequent analyses comparing post-intervention happiness controlled for baseline differences.

Table 1

Means, Standard Deviations, and Effect Sizes for Baseline Variables by Group

	Control ($n = 103$)		Nature ($n = 104$)		$t(205)$	d
	M	SD	M	SD		
Nature Relatedness (6 items)	3.21	1.03	3.28	0.96	0.58	0.07
Inclusion of Nature in Self	4.41	1.58	4.54	1.64	0.59	0.08
Fascination	3.01	0.99	2.90	0.80	0.91	0.12
Positive Affect	3.09	0.72	3.14	0.55	0.52	0.08
Negative Affect	2.16	0.72	2.10	0.74	0.57	0.08
Vitality	4.21	1.36	4.28	1.36	0.36	0.05
Percent Happy	48.66	24.88	47.48	24.03	0.35	0.05
Percent Unhappy	21.33	17.35	21.88	16.92	0.23	0.03
Percent Neutral	30.01	18.60	30.63	18.22	0.24	0.03
Subjective Happiness	4.63	1.52	4.73	1.37	0.51	0.07
Satisfaction with Life	3.75	1.30	4.07	1.14	1.87 [†]	0.26
Depression	35.79	8.69	35.04	8.77	0.62	0.09
Autonomy	4.28	0.77	4.26	0.84	0.17	0.02
Personal Growth	4.73	0.80	4.79	0.69	0.58	0.08
Purpose in Life	4.38	0.88	4.43	0.74	0.49	0.06
Mindfulness	4.13	0.84	4.11	0.72	0.15	0.03

[†] $p < .10$, * $p < .05$, ** $p < .01$.

There was the same proportion of student (59%) and community (41%) participants within each experimental condition. The students were similar, in most respects, to community participants, with some noteworthy exceptions. Community participants were more nature related than students. Examining baseline differences in connectedness according to group and participant type, it was evident that random assignment was not entirely successful. I compared group differences for both baseline nature relatedness and inclusion of nature in self within the student and community samples using two between subjects ANOVAS (with participant type and condition as predictors). There were no significant main effects of participant type or condition (for either connectedness measure), but there were significant interactions between condition and participant type. Analyses for both nature relatedness and inclusion with nature revealed the same pattern: students in the control group were less connected than nature group students, whereas for community participants the control group was higher in connectedness than the nature group (means, standard deviations, and the ANOVA results are presented in Table 2). In subsequent analyses, participant type was included to control for these baseline differences in connectedness.

Table 2

Baseline Differences in Nature Relatedness and Inclusion of Nature by Condition and Participant Type

	Control ($n = 103$)		Nature ($n = 104$)		$F(1,203)$	η^2
	M	SD	M	SD		
Nature Relatedness						
Students ($n = 123$)	2.90	0.97	3.31	0.91		
Community ($n = 84$)	3.64	0.96	3.24	1.04		
Condition					0.00	0.00
Participant Type					0.69	0.41
Condition x Participant Type					8.55**	0.04
Inclusion of Nature in Self						
Students ($n = 123$)	4.13	1.42	4.66	1.58		
Community ($n = 84$)	4.81	1.71	4.36	1.72		
Condition					0.01	0.01
Participant Type					0.15	0.13
Condition x Participant Type					4.75*	0.02

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Community participants were significantly older ($M = 37.86$, $SD = 15.01$) compared to students ($M = 20.95$, $SD = 5.60$), $t(205) = 11.39$, $p < .01$. Students were slightly more satisfied with life, but had lower levels of fascination compared to community participants (means, standard deviations, and results of independent samples t-tests are presented in Table 3). Subsequent analyses with these variables included participant type to control for these initial differences.

Table 3

Means, Standard Deviations, and Effect Sizes for Baseline Variables by Participant Type

	Students ($n = 123$)		Community ($n = 84$)		$t(205)$	d
	M	SD	M	SD		
Nature Relatedness (6 items)	3.11	0.96	3.44	1.01	2.28*	0.32
Inclusion of Nature in Self	4.40	1.51	4.58	1.72	0.72	0.10
Fascination	2.84	0.85	3.12	0.95	2.09*	0.30
Positive Affect	3.06	0.59	3.18	0.70	1.27	0.17
Negative Affect	2.11	0.71	2.15	0.77	0.29	0.05
Vitality	4.34	1.23	4.11	1.53	1.18	0.16
Percent Happy	49.66	22.64	45.74	26.76	1.07	0.15
Percent Unhappy	20.25	15.01	23.60	19.68	1.39	0.19
Percent Neutral	30.09	17.54	30.67	19.61	0.13	0.02
Subjective Happiness	4.75	1.38	4.57	1.54	0.89	0.12
Satisfaction with Life	4.03	1.15	3.72	1.33	1.74 [†]	0.24
Depression	35.41	8.47	35.40	9.11	0.08	0.01
Autonomy	4.25	0.78	4.30	0.84	0.46	0.06
Personal Growth	4.74	0.72	4.80	0.79	0.55	0.08
Purpose in Life	4.44	0.78	4.35	0.85	0.87	0.12
Mindfulness	4.13	0.79	4.11	0.78	0.27	0.03

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Participant Retention and Rank Order Stability

I compared participants who completed all the intervention surveys with those who dropped out of the study after completing the baseline survey. Those who dropped out were generally less happy people (greater percentage of unhappiness, lower life satisfaction, more depression, less subjective happiness, less personal growth, less purpose, and less mindfulness) compared to participants who remained in the study

(means, standard deviations, and results of the comparisons based on retention are presented in Table 4).

Table 4

Means, Standard Deviations, and Baseline Differences by Participant Retention

	Baseline Only (<i>n</i> = 540)		Intervention Completed (<i>n</i> = 207)		<i>t</i> (205)	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Nature Relatedness (6 items)	3.24	0.96	3.25	0.99	0.11	0.01
Inclusion of Nature in Self	4.46	1.70	4.49	1.61	0.21	0.02
Fascination	3.07	0.94	2.96	0.91	1.41	0.12
Positive Affect	3.18	0.77	3.19	0.71	0.06	0.01
Negative Affect	2.21	0.74	2.13	0.73	1.27	0.10
Vitality	4.13	1.47	4.24	1.36	0.93	0.08
Percent Happy	45.66	24.32	47.93	24.43	1.14	0.56
Percent Unhappy	25.16	19.72	21.60	17.05	2.29*	0.19
Percent Neutral	29.01	18.72	30.47	18.44	-0.95	0.08
Subjective Happiness	4.43	1.60	4.68	1.44	1.98*	0.16
Satisfaction with Life	3.66	1.27	3.90	1.23	2.33*	0.19
Depression	37.54	9.82	35.47	8.73	2.67**	0.22
Autonomy	4.22	0.85	4.27	0.80	0.63	0.05
Personal Growth	4.64	0.81	4.77	0.75	1.89 [†]	0.16
Purpose in Life	4.27	0.93	4.41	0.81	1.81 [†]	0.14
Mindfulness	3.87	0.81	4.13	0.79	3.90**	0.32

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Temporal stability of the measures was examined by correlating baseline scores with scores on the same measure at the end of the intervention and then again six months later. Test-retest correlations for the connectedness measures indicated high temporal stability; in general, the happiness variables were also stable over time (i.e., correlations

were significant; see Appendix I, Table 22, for test-retest correlations for all nature and happiness variables).

As a final preliminary investigation of sample and group characteristics, correlations between age and baseline variables were examined. Age was positively correlated with nature relatedness ($r = .34, p < .01$), inclusion of nature in self ($r = .26, p < .01$), fascination ($r = .20, p < .01$), positive affect ($r = .16, p < .01$), autonomy ($r = .24, p < .01$), and personal growth ($r = .14, p < .05$), thus further analyses with these variables included age as a covariate.

Change in Connectedness with Nature Over Time

I expected that participants in the nature condition would become more connected with nature as a result of the four weeks of writing intervention exercises. To test how the nature and control group participants differed in connectedness, I conducted two repeated measures ANOVAs. The first ANOVA examined how nature relatedness (6-item scale) changed over time (baseline and post-intervention), by condition (nature vs. control), and according to participant type (student vs. community). Due to the positive correlation between nature relatedness and age at baseline, analyses were also conducted including age as a covariate. Including age did not alter results, except for the Time x Participant Type interaction (which became insignificant with age included), so findings are reported on analyses without age with that one exception. There was no effect of time on nature relatedness and no significant interaction between time and condition; people did not become more nature related over the intervention period, regardless of the type of intervention (means, standard deviations, and ANOVA results are displayed in Table 5). There was a significant interaction between time and participant type, however

including age as a covariate removed this effect. There was also a significant interaction between time, condition, and participant type (participant type interacted with condition, as well). The control participants had no change in nature relatedness. In the nature condition, student participants declined in nature relatedness, whereas community participants became more nature related over time. Post-hoc analyses on the nature participants indicated the student decline in nature relatedness was not significant, $t(122) = 1.14, p = .26, d = 0.06$, but the community increase was (although only marginally), $t(83) = 1.91, p = .06, d = 0.12$. This three-way interaction is illustrated in Figure 1.

Table 5

Nature Relatedness Means and Standard Deviations at Baseline and Post-Intervention by Condition and Participant Type

	Control ($n = 103$)		Nature ($n = 104$)		$F(1,203)$	η^2
	M	SD	M	SD		
Students ($n = 123$)						
Baseline	2.90	0.97	3.31	0.91		
Post-Intervention	2.93	0.88	3.17	0.93		
Community ($n = 84$)						
Baseline	3.64	0.96	3.24	1.04		
Post-Intervention	3.66	0.94	3.45	0.95		
Time					0.64	0.00
Condition					0.00	0.00
Participant Type					10.65**	0.05
Time x Participant Type					4.94*	0.02
with age as covariate					1.95	0.01
Time x Condition					0.02	0.00
Condition x Participant Type					5.96*	0.03
Time x Condition x Participant Type					5.10*	0.03

† $p < .10$, * $p < .05$, ** $p < .01$.

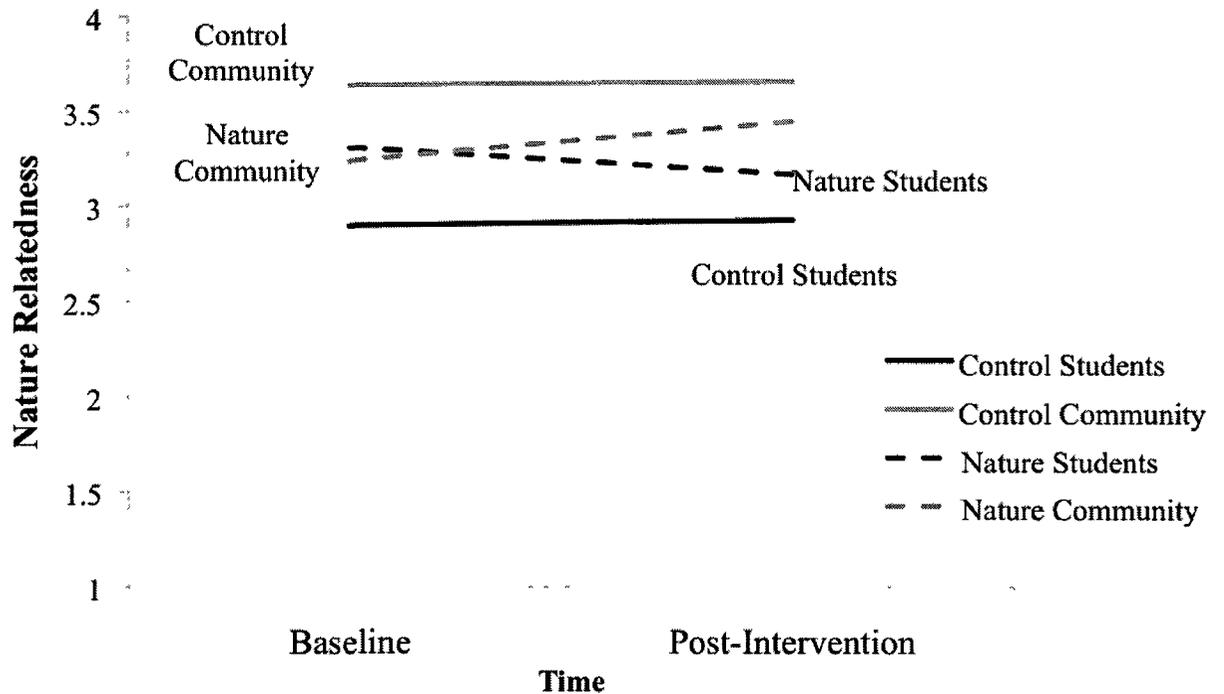


Figure 1. Interaction between Condition and Participant Type for Nature Relatedness over Time.

A second repeated measures ANOVA tested whether inclusion with nature in self changed over time (baseline to post-intervention) by condition (nature vs. control) and participant type (students vs. community). There was a significant effect of time such that all participants declined somewhat in their inclusion with nature over the intervention period (means, standard deviations, and ANOVA results are presented in Table 6), however with age as a covariate this effect was not significant. The nature and control groups did not differ in how their inclusion with nature changed over time and students and community participants also did not differ (there were no significant interactions involving time, condition, or participant type, as illustrated in Figure 2).

Table 6

Inclusion of Nature in Self Means and Standard Deviations at Baseline and Post-Intervention by Condition and Participant Type

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>F</i> (1,204)	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Baseline	4.40	1.58	4.54	1.64		
Post-Intervention	4.15	1.73	4.44	1.56		
Time					5.34*	0.03
with age as covariate					0.06	0.00
Condition					1.02	0.01
Time x Condition					0.65	0.01

† *p* < .10, * *p* < .05, ** *p* < .01.

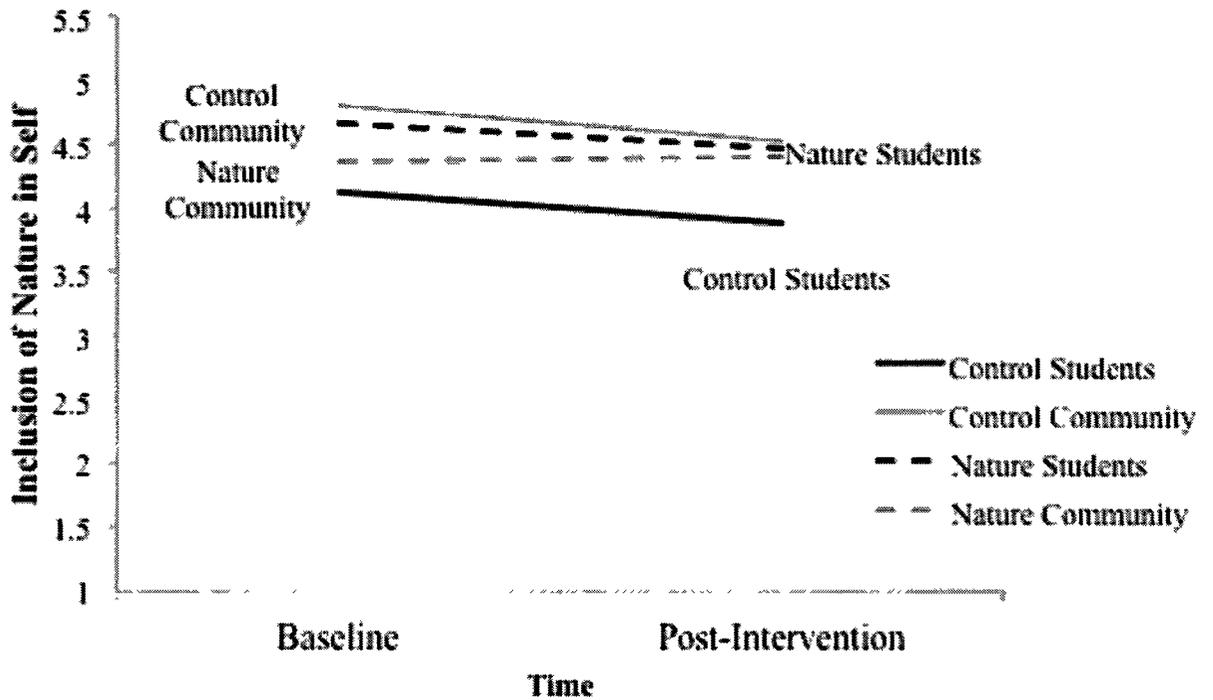


Figure 2. Change in Inclusion With Nature in Self Over Time by Condition

At the end of the intervention, participants completed the full 21-item nature relatedness scale (a more extensive measure of connectedness than at baseline). I used independent samples t-tests to examine group differences on the nature relatedness construct and dimensions. There was no difference in nature relatedness (or any of the nature relatedness dimensions) based on condition (means, standard deviations, t-test results, and effect sizes are presented in Table 7). Because age was related to baseline nature relatedness scores, I also conducted a 2 (nature and control) x 2 (student and community) ANCOVA to compare nature relatedness scores in each intervention condition, according to participant type (because of differences observed at baseline), with age as a covariate. Results were consistent with those from the independent samples t-test. Only age was related to nature relatedness; condition and participant type were unrelated and did not interact to predict nature relatedness. In sum, across the two measures of connectedness, there was no change over time or due to the intervention and the hypothesis that the nature intervention activities would increase nature relatedness was not supported.

Table 7

Nature Relatedness (21-item scale) Means and Standard Deviations After Intervention by Condition and Participant Type

	Control ($n = 103$)		Nature ($n = 104$)		$t(205)$	d
	M	SD	M	SD		
Nature Relatedness	3.49	0.70	3.56	0.66	0.70	0.09
					$F(1,203)$	η^2
Students ($n = 123$)	3.30	0.67	3.50	0.64		
Community ($n = 84$)	3.77	0.65	3.65	0.69		
Condition					0.01	0.01
Participant Type					0.00	0.00
Condition x Participant Type					2.38	0.01

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Experience Sampling Aggregated Nature Time

The bi-weekly ESM nature time data were aggregated to create an average nature contact score for each participant, across the four weeks of reporting (7 surveys). By collapsing over the entire rating period, I obtained individual average ratings for time in nature. These aggregated mean scores provide alternate measures of nature contact that minimize retrospective (memory) biases. I then conducted a 2 (nature and control) x 2 (student and community) ANCOVA to compare the aggregated nature time scores in each intervention condition, according to participant type. Because age was related to baseline nature relatedness and could potentially influence nature contact I included it as a covariate. Consistent with baseline results, age was significantly related to nature

contact, $F(1,203) = 20.78, p = .00, \eta^2 = 0.09$, but including age did not change results (results are reported without age). There were no differences in nature contact due to intervention condition or participant type. Condition interacted with participant type, however, such that the community participants in the nature condition spent more time in nature during the study, compared to the control participants. Students displayed the reverse pattern; those in the control group reported more overall nature contact than the nature group. Thus, the nature intervention activities were associated with more nature contact than the control activities, but only for the community participants (illustrated in Figure 3; ANOVA results are presented in Table 8).

Table 8

Aggregated Nature Contact Means and Standard Deviations by Condition and Participant Type

	Control ($n = 103$)		Nature ($n = 104$)		$F(1,203)$	η^2
	M	SD	M	SD		
Students ($n = 123$)	1.11	1.25	0.75	0.83		
Community ($n = 84$)	0.99	1.36	1.26	1.21		
Condition					0.02	0.02
Participant Type					0.36	0.27
Condition x Participant Type					3.83*	0.02

† $p < .10$, * $p < .05$, ** $p < .01$.

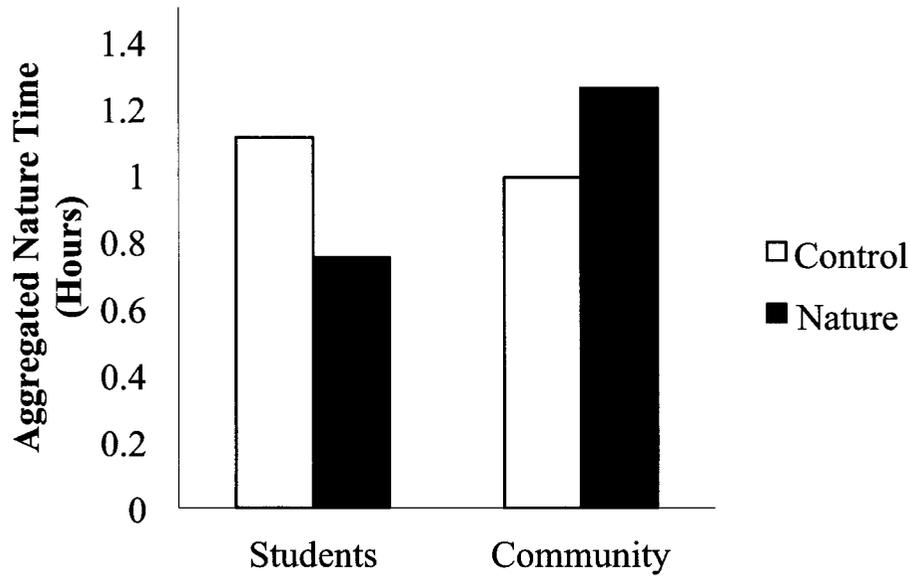


Figure 3. Interaction between Condition and Participant Type for Mean Nature Contact - Aggregated Time in Nature Across 7 Survey Reports About Prior 3-Day Period.

Overall, effects of the nature intervention on connectedness and nature contact were inconsistent. The nature intervention was only effective in promoting nature relatedness and nature contact for community participants; the nature exercises did not increase inclusion with nature in self.

Effect of Intervention Exercises on Nature Contact During the Intervention

The eight different interventions were examined individually for their relationship to both time in nature and happiness, to explore whether there were differences in how effective each activity was in promoting nature contact and state happiness, and to examine compliance rates for intervention exercises. Participants were generally compliant about the writing exercises. The number of surveys completed for each intervention is summarized in Table 9.

Table 9
Writing Intervention Exercises Completed

Survey Number	Surveys Completed (<i>N</i> = 207)	Nature Writing Topic	Control Writing Topic
2	200	Describe recent outdoor place	Describe recent indoor place
3	195	Describe food and origins	Describe music studio
4	197	Senses in outdoor place	Senses in indoor place
5	201	Personality of animal	Personality of fictional person
6	196	Perspective of outdoor element	Perspective of indoor element
7	175	List animal phrases	Describe room
8	197	Describe recent outdoor place	Describe recent indoor place

To examine how nature contact changed by group while people were completing the various activities during the intervention period, I conducted a series of repeated measures ANOVAs with each nature time use report for the seven surveys during the intervention period as a within subject factor and condition as a between subjects factor (see Appendix K, Table 24 for means, standard deviations, and repeated measures ANOVA results). There was no clear pattern in the results; time in nature did not increase for those in the nature condition compared to the control group (reports of time spent in nature in the 3 days following each exercise are illustrated in Figure 4).

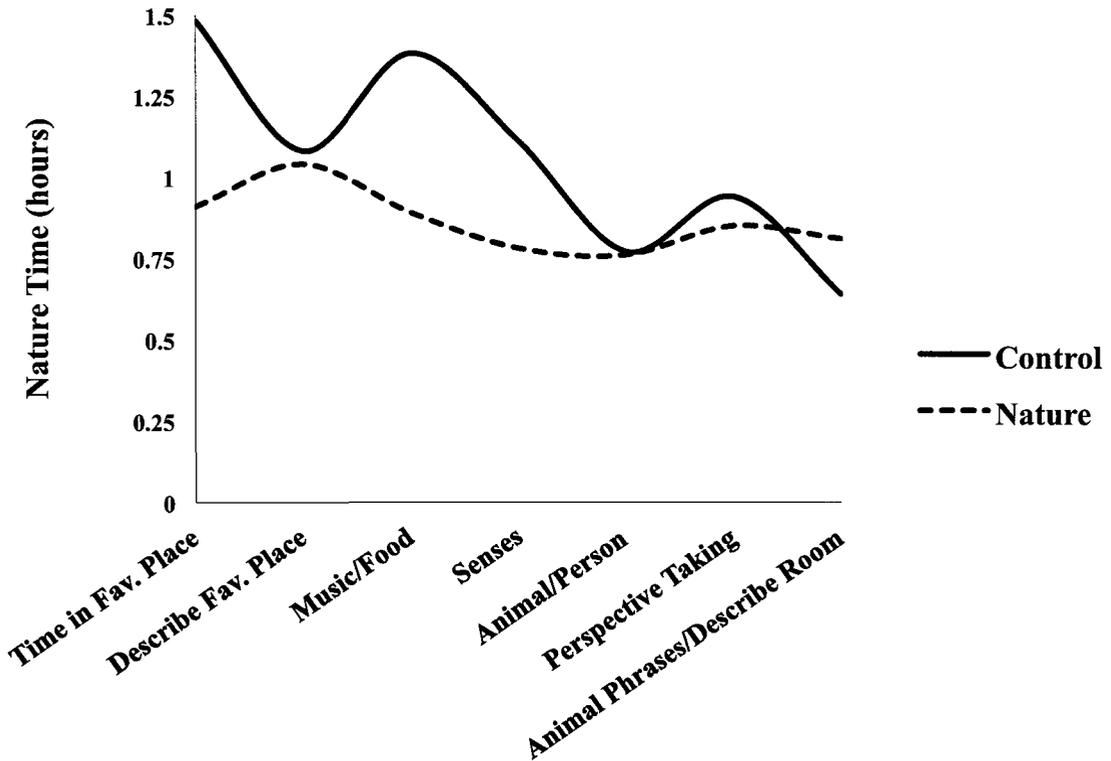


Figure 4. Time in nature following intervention activities according to condition.

Time is the number of hours reportedly spent “on a walk, hike, or activity in nature” in the 3 days preceding each survey. Intervention activity descriptions on horizontal axis are what preceded each time use measurement.

Nature Relatedness and Happiness

Prior research indicates that connectedness with nature is associated with happiness. To test this in the present sample of participants, I examined correlations between baseline nature relatedness and inclusion with nature and the baseline reports of subjective well-being. Connectedness was associated with happiness in the expected direction for all variables (see Table 10). That is, either trait nature relatedness or inclusion with nature (or both) was always positively associated with subjective well-being and negatively associated with ill-being. Connectedness was correlated with both

hedonic (e.g., positive affect, vitality, percent happy, subjective happiness, life satisfaction) and eudaimonic well-being (e.g., autonomy, personal growth, purpose), and had a negative or null relationship with percentage of time unhappy, negative affect, or depression. The connectedness measures were also associated with greater fascination and mindfulness. Thus, consistent with past findings, people who are more related to nature are happier, and, in this study, nature related people were also more mindful and aware of the present.

Table 10

Correlations Between Baseline Nature Relatedness and Happiness Measures

(<i>N</i> = 207)	Nature Relatedness (6-items)	Inclusion with Nature
Fascination	.30**	.35**
Positive Affect	.31**	.44**
Negative Affect	-.14*	-.21**
Vitality	.17*	.36**
Percent Happy	-.03	.25**
Percent Unhappy	-.15*	-.24**
Percent Neutral	.06	-.11
Subjective Happiness	.12	.26**
Life Satisfaction	.09	.26**
Depression	-.09	-.14*
Autonomy	.35**	.31**
Personal Growth	.42**	.37**
Purpose in Life	.22**	.25**
Mindfulness	.24**	.27**

† $p < .10$, * $p < .05$, ** $p < .01$.

Change in Happiness Pre- to Post-Intervention

I expected those in the nature condition would feel happier at the end of the four-week intervention, compared to the control group. To test this, I conducted a series of repeated measures ANOVAs with time (baseline and post-intervention) as a within subject factor and condition (nature and control) as a between subjects factor, for all happiness variables.⁷ I expected fascination, positive affect, vitality, percent happy, subjective happiness, life satisfaction, autonomy, personal growth, and purpose in life to be higher, and negative affect, percent unhappy, and depression to be lower in the nature condition, compared to the control group.

Both the nature and control group participants were less fascinated and had fewer positive emotions after the intervention, regardless of the type of activities they completed (means, standard deviations, and results of the repeated measures ANOVAs for these and all other happiness variables are presented in Table 11). Including age as a covariate reduced the effect of time on fascination and positive affect, however. All participants had lower vitality levels at the end of the intervention, regardless of whether they were in the control or nature intervention.

People showed no change over the intervention period in the percentage of time they felt happy or in their subjective sense of happiness, and these findings did not differ by condition. Similarly, autonomy, personal growth, and purpose in life did not change over time or change differently depending on the type of intervention. All participants reported being more satisfied with life at the end of the intervention, compared to the start, regardless of the activities they completed.

⁷ Analyses (repeated measures ANCOVAs) were also conducted including participant type as a between subjects factor and age as covariate. Unless including these variables influenced the outcome, results are reported on analyses that do not include participant type or age.

People reported less negative affect and less depression at the end of the intervention than at the start, but including age as a covariate removed the effect of time. The type of intervention activities people completed had no effect on either negative affect or depression. There was no change in the amount of time participants reported being unhappy over the intervention period, and this did not differ based on intervention type.

To determine whether the writing exercises had any effect on participants' mindfulness, I conducted a repeated measures ANOVA with baseline and post-intervention mindfulness as a within subject factor and condition as a between subjects factor. Participants had no change in mindfulness over the intervention period, and the type of writing activities also had no effect on mindfulness.

Table 11

Repeated Measure ANOVA Results, Means and Standard Deviations, Comparing Baseline and Post-Intervention Happiness by Condition

	Control ($n = 103$)		Nature ($n = 104$)		$F(1,205)$	η^2
	M	SD	M	SD		
Fascination						
Baseline	3.01	0.99	2.90	0.80		
Post Intervention	2.57	1.13	2.48	1.16		
Time					30.96**	0.13
with age and pp type					0.39	0.00
Condition					0.70	0.00
Time x Condition					0.06	0.00
Positive Affect						0.17
Baseline	3.17	0.77	3.21	0.64		
Post Intervention	2.88	0.93	2.81	0.77		
Time					42.64**	0.17
Condition					0.01	0.00
Time x Condition					1.28	0.01

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>F</i> (1,205)	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Negative Affect						
Baseline	2.17	0.07	2.10	0.07		
Post Intervention	1.96	0.08	1.93	0.08		
Time					10.66**	0.05
with age as covariate					0.02	0.00
Condition					0.18	0.00
Time x Condition					0.09	0.00
Vitality						
Baseline	4.21	1.36	4.28	1.36		
Post Intervention	4.00	1.63	3.83	1.43		
Time					15.73**	0.07
Condition					0.08	0.00
Time x Condition					2.14	0.01
Percent Happy						
Baseline	48.66	24.88	47.48	24.03		
Post Intervention	50.46	26.71	46.12	24.44		
Time					0.03	0.00
Condition					0.72	0.00
Time x Condition					1.60	0.01
Percent Unhappy						
Baseline	21.33	17.35	21.88	16.92		
Post Intervention	21.38	19.33	21.59	17.13		
Time					0.02	0.00
Condition					0.03	0.00
Time x Condition					0.03	0.00
Subjective Happiness						
Baseline	4.63	1.52	4.73	1.37		
Post Intervention	4.69	1.46	4.72	1.35		
Time					0.24	0.00
Condition					0.13	0.00
Time x Condition					0.43	0.00

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>F</i> (1,205)	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Life Satisfaction						
Baseline	3.73	1.30	4.06	1.15		
Post Intervention	4.06	1.27	4.20	1.32		
Time					14.09**	0.07
Condition					2.02	0.01
Time x Condition					2.18	0.01
Depression						
Baseline	35.79	8.69	35.04	8.77		
Post Intervention	35.02	9.59	33.68	8.80		
Time					2.86 [†]	0.01
with age as covariate					0.81	0.00
Condition					0.94	0.01
Time x Condition					0.22	0.00
Autonomy						
Baseline	4.28	0.77	4.26	0.84		
Post Intervention	4.33	0.88	4.24	0.83		
Time					0.14	0.00
Condition					0.19	0.00
Time x Condition					1.09	0.01
Personal Growth						
Baseline	4.73	0.80	4.81	0.67		
Post Intervention	4.73	0.87	4.87	0.72		
Time					0.46	0.00
Condition					1.18	0.01
Time x Condition					0.62	0.00
Purpose						
Baseline	4.38	0.88	4.45	0.73		
Post Intervention	4.35	0.87	4.52	0.81		
Time					0.37	0.00
Condition					1.21	0.01
Time x Condition					1.58	0.01

	Control ($n = 103$)		Nature ($n = 104$)		$F(1,205)$	η^2
	M	SD	M	SD		
Mindfulness						
Baseline	4.13	0.84	4.12	0.72		
Post Intervention	4.10	0.89	4.09	0.71		
Time					0.53	0.00
Condition					0.00	0.00
Time x Condition					0.00	0.00

Note. Condition results are from tests of between subjects effects.

[†] $p < .10$, * $p < .05$, ** $p < .01$.

The intervention activities did not increase happiness. People had fewer negative emotions, less depression, and more satisfaction with life at the end of the study, but also fewer positive emotions and vitality. Contrary to hypotheses, the nature intervention also did not increase participants' psychological well-being (feeling autonomous, having a sense of purpose, and personal growth).

Experience Sampling Aggregated Happiness

The ESM reports (from 7 surveys) collected over the intervention period were aggregated to create average scores on the four happiness variables (fascination, positive and negative affect, and vitality), which were measured twice weekly. Independent samples t-tests were conducted, comparing these four happiness variables by condition (nature vs. control) to test whether the nature intervention promoted greater average happiness during the study (means, standard deviations, t-test results, and effect sizes are presented in Table 12).

Overall, intervention condition was unrelated to average happiness during the month-long intervention period. There were marginally significant differences in fascination between the control and nature groups, but in the opposite direction expected.

People in the nature group had less average fascination during the study, compared to people in the control group.⁸ People in the nature and control conditions had similar average levels of positive and negative affect, and vitality, during the intervention period.

Table 12

Aggregated Happiness Means and Standard Deviations by Condition

	Control ($n = 103$)		Nature ($n = 104$)		$t(205)$	d
	M	SD	M	SD		
Fascination	2.61	0.92	2.42	0.73	1.63 [†]	0.23
Positive Affect	2.92	0.75	2.82	0.70	0.97	0.14
Negative Affect	1.99	0.69	1.90	0.56	1.09	0.14
Vitality	3.96	1.37	3.73	1.26	1.23	0.17

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Effect of Intervention Exercises on State Happiness

To examine if there were any differences in state happiness for the different group intervention exercises, I conducted a series of repeated measures ANOVAs with each state happiness (fascination, positive and negative affect, vitality) report for the seven surveys during the intervention period as a within subject factor and condition as a between subjects factor. The pattern of happiness during the intervention was inconsistent; in some cases the type of intervention activity made a difference, and in other cases it did not. For example, fascination changed over time, was different for each intervention group, and changed differently over time, depending on intervention condition. Positive affect changed over time, and differently depending on condition (see

⁸ When age and participant type were included in the comparison, there were no longer significant group differences in fascination, $F(1,202) = 3.38$, $p = .32$, $\eta^2 = 0.77$, and age was marginally related to fascination, $F(1,202) = 2.67$, $p = .10$, $\eta^2 = 0.01$.

Appendix L, Table 25, for means, standard deviations and the repeated measures ANOVA results for fascination and positive affect). Negative affect and vitality did not change over time or according to the type of intervention activity. Figures 5, 6, and 7 illustrate the findings for state fascination, positive and negative affect (the other happiness variables show a similar pattern). A change in mood can be observed following the music/food exercise (see follow up analyses of this in Appendix M), but overall the results indicate no clear happiness benefits based on the type of intervention activity.

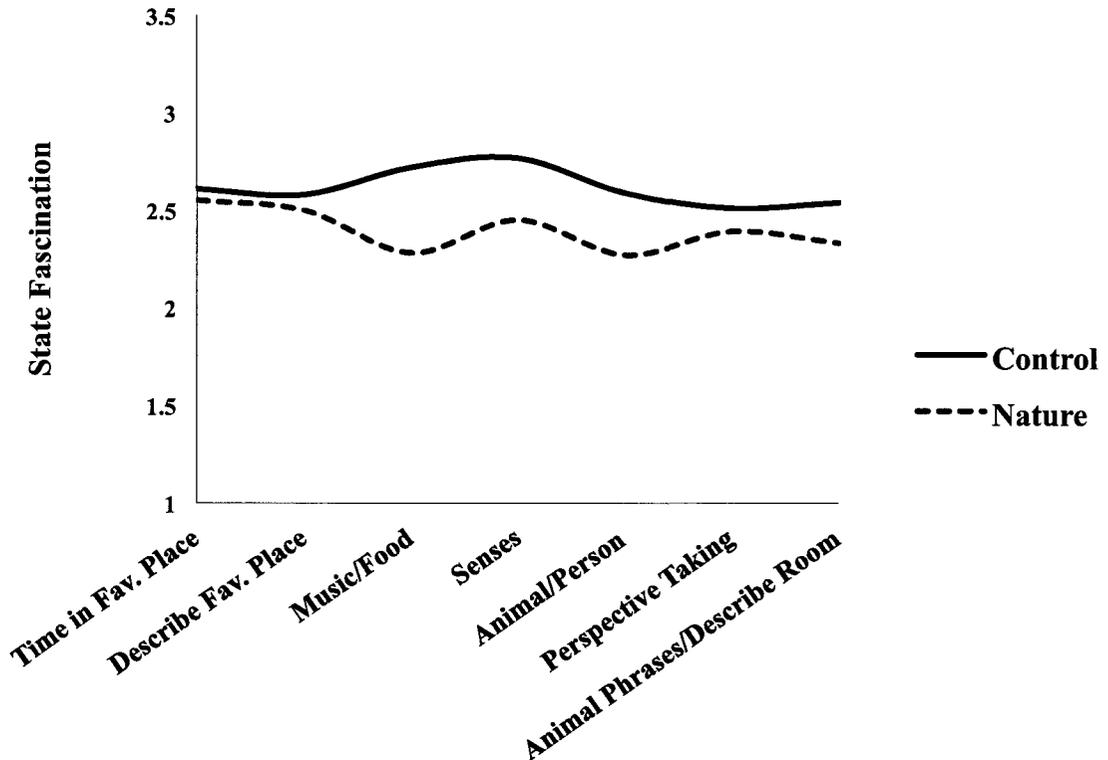


Figure 5. Change in state fascination during intervention by condition. Each measure of state fascination occurred 3-4 days following the intervention activity described on the horizontal axis.

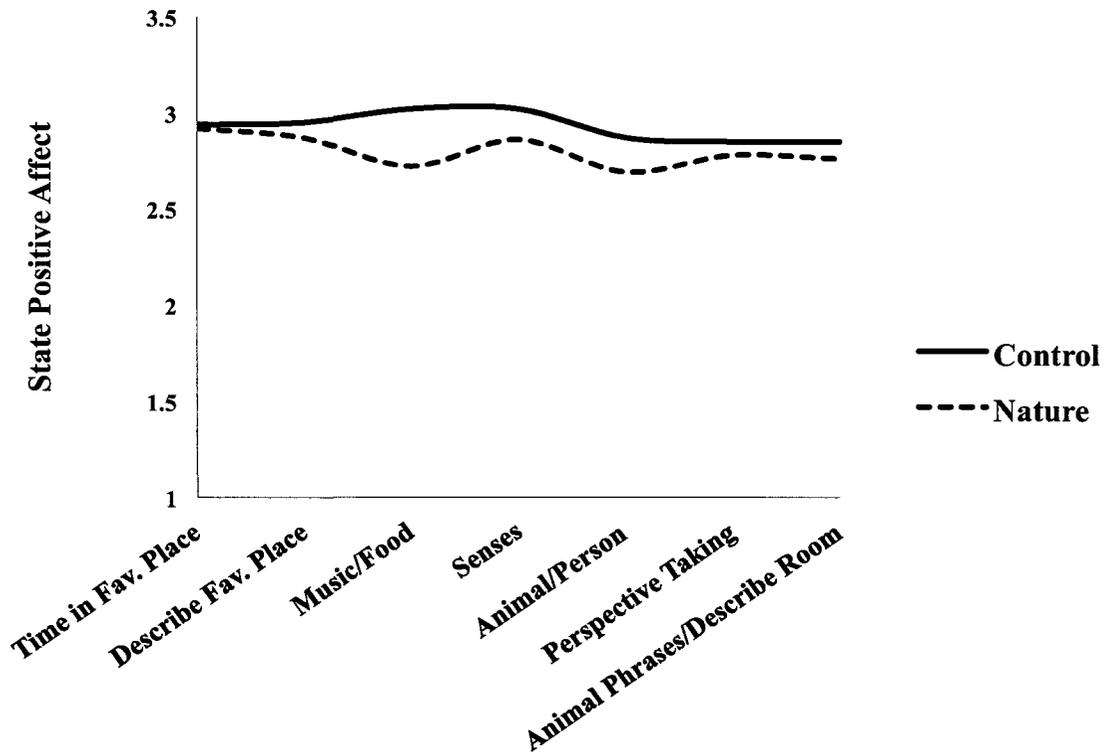


Figure 6. Change in state positive affect during intervention by condition. Each measure of state positive affect occurred 3-4 days following the intervention activity described on the horizontal axis.

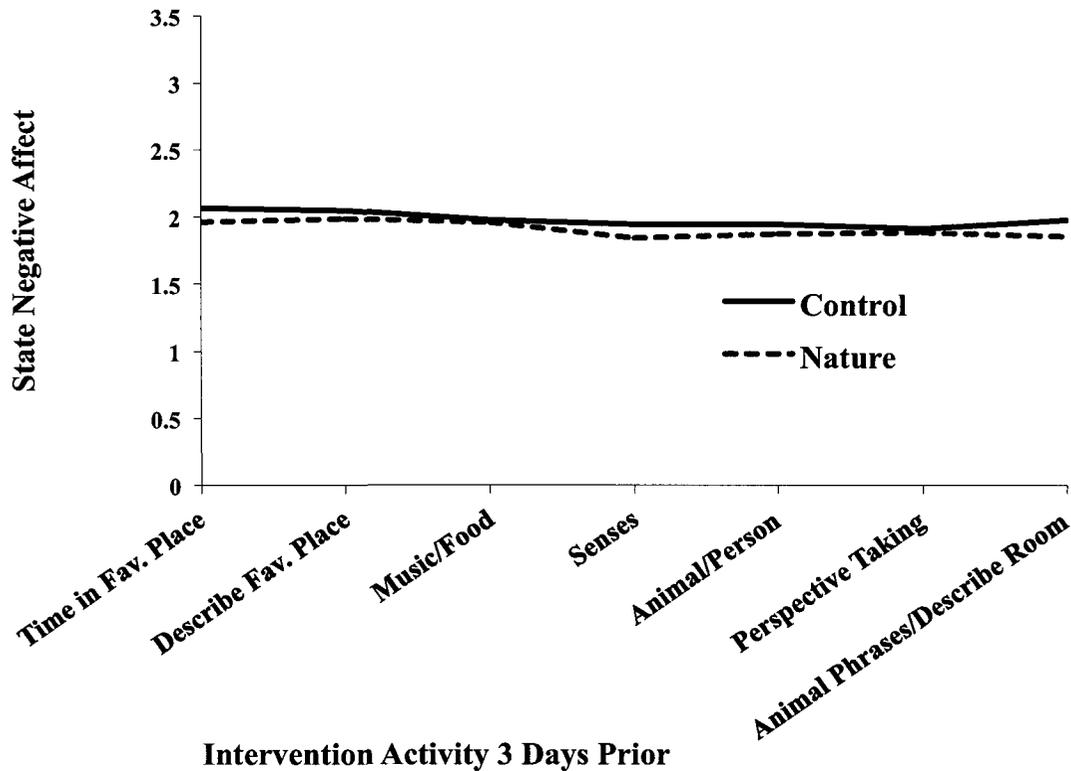


Figure 7. Change in state negative affect during intervention by condition. Each measure of state positive affect occurred 3-4 days following the intervention activity described on the horizontal axis.

In sum, the nature intervention did not produce the happiness increases expected, either over time, when comparing baseline to post-intervention scores, or using aggregated ESM reports of average happiness over a month. People in the nature group were no happier than those in the control group. There were also no particular trends evident in the responses to the individual intervention activities. Overall, contrary to expectations, everyone had less positive affect and vitality, despite the type of activities they completed. Life satisfaction, however, increased for all participants and negative affect declined. Thus, the hypothesis that nature condition participants would report

increased happiness was not supported and, in general, participants were not any more or less happy as a result of either type of intervention.

Post-Intervention Correlations between Nature Variables and Happiness

To explore how nature relatedness, nature contact, and inclusion with nature were related to happiness, in general (i.e., at the individual difference level, regardless of condition), I analyzed correlations between the 6-item and 21-item nature relatedness scales, the inclusion with nature single-item measure, the aggregated nature time scores, and the post-intervention happiness variables. The pattern of correlations was consistent across the four nature variables (correlations are reported in Table 13, below). Nature relatedness and nature contact were associated with both hedonic happiness (e.g., more positive emotions, fewer negative emotions) and eudaimonic happiness (e.g., autonomy, personal growth, purpose). Nature related people reported more positive emotions, fascination, vitality, and eudaimonic well-being (autonomy, personal growth, purpose), and were more mindful. Thus, independent of the intervention condition, participants who were connected with nature and spent time outdoors were happier than disconnected people who avoided nature.

Table 13

Post-Intervention Correlations Between Nature Variables and Happiness Measures

(<i>N</i> = 207)	Nature Relatedness (6 items)	Nature Relatedness (21 items)	Inclusion with Nature	Aggregated Nature Time
Fascination	.15*	.14*	.17*	.34**
Positive Affect	.25**	.30**	.28**	.34**
Negative Affect	-.13	-.22**	-.13	-.07
Vitality	.18**	.27**	.24**	.27**
Percent Happy	.05	.13	.15*	.15*
Percent Unhappy	-.06	-.15*	-.14*	-.15*
Percent Neutral	-.02	-.03	-.07	-.06
Subjective Happiness	.09	.20**	.18**	.22**
Life Satisfaction	.00	.08	.11	.14*
Depression	-.02	-.09	-.11	-.02
Autonomy	.30**	.40**	.27**	.19**
Personal Growth	.35**	.49**	.35**	.22**
Purpose in Life	.17*	.24**	.24**	.07
Mindfulness	.14	.22**	.23**	.20**

† $p < .10$, * $p < .05$, ** $p < .01$.

Nature Relatedness as Mediator Between Intervention Condition and Happiness

I expected the nature intervention would increase nature relatedness, and this increase would mediate the link between intervention condition and happiness, as well as environmental concern. Baron and Kenny's (1986) analyses were conducted to test this. The first step required that the intervention condition predict nature relatedness-change scores. Because condition did not predict change in nature relatedness, the first criteria for mediation was not met and the remaining analyses were not conducted. Community participants in the nature group did increase in nature relatedness, so I tested the

mediation, using only community participants, however, again, the first criteria, that condition predicts nature relatedness change, was not met. Thus, increases in nature relatedness did not mediate the relationship between the intervention and happiness.

Nature Relatedness as Mediator for the Nature Contact-Happiness Relationship

Nature contact is associated with connectedness and happiness. Independent of the interventions, one research goal was to investigate how time in nature is related to connectedness, and how this may enhance happiness. Thus, I expected that people who spent more time in nature (aggregated ESM nature time use scores, reflecting average time spent in nature during the study) would be more connected and have greater levels of happiness than those investing less time in nature contact. Correlations between nature contact, nature relatedness change, and happiness change are presented in Table 14.

Nature contact was correlated with change in fascination, positive affect, vitality, percent happy, subjective happiness, and personal growth. Nature relatedness change was significantly correlated with change in fascination, positive affect, vitality, and percent happy. Thus, spending time in nature (regardless of intervention condition) was associated with greater happiness and connectedness.

To test whether changes in nature relatedness mediated the relationship between nature contact and changes in happiness, the following analyses (Baron & Kenny, 1986) were conducted. First, aggregated nature contact was used to predict nature relatedness change scores. Second, nature contact was used to predict the happiness change variables (listed in Table 14). The regressions were significant for the change in fascination, positive affect, vitality, percent happy, subjective happiness, and personal growth. The non-significant variables (negative affect, life satisfaction, percent unhappy, depression,

autonomy, purpose, mindfulness) were not examined in the next steps of the analyses. Nature relatedness change and nature contact were then entered together to predict each happiness change variable. Mediation was not significant for fascination, positive affect, subjective happiness, or personal growth. Nature relatedness change was a partial (and only marginally significant) mediator for the nature contact-vitality change relationship. The mediation path for the nature contact-percent happy change relationship did not meet the Sobel test for significance (Preacher & Leonardelli, 2001).⁹ Unstandardized and standardized regression coefficients, as well as standard error and coefficients of partial determination are presented in Tables 15 and 16 and the mediation paths are illustrated in Figures 8 and 9.

⁹ Including age and participant type as predictors did not alter the results.

Table 14

Correlations Between Nature Contact, Nature Relatedness Change, and Happiness Change

(N = 207)	Aggregated Nature Contact	Nature Relatedness Change
Fascination Change	.25**	.14*
Positive Affect Change	.26**	.14*
Negative Affect Change	-.01	.01
Vitality Change	.18*	.18*
Percent Happiness Change	.14*	.15*
Percent Unhappiness Change	-.06	-.13
Subjective Happiness Change	.15*	.11
Life Satisfaction Change	.10	.10
Depression Change	-.01	-.03
Autonomy Change	.05	.07
Personal Growth Change	.19**	.12
Purpose in Life Change	.08	.11
Mindfulness Change	.10	.04

† $p < .10$, * $p < .05$, ** $p < .01$.

Table 15

Regression Analysis for Variables Predicting Vitality Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Nature Contact	.15	.06	.18**	2.59	.03
Step 2					
Nature Contact	.13	.06	.15*	2.20	
Nature Relatedness Change	.15	.07	.15*	2.16	.02

Sobel test: $z = 1.63$, $p = .10$.

† $p < .10$, * $p < .05$, ** $p < .01$.

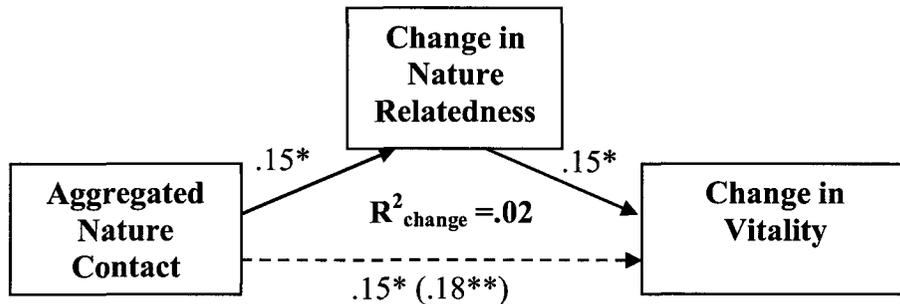
Table 16

Regression Analysis for Variables Predicting Percent Happiness Change

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Step 1					
Nature Contact	.12	.06	.14*	2.01	.02
Step 2					
Nature Contact	.10	.06	.12*	1.69 [†]	
Nature Relatedness Change	.13	.07	.13 [†]	1.79 [†]	.02

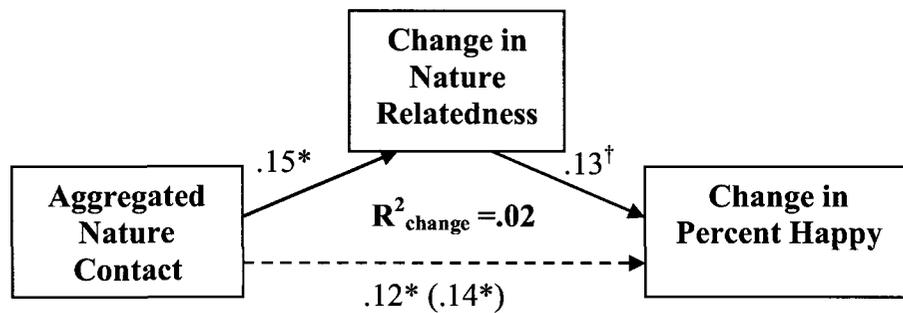
Sobel test: $z = 1.45, p = .15$.

[†] $p < .10$, * $p < .05$, ** $p < .01$.



[†] $p < .10$, * $p < .05$, ** $p < .01$.

Figure 8. Mediation model for nature contact, nature relatedness change, and change in vitality.



† $p < .10$, * $p < .05$, ** $p < .01$.

Figure 9. Mediation model for nature contact, nature relatedness change, and change in percent happy.

Nature Contact as Mediator for the Connectedness-Happiness Relationship

In addition to hypothesizing that time in nature fosters connectedness, I considered the alternate path - that becoming more nature related would inspire nature contact, and this would promote happiness. Therefore, I also investigated whether time in nature mediated the relationship between nature relatedness change and happiness change. I conducted regression analyses to test whether changes in nature relatedness predict time in nature and happiness changes, using Baron and Kenny's (1986) three-step analyses.

First, nature relatedness change scores were used to predict aggregated nature contact. Second, nature relatedness change was used to predict change in the happiness variables. The regressions were significant for the change in fascination, positive affect, vitality, percent happy, and marginally significant for personal growth, and purpose in life. The non-significant variables (negative affect, subjective happiness, life satisfaction, depression, autonomy, mindfulness) were not examined in the next steps of the analyses.

Nature relatedness change and nature contact were then entered together to predict each happiness change variable.¹⁰

Mediation paths for fascination and positive affect were significant, vitality and personal growth were marginally significant, percent happy and purpose in life were not. Thus, changes in nature relatedness were linked to improvements in positive emotions and greater personal growth (but not other aspects of subjective well-being), and this was due to contact with nature. The vitality benefits of nature relatedness increases were partially mediated by nature contact (unstandardized and standardized regression coefficients, as well as standard error and coefficients of partial determination are presented in Table 17; the significant path models are illustrated in Figure 10, 11, and 12). Thus, greater connectedness with nature was associated with more time in contact with nature, and this facilitated improvements in certain aspects of happiness.

Table 17

Regression Analysis for Variables Predicting Changes in Happiness

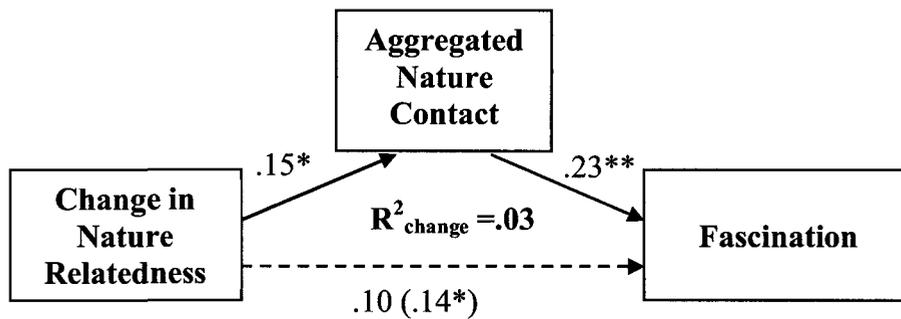
Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>R</i> ²
Fascination Change					
Step 1					
Nature Contact	.14	.07	.14*	1.98	.02
Step 2					
Nature Contact	.10	.07	.10	1.39	
Nature Relatedness Change	.20	.06	.23**	3.32	.05
Sobel test, $z = 2.00, p = .05$					

¹⁰ Given that baseline and post intervention nature relatedness were associated with several well-being variables, I also examined the nature relatedness-nature contact-well-being path from an individual difference perspective, and conducted the same analyses, but with trait (baseline) nature relatedness instead of nature relatedness change. Baseline nature relatedness predicted nature contact during the study, but none of the mediation paths to well-being change were significant.

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Positive Affect Change					
Step 1					
Nature Contact	.15	.07	.14*	2.08	.02
Step 2					
Nature Contact	.10	.07	.10	1.48	
Nature Relatedness Change	.20	.06	.24**	3.44	.05
Sobel test, $z = 2.02, p = .04$					
Vitality Change					
Step 1					
Nature Contact	.18	.07	.18*	2.55	.03
Step 2					
Nature Contact	.15	.07	.15*	2.16	
Nature Relatedness Change	.13	.06	.15*	2.20	.02
Sobel test, $z = 1.66, p = .10$					
Percent Happy Change					
Step 1					
Nature Contact	.15	.07	.15*	2.10	.02
Step 2					
Nature Contact	.12	.07	.13 [†]	1.79	
Nature Relatedness Change	.10	.06	.12 [†]	1.69	.01
Sobel test, $z = 1.40, p = .16$					

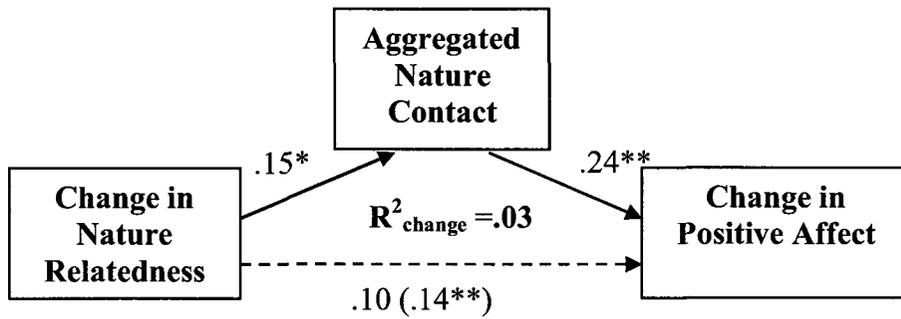
Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Personal Growth Change					
Step 1					
Nature Contact	.12	.07	.12 [†]	1.69	.01
Step 2					
Nature Contact	.09	.07	.09	1.30	
Nature Relatedness Change	.15	.06	.17*	2.44	.03
Sobel test, $z = 1.74, p = .08$					

Note. Results did not change when adding age and participant type as predictors.
[†] $p < .10$, * $p < .05$, ** $p < .01$.



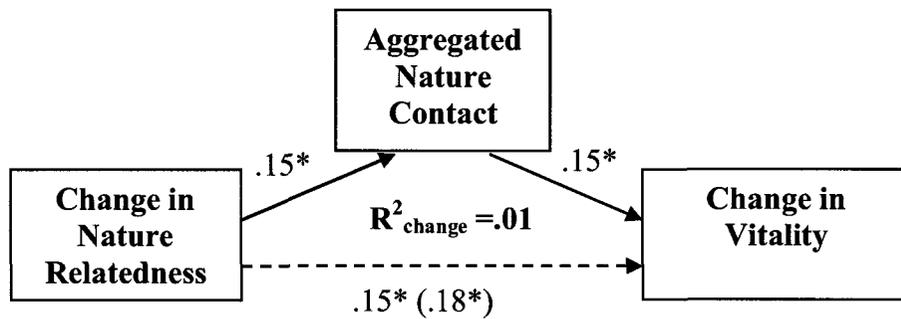
[†] $p < .10$, * $p < .05$, ** $p < .01$.

Figure 10. Mediation model for nature contact, nature relatedness change, and fascination change.



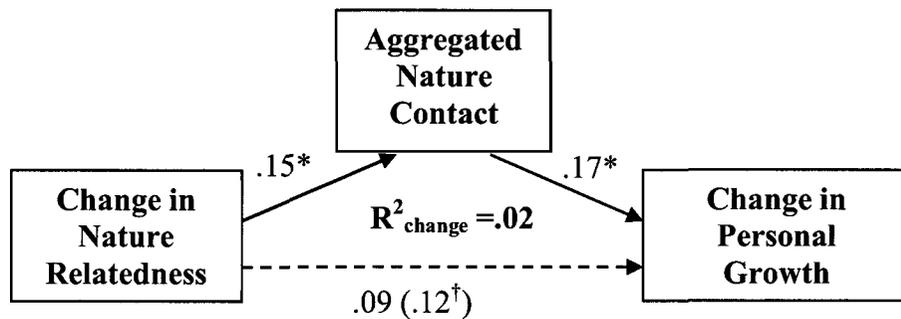
[†] $p < .10$, * $p < .05$, ** $p < .01$.

Figure 11. Mediation model for nature contact, nature relatedness change, and change in positive affect.



[†] $p < .10$, * $p < .05$, ** $p < .01$.

Figure 11. Mediation model for nature contact, nature relatedness change, and vitality change.



[†] $p < .10$, * $p < .05$, ** $p < .01$.

Figure 12. Mediation model for nature contact, nature relatedness change, and change in personal growth.

Post-Intervention Environmental Concern and Behaviour

To test whether the nature intervention was effective in promoting environmental concern and behaviour, t-tests were used to compare the two intervention groups on verbal and actual ecological commitment, environmental concern, and sustainable behaviour.¹¹ There were no significant differences between groups on any of the environmental measures (means, standard deviations, t-tests results, and effect sizes are reported in Table 12). Altruistic environmental concern showed a trend (verging on significance) with the nature group indicating greater environmental concern for all people and future generations, compared to the control condition. Contrary to expectations, however, those who completed the nature intervention activities did not demonstrate greater ecological concern and behaviour, compared to the control group.

Table 12

Means, Standard Deviations, and Comparison of Environmental Measures by Group

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>t</i> (205)	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Verbal Ecological Commitment	6.73	1.95	6.65	2.17	0.25	0.04
Actual Ecological Commitment	3.78	2.37	4.18	2.55	1.16	0.16
Egoistic Concern	5.55	1.54	5.68	1.28	0.63	0.09
Altruistic Concern	5.72	1.59	6.04	1.16	1.64 [†]	0.23
Biospheric Concern	5.49	1.39	5.41	1.33	0.45	0.06
Sustainable Behaviour	20.65	2.86	21.24	3.22	1.39	0.19

[†] $p < .10$, * $p < .05$, ** $p < .01$.

¹¹ 2 (nature vs. control) x 2 (student vs. community) ANCOVAs were also conducted, including age as a covariate. Only in cases where including these additional variables influenced results are they reported.

To explore how nature relatedness, nature contact, and inclusion with nature were related to environmental concern and behaviour (i.e., at the individual difference level, regardless of condition), I analyzed correlations between the 6-item and 21-item nature relatedness scales, the inclusion with nature single-item measure, the aggregated nature time scores, and the post-intervention environmental concern and behaviour variables. The pattern of correlations was consistent across the four nature variables (correlations are reported in Table 13, below). Connectedness and nature contact were associated with greater verbal and actual commitment to the environment, more concern for altruistic and biospheric reasons, and more sustainable behaviour. Thus, independent of the intervention condition, participants who were connected with nature and spent time outdoors were more concerned about the environment and acted more sustainably than people who were less connected.

Table 13

Post-Intervention Correlations Between Nature Variables and Environmental Measures

(<i>N</i> = 207)	Nature Relatedness (6 items)	Nature Relatedness (21 items)	Inclusion with Nature	Aggregated Nature Time
Verbal Ecological Commitment	.55**	.62**	.47**	.27**
Actual Ecological Commitment	.58**	.60**	.49**	.31**
Egoistic Concern	.08	.14	.08	.07
Altruistic Concern	.21**	.28**	.23**	.17*
Biospheric Concern	.48**	.55**	.41**	.13
Sustainable Behaviour	.50**	.52**	.43**	.24**

† $p < .10$, * $p < .05$, ** $p < .01$.

Nature Relatedness as Mediator Between Condition and Environmental Concern

I hypothesized that the nature intervention would lead to increased nature relatedness and, as a result, greater environmental concern and behaviour. Again, because the first step in the mediation was not successful (the nature intervention did not increase connectedness), the remaining analyses were not conducted. There were no increases (or changes) in nature relatedness to mediate between the intervention and environmental concern.

Nature Relatedness as Mediator for the Nature Contact-Environmental Concern Relationship

I expected that people who spent more time in nature would become more connected, and that connectedness would result in greater environmental concern and behaviour (e.g., independent of intervention condition, nature contact was expected to be related to environmental concern). Verbal and actual ecological commitment, as well as sustainable behaviour were significantly correlated with nature relatedness change and nature contact. People who spent more time in nature and changed in their nature relatedness had greater ecological commitment (verbal and actual), more environmental concern for the planet (biospheric), and engaged in more sustainable behaviour. Nature contact was also associated with altruistic environmental concern for other people and future generations (see Table 18). To test the hypothesis that nature contact would lead to increased connectedness, and this connectedness would facilitate (mediate) environmental concern or behaviour, the following analyses (Baron & Kenny, 1986) were conducted. First, aggregated nature contact was used to predict nature relatedness change scores. Second, nature contact was used to predict verbal commitment, actual

commitment, biospheric, altruistic, and egoistic concern, and sustainable behaviour. The regressions were significant for verbal and actual commitment, altruistic environmental concern, and sustainable behaviour; biospheric environmental concern was marginally significant. The only non-significant variable (egoistic concern) was not examined in the next steps of the analyses. Nature relatedness change and nature contact were then entered together to predict each environmental variable.

The relationship between nature contact and sustainable behaviour was partially mediated by nature relatedness change. The effect of nature contact on sustainable behaviour became less powerful when nature relatedness change was included in the model. Similar partial mediation was significant for both verbal and actual ecological commitment. The full mediation path did not reach significance for biospheric concern (Sobel $z = 1.43, p = .15$). Thus, nature contact is related to greater commitment to engage in environmental behaviour, and this is facilitated, in part, by feelings of connectedness. Unstandardized and standardized regression coefficients, as well as standard error and coefficients of partial determination are presented in Table 19. The significant mediation paths are illustrated in Figures 13, 14, and 15.

Table 18

Correlations Between Nature Contact, Nature Relatedness Change, and Environmental Measures

(<i>N</i> = 207)	Aggregated Nature Contact	Nature Relatedness Change
Verbal Ecological Commitment	.27**	.35**
Actual Ecological Commitment	.31**	.32**
Biospheric Concern	.13 [†]	.14*
Altruistic Concern	.17*	.03
Egoistic Concern	.07	.02
Sustainable Behaviour	.24**	.34**

[†] $p < .10$, * $p < .05$, ** $p < .01$.

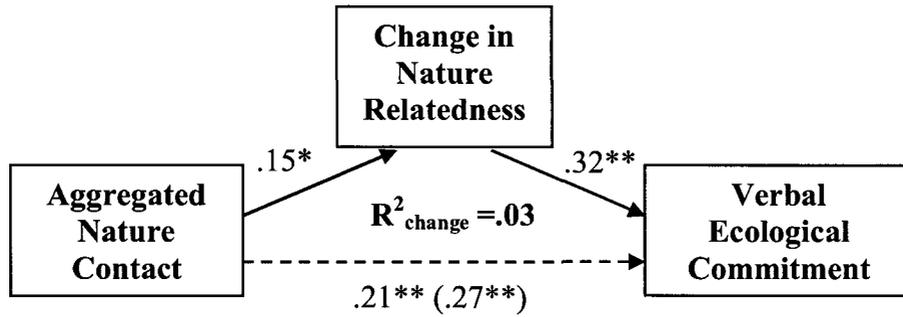
Table 19

Regression Analysis for Variables Predicting Ecological Commitment, Concern, and Sustainable Behaviour

Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Verbal Ecological Commitment					
Step 1					
Nature Contact	.47	.12	.27**	3.95	.07
Step 2					
Nature Contact	.38	.12	.21**	3.29	
Nature Relatedness Change	0.65	.13	.32**	4.86	.10
Sobel test: $z = 2.22, p = .03$					

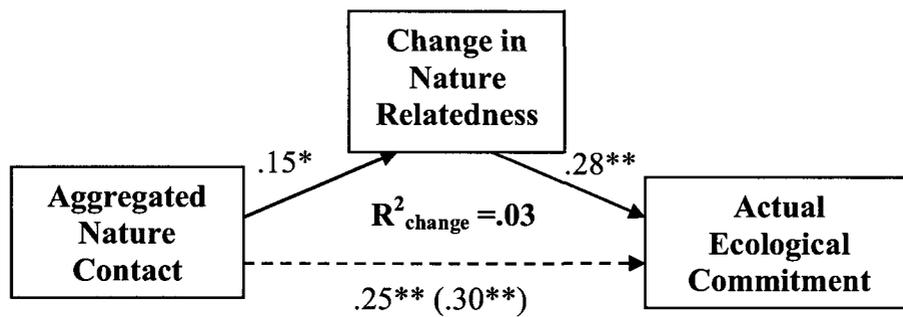
Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	R^2
Actual Ecological Commitment					
Step 1					
Nature Contact	.63	.14	.30**	4.51	.10
Step 2					
Nature Contact	.53	.14	.25**	3.88	
Nature Relatedness Change	.68	.16	.28**	4.23	.07
Sobel test: $z = 2.15, p = .03$					
Altruistic Concern					
Step 1					
Nature Contact	.20	.08	.17*	2.45	.03
Step 2					
Nature Contact	.20	.08	.17*	2.41	
Nature Relatedness Change	-.00	.10	-.00	-.01	.00
Sobel test: $z = 0.01, p = .99$					
Biospheric Concern					
Step 1					
Nature Contact	.15	.08	.13 [†]	1.87	.02
Step 2					
Nature Contact	.13	.08	.11	1.56	
Nature Relatedness Change	.17	.10	.12 [†]	1.75	.02
Sobel test: $z = 1.43, p = .15$					
Sustainable Behaviour					
Step 1					
Nature Contact	.63	.18	.24**	3.57	.06
Step 2					
Nature Contact	.50	.17	.19**	2.89	
Nature Relatedness Change	.93	.20	.30**	4.63	.09
Sobel test: $z = 2.20, p = .03$					

[†] $p < .10$, * $p < .05$, ** $p < .01$.



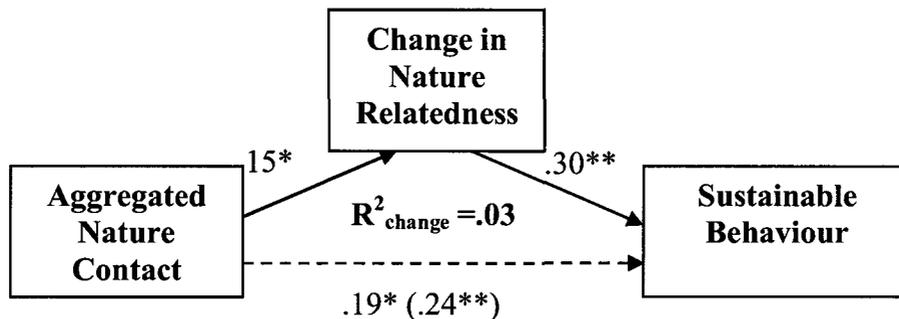
† $p < .10$, * $p < .05$, ** $p < .01$.

Figure 13. Mediation model for nature contact, nature relatedness change, and verbal ecological commitment.



† $p < .10$, * $p < .05$, ** $p < .01$.

Figure 14. Mediation model for nature contact, nature relatedness change, and actual ecological commitment.



† $p < .10$, * $p < .05$, ** $p < .01$.

Figure 15. Mediation model for nature contact, nature relatedness change, and sustainable behaviour.

It is plausible that change in nature relatedness occurred either before people's nature contact, or simultaneously. Although there were no specific hypotheses to this effect, alternate paths seemed plausible, so these were explored. In brief, changes in nature relatedness were associated with verbal commitment, actual commitment, and sustainable behaviour, and this was mediated by nature contact. That is, time in nature partly mediates the relationship between changes in connectedness and environmental concern or behaviour.

Six Month Follow Up

Participants who completed the intervention activities were contacted six months later and invited to participate in a follow up survey which assessed their time use, nature relatedness, happiness, and environmental concern and behaviour. Fifty three people completed the follow up survey. I examined potential differences in these participants, to determine how they differed at the beginning of the study (baseline) and after the intervention phase. These people were not different in happiness or nature relatedness when they began the study, compared to those who did no follow up survey. They also were not different in environmental concern or behaviour after the intervention.

Nature Relatedness at Six Month Follow Up

I expected that any increases in nature relatedness, due to the intervention, would be sustained over time (i.e., observable at the six month follow up assessment), however the intervention was not successful in enhancing connectedness. To test if people might have changed between the intervention and the six month follow up, I conducted two repeated measures ANOVAs (for nature relatedness and inclusion of nature), with time (baseline, post-intervention, six month follow up) as a within subject factor and condition

(nature vs. control) as a between subjects factor.¹² Nature relatedness and inclusion of self in nature did not change from the end of the intervention to the six month follow up (the significant main effect of condition in this subsample reflects that the nature group participants began the study with higher levels of connectedness compared to the control group; means, standard deviations, and repeated measures ANOVA results are presented in Table 20; changes over time are illustrated in Figures 16 and 17).

Table 20

Repeated Measures ANOVA Results for Changes in Nature Relatedness and Inclusion of Nature in Self by Group for Follow Up Participants

	Control ($n = 30$)		Nature ($n = 23$)		$F(2,50)$	η^2
	M	SD	M	SD		
Nature Relatedness (6 items)						
Baseline	3.08	0.97	3.70	0.77		
Post-Intervention	3.08	0.94	3.71	0.76		
Six Month Follow Up	3.06	0.92	3.81	0.86		
Time					0.24	0.01
Condition					8.23**	0.14
Time X Condition					0.53	0.02
Inclusion of Nature						
Baseline	4.14	1.60	4.87	1.58		
Post-Intervention	4.03	1.69	4.78	1.48		
Six Month Follow Up	3.83	1.58	4.83	1.53		
Time					0.87	0.03
Condition					4.00*	0.07
Time X Condition					0.61	0.02

[†] $p < .10$, * $p < .05$, ** $p < .01$.

¹² Including age or participant type did not influence results, so analyses report here are without these variables.

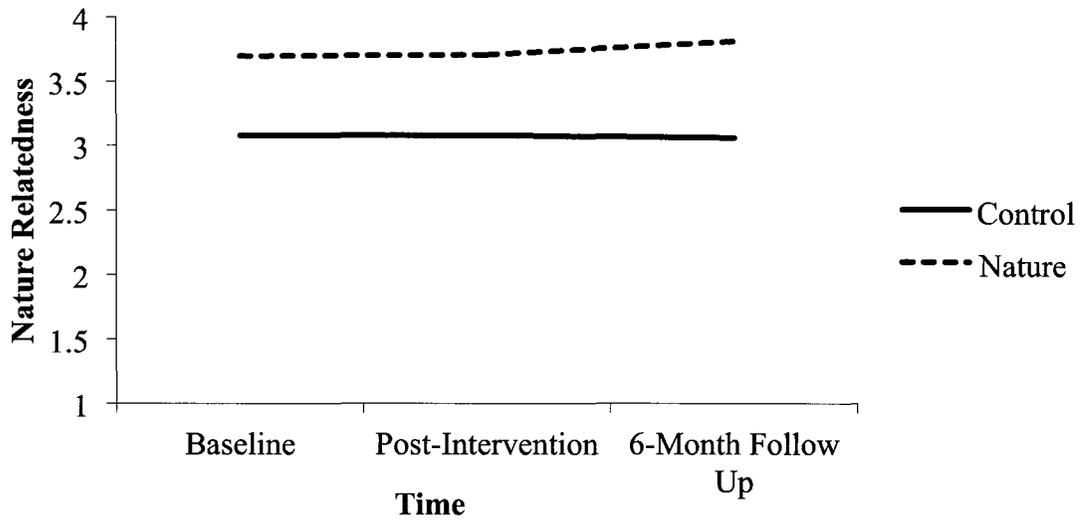


Figure 16. Change in nature relatedness over time by condition for six month follow up participants.

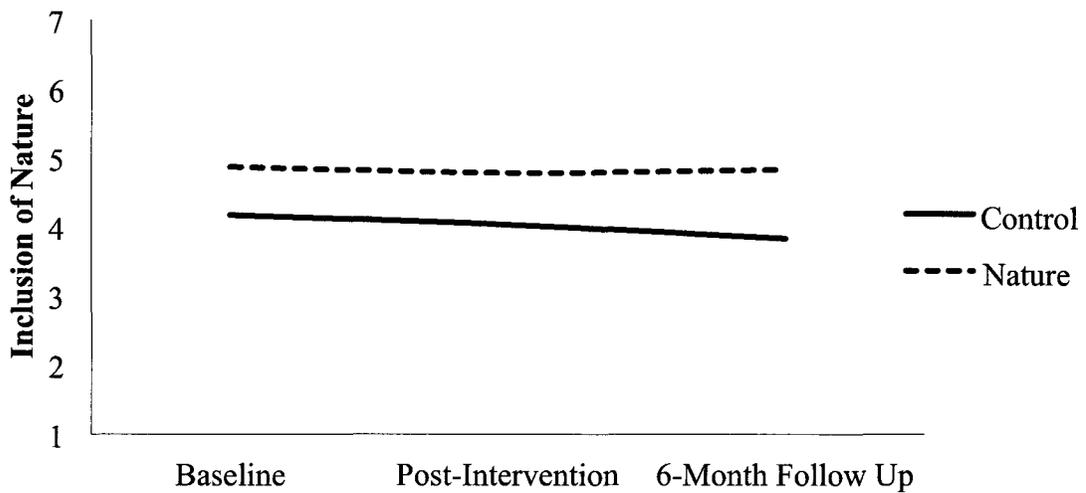


Figure 17. Inclusion of Nature change over time by condition for six month follow up participants.

Happiness at Six Month Follow Up

To test whether any changes in happiness remained six months after the intervention, I conducted a series of repeated measures ANOVAs for the happiness variables with time (baseline, post-intervention, six month follow up) as a within subject factor and condition (control vs. nature) as a between subjects factor.¹³ Fascination and positive affect changed significantly for both control and nature participants during the study; everyone declined after the intervention but had recovered six months later. Including age in the analyses removed these effects, however (see Appendix O, Table 27 for means, standard deviations, and results of the ANOVAs for all happiness variables). The other happiness variables (negative affect, percent happy, life satisfaction, subjective happiness, depression, autonomy, personal growth, and purpose in life) exhibited the same pattern of decline following the intervention and recovery six months later. To better illustrate this pattern, changes in fascination, positive affect, and negative affect are presented in Figures 18, 19, and 20. In general, mindfulness increased for both nature and control participants during the intervention and was still high six months later. These changes in mindfulness differed according to participant type. Mindfulness increased significantly for students in both the nature and control groups during the intervention phase, and was still the same at the six month follow up. Community participants in both conditions had smaller increases in mindfulness than students during the intervention and no increases during the six months that followed.

¹³ Age as covariate and participant type (student vs. community) as a between subjects factor were included, but are only reported where this changed results.

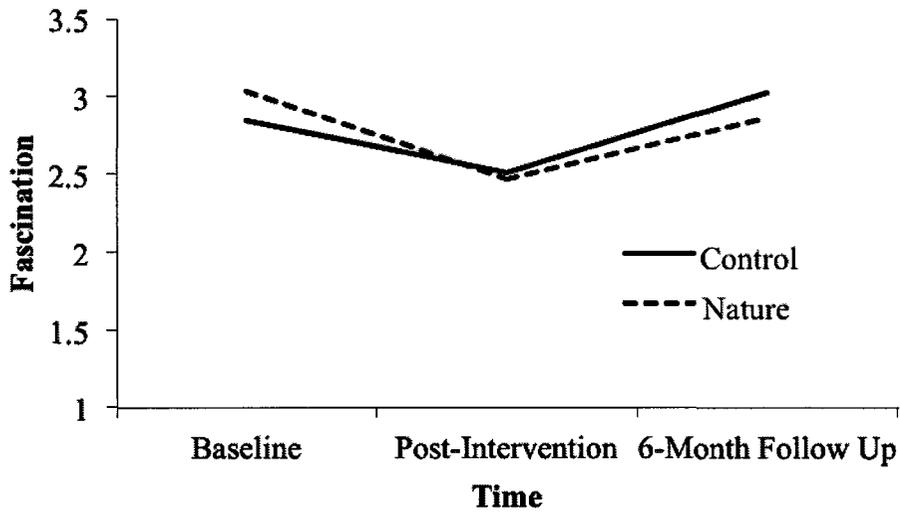


Figure 18. Change in fascination over time by condition for six month follow up participants.

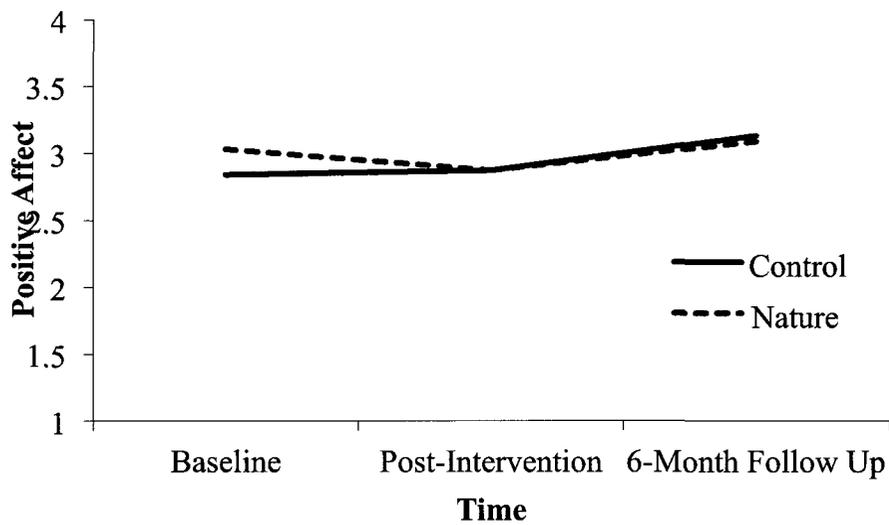


Figure 19. Change in positive affect over time by condition for six month follow up participants.

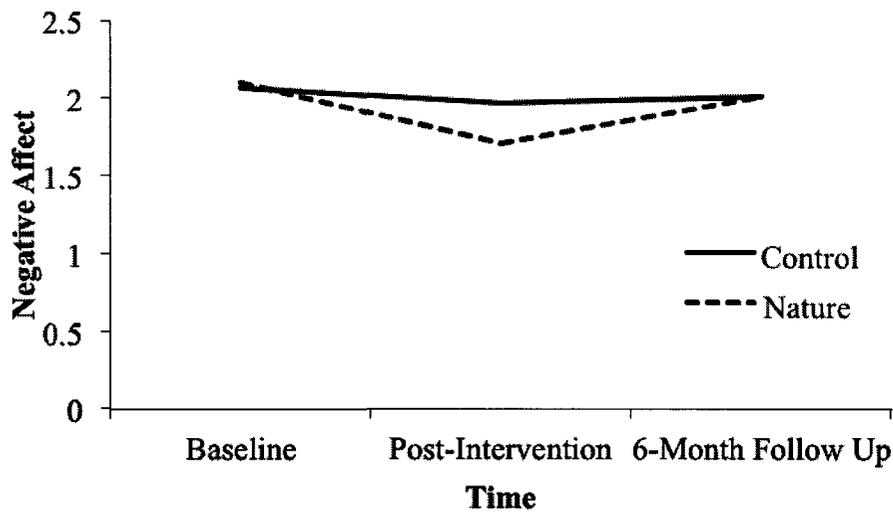


Figure 20. Change in negative affect over time by condition for six month follow up participants.

The nature intervention did not have the intended effect on happiness, either immediately following the intervention or after six months. People in both conditions had declines in happiness during the study, and were similar to baseline by the follow up survey, but any improvements in happiness were not due to the type of intervention they completed.

Environmental Concern and Behaviour at Six Month Follow Up

To test how participants might have changed in sustainable concern and behaviour six months after the intervention, I conducted a series of independent samples t-tests comparing the nature and control groups on verbal and actual commitment, biopheric, altruistic, and egoistic concern, and sustainable behaviour. There was no change six months after the intervention and any marginally significant differences

reflect initial differences (e.g., at baseline).¹⁴ Means and standard deviations, as well as t-test results are presented in Table 21.

Table 21

Means, Standard Deviations, and Comparison of Environmental Measures by Group for Six Month Follow Up Participants

	Control (<i>n</i> = 30)		Nature (<i>n</i> = 23)		<i>t</i> (51)	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Verbal Ecological Commitment	6.50	2.10	6.87	2.12	0.63	0.18
Actual Ecological Commitment	3.97	2.37	4.39	1.97	0.69	0.19
Egoistic Concern	5.96	1.08	6.26	0.91	1.08	0.30
Altruistic Concern	5.87	1.30	6.46	0.77	1.92 [†]	0.55
Biospheric Concern	5.60	1.42	6.18	0.94	1.70 [†]	0.48
Sustainable Behaviour	20.60	3.65	21.91	2.61	1.46	0.41

[†] $p < .10$, * $p < .05$, ** $p < .01$.

There was no significant difference in sustainable concern or behaviour for people who had completed the nature intervention six months earlier, compared to those in the control group. Thus, overall, the nature activities did not produce increases in environmental concern or sustainable behaviour immediately after or in the six months following the intervention.

Discussion

The goals of this study were to promote connectedness with nature using an online writing intervention and to test whether increases in nature relatedness led to

¹⁴ The group differences in altruistic and biospheric concern are not significant when controlling for baseline nature relatedness.

improvements in happiness and environmental concern. By tracking people's nature contact over time I also investigated how differences in trait connectedness were related to patterns of regular exposure to the natural environment. Contrary to expectations, the nature intervention was not successful in increasing connectedness, happiness, or environmental concern. Community people in the nature intervention increased in nature relatedness, but students declined. People who were nature related at the start of the study spent more time in nature, were happier and more ecologically minded, but not as a result of the intervention. These results imply that connectedness is not easily manipulated and to achieve significant and lasting changes would likely require ensuring regular nature contact, over much longer periods of time. Based on the results of this study, a voluntary program of writing and reflecting on nature experiences seems unlikely to motivate sufficient nature contact to increase connectedness.

The Challenge of Increasing Trait Connectedness

The goal of this study was to manipulate nature relatedness - specifically, to increase it by encouraging reflection about past nature experiences, while also encouraging new ones. In general, the nature intervention was not successful in promoting greater connectedness. The community participants became more nature related, however the students were more disconnected at the end of the study. People who felt a subjective sense of connection with nature spent more time outside in nature over the course of the study, but not because of the intervention. It is unclear why only the community participants seemed to benefit from the nature intervention. It may be that community participants enjoyed the study more, or had more opportunities to connect with nature (community participants were from various locations and may not

have experienced the same seasonal constraints as the students). Certainly, for the students in this study, nature relatedness seems difficult to change, particularly with online exercises versus immersion in the natural environment.

Other attempts to increase connectedness have had some success. Bragg (1996) describes how workshops can increase ecological self-concept, but these changes were observed in a small sample who self-selected to participate in intensive role-playing scenarios. Extended wilderness trips also appear to be successful at increasing connectedness (Kaplan & Kaplan, 1989; Kaplan & Talbot, 1983), but this is not practical to implement en masse. Not only does the cost and logistical challenges make wilderness trips an inaccessible intervention technique, but some people may fear nature or find it unpleasant (cf. Bixler & Floyd, 1997; Koole & Van den Berg, 2005). If this is the root of their disconnection, these people are unlikely to willingly spend time in the wilderness. Rather, brief, repeated exposure to nearby nature - urban city parks, for example - may be an effective way to promote connectedness. Forcing a person to spend time in nature (akin to exposure therapy for phobias) might, after an extended time, improve their bond with the natural environment, but it could also trigger reactance and worsen feelings of fear or alienation from nature (cf., virtual nature as therapy; Davidson & Smith, 2003).

Reflecting on nature may be difficult if people do not have many positive experiences from the past to draw from. Modern life, urban design, or technology often separates us from nature and many people may have little experience, or desire to explore or connect with the natural world. People uncomfortable in nature may not have been able to relate to nature using the writing exercises. I designed the intervention exercises to be enjoyable, but the writing activities might have been too difficult, or simply

uninteresting. Early childhood experiences and past encounters in nature influence feelings about the environment (Chawla, 1999; Sebba, 1991), and if these are not pleasant, they may be difficult to change, even with a month-long intervention.

There may also be seasonal barriers than inhibit connectedness. Unpleasant weather may discourage people from spending time outside (Hartig, Catalano, & Ong, 2007). This also has consequences for happiness, if people are unable to engage in the restorative activities nature offers. Opportunities to spend time outdoors may be key to increasing connectedness. A 15-minute walk in urban, nearby nature can increase feelings of inclusion with nature, as well as positive affect and vitality (Nisbet & Zelenski, in press). The findings here suggest that for people who maintain regular nature contact there are positive mental health benefits. People who are connected may be more aware of nature's benefits for personal happiness and this may be what motivates them to spend time in nature. It may be difficult, however, to encourage people to spend a lot of time in nature during less pleasant weather. Participants spent only a few hours outdoors, on average, each week (per 3-day period: $M = 1.01$ hours) during the intervention phase. The most number of hours spent outdoors over 3 days, during the study was 5.86 and the minimum was 0. Those who completed the follow-up survey, during warmer months, reported higher rates of nature contact (approximately three times as much, $M = 2.98$ hours). The participants who completed the follow up study were more nature related, compared to the larger sample, suggesting they might be inclined to spend time in nature, regardless of the season. Regardless of the weather, the experience sampling results illustrate that connected people spend more time outdoors. It may be that to increase connectedness people need both ideal conditions in which to spend time

outdoors (cf., late fall weather), and information about the natural environment that will encourage an understanding of local ecology. Writing activities may not be ideal for increasing nature relatedness or nature contact. It may be that more intensive information and nature experiences are key ingredients for fostering connectedness.

Efficacy of the Nature Relatedness Intervention

In designing the intervention activities, I drew upon positive and social psychology research, and from Pennebaker's (2004) successful expressive writing techniques, hoping that writing about nature experiences would foster connectedness, the same way writing about a positive experience enhances well-being (Burton & King, 2004). The intervention may have failed for several reasons. First, the writing instructions for the two conditions may not have been different enough in terms of including (or prohibiting) nature content. The nature intervention was designed to encourage a connection with the natural environment; the control intervention was intended to be similar, in style and format, but with a focus on the built environment. The nature writing intervention was expected to prompt reflection and contemplation of one's personal relationship and experiences with nature. The control intervention was designed to focus on indoor experiences that did not involve the natural environment or outdoors, but not necessarily unpleasant experiences. In reality, when asked to write about a favourite indoor place, some people wrote about an indoor place, but others wrote about a room they enjoyed because of a nature view, or a travel destination with spectacular nature. Thus, the two conditions may not have been sufficiently different in terms of how much people thought about and wrote about nature. From the written responses, it appears that people in both conditions wrote about nature experiences. The

writing content from control group participants often included descriptions of favourite cottages, verandas, beaches, scenery, and even spectacular nature settings. For example, one control group participant wrote:

“My pleasant indoor place is at our beach home that we rented in Cuba on vacation. The room was very serene with a canopy bed and wide open windows that opened onto the beach. The sounds of the ocean was constant and you could watch the sun rise and set everyday. The smell of the beach was very stagnant, It was always pretty warm there were cool breezes coming from the beach. I felt very relaxed, like a had no worries in the world.”

Not all control group writing was positive, however. Another control participant reflected on her unpleasant day: “I spent time studying. I felt boredom. I felt anxious”, and one person wrote: “I sat on the couch and worked on my laptop, but was continually interrupted by my own mind, leading me to look things up on the internet or find other distractions.” Regardless of the content, neither intervention successfully increased connectedness or happiness in everyone. If the majority of control group participants had written about pleasant experiences, as some did, it is possible that all participants would have been happier after completing the exercises, regardless of condition, but this was not the case.

Some nature intervention activities were likely more enjoyable than others and had an impact on happiness (e.g., the decline then increase in positive emotions following the food/music and indoor/outdoor senses exercises), but overall the type of activities people completed was unrelated to their happiness. From the beginning to the end of the intervention, life satisfaction increased for all participants (perhaps the writing inspired

some self-reflection or gratitude), but many other types of subjective well-being declined (e.g., positive affect). Even the negative aspects of subjective well-being that declined following the intervention rebounded to pre-study levels after six months, however. In other words, any reduction in ill-being that might have offset the decreases in happiness appears to have dissipated after six months.

One possible reason for the overall decline in happiness during the intervention is that the weather at the end could have been significantly less pleasant than at the beginning (e.g., for student participants, the daily average high temperature when they began the study in mid-November was 10.9 °C; it was -14.6 °C when they finished the intervention exercises five weeks later). Most students completed the surveys during the late fall, when daylight and daily average temperatures decline. Cold temperatures and shorter days can have negative consequences on psychological well-being as well as opportunities for nature contact. This is a period when well-being often decreases in students (Cox, Babiker, & Miller, 1981), as final exams approach; well-being also declines in the general public (Oyane, Bjelland, Pallesen, Holsten, & Bjorvatn, 2008), as days get shorter and weather becomes cooler.

The present study was designed to increase happiness by increasing connectedness, however the nature intervention failed to increase connectedness in all participants. Temporary (state) increases in connectedness are associated with greater happiness (Mayer & Frantz, 2004; Nisbet et al., 2009; Nisbet & Zelenski, in press), so I expected that increases in trait connectedness would lead to changes in state happiness. Without a successful nature intervention the anticipated mediation paths (between writing intervention type and happiness) were not appropriate. Not only did the nature

intervention fail to increase happiness in the students, but participants in both conditions were less happy, in some respects (e.g., lower positive affect), after the study, compared to before. Possibly, people just did not enjoy the study or intervention activities.

There is evidence to suggest considerable stability in happiness, so at trait levels it may prove as challenging to manipulate as nature relatedness. For example, other researchers find high retest correlations for positive affect, even measured 6 months apart, and the subjective well-being literature suggests a happiness set point (Lucas, 2007; Lykken & Tellegen, 1996). There have been many successful happiness boosting interventions, however (for a review, see Seligman, Steen, Park, & Peterson, 2005), including studies about writing on positive events, which document lasting effects on happiness and health (e.g., Burton & King, 2004; 2008). Nature relatedness can also be thought of as trait-like, and the retest correlations in this study suggest connectedness is relatively stable. This does not mean connectedness is necessarily fixed, however. Indeed, immersing people in nature (Mayer et al., 2009; Nisbet & Zelenski, in press) – even virtual nature (cf., Weinstein et al., 2009) - can promote connectedness. Increased nature contact and/or experiencing high state connectedness more frequently should promote, or amount to, increasing trait levels over time (cf., Fleeson, 2001). The challenge may lie in how to encourage more frequent nature contact and determine whether this leads to any lasting changes in connectedness.

People who began the study with high levels of nature relatedness had more nature contact throughout the study. There were several significant mediation paths and thus several possible routes from connectedness to happiness (and vice-versa). Nature contact and changes in connectedness may occur simultaneously. That is, nature related

people are drawn to nature and spend more time outdoors. Being outdoors and having frequent nature contact fosters connectedness. Brief walks outdoors are associated with greater positive affect compared to walking inside, and this is due to (mediated by) state connectedness (Nisbet & Zelenski, in press). Thus it is likely that both connectedness and nature contact can foster happiness. The positive emotions experienced in nature are also likely to foster both connectedness and desire for further nature contact. It is also worth noting that some mediation paths were significant for the reverse direction. That is, the happiness-nature relatedness change relationship is partly mediated by nature contact. This idea, that happy people may feel more connected to their environment, is consistent with Brown and Kasser's (2005) findings that happy people are more ecological minded. Given that positive emotions broaden our thought-action repertoires (Fredrickson's, 2000), it follows that being happy may inspire more care and concern for the natural environment.

Modern lifestyles separate us from nature, perhaps making it hard to feel connected. Experimental studies that randomly assign participants to walk in nature (versus inside) show people may not be aware of how happy even brief contact with nearby nature will make them (Nisbet & Zelenski, in press). Indeed, when asked to forecast emotions, people underestimate the positive affect and vitality they will experience walking outside. Given this affective forecasting error, it may be difficult to motivate people to spend more time in nature if they are not convinced of how enjoyable the experience will be. Finding ways to correct these underestimates may be potentially useful for fostering connectedness. It may be that the nature intervention was not successful in fostering nature contact (except for community participants) because people

are underestimating the potential happiness benefits of spending time in nature. There was only one activity that directly encouraged people to spend time in nature. Finding ways to encourage people to regularly walk outside, to work or school for example, might be more effective than a single writing activity.

State connectedness with nature is malleable and can be increased with immersion in nature via photography (Weinstein, Przybylski, & Ryan, 2009), by watching videos (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009), or by taking people on brief walks outdoors (Mayer et al., 2009; Nisbet & Zelenski, in press). Shifting trait connectedness appears to be more difficult. Long periods of exposure to nature, and multiple experiences of nature contact may be required to increase nature relatedness (cf., Kaplan & Talbot, 1983). Given that the activities were largely ineffective in changing connectedness, future interventions could focus on nature contact, versus writing, as a method to increase nature relatedness.

The intervention was designed to increase happiness, through improved nature relatedness, but was not designed as a treatment for depression, or other mental health problems. The idea that nature contact may restore mood in clinical populations or be used in a therapy setting is still new, but nature's restorative powers are being tested in therapeutic interventions such as Burns' nature-guided therapy. Despite the flaws of the present study, evidence of nature's restorative benefits, for both attention (Berman, Jonides, & Kaplan, 2008) and mood (Mayer et al., 2009) suggest nature contact has potential as a therapeutic intervention. Brief experiences in nature have temporary mood (state happiness) benefits (Weinstein et al., 2009; Nisbet & Zelenski, in press), however

future research is needed to determine whether more intense immersion in nature could help people with more severe mood disorders.

It would be unreasonable to presume that every person who feels connected or who lives in close contact with nature will be happy. The potential well-being benefits of nature relatedness could be overridden by extenuating life circumstances such as poverty, abuse, or health issues. For example, Aboriginal people often live in close contact with nature and spiritual and cultural values include a connection to all of creation. Centuries of oppression and cultural disconnection have resulted in alcohol and substance problems for some Aboriginal communities, however (McCormick, 2000), and nature contact is unlikely to solve severe social and psychological problems. Connectedness – not just to nature, but to one’s family, community, or culture – may be more important to well-being than nature relatedness.

It could be that the benefits of nature relatedness stem from a sense of belonging, and that simply feeling connected (to something) is a source of happiness. Exploratory analysis of the distractor items measuring connectedness to country, culture, home, friends, and family, in the present study, suggest nature has unique benefits, however. Feeling connected to other things is not always associated with well-being, whereas connectedness with nature is (family, friends, and home are also related to some of the well-being indicators). Why some people are happy spending time alone in nature, when others are not, may help us to better understand how social context influences nature relatedness and the emotions associated with nature experiences. For people seeking restoration, when safety is not a concern, they seem to prefer solitude (Staats, & Hartig, 2004). Whether the positive emotions that accompany nature contact (e.g., vitality, awe)

are enhanced or inhibited by company is also a question for further investigation. It may be that solitude is most conducive to relaxation whereas company is best for promoting high arousal positive emotions in nature.

Finally, despite past findings of the happiness benefits associated with nature relatedness, the results in the present study suggest there may be no causal path between connectedness and well-being. Indeed, there may be other mechanisms responsible for the well-being effects of nature. People who spend more time outside may be happier because they have more bright light exposure, for example (c.f., aan het Rot, Moskowitz, & Young, 2008). It could be that people who spend more time in nature are able to do so because they have more leisure time or opportunities to relax. The happiest people may simply be the ones who have the luxury of spending time outside. Further research is needed to test these links and to identify other factors that may mediate or moderate any nature-happiness relationships.

Limitations and Future Directions

Recruitment, Compliance with Intervention Instructions, and Writing

Content

Finding ways to recruit diverse types of people, without offering payment, was challenging. Advertising the study as being about happiness was helpful in attracting participants, but may also have appealed to people with unusual characteristics or who were particularly unhappy. This study had additional challenges due to the repeated and longitudinal measures. The bi-weekly surveys may have been burdensome for participants; no doubt, this contributed to the high attrition rate. Happiness is a topic that lends itself well to online studies, as most people are interested in improving their

personal happiness (e.g., a recent Google search I conducted on ‘how to be happy’ yielded 102,000,000 hits). The recruitment method for community participants (ads on social networking sites and research sites) may have attracted mostly unhappy people, as opposed to a more representative sample. Students in this study had similar levels of happiness compared to previous student samples during a similar time in the academic term, however students also received course credit and may have been drawn to the study because it was convenient to participate online (i.e., they may not have taken the study as seriously as community participants).

In this study, random assignment to condition occurred when participants registered and provided their email address. As a function of the website design, participants were randomly assigned to the nature or control group as they began the study, before providing any demographic or other data. This random assignment procedure resulted in samples matched reasonably well on most variables of interest, however gender distribution was unbalanced. Ideally, random assignment would occur after participants complete the demographics portion of any baseline questionnaire. To do this would have required computer programming sophistication beyond the resources available for this study, but it is worthwhile to consider attempting to ensure there are equal numbers of men and women in each experimental condition.

The benefits of attracting participants from all over the globe make online studies appealing, but this approach also has drawbacks. For example, researchers have less control over who completes online surveys, and cannot easily interact with participants if there are problems with the data (particularly when anonymity is a feature). Representativeness is a potential problem, given that the only people who could

participate in this survey were internet users with regular access to a computer. Thus, reaching a wide audience on the world wide web does not ensure that a diverse sample of people actually sign up (Lenert & Skoczen, 2002). The ease of participating in online studies may also be one of the reasons for the relatively high rate of attrition - it was easy to register in this study, but also easy to quit.

Because the majority of participants were students, the sample was relatively homogenous, and any findings are thus limited in generalizability. Students have unique characteristics that may not generalize to people without the same level of education, wealth, and personal freedoms (Henrich, Heine, & Norenzayan, 2010). Nonetheless, online studies are accessible to people who might not otherwise have opportunities to participate in research, or who are limited financially, geographically, or physically, from doing laboratory experiments. This also presents another problem, however. One of the aims of this study was to test the intervention activities as a way to foster connectedness for people who may not regularly access nearby nature. This goal presents a conflict, however, as the type of person drawn to an online study might prefer to avoid nature. The online format may have inadvertently attracted people who prefer being inside and on the computer.

Everyone who finished the intervention part of the study was compliant with the writing instructions. Many people wrote about very personal experiences, and openly expressed their feelings when thinking about their favourite places. People who continued on with the writing exercises were happier (on 7 of the 13 indicators) than people who quit after completing just the baseline survey and first exercise. Said another way, those who quit after the baseline survey were a significantly less happy group of

people compared to those who continued. It is unclear why these people dropped out and whether they would have benefited from the nature intervention exercises. Despite the descriptive information on the study registration (welcome) page, some people may have expected more immediate benefits of participating. Attrition rates were similar, regardless of what condition people were assigned to. Thus, there is no evidence that the first control intervention activity contributed to the unhappiness of those who quit the study, even if it was not designed to increase happiness.

Only a small proportion (25%) of the people who completed the intervention responded to the follow up survey six months later. With student participants, in particular, the timing of the follow up survey, in the summer, meant that many might have been on vacation, out of town, or not responding to email. For students, there was no incentive of course credit to complete the last survey, although they were entered into the draw for \$200. Unfortunately, there were also some technical difficulties with the study website and the automatically generated emails so that, initially, the incentive information about the draw did not appear in the six month follow up emails to students. With so few people responding to the final survey, the sample size was insufficient and power was lacking for some analyses (e.g., examining differences in students versus community participants).

Everyone who completed the intervention received an interim debriefing which contained general information about the goals of the study. Ethically, this was necessary, however it may have influenced responses on the follow up survey. Indeed, people who completed the follow up were unique in that they were more connected with nature compared to those who stopped. This greater connectedness could explain why they

continued; these participants may have been more motivated to complete the final survey because they enjoyed the sense of connection after the intervention. It may also be that following the interim debriefing, connected people were more interested in the topic of nature and happiness and wanted to help with the research. Unless the purpose of the research is hidden entirely from participants, studies on environmental issues may attract more sustainably minded people, particularly when there is no other incentive to attract a broader range of people. The people who completed the follow up survey were indeed more connected, compared to those who did not respond.

Refining the Nature Intervention

This study tested a new intervention technique and could be improved upon in many ways in future efforts to manipulate and study connectedness. The qualitative data from the writing exercises could provide insight into how people think and write about their relationship with the natural world. The writing may help to illustrate reasons for why some people avoid nature contact, and the positive or negative experiences people draw on when thinking about nature. This may also provide clues as to the particular features of natural environments that are perceived as most restorative or that best promote happiness. Researchers have only recently begun to study which elements of nature best promote restoration (e.g., water; White et al., 2010) and more work is needed to determine what features of nature best promote human health and well-being.

Discovering what features of nature are most relaxing, awe-inspiring, or energizing could help to guide the development of future interventions designed to promote nature contact. The nature intervention could have encouraged nature contact more explicitly. The exercises could be tailored to participants' location and seasonal

opportunities for nature contact (e.g., by encouraging people to identify and observe local wildlife). Information about local ecology or natural history may help to encourage nature contact as well as informing people about local environmental issues.

The nature activities did not lead to more concern about the environment or more sustainable behaviour. People who completed the nature intervention indicated marginally greater altruistic environmental concern for other people, and future generations. The intervention activities may have led to more reflection about the benefits of a healthy environment for people, rather than promoting intrinsic valuing of nature. It may be possible to cultivate altruistic motives for nature conservation, and extend willingness to care for the environment beyond human interests, to include the biosphere. This type of environmental altruism, if developed, could potentially promote more sustainable behaviour (Perkins, 2010). In addition to, and separate from the sustainability benefits, altruism arising from connectedness is beneficial in terms of promoting pro-social, caring behaviour towards other people (cf. Weinstein et al., 2009).

Conclusion

Connectedness is a dynamic process. Interactions with the natural world are likely to continuously influence and motivate (or deter) connectedness, trigger responses, and reflection. Building interest in nature contact, if this results in more frequent experience, should feed back into reflection upon those experiences. Incorporating nature experiences into one's self-concept is likely to enhance connectedness, and potentially fuel desire for further contact, if the experiences are positive or evoke fascination. This also suggests that environmental education should incorporate experiences, and not just classroom learning, so people have opportunities to interact with

the natural elements and integrate knowledge by practicing what they have learned about plants, animals, and ecosystems. Most participants in the study were only in contact with nature for a few hours each week. During unpleasant seasons virtual nature may help people feel connected if they cannot get outdoors. This is not an ideal substitute for real nature, and the specific natural elements that make nature restorative are not yet fully understood. But, in the absence of real nature, virtual environments may help people who are disconnected or phobic to overcome their fears, become more comfortable and familiar with nature, and to eventually benefit from the advantages of regular nature contact. Virtual nature, if pervasive, could lead to devaluing the environment (Kahn, Severson, & Rucker, 2009), however for people who have had traumatic or unpleasant nature experiences, this may be a first step towards restoring damaged human-nature connections. Thus, virtual nature may be useful if it can instil greater desire and appreciation for the real thing.

Despite the ineffective nature intervention, the results of this study demonstrate that trait connectedness and nature contact are both promising potential paths to sustainable happiness. Connectedness and nature contact are associated with a type of happiness that may be easier (for the individual) to sustain, and in harmony with ecological sustainability (O'Brien, 2005). The implications for urban design and city planning are that greenspace needs to be incorporated with the built environment in ways that are easily accessible (ideally year-round). Nature need not be remote wilderness to have human health benefits; just living in proximity to greenspace benefits health and longevity (De Vries, Verheij, Groenewegen, & Spreeuwenberg, 2003; Mitchell &

Popham, 2008), but for people who are not (yet) highly connected, it may be easier to encourage more regular contact if there is nature nearby.

Notwithstanding the unsuccessful intervention, the experience sampling methodology illustrates the role of trait connectedness in day-to-day nature experiences and happiness, as well as sustainable behaviour. This research provides useful insight in terms of how to better design interventions in future, and offers a glimpse into some naturalistic behaviour – how contact with nature is related to both happiness and concern about the environment.

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Appendix A: Informed Consent

Below is a description of the study and what's involved.

We are researchers at Carleton University, studying happiness. We have developed a program of activities to increase awareness of your surroundings, which may also improve happiness.

The study involves filling out some questionnaires about your happiness, personality, and well-being, and then completing some activities. Twice a week, for four weeks, you'll receive an email reminder with a link to a short mood and time use survey, as well as an activity. We will be asking you about your happiness, personality, attitudes, and activities at the end of the four weeks, and then again several months later.

To participate in this study, you must be 16 years of age or older, and you need to have internet access for approximately 20 minutes at least twice per week (to access the study web site and activities). There are no risks in this study, however we will be asking you to reflect upon and write about some of your experiences and emotions. We anticipate that this will usually be a positive experience, but, depending on the emotions you write about, you may experience some minor, temporary unpleasantness. All of your answers will be kept confidential. Only the researchers will see your responses. The data collected may be used in research publications and/or for teaching purposes, but will not contain any identifying information.

By clicking 'I agree', below, you are acknowledging that you have read the study's description above, are at least 16 years of age, and agree to participate in the study and receive email reminders. Your endorsement in no way constitutes a waiver of your rights. You may withdraw from the study at any time.

If you are currently a student at Carleton University, enrolled in PSYC1001 or PSYC1002, please click here.

Student participants viewed the following information:

You will receive 4% experimental credits for completing the first phase of the study, which involves completing some surveys and writing exercises twice a week for four weeks. If you also complete the follow up survey, 6 months later, you will be entered in a draw for a \$200 (U.S.) cash prize.

Community participants viewed the following information:

For participating in the study, you can earn up to 10 chances to win a \$500 (U.S.) cash prize, as well as one chance to win a \$200 (U.S.) cash prize for completing a follow up survey 6 months later. Each time you complete one of the bi-weekly surveys, your name will be entered into the draw for \$500 (U.S.), which will take place in August of 2009. The \$200 (U.S.) draw will take place in February 2010.

Email address: _____

"I AGREE"

Should you have any ethical or other concerns about this study then please contact Dr. Avi Parush (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 4173) or Dr. Janet Mantler (Chair, Dept. of Psychology, 520-2600, ext. 2648).

Study Personnel: Elizabeth Nisbet, (520-2600, ext. 1293),
Dr. John M. Zelenski (520-2600 ext. 1609)

Appendix B: Debriefing - Post-Intervention and follow up

NR-Participant Debriefing

Thank you for participating in this study. The goal of this research is to examine how awareness of different surroundings is related to well-being (or happiness).

In this study, we investigated the effects of two different writing interventions. One focused on indoor or built environments and the other on outdoor or natural environments. We are interested in how connected people are to their environments, both inside and outside. In other writing studies, people generally report benefits from writing about meaningful or emotional topics. We are interested in whether writing about different surroundings and environments has similar benefits. It is possible that being connected and aware of our surroundings may improve happiness. These feelings of connectedness to our surroundings and any happiness associated with them may also impact behaviour.

It is possible that being aware of and connected to our environment and surroundings may help people feel happier and be related to different behaviours. Some researchers are finding that people who feel very connected to their outdoor environment are also concerned about environmental issues. We are interested in how experiences in different environments are related to feelings of connectedness as well as happiness. We are interested in testing whether improving people's relationship with their environments is linked to behaviour as well as differences in people's moods and happiness. Examining how people may be connected to their surroundings is helping us to identify how these individual differences are linked to human psychological health. The potential benefits of being connected to the outdoors for human psychological health include stress and anxiety reduction, as well as more positive emotions and general feelings of well-being. In addition, we are interested in how connectedness to different environments may be related to attitudes and behaviour toward those environments. This research tests whether or not writing about connectedness to different environments can help people to feel closer to their environment or surroundings and to feel happier. The exercises you completed were about the outdoor environment. If you would like to try the exercises focused on the indoor environment, please click on the button at the bottom of this page, and you will be directed to the survey using the indoor environment exercises.

Please be assured that your responses will be treated confidentially. In any public presentation of our data, either in print or in speech, we will not present any information that could identify a participant. Once again, our sincere thank you for participating!

Contacts

The following people are involved in this research project and may be contacted at any time if you have any further questions about the project, what it means, or concerns about how it was conducted:

Dr. John M. Zelenski, Department of Psychology, Carleton University, 520-2600 ext 1609

Elizabeth (Lisa) Nisbet, Department of Psychology, Carleton University, 520-2600 ext 1293

Should you have any ethical or other concerns about this study then please contact Dr. Avi Parush, (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 4173) or Dr. Janet Mantler (Chair, Dept. of Psychology, 520-2600, ext. 2648).

If you wish to obtain information about happiness interventions, the following may be of interest: Authentic Happiness Research site: <http://www.authentichappiness.sas.upenn.edu/Default.aspx>

PLEASE CLICK HERE IF YOU WOULD LIKE TO DO THE VERSION OF THE STUDY THAT USES INDOOR ENVIRONMENT EXERCISES.

Control-Participant Debriefing

Thank you for participating in this study. The goal of this research is to examine how awareness of different surroundings is related to well-being (or happiness).

In this study, we investigated the effects of two different writing interventions. One focused on indoor or built environments and the other on outdoor or natural environments. We are interested in how connected people are to their environments, both inside and outside. In other writing studies, people generally report benefits from writing about meaningful or emotional topics. We are interested in whether writing about different surroundings and environments has similar benefits. It is possible that being connected and aware of our surroundings may improve happiness. These feelings of connectedness to our surroundings and any happiness associated with them may also impact behaviour.

It is possible that being aware of and connected to our environment and surroundings may help people feel happier and be related to different behaviours. Some researchers are finding that people who feel very connected to their outdoor environment are also concerned about environmental issues. We are interested in how experiences in different environments are related to feelings of connectedness as well as happiness. We are interested in testing whether improving people's relationship with their environments is linked to behaviour as well as differences in people's moods and happiness. Examining how people may be connected to their surroundings is helping us to identify how these individual differences are linked to human psychological health. The potential benefits of being connected to the outdoors for human psychological health include stress and anxiety reduction, as well as more positive emotions and general feelings of well-being. In addition, we are interested in how connectedness to different environments may be related to attitudes and behaviour toward those environments. This research tests whether or not writing about connectedness to different environments can help people to feel closer to their environment or surroundings and to feel happier. The exercises you completed were about the indoor environment. If you would like to try the exercises focused on the outdoor environment, please click on the button at the bottom of this page, and you will be directed to the survey using the outdoor environment exercises.

Please be assured that your responses will be treated confidentially. In any public presentation of our data, either in print or in speech, we will not present any information that could identify a participant. Once again, our sincere thank you for participating!

Contacts

The following people are involved in this research project and may be contacted at any time if you have any further questions about the project, what it means, or concerns about how it was conducted:

Dr. John M. Zelenski, Department of Psychology, Carleton University, 520-2600 ext 1609

Elizabeth (Lisa) Nisbet, Department of Psychology, Carleton University, 520-2600 ext 1293

Should you have any ethical or other concerns about this study then please contact Dr. Avi Parush, (Chair, Carleton University Ethics Committee for Psychological Research, 520-2600, ext. 4173) or Dr. Janet Mantler (Chair, Dept. of Psychology, 520-2600, ext. 2648).

If you wish to obtain information about the environment and the human relationship with nature, the following may be of interest:

Authentic Happiness Research site: <http://www.authentichappiness.sas.upenn.edu/Default.aspx>

PLEASE CLICK HERE IF YOU WOULD LIKE TO DO THE VERSION OF THE STUDY
THAT USES OUTDOOR ENVIRONMENT EXERCISES.

Appendix C: General Information

Sex: Female/ Male (please circle one)

Age: _____

Ethnicity: _____

What is your educational experience

some high school completed high school
 completed college degree completed trade or apprenticeship training
 some university completed undergraduate degree
 completed master's degree completed PhD

Where did you spend the most time while growing up? (please choose only one response from the options below)

city centre city suburbs small town rural or farm
 other (please specify: _____)

Where do you live now?

city centre city suburbs small town rural or farm
 other (please specify: _____)

What country do you currently live in? _____

What type of building do you currently live in? (please choose only one response from the options below)

apartment or condo duplex or townhouse detached house
 other (please specify: _____)

Are you currently employed? yes no

What is your occupation _____

Are you a student? yes no

Full time OR Part-time

Appendix D: Baseline Well-Being and Nature Questionnaires**PANAS**

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **in general**, that is, on average. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely
_____	interested	_____	irritable	_____
_____	distressed	_____	alert	_____
_____	excited	_____	ashamed	_____
_____	upset	_____	inspired	_____
_____	strong	_____	nervous	_____
_____	guilty	_____	determined	_____
_____	scared	_____	attentive	_____
_____	hostile	_____	jittery	_____
_____	enthusiastic	_____	active	_____
_____	proud	_____	afraid	_____
_____	in awe	_____	fascinated	_____
_____	curious	_____	content	_____
_____	joyous	_____	anxious	_____
_____	sad	_____	happy	_____

Vitality Scale

Please respond to each of the following statements by indicating the degree to which the statement is true for you in general in your life. Use the following scale:

1	2	3	4	5	6	7
not at all true			somewhat true	very true		
1.	I feel alive and vital.					_____
2.	Sometimes I feel so alive I just want to burst.					_____
3.	I have energy and spirit.					_____
4.	I look forward to each new day.					_____
5.	I nearly always feel alert and awake.					_____
6.	I feel energized.					_____

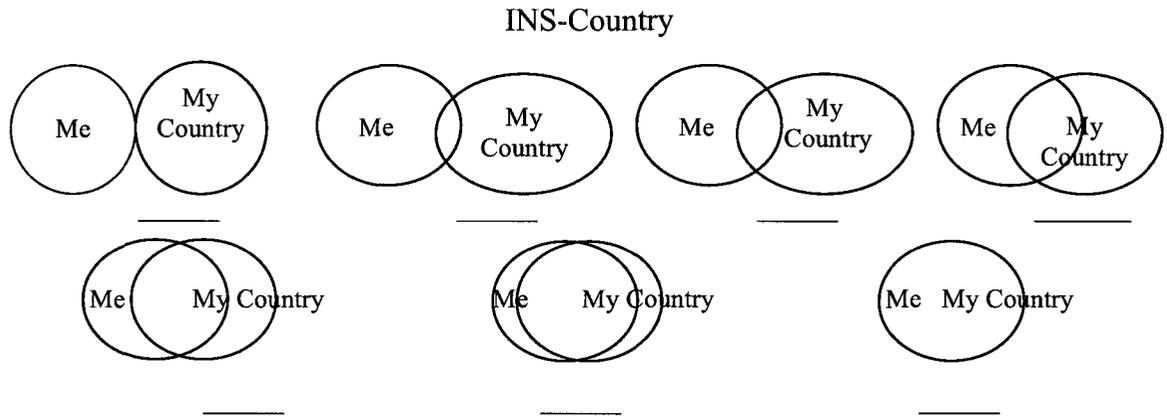
Satisfaction with Life Scale

Below are five statements with which you may agree or disagree. Using the scale below, indicate your agreement with each item by placing the appropriate number On the line preceding that item. Please be open and honest in your responding.

Strong Disagreement	Moderate Disagreement	Slight Disagreement	Slight Agreement	Moderate Agreement	Strong Agreement
1	2	3	4	5	6

- _____ 1. In most ways my life is close to my ideal.
- _____ 2. If I could live my life over, I would change almost nothing.
- _____ 3. I am satisfied with life.
- _____ 4. So far I have gotten the important things I want in life.
- _____ 5. The conditions of my life are excellent.

NOTE: other INS-like items will be included to help distract participants from the true nature of the study (e.g., me/my country, me/my culture, me/my family, me/music, me/my home, me/my friends, me/my partner, me/my environment).



Psychological Well-Being Inventory

The following set of questions deals with how you feel about yourself and your life. Please remember that there are no right or wrong answers.

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
1. I am not afraid to voice my opinions, even when they are in opposition to the opinions of most people.	1	2	3	4	5	6
2. I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
3. I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
4. My decisions are not usually influenced by what everyone else is doing.	1	2	3	4	5	6
5. I don't want to try new ways of doing things--my life is fine the way it is.	1	2	3	4	5	6
6. I tend to focus on the present, because the future nearly always brings me problems.	1	2	3	4	5	6
7. I tend to worry about what other people think of me.	1	2	3	4	5	6
8. I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
9. My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6
10. Being happy with myself is more important to me than having others approve of me.	1	2	3	4	5	6
11. When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6
12. I don't have a good sense of what it is I'm trying to accomplish in life.	1	2	3	4	5	6
13. I tend to be influenced by people with strong opinions.	1	2	3	4	5	6
14. I have the sense that I have	1	2	3	4	5	6

Circle the number that best describes your present agreement or disagreement with each statement.	Strongly Disagree	Disagree Somewhat	Disagree Slightly	Agree Slightly	Agree Somewhat	Strongly Agree
developed a lot as a person over time.						
15. I used to set goals for myself, but that now seems like a waste of time.	1	2	3	4	5	6
16. I have confidence in my opinions, even if they are contrary to the general consensus.	1	2	3	4	5	6
17. I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
18. I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
19. It's difficult for me to voice my own opinions on controversial matters.	1	2	3	4	5	6
20. For me, life has been a continuous process of learning, changing, and growth.	1	2	3	4	5	6
21. I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6
22. I often change my mind about decisions if my friends or family disagree.	1	2	3	4	5	6
23. I gave up trying to make big improvements or changes in my life a long time ago.	1	2	3	4	5	6
24. Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
25. I judge myself by what I think is important, not by the values of what others think is important.	1	2	3	4	5	6
26. There is truth to the saying you can't teach an old dog new tricks.	1	2	3	4	5	6
27. I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6

MAAS

Below is a collection of statements about your everyday experience. Using the 1–6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be.

Circle the number that best describes your present agreement or disagreement with each statement.	<i>almost always</i>	<i>very frequently</i>	<i>somewhat frequently</i>	<i>somewhat infrequently</i>	<i>very infrequently</i>	<i>almost never</i>
1. I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
3. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
6. I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
7. It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5	6
8. I rush through activities without being really attentive to them.	1	2	3	4	5	6

Circle the number that best describes your present agreement or disagreement with each statement.	<i>almost always</i>	<i>very frequently</i>	<i>somewhat frequently</i>	<i>somewhat infrequently</i>	<i>very infrequently</i>	<i>almost never</i>
9. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	1	2	3	4	5	6
10. I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
11. I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
12. I drive places on "automatic pilot" and then wonder why I went there.	1	2	3	4	5	6
13. I find myself preoccupied with the future or the past.	1	2	3	4	5	6
14. I find myself doing things without paying attention.	1	2	3	4	5	6
15. I snack without being aware that I'm eating.	1	2	3	4	5	6

Big Five Factor Inventory

Instructions: For each of the characteristics listed below, rate how descriptive each characteristic is of you using the scale from 1 to 5 as shown below:

1 Disagree strongly	2 Disagree a little	3 Neither Agree or disagree	4 Agree a little	5 Agree strongly
---------------------------	---------------------------	-----------------------------------	------------------------	------------------------

I see myself as someone who/whose . . .

- | | |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1. Is talkative _____ | 27. Takes notice of wildlife wherever I am _____ |
| 2. Does a thorough job _____ | 28. Tends to be lazy _____ |
| 3. Is depressed, blue _____ | 29. Is emotionally stable, not easily upset _____ |
| 4. Is original, comes up with new ideas _____ | 30. Is inventive _____ |
| 5. Always thinks about how my actions affect other people _____ | 31. Feels very connected to my family _____ |
| 6. Feels very connected to my home _____ | 32. Prefers work that is challenging _____ |
| 7. Is reserved _____ | 33. Always thinks about how my actions affect the environment _____ |
| 8. Can be somewhat careless _____ | 34. Has an assertive personality _____ |
| 9. Ideal vacation spot would be a remote wilderness area _____ | 35. Perseveres until the task is finished _____ |
| 10. Is relaxed, handles stress well _____ | 36. Can be moody _____ |
| 11. Ideal vacation would be doing nothing _____ | 37. Values artistic, aesthetic experiences _____ |
| 12. Takes notice of details _____ | 38. Connection to nature is a part of my spirituality _____ |
| 13. Connection to my culture is a part of my spirituality _____ | 39. Is sometimes shy, inhibited _____ |
| 14. Is curious about many different things _____ | 40. Does things efficiently _____ |
| 15. Is full of energy _____ | 41. Remains calm in tense situations _____ |
| 16. Is a reliable worker _____ | 42. Prefers work that is routine _____ |
| 17. Takes notice of beauty wherever I am _____ | 43. Is outgoing, sociable _____ |
| 18. Feels very connected to all living things and the earth _____ | 44. Makes plans and follows through with them _____ |
| 19. Can be tense _____ | 45. Gets nervous easily _____ |
| 20. Is ingenious, a deep thinker _____ | 46. Likes to reflect, play with ideas _____ |
| 21. Generates a lot of enthusiasm _____ | 47. Whose relationship to nature is an important part of who I am _____ |
| 22. Tends to be disorganized _____ | 48. Has few artistic interests _____ |
| 23. Worries a lot _____ | 49. Is easily distracted _____ |
| 24. Whose relationship with family is an important part of who I am _____ | 50. Is sophisticated in art, music, or literature _____ |
| 25. Has an active imagination _____ | |
| 26. Tends to be quiet _____ | |

Appendix E: Bi-Weekly Well-Being ESM Questionnaire

PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way **recently**, that is, over the past 3 days. Use the following scale to record your answers.

	1		2		3		4		5
	very slightly or not at all		a little		Moderately		quite a bit		extremely
_____	interested	_____	irritable						
_____	distressed	_____	alert						
_____	excited	_____	ashamed						
_____	upset	_____	inspired						
_____	strong	_____	nervous						
_____	guilty	_____	determined						
_____	scared	_____	attentive						
_____	hostile	_____	jittery						
_____	enthusiastic	_____	active						
_____	proud	_____	afraid						
_____	in awe	_____	fascinated						
_____	curious	_____	content						
_____	joyous	_____	anxious						
_____	sad	_____	happy						

Vitality

Please respond to each of the following statements by indicating the degree to which the statement is true for you **in the last 3 days**. Use the following scale:

	1	2	3	4	5	6	7
	not at all true			somewhat true		very true	
1.	I feel alive and vital.						_____
2.	Sometimes I feel so alive I just want to burst.						_____
3.	I have energy and spirit.						_____
4.	I look forward to each new day.						_____
5.	I nearly always feel alert and awake.						_____
6.	I feel energized.						_____

How would you best describe today's weather?

Temperature (please choose one):

- ___ warmer than 25°C/77°F
- ___ warmer than 15°C/59°F
- ___ warmer than 10°C/50°F
- ___ warmer than 5°C/41°F
- ___ below 0°C/32°F
- ___ below -5°C/23°F
- ___ below -10°C/14°F
- ___ below -15°C/5°F

Conditions (please choose one):

Sunny _____ 	Mix of sun and cloud _____ 
Cloudy _____ 	Some rain _____ 
Rain all day _____ 	Snow _____ 
_____ Other (please describe: _____)	

Time Use Survey

When answering the following questions on how you spent time, please report on **only** the past three days.

In the last 3 days, how many hours did you spend . . .

	number of hours
Shopping	_____
at a restaurant	_____
listening to music	_____
at a gym or fitness facility	_____
on a walk, hike, or activity in nature	_____
visiting friends	_____
watching television	_____
doing housework	_____
commuting to work/school	_____
talking on the phone	_____
taking care of children	_____
sending e-mail/surfing the internet	_____
Eating	_____
Sleeping	_____
Relaxing	_____

Appendix F: Intervention Instructions

The following is a short exercise to help you reflect on your thoughts, experiences, and awareness of your surroundings.

ACTIVITY #1:

EXPERIMENTAL: Think about being outside in a natural place you are comfortable and familiar with. This could include your backyard or garden, a park in your neighbourhood or on your way to work or school, a river or lake, or a nearby recreation area - any outdoor place you are able to get to. Now think about how you might find a way to take a break and be in this comfortable outdoor space some time soon. Make a list of ways you could plan some time (at least 15 minutes or more) in this place in the coming week. Enter the plan(s) into your daily planner, and commit to taking this time to be in this place soon. When you are in this place, try to be fully aware of your surroundings, noticing as many details about this place as you can. Future activities will ask you some questions about your experiences and the surroundings in this place.

CONTROL: Think about being at home, indoors, in a place you are comfortable and familiar with. This could include bedroom, living room, or any place you are able to get to. Now think about how you might find a way to take a break and be in this comfortable indoor space some time soon. Make a list of ways you could plan to spend some time in this place (at least 15 minutes or more) in the coming week. Enter the plan(s) into your daily planner, and commit to taking this time to be in this place soon. When you are in this place, try to be fully aware of your surroundings, noticing as many details about this place as you can. Future activities will ask you some questions about your experiences and the surroundings in this place.

ACTIVITY #2

EXPERIMENTAL: Think about an outdoor place you chose to spend time in recently. This could be the comfortable outdoor place you planned to be in from the last exercise, or another time you were outdoors recently. This could have been anywhere such as your backyard, a park, or any outside area. Now picture this place in your mind's eye. Spend about 5-10 minutes writing, describing your experience in as much detail as possible. Think about what you thought and felt when you were there. What elements or aspects of the outdoors or nature did you notice? Describe your deepest feelings and your deepest thoughts - ones you experienced then as well as ones that come up as you are writing. Try to re-experience the emotions and then write about them.

CONTROL: Think about an indoor place you chose to spend time in recently. This could be the comfortable indoor place you planned to be in from the last exercise, or another time you were indoors recently. This could have been anywhere such as your bedroom, living room, or any inside area in your home.

Now picture this place in your mind's eye. Spend about 5-10 minutes writing, describing your experience in as much detail as possible. Think about what you thought and felt when you were there. What elements or aspects of the room did you notice? Describe your deepest feelings and your deepest thoughts - ones you experienced then as well as ones that come up as you are writing. Try to re-experience the emotions and then write about them.

ACTIVITY #3

EXPERIMENTAL: Take a moment and think about the food in the meal you ate most recently. This could be foods or beverages or both - anything from breakfast, lunch, dinner, snacks, etc. Now pick one of these items. Spend about 5-10 minutes writing, using the following questions to guide you. Where does this item come from? Is it made or grown in your country or somewhere else? How is the item grown or made? Think about the place the item originates from. How different or similar is it from where you are now? What is the weather and climate like there? What is the soil like? Is the landscape the same? Are there the same or different kinds of people, plants and animals there?

CONTROL: Take a moment and think about some music you listened to most recently. This could be something you listened to on the radio, a home stereo, etc. Now pick one piece of music to think about. Spend about 5-10 minutes writing, using the following questions to guide you. Where does this recording come from? Was it created by someone in your country or somewhere else? Where is the recording made? Think about the place the recording originates from. How different or similar is this place from where you are now? What might the music studio or record company be like? What would the lighting be like there? Is the building the same as yours? Are there the same or different kinds of equipment and decor there?

ACTIVITY #4

EXPERIMENTAL: Think about a pleasant outdoor place and picture this place in your mind. This can be either nearby like your backyard, a park or garden, or far away such as a place you've been on vacation or remember from your past. Now think about all the sensory elements that are part of that pleasant outdoor place (sights, sounds, smells, textures, etc.). Spend about 5-10 minutes writing about these sensations in this place, using the following questions to guide you. What type of sounds would you hear there, from animals, wind or rain, the trees or plants moving, or from people who might be there. What you would see - colours and shapes, things moving or changing. How do things feel; what textures are there? Is cold or warm, wet or dry? What scents would you notice there?

CONTROL: Think about a pleasant indoor place and picture this place in your mind. This can be either nearby like your home, school or work, or far away such as a place you've been on vacation or remember from your past. Now think about all the sensory elements that are part of that pleasant indoor place (sights, sounds, smells, textures, etc.). Spend about 5-10 minutes writing about these sensations in this place, using the following questions to guide you. What type of sounds would you hear there, from the inside of the building, or from machines that might be there. What would you see – colours and shapes, things moving or changing. How do things feel; what textures are there? Is cold or warm, wet or dry? What scents would you notice there?

ACTIVITY #5

EXPERIMENTAL: Think of an animal that you think is interesting. This could be a pet, a wild animal, or any animal you can think of. In as much detail as possible, describe this animal and its characteristics. Spend about 5-10 minutes writing, using the following questions to guide you. What do you admire about this animal? What characteristics does it have? Does this animal have a “personality? Is its personality very different or in some ways similar to yours? What words might be used to describe it that are similar to you? Does it live a solitary life or with others of its kind, or among people? What kind of food does it eat? Where does it live? What kind of landscape? Does it live in buildings or in the wild? How does it interact with others of its kind? Does it ever interact with people? How does (or how did) this animal make you feel?

CONTROL: Think of a fictional person that you think is interesting. This could be from TV, a book, or a movie - any fictional person you can think of. In as much detail as possible, describe this fictional person and their characteristics. Spend about 5-10 minutes writing, using the following questions to guide you. What do you admire about this person? What characteristics do they have? Does this person have a “personality? Is their personality very different or in some ways similar to yours? What words might be used to describe them that are similar to you? Do they live a solitary life or with other people? What kind of food do they eat? Where do they live? Do they live in buildings? How do they interact with others? Do they ever interact with other people? How does this person make you feel?

ACTIVITY #6

EXPERIMENTAL: Imagine you are somewhere outdoors. This can be any place you can think of, imaginary or real. Picture this place in your mind, in as much detail as possible. In your imagination, transport yourself to that place. Now take on the perspective of some element of the outdoors. This can be anything – an animal, a tree, a bird, or the sun, for example. Now spend about 5-10 minutes writing, describing in as much detail as possible how you would see the world from your new perspective. What do you now see and how do you feel?

Over the next few days, try to remember the perspective you wrote about. Take this perspective whenever you can, and be as aware of your surroundings with this perspective as much as possible.

CONTROL: Imagine you are somewhere indoors. This can be any place you can think of, imaginary or real. Picture this place in your mind, in as much detail as possible. In your imagination, transport yourself to that place. Now take on the perspective of some element there. This can be anything – a mirror, a chair, or a desk, for example. Now spend about 5-10 minutes writing, describing in as much detail as possible how you would see the world from your new perspective. What do you now see and how do you feel?

Over the next few days, try to remember the perspective you wrote about. Take this perspective whenever you can, and be as aware of your surroundings with this perspective as much as possible.

ACTIVITY #7

EXPERIMENTAL: Take a few minutes and think about words, phrases, or sayings in the English language that are related to animals. We use many animal words in every day language. For example, we say people “*howl*” with laughter, which describes how dogs or wolves sound.

Now write down as many examples as you can of animals words that are used in every day language, to describe people’s personality or behaviour. Spend about 5-10 minutes writing as many examples of words or phrases to relating to animals as you can think of. Try to be as mindful and aware as you can of all the possible words and phrases that relate to animals.

CONTROL: Take a few minutes and think about words, phrases, or sayings in the English language that can be used to describe the inside of your home. We use many words in every day language to describe our homes inside, such as the type of dwelling, the layout, the decor, and the furnishings. For example, we might say our living room is “*bright*” or “*roomy*”, which describes how the room looks. Now write down as many examples as you can of words to describe the personality of the inside of your home or the rooms in it. Spend about 5-10 minutes writing as many examples of words or phrases to describe your home as you can think of. Try to be as mindful and aware as you can of all the possible words and phrases that relate to the inside of your home.

ACTIVITY #8

EXPERIMENTAL: Take a moment to think about what you did today and reflect on your encounters with nature in your surroundings. What elements of the natural environment did you encounter today? For example, maybe you spent some time with your pet, or outside, or noticed some wildlife. Or perhaps you spent time inside, but noticed the sky or weather through a window. Or, you might have read a news story, book, or magazine article that involved nature, plants, animals, or the outdoors in some way. Next, spend about 5-10 minutes describing these experiences, in as much detail as possible. Describe your deepest feelings and your deepest thoughts - ones you experienced then as well as ones that come up as you are writing. Try to re-experience the emotions and then write about them.

CONTROL: Take a moment to think about what you did today and reflect on your experiences in your indoor surroundings. What elements of your indoor environment did you encounter today? For example, maybe you spent some time relaxing on your couch or working at a desk reading. Or perhaps you spent time watching television and or reading. Or, you might have worked around the house or spent time inside working on your home in some way. Next, spend about 5-10 minutes describing these experiences, in as much detail as possible. Describe your deepest feelings and your deepest thoughts - ones you experienced then as well as ones that come up as you are writing. Try to re-experience the emotions and then write about them.

Appendix G: Post-Intervention and Follow-Up Questionnaires

Nature Relatedness Scale

Instructions: For each of the following, please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think “most people” feel.

1	2	3	4	5
Disagree strongly	Disagree a little	Neither Agree or disagree	Agree a little	Agree strongly

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. I enjoy being outdoors, even in unpleasant weather. _____</p> <p>2. Some species are just meant to die out or become extinct. _____</p> <p>3. Humans have the right to use natural resources any way we want. _____</p> <p>4. My ideal vacation spot would be a remote, wilderness area. _____</p> <p>5. I always think about how my actions affect the environment. _____</p> <p>6. I enjoy digging in the earth and getting dirt on my hands. _____</p> <p>7. My connection to nature and the environment is a part of my spirituality. _____</p> <p>8. I am very aware of environmental issues. _____</p> <p>9. I take notice of wildlife wherever I am. _____</p> <p>10. I don't often go out in nature. _____</p> <p>11. Nothing I do will change problems in other places on the planet. _____</p> | <p>12. I am not separate from nature, but a part of nature. _____</p> <p>13. The thought of being deep in the woods, away from civilization, is frightening. _____</p> <p>14. My feelings about nature do not affect how I live my life. _____</p> <p>15. Animals, birds and plants have fewer rights than humans. _____</p> <p>16. Even in the middle of the city, I notice nature around me. _____</p> <p>17. My relationship to nature is an important part of who I am. _____</p> <p>18. Conservation is unnecessary because nature is strong enough to recover from any human impact. _____</p> <p>19. The state of non-human species is an indicator of the future for humans. _____</p> <p>20. I think a lot about the suffering of animals. _____</p> <p>21. I feel very connected to all living things and the earth. _____</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Environmental Concern

People around the world are generally concerned about environmental problems because of their consequences that result from harming nature. However, people differ in the consequences that concern them the most. Please rate each item below from 1 (not important) to 7 (supreme importance) in response to the question:

I am concerned about environmental problems because of the consequences for _____

- | | |
|----------------------|----------------------------------|
| 1. _____ Animals | 7. _____ My lifestyle |
| 2. _____ Plants | 8. _____ My health |
| 3. _____ Marine Life | 9. _____ All people |
| 4. _____ Birds | 10. _____ Children |
| 5. _____ Me | 11. _____ People in my community |
| 6. _____ My future | 12. _____ My children |

Ecology Scale

Please read the following statements carefully, and indicate either True or False by circling the appropriate letter the right of the item.

	TRUE	FALSE
1. I'd be willing to bicycle or take the bus to school or work in order to reduce air pollution.	T	F
2. I would probably never join a group or club which is concerned solely with ecological issues.	T	F
3. I would be willing to use a rapid transit system to reduce air pollution.	T	F
4. I'm not willing to give up driving on a weekend due to a smog alert.	T	F
5. I'm really not willing to go out of my way to do much about the environment since that's the government's job.	T	F
6. I would donate a day's pay to a foundation to help improve the environment.	T	F
7. I would be willing to stop buying products from companies guilty of polluting the environment, even though it might be inconvenient.	T	F
8. I'd be willing to write my member of parliament concerning ecological problems.	T	F
9. I probably wouldn't go house to house to distribute literature on the environment.	T	F
10. I would not be willing to pay a pollution tax even if it would considerably decrease the pollution problem.	T	F
11. I guess I've never actually bought a product because it had a lower polluting effect.	T	F
12. I keep track of my politicians' voting records on environmental issues.	T	F
13. I have never written a politician concerning the environment.	T	F
14. I have contacted a community agency to find out what I can do about pollution.	T	F
15. I don't make a special effort to buy products in recyclable/reusable containers.	T	F
16. I have attended a meeting of an organization specifically concerned with bettering the environment.	T	F
17. I have switched products for environmental reasons.	T	F
18. I have never joined a cleanup drive.	T	F
19. I have never attended a meeting related to the environment.	T	F
20. I subscribe to environmental publications/newsgroups/listservs.	T	F

Sustainability Survey

1. Which (if any) of the following do you do on a regular basis? (circle all that apply)
- a. separate recyclables from trash
 - b. carry a reusable cup
 - c. buy organic foods
 - d. use public transportation
 - e. refuse to buy certain products based on environmental criteria
 - f. compost organic waste at home
 - g. donate money to aid agencies for the developing world
 - h. consider the environmental impacts of actions
 - i. buy fair trade goods
 - j. volunteer time to non-profit organizations
 - k. plant a garden in the spring
 - l. purchase local produce when it is in season
 - m. participate in community events
 - n. make a vehicle purchase based on emissions and consumption

Time Use Survey

When answering the following questions on how you spent time, please report on **only** the past three days.

In the last 3 days, how many hours did you spend . . .

	number of hours
Shopping	_____
at a restaurant	_____
listening to music	_____
at a gym or fitness facility	_____
on a walk, hike, or activity in nature	_____
visiting friends	_____
watching television	_____
doing housework	_____
commuting to work/school	_____
talking on the phone	_____
taking care of children	_____
sending e-mail/surfing the internet	_____
Eating	_____
Sleeping	_____
Relaxing	_____

For 6-month Follow-Up Only

We are interested in your response to the exercises you completed during the study. Please tell us about your experiences.

	no, never				yes, frequently
Did you continue doing any of the activities that were part of the exercises on your own after the study?	1	2	3	4	5

	not at all useful				very useful
How useful do you feel the exercises were for increasing your happiness?	1	2	3	4	5

	never				very often
How often?	1	2	3	4	5

Do you have any other comments you would like to tell us about the exercises in the study?

Appendix H: Demographic Characteristics of Sample

Table 21

Nature Relatedness and Control Group Differences on Demographic Characteristics

	Control (n = 103)	Nature (n = 104)	<i>U</i>	<i>Z</i>
Ethnicity			4586.50	-1.48
Caucasian	68.3%	77.9%		
Asian	8.7%	9.6%		
mixed	6.7%	4.8%		
Black	5.8%	1.0%		
Nationality:			5051.50	-0.87
Canadian	66.3%	72.1%		
American	14.4%	7.7%		
New Zealand	15.4%	13.5%		
Australia	1.9%	1.9%		
Other	2.0%	4.9%		
Location Growing Up			4823.50	-1.32
city centre	17.3%	15.4%		
suburbs	49.0%	42.3%		
rural/farm	6.7%	16.3%		
small town	25.0%	26.0%		
Location Now			4583.50 [†]	-1.95
city centre	33.7%	32.7%		
suburbs	53.8%	44.2%		
rural/farm	4.8%	7.7%		
small town	7.7%	12.5%		
Dwelling Type			5056.50	-0.74
detached house	51.0%	45.2%		
apartment	19.2%	21.2%		
townhouse	18.3%	20.2%		
university residences	9.6%	11.5%		
Education			4929.50	-1.06
some high school	4.8%	1.0%		
completed high school	21.2%	18.3%		

	Control (<i>n</i> = 103)	Nature (<i>n</i> = 104)	<i>U</i>	<i>Z</i>
college degree	4.8%	9.6%		
some university	51.9%	45.2%		
undergraduate	10.6%	15.4%		
degree				
post-graduate	3.9%	7.7%		
trade	2.9%	2.9%		
Employment status			4897.00	-1.10
Employed	51.0%	58.7%		
Unemployed	48.1%	41.3%		

† $p < .10$, * $p < .05$, ** $p < .01$.

Appendix I: Test-Retest Correlations

Table 22

Test-Retest Correlations - Baseline to Post-Intervention and Six Month Follow Up for Nature and Happiness Variables

	Baseline to Post-Intervention (<i>N</i> = 207)	Post-Intervention to Six Month Follow Up (<i>N</i> = 53)	Baseline to Six Month Follow Up (<i>N</i> = 53)
Nature Relatedness (6 items)	.84**	.85**	.84**
Inclusion of Nature in Self	.78**	.82**	.80**
Fascination	.44**	.55**	.58**
Positive Affect	.54**	.58**	.45**
Negative Affect	.43**	.55**	.55**
Vitality	.67**	.52**	.58**
Percent Happy	.74**	.46**	.38**
Percent Unhappy	.71**	.48**	.25 [†]
Percent Neutral	.63**	.33*	.35*
Subjective Happiness	.85**	.74**	.71**
Satisfaction with Life	.76**	.70**	.71**
Depression	.49**	.48**	.52**
Autonomy	.82**	.85**	.79**
Personal Growth	.76**	.69**	.61**
Purpose in Life	.76**	.63**	.49**
Mindfulness	.70**	.76**	.67**

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Appendix J: Correlations Between Connectedness Measures

Table 23

Correlations Between Short and Long Nature Relatedness Scales, Inclusion of Nature in Self, and Nature Contact

	Nature Relatedness (6 items) Baseline	Inclusion With Nature in Self Baseline
Nature Relatedness (6 items) Baseline	1.00**	.70**
Nature Relatedness (6 items) Post-Intervention	.84**	.63**
Nature Relatedness (6 items) Six month follow up	.84**	.78**
Nature Relatedness (21 items) Post-Intervention	.80**	.62**
Nature Relatedness (21 items) Six month follow up	.77**	.57**
Inclusion of Nature in Self Post-Intervention	.67**	.78**
Inclusion of Nature in Self Six Month Follow Up	.76**	.80**

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Appendix K: Changes in Nature Contact by Condition During Intervention

Table 24

Repeated Measures ANOVAs for Nature Time (ESM) During Intervention by Condition

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>F</i> (1,197)	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Nature Contact						
Survey 2	1.48	2.44	0.91	1.43		
Survey 3	1.08	1.92	1.04	1.27		
Survey 4	1.38	2.19	0.89	1.32		
Survey 5	1.11	2.13	0.78	1.03		
Survey 6	0.77	1.27	0.76	1.13		
Survey 7	0.94	1.60	0.85	1.27		
Survey 8	0.64	0.94	0.81	1.23		
Time					2.91**	0.09
Condition					1.58	0.01
Time x Condition					1.66	0.05

† $p < .10$, * $p < .05$, ** $p < .01$.

Appendix L: Changes in State Fascination and Positive Affect by Condition

Table 25

Repeated Measures ANOVAs for State Fascination and Positive Affect (ESM) by Condition

	Control (<i>n</i> = 103)		Nature (<i>n</i> = 104)		<i>F</i> (1,197)	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Fascination						
Survey 2	2.61	1.02	2.55	0.82		
Survey 3	2.58	1.05	2.50	0.92		
Survey 4	2.72	1.07	2.28	0.89		
Survey 5	2.77	1.09	2.45	0.93		
Survey 6	2.59	1.10	2.27	0.89		
Survey 7	2.51	1.09	2.39	1.00		
Survey 8	2.54	1.18	2.33	0.92		
Time					2.23*	0.06
Condition					3.80*	0.02
Time x Condition					2.66*	0.08
Positive Affect						
Survey 2	2.94	0.84	2.92	0.72		
Survey 3	2.95	0.86	2.87	0.82		
Survey 4	3.02	0.86	2.72	0.79		
Survey 5	3.02	0.86	2.86	0.79		
Survey 6	2.87	0.87	2.69	0.79		
Survey 7	2.85	0.89	2.78	0.93		
Survey 8	2.85	0.95	2.76	0.82		
Time					2.63*	0.07
Condition					1.65	0.01
Time x Condition					1.79 [†]	0.05

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Appendix M: Changes in Fascination and Positive Affect by Condition During Intervention

For the nature group, state happiness (positive affect, vitality, fascination) declined following the food exercise then increased following the next exercise about the senses (this pattern is illustrated for fascination and positive affect in Figures 14 and 15). After the music/food exercise, participants in the nature group reported significantly less positive affect ($M = 2.47$, $SD = 0.94$) compared to the control group ($M = 2.76$, $SD = 1.10$), $t(205) = 2.03$, $p < .05$, $d = .28$. In the next exercise, participants were instructed to think about the sensations (e.g., sights, sounds, smells, textures) of a pleasant outdoor place (versus indoor place in the control group). Nature participants experienced a boost in positive mood (and marginally significant decline in negative mood) at the next measurement, three days later. Means, standard deviations, paired samples t-tests, and effect sizes appear in Table 21.

Table 26

Means, Standard Deviations, and Effect Sizes Comparing Nature Intervention Participants' State Happiness Change from Survey 4 (Following the Food Activity) to 5 (Following the Senses Activity)

	Survey 4 ($n = 103$)		Survey 5 ($n = 103$)		$t(205)$	d
	M	SD	M	SD		
Positive Affect	2.74	0.81	2.87	0.80	2.18*	0.16
Negative Affect	2.21	0.74	2.13	0.73	-1.90 [†]	0.11
Fascination	2.31	0.93	2.47	0.94	1.88 [†]	0.17
Vitality	3.56	1.48	3.76	1.47	1.89 [†]	0.14

[†] $p < .10$, * $p < .05$, ** $p < .01$.

Appendix N: Characteristics of Six Month Follow Up Participants

To examine if the subsample of follow up participants differed on their average time in nature, and connectedness with nature, I conducted three 2 (nature vs. control) x 2 (follow up survey vs. intervention only) ANOVAs, with aggregated nature time, and post-intervention inclusion with nature and nature relatedness as dependent variables. There was a significant interaction between condition and surveys completed for nature relatedness, $F(1,203) = 4.14, p = .04, \eta^2 = 0.02$. Follow up participants in the nature condition had higher nature relatedness scores at the end of the intervention phase ($M = 3.90, SD = 0.55$), compared to control follow up participants ($M = 3.49, SD = 0.71$) or people who did not do the follow up ($M = 3.48, SD = 0.05$).¹⁵

To examine potential happiness differences between control and nature participants, as well as characteristics of those who went on to complete the follow up survey, I conducted a series of 2 (nature vs. control) x 2 (follow up survey vs. intervention only) ANOVAs with each post-intervention happiness measure as dependent variables. There were very few significant main effects or interactions, indicating participants who went on to complete the six month follow up survey were no different in their happiness at the end of the intervention phase from participants who did not respond to the follow up.

¹⁵ The subsample of participants who completed the follow up survey did report marginally greater nature relatedness when measured post-intervention ($M = 3.67, SD = 0.67$), compared to those who finished only the intervention surveys ($M = 3.48, SD = 0.68$), $t(205) = 1.78, p = .08, d = 0.28$. They also had significantly greater nature related-perspective ($M = 4.02, SD = 0.58$) compared to those who finished only the intervention surveys ($M = 3.68, SD = 0.67$), $t(206) = 3.30, p < .01, d = 0.54$.

Appendix O: Changes in Happiness for Six-Month Follow Up Participants

Table 27

Repeated Measures ANOVA Results for Changes in Happiness by Group

	<i>F</i> (2,50)	η^2
Fascination		
Time	11.61**	0.32
with age as covariate	0.65	0.03
Condition	0.00	0.00
Time x Condition	1.28	0.05
Positive Affect		
		0.17
Time	5.72**	0.19
with age as covariate	0.70	0.03
Condition	0.19	0.00
Time x Condition	1.78	0.07
Negative Affect		
Time	3.83*	0.13
with age as covariate	0.31	0.01
Condition	0.24	0.01
Time x Condition	1.46	0.06
Vitality		
Time	2.03	0.08
Condition	0.16	0.00
Time x Condition	2.46	0.09
Percent Happy		
Time	1.41	0.05
Condition	0.36	0.01
Time x Condition	1.69	0.06

	<i>F</i> (2,50)	η^2
Percent Unhappy		
Time	0.29	0.01
Condition	0.06	0.00
Time x Condition	1.81	0.07
Subjective Happiness		
Time	3.45*	0.12
Condition	0.02	0.00
Time x Condition	4.02*	0.14
Life Satisfaction		
Time	0.42	0.02
Condition	0.24	0.01
Time x Condition	0.75	0.03
Depression		
Time	0.77	0.03
Condition	0.22	0.00
Participant Type	0.48	0.01
Time x Condition	0.93	0.04
Time x Participant Type	2.58 [†]	0.10
Condition x Participant Type	0.05	0.00
Time x Condition x Participant Type	0.84	0.03
Autonomy		
Time	0.43	0.02
Condition	0.12	0.00
Time x Condition	0.51	0.02
Personal Growth		
Time	0.60	0.02
Condition	3.79 [†]	0.07
Time x Condition	0.04	0.00

	<i>F</i> (2,50)	η^2
Purpose		
Time	1.47	0.06
Condition	1.90	0.04
Time x Condition	1.13	0.04
Mindfulness		
Time	16.71**	0.41
without participant type	0.66	0.03
Condition	0.01	0.00
Participant Type	2.31	0.05
Time x Condition	0.61	0.02
Time x Participant Type	2.34 [†]	0.11
Condition x Participant Type	1.49	0.03
Time x Condition x Participant Type	2.75 [†]	0.07

[†] $p < .10$, * $p < .05$, ** $p < .01$.